The World’s Smallest Microcontroller
The PIC10F 6-pin Family
Agenda

- PIC10F Family Introduction
- Unique Features of the PIC10F Family
  - 6-Pin SOT Package
  - Comparator
  - New Timer0 clock options
  - Expanded Wake-up options
- Standard Features of the PIC10F Family
- Development Tools
- Application examples
- Additional Resources
PIC10F Family Introduction

Enabling widespread use of microcontrollers as general purpose electronic design building blocks

Physical Size
Available in a 6-pin SOT-23

Cost
Starting at US$0.49 in 10k Quantities

Ease-of-use
33 Instructions, 4 I/O Existing Dev. Tools

Versatile
Flash Microcontroller Analog/Digital
The PIC10F Family enables the widespread use of microcontrollers as general purpose electronic design building blocks

- **small size** enable designers to use it in almost any design without PCB area concerns
- **ease-of-use** allows designs to be completed in a few hours
- **low cost** enables use in applications typically void of electronics
- **versatility and power** of the flash microcontroller make it applicable in a wide range of applications
Unique Features

The PIC10F is the next generation of Microchip’s Baseline MCUs with:

- 6-pin SOT-23 package
- On-board Comparator
- Timer0 Comparator connection for expanded clocking options
- Wake-up on change
Unique Features: 6-Pin SOT Package

- 8 Pin PDIP PIC12C509 1996
- 8 Pin SOIC PIC12C509A 1998
- 8 Pin MSOP PIC12F509 2004
- 6 Pin SOT23 PIC10F20X 2004
- 3 Pin SOT23/SC70 Typical Transistor sizes
Unique Features:
PIC10F2XX Pinout

6-PIN SOT-23

GP0/CIN+ ↔ GP3/MCLR/VPP
Vss ↔ VDD
GP1/CIN- ↔ GP2/T0CKI/COUT/FOSC4

PIC10F200
PIC10F202
PIC10F204
PIC10F206
Unique Features: Comparator

**PIC10F204/206**

- **Multiplexed non-inverting input**
  - GP0 or GP1

- **Multiplexed inverting input**
  - GP1 or 0.6V bandgap reference

- **Programmable Output**
  - Externally on pin GP2
  - Internally as CMPOUT [CMCON0<7>]
  - Output polarity control
  - Pin saving internal connections
    - Tmr0 clock source
    - Wake on change from Sleep
Unique Features: Timer0

- 8-bit real-time clock/counter eliminates overhead on software side for clocking for events
- Optional clock sources
  - Internal FOSC/4
  - External clock input on GP2 (T0CKI)
  - Comparator output (COUT)

Note 1: Bits T0CS, T0SE, PSA, PS2, PS1 and PS0 are located in the Option Register.
2: The prescaler is shared with the Watchdog Timer.
3: Bit CMPT0CS is located in the CMCON0 register. CMCON0<4>.
Unique Features: Wake-up From SLEEP

- All wake-up functions generate a system reset
- Status flags allow firmware to identify the source of reset

<table>
<thead>
<tr>
<th>Source</th>
<th>TO</th>
<th>PD</th>
<th>GPWUF</th>
<th>CWUF</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wake on pin change</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>0</td>
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<tr>
<td>Watch Dog Timer</td>
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<td>1</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Comparator</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Master Clear</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>
Standard PIC10F Features

- Baseline Core with 33 Instructions, 2 Stack Levels
- Flash Program Memory
- Precision 4 MHz Internal Oscillator
- Optional external MCLR input
- Standard 25mA I/O drive capability
- Standard 8-bit Timer
- Low Power (100nA) Sleep current with multiple wake-up sources
- In Circuit Serial Programming™ (ICSP™) capability
Enhanced Features: PIC10F CPU

- **Internal RC Oscillator**
  - IntOSC accuracy over voltage and temperature
    - 4MHz 1% 3.0V, 25°C
    - 4MHz 2% 2.5V-5.5V, 0°C - + 85°C
    - 4MHz 5% 2.0V-5.5V, -40°C - +125°C
  - Calibration value supplied at top of memory
  - Optional external output of FOSC/4

- **Optional external MCLR input enabled by configuration word**
# PIC10F Device Options

<table>
<thead>
<tr>
<th>Device</th>
<th>Program Flash (Words)</th>
<th>Program Data RAM</th>
<th>Internal Osc.</th>
<th>Comparator</th>
</tr>
</thead>
<tbody>
<tr>
<td>PIC10F200</td>
<td>256</td>
<td>16</td>
<td>Yes</td>
<td>-</td>
</tr>
<tr>
<td>PIC10F202</td>
<td>512</td>
<td>24</td>
<td>Yes</td>
<td>-</td>
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<tr>
<td>PIC10F204</td>
<td>256</td>
<td>16</td>
<td>Yes</td>
<td>1</td>
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<tr>
<td>PIC10F206</td>
<td>512</td>
<td>24</td>
<td>Yes</td>
<td>1</td>
</tr>
</tbody>
</table>
Development Tools
Programming the PIC10F

- Supported by Microchip standard programmers
  - PICSTART® Plus (DV003001)
  - PICSTART® Plus upgrade kit (UK003010)
  - MPLAB® ICD2 (DV164005)
  - PRO MATE® II (DV007003)
  - MPLAB® PM3 (DV007004)

- New low pincount Flash specific programmers
  - PICkit™ 1 (DV164101)
  - Universal Adapter Board (AC163020)
  - Baseline Flash Microcontroller Programmer (BFMP ) (PG164101)
PIC10F Programming

- PICkit™ 1 firmware 2.0.0 or newer
  - Firmware/GUI upgrade for PIC10F2xx (UK164101)
PIC10F Programming

- Universal Programmer Adapter board (AC163020)
  - PICkit™ 1
  - BFMP
  - PICSTART® Plus
  - MPLAB® ICD2
PIC10F Programming

- Universal Programmer Adapter board (AC163020)
  - PICkit™ 1
  - BFMP
  - PICSTART® Plus
  - MPLAB® ICD2
PIC10F Programming

- New PIC10F specific programmer (PG164101)
  - Baseline Flash Microcontroller Programmer (BFMP)
BFMP

- Connects to Universal Programmer Adapter board (or your own board)
PIC10F
Application Examples
Examples of potential applications

- Waveform generator
- Identification tags
- Drug tester
- Electronic lock
- Electronic chime
- Pressure sensor
- Water consumption gauge
- Pregnancy tester
- Medication dispensing
- LED Flashlight
- Intelligent power switch
- Light dimmer
- Fan controller
- System watchdog
- Smoke/CO Alarm
- Engine Governor
- Protocol Handler
- Flat Iron temperature control
- DC/DC soft start
- Capacitive switch
- Irrigation control
- Security monitor
“Electronic Glue” Example: Uncertain external interface

- Re-programmable
  - Easy and quick *updates* and changes
  - Flexibility to accommodate *multiple options*

- Remove some *complexity* from the ASIC
  - Do not have to accommodate all possible options

ASIC \[\xrightarrow{\text{Start}}\] PIC10F \[\xleftarrow{\text{Done}}\] PWM, PPM, Manchester, etc.
Disposable Example: Package Handling Alarm

- **Low power** consumption
  - 100nA SLEEP mode
  - Wakeup on pin change
  - Wide operating voltage

- Internal oscillator frequency *stability* for sound generation

- **Small** *size*
  - Easy placement/stick-on
Mechatronics Example: Compressor lock out delay

- Internal Oscillator provide more **accurate timing**

- Mode jumpers and **programmability** give flexible timing options

- No mechanical calibration

- **Test time** reduce from minutes to milliseconds
Waveform Generation Example: Generating a sine wave

Current Solutions

- Phase Shift Oscillator
- Wien Bridge with AGC

PIC10F Solution

- Fewer components
- Programmable
  - Frequency
  - Amplitude
- Less board space
  - Clean and Compact Solution

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PIC10F Summary

- The PIC10F Family enables the widespread use of microcontrollers as general purpose electronic design building blocks
  - The *small size* enable designers to use it in almost any design without PCB area concerns
  - The *ease-of-use* allows designs to be completed in a few hours
  - The *low cost* enables use in applications typically void of electronics
  - The *versatility and power* of the flash microcontroller make it applicable in a wide range of applications
Additional Resources

- PIC10F200/202/204/206 datasheet DS41239
- PIC10F200/202/204/206 Programming Specification DS41228
- Watch for the coming library of Technical Briefs including:
  - Programming Baseline Flash Devices with PICKIT 1
  - Implementing soft-start in a switching power supply
  - Vibration monitor for shipping
  - AC lamp dimmer
  - PFM switching power supply
  - Flatiron temperature control
  - ....with more to come