

8-bit PIC® Microcontrollers



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**Command. Communicate. Control.**



*Flexible Intelligence for  
Embedded Applications*

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# Overview

## Get Ready to See a New World of 8-bit PIC® Microcontrollers

PIC microcontrollers are finding their way into new applications like solar battery chargers, advanced medical devices and solid state lighting. Microchip provides solutions for the entire performance range of 8-bit microcontrollers, with easy-to-use development tools, complete technical documentation, design-in and production support through a global sales and distribution network.



### The Industry's Broadest MCU Offering

There are over 800 8-bit PIC microcontrollers ranging from 6 to 100 pins and up to 128 KB Flash that are pin and code compatible across the portfolio. PIC microcontrollers with eXtreme Low Power (XLP) technology feature the world's lowest active and sleep power consumption with flexible power modes and wake-up sources. The MPLAB® X Integrated Development Environment (IDE) supports all PIC microcontrollers with XC Compiler support and common development boards.

### Peripherals, Performance, and Price Points for any Application

Peripheral integration is key with communication and control peripherals like SPI, I<sup>2</sup>C™, EUSART, PWM, ADC, DAC, op amps, as well as specialized peripherals for USB, LCD and Ethernet. In addition, Microchip offers Core Independent Peripherals that provide even higher levels of flexibility and integration than have never been possible in previous 8-bit microcontrollers. These new Core Independent Peripherals include Configurable Logic Cell (CLC), Complementary Output Generator (COG), Numerically Controlled Oscillator (NCO), Zero Cross Detect (ZCD) and Hardware CVD (Capacitive Voltage Divider). Customers have made PIC MCUs a worldwide standard, with over one million development systems shipped. PIC microcontrollers are quick and easy to design into a wide variety of applications and have a long history of dependable product delivery.

### Scalability & Migration

To provide customers a low-risk development environment, PIC microcontrollers offer seamless migration within the complete range of products. The 8-bit PIC microcontroller family is pin-compatible within a given pin count as well as code compatible between the architectures. Being able to migrate easily between various PIC MCUs allows flexibility to react to changing design requirements and feature enhancements. When you choose a Microchip solution, you maximize on the options for re-use in future product developments and preserve your investments in hardware, software and tools.

### Strength Through Design

In an effort to meet the needs of embedded system designers, silicon manufacturers continue to increase functionality and performance while decreasing the physical size and cost. This provides a significant benefit to both the embedded system designer and end consumer. However, as the demand for sophisticated consumer and embedded products continues to expand, so does the challenge of properly designing such applications.

As semiconductor technology continues to evolve to meet the demand for “smaller, faster and cheaper” solutions, the challenge to provide the key features and attributes needed for the latest embedded design grows. Microchip is committed to implementing technology advances that not only increase the performance and reduce the cost of the microcontroller, but do so without sacrificing key features such as:

- **5V:** As an 8-bit leader, we understand and will continue to support the need for 5V devices.
- **EEPROM:** A key requirement for many embedded designs, cost-effective implementation is critical.
- **Analog Integration:** A rich Analog offering available in a low-cost MCU is a must for many of today's embedded designs.
- **High Voltage Variants:** Allow for connection to an application that has high voltage rails without the need of an external regulator.
- **EMC:** Designed to minimize susceptibility to EMI/EMC, providing the most electrically durable solutions in the industry.

## Global Support

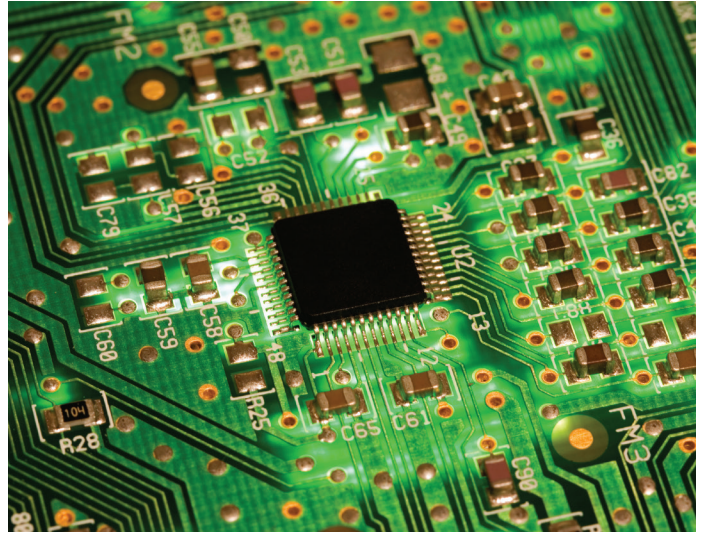
Microchip provides 24/7 global technical support via online and phone access to hundreds of dedicated field application engineers, more than 50 sales offices and our authorized distributor network. Microchip also offers standard code libraries, reference designs, application notes and seminars on-line and at Microchip Regional Training Centers.

[www.microchip.com/8bitresources](http://www.microchip.com/8bitresources)

## Trusted partner

While MCU core commonality is a trend, there are no “drop in” replacements. The reality of MCU selection is that you are entering into a partnership with your MCU supplier. To ensure success, technology leadership is critical, but it is equally important to work with a partner that is committed to strong business fundamentals such as:

- Financial security to weather any economic downturns
- Industry-leading lead times
- Industry-leading quality and reliability (ISO/TS-16949 qualified)
- Industry-leading EOL policy



## 8-bit PIC Microcontroller Key Highlights

### Core Independent Peripherals

- Configurable Logic Cell (CLC)
- Complementary Waveform/Output Generator (CWG/COG)
- Numerically Controlled Oscillator (NCO)
- Programmable Switch Mode Controller (PSMC)
- Signal Measurement Timer
- Hardware Limit Timer

### Faster Time-to-Market

- Free software
- Pin and code compatibility, easy migration
- Pre-programmed parts via Quick Turn Programming (QTP)
- MPLAB Code Configurator

### Intelligent Analog

- Rail-to-rail op amps
- Fast comparators
- 12b/10b/8b ADC
- 9b/8b/5b DAC
- Zero Cross Detect (ZCD)
- Slope Compensation

### Design Support

- Free MPLAB X Integrated Development Environment
- Free C Compilers
- Comprehensive technical documentation
- World-class 24/7 technical support and training

### Essential Features

- 5V+ operation
- EEPROM
- LCD, mTouch™ Sensing Solutions
- USB, CAN, Ethernet
- Analog Integration
- Peripheral Pin Select

### eXtreme Low Power (XLP)

- Active current as low as < 30  $\mu$ A/MHz
- Sleep current as low as < 10 nA
- Battery lifetime > 20 years

### Small Form Factors

- As small as 8-pin 2 × 3 UQFN and 28-pin 4 × 4 UQFN
- Many other package options available, e.g. 3 × 3 QFN, 5 × 5 UQFN, 0.5 mm z-dimension

### Safety Critical Features

- CRC and Memory Scan
- Windowed Watchdog Timer
- Hardware Limit Timer

# PIC MCUs with Core Independent Peripherals

## Core Independent Peripherals

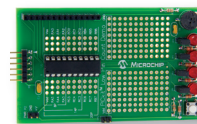
PIC microcontrollers with Core Independent Peripherals take 8-bit MCU performance to a new level. With a number of on-board modules designed to increase capability in any control system, these MCUs represent the best value in embedded design. The following Core Independent Peripherals are designed to handle their tasks with no code or supervision from the CPU to maintain operation. As a result, they simplify the implementation of complex control systems and give designers the flexibility to innovate.

- **CLC (Configurable Logic Cell):** Integrated combinational/sequential logic and interconnection/re-routing of digital peripherals
- **COG (Complementary Output Generator):** An extremely configurable waveform generator with programmable rising and falling edge events, precision dead band (5 ns), polarity, auto shut-down and phase control.
- **CWG (Complementary Waveform Generator):** Automated complementary output with control of key parameters such as dead-band and auto-shutdown states.
- **NCO (Numerically Controlled Oscillator):** Precision linear frequency generator with fine step resolution: < 1 Hz up to 500 KHz. Can also be used as a general purpose 20-bit timer/counter.
- **PSMC (Programmable Switch Mode Controller):** 16-bit PWM with dedicated 64 MHz clock source and event triggering. Features automated complementary output with control of key parameters such as phase, dead-band, blanking and auto shut-down states.
- **16-bit PWM:** High resolution 16-bit PWM with edge and center aligned modes for reduced EMI. Can also be used as a general purpose 16-bit timer/counter.
- **SMT (Signal Measurement Timer):** 24-bit precision timer module providing accurate measurement of any digital signal including period, pulse width, frequency, duration and duty cycle. Can also be used as custom digital protocol decoder.
- **HLT (Hardware Limit Timer):** Hardware monitoring timer for missed periodic events and fault detection. Can also be used as a general purpose 8-bit timer/counter with external reset capabilities.



## Development Tools

### PICkit™ Low Pin Count Development Board (DM164130-9)



- Development board for 8, 14, 20-pin 8-bit PIC MCU
- Populated with PIC16F1829-I/P and ships with PIC18F14K22-I/P (20-pin) MCU
- This board package contains assembled board with area for prototyping circuits and bare board as well
- Software can be rewritten to accommodate new technologies

### PIC10F32X Development Board (AC103011)



- Populated with the PIC10F322 6-pin MCU
- Factory programmed with CWG, NCO and CLC demo software
- Prototype area for development purposes
- User's guide and source code available

## Featured Core Independent Peripherals Product Families

Superset Device	Pins	Flash/RAM Family Range	Analog (Max)	Timers/PWM (Max)	Comms (Max)	Core Independent Peripherals (Max)	Additional Features
PIC10F322	6	448–896B 64B	8-bit ADC (3)	8-bit (2), PWM (2)	–	CLC (1), CWG, NCO	–
PIC12F1572	8	1.75–3.5 KB 128–256 KB	Comp, 10-bit ADC (4), 5-bit DAC (1)	8-bit (2), 16-bit (4), PWM (3)	EUSART (1)	CWG, 16-bit PWM (3)	–
PIC16F1613	8–14	3.5 KB 256B	Comp (2), 10-bit ADC (8), ZCD	8-bit (4), 16-bit (1), PWM (2)	USB	CWG, SMT (2), HLT (3)	CRC/Scan, WWDT
PIC16F1509	8–14	1.75–14 KB 64–512B	Comp (2), 10-bit ADC (12), 5-bit DAC (1)	8-bit (2), 16-bit (1), PWM (4)	EUSART (1), SPI/I <sup>2</sup> C™ (1)	CLC (1), CWG, NCO	–
PIC16F1709	14–20	7–14 KB 256–1 KB	Comp (2), Op amp (2), 10-bit ADC (12), ZCD	8-bit (4), 16-bit (1), PWM (4)	EUSART (1), SPI/I <sup>2</sup> C (1)	CLC (3), COG	Peripheral Pin Select
PIC16F1719	28–40	7–28 KB 512–2KB	Comp (2), Op amp (2), 10-bit ADC (28), ZCD	8-bit (4), 16-bit (1), PWM (4)	EUSART (1), SPI/I <sup>2</sup> C (1)	CLC (4), COG, NCO	Peripheral Pin Select
PIC16F1789	28–40	3.5–28 KB 256–2 KB	Comp (4), Op amp (2), 10-bit ADC (14), 8-bit DAC (4)	8-bit (4), 16-bit (1), PWM (7)	EUSART (1), SPI/I <sup>2</sup> C (1)	PSMC (4)	EEPROM

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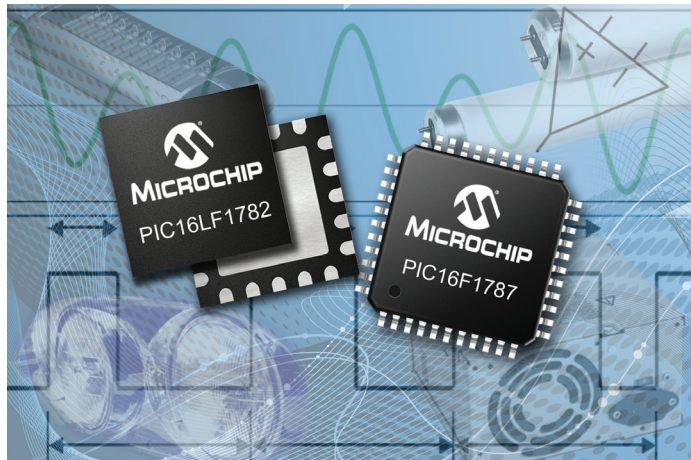
# PIC MCUs with Intelligent Analog

## Intelligent Analog

Microchip's Intelligent Analog solutions help you reduce your component count to design smaller, more cost-effective boards. You will benefit from simplified, higher-performance designs and easier procurement of components. In addition, using the MCU's programmable analog interconnects and programmability offers you increased flexibility and analog topology agility.

The following Analog Peripherals have been integrated to simplify your next design:

- **Op Amps:** A basic building block in electronic design. Integrating these basic building blocks into the microcontroller offers increased flexibility and reliability while reducing BOM costs and board space.
- **High Speed Comparators:** Comparators have been available in the PIC MCU lineup for many years. We now offer feature-rich high speed (50 nS) variants to enable faster response and more efficient closed-loop feedback designs.
- **High Current Sink/Source Pins:** High Current Sink/Source pins with the ability to sink/source 50 mA enable direct MOSFET drive from the microcontroller.
- **Conversion (Analog-to-Digital/Digital-to-Analog):** Within the 8-bit portfolio we provide a wide range of resolution and speed grades available to meet most embedded requirements.
- **Zero Cross Detect:** This peripheral is used to detect when an A/C signal crosses ground (0V when referenced to the rest of the system). Common uses include A/C period measurement and TRIAC control applications. It can also be used as part of an algorithm to help determine optimal periods when switching should occur to reduce application EMI.
- **Slope Compensation:** This integrated peripheral performs the slope compensation function for Peak Current Mode power supplies.



## Development Tools

### F1 PSMC 28-pin Evaluation Board (DM164130-10)



- PSMC development platform using the PIC16F1783
- Break-out headers for application development
- Connect to any F1 motor control add-on
- Prototyping area

### PICDEM™ Lab Development Kit (DM163045)



- Development platform for 6 to 20-pin parts
- Works across different architectures
- Includes comprehensive user guide, labs, and application examples
- Support for PICkit 3 and Expansion Headers

## Featured Core Independent Peripherals Product Families

Superset Device	Pins	Flash/RAM Family Range	Intelligent Analog (Max)	Timers/PWM (Max)	Comms (Max)	Core Independent Peripherals (Max)	Additional Features
PIC16F527	20	1.5 KB 68B	Comp (2), Op amp (2), 8-bit ADC (8)	8-bit (1)	–	–	EEPROM
PIC16F570	28	3 KB 64B	Comp (2), Op amp (2), 8-bit ADC (8)	8-bit (1)	–	–	EEPROM
PIC16F753	8–14	1.75–3.5 KB 64–128B	Comp (2), Op amp (2), 10-bit ADC (8), 9-bit DAC (1), Slope Comp	8-bit (3), 16-bit (1), PWM (1)	–	–	HV Shunt, High-current I/O
PIC16F1709	25–20	3.5–14 KB 256–1 KB	Comp (2), Op amp (2), 10-bit ADC (12), ZCD	8-bit (4), 16-bit (1), PWM (4)	EUSART (1), SPI/I <sup>2</sup> C™ (1)	CLC (3), COG	Peripheral Pin Select
PIC16F1719	28–40	7–28 KB 512–2 KB	Comp (2), Op amp (2), 10-bit ADC (28), ZCD	8-bit (4), 16-bit (1), PWM (4)	EUSART (1), SPI/I <sup>2</sup> C (1)	CLC (4), COG, NCO	Peripheral Pin Select
PIC16F1789	28–40	3.5–28 KB 256–2 KB	Comp (4), Op amp (2), 12-bit ADC (14), 8-bit DAC (4)	8-bit (4), 16-bit (1), PWM (7)	EUSART (1), SPI/I <sup>2</sup> C (1)	PSMC (4)	EEPROM

# Safety-Critical Features

## Summary

Engineers are commonly faced with the challenge of complying with safety standards or the need to add a fail-safe operation in their design, while keeping cost and complexity to a minimum. Additionally, Microchip offers a family of 8-bit MCUs which integrates fault-detecting hardware features to assist you in developing your safety-critical applications. This high level of integration makes these MCUs suitable for many applications like home appliances, industrial machinery, RPM indicators and power supplies.

The Window Watchdog Timer (WWDT), Cyclic Redundancy Check with Memory Scan (CRC/SCAN) and Hardware Limit Timer (HLT) help ease implementation of safety standards or fail-safe features. In addition, the higher-memory products include additional peripherals to support control and power management applications. By eliminating code overhead and external components, these features help reduce design complexity and save costs, while also enabling faster time-to-market.

## Highlights

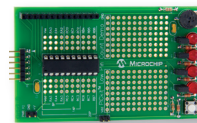
- **Cyclic Redundancy Check with Memory Scan (CRC/SCAN):** Automatically calculates CRC checksum of Program/DataEE memory for non-volatile memory integrity. Additionally provides a general purpose 16-bit CRC for use with memory and communications data. Monitoring is done in hardware with no interruption to the CPU, reducing overall code.
- **Windowed Watchdog Timer (WWDT):** System supervisory circuit that generates a reset when software timing anomalies are detected within a configurable critical window. Gives engineers the flexibility and ease to add monitoring to design.
- **24-bit Signal Measurement Timer (SMT):** Performs high-resolution measurements of any digital signal in hardware, resulting in more precise and accurate measurements. This can be used as a standard timer, ideal for speed control, range finding and RPM indicators.
- **Hardware Limit Timer (HLT):** General purpose 8-bit timer/counter with hardware monitoring capabilities for missed periodic events and fault detection of external hardware.



- **Zero Cross Detect (ZCD):** Detects high-voltage AC signals at the lowest crossing. Simplifies TRIAC and switching control, eliminating the need for additional components.
- **Complementary Waveform Generator (CWG):** Provides non-overlapping complementary waveforms for various inputs including Comparators and PWM, while offering enhanced features like deadband control, auto shutdown, auto reset, phase control, blanking control.
- **Capture Compare and PWM (CCP):** Includes a 10-bit PWM which can be utilized to implement a variety of motor control and lighting applications.

## Development Tools

### PICKIT Low Pin Count Development Board (DM164130-9)



- Development board for 8, 14, 20-pin 8-bit PIC MCU
- Populated with PIC16F1829-I/P and ships with PIC18F14K22-I/P (20-pin) MCU
- This board package contains assembled board with area for prototyping circuits and bare board as well
- Software can be rewritten to accommodate new technologies

## Featured 8-bit MCUs with Safety-Critical Features

Device	Program Memory (Kbytes)	Data SRAM (bytes)	I/O Pins	8/16-bit Timers	Comparators	10-bit ADC (ch)	Zero Cross Detector	CCP/10-bit PWM	CWG	CLC	SMT/HLT	Angular Timer	Window Watchdog Timer	CRC + Memory Scan	Math Accelerator	PPS	EUSART	I <sup>2</sup> C™/SPI
PIC12(L)F1612	3.5	256	6	4/1	1	4	1	2/0	1	0	2/1	0	✓	✓	0	-	0	0
PIC16(L)F1613	3.5	256	12	4/1	2	8	1	2/0	1	0	2/1	0	✓	✓	0	-	0	0

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# PIC Microcontrollers with XLP Technology

## eXtreme Low Power (XLP) Technology

- Sleep currents down to 9 nA
- Active Mode currents down to 30  $\mu\text{A}/\text{MHz}$
- Execution Efficiency with more than 80% PIC MCU single cycle instructions
- Execute code smarter, sleep longer, maximize battery life
- Wake-up sources including RTC, WDT, BOR, Interrupts, Reset or POR

## Low Power Peripheral Integration

Many of today's low power products need advanced peripherals. Microchip offers low power devices with peripherals like USB, LCD and mTouch capacitive sensing. This eliminates the need for additional parts in the application, which saves cost, current and complexity.

## Low Power Reliability

In addition to peripherals, products with XLP have system supervisory circuits specially designed for battery powered products.

- Watchdog Timer down to 200 nA, provides protection against system failure
- Real-Time Clock/Calendar down to 400 nA, provides precise timekeeping
- Brown-out Reset down to 45 nA, protects as batteries are depleted or changed

## Battery Life Estimator

The XLP Battery Life Estimator is a free software utility to aid you in developing eXtreme Low Power applications with Microchip's PIC MCUs featuring XLP technology.

- Profile your application Run and Sleep time (duty cycle)
- Select operating temperature and operating voltage
- Pre-loaded with most common battery specifications  
[www.microchip.com/BLE](http://www.microchip.com/BLE)



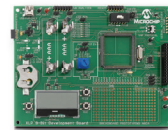
## Run from a Single Battery

The MCP1623/4 and MCP1640 Synchronous Boost Regulators enable single-cell battery applications, ideal for small, portable and lightweight applications.

- Power any PIC MCU down to 0.35V
- Provides 2–5.5V fixed/stable output voltage

## Development Tools

### XLP 8-bit Development Board (DM240313)



- Supports PIC16 and PIC18 devices
- LCD and buttons
- Flexible power options
- Expansion connector
- Current measurement points

## Featured XLP Product Families

Superset Device	Pins	Flash (KB)	Sleep (nA)	Active ( $\mu\text{A}/\text{MHz}$ )	Special Features
PIC16F727	20–44	3.4–14	20	55	–
PIC16F1509	20	7–14	25	30	CLC, CWG, NCO
PIC16F1613	8–14	3.5	50	32	Safety critical and core independent peripherals
PIC16F1709	14–20	3.5–14	50	32	Intelligent analog and core independent peripherals
PIC16F1719	28–40	7–28	50	32	Intelligent analog and core independent peripherals
PIC16F1789	28–40	3.5–28	50	32	Intelligent analog and core independent peripherals
PIC16F1829	8–20	3.5–14	20	55	–
PIC18F1947	28–64	7–28	60	55	LCD
PIC18F46K20	28–40	8–64	50	138	–
PIC18F87K22	20–80	8–128	9	197	–

All numbers are typical values, sleep numbers refer to the lowest power Sleep mode available on each family.

# PIC Microcontrollers with mTouch Technology

## Touch Sensing

Touch sensing has become an alternative to traditional push-buttons and switches providing:

- Lower cost of manufacturing and assembly
- Elegant and stylish designs
- Increased reliability with fewer moving parts
- Proximity-sensitive human interfaces

Microchip's mTouch Sensing Solutions allow you to integrate touch sensing with application code in a single microcontroller, reducing total system cost. Microchip offers a broad portfolio of low-power, low-cost and flexible solutions for keys/sliders and touch screen controllers. Get to market faster using our easy GUI-based tools, free source code and low-cost development tools.

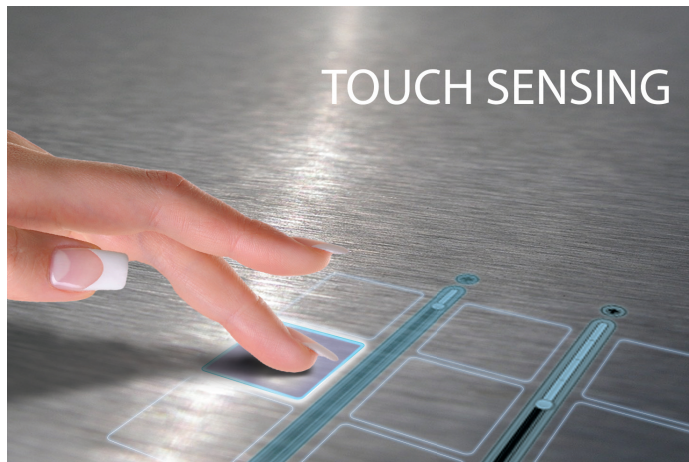
## Keys, Sliders, Wheels and Proximity Detection

- Industry's lowest-power touch sense solutions
  - Capacitive sensing in less than 5  $\mu\text{A}$
  - Proximity sensing down to less than 1  $\mu\text{A}$
- No external components
- Works through plastic, glass and metal surfaces
- Waterproof designs for all weather conditions
- High noise robustness
- Integrated peripherals such as USB, segmented and graphical LCD modules for true human interface system-on-a-chip
- Free software library simplifies implementation and source code puts you in control

## Capacitive Voltage Divider (CVD)

CVD is a charge/voltage based technique to measure relative capacitance on a pin using only the ADC.

- Software implementation
- 8, 16, and 32-bit support
- Proximity sensing support
- Low temperature dependence
- Low  $V_{DD}$  Dependence
- Minimal hardware requirements
- Low-frequency noise rejection
- Metal over cap compatible

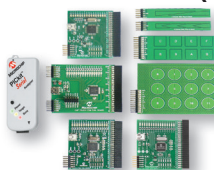


## Hardware CVD

Hardware CVD (HCVD) has been implemented on some of our new devices providing automated capacitive touch sampling, thereby reducing code size and decreasing CPU usage.

## Development Tools

### Enhanced mTouch Capacitive Evaluation Kit (DM183026-2)



- Features PIC16F, PIC18F, PIC24F and PIC32F
- Includes 8 buttons, matrix and sliders daughter boards
- GUI for easy configuration and real time data monitoring

### Metal Over Cap Accessory Kit (AC183026)



- For use with the DM183026-2
- 1 daughter board featuring stainless steel cover
- 1 daughter board featuring a plastic cover

## Featured HCVD Product Families

Device	Pins	Flash/RAM	HCVD	Voltage (V)	Additional Features
PIC12LF1552	8	3.5 KB 256B	✓	1.8–3.6	10-bit ADC (4), SPI/I <sup>2</sup> C™
PIC16LF1554	14	7 KB 256B	✓	1.8–3.6	10-bit ADC (11), EUSART, SPI/I <sup>2</sup> C
PIC16LF1559	20	14 KB 512B	✓	1.8–3.6	10-bit ADC (17), EUSART, SPI/I <sup>2</sup> C

Software CVD available on all PIC MCUs with ADC

[www.microchip.com/mtouch](http://www.microchip.com/mtouch)



# PIC Microcontrollers with LCD

## Segmented Displays

Segmented displays are used in a wide variety of applications, ranging from meters to portable medical devices to thermostats to exercise equipment. PIC MCUs with integrated LCD drivers can directly drive segmented displays with letters, numbers, characters and icons. The main features of Microchip's LCD portfolio include:

- Flexible LCD segments
  - 28 pins: up to 72 segments
  - 44 pins: up to 116 segments
  - 64 pins: up to 184 segments
  - 80 pins: up to 192 segments
  - 100 pins: up to 480 segments
- Variable clock inputs
- Integrated voltage bias generation
- Direct drive for both 3V and 5V powered displays
- Software contrast control for boosting or dimming for different temperature or lighting conditions
- Drive LCD while conserving power in Sleep mode
- Integrated real time clock and calendar for displaying time and date information
- mTouch capacitive touch sensing capability
- Crystal-free USB 2.0 options





## Direct Drive for Segmented Displays

The LCD PIC microcontrollers support direct LCD panel drive capability with no external components needed, lowering total system cost. They have integrated voltage bias generation which allows the MCU to generate the different voltage levels that are required to drive the LCD segment pins and provide good contrast for the display. The LCD MCUs support a range of fixed and variable bias options as well as variable clock inputs, giving you the flexibility to work with many different glass vendors.

## Contrast Control

Software contrast control is a key feature using firmware to either boost or dim the contrast of the display. Boost the contrast up to  $V_{DD}$  or beyond if you are using one of the MCUs with an integrated charge pump. Software contrast control allows you to vary the contrast on the LCD to account for different operating conditions such as temperature, lighting and humidity. Also, software contrast control can be invaluable for portable applications. As the battery level starts to drop, the firmware can apply a boost to the contrast helping extend the battery life while still producing a crisp image on the display.

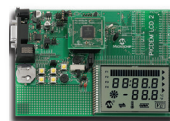
## Featured LCD Product Families

Superset Device	Pins	Flash (KB)	Max Segments	Voltage (V)	Additional Features
 PIC16LF1907	28–40	3.5–14	116	1.8–3.6	10-bit ADC, EUSART
 PIC16(L)F1947	28–64	7–28	184	1.8–5.5	10-bit ADC, EEPROM, I <sup>2</sup> C™, SPI, Comparators
 PIC18F87K90	64–80	32–128	192	1.8–5.5	10-bit ADC, EEPROM, I <sup>2</sup> C, SPI, RTCC, Comparators, ECCP
 PIC18F97J94	64–100	32–128	480	2–3.6	Crystal-free USB, V <sub>BAT</sub> , 12-bit ADC, ECCP, EUSART, I <sup>2</sup> C, SPI, Comparators



## Development Tools

### PICDEM LCD 2 Demo Board (DM163030)



- Illustrates and supports the main features of Microchip's 28-, 40-, 64- and 80-pin LCD PIC microcontrollers
- LCD glass with icons, numbers, alphanumeric and starburst display
- Separate Processor Plug-in Modules (PIMs) are available to evaluate all of the LCD products
- Booster capability for contrast control and dimming

### LCD Explorer Development Board (DM240314)



- Supports PIC24 and PIC18 LCD PIC MCUs with XLP technology
- Current measurement terminals, mTouch sensing solutions and expansion connector
- Eight common LCD glass types
- Supports 1/3 biasing
- CTMU switch to showcase touch sensing
- Four switches implemented for software demonstration
- Power the board using 9V power supply, USB connector, two AAA batteries or connector for V<sub>BAT</sub> current measurement

### PIC18F97J94 PIM Demo Board (MA180034)



- Features 100-pin PIC18F97J94 for evaluation of all 100-, 80- and 64-pin PIC18F97J94 LCD/USB/General Purpose MCUs
- Plugs into LCD Explorer Board (DM240314) for additional functionality
- Contains code examples

# PIC Microcontrollers with Integrated USB

## USB

USB communication is growing in popularity for remote upgrades, downloading data and other portable serial communication applications. Microchip's USB PIC MCUs bring the benefits of full-speed USB to a broad range of embedded designs that can operate in various environments and locations, enabling easy access to other USB devices such as printers, handheld devices or PCs.

### Full-Speed USB 2.0 (Device)

Microchip offers USB solutions capable of full-speed USB operation with the PIC16 and PIC18 family of devices. If USB On-The-Go is a requirement we have solutions in our 16 and 32 bit families.

### Crystal-Free USB

USB communication requires 48 MHz with 0.25% accuracy over temperature. This is typically done with an external crystal and an internal USB. We have recently implemented technologies that allow a crystal-free implementation with the following benefits:

- Lower BOM cost
- Tiny PCB footprint
- Simplified design
- More robust solution

### Free USB Software

Microchip has software to support USB on 8, 16 and 32-bit MCUs. This software is royalty-free source code and also includes sample projects. The 8-bit family supports USB device mode with full-speed operation. Additional software support includes full C and RTOS development environments. Included within this USB Framework Library is Microchip's USB Framework Configuration Tool.

- Generates configuration files with just a few clicks
- Royalty-free source code
- Firmware projects and USB drivers for the PC

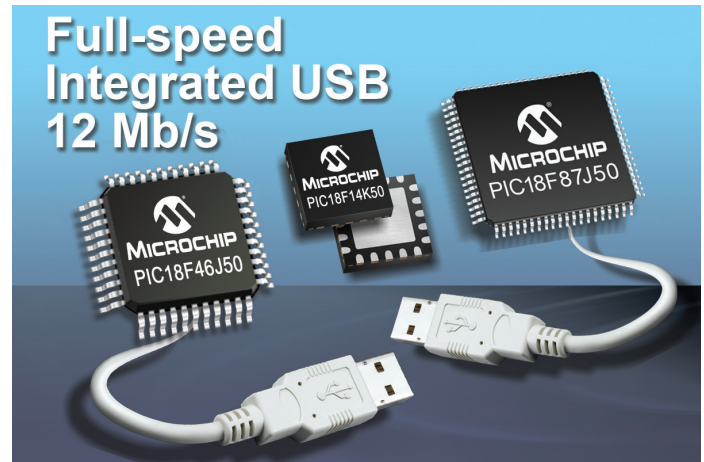
### Add USB to any PIC MCU with EUSART

The MCP2200 is a stand-alone USB to EUSART serial converter that enables full-speed USB connectivity in applications containing a EUSART interface. The MCP2200 has 256 bytes of EEPROM and eight general purpose I/O. It offers a simple plug-and-play solution, allowing USB connectivity with very little design effort.

## Featured Crystal-Free Product Families

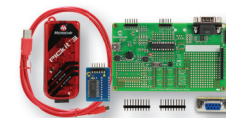
Superset Device	Pins	Flash (KB)	Voltage (V)	Crystal-Free	Additional Features
 PIC16(L)F1459	14–20	14	1.8–5.5	✓	CWG, 10-bit ADC, DAC, I <sup>2</sup> C™, SPI, EUSART
 PIC18(L)F45K50	28–44	16–32	1.8–5.5	✓	10-bit ADC, Comparators, ECCP, EUSART, SPI, I <sup>2</sup> C
 PIC18F97J94	64–100	32–128	2–3.6	✓	V <sub>BAT</sub> , 12-bit ADC, LCD, ECCP, EUSART, I <sup>2</sup> C, SPI, Comparators

[www.microchip.com/usb](http://www.microchip.com/usb)



## Development Tools

### Low Pin Count USB Development Kit (DV164139-2/DM164127-2)



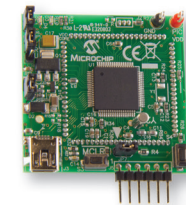
- Development platform for 14 and 20-pin USB MCUs
- For evaluation of PIC16F145X and PIC18F14K50/13K50 20-pin USB MCUs
- Contains hardware, software and code examples
- Self-directed course and lab materials

### PICDEM Full-Speed USB Demo Kit (DM163025-1)



- Evaluation platform for PIC18F2X/4XK50 family of USB MCUs
- Full speed USB 2.0 device without the need for an external crystal
- Populated with the PIC18F45K50

### PIC18F87J94 PIM Demo Board (MA180033)



- Features 80-pin PIC18F87J94 MCU for evaluation of all 80- and 64-pin PIC18F97J94 USB/LCD/General Purpose MCUs
- Can be used with PIC18 Explorer Board (DM183032) for additional functionality
- Contains code examples

# PIC Microcontrollers with Ethernet

## Embedded Ethernet

Microchip addresses the growing demand for embedded Ethernet products with the ENC624J600, ENC424J600 and ENC28J60 as standalone Ethernet controllers, and the PIC18F97J60 family, which are IEEE 802.3™ compliant and fully compatible with 10/100/1000Base-T networks. Microchip's Ethernet solution also includes a free and robust TCP/IP stack optimized for PIC microcontroller and dsPIC® digital signal controller families ([www.microchip.com/tcpip](http://www.microchip.com/tcpip)).

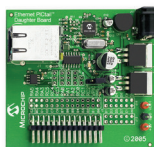
## Development Tools

### PICDEM.net™ 2 Development Board (DM163024)



- Supports ENC28J60 and PIC18F97J60 devices
- Can be developed as web server

### PICtail™ Ethernet Daughter Board (AC164121)



- Can be plugged to any of the PIC18 demonstration boards
- Populated with ENC28J60
- Interfaces to RJ-45 female connector

## Featured Ethernet Product Families

Superset Device	Pins	MCU + Ethernet	Integrated MAC + PHY	Interface	Hardware Security	Pre-programmed MAC	Additional Features
PIC18F97J90	64–100	✓	✓ (10 Base-T)	–	–	–	IEEE 802.3™ compliant, Auto-negotiation, Configurable buffer
ENC28J60	28	–	✓ (10 Base-T)	SPI	–	–	
ENC624J600	44–64	–	✓ (10/100 Base-T)	SPI/Parallel	✓	✓	

[www.microchip.com/ethernet](http://www.microchip.com/ethernet)

# PIC Microcontrollers with CAN & LIN

## Controller Area Network (CAN)

Microchip offers a complete line of 8-, 16- and 32-bit MCUs to meet the needs of high-performance embedded applications using the CAN bus. On-chip peripherals include A/D converters, comparators, motor control PWMs, USART (RS485, RS232, LIN) and Master I<sup>2</sup>C/SPI.

### Microchip's Enhanced CAN Module

- Supports CAN 1.2, CAN 2.0A and CAN 2.0B protocols
- DeviceNet data bytes filter support
- Standard and extended data frames
- 0–8 bytes data length
- Three modes of operation:
  - Mode 0: Legacy mode
  - Mode 1: Enhanced Legacy mode with DeviceNet support
  - Mode 2: FIFO mode with DeviceNet support
- Six buffers programmable as Rx/Tx buffers

## Featured CAN and LIN Product Families

Superset Device	Pins	Flash (KB)	CAN Tx Buffers	CAN Rx Buffers	LIN Tx Rx	Voltage (V)	Additional Features
PIC18F4685	28–44	16–96	3	2	–	2–5.5	LIN USART
PIC18F66K80	28–64	32–64	3	2	–	1.8–5.5	LIN USART
PIC16F1829LIN	14	8K	–	–	Integrated	2.3–5.5	LIN USART

## Local Interconnect Network (LIN)

Microchip offers a LIN compatible USART on a wide variety of microcontrollers. We have recently taken our LIN offering to a new level by offering microcontrollers with integrated LIN transceivers.

[www.microchip.com/can](http://www.microchip.com/can)  
[www.microchip.com/lin](http://www.microchip.com/lin)

## Support

Microchip is committed to supporting its customers in developing products faster and more efficiently. We maintain a worldwide network of field applications engineers and technical support ready to provide product and system assistance. In addition, the following service areas are available at [www.microchip.com](http://www.microchip.com):

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