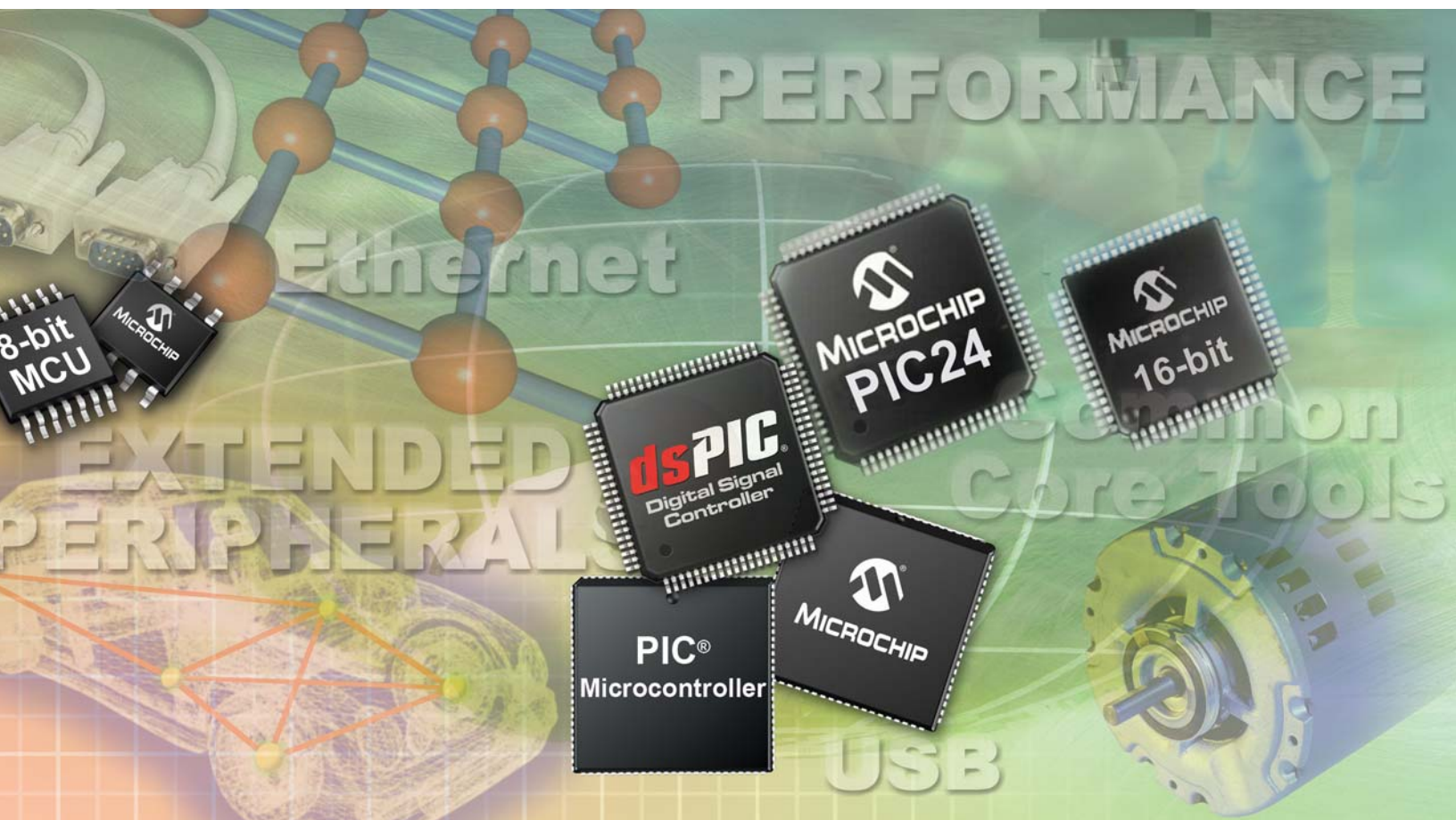




## 16-bit Embedded Control Solutions

- PIC24 Microcontrollers
- dsPIC® Digital Signal Controllers



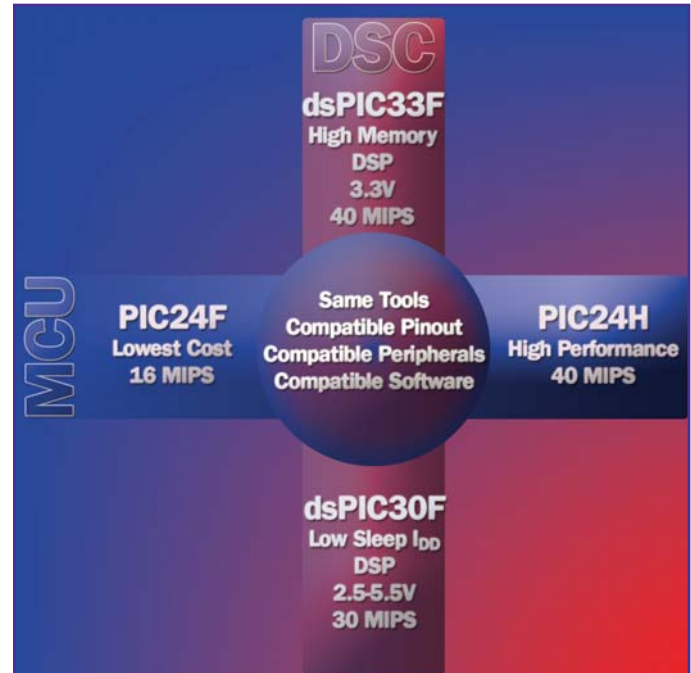
# 16-bit Embedded Control Solutions

*Do you need to add more performance or additional features to your products? Do you need more on-chip memory? Are you concerned with tight schedules and cost goals? How do you decide which embedded control solution will bring the most value to your overall embedded design?*

Microchip's 16-bit solutions are designed to be a broad platform which can serve your needs for many years. If you have designed using our 8-bit PIC® microcontrollers (MCUs) you will be pleased to see that the same MPLAB® Integrated Development Environment used on our smallest 6-pin MCU also supports our most powerful 16-bit controllers. Plus our commitment for peripheral and pinout compatibility has been carried forward to our 16-bit product families. If you are new to Microchip's control solutions, we offer powerful, low cost development tools, a compatible lineup of products that range from low cost to high performance, and a Company dedicated to serving your needs.

Since 2002, Microchip has been #1 in worldwide 8-bit microcontroller shipments\* with a product portfolio that continues to expand to meet the demands of our customers while solving many of their key business issues. With more than 70 16-bit products in our portfolio today and many more on the way, we are committed to offer similar value in the 16-bit realm.

\*Gartner Dataquest, Top Companies Revenue from Shipments of 8-bit MCU - All Applications" April 2005.



## One Architecture, Four Families

Microchip offers two 16-bit Microcontroller (MCU) families plus two 16-bit Digital Signal Controller (DSC) families that give you compatible options across a wide spectrum of price, performance and feature sets. Common attributes among all 16-bit MCU and DSC families are:

- Pinout compatibility
- Software compatibility
- Peripheral compatibility
- Common development tools

Whether your solution requires the lowest cost 16-bit solution, the most powerful 16-bit MCU in the industry, or DSP capability, Microchip offers a broad range of products while preserving the compatibility that helps save you time and money on subsequent designs.

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### RoHS Compliant

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

# The Capability You Need

## 16-bit Microcontroller (MCU) Portfolio

Are cost or performance important considerations for your next design? PIC24 MCUs offer the variety of peripherals, memory sizes and packaging choices you have come to expect from our 8-bit products. Microchip offers two compatible Flash-based 16-bit PIC24 MCU families. The 16 MIPS PIC24F family is designed for cost-sensitive applications. The 40 MIPS PIC24H family is designed for high performance applications. Both families have the same instruction set, share basic peripherals, have common pinouts and use the same tools for development. The PIC24 families are compatible with dsPIC DSCs for easy migration when additional performance or DSP capability is required.

### Optimized C Compiler:

Supporting the PIC24 MCU and dsPIC DSC families, Microchip's 16-bit architecture was designed to optimize C language code size. The architecture was co-developed by compiler writers who emphasized the need for an orthogonal instruction set, many general-purpose registers, powerful indirect with offset addressing and a software stack. Now you can achieve leadership code size in applications, helping your project team hit schedule and code size targets. Reduced code size provides the opportunity to use a smaller memory device, spend less time optimizing code size and respond to those marketing requests for "just one more feature."

### Powerful 16-bit CPU:

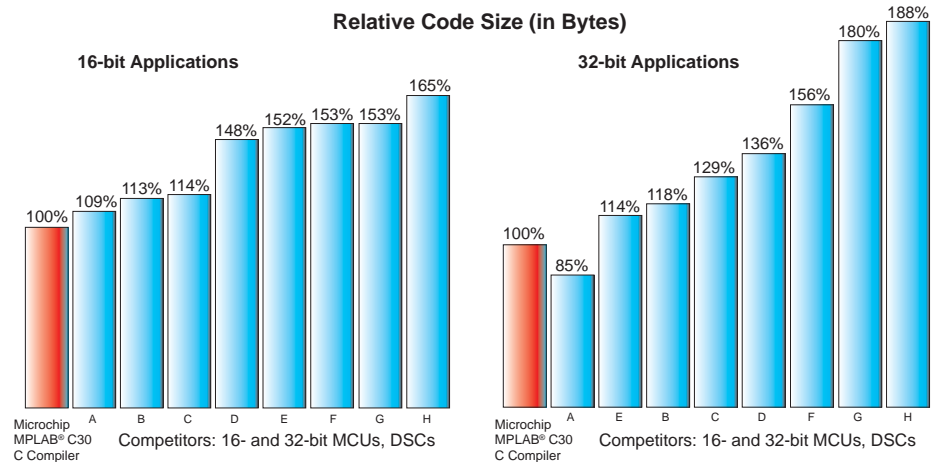
The PIC24 MCU and the dsPIC DSC families execute most instructions in one cycle. Interrupts are serviced quickly and are deterministic. Bit manipulation is accomplished in a single cycle. Add latest generation features, such as zero overhead looping, single-cycle multiply and a barrel shifter, and you have the most powerful 16-bit MCU for your embedded control designs.

### Migration Options:

Once you have designed our 16-bit products into your application, future designs are simplified. You can select from a broad range of memory, pin count, peripheral, performance and price options without changing architecture or development tools. The pinout, software and tool compatibility helps make stepping to different performance or memory points very straightforward. This is also beneficial if you design in an environment of rapidly evolving requirements.

## 16-bit Digital Signal Controller (DSC) Portfolio

Are you looking to add DSP capability to your application? DSCs blend the features of both MCUs and DSPs into a single-chip solution enabling you to add DSP features to your embedded application. Microchip offers two compatible Flash-based 16-bit DSC families. The 30 MIPS dsPIC30F family is designed for applications where 5V operation is important, and the 40 MIPS dsPIC33F family is suited for applications preferring 3.3V or need more on-chip memory. Both DSC families and the PIC24 families have the same base instruction set (DSCs add DSP instructions), share basic peripherals, have common pinouts and use the same tools for development.



### Looking to Add DSP?

If you are an MCU user looking to add DSP features to your embedded design, the dsPIC DSCs make the process easy. The dsPIC DSC retains an MCU look and feel from the architecture to the tools used for development. If you don't have the time to learn about DSP technology, you can use one of the many libraries or filter design tools developed by DSP experts. For DSP experts, Microchip includes the true DSP features you expect: dual 40-bit accumulators, single cycle 16x16 MAC, dual operand fetches, saturation and rounding modes, and zero overhead looping.

### CodeGuard™ Security:

Microchip's CodeGuard Security facilitates encrypted firmware updates and enables multiple parties to more securely share resources (memory, interrupts and peripherals) on a single chip. IP vendors can also program algorithms into segments of on-chip Flash memory and securely distribute their products to OEMs for further customization.

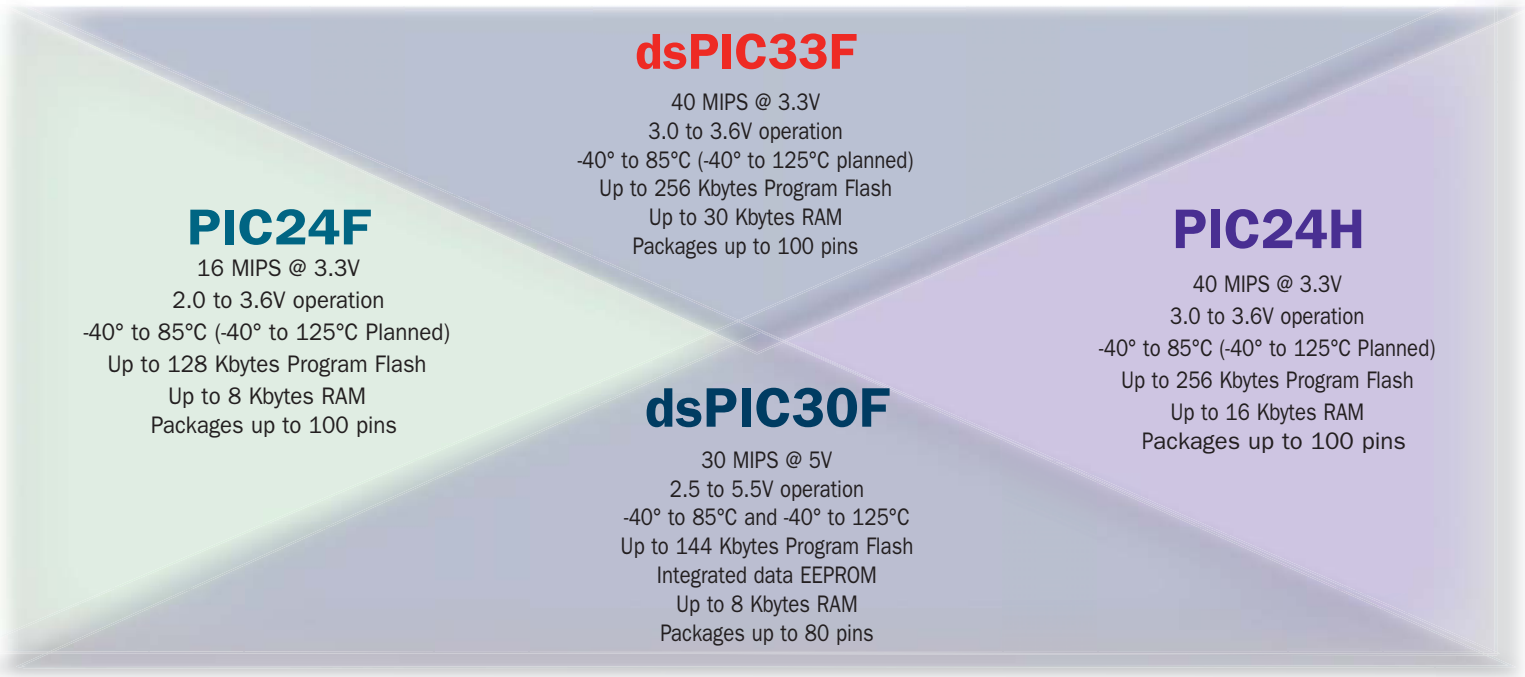
### Flexible Flash:

All of Microchip's 16-bit products employ flexible and secure Flash memory. You can use the Flash memory to store programs or data tables. Additionally, all devices can self-program their own Flash memory in a finished product. The PIC24H and dsPIC DSC families offer advanced security features that enable you to secure your base code and allow OEMs to "customize" the application or alternatively enhance work with encrypted data.

### Considering a 32-bit MCU?

Has your current MCU run out of steam? Microchip's performance-oriented 16-bit solutions can significantly outperform low cost 32-bit controllers for many MCU applications. Why abandon 16-bit deterministic performance, native bit manipulation, fast fixed-latency interrupts and low cost tools to gain inferior 32-bit performance? Many engineers using 32-bit devices have reverted to Microchip's 16-bit products after discovering performance issues during the course of their design.

# One Architecture: Four Compatible Families



## Highly Cost-Effective PIC24F 16-bit MCUs

With 16 MIPS performance and an extensive peripheral set, the PIC24F MCUs are a highly cost-effective solution for all but the most demanding 16-bit applications. The PIC24F also offers an easy migration path for design engineers whose applications have outgrown the performance offered by 8-bit MCUs.

## Highest Performance PIC24H 16-bit MCUs

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, and a user-selectable 10/12-bit Analog-to-Digital Converter (ADC). Integrated Direct Memory Access (DMA) between peripherals and dual-port RAM provides zero overhead data transfers, optimizing CPU throughput.

## Versatile 5 Volt dsPIC30F DSCs

The 30 MIPS dsPIC30F family is developed for applications that benefit from a wide operating voltage (2.5 to 5.5V), extremely low standby current, integrated EEPROM, and for those that prefer 5V operation due to system considerations.

## High Performance, Cost Effective 3.3 Volt dsPIC33F DSCs

The 40 MIPS dsPIC33F family is developed for high performance embedded control applications. Compared to the dsPIC30F family, the dsPIC33F family offers larger RAM and Flash memory options and adds DMA.

	PIC24F	PIC24H	dsPIC30F	dsPIC33F
Best in Class C Compiler Efficiency	✓	✓	✓	✓
Same Instruction Set	✓	✓	Adds DSP	Adds DSP
Same Base Peripherals	✓	✓	✓	✓
Same Pinout	✓	✓	✓	✓
Same Development Tools	✓	✓	✓	✓
Fixed Fast Interrupt Latency	✓	✓	✓	✓
Universal Bit Manipulation	✓	✓	✓	✓
Full Speed from Flash	✓	✓	✓	✓
Single-Cycle Multiply	✓	✓	✓	✓
32/16 & 16/16 Divide	✓	✓	✓	✓
Deterministic Instruction Execution	✓	✓	✓	✓

16-BIT COMPARISON

# 16-bit Product Features Overview

## CPU, Systems & Memory

### Operating Range PIC24F

DC to 16 MIPS
V <sub>DD</sub> range: 2.0 to 3.6V
Ind. (-40° to 85°C) Extended temp. planned

### Operating Range PIC24H & dsPIC33F

DC to 40 MIPS
V <sub>DD</sub> range: 3.0 to 3.6V
Ind. (-40° to 85°C) Extended temp. planned

### Operating Range dsPIC30F

DC to 30 MIPS*
V <sub>DD</sub> range: 2.5 to 5.5V
Ind. (-40° to 85°C) and ext. (-40° to 125°C)
*30 MIPS @ 4.5 to 5.5V, -40° to 85°C

### High Performance CPU

Single cycle execution (most instructions)
C compiler optimized instruction set
16-bit wide data path
76 base instructions: mostly 1 word/1 cycle
16 16-bit general purpose registers
Software stack
16 x 16 fractional/integer multiplier
32/16 and 16/16 divide
40-stage barrel shifter
DSC additions (dsPIC30F & dsPIC33F):
• Adds 8 base DSP instructions
• 2 40-bit accumulators with rounding and saturation options
• Single core combines MCU & DSP features
• Adds Modulo and Bit-reverse address modes

### System Management

Flexible clock options:
• Primary external clock, crystal, resonator
• Secondary lower power 32 kHz oscillator
• Internal RC: fast or low power
• Integrated low jitter PLL
– PLL sourced by ext. and int. clock sources
Programmable power-up timer
Oscillator start-up timer/stabilizer
Watchdog Timer with its own RC oscillator
Clock switching/fail-safe clock monitor

### Interrupt Controller

5 cycle fixed latency
Up to 118 interrupt sources, up to 5 external
7 programmable priority levels
4 processor exceptions and software traps

### Power Management

Switch between clock sources in real-time
Programmable power-on reset start up
Programmable low-voltage detect (dsPIC30F)
Programmable brown-out reset
Idle and Sleep modes with fast wake up

### On-chip Flash, Data EEPROM and RAM

Flash program memory: up to 256 KB
dsPIC30F data EEPROM: up to 4 KB
• 1 million erase/write cycles typical
Data RAM: up to 30 KB

## Peripherals

### Digital I/O

Up to 85 programmable digital I/O pins
Wake-up/Interrupt-on-change on up to 24 pins
High current sink/source (PIC24F & dsPIC30F)

### Communication Modules

3-wire SPI: up to 2 modules
• Framing supports I/O interface to simple codecs
I <sup>2</sup> C™: up to 2 modules
• Full Multi-master and Slave mode support
• 7-bit and 10-bit addressing
UART: up to 2 modules
• Interrupt-on-address bit detect
• Wake-up on Start bit from Sleep mode
• 4-character TX and RX FIFO buffers
Codec interface module
• Supports I <sup>2</sup> S and AC97 protocols
CAN/ECAN 2.0B active: up to 2 modules
• 3 transmit, 2 receive buffers (dsPIC30F)
• 8 transmit, 32 receive buffers (PIC24H & dsPIC33F)
• Wake-up on CAN message

### Timers/Capture/Compare/PWM

Timer/counters: up to nine 16-bit timers
• Can pair up to make 32-bit timers
• 1 timer can run as real-time clock
Input capture: up to 8 channels
• Capture on rising, falling or both edges
• 4-deep FIFO on each capture
Output compare: up to 8 channels
• Single or dual 16-bit compare mode
• 16-bit glitchless PWM mode

### Auxiliary Functions

Parallel Master Slave Port (PMP/PSP):
• 8-bit Parallel IO, highly configurable
• Communicates with external data memory, communications peripherals, LCDs
• Supports 8-bit or 16-bit data
• Supports 16 address lines
Hardware Real-Time Clock/Calendar (RTCC):
• Provides clock, calendar and alarm functions
Programmable CRC generator
Peripheral Pin Select (PPS)

### Hardware DMA PIC24H & dsPIC33F

8 channel DMA, 2 KB dual port RAM
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### Analog Subsystems

Analog comparator:
• Programmable reference
10-bit ADC:
• PIC24F: 500 ksps, 1 module
• dsPIC30F: 1 Msps, 1 module
12-bit ADC:
• dsPIC30F: 200 ksps 1 module
10-/12-bit ADC (user selectable):
• Available on PIC24H and dsPIC33F
• 10-bit: 1.1 Msps, 4 S&H
• 12-bit: 500 ksps, 1 S&H
• Some devices have 2 modules
Common ADC features:
Buffered output or DMA
16-deep result buffer
• dsPIC30F & PIC24F: up to 16 channels auto scanning
• PIC24H & dsPIC33F: up to 32 channels auto scanning

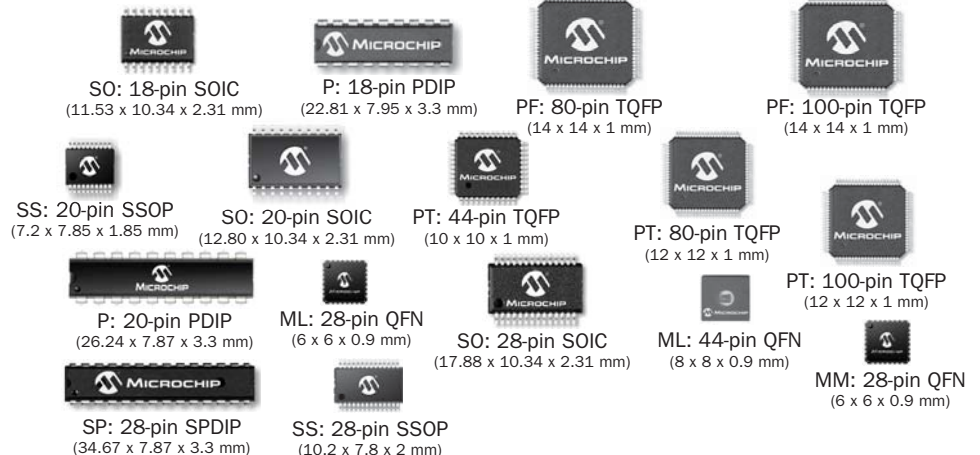
### Motor Control Peripherals

Motor Control PWM: up to 8 outputs
• 4 duty cycle generators
• Independent or complementary mode
• Programmable dead time settings
• Edge or center-aligned
• Manual output override control
• Up to 2 fault inputs
• ADC samples triggered by PWM module
Quadrature encoder interface module
• Phase A, Phase B and index pulse input

### Switch Mode Power Peripherals

10-bit ADC 2 Msps, Up to 4 sample and holds
PS PWM, 1 nS duty cycle resolution
Analog comparators
• Programmable reference

## 16-bit Packages



# PIC24F Family

## 16 MIPS, Lowest Cost

The PIC24F family is ideal for cost-sensitive applications or applications migrating from 8-bit designs for a boost in performance or memory.

Product	Pins	Flash Kbytes	RAM Kbytes	Timer	Capture	Output Compare PWM	RTCC	ADC 10-bit 500 ksp/s	Comparators	UART	SPI	PC™	JTAG	Package Code
PIC24FJ16GA004	44	16	8	4	5	5	Y	1 ADC, 13 ch	2	2	2	2	Y	ML, PT
PIC24FJ16GA002	28	16	8	4	5	5	Y	1 ADC, 10 ch	2	2	2	2	Y	ML, SO, SP, SS
PIC24FJ32GA002	28	32	8	5	5	5	Y	1 ADC, 10 ch	2	2	2	2	Y	ML, SO, SP, SS
PIC24FJ32GA004	44	32	8	5	5	5	Y	1 ADC, 13 ch	2	2	2	2	Y	ML, PT
PIC24FJ48GA004	44	48	8	5	5	5	Y	1 ADC, 13 ch	2	2	2	2	Y	ML, PT
PIC24FJ48GA002	28	48	8	5	5	5	Y	1 ADC, 10 ch	2	2	2	2	Y	ML, SO, SP, SS
PIC24FJ64GA002	28	64	8	5	5	5	Y	1 ADC, 10 ch	2	2	2	2	Y	ML, SO, SP, SS
PIC24FJ64GA004	44	64	8	5	5	5	Y	1 ADC, 13 ch	2	2	2	2	Y	ML, PT
PIC24FJ64GA006	64	64	8	5	5	5	Y	1 ADC, 16 ch	2	2	2	2	Y	PT
PIC24FJ64GA008	80	64	8	5	5	5	Y	1 ADC, 16 ch	2	2	2	2	Y	PT
PIC24FJ64GA010	100	64	8	5	5	5	Y	1 ADC, 16 ch	2	2	2	2	Y	PT, PF
PIC24FJ96GA006	64	96	8	5	5	5	Y	1 ADC, 16 ch	2	2	2	2	Y	PT
PIC24FJ96GA008	80	96	8	5	5	5	Y	1 ADC, 16 ch	2	2	2	2	Y	PT
PIC24FJ96GA010	100	96	8	5	5	5	Y	1 ADC, 16 ch	2	2	2	2	Y	PT, PF
PIC24FJ128GA006	64	128	8	5	5	5	Y	1 ADC, 16 ch	2	2	2	2	Y	PT
PIC24FJ128GA008	80	128	8	5	5	5	Y	1 ADC, 16 ch	2	2	2	2	Y	PT
PIC24FJ128GA010	100	128	8	5	5	5	Y	1 ADC, 16 ch	2	2	2	2	Y	PT, PF

# PIC24H Family

## 40 MIPS, Highest Performance

The PIC24H family is ideal for applications with greater performance or memory requirements or require extensive data movement.

Product	Pins	Flash Kbytes	RAM Kbytes	DMA # Ch	Timer	Capture	Output Compare PWM	ADC 10-/12-bit* 1.1/0.5 Msps	CodeGuard™ Security Segments	UART	SPI	PC™	CAN	JTAG	Package Code
PIC24HJ12GP201	18	12	1	–	3	4	2	1 ADC, 6 ch	2	1	1	1	–	Y	P, SO
PIC24HJ12GP202	28	12	1	–	3	4	2	1 ADC, 10 ch	2	1	1	1	–	Y	SP, SO, ML
PIC24HJ32GP202	28	32	2	–	3	4	2	1 ADC, 10 ch	2	1	1	1	–	Y	SP, SO, MM
PIC24HJ16GP304	44	16	2	–	3	4	2	1 ADC 13 ch	2	1	1	1	–	Y	PT, ML
PIC24HJ32GP204	44	32	2	–	3	4	2	1 ADC 13 ch	2	1	1	1	–	Y	PT, ML
PIC24HJ64GP206	64	64	8	8	9	8	8	1 ADC, 18 ch	3	2	2	1	–	Y	PT
PIC24HJ64GP506	64	64	8	8	9	8	8	1 ADC, 18 ch	3	2	2	2	1	Y	PT
PIC24HJ128GP206	64	128	8	8	9	8	8	1 ADC, 18 ch	3	2	2	2	–	Y	PT
PIC24HJ128GP306	64	128	16	8	9	8	8	1 ADC, 18 ch	3	2	2	2	–	Y	PT
PIC24HJ128GP506	64	128	8	8	9	8	8	1 ADC, 18 ch	3	2	2	2	1	Y	PT
PIC24HJ256GP206	64	256	16	8	9	8	8	1 ADC, 18 ch	3	2	2	2	–	Y	PT
PIC24HJ64GP210	100	64	8	8	9	8	8	1 ADC, 32 ch	3	2	2	2	–	Y	PT, PF
PIC24HJ64GP510	100	64	8	8	9	8	8	1 ADC, 32 ch	3	2	2	2	1	Y	PT, PF
PIC24HJ128GP210	100	128	8	8	9	8	8	1 ADC, 32 ch	3	2	2	2	–	Y	PT, PF
PIC24HJ128GP310	100	128	16	8	9	8	8	1 ADC, 32 ch	3	2	2	2	–	Y	PT, PF
PIC24HJ128GP510	100	128	8	8	9	8	8	1 ADC, 32 ch	3	2	2	2	1	Y	PT, PF
PIC24HJ256GP210	100	256	16	8	9	8	8	1 ADC, 32 ch	3	2	2	2	–	Y	PT, PF
PIC24HJ256GP610	100	256	16	8	9	8	8	2 ADC, 32 ch	3	2	2	2	2	Y	PT, PF

\*PIC24H devices feature one or two user-selectable 1.1 Msps 10-bit ADC (4 S&H) or 500 ksp/s 12-bit ADC (1 S&H)

# dsPIC33F Product Families

## General Purpose Family

The dsPIC33F General Purpose Family is ideal for a wide variety of 16-bit embedded control applications. In addition, the variants with codec interfaces are well suited for speech and audio applications.

Product	Pins	Flash Kbytes	RAM Kbytes	DMA # Ch	Timer 16-bit	Input Capture	Output Compare/Standard PWM	Codec Interface	ADC 10-12-bit* 1.1/0.5 Msps	CodeGuard™ Security Segments	Codec	UART	SPI	I <sup>2</sup> C™	CAN	Package Code
dsPIC33FJ12GP201	18	12	1	–	3	4	2	–	1 ADC, 8 ch	2	–	1	1	1	–	P,SO
dsPIC33FJ12GP202	28	12	1	–	3	4	2	–	1 ADC, 10 ch	2	–	1	1	1	–	SO, SP,ML
dsPIC33FJ32GP202	28	32	2	–	3	4	2	–	1 ADC, 10 ch	2	–	1	1	1	–	SO, SP,MM
dsPIC33FJ16GP304	44	16	2	–	3	4	2	–	1 ADC, 13 ch	2	–	1	1	1	–	PT,ML
dsPIC33FJ32GP204	44	32	2	–	3	4	2	–	1 ADC, 13 ch	2	–	1	1	1	–	PT,ML
dsPIC33FJ64GP206	64	64	8	8	9	8	8	1	1 ADC, 18 ch	3	1	2	2	1	–	PT
dsPIC33FJ64GP306	64	64	16	8	9	8	8	1	1 ADC, 18 ch	3	1	2	2	2	–	PT
dsPIC33FJ64GP706	64	64	16	8	9	8	8	1	2 ADC, 18 ch	3	1	2	2	2	2	PT
dsPIC33FJ128GP206	64	128	8	8	9	8	8	1	1 ADC, 18 ch	3	1	2	2	1	–	PT
dsPIC33FJ128GP306	64	128	16	8	9	8	8	1	1 ADC, 18 ch	3	1	2	2	2	–	PT
dsPIC33FJ128GP706	64	128	16	8	9	8	8	1	2 ADC, 18 ch	3	1	2	2	2	2	PT
dsPIC33FJ256GP506	64	256	16	8	9	8	8	1	1 ADC, 18 ch	3	1	2	2	2	1	PT
dsPIC33FJ64GP708	80	64	16	8	9	8	8	1	2 ADC, 24 ch	3	1	2	2	2	2	PT
dsPIC33FJ128GP708	80	128	16	8	9	8	8	1	2 ADC, 24 ch	3	1	2	2	2	2	PT
dsPIC33FJ64GP310	100	64	16	8	9	8	8	1	1 ADC, 32 ch	3	1	2	2	2	–	PT,PF
dsPIC33FJ64GP710	100	64	16	8	9	8	8	1	2 ADC, 32 ch	3	1	2	2	2	2	PT,PF
dsPIC33FJ128GP310	100	128	16	8	9	8	8	1	1 ADC, 32 ch	3	1	2	2	2	–	PT,PF
dsPIC33FJ128GP710	100	128	16	8	9	8	8	1	2 ADC, 32 ch	3	1	2	2	2	2	PT,PF
dsPIC33FJ256GP510	100	256	16	8	9	8	8	1	1 ADC, 32 ch	3	1	2	2	2	1	PT,PF
dsPIC33FJ256GP710	100	256	30	8	9	8	8	1	2 ADC, 32 ch	3	1	2	2	2	2	PT,PF

## Motor Control and Power Conversion Family

This dsPIC33F family supports motor control applications, such as brushless DC, single- and 3-phase induction and switched reluctance motors. These are also ideal for UPS, inverter and power factor correction applications.

Product	Pins	Flash Kbytes	RAM Kbytes	DMA # Ch	Timer 16-bit	Input Capture	Output Compare/Standard PWM	Motor Control PWM	Quadrature Encoder Interface	ADC 10/12-bit* 1.1/0.5 Msps	CodeGuard™ Security Segments	UART	SPI	I <sup>2</sup> C™	CAN	Package Code
dsPIC33FJ12MC201	20	12	1	–	3	4	2	4+2 ch	1	1 ADC, 4 ch	2	1	1	1	0	SO, P,SS
dsPIC33FJ12MC202	28	12	1	–	3	4	2	6+2 ch	1	1 ADC, 6 ch	2	1	1	1	0	SO, SP,ML
dsPIC33FJ32MC202	28	32	2	–	3	4	2	6+2 ch	1	1 ADC, 6 ch	2	1	1	1	0	SO, SP,MM
dsPIC33FJ16MC304	44	16	2	–	3	4	2	6+2 ch	1	1 ADC, 9 ch	2	1	1	1	0	PT,ML
dsPIC33FJ32MC204	44	32	2	–	3	4	2	6+2 ch	1	1 ADC, 9 ch	2	1	1	1	0	PT,ML
dsPIC33FJ64MC506	64	64	8	8	9	8	8	8 ch	1	1 ADC, 16 ch	3	2	2	2	1	PT
dsPIC33FJ64MC706	64	64	16	8	9	8	8	8 ch	1	2 ADC, 16 ch	3	2	2	2	1	PT
dsPIC33FJ128MC506	64	128	8	8	9	8	8	8 ch	1	1 ADC, 16 ch	3	2	2	2	1	PT
dsPIC33FJ128MC706	64	128	16	8	9	8	8	8 ch	1	2 ADC, 16 ch	3	2	2	2	1	PT
dsPIC33FJ64MC508	80	64	8	8	9	8	8	8 ch	1	1 ADC, 18 ch	3	2	2	2	1	PT
dsPIC33FJ128MC708	80	128	16	8	9	8	8	8 ch	1	2 ADC, 18 ch	3	2	2	2	2	PT
dsPIC33FJ64MC510	100	64	8	8	9	8	8	8 ch	1	1 ADC, 24 ch	3	2	2	2	1	PT,PF
dsPIC33FJ64MC710	100	64	16	8	9	8	8	8 ch	1	2 ADC, 24 ch	3	2	2	2	2	PT,PF
dsPIC33FJ128MC510	100	128	8	8	9	8	8	8 ch	1	1 ADC, 24 ch	3	2	2	2	1	PT,PF
dsPIC33FJ128MC710	100	128	16	8	9	8	8	8 ch	1	2 ADC, 24 ch	3	2	2	2	2	PT,PF
dsPIC33FJ256MC510	100	256	16	8	9	8	8	8 ch	1	1 ADC, 24 ch	3	2	2	2	1	PT,PF
dsPIC33FJ256MC710	100	256	30	8	9	8	8	8 ch	1	2 ADC, 24 ch	3	2	2	2	2	PT,PF

\*dsPIC33 devices feature one or two user-selectable 1.1 Msps 10-bit ADC (4 S&H) or 500 kps 12-bit ADC (1 S&H).

# dsPIC30F Product Families

## General Purpose Family

The dsPIC30F General Purpose Family is ideal for a wide variety of 16-bit embedded control applications. The variants with codec interfaces are well suited for speech and audio applications.

Product	Pins	Flash Memory Kbytes	RAM Bytes	EEPROM Bytes	Timer 16-bit	Input Capture	Output Compare/Standard PWM	Codec Interface	ADC 12-bit 200 ksp/s	CodeGuard™ Security Segments	UART	SPI	I <sup>2</sup> C™	CAN	Package Code
dsPIC30F3014	40/44	24	2048	1024	3	2	2	–	13 ch, 1 S/H	1	2	1	1	–	P, PT, ML
dsPIC30F4013	40/44	48	2048	1024	5	4	4	AC97, I <sup>2</sup> S	13 ch, 1 S/H	3	2	1	1	1	P, PT, ML
dsPIC30F5011	64	66	4096	1024	5	8	8	AC97, I <sup>2</sup> S	16 ch, 1 S/H	3	2	2	1	2	PT
dsPIC30F6011A	64	132	6144	2048	5	8	8	–	16 ch, 1 S/H	3	2	2	1	2	PF, PT
dsPIC30F6012A	64	144	8192	4096	5	8	8	AC97, I <sup>2</sup> S	16 ch, 1 S/H	3	2	2	1	2	PF, PT
dsPIC30F5013	80	66	4096	1024	5	8	8	AC97, I <sup>2</sup> S	16 ch, 1 S/H	3	2	2	1	2	PT
dsPIC30F6013A	80	132	6144	2048	5	8	8	–	16 ch, 1 S/H	3	2	2	1	2	PF, PT
dsPIC30F6014A	80	144	8192	4096	5	8	8	AC97, I <sup>2</sup> S	16 ch, 1 S/H	3	2	2	1	2	PF, PT

## Sensor Family

The dsPIC30F Sensor family products have features designed to support high-performance, cost-sensitive and space-constrained applications. Offered in packages as small as 6x6 mm and with pin counts as low as 18 pins.

Product	Pins	Flash Memory Kbytes	RAM Bytes	EEPROM Bytes	Timer 16-bit	Input Capture	Output Compare/Standard PWM	ADC 12-bit 200 ksp/s	UART	SPI	I <sup>2</sup> C™	I/O Pins (Max.)	Package Code
dsPIC30F2011	18	12	1024	–	3	2	2	8 ch, 1 S/H	1	1	1	12	P, SO, 28-pin ML
dsPIC30F3012	18/44	24	2048	1024	3	2	2	8 ch, 1 S/H	1	1	1	12	P, SO, 44-pin ML
dsPIC30F2012	28	12	1024	–	3	2	2	10 ch, 1 S/H	1	1	1	20	SP, SO, 28-pin ML
dsPIC30F3013	28/44	24	2048	1024	3	2	2	10 ch, 1 S/H	2	1	1	20	SP, SO, 44-pin ML

## Motor Control and Power Conversion Family

This dsPIC30F family supports motor control applications, such as brushless DC, single- and 3-phase induction and switched reluctance motors. These are also ideal for UPS, inverter and power factor correction applications.

Product	Pins	Flash Memory Kbytes	RAM Bytes	EEPROM Bytes	Timer 16-bit	Input Capture	Output Compare/Standard PWM	Motor Control PWM	Quadrature Encoder	ADC 10-bit 1 Msps	CodeGuard™ Security Segments	UART	SPI	I <sup>2</sup> C™	CAN	Package Code
dsPIC30F2010	28	12	512	1024	3	4	2	6 ch	Yes	6 ch, 4 S/H	1	1	1	1	–	SP, SO, MM
dsPIC30F3010	28/44	24	1024	1024	5	4	2	6 ch	Yes	6 ch, 4 S/H	1	1	1	1	–	SP, SO, 44-pin ML
dsPIC30F4012	28/44	48	2048	1024	5	4	2	6 ch	Yes	6 ch, 4 S/H	1	1	1	1	1	SP, SO, 44-pin ML
dsPIC30F3011	40/44	24	1024	1024	5	4	4	6 ch	Yes	9 ch, 4 S/H	1	2	1	1	–	P, PT, ML
dsPIC30F4011	40/44	48	2048	1024	5	4	4	6 ch	Yes	9 ch, 4 S/H	1	2	1	1	1	P, PT, ML
dsPIC30F5015	64	66	2048	1024	5	4	4	8 ch	Yes	16 ch, 4 S/H	1	1	2	1	1	PT
dsPIC30F6015	64	144	8192	4096	5	8	8	8 ch	Yes	16 ch, 4 S/H	3	2	2	1	1	PT
dsPIC30F5016	80	66	2048	1024	5	4	4	8 ch	Yes	16 ch, 4 S/H	1	1	2	1	1	PT
dsPIC30F6010A	80	144	8192	4096	5	8	8	8 ch	Yes	16 ch, 4 S/H	3	2	2	1	2	PF, PT

## Digital Power Conversion Family

This dsPIC30F family supports applications such as Switch Mode Power Supplies (SMPS), induction cooking, UPS, inverter, power factor correction and digital control loops. These devices contain 1 nS resolution PWMs coupled with our fastest on-chip ADC and comparators to facilitate a variety of applications and power supply topologies.

Product	Pins	Flash Memory Kbytes	RAM (Bytes)	ADC 10-bit, 2 Msps Ch.	Analog Comparators	High-Speed PWM	Timers	Input Capture	Output Compare/Standard PWM	UART	SPI	I <sup>2</sup> C™	Package Code
dsPIC30F1010	28	6	256	6 ch, 2 S&H	2	2 x 2	2	–	1	1	1	1	SO, SP, MM
dsPIC30F2020	28	12	512	8 ch, 4 S&H	4	4 x 2	3	1	2	1	1	1	SO, SP, MM
dsPIC30F2023	44	12	512	12 ch, 4 S&H	4	4 x 2	3	1	2	1	1	1	PT, ML

# Designed for real-time control, Microchip's 16-bit controllers offer outstanding reliability, robustness and reduced system cost

## Reliable watchdog timer

Microchip's watchdog timer runs from its internal oscillator independent of the system clock.

## On-chip system clock monitor adds safety

The on-chip clock monitor detects a system clock failure and forces a chip-reset. Restarting the system with the on-chip oscillator provides a graceful way to handle such a catastrophic failure.

## Extended temperature

Currently many dsPIC DSCs offer 125°C options, making Microchip's 16-bit products ideal for industrial applications that run "hot" such as motor control, power conversion, lighting control and "under-the-hood" automotive systems, such as EPS, electronic gearbox, cooling fan control, etc. Most of the 16-bit lineup is expected to offer extended temperature options.

## High-current I/O drives save cost

The dsPIC30F and PIC24F families have I/O pins that can drive LEDs directly or eliminate pre-drivers for external FET switches to save you space and cost.

## On-chip oscillator eliminates crystal, reduces cost

Most 16-bit devices permit the on-chip precision oscillator to be the clock source for your designs. The associated low-jitter PLL can boost the clock to full speed and may eliminate the need for an external crystal. Now you can eliminate the external crystal, save board space and reduce system cost.

## Power save modes optimize power consumption

You have many choices to optimize power consumption inspired by our nanoWatt Technology. Switch to a low frequency on-chip oscillator or divide down the system clock during periods of inactivity. Or you can "power down" core and selected peripherals. Or simply operate at slower speed to conserve power.

## Low Jitter PLL for reliable system operation

On-chip PLL with crystal oscillator input offers low jitter,  $< \pm 0.75\%$  over  $V_{DD}$  and temperature for reliable operation of CAN, UART or other forms of communication.

## Small package, big performance

Several dsPIC DSCs come in QFN packages as small as 6x6 mm. PIC24 MCUs are expected to follow shortly. Now you can add 16-bit performance and save board space too.

## Power-on reset and brown-out reset add robustness, save cost

Intelligent on-chip Power-on Reset eliminates external reset circuitry in most systems. Brown-out can reset the chip in the event of a power glitch. All this adds up to a robust system at a reduced cost.

## Self-monitoring CPU protects against software glitches

Code execution flow is continually monitored to prevent catastrophic failures due to software malfunction. Accesses to non-existing memory locations are trapped, as are stack overflow, stack underflow and uninitialized pointer accesses. Now your real-time system has an added level of safety.

**Microchip's 16-bit product line is designed to meet the rigorous demands of real-time systems. Not only is its real-time performance superior to other 16- and 32-bit controllers, it also offers a number of highly enabling features specifically designed to enhance system reliability and robustness, and reduce system cost by eliminating external components.**

# Powerful Tools and Libraries to Ease Your Development

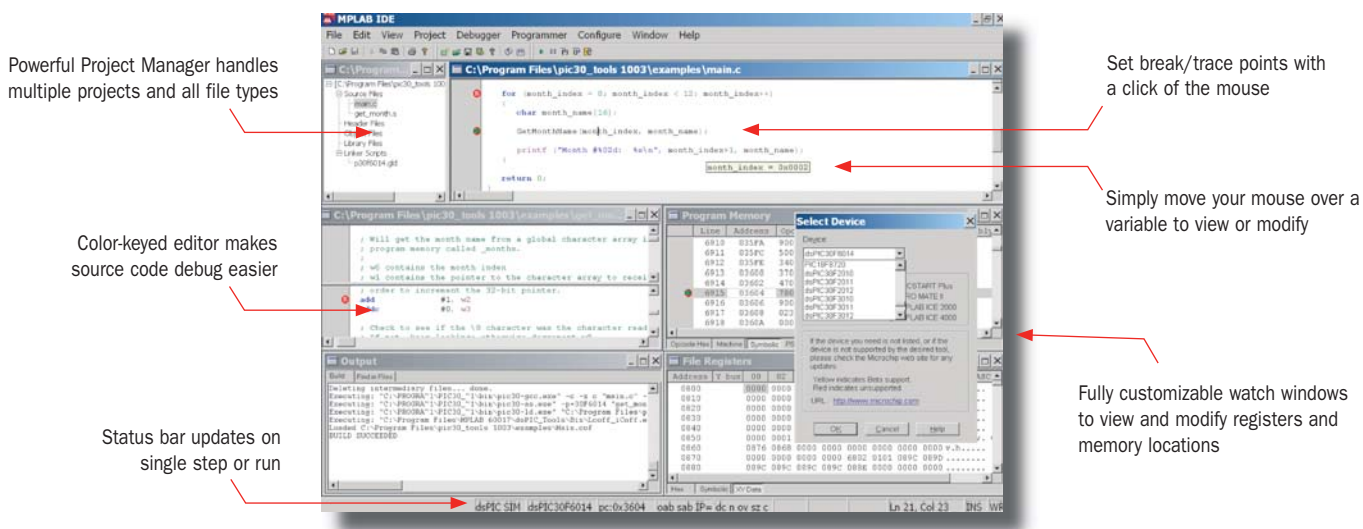
Microchip's 16-bit controllers are supported by an extensive array of development tools, application libraries (many of which are free of charge), development boards and reference designs that allow high-performance embedded solutions to be designed easily and rapidly.



## MPLAB® Integrated Development Environment (IDE)

All of Microchip's MCU and DSC tools operate cohesively under the MPLAB IDE umbrella. The powerful and easy-to-use MPLAB IDE has all of the advanced edit/build/debug features you would expect from a 32-bit debug environment. MPLAB IDE integrates not only software, but all of Microchip's hardware tools and many third party tools. Key features of MPLAB IDE:

- Designed for Windows® XP, 2000 and Windows NT®
- Project build and management
- Flexible watch windows
- Mouse over variable inspection
- Full feature code editor with color context
- Source level debug in ASM and C
- Searchable trace buffers
- Version control integration



## The Essential Software and Hardware Development Tools

Our development tools suite provides value with many free and low-cost tools. You can get started with the MPLAB ICD 2 In-Circuit Debugger/Programmer and the MPLAB IDE for approximately US \$160.

If you already own a PRO MATE® II Full Featured Device Programmer, the dsPIC30F family is supported on it. If you are considering a new full-featured programmer, the MPLAB PM3 is recommended.

Software Development Tools	
MPLAB® IDE	Integrated Development Environment
MPLAB® ASM30	Assembler
MPLAB® SIM	Software Simulator
MPLAB® VDI	Visual Device Initializer
MPLAB® C30	ANSI C Compiler
Hardware Development Tools	
MPLAB® ICD 2	In-Circuit Debugger/Programmer
MPLAB® REAL ICE™	In-Circuit Emulation System
MPLAB® PM3	Full Featured Device Programmer

## Free Evaluation License for Evaluation and Development

A common issue with advanced software libraries is that in order to evaluate the complete library, you must enter into a complex and expensive license arrangement. Now you may download and evaluate Microchip's advanced libraries free of charge from Microchip's web site. (Security libraries must be shipped on CD for \$5.00). Some advanced libraries have a low one-time license fee (no royalty obligation) if you decide to use them in production. Many other libraries are free for production use.

# World Class 16-bit Software Development Tools

## 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 MPLAB C30 C Compiler has a powerful code optimizer; other 16-bit MCUs generate as much as 165 percent larger code for the same application.

## FREE Assembler/Linker/Librarian

The MPLAB ASM30 is a full-featured macro assembler. User defined macros, conditional assembly and a variety of assembler directives make the MPLAB ASM30 a powerful code generation tool.

The MPLAB LINK30 and MPLAB LIB30 are Linker and Librarian modules that allow efficient linking, library creation and maintenance.

## FREE MPLAB SIM Software Simulator

The MPLAB SIM Software Simulator is a full-featured, cycle accurate software simulator. In addition to simulating the CPU and the instruction set, it also supports key peripherals, such as timers, I/O, interrupts, UART and ADC modules. MPLAB SIM has powerful stimulus capabilities and file I/O. It is ideal for algorithm development.



Download a full-featured, time-restricted demonstration version of the MPLAB C30 C Compiler from the Microchip web site for evaluation.

## MPLAB VDI (Visual Device Initializer)

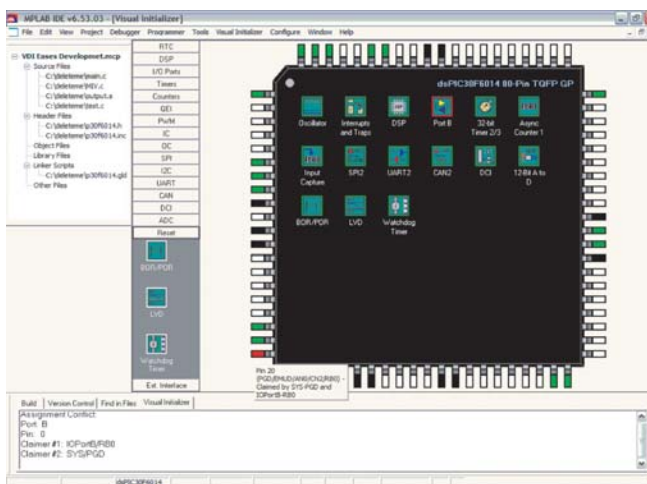


Configuring a powerful 16-bit MCU or DSP can be a complex and challenging task, but not for our 16-bit products. Our MPLAB VDI allows you to configure the entire DSC graphically and when complete, a mouse click generates initialization code usable in assembly or C programs.

The MPLAB VDI does extensive error checking on assignments and conflicts on pins, memories and interrupts, as well as a selection of operating conditions. The generated code files are effortlessly integrated with the rest of your application code through the MPLAB Project Manager.

The detailed reports on resource assignment and configuration simplify project documentation. Key features of the MPLAB VDI:

- Drag-and-drop feature selection
- One click configuration
- Extensive error checking
- Generates initialization code
- Integrates effortlessly in MPLAB Project Manager
- Printed reports ease project documentation requirements



# Jump-start Your Design with Proven and Optimized Building Block Libraries

## FREE Peripheral Driver Library

This library of over 270 C utility functions helps you set up and operate the hardware peripheral modules in various modes. Functions covered in the Peripheral Driver Library:

- 10-bit and 12-bit ADCs
- UART, SPI, I<sup>2</sup>C™ and codec interface
- Motor control PWM and QEI
- General-purpose timers
- Input capture and output compare
- SMPS PWM
- SMPS 10-bit ADC

## FREE Math Library

This IEEE-754 compliant library provides single and double precision floating point ANSI C standard math functions. These routines have been optimized to provide the smallest code size. The library can be used in assembly or C. Key functions in the Math Library:

- sin, cos, tan
- asin, acos, atan
- ln, log10, sqrt, power
- ceil, floor, mod, frexp

## FREE DSP Algorithm Library

This extensive DSP building block library is fully optimized in assembly code for execution speed. The DSP functions can be used in assembly or C. Some key algorithms addressed in the DSP Algorithm Library:

- Cascaded IIR filters
- FIR filters and LMS filters
- Correlation, convolution
- FFT and window functions
- Matrix and vector operations

# Hardware Development Tools

## MPLAB ICD 2 In-Circuit Debugger/Programmer

The MPLAB ICD 2 In-Circuit Debugger/Programmer is a powerful, low-cost development tool. Running under MPLAB IDE, MPLAB ICD 2 can debug ASM or C source code, watch and modify variables, single step and set breakpoints. Key features:

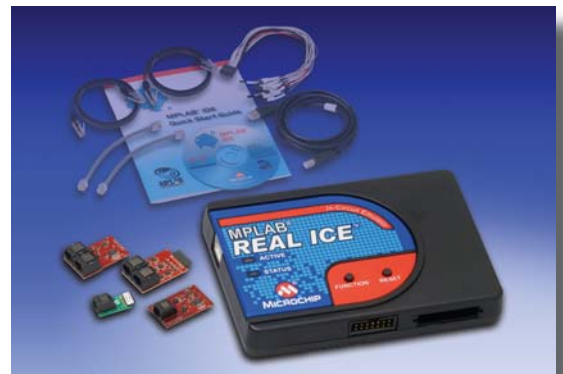
- Full speed operation
- USB or serial port connection to PC
- Flash memory programmer
- Smart watch variable windows
- Advanced breakpoint features



## MPLAB REAL ICE™ In-Circuit Emulation System

The MPLAB REAL ICE In-Circuit Emulator is Microchip's next-generation emulation and debugging system. Initially supporting the dsPIC33F, PIC24H, PIC24F and dsPIC30F601XA 16-bit devices, this system provides a powerful in-circuit emulation platform for easy and rapid application development and debugging. The emulation is performed using special hardware logic on the target device itself, eliminating the need for a separate emulator device. Key features:

- Up to 6 hardware breakpoints
- Up to 1,000 software breakpoints
- User-controlled program memory trace/data memory log
- High-speed USB 2.0 PC interface
- Traditional In-Circuit Serial Programming™ (ICSP™) interface or LVDS (add-on option)
- Run, Halt and Single-step modes
- Logic probe
- Stopwatch



## MPLAB PM3 Device Programmer

MPLAB PM3 Device Programmer is a full-featured, production quality universal device programmer. Using interchangeable socket modules, the MPLAB PM3 supports virtually all programmable devices from Microchip. MPLAB PM3 has improved programming time for many devices and offers a built-in interface for robust ICSP



# Hardware Development Boards: Jump-start Your Design

A variety of hardware development boards are available for the PIC24 MCU and dsPIC DSC, enabling you to shorten your design cycle. These boards are designed to allow easy connection to an MPLAB ICD 2, MPLAB REAL ICE or MPLAB PM3. All development boards include documentation and example source code to accelerate your design.

## Explorer 16 Development Board

This low-cost development board is used to evaluate the features and performance of the PIC24 microcontroller and dsPIC33F digital signal controller families and is an ideal prototyping tool to help you quickly develop and validate key design requirements. Key features:

- Supports PIC24F, PIC24H and dsPIC33F general purpose and motor control products
- Two interchangeable Plug-In Modules (PIMs), one for the PIC24F and one for the dsPIC33F
- Modular design for PICTail™ Plus application-specific daughter cards including:
  - Secure Digital (SD)/Multimedia Card (MMC) to SPI interface (AC164122)
  - Ethernet (AC164123)
  - Compact Flash, IEEE 802.15.4 WPAN™, IrDA® Protocol, Voice Playback daughter cards (Contact Microchip for availability)
  - Motor Control Daughter Card to interface to 3-phase power modules

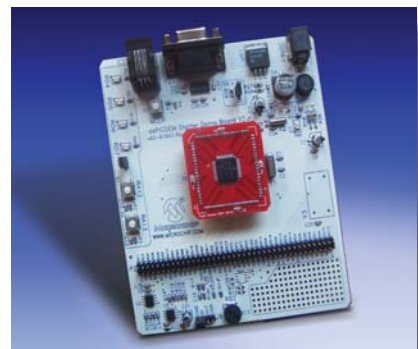


**DM240001**

## dsPICDEM™ 80-pin Starter Development Board

This development board offers a very economical way to evaluate the 80-pin dsPIC30F General Purpose and Motor Control families as well as the dsPIC33F devices. Key features:

- Includes a 80-pin dsPIC30F6014A General Purpose plug-in module (MA300014)
- Accommodates 80-pin dsPIC30F6010 Motor Control plug-in module (MA300013) and the 80- to 100-pin dsPIC33F General Purpose plug-in module (MA330012)
- Power input from 9V supply
- LEDs, switches, potentiometer, UART interface
- ADC input filter circuit for speech-band signal input
- On-board DAC and filter for speech-band signal output
- Circuit prototyping area
- Assembly language demonstration program and tutorial
- Includes a selectable voltage regulator with outputs of 5 to 3.3V



**DM300019**

## 16-bit 28-pin Starter Development Board

This development board is an economical way to get started with any of Microchip's 28-pin 16-bit MCU or DSC devices. Key features:

- Includes a 28-pin PIC24FJ64GA002 and dsPIC33FJ12GP202
- Regulators for 3.3V or 5V operation
- Power input from 9V power supply or USB power source
- Single UART communication channel via USB bridge
- MPLAB ICD 2 and PICKIT™ 2 Connections
- Header for access to all device I/O pins
- Circuit prototyping area including pads for SOIC and SOT-23 devices
- Accommodates all 28-pin, SDIP PIC24, dsPIC30F and dsPIC33F devices



**DM300027**

## Motor Control Development System

This system provides quick prototyping and validation of BLDC, ACIM, PMSM, SR and Power Conversion applications. The system consists of a processor board and one of two optional power modules.

### Power Modules

The dsPICDEM MC1H 3-Phase High-Voltage Power Module (DM300021) supports AC line-powered applications, while the dsPICDEM MC1L 3-Phase Low-Voltage Power Module (DM300022) supports DC-powered applications up to 48V. Key features:

- Full automatic protection of power circuits
- Electrical isolation from power circuits
- Many options for motor feedback signals

### Recommended Processor Boards

DSC Family	Processor Board
dsPIC30F	DM300020
dsPIC33F	DM240001 + AC164128



**DM300021/22**

Note: Power module shown with dsPICDEM MC1 Development Board (DM300020)



**DM300020**

Includes a dsPIC30F6010 plug-in module (MA300013)

# Advanced Development Boards: Complex Designs Made Simple

## PICDEM™ MC LV Motor Control Development Board

This board provides a cost-effective method of evaluating and developing sensed or sensorless BLDC motor control applications. A 28-pin, dsPIC30F3010 device is used with this board. Key features:

- Over-current protection and temperature sensor with I<sup>2</sup>C™ interface
- 3-phase voltage source inverter bridge
- 9 LEDs, 3 for generic status indication and 6 for PWM indication
- Test points for motor current and back EMF sensing
- Speed control potentiometer
- Supports maximum motor ratings of 48V and 2.2A
- Supports 28-pin PIC18 MCUs; specifically the PIC18F2431
- Power supply and motor are available (optional) for out-of-the-box experience



## dsPICDEM SMPS Buck Development Board

This development board implements a simple DC/DC Switch Mode Power Supply (SMPS) and is a good starting point for designers new to digital loop control design. Key features:

- Dual independent buck converters
- Buck converters can operate in Synchronous or Asynchronous modes
- Input voltage range 7V to 15V (nominal 9V)
- Output voltage programmable: 0 to input voltage minus 1.5V
- User can enable a dynamic output load to investigate transient response



## dsPICDEM.net™ Connectivity Development Board

This board provides development support for soft modem and connectivity-related applications. Key features:

- dsPICDEM.net 1 (DM300004-1) supports FCC/JATE PSTN countries
- dsPICDEM.net 2 (DM300004-2) supports CTR-21 PSTN countries
- Includes a dsPIC30F6014 plug-in module (MA300011)
- 10Base-T Ethernet MAC and PHY interface and PSTN interface with DAA/AFE chipset
- Serial communication channels (UART and CAN)
- External EEPROM and RAM memory for storing constants
- General purpose prototyping area and expansion header
- LEDs, switches, potentiometers and LCD display



## dsPICDEM 1.1 Plus General Purpose Development Board

This board provides development support for speech and audio-related applications. Key features:

- Includes a dsPIC30F6014A plug-in module (MA300014)
- Serial communication channels (two UART, SPI, CAN)
- Si3000 codec with MIC IN/Speaker OUT
- General purpose prototyping area and expansion header
- Digital potentiometer, LEDs, switches, etc.



## dsPICDEM 2 Development Board

This development board provides a cost effective way to start designing solutions for all 18-, 28- and 40-pin DIP-packaged dsPIC DSC devices. Key features:

- Development platform for 11 dsPIC DSC devices in 18-, 28- and 40-pin DIP packages including Motor Control, Sensor and General-Purpose family devices
- On-board CAN and UART support
- On-board support for multiple oscillator options
- Example source code and a User Guide is provided to jump-start application development for all 11 devices

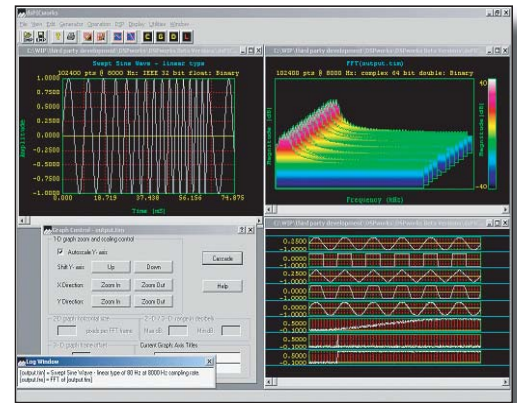


# Develop DSP Algorithms: The Easy Way

## **FREE** dsPICworks™ Data Analysis and DSP Software

The dsPICworks Data Analysis and DSP Software makes it easy to evaluate and analyze DSP algorithms. You can run a variety of DSP and arithmetic operations and analyze your data in both time and frequency domain. Key features of the dsPICworks Data Analysis and DSP Software:

- Visually analyze time and frequency domain data
- DSP operations: FFT, convolution, correlation, DCT and filtering
- Waveform synthesis
- Tool generates one-, two- and three-dimensional frequency graphs
- Data import/export options to interface with MPLAB IDE and MPLAB ASM30
- Support for fractional, integer and IEEE floating point data in decimal and hexadecimal notation



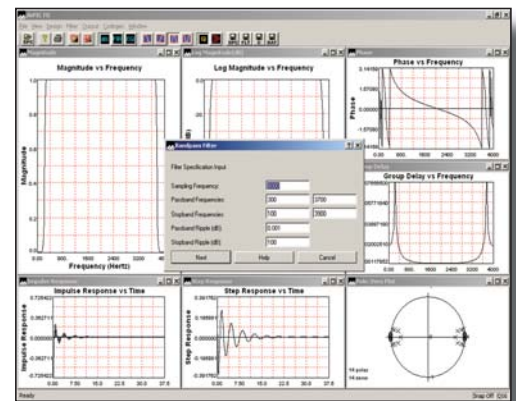
## Digital Filter Design Tool

The Digital Filter Design Tool makes designing and analyzing FIR and IIR filters easy. Enter frequency specifications and filter code and coefficients are generated automatically. Graphical output windows provide the desired filter's characteristics.

## Digital Filter Design Lite Tool

Not ready to purchase the whole Digital Filter package? Why not start Lite? The Digital Filter Design Lite Tool includes most of the features of the full-featured version at a fraction of the cost.

	Filter Design	Filter Design Lite
List Price	\$249	\$29
Low-pass	√	√
High-pass	√	√
Band-pass	√	√
Band-stop	√	√
FIR Taps	Up to 513	Up to 64
IIR Taps for LP/HP	Up to 10	Up to 4
IIR Taps for BP/BS	Up to 20	Up to 8
Generate ASM Code	√	√
Export to MPLAB® IDE	√	√
Export to MPLAB® C30 C Compiler	√	√
MATLAB® Support	√	—



# Operating Systems and Communication Drivers

## RTOS

If you need a Real-Time Operating System (RTOS) to handle multitasking, we have a three-tier solution for you.

- CMX-RTX™: full-featured fully preemptive multi-tasking OS
- CMX-Tiny+™: fully preemptive scaled-down version of the RTX OS
- CMX-Scheduler™: fully preemptive multi-tasking mini OS (FREE)

All three operating systems are fully preemptive and written in assembly language optimized for maximum performance. These RTOS products are developed by CMX and available from Microchip and CMX.

## OSEK and CAN Drivers

Vector Informatik GmbH provides automotive operating systems, sometimes labeled as an OSEK operating system. The Vector Informatik oSCAN operating system, which is based on the OSEK/VDX® standard, provides a multitasking operating system with optimal features for use on MCUs. This product represents a small, sturdy operating system kernel.

The companion support for managing the CAN interface drivers on the dsPIC30F family of products is the CANbedded CAN driver suite from Vector Informatik. This product consists of a number of adaptive source code modules that cover the basic communication requirements in automotive applications.

### RTOS Features:

- Small program memory footprints
- The fastest context switch times
- The lowest interrupt latency times
- True Preemption

### Some of the CAN Functions Supported:

- Initialize CAN Module
- Set CAN Operational Mode
- Set CAN Baud Rate
- Set CAN Mask
- Set CAN Filter
- Send CAN Message
- Receive CAN Message
- Abort CAN Sequence
- Random Number Generator
- Provide Error Notification

# Libraries for Speech Applications

## Speech Encoding/Decoding Libraries

Three options exist for a variety of speech compression/encoding and decompression/decoding applications:

- FREE** • G.711 is available for free. The library is an implementation of the ITU-T G.711 standard which uses A-law or  $\mu$ -law companding to achieve 2: 1 compression.
- G.726A is an implementation of the ITU-T G.726 Annex A standard which uses Adaptive Differential Pulse Code Modulation (ADPCM) encoding algorithm. It can achieve up to an 8:1 compression ratio depending on output bit rate selected.
- SPEEX is a popular standard in the LINUX workstation community which has been adapted for the dsPIC DSC. It uses Code Excited Linear Prediction (CELP) encoding pioneered for cellular applications. It can achieve a 16:1 compression ratio.

Vocoder	Incoming Data Rate (16-bit)	Output Rate	Speech Quality (MOS)	MIPS	Flash (KB)	RAM (KB)	Target
G.711	8 kHz	64 kbps	4.3-4.5	1	3	3.6	PIC24/dsPIC DSC
G.726A	8 kHz	16 to 40 kbps	4.3-4.5	15	6	4	dsPIC DSC
SPEEX	8 kHz	8 kbps	3.7-4.2	19	33	5.4	dsPIC DSC

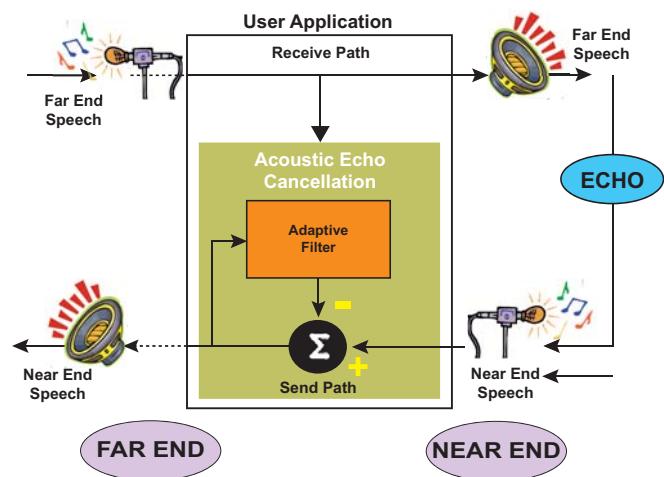
## Noise Suppression Library

This application library suppresses the noise interference in a speech signal, such as ambient noise picked up by a microphone while capturing speech. This algorithm is particularly useful for systems such as hands-free phones, speakerphones, intercoms and headsets where an isolated noise reference is not available. The algorithm handles 0-4 kHz audio bandwidth and provides 10-20 dB of noise reduction. The library also includes some sample rate conversion functions to support input/output sampling rates of 9.6 kHz, 11.025 kHz and 12 kHz.



## Acoustic Echo Cancellation Library

This library provides a function to eliminate the echo generated in the acoustic path between a speaker and a microphone, such as in a speakerphone or an intercom system. This library is fully compliant with the G.167 standard and provides 16, 32 or 64 ms echo delays. It handles 0-4 kHz audio bandwidth and provides echo cancellation of 40-50 dB. It also includes some sample rate conversion functions to support input/output sampling rates of 9.6 kHz, 11.025 kHz and 12 kHz.



### Line Cancellation Library Features:

- 8 kHz sampling rate
- Full duplex
- Compliant with ITU-T G.168 recommendations
- Royalty-free, one-time license

## Line Echo Cancellation Library

This library provides a function to cancel electrical line echoes caused by 2- to 4-wire conversion hybrids in telephone lines. The library can be used in long distance voice communication applications, especially in links involving satellite networks and intercontinental long haul networks, as well as digital networks, such as Voice over IP (VoIP). This library is fully compliant with the ITU-T G.168 recommendation. The library can be used for full-duplex operation. It handles 0-4 kHz audio bandwidth (8 kHz sampling of 16-bit speech data).

## Speech Recognition

Automatic Speech Recognition (ASR) for the dsPIC DSCs supports a variety of voice-activated applications like handset and home appliance control. A Speech Word Library Builder and a Speech Recognition Software Library make up the ASR software suite.

### Speech Recognition Library Features:

- Speaker independent recognition
- PC-based word library builder
- Up to 100 word vocabulary (American English)
- Supports multiple noise profiles
- Suitable for many voice control applications

# Plug and Play with Our Connectivity Libraries



## TCP/IP Protocol Stack

### Microchip Free TCP/IP Stack Software (ENC28J60 driver)

The Microchip TCP/IP Stack is a free suite of programs that provide services for standard TCP/IP-based applications (HTTP server, FTP server, etc.) or it can be used in a custom TCP/IP-based application. The stack is portable across all PIC18, PIC24, dsPIC30F and dsPIC33F products. It contains support for MPLAB C18, HI-TECH PIC-18 and MPLAB® C30 C compilers.

### Microchip Free TCP/IP Stack

- Socket support for TCP and UDP
- RTOS independent
- Full TCP state machine
- Supports ENC28J60 Ethernet controller
- Modules provided: MAC, SLIP, ARP, IP, ICMP, TCP, SNMP, UDP, DHCP, FTP and HTTP

### MicroNet™ TCP/IP Stack by CMX

MicroNet TCP/IP Stack by CMX is specifically designed for optimized use of Flash and RAM resources on the dsPIC DSC. The software runs directly on the processor with no gateways or PCs required. The stack can operate in stand alone mode or work in conjunction with an RTOS. Using only industry standard protocols, CMX-MicroNet offers true TCP/IP networking via direct, dial-up or Ethernet connectivity and wireless Ethernet (802.11b) as well. This library can be readily implemented on the dsPICDEM.net™ Connectivity Board. This stack supports Point-to-Point Protocol, E-mail support and modem control, which are not currently supported on the free Microchip stack

### MicroNet™ TCP/IP Stack by CMX

- RFC compliant protocol stack
- Supports CMX RTOS
- Ethernet NIC driver
- Small Flash/RAM footprint
- Source code provided



## Soft Modem Libraries

### V.22bis/V.22 Soft Modem Library

This library is available free of charge from the Microchip web site. The V.22bis Soft Modem Library is a collection of algorithms for ITU-T compliant V.21/Bell 103, V.22 and V.22bis modems and V.42 recommendations. The V.22bis library comes with full source code and archives that contain object code modules required for linking with your application. The transmit and receive data pump code modules are coded in assembly language for optimal speed and smallest code size, while the AT, V.42 and Data Pump APIs are coded in C. Hardware component drivers, such as UART and Data Converter Interface (DCI) for Analog Front End (AFE) I/O, are provided. This library can be readily implemented on the dsPICDEM.net™ Connectivity Board.

### V.32bis/V.22bis by Microchip

- Data Pump coded in assembly for optimal size and speed
- V.32bis (4800 thru 14,400 bps)
- V.22bis (1200 thru 2400 bps)
- V.42 (LAPM, error correction procedure)

### V.32bis Soft Modem Library

The V.32bis Soft Modem Library is a collection of algorithms for ITU-T compliant V.21/Bell 103, V.22, V.22bis, V.32 and V.32bis modems and V.42 recommendations. The V.32bis library is provided with archives that contain object code modules required for linking with your application. The transmit and receive data pump code modules are coded in assembly language for optimal speed and smallest code size, while the AT, V.42 and Data Pump APIs are coded in C. Hardware component drivers, such as UART and DCI for AFE I/O, are provided. This library can be readily implemented on the dsPICDEM.net Connectivity Development Board.

### V.32/V.22/V.22bis by VOCAL Technologies, LTD

- VOCAL's proven solution on a dsPIC30F
- V.32 (9600 and 4800 bps, non-trellis encoding)
- V.22/V.22bis (2400, 1200 and 600 bps)
- V.42 (LAPM, error correction procedure)

### V.32/V.22/V.22bis Soft Modem Library by VOCAL Technologies, LTD

The Soft Modem Library is a collection of data modulations and protocols (V.32, V.22, V.22bis, V.23, V.21, Bell 103, Bell 212A and Bell 202). This library is provided with archives that contain object code modules, which link to your application. The data modulation is coded in C with in-line assembly language optimization for speed and code size. Hardware component drivers, such as UART and DCI for AFE I/O are provided. This library can be readily implemented on the dsPICDEM.net Connectivity Board.

# More Application Libraries Ready to Use

## Encryption Libraries

Implement reliable secure applications using the Symmetric and Asymmetric Key Embedded Encryption Libraries. Developed for Microchip by NTRU Cryptosystems Inc., these libraries are both proven and optimized. Library functions can be easily called by your C or assembly code.

Alternatively, the 128-bit key AES and Triple-DES Libraries developed by Microchip are available for a production license fee of \$5.00 from microchipDIRECT online at [www.microchipDIRECT.com](http://www.microchipDIRECT.com).

### Symmetric Key Embedded Encryption Library Features:

- 128-bit AES in ECB, CTR, CBC, CBC-MAC and CCM modes
- Triple DES in ECB, CTR, CBC and CBC-MAC modes
- SHA-1, MD5, random number generator (DRBG X9.82)

### Asymmetric Key Embedded Encryption Library Features:

- RSA (1024-bit and 2048-bit modulus) for encryption/decryption and signing/verification
- DSA (1024-bit modulus) for signing/verification
- Diffie-Hellman Key Agreement (1024-bit and 2048-bit modulus)
  - Private/public key generation
  - Shared-key generation
- SHA-1, MD5, random number generator (DRBG X9.82)

### FAT16 File System Library Features:

- Available free for use on Microchip microcontrollers
- Portable across all PIC18, PIC24 and dsPIC DSC products
- Support for MPLAB C18 and MPLAB C30 C Compilers
- Supports SD/MMC and CompactFlash memory cards
- Supports up to 2 GB

## FREE FAT16 File System

The use of removable Flash-based media cards in embedded systems is becoming more prevalent. The FAT 16 File System Library allows you to easily integrate a removable Flash-based media card (up to 2 gigabytes) into your application.

# Motor Control Application Software

The Motor Control Family is suited for advanced AC Induction Motor (ACIM), Brushless DC (BLDC) and Switched Reluctance (SR) motor applications. Two advanced applications are available that run on the dsPIC30F Motor Control Development System. Full documentation and source code are available for free on the Microchip web site for all application notes. Visit the Motor Control Design Center at [www.microchip.com/motor](http://www.microchip.com/motor) for more information about Microchip's motor control solutions.

## FREE Vector Control of an ACIM

This application note describes a fully-tested vector, or field oriented, control algorithm for a 3-phase ACIM. The motor currents, torque and velocity are regulated in control loops. Full documentation and source code are available for free on the Microchip web site. (Application Note: AN908).

## FREE Introduction to ACIM Control

This application note is an introductory approach to the methods described in AN908. Code is provided in an example that offers basic variable speed control of a single or three-phase ACIM. (Application Note: AN984).

## FREE Sensored BLDC Motor Control

This application note describes a fully-tested 3-phase BLDC motor control algorithm with 3 hall-effect sensors. Code is available with and without a PI speed control loop. (Application Note: AN957).

## FREE Sinusoidal PMSM Motor Control

This application note provides a fully working and highly flexible solution for using the dsPIC30F2010 to control a permanent magnet synchronous motor using all shunt windings to predict rotor position. (Application Note: AN1017).

## FREE Sensorless BLDC Control with Back-EMF Filtering

This application note describes how to apply a dsPIC DSC to control a sensorless BLDC motor, using the dsPIC30F6010A device on a dsPICDEM™ MC LV board platform. (Application Note: AN1083).

## FREE Sensorless BLDC Motor Control Using the dsPIC30F6010

This application note describes a fully-tested sensorless control algorithm for a 3-phase BLDC motor. Motor current, motor velocity and bus voltage are regulated in control loops. An LCD menu interface provides adjustment of all sensorless motor control parameters. This application solution utilizes a dsPIC30F6010 device and the dsPICDEM MC1 development system. (Application Note: AN901).

## FREE Sensorless BLDC Motor Control Using the dsPIC30F2010

This application note describes how to provide sensorless BLDC motor control with the dsPIC30F2010 device. The technique used is based on another Microchip application note: Using the dsPIC30F for Sensorless BLDC Control (AN901). This application solution and AN957 present a low pin count solution with minimal I/O and use the PICDEM™ MC LV system with a dsPIC30F2010 device. (Application Note: AN992).

## FREE Sensorless Field-Oriented Control for PMSM Motors

This application note describes how to apply a dsPIC DSC to control a permanent magnet synchronous motor using the field oriented control algorithm. Shunt resistors are used to estimate rotor position. (Application Note: AN1078).

# Resources for Self-paced Learning

## Web Seminars

Microchip offers extensive online resources for designers ranging from downloadable documentation to web seminars (webinars) to online discussion groups. All of these helpful resources are accessible at [www.microchip.com/webseminars](http://www.microchip.com/webseminars) and are updated frequently with the most current information on our products and services.

## Workshop in a Box

Periodically, Microchip or our sales channel partners offer a fee-based, instructor-led Workshop in a Box, a full day, hands-on training session. The registration fee includes a “box” containing a dsPIC DSC development board and related training material that is yours to keep to help you further your development skills.

If you have interest in a dsPIC DSC Introductory Workshop in a Box or a dsPIC DSC Motor Control Workshop in a Box, please contact your sales representative. In-house workshops can be arranged to accommodate larger design teams.

Webinar Topic
Introduction to the dsPIC® Digital Signal Controller
Introduction to Microchip's Development Tools
Introduction to dsPIC30F Architecture - Part 1
Introduction to dsPIC30F Architecture - Part 2
Introduction to MPLAB® IDE Integrated Development Environment
Basic dsPIC30F Development Tools
dsPIC30F Addressing Modes - Part 1
dsPIC30F Addressing Modes - Part 2
Introduction to dsPIC30F DSP Engine and ALU
Introduction to dsPIC30F Interrupts
dsPIC30F 12-bit ADC Module - Part 1
dsPIC30F 12-bit ADC Module - Part 2
dsPIC30F 10-bit ADC Module - Part 1
dsPIC30F 10-bit ADC Module - Part 2
Introduction to the MPLAB® VDI Visual Device Initializer
Serial Communications using the dsPIC30F - Part 1 (UART)
Serial Communications using the dsPIC30F - Part 2 (SPI)
Serial Communications using the dsPIC30F - Part 3 (I <sup>2</sup> C™)
Serial Communications using the dsPIC30F - Part 4 (CAN)

Webinar Topic
General Purpose Timers
dsPIC30F Motor Control Peripherals - Part 1 (MCPWM)
dsPIC30F Motor Control Peripherals - Part 2 (QEI)
Serial Communications using the dsPIC30F I <sup>2</sup> C™ Module
Serial Communications using the dsPIC30F CAN Module
dsPIC® DSC SPI Communication Module
dsPIC® DSC UART Module
dsPIC30F Quadrature Encoder Interface Module
dsPIC30F Motor Control PWM Module
dsPIC33F & PIC24H DMA Module
Introduction to the PIC24F MCU
PIC24F Peripheral Parts 1
PIC24F Peripheral Parts 2
Peripheral Pin Select Introduction

*For more information about additional self-paced learning resources, please visit [www.microchip.com/training](http://www.microchip.com/training)*

## Getting Started

When time is of the essence, it is helpful to get the hints you need when you need them. Use these “Getting Started” documents for specific techniques you can use to jump-start your applications. Getting Started documents are “Application Notes from 40,000 Feet.”

CE001 Using dsPIC30F ADCs and the DSP Library for Signal Filtering (DS92001A)	CE006 Address Error Traps for Easy Debugging (DS92006A)	CE011 Dynamic Clock Division for Low-Power Operation (DS92011A)	CE016 Interfacing to I <sup>2</sup> S Audio Codecs Using dsPIC30F DCI Module (DS92016)
CE002 Configuring 10-Bit dsPIC DSC ADCs for 1 Msps Conversion Rate (DS92002A)	CE007 Stack Error Traps for Easy Debugging (DS92007A)	CE012 Dynamic Clock Switching for Low-Power Operation (DS92012A)	CE017 Reading, Erasing and Writing to dsPIC30F Data EEPROM (DS92017)
CE003 Driving a BLDC with Sinusoidal Voltages Using dsPIC30F (DS92003A)	CE008 Oscillator Failure Traps and Fail-safe Clock Monitoring (DS92008A)	CE013 External Interrupt Pins - Configuration and Use (DS92013A)	CE018 Using the Fast Fourier Transform (FFT) for Frequency Detection
CE004 Timer 1 Used in Real-Time Clock Applications (DS92004A)	CE009 Math Error Traps for Robust Operation (DS92009A)	CE014 Fast Wake-up from Sleep Mode (DS92014A)	CE019 Proportional Integral Derivative (PID) Controllers and Closed-loop Control
CE005 Using FIR Filters from dsPIC DSC Filter Design and DSP Library (DS92005A)	CE010 Performing ADC Conversions in SLEEP (Low-power) Mode (DS92010A)	CE015 Dynamic Tuning of Internal Fast RC Oscillator (DS92015A)	



## Microchip Regional Training Centers

To meet customers’ demands for more training more often, Microchip has established a global network of Regional Training Centers (RTCs) that provide workshops and seminars on a year-round basis. Each RTC offers a multitude of courses on a regular basis to fit with your demanding schedule. You can benefit by learning in small hands-on classroom settings that focus on your specific needs. Visit the Microchip web site at [www.microchip.com/RTC](http://www.microchip.com/RTC) for the latest list.

# Software Development Tools and Operating Systems

Development Tool	Product Name	Description	Part#	List Price <sup>(1)</sup>	Devices Supported			
					PIC24F	PIC24H	dsPIC30F	dsPIC33F
Integrated Development Environment	MPLAB® IDE*	Integrated Development Environment	SW007002	Free	√	√	√	√
	CCS	Integrated Development Environment	-	Contact CCS	√	√	√	√
C Compilers	MPLAB® C30	ANSI C compiler, assembler, linker and librarian	SW006012	\$895	√	√	√	√
	MPLAB® C30 Site License	Site License for compiler	SL006012	\$8950	√	√	√	√
	Embedded Workbench for dsPIC30F	ISO/ANSI C and Embedded C++ compiler in a professional, extensible IDE, (Windows® NT/2000/Windows XP® ) special DSP support included	EWdsPIC 1	Contact IAR	√	√	√	√
	HI-TECH C	ANSI C Compiler for dsPIC® DSCs and PIC24 MCUs, integrates with MPLAB® IDE	dsPIC/PIC24	Contact HI-TECH	√	√	√	√
Operating Systems	CMX-Tiny+™ for dsPIC® DSC	Preemptive Real-time Operating System (RTOS) for dsPIC30F (from CMX)	CMX-Tiny+ for dsPIC30F	Contact CMX	√	√	√	√
		Preemptive Real-time Operating System (RTOS) for dsPIC30F	SW300032	\$3000	√	√	√	√
	CMX-RTX™ for dsPIC® DSC	Fully preemptive Real-time Operating System (RTOS) for dsPIC30F (from CMX)	CMX-RTX for dsPIC30F	Contact CMX	√	√	√	√
		Fully preemptive Real-time Operating System (RTOS) for dsPIC30F	SW300031	\$4000	√	√	√	√
	CMX Scheduler™	Multi-tasking, preemptive scheduler for dsPIC30F	SW300030	Free	√	√	√	√
	osCAN for dsPIC® DSC	OSEK/VDX v2.2	-	Contact Vector	-	√	√	√
	FreeRTOS.org™	Portable, open source, mini real time kernel	-	Contact freeRTOS.org™	√	√	√	√
	SEGGER embOS	Real-time operating system for embedded applications	-	Contact SEGGER	√	√	√	√
Micrium µC/OS-II	Portable, scalable, preemptive real-time, multitasking kernel	-	Contact Micrium	√	√	√	√	
DSP	dsPICworks™	Data analysis and DSP software	SW300023	Free	√	√	√	√
	Digital Filter Design	Full featured graphical IIR and FIR filter design package for dsPIC30F	SW300001	\$249	-	-	√	√
	Digital Filter Design Lite	Graphical IIR and FIR filter design package for dsPIC30F	SW300001-LT	\$29	-	-	√	√

<sup>(1)</sup> List price may change without notice.

\*Includes MPLAB ASM30, MPLAB SIM, MPLAB VDI.

# Development Boards and Reference Designs

Development Tool	Description	Part#	List Price <sup>(1)</sup>	Devices Supported			
				PIC24F	PIC24H	dsPIC30F	dsPIC33F
Starter Development Boards	Explorer 16 Development Board	DM240001	\$129.99	√	√	-	√
	Explorer 16 Development Board + MPLAB® ICD 2 In-Circuit Debugger/Programmer	DV164033	\$299.99	√	√	-	√
	dsPICDEM™ 80-pin Starter Development Board	DM300019	\$79.99	-	-	√	-
	16-bit 28-pin Starter Development Board	DM300027	\$79.99	√	√	√	√
	dsPICDEM™ 2 Development Board	DM300018	\$99.99			√	
General Purpose Development Board	dsPICDEM™ 1.1 Plus General Purpose Development Board	DM300024	\$299.99	-	-	√	√
Motor Control Development Boards	PICDEM™ MC LV Development Board	DM183021	\$129.99	-	-	√	-
	dsPICDEM™ MC1 Motor Control Development Board	DM300020	\$300	-	-	√	-
	dsPICDEM™ MC1H 3-Phase High Voltage Power Module	DM300021	\$800	-	-	√	√
	3-Phase ACIM High Voltage Motor (208/460V)	AC300021	\$120	-	-	√	√
	dsPICDEM™ MC1L 3-Phase Low Voltage Power Module	DM300022	\$700	-	-	√	√
3-Phase BLDC Low Voltage Motor (24V)	AC300020	\$120	-	-	√	√	
Connectivity Development Boards	dsPICDEM.net™ 1 with FCC/JATE-compliant and Ethernet NIC support	DM300004-1	\$389.99	-	-	√	-
	dsPICDEM.net™ 2 with CTR-21-compliant and Ethernet NIC support	DM300004-2	\$389.99	-	-	√	-
SMPS Development Board	dsPICDEM™ SMPS Buck Development Board	DM300023	\$99.99	-	-	√	-

<sup>(1)</sup> List price may change without notice.

# Hardware Development Tools

Development Tool	Description	Part#	List Price <sup>(1)</sup>	Devices Supported			
				PIC24F	PIC24H	dsPIC30F	dsPIC33F
MPLAB® ICD 2	In-Circuit Debugger/Programmer	DV164005	\$159.99	√	√	√	√
	In-Circuit Debugger/Programmer with dsPICDEM™ 1.1 Plus General Purpose Board	DV164032	\$399.99	–	–	√	–
MPLAB® REAL ICE™	In-Circuit Emulator System	DV244005	\$499.98	√	√	√	√
	Performance Pak	AC244002	\$159.98	√	√	√	√
MPLAB® PM3	Full Featured Device Programmer, Base Unit	DV007004	\$895	√	√	√	√
	Socket Module for 18L/28L/40L DIP Devices	AC164301	\$189	√	√	√	√
	Socket Module for 16L (.150)/28L (.300) SOIC Devices	AC164302	\$189	√	√	√	√
	Socket Module for 28L ML Devices	AC164322	\$189	√	√	√	√
	Socket Module for 44L ML Devices	AC164322	\$189	√	√	√	√
	Socket Module for 44L TQFP Devices	AC164305	\$189	√	√	√	√
	Socket Module for 64L TQFP Devices (PF Package)	AC164313	\$189	–	–	√	–
	Socket Module for 64L TQFP Devices (PT Package)	AC164319	\$189	√	√	√	√
	Socket Module for 80L TQFP Devices (PF Package)	AC164314	\$189	–	–	√	–
	Socket Module for 80L TQFP Devices (PT Package)	AC164320	\$189	√	–	√	√
3rd Party Programmers	BPM Microsystems	–	–	√	√	√	√
	Data I/O	–	–	√	√	√	√

<sup>(1)</sup> List price may change without notice.

## Plug-in Modules, PICtail™ Plus and Adapters for Development Boards

A Plug-in Module (PIM) is a daughter board with a PIC® MCU or dsPIC® DSC soldered on top and header socket strips on the bottom. This method allows for easy swapping of devices onto the various development boards, without having to unsolder and resolder parts.

Development Tool	Description	Part#	List Price <sup>(1)</sup>	Devices Supported			
				PIC24F	PIC24H	dsPIC30F	dsPIC33F
PICtail™ Plus Daughter Boards (for use with Explorer 16 Development Board DM240001)	PICtail™ Plus Daughter Board for Secure Digital (SD)/ Multimedia Card (MMC) to SPI interface	AC164122	\$37.99	√	√	–	√
	Ethernet PICtail™ Plus Daughter Board	AC164123	\$39.99	√	√	–	√
	Speech Playback PICtail™ Plus Daughter Board	AC164125	\$45	√	√	–	√
	Prototype PICtail™ Plus Daughter Board	AC164126	\$20	√	√	–	√
	Wireless PICtail™ Plus Daughter Board	AC163027	\$39.99	√	√	–	√
	IrDA® PICtail™ Plus Daughter Board	AC164124	\$25	√	√	–	√
	Speech Standard PICtail™ Plus Daughter Board	AC164125	\$45	√	√	–	√
	Graphic PICtail™ Plus Daughter Board	AC164127	\$125	√	√	–	√
Plug-in Modules	Motor Interface PICtail™ Plus Daughter Board	AC164128	\$125	√	√	–	√
	PC Board with 100-pin PIC24FJ128GA010 MCU sample; use with DM240001 Development Board	MA240011	\$25	√	–	–	–
	PC Board with 100-pin PIC24HJ256GP610 MCU sample; use with DM240001 Development Board	MA240012	\$25	–	√	–	–
	PC Board with 44-pin PIC24FJ64GA004 MCU sample; use with DM240001 Development Board	MA240013	\$25	√	–	–	–
	PC Board with 100-pin dsPIC33FJ256GP710 DSC sample; use with DM240001 Development Board	MA330011	\$25	–	–	–	√
	PC Board with 100-pin dsPIC33FJ256GP710 DSC sample; use with DM300019 Development Board	MA330012	\$25	–	–	–	√
	PC board with 100-pin dsPIC33FJ256MC710 motor control DSC sample; use with DM240001 Development Board	MA330013	\$25	–	–	–	√
	PC Board with 80-pin dsPIC30F6010A motor control DSC sample; use with DM300019 and DM300020 Development Boards	MA300015	\$25	–	–	√	–
	PC Board with 80-pin dsPIC30F6014A general purpose DSC sample; use with DM300024 and DM300019 Development Boards	MA300014	\$25	–	–	√	–
PC Board with 44-pin SMPS dsPIC30F2023 sample; use with DM300019 Development Board	MA300016	\$25	–	–	√	–	

<sup>(1)</sup> List price may change without notice.

# Software Libraries and Application Development Tools

Development Tool	Description	Part#	List Price <sup>(1)</sup>	Devices Supported			
				PIC24F	PIC24H	dsPIC30F	dsPIC33F
dsPIC30F Math Library	Standard math and floating point library (ASM, C Wrapper)	SW300020	Free	√	√	√	√
dsPIC30F Peripheral Library	Peripheral initialization, control and utility routines (C)	SW300021	Free	√	√	√	√
dsPIC30F DSP Library	Essential DSP algorithm suite (Filters, FFT)	SW300022	Free	–	–	√	√
Symmetric Key Embedded Encryption Library	Security encryption software support for AES, triple-DES, SHA-1, RNG and MD5	SW300050 - 5K*	\$2500	–	–	√	√
	Evaluation copy of security encryption software support for AES, triple-DES, SHA-1, RNG and MD5	SW300050-EVAL	\$5				
Triple DES/AES Encryption Libraries	Production license for security encryption software support for AES and Triple-DES	SW300052	\$5	√	√	√	√
Asymmetric Key Embedded Encryption Library	Security encryption software support for RSA, DSA, Diffie-Hellman, SHA-1, RNG and MD5	SW300055 - 5K*	\$2500	–	–	√	√
	Evaluation copy of security encryption software support for RSA, DSA, Diffie-Hellman, SHA-1, RNG and MD5	SW300055-EVAL	\$5	–	–	√	√
Noise Suppression Library	Function to suppress noise interference in speech signals	SW300040 - 5K*	\$2500	–	–	√	√
	Evaluation copy of function to suppress noise interference in speech signals	SW300040-EVAL	Free	–	–	√	√
Acoustic Echo Cancellation Library	Function to eliminate echo generated from a speaker to a microphone	SW300060 - 5K*	\$2500	–	–	√	√
	Evaluation copy of function to eliminate echo generated from a speaker to a microphone	SW300060-EVAL	Free	–	–	√	√
Line Echo Cancellation Library	Function to cancel electrical line echoes caused by 2- or 4-wire conversion hybrids	SW300080-5K	\$2500	–	–	√	√
	Function to cancel electrical line echoes caused by 2- or 4-wire conversion hybrids	SW300080-EVAL	Free	–	–	√	√
TCP/IP Library	TCP/IP connectivity and protocol support	CMX for dsPIC30F	Contact CMX	–	–	√	√
	TCP/IP connectivity and protocol support	SW300024	Free	√	√	√	√
Soft Modem Library	V.22bis/V.22 Soft Modem Library	SW300002	Free	–	–	√	√
	V.32bis Soft Modem Library	SW300003*	\$2500	–	–	√	√
	Evaluation copy of V.32bis Soft Modem Library	SW300003-EVAL	Free	–	–	√	√
	V.32 (non-trellis) Soft Modem Library	–	Contact Vocal	–	–	√	√
Speech Recognition System	Automatic speech recognition system including a PC-based speech training sub-system and a speech recognizer software library (16:1 compression)	SW300010 - 5K*	\$2500	–	–	√	√
	Evaluation copy of automatic speech recognition system including a PC-based speech training sub-system and a speech recognizer software library (16:1 compression)	SW300010-EVAL	Free	–	–	√	√
SPEEX Speech Encoding/Decoding Library	Speech library to perform speech compression and decompression	SW300070 - 5K*	\$2500	–	–	√	√
	Evaluation copy of speech library to perform speech compression and decompression	SW300070-EVAL	Free	–	–	√	√
G.711 Speech Encoding/Decoding Library	APCM speech compression and decompression (2:1 compression)	SW300026	Free	√	√	√	√
G.726A Speech Encoding/Decoding Library	Speech compression and decompression (8:1 compression)	SW300090 - 5K*	\$2500	–	–	√	√
	Evaluation copy of speech compression and decompression (8:1 compression)	SW300090-EVAL	Free	–	–	√	√
FAT16 File System Library	Implements all the standard FAT16 functions: fopen, fread, fwrite, fseek, etc.	SW300027	Free	√	√	√	√
CANbedded for dsPIC® DSC	CAN driver library for dsPIC30F	–	Contact Vector	–	√	√	√

<sup>(1)</sup> List price may change without notice.

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VOCAL Technologies, LTD	+1 716 688 4675	sales@vocal.com	www.vocal.com

# Documentation

Note that all the latest revisions of these documents are available from the Microchip web site.

Document Type	Document Title	Document Number
Overview Documents	PIC24H High Performance 16-bit Microcontroller Family Overview	DS70166
	dsPIC30F High Performance 16-bit Digital Signal Controller Family Overview	DS70043
	dsPIC33F High Performance 16-bit Digital Signal Controller Family Overview	DS70155
Data Sheets	PIC24FJ128GA Family Data Sheet	DS39747
	PIC24HJXXXGXP06/X08/X10 Data Sheet	DS70175
	dsPIC33FJXXXGXP06/X08/X10 Data Sheet	DS70286
	dsPIC30F1010, dsPIC30F202X Data Sheet	DS70178
	dsPIC33FJXXXMCX06/X08/X10 Data Sheet	DS70287
	dsPIC30F2010 Data Sheet	DS70118
	dsPIC30F2011, dsPIC30F2012, dsPIC30F3012, dsPIC30F3013 Data Sheet	DS70139
	dsPIC30F3010, dsPIC30F3011 Data Sheet	DS70141
	dsPIC30F3014, dsPIC30F4013 Data Sheet	DS70138
	dsPIC30F4011, dsPIC30F4012 Data Sheet	DS70135
	dsPIC30F5011, dsPIC30F5013 Data Sheet	DS70116
	dsPIC30F5015, dsPIC30F5016 Data Sheet	DS70149
	dsPIC30F6010 Data Sheet	DS70119
	dsPIC30F6011, dsPIC30F6012, dsPIC30F6013, dsPIC30F6014 Data Sheet	DS70117
	dsPIC30F6011A, dsPIC30F6012A, dsPIC30F6013A, dsPIC30F6014A Data Sheet	DS70143
	dsPIC30F6010A, dsPIC30F6015 Data Sheet	DS70150
Programming Specifications	dsPIC30F Flash Programming Specification	DS70102
	dsPIC33F/PIC24H Flash Programming Specification	DS70152
	PIC24F128GA Programming Specification	DS39768
Reference Manuals	PIC24F Family Reference Manual	DS39710
	dsPIC30F Language Tools Quick Reference Guide	DS51322
	dsPIC30F, dsPIC33F Programmer's Reference Manual	DS70157
	dsPIC30F Family Reference Manual	DS70046
Application Notes	AN833 - Microchip TCP/IP Stack Application Note	DS00833
	AN901 - Using the dsPIC30F for Sensorless BLDC Control	DS00901
	AN908 - Using the dsPIC30F for Vector Control of an AC Induction Motor	DS00908
	AN957 - Sensored BLDC Motor Control Using dsPIC30F2010	DS00957
	AN962 - Implementing Auto Baud on dsPIC30F Devices	DS00962
	AN984 - An Introduction to AC Induction Motor Control Using the dsPIC30F	DS00984
	AN992 - Sensorless BLDC Motor Control Using the dsPIC30F2010	DS00992
	AN1017 - Sinusoidal Control of a PMSM Motor with the dsPIC30F DSC	DS01017
	AN1025 - Converting A 5.0V Supply Rail to a Regulated 3.0V	DS01025
	AN1044 - Data Encryption Routines for PIC24 and dsPIC DSC Devices	DS01044
	AN1045 - Implementing File I/O Functions on Flash Cards Formatted with a FAT16 File System	DS01045
	AN1078 - Sensorless Field Oriented Control for PMSM Motors	DS01078
	AN1083 - Sensorless BLDC Control with Back-EMF Filtering	DS01083
	AN1095 - Emulating Data EEPROM for PIC18 and 16-bit MCUs and DSCs	DS01095
AN1106 - Power Factor Corrector in Power Conversion Applications	DS01106	
Migration Document	PIC18F to PIC24F Migration: An Overview	DS39764

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