microSOLUTIONS DEC 2009

In This Issue...

Need High-Performance Connectivity? Three New PIC32 Families Add Integrated Ethernet, Dual CAN, USB and 128 KB RAM

Microchip Technology is building on the success of its 80 MHz **32-bit PIC32 microcontroller (MCU) portfolio** with three new families that provide up to 128 Kbytes of RAM and extensive connectivity options, including 10/100 Mbps **Ethernet**, two **CAN**2.0b controllers, USB Host, Device and OTG, and 6 UART, 5 I²C™ and 4 SPI ports. These new MCU families are complemented by Microchip's free software stacks, available in source-code form, making it easier for embedded designers to add connectivity to their applications.

The demand for embedded connectivity continues to grow, forcing existing products to run more software stacks simultaneously. The new PIC32MX5/6/7 families are designed specifically for these data-intensive applications. Designers have full access to up to 128 KB of RAM for simultaneous use with the Ethernet, USB and CAN buffers. The integrated Ethernet, CAN and USB modules have a built-in DMA interface to maximize data throughput.

The integrated 100 Mbps Ethernet MAC uses an industry-standard RMII/MIII interface to low-cost, commodity Physical Interface chips (PHYs). Additionally, each MCU has a unique, factory-preprogrammed Ethernet MAC address, which simplifies the manufacturing process.

Flexible, easy-to-use CAN2.0b controllers have been added to the PIC32, which use system RAM for storing up to 1024 messages in 32 buffers. Advanced filtering capabilities include user selectable filter-to-buffer mapping with 32 filters and 4 filter masks. All of these functions allow designers to easily adapt CAN communication schemes to their applications.

Microchip offers free TCP/IP and USB software stacks, including full source code, to further enable easy software development, quicker time to market and lower overall costs. Available software includes two TCP/IP software stacks, along with libraries for USB Host and Device, Advanced Encryption Standard (AES), multiple file systems, advanced graphics, audio and many other software products.

Migrating software across Microchip's 600-plus 8-, 16- and 32-bit PIC® microcontroller portfolio is easy, as its' development tools, USB stacks and TCP/IP stacks span the entire range of PIC MCUs. Additionally, the new PIC32MX5/6/7 families are pin compatible with the existing PIC32 and 16-bit PIC24F USB MCU families.

Example applications for the new PIC32MX5/6/7 families include: Communications (point-of-sale terminals, web servers, CAN-to-Ethernet-to-USB bridges); industrial/medical (automation, controllers, medical devices, security monitoring); consumer/appliance (audio, MP3 decoders, displays, small appliances, fitness equipment); automotive (aftermarket, car alarms, GPS).

The new **PIC32 Ethernet Starter Kit** (part #DM320004, $72) was designed to enable easy Ethernet-based development, and the **PIC32 USB Starter Kit II** (part #DM320003-2, $55) is an upgrade of Microchip's existing USB starter kit for the new families. Owners of the **Explorer 16 Development Board** (part #DM240001) can purchase a $25 plug-in module for development with the new PIC32MX5/6/7 families (part #MA320003).

The three new PIC32MX5/6/7 families are available today for sampling and volume production. 10,000 unit pricing ranges from $4.73 each for the PIC32MX575F256H, up to $6.55 each for the PIC32MX795F512L. Packaging options include 100-pin TQFP and BGA packages, and 64-pin TQFP and QFN packages.

For more information, visit http://www.microchip.com/PIC32

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MCP9800 Temperature Sensor Demo Board	MCP9800DM-TS1	Connects to a PC with USB interface and evaluate the sensor performance of the MCP9800.	$35.00	**$28.00**
Microcontroller Development Tools				
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PICDEM™ Touch Sense 2	DM164128	Offers a complete platform introducing Microchip's mTouch™ Sensing Solutions employing the 16-bit PIC24F MCU.	$99.99	**$79.99**
PIC10F Cap Touch Demo Board	AC103003	Demonstrates the implementation of a single capacitive touch key or proximity sensor using a PIC10F204 or PIC10F206 MCU.	$11.00	**$8.80**
mTouch™ AR1000 Development Kit	DV102011	Includes the AR1000 development board, a 7 four-wire resistive touch screen, a PICkit™ Serial Analyzer, and other necessary tools to get started on AR1000 resistive controllers.	$99.99	**$79.99**
Internet Radio Demo Board	DM183033	Uses the PIC18F67J60 8-bit MCU with integrated 10Base-T MAC and PHY to connect to SHOUTcast servers and stream MP3 data to an audio decoder.	$99.99	**$79.99**
PICDEM™ Lab Development Board	DM163035	Geared toward first-time PIC® MCU users and students, this is designed to provide a comprehensive development and learning platform for virtually all Flash-based 6-, 8-, 14-, 18- and 20-pin, 8-bit PIC MCUs.	$124.99	**$99.99**

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MPLAB® C Compilers				
Item	**Part Number**	**Description**	**Regular Price**	**Sale Price**
MPLAB® C Compiler for PIC18 MCUs	SW006011	A full-featured ANSI C compiler for Microchip's 8-bit PIC18 MCUs.	$495.00	**$396.00**
MPLAB® C Compiler for PIC32 MCUs	SW006015	A full-featured ANSI C compiler for Microchip's 32-bit PIC32 MCUs.	$895.00	**$716.00**
MPLAB® C Compiler for dSPIC® DSCs	SW006013	A full-featured ANSI C compiler for Microchip's 16-bit dsPIC® DSCs.	$495.00	**$396.00**
MPLAB® C Compiler for PIC24 MCUs	SW006014	A full-featured ANSI C compiler for Microchip's 16-bit PIC24 MCUs.	$495.00	**$396.00**
HI-TECH® C Compilers				
Item	**Part Number**	**Description**	**Regular Price**	**Sale Price**
HI-TECH C® Compiler for PIC10/12/16 MCUs (PRO)	SW500010	An ANSI C compiler iimplemented with maximum optimizations to ensure the densest code output and highest performance levels for Microchip's 8-bit baseline and mid-range PIC MCUs.	$1,195.00	**$956.00**
HI-TECH C® Compiler for PIC10/12/16 MCUs (Standard)	SW500005	A mid range ANSI C compiler enabled with ample optimizations levels for Microchip's 8-bit baseline and mid-range PIC MCUs.	$495.00	**$396.00**
HI-TECH C® Compiler for PIC18 MCUs (PRO)	SW500007	An ANSI C compiler implemented with maximum optimizations to ensure the densest code output and highest performance levels for Microchip's 8-bit PIC18 MCUs.	$1,195.00	**$956.00**
HI-TECH C® Compiler for PIC18 MCUs (Standard)	SW500008	A mid range ANSI C compiler enabled with ample optimizations levels for Microchip's 8-bit PIC18 MCUs.	$495.00	**$396.00**
HI-TECH C® Compiler for PIC32 MCUs (PRO)	SW500011	An ANSI C compiler implemented with maximum optimizations to ensure the densest code output and highest performance levels for Microchip's 32-bit PIC32 MCUs.	$1,495.00	**$1,196.00**
HI-TECH C® Compiler for PIC32 MCUs (Standard)	SW500012	A mid range ANSI C compiler enabled with ample optimizations levels for Microchip's 32-bit PIC32 MCUs.	$895.00	**$716.00**
HI-TECH C® Compiler for PIC24 MCUs and dsPIC® DSCs (Standard)	SW500009	A mid range ANSI C compiler enabled with ample optimizations levels for Microchip's 16-bit PIC24 MCUs and dsPIC DSCs.	$895.00	**$716.00**

For more information, visit www.microchip.com/YES

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Microchip Wins 2009 Elektra European Electronics Industry Award

PIC® microcontrollers with XLP Technology receive the prestigious 2009 Elektra Award in the Semiconductor Product of the Year category.

Organized by Electronics Weekly, the 2009 Elektra Awards were held recently in London to recognize companies achieving the highest standards and driving our industry forward.

Through innovative power saving techniques, implemented using extreme low power methodologies, Microchip has successfully developed a range of PIC microcontrollers that have a standby current of just 20 nA, meeting the demand for eXtreme Low Power.

All nanoWatt XLP microcontrollers are supported by Microchip's world-class development tools, including the free **MPLAB® IDE**, the **MPLAB REAL ICE™** emulation system, the **MPLAB ICD 3** in-circuit debugger, the **PICkit™ 3** low-cost debugger/programmer and Microchip's free **C compilers**. These tools are available today at **http://www.microchip.com/XLPTools.**

For more information and to view the complete list of 2009 Elektra Award Winners, visit:
http://www.elektraawards.co.uk/elektraawards2009

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Microchip Offers Industry's Broadest Portfolio of Semiconductors Specified for Operation up to 150°C Ambient

Microchip's high-temperature products enable better connectivity, more intelligent motor control, improved system efficiency and lower system cost when compared to mechanical, or previously-available electronic solutions. Products include 8- and 16-bit PIC® microcontrollers (MCUs) and dsPIC® Digital Signal Controllers (DSCs); serial EEPROM devices, and analog products. Qualified and tested in accordance with AEC-Q100 Grade 0 requirements, the devices are optimum for under-the-hood automotive applications; extreme-environment industrial applications, such as down-hole oil drilling and lighting; and for medical applications such as devices that are sterilized in autoclaves. Engineers can now add intelligence directly into high-temperature applications, where the silicon can be mounted directly onto high-temperature assemblies. This enables new applications for electronics that were not possible before.

Microchip's high-temperature portfolio includes:

- 20 new 16-bit devices with industry-leading MCU performance, including dsPIC33FJ motor-control and general-purpose devices with integrated digital signal processing, CAN connectivity and 12-bit Analog-to-Digital Converters (ADCs)
- PIC24HJ general-purpose MCUs with CAN connectivity and 12-bit ADCs
- High-performance PIC18F4680 8-bit MCU family with CAN connectivity and small footprint, including the PIC18F2585, PIC18F2680 and PIC18F4585 MCUs
- Additional 8-bit PIC MCUs include the PIC16F616 and PIC18F1320 families; and the miniature, 8-pin PIC12F615 MCU
- 25LC080C through 25LC256 SPI serial EEPROM device families, as well as the 24LC01B I²C™ serial EEPROM
- MCP9700 low-power linear active thermistor

The ability to mount silicon directly onto high-temperature assemblies means that Brushless DC (BLDC) motors can be used in place of mechanical, belt-driven actuators for water pumps, engine cooling fans, turbocharger waste gates, and throttle-control applications. This improves fuel efficiency and reduces emissions by enabling intelligent use of more efficient, on-demand technology. Sensors can now be placed directly into automotive gearboxes, engine-coolant systems and oil reservoirs. MCUs featuring CAN and LIN connectivity enable small footprints and efficient bus connections. The elimination of heat shields and extra wiring saves cost and complexity for industrial and automotive applications. Additionally, active electronics can be mounted onto sterile medical instruments and function during the autoclave sterilization process.

Designers can use Microchip's complete suite of standard development tools to design with the new high-temperature devices. This includes the unified, feature-rich, user-friendly and free MPLAB® IDE; a broad selection of MPLAB and HI-TECH C® compilers, with fully functional free versions of both available; a variety of debugging hardware, from the popular PICkit™ 3 Debug Express, to the MPLAB ICD 3 In-Circuit Debugger, to the MPLAB REAL ICE™ In-Circuit Emulator; and a series of MPLAB Starter Kits.

Information regarding package options, ordering samples and purchasing the devices can be found by contacting any Microchip sales representative or authorized worldwide distributor, or by visiting Microchip's on-line **High-Temperature Design Center**.

For more information, visit http://www.microchip.com/hightemp

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Practical Applications of Low-Power Design with nanoWatt XLP

Article written by Mark Hofmann – Advanced Engineer, ***Future Electronics***

In any low power or battery powered application that includes microcontrollers, there are four basic parameters that need to be controlled in order to have a system meet power requirements:

- Low Sleep Current
- Low Active Current
- Fast Wake-Up Time
- Low-Power Monitoring Circuits

Mode of Operation	Best nanoWatt XLP Specifications	Competing MCU Specifications
Sleep	down to 20 nA	100-350 nA
Watchdog Timer	down to 350 nA	800-1000 nA
Real Time Clock/ Calendar	down to 490 nA	1000-1500 nA

Table 1.

As the drive to develop lower-power consumption, longer battery life and higher efficiency devices continues, Microchip has introduced a family of products to help you deliver on your next generation devices. These devices have the lowest sleep currents in the industry and give you the flexibility to meet your design goals. Microchip calls this technology nanoWatt XLP (eXtreme Low-Power) Technology. This technology enables Microchip to define a specification for power consumption in their PIC microcontrollers. These specifications can be seen in Table 1.

While low sleep currents are necessary for a low power system, the advantage of these low sleep currents can be lost if the monitoring circuits around the processor consume too much power. Microchip has optimized these circuits for lowpower operation. For example, the Brown-out Reset (BOR) circuit consumes just 45 nA.

This family of nanoWatt XLP processors range from 8-bit PIC16 processors to the 16-bit PIC24 series. These full featured processors offer a host of peripherals including: USB, CTMU (Capacitive Touch), A/Ds, flexible PWMs and Real Time Clock/Calendar (RTCC), and EEPROM.

New Power Modes

In order to maximize power savings, Microchip has introduced a new power mode for some of their nanoWatt XLP devices. This new power mode, called Deep Sleep, gives the user the ability to reduce their power consumption to as low as 20 nA. Microchip's existing sleep mode powers down the core but allows some peripherals to run and retains the RAM. In Deep Sleep, the core RAM and all of the peripherals are powered off.

Despite this, there are still many sources that can wake the processor from Deep Sleep. These include: Watchdog, BOR, Interrupts, Power On Reset (POR) and Master Reset. When in Deep Sleep, the processor also has 2 words of RAM that are maintained. When the processor wakes from Deep Sleep, the previous state of the device is recorded in these 2 bytes. When the device wakes from Deep Sleep, the processor knows what state it was in before entering Deep Sleep. Also important to note – regardless of Sleep mode, the pin states are retained. The differences between Sleep and Deep Sleep are summarized in Table 2 below.

Low Power Mode	Core Powered Off	Peripherals Powered Off	Wake Up Time	Pin State Maintained	Wake Up Sources	RAM Retention
Sleep	Yes	Some	1-5 ms	Yes	POR, BOR, WDT, INT, RTCC, Periph	Yes
Deep Sleep	Yes	All	Similar to POR	Yes	POR, BOR, WDT INT, RTCC	2-4 Bytes only

Table 2.

When trying to decide which power mode to use, the most important consideration is how long the device will remain asleep. Waking from Deep Sleep is very similar to a POR and the processor must reinitialize the system to wake from Deep Sleep. This requires the processor to remain in active mode much longer than if the sleep mode is used. Realizing the power savings from Deep Sleep requires knowing the differences between Sleep and Deep Sleep and how to use it effectively.

Figure 1.

To view the rest of this article, visit:
http://ww1.microchip.com/downloads/en/DeviceDoc/FutureXLPArticle.pdf

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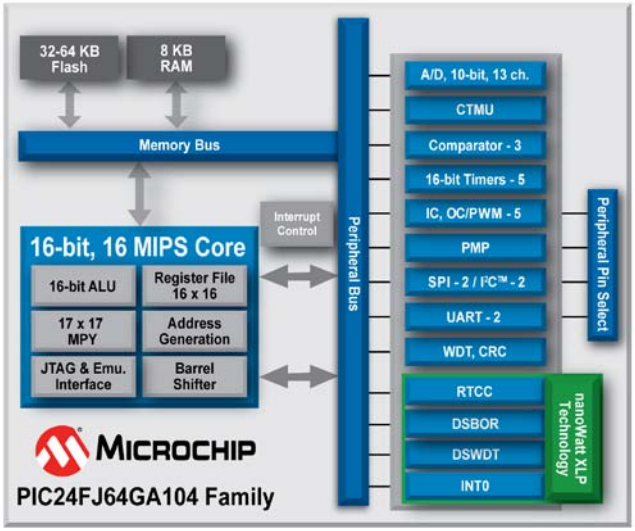
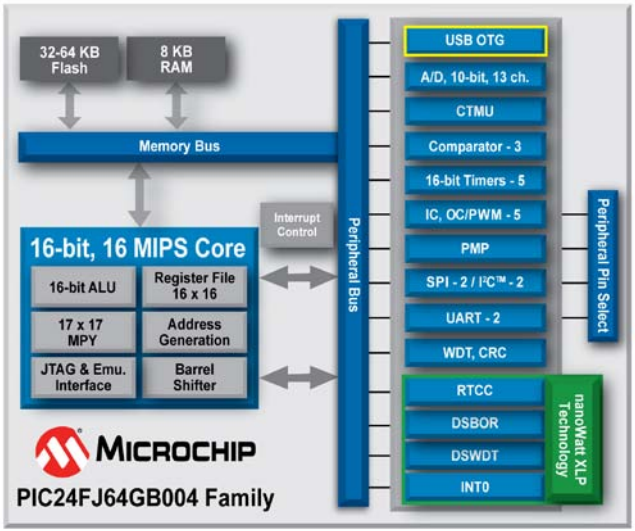
Discover Our Two New 16-bit PIC24F Families for USB and General Purpose Applications Featuring nanoWatt XLP Technology and mTouch™ Sensing





Microchip announced two new families of **16-bit PIC24F** microcontrollers (MCUs) – one with USB functionality and one for general-purpose applications. Both families feature **nanoWatt XLP eXtreme Low Power technology**, small packages and **mTouch™** capacitive touch sensing. The USB family provides for Peripheral, Embedded Host and On-the-Go (OTG) implementations. Microchip's nanoWatt XLP technology provides the world's lowest sleep currents, with current consumption down to 20 nA in Deep Sleep mode, resulting in the lowest power consumption of any MCU with USB OTG – 10 times lower than USB MCUs from other ultra-low-power manufacturers.

The **PIC24FJ64GA104** general-purpose family features nanoWatt XLP technology, 16 MIPS performance, 32 or 64 Kbytes of Flash, 8 Kbytes of RAM, a capacitive touch sensing peripheral, Real Time Clock and Calendar (RTCC), a 10-bit A/D, and the ability to reconfigure digital I/O pins via Peripheral Pin Select. The **PIC24FJ64GB004** family builds on these features with the world's easiest-to-use and most complete Full-Speed USB 2.0 Peripheral, Embedded Host and OTG solution. Both families are available in 28-pin QFN, SOIC and PDIP packages, and 44-pin QFN and TQFP packages.

Example applications for the new PIC24FJ64GA104 and PIC24FJ64GB004 MCUs include: battery-powered (remote controls, security systems, portable meters, irrigation timers), consumer (thermostats, smoke detectors, business card scanners/printers), industrial (utility metering, electronic locks, POS terminals), automotive (remote keyless entry, audio and infotainment), and medical (glucometers, blood pressure monitors, fitness monitors).

Designers can purchase $25 plug-in modules (PIMs) for use with the **Explorer 16 Development Board**, for each of the new MCU families: **PIC24FJ64GA104 PIM** and **PIC24FJ64GB004 PIM**. Additionally, the $60 **USB PICtail™ Plus Daughter Board** is available to enable USB development with the PIC24FJ64GB004 family, using the Explorer 16. All PIC24F microcontrollers are supported by Microchip's world-class development tools, including the free **MPLAB® IDE**, the **MPLAB REAL ICE™** emulation system, the **MPLAB ICD 3** in-circuit debugger, the **PICkit™ 3** low-cost debugger/programmer and Microchip's **free C compilers**.

Microchip also provides extensive **USB training courses**, and complete software support with **free USB class drivers and USB applications support**. Developers can decrease the time to market for their USB designs by utilizing the free USB software framework and application notes that can be downloaded at: **http://www.microchip.com/USB**

All family members are available now for sampling and volume production. Prices start at $2.12 each in 10,000 unit quantities for the PIC24FJ64GA104 general-purpose family members, and $2.32 each in 10,000 unit quantities for the PIC24FJ64GB004 USB family members.

For more information, visit http://www.microchip.com/PIC24

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Reduce Your Development Time, While Improving Efficiency and Performance with New Motor Control Tools from Microchip

Microchip announced two new low-cost development systems, one for the control of high-voltage motors and another for stepper motors. Along with related applications notes and free source-code software, these development tools enable rapid designs using dsPIC® Digital Signal Controllers (DSCs).

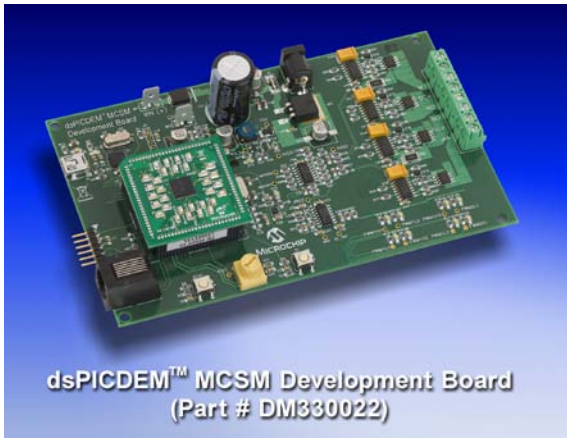
The new **dsPICDEM™ MCHV Development System** is the industry's only development tool for the rapid evaluation and design of a wide variety of high-voltage, closed-loop motor control applications using AC Induction Motors (ACIMs), Brushless DC (BLDC) motors or Permanent Magnet Synchronous Motors (PMSMs). The board includes in-circuit debugging circuitry, eliminating the need for a separate debugger for development with Microchip's dsPIC33 Motor Control DSC families. Additionally, this tool combines a proven motor-control system and Power Factor Correction (PFC) for regulatory requirements.

The new **dsPICDEM MCSM Development Board** is the industry's most cost-effective tool for creating unipolar and bipolar stepper motor applications. This board enables the rapid development of both open-loop and current-closed-loop microstepping routines using Microchip's dsPIC33 Motor Control families. This development tool also provides engineers with a control GUI, which allows them to focus on integrating the other application features and fine-tuning the motor's operation.

Five royalty- and license-free software application notes with source code are being released for development, five with the dsPICDEM MCHV and one with the dsPICDEM MCSM. Designers can utilize Microchip's proven, optimized and efficient code to produce reliable results, while reducing software creation and debug time:

Microchip's free Field Oriented Control (FOC) software libraries enable the development of green motor-based systems. By using these libraries, the engineer can run motors at their peak efficiency and generate the maximum torque using the minimum amount of energy.

Microchip's stepper motor control library enables the development of high-speed stepper motor control applications with variable micro-stepping down to 1/64 of a step. By using closed-loop current control, stepper motors can be run several times faster than their rated speeds with high torque and very-low-noise operation.



Included with Microchip's free **MPLAB® IDE** Integrated Development Environment is an application called the Data Monitoring and Control Interface (DMCI). Using this GUI with a USB cable for communications to the target board via the included Real Time Data Monitoring (RTDM) protocol promotes rapid parameter tuning for different motors. Unlike Microchip, other competitor systems require that the motor be stopped, the source code modified, recompiled, downloaded and the DSC or MCU reprogrammed to see the effect of a control parameter change.

The dsPICDEM™ MCHV Development System (part #DM330023) is $650. The dsPICDEM™ MCSM Development Board (part #DM330022) is $129.99, and is also available as the dsPICDEM™ MCSM Development Kit (part #DV330021, $269.99), which includes a stepper motor and 24-volt power supply.

For more information visit: http://www.microchip.com/DSCMotor

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Letters to Lucio Di Jasio, the author of "Programming 32-bit Microcontrollers in C. Exploring the PIC32", Elsevier Newnes 2008

Dear PIC32 Explorer,

One of the nice things about programming PIC microcontrollers in assembly has always been the ease with which I could keep track of time. I could count individual instructions (one per line) and most/all of them would require a fixed and known amount of clock cycles (4). Now that I am learning to program the PIC32 and I am using the C language, I am at loss. Delay loops duration seems hard to predict and I am never sure how long one line of code will take to execute. Help!

TimeOut

Dear TimeOut,

I understand the feeling, changing from assembly to C language might be a little upsetting especially if you, as so many other assembly programmers (myself included), used to love keeping track of each machine cycle. I will confess that, at the beginning, I used to open frequently the disassembly window of MPLAB® IDE to double check what assembly code the C compiler had produced and try to count cycles. Obviously this was not a practical, nor an efficient, way to work. Eventually, I learned to trust the compiler …

Speaking of delay loops, there are multiple reasons why I urge you to abandon them as soon as possible.

If a counter is used, as in the example below, you are going to run into a number of problems.

```
int i = 0;
while( i++ < DELAY);       // repeat loop DELAY times
```

First of all you need to disable all interrupts to keep the delay accurate and repeatable. Secondly, the delay duration will change with the chosen compiler optimization level.

Finally, on the PIC32 and most modern pipelined architectures like it, a pre-fetch mechanisms and a cache memory are interposed between the core and the memory system. They allow the core to execute a new instruction almost at each clock cycle all the way up to 80 MHz, but they do so in a statistical sort of way. Here and there, the cache will "miss" and one or two "wait states" may be inserted. How often this might happen really depends on the code being executed and many other elements of the design making it practically impossible to predict.

The solution is simple: use the right tool for the job! In other words, if you want to measure time accurately, you'd better use … a timer!

Now in all PIC32MX3/4 models there are five 16-bit peripheral timers (Timer1-5) to choose from. Here is the simplest example using the functions defined in "timer.h", part of the standard peripheral libraries (plib):

```
OpenTimer1( T1_ON | T1_SOURCE_INT, 0);       // user Timer1
WriteTimer1( 0);                             // start counting
while( ReadTimer1() < DELAY);                // wait here
```

Should you need a real long delay, you can combine two 16-bit timers to obtain a new 32-bit timer (Timer2 together with Timer3 or Timer4 and Timer5). Here is an example using Timer4 and Timer5 combined in a new 32-bit timer called Timer45.

```
OpenTimer45( T4_ON | T4_SOURCE_INT, 0)       // Timer4 and 5 combined
WriteTimer45( 0);                            // start counting
while( ReadTimer45() < DELAY);               // wait here
```

In both cases DELAY can be determined from the desired delay time "T" and the Peripheral Bus frequency (FPB) with the following formula:

```
DELAY = T[sec] * FPB[Hz]
```

But there is one more timer hidden inside the PIC32: the "Core" timer! It is part of the MIPS core, rather than the peripheral set and is fed by the system clock instead of the peripheral bus clock like all other timers. This makes it the natural candidate for all sort of scheduling, benchmarking and timing applications since it is independent from the way your peripheral bus (prescaler) is configured.

The core timer is a 32-bit timer, so there is no need to pair it up like we do with the others. It is always "on" and it has a fixed 1:2 prescaler. For example, when operating at 80 MHz, it will be able to provide you with a timed delay of up to about 110 seconds (almost two minutes) with a resolution of 25 ns.

We can use it just like in the examples above to perform a delay loop, using a slightly different set of functions found in the "timer.h" include file:

```
WriteCoreTimer( 0);                          // start counting
while( ReadCoreTimer() < DELAY);             // wait here
```

This time DELAY can be calculated starting from the desired delay time "T" and the System Clock frequency (FSYS) using the following formula:

```
DELAY = T[sec] * FSYS[Hz] / 2
```

Do you have a PIC32 question for Lucio? E-mail him at lucio.dijasio@microchip.com

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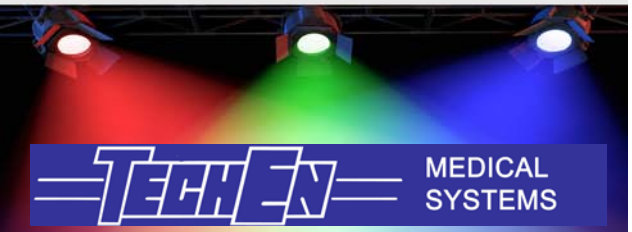
FEATURED

MICROCHIP AUTHORIZED DESIGN PARTNER



TECHEN MEDICAL SYSTEMS

TechEn, Inc. is an electronic engineering, product design services and test systems company focused on providing solutions to the medical device, medical equipment, pharmaceutical and bio-tech industries. TechEn provides technical and regulatory compliant solutions for a variety of product applications. TechEn's goal is to help you and your organization develop and deploy highly effective and successful devices, instruments and systems for regulated environments with strict quality requirements.

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Microchip Welcomes TechEn, Inc. as it's Newest Medical Design Partner

Microchip announced a new Medical Design Partner Specialist. TechEn, Inc. joins Microchip's program of more than 14 Design Partner Specialists in areas such as medical electronics, Radio-Frequency (RF) design and touch sensing. TechEn specializes in medical electronics design and engineering, and has knowledge of regulatory requirements governing the industry, as well as expertise in low-power design – critical items for today's medical-electronic devices. The company is well versed in designing with Microchip's eXtreme Low Power PIC® microcontrollers (MCUs), which feature the world's lowest sleep currents – down to 20 nA.

The "Design Partner Specialist" designation is limited to a select number of Microchip's worldwide authorized design partners. Microchip provides Design Partner Specialists with co-branding opportunities and direct links to its internal vertical-market design and technical resources. The program complements Microchip's online **medical**, **RF** and **touch-sensing** design centers, among others.

Because low power consumption is extremely important for medical applications, OEMs working with Microchip Medical Design Partner Specialists such as TechEn can differentiate their products in the marketplace by having PIC XLP MCUs designed in. The result is extended battery life and fewer battery changes throughout a device's lifetime.

Bill Johnson, chief engineering officer of TechEn, said, "With Microchip's excellent support, PIC XLP MCUs and commitment to delivering products that meet demanding regulatory and reliability requirements for the medical-device industry, TechEn looks forward to facilitating product realization for customers at various stages of design sophistication."

"Customers want to know that their design partner has knowledge and experience with the special requirements of their market," said Mitch Little, vice president of Worldwide Sales and Applications for Microchip. "With their knowledge of the low-power and regulatory requirements governing the medical electronics industry, we are pleased to partner with TechEn to enable customers to enjoy the benefits of Microchip's world-class products, including our PIC XLP MCUs featuring the world's lowest sleep currents. By working with TechEn, Medical OEMs can reap the benefits of XLP technology, and achieve faster time to market, smoother regulatory approval and lower design risk."

For further information about Microchip Technology's Design Partner Program, visit:
http://www.microchip.com/partners

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Time is Running Out!

Microchip Technology's MPLAB® ICD 2 Recycle Program

Click the image above to view the MPLAB ICD 2 Recycle Program Video. To view Microchip's YouTube channel, click **HERE**.

Send us your MPLAB ICD 2 and receive a 25% discount towards the purchase of a new MPLAB ICD 3 In-Circuit Debugger (DV164035), MPLAB REAL ICE™ In-Circuit Emulator (DV244005) or PICkit™ 3 Debug Express (DV164131).

The process is simple.

1. Complete the on-line form **HERE**.
2. Send us your old MPLAB ICD 2. Only send the puck. You can keep the rest.
3. You receive a discount code for 25% off the purchase of a new MPLAB ICD 3 In-Circuit Debugger, MPLAB REAL ICE In-Circuit Emulator or PICkit 3 Debug Express.
4. Place your order on **microchipDIRECT** or through one of our **distribution partners**.
5. You receive your new development tool.
6. We'll recycle or donate your old MPLAB ICD 2 for training.

Hurry! Offer ends December 31st, 2009.

For more information on the MPLAB ICD 2 Recycle Program, visit: http://www.microchip.com/ICD2recycle

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Looking to Enhance Your Embedded Control Designs?

In tough economic times, companies often look for ways to trim expenses as a means to cope with a downturn in sales. One of the areas often targeted for cutbacks is employee training. There is not only the direct cost of the training to contend with, but also travel expenses and time an employee spends away from the job. During this challenging business climate, however, competitive pressures and technology changes don't stop and it is training that can help a company be better positioned to take advantage of the potential upswing.

Microchip, with its global network of Regional Training Centers (RTCs) and third-party training partners, is here to help companies stay competitive with cost-effective, local training. To help companies deal with issues of travel expense and time, classes are given not only in Microchip's facilities, but are also taken on the road. Customized customer premise sessions can be scheduled offering the most convenience. Time away can be managed more efficiently with the flexibility of half or full day class sessions.

To be effective in teaching, instruction must take into account the needs and expertise level of the attendee. Microchip's Regional Training Center classes are developed to provide a coordinated flow enabling engineers to implement a solution to their product development needs. Instruction is developed and presented in product, technology and implementation classes that are grouped into application based curriculum.

Each curriculum flow enables the individual to engage with the training at a level that meets his or her current knowledge and needs. The intent is to provide training that is relevant to each attendee while eliminating the frustration often associated with attending classes that present too much known information or assume a level of knowledge beyond what the attendee currently possesses.

Product/tool classes provide knowledge on how Microchip's products and development tools operate. This knowledge provides the foundation upon which all application instruction is based. Attendance at one of these classes can provide significant value through the reduction in time associated with instruction manuals and data sheet review or trial and error attempts to learn individually. Market forces constantly press companies to add functionality and features to their products often outside their areas of core competence. As a result, engineers must continually broaden their knowledge base. Microchip's technology classes are intended to help engineers gain an understanding of a new field.

Implementation classes combine elements of product and technology instruction to teach engineers how to design a real world application. Classes at this level provide how-to instruction rather than what or why instruction.

Microchip is currently offering classes in the following curriculum: DSP, Ethernet, Human Interface, Motor Control, Power Management, Signal Chain, System Design and USB. Future curriculum is expected to include CAN/LIN, IrDA® , Lighting and RF.

With a worldwide network of Regional Training Centers (RTCs) and certified third-party trainers, Microchip makes it easy to enhance your technical skills, with locations in nearly every metropolitan area across the world!
For those organizations who desire to have a number of employees attend a course at the same time, Microchip can customize any curriculum to meet your specific needs. Our instructors arrive at your location with all presentation materials and equipment, making it easy for your whole team to benefit from a specific course topic in one setting. In addition to the instruction, most Regional Training Center classes offer the opportunity to purchase a set of the development tools used in the class at a discounted price.

If the class you are interested in is not scheduled in your area, you can sign up to receive an alert when a session is scheduled.

For information on scheduling custom in-house training, contact your local RTC directly. Contact information is available on the Microchip RTC web site.

MICROCHIP
Regional Training Centers

For a complete list of classes and locations, visit www.microchip.com/RTC

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Microchip Around Town – Get the latest updates by clicking HERE!

Check out Microchip at Hall 9/9-451

Microchip Technology's Lucio Di Jasio, Marketing Manager, High-Performance Microcontroller Division presents...

Interfacing 16- and 32-bit Microcontrollers to Modern Thin-Film Transistor (TFT) Displays: Cost, Performance and Embedded Control Design in a Fast-Moving Scenario

This presentation focuses on the practical aspects of interfacing modern 16- and 32-bit microcontroller (MCU) architectures to a QVGA Thin-Film Transistor (TFT) display system. Among the many options available, the paper reviews the specific tradeoffs of performance vs. system complexity and cost, with particular attention devoted to the most recent industry trends in the display industry as relevant to embedded-control applications. The pros and cons of utilizing a "smart" chip-on-glass vs. a "dumb" glass display will be discussed, as will the pros and cons associated with using a graphics-controller chip or integrated graphics controller. Additionally, the paper will explain serial vs. parallel (8080 bus) vs. RGB direct-drive options for smart glass connection options. When evaluating the parallel bus option, the presentation focuses on the use of 8- and 16-bit parallel ports and their operation in a DMA system. Performance will be compared against the needs of modern embedded-control applications with regard to refresh rates and animation support, then weighed against ease-of-use, power consumption and total solution cost. Practical design examples based upon 16- and 32-bit MCUs will be presented, with particular reference to an appropriate development platform and an example advanced graphics library.

Microchip Technology's Jonathan Dillon, Senior Applications Engineer, Security, Microcontroller & Technology Development Division presents...

Adding a Capacitive Touch User Interface With Resources Already Present in Your System

With your embedded system already containing a microcontroller, you may be able to replace buttons and proximity sensors with capacitive-touch controls for minimal expense, or even cost savings. Capacitive-touch user interfaces have become popular for modern applications because of their aesthetically pleasing, sleek controls; the fact that they do not involve any moving parts, allowing the system to be sealed from the elements; and because they enable hi-tech control panels. However, the implementation of capacitive-touch user interfaces has been regarded as a mysterious art. For many systems, the building blocks for implementing capacitive sensing, as either a proximity sensor or a button, are already present in the peripherals of their microcontroller, and these resources may currently be unused. This presentation discusses the following three methods for implementing capacitive touch:

1. Using the onboard timers and analog comparators
2. Capacitive sensing with unused I/O and the internal Analog-to-Digital Converter (ADC)
3. Using the capacitive-sensing circuitry embedded into the I/O pins of a number of microcontrollers

Register online, today at: http://www.embedded-world.eu/

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WHAT'S *New* IN MICROCHIP LITERATURE?

Visit our **Technical Documentation** page on www.microchip.com to view the documents.

Doc. Type	Doc. Title	DS No.
Data Sheet	MCP2036 Inductive Sensor Analog Front End Device Data Sheet	22186C
	PIC16F610 Data Sheet	41288F
	MCV20USB Data Sheet	41400B
	PIC32MX5XX/6XX/7XX Data Sheet	61156B
	dsPIC33FJ32MC202/204 and dsPIC33FJ16MC304 Data Sheet	70283G
	dsPIC33FJ32MC202/204 and dsPIC33FJ16MC304 Data Sheet	70289F
	dsPIC33FJ32GP202/204 and dsPIC33FJ16GP304 Data Sheet	70290F
	dsPIC33FJ32MC302/304, dsPIC33FJ64MCX02/X04, and dsPIC33FJ128MCX02/X04 Data Sheet	70291D
	dsPIC33FJ32GP302/304, dsPIC33FJ64GPX02/X04, and dsPIC33FJ128GPX02/X04 Data Sheet	70292D
	PIC24HJ32GP302/304, PIC24HJ64GPX02/X04, and PIC24HJ128GPX02/X04 Data Sheet	70293D
	PIC24HJXXXGPX06A/X08A/X10A Data Sheet	70592B
	dsPIC33FJXXXGPX06A/X08A/X10A Data Sheet	70593B
	dsPIC33FJXXXMCX06A/X08A/X10A Data Sheet	70594B
Reference Manual	16-bit MCU and DSC Programmer's Reference Manual	70157D
Erata	PIC18F6393/6493/8393/8493 Silicon/Data Sheet Errata	80347B
	PIC18F87J10 Family Rev. A5/A6 Silicon Errata	80378B
	PIC18F45K20 0x16-0x1B Errata	80425D
	PIC18F6390/6490/8390/8490 Rev. C1 Silicon Errata	80491A
	PIC18F6310/6410/8310/8410 Rev. C1 Silicon Errata	80492A

Doc. Type	Doc. Title	DS No.
User's Guide	mTouch™ Inductive Touch User's Guide	41407A
	MPLAB® C Compiler for PIC24 MCUs and dsPIC® DSCs User's Guide	51284J
	16-bit Language Tools Libraries	51456F
Specification	UNI/O® Bus Specification	22076D
FRM Chapter	PIC32MX FRM Section 21. UART	61107E
	dsPIC30F FRM Section 21. Inter-Integrated Circuit™ (I^2C™)	70068F
	dsPIC33F FRM Section. 21 Enhanced Controller Area Network (ECAN™)	70185B
	dsPIC33F/PIC24H FRM Section 19. Inter-Integrated Circuit (I^2C)	70195C
	PIC24H FRM Section. 21 Enhanced Controller Area Network (ECAN)	70226C
Programming Specification	PIC18F872X Family Flash Microcontroller Programming Specification	39643C
	PIC16F91X/946 Memory Programming Specification	41244F
	PIC16F/LF182X/PIC12F/LF1822 Programming Specification	41390B
	PIC18F23K22 Programming Specification	41398A
	PIC16F/LF707 Programming Specification	41405A
Product Brief	PIC12F1822 Product Brief	41406A
Misc	Frequently Asked Questions (FAQs) About dsPIC DSC SMPS Devices	93062A

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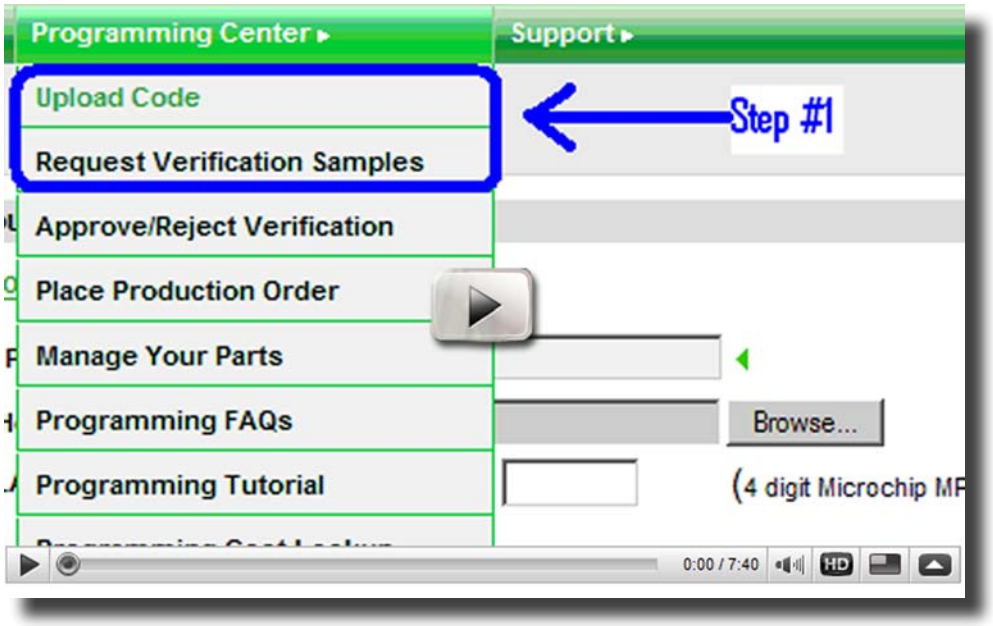
What's New @ microchip DIRECT

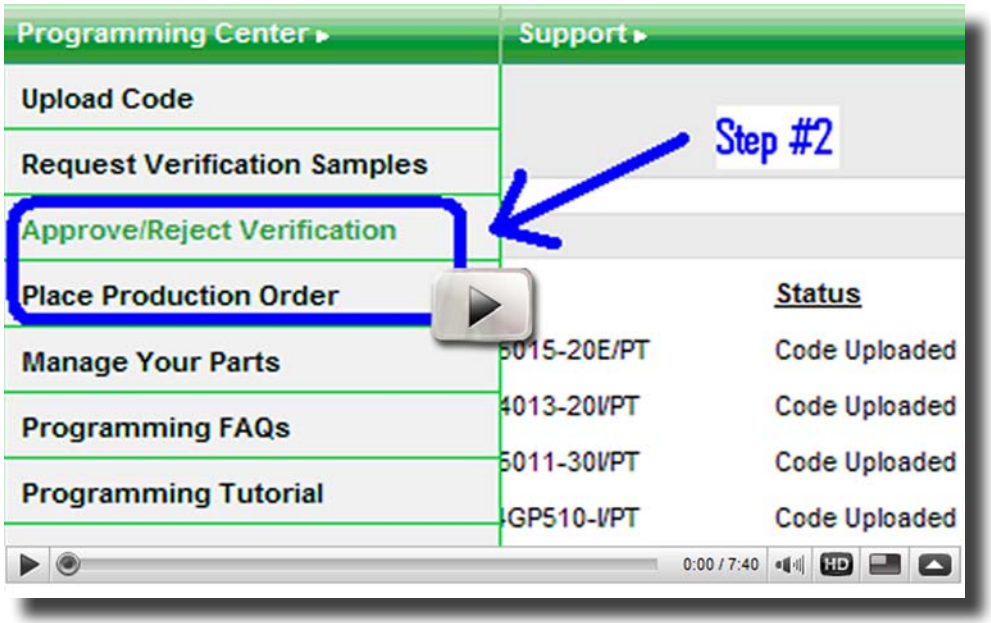
Do you have code and want Microchip to do the programming?

See how the Improved Programming Center at microchipDIRECT can help!
Microchip makes it easy to load and order pre-programmed parts! View programming tutorial here!

Here are two helpful process videos. To view, click on the images below.



Step 1 = Load Code and Submit Verification Order



Step 2 = Accept the Verification and Place the Production Programmed Order

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