Analog & Interface Products

**THERMAL MANAGEMENT**
- Temperature Sensors
- Fan Control and Hardware Management

**LINEAR**
- Single Supply CMOS Op Amps
- Comparators
- RF Power Amplifiers, PGA, SGA

**SAFETY AND SECURITY**
- Smoke Detector ICs
- Piezoelectric Horn Drivers

**POWER MANAGEMENT**
- Linear Regulators
- Switching Regulators
- Digitally-Enhanced & PWM Controllers
- Charge Pump DC/DC Converters
- Battery Management
- USB Port Power Controller
- System Supervisors Voltage Detectors
- Power MOSFET Drivers
- Power MOSFETs

**MIXED SIGNAL**
- Pipelined A/D Converters
- Delta-Sigma & SAR A/D Converters
- Energy Measurement ICs
- Current/DC Power Measurement ICs
- Dual Slope / Display A/D Converters
- D/A Converters
- Digital Potentiometers
- Voltage References

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- USB and I/O Expanders
- Ethernet
- Wireless
- Real Time Clock/Calendar

**MOTOR DRIVER**
- Stepper, DC and 3Φ Brushless
- Supertex

**ANALOG & INTERFACE PRODUCTS**
- USB Port Power Controller
- Current/DC Power Measurement ICs
- Digital Potentiometers
- Voltage References
- Stepper, DC and 3Φ Brushless
- Supertex

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Supertex Broad Market & Key Segment Products

POWER MANAGEMENT
- LED Drivers
- Voltage Regulators
- PWM Controllers
- EL Backlight
- HV Small Signal MOSFETs
- HV Drivers
- HV Specialty ICs

ULTRASOUND
- Analog Multiplexers & Switches
- Transmit Pulsers
- MOSFET Drivers
- Complimentary MOSFET Arrays
- Transmit/Receive Switch ICs
Pipelined A/D Converters

Standard Pipelined ADCs

16-bit
- MCP37231-200
  200 Msps, 8-ch mux

14-bit
- MCP37221-200
  200 Msps, 8-ch mux

ADC with Integrated Digital Down-converter

MCP37D31-200
  200 Msps, 16-bit, 8-ch mux
  Digital Down-converter

MCP37D21-200
  200 Msps, 14-bit, 8-ch mux
  Digital Down-converter
### MOSFET Arrays

#### N-Channel
- **TD9944**
  - 240V$_{DSS}$, 6Ω $R_{DS(ON)}$

#### Complementary
- **TC1550**
  - N-CH: 500V BV$_{DSS}$, 2Ω $R_{DS(ON)}$
  - P-CH: -500V BV$_{DSS}$, 125Ω $R_{DS(ON)}$
- **TC2320**
  - N-CH: 200V BV$_{DSS}$, 7Ω $R_{DS(ON)}$
  - P-CH: -200V BV$_{DSS}$, 12Ω $R_{DS(ON)}$
- **TC6215**
  - N-CH: 150V BV$_{DSS}$, 4Ω $R_{DS(ON)}$
  - P-CH: -150V BV$_{DSS}$, 7Ω $R_{DS(ON)}$
- **TC6320**
  - N-CH: 200V BV$_{DSS}$, 7Ω $R_{DS(ON)}$
  - P-CH: -200V BV$_{DSS}$, 8Ω $R_{DS(ON)}$
- **TC7920**
  - N-CH: 200V BV$_{DSS}$, 13Ω $R_{DS(ON)}$
  - P-CH: -200V BV$_{DSS}$, 15Ω $R_{DS(ON)}$
- **TC8020**
  - N-CH: 200V BV$_{DSS}$, 8Ω $R_{DS(ON)}$
  - P-CH: -200V BV$_{DSS}$, 9.5Ω $R_{DS(ON)}$
- **TC8220**
  - N-CH: 200V BV$_{DSS}$, 5.3Ω $R_{DS(ON)}$
  - P-CH: -200V BV$_{DSS}$, 6.5Ω $R_{DS(ON)}$
Ultrasound Transmit/Receive Switch ICs

1-Channel
- MD0100

2-Channel
- MD0100D

4-Channel
- MD0101
- MD0105

Ultrasound Transmit /Receive Switch ICs Demo & Eval Boards

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Ultrasound MOSFET Drivers

Dual / 2-Channel
- MD1210
- MD1211
- MD1213

Quad / 4-Channel
- MD1810
- MD1811
- MD1812
- MD1813
- MD1820
- MD1821
- MD1822

12-Channel
- 5-Level
  - MD1711
  - MD1712
  - MD1715
- 3-Level
  - MD1716

Ultrasound MOSFET Driver Demo & Eval Boards
Ultrasound Transmit ICs

Beamformers
- MD2131
- MD2134

Continuous Wave
- CW01

Transmit Pulsers
- 1-Channel
  - HV7360
  - HV7361
- 4-Channel
  - HV7331
  - HV738
  - HV748
- 8-Channel
  - HV7350
  - HV7355
HV Drivers

Source-Sink Outputs

- Push-Pull
  - HV3418
  - HV507
  - HV513
  - HV518
  - HV5308
  - HV5408
  - HV574

- Push-Pull H-Bridge
  - HV508

MEMS Drivers/ HV Array Amplifiers

- HV254
- HV256
- HV257
- HV264

Sink Only Outputs

- Open Drain N-Channel
  - HV5122
  - HV5222
  - HV5522
  - HV5523
  - HV5530
  - HV5622
  - HV5623
  - HV5630

- Open Drain P-Channel
  - HV57009

HV Specialty & Driver Demo & Eval Boards
EL Backlight Drivers

Single Lamp
- HV816
- HV823
- HV825
- HV830
- HV833
- HV857
- HV857L
- HV859
- HV860

Inductorless
- HV850
- HV852
- HV853

16-Segment
- HV509
- HV528

Offline
- HV809

Dual Lamp
- HV861

EL Backlight Driver Demo & Eval Boards
<< BACK
LED Drivers

General Purpose
- HV9801A
- HV9803B
- HV9861A
- HV9910B
- HV9910C
- HV9918
- HV9919B
- HV9921/2/3
- HV9925
- HV9930
- HV9931

Backlighting
- HV9803
- HV9911
- HV9912
- HV9961
- HV9963
- HV9967B
- HV9980
- HV9982
- HV9989

Sequential Linear
- CL8800
- CL8801

Automotive
- AT9917
- AT9919
- AT9932
- AT9933

Linear Regulators
- CL2
- CL25
- CL220
- CL320
- CL325
- CL330
- CL520
- CL525
- CL6
- CL7

LED Driver Demo & Eval Boards
MOSFETs

Depletion Mode

Products

N-Channel Enhancement Mode

Products

P-Channel Enhancement Mode

Products
P-Channel Enhancement Mode MOSFETs

P-Channel

Vertical

VP0104
-40V BV_{DSS}, 8Ω R_{DS(ON)}

VP0106
-60V BV_{DSS}, 8Ω R_{DS(ON)}

VN0109
-90V BV_{DSS}, 8Ω R_{DS(ON)}

VP0550
-500V BV_{DSS}, 125Ω R_{DS(ON)}

VP0808
-80V BV_{DSS}, 5Ω R_{DS(ON)}

VP2106
-60V BV_{DSS}, 12Ω R_{DS(ON)}

VP2110
-100V BV_{DSS}, 12Ω R_{DS(ON)}

VP2206
-60V BV_{DSS}, 0.9Ω R_{DS(ON)}

VP2450
-500V BV_{DSS}, 30Ω R_{DS(ON)}

VP3203
-30V BV_{DSS}, 0.6Ω R_{DS(ON)}

Low Threshold

TP0604
-40V BV_{DSS}, 2Ω R_{DS(ON)}

TP0610
-60V BV_{DSS}, 10Ω R_{DS(ON)}

TP0620
-200V BV_{DSS}, 12Ω R_{DS(ON)}

TP2104
-40V BV_{DSS}, 6Ω R_{DS(ON)}

TP2424
-240V BV_{DSS}, 8Ω R_{DS(ON)}

TP2435
-350V BV_{DSS}, 15Ω R_{DS(ON)}

TP2520
-200V BV_{DSS}, 12Ω R_{DS(ON)}

TP2522
-220V BV_{DSS}, 12Ω R_{DS(ON)}

TP2525
-350V BV_{DSS}, 25Ω R_{DS(ON)}

TP2540
-400V BV_{DSS}, 25Ω R_{DS(ON)}

TP2635
-350V BV_{DSS}, 15Ω R_{DS(ON)}

TP2640
-400V BV_{DSS}, 15Ω R_{DS(ON)}

TP2510
-100V BV_{DSS}, 3.5Ω R_{DS(ON)}

TP5322
-220V BV_{DSS}, 12Ω R_{DS(ON)}

TP5335
-350V BV_{DSS}, 30Ω R_{DS(ON)}

Lateral

LP0701
-16.5V BV_{DSS}, 1.5Ω R_{DS(ON)}
Depletion Mode MOSFETs

N-Channel

Vertical

- DN1509
  - 90V $B_{V_{DSX}}$
  - 6Ω $R_{DS(ON)}$

- DN2450
  - 500V $B_{V_{DSX}}$
  - 10Ω $R_{DS(ON)}$

- DN2470
  - 700V $B_{V_{DSX}}$
  - 42Ω $R_{DS(ON)}$

- DN2530
  - 300V $B_{V_{DSX}}$
  - 12Ω $R_{DS(ON)}$

- DN2535
  - 350V $B_{V_{DSX}}$
  - 25Ω $R_{DS(ON)}$

- DN2540
  - 400V $B_{V_{DSX}}$
  - 25Ω $R_{DS(ON)}$

- DN2625
  - 250V $B_{V_{DSX}}$
  - 3.5Ω $R_{DS(ON)}$

Lateral

- DN3135
  - 350V $B_{V_{DSX}}$
  - 35Ω $R_{DS(ON)}$

- DN3145
  - 450V $B_{V_{DSX}}$
  - 60Ω $R_{DS(ON)}$

- DN3525
  - 250V $B_{V_{DSX}}$
  - 10Ω $R_{DS(ON)}$

- DN3535
  - 350V $B_{V_{DSX}}$
  - 10Ω $R_{DS(ON)}$

- DN3545
  - 450V $B_{V_{DSX}}$
  - 20Ω $R_{DS(ON)}$

- DN3765
  - 650V $B_{V_{DSX}}$
  - 8.0Ω $R_{DS(ON)}$

LND01
- 9V $B_{V_{DSX}}$
- 1.4Ω $R_{DS(ON)}$

LND150
- 500V $B_{V_{DSX}}$
- 1000Ω $R_{DS(ON)}$
Voltage Regulators

Linear
- Adjustable 3-Terminal
  - LR8
  - LR12
- SMPS Startup
  - LR645
  - LR745

Inductorless
- Adjustable Off-Line
  - SR086
  - SR087
- Capacitor-Coupled Switch Shunt
  - SR10

AC = Offline Capable

Voltage Regulator Demo & Eval Boards
Fan Control and Hardware Management

Closed Loop Fan Controllers With SMBus/I2C
- PWM Drive, Multi-Temp & Hardware Mgt
  - EMC2103 Single Fan
  - EMC2113 Single Fan
  - EMC2104 Dual Fan
- Linear Drive, Multi-Temp & Hardware Mgt
  - EMC2112 Single Fan
  - EMC2105 Single Fan
  - EMC2106 Dual Fan
- PWM Fan Speed Controllers
  - EMC2301 Single Fan
  - EMC2302 Dual Fan
  - EMC2303 Triple Fan
  - EMC2305 Five Fan

Open Loop Fan Controllers
- SMBus/I2C and Alert
  - EMC2101 Single Int & Remote Tmp
  - EMC6D103S Triple Hardware Mgt
  - EMC2300 Triple Hardware Mgt
  - TC654/55 Dual Thermistor Input
  - TC664/65 Single Thermistor Input
- With Alert
  - TC642/67/8/9 Single, Thermistor Input
  - TC642/67/8/9B Single, Thermistor & Restart
  - TC650/1/2/3 Single, Integrated Tmp

Fan Fault Detection/Prediction
- TC670

Fan Control Demo & Eval Boards
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**PGA/SGA and RF Amplifiers**

**Programmable Gain Amplifiers**
- MCP6S21: 1-ch, low offset
- MCP6S22: 2-ch, low offset
- MCP6S26: 6-ch, low offset
- MCP6S28: 8-ch, low offset
- MCP6S91: 1-ch, low cost
- MCP6S92/3: 2-ch, low cost

**Selectable Gain Amplifiers**
- MCP6G01: 1-ch, fixed gain
- MCP6G02: 2-ch, fixed gain
- MCP6G03: 1-ch, chip select
- MCP6G04: 4-ch, fixed gain

**Power Amplifiers**
- **2.4 GHz PA 11/b/g/n**
  - Pout*: ~18 dBm
  - Pout*: 18 – 22 dBm
  - Pout*: >22 dBm
- **5 GHz PA 11/a/n**
  - Pout*: >22 dBm

**Front End Modules**
- 2.4 GHz 11b/g/n PA+LNA or PA+SW
- 2.4 GHz 11b/g/n PA+SW+LNA
- 2.4 GHz 256QAM FEM PA+SW+LNA
- 5 GHz 11a/n/ac PA+SW+LNA

**LNA**
- 2.4 GHz

*Pout measured @ 3% EVM, using 802.11a or 11g OFDM

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Demo & Eval Boards
Comparators

Push-Pull Output
- 4µs Prop Delay
  - MCP6541/2/3/4
  - MCP65R41
- 50ns Prop Delay
  - MCP6561/2/4

Open Drain Output
- 4µs Prop Delay
  - MCP6546/7/8/9
  - MCP65R46
- 50ns Prop Delay
  - MCP6566/7/9

General Purpose Demo & Eval Boards
Low-Dropout Regulators

**High Voltage**
- MCP1702 13.2V Low Iq, 250 mA
- MCP1703 16V Low Iq, 250 mA
- MCP1703A 16V Low Iq, 250 mA
- MCP1754/S 16V PSRR, 150 mA
- MCP1755/S 16V PSRR, 300 mA
- MCP1804 28V 150 mA
- MCP1790/1 30V Auto, 70 mA

**50mA max**
- TC1014/54
- TC1070/2
- TC2014/54
- TC1223
- TC1016 (80mA)

**100mA max**
- TC1015/55
- TC2015/55
- TC1071/3
- TC1224
- TC1188/9 (120mA)

**250mA max**
- MCP1700
- MCP1701A
- MCP1710

**500mA max**
- MCP1725
- TC1262/3/8
- MCP1825/S

**300mA max**
- TC1107/8
- TC1173/4
- TC1269

**800mA max**
- TC1264/5
- TC2117

**1A max**
- MCP1726
- MCP1826/S

**1.5A max**
- MCP1727
- MCP1827/S

**LDO Combo ICs**
- TC1015/55
- TC1071/3
- TC1223
- TC1188/9 (120mA)

**Application Specific LDOs**
- TC59
- TC1300/7
- TC1303/4 LDO + Switcher
- TC1313 LDO + Switcher

**Dual LDOs**
- TC1301/2

**C = Ceramic Capacitor Stable**

**LDO Demo & Eval Boards**

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Charge Pumps

Inverters/Doublers
- 25mAOutput
  - TC1240/A (4V & 5.5V in)
- 40mAOutput
  - TC7662A (18V in)
- 80mAOutput
  - TC962 (18V in)

20mAOutput
- TC1044S/7660S (12V in)
- TC7660/H (10V in)
- TC7662B (15V in)

Multi Function
- Vin to -2Vin
  - TC682

Regulated Charge Pumps
- Positive Converters
  - MCP1252/3 120mA
  - MCP1256/7/8/9 100mA

Charge Pump Demo & Eval Boards
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Digitally-Enhanced and PWM Controllers

Digitally-Enhanced Power Analog Controllers
- MCP19110/1
  32V Enhanced Power Analog Controller w/ Synchronous Driver Step-Down Topologies
- MCP19114/5
  42V Enhanced Power Analog Controller w/ Synchronous Driver Step-Up Topologies

Synchronous, Step-Down PWM Controllers
- MCP19035
  30V Standalone incl. LDO and Integrated MOSFET Driver

Asynchronous PWM Controllers
- MCP1630/V
  High Speed, MCU-adaptable
- MCP1631/V
  HV version incl. LDO for 16V Operation
- MCP1632
  300kHz/600kHz Controller
- MCP1650/1/2/3
  750kHz Controller

Switching Controller Demo & Eval Boards
# MOSFET Drivers

## 0.5A Peak Output
- TC1410/N single
- MCP1401/2

## 1A Peak Output
- TC1411/N single

## 1.2A Peak Output
- TC1426/7/8 dual
- TC4467/8/9 quad

## 1.5A Peak Output
- **Single**
  - TC4403 floating load
  - TC4626/7 w/ voltage Tripler
  - TC4431/2 30V high/low, 3A source / 1.5A sink
  - MCP1415/6 ‘Tiny’
- **Dual**
  - TC426/7/8, TC4426/7/8
  - TC4426A/27A/28A matched delay
  - TC4404/5 split output, open drain

## 2A Peak Output
- TC1412/N single
- MCP14628
- MCP14700 dual input
- MCP14E6/7/8 w/ Enable

## 4A Peak Output
- MCP14E3/4/5 w/ Enable 4.0A

## 4.5A Peak Output
- MCP1403/4/5 4.5A dual

## 6A Peak Output
- TC429/TC4420/9 single
- MCP1406/7 single

## >6A Peak Output
- TC4421A/2A single, 9A
- TC4451/52 single, 12A

---

**General Purpose Demo & Eval Boards**

- MCP1401/2
- MCP1403/4/5 dual
- MCP1406/7 single
- MCP14E9/10/11 w/ Enable
- MCP14E6/7/8 w/ Enable
- TC4421A/2A
- TC4451/52
Power MOSFETs

25Vds, Voltage Rating

MCP87018
1.8 mΩ, 5x6 mm PDFN

MCP87022
2.2 mΩ, 5x6 mm PDFN

MCP87030
3.0 mΩ, 5x6 mm PDFN

MCP87050
5.0 mΩ, 5x6 mm PDFN

MCP87055
5.5 mΩ, 3.3x3.3mm PDFN

MCP87090
9 mΩ, 3.3x3.3/5x6 mm PDFN

MCP87130
13 mΩ, 3.3x3.3/5x6 mm PDFN
Delta-Sigma / SAR
A/D Converters

SAR ADCs

13-bit
- MCP3301/2/4
  - 100 kmps, diff input

12-bit
- MCP3221
  - 22 kmps, I²C, SOT-23
- MCP3201/2/4/8
  - 100 kmps, SPI

10-bit
- MCP3021
  - 22 kmps, I²C, SOT-23
- MCP3001/2/4/8
  - 200 kmps, SPI

Delta-Sigma ADCs

- MCP3550
  - 22-bit, 13 sps, 50 or 60 Hz rejection
- MCP3551
  - 22-bit, 15 sps, 50 & 60 Hz rejection
- MCP3553
  - 20-bit, 60 sps
- MCP3421
  - 18-bit, SOT23, I²C
- MCP3422/3/4
  - 18-bit, 2/4-ch I²C
- MCP3425
  - 16-bit, SOT23, I²C
- MCP3426/7/8
  - 16-bit, 2/4-ch I²C

ADC Demo & Eval Boards

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Dual Slope / Display A/D Converters

Dual Slope ADCs
- TC500/A/10/14
  17-bit, programmable resolution, diff input
- TC7109/A
  12-bit + sign, diff input

Display ADCs
- BCD/Binary
  - TC14433/A
    BCD, 3½ digit res.
  - TC850
    Binary, 15-bit res.
- LCD
  - TC7106/A/7116/A/7126/A
    3½ digit resolution
  - TC7129
    4½ digit resolution
- LED
  - TC7107/A/7117/A
    3½ digit resolution
Energy Measurement ICs

- **Energy Meter ICs**
  - MCP39F501
    - Power Monitoring IC
    - 4000:1 dynamic range
  - MCP3905A
    - 500:1 dynamic range, PGA 1:16
  - MCP3905L
    - 500:1 dynamic range, PGA 1:16, low pwr
  - MCP3906A
    - 1000:1 dynamic range, PGA 1:32
  - MCP3909
    - 1000:1 dynamic range, PGA 1:16, SPI interface

- **Energy Measurement AFE**
  - MCP3918
    - 1-Ch AFE
  - MCP3910
    - 2-Ch AFE
  - MCP3911
    - 2-Ch AFE
  - MCP3919
    - 3-Ch AFE
  - MCP3912
    - 4-Ch AFE
  - MCP3914
    - 8-Ch AFE
  - MCP3901
    - 5V 2-Ch AFE
  - MCP3903
    - 5V 6-Ch AFE

- **System on Chip**
  - PIC18F86/87J72

- **Energy Measurement Demo & Eval Boards**
  - MCP3905A
  - MCP3905L
  - MCP3906A
  - MCP3909
  - MCP3919
  - MCP3914
Current/DC Power Measurement ICs

Current/DC Power w/ Temp Measurement

- EMC1701
  Current/DC Power w/Ambient Temp

- EMC1702
  Current/DC Power w/Ambient Temp & 1 Temperature Remote

- EMC1704
  Current/DC Power w/Ambient Temp & 3 Temperature Remotes

Current/DC Power Measurement

- PAC1710
  Single High Side Sensor for Current/DC Power Measurement

- PAC1720
  Dual High Side Sensor for Current/DC Power Measurement

Current/DC Power Demo & Eval Boards
USB Port Power Controllers

**Host Free Controller**
- **UCS1001**
  - 9-Built in charger emulation profiles
  - 2.5A Integrated Vbus power switch
  - USB 2.0 Data switch

**Programmable Controllers**
- **UCS1002**
  - 9-Built in charger emulation profiles
  - 1 Programmable profile
  - 2.5A Integrated Vbus power switch
  - USB 2.0 Data switch
  - Highest current algorithm available with SLA

- **UCS81001/2 Automotive**
  - 9-Built in charger emulation profiles
  - 1 Programmable profile
  - 2.5A Integrated Vbus power switch
  - USB 2.0 Data switch
  - Highest current algorithm available with SLA
Digital Potentiometers

- **6-bit**
  - **Non-Volatile**
    - U/D
      - MCP4021
        - Pot, 8MSOP
      - MCP4022
        - Rheo, 6SOT23
      - MCP4023
        - Pot, 6SOT23
      - MCP4024
        - Rheo, 5SOT23
  - **Volatile**
    - U/D
      - MCP4011
        - Pot, 8MSOP
      - MCP4012
        - Rheo, 6SOT23
      - MCP4013
        - Pot, 6SOT23
      - MCP4014
        - Rheo, 5SOT23

- **7-bit**
  - **Non-Volatile**
    - SPI
      - MCP41/24x
        - Single/Dual
      - MCP4341/2
        - Quad
    - I²C
      - MCP45/64x
        - Single/Dual
      - MCP4441/2
        - Quad
  - **Volatile**
    - SPI
      - MCP41/23x
        - Single/Dual
      - MCP4331/2
        - Quad
      - MCP41HV31
        - 36V Single
    - I²C
      - MCP45/63x
        - Single/Dual
      - MCP4431/2
        - Quad
      - MCP40(D)17/8/9
      - MCP45HV31
        - 36V Single

- **8-bit**
  - **Non-Volatile**
    - SPI
      - MCP41/26x
        - Single/Dual
      - MCP4361/2
        - Quad
    - I²C
      - MCP45/66x
        - Single/Dual
      - MCP4461/2
        - Quad
  - **Volatile**
    - SPI
      - MCP41/25x
        - Single/Dual
      - MCP4351/2
        - Quad
      - MCP41H51
        - 36V Single
      - MCP41/2XXX
    - I²C
      - MCP45/65x
        - Single/Dual
      - MCP4451/2
        - Quad
      - MCP45HV51
        - 36V Single
      - << BACK

- **Mixed Signal**
  - Demo & Eval Boards
USB and I/O Expanders

USB Controllers
- USB2.0 Hubs
- USB2.0 Card Readers
- HSIC Hubs and Card Readers
- USB3.0 Hubs

USB Bridges
- MCP2200 USB to UART
- MCP2210 USB to SPI

I/O Expanders
- 8-bit
  - SPI
    - MCP23S08
    - MCP23S09
  - I²C
    - MCP23008
    - MCP23009 3.4 MHz
- 16-bit
  - SPI
    - MCP23S17
    - MCP23S18
  - I²C
    - MCP23016
    - MCP23017
    - MCP23018 3.4 MHz

USB Transceivers
- USB33xx PHYs
- USB Switches
- USB Protection

Interface Demo & Eval Boards

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Piezoelectric Horn Drivers

Voltage Range 2V to 8V
- Voltage Regulator
  - RE46C107
    - Charge Pump, Brown Out
- No Voltage Regulator
  - RE46C104
    - Charge Pump
  - RE46C117
    - Brown Out, Inductive Boost
  - RE46C317/8
    - Inductive Boost

Voltage Range 6V to 16V
- Voltage Regulator
  - RE46C105
    - LED Driver, Brown Out
  - RE46C108
    - Brown Out
  - RE46C109
    - Brown Out, Charge Pump, Interconnect
  - RE46C119
    - Brown Out, Charge Pump, Interconnect
- No Voltage Regulator
  - RE46C100
  - RE46C101
    - LED Driver
Ethernet

**Ethernet Controller**
- ENC424J600/ENC624J600
- ENC28J60
- LAN9217/18
- LAN9220/21

**USB to Ethernet Controller**
- LAN7500
- LAN951X
- LAN9500A
- LAN9730

**ARCNET Controllers**
- COM20019/20/22

**Ethernet Transceivers**
- LAN8710A
- LAN8740A/1A/2A
- LAN8810/20

**Ethernet Switches**
- LAN9303/M
- LAN931X
Real Time Clock/Calendar

- Low Cost
  - I²C
    - MCP7940N
    - MCP7940M No Battery Back-Up

- General Purpose
  - I²C
    - MCP79410/1/2 EE (1k), ID
    - MCP79400/1/2 ID
  - SPI
    - MCP79520/1/2 EE (2k), ID
    - MCP79510/1/2 EE (1k), ID

- Advanced Features
  - SPI
    - Watchdog/Event Input
      - MCP79W20/1/2 EE (2k), ID
      - MCP79W10/1/2 EE (1k), ID

- MCP7940N
- MCP7940M
- MCP79410/1/2 EE (1k), ID
- MCP79400/1/2 ID
- MCP79520/1/2 EE (2k), ID
- MCP79510/1/2 EE (1k), ID
- MCP79W20/1/2 EE (2k), ID
- MCP79W10/1/2 EE (1k), ID
### Analog & Interface Demo and Eval Boards

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</table>
Voltage Regulator Demo and Eval Boards

Inductorless

Adjustable Off-Line

AC SR086DB1

AC SR087DB1

Capacitor-Coupled Switch Shunt

AC SR10DB1

AC = Offline Capable

<< BACK to Voltage Regulators  << BACK to Demo Boards
Ultrasound MOSFET Driver Demo and Eval Boards

Dual / 2-Channel
- MD1213DB1

Quad / 4-Channel
- MD1822DB1
- MD1822DB2
- MD1822DB3

12-Channel
- 5-Level
  - MD1711DB2
  - MD1715DB2
Thermal Demo and Eval Boards

Serial Output
- TC77 PICtail™ Demo Board
- TC72 PICtail™ Demo Board
- MCP9800 PICtail™ Demo Board
- MCP9800 Data Logger Demo Board 2
- MCP9800 Data Logger Demo Board
- MCP9800 Temp Sensor Demo Bd
- Thermocouple Ref. Design
- EMC1043/53 Eval Board
- EMC1043C Eval Board w/ Off-Board Diode
- EMC1412 Eval Board

Voltage Output
- MCP9700 PICtail™ Demo Board
- TC1047A PICtail™ Demo Board
- MCP9700 Thermistor Demo Board

General Purpose
- PT100 RTD Eval Board
- PICKit Serial SPI Demo Board
- PICKit Serial I2C Demo Board

<< BACK to Temp Sensor Products
<< BACK to Demo Boards
Fan Control Demo and Eval Boards

Open Loop Fan Controllers

With SMBus/I2C and Alert

EMC2101 Eval Board
Current/DC Power Sensor Demo and Eval Boards

Current/DC Power Measurement ICS

With Temperature Monitors
- EMC1701 Eval Board

Current/DC Power Only
- PAC1710/20 Eval Board

<< BACK to Current/DC Power Products
<< BACK to Demo Boards
Linear Demo and Eval Tools

**PGA**
- MCP6SX2 Photodiode PICtail™ Demo Board
- MCP6SX2 Thermistor PICtail™ Demo Board
- MCP6S22 PICtail™ Demo Board
- MCP6S2X Eval Board
- PICKit Serial SPI Demo Board

**General Purpose**
- Signal Analysis PICtail™ Daughter Board

**Op Amp**
- MCP6V01 Thermocouple Auto-Zeroed Reference Design
- MCP6V01 Input Offset Demo Board
- MCP651 Input Offset Evaluation Board
- MCP6031 Photodiode PICtail Plus Demo Board
- MCP661 Line Driver Demo Board
- MCP6N11/MCP6V2x Wheatstone Bridge Ref Design
- MCP6421 EMIRR Eval Board

**Others**
- Humidity Sensor PICtail™ Demo Board
- Active Filter Demo Board Kit
- MCP6XXX Amplifier Evaluation Board 1
- MCP6XXX Amplifier Evaluation Board 2
- MCP6XXX Amplifier Evaluation Board 3
- MCP6XXX Amplifier Evaluation Board 4
- MCP6H04 Evaluation Board

<< BACK to PGA/SGA/RF Products  << BACK to Op Amp Products  << BACK to Demo Boards
Wireless Demo and Eval Tools

Wireless Evaluation Boards

- Wi-Fi
- Bluetooth
- Sub-GHz/2.4 GHz/Proprietary/MiWi
- 802.15.4/ZigBee/MiWi

<< BACK to Wireless Products
<< BACK to Demo Boards
Wireless Demo and Eval Tools

RN Wi-Fi
- RN-171-EK / RN-131-EK
- RN-171-PI Ctai l / RN-131-PI Ctai l
- RN-XV-EK1
  (Eval Kit for the RNXV module series)
- RN-XV-RD2
  (Reference design for the RNXV module series)

MRF Wi-Fi
- Wi-Fi G Demo Board (DV102412)
- Wi-Fi G PI Ctai l / PI Ctai l Plus (AC164149)
Wireless Demo and Eval Tools

Bluetooth - Data
- RN-4020-PICtail
- RN-41-EK
- RN-42-EK
- RN41APL-EVAL
- RN42APL-EVAL
- RN-42-HID-RD1

Bluetooth - Audio
- RN52 Bluetooth Audio Evaluation Kit (RN-52-EK)

Bluetooth HCI + PIC32
- PIC32 Bluetooth Audio Development Kit (DV320032)
RF Wireless Transceivers Demo and Eval Tools

- **MRF49XA**
  - MRF49XA PICtail Plus Daughter Board – 433.92 MHz (AC164137-1)
  - MRF49XA PICtail Plus Daughter Board – 868/915 MHz (AC164137-2)

- **MRF89XA**
  - MRF89XAM8A PICtail/PICtail Plus Daughter Board (AC164138-1)
  - ZENA Wireless Adapter – 915 MHz (AC182015-3)
  - ZENA Wireless Adapter – 868 MHz (AC182015-2)

- **MRF89XAM8A**
  - 8-bit Wireless Development Kit – 868 MHz (DM182015-2)
  - MiWi Demo Kit – 868 MHz (DM182016-2)

- **MRF89XAM9A**
  - MRF89XAM9A PICtail/PICtail Plus Daughter Board (AC164138-2)
  - 8-bit Wireless Development Kit – 915 MHz (DM182015-3)
  - MiWi Demo Kit – 915 MHz (DM182016-3)

- **Wireless Network Software**

<< BACK to Wireless Products

<< BACK
A/D Converter Demo Boards

Pipelined ADC
- MCP37XXX Evaluation Board
- MCP37XXX Data Capture Card

Delta-Sigma ADC
- MCP3421 Battery Fuel Gauge Demo Board
- MCP3421 Weight Scale Demo Board
- MCP3421 SOT-23 Eval Board
- MCP342x Eval Boards
- MCP3551 PICtail™ Demo Board
- MCP355X Tiny App. Sensor Demo Board
- MCP355X Sensor App. Dev Board
- Thermocouple Ref. Design

SAR ADC
- MCP3221 PICtail™ Demo Board
- MCP3201/02 MXDEV Daughter Board
- MCP3204/08 MXDEV Daughter Board
Interface
Demo and Eval Boards

I/O Expander
- MCP23x17 Eval Board
- MCP23x08 Eval Board
- GPIO Expander Keypad Demo Board
- PICKit Serial SPI Demo Board
- PICKit Serial I²C™ Demo Board

Infrared
- MCP212x Developer’s Daughter Board
- MCP215x/40 Developer’s Daughter Board
- MCP2140 Wireless Temp Demo Board
- MCP215x Data Logger Demo Board
- MCP2150 Demo Board

USB Bridges
- MCP2221 Breakout Module
- MCP2200 USB to RS232 demo board
- MCP2200 Breakout Module
- MCP2210 Breakout Module
- MCP2210 Eval Board

Passive Access AFE
- MCP2030 Bidirectional Comm. Demo Kit

USB Controllers
- USB Eval Boards

<< BACK to Wireless Products  << BACK to USB and I/O Expander Products  << BACK to Demo Boards
Ethernet Demo and Eval Boards

Ethernet
- PICtail Ethernet Board
- PHY/Switch/Controller Eval Boards
- Ethernet Eval Boards
- LANCheck

<< BACK to Ethernet
<< BACK to Demo Boards
Motor Drive

Dual H-Bridge Driver
- MTS2916A Dual Full-Bridge Stepper Motor Drive Eval Board

3Φ BLDC Motor Controller
- MTD6505 3-Phase BLDC Sensorless Fan Controller Demo Board
- MCP8024 BLDC Motor Driver Evaluation Board
- MCP8063 12V Sensorless Fan Controller Demo Kit
- MCP8025 BLDC Motor Driver Evaluation Board

<< BACK to Motor Drive Products  << BACK to Demo Boards
Real Time Clock/Calendar

MCP7941X RTCC PICtail Plus Daughter Board

MCP795XX RTCC PICtail Plus Daughter Board

<< BACK to Real Time Clock/Calendar

<< BACK to Demo Boards
Ultrasound Transmit IC Demo and Eval Boards

Beamformers
- MD2131DB1
- MD2131DB2
- MD2134DB1
- MD2134DB2

Continuous Wave
- CW01DB1

Transmit Pulsers

1-Channel
- HV7360DB1
- HV7361DB1

4-Channel
- HV7331DB2
- HV738DB1
- HV748DB1
- AN-H59DB1

8-Channel
- HV7350DB1
- HV7355DB1

<< BACK to Ultrasound Transmit ICs

<< BACK to Demo Boards
Ultrasound Transmit/Receive Switch Demo and Eval Boards

1-Channel
MD0100DB1

4-Channel
MD0101DB1

<< BACK to Ultrasound Transmit/Receive Switch ICs
<< BACK to Demo Boards
General Purpose Demo and Eval Boards

- 14-pin SOIC/TSSOP/PDIP Eval Board
- 5 and 6-pin SOT-23 Eval Board
- PICKit Serial SPI Demo Board
- Magnetic Field Evaluation Board
- 8-pin SOIC/MSOP/TSSOP/PDIP Eval Board
- 3-pin SOT-23 Eval Board
- PICKit Serial I²C Demo Board
- Electrical Field Evaluation Board
- PSRR and Digital Noise Evaluation Board

<< BACK to Supervisor Products
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<< BACK to Demo Boards
Appendix

Product Pages
MCP37D31-200

**Features:**
- 16-bit pipelined ADC
- 200 Msps sampling rate
- Low power 490 mW operation at full sampling rate, including LVDS digital I/O
  - 80 mW Standby, 33 mW Shutdown
- >74.7 dBFS SNR at 200 Msps
- >90 dBFS SFDR at 200 Msps
- Internal Digital Down-converter (DDC)
- Decimation filters for improved SNR
- Phase, offset and gain adjust of individual channels
- 8-channel mux
- Fractional delay recovery for time-delay corrections in multi-channel operations (dual/octal-channel modes)
- Input channel bandwidth of 500 MHz
- Output data in serial DDR LVDS or CMOS
- Configuration via SPI
- Industrial temperature range -40°C to +85°C
- VTLA-124 package (9 mm x 9 mm x 0.9 mm)
Features:
- 16-bit pipelined ADC
- 200 Msps sampling rate
- Low power 490 mW operation at full sampling rate, including LVDS digital I/O
  - 80 mW Standby, 33 mW Shutdown
- >74.7 dBFS SNR at 200 Msps
- >90 dBFS SFDR at 200 Msps
- Decimation filters for improved SNR
- Phase, offset and gain adjust of individual channels
- 8-channel mux
- Fractional delay recovery for time-delay corrections in multi-channel operations (dual/octal-channel modes)
- Input channel bandwidth of 500 MHz
- Output data in serial DDR LVDS or CMOS
- Configuration via SPI
- Industrial temperature range -40°C to +85°C
- VTLA-124 package (9 mm x 9 mm x 0.9 mm)
Features:

- 14-bit pipelined ADC
- 200 Msps sampling rate
- Low power 490 mW operation at full sampling rate, including LVDS digital I/O
  - 80 mW Standby, 33 mW Shutdown
- >74.2 dBFS SNR at 200 Msps
- >90 dBFS SFDR at 200 Msps
- Internal Digital Down-converter (DDC)
- Decimation filters for improved SNR
- Phase, offset and gain adjust of individual channels
- 8-channel mux
- Fractional delay recovery for time-delay corrections in multi-channel operations (dual/octal-channel modes)
- Input channel bandwidth of 500 MHz
- Output data in serial DDR LVDS or CMOS
- Configuration via SPI
- Industrial temperature range -40°C to +85°C
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• 14-bit pipelined ADC
• 200 Msps sampling rate
• Low power 490 mW operation at full sampling rate, including LVDS digital I/O
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• >90 dBFS SFDR at 200 Msps
• Decimation filters for improved SNR
• Phase, offset and gain adjust of individual channels
• 8-channel mux
• Fractional delay recovery for time-delay corrections in multi-channel operations (dual/octal-channel modes)
• Input channel bandwidth of 500 MHz
• Output data in serial DDR LVDS or CMOS
• Configuration via SPI
• Industrial temperature range -40°C to +85°C
• VTLA-124 package (9 mm x 9 mm x 0.9 mm)
LP0701

Features:
- $BV_{DSS}$: -16.5V min
- $R_{DS(ON)}$: 1.5Ω max
- Ultra-low threshold
- High input impedance
- Low input capacitance
- Fast switching speeds
- Low on-resistance
- Freedom from secondary breakdown
- Low input and output leakage
- Operating Temperature Range: -55°C to +150°C
- Package Option: TO-92, SOIC-8
Features:

- $B_{V_{DSS}}$: -40V min
- $R_{DS(ON)}$: 2.0Ω max
- Low threshold: -2.4V max
- High input impedance
- Low input capacitance: 95pF typ
- Fast switching speeds
- Low on-resistance
- Free from secondary breakdown
- Low input and output leakage
- Operating Temperature Range: -55°C to +150°C
- Package Option: TO-92
TP0610

Features:
- \( BV_{DSS} \): -60V min
- \( R_{DS(ON)} \): 10\( \Omega \) max
- High input impedance and high gain
- Low power drive requirement
- Ease of paralleling
- Low \( C_{ISS} \) and fast switching speeds
- Excellent thermal stability
- Integral source-drain diode
- Free from secondary breakdown
- Operating Temperature Range: -55°C to +150°C
- Package Option: SOT-23
TP0620

Features:
- \( BV_{DSS} \): -200V min
- \( R_{DS(ON)} \): 12Ω max
- Low threshold: -2.4V max
- High input impedance
- Low input capacitance: 85pF typ
- Fast switching speeds
- Low on-resistance
- Free from secondary breakdown
- Low input and output leakage
- Operating Temperature Range: -55°C to +150°C
- Package Option: TO-92
TP2104

Features:
• $B_{DSS}$: -40V min
• $R_{DS(ON)}$: 6.0Ω max
• High input impedance and high gain
• Low power drive requirement
• Ease of paralleling
• Low $C_{iss}$ and fast switching speeds
• Excellent thermal stability
• Integral source-drain diode
• Free from secondary breakdown
• Operating Temperature Range:
  -55°C to +150°C
• Package Option: TO-92, SOT-23
Features:
- $BV_{DSS}$: -240V min
- $R_{DS(ON)}$: 8.0Ω max
- Low threshold
- High input impedance
- Low input capacitance
- Fast switching speeds
- Free from secondary breakdown
- Low input and output leakage
- Operating Temperature Range: -55°C to +150°C
- Package Option: SOT-89
TP2435

Features:
- $B_{V_{DSS}}$ : -350V min
- $R_{DS(ON)}$: 15Ω max
- Low threshold
- High input impedance
- Low input capacitance
- Fast switching speeds
- Free from secondary breakdown
- Low input and output leakage
- Operating Temperature Range:
  - -55°C to +150°C
- Package Option: SOT-89

Switching Waveform

Test Circuit
TP2502

Features:
• $B V_{D S S}$: -20V min
• $R_{DS(ON)}$: 2.0Ω max
• Low threshold: -2.4V max
• High input impedance
• Low input capacitance: 125pF max
• Fast switching speeds
• Free from secondary breakdown
• Low input and output leakage
• Operating Temperature Range: -55°C to +150°C
• Package Option: SOT-89
Features:

- $BV_{DSS}$: -100V min
- $R_{DS(ON)}$: 3.5Ω max
- Low threshold: -2.4V max
- High input impedance
- Low input capacitance: 125pF max
- Fast switching speeds
- Free from secondary breakdown
- Low input and output leakage
- Operating Temperature Range: -55°C to +150°C
- Package Option: SOT-89
TP2520

Features:
- $B V_{DSS}$: -200V min
- $R_{DS(ON)}$: 12Ω max
- Low threshold: -2.4V max
- High input impedance
- Low input capacitance: 125pF max
- Fast switching speeds
- Free from secondary breakdown
- Low input and output leakage
- Operating Temperature Range: -55°C to +150°C
- Package Option: SOT-89
Features:

- $B_{V_{\text{DSS}}}$: -220V min
- $R_{DS(\text{ON})}$: 12Ω max
- Low threshold: -2.4V max
- High input impedance
- Low input capacitance: 125pF max
- Fast switching speeds
- Free from secondary breakdown
- Low input and output leakage
- Operating Temperature Range: -55°C to +150°C
- Package Option: SOT-89
Features:

- $B V_{DSS}$: -350V min
- $R_{DS(ON)}$: 25Ω max
- Low threshold: -2.4V max
- High input impedance
- Low input capacitance: 60pF typ
- Fast switching speeds
- Free from secondary breakdown
- Low input and output leakage
- Operating Temperature Range: -55°C to +150°C
- Package Option: TO-92
TP2540

Features:

• $B_{V_{DSS}}$: -400V min
• $R_{DSON}$: 25Ω max
• Low threshold: -2.4V max
• High input impedance
• Low input capacitance: 60pF typ
• Fast switching speeds
• Free from secondary breakdown
• Low input and output leakage
• Operating Temperature Range: -55°C to +150°C
• Package Option: TO-92, TO-92, SOT89
TP2635

Features:
- $V_{DSS}$: -350V min
- $R_{DS(ON)}$: 15Ω max
- Low threshold: -2.0V max
- High input impedance
- Low input capacitance
- Fast switching speeds
- Low on-resistance
- Free from secondary breakdown
- Low input and output leakage
- Operating Temperature Range: -55°C to +150°C
- Package Option: TO-92
TP2640

Features:

- $B_{V_{DSS}}$: -400V min
- $R_{DS(ON)}$: 15Ω max
- Low threshold: -2.0V max
- High input impedance
- Low input capacitance
- Fast switching speeds
- Low on-resistance
- Free from secondary breakdown
- Low input and output leakage
- Operating Temperature Range: -55°C to +150°C
- Package Option: TO-92
TP5322

Features:

- $BV_{DSS}: -220V \text{ min}$
- $R_{DS(ON)}: 12\Omega \text{ max}$
- Low threshold: $-2.4V \text{ max}$
- High input impedance
- Low input capacitance: $110\text{pf max}$
- Fast switching speeds
- Low on-resistance
- Free from secondary breakdown
- Low input and output leakage
- Operating Temperature Range: $-55^\circ\text{C to } +150^\circ\text{C}$
- Package Option: TO-92, SOT-23
TP5335

Features:

- $B_{V_{DSS}}$: -350V min
- $R_{DS(ON)}$: 30Ω max
- High input impedance and high gain
- Low power drive requirement
- Ease of paralleling
- Low $C_{ISS}$ and fast switching speeds
- Excellent thermal stability
- Integral source-drain diode
- Free from secondary breakdown
- Operating Temperature Range: -55°C to +150°C
- Package Option: SOT-23
Features:

- \( \text{BV}_{\text{DSS}} \): -40V min
- \( R_{\text{DS(ON)}} \): 8.0\( \Omega \) max
- Free from secondary breakdown
- Low power drive requirement
- Ease of paralleling
- Low \( C_{\text{ISS}} \) and fast switching speeds
- Excellent thermal stability
- Integral source-drain diode
- High input impedance and high gain
- Operating Temperature Range:
  - -55°C to +150°C
- Package Option: TO-92
VP0106

Features:
- $B_{V_{DSS}}$: -60V min
- $R_{DS(ON)}$: 8.0Ω max
- Free from secondary breakdown
- Low power drive requirement
- Ease of paralleling
- Low $C_{ISS}$ and fast switching speeds
- Excellent thermal stability
- Integral source-drain diode
- High input impedance and high gain
- Operating Temperature Range: 
  -55°C to +150°C
- Package Option: TO-92
Features:

- $B_{V_{DSS}}$: -90V min
- $R_{D_{S(ON)}}$: 8.0Ω max
- Free from secondary breakdown
- Low power drive requirement
- Ease of paralleling
- Low $C_{ISS}$ and fast switching speeds
- Excellent thermal stability
- Integral source-drain diode
- High input impedance and high gain
- Operating Temperature Range: -55°C to +150°C
- Package Option: TO-92
Features:

- $\text{BV}_{\text{DSS}} : -500 \text{V min}$
- $R_{\text{DS(ON)}} : 125 \Omega \text{ max}$
- Free from secondary breakdown
- Low power drive requirement
- Ease of paralleling
- Low $C_{\text{ISS}}$ and fast switching speeds
- Excellent thermal stability
- Integral source-drain diode
- High input impedance and high gain
- Operating Temperature Range: -55°C to +150°C
- Package Option: TO-92
Features:

- $BV_{DSS}$: -80V min
- $R_{DS(ON)}$: 5.0Ω max
- Free from secondary breakdown
- Low power drive requirement
- Ease of paralleling
- Low $C_{ISS}$ and fast switching speeds
- Excellent thermal stability
- Integral source-drain diode
- High input impedance and high gain
- Operating Temperature Range: -55°C to +150°C
- Package Option: TO-92
Features:

- $B_{V_{DSS}}$ : -60V min
- $R_{DS(ON)}$: 12Ω max
- Free from secondary breakdown
- Low power drive requirement
- Ease of paralleling
- Low $C_{ISS}$ and fast switching speeds
- Excellent thermal stability
- Integral source-drain diode
- High input impedance and high gain
- Operating Temperature Range: -55°C to +150°C
- Package Option: TO-92
VP2110

Features:

- $\text{BV}_{\text{DSS}}$: -100V min
- $R_{\text{DS(ON)}}$: 12Ω max
- Free from secondary breakdown
- Low power drive requirement
- Ease of paralleling
- Low $C_{\text{ISS}}$ and fast switching speeds
- Excellent thermal stability
- Integral source-drain diode
- High input impedance and high gain
- Operating Temperature Range: -55°C to +150°C
- Package Option: SOT-23
Features:
- $B V_{DSS}$: -60V min
- $R_{DS(ON)}$: 0.9Ω max
- Free from secondary breakdown
- Low power drive requirement
- Ease of paralleling
- Low $C_{ISS}$ and fast switching speeds
- Excellent thermal stability
- Integral source-to-drain diode
- High input impedance and high gain
- Operating Temperature Range: -55°C to +150°C
- Package Option: TO-39, TO-92
VP2450

Features:
- $BV_{DSS}$: -500V min
- $R_{DS(ON)}$: 30Ω max
- Free from secondary breakdown
- Low power drive requirement
- Ease of paralleling
- Low $C_{iss}$ and fast switching speeds
- Excellent thermal stability
- Integral source-to-drain diode
- High input impedance and high gain
- Operating Temperature Range: -55°C to +150°C
- Package Option: TO-92, SOT-89
Features:

- $BV_{DSS}$: -30V min
- $R_{DS(ON)}$: 0.6Ω max
- Free from secondary breakdown
- Low power drive requirement
- Ease of paralleling
- Low $C_{ISS}$ and fast switching speeds
- Excellent thermal stability
- Integral source-to-drain diode
- High input impedance and high gain
- Operating Temperature Range: -55°C to +150°C
- Package Option: TO-92, SOT-89
Features:

- **$BV_{DSS}$**: 60V min
- **$R_{DS(ON)}$**: 3.0Ω max
- Free from secondary breakdown
- Low power drive requirement
- Ease of paralleling
- Low $C_{iss}$ and fast switching speeds
- Excellent thermal stability
- Integral source-drain diode
- High input impedance and high gain
- Operating Temperature Range: -55°C to +150°C
- Package Option: TO-39 Metal Can
Features:

- $BV_{DSS}$: 90V min
- $R_{DS(ON)}$: 4.0Ω max
- Free from secondary breakdown
- Low power drive requirement
- Ease of paralleling
- Low $C_{ISS}$ and fast switching speeds
- Excellent thermal stability
- Integral source-drain diode
- High input impedance and high gain
- Operating Temperature Range: -55°C to +150°C
- Package Option: TO-39 metal can
2N7000

**Features:**
- $BV_{DSS}$: 60V min
- $R_{DS(ON)}$: 5.0Ω max
- Free from secondary breakdown
- Low power drive requirement
- Ease of paralleling
- Low $C_{iss}$ and fast switching speeds
- Excellent thermal stability
- Integral source-drain diode
- High input impedance and high gain
- Operating Temperature Range: -55°C to +150°C
- Package Option: TO-92
2N7002

Features:
- $B_{V_{DSS}}$: 60V min
- $R_{DS(ON)}$: 7.5Ω max
- Free from secondary breakdown
- Low power drive requirement
- Ease of paralleling
- Low $C_{ISS}$ and fast switching speeds
- Excellent thermal stability
- Integral source-drain diode
- High input impedance and high gain
- Operating Temperature Range: -55°C to +150°C
- Package Option: SOT-23 (TO-236AB)
Features:

- $B_{V_{DSS}}$: 60V min
- $R_{DS(ON)}$: 7.5Ω max
- Free from secondary breakdown
- Low power drive requirement
- Ease of paralleling
- Low $C_{ISS}$ and fast switching speeds
- Excellent thermal stability
- Integral source-drain diode
- High input impedance and high gain
- Operating Temperature Range: -55°C to +150°C
- Package Option: TO-92
Features:
• $V_{DSS}$: 40V min
• $R_{DS(ON)}$: 1.8Ω max for TO-92 pkg
• $R_{DS(ON)}$: 2.0Ω max for SOT-89 pkg
• Low threshold: 1.6V max
• High input impedance
• Low input capacitance
• Fast switching speeds
• Low on-resistance
• Free from secondary breakdown
• Low input and output leakage
• Operating Temperature Range: -55°C to +150°C
• Package Option: TO-92, SOT-89
Features:
• $BV_{DSS}$: 60V min
• $R_{DS(ON)}$: 3.0Ω max
• Low threshold: 2.0V max
• High input impedance
• Low input capacitance: 50pF typ
• Fast switching speeds
• Low on-resistance
• Free from secondary breakdown
• Low input and output leakage
• Operating Temperature Range: -55°C to +150°C
• Package Option: TO-92
Features:

- \( BV_{DSS} \): 100V min
- \( R_{DS(ON)} \): 3.0\( \Omega \) max
- Low threshold: 2.0V max
- High input impedance
- Low input capacitance: 50pF typ
- Fast switching speeds
- Low on-resistance
- Free from secondary breakdown
- Low input and output leakage
- Operating Temperature Range: -55°C to +150°C
- Package Option: TO-92
Features:

- $B_{V_{DS}}$: 40V min
- $R_{DS(ON)}$: 0.75Ω max
- Low threshold: 1.6V max
- High input impedance
- Low input capacitance: 140pF typ
- Fast switching speeds
- Low on-resistance
- Free from secondary breakdown
- Low input and output leakage
- Operating Temperature Range: -55°C to +150°C
- Package Option: TO-92
Features:

- $B_{V_{DSS}}$: 60V min
- $R_{DS(ON)}$: 1.5Ω max
- Low threshold: 2.0V max
- High input impedance
- Low input capacitance: 100pF typ
- Fast switching speeds
- Low on-resistance
- Free from secondary breakdown
- Low input and output leakage
- Operating Temperature Range: -55°C to +150°C
- Package Option: TO-92
Features:

- $B_{V_{DSS}}$: 100V min
- $R_{DS(ON)}$: 1.5Ω max
- Low threshold: 2.0V max
- High input impedance
- Low input capacitance: 100pF typ
- Fast switching speeds
- Low on-resistance
- Free from secondary breakdown
- Low input and output leakage
- Operating Temperature Range: -55°C to +150°C
- Package Option: TO-92
Features:

- $\text{BV}_{\text{DSS}}$: 200V min
- $\text{R}_{\text{DS(ON)}}$: 6.0Ω max
- Low threshold: 1.6V max
- High input impedance
- Low input capacitance: 110pF typ
- Fast switching speeds
- Low on-resistance
- Free from secondary breakdown
- Low input and output leakage
- Operating Temperature Range: 
  -55°C to +150°C
- Package Option: TO-92
Features:

- $BV_{DSS}$: 20V min
- $R_{DS(ON)}$: 1.3Ω max
- Low threshold: 1.6V max
- High input impedance
- Low input capacitance: 130pF typ
- Fast switching speeds
- Low on-resistance
- Free from secondary breakdown
- Low input and output leakage
- Operating Temperature Range: -55°C to +150°C
- Package Option: TO-92
Features:

- **$B_{V_{DSS}}$: 60V min**
- **$R_{DS(ON)}$: 2.5Ω max**
- Free from secondary breakdown
- Low power drive requirement
- Ease of paralleling
- Low $C_{ISS}$ and fast switching speeds
- Excellent thermal stability
- Integral source-drain diode
- High input impedance and high gain
- Operating Temperature Range: -55°C to +150°C
- Package Option: TO-92, SOT-23
TN2124

Features:
- $B_{V_{DSS}}$: 240V min
- $R_{DS(ON)}$: 15Ω max
- Free from secondary breakdown
- Low power drive requirement
- Ease of paralleling
- Low $C_{ISS}$ and fast switching speeds
- Excellent thermal stability
- Integral source-drain diode
- High input impedance and high gain
- Operating Temperature Range: -55°C to +150°C
- Package Option: SOT-23
Features:
- $BV_{DSS}$: 300V min
- $R_{DS(ON)}$: 25Ω max
- Free from secondary breakdown
- Low power drive requirement
- Ease of paralleling
- Low $C_{ISS}$ and fast switching speeds
- Excellent thermal stability
- Integral source-drain diode
- High input impedance and high gain
- Operating Temperature Range: -55°C to +150°C
- Package Option: SOT-23
Features:
- $B_{V_{DSS}}$: 250V min
- $R_{DS(ON)}$: 3.5$\Omega$ max
- Low threshold
- High input impedance
- Low input capacitance
- Fast switching speeds
- Low on-resistance
- Free from secondary breakdown
- Low input and output leakage
- Operating Temperature Range: 
  -55°C to +150°C
- Package Option: SOT-89
Features:

- $BV_{DSS}$: 350V min
- $R_{DS(ON)}$: 6.0Ω max
- Low threshold
- High input impedance
- Low input capacitance
- Fast switching speeds
- Low on-resistance
- Free from secondary breakdown
- Low input and output leakage
- Operating Temperature Range: -55°C to +150°C
- Package Option: SOT-89
**Features:**
- $BV_{DSS}$: 18V min
- $R_{DS(ON)}$: 2.5Ω max
- Low threshold
- High input impedance
- Low input capacitance
- Fast switching speeds
- Low on-resistance
- Free from secondary breakdown
- Low input and output leakage
- Operating Temperature Range: -55°C to +150°C
- Package Option: SOT-89
Features:

- $BV_{DSS}$: 40V min
- $R_{DS(ON)}$: 1.0Ω max
- Low threshold: 1.6V max
- High input impedance
- Low input capacitance: 125pF max
- Fast switching speeds
- Low on-resistance
- Free from secondary breakdown
- Low input and output leakage
- Operating Temperature Range: -55°C to +150°C
- Package Option: SOT-89
Features:

- $B_{V_{DSS}}$: 100V min
- $R_{DS(ON)}$: 1.5Ω max
- Low threshold: 2.0V max
- High input impedance
- Low input capacitance: 125pF max
- Fast switching speeds
- Low on-resistance
- Free from secondary breakdown
- Low input and output leakage
- Operating Temperature Range: -55°C to +150°C
- Package Option: SOT-89
Features:

- $V_{DSS}$: 240V min
- $R_{DS(ON)}$: 6.0Ω max
- Low threshold: 2.0V max
- High input impedance
- Low input capacitance: 125pF max
- Fast switching speeds
- Low on-resistance
- Free from secondary breakdown
- Low input and output leakage
- Operating Temperature Range: -55°C to +150°C
- Package Option: SOT-89
Features:
- $BV_{DSS}$: 400V min
- $R_{DS(ON)}$: 12Ω max
- Low threshold: 2.0V max
- High input impedance
- Low input capacitance: 125pF max
- Fast switching speeds
- Low on-resistance
- Free from secondary breakdown
- Low input and output leakage
- Operating Temperature Range: -55°C to +150°C
- Package Option: TO-92, SOT-89
Features:

- $\text{BV}_{\text{DSS}}$: 400V min
- $R_{\text{DS(ON)}}$: 5.0Ω max
- Low threshold: 2.0V max
- High input impedance
- Low input capacitance
- Fast switching speeds
- Low on-resistance
- Free from secondary breakdown
- Low input and output leakage
- Operating Temperature Range: -55°C to +150°C
- Package Option: TO-252, TO-92, SOIC-8
Features:

- $B\!V_{DSS}$: 250V min
- $R_{DS(ON)}$: 7.0Ω max
- Low threshold: 2.0V max
- High input impedance
- Low input capacitance
- Fast switching speeds
- Low on-resistance
- Free from secondary breakdown
- Low input and output leakage
- Operating Temperature Range: -55°C to +150°C
- Package Option: SOT-23, TO-92, SOT-89
**TN5335**

**Features:**
- $B_{V_{DSS}}$: 350V min
- $R_{DS(ON)}$: 15Ω max
- Low threshold
- High input impedance
- Low input capacitance
- Fast switching speeds
- Low on-resistance
- Free from secondary breakdown
- Low input and output leakage
- Operating Temperature Range: -55°C to +150°C
- Package Option: SOT-23, SOT-89
Features:

- $BV_{DSS}$: 40V min
- $R_{DS(ON)}$: 3.0Ω max
- Free from secondary breakdown
- Low power drive requirement
- Ease of paralleling
- Low $C_{ISS}$ and fast switching speeds
- Excellent thermal stability
- Integral source-drain diode
- High input impedance and high gain
- Operating Temperature Range: -55°C to +150°C
- Package Option: TO-92
Features:

- $B_{V_{DSS}}$: 60V min
- $R_{DS(ON)}$: 3.0Ω max
- Free from secondary breakdown
- Low power drive requirement
- Ease of paralleling
- Low $C_{ISS}$ and fast switching speeds
- Excellent thermal stability
- Integral source-drain diode
- High input impedance and high gain
- Operating Temperature Range: -55°C to +150°C
- Package Option: TO-92
Features:
• $B_{V_{DSS}}$: 90V min
• $R_{DS(ON)}$: 3.0Ω max
• Free from secondary breakdown
• Low power drive requirement
• Ease of paralleling
• Low $C_{iss}$ and fast switching speeds
• Excellent thermal stability
• Integral source-drain diode
• High input impedance and high gain
• Operating Temperature Range:
  -55°C to +150°C
• Package Option: TO-92
Features:

- $BV_{DSS}$: 30V min
- $R_{DS(ON)}$: 1.2Ω max
- Free from secondary breakdown
- Low power drive requirement
- Ease of paralleling
- Low $C_{ISS}$ and fast switching speeds
- Excellent thermal stability
- Integral source-drain diode
- High input impedance and high gain
- Operating Temperature Range: -55°C to +150°C
- Package Option: TO-92
Features:

- $BV_{DSS}$: 500V min
- $R_{DS(ON)}$: 60Ω max
- Free from secondary breakdown
- Low power drive requirement
- Ease of paralleling
- Low $C_{ISS}$ and fast switching speeds
- Excellent thermal stability
- Integral source-drain diode
- High input impedance and high gain
- Operating Temperature Range: -55°C to +150°C
- Package Option: TO-92
Features:

- $B_{V_{DSS}}$: 60V min
- $R_{DS(ON)}$: 3.0Ω max
- Free from secondary breakdown
- Low power drive requirement
- Ease of paralleling
- Low $C_{ISS}$ and fast switching speeds
- Excellent thermal stability
- Integral source-drain diode
- High input impedance and high gain
- Operating Temperature Range: -55°C to +150°C
- Package Option: TO-92
Features:

- \( BV_{\text{DSS}} \): 80V min
- \( R_{\text{DS(ON)}} \): 4.0Ω max
- Free from secondary breakdown
- Low power drive requirement
- Ease of paralleling
- Low \( C_{\text{ISS}} \) and fast switching speeds
- Excellent thermal stability
- Integral source-drain diode
- High input impedance and high gain
- Operating Temperature Range: -55°C to +150°C
- Package Option: TO-92
Features:

- $B_{V_{DSS}}$: 120V min
- $R_{DS(ON)}$: 6.0Ω max
- Free from secondary breakdown
- Low power drive requirement
- Ease of paralleling
- Low $C_{ISS}$ and fast switching speeds
- Excellent thermal stability
- Integral source-drain diode
- High input impedance and high gain
- Operating Temperature Range: -55°C to +150°C
- Package Option: TO-92
VN2106

Features:
- $B_{V_{DSS}}$: 60V min
- $R_{DS(ON)}$: 4.0Ω max
- Free from secondary breakdown
- Low power drive requirement
- Ease of paralleling
- Low $C_{ISS}$ and fast switching speeds
- Excellent thermal stability
- Integral source-drain diode
- High input impedance and high gain
- Operating Temperature Range: -55°C to +150°C
- Package Option: TO-92
VN2110

Features:
- $B V_{DSS}$: 100V min
- $R_{DS(ON)}$: 4.0Ω max
- Free from secondary breakdown
- Low power drive requirement
- Ease of paralleling
- Low $C_{iss}$ and fast switching speeds
- High input impedance and high gain
- Operating Temperature Range: -55°C to +150°C
- Package Option: SOT-23
VN2210

Features:

- $B_{V_{DSS}}$: 100V min
- $R_{DS(ON)}$: 0.35Ω max
- Free from secondary breakdown
- Low power drive requirement
- Ease of paralleling
- Low $C_{ISS}$ and fast switching speeds
- Excellent thermal stability
- Integral source-drain diode
- High input impedance and high gain
- Operating Temperature Range: -55°C to +150°C
- Package Option: TO-39, TO-92
Features:

• $BV_{DSS}$: 60V min
• $R_{DS(ON)}$: 7.5Ω max
• Free from secondary breakdown
• Low power drive requirement
• Ease of paralleling
• Low $C_{ISS}$ and fast switching speeds
• Excellent thermal stability
• Integral source-drain diode
• High input impedance and high gain
• Operating Temperature Range: -55°C to +150°C
• Package Option: TO-92
Features:
- $B_V^DSS$: 240V min
- $R_{DS(ON)}$: 1.25$\Omega$ max
- Free from secondary breakdown
- Low power drive requirement
- Ease of paralleling
- Low $C_{ISS}$ and fast switching speeds
- Excellent thermal stability
- Integral source-drain diode
- High input impedance and high gain
- Operating Temperature Range: -55°C to +150°C
- Package Option: TO-92
Features:

- $B_{V_{DS}}$: 240V min
- $R_{DS(ON)}$: 6.0Ω max
- Free from secondary breakdown
- Low power drive requirement
- Ease of paralleling
- Low $C_{iss}$ and fast switching speeds
- Excellent thermal stability
- Integral source-drain diode
- High input impedance and high gain
- Operating Temperature Range: -55°C to +150°C
- Package Option: TO-92
Features:

- $B_{V_{DSS}}$: 240V min
- $R_{DS(ON)}$: 10Ω max
- Free from secondary breakdown
- Low power drive requirement
- Ease of paralleling
- Low $C_{iss}$ and fast switching speeds
- Excellent thermal stability
- Integral source-drain diode
- High input impedance and high gain
- Operating Temperature Range: -55°C to +150°C
- Package Option: TO-92
Features:

- $B_{V_{DSS}}$: 500V min
- $R_{DS(ON)}$: 13Ω max
- Free from secondary breakdown
- Low power drive requirement
- Ease of paralleling
- Low $C_{ISS}$ and fast switching speeds
- Excellent thermal stability
- Integral source-drain diode
- High input impedance and high gain
- Operating Temperature Range: -55°C to +150°C
- Package Option: TO-92, SOT-89
Features:

- $B_{V_{DSS}}$: 600V min
- $R_{DS(ON)}$: 20$\Omega$ max
- Free from secondary breakdown
- Low power drive requirement
- Ease of paralleling
- Low $C_{ISS}$ and fast switching speeds
- Excellent thermal stability
- Integral source-drain diode
- High input impedance and high gain
- Operating Temperature Range: -55°C to +150°C
- Package Option: TO-92, SOT-89
Features:

- $B_{V_{DSS}}$: 50V min
- $R_{DS(ON)}$: 0.3Ω max
- Free from secondary breakdown
- Low power drive requirement
- Ease of paralleling
- Low $C_{ISS}$ and fast switching speeds
- Excellent thermal stability
- Integral source-drain diode
- High input impedance and high gain
- Operating Temperature Range: -55°C to +150°C
- Package Option: TO-92, SOT-89
Features:

- $B_{V_{DSS}}$: 400V min
- $R_{DS(ON)}$: 12Ω max
- Free from secondary breakdown
- Low power drive requirement
- Ease of paralleling
- Low $C_{ISS}$ and fast switching speeds
- Excellent thermal stability
- Integral source-drain diode
- High input impedance and high gain
- Operating Temperature Range: -55°C to +150°C
- Package Option: TO-92
Features:

- 10 to 120V input voltage range
- Current-mode control
- High efficiency
- Up to 1.0MHz internal oscillator
- Internal start-up circuit
- Low internal noise
- 50% maximum duty cycle
- Operating Temperature Range: -55°C to +125°C
- Package Option: SOIC-14
HV9112

**Features:**
- 9.0 to 80V input voltage range
- Current-mode control
- High efficiency
- Up to 1.0MHz internal oscillator
- Internal start-up circuit
- Low internal noise
- 50% maximum duty cycle
- Operating Temperature Range: -55°C to +125°C
- Package Option: SOIC-14
HV9113

Features:

• 10 to 120V input voltage range
• Current-mode control
• High efficiency
• Up to 1.0MHz internal oscillator
• Internal start-up circuit
• Low internal noise
• 99% maximum duty cycle
• Operating Temperature Range: -55°C to +125°C
• Package Option: SOIC-14
HV9120

Features:
- 10 to 450V input voltage range
- <1.3mA supply current
- >1.0MHz clock
- >20:1 dynamic range @ 500KHz
- 49% Maximum duty cycle version
- Low internal noise
- Operating Temperature Range: -55°C to +125°C
- Package Option: SOIC-16
Features:
- 10 to 450V input voltage range
- <1.3mA supply current
- >1.0MHz clock
- >20:1 dynamic range @ 500kHz
- 99% Maximum duty cycle version
- Low internal noise
- Operating Temperature Range: -55°C to +125°C
- Package Option: SOIC-16
TD9944

Features:

- $B V_{\text{DSS}}$: 240V min
- $R_{DS(\text{ON})}$: 6Ω max
- Dual N-channel devices
- Low threshold: 2.0V max
- High input impedance
- Low input capacitance: 125pF max
- Fast switching speeds
- Low on-resistance
- Free from secondary breakdown
- Low input and output leakage
- Operating Temperature Range: -55°C to +150°C
- Package Option: SOIC-8
Features:

- N-Channel
  - $BV_{DSS}: 500\text{V min, } R_{DS(ON)}: 60\Omega \text{ max}$
- P-Channel
  - $BV_{DSS}: -500\text{V min, } R_{DS(ON)}: 125\Omega \text{ max}$
- Independent N- and P-channels
- Electrically isolated N- and P-channels
- Low input capacitance
- Fast switching speeds
- Free from secondary breakdowns
- Low input and output leakage
- Operating Temperature Range: -55°C to +150°C
- Package Option: SOIC-8
TC2320

Features:

- **N-Channel**
  - $BV_{DSS} : 200V\ min$, $R_{DS(ON)} : 7.0\ \Omega\ max$
- **P-Channel**
  - $BV_{DSS} : -200V\ min$, $R_{DS(ON)} : 12\ \Omega\ max$
- Low threshold
- Low on-resistance
- Low input capacitance
- Fast switching speeds
- Freedom from secondary breakdown
- Low input and output leakage
- Independent, electrically isolated N- and P-channels
- Low input and output leakage
- Operating Temperature Range:
  - $-55^\circ C\ to\ +150^\circ C$
- Package Option: SOIC-8
TC6215

Features:
- N-Channel
  - \(BVDSS: 150\,\text{V min, } R_{DS(ON)}: 4.0\,\Omega \text{ max}\)
- P-Channel
  - \(BVDSS: -150\,\text{V min, } R_{DS(ON)}: 7.0\,\Omega \text{ max}\)
- Back to back gate-source Zener diodes
- Guaranteed RDS(ON) at 4.0V gate drive
- Low threshold and low on-resistance
- Independent N- and P-channels
- Electrically isolated N- and P-channels
- Low input capacitance
- Fast switching speeds
- Free from secondary breakdowns
- Operating Temperature Range: -55°C to +150°C
- Package Option: SOIC-8
Features:

- N-Channel
  - $BV_{DSS} : 200V$ min, $R_{DS(ON)} : 7.0\,\Omega$ max
- P-Channel
  - $BV_{DSS} : -200V$ min, $R_{DS(ON)} : 8.0\,\Omega$ max
- Integrated GATE-to-SOURCE resistor
- Integrated GATE-to-SOURCE Zener diode
- Low threshold and low on-resistance
- Low input capacitance
- Fast switching speeds
- Free from secondary breakdown
- Low input and output leakage
- Independent, electrically isolated N- and P-channels
- Operating Temperature Range: -55°C to +150°C
- Package Option: SOIC-8, VDFN-8
TC7920

Features:

• N-Channel
  • $BV_{DSS}$: 200V min, $R_{DS(ON)}$: 7.0Ω max
• P-Channel
  • $BV_{DSS}$: -200V min, $R_{DS(ON)}$: 8.0Ω max
• High voltage Vertical DMOS technology
• Integrated drain output high voltage diodes
• Integrated gate-to-source resistor
• Integrated gate-to-source Zener diode
• Low threshold, Low on-resistance
• Low input & output capacitance
• Fast switching speeds
• Electrically isolated N- and P-MOSFET pairs
• Operating Temperature Range: -55°C to +150°C
• Package Option: VDFN-12
TC8020

Features:

- N-Channel
  - $BV_{DSS}: 200\text{V min, } R_{DS(ON)}: 8.0\Omega\text{ max}$
- P-Channel
  - $BV_{DSS}: -200\text{V min, } R_{DS(ON)}: 9.5\Omega\text{ max}$
- High voltage, vertical DMOS technology
- Integrated gate-to-source resistor
- Integrated gate-to-source Zener diode
- Typical peak output $+/-3.5\text{A at 50V}$
- Low threshold, low on-resistance
- Low input & output capacitance
- Fast switching speeds
- Electrically isolated N- and P-MOSFET pairs
- Operating Temperature Range: -55$^\circ\text{C to } +150^\circ\text{C}$
- Package Option: VQFN-56
TC8220

Features:

- N-Channel
  - $BV_{DSS} : 200V$ min, $R_{DS(ON)} : 5.3\, \Omega$ max
- P-Channel
  - $BV_{DSS} : -200V$ min, $R_{DS(ON)} : 6.5\, \Omega$ max
- High voltage, vertical DMOS technology
- Integrated gate-to-source resistor
- Integrated gate-to-source Zener diode
- Typical peak output +/-3.5A at 50V
- Low threshold, low on-resistance
- Low input & output capacitance
- Fast switching speeds
- Electrically isolated N- and P-MOSFET pairs
- Operating Temperature Range: -55°C to +150°C
- Package Option: VDFN-12
MD0100 / MD0100D

Features:
- Up to ±100V input voltage protection
- Low on resistance - 15Ω typical
- Fast switching speed
- Effectively, a simple two terminal device
- No external supplies needed
- Dual & single channel versions of device
- Operating Temperature Range: 0°C to +125°C
- Package Option: DFN-8, SOT-89
**Features:**

- Up to ±100V input voltage protection
- Low on resistance - 15Ω typical
- Integrated clamp diodes
- Fast switching speed
- Four electrically isolated channels
- No external supplies needed
- Operating Temperature Range: 0°C to +125°C
- Package Option: DFN-18
MD0105

Features:
- Up to ±130V input voltage protection
- Low on resistance - 15Ω typical
- Fast switching speed
- Four electrically isolated channels
- No external supplies needed
- Operating Temperature Range: 0°C to +125°C
- Package Option: DFN-18
MD1210

Features:
- 6ns rise and fall time with 1000pF load
- 2.0A peak output source/sink current
- 1.2V to 5.0V input CMOS compatible
- 4.5V to 13V single positive supply voltage
- Smartlogic threshold
- Low jitter design
- Two matched channels
- Outputs can swing below ground
- Low inductance package
- Thermally-enhanced package
- Operating Temperature Range:
  -20°C to +85°C
- Package Option: QFN-12
MD1211

Features:
- 10ns average rise and fall time with 1000pF load
- 2.0A peak output source/sink current
- 1.8 to 5.0V input CMOS compatible
- 4.5 to 13V total supply voltage
- Dual matched channels
- Reduced clock skew
- Low input capacitance
- Operating Temperature Range: -20°C to +85°C
- Package Option: SOIC-8
Features:

- 6.0ns rise and fall time with 1000pF load
- 2.0A peak output source/sink current
- 1.8 to 5.0V input CMOS compatible
- 4.5 to 13V total supply voltage
- Smart logic threshold
- Low jitter design
- Two matched channels
- Outputs can swing below ground
- Low inductance package
- Thermally-enhanced package
- Operating Temperature Range: -20°C to +85°C
- Package Option: QFN-12
MD1810

Features:
- 6.0ns rise and fall time with 1000pF load
- 2.0A peak output source/sink current
- 1.8 to 5.0V input CMOS compatible
- 5.0 to 12V total supply voltage
- Smart logic threshold
- Low jitter design
- Four matched channels
- Outputs can swing below ground
- Output is high impedance when disabled
- Low inductance package
- Operating Temperature Range:
  -20°C to +85°C
- Package Option: QFN-16
MD1811

Features:

- 6.0ns rise and fall time
- 2.0A peak output source/sink current
- 1.8 to 5.0V input CMOS compatible
- 5.0 to 12V total supply voltage
- Smart logic threshold
- Low jitter design
- Quad matched channels
- Drives two P- and two N-channel MOSFETs
- Outputs can swing below ground
- Low inductance quad flat no-lead package
- Operating Temperature Range: -20°C to +85°C
- Package Option: QFN-16
MD1812

Features:
- 6.0ns rise and fall time
- 2.0A peak output source/sink current
- 1.8 to 5.0V input CMOS compatible
- Smart logic threshold
- Low jitter design
- Quad matched channels
- Drives two N and two P-channel MOSFETs
- Outputs can swing below ground
- Built-in level translator for negative gate bias
- User-defined damping for return-to-zero application
- Low inductance quad flat no-lead package
- Operating Temperature Range:
  - -25°C to +125°C
- Package Option: QFN-16
Features:
- 6ns rise and fall time
- 2.0A peak output source/sink current
- 1.8 to 5.0V input CMOS compatible
- Smart Logic threshold
- Low jitter design
- Quad matched channels
- Drives two N and two P-channel MOSFETs
- Outputs can swing below ground
- Built-in level translator for negative gate bias
- Non-inverting gate driver OUTD for easy logic
- Operating Temperature Range:
  -20°C to +85°C
- Package Option: QFN-16
MD1820

Features:

- Non-inverting, four channel MOSFET driver
- 6.0ns rise and fall time
- 2.0A peak output source/sink current
- 1.8 to 5.0V input CMOS compatible
- 5.0 to 10V total supply voltage
- Smart logic threshold
- Low jitter design
- Four matched channels
- Drives two P- and two N-channel MOSFETs
- Outputs can swing below ground
- Operating Temperature Range: -20°C to +85°C
- Package Option: QFN-16
Features:
- Inverting MOSFET driver
- 6.0ns rise and fall time
- 2.0A peak output source/sink current
- 1.8 to 5.0V input CMOS compatible
- 5.0 to 10V total supply voltage
- Smart logic threshold
- Low jitter design
- Four matched channels
- Drives two P- and two N-channel MOSFETs
- Outputs can swing below ground
- Operating Temperature Range: 20°C to +85°C
- Package Option: QFN-16
MD1822

Features:
- Mixed inversion MOSFET driver
- 6.0ns rise and fall time
- 2.0A peak output source/sink current
- 1.8 to 5.0V input CMOS compatible
- 5.0 to 10V total supply voltage
- Smart logic threshold
- Low jitter design
- Four matched channels
- Drives two P- and two N-channel MOSFETs
- Outputs can swing below ground
- Operating Temperature Range: -20°C to +85°C
- Package Option: QFN-16
MD1711

Features:
- Drives two ultrasound transducer channels
- Generates 5-level waveform
- Drives 12 high voltage MOSFETs
- ±2.0A source and sink peak current
- Up to 20MHz output frequency
- 12V/ns slew rate
- ±3ns matched delay times
- Second harmonic is less than -40dB
- Two separate gate drive voltages
- 1.8 to 3.3V CMOS logic interface
- Operating Temperature Range: 0°C to +125°C
- Package Option: LQFP-48, QFN-48
Features:

- Drives two ultrasound transducer channels
- Generates five-level waveform
- Drives 12 high voltage MOSFETs
- ±2.0A source and sink peak current
- Up to 20MHz output frequency
- 12V/ns slew rate
- ±3.0ns matched delay times
- Second harmonic is less than -40dB
- Two separate gate drive voltages
- 1.8 to 3.3V CMOS logic interface
- Operating Temperature Range: 0°C to +125°C
- Package Option: LQFP-48, QFN-48
Features:

- Advanced CMOS technology
- ±4.75 to 12.9V gate drive voltage
- 2A output source and sink current
- 6.5ns rise and fall time with 1nF load
- 10ns propagation delay
- ±2ns matched delay times
- 12 matched channels
- 1.8V to 3.3V CMOS logic interface
- Smart logic threshold
- Low inductance package
- Operating Temperature Range: 0°C to +70°C
- Package Option: QFN-40
Features:

- Advanced CMOS technology
- 4.5 to 12.5V power supply voltage
- 2.0A output source and sink current
- 6.5ns rise and fall time with 1.0nF load
- 10ns propagation delay
- ±2ns matched delay times
- 12 matched channels
- 1.8 to 3.3V CMOS logic interface
- Smart logic threshold
- Operating Temperature Range: 0°C to +125°C
- Package Option: QFN-40
Features:

- High resolution transmitting waveform
- Up to 3.0A push-pull source-driving current
- 230VP-P maximum output, uses two DN2625 FETs
- Angle vector beamforming I-Q switcher matrix
- 8-bit apodization DAC and 7.5° angular resolution
- Flexible frequency-resolution trade-off
- Programmable aperture windowing
- 250MHz maximum sampling rate
- 25MHz ultrasound maximum frequency
- PWM modulation push-pull current source
- Focusing phase adjustment & chirp waveform
- Fast SPI interface
- 2.5V CMOS logic interface
- +5.0V single power supply
- Low second order harmonic distortions
- Operating Temperature Range:
  0°C to +70°C
- Package Option: QFN-40
Features:

- Multiple-level ultrasound pulser
- Fast switching current source for push-pull topology
- 250MHz maximum frequency, 4.0ns input to output delay
- 15 independent programmable output level registers
- Pulse amplitude modulation (PAM) with 8-bit resolution
- 8-bit apodization DAC for peak output current via SPI
- Very low second order harmonic distortion
- Picoseconds time-jitter from input to output
- Fast SPI write and read-back of level & DAC registers
- +5.0V power supply, 2.5V CMOS logic interface
- Drives DN2625 MOSFETs output up to 230VP-P
- Programmable aperture windowing
- Operating Temperature Range: 0°C to +70°C
- Package Option: QFN-40
Features:
- Low phase noise
- 100V open drain N-channel
- High speed D flip-flop
- High speed MOSFET gate driver
- Up to 200MHz clock input
- VDD and VLL undervoltage lockout
- Operating Temperature Range: 0°C to +70°C
- Package Option: QFN-24
Features:

- HVCMOS® technology for high performance
- High density integration AC coupled pulser
- 0 to ±100V output voltage
- ±2.5A source and sink minimum pulse current
- Up to 35MHz operating frequency
- 2.0ns matched delay times
- 2.5, 3.3 or 5.0V CMOS logic interface
- Low power consumption and very simple to use
- Operating Temperature Range: 0°C to +70°C
- Package Option: LFGA-22
Features:
- HVCMOS® technology for high performance
- High density integration AC coupled pulser
- 0 to ±100V output voltage
- ±2.5A source and sink minimum pulse current
- Up to 35MHz operating frequency
- 2.0ns matched delay times
- 2.5, 3.3 or 5.0V CMOS logic interface
- Built-in two terminal, low noise T/R switch
- Low power consumption and very simple to use
- Operating Temperature Range:
  0°C to +70°C
- Package Option: LFGA-22
HV7331

Features:

- HVCMOS technology for high performance
- High density integrated ultrasound transmitter
- 0 to ±70V output voltage
- ±2.0A source and sink minimum pulse current
- Up to 20MHz operation frequency
- ±2.5ns matched delay times
- 2.5 to 5.0V CMOS logic interface
- Built-in output drain diode and bleed resistors
- CW/RTZ Doppler quick switching
- Two damping mode options
- Operating Temperature Range: 0°C to +70°C
- Package Option: QFN-64
Features:

- HVCMOS technology for high performance
- High density integration ultrasound transmitter
- 0 to ±65V output voltage
- ±750mA source and sink current in Pulse mode
- ±110mA source and sink current in CW mode
- Up to 20MHz operating frequency
- Matched delay times
- 1.2 to 5.0V CMOS logic interface
- Built-in output drain bleed resistors
- Operating Temperature Range: 0°C to +70°C
- Package Option: QFN-48
Features:

- HVCMOS technology for high performance
- High density integration ultrasound transmitter
- 0 to ±75V output voltage
- ±1.25A source and sink current in pulse mode
- ±400mA source and sink current in CW mode
- Up to 20MHz operating frequency
- Matched delay times
- 1.2V to 5.0V CMOS logic interface
- Built-in output drain bleed resistors
- Operating Temperature Range: 0°C to +70°C
- Package Option: QFN-48
Features:

- HVCMOS technology for high performance
- High density integrated ultrasound transmitter
- 0 to ±60V output voltage
- ±1.0A source and sink current in pulse mode
- ±1.0A source and sink current in RTZ mode
- Up to 20MHz operating frequency
- Matched delay times
- Optional clock re-alignment
- 3.3V CMOS logic interface and reference
- +3.3V low voltage supply for VDD
- Built-in linear regulators for floating gate driver
- Built-in output drain diodes & bleed resistors
- Operating Temperature Range:
  0°C to +70°C
- Package Option: QFN-56
Features:

- HVCMOS technology for high performance
- High density integrated ultrasound transmitter
- 0 to +150V output voltage
- ±1.5A source and sink current (min.)
- ±300mA current in CW mode
- Up to 18MHz operating frequency
- Matched delay times
- Built-in gate driver floating voltage regulator
- 2.5 to 3.3V CMOS logic interface
- Operating Temperature Range: 0°C to +70°C
- Package Option: QFN-56
Features:

- HVCMOS® technology for high performance
- Very low quiescent power dissipation (-10µA)
- Output on-resistance typically 22Ω
- Low parasitic capacitances
- DC to 50MHz small signal frequency response
- -60dB typical output off isolation at 5.0MHz
- CMOS logic circuitry for low power
- Excellent noise immunity
- On-chip shift register, latch and clear logic circuitry
- Flexible high voltage supplies
- Operating Temperature Range:
  0°C to +70°C
- Package Option: LQFP-48, PLCC-28
Features:

- HVCMOS® technology for high performance
- Very low quiescent power dissipation (-10µA)
- Output on-resistance typically 22Ω
- Low parasitic capacitances
- DC to 50MHz small signal frequency response
- -60dB typical output off isolation at 5.0MHz
- CMOS logic circuitry for low power
- Excellent noise immunity
- On-chip shift register, latch and clear logic circuitry
- Flexible high voltage supplies
- Operating Temperature Range: 0°C to +70°C
- Package Option: PLCC-28
Features:

- HVCMOS® technology for high performance
- 220V operating conditions
- Output on-resistance typically 22Ω
- 5.0 and 12.0V CMOS logic compatibility
- Very low quiescent current consumption (-10µA)
- -45dB min off isolation at 7.5MHz
- Low parasitic capacitance
- Excellent noise immunity
- Flexible high voltage supplies
- Operating Temperature Range: 0°C to +70°C
- Package Option: LQFP-48
Features:

- HVCMOS® technology for high performance
- Operating voltage of up to 200V
- Output on-resistance typically 22Ω
- Integrated bleed resistors on the outputs
- 5.0V to 12.0V CMOS logic compatibility
- Very low quiescent current consumption
- -58dB typical off isolation at 5.0MHz
- Low parasitic capacitance
- Excellent noise immunity
- Flexible high voltage supplies
- Operating Temperature Range: 0°C to +70°C
- Package Option: LQFP-48
Features:

- HVCMOS® technology for high performance
- Very low quiescent power dissipation
- Low parasitic capacitances
- DC to 50MHz small signal frequency response
- -60dB typical output off isolation at 5.0MHz
- CMOS logic circuitry for low power
- Excellent noise immunity
- On-chip shift register, latch and clear logic circuitry
- Flexible high voltage supplies
- Surface mount packages
- Operating Temperature Range: 0°C to +70°C
- Package Option: LQFP-48, PLCC-28
Features:

- HVCMOS® technology for high performance
- Very low quiescent power dissipation
- Output on-resistance typically 11Ω
- Low parasitic capacitance
- DC to 50MHz small signal frequency response
- -60dB typical off-isolation at 5.0MHz
- CMOS logic circuitry for low power
- Excellent noise immunity
- Serial shift register logic control with latches
- Flexible operating supply voltages
- Surface mount packages
- Operating Temperature Range: 0°C to +70°C
- Package Option: LQFP-48, PLCC-28
HV2201 / HV2301

Features:

- HV2201 without bleed resistors
- HV2301 with integrated bleed resistors
- HVCMOS technology for high performance
- 8 Channels of high voltage analog switch
- 3.3 or 5.0V CMOS input logic level
- 20MHz data shift clock frequency
- Very low quiescent power dissipation
- Low parasitic capacitance
- DC to 50MHz analog signal frequency
- -60dB typical off-isolation at 5MHz
- CMOS logic circuitry for low power
- Excellent noise immunity
- Cascadable serial data register with latches
- Flexible operating supply voltages
- Operating Temperature Range: 0°C to +70°C
- Package Option: LQFP-48, PLCC-28
HV2221 / HV2321

Features:

- HV2221 without bleed resistors
- HV2321 with bleed resistors
- Low on-resistance, 14Ω max.
- HVCMOS technology for high performance
- 3.3 or 5.0V CMOS input logic level
- 20MHz data shift clock frequency
- Very low quiescent power dissipation
- Low parasitic capacitance
- DC to 50MHz small signal frequency response
- -60dB typical off-isolation at 5MHz
- CMOS logic circuitry for low power
- Excellent noise immunity
- Cascadable serial data register with latches
- Flexible operating supply voltages
- Operating Temperature Range: 0°C to +70°C
- Package Option: LQFP-48
HV230

Features:
- HVCMOS® technology for high performance
- Very low quiescent power dissipation (-10µA max.)
- Output on-resistance typically (22Ω typ.)
- Integrated bleed resistors on the outputs
- Low parasitic capacitances
- DC to 50MHz small signal frequency response
- 60dB typical output OFF isolation at 5.0MHz
- CMOS logic circuitry for low power
- Excellent noise immunity
- ON-chip shift register, latch and clear logic circuitry
- Flexible high voltage supplies
- Operating Temperature Range: 0°C to +70°C
- Package Option: LLGA-26
HV232

Features:
- HVCMOS® technology for high performance
- Very low quiescent power dissipation (10µA max.)
- Output on-resistance (22Ω typ.)
- Integrated bleed resistors on the outputs
- Low parasitic capacitances
- DC to 50MHz small signal frequency response
- -60dB typical output off isolation at 5.0MHz
- CMOS logic circuitry for low power
- Excellent noise immunity
- On-chip shift register, latch and clear logic circuitry
- Flexible high voltage supplies
- Operating Temperature Range:
  0°C to +70°C
- Package Option: LQFP-48, PLCC-28
**HV238**

**Features:**
- HVCMOS® technology for high performance
- 220V operating conditions
- Output on-resistance typically 22Ω
- Integrated bleed resistors on the outputs
- 5.0 and 12.0V CMOS logic compatibility
- Very low quiescent power dissipation (-10µA)
- -45dB min off isolation at 7.5MHz
- Low parasitic capacitance
- Excellent noise immunity
- Flexible operating supply voltages
- Operating Temperature Range: 0°C to +70°C
- Package Option: LQFP-48
HV2601 / HV2701

Features:

• HV2601 without bleed resistors
• HV2701 with bleed resistors
• HVCMOS technology for high performance
• Integrated bleed resistors on the outputs
• 16-channel high voltage analog switch
• 3.3V input logic level compatible
• 20MHz data shift clock frequency
• Very low quiescent power dissipation (-10µA)
• Low parasitic capacitance
• DC to 50MHz small signal frequency response
• -60dB typical OFF-isolation at 5.0MHz
• CMOS logic circuitry for low power
• Excellent noise immunity
• Cascadable serial data register with latches
• Flexible operating supply voltages
• Operating Temperature Range:
  0°C to +70°C
• Package Option: LQFP-48, Bumped Die
HV2605 / HV2705

Features:

- HV2605 is without bleed resistors
- HV2705 is with bleed resistors
- HVCMOS technology for high performance
- Integrated bleed resistors on the outputs
- 16-channel high voltage analog switch
- 3.3V input logic level compatible
- 20MHz data shift clock frequency
- Very low quiescent power dissipation (-10μA)
- Low parasitic capacitance
- DC to 50MHz small signal frequency response
- -60dB typical off-isolation at 5.0MHz
- CMOS logic circuitry for low power
- Low harmonic distortion
- Cascadable serial data register with latches
- Flexible operating supply voltages
- Operating Temperature Range:
  0°C to +70°C
- Package Option: LQFP-48
 Features:

- HV2631 without bleed resistors
- HV2731 with bleed resistors
- HVCMOS® technology for high performance
- 220V operating conditions
- 22Ω typical output on-resistance
- Integrated bleed resistors on the outputs
- 3.3V and 5.0V CMOS logic compatibility
- Very low quiescent power dissipation (-10µA)
- -45dB min off isolation at 7.5MHz
- Low parasitic capacitance
- Excellent noise immunity
- Flexible operating supply voltages
- 48-lead LQFP package
- Operating Temperature Range:
  0°C to +70°C
- Package Option: LQFP-48
Features:

- HV2661 without bleed resistors
- HV2761 with bleed resistors
- 24-channel high voltage analog switch
- Integrated bleed resistors on the outputs
- 3.3 or 5.0V CMOS input logic level
- 3:1 MUX-deMUX with 8 states
- 20MHz data shift clock frequency
- HVCMOS technology for high performance
- Very low quiescent power dissipation, 10µA
- Low parasitic capacitance
- DC to 50MHz analog signal frequency
- -60dB typical OFF-isolation at 5.0MHz
- CMOS logic circuitry for low power
- Excellent noise immunity
- Cascadable serial data register with latches
- Flexible operating supply voltages
- Operating Temperature Range: 0°C to +70°C
- Package Option: LQFP-48
Features:

- HV2662 without bleed resistors
- HV2762 with bleed resistors
- 24 Channels of high voltage analog switch
- Integrated bleed resistors on the outputs
- 3.3 or 5.0V CMOS input logic level
- 24 Channel SPST configuration
- 20MHz data shift clock frequency
- HVCMOS technology for high performance
- Very low quiescent power dissipation - (10µA)
- Low parasitic capacitance
- DC to 50MHz analog signal frequency
- -60dB typical OFF-isolation at 5.0MHz
- CMOS logic circuitry for low power
- Excellent noise immunity
- Cascadable serial data register with latches
- Flexible operating supply voltages
- Operating Temperature Range:
  0°C to +70°C
- Package Option: LFGA-64
Features:

- Low harmonic distortion
- Integrated bleed resistors on the outputs
- 3.3 or 5.5V CMOS input logic level
- 20MHz data shift clock frequency
- HVCMOS technology for high performance
- Very low quiescent power dissipation (-10µA)
- Low parasitic capacitance
- DC to 50MHz small signal frequency response
- CMOS logic circuitry for low power
- Excellent noise immunity
- Cascadable serial data register with latches
- Flexible operating supply voltages
- Operating Temperature Range: 0°C to +70°C
- Package Option: LQFP-48
Features:

- HV2801 without bleed resistors
- HV2901 with bleed resistors
- 32-channel high voltage analog switch
- Integrated bleed resistors on the outputs
- 2:1 Multiplexer / Demultiplexer
- 3.3V or 5.0V CMOS input logic level
- 20MHz data shift clock frequency
- HVCMOS technology for high performance
- Very low quiescent power dissipation -10µA
- Low parasitic capacitance
- DC to 50MHz analog signal frequency
- -60dB typical OFF-isolation at 5.0MHz
- CMOS logic circuitry for low power
- Excellent noise immunity
- Cascadable serial data register with latches
- Flexible operating supply voltages
- Operating Temperature Range:
  0°C to +70°C
- Package Option: QFN-64
**Features:**

- 32 Channels of high voltage analog switch
- 2:1 Multiplexer / Demultiplexer
- 3.3 or 5.0V CMOS input logic level
- HVCMOS technology for high performance
- Very low quiescent power dissipation -10µA
- Low parasitic capacitance
- DC to 50MHz analog signal frequency
  - -60dB typical OFF-isolation at 5.0MHz
- CMOS logic circuitry for low power
- Excellent noise immunity
- Flexible operating supply voltages
- Operating Temperature Range:
  0°C to +70°C
- Package Option: QFN-56
HV2809

Features:

- 32-channel high voltage analog switch
- 2:1 multiplexer/demultiplexer
- Enable control for all-OFF state
- 3.3 or 5.0V CMOS input logic level
- HVCMOS technology for high performance
- Very low quiescent power dissipation, 10µA
- Low parasitic capacitance
- DC to 50MHz analog signal frequency
- -60dB typical OFF-isolation at 5.0MHz
- CMOS logic circuitry for low power
- Excellent noise immunity
- Flexible operating supply voltages
- Operating Temperature Range: 0°C to +70°C
- Package Option: QFN-56
HT18

Features:
- 350V breakdown voltage
- 18Ω maximum switch resistance
- Current limiting protection
- Operates at 2.3V input
- Operating Temperature Range: -0°C to +150°C
- Package Option: SOIC-8
Features:

- 350V breakdown voltage
- 18Ω maximum switch resistance
- Current limiting protection
- Operates at 2.3V input
- Operating Temperature Range: -0°C to +150°C
- Package Option: SOIC-8
HV7100

Features:

- High-side drive allows use of tachs
- Direct interface to host controller
- Noise-immune linear speed control
- 4-bit digital speed control
- Operates from single +24/+48V supply
- Programmable PWM frequency
- Undervoltage lockout
- Operating Temperature Range: -40°C to +85°C
- Package Option: SOIC-14
FP0100

Features:

• Up to 100V input voltage protection
• Low on resistance – 4.0Ω typical
• Fast switching speed
• No external supplies needed
• Operating Temperature Range: -40°C to +125°C
• Package Option: SOT-89
HV7800

Features:

- Supply voltage 8.0 to 450V
- Voltage output device
- Typical gain 1.0 ±1%
- Max VSENSE 500mV
- Fast rise and fall times, 700ns to 2.0μs
- Maximum quiescent current 50μA
- Operating Temperature Range:
  - -40°C to +125°C
- Package Option: 5L SOT-23
Features:

- Supply voltage 8.0 to 450V
- Voltage output device
- Typical gain 5.0 ±1%
- Max VSENSE 500mV
- Fast rise and fall times, 700ns to 2.0μs
- Maximum quiescent current 50μA
- Operating Temperature Range: -40°C to +125°C
- Package Option: 5L SOT-23
HV7802

Features:
- Supply voltage 8V to 450V
- Configurable as a current or voltage output device
- Maximum sense amplifier offset of 15mV
- Max VSENSE of 500mV
- Fast rise and fall times, from 700ns to 2.0µs
- Maximum quiescent current of 50µA
- Operating Temperature Range: -40°C to +125°C
- Package Option: MSOP-8
Features:

- Drives capacitive loads up to 200pF
- Programmable drive amplitude (compatible with 40VRMS to 60VRMS lenses)
- On-chip boost converter
- No external inductor
- I²C interface
- Low operating current (≤20mA)
- Low standby current (≤1.0µA)
- Controlled drive edge reduces EMI
- Operating Temperature Range: -40°C to +85°C
- Package Option: WDFN-10
HV254

Features:

• 32 independent high voltage amplifiers
• Up to 250V output voltage
• 3.0V/µs typical output slew rate
• Very low operating current (typically 45µA per channel)
• High value internal feedback resistors
• Fixed gain of 50V/V
• Integrated silicon diode for temperature sensing
• Operating Temperature Range: -10°C to +125°C
• Package Option: MQFP-100
**HV256**

**Features:**
- 32 independent high voltage amplifiers
- 300V operating voltage
- 295V output voltage
- 2.2V/µs typical output slew rate
- Adjustable output current source limit
- Adjustable output current sink limit
- Internal closed loop gain of 72V/V
- 12MΩ feedback impedance
- Operating Temperature Range: -10°C to +85°C
- Package Option: MQFP-100
Features:
- 32 independent high voltage amplifiers
- 300V operating voltage
- 295V output voltage
- 2.2V/µs typical output slew rate
- Adjustable output current source limit
- Adjustable output current sink limit
- Internal closed loop gain of 72V/V
- 12MΩ feedback impedance
- Layout ideal for die applications
- Operating Temperature Range: -10°C to +85°C
- Package Option: MQFP-100
HV264

Features:

- Four independent high voltage amplifiers
- 190V output swing
- 9.0V/μs typical output slew rate
- Fixed gain of 66.7V/V
- High value internal feedback resistors
- Very low operating current
- Operating Temperature Range: -40°C to +100°C
- Package Option: TSSOP-24
Features:

- 10 to 450V input voltage range
- Energy saving hold current mode
- Adjustable microcontroller supply
- Low supply current <1.0mA
- Constant current coil
- Programmable pull-in current, pull-in time, and hold current
- Efficient PWM operation using the relay coils’ inductance
- Operating Temperature Range: -40°C to +85°C
- Package Option: SOIC-16
Features:

- 105Vrms ring signal
- Output over current protection
- 5.0V CMOS logic control
- Logic enable/disable to save power
- Adjustable deadband in single-control mode
- Power-on reset
- Fault output for problem detection
- Operating Temperature Range: -40°C to +85°C
- Package Option: SOIC-20 (300mil)
Features:

- 3.3V operation, logic inputs 3.3V & 5.0V compatible
- Digital control of ring frequency, amplitude and offset
- Control via 8-bit bus or via individual inputs
- 8 built-in ring frequencies: 12, 16\(\frac{2}{3}\), 20, 25, 33\(\frac{1}{3}\), 40, 50, 60Hz
- External ring frequency input
- Low distortion sine wave synthesizer
- AC-only, AC+DC, or DC-only ringer output
- Adjustable over-current protection
- Internal precision voltage references
- Power-on reset and undervoltage lockout for hotswap capability
- Sync output with adjustable lead time for synchronizing ringing relays
- Fault output for problem detection
- Open or closed loop operation
- Efficient 4-quadrant operation
- Zero-cross turn-on with zero-cross turn-off option
- Operating Temperature Range:
  - -40°C to +85°C
- Package Option: LQFP-48
Features:

• ±400V input to output isolation
• ±700V isolation between outputs
• No external voltage supply required
• Dual isolated output drivers
• Option of internal or external clock
• Operating Temperature Range: -40°C to +85°C
• Package Option: VDFN-10, SOIC-8
HT0740

Features:
- ±400V input to output isolation
- Low input logic current, 500µA max
- No external voltage supply required
- Floating isolated output drivers
- 5.0V logic compatible
- Operating Temperature Range: -40°C to +85°C
- Package Option: SOIC-8
**HV9150**

**Features:**
- Wide output voltage range: 6V to 500V
- Low input voltage: 2.7V
- 5W maximum output power with external MOSFET driver
- Built-in charge pump converter for the gate driver
- Programmable switching frequency from 40kHz to 400kHz
- Four programmable duty cycles from 50% to 87.5%
- FB return ground switch for power savings applications
- Built-in delay timer for internal protection
- Non-isolated DC/DC converter
- Processed with HVCMOS® technology
- Operating Temperature Range: -25°C to +125°C
- Package Option: QFN-16
HV509

Features:
- Output voltage up to +200V
- Shift register speed 500kHz @ $V_{DD} = 2.0V$
- 16 high voltage outputs
- High voltage backplane driver
- CMOS input levels
- Operating Temperature Range: -40°C to +125°C
- Package Option: VQFN-32
HV528

Features:
- Output voltage up to +200V
- Shift register speed 500kHz @ VDD = 1.7V
- 16 high voltage outputs
- High voltage backplane driver
- CMOS input levels
- Operating Temperature Range: -40°C to +125°C
- Package Option: VQFN-32
HV809

Features:
- Input voltage up to 200V DC
- 400V peak-to-peak output voltage
- Output load up to 350nF (100in² for 3.5nF/in² lamp)
- Adjustable output lamp frequency
- Adjustable on/off pulsing frequency
- Operating Temperature Range: -25°C to +85°C
- Package Option: SOIC-8, SOIC-8 w/HS
Features:

- 360V$_{pp}$ output voltage for high brightness
- Large output load capability of up to 150nF
- 2.7 to 5.5V operating supply voltage
- Single lithium ion cell compatible
- Adjustable output regulation for dimming
- External switching MOSFET
- Low audible noise
- Output discharge slew rate control
- 1.5V logic
- Dedicated Enable pin
- Two EL frequency controls
- Independent lamp and converter frequency setting
- Split supply capability
- Operating Temperature Range:
  - -40°C to +125°C
- Package Option: QFN-16
**Features:**

- 2.0 to 9.5V operating supply voltage
- DC to AC conversion
- 180V peak-to-peak typical output voltage
- Large output load capability typically 50nF
- Permits the use of high-resistance elastomeric lamp components
- Adjustable output lamp frequency to control lamp color, lamp life, and power consumption
- Adjustable converter frequency to eliminate harmonics and optimize power consumption
- Enable/disable function
- Low current draw under no load condition
- Operating Temperature Range:
  - -25°C to +85°C
- Package Option: SOIC-8
Features:
- 1.0 to 1.6V operating supply voltage
- DC to AC conversion
- Output load of typically up to 6.0nF
- Adjustable output lamp frequency
- Adjustable converter frequency
- Enable function
- Operating Temperature Range: -25°C to +85°C
- Package Option: SOIC-8, MSOP-8
HV830

Features:
- 2.0 to 9.5V operating supply voltage
- DC to AC conversion
- 200V peak-to-peak typical output voltage
- Large output load capability typically 50nF
- Permits the use of high-resistance elastomeric lamp components
- Adjustable output lamp frequency to control lamp color, lamp life, and power consumption
- Enable/disable function
- Low current draw under no load condition
- Very low standby current - 30nA typical
- Operating Temperature Range: -25°C to +85°C
- Package Option: SOIC-8, MSOP-8
Features:

- 1.8 to 6.5V operating supply voltage
- DC to AC conversion
- Separately adjustable lamp and converter frequency
- Output voltage regulation
- Enable/disable function
- Patented output timing for high efficiency
- <100nA shutdown current
- Split supply capability
- LCD backlighting
- Operating Temperature Range: -40°C to +85°C
- Package Option: MSOP-8
HV850

Features:

- No external components required when using an external EL clock frequency
- EL frequency can be set by an external resistor
- Low noise
- DC to AC converter
- Drives up to 5.0nF load (approx. 1.5in² lamp)
- Output voltage regulation
- Enable function
- EL Lamp dimming
- Operating Temperature Range: -25°C to +85°C
- Package Option: MSOP-8
HV852

Features:
- No external components required when using an external EL clock frequency
- EL frequency can be set by an external resistor
- Low Noise
- DC to AC converter
- Drives up to 5.3nF (approx. 1.5in² lamp) load
- Output voltage regulation
- Enable function
- EL Lamp dimming
- Operating Temperature Range: -25°C to +85°C
- Package Option: MSOP-8, WDFN-10
**Features:**

- No external components required when using an external EL clock frequency
- Audible noise reduction with improved EMI
- EL frequency can be set by an external resistor
- DC to AC converter
- Drives up to 5.3nF (approx. 1.5in² lamp) load
- Output voltage regulation
- Enable function
- EL Lamp dimming
- Operating Temperature Range: -25°C to +85°C
- Package Option: MSOP-8, WDFN-10
Features:

- Patented audible noise reduction
- Patented lamp aging compensation
- Patented output timing for high efficiency
- $190 \, V_{pp}$ output voltage for higher brightness
- Single cell lithium ion compatible
- 150nA shutdown current
- Wide input voltage range 1.8V to 5.0V
- Separately adjustable lamp and converter frequencies
- Output voltage regulation
- Split supply capability
- Operating Temperature Range:
  - -40°C to +85°C
- Package Option: WDFN-8, MSOP-8
Features:

- Audible noise reduction
- 190 VPP output voltage for higher brightness
- Single cell lithium ion compatible
- 150nA shutdown current
- Wide input voltage range 1.8V to 5.0V
- Separately adjustable lamp and converter frequencies
- Output voltage regulation
- Split supply capability
- Operating Temperature Range:
  - -40°C to +85°C
- Package Option: WDFN-8, MSOP-8
HV859

**Features:**

- Patented audible noise reduction
- Patented lamp aging compensation
- Patented output timing for high efficiency
- 210 $V_{pp}$ output voltage for higher brightness
- Single cell lithium ion compatible
- 150nA shutdown current
- Wide input voltage range 1.8 to 5.0V
- Separately adjustable lamp and converter frequencies
- Output voltage regulation
- Split supply capability
- Operating Temperature Range: -40°C to +85°C
- Package Option: WDFN-8, MSOP-8
Features:

- Adjustable output regulation for dimming
- 220VPP output voltage for higher brightness
- Single cell lithium ion compatible
- 150nA shutdown current
- Separately adjustable lamp and converter frequencies
- Split supply capability
- Operating Temperature Range: -40°C to +85°C
- Package Option: WQFN-12
Features:
• Adjustable output regulation for dimming
• Lamp fade-in/fade-out capability
• Low audible noise
• 180VPP output voltage for higher brightness
• 1.5V enable input logic high
• Single cell lithium ion compatible
• One miniature inductor to power both lamps
• Separately adjustable lamp and converter frequencies
• Split supply capability
• Operating Temperature Range: -40°C to +85°C
• Package Option: WQFN-16
HV3418

Features:
- Output voltages to 180V
- Low power level shifting
- Shift register speed:
  - 6.0MHz @ VDD = 5.0V
  - 12MHz @ VDD = 12V
- Latched data outputs
- Output polarity and blanking
- CMOS compatible inputs
- Forward and reverse shifting option
- Operating Temperature Range: -40°C to +85°C
- Package Option: PQFP-80
HV507

Features:
- Operating output voltages to 300V
- Low power level shifting from 5.0 to 300V
- Shift register speed: 8.0MHz @ VDD = 5.0V
- 64 latched data outputs
- Output polarity and blanking
- CMOS compatible inputs
- Forward and reverse shifting options
- Operating Temperature Range: 0°C to +70°C
- Package Option: PQFP-80
HV508

Features:
- Logic-selectable output voltage
- 100nF drive capability
- Up to 90V_{P-P}
- 25μs response time
- Operating Temperature Range: -5°C to +60°C
- Package Option: SOIC-8
Features:

- Output voltages to 225V using a ramped supply voltage
- SINK current minimum 100mA
- Shift register speed 8.0MHz
- Strobe and enable inputs
- CMOS compatible inputs
- Forward and reverse shifting options
- Operating Temperature Range: -40°C to +85°C
- Package Option: PQFP-44, PLCC-44
HV513

Features:

- Operating output voltage of 250V
- Low power level shifting from 5.0 to 250V
- Shift register speed 8.0MHz @ VDD = 5.0V
- 8 latch data outputs
- Output polarity and blanking
- Output short circuit detect
- Output high-Z control
- CMOS compatible inputs
- Operating Temperature Range: -40°C to +85°C
- Package Option: WQFN-32, SOIC-24 (300mil)
**HV518**

**Features:**
- 32 output lines
- 90V output swing
- Active pull-down
- Latches on all outputs
- Up to 6.0MHz @ VDD = 5.0V
- Operating Temperature Range: -40°C to +85°C
- Package Option: PDIP-40, PLCC-44
HV5222

**Features:**

- Output voltages to 225V using a ramped supply voltage
- SINK current minimum 100mA
- Shift register speed 8.0MHz
- Strobe and enable inputs
- CMOS compatible inputs
- Forward and reverse shifting options
- Operating Temperature Range:
  - -40°C to +85°C
- Package Option: PQFP-44, PLCC-44
Features:

- Processed with HVCMOS® technology
- Low power level shifting
- Source/sink current minimum 20mA
- Shift register speed 8.0MHz
- Latched data outputs
- CMOS compatible inputs
- Forward and reverse shifting options
- Diode to VPP allows efficient power recovery
- Operating Temperature Range: -40°C to +85°C
- Package Option: PQFP-44, PLCC-44
Features:

- Processed with HVCMOS® technology
- Low power level shifting
- SOURCE/SINK current minimum 20mA
- Shift register speed 8.0MHz
- Latched data outputs
- CMOS compatible inputs
- Forward and reverse shifting options
- Diode to VPP allows efficient power recovery
- Operating Temperature Range: -40°C to +85°C
- Package Option: PQFP-44, PLCC-44
HV7022

Features:
- HVCMOS® technology
- Symmetric row drive (reduces latent imaging in ACTFEL displays)
- Output voltage up to +230V
- Low power level shifting
- Source/sink current minimum 70mA
- Shift register speed 4.0MHz
- Pin-programmable shift direction
- Operating Temperature Range:
  - -40°C to +85°C
- Package Option: PLCC-44
**HV5522**

**Features:**
- Sink current minimum 100mA
- Shift register speed 8.0MHz
- Polarity and blanking inputs
- CMOS compatible inputs
- Forward and reverse shifting options
- Diode to VPP allows efficient power recovery
- Operating Temperature Range: -40°C to +85°C
- Package Option: PQFP-44, PLCC-44
HV5523

Features:
- Sink current minimum 100mA
- Shift register speed 16MHz
- Polarity and blanking inputs
- CMOS compatible inputs
- Operating Temperature Range: -40°C to +85°C
- Package Option: WQFN-44
Features:
- Sink current minimum 100mA
- Shift register speed 8.0MHz
- Polarity and blanking inputs
- CMOS compatible inputs
- Forward and reverse shifting options
- Diode to VPP allows efficient power recovery
- Operating Temperature Range: -40°C to +85°C
- Package Option: PQFP-44, PLCC-44
HV5622

Features:
- Sink current minimum 100mA
- Shift register speed 8.0MHz
- Polarity and blanking inputs
- CMOS compatible inputs
- Forward and reverse shifting options
- Diode to VPP allows efficient power recovery
- Operating Temperature Range: -40°C to +85°C
- Package Option: PQFP-44, PLCC-44
HV5623

Features:
- Sink current minimum 100mA
- Shift register speed 16MHz
- Polarity and blanking inputs
- CMOS compatible inputs
- Operating Temperature Range: -40°C to +85°C
- Package Option: WQFN-44
Features:
- Sink current minimum 100mA
- Shift register speed 8.0MHz
- Polarity and blanking inputs
- CMOS compatible inputs
- Forward and reverse shifting options
- Diode to VPP allows efficient power recovery
- Operating Temperature Range: -40°C to +85°C
- Package Option: PLCC-44
Features:

- 5.0V CMS Logic
- Output voltage up to 80V
- Low power level shifting
- 100MHz equivalent data rate using four dynamic shift registers
- Latched data outputs
- Forward and reverse shifting options (DIR pin)
- Diode to VPP allows efficient power recovery
- Outputs may be hot switched
- Operating Temperature Range: -40°C to +85°C
- Package Option: PQFP-100
Features:
- 5.0V CMS Logic
- Output voltage up to +80V
- Low power level shifting
- 32MHz equivalent data rate
- Latched data outputs
- Forward and reverse shifting options (DIR pin)
- Diode to VPP allows efficient power recovery
- Outputs may be hot switched
- Operating Temperature Range: -40°C to +85°C
- Package Option: PQFP-80
HV57009

Features:

- 5.0V CMOS Logic
- Output voltage up to -85V
- Output current source control
- 16MHz equivalent data rate
- Latched data outputs
- Forward and reverse shifting options (DIR pin)
- Diode to VDD allows efficient power recovery
- Operating Temperature Range: -40°C to +85°C
- Package Option: PQFP-44
Features:

- 5.0V CMS Logic
- Output voltage up to +80V
- Low power level shifting
- 8.0MHz data rate
- Latched data outputs
- Forward and reverse shifting options (DIR pin)
- Diode to VPP allows efficient power recovery
- Outputs may be hot switched
- Operating Temperature Range: -40°C to +85°C
- Package Option: PQFP-80
HV5812

Features:
- Operating voltage up to 80V
- High speed source driver
- 5.0V CMOS logic circuitry
- Up to 5.0MHz data input rate
- Excellent noise immunity
- Flexible high voltage supplies
- Operating Temperature Range: -40°C to +125°C
- Package Option: PDIP-28, PLCC-28, SOIC-28 (300mil)
Features:
- 32 push-pull CMOS output up to 60V
- Low power level shifting
- Shift register speed 5.0MHz
- Latched data outputs
- Bidirectional shift register (DIR)
- Backplane output
- Operating Temperature Range: -40°C to +85°C
- Package Option: PQFP-44, PLCC-44
HV6810

Features:

- High output voltage 80V
- High speed 5MHz @5.0VDD
- Low power IBB ≤ 0.1mA (all high)
- Active pull down 100µA min @25OC
- Output source current 25mA @60V VBB
- Each device drives 10 lines
- High-speed serially-shifted data input
- 5.0V CMOS-compatible inputs
- Latches on all driver outputs
- Operating Temperature Range: -45°C to +85°C
- Package Option: SOIC-20 (300mil)
HV7224

Features:
• Symmetric row drive (reduces latent imaging in ACTFEL displays)
• Output voltage up to +240V
• Low power level shifting
• Source/sink current minimum 70mA
• Shift register speed 3.0MHz
• Pin-programmable shift direction
• Operating Temperature Range: -40°C to +85°C
• Package Option: PQFP-64
Features:
- 5.0V logic and 12V supply rail
- Output voltage up to +200V
- Low power level shifting
- Source/sink current minimum 50mA
- 40MHz equivalent data rate
- Latched data outputs
- Forward and reverse shifting options
- Chip select
- Polarity function
- Operating Temperature Range: -40°C to +85°C
- Package Option: PQFP-64
HV9308

Features:

- Low power level shifting
- Shift register speed 8.0MHz
- Latched data outputs
- 5.0V CMOS compatible inputs
- Forward and reverse shifting options
- Diode to VPP allows efficient power recovery
- Operating Temperature Range: -40°C to +85°C
- Package Option: PQFP-44
**HV9408**

**Features:**
- Output voltages up to 80V
- Low power level shifting
- Shift register speed 8.0MHz
- Latched data outputs
- 5.0V CMOS compatible inputs
- Forward and reverse shifting options
- Diode to VPP allows efficient power recovery
- Operating Temperature Range:
  - -40°C to +85°C
- Package Option: PQFP-44
**Features:**

- Output voltages up to 80V
- Low power level shifting
- Shift register speed 8.0MHz
- Latched data outputs
- 5.0V CMOS compatible inputs
- Forward and reverse shifting options
- Diode to VPP allows efficient power recovery
- Operating Temperature Range: -40°C to +85°C
- Package Option: PQFP-44
Features:

- Constant Output Current
  - 20mA HV9921
  - 50mA HV9922
  - 30mA HV9923
- Universal 85 - 265VAC Operation
- Fixed OFF-Time Buck Converter
- Internal 475V Power MOSFET
- Operating Temperature Range: -40°C to +125°C
- Package Options: TO-92, SOT-89
HV9910B

Features:
- Switch mode controller for single switch LED drivers
- Open loop peak current controller
- Internal 8.0 to 450V linear regulator
- Constant frequency or constant off-time operation
- Linear and PWM dimming capability
- Requires few external components for operation
- Operating Temperature Range: -40°C to +125°C
- Package Options: SOIC-8, SOIC-16
HV9910C

Features:

• Switch mode controller for single switch LED drivers
• Open loop peak current controller
• Internal 15 to 450V linear regulator
• Constant frequency or constant off-time operation
• Linear and PWM dimming capability
• Requires few external components for operation
• Over-temperature protection
• Operating Temperature Range: -40°C to +125°C
• Package Options: SOIC-8, SOIC-16, SOIC-8 w/HS
Features:

- Fast average current control
- Programmable constant off-time switching
- PWM / linear dimming input
- Output short circuit protection with skip mode
- Operating Temperature Range: -40°C to +125°C
- Package Options: SOIC-8, SOIC-16
Features:

- Fast average current control
- Correction for propagation delay and offset voltage
- Fixed off-time switching mode
- Linear dimming input
- PWM dimming input
- Output short circuit protection with programmable skip mode
- Input under-voltage shutdown
- Operating Temperature Range: -40°C to +150°C
- Package Options: SOIC-8
Features:

- Four level switch dimming
- Very accurate current regulator
- Output over-current/short circuit protection
- IC over-temperature protection
- Operating Temperature Range: -40°C to +125°C
- Package Option: SOIC-8, SOIC-16
Features:

- Fast average current control
- Correction for propagation delay and offset voltage
- Fixed off-time switching mode
- Linear dimming input
- PWM dimming input
- Output short circuit protection
- Input under-voltage shutdown
- Operating Temperature Range: -40°C to +125°C
- Package Option: SOIC-8
Features:

- Programmable output current to 50mA
- PWM dimming / enable
- Universal 85 - 264VAC operation
- Fixed off-time buck converter
- Internal 475V power MOSFET
- Over-temperature protection with hysteresis
- Operating Temperature Range: -40°C to +125°C
- Package Option: SOIC-8 w/Heat Slug
Features:

- Constant output current
- Large step-down ratio
- Unity power factor
- Low input current harmonic distortion
- Fixed frequency or fixed off-time operation
- Internal 450V linear regulator
- Input and output current sensing
- Input current limit
- Enable, PWM and phase dimming
- Operating Temperature Range: -40°C to +125°C
- Package Option: SOIC-8 w/Heat Slug
HV9961

Features:
• Fast average current control
• Programmable constant off-time switching
• Linear dimming input
• PWM dimming input
• Output short circuit protection with skip mode
• Operating Temperature Range:
  -40°C to +125°C
• Package Option: SOIC-8, SOIC-16
Features:

- Switch mode controller for single switch converters: Buck, Boost, Buck-boost and SEPIC
- High output current accuracy
- High PWM dimming ratio (>5000:1)
- Internal 40V linear regulator
- Internal ±2% voltage reference
- Constant frequency operation with sync capability
- Programmable soft start
- 10V GATE drivers
- Hiccup mode protection for both short circuit and open circuit conditions
- Operating Temperature Range: -40°C to +150°C
- Package Options: SOIC-16
 Features:

- Switch mode controller for single switch drivers: Buck, Boost, Buck-boost, and SEPIC
- Closed loop control of output current
- High PWM dimming ratio
- Programmable slope compensation
- Enable & PWM dimming
- Output short circuit & over voltage protection
- Synchronization capability
- Programmable MOSFET current limit
- Operating Temperature Range: -40°C to +125°C
- Package Option: SOIC-8, SOIC-16
HV9912

Features:

- Switch mode controller for single switch drivers: Buck, Boost, Buck-boost, and SEPIC
- Works with high side current sensors
- Closed loop control of output current
- High PWM dimming ratio
- Programmable slope compensation
- Linear & PWM dimming
- Hiccup mode protection for both short circuit and open circuit conditions
- Synchronization capability
- Operating Temperature Range: -40°C to +125°C
- Package Option: SOIC-16
HV9982

Features:

• Closed loop control of output current: Buck, Boost, SEPIC
• High PWM dimming ratio
• Internal 40V linear regulator
• Constant frequency operation
• Programmable slope compensation
• Linear and PWM dimming
• Output short circuit protection
• Output over voltage protection
• Hiccup mode protection
• Analog control of PWM dimming
• Operating Temperature Range: -40ºC to +125ºC
• Package Option: VQFN-40 (6x6)
Features:

- Three out-of-phase constant-current boost converters
- Current loop closed with submicrosecond PWM dimming pulses supports PWM dimming >20kHZ
- Internal 40V linear regulator
- External clock input
- External individual reference inputs
- Individual PWM dimming inputs
- Programmable slope compensation +0.2A/-0.4A gate drivers
- Independent short circuit protection with hiccup for each channel
- Latching output open-circuit protection
- Operating Temperature Range: -40ºC to +150ºC
- Package Options: VQFN-40
Features:

- Hysteretic control with high-side current sensing
- Integrated 40V 1.0Ω MOSFET
- >90% Efficiency
- Wide input voltage range: 4.5 to 40V
- ±5% LED current accuracy
- Up to 2.0MHz switching frequency
- Adjustable constant LED current
- Analog or PWM control signal for PWM dimming
- Over-temperature protection
- Operating Temperature Range:
  - -40°C to +125°C
- Package Option: WDFN-8 (3x3)
HV9919B

Features:

• Hysteretic control with high-side current sensing
• Wide input voltage range: 4.5 to 40V
• >90% Efficiency
• Typical ±5% LED current accuracy
• Up to 2.0MHz switching frequency
• Adjustable constant LED current
• Analog or PWM control signal for PWM dimming
• Over-temperature protection
• Operating Temperature Range:
  -40°C to +125°C
• Package Option: WDFN-8 (3x3)
HV9930

Features:
- Constant output current LED driver
- Steps output voltage up or down
- Low EMI
- Variable frequency operation
- Internal 8.0 - 200V linear regulator
- Input and output current sensing
- Input current limit
- Enable & PWM dimming
- Operating Temperature Range: -40°C to +125°C
- Package Option: SOIC-8
Features:

- 3% accurate LED current
- Integrated 60V, 0.8Ω MOSFET
- Low sensitivity to external component variation
- Single resistor LED current setting
- Fixed off-time control
- PWM dimming input
- Output short circuit protection with skip mode
- Over-temperature protection
- Operating Temperature Range: -40°C to +150°C
- Package Options: DFN-8, MSOP-8
Features:

- Integrated 200V, 25Ω (typ.) MOSFETs
- Programmable output current to 80mA per channel
- TTL compatible PWM dimming inputs
- 3-Phase synchronous operation
- Leading edge blanking
- Short circuit protection with skip mode
- Over-temperature protection
- Operating Temperature Range: -40°C to +150°C
- Package Options: SOIC-24 (300mil)
Features:

- 10 to 450V input voltage range
- <1.3mA supply current
- >1.0MHz clock
- >20:1 dynamic range @ 500KHz
- 49% Maximum duty cycle version
- Low internal noise
- Operating Temperature Range: -40°C to +125°C
- Package Options: SOIC-16, PDIP-16
Features:

- 10 to 450V input voltage range
- <1.3mA supply current
- >1.0MHz clock
- >20:1 dynamic range @ 500KHz
- 99% Maximum duty cycle version
- Low internal noise
- Operating Temperature Range: -40°C to +125°C
- Package Options: SOIC-16, PDIP-16
AT9917

Features:

• Switch mode controller for boost, SEPIC & buck converters
• Closed loop control of output current
• Constant frequency operation with programmable slope compensation
• Linear and PWM dimming
• Programmable jitter to reduce EMI
• Output short circuit & over voltage protection
• Programmable hiccup timer
• Temperature fold-back with external NTC resistor
• Meets AEC-Q100 requirements
• Operating Temperature Range: -40°C to +125°C
• Package Option: TSSOP-24
Features:

- Hysteretic control with high-side current sensing
- Wide input voltage range: 4.5 to 40V
- >90% Efficiency
- Typical ±5% LED current accuracy
- Up to 2.0MHz switching frequency
- Adjustable constant LED current
- Analog or PWM control signal for PWM dimming
- Over-temperature protection
- Meets AEC-Q100 requirements
- Operating Temperature Range:
  -40°C to +125°C
- Package Option: WDFN-8 (3x3)
Features:

- Constant output current
- Steps output voltage up or down
- Externally programmable fixed switching frequency
- Temperature fold-back with external NTC resistor
- Internal 40V voltage regulator
- ±1A MOSFET gate driver
- Short LED & Open LED protection
- Input under voltage protection
- Enable & PWM dimming
- Trimmed reference (±3% accurate)
- Meets AEC-Q100 requirements
- Operating Temperature Range:
  - -40°C to 125°C
- Package Option: TSSOP-24
Features:

- Constant current LED Driver
- Steps input voltage up or down
- Low EMI
- Variable frequency operation
- Internal 75V linear regulator
- Input and output current sensing
- Input current limit
- Enable & PWM dimming
- Meets AEC-Q100 requirements
- Operating Temperature Range: -40°C to +125°C
- Package Option: TSSOP-24
Features:
• 5.0 to 90V operating range (VA-B)
• 20mA ±10% at 5.0 - 90V
• 0.01%/°C typical temperature coefficient
• Can be paralleled for higher current
• Operating Temperature Range: -40°C to +125°C
• Package Options: SOT-89, TO-252 (D-PAK), TO-92
Features:

- 5.0 - 90V operating range (VA-B)
- 25mA ±10% at 5.0 - 90V
- 0.01%/°C typical temperature coefficient
- No external components (two terminal device)
- Can be paralleled for higher current
- Operating Temperature Range:
  - -40°C to +125°C
- Package Options: SOT-89, TO-92
Features:

- 5.0 to 220V operating range (VA-B)
- 20mA ±10% at 5.0 - 160V
- 0.01%/°C typical temperature coefficient
- Can be paralleled for higher current
- Operating Temperature Range: -40°C to +125°C
- Package Options: TO-252 (DPAK), TO-220
Features:

- ±6.0% current accuracy at 4.0 - 15V
- 90V standoff voltage
- Separate enable pins for each channel allow for PWM dimming
- Over-temperature protection
- Operating Temperature Range: -40°C to +125°C
- Package Options: SOIC-8 w/Heat Slug
**Features:**

- ±6% current accuracy @ 4.0 - 15V
- 90V standoff voltage
- Separate enable pins for each channel allow for PWM dimming
- Over-temperature protection
- Operating Temperature Range: -40°C to +125°C
- Package Options: SOIC-8 w/Heat Slug
Features:

- ±6.0% current accuracy @ 4.0 - 15V
- 90V standoff voltage
- Separate enable pins for each channel allow for PWM dimming
- Over-temperature protection
- Operating Temperature Range: -40°C to +125°C
- Package Options: SOIC-8 w/Heat Slug
Features:
• 20mA ±10% constant current drive
• 1.0V dropout
• 90V rating for transient immunity
• Temperature compensated
• 4.75 - 90V supply range
• Operating Temperature Range: -40ºC to +125ºC
• Package Options: TO-252 (DPAK), TO-92
Features:

- 25mA ±10% constant current drive
- 1.0V dropout
- 90V rating for transient immunity
- Temperature compensated
- 4.75 - 90V supply range
- Operating Temperature Range: -40°C to +125°C
- Package Options: TO-252 (DPAK), TO-92
Features:

• 100mA ±5% constant current drive
• Built-in reverse polarity protection
• Dimmable via PWM supply
• Over temperature protection
• Tab ground allows direct heat sinking to chassis
• 90V max rating for transient immunity
• Operating Temperature Range:
  -40°C to +125°C
• Package Options: TO-252 (DPAK), TO-220
Features:

- 100mA ±5% constant current drive
- Built-in reverse polarity protection
- Logic level enable
- Dimmable via EN pin
- Over temperature protection
- 90V max rating for transient immunity
- Operating Temperature Range: -40°C to +125°C
- Package Options: SOIC-8 w/Heat Slug
Features:

- Minimal component count (base config: CL8800 + 6 resistors + diode bridge)
- No magnetics, no capacitors
- Up to 7.5W output (13W w/ heat sink)
- >110Lm/W using efficient LEDs
- 85% typical electrical efficiency
- >0.95 power factor
- <20% THD line current
- Low conducted EMI w/o filters
- 85% LED luminous utilization
- Phase dimmer compatible with an RC network
- Operating Temperature Range:
  - -40°C to +125°C
- Package Options: VQFN-33 (6x6)
Features:

- Minimal component count (base config: CL8801 + 4 resistors + diode bridge)
- No magnetics, no capacitors
- Up to 7.5W output (13W w/ heat sink)
- >110Lm/W using efficient LEDs
- 85% typical electrical efficiency
- >0.95 power factor
- <30% THD line current
- Low conducted EMI w/o filters
- 85% LED luminous utilization
- Phase dimmer compatible with an RC network
- Operating Temperature Range: -40°C to +125°C
- Package Options: VQFN-33 (6x6)
DN1509

Features:
- 90V $BV_{DSX(\text{min})}$
- 6.0Ω $R_{DS\text{ON(max)}}$
- High Input Impedance
- Low Input Capacitance
- Fast Switching Speeds
- Low On-Resistance
- Free from Secondary Breakdown
- Low Input and Output Leakages
- Operating Temperature Range: -55°C to +150°C
- RoHS Compliant Package: 3L SOT-89, 5L SOT-23
Features:

- 500V $BV_{DSX(min)}$
- 10Ω $R_{DS(on)(max)}$
- High Input Impedance
- Low Input Capacitance
- Fast Switching Speeds
- Low On-Resistance
- Free from Secondary Breakdown
- Low Input and Output Leakages
- Operating Temperature Range: -55°C to +150°C
- RoHS Compliant Package: TO-252 (DPAK), SOT-89
Features:

- 700V $BV_{DSX(\text{min})}$
- $42\Omega \ R_{\text{DSON (max)}}$
- High Input Impedance
- Low Input Capacitance
- Fast Switching Speeds
- Low On-Resistance
- Free from Secondary Breakdown
- Low Input and Output Leakages
- Operating Temperature Range: -55°C to +150°C
- RoHS Compliant Package: TO-252 (DPAK)
Features:

- 300V $B_{V_DSX}(\text{min})$
- $12\Omega$ $R_{DS(on)}$ (max)
- High Input Impedance
- Low Input Capacitance
- Fast Switching Speeds
- Low On-Resistance
- Free from Secondary Breakdown
- Low Input and Output Leakages
- Operating Temperature Range: -55°C to +150°C
- RoHS Compliant Package: TO-92, SOT-89
DN2535

Features:

- 350V $BV_{DSX}(\text{min})$
- $25\Omega \; R_{\text{DSON}} \; (\text{max})$
- High Input Impedance
- Low Input Capacitance
- Fast Switching Speeds
- Low On-Resistance
- Free from Secondary Breakdown
- Low Input and Output Leakages
- Operating Temperature Range: $-55^\circ\text{C}$ to $+150^\circ\text{C}$
- RoHS Compliant Package: TO-92, TO-220
Features:

- 400V $B V_{DSX(\text{min})}$
- $25\Omega \ \text{R}_{\text{DSON}} \ (\text{max})$
- High Input Impedance
- Low Input Capacitance
- Fast Switching Speeds
- Low On-Resistance
- Free from Secondary Breakdown
- Low Input and Output Leakages
- Operating Temperature Range: -55$^\circ$C to +150$^\circ$C
- RoHS Compliant Package: TO-92, TO-220, SOT-89
 Features:
• 250V BV_{DSX}(min)
• 3.5Ω R_{DSON} (max)
• High Input Impedance
• Low Input Capacitance
• Fast Switching Speeds
• Low On-Resistance
• Free from Secondary Breakdown
• Low Input and Output Leakages
• Operating Temperature Range: -55°C to +150°C
• RoHS Compliant Package: TO-252 (DPAK)
Features:

- $350\text{V } BV_{\text{DSX(min)}}$
- $35\Omega \ R_{\text{DSON (max)}}$
- High Input Impedance
- Low Input Capacitance
- Fast Switching Speeds
- Low On-Resistance
- Free from Secondary Breakdown
- Low Input and Output Leakages
- Operating Temperature Range: $-55^\circ\text{C}$ to $+150^\circ\text{C}$
- RoHS Compliant Package: SOT-23, SOT-89
Features:

- 450V $BV_{DSX}$ (min)
- 60Ω $R_{DSON}$ (max)
- High Input Impedance
- Low Input Capacitance
- Fast Switching Speeds
- Low On-Resistance
- Free from Secondary Breakdown
- Low Input and Output Leakages
- Operating Temperature Range: -55°C to +150°C
- RoHS Compliant Package: SOT-89
Features:

- 250V $BV_{DSX\text{\,(min)}}$
- 6.0Ω $R_{DSON \text{\,(max)}}$
- High Input Impedance
- Low Input Capacitance
- Fast Switching Speeds
- Low On-Resistance
- Free from Secondary Breakdown
- Low Input and Output Leakages
- Operating Temperature Range: -55°C to +150°C
- RoHS Compliant Package: SOT-89
Features:

- 350V $B_{VDSX}$ (min)
- $10\Omega \ R_{DS}$ (max)
- High Input Impedance
- Low Input Capacitance
- Fast Switching Speeds
- Low On-Resistance
- Free from Secondary Breakdown
- Low Input and Output Leakages
- Operating Temperature Range: -55$^\circ$C to +150$^\circ$C
- RoHS Compliant Package: SOT-89
Features:

- 450V $BV_{DSX(\text{min})}$
- $20\Omega \ R_{\text{DSON}} \ (\text{max})$
- High Input Impedance
- Low Input Capacitance
- Fast Switching Speeds
- Low On-Resistance
- Free from Secondary Breakdown
- Low Input and Output Leakages
- Operating Temperature Range: -55°C to +150°C
- RoHS Compliant Package: TO-92, SOT-89
Features:

- 650V $BV_{DSX}$ (min)
- 8.0Ω $R_{DSON}$ (max)
- High Input Impedance
- Low Input Capacitance
- Fast Switching Speeds
- Low On-Resistance
- Free from Secondary Breakdown
- Low Input and Output Leakages
- Operating Temperature Range: -55°C to +150°C
- RoHS Compliant Package: TO-252 (DPAK)
LND01

Features:

- 9.0V $BV_{DSX\text{(min)}}$
- 1.4Ω $R_{DSON\text{ (max)}}$
- Bi-directional
- Low On-Resistance
- Low Input Capacitance
- Fast Switching Speeds
- High Input Impedance and High Gain
- Low Power Drive Requirement
- Ease of Paralleling
- Operating Temperature Range: -55°C to +150°C
- RoHS Compliant Package: 5L SOT-23
**LND150**

**Features:**
- 500V $BV_{DSX}\text{(min)}$
- 1000Ω $R_{DSON}\text{ (max)}$
- Bi-directional
- Low On-Resistance
- Low Input Capacitance
- Fast Switching Speeds
- High Input Impedance and High Gain
- Low Power Drive Requirement
- Ease of Paralleling
- Operating Temperature Range: -55°C to +150°C
- RoHS Compliant Package: SOT-23, TO-92, SOT-89
Features:

• Accepts Inputs from 15V to 450V
• Output currents up to 3.0mA continuous, 30mA peak
• Supply Current Typically 50µA
• Line regulation typically 0.1mV/V
• Output can be trimmed from 8.0 to 12V
• Output current can be increased to 150mA with external FET
• Operating Temperature Range: -55°C to +150°C
• Package Options: SOIC-8, TO-92, TO-220, SOT-89
Features:

- Accepts Inputs from 35V to 450V
- Output Current Limiting
- For PWM ICs with Start-up Threshold Voltage of 13.9V – 18.0V
- Very Low Power Consumption After Start-up
- Operating Temperature Range: -55ºC to +150ºC
- Package Options: TO-92, SOT-89
Features:
- 13.2V - 450V input voltage range
- Adjustable 1.2V - 440V output regulation
- 5% output voltage tolerance
- Output current limiting
- 10µA typical ADJ current
- Internal junction temperature limiting
- Operating Temperature Range: -55°C to +150°C
- Package Options: TO-252 (DPAK), TO-92, SOT-89
Features:

- 13.2V to 100V input voltage range
- Stable with 100nF output capacitor
- Adjustable 1.2V to 88V output regulation
- 5% reference voltage tolerance
- Output current limiting, 50mA min.
- 10µA typical ADJ current
- Over temperature protection
- Operating Temperature Range: -55°C to +150°C
- Package Options: TO-252 (DPAK), TO-92, SOIC-8
Features:
- Efficient operation without magnetics
- No high voltage capacitors
- Adjustable main output voltage (9.0 to 50V)
- Additional 3.3V internal regulator
- Up to 100mA combined output current
- Single BOM for 120VAC/230VAC
- Built-in soft start
- Less than 200mW standby power
- Operating Temperature Range: -40°C to +125°C
- Package Options: SOIC-8 w/Heat Slug
Features:

- Efficient operation without magnetics
- No high voltage capacitors
- Adjustable main output voltage (9.0 to 50V)
- Additional 5.0V internal regulator
- Up to 100mA combined output current
- Single BOM for 120VAC/230VAC
- Built-in soft start
- Less than 200mW standby power
- Operating Temperature Range: -40°C to +125°C
- Package Options: SOIC-8 w/Heat Slug
**Features:**

- Efficiencies up to 75% at 20mA
- Less than 20mW standby power
- Optional 6.0V, 12V or 24V fixed output voltage, or adjustable from 6.0V to 28V
- Output current scalable up to 50mA
- 120VAC to 240VAC input
- No magnetics
- Inherent short circuit protection
- Operating Temperature Range: -40°C to +125°C
- Package Options: SOIC-8
EMC1501

Features:
- Meets JEDEC Standard TSE2002av (JC42.4) for Serial Presence Detect with Temperature Sensor
- Integrated 2kbit EEPROM
- Software EEPROM protection
- Event Pin
- Internal Temperature Monitor
  - 1°C accuracy (25°C to 100°C)
- Programmable High, Low, and TCRIT Limits
- SMBus 2.0 and I²C Compliant interface
- 8-pin 2x3 TDFN
EMC1001

Features:
- Self Contained Internal Temperature Sensor
  - 0.25°C resolution
  - ±1.5°C Accuracy (40°C to 85°C)
- Maskable Interrupt
- One-shot Command during standby
- Programmable Temperature Conversion Rate
- SMBus 2.0 Interface
  - Address selected by external resistor
- 3.0V – 3.6V Operation
- 6-pin SOT-23
Features:
• Resistance Error Correction
• Ideality Factor Configuration
• Remote Thermal Zones
  • ±1.0°C Accuracy (40°C to 80°C)
  • 0.125°C resolution
• Internal Thermal Zone
  • ±3.0°C Accuracy (0°C to 85°C)
• Maskable Interrupt
• One-shot Command during standby
• Programmable Temperature Conversion Rate
• Extended temperature (-64°C to 191°C) available
• Over-limit Filtering with Consecutive Counter
• SMBus Interface
• 8-pin TSSOP
EMC1043/53/63

Features:

• 3 Channel temperature sensor
• Supports two external temperature diodes
  • ±1.0°C Accuracy (40°C to 80°C)
  • 0.125°C Resolution
  • Ideality Factor Configuration
• Accepts 2200pF Cap Across Ext Diodes
• Optional Resistive Error Correction on External Diode
• Resistance Error Correction
  • EMC1063, powers up disabled
• Beta Compensation for substrate diodes
  • EMC1043, ch 2 powers up disabled
  • EMC1053, both channels power up disabled
  • EMC1063, does not have beta compensation
• Internal Temperature Diode
  • ±3°C Accuracy (0°C to 85°C)
  • 0.125°C Resolution
• Low Power Operation, 4uA in standby
• Programmable Conversion Rate
• Reports Hotter of Two Diodes with Dual-core CPU
• 3.0V – 3.6V Operation
• SMBus 2.0 Interface
• 8-pin MSOP
Features:
- 6 / 7 (EMC1046/EMC1047) channel temp sensor
- Supports diodes requiring the BJT or transistor model such as substrate and CPU diodes
- Resistance Error Correction
- Up to six External Temperature Monitors
  - ±1°C Accuracy (60°C < T_{DIODE} < 100°C)
  - 0.125°C Resolution
  - Supports up to 2.2nF filter capacitor
  - Anti-parallel diodes for extra diode support and compact design
- Internal Temperature Monitor
  - ±2°C accuracy
- 3.3V Operation
- 10-pin TSSOP
Features:

- 3.0V – 3.6V Operation
- Single Wire Interface (SST based)
  - SST 1.0 compliant
  - Supports FCS Abort functionality
- Resistance Error Correction
- Ideality Configuration
- Beta Compensation
- Two External Temperature Monitors
  - 0.125°C Resolution
  - ±1°C Accuracy (50°C to 70°C)
  - Diode Fault Reporting
  - Second External Diode
- Internal Temperature Monitor
  - Range -40°C to +125°C
  - 0.125°C resolution
  - ±2°C Accuracy (40°C to 70°C)
- Three Voltage Monitors: 3.3V, 2.5V, VCCP inputs
- 10-pin MSOP
EMC1152

Features:
- 3.0V – 3.6V Operation
- Single Wire Interface (SST based)
  - SST 1.0 compliant
  - Supports FCS Abort functionality
- Resistance Error Correction
- Ideality Configuration
- Beta Compensation
- External Temperature Monitors
  - 0.125°C Resolution
  - ±1°C Accuracy (50°C to 70°C)
  - Diode Fault Reporting
- Internal Temperature Monitor
  - Range -40°C to +125°C
  - 0.125°C resolution
  - ±2°C Accuracy (40°C to 70°C)
- Voltage Monitors:
  - 12V, 5V, 3.3V, 2.5V, VCCP inputs
- 10-pin MSOP
**Features:**

- 3.3V Operation
- Support for diodes requiring BJT/transistor model
  - 45nm, 65nm, and 90nm CPU thermal diodes
- Pin compatible with ADM1032, MAX6649, and LM99
- Automatically determines external diode type
- Resistance Error Correction
- External Temperature Monitors
  - ±1°C Accuracy (60°C < T_{DIODE} < 100°C)
  - 0.125°C resolution
- Internal Temperature Monitor
  - ±2°C accuracy
- Programmable temperature limits for ALERT# and THERM#
- 8-pin MSOP
EMC1403/4

Features:
• 3.3V Operation
• Support for diodes requiring BJT/transistor model
  • 45nm, 65nm, and 90nm CPU thermal diodes
• Automatically determines external diode type
• Resistance Error Correction
• External Temperature Monitors
  • ±1°C Accuracy (60°C < T_{DIODE} < 100°C)
  • 0.125°C resolution
  • Anti-parallel diodes for extra diode support
• Internal Temperature Monitor
  • ±2°C accuracy
• Programmable temperature limits for ALERT# and THERM#
• 10-pin 3x3 DFN, MSOP and 14-pin SOIC
EMC1412/3/4

Features:
- 2 Channel temperature sensor (EMC1412)
- 3 Channel temperature sensor (EMC1413)
- 4 Channel temperature sensor (EMC1414)
- Remote temperature sensors (1, 2, or 3 channels)
  - Automatically determines external diode type
  - Supports BJT/transistor model for substrate diode
  - Resistance Error Correction
- EMC1412 compatible w ADM1032, MAX6649, LM99
- External temperature monitor accuracy
  - ±1°C Accuracy (20°C < T\text{DIODE} < 110°C)
  - 0.125°C resolution
  - Supports up to 2.2nF diode filter capacitor
- Internal temperature monitor accuracy
  - ±1°C accuracy
  - 0.125°C resolution
- Programmable temperature limits for ALERT# and THERM#
- Programmable or fixed SMBus/I2C Address
- 3.3V Operation
- 8-pin 2x3 TDFN, MSOP; 10-pin DFN, MSOP
Features:
- 2 Channel temperature sensor (EMC1182)
- 3 Channel temperature sensor (EMC1183)
- 4 Channel temperature sensor (EMC1184)
- Remote temperature sensors (1, 2, or 3 channels)
  - Automatically determines external diode type
  - Supports BJT/transistor model for substrate diode
  - Resistance Error Correction
- EMC1412 compatible with ADM1032, MAX6649, LM99
- External temperature monitor accuracy
  - ±1°C Accuracy (20°C < T_{DIODE} < 110°C)
  - 0.125°C resolution
  - Supports up to 2.2nF diode filter capacitor
- Internal temperature monitor accuracy
  - ±1°C accuracy
  - 0.125°C resolution
- Programmable temperature limits for ALERT# and THERM#
- Programmable or fixed SMBus/I2C Address
- 3.3V Operation
- 8-pin 2x3 TDFN, MSOP; 10-pin 3x3 DFN
Features:

- 2 Channel temperature sensor (EMC1422)
- 3 Channel temperature sensor (EMC1423)
- 4 Channel temperature sensor (EMC1424)
- Remote temperature sensors (1, 2, or 3 channels)
  - Automatically determines external diode type
  - Supports BJT/transistor model for substrate diode
  - Resistance Error Correction
- EMC1422 compatible with ADM1032, MAX6649, LM99
- Hardware Thermal Shutdown with dedicated SYS_SHDN
  - Configured range 77°C to 112°C in 1°C steps
  - Cannot be disabled or modified by software
- External temperature monitor accuracy
  - $\pm 1^\circ C$ Accuracy ($60^\circ C < T_{DIODE} < 100^\circ C$)
  - 0.125°C resolution
  - Anti-parallel diodes for extra diode support
- Internal temperature monitor accuracy
  - $\pm 2^\circ C$ accuracy
- Programmable temperature limits for ALERT#
- 3.3V Operation
- 8-pin MSOP, 10-pin MSOP
EMC1186/7/8

Features:
• 2 Channel temperature sensor (EMC1186)
• 3 Channel temperature sensor (EMC1187)
• 4 Channel temperature sensor (EMC1188)
• Remote temperature sensors (1, 2, or 3 channels)
  • Automatically determines external diode type
  • Supports BJT/transistor model for substrate diode
  • Resistance Error Correction
• EMC1422 compatible with ADM1032, MAX6649, LM99
• Hardware Thermal Shutdown with dedicated SYS_SHDN
  • Configured range 77°C to 112°C in 1°C steps
  • Cannot be disabled or modified by software
• External temperature monitor accuracy
  • ±1°C Accuracy (60°C < T_{DIODE} < 100°C)
  • 0.125°C resolution
  • Anti-parallel diodes for extra diode support
• Internal temperature monitor accuracy
  • ±2°C accuracy
• Programmable temperature limits for ALERT#
• 3.3V Operation
• 8-pin 2x3 TDFN, 10-pin 3x3 DFN
EMC1428

Features:
- 8 Channel temperature sensor
- Hardware Thermal Shutdown
  - Triggers dedicated SYS_SHDN pin
  - Configured range 77°C to 112°C in 1°C steps
  - Cannot be disabled or modified by software
- Support for diodes requiring BJT/transistor model
- Designed to support 45nm, 65nm and 90nm processors
- Resistance Error Correction
- Up to 7 External Temperature Monitors
  - ±1°C Accuracy (60°C < T_{DIODE} < 100°C)
  - 0.125°C resolution
  - Supports up to 2.2nF diode filter capacitor
  - Anti-parallel diodes for extra diode support
- Internal Temperature Monitor
  - ±2°C accuracy
- Programmable temperature limits for ALERT#
- 3.3V Operation
- 16-pin 4x4 QFN
Features:
• 3.0 – 3.6V Supply Voltage
• Closed-Loop RPM-Based Fan Controller
  • 1% accuracy with external clock input
  • 3% accuracy with internal clock
  • Internal clock can be used as a source
  • Aging fan detection
• Integrated Linear Fan Driver
  • 600mA drive capability
• HW Thermal Shutdown (SYS_SHDN#)
• Reset Function (RESET#) On 5V Supply
• Up to Three Remote Thermal Zones
  • ±1°C accuracy (60°C to 100°C)
  • 0.125°C resolution
  • Designed to support 45nm, 65nm, and 90nm CPU Diodes
  • Eliminates temperature offset due to series resistance from PCB traces and thermal 'Diode'
• I2C/SMBus Interface
• 20-pin 4x4 QFN package
EMC2113

Features:
• Programmable Fan Control circuit
  • 4-wire fan compatible
  • Both low and high frequency PWM
• RPM-based fan control algorithm
  • 2% accurate from 500 – 16k RPM
• Temperature Look-Up Table
  • Eight steps that incorporate up to four temperature zones
• Up to Three External Temperature Channels
• Hardware Programmable Thermal Shutdown
• Internal Temperature Monitor
• 3.3V Supply Voltage
• Open-drain interrupt pin
• SMBus 2.0 Interface
• 16-pin 4x4 QFN package
Features:
- 3.3 Volt Operation
- Fan Control
  - 3 PWM Outputs
  - 4 Fan Tachometer Inputs
  - High frequency fan support for 4 wire fans
  - One fan can be controlled up to 3 temp zones
- Power Saving Modes
- Temperature Monitor
  - Two remote thermal diodes ±3°C accuracy
  - Internal ambient temperature measurement
  - Limit comparison of all monitored values
- Voltage Monitor
- XNOR Tree Test Mode
- SMBus 2.0 Interface
- 16-pin SSOP
EMC2301

Features:
- Programmable Fan Control circuit
  - 4-wire fan compatible
  - High and low speed PWM
  - Optional detection of aging fans
  - Fan Spin Up Control and Ramp Rate Control
  - Alert on fan stall
- Watchdog Timer
- RPM-based fan control algorithm
  - 0.5% accuracy from 500 – 16k RPM (ext. xtal)
  - 1% accuracy from 500 – 16k RPM (int. clock)
- SMBUS 2.0 Interface
- CLK Pin can provide a clock source output
- 8-pin MSOP
EMC2302

Features:
• Two Programmable Fan Control circuits
  • 4-wire fan compatible
  • High and low speed PWM
  • Optional detection of aging fans
  • Fan Spin Up Control and Ramp Rate Control
  • Alert on fan stall
• Watchdog Timer
• RPM-based fan control algorithm
  • 0.5% accuracy from 500 – 16k RPM (ext. xtal)
  • 1% accuracy from 500 – 16k RPM (int. clock)
• SMBUS 2.0 Interface
• CLK Pin can provide a clock source output
• 10-pin MSOP
EMC2303

Features:
- Three Programmable Fan Control circuits
  - 4-wire fan compatible
  - High and low speed PWM
  - Optional detection of aging fans
  - Fan Spin Up Control and Ramp Rate Control
  - Alert on fan stall
- Watchdog Timer
- RPM-based fan control algorithm
  - 0.5% accuracy from 500 – 16k RPM (ext. xtal)
  - 1% accuracy from 500 – 16k RPM (int. clock)
- SMBUS 2.0 Interface
- CLK Pin can provide a clock source output
- 12-pin 4x4 QFN
EMC2305

Features:

• Five Programmable Fan Control circuits
  • 4-wire fan compatible
  • High and low speed PWM
  • Optional detection of aging fans
  • Fan Spin Up Control and Ramp Rate Control
  • Alert on fan stall

• Watchdog Timer

• RPM-based fan control algorithm
  • 0.5% accuracy from 500 – 16k RPM (ext. xtal)
  • 1% accuracy from 500 – 16k RPM (int. clock)

• SMBUS 2.0 Interface

• CLK Pin can provide a clock source output

• 16-pin 4x4 QFN
EMC2101

Features:
- 3.3V Operation
- Automatic Beta Compensation
- Resistance Error Correction
- Self-programming with EEPROM
- Selectable PWM or DAC fan driver output
- Temperature Monitors
  - External channel ±1°C accuracy
  - Internal channel ±2°C accuracy
- SMBus 2.0 Interface
- 8-pin MSOP and SOIC
Features:
- Supports 45nm, 65nm, 90nm CPU Diodes
- Supports BJT and transistor models
- 3.0 – 3.6V Operation
- Closed-loop RMP based Fan Controller
- Integrated Linear Fan Driver
  - 600 mA drive capability
- HW Thermal Shutdown
- Reset Function on 5V Supply
- Three Remote Thermal Zones
  - ±1°C accuracy (60°C to 100°C)
  - 1°C Resolution
- Resistance Error Correction
- 28-pin 5x5 QFN
Features:
• 3.3V Operation
• Programmable Fan Control circuit
  • 4-wire fan compatible
  • High and low frequency PWM
• RPM-based fan control algorithm
  • 2.5% accuracy from 500 – 16k RPM
• Temperature Look-up Table
  • Controls fan speed or PWM drive
  • Supports DTS data from CPU
• Up to Three External Temperature Channels
  • Supports 45nm, 65nm, 90nm CPU Diodes
  • Supports BJT and transistor models
  • Resistance error correction
  • Supports discrete transistors (i.e. 2N3904)
  • ±1°C accuracy (60°C to 100°C)
  • 0.125°C Resolution
• Hardware Programmable Thermal Shutdown
• Internal Temperature Monitor
• SMBus 2.0 Interface
• 12-pin 4x4 QFN and 16-pin 4x4 QFN
Features:

- 3.3V Operation
- Two Programmable Fan Control circuit
  - 4-wire fan compatible
  - High and low frequency PWM
- RPM-based fan control algorithm
  - 2.5% accuracy from 500 – 16k RPM
- Temperature Look-up Table
  - Controls fan speed or PWM drive
  - Supports DTS data from CPU
- Up to Four External Temperature Channels
  - Supports 45nm, 65nm, 90nm CPU Diodes
  - Supports BJT and transistor models
  - Resistance error correction
  - ±1°C accuracy (60°C to 100°C)
  - 0.125°C Resolution
- Up to three thermister compatible voltage inputs
- Hardware Programmable Thermal Shutdown
- Internal Temperature Monitor
- SMBus 2.0 Interface
- 20-pin 4x4 QFN
EMC2105

Features:
- 3.3V Operation
- Programmable Fan Control circuit
  - 600 mA, 5V, high side fan driver
- RPM based fan control algorithm
  - 2% accuracy from 500 – 16k RPM
- Temperature Look-up Table
  - 1 to 4 thermal zones
  - Controls fan speed or fan drive
  - Allows external data to control fan drivers including two DTS channels
- Up to Four External Temperature Channels
  - Supports 45nm, 65nm, 90nm CPU Diodes
  - Supports BJT and transistor models
  - Resistance error correction
  - ±1°C accuracy (60°C to 100°C)
  - 0.125°C Resolution
- SMBus 2.0 Interface
- 20-pin 4x4 QFN
Features:

• 3.3V Operation
• Two Programmable Fan Control circuit
  • 4-wire fan compatible
  • High and Low speed PWM
  • 600 mA, 5V, high side fan driver
• RPM based fan control algorithm
  • 2% accuracy from 500 – 16k RPM
• Temperature Look-up Table
  • 1 to 4 thermal zones
  • Controls fan speed or fan drive
  • Allows external data to control fan drivers including two DTS channels
• Up to Four External Temperature Channels
  • Supports 45nm, 65nm, 90nm CPU Diodes
  • Supports BJT and transistor models
  • Resistance error correction
  • ±1°C accuracy (60°C to 100°C)
  • 0.125°C Resolution
• SMBus 2.0 Interface
• 28-pin 5x5 QFN
EMC6D102

Features:
• 3.3V Operation
• Fan Control
  • Three PWM Outputs
  • Four Fan Tachometer Inputs
  • Fan ramp rate control for noise reduction
• Temperature Monitor
  • Monitoring two remote thermal diodes
  • Internal ambient temperature measurement
• Voltage Monitor
  • Monitor power supplies (2.5V, 5V, 12V, Vcc)
• Power saving modes
• 5 VID (Voltage Identification Inputs)
• XNOR Tree Test Mode
• SMBus 2.0 Interface
• 24-pin SSOP
EMC6D103S

Features:
• 3.3V Operation
• Fan Control
  • Three PWM Outputs
  • Four Fan Tachometer Inputs
  • 4-wire fan compatible
  • Fan ramp rate control for noise reduction
• Temperature Monitor
  • Monitoring two remote thermal diodes
  • Internal ambient temperature measurement
• Voltage Monitor
  • Monitor power supplies (2.5V, 5V, 12V, Vcc)
• Power saving modes
• 5 VID (Voltage Identification Inputs)
• XOR Tree Test Mode
• SMBus 2.0 Interface
• 24-pin SSOP
EMC1701

Features:

• High-side current sensor
  • Bi-directional current measurement
  • Measures bus voltage
  • 1% current measurement accuracy
  • Integrated over 82ms to 2.6sec, 11-bit resolution
  • 3V to 24V voltage bus voltage range
• Calculates proportional power
• Independent hardware set instantaneous current peak detector (EMC1701-1 only)
  • Software controls to program time duration and magnitude threshold
• Power supply options
  • Bus or separately powered for low voltage operation
• Internal temperature monitor
  • ±1°C accuracy (-5°C < TA < 85°C)
• ALERT# and THERM# outputs for temperature, voltage, and out-of-current limit reporting
• I2C/SMBus 2.0 Interface
• Industrial temperature range: -40°C to +85°C
• 10-pin MSOP, 12-pin 4x4 QFN
Features:
• High-side current sensor
  • Bi-directional current measurement
  • Measures bus voltage
  • 1% current measurement accuracy
  • Integrated over 82ms to 2.6sec, 11-bit resolution
  • 3V to 24V voltage bus voltage range
• Calculates proportional power
• Independent hardware set instantaneous current peak detector
• Power supply options
  • Bus or separately powered for low voltage operation
• Internal temperature monitor
  • ±1°C accuracy (-5°C < T<sub>A</sub> < 85°C)
• One external temperature monitor
  • 1°C accuracy (20°C < T<sub>DIODE</sub> < 110°C) with 0.125°C resolution
• ALERT# and THERM# outputs for temperature, voltage, and out-of-current limit reporting
• I2C/SMBus 2.0 interface
• Industrial temperature range: -40°C to +85°C
• 12-pin 4x4 QFN
EMC1704

Features:

- High-side current sensor
  - Bi-directional current measurement
  - Measures bus voltage
  - 1% current measurement accuracy
  - Integrated over 82ms to 2.6sec, 11-bit resolution
  - 3V to 24V voltage bus voltage range
- Calculates proportional power
- Independent hardware set instantaneous current peak detector
- Bus or separately powered for low voltage operation
- Internal temperature monitor
  - ±1°C accuracy (-5°C < T_A < 85°C)
- Up to 3 external temperature monitor
  - 1°C accuracy (20°C < T_DIODE < 110°C) with 0.125°C resolution
- ALERT# and THERM# outputs for temperature, voltage, and out-of-current limit reporting
- General purpose I/O
- I2C/SMBus 2.0 interface
- Industrial temperature range: -40°C to +85°C
- 14-pin SOIC, 16-pin 4x4 QFN
Features:
• High-side current sensor
  • Current measurement is integrated over 2.5ms to 2.6sec with up to 11-bit resolution
  • 1% current measurement accuracy in positive range
  • Measures $V_{\text{SOURCE}}$ voltage
• Calculates proportional power
• $V_{\text{SOURCE}}$ voltage range 0V to 40V
  • Bi-directional current sensing
• Auto-zero input offset voltage
• Digital averaging
• 5µA typical Standby current
• Programmable sense voltage range
  • ±10mV, ±20mV, ±40mV, and ±80mV
• Industrial temperature range: -40°C to +85°C
• ALERT# output for voltage and current out of limit transients
• SMBus 2.0 communications interface
• Sample time configurable from 2.5ms-320ms
  • With averaging effective sampling times up to 2.6sec
• Power supply range 3.0V to 5.5V
• 10-pin 3x3 DFN
Features:

- Dual High-side current sensor
  - Current measurement is integrated over 2.5ms to 2.6sec with up to 11-bit resolution
  - 1% current measurement accuracy in positive range
  - Measures $V_{SOURCE}$ voltage
- Calculates proportional power
- $V_{SOURCE}$ voltage range 0V to 40V
  - Bi-directional current sensing
- Auto-zero input offset voltage
- Digital averaging
- 5µA typical Standby current
- Programmable sense voltage range
  - $\pm 10\text{mV, } \pm 20\text{mV, } \pm 40\text{mV, and } \pm 80\text{mV}$
- Industrial temperature range: -40°C to +85°C
- ALERT# output for voltage and current out of limit transients
- SMBus 2.0 communications interface
- Sample time configurable from 2.5ms-320ms
  - With averaging effective sampling times up to 2.6sec
- Power supply range 3.0V to 5.5V
- 10-pin 3x3 DFN
**Features:**

- Port power switch with two current limit behaviors
  - 2.9 V to 5.5 V source voltage range
  - Up to 2.5 A current with 55 mΩ On Resistance
  - Over-current trip or constant current limiting
  - Soft turn-on circuitry
  - Selectable current limit
  - Dynamic thermal management
  - Under- and over-voltage lockout
  - Back-drive, back-voltage protection
  - Latch or auto-recovery (low test current) fault handling
  - Selectable active high or low power switch enable
  - BC1.2 VBUS discharge port renegotiation function
- Selectable/automatic cycling of USB data line charger emulation profiles
  - USB-IF BC1.2 charging downstream port (CDP) and dedicated charging port (DCP) modes, YD/T-1591, and most Apple® and RIM® protocols standard
  - USB 2.0 compliant high-speed data switch (in Passthrough and CDP modes)
  - Nine preloaded charger emulation profiles for maximum compatibility coverage of peripheral devices
- Charging Active (UCS1001-1) or Attach Detection (UCS1001-2) open-drain output
- Fault Alert open-drain output
- Ultra low power Sleep state
- Optional split supply support for VBUS and VDD for low power in system standby states
- Wake on Attach USB (UCS1001-2)
- Industrial temperature range: -40°C to +85°C
- IEC61000-4-2 8 / 15 kV ESD immunity
- UL recognized and EN/IEC 60950-1 (CB) certified
Features:

- Port power switch with two current limit behaviors
  - 2.9 V to 5.5 V source voltage range
  - Up to 2.5 A current with 55 mΩ On Resistance
  - Over-current trip or constant current limiting
  - Soft turn-on circuitry
  - Programmable current limit
  - Dynamic thermal management
  - Under- and over-voltage lockout
  - Back-drive, back-voltage protection
  - Latch or auto-recovery (low test current) fault handling
  - BC1.2 VBUS discharge port renegotiation function

- Selectable/automatic cycling of USB data line charger emulation profiles
  - USB-IF BC1.2 charging downstream port (CDP) and dedicated charging port (DCP) modes, YD/T-1591, and most Apple® and RIM® protocols standard; others as defined via the SMBus 2.0/I2C®
  - USB 2.0 compliant high-speed data switch (in Passthrough and CDP modes)
  - Nine preloaded charger emulation profiles for maximum compatibility
  - One custom programmable charger profile for portable device support

- Self-contained current monitoring and charge rationing for power allocation applications
- Automatic shutdown when Battery Full option and low power Sleep state
- Low power Attach Detection and open-drain A_DET# pin
- Optional split supply support for VBUS and VDD for low power in system standby states
- Wake on Attach USB
- SMBus 2.0/I2C communications
- Wide operating temperature range: -40°C to +85°C
- IEC61000-4-2 8 / 15 kV ESD immunity
- UL recognized and EN/IEC 60950-1 (CB) certified
Features:

- Port power switch with two current limit behaviors
  - 2.9 V to 5.5 V source voltage range
  - Up to 2.5 A current with 55 mΩ On Resistance
- Over-current trip or constant current limiting
- Soft turn-on circuitry
- Programmable current limit
- Dynamic thermal management
- Under- and over-voltage lockout
- Back-drive, back-voltage protection
- Latch or auto-recovery (low test current) fault handling
- BC1.2 VBUS discharge port renegotiation function
- Selectable/automatic cycling of USB data line charger emulation profiles
  - USB-IF BC1.2 charging downstream port (CDP) and dedicated charging port (DCP) modes, YD/T-1591, and most Apple® and RIM® protocols standard; others as defined via the SMBus 2.0/I²C®
  - USB 2.0 compliant high-speed data switch (in Passthru, SDP, CDP modes)
  - Nine preloaded charger emulation profiles for maximum compatibility
  - One custom programmable charger profile for portable device support
- Self-contained current monitoring and charge rationing for power allocation applications
- Automatic shutdown when Battery Full option and low power Sleep state
- Low power Attach Detection and open-drain A_DET# pin
- Optional split supply support for VBUS and VDD for low power in system standby states
- Wake on Attach USB
- UCS81002 issues an Alert on Reset
- SMBus 2.0/I²C communications
- Wide operating temperature range: -40°C to +85°C
- IEC61000-4-2 8 / 15 kV ESD immunity
Features:
• 5-Pin SOT-23A
• Factory-programmed Thresholds from 45°C to +125°C in 10°C Increments
• Pin Selectable +2°C or +10°C Hysteresis
• ±0.5°C (typ.) Threshold Accuracy Over Full Temperature Range
• No External Components Required
• 17μA Supply Current (typ.)
Features:

- User Programmable Hysteresis and Temperature Set Point
- Easily Programs with 2 External Resistors
- Wide Temperature Detection Range:
  - 0°C to 70°C: (TC620/TC621CCX)
  - -40°C to +125°C: (TC620/TC621CVX)
  - -40°C to +85°C: (TC620/TC621CEX)
  - -55°C to +125°C: (TC620/TC621CMX)
- Onboard Temperature Sensing Applications (TC620X)
- External NTC Thermistor for Remote Sensing Applications (TC621X)
- Available in 8-Pin PDIP and SOIC Packages
Features:

• Temperature Set Point Easily Programs with a Single External Resistor
• Operates with 2.7V Power Supply (TC624)
• TO-220 Package for Direct Mounting to Heatsink (TC622XAT) or Standard 8-Pin PDIP and SOIC
TC623

Features:
• Integrated Temp Sensor and Detector
  Operate from a Supply Voltage as Low as 2.7V
• Replaces Mechanical Thermostats and Switches
• On-Chip Temperature Sense
• 8-Pin DIP or SOIC for Direct PCB Mounting
• 2 User Programmable Temperature Set Points
• 2 Independent Temperature Limit Outputs
• Heat/Cool Regulate Output
Features:
• Supply Voltage Range: 2.7V to 4.4V
• Wide Temperature Measurement Range: -40°C to +125°C
• High Temperature Converter Accuracy: ±2°C (max.) at 25°C
• Linear Temperature Slope: 6.25mV/°C
• Very Low Supply Current: 35µA Typical
• Small 3-Pin SOT-23B Package
TC1047/47A

Recommend MCP9700/1/A

Features:
• Supply Voltage Range:
  TC1047: 2.7V to 4.4V
  TC1047A: 2.5V to 5.5V
• Wide Temperature Measurement Range:
  -40°C to +125°C
• High Temperature Converter Accuracy:
  ±2°C (max.) at 25°C
• Linear Temperature Slope: 10 mV/°C (typ.)
• Available in 3-Pin SOT-23B Package
• Very Low Supply Current: 35μA (typ.)
• Pin Compatible to the MCP9700/1/A
MCP9700/1/A

Features:
• Tiny Analog Temperature Sensor
• Available Packages: SC-70-5, SOT-23-5, TO-92-3
• Wide Temperature Measurement Range:
  -40°C to +125°C
• Accuracy:
  ±2°C (max.), 0°C to +70°C (MCP9700A/9701A)
  ±4°C (max.), 0°C to +70°C (MCP9700/9701)
• Optimized for Analog-to-Digital Converters
  (ADCs):
  10.0 mV/°C (typ.) MCP9700/9700A
  19.5 mV/°C (typ.) MCP9701/9701A
• Wide Operating Voltage Range:
  VDD = 2.3V to 5.5V MCP9700/9700A
  VDD = 3.1V to 5.5V MCP9701/9701A
• Low Operating Current: 6 μA (typ.)
• Optimized to Drive Large Capacitive Loads
Features:

• Temperature-to-Digital Converter
• SPI™ Compatible Interface
• 10-Bit Resolution (0.25°C/Bit)
• ±2°C (max.) Accuracy from -40°C to +85°C
• ±3°C (max.) Accuracy from -55°C to +125°C
• 2.65V to 5.5V Operating Range
• Low Power Consumption:
  250μA (typ.) Continuous Temperature Conversion Mode
  1μA (max.) Shutdown Mode
• Power Saving One-Shot Temperature Measurement
• Industry Standard 8-Pin MSOP Package
• Space Saving 8-Pin DFN (3x3 mm) Package
Features:
• Digital Temperature Sensing in SOT-23-5 or TO-220 Packages
• Outputs Temperature as an 8-Bit Digital Word
• Simple SMBus/I²C™ Serial Port Interface
• Solid-State Temperature Sensing:
  ±2°C (max.) Accuracy from +25°C to +85°C
  ±3°C (max.) Accuracy from 0°C to +125°C
• 2.65V to 5.5V Operating Range
• Supply voltage of 2.7V to 5.5V
• Low Power Consumption:
  250μA (typ.) Operating Current
  1μA (max.) Standby Mode Current
TCN75A

Features:
- Temperature-to-Digital Converter
- Accuracy:
  ±1°C (typ.) from -40°C to +125°C
  ±2°C (max.) from -40°C to +125°C
- User-selectable Resolution:
  0.5°C to 0.0625°C
- Operating Voltage Range: 2.7V to 5.5V
- 2-wire Interface: I²C™ Compatible
- Operating Current: 200µA (typ.)
- Shutdown Current: 2µA (max.)
- Power-saving One-shot Temperature Measurement
- Available Packages: MSOP-8, SOIC-8
Features:
- Digital Temperature Sensing in 5-Pin SOT-23A and 8-Pin SOIC Packages
- Outputs Temperature as a 13-Bit Digital Word
- SPI and MICROWIRE™ Compatible Interface
- Solid State temperature Sensing
  ±1°C (max.) accuracy from +25°C to +65°C
  ±2°C (max.) accuracy from -40°C to +85°C
  ±3°C (max.) accuracy from -55°C to +125°C
- 2.7V to 5.5V Operating Voltage Range
- Lower Power
  250μA (typ.) Continuous Conversion Mode
  0.1μA (typ.) Shutdown Mode
MCP9800/1/2/3

Features:
• Temperature-to-Digital Converter
• Accuracy with 12-bit Resolution
  ±1°C (max.) accuracy from -10°C to +85°C
  ±2°C (max.) accuracy from -10°C to +125°C
  ±3°C (max.) accuracy from -55°C to +125°C
• User-selectable Resolution: 9 - 12 bit
• 2.7V to 5.5V Operating Voltage Range
• 2-wire Interface: I²C™/SMBus Compatible
• Lower Power
  200μA (typ.) Operating Current
  1μA (max.) Shutdown Mode
• Power-saving One-shot Temperature Measurement
• Available Packages: SOT-23-5, MSOP-8, SOIC-8

Online Datasheet
MCP9804

Features:
• Accuracy:
  - ±0.25°C (typical) from -40°C to +125°C
  - ±1°C (maximum) from -40°C to +125°C
• User Selectable Measurement Resolution:
  0.5°C, 0.25°C, 0.125°C, 0.0625°C
• User Programmable Temperature Limits:
  - Temperature Window Limit
  - Critical Temperature Limit
• User Programmable Temperature Alert Output
• Operating Voltage Range: 2.7V to 5.5V
• Operating Current: 200 μA (typical)
• Shutdown Current: 0.1 μA (typical)
• 2-wire Interface: I²C/SMBus Compatible
• Available Packages: 2x3 DFN-8, MSOP-8
Features:
• Meets JEDEC Standard JC42.4
• Temperature-to-Digital Converter
• Accuracy with 0.25°C/LSB Resolution:
  ±1°C (max.) accuracy from +75°C to +95°C
  ±2°C (max.) accuracy from +40°C to +125°C
  ±3°C (max.) accuracy from -20°C to +125°C
• Programmable Temperature Monitor Boundary
• Critical Temperature Output
• Operating Voltage Range: 3.0V to 3.6V
• 2-wire Interface: I2C™/SMBus Compatible
• Lower Power
  200μA (typ.) Operating Current
  0.1μA (typ.) Shutdown Current
• Available Packages: 2x3 DFN-8, TSSOP-8
Features:

- **Accuracy:**
  - ±0.25 (typical) from -40°C to +125°C
  - ±0.5°C (maximum) from -20°C to 100°C
  - ±1°C (maximum) from -40°C to +125°C
- **User-Selectable Measurement Resolution:**
  - +0.5°C, +0.25°C, +0.125°C, +0.0625°C
- **User-Programmable Temperature Limits:**
  - Temperature Window Limit
  - Critical Temperature Limit
- **User-Programmable Temperature Alert Output**
- **Operating Voltage Range:** 2.7V to 5.5V
- **Operating Current:** 200 μA (typical)
- **Shutdown Current:** 0.1 μA (typical)
- **2-wire Interface:** I2C™/SMBus Compatible
- **Available Packages:** 2x3 DFN-8, MSOP-8

**Package Types**

*Includes Exposed Thermal Pad (EP); see Table 3-1.*
MCP9843/98243

Features:
- Meets JEDEC Specification
  - MCP9843 - JC42.4-TSE3000B3
- Temperature Sensor
  - MCP98243 --> JC42.4-TSE2002B3
- Temperature Sensor with 2 Kbit Serial EEPROM for Serial Presence Detect (SPD)
- I²C/SMBus Interface
- Packages: DFN-8, TDFN-8, UDFN-8, TSSOP-8

Temperature Sensor Features
- Sensor Accuracy (Grade B):
  - ±0.2°C/±1°C (typ./max.) → +75°C to +95°C
  - ±0.5°C/±2°C (typ./max.) → +40°C to +125°C
  - ±1°C/±3°C (typ./max.) → -20°C to +125°C
- Operating Current: 200 µA (typical)
- \( V_{DD} \): 2.7V to 5.5V

Serial EEPROM Features (MCP98243)
- \( V_{DD} \): 1.8V to 5.5V
- Operating Current:
  - Write : 1.1 mA (typical) for 3.5 ms (typical)
  - Read : 100 µA (typical)
- Permanent and Reversible Software Write Protect
Features:
• Meets JEDEC Specification:
  - JC42.4-TSE2004B1 Temperature Sensor with 4 Kbit Serial EEPROM for Serial Presence Detect (SPD)
• 1MHz, 2-wire I2C Interface
• \(V_{DD}: 1.7\text{V to 3.6V}\)
• Operating Current: 100 \(\mu\text{A (typ., EEPROM Idle)}\)
• Package: TDFN-8

Temperature Sensor Features
• Sensor Accuracy (Grade B):
  - \(\pm0.2^\circ\text{C/}\pm1^\circ\text{C (typ./max.) between +75^\circ\text{C to +95^\circ\text{C}\)}}\)
  - \(\pm0.5^\circ\text{C/}\pm2^\circ\text{C (typ./max.) between +40^\circ\text{C to +125^\circ\text{C}\)}}\)
  - \(\pm1^\circ\text{C/}\pm3^\circ\text{C (typ./max.) between -40^\circ\text{C to +125^\circ\text{C}\)}}\)

Serial EEPROM Features
• Operating Current:
  - Write: 250 \(\mu\text{A (typical) for 3 ms (typical)}\)
  - Read :100 \(\mu\text{A (typical)}\)
• Reversible Software Write Protect
• Software Write Protection for each 1 Kbit Block
• Organized as two banks of 256 x 8-bit (2 Kbit x 2)
Features:

- User Selectable Measurement Resolution:
  - +0.5°C, +0.25°C, +0.125°C, +0.0625°C
- User Programmable Temperature Limits:
  - Temperature Window Limit
  - Critical Temperature Limit
- User Programmable Temperature Alert Output
- I2C Interface
- \( V_{DD} \): 1.7V to 3.6V
- Operating Current: 100 μA (typ.)
- Package: 8-lead TDFN

Temperature Sensor Features

- Sensor Accuracy (Grade B):
  - ±0.2°C/±1°C (typ./max.) between +75°C to +95°C
  - ±0.5°C/±2°C (typ./max.) between +40°C to +125°C
  - ±1°C/±3°C (typ./max.) between -40°C to +125°C
Features:

- Factory Set Temperature Switch
- Wide Operating Voltage Range: 2.7V to 5.5V
- Low Supply Current: 25 μA (typ.)
- Temperature Switch Accuracy:
  - ±1°C (typical)
  - ±4°C (maximum) -15°C to +75°C
  - ±6°C (maximum) -40°C to +125°C
- Switch Threshold Options (Hot/Cold):
  - Rising Temp.: MCP9501/2 (Hot Option)
  - Falling Temp.: MCP9503/4 (Cold Option)
- Output Configuration Options:
  - Active Low, Open-Drain Output: MCP9501/3
  - Uses External Pull-up Resistor
  - Active-High, Push-Pull Output: MCP9502/4
- User Selectable Hysteresis: 2°C or 10°C (typical)
- 5-lead SOT-23 package
Features:
• Resistor-Programmable Temperature Switch
• Wide Operating Voltage Range: 2.7V to 5.5V
• Low Supply Current: 30μA (typ.)
• Temperature Switch Accuracy:
  ±0.5°C (typ.) at +25°C, +45°C
  ±1°C (typ.) 0°C to +70°C
  ±3.5°C (max.) 0°C to +125°C
  ±4.5°C (max.) -20°C to +125°C
  ±2°C (typ.) -40°C to +125°C
• Sensor Options available:
  Switch for rising temperature: Cold to Hot (H)
  Switch for falling temperature: Hot to Cold (C)
• Output Configurations:
  Open-Drain:
    - External Pull-up Resistor: MCP9509
    - Internal Pull-up Resistor: MCP9510
  Active-Low, Push-Pull: MCP9510
  Active-High, Push-Pull: MCP9510
• User Selectable Hysteresis: 2°C or 10°C (typ.)
• Space-Saving SOT-23-5, SOT-23-6 Packages
Features:

• Temperature Proportional Fan Speed for Acoustic Control and Longer Fan Life
• Efficient PWM Fan Drive
• 3.0V to 5.5V Supply Range:
  - Fan Voltage Independent of TC647 Supply Voltage
  - Supports any Fan Voltage
• FanSense™ Fault Detection Circuits Protect Against Fan Failure and Aid System Testing
• Shutdown Mode for “Green” Systems
• Supports Low Cost NTC/PTC Thermistors
• Over-temperature Indication
• Space Saving 8-Pin MSOP Package
**Features:**

- Temperature Proportional Fan Speed for Acoustic Control and Longer Fan Life
- Efficient PWM Fan Drive
- 3.0V to 5.5V Supply Range:
  - Fan Voltage Independent of TC646 Supply Voltage
  - Supports any Fan Voltage
- FanSense™ Fault Detection Circuits Protect Against Fan Failure and Aid System Testing
- Shutdown Mode for “Green” Systems
- Supports Low Cost NTC/PTC Thermistors
- Over-temperature Indication
Features:
• Temperature Proportional Fan Speed for Acoustic Control and Longer Fan Life
• Efficient PWM Fan Drive
• 3.0V to 5.5V Supply Range:
  - Fan Voltage Independent of TC647 Supply Voltage
  - Supports any Fan Voltage
• FanSense™ Fault Detection Circuits Protect Against Fan Failure and Aid System Testing
• Shutdown Mode for “Green” Systems
• Supports Low Cost NTC/PTC Thermistors
• Over-temperature Indication
• Space Saving 8-Pin MSOP Package
Features:

• Temperature Proportional Fan Speed for Acoustic Control and Longer Fan Life
• Efficient PWM Fan Drive
• 3.0V to 5.5V Supply Range:
  - Fan Voltage Independent of TC647 Supply Voltage
  - Supports any Fan Voltage
• Over-temperature Fan Detection
• Shutdown Mode for “Green” Systems
• Supports Low Cost NTC/PTC Thermistors
• Space Saving 8-Pin MSOP Package
Features:
• Temperature Proportional Fan Speed for Acoustic Control and Longer Fan Life
• Efficient PWM Fan Drive
• 3.0V to 5.5V Supply Range:
  - Fan Voltage Independent of TC649 Supply Voltage
  - Supports any Fan Voltage
• FanSense™ Fault Detection Circuits Protect Against Fan Failure and Aid System Testing
• Shutdown Mode for “Green” Systems
• Supports Low Cost NTC/PTC Thermistors
• Over-temperature Indication
• Space Saving 8-Pin MSOP Package
Features:

- Temperature Proportional Fan Speed for Acoustic Control and Longer Fan Life
- Efficient PWM Fan Drive
- 3.0V to 5.5V Supply Range:
  - Fan Voltage Independent of TC642B/TC647B Supply Voltage
  - Supports any Fan Voltage
- FanSense™ Fault Detection Circuits Protect Against Fan Failure and Aid System Testing
- Shutdown Mode for “Green” Systems
- Supports Low Cost NTC/PTC Thermistors
- Over-temperature Indication
- Fan Auto-Restart
- Space Saving 8-Pin MSOP Package
Features:
- Temperature Proportional Fan Speed for Acoustic Control and Longer Fan Life
- Efficient PWM Fan Drive
- 3.0V to 5.5V Supply Range:
  - Fan Voltage Independent of TC646B/TC648B/TC649B Supply Voltage
  - Supports any Fan Voltage
- FanSense™ Fault Detection Circuits Protect Against Fan Failure and Aid System Testing (TC646B/TC649B)
- Shutdown Mode for “Green” Systems
- Supports Low Cost NTC/PTC Thermistors
- Over-temperature Indication (TC646B/TC648B)
- Fan Auto-Restart
- Space Saving 8-Pin MSOP Package
Features:

- Integrated Temperature Sensing and Multi-Speed Fan Control
- Built-in Over Temperature Alert
- Temperature Proportional Fan Speed Control for Acoustic Noise Reduction and Longer Fan Life
- Pulse Width Modulation Output Drive for Cost and Power Savings
- Solid-State Temperature Sensing
- ±1°C (typ.) accuracy +25°C to +70°C
- 2.8V to 5.5V Operating Range
- TC651 includes Auto Fan Shutdown
- Low Operating Current 50μA (typ.)
Features:

- Integrated Temperature Sensing and Multi-Speed Fan Control
- FanSense™ Fan Fault Detect Circuitry
- Built-in Over Temperature Alert
- Temperature Proportional Fan Speed Control for Acoustic Noise Reduction and Longer Fan Life
- Pulse Width Modulation Output Drive for Cost and Power Savings
- Solid-State Temperature Sensing
- ±1°C (typ.) Accuracy +25°C to +70°C
- 2.8V to 5.5V Operating Range
- TC651 includes Auto Fan Shutdown
- Low Operating Current 50µA (typ.)
Features:

- FanSense™ Protects against Fan Failure and Eliminates the Need for 3-wire Fans
- Temperature Proportional Fan Speed Control for Acoustic Noise Reduction and Longer Fan Life
- Over Temperature Detection (TC655)
- Provides RPM Data
- 2-Wire SMBus™ Compatible Interface
- Software Controlled Shutdown Mode for “Green” Systems
- Supports Low Cost NTC/PTC Thermistors
- Space Saving 10-pin MSOP Package
- Temperature Range: -40°C to +85°C
Features:
- FanSense™ Protects against Fan Failure and Eliminates the Need for 3-wire Fans
- Temperature Proportional Fan Speed Control for Acoustic Noise Reduction and Longer Fan Life
- Over Temperature Detection (TC665)
- Provides RPM Data
- 2-Wire SMBus™ Compatible Interface
- Supports any Fan Voltage
- Software Controlled Shutdown Mode for “Green” Systems
- Supports Low Cost NTC/PTC Thermistors
- Space Saving 10-pin MSOP Package
- Temperature Range: -40°C to +85°C
TC670

Features:
• Fan Wear-Out Detection for 2-Wire Linear-Controlled Fans
• Replacement System for 3-Wire Fans
• Fan Alert Signal when Fan Speed is below Programmed Threshold
• CLEAR Capability for Eliminating False Alarm
• Low Operating Current, 90μA (typ.)
• $V_{DD}$ Range 3.0V to 5.5V
• Available in a 6-Pin SOT-23 Package
Features:
• Gain Bandwidth Product: 2.8MHz (typ.)
• Low Quiescent Current: 230μA/amplifier (typ.)
• Input Offset Voltage (max): ±2 mV
• Single-Supply: 2.7V to 6V
• Rail-to-Rail Output
• Input Range Includes Ground
• Unity-Gain Stable
• Chip Select (CS): MCP603 only
• Temperature Ranges:
  Industrial: -40°C to +85°C
  Extended: -40°C to +125°C
• Available in Single, Dual and Quad
Features:
• Gain Bandwidth Product: 155 kHz
• Low Quiescent Current: 25µA (max.)
• Low Input Offset Voltage: ±250µV (max.)
• Power Supply Voltage: 2.5V to 6V
• Low Input Bias Current: 80pA (max.) at 85°C
• Unity Gain Stable
• Rail to Rail Output
• Chip Select Capability: MCP608
• Industrial Temperature Range:
  -40°C to +85°C
• Available in Single, Dual and Quad Packages
• Available in PDIP, SOIC, MSOP, TSSOP
Features:

• Gain Bandwidth Product: 190 kHz
• Low Quiescent Current: 25µA (max.)
• Low Input Offset Voltage: ±150µV (max.)
• Power Supply Voltage: 2.3V to 5.5V
• Low Noise: 2.2µV_{P-P} (typ.), 0.1Hz to 10Hz
• Low Input Offset Current: 0.3nA (typ.)
• Rail to Rail Output
• Unity Gain Stable
• Chip Select Capability: MCP618
• Industrial Temperature Range: -40°C to +85°C
• Available in Single, Dual and Quad
• Available in PDIP, SOIC, MSOP, TSSOP
Features:

• Gain Bandwidth Product: 1MHz (typ.)
• Supply Current: 100µA (typ.)
• Input Offset Voltage (max): ±4.5 mV
• Supply Voltage: 1.8V to 6V
• Rail to Rail Input/Output
• Phase Margin: 90° (typ.)
• Temperature Ranges:
  Industrial: -40°C to +85°C
  Extended: -40°C to +125°C
• Available in Single, Dual and Quad
• Packages
  Single: SOT23, SC70
  Dual: MSOP, 2x3 DFN
  Quad: SOIC, TSSOP
Features:
• Gain Bandwidth Product: 1MHz (typ.)
• Supply Current: 45µA (typ.)
• Input Offset Voltage (max): ±4.5 mV
• Supply Voltage: 1.8V to 6V
• Phase Margin: 65° (typ.)
• Rail to Rail Input/Output
• Temperature Ranges:
  Extended: -40°C to +125°C
• Available in Single, Dual and Quad
• Packages:
  Singles: SC70, SOT23
  Dual: SOIC, 2x3 TDFN
  Quad: TSSOP, SOIC
Features:
- Gain Bandwidth Product: 1MHz (typ.)
- Supply Current: 85µA (typ.)
- Input Offset Voltage (max): ±5 mV
- Supply Voltage: 1.8V to 6V
- Phase Margin: 90° (typ.)
- Rail to Rail Input/Output
- Temperature Ranges:
  - Extended: -40°C to +125°C
- Available in Single, Dual and Quad
Features:
- Gain Bandwidth Product: 2.8MHz (typ.)
- Supply Current: 200μA (typ.)
- Input Offset Voltage (max): ±3 mV
- Supply Voltage: 2.7V to 6.0V
- Rail to Rail Output
- Phase Margin: 50° (typ.)
- Temperature Ranges:
  Extended: -40°C to +125°C
- Available in Single, Dual and Quad
Features:
- Gain Bandwidth Product: 2MHz (typ.)
- Supply Current: IQ = 150µA (typ.)
- Input Offset Voltage (max): ±4 mV
- Supply Voltage: 2.0V to 6V
- Rail to Rail Input/Output
- Phase Margin: 65° (typ.)
- Temperature Ranges:
  - Extended: -40°C to +125°C
- Available in Single, Dual and Quad
Features:
- Gain Bandwidth Product: 10MHz (typ.)
- Supply Current: 850µA (typ.)
- Input Offset Voltage (max): ±4mV
- Supply Voltage: 2.4V to 6V
- Rail to Rail Input/Output
- Phase Margin: 65° (typ.)
- Temperature Ranges:
  - Extended: -40°C to +125°C
- Available in Single, Dual and Quad
**Features:**

- Gain Bandwidth Product: 60 MHz (typical)
- Single/Dual/Triple/Quad
- Supply Current: 6.0 mA (typical)
- Input Offset Voltage (max): ±8 mV
- Supply Voltage: 2.5V to 5.5V
- Short Circuit Current: 90 mA (typical)
- Noise: 6.8 nV/√Hz (typical, at 1 MHz)
- Rail-to-Rail Output
- Slew Rate: 32 V/μs (typical)
- Available in Single, Dual and Quad
- Chip Select: MCP663, MCP665, MCP669
- Extended Temperature Range: -40°C to +125°C
Features:
• Gain Bandwidth Product: 24 MHz (typical)
• Supply Current: 2.5 mA (typical)
• Input offset voltage (max): ±8 mV
• Power Supply: 2.5V to 5.5V
• Short Circuit Current: 70 mA (typical)
• Noise: 10 nV/√Hz (typical, at 1 MHz)
• Rail-to-Rail Output
• Slew Rate: 10 V/µs (typical)
• Available in Single, Dual and Quad
• Chip Select: MCP633, MCP635, MCP639
• Extended Temperature Range: -40°C to +125°C
Features:
- Gain Bandwidth Product: 10MHz (typ.)
- Low Supply Current: 1mA (typ.)
- Low Offset Voltage:
  - Industrial Temperature: ±500μV (max.)
  - Extended Temperature: ±250μV (max.)
- Power Supply Range: 2.5V to 5.5V
- Low Noise: 8.7nV/√Hz, at 10kHz (typ.)
- Rail-to-Rail Input/Output
- Mid-Supply $V_{\text{REF}}$: MCP6021 and MCP6023
- Unity Gain Stable
- Temperature Range: -40°C to +125°C
Features:
- Gain Bandwidth: 50MHz (typ.)
- Low Supply Current: 6mA (typ.)
- Calibrated Offset Voltage: ±200μV (max.)
- Power Supply Range: 2.5V to 5.5V
- Short Circuit Current: 100mA (typ.)
- Low Noise: 7.5nV/√Hz, at 1MHz (typ.)
- Slew Rate: 30V/μs (typ.)
- Rail-to-Rail Output
- Calibrate/Chip Select Pin Options
- Temperature Range: Extended: -40°C to +125°C
**Features:**
- Gain Bandwidth Product: 20MHz (typ.)
- Single/Dual/Quad Supply Current: 2.5mA (typ.)
- Calibrated Input Offset: ±200μV (max.)
- Power Supply: 2.5V to 5.5V
- Short Circuit Current: 70mA (typ.)
- Noise: 13nV/√Hz (typ., at 1MHz)
- Rail-to-Rail Output
- Slew Rate: 10V/μs (typ.)
- Calibrate/Chip Select Pin Options
- Extended Temperature Range: -40°C to +125°C
Features:
• Gain Bandwidth Product: 9kHz (typ.)
• Low Supply Current: 450nA/Amplifier (typ.)
• Input Offset Voltage (max): ±4.5 mV
• Supply Voltage Range: 1.4V to 6V (max.)
• Rail-to-Rail Input/ Output
• Unity Gain Stable
• Available in Single, Dual and Quad
• Packages:
  Singles: SC70, SOT23
  Dual: SOIC, MSOP
  Quad: TSSOP, SOIC
Features:
• Gain Bandwidth Product: 14kHz (typ.)
• Low Supply Current: 600nA/Amplifier (typ.)
• Input Offset Voltage (max): ± 3 mV
• Supply Voltage Range: 1.4V to 6V (max.)
• Rail-to-Rail Input/ Output
• Unity Gain Stable
• Available in Single, Dual and Quad
• Chip Select (CS) with MCP6043
**Features:**

- Gain Bandwidth Product: 10 kHz (typ.)
- Ultra Low Quiescent Current: 0.9μA (typ.)
- Low Offset Voltage: ±150μV (max.)
- Wide Power Supply Voltage: 1.8V to 5.5V
- Rail-to-Rail Input and Output
- Unity Gain Stable
- Chip Select (CS) capability: MCP6033
- Extended Temperature Range: -40°C to +125°C
Features:
- Gain Bandwidth Product: 385kHz (typ.)
- Ultra Low Quiescent Current: 30μA (typ.)
- Low Offset Voltage: ±150μV (max.)
- Wide Power Supply Voltage: 1.8V to 6.0V
- Rail-to-Rail Input and Output
- Unity Gain Stable
- Extended Temperature Range: -40°C to +125°C

\[ Z_{IN} = R_L + j\omega L \]
\[ L = R_L RC \]
Features:
• Gain Bandwidth Product: 730kHz (typ.)
• Ultra Low Quiescent Current: 60μA (typ.)
• Low Offset Voltage: ±150μV (max.)
• Wide Power Supply Voltage: 1.8V to 6.0V
• Rail-to-Rail Input and Output
• Unity Gain Stable
• Extended Temperature Range: -40°C to +125°C
MCP6071/2/4

**Features:**
- Gain Bandwidth Product: 1.2MHz (typ.)
- Ultra Low Quiescent Current: 110μA (typ.)
- Low Offset Voltage: ±150μV (max.)
- Wide Power Supply Voltage: 1.8V to 6.0V
- Rail-to-Rail Input and Output
- Unity Gain Stable
- Extended Temperature Range: -40°C to +125°C
Features:
- Gain Bandwidth Product: 100kHz (typ.)
- Low Quiescent Current: 600nA/amplifier (typ.)
- Input Offset Voltage: ±3 mV (max)
- Wide Supply Voltage Range: 1.4V to 6V
- Stable for gains of 10 V/V or higher
- Rail-to-Rail Input/Output
- Available in Single, Dual, and Quad
- Chip Select (CS) with MCP6143
- Available in 5-lead and 6-lead SOT-23
- Temperature Ranges:
  Industrial: -40°C to +85°C
  Extended: -40°C to +125°C
Features:
• Gain Bandwidth Product: 300kHz (typ.)
• Supply Current: \( I_Q = 20 \mu A \) (typ.)
• Input Offset voltage: \( \pm 5 \) mV (max)
• Supply Voltage: 1.8V to 6V
• Rail-to-Rail Input/Output
• Extended Temperature Range: 
  -40°C to + 125°C
• Available in 5-pin SC-70 and SOT-23

Summing Amplifier Circuit
Features:
- Gain Bandwidth Product: 550kHz (typ.)
- Supply Current: $I_Q = 50\mu A$ (typ.)
- Input Offset Voltage: ±5 mV (max)
- Supply Voltage: 1.8V to 5.5V
- Rail-to-Rail Input/Output
- Extended Temperature Range: -40°C to +125°C
- Available in 5-pin SC-70 and SOT-23
Features:
• Gain Bandwidth Product: 90kHz (typ.)
• Supply Current: $I_Q = 4.4 \mu A$ (typ.)
• Input Offset Voltage: $\pm 1$ mV (max)
• Supply Voltage: 1.8V to 5.5V
• Rail-to-Rail Input/Output
• Enhanced EMI Protection:
  Electromagnetic Interference Rejection Ratio (EMIRR) 97 dB at 1.8 GHz
• Extended Temperature Range:
  -40°C to + 125°C
• Available in Single, Dual and Quad Packages
Features:

- Gain Bandwidth Product: 2MHz (typ.)
- Supply Current: $I_Q = 170\mu A$ (typ.)
- Input Offset Voltage: $\pm 3\, mV$ (max)
- Supply Voltage: 2.0V to 6V
- Rail-to-Rail Input/Output
- Extended Temperature Range: -40°C to +125°C
- Available in Single, Dual and Quad Packages
Features:
• Gain Bandwidth Product: 5MHz (typ.)
• Supply Current: $I_Q = 450\mu$A (typ.)
• Input Offset Voltage: ±3 mV (max)
• Supply Voltage: 2.2V to 6V
• Rail-to-Rail Input/Output
• Extended Temperature Range: -40°C to +125°C
• Available in Single, Dual and Quad Packages
**Features:**

- Low Noise: 5.4nV/√Hz (typ.)
- Gain Bandwidth Product: 3.5MHz (typ.)
- Low Quiescent Current: 520μA (typ.)
- Input Offset voltage: ±1.5 mV (max)
- Wide Supply Voltage Range: 2.2V to 5.5V
- PSRR: 100 dB (typ.), CMRR: 95 dB (typ.)
- Extended Temperature Range: -40°C to +125°C
- Unity Gain Stable
- Small Package: SOT-23
Features:
• Gain Bandwidth Product: 10MHz (typ.)
• Supply Current: $I_Q = 1.0 \text{ mA}$ (typ.)
• Supply Voltage: 2.4V to 6V
• Input Offset Voltage: ±3 mV (max)
• Rail-to-Rail Input/Output
• Extended Temperature Range: -40°C to +125°C
• Available in Single, Dual and Quad Packages
Features:
• Gain Bandwidth Product: 2 MHz (typ.)
• Supply Current: $I_Q = 170 \mu A$ (typ.)
• Input Offset Voltage: ±3 mV (max)
• Supply Voltage: 2.0V to 6V
• Rail-to-Rail Input/Output
• Dual with Chip Select
• Extended Temperature Range: –40°C to +125°C
Features:
• Gain Bandwidth Product: 2 MHz (typ.)
• Supply Current: $I_Q = 170 \, \mu A$ (typ.)
• Input Offset Voltage: $\pm 3 \, mV$ (max)
• Supply Voltage: 2.0V to 6V
• Rail-to-Rail Input/Output
• Dual with Chip Select
• Extended Temperature Range: $-40^\circ C$ to $+125^\circ C$
MCP6295

**Features:**
- Gain Bandwidth Product: 10 MHz (typ.)
- Supply Current: \( I_Q = 1.0 \, \text{mA} \) (typ.)
- Input Offset Voltage: \( \pm 3 \, \text{mV} \) (max)
- Supply Voltage: 2.4V to 6V
- Rail-to-Rail Input/Output
- Dual with Chip Select
- Extended Temperature Range: -40°C to +125°C
Features:

- Gain Bandwidth Product: 2 MHz (typ.)
- Supply Current: $I_Q = 100 \mu A$ (typ.)
- Input Offset Voltage: $\pm 1.5$ mV (max)
- Supply Voltage: 2.0V to 5.5V
- Rail-to-Rail Input/Output
- Extended Temperature Range: -40°C to +125°C
- Available in Single, Dual and Quad Packages
Features:
• Gain Bandwidth Product: 4 MHz (typ.)
• Supply Current: $I_Q = 240 \, \mu A$ (typ.)
• Input Offset Voltage: $\pm 1.5 \, mV$ (max)
• Supply Voltage: 2.0V to 5.5V
• Rail-to-Rail Input/Output
• Extended Temperature Range: -40°C to +125°C
• Available in Single, Dual and Quad Packages
Features:
• Gain Bandwidth Product: 7.5 MHz (typ.)
• Supply Current: $I_Q = 530 \, \mu A$ (typ.)
• Input Offset Voltage: $\pm 1.5 \, mV$ (max)
• Supply Voltage: 2.0V to 5.5V
• Rail-to-Rail Input/Output
• Extended Temperature Range: -40°C to +125°C
• Available in Single, Dual and Quad Packages
TC913A/913B

Features:

• First Monolithic Dual Auto-Zeroed Operational Amplifier
• Excellent AC Operating Characteristics:
  - Slew Rate; 2.5V/μs
  - Unity-Gain Bandwidth; 1.5MHz
• Low Supply Current; 650μA
• Chopper Amplifier Performance Without External Capacitors:
  - \( V_{OS} \): ±15μV (max.)
  - \( V_{OS} \): Drift; 0.15μV/°C (max.)
  - Saves Cost of External Capacitors
• High DC Gain; 120dB
• Low Input Voltage Noise:
  - 0.65μV_{P-P} (0.1Hz to 10Hz)
• Wide Common Mode Voltage Range:
  - \( V_{SS} \) to \( V_{DD} \) -2V
• High Common Mode Rejection; 116dB
• Dual or Single Supply Operation:
  ±3.5V to ±8.3V
  +7V to +16V
• SOIC Packages Available
• Pin Compatible with LM358, OP-14, MC1458, ICL7621, TL082, TLC322
**Features:**

- **Gain Bandwidth Product:** 1.3 MHz (typ.)
- **Low Power and Supply Voltages:**
  - $I_Q$: 300μA/amplifier (typ.)
  - Wide Supply Voltage Range: 1.8V to 5.5V
- **High DC Precision:**
  - $V_{OS}$ Drift: ±50nV/°C (max.)
  - Input Offset Voltage: $V_{OS} = \pm 2$ μV (max.)
  - AOL: 130 dB (min.)
  - PSRR: 130 dB (min.)
  - CMRR: 130 dB (min.)
  - $E_{ni}$: 2.5 μV_{P-P} (typ.), $f = 0.1$Hz to 10Hz
  - $E_{ni}$: 0.79 μV_{P-P} (typ.), $f = 0.01$Hz to 1Hz
- **Rail-to-Rail Input/Output**
- **Unity Gain Stable**
- **Available in Single and Dual**
  - Single with Chip Select (CS): MCP6V03
- **Extended Temperature Range:**
  - -40°C to +125°C
Features:

- Gain Bandwidth Product: $1.3 \, \text{MHz} \, (\text{typ.})$
- Low Power and Supply Voltages:
  - $I_Q$: $300\mu\text{A/amp}(\text{typ.})$
  - Wide Supply Voltage Range: $1.8\text{V}$ to $5.5\text{V}$
- High DC Precision:
  - Input Offset Voltage: $\pm 3 \, \mu\text{V} \, (\text{max.})$
  - $V_{OS}$ Drift: $\pm 50\text{nV/°C} \, (\text{max.})$
  - AOL: $125 \, \text{dB} \, (\text{min.})$
  - PSRR: $125 \, \text{dB} \, (\text{min.})$
  - CMRR: $120 \, \text{dB} \, (\text{min.})$
  - $E_{ni}: 1.7 \, \mu\text{V}_{\text{P-P}} \, (\text{typ.}), \, f = 0.1\text{Hz} \, \text{to} \, 10\text{Hz}$
  - $E_{ni}: 0.54 \, \mu\text{V}_{\text{P-P}} \, (\text{typ.}), \, f = 0.01\text{Hz} \, \text{to} \, 1\text{Hz}$
- Rail-to-Rail Input/Output
- Unity Gain Stable
- Available in Single and Dual
  - Single with Chip Select (CS): MCP6V08
- Extended Temperature Range: $-40°C \, \text{to} \, 125°C$
Features:

• Gain Bandwidth Product: 80 kHz (typ.)
• Low Power and Supply Voltages:
  - $I_Q$: 7.5 μA/amplifier (typ.)
  - Wide Supply Voltage Range: 1.6V to 5.5V
• High DC Precision:
  - Input Offset Voltage: ±8 μV (max.)
  - $V_{OS}$ Drift: ±50nV/°C (max.)
  - AOL: 112 dB (min.)
  - PSRR: 118 dB (min.)
  - CMRR: 119 dB (min.)
  - Eni: 2.1 μV_{P-P} (typ.), f = 0.1Hz to 10Hz
  - Eni: 0.67 μV_{P-P} (typ.), f = 0.01Hz to 1Hz
• Rail-to-Rail Input/Output
• Unity Gain Stable
• Small Packages:
  - Singles in SC70, SOT-23
  - Duals in MSOP-8, 2x3 TDFN
  - Quad in TSSOP-14
• Extended Temperature Range: -40°C to 125°C
Features:

- Gain Bandwidth Product: 300 kHz (typ.)
- Low Power and Supply Voltages:
  - $I_Q$: 23 μA/amplifier (typ.)
  - Wide Supply Voltage Range: 1.8V to 5.5V
- High DC Precision:
  - Input Offset Voltage: ±8 μV (max.)
  - $V_{OS}$ Drift: ±50nV/°C (max.)
  - AOL: 120 dB (min.)
  - PSRR: 120 dB (min.)
  - CMRR: 120 dB (min.)
  - $\text{En}_i$: 1.0 μV$_{p-p}$ (typ.), f = 0.1Hz to 10Hz
  - $\text{En}_i$: 0.33 μV$_{p-p}$ (typ.), f = 0.01Hz to 1Hz
- Rail-to-Rail Input/Output
- Unity Gain Stable
- Small Packages:
  - Singles in SC70, SOT-23
  - Duals in MSOP-8, 2x3 TDFN
  - Quad in TSSOP-14
- Extended Temperature Range: -40°C to 125°C
Features:

- Gain Bandwidth Product: 2 MHz (typ.)
- Supply Current: 620 µA/amplifier (typ.)
- Input Offset Voltage (max): ±2 µV (max.)
- Supply Voltage Range: 2.3V to 5.5V
- Dual Channel
- High DC Precision:
  - VOS Drift: ±50 nV/°C (max.)
  - AOL: 133 dB (min.)
  - PSRR: 125 dB (mini.)
  - CMRR: 125 dB (min.)
  - Eni: 1 µVP-P (typ.), f = 0.1 Hz to 10 Hz
  - Eni: 0.32 µVp-p (typ.), f = 0.01 Hz to 1 Hz
- Rail-to-Rail Input/Output
- Unity Gain Stable
- 8-Pin SOIC and 4x4 DFN Packages
- Extended Temperature Range: -40°C to +125°C
Features:
- Gain Bandwidth Product: 1.2 MHz (typ.)
- Supply Current: 135 μA/amplifier (typ.)
- Input Offset Voltage (max): ±3.5 mV
- Supply Voltage: 3.5V to 16V
- High DC Precision:
  - $V_{OS}$ Drift: $±2.5 \, \mu V/°C$ (max.)
  - PSRR: 87 dB (min.)
  - CMRR: 78 dB (min.)
- Rail-to-Rail Output
- Unity Gain Stable
- Available in
  - Single: MCP6H01
  - Dual: MCP6H02
  - Quad: MCP6H04
- Extended Temperature Range: -40°C to 125°C
MCP6H71/2/4

Features:
- Gain Bandwidth Product: 2.7 MHz (typical)
- Supply Voltage Range:
  - Single-Supply Operation: 3.5V to 12V
  - Dual-Supply Operation: ±1.75V to ±6V
- Input Offset Voltage: ±1 mV (typical)
- Quiescent Current: 480 µA (typical)
- Common Mode Rejection Ratio: 103 dB (typical)
- Power Supply Rejection Ratio: 105 dB (typical)
- Rail-to-Rail Output
- Slew Rate: 2 V/µs (typical)
- Unity Gain Stable
- Extended Temperature Range: -40°C to +125°C
Features:
• Gain Bandwidth Product: 5.5 MHz (typ.)
• Supply Voltage Range:
  - Single-Supply Operation: 3.5V to 12V
  - Dual-Supply Operation: ±1.75V to ±6V
• Quiescent Current: 0.7 mA/amplifier (typ.)
• Input Offset Voltage: ±1 mV (typ.)
• Common Mode Rejection Ratio: 100 dB (typ.)
• Power Supply Rejection Ratio: 102 dB (typ.)
• Rail-to-Rail Output
• Gain Bandwidth Product: 5.5 MHz (typical)
• Slew Rate: 5 V/µs (typical)
• Unity Gain Stable
• Extended Temperature Range: -40°C to +125°C
Features:

- Gain Bandwidth Product: 10 MHz (typ.)
- Supply Current: 2 mA/amplifier (typ.)
- Input Offset Voltage (max): ±4 mV
- Supply Voltage: 3.5V to 12V
- High DC Precision:
  - $V_{OS}$ Drift: $\pm 4 \, \mu V/°C$ (max.)
  - PSRR: 75 dB (min.)
  - CMRR: 75 dB (min.)
- Rail-to-Rail Output
- Unity Gain Stable
- Available in
  - Single: MCP6H91
  - Dual: MCP6H92
  - Quad: MCP6H94
- Extended Temperature Range: -40°C to 125°C
Features:
- Gain Bandwidth: 2 MHz
- Supply current: 3.5 mA (max)
- Low Input Offset Voltage: ±5 μV (typ.)
- Supply Voltage Range: 4.5V to 16V
- Low Input Offset Voltage Drift: 0.05μV/°C (max.)
- Low Input Bias Current: 10pA (max.)
- High Impedance Differential CMOS Inputs: 10^{12}Ω
- High Open Loop Voltage Gain: 120dB (min.)
- Low Input Noise Voltage: 2.0μV_{P-P}
- High Slew Rate: 2.5V/μs
- Low Power Operation: 20mW
- Output Clamp Speeds Recovery Time
- Compensated Internally for Stable Unity Gain
- Direct Replacement for ICL7650
- Available in 8-Pin PDIP and 14-Pin PDIP
Features:

• Gain Bandwidth Product: 0.4 MHz
• Supply Current: 3 mA (max)
• Low Offset Over Temperature Voltage: 10μV
• Supply Voltage Range: 5V to 16V
• Ultra Low Long Term Drift: 150nV/month
• Low Temperature Drift: 100nV/°C
• Low DC Input Bias Current: 15pA
• High Gain, CMRR and PSRR: 110dB (min.)
• Low Input Noise Voltage: 0.2μV_{P-P} (DC to 1Hz)
• Compensated Internally for Stable Unity Gain
• Clamp circuit for Fast Overload Recovery
MCP6N11

**Features:**
- Bandwidth: 500 kHz (typical, Gain = GMIN)
- Rail-to-Rail Input and Output
- Gain Set by 2 External Resistors
- Minimum Gain (GMIN) Options: 1, 2, 5, 10 or 100 V/V
- Common Mode Rejection Ratio (CMRR): 115 dB (typical, GMIN = 100)
- Power Supply Rejection Ratio (PSRR): 112 dB (typical, GMIN = 100)
- Supply Current: 800 μA/channel (typical)
- Single Channel
- Enable/VOS Calibration pin: (EN/CAL)
- Power Supply: 1.8V to 5.5V
- Extended Temperature Range: -40°C to +125°C
MCP6N16

Features:
- Zero-Drift Architecture
  - Low Vos, 17 uV (Gmin = 100)
  - Low offset drift: ±60 nV/°C
  - No 1/f noise
  - CMRR: 112 dB minimum
  - PSRR: 110 dB minimum
- Flexibility
  - Rail to rail input/output
  - Gain set by two external resistors
- Enhanced EMI Protection
- Bandwidth of 500 kHz
- Operating voltage: 1.8 to 5.5V
Features:
- Multiplexed Inputs: 1, 2, 6 or 8 Channels
- 8 Gain Selections:
  +1, +2, +4, +5, +8, +10, +16, or +32 V/V
- Serial Peripheral Interface (SPI)
- Rail-to-Rail Input and Output
- Low Gain Error: ±1% (max.)
- Low Offset: ±275μV (max.)
- High Bandwidth: 2 to 12MHz (typ.)
- Low Noise: 10nV/√Hz @ 10kHz (typ.)
- Low Supply Current 1.0mA (typ.)
- Single Supply: 2.5V to 5.5V
Features:
• Multiplexed Inputs: 1 or 2 Channels
• 8 Gain Selections:
  +1, +2, +4, +5, +8, +10, +16, or +32 V/V
• Serial Peripheral Interface (SPI)
• Rail-to-Rail Input and Output
• Low Gain Error: ±1% (max.)
• Offset Mismatch Between Channels: 0μV
• High Bandwidth: 1 to 18MHz (typ.)
• Low Noise: 10 nV/√Hz @ 10kHz (typ.)
• Low Supply Current 1.0mA (typ.)
• Single Supply: 2.5V to 5.5V
• Extended Temperature Range: -40°C to +125°C
Features:

• 3 Gain Selections: +1, +10, +50 V/V
• One Gain Select Input per Amplifier
• Rail-to-Rail Input and Output
• Low Gain Error: ±1% (max.)
• High Bandwidth: 250 to 900kHz (typ.)
• Low Supply Current: 110μA (typ.)
• Single Supply: 1.8V to 5.5V
• Extended Temperature Range: -40°C to +125°C
Features:
- Low Quiescent Current: 600nA/comparator (typ.)
- Rail-to-Rail Input: $V_{SS} -0.3V$ to $V_{DD} +0.3V$
- CMOS/TTL-Compatible Output
- Propagation Delay: 4μs (typ.), 100mV Overdrive
- Wide Supply Voltage Range: 1.6V to 5.5V
- Available in Single, Dual and Quad
- Single available in SOT-23-5, SC-70-5
- Chip Select (CS) with MCP6543
- Low Switching Current
- Internal Hysteresis: 3.3mV (typ.)
- Temperature Ranges:
  - Industrial: -40°C to +85°C
  - Extended: -40°C to +125°C
Features:

- Low Quiescent Current: 600nA/comparator (typ.)
- Rail-to-Rail Input: $V_{SS} -0.3V$ to $V_{DD} +0.3V$
- Open-Drain Output: $V_{OUT} \leq 10V$
- Propagation Delay: 4μs (typ.), 100 mV Overdrive
- Wide Supply Voltage Range: 1.6V to 5.5V
- Single available in SOT-23-5, SC-70-5
- Available in Single, Dual and Quad
- Chip Select (CS) with MCP6548
- Low Switching Current
- Internal Hysteresis: 3.3mV (typ.)
- Temperature Range:
  - Industrial: -40°C to +85°C
  - Extended: -40°C to +125°C
MCP65R41/46

Features:
- Integrated Reference Voltage
  - Factory Set Reference Voltage: 1.21V or 2.4V
  - Tolerance: ±1% (typ.)
- Low Quiescent Current: 2.5 μA (typ.)
- Propagation Delay: 4μs (typ.), 100mV Overdrive
- Input Offset Voltage: ±3mV (typ.)
- Rail-to-Rail Input: \( V_{SS} \) -0.3V to \( V_{DD} \) +0.3V
- CMOS/TTL-Compatible Output
- Wide Supply Voltage Range: 1.8V to 5.5V
- Output Options:
  - MCP65R41 Push-Pull
  - MCP65R46 Open-Drain
- SOT-23-6
- Extended Temperature Ranges: -40°C to +125°C

* Pull-up resistor required for the MCP65R46 only.
Features:

- Propagation Delay at $1.8V_{DD}$:
  - 56ns (typ.) High to Low
  - 49ns (typ.) Low to High
- Low Quiescent Current: 100μA (typ.)
- Input Offset Voltage: ±3mV (typ.)
- Rail-to-Rail Input: $V_{SS} -0.3V$ to $V_{DD} +0.3V$
- CMOS/TTL Compatible Output
- Wide Supply Voltage Range: 1.8V to 5.5V
- Available in Single, Dual, and Quad
- Packages: SC70-5, SOT-23-5, SOIC, MSOP, TSSOP
**Features:**

- Propagation Delay at $1.8V_{DD}$:
  - 56ns (typ.) High to Low
- Low Quiescent Current: 100μA (typ.)
- Input Offset Voltage: ±3mV (typ.)
- Rail-to-Rail Input: $V_{SS}$ -0.3V to $V_{DD}$ +0.3V
- Open-Drain Output
- Wide Supply Voltage Range: 1.8V to 5.5V
- Available in Single, Dual, and Quad
- Packages: SC70, SOT-23-5, SOIC, MSOP, TSSOP
**Features:**

- Low Supply Current: 50μA (typ.)
- Low Dropout Voltage
- Choice of 50mA (TC1014), 100mA (TC1015) and 150mA (TC1185) Output
- High Output Voltage Accuracy
- Standard or Custom Output Voltages
- Power Saving Shutdown Mode
- Reference Bypass Input for Ultra Low-Noise Operation
- Overcurrent and Overtemperature Protection
- Space-Saving 5-Pin SOT-23 Package
- Pin-Compatible Upgrades for Bipolar Regulators
Features:
• Low Ground Current for Longer Battery Life
• Low Dropout Voltage
• Choice of 50mA (TC1054), 100mA (TC1055) and 150mA (TC1186) Output
• High Output Voltage Accuracy
• Power-Saving Shutdown Mode
• ERROR Output Can Be Used as a Low Battery Detector or Microcontroller Reset Generator
• Overcurrent and Overtemperature Protection
• 5-Pin SOT-23 Package
• Pin Compatible Upgrades for Bipolar Regulators
**Features:**
- 50μA Ground Current for Longer Battery Life
- Adjustable Output Voltage
- Very Low Dropout Voltage
- Choice of 50mA (TC1070), 100mA (TC1071) and 150mA (TC1187) Output
- Power-Saving Shutdown Mode
- Overcurrent and Overtemperature Protection
- Space-Saving 5-Pin SOT-23 Package
- Pin Compatible with Bipolar Regulators
Features:
• 50μA Ground Current for Longer Battery Life
• Very Low Dropout Voltage
• Choice of 50mA (TC1072) and 100mA (TC1073) Output
• High Output Voltage Accuracy
• Standard or Custom Output Voltages
• Power-Saving Shutdown Mode
• ERROR Output Can Be Used as a Low Battery Detector or Processor Reset Generator
• Bypass Input for Low Noise Operation
• Overcurrent and Overtemperature Protection
• Space-Saving 6-Pin SOT-23 Package
• Pin Compatible Upgrades for Bipolar Regulators
• Standard Output Voltage Options:
  1.8V, 2.5V, 2.6V, 2.7V, 2.8V, 2.85V, 3.0V, 3.3V, 3.6V, 4.0V, 5.0V
• Other output voltages are available. Please contact Microchip Technology Inc. for details.
Features:

• Low Supply Current: 55 μA (typical)
• Low Dropout Voltage: 45 mV (typ.) @ 50 mA
• High-Output Voltage Accuracy: ±0.4% (typ.)
• Standard or Custom Output Voltages
• Power-Saving Shutdown Mode
• Reference Bypass Input for Ultra Low-Noise Operation
• Fast Shutdown Response Time: 60 μs (typ.)
• Overcurrent and Overtemperature Protection
• Space-Saving 5-Pin SOT-23A Package
• Pin-Compatible Upgrades for Bipolar Regulators
• Stable with Ceramic Output Capacitors
• Wide Operating Temperature Range:
  -40°C to +125°C
• Standard Output Voltage Options:
  1.8V, 2.5V, 2.6V, 2.7V, 2.8V, 2.85V, 3.0V,
  3.3V, 5.0V
Features:

• Low Supply Current: 55μA (typ.)
• Low Dropout Voltage:
  45 mV (typ.) @ 50 mA
• High Output Voltage Accuracy: ±0.4% (typ.)
• Standard or Custom Output Voltages
• Power-Saving Shutdown Mode
• ERROR Output Can Be Used as a Low Battery Detector or Processor Reset Generator
• Fast Shutdown Response Time: 60μs (typ.)
• Overcurrent and Overtemperature Protection
• Space-Saving 5-Pin SOT-23A Package
• Pin Compatible Upgrades for Bipolar Regulators
• Stable with Ceramic Output Capacitors
Features:

- Extremely Low Ground Current for Longer Battery Life
- Very Low Dropout Voltage
- Choice of 50mA and 100mA Output (TC1223 and TC1224, respectively)
- High Output Voltage Accuracy
- Standard or Custom Output Voltages
- Power Saving Shutdown Mode
- Overcurrent and Overtemperature Protection
- Space-Saving 5-Pin SOT-23A Package
- Pin Compatible Upgrades for Bipolar Regulators
Features:
- 48V (43.5V ±10%) load dump protected for 180ms with a 30 second repetition rate (FORD Test Pulse G Loaded)
- Wide steady state supply voltage, 6.0V to 30.0V
- Extended Junction Temperature Range: -40°C to +125°C
- Fixed output voltages: 3.0V, 3.3V, 5.0V
- Low quiescent current: 70μA (typ.)
- Low shutdown quiescent current: 10μA (typ.)
- Output Voltage Tolerances of ±2.5% over the temperature range
- Maximum output current of 70mA @ +125°C Junction Temperature
- Maximum continuous input voltage of 30V
- Internal thermal overload protection, +157°C (typ.) Junction Temperature
- Internal short circuit current limit, 120mA (typ.) for +5V option
- Short Circuit Current Foldback
- Shutdown Input option (MCP1791)
- Power Good Output option (MCP1791)
- High PSRR, -90 dB @100Hz (typ.)
- Stable with 1μF to 1000μF tantalum and electrolytic Capacitors
- Stable with 4.7μF to 1000μF ceramic capacitors
Features:

- Space-Saving 5-Pin SC-70 Package
- Low Operating Current: 53µA (typ.)
  Shutdown Mode: 0.05µA (typ.)
- Very Low Dropout Voltage
- Rated 80mA Output Current
- Requires only 1µF Ceramic Output Capacitance
- High Output Voltage Accuracy: ±0.5% (typ.)
- 10µs (typ.) Wake-Up Time from SHDN
- Overcurrent and Overtemperature Protection
- Pin Compatible Upgrades for Bipolar Regulators
TC1015

Features:
• Low Supply Current: 50μA (typ.)
• Low Dropout Voltage
• Choice of 50mA (TC1014), 100mA (TC1015) and 150mA (TC1185) Output
• High Output Voltage Accuracy
• Standard or Custom Output Voltages
• Power Saving Shutdown Mode
• Reference Bypass Input for Ultra Low-Noise Operation
• Overcurrent and Overtemperature Protection
• Space-Saving 5-Pin SOT-23 Package
• Pin Compatible Upgrades for Bipolar Regulators
Features:

- Low Ground Current
- Low Dropout Voltage
- Choice of 50mA (TC1054), 100mA (TC1055) and 150mA (TC1186) Output
- High Output Voltage Accuracy
- Power-Saving Shutdown Mode
- ERROR Output Can Be Used as a Low Battery Detector or Microcontroller Reset Generator
- Overcurrent and Overtemperature Protection
- 5-Pin SOT-23 Package
- Pin Compatible Upgrades for Bipolar Regulators
TC2015

Features:
• Low Supply Current: 55 μA (typical)
• Low Dropout Voltage: 90 mV (typ.) @ 100 mA
• High-Output Voltage Accuracy: ±0.4% (typ.)
• Standard or Custom Output Voltages
• Power-Saving Shutdown Mode
• Reference Bypass Input for Ultra Low-Noise Operation
• Fast Shutdown Response Time: 60μs (typ.)
• Over-current and Over-temperature Protection
• Space-Saving 5-Pin SOT-23A Package
• Pin-Compatible Upgrades for Bipolar Regulators
• Stable with Ceramic Output Capacitors
• Wide Operating Temperature Range: -40°C to +125°C
TC2055

Features:
- Low Supply Current, 55 μA (typ.)
- Low Dropout Voltage: 90 mV (typ.) @ 100 mA
- High Output Voltage Accuracy: ±0.4% (typ.)
- Standard or Custom Output Voltages
- Power-Saving Shutdown Mode
- ERROR Output Can Be Used as a Low Battery Detector or Processor Reset Generator
- Fast Shutdown Reponse Time: 60μs (typ.)
- Overcurrent and Overtemperature Protection
- Space-Saving 5-Pin SOT-23A Package
- Pin Compatible Upgrades for Bipolar Regulators
- Stable with Ceramic Output Capacitors
Features:
- 50μA Ground Current for Longer Battery Life
- Adjustable Output Voltage
- Very Low Dropout Voltage
- Choice of 50mA (TC1070), 100mA (TC1071) and 150mA (TC1187) Output
- Power-Saving Shutdown Mode
- Over Current and Over Temperature Protection
- Space-Saving 5-Pin SOT-23 Package
- Pin Compatible with Bipolar Regulators
TC1073

Features:
• 50μA Ground Current for Longer Battery Life
• Adjustable Output Voltage
• Very Low Dropout Voltage
• Choice of 50mA (TC1070), 100mA (TC1071) and 150mA (TC1187) Output
• Power-Saving Shutdown Mode
• Overcurrent and Overtemperature Protection
• Space-Saving 5-Pin SOT-23 Package
• Pin Compatible with Bipolar Regulators
**Features:**

- Low Ground Current for Longer Battery Life
- Low Dropout Voltage
- Choice of 50mA (TC1223), 100mA (TC1224) Output Current
- High Output Voltage Accuracy
- Standard of Custom Output Voltages
- Power Saving Shutdown Mode
- Overcurrent and Overtemperature Protection
- Space-Saving 5-Pin SOT-23A Package
- Pin Compatible Upgrades for Bipolar Regulators
Features:

- Input Voltage Range: 2.7V to 6.0V
- 120mA Output Current
- Low Supply Current: 50μA, (typ.)
- Low Dropout Voltage: 110mV (typ.)
  @ 100mA
- Fast Turn-On from Shutdown:
  140μs (typ.)
- Low Output Noise
- Overcurrent and
  Overtemperature Protection
- Low Power Shutdown Mode
- Auto Discharge of Output Capacitor
  (TC1189)
MCP1804

Features:
• 150 mA Output Current
• Low Dropout Voltage, 260mV typ. @ 20mA, \( V_R=3.3 \text{V} \)
• 50 μA Typical Quiescent Current
• 0.01 μA Typical Shutdown Current
• Input Operating Voltage Range: 2.0V to 28.0V
• Standard Output Voltage Options (1.8V, 2.5V, 3.0V, 3.3V, 5.0V, 10.0V, 12.0V)
• Output Voltage Accuracy: ±2%
• Output voltages from 1.8V to 18.0V in 0.1V increments are available upon request
• Stable with Ceramic output capacitors
• Current Limit Protection With Current Foldback
• Shutdown pin
• High PSRR: 50 dB typical @ 1 kHz
**Features:**

- Low Supply Current: 50μA (typ.)
- Low Dropout Voltage
- Choice of 50mA (TC1014), 100mA (TC1015) and 150mA (TC1185) Output
- High Output Voltage Accuracy
- Standard or Custom Output Voltages
- Power-Saving Shutdown Mode
- Reference Bypass Input for Ultra Low-Noise Operation
- Overcurrent and Overtemperature Protection
- Space-Saving 5-Pin SOT-23 Package
- Pin-Compatible Upgrades for Bipolar Regulators
TC1186

Features:
- Low Ground Current for Longer Battery Life
- Low Dropout Voltage
- Choice of 50mA (TC1014), 100mA (TC1015) and 150mA (TC1185) Output
- High Output Voltage Accuracy
- Standard or Custom Output Voltages
- Power Saving Shutdown Mode
- Error Output Can Be Used as a Low Battery Detector or Microcontroller Reset Generator
- Overcurrent and Overtemperature Protection
- Space-Saving 5-Pin SOT-23A Package
- Pin-Compatible Upgrades for Bipolar Regulators
TC1187

Features:
• 50μA Ground Current for Longer Battery Life
• Adjustable Output Voltage
• Very Low Dropout Voltage
• Choice of 50mA (TC1070), 100mA (TC1071) and 150mA (TC1187) Output
• Power-Saving Shutdown Mode
• Overcurrent and Overtemperature Protection
• Space-Saving 5-Pin SOT-23 Package
• Pin Compatible with Bipolar Regulators
Features:
• Low Supply Current: 80μA (max.)
• Low Dropout Voltage: 140mV (typ.) @ 150mA
• High-Output Voltage Accuracy: ±0.4% (typ.)
• Standard or Custom Output Voltages
• Power-Saving Shutdown Mode
• Reference Bypass Input for Ultra Low-Noise Operation
• Fast Shutdown Response Time: 60μs (typ.)
• Over-current and Over-temperature Protection
• Space-Saving 5-Pin SOT-23A Package
• Pin-Compatable Upgrades for Bipolar Regulators
• Stable with Ceramic Output Capacitors
• Wide Operating Temperature Range: -40°C to +125°C
TC2186

Features:
- Low Supply Current: 55μA (typ.)
- Low Dropout Voltage: 140mV (typ.) @ 150mA
- High Output Voltage Accuracy: ±0.4% (typ.)
- Standard or Custom Output Voltages
- Power-Saving Shutdown Mode
- ERROR Output Can Be Used as a Low Battery Detector or Processor Reset Generator
- Fast Shutdown Response Time: 60μs (typ.)
- Overcurrent and Overtemperature Protection
- Space-Saving 5-Pin SOT-23A Package
- Pin Compatible Upgrades for Bipolar Regulators
- Stable with Ceramic Output Capacitors
Features:

- Space Saving 5-Pin SC-70 and SOT-23 Packages
- Low Operating Current: 53μA (typ.)
  Shutdown Mode: 0.05μA (typ.)
- High Output Voltage Accuracy: ±0.5% (typ.)
- Very Low Dropout Voltage
- Rated 150mA Output Current
- Wake-Up Time from SHDN: 10μs (typ.)
- Overcurrent and Overtemperature Protection
- Pin Compatible Upgrades for Bipolar Regulators
- Requires Only 1μF Ceramic Output Capacitance
**Features:**

- 150mA (max.) Output Current
- Low Dropout Voltage,
  
  200mV (typ.) @ 100mA
- 25μA (typ.) Quiescent Current
- 0.01μA (typ.) Shutdown Current
- Input Operating Voltage Range:
  
  2.0V to 10.0V
- Standard Output Voltage Options:
  
  0.9V, 1.2V, 1.8V, 2.5V,
  3.0V, 3.3V, 5.0V, 6.0V
- Output voltage accuracy:
  
  ±2% (\(V_R > 1.5V\)),
  ±30mV (\(V_R \leq 1.5V\))
- Stable with Ceramic output capacitors
- Current Limit Protection
- Shutdown pin
- High PSRR: 70dB (typ.) @ 10kHz
MCP1802

Features:

- 300mA (max.) Output Current
- Low Dropout Voltage,
  200mV (typ.) @ 100 mA
- 25μA (typ.) Quiescent Current
- 0.01μA (typ.) Shutdown Current
- Input Operating Voltage Range:
  2.0V to 10.0V
- Standard Output Voltage Options:
  0.9V, 1.2V, 1.8V, 2.5V,
  3.0V, 3.3V, 5.0V, 6.0V
- Output voltage accuracy:
  ±2% ($V_R > 1.5V$),
  ±30mV ($V_R \leq 1.5V$)
- Stable with Ceramic output capacitors
- Current Limit Protection
- Shutdown pin
- High PSRR: 70dB (typ.) @ 10kHz
**Features:**

- 300mA Output Current Capability
- Input Operating Voltage Range: 2.1V to 6.0V
- Adjustable Output Voltage Range: 0.8V to 5.0V (MCP1824 only)
- Standard Fixed Output Voltages: 0.8V, 1.2V, 1.8V, 2.5V, 3.0V, 3.3V, 5.0V
- Other Fixed Output Voltage Options Available Upon Request
- Low Dropout Voltage: 200mV (typ.) @ 300mA
- Typical Output Voltage Tolerance: 0.4%
- Stable with 1.0μF Ceramic Output Capacitor
- Fast Response to Load Transients
- Low Supply Current: 120μA (typ.)
- Low Shutdown Supply Current: 0.1μA (typ.) (MCP1824 only)
- Fixed Delay on Power Good Output (MCP1824 only)
- Short Circuit Current Limiting and Overtemperature Protection
- 5-Lead Plastic SOT-223, SOT-23 Package Options (MCP1824)
- 3-Lead Plastic SOT-223 Package Option (MCP1824S)
Features:
• 500mA Output Current Capability
• Input Operating Voltage Range: 2.1V to 6.0V
• Adjustable Output Voltage Range: 0.8V to 5.0V (MCP1825 only)
• Standard Fixed Output Voltages: 0.8V, 1.2V, 1.8V, 2.5V, 3.0V, 3.3V, 5.0V
• Other Fixed Output Voltage Options Available Upon Request
• Low Dropout Voltage: 210mV (typ.) at 500mA
• Typical Output Voltage Tolerance: 0.5%
• Stable with 1.0μF Ceramic Output Capacitor
• Fast response to Load Transients
• Low Supply Current: 120μA (typ.)
• Low Shutdown Supply Current: 0.1μA (typ.) (MCP1825 only)
• Fixed Delay on Power Good Output (MCP1825 only)
• Short Circuit Current Limiting and Overtemperature Protection
• TO-263-5 (DDPAK-5), TO-220-5, SOT-223-5 Package Options (MCP1825)
• TO-263-3 (DDPAK-3), TO-220-3, SOT-223-3 Package Options (MCP1825S)
Features:

• 1000mA Output Current Capability
• Input Operating Voltage Range: 2.3V to 6.0V
• Adjustable Output Voltage Range: 0.8V to 5.0V (MCP1826 only)
• Standard Fixed Output Voltages: 0.8V, 1.2V, 1.8V, 2.5V, 3.0V, 3.3V, 5.0V
• Other Fixed Output Voltage Options Available Upon Request
• Low Dropout Voltage: 250mV (typ.) @ 1000mA
• Typical Output Voltage Tolerance: 0.5%
• Stable with 1.0μF Ceramic Output Capacitor
• Fast response to Load Transients
• Low Supply Current: 120μA (typ.)
• Low Shutdown Supply Current: 0.1μA (typ.) (MCP1826 only)
• Fixed Delay on Power Good Output (MCP1826 only)
• Short Circuit Current Limiting and Overtemperature Protection
• TO-263-5 (DDPAK-5), TO-220-5, SOT-223-5 Package Options (MCP1826).
• TO-263-3 (DDPAK-3), TO-220-3, SOT-223-3 Package Options (MCP1826S).
**Features:**

- 1.6μA (typ.) Quiescent Current
- Input Operating Voltage Range: 2.3V to 6.0V
- Output Voltage Range: 1.2V to 5.0V
- 250mA Output Current for Output Voltages ≥ 2.5V
- 200mA Output Current for Output Voltages < 2.5V
- Low Dropout voltage: 178mV (typ.) @ 250mA for $V_{OUT} = 2.8V$
- 0.4% (typ.) Output Voltage Tolerance
- Stable with 1.0μF Ceramic Output Capacitor
- Short Circuit Protection
- Overtemperature Protection
MCP1701A
Recommend MCP1703A for new designs

Features:
- 2.0μA (typ.) Quiescent Current
- Input Operating Voltage up to 10.0V
- Low Dropout Voltage
  - 120mV (typ.) @ 100mA
  - 380mV (typ.) @ 200mA
- High Output Current:
  250mA (V\text{OUT} = 5.0V)
- High-Accuracy Output Voltage: 2% (max.)
- Low Temperature Drifting: 100ppm/°C
- Excellent Line Regulation: 0.2%/V
- Short Circuit Protection
- Package Options:
  SOT-23A-3, SOT-89-3, TO-92-3
- Standard Output Voltage Options:
  1.8V, 2.5V, 3.0V, 3.3V, 5.0V
**Features:**

- 2.0μA Quiescent Current (typ.)
- Input Operating Voltage Range: 2.7V to 13.2V
- 250mA Output Current for Output Voltages ≥ 2.5V
- 200mA Output Current for Output Voltages < 2.5V
- Output voltage range 1.2V to 5.5V in 0.1V increments (50mV increments available upon request)
- Stable with 1.0μF to 22μF Output Capacitor
- Short-Circuit Protection
- Overtemperature Protection
- Package Options: 3-Pin SOT-23A, 3-Pin SOT-89, TO-92-3
Features:
- 2.0μA Quiescent Current (typ.)
- Input Operating Voltage Range: 2.7V to 16V
- 250mA Output Current for Output Voltages ≥ 2.5V
- 200mA Output Current for Output Voltages < 2.5V
- 0.4% (typ.) Output Voltage Tolerance
- Output voltage range 1.2V to 5.5V in 0.1V increments (50mV increments available upon request)
- Stable with 1.0μF to 22μF Output Capacitor
- Short-Circuit Protection
- Overtemperature Protection
- Package Options: 3-Pin SOT-23A, 3-Pin SOT-89, TO-92-3, 2x3 DFN
MCP1703A

Features:
- 2.0μA Quiescent Current (typ.)
- Input Operating Voltage Range: 2.7V to 16V
- 250mA Output Current for Output Voltages ≥ 2.5V
- 200mA Output Current for Output Voltages < 2.5V
- 0.4% (typ.) Output Voltage Tolerance
- Output voltage range 1.2V to 5.5V in 0.1V increments (50mV increments available upon request)
- Stable with 1.0μF to 22μF Output Capacitor
- Short-Circuit Protection
- Overtemperature Protection
- Package Options: 3-Pin SOT-23A, 3-Pin SOT-89, TO-92-3, 2x3 DFN
Features:
• Ultra-Low Quiescent Current: 20 nA (typ)
• Ultra-Low Shutdown Supply Current: 0.1 nA (typ)
• Input Operating Voltage Range: 2.5V to 5.5V
• 200 mA Output Current Capability for VOUT < 3.5V
• 100 mA Output Current Capability for VOUT > 3.5V
• Standard Output Voltages
  • 1.2V, 1.8V, 2.5V, 3.3V, 4.2V
• Low Dropout Voltage:
  450 mV Maximum at 200 mA
• Stable with 1.0 µF Ceramic Output Capacitor
• Overcurrent Protection
• Space Saving 8-Lead 2x2 DFN-8
Features:
• High PSRR: >70 dB @ 1 kHz typical
• 56.0 µA Typical Quiescent Current
• Input Operating Voltage Range: 3.6V to 16.0V
• 150 mA Output Current
• Low Dropout Voltage, 300 mV Typical @ 150 mA
• 0.4% Typical Output Voltage Tolerance
• Standard Output Voltage Options (1.8V, 2.5V, 2.8V, 3.0V, 3.3V, 4.0V, 5.0V)
• Output Voltage Range 1.8V to 5.5V in 0.1V increments
• Output Voltage Tolerances of ±2.0% Over Temperature
• Stable with Minimum 1.0 µF Output Capacitance
• Power Good Output
• Shutdown Input
• True Current Foldback Protection
• Short-Circuit Protection
• Overtemperature Protection
Package Options:
3-pin SOT-23A, SOT-89, SOT-223, 2x3 DFN-8 (MCP1754S)
5-pin SOT-23, SOT-223, and 2x3 DFN-8
Features:
• High PSRR: >70 dB @ 1 kHz typical
• 68.0 μA Typical Quiescent Current
• Input Operating Voltage Range: 3.6V to 16.0V
• 300 mA Output Current
• Low Dropout Voltage, 300 mV Typical @ 300 mA
• 0.85% Typical Output Voltage Tolerance
• Standard Output Voltage Options (1.8V, 2.5V, 2.8V, 3.0V, 3.3V, 4.0V, 5.0V)
• Output Voltage Range 1.8V to 5.5V in 0.1V increments
• Output Voltage Tolerances of ±2.0% Over Temperature
• Stable with Minimum 1.0 μF Output Capacitance
• Power Good Output
• Shutdown Input
• True Current Foldback Protection
• Short-Circuit Protection
• Overtemperature Protection

Package Options:
3-pin SOT-223, 8-lead 2x3 (MCP1755S)
5-pin SOT-23, SOT-223, and 8-lead 2x3 DFN (MCP1755)
TC1107

Features:
- Extremely Low Supply Current: 50µA (typ.)
- Very Low Dropout Voltage
- 300mA Output Current
- High Output Voltage Accuracy
- Standard or Custom Output Voltages
- Power Saving Shutdown Mode
- Bypass Input for Ultra-Quiet Operation
- Over-Current and Over-Temperature Protection
- Space Saving MSOP Package Option
Features:
• Extremely Low Supply Current: 50µA (typ.)
• Very Low Dropout Voltage
• 300mA Output Current
• High Output Voltage Accuracy
• Standard or Custom Output Voltages
• Overcurrent and Overtemperature Protection
Features:
- Extremely Low Supply Current
- Very Low Dropout Voltage
- 300mA Output Current
- ERROR Output can be used as a Low Battery Detector or Processor Reset Generator
- Power Saving Shutdown Mode
- Bypass Input for Ultra-Quiet Operation
- High Output Voltage Accuracy
- Standard or Custom Output Voltages
- Overcurrent and Overtemperature Protection
- Space Saving MSOP Package Option
Features:
• Extremely Low Supply Current: 50μA (typ.)
• Very Low Dropout Voltage
• 300mA Output Current
• Adjustable Output Voltage
• Power Saving Shutdown Mode
• Bypass Input for Ultra-Quiet Operation
• Overcurrent and Overtemperature Protection
• Space Saving MSOP Package Option
Features:
• Very Low Ground Current for Longer Battery Life
• Very Low Dropout Voltage
• 300mA Output Circuit
• High Output Voltage Accuracy
• Standard or Custom Output Voltages
• Power Saving Shutdown Mode
• Bypass Input for Ultra-Quiet Operation
• Over Current and Over Temperature Protection
• Space-Saving MSOP Package
MCP1725

Features:

• 500mA Output Current Capability
• Input Operating Voltage Range: 2.3V to 6.0V
• Adjustable Output Voltage Range: 0.8V to 5.0V
• Standard Fixed Output Voltages: 0.8V, 1.2V, 1.8V, 2.5V, 3.0V, 3.3V, 5.0V
• Other Fixed Output Voltage Options Available Upon Request
• Low Dropout Voltage: 210mV (typ.) @ 500mA
• Output Voltage Tolerance: 0.5% (typ.)
• Stable with 1.0µF Ceramic Output Capacitor
• Low Supply Current: 120µA (typ.)
• Adjustable Delay on Power Good Output
• Short Circuit Current Limiting and Overtemperature Protection
• Small Packaging: 2x3 DFN-8 and SOIC-8 Packages
Features:
• Very Low Dropout Voltage
• 500mA Output Current
• High Output Voltage Accuracy
• Standard or Custom Output Voltages
• Overcurrent and Overtemperature Protection
**Features:**
- Very Low Dropout Voltage
- 500mA Output Current
- High Output Voltage Accuracy
- Standard or Custom Output Voltages
- Overcurrent and Overtemperature Protection
- SHDN Input for Active Power Management
- ERROR Output can be used as a Low Battery Detector (SOIC only)
Features:
• Very Low Dropout Voltage
• 800mA Output Current
• High Output Voltage Accuracy
• Standard or Custom Output Voltages
• Overcurrent and Overtemperature Protection
**TC1265**

**Features:**
- Very Low Dropout Voltage
- 800mA Output Current
- High Output Voltage Accuracy
- Standard or Custom Output Voltages
- Overcurrent and Overtemperature Protection
- SHDN Input for Active Power Management
- ERROR Output to Detect Low Battery (SOIC only)
**Features:**
- Very Low Dropout Voltage
- 800mA Output Current
- High Output Voltage Accuracy
- Standard or Custom Output Voltages
- Overcurrent and Overtemperature Protection
- Space Saving SOT-223 Package
- Fixed Output Voltages: 1.8V, 2.5V, 3.0V, 3.3V
MCP1726

Features:
• 1A Output Current Capability
• Input Operating Voltage Range: 2.3V to 6.0V
• Adjustable Output Voltage Range: 0.8V to 5.0V
• Standard Fixed Output Voltages: 0.8V, 1.2V, 1.8V, 2.5V, 3.0V, 3.3V, 5.0V
• Low Dropout Voltage: 220mV (typ.) @ 1A
• Output Voltage Tolerance: 0.4% (typ.)
• Stable with 1.0μF Ceramic Output Capacitor
• Fast response to Load Transients
• Low Supply Current: 140μA (typ.)
• Low Shutdown Supply Current: 0.1μA (typ.)
• Adjustable Delay on Power Good Output
• Short Circuit Current Limiting and Overtemperature Protection
• 3x3 DFN-8 and SOIC-8 Package Options
Features:

• Up to 1.5A output load current
• Low Dropout Voltage: 330mV (typ.) @ 1.5A
• Output voltage from 0.8V to 5.0V, both fixed and adjustable
• Stable with 1.0μF ceramic output capacitor
• Output Voltage Tolerance: 0.5% (typ.)
• Power good output with adjustable delay
• Low supply current: 140μA (typ.)
• Low shutdown current: 0.1μA (typ.)
• Short Circuit Current Limiting and Overtemperature Protection
• DFN-8 3x3 and SOIC-8 Pb-free packages
MCP1827/S

Features:
- 1.5A Output Current Capability
- Input Operating Voltage Range: 2.3V to 6.0V
- Adjustable Output Voltage Range: 0.8V to 5.0V (MCP1827 only)
- Standard Fixed Output Voltages: 0.8V, 1.2V, 1.8V, 2.5V, 3.0V, 3.3V, 5.0V
- Other Fixed Output Voltage Options Available Upon Request
- Low Dropout Voltage: 330mV (typ.) @ 1.5A
- Output Voltage Tolerance: 0.5% (typ.)
- Stable with 1.0μF Ceramic Output Capacitor
- Fast response to Load Transients
- Low Supply Current: 120μA (typ.)
- Low Shutdown Supply Current: 0.1μA (typ.) (MCP1827 only)
- Fixed Delay on Power Good Output (MCP1827 only)
- Short Circuit Current Limiting and Overtemperature Protection
- 5-Lead Plastic DDPAK, 5-Lead TO-220 Package Options (MCP1827)
- 3-Lead Plastic DDPAK, 3-Lead TO-220 Package Options (MCP1827S)
Features:
- Low Dropout Voltage
  120mV (typ.) @ 50mA
  380mV (typ.) @ 100mA for -5.0V Out
- High Output Voltage Accuracy: 2% (max.)
- Low Supply Current: 3.5µA (typ.)
- Small Package: 3-Pin SOT-23A
Features:
• LDO with Integrated Microprocessor Reset Monitor Functionality
• Low Supply Current: 80µA (typ.)
• Stable with Any Type of Capacitor
• Very Low Dropout Voltage
• 10µs (typ.) Wake Up Time from SHDN
• Standard or Custom Output and Detected Voltages
• Power-Saving Shutdown Mode
• Bypass Input for Ultra-Quiet Operation
• Separate Input and Detected Voltage
• 140ms Guaranteed Minimum RESET Output Duration
Features:
• Four Independent 150mA LDOs
• Low Supply Current 220μA (typ.)
• SelectMode™: Selectable Output Voltages for High Design Flexibility
• Low Dropout Voltage: 100mV (typ.) with 150mA load
• 10μs (typ.) Wake Up Time from SHDN
• High Output Voltage Accuracy: 0.5% (typ.)
• Power-Saving Shutdown Mode
• RESET Output used as a Low Battery Detector or Processor Reset Generator
• Overcurrent and Overtemperature Protection
• Small 16-Pin QSOP Package
Features:

- **Dual-Output Regulator** (500mA Buck Regulator and 300mA LDO)
- **Power-Good Output** with 300ms Delay
- **Quiescent Current**: 65μA (typ.)
- **Independent Shutdown** for Buck and LDO Outputs (TC1303)
- **Synchronous Buck Regulator**:  
  - Over 90% (typ.) Efficiency  
  - 2.0MHz Fixed-Frequency PWM  
  - Automatic PWM to PFM Mode Transition  
  - Adjustable and Standard Output Voltages
- **Low-Dropout Regulator**:  
  - Dropout Voltage: 137mV @ 200mA (typ.)  
  - Standard Fixed Output Voltages
- **Power-Good Function**:  
  - Monitors Buck Output Function (TC1303A)  
  - Monitors LDO Output Function (TC1303B)  
  - Monitors Both Buck and LDO Output Function (TC1303C and TC1304)
- **Sequenced Startup and Shutdown** (TC1304)
- **Small 10-Pin 3x3 DFN or MSOP Package**
TC1313

Features:

• Dual-Output Regulator (500mA Buck Regulator and 300mA LDO)
• Quiescent Current: 57μA (typ.)
• Independent Shutdown for Buck and LDO Outputs
• Synchronous Buck Regulator:
  - Over 90% (typ.) Efficiency
  - 2.0MHz Fixed-Frequency PWM
  - Automatic PWM to PFM Mode Transition
  - Adjustable and Standard Output Voltages
• Low-Dropout Regulator:
  - Dropout Voltage: 137mV @ 200mA (typ.)
  - Standard Fixed Output Voltages
• Undervoltage Lockout (UVLO)
• Output Short Circuit Protection
• Overtemperature Protection
• Small 10-Pin 3x3 DFN or MSOP Package

<< BACK to Switchers << BACK to LDOs
Features:

- Dual Output LDO with Microcontroller Reset Monitor Functionality:
  - $V_{OUT1} = 1.5$ to $3.3V$ @ $300mA$
  - $V_{OUT2} = 1.5V$ to $3.3V$ @ $150mA$
  - $V_{RESET} = 2.20V$ to $3.20V$
- Output Voltage and RESET Threshold Voltage Options Available (See Table 8-1)
- Low Dropout Voltage:
  - $V_{OUT1}$: $104$mV @ $300mA$ (typ.)
  - $V_{OUT2}$: $150$mV @ $150mA$ (typ.)
- Low Supply Current: $116\mu$A (typ.)
- Reference Bypass Input for Low Noise Operation
- Both Output Voltages Stable with a Minimum 1µF Ceramic Output Capacitor
- Separate Input for RESET Detect Voltage (TC1301A)
- Separate $V_{OUT1}$ and $V_{OUT2}$ SHDN Pins (TC1301B)
- Power Saving Shutdown Mode
- Small 8-Pin DFN and MSOP Packages
Features:

- **Dual Output LDO:**
  - $V_{OUT1} = 1.5$ to $3.3V @ 300mA$
  - $V_{OUT2} = 1.5V$ to $3.3V @ 150mA$
  - $V_{RESET} = 2.20V$ to $3.20V$
- **Output Voltage Options (See Table 8-1)**
- **Low Dropout Voltage:**
  - $V_{OUT1}$: $104mV$ @ $300mA$ (typ.)
  - $V_{OUT2}$: $150mV$ @ $150mA$ (typ.)
- **Low Supply Current**: $116\mu A$ (typ.)
- **Reference Bypass Input for Low Noise Operation**
- **Both Output Voltages Stable with a Minimum 1µF Ceramic Output Capacitor**
- **Separate $V_{OUT1}$ and $V_{OUT2}$ SHDN Pins (TC1302B)**
- **Power Saving Shutdown Mode**
- **Overtemperature and Overcurrent Protection**
- **Small 8-Pin DFN and MSOP Packages**
Features:
• Converts +5V Logic Supply to ±5V System
• Wide Input Voltage Range: 1.5V to 12V
• Efficient Voltage Conversion: 99.9%
• Excellent Power Efficiency: 98%
• Low Power Consumption: 80μA @ V_IN = 5V
• Low Cost and Easy to Use
• Only Two External Capacitors Required
• RS-232 Negative Power Supply
• Available in 8-Pin SOIC and 8-Pin Plastic DIP Packages
• Improved ESD Protection: Up to 10kV
• No External Diode Required for High Voltage Operation
• Frequency Boost Raises F_{OSC} to 45kHz
Features:
- Oscillator Boost from 10kHz to 45kHz
- Converts +5V Logic Supply to ±5V System
- Wide Input Voltage Range: 1.5V to 12V
- Efficient Voltage Conversion: 99.9%
- Excellent Power Efficiency: 98%
- Low Power Consumption: 80μA @ V_{IN} = 5V
- Low Cost and Easy to Use
- Only Two External Capacitors Required
- Available in 8-Pin SOIC Package
- Improved ESD Protection: Up to 10kV
- No External Diode Required for High Voltage Operation
Features:

- Wide Input Voltage Range: 1.5V to 12V
- Efficient Voltage Conversion: 99.9%
- Excellent Power Efficiency: 98%
- Low Power Consumption: $80 \mu A @ V_{\text{IN}} = 5V$
- Low Cost and Easy to Use
- Only Two External Capacitors Required
- Available in 8-Pin SOIC Package, PDIP, and CERDIP Packages
- Improved ESD Protection: 3kV HBM
- No External Diode Required for High Voltage Operation
Features:

- Wide Input Voltage Range: 1.5V to 10V
- Efficient Voltage Conversion: 99.7%
- Power Efficiency: 85%
- Pin Compatible with TC7660, High Frequency Performance DC-to-DC Converter
- Low Cost, Only Two External Capacitors Required (1μF)
- Available in 8-Pin SOIC Package and PDIP Packages
Features:
• Wide Operating Voltage Range: 1.5V to 15V
• Boost Pin (Pin 1) for Higher Switching Frequency
• High Power Efficiency: 96%
• Easy to Use: Requires Only 2 External Non-Critical Passive Components
• Improved Direct Replacement for Industry Standard ICL7660 and Other Second Source Devices
Features:
- 6-Pin SOT-23A Package
- >99% Typical Voltage Conversion Efficiency
- Voltage Doubling
- Input Voltage Range:
  TC1240: +2.5 to +4.0V
  TC1240A: +2.5V to +5.5V
- Low Output Resistance:
  TC1240: 17Ω (typ.)
  TC1240A: 17Ω (typ.)
- Only Two External Capacitors Required
- Low Supply Current
  TC1240: 180µA (typ.)
  TC1240A: 550µA (typ.)
- Power-Saving Shutdown Mode: 1µA (max.)
- Fully Compliant with 1.8V Logic Systems
Features:
- Wide Operating Range: 3V to 18V
- 40mA Output Current
- Pin Compatible with ICL7662/SI7661/TC7660/ LTC1044
- No External Diodes Required
- Low Output Impedance @ \( I_L = 20 \text{mA}, 40\Omega \) (typ.)
- No Low-Voltage Terminal Required
- CMOS Construction
- Available in 8-Pin PDIP Package
Features:
- Pin Compatible With TC7662/ICL7662/SI7661
- High Output Current: 80mA
- No External Diodes Required.
- Wide Operating Range: 3V to 18V
- Low Output Impedance: 28Ω (typ.)
- No Low Voltage Terminal Required
- Application Zener On Chip
- OSC Frequency Doubling Pin Option for Smaller Output Capacitors
Features:

- Doubling/Inverting Functionality
- 99.9% Voltage Conversion Efficiency
- 92% Power Conversion Efficiency
- Wide Input Voltage Range: +2.4V to +5.5V
- Only 3 External Capacitors Required
- 185μA Supply Current
- Space Saving 8-Pin SOIC and PDIP Packages
MCP1252/3

Features:

• Inductorless, Buck/Boost, DC/DC Converter
• Low Power: 80μA (typ.)
• High Output Voltage Accuracy: ±2.5% (V_{OUT} Fixed)
• 120mA Output Current
• Wide Operating Temperature Range: -40°C to +85°C
• Thermal Shutdown and Short-Circuit Protection
• Uses Small Ceramic Capacitors
• Switching Frequency:
  MCP1252: 650kHz
  MCP1253: 1MHz
• Low Power Shutdown Mode: 0.1μA (typ.)
• Shutdown Input Compatible 1.8V Logic
• V_{IN} Range: 2.1V to 5.5V
• Selectable Output Voltage (3.3V or 5.0V) or Adjustable Output Voltage
• Space-saving, 8-Lead MSOP
• Soft-Start Circuitry to Minimize In-Rush Current
Features:
• Inductorless 1.5x, 2x Boost DC/DC Converter
• Output Voltage: 3.3V
• Voltage Accuracy: ±3.0% (V_{OUT} Fixed)
• Output Current Up To 100mA
• 20mV_{P-P} Output Voltage Ripple
• Temperature Range: -40°C to +125°C
• Thermal Shutdown and Short Circuit Protection
• Uses small Ceramic Capacitors
• Switching Frequency: 650kHz
• Power Good Output
• Low Power SLEEP Mode: MCP1256/7
• Low Power Shutdown Mode: 0.1µA (typ.)
• Shutdown Input Compatible with 1.8V Logic
• V_{IN} Range: 1.8V to 3.6V
• Soft-Start Circuitry to Minimize In-Rush Current
• Packages: 10-Pin MSOP, 10-Lead 3x3 DFN
Features:
- 57µA (typ.) Supply Current
- 1A Output Current
- 0.5µA Shutdown Mode
- 300 kHz Switching Frequency for Small Inductor Size
- Programmable Soft-Start
- 92% Efficiency (typ.)
- Small Package: 5-Pin SOT-23A

3.3V Regulated Supply Using 6V NiMH Battery Pack Input
TC120

Features:
• Internal Switching Transistor
• 600mA Output Current
• External Switching Transistor Control for Output Currents of 2A+
• 300kHz Oscillator Frequency Supports Small Inductor Size
• Short Circuit Protection
• Built-In Undervoltage Lockout
• 95% Efficiency (typ.)
• Automatic Switchover to Current-Saving PFM Mode at Low Output Loads
• Automatic Output Capacitor Discharge While in Shutdown
• Programmable Soft-Start Time
• Power-Saving Shutdown Mode
• Small 8-Pin SOP Package
Features:
- Input Range: 2.7V to 5.5V
- Low Output Voltage Capability: 0.9V
- 500mA Continuous Output Current
- 3 operating modes: PWM, PFM and LDO
- Auto-Switching from PWM/PFM Operation
- Integrated Buck and Synchronous Switches
- Ceramic or Electrolytic Filtering Capacitors
- Shutdown mode
- 750kHz Fixed Switching Frequency
- Oscillator Synchronization to 1.0MHz PWM
- Integrated UVLO, Soft-start, and Overtemperature protection
- Short circuit protection
- Temperature Range: -40°C to +85°C
- Small 8-Pin MSOP Package
Features:
• Input Voltage Range: 2.7V to 5.5V
• Fixed switching frequency: 1.4MHz
• Integrated Buck and Synchronous Switches
• Continuous Output Current: 1A
• Adjustable Output Voltage Range: 0.8V to 5.0V
• 100% duty cycle capability for Low Input Voltages
• Shutdown Control with $I_Q < 0.01 \mu A$ (typ.)
• Overvoltage, Overcurrent, and Thermal Protection
• Under Voltage Lockout (UVLO)
• Integrated soft start
• Space Saving 8-Pin MSOP, DFN Packages
• Extended Operating Temperature Range: -40°C to +85°C
MCP1602

**Features:**

- Power-Good Output with 262ms Delay
- Over 90% Efficiency (typ.)
- Output Current: up to 500mA
- Low Quiescent Current: 45μA (typ.)
- Low Shutdown Current: 0.05μA (typ.)
- Automatic PWM to PFM Mode Transition
- Adjustable Output Voltage: 0.8V to 4.5V
- Fixed Output Voltage: 1.2V, 1.5V, 1.8V, 2.5V, 3.3V
- 2.0MHz Fixed-Frequency PWM (Heavy Load)
- Internally Compensated
- Undervoltage Lockout (UVLO)
- Overtemperature Protection
- Overcurrent Protection
- 8-Lead MSOP, 8-Lead 3x3 DFN
Features:

• Over 90% Efficiency (typ.)
• Output Current: up to 500mA
• Low Quiescent Current: 45μA (typ.)
• Low Shutdown Current: 0.01μA (typ.)
• Automatic PWM to PFM Mode Transition
• Adjustable Output Voltage:
  0.8V to 4.5V
• Fixed Output Voltage:
  1.2V, 1.5V, 1.8V, 2.5V, 3.3V
• 2.0MHz Fixed-Frequency PWM (Heavy Load)
• Internally Compensated
• Undervoltage Lockout (UVLO)
• Overtemperature Protection
• 100% Duty Cycle Operation
• Space Saving Packages:
  5-Lead TSOT, 8-Lead 2x3 DFN
**Features:**

- Up to 95% Typical Efficiency
- Input Voltage Range: 4.4V to 30V
- 1A Output Current Capability
- Output Voltage Range: 2.0V to 24V
- Integrated N-Channel High-Side Switch: 300 mΩ
- Integrated N-Channel Low-Side Switch: 170 mΩ
- Stable Reference Voltage: 0.8V
- Automotive PFM/PWM Operation
  - 500 kHz PWM Operation
  - MCP16312 proved PWM-Only Operation
- Low Quiescent Current
  - 44 µA (PFM Mode, typical)
  - 3 µA Shutdown (typical)
- Peak Current Mode Control
- Undervoltage Lockout (UVLO)
- Overtemperature Protection
- 8-lead MSOP and 2x3 TDFN
Features:
• Up to 95% Typical Efficiency
• Input Voltage Range: 6.0V to 24V
• 1A Output Current
• Fixed Output Voltages: 0.9V, 1.5V, 1.8V, 2.5V, 3.3V, 5V with 2% Output Voltage Accuracy
• Adjustable Version Output Range: 0.9V to 5V
• Integrated N-Channel High-Side Switch: 180 mΩ
• Integrated N-Channel Low-Side Switch: 120 mΩ
• 1 MHz Fixed Frequency
• Peak Current Mode Control
• Stable with Ceramic Capacitors
• Undervoltage Lockout (UVLO): 5.75V
• Overtemperature Protection
• VOUT Overvoltage Protection
• Power Good Indicator
• 16-lead 3x3 QFN
Features:

- Up to 95% Typical Efficiency
- Input Voltage Range: 6.0V to 24V
- 2A Output Current
- Fixed Output Voltages: 0.9V, 1.5V, 1.8V, 2.5V, 3.3V, 5V with 2% Output Voltage Accuracy
- Adjustable Version Output Range: 0.9V to 5V
- Integrated N-Channel High-Side Switch: 180 mΩ
- Integrated N-Channel Low-Side Switch: 120 mΩ
- 1 MHz Fixed Frequency
- Peak Current Mode Control
- Stable with Ceramic Capacitors
- Undervoltage Lockout (UVLO): 5.75V
- Overtemperature Protection
- VOUT Overvoltage Protection
- Power Good Indicator
- 16-lead 3x3 QFN
Features:
- Up to 95% Typical Efficiency
- Input Voltage Range: 6.0V to 18V
- 3A Output Current
- Fixed Output Voltages: 0.9V, 1.5V, 1.8V, 2.5V, 3.3V, 5V with 2% Output Voltage Accuracy
- Adjustable Version Output Range: 0.9V to 5V
- Integrated N-Channel High-Side Switch: 180 mΩ
- Integrated N-Channel Low-Side Switch: 120 mΩ
- 1 MHz Fixed Frequency
- Peak Current Mode Control
- Stable with Ceramic Capacitors
- Undervoltage Lockout (UVLO): 5.75V
- Overtemperature Protection
- VOUT Overvoltage Protection
- Power Good Indicator
- 16-lead 3x3 QFN
MCP16331

Features:
- Up to 96% Efficiency
- Input Voltage Range: 4.4V to 50V
- Output Voltage Range: 2.0V to 24V
- 2% Output Voltage Accuracy
- Minimum 500 mA Output Current
  - See Figure 2-9 for Maximum Output Current vs VIN
- 500 kHz Fixed Frequency
- Adjustable Output Voltage
- Low Device Shutdown Current
- Peak Current Mode Control
- Internal Compensation
- Stable with Ceramic Capacitors
- Internal Soft-Start
- Internal pull up on EN
- Cycle-by-Cycle Peak Current Limit
- Undervoltage Lockout (UVLO): 4.1V to Start; 3.6V to Stop
- Overtemperature Protection
- Packages: 6-Lead SOT-23, 8-Lead 2x3 TDFN
MCP1661

Features:
• Up to 92% Efficiency
• High Output Voltage Range: up to 32V
• 1.3A Peak Input Current Limit:
  - IOU7 > 200 mA @ 5.0V VIN, 12V VOUT
  - IOU7 > 125 mA @ 3.3V VIN, 12V VOUT
  - IOU7 > 100 mA @ 4.2V VIN, 24V VOUT
• Input Voltage Range: 2.4V to 5.5V
• Undervoltage Lockout (UVLO):
  - UVLO@VIN Rising: 2.3V, typical
  - UVLO@VIN Falling: 1.85V, typical
• No Load Input Current: 250 μA, typical
• Sleep mode: 200 nA
• PWM Operation with Skip mode: 500 kHz
• Feedback Voltage Reference: VFB = 1.227V
• Cycle-by-Cycle Current Limiting
• Internal Compensation
• Inrush Current Limiting and Internal Soft-Start
• Output Overvoltage Protection (OVP)
• Overtemperature Protection
• Easily Configurable for SEPIC or Flyback Topologies
• Packages:5-Lead SOT-23, 2x3 8-Lead TDFN
MCP1662

Features:
• Up to 92% Efficiency
• Drive LED Strings in Constant Current
• 1.3A Peak Input Current Limit:
  - ILED up to 200 mA @ 5.0V VIN, 4 White LEDs
  - ILED up to 125 mA @ 3.3V VIN, 4 White LEDs
  - ILED up to 100 mA @ 4.2V VIN, 8 White LEDs
• Input Voltage Range: 2.4V to 5.5V
• Feedback Voltage Reference: VFB = 300 mV
• Undervoltage Lockout (UVLO):
  - UVLO@VIN Rising: 2.3V, typical
  - UVLO@VIN Falling: 1.85V, typical
• Sleep Mode: 200 nA
• PWM Operation: 500 kHz Switching Frequency
• Cycle-by-Cycle Current Limiting
• Internal Compensation
• Inrush Current Limiting and Internal Soft Start
• Open Load Protection (OLP)
• Overtemperature Protection
• Packages: 5-Lead SOT-23, 8-Lead 2x3 TDFN
TC110

Features:

- Guaranteed Start-Up at 0.9V
- Supply Current: 50µA @ 100kHz (typ.)
- Shutdown Mode: 0.5µA
- 300mA Output Current @ \( V_{IN} \geq 2.7V \)
- 100KHz and 300KHz Switching Frequency Options
- Programmable Soft-Start
- 84% Efficiency
- Small Package: 5-Pin SOT-23A
Features:
• High Efficiency at Low Output Load Currents via PFM Mode
• Guaranteed Start-Up at 0.9V
• 80μA (typ.) Supply Current
• 85% (typ.) Efficiency at 100mA
• Output Current: 140mA (typ.) @ V_{IN} = 2.0V
• Low Power Shutdown Mode
• No External Switching Transistor Needed
• Space Saving SOT-89 Package
Features:
• High-Speed PWM Controller
• Fixed Switching Frequency Options (fSW): 300 or 600 kHz
• Integrated Low-Side MOSFET Driver support many Low-Side Power Conversion Topologies
• Configurable as either a Peak Current Mode Controller or a Voltage Mode Controller
• Internal UVLO, OVLO, and over temperature protection
• Low Operating Current < 5 mA (typical)
• Extended Temperature Range: -40°C to +125°C
Features:
• Output Power Capability Over 5 Watts
• Output Voltage Capability: 3.3V to Over 100V
• 750kHz Gated Oscillator Switching Frequency
• Adaptable Duty Cycle for Battery or Wide-Input, Voltage-Range Applications
• Input Voltage Range: 2.0V to 5.5V
• Capable of SEPIC® and Flyback Topologies
• Shutdown Control with $I_Q < 0.1\mu A$ (typ.)
• Low Operating Quiescent Current: $I_Q = 120\mu A$
• Voltage Feedback Tolerance: 0.6% (typ.)
• Popular MSOP-8 Package
• Peak Current Limit Feature
• Two Undervoltage Lockout (UVLO) Options: 2.0V or 2.55V
• Extended Temperature Range: -40°C to +125°C
MCP19035

Features:
• Vin Range: 5.0V to 30.0V
• Voltage Mode Controller
• Switching Freq:
  • 300 kHz
  • 600 kHz
• Dead Time Options: 12ns/20ns
• Integrated Current limit
• Integrated MOSFET Driver
  • Logic-Level (5V) Drive
  • 1/2A – Source/Sink Drive Strength
• Over temperature Protection
• Package: 10-lead 3x3 DFN
• Extended Temperature Range:
  -40°C to +125°C
MCP19110/1

Features:
• Wide Operating Voltage Range: 4.5-32V
• Analog Peak-Current Mode PWM Control
• Integrated 8-Bit PIC® Microcontroller
• Significant Configurability: Adjustable Analog Compensation, Switching Frequency, MOSFET Deadtime, Etc...
• PMBUS® Compliant I2C Interface
• Integrated Synchronous High- and Low-Side MOSFET Drivers
• Integrated Current Sense
• Minimal External Components Needed
• Custom Algorithm Support

Package:
• MCP19110 – 28 lead 4x4 mm QFN
• MCP19111 – 28 lead 5x5 mm QFN

Extended Temperature Range:
-40°C to +125°C
Features:

- Dual low-side gate drive outputs
- $V_{IN}$ Range: 4.5V to 42.0V
- Switching Freq: 100kHz to 1MHz
  - Supports Quasi-Resonant Mode
- 5V LDO w/ 15mA auxiliary output
- Integrated, Low-Side MOSFET Driver
  - 1A Source, 1.5A Sink
  - Supports Flyback, SEPIC, Boost, and Ćuk Topologies.
- Fully Programmable – Integrated PIC16 Core
  - MPLABX Support, GUI-Configurable
  - 4k word Flash, 256b RAM
  - Adjustable Current limit/ULVO/OVLO/…
  - Up to 12 General Purpose I/O
  - $I^2C^{\text{TM}}$ Communication Interface
- Operating Temperature: -40°C to +125°C
- Package(s): 24L QFN 4x4mm, 28L QFN 5x5mm
Features:

• Up to 96% Typical Efficiency
• 425 mA Typical Peak Input Current Limit:
  - I_{OUT} > 50 mA @ 1.2V V_{IN}, 3.3V V_{OUT}
  - I_{OUT} > 175 mA @ 2.4V V_{IN}, 3.3V V_{OUT}
  - I_{OUT} > 175 mA @ 3.3V V_{IN}, 5.0V V_{OUT}
• Low Start-up Voltage: 0.65V, typical 3.3V V_{OUT} @ 1 mA
• Low Operating Input Voltage: 0.35V, typ. 3.3V V_{OUT} @ 1 mA
• Adjustable Output Voltage Range: 2.0V to 5.5V
• Maximum Input Voltage: V_{OUT} < 5.5V
• Automatic PFM/PWM Operation (MCP1624):
  - PFM Only Operation (MCP1623)
  - 500 kHz PWM Operation
• Low Device Quiescent Current: 19 μA, typ. PFM Mode
• Internal Synchronous Rectifier
• Internal Compensation
• Inrush Current Limiting and Internal Soft-Start
• Shutdown Current: < 1 μA
• Low Noise, Anti-Ringing Control
• Over temperature Protection
• Available Packages: SOT23-6, 2x3 8-Lead DFN
Features:

- Up to 96% Typical Efficiency
- 800 mA Typical Peak Input Current Limit:
  - $I_{OUT} > 100 \text{ mA} @ 1.2\text{V } V_{IN}, 3.3\text{V } V_{OUT}$
  - $I_{OUT} > 350 \text{ mA} @ 2.4\text{V } V_{IN}, 3.3\text{V } V_{OUT}$
  - $I_{OUT} > 350 \text{ mA} @ 3.3\text{V } V_{IN}, 5.0\text{V } V_{OUT}$
- Low Start-up Voltage: 0.65V, typical 3.3V $V_{OUT} @ 1 \text{ mA}$
- Low Operating Input Voltage: 0.35V, typ. 3.3V $V_{OUT} @ 1 \text{ mA}$
- Adjustable Output Voltage Range: 2.0V to 5.5V
- Maximum Input Voltage: $V_{OUT} < 5.5\text{V}$
- Automatic PFM/PWM Operation (MCP1640/C):
  - PFM Operation Disabled (MCP1640B/D)
  - PWM Operation: 500 kHz
- Low Device Quiescent Current: 19 $\mu$A, typ. PFM Mode
- Internal Synchronous Rectifier
- Internal Compensation
- Inrush Current Limiting and Internal Soft-Start
- Selectable, Logic Controlled, Shutdown States:
  - True Load Disconnect Option (MCP1640/B)
  - Input to Output Bypass Option (MCP1640C/D)
- Shutdown Current (All States): < 1 $\mu$A
- Low Noise, Anti-Ringing Control
- Over temperature Protection
- Available Packages: SOT23-6, - 2x3 8-Lead DFN
MCP1643
1.6A LED Driver

Features:
• 1.6A Typical Peak Input Current Limit
• Up to 550 mA LED Load Current
• Low Start-up Voltage: 0.65V (typical, 25 mA LED Current)
• Low Operating Input Voltage: down to 0.5V
• Maximum Input Voltage < VLED<5.0V
• Maximum Output Voltage: 5.0V
• Overvoltage Protection
• Low Reference Voltage: VFB= 120 mV
• Pulse-Width Modulation Mode Operation (1 MHz)
• Internal Synchronous Rectifier
• Internal Compensation
• Inrush Current Limiting
• Internal Soft-Start (240 µs typical)
• Shutdown (EN = GND): True Load Disconnect
• Dimming Control by Variable Duty Cycle
• Shutdown Current: 1.2 µA (typical)
• Overtemperature protection
• Packages: MSOP-8, 2x3 DFN-8
Features:

- Up to 96% Typical Efficiency
- 650mA Typical Peak Input Current Limit:
  - IOUT > 100 mA @ 3.3V VOUT, 1.2V VIN
  - IOUT > 250 mA @ 3.3V VOUT, 2.4V VIN
  - IOUT > 225 mA @ 5.0V VOUT, 3.3V VIN
- Low Device Quiescent Current:
  - Output Quiescent Current: < 4 μA typical
- Shutdown Current: 0.6 μA typical
- Low Start-up Voltage: 0.82V, 1 mA load
- Low Operating Input Voltage: down to 0.35V
- Adjustable Output Voltage Range: 1.8V to 5.5V
- Maximum Input Voltage ≤ VOUT < 5.5V
- Automatic PFM/PWM Operation:
  - PWM Operation: 500 kHz
  - PFM Output Ripple: 150 mV typical
- Internal Synchronous Rectifier
- Internal Compensation
- Inrush Current Limiting and Internal Soft Start (1.5 ms typical)
- Selectable, Logic Controlled, Shutdown States:
  - True Load Disconnect Option (MCP16251)
  - Input to Output Bypass Option (MCP16252)
- Anti-Ringing Control, Overtemperature Protection
- Available Packages: SOT-23-6, 2x3 8-Lead TDFN
**Features:**
- Up to 96% Typical Efficiency
- Input Voltage Range:
  - 4.0V to 30V (MCP16301)
  - 4.7V to 36V (MCP16301H)
- Output Voltage Range: 2.0V to 15V
- 2% Output Voltage Accuracy
- Integrated N-Channel Buck Switch
- 600 mA Output Current
- 500 kHz Fixed Frequency
- Adjustable Output Voltage
- Low Device Shutdown Current
- Peak Current Mode Control
- Internal Compensation
- Stable with Ceramic Capacitors
- Internal Soft-Start
- Cycle by Cycle Peak Current Limit
- Under Voltage Lockout (UVLO): 3.5V
- Overtemperature Protection
- SOT-23-6 Package
- Temperature Range: -40°C to +85°C
Features:

• High-Speed PWM Operation (12ns Current Sense to Output Delay)
• Operating Temperature Range: -40°C to +125°C
• Precise Peak Current Limit (±5% MCP1630)
• Voltage Mode and Average Current Mode Control (MCP1630V)
• CMOS Output Driver
• External Oscillator Input
• External voltage Reference Input
• Peak Current Mode Operation > 1MHz
• Low Operating Current: 2.8mA (typ.)
• Fast Output Rise and Fall Times: 5.9ns and 6.2ns
• Undervoltage Lockout (UVLO) Protection
• Output Short Circuit and Overtemperature Protection
• Space Saving 8-Pin MSOP
Features:

- Programmable Switching Battery Charger Designs
- High-Speed Analog PWM Controller: 2MHz
- Peak Current Mode Control (MCP1631)
- Voltage Mode Control (MCP1631V)
- High Voltage Options Operate to +16V Input:
  - MCP1631HV Current Mode
  - MCP1631VHV Voltage Mode
- Output Voltage Options: +5.0V or +3.3V, 250mA
- External Oscillator and Ext. Reference Inputs
- Error Amplifier, Battery Current $I_{SNS}$ Amplifier, Battery Voltage $V_{SNS}$ Amplifier Integrated
- Integrated Overvoltage Comparator
- Integrated Low Side MOSFET Driver: 1A Peak
- Shutdown mode reduces $I_Q$ to 2.4μA (typ.)
- Internal Overtemperature Protection
- Undervoltage Lockout (UVLO)
- Package Options:
  - 4x4 20-Lead QFN (MCP1631/MCP1631V)
  - 20-Lead TSSOP, 20-Lead SSOP (all devices)
Features:
• Precision VCC Monitor for 2.5V, 3.0V, 3.3V, 5.0V Nominal Voltage Supplies
• 140ms Minimum RESET Time Out Period
• RESET Output Guaranteed to $V_{CC} = 1.0V$ (TCM809)
• Low 12µA Supply Current
• Push-Pull RESET Output
• No External Components
• Temperature Range:
  Industrial SC-70 (E): -40°C to +85°C
  Extended SOT-23 (V): -40°C to +125°C
Features:
• Precision $V_{DD}$ Monitor
• 140ms Minimum RESET Output Duration
• Output Valid to $V_{DD} = 1.2$V
• $V_{DD}$ Transient Immunity
• Small 3-Pin SOT-23B Package
• No External Components
Features:
- Precision Voltage Monitor: 2.63V, 2.93V, 3.08V, 4.38V and 4.63V trip points (typ.)
- Manual Reset input
- Reset Time-out Delay:
  Standard: 280ms (typ.)
  Optional: 2.19ms, and 35ms (typ.)
- Power Consumption ≤ 15μA (max.)
- Active Low Output Options:
  Push-Pull Output and Open-Drain Output
- Active High Output Option: Push-Pull Output
- Replacement for (Specification compatible):
  TC1270, TC1271, TyyCM811, TCM812
- Low Voltage Operation: (1.0V)
- ESD protection:
  ≥ 4kV Human Body Model (HBM)
  ≥ 400V Machine Model (MM)
- Extended (E) Temperature Range:
  -40°C to +125°C
- Package Options:
  4-lead SOT-143, 5-lead SOT-23
MCP100/101

Features:
• Holds Microcontroller in Reset until Supply Voltage Reaches Stable Operating Level
• Resets Microcontroller during Power Loss
• Precision Monitoring of 3.0V, 3.3V, and 5V Systems
• 7 Voltage Trip Points Available
• Active Low RESET Pin (MCP100) of Active high RESET (MCP101)
• Push-Pull Output
• Holds RESET’/RESET for 350ms (typ.)
• RESET’/RESET to $V_{DD} = 1.0V$
• Accuracy of ±125mV for 5V Systems and ±75mV for 3V Systems Over Temperature
• 45μA Typical Operating Current
• Temperature Range:
  -40°C to +85°C
Features:

• Holds Microcontroller in Reset until Supply Voltage Reaches Stable Operating Level
• Resets Microcontroller during Power Loss
• Precision Monitoring of 3.0V, 3.3V, and 5V Systems
• 7 Voltage Trip Points Available
• Active Low RESET Pin
• Open Drain Output
• Internal Pull-Up Resistor: 5kΩ (MCP130)
• Holds RESET for 350ms (typ.)
• RESET to V_{DD} = 1.0V
• Accuracy of ±125mV for 5V Systems and ±75mV for 3V Systems Over Temperature
• 45μA (typ.) Operating Current
• Temperature Range:
  -40°C to +85°C
Features:

• Ultra Low Supply Current: 1.75μA (max.)
• Precision Monitoring of: 1.90V, 2.32V, 2.63V, 2.93V, 3.08V, 4.38V and 4.63V
• Resets Microcontroller during Power Loss
• Active Low RESET Pin
  MCP121: Active-Low, Open-Drain
  MCP131: Active-Low, Open-Drain with Internal Pull-Up Resistor
  MCP102 and MCP103: Active-Low, Push-Pull
• Reset Delay Timer: 120ms Delay (typ.)
• Space Saving SOT-23-3, TO-92 and SC70 Packages
• Temperature Range:
  -40°C to +125°C (except MCP1xx-195)
  -40°C to +85°C
Features:
• Incorporates the Functionality of the Industry Standard TC1232 (Processor Monitor, Watchdog and Manual Override Reset Controller) into a Small, Lower Cost Package
• Guards Against Unstable Processor Operation Resulting from Power “Brown-Out”
• Automatically Halts and Restarts an Out-of-Control Microprocessor
• Output can be Wire-ORed, or Hooked to Manual RESET Push-button Switch
• Space-Saving 3-Pin TO-92 or SOT-223 Package
Features:
• Precision Voltage Monitor: Adjustable +4.5V or +4.75V
• Reset Pulse Width: 250ms (min.)
• No External Components
• Adjustable Watchdog Timer: 150ms, 600ms or 1.2s
• Debounced Manual Reset Input for External Override
Features:

• Low supply current: 1μA (typ.)
• Precision monitoring trip point options: 2.9V and 4.6V (Standard Offerings) 2.0V to 4.7V in 100 mV increments
• Resets Microcontroller in a Power-loss Event
• Reset Delay Time Out Option: 1.4ms, 30ms, 200ms, or 1.6s (typ.)
• Watchdog Timer Input Time Out Options: 6.3ms, 102ms, 1.6s, or 25.6s (typ.)
• Manual Reset (MR) Input (Active-low)
• Single and Complementary Reset Output(s)
• Reset Output Options: Push-Pull (Active-high or Active-low) Open-Drain (Internal or External Pull-up)
• Temperature Range: -40°C to +85°C for trip points 2.0 to 2.4V -40°C to + 125°C for trip points > 2.5V
• Voltage Range: 1.0V to 5.5V
• Space Saving SOT-23-5 Packaging
Features:

- Low Supply Current: 1.75μA (max.)
- Precision Monitoring Options:
  1.90V, 2.32V, 2.63V, 2.90V, 2.93V, 3.08V, 4.38V and 4.63V
- Resets Microcontroller in a Power-loss Event
- Active-low \( V_{\text{OUT}} \) Pin:
  MCP111: Active-low, Open-drain
  MCP112: Active-low, Push-pull
- Temperature Range:
  -40°C to +125°C (except MCP1xx-195)
  -40°C to +85°C
- Space Saving SC-70, SOT23-3 and TO-92 Packages
Features:
- Precise Detection Thresholds: ±2.0%
- Small Package: 3-Pin SOT-23A
- Low Supply Current: 1μA (typ.)
- Wide Detection Range: 1.6V to 6.0V
- Wide Operating Voltage Range: 0.7V to 10V
- Built-in Delay Circuit: 50ms to 200ms
- Open-drain Output
Features:

• Precise Detection Thresholds:
  Standard ±2.0%, Custom ±1.0%
• Small Packages:
  3-Pin SOT-23A,
  3-Pin SOT-89, TO-92
• Low Current Drain: 1μA (typ.)
• Wide Detection Range:
  1.1V to 6.0V
• Wide Operating Voltage Range:
  0.7V to 10V
Features:
• Latch-Up Protected: Will Withstand 500mA Reverse Current
• Input Will Withstand Negative Inputs Up to 5V
• ESD Protected: 4kV
• High Peak Output Current: 0.5A
• Wide Input Supply Voltage Operating Range: 4.5V to 16V
• High Capacitive Load Drive Capability: 500pF in 25ns (typ.)
• Short Delay Time: 30ns (typ.)
• Consistent Delay Times With Changes in Supply Voltage
• Matched Delay Times
• Low Supply Current
  With Logic ‘1’ Input: 500µA
  With Logic ‘0’ Input: 100µA
• Low Output Impedance: 16Ω
• Space Saving 8-pin MSOP Package
• Pinout Same as TC1411/TC1412/TC1413
Features:

- High Peak Output Current: 500mA (typ.)
- Wide Input Supply Voltage Operating Range: 4.5V to 18V
- Low Shoot-Through/Cross-Conduction Current in Output Stage
- High Capacitive Load Drive Capability:
  - 470pF in 19ns (typ.)
  - 1000pF in 34ns (typ.)
- Short Delay Times: 35ns (typ.)
- Matched Rise/Fall Times
- Low Supply Current:
  - With Logic ‘1’ Input – 0.85mA (typ.)
  - With Logic ‘0’ Input – 0.10mA (typ.)
- Latch-Up Protected: Will Withstand 500mA Reverse Current
- Logic Input Will Withstand Negative Swing Up To 5V
- Space Saving 5-Pin SOT-23 Package
Features:
• Latch-Up Protected: Will Withstand 500mA Reverse Current
• Input Will Withstand Negative Inputs Up to 5V
• ESD Protected: 4kV
• High Peak Output Current: 1A
• Wide Input Supply Voltage Operating Range: 4.5V to 16V
• High Capacitive Load Drive Capability: 1000pF in 25ns (typ.)
• Short Delay Time: 30ns (typ.)
• Matched Delay Times
• Low Supply Current
  With Logic ‘1’ Input: 500μA
  With Logic ‘0’ Input: 100μA
• Low Output Impedance: 8Ω
• Available in Space-Saving
  8-pin MSOP Package
• Pinout Same as TC1410/TC1412/TC1413
Features:

• Low Cost
• Latch-Up Protected: Will Withstand 500mA Reverse Output Current
• ESD Protected ±2kV
• High Peak Output Current: 1.2A
• Wide Operating Range: 4.5V to 16V
• High Capacitive Load Drive Capability: 1000pF in 38ns
• Low Delay Time: 75ns (max.)
• Logic Input Threshold Independent of Supply Voltage
• Output Voltage Swing to Within 25mV of Ground or $V_{DD}$
• Low Output Impedance: 8Ω
Features:

• High Peak Output Current: 1.2A
• Wide Operating Range: 4.5V to 18V
• Symmetrical Rise/Fall Times: 25ns
• Short, Equal Delay Times: 75ns
• Latch-proof. Will Withstand 500mA Inductive Kickback
• 3 Input Logic Choices: AND / NAND / AND + Inv
• ESD Protection on all pins: 2kV
**TC4403**

**Features:**
- Low Quiescent Current: 300µA (max.)
- Capacitive Inputs With 300mV Hysteresis
- Both Inputs Must Be Driven to Drive Load
- Low Output Leakage
- High Peak Current Capability
- Fast Output Rise Time
- Outputs Individually Testable
Features:
• Power Driver With On Board Voltage Booster
• Low $I_{DD}$: $<4mA$
• Small Package: 8-Pin PDIP
• Under-Voltage Circuitry
• Fast Rise-Fall Time: $<40$ns @1000pF
• Below-Rail Input Protection
TC4431/2

Features:
• High Peak Output Current: 1.5A
• Wide Operating Range: 4.5V to 30V
• High Capacitive Load Drive Capability: 1000pF in 25ns
• Short Delay Times: < 78ns (typ.)
• Low Supply Current:
  With Logic ‘1’ Input: 2.5mA
  With Logic ‘0’ Input: 300µA
• Low Output Impedance: 7Ω (typ.)
• Latch-Up Protected: Will Withstand > 300mA Reverse Current
• ESD Protected: 4kV
**Features:**

- **High-Speed Switching** ($C_L=1000\text{pF}$): 30ns
- **High Peak Output Current**: 1.5A
- **High Output Voltage Swing**:
  - $V_{DD} - 25\text{mV}$
  - GND +25mV
- **Low Input Current** (Logic ‘0’ or ‘1’): 1μA
- **TTL/CMOS Input Compatible**
- **Wide Operating Supply Voltage**: 4.5V to 18V
- **Current Consumption**:
  - Inputs Low: 0.4mA
  - Inputs High: 8mA
- **Low Output Impedance**: 6Ω
- **Pinout Equivalent of DS0026 and MMH0026**
- **Latch-Up Resistant**: Withstands > 500mA
- **Reverse Current**
- **ESD Protected**: 2kV
**Features:**

- High-Speed Switching ($C_L=1000\text{pF}$): 30ns
- High Peak Output Current: 1.5A
- Short Delay Times: 40ns (typ.)
- Wide Operating Supply Voltage: 4.5V to 18V
- Matched Rise and Fall Times
- Current Consumption:
  - Logic ‘1’ Input: 4mA (typ.)
  - Logic ‘0’ Input: 400μA (typ.)
- Low Output Impedance: 7Ω (typ.)
- Pinout Equivalent TC426/TC427/TC428
- Latch-Up Resistant: Withstands 0.5A Reverse Current
- ESD Protected: 4kV

**Diagram:**

Note 1: TC4426 has two inverting drivers; TC4427 has two non-inverting drivers; TC4428 has one inverting and one non-inverting driver.

Note 2: Ground any unused driver input.
**TC4426A/27A/28A**

**Features:**
- High Peak Output Current: 1.5A
- Wide Input Supply Voltage Operating Range: 4.5V to 18V
- High Capacitive Load Drive Capability: 1000pF in 25ns (typ.)
- Short Delay Times: 30ns (typ.)
- Matched Rise, Fall and Delay Times
- Low Supply Current:
  - With Logic ‘1’ Input: 1mA (typ.)
  - With Logic ‘0’ Input: 100μA (typ.)
- Low Output Impedance: 7Ω (typ.)
- Latch-Up Protected: Will Withstand 0.5A Reverse Current
- Input Will Withstand Negative Inputs Up to 5V
- ESD Protected: 4kV
- Pin-compatible with TC426/27/28 and TC4426/27/28
- 8-Pin MSOP and 8-Pin 6x5 DFN Packages

*Note 1: TC4426A has two inverting drivers; TC4427A has two non-inverting drivers; TC4428A has one inverting and one non-inverting driver.*

*2: Ground any unused driver input.*

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Online Datasheet

TC1426/7/8 >>

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TC4426/7/8 >>

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Features:
- Independently-Programmable Rise and Fall Times
- Low Output Impedance: 7Ω (typ.)
- High Speed $t_R$, $t_F$: < 30ns with 1000pF Load
- Short Delay Times: < 30ns
- Wide Operating Range: 4.5V to 18V
- Latch-Up Protected: Will Withstand > 500mA Reverse Current (Either Polarity)
- Input Withstands Negative Swings Up to -5V
Features:
• High Peak Output Current: 2A
• Latch-Up Protected: Will Withstand 500mA Reverse Current
• Input Will Withstand Negative Inputs Up to 5V
• ESD Protected: 4kV
• Wide Operating Range: 4.5V to 16V
• High Capacitive Load Drive Capability: 1000pF in 18ns
• Short Delay Time: 35ns (typ.)
• Matched Delay Times
• Low Supply Current
  With Logic ‘1’ Input: 500µA (typ.)
  With Logic ‘0’ Input: 100µA (typ.)
• Low Output Impedance: 4Ω (typ.)
• Pinout Same as TC1410/11/13
• Space Saving 8-Pin MSOP Package
Features:
- Dual Output MOSFET Driver for Synchronous Applications
- High Peak Output Current: 2A (typ.)
- Adaptive Cross Conduction Protection
- Internal Bootstrap Blocking Device
- +36V BOOT Pin Maximum Rating
- Enhanced Light Load Efficiency Mode
- Low Supply Current: 80μA (typ.)
- High Capacitive Load Drive Capability: 3300pF in 10ns (typ.)
- Tri-State PWM Pin for Power Stage Shutdown
- Input Voltage Undervoltage Lockout Protection
- Space Saving Packages: 8-Lead SOIC, 8-Lead 3x3 DFN
Features:

- Independent PWM Input Control for High-Side and Low-Side Gate Drive
- Input Logic Level Threshold 3.0V TTL Compatible
- Dual Output MOSFET Drive for Synchronous Applications
- High Peak Output Current: 2A (typ.)
- Internal Bootstrap Blocking Device
- +36V BOOT Pin Maximum Rating
- Low Supply Current: 45μA (typ.)
- High Capacitive Load Drive Capability: 3300pF in 10.0ns (typ.)
- Input Voltage Undervoltage Lockout Protection
- Overtemperature Protection
- Packages: 8-Lead SOIC, 8-Lead 3x3 DFN
Features:

- High Peak Output Current: 1.5A (typ.)
- Wide Input Supply Voltage Operating Range: 4.5V to 18V
- Low Shoot-Through/Cross-Conduction - Current in Output Stage
- High Capacitive Load Drive Capability:
  - 470pF in 13ns (typ.)
  - 1000pF in 20ns (typ.)
- Short Delay Times: 41ns ($t_{D1}$), 48ns ($t_{D2}$), (typ.)
- Low Supply Current:
  - With Logic ‘1’ Input: 0.65mA (typ.)
  - With Logic ‘0’ Input: 0.1mA (typ.)
- Latch-Up Protected: Will Withstand 500mA Reverse Current
- Logic Input Withstands Negative Swing up to 5V
- Space-saving 5-SOT-23 Package
TC1413/N

Features:
• High Peak Output Current: 3A
• Latch-Up Protected: Will Withstand 500mA Reverse Current
• Input Will Withstand Negative Inputs Up to 5V
• ESD Protected: 4kV
• Wide Operating Range: 4.5V to 16V
• High Capacitive Load Drive Capability: 1800pF in 20ns
• Short Delay Time: 35ns (typ.)
• Matched Delay Times
• Low Supply Current  
  With Logic ‘1’ Input: 500μA  
  With Logic ‘0’ Input: 100μA
• Low Output Impedance: 2.7Ω
• Pinout Same as TC1410/11/12
• Space Saving 8-Pin MSOP Package
Features:

- High Peak Output Current: 3A
- Wide Input Supply Voltage Operating Range: 4.5V to 18V
- High Capacitive Load Drive Capability: 1800pF in 25ns
- Short Delay Times: < 40ns (typ.)
- Matched Rise/Fall Times
- Low Supply Current:
  - With Logic ‘1’ Input: 3.5mA (max.)
  - With Logic ‘0’ Input: 350μA (max.)
- Low Output Impedance: 3.5Ω (typ.)
- Latch-Up Protected: Will Withstand 1.5A Reverse Current
- Logic Input Will Withstand Negative Swing up to 5V
- ESD Protected: 4kV
- Pin compatible with the TC4423A/24A/25A and TC4426A/27A/28A devices
Features:

- High Peak Output Current: 4.5A
- Wide Input Supply Voltage Operating Range: 4.5V to 18V
- High Capacitive Load Drive Capability: 1800pF in 12ns
- Short Delay Times: 40ns (typ.)
- Matched Rise/Fall Times
- Low Supply Current:
  - With Logic ‘1’ Input: 1.0mA (max.)
  - With Logic ‘0’ Input: 150μA (max.)
- Low Output Impedance: 2.5Ω (typ.)
- Latch-up protected: will withstand 1.5A reverse current
- Logic input will withstand negative swing up to 5V
- Pin compatible with the TC4423/24/25 and TC4426A/27A/28A
- Space-saving 8-Pin 150 mil body SOIC and 8-Pin 6x5 DFN packages
Features:

- High Peak Output Current: 4.5A
- Wide Input Supply Voltage Operating Range: 4.5V to 18V
- High Capacitive Load Drive Capability: 2200pF in 15ns
- Short Delay Times: 40ns (typ.)
- Low Supply Current:
  - With Logic ‘1’ Input: 1.0mA (max.)
  - With Logic ‘0’ Input: 150μA (max.)
- Latch-Up Protected: Will Withstand 1.5A Reverse Current
- Logic Input Will Withstand Negative Swing up to 5V
- Packages: 8-Pin SOIC, PDIP, 6x5 DFN, and 16-Pin SOIC
Features:

- High Peak Output Current: 4.0A
- Independent Enable Function for Each Driver Output
- Low Shoot-Through/Cross-Conduction Current in Output Stage
- Wide Input Supply Voltage Operating Range: 4.5V to 18V
- High Capacitive Load Drive Capability:
  - 2200pF in 15ns (typ.)
  - 5600pF in 26ns (typ.)
- Short Delay Times: 50ns (typ.)
- Latch-Up Protected: Will Withstand 1.5A Reverse Current
- Logic Input Will Withstand Negative Swing Up To 5V
- Space-Saving Packages:
  - 8-Pin 6x5 DFN, PDIP, SOIC
Features:

- High peak output Current: 2A (typ.)
- Dual Outputs
  - Dual inverting: MCP14E6
  - Dual non-inverting: MCP14E7
  - Complementary outputs: MCP14E8
- Enable Function for each Driver
- Low Shoot-Through/Cross-Conduction Current in output Stage
- Wide Input Operating Range: 4.5v to 18V
- High Capacitive Load drive Capability:
  - 1000 pF in 15 nsec (typ.)
- Short Delay Times: 45 nsec (typ.)
- Latch-up Protected
  - Passed JEDEC JESD78A
- Input are TTL/CMOS compatible and will withstand negative swings up to 5V
- ESD Protected: 4kV
- Packages:
  8-Pin 6x5 DFN, PDIP, SOIC
Features:

• High peak output Current: 3A (typ.)
• Dual Outputs (E9/10/11):
  - Dual inverting: MCP14E9
  - Dual non-inverting: MCP14E10
  - Complementary outputs: MCP14E11
• Enable Function for each Driver
• Low Shoot-Through/Cross-Conduction
Current Wide Input Operating Range: 4.5v to 18V
• High Capacitive Load drive Capability:
  - 1800 pF in 17 nsec (typ.)
• Short Delay Times: 45 nsec (typ.)
• Latch-up Protected
  - Passed JEDEC JESD78A
• Input are TTL/CMOS compatible and will withstand negative swings Up To 5V
• ESD Protected: 4kV
• Packages:
  8-Pin 6x5 DFN, PDIP, SOIC
Features:

- High Peak Output Current: 6.0A (typ.)
- Wide Input Supply Voltage Operating Range: 4.5V to 18V
- High Capacitive Load Drive Capability: 2500pF in 20ns, 6800pF in 40ns
- Short Delay Times: 40ns (typ.)
- Matched Rise/Fall Times
- Low Supply Current:
  - With Logic ‘1’ Input: 130μA (typ.)
  - With Logic ‘0’ Input: 35μA (typ.)
- Latch-Up Protected: Will Withstand 1.5A Reverse Current
- Logic Input Will Withstand Negative Swing up to 5V
- Pin compatible with the TC4420/TC4429
- Space-saving 8-Pin SOIC, PDIP and 8-Pin 6x5 DFN Packages
Features:
- High Peak Output Current: 6A
- Wide Input Supply Voltage Operating Range: 7V to 18V
- High Capacitive Load Drive Capability: $C_L = 2500\text{pF}$ in 35ns (max.)
- Short Delay Times: 75ns (max.)
- Low Supply Current:
  - With Logic ‘1’ Input: 5mA (max.)
  - With Logic ‘0’ Input: 0.5mA (max.)
- Logic Input Threshold Independent of Supply Voltage
- Output Voltage Swing Within 25mV of Ground or $V_{\text{DD}}$
- Space Saving 8-Pin SOIC Package
TC4420/9

Features:
• Latch-Up Protected: Will Withstand >1.5A Reverse Output Current
• Logic Input Will Withstand Negative Swing up to 5V
• ESD Protected: 4kV
• Matched Rise and Fall Times: 25ns
• High Peak Output Current: 6A Peak
• Wide Operating Range: 4.5V to 18V
• High Capacitive Load Drive: 10,000pF
• Short Delay Time: 55ns (typ.)
• Logic High Input, Any Voltage: 2.4V to V_{DD}
• Low Supply Current with Logic ‘1’ Input 450µA (typ.)
• Low Output Impedance: 2.5Ω
• Output Voltage Swing to Within 25mV of Ground or V_{DD}
**Features:**

- **High Peak Output Current:** 9A
- **Wide Input Supply Voltage Operating Range:** 4.5V to 18V
- **High Continuous Output Current:** 2A (max.)
- **Fast Rise and Fall Times:**
  - 30ns with 4,700pF Load
  - 180ns with 47,000pF Load
- **Short Propagation Delays:** 30ns (typ.)
- **Low Supply Current:**
  - With Logic ‘1’ Input: 200μA (typ.)
  - With Logic ‘0’ Input: 55μA (typ.)
- **Low Output Impedance:** 1.4Ω (typ.)
- **Latch-Up Protected:** Will Withstand 1.5A Output Reverse Current
- **Input Will Withstand Negative Inputs up to 5V**
- **Pin-Compatibile with the TC4420/TC4429**
- **Space-saving 8-Pin 6x5 DFN Package**
**Features:**

- High Peak Output Current: 9A
- Wide Input Supply Voltage Operating Range: 4.5V to 18V
- High Continuous Output Current: 2A (max.)
- Fast Rise and Fall Times:
  - 30ns with 4,700pF Load
  - 180ns with 47,000pF Load
- Short Propagation Delays: 30ns (typ.)
- Low Supply Current:
  - With Logic ‘1’ Input: 200μA (typ.)
  - With Logic ‘0’ Input: 55μA (typ.)
- Low Output Impedance: 1.4Ω (typ.)
- Latch-Up Protected: Will Withstand 1.5A Output Reverse Current
- Input Will Withstand Negative Inputs Up to 5V
- Pin-Compatible with the TC4420/TC4429
- Space-saving 8-Pin 6x5 DFN Package
TC4451/4452

Features:
- High Peak Output Current: 13A (typ.)
- Wide Input Supply Voltage Operating Range: 4.5V to 18V
- High Continuous Output Current: 2.6A (max.)
- Matched Fast Rise and Fall Times:
  - 21ns with 10,000 pF Load
  - 42ns with 22,000 pF Load
- Matched Propagation Delays: 44ns (typ.)
- Low Supply Current:
  - With Logic ‘1’ Input: 140μA (typ.)
  - With Logic ‘0’ Input: 40μA (typ.)
- Low Output Impedance: 0.9Ω (typ.)
- Latch-Up Protected: Will Withstand 1.5A Output Reverse Current
- Input Will Withstand Negative Inputs up to 5V
- Pin- Compatible with the TC4420/TC4429, TC4421/TC4422 and TC4421A/TC4422A
- Space-Saving, Thermally-Enhanced, 8-Pin DFN Package
Features

- Low Drain-to-Source On Resistance (RDS(ON))
- Low Total Gate Charge (QG) and Gate-to-Drain Charge (QGD)
- Low Series Gate Resistance (RG)
- Fast Switching = Capable of Short Dead-Time Operation for Maximum Power Conversion Efficiency
- ROHS Compliant

Use with Microchip’s Switching Controllers and/or MOSFET Drivers
Features:
• Linear Charge Management Controller for Single Lithium-Ion Cells
• High Accuracy Preset Voltage Regulation: ±1% (max.)
• Two Preset Voltage Regulation Options: 4.1V, MCP73826-4.1 4.2V, MCP73826-4.2
• Programmable Charge Current
• Automatic Cell Preconditioning of Deeply Depleted Cells, Minimizing Heat Dissipation During Initial Charge Cycle
• Automatic Power-Down when Input Power Removed
• Temperature Range: -20°C to +85°C
• Packaging: 6-Pin SOT-23A
Features:

• Linear Charge Management Controller for Single Lithium-Ion Cells
• High Accuracy Preset Voltage Regulation: ±1% (max.)
• Two Preset Voltage Regulation Options:
  4.1V, MCP73827-4.1
  4.2V, MCP73827-4.2
• Programmable Charge Current
• Automatic Cell Preconditioning of Deeply Depleted Cells, Minimizing Heat Dissipation During Initial Charge Cycle
• Charge Status Output for LED Drive or Microcontroller Interface
• Charge Current Monitor Output
• Automatic Power-Down when Input Power Removed
• Temperature Range: -20°C to +85°C
• Packaging: 8-Pin MSOP
**Features:**

- Linear Charge Management Controller for Single Lithium-Ion Cells
- High Accuracy Preset Voltage Regulation: ±1% (max.)
- Two Preset Voltage Regulation
  - 4.1V, MCP73828-4.1
  - 4.2V, MCP73828-4.2
- Programmable Charge Current
- Automatic Cell Preconditioning of Deeply Depleted Cells, Minimizing Heat Dissipation During Initial Charge Cycle
- Charge Complete Output CD10 for LED Drive or Microcontroller Interface
- Continuous Temperature Monitoring
- Automatic Power-Down when Input Power Removed
- Temperature Range: -20°C to +85°C
- Packaging: 8-Pin MSOP
**Features:**

- Linear Charge Management Controllers
  - Integrated Pass Transistor
  - Integrated Current Sense
  - Reverse Blocking Protection
- High-Accuracy Preset Voltage Regulation: ±0.5% (max.)
- Two Selectable Voltage Regulation Options: 4.1V, 4.2V
- Programmable Charge Current
- USB Compatible Charge Current Settings
- Programmable Safety Charge Timers
- Preconditioning of Deeply Depleted Cells
- Automatic End-of-Charge Control
- Optional Continuous Cell Temperature Monitoring - MCP73853
- Charge Status Output for Direct LED Drive
- Fault Output for Direct LED Drive - MCP73853
- Automatic Power-Down
- Thermal Regulation
- Temperature Range: -40°C to +85°C
- Packaging:
  16-Lead, 4x4 mm QFN (MCP73853)
  10-Lead, 3x3 mm DFN (MCP73855)
Features:
• Linear Charge Management Controllers
• High-Accuracy Preset Voltage Regulation: ±0.5% (max.)
• Four Preset Voltage Regulation Options:
  4.1V, MCP73841-4.1, MCP73843-4.1
  4.2V, MCP73841-4.2, MCP73843-4.2
  8.2V, MCP73842-8.2, MCP73844-8.2
  8.4V, MCP73842-8.4, MCP73844-8.4
• Programmable Charge Current
• Programmable Safety Charge Timers
• Preconditioning of Deeply Depleted Cells
• Automatic End-of-Charge Control
• Optional Continuous Cell Temperature Monitoring (MCP73841 and MCP73842)
• Charge Status Output for Direct LED Drive
• Automatic Power-Down when Input Power Removed
• Temperature Range: -40°C to 85°C
• Packaging:
  MSOP-10: MCP73841, MCP73842
  MSOP-8: MCP73843, MCP73844
**Features:**

- Complete Linear Charge Management Controller
  - Integrated Pass Transistor
  - Integrated Current Sense
  - Integrated Reverse Discharge Protection
- Constant Current/Constant Voltage Operation
- High Accuracy Preset Voltage Regulation: 4.20V + 0.75% over temperature
- Programmable Charge Current:
  - MCP73830L: 20 mA – 200 mA
  - MCP73830: 100 mA – 1000 mA
- Soft-start to avoid inrush current
- Preconditioning: 10% and No Preconditioning
- Fixed Elapse Timer: 0 Hour or 4 Hours
- Fixed Preconditioning Timer: 1 Hour
- Automatic Recharge: Optional
- Automatic End-of-Charge Control Termination: 7.5%/10%
- Automatic Power-Down when Input Power Removed
- Under Voltage Lockout (UVLO)
- Chip/Charge Enable Pin (CE)
- Packaging: TDFN-6 (2x2 mm)
- Pin-to-pin functional compatible to LTC4065LX
- Temperature Range: -40°C to +85°C
Features:

- Linear Charge Management Controller:
  - Integrated Pass Transistor
  - Integrated Current Sense
  - Reverse Discharge Protection
- High Accuracy Preset Voltage Regulation: ±0.75%
- Four Voltage Regulation Options: 4.20V, 4.35V, 4.40V, 4.50V
- Programmable Charge Current: 15mA to 500mA
- Selectable Preconditioning: 10%, 20%, 40%, or Disable
- Selectable End-of-Charge Control: 5%, 7.5%, 10%, or 20%
- Charge Status Output
  Tri-State Output - MCP73831
  Open-Drain Output - MCP73832
- Automatic Power-Down
- Thermal Regulation
- Temperature Range: -40°C to +85°C
- Packaging: 8-Pin, 2x3 mm DFN, 5-Lead, SOT-23
Features:

- Complete Linear Charge Management Controller:
  - Integrated Pass Transistor, Current Sense and Reverse Discharge Protection
- Constant Current / Constant Voltage Operation with Thermal Regulation
- High Accuracy Preset Voltage Regulation: 4.2V, 4.35V, 4.4V, or 4.5V, ±0.75%
- Programmable Charge Current: 1A (max.)
- Preconditioning of Deeply Depleted Cells
  - Selectable Current Ratio
  - Selectable Voltage Threshold
- Automatic End-of-Charge Control
  - Selectable Current Threshold
  - Selectable Safety Time Period
- Automatic Recharge
  - Selectable Voltage Threshold
- Two Charge Status Outputs
- Cell Temperature Monitor
- Low-Dropout Linear Regulator Mode
- Automatic Power-Down when Input Power Removed
- Under Voltage Lockout
- Available Packages: 3mm x 3mm DFN-10, MSOP-10
Features:

- High Accuracy Preset Voltage Regulation: + 0.5%
- Available Voltage Regulation Options: 4.20V, 4.35V, 4.4V, or 4.5V
- Complete Linear Charge Management Controller:
  - Autonomous Power Source Selection
  - Integrated Pass Transistors
  - Integrated Current Sense
  - Integrated Reverse Discharge Protection
- Constant Current (CC) / Constant Voltage (CV) Operation with Thermal Regulation
- Selectable USB-Port Charge Current:
  - Low: 1 Unit Load / High: 5 Unit Loads
- Programmable AC-Adapter Charge Current: 15mA to 1000mA
- Two Charge Status Outputs
- Power-Good Monitor: MCP73837
- Timer Enable: MCP73838
- Automatic Recharge:
  - Selectable Voltage Threshold
- Automatic End-of-Charge Control:
  - Selectable Charge Termination Current Ratio
  - Selectable Safety Timer Period
- Preconditioning of Deeply Depleted Cells - can be disabled
- Battery Cell Temperature Monitor
- UVLO (Undervoltage Lockout)
- Automatic Power-Down when Input Power is Removed
- Low-Dropout (LDO) Linear Regulator Mode
- Temperature Range: -40°C to 85°C
- Packaging:
  10-Lead 3 mm x 3 mm DFN, 10-Lead MSOP
Features:

- Integrated System Load Sharing and Battery Charge Management
  - Simultaneously Power the System and Charge the Li-Ion Battery
  - Resistor Programmable Fast Charge Current: 50mA to 1A
- Integrated Pass Transistors, Current Sense and Reverse Discharge Protection
- Selectable Input Power Sources: USB Port or AC-DC Wall Adapter
- Preset High Accuracy Charge Voltage Options: 4.10V, 4.20V, 4.35V or 4.40V
- Regulation Tolerance: ±0.5% (typ.)
- 0.1°C Preconditioning for Deeply Depleted Cells
- Resistor Programmable Termination Set Point
- Automatic Recharge and End-of-Charge Control
- Safety Timer With Timer Enable/Disable Control
- Battery Cell Temperature Monitor
- Undervoltage Lockout (UVLO)
- Low Battery Status Indicator (LBO)
- Power-Good Status Indicator (PG)
- Temperature Range: -40°C to 85°C
- Packaging: 20-Lead QFN (4 mm x 4 mm)
**Features:**

- Complete Linear Charge Management Controller:
  - **Integrated Input Overvoltage Protection**
  - Integrated Pass Transistor
  - Integrated Current Sense
  - Integrated Reverse Discharge Protection
- Constant Current / Constant Voltage Operation with Thermal Regulation
- 4.15V Undervoltage Lockout (UVLO)
- **18V Absolute Maximum Input with OVP:** 6.5V (MCP738113) and 5.8V (MCP738114)
- High Accuracy Preset Voltage Regulation Through Full Temperature Range (-5°C to 55°C): ±0.5%
- Battery Charge Voltage Options: 4.10V, 4.20V, 4.35V or 4.4V
- Resistor Programmable Fast Charge Current: 130mA to 1100mA
- Preconditioning of Deeply Depleted Cells
- Integrated Precondition Timer
- Automatic End-of-Charge Control:
  - Automatic Recharge: Available Options: 95% or Disable
- Charge Status Output - Two Style Options
- Soft start
- Temperature Range: -40°C to +85°C
- Packaging: DFN-10 (3 mm x 3 mm)
Features:

- Complete Linear Charge Management Controller:
  - Integrated Input Overvoltage Protection, Pass Transistor, Current Sense, Reverse Discharge Protection
- Constant Current / Constant Voltage Operation w/ Thermal Regulation
- 4.15V Undervoltage Lockout (UVLO)
- 18V Absolute Maximum Input with OVP:
  - 6.5V (MCP73123) and 13V (MCP73223)
- High Accuracy Preset Voltage Regulation Through Full Temperature Range (-5°C to +55°C):
  - ±0.5% (MCP73123) and ±0.6% (MCP73223)
- Battery Charge Voltage Options:
  - 3.6V (MCP73123) and 7.2V (MCP73223)
- Resistor Programmable Fast Charge Current: 30mA to 1100mA
- Preconditioning of Deeply Depleted Cells: Avail Options: 10% or Disable
- Integrated Precondition Timer: 32 Minutes or Disable
- Automatic End-of-Charge Control:
  - Selectable Minimum Current Ratio: 5%, 7.5%, 10% or 20%
  - Elapse Safety Timer: 4 HR, 6 HR, 8 HR or Disable
- Automatic Recharge: Available Options: 95% or Disable
- Factory Preset Charge Status Output: On/Off or Flashing
- Soft Start
- Temperature Range: -40°C to +85°C
- Packaging: DFN-10 (3 mm x 3 mm)
Features:

• Complete Linear Charge Management Controller:
  - Integrated Input Overvoltage Protection, Pass Transistor, Current Sense, Reverse Discharge Protection
• Constant Current / Constant Voltage Operation w/Thermal Regulation
• 4.15V Undervoltage Lockout (UVLO)
• 13V Input Overvoltage Protection
• High Accuracy Preset Voltage Regulation
  Through Full Temperature Range (-5°C to +55°C): ±0.6%
• Battery Charge Voltage Options: 8.20V, 8.40V, 8.7V or 8.8V
• Resistor Programmable Fast Charge Current: 130mA to 1100mA
• Preconditioning of Deeply Depleted Cells: 10% or Disable
• Integrated Precondition Timer: 32 Minutes or Disable
• Automatic End-of-Charge Control:
  - Selectable Minimum Current Ratio: 5%, 7.5%, 10% or 20%
  - Elapse Safety Timer: 4 HR, 6 HR, 8 HR or Disable
• Automatic Recharge: Available Options: 95% or Disable
• Factory Preset Charge Status Output: On/Off or Flashing
• Soft Start
• Temperature Range: -40°C to +85°C
• Packaging: DFN-10 (3 mm x 3 mm)
Features:
• Complete Linear Charge Management Controller
  - Integrated Pass Transistor
  - Integrated Current Sense
  - Integrated Reverse Discharge Protection
• Constant Current / Constant Voltage Operation with Thermal Regulation
• High Accuracy Preset Voltage Regulation: ±1%
• Voltage Regulation: 4.20V
• Selectable Charge Current:
  - MCP73811: 85mA / 450mA
• Programmable Charge Current:
  - MCP73812: 50mA to 500mA
• Minimum External Components Required:
  - MCP73811: 2 Ceramic Capacitors
  - MCP73812: 2 Ceramic Capacitors and 1 Resistor
• No Preconditioning
• External End-of-Charge Control
• Automatic Power-Down when Input Power Removed
• Active High Charge Enable
• Temperature Range: -40°C to +85°C
• Packaging: 5-Lead SOT-23
MCP3301

Features:
- Full Differential Inputs
- 13-bit Resolution
- ±1 LSB (max.) DNL
- ±1 LSB (max.) INL (MCP3301-B)
- ±2 LSB (max.) INL (MCP3301-C)
- Single Supply Operation: 2.7V to 5.5V
- 100 kps Sampling Rate with 5V Supply Voltage
- 50 kps Sampling Rate with 2.7V Supply Voltage
- 50nA (typ.) Standby Current
- 450μA (max.) Active Current at 5V
- Industrial Temperature Range: -40°C to +85°C
- 8-Pin MSOP, PDIP and SOIC Packages
- MXDEV™ Evaluation Kit Available
Features:
- Full Differential Inputs
- 13-bit Resolution
- MCP3302: 2 Differential of 4 Single Ended Inputs
- MCP3304: 4 Differential or 8 Single Ended Inputs
- ±1 LSB (max.) DNL
- ±1 LSB (max.) INL (MCP3302/04-B)
- ±2 LSB (max.) INL (MCP3302/04-C)
- Single Supply Operation: 2.7V to 5.5V
- 100 ksamples Sampling Rate with 5V Supply Voltage
- 50 ksamples Sampling Rate with 2.7V Supply Voltage
- 50nA (typ.) Standby Current
- 450μA (max.) Active Current at 5V
- Industrial Temperature Range: -40°C to +85°C
- 14 and 16-Pin PDIP, SOIC and TSSOP Packages
- MXDEV™ Evaluation Kit Available
MCP3221

Features:
- 12-bit Resolution
- ±1 LSB DNL, ±2 LSB INL (max.)
- 250μA (max.) Conversion Current
- 5nA (typ.) Standby Current
- I²C™ Compatible Serial Interface:
  - 100 kHz Standard Mode
  - 400 kHz Fast Mode
- Up to 8 Devices on a Single 2-Wire Bus
- Single-Ended Analog Input Channel
- On-Chip Sample and Hold
- On-Chip Conversion Clock
- Single-Supply: 2.7V to 5.5V
- Temperature Range:
  - Industrial: -40°C to +85°C
  - Extended: -40°C to +125°C
- Small SOT-23 Package
MCP3201

Features:
- 12-bit Resolution
- ±1 LSB (max.) DNL
- ±1 LSB (max.) INL (MCP3301-B)
- ±2 LSB (max.) INL (MCP3301-C)
- SPI Serial Interface: Modes 0,0 and 1,1
- Single Supply Operation: 2.7V to 5.5V
- 100 ksp/s (max.) Sampling Rate at 5V
- 50 ksp/s (max.) Sampling Rate at 2.7V
- 500nA (typ.) Standby Current
- 400μA (max.) Active Current at 5V
- On-Chip Sample and Hold
- Industrial Temperature Range: -40°C to +85°C
- 8-Pin MSOP, PDIP, SOIC and TSSOP Packages
MCP3202

Features:
• 12-bit Resolution
• ±1 LSB (max.) DNL
• ±1 LSB (max.) INL (MCP3302-B)
• ±2 LSB (max.) INL (MCP3302-C)
• 2 Input Channels
• Analog Inputs Programmable as Single-Ended or Pseudo-Differential Pairs
• SPI Serial Interface: Modes 0,0 and 1,1
• Single Supply Operation: 2.7V to 5.5V
  100 ksps (max.) Sampling Rate at 5V
  50 ksps (max.) Sampling Rate at 2.7V
• 500nA (typ.) Standby Current
• 550μA (max.) Active Current at 5V
• On-Chip Sample and Hold
• Industrial Temperature Range: -40°C to +85°C
• 8-Pin MSOP, PDIP, SOIC and TSSOP Packages
MCP3204/8

Features:
• 12-bit Resolution
• ±1 LSB (max.) DNL
• ±1 LSB (max.) INL (MCP3304/08-B)
• ±2 LSB (max.) INL (MCP3304/08-C)
• 4 (MCP3204) or 8 (MCP3208) Input Channels
• Analog Inputs Programmable as Single-Ended or Pseudo-Differential Pairs
• SPI Serial Interface: Modes 0,0 and 1,1
• Single Supply Operation: 2.7V to 5.5V
  100 ksamples (max.) Sampling Rate at 5V
  50 ksamples (max.) Sampling Rate at 2.7V
• 500nA (typ.) Standby Current
• 400μA (max.) Active Current at 5V
• On-Chip Sample and Hold
• Industrial Temperature Range: -40°C to +85°C
• PDIP, SOIC and TSSOP Packages

* Note: Channels 5-7 available on MCP3208 Only
Features:
• 10-bit Resolution
• Singly Supply: 2.7V to 5.5V
• ±1 LSB DNL, ±1 LSB INL (max.)
• 250μA (max.) Conversion Current
• 5nA (typ.) Standby Current, 1μA (max.)
• I²C™ Compatible Serial Interface
  100 kHz Standard Mode
  400 kHz Fast Mode
• 22.3 ksp/s in Fast Mode
• Up to 8 Devices on Single 2-Wire Bus
• Single-Ended Analog Input Channel
• On-Chip Sample and Hold
• On-Chip Conversion Clock
• Extended Temperature Range:
  -40°C to +125°C
• Small SOT-23 Package
MCP3001

Features:

- 10-bit Resolution
- Singly Supply: 2.7V to 5.5V
  200 ksps Sampling Rate at 5V
  75 ksps Sampling Rate at 2.7V
- ±1 LSB DNL, ±1 LSB INL (max.)
- SPI Serial Interface: modes 0,0 and 1,1
- On-Chip Sample and Hold
- Low Power CMOS Technology:
  5nA (typ.) Standby Current, 2μA (max.)
  500μA (max.) Active Current at 5V
- Industrial Temperature Range:
  -40°C to +85°C
- Space Saving 8-Pin SOIC, MSOP, TSSOP and PDIP Packages
Features:

- 10-bit Resolution
- Singly Supply: 2.7V to 5.5V
  200 ksps Sampling Rate at 5V
  75 ksps Sampling Rate at 2.7V
- ±1 LSB DNL, ±1 LSB INL (max.)
- Analog Inputs:
  Single-Ended or Pseudo-Differential Pairs
- SPI Serial Interface: modes 0,0 and 1,1
- On-Chip Sample and Hold
- Low Power CMOS Technology:
  5nA (typ.) Standby Current, 2μA (max.)
  550μA (max.) Active Current at 5V
- Industrial Temperature Range:
  -40°C to +85°C
- Space Saving 8-Pin SOIC, MSOP, TSSOP and PDIP Packages
Features:

- 10-bit Resolution
- Singly Supply: 2.7V to 5.5V
  - 200 ksps Sampling Rate at 5V
  - 75 ksps Sampling Rate at 2.7V
- 4 (MCP3004) or 8 (MCP3008) Input Channels
- ±1 LSB DNL, ±1 LSB INL (max.)
- Analog Inputs:
  - Single-Ended or Pseudo-Differential Pairs
- SPI Serial Interface: modes 0,0 and 1,1
- On-Chip Sample and Hold
- Low Power CMOS Technology:
  - 5nA (typ.) Standby Current, 2μA (max.)
  - 500μA (max.) Active Current at 5V
- Industrial Temperature Range:
  - -40°C to +85°C
- SOIC, TSSOP and PDIP Packages
Features:

• 22-bit ADC in Small 8-pin MSOP Package

• Ultra-Low Conversion Current (MCP3550/1):
  - 100μA (typ.) ($V_{DD} = 2.7V$)
  - 120μA (typ.) ($V_{DD} = 5.0V$)

• Low-Output Noise of 2.5μVRMS with Effective Resolution of 21.9 bits (MCP3550/1)

• Offset Error: 3μV (typ.)

• Full Scale Error: 2ppm (typ.)

• INL Error: 6ppm (max.)

• Total Unadjusted Error Less Than 10ppm

• Data rate
  - MCP3550/1: 15sps
  - MCP3553: 60sps

• No Digital Filter Settling Time, Single-Command Conversions through 3-wire SPI Interface

• 50/60Hz Rejection (MCP3550/1)

• Differential Input with $V_{SS}$ to $V_{DD}$ Common Mode Range

• 2.7V to 5.5V Single-Supply Operation

• Extended Temperature Range: -40°C to +125°C
Features:
- 18-bit ΔΣ ADC in a SOT-23-6 package
- On-board Voltage Reference
- On-board Programmable Gain Amplifier:
  Gains of 1, 2, 4 or 8
- One-Shot or Continuous Conversion
- Low current consumption:
  145μA (typ.), $V_{DD} = 3V$, Continuous
  39μA (typ.), $V_{DD} = 3V$, One-Shot
- Programmable Data Rate Options:
  3.75 sps (18 bits), 15 sps (16 bits),
  60 sps (14 bits), 240 sps (12 bits)
- INL: 10ppm of FSR ($FSR = 4.096V/PGA$)
- Self Calibration of Internal Offset and Gain
  per each Conversion
- Differential Input Operation
- Supports $I^2C$™ Serial Interface:
  Standard, Fast and High Speed Modes
- Single Supply Operation: 2.7V to 5.5V
- On-board Oscillator
- Extended Temperature Range: -40°C to 125°C
Features:
- 18-bit ΔΣ ADC
- Multi-Channel inputs
  - 2-channel (MCP3422/3)
  - 4-channel (MCP3424)
- On-board Voltage Reference
- On-board Programmable Gain Amplifier:
  - Gains of 1, 2, 4 or 8
- One-Shot or Continuous Conversion
- Low current consumption:
  - 145μA (typ.), $V_{DD} = 3V$, Continuous
  - 39μA (typ.), $V_{DD} = 3V$, One-Shot
- Programmable Data Rate Options:
  - 3.75 sps (18 bits), 15 sps (16 bits),
    60 sps (14 bits), 240 sps (12 bits)
- INL: 10ppm of FSR (FSR = 4.096V/PGA)
- Self Calibration of Internal Offset and Gain per each Conversion
- Differential Input Operation
- Supports I²C™ Serial Interface
  - User-selectable addressing (MCP3423/4)
- Single Supply Operation: 2.7V to 5.5V
- Extended Temperature Range: -40°C to 125°C
MCP3425

Features:

• 16-bit ΔΣ ADC in a SOT-23-6 package
• Differential Input Operation
• Self Calibration of Internal Offset and Gain per each Conversion
• On-board Voltage Reference
  Accuracy: 2.048V ±0.05%
• On-board Programmable Gain Amplifier:
  Gains of 1, 2, 4 or 8
• On-board Oscillator
• INL: 10ppm of FSR (FSR = 4.096V/PGA)
• Programmable Data Rate Options
  - 15 sps (16 bits), 60 sps (14 bits), 240 sps (12 bits)
• One-Shot or Continuous Conversion options
• One-Shot Conversion
  9.7µA (typ.) with 16-bit mode
  2.4µA (typ.) with 14-bit mode
  0.6µA (typ.) with 12-bit mode
• Low current consumption:
  145µA typical (V_{DD} = 3V, Continuous)
• Supports I²C™ Serial Interface:
  Standard, Fast and High Speed Modes
• Single Supply Operation: 2.7V to 5.5V
• Extended Temperature Range: -40°C to 125°C
Features:

- 16-bit ΔΣ ADC
  - 2 channels: MCP3426 and MCP3427
  - 4 channels: MCP3428
- Differential Input Full Scale Range Operation
- Self Calibration of Internal Offset and Gain per each Conversion
- On-board Voltage Reference: Accuracy: 2.048V ±0.05%
- On-board Programmable Gain Amplifier: Gains of 1, 2, 4 or 8
- On-board Oscillator
- INL: 10ppm of FSR
- Programmable Data Rate Options
  - 5 sps (16 bits), 60 sps (14 bits), 240 sps (12 bits)
- One-Shot or Continuous Conversion options
- One-Shot Conversion
  - 9 µA (typ.) with 16-bit mode
  - 2.25 µA (typ.) with 14-bit mode
  - 0.56 µA (typ.) with 12-bit mode
- Low current consumption:
  - 135 µA typical (V_{DD} = 3V, Continuous)
- Supports I²C™ Serial Interface:
  - User configurable address pins (MCP3427/MCP3428)
- Single Supply Operation: 2.7V to 5.5V
- Extended Temperature Range: -40°C to 125°C
Features:

- Power Monitoring Accuracy capable of 0.1% error across 4000:1 dynamic range
- Built-in calculations:
  - Active, Reactive and Apparent Power
  - RMS Current, RMS Voltage
  - Line Frequency, Power Factor
- Fast Calibration Routine
- Programmable Event Notifications such as overcurrent and voltage sag, surge protection
- 512 bytes User-accessible EEPROM
- Non-volatile On-chip Memory, no external memory required
- 2-wire UART interface supporting multiple devices on a single bus
- Low-Drift Internal Voltage Reference: 10 ppm/°C typical
- 28-lead 5x5 QFN package
- Extended Temperature Range: -40°C to +125°C
Features:

- Supplies active (real) power measurement for single-phase, residential energy metering
- Supports IEC 62053 International Energy Metering Specification and legacy IEC 1036/61036/687 Specifications
- Two multi-bit, DAC, second-order, 16-bit, Delta-Sigma Analog-to-Digital Converters (ADCs)
- Reduced pulse width of calibration output frequency and mechanical counter drive for low power meter designs (MCP3905L)
- Increased output frequency constant options for meter design (MCP3905L)
- 0.1% typical measurement error over 500:1 dynamic range (MCP3905A / MCP3905L)
- 0.1% typical measurement error over 1000:1 dynamic range (MCP3906A)
- Programmable Gain Amplifier (PGA) for small signal inputs supports low value shunt current sensor:
  16:1 PGA - MCP3905A / MCP3905L
  32:1 PGA - MCP3906A
- Ultra-low drift on-chip reference: 15ppm/°C (typ.)
- Direct drive for electromagnetic mechanical counter and two-phase stepper motors
- Low $I_{DD}$ of 4mA (typ.)
- Tamper output pin for negative power indication
- Industrial Temperature Range: -40°C to +85°C
- Supplies instantaneous real power on HF$_{OUT}$ for meter calibration
MCP3909

Features:

• Supports IEC 62053 International Energy Metering Specification and legacy IEC 1036/61036/687 Specifications
• Digital waveform data access through SPI interface
  - 16-bit Dual ADC output data words
  - 20-bit Multiplier output data word
• Dual functionality pins support serial interface and simultaneous Active Power Pulse Output
• Two 16-bit second order delta-sigma Analog-to-Digital Converters (ADCs) with multi-bit DAC
  - 81 dB SINAD (typ.) both channels
• 0.1% typical active energy measurement error over 1000:1 dynamic range
• PGA for small signal inputs supports low value shunt current sensor
• Ultra-low drift on-chip reference: 15ppm/°C (typ.)
• Direct drive for electromagnetic mechanical counter and two-phase stepper motors
• Low I_{DD} of 4mA (max.)
• Tamper output pin for negative power indication
• Industrial Temperature Range: -40°C to +85°C
Features:

- Two synchronous sampling 16/24-bit resolution Delta-Sigma A/D Converters
- 91 dB SINAD, -104 dBC THD (up to 35th harmonic), 109 dB SFDR for each channel
- Programmable data rate up to 64 ksp/s
- Ultra low power shutdown mode with <2 μA
- -133 dB Crosstalk between the two channels
- Low Drift Internal Voltage Reference: 12 ppm/°C
- Differential Voltage Reference Input Pins
- High Gain PGA on each channel (up to 32 V/V)
- Phase Delay Compensation: 1 μs time resolution
- Separate Modulator outputs for each channel
- High-Speed Addressable 20 MHz SPI Interface with Mode 0,0 and 1,1 Compatibility
- Independent analog and digital power supplies 4.5V - 5.5V AV_{DD}, 2.7V - 5.5V DV_{DD}
- Low Power consumption: 14 mW typical at 5V
- Available in small 20-lead SSOP package
- Extended Temperature Range: -40°C to +125°C
Features
- 2.7V - 3.6V AVDD, DVDD
- Two Synchronous Sampling 16/24-bit ΔΣ ADCs
- 94.5 dB SINAD, -106.5 dB THD (up to 35th harmonic), 111 dB SFDR
- Programmable Data Rate up to 125 ksp/s
- Oversampling Ratio up to 4096
- -122 dB Crosstalk between the Two Channels
- Low Drift 1.2V Internal Voltage Reference: 7 ppm/°C
- Differential Voltage Reference Input Pins
- PGA on Each Channel (up to 32V/V)
- Phase Delay Compensation: 1 µs Time Resolution
- Separate Modulator Outputs for Each Channel
- Separate Data Ready Pin for Easy Synchronization
- Individual 24-bit Digital Offset and Gain Error Correction for Each Channel
- High-Speed 20 MHz SPI Interface
- Continuous Read/Write Modes
- Low Power Consumption down to 5.6 mW at 3.3V
- Extended Temperature Range: -40°C to +125°C
- 20-lead QFN and SSOP Packages
- Pin-to-pin Compatible with MCP3901
Features

- Single 24-bit ΔΣ ADC
- 93.5 dB SINAD, -107 dBC Total Harmonic Distortion (THD) (up to 35th Harmonic), 112 dBFS SFDR
- Flexible Serial Interface that Includes Both SPI and a Simple 2-Wire Interface Ideal for Polyphase Shunt Energy Meters
- Advanced Security Features:
  - 16-bit CRC checksum
  - Register map lock with 8-bit secure key
- Programmable Data Rate, up to 125 ksp/s
- Oversampling Ratio up to 4096
- Internal Voltage Reference: 9 ppm/°C drift
- PGA (up to 32 V/V)
- Phase Delay Compensation: 1 µs Time Resolution
- Separate Data Ready Pin for Easy Synchronization
- 24-bit Digital Offset and Gain Error Correction
- High-Speed 20 MHz SPI interface
- Continuous Read/Write Modes for Minimum Communication Time
- Extended Temperature Range: -40°C to +125°C
  - All specifications are valid down to -45°C
- 20-lead SSOP and QFN Packages
**Features**

- Two 24-bit ΔΣ ADC
- 93.5 dB SINAD, -107 dBc Total Harmonic Distortion (THD) (up to 35th Harmonic), 112 dBFS SFDR
- Enables 0.1% Typical Active Power Measurement Error over a 10,000:1 Dynamic Range
- Flexible Serial Interface that Includes Both SPI and a Simple 2-Wire Interface Ideal for Polyphase Shunt Energy Meters
- Advanced Security Features:
  - 16-bit CRC checksum
  - Register map lock with 8-bit secure key
- Programmable Data Rate, up to 125 ksp's
- Oversampling Ratio up to 4096
- -122 dB Crosstalk between Channels
- Low Drift Internal Voltage Reference: 9 ppm/°C
- PGA on Each Channel (up to 32 V/V)
- Phase Delay Compensation: 1 µs Time Resolution
- Separate Data Ready Pin for Easy Synchronization
- 24-bit Digital Offset and Gain Error Correction
- High-Speed 20 MHz SPI interface
- Extended Temperature Range: -40°C to +125°C
  - All specifications are valid down to -45°C
- 20-lead SSOP and QFN Packages
Features
- Three Synchronous Sampling 24-bit ΔΣ ADCs
- 93.5 dB SINAD, -107 dBC Total Harmonic Distortion (THD) (up to 35th Harmonic), 112 dBFs SFDR
- Enables 0.1% Typical Active Power Measurement Error over a 10,000:1 Dynamic Range
- Advanced Security Features:
  - 16-bit CRC checksum
  - Register map lock with 8-bit secure key
- Programmable Data Rate up to 125 ksp/s
- Oversampling Ratio up to 4096
- -122 dB Crosstalk between Channels
- Low Drift Internal Voltage Reference: 9 ppm/°C
- PGA on Each Channel (up to 32 V/V)
- Phase Delay Compensation: 1 μs Time Resolution
- Separate Data Ready Pin for Easy Synchronization
- Individual 24-bit Digital Offset and Gain Error Correction for Each Channel
- High-Speed 20 MHz SPI interface with 2-Wire Interface Mode
- Continuous Read/Write Modes for Minimum Communication Time
- Extended Temperature Range: -40°C to +125°C
- 28-lead QFN and SSOP Packages
Features

• Four Synchronous Sampling 24-bit ΔΣ ADCs
• 93.5 dB SINAD, -107 dBc Total Harmonic Distortion (THD) (up to 35th Harmonic), 112 dBFS SFDR
• Enables 0.1% Typical Active Power Measurement Error over a 10,000:1 Dynamic Range
• Advanced Security Features:
  • 16-bit CRC checksum
  • Register map lock with 8-bit secure key
• Programmable Data Rate up to 125 ksps
• Oversampling Ratio up to 4096
• -122 dB Crosstalk between Channels
• Low Drift Internal Voltage Reference: 9 ppm/°C
• PGA on Each Channel (up to 32 V/V)
• Phase Delay Compensation: 1 µs Time Resolution
• Separate Data Ready Pin for Easy Synchronization
• Individual 24-bit Digital Offset and Gain Error Correction for Each Channel
• High-Speed 20 MHz SPI interface
• Continuous Read/Write Modes for Minimum Communication Time
• Extended Temperature Range: -40°C to +125°C
• 28-lead QFN and SSOP Packages
Features

- Six Synchronous Sampling 24-bit ΔΣ ADCs
- 94.5 dB SINAD, -107 dBc Total Harmonic Distortion (THD) (up to 35th Harmonic), 112 dBFS SFDR
- Enables 0.1% Typical Active Power Measurement Error over a 10,000:1 Dynamic Range
- Advanced Security Features:
  - 16-bit CRC checksum
  - Register map lock with 8-bit secure key
- Programmable Data Rate up to 125 ksamples/s
- Oversampling Ratio up to 4096
- -122 dB Crosstalk between Channels
- Low Drift Internal Voltage Reference: 9 ppm/°C
- PGA on Each Channel (up to 32 V/V)
- Phase Delay Compensation: 1 μs Time Resolution
- Separate Data Ready Pin for Easy Synchronization
- Individual 24-bit Digital Offset and Gain Error Correction for Each Channel
- High-Speed 20 MHz SPI interface
- Continuous Read/Write Modes for Minimum Communication Time
- Extended Temperature Range: -40°C to +125°C
- 28-lead SSOP and 40-lead μQFN Package
Features

- Eight Synchronous Sampling 24-bit ΔΣ ADCs
- 94.5 dB SINAD, -107 dBc Total Harmonic Distortion (THD) (up to 35th Harmonic), 112 dBFS SFDR
- Enables 0.1% Typical Active Power Measurement Error over a 10,000:1 Dynamic Range
- Advanced Security Features:
  - 16-bit CRC checksum
  - Register map lock with 8-bit secure key
- Programmable Data Rate up to 125 ksp/s
- Oversampling Ratio up to 4096
- -122 dB Crosstalk between Channels
- Low Drift Internal Voltage Reference: 9 ppm/°C
- PGA on Each Channel (up to 32 V/V)
- Phase Delay Compensation: 1 μs Time Resolution
- Separate Data Ready Pin for Easy Synchronization
- Individual 24-bit Digital Offset and Gain Error Correction for Each Channel
- High-Speed 20 MHz SPI interface
- Continuous Read/Write Modes for Minimum Communication Time
- Extended Temperature Range: -40°C to +125°C
- 28-lead SSOP and 40-lead μQFN Package
Features:

- Six Synchronous Sampling 16/24-bit Resolution Delta-Sigma A/D Converters with Proprietary Multi-Bit Architecture
- 91 dB SINAD, -100 dBc Total Harmonic Distortion (THD) (up to 35th harmonic), 102 dB Spurious-free Dynamic Range (SFDR) for Each Channel
- Programmable Data Rate up to 64 kSPS
- Ultra Low-Power Shutdown Mode with <2 µA
- -115 dB Crosstalk Between any Two Channels
- Low Drift Internal Voltage Reference: 5 ppm/°C
- Differential Voltage Reference Input Pins
- High Gain PGA on Each Channel (up to 32 V/V)
- Phase Delay Compensation Between Each Pair of Channels with 1 µs Time Resolution
- High-Speed Addressable 10 MHz SPI Interface with Mode 0,0 and 1,1 Compatibility
- Independent Analog and Digital Power Supplies 4.5V - 5.5V AVDD, 2.7V - 3.6V DVDD
- Available in Small 28-lead SSOP Package
- Extended Temperature Range: -40°C to +125°C
Features:

- Dual-channel 16-/24-bit Analog Front End (AFE) with Delta-Sigma A/D Converters and high-gain PGAs for 90 dB SINAD and -101 dBc THD (to 35th harmonic) performance
- 12-bit, 12-channel, 100ksps SAR A/D Converter
- LCD driver for up to 132 pixels with voltage boost regulator
- Hardware Real-Time Clock & Calendar
- Charge Time Measurement Unit (CTMU) for temperature sensing and capacitive touch
- Program Memory: 128k (PIC18F87J72), 64k (PIC18F86J72)
- Two Analog Comparators
- Two UARTs
- One Master Synchronous Serial Port (MSSP)
- Four Timers
- Two Capture/Compare/PWM (CCP)
- Up to 12 MIPS performance
- Internal oscillator support 31kHz to 8MHz and 4xPLL
- 8x8 Single Cycle Hardware Multiply
- nanoWatt low power with Run, Idle and Sleep modes
- Brown-Out-Reset (BOR)
- Low Voltage Detect (LVD)
- Operating Voltage Range: 2.0 to 3.6V for Digital and 12-bit ADC; 4.5 to 5.5V for 16-/24-bit AFE
Features:
• Precision (up to 17 bits) A/D Converter “Front End”
• 3-Pin Control Interface to Microprocessor
• Flexible: User Can Trade-off Conversion Speed for Resolution
• Single-Supply Operation (TC510/TC514)
• 4 Input, Differential Analog MUX (TC514)
• Automatic Input Voltage Polarity Detection
• Low Power Dissipation:
  (TC500/TC500A): 10mW
  (TC510/TC514): 18mW
• Wide Analog Input Range:
  ±4.2V (TC500A/TC510)
• Directly Accepts Bipolar and Differential Input Signals
**Features:**

- Zero Integrator Cycle for Fast Recovery from Input Overloads
- Eliminates Cross-Talk in Multiplexed Systems
- 12-Bit Plus Sign Integrating A/D Converter with Over Range Indication
- Sign Magnitude Coding Format
- True Differential Signal Input and Differential Reference Input
- Low Noise: 15μV_{P-P} (typ.)
- Input Current: 1pA (typ.)
- No Zero Adjustment needed
- TTL Compatible, Byte Organized Tri-State Outputs
- UART Handshake Mode for simple Serial Data Transmissions
Features:
• Accuracy: ±0.05% of Reading ±1 Count
• Two Voltage Ranges: 1.999V and 199.9mV
• Up to 25 Conversions Per Second
• Z_{IN} > 1000MΩ
• Single Positive Voltage Reference
• Auto-Polarity and Auto-Zero
• Overrange and Underrange Signals Available
• Operates in Auto-Ranging Circuits
• Uses On-Chip System Clock or External Clock
• Wide Supply Range: ±4.5V to ±8V
Features:
• 15-bit Resolution Plus Sign Bit
• Up to 40 Conversions per Second
• Integrating ADC Technique:
  - Monotonic
  - High Noise Immunity
  - Auto-Zeroed Amplifiers Eliminate Offset Trimming
• Wide Dynamic Range: 96dB
• Low Input Bias Current: 30pA
• Low Input Noise: 30μV_{p-p}
• Sensitivity: 100μV
• Flexible Operational Control
• Continuous or On Demand Conversions
• Data Valid Output
• Bus Compatible, 3-State Data Outputs:
  - 8-Bit Data Bus
  - Simple μP Interface
  - Two Chip Enables
  - Read ADC Result Like Memory
• ±5V Power Supply Operation: 20mΩ
• 40-Pin Dual-in-Line or 44-Pin PLCC Packages
Features:

- Internal Reference with Low Temperature Drift:
  - TC7106/7: 80ppm/°C (typ.)
  - TC7106A/7A: 20ppm/°C (typ.)
- Drives LCD (TC7106) or LED (TC7107) Display Directly
- Zero Reading with Zero Input
- Low Noise for Stable Display
- Auto-Zero CycleEliminates Need for Zero Adjustment
- True Polarity Indication for Precision Null Applications
- Convenient 9V Battery Operation (TC7106A)
- High-Impedance CMOS Differential Inputs: $10^{12}\Omega$
- Differential Reference Inputs Simplify Ratiometric Measurements
- Low-Power Operation: 10mW
**Features:**

- Low Temperature Drift Internal Reference
  - TC7116/TC7117: 80ppm/°C (typ.)
  - TC7116A/TC7117A: 20ppm/°C (typ.)
- Display Hold Function
- Directly Drives LCD or LED Display
- Zero Reading With Zero Input
- Low Noise for Stable Display: 2V or 200mV
- Full-Scale Range (FSR)
- Auto-Zero Cycle Eliminates Need for Zero
- Adjustment Potentiometer
- True Polarity Indication for Precision Null Applications
- Convenient 9V Battery Operation:
  - TC7116/TC7116A
- High Impedance CMOS Differential Inputs:
  - $10^{12}$ Ω
- Low Power Operation: 10mW
Features:
• Internal Reference with Low Temperature Drift:
  TC7126: 80ppm/°C (typ.)
  TC7126A: 35ppm/°C (typ.)
• Zero Reading with Zero Input
• Low Noise: 15μV_{P-P}
• High Resolution: 0.05%
• Low Input Leakage Current:
  1pA (typ.), 10pA (max.)
• Precision Null Detectors with True Polarity at Zero
• High-Impedance Differential Input
• Convenient 9V Battery Operation with Low-Power Dissipation:
  500μW (typ.), 900μW (max.)
**Features:**

- Count Resolution: ±19,999
- Resolution on 200mV Scale: 10μV
- True Differential Input and Reference
- Low Power Consumption: 500μA at 9V
- Direct LCD Driver for 4½ Digits, Decimal Points, Low Battery Indicator, and Continuity Indicator
- Overrange and Underrange Outputs
- Range Select Input: 10:1
- High Common Mode Rejection Ratio: 110dB
- External Phase Compensation Not Required

*Note: RC network between Pins 26 and 28 is not required.*
Features:

• Nonvolatile Digital Potentiometer in SOT-23, MSOP and SOIC Packages
• 64 Taps: 63 Resistors with Taps to $V_{SS}$ and $V_{DD}$
• Simple Up/Down (U/D) Protocol
• Automatic Recall of Potentiometer Wiper Settings
• Resistance Values: 2 kΩ, 5 kΩ, 10 kΩ, 50 kΩ
• Low Tempco:
  Absolute (Rheostat): <100ppm (typ.)
  Ratiometric (Potentiometer): <10ppm (typ.)
• Low Wiper Resistance: 75Ω (typ.)
• WiperLock™ Technology to Secure the EEPROM
• Low-Power Operation: 1μA (max.) Static Current
• Wide Operating Voltage: 2.7V to 5.5V
• Extended Temperature Range: -40°C to +125°C
Features:
- Volatile Digital Potentiometer in SOT-23, MSOP and SOIC Packages
- 64 Taps: 63 Resistors with Taps to $V_{SS}$ and $V_{DD}$
- Simple Up/Down (U/D) Protocol
- Automatic Recall of Potentiometer Wiper Settings
- Resistance Values: 2.1 kΩ, 5 kΩ, 10 kΩ, 50 kΩ
- Low Tempco:
  - Absolute (Rheostat): 50ppm (typ.)
  - Ratiometric (Potentiometer): 10ppm (typ.)
- Low Wiper Resistance: 75Ω (typ.)
- High-Voltage Tolerant Digital Inputs: up to 12V
- Low-Power Operation: 1μA (max.) Static Current
- Wide Operating Voltage: 2.7V to 5.5V
- Extended Temperature Range: -40°C to +125°C
**MCP4017/8/9**

**Features:**
- Potentiometer or Rheostat configuration options
- 7-bit: Resistor Network Resolution
  - 127 Resistors (128 Steps)
- Zero Scale to Full Scale Wiper operation
- RAB Resistances: 5kΩ, 10kΩ, 50kΩ, or 100kΩ
- Low Wiper Resistance: 100Ω (typ.)
- Low Tempco:
  - Absolute (Rheostat): 50ppm (typ.) (0°C to 70°C)
  - Ratiometric (Potentiometer): 10ppm (typ.)
- Simple I²C™ Protocol with read & write commands
- Brown-out reset protection: 1.5V (typ.)
- Power-on Default Wiper Setting (mid-scale)
- Low-Power Operation:
  - 2.5µA Static Current (typ.)
- Wide Operating Voltage Range:
  - 2.7V to 5.5V - Device Characteristics Specified
  - 1.8V to 5.5V - Device Operation
- Wide Bandwidth (-3dB) Operation:
  - 2MHz (typ.) for 5.0kΩ device
- Extended temperature range (-40°C to +125°C)
- Very small package (SC70)
Features:

- Potentiometer or Rheostat configuration options
- 7-bit: Resistor Network Resolution: 127 Resistors (128 Steps)
- Zero Scale to Full Scale Wiper operation
- RAB Resistances: 5kΩ, 10kΩ, 50kΩ, or 100kΩ
- Low Wiper Resistance: 100Ω (typ.)
- Low Tempco:
  - Absolute (Rheostat): 50ppm (typ.) 0°C to 70°C
  - Ratiometric (Potentiometer): 15ppm (typ.)
- I²C™ Protocol
  - Supports SMBus 2.0 Write Byte/Word Protocol Formats
  - Supports SMBus 2.0 Read Byte/Word Protocol Formats
- Standard I²C Device Addresses:
  - All devices offered with address “0101110”
  - MCP40D18 also offered with address “0111110”
- Brown-out reset protection: 1.5V (typ.)
- Power-on Default Wiper Setting (mid-scale)
- Low-Power Operation:
  - 2.5μA Static Current (typ.)
- Wide Operating Voltage Range:
  - 2.7V to 5.5V - Device Characteristics Specified
  - 1.8V to 5.5V - Device Operation
- Wide Bandwidth (-3dB) Operation:
  - 2 MHz (typ.) for 5.0kΩ device
- Extended temperature range (-40°C to +125°C)
- Very small package (SC70)
- Lead free (Pb-free) package
Features:
• 256 taps for each potentiometer
• Potentiometer values for 10kΩ, 50kΩ and 100kΩ
• Single and dual versions
• SPI™ serial interface (mode 0,0 and 1,1)
• ±1 LSB max INL & DNL
• Low power CMOS technology
• 1μA (max.) supply current in static operation
• Multiple devices can be daisy-chained together (MCP42XXX only)
• Shutdown feature open circuits of all resistors for maximum power savings
• Hardware shutdown pin available on MCP42XXX only
• Single supply operation (2.7V to 5.5V)
• Industrial temperature range: -40°C to +85°C
• Extended temperature range: -40°C to +125°C

Upgrades Available. Click on the links below

Volatile Options
MCP413x, MCP415x, MCP423x, MCP425x

Non-Volatile Options
MCP414x, MCP416x, MCP424x, MCP426x
Features:

• Single or Dual Resistor Network options
• Potentiometer or Rheostat Configuration Options
• Resistor Network Resolution
  7-bit: 128 Resistors (129 Steps)
  8-bit: 256 Resistors (257 Steps)
• $R_{AB}$ Resistances options of:
  5kΩ, 10kΩ, 50kΩ, 100kΩ
• Low Tempco:
  Absolute (Rheostat): 50ppm (typ.) 0°C to 70°C
  Ratiometric (Potentiometer): 15ppm (typ.)
• SPI Serial Interface (10MHz, modes 0,0 & 1,1)
  High-Speed Read/Writes to wiper registers
  SDI/SDO multiplexing (MCP41X1 only)
• High-Voltage Tolerant Digital Inputs: up to 12.5V
• Supports Split Rail Applications
• Wide Operating Voltage:
  2.7V to 5.5V - Device Characteristics Specified
  1.8V to 5.5V - Device Operation
• Wide Bandwidth (-3dB) Operation:
  2MHz (typ.) for 5.0kΩ device
• Extended temperature range: -40°C to +125°C
Features:

- Single or Dual Resistor Network options
- Potentiometer or Rheostat configuration options
- Resistor Network Resolution
  - 7-bit: 128 Resistors (129 Steps)
  - 8-bit: 256 Resistors (257 Steps)
- $R_{AB}$ Resistances options: 5kΩ, 10kΩ, 50kΩ, 100kΩ
- Low Tempco:
  - Absolute (Rheostat): 50ppm (typ.) 0°C to 70°C
  - Ratiometric (Potentiometer): 15ppm (typ.)
- SPI serial interface (10MHz, modes 0,0 & 1,1)
  - High-Speed Read/Writes to wiper registers
  - Read/Write to Data EEPROM registers
  - Serially enabled EEPROM write protect
  - SDI/SDO multiplexing (MCP41X1 only)
- Write Protect Feature:
  - Hardware Write Protect (WP) Control pin
  - Software Write Protect (WP) Configuration bit
- Supports Split Rail Applications
- Wide Operating Voltage:
  - 2.7V to 5.5V - Device Characteristics Specified
  - 1.8V to 5.5V - Device Operation
- Wide Bandwidth (-3dB) Operation: 2MHz (typ.) 5.0kΩ
- Extended temperature range (-40°C to +125°C)
Features:

- Single or Dual Resistor Network options
- Potentiometer or Rheostat configuration options
- Resistor Network Resolution
  - 7-bit: 128 Resistors (129 Steps)
  - 8-bit: 256 Resistors (257 Steps)
- $R_{AB}$ Resistances options of: 5kΩ, 10kΩ, 50kΩ, 100kΩ
- Zero-Scale to Full-Scale Wiper operation
- Low Wiper Resistance: 75Ω (typ.)
- Low Tempco:
  - Absolute (Rheostat): 50ppm (typ.) 0°C to 70°C
  - Ratiometric (Potentiometer): 15ppm (typ.)
- Non-volatile Memory
  - Automatic Recall of Saved Wiper Setting
  - WiperLock™ Technology
  - 10 General Purpose Memory Locations
- I²C™ Serial interface: 100kHz, 400kHz and 3.4MHz support
- Serial protocol allows:
  - High-Speed Read/Write to wiper, Read/Write to EEPROM, Write Protect to be enabled/disabled, WiperLock to be enabled/disabled
- Resistor Network Terminal Disconnect Feature via the Terminal Control (TCON) Register
- Write Protect Feature:
- Brown-out reset protection: 1.5V (typ.)
- Serial Interface Inactive current: 2.5µA (typ.)
- High-Voltage Tolerant Digital Inputs: up to 12.5V
- Wide Operating Voltage:
  - 2.7V to 5.5V - Device Characteristics Specified
  - 1.8V to 5.5V - Device Operation
- Wide Bandwidth (-3dB) Operation: 2MHz (typ.) for 5.0kΩ device
- Extended temperature range: -40°C to +125°C
MCP453x/455x/463x/465x

Features:
- Single or Dual Resistor Network options
- Potentiometer or Rheostat configuration options
- Resistor Network Resolution
  7-bit: 128 Resistors (129 Steps)
  8-bit: 256 Resistors (257 Steps)
- RAB Resistances options of: 5kΩ, 10kΩ, 50kΩ, 100kΩ
- Zero-Scale to Full-Scale Wiper operation
- Low Wiper Resistance: 75Ω (typ.)
- Low Tempco:
  Absolute (Rheostat): 50ppm (typ.) 0°C to 70°C
  Ratiometric (Potentiometer): 15ppm (typ.)
- I²C™ Serial interface
  100kHz, 400kHz and 3.4MHz support
- Serial protocol allows:
  - High-Speed Read/Write to wiper
  - Increment/Decrement of wiper
- Resistor Network Terminal Disconnect Feature
  via the Terminal Control (TCON) Register
- Brown-out reset protection: 1.5V (typ.)
- Serial Interface Inactive current: 2.5µA (typ.)
- High-Voltage Tolerant Digital Inputs: up to 12.5V
- Wide Operating Voltage:
  2.7V to 5.5V - Device Characteristics Specified
  1.8V to 5.5V - Device Operation
- Wide Bandwidth (-3dB) Operation:
  2MHz (typ.) for 5.0kΩ device
- Extended temperature range: -40°C to +125°C
Features:

- Quad Resistor Network
- Volatile and nonvolatile memory options available
- Potentiometer or Rheostat Configuration Options
- Resistor Network Resolution:
  - 7-bit: 128 Resistors (129 Taps)
  - 8-bit: 256 Resistors (257 Taps)
- RAB Resistances Options of: 5kΩ, 10kΩ, 50kΩ, 100kΩ
- Zero Scale to Full Scale Wiper Operation
- Low Wiper Resistance: 75 Ω (typical)
- Low Tempco:
  - Absolute (Rheostat): 50 ppm typical (0°C to 70°C)
  - Ratiometric (Potentiometer): 15 ppm typical
- SPI Serial Interface (10 MHz, Modes 0,0 and 1,1):
  - High-Speed Read/Writes to wiper registers
- Resistor Network Terminal Disconnect Feature via Terminal Control (TCON) Register
- Reset Input Pin
- Brown-out Reset Protection (1.5V typical)
- Serial Interface Inactive Current (2.5 μA typical)
- High-Voltage Tolerant Digital Inputs: Up to 12.5V
- Supports Split Rail Applications
- Internal Weak Pull-up on all Digital Inputs
- Wide Operating Voltage: - 2.7V to 5.5V
  - Device Characteristics Specified - 1.8V to 5.5V
- Wide Bandwidth (-3 dB) Operation: 2 MHz (typ.) for 5.0 kΩ device
- Extended Temperature Range (-40°C to +125°C)
Features:

- Quad Resistor Network
- Potentiometer or Rheostat Configuration Options
- Resistor Network Resolution:
  - 7-bit – 128 Resistors (129 Taps)
  - 8-bit – 256 Resistors (257 Taps)
- Four RAB Resistances options: 5kohm, 10kohm, 50kohm, 100kohm
- Zero-scale to Full-scale Wiper Operation
- Low Wiper Resistance – 75 Ω typical
- \(^{2}\)C Serial Interface Support: 100kHz, 400kHz, 3.4MHz
- Brown-out Reset Protection – 1.5V typical
- Serial Interface Inactive Current – 2.5 uA typical
- High-Voltage Tolerant Digital Inputs Up to 12.5V
- Internal Weak Pull-up on All Digital Inputs, except SCL and SDA
- Wide Operating Voltage:
  - 2.7V to 5.5V - Device Characteristics Specified
  - 1.8V to 5.5V - Device Operation
- Wide Bandwidth (-3 dB) Operation: 2 MHz typical (5.0 kohm Device)
- Extended Temperature Range (-40°C to +125°C)
- Three Package Options: 4x4 QFN-20 TSSOP-20 TSSOP-14
MCP41HV31/51

Features:

• High-Voltage Analog Support:
  - +36V Terminal Voltage Range (DGND = V-)
  - ±18V Terminal Voltage Range (DGND = V- + 18V)
• Wide Operating Voltage:
  - Analog: 10V to 36V (specified performance)
  - Digital: 2.7V to 5.5V
  - 1.8V to 5.5V (DGND □ V- + 0.9V)
• Single Resistor Network
• Potentiometer Configuration Options
• Resistor Network Resolution
  - 7-bit: 127 Resistors (128 Taps) MCP41HV31
  - 8-bit: 255 Resistors (256 Taps) MCP41HV51
• RAB Resistance Options:
  - 5 kΩ, 10 kΩ, 50 kΩ, 100 kΩ
• High Terminal/Wiper Current (IW) Support:
• Zero-Scale to Full-Scale Wiper Operation
• Low Wiper Resistance: 75 Ω (Typical)
• Low Tempco:
  - Absolute (Rheostat): 50 ppm Typical (0°C to +70°C)
  - Ratiometric (Potentiometer): 15 ppm Typical
• SPI Serial Interface
• Resistor Network Terminal Disconnect Via:
  - Shutdown Pin (SHDN) or Terminal Control (TCON) Register
• Write Latch (WLAT) Pin
• Power-On Reset / Brown-Out Reset
• Extended Temperature Range (-40°C to +125°C)
• Package Types: TSSOP-14 and QFN-20 (5x5)
Features:

- **High-Voltage Analog Support:**
  - +36V Terminal Voltage Range (DGND = V-)
  - ±18V Terminal Voltage Range (DGND = V- + 18V)
- **Wide Operating Voltage:**
  - Analog: 10V to 36V (specified performance)
  - Digital: 2.7V to 5.5V
  - 1.8V to 5.5V (DGND = V- + 0.9V)
- **Single Resistor Network**
- **Resistor Network Resolution**
  - 7-bit: 127 Resistors (128 Taps) MCP45HV31
  - 8-bit: 255 Resistors (256 Taps) MCP45HV51
- **RAB Resistance Options:**
  - 5 kΩ, 10 kΩ, 50 kΩ, 100 kΩ
- **High Terminal/Wiper Current (IW) Support:**
- **Zero-Scale to Full-Scale Wiper Operation**
- **Low Wiper Resistance:** 75 Ω (Typical)
- **Low Tempco:**
  - Absolute (Rheostat): 50 ppm Typical (0°C to +70°C)
  - Ratiometric (Potentiometer): 15 ppm Typical
- **I2C Serial Interface**
- **Resistor Network Terminal Disconnect Via:**
  - Shutdown Pin (SHDN) or Terminal Control (TCON) Register
- **Write Latch (WLAT) Pin**
- **Power-On Reset / Brown-Out Reset**
- **Extended Temperature Range:** (-40°C to +125°C)
- **Package Types:** TSSOP-14 and QFN-20 (5x5)
MCP47A1

Features:
• 6-bit DAC
  - 65 Taps: 64 Resistors with Taps to Full-Scale and Zero-Scale
• VREF Pull-down Resistance: 20 kOhms (typical)
• VOUT Voltage Range: VSS to VREF
• SMBus/ I²C Compatible Interface
• Brown-out Reset Protection (1.5V typical)
• Power-on Default Wiper Setting (Mid-scale)
• Low-Power Operation: 90 µA Static Current (typ.)
• Wide Operating Voltage Range: -1.8V to 5.5V
• Low Tempco: 15 ppm (typ.)
• 100 kHz (typical) Bandwidth (-3 dB) Operation
• Extended Temperature Range: -40°C to +125°C
• 6-lead SC70
MCP47DA1

Features:
• 6-bit DAC
  - 65 Taps: 64 Resistors with Taps to Full-Scale and Zero-Scale (Wiper Code 00h to 40h)
  - 7-bit Serial Data (00h to 7Fh, 00h - 20h = Zero-Scale and 60h - 7Fh = Full-Scale)
• VREF Pull-down Resistance: 30 kΩ (typ.)
• VOUT Voltage Range
  - 1/3 * VREF to 2/3 * VREF
• SMBus/ I2C Compatible Interface
• Brown-out Reset Protection (1.5V typ.)
• Power-on Default Wiper Setting (Mid-scale)
• Low-Power Operation: 90 μA Static Current (typ.)
• Wide Operating Voltage Range:
  - 2.7V to 5.5V - Device Characteristics Specified
  - 1.8V to 2.7V - Device Operation
• Low Tempco: 15 ppm (typ.)
• 100 kHz (typical) Bandwidth (-3 dB) Operation
• Extended Temperature Range (-40°C to +125°C)
• 6-lead SOT-23, SC70
MCP4725

Features:
- 12-bit Resolution
- On-Board Non-Volatile Memory (EEPROM)
- ±0.2 LSB DNL (typ.)
- External A0 Address Pin
- Normal or Power-Down Mode
- Fast Settling Time of 6μs (typ.)
- External Voltage Reference ($V_{DD}$)
- Rail-to-Rail Output
- Low Power Consumption
- Single-Supply Operation: 2.7V to 5.5V
- I²C™ Interface:
  - Eight Available Addresses
  - Standard (100 kbps), Fast (400 kbps), and High-Speed (3.4 Mbps) Modes
- Extended Temperature Range: -40°C to +125°C
- 6-lead SOT-23 Package
Features:
• Output Voltage Resolutions
  - 12-bit: MCP4726
  - 10-bit: MCP4716
  - 8-bit: MCP4706
• Fast Settling Time of 6μs (typ.)
• Rail-to-Rail Output
• DAC Voltage Reference Options
  - $V_{DD}$ or $V_{REF}$ Pin
• Output Gain Options: Unity (1x) or 2x
• Nonvolatile Memory (EEPROM)
  - Auto Recall of DAC register setting
  - Auto Recall of Device Configuration
• Low Power Consumption
  - Normal Operation: 210 μA (typ.)
  - Power Down: 60 nA (typ.)
• Power Down Modes
• Single-Supply Operation: 2.7V to 5.5V
• I²C™ Interface
• Small 6-lead SOT-23 and 2x2 DFN Packages
• Extended Temperature Range: -40°C to +125°C
**Features:**

- 12-Bit Voltage Output DAC with 4 Buffered Outputs
- On-Board Non-Volatile Memory (EEPROM) for DAC Codes and I²C™ Address Bits
- Internal or External Voltage Reference Selection
- Output Voltage Range:
  - Using Internal $V_{REF}$ (2.048V):
    - 0.000V to 2.048V with Gain Setting = 1
    - 0.000V to 4.096V with Gain Setting = 2
  - Using External $V_{REF}$ ($V_{DD}$): 0.000V to $V_{DD}$
- ±0.2 LSB DNL (typ.)
- Fast Settling Time: 6μs (typ.)
- Normal or Power-Down Mode
- Low Power Consumption
- Single-Supply Operation: 2.7V to 5.5V
- I²C Interface:
  - Address bits: User Programmable to EEPROM
  - Standard (100 kbps), Fast (400 kbps) and High Speed (3.4 Mbps) Modes
- 10-Lead MSOP Package
- Extended Temperature Range: -40°C to +125°C
MCP4801/4811/4821

Features:
• MCP4801: 8-Bit Voltage Output DAC
• MCP4811: 10-Bit Voltage Output DAC
• MCP4821: 12-Bit Voltage Output DAC
• Rail-to-Rail Output
• SPI Interface with 20 MHz Clock Support
• Simultaneous Latching of the DAC Output with LDAC Pin
• Fast Settling Time of 4.5 μs
• Selectable Unity or 2x Gain Output
• 2.048V Internal Voltage Reference
• 50ppm/°C $V_{\text{REF}}$ Temperature Coefficient
• 2.7V to 5.5V Single-Supply Operation
• Extended Temperature Range: -40°C to +125°C
MCP4802/4812/4822

Features:
• MCP4802: Dual 8-Bit Voltage Output DAC
• MCP4812: Dual 10-Bit Voltage Output DAC
• MCP4822: Dual 12-Bit Voltage Output DAC
• Rail-to-Rail Output
• SPI Interface with 20 MHz Clock Support
• Simultaneous Latching of the Dual DACs with LDAC pin
• Fast Settling Time of 4.5 μs
• Selectable Unity or 2x Gain Output
• 2.048V Internal Voltage Reference
• 50ppm/°C V_{REF} Temperature Coefficient
• 2.7V to 5.5V Single-Supply Operation
• Extended Temperature Range: -40°C to +125°C
**Features:**

- MCP4901: 8-Bit Voltage Output DAC
- MCP4911: 10-Bit Voltage Output DAC
- MCP4921: 12-Bit Voltage Output DAC
- Rail-to-Rail Output
- SPI Interface with 20 MHz Clock Support
- Simultaneous Latching of the DAC Output with LDAC Pin
- Fast Settling Time of 4.5 μs
- Selectable Unity or 2x Gain Output
- External Voltage Reference Input
- External Multiplier Mode
- 2.7V to 5.5V Single-Supply Operation
- Extended Temperature Range: -40°C to +125°C
MCP4902/4912/4922

Features:
- MCP4902: Dual 8-Bit Voltage Output DAC
- MCP4912: Dual 10-Bit Voltage Output DAC
- MCP4922: Dual 12-Bit Voltage Output DAC
- Rail-to-Rail Output
- SPI Interface with 20 MHz Clock Support
- Simultaneous Latching of the Dual DACs with LDAC pin
- Fast Settling Time of 4.5 μs
- Selectable Unity or 2x Gain Output
- External Voltage Reference Inputs
- External Multiplier Mode
- 2.7V to 5.5V Single-Supply Operation
- Extended Temperature Range: -40°C to +125°C
**TC1321**

**Features:**
- 10-bit Voltage Output DAC
- 2.5V to 5.5V Singly Supply Operation
- Simple SMBus/I²C™ Serial Interface
- Low Power:
  - 350μA Operation, 0.5μA Shutdown
- 8-Pin SOIC and 8-Pin MSOP Packages
Features:
- 8-bit Voltage Output DAC
- 2.5V to 5.5V Singly Supply Operation
- Simple SMBus/I²C™ Serial Interface
- Low Power: 350µA Operation, 0.5µA Shutdown
- 8-Pin SOIC and 8-Pin MSOP Packages
Features:

• Implements Full CAN V2.0A and V2.0B at 1 Mb/s:
  0 - 8 byte message length
  Standard and extended data frames, Support for remote frames
  Programmable bit rate up to 1 Mb/s
  Two receive buffers with prioritized message storage
  Six full acceptance filters, Two full acceptance filter masks
  Three transmit buffers with prioritization and abort feature
  Loop-back mode for self test operation

• Hardware Features:
  High Speed SPI Interface (5MHz at 4.5V I-temp)
  Supports SPI modes 0, 0 and 1, 1
  Clock out pin with programmable prescaler
  Interrupt output pin with selectable enables
  ‘Buffer full’ output pins configurable as interrupt pins for
  each receive buffer or as general purpose digital outputs
  ‘Request to Send’ input pins configurable as control pins to
  request immediate message transmission for each transmit
  buffer general purpose digital inputs
  Low Power Sleep mode

• Low power CMOS technology:
  Operates from 3.0V to 5.5V
  5mA active current typical
  10μA standby current typical at 5.5V
• Temperature ranges supported: Extended: -40°C to +125°C
Features:

- Implements CAN V2.0B at 1 Mb/s
- 0 - 8 byte length in the data field
- Standard and extended data and remote frames
- Receive buffers, masks and filters
- Data byte filtering on the first two data bytes (applies to standard data frames)
- Three transmit buffers with prioritization and abort features
- High-speed SPI™ Interface (10MHz):
  - One-Shot more ensures message transmission is attempted only one time
  - Clock out pin with programmable prescaler
  - Start-of-Frame (SOF) signal is available for monitoring the SOF signal
- Interrupt output pin with selectable enables
- Buffer Full output pins configurable as
  - Interrupt output for receive buffer
  - General purpose Output
- Request-to-Send (RTS) input pins individually configurable as
  - Control pins to request transmission for each transmit buffer
  - General Purpose inputs
- Low-Power CMOS technology
  - Operates from 2.7V to 5.5V
  - 5mA active current (typ.)
  - 1µA standby current (typ.) (Sleep mode)
- Temperature ranges: -40°C to +125°C
Features:

- Stand-Alone CAN2.0B Controller with Integrated CAN Transceiver and Serial Peripheral Interface (SPI)
- Up to 1 Mb/s Operation
- Very Low Standby Current (10 μA, typical).
- Up to 10 MHz SPI Clock Speed
- Interfaces Directly with Microcontrollers with 2.7V to 5.5V I/O
- Packages: SSOP-28L and 6x6 QFN-28L
- Extended Temperature Range: -40°C to +125°C
Features:

• Implements CAN V2.0B
  - Programmable bit rate up to 1 Mb/s
  - One programmable mask, two programmable filters
  - Three auto-transmit buffers, two message reception buffers
  - Does not require synchronization or configuration messages
  - Enables simple CAN nodes to be created without an MCU

• Hardware Features
  - Non-volatile memory for user configuration
  - User configuration automatically loaded on power-up
  - 8 GPIO lines individually selectable as inputs or outputs
  - Individually selectable transmit-on-pin change for each input
  - Programmable conversion clock and \( V_{REF} \) sources
    (MCP2505X devices only)
  - Message scheduling capability
  - Two 10-bit PWM outputs with independently programmable frequencies
  - Device configuration can be modified via CAN bus messages
  - In-Circuit Serial Programming™ (ICSP™) of default configuration memory
  - Optional 1-wire CAN bus operation

• Low-power CMOS technology
  - Operates from 2.7V to 5.5V
  - 10mA active current (typ.)
  - 30μA standby current (CAN Sleep mode)

• 14-pin PDIP (300 mil) and SOIC (150 mil) packages

• Available temperature ranges:
  - Industrial (I): -40°C to +85°C
  - Extended (E): -40°C to +125°C
Features:

• Implements CAN V2.0B
  - Programmable bit rate up to 1 Mb/s

• Hardware Features
  - Non-volatile memory for configuration
  - Eight general-purpose I/O lines
  - Individually selectable transmit-on-pin change for each input
  - Programmable conversion clock and VREF (MCP2505X devices only)
  - Message scheduling capability
  - Two 10-bit PWM outputs with independently programmable frequencies
  - In-Circuit Serial Programming™ (ICSP™) of default configuration memory
  - Optional 1-wire CAN bus operation

• Low-power CMOS technology
  - Operates from 2.7V to 5.5V
  - 30μA standby current (CAN Sleep mode)

• 14-pin PDIP and SOIC packages

• Available temperature ranges:
  - Industrial (I): -40°C to +85°C
  - Extended (E): -40°C to +125°C
Features:

• Supports 1 Mb/s operation
• Implements ISO-11898 standard physical layer requirements
• Suitable for 12V and 24V systems
• Externally-controlled slope for reduced RFI emissions
• Detection of ground fault (permanent dominant) on TXD input
• Power-on reset and voltage brown-out protection
• An unpowered node or brown-out event will not disturb the CAN bus
• Low current standby operation
• Protection against damage due to short-circuit conditions (positive or negative battery voltage)
• Protection against high-voltage transients
• Automatic thermal shutdown protection
• Up to 112 nodes can be connected
• High noise immunity due to differential bus implementation
• Temperature ranges: -40°C to +125°C
Features:

• Supports 1 Mb/s operation
• Implements ISO-11898-5 standard physical layer requirements
• Very low standby current (Typ: 5µA)
• VIO supply pin (MCP2562) to interface directly to CAN controllers and microcontrollers with 1.8V to 5V I/O
• SPLIT output pin (MCP2561) to stabilize common mode in biased split termination schemes
• Permanent dominant detection on TXD and bus
• Power-on Reset and voltage brown-out protection on VDD and VIO pin
• Short-circuit protection
• Protection against high-voltage transients
• Thermal Shutdown protection
• Suitable for 12V and 24V systems
• Up to 112 nodes can be connected
• High-noise immunity
• High ESD protection on CANH and CANL, IEC61000-4-2 > 8kV
• Available in PDIP-8L, SOIC-8L and 3x3 DFN-8L.
• Temperature ranges: Extended -40°C to +125°C, High -40°C to +150°C
Features:

- Optimized for CAN FD (Flexible Data rate) at 2, 5 & 8 Mbps
  - Maximum Propagation Delay: 120 ns
  - Loop Delay Symmetry: -10%/+10% (2 Mbps)
- Very Low Standby Current of 5 μA (typical)
- VIO Supply Pin to Interface Directly to CAN Controllers and Microcontrollers with 1.8V to 5.5V I/O
- SPLIT Output Pin
- Detection of Ground Fault
- Power-on Reset and Voltage Brown-Out Protection on VDD Pin
- Short-Circuit Protection
- Protection Against High-Voltage Transients
- Automatic Thermal Shutdown Protection
- Suitable for 12V and 24V Systems
- Meets/exceeds automotive requirements including “Hardware Requirements for LIN, CAN and FlexRay Interfaces in Automotive Applications”, Version 1.3, May 2012
- ESD Protection on CANH & CANL, IEC61000-4-2 up to ±14 kV
- Available in PDIP-8L, SOIC-8L and 3x3 DFN-8L
- Temperature ranges:
  - Extended (E): -40°C to +125°C
  - High (H): -40°C to +150°C
Features:

- Supports with IrDA® Physical Layer Specification (version 1.3)
- UART to IR Encoder/Decoder
  - Interfaces with IrDA Compliant Transceivers
  - Used with any UART, including standard 16550 UART and microcontroller UART
- Transmit/Receive formats supported:
  - 1.63μs
- Hardware or Software Baud rate selection
  - Up to IrDA standard 115.2 kbaud operation
  - Up to 312.5 kbaud operation (at 20MHz)
  - Low power mode
- Pb-free packaging
Features:

- Pinout compatible with HSDL-7000
- Compliant with IrDA® Standard Physical Layer Specification (version 1.3)
- UART to IrDA Standard Encoder/Decoder
  - Interfaces with IrDA Standard Compliant Transceiver
- Baud Rates:
  - Up to IrDA Standard 115.2 kbaud Operation
- Transmit/Receive Formats (Bit Width) Supported:
  - 1.63μs
- Low-power Mode (2μA at 1.8V, +125°C)
- Pb-free packaging
Features:

- Implements the IrDA® standard
- Provides IrDA standard physical signal layer support including:
  - Bidirectional communication
  - CRC implementation
  - Fixed Data communication rate of 9600 baud
- Includes UART-to-IrDA standard encoder/decoder functionality:
  - Easily interfaces with industry standard UARTs and infrared transceivers
- UART interface for connecting to Data Communications Equipment (DCE) or Data Terminal Equipment (DTE) systems
- Transmit/Receive formats (bit width) supported:
  - 1.63μs
- Hardware UART Support:
  - 9.6 kbaud baud rate
  - 29 Byte Data Buffer Size
- Infrared Supported:
  - 9.6 kbaud baud rate
  - 64 Byte Data Packet Size
- Operates as Secondary Device
- Automatic Low Power mode
  - < 60μA when no IR activity present (PHACT = L)
Features:
• Implements the IrDA® standard
• Provides IrDA standard physical signal layer
• Includes UART-to-IrDA standard encoder/decoder functionality
• Easily communicates with 16-bit PIC Microcontroller IrDA Standard Stack Library
• UART interface for connecting to Data Communications Equipment (DCE) or Data Terminal Equipment (DTE) systems
• Transmit/Receive formats (bit width) supported:
  1.63μs (Transmit & Receive), 3/16 bit time (Receive Only)
• Hardware UART Support:
  9.6 kbaud baud rate, 60 Byte Data Buffer Size (64 Byte Packet)
• Infrared Supported:
  - 9.6 kbaud baud rate, 64 Byte Packet Size (60 Data Bytes)
• Operates as Secondary Device
• Wide Operating Voltage: 2.0V to 5.5V
• Automatic Low Power mode:
  < 23μA (max.) @ 2.0V, when no IR activity present (PHACT = L)
• Footprint Compatibility with MCP2140

CMOS Technology
• Low power, high-speed CMOS technology
• Low voltage operation
• Industrial temperature range
• Low power consumption:
  - < 407μA (max.) @ 2.0V, 3.6864 MHz
Features:

- Implements the IrDA® standard including:
  - IrLAP, IrLMP, IAS, TinyTP, IrCOMM (9-wire “cooked” service class)
- Provides IrDA standard physical signal layer support including:
  - Bidirectional communication, CRC implementation
  - Data communication rates up to 115.2 kbaud
- Includes UART to IrDA standard encoder/decoder functionality: Easily interfaces with industry standard UARTs and infrared transceivers
- UART interface for connecting to Data Terminal Equipment (DTE) systems
- Transmit/Receive formats (bit width) supported: 1.63μs
- Hardware baud rate selection for UART:
  - 9.6 kbaud, 19.2 kbaud, 57.6 kbaud, 115.2 kbaud
- Infrared baud rates supported:
  - 9.6 kbaud, 19.2 kbaud, 38.4 kbaud, 57.6 kbaud, 115.2 kbaud
- 64 Byte Data Packet Size
- Programmable Device ID String
- Operates as Secondary Device

CMOS Technology

- Low power, high-speed CMOS technology
- Fully static design
- Low voltage operation
- Industrial temperature range
- Low power consumption
  - < 1mA @ 3.3 V, 11.0592MHz (typ.), 3μA (typ.) @ 5.0V when disabled
Features:
• Implements the IrDA® standard including:
  - IrLAP, IrLMP, IAS, TinyTP, IrCOMM (9-wire “cooked” service class)
• Provides IrDA standard physical signal layer support including:
  - Bidirectional communication, CRC implementation
  - Data communication rates up to 115.2 kbaud
• Includes UART to IrDA standard encoder/decoder functionality:
  Easily interfaces with industry standard UARTs and infrared transceivers
• UART interface for Data Terminal Equipment (DTE) systems
• Transmit/Receive formats (bit width) supported: 1.63μs
• Hardware baud rate selection for UART:
  - 9.6 kbaud, 19.2 kbaud, 57.6 kbaud, 115.2 kbaud,
• Infrared baud rates supported:
  - 9.6 kbaud, 19.2 kbaud, 38.4 kbaud, 57.6 kbaud, 115.2 kbaud
• 64 Byte Data Packet Size
• Programmable Device ID String
• Operates as Secondary Device

CMOS Technology
• Low power, high-speed CMOS technology
• Fully static design
• Low voltage operation
• Industrial temperature range
• Low power consumption
  < 1mA @ 3.3V, 11.0592MHz (typ.), 3μA (typ.) @ 5.0V when disabled
MCP1525/41

Features:
• Precision Voltage Reference
• Output Voltages of 2.5V and 4.096V
• Initial Accuracy of ±1% (max.)
• Temperature Drift: ±50ppm/°C (max.)
• Output Current Drive: ±2mA
• Operating Current: 100μA @ 25°C (max.)
• Small SOT23-3 and TO-92 Packages
• Industrial Temperature Range: -40°C to +85°C
Features:
- Supports baud rates up to 20 kbaud
- 40V load dump protected
- Wide supply voltage, 6.0 to 18.0V, continuous
  - Maximum input voltage of 30V
- Extended Temperature Range: -40°C to +125°C
- Interface to standard USARTs
- Compatible with LIN Spec 1.3
- Local Interconnect Network (LIN) Line pin:
  - Internal pull-up resistor and diode
  - Protected against ground shorts (LIN pin to ground)
  - Protected against LIN pin loss of ground
  - High current drive, $40mA \leq I_{OL} \leq 200mA$
- Automatic thermal shutdown
- On-board Voltage Regulator:
  - Output voltage of 5V with $\pm 5\%$ tolerances over temperature range
  - Maximum output current of 50mA
  - Able to drive an external series-pass transistor for increased current supply capability
  - Thermal overload protection & short-circuit current limit
  - External components limited to filter capacitor only and load capacitor
Features:

- **Vreg**: 3.3V or 5.0V, 50mA, ±3% Accuracy across temperature
- **Temp Range**: -40°C to 125°C
- **V_{BB} regulation**: 6V to 18V
- **V_{BB} continuous**: -0.3V to 30V
- **V_{BB} load dump**: 43V
- Low power consumption to meet car makers requirements
  - Transmitter off mode: 90µA (typ.), Power down current: 16µA (typ)
- Compliant to LIN Specifications 1.x, 2.0, 2.1 and SAE J2602
- Baud rates supported up to 20 kbaud
- EMC Performance meets stringent car maker requirements
  - Reports available upon request
- Very high ESD on LIN, Vbat of +/- 8kV HBM
- Wake up through LIN bus activity and or CS/LWake going high
- Fail safe features
  - LIN pin with internal pull up resistor
  - LIN pin protected against ground shorts, loss of ground
  - Automatic thermal shutdown protection
  - Vreg thermal overload protection and short circuit current limit
  - TXD has internal pull up. Forced to ‘1’ if Vreg < 1.8V
  - CS has internal pull down. No disruptive data during MCU POR
  - Fault/TXE signals a mismatch between TXD and LIN Bus
- RESET Output on **MCP2022** in case MCU BOR is not available
Features:

• The MCP2021A/2A is compliant with:
  - LIN Bus Specifications Version 1.3, and 2.x.
  - SAE J2602-2
• Support Baud Rates up to 20 kBaud
• 43V Load Dump Protected
• Maximum Continuous Input Voltage of 30V
• Wide LIN Compliant Supply Voltage, 6.0 - 18.0V
• Interface to PIC® EUSART and Standard USARTs
• Wake-up on LIN Bus Activity or Local Wake Input
• LIN Bus Pin
• TXD and LIN Bus Dominant Time-out Function
• Two Low-Power Modes
  - TRANSMITTER OFF Mode: 90 μA (typical)
  - POWER DOWN Mode: 4.5μA (typical)
• Output Indicating Internal RESET State (POR or SLEEP Wake)
• MCP2021A/2A On-chip Voltage Regulator
  - Output Voltage of 5.0V or 3.3V, 70 mA
• Automatic Thermal Shutdown
• High EMI, Low EME (Electromagnetic Emission )
• Robust ESD Performance: ±15 kV for LBUS and VBB pin (IEC61000-4-2)
• Transient Protection for LBUS and VBB Pins in Automotive Environment (ISO7637)
• Meets Stringent Automotive Design Requirements Including “OEM Hardware Requirements for LIN, CAN and FlexRay Interfaces in Automotive Applications”, Version 1.2, March 2011
• Extended Temperature Range: -40 to +125°C
• 8-lead 4x4 mm DFN, PDIP, SOIC, TSSOP
Features:

- The MCP2025 is compliant with:
  - LIN Bus Specifications Version 1.3, and 2.x
  - SAE J2602-2
- Supports Baud Rates up to 20 kBaud
- 43V Load Dump Protected
- Maximum Continuous Input Voltage of 30V
- Wide LIN Compliant Supply Voltage: 6.0-18.0V
- Interface to PIC® EUSART and Standard USARTs
- Wake-up on LIN Bus Activity or Local Wake Input
- LIN Bus Pin
- TXD and LIN Bus Dominant Time-out Function
- Two Low-power Modes
  - TRANSMITTER-OFF: 90 μA (typical)
  - POWER-DOWN mode: 4.5 μA (typical)
- MCP2025 On-chip Voltage Regulator
  - Output Voltage of 5.0V or 3.3V, 70 mA
- Automatic Thermal Shutdown
- High EMI, Low EME (Electromagnetic Emission)
- Robust ESD Performance: ±15 kV for LBUS and VBB Pin (IEC61000-4-2)
- Transient Protection for LBUS and VBB pins in Automotive Environment (ISO7637)
- Meets stringent automotive design requirements including “OEM Hardware Requirements for LIN, CAN and FlexRay Interfaces in Automotive Applications”, Version 1.2, March 2011
- Extended Temperature Range: -40 to +125°C
- 8-lead 4x4 mm DFN, PDIP, and SOIC
**Features:**

- The MCP2050 is compliant with:
  - LIN Bus Specifications Version 1.3, and 2.x
  - SAE J2602-2
- Support Baud Rates Up to 20 kBaud
- 43V Load Dump Protected
- Maximum Continuous Input Voltage of 30V
- Wide LIN Compliant Supply Voltage, 6.0-18.0V
- Interface to PIC® EUSART and Standard USARTs
- Wake-up on LIN Bus Activity or Local Wake Input
- LIN Bus Pin
- TXD and LIN Bus Dominant Time-out Function
- Two Low-power Modes
  - TRANSMITTER OFF Mode: 90 µA (typical)
  - POWER DOWN Mode: 4.5 µA (typical)
- Output Indicating Internal RESET State (POR or SLEEP Wake)
- MCP2050 On-chip Voltage Regulator
  - Output Voltage of 5.0V or 3.3V, 70 mA
- Programmable Windowed Watchdog Timer (WWDT)
- Ratiometric Output of VBAT Voltage Scaled to VREG
- Automatic Thermal Shutdown
- Robust ESD Performance: ±15 kV for LBUS and VBB pin (IEC61000-4-2)
- Transient Protection for LBUS and VBB Pins in Automotive Environment (ISO7637)
- Meets Stringent Automotive Design Requirements
- Extended Temperature Range: -40 to +125°C
Features:

Universal Serial Bus (USB):
- Supports full-speed USB (12 Mb/s)
- Implements USB protocol composite device CDC device for communications, configuration and I/O control
- 128 byte buffer to handle data throughput at any UART baud rate:
- Fully configurable VID and PID assignments, and string descriptors
- Bus powered or self-powered
- USB 2.0 Compliant

USB Driver and Software Support:
- Uses standard Microsoft® Windows® drivers for Virtual Com Port (VCP)
- Configuration utility for initial configuration

Universal Asynchronous Receiver/Transmitter (UART):
- Responds to SET LINE CODING commands to dynamically change baud rates
- Supports baud rates: 300-1000k
- Hardware flow control
- UART signal polarity option

General Purpose Input/Output (GPIO) Pins: Eight GPIO pins

EEPROM: 256 bytes of user EEPROM

Other:
- USB activity LED outputs (TxLED and RxLED)
- SSPND output pin
- USBCFG output pin (indicates if requested current is allowed)
- Operating voltage: 3.0-5.5V
- Oscillator input: 12 MHz
- ESD protection > 4 kV HBM
- Industrial (I) Operating Temperature: -40°C to +85°C
- Available in 20-lead 5x5 QFN, SOIC, and SSOP Packages
Features:

Universal Serial Bus (USB)
- Supports Full-Speed USB (12 Mb/s)
- Human Interface Device (HID) device
- 128-Byte Buffer to Handle Data Throughput:
- Fully Configurable VID, PID Assignments and String Descriptor (factory programming also available)
- Bus Powered or Self-Powered
- USB 2.0 Compliant

USB Driver and Software Support
- Uses Standard HID Drivers
- Configuration Utility for Device’s Power-up Configuration
- Utility for USB-SPI Communication, GPIO Manipulation, Features Usage

SPI Master Peripheral
- Supports all Four SPI modes (Mode 0, 1, 2, 3)
- Bit Rates from 1500 bps up to 12 Mbps
- Configurable Delays for SPI Transactions:
- SPI Transactions Lengths of up to 65535 Bytes Long
- Up to 9 Chip Select lines – to be used in any combination

General Purpose Input/Output (GPIO) Pins: 8 GPIO pins

EEPROM: 256 Bytes of User EEPROM

Other
- USB Activity LED Output
- SSPND Output Pin (to signal USB Suspend state)
- USBCFG Output Pin
- Operating Voltage: 3.3-5.5V
- Oscillator Input: 12 MHz
- Available in 20-lead 5x5 QFN, SOIC, and SSOP Packages
USB251xB 5th Gen USB2.0 Certified Hub

Features:
- Full Featured 5th generation USB 2.0 4-Port
- Fully configurable via EPPROM, SMbus
- Supports Battery Charging USB BC 1.1
- PHYBoost, PortMap, PortSwap, MultiTRAK™ Technology
- Self & Bus Powered
- Overcurrent Protection Ganged and Individual Modes
- LED Drivers
- QFN36 - Package
- World class interoperability & customer support

Next Gen Hubs

<table>
<thead>
<tr>
<th>USB2514B</th>
<th>USB2534</th>
<th>36pin low power</th>
</tr>
</thead>
<tbody>
<tr>
<td>USB2513B</td>
<td>USB2533</td>
<td></td>
</tr>
<tr>
<td>USB2512B</td>
<td>USB2532</td>
<td></td>
</tr>
<tr>
<td>USB3503 (HSIC)</td>
<td>USB3613 (HSIC)</td>
<td>Mobile apps WLCSP</td>
</tr>
<tr>
<td>USB3803</td>
<td>USB3813</td>
<td></td>
</tr>
<tr>
<td>USB2412</td>
<td>USB2422</td>
<td>24pin lower cost</td>
</tr>
<tr>
<td>USB4604 (I/O Bridging)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>USB4624 (+HSIC)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

USB251xB

4 USB 2.0 downstream ports

Features:
- USB 2.0 downstream ports
- 3.3V, 1.2V, 24MHz
- EEPROM, SPI, SMBUS
- Self & Bus Powered
- Overcurrent Protection Ganged and Individual Modes
- LED Drivers
- QFN36 - Package
- World class interoperability & customer support
USB2.0 Hub Controllers

**USB253x/3x13/46x4**

- Integrated Controller with “Quad Page” Configuration Management for utmost flexibility
- Flex Connect (Port Reversal) 0,1
- I/O Bridging with Programmable Interfaces
  - USB to SPI, UART, I2C
- BC1.1, BC1.2, Apple Charging and China Charger compatibility
- 2/3/4 port options in 36-pin QFN package
- HSIC versions available to interface with many major processors
- USB3x13 in miniature WLCSP ideal for mobile applications
- USB46x4 in 48-pin QFN package
- Pin Compatible versions w/USB2514B

[Online Datasheet]
# USB2.0 Hub

**USB46x4 and USB3x13**

## Same features as the USB253x Family

**USB4604 and USB4624**

<table>
<thead>
<tr>
<th>SPECS</th>
<th>USB4604</th>
<th>USB4624</th>
</tr>
</thead>
<tbody>
<tr>
<td>Upstream Port</td>
<td>USB2.0 or HSIC</td>
<td></td>
</tr>
<tr>
<td>Downstream Ports</td>
<td>4 x USB2.0</td>
<td>2 x USB2.0 / 2 x HSIC</td>
</tr>
<tr>
<td>Package</td>
<td>48-pin QFN</td>
<td></td>
</tr>
</tbody>
</table>

**USB3613 and USB3813**

<table>
<thead>
<tr>
<th>SPECS</th>
<th>USB3613</th>
<th>USB3813</th>
</tr>
</thead>
<tbody>
<tr>
<td>Upstream Port</td>
<td>HSIC</td>
<td>USB2.0</td>
</tr>
<tr>
<td>Downstream Ports</td>
<td>2 x USB2.0 / 1 x HSIC</td>
<td></td>
</tr>
<tr>
<td>Ref Clock</td>
<td>12/19.2/26/38.4Mhz*</td>
<td></td>
</tr>
<tr>
<td>Package</td>
<td>30-ball WLCSP</td>
<td></td>
</tr>
</tbody>
</table>

*Can share system reference clock*
# USB Flash Media Controller Overview

<table>
<thead>
<tr>
<th>USB Card Reader Products</th>
<th>USB2244</th>
<th>USB2250</th>
<th>USB2640</th>
<th>USB2660</th>
<th>USB4640</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Up Stream Interface</strong></td>
<td>USB 2.0</td>
<td>USB 2.0</td>
<td>USB 2.0</td>
<td>USB 2.0</td>
<td>HSIC (USB 2.0)</td>
</tr>
<tr>
<td><strong>Down Stream Output</strong></td>
<td>SD, MMC</td>
<td>SD, MMC, CF, MS, xD</td>
<td>SD, MMC, MS, xD</td>
<td>2xSD, 2xMMC, MS, xD</td>
<td>SD, MMC, MS, xD</td>
</tr>
<tr>
<td><strong>Down Stream USB Ports</strong></td>
<td>None</td>
<td>None</td>
<td>2</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td><strong>Logical Units</strong></td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td><strong>Package</strong></td>
<td>36 QFN (6 x 6 x 0.9)</td>
<td>128 VTQDP (14 x 14 x 1.1)</td>
<td>48 QFN (7 x 7 x 0.9)</td>
<td>64 QFN (9 x 9 x 0.9)</td>
<td>48 QFN (7 x 7 x 0.9)</td>
</tr>
</tbody>
</table>

*SD – SecureDigital, MMC – MultiMediaCard, CF – Compact Flash, MS – Memory Stick, xD – xD Picture Card*

- Ultra-fast flash media reader/writer for external memory card storage or embedded flash memory
  - SD, MMC/eMMC, MS / MS-Pro / MS-Pro-HG, xD
- USB interface for design ease and flexibility on placement
- USB port expansion options
High-Speed Inter-Chip [HSIC]; USB2 chip-to-chip interconnect
- HSIC removes the analog transceivers designed for 5M cables in USB2 Eco Systems
- Absolutely 100% software compatible as “USB Host” sees no different behavior

<table>
<thead>
<tr>
<th>Product</th>
<th>Upstream</th>
<th>Downstream</th>
<th>Package</th>
<th>Applications</th>
</tr>
</thead>
<tbody>
<tr>
<td>USB4640-HZH</td>
<td>HSIC</td>
<td>USB x2</td>
<td>48 QFN</td>
<td>Hub Combo (w/card reader)</td>
</tr>
<tr>
<td>USB4624-1080HN</td>
<td>HSIC/USB</td>
<td>USB x2 /</td>
<td>48 QFN</td>
<td>Hub Controller</td>
</tr>
<tr>
<td></td>
<td></td>
<td>HSIC x2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>USB4604-1080HN</td>
<td>HSIC/USB</td>
<td>USB x4</td>
<td>48 QFN</td>
<td>Hub Controller</td>
</tr>
<tr>
<td>USB3503A-1-GL</td>
<td>HSIC</td>
<td>USB x3</td>
<td>25 WLCSP</td>
<td>Mobile Hub with HSIC</td>
</tr>
<tr>
<td>USB3813-1080XY</td>
<td>USB</td>
<td>USB x2 /</td>
<td>30 WLCSP</td>
<td>Mobile Hub Controller</td>
</tr>
<tr>
<td></td>
<td></td>
<td>HSIC x1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>USB3613-1080XY</td>
<td>HSIC</td>
<td>USB x2 /</td>
<td>30 WLCSP</td>
<td>Mobile Low-Power Hub Controller</td>
</tr>
<tr>
<td></td>
<td></td>
<td>HSIC x1</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

HSIC lowers power with 1.2V signaling
**note USB2 Signaling is 3.3V**
USB3.0 Solutions Overview

- Leveraging leadership position and expertise in USB
- **Third generation of USB3.0 hub solutions**
  - USB-IF compliant hub
  - Hybrid solutions (USB2.0/3.0 ports)
  - High levels of integration featuring integrated controller providing ease-of-use and flexibility
- Battery charger detection support
  - USB-IF Battery Charger v1.2
  - Apple charger, China charger, RIM
- **Industry’s Most Complete Hub Product Line**

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Downstream</th>
<th>USB3 Logo</th>
</tr>
</thead>
<tbody>
<tr>
<td>USB5537B-5000AKZE</td>
<td>7 Port Hybrid</td>
<td>TID 330000039</td>
</tr>
<tr>
<td>USB5534B-5000JZX</td>
<td>4 Port</td>
<td>TID 330000041</td>
</tr>
<tr>
<td>USB5533B-5000JZX</td>
<td>3 Port</td>
<td>TID 330000041</td>
</tr>
<tr>
<td>USB5532B-5000JZX</td>
<td>2 Port</td>
<td>TID 330000041</td>
</tr>
</tbody>
</table>
## USB Transceiver Product Overview

<table>
<thead>
<tr>
<th>USB PHY Products</th>
<th>USB3450</th>
<th>USB3500</th>
<th>USB3280</th>
<th>USB3300</th>
<th>USB334x</th>
<th>USB333x</th>
</tr>
</thead>
<tbody>
<tr>
<td>PHY Interface</td>
<td>UTMI+ (Device or Host)</td>
<td>UTMI+ (Device, Host, or OTG)</td>
<td>UTMI (Device)</td>
<td>ULPI (Device, Host, or OTG)</td>
<td>ULPI (Device, Host, or OTG)</td>
<td>ULPI (Device, Host, or OTG)</td>
</tr>
<tr>
<td>HS &amp; FS USB</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>LS USB</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Data Interface</td>
<td>8 bit Bidir</td>
<td>8 bit Bidir</td>
<td>8 bit Bidir</td>
<td>8 bit Bidir</td>
<td>8 bit Bidir</td>
<td>8 bit Bidir</td>
</tr>
<tr>
<td>Internal Reg</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Package Body size (mm)</td>
<td>40 QFN (6 x 6 x 0.9)</td>
<td>56 QFN (8 x 8 x 0.9)</td>
<td>36 QFN (6 x 6 x 0.9)</td>
<td>40 VFBGA (4 x 4 x 0.9)</td>
<td>32 QFN (5 x 5 x 0.9)</td>
<td>24 QFN (4 x 4 x 0.9)</td>
</tr>
</tbody>
</table>

**Figure:**

The figure illustrates the relationship between the USB Transceiver, Host Controller, and ULPI components, highlighting their integration in USB2 devices. This diagram supports the table by visually connecting the components and their functionalities within the USB transceiver product overview.
Features:
- High-bandwidth USB 2.0 Switch with Dual Enables
  - For high-speed USB 2.0 data
- Multiplex differential outputs from a USB host device to one of two corresponding outputs
  - Enable DP/DM multiplexing
  - Flexible solution for embedded applications
- Ultra-low Current Consumption
  - Active (switch ON) = 5 uA (Vcc = 3V)
  - Standby (switch OFF) = 0.01 uA (Vcc = 3V)
- Competitive USB 2.0 Switch Specifications
  - Designed to pass USB signals from 0 to 3.3V
  - USB Mux on resistance < 6 ohms
  - USB Mux off leakage < 0.5 uA
  - Off isolation < -40 dB
  - On capacitance < 6 pF
  - High bandwidth: 1 GHz
- Extreme ESD Protection ± 15 kV (IEC)
- Package:
  - 10-lead 1.3 mm x 1.8 mm QFN with 0.4 mm pitch
  - 10-lead 1.6 mm x 2.1 mm QFN with 0.5 mm pitch
Features:
• Integrated and Flexible USB Port Protection and Detection with Hi-Speed USB Switch
• ESD Protection: Up to ±15 kV
• VBUS Overvoltage Protection
  • Low resistance switch for high current pass-through
  • Up to 28V of protection
• High-speed USB Switch for Port Sharing
  • Enable DP/DM multiplexing
  • Flexible solution for embedded applications
• Complete Battery Charger Detection Capability
  • USB-IF 1.1 battery charging (up to 1.5A)
  • Dedicated charging port (DCP) *i.e. Wall A/C adapter*
  • Charging downstream port (CDP) *i.e. USB-IF BC 1.1 port*
  • Standard downstream port (SDP) *i.e. PC or hub*
  • Supports detection of majority of USB (SE1) chargers
• Optional I²C Interface
• Package:
  • 16-lead 3x3 QFN
Features:

- Compliant with LIN Bus Specifications 1.3, 2.0, and 2.1 and are compliant to SAE J2602
- MCP2003/3A is industry standard pin-out
- MCP2004/4A supports Fault/TXE pin (Fault Output/Transmitter Enable)
- Support Baud Rates up to 20 Kbaud
- 43V load dump protected
- Very low EMI meets stringent OEM requirements
- Very high ESD immunity
  - >20kV on VBB (IEC 61000-4-2)
  - >14kV on LBUS (IEC 61000-4-2)
- Very high immunity to RF disturbances: Meets stringent OEM requirements
- Wide supply voltage, 6.0V - 18.0V continuous
- Extended Temperature Range: -40 to +125°C
- Interface to PIC® EUSART and standard USARTs
- Local Interconnect Network (LIN) bus pi
- Automatic thermal shutdown
- Low-power mode: ≈ 5 μA
- Software Library support for most
Features:

- 8-bit Remote Bidirectional I/O Port
- High-speed I²C™ Interface (MCP23008): 100kHz, 400kHz and 1.7MHz Modes
- High-speed SPI Interface (MCP23S08): 10MHz
- Hardware Address pins:
  - Three for the MCP23008 to allow up to Eight Devices on the bus
  - Two for the MCP23S08 to allow up to Four Devices using the same chip-select
- Configurable Interrupt Output Pin: Active-high, Active-low or Open-drain
- Configurable interrupt source
- Polarity Inversion Register to Configure the Polarity of the Input Port Data
- External Reset Input
- Low standby current: 1μA (max.)
- Operating voltage: 1.8V to 5.5V
Features:

- **8-bit remote bidirectional I/O port:**
  - I/O pins default to input
- **Open-drain outputs:**
  - 5.5V tolerant, 25mA sink capable (per pin), 200 mA total
- **High-speed I²C™ interface:** *(MCP23009)*
  - 100 kHz, 400 kHz, 3.4MHz
- **High-speed SPI interface:** *(MCP23S09)*
  - 10MHz
- **Single hardware address pin:** *(MCP23009)*
  - Voltage input to allow up to eight devices on the bus
- **Configurable interrupt output pins:**
  - Configurable as active-high, active-low or open-drain
- **Configurable interrupt source:**
  - Interrupt-on-change from configured defaults or pin change
- **Polarity inversion register to configure the polarity, of the input port data**
- **External reset input**
- **Low standby current as low as 1µA**
- **Operating voltage:** 1.8V to 5.5V

Packages: 16-pin 3x3 QFN, 18-pin PDIP, 18-pin SOIC, 20-pin SSOP
MCP23017 / 23S17

Features:

• 16-bit remote bidirectional I/O Port:
• High-speed I²C™ interface (MCP23017): 100kHz, 400kHz and 1.7MHz modes
• High-speed SPI interface (MCP23S17): 10MHz (max.)
• Three Hardware Address Pins to allow up to Eight Devices on the Bus
• Configurable Interrupt Output Pins: Configurable as Active-high, Active-low or Open-drain
• INTA and INTB can be Configured to Operate Independently or Together
• Configurable Interrupt Source:
  - Interrupt-on-change from configured register defaults or pin changes
• Polarity Inversion Register to Configure the Polarity of the Input Port Data
• External Reset Input
• Low standby current: 1μA (max.)
• Operating voltage: 1.8V to 5.5V
• Packages: 28-pin PDIP, SOIC, SSOP and QFN
Features:

- **16-bit remote bidirectional I/O port:**
  - I/O pins default to input
- **Open-drain outputs:**
  - 5.5V tolerant, 25mA sink capable (per pin), 400mA total
- **High-speed I²C™ interface:** (MCP23018)
  - 100kHz, 400kHz, 3.4MHz
- **High-speed SPI interface:** (MCP23S18)
  - 10MHz: $2.7V \leq V_{DD} \leq 5.5V$
- **Single hardware address pin:** (MCP23018)
  - Voltage input to allow up to eight devices on the bus
- **Configurable interrupt output pins:**
  - Configurable as active-high, active-low or open-drain
- **Configurable interrupt source:**
  - Interrupt-on-change from configured defaults or pin change
- **Polarity inversion register to configure the polarity of the input port data**
- **External reset input**
- **Low standby current:**
  - $1\mu A (-40^\circ C \leq T_A \leq +85^\circ C)$
  - $6\mu A (+85^\circ C \leq T_A \leq +125^\circ C)$
- **Operating voltage:** 1.8V to 5.5V
- **Packages:** 28-pin PDIP, 28-pin SOIC (300 mil), 24-pin QFN, 24-pin SSOP (MCP23018 only)
**MCP23016**

**Features:**
- 16-Bit Remote Bidirectional I/O Port
- Fast I²C™ bus Clock Frequency (0 to 400 kbits/s)
- Three Hardware Address Pins allow use of up to Eight Devices
- High-current Drive Capability per I/O: ±25mA
- Open-drain interrupt output on input change
- Interrupt Port Capture Register
- Internal Power-On Reset (POR)
- Polarity Inversion Register to Configure the Polarity of the Input Port Data
- Compatible with most Microcontrollers
- Industrial temperature range: -40°C to +85°C
**Features:**

- Low Quiescent Current (<100nA)
- Low Driver $R_{ON}$: 20Ω (typ.) at 9V
- Wide Operating Voltage Range
- 8-pin PDIP and SOIC Packages
- Available in RoHS Compliant Pb-free Packaging
**Features:**

- Low Quiescent Current (<100nA)
- Low Driver $R_{ON}$: 20Ω (typ.) at 9V
- Wide Operating Voltage Range
- 8-pin PDIP and SOIC Packages
- Available in RoHS Compliant Pb-free Packaging
RE46C104

Features:
• Low Quiescent Current
• Low Driver $R_{ON}$
• Wide Operating Voltage Range
• Available in RoHS Compliant Pb Free Packaging

Typical Application Diagram
Features:
• Low Quiescent Current
• Low Horn Driver R_{ON}
• Voltage Regulation to 3.3V or 5V
• Low Battery Detection
• Available in PDIP and SOIC packaging
Features:
• Low Quiescent Current
• 10V Up Converter
• Low Horn Driver $R_{ON}$
• Voltage Regulation to 3.0V or 3.3V
• Low Battery Detection
RE46C108

Features:
• Low Quiescent Current
• Low Horn Driver $R_{ON}$
• Voltage Regulation to 3.3V or 5V
• Available in PDIP and SOIC packages
Features:
• Low Quiescent Current
• 12V Boost Regulator
• Low Horn Driver $R_{ON}$
• 3V Regulator, other Options Available
• Low Battery Detection Interface
• Power Good and Brownout Circuits
• Device interconnection
• Available in PDIP and SOIC packages
Features:
- Low Quiescent Current
- 10V Up Converter
- Low Horn Driver $R_{ON}$
- Available in PDIP and SOIC Packages
Features:
• Low Quiescent Current
• 12V Boost Regulator
• Low Horn Driver $R_{ON}$
• 3V Regulator, other Options Available
• Low Battery Detection Interface
• Power Good Circuit
• Device interconnection
• Available in PDIP and SOIC packages
Features:
• 3V Operation
• Low Quiescent Current
• 10V Up Converter
• Low Horn Driver $R_{ON}$
• Horn Enable
  • RE46C317: Three states
  • RE46C318: Two states
• Compatible with RE46C117
• Available in 8-lead PDIP and SOIC
Features:
• Guard Outputs for Ion Detector Input
• ±0.75pA Detect Input Current
• Internal Reverse Battery Protection
• Internal Low Battery Detection
• Pin Selectable Horn Pattern
• Low Quiescent Current Consumption (<6.5µA)
• 16-lead PDIP
• ESD Protection on all Pins
**RE46C121**

**Features:**
- Guard Outputs for Ion Detector Input
- ±0.75pA Detect Input Current
- Internal Reverse Battery Protection
- Internal Low Battery Detection
- Low Quiescent Current Consumption (<6.5µA)
- Available in 16-lead PDIP or 16-lead SOIC
- ESD Protection on all Pins
- Interconnect up to 40 Detectors
Features:
- >1500V ESD Protection (HBM) on all Pins
- Guard Outputs for Ion Detector Input
- ±0.75pA Detect Input Current
- Internal Reverse Battery Protection
- Low Quiescent Current Consumption (<6.5µA)
- Available in 16-lead PDIP or 16-lead SOIC
- Internal Low Battery Detection
- Power Up Low Battery Test
- Interconnect up to 40 Detectors
- 10 Minute Timer for Sensitivity Control
Features:

- Guard Outputs for Ion Detector Input
- ±0.75pA Detect Input Current
- Internal Reverse Battery Protection
- Internal Low Battery Detection
- Low Quiescent Current Consumption (<6.5µA)
- Available in 16-lead PDIP or 16-lead SOIC
- ESD Protection on all Pins
- Interconnect up to 40 Detectors
Features:
• Guard Outputs for Ion Detector Input
• ±0.75pA Detect Input Current
• Internal Reverse Battery Protection
• Low Quiescent Current Consumption (<6.5µA)
• Available in 16-lead PDIP or 16-lead SOIC
• ESD Protection on all Pins
• Internal Low Battery Detection
• Interconnect up to 40 Detectors
• 8 Minute Timer for Sensitivity Control
Features:
• >1500V ESD Protection (HBM) on all Pins
• Guard Outputs for Ion Detector Input
• ±0.75pA Detect Input Current
• Internal Reverse Battery Protection
• Low Quiescent Current Consumption (<6.5µA)
• Available in 16-lead PDIP or 16-lead SOIC
• Internal Low Battery Detection
• Power Up Low Battery Test
• Interconnect up to 40 Detectors
Features:
• Temporal Horn Pattern or Continuous Tone
• Alarm Memory
• Sensitivity Control Times:
  - 9 minutes (RE46C165/6)
  - 1.2 minutes (RE46C167/8)
• I/O Filter and Charge Dump
• Interconnect up to 40 Detectors
• Internal Power-on Reset
• >2000V ESD Protection (HBM) on All Pins
• Low Quiescent Current Consumption (<8 μA)
• Internal Low Battery Detection and Chamber Test
• RoHS Compliant Lead-Free Packaging:
  PDIP, SOIC
Features:
• Pin Selectable Horn Patterns:
  Temporal or Continuous Horn Patterns
• Alarm Memory
• Sensitivity Control Timer:
  - 8 minute Timer for RE46C162
  - 1 minute Timer for RE46C163
• >1500V ESD Protection (HBM) on All Pins
• Guard Outputs for Ion Detector Input
• ±0.75 pA Detect Input Current
• Internal Reverse Battery Protection
• Low Quiescent Current Consumption (<6.5 μA)
• I/O Filter and Charge Dump
• Internal Low Battery Detection
• Power-up Low Battery Test
• Interconnect up to 66 Detectors
• RoHS Compliant, Lead Free Packaging: PDIP
Features:
- Guard Outputs for Ion Detector Input
- ±0.75pA Detect Input Current
- Internal Reverse Battery Protection
- Low Quiescent Current Consumption (<6.5µA)
- Available in 16-lead PDIP or 16-lead SOIC
- ESD Protection on all Pins
- Internal Low Battery Detection
- Interconnect up to 40 Detectors
Features:
• >1500V ESD Protection (HBM) on all Pins
• Guard Outputs for Ion Detector Input
• ±0.75pA Detect Input Current
• Internal Reverse Battery Protection
• Low Quiescent Current Consumption (<6.5µA)
• Available in 16-lead PDIP package
• Internal Low Battery Detection
• Power Up Low Battery Test
• Interconnect up to 40 Detectors
• Pin selectable horn patterns
• 8 Minute Timer for Sensitivity Control
Features:

- Guard Outputs for Ion Detector Input
- ±0.75µA Detect Input Current
- Microprocessor A/D Compatible Analog Output
- Low Quiescent Current Consumption (<10µA)
- Available in 8-lead PDIP or 8-lead SOIC
- 2000V ESD Protection (HBM)
Features:
• Guard Outputs for Ion Detector Input
• ±0.75pA Detect Input Current
• Microprocessor A/D Compatible Analog Output
• Low Quiescent Current Consumption (<10µA)
• Available in 8-lead PDIP or 8-lead SOIC
• 2000V ESD Protection (HBM)
Features:
• Low Quiescent Current: 600 nA/Amplifier (typical)
• Rail-to-Rail Input/Output
• Gain Bandwidth Product: 10 kHz (typical)
• Wide Supply Voltage Range: 1.8V to 5.5V
• Unity Gain Stable
• Temperature Ranges: -10°C to +60°C
• Single: RE46C311
• Dual: RE46C312
Features:
- Internal Power On Reset
- Low Quiescent Current Consumption
- Available in 16-lead PDIP or SOIC
- ESD Protection on all Pins
- Interconnect up to 40 Detectors
- 10 Minute Timer for Sensitivity Control
- Temporal Horn Pattern
- Internal Low Battery and Chamber Test
Features:
• Internal Power On Reset
• Low Quiescent Current Consumption
• Available in 16-lead PDIP or SOIC
• ESD Protection on all Pins
• Interconnect up to 40 Detectors
• Temporal Horn Pattern
• Low Battery and Chamber Test
Features:

• Internal Power On Reset
• Low Quiescent Current Consumption
• Available in 16-lead PDIP or SOIC
• ESD Protection on all Pins
• Interconnect up to 40 Detectors
• Continuous Horn Pattern
• Low Battery and Chamber Test
Features:
• Internal Power On Reset
• Low Quiescent Current Consumption
• Available in 16-lead PDIP or SOIC
• ESD Protection on all Pins
• Interconnect up to 40 Detectors
• 10 Minute Timer for Sensitivity Control
• Continuous Horn Pattern
• Internal Low Battery and Chamber Test
**Features:**

- Internal Power On Reset
- Low Quiescent Current Consumption
- Available in 16-lead PDIP or SOIC
- ESD Protection on all Pins
- Interconnect up to 40 Detectors
- 10 Minute Timer for Sensitivity Control
- Temporal Horn Pattern
- Internal Low Battery and Chamber Test
- Alternate Diagnostic Mode
Features:
- Two AA battery Operation
- Internal Power On Reset
- Low Quiescent Current Consumption
- Internal IRED driver with Programmable IRED Current
- Programmable Photo Amplifier
- Programmable Smoke Sensitivity Levels
- 9 Minute Timer for Sensitivity Control
- Chamber Test with Programmable Sensitivity Level
- Internal Low Battery Test with Programmable Threshold
- Interconnect up to 40 Detectors
- Local Alarm Memory
- Temporal or Continuous Horn Pattern
- All internal Oscillator
- Available 16L N SOIC
Features:
• Two AA battery Operation
• Low Quiescent Current Consumption
• Programmable IRED Current
• Programmable Photo Amplifier
• 6-Bit ADC
• Programmable Smoke Alarm Levels
• Long Term Drift Adjustment
• 9 Minute Timer for Sensitivity Control
• Chamber Test with Programmable Alarm Level
• Low Battery Test with Programmable Threshold
• Interconnect up to 40 Detectors
• Local Alarm Memory
• Temporal or Continuous Horn Pattern
• 10 Year End of Life Indicator
• Pin-for-Pin Compatible with the RE46C190
• Contact AIPD Marketing for additional information
RE46C200

Features:
- 6.5 - 12V Operation
- Low Quiescent Current
- Programmable IRED Current
- Programmable Photo Amplifier
- Programmable Alarm Levels
- 6-Bit ADC
- Long Term Drift Adjustment
- Programmable Low Battery Test
- Programmable Low Battery Hush
- Programmable Horn Pattern
- Horn Synchronization
- Automatic Alarm Locate
- 10-year End-of-Life Indication
- Local Alarm Memory
- Smart IO for CO alarm option
- 9 Minute or 80 Second Hush Timer
- Smart HUSH option
- Contact AIPD Marketing for additional information
RE46C180

Features:
• 6 – 12V Operation
• Low Quiescent Current Consumption
• Programmable Standby Sensitivity
• Programmable HUSH Sensitivity
• Programmable Hysteresis
• Programmable Chamber Voltage for Push-to-Test (PTT) and Chamber Test
• Programmable ±150 mV Low Battery Set Point
• Internal Ionization Chamber Test
• Internal Low Battery Test
• Internal Power-On Reset and Power-up Low
• Alarm Memory
• Auto Alarm Locate
• Horn Synchronization
• IO Filter and Charge Dump
• Smart Interconnect, up to 40 Detectors
• ±5% All Internal Oscillator
• 9 Minute or 80 Second Timer for Sensitivity Control
• Temporal or Continuous Horn Pattern
• Guard Outputs for Ion Detector Input
• ±0.75 pA Detect Input Current
• 10-year End-of-Life Indication

<< BACK
Features:

- Low Quiescent Current
- Operation from 2V to 12V
- 9.8V Boost Regulator
- Horn Driver
- LED Driver
- Bidirectional Interconnect
- 3.3V Regulator
- Internal Operation Amplifiers
  - ±1mV Input Offset
  - Rail to Rail Input and Output
  - 10kHz Gain Bandwidth Product
  - Unity Gain Stable
- Package: 20-lead SSOP
Features:
• Able to drive both windings of a bipolar stepper motor
• Load voltage supply range: 10V to 40V
• Output current upto 750mA (each bridge)
• Internal fixed Toff time PWM current control
• Built-in protection diodes
• Internal thermal shutdown
• Under-voltage lockout
• LS-TTL compatible logic inputs with pull up resistors
• Low Ron output resistance
• Low quiescent current
MTD6501C/D/G

Features:
• Position sensorless BLDC drivers (no Hall sensor required)
• 180° sinusoidal drive, for high efficiency and low acoustic noise
• Support 2V to 14V power supplies
• Speed control through PAM and/or PWM
• Built-in frequency generator
• Built-in lockup protection and automatic recovery circuit (external capacitor not necessary)
• Built-in over current limitation and short circuit protection
• Built-in thermal shutdown protection
• No external tuning required
• Boost Mode (Optional BEMF Pre-Amplification in MTD6501D)
• 20 kHz (MTD6501C/D), 23 kHz (MTD6501G)
Features:
• Position Sensorless BLDC Drivers (No Hall Sensor Required)
• 180° Sinusoidal Drive for High Efficiency and Low Acoustic Noise
• Support 2V to 5.5V Power Supplies
• Direction Control:
  • Forward direction: connect DIR pin to GND or leave floating
  • Reverse direction: connect DIR pin to VDD
• Speed Control through Power Supply Modulation (PSM) and/or Pulse-Width Modulation (PWM)
• Built-in Frequency Generator (FG Output Signal)
• Built-in Lock-up Protection and Automatic Recovery Circuit (External Capacitor not Necessary)
• Built-in Over Current Limitation
• Built-in Thermal Shutdown Protection
• No External Tuning Required
• 10-lead 3x3 TDFN
• Extended Temperature Range: -40°C to +125°C
Features:
• 180° Sinusoidal Drive
  • high efficiency and low acoustic noise
• Position Sensorless BLDC Drivers
• Integrated Power Transistors
• Supports 2V to 5.5V Power Supplies
• Programming Resistor (RPROG) setting to fit motor constant (Km) range from 3.25 mV/Hz to 52 mV/Hz
• Direction Control:
  • Speed Control through Power Supply Modulation (PSM) and/or Pulse-Width Modulation (PWM)
• Built-in Frequency Generator (FG Output Signal)
• Built-in Lockup Protection and Automatic Recovery Circuit
• Built-in Overcurrent Limitation
• Built-in Thermal Shutdown Protection
• Built-in Over Voltage Protection
• No External Tuning Required
• Extended Temperature Range: -40°C to +125°C
• 10-Lead 3mm x 3mm UDFN
Features:
• Three Half-bridge Drivers Configured to Drive External High-Side NMOS and Low-Side NMOS MOSFETs:
  • Independent input control for high-side NMOS and low-side NMOS MOSFETs
  • Peak output current: 0.5A @ 12V
  • Shoot-through protection
  • Overcurrent and short circuit protection
• Adjustable Output Buck Regulator (750 mW)
• Two LDOs: 5V @ 20 mA / 12V @ 20 mA
• Internal Bandgap Reference
• Three Operational Amplifiers for Motor Phase Current Monitoring and Position Detection
• Overcurrent Comparator and Thermal Shutdown
• Two Level Translators
• Input Voltage Range: 6 - 40V
• Operational Voltage Range: 6 - 28V
• Undervoltage Lockout (UVLO): 6V
• Overvoltage Lockout (OVLO): 28V
• Transient (100 ms) Voltage Tolerance: 48V
• Temperature Range: -40 to +150°C (H-Temp)
MCP8025

**Features:**
- LIN Transceiver Interface: Compliant with LIN Bus Specifications 1.3, 2.2, and SAE J2602
- Three Half-bridge Drivers Configured to Drive External High-Side NMOS and Low-Side NMOS MOSFETs:
  - Independent input control for high-side NMOS and low-side NMOS MOSFETs
  - Peak output current: 0.5A @ 12V
  - Shoot-through protection
  - Overcurrent and short circuit protection
- Adjustable Output Buck Regulator (750 mW)
- Two LDOs: 5V @ 30 mA / 12V @ 30 mA
- Buck Regulator Undervoltage Lockout: 4.0V
- One Operational Amplifiers for Motor Phase Current Monitoring and Position Detection
- Overcurrent Comparator and Thermal Shutdown
- Operational Voltage Range: 6 - 19V
- Undervoltage Lockout (UVLO): 5.5V
- Overvoltage Lockout (OVLO): 20V
- Transient (100 ms) Voltage Tolerance: 48V
- Temperature Range: -40 to +150°C
MCP8026

Features:

- Three Half-bridge Drivers Configured to Drive External High-Side NMOS and Low-Side NMOS MOSFETs:
  - Independent input control for high-side NMOS and low-side NMOS MOSFETs
  - Peak output current: 0.5A @ 12V
  - Shoot-through protection
  - Overcurrent and short circuit protection
- Adjustable Output Buck Regulator (750 mW)
- Two LDOs: 5V @ 30 mA / 12V @ 30 mA
- Internal Bandgap Reference
- Buck Regulator Undervoltage Lockout: 4.0V
- Three Operational Amplifiers for Motor Phase Current Monitoring and Position Detection
- Overcurrent Comparator and Thermal Shutdown
- Two Level Translators
- Operational Voltage Range: 6 - 28V
- Undervoltage Lockout (UVLO): 5.5V
- Overvoltage Lockout (OVLO): 32V
- Transient (100 ms) Voltage Tolerance: 48V
- Temperature Range: -40 to +150°C
Features:
- Automotive AEC-Q100 Qualified
- Position Sensorless BLDC Drivers
  - No Hall Sensor Required
- 23 kHz PWM Output Frequency
- 180° Sinusoidal Drive
  - High Efficiency And Low Acoustic Noise
- Support 2V to 14V Power Supplies
- Speed Control Through Power Supply and/or PWM
- Built-in 1.5A Over Current Limitation
- Built-in Frequency Generator (FG Output Signal)
- Built-in Lock-up Protection and Automatic Recovery Circuit
- Built-in Thermal Shutdown Protection
- No External Tuning Required
- 8-lead 4x4 DFN
- Extended Temperature Range: -40 to +125°C
Features:

- IEEE 802.3 compatible Ethernet Controller
- Integrated MAC and 10BASE-T PHY
- Supports one 10BASE-T port with Automatic Polarity Detection and Correction
- Supports Full and Half-Duplex modes
- Programmable Automatic Retransmit on Collision
- Programmable Padding and CRC Generation
- Programmable Automatic Rejection of Erroneous Packets
- SPI Interface: Clock Speeds up to 20MHz
Features:
• IEEE 802.3™ Compliant Fast Ethernet Controller - Integrated
• MAC and 10/100Base-T PHY - Hardware Security
• Acceleration Engines
• Factory Preprogrammed Unique MAC Address - Supports
• one 10/100Base-T Port with Automatic Polarity Detection and
• Correction
• Supports Auto-Negotiation
• Support for Pause Control Frames, including Automatic
• Transmit and Receive Flow Control
• Supports Half and Full-Duplex Operation
• Programmable Automatic Retransmit on Collision

Available MCU Interfaces:
• 14 Mbit/s SPI interface with enhanced set of opcodes
• 8-bit multiplexed parallel interface

Security Engines:
• High-performance, modular exponentiation engine with up to
• 1024-bit operands
• Supports RSA® and Diffie-Hellman key exchange algorithms
• Fast MD5 hash computations
• Fast SHA-1 hash computations

Package: 44-Pin (TQFP and QFN)
LAN8710A/20A 10/100 Ethernet Physical Layer

Features
- Excellent ESD Protection levels without any external protection devices
  - Meets / exceeds IEC requirements
- Integrated DSP with adaptive equalizer
- Integrated 1.2V Linear Regulator
- Incorporates SMSC flexPWR®
  - Flexible I/O voltage down to 1.8V
  - Extremely low energy detect standby mode
- Uses a low cost 25MHz xtal for RMII
- Lead free ROHS compliant packages:
  - LAN8710: 32QFN 5x5mm (MII/RMII)
  - LAN8720: 24QFN 4x4mm (RMII only)
- Commercial (0 to +70°C) and Industrial (-40 to +85°C) temperature supported

Other Solutions
- Ethernet PHY: Discrete
- Regulator: Discrete
- ESD protection: External
- Passive: 30+

SMSC Solutions
- Single Solution!

LAN8710A/20A Solution Integrates Functions 3-To-1!!
LAN8740A/1A/2A
Enhanced Ethernet PHY

Features
- Energy Efficient Ethernet 802.3az
- Wake On LAN support (WoL)
- Cable Diagnostics
- HP Auto-MDIX
- Compliant with IEEE 802.3/802.3u
- Integrated DSP with adaptive equalizer
- Integrated 1.2V Linear Regulator
- Uses a low cost 25MHz xtal for RMII
- Lead free ROHS compliant packages:
  - LAN8740A/41A: 32QFN (MII/RMII)
  - LAN8742A: 24QFN (RMII only)

Target Applications
- PC Docking
- Port Replicators
- USB to eNet Dongle
- Digital Signage
- Networked Printers
- Netbook/Tablet
- PVR, STB
- Digital TV
- SoC Reference Platforms

Commercial (0 to +70C) and Industrial (-40 to +85C) temperature supported
LAN8810/20
Gigabit Ethernet

Features
- Small Footprint, Low Power
- HP Auto-MDIX support with IEEE 802.3ab specs at 10/100/1000 Mbps operation
- Excellent ESD Protection levels without any external protection device
- Flexible configurations for LED status indicators
- Implements Energy Detection and Power Down modes
- Link status change and wake-up detection
- Lead free ROHS compliant packages:
  - LAN8810: 72QFN 10x10mm (GMII)
  - LAN8820: 56QFN 8x8mm (RGMII)
- Temperature Range:
  - Commercial 0°C to +70°C
  - Industrial -40°C to +85°C

Target Applications
- Industrial PC
- VoIP gateway
- SOHO/SMB router
- Industrial Networks
- Security/Inspection
- Cameras
LAN92XX 10/100 Ethernet Controllers

Features:
• High performance 16/32-bit local bus Ethernet controllers
• Support HP Auto MDIX™
• Minimizes dropped packets
  • Internal buffer memory can store over 200 packets
  • Automatic PAUSE and back-pressure flow control
• Reduced host CPU MIPS consumption
• Reduced-power modes
  • Numerous power management modes
• Wake on LAN
• Magic packet wakeup
• Wakeup indicator event signal
• Link status change
• Flexible address filtering modes
• Full Driver Support for popular OS

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<th>LAN9220</th>
<th>LAN9217</th>
<th>LAN9218</th>
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<tr>
<td>Bus Interface</td>
<td>16-bit</td>
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<td>16-bit</td>
<td>32-bit</td>
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<td>I/O voltage supported</td>
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<td>1.8v to 3.3v</td>
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<td>Performance</td>
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<td>Industrial Temp available</td>
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<td>Checksum Offload Engine</td>
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<td>56 QFN</td>
<td>100 TQFP</td>
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</table>

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LAN9303 Enhanced 10/100 3 Port Switch

Features:

- **High-performance, full-featured 3 port switch**
  - IEEE 802.1Q VLAN support
- IGMP snooping for multicast packet filtering
- Up to 200Mbps network speed via Turbo MII interface
- Optional EEPROM or external CPU serial management support via I2C interface
- **Unique virtual PHY feature simplifies software development by mimicking multiple switch ports as a single-port PHY**
- Integrated reg enables single 3.3V supply
- +/- 8kV/15kV per port ESD protection
- Lead free ROHS compliant packages
  - **LAN9303**: 56-pin QFN 8x8mm
  - **LAN9303M**: 72-pin QFN 10x10mm
- Commercial (0 to +70C) and Industrial (-40 to +85C) temperature supported
LAN93xx 3-Port 10/100 Ethernet Switch Family

- High Performance, full feature 3-port switches
  - VLAN, QoS packet prioritization, Rate Limiting, IGMP Snooping and Management Function
- Unique Virtual PHY feature
  - Simplifies software development by mimicking the multiple switch ports as a single port PHY
- Port mirroring / monitoring / sniffing: ingress and / or egress traffic on any port or port pair
- Industrial Temp support (-40 to 85 °C)

<table>
<thead>
<tr>
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<th>LAN9303/LAN89303</th>
<th>LAN9303M</th>
<th>LAN9313</th>
<th>LAN9311</th>
<th>LAN9312</th>
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<tr>
<td>Interface</td>
<td>Single MII/RMII/Turbo MII</td>
<td>Dual MII/RMII/Turbo MII</td>
<td>Single MII</td>
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<td>Package</td>
<td>56 QFN (8x8mm)</td>
<td>72 QFN (10x10mm)</td>
<td>128 VTQFP (16x16mm)</td>
<td>128 VTQFP (16x16mm)</td>
<td>128 VTQFP (16x16mm)</td>
</tr>
</tbody>
</table>
LAN9500A USB 2.0 to 10/100 Ethernet

Features:
- Fully supports IEEE 802.3/802.3u standards
- Implements NetDetach™ and WoL support for reduced system power consumption
- Supports PCI-like PME Wake
- Supports EEPROM-less operation for reduced BOM costs
- Excellent ESD Protection levels without any external protection device
  - $\pm 8kV$ / $\pm 15kV$ for contact/air discharge mode per IEC61000-4-2
- UniClock Technology requires single 25 MHz crystal for both USB and Ethernet
- Package: 56-pin QFN 8x8mm
- Commercial (0 to +70°C) and Industrial (-40 to +85°C) temperature supported

Target Applications
- PC Docking
- Port Replicators
- USB to eNet Dongle
- Digital Signage
- Networked Printers
- Netbook/Tablet
- PVR, STB
- Digital TV
- SoC Reference Platforms
LAN9730
HSIC to 10/100 Ethernet

Features

- Software compatibility - Transparent to USB software stack and device drivers
- Fully supports IEEE 802.3/802.3u standards
- Power savings - Eliminate two USB PHY’s in on-board USB chip-to-chip connection
  - 2-pin interface: Clock, Data
- Implements WoL support for reduced system power consumption
- Supports EEPROM-less operation for reduced BOM costs
- UniClock Technology requires single 25 MHz crystal for USB & Ethernet
- Lead free ROHS compliant packages

LAN9730: 56-pin QFN 8x8mm

Target Applications

- IP TV Players
- Set Top Box
- Digital TV
- Docking (wireless)
- Digital Signage
- Netbook/Tablet
- SoC Reference Platforms
- TI OMAP5, Nvidia Tegra, Marvell

What is HSIC - USB chip-to-chip interconnect. HSIC removes the analog transceivers found in normal USB. HSIC is meant to be a point to point connection between a host and device on the same PCB.

Commercial (0 to +70C) and Industrial (-40 to +85C) temperature supported
LAN7500 USB to Gigabit Ethernet

Features:

• Fully supports IEEE 802.3/802.3u/802.3ab standards
• Implements NetDetach™ for reduced system power consumption
• Excellent ESD Protection levels without any external protection device
  • $\pm 8kV / \pm 15kV$ for contact/air discharge mode per IEC61000-4-2
• Supports EEPROM-less operation for reduced BOM costs
• UniClock Technology requires single 25 MHz crystal for both USB and Ethernet
• Package:
  • 56-pin QFN 8x8mm
  • Commercial (0 to +70C) and Industrial (-40 to +85C) temperature supported

Target Applications

• PC Docking
• Port Replicators
• USB to eNet Dongle
• Digital Signage
• Networked Printers
• Netbook/Tablet
• PVR, STB
• Digital TV
• SoC Reference Platforms
LAN951X USB 2.0 Hub
10/100 Ethernet Combo

Features:

• USB to Ethernet controller with USB2.0 hub integrated
  • 1st in the industry!
  • 2, 3 or 4 additional USB downstream ports and 10/100 Ethernet
    • LAN9512 → 2 downstream ports
    • LAN9513 → 3 downstream ports
    • LAN9514 → 4 downstream ports
• Unique BOM cost saving features
  • Only a single 25MHz crystal needed for both USB and Ethernet
  • Built in 8kv/15kv contact/air discharge ESD protection
  • 24MHz clock out provided to connect additional SMSC USB hub if needed
• Extensive power management features
  • WOL, Magic Packet, GPIO assertion, Link Status Change
• Package: 64QFN 9x9mm Package

Target Applications
• PC Docking
• Port Replicators
• USB to eNet Dongle
• Digital Signage
• Networked Printers
• Netbook/Tablet
• PVR, STB
• Digital TV
• SoC Reference Platforms

Online Datasheet
<< BACK
Features:

- ANSI Standard 878.1
- **Deterministic** protocol based on Token Passing.
  - Perfect for Automation and Process applications
- 3.3v Power Supply
- Low software overhead
- Simple address & data interface
  - Compatible with any SoC
  - 8/16 bit bus
- COM20019 312Kbps data rate
- COM20020 5Mbps data rate
- COM20022 10Mbps data rate
- Devices come in either 28PLCC or 48TQFP
  - COM20022 48TQFP only
- Commercial (0 to +70C) and Industrial (-40 to +85C) temperature supported

**Target Applications**

- Transportation
- Gaming
- Photo Development Equipment
- Medical Equipment
- Process Equipment
- Building Automation
- ATM’s
- Robotics
- Power generation

**Additional information available at the ARCnet Trade Association WEB site**

www.arcnet.com
LANCheck Online Review is a personalized, value-added service available at no charge to customers who have selected our Ethernet offerings for their application design-in. LANCheck will support your design process by providing guidance through the complete design cycle – from initial schematic design to PCB design.

Benefits:
- Accelerated design cycle, reduced design risk & improves time-to-market
- Savings in PCB costs by reducing spins
- Address EMI and ESD compliance requirements early on in the design cycle
- “Heads-up” provided in the LANCheck feedback on subtle specifications for companion parts (magnetics, crystals, oscillators)
- On-line documentation allows the customer to “help themselves” and eliminates any back-and-forth between the factory, saving time
2.4 GHz High Efficiency Power Amplifier

SST12LP14E-QX8E
8-lead 2x2x0.45 mm

SST12LP14E-QX6E
6-lead 1.5x1.5x0.45 mm

SST12LP19E-QX8E
8-lead 2x2x0.45 mm

SST12LP19E-QX6E
6-lead 1.5x1.5x0.40 mm

Features:
- Gain: 23.5 dB
- EVM: ~2.5%@18dBm
- Current: 95mA@18dBm
- 11b ACPR: 22 dBm
- Matched input
- Ultra low shutdown current: < 3 uA
- Low control current: Iref= 2mA
- Low Harmonics: f2, f3, f4, f5 Harmonics <30dBc at 22dBm output
- Temperature stable, wide dynamic range, dB-Linear Power Detectors
- High ESD: > 1000 V HBM
- Used on Marvell, Atheros, and MediaTek reference Designs

Features:
- Gain: 26 dB
- EVM: ~2.5%@18dBm , 3% @ 19.5 dBm
- Current: 95mA@18dBm
- 11b ACPR: 23 dBm
- Matched input
- Ultra low shutdown current: < 3 uA
- Low control current: Iref= 2mA
- Low Harmonics: f2, f3, f4, f5 Harmonics <30dBc at 22dBm output
- Temperature stable, wide dynamic range, dB-Linear Power Detectors
- Cost down equivalent for 12LP14E
- High ESD level: > 1000 V HBM
2.4 GHz High Efficiency Power Amplifier

SST12LP18E-QX8E
8-lead 2x2x0.45 mm

Features:

• Gain: 25 dB
• EVM: 18 dBm at 3% added EVM with 54Mbps 802.11g signal
• 17 dBm at 1.8% added EVM with 802.11ac 256 QAM, 2.4 GHz
• Current: 140mA@18dBm
• 11b ACPR: 22.5 dBm
• Matched input
• Ultra low shutdown current: < 3 uA
• Low control current: Iref < 2mA
• Low Harmonics:
  f2, f3, f4, f5 Harmonics <30dBc at 23dBm output
• Temperature stable, wide dynamic range, dB-Linear Power Detectors
• Low Vreg: as low as 2.7V
• High ESD level: > 1000 V HBM
• Cost down equivalent for 12LP14E
2.4 GHz High Gain Power Amplifier

SST12LP08-QXBE
12-lead 2x2x0.45 mm

SST12LP08-QX6E
6-lead 1.5x1.5x0.45 mm

Features:
• Gain: 32 dB
• EVM: ~2.5%@20dBm
• Current: 148mA@20dBm
• 11b ACPR: 23.5 dBm
• Ultra Low shutdown current: < 3 uA
• Low control current: 2 mA
• Low Harmonics: f2, f3, f4, f5 Harmonics <40dBc at 22dBm output
• Temperature stable, wide dynamic range, dB-Linear Power Detectors
• Used on Ralink, RealTek reference designs

SST12LP08A-QX8E
8-lead 2x2x0.45 mm

Features:
• Gain: 29 dB
• EVM: ~2.5%@20dBm
• Current: 150mA@20dBm
• 11b ACPR: 23.5 dBm
• Ultra Low shutdown current: < 2 uA
• Low control current: 2 mA
• Low Harmonics: f2, f3, f4, f5 Harmonics <40dBc at 22dBm output
• Temperature stable, wide dynamic range, dB-Linear Power Detectors
• Pin-compatible with 12LP14E-QX8E
• Used on Atheros reference designs

SST12LP14A-QVCE
16-lead 3x3x0.9 mm QFN

Features:
• Gain: 30 dB
• EVM: ~4%@21dBm
• Current: 185mA@21dBm
• 11b ACPR: 23 dBm
• Ultra Low shutdown current: < 0.1 uA
• Low control current: < 2 mA
• Low Harmonics:
  • f2, f3, f4, f5 Harmonics <40dBc at 22dBm output
• Temperature stable, wide dynamic range, dB-Linear Power Detectors
• Used on Ralink reference design
2.4 GHz Fully Integrated Power Amplifier

SST12LP17E-XX8E
8-lead 2x2x0.4mm

Features:
- Gain: 28 dB
- EVM: ~3%@18dBm
- Current: 105mA@18dBm
- ACPR: 22 dBm
- Matched input and output
- Ultra Low shutdown current: < 3 uA
- Low control current: 2 mA
- Low Harmonics: f2, f3, f4, f5 Harmonics <40dBc at 23dBm output
- Temperature stable, wide dynamic range, dB-Linear Power Detectors
- Only one external component

SST12LP20-QUAE
8-lead 2x2x0.55mm

Features:
- Gain: 30 dB
- EVM: ~3%@18dBm
- Current: 110mA@18dBm
- ACPR: 21 dBm
- Matched input and output
- Ultra Low shutdown current: < 3 uA
- Low control current: 2 mA
- Low Harmonics: f2, f3, f4, f5 Harmonics <25dBc at 22dBm output
- Temperature stable, wide dynamic range, dB-Linear Power Detectors
- Only one external component
- Pin compatible to SE2568U
2.4 GHz High-Power Power Amplifier

**SST12LP15A-QVCE**
16-lead 3x3x0.9 mm

- **Features:**
  - Gain: 32 dB
  - EVM: ~3%@22dBm
  - Current: 230mA@22dBm
  - ACPR: 25 dBm
  - Ultra Low shutdown current: < 2 uA
  - Low control current: 2 mA
  - Low Harmonics: f2, f3, f4, f5
  - Harmonics <40dBc at 22dBm output
  - Temperature stable, wide dynamic range, dB-Linear Power Detectors
  - Used on Atheros, Ralink, RealTek reference designs

**SST12LP15B-QVCE**
16-lead 3x3x0.9 mm

- **Features:**
  - Gain: 36 dB
  - EVM: ~3%@23dBm
  - Current: 280mA@23dBm
  - ACPR: 25.5 dBm
  - Ultra Low shutdown current: < 2 uA
  - Low control current: 2 mA
  - Low Harmonics: f2, f3, f4, f5
  - Harmonics <40dBc at 22dBm output
  - Temperature stable, wide dynamic range, dB-Linear Power Detectors
  - Cost down equivalent for 12LP15A

**SST12LP15B-QXBE**
12-lead 2x2x0.45 mm

- **Features:**
  - Gain: 32 dB
  - EVM: ~3%@23dBm
  - Current: 310mA@23dBm
  - ACPR: 25.5 dBm
  - Ultra Low shutdown current: < 2 uA
  - Low control current: 2 mA
  - Low Harmonics: f2, f3, f4, f5
  - Harmonics <40dBc at 22dBm output
  - Temperature stable, wide dynamic range, dB-Linear Power Detectors
  - Providing high output power in a small package

Online Datasheet

SST12CP11/11C
2.4 GHz High-Power Power Amplifier Cont’d

SST12CP11-QVCE
16-lead 3x3x0.9 mm

Features:
• Gain: 34 dB
• EVM: ~3% @ 25 dBm (5V)
  ~2.5% @ 23.5 dBm, 802.11n HT40
  ~1.75% @ 21.5 dBm, MCS9 HT40 256QAM
• Current: 440 mA @ 25 dBm (5V)
• ACPR: 28.5 dBm
• Ultra Low shutdown current: < 3 µA
• Low control current: 2 mA
• Temperature stable, wide dynamic range, dB-
  Linear Power Detectors
• Low Harmonics: f2, f3, f4, f5 Harmonics
  <38 dBc at 25 dBm output

SST12CP11C-QUCE (256QAM PA)
16-lead 3x3x0.55 mm

Features
• 5V operation
• Gain: 37 dB
• Linear power for WLAN applications
  • 23.5 dBm at 1.75% EVM, MCS9-HT40
  • 25 dBm at 3% EVM 802.11g OFDM 54 Mbps
  • 28 dBm 802.11b/g spectrum mask compliant
• Integrated power detector
  • Temperature compensated
  • VSWR insensitive
  • >20 dB dynamic range (dB wise linear)
• Matched input RF port
• DC blocked input and output ports
• Lead Free, Halogen Free, RoHS compliant
• 12CP11 Pin-to-Pin
2.4 GHz High Power Power Amplifier Cont’d

SST12CP12-QUCE (256QAM PA)
16-lead 3x3x0.55 mm

Features
- Gain: 33dB
- High Power:
  - Meet 802.11g OFDM spectrum mask up to 28.5dBm
- High Linearity
  - 1.75% dynamic EVM @ 23dBm, 256QAM, 40MHz channel
  - 2.5% EVM @ 24dBm, 802.11n, MCS7, HT40
  - 3.0% EVM @ 25.5dBm, 802.11g 54Mbps OFDM
- 28 dBm 802.11b spectrum mask compliant
- VSWR and temperature insensitive power detector with 20dB dynamic range
- 5V power supply
- RFMD RF5602 Pin-compatible

SST12CP21-QUCE (256QAM PA)
16-lead 3x3x0.55 mm

Features
- 5V operation
- Gain: 39 dB
- Linear power for WLAN applications
  - 23dBm at 1.75% EVM, MCS9-HT40 with 320mA
  - 25dBm at 3% EVM 802.11g OFDM 54Mbps with 350mA
  - 28 dBm 802.11b/g spectrum mask compliant
- Integrated power detector
  - Temperature compensated
  - VSWR insensitive
  - >20 dB dynamic range (dB wise linear)
- Matched input RF port
- DC blocked input port
- Lead Free, Halogen Free, RoHS compliant
- SE2623L1 Pin-to-Pin

SST12LP15A/15B

Online Datasheet
5 GHz High Efficiency Power Amplifier

**Normal Power PA**
SST11CP15E-QUBE
12-lead 2x2x0.55 mm

- **Features:**
  - Gain: 27 dB
  - EVM: ~3%@18dBm at 3.3V
  - ~3%@20dBm at 5V
  - 1.8%@16dBm for 315 Mbps 802.11ac at 3.3V
  - Current: 200mA@18dBm
  - ACPR: 22 dBm at 3.3V
  - 24dBm at 5V
  - Ultra Low shutdown current: < 1 uA
  - Low control current: 3 mA
  - Low Harmonics: f2, f3, f4, f5 Harmonics <40dBc at 22dBm output
  - Temperature stable, wide dynamic range, dB-Linear Power Detectors

**High Power PA**
SST11LP12-QCF
16-lead 3x3x0.7 mm

- **Features:**
  - Gain: 28 dB
  - EVM: ~3%@21dBm
  - Current: 280mA@21dBm
  - ACPR: 24 dBm
  - Ultra Low shutdown current: < 3 mA
  - Low control current: 3 mA
  - Low Harmonics: f2, f3, f4, f5 Harmonics <40dBc at 22dBm output
  - Temperature stable, wide dynamic range, dB-Linear Power Detectors
  - Used on Atheros reference designs

[Online Datasheet]
High Power 11ac PA  
SST11CP16-QXCE  
16-lead 3x3x0.5 mm

**Features:**

- **Gain:** 30 dB across band 5.1-5.9 GHz
- **High linear output power (at 5V):**
  - 21.5 dBm at 3% EVM with 54 Mbps 802.11a
  - 20 dBm at 2.5% EVM with 65 Mbps 802.11n
  - 19 dBm at 1.8% EVM with 351 Mbps 802.11ac
- **Current:** 340mA@22dBm
- **ACPR:** 25.5 dBm with 802.11a mask compliance
- **Ultra Low shutdown current:** < 1uA
- **Low control current:** 2 mA
- **Low Harmonics:** f2, f3, f4, f5 Harmonics <40dBc at 22dBm output
- **Temperature stable, wide dynamic range, dB-Linear Power Detectors**
- **50Ω on-chip input match and simple output match**
2.4 GHz LNA

SST12LN01-QU6E
6-lead 3x1.6x0.55 mm QFN

Features:
- Gain: 14 dB
- Noise Figure: 1.55 dB
- Current: 11mA
- Input P1dB: -7 dBm
- Match: Fully Matched
- Used on Ralink reference designs
2.4 GHz Front End Modules

WiFi Transmitter / Receiver Module
SST12LF01-QDE
24-lead 4x4x0.8 mm

Features:
- Configuration: PA, LNA
- Tx Gain: 29 dB
- Tx EVM: 3%@19.5dBm
- Tx Current: 130mA@19.5dBm
- Tx ACPR: 22 dBm
- Ultra Low shutdown current: < 3 uA
- Low control current: 2 mA
- Rx Gain: 12 dB
- Rx Noise Figure: 1.45dB
- Rx Current: 10mA

WiFi-Bluetooth dual mode modules
SST12LF02-QXCE
16-lead 3x3x0.45 mm

Features:
- Configuration: PA, LPF & SP3 SW
- Low external component counts: Only 2 external components for optimized performance
- Pin compatible with RFMD RF5325
- Low loss Receiver paths: <1dB from Antenna to WLAN RX or BT
- Tx Gain: 30 dB
- Temperature stable, wide dynamic range, dB-Linear Power Detectors
- EVM: ~2.5%@19dBm
- Current: 140mA@19dBm
- ACPR: 22 dBm
- Ultra Low shutdown current: < 3 uA
- Low control current: 2 mA
WiFi-Bluetooth dual mode modules
SST12LF03-QXCE
20-lead 3x3x0.55 mm

Features:

- Configuration: PA, LPF, LNA & SP3 SW
- All RF ports 50Ω-matched and DC-decoupled
- Low external component counts:
  Only 2 external components for optimized performance
- Tx Gain: 28 dB
- Temperature stable, wide dynamic range, dB-Linear Power Detectors
- EVM: >3%@19dBm for 54 Mbps 802.11g signal
- Current: 130mA@19dBm
- ACPR: 22 dBm
- Ultra Low shutdown current: < 3 uA
- Low control current: 2 mA
- Low Harmonics: f2, f3, f4, f5 Harmonics <35dBc at 22dBm output
- Rx gain: 12 dB
- High P1-dB LNA: > 5 dBm
- Noise Figure: 3.1 dB
- Bluetooth path: typical 2.5 dB loss
2.4GHz 802.11b/g/n/256 QAM Front End Module

SST12LF09-Q3CE
16-lead 2.5x2.5x0.4 mm

Features
- 50Ω input/output matched, DC decoupled
- PA, LNA with bypass, SP3T antenna SW
- 3.3V to 5.0V power supply
- Transmitter Chain
  - 24dB gain
  - 1.8% dynamic EVM@15dBm(3.6V); 16.5dBm(5.0V)
  - 256-QAM, 40MHz BW
  - 3.0% dynamic EVM@17dBm(3.6V); 18.5dBm(5.0V)
  - 802.11g 54Mbps OFDM
  - VSWR and temperature insensitive power detector with 20dB dynamic range
- Receiver Chain
  - 12dB LNA gain
  - 2.5dB Noise Figure
  - Input P1dB -6dBm
  - 9dB LNA bypass loss
- AWL9281 and SKY85303 P2P
**5GHz 802.11a/n/ac Front End Module**

**Features**
- 5GHz 802.11a/n/ac FEM
- 50Ω input/output matched, DC decoupled
- PA, LNA with bypass, SPDT antenna SW
- 3.0~5.0V operating voltage
- Transmitter Chain
  - 30dB gain
  - 802.11ac MCS9, 80MHz
  - 1.8% dynamic EVM@16dBm (3.3V); 17dBm (5.0V)
  - 3.0% dynamic EVM@18dBm (3.3V); 19dBm (5.0V)
  - VSWR and temperature insensitive power detector with 20dB dynamic range
- Receiver Chain
  - 12dB LNA gain
  - Input P1dB -7dBm
  - LNA bypassed 8dB loss, P1dB > 20dBm
  - Noise Figure 2.95dB
- 16-Lead 2.5mm x 2.5mmx0.4mm QFN
- SKY85706 P2P
Features:
• Three input pins for analog input signals
• High input detection sensitivity: 3mV_{P-P} (typ.)
• High modulation depth sensitivity (as low as 8%)
• Three output selections:
  Demodulated data, Carrier clock, RSSI
• Input carrier frequency: 125kHz (typ.)
• Input data rate: 10 kbps, maximum
• 8 internal Configuration registers
• Bidirectional transponder communication
  (LF talk back)
• Programmable antenna tuning capacitance
  (up to 63pF, 1pF/step)
• Programmable output enable filter
• Low standby current: 4μA (typ.) with 3 channels enabled
• Low operating current:
  13μA (typ.) with 3 channels enabled
• Serial Peripheral Interface (SPI™) with external devices
• Supports Battery Back-Up mode and battery-less operation with external circuits
• Industrial Temperature Range:
  -40°C to +85°C (industrial)
Features:

• Single Analog Input Pin for Signal Detection
• High Input Detection Sensitivity (3 mVPP, typical)
• High Modulation Depth Sensitivity (as low as 8%)
• Three Output Type Selections:
  - Demodulated Data
  - Carrier Clock
  - Received Signal Strength Indicator (RSSI)
• Input Carrier Frequency: 125 kHz, typical
• Input Data Rate: 10 Kbps, maximum
• 8 Internal Configuration Registers
• Bidirectional Transponder Communication via the same input pin (LF talk-back)
• Programmable Antenna Tuning Capacitance (up to 63 pF, 1 pF/step)
• Programmable Output Enable Filter
• Low Standby Current: 2 μA, typical
• Low Operating Current: 10 μA, typical
• Serial Peripheral Interface (SPI) with external devices
• Industrial Temperature Range: -40°C to +85°C
• 14-lead TSSOP
Features:
- FCC/CE/IC certified 2.4-GHz IEEE 802.11b/g transceiver
- Small form factor: 27 x 18 x 3.1 mm (RN171), 37mm x 20 mm x 3.5 mm (RN131)
- Configurable transmit power: 0 to 10 dBm (RN171)
- RF pad connector for antennas (RN171)
- Certified antennas: Chip antenna, 4” dipole, PCB trace, and wire antenna (RN171), Chip antenna and U.FL Connector (RN131)
- Ultra-low power: 4-uA sleep, 38-mA Rx, 120-mA Tx at 0dBm (RN171)

Description:
The RN171 / RN131 module is a complete, standalone TCP/IP wireless networking module. With its small form factor and extremely low power consumption, the RN171 / RN131 is perfect for mobile wireless applications such as asset monitoring, sensors, and portable battery operated devices. It incorporates a 2.4-GHz radio, 32-bit SPARC processor, TCP/IP stack, real-time clock, crypto accelerator, power management, and analog sensor interfaces.

The module is preloaded with firmware to simplify integration and minimize application development. In the simplest configuration, the hardware only requires four connections (PWR, TX, RX, and GND) to create a wireless data connection.
Features:
• EEE 802.11-compliant RF transceiver
• Serialized unique MAC address
• Data rate: 1 to 11 Mbps for 802.11b / 6 to 54 Mbps for 802.11g
• Compatible with IEEE 802.11b/g/n networks
• Small size: 21 mm x 31 mm 36-pin Surface Mount module
• Integrated PCB antenna (MRF24WG0MA)
• External antenna option (MRF24WG0MB) with ultra-miniature coaxial (U.FL) connector
• Easy integration into final product – accelerates product development, provides quicker time to market
• Radio regulation certification for United States (FCC), Canada (IC), and Europe (ETSI)
• Designed for use with Microchip microcontroller families (PIC18, PIC24, dsPIC33, and PIC32) with downloadable Microchip TCP/IP Stack

RF/Analog Features:
• ISM Band 2.400 to 2.484 GHz operation
• Channels 1-11
• DSSS/OFDM modulation
• Application throughput: 4500 kbps
• -95 dBm Typical sensitivity at 1 Mbps
• +18 dBm Typical 802.11b TX power with control
• +16 dBm Typical 802.11g TX power with control
• Integrated low phase noise VCO, RF frequency synthesizer, PLL loop filter and PA
• Integrated RSSI ADC and I/Q DACs, RSSI readings available to host
Features:
- Direct internet connectivity provides internet access to every node
- Point to point connectivity to every node without the need for custom profiles
- Based on common 802.15.4 footprint
- 3 Antenna options available – wire (RN171XVW-I/RM), reverse polarity SMA connector (RN171XVS-I/RM), and U.FL connector (RN171XVU-I/RM)
- Ultra low power: 4μA sleep mode, 38mA active
- Onboard TCP/IP stack includes DHCP, UDP, DNS, ARP, ICMP, HTTP client, FTP client and TCP

Description:
The RN171XV module is a certified Wi-Fi solution especially designed for customers who want to migrate their existing 802.15.4 architecture to a standard TCP/IP based platform without having to redesign their existing hardware. The RN171XV is available in 3 antenna options: Wire (RN171XVW-I/RM), reverse polarity SMA connector (RN171XVS-I/RM) and U.FL connector (RN171XVU-I/RM). The RN171XV module is based upon the robust RN171 Wi-Fi module and incorporates an 802.11 b/g radio, 32 bit processor, TCP/IP stack, real-time clock, crypto accelerator, power management unit and analog sensor interface. The RN171XV module supports infrastructure networking for worldwide internet access directly by every node and adhoc connectivity for fully connected point to point networks, unlike many 802.15.4 implementations that need extensive, custom application profiles and additional bridging products.
Features:
• IEEE Std. 802.11-compliant RF Transceiver
• Serialized unique MAC address
• Data Rate: 1 and 2 Mbps
• Small size: 21mm x 31mm 36-pin Surface Mount Module
• Integrated PCB antenna (MRF24WB0MA)
• External antenna option (MRF24WB0MB) with ultra miniature coaxial (U.FL) connector
• Range: up to 400m (1300 ft.)
• Easy integration into final product – accelerates product development, provides quicker time to market
• Radio regulation certification for United States (FCC), Canada (IC), Europe (ETSI) and Japan (ARIB)
• Wi-Fi® certified (WFA ID: WFA7150)
• Designed for use with Microchip microcontroller families (PIC18, PIC24, dsPIC33, and PIC32) with downloadable Microchip TCP/IP Stack

RF/Analog Features:
• ISM Band 2.400-2.483.5 GHz operation
• 14 Channels selectable individually or domain-restricted
• DSSS Modulation
• -91 dBm Typical sensitivity at 1 Mbps
• +10 dBm Typical output power with control
• Integrated low phase noise VCO, RF frequency synthesizer, PLL loop filter and PA
• Digital VCO and filter calibration
• Integrated RSSI ADC and I/Q DACs, RSSI readings available to host
• Balanced receiver and transmitter characteristics for low power consumption
RN4020

Features:
- Fully-certified Bluetooth® version 4.1 module
- On-board embedded Bluetooth low energy stack
- Simple ASCII command interface over UART
- Multiple IOs for control and status
- Secure AES128 encryption
- GAP,GATT,SM, L2CAP and integrated public profiles
- Create custom services using command API
- Data streaming with Microchip’s Low Energy Data Profile (MLDP)
- Scripting for standalone module operation with analog and digital data collection
- 7 dBm transit power for 100m+ range
- Field-upgradeable via the UART interface or over-the-air
- Software configurable role as peripheral or central, client or server
- Compact form factor 11.5 x 19.5 x 2.5mm
- Low power modes
- UART interface, GPIO, ADC
- 64KB internal serial flash
- Castellated SMT pads for easy and reliable PCB mounting
- Environmentally friendly, RoHS compliant
- Certifications: FCC, IC, CE, QDID

Description:
The RN4020 is a fully-certified, Bluetooth Version 4.1 low energy module for designers who want to easily add low power wireless capability to their products. The small form factor, surface mount module has the complete Bluetooth stack on-board and is controlled via simple ASCII commands over the UART interface. The RN4020 also includes all Bluetooth SIG profiles, as well as MLDP (Microchip Low-energy Data Profile) for custom data. Developers can utilize the scripting feature to enable standalone operation without a host MCU or Processor. The RN4020 can be remote controlled by another module over a secure connection and can be updated via the UART interface or over-the-air. The module has a built-in high performance PCB antenna optimally tuned for long range, typically over 100 meters. The compact size, 11.5 x 19.5 x 2.5mm, enables ease of integration in size-constrained applications. The RN4020 can be used with any low cost microcontroller for intelligent Bluetooth Low Energy applications.
**Features:**

- Fully certified Class 1 (RN41), Class 2 (RN42) Bluetooth 2.1 + EDR module
- Onboard embedded Bluetooth stack (no host processor required)
- UART (SPP or HCI) and USB (HCI only) data connection hardware interfaces
- Supports Bluetooth data link to iPhone/iPad/iPod Touch
- Supports HID profile for making accessories such as keyboards, mouse, pointing devices
- Programmable low power modes
- Secure communications, 128 bit encryption
- Error correction for guaranteed packet delivery
- UART local and over-the-air RF configuration
- Auto-discovery/pairing requires no software configuration (instant cable replacement)
- Castellated SMT pads for easy and reliable PCB mounting
- The standard part number (RN41-I/RM / RN42-I/RM) supports SPP and DUN profiles
- Available in multiple configurations: Apple-compatible firmware (RN4xAPL-I/RM), HCI mode (RN4xHCI-I/RM), HID mode (RN4xHID-I/RM), USB mode (RN4xU-I/RM), and socket module (RN4xSM-I/RM)
- Available without antenna (RN41N-I/RM)
- Bluetooth SIG qualified

**Description:**

The RN41 / RN42 is a small form factor, low power, simple to integrate Bluetooth radio for OEMs adding wireless capability to their products. The RN41 / RN42 is perfect for battery powered applications and by default is ready to use in the SPP (Serial Port Profile) configuration. It uses only 250 µA in sleep mode while still being discoverable and connectable. Multiple low power modes available allow you to dial in the lowest power profile for your application. The RN41 / RN42 supports multiple Bluetooth profiles, is fully certified, and is simple to design in, making it a complete embedded Bluetooth solution. The RN41 / RN42 is also available without antenna (RN41N / RN42N). This is useful when the application requires an external antenna. The RN41N / RN42N is form, function, and pin compatible with the RN41 / RN42.
Features:
• Fully certified Bluetooth version 3.0 audio module, fully compatible with Bluetooth version 2.1+EDR, 1.2, and 1.1
• Software configurable through commands over UART console interface
• Embedded Bluetooth stack profiles: SPP, A2DP, HFP/HSP, and AVRCP
• Supports iAP profile discovery for iPhone® and iPod® Bluetooth accessories
• Available as an A2DP audio source or sink
• Postage-stamp-sized form factor, 13.5 x 26 x 2.7mm
• Dual-channel, differential audio input and output for highest quality audio
• External audio codecs supported via I2S and S/PDIF interface
• Castellated SMT pads for easy and reliable PCB mounting
• Additional support for codecs such as aptX®, AAC, MP3, and others
• Environmentally friendly, RoHS compliant

Description:
The RN52 Bluetooth audio module provides a fully integrated solution for delivering high-quality stereo audio in a small form factor. It combines a Class 2 Bluetooth radio with an embedded DSP processor, controlled and configured by simple ASCII commands and GPIO. It integrates RF, a baseband controller, and DSP, making it a complete Bluetooth audio wireless link. The RN52 supports HSP/HFP, A2DP, AVRCP, SPP, and iAP profiles and includes support for codecs such as SBC, aptX®, and AAC. It provides a UART interface, GPIO, stereo speaker outputs, stereo microphone inputs, and a USB port.
RN41XV / RN42XV

Features:
• Fully certified Bluetooth® version 2.1 module, supports version 2.1 + Enhanced Data Rate (EDR)
• Backwards-compatible with Bluetooth version 2.0, 1.2, and 1.1
• Pin compatible with widely used 2 x 10 (2mm) socket typically used for 802.15.4 applications
• Low power: 30 mA connected, < 10 mA sniff mode
• UART (SPP or HCI) and USB (HCI only) data connection interfaces
• Sustained SPP data rates: 240 Kbps (slave), 300 Kbps (master)
• HCI data rates: 1.5 Mbps sustained, 3.0 Mbps burst in HCI mode
Embedded Bluetooth stack profiles included (requires no host stack): GAP, SDP, RFCOMM, and L2CAP protocols, with SPP, HID and DUN profile support
• Bluetooth SIG certified
• Certifications: FCC, IC, CE
• Environmentally friendly, RoHS compliant
• 2 antenna options available: Chip antenna (RN41XVC-I/RM) and U.FL connector for external antenna (RN41XVU-I/RM)

Description:
The RN41XV module provides drop-in, certified Bluetooth connectivity for existing systems using 802.15.4 modules. Based on the popular 2 x 10 (2mm) socket footprint often found in embedded applications, the RN41XV offers a complete wireless solution for customers looking to migrate to a standard protocol without modifying existing hardware. The RN41XV is built upon Roving’s RN41 low power Bluetooth module. The module has an embedded Bluetooth stack and supports multiple interface protocols and profiles including the commonly used SPP and HID profiles.
Features:
• Socket module with UART interface
• 3.3/5V logic CMOS I/O (RS-232 as well)
• Fully qualified Bluetooth 2.1/2.0/1.2/1.1 module
• Bluetooth v2.1+EDR support
• Low power (8-30 mA connected, 2 mA idle)
• UART supports baud rates from 1,200 to 3Mbit
• Sustained SPP data rates - 240Kbps (slave), 300Kbps (master)
• HCI data rates - 1.5Mbps sustained, 3.0Mbps burst in HCI mode
• HCI mode, or SPP/DUN software stacks available.
• Embedded Bluetooth stack profiles included (requires no host stack): GAP, SDP, RFCOMM and L2CAP, with SPP, DUN and HID profiles.
• RS232 on board with power enable on IO pin.
• Bluetooth SIG Qualified, End Product Listing
• Class 1 high power amplifier (RN41SM only) with on board ceramic RF chip antenna.
• Certifications: FCC, ICS, CE
• Environmentally friendly, RoHS compliant

Description:
The RN41SM / RN42SM is a though hole, low power, highly flexible Bluetooth socket module. This module supports SPP/DUN and HCI Bluetooth interface protocols, is simple to design in and fully certified. With its high performance on chip antenna and support for Bluetooth® Enhanced Data Rate (EDR), the RN41 / RN42 delivers up to 3 Mbps data rate for distances to 100M / 20M. The RN41/RN42 socket module is the perfect method for adding Bluetooth wireless capability to existing products without redesign, saving you significant time and money.
Features:
- Fully integrated ultra low-power, sub-GHz transceiver
- Wide-band half-duplex transceiver
- Supports proprietary sub-GHz wireless protocols
- Simple 4-wire SPI-compatible interface
- CMOS/TTL-compatible I/Os
- On-chip oscillator circuit
- Dedicated clock output
- Operating voltage: 2.1V-3.6V
- Low-current consumption
- Supports Industrial temperature
- Complies with ETSI EN 300 220 and FCC part 15
- Small, 32-pin TQFN package

Module Features
- Module designed from the MRF89XA integrated ultra low-power, sub-GHz transceiver IC.
- The MRF89XAM8A is an 868 MHz radio transceiver module
- The MRF89XAM9A is a 915 MHz radio transceiver module
- Supports proprietary sub-GHz wireless protocols
- Simple, SPI Interface with Interrupts
- Small size: 0.7" x 1.1" (17.8 mm x 27.9 mm), surface mountable
- Integrated crystal, internal voltage regulator, matching circuitry and Printed Circuit Board (PCB) antenna
- Easy integration into final product
- Compatible with Microchip’s Microcontroller families (PIC16, PIC18, PIC24, dsPIC33 and PIC32)
- Conforms to the following ETSI standards:
  - EN 300 220-2 V2.3.1 (2001–02)
  - EN 301 489-3 V1.4.1 (2002–08)
Features:
- Fully Integrated Sub-GHz Transceiver
- Supports Proprietary Sub-GHz Wireless Protocols
- 4-Wire Serial Peripheral Interface (SPI)
- CMOS/TTL Compatible I/Os
- Clock and Reset Signals for Microcontroller
- Integrated 10 MHz Oscillator Circuitry
- Integrated Low Battery Voltage Detector
- Supports Power-Saving Modes
- Operating Voltage: 2.2V-3.8V
- Low-Current Consumption, Typically:
  - 11mA in RX mode
  - 15mA in TX mode
  - 0.3mA in Sleep mode
- Industrial Temperature Range
- 16-Pin TSSOP Package

RF/Analog Features
- Supports ISM Band Sub-GHz Frequency Ranges (433, 868 and 915 MHz)
- Modulation Technique: FSK with FHSS Capability
- Supports High Data Rates:
  - Digital mode 115.2 kbps, max.
  - Analog mode 256 kbps, max.
- Differential RF Input/Output:
  - -110 dBm Typical Sensitivity with 0 dBm Maximum Input Level
  - +7 dBm Typical Transmit Output Power
- High-Resolution Programmable PLL Synthesizer
- Integrated Power Amplifier
- Integrated Low Phase Noise VCO Frequency
- Synthesizer and PLL Loop Filter
- Automatic Frequency Control

![MRF49XA Pinout Diagram]
MRF24XA is an IEEE 802.15.4™ Standard compliant 2.4 GHz RF transceiver with feature extensions. MRF24XA integrates the PHY and MAC functionality in a single chip solution. MRF24XA implements a low-cost, low-power, high data rate (125 kbps to 2 Mbps) Wireless Personal Area Network (WPAN) device.

Features:
IEEE 802.15.4™-2003 and IEEE 802.15.4-2006 Standard Compliant RF transceiver
• Multiple air data rates:
  - 250 kbps (IEEE 802.15.4)
  - 125, 500, 1000, 2000 kbps, co-existence with standard networks
• Configurable TX output power: -17.5 to 0 dBm
• Frame header duration scales with the selected data rate
• On-the-fly, per-frame air-data-rate detection (link-by-link independent air data rates)
• Inferred destination addressing (to further save on framing overheads; optional)
MRF24J40 is a complete IEEE 802.15.4 radio and operates in the 2.4GHz freq band. The MRF24J40 supports ZigBee™, MiWi™ protocols and proprietary protocols to provide an ideal solution for wireless sensor networks, home automation, building automation and consumer applications.

Module Features:
- IEEE Std. 802.15.4™ Compliant RF Transceiver
- Supports ZigBee®, MiWi™, MiWi™ P2P and Proprietary Wireless Networking Protocols
- Small Size: 0.7" x 1.1" (17.8 mm x 27.9 mm), Surface Mountable
- Integrated Crystal, Internal Voltage Regulator, Matching Circuitry and PCB Antenna
- Easy Integration into Final Product
- Radio Regulation Certification for United States (FCC), Canada (IC) and Europe (ETSI)
- Compatible with Microchip Microcontroller Families
- Up to 400m Range (outdoor, line-of-sight)

Operational:
- 20/10/5/2.5 MHz Clock Output:
- Operating Voltage: 2.4-3.6V (3.3V typ.)
- Temperature Range: -40°C to +85°C Industrial
- Simple, Four-Wire SPI Interface
- Low-Current Consumption:
  - RX mode: 19 mA (typ.), TX mode: 23 mA (typ.), Sleep: 2 µA (typ.)
- Supports Power Save mode
Features:
• Battery Backed Real-Time Clock/Calendar (RTCC):
  - Hours, Minutes, Seconds, Day of Week, Day, Month & Year
  - Dual Alarms
• On-Chip Digital Trimming/Calibration
• Open-Drain Output:
  - Selectable Frequency Clock Output
  - Alarm Output
• Power-Fail Time-Stamp
• Low-Power CMOS Technology:
  - Battery Backup Current: <700nA @ 1.8V
  - 400 kHz I²C™
• Packages: 8-Lead SOIC, TSSOP, 2x3 TDFN, MSOP
• Industrial Temperature Range:
  • -40°C to +85°C (Industrial)

Memory:
• 64 Bytes Battery Backed SRAM
• Protected 64-Bit Unique ID memory space:
  - EUI-48™ or EUI-64™ MAC address
  - Custom ID Programming

Device Selection Table:

<table>
<thead>
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<th>Part Number</th>
<th>Unique ID</th>
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<td>EUI-48™</td>
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</table>
Features:
• Real-Time Clock/Calendar (RTCC):
  - Hours, Minutes, Seconds, Day of Week, Day, Month & Year
  - Dual Alarms
• On-Chip Digital Trimming/Calibration
• Open-Drain Output:
  - Selectable Frequency Clock Output
  - Alarm Output
• 400 kHz I²C™
• Packages: 8-Lead SOIC, TSSOP, 2x3 TDFN, MSOP, PDIP
• Industrial Temperature Range:
  • -40°C to +85°C (Industrial)

Memory:
• 64 Bytes SRAM
Features:

- Battery Backed Real-Time Clock/Calendar (RTCC):
  - Hours, Minutes, Seconds, Day of Week, Day, Month & Year
  - Dual alarms
- On-Chip Digital Trimming/Calibration
- Open-Drain Output:
  - Selectable Frequency Clock Output
  - Alarm Output
- Power-Fail Time-Stamp
- Low-Power CMOS Technology:
  - Battery Backup Current: <700nA @ 1.8V
  - 400 kHz I²C™
- Packages: 8-Lead SOIC, TSSOP, 2x3 TDFN, MSOP, PDIP
- Temperature Ranges:
  - -40°C to +85°C (Industrial)
  - -40°C to +125°C (Extended)

Memory:

- 64 Bytes Battery Backed SRAM
Features:

- Battery Backed Real-Time Clock/Calendar (RTCC):
  - Hours, Minutes, Seconds, Day of Week, Day, Month & Year
  - Dual alarms
- On-Chip Digital Trimming/Calibration:
- Open-Drain Output:
  - Selectable Frequency Clock Output
  - Alarm Output
- Power-Fail Time-Stamp
- Low-Power CMOS Technology:
  - Battery Backup Current: <700nA @ 1.8V
  - 400 kHz I²C™
- Packages: 8-Lead SOIC, TSSOP, 2x3 TDFN, MSOP
- Industrial Temperature Range:
  - -40°C to +85°C (Industrial)

Memory:

- 64 Bytes Battery Backed SRAM
- 1 Kbits EEPROM (128x8)
- Protected 64-Bit Unique ID memory space:
  - EUI-48™ or EUI-64™ MAC address
  - Custom ID programming

Device Selection Table:

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</table>

Diagram of MCP79410/11/12
Features:
- Battery Backed Real-Time Clock/Calendar:
  - Hours, Minutes, Seconds, Hundredth of Seconds, Day of Week, Month, Year & Leap Year
  - Dual Alarms
- Open-Drain Output:
  - Selectable Frequency Clock Output
  - Alarm Output
- On-Chip Digital Trimming/Calibration
- Power-Fail Time-Stamp
- 1.8V to 3.6V Operating Voltage
- Low Operating Current:
  - VBAT Timekeeping Current: <700nA @ 1.8V
- 5 MHz SPI
- 10-lead MSOP & TDFN
- Industrial Temperature Range:
  - -40°C to +85°C

Memory:
- 64-Byte Battery-Backed SRAM
- 2 Kbit and 1 Kbit EEPROM Memory
- Protected 128-Bit Unique ID memory space:
  - EUI-48™ or EUI-64™ MAC address
  - Custom ID programming

Device Selection Table:

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<td>MCP79512</td>
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<td>EUI-64™</td>
</tr>
<tr>
<td>MCP79522</td>
<td>2</td>
<td>EUI-64™</td>
</tr>
</tbody>
</table>
Features:
• Battery Backed Real-Time Clock/Calendar:
  - Hours, Minutes, Seconds, Hundredth of Seconds, Day of Week, Month, Year & Leap Year
  - Dual Alarms
• Open-Drain Output:
  - Selectable Frequency Clock Output
  - Alarm Output
• On-Chip Digital Trimming/Calibration
• Power-Fail Time-Stamp
• 1.8V to 3.6V Operating Voltage
• Low Operating Current:
  - VBAT Timekeeping Current: <700nA @ 1.8V
• 10 MHz SPI
• 14-Lead SOIC & TSSOP
• Industrial Temperature Range:
  • -40°C to +85°C

Enhanced Features:
• Programmable Watchdog Timer with dedicated output pin
• High-Speed Digital Event Detect (EVHS) with transition count
• Debounced Low-Speed Event Detect (EVLS)

Device Selection Table:

<table>
<thead>
<tr>
<th>Part Number</th>
<th>EEPROM (Kbits)</th>
<th>Unique ID</th>
</tr>
</thead>
<tbody>
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<tr>
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<tr>
<td>MCP795W11</td>
<td>1</td>
<td>EUI-48™</td>
</tr>
<tr>
<td>MCP795W21</td>
<td>2</td>
<td>EUI-48™</td>
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<tr>
<td>MCP795W12</td>
<td>1</td>
<td>EUI-64™</td>
</tr>
<tr>
<td>MCP795W22</td>
<td>2</td>
<td>EUI-64™</td>
</tr>
</tbody>
</table>

Memory:
• 64-Byte Battery-Backed SRAM
• 2 Kbit and 1 Kbit EEPROM Memory
• Protected 128-Bit Unique ID memory space:
  - EUI-48™ or EUI-64™ MAC address
  - Custom ID programming
The MD0100DB1 demo board contains four MD0100DK6-G dual packages providing 8 T/R switches in the system. There are no other external components on the board. This demo board replaces 8 discrete diode bridge protection circuits. The input of the MD0100DB1 is called TX which is connected to the output of the transmitter, and the output is called RX which is connected to the input of the receiver. The TX and RX are interchangeable. The MD0100DB is especially laid out so that all the inputs are on one side and all the outputs are on other side of the board. It provides for easy replacement on the system for testing.
The MD0101DB1 demoboard contains two MD0101 packages providing eight T/R switches in the system. This demoboard replaces eight discrete diode bridge protection circuits. The input of the MD0101DB1 is called TX, which is connected to the output of the transmitter, and the output is called RX, which is connected to the input of the receiver. The clamping diodes are integrated between the RX and RGND. There is a 0Ω resistor connected between the RGND and the ground plane of the board. If external diodes are desired, the 0Ω resistor has to be removed and the external diodes can then be connected between the RX and RGND. The MD0101DB1 is especially layed out so that all inputs are on one side and all outputs are on the other side of the board. This provides easy access and replacement on the system for testing.
The MCP37xxx-200 VTLA Evaluation Board (ADM00505) provides the opportunity to evaluate the performance of the MCP37xxx-200 Device Families. With the MCP37D31, 200Msps pipelined A/D converter on-board, the user can evaluate the functionality of the 200Msps A/D converters and the digital signal processing features. With the help of a compatible data capture card, the evaluation board can provide the user with performance analysis features through the PC GUI.

For proper operation, this evaluation board must be used with a compatible data capture card.

**Products supported**
- MCP37D31-200
- MCP3421
- MCP1727
The MCP37xxx Data Capture Card (ADM00506) is an FPGA-based memory buffer for the digital data received from the Analog to Digital Converter (ADC) on board the MCP37xxx Evaluation Boards. The data capture card connects to a PC via a USB cable, providing the user with two functionalities:

- The ability to send user commands directly to the MCP37xxx device using the PC GUI.
- The ability to collect data from the Evaluation Board and send it to the PC GUI.

For proper operation, this data capture card must be used with a compatible evaluation board.
The SR086DB1 demoboard is an inductorless switching power supply intended for operation directly from a 120/230VAC line. Two outputs, 12.6V and 3.3V are provided. The operating principle is to turn on a pass transistor when the rectified AC input is below the output voltage, and to turn it off when the output storage capacitor is charged up to the regulation point. Since the output capacitor charges up on the rising edge of a sine wave, reasonable efficiencies can be obtained without the use of magnetics.
The SR087DB1 demoboard is an inductorless switching power supply intended for operation directly from a 120/230VAC line. Two outputs, 12.6V and 5.0V are provided. The operating principle is to turn on a pass transistor when the rectified AC input is below the output voltage, and to turn it off when the output storage capacitor is charged up to the regulation point. Since the output capacitor charges up on the rising edge of a sine wave, reasonable efficiencies can be obtained without the use of magnetics.

Products supported

- SR087
The SR10 is an inductorless switching power supply controller intended for operation directly from a rectified 120/240VAC line. Due to the capacitor-coupled, switched shunt topology (CCSS), it exhibits low standby power and good efficiency while employing no magnetics nor high voltage electrolytic capacitors. To meet a wide variety of applications, the SR10DB1 is highly configurable. Many components are socketed. Half or full-wave rectification is jumper-selectable. Output voltage is jumper-selectable to 3 fixed voltages or may be set anywhere in the range of 6 - 28V using an on-board feedback divider.
The MD1213DB1 can drive a transducer as a single channel transmitter for ultrasound and other applications. The demoboard consists of one MD1213 combined with TC6320. Logic control inputs INA, INB and OE of the MD1213 are controlled via the six-pin head connector on the board. Due to the fast signal rise and fall time requirement, every ground wire of the ribbon cable must be used to connect from the logic signal source. When OE is enabled, it should receive the same voltage as the logic source circuit’s power supply.

Products supported
- MD1213K6-G
The MD1822DB1 is a demoboard for the three level ±100V 2.5A pulser chip-set of the MD1822 MOSFET driver and the TC7920 MOSFET. The demoboard consists of one MD1822 in the 3x3 QFN-16 package driving the TC7920 which has two pairs of high speed and high voltage complimentary P- and N-Channel MOSFETs in one 4x4 DFN-8 package. This circuit is an ideal, cost-optimized, high voltage and high current RTZ ultrasound transmit pulser.
The MD1822DB2 is a demoboard for the three level ±100V 2.5A pulser chip-set of the MD1822 MOSFET driver and the TC6320 MOSFET. The demoboard consists of one MD1822 in a 3x3mm, 16-lead QFN package driving the TC6320, which has one pair of high speed and high voltage complimentary P- and N-Channel MOSFETs in one 4x4mm, 8-lead DFN package. This circuit is an ideal, cost-optimized, high voltage and high current RTZ ultrasound transmit pulser.

Products supported
- MD1822
- TC6320
The MD1822DB3 is a demoboard for the three level ±100V 2.5A pulser chip-set of the MD1822 MOSFET driver and the TC8220 MOSFET. The demoboard consists of one MD1822 in the 3x3mm 16-lead QFN package driving the TC8220 which has two pairs of high speed and high voltage complimentary P- and N-MOSFETs in in one 4x4mm, 8-lead DFN package. This circuit is an ideal, cost-optimized, high voltage and high current RTZ ultrasound transmit pulser.

Products supported
- MD1822
- TC8220
MD1711DB2 Demo Board

The MD1711DB2 demoboard is a five-level, dual-channel, +/-100V, 2.0A, return-to-zero pulser. It can directly drive two 50 or 75Ω impedance transducers for 1.0MHz to 20MHz medical ultrasound imaging or NDT applications.

The MD1711DB2 consists of one MD1711 in a 48-Lead LQFP package driving six TC6320 complementary high voltage MOSFET pairs in 8-Lead SOIC packages. The external logic signal connector, J13, connects all the input control signals of the MD1711 to the user’s logic control source via a short ribbon cable. In typical two-, three- or five-level bipolar pulsing, PW or CW waveforms can be generated by the proper input control signal listed below. Jumpers are provided for the output, such that it can drive either the on-board RC load 220pF capacitor in parallel with a 1.0KΩ resistor or with an external load of cable to the user’s ultrasound testing transducer.

Products supported

- MD1711
- TC6320
MD1715DB2 Demo Board

The MD1715DB2 demoboard can drive two transducers as a five-level, two channel transmitter for ultrasound and other applications.

The demoboard consists of one MD1715 in a 6x6mm 40-lead QFN package driving 12 high voltage FETs in six TC8020s in one 8x8mm 56-lead QFN package. The CPLD programmable logic circuit 40MHz crystal oscillator generates accurate timing high-speed waveforms on a separate CPL board. There are multiple frequencies and waveform combinations that can be selected as bipolar pulse waveforms. External clock input can be used if the on board oscillator is disabled. The external trigger input can be used to synchronize the output waveforms. There are five push buttons for selecting the demo waveform, frequency, phase, mode selection functions. Color LEDs indicate the demo selection states. Jumpers on board for select the SMA connector to the external loads or the 220pF//1k on board dummy load.

Products supported
- MD1715
- TC8020

P/N: MD1715DB2
The MD2131DB1 demo board is used to generate the ultrasound transmit beamforming waveform with the Gaussian profile, and the adjustable frequency, amplitude, and phase angle. The MD2131DB1 circuit uses two depletion-mode MOSFETs in the push-pull mode to drive the center tapped, wide band, ultrasound output transformer. The sources of the MOSFETs are directly driven by the MD2131’s two outputs, whose maximum peak sinking current is up to 3.0A. These current source outputs are controlled by the MD2131’s internal angular vector switch matrix and the in-phase and quadrature PWM input signals.
The MD2131DB2 demoboard is used to generate the ultrasound transmit beamforming waveform with the Gaussian profile, and the adjustable frequency, amplitude and phase angle. It also provides information about how to design a user application circuit and PCB using the Supertex MD2131 and DN2625 devices. The MD2131DB2 circuit uses two depletion-mode MOSFETs in the push-pull mode to drive the center tapped, coupled, RF power inductor. The sources of the MOSFETs are directly driven by the MD2131’s two outputs, whose maximum peak sinking current is up to 3.0A. These current source outputs are controlled by the MD2131’s internal angular vector switch matrix and the in-phase and quadrature PWM input signals.

Products supported

- MD2131
The MD2134DB1 demoboard is used to generate the ultrasound transmit beam forming waveform with the Gaussian profile, and the adjustable frequency, amplitude and phase angle. The MD2134DB1 circuit uses a pair of depletion mode, high voltage, DN2625 MOSFETs in the push-pull mode to drive the center-tap wide band ultrasound output transformer. The MOSFETs are in one 8-Lead DFN surface mount package. The sources of the MOSFETs are directly driven by the MD2134’s two outputs, whose maximum peak sinking current is up to 3.3A. These current-source outputs are controlled by the MD1234’s internal current source switch array and the input signals M[3:0].
The MD2134DB2 demo board is used to generate the ultrasound transmit beamforming waveform with the Gaussian profile, and the adjustable frequency, amplitude and phase angle. It also provides information on how to design a user application circuit and PCB using the Supertex MD2134 and DN2625 devices. The MD2134DB2 circuit uses two depletion-mode MOSFETs in the push-pull mode to drive the coupled inductor. The sources of the MOSFETs are directly driven by the MD2134’s two outputs, whose maximum peak sinking current is up to 3.0A. These current source outputs are controlled by the MD2134’s internal array-switch of the fast PAM current sources.
The CW01 has 6 logic inputs; OE, CLK, DIN1, DIN2, DIN3, and DIN4. Every logic input has a 10kΩ pull down resistor. There are 3 power input voltages: VLL, VDD and VDX. VLL is the input logic level, typically 2.5V. VDD is the level translator, typically 5.0V. VDX is the gate drive voltage, and is at the same voltage level as VDD. High peak currents will be drawn from VDX during switching. Each supply has a series ferrite bead and a 0.1μF ceramic chip capacitor to keep the supply clean from high frequency noise. There are 4 outputs: HV1, HV2, HV3 and HV4. These are the connections to the drains of 100V, 7.0Ω, N-channel MOSFETs.
The HV7360DB1 is a demoboard for the HV7360, a three level +/-100V 2.5A pulser, with integral MOSFET driver and P&N channel output MOSFETs. The demoboard consists of four channels of high speed matched driver, four gatecoupling capacitors driving two pairs of high speed and high voltage complimentary P- and N-MOSFETs in one 5x7mm, 22-lead LFGA package. This circuit is an ideal, size-optimized, high voltage and high current RTZ ultrasound transmit pulser.

Products supported

- HV7360
The HV7361DB1 is a demoboard for the HV7361, a three level +/-100V 2.5A pulser, with integral MOSFET driver, P&N channel output MOSFETs and a T/R switch. The demoboard consists of four channels of high speed matched driver, four gate-coupling capacitors driving two pairs of high speed and high voltage complimentary P- and N-MOSFETs in one 5x7mm, 22-lead LFGA package. This circuit is an ideal, sizeoptimized, high voltage and high current RTZ ultrasound transmit pulser.

Products supported

- HV7361
HV7331DB2 Demo Board

The HV7331DB2 demoboard is used to generate the basic high voltage pulse waveform as an ultrasound transmitting pulser. The HV7331DB2 output waveforms can be displayed directly by using an oscilloscope connected with the scope probe to the test points TX1~4 and GND. The soldering jumper can select whether or not to connect the onboard dummy-load, a 330pF capacitor paralleling with a 2.5kΩ resistor. The test points can be used to connect the user’s transducer to easily evaluate the pulser.

Products supported
- HV7331

P/N: HV7331DB2
The HV738DB1 demoboard is used to generate the basic high voltage pulse waveform as an ultrasound transmitting pulser. The HV738 circuit uses the DC coupling method in all level translators. There are no external coupling capacitors needed. The VPP and VNN rail voltages can be hanged rather quickly, compared to a high voltage capacitor gate coupled driving pulser. This direct coupling topology of the gate drivers not only saves two high voltage capacitors per channel, but also makes the PCB layout easier.

Products supported

- HV738
The HV748DB1 demoboard is used to generate the basic high voltage pulse waveform as an ultrasound transmitting pulser. The HV748 circuit uses the DC coupling method in all level translators. There are no external coupling capacitors needed. The VPP and VNN rail voltages can be changed rather quickly, compared to a high voltage capacitor gate coupled driving pulser. This direct coupling topology of the gate drivers not only saves two high voltage capacitors per channel, but also makes the PCB layout easier.

**Products supported**
- HV748
The AN-H59DB1 is a high voltage DC/DC converter power supply demoboard designed to provide the required voltages needed for the HV738DB1 or HV748DB1 ultrasound transmitter demo boards. It generates five output voltages from the 12V input.

**Products supported**
- HV738
- HV748

P/N: AN-H59DB1
The HV7350DB1 demoboard is used to generate the basic high voltage pulse waveform as an ultrasound transmitting pulser. The HV7350 circuit uses DC coupling from a 3.3V logic input to output Tx1~8 internally, therefore the chip needs three sets of voltage supply rails: VLL +3.3V, VDD +5.0V and VPP/VNN ±10 to ±60V. The VPP and VNN rail voltages can be changed rather quickly, compared to the capacitor gatecoupled driving pulsers. This direct coupling topology of the gate drivers not only saves two high voltage capacitors per channel, but also makes the PCB layout easier.

Products supported

- HV7350
The HV7355DB1 demo board is used to generate the basic high voltage pulse waveform as an ultrasound transmitting pulser. The HV7355 circuit uses DC-coupling from a 3.3V logic input to output TX0~7 internally, therefore the chip needs three sets of voltage supply rails: VLL (+3.3V), VDD/VSS (+/-5.0V) and VPP (up to +150V). The VPP high voltage supply can be changed rather quickly, compared to the capacitor gatecoupled driving pulser. This direct coupling topology of the gate drivers not only saves two high voltage capacitors per channel, but also makes the PCB layout easier.
The HV892DB1 liquid lens driver demoboard is controlled via an I2C interface, is capable of driving capacitive loads of up to 200pF, and is compatible with 40VRMS to 60VRMS lenses. A charge pump boost converter integrated on-chip provides the high voltage necessary for driving the lens. No external inductors or diodes are needed. The board requires only two ceramic chip capacitors to complete a lens driver circuit. An H-bridge output stage provides AC drive to the lens, allowing the use of a single high voltage boost converter while providing alternating polarity to the lens. Controlled rising and falling edges on the drive waveform reduces EMI.

Products supported

- HV892
The HV7100DB1 is a fan controller/driver designed to operate from +24 or +48V supplies. Fan speed is controlled by pulse width modulating the supply voltage provided to the fans. For fans that do not work properly with a PWM supply, an included daughter board contains an LC filter for converting the pulse width modulated output of the main board to a DC output voltage.

Products supported
- HV7100
The HV254DB1 is a 32-channel 250V amplifier array with a nominal gain of 50V/V. The HV254DB1 provides a means to easily evaluate the HV254FG device. A high voltage supply, VPP, and two low voltage supplies, V+ and V-, are required. These connections can be made via the J1 header provided on the board. There are 32 pads on the left side of the board for the input signals and 32 pads on the right for the outputs.

Products supported

- HV254
The HV256DB1 is a 32-Channel 295V amplifier array with a nominal gain of 72V/V. The purpose of the HV256DB1 is to provide a means to easily evaluate the HV256FG device. A high voltage supply, VPP, and two low voltage supplies, VDD and VNN, are required. These connections can be made via the J1 header provided on the board. There are 32 pads on the left side of the board for the input signals and 32 pads on the right for the outputs.

Products supported

- HV256
The HV257DB2 is a 32-Channel, 295V, sample and hold amplifier array with a nominal gain of 72V/V. The purpose of the HV257DB2 is to provide a means to easily evaluate the HV257FG device. A high voltage supply, VPP, and four low voltage supplies, AVDD and DVDD, AVNN and DVNN, are required. Referring to the demo board drawing shown below, the logic and VSIG connections are on the left, the high voltage outputs are on the bottom, and the supplies are on the right.

Products supported

- HV257
The HV264TS-G is a quad high voltage amplifier array device in a 24-pin TSSOP package. The HV264DB1 demo board provides a platform to evaluate this device. This demoboard requires only a minimum setup including a VDD low voltage supply, a VPP high voltage supply, and a signal source. The demoboard provides the input/output connections through two 6-pin headers.

Products supported

- HV264TS-G

P/N: HV264DB1
HV9150DB1 Demo Board

The HV9150DB1 demo board is for the evaluation of the HV9150 hysteretic DC/DC controller. This demo board consists of all necessary components to create a 5V to 200V step up converter capable of providing 600mW of output power. This DC/DC converter has a single voltage input and a single voltage output. The demo board is configured to use the internal voltage reference. In addition, the user also has access to an external voltage reference pin if it is preferred. The output voltage can be adjusted from 50V to 200V by adjusting the potentiometer next to the output terminals. The potentiometer is used in the resistor feedback network for demonstration purposes.
The HV9910BDB1 demo board is an offline, high current LED driver designed to drive a 40V LED string at 1.4A from a 110V input. The demo board uses HV9910B LED driver IC to drive a buck converter. The HV9910BDB1 has a typical full load efficiency of 88%, with the buck converter efficiency (excluding the diode bridge rectifier and EMI filter) at 93%. The demo board also meets CISPR-15 conducted EMI standards. The output current can be adjusted in two ways – either with linear dimming using the onboard potentiometer or with PWM dimming by applying a TTL-compatible square wave signal at the PWMD terminal. Using linear dimming, the output current of the HV9910DB1 can be lowered to about 0.1A (note: zero output current can be obtained only by PWM dimming).
The HV9910BDB2 demo board is a high brightness LED power driver to supply a string of LEDs using the HV9910B IC from a universal AC input. The HV9910BDB2 can supply a maximum output current of 350mA to drive 10 - 40V LED strings from a wide input voltage - 90 to 265VAC, 50/60Hz. The power conversion stage of the HV9910BDB2 consists of a diode bridge rectifier, followed by a current-controlled buck converter operating at a switching frequency of 50kHz. The nominal output current of the demo board can be adjusted to any value between 30 and 350mA using the on-board trimming potentiometer. PWM dimming can be achieved by applying a pulse-width-modulated square wave signal between the PWMD and GND pins. Zero output current can be obtained only by PWM dimming. The HV9910BDB2 is not CISPR-15 compliant. Additional filtering is required to make the board meet CISPR-15 limits.

Products supported
- HV9910BNG-G

P/N: HV9910BDB2
The HV9910BDB3 demoboard is a high current LED driver designed to drive one LED or two LEDs in series at currents up to 1.0A from a 10 – 30VDC input. The demoboard uses HV9910B Universal LED driver IC to drive a buck converter. The HV9910BDB3 can be configured to operate in either a constant frequency mode (for driving a single LED) or in a constant off-time mode (for driving two LEDs). The output current can be adjusted in two ways – either with linear dimming using the onboard potentiometer or with PWM dimming by applying a TTL – compatible square wave signal at the PWMD terminal. Using linear dimming, the output current of the HV9910DB1 can be lowered to about 0.01A (note: zero output current can be obtained only by PWM dimming).

Products supported

- HV9910BLG-G
The HV9910BDB7 demonstrates the use of an HV9910B control IC in an off-line, High Brightness LED driver application. The board incorporates power factor correction (PFC) and satisfies the limits for harmonic currents according to the EN61000-3-2 Class C standard having total harmonic distortion (THD) less than 20%. The board features a low component count and long life operation due to the absence of electrolytic capacitors. The board is designed to supply a string of LEDs with a current of 350mA and a voltage in the 65 to 105V range from a 220/230VAC line.

Products supported
- HV9910BLG-G
The HV9918DB1 demo board is a high current LED driver designed to drive one or two LEDs at 700mA from a 9.0 - 16VDC input. The demo board uses HV9918 hysteretic buck LED driver IC.

**Products supported**

- HV9918K7-G
The HV9919BDB1 demoboard is a high current LED driver designed to drive one LED at 1.0A from a 9.0 - 16V DC input. The demoboard uses HV9919 hysteretic buck LED driver IC. The HV9919BDB1 includes two PWM dimming modes. The analog control of the PWM dimming mode allows the user to dim the LED using a 0 - 2.0V analog signal applied between the ADIM and GND pins (0V gives 0% and 2.0V gives 100%). In this mode, the PWM dimming frequency is set to 1kHz on the board. The digital control of PWM dimming mode allows the user to dim the LEDs using an external, TTL-compatible square wave source applied between DIM and GND. In this case, the PWM dimming frequency and duty ratio are set by the external square wave source.
The HV9921DB1 demoboard is a complete LED power driver to supply a string of LEDs using the HV9921, an integrated 3-pin high input voltage constant-current buck regulator IC. The HV9921 integrates a 500V switching MOSFET and can operate directly from the rectified universal AC line voltage range of 80 to 265VAC. The current in the LED string is internally programmed to 20mA ±15%. The HV9921DB1 is ideally suited for driving strings of LEDs having forward voltage from 20 to 50V at high efficiency (typically 80% at 120VAC). The HV9921DB1 is a peak current-controlled buck converter operating with fixed off-time of 10.5us. Its fixed off-time control scheme provides good stability and tight regulation of the LED current throughout the input AC line voltage range. As its switching frequency varies over the AC line cycle, the HV9921 inherently introduces frequency dither and simplifies the compliance with EMI regulations.
The HV9922DB1 demo board is a complete LED power driver to supply a string of LEDs using the HV9922, an integrated 3-pin high input voltage constant-current buck regulator IC. The HV9922 integrates a 500V switching MOSFET and can operate directly from the rectified universal AC line voltage range of 80 to 265VAC. The current in the LED string is internally programmed to 20mA ±15%. The HV9922DB1 is ideally suited for driving strings of LEDs having forward voltage from 20 to 30V at high efficiency (typically 80% at 120VAC). The HV9922DB1 is a peak current-controlled buck converter operating with fixed off-time of 10.5µs. Its fixed off-time control scheme provides good stability and tight regulation of the LED current throughout the input AC line voltage range. As its switching frequency varies over the AC line cycle, the HV9922 inherently introduces frequency dither and simplifies the compliance with EMI regulations.
The HV9922DB2 is a universal input, offline, non-isolated auxiliary power supply using HV9922 constant current switching regulator IC. The output voltage is regulated to 23V +/-5% and is referenced to the negative side of the diode bridge rectifier (i.e. ground of the rectified DC voltage). The demoboard is protected against output open circuit and short circuit conditions and meets FCC Class B (residential) EMI limits. The HV9922 acts as a constant 50mA current source which is sourced into an output zener diode. On the demoboard, a 22V zener diode is used at D2 to regulate the output voltage to 23V within +/-5%. Lower output voltages can be obtained by using an appropriate 2W zener diode in parallel to D2 in the space provided on the demoboard (D3).

Products supported

- HV9922N3-G
The HV9923DB1 demoboard is a complete LED power driver to supply a string of LEDs using the HV9923, an integrated 3-pin high input voltage constant-current buck regulator IC. The HV9923 integrates a 500V switching MOSFET and can operate directly from the rectified universal AC line voltage range of 80 to 265VAC. The current in the LED string is internally programmed to 30mA ±15%. The HV9923DB1 is ideally suited for driving strings of LEDs having forward voltage from 20 to 30V at high efficiency (typically 80% at 120VAC). The HV9923DB1 is a peak current-controlled buck converter operating with fixed off-time of 10.5us. Its fixed off-time control scheme provides good stability and tight regulation of the LED current throughout the input AC line voltage range. As its switching frequency varies over the AC line cycle, the HV9923 inherently introduces frequency dither and simplifies the compliance with EMI regulations.

**Products supported**

- HV9923N3-G
The HV9925DB1 demo board is a complete LED power driver to supply a string of LEDs using the HV9925, an integrated, high-voltage, buck regulator IC featuring programmable output current and PWM dimming. The HV9925 includes a 500V switching MOSFET and can operate directly from rectified AC line voltages of 80 to 135VAC. The current in the LED string is externally programmed to 50mA ±10% by a single resistor RS. The HV9925DB1 is ideally suited for driving strings of LEDs having forward voltage from 20V to 60V at high efficiency. The HV9925DB1 is a peak current-controlled buck converter operating with a fixed off-time of 10.5µs. Its fixed off-time control scheme provides good stability and tight regulation of the LED current throughout the input AC line voltage range. As its switching frequency varies over the AC line cycle, the HV9925 inherently introduces frequency dither and simplifies the compliance with EMI regulations.

Products supported

- HV9925N3-G
The HV9930DB1 is an LED driver demo board capable of driving up to 7 1-watt LEDs in series from an automotive input of 9 - 16VDC. The demo board uses HV9930 in a boost-buck topology. The converter operates at frequencies in excess of 300kHz and has excellent output current regulation over the input voltage range. It can also withstand transients up to 42V and operate down to 6V input. The converter is also protected against open LED and output short circuit conditions. Protection against reverse polarity up to 20V is also included.
HV9930DB2 Demo Board

The HV9930DB2 is a LED driver demoboard capable of driving 4 3-watt LEDs in series from an input of 9 - 25V DC. The demoboard uses HV9930 in a boost-buck topology. The converter has excellent line and load regulation over the entire input and output voltage range. The full load efficiency of the converter is typically greater than 80%. The converter is also protected against open LED and output short circuit conditions.

Products supported

- HV9930LG-G
The HV9931 LED driver is primarily targeted at low to medium power LED lighting applications where galvanic isolation of the LED string is not an essential requirement. The driver provides near unity power factor and constant current regulation using a two stage topology driven by a single MOSFET and control IC. Triac dimming of this design is possible with the addition of some components for preloading and inrush current shaping. The HV9931DB1 is designed for a fixed string current of 350mA and a string voltage of 40V for a load power of about 14W. The board will regulate current for an output voltage down to 0V. Nominal input is 120VAC. Design for universal input (85 to 265VAC) is by all means possible but does increase cost and size while lowering efficiency.

Products supported
- HV9931LG-G
The HV9931 LED driver is primarily targeted at low to medium power LED lighting applications where galvanic isolation of the LED string is not an essential requirement. The driver provides near unity power factor and constant current regulation using a two stage topology driven by a single MOSFET and control IC. Triac dimming of this design is possible with the addition of some components for preloading and inrush current shaping.

The HV9931DB2 is designed for a fixed string current of 350mA and a string voltage of 40V for a load power of about 14W. The boards will regulate current for an output voltage down to 0V. Nominal input voltage is 230VAC. Design for universal input (85 to 265VAC) is by all means possible but does increase cost and size while lowering efficiency.

**Products supported**

- HV9931LG-G
The HV9931DB5 demoboard is a high brightness (HB) LED power driver to supply one HB LED, using the HV9931 IC from either a 110 or 220VAC supply. The HV9931DB5 is ideal for incandescent retrofit applications, as it features a very small size and a low component count. The HV9931DB5 avoids the use of electrolytic capacitors, which reduce the lifetime of the circuit in high ambient temperatures (which would be found in the base of a bulb). The demo board can be used to test the performance of the HV9931 as a constant current driver to power LEDs. The HV9931DB5 uses a unique cascaded converter circuit, with a single active switch, to achieve the high step down conversion ratio required for operating low voltage LEDs from a high input voltage. This circuit allows the converter to operate at a high switching frequency, about 120kHz, while still regulating the output current at all times. The HV9931DB5 supplies 350mA to a 4.0V(max) LED with input voltages ranging from 90 – 265VAC 50/60Hz.
The HV9861ADB1 demoboard is a high-brightness LED driver employing the patented average-mode, constant current control scheme. The power conversion stage of the HV9861ADB1 consists of a diode bridge rectifier followed by a buck converter operating with fixed off-time of 20µs. The HV9861ADB1 LED driver features tight regulation of the LED current within a few milliamps over the entire range of the input AC line and the output LED string voltage. The LED current accuracy is almost insensitive to the passive component tolerances, such as the output filter inductance or the timing resistor. The accuracy of the LED current is mainly determined by the internal 270mV ± 3% reference voltage of the HV9861A control IC and by the external current sense resistor tolerance.

Products supported
- HV9861ANG-G
Certain target markets for LED lighting require a power factor of at least 90%. A power factor over 90% can be attained using valley fill power factor correction with the addition of a small boost converter. The boost converter lowers line current distortion by adding line current draw in the valley and lowering the peak amplitude of the valley fill capacitor recharging current.

Products supported
- HV9861LG-G
The HV9911DB1 is an LED driver capable of driving up to 20 one-watt LEDs in series from an input of 21 - 27VDC. The demoboard uses HV9911 in a boost topology. The converter has a very good initial regulation (+/- 5%) and excellent line and load regulation over the entire input and output voltage range (<+/- 1%). The full load efficiency of the converter is typically greater than 90%.

Products supported

- HV9911NG-G
The HV9911DB2 is an LED driver capable of driving up to twenty 100mA LEDs in series from an input of 9 - 16V DC. The demoboard uses HV9911 IC in a boost topology. The converter has a very good initial regulation, (+/- 5%), and excellent line and load regulation over the entire input and output voltage range (<+/- 1%). The full load efficiency of the converter is typically greater than 85%.

Products supported

- HV9911NG-G
The HV9911DB3 is an LED driver capable of driving up to 25 one-watt LEDs in series from an input of 130 - 200VDC. The demoboard uses Supertex’s HV9911 in a buck topology with the HV7800 used for high side current sensing. The converter has a very good initial regulation (+/-5%) and excellent line and load regulation over the entire input and output voltage range (<+-2%). The full load efficiency of the converter is typically greater than 85%.

Products supported

- HV9911NG-G
The HV9911DB4 is an LED driver demoboard capable of driving one to six three-watt LEDs in series from an input of 9.0 - 16VDC. The demoboard uses HV9911 in a SEPIC topology to drive LED string voltages higher or lower than the input voltage. The converter has a very good initial regulation (+/-5%), and excellent line and load regulation over the entire input and output voltage range (<+/-1%). The full load efficiency of the converter is typically greater than 85%.

Products supported

- HV9911NG-G
The HV9912DB1 is an LED driver demoboard capable of driving up to 20 one-watt LEDs in series from an input of 21 - 27VDC. It uses the HV9912 in a boost topology. The converter has very good initial regulation (+/-5%) and excellent line and load regulation over the entire input and output voltage range (<+/1%). The full load efficiency of the converter is typically greater than 90%.

Specifications:
- Input: 21 - 27VDC
- Output Voltage: 40 - 80V
- Output Current: 350mA
- Overvoltage: 92V
- Short Circuit Protection Included

P/N: HV9912DB1

Products supported
- HV9912NG-G
The HV9961 demo board is a high-brightness LED driver employing the patent-pending average-mode constant current control scheme. The power conversion stage of the HV9961DB1 consists of a diode bridge rectifier followed by a buck converter operating with fixed off-time of 20µs. The HV9961DB1 LED driver features tight regulation of the LED current within a few milliamps over the entire range of the input AC line and the output LED string voltage.

Products supported
- HV9961NG-G
The HV9980B1 demoboard is an RGB or multi-channel white LED backlight driver designed to drive LEDs for a large-screen TV. The HV9980DB1 can drive three common-anode LED strings from a 100 - 140V input at currents up to 70mA in steady state. It can also drive the LEDs at currents as large as 160mA for short durations to facilitate backlight scanning mode.
The HV9982DB1 is a three channel boost LED driver demoboard using HV9982 LED Driver IC. The LED driver can be used to drive RGB or multi channel white LEDs from a 24V input. The LED string current can be adjusted up to a maximum of 100mA. The demoboard has good current matching between strings and an excellent PWM dimming response, making it ideal for LED backlight applications.

The HV9982DB1 uses the HV9982 LED driver IC to drive three discontinuous conduction mode boost converters at a 500kHz switching frequency. The clocks of the three channels are phase shifted to provide ripple cancellation at the input and thus reducing the input capacitor requirements. The output current level can be adjusted using an external voltage source at the REF terminal.

The HV9982DB1 includes hiccup mode protection for both short circuit and open circuit conditions to ensure that it recovers from a momentary fault condition. It also enables the board to survive prolonged fault conditions without any damage to both the driver as well as the LEDs.

The HV9982DB1 also includes an on-board PWM generator for analog control for PWM dimming (for backward compatibility with CCFL controllers). This feature enables the user to PWM dim the driver with a 0 - 2.0V analog signal input and helps to achieve zero LED current with an analog dimming input.
HV9967BDB1 Demo Board

The HV9967BDB1 demo board is a high-brightness LED driver designed to drive 4 LEDs in series at currents up to 350mA from a 20 - 60V DC input. The demo board uses the HV9967B in a buck configuration in a constant off-time mode. The HV9967BDB1 LED driver features tight regulation of the LED current within a few milliamps over the entire range of the input voltage (i.e. 20 - 60VDC). The LED current accuracy is almost insensitive to the passive component tolerances, such as the inductance or the timing resistor.

Products supported
- HV9967BMG-G
The AT9919DB1 demo board is a high current LED driver designed to drive one LED at 1.0A from a 9.0 - 16VDC input. AT9919DB1 includes two PWM dimming modes. The analog control of the PWM dimming mode allows the user to dim the LED using a 0 - 2.0V analog signal applied between the ADIM and GND pins (0V gives 0% and 2.0V gives 100%). In this mode, the PWM dimming frequency is set to 1kHz on the board. The digital control of PWM dimming mode allows the user to dim the LEDs using an external, TTL-compatible square wave source applied between DIM and GND. In this case, the PWM dimming frequency and duty ratio are set by the external square wave source.
AT9933DB1 Demo Board

The AT9933DB1 is an LED driver capable of driving up to 7 1-watt LEDs in series from an automotive input of 9 - 16V DC. The demoboard uses AT9933LG-G in a boost-buck topology. The converter operates at frequencies in excess of 300kHz and has excellent output current regulation over the input voltage range. It can also withstand transients up to 42V and operate down to 6V input. The converter is also protected against open LED and output short circuit conditions. Protection against reverse polarity up to 20V is also included.
The HV816DB2 is a high brightness demo board with the circuitry to drive a 10in2 EL lamp using the HV816 in a 4x4 QFN-16 package.

**Products supported**
- HV816K6-G
The HV816DB3 is a demoboard designed for high power applications using the HV816 4x4 QFN-16 package. The HV816DB3 board has the circuitry to drive a 16.5in2 EL lamp. For applications requiring smaller lamps and/or lower power, please refer to the HV816DB2 demoboard datasheet.

**Products supported**
- HV816K6-G
The HV823DB1 EL Driver demo board contains all the circuitry necessary to drive an EL (Electroluminescent) lamp. The supplied circuit has been optimized to drive an 8.0in² lamp from a 3.0 to 3.3V supply. The circuit may be customized with different component values to suit a particular application.

Products supported
- HV823LG-G
The HV825DB1 EL Driver demoboard contains all the circuitry necessary to drive an EL (Electroluminescent) lamp. The supplied circuit has been optimized to drive a 1.5in² lamp from a 1.5V supply. The circuit may be customized with different component values to suit a particular application.

Products supported
- HV825
The HV830DB1 EL Driver demoboard contains all the circuitry necessary to drive an EL (Electroluminescent) lamp. The supplied circuit has been optimized to drive an 8.0in2 lamp from a 3.0 to 3.3V supply. The circuit may be customized with different component values to suit a particular application.

Products supported
- HV830
HV833DB1 Demo Board

The HV833DB1 demoboard contains all necessary circuitry to demonstrate the features of the HV833 EL lamp driver.

Products supported
- HV833
The HV857DB1 demo board contains all necessary circuitry to demonstrate the features of the HV857 EL lamp driver.

Products supported
- HV857MG-G
The HV857LDB1 demoboard contains all necessary circuitry to demonstrate the features of the HV857L EL lamp driver.

Products supported

- HV857LMG-G

P/N: HV857LDB1
The HV859DB1 demoboard contains all the necessary circuitry needed to demonstrate the features of the HV859 EL lamp driver.

Products supported

- HV859MG-G
The HV860DB1 demoboard contains all necessary circuitry to demonstrate the features of the HV860 EL lamp driver.

Products supported

- HV860K7-G
The HV861DB1 demoboard contains all the necessary circuitry to demonstrate the features of the HV861 dual EL Lamp driver.
The HV852DB1 demoboard contains all necessary circuitry to demonstrate the features of the HV852 EL lamp driver.

Products supported
- HV852K7-G
The HV853DB1 demo board contains all the necessary circuitry to demonstrate the features of the HV853 EL lamp driver. The HV853 is the low noise version of the EL driver HV852 with improved EMI performance.

**Products supported**
- HV853K7-G
The HV809DB2 EL Driver demo board contains all the circuitry necessary to drive an EL (Electroluminescent) lamp.

Products supported

- HV809
Ethernet EVBs
(PHY/Switch/Controller)

LAN874x 10/100 Ethernet PHY Customer Evaluation Board
EVB8740

LAN922x Ethernet Controller w/Variable I/O Customer Evaluation Board
EVB-LAN9221-MINI

LAN921x Ethernet Controller Customer Evaluation Board
EVB-LAN9218I-MINI

LAN9303 3-Port Managed Ethernet Switch Customer Evaluation Board
EVB9303M

LAN931x 3-Port Ethernet Switch with Flexible Interfaces Customer Evaluation Board
EVB-LAN9313M

* NOTE: Contact Marketing for GbE PHY tools
Ethernet Evaluation Boards

- **LAN9500A**
  - High-Speed USB 2.0 to 10/100 Ethernet Customer Evaluation Board
  - EVB-LAN9500A-LC
  - EVB-LAN9500A-MII

- **LAN7500**
  - High-Speed USB 2.0 to 10/100/1000 Ethernet Customer Evaluation Board
  - EVB-LAN7500-LC
  - EVB-LAN7500

- **LAN951x High-Speed USB 2.0 to 10/100 Ethernet Hub Customer Evaluation Board**
  - EVB9514

- **LAN9730 High-Speed USB 2.0 HSIC to 10/100 Ethernet Customer Evaluation Board**
  - EVB-LAN9730-MII

Online Datasheet
<< BACK
The TC72 Digital Temperature Sensor PICtail™ Demo Board demonstrates how to interface the TC72 Temperature Sensor device to a microcontroller. A PIC16F676 14-pin Flash-based 8-bit CMOS microcontroller is included with the demo board, which can be used with the PICkit™ 1 Flash Starter Kit, along with firmware that provides the SPI interface and temperature conversion routines, to communicate with the TC72.

The Demo Board can also be used as a stand-alone module to quickly add thermal-sensing capability to any existing application. This basic sensor functionality is implemented on a small PCB.

**Products supported**
- TC72
- PIC16F676
The TC77 Thermal Sensor PICtail™ Demo Board demonstrates how to interface the TC77 device to a microcontroller. A PIC16F676 14-pin Flash-based 8-bit CMOS microcontroller is included with the demo board, which can be used with the PICkit™ 1 Flash Starter Kit, along with firmware that provides the SPI interface and temperature conversion routines, to communicate with the TC77.

The Demo Board can also be used as a stand-alone module to quickly add thermal-sensing capability to any existing application. This basic sensor functionality is implemented on a small PCB.

Products supported
- TC77
- PIC16F676
The MCP9800 Thermal Sensor PICtail™ Demo Board demonstrates how to interface the MCP9800 to a PIC® microcontroller using the PICkit™ 1 Flash Starter Kit as a platform. A PIC16F676 14-pin Flash-based 8-bit CMOS microcontroller is included with the demo board, which can be used with the PICkit™ 1 Flash Starter Kit. Also included is firmware that provides the I²C™ interface and temperature conversion routines, to communicate with the MCP9800 and to convert the serial data.

The MCP9800 Thermal Sensor PICtail Demo Board can also be used as a stand-alone module to quickly add thermal sensing capability to any existing application. This basic sensor functionality is implemented on a small Printed Circuit Board (PCB) and an interface via a standard 100 mil header.
The MCP9800 Temperature Data Logger Demo Board demonstrates how to use the MCP9800 and an on-board EEPROM to log temperature data. A PIC16F676 14-pin Flash-based 8-bit CMOS microcontroller is used with the MCP9800 and stores the temperature data in EEPROM. The PIC microcontroller also communicates with a PC using the PICkit1™ Flash Starter Kit. The temperature data stored in the EEPROM can be transferred to a PC using the PICkit™ 1 software and can be saved in .csv format. The data file can be opened using Microsoft® Excel® software.

The MCP9800 Temperature Data Logger Demo Board can also be used as a stand-alone module, powered with a lithium battery, to measure ambient temperature and store up to 4096 temperature samples over an extended period of time.
The MCP9800 Temperature Data Logger Demo Board 2, once programmed, will log temperature measurements for a predetermined amount of time until the 24LC16B is fully programmed with temperature data (i.e., 2,048 temperature readings). Each sample uses one byte of memory. The intervals can be changed in the firmware provided by changing the TIMEOUTVAL variable. The firmware will take measurements for approximately 45 minutes (approx. 1 sample/sec).

**Products supported**
- MCP9800
- MCP101
- PIC10F202
- 24LC16B
The MCP9800 Temperature Sensor Demo Board demonstrates the sensor’s features. Users can connect the demo board to a PC with USB interface and evaluate the sensor performance. The 7-Segment LED displays temperature in degrees Celsius or degrees Fahrenheit; the temperature alert feature can be set by the users using an on board potentiometer. An alert LED is used to indicate an over temperature condition. In addition, temperature can be datalogged using the Microchip Thermal Management Software Graphical User Interface (GUI). The sensor registers can also be programmed using the GUI.

Products supported
- MCP9800
- PIC18F2550
The Thermocouple Reference Design demonstrates Microchip’s solution to accurately measure temperature using a Thermocouple and an 18-bit ADC, MCP3421. This solution eliminates the need for the traditional analog instrumentation system calibration or gain and offset trimming techniques. In addition, the Thermocouple linearization techniques can be implemented in firmware or software.

Products supported
- MCP9804
- MCP3421
- PIC18F2550
The MCP9700 Temperature-to-Voltage Converter PICtail™ Demo Board demonstrates how to interface the MCP9700 to a PIC® microcontroller using the PICkit™ 1 Flash Starter Kit as a platform. A PIC16F676 14-pin, Flash-based, 8-bit CMOS microcontroller device is included with the demo board that can be used with the PICkit™ 1 Flash Starter Kit, along with firmware that provides the interface to the MCP9700 Temperature-to-Voltage Converter PICtail™ Demo Board and the voltage-to-temperature conversion routines.

The demo board can also be used as a stand-alone module to quickly add thermal sensing capability to any existing application. This basic sensor functionality is implemented on a small PCB and an interface via a standard 100 mil header.

Products supported
- MCP9700
- PIC16F676

P/N: MCP9700DM-PCTL
The MCP9700 Thermistor Demo Board contains the analog circuitry to measure temperature. It uses BC Components’ 232264055103 NTC thermistor to convert temperature to resistance. The thermistor is placed in a voltage divider which converts resistance to voltage. This voltage is filtered and placed at the MCP6S22 Programmable Gain Amplifier’s (PGA) CH0 input. The PGA gains and buffers the thermistor. In addition, the board includes the MCP9700 Linear Active Thermistor. The MCP9700 outputs voltage proportional to temperature. A PIC18F2550 is used to both measure the voltage output of the MCP9700 and the MCP6S22 using an integrated 10-bit Analog to Digital Converter and communicate to a PC via USB interface. Temperature can be data logged using Microchip Thermal Management Software Graphical User Interface (GUI).

Products supported
- MCP9700
- MCP6S92
- PIC18F2550
The TC1047A Temperature-to-Voltage Converter PICtail™ Demo Board demonstrates how to interface the TC1047A to a PIC® microcontroller using the PICkit™ 1 Flash Starter Kit as a platform. A PIC16F676 14-pin, Flash-based, 8-bit CMOS microcontroller device is included with the demo board that can be used with the PICkit™ 1 Flash Starter Kit, along with firmware that provides the interface to the TC1047A Temperature-to-Voltage Converter PICtail™ Demo Board and the voltage-to-temperature conversion routines.

The demo board can also be used as a stand-alone module to quickly add thermal sensing capability to any existing application. This basic sensor functionality is implemented on a small PCB and an interface via a standard 100 mil header.

**Products supported**
- TC1047A
- PIC16F676

P/N: TC1047ADM-PICTL
The PT100 RTD Evaluation Board allows the user to evaluate Microchip’s solution to accurately measure temperature using RTD. When biasing RTDs to measure temperature, self-heat due to power dissipation has to be considered. RTD resistance availability typically ranges from 100Ω to 5,000Ω. In order to measure the output voltage across the RTD over a wide temperature range, the biasing current has to be relatively high. This higher current causes more power dissipation through heat and skews the temperature reading. Microchip’s solution to this challenge is to use a MCP6S26 Programmable Gain Amplifier (PGA) to increase the sensor dynamic output range and increase measurement resolution while significantly reducing the biasing current magnitude.

Products supported
- MCP6S26
- MCP3301
- MCP6024
- MCP41010
- MCP6002
- TC1071
- PIC18F2550
EMC1043/53 Evaluation Board

The EMC1043/53 Evaluation Board provides the means to demonstrate the EMC1043/53 features and to view and modify registers through USB. LED indicators and test points are included to show status information. 2N3904 diode-connected transistors are installed on the PCB.

Products supported
- EMC1043
- EMC1053
The EMC1043 Triple Temperature Sensor Evaluation Board is a USB-based platform for evaluating the EMC1043 device. It provides the means to demonstrate the EMC1043 features and to view and modify registers through USB. LED indicators and test points are included to show status information. The 2N3904 diode-connected transistors are installed on the PCB.

Products supported
- EMC1043
The EMC1412 Evaluation Board provides the means to demonstrate the EMC1412 features and to view and modify registers through USB. LED indicators and test points are included to show status information and a fan driver circuit linearly drives a 5V fan to 3 different speeds based on programmable temperature limits.

Products supported

- EMC1412
The EMC2101 EVB is a USB-based platform that provides the means to demonstrate EMC2101 features and to view and modify registers. A +12V fan and power supply are provided to demonstrate the fan control functionality. LEDs indicate status information and test points are included to monitor system voltages with a user provided voltmeter or oscilloscope. Also included are:

- Headers for connecting a remote diode or CPU/GPU thermal diode
- Chip Manager (SMSC application) allows:
  - Viewing and changing register values
  - Graphing of any register
  - Resistance Error Correction verification
- Autonomous register loading via included EEPROM (EMC2101-R only)
- USB communication to evaluation board
- An external SMBus master may also be used via jumper settings

Products supported

- EMC2101

P/N: ADM00492
The EMC1701 EVB is a USB-based platform that provides the means to evaluate features and to view and modify registers. LEDs indicate status information and test points are included to monitor system voltages with a user-provided voltmeter or oscilloscope. The features include:

- **The SMSC Chip Manager application allows:**
  - Viewing and changing register values
  - Graphing registers
  - Saving settings for all registers to allow quick configuration at later time

- **The Evaluation Board provides:**
  - Test pins and LEDs for monitoring onboard function
  - Screw terminal connections for monitoring external system current up to 20A
  - Multiple onboard adjustable current sources (steady state, square wave, test pulse)
  - USB to SMBus bridge for power and communications
  - Capability to connect directly to external SMBus master

**Products supported**

- EMC1701
The PAC1710/20 Single-Dual High Side DC Current Sense Eval Board provides the means to evaluate features and to view and modify registers of both PAC1710 and PAC1720. There are two modes of EVB current monitoring operation: Demo Mode, which monitors an onboard current source, and Sys Mode, which monitors an external current source. LEDs indicate status information, and test points are included to monitor system voltages with a user-provided voltmeter or oscilloscope.

**Features:**
- Chip Manager software allows viewing and changing register values
- USB to SMBus bridge for power and communications
- Test points and LEDs for monitoring onboard function
- Screw terminal connections for monitoring external system current up to 20A
- Multiple onboard adjustable current sources (steady state, square wave, test pulse)
- Capability to connect directly to external SMBus master

**Products supported**
- PAC1710
- PAC1720

Products supported
- UCS1001-1
- UCS1001-2
The UCS1002 Evaluation Board allows the user to use a graphical user interface to demonstrate the Highest Current Algorithm, apply charger emulation profiles, and set up for full BC1.2 CDP, DCP, and SDP modes. Options in the GUI include custom profile register configuration, dead battery routines, charge ration operation, and configuration of fault handling.

Products supported

- UCS1002

P/N: EVB-UCS1002
The Photodiode PGA PICtail™ Daughter Board contains the analog circuitry to convert light incident to the photodiode to current. The op amp converts current to voltage (transimpedance amplifier). This voltage is sent to the CH0 input of the PGA. The PGA gains and buffers this output, which is sent off-board ($V_{OUT}$). Board power is applied to the +5V and GND inputs. The SPI bus makes it possible to control the PGA; its gain and input channel can be set as desired form the software.

Products supported
- MCP6S22
- MCP6001
The Thermistor PGA PICtail™ Daughter Board uses BC Components’ NTC thermistor to convert temperature to resistance. The thermistor is placed in a voltage divider which converts resistance to voltage. The voltage is filtered and placed at the MCP6S22 Programmable Gain Amplifier’s (PGA) CH0 input. The PGA gains and buffers this output, which is sent off-board (V_{OUT}). Board power is applied to the +5V and GND inputs. The SPI bus makes it possible to control the PGA; its gain and input channel can be set as desired from the software.

Products supported

- MCP6S22
The MCP6S22 PGA PICtail™ Demo Board is used to evaluate and demonstrate Microchip Technology’s Programmable Gain Amplifier (PGA) family, MCP6S21/2/6/8. This board has a user interface program the MCP6S22 two-channel PGA. It can also be interfaced with Microchip’s PICkit™ 1 Flash Starter Kit Development Board. This platform allows the user to develop firmware that selects the PGA gains and channels using SPI interface.

The demo board can also be used stand-alone, with a user interface that allows the PGA gains and channels to be selected without a firmware development. The board uses a USB interface to communicate with a PC, while the PICkit™ software can be used as a Graphical User Interface (GUI) to display the PGA output voltage.

Products supported
- MCP6S22
- MCP3301
- MCP1701A
- PIC16C745

P/N: MCP6S22DM-PICTL
The single-channel MCP6S21 and six-channel MCP6S26 have been selected for this evaluation board. The PIC16F676 microcontroller is used on-board DIP switch settings that are configured according to the table printed on the evaluation board. This allows the user to program the channel, gain and shutdown of each PGA. Either PGA or both PGAs can be shut down. The six channels of the MCP6S26 and the PGA gains of 1, 2, 4, 5, 8, 10, 16 and 32 V/V can be configured.

### Products supported
- MCP6S21
- MCP6S26
- PIC16F676
The Humidity Sensor PICtail™ Demo Board senses the ambient relative humidity by changes in the capacitance of the humidity sensor (HS1101LF from Humirel). This sensor is connected to a MCP6291 op amp and a resistor to form an inverting (Miller) integrator. The PIC16F690 microcontroller sends a square wave to the input of the integrator, which the integrator converts to a triangle wave at its output. The firmware controls the magnitude of the triangle wave and measure the integration time. The microcontroller measure the time it takes for the triangle wave to rise and fall. These times are converted to a capacitance value.
FilterLab® is an innovative software tool that simplifies active filter design. Available at no cost, the FilterLab® active filter software design tool provides full schematic diagrams of the filter circuit with component values and displays the frequency response.

**Features**
- Allows the design of low-pass filters up to an 8th order filter with Chebyshev, Bessel or Butterworth responses from frequencies of 0.1 Hz to 10 MHz
- Selection of flat passband or sharp transition from passband to stopband
- Options, such as minimum ripple factor, sharp transition and linear phase delay, are available
- Changes in capacitor values can be implemented
- Generates a spice model of the designed filter allowing time domain analysis in spice simulations

**Products supported**
- MCP6xxx
The Signal Analysis PICtail™ Daughter Board works as an extension to the PICkit™ 1 Flash Starter Kit. When combined with the PICkit™ V2.0.0 (or later) firmware and the PICkit™ 1 Signal Analysis PC Application, the Signal Analysis PICtail™ Daughter Board can perform signal analysis capabilities such as:

- Real-time Strip Chart
- Oscilloscope
- Fast Fourier Transformation (FFT)
- Histogram
- Programming

**Products supported**

- PIC16F684
- 25LC640

P/N: AC164120
Active Filter Demo Board Kit

This kit is intended to support active filters designed by FilterLab® V2.0. These filters are all pole and are built by cascading first and second order sections. Higher frequency filters (e.g., a low-pass filter with cutoff at 1 MHz) can have their design initially verified on these boards.

Products supported

- MCP6271
The MCP6XXX Amplifier Evaluation Board 1 is designed to support inverting/non-inverting amplifiers, voltage followers, inverting/non-inverting comparators and inverting/non-inverting differentiators.

Products supported
- MCP6XXX
The MCP6XXX Amplifier Evaluation Board 2 is designed to support inverting/non-inverting summing amplifiers.

- Products supported
  - MCP6XXX

P/N: MCP6XXXEV-AMP2
The MCP6XXX Amplifier Evaluation Board 3 is intended to support the difference amplifier circuits.

Products supported

- MCP6XXX

P/N: MCP6XXXEV-AMP3
The MCP6XXX Amplifier Evaluation Board 4 is designed to demonstrate an inverting integrator using one op amp and supporting circuitry. This section details the conversion of the topology to the MCP6XXX Amplifier Evaluation Board 4. Figure shows the circuit diagram for the board.

Products supported
- MCP6XXX
The MCP6H04 Evaluation Board is intended to support an instrumentation amplifier and show the capability of the MCP6H04 operational amplifier. It uses a quad op amp in a difference amplifier configuration with input buffers and voltage reference. The test points for the power supply, ground, input signals, output signals, and voltage reference allow lab equipment to be connected to the board.
The MCP6V01 Thermocouple Auto-Zeroed Reference Design demonstrates how to use a difference amplifier system to measure electromotive force (EMF) voltage at the cold junction of thermocouple in order to accurately measure temperature at the hot junction. This can be done by using the MCP6V01 auto-zeroed op amp because of its ultra low offset voltage ($V_{OS}$) and high common mode rejection ratio (CMRR).

**Products supported**
- MCP6V01
- MCP9800
- MCP1541
- PIC18F2550
The MCP6V01 Input Offset Demo Board is intended to provide a simple means to measure the MCP6V01/2/3 op amps input offset voltage (\(V_{OS}\)) under a variety of bias conditions. This \(V_{OS}\) includes the specified input offset voltage value found in the data sheet plus changes due to power supply voltage (PSRR), common mode voltage (CMRR), output voltage (\(A_{OL}\)) and temperature (\(I_{VOS}/I_{TA}\)).

**Products supported**
- MCP6V01
- MCP6V03
- MCP6V06
- MCP6V08

P/N: MCP6V01DM-VOS
The MCP651 Input Offset Evaluation Board is intended to provide a simple means to measure the MCP651 op amp’s input offset voltage under a variety of operating conditions. The measured input offset voltage includes the input offset voltage specified in the data sheet plus changes due to: power supply voltage (PSRR), common mode voltage (CMRR), output voltage, input offset voltage drift over temperature and 1/f noise.

The MCP651 Input Offset Evaluation Board works most effectively at room temperature (near +25°C). Measurements at other temperatures should be done in an oven where the air velocity is minimal.

Products supported
- MCP651
- MCP6V01
The MCP6031 Photodiode PICtail™ Plus Demo Board demonstrates how to use a transimpedance amplifier, which consists of MCP6031 high precision op amp and external resistors, to convert photo-current to voltage.
This demo board uses the MCP661 in a very basic application for high-speed op amps; a 50Ω line (coax) driver.

It gives:
- A 30 MHz solution
- High speed PCB layout techniques
- A means to test AC response, step response and distortion

Both the input and the output are connected to lab equipment with 50Ω BNC cables. There are 50Ω terminating resistors and transmission lines on the board.

The op amp is set to a gain of 2V/V to overcome the loss at its output caused by the 50Ω resistor at that point.

Connecting lab supplies to the board is simple; there are three surface mount test points provided for this purpose.

Products supported:
- MCP661
- MCP662
- MCP665
This board demonstrates the performance of Microchip’s MCP6N11 instrumentation amplifier (INA) and a traditional three op amp INA using Microchip’s MCP6V26 and MCP6V27 auto-zeroed op amps. The input signal comes from an RTD temperature sensor in a Wheatstone bridge. Real world interference is added to the bridge’s output, to provide realistic performance comparisons. Data is gathered and displayed on a PC, for ease of use. The USB PICmicro® microcontroller and included Graphical User Interface (GUI) provides the means to configure the board and collect sample data.

**This Kit Contains:**
- 1x MCP6N11 Wheatstone Bridge Reference Design
- 1x Mini USB Cable
The MCP6421 EMIRR Evaluation Board is intended to support the electromagnetic interference rejection ratio (EMIRR) measurement and to show the electromagnetic interference (EMI) rejection capability of the MCP6421 operational amplifier.

Products supported
- MCP6421
The MCP1726 1A LDO Evaluation Board allows the user to evaluate both the fixed and adjustable versions of the part in the 8-pin SOIC and 8-lead 3x3 DFN packages. An on-board potentiometer allows the user to easily set the output voltage of the adjustable voltage version of the device. Status LEDs indicate when input voltage is applied and when the Power Good (PWRGD) output is in a high condition (output voltage is in regulation).

Connection terminals are provided for the input voltage, output voltage, ground, power good and shutdown.

P/N: MCP1726EV
The SOT223-5 Voltage Regulator Evaluation Board is designed to be used to facilitate the evaluation of Microchip’s voltage regulators or to be used as a standalone voltage regulator board. Jumpers have been placed on the board to facilitate testing of specific voltage regulator parameters. The jumpers may also be used to select pull-up and pull-down voltage levels.

**Features:**
- Input and Output headers for future connection to Line Step and Load Step modules
- Ample test points to attach multi-meters, power supplies, and loads
- Jumper to select ground current measurement
- Jumper to select input capacitor
- Jumper to select two different load resistors
- Jumper to select shutdown pin input: $V_{DD}$, GND, or use test point
- Jumper to connect input capacitor to circuit
- SMT0805 PCB footprints for user Power-Good pull-up resistor
- SMT0805 PCB footprints for user Adjustable Voltage resistor divider
- SMT0805 PCB footprints for user Bypass Capacitor

**Products supported**
- MCP1790
- MCP1824
- MCP1825
- MCP1826

P/N: SOT223-5EV-VREG
SOT23-3 Voltage Regulator Eval Board

The SOT23-3 Voltage Regulator Evaluation Board is designed to evaluate and test voltage regulators. By soldering the desired device to the evaluation board, the user can easily validate several parameters of the device.

The SOT23-3 Voltage Regulator Evaluation Board does not come with a voltage regulator soldered onto the board. This allows the user to attach the voltage regulator of their choosing to the board and perform quiescent current, ground current, Power Supply Ripple Rejection (PSRR), and other desired tests.

The SOT23-3 Voltage Regulator Evaluation Board is based upon a modular concept which will allow the user to plug in additional boards to increase the test capability of the voltage regulator.

Features:
• Input and Output headers for future connection to Line Step and Load Step Modules
• Ample test points to attach multimeters, power supplies, and loads
• Jumper to select ground current measurement
• Jumper to connect output load resistor
• Jumper to connect input capacitor to circuit
• Jumper to select one of two device pinouts

P/N: SOT23-3EV-VREG

Products supported
- MCP1701A
- MCP1702
- MCP1703
The TO220-3 / TO263-3 Voltage Regulator Evaluation Board is designed to provide functional evaluation of Microchip Voltage Regulators that utilize the TO220-3 and TO263-3 package. The TO220-3 / TO263-3 Voltage Regulator Evaluation Board does not come with a voltage regulator soldered onto the board. This allows the user to attach the voltage regulator of their choosing to the board and perform quiescent current, ground current, PSRR, and other desired tests.

**Products supported**
- MCP1790
- MCP1825S
- MCP1826S
- MCP1827S

P/N: TO263-3EV-VREG
The SOT89-3 Voltage Regulator Evaluation Board is designed to provide functional evaluation of Microchip Voltage Regulators that utilize the SOT89-3 package. The SOT89-3 Voltage Regulator Evaluation Board does not come with a voltage regulator soldered onto the board. This allows the user to attach the voltage regulator of their choosing to the board and perform quiescent current, ground current, PSRR, and other desired tests.

**Products supported**
- MCP1700
- MCP1701A
- MCP1702
- MCP1703
The TC1016/TC1017 LDO Evaluation Board is used to evaluate Microchip’s TC1016 and TC1017, 80mA and 150mA, Low-Dropout (LDO) regulators. This evaluation board contains one circuit for the 5-pin SC-70 package (3.0V output voltage device) and one for the 5-pin SOT-23 package (1.8V output voltage device). Any output voltage version of either device can be used in both circuits. Both LDOs on the TC1016/TC1017 LDO Evaluation Board are the TC1017 devices.

**Products supported**
- TC1016
- TC1017
The MCP1710 Demo Board demonstrates how the MCP1710 device operates over a wide input voltage and load range. Test points are provided for input and output, allowing the demo board to be connected directly to a system. A copper via connected to the EN input can be used to turn the MCP1710 on and off. Turning the device on, (EN > 70% of VIN) will enable the device. When the EN pin is less than 30% of VIN, the device output is turned off.

**Features:**
- Output Voltage set to 3.0V
- 200 mA Output Current
- EN Input Test Point
- Input Voltage Range 2.5V to 5.5V
- Ultra Low Quiescent Current of 20 nA
- Low-Dropout Voltage: 450 mV Maximum at 200 mA
The MCP1256/7/8/9 Charge Pump Evaluation Board is an evaluation and demonstration tool for Microchip Technology’s MCP1256/7/8/9 Regulated 3.3V Low-Ripple Charge Pumps with low-operating current SLEEP mode or BYPASS mode. The design provides for dynamic versatility.

Products supported
- MCP1256
- MCP1257
- MCP1258
- MCP1259
The MCP1252 Charge Pump Backlight LED Demo Board demonstrates the use of a charge pump device in a LED application. The board also serves as a platform to evaluate the MCP1252 device generally.

**Products supported**
- MCP1252
The MCP1252/3 Evaluation Board is an evaluation kit designed to support Microchip’s MCP1252*33X50, MCP1252-ADJ, MCP1253-33X50 and MCP1253-ADJ low noise, positive-regulated charge pump devices.

**Products supported**
- MCP1252
- MCP1253

P/N: MCP1252/3EV
The MCP1612 is a 1A, 1.4 MHz, fully integrated buck regulator. The output voltage is selectable from 0.8V to $V_{\text{IN}}$ by use of an external resistor divider.

The MCP1612 Evaluation Board contains two independent buck regulators featuring the 8-pin MSOP and 8-pin DFN packages. The output voltage is set to one of eight different preset values (four per regulator circuit) by use of a two-position DIP switch. Each regulator circuit can supply an output current of 0 to 1A.
The MCP1601 is a 500mA synchronous buck regulator. Both the high-side buck P-channel and the low-side N-channel switches are integrated within the device. The integrated synchronous switch makes the MCP1601 very efficient, even when converting unregulated input voltages to low-voltage, fixed outputs. This evaluation board is designed for a wide range of output voltages and currents. For specific applications, smaller inductors, shielded inductors, tantalum capacitors and different output voltage settings can improve the total DC/DC converter performance and cost.

Products supported
- MCP1601

P/N: MCP1601EV
The MCP1602 Evaluation Board demonstrates the features and capabilities of Microchip's MCP1602 Evaluation Board 500mA PFM/PWM Synchronous Buck Regulator. The MCP1602 is a step-down (Buck) switching regulator with a Power-Good monitor to provide a highly integrated solution for systems that require supply voltage between 0.8V to 4.5V. The MCP1602 requires input voltage range from 2.7V to 5.5V. The MCP1602 Evaluation Board includes a MCP1602 circuit that has a Shutdown feature and a 4-position Dip Switch to select between different output voltages. MCP1602 Evaluation Board is available in 0.8V, 1.2V, 1.8V, 2.5V and 3.3V. Additional test points are available on the MCP1602 Evaluation Board for reviewing the performances and features of MCP1602 Evaluation Board.
The MCP1603 Buck Converter Evaluation Board is designed to demonstrate Microchip's MCP1603 in an adjustable output voltage configuration. The MCP1603 is a 500mA synchronous buck regulator that features both Pulse Frequency Modulation (PFM) and Pulse Width Modulation (PWM). The PFM mode is used at light loads to improve system efficiency, while the 2.0 MHz PWM mode is entered at heavy loads. The transition between PFM and PWM modes automatically occurs without any external intervention. The MCP1603 is available in both adjustable parts that require an external divider to set the output voltage and fixed output voltage parts.

Features:
• Compact size and low profile 500mA Converter design
• Wide Input voltage range from 2.7V to 5.5V
• Five different output voltage settings: 0.8V, 1.8V, 2.5V, and 3.3V
• Test points for connecting input voltage source and external load

P/N: MCP1603EV
The MCP1603 Tiny Reference Design Board demonstrates the use of Microchip’s MCP1603 device in a step-down application. The evaluation board is a fully functional platform to evaluate the MCP1603 buck regulator over the input voltage, output voltage and current range of the device. The evaluation board is designed to show off one of the main advantages of MCP1603 – its small size. Test points are provided to allow easy connection of the input voltage source and the output load.
MCP16301 High Voltage Buck Converter Demo Board

MCP16301 High Voltage Buck Converter 600 mA Demo Board supports the development of MCP16301 device. The MCP16301 is a highly integrated, high-efficiency, fixed frequency, step-down DC-DC converter in a popular 6-pin SOT23 package that operates from input voltage sources up to 30V. Integrated features include a high-side switch, fixed-frequency peak-current mode control, internal compensation, peak current limit and over-temperature protection. Minimal external components are necessary to develop a complete step-down DC-DC converter power supply.
Demo board supporting the development of MCP16301 high input voltage, 300mA, D2PAK buck converter.

This Kit Contains:
• MCP16301 300mA D2PAK Demo Board

Products supported
- MCP16301
The MCP16301 High-Voltage Single-Inductor Cuk LED Driver Demo Board is designed to operate from a 6V to 18V input and regulate the output current to 300 mA. Test points for input power are provided to demonstrate the capability of the demo board over the entire range. The demo board was designed using small surface-mount components to show application size for a high-voltage single-inductor Cuk LED driver design. Compared with the traditional asynchronous buck converter, the MCP16301 High-Voltage Single-Inductor Cuk LED Driver Demo Board has an additional resistor and capacitor for compensation.

Features:
- 6V to 18V Input Voltage
- Input voltage can be lower or higher than the output voltage
- 300 mA output current
- Four 3W LEDs
- Dimming can be achieved by pulsing the enable pin on the MCP16301

P/N: ARD00410

Products supported
- MCP16301
The MCP16301 5V/600mA Low Noise Evaluation Board is used to demonstrate a high voltage input DC-DC converter design, which can deliver high efficiency, while minimizing high-frequency switching noise. The board steps down high input voltages, up to 30V, to a low output voltage, having more than 90% efficiency and a minimum of 30 mV output ripple. High-frequency input/output noise generated by the switching converters can reach high-noise levels that interfere with other devices powered from the same source. The high amplitude of high-frequency noise can disturb some RF systems. High efficiency is achieved with the MCP16301 buck converter by switching the integrated N-Channel MOSFET at a high speed. The evaluation board is optimized for 12V Input and 100 mA load.

**Features:**
- Input voltage: 6 to 30V
- Output voltage: 5V
- Output capability: 600 mA load current
- Output ripple plus noise: 30 mV\textsubscript{p-p} @ 12V input and 100 mA load
- Low radiated noise
- Efficiency: up to 91% @ 12V input
The MCP16301 High Voltage Buck-Boost Demo Board is designed to operate from a 5V to 30V input and regulate the output to 12V. Test points for input power and load are provided to demonstrate the capability of the demo board over the entire range. The MCP16301 High Voltage Buck-Boost Demo Board was designed using small surface-mount components to show application size for a high voltage buck-boost design.

**Features:**
- Input Voltage Range: 4.0V to 30V
- Output Voltage Range: 2.0V to 15V
- Up to 96% Typical Efficiency
- 2% Output Voltage Accuracy
- Integrated N-Channel Switch: 460 mΩ
- 500 kHz Fixed Frequency
The MCP16311/2 Synchronous Buck Converter Evaluation Board is used to evaluate and demonstrate Microchip Technology’s MCP16311/2 product. This board demonstrates the MCP16311 (PFM/PWM – low quiescent current) and the MCP16312 (PWM only – low output voltage ripple) in two buck converter applications with two output voltages. It can be used to evaluate both package options: 8LD MSOP and 8LD 2 x 3 TDFN. The MCP16311/2 Synchronous Buck Converter Evaluation Board was developed to help engineers reduce the product design cycle time. Two common output voltages can be selected: 3.3V and 5.0V. The first converter with the 8LD MSOP package is a PWM/PFM device with a fixed output of 3.3V, while the second converter with the 2 x 3 8LD TDFN package is a PWM-only device, with a fixed output of 5V.

Features:
- Input Voltage Range (VIN): 4V to 30V
- Fixed Output Voltage: 3.3V and 5.0V
- Output Current: Typically 1A @ 3.3V Output, 12V Input
- Automatic PFM/PWM Operation for MCP16311, or PWM-only for MCP16312
- PWM Switching Frequency: 500 kHz
- Internal Compensation
- Internal Soft Start
- Overtemperature Protection

Products supported
- MCP16311
- MCP16312
The MCP16321 Evaluation Board is designed to operate from a 6V to 24V input and regulate the output to 3.0V. Test points for input power and load are provided to demonstrate the capability of the MCP16321 Evaluation Board over the entire range. The MCP16321 Evaluation Board was designed using small surface-mount components to show application size for a high-voltage buck design.

Features:
- 6V to 24V Input
- 3.0V Output
- 1A Maximum Output Current

Products supported
- MCP16321
The MCP16322 Evaluation Board is designed to operate from a 6V to 24V input and regulate the output to 3.0V. Test points for input power and load are provided to demonstrate the capability of the MCP16322 Evaluation Board over the entire range. The MCP16322 Evaluation Board utilizes small surface-mount components to show application size for a high-voltage buck design.

**Features:**
- 6V to 24V Input
- 3.0V Output
- 2A Maximum Output Current

**Products supported**
- MCP16321
- MCP16322
The MCP16323 Evaluation Board is designed to operate from a 6V to 18V input and regulate the output to 3.0V. Test points for input power and load are provided to demonstrate the capability of the MCP16323 Evaluation Board over the entire range. The MCP16323 Evaluation Board was designed using small surface-mount components to show application size for a high-voltage buck design.

**Features:**
- 6V to 18V Input
- 3.0V Output
- 3A Maximum Output Current

**Products supported**
- MCP16323
The MCP16331 Buck Converter Evaluation Board is used to evaluate and demonstrate Microchip Technology’s MCP16331 product in the SOT-23 package. This board demonstrates the MCP16331 in a buck-converter application with two selectable output voltages. Test points are provided for the input and output, allowing the board to be connected directly to a system. Additional test points are provided to access the EN pin, in order to modify the state of the converter and also access the SW pin, in order to see the switching waveform. The MCP16331 High-Voltage Buck Converter Evaluation Board was developed to help engineers reduce product design cycle time.

Features:
• Input voltage range, VIN: 6V to 50V
• Converter can be turned on/off by using a jumper
• Fixed output voltage: 3.3V or 5.0V (selectable)
• Typical output current: 500 mA
• PWM Switching Frequency = 500 kHz
• Internal compensation
• Internal soft-start
• Over-temperature protection
The TC1303B Dual-Output Regulator with Power-Good Output Demo Board can be used to evaluate the TC1303B device over the input voltage range and output current range for both the synchronous buck regulator output and the low-dropout linear regulator output.

Test points are provided for input power, output loads, shutdown control and power-good monitoring.

P/N: TC1303BDM-DDBK1
The TC1303C DFN Adjustable Output demo board demonstrates the use of Microchip's TC1303C device in applications that require dual supply voltage. The demo board is used to evaluate the TC1303C device over the input voltage range, output voltage and current range for both the synchronous buck regulator output and the low dropout linear regulator output.
The MCP1632 300 kHz Boost Converter Demo Board is a compact, highly efficient, step-up voltage converter that will convert the input voltage rail (typically 5V) to a regulated 12V output voltage. The maximum output current for this demo board is 0.9A. The board demonstrates the capabilities of the MCP1632 PWM controller. Test points for various signals are provided for measuring different parameters of the converter. The Demo Board can be modified to support output voltages from 9V to 15V by changing a single resistor.

**Features:**
- Input Voltage Range: 3.6V to 5.5V
- Output Voltage: 12V (9V to 15V adjustable)
- Maximum Output Current: 0.9A
- 90% typical efficiency at 12V/0.8A output and 5V input
- 300 kHz fixed switching frequency
- Overcurrent Protection for MOSFETs
- Shutdown input for low-power Standby mode
- UVLO with 2.7V and 2.8V typical thresholds

**Products supported**
- MCP1632

P/N: ADM00530
The MCP1650 SEPIC Demo Board is a complete, step-up or step-down, Switch mode, DC-DC power converter. The MCP1650 SEPIC Demo Board generates a regulated 5.0V output at load currents up to 160mA. The SEPIC topology has the ability to step-up or step-down the input voltage. The input voltage range for the MCP1650 SEPIC Demo Board is from 3.0V to 7.0V. Test points are provided for input power, output load and shutdown control.

Products supported

- MCP1650
The MCP1650 Multiple White LED Demo Board demonstrates the use of a conventional boost topology in a LED application. The board also serves as a platform to evaluate the MCP1650 boost controller.

**Products supported**
- MCP1650
- PIC10F202
The MCP1650 Boost Controller Evaluation Board is used to evaluate and demonstrate Microchip Technology’s MCP1650/51/52/53 Boost Controller product family. This board used the MCP1650/51/52/53 in two high-power, boost-converter applications. The first application features the MCP1651 98-pin MSOP0 with the low battery detect feature. The input voltage for the MCP1651 application is 2.8V to 4.8V, with the output boosted to 5V. The second application uses the MCP1653 (10-pin MSOP), which features both the low battery detect and power good features. The input voltage for this application is 3.3V with the output boosted to 12V.

Products supported:
- MCP1650
- MCP1651
- MCP1652
- MCP1653

P/N: MCP1650EV
MCP19035 300 kHz Buck Controller Eval Board

The MCP19035 300 kHz Synchronous Buck Controller Evaluation Board is a compact, highly efficient, step-down voltage regulator that will convert the input voltage rail (typically 12V) to 1.8V regulated output voltage. The maximum output current for this step-down converter is 15A. The board demonstrates the capabilities of the MCP19035 300 kHz synchronous buck converter, as well as Microchip's high-performance power MOSFET transistors. Test points for various signals are provided for measuring different parameters of the converter. The evaluation board can be modified to support output voltages from 0.9V to 3.3V by changing a single resistor. Microchip's companion Power MOSFETs are used in the design.

Products supported
- MCP19035
- MCP87050
- MCP87022

P/N: ADM00434
The MCP19035 600 kHz Synchronous Buck Controller Evaluation Board is a compact, highly efficient, step-down voltage regulator that will convert the input voltage rail (typically 12V) to 1.8V regulated output voltage. The maximum output current for this step-down converter is 10A. The board demonstrates the capabilities of the MCP19035 600 KHz Synchronous Buck Converter, as well as Microchip's high-performance power MOSFET transistors. Test points for various signals are provided for measuring different parameters of the converter. The evaluation board can be modified to support output voltages ranging from 0.9V to 3.3V by changing a single resistor.

**Features:**
- Input Voltage Range: 8V to 14V
- Output Voltage: 1.8V (can be adjusted by changing one resistor between 0.9V and 3.3V)
- Maximum Output Current: 10A
- 88% typical efficiency at 1.8V/10A output and 12V input
- 600 kHz fixed switching frequency
- On-board High Performance Power MOSFET Transistors
- Overcurrent Protection for High and Low-Side MOSFETs
- Power Good (PGOOD) output for monitoring the output voltage quality
- Shutdown input for placing the converter in low-power standby mode
- Under Voltage Lockout (UVLO) with 4.2V and 3.6V typical thresholds

**Products supported**
- MCP19035
- MCP87050
- MCP87022
The MCP19111 Evaluation Board demonstrates how the MCP19111 device operates in a synchronous buck topology over a wide input voltage and load range. Nearly all operational and control system parameters are programmable by utilizing the integrated PIC microcontroller core. MPLAB X IDE can be used in conjunction with a Graphical User Interface (GUI) plug-in to easily configure the MCP19111. Alternatively, the user can program the MCP19111 using their own firmware, tailoring it to their application. The evaluation board contains headers for ICSP™ (In-Circuit Serial Programming™) as well as I²C communication, pull-up and pull-down resistor pads and test point pads on each GPIO pin, and two push buttons for system development.
The MCP19114 Flyback Standalone Evaluation Board and Graphical User Interface (GUI) demonstrate the MCP19114 performance in a synchronous Flyback topology. It is configured to regulate load current, and is well suited to drive LED loads. Nearly all operational and control system parameters are programmable through the integrated PIC MCU core. The MCP19114 evaluation board comes preprogrammed with firmware designed to operate with the GUI interface. Microchip’s MPLABX IDE (Integrated Development Environment) can be used to develop and program user-defined firmware, thus customizing it to the specific application. The evaluation board contains headers for ICSPTM (In-Circuit Serial Programming) as well as I2C™ communication. Several test points have been designed into the PWB for easy access and development purposes. The MCP19114-Flyback Standalone Evaluation Board also demonstrates an optimized PCB (Printed Circuit Board) layout that minimizes parasitic inductance, while increasing efficiency and power density. Proper PCB layout is critical to achieve optimum MCP19114 operation as well as power train efficiency and noise minimization.

**Features**
- Ceramic and bulk capacitors on the input reduce RMS ripple current and tame input voltage deviation caused by load transients
- Ceramic capacitors on the output reduce voltage ripple and provide energy to the output while the primary side is being re-energized
- PC software provides simple interface to evaluating the evaluation board
- Vin range: 8V to 14V
- Adjustable Vout range: 0V to 50V
- Maximum output current: 500mA with proper air flow
- Programming and I2C communication headers

P/N: ADM00578
The MCP1640 Synchronous Boost Converter Evaluation Board uses the MCP1640 in a high-efficiency (up to 96%), fixed frequency (500MHz), step-up DC-DC converter. It demonstrates:

- Easy-to-use and minimum number of external components power supply solution for applications powered by one-cell, two-cell, or three-cell alkaline, NiCd/NiMH; one-cell Li-Ion or Li-Polymer batteries
- Selection of the best operating mode for efficiency (PWM/PFM)
- A wide input voltage range (0.35 to 5.5V) and low start-up voltage (0.65V)
- PCB layouts recommendation for SOT23-6 and 2x3mm-8 DFN packages
- Three common output voltages to evaluate: 2.0V, 3.3V and 5.0V enable selection (when disabled, the MCP1640 disconnects the path from input to output for “true-disconnect”).

P/N: MCP1640EV-SBC

Products supported

- MCP1640
The MCP1640 Single Quadruple-A Battery Boost Converter Reference Design demonstrates how the MCP1640 device, with the True Output Disconnect Shutdown option, works attached to a microcontroller application. This board demonstrates how to optimize battery life using the MCP1640, and an 8-bit low cost PIC microcontroller, to reduce the No Load Input Current for applications that operate in Standby mode for a long period of time. During Standby, the enable signal for the MCP1640 has a low frequency, with less than 1% positive duty cycle. This maintains the output of the MCP1640 device up to 2.3V, which is sufficient to keep the PIC microcontroller live. This solution reduces up to 80% of the No Load Input Current the MCP1640 consumes in PFM Mode.

Products supported
- MCP1640
- PIC12F617
The MCP1640 12V/50 mA Two Cells Input Boost Converter Reference Design is designed to demonstrate the MCP1640 device’s high-voltage boost capability above its typical output range of 5.5V. This board boosts the low-voltage input to 12V and up to 70 mA load. By changing specific resistors, a lower/higher output than 12V can be obtained. The MCP1640 Input Boost Converter was developed to help engineers reduce product design cycle time. At 2.0V input and 12V output, the board is capable of a maximum of 50 mA load current.

This Kit Contains:
• 1x MCP1640 12V/50 mA Two Cells Input Boost Converter Board

Products supported
- MCP1640B
The MCP1643 Synchronous Boost LED Constant Current Regulator Evaluation Board is used to evaluate and demonstrate Microchip Technology’s MCP1643 device. This board demonstrates the MCP1643 in a boost converter application supplied by one AA battery, or from an external voltage source, which drives an LED with three selectable currents. This evaluation board was developed to help engineers reduce the product design cycle time. Four output currents can be selected: 25, 50, 75 and 100mA. The output current can be changed with a dual switch that changes the external LED current sense equivalent resistance. An enable switch is used to enable and disable the converter. When enabled, the MCP1643 will regulate the output current; when disabled, the MCP1643 disconnects the path from input to output for “true-disconnect”. In this state, the current consumed from the battery is 1 µA, typically.

Features:
• Can be powered by one-cell Alkaline, NiCd, or NiMH batteries, or by external power supply
• Input voltage range, $V_{IN}$: 0.35V to 2.5V, with $V_{IN} < V_{OUT}$
• Start-up voltage: 0.65V
• Fixed output current: 25 mA 50 mA, 75 mA or 100 mA, selected
• PWM Switching Frequency: 1 MHz
• Mechanical battery reverse polarity protection

P/N: ADM00435

Products supported

- MCP1643
The MCP16251 and MCP1640B Synchronous Boost Converters Evaluation Board is used to evaluate and demonstrate Microchip Technology’s MCP16251 and MCP1640B products. This board demonstrates the MCP16251/MCP1640B in two boost-converter applications with multiple output voltages. It can be used to evaluate both package options (SOT-23-6 and 2x3 mm 8-(T)DFN). The MCP16251 and MCP1640B Synchronous Boost Converters Evaluation Board was developed to help engineers reduce the product design cycle time. Three common output voltages can be selected: 2.0V, 3.3V and 5.0V. The output voltage can be changed with a mini-dip switch that changes the external resistor divider. A switch connected to the EN pin is used to enable and disable the converters. When enabled, the MCP16251/MCP1640B will regulate the output voltage; when disabled, the MCP16251/MCP1640B disconnects the path from input to output for “true-disconnect”.

**Features:**

- Can be powered by one-cell, two-cell, or three-cell alkaline, NiCd, NiMH, one-cell Li-Ion or Li-Polymer batteries
- Input voltage range (V\text{IN}): 0.35V to 5.5V, with V\text{IN} \leq V\text{OUT}
- Fixed output voltage: 2.0V or 3.3V and 3.3V or 5.0V, selected using a mini-dip switch on board
- Output current: typical 125 mA @ 3.3V Output, 1.5V Input or 200 mA @ 5.0V Output, 3V Input

**Products supported**

- MCP16251
- MCP1640B

P/N: ADM00458
The TC115 Evaluation Board is a complete, step-up, switch-mode, dc-dc power converter. The TC115 Evaluation Board generates a regulated 3.0V output at load currents up to 110mA. Different output voltages are obtainable by replacing the fixed 3.0V output with a fixed 3.3V or 5.0V device. Since the TC115 operate from a minimum input voltage of 0.9V, the input voltage can be provided by a single-cell battery.
This board demonstrates the MCP1662 in a boost-converter application supplied by two AA batteries, or from an external voltage source, which drives a string of LEDs with three selectable currents: 30 mA, 60 mA and 90 mA. The output current can be changed with a dual switch that changes the external LED current sense equivalent resistance (RSET). An enable switch is used to enable and disable the converter. When enabled, the MCP1662 will regulate the output current; when disabled, the current consumed from the battery by the device is typically less than 20 nA.

Features:
- Can be powered by two-cell Alkaline, NiCd, NiMH or Lithium AA cell batteries
- Input Voltage range (V IN): 2.4V to 5.5V,
- Undervoltage Lockout: 2.3V to Start; 1.85V to Stop
- Adjustable Output Current: 30 mA, 60 mA or 90 mA, selected using a dual switch on-board
- PWM Switching Frequency: 500 kHz
- Enable converter using switch on board
- 1.3A Peak Input Current Limit
- Overtemperature Protection
- Open Load Protection in case of: LED fail or FB disconnected/fault
The MCP1661 High-Voltage Boost and SEPI Converters Evaluation Board is used to evaluate Microchip Technology’s MCP1661 product. This board demonstrates the MCP1661 capabilities in two different topologies:

- 12V output Boost Converter application supplied from an external voltage source (VIN < 5.5V, e.g., two cell boost to 12V)
- 3.3V output SEPI Converter application supplied from a Li-Ion Cell. It can be used to evaluate the SOT-23-5 package. The MCP1661 High-Voltage Boost and SEPI Converters Evaluation Board was developed to help engineers reduce product design cycle time.

In both the MCP1661 Boost Application and MCP1661 SEPI Application, the output voltage is set to the proper value using an external resistor divider, resulting in a simple and compact solution.

In the MCP1661 SEPI Application, a switch is used to enable and disable the converter. When enabled, the MCP1661 will regulate the output voltage; when disabled, the MCP1661 SEPI Application will disconnect the path from input to output.

Features:

- MCP1661 device can be evaluated in two separate applications: Boost and SEPI
- Start-up Voltage: 2.3V (UVLO Start)
- Input Voltage range (VIN) after start-up: 2.4V to 5.5V,
- Output Voltage:
  - 12V (for MCP1661 Boost Application)
  - 3.3V (for MCP1661 SEPI Application)
- Output Current: typical 125 mA @ 12V Output, 3.3V Input (Boost)
The TC110 Boost Converter Demo Board can charge Li-Ion Batteries with single-cell Alkaline battery or 2-cell Alkaline battery at maximum 500mA constant current. The TC110 Boost Converter Demo Board is used to evaluate Microchip’s TC110 PFM/PWM Step-Up DC/DC Controller. The TC110 is a step-up (Boost) switching controller that can regulate output voltage with a typical start-up voltage of 0.9V. The TC110 Boost Converter Demo Board also includes a MCP73832 Miniature Single-Cell, Fully Integrated Li-Ion, Li-Polymer Charge Management Controllers. Microchip’s MCP73832 is a highly advanced linear charge management controller used in space-limited, cost-sensitive applications.
Microchip and Accelerated Designs Inc. have collaborated together to provide Microchip customers with schematic symbols and PCB footprints for Microchip products.

Both PCB footprints and schematic symbols are available for download in a vendor neutral format which can then be exported to the leading EDA CAD/CAE design tools using the Ultra Librarian Reader. The reader is available for free download.

Providing components based on parametric data through the Ultra Librarian Reader will allow Microchip customers to reliably create consistent quality CAD entities to an established standard with minimal effort. It is anticipated that this free download service will save Microchip’s customers significant time.
The MCP1630 Dual Buck Demo Board is a complete, stand-alone, dual-output power supply capable of 20A per output, powered from a +12V input source. This board utilizes Microchip’s MCP1630 (high-speed PIC® MCU PWM MSOP8), PIC16F684 (MCU Flash TSSOP13), MCP6231U (Op Amp SC-70) and TC6501 (Temperature Switch SOT23A-5). The input voltage range for the demo board is +9.0V to +13.5V. Both adjustable regulated outputs are capable of 20A.
The MCP1630 1A Bias Supply Demo Board is a complete, step-down, switch-mode, DC-DC power converter. The demo board generates a regulated output voltage for systems requiring a bias of 3.3V or 5V at load currents up to 1A. Different output voltages can be obtained with minor modifications to the firmware and/or hardware.

Products supported
- MCP1630
- MCP1701A
- PIC10F200
The MCP1630 Coupled Inductor Boost Converter Demo Board demonstrates Microchip’s High-Speed Pulse Width Modulator (PWM) used in a coupled inductor design. When used in conjunction with a microcontroller, the MCP1630 device will control the power system duty cycle to provide different regulated output voltages using push button S1. The PIC12F683 microcontroller is used to generate oscillator pulses, can also be programmed to monitor the board ambient temperature using the MCP9700 Linear Active Thermistor™ device and provide different regulated output voltages for different thermal readings. The MCP1630 device generates duty cycle based on various external inputs. External signals include the input oscillator pulses, reference voltage from PIC12F683 device, and the feedback voltage. The output signal is a square-wave pulse given to drive the MOSFET.

Products supported
- MCP1630
- PIC12F683
- MCP9700

P/N: MCP1630DM-DDBS2
MCP1630 Boost Mode LED Driver Demo Board

The MCP1630 Boost Mode LED Driver Demo Board is a step-up, switch-mode, DC-DC converter used for power LED applications. The demo board provides a 350mA or 700mA constant current source. Other output currents can be obtained with minor modifications to the board. The demo board utilized Microchip's MCP1630V high-speed pulse width modulator (PWM). The 8-pin MCP1630 device contains the analog components necessary for an analog switch-mode control loop including an error amplifier, PWM comparator, and a high current driver pin. The switching frequency and maximum duty cycle for the MCP1630V are determined by an external clock source. An 8-pin PIC12F683 microcontroller is used to provide a 500 kHz switching clock for the MCP1630V. In addition, the PIC12F683 firmware supervises the circuit output voltage and can optionally dim the LEDs when a potentiometer is attached.

Features:
- Compact size with high output power
- High efficiency over entire operating input voltage range
- Selectable output current: 350mA or 700mA
- Maximum output power: 30W
- Optional software dimming control
- Factory programmed source code provided
- Switching frequency, maximum duty cycle, and MCP1630 reference voltage can be modified in firmware

P/N: MCP1630DM-LED2

Products supported
- MCP1630V
- PIC12F683
- MCP1702

<< BACK to Switching Controller Boards
The MCP1630 Automotive Input Boost Converter Demo Board demonstrates the use of a conventional boost topology with automotive input. The board also serves as a platform to evaluate the MCP1630/V devices.

The MCP1630/V inputs were developed to be easily attached to the I/O of a microcontroller. The microcontroller unite (MCU) supplies the oscillator pulses and reference voltage ($V_{REF}$) to the MCP1630/V devices to provide the most flexible and adaptable power system. The power system switching frequency and maximum duty cycle are set using the I/O of the MCU. The reference input to the high-speed PWM can be external, a D/A Converter (DAC) output or as simple as an I/O output from the MCU. This enables the power system to adapt to many external signals.

The board utilizes Microchip's MCP1630/V integrated with the PIC12F683 Flash-based MCU. The converter is capable of delivering an output voltage of 36.5V at 400mA load current with maximum power of 14.6W.

Products supported
- MCP1630
- PIC12F683
The MCP1630 Automotive Input Triple Output Converter Demo Board demonstrates the use of a SEPIC topology for Automotive applications. The board also serves as a platform to evaluate the MCP1630 device.

Products supported:
- MCP1630
- PIC12F683
The MCP1630 Low-Cost Li-Ion Battery Charger is used to evaluate Microchip’s MCP1630 in a SEPIC power converter application. As provided, the MCP1630 Low-Cost Li-Ion Battery Charger is capable of charging a single-cell, Li-Ion battery pack form an input voltage of 6V to 18V. The MCP1630 Low-Cost Li-Ion Battery Charger provides a constant current, constant voltage charge with preconditioning, cell temperature monitoring and battery pack fault monitoring. Also, the charger provides a status or fault indication. The MCP1630 Low-Cost Li-Ion Battery Charger automatically detects the insertion or removal of a battery pack.

Products supported
- MCP1630
- MCP6292
- PIC12F683
The MCP1630 Low-Cost NiMH Battery Charger Reference Design is used to charge three series cell NiMH or NiCd batteries. The board uses the MCP1630 high-speed analog PWM and PIC12F683 to generate the charge algorithm for NiMH or NiCd batteries.

Products supported:
- MCP1630
- MCP6292
- PIC12F683
- MCP1702

P/N: MCP1630RD-NMC1
The MCP1630 Li-Ion Multi-Bay Battery Charger is a complete, stand-alone, constant-current, constant-voltage battery charger for single-cell Li-Ion battery packs. Different battery chemistries (i.e. three NiMH or NiCd batteries connected in series) can be charged with minor modifications to the firmware. This board utilizes Microchip’s MCP1630 high-speed PWM, MCP6292 dual op-amp and PIC18F2410 Flash MCU. The input voltage range is 10V to 28V. The output is capable of charging at a fast-charge rate of 2A constant current.

Products supported
- MCP1630
- MCP6292
- PIC18F2410

P/N: MCP1630RD-LIC1
The MCP1630 NiMH Demo Board is a complete stand-alone constant current battery charger and simple fuel gauge for four NiMH series batteries. This board utilizes Microchip’s MCP1630 high-speed PWM, MCP1700 LDO Regulator, MCP6042T Op-Amp, PIC16LF818 Flash MCU, TC54 Voltage detector and TC1047A Temperature-Voltage Converter. The input voltage range for the demo board is 8V to 15V. The output is capable of charging four NiMH batteries with up to 1.6V per cell at a fast charge rate of 500mA constant current.

**Products supported**
- MCP1630
- MCP6042
- TC1047A
- MCP1700
- TC54
- PIC16LF818
The MCP163V Bidirectional 4 Cell Li-Ion Charger Reference Design demonstrates the use of a bidirectional buck-boost converter used to charge multiple series cell Li-Ion batteries with the presence of an input source (boost) and provide a regulated output voltage when the input source is removed (buck). The board also serves as a platform to evaluate the MCP1630V device.

Products supported
- MCP1630V
- MCP6022
- PIC16F88
The MCP1631 Multi-Chemistry Battery Charger Reference Design is a complete stand-alone constant current battery charger for NiMH, NiCd or constant current / constant voltage for Li-Ion battery packs. When charging NiMH or NiCd batteries, the reference design is capable of charging one, two, three or four batteries connected in series. If Li-Ion chemistry is selected, the board is capable of charging one or two series batteries. This board utilizes Microchip’s MCP1631HV (high-speed PIC® MCU PWM TSSOP-20) and PIC16F883 (28 pin SSOP). The input voltage range for the demo board is 5.5V to 16V.
The MCP1631HV Digitally Controlled Programmable Current Source Reference Design is used to drive and dim one or more power LEDs in a series or parallel topology (depending on the LED’s capability). The reference design may also be used to charge one to four cell NiMH/NiCd or one to two cell Li-Ion battery packs. The board uses the MCP1631HV high-speed analog PWM controller and PIC16F616 microcontroller to generate the proper dimming ratio for LEDs or charge algorithm for NiMH, NiCd and Li-Ion batteries. The boards is used to evaluate Microchip’s MCP1631HV in a SEPIC power converter application.
The MCP73831 Evaluation Board is an evaluation and demonstration tool for Microchip’s MCP73831 miniature single-cell, fully-integrated Li-Ion, Li-Polymer charge-management controllers.

Two evaluation boards are provided in the MCP73831 Evaluation kit. The boards are set up to evaluate simple, stand-alone, linear charging of single-cell Li-Ion/Li-Polymer battery packs (the battery packs are not included). Each board design provides constant current charging followed by constant voltage charging with automatic charge termination. In addition, the MCP73831-2AC board provides preconditioning of deeply depleted cells.
The MCP73833 Li-Ion Battery Charger Evaluation Board is an evaluation and demonstration tool for Microchip’s MCP73833/4 Stand-Alone Linear Li-Ion/Li-Polymer Charge Management Controllers.

The evaluation board has two circuits provided with one circuit fully assembled and tested. Each circuit is set up to evaluate simple, stand-alone, linear charging of single cell Li-Ion/Li-Polymer battery packs (the battery packs are not included).

The circuits can be evaluated independently. Each circuit design provides constant current charging followed by constant voltage charging with automatic charge termination and battery temperature monitoring. In addition, the assembled MCP73833/4-FC circuit provides preconditioning of deeply depleted cells.

**Products supported**

- MCP73833
- MCP73834
The MCP73855 Evaluation Board is an evaluation and demonstration tool for Microchip Technology’s MCP73855 USB Compatible Li-Ion/Li-Polymer Charge Management Controller. The design provides for dynamic versatility while being able to handle accurate measurements. The MCP73855 Evaluation Board allows for the evaluation of the MCP73855 device in a variety of applications.
The MCP7382X Evaluation Board is an evaluation and demonstration tool for Microchip Technology's MCP7382X Single Cell Li-Ion Charge Management Controllers. The design provides for dynamic versatility while being able to handle accurate measurements. The MCP7382X Evaluation Board allows for the evaluation of the MCP7382X device in a variety of applications.
MCP7381x Eval Board

The MCP7381X Li-Ion Battery Charger Evaluation Board demonstrates the features and abilities for Microchip’s MCP7381X Li-Ion Battery Charger Evaluation Board. Simple, Miniature Single-Cell, Fully Integrated Li-Ion / Li-Polymer Charge Management Controllers. The MCP73811/2 are stand-alone highly integrated linear Li-Ion battery chargers that employ a constant current/constant voltage (CCCV) charge algorithm for cost sensitive and space limited applications.
The MCP73113 OVP Single-Cell Li-Ion Battery Charger Evaluation Board demonstrates the features of Microchip’s MCP73113 “Single-Cell Li-Ion / Li-Polymer Battery Charge Management Controller with Input Overvoltage Protection”.

Products supported
- MCP73113
- MCP73114
The MCP73213 OVP Dual-Cell Li-Ion Battery Charger Evaluation Board demonstrates the features of Microchip’s MCP73213 “Dual-Cell Li-Ion / Li-Polymer Battery Charge Management Controller with Input Overvoltage Protection”.

**Products supported**
- MCP73213
The MCP73123/223 is a highly integrated Li-Ion battery charge management controller for use in space-limited and cost-sensitive applications. The MCP73123/223 provides specific charge algorithms for Lithium Iron Phosphate batteries to achieve optimal capacity and safety in the shortest charging time possible. Along with its small physical size, the low number of external components makes the MCP73123/223 ideally suitable for low-cost and small-capacity (less than 2000 mAh) LiFePO₄ battery applications. It will take longer time to complete a charge cycle for larger capacity LiFePO₄ battery packs.

**Products supported**
- MCP73123
- MCP73223
The MCP73871 Evaluation Board is designed to demonstrate Microchip's stand-alone linear Li-Ion battery charger with system power path and load sharing management control solution. The system load is also supported by the Li-Ion battery when input power is disconnected. A number of device options allow the MCP73871 device to be utilized in a variety of applications.

P/N: MCP73871EV
This reference design is developed to assist product designers in reducing product design cycle and time by utilizing Microchip’s favorite stand-alone Li-Ion battery charge management controllers with system power path management.

**Features:**
- Load sharing system power path management that support charging single cell Li-Ion battery and system load at the same time without affecting charging algorithm of Microchip’s stand-alone charge management controllers.
- The system load is supported by Li-Ion battery when input power source is removed.
- Blue LED indicates charge status.
- Additional Red LED to indicate Power-Good (PG) and Green LED to indicate charge complete (Available from MCP73833).
- Dip Switch to select programmable fast charge current between 1000mA (H) and 50mA (L) for MCP73833 and 400mA (H) and 25mA (L) for MCP73832.
- Available THERM pin on the MCP73833 for temperature monitoring with a thermistor. It is disabled by default and can be enabled to use with NTC thermistor.

**Products supported**
- MCP73831
- MCP73832
- MCP73833
- MCP73834
The MCP73871 Demo Board with Voltage Proportional Current Control is designed to demonstrate Microchip's stand-alone linear Li-Ion battery charger with system power path and load sharing management control solution. The MCP73871 integrates the required elements to meet design challenges when developing new Li-Ion / Li-Polymer batteries powered products.

The MCP73871 Demo Board with Voltage Proportional Current Control is designed to deliver minimum 1.5A total current to system load and to a single cell Li-Ion battery at 4.2V preset voltage regulation (4.1V, 4.35V and 4.4V options are also available for MCP73871). The board has a dip switch helping to decides the input power source between AC-DC wall adapter and USB port (AC/USB) and control input current limits, enable charge timer and enable charging.

The MCP73871 Demo Board with Voltage Proportional Current Control comes with a factory preset low-battery indicator (LBO) when input is absent. The preset value is 3.2V and STAT1 LED (green) with turn ON if the battery voltage is below the threshold voltage.
The MCP73837/8 AC/USB Dual Input Battery Charger Evaluation Board demonstrates Microchip’s stand-alone Linear Li-Ion Battery Chargers - MCP73837 and MCP73838. The MCP73837/8 require only minimum components to implement a complete battery charge management circuit. The MCP73837/8 are designed to select AC-Adapter or USB-Port Power Source automatically where AC-Adapter provides the charge current when both sources are present.

Products supported
- MCP73837
- MCP73838
The MCP3421 Weight Scale Demo Board is designed to evaluate the performance of the low-power consumption, 18-bit ADC in an electronic weight scale design. Next to the MCP3421 there is a low-noise, auto-zero MCP6V07 op amp. This can be used to investigate the impact of extra gain added before the ADC for performance improvement. The PIC18F4550 is controlling the LCD and the USB communication with the PC. The GUI is used to indicate the performance parameters of the design and for calibration of the weight scale.

Products supported
- MCP3421
- MCP6V07

P/N: MCP3421DM-WS
MCP3421 Evaluation Board

The MCP3421 Evaluation Board assists in the evaluation of the MCP3421 device in a simple way. The evaluation board contains minimum components: MCP3421, two bypass capacitors, and two loading resistors for the I²C™ bus.

Products supported

- MCP3421
The MCP3421 Battery Fuel Gauge Demo Board demonstrates how to measure the battery voltage and discharging current using the MCP3421.

The MCU algorithm calculates the battery fuel being used. This demo board is shipped with 1.5V AAA non-rechargeable battery. The demo board displays the following parameters:
(a) Measured battery voltage.
(b) Measured battery discharging current.
(c) Battery Fuel Used (calculated).

The MCP3421 Battery Fuel Gauge Demo Board also can charge a single-cell 4.2V Li-Ion battery. This feature, however, is disabled by firmware since the demo kit is shipped to customer with non-rechargeable 1.5V AAA battery.

Please contact Microchip Technology Inc if you want to use the battery rechargeable feature.
The MCP342x Evaluation Boards enable the easy evaluation of the MCP3422/3/4/5 Delta-Sigma Analog-to-Digital Converters (ADCs). Each board has analog input connection pads and various test pads. The user can connect inputs and test the conversion results using the PICkit™ Serial Analyzer and its PC graphic user interface (GUI).

Features:
• Evaluate the MCP342x using the PICKit Serial Analyzer
• The user can write the MCP342x configuration register and read output codes by using the PICKit Serial Analyzer
• The sensor signal can be connected to the input pads of the board
• I²C™ communication signal (SCL and SDA) can be monitored at the SCL and SDA pins on the board
• Evaluate the MCP342x performance using by simply connecting the SCL and SDA pins to the user's PC board

Products supported
- MCP3422
- MCP3423
- MCP3424
- MCP3425

P/N: MCP3422EV, MCP3423EV, MCP3424EV, MCP3425EV
The MCP3551 PICtail™ Demo Board allows the system designer to evaluate the operation of the MCP3551 22-Bit Delta-Sigma ADC. The board demonstrates the MCP3551 performance in a low-noise environment.

**Products supported**
- MCP3551
- PIC18F4550
The MCP3550/1/3 devices are 2.7V to 5.5V low-power, 22-bit Delta-Sigma ADCs. The MCP355x Tiny Application Sensor Demo Board is used to demonstrate the most basic application of the devices using a ratiometric connection with \( V_{DD} \) as \( V_{REF} \). The board includes all the necessary PCB circuits and layout tips required to obtain the performance demonstrated on the PC.

**Products supported**
- MCP3550
- MCP3551
- MCP3553
- PIC18F4550
The MCP355X Sensor Application Developer’s Board allows for the easy system design of high resolution systems such as weigh scale, temperature sensing, or other small signal systems requiring precise signal conditioning circuits. The reference design includes firmware that performs all the necessary functions including ADC sampling, USB communication for PC data analysis, LCD display output, zero cancellation, full scale calibration, and units display in gram (g), kilogram (kg), or ADC output units.

**Products supported**
- MCP3550
- MCP3551
- MCP3553
- MCP617
- PIC18F4550
- PIC16F877

P/N: MCP355XDM-MS1
The MCP3221 device is a low-power, 12-bit A/D Converter (ADC) in a SOT-23 package. It communicates via an I²C™ interface. A stand-alone demonstration is possible using a USB port and the DataView™ software. The MCP3221 Pictail™ Demo Board is also used to evaluate and demonstrate the MCP3221 device using the PICkit™ 1 Flash Starter Kit.

Products supported
- MCP3221
- PIC16C745

P/N: MCP3221DM-PCTL
The daughter boards for this evaluation and demonstration tool is for the MCP3001/2 stand-alone A/D Converters, and is designed to be used in conjunction with the MXDEV™ Driver Board (available separately).

<table>
<thead>
<tr>
<th>Products supported</th>
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<tbody>
<tr>
<td>MCP3001</td>
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<tr>
<td>MCP3002</td>
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<td>MCP3201</td>
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<td>MCP3202</td>
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<td>MCP3301</td>
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<td>MCP3302</td>
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P/N: DV3201A
The daughter boards for this evaluation and demonstration tool is for the MCP3004/8 and MCP3204/8 stand-alone A/D Converters, and is designed to be used in conjunction with the MXDEV™ Driver Board (available separately).

Products supported
- MCP3304
- MCP3004
- MCP3008
- MCP3204
- MCP3208
The MCP3905A/06A device is an energy metering IC that supplies average active power information via a pulse output with direct drive for mechanical counters. It also includes a higher-frequency output that supplies instantaneous power information for calibration. The device contains function blocks specific for IEC energy meter compliance, such as a no-load threshold and startup current.

The MCP3905A/06A Energy Meter Reference Design Printed Circuit Board (PCB) is used as a reference design for single-phase, residential meters.

Products supported
- MCP3905A
- MCP3906A
MCP3905A Eval Board

The MCP3905A/06A Evaluation Board is designed to test a variety of meter designs using the MCP3905A/06A energy metering Integrated Circuit (IC). Stand-alone MCP3905A/06A energy meter designs, as well as those using a PIC® Microcontroller Unit (MCU), are easily designed using this evaluation board as the prototype Analog Front-End (AFE).

Products supported
- MCP3905A
- MCP3906A

P/N: MCP3905EV
The MCP3909 3-Phase Energy Meter Reference Design is a fully functional 3-phase meter. There are two boards that comprise the complete meter: the main board and the USB communications module. The communications module shipped with this kit is the PIC18F4550 USB Interface module. The USB interface module also includes an LCD display. The main board contains the analog circuitry and the PIC18F2520 device that functions as the main RMS engine.

Products supported
- MCP3909
- PIC18F2520
- PIC18F4550

P/N: MCP3909RD-3PH1
The MCP3909 ADC Evaluation Board for 16-Bit MCUs system provides the ability to evaluate the performance of the MCP3909 dual channel ADC. It also provides a development platform for 16-bit PIC based applications, using existing 100-pin PIM systems compatible with the Explorer-16 and other high pin-count PIC demo boards. The system comes with programmed PIC24FJ128GA010 and dsPIC33FJ256GP710 PIM modules that communicate both to on-board LCD and a LabVIEW GUI for both in-circuit and PC signal processing.

Products supported
- MCP3909
- PIC18F86J65

P/N: MCP3909EV-MCU16
The MCP3909/dsPIC33F 3-Phase Energy Meter Reference Design is a fully functional energy meter with many advanced features such as harmonic analysis, per phase distortion information, sag detection, four quadrant energy measurement, and active and reactive power calculation. It uses Microchip’s powerful 16-bit dsPIC33F Microcontroller Unit (MCU).

This reference design is unique in the fact that all calculations take advantage of the dsPIC33F DSP engine, and all output quantities are calculated in the frequency domain through the use of Discrete Fourier Transforms (DFT). This approach yields a large volume of outputs for a variety of meter designs, from simple active power only energy meters, to advanced energy meters requiring harmonic analysis. Another significant advantage of this design, is that the dsPIC firmware implements a quasi-synchronous sampling algorithm, eliminating the need for external zero-crossing detection and PLL circuit for the synchronization of ADC samples to line frequency. The line frequency is measured in software and corrected for measurement errors caused by frequency fluctuations in the power grid. This additional processing on the dsPIC reduces the overall meter cost by eliminating the requirement for a PLL circuit.
The MCP3909/PIC18F85J90 Single Phase Shunt Energy Meter is a fully functional single phase meter. The design uses a half wave rectified power supply circuit and a shunt current sensing element. A single MCP3909 acts as the analog front end measurement circuitry. The PIC18F85J90 directly drives the LCD glass and displays active energy consumption.

The meter design contains serially accessible registers and is intended to be flexible and upgraded to a variety of PIC® micro-based energy meter designs using the firmware presented herein. The “Single Phase Energy Meter Software” offers a functional and simple means to monitor and control the PIC18F85J90 and can be used to create custom calibration setups.
The MCP3901 ADC Evaluation Board for 16-Bit MCUs system provides the ability to evaluate the performance of the MCP3901 dual channel ADC. It also provides a development platform for 16-bit PIC based applications, using existing 100-pin PIM systems.

**Products supported**
- MCP3901
- PIC24F
- PIC24H
- dsPIC33
- PIC18F86J55
The MCP3910 ADC Evaluation Board for 16-Bit MCUs provides the opportunity to evaluate the performance of the MCP3910 dual-channel ADCs in a multiple device, isolated system. It comes with four MCP3910s, three of which are isolated and operate in 2-wire Serial Interface Mode. It also provides a development platform for 16-bit PIC® microcontroller-based applications, using existing 100-pin PIM systems, compatible with the Explorer 16 and other high pin count PIC device demo boards. The system comes with programmed PIC24FJ256GA110 PIM modules that communicate with the PC software for viewing data samples sent from the board.

**Features:**
- Four MCP3910 devices for complete 3-phase isolated and neutral system evaluation
- Selectable Phase A, B, C, or N (neutral) MCP3910 dual channel output display on the PC Software Interface
- Simultaneous 55 ksps at 95 dB SINAD performance on any MCP3910 channel
- Single-phase MCP3910 performance analysis through graphical PC tools showing Noise Histogram, Frequency Domain (FFT), Time domain scope plot, and statistical numerical analysis
- PICtail® Plus connectors for Explorer 16 daughter board compatibility

**Products supported**
- MCP3911
- PIC24F
- dsPIC33

P/N: ADM00425
The MCP3911 ADC Evaluation Board for 16-Bit MCUs system provides the ability to evaluate the performance of the MCP3911 dual-channel ADC. It also provides a development platform for 16-bit PIC-based applications, using existing 100-pin PIM systems compatible with the Explorer-16 and other high pin count PIC demo boards. The system comes with a programmed PIC24FJ256GA110 PIM module that communicates with the included PC software for data exchange and ADC configuration.

**Features:**
- Dual ADC MCP3911 output display using serial communication to PC software (Energy Management Utility)
- Simultaneous 55 ksp/s at 95 dB SINAD performance
- System and ADC performance analysis through graphical PC tools showing Noise Histogram, Frequency Domain (FFT), Time domain scope plot, and statistical numerical analysis
- PICtail Plus connectors for Explorer-16 daughter board compatibility

**Products supported**
- MCP3911
- PIC24F
- dsPIC33

**P/N:** ADM00398
The MCP3919 ADC Evaluation Board for 16-Bit MCUs system provides the opportunity to evaluate the performance of the MCP3919 three-channel AFE. It also provides a development platform for 16-bit PIC® based applications, using existing 100-pin PIC microcontroller Plug-in Module (PIM) systems that are compatible with the Explorer 16 and other high pin count PIC® based demo boards. The system comes with a programmed PIC24FJ256GA110 PIM module that communicates with the Energy Management Utility software.

Features:
• Three-Channel ADC MCP3919 output display using serial communication to PC software
• Simultaneous 57 ksp/s at OSR32 address loop ALL or 95 dB SINAD at OSR512 performance on MCP3919
• System and ADC performance analysis showing Noise Histogram, Frequency Domain (FFT), Time domain scope plot, and statistical numerical analysis
• PICtail Plus connectors for Explorer-16 daughter board compatibility

Products supported
- MCP3919
- PIC24F
- dsPIC33

P/N: ADM00573
The MCP3912 ADC Evaluation Board for 16-Bit MCUs system provides the opportunity to evaluate the performance of the MCP3912 four-channel AFE. It also provides a development platform for 16-bit PIC® based applications, using existing 100-pin PIC microcontroller Plug-in Module (PIM) systems that are compatible with the Explorer 16 and other high pin count PIC® based demo boards. The system comes with a programmed PIC24FJ256GA110 PIM module that communicates with the Energy Management Utility software.

Features:
- Four-Channel ADC MCP3912 output display using serial communication to PC software
- Simultaneous 57 kspS at OSR32 address loop ALL or 95 dB SINAD at OSR512 performance on MCP3912
- System and ADC performance analysis showing Noise Histogram, Frequency Domain (FFT), Time domain scope plot, and statistical numerical analysis
- PICtail Plus connectors for Explorer-16 daughter board compatibility

P/N: ADM00499

Products supported
- MCP3912
- PIC24F
- dsPIC33
The MCP3913 ADC Evaluation Board for 16-Bit MCUs system provides the opportunity to evaluate the performance of the MCP3913 six-channel AFE. It also provides a development platform for 16-bit PIC® based applications, using existing 100-pin PIC microcontroller Plug-in Module (PIM) systems that are compatible with the Explorer 16 and other high pin count PIC® based demo boards. The system comes with a programmed PIC24FJ256GA110 PIM module that communicates with the Energy Management Utility software.

**Features:**
- Six-Channel ADC MCP3913 output display using serial communication to PC software
- Simultaneous 57 ksp/s at OSR32 address loop ALL or 95 dB SINAD at OSR512 performance on MCP3913
- System and ADC performance analysis showing Noise Histogram, Frequency Domain (FFT), Time domain scope plot, and statistical numerical analysis
- PICtail Plus connectors for Explorer-16 daughter board compatibility

**Products supported**
- MCP3913
- PIC24F
- dsPIC33
The MCP3914 ADC Evaluation Board for 16-Bit MCUs system provides the opportunity to evaluate the performance of the MCP3914 eight-channel AFE. It also provides a development platform for 16-bit PIC® based applications, using existing 100-pin PIC microcontroller Plug-in Module (PIM) systems that are compatible with the Explorer 16 and other high pin count PIC® based demo boards. The system comes with a programmed PIC24FJ256GA110 PIM module that communicates with the Energy Management Utility software.

**Features:**
- Eight-Channel ADC MCP3914 output display using serial communication to PC software
- Simultaneous 57 ksp/s at OSR32 address loop ALL or 95 dB SINAD at OSR512 performance on MCP3914
- System and ADC performance analysis showing Noise Histogram, Frequency Domain (FFT), Time domain scope plot, and statistical numerical analysis
- PICtail Plus connectors for Explorer-16 daughter board compatibility

**Products supported**
- MCP3914
- PIC24F
- dsPIC33

P/N: ADM00523
The MCP3903 ADC Evaluation Board for 16-bit MCU system provides the ability to evaluate the performance of the MCP3903 six channel sigma-delta ADC. It also provides a development platform for 16-bit PIC-based applications, using existing 100-pin PIM systems.

**Features:**
- MCP390x DataVIEW PC software interface for communicating and controlling the MCP3903 Evaluation board through the virtual COM port created by the on-board MCP2200
- System and ADC performance analysis through graphical PC tools showing noise histogram, frequency domain (FFT), time domain scope plot, and statistical numerical analysis
- Robust hardware design with analog grounding and analog/digital separation, allowing low noise evaluation of the MCP3903 device.
- Separate power supplies and power planes - 4 layer board
- PICtail Plus connectors for Explorer-16 daughter board compatibility

**Products supported**
- MCP3903
- PIC24F
- PIC24H
- dsPIC33
The PIC18F87J72 Evaluation Board provides a platform for developing and evaluating applications which are based on the PIC18F87J72 device. These applications can range from accurate measurement of low signals like an output signal of a load cell to processing of information for metering and other metrology applications like Energy meter, Flowmeter, Heatmeter and so on. The device is capable of interfacing to a large variety of voltage and current sensors, including shunts, Current Transformers (CT), Rogowski coils and Hall Effect sensors.

Features:
- Seven-Segment LCD Display
- Real Time Clock and Calendar function
- Capacitive Touch keys
- PICtail™ connectors for PIC18 daughter boards
- Easy configuration of the Dual-Channel Delta-Sigma ADC
- Graphical PC tools for system and ADC performance analysis
The MCP39F501 Power Monitor Demonstration Board is a fully functional single-phase power monitor. This low-cost design does not use any transformers and requires few external components. The device calculates typical power quantities as defined in the MCP39F501 data sheet. The MCP39F501 Power Monitor Utility software is used to calibrate and monitor the system, and can be used to create custom calibration setups. For some accuracy requirements, only a single point calibration may be needed.

Features:
- Displays Active, Reactive and Apparent Power, RMS Current, RMS Voltage, Line Frequency, Power Factor and Temperature using PC software
- Event notifications, such as Over Current, Over Power, Over/Under Frequency, Over/Under Temperature, and Voltage Sag/Surge
- Device configuration through PC software, including Event Notifications, Gain Calibration, EEPROM, Calculation Multipliers, and I/O settings
- 120V and 220V operation

P/N: ARD00455
The MCP39F501 Power Monitor PICtail™ Evaluation Board duals as a fully functional single-phase power monitor and development platform. This low-cost design does not use any transformers and requires few external components. The device calculates active power, reactive power, RMS current, RMS voltage, power factor, line frequency and other typical power quantities as defined in the MCP39F501 data sheet. The MCP39F501 Power Monitor Utility software is used to calibrate and monitor the system and can be used to create custom calibration setups. For some accuracy requirements only a single point calibration may be needed.

**Features:**
- PICtail board allows development with Microchip’s 16-bit and 32-bit microcontrollers using the Explorer 16 Development Board (DM240001)
- PC software displays power quantities, event notifications and allows device configuration

**Products supported**
- MCP39F501
- PIC® MCUs
The PIC18F87J72 Energy Monitoring PICtail™ Plus Daughter Board is a single phase energy monitor daughter board featuring the PIC18F87J72 high performance 8-bit MCU with 16/24-bit delta-sigma A/D converters. This low cost design uses a shunt for the current sensor in place of expensive current transformers. The PIC18F87J72 calculates active/reactive energy, forward/reverse energy, active/reactive/apparent power and RMS current/voltage.

The Energy Monitoring PICtail Plus Daughter Board interfaces to the Explorer 16 Development Board (DM240001) where additional evaluation can be performed. Through the Explorer 16 Development Board, wired and wireless network connections can be made through other PICtail Daughter boards such as the Ethernet PICtail (AC164123) and the WiFi PICtail (AC164136-4).
The PIC18F87J72 Single Phase Energy Meter Reference Design is a fully functional single phase meter featuring the PIC18F87J72 MCU with Analog Front End. This low cost design uses a shunt for the current sensor in place of expensive current transformers. The PIC18F87J72 directly drives the LCD and includes both an isolated USB connection and non-isolated RS232 interface for meter calibration and access to the device power calculations. The system calculates active/reactive energy, forward/reverse energy, active/reactive/apparent power and RMS current/voltage. The Microchip Energy Meter 1-Phase Software is used to calibrate and monitor the system. It can also be used to create custom calibration setups. For some accuracy requirements only a single point calibration may be required. The energy meter software offers an automated step by step calibration process that can be used to quickly calibrate energy meters.
The MCP3901 and PIC18F65J90 Energy Meter Reference Design is a fully functional IEC Class 0.5 compliant single-phase meter. This low-cost design does not use any transformers and requires few external components. The PIC18F65J90 directly drives the LCD and includes both an isolated USB connection for meter calibration and access to the device power calculations. The system calculates active energy, active power, RMS current, RMS voltage, reactive energy, reactive power, apparent power, and other typical power quantities.

The Microchip Energy Meter 1-Phase Software is used to calibrate and monitor the system and can be used to create custom calibration setups. The energy meter software offers an automated step-by-step calibration process that can be used to quickly calibrate energy meters.

Products supported
- MCP3901
- PIC18F65J90
The MCP3911 and PIC18F85K90 Single-Phase Anti-Tamper Energy Meter is a fully functional single-phase meter with enhanced capabilities, such as battery backup, RTC and anti-tamper features. The two current channels are measured with the MCP3911 device and the voltage channel is measured with the 12-bit SAR ADC integrated in the microcontroller. This design has two sensors for the current measurements: a current transformer and a shunt. The PIC18F85K90 microcontroller directly drives the LCD and communicates via UART with the MCP2200, offering an isolated USB connection for meter calibration and access to the device power calculations. The system calculates active and reactive energy, active, reactive and apparent power, power factor, RMS current, RMS voltage and the line frequency. The Microchip Energy Meter Software is used to calibrate and monitor the system.

Features:
- Rated 5(60)A 220V 3200 imp/kWh IEC62053-22 Class 0.5 Meter
- Calculates active and reactive energy, active, reactive and apparent power, power factor, RMS current, RMS voltage and the line frequency
- Anti-tamper monitoring including neutral monitoring, current circuit reversal, magnetic field disturbance and cover opening detection
- Microchip Energy Meter Software to calibrate and monitor the system
- Calibration can be done in closed loop or open loop

P/N: ARD00385
The MCP6L2 and PIC18F66J93 Energy Meter is a fully functional single-phase meter that uses the 12-bit successive approximation analog-to-digital converter (SAR ADC) integrated in the microcontroller. This low-cost design has a shunt as the current sensor. The signal from the shunt is amplified by two external operational amplifiers and applied to the input of the ADC. The PIC18F66J93 directly drives the LCD and communicates via UART with the MCP2200, offering an isolated USB connection for meter calibration and access to the device power calculations. The system calculates active and reactive energy; active, reactive and apparent power; power factor; RMS current; RMS voltage, and line frequency.

The Microchip energy meter software is used to calibrate and monitor the system. The calibration can be done in closed loop or open loop. When connected to a stable source of voltage and current, the meter can do an auto-calibration by including the open loop calibration routine and formulas in the firmware.

Features:
- Energy meter software allows calibration and system monitoring
- Isolated USB connection
- Calculates active and reactive energy, active and apparent power, power factor, RMS current, RMS voltage, and line frequency
The MCP4725 SOT-23-6 Evaluation Board is a quick and easy evaluation tool for the MCP4725 12-bit DAC device. It works with Microchip's popular PICkit™ Serial Analyzer or independently with the customer's applications board.

Connect the MCP4725 SOT-23-6 Evaluation Board to the PICkit™ Serial Analyzer and type in the DAC input data in the PICkit™ Serial Analyzer's PC Graphical User Interface program.

The PICkit™ Serial Analyzer will then send the user's data to the DAC device automatically. The DAC's analog output will be available immediately at the output pin. The user will appreciate the simplicity of evaluating the DAC device using this kit.

The customer also can connect the MCP4725 SOT-23-6 Evaluation Board directly to their applications board and test out their systems functions immediately.

The MCP4725 SOT-23-6 Evaluation Board kit includes two of the Evaluation Boards. The PICkit™ Serial Analyzer is sold separately.
The MCP4725 PICtail™ Plus Daughter Board (P/N MCP4725DM-PTPLS) contains an MCP4725 12-bit Digital-to-Analog Converter (DAC). This daughter board has the following two interfaces:

- Explorer 16 Starter Kit (P/N: DV164033) for 16-bit MCU environment
- PICkit™ Serial Analyzer (P/N: DV164122) for reading and writing the DAC register and observing the DAC output

The user can connect this daughter board to one of the above tools and perform their own experiments.
The MCP47X6 PICtail™ Plus Daughter Board allows customers to evaluate the capabilities of the MCP4726, MCP4716, and MCP4706 devices. This board can be controlled by the MCU of the Explorer 16 Development Board (P/N: DV164033) or by a PICkit™ Serial Analyzer. The board also provides easy access via test points to desired signals to monitor device operation. A buzzer is supplied that is connected to the output of the MCP4726, which allows generation of an audible sound. The buzzer has a volume control.

Products supported

- MCP4706
- MCP4716
- MCP4726
The MCP4728 Evaluation Board is a tool for quick and easy evaluation of the MCP4728 4-channel 12-bit DAC device. It contains the MCP4728 device and connection pins for the Microchip's popular PICkit™ Serial Analyzer. Simply connect the MCP4728 Evaluation Board to the PICkit™ Serial Analyzer and type in the DAC input data in the PICkit™ Serial Analyzer's PC Graphical User Interface program. The PICkit™ Serial Analyzer will then send the user's data to the DAC device automatically. The new DAC's analog outputs will be available immediately at the DAC output pins.
The MCP4XXX Digital Potentiometer Daughter Board allows the system designer to quickly evaluate the operation of Microchip Technology's MCP42XXX and MCP4021 Digital Potentiometers. The MCP42XXX are dual digital potentiometer devices that have the same characteristics as their single digital potentiometer devices (MCP41XXX). The MCP4021 devices are non-volatile devices that have similar characteristics as their volatile memory version (MCP4011). The board supports two MCP42XXX devices to allow the resistor networks to be “tacked” and form a programmable windowed digital potentiometer and an MCP4021 device, which can be replaced with an MCP4011 device. The board has one MCP42010 device (10kΩ), which can be the rheostats at the ends, and one MCP42010 device (10kΩ) which is the potentiometer in the middle and a separate standalone potentiometer.

Products supported
- MCP4011
- MCP4021
- MCP42XXX

P/N: MCP4XXXDM-DB
The MCP402X Digital Potentiometer Evaluation Board (MCP402XEV) allows the system designer to quickly evaluate the operation of Microchip Technology’s MCP401X/2X Digital Potentiometer products.

Products supported
- MCP4011
- MCP4012
- MCP4013
- MCP4014
- MCP4021
- MCP4022
- MCP4023
- MCP4024
The MCP401XEV Evaluation Board allows the system designer to quickly evaluate the operation of the MCP40D18 Digital Potentiometer device. The board uses the SC70EV Generic PCB and has been populated for the MCP40D18. The 6-pin header (PICkit Serial) has been jumpered to the MCP40D18’s appropriate pins. This allows the PICkit Serial to communicate with the device.

Products supported
- MCP40D17
- MCP40D19
- MCP4017
- MCP4018
- MCP4019

P/N: MCP401XEV
The MCP42XX Evaluation Board allows the system designer to quickly evaluate the operation of Microchip Technology’s MCP4261 Digital Potentiometer device. The board uses the TSSOP20EV Generic PCB and has been populated for the MCP4261. The 6-pin header (PICkit Serial) has been jumpered to the MCP4261’s appropriate pins. This allows the PICkit Serial to communicate with the device.

**Products supported**
- MCP4231
- MCP4241
- MCP4251
- MCP4261

P/N: MCP42XXEV
The MCP43XX Evaluation Board allows the system designer to quickly evaluate the operation of Microchip Technology’s MCP4361 Digital Potentiometer device. The board uses the TSSOP20EV Generic PCB and has been populated for the MCP4361. The 6-pin header (PICkit Serial) has been jumpered to the MCP4361’s appropriate pins. This allows the PICkit Serial to communicate with the device.

**Products supported**
- MCP4331
- MCP4341
- MCP4351
- MCP4361
The MCP46XX Evaluation Board allows the system designer to quickly evaluate the operation of Microchip Technology’s MCP4661 Digital Potentiometer device. The board uses the TSSOP20EV Generic PCB and has been populated for the MCP4661. The 6-pin header (PICkit Serial) has been jumpered to the MCP4661’s appropriate pins. This allows the PICkit Serial to communicate with the device.

Products supported

- MCP4631
- MCP4641
- MCP4651
- MCP4661
The MCP42XXX Evaluation Board kit contains an evaluation board, prototype board, RS-232 cable, 9V DC power supply, MXLAB software, user guide, warranty/registration card, digital potentiometers and PIC® MCU.

**Products supported**
- MCP42010
- MCP42050
- MCP42100
The MCP42XX PICtail™ Plus Daughter Board is used to demonstrate the operation of the MCP42XX Digital Potentiometers. The operation of the MCP41XX devices is similar to the MCP42XX devices. Therefore, this demo board can be used as a development platform for either device family.

This board is designed to be used in conjunction with either the PIC24 Explorer 16 Demo Board or the PICkit™ Serial Analyzer.

**Products supported**
- MCP4231/2
- MCP4241/2
- MCP4251/2
- MCP4261/2
The MCP46XX PICtail™ Plus Daughter Board demonstrates the features and abilities of Microchip’s MCP45XX and MCP46XX Digital Potentiometers. This board is designed to exclusively use the MCP46X1 devices. The MCP4661 uses an \textit{I^{2}C}™ interface and can be controlled via the PICkit Serial Analyzer interface or via the PICtail™ Plus interface.

**Products supported**
- MCP4631/2
- MCP4641/2
- MCP4651/2
- MCP4661/2
The Analog Evaluation System gives system designers the ability to control Microchip sand-alone analog devices, acquire data and then analyze the data using strip charts, histograms and Fast Fourier Transforms (FFTs). User-friendly data analysis software is included with the device-specific Daughter Boards.

The evaluation system consists of two parts: a Driver Board, which performs the data analysis and connects to a PC for subsequent analysis and display; and a Daughter Board, which plugs into the Driver Board and contains the device to be evaluated. Device-specific software is included.

In addition to the ability of the Driver Board to work with device-specific Daughter Boards, users can create their own daughter boards based on their own design requirements. Also, there is a prototype area on the Driver Board for user-designed circuits that could be used in place of the Daughter boards.

Products supported
- MCP330x
- MCP320x
- MCP300x
- MCP42xxx

P/N: DVMCPA
The Mixed Signal PICtail™ Demo Board allows the system designer to quickly evaluate the suitability of several Microchip analog products for their product’s design. Microchip’s Digital-to-Analog Converters (DACs), Analog-to-Digital Converters (ADCs), V<sub>REF</sub>, Low Dropout Output (LDO) regulators and the PIC16F7X devices are supported. Evaluation precision analog products for specific applications can be challenging for practical reasons. First, many products are only available in surface-mount packages. Secondly, analog circuits tend to be affected adversely by system noise. Common bread boarding techniques are not practical for these reasons. The Mixed Signal PICtail™ Demo Board utilizes a 4-layer PCB with attention paid to reducing system noise.

Products supported
- MCP3551
- MCP3302/04
- MCP482x
- MCP492x
- TC132x
- MCP617
- MCP15xx
- MCP1701A
- MCP1700
- PIC16F767

P/N: MXSIGDM
The MCP2515 Development Kit is a two-node Controller Area Network (CAN) tool that can be used in the evaluation/implementation of the MCP2515 stand-alone CAN controller. The software allows manipulation of the MCP2515 at the bit and byte levels with one template, while providing high-level control with a second template.

- One node is controlled by the PC that acts as a microcontroller using the provided software. This node can be used for basic MCP2515 evaluation/development (“node 0”)
- The second node is controlled by a microcontroller that is programmed by the user as part of device validation and/or system development

The two nodes are connected via CAN bus that is also routed off-board through a connector, allowing the target board to be connected to an external CAN bus (“node 1”)
The MCP2515 PICtail™ Demo Board allows the system designer to quickly evaluate the operation of the MCP2515 Stand-Alone CAN Controller. The board demonstrates the MCP2515 in a CAN bus environment. In addition, the kit includes a MCP25020 CAN I/O Expander node which demonstrates the device on a CAN bus.

**Products supported**

- MCP2515
- MCP2551
- MCP25020
- PIC16F676
The MCP2515 PICtail™ Plus Daughter Board is a simple Controller Area Network (CAN) board designed to be used with boards containing the PICtail Plus connector.

The board also has the PICkit™ Serial connector for interfacing to the PICkit Serial Analyzer tool. The CAN node consists of the MCP2515 Stand-Alone CAN controller and MCP2551 CAN transceiver.

The PICkit Plus and PICkit Serial connectors allow the board to be interfaced to a variety of PIC® micros so that the user can develop a CAN node. The board also contains headers or test points for most of the MCP2515 pins to allow the external functions to be monitored/evaluated.

Products supported
- MCP2515
- MCP2551
The MCP2515 CAN Bus Monitor Demo Board kit contains two identical boards which can be connected together to create a simple two node Controller Area Network (CAN) bus, which can be controlled and/or monitored via the included PC interface. The board(s) can also be connected to an existing CAN bus.

**Products supported**
- MCP2515
- MCP2551
The MCP250XX Development Kit is an evaluation, demonstration and development tool for Microchip Technology’s 14-pin CAN IO/O Expanders. The MCP3250XX can be evaluated easily by installing the provided software and running the demonstration program. Furthermore, development can be accomplished by utilizing the bare CAN node with the prototyping area, as well as with the on-board device programmer.

The development board has the ability to program the user-defined defaults by using the device programmer module and the supplied software. Alternatively, the In-Circuit Serial Programming™ (ICSP™) protocol can be used to program the MCP250XX using the 5-pin header, which is connected to a 14-pin socket on the board.

**Products supported**
- MCP2515
- MCP25020
- MCP25050
The MCP212X Developer's Daughter Board is used to evaluate and demonstrate the MCP2122 or MCP2120 IrDA® Standard Encoder/Decoder device. This allows the system designer to implement a low-cost, wireless IR port in any application providing support for IrDA standard bit encoding/decoding.

The MCP212X Developer's Daughter Board is designed to interface to several of the “new” low-cost PIC® microcontroller-based demonstration boards, or to be interfaced into your application. Multiple header interfaces are available that allow support for the many different PCIDEM™ Demo Boards, as well as being easily jumpered into systems for development purposes.

**Products supported**
- MCP2122
- MCP2120

Note 1: Only required if data is communicated with the PC. Some program modes “respond” to received data (data not sent to PC).
MCP215x/40 Developer’s Daughter Board

The MCP215X/40 Developer’s Daughter Board is used to evaluate and demonstrate the MCP2150. MCP2155 or MCP2140 IrDA® Standard Protocol Handler with Encoder/Decoder devices. This allows the system designer to implement a low-cost, wireless IR port in any application providing support for IrDA standard bit encoding/decoding.

The MCP215X/40 Developer’s Daughter Board is designed to interface to several of the “new” low-cost PIC® microcontroller-based demonstration boards, or to be interfaced into your application. Multiple header interfaces are available that allow support for the many different PCIDEM™ Demo Boards, as well as being easily jumpered into systems for development purposes.

Products supported
- MCP2150
- MCP2155
- MCP2140

Note 1: The PC may be a notebook with an integrated IR port.
Note 2: Only required if data is communicated with the PC. Some PCIDEM™ HPC Explorer Demo Board program modes “respond” to received data (data not sent to PC).

P/N: MCP215X/40EV-DB
The MCP2140 IrDA® Standard Protocol Stack Controller device allows the system designer to implement a low-cost wireless IR port in any application, providing support for the IrDA standard protocol stack and IrDA standard bit encoding/decoding.

The MCP2140 IrDA Standard Wireless Temperature Sensor Demo Board is used to evaluate and demonstrate the MCP2140 device in data-logging application by transmitting ambient temperature to a PDA (e.g., Palm™ PDA) or laptop computer. It is intended to serve as an example to assist system designers in developing an IrDA standard node using the MCP2140 device.

Products supported
- MCP2140
- TC1047A
- PIC18F1320

P/N: MCP2140DM-TMPSNS
The MCP215X IrDA Standard Protocol Stack Controller device allows the system designer to implement a low-cost wireless IR port in any application, providing support for the IrDA standard protocol stack and IrDA standard bit encoding/decoding.

The MCP215X Data Logger Demo Board is used to evaluate and demonstrate the MCP2150 or MCP2155 device in data-logging application. The board will communicate to a Primary device, such as a PDA (e.g., Palm™) or laptop computer. It is intended to serve as an example to assist system designers in developing an IrDA standard node using the MCP215X device.

Though the MCP215X Data Logger Demo Board ships with a MCP2150 installed, this device may be interchanged with a MCP2155, allowing the MCP2155 to be evaluated.

**Products supported**

- MCP2150
- MCP2155
The MCP2150 Developer's Board allows for the easy demonstration and development of IrDA applications. The board can be powered via USB or the power test points (VDD and GND).

The Host interface can be connected to the UART driver device for communication over the DB-9 connector (for IrDA to UART operation), connected to the PIC18F65J50 for stand alone operation, or connected to the PIC18F65J50 with the PIC18F65J50 connected to the UART driver device (for pass-through operation).

Products supported
- MCP2150
- MCP111
- TC1108
- PIC18F86J50

P/N: MCP2150DM
ECAN/LIN PICtail Plus Daughter Board

The ECAN/LIN PICtail™ Plus Daughter Board is used with the Explorer 16 Development Board to facilitate rapid implementation and evaluation of applications that use Controller Area Network (CAN) and Local Interconnect Network (LIN) interfaces and are implemented on dsPIC33F Digital Signal Controllers and PIC24H 16-bit microcontrollers.

Products supported
- MCP2551
- MCP2021
Microchip offers two similar PICDEM CAN-LIN demonstration boards to support different PICmicro® devices. All demonstrate the main features of the devices, especially those features of the integrated CAN module. In addition to the CAN network, the board also employs a LIN sub-network using Microchip's PIC16C43X and PIC18F320 device families. Each PICDEM CAN-LIN demonstration board includes both firmware and PC software for simulating a CAN network. The firmware comes pre-programmed on the sample device. The PC software and documentation are furnished on a CD-ROM.

Products supported
- PICDEM CAN-LIN supports:
  - PIC18F258, 2580, 2680, 2685, PIC18F458, 4580, 4680, 4685
  - PIC16C432 with integrated LIN Bus transceiver
- PICDEM CAN-LIN 3 supports:
  - PIC18F6680, PIC18F8680
  - PIC18F1320
  - MCP201 LIN Bus transceiver

P/N: DM163011, DM163015
The LIN Serial Analyzer development system enables a Personal Computer (PC) to communicate with a LIN (Local Interface Network) bus. The PC program uses a graphical user interface to enter and display message frames occurring on the target bus. The LIN Serial Analyzer consists of several components, that together, make a network debug and analysis tool.
Automotive Ambient Lighting Module

The Automotive Ambient Interior Lighting Module Reference Design demonstrates microcontroller-based control of RGB LED devices. This module can be controlled remotely by a master body controller via a LIN bus. These modules are offered in a very compact form-factor board and comprise of a PIC12F615 MCU, an MCP2021 LIN transceiver/voltage regulator, and RGB LED. LIN commands are interpreted by the module to control color mixing (16,383 colors) and intensity (1023 levels).

Products supported
- MCP2120
- PIC12F615
The MCP23X17 Evaluation Board allows the system designer to evaluate the operation of the MCP23X17 General Purpose I/O (GPIO) expander. The board demonstrates the MCP23X17 performance in a simple circuit (4 inputs and 12 outputs).

**Products supported**
- MCP23017
- MCP23S17

P/N: MCP23X17EV
The MCP23008/MCP23S08 Evaluation Board allows the system designer to quickly evaluate the operation of the MCP2X08 8-bit GPIO expanders. The board demonstrates the I/O expansion capabilities/operation of both the MCP213008 (I^2C™ Interface) and MCP23S08 (SPI interface).

**Products supported**
- MCP23008
- MCP23S08
The GPIO Expander Keypad and LCD Demo Board allows the system designer to evaluate the operation of the MCP23X17 and MCP23X08 General Purpose I/O (GPIO) Expanders. The board demonstrates the GPIO Expanders' performance in keypad and LCD example.

**Products supported**
- MCP23008
- MCP23S08
- MCP23017
- MCP23S17
- MCP1702
- PIC18F4550
The PICKit™ Serial SPI Demo Board demonstrates SPI serial communications and operation of the following devices:

- 25LC020A – 2K SPI Bus Serial EEPROM
- TC77-5.0 – Thermal Sensor with SPI Interface
- MCP3201 – 2.7V 12-bit A/D Converter with SPI Serial Interface
- MCP4822 – 12-bit DAC with Internal V<sub>REF</sub> and SPI Interface
- MCP41010 – Single/Dual Digital Potentiometer with SPI Interface
- MCP6S92 – Single-Ended, Rail-to-Rail I/V, Low-Gain PGA
- MCP23S08 – 8-bit I/O Expander with Serial Interface

The PICKit™ Serial SPI Demo Board was designed to easily connect to the PICKit Serial Analyzer (DV164122). The PICKit Serial Analyzer provides the SPI master mode serial communications and power. The PICKit™ Serial SPI Demo Board devices all operate in the SPI slave mode and can easily be connected to virtually any demo or development board by connecting the communications lines to connector P1.

P/N: PKSERIAL-SPI1

Products supported

- TC77
- MCP3201
- MCP4822
- MCP41010
- MCP6S92
- MCP23S08
- 25LC020A
The PICkit™ Serial I\(^2\)C™ Demo Board demonstrates I\(^2\)C™ serial communications and operation of the following devices:

- 24LC02B – 2K Serial EEPROM
- MCP9801 – High-Accuracy Temperature Sensor
- MCP3221 – Low-Power 12-bit A/D Converter
- TC1321 – 10-bit DAC
- MCP23008 – 8-bit I/O Expander

The PICkit™ Serial I\(^2\)C™ Demo Board was designed to easily connect to the PICkit Serial Analyzer (DV164122). The PICkit Serial Analyzer provides the I\(^2\)C™ master mode serial communications and power. The board devices all operate in the I\(^2\)C™ slave mode and can easily be connected to virtually any demo or development board by connecting the communications lines to connector P1.
The PSRR and Digital Noise Evaluation Board (104-00139) is designed to explore and quantify the effects of power and digital noise on system performance. These experiments will help system designers understand the impact that power and digital noise can have in their design.

The PSRR and Digital Noise Evaluation Board supports measurement of Power Supply Rejection Ratio (PSRR) performance of Operational Amplifiers, as well as illustrates effects of Digital Interface spikes on Chip Select pins (and $V_{DD}$, $V_{OUT}$, $V_{IN}$ pins). The various measurements demonstrate importance of $I_{DDQ}$ on PSRR and Digital Noise performance.
The E-Field Evaluation Board (EFIELDDEV) is designed to demonstrate E-field coupling under various conditions on a Printed Circuit Board (PCB). These experiments will help system designers understand the impact PCB layout techniques have on controlling E-field noise in their design.

The E-Field Evaluation Board PCB supports measurement of capacitive trace-trace coupling, in 1-layer, 2-layer, and 3-layer experiments; in each experiment, Transmitter-to-Receiver PCB trace spacings are varied, to demonstrate how coupling changes with distance.
The Magnetic Field Evaluation Board (104-00138) is designed to demonstrate H-field coupling under various conditions. These experiments will help system designers understand the impact PCB layout techniques have on controlling magnetic coupling in their design.

The Magnetic Field Evaluation Board supports measurement of inductive (magnetic) trace-to-loop and loop-to-loop coupling, with and without shielding by planes.
The MCP2030 Bidirectional communication Demo Kit consists of two Transponders and a Base Station unit. The Transponder consists of an MCP2030 (stand-alone, three-axis analog front-end device), a PIC16F636, and a MCP3421 (18-bit delta-sigma analog-to-digital converter). Unlike the existing PKE Reference Design System (P/N: APGRD001) from Microchip Technology, this Transponder uses stand-alone devices for the bidirectional passive keyless entry (PKE) operation. This system also demonstrates the received signal strength indicator (RSSI) function using the MCP3421 delta-sigma ADC.

The MCP203 Bidirectional Communication Demo Kit has been designed for easy modification by customers. The firmware of both the Transponder and Base Station units can be easily modified using the MPLAB® in-circuit serial programmers.

Products supported:
- MCP2030
- MCP3421
- TC4421
- PIC18F4680
- PIC16F636
The RN-171-EK / RN-131-EK is an 802.11 b/g Wi-Fi evaluation kit for the RN171 / RN131 module that can be used to quickly add Wi-Fi connectivity to embedded applications. It has the flexibility to connect directly to a PC via a standard USB interface or to embedded processors through the TTL/UART interface. The board includes 2 convenient pushbuttons for controlling both SoftAP and WPS (Wi-Fi Protected Setup) mode without software configuration. The status LEDs and jumpers enable rapid prototyping and integration into existing systems.

The RN-171-EK can be powered by both a USB cable (included in the kit) or batteries. The board contains a battery boost circuit which makes it possible to power the board using two AAA batteries (the input voltage can go down to 2.0 V DC when using the battery boost circuit). The battery boost circuit makes the RN-171-EK perfect for battery powered applications such as sensors, data acquisition systems, controllers, etc.
The RN Wi-Fi PICtail™/ PICtail Plus Daughter Boards allow customers to easily develop Wi-Fi applications using Microchip’s 8, 16 and 32-bit PIC® microcontrollers. Includes a fully integrated TCP/IP stack allowing for a simple serial to Wi-Fi connection to the microcontroller.

**Key Features:**
- FCC/CE/IC certified 2.4 GHz IEEE 802.11b/g transceiver
- Plugs into Microchip’s Explorer 16 and PIC18 Explorer development boards
- Adds wireless capability to designs targeting the Microchip development ecosystem.
- Compatible with 4, 8, 16, and 32-bit MCUs
- Ultra-low power: 4 µA sleep, 38 mA Rx, 120 mA Tx at 0 dBm (RN-171-PICTAIL) and 4 µA sleep, 40 mA Rx, 210 mA Tx (RN-131-PICTAIL)
- Configurable transmit power
- PCB trace antenna (RN-171-PICTail) and on-board ceramic chip antenna (RN-131-PICTail)

**Kit Contents:**
- RN-171-PICTail or RN-131PICtail Daughter Board
- 2 jumpers (for use with the PIC18 Explorer board only)
The RN-XV-EK1 is an evaluation kit for the RN171XV series of modules. The board connects to a PC via a standard USB cable (included in the kit), and provides 2 pushbutton switches to control WPS mode and to reset the module.

**Key Features:**
- Evaluation kit for the RN171XV module based on Roving Networks’ robust RN171 Wi-Fi module
- Supports several antenna options, depending on the RN171XV module selected
- WPS pushbutton for easy configuration
- Reset pushbutton wakes the module
- Standard USB connector
- Hardware interface: USB via FTDI chipset

**Kit Contents**
- RN-XV-RD2 reference design board
- USB cable

P/N = RN-XV-EK1
The RN-XV-RD2 is a dual relay I/O reference design that demonstrates the RN171XV series of Wi-Fi modules. This convenient reference design includes a USB cable that connects directly from the board to a PC for programming the module over the UART. The board has 2 relays capable of switching up to 240 volts and multiple pushbuttons for reset, ad hoc/WPS mode, and AP mode. Also includes status LEDs and jumpers for quickly and easily evaluating the RN171XV series of modules.

**Key Features:**
- Reference design for evaluating the RN171XV 802.11 b/g Wi-Fi module
- Kit includes a standard USB cable that connects directly from the board to a PC for programming the module over the UART
- Contains 2 10-amp relays capable of switching up to 240V
- Built in temperature sensor
- External temperature probe connector
- 3 status LEDs that mimic the LEDs on the RN171XV module
- 4 pushbutton switches and jumpers to simplify development
- 10 GPIO pins accessible via the 3.3V headers
- Voltage regulator
- Supports several RN171XV antenna options: Wire, SMA connector, U.FL connector

**Kit Contents**
- RN-XV-RD2 reference design board
- USB cable

P/N = RN-XV-RD2
The Wi-Fi® G Demo Board is a compact demonstration platform for customers to easily evaluate and configure Microchip’s new MRF24WG0MA Wi-Fi module. The demo board is a fully-functional standalone web server powered by 2 AAA batteries. It comes with a PIC32 pre-programmed with the Microchip TCP/IP stack, connected to an onboard, fully-certified MRF24WG0MA Wi-Fi module.

**Key Features:**
- Complete IEEE 802.11 b/g Wi-Fi Solution
- Supports Infrastructure/Ad hoc networks and SoftAP networking
- Web server allows for configuration of network settings
- Headers bring out signals for quick prototyping

**The Wi-Fi G Demo Board Offers:**
- Schematics
- Complete applications compliant with Microchip TCP/IP reference source code library
- Reference application source code

**Kit Contents:**
- Wi-Fi G Demo Board
- Wi-Fi G Demo Board Information Sheet

P/N = DV102412
The Wi-Fi PICtail/PICtail Plus Daughter Board is a demonstration board for evaluating Wi-Fi connectivity using PIC microcontrollers and the MRF24WG0MA module. This product is compatible with the Explorer 16 Development Board (DM240001), PICDEM.net2 Development Board (DM163024) and PIC32 Starter Kit (DM320001) with I/O Expansion Board (DM320002).

The TCPIP stack and demo applications can be downloaded from www.microchip.com/MLA

Module Key Features:
- Supports low-power, 802.11b/g to 5mbps data-rate
- Wi-Fi FCC (USA), IC (Canada), ETSI (Europe) Certified
- Integrated PCB Antenna with Simple four-wire SPI interface to PIC® microcontroller
- WEP, WPA-PSK, WPA2-PSK Security
- SoftAP, WPS, and Wi-Fi Direct Client functionality

P/N = AC164149
The RN4020 PICtail / PICtail Plus Board is a Bluetooth® Low Energy demonstration board that showcases the Microchip RN4020 module, a fully-certified Bluetooth Version 4.1 low energy module for designers who want to easily add low power wireless capability to their products. This flexible development board includes the RN4020 paired with an eXtreme Low Power PIC18F25K50 microcontroller.

This convenient development board includes a USB to UART interface for plug-and-play capability. The high-speed UART interface and the General Purpose Input Output (GPIO) ports are available on the RN4020 module to configure, control and transfer data. The RN-4020-PICtail also includes PICtail and PICtail Plus interfaces for connecting to Microchip development boards. The on-board PIC18 microcontroller can be custom programmed via the available PICKit serial programmer / debugger interface. The board also includes on-board connection and data status LEDs enabling rapid prototyping and fast time to market.

**Key Features:**
- Enables flexible development with the RN4020 BTLE Module
- USB to UART Interface, to quickly get started
- Connection and data status LEDs
- PICtail™ and PICtail Plus interfaces for connection to Microchip development boards
- eXtreme Low Power PIC18F25K50 MCU on-board
- PICKit™ serial programmer / debugger interface
- Multiple options for programming and experimentation
The RN-41-EK / RN-42-EK is a fully certified Class 1 Bluetooth evaluation kit for the RN41-I/RM / RN42-I/RM module. It has the flexibility to connect directly to a PC via a standard USB interface or to embedded processors through the TTL UART interface. The status LEDs, switches, and signal headers enable rapid prototyping and integration into existing systems.

**Key Features:**
- Evaluation board with USB interface
- Fully certified Bluetooth 2.1 + EDR/2.1/2.0/1.1 module
- Low power (8-30 mA connected, 2 mA idle)
- Embedded Bluetooth stack profiles included (requires no host stack): GAP, SDP, RFCOMM and L2CAP, with SPP, HID, and DUN profiles
- Supports various modes including HCI and SPP/DUN
- FCC, IC, CE certified, RoHS compliant
Microchip’s Bluetooth® APL modules natively support iAP (iPod Accessory Protocol) data connections and directly manage authentication, reducing engineering effort and cost, and simplifying accessory product design. Apple iOS devices such as the iPhone freely connect with Bluetooth hands-free and headset accessories. However, establishing Bluetooth data connections with Apple devices requires a unique discovery/pairing sequence and negotiation with the Apple authentication co-processor.

APL modules are based on the standard RN41 and RN42, making them footprint compatible. Power, ground and UART connections are identical, and connection of the Apple authentication chip is direct to the module via a 3-wire interface.

Key Features:
- Discoverable/Connectable with iPhone, iPod or iPad
- Allows dual profile Bluetooth® connections to other smartphone or computing platforms
- Automatically stores Bluetooth® address of the last paired iPhone, iPod, or iPad device, for quick reconnection
- Secure Simple Pairing (SSP) enables 'no PIN code required' operation
- Supports the complete Roving Networks Bluetooth® feature set
- Direct hardware connection to the authentication coprocessor
- No iAP firmware development required for authentication on host microprocessor
- Class 1 (~100m) and Class 2 (~30m) versions available

The RN-4x-APL-EVAL evaluation kits include:

RN-4x-APLX development board which contains:
- RN4xAPL-I/RM module
- Apple authentication co-processor
- Status LEDs
- Power regulation
- RS232 and TTL signals
- Four RN4xAPL-I/RM modules
- Complete design documents including schematics
- Source code for the Roving Networks Diagnostic Application

All products designed to connect to iPhones, iPods and iPads, including those that incorporate the Roving Bluetooth® APL module must be registered and approved with Apple’s Made for iPod (MFi) program. Developers of such products should visit Apple’s developer portal at: [http://developer.apple.com/ipod/](http://developer.apple.com/ipod/). With MFi membership, engineers can purchase the evaluation kit which includes detailed documentation and support.
The RN Bluetooth modules support many different profiles including SPP, DUN, iAP and HID. HID, or Human Interface Device, refers to the device providing the service of human data input and output to and from the host. The Bluetooth HID profile enables customers to develop products such as a game controller, keyboard, mouse, or pointing device. Additionally, Microchip has extended the basic HID capability to allow programmability and control of devices like the iPad for example.

**Reference design**

To demonstrate the capabilities of the HID firmware, Microchip has a reference design called the [RN-42-HID-RD1](#) based on the RN42 Bluetooth module running the HID profile. This HID reference design offers three modes of operation:

- **Presenter mode**: Enables the control of presentation software such as Microsoft® Powerpoint
- **Music mode**: Enables the control of music functions such as pause, play, volume controls and switching tracks on devices such as iPhones® and iPods®
- **Custom mode**: Enables programming of each button to send a sequence of keys
The RN-52-EK is an evaluation kit for the RN52, a fully certified Bluetooth version 3.0 audio module, and fully compatible with Bluetooth version 2.1 + EDR. It demonstrates the key features of the RN52 allowing designers to quickly and easily evaluate and develop prototypes.

Features:
- Based on RN52 Bluetooth audio module
- Demonstrates key features of RN52 module for embedded systems
- Allows designers to develop prototypes and proof of concept
- Dual channel audio output and input available in analog and digital formats
- Provides interface to external devices
- USB port to supply power and access to command interface
- Built-in amplifier for stereo audio output and 6 function buttons
- Additional support for codecs such as aptX®, AAC, MP3, and others

Supported Bluetooth Profiles:
- A2DP stereo audio (sink mode, SBC codec)
- AVRCP media player remote control
- HFP/HSP can accept a phone call from mobile phone
- SPP allows serial data over UART
- iAP Profile discovery

P/N = RN-52-EK

Kit Contents:
- RN52 Evaluation board
- USB cable
- Two stereo mini-speakers
- Microphone
The PIC32 Bluetooth® Audio Development Kit provides a comprehensive solution to develop Bluetooth A2DP audio streaming solutions and applications. The board is coupled with two daughter cards: the Bluetooth HCI Radio Daughter Card that demonstrates a low cost Bluetooth implementation and the Audio DAC Daughter Card that demonstrates a high quality 16/24-bit, 32-192 KHz audio conversion/amplification for line or headphones. The kit ships with demo code that enables wireless streaming digital audio from any Bluetooth enabled Smartphone or portable music player or over USB.

Key Features:
• PIC32MX450/470 MCU
• HCI Bluetooth module Daughter Card (QDID Certified Module)
• 16/24-bit, 32-192KHz DAC/Amp Daughter Card
• USB Host/Device audio support
• USB Charging
• 2 inch color LCD Display
• Headphone/Line Out
• Audio Control function

Bluetooth /USB Audio Software Support for:
• Apple*
• Samsung Audio
• Google/Android AOA Audio
• Bluetooth Audio w/ SBC & AAC Decode
• Bluetooth Stack QDID Certified

*For Apple USB Authenticated applications contact applesupport@microchip.com
The MRF49XA PICtail/PICtail Plus Daughter Board is a demonstration and development daughter board for the MRF49XA ISM Band Sub-GHz RF Transceiver. The daughter board can plug into multiple Microchip Technology demonstration and development boards. For example, for 8-bit microcontroller development using the PIC18 Explorer Board (DM183032) or 16-bit microcontroller development using the Explorer 16 Development Board (DM240001). Supported MiWi software stack and radio utility driver can be downloaded from the Microchip website at: www.microchip.com/wireless.
The MRF49XA PICtail/PICtail Plus Daughter Board is a demonstration and development daughter board for the MRF49XA ISM Band Sub-GHz RF Transceiver. The daughter board can plug into multiple Microchip Technology demonstration and development boards. For example, for 8-bit microcontroller development using the PIC18 Explorer Board (DM183032) or 16-bit microcontroller development using the Explorer 16 Development Board (DM240001). Supported MiWi software stack and radio utility driver can be downloaded from the Microchip website at: www.microchip.com/wireless.

Part #AC164137-2
The MRF89XAM8A PICtail/PICtail™ Plus Daughter Board is a demonstration and development daughter board for the 868 MHz radio transceiver module which conforms to the European ETSI standard.

The module is surface mounted to a PICtail/PICtail Plus daughter board that plugs into multiple Microchip demonstration and development boards like the PICDEM PIC18 Explorer Board (DM183032) for 8-bit microcontroller development, or the Explorer 16 Development Board (DM240001) for 16-bit microcontroller development.

Targeted for the MiWi™ Development Environment and other proprietary wireless protocol applications, the MRF89XAM8A is a perfect solution for low-cost, low-power, complete embedded wireless applications. Supporting software stacks and application notes may be downloaded from www.microchip.com/wireless.

Part #AC164138-1
The ZENA™ Wireless Adapter is a multi-function Universal Serial Bus (USB) wireless adapter connecting USB-equipped desktop or notebook computers with Microchip wireless products for development or application uses.

As a development tool, the ZENA Wireless Adapter can be used as a protocol analyzer or as a diagnostic tool. It can also be used to connect the computer as a wireless node to the network for application use.

The ZENA Wireless Adapter is capable of performing a variety of functions and each function can be programmed into the adapter using the USB boot loader.

The ZENA Wireless Adapter is preprogrammed with a MiWi™ Wireless Protocol Sniffer application. This allows the user to display MiWi Wireless Protocol packets in a graphical format in the Wireless Development Studio.

Upload firmware applications from the Wireless Development Studio.
The ZENA™ Wireless Adapter is a multi-function Universal Serial Bus (USB) wireless adapter connecting USB-equipped desktop or notebook computers with Microchip wireless products for development or application uses.

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The ZENA Wireless Adapter is capable of performing a variety of functions and each function can be programmed into the adapter using the USB boot loader.

The ZENA Wireless Adapter is preprogrammed with a MiWi™ Wireless Protocol Sniffer application. This allows the user to display MiWi Wireless Protocol packets in a graphical format in the Wireless Development Studio.

Upload firmware applications from the Wireless Development Studio.

Part #AC182015-2
8-bit Wireless Development Kit – 868 MHz MRF89XA is an easy-to-use evaluation and development platform for Sub GHz application designers. This kit includes Microchip’s MRF89XAM8A transceiver module and also features Microchip’s PIC18 XLP microcontroller family. The kit includes complete hardware needed to rapidly prototype wireless applications. The demonstration kit is pre-programmed with MiWi™ protocol stack and you can find the demo instructions in the user’s guide. To learn more about MiWi wireless protocol, please visit www.microchip.com/MiWi.

The PIC18 demonstration board is equipped with a 28-pin PICtail™ connector to interface with Microchip's wireless transceiver PICtail daughter boards such as MRF24J40MA, MRF89XAM8A and MRF49XA.

Developers can reprogram or modify the PIC18 MCU Flash memory and develop and debug application code all on the same platform.

Part #DM182015-2
MiWi Demo Kit – 868 MHz MRF89XA is an easy-to-use evaluation and development platform for 868 MHz applications. This kit includes Microchip’s MRF89XAM8A transceiver module and also features Microchip’s PIC18 XLP microcontroller family. The kit includes complete hardware needed to rapidly prototype wireless applications. The demonstration kit is pre-programmed with MiWi™ protocol stack and you can find the demo instructions in the user’s guide. To learn more about MiWi wireless protocol, please visit www.microchip.com/MiWi. Developers can reprogram or modify the PIC18 MCU Flash memory and develop and debug application code all on the same platform.
The MRF89XAM9A PICTail/PICtail™ Plus Daughter Board is a demonstration and development daughter board for the 915 MHz radio transceiver module which is FCC certified. The module is surface mounted to a PICtail/PICtail Plus daughter board that plugs into multiple Microchip demonstration and development boards like the PICDEM PIC18 Explorer Board (DM183032) for 8-bit microcontroller development, or the Explorer 16 Development Board (DM240001) for 16-bit or 32-bit microcontroller development.

Targeted for the MiWi™ Development Environment and other proprietary wireless protocol applications, the MRF89XAM9A is a perfect solution for low-cost, low-power, complete embedded wireless applications. Supporting software stacks and application notes may be downloaded from www.microchip.com/wireless.

Part #AC164138-2
8-bit Wireless Development Kit – 915 MHz MRF89XA is an easy-to-use evaluation and development platform for Sub GHz application designers. This kit includes Microchip’s MRF89XAM8A transceiver module and also features Microchip’s PIC18 XLP microcontroller family. The kit includes complete hardware needed to rapidly prototype wireless applications. The demonstration kit is pre-programmed with MiWi™ protocol stack and you can find the demo instructions in the user’s guide. To learn more about MiWi wireless protocol, please visit www.microchip.com/MiWi.

The PIC18 demonstration board is equipped with a 28-pin PICtail™ connector to interface with Microchip's wireless transceiver PICtail daughter boards such as MRF24J40MA, MRF89XAM8A and MRF49XA.

Developers can reprogram or modify the PIC18 MCU Flash memory and develop and debug application code all on the same platform.
MiWi Demo Kit – 915 MHz MRF89XA is an easy-to-use evaluation and development platform for 868 MHz applications. This kit includes Microchip’s MRF89XAM8A transceiver module and also features Microchip’s PIC18 XLP microcontroller family. The kit includes complete hardware needed to rapidly prototype wireless applications. The demonstration kit is pre-programmed with MiWi™ protocol stack and you can find the demo instructions in the user’s guide. To learn more about MiWi wireless protocol, please visit www.microchip.com/MiWi. Developers can reprogram or modify the PIC18 MCU Flash memory and develop and debug application code all on the same platform.
RF based Remote Controls are becoming more prevalent as they enable non line-of-sight and provide bi-directional communication. A high-end remote control typically has a graphics display, a number of keys and a radio to communicate with the target devices.

Microchip’s Remote Control Demo Board (Part # DM240315-2) integrates Graphics, mTouch, USB and RF4CE into a single demo. The board demonstrates a remote populated with PIC24FJ256DA210 MCU, 3.5" Graphical TFT LCD with resistive touch screen, capacitive touch keys with plastic overlay, MRF24J40 2.4 GHz transceiver and ZENA™ wireless Adapter.

Part #DM240315-2
The ZENA™ Wireless Adapter is a multi-function Universal Serial Bus (USB) wireless adapter connecting USB-equipped desktop or notebook computers with Microchip wireless products for development or application uses. As a development tool, the ZENA Wireless Adapter can be used as a protocol analyzer or as a diagnostic tool. It can also be used to connect the computer as a wireless node to the network for application use.

The ZENA Wireless Adapter is capable of performing a variety of functions and each function can be programmed into the adapter using the USB boot loader.

The ZENA Wireless Adapter is preprogrammed with a MiWi™ Wireless Protocol Sniffer application. This allows the user to display MiWi Wireless Protocol packets in a graphical format in the Wireless Development Studio.

Upload firmware applications from the Wireless Development Studio.
The PICDEM Z Demonstration Kit is designed to allow developers to evaluate and experiment with Microchip RF solutions. It is designed to work with either the ZigBee™ or MiWi™ protocol. The PICDEM Z Demonstration Kit provides two nodes to create a simple two-node network. If required, additional nodes may be purchased to expand the network. The preprogrammed demo application firmware shows a simple two-node ZigBee™ protocol network. Using either the MiWi Wireless Networking Protocol Stack or the Microchip Stack for ZigBee™ Protocol source code, available free of charge from the Microchip website, developers can develop their own applications.

**Products supported**
- MRF24J40
- TC77-3.3MCTTR
- PIC18LF4620

P/N: DM163027 and AC163027
MiWi™ Protocol to Wi-Fi® Wireless Demo kit allows developers to evaluate and experiment with MiWi protocol to Wi-Fi gateway solutions. The kit includes a Wireless Evaluation Board with both the MiWi protocol and Wi-Fi transceivers. The kit also includes two MiWi Demo Boards to create a three node MiWi protocol network. The Wireless Evaluation Board can be connected to a client device, such as a laptop or a mobile phone using the Wi-Fi network. Based on the application running on the MiWi protocol nodes, the information exchanged can be displayed on the client device. To learn more about MiWi wireless protocol, please visit www.microchip.com/MiWi & To learn more about WiFi solutions, please visit www.microchip.com/WiFi.

Demo Software
The demo software can be downloaded from the “Microchip Libraries of Applications” at www.microchip.com/MLA. After installing the MLA, you can find the demo source code at ..\Microchip Solutions \ Combo folder.
MiWi Demo Kit – 2.4 GHz MRF24J40 is an easy-to-use evaluation and development platform for IEEE 802.15.4 application designers. This kit includes Microchip’s MRF24J40MA transceiver module and also features Microchip’s PIC18 XLP microcontroller family. The kit includes complete hardware needed to rapidly prototype wireless applications. The demonstration kit is pre-programmed with MiWi™ protocol stack and you can find the demo instructions in the user’s guide. To learn more about MiWi wireless protocol, please visit www.microchip.com/MiWi.

Developers can reprogram or modify the PIC18 MCU Flash memory and develop and debug application code all on the same platform.
8-bit Wireless Development Kit – 2.4 GHz MRF24J40 is an easy-to-use evaluation and development platform for IEEE 802.15.4 application designers. This kit includes Microchip’s MRF24J40 transceiver module and also features Microchip’s PIC18 XLP microcontroller family. The kit includes complete hardware needed to rapidly prototype wireless applications. The demonstration kit is pre-programmed with MiWi™ protocol stack and you can find the demo instructions in the user’s guide. To learn more about MiWi wireless protocol, please visit www.microchip.com/MiWi.

The PIC18 demonstration board is equipped with a 28-pin PICtail™ connector to interface with Microchip's wireless transceiver PICtail daughter boards such as MRF24J40MA, MRF89XAM8A and MRF49XA.

Developers can reprogram or modify the PIC18 MCU Flash memory and develop and debug application code all on the same platform.
The MRF24J40MA PICtail Plus 2.4GHz Radio Frequency Card is built with the NEW agency-certified MRF24J40MA IEEE 802.15.4 RF transceiver module. The module is attached to a PICTail Plus carrier board allowing the RF Board to be used with an Explorer 16 development kit. Targeted for ZigBee, MiWi, and MiWi P2P wireless protocol applications, the MRF24J40MA is a perfect solution for low-cost, low-power complete embedded wireless PAN applications.

Part #AC164134
The MRF24J40MA PICtail/PICtail Plus Daughter Board is a demonstration and development daughter board for the agency-certified MRF24J40MA 2.4GHz IEEE Std. 802.15.4™ +0 dBm RF Transceiver Module.

The module is surface-mounted to a PICtail/PICtail Plus daughter board that allows it to plug into multiple Microchip Technology Demonstration and development boards like the PIC18 Explorer Board (DM183022) for 8-bit microcontroller development or the Explorer 16 Development Board (DM240001) 16-bit microcontroller development.

Targeted for ZigBee® and MiWi™ Development Environment wireless protocol applications, the MRF24J40MA is a perfect solution for low-cost, low-power complete embedded wireless PAN applications. Supporting software stacks and application notes may be downloaded from the Microchip website at [http://www.microchip.com/wireless](http://www.microchip.com/wireless)

Part #AC164134-1
The MRF24J40MC PICtail/PICtail Plus Daughter Board is a demonstration and development daughter board for the MRF24J40MC 2.4GHz IEEE Std. 802.15.4™ 20 dBm RF Tranceiver Module with external antenna.

The daughter board can plug into multiple Microchip Technology Demonstration and development boards. For example, for 8-bit microcontroller development using the PIC18 Explorer Board (DM183032) or 16-bit microcontroller development using the Explorer 16 Development Board (DM240001).

Supporting software stacks and application notes may be downloaded from the Microchip website at http://www.microchip.com/wireless.

Part #AC164143
The MRF24XA PICtail™/PICtail Plus Daughter Board is a demonstration and development daughter board for the MRF24XA Low-Power, 2.4 GHz ISM-Band IEEE 802.15.4™ RF transceiver.

The daughter board can be plugged into multiple Microchip Technology demonstration and development boards. For example, the daughter board is appropriate for 8-bit microcontroller development using the PIC18 Explorer Board (DM183032) or for 16-bit and 32-bit microcontroller development using the Explorer 16 Development Board (DM240001).

Targeted for ZigBee® and MiWi™ Development Environment wireless protocol applications, the MRF24XA is a perfect solution for low-cost, low-power and battery powered embedded wireless PAN applications. Supporting software stacks and application notes may be downloaded from the Microchip website at Personal Area Networks Design Center: http://www.microchip.com/pan
Microchip offers three FREE wireless protocol stacks to our customers to aid them in their IEEE 802.15.4 short-range wireless networking development and now we offer the Certified ZigBee PRO protocol stack for those customers needing the advanced features of this new protocol.

**ZigBee® PRO**
- Certified ZigBee PRO protocol stack
- Part of Microchip’s Certified ZigBee PRO Compliant Platform

**ZigBee® Residential**
- Certified ZigBee 2006 protocol stack
- Part of Microchip’s Certified ZigBee Compliant Platform

**MiWi™**
- Microchip Wireless Proprietary protocol stack
- Based on IEEE 802.15.4 standard
- Small footprint, highly optimized Mesh and Star Network protocol

**MiWi™ P2P**
- Microchip Wireless Proprietary peer-to-peer protocol stack
- Based on IEEE 802.15.4 standard
- Ultra-Small footprint (3KB), Peer-to-Peer Network protocol
Microchip offers three FREE wireless protocol stacks to our customers to aid them in their IEEE 802.15.4 short-range wireless networking development and now we offer the Certified ZigBee PRO protocol stack for those customers needing the advanced features of this new protocol.

**ZigBee® PRO**
- Certified ZigBee PRO protocol stack
- Part of Microchip’s Certified ZigBee PRO Compliant Platform

**ZigBee® Residential**
- Certified ZigBee 2006 protocol stack
- Part of Microchip’s Certified ZigBee Compliant Platform

**MiWi™**
- Microchip Wireless Proprietary protocol stack
- Based on IEEE 802.15.4 standard
- Small footprint, highly optimized Mesh and Star Network protocol

**MiWi™ P2P**
- Microchip Wireless Proprietary peer-to-peer protocol stack
- Based on IEEE 802.15.4 standard
- Ultra-Small footprint (3KB), Peer-to-Peer Network protocol
The Ethernet PICtail™ Daughter Board is an Ethernet demonstration board for evaluating Microchip Technology's ENC28J60 stand-alone 10 Base-T Ethernet controller. It is an expansion board compatible with a number of PICDEM™ demonstration boards. A complete list of compatible PICDEM™ demonstration boards is available on Microchip's web site.

Products supported
- ENC28J60
- 25LC256
USB EVBs Continued

- **USB3740**
  - USB2.0 2-Port Switch
  - Customer Evaluation Board
  - EVB-USB3740

- **USB375x**
  - USB2.0 Port Protection w/Switch
  - Customer Evaluation Board
  - EVB-USB3750

- **USB333x**
  - USB PHY (Mobile)
  - Customer Evaluation Board
  - EVB-USB3330

- **USB334x**
  - USB PHY (General)
  - Customer Evaluation Board
  - EVB-USB3340

- **USB266x**
  - USB2.0 Flash Media Controller w/Hub
  - Customer Evaluation Board
  - EVB-USB2660
The MCP2200EV-VCP is a USB to RS232 development and evaluation board for the MCP2200 USB to UART device. The board allows for easy demonstration and evaluation of the MCP2200. The accompanying software allows the special device features to be configured and controlled.

The board is powered from USB. Each I/O has an associated test point. In addition, two I/O are connected to LEDs which are used to indicate USB to UART traffic when the associated pins are configured as TxLED and RxLED pins respectively.
The MCP2200 Breakout Module is a development and evaluation platform for the USB-to-UART (Universal Serial Bus-to-Universal Asynchronous Receiver/Transmitter) serial converter MCP2200 device. The module is comprised of a single Dual In-Line Package (DIP) form-factor board.
The MCP2210 Breakout Module can be used with either the MCP2210 Motherboard or as a standalone USB to SPI (Master) bridge module. The breakout board provides all the needed signals in order to assist the user in building their own boards using the MCP2210. The MCP2210 Utility software allows custom device configuration. In addition, a DLL package is also available in order to allow development of custom software utilizing the MCP2210.

**Products supported**

- MCP2210
The MCP2210 Evaluation Kit is a development and evaluation platform for the MCP2210 device. The MCP2210 Motherboard is designed to work together with the MCP2210 Breakout Board (included). The motherboard provides the test points needed for measurements and it also contains the following SPI slave chips:

- MCP23S08 – 8 bit I/O expander
- MCP3204 – 4 channel, 12-bit ADC
- 25LC02 – 2kbit EEPROM
- TC77 – temperature sensor

All the mentioned chips are SPI slaves controlled by the MCP2210. The MCP2210 Eval Board Demo software can be used to demonstrate the MCP2210 as a USB-to-SPI (Master) device and allow I/O control. In addition, the MCP2210 Utility software allows custom device configuration. A DLL package is also available in order to allow development of custom software using the MCP2210.
The MCP2221 Breakout Module is a development and evaluation platform comprised of a single DIP form factor board. The provided supporting software demonstrates the capabilities of the MCP2221 device as a USB-to-UART/I2C/SMBus protocol converter. Additionally, these tools provide simple access for I/O control and the ability to establish custom device configuration. Custom tools can also be created through the use of the provided DLL package.

**Features:**
- UART Tx and Rx signals
- I2C/SMBus clock and data lines (SCL and SDA)
- Four GP lines, configurable for GPIO, dedicated or alternate function operation
- User-selectable (jumper) power supply of 3.3V or 5V (up to 500 mA)
- DIP form factor
- PICkit™ Serial Analyzer header — used for UART and I2C/SMBus communication only
The demo board is a complete stand-alone smoke detector application with a smoke chamber emulator. The demo board allows evaluation of all the functions of the RE46C190. Key test points of the device are available at the bottom edge of the demo board. The demo board is designed for battery operation using a CR123A battery or can be operated using a power supply. The RE46C190 application circuit is on the right side of the board by the battery holder and piezo horn and the smoke chamber emulator is on the left. The smoke chamber emulator can be disconnected from the application circuit and a photo smoke chamber or its components can be connected to the demo board.
The MTS2916A Dual Full-Bridge Stepper Motor Driver Evaluation Board demonstrates the capabilities of the MTS2916A to control both windings of a bipolar stepper motor. The board also demonstrates the capabilities of the MTS62C19A, which has the same functionality, but different pin assignments. A PIC16F883 is utilized for motor control processing.

This evaluation board incorporates features through the implementation of push button switches and a variable speed input potentiometer to exercise a stepper motor in Full-Step, Half-Step, Modified Half-Step and Microstepping modes. LEDs indicate a binary representation of which mode has been selected. The evaluation board and the stepper motor can be powered from a single power input J1 (7 VDC to 12 VDC) with jumper JP2 installed. For higher motor voltages, make sure JP2 is not installed, and connect VLOAD at J4. Numerous test points have been designed into the board to allow easy access.
The MTD6505 3-Phase BLDC Sensorless Fan Controller Demonstration Board allows the control and monitoring of the MTD6505 device using PC software connected to the board via a USB connection. The included board software provides several features including $V_{DD}$ control and monitoring, pulse-width modulation (PWM) control, speed and current consumption monitoring. It also allows selecting the $R_{PROG}$ resistor value for fan fitting.
The MCP8024 TQFP BLDC Motor Driver Evaluation Board demonstrates Microchip’s MCP8024 3-Phase Brushless DC (BLDC) Motor Gate Driver in a BLDC motor drive application. The MCP8024 contains the high-side and low-side drivers for external N-channel MOSFETs. A dsPIC33FJ32MC204 motor control processor is used to supply the PWM inputs to the MCP8024 as well as handle the high-speed Analog-To-Digital Conversion (ADC) required for 40 KHz PWM operation. The MCP8024 onboard UART is used to configure the MCP8024 and to send fault information to the dsPIC controller. The evaluation board firmware uses a 6-step trapezoidal drive control algorithm to demonstrate the MCP8024 capabilities.

**Features:**
- Input Operating Voltage Range: +7.0V to +28V
- 500 mA (max) of gate drive current for external N-Channel MOSFETs
- Drives up to a 15 Amp BLDC motor
- 750 mW Buck Regulator with resistor programmable output voltage
- RESET momentary contact switch
- Two Spare user programmable momentary contact switches
- 100 pin dsPIC PIM header for use with MA330017 compatible PIMs
- PICkit 3, Real Ice, and ICD3 debugger interfaces
- Speed control potentiometer
- Terminal block for 5V or 12V Hall effect sensors
- SPI and I2C headers for user communications use

**P/N:** ADM00557

**Products supported**
- MCP8024
- dsPIC33FJ32MC204
MCP8063 12V 3-Phase BLDC Sensorless Fan Controller Kit

The MCP8063 12V 3-Phase BLDC Sensorless Fan Controller Demonstration Kit allows the control and monitoring of Microchip 12V fan driver devices, such as the MCP8063 or MTD6501, using a PC software connected to the demo board via a USB connection. The MCP8063 12V 3-Phase BLDC Sensorless Fan Controller Demonstration Board software provides several features, such as fan driver power supply control and monitoring, pulse-width modulation (PWM) control, and speed and current consumption monitoring. It also allows automatic application testing.

Features:
• PC software allows controlling and monitoring the MCP8063 3-Phase Fan Controller via USB connection
• VDD voltage control and IDD current measurement
• PWM control for speed setting
• FG measurement for speed monitoring
• Automated test measurement

Products supported
- MCP8026

P/N: ADM00575
MCP8025 BLDC Motor Driver Evaluation Board

The MCP8025 TQFP BLDC Motor Driver Evaluation Board demonstrates Microchip’s 3-Phase Brushless DC (BLDC) Motor Gate Driver with Power Module, MCP8025, used in a BLDC motor drive application. When used in conjunction with a microcontroller, the MCP8025 will provide the necessary drive signals to drive for a 3-Phase BLDC motor.

The MCP8025 contains the high-side and low-side drivers for external N-channel MOSFETs. A dsPIC33EP256MC504 processor is used to supply the PWM inputs to the MCP8025 as well as handle the high-speed Analog-To-Digital Conversion (ADC) required for 50 kHz PWM operation.

Features:
- Input Operating Voltage Range: +6.0V to +19V
- Drives up to a 15A BLDC motor
- ON/OFF momentary contact switch
- Reset momentary contact switch
- Spare user-programmable momentary contact switch
- PWM signal LED indicators
- PICkit 3 and MPLAB ICD 3 debugger interfaces
- Speed control potentiometer
- Terminal block for 5V and 12V Hall-effect sensors
- LIN terminal block for user communications use
- Complete “C” source code (provided on the board web page)

P/N: ADM00600

Products supported
- MCP8025
- dsPIC33EP256MC504
The MCP7941x RTCC PICtail™ Plus Daughter Board demonstrates the features and abilities of the MCP7941x and MCP7940x Real-Time Clock/Calendar family in standard development platforms. By designing this daughter board with the PICtail Plus, PICtail and PICkit™ Serial connectors, it will operate with the Explorer 16 Development Board, the PICDEM PIC18 Explorer Board, the XLP16-bit Development Board and the PICkit Serial Analyzer tool. Also included is a 3V coin cell battery that can be installed in the coin cell holder for backup power.

**Products supported**
- MCP79410
- MCP79411
- MCP79412
- MCP79400
- MCP79401
- MCP79402
- MCP7940N

P/N: AC164140
The MCP795XX RTCC PICtail™ Plus Daughter Board demonstrates the features and abilities of the MCP795xx SPI Real-Time Clock/Calendar (RTCC) family in standard development platforms. This daughter board will support the full featured 14-pin MCP795W2x and MCP795W1x devices along with the mid-range 10-pin MCP7952x and MCP7951x devices. By designing this daughter board with both PICtail and PICtail Plus connectors, it will operate with the Explorer 16 Development Board and the PICDEM PIC18 Explorer Board. Also included is a 3V coin cell battery for backup power to the RTCC.

**Products supported**
- MCP7951x
- MCP7952x
- MCP795W1x
- MCP795W2x
The Voltage Supervisor SOT-23-5/6 Evaluation Board allows the system designer to quickly evaluate the operation of Microchip Technology’s Voltage Supervisors and Voltage Detectors in the SOT-23-5 (5-pin SOT-23) or SOT-23-6 (6-pin SOT023) packages.

The Voltage Supervisor SOT-23-5/6 Evaluation Board PCB supports the four different SOT-23-6 pinouts (which also supports compatible SOT-23-5 footprints) and one SOT-23-5 footprint.

This board has been made generic so that other devices in the SOT-23-5 and SOT-23-6 packages may be supported with this board.

**Products supported**
- 5-pin SOT-23 packages
- 6-pin SOT-23 packages
The Voltage Supervisor SOT-23 Evaluation Board allows the system designer to quickly evaluate the operation of Microchip Technology’s Voltage Supervisors and Voltage Detectors in the SOT-23-3 (3-pin SOT-23) package. The Voltage Supervisor SOT-23 Evaluation Board PCB supports the four different SOT-23-3 pinouts for the product family. This board has been made generic so that other devices in the SOT-23-3 package may be supported with this board.

Products supported
- 3-pin SOT-23 packages

P/N: VSUPEV
The 8-Pin SOIC/MSOP/TSSOP/DIP Evaluation Board allows the system designer to quickly evaluate the operation of Microchip Technology’s devices in any of the following 8-pin packages: SOIC, MSOP, DIP, TSSOP.

**Products supported**
- 8-pin SOIC packages
- 8-pin MSOP packages
- 8-pin TSSOP packages
- 8-pin PDIP packages

**Note:**
1. Can be any passive component (C, R, L) that fits into a 0.150 surface-mount footprint.
2. Optional power device filtering capacitors.
3. When installing this component, ensure to cut the trace between the two pads of the device.

P/N: SOIC8EV
The 14-Pin SOIC/TSSOP/DIP Evaluation Board allows the system designer to quickly evaluate the operation of Microchip Technology's devices in any of the following 14-pin packages: SOIC, DIP, TSSOP.
Analog and Interface Overview
Universe of Embedded Control Systems

- Microchip's Analog Products
- Other Microchip Offerings

- Digital Pot
- Amplifiers
- Precision Voltage Reference
- Filters
- A/D
- Power Conversion
- Power Management - Regulators - Supervisory
- Non-Volatile Memory, Serial SRAM
- RF Transmit/Receive
- High Voltage I/O's
- IR Communications
- Telecom DTMF Codec
- Power Amplifiers
- Power Drivers
- Motor Drivers
- D/A
- LCD Drivers
- LED Drivers
- Transceivers - RS232/485 - CAN, LIN - USB
- Bus Communication - CAN, LIN - USB - Ethernet
- Digital Peripherals - PWM - Real Time Clock
- Encryption (Keeloq) - Speech Co-Processing
- Smoke Detector ICs
- Piezoelectric Horn Drivers

Microcontrollers

Universe of Embedded Control Systems
Focus on Applications

- **Power and Flow Metering**
  - Signal conditioning
  - Power management
  - Analog-to-digital conversion
  - Data computation
  - Temperature monitoring

- **Smoke & CO Detectors**
  - ASICs
  - Power management
  - Signal conditioning

- **PCs Laptops, Servers and Gaming**
  - Signal conditioning
  - Power management
  - Temperature sensing
  - Fan control

- **Temperature Measurement**
  - Temperature sensors
  - Signal conditioning
  - Power management
  - Analog-to-digital conversion,
  - Data computation

- **Power Supplies**
  - Power management
  - Temperature monitoring

- **Lighting**
  - LED drivers w/ offline capability
  - Power management
  - Temperature monitoring
Proprietary Enabling Technology

Low Power CMOS Process
Lower power than competing processes

Understanding of Customer Needs
Only necessary features are included, unnecessary power consuming features are excluded

Simplified Designs
Proprietary designs reduce circuit complexity for more performance and less power

Non-volatile Trim
Accuracy achieved through after-package trimming, not complex, power consuming circuitry

Expertise on multiple process nodes
Advanced Lithographies

High Voltage Technology
Offline and automotive capabilities

A Complete Analog Solution
What Makes Microchip Analog Different?

- **Flexibility to customers:**
  - Using both internal and external fabs allows flexibility and safety for our customers
  - Our knowledge of NVM makes analog easier to manufacture and offers flexibility

- **Analog for digital systems:**
  - Easy to use development tools
  - Standard digital serial interfaces

- **Design-in support**
Microchip Analog/Interface Attributes

- Low power/low voltage
  - Op amps with lowest power for a given gain bandwidth: 450nA/1.4V/9kHz Op Amps
  - 0.65V start-up voltage switching regulator

- Robustness
  - MOSFET drivers lead the industry in latch-up immunity/stability
Integration
- Switcher + LDO, LDO + reset
- PGA integrates MUX, resistive ladder, gain switches, high-performance amplifier, SPI interface

Innovation
- Zero-Drift and mCal auto-calibration technology
- Sinusoidal motor drivers
- Proprietary algorithms for low power high accuracy ADC and high-speed ADC families
Space savings

- ADC, Op amps, comparators, Supervisors and LDOs in SC70, ADCs, temperature sensors in SOT-23
- CAN and IrDA® standard protocol stack embedded in an 18-pin packages

Accuracy

- Offset trimmed after packaging using non-volatile memory
Worldwide Manufacturing Locations

- Arizona Corp. HQ
- Fab 2
- Oregon Fab 4
- Bangkok Test & Assembly
Worldwide Technical Support Centers

The only non-commissioned sales team in the semiconductor industry
AIPD has developed design centers of excellence for specific applications:

- ACE Center for Energy Measurement (Romania)
- ACE Center for Interface Solutions (Chandler, AZ)
- ACE Center for Motor Solutions (Endwell, NY)
- ACE Center for Power Supplies (Endwell, NY)
- ACE Center for Smoke Detectors (Norristown, PA)
Offer a wide range of high-accuracy, space-saving, low-power products well suited for portable applications

- Offer great cost-to-performance ratio
- Low voltage operation and low current consumption
- DC fan speed control/DC fan fault detection
- Over-, under-temperature monitoring
- Temperature measurement
- Thermal calibration
Power Management Solution

Microchip’s Winning Attributes

- High-voltage product offering
- Built-in intelligence
- Optimized, high-efficiency power conversion
- Low power, low startup voltage regulators
- Small footprint
- Stability & robustness
Provide complete system solutions for sensor signal conditioning & data acquisition applications, while focusing on:

- Integration: reduced component count
- Low power: low operating current and voltage
- Precision: high resolution, low offset voltage
- Low system cost: affordable pricing
- Small footprints
Microchip’s Winning Attributes

- Lower cost to performance ratio
- Lowest supply current Op Amps for a given Gain-Bandwidth Product
- High accuracy delta-sigma ADCs and high-speed pipelined ADCs
- Broad digital potentiometer portfolio
Develop MCU/DSP-synergistic products for the automotive and industrial market segments
- CAN, LIN, infrared, ethernet, RF, USB to UART
- Transceivers, expanders

Enable the implementation of wireless and wire-line communication via inexpensive & easy-to-use products
Microchip’s Winning Attributes

- Horn drivers meet loudness requirements
- Electronic calibration
- 3V operation, Single cell battery operation
- Piezo Horn Drivers
  - Piezo alarm system, industrial and consumer
  - CO Detectors, MCU Smoke Detectors
  - E-bike horns
- Photoelectric Smoke Detectors
- Ion Smoke Detectors
Motor Drive and Control Solution

- Portfolio Offering includes
  - Dual H-bridge motor drivers
  - Integrated sensorless sinusoidal 3-phases BLDC fan drivers
- Lowest supply current Vs. major competitors
- Total solution provider with PIC MCU and dsPIC DSC
- Applications in Industrial & Security, Automotive & Medical, Appliances
Summary

- Complete Embedded Control solution provider
  - Strong low power portfolio
  - High voltage product focus
  - High integration in space-saving packages
- Best lead-time in the industry
- Excellent worldwide technical support
- Excellent design and training resources
End Equipments

Appliance
- Beverage Machine
- Robot Vacuum Cleaner

Automotive
- HVAC
- In-Vehicle Network Communication
- LED Control Module (Exterior Lighting)
- LED Control Module (Interior Ambient)
- Smart Actuators in Turbo Charger
- USB Breakout Box

Consumer
- Power Tools (Professional, Household)
- Set-Top/PVR Boxes
- Weigh Scales
- Wireless Handsets

Computing
- Computing (Main board)
- Ethernet Switch
- Servers

Home Alarm
- Security Systems (Security Panel, Keypad, Sensors)

Home - Smoke & CO Detection
- 10 Yr Low Voltage
- Addressable Smoke Detectors
- CO Detector
- CO Companion
- Low Cost Smoke Detectors

Lighting
- LED lighting

Medical Equipment
- Blood Glucose Meter
- Digital Thermometer
- ECG/EKG System

Motor Control/Drive
- High Power
- High Integration

Power Supply
- Power Supplies (End Market)
- Distributed Point-of-Load Power Architecture
- Power Monitoring
- Digital Power

Utility Metering
- Energy Meter
- Signal Chain Generic Blk. Dia.

<< BACK to Products
Microchip Analog Products for Motor Control Applications
Microchip’s Winning Attributes

- Industry standard footprint – Dual H-bridge motor drivers
- Lowest supply current Vs. major competitors!
- Integrated sensorless sinusoidal algorithm – 3-phase BLDC fan drivers (3mm x 3mm DFN, TDFN, UDFN packages)
- Total solution provider with PIC MCU and dsPIC DSC
Microchip’s Winning Attributes

- One of the first & leading suppliers in MOSFET driver and temperature sensor products
- Large offering of DC-DC converters and Resets covering needed voltages
- RR-I/O op amps reduce design concerns
- Attach sell with PICmicro, frequently used
- Great lead times and customer support
- Growing portfolio of Motor Driver ICs
MCP8024

Features:
- Three Half-bridge Drivers Configured to Drive External High-Side NMOS and Low-Side NMOS MOSFETs:
  - Independent input control for high-side NMOS and low-side NMOS MOSFETs
  - Peak output current: 0.5A @ 12V
  - Shoot-through protection
  - Overcurrent and short circuit protection
- Adjustable Output Buck Regulator (750 mW)
- Two LDOs: 5V @ 20 mA / 12V @ 20 mA
- Internal Bandgap Reference
- Three Operational Amplifiers for Motor Phase Current Monitoring and Position Detection
- Overcurrent Comparator and Thermal Shutdown
- Two Level Translators
- Input Voltage Range: 6 - 40V
- Operational Voltage Range: 6 - 28V
- Undervoltage Lockout (UVLO): 6V
- Overvoltage Lockout (OVLO): 28V
- Transient (100 ms) Voltage Tolerance: 48V
- Temperature Range: -40 to +150°C
Function: coordinating all the control and monitor functions - the brain of the system

Popular products: PIC16F182X, 178X, 75X, 15XX, 193X

Attributes:
- Upwards of 32MHz internal OSC
- 4 channel Programmable Switch Mode Controller (PSMC)
- Integrated high performance comparators, op-amp, 10/12 bit ADC, 5/8/9 bit DAC, CCP, COG, NCO, CLC
- Slope compensation
- 256 bytes of EEPROM
- Available in various packages
Key Features

- Enhanced Mid-Range core (EMR)
- Flash Program Memory with self read/write capability
- Data EEPROM
- Low Power Internal 32kHz/32MHz osc.
- Integrated Temperature Indicator
- Up to 14-Channel 10bit / 12bit ADC w/Vref
- Up to (4) PSMC (Programmable Switch Mode Controller)
- Extended Watchdog Timer (EWDT)
Key Features (contd.)

- Up to (4) High Performance Comparators with selectable Voltage Reference
- Up to (3) Operation Amplifiers with rail-to-rail input/output
- Up to (3) CCP (Capture, Compare, PWM)
- (1) 8-bit DAC (Digital to Analog Converter)
- (3) 5-bit DAC (Digital to Analog Converter) (PIC16F1788/9 ONLY)
- (1) MI²C, (1) SPI, (1) EUSART w/auto baud
- (2) 8-bit Timer (TMR0/TMR2) & (1) 16-bit Timer (TMR1)
Application Example: Sensorless 3-Φ BLDC Motor

- **High Efficiency closed-loop control enabling higher RPMs**
- **Cost effective integration with BOM reductions**
  - OpAmp, Voltage Reference, reduced size of inductors, capacitors, & resistors

3-phase drive controlled by PIC16F178X microcontroller with (3) complementary pairs for maximum efficiency

- 16-bit PWM with dedicated 64MHz clock
- 6 steerable outputs or 3 steerable output pairs
- Blanking Control for transient filtering
- Independent rising/falling output control
- Dead band with independent rise & fall control
- Polarity Control / Auto Shutdown & Restart

- **Firmware control** of PSMC based on T1G & ADC input
- BEMF Zero Cross Commutation Sensing: Determines the position & speed of the motor
- Commutation period measurement for speed & position control
- 8-bit DAC Voltage Reference for adjustable commutation point (RPM set point)
- 10b or 12b ADC for high resolution voltage measurements for over current detection
- Rail – Rail OpAmp in Gain operation allows use of smaller current sense resistor for less energy loss
- Voltage divider to determine commutation point
- Current sense and feedback to sustain constant current
- High Voltage MOSFET Drive Stage

- Firmware control
- PSMC Programmable Switch Mode Controller
- TMR1 Gate
- Comparator
- 8-bit DAC
- 10/12b ADC
- OpAmp
- 64 MHz Clock
- PIC16F178X
- High Voltage MOSFET
- Rail – Rail OpAmp
High Power Motor Control/ Drive

AC Input → Isolation → PWR Management → Supervisor

Motor → MOSFET/ IGBT → MOSFET Driver → MCU/DSP /CPU

Temp Sensor → Op Amp → ADC

Vref
# Temperature Sensors

**Function: Measuring and providing Temperature information**

<table>
<thead>
<tr>
<th>Popular Products</th>
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</tr>
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<tbody>
<tr>
<td>MCP9808 Digital temperature sensor</td>
<td>The MCP9808 converts temperatures between -20°C and +100°C to a digital word with ±0.5°C (max.) accuracy</td>
<td>Click Here</td>
</tr>
<tr>
<td>MCP9700 Linear Active Thermistor™ ICs</td>
<td>The output voltage of this device is directly proportional to measured temperature. The MCP9700 can accurately measure temperature from -40°C to +150°C with the output calibrated to a slope of 10mV/°C and has a DC offset of 500mV.</td>
<td>Click Here</td>
</tr>
</tbody>
</table>
Attributes:
- Small SC70, SOT-23 and DFN leadless packages
- Very low operating current: 35 to 250µA (typ)
- Very low shutdown current: 1µA (max)
- High temp accuracy: ±0.25°C
- Simple operation: no need for external components
- Analog and digital (SPI™, I2C™, SMBus™) devices
- High temperature resolution
Low-Power LDOs

Function: providing regulated, low-noise supply voltages for the system

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<tr>
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<tr>
<td>MCP1700</td>
<td>The MCP1700 can source up to 250mA of current with an extremely low input-output voltage differential of 178mV at 250mA, with the low current consumption of only 2 µA.</td>
<td>Click Here</td>
</tr>
<tr>
<td>MCP1703A</td>
<td>With 250 mA maximum output, MCP1703 works with input voltage of up to 16V and in combination with its low current consumption of 2 µA</td>
<td>Click Here</td>
</tr>
</tbody>
</table>
Low-Power LDOs
Winning Attributes

Attributes:

- Extremely low operating current: as low as 1µA
- High output voltage accuracy
- Stability with ceramic capacitors
- Wide range of output voltage options
- Space-saving SC70 and SOT-23 packages
- Wide range of features: shutdown mode
**Function:** System supervisor circuits designed to monitor VCC in digital systems and provide a reset signal to the host processor when needed

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<tr>
<td>TCM809</td>
<td>The reset output is driven active within 20 μsec of VCC falling through the reset voltage threshold. Reset is maintained active for a minimum of 140msec after VCC rises above the reset threshold.</td>
<td>Click Here</td>
</tr>
<tr>
<td>MCP1xx</td>
<td>The MCP1xx are a family of voltage supervisory devices which also operates as protection from brown-out conditions when the supply voltage drops below a safe operating level</td>
<td>Click Here</td>
</tr>
</tbody>
</table>
Attributes:

- Tiny SOT-23 and SC-70 packages
- Very low operating current: as low as 1µA (max)
- High threshold voltage accuracy: ±2.8% (max)
- \( V_{DD} \) transient immunity
- Many available options: push-pull output, open-drain output and internal pull-up resistor
# Synchronous Buck MOSFET Drivers

## Function: driving the high power devices (MOSFETs in synch. Buck configuration)

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<tr>
<td>MCP14628 Dual Output MOSFET Driver for Synchronous Applications</td>
<td>The MCP14628 is a synchronous MOSFET driver used for driving MOSFETs in a rectified bridge arrangement. There are two separate drivers contained in the MCP14628. The low-side driver output drives a non-floating or ground reference N-Channel MOSFET. The high-side driver is designed to drive a floating N-Channel MOSFET. An external bootstrap capacitor is used to provide the additional voltage.</td>
<td>Click Here</td>
</tr>
<tr>
<td>MCP14700 Synchronous MOSFET Driver w/separate High/Low side control</td>
<td>The MCP14700 is a high-speed synchronous MOSFET driver designed to optimally drive a high-side and low-side N-Channel MOSFET. The MCP14700 has two PWM inputs to allow independent control of the external N-Channel MOSFETs.</td>
<td>Click Here</td>
</tr>
</tbody>
</table>
Attributes:

- Operating voltage range: 5V to 30V
- Peak current capability: 2A source, 4A sink
- Internal Bootstrap Blocking Device
- Low Supply Current: 80 μA (typical)
- Space Saving Packages: SOIC, DFN
## Operational Amplifiers

- **Function:** buffering and filtering sensor feedback

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<td>MCP6004</td>
<td>The MCP6004 is a quad general purpose op amp offering rail-to-rail input and output over the 1.8 to 6V operating range. This amplifier has a typical GBWP of 1 MHz with typical quiescent current of 100 microamperes.</td>
<td>Click Here</td>
</tr>
<tr>
<td>MCP6H04</td>
<td>MCP6H04 has a wide supply voltage range of 3.5V to 16V and rail-to-rail output operation. This device has a gain bandwidth product of 1.2 MHz (typical), while only drawing 135 µA/amplifier (typical) of quiescent current.</td>
<td>Click Here</td>
</tr>
<tr>
<td>MCP6294</td>
<td>MCP6294 provide wide bandwidth of 10 MHz Gain Bandwidth Product. This family also operates from a single supply voltage as low as 2.4V to 6V, while drawing 1 mA (typical) quiescent current.</td>
<td>Click Here</td>
</tr>
</tbody>
</table>
Operational Amplifiers

 Attributes:

- Small SC-70, TDFN and SOT-23 packages
- GBWP: 9 kHz to 60MHz
- Excellent operating current-to-GBWP ratio
- Mostly rail-to-rail inputs and outputs
- Offset voltage: as low as 2µV (MCP6V0x)
- Chip Select capability for power savings
Analog-to-Digital Converters

Function: converting analog feedback signals from motor to digital signals for MCU

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<tr>
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<tr>
<td>MCP3221</td>
<td>The MCP3221 is a 12-bit SAR A/D converter. Available in the SOT-23 package, the MCP3221 provides a low max. conversion current and standby current of 250 µA and 1 µA respectively. Communication to the MCP3221 is performed using a 2-wire I2C™ Compatible interface. The MCP3221 runs on a single supply voltage range of 2.7 V to 5.5 V.</td>
<td>[Click Here]</td>
</tr>
<tr>
<td>MCP3201</td>
<td>The MCP3201 12-bit Analog-to-Digital Converter (ADC) combines high performance and low power consumption in a small package, making it ideal for embedded control applications. The MCP3201 features SAR architecture and a SPI serial interface, allowing 12-bit ADC capability to be added to any PIC® microcontroller. The MCP3201 features 100k samples/second, 1 input channel, low power consumption (5nA typical standby, 400µA max. active).</td>
<td>[Click Here]</td>
</tr>
</tbody>
</table>
SAR ADC Attributes:

- Resolution: 8 to 13 bits
- Max sampling rate: up to 200 ksps
- Linearity: ±1 LSB DNL, ±1 LSB INL
- Current consumption: 175 to 500μA (max.)
- Single supply voltage: 2.7V to 5.5V
- Small packages: SOT-23 and MSOP
Voltage References

- **Function:** providing the system with an accurate analog voltage for comparison (needed for ADC)

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<tr>
<td>MCP1525</td>
<td>MCP1525 is a low power, high precision voltage reference. It provides a precise output voltage of 2.5V which is then compared to other voltages in the system. This voltage reference is normally used in the 3V to 5V systems, where there may be wide variations in supply voltage and a need to minimize power dissipation.</td>
<td>Click Here</td>
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Voltage References

Attributes:
- 1.2V (TC1070), 2.5V or 4.096V output
- Initial accuracy: ±1% (max)
- Temperature coefficient: 50ppm/°C (max)
- Output current: ±2mA
- Operating current: 100µA (max)
- Industrial temperature range: -40°C to +85°C
- SOT-23 and TO-92 packages
PIC Microcontrollers

- **Function:** coordinating all the control and monitor functions - the brain of the system
- **Popular products:** PIC16F182X, 178X, 75X, 15XX, 193X
- **Attributes:**
  - Upwards of 32MHz internal OSC
  - 4 channel Programmable Switch Mode Controller (PSMC)
  - Integrated high performance comparators, op-amp, 10/12 bit ADC, 5/8/9 bit DAC, CCP, COG, NCO, CLC
  - Slope compensation
  - 256 bytes of EEPROM
  - Available in various packages
PIC16F178x
Key Features

- Enhanced Mid-Range core (EMR)
- Flash Program Memory with self read/write capability
- Data EEPROM
- Low Power Internal 32kHz/32MHz osc.
- Integrated Temperature Indicator
- Up to 14-Channel 10bit / 12bit ADC w/Vref
- Up to (4) PSMC (Programmable Switch Mode Controller)
- Extended Watchdog Timer (EWDT)
Up to (4) High Performance Comparators with selectable Voltage Reference

Up to (3) Operation Amplifiers with rail-to-rail input/output

Up to (3) CCP (Capture, Compare, PWM)

(1) 8-bit DAC (Digital to Analog Converter)

(3) 5-bit DAC (Digital to Analog Converter)

(PIC16F1788/9 ONLY)

(1) MI2C, (1) SPI, (1) EUSART w/auto baud

(2) 8-bit Timer (TMR0/TMR2) & (1) 16-bit Timer (TMR1)
Application Example: Sensorless 3-Phase BLDC Motor

- High Efficiency closed-loop control enabling higher RPMs
- Cost effective integration with BOM reductions
  - OpAmp, Voltage Reference, reduced size of inductors, capacitors, & resistors
- 16-bit PWM with dedicated 64MHz clock
- 6 steerable outputs or 3 steerable output pairs
- Blanking Control for transient filtering
- Independent rising/falling output control
- Dead band with independent rise & fall control
- Polarity Control / Auto Shutdown & Restart

- 3-phase drive controlled by PIC16F178X microcontroller with (3) complementary pairs for maximum efficiency

- BEMF Zero Cross Commutation Sensing: Determines the position & speed of the motor
- Commutation period measurement for speed & position control
- 8-bit DAC Voltage Reference for adjustable commutation point (RPM set point)
- 10 or 12b ADC for high resolution voltage measurements for over current detection
- Current sense and feedback to sustain constant current
- Rail – Rail OpAmp in Gain operation allows use of smaller current sense resistor for less energy loss

- Firmware control of PSMC based on T1G & ADC input
- Firmware control of PSMC based on T1G & ADC input
- Voltage divider to determine commutation point

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- Firmware control of PSMC based on T1G & ADC input
- Voltage divider to determine commutation point
Microchip Analog Products for Signal Chains
Microchip’s Winning Attributes

- Low operating current to extend battery life
- A wide variety of analog and digital products for complete system solution
- Integration & small packages to occupy smaller footprints on the board and reduce cost
- High accuracy by trimming offset after packaging using non-volatile memory
- Competitive pricing for making the end equipment attractive on the market
- Great lead times and customer support
## Current Sensing

- **Function:** To measure current and voltage and communicate over SMBus

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<tr>
<td>PAC1710</td>
<td>The PAC1710 is a high-side bi-directional current sensing monitor with precision voltage measurement capabilities. The power monitor measures the voltage developed across an external sense resistor to represent the high-side current of a battery or voltage regulator.</td>
<td><a href="#">Click Here</a></td>
</tr>
<tr>
<td>PAC1720</td>
<td>The PAC1720 is a dual high-side bi-directional current sensing monitor with precision voltage measurement capabilities. Each sensor measures the voltage developed across an external sense resistor to represent the high-side current of a battery or voltage regulator.</td>
<td><a href="#">Click Here</a></td>
</tr>
</tbody>
</table>
Operational Amplifiers

- **Function:** buffering and filtering sensor signals for preserving signal characteristics and rejecting unwanted frequencies

### Popular Products

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<tbody>
<tr>
<td>MCP6404</td>
<td>The MCP6404 is a quad general purpose op amp offering rail-to-rail input and output over the 1.8 to 6V operating range. This amplifier has a typical GBWP of 1 MHz with typ. quiescent current of 40microamperes.</td>
<td>Click Here</td>
</tr>
<tr>
<td>MCP6N11</td>
<td>The MCP6N11 single instrumentation amplifier is optimized for single-supply operation with rail-to-rail input and output performance. Two external resistors set the gain, minimizing gain error and drift over temperature. The supply voltage range of 1.8V to 5.5V is low enough to support many portable applications</td>
<td>Click Here</td>
</tr>
</tbody>
</table>

Additional Suggested Products: MCP60x, MCP644x, MCP600x, MCP603x, MCP6Vxx
Operational Amplifiers

Attributes:

- Small SC-70, TDFN and SOT-23 packages
- GBWP: 9 kHz to 60MHz
- Excellent operating current-to-GBWP ratio
- Mostly rail-to-rail inputs and outputs
- Offset voltage: as low as 2μV (MCP6V0x)
- Chip Select capability for power savings
## Analog-to-Digital Converters

- **Function:** Converting analog voltage or current signal (pressure, position, temperature, etc.) into digital data that a microcontroller can use

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<tr>
<td>MCP3221</td>
<td>The MCP3221 is a 12-bit SAR A/D converter. Available in the SOT-23 package, the MCP3221 provides a low max. conversion current and standby current of 250 µA and 1 µA respectively. Communication to the MCP3221 is performed using a 2-wire I2C™ Compatible interface. The MCP3221 runs on a single supply voltage range of 2.7 V to 5.5 V.</td>
<td><img src="#" alt="Click Here" /></td>
</tr>
<tr>
<td>MCP3421</td>
<td>The MCP3421 is a single channel low-noise, high accuracy Delta-Sigma A/D converter with differential inputs and up to 18 bits of resolution in a small SOT-23-6 package. The device uses a two-wire I2C™ compatible serial interface and operates from a single power supply ranging from 2.7V to 5.5V.</td>
<td><img src="#" alt="Click Here" /></td>
</tr>
</tbody>
</table>

**Winning Attributes**
Analog-to-Digital Converters

- **SAR Attributes:**
  - Resolution: 8 to 13 bits
  - Max sampling rate: up to 200 ksp
  - Linearity: ±1LSB DNL, ±1LSB INL
  - Current consumption: 175 to 500µA (max.)
  - Single supply voltage: 2.7V to 5.5V
  - Small packages: SOT-23 and MSOP

- **Delta-Sigma Attributes:**
  - Resolution: 16 to 22 bits
  - Max sampling rate: up to 240 sps
  - Current consumption: 120 to 155 µA (max.)
  - Single supply voltage: 2.7V to 5.5V
  - Small packages: SOT-23 and MSOP
Digital Potentiometers

- Function: buffering and filtering sensor signals for preserving signal characteristics and rejecting unwanted frequencies

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<tr>
<td>MCP4021</td>
<td>The MCP402X devices are non-volatile, 6-bit (64 wiper steps) digital potentiometers that are programmed/reprogrammed through a simple up/down serial interface.</td>
<td>Click Here</td>
</tr>
<tr>
<td>MCP45xx</td>
<td>The MCP45XX devices offer a wide range of product offerings using an I2C™Compatible interface. This family of devices support a 7-bit resistor network, Non-Volatile memory configurations, and Potentiometer and Rheostat pinouts. WiperLock Technology allows application-specific calibration settings to be secured in the EEPROM.</td>
<td>Click Here</td>
</tr>
</tbody>
</table>

Additional Suggested Products: MCP46xx, 43xx, MCP44xx
Digital Potentiometers

- **Attributes:**
  - 6 to 8-bit resolution
  - 2k, 5k, 10k, 50k and 100k Ohm options
  - Low operating and shutdown current
  - ±1 LSB max INL & DNL
  - Single or dual per package
  - Small SOT-23 & 3x2 DFN packages
# Voltage References

- **Function:** providing the system with an accurate analog voltage for comparison (needed for ADC)

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<tr>
<td>MCP1525</td>
<td>MCP1525 is a low power, high precision voltage reference. It provides a precise output voltage of 2.5V which is then compared to other voltages in the system. This voltage reference is normally used in the 3V to 5V systems, where there may be wide variations in supply voltage and a need to minimize power dissipation.</td>
<td>Click Here</td>
</tr>
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</table>
Voltage References

Attributes:

- 1.2V (TC1070), 2.5V or 4.096V output
- Initial accuracy: ±1% (max)
- Temperature coefficient: 50ppm/°C (max)
- Output current: ±2mA
- Operating current: 100μA (max)
- Industrial temperature range: -40°C to +85°C
- SOT-23 and TO-92 packages
Function: monitoring critical voltage levels and providing regulated, low-noise supply voltages ($V_{in} > V_{out}$) for the system

<table>
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</tr>
</thead>
<tbody>
<tr>
<td>MCP1700</td>
<td>The MCP1700 can source up to 250mA of current with an extremely low input-output voltage differential of 178mV at 250mA. with the low current consumption of only</td>
<td>Click Here</td>
</tr>
<tr>
<td>TCM809</td>
<td>The reset output is driven active within 20 µsec of VCC falling through the reset voltage threshold. Reset is maintained active for a minimum of 140msec after VCC rises above the reset threshold.</td>
<td>Click Here</td>
</tr>
<tr>
<td>MCP1xx</td>
<td>The MCP1xx are a family of voltage supervisory devices which also operates as protection from brown-out conditions when the supply voltage drops below a safe operating level</td>
<td>Click Here</td>
</tr>
</tbody>
</table>
Attributes:

- Extremely low operating current: as low as 1µA (typ)
- Initial accuracy: ±2%
- Wide range of voltage options
- Industrial temperature range: -40°C to +85°C
- SC-70, SOT-23 and TO-92 packages
Infrared

Function: providing low-cost, wireless two-way data connection

<table>
<thead>
<tr>
<th>Popular Products</th>
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<tbody>
<tr>
<td>MCP2122</td>
<td>Converts serial data from UART bit streams to IrDA standard bit streams (encodes) and from IrDA standard bit streams to UART bit streams (decodes). Requires input clock that is 16x needed baud rate.</td>
<td>Click Here</td>
</tr>
<tr>
<td>MCP2140</td>
<td>MCP2140 embeds IrDA protocol handling and bit encoding/decoding, and provides the lowest cost, lowest power consumption solution for adding IrDA connectivity to embedded systems</td>
<td>Click Here</td>
</tr>
<tr>
<td>MCP2155</td>
<td>MCP2155 provided IrDA protocol handling PLUS bit encoding/decoding functionality for Data Communication Equipment (DCE) applications in one low pincount device. Supports the IrCOMM (9-wire cooked service class), TinyTP, IrLMP, and IrLAP layers of the IrDA Standard protocol stack PLUS the bit encoding/decoding portion of the IrPHY</td>
<td>Click Here</td>
</tr>
</tbody>
</table>
Infrared

Attributes:

- Enable infrared communication to be easily added to existing system
- IrDA® standard protocol embedded on chip (up to 115.2 kbaud)
- DTE and DCE applications supported
- Simple and flexible infrared encoder/decoder
- Easy to use developer’s kit
PIC Microcontrollers

- Function: providing all the control and some peripheral functions
- Popular products: PIC16F627/8, PIC12F675, PIC16C781/2
- Attributes:
  - 20MHz operating speed
  - PWM output (PIC16F627/8)
  - Integrated comparators, op-amp, ADC, DAC
  - 128 bytes of EEPROM
  - Available in PDIP, SOIC, and TSSOP packages
  - 8-pin solutions (PIC12F675)
Only 35 Instructions to Learn:
- All single-cycle instructions except branches

Operating Speed:
- DC – 20 MHz clock input
- DC – 200 ns instruction cycle

1024 x 14 On-chip Flash Program Memory
Self Read/Write Program Memory
64 x 8 SRAM
Interrupt Capability
8-Level Deep Hardware Stack
Direct, Indirect and Relative Addressing modes
Microchip Analog Products for Wireless Handsets and Modules
Microchip’s Winning Attributes

- Low operating current to extend battery life
- Integration & small packages to occupy smaller footprints on the board and reduce cost
- Competitive pricing for making the end equipment attractive on the market
- Low noise operation for allowing “clean” RF communication
- Wide product offering for minimizing customer’s transaction and inventory costs
- Great lead times and customer support
Microchip Products for Wireless Handsets

Op Amps
- MCP6001
- MCP6021
- MCP6031
- MCP6441

LDO for RF (x 3)
- TC1016
- TC2185
- TC1300/1

Buck DC/DC
- MCP1603
- MCP1640
- MCP1632x
- MCP16301

150mA LDO
- TC1016
- TC2185
- TC1300/1

SIM Interface (GSM)
- MCP111/112
- TCM809/10

Reset IC
- SC70
- MCP731xx
- MCP7383x
- MCP73871

Power Management

ADC
DAC
CODEC
CPU
Memory

Stereo Audio Amp.

Hands-free Power Amp
Regulated Charge pump, Temp Sensor
Vibrator

IrDA® Encoder/Decoder
MCP2122

Li-Ion Charger
- SOT23
- MCP731xx
- MCP7383x
- MCP73871

Wall Charger
Li-Ion Monitor IC (Power Smart)

<< BACK to CONTENTS
# Power Over USB Controllers

<table>
<thead>
<tr>
<th>Popular Products</th>
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</tr>
</thead>
<tbody>
<tr>
<td>UCS1001</td>
<td>USB Port Power Controller with Charger Emulation</td>
<td>Click Here</td>
</tr>
<tr>
<td>UCS1002</td>
<td>Programmable USB Port Power Controller with Charger Emulation</td>
<td>Click Here</td>
</tr>
</tbody>
</table>
# Low Dropout Regulators

<table>
<thead>
<tr>
<th>Function</th>
<th>Popular Products</th>
<th>Description</th>
<th>Product Web Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Supply power to the analog (baseband) section - RF, IF, audio</td>
<td>MCP1700</td>
<td>The MCP1700 can source up to 250mA of current with an extremely low input-output voltage differential of 178mV at 250mA. with the low current consumption of only</td>
<td>Click Here</td>
</tr>
<tr>
<td></td>
<td>TC1016</td>
<td>80mA, LDO With Shutdown in SC70</td>
<td>Click Here</td>
</tr>
<tr>
<td></td>
<td>TC1301</td>
<td>300 mA, Dual LDO With Microcontroller RESET Function</td>
<td>Click Here</td>
</tr>
</tbody>
</table>
| Supply power to the digital section - modem, DSP, codec         | TC1173            | Low Supply Current for Longer Battery Life  
Very Low Dropout Voltage  
300 mA Output Current  
Standard or Custom Output Voltages  
ERROR Output Can be Used as a Low Battery Detector or Processor Reset Generator  
Power-Saving Shutdown Mode  
Bypass Input for Ultra-Quiet Operation  
Over-Current and Over-Temperature Protection | Click Here       |
Low Dropout Regulators

Attributes:
- Tiny SOT-23 and SC-70 packages
- Small MSOP packages and high integration
- Very low operating current: 80μA (max)
- High output voltage accuracy: ±2% (max)
- Excellent dynamic performance (line & load regulation)
- Very low dropout voltage:
  - As low as 90mV @ 100mA
  - 210mV @ 300mA
- Stability with ceramic output capacitors
- Very low output noise
Function: Resets the CPU, DSP, and modem when supply voltage falls below threshold

**Popular Products**

<table>
<thead>
<tr>
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<tbody>
<tr>
<td>TCM809</td>
<td>The reset output is driven active within 20 µsec of VCC falling through the reset voltage threshold. Reset is maintained active for a minimum of 140msec after VCC rises above the reset threshold.</td>
<td>Click Here</td>
</tr>
<tr>
<td>MCP100/1/2/3/21/20/31</td>
<td>The MCP1xx are a family of voltage supervisory devices which also operates as protection from brown-out conditions when the supply voltage drops below a safe operating level</td>
<td>Click Here</td>
</tr>
</tbody>
</table>
Attributes:

- Tiny SOT-23 and SC-70 packages
- Very low operating current: as low as 1µA (max)
- High threshold voltage accuracy: ±2.8% (max)
- $V_{DD}$ transient immunity
- Manual RESET
- Many available options: push-pull output, open-drain output and internal pull-up resistor
Voltage Detectors

- **Function:** Monitor battery voltage level and indicate low-battery condition, monitor regulated supply voltages to RF, IF, and analog baseband sections.

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<tr>
<td>MCP111/2</td>
<td>The MCP111/112 Series are CMOS voltage detectors are well suited for portable, consumer electrics applications due to the extremely low 1uA operating current and small surface-mount packaging. These devices are designed to hold the microcontroller in reset until the supply voltage reaches a predetermined operating level. These devices also protect against brownout conditions that occur as a result of the supply voltage dropping below a tolerable level.</td>
<td>Click Here</td>
</tr>
</tbody>
</table>
Voltage Detectors

- **Attributes:**
  - Tiny SOT-23 and SC-70 packages
  - Very low operating current: 1µA (typ)
  - Precise thresholds: ±2% (typ)
  - Open-drain and push-pull outputs
### Battery Chargers

**Function:** Charge & monitor the Lithium Ion battery

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<tr>
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<tbody>
<tr>
<td>MCP731xx</td>
<td>The MCP73811/2 devices are linear charge management controllers that are designed to provide specific charge algorithms for single cell Li-Ion or Li-Polymer battery to achieve optimal capacity in the shortest charging time possible.</td>
<td><a href="#">Click Here</a></td>
</tr>
<tr>
<td>MCP732xx</td>
<td>The MCP73123/223 is a highly integrated Lithium Iron Phosphate (LiFePO4) battery charge management controller that provide specific charge algorithms for LiFePO4 batteries to achieve optimal capacity and safety in the shortest charging time possible. Along with its small physical size, the low number of external components makes the MCP73123/223 ideally suitable for various applications.</td>
<td><a href="#">Click Here</a></td>
</tr>
</tbody>
</table>
Attributes:
- Small thermally efficient DFN and QFN packages
- High-accuracy voltage regulation: ±0.5% (max)
- Low operating current: 260μA (typ)
- Shutdown and pre-conditioning modes
- Temperature monitor & charge complete indicator
- USB/AC inputs
- Loadsharing
- Overvoltage Protection (OVP)
## Operational Amplifiers

### Function: filtering/amplifying for analog baseband and audio signal processing

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<tr>
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<tr>
<td>MCP6404</td>
<td>The MCP6404 is a quad general purpose op amp offering rail-to-rail input and output over the 1.8 to 6V operating range. This amplifier has a typical GBWP of 1 MHz with typ. quiescent current of 40 µA.</td>
<td>Click Here</td>
</tr>
<tr>
<td>MCP603x</td>
<td>The MCP6031/2/3/4 op amps have a gain bandwidth of 10 kHz with a low typical operating current of 900 nA and an offset voltage that is less than 150 µV.</td>
<td>Click Here</td>
</tr>
<tr>
<td>MCP60x</td>
<td>MCP601/2/3/4 operational amplifier (op amp) has a gain bandwidth product of 2.8 MHz with low typical operating current of 230 µA and an offset voltage that is less than 2 mV.</td>
<td>Click Here</td>
</tr>
</tbody>
</table>
Operational Amplifiers

Attributes:
- Small SC-70, TDFN and SOT-23 packages
- GBWP: 9 kHz to 60MHz
- Excellent operating current-to-GBWP ratio
- Mostly rail-to-rail inputs and outputs
- Offset voltage: as low as 2µV (MCP6V0x)
- Chip Select capability for power savings
Charge Pumps

Function: powering white LEDs, providing negative DC bias for LCD or GaAs transmit power amplifier, converting Li-Ion voltage to DC voltage level required by the system

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<tr>
<td>MCP1252/3</td>
<td>The MCP1252/3 are inductorless, positive-regulated charge pump DC/DC converters. The devices generate a regulated fixed (3.3V or 5.0V) or adjustable output voltage. They are specifically designed for applications requiring low noise and high efficiency and are able to deliver up to 120 mA output current. The devices allow the input voltage to be lower or higher than the output voltage, by automatically switching between buck/boost operation.</td>
<td>Click Here</td>
</tr>
</tbody>
</table>
Charge Pumps

Attributes:
- Small SOT-23 and MSOP packages
- Very low operating current
- High voltage conversion efficiency: up to 95%
- Switching frequency: 10kHz to 1MHz
- Inductorless operation: reduced cost and EMI noise
- Low-power shutdown mode
Temperature Sensors

- Function: adjusting LCD contrast, measuring RF Power Amplifier temperature, thermally compensate RF oscillator

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<tr>
<td>MCP9808 Digital temperature sensor</td>
<td>The MCP9808 converts temperatures between -20°C and +100°C to a digital word with ±0.5°C (max.) accuracy</td>
<td>Click Here</td>
</tr>
<tr>
<td>MCP9700 Linear Active Thermistor™ ICs</td>
<td>The output voltage of this device is directly proportional to measured temperature. The MCP9700 can accurately measure temperature from -40°C to +150°C with the output calibrated to a slope of 10mV/°C and has a DC offset of 500mV.</td>
<td>Click Here</td>
</tr>
</tbody>
</table>
Temperature Sensors Winning Attributes

Attributes:
- Small SC70, SOT-23 and DFN leadless packages
- Very low operating current: 35 to 250µA (typ)
- Very low shutdown current: 1µA (max)
- High temp accuracy: $\pm0.25^\circ$C
- Simple operation: no need for external components
- Analog and digital (SPI™, I2C™, SMBus™) devices
- High temperature resolution
Switching Regulators

**Function:** efficiently convert Li-Ion voltage to DC voltage level required by the DSP or CPU

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<td>MCP163xx</td>
<td>MCP163xx are highly integrated, high-efficiency, fixed frequency, step-down DC-DC converter that operates from input voltage sources up to 30V. Integrated features include a high side switch, fixed frequency Peak Current Mode Control, internal compensation, peak current limit and over temperature protection. Minimal external components are necessary to develop a complete step-down DC-DC converter power supply.</td>
<td>Click Here</td>
</tr>
<tr>
<td>MCP1640</td>
<td>The MCP1640 is a compact, high-efficiency, fixed frequency, synchronous step-up DC-DC converter. It provides an easy-to-use power supply solution for applications powered by either one-cell, two-cell, or three-cell alkaline, NiCd, NiMH, one-cell Li-Ion or Li-Polymer batteries.</td>
<td>Click Here</td>
</tr>
</tbody>
</table>
Attributes:

- Small SOT and DFN package
- Auto-switching PWM/PFM operation
- Efficiency as high as 96%
- Very low shutdown current <1µA (typ)
- Input voltage as high as 30V
- UVLO, Soft-start & over-temperature protection
- Boost Start-up as low as 0.65V
Infrared

- **Function:** providing low-cost, wireless two-way data connection - infrared port

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<td>MCP2122</td>
<td>Converts serial data from UART bit streams to IrDA standard bit streams (encodes) and from IrDA standard bit streams to UART bit streams (decodes). Requires input clock that is 16x needed baud rate.</td>
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<td>MCP2140</td>
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Infrared

Attributes:

- Enable infrared communication to be easily added to existing system
- IrDA® standard protocol embedded on chip (up to 115.2 kbaud)
- DTE and DCE applications supported
- Simple and flexible infrared encoder/decoder
- Easy to use developer’s kit
Microchip Analog Products for Power Supplies
Microchip’s Winning Attributes

- A wide variety of analog and digital products for complete system solution
- One of the first & leading suppliers in MOSFET driver and temperature sensor products
- Great lead times and customer support
- Competitive pricing for making the end equipment attractive on the market
- Small packages to occupy smaller footprints on the board and reduce cost
Typical DC/DC Brick Diagram

- Charge Pumps
- LDO
- Integrated Regulators
- Op Amp
- PWM
- MCU/DSP
- A/D
- Vref
- Fan Manager
- Fan Motor Driver
- MOSFET Driver
- MOSFETs
- Temp Sensor

Control
Current or Voltage
Current Sensing
Monitoring/Load current information

Power Monitoring
Distributed Point-of-Load Power Architecture
<< BACK to CONTENTS
## Current Sensing

- **Function:** To measurement current and voltage and communicate over SMBus

<table>
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<tr>
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<tr>
<td>PAC1710</td>
<td>The PAC1710 is a high-side bi-directional current sensing monitor with precision voltage measurement capabilities. The power monitor measures the voltage developed across an external sense resistor to represent the high-side current of a battery or voltage regulator.</td>
<td><a href="#">Click Here</a></td>
</tr>
<tr>
<td>PAC1720</td>
<td>The PAC1720 is a dual high-side bi-directional current sensing monitor with precision voltage measurement capabilities. Each sensor measures the voltage developed across an external sense resistor to represent the high-side current of a battery or voltage regulator.</td>
<td><a href="#">Click Here</a></td>
</tr>
</tbody>
</table>
Function: controlling fan speed according to ambient temperature for reducing acoustic noise and extending fan life

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<tbody>
<tr>
<td>EMC2101</td>
<td>The EMC2101 is an SMBus 2.0 compliant, integrated fan control solution complete with two temperature monitors, one external and one internal.</td>
<td>Click Here</td>
</tr>
</tbody>
</table>
## Fan Motor Driver

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<tbody>
<tr>
<td><strong>Three-Phase BLDC Fan Motor Drivers</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MTD6501C/D/G (23kHz)</td>
<td>Standalone 3-Φ Sinusoidal Sensorless BLDC Motor Controller. 12V; $I_{\text{MAX}} = 800 \text{ mA}$</td>
<td>Click Here</td>
</tr>
<tr>
<td>MTD6502B</td>
<td>Standalone 3-Phase Sinusoidal Sensorless BLDC Motor Controller. 5V Application; $I_{\text{MAX}} = 750 \text{ mA}$; TDFN - 10</td>
<td>Click Here</td>
</tr>
<tr>
<td>MTD6505</td>
<td>Standalone 3-Phase Sinusoidal Sensorless BLDC Motor Controller - 5V Application; $I_{\text{MAX}} = 750 \text{ mA}$; UDFN – 10; Programmable BEMF Coefficient</td>
<td>Click Here</td>
</tr>
</tbody>
</table>
**Temperature Sensors**

- **Function:** Shutting down the system when temperature rises above operating limit

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<tr>
<td>TC1047A</td>
<td>Supply Voltage Range: 2.5V to 5.5V, Wide Temperature Measurement Range: -40°C to +125°C, High Temperature Converter Accuracy: ± 2°C, Max, at 25°C, Linear Temperature Slope: 10mV/°C, Very Low Supply Current: 35µA Typical</td>
<td><a href="#">Click Here</a></td>
</tr>
<tr>
<td>EMC1701</td>
<td>The EMC1701 is a combination high-side current sensing device with precision temperature measurement. It measures the voltage developed across an external sense resistor to represent the high-side current of a battery or voltage regulator.</td>
<td><a href="#">Click Here</a></td>
</tr>
<tr>
<td>EMC1412</td>
<td>The EMC1412 is a high accuracy, low cost, System Management Bus (SMBus) temperature sensor. Advanced features such as Resistance Error Correction, Beta Compensation and automatic diode type detection combine to provide a robust solution for complex environmental monitoring applications</td>
<td><a href="#">Click Here</a></td>
</tr>
</tbody>
</table>
Temperature Sensors

Attributes:

- High temperature accuracy: ±1°C (typ)
- Small SOT-23 packages
- Very low power consumption
- Wide temperature range: -55°C to +125°C
- Voltage, logic and serial output options available
MOSFET Drivers

- **Function:** driving the high power devices (MOSFETs, bipolar transistors, IGBTs)

<table>
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| TC4427A          | Supply Voltage Range: 2.5V to 5.5V  
Wide Temperature Measurement Range: -40°C to +125°C  
High Temperature Converter Accuracy: ± 2°C, Max, at 25°C  
Linear Temperature Slope: 10mV/°C  
Very Low Supply Current: 35µA Typical | [Click Here](#) |
| MCP1415/16       | The MCP1415/16 devices are small footprint Low-Side MOSFET drivers capable of supplying 1.5A peak output current in a SOT23 5L package. | [Click Here](#) |
| MCP14E3/E4/E5    | The MCP14E3/E4/E5 devices are a family of 4.5A, dual output buffers/MOSFET drivers with separate enable functions for each output.  
As MOSFET drivers, the MCP14E3/E4/E5 can easily charge 2200 pF gate capacitance in under 28 nsec (max) | [Click Here](#) |
MOSFET Drivers

Attributes:

- Operating voltage range: 4.5V to 18V (TC4431/2, 30V)
- Peak current capability: 0.5A to 12.0A
- Operating junction temperature up to 150°C
- Drive capability: 470pF in 15ns, 47,000pF in 180ns
- Input / output delay: 30 to 75ns
- Single, dual, quad configurations
- Superior ESD & latch-up protection
## Voltage References

- **Function:** providing the system with an accurate analog voltage for comparison

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<tr>
<td>MCP1525</td>
<td>MCP1525 is a low power, high precision voltage reference. It provides a precise output voltage of 2.5V which is then compared to other voltages in the system. This voltage reference is normally used in the 3V to 5V systems, where there may be wide variations in supply voltage and a need to minimize power dissipation.</td>
<td>Click Here</td>
</tr>
</tbody>
</table>

*Click Here*
Voltage References

Attributes:
- 2.5V or 4.096V output
- Initial accuracy: ±1% (max)
- Temperature coefficient: 50ppm/°C (max)
- Output current: ±2mA
- Operating current: 100μA (max)
- Industrial temperature range: -40°C to +85°C
- SOT-23 and TO-92 packages
PWM Controllers

- Function: provide drive signal for MOSFET drivers

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<tr>
<td>MCP1630</td>
<td>The MCP1630 is a high-speed Pulse Width Modulator (PWM) used to develop intelligent power systems. When used with a microcontroller, the MCP1630 will control the power system duty cycle to provide output voltage or current regulation. The MCP1630 inputs are designed to be easily attached to the I/O of a microcontroller, which supplies the reference and oscillator to the MCP1630, to generate a flexible and adaptable power system.</td>
<td>Click Here</td>
</tr>
</tbody>
</table>
PWM Controllers

**Attributes:**
- High speed PWM operation
- Peak current mode operation to 1.0MHz
- Wide operating temperature range, -40°C to +125°C
- (1630) accepts variable controlling inputs from µC
- UVLO, short circuit, over current protection circuits
- Precision peak current limiting
PIC Microcontrollers

- **Function:** providing all the control functions and the PWM output for the system
- **Popular products:** PIC16F182X, 178X, 75X, 15XX, 193X

- **Attributes:**
  - Upwards of 32MHz internal OSC
  - Slope compensation
  - 4 channel programmable switch mode controller (PSMC)
  - Integrated high performance comparators, op-amp, 10/12 bit ADC, 5/8/9 bit DAC
  - 256 bytes of EEPROM
  - Available in various packages
# Operational Amplifiers

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<thead>
<tr>
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</tr>
</thead>
<tbody>
<tr>
<td>Sense and gain up output current - low offset voltage required for minimizing measurement error</td>
<td>MCP602x</td>
<td>The MCP6021/2/3/4 op amps have a gain bandwidth of 10 MHz with a low typical operating current of 1mA and an offset voltage that is less than 150 µV.</td>
<td>Click Here</td>
</tr>
<tr>
<td>MCP6V01 Zero Drift Op Amps</td>
<td>VOS: ±2 µV (maximum), PSRR: 130 dB (minimum), CMRR: 130 dB (minimum), IQ: 300 µA/amplifier (typical) Wide Supply Voltage Range: 1.8V to 5.5V</td>
<td>Click Here</td>
<td></td>
</tr>
<tr>
<td>Provide feedback compensation by sensing output voltage and comparing it with reference voltage</td>
<td>MCP6404</td>
<td>The MCP6404 is a quad general purpose op amp offering rail-to-rail input and output over the 1.8 to 6V operating range. This amplifier has a typical GBWP of 1 MHz with typ. quiescent current of 40 microamperes.</td>
<td>Click Here</td>
</tr>
<tr>
<td>MCP60x</td>
<td>MCP601/2/3/4 (op amp) has a gain bandwidth product of 2.8 MHz with low typical operating current of 230 µA and an offset voltage that is less than 2 mV.</td>
<td>Click Here</td>
<td></td>
</tr>
</tbody>
</table>
Operational Amplifiers

Attributes:

- Small SC-70, TDFN and SOT-23 packages
- GBWP: 9 kHz to 60MHz
- Excellent operating current-to-GBWP ratio
- Mostly rail-to-rail inputs and outputs
- Offset voltage: as low as 2µV (MCP6V0x)
- Chip Select capability for power savings
## Power Management

<table>
<thead>
<tr>
<th>Popular Products</th>
<th>Description</th>
<th>Product Web Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>MCP1790</td>
<td>The MCP1790 is a 70 mA, ceramic output cap stable, high voltage, Low Dropout Regulator (LDO). The MCP1790 is capable of handling continuous input voltage of up to 30V and is load dump protect for up to 48V</td>
<td>Click Here</td>
</tr>
<tr>
<td>TC7660/2</td>
<td>The TC7660 is a charge pump voltage converter that +1.5V to +10V input to a corresponding -1.5V to -10V output using two low-cost capacitors</td>
<td>Click Here</td>
</tr>
<tr>
<td>MCP16311/2</td>
<td>The MCP16311/2 is a compact, high-efficiency, fixed frequency PWM/PFM, synchronous step-down DC-DC converter that operates from input voltage sources up to 30V. Integrated features include a high-side and a low-side switch, fixed frequency Peak Current Mode Control, internal compensation, peak-current limit and over temperature protection.</td>
<td>Click Here</td>
</tr>
<tr>
<td>MCP1632x</td>
<td>The MCP16321/2 is a highly integrated, high-efficiency, fixed frequency, synchronous step-down DC-DC converter in a that operates from input voltages up to 24V.</td>
<td>Click Here</td>
</tr>
</tbody>
</table>
Distributed Point-of-Load Power Architecture

AC/DC, Offline Converter

- DC/DC Controller (DEPA) MCP19111
- DC/DC Controller (Standard) MCP19035
- DC/DC- Buck Regulator (Integrated Switches) MCP163xx
- DC/DC (LDO) MCP1790

MOSFETs

Magnetics

Power Stage of Ethernet Switch

Power Monitoring

Typical DC/DC Brick Diagram

<< BACK to CONTENTS
Function: Customizable, Analog-based Power Conversion Controller driving external, logic-level MOSFETs in high-power, power conversion applications

<table>
<thead>
<tr>
<th>Popular Products</th>
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</tr>
</thead>
<tbody>
<tr>
<td>MCP19111</td>
<td>The MCP19111 is a mid-voltage (4.5-32V) analog-based PWM controller family with an integrated 8-bit PIC® Microcontroller. This unique product combines the performance of a high-speed analog solution, including high-efficiency and fast transient response, with the configurability and communication interface of a digital solution. The MCP1911x family, when combined with Microchip’s MCP87xxx MOSFETs, or any low-FOM MOSFET, produce high-efficiency (&gt;96%) DC/DC power-conversion solutions.</td>
<td>Click Here</td>
</tr>
</tbody>
</table>
Digitally-Enhanced Power Analog

**Attributes:**
- Analog power conversion performance, offering fast response and high efficiency
- Digital interface to support higher-level functions, including communication and implementation of customer IP.
DC/DC Power Controller

- Function: Standalone, Analog-Based PWM Power Conversion Controller driving external, logic-level MOSFETs in high-power, power conversion applications

<table>
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<tr>
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<tbody>
<tr>
<td>MCP19035</td>
<td>The MCP19035 is a small, analog-based PWM controller family with integrated synchronous MOSFET drivers offering outstanding transient performance. The MCP19035 operates over a wide 4.5 - 30Vdc range, has a 300 kHz switching-frequency, and offers a factory-adjustable dead-time setting, allowing designers to optimize the performance across a wide selection of MOSFET devices. The MCP19035 family, when combined with Microchip’s MCP87xxx MOSFETs, or any low-FOM MOSFET, produces high-efficiency (&gt;96%) DC/DC power-conversion solutions.</td>
<td>Click Here</td>
</tr>
</tbody>
</table>
# High-Speed MOSFETs

## Function: High-Efficiency, Switched Mode Power Conversion Power Devices

<table>
<thead>
<tr>
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</tr>
</thead>
<tbody>
<tr>
<td>MCP87xxx</td>
<td>The MCP87xxx family of high-speed MOSFETs have been designed to optimize the trade-off between ultra-low On-state resistance (Rds-on) and Gate Charge (Qg) to maximize power conversion efficiency in switched mode power supplies.</td>
<td>Click Here</td>
</tr>
</tbody>
</table>
High-Speed MOSFETs

Attributes:

- Very Low Rds_on and Gate Charge (Qg)
- Optimized for high-efficiency Power Conversion

<table>
<thead>
<tr>
<th>Product ID</th>
<th>Type</th>
<th>Config</th>
<th>Vds (V)</th>
<th>Vgs (V)</th>
<th>Rds_on @ 4.5V (mΩ-typ)</th>
<th>Qg (nC)</th>
<th>Package</th>
</tr>
</thead>
<tbody>
<tr>
<td>MCP87022*</td>
<td>N</td>
<td>Single</td>
<td>25</td>
<td>+10/-8</td>
<td>2.2</td>
<td>25</td>
<td>5x6 DFN</td>
</tr>
<tr>
<td>MCP87030</td>
<td>N</td>
<td>Single</td>
<td>25</td>
<td>+10/-8</td>
<td>3</td>
<td>13.3</td>
<td>5x6 DFN</td>
</tr>
<tr>
<td>MCP87050*</td>
<td>N</td>
<td>Single</td>
<td>25</td>
<td>+10/-8</td>
<td>5</td>
<td>9</td>
<td>5x6 DFN</td>
</tr>
<tr>
<td>MCP87055*</td>
<td>N</td>
<td>Single</td>
<td>25</td>
<td>+10/-8</td>
<td>5.5</td>
<td>6</td>
<td>3.3x3.3 DFN</td>
</tr>
<tr>
<td>MCP87090</td>
<td>N</td>
<td>Single</td>
<td>25</td>
<td>+10/-8</td>
<td>9</td>
<td>4</td>
<td>5x6 DFN 3.3x3.3 DFN</td>
</tr>
<tr>
<td>MCP87130</td>
<td>N</td>
<td>Single</td>
<td>25</td>
<td>+10/-8</td>
<td>13</td>
<td>2.9</td>
<td>5x6 DFN 3.3x3.3 DFN</td>
</tr>
</tbody>
</table>
# DC/DC- Buck Regulator

## Popular Products

<table>
<thead>
<tr>
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</tr>
</thead>
<tbody>
<tr>
<td>MCP16301</td>
<td>The MCP16301 is a high-input voltage step-down regulator, capable of supplying 600 mA to a regulated output voltage from 2.0V to 15V.</td>
<td><a href="#">Click Here</a></td>
</tr>
<tr>
<td>MCP1632x</td>
<td>The MCP16321/2 is a highly integrated, high-efficiency, fixed frequency, synchronous step-down DC-DC converter in a 16-pin QFN package that operates from input voltages up to 24V. Integrated features include a high-side and low-side N-Channel switch, fixed frequency Peak Current Mode Control, internal compensation, peak current limit, VOUT overvoltage protection and over temperature protection. Minimal external components are necessary.</td>
<td><a href="#">Click Here</a></td>
</tr>
<tr>
<td>MCP16311/2</td>
<td>The MCP16311/2 is a compact, high-efficiency, fixed frequency PWM/PFM, synchronous step-down DC-DC converter in a 8-pin MSOP, or 2 x 3 TDFN package that operates from input voltage sources up to 30V. Integrated features include a high-side and a low-side switch, fixed frequency Peak Current Mode Control, internal compensation, peak-current limit and over temperature protection.</td>
<td><a href="#">Click Here</a></td>
</tr>
</tbody>
</table>
DC/DC Controller (LDO)

- Function: Providing regulated, low-noise supply voltages (Vin>Vout) for the system

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<td>The MCP1790 is a 70 mA, ceramic output cap stable, high voltage, Low Dropout Regulator (LDO). The MCP1790 is capable of handling continuous input voltage of up to 30V and is load dump protect for up to 48V</td>
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</tr>
</tbody>
</table>
Personal Video Recorders (Set-Top Box)
Microchip’s Winning Attributes

- Large offering of LDO and Resets covering needed voltages
- Heat reducing DC to DC converters at needed voltages
- RR-I/O Op Amps reduce design concerns
- Attach sell with PICmicro often used in Set-Top Box for system control and power management
- Wide product offering for minimizing customer’s transaction and inventory costs
- Great lead times and customer support
## Popular Products

<table>
<thead>
<tr>
<th>Product</th>
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<th>Product Web Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>MCP1754</td>
<td>The MCP1754/5 is a 16 volt, high PSRR voltage regulator with short circuit current foldback. The MCP1754 regulator provides up to 150 mA of current. The MCP1755 regulator provides up to 300 mA of current. The input operating voltage range is specified from 3.6V to 16V continuous, 18V absolute maximum, 12 VDC systems. Simplified, low pin count versions of the of these devices are also available</td>
<td>Click Here</td>
</tr>
<tr>
<td>MCP1755</td>
<td></td>
<td>Click Here</td>
</tr>
</tbody>
</table>
## RTC/ Memory

<table>
<thead>
<tr>
<th>Function</th>
<th>Popular Products</th>
<th>Description</th>
<th>Product Web Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Real Time Clock</td>
<td>MCP79410</td>
<td>The MCP79410 general purpose I2C™ Compatible real-time clock/calendar (RTCC) is highly integrated with nonvolatile memory and advanced features normally found in higher priced devices. These features include a battery switchover circuit for backup power, a timestamp to log power failures and digital trimming for accuracy.</td>
<td>Click Here</td>
</tr>
<tr>
<td>EEPROM</td>
<td>24LC256</td>
<td>24AA256/24LC256/24FC256 (24XX256*) is a 32K x 8 (256 Kbit) Serial Electrically Erasable PROM, capable of operation across a broad voltage range (1.7V to 5.5V).</td>
<td>Click Here</td>
</tr>
<tr>
<td>FLASH</td>
<td>SST2xVF032x, SST2xVF064x</td>
<td>The 25 Series SPI family is among the industry's lowest power 3.0V and 1.8V products. Lower pin count means less space, smaller PCBs, reduced system costs and lower power consumption. The industry's fastest erase times mean cost savings during manufacturing.</td>
<td>Click Here</td>
</tr>
</tbody>
</table>
# Fan Controller/ Temp Sensor

## Function Table

<table>
<thead>
<tr>
<th>Function</th>
<th>Popular Products</th>
<th>Description</th>
<th>Product Web Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fan Controller</td>
<td>EMC2101</td>
<td>SMBus Fan Control with 1°C Accurate Temperature Monitoring</td>
<td>[Click Here]</td>
</tr>
<tr>
<td>Temperature Sensor</td>
<td>EMC140x</td>
<td>1°C Temperature Sensor with Beta Compensation</td>
<td>[Click Here]</td>
</tr>
</tbody>
</table>
# Capacitive Touch Solutions

<table>
<thead>
<tr>
<th>Function</th>
<th>Popular Products</th>
<th>Description</th>
<th>Product Web Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Capacitive Touch Solutions</td>
<td>CAP11/12xx</td>
<td>SMSC's capacitive touch sensor products, featuring RightTouch® technology, set a new standard in simplifying development, improving noise immunity, and lowering BOM costs in PC, LCD monitors, white goods and consumer electronic designs. These devices have been carefully designed to filter for common noise sources such as backlight inverters, DC-DC switching regulators and wireless frequencies. They support a wide variety of interfaces such as I2C, SMBus, SMSC BC-Link™ and SPI and also provide world-class ESD protection of ±8kV HBM with no external ESD protection circuits required.</td>
<td>Click Here</td>
</tr>
</tbody>
</table>
## mTouch and Input Sensing Solutions

<table>
<thead>
<tr>
<th>Popular Products</th>
<th>Description</th>
<th>Product Web Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>AR10xx</td>
<td>The Microchip mTouch™ AR1000 Series Resistive Touch Screen Controller is a complete, easy to integrate, cost-effective and universal touch screen controller chip solution. The AR1000 Series has sophisticated proprietary touch screen decoding algorithms to fully process all touch data and save the host from this overhead. More than the usual “preprocessing” features of other low cost devices, the AR1000 delivers reliable, validated and calibrated touch.</td>
<td>Click Here</td>
</tr>
<tr>
<td>MTCH6301</td>
<td>The MTCH6301 is a turnkey projected capacitive touch controller that allows easy integration of multi-touch and gestures to create a rich user interface in your design.</td>
<td>Click Here</td>
</tr>
</tbody>
</table>
## USB Transceiver

<table>
<thead>
<tr>
<th>Popular Products</th>
<th>Description</th>
<th>Product Web Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>USB334x</td>
<td>Highly Integrated, Hi-Speed USB 2.0 ULPI Transceiver Family for Consumer Electronics Applications</td>
<td><a href="#">Click Here</a></td>
</tr>
<tr>
<td>USB333x</td>
<td>Ultra Small and Highly Integrated, Hi-Speed USB 2.0 ULPI Transceiver Family for Mobile Consumer Electronics Applications</td>
<td><a href="#">Click Here</a></td>
</tr>
</tbody>
</table>
## USB Ethernet Controller or Hub

<table>
<thead>
<tr>
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<th>Description</th>
<th>Product Web Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>USB251x</td>
<td>USB251x is a family of versatile, cost-effective and power-efficient USB 2.0 hub controllers. Leveraging SMSC's innovative MultiTRAK™ technology that delivers industry-leading data throughput in mixed-speed USB environments, the USB251x family is designed for applications that demand low power and a small footprint without compromising on performance.</td>
<td>Click Here</td>
</tr>
<tr>
<td>USB2602</td>
<td>4th Generation USB 2.0 Flash Media Controller with Integrated Card Power FETs and HS Hub</td>
<td>Click Here</td>
</tr>
</tbody>
</table>
# USB Flash Media Controller

## Popular Products

<table>
<thead>
<tr>
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</tr>
</thead>
<tbody>
<tr>
<td>USB224x</td>
<td>USB 2.0 Flash Media Card Controller with Integrated Card Power FETs</td>
<td>Click Here</td>
</tr>
<tr>
<td>USB264x</td>
<td>USB 2.0 Flash Media Controller with Integrated Card Power FETs and HS Hub</td>
<td>Click Here</td>
</tr>
</tbody>
</table>
# Ethernet Controller and Switches

<table>
<thead>
<tr>
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<th>Product Web Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>LAN921x</td>
<td>High-Performance Small Form Factor Single-Chip Ethernet Controller with HP Auto-MDIX Support</td>
<td><a href="#">Click Here</a></td>
</tr>
<tr>
<td>LAN922x</td>
<td>High-Performance Small Form Factor Single-Chip Ethernet Controller with 16-bit Non-PCI interface with Variable Voltage I/O</td>
<td><a href="#">Click Here</a></td>
</tr>
<tr>
<td>LAN9303</td>
<td>3-port 10/100 Ethernet switch with flexible configuration options supporting a wide variety of different applications and architectures.</td>
<td><a href="#">Click Here</a></td>
</tr>
<tr>
<td>LAN931x</td>
<td>3-port 10/100 Ethernet switch with flexible configuration options supporting a wide variety of different applications and architectures. Additional MII port provided to further expand customer use cases.</td>
<td><a href="#">Click Here</a></td>
</tr>
</tbody>
</table>
## WiFi Front End Module

<table>
<thead>
<tr>
<th>Popular Products</th>
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</tr>
</thead>
<tbody>
<tr>
<td>MRF24WG0MA/B</td>
<td>MRF24WB0MA is an agency certified IEEE 802.11 Wi-Fi radio transceiver module. The MRF24WB0MA has an integrated PCB antenna, matching circuitry, and supports Wi-Fi with the free TCP/IP protocol stack. The MRF24WB0MA Module connects to hundreds of PIC® microcontrollers via a 4-wire SPI interface and is an ideal solution for low-power, low data-rate Wi-Fi sensor networks, home automation, building automation and consumer applications.</td>
<td>Click Here</td>
</tr>
</tbody>
</table>
## Zigbee

<table>
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</thead>
<tbody>
<tr>
<td>MRF24WG0MA/B</td>
<td>MRF24J40 is a complete IEEE 802.15.4 radio and operates in the 2.4GHz freq band. The MRF24J40 supports ZigBee™, MiWi™ protocols and proprietary protocols to provide an ideal solution for wireless sensor networks, home automation, building automation and consumer applications</td>
<td>Click Here</td>
</tr>
<tr>
<td>PIC18F46J50</td>
<td>This low power and high performance 8-bit MCU with integrated full-speed USB 2.0 and peripheral flexibility comes in a small package for cost sensitive applications in the PIC18 J-series. New features include Deep sleep mode for low power applications, Peripheral Pin Select for design flexibility for mapping peripherals to I/O pins and a CTMU module for easy capacitive touch user interfaces. The PIC18F46J50 family is ideal for applications requiring cost-effective, low-power USB solutions with a robust peripheral set in a small package.</td>
<td>Click Here</td>
</tr>
</tbody>
</table>
Power Management for Set-Top box

- Power Mgt. (LDOs, DC/DC)
- Supervisor
- Hard Drive
- Thermal Mgt.
- PIC® MCU Control Monitor
- Power Supply
- FAN

<< BACK to CONTENTS  << BACK to BLOCK DIAGRAM
Function: coordinating all the control, some peripheral functions and monitor functions - the brain of the system

Popular products: PIC16F15XX, 182X, 193X

Attributes:
- Up to 32 MHz operating speed
- On board CCP, CLC, CWG, NCO
- Integrated comparators, op-amp, 12-bit ADC, 5/8/9 bit DAC
- Up to 256 bytes of EEPROM
- Available in UQFN, QFN, PDIP, SOIC, and TSSOP packages
1A- 1.5A Low Dropout Regulators

- Function: converting 5V to low-noise 3.3V, 2.5V, or 1.8V voltage levels for the various system components

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<tr>
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</thead>
<tbody>
<tr>
<td>MCP1727</td>
<td>The MCP1727 is a 1.5A, ceramic output cap stable, low output voltage Low Dropout Regulator (LDO) with shutdown and user-programmable delay for power good function.</td>
<td>Click Here</td>
</tr>
<tr>
<td>MCP1726</td>
<td>The MCP1726 is a 1A, ceramic output cap stable, low output voltage Low Dropout Regulator (LDO) with shutdown and user-programmable delay power good functions.</td>
<td>Click Here</td>
</tr>
</tbody>
</table>

NEXT: Switching Regulators >>
1A-1.5A Low Dropout Regulators

**Attributes:**

- Very low operating current: 80µA (typ)
- High output voltage accuracy: ±2.5% (max)
- Excellent dynamic performance (line & load regulation)
- Very low dropout voltage: as low as 450mV @ 800mA (typ)
- Package offering: SOT-223, SOIC, TO-220, DDPAK
# Switching Regulators

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</thead>
<tbody>
<tr>
<td>MCP16321/2</td>
<td>The MCP16321/2 is a highly integrated, high-efficiency, fixed frequency, synchronous step-down DC-DC converter in a 16-pin QFN package that operates from input voltages up to 24V.</td>
<td><a href="#">Click Here</a></td>
</tr>
<tr>
<td>MCP16323</td>
<td>The MCP16323 is a highly integrated, high-efficiency, fixed frequency, synchronous step-down DC-DC converter in a 16-pin QFN package that operates from input voltages up to 18V.</td>
<td><a href="#">Click Here</a></td>
</tr>
<tr>
<td>MCP16311/2</td>
<td>The MCP16311/2 is a compact, high-efficiency, fixed frequency PWM/PFM, synchronous step-down DC-DC converter in a 8-pin MSOP, or 2 x 3 TDFN package that operates from input voltage sources up to 30V. Integrated features include a high-side and a low-side switch, fixed frequency Peak Current Mode Control, internal compensation, peak-current limit and over temperature protection. The MCP16311/2 provides all the active functions for local DC-DC conversion, with fast transient response and accurate regulation.</td>
<td><a href="#">Click Here</a></td>
</tr>
</tbody>
</table>
Switching Regulators

Attributes:

- Regulator and controller (external FET) solutions
- Small SOT-23, MSOP and SOP packages
- Auto-switching PWM/PFM operation
- 300kHz and 750kHz switching frequency
- UVLO, Soft-start & over-temperature protection
- Efficiency as high as 95%
- Very low operating current
**Function:** Reset the CPU and/or MCU when supply voltage falls below threshold

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<tr>
<td>MCP13xx</td>
<td>The MCP13xx voltage supervisors provide precision monitoring trip points, Watch Dog Timer inputs, Manual Reset with a low Supply current of 10 µA over extended temperature range from 1.0V to 5.5V supply.</td>
<td>Click Here</td>
</tr>
<tr>
<td>TCM809</td>
<td>The reset output is driven active within 20 µsec of VCC falling through the reset voltage threshold. Reset is maintained active for a minimum of 140msec after VCC rises above the reset threshold.</td>
<td>Click Here</td>
</tr>
</tbody>
</table>
RESET Monitors

Attributes:
- Tiny SOT-23 and SC-70 packages
- Very low operating current: as low as 10µA (max)
- High threshold voltage accuracy: ±2.8% (max)
- $V_{DD}$ transient immunity
- Watchdog Timer / manual reset (MCP13xx, TC1232)
- Many available options: push-pull output, open-drain output and internal pull-up resistor
## Temperature Sensors

- **Function:** To Monitor temperature and initiate actions during over-temperature conditions

### Popular Products

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<thead>
<tr>
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</tr>
</thead>
<tbody>
<tr>
<td>TCN75</td>
<td>TCN75 is a serially programmable temperature sensor that notifies the host controller when ambient temperature exceeds a user-programmed setpoint. Hysteresis is also programmable.</td>
<td>[Click Here]</td>
</tr>
<tr>
<td>MCP9808 Digital temperature sensor</td>
<td>The MCP9808 converts temperatures between -20°C and +100°C to a digital word with ±0.5°C (max.) accuracy</td>
<td>[Click Here]</td>
</tr>
</tbody>
</table>

[<< BACK to BLOCK DIAGRAM] [NEXT: Fan Managers >>]

[Winning Attributes]
**Temperature Sensors**

- **Attributes:**
  - Small SOT-23 and MSOP-8 packages
  - Very low operating current: 250µA (typ)
  - Very low shutdown current: 1µA (typ)
  - High temp accuracy: ±1°C (typ)
  - Simple operation: no need for external components
  - Analog and digital (SPI™, I²C™, SMBus™) devices
Fan Managers

Function: controlling fan speed according to ambient temperature for reducing acoustic noise and extending fan life

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<tr>
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<tbody>
<tr>
<td>TC652</td>
<td>The TC652/653 are integrated temperature sensors and brushless DC fan speed controllers with FanSense™ technology. The TC652/653 measure their junction temperature and control the speed of the fan based on that temperature, making them especially suited for applications in modern electronic equipment. The FanSense™ fan fault detect circuitry eliminates the need for a more expensive 3 wire fan.</td>
<td>Click Here</td>
</tr>
</tbody>
</table>
Attributes:

- Small MSOP packages
- High temp accuracy: ±1°C (typ)
- Fan failure detection
- Very low power consumption
- Wide range of features: SMBus™ Interface, Auto-shutdown, Minimum fan speed, Over-temp indication, etc.
# Operational Amplifiers

## Function: buffering and filtering signals

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<tr>
<td>MCP6004</td>
<td>The MCP6004 is a quad general purpose op amp offering rail-to-rail input and output over the 1.8 to 6V operating range. This amplifier has a typical GBWP of 1 MHz with typical quiescent current of 100 microamperes.</td>
<td>Click Here</td>
</tr>
<tr>
<td>MCP6H04</td>
<td>MCP6H04 has a wide supply voltage range of 3.5V to 16V and rail-to-rail output operation. This device has a gain bandwidth product of 1.2 MHz (typical), while only drawing 135 µA/amplifier (typical) of quiescent current.</td>
<td>Click Here</td>
</tr>
<tr>
<td>MCP6294</td>
<td>MCP6294 provide wide bandwidth of 10 MHz Gain Bandwidth Product. This family also operates from a single supply voltage as low as 2.4V to 6V, while drawing 1 mA (typical) quiescent current.</td>
<td>Click Here</td>
</tr>
</tbody>
</table>

 Winning Attributes

 << BACK to BLOCK DIAGRAM
Operational Amplifiers

Attributes:

- Small SC-70, TDFN and SOT-23 packages
- GBWP: 9 kHz to 60MHz
- Excellent operating current-to-GBWP ratio
- Mostly rail-to-rail inputs and outputs
- Offset voltage: as low as 2µV (MCP6V0x)
- Chip Select capability for power savings
# Analog-to-Digital Converters

- **Function:** implementing Automatic Gain Control (AGC) for the tuner - frequency adjustment

## Popular Products

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<td>The MCP3201 12-bit Analog-to-Digital Converter (ADC) combines high performance and low power consumption in a small package, making it ideal for embedded control applications. The MCP3201 features SAR architecture and a SPI serial interface, allowing 12-bit ADC capability to be added to any PIC® microcontroller. The MCP3201 features 100k samples/second, 1 input channel, low power consumption (5nA typical standby, 400µA max. active).</td>
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[Winning Attributes](#)  
[<< BACK to BLOCK DIAGRAM](#)
Analog-to-Digital Converters

**SAR Attributes:**
- Resolution: 8 to 13 bits
- Max sampling rate: up to 200 ksp
- Linearity: ±1LSB DNL, ±1LSB INL
- Current consumption: 175 to 500µA (max.)
- Single supply voltage: 2.7V to 5.5V
- Small packages: SOT-23 and MSOP

**Delta-Sigma Attributes:**
- Resolution: 16 to 22 bits
- Max sampling rate: up to 240 sps
- Current consumption: 120 to 155 µA (max.)
- Single supply voltage: 2.7V to 5.5V
- Small packages: SOT-23 and MSOP
Microchip Analog Products for Medical Applications
Microchip’s Winning Attributes

- Large offering of LDO and Resets covering needed voltages
- RR-I/O op amps reduce design concerns
- High Precision Operational Amplifiers
- Low Power consumption
- Attach sell with PICmicro, frequently used
- Great lead times and customer support
ECG/EKG Block Diagram

INA → Filter → GAIN → ADC → PICxxxx

Power Management
Voltage Supervisor

Digital Thermometer  Blood Glucose Meter  << BACK to CONTENTS
PIC Microcontrollers

- Function: coordinating all the control, some peripheral functions and monitor functions - the brain of the system
- Popular products: PIC16F178X, 75X, 15XX
- Attributes:
  - Up to 32 MHz operating speed
  - PWM output (PIC1XF75X)
  - Integrated hi-speed, comparators, op-amp, 12-bit ADC, 5/8/9 bit DAC, CCP, COG
  - Up to 256 bytes of EEPROM
  - Available in UQFN, QFN, PDIP, SOIC, and TSSOP packages
Instrumentation Amplifiers

- Function: buffering and filtering sensor signals for preserving signal characteristics and rejecting unwanted frequencies

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<td>MCP6N11</td>
<td>The MCP6N11 single instrumentation amplifier is optimized for single-supply operation with rail-to-rail input and output performance. Two external resistors set the gain, minimizing gain error and drift over temperature. The supply voltage range of 1.8V to 5.5V is low enough to support many portable applications</td>
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Operational Amplifiers

**Function:** Provide gain to small signals

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<td>MCP6V11 Zero Drift Op Amps</td>
<td>Gain-Bandwidth Product: 80 kHz, Offset Voltage: ±8 µV (max.), IQ: 11 µA (typ.), Wide Supply Voltage Range: 1.6V to 5.5V</td>
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<td>MCP6444</td>
<td>The MCP6444 is a quad general purpose op amp offering rail-to-rail input and output over the 1.8 to 6V operating range. This amplifier has a typical GBWP of 9 kHz with typ. quiescent current of 450 nA.</td>
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<td>MCP60x</td>
<td>MCP601/2/3/4 (op amp) has a gain bandwidth product of 2.8 MHz with low typical operating current of 230 µA and an offset voltage that is less than 2 mV.</td>
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Analog-to-Digital Converters

- **Function:** converting analog feedback signals to digital signals for MCU

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Low-Power LDOs

- **Function:** providing regulated, low-noise supply voltages for the system

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<td>80mA , LDO With Shutdown in SC70</td>
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<< BACK to BLOCK DIAGRAM
# RESET Monitors

- **Function:** Reset the CPU and/or MCU when supply voltage falls below threshold

## Popular Products

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### Product Web Page

- [Click Here](#) for MCP13xx
- [Click Here](#) for TCM809
PIC Microcontrollers

- Function: coordinating all the control, some peripheral functions and monitor functions - the brain of the system
- Popular products: PIC16F178X, 75X, 15XX
- Attributes:
  - Up to 32 MHz operating speed
  - PWM output (PIC1XF75X)
  - Integrated hi-speed, comparators, op-amp, 12-bit ADC, 5/8/9 bit DAC, CCP, COG
  - Up to 256 bytes of EEPROM
  - Available in UQFN, QFN, PDIP, SOIC, and TSSOP packages
  - 8-pin solutions (PIC12F752)
## Power Management

- **Function:** providing regulated, low-noise supply voltages for the system

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Function: providing the system with an accurate analog voltage for comparison

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# Operational Amplifiers

## Function: buffering and filtering signals

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Analog-to-Digital Converters

**Function:** converting analog feedback signals to digital signals for MCU

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<td>The MCP3421 is a single channel low-noise, high accuracy Delta-Sigma A/D converter with differential inputs and up to 18 bits of resolution in a small SOT-23-6 package. The device uses a two-wire I2C™ compatible serial interface and operates from a single power supply ranging from 2.7V to 5.5V.</td>
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</table>
Digital Thermometer

- Ambient Temperature Sensing Element
- Signal Conditioning
- Microcontroller
- Power Management
- User Interface
- ECG/EKG System
- Blood Glucose Meter
- LCD
- 98.5
- Audio Alert
- << BACK to CONTENTS
Microchip offers high resolution SAR and Delta-Sigma ADC and a wide range of high bandwidth, low current and cost effective operational amplifiers

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<tr>
<td>MCP6231/2/4</td>
<td>MCP6231/1R/1U/2/4 - Family of operational amplifiers Gain Bandwidth Product: 300 kHz (typical), Low Supply Current: = 20 μA (typical), Wide Supply Voltage: 1.8V to 6.0V</td>
<td>Click Here</td>
</tr>
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# Power Management

- **Wide range of Voltage Regulators and DC-DC Converters**

## Popular Products

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</tr>
<tr>
<td>MCP1700/2/3A</td>
<td>Input Voltage Options between 6V and 16V, Very low active current &lt; 2 μA, Multiple small package options (SOT23-3), Custom output voltages available upon request</td>
<td>Click Here</td>
</tr>
<tr>
<td>TC101(4/5/85) Linear Regulators</td>
<td>Low Supply Current (50 μA, typical), Power-SavingShutdown Mode Pin Options for outputs of 50mA, 100mA, 150mA</td>
<td>Click Here</td>
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</table>

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Thermal Compensation

- In many cases ambient temperature compensation requires a second sensor.

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<tr>
<td>MCP9808 Digital temperature sensor</td>
<td>The MCP9808 converts temperatures between -20°C and +100°C to a digital word with ±0.5°C (max.) accuracy</td>
<td>[Click Here]</td>
</tr>
<tr>
<td>MCP9700 Linear Active Thermistor™ ICs</td>
<td>The output voltage of this device is directly proportional to measured temperature. The MCP9700 can accurately measure temperature from -40°C to +150°C with the output calibrated to a slope of 10mV/°C and has a DC offset of 500mV.</td>
<td>[Click Here]</td>
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PIC Microcontrollers

- Function: coordinating all the control, some peripheral functions and monitor functions - the brain of the system
- Popular products: PIC16F193X, PIC18F65J90/94
- Attributes:
  - Up to 32 MHz operating speed
  - PWM output (PIC16F193X)
  - Integrated LCD controller, up to 256 segments
  - Integrated comparators, op-amp, 12-bit ADC, 5/8/9 bit DAC
  - Up to 256 bytes of EEPROM
Microchip Analog Products for Smoke and CO Detectors
Addressable Smoke Detector

- **Sensor**
- **Op Amp**
- **PIC® Microcontroller**
  - **A/D**
- **9V to 24V**
- **3V - 5V**
- **Voltage Regulator**
- **Smoke Detector ICs**
- **Horn Driver**

- **CO Companion**
- **10 Yr Low Voltage Smoke Detector**
- **CO Detectors**
- **Low cost Smoke Detectors**
- **Home Alarm Systems**

<< BACK to CONTENTS
Low Cost Smoke Detector

- Sensor
- 9V
- Ion or Photo Smoke IC
- LED Driver
- Voltage Regulator
- Boost Switcher or Charge Pump
- Smoke Detector Logic
- Horn Driver

10 Yr Low Voltage Smoke Detector
10 Year Low Voltage Photoelectric Smoke Detector

- 3V
- Photo Smoke IC
- LED Driver
- Voltage Regulator
- Boost Switcher or Charge Pump
- Interconnect
- Smoke Detector Logic
- Horn Driver

Additional Links:
- CO Companion
- CO Detectors
- Low cost Smoke Detectors
- Addressable Smoke Detectors
- Home Alarm Systems
- << BACK to CONTENTS
CO Detector Companion IC

3V to 9V
DC Supply
AC Power

Power Mgmt.
LED Driver
Voltage Regulator
Boost Regulator
Interconnect
CO Amp
Horn Driver

PIC® Microcontroller

CO Detectors
10 Yr Low Voltage Smoke Detector
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## Operational Amplifiers

### Function: Provide gain to small signals

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Comparators

- **Function:** Establish alarm thresholds (primarily in smoke detectors)

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<td>MCP6567</td>
<td>These comparators are optimized for low power, single-supply operation with greater than rail-to-rail input operation. The open drain output of the MCP6566/7/9 family with a pull-up resistor, can be used as a level shifter for any desired voltage from 1.6V to 5.5V.</td>
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Analog-to-Digital Converters

Function: converting analog feedback signals to digital signals for MCU

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### RESET Monitors

- **Function:** Reset the CPU and/or MCU when supply voltage falls below threshold

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Voltage References

- **Function:** providing the system with an accurate analog voltage for comparison

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<td><a href="#">Click Here</a></td>
</tr>
<tr>
<td>MCP111/2</td>
<td>The MCP111/112 voltage detectors have extremely low 1uA operating current and small form factor. They hold the microcontroller in reset until the supply voltage reaches a predetermined operating level. These devices also protect against brownout conditions</td>
<td><a href="#">Click Here</a></td>
</tr>
<tr>
<td>LDO MCP1700/3A</td>
<td>The MCP1700/3A are CMOS low dropout positive voltage regulators which can source up to 250mA of current with an extremely low input-output voltage differential. The low dropout voltage combined with the low current consumption makes this part ideal for battery operation.</td>
<td><a href="#">MCP1700</a>, <a href="#">MCP1703A</a></td>
</tr>
<tr>
<td>MCP16301</td>
<td>The MCP16301 is a highly integrated, high-efficiency, fixed frequency, step-down DC-DC converter in a popular SOT-23 package that operates from input voltage sources up to 30V</td>
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## Temperature Sensor

- **Function:** provides temperature measurement

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<tr>
<td>TC1047</td>
<td>The TC1047A is a linear output temperature sensor whose output voltage is directly proportional to measured temperature. For the TC1047A, the output voltage range is typically 100mV at -40°C, 500mV at 0°C, 750mV at +25°C, and 1.75V at +125°C. A 10mV/°C voltage slope allows for the wide temperature range.</td>
<td>Click Here</td>
</tr>
<tr>
<td>MCP9700 Linear Active Thermistor™ ICs</td>
<td>The output voltage of this device is directly proportional to measured temperature. The MCP9700 can accurately measure temperature from -40°C to +150°C with the output calibrated to a slope of 10mV/°C and has a DC offset of 500mV.</td>
<td>Click Here</td>
</tr>
</tbody>
</table>

<< BACK to BLOCK DIAGRAM
Function: coordinating all the control and monitor functions - the brain of the system

Popular products: PIC16F161X, 527/570, 32X, 182X, 75X, 15XX

Attributes:

- Up to 32MHz operating speed
- PWM output (PIC16F182X)
- Programmable switch mode controller (PIC16F75X)
- Integrated comparators, op-amp, 12-bit ADC, 8-bit DACs
- Up to 256 bytes of EEPROM
- Available various packages
High Performance RISC CPU:
- Only 35 instructions to learn
- All single cycle instructions (200 ns), except for program branches which are two-cycle
- Operating speed:
  - DC - 20 MHz oscillator/clock input
  - DC - 200 ns instruction cycle
- Memory
  - 1024 x 14 words of FLASH Program Memory
  - 64 x 8 bytes of Data Memory (SRAM)
  - 128 x 8 bytes of EEPROM data memory
- Interrupt capability
- 16 special function hardware registers
- 8-level deep hardware stack
- Direct, Indirect, and Relative Addressing modes

Peripheral Features:
- 6 I/O pins with individual direction control
- High current sink/source for direct LED drive
- Analog comparator module with:
  - One analog comparator
  - Programmable on-chip comparator voltage reference (CVREF) module
  - Programmable input multiplexing from device inputs
  - Comparator output is externally accessible
- Analog-to-Digital Converter module (PIC12F675):
  - 10-bit resolution
  - Programmable 4-channel input
  - Voltage reference input
- Timer0: 8-bit timer/counter with 8-bit programmable prescaler
- Enhanced Timer1:
  - 16-bit timer/counter with prescaler
  - External Gate Input mode
  - Option to use OSC1 and OSC2 in LP mode as Timer1 oscillator, if INTRC Oscillator mode selected
- 64 bytes of general purpose RAM
<table>
<thead>
<tr>
<th>RE46C190</th>
<th>Description</th>
</tr>
</thead>
</table>
|          | • Two AA battery Operation  
|          | • Internal Power On Reset  
|          | • Low Quiescent Current Consumption  
|          | • Internal IRED driver with Programmable IRED Current  
|          | • Programmable Photo Amplifier  
|          | • Programmable Smoke Sensitivity Levels  
|          | • 9 Minute Timer for Sensitivity Control  
|          | • Chamber Test with Programmable Sensitivity Level  
|          | • Internal Low Battery Test with Programmable Threshold  
|          | • Interconnect up to 40 Detectors  
|          | • Local Alarm Memory  
|          | • Temporal or Continuous Horn Pattern  
|          | • All internal Oscillator  
<p>|          | • Available 16L N SOIC                                                                                                                                  |</p>
<table>
<thead>
<tr>
<th>Description</th>
<th>Product Web Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>RE46C800 • The RE46C800 provides all of the necessary analog, interface,</td>
<td>Click Here</td>
</tr>
<tr>
<td>and power management functions necessary to build a microcontroller based</td>
<td></td>
</tr>
<tr>
<td>CO or toxic gas detector. • The RE46C800 is intended for use with two</td>
<td></td>
</tr>
<tr>
<td>terminal electrochemical CO and toxic gas sensors. • The uncommitted op</td>
<td></td>
</tr>
<tr>
<td>amp can also be used for heat detector applications</td>
<td></td>
</tr>
</tbody>
</table>
EEPROM Memory

- Function: storing factory calibration values and the "life" clock of a CO sensor
- Popular products: 24LCxxx, 93xx46A/B, 25LCxxx

- Attributes:
  - SPI™, I²C™ and Microwire® Interface
  - Small SOT-23 and MSOP packages
  - Densities from 128 to 512k
  - Supply voltages as low as 1.8V
  - E/W Cycles: 1M
93XX46A/B - Microwire EEPROM

Features

- Low power CMOS technology
- ORG pin to select word size for ‘46C version
- 128 x 8-bit organization ‘A’ ver. devices (no ORG)
- 64 x 16-bit organization ‘B’ ver. devices (no ORG)
- Self-timed ERASE/WRITE cycles (including auto-erase)
- Automatic ERAL before WRAL
- Power on/off data protection circuitry
- Industry standard 3-wire serial I/O
- Device status signal (READY/BUSY)
- Sequential READ function
- 1,000,000 E/W cycles
- Data retention > 200 years
- Temperature ranges supported
  - Industrial (I) -40°C to +85°C
  - Automotive (E) -40°C to +125°C

<< BACK to BLOCK DIAGRAM
Horn Drivers

- Horn Drivers allows battery operation of a piezoelectric horn
  - Piezoelectric horns are a low cost, high efficiency method to achieve the sound pressure required.

- Horn Drivers provide these advantages:
  - Realize cost savings by reducing component count
  - Increase battery life, low current low voltage
  - Switchers and charge pumps for even lower voltage operation
  - Self resonance calibration
Horn Driver Family (1)

- Piezoelectric Horn Drivers, baseline ASIC Products
  - RE46C100 basic model, Vdd 6V - 16V
  - RE46C101 with LED Driver, Vdd 6V - 16V
  - RE46C104 with Voltage Converter, Vdd 4V-8V
  - RE46C117 with Charge Pump, Vdd 2V - 5V
Horn Driver Family (2)

- Piezoelectric Horn Drivers with controller
- Voltage Regulators ASIC products
  - RE46C108 Vreg pin select 3.3V or 5V, Vdd 6V-12V
  - RE46C105 Vreg pin select 3.3V or 5V, Low Battery, LED Driver, Vdd 6V-12V
  - RE46C107 Vreg pin select 3V or 3.3V, Low Battery, Brownout, Vdd 2V-5V
  - RE46C109 Vreg 3.0V, Low Battery, I/O, Brownout, Vdd 6-12V
  - RE46C119 Vreg 3.0V, Low Battery, I/O, Power Good, 6V-12V

<< BACK to BLOCK DIAGRAM
Smoke Detector ICs

- Smoke Detector ICs allows implementation of low power Ionization or photoelectric smoke detectors

- Advantages:
  - Low battery detection
  - Integrated horn driver

- Advantages for selected detectors
  - Interconnect for sounding multiple units
  - Sensitivity/Hush Timer
  - Reverse battery protection
  - 24V Regulator and step-up regulator
# Ionization Smoke ICs

<table>
<thead>
<tr>
<th>Popular Products</th>
<th>Description</th>
<th>Product Web Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>RE46C12x</td>
<td>Hush, Interconnect, Continuous or Temporal Pattern, Reverse Chamber Polarity</td>
<td><a href="#">Click Here</a></td>
</tr>
<tr>
<td>RE46C152</td>
<td>Hush, Interconnect, Pin-select Temporal and Continuous Pattern</td>
<td><a href="#">Click Here</a></td>
</tr>
<tr>
<td>RE46C162/3</td>
<td>Interconnect, Temporal or Continuous Horn Pattern, Alarm Memory</td>
<td><a href="#">Click Here</a></td>
</tr>
</tbody>
</table>
Photoelectric Smoke ICs

<table>
<thead>
<tr>
<th>Popular Products</th>
<th>Description</th>
<th>Product Web Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>RE46C140/1/3/5/</td>
<td>Hush Timer, Interconnect, Temporal and Continuous Horn Pattern</td>
<td></td>
</tr>
<tr>
<td>RE46C165/6/7/8</td>
<td>Hush Timer, Interconnect, Temporal and Continuous Horn Pattern, Alarm Memory. Ideal for new home construction market</td>
<td>Click Here</td>
</tr>
</tbody>
</table>

Low cost Smoke Detectors
Addressable Smoke Detectors
CO Detectors
10 Yr Low Voltage Smoke Detector
Microchip

Weigh Scale
Typical Weigh Scale

Load Cell → Op Amp → ADC → PIC® Microcontroller → MCP2200 USB to UART → Interface

Vref

Power Management

Switchers → Battery Chargers → LDO → Battery

Supervisor

Weigh Scale Demo board
# Operational Amplifiers

<table>
<thead>
<tr>
<th>Function</th>
<th>Popular Products</th>
<th>Description</th>
<th>Product Web Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sense and gain up output current - low offset voltage required for minimizing measurement error</td>
<td>MCP603x</td>
<td>The MCP6031/2/3/4 op amps have a gain bandwidth of 10 kHz with a low typical operating current of 1.35µA and an offset voltage that is less than 150 µV.</td>
<td><a href="#">Click Here</a></td>
</tr>
<tr>
<td>Provide feedback compensation by sensing output voltage and comparing it with reference voltage</td>
<td>MCP6V0x Zero Drift Op Amps</td>
<td>VOS: ±2 µV (maximum), PSRR: 130 dB (minimum), CMRR: 130 dB (minimum), IQ: 300 µA/amplifier (typical)</td>
<td><a href="#">Click Here</a></td>
</tr>
<tr>
<td></td>
<td>MCP627x/8x/9x</td>
<td>The MCP627/8/9x family general purpose op amp offering rail-to-rail input and output over the 1.8 to 6V operating range. This amplifier has a typical GBWP of 2-10 MHz with low quiescent current in small packages</td>
<td><a href="#">Click Here</a></td>
</tr>
<tr>
<td></td>
<td>MCP60x</td>
<td>MCP601/2/3/4 (op amp) has a gain bandwidth product of 2.8 MHz with low typical operating current of 230 µA and an offset voltage that is less than 2 mV.</td>
<td><a href="#">Click Here</a></td>
</tr>
</tbody>
</table>
Operational Amplifiers

Attributes:
- Small SC-70, TDFN and SOT-23 packages
- GBWP: 9 kHz to 60MHz
- Excellent operating current-to-GBWP ratio
- Mostly rail-to-rail inputs and outputs
- Offset voltage: as low as 2µV (MCP6V0x)
- Chip Select capability for power savings
Voltage References

- **Function:** providing the system with an accurate analog voltage for comparison

<table>
<thead>
<tr>
<th>Popular Products</th>
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</tr>
</thead>
<tbody>
<tr>
<td>MCP1525</td>
<td>MCP1525 is a low power, high precision voltage reference. It provides a precise output voltage of 2.5V which is then compared to other voltages in the system. This voltage reference is normally used in the 3V to 5V systems, where there may be wide variations in supply voltage and a need to minimize power dissipation.</td>
<td>Click Here</td>
</tr>
</tbody>
</table>
**Function:** Enables USB connectivity in applications that have UART/SPI interface

<table>
<thead>
<tr>
<th>Popular Products</th>
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</tr>
</thead>
<tbody>
<tr>
<td>MCP2200</td>
<td>The MCP2200 is a USB-to-UART serial converter. The device reduces external components by integrating the USB termination resistors. The MCP2200 also has 256-bytes of integrated user EEPROM. The MCP2200 has eight general purpose input / output pins. Four of the pins have alternate functions to indicate USB and communication status.</td>
<td><a href="#">Click Here</a></td>
</tr>
<tr>
<td>MCP2210</td>
<td>The MCP2210 is a USB-to-SPI Master converter. The device reduces external components by integrating the USB termination resistors. The MCP2210 also has 256 bytes of integrated user EEPROM. The MCP2210 has nine general purpose input/output pins. Seven pins have alternate functions to indicate USB and communication status.</td>
<td><a href="#">Click Here</a></td>
</tr>
</tbody>
</table>
## Battery Chargers

### Function: Charge & monitor the Lithium battery chemistries

<table>
<thead>
<tr>
<th>Popular Products</th>
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<th>Product Web Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>MCP731xx</td>
<td>The MCP73811/2 devices are linear charge management controllers that are designed to provide specific charge algorithms for single cell Li-Ion or Li-Polymer battery to achieve optimal capacity in the shortest charging time possible.</td>
<td><a href="#">Click Here</a></td>
</tr>
<tr>
<td>MCP732xx</td>
<td>The MCP73123/223 is a highly integrated Lithium Iron Phosphate (LiFePO4) battery charge management controller that provide specific charge algorithms for LiFePO4 batteries to achieve optimal capacity and safety in the shortest charging time possible. Along with its small physical size, the low number of external components makes the MCP73123/223 ideally suitable for various applications.</td>
<td><a href="#">Click Here</a></td>
</tr>
</tbody>
</table>
Battery Chargers

Attributes:

- Small thermally efficient DFN and QFN packages
- High-accuracy voltage regulation: ±0.5% (max)
- Low operating current: 260µA (typ)
- Shutdown and pre-conditioning modes
- Temperature monitor & charge complete indicator
- USB/AC inputs
- Loadsharing
- Overvoltage Protection (OVP)
PIC Microcontrollers

- Function: coordinating all the control, some peripheral functions and monitor functions - the brain of the system
- Popular products: PIC16F193X, PIC18F65J90/94, K87K90
- Attributes:
  - Up to 32 MHz operating speed
  - PWM output (PIC16F193X)
  - Integrated LCD controller, up to 256 segments
  - Integrated comparators, op-amp, 12-bit ADC, 5/8/9 bit DAC
  - Up to 256 bytes of EEPROM
  - Available in PDIP, SOIC, and TSSOP packages
## Switching Regulators

<table>
<thead>
<tr>
<th>Popular Products</th>
<th>Description</th>
<th>Product Web Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>MCP1601</td>
<td>The MCP1601 is a synchronous Buck (step-down) switching regulator that can continuously supply 500mA of load current. This device can provide output voltages of 0.9V to Vin with an operating efficiency that can exceed 92%.</td>
<td>Click Here</td>
</tr>
<tr>
<td>MCP16251/2</td>
<td>The MCP16251/2 is a compact, high-efficiency, fixed frequency, synchronous step-up DC-DC converter. This family of devices provides an easy-to-use power supply solution for applications powered by either one-cell, two-cell or three-cell alkaline, NiCd, NiMH and one-cell Li-Ion or Li-Polymer batteries.</td>
<td>Click Here</td>
</tr>
<tr>
<td>MCP1640</td>
<td>The MCP1640 is a compact, high-efficiency, fixed frequency, synchronous step-up DC-DC converter. It provides an easy-to-use power supply solution for applications powered by either one-cell, two-cell, or three-cell alkaline, NiCd, NiMH, one-cell Li-Ion or Li-Polymer batteries.</td>
<td>Click Here</td>
</tr>
</tbody>
</table>
Switching Regulators

Attributes:

- Regulator and controller (external FET) solutions
- Small SOT-23, MSOP and SOP packages
- Auto-switching PWM/PFM operation
- 300kHz and 750kHz switching frequency
- UVLO, Soft-start & over-temperature protection
- Efficiency as high as 95%
- Very low operating current
### Function: Reset the CPU and/or MCU when supply voltage falls below threshold

<table>
<thead>
<tr>
<th>Popular Products</th>
<th>Description</th>
<th>Product Web Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>MCP13xx</td>
<td>The MCP13xx voltage supervisors provide precision monitoring trip points, Watch Dog Timer inputs, Manual Reset with a low Supply current of 10 μA over extended temperature range from 1.0V to 5.5V supply.</td>
<td>Click Here</td>
</tr>
<tr>
<td>TCM809</td>
<td>The reset output is driven active within 20 μsec of VCC falling through the reset voltage threshold. Reset is maintained active for a minimum of 140msec after VCC rises above the reset threshold.</td>
<td>Click Here</td>
</tr>
</tbody>
</table>
Attributes:

- Tiny SOT-23 and SC-70 packages
- Very low operating current: as low as 10µA (max)
- High threshold voltage accuracy: ±2.8% (max)
- $V_{DD}$ transient immunity
- Watchdog Timer / manual reset (MCP13xx, TC1232)
- Many available options: push-pull output, open-drain output and internal pull-up resistor
**Low-Power LDOs**

Function: providing regulated, low-noise supply voltages for the system

<table>
<thead>
<tr>
<th>Popular Products</th>
<th>Description</th>
<th>Product Web Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>MCP1824/5/6/7</td>
<td>The MCP1825 is a 500 mA, ceramic output cap stable, low output voltage, Low Dropout Regulator (LDO) with shutdown and power good functions (fixed output version only). It is part of the family of LDOs that includes 300 mA MCP1824, 1A MCP1826 and 1.5A MCP1827.</td>
<td>Click Here</td>
</tr>
<tr>
<td>MCP1703A</td>
<td>With 250 mA maximum output, MCP1703 works with input voltage of up to 16V and in combination with its low current consumption of 2 µA</td>
<td>Click Here</td>
</tr>
</tbody>
</table>
## ADC Portfolio

### Function: Converting analog voltage or current signal (pressure) into digital data

<table>
<thead>
<tr>
<th>Popular Products</th>
<th>Description</th>
<th>Product Web Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>MCP3421</td>
<td>The MCP3421 is a single channel low-noise, high accuracy Delta-Sigma A/D converter with differential inputs and up to 18 bits of resolution in a small SOT-23-6 package. The device uses a two-wire I2C™ compatible serial interface and operates from a single power supply ranging from 2.7V to 5.5V.</td>
<td>Click Here</td>
</tr>
<tr>
<td>MCP3551</td>
<td>MCP355X devices are 2.7V to 5.5V, 22-bit delta-sigma A/D converters. The family exhibit good linearity, high accuracy and low noise performance for applications where sensor measurements such as pressure are performed.</td>
<td>Click Here</td>
</tr>
</tbody>
</table>

---

Winning Attributes

<< BACK to BLOCK DIAGRAM
Delta-Sigma Analog-to-Digital Converters

Attributes:
- Resolution: 16 to 22 bits
- Max sampling rate: up to 240 sps
- Current consumption: 120 to 155 µA (max.)
- Single supply voltage: 2.7V to 5.5V
- Small packages: SOT-23 and MSOP
Devices Supported:
MCP3421, MCP6V07, PIC18F4550

Summary Description:
The MCP3421 Weight Scale Demo Board is designed to evaluate the performance of the low-power consumption, 18-bit ADC in an electronic weight scale design. Next to the MCP3421 there is a low-noise, auto-zero MCP6V07 op amp. This can be used to investigate the impact of extra gain added before the ADC for performance improvement. The PIC18F4550 is controlling the LCD and the USB communication with the PC. The GUI is used to indicate the performance parameters of the design and for calibration of the weight scale.

This Kit Contains:
• MCP3421 Weight Scale Demo Board
• 9V Power adapter
• Mini USB cable
• CD with software and documentation
Microchip’s Winning Attributes

- Industry leading Analog Front End (AFE) accuracy (SINAD, THD, SFDR)
- High performance integration
- Full solution
  - Flexible and upgradable solution with AFE+PIC® MCUs and SoC solutions
  - System solution with wireless, memory, analog
- Great technical support
  - Numerous reference designs and evaluation boards
  - ACE Metrology Team
Energy Meter Block Diagram

- **Power Management**
- **Human Interface**
- **Data Logging & Calibration**
  - EEPROM Serial
  - SRAM Serial
  - Flash
  - RTCC

- **Metrology**
  - Voltage & Current Sensors
  - Measurement AFE

- **Communication**
  - Wired
  - Wireless
## Power Management

<table>
<thead>
<tr>
<th>Popular Products</th>
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<th>Product Web Page</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>LDO</strong>&lt;br&gt;MCP1700&lt;br&gt;MCP1703A</td>
<td>The MCP1700/3A are CMOS low dropout positive voltage regulators which can source up to 250mA of current with an extremely low input-output voltage differential. The low dropout voltage combined with the low current consumption makes this part ideal for battery operation.</td>
<td><a href="#">MCP1700</a>, <a href="#">MCP1703A</a></td>
</tr>
<tr>
<td><strong>MCP16311/2</strong></td>
<td>The MCP16311/2 is a compact, high-efficiency, fixed frequency PWM/PFM, synchronous step-down DC-DC converter in a 8-pin MSOP, or 2 x 3 TDFN package that operates from input voltage sources up to 30V. Integrated features include a high-side and a low-side switch, fixed frequency Peak Current Mode Control, internal compensation, peak-current limit and overtemperature protection. The MCP16311/2 provides all the active functions for local DC-DC conversion, with fast transient response and accurate regulation.</td>
<td><a href="#">Click Here</a></td>
</tr>
</tbody>
</table>
## Voltage
- Resistive Divider from line voltage

## Current: 4 main sensor types

<table>
<thead>
<tr>
<th>Current Sensor</th>
<th>Cost</th>
<th>Power Consumption</th>
<th>High Current Capability</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Current Shunt</td>
<td>Very Low</td>
<td>Medium</td>
<td>Poor</td>
<td>Accurate resistor, 100μΩ to 500mΩ, non-isolated</td>
</tr>
<tr>
<td>Current Transformer</td>
<td>Medium</td>
<td>Low</td>
<td>Good</td>
<td>Winding with magnetic core, isolated</td>
</tr>
<tr>
<td>Rogowski Coil</td>
<td>Low-Med</td>
<td>Low</td>
<td>Very Good</td>
<td>Helical coil, output needs to be integrated, isolated</td>
</tr>
<tr>
<td>Hall Effect Transformer</td>
<td>High</td>
<td>Medium</td>
<td>Good</td>
<td>Hall plate, isolated</td>
</tr>
</tbody>
</table>
Energy Calculation ICs provide energy and power calculations, simplifying design.

Energy Measurement AFEs provide the most flexible and highest accuracy solutions.

from current sensor
ADC
serial interface
from voltage sensor
ADC
# Energy Measurement
## Analog Front Ends

### 1st Generation:
- 5V Analog $V_{DD}$
- 2.7V-5.5V Digital $V_{DD}$

<table>
<thead>
<tr>
<th>Part Number</th>
<th># of ADCs</th>
<th>Power Measurement</th>
</tr>
</thead>
<tbody>
<tr>
<td>MCP3918</td>
<td>1</td>
<td>1-Phase or 3-Phase (Isolated)</td>
</tr>
<tr>
<td>MCP3910</td>
<td>2</td>
<td>1-Phase or 3-Phase (Isolated)</td>
</tr>
<tr>
<td>MCP3911</td>
<td>2</td>
<td>1-Phase</td>
</tr>
<tr>
<td>MCP3913</td>
<td>6</td>
<td>3-Phase</td>
</tr>
<tr>
<td>MCP3914</td>
<td>8</td>
<td>3-Phase w/ Neutral</td>
</tr>
<tr>
<td>MCP3901</td>
<td>2</td>
<td>1-Phase</td>
</tr>
<tr>
<td>MCP3903</td>
<td>6</td>
<td>3-Phase</td>
</tr>
</tbody>
</table>

### 2nd Generation:
- Improved performance
- Added features
- 2.5V–3.6V Analog $V_{DD}$
- 2.5V–3.6V Digital $V_{DD}$

<table>
<thead>
<tr>
<th>Part Number</th>
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<tbody>
<tr>
<td>MCP3918</td>
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<tr>
<td>MCP3913</td>
<td></td>
<td></td>
</tr>
<tr>
<td>MCP3914</td>
<td></td>
<td></td>
</tr>
<tr>
<td>MCP3901</td>
<td></td>
<td></td>
</tr>
<tr>
<td>MCP3903</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### Energy measurement AFEs enables the most flexible and highest accuracy solutions

<table>
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<tr>
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</thead>
<tbody>
<tr>
<td>MCP391X</td>
<td>The MCP391X family are 3V Analog Front Ends (AFE), containing up to eight Delta-Sigma Analog-to-Digital Converters (ADC), PGAs, phase delay compensation block, low-drift voltage reference, digital offset and gain errors calibration registers, and high-speed 20 MHz SPI interface. The family enables 0.1% typical active power measurement error over a 10000:1 dynamic range and are capable of interfacing a variety of voltage and current sensors, including shunts, current transformers, Rogowski coils and Hall-effect sensors.</td>
<td>Click Here</td>
</tr>
</tbody>
</table>
Attributes:

- Industry leading accuracy enables 0.1% active power measurement error (typ.) over a 10000:1 dynamic range, use of smaller shunt sensors, and reduction in calibration requirements.
- Programmable data rate up to 125 ksp/s allows device to run at low power or at high speed for advanced signal acquisition such as for harmonic analysis.
- High performance integration including PGAs, low-drift voltage reference, phase delay block, CRC checksum and register-map lock.
Total Harmonic Distortion and Signal-to-Noise and Distortion Ratio are measures of a device’s accuracy.
Energy Measurement ICs

- Energy measurement calculation ICs provide energy and power calculations on one device

<table>
<thead>
<tr>
<th>Popular Products</th>
<th>Description</th>
<th>Product Web Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>MCP3905A</td>
<td>The MCP3905A are energy measurement ICs supporting the IEC 62053 international energy metering specification. The output of the device includes a frequency proportional to the average active (real) power at the inputs as well as a higher frequency output proportional to the instantaneous power for meter calibration. These devices incorporate two 16-bit delta-sigma ADCs with a programmable gain up to 16 and on-chip voltage reference. The MCP3909 also includes an SPI interface for ADC and multiplier output data.</td>
<td>Click Here</td>
</tr>
<tr>
<td>MCP3906A</td>
<td></td>
<td></td>
</tr>
<tr>
<td>MCP3909</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Winning Attributes
Energy Measurement AFE
Winning Attributes

Attributes:

- Dynamic Range:
  - MCP3905A 500:1
  - MCP3906A 1000:1
  - MCP3909 1000:1

- Provides active power pulse output
- MCP3909 includes SPI interface for ADC and multiplier output data
- MCP3905A/06A pin-to-pin compatible with ADE7755
Function:
- Power calculations
- More powerful MCUs for (wireless) communications

SoC Solutions (AFE+PIC): PIC18F86J72 and PIC18F87J72

Popular products:
- PIC16F15XX
- PIC16F182X
- PIC18F65J90
- PIC24FJ128GA306, PIC24FJ128GA310
- PIC32 (advanced smart meters)
PIC18F87J72 with Energy Measurement AFE
## Microchip Calculation Library

<table>
<thead>
<tr>
<th>MCU</th>
<th>Phase Sensor</th>
<th>Active Power</th>
<th>V &amp; I rms</th>
<th>Apparent Power</th>
<th>Reactive Power</th>
<th>Harmonic Analysis</th>
</tr>
</thead>
<tbody>
<tr>
<td>PIC18 8-bit, 12 MIPS</td>
<td>1Φ-Shunt 3Φ-CT</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>n/a</td>
</tr>
<tr>
<td>PIC24F/H 16b, 16-70 MIPS</td>
<td>1Φ- Shunt/CT 3Φ-Shunt, CT, RGC</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>TBD</td>
</tr>
<tr>
<td>dsPIC33 16b, 40-70 MIPS</td>
<td>1Φ-Shunt 3Φ-CT</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>PIC32 32-bit, 80MHz</td>
<td>1Φ-Shunt 3Φ-CT</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
</tbody>
</table>

CT = Current Transformer, RGC = Rogowski Coil

- A.C.E metrology team has developed a library of firmware that is available for customer use and can assist in customization
RTCC
Monitoring Time of Usage

- Energy billing purposes
  - Accurate time & energy usage monitored and stored
- Smart energy communications
  - Timestamp usually included with messages
  - MAC address loaded in MCU or RTCC with unique ID
- Periodic system status to validate meter operation
  - Timestamp logged each time a self diagnostics is performed
Data Logging:
- Meter operation is periodically monitored & recorded
- Energy usage by the consumer is measured and stored
  - High endurance memory is a requirement
    - Energy usage saved every minute / hour
    - Up to 525,600 Write Cycles / Year

Calibration:
- Calibration parameters stored in non-volatile memory
Human Interface Solutions

- **Display**
  - Graphics
  - Segmented LCD
  - Monochrome
  - Full color

- **Touch sense**
  - Capacitive touch
  - Resistive touch screens
  - Tactile buttons
  - Rotary switches

- **Audio and speech**

[www.microchip.com/humaninterface](http://www.microchip.com/humaninterface)

<< BACK to BLOCK DIAGRAM
Data Communication

- Methods vary based on application requirements
  - Physical environments
  - Standard protocol interfaces
- Wireless
  - ZigBee, WiFi, MiWi, Z-Wave, proprietary
- Wired
  - PLC, Ethernet, USB, Home Plug, BACnet, proprietary
- Protocols
  - DLMS, COSEM, Smart Energy Profile
Microchip Wi-Fi Solution

- Driver incorporated into Microchip TCP/IP stack
- Compatibility across nearly every major Microchip MCU family
- Demo Source Code and Applications
- PICtails and PICtail-based development kits shipping now
Microchip Sub-GHz Wireless Solutions

- **Multiple frequency options**
  - 868/915/950 MHz
  - FSK/OOK Modulation

- **Low current operation**
  - Low Rx Current = 3 mA
  - Low Tx Current = 25 mA @ +10 dBm

- **Integrated power amplifier (+12.5 dBm)**

- **High receiver sensitivity**
  - -107 dBm FSK/ -113dBm OOK)

- **Automatic frequency control (AFC)**

- **Module features:**
  - FCC (U.S.A.), IC (Canada), and ETSI (Europe) compliant
  - Surface-mountable PCB
Microchip 2.4 GHz Solutions

- **Transceiver Features:**
  - Supports MiWi™, MiWi P2P & ZigBee®
  - 2.4GHz IEEE 802.15.4 compliant
  - In-line/stand-alone encryption
  - Automatic MAC retransmit
  - 18 mA(RX)/22 mA(TX)/2 µA(Sleep)

- **Module Features:**
  - Integrated PCB antenna
  - FCC (U.S.A.), IC (Canada), and ETSI (Europe) certified
Analog Products in Automotive: Heating, Ventilation and Air Conditioning (HVAC) system
Automotive HVAC control

- Automotive heating, ventilation and air conditioning (HVAC) system is designed to provide passengers’ desired cabin temperature while keeping the engine from overheating.

- Microchip offers comprehensive solutions to control HVAC applications such as fans, blowers, pumps, condensers and compressors to efficiently achieve such tasks.
Automotive - HVAC

Discrete High Voltage MOSFETS Driver

- MOSFET Drivers
  - Speed Control
    - High Voltage MOSFETs
  - Speed Feedback
- MCU
  - CAN/LIN
  - Thermal Management
- CAN/LIN
- LIN/CAN BUS

Integrated High Voltage MOSFETS Driver

- CAN/LIN
- MCU
  - MOSFET Drivers
  - Speed Feedback
  - Speed Control
- BLDC/DC/Step Motor

HVAC Applications

- Air Door (DC/Step Motor)
- Flaps (DC/Step Motor)
- Heater Valve (DC/Step Motor)
- Main Blower (BLDC Motor)
- Engine Cooling Fans (BLDC Motor)
- Air Door (DC/Step Motor)
- Compressor (On/OFF)
## MOSFET Drivers

<table>
<thead>
<tr>
<th>Popular Products</th>
<th>Description</th>
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</tr>
</thead>
<tbody>
<tr>
<td>MCP140X, MCP141X, MCP14628</td>
<td>Low-side and low-side/high-side drivers</td>
<td><a href="#">MOSFET Driver's Parametric Search table</a></td>
</tr>
</tbody>
</table>
## Thermal Management

<table>
<thead>
<tr>
<th>Suggested Products</th>
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<tr>
<td>MCP9700/MCP9800</td>
<td>Improves control of color temperature and detects disconnected LED channel. MCP9700 outputs analog voltage that is proportional to the temperature (-40°C to 150°C). MCP9800 outputs temperature data (-55°C to 125°C) via I²C™/SMBus two-wire interface.</td>
<td>MCP9700</td>
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<tr>
<td>EMC2101</td>
<td>The EMC2101 is an SMBus 2.0 compliant, integrated fan control solution complete with two temperature monitors, one external and one internal. Each temperature channel has programmable high limits that can assert an interrupt.</td>
<td>EMC2101</td>
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<td>EMC1412</td>
<td>The EMC1412 is a high accuracy, low cost, System Management Bus (SMBus) temperature sensor. Advanced features such as Resistance Error Correction (REC), Beta Compensation and automatic diode type detection combine to provide a robust solution for complex environmental monitoring applications.</td>
<td>EMC1412</td>
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</tr>
<tr>
<td>PIC16F1829LIN</td>
<td>8-bit MCU with an integrated LIN transceiver.</td>
<td><a href="#">PIC16F1829LIN</a></td>
</tr>
<tr>
<td>PIC18FXX31</td>
<td>8-bit MCU with LIN slave support</td>
<td><a href="#">PIC18FXX31</a></td>
</tr>
<tr>
<td>PIC18F4680</td>
<td>8-bit MCU with enhanced CAN module and LIN master/slave support</td>
<td><a href="#">PIC18F4680</a></td>
</tr>
<tr>
<td>PIC24/dsPIC33</td>
<td>16-bit MCU and DSC with enhanced CAN controller and LIN master/slave support. Supports Sensorless field-oriented motor control algorithm to achieve stunning performance.</td>
<td><a href="#">PIC24/dsPIC33</a></td>
</tr>
</tbody>
</table>
# CAN/LIN Communication

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<td><strong>LIN</strong></td>
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<td></td>
</tr>
<tr>
<td>MCP2003/4/3A/4A</td>
<td>Standalone LIN transceivers. EMC/ESD performance is among the best in automotive industry. The MCP2003 is available in an industry standard pin out and the MCP2004 offers a TXE/Fault pin which allows users the ability to disable and enable the transmitter in addition to a fault output</td>
<td>MCP2003</td>
</tr>
<tr>
<td>MCP2021A/2A MCP2025</td>
<td>The MCP202X family of LIN transceivers integrates a LIN physical layer, 3.3V or 5V internal voltage regulator and POR/BOR Reset function.</td>
<td>MCP2021/2A MCP2025</td>
</tr>
<tr>
<td>MCP2050</td>
<td>LIN transceivers with an integrated voltage regulator and an integrated windowed watchdog timer</td>
<td>MCP2050</td>
</tr>
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<td>PIC16F1829LIN</td>
<td>8-bit MCU with an integrated LIN transceiver.</td>
<td>PIC16F1829 LIN</td>
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<tr>
<td><strong>CAN</strong></td>
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<td></td>
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<tr>
<td>MCP2515</td>
<td>Stand-alone CAN controller supports CAN V2.0B specification Can also interface with MCU with Standard SPI.</td>
<td>MCP2515</td>
</tr>
<tr>
<td>MCP2561/2</td>
<td>CAN transceiver.</td>
<td>MCP2561</td>
</tr>
</tbody>
</table>

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Analog Products in Automotive: Interior LED Ambient Module
Interior Automotive LED ambient Module:

LED ambient module controls an integrated RGB LEDs unit, which enables real-time LEDs color and brightness control. With this design, interior lightings are no longer monotonic. Adjustable multicolor allows passengers for a more personalized ambient lighting experience. The small size of LEDs also makes implementing lighting in small spaces easier.

Application examples

Foot well lights, cup holder lights, cluster backlighting, Tell Tale lights, and LCD panel backlighting
LED ambient module controls an integrated RGB LEDs unit, which enables real-time LEDs color and brightness control.
# MCU: RGB LED Controller

## Suggested Products

<table>
<thead>
<tr>
<th>Product</th>
<th>Description</th>
</tr>
</thead>
</table>
| 8-bit PIC12/16/18 MCU | • Integrated DAC or PWM modules are used to control LEDs color or brightness.  
• The resolution of the DAC or PWM for the selected MCU is directly proportional to the number of color combination capable of being created with the RGB LEDs.  
• CCP module is used to detect defect.  
• NanoWatt XLP microcontrollers from the PIC16/ PIC18 families have the industry leading low quiescent current characteristics.  
• These MCUs further conserve battery life when LEDs are on while ignition is off.  
• Small MCU footprints are available to support the desired styling factor for various lighting components. |

[Click Here](#)
<table>
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<tr>
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</tr>
</thead>
<tbody>
<tr>
<td>MCP2003A/4A</td>
<td>Standalone LIN transceivers.</td>
<td>MCP2003A</td>
</tr>
<tr>
<td>MCP2021A/2A MCP2025</td>
<td>LIN transceivers with an integrated voltage regulator.</td>
<td>MCP2021/2A</td>
</tr>
<tr>
<td>MCP2025</td>
<td></td>
<td>MCP2025</td>
</tr>
<tr>
<td>MCP2050</td>
<td>LIN transceivers with an integrated voltage regulator and an integrated windowed watchdog timer.</td>
<td>MCP2050</td>
</tr>
<tr>
<td>PIC16F1829LIN</td>
<td>8-bit MCU with an integrated LIN transceiver and 5V LDO</td>
<td>PIC16F1829 LIN</td>
</tr>
</tbody>
</table>
Voltage Regulators

<table>
<thead>
<tr>
<th>Suggested Products</th>
<th>Description</th>
<th>Product Web Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>MCP1790/1</td>
<td>The low power, low dropout regulator is used to reduce battery depletion while the vehicle is in the <em>ignition off</em> condition. This product meets the current low power requirements of automakers.</td>
<td>MCP1790</td>
</tr>
</tbody>
</table>
Analog Products in Automotive: Exterior LED Control Module
Microchip offers broad range of high brightness LED control solutions for automotive exterior lightings. These solutions support flexible power train topologies to support constant LED current regulation, fail-safe monitoring and maximization of LEDs lifetime and efficiency.

Example Applications:
- Fog lights, Taillights, Daytime running light, position light
- High/Low Beam, corner light. Headlamp
Automotive: Exterior LED Control Module

- **PIC® MCU/ dsPIC DSC**
- **Auxiliary Power Supply**
- **I/O Ref**
- **LIN/ CAN**
- **Other Peripherals**

- **LED Driver**
  - PWM current regulation
  - Current and fail-safe feedbacks

- **Power Train/ LED-String**

- **LIN/ CAN BUS**

- **Low- End Single LED String Solution**
- **Mid- Range Mult. LED String Solution**
- **High- End Mult. LED String Solution**
<table>
<thead>
<tr>
<th>Suggested Products</th>
<th>Description</th>
<th>Product Web Page</th>
</tr>
</thead>
</table>
| PIC12F683/PIC12HV752 | • Ideal for low-end LED drivers such as fog light/turn light, which has lower stability requirements than most exterior front light units and doesn’t require dimming  
• Hysteretic Current control  
• Integrated analog peripherals with minimum digital support for low-cost/high performance SMPS applications | PIC12F683 |
| dsPIC33F GS family | • Ideal for High End Multi. LED String Solution  
• Multi-channel control (up to 18 LED channels)  
• Up to 18 high-speed PWM channels (1.04ns resolution)  
• Each PWM output can be individually adjusted in frequency, duty ratio and phase shift.  
• Each PWM output can be chopped by a lower frequency to support flexible dimming outputs. | dsPIC33F/E |
| PIC16F1829LIN | 8-bit MCU with an integrated LIN transceiver | PIC16F1829 LIN |
For low-end single LED string solution, a low cost 8-bit PIC MCU can be used to provide close-loop single LED string current regulation.

<table>
<thead>
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</thead>
</table>
| PIC12F683/PIC12HV752 | • Ideal for low-end LED drivers such as fog light/turn light, which has lower stability requirements than most exterior front light units and doesn’t require dimming  
 • Hysteretic Current control  
 • Integrated analog peripherals with minimum digital support for low-cost/high performance SMPS applications |
More than one discrete PWM controllers can be added to a low cost PIC MCU to support the additional LED strings.

The PWM controller provides additional built-in analog modules and MOSFET driver needed for each LED string control.

This approach is also ideal for an existing system that already has a low cost MCU in place. Instead of replacing the MCU, designer can attach the additional PWM controllers to the MCU.
LED Driver

SEPIC Topology

Boost Topology

Flyback Topology
(Synchronous)

…and more, including Ćuk and Forward Converters
(Broad Topology Support)
## MCP19114

### Popular Products

<table>
<thead>
<tr>
<th>Product</th>
<th>Description</th>
<th>Product Web Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>MCP19114/5</td>
<td>The MCP19114 is a mid-voltage (4.5-42V) analog-based PWM controller with an integrated 8-bit PIC™ Microcontroller. This unique product family combines the performance of a high-speed analog solution, including high-efficiency and fast transient response, with the configurability and communication interface of a digital solution. Combining these solution types creates a new family of devices that maximizes the strengths of each technology to create a more cost-effective, configurable, high-performance power conversion solution.</td>
<td>Click Here</td>
</tr>
</tbody>
</table>

**MCP19114 Flyback Standalone Evaluation Board:**

The MCP19114-Flyback Standalone Evaluation Board and Graphical User Interface (GUI) demonstrate the MCP19114 performance in a synchronous Flyback topology. It is configured to regulate load current, and is well suited to drive LED loads.
## MCU + PWM Controller based LED Driver

### Suggested Products

<table>
<thead>
<tr>
<th>Product</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>MCP1630</td>
<td>• Small footprint discrete high-speed PWM controllers (2MHz), as stand alone (MCP1632) or in conjunction with a MCU (MCP1630/1).&lt;br&gt;• Single MCU attaches multiple PWM controllers for desired number of LED strings control (One LED string per MCP1630/31).&lt;br&gt;• Peak Current Mode Control.&lt;br&gt;• High Voltage Options Operate to +16V Input.&lt;br&gt;• Integrated Overvoltage Comparator and Low Side MOSFET Driver.&lt;br&gt;• Over-temperature Protection and Under-voltage Lockout (UVLO).</td>
</tr>
<tr>
<td>MCP1631</td>
<td></td>
</tr>
<tr>
<td>MCP1632</td>
<td></td>
</tr>
</tbody>
</table>

### App Notes/ Ref. Designs

- [Dimming Power LEDs Using a SEPIC Converter and MCP1631 PIC Attach PWM Controller](#)
- [MCP1630 SEPIC Automotive LED Driver Reference Design](#)
- [MCP1632 - 300 kHz Boost Converter Demo Board](#)
For high-end multi LED strings solution, a 16-bit DSC (dsPIC33F GS) is recommended because it has the necessary integrated PWM drivers and analog modules to provide up to 18 LED strings or Matrix control. With this approach, discrete PWM controllers are not needed.
## dsPIC33F

<table>
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| dsPIC33F/E GS family | • Ideal for High End Multi. LED String Solution  
• Multi-channel control (up to 18 LED channels)  
• Up to 18 high-speed PWM channels (1.04ns resolution)  
• Each PWM output can be individually adjusted in frequency, duty ratio and phase shift.  
• Each PWM output can be chopped by a lower frequency to support flexible dimming outputs. | dsPIC33F/E |

| App Notes/ Ref. Designs | | |
|-------------------------|-------------------------------|
| | • High Brightness LEDs by dsPIC® “GS” Series (doc# en550157.pdf)  
• Digital LED Lighting Development Kit (DM330014) |
## CAN/ LIN Communication

<table>
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<tr>
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<tr>
<td><strong>LIN</strong></td>
<td></td>
<td></td>
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<tr>
<td>MCP2003/4/3A/4A</td>
<td>Standalone LIN transceivers. EMC/ESD performance is among the best in automotive industry. The MCP2003 is available in an industry standard pin out and the MCP2004 offers a TXE/Fault pin which allows users the ability to disable and enable the transmitter in addition to a fault output.</td>
<td>MCP2003</td>
</tr>
<tr>
<td>MCP2021A/2A MCP2025</td>
<td>The MCP202X family of LIN transceivers integrates a LIN physical layer, 3.3V or 5V internal voltage regulator and POR/BOR Reset function.</td>
<td>MCP2021/2A</td>
</tr>
<tr>
<td>MCP2050</td>
<td>LIN transceivers with an integrated voltage regulator and an integrated windowed watchdog timer.</td>
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</tr>
<tr>
<td>PIC16F1829LIN</td>
<td>8-bit MCU with an integrated LIN transceiver.</td>
<td>PIC16F1829LIN</td>
</tr>
<tr>
<td><strong>CAN</strong></td>
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<tr>
<td>MCP2515</td>
<td>Stand-alone CAN controller supports CAN V2.0B specification. Can also interface with MCU with Standard SPI.</td>
<td>MCP2515</td>
</tr>
<tr>
<td>MCP2561/2</td>
<td>CAN transceiver.</td>
<td>MCP2561</td>
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## Other Analog Peripherals

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<tr>
<td><strong>Voltage Regulators</strong></td>
<td>The low power, low dropout regulator is used to reduce battery depletion while the vehicle is in the <em>ignition off</em> condition. This product meets the current low power requirements of automakers.</td>
<td><a href="#">LDO Parametric Table</a></td>
</tr>
<tr>
<td>MCP170X family</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Temperature Sensors</strong></td>
<td>Improves control of color temperature and detects disconnected LED channel. MCP9700 outputs analog voltage that is proportional to the temperature (-40C to 150C). MCP9800 outputs temperature data (-55C to 125C) via I²C™/SMBus two-wire interface.</td>
<td><a href="#">MCP9700</a> <a href="#">MCP9800</a></td>
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<td><strong>EMC1412</strong></td>
<td>The EMC1412 is a high accuracy, low cost, System Management Bus (SMBus) temperature sensor. Advanced features such as Resistance Error Correction (REC), Beta Compensation and automatic diode type detection combine to provide a robust solution for environmental monitoring applications.</td>
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</table>
Analog Products in Automotive: Smart Actuators in Turbo Charger
Smart Actuators are actuators that use microcontrollers to perform intelligent tasks. They are being utilized more and more in the automotive engine environment to enhance fuel efficiency.

Example Applications:
- Turbo Charger Waste Gate; the Electrical Turbo Charger Bypass, and the Air/Exhaust Bypassing Valves.
Turbo Charger Waste Gate w/Smart Actuator Controller

Battery

Voltage Regulator

EEPROM

PWM

MCU/DSP

CAN/ LIN

A/D

MOSFET Driver

Position Indicator (Magneto Resistive)

Temp Sensor

MOSFETs

Actuator Inductor

Current Sense

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<td>MCP2021/2A</td>
<td></td>
</tr>
<tr>
<td>MCP2050</td>
<td>LIN transceivers with an integrated voltage regulator and an integrated windowed watchdog timer.</td>
<td>MCP2050</td>
<td></td>
</tr>
<tr>
<td>PIC16F1829LIN</td>
<td>8-bit MCU with an integrated LIN transceiver.</td>
<td>PIC16F1829LIN</td>
<td></td>
</tr>
<tr>
<td>MCP2515</td>
<td>Stand-alone CAN controller supports CAN V2.0B specification Can also interface with MCU with Standard SPI.</td>
<td>MCP2515</td>
<td></td>
</tr>
<tr>
<td>MCP2561/2</td>
<td>CAN transceiver.</td>
<td>MCP2561</td>
<td></td>
</tr>
</tbody>
</table>
## Thermal Management

<table>
<thead>
<tr>
<th>Suggested Products</th>
<th>Description</th>
<th>Product Web page</th>
</tr>
</thead>
<tbody>
<tr>
<td>MCP9700/ MCP9800/</td>
<td>Improves control of color temperature and detects disconnected LED channel. MCP9700 outputs analog voltage that is proportional to the temperature (-40°C to 150°C). MCP9800 outputs temperature data (-55°C to 125°C) via I²C™/SMBus two-wire interface.</td>
<td>MCP9700, MCP9800</td>
</tr>
<tr>
<td>EMC2101</td>
<td>The EMC2101 is an SMBus 2.0 compliant, integrated fan control solution complete with two temperature monitors, one external and one internal. Each temperature channel has programmable high limits that can assert an interrupt.</td>
<td>EMC2101</td>
</tr>
<tr>
<td>EMC1412</td>
<td>The EMC1412 is a high accuracy, low cost, System Management Bus (SMBus) temperature sensor. Advanced features such as Resistance Error Correction (REC), Beta Compensation and automatic diode type detection combine to provide a robust solution for complex environmental monitoring applications.</td>
<td>EMC1412</td>
</tr>
</tbody>
</table>
MOSFET Drivers

<table>
<thead>
<tr>
<th>Popular Products</th>
<th>Description</th>
<th>Product Web Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>MCP140X, MCP141X, MCP14628, MCP14700</td>
<td>Low-side and low-side/high-side drivers. Used as a low-to-high voltage bridge to allow an MCU with a low voltage output to drive a motor that requires higher voltage</td>
<td><a href="#">MOSFET Driver's Parametric Search table</a></td>
</tr>
</tbody>
</table>
## Voltage Regulators

<table>
<thead>
<tr>
<th>Suggested Products</th>
<th>Description</th>
<th>Product Web Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>MCP1790/1</td>
<td>The low power, low dropout regulator is used to reduce battery depletion while the vehicle is in the <em>ignition off</em> condition. This product meets the current low power requirements of automakers.</td>
<td>MCP1790</td>
</tr>
</tbody>
</table>
# PWM Controller

<table>
<thead>
<tr>
<th>Suggested Products</th>
<th>Description</th>
<th>Product Web Page</th>
</tr>
</thead>
</table>
| MCP1630/31         | - Small footprint discrete high-speed PWM controllers (2MHz) in conjunction with a MCU.  
- Single MCU attaches multiple PWM controllers for desired number of LED strings control (One LED string per MCP1630/31).  
- Peak Current Mode Control.  
- High Voltage Options Operate to +16V Input.  
- Integrated Overvoltage Comparator and Low Side MOSFET Driver.  
- Over-temperature Protection and Under-voltage Lockout (UVLO). | MCP1630  
MCP1631 |
# EEPROM

<table>
<thead>
<tr>
<th>Suggested Products</th>
<th>Description</th>
<th>Product Web Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>25LCxxx Family</td>
<td>A standalone serial data EEPROM is used to provide cost-effective data storage options for position logging or position calibration.</td>
<td><a href="#">Serial EEPROM offering</a></td>
</tr>
</tbody>
</table>
## MCU

<table>
<thead>
<tr>
<th>Suggested Products</th>
<th>Description</th>
<th>Product Web Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>8-bit PIC12/PIC16 MCU</td>
<td>Provides simple control for rotary or linear switches, such as for use in relays and valves. Acts as a gateway between a specific position indicator interface such as SENT and a standard serial interface such as SPI/I2C. Controls the BLDC motor.</td>
<td><a href="#">8-Bit PIC® MCU</a></td>
</tr>
<tr>
<td>16-bit PIC24 MCU / dsPIC33 DSC</td>
<td>Used in applications that require digital filtering and high-end algorithms, such as the calculation of actuator positions from real-time analog Sine and Cosine signals. Controls BLDC motor. Supports AUTOSAR.</td>
<td><a href="#">16-Bit PIC® MCU</a></td>
</tr>
<tr>
<td>PIC16F1829LIN</td>
<td>8-bit MCU with an integrated LIN transceiver</td>
<td><a href="#">PIC16F1829 LIN</a></td>
</tr>
</tbody>
</table>
Analog Products in Automotive: In-Vehicle Network Communication
In-Vehicle Network Communication

LIN Application Diagram

Low Integration
- Voltage Regulator
- MCU/DSP
- LIN PHY

Medium Integration
- MCU/DSP
- LIN PHY with int. Vreg

High Integration
- MCU/DSP with int.
- LIN PHY, Vreg

CAN Application Diagram

- CAN PHY
- CAN Controller
- MCU/DSP

Discrete Can Controller

- CAN PHY
- MCU/DSP with int. CAN Controller

Integrated Can Controller
## Low Integration LIN Communication

<table>
<thead>
<tr>
<th>Microchip Solutions</th>
<th>Suggested Products</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>LIN</td>
<td>MCP2003/4/3A/4A</td>
<td>Standalone LIN transceivers. Offers a TXE/Fault pin which allows users the ability to disable and enable the transmitter in addition to a fault output.</td>
</tr>
<tr>
<td>MCU and DSC with Can/LIN Controller integrated</td>
<td>PIC16F690/PIC16F182x</td>
<td>8-bit MCU with LIN slave support</td>
</tr>
<tr>
<td></td>
<td>PIC18F4680</td>
<td>8-bit MCU with enhanced CAN module and LIN master/slave support</td>
</tr>
<tr>
<td></td>
<td>dsPIC30F4012</td>
<td>16-bit DSC with standard CAN module and LIN master/slave support</td>
</tr>
<tr>
<td></td>
<td>PIC24/dsPIC33</td>
<td>16-bit MCU and DSP with enhanced CAN controller and LIN master/slave support</td>
</tr>
<tr>
<td></td>
<td>PIC32MX5XX/PIC32MX7X</td>
<td>32-bit MCU with 32-bit CAN module and LIN master/slave support</td>
</tr>
<tr>
<td>Voltage Regulation</td>
<td>MCP1790/1 family</td>
<td>The low power, low dropout regulator is used to reduce battery depletion while the vehicle is in the ignition off condition.</td>
</tr>
</tbody>
</table>
## Medium Integration LIN Communication

<table>
<thead>
<tr>
<th>Microchip Solutions</th>
<th>Suggested Products</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>LIN</strong></td>
<td><strong>MCP2021A/2A</strong></td>
<td>Standalone LIN Transceivers. Offers built-in 3.3V or 5V internal voltage regulator and POR/BOR Reset function.</td>
</tr>
<tr>
<td></td>
<td><strong>MCP2025</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>MCP2050</strong></td>
<td>Standalone LIN Transceiver. Offers built-in voltage regulator and an integrated windowed watchdog timer.</td>
</tr>
<tr>
<td><strong>MCU and DSC with Can/LIN Controller Integrated</strong></td>
<td><strong>PIC16F690/PIC16F182x</strong></td>
<td>8-bit MCU with LIN slave support</td>
</tr>
<tr>
<td></td>
<td><strong>PIC18F4680</strong></td>
<td>8-bit MCU with enhanced CAN module and LIN master/slave support</td>
</tr>
<tr>
<td></td>
<td><strong>dsPIC30F4012</strong></td>
<td>16-bit DSC with standard CAN module and LIN master/slave support</td>
</tr>
<tr>
<td></td>
<td><strong>PIC24/dsPIC33</strong></td>
<td>16-bit MCU and DSP with enhanced CAN controller and LIN master/slave support</td>
</tr>
<tr>
<td></td>
<td><strong>PIC32MX5XX/PIC32MX7X</strong></td>
<td>32-bit MCU with 32-bit CAN module and LIN master/slave support</td>
</tr>
</tbody>
</table>
# High Integration LIN Communication

<table>
<thead>
<tr>
<th>Microchip Solutions</th>
<th>Suggested Products</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>LIN</strong></td>
<td>PICF16F1829LIN</td>
<td>Small footprint 8-bit MCU with an integrated LIN transceiver.</td>
</tr>
<tr>
<td>MCU and DSC with Integrated Can/LIN Controller</td>
<td>PIC16F690/PIC16F182x</td>
<td>8-bit MCU with LIN slave support</td>
</tr>
<tr>
<td></td>
<td>PIC18F4680</td>
<td>8-bit MCU with enhanced CAN module and LIN master/slave support</td>
</tr>
<tr>
<td></td>
<td>dsPIC30F4012</td>
<td>16-bit DSC with standard CAN module and LIN master/slave support</td>
</tr>
<tr>
<td></td>
<td>PIC24/dsPIC33</td>
<td>16-bit MCU and DSP with enhanced CAN controller and LIN master/slave support</td>
</tr>
<tr>
<td></td>
<td>PIC32MX5XX/PIC32MX7X</td>
<td>32-bit MCU with 32-bit CAN module and LIN master/slave support</td>
</tr>
</tbody>
</table>
Discrete CAN Controller

<table>
<thead>
<tr>
<th>Microchip Solutions</th>
<th>Suggested Products</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>CAN</td>
<td>MCP2515</td>
<td>Stand-alone CAN controller supports CAN V2.0B specification Interfaces with MCU with Standard SPI.</td>
</tr>
<tr>
<td></td>
<td>MCP2561/2</td>
<td>CAN transceiver.</td>
</tr>
<tr>
<td>MCU and DSC with Integrated Can Controller</td>
<td>PIC18F4680</td>
<td>8-bit MCU with enhanced CAN module and LIN master/slave support</td>
</tr>
<tr>
<td></td>
<td>dsPIC30F4012</td>
<td>16-bit DSC with standard CAN module and LIN master/slave support</td>
</tr>
<tr>
<td></td>
<td>PIC24/dsPIC33</td>
<td>16-bit MCU and DSP with enhanced CAN controller and LIN master/slave support</td>
</tr>
<tr>
<td></td>
<td>PIC32MX5XX/PIC32MX7X</td>
<td>32-bit MCU with 32-bit CAN module and LIN master/slave support</td>
</tr>
</tbody>
</table>
## Integrated CAN Controller

<table>
<thead>
<tr>
<th>Microchip Solutions</th>
<th>Suggested Products</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>MCU and DSC with Integrated Can/LIN Controller</td>
<td>PIC18F4680</td>
<td>8-bit MCU with enhanced CAN module and LIN master/slave support</td>
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<td></td>
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<td>16-bit MCU and DSP with enhanced CAN controller and LIN master/slave support</td>
</tr>
<tr>
<td></td>
<td>PIC32MX5XX/PIC32MX7X</td>
<td>32-bit MCU with 32-bit CAN module and LIN master/slave support</td>
</tr>
</tbody>
</table>
Analog Products in Home Security Alarm Systems
Home Security Alarm System

- Sensors: PIR, Glass Break, Door/Window Contact
- Co Sensors/Smoke Alarms
- Zone Expanders
- Communication
- Security Panel
- Keypad Panel
- Monitoring Service
- Siren/Horn
Security Panel Block Diagram

- Power Management
- Temperature Sensor
- External FLASH Image
- Scratch Pad RAM
- PIC® MCU /dsPIC®
- WiFi
- Wireless
- Ethernet
- POTS Line
- Cellular

Link to Zone Expanders or Sensors
Keypad Panel Block Diagram

- Touch Screen
- Security Panel
- PIC® MCU /dsPIC®
- Wireless
- EEPROM
- Ext. FLASH Backup
- Graphical LCD
- Character/Icon LCD
- I/O Expanders
- Button Array
Sensor Block Diagram

Power Management

- Battery Voltage Detector
- LDO
- Battery

Sensor

- PIR
- Glass Break
- Door/Window Contact

Op Amp

PIC® Microcontroller

Wireless
# 16/32-Bit Microcontroller

<table>
<thead>
<tr>
<th>Suggested Products</th>
<th>Description</th>
<th>Product Web Page</th>
</tr>
</thead>
</table>
| **PIC32M**         | MIPS M4K Core  
• Up to 80 MHz, 1.65 DMIPS/MHz  
• 5 Stage Pipeline devices  
• Temperature Range: -40°C to 105°C  
• AEC-Q100 qualified  
**Date and Code**  
• Up to 512 KB Flash  
• Up to 128 KB SRAM  
• Separate Buses for Instructions and Data  
**Connected Peripherals with DMA**  
• Full-speed USB Host/Device/OTG  
• 10/100 Ethernet MAC with MII/RMII Interfaces  
• 2x CAN 2.0B Ports  
• Up to 6 UART, 5 I²C™, 4 SPI Ports, CTMU and I²S  
• Up to 8 Additional Channels of General Purpose DMA | Click Here |
| **PIC24F**         | The PIC24F microcontroller family features cost effective, 16 MIPS 16-bit MCU performance and many devices with Microchip's eXtreme Low Power Technology | Click Here |

<< BACK to Keypad Panel Blk Diagram  
<< BACK to Security Panel Blk Diagram
# 8-Bit Microcontroller

<table>
<thead>
<tr>
<th>Suggested Products</th>
<th>Description</th>
<th>Product Web Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>PIC12/16/18</td>
<td><strong>Flexible Intelligence</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Continuous re-investment in 8-bit portfolio</td>
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</tr>
<tr>
<td></td>
<td>- Industry's most robust offering</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Pin and code compatible across families</td>
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</tr>
<tr>
<td></td>
<td>- 6 pin DFN to 100 pin TQFP</td>
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<tr>
<td></td>
<td>- 375B to 128KB Flash</td>
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<tr>
<td></td>
<td>- 16B to 4KB RAM</td>
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<tr>
<td></td>
<td>- Onboard EEPROM</td>
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</tr>
<tr>
<td></td>
<td>- 1.8V to 5.5V+ Operation</td>
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<tr>
<td></td>
<td><strong>Innovative Integration</strong></td>
<td></td>
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<tr>
<td></td>
<td>- Core Independent Peripherals</td>
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<tr>
<td></td>
<td>- Complementary Output Generator</td>
<td></td>
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<tr>
<td></td>
<td>- Configurable Logic Cell</td>
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</tr>
<tr>
<td></td>
<td>- Numerically Controlled Oscillator</td>
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<tr>
<td></td>
<td>- Rail to Rail Op-Amps, Fast Comparators</td>
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</tr>
<tr>
<td></td>
<td>- Programmable Switch Mode Controller</td>
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</tr>
<tr>
<td></td>
<td>- High Resolution PWM, ADC, DAC</td>
<td></td>
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<tr>
<td></td>
<td>- I2C, SPI, UART, USB, Ethernet</td>
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<tr>
<td></td>
<td><strong>eXtreme Low Power</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Lowest power sleep modes with flexible wake-up sources</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Active currents down to 35 uA/MHz</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Sleep current as low as 20nA</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Battery lifetime ≥ 20 years</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Operation down to 1.8V</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Single cell operation</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Special low power BOR, WDT, RTC</td>
<td></td>
</tr>
</tbody>
</table>
## Temperature Sensors

- **Function:** Measuring and providing Temperature information

<table>
<thead>
<tr>
<th>Popular Products</th>
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<th>Product Web Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>MCP9808 Digital temperature sensor</td>
<td>The MCP9808 converts temperatures between -20°C and +100°C to a digital word with ±0.5°C (max.) accuracy</td>
<td>[Click Here]</td>
</tr>
<tr>
<td>MCP9700 Linear Active Thermistor™ ICs</td>
<td>The output voltage of this device is directly proportional to measured temperature. The MCP9700 can accurately measure temperature from -40°C to +150°C with the output calibrated to a slope of 10mV/°C and has a DC offset of 500mV.</td>
<td>[Click Here]</td>
</tr>
</tbody>
</table>
## Operational Amplifiers

### Function: buffering and filtering signals

<table>
<thead>
<tr>
<th>Popular Products</th>
<th>Description</th>
<th>Product Web Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>MCP603x</td>
<td>The MCP6031/2/3/4 op amps have a gain bandwidth of 10 kHz with a low typical operating current of 0.9 µA and an offset voltage that is less than 150 µV.</td>
<td><a href="#">Click Here</a></td>
</tr>
<tr>
<td>MCP6V11 Zero Drift Op Amps</td>
<td>Gain-Bandwidth Product: 80 kHz, Offset Voltage: ±8 µV (max.), IQ: 11 µA (typ.), Wide Supply Voltage Range: 1.6V to 5.5V</td>
<td><a href="#">Click Here</a></td>
</tr>
<tr>
<td>MCP6444</td>
<td>The MCP6444 is a quad general purpose op amp offering rail-to-rail input and output over the 1.8 to 6V operating range. This amplifier has a typical GBWP of 9 kHz with typ. quiescent current of 450 nA.</td>
<td><a href="#">Click Here</a></td>
</tr>
<tr>
<td>MCP60x</td>
<td>MCP601/2/3/4 (op amp) has a gain bandwidth product of 2.8 MHz with low typical operating current of 230 µA and an offset voltage that is less than 2 mV.</td>
<td><a href="#">Click Here</a></td>
</tr>
</tbody>
</table>
Function: Provide general purpose parallel I/O expansion for I²C™ or SPI applications

<table>
<thead>
<tr>
<th>Popular Products</th>
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</tr>
</thead>
<tbody>
<tr>
<td>MCP23018/S18</td>
<td>MCP23018/S18 is a 16-bit I/O expander for high speed I²C™ Compatible interface. MCP23018 is available in the following packages: 28-pin PDIP (300 mil), 28-pin SOIC (300 mil), 24-pin SSOP, 24-pin QFN (4x4)</td>
<td>Click Here</td>
</tr>
</tbody>
</table>
## Power Management

<table>
<thead>
<tr>
<th>Popular Products</th>
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<th>Product Web Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>MCP13xx</td>
<td>The MCP13xx are voltage supervisor devices designed to keep a microcontroller in reset until the system voltage has reached and stabilized at a proper level for reliable system operation.</td>
<td>Click Here</td>
</tr>
<tr>
<td>MCP111/2</td>
<td>The MCP111/112 voltage detectors have extremely low 1uA operating current and small form factor. They hold the microcontroller in reset until the supply voltage reaches a predetermined operating level. These devices also protect against brownout conditions.</td>
<td>Click Here</td>
</tr>
<tr>
<td>MCP1700/3A</td>
<td>The MCP1700/3A are CMOS low dropout positive voltage regulators which can source up to 250mA of current with an extremely low input-output voltage differential. The low dropout voltage combined with the low current consumption makes this part ideal for battery operation.</td>
<td>MCP1700, MCP1703A</td>
</tr>
<tr>
<td>MCP16301/H</td>
<td>The MCP16301 is a highly integrated, high-efficiency, fixed frequency, step-down DC-DC converter in a popular SOT-23 package that operates from input voltage sources up to 36V.</td>
<td>Click Here</td>
</tr>
</tbody>
</table>
## Touch and Input Sensing Solutions

<table>
<thead>
<tr>
<th>Popular Products</th>
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</tr>
</thead>
<tbody>
<tr>
<td>AR10xx</td>
<td>The Microchip mTouch™ AR1000 Series Resistive Touch Screen Controller is a complete, easy to integrate, cost-effective and universal touch screen controller chip solution. The AR1000 Series has sophisticated proprietary touch screen decoding algorithms to fully process all touch data and save the host from this overhead. More than the usual “preprocessing” features of other low cost devices, the AR1000 delivers reliable, validated and calibrated touch</td>
<td><a href="#">Click Here</a></td>
</tr>
<tr>
<td>MTCH6301</td>
<td>The MTCH6301 is a turnkey projected capacitive touch controller that allows easy integration of multi-touch and gestures to create a rich user interface in your design.</td>
<td><a href="#">Click Here</a></td>
</tr>
</tbody>
</table>
## Memory

<table>
<thead>
<tr>
<th>Function Block</th>
<th>Popular Products</th>
<th>Description</th>
<th>Product Web Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>External Flash Image</td>
<td>SST39V</td>
<td>The SST39 Series MPF™ (Multi-Purpose Flash) products, including MPF+ and Advanced MPF+, provide fast read and program times with features such as Erase-Suspend/Erase-Resume, Boot Block, Security ID, Hardware Reset and heightened protection features.</td>
<td>Click Here</td>
</tr>
<tr>
<td>SST25</td>
<td></td>
<td>The SST25xx family of Serial FLASH is among the industry’s lowest power 3.0V and 1.8V products.</td>
<td>Click Here</td>
</tr>
<tr>
<td>EEPROM</td>
<td>24LC 25LC</td>
<td>Microchip offers the broadest range of Serial EEPROM devices (from 128 bits to 1 Mbit) over the widest operating voltage range (1.7 to 5.5V). Microchip Serial EEPROMs are compatible with the I²C®, SPI, Microwire, as well as the new single-I/O UNI/O® bus.</td>
<td>Click Here</td>
</tr>
<tr>
<td>Scratch Pad RAM</td>
<td>23LC</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
## Wireless

<table>
<thead>
<tr>
<th>Function Block</th>
<th>Popular Products</th>
<th>Description</th>
<th>Product Web Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wireless/ WiFi®</td>
<td>MRF24xx</td>
<td>The MRF Module connects to hundreds of PIC® microcontrollers via a 4-wire SPI interface and is an ideal solution for lower-power, low data-rate Wi-Fi® sensor networks</td>
<td>Click Here</td>
</tr>
<tr>
<td></td>
<td>RN-17</td>
<td>The RN171 is a standalone, complete Wi-Fi® networking module. Due to its small form factor and extremely low power consumption, it is perfect for wireless applications such as asset monitoring, sensors, and battery operated devices.</td>
<td></td>
</tr>
</tbody>
</table>
| Ethernet       | ENC624x, 11/24/25AA, LANxxx       | **External Controllers**  
Offer low-cost stand-alone 10/100Base-T Ethernet interface controller with integrated MAC and PHY.  
Connect to MCUs through either serial or parallel interfaces  
[Support Products](#)  
EUI-48™/EUI-64™ MAC Address Chips  
[SMSC Products](#)  
Ethernet Switches and Controllers  
USB to Ethernet Bridges  
Ethernet Transceivers  
ARCNet Controllers                                                                 | Click Here       |
Power Tools
Professional Power Tools

- Battery Charger
- Fuel Gauge

Power Management

MOSFET Drivers

MCU/DSP

Comparator

Vref

Op Amp

Current Feedback

Motor

Mechanical Feedback

Household Tools

<< BACK to CONTENTS
Battery Charger

SEPIC Charger Block Diagram

MCP1631HV

PIC16F883

Vbat

Vtemp

VREG

V_IN

V_BATT

Fuel Gauge

Battery Thermistor

Profession Power Tools

Household Tools
## PWM Controller

<table>
<thead>
<tr>
<th>Suggested Products</th>
<th>Description</th>
<th>Product Web Page</th>
</tr>
</thead>
</table>
| MCP1630/1          | • Small footprint discrete high-speed PWM controllers (2MHz) in conjunction with a MCU.  
                    • Peak Current Mode Control.  
                    • High Voltage Options Operate to +16V Input.  
                    • Integrated Overvoltage Comparator and Low Side MOSFET Driver.  
                    • Over-temperature Protection and Under-voltage Lockout (UVLO). | MCP1630  
                    MCP1631 |
| MCP1631RD-MCC2: MCP1631HV Multi-Chemistry Battery Charger Reference Design | | Click Here |
| MCP1631RD-DCPC1: MCP1631HV Digitally Controlled Programmable Current Source Reference Design | | Click Here |
PIC Microcontrollers

- Function: coordinating all the control and monitor functions - the brain of the system
- Popular products: PIC16F182X, 178X, 75X, 15XX, 193X

- Attributes:
  - Upwards of 32MHz internal OSC
  - 4 channel Programmable Switch Mode Controller (PSMC)
  - Integrated high performance comparators, op-amp, 10/12 bit ADC, 5/8/9 bit DAC, CCP, COG, NCO, CLC
  - Slope compensation
  - 256 bytes of EEPROM
  - Available in various packages
## Microcontroller

<table>
<thead>
<tr>
<th>Suggested Products</th>
<th>Description</th>
<th>Product Web Page</th>
</tr>
</thead>
</table>
| PIC16F883          | • This powerful yet easy-to-program (only 35 single word instructions) CMOS FLASH-based 8-bit microcontroller in a 28 pin package.  
  • The PIC16F883 features 256 bytes of EEPROM data memory, 2 Comparators, 11 channels of 10-bit ADC, 1 capture/compare/PWM and 1 Enhanced capture/compare/PWM functions, a synchronous serial port that can be configured as either 3-wire Serial Peripheral Interface (SPI™) or the 2-wire Inter-Integrated Circuit (I²C™) bus and an Enhanced Universal Asynchronous Receiver Transmitter (EUSART). | PIC16F833         |
Fuel Gauge

- **Function:** To track remaining battery level or charging status

**Diagram:**
- Battery
- Current Sense Resistor
- MCP3421
  - $V_{IN+}$
  - $V_{IN-}$
  - $V_{DD}$
  - $AV_{SS}$
  - $AV_{DD}$
  - SCL
  - SDA
- $I^2C$ Bus Line
- Data Line
- To MCU
- To Load
Function: Converting analog voltage or current signal (pressure) into digital data

<table>
<thead>
<tr>
<th>Popular Products</th>
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<tbody>
<tr>
<td>MCP3421</td>
<td>The MCP3421 is a single channel low-noise, high accuracy Delta-Sigma A/D converter with differential inputs and up to 18 bits of resolution in a small SOT-23-6 package. The device uses a two-wire I2C™ compatible serial interface and operates from a single power supply ranging from 2.7V to 5.5V.</td>
<td>Click Here</td>
</tr>
<tr>
<td>AN1156: Application Note on Battery Fuel Measurement Using Delta-Sigma ADC Devices</td>
<td></td>
<td>Click Here</td>
</tr>
<tr>
<td>MCP3421DM-BFG: Battery Fuel Gauge Demo Board</td>
<td></td>
<td>Click Here</td>
</tr>
</tbody>
</table>
## Linear Products

<table>
<thead>
<tr>
<th>Function</th>
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</tr>
</thead>
<tbody>
<tr>
<td>Sense and gain up output current. Low offset voltage required for minimizing measurement error</td>
<td>MCP62x</td>
<td>The MCP62x mCAL op amps have a gain bandwidth of 20 MHz with a low typical operating current of 2.5 mA and an offset voltage that is less than 200 µV. They feature on-chip Input offset voltage calibration</td>
<td>Click Here</td>
</tr>
<tr>
<td>Provide feedback compensation by sensing O/P voltage and comparing it with ref. voltage</td>
<td>MCP60x</td>
<td>MCP601/2/3/4 (op amp) has a gain bandwidth product of 2.8 MHz with low typical operating current of 230 µA and an offset voltage that is less than 2 mV.</td>
<td>Click Here</td>
</tr>
<tr>
<td>Compares voltage output of the amplifier to a reference to determine over current condition</td>
<td>MCP65xx</td>
<td>These comparators are optimized for low power, single-supply operation with greater than rail-to-rail input operation. Available in push-pull and Open drain outputs, the MCP656x family supports rail-to-rail output swing. The output limits supply current surges, and dynamic power consumption while switching.</td>
<td>Click Here</td>
</tr>
</tbody>
</table>
# Synchronous Buck MOSFET Drivers

## Function: driving the high power devices

<table>
<thead>
<tr>
<th>Popular Products</th>
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<tbody>
<tr>
<td>MCP14700 Synch. MOSFET Driver w/separate High/Low side control</td>
<td>The MCP14700 is a high-speed synchronous MOSFET driver designed to optimally drive a high-side and low-side N-Channel MOSFET. The MCP14700 has two PWM inputs to allow independent control of the external N-Channel MOSFETs.</td>
<td>Click Here</td>
</tr>
<tr>
<td>MCP1401/2</td>
<td>The MCP1401/02 MOSFET drivers are inverting and non-inverting respectively. These MOSFET drivers are small size and allow the gate driver to be positioned close to the MOSFET's physical gate connection, which minimizes gate bounce caused by the parasitic PCB layout. This also minimizes gate rise-and-fall times, propagation-delay times and shoot-through current, all of which help to increase system efficiency and reduce power dissipation.</td>
<td>Click Here</td>
</tr>
</tbody>
</table>
# Power Management

<table>
<thead>
<tr>
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</tr>
</thead>
<tbody>
<tr>
<td>MCP16321/2</td>
<td>The MCP16321/2 is a highly integrated, high-efficiency, fixed frequency, synchronous step-down DC-DC converter in a 16-pin QFN that operates from input voltages up to 24V.</td>
<td><strong>Click Here</strong></td>
</tr>
<tr>
<td>MCP16323</td>
<td>The MCP16323 is a highly integrated, high-efficiency, fixed frequency, synchronous step-down DC-DC converter in a 16-pin QFN package that operates from input voltages up to 18V.</td>
<td><strong>Click Here</strong></td>
</tr>
<tr>
<td>MCP16311/2</td>
<td>The MCP16311/2 is a compact, high-efficiency, fixed frequency PWM/PFM, synchronous step-down DC-DC converter that operates from input voltage sources up to 30V. Integrated features include a high-side and a low-side switch, fixed frequency Peak Current Mode Control, internal compensation, peak-current limit and over temp. protection.</td>
<td><strong>Click Here</strong></td>
</tr>
<tr>
<td>MCP1790</td>
<td>The MCP1790 is a 70 mA, ceramic output cap stable, high voltage, Low Dropout Regulator (LDO). The MCP1790 is capable of handling continuous input voltage of up to 30V and is load dump protect for up to 48V.</td>
<td><strong>Click Here</strong></td>
</tr>
</tbody>
</table>
Function: providing the system with an accurate analog voltage for comparison

<table>
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<tr>
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<tbody>
<tr>
<td>MCP1525</td>
<td>MCP1525 is a low power, high precision voltage reference. It provides a precise output voltage of 2.5V which is then compared to other voltages in the system. This voltage reference is normally used in the 3V to 5V systems, where there may be wide variations in supply voltage and a need to minimize power dissipation.</td>
<td>Click Here</td>
</tr>
</tbody>
</table>
## USB Hub & Flash Media Card Controllers

<table>
<thead>
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</tr>
</thead>
<tbody>
<tr>
<td>USB224x</td>
<td>USB 2.0 Flash Media Card Controller with Integrated Card Power FETs</td>
<td>[Click Here]</td>
</tr>
<tr>
<td>USB264x</td>
<td>USB 2.0 Flash Media Controller with Integrated Card Power FETs and HS Hub</td>
<td>[Click Here]</td>
</tr>
</tbody>
</table>
# USB Port Charger

<table>
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<tr>
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</tr>
</thead>
<tbody>
<tr>
<td>UCS81002</td>
<td>The UCS81002 is a USB port power controller with charging emulation. It highlights nine pre-loaded charger emulation profiles and is compatible with BC1.2 CDP, DCP, YD/T-1591 as well as most Apple® and RIM® portable devices, e-books and tablets. Capable of up to 2.5A of continuous current and integrates a USB 2.0 compatible switch. I2C/SMBus communication allowing customer charge emulation profiles. The ‘8’ USC81002 represents automotive part ordering number. Standard part is USC1002.</td>
<td>UCS81002</td>
</tr>
</tbody>
</table>
# DC Smart Power Supply

<table>
<thead>
<tr>
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</thead>
<tbody>
<tr>
<td>MCP19111</td>
<td>The MCP19111 is a mid-voltage (4.5-32V) analog-based PWM controller family with an integrated 8-bit PIC(R) Microcontroller. This unique product combines the performance of a high-speed analog solution, including high-efficiency and fast transient response, with the configurability and communication interface of a digital solution. Combining these solution types creates a new family of devices that maximizes the strengths of each technology to create a more cost-effective, configurable, high-performance power conversion solution.</td>
<td>MCP19111</td>
</tr>
</tbody>
</table>
High End Beverage Machine
High End Beverage Machine

AC Input → Isolation → PWR Management

Pump 1
MOSFET/IGBT → MOSFET Driver

Pump 2
MOSFET/IGBT → MOSFET Driver

Main MCU → Graphics MCU → LCD Display

Main MCU

Touch MCU → Touch Solutions

Power Driver

Temp Sensor

Warming Element
Temperature Sensors

**Function:** Measuring and providing Temperature information

<table>
<thead>
<tr>
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</thead>
</table>
| **MCP9800 Digital temperature sensor** | • 2-wire I²C™/SMBus Compatible Interface  
• User Selectable 9- to 12-Bit Resolution  
• ±1°C Accuracy from -10°C to +85°C  
• ±2°C Accuracy from +85°C to +125°C  
• Low Operating Current: 220 µA (typical)  
• Shutdown Mode: 1 µA (max) | Click Here |
| **MCP9700 Linear Active Thermistor™ ICs** | The output voltage of this device is directly proportional to measured temperature. The MCP9700 can accurately measure temperature from -40°C to +150°C with the output calibrated to a slope of 10mV/°C and has a DC offset of 500mV. | Click Here |
Temperature Sensors
Winning Attributes

Attributes:
- Small SC70, SOT-23 and DFN leadless packages
- Very low operating current: 35 to 250µA (typ)
- Very low shutdown current: 1µA (max)
- High temp accuracy: ±0.25°C
- Simple operation: no need for external components
- Analog and digital (SPI™, I2C™, SMBus™) devices
- High temperature resolution
Low-Power LDOs

Function: providing regulated, low-noise supply voltages for the system

<table>
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<tbody>
<tr>
<td>MCP1700</td>
<td>The MCP1700 can source up to 250mA of current with an extremely low input-output voltage differential of 178mV at 250mA. with the low current consumption of only</td>
<td><a href="#">Click Here</a></td>
</tr>
<tr>
<td>MCP1703A</td>
<td>With 250 mA maximum output, MCP1703 works with input voltage of up to 16V and in combination with its low current consumption of 2 µA</td>
<td><a href="#">Click Here</a></td>
</tr>
</tbody>
</table>
Attributes:

- Extremely low operating current: as low as 1 µA
- High output voltage accuracy
- Stability with ceramic capacitors
- Wide range of output voltage options
- Space-saving SC70 and SOT-23 packages
- Wide range of features: shutdown mode
**Function**: System supervisor circuits designed to monitor VCC in digital systems and provide a reset signal to the host processor when needed

<table>
<thead>
<tr>
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</thead>
<tbody>
<tr>
<td>TCM809</td>
<td>The reset output is driven active within 20 µsec of VCC falling through the reset voltage threshold. Reset is maintained active for a minimum of 140msec after VCC rises above the reset threshold.</td>
<td>Click Here</td>
</tr>
<tr>
<td>MCP1xx</td>
<td>The MCP1xx are a family of voltage supervisory devices which also operates as protection from brown-out conditions when the supply voltage drops below a safe operating level</td>
<td>Click Here</td>
</tr>
</tbody>
</table>
RESET Monitors Winning Attributes

- **Attributes:**
  - Tiny SOT-23 and SC-70 packages
  - Very low operating current: as low as 1µA (max)
  - High threshold voltage accuracy: ±2.8% (max)
  - $V_{DD}$ transient immunity
  - Many available options: push-pull output, open-drain output and internal pull-up resistor
## Synchronous Buck MOSFET Drivers

### Function: driving the high power devices (MOSFETs in synch. Buck configuration)

<table>
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<tr>
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</tr>
</thead>
<tbody>
<tr>
<td>MCP14628</td>
<td>The MCP14628 is a synchronous MOSFET driver used for driving MOSFETs in a rectified bridge arrangement. There are two separate drivers contained in the MCP14628. The low-side driver output drives a non-floating or ground reference N-Channel MOSFET. The high-side driver is designed to drive a floating N-Channel MOSFET. An external bootstrap capacitor is used to provide the additional voltage.</td>
<td>Click Here</td>
</tr>
<tr>
<td>MCP14700</td>
<td>The MCP14700 is a high-speed synchronous MOSFET driver designed to optimally drive a high-side and low-side N-Channel MOSFET. The MCP14700 has two PWM inputs to allow independent control of the external N-Channel MOSFETs.</td>
<td>Click Here</td>
</tr>
</tbody>
</table>
Synchronous Buck MOSFET Drivers

Attributes:

- Operating voltage range: 5V to 30V
- Peak current capability: 2A source, 4A sink
- Internal Bootstrap Blocking Device
- Low Supply Current: 80 μA (typical)
- Space Saving Packages: SOIC, DFN
### Operational Amplifiers

- **Function:** buffering and filtering sensor feedback

<table>
<thead>
<tr>
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<tbody>
<tr>
<td>MCP6004</td>
<td>The MCP6004 is a quad general purpose op amp offering rail-to-rail input and output over the 1.8 to 6V operating range. This amplifier has a typical GBWP of 1 MHz with typical quiescent current of 100 microamperes.</td>
<td><a href="#">Click Here</a></td>
</tr>
<tr>
<td>MCP6H04</td>
<td>MCP6H04 has a wide supply voltage range of 3.5V to 16V and rail-to-rail output operation. This device has a gain bandwidth product of 1.2 MHz (typical), while only drawing 135 µA/amplifier (typical) of quiescent current.</td>
<td><a href="#">Click Here</a></td>
</tr>
<tr>
<td>MCP6294</td>
<td>MCP6294 provide wide bandwidth of 10 MHz Gain Bandwidth Product. This family also operates from a single supply voltage as low as 2.4V to 6V, while drawing 1 mA (typical) quiescent current.</td>
<td><a href="#">Click Here</a></td>
</tr>
</tbody>
</table>
Operational Amplifiers

Attributes:
- Small SC-70, TDFN and SOT-23 packages
- GBWP: 9 kHz to 60MHz
- Excellent operating current-to-GBWP ratio
- Mostly rail-to-rail inputs and outputs
- Offset voltage: as low as 2µV (MCP6V0x)
- Chip Select capability for power savings
## Analog-to-Digital Converters

- **Function:** converting analog feedback signals from motor to digital signals for MCU

<table>
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<tr>
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<tbody>
<tr>
<td>MCP3221</td>
<td>The MCP3221 is a 12-bit SAR A/D converter. Available in the SOT-23 package, the MCP3221 provides a low max. conversion current and standby current of 250 µA and 1 µA respectively. Communication to the MCP3221 is performed using a 2-wire I2C™ Compatible interface. The MCP3221 runs on a single supply voltage range of 2.7 V to 5.5 V.</td>
<td>Click Here</td>
</tr>
<tr>
<td>MCP3201</td>
<td>The MCP3201 12-bit Analog-to-Digital Converter (ADC) combines high performance and low power consumption in a small package, making it ideal for embedded control applications. The MCP3201 features SAR architecture and a SPI serial interface, allowing 12-bit ADC capability to be added to any PIC® microcontroller. The MCP3201 features 100k samples/second, 1 input channel, low power consumption (5nA typical standby, 400µA max. active).</td>
<td>Click Here</td>
</tr>
</tbody>
</table>
SAR ADC Attributes:

- Resolution: 8 to 13 bits
- Max sampling rate: up to 200 ksps
- Linearity: ±1LSB DNL, ±1LSB INL
- Current consumption: 175 to 500µA (max.)
- Single supply voltage: 2.7V to 5.5V
- Small packages: SOT-23 and MSOP
## Voltage References

- **Function:** providing the system with an accurate analog voltage for comparison (needed for ADC)

### Popular Products

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<tr>
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<tbody>
<tr>
<td>MCP1525</td>
<td>MCP1525 is a low power, high precision voltage reference. It provides a precise output voltage of 2.5V which is then compared to other voltages in the system. This voltage reference is normally used in the 3V to 5V systems, where there may be wide variations in supply voltage and a need to minimize power dissipation.</td>
<td>Click Here</td>
</tr>
</tbody>
</table>
Voltage References

Attributes:
- 1.2V (TC1070), 2.5V or 4.096V output
- Initial accuracy: ±1% (max)
- Temperature coefficient: 50ppm/°C (max)
- Output current: ±2mA
- Operating current: 100µA (max)
- Industrial temperature range: -40°C to +85°C
- SOT-23 and TO-92 packages
## PIC Microcontrollers

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</thead>
<tbody>
<tr>
<td>Main MCU (Including Touch &amp; Color Graphics)</td>
<td>PIC32MX</td>
<td>Microchip's 32-bit portfolio with the MIPS microAptiv or M4K core offer high performance microcontrollers, and all the tools needed to develop your embedded projects. With MPLAB® Harmony software framework, low cost development tools, and pin/peripheral compatibility from 16-bit product lines, PIC32 MCUs shorten time to market and allow your designs to grow.</td>
<td>Click Here</td>
</tr>
<tr>
<td>Main MCU (Including Touch &amp; Simple Graphics)</td>
<td>PIC16F193x</td>
<td>This versatile 40-pin MCU is also a member of Microchip's extreme low power microcontroller family featuring nanoWatt XLP technology. Debug and Programming support is available via PICkit™ 3, and MPLAB®® ICD 3</td>
<td>Click Here</td>
</tr>
</tbody>
</table>
## Capacitive Touch Solutions

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</thead>
<tbody>
<tr>
<td>Capacitive Touch Solutions</td>
<td>CAP11/12xx</td>
<td>SMSC's capacitive touch sensor products, featuring RightTouch® technology, set a new standard in simplifying development, improving noise immunity, and lowering BOM costs in PC, LCD monitors, white goods and consumer electronic designs. These devices have been carefully designed to filter for common noise sources such as backlight inverters, DC-DC switching regulators and wireless frequencies. They support a wide variety of interfaces such as I2C, SMBus, SMSC BC-Link™ and SPI and also provide world-class ESD protection of ±8kV HBM with no external ESD protection circuits required.</td>
<td>Click Here</td>
</tr>
</tbody>
</table>

<< Next: mTouch Solutions>
## mTouch and Input Sensing Solutions

<table>
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<tbody>
<tr>
<td>AR10xx</td>
<td>The Microchip mTouch™ AR1000 Series Resistive Touch Screen Controller is a complete, easy to integrate, cost-effective and universal touch screen controller chip solution. The AR1000 Series has sophisticated proprietary touch screen decoding algorithms to fully process all touch data and save the host from this overhead. More than the usual “preprocessing” features of other low cost devices, the AR1000 delivers reliable, validated and calibrated touch.</td>
<td><a href="#">Click Here</a></td>
</tr>
<tr>
<td>MTCH6301</td>
<td>The MTCH6301 is a turnkey projected capacitive touch controller that allows easy integration of multi-touch and gestures to create a rich user interface in your design.</td>
<td><a href="#">Click Here</a></td>
</tr>
</tbody>
</table>
Robot Vacuum Cleaner
Robot Vacuum Cleaner

Battery Charger
Battery (NiMH)

Motors (x3)
MOSFETs/IGBTs (x3)
Movement/Direction Control

Suction Motor
MOSFET/IGBT

Op Amp

DC/DC Conversion

MOSFET Drivers (x3)

High Integration (Motor Driver + DC/DC Conversion) (x1)

Main MCU

Temp Sensor

OR

MCU

User Interface

Op Amp

Infrared Sensor

<< BACK to CONTENTS
Features:

- Three Half-bridge Drivers Configured to Drive External High-Side NMOS and Low-Side NMOS MOSFETs:
  - Independent input control for high-side NMOS and low-side NMOS MOSFETs
  - Peak output current: 0.5A @ 12V
  - Shoot-through protection
  - Overcurrent and short circuit protection
- Adjustable Output Buck Regulator (750 mW)
- Two LDOs: 5V @ 20 mA / 12V @ 20 mA
- Internal Bandgap Reference
- Three Operational Amplifiers for Motor Phase Current Monitoring and Position Detection
- Overcurrent Comparator and Thermal Shutdown
- Two Level Translators
- Input Voltage Range: 6 - 40V
- Operational Voltage Range: 6 - 28V
- Undervoltage Lockout (UVLO): 6V
- Overvoltage Lockout (OVLO): 28V
- Transient (100 ms) Voltage Tolerance: 48V
- Temperature Range: -40 to +150°C
Low-Power LDOs

- Function: providing regulated, low-noise supply voltages for the system

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<tr>
<td>MCP1700</td>
<td>The MCP1700 can source up to 250mA of current with an extremely low input-output voltage differential of 178mV at 250mA. with the low current consumption of only 2 µA.</td>
<td>[Click Here]</td>
</tr>
<tr>
<td>MCP1703A</td>
<td>With 250 mA maximum output, MCP1703 works with input voltage of up to 16V and in combination with its low current consumption of 2 µA</td>
<td>[Click Here]</td>
</tr>
</tbody>
</table>
## Operational Amplifiers for Sensor Signal Conditioning

### Popular Products

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<tr>
<td>MCP600x</td>
<td>The MCP600x is a quad general purpose op amp offering rail-to-rail input and output over the 1.8 to 6V operating range. This amplifier has a typical GBWP of 1 MHz with typical quiescent current of 100 microamperes/amp.</td>
<td>Click Here</td>
</tr>
<tr>
<td>MCP64xx</td>
<td>MCP64xx family of Low Power Op Amps are designed with Microchip’s advanced CMOS process. The MCP64xx Op Amps have low Quiescent Current, Input Offset Voltage and GBWP ranging from 9Khz to 7.5 MHz (typ.). Low power and small form factor make these devices ideal of many portable applications.</td>
<td>Click Here</td>
</tr>
<tr>
<td>MCP6294</td>
<td>MCP6294 provide wide bandwidth of 10 MHz Gain Bandwidth Product. This family also operates from a single supply voltage as low as 2.4V to 6V, while drawing 1 mA (typical) quiescent current.</td>
<td>Click Here</td>
</tr>
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</table>

<< BACK to BLOCK DIAGRAM
## Operational Amplifiers in the Control Loop

<table>
<thead>
<tr>
<th>Popular Products</th>
<th>Description</th>
<th>Product Web Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>MCP63x</td>
<td>The MCP63x family of operational amplifiers features high gain bandwidth product (24 MHz) and high output short circuit current. Some devices also provide a Chip Select pin that supports a low power mode of operation. These amplifiers are optimized for high speed, low noise and distortion, single-supply operation with rail-to-rail output and an input that includes the negative rail.</td>
<td>Click Here</td>
</tr>
<tr>
<td>MCP66x</td>
<td>The MCP66x family of operational amplifiers features high gain bandwidth product, and high output short circuit current. High Gain Bandwidth of 60 MHz, Short Circuit Current of 90 mA, Noise: 6.8nV/rtHz, Rail-to-Rail Output, Slew Rate: 27 V/us</td>
<td>Click Here</td>
</tr>
<tr>
<td>MCP629x</td>
<td>MCP629x family provides wide bandwidth of 10 MHz Gain Bandwidth Product. This family also operates from a single supply voltage as low as 2.4V to 6V, while drawing 1 mA (typical) quiescent current.</td>
<td>Click Here</td>
</tr>
</tbody>
</table>
# MOSFET Drivers

<table>
<thead>
<tr>
<th>Popular Products</th>
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</tr>
</thead>
<tbody>
<tr>
<td>MCP14700 Synch. MOSFET Driver w/separate High/Low side control</td>
<td>The MCP14700 is a high-speed synchronous MOSFET driver designed to optimally drive a high-side and low-side N-Channel MOSFET. The MCP14700 has two PWM inputs to allow independent control of the external N-Channel MOSFETs.</td>
<td>Click Here</td>
</tr>
<tr>
<td>MCP1401/2</td>
<td>The MCP1401/02 MOSFET drivers are inverting and non-inverting respectively. These MOSFET drivers are small size and allow the gate driver to be positioned close to the MOSFET's physical gate connection, which minimizes gate bounce caused by the parasitic PCB layout. This also minimizes gate rise-and-fall times, propagation-delay times and shoot-through current, all of which help to increase system efficiency and reduce power dissipation.</td>
<td>Click Here</td>
</tr>
<tr>
<td>TC4427A</td>
<td>Supply Voltage Range: 2.5V to 5.5V Wide Temperature Measurement Range: -40°C to +125°C High Temperature Converter Accuracy: ± 2°C, Max, at 25°C Linear Temperature Slope: 10mV/°C Very Low Supply Current: 35µA Typical</td>
<td>Click Here</td>
</tr>
</tbody>
</table>
## PWM Controller

<table>
<thead>
<tr>
<th>Suggested Products</th>
<th>Description</th>
<th>Product Web Page</th>
</tr>
</thead>
</table>
| MCP1630/1          | • Small footprint discrete high-speed PWM controllers (2MHz) in conjunction with a MCU.  
                    • Peak Current Mode Control.  
                    • High Voltage Options Operate to +16V Input.  
                    • Integrated Overvoltage Comparator and Low Side MOSFET Driver.  
                    • Over-temperature Protection and Under-voltage Lockout (UVLO). |
| MCP1631RD-MCC2: MCP1631HV Multi-Chemistry Battery Charger Reference Design |
| MCP1631RD-DCPC1: MCP1631HV Digitally Controlled Programmable Current Source Reference Design |

[Click Here](#)
<table>
<thead>
<tr>
<th>Suggested Products</th>
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</thead>
<tbody>
<tr>
<td>PIC16F883</td>
<td>• This powerful yet easy-to-program (only 35 single word instructions) CMOS FLASH-based 8-bit microcontroller in a 28 pin package.&lt;br&gt;• The PIC16F883 features 256 bytes of EEPROM data memory, 2 Comparators, 11 channels of 10-bit ADC, 1 capture/compare/PWM and 1 Enhanced capture/compare/PWM functions, a synchronous serial port that can be configured as either 3-wire Serial Peripheral Interface (SPI™) or the 2-wire Inter-Integrated Circuit (I²C™) bus and an Enhanced Universal Asynchronous Receiver Transmitter (EUSART).</td>
<td>PIC16F833</td>
</tr>
</tbody>
</table>
Fuel Gauge

- Function: To track remaining battery level or charging status

![Diagram of Fuel Gauge setup]

- Battery
- Current Sense Resistor
- MCP3421
- I²C Bus Line
- Data Line
- To Load
- To MCU

Microchip
# Analog to Digital Convertor

- **Function:** Converting analog voltage or current signal (pressure) into digital data

<table>
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<tr>
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<tbody>
<tr>
<td>MCP3421</td>
<td>The MCP3421 is a single channel low-noise, high accuracy Delta-Sigma A/D converter with differential inputs and up to 18 bits of resolution in a small SOT-23-6 package. The device uses a two-wire I2C™ compatible serial interface and operates from a single power supply ranging from 2.7V to 5.5V.</td>
<td><a href="#">Click Here</a></td>
</tr>
<tr>
<td>AN1156: Application Note on Battery Fuel Measurement Using Delta-Sigma ADC Devices</td>
<td></td>
<td><a href="#">Click Here</a></td>
</tr>
<tr>
<td>MCP3421DM-BFG: Battery Fuel Gauge Demo Board</td>
<td></td>
<td><a href="#">Click Here</a></td>
</tr>
</tbody>
</table>
# Temperature Sensors

## Function: Measuring and providing Temperature information

<table>
<thead>
<tr>
<th>Popular Products</th>
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</tr>
</thead>
</table>
| **MCP9800 Digital temperature sensor** | • 2-wire I²C™/SMBus Compatible Interface  
• User Selectable 9- to 12-Bit Resolution  
  • ±1°C Accuracy from -10°C to +85°C  
  • ±2°C Accuracy from +85°C to +125°C  
• Low Operating Current: 220 µA (typical)  
• Shutdown Mode: 1 µA (max) | [Click Here](#) |
| **MCP9700 Linear Active Thermistor™ ICs** | The output voltage of this device is directly proportional to measured temperature. The MCP9700 can accurately measure temperature from -40°C to +150°C with the output calibrated to a slope of 10mV/°C and has a DC offset of 500mV. | [Click Here](#) |
PIC Microcontrollers

- Function: coordinating all the control and monitor functions - the brain of the system
- Popular products: PIC16F182X, 178X, 75X, 15XX, 193X

Attributes:
- Upwards of 32MHz internal OSC
- 4 channel Programmable Switch Mode Controller (PSMC)
- Integrated high performance comparators, op-amp, 10/12 bit ADC, 5/8/9 bit DAC, CCP, COG, NCO, CLC
- Slope compensation
- 256 bytes of EEPROM
- Available in various packages
Lighting
LED Lighting

AC/ DC LED Driver

AC Source → Current Regulation → LEDs

DC/ DC LED Driver

Low Voltage DC → Step - Up Current Regulation → LEDs

DC/ DC LED Driver

High Voltage DC → Step - Down Current Regulation → LEDs
### AC/DC LED Driver - Current Regulation

<table>
<thead>
<tr>
<th>Solutions</th>
<th>Description</th>
<th>Reference Circuit</th>
</tr>
</thead>
<tbody>
<tr>
<td>MCU + MOSFET Driver</td>
<td>This solution is implemented using a PIC12F752 and MOSFET drivers</td>
<td></td>
</tr>
</tbody>
</table>
| Universal Offline Linear Sequential LED Driver | **Pros for Linear Solutions:**  
  • Inherently high PF (over 90% at 220V)  
  • No EMI (linear solution)  
  • Very few external components  
  • Small form                                                                   |                    |
| Universal Offline Switching LED Driver   | **Pros for Switching Solutions**  
  • No flicker  
  • Higher LED utilization  
  • More uniform brightness between channels/strings  
  • Switching solutions generate less heat                                         |                    |
# Step-Up Current Regulation

<table>
<thead>
<tr>
<th>Solutions</th>
<th>Description</th>
<th>Reference Circuit</th>
</tr>
</thead>
<tbody>
<tr>
<td>MCP19114 based LED Driver</td>
<td>Programmable LED driver capable of high efficiency, high current drive in a minimal component count. Highly customizable, to maximize design flexibility, and can be implemented in flyback, SEPIC, and boost topologies.</td>
<td><img src="reference.png" alt="Reference Circuit" /></td>
</tr>
<tr>
<td>HV9912 based LED Driver</td>
<td>Boost topology LED drive solution, &gt;90% efficient and capable of boosting up to 90V to drive up to 20W of series connected LEDs from a low (&gt;9V) input</td>
<td><img src="reference.png" alt="Reference Circuit" /></td>
</tr>
<tr>
<td>MCP1643 Boost Converter LED Drive Solutions</td>
<td>Constant current drive circuit with a low component count, up to 550 mA output current, up to 90% efficient, with a low 1.2 uA shutdown current, and dimmable with a PWM signal</td>
<td><img src="reference.png" alt="Reference Circuit" /></td>
</tr>
<tr>
<td>MCP16301 Ćuk Converter Circuit</td>
<td>Compact, low component count, 300 mA constant current regulation circuit capable of driving up to 15V of LEDs in series</td>
<td><img src="reference.png" alt="Reference Circuit" /></td>
</tr>
<tr>
<td>MCP1259 Regulated Charge Pump LED Drive Circuit</td>
<td>Generates a high accuracy 3.3V output from a 1.8 to 3.6V input, which can be used to supply up to 100mA of output current for LED drive from a variety of battery or DC power sources</td>
<td><img src="reference.png" alt="Reference Circuit" /></td>
</tr>
</tbody>
</table>
## Step-Down Current Regulation

<table>
<thead>
<tr>
<th>Solutions</th>
<th>Description</th>
<th>Reference Circuit</th>
</tr>
</thead>
<tbody>
<tr>
<td>LDO+MCU+ MOSFET Driver</td>
<td>Digitally controlled, high brightness LED drive circuit implemented using a discrete buck circuit controlled with a PIC12F752 MCU</td>
<td><img src="#" alt="Reference Circuit" /></td>
</tr>
<tr>
<td>HV9967 based Buck LED Drive circuit</td>
<td>Compact buck LED drive solution with tight (3%) current regulation, short circuit protection, and capable of 60V DC input with the integrated low side MOSFET</td>
<td><img src="#" alt="Reference Circuit" /></td>
</tr>
<tr>
<td>MCP16312 Buck Converter LED Drive Circuit</td>
<td>Constant current source to drive one or more LEDs using a buck implementation. Low component count, with integrated MOSFETs and control logic</td>
<td><img src="#" alt="Reference Circuit" /></td>
</tr>
</tbody>
</table>
DC/DC MCU Based LED Driver
DC/ DC MCU Based LED Driver

**Battery**

**LDO**

**7.2V**

**5V**

**MCU (PIC12F752)**

**ADC Input**

**Comparator Input**

**PWM Output**

**MOSFET Driver**

**Resistive Temperature Sensor**

**LED**

**1000 lumen output at 10W**

**LED current sense and feedback to sustain constant light output**

**Real time temperature monitoring of LED for fail-safe operation**

**Synchronous Buck Regulator controlled by PIC12F752 microcontroller for maximum efficiency**

**Controls operational modes based on position of selector ring**

**Interrupt on Change**

**ADC Input**

**Multiple hall effect sensors to determine position of magnetic ring**

**Magnetic selector ring**

**Multiple hall effect sensors to determine position of magnetic ring**

**Magnetic selector ring design can be replaced to accommodate mechanical push-buttons and switches**

**Battery capacity can be scaled to accommodate specific mechanical capacity and desired run-times**

**(4) AA Ultimate Lithium batteries in series supplying 7.2V**

**DC/ DC MCU Based LED Driver**
LED drive and closed loop control determined by current sense and temperature

Controls operational modes based on position of selector ring

5b Digital Analog Converter (DAC)
- Allows the use of smaller current sense resistor
- High resolution eliminates external Op-amp
- Less power consumption and better efficiency

High Performance Comparators
- 40ns response time

PIC12F752 Internal Connections for LED Control

- PWM
- 5 bit DAC
- Comparator
- Complimentary Output Generator (COG)

Complementary Output Generator (COG)
- 1 of 2 available outputs utilized
- Frequency determined by PWM
- Provides dead-band control for the synchronous switches
- Provides blanking control to prevent transient behavior

Lower average current

Click Here for the Product Page
# Synchronous Buck MOSFET Drivers

**Function:** driving the high power devices (MOSFETs in synch. Buck configuration)

<table>
<thead>
<tr>
<th>Popular Products</th>
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<th>Product Web Page</th>
</tr>
</thead>
</table>
| **MCP14628**  
Dual Output MOSFET Driver for Synchronous Applications | The MCP14628 is a synchronous MOSFET driver used for driving MOSFETs in a rectified bridge arrangement. There are two separate drivers contained in the MCP14628. The low-side driver output drives a non-floating or ground reference N-Channel MOSFET. The high-side driver is designed to drive a floating N-Channel MOSFET. An external bootstrap capacitor is used to provide the additional voltage. | Click Here |
| **MCP14700**  
Synchronous MOSFET Driver w/separate High/Low side control | The MCP14700 is a high-speed synchronous MOSFET driver designed to optimally drive a high-side and low-side N-Channel MOSFET. The MCP14700 has two PWM inputs to allow independent control of the external N-Channel MOSFETs. | Click Here |

<< BACK to BLOCK DIAGRAM
Low Power LDOs

- **Function:** providing regulated, low-noise supply voltages for the system

<table>
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<tr>
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</thead>
<tbody>
<tr>
<td>MCP1700</td>
<td>The MCP1700 can source up to 250mA of current with an extremely low input-output voltage differential of 178mV at 250mA. with the low current consumption of only 2 µA.</td>
<td><a href="#">Click Here</a></td>
</tr>
<tr>
<td>MCP1703A</td>
<td>With 250 mA maximum output, MCP1703 works with input voltage of up to 16V and in combination with its low current consumption of 2 µA</td>
<td><a href="#">Click Here</a></td>
</tr>
</tbody>
</table>

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AC/DC LED Driver System
AC/DC MCU Based LED Driver System

90-240VAC Input

Primary Stage

PIC12F752 Microcontroller

MOSFET Driver

Secondary Stage

Bootstrap Voltage Regulator

≈20VDC / 375mA Output

<< BACK
8-Pin Flash-Based, 8-Bit CMOS MCU
- Flash Program Memory with self read/write capability
- Mid-Range Core, Internal 8MHz oscillator
- 2 x High Speed Analog Comparators (50nS)
- 1 x Capture-Compare-PWM (CCP)
- 4 x 10-bit Analog-to-Digital Converter (ADC) with voltage reference,
- 1 x Dual Range 5-bit Digital-to-Analog Converter (DAC)
- Complementary Output Generator (COG): Complementary Waveforms from selectable sources
- Watchdog Timer (WDT)
- Power-On/Off-Reset, Brown-Out Reset (BOR)
- In Circuit Serial Programming (ICSP)
- Wide Operating Voltage of PIC12F752 variant
- High Voltage PIC12HV752 variant (2.0V – user defined) with internal shunt regulator

Click Here for the Product Page
MOSFET Drivers

**Function:** driving the high power devices (MOSFETs, bipolar transistors, IGBTs)

<table>
<thead>
<tr>
<th>Popular Products</th>
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</table>
| TC4427A          | Supply Voltage Range: 2.5V to 5.5V  
                 | Wide Temperature Measurement Range: -40°C to +125°C  
                 | High Temperature Converter Accuracy: ± 2°C, Max, at 25°C  
                 | Linear Temperature Slope: 10mV/°C  
                 | Very Low Supply Current: 35µA Typical | Click Here |
| MCP1415/16       | The MCP1415/16 devices are small footprint Low-Side MOSFET drivers capable of supplying 1.5A peak output current in a SOT23 5L package. | Click Here |
| MCP14E3/E4/E5    | The MCP14E3/E4/E5 devices are a family of 4.5A, dual output buffers/MOSFET drivers with separate enable functions for each output. As MOSFET drivers, the MCP14E3/E4/E5 can easily charge 2200 pF gate capacitance in under 28 nsec (max) | Click Here |
LED Driver System using MCP19114
DC/ DC LED Driver System using MCP19114

**SEPIC Topology**

**Boost Topology**

...and more, including Ćuk and Forward Converters (Broad Topology Support)

**Flyback Topology**

(Synchronous)
### MCP19114

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<tr>
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</tr>
</thead>
<tbody>
<tr>
<td>MCP19114/5</td>
<td>The MCP19114 is a mid-voltage (4.5-42V) analog-based PWM controller with an integrated 8-bit PIC™ Microcontroller. This unique product family combines the performance of a high-speed analog solution, including high-efficiency and fast transient response, with the configurability and communication interface of a digital solution. Combining these solution types creates a new family of devices that maximizes the strengths of each technology to create a more cost-effective, configurable, high-performance power conversion solution.</td>
<td>Click Here</td>
</tr>
</tbody>
</table>

**MCP19114 Flyback Standalone Evaluation Board:**
The MCP19114-Flyback Standalone Evaluation Board and Graphical User Interface (GUI) demonstrate the MCP19114 performance in a synchronous Flyback topology. It is configured to regulate load current, and is well suited to drive LED loads.
Supertex LED Drivers
Sequential Linear LED drivers (120V/230VAC)

- Up to 1000 Lumens at 100Lm/W
- Direct AC Operation at 120VAC / 230VAC
- Inherently Quiet — No EMI Filters Needed
- Inherent Dimmer Compatibility
### CL8800

<table>
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<tr>
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</tr>
</thead>
<tbody>
<tr>
<td>CL8800</td>
<td>CL8800 and CL8801, sequential, linear LED drivers designed to drive long strings of low cost, low current LEDs in solid-state replacements for fluorescent tubes, incandescent bulbs and CFL bulbs. Both ICs minimize driver circuit component counts, requiring just four or six resistors and a diode bridge in addition to the IC. Two to four additional components in the circuit provide transient protection, and neither capacitors nor magnetic components are required. Because the ICs are multi-stage linear current regulators, there are no high frequency switching currents and, thus, no need for a front-end EMI filter. CL8800 is intended for 230VAC input, while CL8801 is for 120VAC input. Luminous efficiencies of greater than 115lm/W are achievable with both ICs.</td>
<td>Click Here</td>
</tr>
</tbody>
</table>
Universal Offline Switching
LED driver Solution

- Universal Inputs – 110 to 240Vac
- High Power Factor – 0.94 or higher
- High Efficiency – 88%@110Vac & 85%@230Vac
- Example Application: 20W LED tube
### HV9910C

<table>
<thead>
<tr>
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<th>Product Web Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>HV9910C</td>
<td>HV9910C is designed to convert high voltage supplies (85V – 265VAC rectified) or (15V – 450VDC) to a constant current source for powering a string or a combination of strings of high brightness LEDs. It can be programmed to operate in either a constant frequency or constant off-time mode and includes a 15 – 450V linear regulator which allows it to work from a wide range of input voltages without the need for an external low voltage supply. HV9910C requires only three external components (apart from the power stage) to produce a controlled LED current making it an ideal solution for low system cost. Furthermore, the low component count allows for higher reliability and minimum board space.</td>
<td>Click Here</td>
</tr>
</tbody>
</table>
HV9912 Based LED Driver

- High Efficiency – greater than 90%
- High output current accuracy - Closed loop control
- High Boost – 10x from Vin of 9V to V_{out} of 90V
- Example Application: 20W LED Strip

24Vdc

90Vdc (max)

Ex. 20pcs 1W LED in series
<table>
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<tr>
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</thead>
<tbody>
<tr>
<td>HV9912</td>
<td>The HV9912 is a current mode control LED driver IC designed to control single switch PWM converters (buck, boost, buck-boost or SEPIC) in a constant frequency mode. The controller uses a peak current-mode control scheme with programmable slope compensation and includes an internal transconductance amplifier to control the output current in closed loop enabling high output current accuracy. In the constant frequency mode, multiple HV9912 ICs can be synchronized to each other or to an external clock using the SYNC pin. Programmable MOSFET current limit enables current limiting during input under voltage and output overload conditions. The IC also includes a 0.2A source and 0.4A sink gate driver that makes the HV9912 suitable for high power applications</td>
<td>Click Here</td>
</tr>
</tbody>
</table>
HV9967 based Buck LED Driver

- High current accuracy – 3% LED Current control
- Space saving – integrated 60V MOSFET
- Output short circuit & over-temp protection
- Example Application: Cove Lights

Vo=42Vdc
Io =105mA
### HV9967B

**Description**

The HV9967B is an average-mode current control LED driver IC operating in a constant off-time mode. The IC features an integrated 60V, 0.8Ω MOSFET that can be used as a stand-alone buck converter switch, or connected as a source driver for driving an external high-voltage depletion-mode MOSFET. The HV9967B is powered through its switching output when the integrated switch is off. Hence, the same external MOSFET can be used as a high-voltage linear regulator for powering the IC. The LED current is programmed with one external resistor. The average-mode current control method does not produce a peak-to-average error, and therefore greatly improves current accuracy and line and load regulation of the LED current without any need for loop compensation or direct sensing of the LED current at a high-voltage potential. The auto-zero circuit cancels the effects of the input offset voltage and of the propagation delay of the current sense comparator.

### Popular Products

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<tr>
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<tbody>
<tr>
<td>HV9967B</td>
<td>The HV9967B is an average-mode current control LED driver IC operating in a constant off-time mode. The IC features an integrated 60V, 0.8Ω MOSFET that can be used as a stand-alone buck converter switch, or connected as a source driver for driving an external high-voltage depletion-mode MOSFET. The HV9967B is powered through its switching output when the integrated switch is off. Hence, the same external MOSFET can be used as a high-voltage linear regulator for powering the IC. The LED current is programmed with one external resistor. The average-mode current control method does not produce a peak-to-average error, and therefore greatly improves current accuracy and line and load regulation of the LED current without any need for loop compensation or direct sensing of the LED current at a high-voltage potential. The auto-zero circuit cancels the effects of the input offset voltage and of the propagation delay of the current sense comparator.</td>
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</table>

### Product Web Page

Click Here
LED Driver System using Regulators
MCP16301 Cuk LED Drive Circuit
<table>
<thead>
<tr>
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</tr>
</thead>
</table>
| MCP16301         | The MCP16301 is a high-input voltage step-down regulator, capable of supplying 600 mA to a regulated output voltage from 2.0V to 15V.  
• Operation from 6V to 18V input voltage  
• Capable of supplying 300 mA of current  
• Drives up to 15V of LEDs in series  
• Implemented with only 11 components  
• Demo board available on Microchip direct | Click Here |
MCP1259 Charge Pump LED Lighting Circuit

- **VIN**: 1.6V to 3.6V
- **CIN**: 10 μF
- **C1**: 1 μF
- **C2**: 1 μF
- **R1**: 10 μF
- **VOUT**: 3.3V
- **Low Battery Indicator**

Components Diagram:

- MCP1259

Switch States:

- **ON**
- **OFF**
### MCP1259

<table>
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<tr>
<th>Popular Products</th>
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</thead>
<tbody>
<tr>
<td>MCP1259</td>
<td>The MCP1256-9 family of inductorless, positive regulated charge pump DC/DC converters, generate a regulated 3.3 V output voltage from a 1.8 V to 3.6 V input. They are specifically designed for applications operating from 2 cell alkaline, 2 cell Ni-Cd, 2 cell Ni-MH, or one primary lithium coin cell battery. These devices automatically switch from 1.5x to 2x boost operation modes to maintain high efficiency. In addition, at light output loads, the MCP1256 and MCP1257 can be placed in a sleep mode, lowering the quiescent current while maintaining the regulated output voltage.</td>
<td>Click Here</td>
</tr>
</tbody>
</table>
MCP16312 Buck Converter
LED Drive Application

V_{IN} = 12V

C_{IN} 2 \times 10 \mu F

C_{VCC} 1 \mu F

R_{EN} 1 \text{ M\Omega}

C_{BOOST} 0.1 \mu F

L_1 15 \mu H

I_{LED} = 400 mA

1 \times \text{White LED}

R_B = 2 \Omega

R_B = \frac{V_{FB}}{I_{LED}}

C_{OUT} 2 \times 10 \mu F
MCP16312

<table>
<thead>
<tr>
<th>Popular Products</th>
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</tr>
</thead>
</table>
| MCP16312         | - Up to 95% Efficiency  
                   - Input Voltage Range: 4.4V to 30V  
                   - 1A Output Current Capability  
                   - Output Voltage Range: 2.0V to 24V  
                   - Integrated N-Channel Low and High-Side Switches  
                   - Low Device Shutdown Current: 3 μA typical  
                   - Low Device Quiescent Current: 44 μA  
                   - Internal Compensation  
                   - Internal Soft-Start: 300 μs (EN low to high)  
                   - Peak Current Mode Control  
                   - Cycle-by-Cycle Peak Current Limit  
                   - Undervoltage Lockout (UVLO)  
                   - Overtemperature Protection  
                   - MSOP-8 or 2x3 TDFN-8 package | Click Here |

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## MCP1643

<table>
<thead>
<tr>
<th>Popular Products</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>MCP1643</td>
<td>MCP1643 is a compact, high-efficiency, fixed frequency, synchronous step-up LED driver, that operates from one and two-cell alkaline and NiMH/NiCd batteries and can also drive two red/green/yellow series connection LEDs.</td>
</tr>
<tr>
<td></td>
<td>- Constant current drive capability with a low component count, area-efficient circuit</td>
</tr>
<tr>
<td></td>
<td>- 1 MHz PWM synchronous boost operation with up to 550 mA output current</td>
</tr>
<tr>
<td></td>
<td>- Low-voltage reference input to maximize LED efficiency conversion (V_{FB} = 120 \text{ mV})</td>
</tr>
<tr>
<td></td>
<td>- Capable of start up with only 0.65V input, and continuous operation with an input above 0.5V</td>
</tr>
<tr>
<td></td>
<td>- Low 1.2 (\mu)A shutdown current</td>
</tr>
<tr>
<td></td>
<td>- Over-voltage protection halts device operation (floating output) if the LED fails or is disconnected</td>
</tr>
<tr>
<td></td>
<td>- Up to 90% efficiency</td>
</tr>
<tr>
<td></td>
<td>- 240 (\mu)s soft start time</td>
</tr>
<tr>
<td></td>
<td>- Available in tiny footprint 8-lead 2x3 DFN or 8-pin MSOP packages</td>
</tr>
</tbody>
</table>
# Temperature Sensor

<table>
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<td>Temperature Sensor</td>
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<td>1°C Multi-Remote Temperature Sensors with Automatic Beta Compensation (3.3V SMBus) These sensors can monitor temperature up to 8 inches (24cm) away from the IC</td>
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<tr>
<td>Temperature Sensor</td>
<td>EMC118x</td>
<td>1°C Multi-Remote Temperature Sensors with Automatic Beta Compensation (1.8V SMBus) These sensors can monitor temperature up to 8 inches (24cm) away from the IC</td>
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While some systems control fans from the embedded controller, other systems use stand-alone fan controller such as these.

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<td>Fan Controller</td>
<td>EMC2103-1</td>
<td>The EMC2103-1 is a complete system thermal management system. It contains a single closed loop PWM fan driver with tachometer input, 2 temperature monitors, a shutdown and alert output, and an 8 entry fan speed look up table.</td>
<td>Click Here</td>
</tr>
<tr>
<td>Fan Controller</td>
<td>EMC2113</td>
<td>The EMC2113 is a complete system thermal management system. It contains a single closed loop PWM fan driver with tachometer input, 4 temperature monitors, a shutdown and alert output, and an 8 entry fan speed look up table.</td>
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JEDEC DIMM module specifications have defined temperature sensors with EEPROM. The devices below can be used for this purpose or for data logging.

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<td>MCP98243</td>
<td>The MCP98243 meets JEDEC’s JC42.4-TSE2002B3 with 2K bit serial EEPROM. Along with a wide operating voltage range of 1.8V - 5.5V, this device meets class B accuracy with ( \pm 0.2^\circ C/\pm 1^\circ C ) (typ./max.) from +75°C to +95°C</td>
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<td>MCP98244</td>
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</table>
USB charging is becoming more complicated as it becomes more ubiquitous. The device below can be uniquely configure for a discovery phase for new products, measure current, and be implemented in a system to allow for charging profile updates.

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<tr>
<td>USB Port Power Controller</td>
<td>UCS1002-2</td>
<td>This USB port power controller turns USB ports into universal charging ports. The UCS1002 uniquely combines a power switch and high speed switch with programmability and current measurement. Using the 9 built-in charging profiles and 1 programmable profile, a system designer can create an updateable USB charging port for new products yet to come. The current measurement function can be used to search for the highest charging current on unknown devices.</td>
<td>Click Here</td>
</tr>
</tbody>
</table>
Op Amps

Point sticks on notebooks send analog signals through multiple Op Amps for signal conditioning before the signal reaches a controller. The devices below have been used for this function.

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<tbody>
<tr>
<td>Op Amp for point stick or joy stick</td>
<td>MCP6L4T-E/ST</td>
<td>The MCP6L4 quad operational amplifier (op amp) has a gain bandwidth product of 2.8 MHz with low typical operating current of 200 µA. This device has a low input offset voltage of 3 mV.</td>
<td>Click Here</td>
</tr>
<tr>
<td>Op Amp for point stick or joy stick</td>
<td>MCP6L2T-E/MS</td>
<td>The MCP6L2 dual operational amplifier (op amp) has a gain bandwidth product of 2.8 MHz with low typical operating current of 200 µA. This device has a low input offset voltage of 3 mV.</td>
<td>Click Here</td>
</tr>
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IO Expanders are often used to insert additional functionality laptops that have an additional function version of a base model.

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<tr>
<td>IO Expander</td>
<td>MCP23017-E/ML</td>
<td>This is a 16-bit I/O port consisting of two 8-bit ports. The system master can enable the I/Os as either inputs or outputs over the I(^2)C. The data for each input or output is kept in the corresponding input or output register. All data is readable over the I(^2)C with 2 configurable interrupts to limit the need for polling registers.</td>
<td>Click Here</td>
</tr>
</tbody>
</table>
| IO Expander    | ECE1088, ECE1099, ECE1105 | ECE1088 has 20 GPIOs  
ECE1099 has 32 GPIOs and 23:8 keyscan  
ECE1105 has 40 GPIOs, 23:8 keyscan, & 2 PS/2 | Click Here       |
Current Sensing

Current is normally measured using one of two types of devices. First is via an inexpensive op amp with a feedback loop configured for the sense resistor and range possible currents. Second is with a high-side current sensor. Microchip offers this second type of device with an SMBus/I2C interface.

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<tr>
<td>Op Amps for Current Sensing</td>
<td>MCP6021/3</td>
<td>Theses op amps have a gain bandwidth of 10 MHz with a low typical operating current of 1mA and an offset voltage that is less than 150 µV</td>
<td>MCP602x</td>
</tr>
<tr>
<td></td>
<td>MCP6291/3</td>
<td></td>
<td>MCP629x</td>
</tr>
<tr>
<td>High Side Current Sensing</td>
<td>PAC1710</td>
<td>The PAC1710 is a high-side bi-directional current sensor. Voltage across an external sense resistor is measured to represent the current of a voltage rail. The PAC1710 also measures the SENSE+ voltage to calculate average power over the integration period. The device will assert an ALERT when high and low limits are exceeded for current sense and bus voltage.</td>
<td>Click Here</td>
</tr>
<tr>
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<td>Description</td>
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</tr>
<tr>
<td>---------------</td>
<td>------------------</td>
<td>-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
<td>------------------</td>
</tr>
<tr>
<td>Motor Driver</td>
<td>MTD6505</td>
<td>The MTD6505 is a 3-phase full-wave sensorless driver for brushless DC (BLDC) motors. It features 180° sinusoidal drive, high torque output and silent drive. With the adaptive features, parameters and wide range of power-supplies (2V to 5.5V), the MTD6505 is intended to cover a broad range of motor characteristics, while requiring minimum external components. Speed control can be achieved through either power supply modulation (PSM) or pulse-width modulation (PWM). The frequency generator (FG) output enables precision speed control in closed-loop applications. The MTD6505 device includes Lockup Protection mode to turn off the output current when the motor is in a lock condition, with an automatic recovery feature.</td>
<td>Click Here</td>
</tr>
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## Mobile Embedded Controllers

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<tr>
<td>Mobile Embedded Controller</td>
<td>MEC1308</td>
<td>8-bit embedded controller with 64k bytes SRAM, 2 SMBus, 4 PWMs, 2 tachs, 1 serial, ADC, 55 GPIOs, RC-6, 1SMSC BC-Link, 4 PS/2, SPI Flash Memory interface</td>
<td>Click Here</td>
</tr>
<tr>
<td>Mobile Embedded Controller</td>
<td>MEC1312</td>
<td>8-bit embedded controller with 96k bytes SRAM, 3 SMBus, PECI, 4 PWMs, 2 tachs, 1 serial, ADC, 63 GPIOs, 1SMS CBC-Link, 4 PS/2, SPI Flash Memory interface</td>
<td>Click Here</td>
</tr>
<tr>
<td>Mobile Embedded Controller</td>
<td>MEC1620</td>
<td>32-bit embedded controller with 192k bytes of embedded flash, 1k bytes EEPROM, 16k bytes SRAM, 16 ADC, connected standby, 3 SMBus, 2 SPI, 16 PWM, 6 tachs, 1 serial, HDMI-CEC, 153 GPIOs</td>
<td>Click Here</td>
</tr>
</tbody>
</table>
## Sensor Hub

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<tr>
<td>Sensor Hub</td>
<td>SSC7102</td>
<td>The SSC7102 sensor fusion hub is a Windows 8.1 certified, HID over I²C, low-power, flexible, turnkey solution. SSC7102 makes implementing sensor fusion easy for ultrabooks, tablets, and smartphones. Microchip partnered with multiple industry-leading sensor manufacturers and sensor-fusion specialists to create this solution, enabling faster time to market without the need for sensor-fusion expertise. The SSC7102 consumes only ~4mA while running complex sensor-fusion algorithms, resulting in longer battery life for Windows 8.1 tablet, laptop, ultrabook, and smartphone applications.</td>
</tr>
</tbody>
</table>

[Click Here]
## USB 2.0 and 3.0 Hubs

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<td>USB 3.0 Hub</td>
<td>USB553xB</td>
<td>These 2/3/4/7-port hub controllers are SuperSpeed/Hi-Speed, configurable and compliant with USB 3.0. USB 3.0 traffic can also operate in parallel with a USB 2.0 traffic without being not affected by slower data.</td>
<td>Click Here</td>
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<tr>
<td>USB 2.0 Hub</td>
<td>USB251xB</td>
<td>These 2/3/4 port USB 2.0 hub controllers excel at data throughput in mixed-speed USB environments. Programmable features include PortMap, PortSwap, and PHYBoost to simplify PCB layout &amp; optimize BOM cost.</td>
<td>Click Here</td>
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<tr>
<td>USB 2.0 Hub</td>
<td>USB2534</td>
<td>This 4 port hub is compliant with the USB 2.0 and Link Power Management. It provides an additional USB endpoint for use as a USB to I2C interface, allowing external devices to be monitored, controlled, or configured via USB.</td>
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</tr>
<tr>
<td>USB2.0 or HSIC</td>
<td>USB4604</td>
<td>This is an OEM configurable USB 2.0 hub controller with 4 downstream ports. It is compliant with the USB 2.0, USB 2.0 Link Power Management &amp; High-Speed Inter-Chip.</td>
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## Capacitive Sensing and Gesturing

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<tr>
<td>Proximity, Buttons, and Sliders</td>
<td>Various</td>
<td>Microchip offers both turnkey products for a no code development plug-and-play solution, as well as a proven robust firmware solution that leverage our vast PIC microcontroller portfolio. Our broad range of solutions include high sensitivity proximity detection, keys, sliders, Metal-over-Capacitive (MoC) touch sensing and more.</td>
<td><strong>Click Here</strong></td>
</tr>
<tr>
<td>Gesturing</td>
<td>Various</td>
<td>Microchip’s patented GestIC technology unleashes the 3rd dimension for the realization of revolutionary new User Interfaces. Our E-field sensing technology detects the proximity of a human hand and gives accurate X-Y-Z coordinates and recognized 3D gestures.</td>
<td><strong>Click Here</strong></td>
</tr>
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## SPI Flash

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</table>
| SPI Flash  | Various          | Microchip’s Serial Quad Interface (SQI™) and SPI flash memories are manufactured with our proprietary, high performance CMOS SuperFlash® Technology, significantly improving performance (erase any block in less than 25ms) and reliability (100 years data retention) while lowering power consumption.  
• 512Kb-64Mb in 3V and multiple densities in 1.8V  
• SQI™ flash – Up to 104MHz and includes advanced security features |

[Click Here]

<< BACK to BLOCK DIAGRAM
Servers
Main board
# Temperature Sensor

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<td>EMC1428</td>
<td>The EMC1428 is a high accuracy, low cost, System Management Bus (SMBus) temperature sensor. Each device provides ±1°C accuracy for external diode temperatures and ±2°C accuracy for the internal diode temperature. The EMC1428 monitors up to eight temperature channels (up to seven external and one internal).</td>
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While some systems control fans from the embedded controller, other systems use stand-alone fan controller such as these.

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<td>EMC230x</td>
<td>The EMC230x is an SMBus compliant fan controller with up to five independently controlled PWM fan drivers. Each fan driver is controlled by a programmable frequency PWM driver and Fan Speed Control algorithm that operates in either a closed loop fashion or as a directly PWM-controlled device. The closed loop Fan Speed Control algorithm (FSC) has the capability to detect aging fans and alert the system. It will likewise detect stalled or locked fans and trigger an interrupt. Additionally, the EMC230x offers a clock output so that multiple devices may be chained and slaved to the same clock source for optimal performance in large distributed systems.</td>
</tr>
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## Current Sensor

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<tr>
<td>PAC1710</td>
<td>The PAC1710 is a high-side bi-directional current sensing monitor with precision voltage measurement capabilities. The power monitor measures the voltage developed across an external sense resistor to represent the high-side current of a battery or voltage regulator.</td>
<td>Click Here</td>
</tr>
<tr>
<td>PAC1720</td>
<td>The PAC1720 is a dual high-side bi-directional current sensing monitor with precision voltage measurement capabilities. Each sensor measures the voltage developed across an external sense resistor to represent the high-side current of a battery or voltage regulator.</td>
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# Digital Potentiometers/ DAC

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<td>DAC</td>
<td>MCP47DA1</td>
<td>The MCP47DA1 devices are volatile, 6-Bit digital Digital-to-Analog converter(DAC) with a windowed output for server voltage margining applications. The MCP47DA1 has a windowed output (1/3 to 2/3 of VREF). The DAC setting is controlled through an I2C™Compatible serial interface. The I2C™Compatible slave addresses of “010 1110” and “011 1110” are supported.</td>
<td>Click Here</td>
</tr>
<tr>
<td>Digital Potentiometer</td>
<td>MCP40D18</td>
<td>The MCP40D17/8/9 devices offer a wide range of product offerings using an I2C™Compatible interface. This family of devices support a 7-bit resistor network, volatile memory configuration, and potentiometer and rheostat pinouts. This device family is offered in miniature 5 and 6 lead SC-70 packaging.</td>
<td>Click Here</td>
</tr>
</tbody>
</table>
The MCP2200 is a USB-to-UART serial converter which enables USB connectivity in application that have a UART interface. The device reduces external components by integrating the USB termination resistors. The MCP2200 also has 256-bytes of integrated user EEPROM. The MCP2200 has eight general purpose input / output pins. Four of the pins have alternate functions to indicate USB and communication status.
# USB Hubs

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<td>USB4604</td>
<td>This is an OEM configurable USB 2.0 hub controller with 4 downstream ports. It is compliant with the USB 2.0, USB 2.0 Link Power Management &amp; High-Speed Inter-Chip</td>
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</table>
USB3740

Features:
• High-bandwidth USB 2.0 Switch with Dual Enables
  • For high-speed USB 2.0 data
• Multiplex differential outputs from a USB host device to one of two corresponding outputs
  • Enable DP/DM multiplexing
  • Flexible solution for embedded applications
• Ultra-low Current Consumption
  • Active (switch ON) = 5 uA (Vcc = 3V)
  • Standby (switch OFF) = 0.01 uA (Vcc = 3V)
• Competitive USB 2.0 Switch Specifications
  • Designed to pass USB signals from 0 to 3.3V
  • USB Mux on resistance < 6 ohms
  • USB Mux off leakage < 0.5 uA
  • Off isolation < -40 dB
  • On capacitance < 6 pF
  • High bandwidth: 1 GHz
• Extreme ESD Protection ± 15 kV (IEC)
• Package:
  • 10-lead 1.3 mm x 1.8 mm QFN with 0.4 mm pitch
  • 10-lead 1.6 mm x 2.1 mm QFN with 0.5 mm pitch
LAN8810/20 Features

- Small Footprint, Low Power
- HP Auto-MDIX support with IEEE 802.3ab specs at 10/100/1000 Mbps operation
- Excellent ESD Protection levels without any external protection device
- Flexible configurations for LED status indicators
- Implements Energy Detection and Power Down modes
- Link status change and wake-up detection
- Lead free ROHS compliant packages:
  - LAN8810: 72QFN 10x10mm (GMII)
  - LAN8820: 56QFN 8x8mm (RGMII)
- Temperature Range:
  - Commercial 0°C to +70°C
  - Industrial -40°C to +85°C
PIC24F128GB204 Product Family with Security

What’s new:
- AES / DES HW encryption
- OTP key storage
- Random Number Generator
- UART with ISO7816

Highlights
- 64 to 128KB Flash
- 8KB RAM
- 28 to 44pins
- XLP low power with Vbat

Peripherals
- USB OTG
- 4 UARTs w/ ISO7816
- 3 SPI w/ I²S, 2 I²C™
- 12-bit ADC, 12ch
- CTMU
- 5 16-bit Timer
- 6 IC, 6 OC

<< BACK to BLOCK DIAGRAM
**RTCC**

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<tr>
<td>MCP79410</td>
<td>The MCP79410 general purpose I2C™ Compatible real-time clock/calendar (RTCC) is highly integrated with nonvolatile memory and advanced features normally found in higher priced devices. These features include a battery switchover circuit for backup power, a timestamp to log power failures and digital trimming for accuracy. In addition, non-volatile memory is included along with a Unique ID in a locked section of EEPROM that can be unlocked and programmed by the End User.</td>
<td></td>
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# BIOS and BOOT Flash

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<tr>
<td>SST26VF032B</td>
<td>The SST26VF032B/032BA Serial Quad I/O (SQI) flash device utilizes a 4-bit multiplexed I/O serial interface to boost performance while maintaining the compact form factor of standard serial flash devices. SST26VF032B/032BA also support full command-set compatibility to traditional Serial Peripheral Interface (SPI) protocol. Operating at frequencies reaching 104 MHz, the SST26VF032B/032BA enables minimum latency execute-in-place (XIP) capability without the need for code shadowing on an SRAM. The device’s high performance and reliability make it the ideal choice for Network Appliance, DSL and Cable Modems, Wireless Lan, Computing, Digital TV, Smart Meter, Server, Set Top Box, Automotive and other Industrial applications.</td>
<td><a href="#">Click Here</a></td>
</tr>
</tbody>
</table>
Distributed Point-of-Load Power Architecture

AC/DC, Offline Converter

DC/DC Controller (DEPA) MCP19111 → MOSFETs → Magnetics

DC/DC Controller (Standard) MCP19035 → MOSFETs → Magnetics

DC/DC- Buck Regulator (Integrated Switches) MCP163xx → Magnetics

DC/DC (LDO)
**Function:** Customizable, Analog-based Power Conversion Controller driving external, logic-level MOSFETs in high-power, power conversion applications

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<tr>
<td>MCP19111</td>
<td>The MCP19111 is a mid-voltage (4.5-32V) analog-based PWM controller family with an integrated 8-bit PIC® Microcontroller. This unique product combines the performance of a high-speed analog solution, including high-efficiency and fast transient response, with the configurability and communication interface of a digital solution. The MCP1911x family, when combined with Microchip’s MCP87xxx MOSFETs, or any low-FOM MOSFET, produce high-efficiency (&gt;96%) DC/DC power-conversion solutions.</td>
<td>[Click Here]</td>
</tr>
</tbody>
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## DC/DC Power Controller

- **Function:** Standalone, Analog-Based PWM Power Conversion Controller driving external, logic-level MOSFETs in high-power, power conversion applications

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<th>Popular Products</th>
<th>Description</th>
<th>Product Web Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>MCP19035</td>
<td>The MCP19035 is a small, analog-based PWM controller family with integrated synchronous MOSFET drivers offering outstanding transient performance. The MCP19035 operates over a wide 4.5 - 30Vdc range, has a 300 kHz switching-frequency, and offers a factory-adjustable dead-time setting, allowing designers to optimize the performance across a wide selection of MOSFET devices. The MCP19035 family, when combined with Microchip's <a href="#">MCP87xxx MOSFETs</a>, or any low-FOM MOSFET, produces high-efficiency (&gt;96%) DC/DC power-conversion solutions.</td>
<td><a href="#">Click Here</a></td>
</tr>
</tbody>
</table>

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<< BACK to POL BLOCK DIAGRAM
# High-Speed MOSFETs

## Function: High-Efficiency, Switched Mode Power Conversion Power Devices

<table>
<thead>
<tr>
<th>Popular Products</th>
<th>Description</th>
<th>Product Web Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>MCP87xxx</td>
<td>The MCP87xxx family of high-speed MOSFETs have been designed to optimize the trade-off between ultra-low On-state resistance (Rds-on) and Gate Charge (Qg) to maximize power conversion efficiency in switched mode power supplies.</td>
<td>Click Here</td>
</tr>
</tbody>
</table>

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<< BACK to POL BLOCK DIAGRAM
High-Speed MOSFETs

- Very Low Rds_on and Gate Charge (Qg)
- Optimized for high-efficiency Power Conversion

<table>
<thead>
<tr>
<th>Product ID</th>
<th>Type</th>
<th>Config</th>
<th>Vds (V)</th>
<th>Vgs (V)</th>
<th>Rds_on @ 4.5V (mΩ-typ)</th>
<th>Qg (nC)</th>
<th>Package</th>
</tr>
</thead>
<tbody>
<tr>
<td>MCP87022*</td>
<td>N</td>
<td>Single</td>
<td>25</td>
<td>+10/-8</td>
<td>2.2</td>
<td>25</td>
<td>5x6 DFN</td>
</tr>
<tr>
<td>MCP87030</td>
<td>N</td>
<td>Single</td>
<td>25</td>
<td>+10/-8</td>
<td>3</td>
<td>13.3</td>
<td>5x6 DFN</td>
</tr>
<tr>
<td>MCP87050*</td>
<td>N</td>
<td>Single</td>
<td>25</td>
<td>+10/-8</td>
<td>5</td>
<td>9</td>
<td>5x6 DFN</td>
</tr>
<tr>
<td>MCP87055*</td>
<td>N</td>
<td>Single</td>
<td>25</td>
<td>+10/-8</td>
<td>5.5</td>
<td>6</td>
<td>3.3x3.3 DFN</td>
</tr>
<tr>
<td>MCP87090</td>
<td>N</td>
<td>Single</td>
<td>25</td>
<td>+10/-8</td>
<td>9</td>
<td>4</td>
<td>5x6 DFN 3.3x3.3 DFN</td>
</tr>
<tr>
<td>MCP87130</td>
<td>N</td>
<td>Single</td>
<td>25</td>
<td>+10/-8</td>
<td>13</td>
<td>2.9</td>
<td>5x6 DFN 3.3x3.3 DFN</td>
</tr>
</tbody>
</table>
# DC/DC- Buck Regulator

## Popular Products

<table>
<thead>
<tr>
<th>Product</th>
<th>Description</th>
<th>Product Web Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>MCP16301</td>
<td>The MCP16301 is a high-input voltage step-down regulator, capable of supplying 600 mA to a regulated output voltage from 2.0V to 15V.</td>
<td>Click Here</td>
</tr>
<tr>
<td>MCP1632x</td>
<td>The MCP16321/2 is a highly integrated, high-efficiency, fixed frequency, synchronous step-down DC-DC converter in a 16-pin QFN package that operates from input voltages up to 24V. Integrated features include a high-side and low-side N-Channel switch, fixed frequency Peak Current Mode Control, internal compensation, peak current limit, VOUT overvoltage protection and over temperature protection.</td>
<td>Click Here</td>
</tr>
<tr>
<td>MCP16311/2</td>
<td>The MCP16311/2 is a compact, high-efficiency, fixed frequency PWM/PFM, synchronous step-down DC-DC converter in a 8-pin MSOP, or 2 x 3 TDFN package that operates from input voltage sources up to 30V. Integrated features include a high-side and a low-side switch, fixed frequency Peak Current Mode Control, internal compensation, peak-current limit and over temperature protection.</td>
<td>Click Here</td>
</tr>
</tbody>
</table>

<< BACK to Server BLOCK DIAGRAM
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DC/DC Controller (LDO)

- **Function:** Providing regulated, low-noise supply voltages ($V_{in}>V_{out}$) for the system

<table>
<thead>
<tr>
<th>Popular Products</th>
<th>Description</th>
<th>Product Web Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>MCP1790</td>
<td>The MCP1790 is a 70 mA, ceramic output cap stable, high voltage, Low Dropout Regulator (LDO). The MCP1790 is capable of handling continuous input voltage of up to 30V and is load dump protect for up to 48V</td>
<td>Click Here</td>
</tr>
</tbody>
</table>
| MCP1754/5        | The MCP1754/5 is a 16 volt, high PSRR voltage regulator with short circuit current foldback. The MCP1754 regulator provides up to 150 mA of current. The MCP1755 regulator provides up to 300 mA of current. The input operating voltage range is specified from 3.6V to 16V continuous, 18V absolute maximum, 12 VDC systems. Simplified, low pin count versions of the of these devices are also available | MCP1754  
MCP1755 |
Power Monitoring
Power Monitoring

Power Distribution Unit (PDU)

- AC Power
  - Relay
  - Current Sensor
  - PSU
  - Relay
  - Current Sensor
  - PSU
  - Relay
  - Current Sensor
  - PSU

MOSFETS

Energy Measurement AFE

MCP39F501 Power Monitor

Power Supply Unit (PSU)

- 1-Φ Power
  - X, Y Capacitors
  - Filter
  - Shunt & Isolation
  - Bridge & PFC
  - DC/DC

MCU

- SPI
- GPIO
- UART
- LEDs
- Ethernet/Wi-Fi®

<< BACK to Servers
<< BACK to CONTENTS
## MCP39F501

<table>
<thead>
<tr>
<th>Popular Products</th>
<th>Description</th>
<th>Product Web Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>MCP39F501</td>
<td>The MCP39F501 is a highly integrated, single-phase power-monitoring IC designed for real-time measurement of input power for AC/DC power supplies, power distribution units and industrial applications. It includes dual-channel delta sigma ADCs, a 16-bit calculation engine, EEPROM and a flexible 2-wire interface. An integrated low-drift voltage reference addition to 94.5 dB of SINAD performance on each measurement channel allows for better than 0.1% accurate designs across a 4000:1 dynamic range</td>
<td>Click Here</td>
</tr>
</tbody>
</table>
### Popular Products

<table>
<thead>
<tr>
<th>MCP3913/14</th>
<th>Description</th>
<th>Product Web Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>The MCP3913/4 device is a 3V six/eight-channel Analog Front End (AFE, containing six synchronous sampling delta-sigma ADCs, six PGAs, phase delay compensation block, low-drift internal voltage reference, digital offset and gain error calibration registers, and high-speed 20 MHz SPI compatible serial interface. The MCP3913 AFE includes advanced security features to secure the communications and the configuration settings, such as a CRC-16 checksum on both serial data outputs and static register map configuration. It also includes a register-map lock through an 8-bit secure key to stop unwanted write commands from processing. The MCP3913 AFE is capable of interfacing with a variety of voltage and current sensors, including shunts, current transformers, Rogowski coils and Hall-effect sensors.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

[Click Here]
## Microcontroller

<table>
<thead>
<tr>
<th>Popular Products</th>
<th>Description</th>
<th>Product Web Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>PIC32MX</td>
<td>32-bit Microcontrollers (up to 512 KB Flash and 128 KB SRAM) with Graphics Interface, USB, CAN, and Ethernet.</td>
<td>Click Here</td>
</tr>
<tr>
<td>PIC24F</td>
<td>The PIC24F microcontroller family features cost effective, 16 MIPS 16-bit MCU performance and many devices with Microchip’s eXtreme Low Power Technology. Unique features include USB-OTG, to act as a USB Device or Host, a Charge Time Measurement Unit (CTMU) that allows precision time measurement, capacitive measurement for mTouch™ applications and an integrated graphics or segmented display controller. The PIC24 Lite family (PIC24FxxKxxx) features lowest cost and lowest power in small pin count options, with integrated EEPROM, Op Amps, DACs, flexible PWMs and Configurable Logic Cell (CLC) for real time logic control.</td>
<td>Click Here</td>
</tr>
</tbody>
</table>
Power Stage (Ethernet Switch)

AC/DC Power Supply
- MCU (Digital Power)
  - Primary
  - MOSFET Driver

Intermediate Bus Converter (IBC)
- MCU (Digital Power)
  - Temp Sensor
  - MOSFET Driver
  - MOSFET

DC/DC Points of Loads & Switchers
- 1.5V
- 1.2V
- 1.0V
- 0.9V
- 1.8V
- 2.5V
- 3.3V

Reference Design Webpage

<< BACK to Ethernet Switch
720W AC/DC Power Supply Reference Design
High-Level Block Diagram

- **Input Filter**
- **Rectifier**
- **2-Phase Interleaved PFC**
  - CTs
  - MCP 9700
- **2-Phase Interleaved Two-Switch Forward**
  - GTs
  - CTs
  - MCP 9700
- **Synchronous Rectifier**
- **O-ring**
- **Output Filter**
- **Charge Pump**

- **Primary dsPIC33FJ16GS502**
  - UART
  - +3.3V
  - +12V
- **Secondary dsPIC33FJ16GS504**
  - UART
  - +3.3V
  - +12V

- **Auxiliary Power Supply**
  - +3.3V
  - +12V

- **MCP14E4**
- **MCP6H02**
- **MCP9700**

- **I²C**
- **I-Share Bus**
- **Fan Control**

Reference Design Webpage
<< BACK to Ethernet Switch Power Stage
<< BACK to Main End Equipments Page

Isolation
# USB 2.0 and 3.0 Hubs

<table>
<thead>
<tr>
<th>Function</th>
<th>Popular Products</th>
<th>Description</th>
<th>Product Web Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>USB 3.0 Hub</td>
<td>USB553xB</td>
<td>These 2/3/4/7-porthub controllers are SuperSpeed /Hi-Speed, configurable and compliant with USB 3.0. USB 3.0 traffic can also operate in parallel with a USB 2.0 traffic without being not affected by slower data.</td>
<td>Click Here</td>
</tr>
<tr>
<td>USB 2.0 Hub</td>
<td>USB251xB</td>
<td>These 2/3/4 port USB 2.0 hub controllers excel at data throughput in mixed-speed USB environments. Programmable features include PortMap, PortSwap, and PHYBoost to simplify PCB layout &amp; optimize BOM cost.</td>
<td>Click Here</td>
</tr>
<tr>
<td>USB 2.0 Hub</td>
<td>USB2534</td>
<td>This 4 port hub is compliant with the USB 2.0 and Link Power Management. It provides an additional USB endpoint for use as a USB to I2C interface, allowing external devices to be monitored, controlled, or configured via USB.</td>
<td>Click Here</td>
</tr>
<tr>
<td>USB 2.0 or HSIC</td>
<td>USB4604</td>
<td>This is an OEM configurable USB 2.0 hub controller with 4 downstream ports. It is compliant with the USB 2.0, USB 2.0 Link Power Management &amp; High-Speed Inter-Chip.</td>
<td>Click Here</td>
</tr>
</tbody>
</table>
## USB-to-UART/SPI

- **Function:** Enables USB connectivity in applications that have UART/SPI interface

<table>
<thead>
<tr>
<th>Popular Products</th>
<th>Description</th>
<th>Product Web Page</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>MCP2200</strong></td>
<td>The MCP2200 is a USB-to-UART serial converter. The device reduces external components by integrating the USB termination resistors. The MCP2200 also has 256-bytes of integrated user EEPROM. The MCP2200 has eight general purpose input / output pins. Four of the pins have alternate functions to indicate USB and communication status.</td>
<td>Click Here</td>
</tr>
<tr>
<td><strong>MCP2210</strong></td>
<td>The MCP2210 is a USB-to-SPI Master converter. The device reduces external components by integrating the USB termination resistors. The MCP2210 also has 256 bytes of integrated user EEPROM. The MCP2210 has nine general purpose input/output pins. Seven pins have alternate functions to indicate USB and communication status.</td>
<td>Click Here</td>
</tr>
</tbody>
</table>
## USB Transceiver Product Overview

<table>
<thead>
<tr>
<th>USB PHY Products</th>
<th>USB3450</th>
<th>USB3500</th>
<th>USB3280 USB3290</th>
<th>USB3300</th>
<th>USB334x</th>
<th>USB333x</th>
</tr>
</thead>
<tbody>
<tr>
<td>PHY Interface</td>
<td>UTMI+ (Device or Host)</td>
<td>UTMI+ (Device, Host, or OTG)</td>
<td>UTMI (Device)</td>
<td>ULPI (Device, Host, or OTG)</td>
<td>ULPI (Device, Host, or OTG)</td>
<td>ULPI (Device, Host, or OTG)</td>
</tr>
<tr>
<td>HS &amp; FS USB</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>LS USB</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Data Interface</td>
<td>8 bit Bidir</td>
<td>8 bit Bidir</td>
<td>8 bit Bidir</td>
<td>8 bit Bidir</td>
<td>8 bit Bidir</td>
<td>8 bit Bidir</td>
</tr>
<tr>
<td>Internal Reg</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Package Body size (mm)</td>
<td>40 QFN (6x 6 x 0.9)</td>
<td>56 QFN (8 x 8 x 0.9)</td>
<td>36 QFN (6 x 6 x 0.9)</td>
<td>40 VFBGA (4 x 4 x 0.9)</td>
<td>32 QFN (5 x 5 x 0.9)</td>
<td>24 QFN (4 x 4 x 0.9)</td>
</tr>
</tbody>
</table>

**SOC or PIC32**

USB Host Controller

ULPI

USB2

<< BACK to BLOCK DIAGRAM
# USB Flash Media Controller Overview

<table>
<thead>
<tr>
<th>USB Card Reader Products</th>
<th>USB2244</th>
<th>USB2250</th>
<th>USB2640</th>
<th>USB2660</th>
<th>USB4640</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Up Stream Interface</strong></td>
<td>USB 2.0</td>
<td>USB 2.0</td>
<td>USB 2.0</td>
<td>USB 2.0</td>
<td>HSIC (USB 2.0)</td>
</tr>
<tr>
<td><strong>Down Stream Output</strong></td>
<td>SD, MMC</td>
<td>SD, MMC, CF, MS, xD</td>
<td>SD, MMC, MS, xD</td>
<td>2xSD, 2xMMC, MS, xD</td>
<td>SD, MMC, MS, xD</td>
</tr>
<tr>
<td><strong>Down Stream USB Ports</strong></td>
<td>None</td>
<td>None</td>
<td>2</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td><strong>Logical Units</strong></td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td><strong>Package</strong></td>
<td>36 QFN (6 x 6 x 0.9)</td>
<td>128 VTQDP (14 x 14 x 1.1)</td>
<td>48 QFN (7 x 7 x 0.9)</td>
<td>64 QFN (9 x 9 x 0.9)</td>
<td>48 QFN (7 x 7 x 0.9)</td>
</tr>
</tbody>
</table>

*SD – SecureDigital, MMC – MultiMediaCard, CF – Compact Flash, MS – Memory Stick, xD – xD Picture Card*

- **Ultra-fast flash media reader/writer for external memory card storage or embedded flash memory**
  - SD, MMC/eMMC, MS / MS-Pro / MS-Pro-HG, xD
- **USB interface for design ease and flexibility on placement**
- **USB port expansion options**

---

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# Ethernet Physical Layer

<table>
<thead>
<tr>
<th>Popular Products</th>
<th>Description</th>
<th>Product Web Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>LAN8710A/20A</td>
<td>Excellent ESD Protection levels without any external protection devices. Integrated DSP with adaptive equalizer. Integrated 1.2V Linear Regulator. Incorporates SMSC flexPWR. Uses a low cost 25MHz xtal for RMII. Lead free ROHS compliant packages: Commercial (0 to +70C) and Industrial (-40 to +85C) temperature supported</td>
<td>Click Here</td>
</tr>
<tr>
<td>LAN8740A/1A/2A</td>
<td>Energy Efficient Ethernet 802.3az, Wake On LAN support (WoL), Cable Diagnostics, HP Auto-MDIX, Compliant with IEEE 802.3/802.3u, Integrated DSP with adaptive equalizer, Integrated 1.2V Linear Regulator, Uses a low cost 25MHz xtal for RMII Lead free ROHS compliant packages</td>
<td>Click Here</td>
</tr>
</tbody>
</table>
PIC24F128GB204 Product Family with Security

- What’s new:
  - AES / DES HW encryption
  - OTP key storage
  - Random Number Generator
  - UART with ISO7816

- Highlights
  - 64 to 128KB Flash
  - 8KB RAM
  - 28 to 44pins
  - XLP low power with Vbat

- Peripherals
  - USB OTG
  - 4 UARTs w/ ISO7816
  - 3 SPI w/ I²S, 2 I²C™
  - 12-bit ADC, 12ch
  - CTMU
  - 5 16-bit Timer
  - 6 IC, 6 OC

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## Thermal Management

<table>
<thead>
<tr>
<th>Suggested Products</th>
<th>Description</th>
<th>Product Web page</th>
</tr>
</thead>
<tbody>
<tr>
<td>MCP9700/</td>
<td>Improves control of color temperature and detects disconnected LED channel.</td>
<td>MCP9700</td>
</tr>
<tr>
<td>MCP9800/</td>
<td>MCP9700 outputs analog voltage that is proportional to the temperature (-40°C to 150°C). MCP9800 outputs temperature data (-55°C to 125°C) via I²C™/SMBus two-wire interface.</td>
<td>MCP9800</td>
</tr>
<tr>
<td>EMC2301</td>
<td>The EMC2301 is an SMBus compliant fan controller with a PWM fan driver. The fan driver is controlled by a programmable frequency PWM driver and Fan Speed Control algorithm that operates in either a closed loop fashion or as a directly PWM-controlled device and has the capability to detect aging fans and alert the system. It will likewise detect stalled or locked fans and trigger an interrupt.</td>
<td>EMC2301</td>
</tr>
<tr>
<td>EMC1412</td>
<td>The EMC1412 is a high accuracy, low cost, System Management Bus (SMBus) temperature sensor. Advanced features such as Resistance Error Correction (REC), Beta Compensation and automatic diode type detection combine to provide a robust solution for complex environmental monitoring applications.</td>
<td>EMC1412</td>
</tr>
</tbody>
</table>
dsPIC33 GS Architecture

- **Flash Memory**
- **RAM**
- **DMA**

**Internal Peripherals**
- Internal RC Oscillator
- WDT & Power Mgr.
- 16b/32b Timers
- LFSR Jitter Generator

**Communication**
- EUART, I²C, SPI
- CAN

**Enhanced I/O-Functions**
- Input Capture
- Output Compare

**Enhanced SMPS Peripherals**
- PWM with 1ns resolution
- 10bit 2x 2Msps ADC
- 25ns Comp. with 10bit DAC

**16-Bit dsPIC® DSC Core**
- 16-Bit ALU
- 17b x17b Multiply
- JTAG Interface
- 16x 16b WRegisters

- DSP Engine
- Dual X & Y AGU
- Barrel Shifter
- Dual 40b Accumulators

**Memory Bus**

**Peripheral Bus**

- 18-100 Pin Packages

**dsPIC® DSC webpage**

<< BACK to Ethernet Switch  << BACK to Power Stage
## Operational Amplifiers

<table>
<thead>
<tr>
<th>Suggested Products</th>
<th>Description</th>
<th>Product Web page</th>
</tr>
</thead>
<tbody>
<tr>
<td>MCP6H02</td>
<td>The MCP6H02 operational amplifier (op amp) has a wide supply voltage range of 3.5V to 16V and rail-to-rail output operation. This device is unity gain stable and has a gain bandwidth product of 1.2 MHz (typical), while only drawing 135 µA/amplifier (typical) of quiescent current. The MCP6H02 family is fully specified from -40°C to +125°C and is available in 8L-SOIC and 8L- 2x3 TDFN</td>
<td>MCP6H02</td>
</tr>
<tr>
<td>MCP6H92</td>
<td>The MCP6H92 operational amplifier (op amp) has a wide supply voltage range of 3.5V to 12V and rail-to-rail output operation. This device is unity gain stable and has a gain bandwidth product of 10 MHz (typical), while only drawing 2 mA/amplifier (typical) of quiescent current. The MCP6H92 is fully specified from -40°C to +125°C and is available in 8L-SOIC and 8L- 2x3 TDFN</td>
<td>MCP6H92</td>
</tr>
</tbody>
</table>
# MOSFET Drivers

**Function:** driving the high power devices (MOSFETs, bipolar transistors, IGBTs)

<table>
<thead>
<tr>
<th>Popular Products</th>
<th>Description</th>
<th>Product Web Page</th>
</tr>
</thead>
</table>
| TC4427A          | Supply Voltage Range: 2.5V to 5.5V  
Wide Temperature Measurement Range: -40°C to +125°C  
High Temperature Converter Accuracy: ± 2°C, Max, at 25°C  
Linear Temperature Slope: 10mV/°C  
Very Low Supply Current: 35µA Typical | [Click Here](#) |
| MCP1415/16       | The MCP1415/16 devices are small footprint Low-Side MOSFET drivers capable of supplying 1.5A peak output current in a SOT23 5L package. | [Click Here](#) |
| MCP14E3/E4/E5    | The MCP14E3/E4/E5 devices are a family of 4.5A,dual output buffers/MOSFET drivers with separate enable functions for each output. As MOSFET drivers, the MCP14E3/E4/E5 can easily charge 2200 pF gate capacitance in under 28 nsec (max) | [Click Here](#) |
**Charge Pumps**

Function: powering white LEDs, providing negative DC bias for LCD or GaAs transmit power amplifier, converting Li-Ion voltage to DC voltage level required by the system

<table>
<thead>
<tr>
<th>Popular Products</th>
<th>Description</th>
<th>Product Web Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>MCP1252/3</td>
<td>The MCP1252/3 are inductorless, positive-regulated charge pump DC/DC converters. The devices generate a regulated fixed (3.3V or 5.0V) or adjustable output voltage. They are specifically designed for applications requiring low noise and high efficiency and are able to deliver up to 120 mA output current. The devices allow the input voltage to be lower or higher than the output voltage, by automatically switching between buck/boost operation.</td>
<td>Click Here</td>
</tr>
</tbody>
</table>