microSOLUTIONS JUNE 2009

In This Issue...

Introducing the Industry's First Op Amps With On-Chip, One-Shot Calibration Circuit

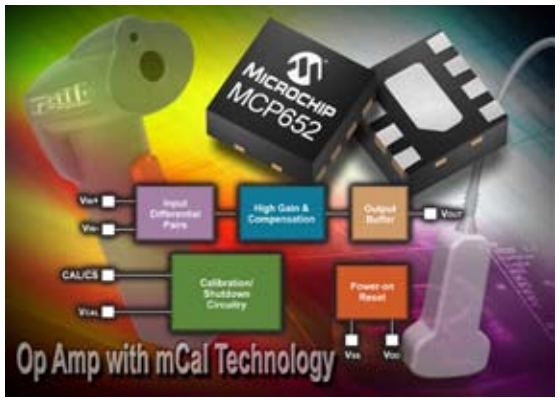
The **MCP651/2/5** family of operational amplifiers from Microchip feature low offset. At power up, these op amps are calibrated using mCal. Some package options also provide a calibration/chip select pin (CAL/CS) that supports a low power mode of operation, with offset calibration at the time normal operation is re-started. These amplifiers are optimized for high speed, low noise and distortion, single-supply operation with rail-to-rail output and an input that includes the negative rail.

Susie Inouye, research director and principal analyst with Databeans, Inc. said, "Real-time control is gaining momentum in the electronics market, resulting in a rejuvenation of demand for high-speed amplifiers. We expect overall high-speed amplifier revenue to outpace the overall amplifier market, growing at close to 10 percent on average annually each year for the next five years. Microchip's mCal technology provides customers with an innovative precision and high-speed solution that can be calibrated in the field, allowing greater flexibility and performance in equipment designs."

"The MCP65X is the industry's first op amp family to feature an on-chip, one-shot calibration circuit that is active upon power-up or controlled via an external hardware pin," said Bryan Liddiard, vice president of marketing with Microchip's Analog and Interface Products Division. "This unique mCal feature leverages Microchip's expertise in both analog and digital to provide an innovative solution for high-speed, high-precision applications."

The **MCP651 Evaluation Board** (Part #MCP651EV-VOS) provides a simple means for measuring the MCP651 op amp's input offset voltage under a variety of conditions. The measured input offset voltage includes the input offset voltage specified in the MCP651 data sheet, plus changes due to power-supply voltage, common-mode voltage, output voltage, input offset-voltage drift over temperature and 1/f noise. The board is priced at $30.

The MCP651 op amp is available in an 8-pin SOIC package for $1.21 each, in 10,000-unit quantities. The MCP652 is also available in an 8-pin SOIC package for $1.49 each in 10,000-unit quantities, and in a 3x3 mm DFN package for $1.55 each in 10,000-unit quantities. The MCP655 is available in 10-pin MSOP and 3x3 mm DFN packages for $1.58 each in 10,000-unit quantities, for both package options.



Features

- Gain Bandwidth Product: 50 MHz (typ.)
- Short Circuit Current: 100 mA (typical)
- Noise: 7.5 nV/√Hz (typical, at 1 MHz)
- Calibrated Input Offset: ±200 µV (max.)
- Rail-to-Rail Output
- Slew Rate: 30 V/µs (typ.)
- Supply Current: 6.0 mA (typ.)
- Power Supply: 2.5V to 5.5V
- Extended Temperature Range: -40°C to +125°C

Typical Applications

- Driving A/D Converters
- Power Amplifier Control Loops
- Barcode Scanners
- Optical Detector Amplifier

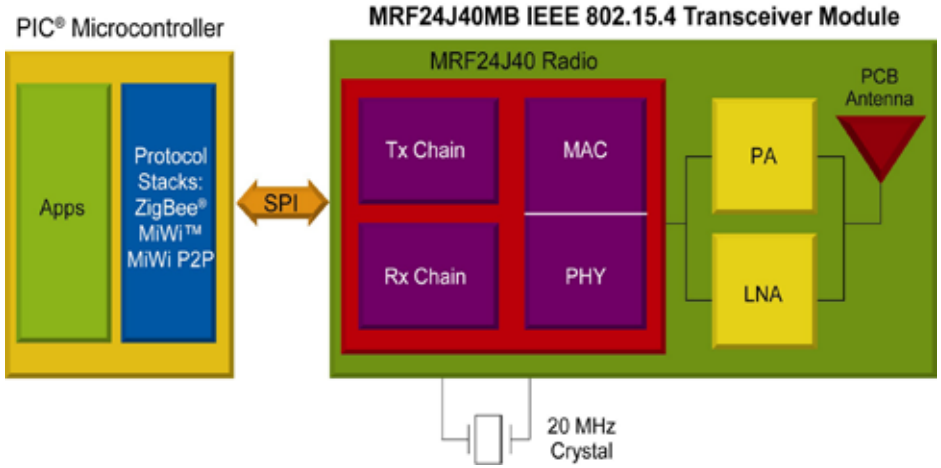
Design Aids

- SPICE Macro Models
- FilterLab® Software
- Mindi™ Circuit Designer & Simulator
- Microchip Advanced Part Selector (MAPS)
- Analog Demonstration and Evaluation Boards
- Application Notes

Learn more about these devices at http://www.microchip.com/MCP65X

Longer-Range IEEE 802.15.4 Wireless Module and Certified ZigBee® PRO Stack Now Available

Microchip has two additions to its IEEE 802.15.4 and ZigBee® portfolio for short-range, low-data-rate embedded wireless networking. The **MRF24J40MB** is Microchip's second 2.4 GHz Radio Frequency (RF), surface-mountable transceiver module. This new module adds +20 decibels per milliwatt (dBm) of transmit power via an integrated Power Amplifier (PA) and -102 dBm of receive sensitivity via the integrated Low Noise Amplifier (LNA) to the proven IEEE 802.15.4 compliant transceiver, PCB antenna and discrete matching circuitry. More transmit power allows designers to expand the range of their IEEE 802.15.4-based ZigBee or proprietary-protocol wireless networks.



The module approach eliminates RF design time, expertise and expense, while accelerating time to market and mitigating development risk. This module is pending agency certification, which is another time and cost savings measure that adds value for the adopter. Microchip makes it easy to combine this module with the perfect balance of microcontroller memory, performance, peripherals and price from among hundreds of its industry-leading 8-, 16- and 32-bit PIC® microcontrollers (MCUs) and dsPIC® Digital Signal Controllers (DSCs).

On the software side, Microchip's newly certified **ZigBee PRO** protocol stack provides yet another option for IEEE 802.15.4-based wireless networks using Microchip's PIC MCUs. The combination of Microchip's ZigBee PRO stack, the MRF24J40 transceiver radio or transceiver modules, and any of its 16-bit PIC24 MCUs or dsPIC33 DSCs forms Microchip's ZigBee PRO Compliant Platform, as certified by the ZigBee Alliance.

In addition to providing the ZigBee protocol stacks, designers who don't require interoperability or large-node networks can save on certification and microcontroller memory costs by utilizing Microchip's free and proprietary MiWi™ and MiWi P2P IEEE 802.15.4-based protocol stacks. All of Microchip's ZigBee and proprietary stacks are available for download today from its online Wireless Design Center at **http://www.microchip.com/Wireless**.

A variety of wireless networking applications are appropriate for Microchip's IEEE 802.15.4/ZigBee solutions, such as AMR/AMI metering, industrial monitoring and control, home and building automation, remote control, low-power wireless sensor networks and lighting control. The new MRF24J40MB module offers customers extended range for distant-node communication, while eliminating design and certification costs, reducing risk, and enabling quick time to market.

Designers can integrate the MRF24J40MB transceiver module with the appropriate 16-bit PIC24 MCUs, dsPIC DSCs and 32-bit PIC32 MCUs, by purchasing the new **MRF24J40MB PICtail™ Plus Daughter Board** (part #AC163028-2). This daughter board is designed to plug into the **Explorer 16 Modular Development Board**, which has available processor plug-in modules for all of Microchip's 16- and 32-bit families. Additionally, the **ZENA™ Wireless Network Analyzer** is available to graphically display wireless network traffic, analyze the complete network traffic and graphically display decoded packets. All of these tools are available today.

Engineering samples of the MRF24J40MB transceiver module are available today, and volume production is expected to be available in July. Budgetary pricing starts at $13.09 each in 10,000-unit quantities.

Learn more about these products at http://www.microchip.com/Wireless

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Microchip Enables Embedded Wi-Fi in PIC® MCU Designs With ZeroG Wireless-Based Development Tools

Microchip and ZeroG Wireless, Inc. signed a multi-year, non-exclusive deal, which began with a joint engineering program to develop an optimized Wi-Fi solution for embedded designers and resulted in modules for Microchip's 8-, 16- and 32-bit PIC® microcontrollers (MCUs) and dsPIC® Digital Signal Controllers (DSCs). The agreement ensures long-term compatibility and availability of this joint solution.

The ZeroG Wireless **Wi-Fi I/O** (**ZG2100M** and **ZG2101M**) is an easy-to-implement, low-power, low-system-cost Wi-Fi solution that provides Wi-Fi connectivity for nearly any electronic device. The new Microchip development tools are based on the standard Microchip PICtail™ and PICtail Plus daughter-board connectors, which allow a designer to easily plug Wi-Fi connectivity into a variety of Microchip development kits. These kits allow easy development with the 8-bit **PIC18**, 16-bit **PIC24** and 32-bit **PIC32** MCUs, as well as the **dsPIC DSCs** using the broad Microchip development tools and MPLAB® Integrated Development Environment.

"We have watched the Wi-Fi market continue to grow, and have correspondingly seen an increase in our customers' requests for an embedded Wi-Fi solution," said Steve Caldwell, director of Microchip's RF Products Division. "ZeroG Wireless has developed an embedded Wi-Fi product that meets the needs of PIC microcontroller designers, and our tools make it easy to integrate."

Partnering with Microchip to develop and distribute a highly optimized solution for their customers has provided us with an opportunity to directly reach thousands of customers who would like to 'just add Wi-Fi' to their embedded design," said Tim Colleran, vice president of marketing, ZeroG Wireless. "Microchip is a leader in the embedded market, and we feel our unique business model has provided us with the opportunity to team with such leaders."

The **ZeroG Wi-Fi PICtail/ PICtail Plus Daughter Board** (part #AC164136-2) is available today for $59.99, and consists of the ZeroG ZG2100M FCC and Wi-Fi certified module. This daughter board allows designers to quickly create a direct connection to the Internet by seamlessly connecting to standard wireless access points. In managing the connection, the ZeroG ZG2100M module controls the MAC and baseband layers, and is connected to the host MCU or DSC via an SPI port. The 8/16/32-bit PIC MCU or dsPIC DSC that resides on the Microchip development board controls the free Microchip TCP/IP networking stack and runs the system application. Additional key features of the daughter board include:

- FCC, IC and ETSI Certified, providing considerable cost savings and quick time to market
- Wi-Fi Certified and IEEE 802.11b Compliant wireless solution
- ZG2100M small-footprint module with integrated antenna, MAC, baseband, RF and power amplifier
- Microchip's free TCP/IP stack supports standard suite of Internet Protocols
- Supports WEP, WPA and WPA2 security protocols

The **ZeroG IEEE 802.11 Development Kit for Explorer 16** (part #AC164136) is available today for $189.99. This kit demonstrates 802.11 Wi-Fi connectivity using the separately available **Explorer 16 Development Board**, which supports all of Microchip's 16-bit PIC24 MCUs, 32-bit PIC32 MCUs and dsPIC DSCs. Everything you need to connect and begin development with the Explorer 16 is contained within the kit, including:

- ZeroG Wi-Fi PICtail/PICtail Plus Daughter Board
- Pre-programmed PIC24FJ128GA010 Plug-in Module for the Explorer 16, with TCP/IP and Web server application
- Pre-configured wireless broadband router

The ZeroG ZG2100M and ZG2101M Wi-Fi transceiver modules are also available today for $31.95 each in single-unit quantities. The modules provide a complete Wi-Fi wireless connection with full FCC, ETSI, IC and Wi-Fi certification, which reduces the overall design risk, eliminates design and certification cost, and enables quick time-to-market for customers wanting to add Wi-Fi to their PIC microcontroller-based products.

For additional information, visit **http://www.microchip.com/Wireless**.

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nanoWatt and nanoWatt XLP™ Technology: An Introduction to Microchip's Low-Power Devices

Increasing demand for lower power consumption in electronic systems has highlighted the need for lower power microcontrollers. Embedded system designers have voiced a need for; high performance MCUs with higher degree of peripheral integration while simultaneously lowering power consumption of whole system at very low level. A new breed of extreme low power microcontrollers is now available that reduce sleep current to unprecedented levels while integrating features for touch-sensing, USB and graphics applications.

With the introduction of nanoWatt XLP™ Technology, Microchip continues to focus on power consumption as a key design goal. The result is devices with not only impressive features and performance, but power consumption below long-standing industry minimums. When creating a low-power application, it is important to approach all aspects of the design from a low-power perspective. Let's have an initial look at the low-power modes on PIC microcontrollers with nanoWatt XLP Technology, which are a central source of power savings for many designs. It is important to be very familiar with how and when these features are used in order to maintain the lowest possible power consumption.

PIC MCUs with nanoWatt eXtreme Low Power (nanoWatt XLP) improve upon the original nanoWatt technology by dramatically reducing static power consumption and providing new flexibility for dynamic power management

Now let's look at some important power-saving operating modes for nanoWatt XLP technology devices:

Deep Sleep Mode

Deep Sleep mode is the lowest static power mode, producing the lowest power consumption possible without removing power to the part completely. Deep Sleep reaches this low-power state by internally removing power from most of the components of the part. The core, on-chip voltage regulator (if present), most peripherals, and (in some cases) RAM, are all powered down in Deep Sleep mode. The dedicated low-power Brown-out Reset (DSBOR) and Watchdog Timer Reset (DSWDT) for monitoring voltage and time-out events in Deep Sleep. Deep Sleep offers exceptionally low current, even on devices using an internal regulator, which normally requires a few microamperes of current. Removing the power from most of the part has the additional benefit of lower current consumption at high temperatures, since there are fewer active circuits that leak current. Deep Sleep mode is intended for use with applications that require very long battery life.

Sleep Mode

Sleep mode is the standard low-power mode for virtually all PIC microcontrollers; its implementation predates the original nanoWatt Technology. In Sleep mode, the main CPU clock and most peripheral clock sources are shut down, bringing the device to a low power state. The current device state is maintained, including RAM, SFRs and the Program Counter (PC). Wake-up sources vary between device families. All PIC devices can use the WDT, the 32 kHz Timer (Timer1 on most devices) and one or more external interrupt sources. PIC18, PIC24 and PIC32 devices also have a number of peripherals that are capable of waking up the device; these include the ADC, comparators and serial communications modules. Total wake-up times also vary between families; most devices implement options to change wake-up time and allow flexibility in design.

Sleep mode is often used when an application needs short loop times with frequent wake-up (generally less than 1 second), require peripheral wake-up sources and perform analog sampling with ADC or comparators while asleep.

Deciding Between Sleep and Deep Sleep

A helpful way to determine whether Sleep or Deep Sleep is more effective is to calculate the Breakeven Time (TBE) for a particular application. This time indicates how long a device must remain in Deep Sleep mode to have lower total power consumption than Sleep mode, once the higher power requirements for restart from Deep Sleep are accounted for.

Ultra Low-Power Wake-up

The Ultra Low-Power Wake-up (ULPWU) on RA0 allows a slow falling voltage to generate an interrupt-on-change without excess current consumption. When the voltage on RA0 drops below VIL, an interrupt will be generated, which will cause the device to wake-up and execute the next instruction. This feature provides a low-power technique for periodically waking up the device from Sleep mode.

Idle and Doze Modes

Idle and Doze modes are dynamic power reduction modes that are intended to allow more peripheral functionality than static power modes, such as Sleep, while still reducing current consumption below Run mode. These modes allow for significant power reduction at times when peripheral operation is critical, but CPU activity is not. Idle mode is a feature introduced with the original version of nanoWatt Technology. In Idle mode, the system clock is removed from the CPU, but is still provided to the peripherals. Depending on the device family, some or all of the peripherals may continue to operate in Idle mode. In Doze mode (available on PIC24, PIC32 and dsPIC33 devices only), the system clock is split into separate CPU and peripheral clocks. Idle or Doze Modes could be used when CPU is not being used to full potential.

Clock Switching

Also introduced in the original nanoWatt Technology, clock switching is an important low-power feature. This is because it offers enormous flexibility for reducing dynamic current consumption, as clock speed is the most important factor in dynamic power. While Idle and Doze mode both allow the reduction of the speed of the CPU clock, the peripherals are still clocked at full speed and consume full current. Therefore, it is important to be able to reduce the speed of the clocks to the entire device. The flexible clock switching systems implemented in PIC microcontrollers allow for switching to the most appropriate clock source for a given situation. For example, an application may use a slow clock for code sections that are not time critical, then switch to a fullspeed clock source for processing computation intensive or time critical code. Such flexibility is necessary when implementing a low-power system in order to ensure the lowest power consumption possible. As with the other dynamic power-saving modes, clock switching is best used in cases where the use of Sleep or Deep Sleep is not possible. Clock switching should be used instead of Idle or Doze modes in any case where clock speed is not critical for both the CPU and the peripherals, as it can provide significantly lower power than Idle and Doze modes.

Download Application Note (AN1267) at www.microchip.com/xlp for more information on nanoWatt XLP™ devices and how to use low power features.

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Are you starting a new project or even a new job?

Do you need to expand your skill set in today's competitive marketplace?

Are you interested in learning about new technology?

Since 1997, Microchip's annual Worldwide MASTERs Conference has expanded to offer additional technical classes and networking events designed specifically for the embedded engineering community.

This event offers product and technical training presented by engineers for engineers. With over 80 classes to choose from, whether your training needs are basic, intermediate or advanced, we have a class to enhance your skill set.

What is the MASTERs Conference?

The MASTERs Conference is three days of technical training for embedded systems design engineers. The classes are taught by Microchip engineers and technical experts and include classes for all experience levels.

What is the Pre-Conference?

For two days prior to the start of the regular MASTERs Conference, engineers can get a 'jump start' on their week with in-depth training on tools, devices and applications. Classes are designed for beginners needing an introduction to Microchip products as well as advanced engineers looking for in-depth, application specific training.

Networking and Evening Events

Have a product or application question that you want to discuss with our factory experts? Stop by the "Ask the Experts" tables after class for one-on-one discussions with our product developers. Or just relax and enjoy a myriad of other family-friendly activities each evening. Team up with a friend or family member to build and race a "hover mouse"; play a game of Texas Hold 'Em; compete with other attendees in Wii® games, robot programming and more. All Evening Events are included in the Conference cost.

Learn more about the MASTERs Conference at http://www.microchip.com/MASTERs

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CCS C Compiler Release of Principal Version 4.100

CCS announces the release of version 4.100 for all CCS C Compilers, which includes many new and exciting features, functionality and support.

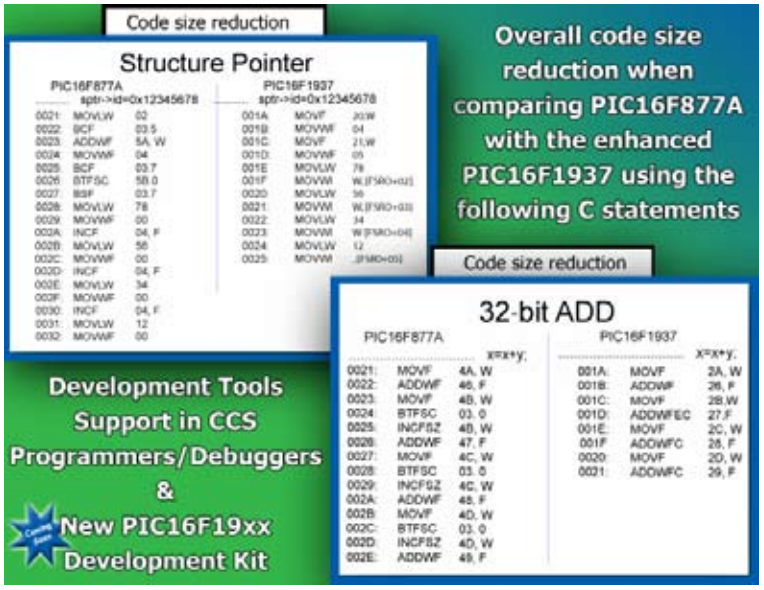
CCS has improved string-handling functions to be optimized built-in functions that will accept any combination of constant and variable arguments. The new compiler also includes an optimized printf, including string compression for 7-bit ASCII strings on 14-bit opcode parts. Many printf strings will take half of the ROM space on most PIC® microcontrollers from Microchip Technology.

The newly added syntax extensions will allow the use of some standard operators, such as +, = and ==, directly on strings. Powerful syntax extensions also permit the use of strings in a switch statement, providing an easy to use and efficient string comparison.

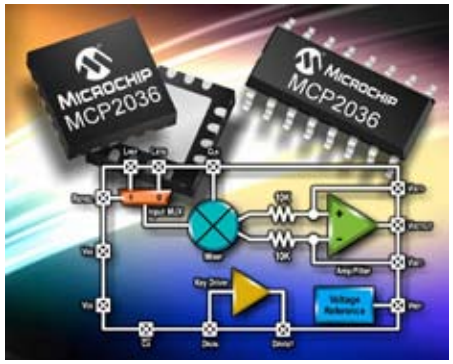
Additionally, version 4.100 includes support for the enhanced Mid-Range family of PIC® microcontrollers, including large arrays and built-in functions such as a context switch. The compiler includes a library for #USE TOUCH_PAD for capacitive touch-sensing. PIC® microcontrollers with the onboard mTouch™ module, such as the PIC16F727, will utilize internal features when available.

Version 4.100 will be available to any customer on active maintenance.

For additional information visit **http://www.ccsinfo.com/V4.1release**.



New Analog Front End for Inductive Touch Sensing



Complimenting Microchip's royalty-free mTouch™ Inductive Touch-Sensing Solutions, the fully-integrated MCP2036 Analog Front End (AFE) works with almost any 8-, 16- or 32-bit PIC® Microcontroller (MCU) or dsPIC® Digital Signal Controller (DSC), making it even easier and more cost effective for designers to enhance user interfaces with inductive touch-sensing technology.

This inductive-touch AFE includes a multiplexer, a frequency mixer, an amplifier, a driver and a voltage reference, which drastically lowers component count, and reduces design size and cost. Additionally, the AFE can be easily configured for a variety of applications in the appliance, industrial and automotive markets, among others.

Inductive touch sensing's fundamental operating principles enable it to work through a front panel, such as plastic, stainless steel or aluminum. The technology also works through thick gloves and on surfaces where liquids are present. These characteristics make inductive touch sensing suitable for applications in the appliance market because of the possibility of a stainless steel front panel; the industrial market because of the technology's robustness; and the automotive market because of the technology's sleek aesthetics and ability to reduce accidental-touch triggers.

Designers wanting to learn more about implementing touch sensing into their applications can visit Microchip's online touch-sensing design center at **http://www.microchip.com/mtouch**. This comprehensive web site provides a host of application notes, source code and other technical resources related to developing touch-sensing designs.

The MCP2036 AFE is available in a 16-pin, 4x4 mm QFN package, as well as 14-pin PDIP and SOIC packages. The device is priced starting at $0.33 each, in 10,000-unit quantities. Samples are available today at **http://sample.microchip.com**. Volume-production quantities are also available now.

For further information, visit **http://www.microchip.com/mcp2036**.

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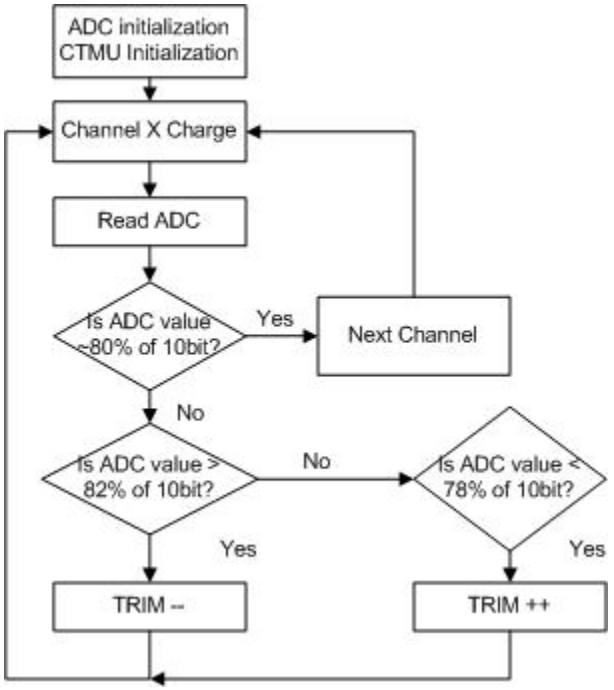
Featured Blog: www.Blog.NotesFromTheLab.com – a Human Interface Blog

How to minimize the issues caused by PCB variations in Capacitive Touch Applications

The capacitive touch is a "cool" alternate to the tactile switches and membrane switches, but when it comes to the layout of the key board in a capacitive touch application, there are many challenges. Ideally, having the same trace length from the microcontroller to the cap touch pad is desired. But in real life applications there are many challenges, the major challenges are the area for keys being too small in size and the need for the keys to be placed very close to each other. In addition, the form factor of the application board can add another level of complexity, where the microcontroller may be on one end of the large board and the keys may be on the other end, making the traces to the touch pad too long. Also in many applications a display may be placed in the middle of the board and the keys placed on either side of the display.



In these situations, the trace resistance and inductances connecting the sensor to micro may vary based on the key placement with respect to the microcontroller. The Charge Time Measurement Unit (CTMU) on many PIC24F and PIC18F architectures tune the channels to read more of less the same voltage, i.e., the CTMU is a constant current source. The nominal current source selections available are 0.55 uA, 5.5 uA and 55 uA. A benefit of the CTMU is that the current source can be trimmed up to ±62% of the nominal value. On the channels that use a long trace to connect to the capacitive senor, the current can be scaled up to compensate the transmission losses in the trace. On the channels that are short, the current can be scaled down to keep the ADC reading at the same level as the channels with long trace length. This simplifies the algorithm by not having to vary the trip levels and filtering mechanism for each channel. This reduces the code size used for the cap touch application.

A simplified flow chart above shows an automatic leveling of the channels, by trimming the current according to the trace length and variation in sensor size. – Posted by Padmaraja Yedamale, Team Leader/Pr. Applications Engineer at Microchip Technology Inc.

Padmaraja has an Engineering degree in Electrical and Electronics from University of Mysore, India, and has more than 13 years experience designing hardware and software for embedded control systems. He started his career as an R&D engineer at the Kirloskar Electric Co. in India, and worked for nearly four years concentrating on motor control for industrial automation systems. His next two years were spent at Sanyo Semiconductors as a software design engineer where he specialized in developing firmware for home electronics and appliances. He has been with Microchip for 8 years, working on various home appliance solutions and 16-bit MCU based applications, including capacitive touch sensing.

For additional information, visit http://www.blog.notesfromthelab.com

Learn more about the Charge Time Measurement Unit with this Web Seminar!

Overview of Charge Time Measurement Unit (CMTU)

This 19-minute seminar gives an overview of the new peripheral on PIC® microcontrollers called Charge Time Measurement Unit (CTMU). This peripheral is ideal for capacitive touch and many other applications.

View the Web Seminar now at **http://techtrain.microchip.com/webseminars/ArchivedDetail.aspx?Active=188**

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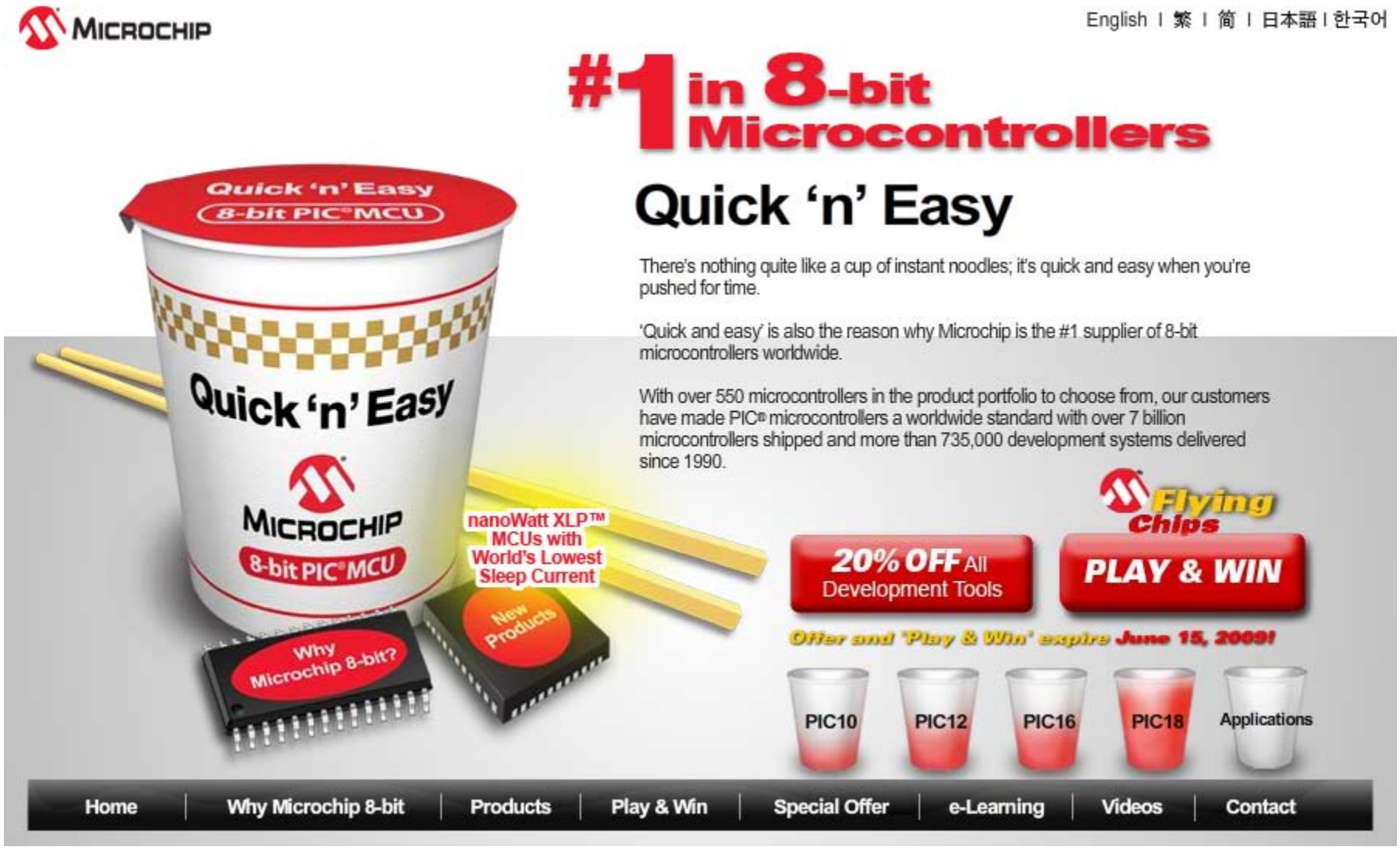

Log on now to **www.microchip.com.hk/quickneasy/** to:

- Learn about the features, benefits and applications of Microchip's 8-bit PIC® microcontrollers
- Enjoy exclusive discounts off Microchip world-class development tools
- Play the online game "Flying Chips" and win attractive prizes
- Plus, view our popular web seminars and videos

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dsPIC® DSC Speech and Audio Fast Forward Tool

There are many examples of embedded system applications which require speech and audio features. Microchip's suite of speech and audio solutions contain libraries such as Noise Suppression, Acoustic Echo Cancellation, Line Echo Cancellation and Graphic Equalizer. Each of these libraries feature adjustable parameters which can be tuned to optimize the application performance.

The dsPIC DSC Speech and Audio Fast Forward (SAFF) Tool provides a PC based Graphic User Interface (GUI) that allows application designers to change and control library parameters in real time while the library algorithm executes in the application. The tool uses the PC COM port to communicate with target dsPIC DSC devices over a serial communication channel. As the designer changes algorithm parameters via the GUI, the SAFF tool interprets these changes and issues commands to the SAFF engine running on the target. The SAFF engine modifies the algorithm parameters thus causing the changes to take effect in real time. When the system design has converged to the desired performance, the designer can then hard code the algorithm parameters in the final product firmware build.

The SAFF tool supports four libraries; Noise Suppression, Acoustic Echo Cancellation, Line Echo Cancellation and the Graphic Equalizer. The SAFF engine on the target implements the most optimal full duplex interconnection of these libraries. The application can then be designed around this implementation. Libraries can be enabled and disabled via the GUI. The SAFF tool implements a code generation feature which uses code templates to generate code for popular dsPIC DSC development boards. Designers can implement their own templates for their custom dsPIC DSC hardware.

Applications that could benefit from SAFF include:

- Automobile Hands-free Cell Phone Kits
- Speakerphones
- Intercoms
- Teleconferencing Systems
- Headsets
- Any microphone-based application

For additional information, visit
http://www.microchip.com/stellent/idcplg?IdcService=SS_GET_PAGE&nodeId=1406&dDocName=en538480

New MPLAB® Starter Kit for PIC24H MCUs Makes Adding Advanced 16-bit Control to Embedded Designs Cost Effective & Easy

The **MPLAB Starter Kit for PIC24H MCUs**, includes everything you need to develop and evaluate Human-Machine Interfaces (HMIs) and intelligent sensor processing for embedded designs, at the low cost of $59.98. The kit is based on the **PIC24HJ128GP504 16-bit microcontroller** (MCU), which features up to 40 MIPS performance, 128 Kbytes of Flash, 8 Kbytes of RAM and a full complement of integrated peripherals. For advanced HMIs, the kit includes an Organic Light Emitting Diode (OLED) array display that is supported by the **Free Microchip Graphics Library**, low-cost audio and speech playback capability for user prompts, and user-input capabilities. For intelligent sensor processing development, the Starter Kit board has a tri-axial analog accelerometer interfaced to the PIC24H, along with example applications such as motion-sensitive gaming.

The MPLAB Starter Kit for PIC24H MCUs lets you run the included accelerometer-based sample programs and check out the interaction of the accelerometer and the switches with the MCU on the visual display, while listening to speech playback. You can connect your own analog sensors for signal processing, and can download and test your own applications.

Additional key features of the MPLAB Starter Kit for PIC24H MCUs include:

- Integrated debugger/programmer
- USB powered
- 128x64 OLED display and onboard speaker
- Low-cost speech playback via G.711 compression
- Two switches for application utility
- Separate analog conditioning circuitry to plug in a wide range of sensors for sensor signal processing
- CD with Microchip's MPLAB Integrated Development Environment, including a full editor, programmer and debugger; MPLAB C compiler; code examples and user's guide

For additional information, visit
http://www.microchip.com/Tools

mCal - Dynamic Calibration for Op-Amps

New to Microchip's Linear Product Line is a family of operational amplifiers optimized for high speed, low noise and distortion, single-supply operation with rail-to-rail output and an input that includes the negative rail.

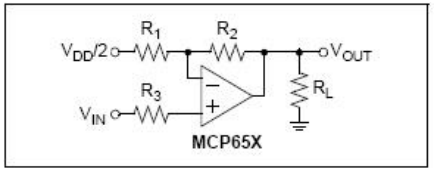
Well then... what's so special about mCal?

The internal mCal circuitry, when activated, starts a delay timer (to wait for the op amp to settle to its new bias point), then calibrates the input offset voltage (VOS). The mCal circuitry is triggered at power-up (and after some power brown out events) by the internal POR, and by the memory's Parity Detector. The power up time, when the mCal circuitry triggers the calibration sequence, is 200 ms (typical).

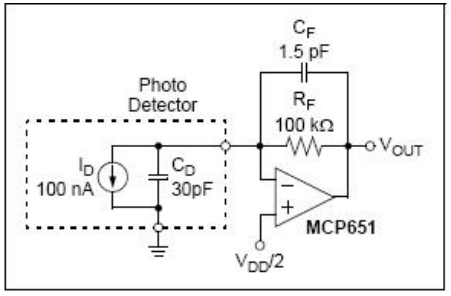
What applications benefit from mCal?

The following are a few examples of applications that benefit from mCal and low offset performance.

POWER DRIVER WITH HIGH GAIN: This figure (right) shows a power driver with high gain (1 + R2/R1). The MCP651/2/5 op amp's short circuit current makes it possible to drive significant loads. The calibrated input offset voltage supports accurate response at high gains. R3 should be small, and equal to R1||R2, in order to minimize the bias current induced offset.



OPTICAL DETECTOR AMPLIFIER: The figure below shows a transimpedance amplifier, using the MCP651 op amp, in a photo detector circuit. The photo detector is a capacitive current source. The op amp's input common mode capacitance (5 pF, typical) acts in parallel with CD. RF provides enough gain to produce 10 mV at VOUT. CF stabilizes the gain and limits the transimpedance bandwidth to about 1.1 MHz. RF's parasitic capacitance (e.g., 0.2 pF for a 0805 SMD) acts in parallel with CF.



For additional information, visit http://analogtalk.com/?p=190

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New Motor Control Training Workshops Announced!

MICROCHIP
Regional Training Centers

Learn how to control Sensorless BLDC or PMSM motors in two new hands-on workshops that are being offered through Microchip's Regional Training Centers.

Sensorless BLDC Control with Back-EMF Filtering Using a Majority Function

(Register for class MCT0301)

Microchip is rolling out an updated version of the popular sensorless BLDC hands-on workshop to many cities across North America. The revised workshop will feature the robust majority function algorithm for digitally filtering the Back-Electromotive Force (BEMF), eliminating the need for comparators and position sensors.

Each participant will work with the new dsPIC33F-based dsPICDEM™ MCLV Development Board, along with Microchip's Integrated Development Environment, including visual tools for motor control development.

MCT0301 Class Offerings

06/17 - Detroit
06/17 - Milan
06/23 - Chicago
07/01 - Winnersh
07/01 - Ismaning
07/15 - Pforzheim
07/15 - Padova
07/16 - Ismaning
08/12 - Haan

Sensorless Field Oriented Control for PMSM Motors

(Register for class MCT7101)

Permanent Magnet Synchronous Motors (PMSM) are often considered "exotic" or useful only for appliance applications plus perhaps a few niche markets. The reality is that PMSM motors have been gaining significant traction in a number of widely diversified applications.

Advantages of PMSM motors include:

- Excellent torque at low speeds
- Small size
- Lower Torque Ripple improves position control
- Better efficiency
- Less heat generated
- Compared to brushed motors, better EMI and reliability

Historically, the cost of the motor and the cost and complexity of control hindered the decision to use this motor type. The PMSM motor consists of a magnetic rotor and wound stator construction. Having no bulky copper rotor windings saves weight, size and the cost of copper but adds the expense of magnets. This expense may be reduced in the future when key patents expire for the underlying rare earth-based magnet technology. The cost of control is reduced by employing low-cost dsPIC® Digital Signal Controllers (DSCs) and (optionally) removing expensive sensors by incorporating back-EMF to calculate rotor position. Microchip has addressed the complexity issue by providing free libraries and dedicated motor control development tools.

MCT7101 Class Offerings

06/18 - Milan
07/02 - Winnersh
07/02 - Ismaning
07/15 - Pforzheim
07/16 - Padova
08/13 - Haan

For more information on this topic, visit http://www.microchip.com/motorworkshops

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The Runner-up of the contest was Smart Home Base – Skype enabled cellular phone personal assistant by Jingxi Zhang.

Benefits:

- Using your cellular phone to call to or receive calls from foreign countries without international long distant fee
- Update your schedule by directly talking to your cellular phone at any time and place
- Home voice message forwarding to your cellular phone
- Cast voice message to multiple parties
- Remote home appliances control

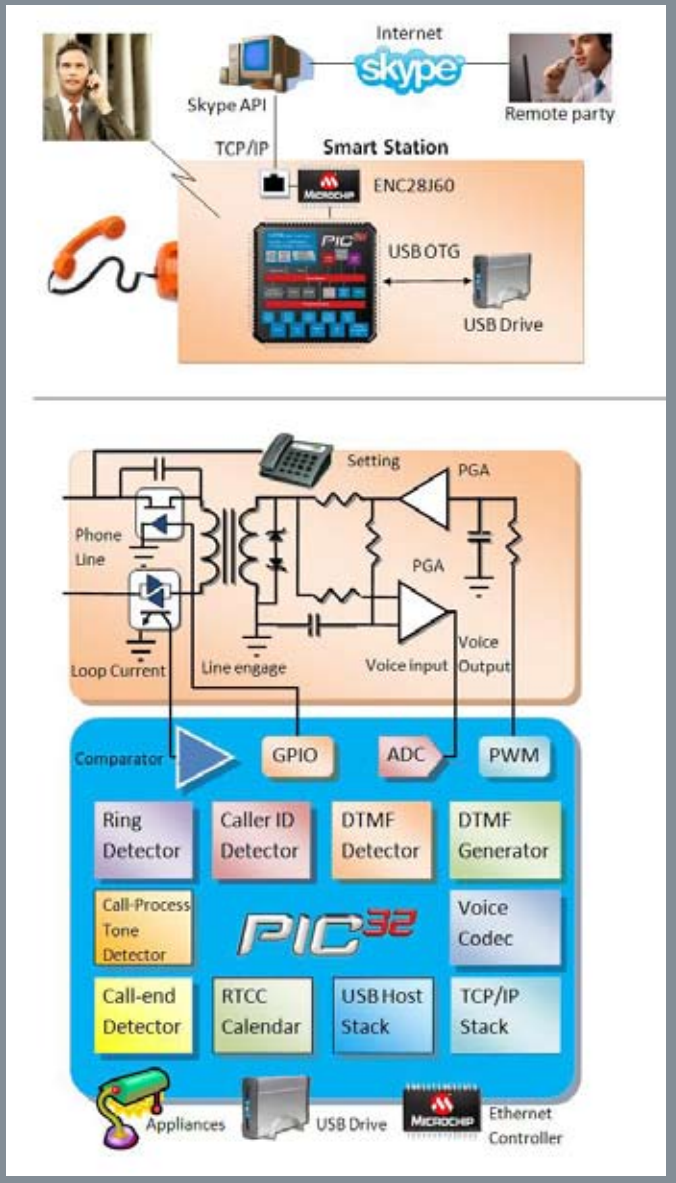
Abstract

I always use the free Skype service at my computer to talk to my friends in different countries to save the international long distance call charges However, I have to stay in front of my computer when I call my friends or receive calls from them. Ideally I can pick up my cellular phone (or the home phone) to call my Skype contacts or to receive the Skype calls when I'm away from my home or office. Another desirable feature would be to use my cellular phone service to plan my schedule by directly talking to my phone and receiving a voice reminder later when the event is due.

The Smart Home Base is the device to fill these needs. PIC32-based Smart Home Base connects to the land line telephone port at the office or home. The PIC32 microcontroller can handle the incoming call and automatically make a call. It can digitize the incoming voice and generate the outgoing voice. The Smart Home Base also connects to a host computer through the Ethernet TCP/IP link. By interfacing the Skype API through the Skype4Com Windows library the Smart Home Base can receive instructions from a cellular phone and make a Skype call to a contact. After the Skype connection is made successfully, the Smart Home Base then relays the voice traffic between the cellular phone and the Skype service. If a friend calls using Skype when I am away from my computer, the Smart Home Base answers the Skype call and asks the caller to wait while it automatically places a call to my cellular phone. When I answer the phone call I can start to talk using Skype through my cellular phone.

The Smart Home Base has a USB disk for storing the digitized user voice. With the Smart Home Base, I can use my normal cellular phone any time and place to schedule appointments, check my events or broadcast a voice message to multiple destinations. I don't need to carry a laptop or PDA, nor do need to type on the keypad. To schedule an event, I use my cellular phone to dial my office. The Smart Home Base in my office recognizes my cellular phone caller ID and starts to listen to my instruction. After keying in the date and time, I simply say the event or appointment. My voice is recorded on the Smart Home Base. When the scheduled time is due, the Smart Home Base spontaneously wakes up, makes a call to my cellular phone and plays back the recorded voice description of the event. The Smart Home Base can also record incoming messages to my office and forward them to my cellular phone. When I make a phone call and the other party's line is busy, I can call the Smart Home Base, have the Smart Home Base repeatedly dial the line and deliver my (recorded) message to the other party. With the Smart Home Base I can make a single call and send it to many parties. The Smart Home Base also allows me to use my cellular phone to remotely turn on or off my office appliances. Best of all, the services are free.

View the complete design at **http://mypic32.com/web/guest/contestantsprofiles?profileID=42421**.



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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.

To register for any of the classes offered around the world, please visit our web site at: www.microchip.com/RTC.

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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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.
Application Note	AN1254, PIC16F616 Capacitive Touch Algorithm Simulation	01254A
	AN1265, KEELOQ® with AES MCU-based Code Hopping Encoder	01265A
	AN1266, KEELOQ® with XTEA MCU-based Code Hopping Encoder	01266A
	AN1268, mTouch™ Capacitive Sensing Using Period Method	01268A
	AN1269, Using C30 to Interface with Serial SRAM	01269A
Data Sheet	24AA64F Data Sheet	22154A
	CMOS Ionization Smoke Detector ASIC	22157A
	CMOS Ionization Smoke Detector ASIC with Interconnect	22158A
	DC to DC Converter and Piezoelectric Horn Driver	22159A
	DC to DC Converter, Voltage Regulator and Piezoelectric Horn Driver	22160A
	Ionization Smoke Detector IC	22161A
	Ionization Smoke Detector IC	22162A
	Piezoelectric Horn Driver and LED Circuit	22163A
	Piezoelectric Horn Driver and Voltage Converter	22164A
	Piezoelectric Horn Driver and Voltage Regulator	22165A
	Piezoelectric Horn Driver Circuit	22166A
	Piezoelectric Horn Driver with Voltage Regulator and LED Driver	22167A
	Voltage Regulator, Voltage Converter and Piezoelectric Horn Driver	22168A
	Voltage Regulator, Voltage Converter and Piezoelectric Horn Driver	22169A
	CMOS Ionization Smoke Detector ASIC with Interconnect	22170A
	CMOS Ionization Smoke Detector ASIC with Interconnect	22171A
	CMOS Ionization Smoke Detector ASIC with Interconnect	22172A
	CMOS Ionization Smoke Detector ASIC with Interconnect and Timer Mode	22173A
	CMOS Ionization Smoke Detector ASIC with Interconnect and Timer Mode	22174A
	CMOS Ionization Smoke Detector ASIC with Interconnect, Timer Mode and Tone Select	22175A
	CMOS Photoelectric Smoke Detector ASIC with Intelligent Interconnect and Timer Mode	22176A
	CMOS Photoelectric Smoke Detector ASIC with Interconnect	22177A
	CMOS Photoelectric Smoke Detector ASIC with Interconnect	22178A
	CMOS Photoelectric Smoke Detector ASIC with Interconnect and Timer Mode	22179A
	CMOS Photoelectric Smoke Detector ASIC with Interconnect and Timer Mode	22180A
	CMOS Photoelectric Smoke Detector ASIC with Interconnect and Timer Mode	22181A

Doc. Type	Doc. Title	DS No.
Data Sheet	24AA32AF/LC32AF Data Sheet	22184A
	PIC24F04KA201 Family Data Sheet	39937B
	dsPIC33FJ32MC302/304 and dsPIC33FJ64128MCX02/X04 Data Sheet	70291C
	dsPIC33FJ32GP302/304, dsPIC33FJ64GPX02/X04, and dsPIC33FJ128GPX02/X04 Data Sheet	70292C
	PIC24HJ32GP302/304 PIC24HJ64128GPX02/X04 Data Sheet	70293C
	MRF49XA Data Sheet	70590B
Errata	PIC16F91X/946 Errata	80238C
	PIC16F6XX/690 Errata	80243K
	PIC24FJ256GB110 Family Errata	80369E
	PIC18F26K20/46K20 Rev. B2/B3 Silicon Errata	80404B
	PIC18F46J50 Family Rev. A2 Silicon Errata	80436B
	dsPIC33FJ06GS101/X02 and dsPIC33FJ16GSX02/X04 Family Silicon Errata and Data Sheet Clarification	80439D
	PIC18F23/43K20 Family Errata	80469A
	PIC24FJ64GA004 Family Silicon Errata and Data Sheet Clarification	80470A
	PIC18F85J90 Family Rev. A5 Silicon Errata	80472A
	PIC24F04KA201 Silicon/Data Sheet Errata	80474A
Programming Specification	PIC18F97J60 Family Programming Specification	39688D
	PIC18F2XK20 Programming Specification	41297E
	PIC18F13K50 Memory Programming Specification	41342D
	PIC18F13K22 Programming Specification	41357B
	dsPIC33F/PIC24H Flash Programming Specification	70152G
Migration Guide	PIC16F1XXX Software Migration	41375A
User's Guide	PIC18F4XK20 Starter Kit User's Guide	41344C
	PICDEM™ Lab Flowcode Companion Guide	41381A
	MPLAB Assembler, Linker and Utilities for PIC32 MCUs User's Guide	51833A
Header Spec.	Header Specification	51292R
Product Brief	PIC12F617 Product Brief	41388A

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HI-TECH C
COMPILERS
by Microchip Technology

What makes HI-TECH C Compilers by Microchip Technology Different?

HI-TECH C compilers are enabled with Omniscient Code Generation™ (OCG). OCG is not just a few extra optimizations thrown in for good measure; it is a fundamentally different way of compiling C code.

The traditional way of compiling a program is this: Take the first C source file which is preprocessed, parsed and passed to the code generator and assembler to produce an object file – the intermediate file format. The next file is processed in a similar way, forming another object file; then the next file, and so on. In the second stage of compilation the linker combines all the object files.

The problem is that the code generator, which does most of the work, can only see what is contained in the file it is currently processing. It has no concept of what is going on in other files. The linker is the only application to see the entire program, but it can only see object files, not the C code, and by link time it is usually too late to make any changes.

A HI-TECH C compiler with OCG again takes each C file separately, but only preprocesses and parses each file. The output p-code file is the new intermediate file format. Then, in the second stage of compilation, the code generator reads in all the p-code files and generates assembly for the entire C program in the one step. The assembler and linker are run after the code generator has completed. The C scope of objects is maintained by the code generator, so this is not like including all the source code into the one file.

There are many optimizations that can be performed as a result of being able to see the entire program. For example, say a variable is defined, but never used, in one module. An ordinary compiler cannot remove it when it is processing that module because it has to assume it might be used in other modules. Even if the linker could remove it, doing so after the code generator and assembler have run is not the best strategy. Since the OCG compiler can see the entire program, it can determine the exact variable usage and, if possible, remove the unused variable even before the first assembly instruction is output.

Omniscient Code Generation™ is available in HI-TECH C compilers for PIC10/12/16/18/32 MCUs. A HI-TECH C compiler for dsPIC® DSCs and PIC24 MCUs is also currently available, with OCG optimization features to be implemented by the third-quarter of 2009.

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