MICROCHIP

High-Performance PIC24 Microcontroller Family

More Performance, Less Risk

Today's embedded designers look for high-performance microcontrollers with integrated functions and peripherals to help reduce their total system cost. Microchip's 8-bit PIC® microcontrollers have met this need with features such as pin and code compatibility, a common development tool environment and an advanced core. But increasing application demands and complexity have created a need for additional choices.
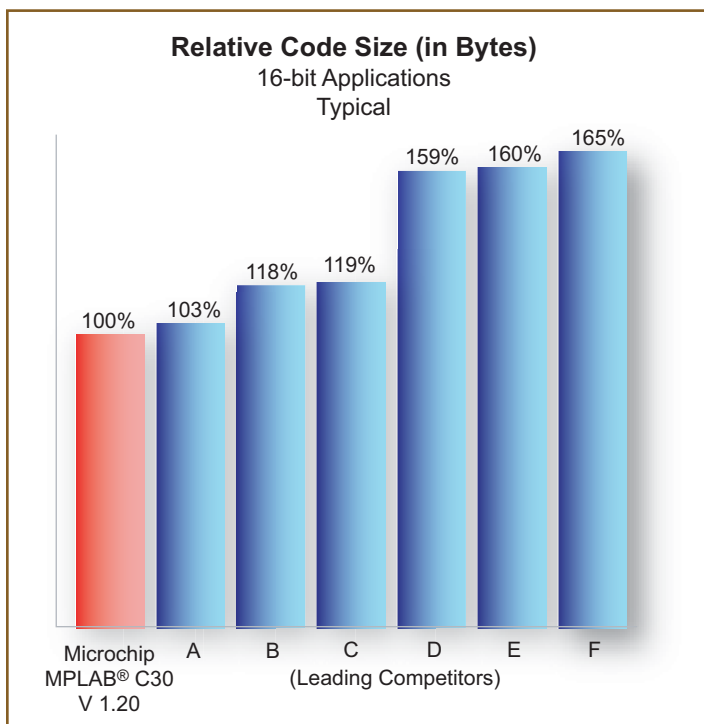
Having options is critical to a product's success. And one of the most important choices the design engineer makes is the appropriate microcontroller selection. Microchip's PIC24 16-bit microcontrollers offer new levels of choice in performance, memory, peripherals and packaging. Microchip's advanced technology and migration strategy deliver the most cost-effective system solution for embedded designers.

New PIC24 16-bit Architecture

The PIC24 16-bit architecture was designed to optimize C language code size. Embedded designers using the MPLAB® C30 C compiler can achieve leadership code size in applications, helping project teams hit schedule and code size targets. Reduced code size provides the opportunity to use a smaller memory device at a lower price, reduce time spent optimizing and fine-tuning code size to fit the memory space, and also respond to those marketing requests for "just one more feature."

Design engineers whose applications now require a 16-bit microcontroller can expect to find all the features they value with the 8-bit PIC microcontrollers. The PIC24 architecture features include:

- Single cycle instruction execution
- Full-speed operation from Flash memory

Relative Code Size (in Bytes)
16-bit Applications
Typical

Microchip MPLAB® C30 V 1.20	A	B	C	D	E	F
100%	103%	118%	119%	159%	160%	165%

(Leading Competitors)

- Short 5 cycle interrupt latency
- Fast and easy bit manipulation – single cycle
- Single cycle hardware multiply
- 32/16 and 16/16 divide instructions
- Deterministic instruction execution
- Same familiar development tools and MPLAB® Integrated Development Environment (IDE)

Rich Portfolio for Added Flexibility

The PIC24 16-bit microcontroller family debuts with 22 general-purpose devices divided between two series, the PIC24F and PIC24H.

- PIC24F: 16 MIPS, lowest cost
  PIC24H: 40 MIPS, highest performance
- 64-256 Kbytes of Flash program memory
- 8-16 Kbytes of RAM
- Family expansion includes larger RAM and additional peripherals

These general-purpose PIC24 microcontrollers include several features that maximize application flexibility and reliability, and minimize cost through elimination of external components.

System Robustness and Management Features

- Flexible high-speed and low-power integrated oscillators with PLL eliminates need for external crystal
- Power-on Reset and Fail-safe clock monitor
- nanoWatt Technology Power Management
- On-chip Low-dropout Voltage Regulator (LDO)
- Simplified and highly flexible interrupt structure

Highly Cost-Effective PIC24F 16-bit Microcontrollers

With 16 MIPS performance and an extensive peripheral set, the PIC24F microcontrollers are a highly cost-effective solution for all but the most demanding 16-bit applications. The PIC24F also offers a new migration option for design engineers whose applications may be outgrowing the performance offered by 8-bit microcontrollers, and need to stay cost competitive.

Highest-Performance PIC24H 16-bit Microcontrollers

For more demanding applications, the PIC24H offers 40 MIPS performance, more memory and additional peripherals. The PIC24H family adds up to 2 CAN communication modules, user selectable 10/12-bit Analog-to-Digital (A/D) converter and enhanced timer functions. And integrated Direct Memory Access (DMA) between peripherals and dual-port RAM provides zero overhead data transfers, optimizing CPU throughput.

Seamless Migration Reduces Development Risk

The two pin-and-code compatible PIC24 series deliver the options needed to hit the performance, cost and schedule goals demanded by any project. The PIC24F and PIC24H series are completely software and MPLAB IDE compatible, providing easy migration as project requirements change. This gives design engineers the ability to add performance and functionality to applications without sacrificing the initial investment and engineering resources.

There's also the option to easily step up to digital signal processing (DSP) capability with the fully-compatible 16-bit dsPIC® Digital Signal Controller (DSC) family for more advanced algorithms and signal processing. Compatibility with dsPIC DSCs provides engineers with a path to even greater performance coupled with DSP as application requirements increase.

"With their dsPIC® DSCs and PIC24 MCUs, Microchip is the only company on the planet with truly unified DSP and MCU product lines..."
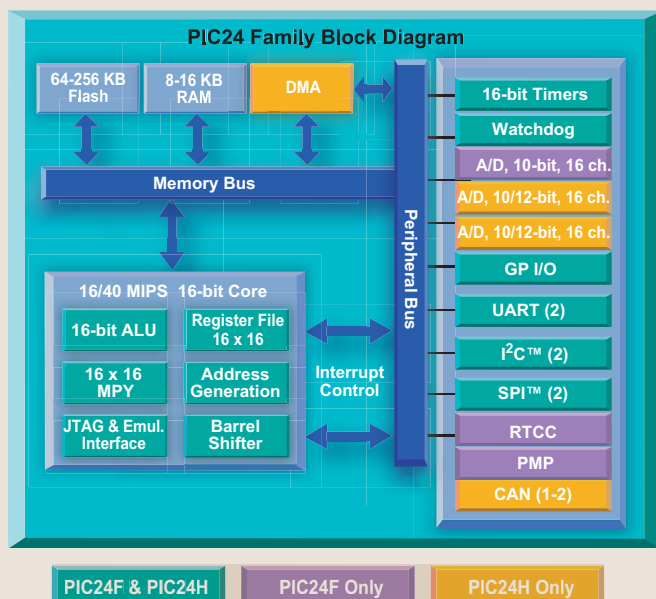
Will Strauss, president of Forward Concepts

Peripherals, Memory and Analog

Communications, real-time control, waveform generation, analog interface and system monitoring are all integrated in the PIC24 Family, coupled with a wide range of memory options.

Additional PIC24 key features include:

- Two ports each of UART, SPI™ and I²C™
- Up to two CAN ports
- Real-Time Clock Calendar (RTCC)
- A 16-channel, 500 ksps 10-bit A/D converter is featured in the PIC24F
- A user selectable 500 ksps 12-bit A/D converter or 1.1 Msps 10-bit A/D converter in the PIC24H
- JTAG boundary scan and Flash programming
- 8-channel DMA with 2 KB dual port RAM

Memory
Up to 256 KB self-programmable Flash
Up to 16 KB RAM
DMA to internal peripherals with 2 KB dual port RAM
Parallel Master Port (PMP) interface to external data memory and peripherals

Communications	Key Features
UART	Asynchronous channel supporting LIN, IrDA®, RS-232, RS-485 with 4-deep FIFO buffer
SPI™	High-speed synchronous channel including 8-deep FIFO buffer
I²C™	Support Multi-Master/Slave mode with 7-bit/10-bit addressing
CAN with buffer, filters	Automotive/Industrial standard, includes 8 transit and 32 receive buffers

Timers/Control	Key Features
16-bit timers, cascadable to 32-bit	Cascadable to 32-bit, up/down, with multiple clock sources including a low-power 32 kHz oscillator, trigger for A/D conversion
Input Capture (IC)	The highly configurable Input Capture, Output Compare and PWM modules are easily configured with the Timer modules to generate waveforms and monitor external events
Output Compare (OC)	
Pulse Width Modulation (PWM)	
Watchdog Timer (WDT)	On-chip low-power RC oscillator, post-scaler for wide range of time-out values
Real Time Clock Calendar (RTCC)	Minimal software support required, multiple clock source options and calibration

Analog	Key Features
10/12-bit A/D converter	Up to 32 channels on PIC24H
10-bit A/D converter	Up to 16 channels on PIC24F
Comparators	With on-chip programmable reference voltage
Integrated Voltage Regulator with Power-on Reset and Brown-out Reset	Power-on Reset and Brown-out Reset provide stable system operation

Roadmap for Growing Application Needs
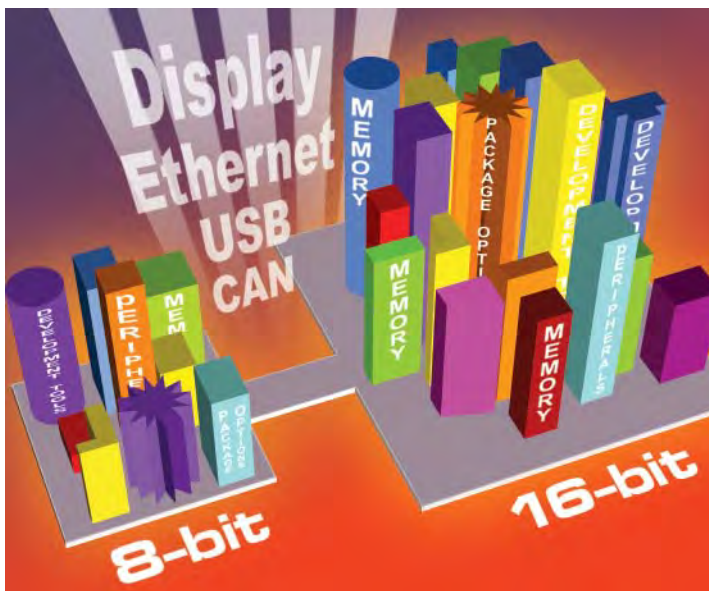
The need to provide cost-effective, compatible product families to embedded control engineers has always been at the core of Microchip's strategy. The addition of the PIC24 16-bit product line provides an effective migration path for current 8-bit designers as their design requirements grow. The PIC24 family also provides competitive alternatives to new customers who are looking for 16-bit microcontroller suppliers with a proven track record of innovation, a broad portfolio of products that are easy to use, and outstanding development tools and support to ensure their success.

As the PIC24 family grows, additional peripheral support is planned including integrated Ethernet, USB and Display capabilities.

PIC24 Product Family

Product	Pins	Flash Kbytes	SRAM Bytes	Timer	Capture	Output Comp. PWM	Real Time Clock Calendar	A/D 10-bit 500 kSPS	A/D 12-bit 500 kSPS	UART	SPI™	I²C™	CAN	Parallel Master Port	JTAG
PIC24F Family – 16 MIPS, Lowest Cost															
PIC24FJ64GA006	64	64	8	5	5	5	Y	16	-	2	2	2	-	Y	Y
PIC24FJ64GA008	80	64	8	5	5	5	Y	16	-	2	2	2	-	Y	Y
PIC24FJ64GA010	100	64	8	5	5	5	Y	16	-	2	2	2	-	Y	Y
PIC24FJ96GA006	64	96	8	5	5	5	Y	16	-	2	2	2	-	Y	Y
PIC24FJ96GA008	80	96	8	5	5	5	Y	16	-	2	2	2	-	Y	Y
PIC24FJ96GA010	100	96	8	5	5	5	Y	16	-	2	2	2	-	Y	Y
PIC24FJ128GA006	64	128	8	5	5	5	Y	16	-	2	2	2	-	Y	Y
PIC24FJ128GA008	80	128	8	5	5	5	Y	16	-	2	2	2	-	Y	Y
PIC24FJ128GA010	100	128	8	5	5	5	Y	16	-	2	2	2	-	Y	Y
PIC24H Family – 40 MIPS, Highest Performance															
PIC24HJ64GP206	64	64	8	9	8	8	-	*	18	2	2	1	-	-	Y
PIC24HJ64GP210	100	64	8	9	8	8	-	*	32	2	2	2	-	-	Y
PIC24HJ64GP506	64	64	8	9	8	8	-	*	18	2	2	2	1	-	Y
PIC24HJ64GP510	100	64	8	9	8	8	-	*	32	2	2	2	1	-	Y
PIC24HJ128GP206	64	128	8	9	8	8	-	*	18	2	2	2	-	-	Y
PIC24HJ128GP210	100	128	8	9	8	8	-	*	32	2	2	2	-	-	Y
PIC24HJ128GP306	64	128	16	9	8	8	-	*	18	2	2	2	-	-	Y
PIC24HJ128GP310	100	128	16	9	8	8	-	*	32	2	2	2	-	-	Y
PIC24HJ128GP506	64	128	8	9	8	8	-	*	18	2	2	2	1	-	Y
PIC24HJ128GP510	100	128	8	9	8	8	-	*	32	2	2	2	1	-	Y
PIC24HJ256GP206	64	256	16	9	8	8	-	*	18	2	2	2	-	-	Y
PIC24HJ256GP210	100	256	16	9	8	8	-	*	32	2	2	2	-	-	Y
PIC24HJ256GP610	100	256	16	9	8	8	-	*	2 x 32	2	2	2	2	-	Y

*PIC24H features a user selectable 500 ksps 12-bit A/D or 1.1 Msps 10-bit A/D

World-Class Development Tools

Competitive market conditions force businesses to examine every aspect of their product life cycle to maximize productivity and minimize expense. Easy-to-learn, low-cost common development tools are one way to reduce risk and time to market.
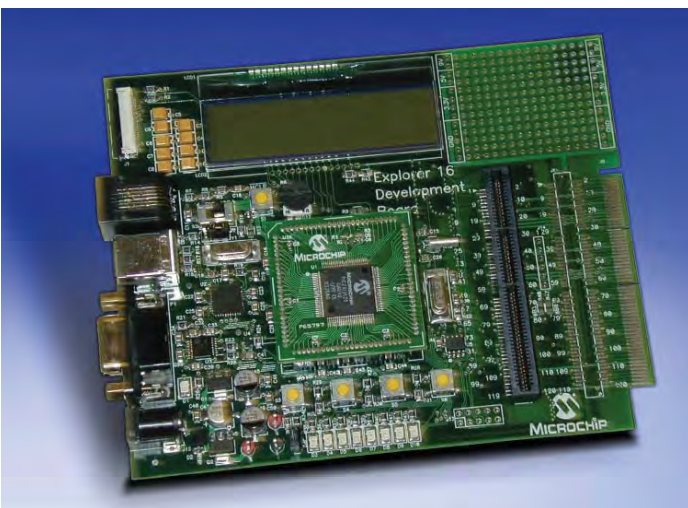
Common Development Environment

Whether you are designing with the smallest 8-bit PIC microcontroller, or a high-performance 16-bit PIC24 microcontroller or a dsPIC Digital Signal Controller, all share a common development environment. Microchip's MPLAB® IDE serves as the single, unified graphical user interface for Microchip and third-party software and hardware development tools. Moving between tools, such as the included assembler, linker and visual device initializer, is seamless and upgrading is easy. Start today with the MPLAB IDE by downloading it for FREE from the Microchip web site – **www.microchip.com**.

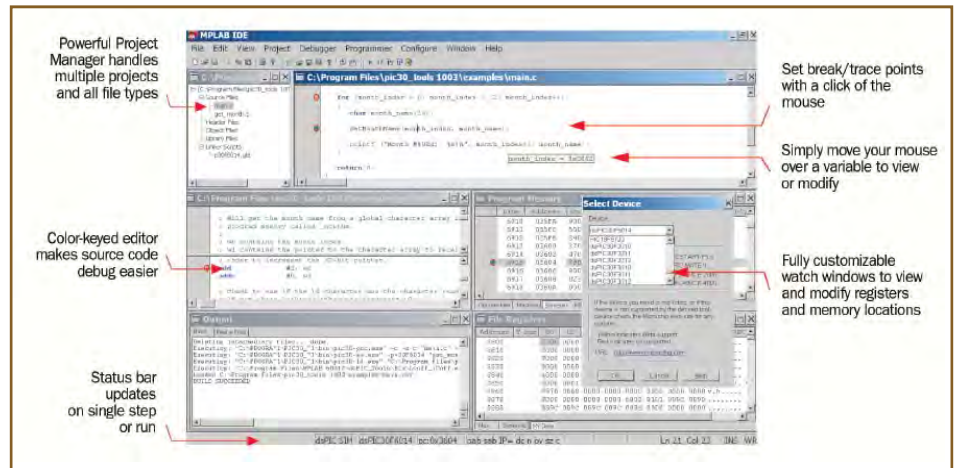*MPLAB® IDE Graphical User Interface*

Explorer 16 Development Board

The Explorer 16 Development Board (DM240001) offers a very economical way to evaluate the features and performance of both the PIC24 microcontroller and the dsPIC33F General Purpose Digital Signal Controller families. This board is an ideal prototyping tool to help you quickly develop and validate key design requirements. Coupled with the MPLAB ICD 2 In Circuit Debugger (available separately), you now have real-time emulation and debug facilities to speed your evaluation.

Key Features:

- 100-pin PIC24 and 100-pin dsPIC33F General Purpose Plug-in Modules (PIM)
- Microchip's TC1047A high accuracy, analog output temperature sensor
- Alpha-numeric 16 x 2 LCD Display

- Terminal interface program and menu programs
- PICtail™ Plus Connector for future expansion boards
- Expansion connector to access the device's full pin-out and bread board area

MPLAB® C30 C Compiler

The MPLAB C30 C Compiler is a full-featured, ANSI compliant optimizing compiler. The MPLAB C30 C Compiler includes a complete ANSI C standard library, including string manipulation, dynamic memory allocation, data conversion, timekeeping and math libraries. The cost-effective MPLAB C30 Compiler supports Microchip's complete 16-bit portfolio of PIC24 microcontrollers and dsPIC Digital Signal Controllers. Start today with the MPLAB C30 by downloading the 60-day, full-featured demo for FREE from the Microchip web site at **www.microchip.com**.

MPLAB® ICD 2 In-Circuit Debugger

The MPLAB ICD 2 In-Circuit Debugger is a powerful, low-cost all-in-one real-time emulation controller/programmer for PIC microcontrollers and dsPIC DSCs. Running under MPLAB IDE, MPLAB ICD 2 can debug Assembly or C source code, watch and modify variables, single step and set breakpoints.

Key Features:

- USB or serial port connection to the PC
- Supports full PIC24 and dsPIC DSC supply voltage range
- Can be used as an inexpensive programmer
- Smart watch variable windows
- Advanced breakpoint features

MPLAB® ICD 2

Explorer 16 Development Board

Worldwide Sales & Service

It takes more than product specifications to create loyal customers. In addition to a broad product portfolio, Microchip understands the value of a complete design solution. That's why we maintain a worldwide network of sales and support. Our technical support is unmatched with a global network of experienced field application engineers and technical support personnel ready to provide product and system assistance to help engineers further streamline their design, prototype and production activities. Visit our technical support web site at **http://support.microchip.com**.

Product Portfolio

Microchip's broad product portfolio includes:

- Peripheral-rich 8- and 16-bit PIC® Microcontrollers
- High-performance 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

Sales Office Listing

Technical Support: **http://support.microchip.com**

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Korea - Gumi
Tel: 82-54-473-4301

Korea - Seoul
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