

# PIC16F18013/14/23/24 Full-Featured 8/14-Pin Microcontrollers

PIC16F18013/14/23/24



## Introduction

The PIC16F18076 microcontroller family has a suite of digital and analog peripherals that enable cost-sensitive sensor and real-time control applications. This product family is available from 8 to 44-pin packages in a memory range of 3.5 KB to 28 KB, with speeds up to 32 MHz. The family includes a 10-bit Analog-to-Digital Converter with Computation (ADCC), automated Capacitive Voltage Divider (CVD) techniques for advanced capacitive touch sensing, an 8-bit Digital-to-Analog Converter (DAC) module, and many more waveform control and communication peripherals. This small form factor, feature-rich device is well suited for low-cost sensor and control applications.

## PIC16F18076 Family Summary

**Table 1. Devices Included in This Data Sheet**

Device	Program Flash Memory (bytes)	Data Flash Memory (EEPROM)(bytes)	Data SRAM (bytes)	Memory Access Partition/ Device Information Area	I/O Pins <sup>(1)</sup> / Peripheral Pin Select	8-Bit Timers with HLT/ 16-Bit Timers <sup>(2)</sup>	10-Bit PWM/ CCP	10-Bit ADC Channels (External/Internal)	Charge Pump	I <sup>2</sup> C/SPI	EUSART	NCO	CWG	CLC	FVR	CMP	8-bit DAC	ZCD	SMBus Compatible I/O Pads	External Interrupt Pins	Interrupt-on-Change Pins	Watchdog Timer
PIC16F18013	3.5K	128	256	Y/Y	6/Y	3/3	3/2	5/4	1	1/1	1	1	0	4	2	1	1	1	Y	1	6	Y
PIC16F18014	7K	128	512	Y/Y	6/Y	3/3	3/2	5/4	1	1/1	1	1	0	4	2	1	1	1	Y	1	6	Y
PIC16F18023	3.5K	128	256	Y/Y	12/Y	3/3	3/2	11/4	1	1/1	1	1	0	4	2	1	1	1	Y	1	12	Y
PIC16F18024	7K	128	512	Y/Y	12/Y	3/3	3/2	11/4	1	1/1	1	1	0	4	2	1	1	1	Y	1	12	Y

**Table 2. Devices Not Included in This Data Sheet**

Device	Program Flash Memory (bytes)	Data Flash Memory (EEPROM)(bytes)	Data SRAM (bytes)	Memory Access Partition/ Device Information Area	I/O Pins <sup>(1)</sup> / Peripheral Pin Select	8-Bit Timers with HLT/ 16-Bit Timers <sup>(2)</sup>	10-Bit PWM/ CCP	10-Bit ADC Channels (External/Internal)	Charge Pump	I <sup>2</sup> C/SPI	EUSART	NCO	CWG	CLC	FVR	CMP	8-bit DAC	ZCD	SMBus Compatible I/O Pads	External Interrupt Pins	Interrupt-on-Change Pins	Watchdog Timer
PIC16F18015	14K	128	1024	Y/Y	6/Y	3/3	3/2	5/4	1	2/2	2	1	1	4	2	1	1	1	Y	1	6	Y
PIC16F18025	14K	128	1024	Y/Y	12/Y	3/3	3/2	11/4	1	2/2	2	1	1	4	2	1	1	1	Y	1	12	Y

.....continued

Device	Program Flash Memory (bytes)	Data Flash Memory (EEPROM)(bytes)	Data SRAM (bytes)	Memory Access Partition/ Device Information Area	I/O Pins <sup>(1)</sup> / Peripheral Pin Select	8-Bit Timers with HLT/ 16-Bit Timers <sup>(2)</sup>	10-Bit PWM/ CCP	10-Bit ADC Channels (External/Internal)	Charge Pump	I <sup>2</sup> C/SPI	EUSART	NCO	CWG	CLC	FVR	CMP	8-bit DAC	ZCD	SMBus Compatible I/O Pads	External Interrupt Pins	Interrupt-on-Change Pins	Watchdog Timer
PIC16F18026	28K	256	2048	Y/Y	12/Y	3/3	3/2	11/4	1	2/2	2	1	1	4	2	1	1	1	Y	1	12	Y
PIC16F18044	7K	128	512	Y/Y	18/Y	3/3	3/2	17/4	1	2/2	2	1	1	4	2	1	1	1	Y	1	18	Y
PIC16F18045	14K	128	1024	Y/Y	18/Y	3/3	3/2	17/4	1	2/2	2	1	1	4	2	1	1	1	Y	1	18	Y
PIC16F18046	28K	256	2048	Y/Y	18/Y	3/3	3/2	17/4	1	2/2	2	1	1	4	2	1	1	1	Y	1	18	Y
PIC16F18054	7K	128	512	Y/Y	25/Y	3/3	3/2	24/4	1	2/2	2	1	1	4	2	1	1	1	Y	1	25	Y
PIC16F18055	14K	128	1024	Y/Y	25/Y	3/3	3/2	24/4	1	2/2	2	1	1	4	2	1	1	1	Y	1	25	Y
PIC16F18056	28K	256	2048	Y/Y	25/Y	3/3	3/2	24/4	1	2/2	2	1	1	4	2	1	1	1	Y	1	25	Y
PIC16F18074	7K	128	512	Y/Y	36/Y	3/3	3/2	35/4	1	2/2	2	1	1	4	2	1	1	1	Y	1	25	Y
PIC16F18075	14K	128	1024	Y/Y	36/Y	3/3	3/2	35/4	1	2/2	2	1	1	4	2	1	1	1	Y	1	25	Y
PIC16F18076	28K	256	2048	Y/Y	36/Y	3/3	3/2	35/4	1	2/2	2	1	1	4	2	1	1	1	Y	1	25	Y

**Notes:**

- Total I/O count includes one input-only pin ( $\overline{\text{MCLR}}$ ).
- Timer0 can be configured as either an 8 or 16-bit timer.

**Core Features**

- C Compiler Optimized RISC Architecture
- Operating Speed:
  - DC-32 MHz clock input
  - 125 ns minimum instruction time
- 16-Level Deep Hardware Stack
- Low-Current Power-on Reset (POR)
- Configurable Power-up Timer (PWRT)
- Brown-out Reset (BOR)
- Watchdog Timer (WDT)

**Memory**

- Up to 28 KB of Program Flash Memory
- Up to 2 KB of Data SRAM Memory
- Up to 256 Bytes of Data EEPROM Memory
- Memory Access Partition (MAP) with Program Flash Memory Partitioned into:
  - Application block
  - Boot block
  - Storage Area Flash (SAF) block

- Programmable Code Protection and Write Protection
- Device Information Area (DIA) Stores:
  - Fixed Voltage Reference (FVR) measurement data
  - Microchip Unique Identifier (MUI)
- Device Characteristics Information (DCI) Stores:
  - Program/erase row sizes
  - Pin count details
- Direct, Indirect, and Relative Addressing Modes

## Operating Characteristics

- Operating Voltage Range:
  - 1.8V to 5.5V
- Temperature Range:
  - Industrial: -40°C to 85°C
  - Extended: -40°C to 125°C

## Power-Saving Functionality

- Sleep:
  - Reduce device power consumption
  - Reduce system electrical noise while performing ADC conversions
- Low Power Mode Features:
  - Sleep:
    - < 900 nA typical @ 3V/25°C (WDT enabled)
    - < 600 nA typical @ 3V/25°C (WDT disabled)
  - Operating Current:
    - 48  $\mu$ A typical @ 32 kHz, 3V/25°C
    - < 1 mA typical @ 4 MHz, 5V/25°C

## Digital Peripherals

- Two Capture/Compare/PWM (CCP) Modules:
  - 16-bit resolution for Capture/Compare modes
  - 10-bit resolution for Pulse-Width Modulator (PWM) mode
- Three Pulse-Width Modulators (PWM):
  - 10-bit resolution
- Four Configurable Logic Cells (CLC):
  - Integrated combinational and sequential logic
- One Configurable 8/16-Bit Timer (TMR0)
- Two 16-Bit Timers (TMR1/3) with Gate Control
- Three 8-Bit Timers (TMR2/4/6) with Hardware Limit Timer (HLT)
- One Numerically Controlled Oscillator (NCO):
  - Generates true linear frequency control and increased frequency resolution
  - Input clock up to 64 MHz
- Up to Two Enhanced Universal Synchronous Asynchronous Receiver Transmitters (EUSART):
  - RS-232, RS-485, and LIN compatible

- Auto wake-up on Start
- Up to Two Host Synchronous Serial Ports (MSSP):
  - Serial Peripheral Interface (SPI) mode:
    - Client select synchronization
  - Inter-Integrated Circuit (I<sup>2</sup>C) mode:
    - 7/10-bit Addressing modes
- Peripheral Pin Select (PPS):
  - Enables pin mapping of digital I/O
- Device I/O Port Features:
  - Up to 35 I/O pins
  - One input-only pin
  - Individual I/O direction, open-drain, input threshold, slew rate, and weak pull-up control
  - Interrupt-on-Change (IOC) on up to 25 pins
  - One external interrupt pin

## Analog Peripherals

- Analog-to-Digital Converter with Computation (ADCC):
  - 10-bit resolution
  - Up to 35 external input channels
  - Four internal input channels
  - Internal ADC oscillator (ADCRC)
  - Operates in Sleep
  - Selectable auto-conversion trigger sources
- Charge Pump Module:
  - Improves accuracy of analog modules at low voltages
- 8-Bit Digital-to-Analog Converter (DAC):
  - Output available on one I/O pin
  - Internal connections to ADC and Comparators
- One Comparator (CMP):
  - Up to four external inputs
  - Configurable output polarity
  - External output via Peripheral Pin Select
- Zero-Cross Detect (ZCD):
  - Detect when AC signal on pin crosses ground
- Two Fixed Voltage References (FVR):
  - Selectable 1.024V, 2.048V, and 4.096V output levels
  - FVR1 internally connected to ADC
  - FVR2 internally connected to Comparator and DAC

## Clocking Structure

- High-Precision Internal Oscillator Block (HFINTOSC):
  - Selectable frequencies up to 32 MHz
  - $\pm 2\%$  at calibration

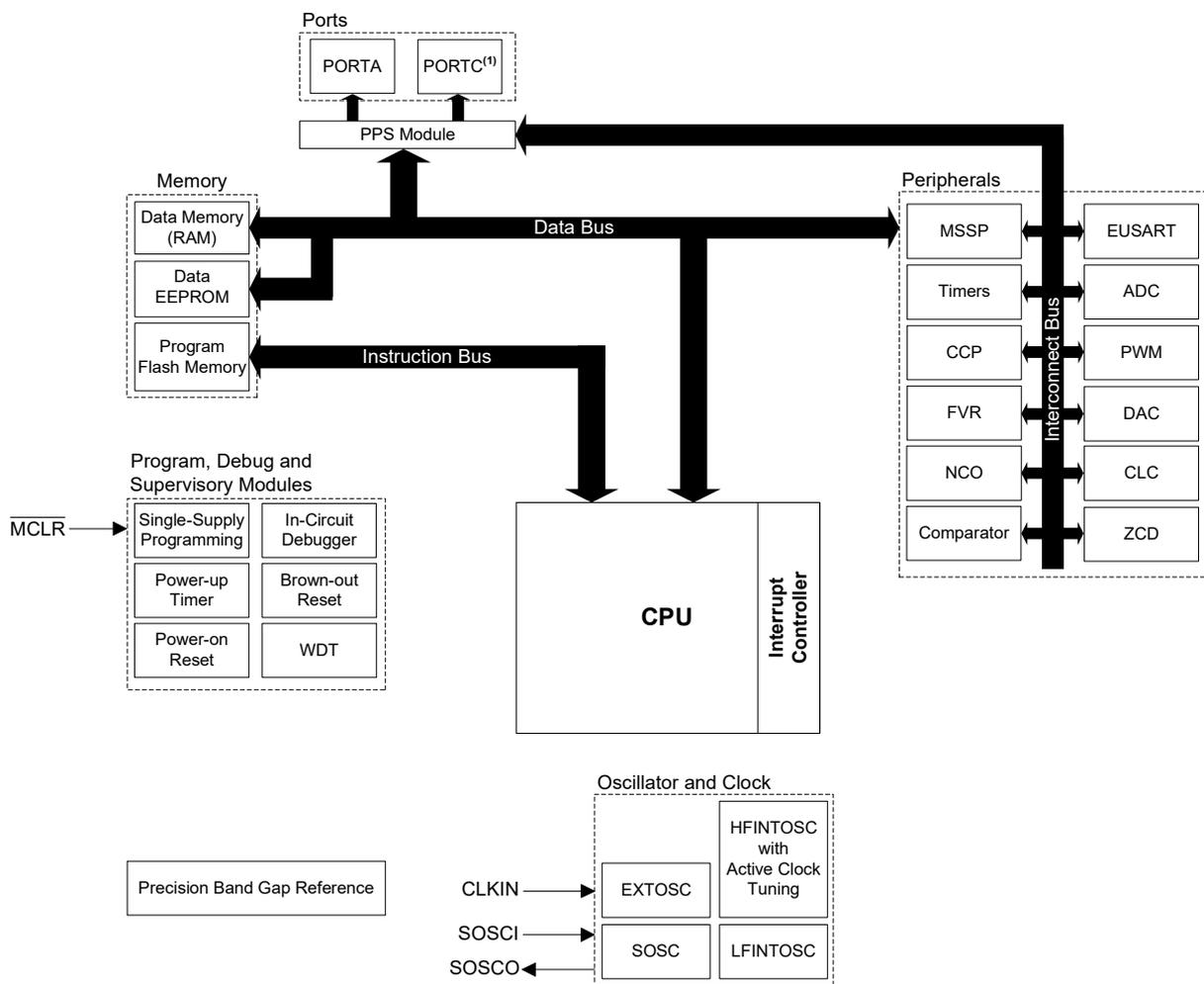
- Internal 31 kHz Oscillator (LFINTOSC)
- External High-Frequency Clock Input:
  - Two External Clock (EC) Power modes
- Secondary Oscillator (SOSC)

**Programming/Debug Features**

- In-Circuit Serial Programming™ (ICSP™) via Two Pins
- In-Circuit Debug (ICD) with Three Breakpoints via Two Pins
- Debug Integrated On-Chip

**Block Diagram**

Figure 1. PIC16F18013/14/23/24 Block Diagram



**Note:**

1. Available on 14-pin devices only.