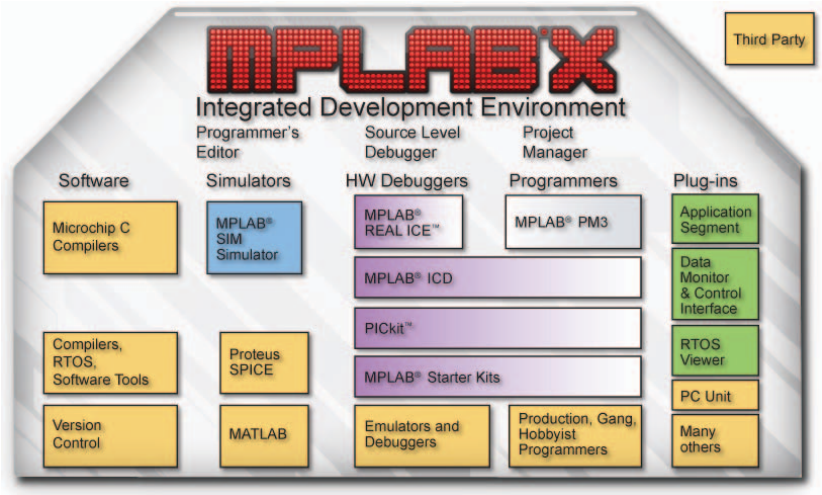
microSOLUTIONS Jan 2011

In This Issue...

MPLAB® X: The new Integrated Development Environment from Microchip... Now in Beta!

MPLAB® X IDE is a software program that runs on a PC (Windows®, Mac OS®, Linux®) to develop applications for Microchip microcontrollers and digital signal controllers. It is called an Integrated Development Environment, or IDE, because it provides a single integrated "environment" to develop code for embedded microcontrollers.

MPLAB X IDE brings many changes to the PIC® microcontroller development tool chain. Unlike previous versions of MPLAB which were developed completely in-house, MPLAB X is based on the open source NetBeans IDE from Oracle. Taking this path has allowed us to add many frequently requested features very quickly and easily while enabling a much more extensible architecture to bring users even more new features in the future. It also provides many new features that will be especially beneficial to users of our 16-bit and 32-bit families.



Where can I find more information?

The **MPLAB X Reference Center** provides answers to the most commonly asked questions from our veteran users to get up to speed with the new IDE as quickly as possible. Over time, we will add more content directed at novice users to give them a jump start into developing applications with the PIC microcontroller family.

In the Reference Center you will find information on:

- Installation and Configuration
- Creating and Working With Projects
- Working with Version Control Systems
- Working with Issue Trackers
- Working With The Editor
- Navigating Through Projects
- Building, Debugging and Running Applications
- Programming Devices
- Toolbar Quick References
- Debug and Programming Tools
- Frequently Asked Questions
- General Troubleshooting Techniques

To learn more about the MPLAB X IDE, beta, tools and references available to you, visit:
http://www.microchip.com/mplabx

Does your photoelectric smoke detector need to operate off of 3V?

IC Features Horn Driver and Boost Regulator; Reduces Cost and Component Count; Simplifies Design

Microchip has announced the **RE46C190** 3V photo smoke-detector IC with horn driver and boost regulator. The world's first smoke-detector IC to offer low-voltage operation with programmable calibration and operating modes, the RE46C190 IC enables the desired operating modes to be selected and calibrated during manufacturing. This simplifies smoke-detector design and manufacturing, and reduces component count and cost. Additionally, the IC's low operating current of 8 microamperes typical enables up to 10 years of operation from a single lithium battery. Two alkaline batteries may also be used to power the RE46C190.

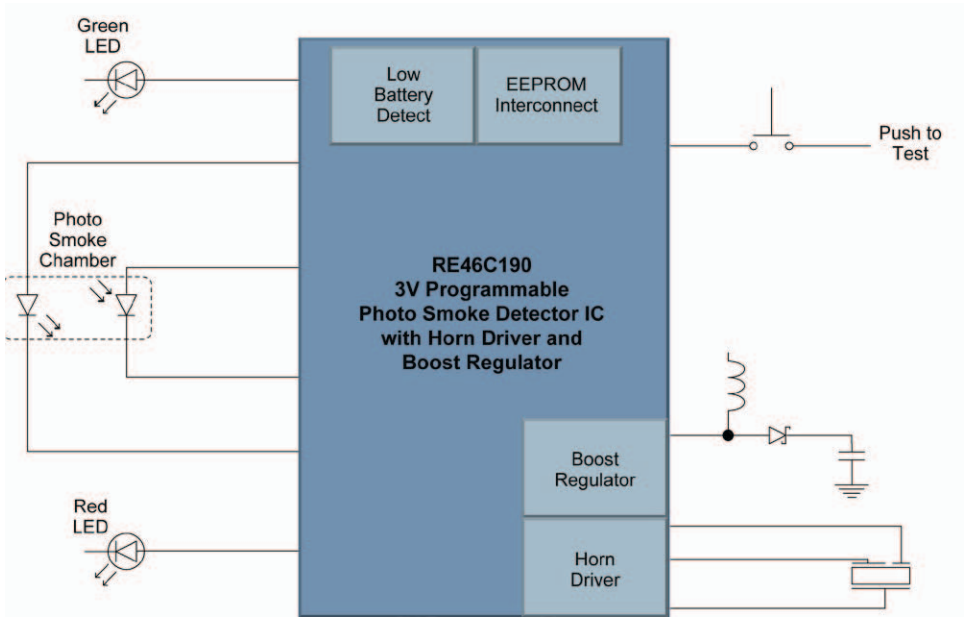
Programmable calibration and selection of smoke-detector operating modes provides designers with an easy way to control smoke-detector operation, and enables a single IC to be used to design smoke detectors for different markets and regulatory requirements. This feature also reduces the number of external components required, as electronic programmability allows the integration of several formerly external components into the IC, which in turn reduces costs associated with manufacturing and inventory.

Microchip already offers a broad line of **PIC® microcontrollers**, **horn drivers**, **smoke-detector ICs**, and **signal-chain** and **power-management devices** that enable numerous smoke-detector applications, from simple residential detectors to programmable commercial systems. The addition of a low-voltage smoke-detector IC with programmable calibration and operating modes demonstrates Microchip's steadfast commitment to developing innovative products for the smoke-detector market.

The RE46C190 smoke-detector IC is available in a 16-pin SOIC 150 mil. package in 10,000-unit quantities.

Features:

- Two AA battery Operation
- Low Quiescent Current Consumption
- Internal IRED Driver with Programmable IRED Current
- Programmable Photo Amplifier
- Programmable Smoke Sensitivity Levels
- 9 Minute Timer for Reduced Sensitivity Operation
- Chamber Test with Programmable Sensitivity Level
- Internal Low Battery Test with Programmable Threshold
- Interconnect up to 40 Detectors
- Local Alarm Memory
- Temporal or Continuous Horn Pattern
- All internal Oscillator



To learn more about Microchip's latest Smoke Detector IC visit:
http://www.microchip.com/wwwproducts/Devices.aspx?dDocName=en552256

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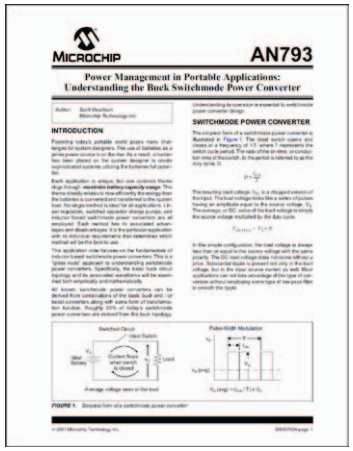
8-Bit MCUs: Sophisticated Solutions for Simple Applications

White Paper Introduction


MICROCHIP AN793

Power Management in Portable Applications: Understanding the Buck Switchmode Power Converter

The **8-bit Microcontroller (MCU)** has been around for close to 40 years. In this age of rapidly advancing technology, when electronic devices seem to become obsolete not long after they get to market, that boggles the mind. To what can we attribute such longevity? There are a variety of answers.

For starters, today's 8-bit MCUs are not the same as the ones that first appeared in the early 1970s. They are smaller, faster, cheaper, require less power, are easier to program, and offer more features and peripherals. In the early days of 8-bit MCUs, 500,000 instructions per second was considered state of-the-art. Of course, back then, typical clock rates were in the 1-2 MHz range; today's 8-bit units offer a wide range of performance options up to 64 MHz with 16 million instructions per second.

8-bit MCUs are optimized for low power and simple code. They will always be the easiest and most cost-effective solution for basic embedded control. The low-cost tools and fast time to market for developing with 8-bit MCUs make them an ideal choice when engineers need to quickly solve problems. The cost optimized 8-bit MCUs have smaller code, lower power and offer more robustness to environmental noise.

The amount of integrated memory, too, has increased dramatically over the years. Microchip's 8-bit portfolio now ranges from 384 bytes of program memory for extremely low cost, simple applications to 128 KB Flash and up to 4 KB RAM for more sophisticated drivers, stacks and libraries. So, even with a low-cost 8-bit MCU, there is plenty of bandwidth to implement an internet radio or a wireless energy monitor device.

Features And Peripherals

The fact of the matter is, today's 8-bit MCUs pack a lot of features into a small, cost-effective package. Take Microchip's **PIC10F2XX** family, for example, which comes in small 6-pin, 2x3 DFN, or SOT-23 packages. Despite being the smallest microcontrollers in the world, these MCUs are helpful for adding smarts to discrete or analog centric legacy designs where previously no electronics were needed.

Microchip's PIC® MCUs integrate a broad array of peripherals, which greatly increases the number of potential applications in which they can be used. Most embedded applications require some level of connectivity with other ICs or the outside world. Microchip offers 8-bit MCUs with standard integrated communications peripherals such as SPI, USART (RS-232/RS-485), I²C™, CAN and LIN.

In addition, many PIC MCUs also integrate USB for data logging, remote field upgrades, RS-232 replacement and diagnostic equipment. Microchip's USB MCUs include full-speed USB 2.0 operation up to 12 Mbits/sec across 14-to 80-pins and from 8 to 128 KB Flash, from the **PIC18F14K50** family to the **PIC18F87J50** family. All of the USB MCUs are supported by Microchip's free USB drivers and stack, or you can use the pre-programmed USB to UART bridge, **MCP2200,** to add USB connection to any PIC MCU.

Many applications are also adding Ethernet connectivity to take advantage of the internet for remote monitoring or control of embedded applications. Designers can choose between Microchip's standalone Ethernet controllers (**ENC28J60** or **ENC624J600**) with on-board MAC and PHY, or their single-chip PIC18F97J60 solution that integrates the 10-BASE-T Ethernet MAC and PHY into the PIC MCU in a single package. Whether you choose the integrated solution or pair the Ethernet controller with a separate PIC MCU, it is easy to add Ethernet connectivity to your 8-bit design using Microchip's free TCP-IP stack and low-cost tools. **Read more...**

Figure 1: Broad Portfolio of 8-Bit PIC® MCUs

Click below to view the full white paper
http://ww1.microchip.com/downloads/en/DeviceDoc/39993A.pdf

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Low Power Case Studies Demonstrate the Value of nanoWatt XLP Technology for Battery Powered Applications

As the drive to develop lower power, longer battery life and higher efficiency into embedded applications continues, Microchip offers a PIC® microcontroller (MCU) family that helps you to deliver the next generation of portable/energy-efficient applications. These MCUs have the lowest sleep currents in the industry and give you the flexibility to meet your design goals. Microchip calls this low power MCU technology "**nanoWatt XLP (eXtreme Low-Power) Technology**."

To demonstrate the value of this exciting line of eXtreme Low-Power MCUs, Microchip has created three Low Power Case Studies to showcase the breakthrough claims in energy efficiency and flexibility that differentiate PIC MCUs with XLP Technology from the competition.

Low Power Case Study #1:

Actual Algorithm Execution

This case study measures the actual time to execute a common algorithm in order to compare the true energy consumed by a **PIC24 MCU** with nanoWatt XLP Technology with a MSP430 MCU from TI. To summarize, the PIC24 MCU with XLP executed faster, slept longer and provided 2X the battery life with lower average current compared to the MSP430.

Click here to read this case study

Low Power Case Study #2:

Longer Battery Life

In this case study, Microchip's PIC24 MCU with nanoWatt XLP Technology demonstrates a 10% to 30% longer battery life compared to TI's MSP430 MCU in a portable measurement system example with low duty cycle (99.9% of time spent in deep sleep mode).

Click here to read this case study

Low Power Case Study #3:

Thermostat Case Study

The final case study illustrates the flexibility of the PIC® MCU platform for a complete line of energy-efficient thermostats ranging from a low-cost/entry model with segmented display to a fully-featured model with graphical display and touch sensing technology.

Click here to read this case study

To learn more about nanoWatt XLP technology, please visit:
http://www.microchip.com/en_us/technology/xlp/

Built-in Compiler Functions Speed Code Execution

Make full use of the PIC24 or dsPIC® DSC's processing capabilities with the built-in compiler functions.

Standard C provides a great way to write code for **PIC24** MCUs and **dsPIC controllers**, but sometimes programs written entirely in C just don't have the performance an application demands. Before turning to assembly, take a look at the built-in functions of the **MPLAB C compiler**. Written in assembly and designed to take full advantage of the PIC24 and dsPIC DSC's advanced hardware, the built-in functions can easily be called anywhere in a C program without the limitations or complexity of inline assembly. Furthermore, because they are directly converted into assembly code by the compiler, no function calls or library routines are called, further speeding the functions execution. The built-in functions span a wide variety of operations, including many extremely useful general purpose and mathematical operations.

Name	*Functions*	*Description*
Fractional Division	***__builtin_divf***	Returns the integer value of the quotient num/den.
Euclidian Distance	***__builtin_ed*** ***__builtin_edac***	Calculates the Euclidian distance and returns the value in an accumulator
Accumulator Functions	***__builtin_lac*** ***__builtin_mac*** ***__builtin_sac*** ***__builtin_sacr*** ***__builtin_sftac***	Functions for working with the accumulator, including loading, storing, multiply and accumulate, and shifting.
Multiply Functions	***__builtin_mulss*** ***__builtin_mulsu*** ***__builtin_mulus*** ***__builtin_muluu***	Functions for multiplying all signed or unsigned variants of two numbers.
Flash Programming Functions	***__builtin_tblrdh*** ***__builtin_tblrdl*** ***__builtin_tblwth*** ***__builtin_tblwtl*** ***__builtin_write_NVM***	Functions for writing and reading the flash memory, these functions take care of all the setup needed to read/write the flash.

For example, coding a multiply and accumulate function in C might take several lines of code, not invoke the dedicated MAC hardware found on dsPIC devices, and require a function context switch. Using the built-in function *__builtin_mac* takes one line of code, automatically takes advantage of the dsPIC hardware, and the compiler directly inserts the optimized assembly code where the built-in function is called. With just one function, the C code is simplified and the resulting program runs much faster!

The next time PIC24 MCUs or dsPIC DSCs just do not seem to have enough processing power, take a moment to retrofit the project with the built-in functions and see what happens! For new projects, build them with the built-in functions at the beginning to take full advantage of Microchip's advanced compiler functions and PIC hardware features.

For a complete listing of the built-in functions of the MPLAB C compiler see Appendix B of the **MPLAB C Compiler User's Guide.**

MPLAB® C Compiler for PIC24 MCUs and dsPIC® DSCs User's Guide Preview

The **dsPIC**® family of Digital Signal Controllers (**dsPIC30F** and **dsPIC33F DSCs**) combines the high performance required in DSP applications with standard microcontroller features needed for embedded applications. **PIC24 MCUs** are identical to the dsPIC DSCs with the exception that they do not have the digital signal controller module or that subset of instructions. They are a subset and are high-performance microcontrollers intended for applications that do not require the power of the DSC capabilities.

All of these devices are fully supported by a complete set of software development tools, including an optimizing C compiler, assembler, linker and an archiver/librarian.There are three Microchip compilers that support various **Microchip 16-bit devices**. Each compiler is an ANSI x3.159-1989-compliant, optimizing C compiler and are ports of the GCC compiler from the Free Software Foundation. Two compilers include language extensions for dsPIC DSC embedded-control applications.

Click here to continue reading.

For a complete listing of the built-in functions of the MPLAB C compiler see Appendix B of the MPLAB C Compiler User's Guide: http://ww1.microchip.com/downloads/en/DeviceDoc/51284J.pdf

How to Avoid MOSFET Driver Overstress

MOSFET drivers are used in many applications to drive the high input capacitance of a power MOSFET device. MOSFET drivers are very reliable when used within their operating specifications. Care must be taken, to control supply line transients and power dissipation, and prevent latch-up.

Avoiding Supply Line Transients

During switching transitions, parasitic inductances can create transients on the supply line, and those can create electrical overstress. Proper bypass capacitor selection and PCB layout must be performed to protect the driver from voltage transients during switching transitions. Proper PCB layout is necessary to minimize parasitic inductance in the supply path, and the ground path. Microchip provides MOSFET driver models for the following devices:

- TC1410
- TC1411
- TC1412
- TC4404/05
- TC4420/29
- TC4421/22
- TC4423/24/25
- TC4423A/24A/25A
- TC4426/27/28
- TC4426A/27A/28A
- TC4431/32
- TC4451/52
- TC4467/68/69

Simulating Supply Line Transients

The Mindi™ Circuit Designer and Simulator can be used to simulate supply line transients. The following simulation includes the parasitic inductances that are associated with package inductance, bypass capacitor parasitic series inductance, and printed wiring board inductance. The PCB Trace Inductance diagram in Figure 1 shows the TC4423A device (3A peak output current) in a circuit with following items:

- L4 – parasitic inductance in series with ground pin
- L5 – parasitic inductance in series with VDD pin
- L1, L2 – parasitic inductance in series with the bypass capacitor
- Capacitor C2 (1 nF) is used to represent the MOSFET
- L3 – the inductance from the TC4423A device to the power source

Note that the inductance between the driver output and C2 (MOSFET) is not included in this circuit simulation, but should be included in common practice. Additionally, the driver should be located as close to the output MOSFET as possible.

Before simulation can begin, a symbol for the MOSFET driver must be created, and a MOSFET driver model netlist must be assigned to that symbol. Pressing the F11 key in Mindi opens a window where the model netlist can be copied, and the symbol can be assigned to that model netlist. For example, assume that the following characteristics are applied to the items in the simulated circuit in Figure 1:

- L4 and L5 – SOIC package leads PCB trace = 10 nh
- L1 and L2 – series inductance of a 0805 ceramic capacitor PCB trace = 10 n
- L3 – PCB trace inductance from the VDD pin to the power source that feeds the MOSFET driver

Note that the parasitic series resistance and input/output PCB inductance have been omitted from this simulation, but they are available for inclusion.

The results of the simulation illustrate the voltage overshoot effect caused by the parasitic inductances. The supply line and VOUT will overshoot. The overshoot is a result of parasitic inductance. Care must be taken so that the overshoot does not exceed the maximum operating voltage.

To minimize parasitic inductance in the supply path and ground path, a proper bypass capacitor must be selected and an associated PCB layout must be completed to reduce voltage transients during switching transitions.

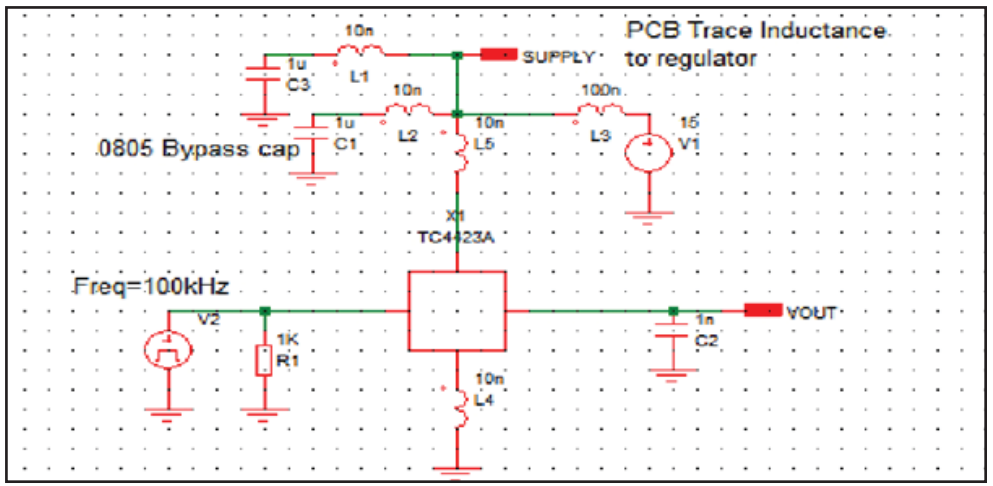

Figure 1: Schematic – Parasitic Inductances.

Driver models and the Mindi Circuit Designer and Simulator software package can be downloaded from: http://www.microchip.com

HOW DOES YOUR DESIGN FIT INTO SMART ENERGY?

EMBEDDED DESIGNERS FORUM

LIVE • ON DEMAND

Whether you're looking to monitor, measure, control, display, convert or use energy more efficiently, Microchip has the latest technologies and products to help you design products for the emerging Smart Energy market.

Microchip's Worldwide Embedded Designers Forum (EDF) is one-day seminar designed to give you the tools and knowledge needed to take your design to the next level and help you stay ahead in today's competitive environment.

Six of nine focused modules featuring the latest technologies in low power, human interface and connectivity will be presented in each seminar. Learn how to apply these technologies into Smart Energy through discussions and demonstrations led by Microchip's expert staff. Modules are packed with practical information and advice on how to achieve the lowest power consumption, add a more stylish user interface, run more complex software, add USB connectivity and save money on development and system BOM cost.

The EDF's in North America ran in October 2010 and a Virtual Conference was held live on November 2nd. The material is available on demand at **www.microchip.com/VirtualEDF.** The Virtual EDF features all nine modules (and more!). For additional details, please see the sidebar.

MODULES

- Adding USB to your Embedded Designs
- Connectivity Solutions for Embedded Designs
- Touch Screen Sensing and Graphical Displays
- Touch Sensing Solutions for Keys and Sliders
- Smart Energy Monitoring
- Smart Power Conversion
- Designing for Optimum Energy Usage
- Signal Conditioning for Embedded Applications
- Exploring MPLAB® Development Tools

THE VIRTUAL EDF

Now available to view online
www.microchip.com/VirtualEDF

Microchip & Digi-Key are pleased to bring an online component to support designers who are unable to attend one of our in-person seminars.

Attendees of the FREE Virtual Embedded Designers Forum learn from and interact directly with industry experts and technology providers via 12 presentations including keynote presentations featuring Energizer® and Google PowerMeter™, interactive chats, a virtual exhibit hall, and gain access to a comprehensive collection of educational material and resources supporting Microchip and the Smart Energy market.

All content from the live event has been archived and is available on-demand for 12 months.

DATES & LOCATIONS

For a complete list of worldwide locations, visit:
www.microchip.com/EDF

Space is still available in Euope and Asia, visit www.microchip.com/EDF for a complete list of locations and dates

North America
Now available on demand

Europe
Now to March 2011

Asia
Now to March 2011

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www.microchip.com/EDF

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Interact with Microchip at "MCHP Tube"

Microchip's Academic Program team has launched a YouTube-based show called "**MCHP Tube**." – an online video newscast for all things Microchip with a focus on Academia. Here you'll find the latest information on new products, technologies and software/hardware development tools from both Microchip and Third-party sources.

This monthly show targets academics worldwide and is divided into four sections:

Headliners – we will discuss new academic-friendly development resources brought to you by Microchip and our authorized Design Partners.

University Student Project – students can submit a video featuring a student project based on Microchip products.

Ask Microchip – viewers can ask a question and a qualified Microchip support person will answer it.

Where in the World is Marc McComb? – Marc is Microchip's Academic Sales Engineer and in each edition will talk about new products and tools that are a good fit for academics.

To submit a video on a student project or ask a question for the "Ask Microchip" section, email us at **mchptube@microchip.com**.

You can also visit **www.microchip.com/mchptube** for more information on the show.

MCHP Tube provides the opportunity for Students, Teachers and Professors to interact with Microchip directly!!

Click on the image above to view the fourth episode of MCHP Tube. To view Microchip's YouTube channel, click HERE.

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Join Microchip At The Following Worldwide Events

ECN Webcast
Online January 19 2011
Available for 6 months

Join *Jefferay Lawton, Product Marketing Engineer* as he presents "Signal Chain Conditioning with Op Amps and ADCs" Solar power chargers are convenient, in that they provide a completely wireless power system. Unfortunately, the stacked efficiency of the various switching converters typically results in a loss of 20 to 30 percent. Learn how converter topology efficiency can be increased, while decreasing both cost and board space. The secret is a unified system that handles maximum power conversion for the solar cells, battery charging and load regulation. This presentation will discuss the topology in depth, including tradeoffs and the role of load regulation.
Register online at: **http://www.ecnmag.com/tags/Sections/Webcasts/**

Macworld 2011
San Francisco, CA
January 27-29, 2011

Join Microchip at Macworld 2011 in the Mobile Apps Showcase – booth #818. Microchip will have experts onsite demonstrating its Development Kits for iPod® and iPhone® Accessories. We are pleased to offer you a FREE expo hall pass that will admit you to the premier showcase of Apple-related products and technologies - or you can attend the conference at a savings of 15%. Macworld 2011 is a four day event that offers access to hundreds of Apple related products and services. You will discover cool software, hardware and accessories to use with your favorite Apple devices. You will also find expert advice, demonstrations and instruction by the very people that develop these products. Macworld conference programs feature industry leading minds, presenting cutting edge product training on the topics you most want to learn.
Register for your FREE expo pass: **http://rcsreg.com/macworld/BBE47156**

Integrating Touch Interfaces
Virtual Conference on Demand

Join *Microchip* at the EE Times Integrating Touch Interfaces virtual conference, the leading resource for engineers to learn about the latest hardware and software solutions, design techniques and algorithms that industry leaders are using in successful designs.In this virtual setting, you can hear expert keynotes and participate in panel sessions and interactive chat to learn the latest about evaluating and choosing between several sensor technologies, touch surface materials, front and back-end analog and digital controllers, as well as device drivers, middleware and application-level touch routines.
Register online at: **http://www.eetimes.com/touch/**

Motor, Drive and Automation Systems 2011
San Antonio, TX
March 1-2, 2011

Join *Patrick Heath, Strategic Marketing Manager,* as he discusses "Techniques for Improved Stepper Motor Control" Typical stepper motor control uses an open-loop, voltage-control method, where the faster the voltage ramps in the motor phase, the quicker the step is taken. While this method works well, it is not optimized for energy efficiency nor speed. Using a low-cost, motor-control digital signal controller with comparators, a closed-loop, current-control mode of operation can be implemented. This control method provides a significant step speed increase of up to 25 times faster, At the same time, by controlling the currents, stepper-motor energy consumption is optimized. Another significant advantage of this control technique is a marked reduction in the motor noise level.
Register online at: **http://www.e-driveonline.com**

Embeddedworld 2011
Nuremberg Germany
March 1-3, 2011

Join *Microchip Technology* at the Embedded World Exhibition & Conference, the world´s biggest exhibition of its kind and the meeting-place of the international embedded community. Embedded technologies are in action everywhere - whether in the car, data and telecommunication systems, industrial and consumer electronics, military systems or aerospace. Last year 730 exhibitors showed the 18,350 visitors a full range of products for embedded technologies in 2010: hardware, software, tools, services and lots more. Drop by booth 9/9 451 to view Microchip's latest innovations including the newset PIC32.
Register online at: **http://www.embedded-world.de/en/**

Register for one or more of these great events at the links above!

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

Microchip's Digital Power Seminars: 2nd Edition

Learn about the latest in digital power conversion from Microchip with the next generation of reference designs.

The Second Edition of Microchip's Digital Power Seminar explores the benefits digital control can bring to several advanced topologies and applications.

Designed for those new to digital power and those already familiar with the subject, the seminar covers a wide range of topics using Microchip's new reference designs. Traditional power conversion uses fixed function analog ICs to regulate power conversion. Using a Microchip dsPIC® DSC the power stage can be controlled digitally through software, enabling a fully programmable and flexible solution. This is becoming increasingly important as the market is looking for more efficient power supplies that pack more features into a single design. The seminar reviews the basics of digital power and then explores how digital power brings more capabilities to lots of applications. Using Microchip's new reference designs, the seminar takes an in depth look at how digital control can be used in modern power conversion applications and covers the following topics in detail:

1. DC/DC Power Conversion Using a Quarter Brick Sized Phase Shifted Full Bridge.
2. Resonant Power Conversion Using a DC/DC LLC Topology
3. Solar Micro Inverter Using a Grid Tied Inverter System
4. LED Lighting Using a Buck or Boost Topology
5. HID Lighting Using Digital Control

Register online, today at: http://www.microchip.com/dps

Register today for your FREE ticket!

Space is limited, register today!

Lunch is provided.

Every registrant in attendance will be eligible to win a digital power start kit bundle, which includes:

- **16-bit 28-pin Starter Board**
- **PICkit™ 3 Programmer/Debugger**
- **Buck/Boost PICtail™ Plus Daughter Board**

Dallas, TX	January 27, 2011
San Jose, CA	February 8, 2011
Orange County, CA	February 9, 2011
Vancouver, BC	February 15, 2011
Huntsville, AL	February 16, 2011
Chicago, IL	February 17, 2011
Boston, MA	February 22, 2011
Toronto	February 24, 2011

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Online Microchip Training Initiatives

For any training program to be effective it needs to provide the right information at the right time in the right place to the right people. The more these conditions aren't met, the less effective the training becomes. To help our customers get the most from the technical training we offer, Microchip is rolling out two new training initiatives to supplement the courses given in our network of Regional Training Centers (RTC) and by third party trainers.

While classroom based training is a great opportunity to interact with a knowledgeable instructor, its effectiveness can be hampered by the need to travel to the classroom. If the knowledge you need is not available in a convenient location when you want it, the costs and time associated with travel may make attendance impractical. To help overcome this obstacle, Microchip is now offering several RTC courses via the internet using Microsoft Live Meeting. These are the same instructor led classes optimized for online delivery. You don't need to wait for a particular class to come to your town or travel to attend: take the class when you need it from the convenience of your office or home.

To see the schedule of live online classes, visit: **www.microchip.com/rtc** and select "Find classes > Search" in the "By Location" section of the search page.

Select the "Show Live Online Classes Only" radio button and click Search. After registering for a class, your access code and instructions will be sent in the confirmation email.

Microchip is currently in the process of creating self-paced instructional modules that can be taken "on demand" at your convenience. If all you really need is some specific information or instruction on how to perform a simple task; like how the UART operates or how to set a break point in MPLAB® IDE, we urge you to try these modules. The first of these will appear near the end of the year and will be focused on our new development platform MPLAB X.

These new programs continue Microchip's objective of giving our customers the freedom to innovate.

Training Opportunities From Microchip and Avnet Memec

Want to learn from an expert?

These classes include hands on motor control development work, so you can learn the theory and then put it into practice. Additional classes are available that cover the device programming and peripheral usage, C language and control techniques that are not specific to motor control.

Class	Hours	Hands On	Abstract	City/Date
MCT 0101: Overview of Intelligent Motor Control	4	No	This class reviews common motor types, control algorithms and motor interface design. It serves as a broad introduction to Microchip's motor control portfolio.	San Jose: Feb. 9 Chicago: Feb. 9 Minneapolis: Mar. 23
MCT 3101: BLDC Control Techniques	7	Yes	This class presents an in-depth analysis of Microchip's BLDC motor control algorithms. The class also provides an overview of the dsPIC® DSC's motor control peripherals. Attendees will use the DMCI to modify algorithms and control the motor. Sensors, sensorless and field oriented control are all covered.	San Jose: Feb. 10 Chicago: Feb. 10 Minneapolis: Mar. 24

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 at www.microchip.com to view the documents.

Doc. Type	Doc. Title	DS No.
Application Note	AN1071, IrDA® Standard Stack for Microchip 16-/32-bit Microcontroller	01071B
	AN1363, MRF24WB0M Indoor and Outdoor Antenna Range Testing	01363A
Data Sheet	MCP1415/16, 2-Wire High Accuracy Temperature Sensor	22092D
	110 uA, High Precision Op Amps	22142B
	30 uA, High Precision Op Amps	22182B
	60 uA, High Precision Op Amps	22189B
	3.0 uA Comparator with Integrated Reference Voltage	22269A
	CMOS Low Voltage Photoelectric Smoke Detector ASIC with Interconnect and Timer Mode	22271A
	PIC18F/LF2X/4XK22 Data Sheet	41412D
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	PIC32MX795F512L 100-pin to 100-pin TQFP CAN-USB Plug-In Module (PIM) Information Sheet	51949A
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	PIC32MX575/675/695/775/795 Family Silicon Errata and Data Sheet Clarification	80440C
	PIC16F/LF1946/47 Family Silicon Errata and Data Sheet Clarification	80460E
	PIC16F/LF1938/1939 Silicon Errata and Data Sheet Clarification	80463E
	PIC18F47J53 Family Silicon Errata and Data Sheet Clarification	80467E
	PIC18F87K22 Family Silicon Errata and Data Sheet Clarification	80473F
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	MRF24WB0MA/MRF24WB0MB RF Transceiver Errata	80486E
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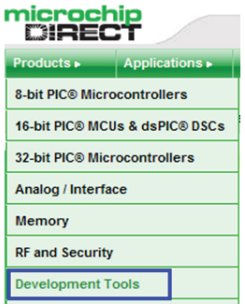

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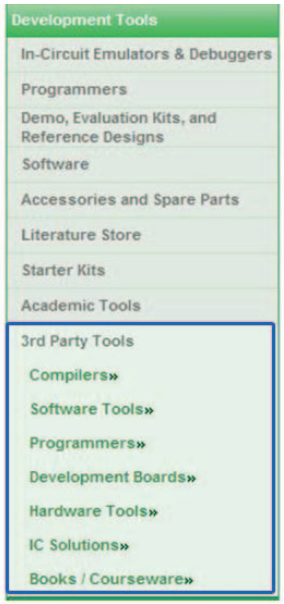

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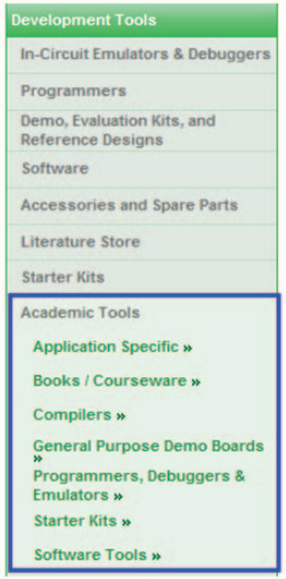

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