JULY 27 - AUGUST 1, 2009 • JW MARRIOTT DESERT RIDGE RESORT • PHOENIX, ARIZONA

MASTERs 2009

THE WORLDWIDE CONFERENCE FOR EMBEDDED CONTROL ENGINEERS

CONFERENCE PREVIEW

MICROCHIP
MASTERs Conference

www.microchip.com/MASTERs

ABOUT THE MASTERs CONFERENCE

Since 1997, Microchip's MASTERs (Microchip Annual Strategic Technical Engineering Review) Conference has drawn an engineering audience from around the globe.

With more than 80 different engineer-to-engineer technical training classes offered, the MASTERs Conference continues to arm embedded systems designers with extensive product and technology information.

Who Should Attend?

Those who are looking for solutions to embedded control challenges or in-depth education on Microchip's products. Design engineers and engineering managers will benefit from the Conference by interfacing with Microchip Application Engineers and other technical experts. Students graduating from the MASTERs program will be equipped to go out and use Microchip products to full advantage. Certificates will be awarded upon completion of the Conference.

Pre-Conference Classes

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.

So, if you would like the opportunity to learn more while at the MASTERs Conference, be sure to attend Microchip's Pre-Conference days on July 27 & 28.

Resort Premises

JW Marriott Desert Ridge Resort & Spa, Arizona's largest luxury resort, is woven into the Sonoran Desert where northern Phoenix meets Scottsdale. The resort has 10 distinctive dining selections, Signature Golf Course and Championship Course, Spa, Health Club, Tennis Center, Fitness Center and four acres of pools and waterways including the Lazy River with a serpentine slide. Please visit the resort web site at www.jwdesertridgeresort.com for more information. The resort is just 20 minutes north of Phoenix Sky Harbor International Airport.

Arizona Climate

As you probably know, Phoenix offers a desert climate. During the month of July, you can expect hot, dry weather. Typical high temperatures during the Conference will range between 105°F (41°C) and 115°F (46°C) and typical evening temperatures will range between 80°F (27°C) and 90°F (32°C).

Enjoy Arizona

Take advantage of the scenic beauty of Arizona before or after the Conference by visiting the Grand Canyon or the fiery red rock cliffs of Sedona. Take a ride through the Saguaro cactus-studded desert in a Hummer, embark on a hot air balloon ride or enjoy rafting down a river. For information on Arizona, visit www.arizonaguide.com

REGISTRATION FEES

Conference Registration: $1295.00 USD
Includes entry to the MASTERs Conference classes (July, 29, 30, 31 & August 1), a USB Drive with all class material and overnight accommodations, tax and gratuities for three nights (July, 29, 30 & 31), meals and entertainment.

Pre-Conference Registration: $995.00 USD
Includes Pre-Conference classes (July 27 & 28), overnight accommodations, tax and gratuities for three nights (July 26, 27 & 28), meals and entertainment (July 27 & 28 only).

Payment due within 30 days of registration. Attendees must register at www.microchip.com/MASTERs by July 13, 2009.

Registration Discounts Are Available! (See our web site for details. Some restrictions apply.)
This year we are offering various discounts for all attendees:

- Save $155 off the MASTERs Conference Registration and $50 off the Pre-Conference when you register by May 8.
- No hotel room needed? Save 25% off of the MASTERs Conference Registration and Pre-Conference Registration.
- Authorized Design Partners receive a minimum of 20% off the MASTERs Conference Registration.
- Professors in the Microchip Academic Program receive a 30% discount off the MASTERs Conference Registration.
- A 20% Group Discount is available for groups of 6-10 or 25% for groups of 11 or more.

GENERAL DETAILS

Accommodations
Overnight accommodations, tax and gratuities at the JW Marriott Desert Ridge Resort in Phoenix, AZ are included in the cost of attending the Conference. In the event the JW Marriott Resort has reached full capacity, Microchip will accommodate attendees at a nearby hotel and provide transportation between the two locations.

The JW Marriott Desert Ridge offers complimentary use of its Fitness Center and complimentary coffee in each sleeping room. For your convenience, Microchip will provide FREE Internet access in the 'Cyber Cafe', 24 hours a day beginning Monday, July 27 at 5:00 PM through Saturday, August 1 at 1:00 PM.

The JW Marriott Desert Ridge requires a credit card or cash upon check-in. If paying by cash, the resort requires the entire room charge plus tax and an additional deposit of $50.00 (US) per day for incidental charges (phone, etc.). If paying cash, an additional $500.00 (US) deposit is required if you request a mini-bar key. If paying by credit card, credit approval will be automatically authorized for room charges and tax plus the additional $50.00 (US) per day deposit. Upon check-out, the final billing charges will be applied to your card.

Conference Check-in
At check-in, you will receive your badge which must be worn throughout the Conference during classes, meals and events. The back of each badge will show your individual schedule for the week.

Meals and Meal Ticket Purchases
Meals are included in the cost of the Conference beginning with breakfast on Wednesday, July 29, through breakfast on Saturday, August 1, at The JW Marriott Desert Ridge Resort (Pre-Conference meals start on Monday, July 27). Meals are pre-arranged in a private banquet room.

If desired, guests can dine together with you for an additional fee which will be collected by Microchip. Meal tickets can be purchased anytime during the Conference. This fee can be paid by credit card or cash, but cannot be added to your incidental room charge. If guests desire to dine elsewhere, there are an assortment of restaurants on the Resort premises.

Meal cost, per guest accompanying you, but not attending the Conference (including tax and gratuity):

- Breakfast US $23.00, per meal, per day
- Lunch US $29.00, per meal, per day
- Dinner US $52.00, per meal, per day

Children under 12 will be charged half price and children under 5 eat free .

Attire
Proper attire for all classes and events is business casual. As the temperature outside will be quite warm, short sleeve polo-type shirts and shorts or cotton slacks are suggested for comfort.

Printed Class Material
FedEx Kinko's is on-site for your convenience. You may purchase printed copies of class slides for as many classes as you would like or purchase them all if desired. Prices will vary depending on number of pages printed and will be available during the Conference for purchase. Identify yourself with the MASTERs Conference to receive discounted rates. If you want the printed material available to bring to your classes, we suggest you visit the FedEx Kinko's office as early as possible prior to your first class.

Development Tools Store
Microchip offers a wide selection of the most popular development tools at deeply discounted prices to MASTERs attendees during the Conference. The Development Tools Store is open each day of the Conference (July 29 – August 1) for your convenience. Orders will be processed through our microchipDIRECT site. If you haven't previously registered on the site please do so before the Conference to save time. Registration can be easily completed by visiting www.microchipdirect.com.

Microchip MASTERs Merchandise Store
Want to take home something to show that you attended the 2009 Masters Conference? Or maybe a gift for someone? Then visit our MASTERs Merchandise Store where we will have an assortment of items to purchase with the Microchip logo. We accept Visa, MasterCard, American Express or US currency.

Microchip On-site Office
Have questions about registration, schedules, evening events or classroom locations? Whatever you can't find on our website can be answered by our friendly staff in the Microchip on-site office. Our staff is waiting to help you make the most of your Conference experience.

Third Party Bazaar
Interested in additional tools available to help decrease development time when using Microchip products? Browse around the Third Party Bazaar and discuss your needs with select Third Party partners who will have demos, literature and technical experts on site. The Bazaar will be staffed during Conference check-in as well as lunch breaks and at the end of the day after classes, giving you plenty of time to review their products.

PRE-CONFERENCE DETAILS

July 27-28, 2009

Pre-Conference Check-in

For attendees participating in Pre-Conference Classes beginning Monday, July 27, registration will take place on:

Sunday, July 26, 2:00-8:00 PM

Monday, July 27, 7:00-8:00 AM

Meals for the Pre-Conference

All attendee meals are included in the cost of the Conference – meal tickets may be purchased for guests traveling with you but not attending the Conference (See Meal Ticket Purchases).

Includes breakfast on Monday, July 27, through dinner Tuesday, July 28.

Pre-Conference Attendees:

Breakfast Buffet	
Monday-Tuesday	6:30-8:00 AM
Lunch Buffet	
Monday-Tuesday	12:00-1:15 PM
Dinner Buffet	
Monday-Tuesday	5:30-7:30 PM

CONFERENCE DETAILS

July 29-August 1, 2009

Conference Check-in

For attendees participating in the Conference beginning Wednesday, July 29, registration will take place on:

Tuesday, July 28, 2:00-8:00 PM

Wednesday, July 29, 7:00-8:00 AM

Meals for the Conference

All attendee meals are included in the cost of the Conference – meal tickets may be purchased for guests traveling with you but not attending the Conference (See Meal Ticket Purchases).

Includes breakfast on Wednesday, July 29, through breakfast on Saturday, August 1.

Conference Attendees:

Breakfast Buffet	
Wednesday-Saturday	6:30-8:00 AM
Lunch Buffet	
Wednesday-Friday	12:00-1:15 PM
Dinner Buffet	
Wednesday	6:45-8:30 PM
Thursday-Friday	5:30-7:30 PM

MASTERs 2009 PRE-CONFERENCE AND CONFERENCE AGENDA

Pre-Conference Agenda

Monday, July 27, 2009

Registration	7:00-8:00 AM
Breakfast	6:30-8:00 AM
Class Session 1	8:00-9:45 AM
Break	9:45-10:15 AM
Class Session 2	10:15-12:00
Lunch	12:00-1:15 PM
Class Session 3	1:15-3:00 PM
Break	3:00-3:30 PM
Class Session 4	3:30-5:15 PM
Dinner	5:30-7:30 PM
Evening Events	7:30-10:00 PM

Tuesday, July 28, 2009

Breakfast	6:30-8:00 AM
Class Session 1	8:00-9:45 AM
Break	9:45-10:15 AM
Class Session 2	10:15-12:00
Lunch	12:00-1:15 PM
Class Session 3	1:15-3:00 PM
Break	3:00-3:30 PM
Class Session 4	3:30-5:15 PM
Registration for MASTERs	2:00-8:00 PM
Dinner	5:30-7:30 PM
Evening Events	7:30-10:00 PM

MASTERs Conference Agenda

Wednesday, July 29, 2009

Registration	7:00-8:00 AM
Breakfast	6:30-8:00 AM
Class Session 1	8:00-9:45 AM
Break	9:45-10:15 AM
Class Session 2	10:15-12:00
Lunch	12:00-1:15 PM
Class Session 3	1:15-3:00 PM
Break	3:00-3:30 PM
Class Session 4	3:30-5:15 PM
Keynote Address	5:30-6:45 PM
Dinner	6:45-8:30 PM
Evening Events	7:30-10:00 PM

Thursday, July 30, 2009

Breakfast	6:30-8:00 AM
Class Session 1	8:00-9:45 AM
Break	9:45-10:15 AM
Class Session 2	10:15-12:00
Lunch	12:00-1:15 PM
Class Session 3	1:15-3:00 PM
Break	3:00-3:30 PM
Class Session 4	3:30-5:15 PM
Dinner	5:30-7:30 PM
Evening Events	7:30-10:00 PM

Friday, July 31, 2009

Breakfast	6:30-8:00 AM
Class Session 1	8:00-9:45 AM
Break	9:45-10:15 AM
Class Session 2	10:15-12:00
Lunch	12:00-1:15 PM
Class Session 3	1:15-3:00 PM
Break	3:00-3:30 PM
Class Session 4	3:30-5:15 PM
Dinner	5:30-7:30 PM
Evening Events	7:30-10:00 PM

Saturday, August 1, 2009

Breakfast	6:30-8:00 AM
Class Session 1	8:00-9:45 AM
Break	9:45-10:15 AM
Class Session 2	10:15-12:00

(Agenda is subject to change. Please check our web site for the most current schedule.)

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SPECIAL EVENTS

Keynote Address
Join Steve Sanghi, the President and CEO of Microchip Technology Inc., and your colleagues as we officially kick off our Annual MASTERs Conference on July 29. Dinner follows immediately after the Keynote Address.

Cyber Café
Need to check in with the office or just surf the web? Use your laptop or one of our computers to access the internet free-of-charge during the Conference.

Bus Trip to Fry's Electronics
Join us for an excursion to the local Fry's Electronics Super Store. They have a great selection of electronic components, games, etc. at reasonable prices. Seats fill up quickly, so be sure to sign up early at the Information and Activities table located in the Ballroom Lobby.

Webmaster for a Day
If Microchip's web site only had _____! Fill in the blank and tell us what you think. Spend 5 minutes with us at this year's MASTERs Conference and become a "Webmaster for the Day!" No appointment necessary, just follow the signs and drop by anytime!

Keep up on industry trends, implement the latest design techniques and stay ahead of the competition with technical training from Microchip Technology.

Microchip's global network of **Regional Training Centers** (RTCs) offer a variety of targeted design classes that can add functionality to current applications and help your team take advantage of new technologies, applications and device peripherals.

Small class sizes offer plenty of one-on-one interaction with our expert instructors. In addition to standard class offerings, Microchip can customize any curriculum to meet the specific needs of your company, department or team. We can even bring the class to your location – equipment and all!

Microchip offers basic, intermediate and advanced classes in a wide range of topics, including:

- Embedded Software Design Techniques
- Designing a USB Embedded Host Application
- Introduction to the C Programming Language for Embedded Control Engineers
- Getting Started with Microchip Tools: MPLAB® IDE, MPLAB Simulator and MPLAB REAL ICE™
- Designing with mTouch™ Capacitive Touch Sensing Solutions
- SSL Security for TCP/IP Stack

MICROCHIP
Regional Training Centers

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

EVENING ACTIVITIES

(Dates and locations to be announced – check our web site for the most current schedule.)

We are pleased to offer activities especially designed to entertain and educate all attendees, including children who attend the Conference as guests. We hope you enjoy these free activities and look forward to any feedback and suggestions you might have for future Conferences.

HoverMice

Microchip HoverMice are small, fast and fun for parent/child teams of all ages. Teams of 2-5 will compete to build the fastest foam hovercraft and race on a 15-foot track. Construction materials include foam coffee cups, Depron foam trays, N-20 electric motors with props, and a 3V LiOn battery to power your racer. Show us how fast your mouse can scurry down the track.

Battle Bots

Microchip is proud to announce the return of the laser tag robotic competition. Each team is given a high-tech bot chassis, programming tools, and 4 hours to produce the most lethal Battle Bot on two treads.

Casino Tables/Sports Bar Games

Join us for lots of fun and try your luck at our numerous Casino tables. Compete against your peers in Air Hockey, Foosball, Ping Pong, Super Shot Basketball or Electronic Darts. Spend time competing with others playing Wii® games too!

Video Central

Stop by and try out games that get you moving as well as traditional video favorites for all ages. There will be WII Sports & many other favorites. What better way to unwind after a full day of classes. Bring your family & enjoy.

Virtual BattleZone

Remember the old BattleZone video game? Well we just went one better and created the real deal. Four remotely piloted battle tanks, armed with the latest in IR laser tag gear and manned by you. You drive the tank, you fire the gun, and you are in the action, stalking your enemy with only your wits and a bots eye view of the action.

Microchip Space Center

Some of the things Microchip engineers have been working on are literally out of this world. Check out the latest in low-cost space suit-based satellites; a working amateur radio station that uses the latest in amateur-position reporting systems; and an exhibition of the latest in high-altitude, near-space exploration.

Texas Hold-em

You saw the high rollers go broke last year. Well they're back and this time they brought some friends. That's right, the wildly fun Texas Hold-em contest is back and bigger than ever, so step right up and we will deal the cards.

Micro-Cricket-Hunt

Down here in Arizona we have crickets... and these little critters seem to be able to find the best hiding places, all while chirping away as loud as possible. We thought we'd take cricket hunting high tech and created the Micro-Cricket-hunt. Be sure to join the hunt in two to three person teams! Each team will have a cricket detector and turned loose to hunt the Wiley Crickets. The first to find them all wins.

Bridge to Nowhere

Attention all aspiring bridge builders! Please report to the construction area, we have a bridge to build. Who cares if it is a bridge to nowhere? The team that builds the strongest bridge wins! There's a consolation prize should you not win... you can eat the construction materials when you're done!

First Robotics

Microchip is an Organizing Sponsor of Arizona Regional FIRST Robotics competition and a Platinum Sponsor of FIRST (For Inspiration and Recognition of Science and Technology). Come and watch as the students use their problem-solving skills and creativity as they work together and compete with their robots.

Fab Simulation Tour

Have you ever seen the inner workings of a Fab? This simulated tour shows you the workings of Microchip's Fab2. Physical samples will be available along with Fab experts to answer questions about the wafer processing and equipment.

Mad Science

Be sure to bring your kids to this spellbinding event! Watch the Mad Scientist as he uses hot air, smoke, a hovercraft and more to show the principles of air and pressure. The demonstration is followed by a hands-on workshop for your kids to enjoy.

Dive-In Movies

This is a great way to relax after a full day of classes! Get the family together, grab an inner tube and cool drink at the poolside bar and you're ready to enjoy the evening watching a movie on the giant inflatable screen in the main pool.

Beer Boat Regatta

Compete with other drivers in this poolside event to see who can maneuver the fastest boat and carry the most weight across an obstacle course. You will be provided with materials to build your boat, motor and controller, and then everyone will proceed outside for the final race.

Various other family events will be announced soon!

JOIN THE MASTERs COMMUNITY ON YOUR FAVORITE WEB SITES

Join the Microchip Technology Inc. MASTERs Conference Group on LinkedIn!

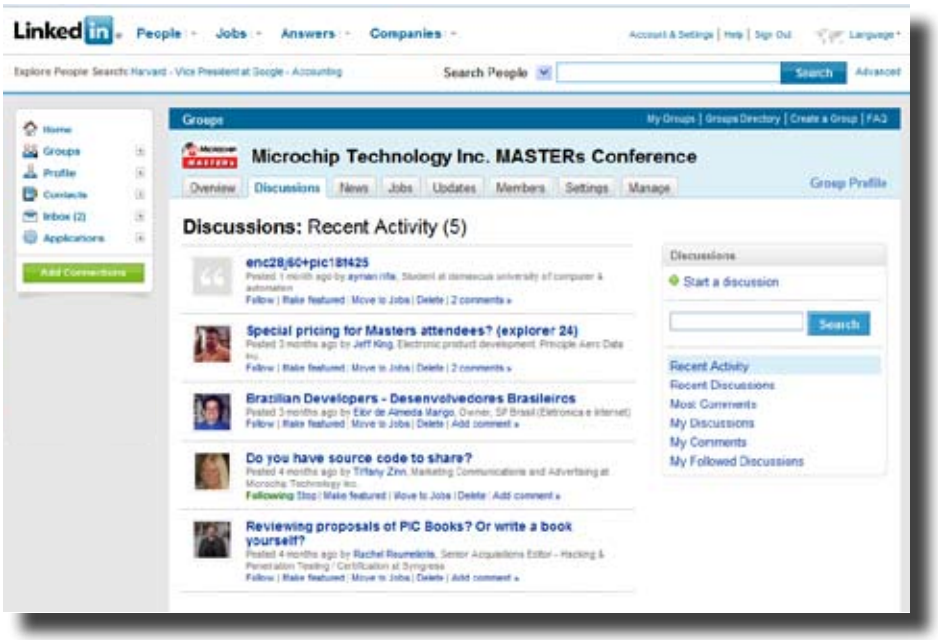
This group gives you the opportunity to network with MASTERs attendees and presenters anytime.

You can use it to schedule appointments during MASTERs, post news, even participate in MASTERs-related discussions.

This is a great way to build your resume and let your LinkedIn contacts know about your connection with MASTERs!

As a member of this group, you can even post your suggestions on how we can improve the event each year!

Join this group today at
http://www.linkedin.com/groups?home=&gid=73575



Become a Fan of the Microchip Technology MASTERs Conference on facebook!

This is a great way to connect with other attendees and presenters on the site. You can even share or view photos and videos from the Conference. Be sure to check the site often for news and special offers!

Become a Fan today at
http://www.facebook.com/pages/Microchip-Technology-MASTERs-Conference/27402011226

THE 2009 MASTERs CONFERENCE CLASS LIST

Class	Title	Abstract	Hours	Tech Level	Prerequisites
1301 MPP	Microchip's Product Portfolio	New to Microchip products? Don't know where to start? Then this class is for you! Microchip has been making microcontrollers since 1990 and over this period we have gone from making baseline 8-bit microcontrollers to advanced 16- and 32-bit microcontrollers. This class will give a brief overview of the 8-, 16- and 32-bit architectures that Microchip offers. Additionally, since peripherals are important for embedded applications, this class will give a brief overview of all the peripherals offered in PIC® MCUs and give examples of how they can be used in specific embedded applications. This class will also give a brief overview of Microchip's analog and peripheral stand-alone devices. Finally, to complete your embedded application, you will need software and hardware tools, which will be described and discussed. After attending this class, you will have a good idea of what Microchip products and tools best fit your application needs.	1.75	1	
1302 NEW	The Latest PIC® Microcontroller Products: 12 Months Ahead	This class provides an overview of Microchip's new PIC® microcontroller products, including the latest 8/16/32-bit microcontroller offerings and new peripheral capabilities. A detailed review of selected key products and improved capabilities is provided so you can leave with many ideas for designing with these microcontrollers.	1.75	1	
1303 ECA	Introducing the Enhanced PIC16 Architecture	The highly successful PIC16 architecture is receiving an overhaul. Attendees of this class will learn what has been changed, why the changes were made, and how these changes affect your designs. Additionally, there will be demonstrations and examples of the new architecture enhancements. Come and learn what the new core can do for your applications!	1.75	2	Attendees registering for this class should have a basic understanding of either the PIC16 or PIC10/12 instruction sets.
1304 ECP	An Overview of Peripherals Using the PIC16F1937 Enhanced Core Device	This course will cover a general overview of the peripherals found on the PIC16F1937, Microchip's first enhanced Mid-Range microcontroller, and how the peripherals differ from other devices. We will review and demonstrate the Liquid Crystal Display and Analog-to-Digital Converter modules as well as Capacitive Sensing and Timers. We will also review the Compare/Capture/Enhanced Pulse Width Modulation and Comparator modules. Each demonstration will build on itself, ending with an application that uses all the peripherals discussed and some of the new enhancements.	1.75	2	This is not a beginner course. All attendees must have some experience or understanding of PIC® microcontrollers, peripheral operation and programming.
1305 AD1 HANDS ON	Hands-on Application Development with 8-bit Microcontrollers I	Using an 8-bit microcontroller, a PICDEM™ 2 Plus demo board and programming in C, we will build a clock design from component software pieces (RTCC, interrupts, etc.). Development will start with separate components and then we'll combine them to create a functional system. Proper coding techniques for embedded projects will be reviewed.	4	2	Attendees are expected to have a basic knowledge of the C programming language and to be familiar with MPLAB® IDE. Advanced knowledge of software development is not expected; introductory techniques will be taught here.
1306 AD2 HANDS ON	Hands-on Application Development with 8-bit Microcontrollers II	This is the follow-on class for the "Hands-on Application Development with 8-bit Microcontrollers I". This class will build upon the original clock design presented in the first class, adding serial communications using UART and I2C™, a command decoder/handler, and a more complex system control function to turn the design into an oven controller. The class will stress modular design and multitasking. The microcontroller used in the labs will be the PIC16F1937 in a PICDEM™ 2 plus board.	4	3	Attendees registering for this class must complete the first course in this series, class "1305 AD1 Hands-on Application Development with 8-bit Microcontrollers I". Attendees registering for this class should have general architectural knowledge about the MIcrochip PIC16 series of microcontrollers and a working knowledge of C programming.

Tech Levels
1: No prior PIC® microcontroller knowledge/experience necessary.
2: Basic knowledge of PIC® microcontroller architecture and instruction set.
3: Basic knowledge and some practical programming/design experience.
4: Thorough understanding of PIC® microcontroller architecture, instruction sets and programming experience.
5: Advanced – attendees should have considerable experience before attending.

THE 2009 MASTERs CONFERENCE CLASS LIST

Class	Title	Abstract	Hours	Tech Level	Prerequisites
1307 P18 HANDS ON	PIC18 MIcrocontroller Peripheral Configuration and Usage Using the MPLAB® C Compiler for PIC18 MCUs (C18)	This class covers the fundamentals of the PIC18 microcontroller families architecture and instruction set. Topics covered include the programmer's model, data and program memory organization, clocking structures, assembly language and special features of the devices. Basic concepts are reinforced through the writing of two simple assembly language programs. The first program turns on an LED connected to one of the I/O pins, and the second program adds software loops and delay routines to make the LED blink at a specific rate. This process involves the use of the MPLAB® SIM simulator to simulate and debug the programs. Ultimately, a PIC18F4520 microcontroller is programmed using MPLAB® ICD 3 on a PICDEM™ 2 Plus Demonstration Board.	8	1	Attendees registering for this class should have a working knowledge of MPLAB® IDE and programming in 'C'.
1308 GSS HANDS ON	Getting Started with 16-bit Devices - Standard 16-bit Peripheral Configuration and MPLAB® C Compiler for PIC24 MCUs and dsPIC® DSCs (C30) Programming Techniques	This hands-on class covers the standard peripheral set of Microchip's PIC24 microcontroller and dsPIC® digital signal controller families and the MPLAB® C Compiler for PIC24 MCUs and dsPIC DSCs (C30). Using hands-on exercises and the MPLAB® C Compiler for PIC24 MCUs and dsPIC DSCs, students become familiar programming the I/O ports, interrupts, ADC, timers and UART modules. Although based on the PIC24 microcontrollers, these principles are directly applicable to Microchip's entire 16-bit family including the PIC24F, PIC24H, dsPIC30F and dsPIC33F devices. Attendees will leave the class with a detailed knowledge of Microchip's 16-bit architecture and device peripherals.	4	2	Attendees registering for this class should have practical knowledge of MPLAB® IDE and basic C language skills (other high level language skills are also OK).
1309 P32	PIC32 Technical Introduction	Microchip recently announced its PIC32 family of 32-bit microcontrollers. Along with the high-performance 32-bit CPU, PIC32 products include many new peripherals and free software solutions. This class offers an overview of the PIC32 architecture and new peripherals such as prefetch cache, DMA, USB and interrupt controller. It will survey software and hardware tools from Microchip and its 3rd party partners. Attendees will also see some peripherals in action via pre-programmed demonstrations.	1.75	1	
1310 HPH HANDS ON	Getting Started with PIC32 - Hands On	This class introduces the attendee to the basic operation of the PIC32MX microcontroller. Attendees are led through several hands-on exercises using the PIC32MX Starter Kit to demonstrate key concepts of the PIC32MX architecture. By the end of this class, attendees will have created and debugged several PIC32 projects.	4	2	Attendees registering for this class should have an understanding of C programming.
1311 MMP HANDS ON	PIC32 Presents: Maximize Migration Performance	Microchip's 32-bit microcontrollers offer many new peripherals to the PIC® MCU family that will maximize performance. Attendees will be introduced to PIC32's new peripherals and features through a series of hands-on labs. Topics that will be discussed include prefetch cache, DMA, interrupts, memory mapping and functions that are executed from RAM. Attendees should be familiar with the PIC32 and know how to use MPLAB® IDE. They should also have a good understanding of the C coding language because the concepts of pointers and structures will be used.	4	3	Attendees registering for this class should have an understanding of PIC® MCU peripherals, how to use MPLAB® IDE and an understanding of C coding language concepts such as pointers and structures.
1312 LPP	Creating a Low-Power Application with PIC® MCUs	Do you want to create a low-power application? Don't know where to start, or just want to see the possibilities? This class will cover important factors for low power and will provide tips and tricks for how to get the most out of PIC® MCU low-power features. The class will also discuss new technologies available on PIC® MCU devices, and how to use them to minimize power consumption in your application. Examples will be provided on how to use each feature in a real application, and a demonstration of various power-saving techniques will be shown.	1.75	2	

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THE 2009 MASTERs CONFERENCE CLASS LIST

Class	Title	Abstract	Hours	Tech Level	Prerequisites
1313 ZDT HANDS ON	Achieve Zero Down Time: Implement Live, Fail-Safe Firmware Updates on the PIC24F	In this hands-on class, students will use C code to implement a single-chip, fail-safe bootloader (FSBL) supporting firmware updates during active system operation. The FSBL also allows the MCU to continue executing the old revision of the custom application in the event of a download interruption. The FSBL is useful for critical tasks such as closed-loop output power level control, implementing failover between multiple CPU cards, or any situation where a firmware update failure could cause down time or product returns.	4	5	Attendees registering for this class should have advanced C programming skills, an understanding of the C build process including compiling and linking, as well as familiarity with AN1157 “A Serial Bootloader for PIC24F Devices.”
1314 GST HANDS ON	Getting Started with Microchip Development Tools: MPLAB® IDE, MPLAB® SIM Simulator and MPLAB® ICD 3	This hands-on class covers the basics of getting started with Microchip development tools. Following an introduction to all Microchip tools, hands-on exercises are conducted using MPLAB® IDE and the MPLAB® SIM simulator. Attendees go through step-by-step creation of a project, editing and compiling a program, running a program and using the simulator. The MPLAB® ICD 3 is then used to connect to the PC hardware, program an actual device and then run a program. The MPLAB® ICD 3 Debug mode is also introduced and debugging basics are described, such as how to set a breakpoint, etc. The hardware used is a PICDEM™ 2 Plus with a PIC18F4520 device. Attendees leave with a basic knowledge of Microchip tools. They can use this knowledge to learn more about PIC16, PIC18 and PIC24 microcontrollers or dsPIC® digital signal controller devices.	4	1	Attendees registering for this class should have a basic MCU background.
1315 MPL	MPLAB® IDE and Development Tools: Today and Tomorrow	As Microchip’s product line has expanded, tools offerings have similarly been increased to cover new devices and technologies. This course will provide a review of Development Tool’s feature deployment since last year, and a brief overview of tools from emulators, programmers, in-circuit debuggers and evaluation/prototype boards, to third party hardware and software components. Attendee involvement will be a crucial element of this session. In addition, a comparison of features and recommendations for using the MPLAB® ICD 3 vs PICkit™ 3 vs MPLAB® REAL ICE™ in-circuit emulator will be presented.	1.75	1	
1316 SIM HANDS ON	MPLAB® Simulators Advanced Stimulus	Stimulus is the simulation of hardware signals. Test your firmware prior to hardware being available by using simulated hardware signals. Using demonstrations followed by hands-on exercises, you will use the Stimulus Control Language (SCL) Generator to create advanced stimulus signals, like repeating and conditional start and stop, to form complex stimulus signal injection. For the examples you will create, apply and verify the stimulus required to simulate key bounce and grey code encoder signals. You will also create multiple A/D injection signals to test an example zero crossover detection program which calculates real-time power, current and voltage overload detection. You will learn how to use DMCI (Data Monitor and Control Interface) to verify the waveforms and output. You will also use the DMCI to apply variable data to the firmware (control).	1.75	4	Attendees registering for this class should have a sound knowledge of using the MPLAB® Simulators, MPLAB® IDE and how to create and build projects in it, as well as a basic understanding of the C programming language and dsPIC30F/PIC24 architecture.
1317 CPL HANDS ON	Introduction to the C Programming Language	This two day class provides an introduction to the C programming language (as specified by the ANSI C89 standard) in the context of embedded systems. We will cover the C language from the ground up from a non-hardware-specific point of view in order to focus on the various elements of the C language itself. While not required, previous experience with any programming language or experience with microcontrollers would be helpful. The presentation will be accompanied by a series of hands-on exercises designed to reinforce the fundamentals, all of which will be conducted within the MPLAB® SIM simulator. Skills learned in this class will be applicable to any ANSI C compiler. Hardware and compiler-specific details such as interrupts, memory models and optimization will not be discussed. These topics will be covered in the compiler specific classes.	16	1	Attendees registering for this class should have experience using MPLAB® IDE.

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Class	Title	Abstract	Hours	Tech Level	Prerequisites
1318 CCS HANDS ON	Using the CCS C Compiler for Rapid Development of Microcontroller Applications	This class will instruct users in the most productive use of the CCS C compiler for all Microchip microcontrollers. Attendees will learn techniques for code reuse and easy migration to new target chips, including moving easily from an 8-bit PIC® MCU to a 16-bit PIC® MCU. CCS's API for controlling the PIC® MCU's peripherals will be covered, including CCS's unique API that allows serial I/O (asynchronous, SPI, I2C™) on any GPIO pins. The hands-on portion of the class will use the CCS C Compiler to allow participants to see how quick and easy it is to develop complex applications from scratch. Also during the hands-on portion, participants will learn use of the application Wizard, basic IDE use, programming concepts and advanced debugging techniques such as real time debugging, rapid unit level testing, and using the CCS ICD. New features added to the compiler since last year's class will also be discussed. Note: This class will be presented by a representative from CCS Inc.	4	4	Attendees registering for this class should have a basic knowledge of PIC® microcontrollers, and prior knowledge of C is helpful.
1319 HTC	HI-TECH C® PRO Compiler and the Enhanced Mid-Range PIC® MCU Family	This class will introduce programmers to the new enhanced mid-range family of PIC® MCU devices through HI-TECH Software's ANSI C cross compiler. Comparisons of compiler output will be shown, highlighting the improvements offered by the new architecture. By way of theory and practical demonstration, the class will also look at more fundamental compiler topics such as: memory allocation, data types, Interrupt Service Routines, in-line assembly, and C-assembly interaction. In addition, integration with Microchip's MPLAB® IDE will be detailed, as well as the use of debug files to help with code development. This class does not cover programming in C; rather, it looks at the features and operation of the "HI-TECH C® Pro for the 10/12/16 MCU Family" compiler. However, the material will have some relevance for all HI-TECH compilers supporting PIC® MCUs and dsPIC® DSCs.	1.75	3	Attendees registering for this class should have a working knowledge of the C programming language.
1320 C18 HANDS ON	Getting Started with MPLAB® C Compiler for PIC18 MCUs (C18)	This class provides C programmers with an introduction to the features and mechanics of the MPLAB® C Compiler for PIC18 MCUs (C18). The class covers many of the compiler directives and the code structure requirements that must be understood to effectively write code for the Microchip PIC18 platform. Topics include project setup, variable allocation, code allocation, Interrupt Service Routines, creation and use of libraries, mixing C and assembly, memory models, optimization and an overview of Microchip specific extensions for embedded systems programming. Concepts are reinforced through a series of focused hands-on exercises using the PICDEM™ 2 Plus Demonstration Board with a general purpose PIC18 family device.	4	1	Attendees registering for this class should have a working knowledge of the C programming language.
1321 C30 HANDS ON	Embedded C Programming: Getting Started with the MPLAB® C Compiler for PIC24 MCUs and dsPIC® DSCs (C30)	This class provides C programmers with an introduction to the features and mechanics of the MPLAB® C Compiler for PIC24 MCUs and dsPIC® DSCs (C30). The class covers many of the compiler directives and the code structure requirements that must be understood to effectively write code for the Microchip 16-bit platform. Topics include project setup, variable allocation, code allocation, Interrupt Service Routines, creation and use of libraries, mixing C and assembly, memory models, optimization and an overview of Microchip specific extensions for embedded systems programming. Concepts are reinforced through a series of focused hands-on exercises using MPLAB® IDE, MPLAB® REAL ICE™ in-circuit emulator and the Explorer 16 Demo Board. This class does not teach the C programming language itself. Attendees should already be comfortable with the C language.	4	2	Attendees registering for this class should have experience using MPLAB® IDE, and familiarity with the C programming language.

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1322 M30	MPLAB® C Compiler for PIC24 MCUs and dsPIC® DSCs (C30): New Features and Q&A Session	The first segment of this class will introduce key new features of the MPLAB® C Compiler for PIC24 MCUs and dsPIC® DSCs (C30) v3.20. The second segment will answer customer questions that have been pre-submitted. If you want to enter a question or see the questions already submitted see website for details. Preference will be given to the most common questions in order to appeal to the broadest possible audience. An overview of future plans for the MPLAB® C Compiler for PIC24 MCUs and dsPIC® DSCs development will also be presented. This class is intended to appeal to current users of the MPLAB® C Compiler for PIC24 MCUs and dsPIC® DSCs who may have questions about specific features of the compiler.	4	3	Previous working experience with the MPLAB® C Compiler for PIC24 MCUs and dsPIC® DSCs.
1323 IDB HANDS ON	Intermediate Debugging Techniques: Using Special Features in Development Tools and PIC® MCU Devices.	In this intermediate course, Development Tool's experts will take you through practical concepts and debugging techniques that you can use during your product development. These techniques exploit the capabilities of the tools and debugging resources built into the devices. The course begins with a complete explanation of hardware and software breakpoints. The differences between them will be covered in detail and will be demonstrated with examples. Breakpoint resources are used to localize bugs in a malfunctioning program. The watch window mechanism and its use will also be demonstrated. The watch window is used to analyze and modify variables to aid in the testing and verificaton of a program. In conjuction with the watch window, single step operations and animate will also be covered to demonstrate how they can be applied to monitor program execution. Finally, the stopwatch and stack overflow window and their usage within a program will be demonstrated.	1.75	1	
1324 DBC	Debugging Embedded C Applications using MPLAB® IDE	Debugging embedded code requires an understanding of the application, the C language and development tools. This course uses the experience of embedded developers and the features built into the MPLAB® C compilers and IDE to present useful tools and techniques for debugging embedded applications. In particular, this course covers C language techniques for unit testing and debugging applications, as well as using the capabilities of the MPLAB® SIM simulator to test applications.	1.75	3	Attendees registering for this class should have a working knowledge of C and familiarity with MPLAB® IDE.
1325 ADB HANDS ON	Advanced Debugging Techniques: Using Special Features in Development Tools and PIC® MCU Devices	In this advanced course, you will go through practical debugging techniques that you can use again and again during your development. These techniques are tested and proven time savers that exploit capabilities built into the chips and tools that you are using right now. This class covers the second level of features that you can access using the system of the compiler, IDE, hardware tools and devices. This course starts with data capture, goes through trace, and finishes with techniques for traps/interrupts and intermittent problems. The course also builds on the concepts and techniques presented in the intermediate courses so, if you don't have thorough understanding of breakpoints and watches, take the intermediate courses first.	1.75	5	Attendees registering for this class should have taken the intermediate debugging techniques classes (Compiler and Hardware) or equivalent experience.
1326 RTF	RTOS Fundamentals	With the development of sophisticated application solutions on advanced 16- and 32-bit microcontrollers, users are looking to Real-Time Operating Systems (RTOSs) as a method for managing the software complexity. This class provides attendees with a background in the fundamentals of RTOSs, covering the basic terminology, how time is shared between tasks on a single processor, and how a scheduler can control the system operation. The class then goes on to cover more advanced topics such as inter-task communication and synchronization between tasks. Presented without focusing on any particular RTOS, this class serves as a useful grounding in the subject matter and will provide attendees with information allowing them to make informed decisions when selecting an RTOS for their next application.	1.75	3	

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1327 MRT HANDS ON	Developing uC/OS-II Based RTOS Applications	Although a Real-Time Operating System (RTOS) is an immensely helpful means of coping with the complex projects that 16-bit and 32-bit microcontrollers facilitate, many embedded systems developers who regularly deal with such devices actually have little RTOS experience. This class, in which attendees are guided through a series of engaging programming exercises, is an ideal opportunity to gain such experience. uC/OS-II, the popular RTOS from Micrium, is the focus of both the class's exercises and its lecture content. In addition to covering uC/OS-II basics, such as setting up projects and creating tasks, the class delves into topics that are somewhat more challenging, such as mutual exclusion, inter-task communication, and interrupt handling. The exercises through which these topics are explained incorporate uC/OS-II's full source code and are provided to attendees at the conclusion of the class. These exercises target the PIC32, but can easily be adapted to other Microchip devices. Note: This class will be presented by a representative from Micrium.	4	3	Attendees should have a solid understanding of the C programming language and would benefit from taking the class "1326 RTF RTOS Fundamentals".
1328 THR	Using MPLAB® IDE and ThreadX to Analyze how RTOS Priority Assignment can Impact Context Switch Overhead in PIC32 Applications	Context switch time is one of the most important measures of real-time performance in embedded systems. In a real-time application running on an RTOS, the way priorities are assigned to application threads, and the RTOS scheduling algorithms used, can impact the number of context switches a system will have to perform, and consequently affect system performance. In this class, students will learn that assigning each thread a unique priority, and the subsequent use of a preemptive scheduling approach, may cost valuable CPU cycles and increased overhead. By assigning multiple threads the same priority, and using round-robin scheduling, applications can minimize the number of context switches needed, and thereby leave more CPU cycles for the application itself. This class uses a graphical event analysis tool and MPLAB® IDE to explore several examples that illustrate and quantify the benefit of running multiple threads at the same priority. Furthermore, students will learn how running multiple threads at the same priority makes it possible to properly address priority inheritance, and to implement round-robin and time-slice scheduling, all of which are valuable tools for the real-time system designer. Note: This class will be presented by a representative from Express Logic, Inc.	1.75	3	Attendees registering for this class should have experience in use of the C programming language, and some familiarity with the use of a Real-Time Operating System (RTOS).
1329 CAR HANDS ON	Complex Applications – Integrating Microchip's Libraries Using an RTOS	Complex applications often demand the use of multiple software libraries and stacks. However, integrating those software elements together is often difficult. This class discusses the problems and demonstrates how a Real Time Operating System can be used to simplify the task. Using the FreeRTOS kernel, attendees will focus on integrating the Graphics Library with other software elements and explore the optimizations that can be made. The presentation is complemented by practical application development and attendees will be challenged to develop a complex application that interoperates with software from their classmates.	4	5	Attendees registering for this class should have attended the RTOS fundamentals class and/or should be familiar with RTOS operation. Attendees should also be confident in 'C' programming and, although not required, an appreciation of the Graphics Library would be useful.
1330 SOA	Selecting Op Amps and Circuits for Sensor Applications	Today, operational amplifiers (op amps) are among the most widely used electronic devices in a vast array of consumer, industrial, and scientific applications. Selecting a suitable op amp can simplify the design process. This class will discuss common single supply op amp circuits (voltage follower, inverting amplifier, non-inverting amplifier, and difference amplifier), primary op amp specs with DC error analysis and basic analog sensor conditioning circuits with demonstration. Through lecture and live demonstration, upon completion of this class you will be able to recognize common single supply op amp circuits, choose an op amp that suits your application's requirements well and explain the use of op amps in sensor conditioning circuits.	1.75	1	

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1331 ADC	Analog-to-Digital Converters (ADCs) for Sensor Applications	Analog-to-digital converters are critical components for designing sensor applications. Understanding the differences between stand-alone and integrated ADC solutions is an important part of the design process. This lecture class will discuss techniques for proper design and ADC selection for various sensor applications. Upon completion of this course, you will be able to choose the right ADC for your application and recognize important design trade-offs using Microchip's MCP3901 and MCP342x high precision Delta-Sigma ADC's.	1.75	2	
1332 MIX	Problem Solving Using Mixed-Signal Peripherals on PIC® Microcontrollers	Traditional mixed-signal design normally just mentions the A/D converter. This class goes further by including alternate/novel ways to use comparators, timers, SR latches, PWM modules and other microcontroller peripherals to interact with the analog world, all while using minimal components and firmware code. A variety of applications and demonstrations are presented.	1.75	2	Prior experience with PIC® microcontroller tools, such as MPLAB® IDE, MPLAB ICD 2 and PICkit™ 2.
1333 OPT	The Eyes of the Microcontroller - Interfacing Optoelectronic Sensors to the PIC® Microcontroller	Light sensing is key to an increasing number of applications, including simple object detection and measurement; image sensing; position and motion sensing; analysis and diagnostics; environmental sensing involving ambient light, dust or smoke; and color sensing, to name a few. This session will begin by looking at various ways to sense light and how to select the right optical sensor for the job. Details involved in the interface of various types of optical sensors to the PIC® microcontroller will be examined. Techniques for extracting meaningful information from the signal will be discussed, including simple data processing algorithms with short code examples. Real-world applications will be demonstrated to further illustrate concepts discussed in the course. Note: This class will be presented by a representative from Texas Advanced Optoelectronic Solutions (TAOS) Inc.	1.75	3	
1334 SSL	Solid State Lighting - A Lifetime of Accurately Controlled Color Temperature	Solid State Lighting (SSL) systems have become disruptive in the lighting market. One of the criticisms of LED lighting is the quality of light produced by "white" LEDs. Using LEDs of two or more colors creates a system that is tunable, generating the color temperature desired which eliminates this criticism. A tunable system limits the need for LED binning, reducing the LED cost. Producing the desired output requires a system that can not only regulate the output, but measure and adjust each output. This class will illustrate hardware and firmware design for an optical feedback control system that will produce the expected light output. The control system will be applied to different types of optical RGB sensors, LED driver topologies and LED modules. System calibration procedure and calibration matrix generation will be explored. Additionally, the PID control firmware will be discussed and tuning of the coefficients will be illustrated using Data Monitor Control Interface (DMCI) available in the MPLAB IDE. Hardware demonstrations will be used to illustrate the topics discussed throughout the class. Note: This class will be co-presented by a representative from Texas Advanced Optoelectronic Solutions (TAOS), Inc.	1.75	3	
1335 PCL	Power Conversion for High Power Solid State Lighting Applications	Recent developments in solid state (LED) lighting are disrupting the lighting market as we have known it. Highly efficient LEDs are now beginning to replace other types of lighting technology. Along with this new technology comes the challenge of power management. Designers are now required to provide a constant DC source while working with wide input voltages. This lecture will discuss some innovative techniques to power LEDs using the SEPIC, single switch buck/boost, and inductive fed push/pull converters for automotive applications. For general lighting with AC voltage, the flyback converter and a higher power boost/buck converter will be presented. Both of these converters will apply PFC to provide an efficient solution.	1.75	2	Attendees registering for this class should have a basic knowledge of linear and switch mode power conversion circuits.

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1336 CTF	Capacitive Touch Fundamentals	This is an introductory class to simple capacitive sensors, like buttons. The class will discuss how capacitive touch systems work, system design considerations, how Microchip's mTouch™ solutions are implemented, and end-user implementation. The class will not discuss touch screens in detail although the class "1339 TSC" covers touch screens in depth. In addition, the class "1337 CTMU" covers the CTMU module and has hands-on activities for touch sensing.	1.75	1	
1337 CTMU HANDS ON	Capacitive Touch Sensing Hands-On Using CTMU	This class on Microchip's CTMU module will describe the features of the module and how to use it in a capacitive touch application. An in-depth look at the mTouch™ capacitive touch software will be discussed including hands-on labs. This class will cover how to use the Diagnostics Tool (GUI) to customize and tune a capacitive touch application. Real examples with hardware will be demonstrated in this class. This class will also cover several other applications in which the CTMU can be used, such as precision time measurement, inexpensive temperature measurement, humidity measurement, absolute capacitance measurement, etc. Demonstrations ranging from capacitive touch button, capacitive touch slider, coax cable length measurement to temperature measurement using a diode will be shown.	4	3	Basic understanding of electronics and physics. Suggested reading include the application notes AN1101, AN1102, AN1250 and the "Overview of Charge Time Measurement Unit" WebSeminar at www.microchip.com/webseminars. Working experience with MPLAB C30 and MPLAB® IDE is suggested.
1338 TSM	Touch Sensing Through Metal	Inductive touch is one of the most exciting new user interface technologies to be introduced by Microchip. It combines the high tech appeal of capacitive touch with the robust protection of a solid front panel. It even works with a styles or gloves. This class will cover all aspects of an Inductive touch interface design, including selecting an appropriate Fascia and Target material (front panel), designing the inductance to digital converter circuit, and the firmware necessary to detect and decode a button press.	1.75	2	C programming and PIC16 Architecture
1339 TSC	Introduction to Microchip Touch Screen Controllers	This course will provide a solid foundation for understanding Microchip's touch screen technology offerings. There will be a discussion of analog resistive, surface capacitive, and projected capacitive technologies, followed by an in-depth exploration of Microchip's latest touch screen controllers. During the presentation, topics on integration, touch screen selection, and applications will be covered, including several demos. This class is specific to touch screen controllers.	1.75	1	It is recommended that attendees take the course "1336 CTF Capacitive Touch Sense Fundamentals" prior to taking this course.
1340 GFX1	Introduction to Microchip's Graphic Display Solutions	This class is an overview of the characteristics and architecture of Microchip's Graphics Display Solutions. This class will explain what hardware and software design tools are available. This session will also cover display screen selection/procurement strategy, offering tips on how to interpret information in data sheets, and how to identify if a system would require an external LCD controller and backlight. In addition, explanations will be provided on display screen initialization as well as steps on how to develop a driver for your own chosen display that is not currently supported by Microchip's Graphics Library. The session will also feature in-class demonstrations of various user interfaces built from Microchip Graphics Library and development boards and will conclude with recommendations for resources, training and documentation. To find out more about the solution before signing up, visit www.microchip.com/graphics.	1.75	1	Basic understanding of graphical interfaces is advised.
1341 GFX2 HANDS ON	Designing with Microchip's Graphics Library - Hands-On	This hands-on class will teach students how to harness the power of Microchip's Graphics Library to decrease the development time of sophisticated human interfaces using graphical LCD display technologies with various input devices. During the hands-on portion of this class, students will use the Microchip Graphics Library, the Explorer 16 development board and the Graphics PICtail™ Plus Daughter board to implement a real life application.	8	3	Experience with C Programming and MPLAB® IDE

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1342 LCD HANDS ON	Segmented LCD Hands-On for Embedded Engineers	Participants will learn the basics of LCDs, what LCDs are compatible with, the LCD Driver Module, the process of specifying custom glass, developing control software for Microchip LCD devices, and optimizing designs in the areas of human factors and low-power operation. The hands-on portion of the class will focus on LCD development and showcase the PIC18F87J90 device. The same principles could be applied to the PIC18FXX90, PIC16F91X & PIC16F946 LCD device families. Participants will learn how to configure an LCD using the MPLAB® segment LCD GUI as well as how to integrate the RTCC, CTMU and LCD in an application.	4	2	Experience with MPASM™ assembly, or C, PIC® MCU architecture and instruction set.
1343 AUD	Prerecorded and Streaming Audio Playback Using a PIC® Microcontroller	Prerecorded and streaming audio is available everywhere. From simply ripping a CD to using straight-forward yet sophisticated programs such as GarageBand, prerecorded digital audio is easy to create. Add the real-time streaming audio available from hundreds of internet sites, and your embedded application need never be silent again. But how do you take advantage of this friendly, comfortable user interface? This class will introduce various audio formats and sources, identify the required hardware components, and show the basic software structure required to obtain and stream the audio data. Demos will include playing audio from at least three different sources.	1.75	1	
1344 DSP1 HANDS ON	DSP Part 1: Using the DSP Features of the dsPIC® Digital Signal Controller (DSC)	This first part of the two-part DSP class series will describe the DSP-oriented architectural features of the dsPIC® DSC's architecture in detail. These include the DSP Engine, DSP instructions, DO and REPEAT loops, Program Space Visibility, DMA, Modulo and Bit-Reversed Addressing. Through hands-on exercises using the on-chip ADC peripheral and a combination of C and assembly language programming, attendees will learn how to use the above DSP features to develop custom signal processing algorithms. Finally, the above features will be integrated into an example sensor processing application.	4	2	Some basic experience with embedded programming in assembly language.
1345 DSP2 HANDS ON	DSP Part 2: Designing a DSP Application Using the dsPIC® DSC	This second part of the two-part DSP class series brings the architectural features studied in Part 1 into the practical domain, by utilizing powerful software tools available for the dsPIC® DSCs architecture. First, attendees will learn the basics of digital filters and utilize the dsPIC DSC Filter Design tool to design FIR and IIR filters based on specified characteristics. Then we will cover how to program the dsPIC DSC with the designed filter coefficients and the filtering functions available in the dsPIC DSP library and run it on real-time signals. The usage of the new MPLAB® plug-in for dsPIC DSC Filter Design tool is also introduced. Finally we will review how to use the dsPICworks™ tool to generate and analyze data, including observing the frequency spectrum of generated signals using the 32b Fourier transform functions available in the dsPIC DSP library.	4	3	Familiarity with basic programming in C language.
1346 BAT	Strategies for Battery Management in the Portable World	When designing battery system for portable applications, topology selection and feature set can make or break the success of new products. New standards and new battery technologies continue to grow and make it hard for designers to determine the right solution for their applications. This course will explain the development of battery-powered devices, and how to efficiently use and restore energy from rechargeable batteries. Topology advantages, standalone and embedded charger designs will be demonstrated, with regard to meeting many new global standards to reduce design time and cost.	1.75	1	

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1347 PCF HANDS ON	Digital Power Conversion Using dsPIC® DSCs: SMPS Basics	The SMPS dsPIC DSCs incorporate several features that make them ideally suited for controlling digital power supplies. Both the digital signal processing capabilities and the Intelligent Power Peripheral are key features to these devices. Hands-on exercises will familiarize attendees with the peripheral and the DSP algorithms. Buck and boost converters are analyzed to understand their basic behavior; voltage and current control modes are introduced and implemented; PID theoretical basics are explained and used to control the digital loops. Hands-on labs cover all the mentioned topics. The new Buck Boost Board is the hardware platform used in the labs.	4	2	Basic knowledge of the dsPIC DSC architecture. Knowledge of C.
1348 BPC	Power Conversion Applications With Baseline PIC10 and PIC12 Products	Learn how to solve power conversion problems using low cost Baseline PIC® microcontrollers. This class will provide solutions to real-world power conversion problems using the features of these devices in unique and clever ways. A review of the strengths and weaknesses of common power conversion topologies followed by a discussion of PIC microcontroller strengths and features will show how they can be exploited as low-cost solutions in common applications. Several specific applications will be explored in detail including schematics and code examples. Note: This class will be presented by a representative from Diversified Engineering.	1.75	3	Attendees registering for this class should have an understanding of commonly used power conversion topologies and their control requirements.
1349 PFC	Digital Power Conversion Using dsPIC® DSCs: Power Factor Correction	This class is designed to help understand how the dsPIC® DSC simplifies the digital power conversion. This class will discuss: power conversion from available universal AC input to high voltage DC (400V) with power factor correction (PFC); hardware design and software implementation of the single stage and interleaved PFC based on average current mode control; advantages and disadvantages of single stage and interleaved PFC designs; the concepts of load balancing between two stages and its digital implementation; and demonstration of the single stage and interleaved PFC reference design. Topology overview, software Implementation, MATLAB modeling, design calculations, benefits of digital control, and related demonstrations will also be reviewed.	1.75	3	Basic understanding of dsPIC DSC peripherals and power conversion topologies
1350 PST	Digital Power Conversion Using dsPIC® DSCs: Phase-Shifted Full-Bridge Topology	This class is designed to help attendees understand how dsPIC® DSCs simplify the digital power conversion. This class will discuss: high voltage DC to low voltage DC conversion using the Phase shifted full bridge topology; Intermediate Bus Converter design in quarter brick foot prints using a single dsPIC DSC; hardware design and software implementation of the DC-DC converter reference design; and demonstration of the high voltage DC to low voltage DC conversions and quarter brick reference design. Topology overview, software Implementation, MATLAB modeling, design calculations, benefits of digital control, and demonstrations will also be covered.	1.75	3	Basic understanding of dsPIC DSC peripherals and power conversion topologies
1351 PPB	Digital Power Conversion Using dsPIC® DSCs: Push-Pull Boost Topology	Digital implementation of power conversion is latest trend in UPS application to offer design flexibility, high performance and high reliability. The SMPS dsPIC® DSC family supports all the power conversion technology used in power industries. This class covers the design and digital implementation of push-pull boost section of digital off-line UPS. Topics will cover the different power architecture of boost section, MATLAB modeling, digital implementation of control, and power managements. The class includes a demonstration of the off-line UPS reference design.	1.75	3	Attendees should have basic knowledge of SMPS and various power conversion architecture/ topology. Attendees should have basic knowledge of DSP, C and assembly language programming.

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Class	Title	Abstract	Hours	Tech Level	Prerequisites
1352 SWG	Digital Power Conversion Using dsPIC® DSCs: True Sine Wave Generation Using Inverter Topology	Digital implementation of power conversion is the latest trend in UPS applications, offering design flexibility, high performance and high reliability. The SMPS dsPIC® DSC family supports all the power conversion technology used in power industries. This class covers the design and digital implementation of Inverter of digital off-line UPS. Topics will cover the different power architecture of inverter section, MATLAB modeling, digital implementation of control and power managements. The class includes a demonstration of the off-line UPS reference design.	1.75	3	Attendees should have basic knowledge of SMPS and various power conversion architecture/ topology. Attendees should have basic knowledge of various Inverter topology. Attendees should have basic knowledge of DSP, C and assembly language programming.
1353 IMC	Overview of Intelligent Motor Control Solutions	This class is an overview of common motor types, applications, control algorithms, and motor interface design. This class will cover basic motor theory and vocabulary. Motor types discussed include DC Brush Motor, DC Brushless Motor, Stepper Motor, Switched Reluctance Motor and AC Induction. Common motor control algorithms and resources required will be reviewed. This class will also cover motor interface design including motor control peripherals, motor position detection, and driver electronics.	4	1	
1354 BMC	3-Phase Sensorless Brushless Motor Control with Low-Cost PIC16F Microcontrollers	In this class we discuss: how a 3-phase brushless motor operates, the drive circuitry required to commutate the motor, and the methods for determining the motor position. Emphasis is on controlling the motor with a low cost PIC16Fxxx Mid-range microcontroller. Recent enhancements to the PIC16Fxxx peripherals that simplify motor control are covered. Code techniques for motor start-up, acceleration, and steady state operation are covered, as are techniques for reducing torque ripple and regenerative breaking. We also look at some problems associated with high-speed operation above 40,000 RPM, and how they can be overcome. Live motor demonstrations will be performed to illustrate back EMF waveforms and motor control performance.	1.75	2	
1355 MCW HANDS ON	dsPIC® Digital Signal Controllers (DSCs) Motor Control Workshop	This updated workshop class provides a detailed overview of BLDC motor theory and control algorithms. The class also provides an introduction to the dsPIC30F/33F architecture, and motor control peripherals, along with an in-depth look at the newest Microchip sensorless BLDC Motor Control application (AN1160) and Motor Control Graphical User Interface.	8	3	Basic knowledge of embedded programming and the MPLAB® Integrated Development Environment.
1356 FOC HANDS ON	Advanced Motor Control: Sensor-less FOC for PMSM with dsPIC® Digital Signal Controllers	This class teaches the fundamentals of advanced motor control for PMSM (permanent magnet synchronous motors), which are similar in construction to BLDC (brushless DC motors). The PMSM is receiving attention from designers who are concerned about optimal smooth torque control, low audible noise and extracting the best motor efficiency. It is a two-for-one class because the FOC (field oriented control) method learned can also be applied to ACIM (AC Induction motors). In the class, you will also learn advanced sensor-less control techniques to estimate rotor position using a current observer, slide mode controller and digital filtering. You will be shown how the dsPIC® DSC engine can implement this advanced control system and carry out practical exercises using the real time DMCI (Data Monitoring and Control Interface). It is a must for motor control engineers or anyone interested in the advanced solutions offered by Microchip.	4	3	Basic understanding of motor control fundamentals (detailed in application note AN1078).
1357 SPI HANDS ON	Using a High-Speed, High-Density SPI EEPROM to Implement a Model Car Collision Datalogger	Interested in using a high-speed, high-density SPI serial EEPROM in your next design? This class will teach you the basics of the SPI protocol through a hands-on demonstration. Utilizing the MSSP module on a PIC18 family microcontroller, a model car collision datalogging application will be implemented, with the data being stored in the serial EEPROM. This data will then be transmitted to a PC via RS-232 for analysis. There will be a lab session where participants will implement the high-level SPI routines to store the data into the EEPROM and also to read the data from the EEPROM for transmission to the PC.	1.75	2	Working knowledge of PIC18 MCUs, PIC18 assembly or MPLAB® C18 language, and MPLAB IDE.

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1358 I2C HANDS ON	Using an I²C™ EEPROM to Implement a Temperature Datalogger	This is a great way to learn I²C basics and to see how a temperature sensor product can be made with only a few dollars' worth of parts. Attendees will learn the I²C protocol through a hands-on demonstration. The I²C protocol will be 'bit-banged' on a PIC10F202 using assembly language and will be used to read a temperature sensor (MCP9800) and store the temperature data periodically into a 24LC16B serial EEPROM. The class will consist of a classroom session which will teach the I²C basics, including writing to and reading from a serial EEPROM. There will be a lab session where the participant will implement the protocol to read temperature data and store that data onto an I²C serial EEPROM. The data will then be read using the MPLAB® Starter Kit for Serial Memory Products.	1.75	2	Working knowledge of PIC10 MCUs, PIC® MCU assembly language programming and MPLAB® IDE.
1359 OSC HANDS ON	How to Debug I²C™ Devices with an Oscilloscope	Every embedded engineer needs to identify whether or not a device complies to the I²C™ protocol. This class covers debugging the complete I²C protocol stack with an oscilloscope to identify the reasons for failure in the communication chain. These debug techniques will help identify both communication and initiation errors and show how your oscilloscope can aid at every step, from powering up the circuit the first time, to the final quality validation. The hands-on component of this course will provide practical skills for debugging I²C with an oscilloscope to improve development and validation. Note: This class will be presented by a representative from LeCroy Corporation.	1.75	1	
1360 UNI HANDS ON	Using the New UNI/O® Serial EEPROM to Implement a Cartridge Identification Application	Need external nonvolatile storage, but don't think you have enough available I/O? This class will teach you the basics of Microchip's UNI/O® bus, which features a single I/O pin for all communication, through a hands-on demonstration. Utilizing a PIC18 family microcontroller, software-based communication will be implemented for a cartridge identification application using the UNI/O Serial EEPROM. There will be a lab session where participants will implement the high-level UNI/O bus routines to read and verify an identification key stored in the Serial EEPROM, and to write additional data to the EEPROM.	1.75	2	Working knowledge of PIC18 MCUs, PIC18 assembly or MPLAB® C18 language programming, and MPLAB IDE.
1361 CAN HANDS ON	Controller Area Network (CAN) Basics	This class discusses the basic operation of the Controller Area Network (CAN). A basic overview of the protocol will be discussed. From there, the class will drill down to specific areas such as bit timing, arbitration, error detection and recovery from errors, as well as other areas which contribute to the overall robustness of the CAN protocol. An overview of Microchip's standard CAN module will be discussed as a prelude to the hands-on portion. During the hands-on portion, each attendee will configure the CAN controller to communicate on the bus using a predefined higher layer protocol. Each CAN node will be configured to be inter-operable on the bus. i.e., bit timing, message fields, masks and filters, etc. will all be setup so that the CAN bus operates as one distributed control system. Attendees will leave the class with a basic understanding of CAN. No firmware will be written for the class.	4	1	
1362 CAN2 HANDS ON	CAN (Controller Area Network) In-Depth Using 8-bit and 16-bit ECAN™ Solutions	CAN (Controller Area Network) is a common serial communication protocol in automotive, marine, factory automation and other fields. Microchip's Enhanced CAN solution (ECAN) solutions provide many features to the system designer which allow efficient CAN bus communication with minimal CPU overhead. This class will cover Microchip's latest 8-bit and 16-bit microcontroller ECAN™ solutions using hands-on examples that will involve the attendees writing their own firmware.	4	4	Good fundamental understanding of CAN or have taken the "1361 CAN Controller Area Network (CAN) Basics" class and have basic experience with assembly programming, C programming, and MPLAB® IDE. It is also advisable that you have experience in programming one of the 16-bit devices.

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1363 USB1	Overview of USB Connectivity Solutions	Serial Communications protocols like RS232 are fast becoming obsolete for faster and more efficient serial communications protocols like USB. Embedded USB connectivity has its own challenges. This class helps customers understand the challenges of connecting their embedded application using USB. Through a demo, the seminar shows the ease and simplicity of using Microchip's USB solutions.	1.75	1	
1364 USB2	Introduction to Full-Speed USB	USB is becoming more common in embedded systems as a replacement solution for disappearing serial ports on the computer. In this class you will learn about this communication protocol and its features. Basic USB architecture and standards will be presented to help audiences evaluate the USB capability of Microchip's PIC18/24/32 USB microcontrollers. This class will also give you an idea of what kind of tasks you will need to do, and what factors you will have to consider when designing a USB application. A few demonstrations will be presented, including use of a hardware USB protocol analyzer.	1.75	1	Instructor highly recommends attendees read the following material before class: www.beyondlogic.org/usbnutshell/usb1.htm
1365 USB3 HANDS ON	USB: Bridging the Gap Between PC Application and End Device	A typical embedded USB application consists of a host application and a peripheral device. By now you're pretty good at creating embedded device applications and PC applications, but not sure how to connect the two ends over USB. This class will examine five ways to transfer generic data between the host and a device: CDC class, HID class, WinUSB, libUSB and the Microchip General Purpose USB Windows driver for custom application development. Lab exercises and demos will show the programming level details of each method. The class will examine the advantages and disadvantages of each method. Also USB PC Program design considerations, techniques and tips will be presented and discussed through examples and demonstrations. Class exercises will use Microsoft Visual C++.NET and Microchip's C18 Compiler.	4	4	Experience in C and C++ and a basic understanding of USB.
1366 USB4	USB Embedded Host and On-The-Go (OTG)	Does your application need to attach to a USB device such as a thumb drive or a mouse? Does your device need to be a USB device during some parts of operation and a host during other parts of operation? The USB On-The-Go (OTG) Supplement was designed to allow embedded devices with substantially less resources than a computer to become hosts to other USB devices. Learn more about the different USB hosting options, and how these decisions affect your designs electrically and mechanically. Learn about the available software solutions that Microchip has to offer, and which classes are available to get more hands-on experience. We will demo available host solutions including datalogging data to a thumb drive.	1.75	1	Basic understanding of the USB protocol.
1367 USB5 HANDS ON	Designing a Custom Class, Full-Speed USB Embedded-Host Application	USB is a common and powerful interface for connecting peripheral devices to a host. Microchip provides a framework that facilitates the design and implementation of embedded USB hosts using PIC24 and PIC32 microcontrollers. This class teaches the student how to design an embedded host application using the Microchip USB framework. It guides the attendee through the process of developing a driver and application that acts as a host to a simple USB device, using a series of lectures and hands-on labs. Students will have the choice of using either the PIC24 or PIC32 microcontrollers during the labs.	4	3	Should take "1364 USB2 Introduction to Full Speed USB" class (or have prior USB knowledge) before attending this class. Attendees should also be familiar with MPLAB® IDE and the Explorer 16 board, and have a working knowledge of the C programming language.

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Class	Title	Abstract	Hours	Tech Level	Prerequisites
1368 USB6 HANDS ON	Introduction to VB.Net	This hands-on class is an introduction to VB.Net. The class is intended to cover the basics of VB.Net to be used in the USB Made Easy with VB.Net class. The main topics that will be covered include: building a GUI interface, using local and global variables as well as array manipulation. Basic building blocks of VB.Net will also be covered, such as Subroutines and Functions, and Interfacing to a DLL (Windows APIS). Participants will also learn the fundamentals of Class Based Programming, including creating a new class, public and private properties, methods as well as class usage.	1.75	1	This class is recommended for those who are planning to take the "USB Made Easy with VB.Net" course.
1369 USB7 HANDS ON	HID Made Easy with VB.Net	This hands-on class covers the principles of bidirectional HID communication with VB.Net. The emphasis of this class is HID Custom Device class. Participants will be introduced to the VB.Net HID Class, as well as the sample HID Communicator application. After lecture and multiple hands-on exercises (from scratch), participants will be able to write code in VB.Net to perform Single and Multiple point acquisitions. Multiple hands-on exercises will allow attendees to become comfortable with creating custom HID applications from scratch. The following topics will also be covered in detail: WM_DEVICECHANGE and device enumeration, Device Instance, Sequential HID Write/Reads, non-blocking multithreaded HID Write/Reads, as well as Bootloader Interface.	4	1	Basic knowledge of VB.Net or completing the "Introduction to VB.Net" course.
1370 USB8 HANDS ON	USB Made Easy with VB.Net	This hands-on class covers the principles of bidirectional USB communication with VB.Net. Participants will be introduced to the VB.Net USB Class, as well as the sample USB Communicator application. After lecture and multiple hands-on exercises (from scratch), participants will be able to write code in VB.Net to perform Single and Multiple point acquisitions, Continuous Data Acquisition, USB Descriptor Acquisition, Retrieving Device Manufacturer's Serial Number as well as Product and Manufacturer's String from a custom USB device. The following topics will also be covered in detail: WM_DEVICECHANGE, Device Instance/Serial Number retrieval as well as Professional Look and Feel of the Windows Application.	4	2	Basic knowledge of VB.Net or completing the "Introduction to VB.Net" course.
1371 FAT HANDS ON	Using the FAT File System Library to Manipulate Files on a USB Thumbdrive	Applications that must store or access data on various Flash-based mass storage devices, such as SecureDigital (SD) cards and USB thumb drives, need to be able to interface to the underlying file system. This hands-on class will teach the basics of the FAT16/32 file system (one of the most commonly available file systems) and how to use Microchip's Memory Disk Drive (MDD) file system library (AN1045). Attendees will create and manipulate files and directories on a USB thumb drive using Microchip's USB Host Stack (AN1140). This class will also briefly cover the various physical layers available with the MDD library, including USB thumb drives, SD cards and CompactFlash cards.	4	3	Attendees registering for this class should have experience using the C programming language and the MPLAB® IDE and debugging tools.
1372 TCP1	TCP/IP-Ethernet as a Connectivity Solution	Embedded systems typically have a communication interface to allow for maintenance, monitoring, control and/or transfer of data. These communication interfaces have evolved offering designers many choices for technology solutions. Most of the newer solutions also offer an improvement in performance due to improvements by design. These newer solutions also tend of offer a lower cost of ownership due to economies of scale when they are used for multiple market segments. This seminar explores alternatives for these interfaces including the newest technologies available. The value proposition of the TCP/IP over Ethernet solution is highlighted by confirming its characteristics and advantages. This session also covers the TCP/IP basics for engineers with little to no experience with this solution. This session will review Microchip's existing hardware and firmware solutions for TCP/IP along with some advanced information on future products. The session also recommends resources, training and documentation. After completing this seminar attendees should have enough TCP/IP background to determine if it's a solution for their present and/or future embedded communication needs.	1.75	1	

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Class	Title	Abstract	Hours	Tech Level	Prerequisites
1373 TCP2	Understanding Basic Networking Protocols and Serial-to-Ethernet Applications	The main elements to be presented in this class will include practical Ethernet operation, Internet Protocols and embedded Ethernet construction projects using the Microchip line of embedded Ethernet devices. The lecture will focus on the low-level operations of Ethernet and the Internet protocols. A complete embedded network based on the Microchip Ethernet devices will be available for the class to touch and feel. Serial-to-Ethernet projects using Microchip Ethernet devices will also be offered to the class. This course includes a network monitoring segment. Network captures will be used liberally throughout each segment of the class to reinforce various protocol and hardware concepts. Note: This class will be presented by a representative from EDTP Electronics, Inc.	1.75	1	
1374 TCP3 HANDS ON	Designing Embedded TCP/IP Monitor & Control 1	This class delivers a complete design example of a TCP/IP control and status monitoring application. The information presented can be applied to designs using 1) Microchip's MAC/PHY transceiver devices and/or 2) Microchip's PIC18 microcontrollers with a built-in transceiver. Communication concepts are introduced from the interfaces of the foundation (ARP, IP, DHCP, DNS etc.) and application layers (SMTP, SNMP etc). PHY layer fundamental characteristics are also discussed. Details of the API commands for TCP, HTTP and file system protocols are explained. The student upon completion of the class should know how to modify the Microchip stack firmware with their application requirements. This class highlights the cross-platform compatibility of Microchip's TCP/IP stack by allowing attendees to implement the application during class on the platform of their choice: PIC18, PIC24 or PIC32.	8	2	Proficient in MPLAB® IDE; Proficient in C programming, Familiar with PIC18F, PIC24F or PIC32MX architectures, Familiar with TCP/IP basics.
1375 TCP4 HANDS ON	Designing Embedded TCP/IP Monitor & Control 2	This hands-on class is designed to improve the understanding of a few HTTP server features in Microchip's free TCP/IP stack that are beyond the content covered in the "Web-based Monitoring and Control 1" course. The class will teach attendees how to use the HTTP Post Method, HTTP Authentication, Dynamic DNS and the basics of using Wireshark network protocol analyzer. The hands-on content of the course will challenge attendees to use what they have learned to make modifications to code examples using the HTTP Post Method and HTTP Authentication, and verify the code changes using the Wireshark protocol analyzer. The Dynamic DNS section will provide information on setting up a URL for the board using a free dynamic DNS service, and discuss relevant items such as Internet Service Provider (ISP) port restrictions and port forwarding, which should be understood before implementing a dynamic DNS service. When the attendees walk out of the class, they'll be able to deliver and troubleshoot applications that must upload large amounts of data to the embedded web server, provide login access control, and enable the server to be viewed over the Internet using a dynamic DNS service.	4	4	"1374 TCP3 Web-based Monitoring and Control I" or the Regional Training Center (RTC) class COM4201
1376 TCP5 HANDS ON	Web Devices Made Simple: TCPmaker Hands-on	Looking for a quick and easy way to make embedded web devices, without having to learn JavaScript, AJAX, and all that other stuff? Get your hands on TCPmaker Pro! In this updated hands-on course, you'll learn how to use TCPmaker's powerful drag and drop Visual Page Designer to make great looking interactive web pages that are perfect for data acquisition and control over the web. You'll learn about TCPmaker's many new screen controls that you can use in your designs, and even how to command them to change their appearance and behavior on your browser, using simple commands in your PIC® microcontroller code! TCPmaker generates CUSTOM source code for your PIC MCU. All you need to do is fill in some small event handlers, compile the code and program your device. You're on the Ethernet, in minutes! Note: This class will be presented by a representative from Trace Systems Inc.	4	3	Basic knowledge of PIC microcontrollers and familiarity with MPLAB® IDE and C compiler.

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Class	Title	Abstract	Hours	Tech Level	Prerequisites
1377 SIG	Signal Integrity, Transmission Lines and Ethernet	Have you ever cranked up the timebase on your scope and wondered how the signal got so messed up? As processor and communication speeds increase, it is inevitable that the embedded designer will run into a circuit where the signal doesn't look quite right. As signaling speeds increase, getting that signal to its intended destination without detrimental distortion requires more care, a field of design known as signal integrity, or SI. You don't have to be an SI expert to make a design work. Information presented in this course will help you decide when you need to be concerned about SI, and when it really doesn't matter. This course will show you design techniques that work when SI does matter. SI also matters when you are trying to connect with a device that is beyond your control, but conforms to a standard. This course will discuss one specific standard, Ethernet (IEEE802.3), along with the SI and interconnection challenges that Ethernet presents.	1.75	2	Attendees registering for this class should have a basic understanding of PCB layout.
1378 WN1	Introduction to Wireless Networking with IEEE Std 802.15.4™	Overview of the characteristics and architecture. In depth explanation of the Physical and MAC layers. Demonstration of LR-WPAN in class. This class is a prerequisite to the Microchip ZigBee® and MiWi™ networking technology classes.	4	1	Basic understanding of wireless networking.
1379 WN2 HANDS ON	Advanced Wireless Networking with MiWi™ and MiWi™ P2P Protocols	This class will provide hands-on experience with the Microchip Wireless protocol – MiWi™ and MiWi™ P2P protocols. MiWi™ and MiWi™ P2P protocols are lightweight, short distance wireless networking protocols. Both protocols are built on the top of IEEE 802.15.4 specification. This class includes an overview of both protocols' specifications, their potential applications, as well as practical limitations. We will compare the performance and abilities of both protocols to the ZigBee® protocol for the various applications and discuss the pros and cons of all solutions.	4	3	Mid-level C programming skills. Familiarity with IEEE 802.15.4 specification or take the MASTERs class "1378 WN1 Introduction to Wireless Networking on IEEE 802.15.4" before hand.
1380 WN3 HANDS ON	Advanced Wireless Networking with the ZigBeePRO Protocol	This class will provide an in-depth introduction to the ZigBee® protocol, as well as give an overview of the ZigBeePRO Feature Set. Specific areas that will be covered include definitions of common ZigBee terminology, description of the ZigBee device types, as well as descriptions of the network topologies that ZigBee supports. A sample ZigBee application will be used to demonstrate some of the salient features of the Microchip ZigBeePRO Feature Set stack.	4	3	Attendees should take "1378 WN1 Introduction to wireless networking with IEEE 802.15.4" before hand
1381 WN4	Advanced Wireless Networking with 802.11	This class is about embedding 802.11 in low-cost PIC® microcontroller-based applications. It will cover configuring the Microchip TCP/IP stack to work with the ZeroG 802.11 solution. Topics will include the features, design, limitations and regulatory issues to bring your product to market.	1.75	2	TCP/IP Stack knowledge preferred but not required.
1382 WAD	Wireless Antenna Design and Testing	Wireless is already a common presence in our lives. Designing new wireless products requires a good knowledge of antennas, at least from the perspective of employing and positioning this element in the new project. This course will initiate the attendee into antenna parameters, method of measurements, criteria of selecting the antenna to use, and a quick introduction into designing printed circuit board antennas for ISM band. Additional notes will cover generalities about wireless ISM band, minimum detectable signal and RF propagation.	1.75	2	Attendees registering for this class should have basic knowledge of radio frequency at a high school level.

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1383 PGN	Power, Ground and Noise	Microcontroller applications often involve low level sensor signals and moderate power drive circuitry in addition to the microcontrollers. Peaceful coexistence (low noise) with these three extremes requires careful design and attention to detail in the design of the Power and Ground distribution. This class will discuss sources of noise in all three areas, and the paths it travels around the circuit. It will discuss good layout practices, their impact on noise, and the theory behind them. Also reviewed will be the proper selection and placement of noise isolating and limiting components. Several PCB designs will be used in practical demonstrations to show the application and impact of the noise control techniques discussed. This class is recommended for any designer who has struggled to keep digital and power noise out of sensitive input circuits, or who is just curious about where all the black magic rules of thumb for board layout originate.	1.75	2	
1384 SCE	Signal Conditioning in the Embedded World	This class covers a broad range of signal conditioning techniques for 8-bit microcontrollers with an emphasis on the practical implementation of textbook theory. Topics that will be covered are A/D conversion, analog and digital filtering, and sensor interfacing. The class will touch on some basic concepts regarding attenuating unwanted noise signals, feedback systems and PID control. This class will use an inverted pendulum for demonstration. The class is updated from previous years with more focus on the key areas and examples.	4	1	
1385 ZAP	ZAP! Switch and input circuits in harsh electrical environments	Most embedded systems engineers understand the basic circuit needs for a switch – pull-up resistors and switch de-bounce. This course will look at many of the practical circuit requirements that aren't discussed in engineering textbooks. The circuit implementations presented cover ESD, EMC, noise immunity, ground offset, robust voltage thresholds, over-voltage protection, switch reliability (wetting) requirements, and other technical details typically found in automotive, industrial, electrical and other harsh electrical environments. The interface issues extend beyond switches to analog input protection and general-purpose interface circuits.	1.75	1	
1386 CBD HANDS ON	Optimizing PCB Design for Signal Integrity, Power and EMI	Getting schematics and PCB design right the first time saves engineers time and money. Utilizing proper tools and techniques can greatly improve development cycle times. This hands-on class introduces best-known methods that address common "design for performance" issues with signal integrity, power and electromagnetic interference. Students will use the Mentor Graphics System Design tools to apply schematic rules, constraints, debugging techniques, and implement the "3-T's" of design performance optimization. Note: This class will be presented by a representative from Mentor Graphics.	4	2	Attendees registering for this class should have used EDA tools for entering schematics and PCB layout information, as well as understand the basic principals of signal integrity due to signal termination, signal length, electromagnetic inductance and power.
1387 PLT	Plant Tour	Take a tour of the Microchip Tempe fab area and see first hand how chips are manufactured in high volume. Learn some of the intricacies and fascinating facts that comprise an efficient wafer fab area to produce high volume microcontrollers, analog/interface and memory products. Space is limited in this class and fills up quickly. Please note that attendees taking this tour will be entering a clean room envinronment and therefore no hairspray, make-up or cologne is allowed. Participants must also wear closed-toe shoes.	4	1	This tour requires you to wear 'bunny suits', therefore, no make-up, cologne or hair spray. You must also wear closed-toe leather shoes

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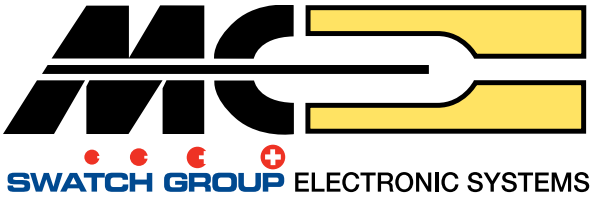

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