



## 8-bit PIC® Microcontroller Solutions

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### Lead (Pb)-Free Packaging

Microchip has converted from tin-lead (SnPb)-plated product packaging to lead (Pb)-free product packaging across the entire portfolio of PIC® microcontrollers, dsPIC® digital signal controllers, serial EEPROMs, stand-alone analog and other devices. This enables our customers to achieve compliance with new regulations around the world such as the European Union Restrictions on Hazardous Substances in Electrical and Electronic Equipment (RoHS) directive.

**Microchip Technology**, a leading provider of microcontroller and analog semiconductors, offers complete embedded control solutions that combine time-to-market advantages with high performance and increased functionality. Microchip's broad family of 8-bit microcontrollers features a proprietary RISC-based architecture and is marketed under the PIC microcontroller brand name.

## THE MICROCHIP ADVANTAGE

With more than 350 microcontrollers in the product portfolio, Microchip can provide solutions for the entire performance range of 8-bit microcontrollers. The PIC microcontroller solution features a powerful architecture, flexible memory technologies, comprehensive easy-to-use development tools, complete technical documentation and post design-in support through a worldwide sales and distribution network.

Microchip's proprietary PIC microcontrollers have quickly become a worldwide standard with over four billion devices shipped and more than 500,000 development systems delivered since 1990. Microchip is recognized as the #1 supplier of 8-bit microcontrollers, based on worldwide unit shipments\*.

### Low-Risk Product Development

PIC microcontrollers achieve low-risk product development by providing seamless program size expansion. Pin compatibility facilitates drop-in replacements of package types as well as variations of reprogrammable (Flash) and one-time programmable (OTP) program memories without having to completely re-write code.

Microchip's MPLAB® Integrated Development Environment (IDE), a simple yet powerful development environment, supports low-risk product development by providing a complete management solution for all development systems in one tool. Whether programming a 6 or 100-pin device, learn and utilize one environment for all PIC microcontroller design activities.

### Faster Time to Market

Microchip's seamless migration path with standard pin schemes and code compatibility allows engineers to reuse verified code and a proven printed circuit board layout. Adding higher memory options, incremental I/O and analog peripherals can be accomplished without losing their software investment, reducing time to market.

### Lower Total System Cost

A broad product portfolio allows Microchip to offer engineers an appropriate integration of both analog and digital peripherals, ranging from simple digital to sophisticated analog modules. These integrated peripherals minimize component count and thereby lower total system cost while increasing reliability. Microchip's flexible Flash and OTP memory options streamline product development and promote even greater cost savings.

### Dependable Delivery and Quality

Microchip has a long history of providing dependable product delivery. The Company's quality systems for semiconductor products are ISO/TS-16949: 2002 certified, and the quality system for development tools is designed, manufactured and certified to ISO-9001:2000.

### Outstanding Support

Microchip's 24/7 global technical support line offers technical support resources any time help is needed. Also available are hundreds of dedicated field applications engineers located in more than 50 sales offices and through authorized distributors worldwide. Standard code libraries, reference designs, application notes and seminars are offered online and at Microchip Regional Training Centers. These options support the demands of a diversified customer base and a wide range of end product applications.

\*Gartner Dataquest, 2003 Microcontroller Market Share & Unit Shipments, Tom Starnes, June 2003

Microchip's 8-bit PIC microcontrollers provide the performance required for 4, 8 and 16-bit microcontroller applications. Microchip's PIC microcontrollers, available in 6 to 100-pin packages, offer the best price/performance ratio in the industry. Flexible memory technologies such as Flash, OTP, read-only memory (ROM) and ROM-less ensure an ideal PIC microcontroller for any application.

## PIC® MICROCONTROLLER OVERVIEW

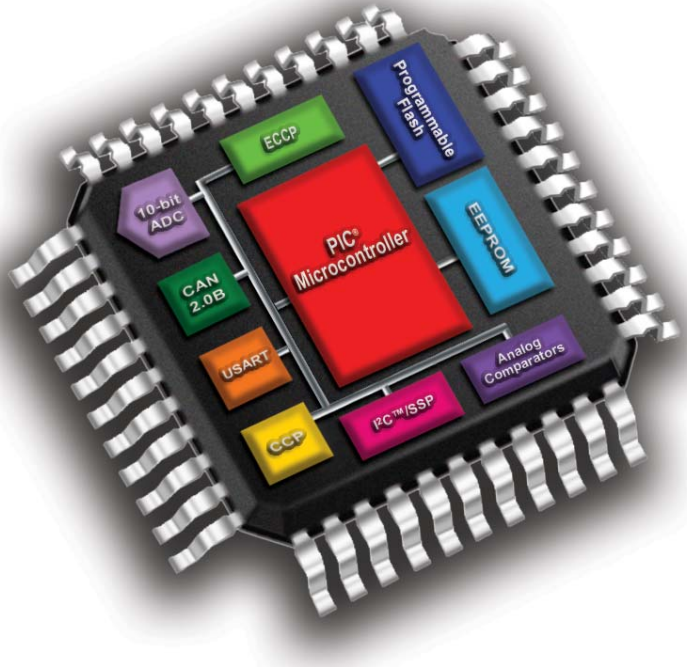
### RISC-based Architecture

The 8-bit PIC microcontroller architecture is based on a modified Harvard RISC instruction set that provides an easy migration path from 6 to 100 pin and from 384 bytes to 128 Kbytes of program memory.

By combining RISC features with a modified Harvard dual-bus architecture, Microchip's fast and flexible 10-16 MIPS PIC18F core is the most popular architecture for new microcontroller designs. A simple instruction set and seamless migration between product families make PIC microcontrollers the logical choice for designs requiring flexibility and performance.

### ADVANTAGES

- 12, 14 and 16-bit wide instructions are upward compatible and tailored to maximize processing efficiency and boost performance.
- Instructions and data are transferred on separate buses, avoiding processing bottlenecks and increasing overall system performance.
- Two-stage pipelining enables one instruction to be executed while the next instruction is fetched.
- Single wide word instructions increase software code efficiency and reduce required program memory.
- Programming and debugging tasks are easy to learn and perform with Microchip's simple instruction set.
- Upward device compatibility allows designers to retain their capital investment in code development and development tool resources.
- Diverse Flash memory offering provides industry standard to industry leading endurance and retention. Devices with the self-write option have the ability to remotely program and upgrade the MCU application in the field.
- Data EEPROM is an available option for those applications which require secure, non-volatile memory for data that changes frequently.



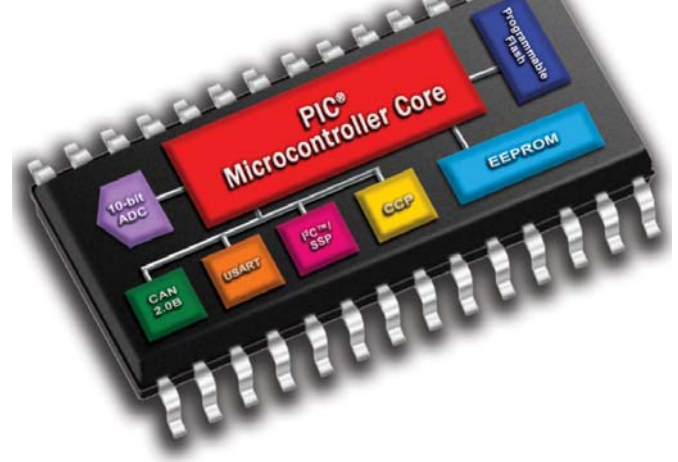
### ON-CHIP PERIPHERAL SET

PIC microcontrollers offer a wide range of products with broad on-chip peripheral features including:

- **Communications Peripherals and Protocols:**
  - RS-232/RS-485
  - SPI
  - I<sup>2</sup>C™
  - USB
  - Ethernet/TCP-IP
  - CAN
  - LIN
  - Radio frequency
- **Control and Timing Peripherals:**
  - Capture/Compare
  - Pulse Width Modulators (PWMs)
  - Counters/timers
  - Watchdog timers
- **Display Peripherals:**
  - LED drivers
  - LCD drivers
- **Analog Peripherals:**
  - Up to 12-bit analog-to-digital (A/D) converters
  - Comparators and op amps
  - Brown-out detectors
  - Low-voltage detectors
  - Temperature sensors
  - Oscillators
  - Voltage references
  - Digital-to-Analog (D/A) converters
  - Voltage regulators



Microchip offers flexible programming options that allow engineers to choose the most appropriate memory technology for their applications. These programming options address procurement issues by reducing and limiting work-in-process liability and facilitating finished goods code revisions. Microchip's worldwide distributors stock Flash and OTP device inventory, allowing designers to respond to immediate sales opportunities or accommodate engineering changes off the shelf.



## FLEXIBLE PROGRAMMING OPTIONS

### **In-Circuit Serial Programming™ (ICSP™) Technology**

Microchip's Flash and OTP PIC microcontrollers feature Microchip's proprietary ICSP capability. ICSP technology allows the microcontroller to be programmed after being placed on a circuit board, offering tremendous flexibility, reduced development time, increased manufacturing efficiency and improved time to market. This popular technology enables cost-reduced field upgrades, system calibration during manufacturing and the addition of unique identification codes to the system. Microchip offers the most non-intrusive programming methodology in the industry requiring only two I/O pins for most devices.

### **Self Programming**

Many of Microchip's Flash microcontroller families feature a self-programming capability. Self programming enables remote upgrades to the Flash program memory and the end equipment through a variety of mediums, ranging from Internet and modem to RF and infrared. Microchip's Self-Write Flash allows for easy code revisions in the end user's application.

### **One-Time Programmable (OTP)**

OTP PIC microcontrollers are manufactured in high volumes without specific software and can be shipped immediately for custom programming.

### **Quick-Turn Programming (QTP)**

Microchip offers a QTP programming service for factory production orders. This service is ideal for designers who choose not to program devices in their own factories and whose production code patterns have stabilized.

### **Serialized Quick-Turn Programming (SQTP<sup>SM</sup>)**

The SQTP service is a unique, flexible programming option that allows Microchip to program serialized, random or pseudo-random numbers into each device. Serial programming allows each device to have a unique number that can serve as an entry code, password or identification number.

### **Read-Only Memory (ROM)**

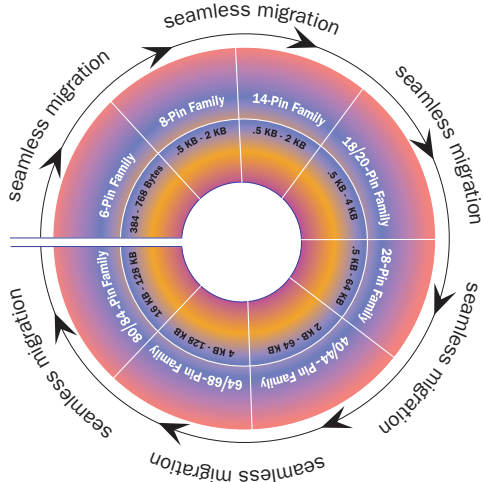
Microchip offers masked ROM versions of many of its most popular PIC microcontrollers, providing engineers with the lowest cost option for high-volume products with stable firmware.

*Compatibility is key to re-using and re-inventing PIC microcontroller designs. The standardized pin schemes of the PIC microcontroller families support building a code library not traditionally available from other suppliers. This unique feature provides socket, software and peripheral compatibility, making it possible for new features to be added to existing applications. Each pin is capable of accommodating several peripheral functions, allowing designers to add or swap functionality without changing the printed circuit board, thus minimizing or eliminating costly re-design.*

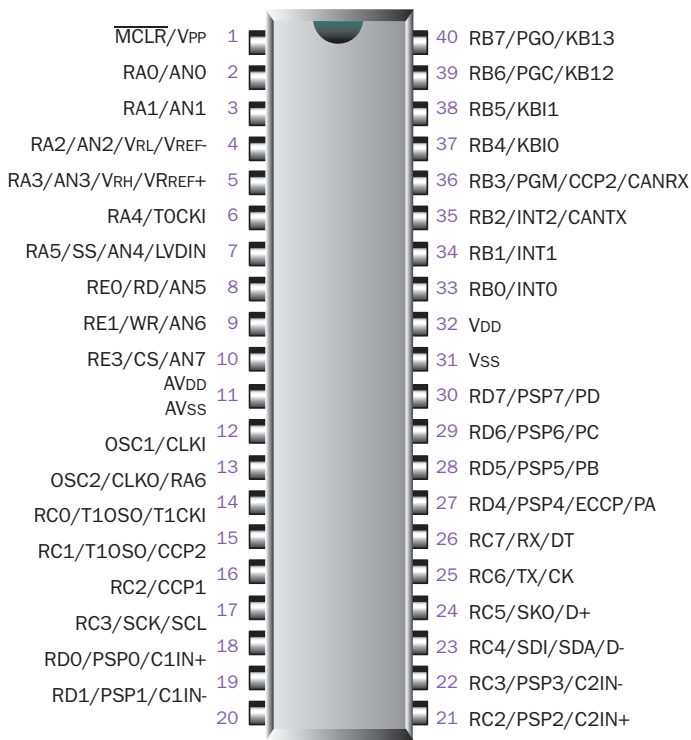
## PIC® MICROCONTROLLER MIGRATION STRATEGY

As part of an inherent strategy to offer customers a low-risk development environment, the PIC microcontroller family offers easy migration within the complete range of products. Migration between the different PIC microcontrollers enables several advantages such as future cost reductions, feature enhancements and late development changes with minimal impact to the existing hardware, software and the engineering development environment.

The PIC microcontroller family is pin compatible within a given pin count as well as code compatible between the different architectures. This offers a seamless migration path between the different PIC microcontrollers that protects investments made in software development and design tools.



## EXAMPLE OF PIC® MICROCONTROLLER MIGRATION



### Example device list:

PIC16C65	PIC18C442	2 KB ROM
PIC16C65B	PIC18C452	
PIC16C662	PIC18F4220	
PIC16C67	PIC18F4320	
PIC16C74B	PIC18F4331	
PIC16C765	PIC18F4420	
PIC16C77	PIC18F4431	
PIC16C774	PIC18F4480	
PIC16F74	PIC18F4520	
PIC16F747	PIC18F4580	
PIC16F77	PIC18F4685	
PIC16F777		
PIC16F871		
PIC16F874		
PIC16F874A		
PIC16F877		
PIC16F877A		
PIC16F914		
PIC16F917		

**128 KB Flash**

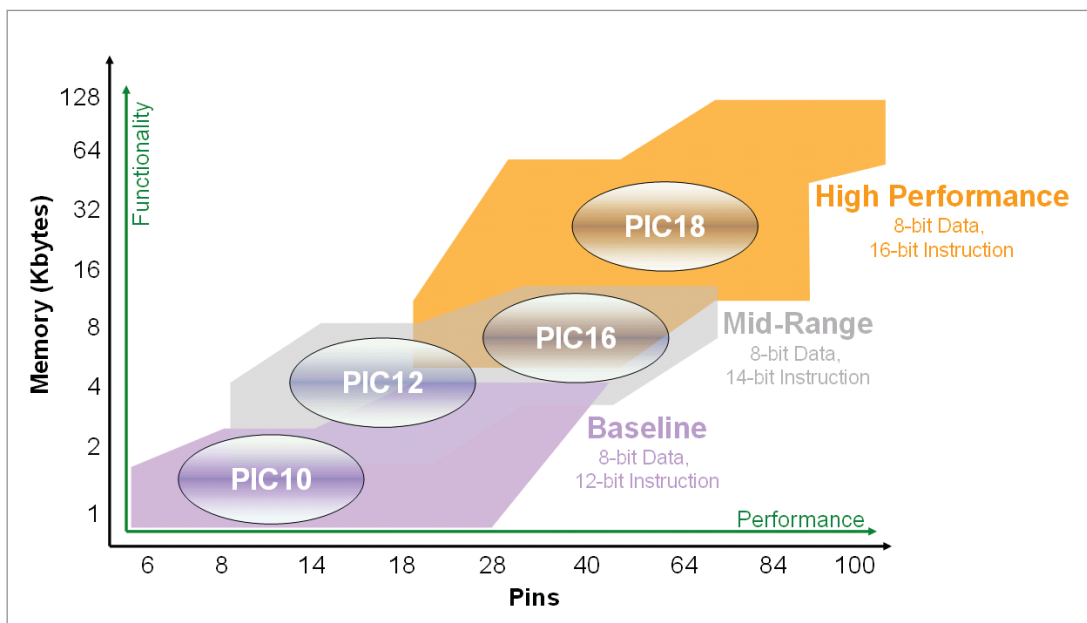
**Pin and Code Compatibility also for 8, 14, 18, 28, 64 and 80/84-pin packages**

Refer to the Microchip Advanced Part Selector (MAPS) for more migration path options: [www.microchip.com/maps](http://www.microchip.com/maps)

Microchip's 8-bit PIC microcontrollers fall into three product architecture categories providing a variety of options for any application requirement:

- **Baseline 8-bit Architecture:** 12-bit program word
- **Mid-Range 8-bit Architecture:** 14-bit program word
- **High Performance 8-bit Architecture:** 16-bit program word

## PIC® MICROCONTROLLER PRODUCT ARCHITECTURES



### BASELINE ARCHITECTURE

The Baseline Architecture includes the PIC10F family and portions of the PIC12 and PIC16 families. These devices utilize a 12-bit program word architecture with 6 to 28-pin package options. The concisely defined feature set of the Baseline Architecture enables the most cost-effective product solutions. A range of low operating voltages makes this architecture ideal for battery-operated applications.

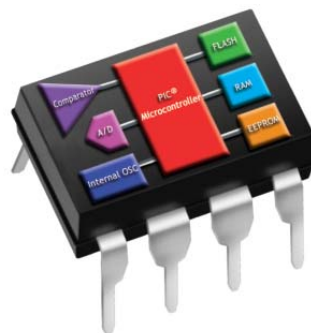
The PIC10F family is Microchip's latest addition to the product portfolio. The PIC10F200 series provides another industry first, an inexpensive 8-bit Flash microcontroller in a 6-pin package. With only six pins, they are extremely easy to use and have a short learning curve for anyone not experienced in designing with microcontrollers. In addition, they can be used for a number of design challenges not traditionally solved by a microcontroller.

The PIC12 family packs Microchip's powerful RISC-based PIC microcontroller 12-bit program word architecture into 8-pin DIP or SOIC packages with Flash or OTP program memory options.

The PIC16C5X and PIC16F5X are well-established Baseline products, offered in 14, 18, 20 and 28-pin SOIC and SSOP packages.

#### Baseline Product Features

- Low pin count and small form factor
- Flexible Flash program memory
- Low power capability
- Cost sensitive
- Ease of use

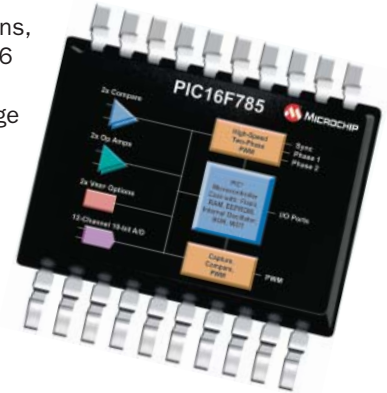


## MID-RANGE ARCHITECTURE

The Mid-Range Architecture includes members of the PIC12 and PIC16 families that feature a 14-bit program word architecture. These families are available with 8 to 64-pin package options.

The PIC microcontrollers featuring Microchip's Mid-Range 14-bit program word architecture are available in higher pin count packages with Flash and OTP program memory options. The Flash products offer an operating voltage range of 2.0V to 5.5V, small package footprints, interrupt handling, a deeper hardware stack, multiple A/D channels and EEPROM data memory. All of these features provide the Mid-Range microcontrollers with an intelligence level not previously available because of cost or size considerations.

The Mid-Range PIC16 devices offer a wide range of package options, as well as low-to-high levels of peripheral integration. These PIC16 devices feature various serial analog and digital peripherals, such as USB, SPI, I<sup>2</sup>C™, USART, LCD and A/D converters. The Mid-Range PIC16 microcontrollers have interrupt handling capability with an 8-level hardware stack.



### Mid-Range Product Features

- Expansive package offerings – 8 to 64 pins
- Flexible Flash program memory
- Low power capability
- Rich peripheral set
- 5 MIPS operating performance
- Optimal cost-to-performance ratio

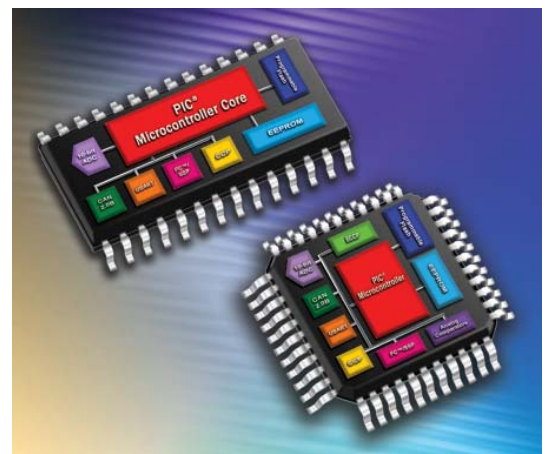
## HIGH PERFORMANCE ARCHITECTURE

Microchip's High Performance Architecture encompasses the PIC18 family of devices. These microcontrollers utilize a 16-bit program word architecture with 18 to 100-pin package options.

The PIC18 devices are high performance microcontrollers with integrated A/D converters. All PIC18 microcontrollers incorporate an advanced RISC architecture that supports Flash devices. The PIC18 has enhanced core features, 32 level-deep stack and multiple internal and external interrupts. The separate instruction and data buses of the Harvard architecture allow a 16-bit instruction word with separate 8-bit data. The two-stage instruction pipeline enables all instructions to execute in a single cycle, except for program branches, which require two cycles. A total of 79 instructions are available. The PIC18 family has special features such as integrated CAN or Ethernet control, to reduce external components, thus minimizing cost, enhancing system reliability and reducing power consumption. The PIC18 family builds on the foundation established by the other 8-bit PIC microcontrollers and provides engineers with a smooth, easy migration to these higher levels of performance and feature sets.

### High Performance Product Features

- Expansive package offerings – 18 to 100 pin
- Flexible Flash program memory, many devices with self-write capability
- Low power capability on devices with nanoWatt technology
- Linear program memory space up to 2 Mbytes
- 10-16 MIPS operating performance
- Hardware 8 x 8 multiplier
- Advanced communication peripherals and protocols (CAN, LIN, USB, ZigBee™ and TCP/IP)
- J-Series for competitive cost sensitive applications with high memory densities
- K-Series for new level of performance in 8-bit MCUs





To meet the increasing demand for integrated features coupled with processing capabilities in battery-powered products, Microchip's family of low power microcontrollers provides extensive power management options. These devices offer a cost-effective solution for intelligent systems that require extended battery life and energy-efficient operation.



# LOW-POWER nanoWatt TECHNOLOGY

## Microchip's nanoWatt Technology

Take control of overall system power consumption with Microchip's Power-Managed PIC microcontrollers featuring nanoWatt Technology.

Microchip's proprietary nanoWatt Technology provides industry leading low-power operating voltage ranges and flexible power-managed technology from DC up to 64 MHz.

## What is nanoWatt Technology?

nanoWatt Technology is Microchip's unique blend of process technology, design techniques and flexible power management features that give users the ability to design systems with extremely constrained power budgets.

Very often, the limiting factor in low power operation of any MCU is static current consumption. Microchip has developed its process technology and design methodologies to keep leakage current to a minimum. In fact, the typical PIC microcontroller with nanoWatt Technology draws less than 50 nano-amperes in Sleep mode.

Realizing that voltage is also a hurdle to reducing power consumption, Microchip has designed many of its nanoWatt Technology microcontrollers to be fully operable with any supply rated between 2 Volts and 5.5 Volts.

PIC microcontrollers with nanoWatt Technology support up to nine oscillator modes. These include the option to select from two typical internal clock sources – a software configurable 8 MHz oscillator for normal operation and a 31 KHz oscillator for use when low power consumption is a necessity. Clock frequency can be switched on the fly, allowing the user to transition between external clocks and the internal oscillators with no delay in code execution. A two-speed start-up feature takes advantage of this seamless transition by running from either of the internal oscillators while an external clock source stabilizes on start-up. After the external source has stabilized, the microcontroller automatically makes a clock switch, saving precious "up" time in applications with low power budgets.

nanoWatt Technology microcontrollers allow design engineers to fine tune their system power consumption with several new power managed modes. These include configurable Idle and Sleep modes that let designers tailor current consumption levels and clocking options to fit any power budget, as well as an Ultra Low Power Wake-up (ULPW) mode that drastically reduces current draw during wake-up.

nanoWatt Technology provides excellent intrinsic performance, combined with flexibility in supply voltage selection, clock frequency and power modes.

Complementing a broad portfolio of nanoWatt Technology PIC microcontrollers, Microchip also offers a wide range of low-power analog devices, enabling engineers to select a complete system power consumption solution from one source.

## FEATURED DEVELOPMENT TOOLS

### PICDEM™ Low Power Solutions Demonstration Board



The PICDEM™ Low Power Solutions Demonstration Board (DM163026) gives designers a convenient and fun way to explore the nanoWatt technology features of PIC microcontrollers within a functional ultrasonic range-finder application using the PIC18F4620.

This tool is ideal for learning nanoWatt Technology features and implementing system power reduction techniques. This board is part of the *Workshop-in-a-Box 2*, a complete nanoWatt Technology training kit designed for self-paced and instructor led training.

The Low Power Solutions Demonstration Board CD-ROM includes three self-paced, step-by-step lab exercises, using the PIC18F4620, which illustrate the following concepts:

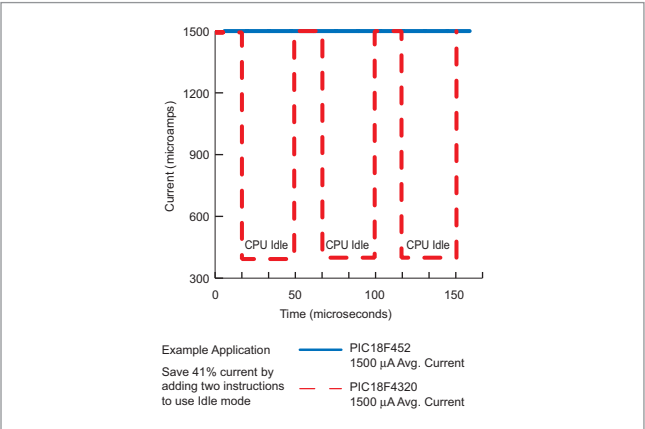
- nanoWatt Technology features to reduce power consumption
- Improving system power consumption
- Improving board performance

### PICDEM™ 4 Demonstration Board

The PICDEM™ 4 Demonstration Board (DM163014) provides a simple, low-cost learning tool for evaluating Microchip's Power-Managed PIC microcontrollers. The board supports PIC12F, PIC16F and PIC18F Flash microcontrollers in 8, 14 and 18-pin packages.



## Power-Saving Application Example



## APPLICATION EXAMPLES

Consumer	Communications	Industrial	Automotive	Appliance
Motion Detectors Thermostats Remote Controls Battery Management	Telephone Handsets Microphone Controls UART Replacements Handset Displays	Utility Metering Portable Instruments Data Acquisition Motor Control	Light Dimmers Intelligent Sensors Proximity Detectors Keyless Entry Tire Pressure Monitors	Refrigerator Control Units Smart Relays Delay Timers Temperature Sensors



## HIGH PIN COUNT, HIGH-DENSITY MEMORY



The high pin count, high-density memory, Flash PIC18F microcontroller family continues to expand, offering larger memory sizes, higher pin count packages, more communications interfaces and higher performance. These devices also feature socket, software and peripheral compatibility, providing scalability for complex embedded designs. The PIC18F family is ideally suited for applications requiring scalable large memory and higher pin counts, offering designers added I/Os, timers, a feature-rich peripheral set and the flexibility of field self-programmability with Flash program memory. The PIC18F microcontrollers can serve as cost-efficient solutions for general-purpose applications and for applications that are written in C, require an RTOS or use a complex communications protocol stack, such as TCP/IP, DeviceNet™ or ZigBee™ protocols.

The high pin count, high-density memory PIC18F family supports:

- LCD displays: up to 192 segments
- USB interfaces: speeds up to 12 Mbits/s
- CAN interfaces: CAN 2.0B Active
- LIN interfaces: LIN 1.2
- ZigBee™ technology capable: IEEE 802.15.4 transceiver and stack
- Ethernet capable: 10BASE-T, TCP/IP stack (integrated or standalone ethernet controller)
- PIC18 J-Series for cost sensitive applications

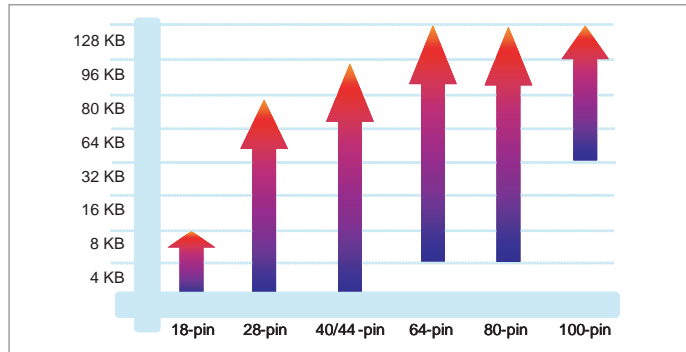
### APPLICATION EXAMPLES

Consumer	Medical	Industrial	Automotive	Appliance
Exercise Equipment Universal Remote Controls Toys/Games Security/Alarms Computer Peripherals Battery Chargers Spa Controls	Defibrillators Blood Pressure Monitors Glucose Monitors Diagnostic Equipment Biometrics Thermometers	Motion Control Uninterruptible Power Supplies HVAC Power Meters Factory Automation Security Data Loggers	Rain Sensors Windows/Locks/Doors Immobilizers Power Steering Tire Pressure Monitors Wiper Motor Controls Compasses	White Goods Robotic Controls HVAC Air Conditioners Thermostats Sensors Motor Control

### High Pin Count, High-Density Memory Microcontroller Features

- Up to four serial interfaces (2x EUSART, 2x I<sup>2</sup>C/SPI)
- Up to five timers/counters
- Up to five Capture/Compare/PWM (CCP) modules
- nanoWatt Technology Power Management
- Hardware 8 x 8 multiplier
- 40-64 MHz operation, 10-16 MIPS
- Flash program memory: up to 128 Kbytes
- EEPROM memory: up to 1 Kbyte
- RAM memory: up to 4 Kbytes
- I/O pins: range from 16 to 70
- Voltage ranges targeting 5V or 3V applications

### A Complete High Pin Count, High-Density Memory Solution



### FEATURED DEVELOPMENT TOOLS

#### PICDEM™ HPC Explorer Board



The PICDEM™ HPC Explorer Board (DM183022) is a low-cost tool ideally suited for evaluating the performance of Microchip's high memory and high pin count PIC18F 8-bit microcontrollers. This board can be used to demonstrate many PIC18F devices, including PIC18F8722 and PIC18F87J11 families.

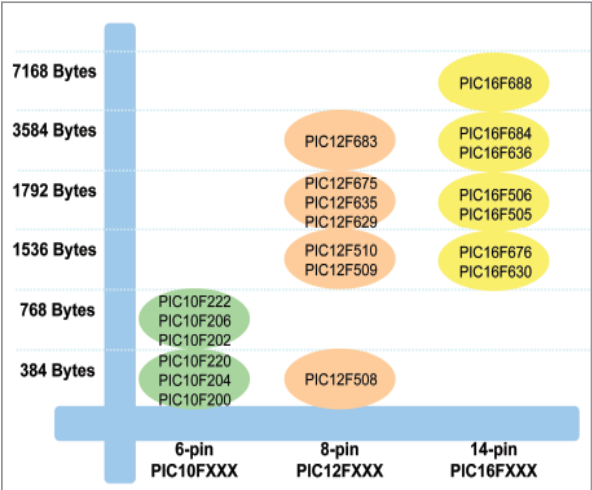
The MPLAB Visual Device Initializer (VDI) makes it easy to configure the PIC18F devices by simply dropping icons onto the chip diagram and setting up operational parameters in a dialog box. This tool graphically configures the microprocessor and peripherals and when complete, a mouse click generates code usable in assembly language or C programs.

- Refer to PIC18 Development Tool Overview: (DS39673)

Low pin count microcontrollers have emerged as one of the fundamental building blocks for any electronic application. Kitchen appliances, smoke detectors, toys, power supplies, security systems, PC motherboards and almost any other electronic device which people take for granted in their everyday lives can use a microcontroller as a primary building block in the design.

## LOW PIN COUNT AND SPACE-CONSTRAINED

### A Complete Low Pin Count Solution



Microchip offers the most complete family of low pin count Flash microcontrollers available. These devices range from easy-to-use 6-pin microcontrollers, which can replace discrete logic functions, to 20-pin microcontrollers with advanced analog and communications peripherals that can serve as the central processor in an application.

The 8-bit PIC microcontroller architecture is easy to learn, and users can readily move from the Baseline (x12) Architecture to the Mid-Range (x14) or High Performance (x16) Architectures as their design changes or as additional features are required, such as interrupts, additional memory or interfacing to advanced hardware peripherals.

### 6-Pin PIC® Microcontrollers

Microchip continues to push the limits of the 8-bit microcontroller with the PIC10F family of 6-pin microcontrollers. The family now consists of six members (PIC10F200, PIC10F202, PIC10F204, PIC10F206, PIC10F220 and PIC10F222) that offer 384 bytes to 768 bytes of Standard Flash program memory and 16 bytes to 24 bytes of data RAM memory. Current offerings include options with basic functionality as well as comparators or A/D converters.

While the PIC10F family is ideal for any space-constrained application, its combination of small form factor, high performance and extremely low cost is creating new applications for the PIC10F that are not traditionally served by microcontrollers:

**“Electronic Glue”** – Design in a PIC10F microcontroller from the start to accommodate bug fixes and last-minute changes. This can avoid costly and time-consuming silicon revisions or board changes.

**Logic Control** – Optimize board space and cost by incorporating a PIC10F microcontroller for logic control. A PIC10F allows implementation of a more complex solution and can take the place of passive discrete logic functions such as delays, smart gates, signal conditioning, simple state machines, encoders/decoders, etc. Get the latest product information at:

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

**Intelligent Disposable Electronics** – Given the small form factor and economical cost, the PIC10F family is ideal for many emerging “disposable” applications incorporating electronics intelligence, such as pregnancy testers, dialysis monitoring (blood sugar), drug testers and much more.

**Waveform Generation** – A PIC10F microcontroller can replace traditional 555 timers, PWMs, remote control encoders, pulse generation, programmable frequency source, resistor programmable oscillators and much more.

**“Mechatronics”/Mechanical Functions** – Replace traditional mechanical functions, such as smart switches, mode selectors, remote I/Os, timers, LED flashers and any other form of mechanical timers and switches with a PIC10F microcontroller, which provides the power and flexibility advantages of a microcontroller solution.

### FEATURED DEVELOPMENT TOOLS

#### PIC10F2XX Universal Programmer Adapter

The PIC10F2XX Universal Programmer Adapter (AC163020) provides PIC10F socket support for both the SOT-23 and DIP-8 packages. It allows interfacing to Microchip’s low cost family of programmers: PICKit™ 1, PICKit 2, MPLAB ICD 2, PICSTART® Plus and the BFMP

#### PIC10F2XX SOT-23 to DIP-8 Programmer Adapter

This Programmer Adapter Kit (AC163021) consists of five PIC10F206 SOT-23, five-pin scramble boards and DIP pins. Once assembled, this acts like a standard 8-pin DIP and can be used directly in standard development tool sockets. Note that the PIC10F 8-pin DIP pin-out is family specific and differs from the standard 8-pin DIP pin-out. This kit is NOT intended for production applications and should be used only as a method of early evaluation.



### APPLICATION EXAMPLES

Consumer	Communications	Industrial	Automotive	Appliance
Motion Detectors Thermostats Remote Controls Battery Management CO/Smoke Detectors Toys	Telephone Handsets Microphone Controls UART Replacements Handset Displays	Utility Metering Portable Instruments Data Acquisition Motor Control: stepper, fan control, brushless DC, AC induction, switched reluctance	Light Dimmers Intelligent Sensors Proximity Detectors Keyless Entry Tire Pressure Monitors Dash Controllers Seat Controllers	Refrigerator Control Units Smart Relays Delay Timers Temperature Sensors

*The vast majority of modern 8-bit embedded designs require microcontrollers that are capable of performing an unprecedented variety of tasks. Integrated serial communications interfaces, replacement of antiquated components and motor control capability are now “must haves” on many engineers’ shopping lists. Microchip’s latest Mid-Range product families provide the features to meet the demands of today’s systems.*

## MEDIUM PIN COUNT: 20, 28 and 40-PIN PLAYERS IN EMBEDDED CONTROL



Many embedded systems have evolved from being single-function “islands of control” to multi-dimensional entities that perform a number of tasks and are capable of communicating with other systems if needed. For example, today’s Uninterruptible Power

Supplies (UPS) require a level of control that allow them to monitor and intelligently adapt to changing power conditions, self-diagnose problems, maintain historical data and communicate with other UPS units or master controllers. Quite often, a single microcontroller is used to handle all of these tasks due to system cost or board space constraints. Microchip’s latest 20, 28 and 40-pin Mid-Range families aim to satisfy these demands.

The **PIC16F690 family** (PIC16F690/689/687/685/677/631) is the industry’s most comprehensive 20-pin family of microcontrollers, with six variants ranging from 3.5K to 14 Kbytes of Enhanced Flash, up to 256 bytes of RAM, and a mix of peripherals including EUSART, CCP and onboard analog comparators. These devices are well suited for designers with applications that need more code space or I/O than 14-pin variants supply, and are looking to increase system performance and code efficiency by employing hardware motor control and communications capability. The PIC16F690 family brings features normally found on more expensive microcontrollers into cost-sensitive applications, with special attention on providing the right feature set at the right price point. As an example, the PIC16F677 is the industry’s lowest cost microcontroller with hardware I<sup>2</sup>C™ capability.

The **PIC16F887 family** (PIC16F887/886/884/883/882) is Microchip’s latest 28 and 40/44-pin Mid-Range product offering. The five devices in the family are available with 3.5K, 7K or 14K of self-write Flash memory, up to 256 bytes of data EEPROM and up to 368 bytes of RAM. All feature 10-bit ADC, dual comparators, Master SSP/Master I<sup>2</sup>C, EUSART and ECCP. The PIC16F887 family is an excellent choice for systems whose control code fits within a small footprint, but require more extensive communication or actuation capability than 8-bit microcontrollers traditionally offer.

### Continuous Product Improvement

Microchip continues to increase the functionality and performance of its products with each successive generation, providing features that help simplify the design of embedded control systems. The PIC16F690 and PIC16F887 families share several enhancements that make designing control architectures for multi-dimensional, interconnected systems easier.

#### ■ Enhanced Hardware Serial Communications

It is often necessary to interface the main microcontroller with external memories, digital sensor ICs, display devices or other controllers in a system. Our EUSART and SSP/Master SSP peripherals can be configured to use many of the communication protocols commonly found in embedded applications, giving users flexibility while saving cost and code space.

#### ■ Advanced Analog Peripherals

Our 10-bit ADCs have the precision necessary to eliminate the added cost of external ADCs from your system. In addition, new dual comparators with S/R Latch mode can be used to replace 555 timers, simple op-amps, delta-sigma ADCs and other analog functions normally available in external ICs.

#### ■ In-Circuit Debugging

Fine tune the control code on your target board with any member of the PIC16F690 or PIC16F887 families. “Debug Mode” uses minimal hardware resources and saves engineers both time and cost.

#### ■ Miniaturized Package Options

The 4x4 mm 20-pin QFN (690 family), 6x6 mm 28-pin QFN, and the 8x8 mm 44-pin QFN (887 family) allow designers to squeeze high levels of performance into space-constrained applications.

### APPLICATION EXAMPLES

Consumer	Communications	Industrial	Automotive	Appliance
Uninterruptible Power Supplies (UPS) “Networked” Smoke Detectors Home Automation Controller E-Bike Controller Swimming Pool Alarm	RFID Tag Reader Telecom Base Station	Remote Flow Meter Commercial Deep Fryer Gate Opener	LED Lighting Control Power Management Module Cooling Fan Control Tire Pressure Monitor Receiver	Corded Drill Electrical Relay



The first PIC microcontroller of its kind, the 14-pin PIC16F616 provides an increased feature set inclusive of comparators with controllable hysteresis. High voltage variations are also available and provide an integrated shunt voltage regulator making it ideal for cost-sensitive applications. The PIC16HV616 offers the ability to run as low as 2.0V and up to an unspecified user-defined maximum voltage.

## PIC® MICROCONTROLLERS WITH HIGH VOLTAGE SUPPORT AND FAN CONTROL CAPABILITIES



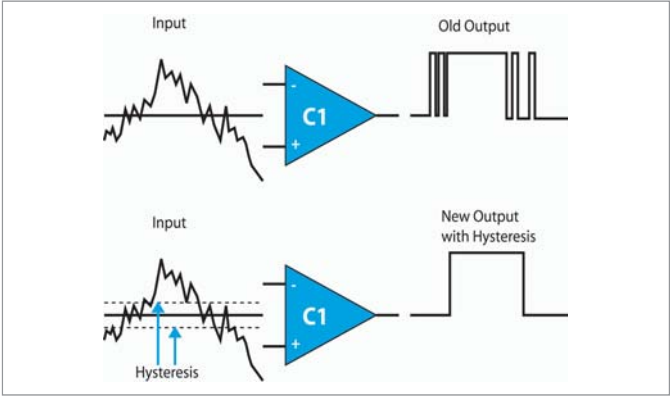
Designing the simplest solution to a complex problem such as fan/motor control on a system board is often challenging. Microchip simplifies both design and implementation with the new PIC16F616 and PIC16F785 microcontrollers.

Both devices are also available as high voltage variations, PIC16HV616 and PIC16HV785, providing an integrated shunt voltage regulator allowing high voltage support. Both offer the ability to run as low as 2.0V, and up to an unspecified user-defined maximum voltage. These high voltage variations are ideal for cost-sensitive applications with high voltage power rails, as they eliminate the additional expense required in stepping down the input voltage.

As with most PIC microcontrollers, the PIC16F616 and PIC16F785, as well as the high voltage variants, can easily be utilized in a wide array of general purpose applications. Additional unique features do however make them particularly well suited for focused applications such as motor or fan control. The comparators on the PIC16F616 and PIC16HV616 are steerable and designed with greater hysteresis, providing the ability to use a Hall effect sensor for speed monitoring of a fan or motor.

Due to the differential signaling of the Hall effect sensor, traditional comparators do not always provide the ability to accurately translate the varying frequency of the Hall effect sensor into a manageable digital signal. With the addition of hysteresis, these newly designed comparators will in effect provide a trigger window and ultimately greater ease in such translations. This paired with the integrated PWM makes these products a robust fan-control solution that is more cost effective and flexible than traditional dedicated fan control methods. For those not wanting or requiring the hysteresis, the ability to shut this down and use as a traditional comparator is also provided. Get the latest product information at: [www.microchip.com/STARTNOW](http://www.microchip.com/STARTNOW).

### Comparator with Hysteresis (PIC16F616 and PIC16HV616)



### Microchip's Fan Control Solution

#### Component Cost Savings Versus Traditional Methods

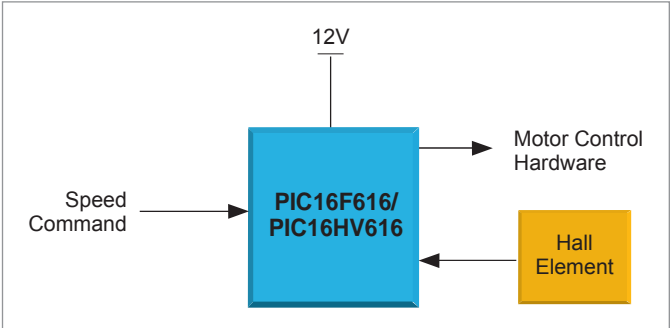
- Voltage regulator
- Input signal conditioning
- Hall effect sensor

#### System Advantages

- Cost effective
- Supports direct 12V power supply through integrated shunt regulator
- Meets latest industry fan control specifications
- Easily upgraded and customized
- Simplicity through reduction in component count
- Can interface directly to a Hall effect element

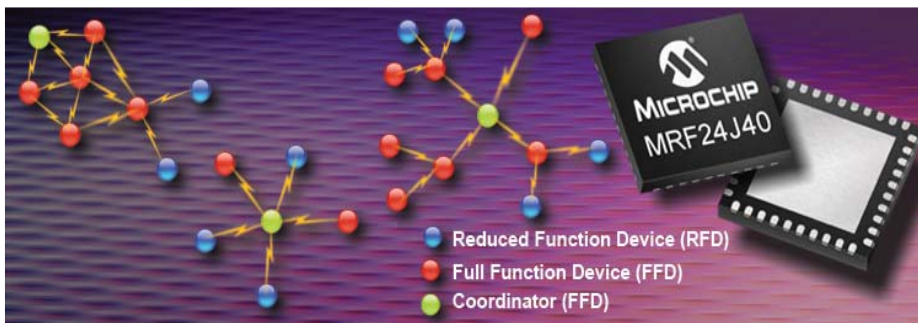
In addition, Microchip offers a full line of fan controllers and fan fault detectors.

#### Fan Control Solution



### APPLICATION EXAMPLES

Consumer	Industrial	Automotive	Appliance
Personal Computers Battery Chargers	Fan Control Motor Control Power Supplies	Power Windows Interior Light Dimmer Controls Keyless Entry Seat Controls	Blenders Toasters Power Drills



Wireless Transceiver	MCU to support ZigBee™	MCU to support MiWi™
MRF25J40	Any PIC18, PIC24 or dsPIC® DSC with >32 KB program memory*	Any PIC16, PIC18, PIC24 or dsPIC® DSC with >4 KB program memory*

\*Program memory sizes depend on desired configuration.

Microchip offers the MRF24J40 wireless transceiver for ZigBee™ or MiWi™ connectivity in embedded applications. Use this transceiver with a PIC® microcontroller to pair the MRF24J40 803.15.4 wireless transceiver with over 300 Microchip MCUs to make an easy wireless network. The highly integrated MRF24J40 is IEEE 802.15.4 compliant and supports both ZigBee and MiWi protocols. The low-power MRF24J40 comes in a small 40-pin QFN package. Microchip provides free protocol stacks for both ZigBee and MiWi applications.



Microchip offers a free ZigBee software stack, enabling lower development and system costs. The Microchip stack was written to meet the ZigBee industry standard and ensure interoperability. Designers can now download Microchip's Free ZigBee stack at: [www.microchip.com/zigbee](http://www.microchip.com/zigbee).

#### Features:

- Industry standard, interoperable
- Supports 65k nodes and infinite hops
- Protocol stack ideal for running on PIC18, PIC24 MCUs or dsPIC DSCs (>32 KB program memory)



Developed by Microchip, the MiWi™ protocol is a simple wireless protocol designed for low data rate, short distance, cost constrained networks. The MiWi stack can be downloaded for free at: [www.microchip.com/miwi](http://www.microchip.com/miwi).

#### Features:

- Proprietary standard, small networks
- Supports 1k nodes, 4 hops
- Compact code size ideal for PIC16
- PIC18, PIC24 or dsPIC DSCs (>4 KB flash)

## APPLICATION EXAMPLES

Building Control	Security/Alarm	Automotive	Consumer	Medical	Meter
HVAC Thermostats Lighting Control Window Coverings Digital Door Phone	Building Security Systems Fire Safety Equipment Swimming Pool Alarm Wireless Monitoring/ Electronic Alarms	Obstacle Warning System Vehicle Tracking Device Motor-Home RF Communication Emergency Vehicle Lighting	Mobile Gaming Consumer Gaming Child/Student Tracker Remote Control	Medical Dispensing Maternity Ward Monitor Biomedical Sensors Monitoring	Flow Meter for Bar Taps Pre-Payment Metering

## DEVELOPMENT TOOLS

### PICDEM™ Z 2.4 GHz Development Kit (DM163027-4)

- 2x MRF24J40 daughter cards
- Antenna reference design
- 2x PICDEM Z boards
- ZENA™ Network Analyzer board
- CD ROM with documentation



Note: the MRF24J40 daughter card (AC163027-4) and the ZENA Network Analyzer board (DM183023) can also be purchased separately.

### ZENA™ NETWORK ANALYZER

The ZENA Network Analyzer (DM183023) tool is a wireless network analyzer that graphically displays wireless network traffic following the IEEE 802.15.4 specification on the 2.4 GHz band. The ZENA analyzer supports both the ZigBee and MiWi protocols. In conjunction with the hardware packet sniffer, the software can analyze complete network traffic and graphically display decoded packets. It can also display a graphical representation of the network topology and the messages as they flow through the network. This information can then be saved and/or exported for further analysis. Debugging a wireless network without the



ZENA analyzer is like trying to debug a circuit without an oscilloscope. If you are developing with either the ZigBee or the MiWi protocol, the ZENA analyzer is an essential development tool.

Integrated segmented LCD drivers are ideal for embedded control applications that need to communicate with and display relevant information to the outside world. Many applications can benefit from cost-effective LCD control modules within a Flash-based PIC® microcontroller.

## PIC® MICROCONTROLLERS WITH AN INTEGRATED LCD MODULE



Microchip supports several families of microcontrollers with on-chip LCD driver control including the Mid-Range PIC16 and High Performance PIC18 families. The breadth of LCD segment drivers, package sizes and integrated features for embedded control application gives the designer flexibility to create different solutions based on the demand of varying market segments all from a single design.

### High Performance LCD Solutions

The PIC18F8490 and PIC18F85J90 families of LCD microcontrollers offer greater memory density and higher pin counts to meet the demands of more complex segmented LCD applications with features including:

- 128-192 LCD segments
- 8-32 Kbytes Flash program memory
- Low-power nanoWatt Technology
- Advanced instruction set optimized for code efficiency, performance and use with C
- Internal oscillator for flexible clock system, fail safe clock
- Integrated analog peripherals such as A/D converters and comparators
- I<sup>2</sup>C™/SPI/UART serial communications
- 64 and 80-pin package options
- PIC18F85J90 family include LCD voltage boost regulator

LCD PIC® Microcontrollers		
High Performance		Mid-Range
PIC18F6390	PIC18F8390	PIC16F913
PIC18F63J90	PIC18F83J90	PIC16F914
PIC18F6490	PIC18F8490	PIC16F916
PIC18F64J90	PIC18F84J90	PIC16F917
PIC18F65J90	PIC18F85J90	PIC16F946

### Mid-Range LCD Solutions

The PIC16F913/914/916/917/946 LCD microcontrollers provide a strong balance between price and LCD pixel count.

The PIC16F913/914/916/917/946 feature set includes:

- 60-168 LCD segments
- 7/14 Kbytes Flash program memory
- 256 bytes data EEPROM
- Low-power nanoWatt Technology
- 35 easy-to-learn instructions
- 32 kHz to 8 MHz internal oscillator for flexible clock system, fail safe clock
- Integrated analog peripherals such as A/D converters and comparators
- I<sup>2</sup>C/SPI/AUSART serial communications

### FEATURED DEVELOPMENT TOOLS



#### PICDEM™ LCD 2 Demonstration Board

The PICDEM LCD 2 Development Board (DM163030) is available featuring the PIC18F85J90. There are plug-in modules available for evaluating the PIC18F8490, PIC16F917 and

PIC16F946 families. This board has battery operation with a 3V button cell and features 3V LCD glass with icons, numbers and support for alphanumeric and starburst display. The booster capability also supports contrast control and dimming. Parts are pre-programmed with demonstration software.

#### PICDEM™ LCD Plug-In Modules

The PICDEM LCD Plug-In Module (MA160011) allows easy development on the LCD demonstration board with PIC16F913/914/916/917/946 microcontrollers.

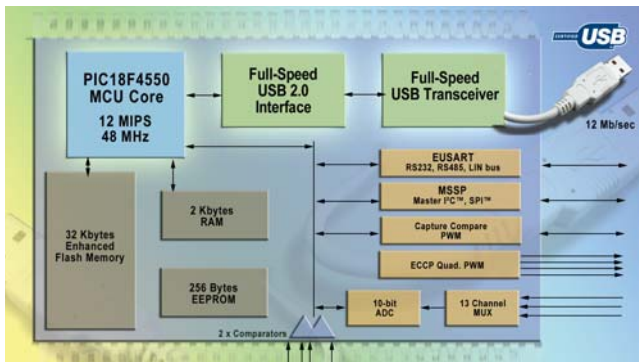
For more information visit: [www.microchip.com/LCD](http://www.microchip.com/LCD).

### APPLICATION EXAMPLES

Consumer	Medical	Industrial	Automotive	Appliance
Thermostat Battery Management Sprinkler Controller Security System Exercise Equipment Baby Alarm Lawnmower Clock Radio	Temperature Reader Fertility Computer Drug Injector Nurse Call System Medical Pump	Utility Meter Portable Instruments Data Acquisition Gasoline Pump Air Conditioner Payment System Gas Detection Solar Power Measurement	Dashboard Tire Pressure Sensor Battery Vehicle Display Audio System	Refrigerator Stove/Oven Microwave Coffee Maker Bread Maker Washing Machine Clothes Dryer



## PIC® MICROCONTROLLERS WITH INTEGRATED USB



Microchip offers USB solutions capable of full-speed USB operation (up to 12 Mbits/s) in a new PIC18F family of devices, as well as low-speed operation (1 Mbits/s) in PIC16C devices.

### Full-Speed USB 2.0: PIC18FXX5X

USB communication is growing in popularity for remote upgrades, downloading data and other applications requiring portable serial communication. Microchip's full-speed USB PIC microcontrollers, including the PIC18F4550, PIC18F4450 and PIC18F87J50 families, bring the benefits of full-speed USB to a broad range of embedded applications. These devices can operate in various environments and locations, enabling easy access to other USB devices such as printers, handheld devices or computers. No need to become an expert in USB drivers to get your old serial port application up and running with our free USB drivers.

The USB family of microcontrollers offer:

- Performance: 12 MIPS
- Memory
  - 16 to 128 Kbytes Enhanced Flash
  - Up to 4 KB Data RAM
- Analog Features
  - 10-bit A/D converter
  - Two analog comparators
- Communication features
  - Up to 2 SPI/I<sup>2</sup>C™
  - Up to 2 UART
  - Up to 5 PWM
- Some with Parallel Master Port

USB PIC® Microcontrollers		
Low-Speed	Full-Speed	
PIC16C745 PIC16C765	PIC18F2450 PIC18F2455 PIC18F2550 PIC18F4450 PIC18F4455 PIC18F4550	PIC18F65J50 PIC18F66J50 PIC18F66J55 PIC18F67J50 PIC18F85J50 PIC18F86J50 PIC18F86J55 PIC18F87J50

### Low-Speed USB: PIC16C745/765

Microchip also offers CMOS OTP-based 8-bit microcontrollers in 28 and 40-pin packages that are certified for the low-speed USB standard.

The PIC16C745/765 offer:

- 5 channel, 8-bit A/D converters
- Universal Asynchronous Receiver Transmitter (USART) (also known as the Serial Communication Interface)
- Easy adaptability for PC-related peripherals, as well as UPS, joysticks and medical applications

### FEATURED DEVELOPMENT TOOLS

#### PICDEM™ Full-Speed USB Demonstration Board



The PICDEM FS-USB (DM163025) is a demonstration and evaluation board for the PIC18F4550 family of Flash microcontrollers with full-speed USB 2.0 interface. The board contains a PIC18F4550 microcontroller in a 44-pin TQFP package, representing the superset for the 28 and 40/44-pin PIC18 USB devices.

In addition, a Full-Speed USB Plug-in Module (MA180021) features the PIC18F87J50 and can be used either as a stand-alone demo board or as a plug-in to the PIC18 HPC Explorer board for evaluating the 64/80-pin PIC18 USB devices.

Download free USB drivers and bootloader as well as application notes at: [www.microchip.com/USB](http://www.microchip.com/USB).

### APPLICATION EXAMPLES

Consumer	Medical	Industrial	Automotive	Battery Powered
Business Card Scanners White-board Digitizers Voice Recorders Uninterruptible Power Supplies MP3 Players Fire Alarms Security-system Programmers	Voice-activated Applications Advanced Wheel Chairs Research Equipment Automation	Manufacturing Tools Data Loggers Smart Displays Micro Fuel Cells Gambling-machine Peripheral RFID Readers Robot Controllers Industrial Timers Gas-flow Analyzers	Vehicle Network Buses Diagnostic Tools Vehicle Trace Recorders Ultrasonic Sensors	Handheld Tools Sensors Security Applications Remote Controls Home Automation

The advantages of Ethernet connectivity for data distribution, remote monitoring and remote control of embedded applications are widely acknowledged. Ethernet's infrastructure, performance, interoperability, scalability and ease of development are unrivaled among communication standards. Microchip is unveiling embedded Ethernet solutions that meet market demands and requirements.

## PIC® MICROCONTROLLERS WITH ETHERNET CAPABILITIES



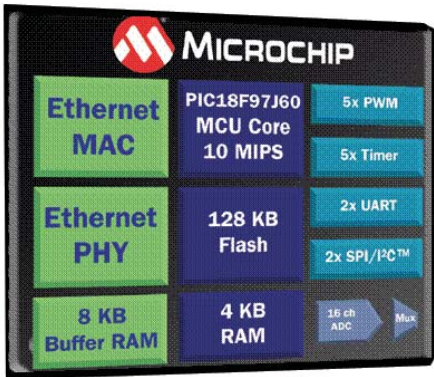
Microchip offers Ethernet solutions designed specifically for the embedded control market, capable of 10 Mbps. In addition to the single chip PIC18F microcontroller with integrated Ethernet MAC and PHY, a stand alone

Ethernet controller can be matched with many PIC microcontrollers for additional flexibility. No matter the application requirement, Microchip offers cost-effective, easy-to-use solutions for remote communication with embedded applications. Combined with Microchip's free TCP/IP software stack, a complete Ethernet solution is provided for adding remote monitoring and control to embedded applications.

### PIC18F Microcontroller with Integrated Ethernet

Microchip's feature-rich PIC18F97J60 family comes with up to 128 Kbytes of Flash program memory, 3 Kbytes of SRAM, 8 Kbytes of Ethernet buffer RAM and package options of 64, 80 and 100-pin TQFP.

- Additional features include:
- Integrated MAC and PHY
  - 10-bit ADC
  - Two analog comparators
  - 2 x UART
  - 2 x SPI/I<sup>2</sup>C™



### Stand-Alone Ethernet Controller

Microchip's ENC28J60 is a 28-pin IEEE 802.3 compliant stand-alone Ethernet controller with on-board MAC and PHY, 8 Kbytes of buffer RAM and SPI interface. Available in a small QFN package, the ENC28J60 provides a low pin count solution for remote communication with embedded applications. Match this controller with any PIC18, PIC24 MCU or dsPIC® DSC for a completely flexible Ethernet solution.

Ethernet Family	
PIC18F67J60	64 to 128K Flash, 64-pins
PIC18F87J60	64 to 128K Flash, 80-pins
PIC18F97J60	64 to 128K Flash, 100-pins
ENC28J60	Ethernet Controller with SPI

### FEATURED DEVELOPMENT TOOLS

#### Ethernet PICDEM.net™ 2 Demonstration Board and PICTail™ Daughter Boards



The PICDEM.net 2 Development Board (DM163024) is an Internet/Ethernet development board supporting both the popular ENC28J60 Ethernet Controller and the PIC18F97J60 single-chip Ethernet microcontroller family. Using this board and Microchip's free TCP/IP

stack, a web server can be developed showcasing the capability to remotely monitor and control embedded applications over the Internet.

PICTail Daughter Boards featuring the ENC28J60 can be used to add Ethernet capability to existing PIC18 HPC Explorer Boards or the Explorer 16 Board for 16-bit MCUs and DSCs. The Ethernet PICTail Daughter Board (AC164121) plugs into the PIC18 High-Pin-Count Explorer Board (DM183022). The Ethernet PICTail Plus Daughter Board (AC164123) plugs into the Explorer 16 board (DM240001). These Ethernet PICTail boards provide a cost effective method for evaluating and developing Ethernet control applications with PIC microcontrollers and dsPIC digital signal controllers.

For more information about these Ethernet controllers or to download the FREE TCP/IP protocol stack for PIC18, PIC24 MCUs or dsPIC DSCs go to: [www.microchip.com/Ethernet](http://www.microchip.com/Ethernet).



### APPLICATION EXAMPLES

Consumer	Communications	Industrial	Security	Appliance
Vending Machines Hotel Mini Bars Home Control/Automation	VoIP Phone Adapters Point-of-Sale Terminals Servers/Networks	Control/Automation Power Supplies Lighting Control Environmental Control	Asset Monitoring Fire and Safety Security Panels Access Control Fingerprint Recognition	General Appliances

## MICROCHIP TECHNOLOGY'S PRODUCT PORTFOLIO

- 8-bit PIC Microcontrollers
- 16-bit PIC Microcontrollers
- 16-bit dsPIC Digital Signal Controllers
- Battery Management ICs
- Thermal Management ICs
- Power Management ICs
- Linear ICs
- Mixed-Signal ICs
- Interface Devices
- Radio Frequency Products
- KEELoQ® Security Devices
- Serial EEPROMs
- MPLAB Development Tools

### Development Tools

Microchip has established a reputation for its comprehensive set of world-class, low-cost, easy-to-use application development tools. These tools help systems designers quickly design, debug and program PIC microcontrollers and dsPIC® digital signal controllers for specific applications. Microchip's MPLAB® IDE and student version of C-Compilers can be downloaded at: [www.microchip.com](http://www.microchip.com) free of charge.

The following documents and additional information are available on the Microchip web site ([www.microchip.com](http://www.microchip.com)).

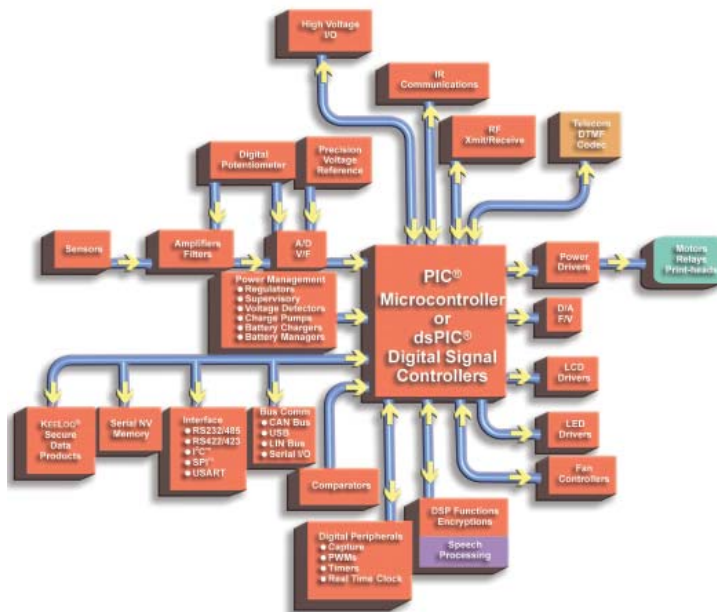
- Low Cost Development Tools Guide, DS51560
- Development Systems Ordering Guide, DS30177

### Memory Products

#### 128-bit to 1 Mbit Serial EEPROMs

Microchip offers a broad portfolio of high performance serial EEPROMs in extremely small package sizes, including a new 2x3 millimeter DFN (Dual Flat No leads) package option, across the entire product line of I<sup>2</sup>C™ and Microwire serial EEPROMs. With the new 64-Kbit I<sup>2</sup>C and 16-Kbit Microwire serial EEPROMs now featured in this tiny DFN package, Microchip offers the highest-density memory serial EEPROMs in the smallest standard package available today. Specialty/ID EEPROMs for PC monitors, DIMM modules and riser cards, as well as serial EEPROM development tools that include the SEEVAL® 32 Serial EEPROM Evaluation Kit (DV243002) and Total Endurance™ Model software version 4.0.

## COMPLETE EMBEDDED CONTROL SOLUTIONS



### 16-bit Family of Products

As embedded applications grow in complexity and performance requirements increase, Microchip has introduced several new 16-bit devices. The PIC24F and PIC24H 16-bit microcontroller families enable an easy migration from the other 8-bit PIC microcontrollers, with higher performance, more memory and faster peripherals. The PIC24F products are cost effective 16-bit microcontrollers with up to 16 MIPS and the high performance PIC24H microcontrollers provide up to 40 MIPS; both have a rich set of Flash memory and peripherals.

For additional power and performance, consider Microchip's dsPIC digital signal controllers (DSC), including the dsPIC30 and dsPIC33 families, for up to 40 MIPS. A digital signal controller is a single chip embedded controller that seamlessly integrates the control attributes of a microcontroller with the computation and throughput capabilities of a digital signal processor. The dsPIC products feature a fully implemented DSP engine, C compiler friendly design with familiar tools and ease-of-use. Microchip is a leader in 16-bit performance and C code efficiency, with development tools and application libraries enabling faster time to market and ease-of-use.

All of these 16-bit solutions have compatible software, development tools, and many of the devices have shared pin-outs and peripherals. These solutions target motor control and power conversion, sensor control, automotive, speech, audio and general purpose applications.

### Analog and Interface Products

Microchip is a leader in low power analog solutions with a growing portfolio of stand-alone analog and interface products that complement our broad microcontroller product lines.

#### Thermal Management

- Temperature Sensors
- Fan Speed Controllers/  
Fan Fault Detectors

#### Power Management

- LDO & Switching Regulators
- Charge Pump DC/DC Converters
- Power MOSFET Drivers
- PWM Controllers
- System Supervisors
- Voltage Detectors
- Voltage References

#### Battery Management

- Li-Ion/Li-Polymer Battery Chargers
- Smart Battery Managers

#### Linear

- Op Amps
- Programmable Gain Amplifiers
- Comparators
- Linear Integrated Devices

#### Mixed-Signal

- A/D Converter Families
- Digital Potentiometers
- D/A Converters
- V/F and F/V Converters
- Energy Measurement ICs

#### Interface

- CAN Peripherals
- Infrared Peripherals
- LIN Transceiver
- Serial Peripherals
- Ethernet Controller



## 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):

- **Support** link provides a way to get questions answered fast.
- **Sample** link offers free evaluation samples of any Microchip device.
- **Training** link offers webinars, registration for local seminars/workshops and information on annual MASTERS events held throughout the world.

## Purchase



microchipDIRECT is a web-based purchasing site that gives you 24-hour-a-day

access to all Microchip devices and tools, including pricing, ordering, inventory and support. You can buy the products you need on a easily opened Microchip line of credit.

## Sales Office Listing

Technical Support: <http://support.microchip.com>

### AMERICAS

#### Atlanta

Tel: 678-957-9614

#### Boston

Tel: 774-760-0087

#### Chicago

Tel: 630-285-0071

#### Cleveland

Tel: 216-447-0464

#### Dallas

Tel: 972-818-7423

#### Detroit

Tel: 248-538-2250

#### Kokomo

Tel: 765-864-8360

#### Los Angeles

Tel: 949-462-9523

#### Santa Clara

Tel: 408-961-6444

#### Toronto

Mississauga, Ontario  
Tel: 905-673-0699

### ASIA/PACIFIC

#### Australia - Sydney

Tel: 61-2-9868-6733

#### China - Beijing

Tel: 86-10-8528-2100

#### China - Chengdu

Tel: 86-28-8665-5511

#### China - Fuzhou

Tel: 86-591-8750-3506

#### China - Hong Kong SAR

Tel: 852-2401-1200

#### China - Qingdao

Tel: 86-532-8502-7355

#### China - Shanghai

Tel: 86-21-5407-5533

#### China - Shenyang

Tel: 86-24-2334-2829

#### China - Shenzhen

Tel: 86-755-8203-2660

#### China - Shunde

Tel: 86-757-2839-5507

#### China - Wuhan

Tel: 86-27-5980-5300

#### China - Xian

Tel: 86-29-8833-7250

### ASIA/PACIFIC

#### India - Bangalore

Tel: 91-80-4182-8400

#### India - New Delhi

Tel: 91-11-4160-8631

#### India - Pune

Tel: 91-20-2566-1512

#### Japan - Yokohama

Tel: 81-45-471- 6166

#### Korea - Gumi

Tel: 82-54-473-4301

#### Korea - Seoul

Tel: 82-2-554-7200

#### Malaysia - Penang

Tel: 60-4-646-8870

#### Philippines - Manila

Tel: 63-2-634-9065

#### Singapore

Tel: 65-6334-8870

#### Taiwan - Hsin Chu

Tel: 886-3-572-9526

#### Taiwan - Kaohsiung

Tel: 886-7-536-4818

#### Taiwan - Taipei

Tel: 886-2-2500-6610

#### Thailand - Bangkok

Tel: 66-2-694-1351

### EUROPE

#### Austria - Wels

Tel: 43-7242-2244-39

#### Denmark - Copenhagen

Tel: 45-4450-2828

#### France - Paris

Tel: 33-1-69-53-63-20

#### Germany - Munich

Tel: 49-89-627-144-0

#### Italy - Milan

Tel: 39-0331-742611

#### Netherlands - Drunen

Tel: 31-416-690399

#### Spain - Madrid

Tel: 34-91-708-08-90

#### UK - Wokingham

Tel: 44-118-921-5869

11/28/06



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