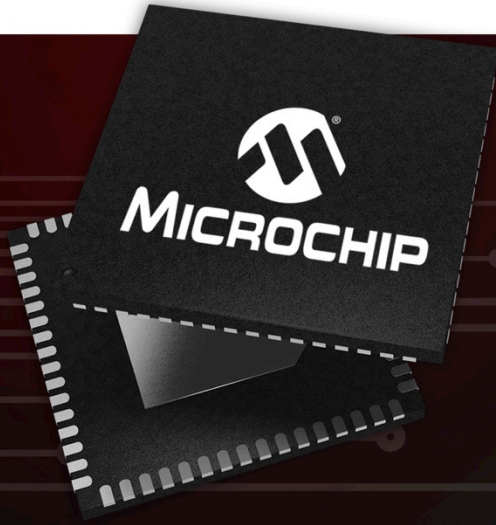
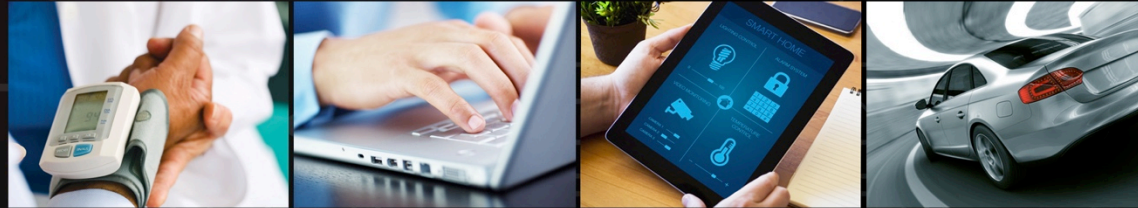




A Leading Provider of Microcontroller, Security,
Mixed-Signal, Analog & Flash-IP Solutions



Microchip Total System Solutions for Space
Nicolas Ganry
Space Forum 2019

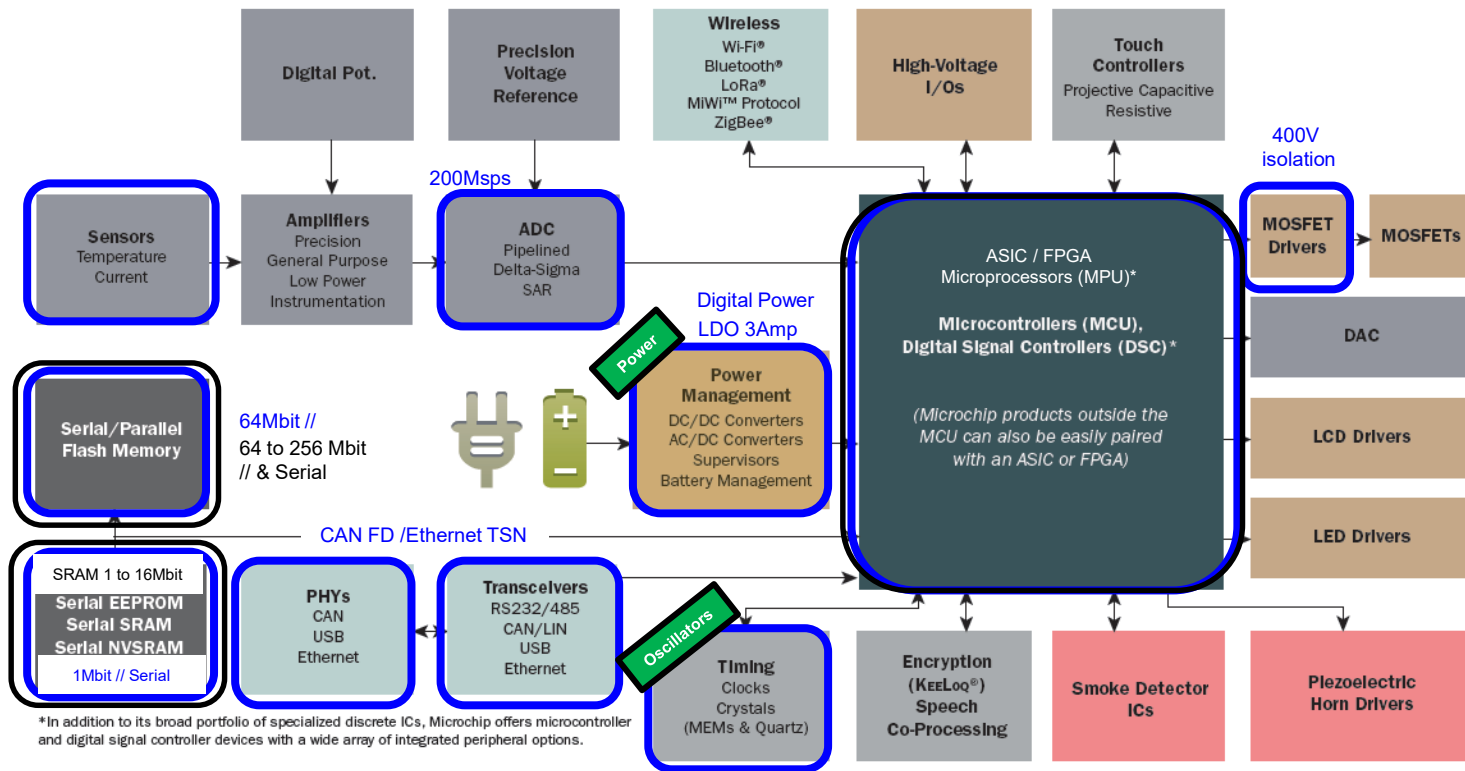
Companions Products for Space



RT

RH

Dedicated Space products line

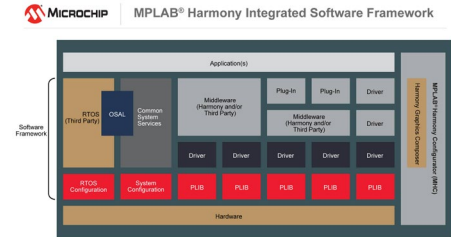


*In addition to its broad portfolio of specialized discrete ICs, Microchip offers microcontroller and digital signal controller devices with a wide array of integrated peripheral options.

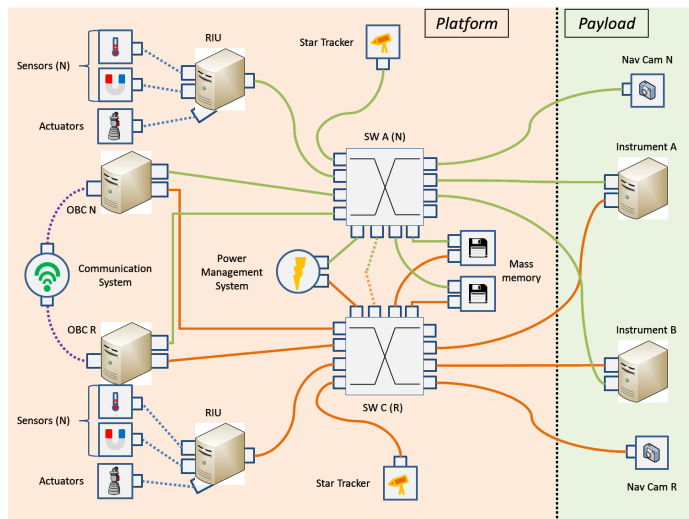
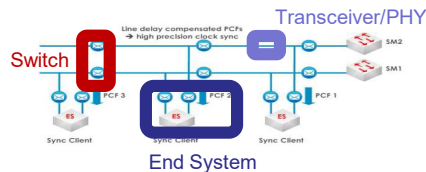
Total System Solutions Aerospace & Defense



- **Enabling complete solutions with :**
 - Companions : transceivers, switches, interfaces, ...
 - Applications notes, system and hardware design examples
 - Software libraries as example and tools for targeted application
- **Ethernet safety – AVB/TSN**
- **CAN/CAN FD networks**
- **Motor control solutions**
- **Digital power migration**
- **FPGA in-flight reprogramming**
- **Control with precision timing**
- **Space interfaces, SpaceWire**
- **Others : ADC, IO extension ...**



Ethernet Safety



• End System

Products	Rad	Type	Available
SAMV71RT	RT	Arm MCU w Ethernet TSN 100Mb	FM
SAMRH71	RH	Arm SoC w Ethernet TSN 100Mb	ES
RT FPGA	RH	w TSN IP targeting 1Gbit	
MPU RT	RT	Arm SoC Ethernet TSN 1Gbit	

Production
Development
Roadmap

• PHY

Products	Rad	Type	Available
VSC8540/41 RT	RT	100Mb/1Gbit Ethernet Transceiver, RMII/RGMII	ES H219 FM H120

• Switch

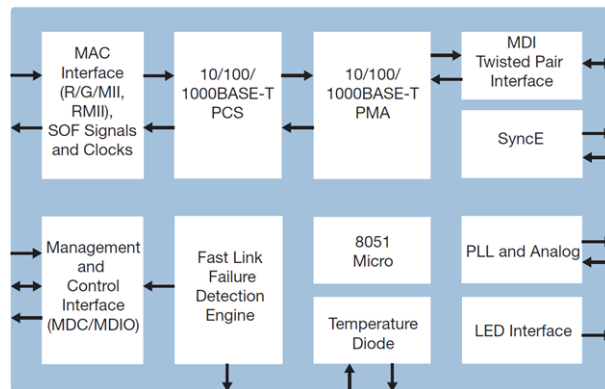
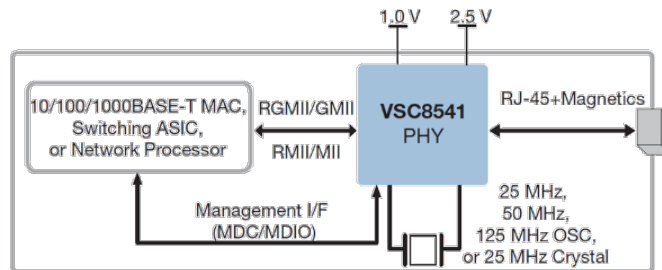
Products	Rad	Type	Available
Gbit Switch	RT	Gbit Ethernet Switch TSN/AVB	

VSC8541RT

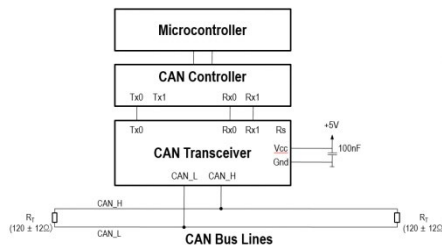
Mbit/Gbit Ethernet PHY



- Compliant with IEEE 802.3
 - 10BASE-T
 - 10BASE-Te
 - 100BASE-TX
 - 1000BASE-T
- Supports GMII and **RGMI** (version 1.3), **RMII** (version 1.2), and MII at 1.5 V, 1.8 V, 2.5 V, and 3.3 V LVCMOS
- RGMI version 2.0 timing compliant
- Supports clocking from 25 MHz crystal or 25/50/125 MHz oscillator
- Microcontroller-free configurability through hardware strapping
- Best-in-Class power consumption



CAN (FD) Network



ATmegaS64M1



SAM3X8ERT



CAN Network



SAMRH71F20



SAMV71Q21RT

● End System

Products	Rad	Type	Available
RT MCU	RT	MCU w CAN & CAN FD	FM
RT FPGA	RH	w CAN & CAN FD IP	FM
SAMRH71	RH	Arm SoC w CAN FD interface	ES
MPU RT	RT	Arm MPU w CAN FD capabilities	

● PHY

Products	Rad	Type	Available
CAN PHY	RT	High-speed CAN FD transceiver	

● Interfaces

Products	Rad	Type	Available
CAN Bridge	RT	SPI to CAN FD controller	

Production

Development

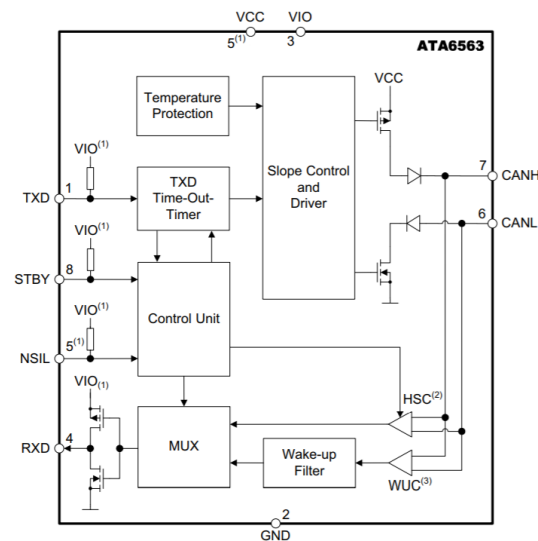
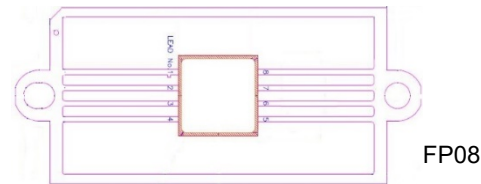
Roadmap

ATA6563RT

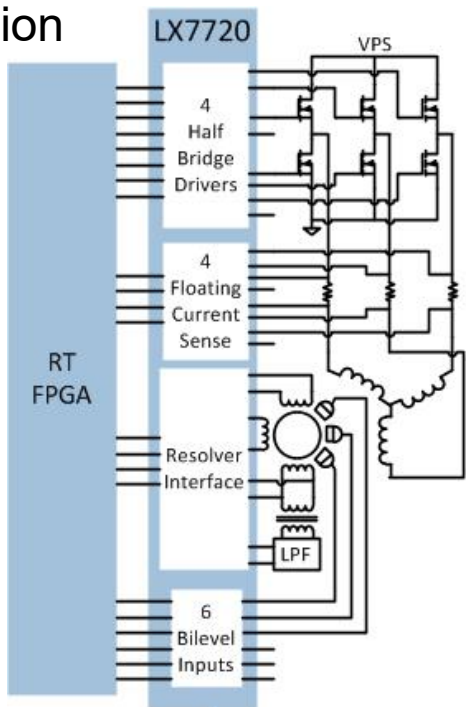
High-speed CAN FD transceiver



- **CAN FD up to 5 Mbit/s**
- **ISO 11898-2**
- **ISO 11898-5**
- **ISO 11898-2: 2016** (Remote wake-up via CAN bus with Wake-Up on Pattern (WUP))
- **SAE J2962-2 compliant**
- **Direct interfacing to microcontrollers with supply voltages from 3V to 5V**
- **Temp range: -55°C / +125°C**



RH solution



Processing / Control Units

Products	Rad	Type	Available
RT MCU	RT	ATMEGAS64M1 / SAMV71RT	FM
RT FPGA	RH	RTAX / RT4G	FM
SAMRH71	RH	Arm SoC MPU	ES

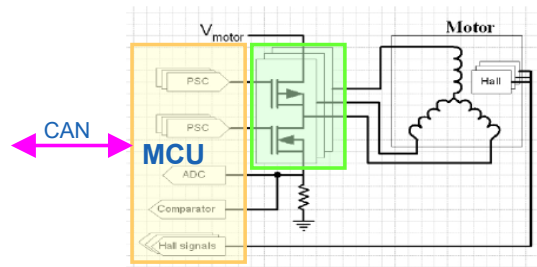
Production

Development

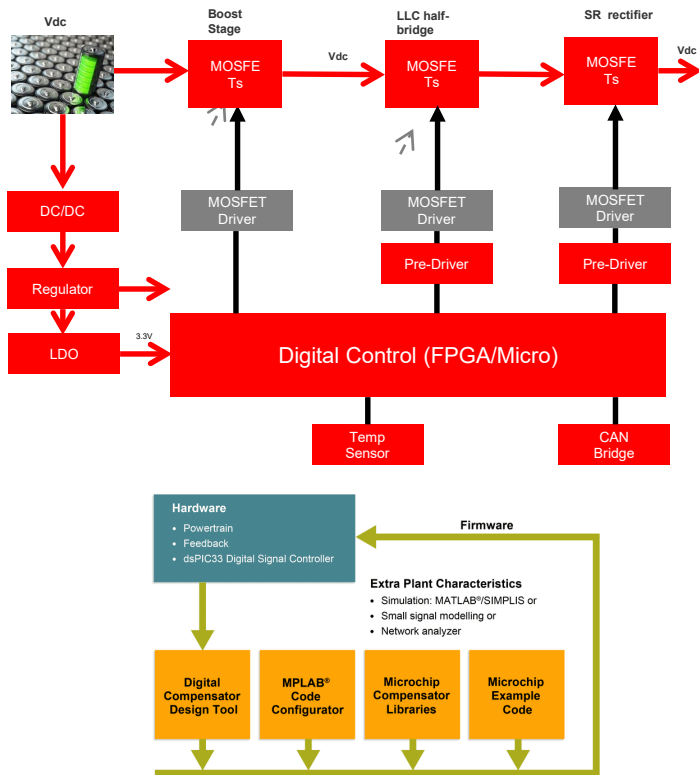
Roadmap

Companions

Products	Rad	Type	Available
LX7720	RH	Power Driver w Rotation & Position Sensing	FM



RT
solution



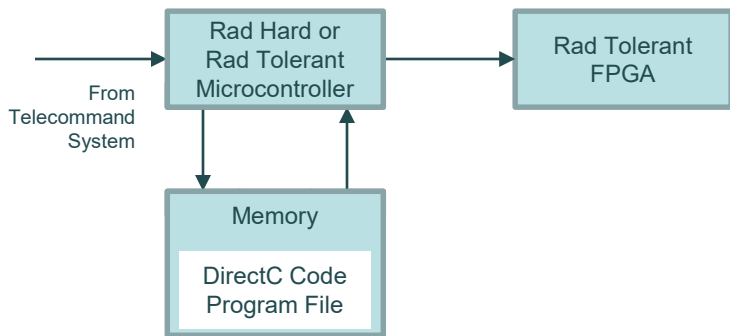
Processing / Control Units

Products	Rad	Type	Available
RT MCU	RT	Arm MCU SAM3XE/ SAMV71RT	ES/FM
RT FPGA	RH	RTAX / RTG4	FM
SAMRH71	RH	Arm SoC MPU	ES
Digital Power MCU	RT	Digital Signal Controller, MCU16	

Companions

Products	Rad	Type	Available
https://www.microsemi.com/product-directory/radiation-hardened-devices/1733-power-management	RH	Rad Hard Power Products	FM

Production
Development
Roadmap



Production

Development

Roadmap

Microcontroller controls in-flight programming process of RT FPGA

- Accept new programming Direct C bitstream from up-link via telecommand system, store it in memory
- Place FPGA into programming mode
- Execute Direct C code to initiate transfer of programming bitstream to FPGA
- Monitor FPGA return to operation, and re-initiate programming in case of programming upset

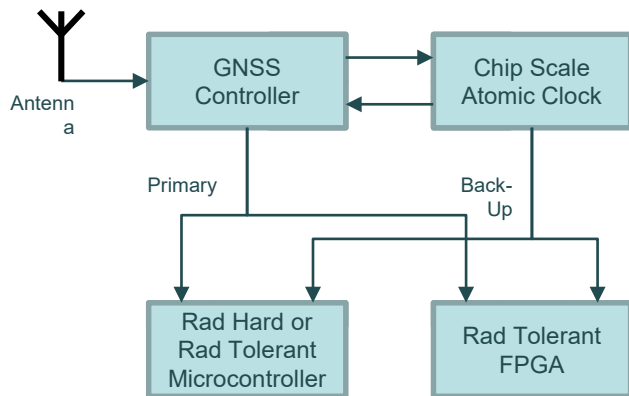
• Processing / Control Units

Products	Rad	Type	Available
RT FPGA	RH	Rad Tolerant FPGA, RTG4	FM
RT MCU	RT	ATmegaS or SAMV71RT	FM
SAMRH71	RH	Arm SoC MPU	ES

• Memory

Products	Rad	Type	Available
RT Flash	RT	64Mbit // interface	
RH Flash	RH	64Mbit to 256Mbit , // & serial	

Control with Precision Timing



- GNSS Controller provides GNSS time signal to Microcontroller or FPGA
 - Precision navigation and timing applications
 - Precision time stamping on data processing

• Processing / Control Units

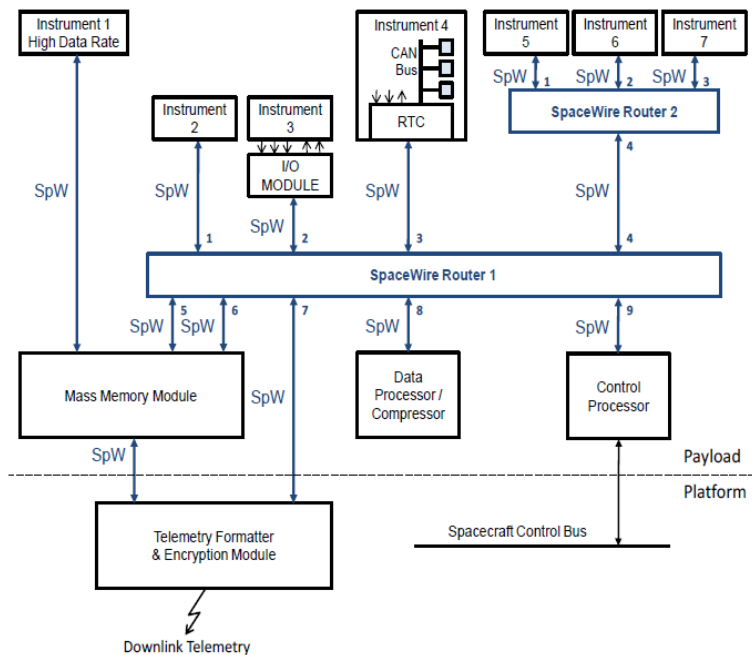
Products	Rad	Type	Available
RT FPGA	RH	Rad Tolerant FPGA, RTG4	FM
AT7991	RH	GNSS Controller SoC Sparc V8	FM
Arm MCU	RT	SAM3X8ERT	FM Q419
SAMRH71	RH	Arm SoC MPU	ES

• CSAC

Products	Rad	Type	Available
SA.45s	RT	Chip Scale Atomic Clock	FM

- Chip Scale Atomic Clock provides precision timing with long holdover for GNSS-denied environments
 - Weak or absent GNSS signal can cause loss of precise timing info
 - CSAC can provide precise timing back-up to maintain system functions

Production
Development
Roadmap



Processing / Control Units

Products	Rad	Type	Available
RT FPGA	RH	w any SpaceWire IP	FM
AT7913	RH	SparcV8 SoC w 2x Spw channels	FM
SAMRH71	RH	Arm SoC w 2x Spw channels	ES

Network

Products	Rad	Type	Available
AT7910	RH	10 channels Spw Router	FM

Interfaces/ Transceivers

Products	Rad	Type	Available
RT FPGA	RH/ RT	SPI to Spacewire bridge	FM

Production
Development
Roadmap

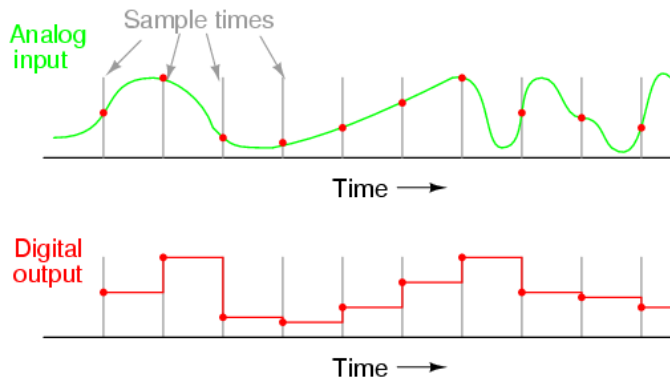
- **Analog to Digital Conversion**

Production

Development

Roadmap

Products	Rad	Type	Available
LX7730	RH	64 Analog In Telemetry Controller	FM
MCP37D31-RT200	RT	200MSPS, 16bit, Pipeline ADC	HP FM Q419

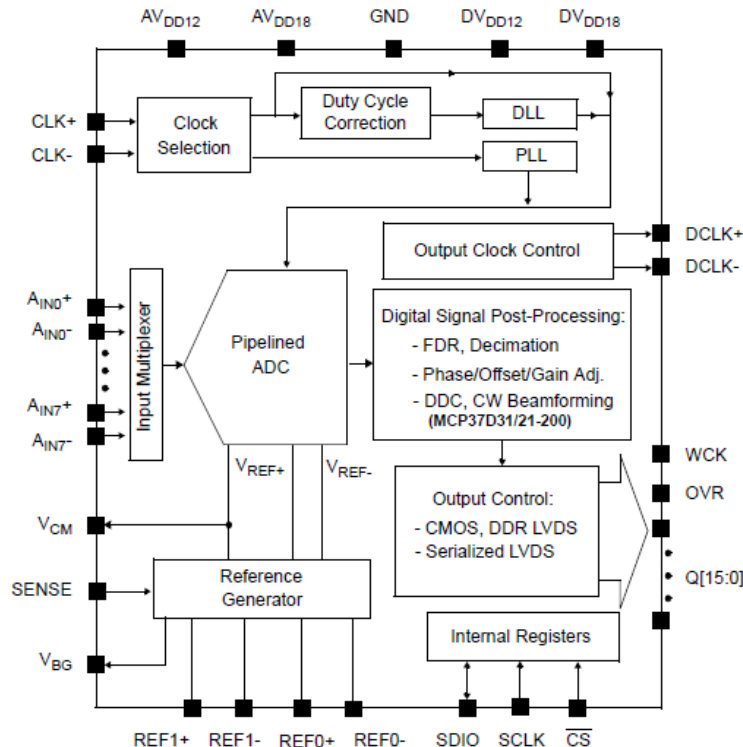


MCP37X31-200

200MSPS, 16bit, Pipeline ADC



- **16-bit resolution**
- **200 MspS maximum sampling rate**
- **Low power at full sampling rate:**
 - 490 mW including LVDS digital I/O
- **Power saving modes:**
 - 80 mW during Standby
 - 33 mW during Shutdown
- **Signal to Noise Ratio:**
 - >74 dBFS at 200 MspS
- **Spurious Free Dynamic Range:**
 - >90 dBFS at 200 MspS
- **Digital processing features:**
 - Integrated digital down-converter
 - Decimation filters for improved SNR
 - Individual phase, offset and gain adjustment
 - Fractional delay recovery
 - Data available through serial DDR LVDS or parallel CMOS interface (SPI configuration)



ES Available
FM Q419,
 Plastic version only

TFBGA-121
 VTLA-124
 packages

- **Total System Solution approach for Space applications**
- **Ongoing TSS activities :**
 - Ethernet safety – AVB/TSN
 - CAN/CAN FD networks
 - Motor control solutions
 - Digital power migration
 - FPGA in-flight reprogramming
 - Control with precision timing
 - Space interfaces, SpaceWire
 - Analog to Digital conversion
- **Feel free to propose any items / components required for your own system. We're open to any new ideas.**



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<http://www.microchip.com/design-centers/aerospace-and-defense>



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Thank You