microSOLUTIONS

MARCH 2009

Visit Microchip Technology in Booth 416 at ESC Silicon Valley 2009!

Microchip Technology is offering a selection of FREE 30-40 minute technical training sessions in Booth 416 at ESC Silicon Valley 2009. Seating is limited, so sign up today for the sessions that interest you at **http://www.microchip.com/ESC**

Digital Power Solutions (Level: Intermediate): Learn about the various levels of digital control and solutions available from Microchip. We will also present the support available to help you make the switch from analog to digital.

Ethernet Solutions (Level: Intermediate) Learn about Microchip's wired ethernet and WiFi solutions. Products, software and development tools for implementations using our stand-alone Ethernet controller, our family of microcontrollers with on-chip Ethernet controller and WiFi solutions will be discussed.

Human Interface Solutions (Touch Sense and Graphics) (Level: Introductory) Learn about the hardware and software solutions from Microchip that can help you easily integrate a touch solution into their next design.

Innovations in 8-bit Microcontrollers (Level: Introductory) Learn about some of the recent advances in Microchip's PIC® families of 8-bit microcontrollers and the benefits and advantages you can reap from them.

RF – ZigBee® and MiWi™ Solutions (Level: Intermediate) Learn about two alternatives from Microchip to solve this problem: the interoperable ZigBee® protocol and the proprietary MiWi™ protocol. Learn the differences between these two protocols and be shown the products and tools used to implement solutions.

USB Solutions (Level: Introductory) Learn about Microchip's USB solutions for end point devices as well as Embedded Host applications. A demo shows the simplicity of using Microchip's USB solutions.

ESC EMBEDDED SYSTEMS CONFERENCE
8-BIT MICROCONTROLLERS
San Jose, CA • March 30 - April 3, 2009 • McEnery Convention Center • Booth #416

KEYNOTE ADDRESS

Microchip's CEO Steve Sanghi will present a keynote address entitled "The Embedded Processing Iceberg: Limitless Innovation Opportunities" at ESC on Wednesday, April 1, 9:30 am - 10:30 am in the Civic Auditorium.
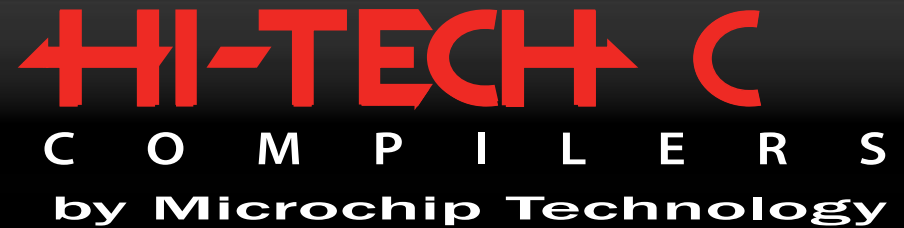
The embedded processing community is the heart and soul of this innovation, in a wide variety of market segments. The efforts, creativity and ingenuity of the embedded processing community will lead the global economy back to a healthy position.

Meet the Newest Members of the Microchip Team at Booth 129 (See page 2 for details!)

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

HI-TECH SOFTWARE is now... HI-TECH C COMPILERS by Microchip Technology

Microchip Technology Inc. has acquired HI-TECH Software, a world-class provider of development tools for embedded systems!

Best known for its high-performance ANSI C compilers, featuring the optimizing, whole-program compilation technology, Omniscient Code Generation, HI-TECH Software has been a premier third-party provider of C compilers for Microchip's 8-, 16- and 32-bit PIC® microcontrollers (MCUs) and dsPIC® Digital Signal Controllers (DSCs) for over a decade.

"With the addition of the HI-TECH Software portfolio, Microchip now offers a complete suite of highly efficient compilers supporting all Microchip devices, from the smallest 8-bit PIC10 MCU to the largest 32-bit PIC32 MCU," said Derek Carlson, Microchip's vice president of Development Tools. "The HI-TECH acquisition also extends Microchip leadership in compiler technology by providing users with the option to develop their C code using the Mac OS X and Linux operating systems."

"HI-TECH Software's focus on high-performance compilation for Microchip parts is now even sharper," commented Clyde Stubbs, CEO of HI-TECH. "Microchip customers can expect to be offered development tools that are more powerful and easier to use than anything previously available for any microcontroller."

HI-TECH Customer Support, Product Availability and Discounts

HI-TECH's customers should continue to contact HI-TECH through the normal sales and support channels that existed prior to this acquisition. In order to provide the best possible products for Microchip microcontrollers and digital signal controllers, the HI-TECH team will now focus its energies exclusively on Microchip-related products. Existing support agreements for other products will be honored for the duration of those agreements. For more information, please visit HI-TECH's Web site at http://www.htsoft.com or contact HI-TECH at support@htsoft.com.

From now until September 30, 2009, Microchip is offering a 20% discount on Microchip development tools for HI-TECH customers through http://www.microchipdirect.com, and a 50% exchange discount to owners of HI-TECH compilers for non-Microchip products. Please contact HI-TECH for details.

In addition to purchasing through the HI-TECH Web site, all HI-TECH compilers for Microchip's PIC MCUs and dsPIC DSCs are also available from http://www.microchipdirect.com. Additionally, Microchip customers can now contact Microchip Technical Support at http://support.microchip.com for any of their HI-TECH compiler support needs.

About HI-TECH

HI-TECH Software is a world-class provider of development tools for embedded systems. Founded in 1984 in Brisbane, Australia, HI-TECH Software is best known for its high-performance ANSI C compilers featuring the optimizing, whole-program compilation technology, Omniscient Code Generation. The company has supported Microchip Technology Inc. for over a decade as a leading third-party provider of C compilers for PIC MCUs and dsPIC DSCs.

Meet the New HI-TECH at Booth 129 at ESC West!

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Introducing the Industry's First 8-bit MCUs for Segmented Display Applications with Hardware Real-Time Clock and Integrated Capacitive-Touch Peripheral

The 64- and 80-pin **PIC18F87J90** 8-bit direct LCD-drive microcontrollers (MCUs) with nanoWatt Technology extend the memory reach and peripheral set of Microchip's LCD MCU portfolio. They feature 64 to 128 KB Flash and 4 KB RAM, and are the industry's first 8-bit MCUs to include a Real-Time Clock and Calendar (RTCC), and Charge Time Measurement Unit (CTMU) peripheral for capacitive touch sensing or precise time measurement. The PIC18F87J90 devices are pin compatible with Microchip's PIC18F85J90 devices, providing an easy migration path across Microchip's entire LCD-drive MCU family and simplified application upgrades.

Many designers want to enhance and add features to their display applications, such as capacitive or inductive touch user interfaces. The PIC18F87J90 products meet this need head-on, with their extended memory range and integrated peripheral set including the CTMU. With Microchip's unique nanoWatt Technology, the MCUs help maintain the system's low-power ratings, and can even drive the display in sleep mode to conserve power.
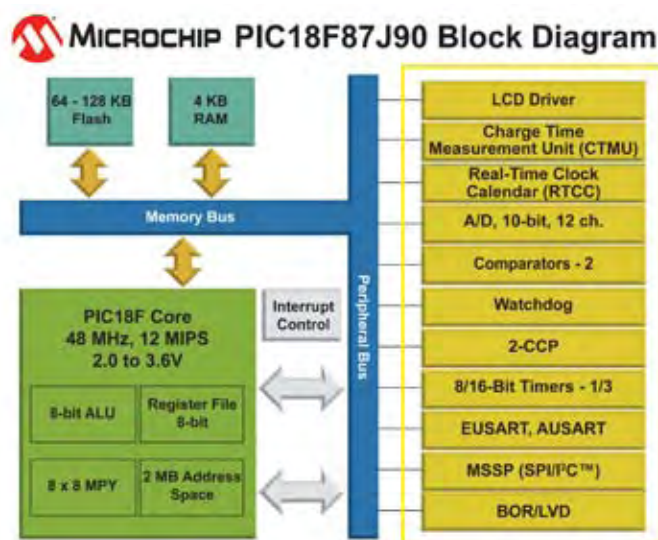
Additionally, the onboard LCD module contains a software-programmable contrast controller, which provides display boost or dimming and compensates for environmental elements such as temperature and lighting. The on-chip hardware RTCC works even in sleep mode to enable real-time tracking and lower power consumption.

The PIC18F87J90 MCUs are designed for cost-sensitive embedded display applications in the consumer (white goods, game controllers, exercise equipment, thermostat and counter top appliances); industrial (home-alarm/security-system keypads, power meters, data logging and central AC communication controllers); medical (flow meters, patient monitors, laboratory instruments and home-diagnostic devices); and automotive markets (dashboard and control panels).

To get started with the PIC18F87J90 family, customers can use the **PICDEM™ LCD 2 Demo Board** (part # DM163030, $125) in combination with the **PIC18F87J90 Plug-In Module** (part # MA180025, $25), which includes capacitive-touch buttons. Both are available today.

Additionally, the PIC18F87J90 family is supported by Microchip's standard development tool suite, including the free **MPLAB® Integrated Development Environment IDE** (http://www.microchip.com/MPLAB), the **MPLAB C Compiler for PIC18** and the **MPLAB ICD 3 In-Circuit Debugger** (part # DV164035). The MPLAB IDE now comes with the free Segmented Display GUI, which makes it easy to generate the code needed to drive LCD displays.

Prices for the PIC18F87J90 family start at $2.58 in 10,000-unit quantities. Samples are available today at http://sample.microchip.com. Volume production quantities of each device can be ordered today.

For additional information, visit www.microchip.com/LCD or watch the video at http://www.youtube.com/watch?v=xInj6UHgIXk

Microchip PIC18F87J90 Block Diagram

FREE Segmented Display Designer GUI Now part of MPLAB® IDE

Faster development time with Segmented LCD Designer GUI

- ✓ Segmented Display GUI makes it easy to generate the code needed to drive LCD displays

- ✓ Just drag & drop to customize your display and the tool will generate the code for you!

Free, new and integrated features with MPLAB® IDE v8.20 or higher:
www.microchip.com/mplab

Support PIC MCUs with LCD controllers for driving segmented displays including the PIC18FxxJ90 which comes in 64/80 pins and scales from 8 – 128KB Flash with up to 192 pixels.

Segmented Display Designer is MPLAB IDE Plug-in and it is listed under MPLAB IDE Tools menu. It has to be accessed from **MPLAB->Tools->Segmented Display Designer**. It is integrated with MPLAB IDE frame work.

Segmented Display Designer consists of following 3 pieces
1. **Component Window** – Allows the user to create different components
2. **Components** – Lists all the components that is already created
3. **LCD Panel** – Allows the user to design the LCD Panel with the components already created

Segment Designer Plug-in provides the building blocks for the creation of the components including:

1. Rectangular Segments
2. Rounded Rectangular Segments
3. Circular Segment
4. Diagonal Segments
5. Text Component
6. Graph (PIE and Bar)
7. Hollow Segments
8. Numeric Display Component

Introducing the Industry's Lowest Voltage EEPROM Devices

The **24VL014**, **24VL014H**, **24VL024**, **24VL024H** and **24VL025** (**24VLXX**) series of devices has an operating voltage down to 1.5V for both Read and Write operations, with a very low operating current well below 400 microamperes. As an added feature, the 24VL014, 24VL024 and 24VL025 can be ordered with a full-array write protect, while the 24VL014H and 24VL024H devices support a half-array write protect. In densities of 1K or 2 Kbits, these EEPROM devices are the first to support this low voltage level, and they are versatile enough to support two different write-protect features.

Following the previously announced **34AA02**, **34LC02** and **34VL02** (**34XX02**) low-voltage EEPROM devices, the 24VLXX devices provide another option for designers looking to maximize battery life in their applications. With an operating frequency of 100 kHz at 1.5V, the new EEPROMs can operate in portable and handheld applications with very low voltages, thus reducing power consumption and extending the useful life of the battery.

The very low voltage EEPROM devices are supported by the **MPLAB® Starter Kit for Serial Memory Products** (Part # DV243003). The kit includes the MPLAB Starter Kit for serial memory products board, a serial EEPROM starter pack, a USB cable, and a CD containing the **MPLAB IDE**, Total Endurance™ software model and a serial EEPROM interface tool. It can be ordered today for $79.98.

See a video overview of the kit at
http://www.youtube.com/watch?v=MhSjd_aoKQY

These devices are available in an 8-pin SOIC, MSOP, PDIP and 2 mm x 3 mm TDFN package. The 24VL014 and 24VL014H devices are priced at $0.31 each for the SOIC package and up to $0.37 each for the TDFN package, in 10,000-unit quantities. The 24VL024, 24VL024H and 24VL025 devices are priced at $0.34 each for the SOIC package and up to $0.40 for the TDFN package, in 10,000-unit quantities. Samples and volume production quantities are available now.

For additional information, visit www.microchip.com/VL

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Learn About the PIC18 Family in this New Video

- Up to 16 MIPS performance with advanced peripherals
- J-Series for cost-sensitive applications with high levels of integration
- K-Series for low power, high-performance applications

The PIC18 family utilizes a 16-bit program word architecture and incorporates an advanced RISC architecture with 32 level-deep stack, 8x8 hardware multiplier, and multiple internal and external interrupts. With the highest performance in Microchip's 8-bit portfolio, the PIC18 family provides up to 16 MIPS and linear memory. PIC18 is the most popular architecture for new 8-bit designs where customers want to program in C. Choose from over 150 PIC18 products supporting both 3V and 5V applications with packages ranging from 18 to 100 pins. Integration is key on the PIC18 devices, with support for connectivity and human interface peripherals including: USB, Ethernet, touch sensing, LCD display drivers and CAN – all with free supporting software and application notes to help you get to market faster.

See the PIC18 MCUs in action on YouTube!
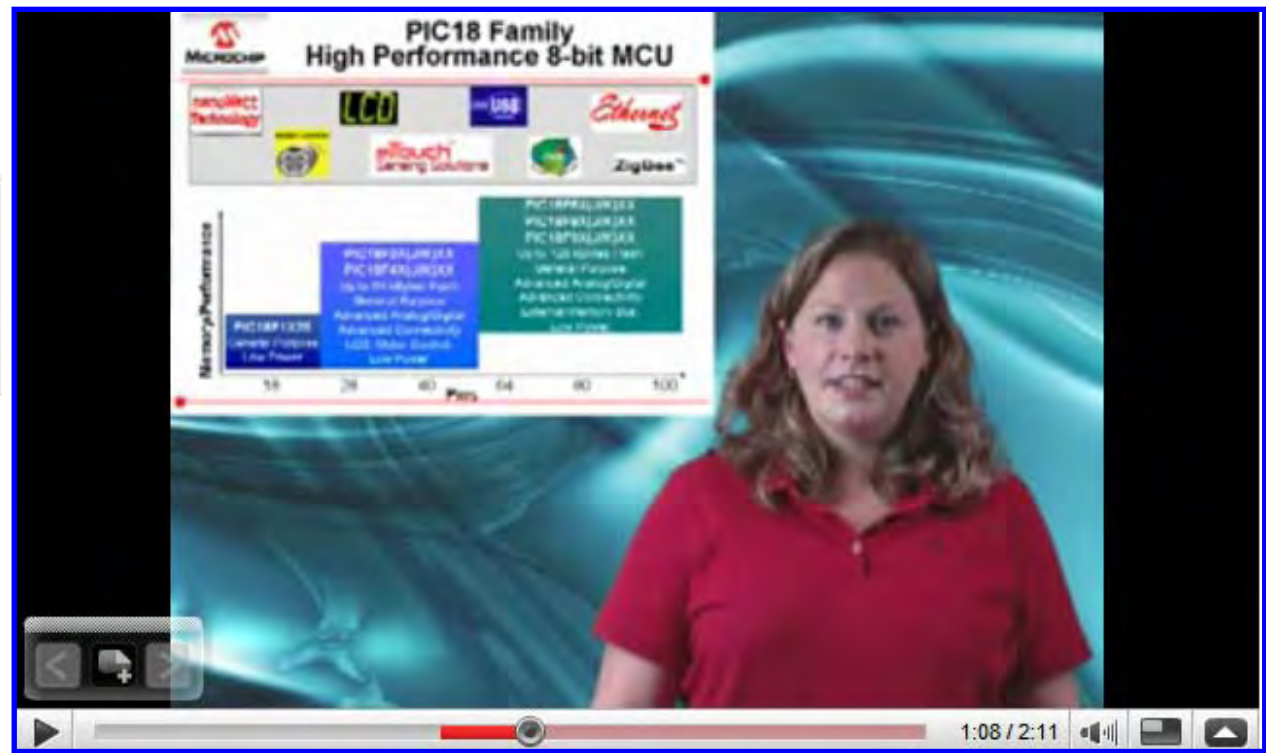
http://www.youtube.com/watch?v=iC3BTIfFHM4

Using the Capacitive Sensing Module on the PIC16F72X

INTRODUCTION

Application Note AN1171 describes the use of the Capacitive Sensing Module (CSM) present on all PIC16F72X devices. The CSM simplifies the amount of hardware and software setup needed for capacitive sensing applications. Only the sensing pads on the PCB need to be added. It is recommended that application note AN1101, "Introduction to Capacitive Sensing" be read in order to understand the capacitive sensing concepts.

CAPACITIVE SENSING MODULE

The CSM allows the user to design a capacitive sensing system without an external oscillator circuit. The CSM has its own software-controlled oscillator. It can also monitor up to 16 inputs. In a typical application, the CSM is directly attached to pads on a PCB and covered by an insulating material. When the insulating material above a pad is touched by the user's fingertip, the capacitance of the pad increases, thus causing a frequency shift in the CSM. For more information on the CSM hardware, please refer to the device data sheet.

This module simplifies the software needed for capacitive sensing: it is only necessary to initialize a few registers and then set the appropriate method of measuring the change in frequency.

MODULE INITIALIZATION

To initialize the CSM, the appropriate cap sense inputs must be initialized as analog inputs. Then, the CSM registers are set, as shown in Example 1.

```
EXAMPLE 1:    SETUP OF THE CAPACITIVE SENSING MODULE

        TRISA   = 0x30;
        ANSELA  = 0x30;             // CPS7, CPS6 initialized as analog inputs
        TRISB   = 0x3F;
        ANSELB  = 0x3F;             // CPS0-CPS5 initialized as analog inputs
        TRISD   = 0xFF;
        ANSELD  = 0xFF;             // CPS8-CPS15 initialized as analog inputs
        CPSCON0 = 0x8C;             // Cap sense on, high range oscillator,
        CPSCON1 = 0x00;             // Cap sense channel input 0 is selected
```

FREQUENCY MEASUREMENT

Once these registers are set, the module will start oscillating. Now, the appropriate method of measuring the frequency needs to be set. There are several methods that can be applied:

- Use Timer0 as a timer resource for the CSM.
- Use Timer2 as a timer resource. Timer2 has a greater flexibility in defining the time base by using PR2 to set the desired time base.
- Use the WDT wake from Sleep event as the time base.

FREQUENCY MEASUREMENT: TIMER1 GATE

All of these methods use the Timer1 gate input. Timer1 will act as a counter; it will increment at every rising edge of the Cap Sensing Module output frequency. The time base selected will start and stop the counter. The user can then read the value on Timer1, which would be a measure of the oscillator frequency. It is recommended to use Timer1 Gate in One-Shot mode to measure the full-cycle length of the chosen time base.

The completion of the Timer1 Gate event, triggered by the chosen time base overflow, will generate a Timer1 Gate Interrupt. When servicing this interrupt, the value of TMR1 can be read to determine the oscillator frequency.

For more information on the Timer1 Gate hardware setup, please refer to the device data sheet.

FREQUENCY MEASUREMENT: TIMER0 TIME BASE

To setup the Timer0 time base, the OPTION register as well as the interrupt flag and the enable bit need to be set accordingly during initialization. T1GSS (Timer1 Gate Source Select, T1GCON<1:0>), bits <1:0>, is set to '01' so the Timer0 overflow output becomes the Timer1 Gate Source. The setup code is shown on Example 2:

```
EXAMPLE 2:    TIMER0 TIME BASE SETUP

        OPTION  = 0xC3;         // fosc/4, hi-lo edge transition, 1:16 prescaler
        TMR0IF  = 0;            // clear TMR0 interrupt flag
        TMR0IE  = 1;            // enable TMR0 interrupt
        T1CON   = 0xC5;         // Timer1 initialization
        T1GCON  = 0xE1;         // Timer1 gate init /Toggle Mode/TMR0 time base
        TMR1GIF = 0;            // Clear Gate Interrupt Flag
        TMR1GIE = 1;            // Enable Gate Interrupt
```

FREQUENCY MEASUREMENT: TIMER2 TIME BASE

To setup the Timer2 time base, the T2CON register must be set with the desired prescalers. In addition, the user may want to load a value into PR2 register to adjust the sensor scan rate. T1GSS (T1GCON <1:0>) is set to '10' so the Timer2 Match PR2 output becomes the Timer1 Gate Source.

FREQUENCY MEASUREMENT: WDT TIME BASE

To set up the Watchdog Timer (WDT) as the time base, one has to set T1GSS (T1GCON <1:0>) to '11' and set TMR1GE. A Timer1 Gate Interrupt will be generated every time the Watchdog Timer overflows. The Timer1 Gate Interrupt will be generated even with WDT disabled in the Configuration Word. The PSA bit in the OPTION register may be set to select the prescaler for the WDT

Download the complete Application Note at
http://www.microchip.com/stellent/idcplg?IdcService=SS_GET_PAGE&nodeId=1824&appnote=en534210   RETURN TO FRONT PAGE

Need More Board Space for Your 16- or 32-bit Design?

As consumer desire for mobility increases, the demand for powerful, yet small and light products continues to grow. QFN (Quad, Flat, No Lead) packages - Smaller, thinner packages with improved thermal characteristics are key to meeting this demand, while also providing lower capacitance and lead inductance, thin profile, low weight, smaller board footprint and routing area, and no fragile external leads to ease handling and assembly.

Microchip's new 64-pin QFN packages are ideally suited for space constrained products, such as PC cards, laptop motherboards, cellular phones, portable medical equipment, and handheld meters. They are also suited for industrial products that require increased thermal, electrical or RF (radio frequency) environments. The packages support the **PIC24FJ256GA1/GB1** family and the **PIC32 family**. These represent the largest Flash memory density available in a 64 pin 16 bit microcontroller (256 KB), as well as the largest Flash density available in a 64 pin QFN for a 32 bit microcontroller (512 KB).

The parts numbers for the new QFN packages are:

PIC24F Family	PIC32 Family
IC24FJ128GA106 –I/MR	PIC32MX340F256H-80I/MR
PIC24FJ128GA106 –E/MR	PIC32MX320F128H-80I/MR
PIC24FJ192GA106 –I/MR	PIC32MX320F064H-80I/MR
PIC24FJ192GA106 –E/MR	PIC32MX320F032H-40I/MR
PIC24FJ256GA106 –I/MR	PIC32MX440F256H-80I/MR
PIC24FJ256GA106 –E/MR	PIC32MX340F512H-80I/MR
PIC24FJ64GB106 –I/MR	PIC32MX340F128H-80I/MR
PIC24FJ128GB106 –I/MR	PIC32MX440F512H-80I/MR
PIC24FJ192GB106 –I/MR	PIC32MX440F128H-80I/MR
PIC24FJ256GB106 –I/MR	PIC32MX420F032H-40I/MR

For more details on our Packaging Specifications, please visit
http://www.microchip.com/stellent/idcplg?IdcService=SS_GET_PAGE&nodeId=1415

Lafayette Instrument Selects the PIC18F6527 MCU and MCP73863 Charger for the World's First Wireless Polygraph System

The **PIC18F6527** microcontroller (MCU) is used in the LX5000 polygraph's modular Data Acquisition System (DAS) and LX5KBTW wireless Bluetooth® module; while the MCP73863 charge-management controller is part of the LX5K-BC Li-Ion battery-charging system. Lafayette Instruments selected the PIC18F6527 MCU because of its low-power nanoWatt Technology, its four serial ports, and its large amounts of Flash and RAM for buffering. The **MCP73863** charger was selected because of its low cost, small size, charge-status indicators, thermal-management and automatic charge-termination capabilities, safety timers and ability to minimize the number of required external components. With eight MCP73863 charge-management controllers employed, the LX5K-BC is capable of charging up to eight Li-Ion batteries in just two hours.

Chris Fausett, vice president of sales for Lafayette's polygraph products, said, "In moving from initial concept to final design of our new polygraph system, Microchip's unsurpassed product offerings exceeded all of our expectations and gave us the tools necessary to meet our design requirements."

"We are pleased to partner with Lafayette on its industry-leading products that utilize our MCP73863 Li-Ion/Polymer charge-management controller," said Rich Simoncic, vice president of Microchip's Analog and Interface Products Division. "Microchip's broad portfolio of Li-Ion/Li-Polymer charge-management controllers allows our customers to best choose their desired feature combination. Features such as thermal management, charge termination and safety timers, combined with its small size and cost, make the MCP73863 Li-Ion/Li-Polymer charge-management controller ideal for portable applications, such as Lafayette's wireless polygraphs."

With its nanoWatt technology, small footprint and integrated analog capabilities, the PIC18F6527 is a natural fit for enhancing Lafayette's wireless polygraphs," said Mitch Obolsky, vice president of Microchip's Advanced Microcontroller Architecture Division.

A Breadboard-friendly Way to Prototype PIC32 Designs

Submitted By Brian Schmalz

When I first heard about the **PIC32** with USB, I couldn't wait to get started prototyping my first project using this new processor. But the early **PIC32 Starter Kit** did not easily adapt to the breadboards typically used for prototyping. So the **USB Bit Whacker 32** (**UBW32**) was born. Loosely modeled after a previous project (the USB Bit Whacker – UBW – based on a **PIC18F2550**) I decided I needed a simple and inexpensive board with the biggest and best PIC32 that would fit on my breadboard. Just as with the previous UBW design, the UBW32 is open source and complete design files are available. The hobbyist-friendly company SparkFun Electronics (**http://www.sparkfun.com/commerce/product_info.php?products_id=8971**) decided to produce both designs so that anyone could get started with their PIC32 project at a low cost.

The UBW32 comes with the Microchip HID Bootloader already installed, and a simple CDC based command parser for simple input and output commands. The bootloader allows users to easily write their own firmware and download it to the UBW32, using it as a development platform for their new code. The simple I/O commands already present on the UBW32 also allow users to treat the board as a very large, very fast I/O expansion system for their PC. Since almost any language on the PC can open a serial port and send ASCII commands, this opens the door for all sorts of real-world connectivity opportunities to the PC. As a development platform, or a USB based I/O module, the UBW32 is generic and a great way to get started with the powerful PIC32 processor family.

The UBW32 sports a **PIC32MX460F512L**, three push buttons, five LEDs and a USB connector. There are pads on the back for a USB host connector and 5 volt pull up resistors on each I/O pin. The UBW32 can be purchased for $40 from SparkFun. Complete documentation, layout files and example project code is available at **http://schmalzhaus.com/UBW32/**.

Would you like a chance at a free board? SparkFun is giving away 5 UBW32 boards during the week of March 20-27. Simply login to the PIC32 Design Challenge web site at **http://www.myPIC32.com** and view 2 of the remaining 8 designs. See contest web site for eligibility rules.

Brian Schmalz is an open source hardware and software maker. SparkFun builds some of his designs so others can share in his PIC® MCU-powered joy. During the day, he is an embedded systems engineer for Logic Product Development, a product development and manufacturing company based in Minneapolis, Minnesota. For more on Logic Product Development, see page 12.

PIC32™ DESIGN CHALLENGE

MICROCHIP · Digi-Key CORPORATION · techinsights · TELL A FRIEND

www.myPIC32.com

Congratulations to the Great 8

THE GREAT 8
Which is the best application? That's for you to decide.
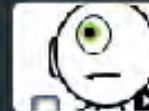
View All!

- FIGARO the lawn-barber by kile
- L.A.T.H.I - Intellegent Helper by boseji
- BUMS (Bathroom Utilities) by bmorse
- Smart Home Base - Skype by jingxizhang
- Carb Counter Plus by mimemike
- PIC'n The Beehive by carl
- Portable Notetaker for Blinds by txnghia
- COMA - The All In One by ganzziani

YOU can win weekly prizes just for being a part of the community! You can rate and vote on each contestant's design according to the design value criteria, post blogs and participate in the member forums. You can also post comments and suggestions in the contestant blogs and profiles to help them advance their designs. Join today at www.myPIC32.com.

The first phase of the contest generated 396 abstracts, of which 126 designs were selected to develop their hardware for Phase 2. The Top 32 contestants moved on to Phase 3 to complete their software design. Now, the Top 8 contestants will have an additional few months to polish their current design and source code with on-going input/help from the community and suggestions from the 3 judges and other experts.

Starting March 16, 2009, community members will finalize their votes, and the top 5 designers will be flown to the Embedded Systems Conference 2009 in Silicon Valley where the judges will cast their votes live on April 1. The judges' and community votes will be combined, the final winners will be announced live at the event, and prizes will be awarded.

The 2008 PIC32 Design Challenge's Ultimate Embedded Designer will win a fantastic home theatre system, including a 57" 1080p LCD TV and Bose® Lifestyle V20 System worth over $8000! Second and third place winners will also receive great prizes. See prize and contest rules and regulations for complete details!

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Introducing FATFs, An Open-source File System with Multiple Drive Support

By Sean Justice and Clayton Pillion; Microchip Technology

USB Thumbdrives, SD Cards, serial flash, and other low-cost memory products have become common place in embedded products these days - many times more than one memory format is used on the same product. Microchip's family of PIC32 microcontrollers easily interfaces to these popular memory products and has plenty of processing performance to simultaneously manage multiple drive sources. However, the necessary software was missing until Microchip ported FATFs (pronounced "Fat F-S") to the PIC32 microcontroller family. FATFs is an open source file system software stack designed for microcontrollers to easily access multiple media sources during run-time. This small footprint low-overhead software supports FAT 32, FAT 16, and FAT 12 formats using an 8.3 file name format. Lastly, this open source software has a license model that will put a big smile on your boss's face – it is free for commercial use and there are no requirements to share your precious source code with anyone else.

ADVANTAGES

Using FATFs as your application's file system has many advantages such as write buffer flushing, large number of media drive support, easy drive addition, compile time options to minimize memory footprint, simultaneous multiple media access, and application control of file structures.

FATFs handles corruption due to accidental failure or RTOS context switching by providing a routine, `f _ sync`, that flushes the write buffer. The user can easily add drives to the file system by modifying the source file, `diskio`.

Under the current implementation diskio allows for up to 256 different media drives at one time. Adding media drives is easy, only needing to confirm to the defined `diskio` stub functions. Much like PCs, the root directory of the media source is assigned a character which is passed when accessing a file. For FATFs, the media source is assigned a numeric character. For example the SPI SD Card media source is designated by "1", so opening a file named "`myfile.txt`" requires the string "`1:myfile.txt`."

FATFs has compile time options that help to reduce the overall memory footprint. Some of these options include `_ FS _ READONLY` and `_ FS _ MINIMIZE`. The option `_ FS _ READONLY` defines the FATFs to only perform read access to media devices. This reduces the memory footprint by not including routines that perform write operations. The other option `_ FS _ MINIMIZE` allows the user to set minimal levels of functionality to be enabled or disabled.

FATFs allows the user to open files by using a locally stored structure. There is no pre-defined limit to the number of files structures that can be used at one time as this helps developers efficiently manage memory usage of file structures at run time and can possibly avoid using precious global memory for file structures.

PIC32 Features

FATFs has been ported and available for download here. The hardware required to run the demo is a PIC32 Starter Kit (DM320001 or DM320003); I/O Expansion Board (DM320002) and a PICtail™ Daughter Board for SD & MMC Cards (AC164122). Currently there is only one drive supported, SPI-SD Card interface, but more are expected to be released soon.

Coming Soon: PIC32 FATFs Features

Two new media drivers for FATFs are currently in development: USB Thumbdrive and the SD Card interface on the Solomon Systech SSD1926. The USB Thumbdrive media driver uses the free Microchip USB host software stack that includes mass storage device class support. The Solomon Systech SSD1926 is a graphics controller with a 4-wire SD Card interface. Future Microchip development boards will use this controller with full software support in the Microchip Graphics Library.

In summary, if your design requires a microcontroller to access multiple drive sources, FATFs is an excellent open source solution that is free for commercial use. Combine this software with Microchip's PIC32 MCUs to deliver low-cost designs that interface with a wide range of popular memory products.

MICROCHIP
Regional Training Centers

New Motor Control Training Workshops Announced!

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

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

(Register for class MCT0301)

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

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

MCT0301 Class Offerings

3/25 – Toronto
5/6 – Boston
5/7 – Cleveland
5/28 – San Jose
6/17 – Detroit

Sensorless Field Oriented Control for PMSM Motors

(Register for class MCT7101)

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

Advantages of PMSM motors include:

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

MCT7101 Class Offerings

3/17 – Houston
3/18 – San Jose
3/19 – Southern California
3/24 – Chicago
3/25 – Boston
3/26 – Toronto

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

New Video!
Design Tools for BLDC & PMSM Motors

Learn about the available design tools for your next motor control application.

http://www.youtube.com/watch?v=5uOCGCvVOoO

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

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FEATURED

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LOGIC

The engineers at Logic Engineering Design Services are highly proficient with Microchip's PIC® MCU product line, and have extensive experience developing products with the PIC12, PIC16, and PIC18 microcontroller families. Recent PIC MCU projects include industrial controls, robotics, data acquisition and monitoring, motion control, handheld devices, and remote sensors. Logic Product Development is a full service product development firm. The company has provided product development services for over 40 years.

Logic offers services in mechanical engineering, industrial design, electrical engineering, and systems and software engineering. Logic's market discriminator is the integration of two or more of these services to offer end-to-end product development capability, including the transition to manufacturing and order fulfillment. Logic's primary offering is time-to-market through superior experience, integrated development processes, and cross-functional teams.

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This support is not limited to Microchip's broad line of 8-bit microcontrollers, but also includes the growing line of analog products, 16-bit microcontrollers and digital signal controllers and 32-bit microcontrollers. If your design could use a boost, let a Design Partner help you get to market faster with Microchip.

To access Microchip's extensive network of Design Partners around the world, visit **www.microchip.com/Partners** to find an expert to help you get to market faster.

This month, Microchip launched a brand new specialist category known as the mTouch Design Partner Specialist category within the Global Design Partner Program.

MICROCHIP mTouch™ DESIGN PARTNER SPECIALIST

These specialists will be made up of existing Microchip partners who are experts in capacitive, inductive and touch screen applications. Microchip customers can access these partners at **www.microchip.com/mtouch** when the partners have been identified and made public in the near term.

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This new mTouch specialist category is a great addition to our very successful Medical and RF Specialists that have provided a vital resource for our customers to achieve certifications and launch their new products to market with confidence. If you are looking for design assistance in these two areas, visit **www.microchip.com/Medical** and **www.microchip.com/rf** to find a specialist.

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nanoPower FORUM
SAN JOSE, CA
MAY 18-20, 2009
MAKING THE MOST FROM MILLIWATTS

Join Microchip Technology Technical Staff Engineer Keith Curtis, as he presents "The Advantage of Microcontrollers in Low-Power Applications". By definition, embedded applications require some form of microcontroller to provide intelligence and control. The challenge in battery-powered embedded applications is to provide this intelligence and control without burning through battery capacity. This presentation explores many of the pitfalls and problems that designers run into with regard to low-power design, and provide suggestions and guidelines for minimizing current consumption. Specifically, examples of how to minimize I/O currents are covered, as well suggestions for lowering current consumption through reductions in the system-clock frequency and turning off idle or unused peripherals (both internal and external).

http://nanopower.darnell.com/

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Deep Sleep Mode on Microchip PIC18 and PIC24 Microcontrollers

Serial SRAM Overview

Serial SRAM Usage Recommendations

Hi-Tech C® PRO Compiler for the PIC10/12/16 MCU Family

Tutorial on the MPLAB® Starter Kit for PIC24H Microcontrollers

Introduction to Microchip's Development Tools

Introduction to MPLAB® IDE

Introduction to the MPLAB® SIM Software Simulator

Microchip's Inductive mTouch™ Sensing Solution

Introducing the Enhanced Mid-Range Architecture

sensors expo & conference

Join Youbok Lee, Ph.D., Technical Staff Engineer in Microchip's Analog and Interface Products Division as he presents...

Interface Circuit Requirements to Reduce Noise in Sensor Applications
Wednesday, June 10, 2009
11:00 AM - 11:40 AM

Delta-Sigma Analog-to-Digital Converters (ADCs) are based upon the over-sampling principle of input signals. For example, the over-sampling ratio for an 18-bit Delta-Sigma ADC can be as high as a few thousand. A higher over-sampling ratio means a higher number of averaging input signals, resulting in a higher signal-to-noise ratio. Some high-performance Delta-Sigma ADCs include an internal Programmable Gain Amplifier (PGA) which allows the ADC to convert a very weak input signal with high resolution. With a high over-sampling ratio and this onboard PGA, these types of ADCs are suitable for sensor applications where the sensor output-signal level is weak relative to the noise level. This presentation will demonstrate methods for reducing noise in sensor applications using the latest Delta-Sigma ADCs, presenting design examples to show how to design sensor-interface circuits to reduce noise in temperature, flow, pressure and weigh-scale measurement applications.

Join Youbok Lee, Ph.D., Technical Staff Engineer in Microchip's Analog and Interface Products Division and Steven Bible, Applications Engineering Manager in Microchip's Radio Frequency (RF) Products Division as they present...

Sensor Interface Design for Secure Wireless Remote Sensing
Wednesday, June 10, 2009
2:30 PM - 3:10 PM

This presentation will demonstrate the requirements of sensor interfaces for rapid and secure monitoring of temperature, pressure and humidity over wireless networks. Design examples will be presented involving a microcontroller, and RF circuits interfacing to sensors will be presented. Power consumption versus data integrity over the various data formats for wireless sensor applications will be provided.

Looking to Enhance Your Embedded Control Designs?

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

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

Call one of Microchip's RTCs and ask one of our experienced Technical Training Engineers how Microchip can help you with your training investment.

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

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This Month's Wiki:

USB Connection

ICwiki

Microchip's **ICwiki** is an online, open-content collaborative source for microelectronic knowledge, from a voluntary association of individuals and groups working to develop a common resource. Wikis allow for linking among any number of pages. This ease of interaction and operation makes a wiki an effective tool for mass collaborative authoring.

Abstract:
This demo shows how to set up a USB connection between the PC and the FLEX board. The aim is to control the dsPIC LED and the PIC18 LED system from the host PC. The dsPIC LED is controlled by the SPI communication with the PIC18. The application is divided into three parts:
• In the first part a brief description of the USB set-up is provided. The aim is to give a brief overview of the USB protocol.
• The second part concerns the dsPIC side with the use of the SPI connection with the PIC18.
• The third part concerns the PC side application. You can download a simple application under Windows (XP or Vista) to communicate with FLEX in order to switch on and off both LEDs of dsPIC and PIC18.

Future application notes will develop the USB connection up to the control of the dsPIC functions through the host PC with a Linux application.

Authors: Francesco Focacci (Evidence)

Software
On the FLEX side:
• The software is based on the PICkit2 firmware provided by Microchip. This allows to use the HID set-up for the PIC18.
• The dsPIC is programmed using Erika. This example uses functions for the SPI not yet implemented in Erika 1.4.2.X, future version will support the SPI communication.

On the PC side, you need a specific application that identifies and enumerates the device and that is able to send and receive data through USB.

Hardware
This is the list of hardware components needed to reproduce the demo:
• FLEX board, full version
• PC
• ICD2 programmer

Now you have two options:
1. Use the demo board for SPI communication between PIC18 and dsPIC
2. Use wires to connect directly the PIC18 with dsPIC without the demo board

To view this entire entry, visit http://www.microchip.com/wiki/Wiki.aspx?WikiID=91&

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Doc. Type	Doc. Title	DS No.
Application Note	Generic Client Driver for a USB Embedded Host	01143A
	Using the Capacitive Sensing Module on the PIC16F72X	01171B
	KeeLoq® Receiver System Interfaced to I²C™ Bus	01248A
	Microchip CTMU for Capacitive Touch Applications	01250A
	11AA010 HI-TECH C and Timer	01251A
Data Sheet	24AA16/LC16B Data Sheet	21703H
	24AA04/LC04B Data Sheet	21708H
	24AA02/LC02B Data Sheet	21709J
	24AA08/LC08B Data Sheet	21710J
	24AA01/LC01B Data Sheet	21711J
	24AA32A/24LC32A Data Sheet	21713J
	PIC18F46J50 Family Data Sheet	39931B
	PIC18F46J11 Family Data Sheet	39932B
	PIC18F87J90 Family Data Sheet	39933C
	HA3078 28-Pin Flash-Based, 8-Bit CMOS MCU Data Sheet	41374A
Technical Brief	Use PIC32 Boot Flash to Expand Program Memory	93015A
	Using the PIC® MCU CTMU for Temperature Measurement	93016A
Reliability Report	Q4 Quality Reliability Report	00097AF
Errata	PIC18F1220/1320 Rev. D0 Silicon/Data Sheet Errata	80244D
	PIC18F2480/2580/4480/4580 Data Sheet Errata	80267C
	PIC18F87J10 Family Data Sheet Errata	80315E
	PIC24FJ256GA110 Family Data Sheet Errata	80385B
	PIC24FJ128GA010 Family Rev. C1 Silicon Errata	80422B
	PIC18F24/25/44/45K20 Device ID Rev. 0x16 Silicon Data Sheet Errata	80425A
	PIC18F87J90 Family Rev. A1 Silicon Errata	80432B
	PIC18F97J60 Family Rev. A1 Silicon Errata	80433A
	PIC18F2420/2520/4420/4520 Data Sheet Clarification	80434A
	PIC18F46J11 Family Rev. A2 Silicon Errata	80435A
FRM Section	dsPIC33F FRM Section 32. Interrupts (Part III)	70214B
User's Guide	PIC18F14K50 Low Pin Count USB Development Kit User's Guide	41356B
	PICDEM™ Lab Development Kit User's Guide	41369A
	PIC32MX Starter Kit User's Guide	61144D
Programming Specification	PIC18F1230/1330 Flash MCU Programming Specification	39752B
	PIC16F72X/PIC16LF72X Memory Programming Specification	41332B

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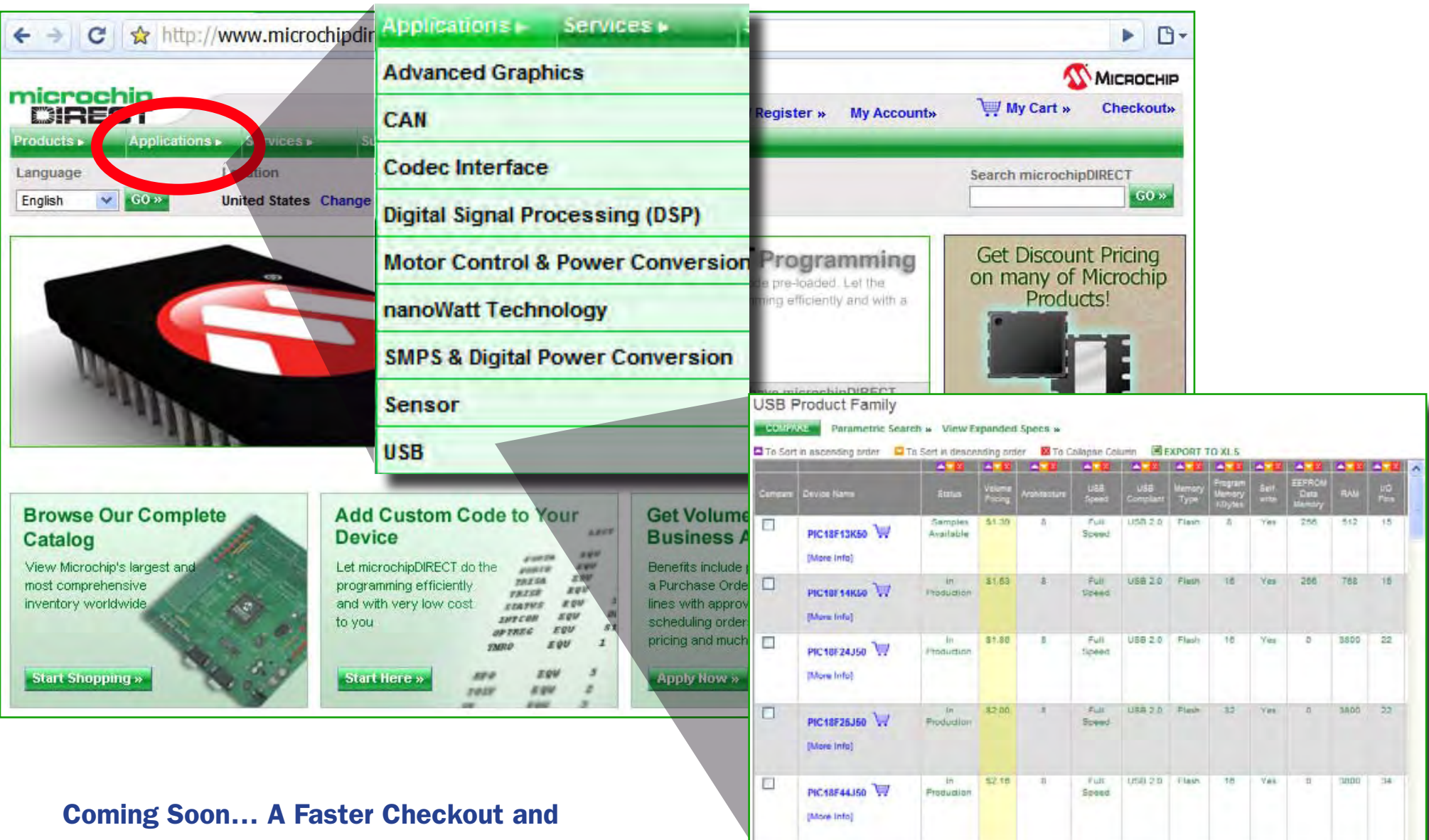
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