MICROCHIP'S UNIVERSITY PROGRAM

The Microchip University Program assists professors and students in their efforts to incorporate Microchip’s PIC® microcontrollers, dsPIC® digital signal controllers, analog semiconductors, serial EEPROMs and the patented KEELOQ® security devices in their courses/projects.

Developing curriculum on the PIC microcontroller architecture and using Microchip products in the classroom helps ensure that students are well prepared for their engineering careers.

Adding topics on Microchip products to your current course plan is a simple process – one designed to benefit students and instructors alike. Offering courses or content on the PIC microcontroller architecture draws students to schools and universities – it is a widely accepted and leading edge architecture. This interaction can help students quickly grasp industry techniques and methods used to address a fast changing and highly competitive workplace, further reinforcing their own academic and professional growth.

The Microchip University Program Provides:

- Diverse products for classroom use
- Curriculum support – whole course solution
- Course creation reference material
- Publication and technical support
- Discounts on Microchip development systems
- Free student edition software
- Suite of programming development tools/demo boards
- Free samples
- Support of special university development and design projects
- Regional training centers
- University program web site: www.microchip.com/university

*Gartner Dataquest, 2003 Microcontroller Market Share & Unit Shipments, Tom Starnes, June 2003
8-bit PIC® Microcontroller Product Architectures
Microchip’s 8-bit PIC microcontrollers fall into three product architecture categories providing a variety of options for any application.

Baseline 8-bit Architecture
The Baseline Architecture includes the PIC10F family and portions of the PIC12 and PIC16 families. These devices utilize a 12-bit program word architecture with 6- to 28-pin package options. The concise feature set of the Baseline Architecture is ideal for battery-operated applications.

Mid-Range 8-bit Architecture
The Mid-Range Architecture includes members of the PIC12 and PIC16 families that feature a 14-bit program word architecture. These families are available with 8- to 64-pin package options. PIC microcontrollers featuring Microchip’s Mid-Range 14-bit program word architecture are available in higher pin count packages with Flash and OTP program memory options.

High Performance 8-bit Architecture
Microchip’s High Performance Architecture encompasses the PIC18 family of devices. These microcontrollers utilize a 16-bit program word architecture with 18- to 80-pin package options. The PIC18 devices are high performance microcontrollers with integrated A/D converters and an advanced RISC architecture that supports Flash and OTP devices. The PIC18 family has special features to reduce external components, thus minimizing cost, enhancing system reliability and reducing power consumption. The PIC18 family builds on the foundation established by the other 8-bit PIC microcontrollers and provides engineers with a smooth, easy migration to these higher levels of performance and feature sets.

16-bit PIC® Microcontrollers and dsPIC® Digital Signal Controllers
As embedded applications grow in complexity with increasing performance requirements, Microchip has introduced more than 70 new 16-bit devices and continues to introduce more. The PIC24F and PIC24H 16-bit microcontroller families enable an easy migration from the 8-bit PIC microcontrollers, with higher performance, memory and faster peripherals. This migration path continues with the dsPIC digital signal controllers, including the dsPIC30 and dsPIC33 families. These 16-bit solutions have compatible software, development tools and many of the devices have shared pin-outs and peripherals. Microchip is a leader in 16-bit performance and C code efficiency.

16-bit Solutions One Architecture: Three Compatible Families
PIC24
- 16 and 40 MIPS versions @3.3V
- 3.0 to 3.6V operation
- -40° to 85°C (-40° to 125°C planned)
- Up to 256 KB Program Flash
- Data EEPROM emulation in Program Flash
- Up to 32 KB RAM
- 18- to 80-pin packages

dsPIC30F
- 30 MIPS @5V
- 2.5 to 5.5V operation
- -40° to 85°C and -40° to 125°C
- Up to 164 KB Program Flash
- Integrated Data EEPROM
- Up to 8 KB RAM
- 28- to 80-pin packages

dsPIC33F
- 40 MIPS @3.3V
- 3.0 to 3.6V operation
- -40° to 85°C (extended temp. planned)
- Up to 256 KB Program Flash
- Data EEPROM emulation in Program Flash
- Up to 32 KB RAM
- 64- to 100-pin packages
- 8 channel DMA

Microchip’s 8- and 16-bit Solutions

Analog and Interface Products
Microchip offers a family of analog and interface products that complement our broad microcontroller product lines.

Power Management
LDO and Switching Regulators, Charge Pump DC/DC Converters, Power MOSFET Drivers, PWM Controllers, System Supervisors, Voltage Detectors, Voltage References.

Thermal Management
Temperature Sensors, Fan Speed Controllers and Fan Fault Detectors.

Battery Management
Li-Ion/Li-Polymer Battery Chargers and Smart Battery Managers.

Linear
Op Amps, Programmable Gain Amplifiers, Comparators and Linear Integrated Devices.

Mixed Signal
A/D Converters, Digital Potentiometers, D/A Converters, V/F and F/V Converters and Energy Measurement ICs

Interface Devices
CAN Peripherals, Infrared Peripherals, LIN Transceivers, Serial Peripherals and Ethernet Controllers.

Memory Products
Microchip offers one of the broadest lines of serial EEPROM memory spanning every density from 128 bit to 1 megabit; high-speed versions of all three popular serial buses; industry-leading quality, read/write endurance and data retention; generous and flexible voltage and temperature ranges; and tiny, space-saving packages. These devices are used in virtually any embedded control design, including consumer audio/video, telecom, computer/peripheral, appliance, automotive, industrial and medical applications.
CURRICULUM SUPPORT – WHOLE COURSE SOLUTION

Microchip actively works with university professors and other experts in the field to support the development of whole course solutions. These solutions combine the necessary tools for teaching PIC microcontroller classes such as textbooks, lab boards, lab exercises and more.

Available Textbooks

Professors and students have access to more than 70 textbooks in nine languages to support their efforts in learning more about Microchip’s architectures and product offerings. A book list is available on the Microchip web site at: www.microchip.com/university. A few examples are shown below.

Embedded Design with the PIC18F452 Microcontroller
   John E. Peatman, Georgia Institute of Technology
   ISBN: 0-130462-13-6 (Prentice Hall)
   This book can be used in a one-semester university course at the senior level. The book’s focus is to develop three capabilities in the design process: to understand and use components, to exploit powerful algorithmic processes, and to break down the complexity of an instrument or device so as to meet its specifications. The first printing of the book comes complete with the QwikFlash development board, which, when populated, is used as an example in the book for interfacing the PIC18F452 to various external components.

123 PIC® Microcontroller Experiments for the Evil Genius
   Myke Predko
   This book was developed for Grade 11 (junior) and Grade 12 (senior) high school students preparing for post secondary education in engineering, computer science, mathematics or physical sciences. It is also appropriate for university students or technical hobbyists looking for more information on programming and interfacing PIC microcontrollers into an application. Each experiment builds on those before it, so users develop a hands-on, practical understanding of microcontroller programming, Microchip’s PICkit™ 1 Flash Starter Kit (DV164101) and the Signal Analysis PiCtail™ Daughter Board (AC153120) are used in the experiments.

Learn Hardware, Firmware and Software Design
   O.G. Popa
   ISBN: 0-973567-8-72 (O.G. Popa)
   Learn Hardware, Firmware and Software Design is a practical, hands-on design project with three parts. The book was intentionally planned and structured as a tutorial guide, to help readers gain real hardware, firmware and software design skills. This book explains everything step-by-step, in detail and each new chapter adds gradually to the previously built modules. Although the book has only 368 pages, it also comes with over 400 pages of extremely valuable firmware and software source code.

PIC Microcontroller: An Introduction Software and Hardware Interfacing
   Han-Way Huang
   (Delmar Thomson Learning)
   This book presents a thorough introduction to the Microchip PIC microcontroller family, including all of the programming and interfacing for peripheral functions. A step-by-step approach to PIC microcontroller assembly language programming is presented, with tutorials that demonstrate how to use such inherent development tools such as the MPLAB® Integrated Development Environment, PIC18 C compiler, the MPLAB ICD 2 in-circuit debugger and several demo boards.

Microprocessors from Assembly Language to C Using the PIC18FXX2
   Robert H. Reese
   (DaVinci Engineering Press)
   This book is intended to be used as a first course in microprocessors discussing the PIC18XX2 microcontroller. The first seven chapters provide an introduction to assembly language programming using the PIC18XX instruction set, with all assembly language examples set in a C language context. The remaining eight chapters cover microcontroller interfacing topics using the PIC18F242, with all examples written in C to promote maximum understanding of the hardware topic being studied. A goal of this book is to prepare students for advanced courses in embedded systems or computer architecture.

A Baker’s Dozen - Real Analog Solutions for Digital Designers
   Bonnie Baker
   This is a hands-on designer’s guide to the most important topics in analog electronics – such as A/D and D/A conversion, op amps, filters and integrating analog and digital systems – aimed at engineers whose primary experience/education is in digital. It will teach such readers how to “think analog” as well. Special attention is also given to fundamental topics, such as noise and how to use analog test and measurement equipment, that are often ignored in other analog titles.

NOTE: Microchip provides a list of books on the Microchip web site as a convenience. The listing of a book does not imply endorsement by Microchip of the book or the contents of the book. Microchip makes no warranty as to the accuracy of the information in a book on this list. Books about PIC microcontrollers can be purchased at local bookstores, or on www.amazon.com.
Course Creation Reference Material
The Microchip web site, www.microchip.com, contains material particularly helpful for course and syllabus development. Resources include:
- Application Notes
- Web Seminars
- Reference Designs
- Tutorials
- Tips and Tricks Guides
- Data Sheets
- Application Design Centers
- Reference Manuals
- Web Forums
- On-line Discussion Groups
- Textbooks
- Lab Exercises
- Third Party Teaching Tools

List of Class Material and Documentation
A wealth of information on PIC microcontroller products and tools is available to review and download, including: data sheets, application ideas and reference literature. Key items that may be helpful include:
- Low Cost Development Tools Guide, DS51560
- Development Systems Ordering Guide, DS30177
- Product Selector Guide, DS00148
- MPLAB IDE User’s Guide, DS51519
Microchip supports resource conservation, and consequently offers our technical documentation and literature as downloads from the Microchip web site. Limited printed material is available for special purchase at reduced costs for universities. Requests for printed material sent on school letterhead will be reviewed for availability. Send to:

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On-Line Design Resources

![CAN](www.microchip.com/CAN)

![Ethernet](www.microchip.com/Ethernet)

![LCD](www.microchip.com/LCD)

![Motor](www.microchip.com/Motor)

![USB](www.microchip.com/USB)

![ZigBee](www.microchip.com/USB)
Software Tools

MPLAB® IDE

MPLAB Integrated Development Environment (IDE) is a free Windows® application supporting multiple debugging tools in a single development platform. The MPLAB IDE supports editing source files, compiling, downloading to a PIC microcontroller emulator and simulator tools and debugging using source files, absolute listing files or machine code.

MPLAB® C18 Compiler (Student Edition)

The MPLAB C18 Compiler is a full-featured ANSI compliant C compiler for the PIC18 family of 8-bit PIC microcontrollers. MPLAB C18 is a 32-bit Windows console application as well as a fully integrated component of Microchip’s MPLAB IDE, allowing source level debugging with the MPLAB ICE In-Circuit Emulator, the MPLAB ICD 2 In-Circuit Debugger and the MPLAB SIM simulator.

Projects, compiler switches and linker customizations can be controlled completely within MPLAB IDE to provide a full graphical front end for this powerful compiler. The free Student Edition has all of the features of the full compiler and libraries. After 60 days, the optimizations related to procedural abstraction and to the extended instruction set of the newer PIC18XXX devices will be disabled. Code compiled after the expiration date will function, but may occupy more memory space.

MPLAB® C30 Compiler (Student Edition)

The MPLAB C30 Compiler is a full-featured, ANSI compliant optimizing compiler. The MPLAB C30 C Compiler includes a complete ANSI C standard library, including string manipulation, dynamic memory allocation, data conversion, timekeeping, DSP and math libraries. The MPLAB C30 Compiler has a powerful code optimizer; other 16-bit microcontrollers generate as much as 165 percent larger code for the same application.

FilterLab® Active Filter Design Software

The FilterLab software is an innovative software tool that simplifies active filter design. Available at no cost, the FilterLab active filter software design tool provides full schematic diagrams of the filter circuit with component values and displays the frequency response.

dsPICworks™ Data Analysis and DSP Software

The dsPICworks tool makes it easy to evaluate and analyze DSP algorithms. A variety of DSP and arithmetic operations can be run and the data analyzed in both time and frequency domain. Key features of the dsPICworks Data Analysis and DSP software include:

- Visually analyze time and frequency domain data
- DSP operations: FFT, convolution, correlation, DCT and filtering
- Waveform synthesis
- Tool generates one, two and three-dimensional frequency graphs
- Data import/export options to interface with MPLAB IDE and MPLAB ASM30
- Support for fractional, integer and IEEE floating point data in decimal and hexadecimal notation

Digital Filter Design Tool (SW300001)

The Digital Filter Design tool makes designing and analyzing FIR and IIR filters easy. Enter frequency specifications and filter code and coefficients are generated automatically. Graphical output windows provide the desired filter’s characteristics.

Digital Filter Design Lite (SW300001-LT)

The Digital Filter Design Lite software package provides a subset of the functionality in the full version of Digital Filter Design at a fraction of the cost. The differences between the two versions lie in the number of supported FIR and IIR taps and the presence of MATLAB support.
Learning Technology and Hardware Tools

**PICKit™ 2 Starter Kit (DV164120)**
The PICKit 2 Starter Kit is a low-cost development tool with an easy-to-use interface for programming many of Microchip's Baseline, Mid-Range and High-Performance Flash microcontrollers. The kit includes everything needed to evaluate and develop applications and enables users to start writing code and programming with PIC microcontrollers. Instructions are provided in a series of 12 lessons with all source code files furnished. The starter kit also features full-speed USB support and firmware upgradeability.

**Explorer 16 Development Board (DM240001)**
The Explorer 16 Development Board is a low cost, efficient development board to evaluate the features and performance of Microchip's 16-bit PIC24 microcontroller and dsPIC33 Digital Signal Controller (DSC) families. Coupled with the MPLAB ICD 2 In-Circuit Debugger, real-time emulation and debug facilities speed evaluation and prototyping of application circuitry.

**MPLAB® ICD 2 In-Circuit Debugger/Programmer (DV164005)**
The MPLAB ICD 2 is a low-cost development tool that connects to a PC and the designer's target board for direct in-circuit debugging of the target PIC microcontroller. This tool allows users to download programs to be executed in real time or single step, establish watch variables, set break points, complete memory read/writes and more. The MPLAB ICD 2 can also be used as a development programmer for the target PIC microcontroller.

**PICSTART® Plus Development Programmer (DV003001)**
The PICSTART Plus programmer is a low cost flexible design tool for PIC microcontrollers. It runs under MPLAB IDE and comes complete with assembler, simulator, programmer and product samples.

**MCP2515 CAN Controller PICtail™ Demonstration Board (MCP2515DM-PCTL)**
This demo board implements a simple CAN bus using two nodes, one using the MCP2515 Stand Alone CAN Controller and the other using the MCP25020 CAN I/O Expander. Each node utilizes one input (push button) and one output (LED). The boards demonstrate a simple, inexpensive implementation of a CAN bus.

**MCP9800 Temperature Sensor PICtail™ Demonstration Board (MCP9800DM-PCTL)**
This board demonstrates how to interface the MCP9800 to a PIC® microcontroller using the PICkit™ 1 Flash Starter Kit as a platform. The demo board can also be used as a stand-alone module to quickly add thermal sensing capability to any existing application.

**SEEVAL® 32 Serial EEPROM Designer's Kit (DV243002)**
SEEVAL 32 is a powerful, easy-to-use tool for serial EEPROMs. The kit includes a versatile, socketed programmer/reader board and Windows-based software for reading and writing serial EEPROMs. The tool provides visual representation of the memory array on-screen, endurance cycling, and allows data files to be stored and retrieved from disk. This kit features everything necessary to quickly develop a robust and reliable serial EEPROM design and greatly reduce the time required for system integration and hardware/software debug.

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SUPPORT OF SPECIAL UNIVERSITY DEVELOPMENT AND DESIGN PROJECTS

Learning about Microchip products is not a static process. Professors and their students have produced innovative solutions and applications using PIC microcontrollers and analog products. Microchip supports numerous student and university projects. To find out more, visit the Microchip University Corner at: www.microchip.com/university.

**Robotics Competitions**

Microchip is an Official Supplier of FIRST (For Inspiration and Recognition of Science and Technology), donating microcontrollers and development tools to more than 1,200 high school teams worldwide who compete in this high-energy, high-tech robotics competition. Microchip is also the Organizing Sponsor and Leader in Technology Sponsor for the FIRST Robotics Competition (FRC) Arizona Regional. For more information about the FIRST organization, visit their web site at: www.usfirst.org.

In addition, Microchip supports the National Association of Robots Creator (ANCR) in partnership with Anger's University Institute of Technology (IUT) and their annual competition the French Robotic Cup E=M6.

**Solar Race Car Teams**

Microchip supports many of the solar race car teams for the America Solar Challenge for the Formula Sun racing events. Some of the teams using Microchip devices include:

- Kansas State University Solar Car Racing Team
- Kansas State University - Manhattan, KS
- Team PrISUm
- Iowa State University - Ames, IA
- McMaster Solar Car Project
- McMaster University - Hamilton, ON, Canada
- Wayne State Formula SAE Racing
- Wayne State University - Detroit, MI
- Team iSun
- McGill University - Montreal, Quebec, Canada
- Midnight Sun Solar Race Team
- University of Waterloo - Waterloo, ON Canada
Support

Microchip is committed to supporting its customers in developing products faster and more efficiently. We maintain a worldwide network of field applications engineers and technical support ready to provide product and system assistance. In addition, the following service areas are available at www.microchip.com:

- **Support** link provides a way to get questions answered fast.
- **Sample** link offers free evaluation samples of any Microchip device.
- **Training** link offers webinars, registration for local seminars/workshops and information on annual MASTERS events held throughout the world.

Sales Office Listing

Technical Support: http://support.microchip.com

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