MICROCHIP

dsPIC30F Digital Signal Controllers
## The Best of Both Worlds

What is a Digital Signal Controller?

A digital signal controller (DSC) is a single-chip, embedded controller that seamlessly integrates the control attributes of a microcontroller (MCU) with the computation and throughput capabilities of a digital signal processor (DSP).

Microchip's dsPIC30F digital signal controller offers everything you would expect from a powerful 16-bit MCU: fast, sophisticated and flexible interrupt handling; a wide array of digital and analog peripheral functions; power management; flexible clocking options; power-on-reset; brown-out protection; watchdog timer; code security; full-speed real-time emulation; and full-speed in-circuit debug solutions.

By skillfully adding DSP capability to a powerful 16-bit MCU, Microchip's dsPIC30F digital signal controller achieves the best of both worlds and marks the beginning of a new era in embedded control.
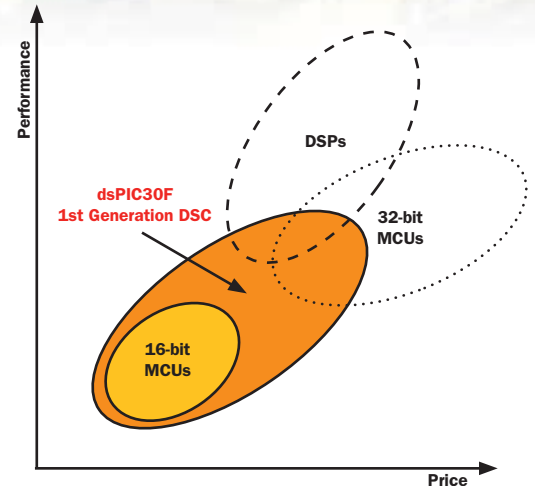
The Capability You Need

Powerful 16-bit MCU:

The dsPIC30F executes most of its instructions in 1 cycle (33ns at 30MIPS). Combine this high instruction throughput with true DSP capabilities, such as single cycle 16-bit multiply and zero overhead looping, and you have the most powerful 16-bit MCU at your command.

Looking to Add DSP?

If you are one of the many MCU users looking to add DSP features to your system, chances are you don't like your choices. Adding a DSP chip to your existing MCU-based system can be costly and complicated. The dsPIC30F DSC is designed to look and feel like an MCU. Adding DSP functionality in the familiar controller-like environment can be accomplished with ease.

Reliable Flash:

The dsPIC30F incorporates Microchip's PEEC Flash process technology with data retention of 40+ years at 85°C, endurance of 1 million cycles typical at 85°C and fast programming time. There is no better Flash technology for embedded control.

Additionally, the dsPIC30F can securely self-program its own Flash memory in a finished product.

DSP for the DSP Expert!

If you are a seasoned DSP developer, you'll be amazed at the capabilities the dsPIC30F offers—everything you expect from a DSP of its class: dual 40-bit accumulators, single cycle 16x16 MAC, 40-bit barrel shifter, dual operand fetches and DO and REPEAT loops. Then we added a few items usually missing from DSPs: flexible interrupts, large register sets, a watchdog timer, clock fail detect and real-time emulation to name a few.

Optimized C Compiler:

The dsPIC30F architecture was co-developed by our C compiler team. The result is a high C code efficiency when compared to any 16-bit MCU or DSP.

C code benchmarks show that competitive 16-bit MCUs require as much as 70% more program code space for the same application program written in C.
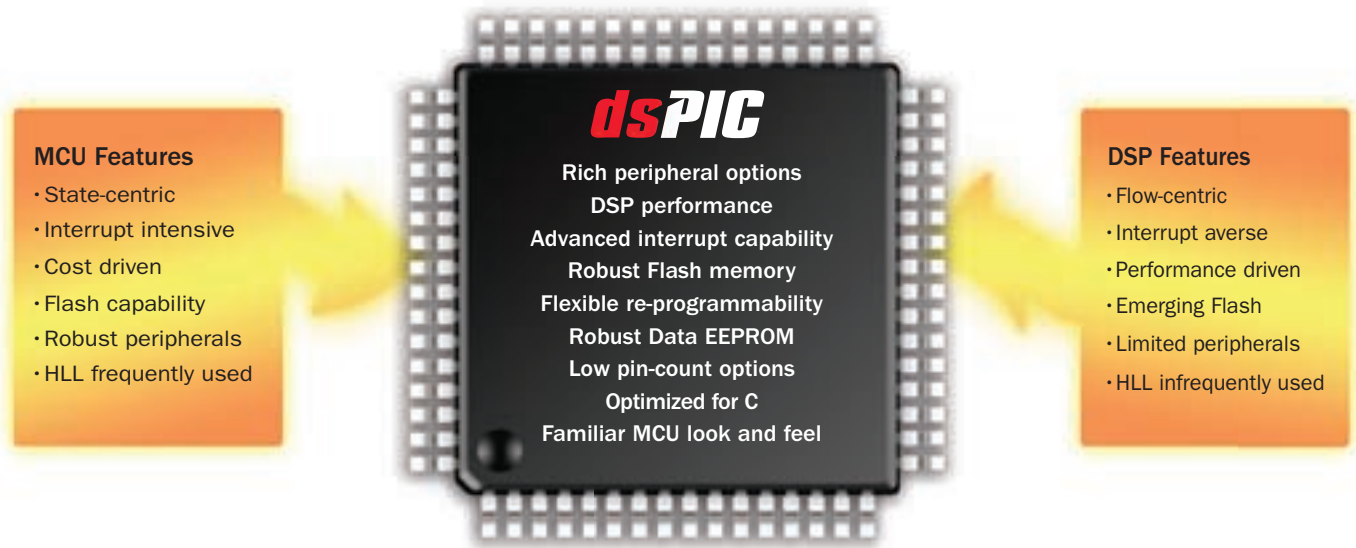
Considering a 32-bit MCU?

Considering a 32-bit controller because your current MCU has run out of steam?

The dsPIC30F with integrated DSP can outperform a 32-bit controller in many applications. Outstanding C code efficiency for 32-bit data type reduces memory requirements and cost.

Future dsPIC30F variants with larger program memory are already planned to give you a long-term roadmap with the dsPIC® DSC architecture.

Best of Both Worlds

MCU Features
- State-centric
- Interrupt intensive
- Cost driven
- Flash capability
- Robust peripherals
- HLL frequently used

dsPIC

Rich peripheral options
DSP performance
Advanced interrupt capability
Robust Flash memory
Flexible re-programmability
Robust Data EEPROM
Low pin-count options
Optimized for C
Familiar MCU look and feel

DSP Features
- Flow-centric
- Interrupt averse
- Performance driven
- Emerging Flash
- Limited peripherals
- HLL infrequently used

Bridging the Performance Gap

Microchip's dsPIC30F places unprecedented performance in the hands of 16-bit MCU designers. dsPIC controllers have the "heart" of a 16-bit MCU with robust peripherals and fast interrupt handling capability and the "mind" of a DSP that manages high computation activities, creating the optimum single-chip solution for embedded system designs. This enables you to add powerful new features to your product and integrate functions to save board space.

Outstanding MCU Performance

The first 16-bit MCUs were developed to overcome the native 64KB boundary imposed by 8-bit MCUs. The need for advanced performance was not con-templated in these early architectures. When the need for performance became obvious, next-generation devices were developed, but were constrained by backward compatibility requirements and legacy issues.

Developed from the ground up, the dsPIC digital signal controller addresses traditional 16-bit requirements without sacrificing performance. It combines state-of-the-art 16-bit MCU performance in its general-purpose register based core with all the features you need for DSP operations.

Competitive DSP Performance

The dsPIC30F balances its outstanding MCU qualities with competitive DSP performance. All the features you require from a high performance robust DSP are seamlessly integrated in the dsPIC digital signal controller.

Function	Cycle Count Equation	Conditions*	Number of Cycles	Execution Time @30 MIPS
Complex FFT**	-	N=64	3739	124.6 μs
Complex FFT**	-	N=128	8485	282.8 μs
Complex FFT**	-	N=256	19055	635.2 μs
Block FIR	53+N(4+M)	N=32, M=32	1205	40.2 μs
Block FIR Lattice	41+N(4+7M)	N=32, M=32	7337	244.6 μs
Block IIR Canonic	36+N(8+7S)	N=32, S=4	1188	39.6 μs
Block IIR Lattice	46+N(16+7M)	N=32, M=8	2350	78.3 μs
Matrix Add	20+3(C*R)	C=8, R=8	212	7.1 μs
Matrix Transpose	16+C(6+3(R-1))	C=8, R=8	232	7.7 μs
Vector Dot Product	17+3N	N=32	113	3.8 μs
Vector Max	19+7(N-2)	N=32	229	7.6 μs
Vector Multiply	17+4N	N=32	145	4.8 μs
Vector Power	16+2N	N=32	80	2.7 μs

*C= #columns, N=# samples, M=#taps, S=#sections, R=#rows
**Complex FFT routine inherently prevents overflow

1 cycle = 33 nanoseconds @ 30 MIPS

dsPIC30F Family Block Diagram
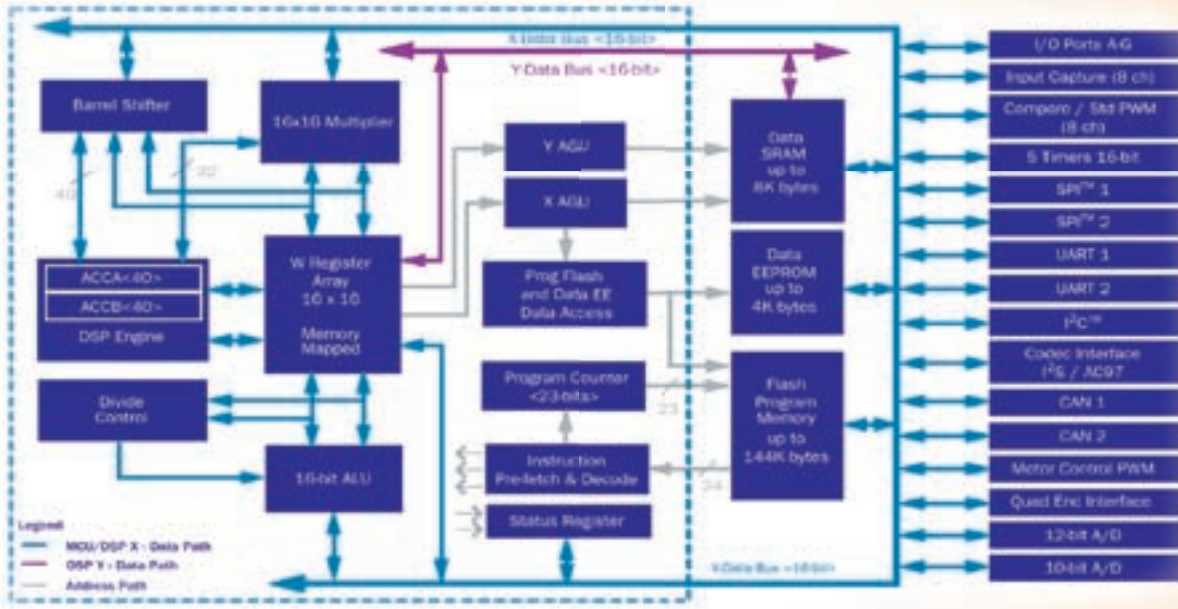
dsPIC30F Features Overview

Operating Range

DC - 30 MIPS*
Wide VDD range: 2.5 - 5.5V
Ind.(-40 to 85°C) and ext. (-40 to 125°C)
*30 MIPS @ 4.5-5.5 volts, -40 to 85°C

High Performance DSC CPU

Modified Harvard architecture
C compiler optimized instruction set
16-bit wide data path
24-bit wide instructions
84 base instructions: mostly 1 word/1 cycle
16 16-bit general purpose registers
2 40-bit accumulators ・With rounding and saturation options
Flexible and powerful addressing modes ・Indirect, modulo and bit-reversed
Software stack
16 x 16 fractional/integer multiplier
32/16 & 16/16 divide
Single cycle multiply-and-accumulate
40-stage barrel shifter

Interrupt Controller

5 cycle latency
Up to 45 interrupt sources, up to 5 external
7 programmable priority levels
4 processor exceptions and software traps

Digital I/O

Up to 54 programmable digital I/O pins
Wake-up/Interrupt-on-change on up to 24 pins
25 mA sink and source on all I/O pins

On-Chip Flash, Data EEPROM & SRAM

Flash program memory: up to 144K Bytes ・100K erase/write cycles typ
Data EEPROM: up to 4K Bytes ・1M erase/write cycle typ
Data SRAM: up to 8K bytes

System Management

Flexible clock options: ・External, crystal, resonator, internal RC ・Fully integrated PLL (4X, 8X, 16X) ・Extremely low jitter PLL
Programmable power-up timer
Oscillator start-up timer/stabilizer
Watchdog timer with its own RC oscillator
Fail-safe clock monitor

Power Management

Switch between clock sources in real time
Power management by peripheral
Programmable low-voltage detect
Programmable brown-out reset
IDLE and SLEEP modes with fast wake-up

Timers/Capture/Compare/PWM

Timer/counters: up to 5 16-bit timers ・Can pair up to make 32-bit timers ・1 timer can run as real time clock with external 32 KHz oscillator
Input capture: up to 8 channels ・Capture on up, down 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

Communication Modules

3-wire SPI™: up to 2 modules ・Framing supports I/O interface to simple CODECs
I2C™ full multi-master slave mode support ・7-bit and 10-bit addressing ・Bus collision detection and arbitration
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 I2S and AC97 protocols
CAN 2.0B active: up to 2 modules ・3 transmit & 2 receive buffers ・Wake-up on CAN message

Motor Control Peripherals

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

Analog-to-Digital Converters

10-bit 500 ksps A/D converter module ・2 or 4 simultaneous samples ・Up to 16 input channels with auto scanning ・16 deep result buffer ・Conversion possible in SLEEP mode
12-bit 100 ksps A/D converter module ・Up to 16 input channels with auto scanning ・16 deep result buffer ・Conversion possible in SLEEP mode

dsPIC30F Product Families

General Purpose Family

The dsPIC30F General Purpose Family is ideal for a wide variety of 16-bit MCU class embedded applications. In addition, the variants with CODEC interfaces are well suited for audio applications.

Product	Pins	Program Memory K Bytes	SRAM Bytes	EEPROM Bytes	Timer 16-bit	Input Capture	Output Compare/ Standard PWM	CODEC Interface	A/D 12-bit 100 ksps	UART	SPI™	I2C™	CAN	I/O Pins (max.)*
dsPIC30F3014	40/44	24	2048	1024	3	2	2	—	13 ch	2	1	1	—	30
dsPIC30F4013	40/44	48	2048	1024	5	4	4	AC97, I2S	13 ch	2	1	1	1	30
dsPIC30F5011	64	66	4096	1024	5	8	8	AC97, I2S	16 ch	2	2	1	2	52
dsPIC30F6011	64	132	6144	2048	5	8	8	—	16 ch	2	2	1	2	52
dsPIC30F6012	64	144	8192	4096	5	8	8	AC97, I2S	16 ch	2	2	1	2	52
dsPIC30F5013	80	66	4096	1024	5	8	8	AC97, I2S	16 ch	2	2	1	2	68
dsPIC30F6013	80	132	6144	2048	5	8	8	—	16 ch	2	2	1	2	68
dsPIC30F6014	80	144	8192	4096	5	8	8	AC97, I2S	16 ch	2	2	1	2	68

Motor Control and Power Conversion Family

This family of dsPIC30F controllers is designed to support a variety of motor control applications, such as brushless DC motors, single and 3-phase induction motors and switch reluctance motors. These products are also well suited for uninterruptable power supply (UPS), inverters, switched mode power supplies and power factor correction and also for controlling the power management module in servers, telecom equipment and other industrial equipment.

Product	Pins	Program Memory K Bytes	SRAM Bytes	EEPROM Bytes	Timer 16-bit	Input Capture	Output Compare/ Standard PWM	Motor Control	A/D 10-bit 500 ksps	Quadrature Encoder	UART	SPI™	I2C™	CAN	I/O Pins (max.)*
dsPIC30F2010	28	12	512	1024	3	4	2	6 ch	6 ch	Yes	1	1	1	—	20
dsPIC30F3010	28	24	1024	1024	5	4	2	6 ch	6 ch	Yes	1	1	1	—	20
dsPIC30F4012	28	48	2048	1024	5	4	2	6 ch	6 ch	Yes	1	1	1	1	20
dsPIC30F3011	40/44	24	1024	1024	5	4	4	6 ch	9 ch	Yes	2	1	1	—	30
dsPIC30F4011	40/44	48	2048	1024	5	4	4	6 ch	9 ch	Yes	2	1	1	1	30
dsPIC30F5015	64	66	2048	1024	5	4	4	8 ch	16 ch	Yes	1	2	1	1	52
dsPIC30F6010	80	144	8192	4096	5	8	8	8 ch	16 ch	Yes	2	2	1	2	68

Sensor Family

The dsPIC30F Sensor Family products have features designed to support high-performance, low-cost embedded control applications. The 18- and 28-pin packages are designed to fit space-critical applications.

Product	Pins	Program Memory K Bytes	SRAM Bytes	EEPROM Bytes	Timer 16-bit	Input Capture	Output Compare/ Standard PWM	A/D 12-bit 100 ksps	UART	SPI™	I2C™	I/O Pins (max.)*
dsPIC30F2011	18	12	1024	—	3	2	2	8 ch	1	1	1	12
dsPIC30F3012	18	24	2048	1024	3	2	2	8 ch	1	1	1	12
dsPIC30F2012	28	12	1024	—	3	2	2	10 ch	1	1	1	20
dsPIC30F3013	28	24	2048	1024	3	2	2	10 ch	2	1	1	20

* Maximum I/O pin count includes pins shared by the peripheral functions.

One Architecture Many Solutions

The versatile dsPIC30F family provides solutions for embedded control applications and offers a wide variety of digital and analog peripheral modules. Choose a large pin-count, large memory dsPIC30F device as a main controller in a large, complex embedded system. Or, select a small pin-count, small package device to tackle a single motor or a sensor. No other 16-bit MCU or DSP family gives you so much flexibility.

Invest in the dsPIC30F family once and reap the benefit over many applications.

Motor Control

The dsPIC30F is ideal for motors requiring more than a basic microcontroller. Whether you need a little more computation power or full DSP capability, the dsPIC30F delivers.

Apply the dsPIC30F for sensorless control, precision speed/position/servo control, torque management, variable speed motors, high RPM motors, variable load applications, noise reduction or energy efficiency improvement. Brushless DC, AC Induction or Switch Reluctance motors are ideal candidates for the dsPIC30F family of controllers.

Applications: **Enabling Features of the dsPIC30F:**

- Heating, ventilation and air conditioning
- Electronic hydraulic power steering
- Electronic power steering
- Industrial gate opener
- Seat belt tensioner
- Exercise equipment
- Washing machine
- Vacuum cleaners
- Industrial pumps
- Stability control
- Power tools
- Refrigeration

- 1 or 2 fault pins
- 6 or 8 motor PWM output
- Complementary or independent PWM
- Center-aligned or edge-aligned PWM
- Two programmable dead times
- 28-, 40-, 64- and 80-pin variants
- 10-bit 500 ksps A/D converter
- 2 or 4 simultaneous samples
- 5V native operation for noisy environment
- On-chip Quadrature Encoder Interface
- Motor control algorithm reference design
- Synchronized A/D sampling with PWM cycle

Internet Connectivity

If your embedded control system needs to be connected to the Internet or to a dial-up phone line, the dsPIC30F provides you with a single chip solution. The "ready-to-use" TCP/IP, Ethernet driver and soft-modem application libraries enable you to add connectivity to your design quickly.

Applications: **Enabling Features of the dsPIC30F:**

- Remote diagnostics of industrial equipment
- Remote medical equipment
- Water, gas, electric meters
- Industrial gate openers
- Remote monitoring
- Vending machines
- Power line modem
- Security systems
- Set top boxes

- UART interface
- Full TCP/IP software library
- Soft-modem library (V.32/V.22)
- RTOS for multitasking
- Ethernet driver software
- Reduced board space
- Reduced total system cost

Speech and Audio

Often speech and audio applications use a DSP for algorithm processing and an MCU for control. The dsPIC30F can replace both in many applications and reduce total system cost. The dsPIC digital signal controller provides enough MIPS for many speech and audio applications such as noise and echo cancellation, speech recognition and quality speech playback.

The dsPIC digital signal controller is also an ideal companion to a main DSP in high-end audio applications, offloading functions such as a digital tuner, satellite radio, equalizers, etc.

Applications:

Enabling Features of the dsPIC30F:

- Intercom system noise cancellation
- Self-powered subwoofer control
- High quality speech playback
- Distributed speaker network
- Musical instrument effects
- Voice activated microphone
- Noise cancelling headsets
- Cabin noise cancellation
- Speech recognition
- Speaker phones
- Hands free port

- Ready to use DSP library
- CODEC interface: AC97 and I^2S
- 12-bit, 100 ksps A/D converter
- Graphical filter design package
- Speech recognition application library
- Small footprint package options
- Reduced total system cost
- Reduced board space

Power Conversion and Monitoring

The dsPIC30F is ideal for a variety of power conversion and monitoring applications. UPSs, inverters, as well as power management units within complex equipment, such as copiers, telecom switches and routers, require advanced power management. The dsPIC30F has pulse width modulation (PWM) outputs, fast analog-to-digital conversion and plenty of computation power to satisfy the needs of these applications.

Applications:

Enabling Features of the dsPIC30F:

- Power and environment monitor in servers
- Power management for equipment
- Power factor correction
- AC-to-DC converters
- DC-to-DC converters
- Electric vehicle
- Inverters
- UPS

- 10-bit 500 ksps A/D converter
- 2 or 4 simultaneous samples
- 1 or 2 fault pins
- 6 or 8 PWM output
- Complementary or independent PWM
- Center-aligned or edge-aligned PWM
- 117 KHz PWM frequency @10-bit resolution
- Two programmable dead times
- 28-, 40-, 64- and 80-pin variants
- 5V native operation for noisy environment
- Synchronized A/D sampling with PWM cycle

Sensor Control

The 18- and 28-pin small footprint dsPIC30F parts are ideal for advanced sensor control. The combination of a 12-bit A/D converter, communication peripherals, power management features and DSP capability makes it possible to create intelligent sensor interface modules. These devices can also assist an overloaded central controller.

Applications:

Enabling Features of the dsPIC30F:

- Advanced 2-D PIR detection
- Chemical and gas sensor
- Glass break detector
- Gyroscopic modules
- Arc fault detection
- Knock detection
- Vibration sensor
- Pressure sensor
- Torque sensor
- Rain sensor

- Data EEPROM
- DSP capability
- High speed input capture
- Small footprint 18- or 28-pin packages
- 12-bit 100 ksps A/D converter
- SPI™, I²C™ and UART communication ports
- Visual digital filter design tool
- Configurable Flash memory can update algorithms over time

Automotive

Microchip is a QS-9000 qualified supplier to major automotive manufacturers. Most of our products are available for automotive-grade temperature requirements and support a long product life cycle.

Available in 18- to 80-pin packages, the dsPIC30F family is ideal for a variety of automotive applications from a large central controller to small sensor interface or peripheral processor.

Applications:

Enabling Features of the dsPIC30F:

- Electrically assisted hydraulic steering
- Electronic clutch and gearbox
- Roll and stability controller
- Electronic power steering
- Cabin noise cancellation
- Advanced battery monitor
- Airbag main controller
- Ignition controller
- Side impact airbag
- Occupant sensor
- Fuel pressure control
- Rain sensor

- DSP capability
- Powerful MCU core
- CAN and OSEK library
- 18- to 80-pin products
- One or two CAN 2.0B modules
- Long product life cycle supported
- Broad product selection addresses many applications
- High reliability Flash with typical endurance of one million erase/write cycles and data retention of >40 years

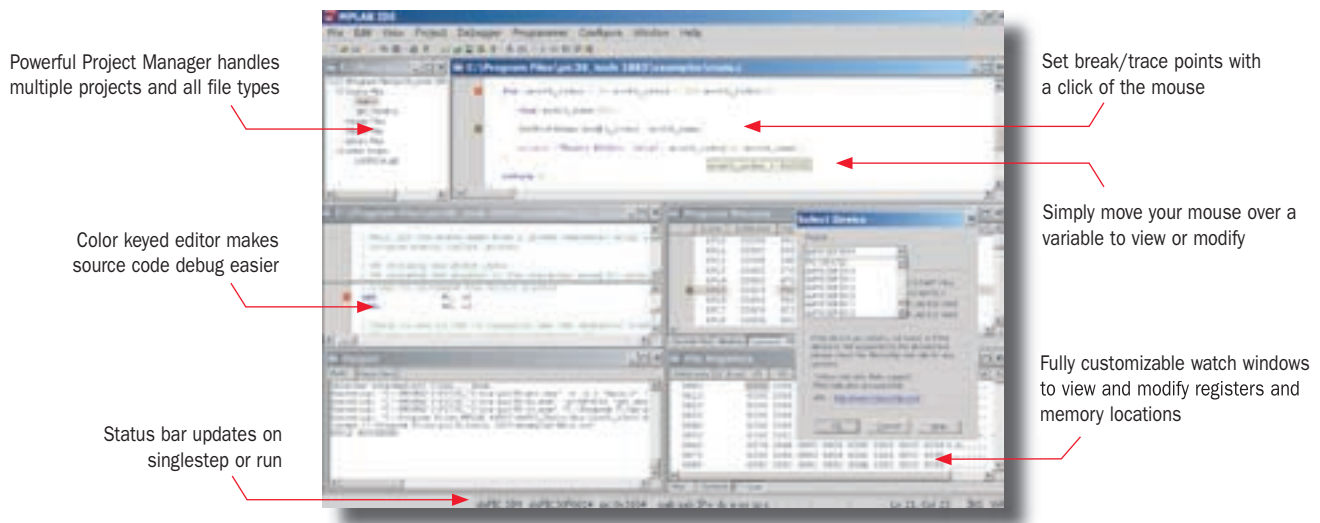# Powerful Tools and Libraries to Ease Your Development

The dsPIC30F family comes with an extensive array of development tools, application libraries, development boards and reference designs for a whole product solution.

MPLAB® Integrated Development Environment

All dsPIC30F tools operate seamlessly under the MPLAB IDE umbrella. The powerful and yet 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. The key features of MPLAB IDE are:

- Designed for Windows® XP, 2000, ME, 98 SE and 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

Powerful Project Manager handles multiple projects and all file types

Color keyed editor makes source code debug easier

Status bar updates on singlestep or run

Set break/trace points with a click of the mouse

Simply move your mouse over a variable to view or modify

Fully customizable watch windows to view and modify registers and memory locations

The Essential Software and Hardware Development Tools

Microchip is committed to making your development as easy and efficient as possible. This commitment is the reason why Microchip develops its own software and hardware tools. You have our full technical support whether the issue is silicon or tools related.

The dsPIC30F development tools suite provides value with many free and low cost tools. You can get started with the MPLAB ICD 2 In-Circuit Debugger and the MPLAB IDE Integrated Development Environment for approximately US $160.

MPLAB IDE	Integrated Development Environment
MPLAB ASM30	Assembler*
MPLAB SIM30	Software Simulator*
MPLAB C30	ANSI C Compiler
MPLAB ICD 2	In-Circuit Debugger / Development Programmer
MPLAB ICE 4000	In-Circuit Emulator
PRO MATE® II	Full Featured Device Programmer
MPLAB PM 3	Full Featured Device Programmer

*comes with no-cost MPLAB IDE

World Class Software Development Tools

Assembler/Linker/Librarian

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.

MPLAB LINK30 and MPLAB LIB30 are Linker and Librarian modules that allow efficient linking, library creation and maintenance.
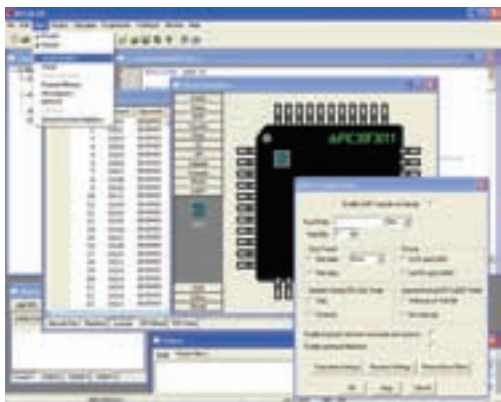
MPLAB SIM30 Software Simulator

MPLAB SIM30 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 timer, I/O, interrupts, UART and A/D modules. MPLAB SIM30 has a powerful stimulus language and File I/O. It is ideal for development of algorithms and utilities.

MPLAB C30 C Compiler

MPLAB C30 is a full-featured, ANSI compliant optimizing compiler. MPLAB C30 includes a complete ANSI C standard library, including string manipulation, dynamic memory allocation, data conversion, timekeeping and math libraries.

MPLAB C30 has a powerful code optimizer. Other 16-bit MCUs generate as much as 70 percent larger code for the same application.

Industry Leading C Code Efficiency

The dsPIC30F was designed with a robust, full-featured instruction set optimized for C compiler efficiency from the start. Coupled with Microchip's highly optimizing MPLAB C30 C Compiler, this combination produces results that fit in on-chip Flash memory.

Relative Code Size (in Bytes)

MPLAB VDI Visual Device Initializer

Configuring a powerful 16-bit MCU or DSP can be a complex and challenging task, but not with the dsPIC30F. Our MPLAB VDI Visual Device Initializer allows you to configure the entire processor graphically, and when complete, a mouse click generates code usable in Assembly or C programs.
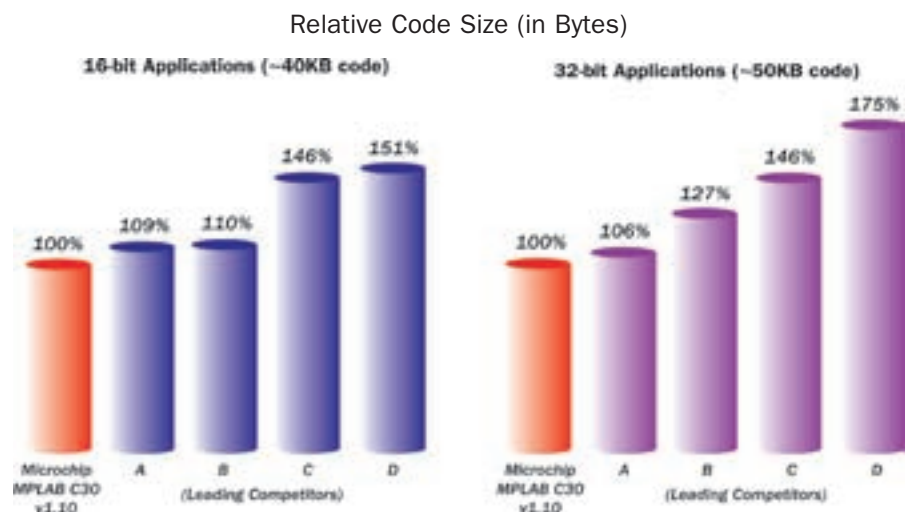
MPLAB VDI does extensive error checking on assignments and conflicts on pins, memories and interrupts as well as selection of operating conditions. The generated code files are seamlessly integrated with the rest of your application code through MPLAB Project.

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

· Drag-and-drop feature selection
· One click configuration
· Extensive error checking
· Generates initialization code
· Integrates seamlessly in MPLAB Project
· Printed reports ease project documentation requirements
· MPLAB VDI is included in MPLAB IDE

Design DSP Algorithms: The Easy Way

FREE dsPICworks™: Data Analysis and DSP Software

The dsPICworks data analysis tool 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 include:

· Visually analyze time and frequency domain data
· DSP operations: FFT, convolution, correlation, and DCT
· 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
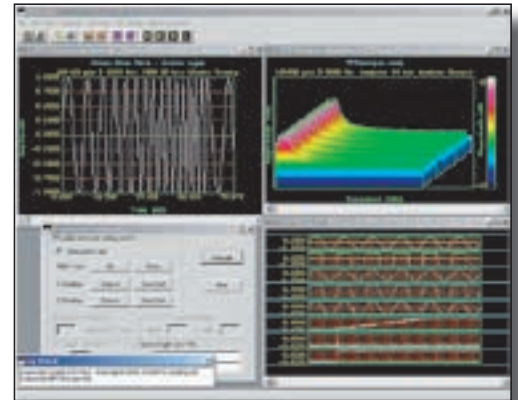
Digital Filter Design

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.

Key features include:

· Low pass, high pass, band pass, and band stop filter support
· FIR filters with up to 513 taps
· IIR filter with up to 10 taps for low pass and high pass filters
· IIR filter with up to 20 taps for band pass and band stop filters
· Generates dsPIC30F ASM code & filter coefficient files for export to MPLAB IDE
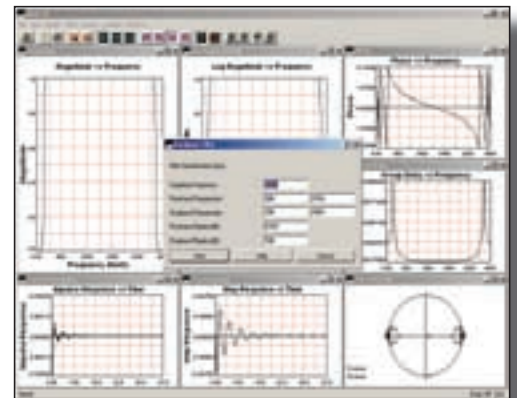
Jumpstart Your Design with Proven and Optimized Building Block Libraries

FREE Math Library

This IEEE-754 compliant library provides floating point and double precision 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 include:

· 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 are:

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

FREE Peripheral Driver Library

This library of over 270 C utility functions helps you setup and operate the hardware peripheral modules in various modes. Functions cover:

· 10-bit and 12-bit A/D converters
· UART, SPI™ and I2C™
· Motor control PWM & QEI
· General purpose timers
· Input capture & output compare

Plug and Play with Our Connectivity Libraries

TCP/IP Protocol Stack

Connect to the Internet in no time using proven, professional quality TCP/IP software libraries. Protocols supported include: FTP, TFTP and SMTP Application Protocol layers; ICMP, IP, TCP and UDP Transport and Internet layers; and network access layers, such as PPP, SLIP, ARP and DHCP.

> **MicroNet™ TCP/IP Stack by CMX**
> · RFC compliant protocol stack
> · Seamlessly supports CMX RTOS
> · Ethernet NIC driver

V.32/V.22 Embedded Modem Solutions

Developing a software modem can be time consuming. Making sure it is compliant and reliable can be challenging and expensive. Get connected fast with proven, professional quality embedded modem software at a very affordable price.

> **V.32/V.22bis by VOCAL Technologies**
> · Vocal's proven solution ported to dsPIC30F
> · V.32 (9600 bps, non-trellis encoding)
> · V.22/V.22bis (1200/2400 bps)
> · V.42 (LAPM)

> **V.32/V.22bis by Microchip**
> · Coded in Assembly and C for optimal size and speed
> · V.32/V.32bis (9600/14,400 bps)
> · V.22/V.22bis (1200/2400 bps)
> · V.42 (LAPM)

More Application Libraries: Ready to Use

Speech Recognition

Automatic Speech Recognition (ASR) for the dsPIC30F family can support a wide range of voice-activated applications. A speech training subsystem and a speech recognition software library make up the ASR software suite. Key features of the ASR application software are:

· Speaker independent/dependent recognition
· PC-based custom training tool
· Up to 100 word vocabulary
· Supports multiple noise profiles
· Suitable for many voice control applications

RTOS

If you need a real-time operating system 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 & 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.

Hardware Development Tools

MPLAB ICD 2
In-Circuit Debugger

MPLAB ICD 2 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 include:

· Full speed operation
· USB or serial port connection to PC
· Supports full dsPIC digital signal controller supply voltage range
· Can be used as an inexpensive programmer
· "Smart watch" variable windows

MPLAB PM3
Device Programmer

MPLAB PM3 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 built-in interface for robust In-Circuit Serial Programming™ (ICSP™).

If you already own a PRO MATE® II Device Programmer, the dsPIC30F family is fully supported on the PRO MATE II programmer through a new set of socket modules.

MPLAB ICE 4000
In-Circuit Emulator

The powerful, full-featured real-time MPLAB ICE 4000 In-Circuit Emulator is capable of debugging the most demanding real-time systems. Key features include:

· Full speed real time emulation
· Supports full dsPIC digital signal controller supply voltage range
· 64K deep x 216-bit wide trace memory
· Unlimited breakpoints
· Complex break, trace and trigger logic
· Multi-level trigger up to four levels
· 48-bit time stamp
· USB or LPT port connection to PC
· Stopwatch

Hardware Development Boards: Jumpstart Your Design

A variety of hardware development boards are available for the dsPIC30F, enabling you to shorten your design cycle. These boards are designed to allow easy plug-in of an MPLAB ICD 2 or an MPLAB ICE 4000 emulator.

dsPICDEM™ Starter Demo Board

Key features of the dsPICDEM Starter Demo Board are:

· dsPIC30F6012 general purpose device on 64-pin adapter plug
· MPLAB ICD 2 connector for programming/debugging
· General purpose prototype area along with RS232 support on UART2
· LEDs, switches, and potentiometer

dsPICDEM™ 1.1 General Purpose Development Board

Key features of the dsPICDEM General Purpose Development Board are:

· Serial communication channels (two UARTS, SPI, CAN)
· Si3000 CODEC with MIC IN/Speaker OUT
· General purpose prototyping area and expansion header
· 122x32 dot addressable LCD
· Digital Potentiometer for DAC capability
· LEDs, switches, potentiometers and temperature sensor
· MPLAB ICD 2 and MPLAB ICE 4000 emulator support

dsPICDEM.net™ Connectivity Development Board

Key features of the dsPICDEM.net Board are:

· 10-Base T Ethernet MAC and PHY interface
· PSTN interface with DAA/AFE chipset
· Serial communication channels (UART and CAN)
· External EEPROM memory for storing constants
· External 64K x 16 SRAM memory
· General purpose prototyping area and expansion header
· LEDs, switches, potentiometers and temperature sensor
· 2x16 LCD display
· MPLAB ICD 2 and MPLAB ICE 4000 emulator support

dsPIC30F Motor Control Development System

The dsPIC30F Motor Control Development System provides you with a method for quick prototyping and validation of BLDC, SR, PMAC, ACIM, and UPS applications. The system consists of the dsPIC MC1 motor control development board and one of two optional power modules. The dsPICDEM MC1H 3-Phase High Voltage Power Module supports AC line powered applications while the dsPICDEM MC1L 3-Phase Low Voltage Power Module supports DC powered applications up to 48 volts. Some key features include:

· Heatsink for ambient cooling of
  power sections
· Full automatic protection of power circuits
· Electrical isolation from power circuits
· Many options for motor feedback signals
· MPLAB ICD 2 and MPLAB ICE 4000
  emulator support

dsPIC30F Tools and Documentation

Essential Software Tools / Essential Hardware Tools / Software Libraries and Application Development Tools

Development Tool	Description	Part#	Available From	List Price (1)
MPLAB IDE 6.xx	Integrated Development Environment	SW007002	Microchip	Free
MPLAB ASM30	Assembler (included in MPLAB IDE)	--	Microchip	Free
MPLAB SIM30	Software Simulator (included in MPLAB IDE)	--	Microchip	Free
MPLAB VDI	Visual Device Initializer for dsPIC30F (included in MPLAB IDE)	--	Microchip	Free
MPLAB C30	ANSI C Compiler, Assembler, Linker & Librarian	SW006012	Microchip	$895
MPLAB ICD 2	In Circuit Debugger & Device Programmer	DV164005	Microchip	$159
MPLAB ICD 2	In Circuit Debugger & Device Programmer With dsPICDEM Starter Demo Board	DV164030	Microchip	$209
MPLAB ICE 4000	In Circuit Emulator Pod	ICE4000	Microchip	$2560
	Processor Module for dsPIC30F	PMF30XA1	Microchip	$595
	Device Adapter for 80L/64L TQFP Devices	DAF30-2	Microchip	$295
	Device Adapter for 44L TQFP Devices	DAF30-3	Microchip	$295
	Device Adapter for 40L/28L/18L DIP & SOIC Devices	DAF30-4	Microchip	$295
	Transition Socket for 18L SOIC	XLT18SO	Microchip	$75
	Transition Socket for 18L DIP	ACICE0202	Microchip	$20
	Transition Socket for 28L SOIC	XLT28SO	Microchip	$75
	Transition Socket for 28L DIP	ACICE0204	Microchip	$30
	Transition Socket for 40L DIP	ACICE0206	Microchip	$40
	Transition Socket for 44L TQFP	XLT44PT	Microchip	$125
	Transition Socket for 64L TQFP (PF Package)	XLT64PT3	Microchip	$125
	Transition Socket for 64L TQFP (PT Package)	XLT64PT2	Microchip	$125
	Transition Socket for 80L TQFP (PF Package)	XLT80PT2	Microchip	$125
	Transition Socket for 80L TQFP (PT Package)	XLT80PT	Microchip	$125
MPLAB PRO MATE II	Full Featured Device Programmer, Base Unit	DV007003	Microchip	$695
	Socket Module for 18L DIP/SOIC Devices	AC30F005	Microchip	$189
	Socket Module for 28L DIP/SOIC Devices	AC30F004	Microchip	$189
	Socket Module for 40L DIP Devices	AC30F003	Microchip	$159
	Socket Module for 44L TQFP Devices	AC30F006	Microchip	$159
	Socket Module for 64L TQFP Devices (PF Package)	AC30F002	Microchip	$159
	Socket Module for 64L TQFP Devices (PT Package)	AC30F008	Microchip	$159
	Socket Module for 80L TQFP Devices (PF Package)	AC30F001	Microchip	$159
	Socket Module for 80L TQFP Devices (PT Package)	AC30F007	Microchip	$159
MPLAB PM3	Full Featured Device Programmer, Base Unit	DV007004	Microchip	$895
	Socket Module for 18L/28L/40L DIP Devices	AC164301	Microchip	$189
	Socket Module for 16L(,150)/28L(,300) SOIC Devices	AC164302	Microchip	$189
	Socket Module for 44L TQFP Devices	AC164305	Microchip	$189
	Socket Module for 64L TQFP Devices (PF Package)	AC164313	Microchip	$189
	Socket Module for 64L TQFP Devices (PT Package)	AC164303	Microchip	$189
	Socket Module for 80L TQFP Devices (PF Package)	AC164314	Microchip	$189
	Socket Module for 80L TQFP Devices (PT Package)	AC164304	Microchip	$189
dsPIC30F Math Library	Basic & Floating Point Library (ASM, C Wrapper)	SW300020	Microchip	Free
dsPIC30F Peripheral Library	Peripheral Initialization, Control and Utility Routines (C)	SW300021	Microchip	Free
dsPIC30F DSP Library	Essential DSP algorithm suite (Filters, FFT)	SW300022	Microchip	Free
dsPICworks	Graphical data analysis and conversion tool for DSP algorithms	SW300023	Microchip	Free
Digital Filter Design	Graphical IIR & FIR filter design package for dsPIC30F	SW300001	Microchip	$249
CMX-RTX for dsPIC	Fully preemptive Real Time Operating System (RTOS) for dsPIC30F (from CMX)	CMX-RTX for dsPIC	CMX	$4000
CMX-RTX for dsPIC	Fully preemptive Real Time Operating System (RTOS) for dsPIC30F	SW300031	Microchip	$4000
CMX-Tiny+ for dsPIC	Preemptive Real Time Operating System (RTOS) for dsPIC30F (from CMX)	CMX-Tiny+ for dsPIC	CMX	$3000
CMX-Tiny+ for dsPIC	Preemptive Real Time Operating System (RTOS) for dsPIC30F	SW300032	Microchip	$3000
CMX Scheduler	Multi-tasking, preemptive scheduler for dsPIC30F		CMX	Free

Software Libraries and Application Development Tools Continued / Compilers, C, C++ and IDE from Development Partners / Development Boards and Reference Designs / Plug-in Modules

Development Tool	Description	Part#	Available From	List Price (1)
TCP/IP Library	CMX-MicroNet for dsPIC30F TCP/IP connectivity and protocol support	CMX-MicroNet for dsPIC30F	CMX	Contact Vendor
Soft Modem Library	V.22bis/V.22 Soft Modem Library	SW300002	Microchip	Free
Soft Modem Library	V.32 (non-trellis) Soft Modem Library	SW300003	Microchip	Contact Microchip
Soft Modem Library	V.32 (non-trellis) Soft Modem Library		VOCAL Technologies	Contact Vendor
Speech Recognition System	Automatic speech recognition system including a PC-based speech training sub-system and a speech recognizer software library	SW300010	Microchip	Contact Microchip
CANbedded for dsPIC	CAN Driver Library for dsPIC30F		Vector Informatik	Contact Vendor
osCAN for dsPIC	OSEK/VDX v2.2		Vector Informatik	Contact Vendor
Embedded Workbench for dsPIC30F	ISO/ANSI C and Embedded C++ Compiler in a professional, extensible IDE (Windows 98/ME/NT4/2000/XP) Special DSP support included.	EWdsPIC 1	IAR	Contact Vendor
C Compiler	ANSI C Compiler for dsPIC30F	dsPICC	HI-TECH	$950
C Compiler	C Compiler for dsPIC30F	PCDSP	CCS	$200
C Compiler with IDE	C Compiler for dsPIC30F with IDE	PCWHD	CCS	$550
General Purpose Development	dsPICDEM 1.1 Development Board for 80L TQFP devices	DM300014	Microchip	$299
Starter Demo	dsPICDEM Starter Demo Board	DM300016	Microchip	$79
Motor Control and Power Conversion Development	dsPICDEM MC1 Motor Control Development Board	DM300020	Microchip	$300
	dsPICDEM MC1H 3-Phase High Voltage Power Module	DM300021	Microchip	$800
	3-Phase ACIM High Voltage Motor (208/460V)	AC300021	Microchip	$120
	dsPICDEM MC1L 3-Phase Low Voltage Power Module	DM300022	Microchip	$700
	3-Phase BLDC Low Voltage Motor (24V)	AC300020	Microchip	$120
Connectivity Development	dsPICDEM.net 1 with FCC/JATE and Ethernet NIC support (FCC compliant)	DM3000041	Microchip	$389
Connectivity Development	dsPICDEM.net 2 with PSTN and Ethernet NIC support (Global compliant)	DM3000042	Microchip	$389
Plug-in Module	Daughter PC board with 80-pin dsPIC30F6014 general purpose MCU sample. Easy to plug in to/remove from a development board	MA300011	Microchip	$25
Plug-in Module	Daughter PC board with 64-pin dsPIC30F6012 general purpose MCU sample. Easy to plug in to/remove from a development board	MA300012	Microchip	$25
Plug-in Module	Daughter PC board with 80-pin dsPIC30F6010 motor control MCU sample. Easy to plug in to/remove from a development board	MA300013	Microchip	$25

Documents (2)

Description	Document Number
dsPIC30F High Performance 16-bit Digital Signal Controller Family Overview	DS70043
dsPIC30F Programmer's Reference Manual	DS70030
dsPIC30F Family Reference Manual	DS70046
dsPIC30F Data Sheet, Motor Control and Power Conversion Family	DS70082
dsPIC30F Data Sheet, Sensor and General Purpose Controller Family	DS70083
dsPIC30F Technical CD-ROM (contains all of the above)	DS70084

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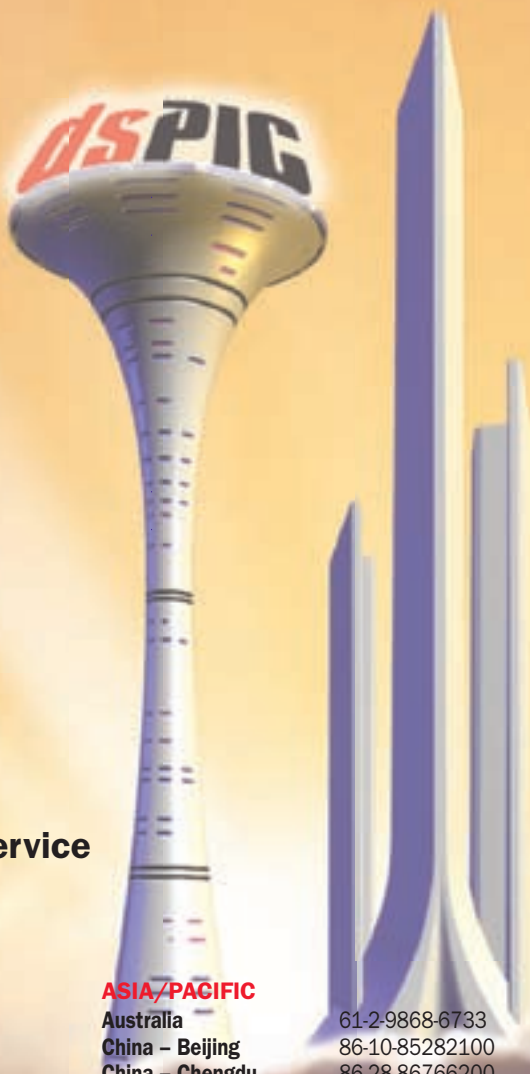
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