



**THE DATASHEET OF  
MCP2021-500E/SN**





## Quick Guide to Microchip Development Tools



## MPLAB® X IDE, Atmel Studio and Software Tools

Microchip is proud to offer development tools for AVR® and SAM MCUs in addition to our classic development tools for PIC® MCUs and dsPIC® DSCs. Together, Microchip offers the strongest development tool chains for the industry’s most popular products. Microchip produces approximately 2,000 development tools, of which only a selection are featured in this document. For the full listing of Microchip’s development tools, please visit the online Development Tools Selector (DTS) at [www.microchip.com/dts](http://www.microchip.com/dts) or visit our application sites on [www.microchip.com](http://www.microchip.com).

### Development Tool Selector

Microchip’s development tools selector is an online/offline application that allows you to view development tools through a Graphical User Interface (GUI) with filter and search capabilities to easily find development tools associated with Microchip products. Just enter a development tool or Microchip device in the search box and DTS quickly displays all related tools and devices. Updated after every MPLAB X IDE release, DTS is available online and offline at: [www.microchip.com/dts](http://www.microchip.com/dts).

### Development Tool Ecosystem: Software

		AVR® MCU	PIC® MCU	dsPIC® DSC	SAM MCU	xEC** MCU
IDEs	MPLAB® X IDE	✓	✓	✓	✓	✓
	MPLAB Xpress	✓	✓	✓		
	Atmel Studio	✓			✓	
Compilers	MPLAB XC	✓	✓	✓	✓	✓
	AVR GCC	✓				
	Arm® GCC				✓	
Configurators	MPLAB Code Configurator	✓	✓	✓		
	MPLAB Harmony		✓*		✓	
	Atmel Start	✓			✓	

\*32-bit PIC only

\*\* xEC is the CEC/MEC families of devices

## MPLAB X IDE

MPLAB X IDE is Microchip's free integrated development environment for PIC, AVR and SAM MCUs and dsPIC DSCs. Incorporating a powerful and highly functional set of features, it allows you to easily develop applications. Based on the NetBeans IDE from Oracle, MPLAB X IDE runs on Windows®, Linux® and Mac OS X®. Its unified GUI helps to integrate software and hardware development tools from Microchip and third-party sources to give you high-performance application development and extensive debugging capabilities. MPLAB X IDE can also seamlessly import your Arduino® sketches, providing a simple transition path from makerspace to marketplace.



The flexible and customizable interface allows you to have multiple debug tools connected to your computer at the same time. You can select any tool you desire for a specific project or configuration within a project. With complete project management, visual call graphs, a configurable watch window and a feature-rich editor that includes code-completion and hyperlink navigation, MPLAB X IDE is fully equipped to meet the needs of experienced users while remaining flexible and user-friendly for even those who are new to the IDE.

MPLAB X IDE brings a host of features to help you quickly debug your projects and minimize your development time. Some newer features include:

- Data Visualizer: No need to purchase extra visualizations tools since real-time streaming data can be viewed in Data Visualizer
- I/O View: Pin states can be verified and manipulated with I/O View for fast hardware verification
- Helpful Design Resources: Save time with useful links to software libraries, datasheets and user guides that are provided automatically
- Easy to Use: Register and bit definitions are now just a click away

## MPLAB Xpress Cloud-based IDE

MPLAB Xpress Cloud-Based IDE is an online development environment that contains the most popular features of our award-winning MPLAB X IDE. This simplified and distilled application is a faithful reproduction of our desktop-based program, which allows you to easily transition between the two environments.

MPLAB Xpress is a perfect starting point for new users of PIC and AVR MCUs - no downloads, no machine configuration and no waiting to get started on your system development.

MPLAB Xpress incorporates the latest version of MPLAB Code Configurator, which enables users to automatically generate initialization and application C code for 8- and 16-bit PIC and AVR MCUs and dsPIC DSCs using a graphical interface and pin map.

With massive amounts of storage available, you can store your current projects in the Cloud. The Community feature allows you to share your ideas with others and gain inspiration from the shared code repository.

Best of all, MPLAB Xpress cloud-based IDE is free and can be accessed from any Internet-connected PC or Mac, anywhere in the world.

## Compatible Hardware

- MPLAB Xpress evaluation boards
- Curiosity development boards
- Explorer 16/32 Development Board
- MPLAB PICKit™ 4 and MPLAB Snap Programmer/Debugger

## MPLAB X IDE Plug-Ins

### MPLAB Code Configurator

MPLAB Code Configurator (MCC) is a free, graphical programming environment that generates seamless, easy-to-understand C code to be inserted into your project. Using an intuitive interface, it enables and configures a rich set of peripherals and functions specific to your application.

MPLAB Code Configurator supports 8-bit, 16-bit and PIC and AVR microcontrollers. MCC is incorporated into both the down-loadable MPLAB X IDE and the cloud-based MPLAB Xpress IDE.

- Free graphical programming environment
- Intuitive interface for quick start development
- Automated configuration of peripherals and functions
- Minimized reliance upon product datasheet
- Reduces overall design effort and time
- From novice to expert, accelerates generation of production ready code



### MPLAB Harmony Configurator

The MPLAB Harmony Configurator (MHC) is a time-saving hardware configuration utility for MPLAB Harmony, Microchip's award winning software framework for PIC32 and SAM MCUs. You can use MHC to get visual understanding and control of the configuration of their target device and application. MHC is a fully integrated tool within MPLAB X IDE.

- Generates all hardware configuration code
- Generates all middleware framework related code
- Automatically updates the active MPLAB X IDE project with all required files



### MPLAB Harmony Graphics Composer

MPLAB Harmony Graphics Composer (MHGC) is Microchips industry-leading GUI design tool for PIC32 microcontrollers. As a fully-integrated component of MHC, MHGC will accelerate your application's front end design without leaving the MPLAB X IDE.

### Integrated Programming Environment

The Integrated Programming Environment (IPE) is a software application that provides a simple interface to quickly access key programmer features. IPE provides a secure programming environment for production programming. It is bundled in the MPLAB X IDE installation package.

### motorBench® Development Suite

The motorBench Development Suite is a GUI-based software development tool for Field Oriented Control (FOC) of low-voltage motors (up to 48 volts and 10 amps), performing accurate measurement of critical motor parameters, automatic tuning of feedback control gains and generating source code for an MPLAB X project, utilizing the Motor Control Application Framework (MCAF). This graphical, interactive development environment helps motor control embedded engineers save time in starting up and running new motors with no load or a constant load, especially when the motor parameters are unknown. The motorBench Development Suite is an MPLAB X plug-in.

The user interface takes you step-by-step through the project, with context-sensitive help files at your fingertips inside the tool.

- motorbench-start-screen
- Quickly get stable PI (proportional integral) control loop gains for velocity and torque
- See how the control loop gains affect the system through Bode plots
- Generate code straight into an MPLAB X project
- Integrated help files guide through each step



## Atmel Studio 7 IDP

Atmel Studio 7 is the Integrated Development Platform (IDP) for developing and debugging all AVR and SAM microcontroller applications. The Atmel Studio 7 IDP gives you a seamless and easy-to-use environment to write, build and debug your applications written in C/C++ or assembly code. It also connects seamlessly to the debuggers, programmers and development kits that support AVR and SAM devices. AVR/Arm GNU compiler, assembler and linker are included, IDE and compiler solutions are also available from Keil and IAR.

Additionally, Studio 7 includes Gallery, an online app store that allows you to extend your development environment with plug-ins developed by Microchip as well as third-party tool and embedded software vendors. Studio 7 can also seamlessly import your Arduino® sketches as C++ projects, providing a simple transition path from makerspace to marketplace.



## Data Visualizer

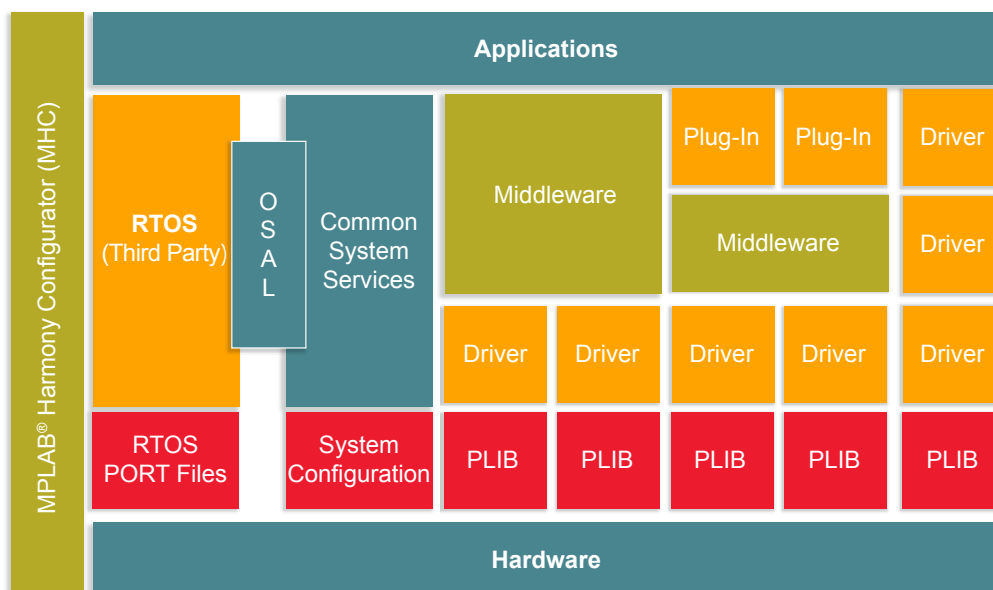
The Data Visualizer is a program to process and visualize data. The Data Visualizer is capable of receiving data from various sources such as the Embedded Debugger Data Gateway Interface (DGI) and COM ports. Track your applications run-time using a terminal graph or oscilloscope, or analyze the power consumption of your application through correlation of code execution and power consumption, when used together with a supported probe or board. Having full control of your code's run-time behavior has never been easier.

## MPLAB Harmony Software Framework

### MPLAB Harmony Software Framework for PIC32 and SAM MCUs

MPLAB Harmony is a flexible, abstracted, fully integrated firmware development environment for PIC32 and SAM microcontrollers. It enables robust framework development of interoperable RTOS-friendly libraries with quick and extensive Microchip support for third-party software integration. MPLAB Harmony includes a set of peripheral libraries, drivers and system services that are readily accessible for application development. It features the MPLAB Harmony Configurator plug-in that provides a graphical way to select and configure all MPLAB Harmony components, including middleware, system services and peripherals, with ease. Get the latest updates at [www.microchip.com/harmony](http://www.microchip.com/harmony).

## MPLAB Harmony



## Atmel START

Atmel START is an innovative online tool for intuitive, graphical configuration of embedded AVR and SAM software projects. It lets you select and configure software components, drivers and middleware, as well as complete example projects, specifically tailored to the needs of your application. The configuration stage lets you review dependencies between software components, conflicts and hardware constraints. In the case of a conflict, Atmel START will automatically suggest solutions that fit your specific setup.

# START

With graphical pin-mux and clock configuration, you can easily match your software and drivers with your own hardware layout. The tool also provides automated assistance for retargeting projects and applications for different devices. Getting that sample code to run on your board has never been easier.

Since Atmel START is an online tool, no installation is required. When you are finished with your configuration, you can download it for use together with your preferred Integrated Development Environment (IDE), including MPLAB X IDE, Atmel Studio, Keil or IAR and continue development. If you later need to change the configuration you can load it in Atmel START, reconfigure and continue where you left off.

Atmel START is based on the latest generation of the Atmel Software Framework, ASFv4. The driver layer in ASFv4 has been rearchitected for better performance and reduced code size. Care has been taken to make sure that code generated by Atmel START is readable, as well as easy to navigate and extend. Please refer to the user guide to learn more about what's new in ASFv4.

You can download and securely purchase both Microchip and third-party compilers, advanced debugging tools, real-time operating systems, communication systems and other extensions and plug-ins straight from the Atmel Studio 7 development platform.

## MPLAB Mindi™ Analog Simulator

MPLAB Mindi Analog Simulator reduces circuit design time and design risk by simulating analog circuits prior to hardware prototyping. The simulation tool uses a SIMetrix/SIMPLIS simulation environment, with options to use SPICE or piecewise linear modeling, that can cover a very wide set of possible simulation needs. This capable simulation interface is paired with proprietary model files from Microchip, to model specific Microchip analog components in addition to generic circuit devices. Finally, this simulation tool installs and runs locally, on the your own PC. Once downloaded, no internet connection is required, and the simulation run time is not dependent on a remotely located server. The result is fast, accurate analog circuit simulations. Benefits include:

- Run the simulation tool directly on your own PC; once installed no internet connection is required
- Choose from SPICE or piecewise linear SIMPLIS models, for accurate results in fast simulations
- Model a wide variety of analog systems using standard or Microchip proprietary component models
- Generate time or frequency domain responses for open and closed loop systems
- Perform AC, DC and transient analysis
- Use sweep modes to identify circuit sensitivities to device behaviors, load variations, or tolerances
- Validate system response, control and stability
- Identify problems before building hardware





## MPLAB XC Compilers

Microchip's line of award-winning MPLAB XC Compilers provides a comprehensive solution for your project's software development and is offered in free, unrestricted-use downloads. Finding the right compiler to support your device is simple:

- MPLAB XC8 supports all 8-bit PIC and AVR MCUs
- MPLAB XC16 supports all 16-bit PIC and SAM MCUs and dsPIC DSCs
- MPLAB XC32/32++ supports all 32-bit PIC MCUs

## Features

When combined with Microchip's award-winning, free integrated development environment, MPLAB X IDE, the full graphical front end provides:

- Editing errors and breakpoints that match corresponding lines in the source code
- Single stepping through C and C++ source code to inspect variables and structures at critical points
- Data structures with defined data types, including floating point, display in watch windows

## MPLAB XC Licenses for Functional Safety



Microchip offers TÜV SÜD certified functional safety compiler packages that support all our PIC, dsPIC, AVR and SAM products to make your tool qualification effort easier. The packages include all the documentation, reports and certificates for a fully qualified development environment for the following functional safety standards:

- ISO 26262
- IEC 61508
- IEC 62304

## MPLAB XC Compiler Licenses

Need to optimize your code size reduction or get better speed from your project's software? PRO licenses are available to unlock the full potential of the MPLAB XC compiler's advanced-level optimizations, maximum code size reductions and best performance. The MPLAB XC Compiler contains a free, 60-day trial of a PRO license for evaluation when activated.

MPLAB XC Compiler licenses come in a wide variety of licensing options and most come with one year of High Priority Access (HPA). HPA must be renewed at the end of twelve months. HPA includes:

- Unlimited advanced optimizations on new compiler versions
- New architecture support
- Bug fixes
- Priority technical support
- Free shipping on all development tool orders from [www.microchip.com/purchase](http://www.microchip.com/purchase)

License Type	Installs On	# of Activations	# of Users	Wait Time Between Users	HPA Included
Workstation License	Workstation	3	1	None	Yes
Subscription License	Workstation	1	1	None	No
Site License	Network	1	Varies by Seat	None	Yes
Network Server License	Network	1	Unlimited	One Hour	Yes
Virtual Machine*	Network	1	N/A	N/A	No
Dongle License	Dongle	N/A	Unlimited	None	No

\*This license must be used in addition to a network server or site license to enable the license to work in a virtual machine environment.

### MPLAB Code Coverage



MPLAB Code Coverage is an easy way to measure code coverage; it runs untethered and self-contained so no need to add clumsy cabling or fragile wires and as minimal impact on code size and execution speed. Fully integrated into MPLAB X IDE, the tool seamlessly integrates into the developer's project.

MPLAB Code Coverage is a license that works in tandem with any MPLAB XC C compiler, either with an MPLAB XC PRO license or not. With an MPLAB Code Coverage license, code coverage percentage, analytical and navigational tools, dashboards, summaries and reports are provided inside MPLAB X IDE.

### Microchip Library of Applications

The Microchip Libraries for Applications (MLA) enhances interoperability for applications that require more than one library for 8-16-bit PIC MCUs. Available software libraries include USB, graphics, file I/O, crypto, Smart Card, MiWi™ protocol, TCP/IP Wi-Fi® and smartphone. The package includes source code, drivers, demos, documentation and utilities. All projects are prebuilt for MPLAB X IDE and respective XC compiler.

### ClockWorks® Configurator

ClockWorks Configurator is an online tool enabling you to create designs/configurations and request data sheets, part numbers and samples for those designs. The user interface is graphical and easy to use, and dynamic data sheets and block diagrams are generated instantly for all of your designs. At each phase email notifications are sent out to all involved parties to keep you up-to-date with the status of your request. ClockWorks Configurator has different views and level of accessibilities based on the user roles.

### Third-Party Tools

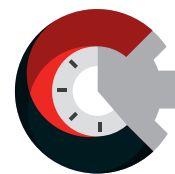
Microchip's third-party tools and providers offer a diverse range of embedded-design development boards and software that complement the development tools we develop in house. Over 300 Microchip third-party recognized providers and premier partners provide development tools for almost

every embedded application. Premier third-party partners in particular areas are certified by our engineers to be the best in the industry providing not only a large array of software and hardware tools but superior support for the products as well.

### Academic Program

Microchip's Academic Program demonstrates our on-going commitment to education by offering unique benefits and resources for educators, researchers and students worldwide. We are a resource for Academia to help integrate Microchip products and technologies into the classroom. Benefits include:

- Free access to labs, curriculum and course materials
- Silicon donations to help seed labs
- One-on-one consultations
- Tool samples for professors to evaluate
- 25% academic discount on many Microchip and third-party tools
- Free training on Microchip products and technologies
- Discounts when attending Microchip's MASTERS Conference



**ClockWorks®**  
**CONFIGURATOR**

# In-Circuit Emulators and Debuggers

## In-Circuit Emulators and Debuggers

Microchip offers a range of programmers, emulators, debugger/programmers and extensions to support all device architectures and more are on the way. All solutions are USB-powered and fully integrated into their respective IDE. MPLAB ICD 4 offers debugging and hardware features sufficient for most users. MPLAB Snap, MPLAB PICkit 4 Debugger/Programmer, Atmel ICE, J-32 Debug Probe and Power Debugger are economical choices for basic debugging functions. MPLAB ICD 4 and MPLAB PICkit 4 can be used as programmers in a production environment.

### MPLAB ICD 4 In-Circuit Debugger (DV164045)



The MPLAB ICD 4 In-Circuit Debugger/Programmer is Microchip's fastest, cost-effective debugging and programming tool for PIC and SAM MCUs and dsPIC DSCs. This speed is provided by a 300 MHz, 32-bit MCU with 2 MB of RAM and a high-speed FPGA to yield faster communications, downloads and debugging. It debugs and programs with the powerful, yet easy-to-use graphical user interface of MPLAB X IDE. The MPLAB ICD 4 is connected to your PC using a hi-speed USB 2.0 interface and is connected to the target with a debugging connector which is also compatible with the MPLAB ICD 3 or MPLAB REAL ICE™ In-Circuit Emulator systems.

### MPLAB PICkit 4 In-Circuit Debugger (PG164140)

With support for PIC, AVR and SAM MCUs and dsPIC signal processors, it features the same 300 MHz, 32-bit MCU as the ICD 4, hi-speed USB 2.0 and matches the silicon clocking speed to program as fast as the device will allow. Its wide target voltage supports a variety of devices along with several debug protocols. It includes a micro SD card slot to support Programmer-To-Go functionality.



### MPLAB Snap In-Circuit Debugger (PG164100)



The MPLAB Snap In-Circuit Debugger/Programmer allows affordable, fast and easy debugging and programming of PIC, AVR and SAM MCUs and dsPIC signal processors. using the powerful graphical user interface of MPLAB X Integrated Development Environment (IDE) version 5.05 or later. It also features a 300 MHz, 32-bit MCU as MPLAB ICD 4 and hi-speed USB 2.0.

### Atmel ICE (ATATMEL-ICE)

Atmel ICE is a powerful development tool for debugging and programming Arm® Cortex®-M based SAM and AVR microcontrollers with on-chip debug capability. Atmel ICE supports:

- Programming and on-chip debugging of all 32-bit AVR MCUs on both JTAG and aWire interfaces
- Programming and on-chip debugging of all AVR XMEGA devices on both JTAG and PDI 2-wire interfaces
- JTAG and SPI programming and debugging of all 8-bit AVR MCUs with OCD support on either JTAG or debugWIRE interfaces
- Programming and debugging of all SAM Arm Cortex-M based MCUs on both SWD and JTAG interfaces
- Programming of all 8-bit tinyAVR® MCUs with support for the TPI interface



### Power Debugger (ATPOWERDEBUGGER)

Power Debugger is a powerful development tool for debugging and programming AVR microcontrollers using UPDI, JTAG, PDI, debugWIRE, aWire, TPI or SPI target interfaces and Arm Cortex-M based SAM microcontrollers using JTAG or SWD target interfaces. The Power Debugger streams power measurements and application debug data to Data Visualizer for real-time analysis.

## J-32 Debug Probe



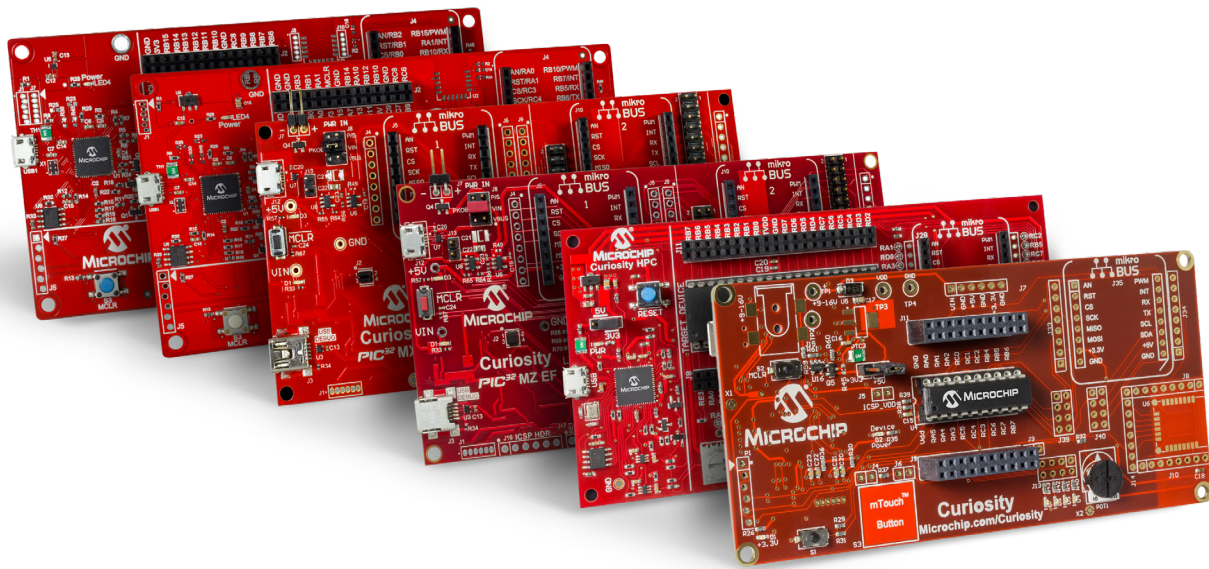
J-32 Debug Probe is a JTAG emulator that supports all of Microchip's 32-bit MCU and MPU offerings, including Thumb mode. It supports download speeds up to 480 Mbit/s and maximum JTAG speeds up to 15 MHz. It also supports Serial Debug Wire (SWD), Microchip's In-Circuit Serial Programming (ICSP) and ETB Trace.

## In-Circuit Emulators and Debuggers

Feature	MPLAB® ICD 4	MPLAB PICKIT™ 4	MPLAB Snap	Atmel ICE	J-32 Debug Probe	Power Debugger
Products Supported	PIC®, SAM MCU, dsPIC® DSC*	PIC, AVR, SAM MCU, dsPIC DSC	PIC, AVR, SAM MCU, dsPIC DSC*	AVR MCU, SAM MCU	32-bit PIC, SAM MCU, SAM MPU	AVR MCU, SAM MCU
IDE Supported	MPLAB X IDE	MPLAB X IDE	MPLAB X IDE	Studio	MPLAB X IDE	Studio
USB 2.0 Speed	High	High	High	High	High	High
USB Driver	Microchip	Microchip	Microchip	HID + Microchip	Segger	HID + Microchip
USB Powered	Yes	Yes	Yes	Yes	Yes	Yes
Programmable Vpp	Yes	Yes	No	No	No	No
Power to Target	Yes - 1A	Yes - 50 mA	No	No	No	No
Programmable Vdd	Yes	Yes	No	No	Yes	No
Vdd Drain from Target	< 1 mA	< 1 mA	< 1 mA	< 1 mA	< 25 mA	< 1 mA
Over Voltage/Current Protection	Yes, HW	Yes, SW	OV only	Yes, HW	Yes	Yes, HW
Breakpoints	Complex	Simple	Simple	Target Dependent	Yes	Target Dependent
Software Breakpoints	Yes	Yes	Yes	Yes	Yes	Yes
Memory for target image storage	No	Micro SD Card	No	No	No	No
Serialized USB	Yes	Yes	Yes	Yes	Yes	Yes
Trace, Native	No	No	No	Coresight, SWO	Coresight, SWO	Coresight, SWO
Trace, Other (SPI, PORT, Inst)	No	No	No	SPI, UART	No	SPI, UART, I²C, USART
Data Capture	No	No	No	No	Target Dependent	No
Logic/Probe Triggers	No	No	No	No	No	4 Channels
High-Speed Performance PAK (LVDS)	No	No	No	No	No	No
Production Programmer	Yes	Yes	No	No	Yes	No
Power Measurement/Profiling	No	No	No	No	No	2 Channels
Part Number	DV164045	PG164140	PG164100	ATATMEL-ICE	DV164232	ATPOWERDEBUGGER
MSRP	\$249.99	\$47.95	\$14.95	\$130.00	\$190.00	\$190.00

\*Full device support in progress. Please review documentation for complete list of supported devices.

# Curiosity Development Boards



## Curiosity Development Boards

### Internet of Things Ready

Have an Internet of Things (IoT) design idea? Curiosity development boards can make it real. A full complement of accessory boards is available via the MikroElektronika MikroBUS™. Out of the box, the development board offers several options for user interface.

#### PIC32MM USB Curiosity Development Board (DM320107)

- PIC32MM0256GPM064 featuring USB 2.0 OTG and DMA
- Ideal prototyping board for USB, high resolution audio, Bluetooth Audio, BTLE and other general-purpose applications

#### PIC16F18446 Curiosity Nano Evaluation Kit (DM164144)

- With full program and debug capabilities, the PIC16F18446 Curiosity Nano evaluation kit offers complete support for your next design.

#### dsPIC33CH Curiosity Development Board

- The dsPIC33CH Curiosity Development Board (DM330028-2) is intended as a cost effective development and demonstration platform for the entire dsPIC33CH family of dual core high performance digital signal controllers.

#### Curiosity PIC32MZEF Development Board (DM320104)

- PIC32MZ2048EFM with integrated FPU, crypto accelerator
- Supports PIC32 Audio Codec Daughter Card - AK4642EN (AC320100)

#### Curiosity PIC32MX470 Development Board (DM320103)

- PIC32MX470512H with full-speed USB
- Excellent development board for audio, USB and Bluetooth applications

#### PIC32MM Curiosity Development Board (DM320101)

- PIC32MM0064GPL036 featuring eXtreme Low Power (XLP) technology
- Ideal for developing battery-operated applications, portable medical monitoring devices and IoT sensor nodes

#### dsPIC33CK Curiosity Development Board

- The dsPIC33CK Curiosity Development Board (DM330030) is a cost-effective development and demonstration platform for the dsPIC33CK family of single-core high performance digital signal controllers.

## Xplained Boards

Xplained is a fast prototyping and evaluation platform for AVR and Arm-based MCUs. These low-cost, easy-to-use evaluation kits are ideal for demonstrating the features and capabilities of MCUs and MPUs and can be customized with a wide range of expansion boards. Development is easy with a rich selection of example projects and code drivers provided in the Advanced Software Framework (ASF), as well as support in Atmel Studio and from third-party IDEs. Choose from three types of Xplained kits: A few examples of Xplained development boards are shown, many more available on [www.microchip.com](http://www.microchip.com).

### **ATtiny817 Xplained Pro (ATTINY817-XPRO)**

The ATtiny817 Xplained Pro Evaluation Kit is a hardware platform for evaluating the latest tinyAVR microcontrollers. The evaluation kit comes with a fully integrated debugger that provides seamless integration with Atmel Studio.

### **ATmega328PB Xplained Mini (ATMEGA328PB-XMINI)**

The ATmega328PB Xplained Mini Evaluation Kit is a hardware platform for evaluating the ATmega328PB MCU. The evaluation kit comes with a fully integrated debugger that provides seamless integration with Atmel Studio.

### **ATtiny104 Xplained Nano Evaluation Kit (ATTINY104-XNANO)**

The ATtiny104 Xplained Nano Evaluation Kit is a hardware platform for evaluating ATtiny102/ATtiny104 microcontrollers. Supported by Atmel Studio free integrated development platform, the kit provides easy access to all device I/O, one button and one LED. The Xplained Nano Evaluation Kit includes an on-board programmer.

### **ATtiny817 Xplained Mini (ATTINY817-XMINI)**

The ATtiny817 Xplained Mini Evaluation Kit is a hardware platform for evaluating ATtiny817, ATtiny816, ATtiny814 and ATtiny417 microcontrollers. The evaluation kit comes with a fully integrated debugger that provides seamless integration with Atmel Studio.

### **SAML10 Xplained Pro Evaluation Kit (DM320204)**

The SAM L10 Xplained Pro evaluation kit is ideal for evaluating and prototyping with the ultra low power SAML10 Arm® Cortex®-M23 based microcontrollers. The SAM L10 MCU features general purpose embedded control capabilities with enhanced peripheral touch controller and advanced analog.

The kit is supported by various demo examples which includes water tolerant touch, keypad touch, low power weather station and SleepWalking demos.

### **SAML11 Xplained Pro Evaluation Kit (DM320205)**

The SAML11 Xplained Pro evaluation kit is ideal for evaluating and prototyping with the ultra low power SAML11 Arm Cortex-M23 based microcontrollers integrating robust security which includes Arm TrustZone®, secure boot, crypto acceleration, secure key storage and chip-level tamper detection. In addition to security the SAM L11 MCU features general purpose embedded control capabilities with enhanced peripheral touch controller and advanced analog.

The kit is supported by demo examples which includes trusted execution environment, secure LoRa IoT node and Amazon Web Services (AWS) & Google cloud enrollment using Trustonic Kinibi-M.

## Expansion Boards for Xplained Pro

Expansion boards are available for Xplained Pro development board to easily add radio, touch, display and many other functions to the development platform. These expansions are tightly integrated into the Studio 7 development environment and software libraries are available in Microchip's Advanced Software Framework (ASF).

### **ATWINC1500-XSTK Xplained Pro Starter Kit (ATWINC1500-XSTK)**

The ATWINC1500-XSTK Xplained Pro Starter Kit is a hardware platform for evaluating the ATWINC1500 low-cost, low-power 802.11 b/g/n Wi-Fi network controller module.

### **BNO055 Xplained Pro Extension Kit (ATBNO055-XPRO)**

BNO055 Xplained Pro is an extension with the Bosch BNO055 intelligent 9-axis absolute orientation sensor and a RGB LED. It connects to the extension headers of any Xplained Pro Evaluation Kit.

### **Ethernet1 Xplained Pro Extension Kit (ATETHERNET1-XPRO)**

Ethernet1 Xplained Pro is an extension board in the Xplained Pro Evaluation Platform. The board enables you to experiment with Ethernet network connectivity applications.

### **I/O1 Xplained Pro Extension Kit (ATIO1-XPRO)**

I/O1 Xplained Pro provides a light sensor, temperature sensor and microSD card. It connects to the extension headers of any Xplained Pro evaluation kit.

### **OLED1 Xplained Pro Extension Kit (ATOLED1-XPRO)**

OLED1 Xplained Pro is an extension kit with a 128 x 32 OLED display, three LEDs and three push buttons. It connects to the extension headers of any Xplained Pro evaluation kit.

### **PROTO1 Xplained Pro Extension Kit (ATPROTO1-XPRO)**

PROTO1 Xplained Pro provides easy prototyping on the Xplained Pro platform. It connects to the extension headers of any Xplained Pro evaluation kit and can be used as a gateway to other Xplained Pro extension boards with its own Xplained Pro extension header.

### **RS485 Xplained Pro Extension Evaluation Kit (ATRS485-XPRO)**

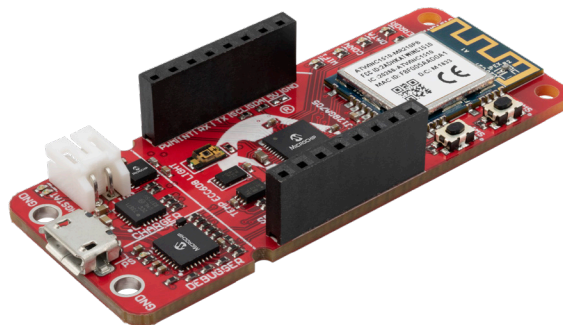
The RS485 Xplained Pro extension evaluation kit is ideal for evaluation and prototyping applications involving RS485/422 features of the SAMC21 Cortex-M0+ processor-based microcontrollers.

### **mikroBUS Xplained Pro (ATMBUSADAPTER-XPRO)**

The mikroBUS Xplained Pro is an extension Board in the Xplained Pro evaluation platform. It is designed to demonstrate mikroBUS click boards™ with Xplained Pro MCU boards.

## Starter Kits

Starter kits are complete, affordable, turnkey solutions consisting of the hardware and software sufficient for exploring specific applications or the features of the device family they represent. Most kits include an on-board or separate debugger and tutorials. To get started, simply install and start MPLAB X IDE, connect the hardware and step through the easy-to-follow tutorials.



### PIC-IoT WG Development Board (AC164164)

The PIC-IoT WG Development Board combines a powerful PIC24FJ128GA705 MCU, an ATECC608A CryptoAuthentication™ secure element IC and the fully-certified ATWINC1510 Wi-Fi network controller - which provides the most simple and effective way to connect your embedded application to the Google Cloud IoT Core. The board also includes an on-board debugger, and requires no external hardware to program and debug the MCU.

### MPLAB Xpress Evaluation Boards

The centerpiece of the MPLAB Xpress evaluation board is the PIC16 MCU; an 8-bit device with the unique combination of low-power consumption, performance to handle almost any application task and on-chip peripherals that enable you to control your system with a minimal amount of code. Peripherals can be set up graphically using the MPLAB Code Configurator plug-in, saving you weeks of development time. It features MikroElektronika Click expansion, drag-and-drop programming and seamless integration into MPLAB Xpress cloud-based IDE.

- PIC16F18345 (DM164141)
- PIC16F18855 (DM164140)
- PIC16F18877 (DM164142)

### Explorer 8 Development Kit (DM160228)

The Explorer 8 Development Kit is a full-featured development board and platform for 8-bit PIC microcontrollers. This kit is a versatile development solution, featuring several options for external sensors, off-board communication and human interface.

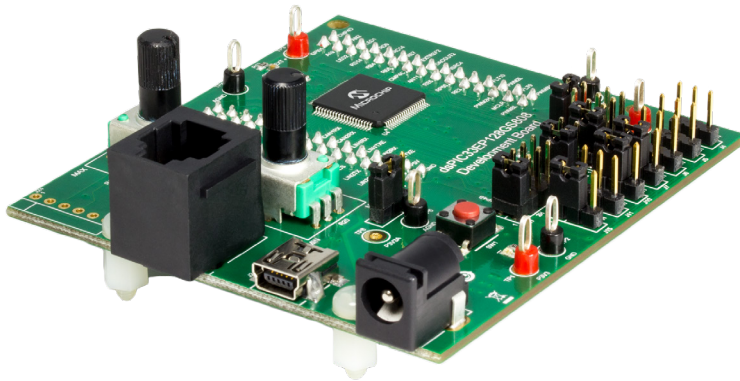
### Explorer 16/32 Development Board/Kit

- DM240001-2 (stand-alone board)
- DM240001-3 (board with PIMs and cables)

The Explorer 16/32 Development Board is a modular development system supporting PIC24, dsPIC33 and PIC32 devices. The board comes with several new features including an integrated programmer/debugger, on-board USB communication and USB-to-serial communication bridge. The board's wide ecosystem includes mikroBUS, Pmod and PICtail™ Plus interfaces that support click boards, Pmod boards and PICtail Plus daughter cards.

### PICDEM Lab II Development Platform (DM163046)

The PICDEM™ Lab II Development Platform is a development and teaching platform for use with 8-bit PIC MCUs. At its center, a large prototyping breadboard enables you to easily experiment with different values and configurations of analog components for system optimization. Several external connectors allow for user-customizable expansion, while our library of labs and application notes enrich the development experience.



## **dsPIC33EP128GS808 Development Board (DM330026)**

The dsPIC33EP128GS808 Development Board consists of an 80-pin microcontroller for operating on a standalone basis or interfacing with CAN/LIN/J2602 PICtail (Plus) Daughter Board. In the standalone mode, the board can be used for verifying the peripheral functionality. The board contains single order RC filters to emulate power supply functionality in open or closed loop mode along with ADC and PWM peripherals.

## **Intelligent Analog PIC24 Starter Kit (DM240015)**

This starter kit features the PIC24FJ128GC010 family with advanced integrated analog peripherals. The board includes an analog header, allowing clean signals to be accessed for easy prototyping. The board also includes sensors for light, touch and temperature as well as USB, potentiometer, microphone and headphone interface. Comprehensive demos are included as well as integrated programmer and debugger.

## **PIC32MZ Embedded Connectivity with Floating Point Unit (EF) Starter Kit (DM320007)**

The PIC32MZ Embedded Connectivity with Floating Point Unit (FPU) (EF) Family Starter Kit (DM320007 for non-crypto development or DM320007-C for crypto development) provides a low-cost method for the development and testing of USB and Ethernet-based applications with PIC32MZ EF family devices.

## **PIC32MK GP Development Kit (DM320106)**

The PIC32MK GP Development Kit offers a low-cost solution for those looking to build projects with the PIC32MK series of devices, featuring a rich assortment of CAN, USB, ADC and GPIO type inputs. This board also includes a Soloman System SSD1963 graphics driver and 30-pin connector to enable graphics applications with available LCD panels.

## **PIC32MX274 XLP Starter Kit (DM320105)**

The PIC32MX XLP Starter Kit is a fully integrated 32-bit development platform featuring the high-performance PIC32MX274 series MIPS MCU. The kit includes an integrated programmer/debugger, and is fully integrated with Microchip's MPLAB X IDE. Additionally, the starter kit sports BTLE connectivity, a 9-axis accelerometer, light sensor and barometric sensor enabling different IoT data logging applications. Boards are fully integrated into PIC32's powerful software framework, MPLAB Harmony.

## **Multimedia Expansion Board II (DM320005-5)**

This board is a highly integrated, compact and flexible development platform. Integrates with the PIC32MZ Starter Kits for a complete graphics development solution. The MEB-II kit features a 4.3" WQVGA maXTouch® display daughter board.

## Bluetooth

### **BM70 Bluetooth PICtail/PICtail Plus Board (BM-70-PICTAIL)**

This board is designed to emulate the function of Microchip's BM70 BLE module, allowing you to evaluate the capabilities of the device. The board includes an integrated configuration and programming interface for plug-and-play capability. The development kit includes the BM70BLES1FC2 module and the BM70BLES1FC2 carrier board.

### **RN4870 Bluetooth Low Energy PICtail/PICtail Plus Daughter Board (RN-4870-SNSR)**

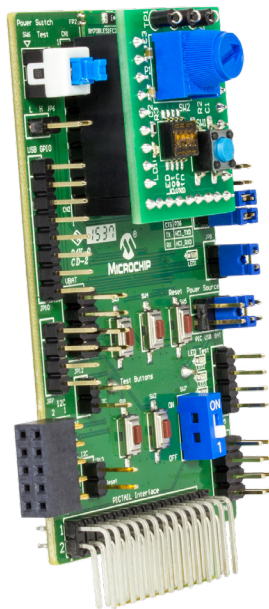
This board is based on the ultra-compact Bluetooth 4.2 Low Energy RN4870 module. The RN4870 uses a simple ASCII command interface over the UART. The board enables evaluation of the RN4870 and development of Bluetooth low Energy applications.

### **SAMB11 Xplained Pro Evaluation Kit (ATSAMB11-XPRO)**

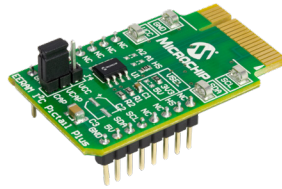
This kit is a hardware platform to evaluate the ATSAMB11-MR510CA module for a complete Bluetooth Low Energy application on an Arm Cortex-M0 based MCU. The ATSAMB11-MR510CA module is based on Microchip's industry leading lowest-power Bluetooth Low Energy 4.1-compliant SoC, ATSAMB11.

### **PIC32 Bluetooth Audio Development Kit (DV320032)**

The PIC32 Bluetooth Audio Development Kit with PIC32MX470F512L on board offers an excellent means for designing and developing a low-cost Bluetooth audio system. The features include Bluetooth audio streaming with low-cost HCI radio module, compatibility with Bluetooth-enabled smartphones and portable music players, USB memory stick support, 2 inch color LCD display, high-quality 24-bit and 192 kHz audio conversion for line or headphones.



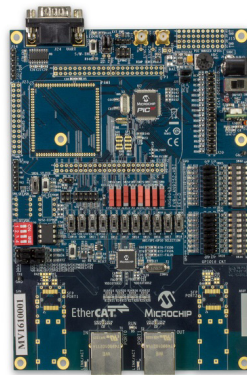
# Application-Specific Development Tools



## EERAM

### EERAM I<sup>2</sup>C PICtail Kit (AC500100)

This kit is a package of two I<sup>2</sup>C serial EERAM (4 KB [47C04], 16 KB [47C16]) PICtail boards. This kit supports PICtail Plus and mikroBUS connections and operates with the Explorer 8 Development Board, the Explorer 16/32 Development Board and many other tools.



## Ethernet

### KSZ9897 Switch Evaluation Board with LAN7801 and KSZ9031 (EVB-KSZ9897)

This board features a completely integrated triple speed (10Base-T/100-Base-TX/1000Base-T) Ethernet switch with seven ports. The board has six physical ports and one USB-to-Ethernet port. The board also features the LAN7800 USB-to-Ethernet bridge and KSZ9031 Gigabit PHY.

### KSZ9477 Managed Switch Evaluation Board with SAMA5D36 MPU (EVB-KSZ9477)

This board features a completely integrated triple speed (10Base-T/100-Base-TX/1000Base-T) Ethernet switch with five ports and one SFP port. The Arm-based SAMA5D3 host processor implements advanced switch management features such as IEEE 1588 v2, AVB and authentication while being reprogrammable.

### LAN9252 EtherCAT<sup>®</sup> Slave Controller Evaluation Kit with HBI PDI Interface (EVB-LAN9252-HBIPLUS)

This board is a standalone platform to develop an EtherCAT slave device with PIC32 or other SoCs/MCUs/MPUs with more advanced features over the standard HBI board.

### KSZ8851SNL Evaluation Board (KSZ8851SNL-EVAL)

This board is for the evaluation of this single-port Ethernet controller. With a 32-pin QFN (5 × 5 mm) package, it is ideal for applications requiring SPI and provides a basic software driver and configuration utility.

### LAN7800LC Evaluation Board (EVB-LAN7800LC)

With a ultra-low cost BOM, this evaluation board integrates the USB Type-C™ connector to implement a high-speed data transfer to Gigabit Ethernet with on-board RJ45 connector. Software drivers for Windows, OS X and Linux operating systems are available.



### **Ethernet PICtail Plus Daughter Board (AC164123)**

Designed for flexibility while evaluating and developing Ethernet control applications, this board can be plugged into Microchip's Explorer 16 Development Board (DM240001) and can be used with the Microchip TCP/IP stack to connect with any Microchip 16-bit MCU.

### **Fast 100 Mbps Ethernet PICtail Plus Daughter Board (AC164132)**

This board is populated with a 64-pin ENC624J600 Ethernet controller and interfaces to the RJ-45 connector. It can be plugged into the Explorer 16 Development Board (DM240001) and the PIC18 Explorer Board (DM183032) allowing connection to any of our 8-, 16- and 32-bit products.

### **PICDEM.net™ 2 Development Board (DM163024)**

This Internet/Ethernet development board supports both the ENC28J60 Ethernet controller and the single-chip Ethernet PIC18F97J60 MCU. Using this board with our free TCP/IP stack, you can develop a web server to demonstrate the ability to remotely monitor and control embedded applications over the Internet.

### **PIC32 Ethernet Starter Kit II (DM320004-2)**

This kit provides the easiest and lowest-cost method to experience 10/100 Ethernet development with PIC32 microcontrollers. It combines LAN8720A and Microchip's free TCP/IP software.

### **LAN8720A PHY Daughter Board (AC320004-3)**

Populated with a high-performance, small-footprint, low-power 10Base-T/100Base-TX Ethernet LAN8720A PHY, this board is designed for easy development of RMI Ethernet control applications when plugged into the PIC32-compatible starter kits.

### **LAN9303 PHY Switch Daughter Board (AC320004-4)**

Used with the PIC32 Ethernet Starter Kit II, this board provides an easy and low-cost way to implement 10/100 Ethernet switching. Combined with Microchip's free TCP/IP software, this kit gets your project running quickly.

## **Graphics and LCD**

### **LCD Explorer XLP Development Board (DM240314)**

This development board supports 100-pin PIC MCUs with eight common segmented LCD drivers. It ships with the PIC24FJ128GA310 and other families can be evaluated with different processor PIMs. In addition to the display, the board includes a PICtail Plus connector for daughter cards. It can be powered from USB, battery or 9V power supply and includes V<sub>BAT</sub> battery back-up.

### **PIC24FJ256DA210 Development Board (DM240312)**

This graphics development board is for developing colorful graphics displays with the PIC24FJ256DA210 family. The board includes touch pads, USB and a PICtail Plus connector for daughter cards. Match this board with your desired display size and it easily connects to the 3.2" Truly TFT Display (AC164127-4), 4.3" Powertip TFT Display (AC164127-6) or Display Prototype Board (AC164139).

## LoRa

### 915 MHz RN2903 LoRa Technology Mote (DM164139)

The RN2903 LoRa Mote is a LoRaWAN™ Class A end-device based on the RN2903 LoRa modem. As a standalone battery-powered node, the Mote provides a convenient platform to quickly demonstrate the long-range capabilities of the modem, as well as to verify inter-operability when connecting to LoRaWAN v1.0 compliant gateways and infrastructure.

### LoRa Technology Evaluation Kit (DV164140-2)

The LoRa Network Evaluation Kit makes it easy for you to test LoRa technology, range and data rate. The full-featured gateway board includes an LCD screen, SD Card for configuring data, Ethernet connection, 915 MHz antenna and full-band capture radios. The Gateway Evaluation Kit also includes two RN2903 Mote boards (DM164139).

## Long-Range Wide-Area Network (LoRaWAN)

### 868 MHz RN2483 LoRa Technology Mote (DM164138)

The RN2483 LoRa Motes are LoRaWAN Class A end-devices based on the RN2483 LoRa modem. It is ideal for IoT applications in remote locations. As a standalone battery-powered node, the mote provides a convenient platform to quickly demonstrate the long-range capabilities of the modem, as well as to verify inter-operability when connecting to LoRaWAN v1.0 compliant gateways and infrastructure.

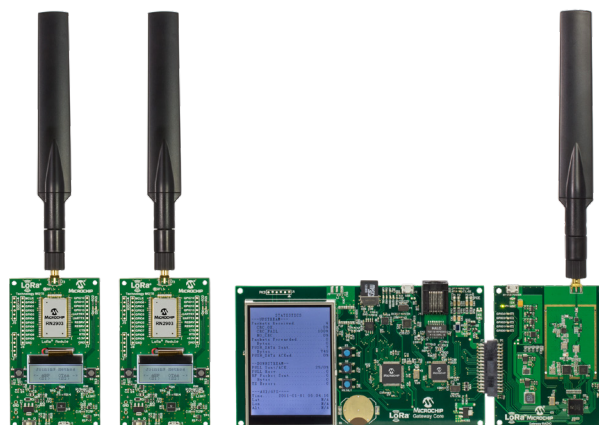
### RN2483/RN2903 LoRa Technology PICtail/PICtail Plus Daughter Board (RN-2483-PICTAIL for EU, RN-2903-PICTAIL for US)

The RN2483 and RN2903 LoRa Technology PICtail/PICtail Plus Daughter Boards are development boards that showcase the Microchip RN2483/2903 Low-Power, Long-Range LoRa Technology Transceiver Module. Development of a LoRa system with these modules connected to Microchip's PIC MCU line is possible on the PIC18 Explorer Boards via the 28-pin PICtail connector, or on the Explorer 16 Boards using the 30-pin card edge PICtail Plus connector.

## MiWi Wireless Networking Protocol

### MiWi Protocol Demo Kit – 2.4 GHz MRF24J40 (DM182016-1)

The MiWi Protocol Demo Kit – 2.4 GHz MRF24J40 is an easy-to-use evaluation and development platform for IEEE 802.15.4 applications. You can develop/debug and demo application code all on the same platform. The kit includes all hardware needed to rapidly prototype wireless applications, and is pre-programmed with the MiWi Mesh protocol stack.



## Motor Control and Power Conversion

### Digital Power Starter Kit (DM330017-2)

This kit uses the dsPIC33EP64GS502 DSC to implement a buck converter and a boost converter. The board has an LCD for showing voltage, current, temperature/fault conditions and an integrated programmer/debugger, all powered by the included 9V power supply.

### Motor Control Starter Kit (DM330015)

This board includes a small 3-phase BLDC motor driven by dsPIC33FJ16MC102 motor control device and integrated programmer and debugger, powered by 9V power supply.

### dsPICDEM™ MCHV-2/3 Development System (DM330023-2/DM330023-3)

This high-voltage development system is targeted to control BLDC motors, PMSM and AC Induction Motors (ACIM) in sensor or sensorless operation. The rated continuous output current from the inverter is 6.5 A (RMS), allows up to approximately 2 kVA output when running from a 208V to 230V single-phase input voltage. The MCHV-3 adds support for Power Factor Correction (PFC) with a maximum output of 1 kW at 400V.

### Low-Voltage Motor Control Development Bundle (DV330100)

Evaluate and develop dual/single motor controls to drive BLDC motors or PMSMs concurrently or one of each. The dsPIC DSC Signal Board supports both 3.3V and 5V operated devices for various applications and frequently used human interface features along with the communication ports. The Motor Control 10–24V Driver Board (Dual/Single) supports currents up to 10A.

### Buck/Boost Converter PICtail Plus Card (AC164133)

This is a development platform for dsPIC SMPS and digital power conversion GS family of digital signal controllers. It consists of two independent DC/DC synchronous buck converters and one independent DC/DC boost converter. The board operates from an input supply of +9V to +15V DC and can be controlled either by interfacing to the 28-pin Starter Development board or to Explorer 16/32 Development Board.

## Power over Ethernet (PoE)

### PIC18 PoE Development Kit (DV161001)

Consisting of a PIC18 PoE Main Board, PoE Programmer Adapter and I/O Starter Extension, the PIC18 PoE Development Kit provides everything you need to begin developing within the Ethernet of Everything (EoE) environment. Customization and experimentation are simplified via an extension header that is mikroBUS compatible on the PIC18 PoE Main Board allowing for various sensors, controllers and drivers to be easily incorporated into your application.

## Real-Time Clock/Calendar (RTCC)

### MCP79410 RTCC PICtail Plus Daughter Board (AC164140)

This board demonstrates the MCP7941X and MCP7940X I<sup>2</sup>C Real-Time Clock/Calendar (RTCC) family. It uses the PICtail Plus, PICtail and PICkit serial connector and operates with the Explorer 16 Development Board, the PICDEM PIC18 Explorer Board, the XLP 16-bit Development Board and the PICkit Serial Analyzer tool.

### MCP795XX PICtail Plus Daughter Board (AC164147)

This board shows the MCP795XX SPI RTCC family functions. It includes the 14-pin MCP795W2X and MCP795W1X devices and both PICtail and PICtail Plus connectors. Operating with the Explorer 16 Development Board and the PICDEM PIC18 Explorer Board, the board hosts a coin cell for RTCC backup.

## Security

### **AT88CK101 Development Kit (AT88CK101SK-MAH-XPRO)**

A development tool for applications that protect confidential files, encrypt downloads, perform two-factor logons, authenticate products and prevent software piracy. The starter kit includes an AVR baseboard (ATMicrobase) with a USB interface that lets you learn and experiment on your PC. The CryptoAuthentication Evaluation Studio (ACES), which can be used with this kit includes a configuration environment that allows the ability to configure, demonstrate, and personalize the CryptoAuthentication device.

## Serial EEPROM

### **MPLAB Starter Kit for Serial Memory Products (DV243003)**

This kit includes everything necessary to quickly develop a robust and reliable Serial EEPROM design, greatly reducing the time required for system integration and hardware/software fine-tuning. Supports the Microchip UNI/O bus, I<sup>2</sup>C, SPI and Microwire Serial EEPROMs.

### **Total Endurance (TotalEnduranceSoftware)**

The software provides functional visibility to serial EEPROM applications. Target systems are input via an advanced mathematical model which predicts back the performance and reliability of the serial EEPROM in that target. Design trade-off analysis takes minutes and delivers robust design results.

### **Serial EEPROM PIM PICtail Pack (AC243003)**

A package of four serial EEPROM (I<sup>2</sup>C, SPI, Microwire, UNI/O<sup>®</sup>) PICtail boards that interface with the PICtail Plus connector, the MPLAB Starter Kit for Serial Memory Products (DV243003) and the PICkit Debugger.

## Serial SRAM

### **SPI SRAM PICtail with Battery Backup (AC164151)**

The AC164151 is a PICtail and PICtail Plus development board that demonstrates the features of the 23LCV1024 1 Mbit Serial SRAM with battery backup on standard development platforms.

## System-on-Chip

### **SAMR30 Xplained Pro Evaluation Kit (ATSAMR30-XPRO)**

The SAMR30 Xplained Pro is a hardware platform designed to evaluate the SAMR30G18A SoC. This kit is supported by Atmel Studio, an integrated development platform, which provides predefined application examples.

## Touch Sensing Technology

### MGC3130 Single Zone Hillstar Evaluation Kit (DM160218)

This kit builds a complete MGC3130 reference system consisting of the MGC3130 module, I<sup>2</sup>C-to-USB bridge module and a 4-layer reference electrode 95 × 60 mm sensitive area. The Hillstar package includes an artificial hand for parameterization and performance evaluation of the sensor. With the MGC3130 software package including Aurea graphical user interface and GestIC<sup>®</sup> technology library, the MGC3130 Software Development Kit (SDK) and a set of electrode reference designs the Hillstar Development Kit is prepared for an easy design-in of the MGC3130 module.

### QT1 Xplained Pro Extension Kit (ATQT1-XPRO)

QT1 Xplained Pro Kit is an extension kit that enables evaluation of self- and mutual-capacitance mode using the Peripheral Touch Controller (PTC). The kit shows how easy it is to design a capacitive touch board solution using the PTC without the need for any external components. The kit includes two boards, one using self capacitance and one using mutual capacitance.

### QT2 Xplained Pro Extension Kit (ATQT2-XPRO)

QT2 Xplained Pro is a QTouch<sup>®</sup> surface extension board for Xplained Pro boards that demonstrates the PTC as a high-performance touch-surface controller. The PTC controller uses very little power and resources from the MCU, which makes it easy to integrate touch surface support into your main project.

### QT3 Xplained Pro Extension Kit (ATQT3-XPRO)

QT3 Xplained Pro is a QTouch keypad extension board demonstrating an ultra-low power keypad design using the PTC. Utilizing the PTCs, low-power capabilities, it enables the market's lowest-power wake-up on touch.

### QT4 Xplained Pro (ATQT4-XPRO)

The QT4 Xplained Pro is an extension board that enables evaluation of self-capacitance touch and proximity sensors using the PTC. The kit shows how easy it is to design a capacitive touch board solution using the PTC without the need for any external components.

### QT5 Xplained Pro Extension Kit (ATQT5-XPRO)

QT5 Xplained Pro is an extension kit that enables evaluation of mutual-capacitance touch using the PTC. The kit shows how easy it is to design a nice-looking capacitive-touch interface using the PTC module. The kit includes one board with a curved QTouch mutual-capacitance slider and two QTouch mutual-capacitance buttons.

### QT6 Xplained Pro (ATQT6-XPRO)

The QT6 Xplained Pro is a QTouch surface extension board for Xplained Pro boards that demonstrates the PTC as a high-performance touch-surface controller.

### MTCH108 Evaluation Board (DM160229)

The MTCH10X Evaluation Board provides an out-of-the-box experience for performance and the robustness of Microchip touch solutions.



## **CAP1188 Evaluation Kit (DM160222)**

The CAP1188 Evaluation Kit provides an easy platform for evaluating and developing a variety of capacitive touch sense applications and LED configuration using CAP11XX family.

## **CAP1298 Evaluation Kit (DM160223)**

The CAP1298 Evaluation Kit provides an easy platform for evaluating and developing a variety of capacitive touch sense and proximity applications using CAP12XX family.

## **Low-Cost mTouch® Evaluation Kit (DM160227)**

This kit is a platform to evaluate and develop capacitive touch application using mTouch technologies. The kit shows a proximity sensing solution, different button sizes as well as how to use a guard for better noise performance. It also features mTouch algorithm for water rejection.

## **Low-Power Projected Capacitive Touchpad Development Kit (DM160219)**

This kit allows you to quickly integrate gestures and XY touch into your design. The kit includes everything needed to create a rich user interface, including a USB connection to our GUI for customized solutions. Gestures and Projected Capacitive (PCap) Touch are supported by the MTCH6102, Microchip's turnkey PCap touch controller.

## **tiny817 Water-Tolerance Demo Kit (ATTINY817-QTMOISTD)**

The tiny817 QTouch Moisture Demo Kit demonstrates the high-performance capacitive touch support of the PTC while achieving best-in-class conducted immunity and moisture tolerance.



**USB****USB4604 Hi-Speed USB 2.0 Programmable 4-Port Controller Hub with FlexConnect and I/O Bridging (EVB-USB4604)**

The EVB-USB4604 is used to evaluate the full-featured USB46X4 family of programmable controller hubs. It features full programmability and unique features such as FlexConnect and I/O bridging.

**USB3740 Hi-Speed USB 2.0 2-Port Switch (EVB-USB3740)**

The EVB-USB3740 is used to evaluate our USB3740 USB 2.0 compliant 2-port switch. Some applications require a single USB port to be shared with other functions. The USB3740 is a small and simple 2-port switch providing system design flexibility.

**USB375X Hi-Speed USB 2.0 Port Protection with Integrated Switch and Charger Detection (EVB-USB3750)**

The EVB-USB3750 is used to evaluate our USB375X family of integrated USB 2.0 port protection devices. The USB375X integrates a high level of ESD protection to the USB port, which is typically exposed to the harsh environment of the outside world. It also incorporates our Hi-Speed USB 2.0 switch as well as battery charger detection, all in a conveniently small package.

**PIC18F Starter Kit (DM180021)**

The PIC18 Starter Kit functions as a USB mouse, joystick or mass storage device all using the on-board capacitive touch sense pads. It includes a MicroSD™ memory card, potentiometer, acceleration sensor and OLE display. This board features the PIC18F46J50 MCU with 64 KB Flash, 4 KB RAM, XLP low power, mTouch touch sensing and USB.

**PIC24F Starter Kit (DM240011)**

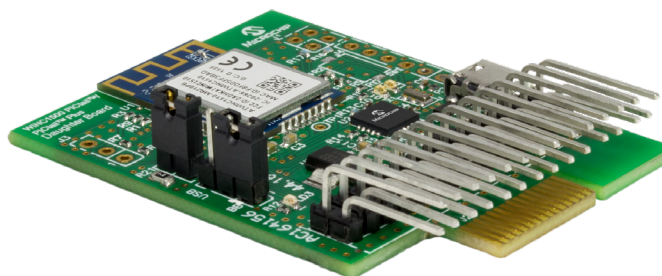
The PIC24F Starter Kit contains everything needed to begin exploring the high performance and versatility of the PIC24F microcontroller family. This inexpensive kit includes USB device and host connectors, tri-color LED, capacitive touch pad and an OLED display. Menu driven demonstration software supports data logging, thumb drive and graphics applications to test the PIC24F MCU.

**Wi-Fi****WINC1500 PICtail/PICtail Plus Daughter Board (AC164156)**

The WINC1500 PICtail/PICtail Plus Daughter Board is a demonstration and development board for the WINC1510-MR210PB Wi-Fi module with PICtail and PICtail Plus connectors to interface with a PIC microcontroller on the Explorer 16 and PIC32 Ethernet Starter II Kit.

**WINC1500 Xplained Pro Evaluation Board (ATWINC1500-XPRO)**

The extension board is part of the Xplained Pro evaluation board platform and allows you to evaluate the WINC1500 low-cost, low-power 802.11 b/g/n Wi-Fi network controller module.



## CAN and LIN

### dsPIC33EV 5V CAN-LIN Starter Kit (DM330018)

The dsPIC33EV 5V CAN-LIN Starter Kit features the dsPIC33EV256GM106 Digital Signal Controller (DSC) for automotive and motor control applications. The starter kit contains serial data ports for CAN, LIN and SENT, a self-contained USB programming/debug interface and an expansion footprint for flexibility in application hardware development.

### MCP25625 PICtail Plus Daughter Board (ADM00617)

The MCP25625 PICtail Plus Daughter Board is a simple CAN board designed to be used with boards containing the PICtail Plus connector. The board also has the PICkit Serial connector for interfacing to the PICkit Serial Analyzer tool. The single-chip solution CAN node consists of the MCP25625 CAN Controller with Integrated Transceiver.

### SAM HA1G16A Xplained Pro (ATSAMHA1G16A-XPRO)

The SAMHA1G16A Xplained Pro Evaluation Kit is ideal for evaluating and prototyping with SAMHA1G16A Arm Cortex-M0+ based microcontrollers.

## High-Voltage Drivers

### HV582 96-Channel High-Voltage Driver IC Evaluation Board (ADM00697)

### HV583 128-Channel High-Voltage Driver IC Evaluation Board (ADM00677)

These boards facilitate quick implementations for display and printer driver applications with flexible input/output connection interface. The boards are designed around the HV582/3, a unipolar, 96-channel low-voltage serial to high-voltage parallel converter with push-pull outputs.

### DN2470-Based Linear Regulator Input Voltage Range Extender Evaluation Board (ADM00682)

Universal off-line linear regulation demo using the 700V depletion-mode FET DN2470. The board features off-line regulation using three different selectable LDOs: MCP1754, MCP1755 and MCP1790.

## LED Drivers

### HV98100 120VAC Off-Line LED Driver Evaluation Board (ADM00786)

The HV98100 120 VAC Off-Line LED Driver Evaluation Board is designed to demonstrate the performance of the HV98100 LED Driver IC. The evaluation board drives a 120V LED string at 120 mA from a 120 VAC input voltage with high input power factor and low total harmonic distortion.

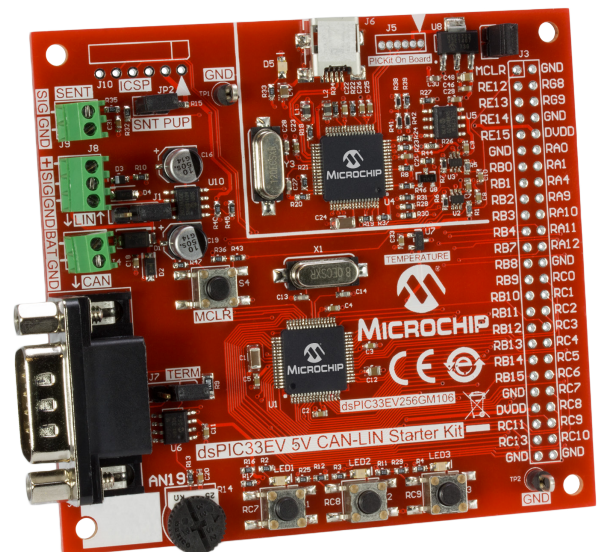
## Motor Drivers

### ATA6826-DK (ATA6826-DK)

The application board allows loads to be easily adapted via its row connector pins. Design software controls its SPI interface via the PC parallel port. The board contains everything needed to start operation, including a link cable to PC 25-lead 1:1, application note and datasheet.

### ATA6823-DK (ATA6823-DK)

The development kit contains a main board with an H-bridge gate driver (ATA6823), external FETs and DC motor. The controller board is populated with an ATmega88 microcontroller and LCD display.



## Arduino Boards for Makers

Today, both Microchip AVR 8-bit MCUs and Microchip 32-bit Arm-based MCUs power a variety of Arduino's easy-to-use boards including:

### Arduino Zero

Based on the Microchip's SAMD21 MCU, the Zero is a simple, elegant and powerful 32-bit extension of the platform aiming to provide creative individuals the potential to realize truly innovative ideas for smart IoT devices, wearable technology, high-tech automation, robotics and projects not yet imagined.

### Arduino Uno

Based on the Microchip AVR ATmega328, the Uno board is a low-cost Arduino board with a simpler circuit. The software onboard includes a USB driver that can simulate a mouse, keyboard and serial port. In addition, the bootloader includes a serial port and USB mass storage driver.

### Arduino Due

Based on an Microchip SAM3 MCU, the Due board is ideal for home automation projects and can run up to 96 MHz.

### Arduino Wi-Fi Shield 101

Built on an easy-to-use extension that can be seamlessly connected to any Arduino board, the Wi-Fi Shield 101 is powered by the Microchip SmartConnect wireless network controller and an Microchip CryptoAuthentication ATECC108 device.

### Arduino Leonardo

Based on the Microchip megaAVR® ATmega32U4, the Arduino Leonardo is a low-cost Arduino board. It has the same shape and connectors as the UNO board, but it has a simpler circuit. On the software side it provides a USB driver able to simulate a mouse, a keyboard and a serial port.

## Books

### Embedded C Programming Book and E3mini Board Bundle for CCS Compilers (TBDL001)

This bundle includes *Embedded C Programming: Techniques and Applications of C and PIC MCUs*, a book by Mark Siegesmund, and the E3mini Development Board. This book provides a hands-on introductory course on concepts of C programming using a PIC microcontroller and the CCS C compiler.

## Compilers and IDEs

CCS provides a line of full-featured C compilers for 8-bit and 16-bit MCUs. These compilers include a generous library of built-in functions, pre-processor commands and ready-to-run example programs to quickly jumpstart any project. Several versions are available, depending on which MCU families you plan to use and whether you prefer a command-line tool or a full-featured IDE. The CCS IDE provides several advanced features, including a unique Profiler Tool to track time and usage information for use on functions, code blocks as well as receiving live data from running programs. CCS compilers are compatible with MPLAB X IDE and MPLAB programmer/debuggers. For more information, please visit:

[www.microchip.com/ccs](http://www.microchip.com/ccs).

- PCM - CCS C Command-line Compiler for Midrange Family of PIC MCUs (SW500003-DL)
- PCH - CCS C Command-line Compiler for PIC18 Family of PIC MCUs (SW500002-DL)
- PCD CCS C Command-line Compiler for PIC24 MCUs/ dsPIC DSCs (SW500021-DL)
- PCWH CCS C IDE Compiler for Baseline, Midrange, and PIC18 Families of PIC MCUs (SW500004-DL)
- PCWHD CCS C IDE for Microchip 8-bit and 16-bit PIC MCU Families (SW500024-DL)

MikroElektronika provides a line of optimizing C, basic and pascal compilers for 8-, 16- and 32-bit MCUs. Each compiler features an intuitive IDE, advanced optimizations, lots of hardware and software libraries and additional tools that will help you in your work. A comprehensive Help file is included with ready-to-use examples designed to jump start your projects. The compiler license includes free upgrades and product lifetime tech support, and it can be used on multiple computers (USB dongle included.) Object files created with MikroElektronika compilers can be imported into MPLAB X IDE if desired. For a listing of products, please visit: [www.microchip.com/mikroe](http://www.microchip.com/mikroe).

### SOMNIUM DRT Cortex-M IDE

The SOMNIUM DRT Cortex-M IDE provides you with the best possible C/C++ code quality along with state-of-the-art debug, all in a single professional development tools product, allowing you to reach the market faster with reduced costs, all while achieving the best quality design.

- TSW1017 - 1-User, Fixed License
- TWS1018 - 3-User, Floating License

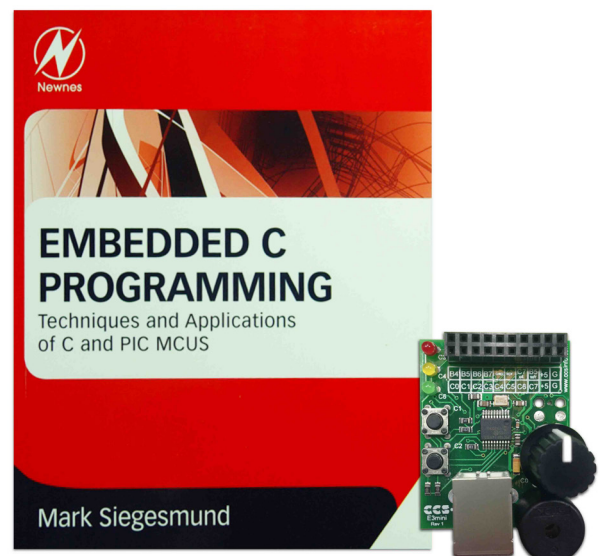
## Development Hardware

### PIC24FJ1024GB610 General Purpose Plug-In Module (PIM) (MA240023)

The PIC24FJ1024GB610 Plug-in Module is designed to demonstrate the capabilities of the PIC24FJ1024GB610 family using the Explorer 16 Demonstration Board. Most of the pins from the device are mapped directly to the PIM connector (100-Pin ICE). The exceptions are those pins that are remapped to provide remappable functionality to the pins in the PICtail Plus socket.

### Click by MikroElektronika

Many of Microchip's latest development boards feature a MikroElektronika Click expansion port which can be used to connect over 340 extensions from MikroElektronika. This makes it easy to extend PIC MCU functionality into Bluetooth, specialized analog, GSM, GPS, UNO, 3D motion and so much more. Visit Microchip's third-party site for more information.



## **mikromedia workStation v7 (TMIK021)**

mikromedia workStation v7 provides full development environment for mikromedia boards. It features on-board debugger, multi-media modules, four mikroBUS host sockets and a large breadboard area.

## **mikromedia Board for PIC24 (TMIK010)**

The Mikromedia Board for PIC24 is a palm-sized unit with amazing multimedia capabilities. Based on the PIC24F256GB110 with USB On-The-Go (OTG), it includes a 320 x 240 TFT display with touchscreen, stereo MP3 codec, 8 Mbit serial Flash, microSD card slot, headphone jack and USB connector. Powered by USB, the board can easily play MP3 files from a microSD card with full 320 kbps quality.

## **mikromedia Board for PIC32 (TMIK012)**

The Mikromedia Board for PIC32 fits comfortably in the palm of your hand and provides amazing multimedia capability. Based on the PIC32MX460F512L MCU, it includes a 320 x 240 TFT display with touchscreen, stereo codec, 8 Mbit serial Flash, microSD card slot, headphone and microphone jacks and a USB connector. Powered by USB, the board is capable of playing videos directly from a microSD card at 15 fps.

## **mikromedia PROTO Shield (TMIK032)**

mikromedia PROTO Shield is an extension board that is pin-compatible with all mikromedia boards from MikroElektronika. It enables users to place components and provide additional functionality to the base mikromedia board.

## **CCS EZ Web Lynx 3V Module (TDKEZW3)**

## **CCS EZ Web Lynx 5V Module (TDKEZW5)**

EZ Web Lynx is a simple embedded Ethernet integration device to get a product online fast! This tiny unit can easily be added to any existing electronic design to gain Ethernet capability, reducing development and engineering time.

## **CCS EZ Web Lynx 3V Development Kit (TDKEZW3-DEV)**

## **CCS EZ Web Lynx 5V Development Kit (TDKEZW5-DEV)**

These low-cost kits includes all hardware, software and documentation needed to speed integration of EZ Web Lynx Ethernet modules into your design. Monitor and control analog and digital I/O on the docking station using custom HTML tags. Use the IDE to develop custom dynamic web pages and send alarm/status emails simply by programming in HTML. Complete documentation includes design examples for temperature monitoring, using conditional HTML tags and controlling pin I/O.

## **CCS PRIME8 Production Programmer (Touch Screen) (TPGPRM8-2)**

The latest version of CCS's Prime8 Production Programmer (53504-830) is a low-cost way to program up to eight devices concurrently. Prime8 operates in standalone mode or when connected to a PC. The unit will supply up to 200 mA at 2–5V to power target devices. It can program all devices in the PIC10, PIC12, PIC14, PIC16, PIC17, PIC18, PIC24, dsPIC DSC and PIC32 families. The newest features include flash-drive readability, faster programming speed and a graphics display touchscreen menu with easy-to-read icons.



## Development Software

### Flowcode 7 for AVR/Arduino Products – Standard (TSW1013)

Flowcode 7 is a flowchart-style programming tool that enables you to create complex electronic and electromechanical systems. The tool utilizes graphics in place of complex coding, meaning it is ideal for both beginners and experienced engineers. Flowcode 7 software is straight forward and easy to use, so you can develop your ideas in no time.



### MikroElektronika Visual TFT (SW500189)

Visual TFT is a Windows application for rapid development of graphical user interfaces on TFT displays. It generates source code for all MikroElektronika compilers—mikroC, mikroBasic and mikroPascal—for all supported MCU and DSC architectures, including PIC MCUs and with many drag-and-drop components makes building applications easy and fast. Visual TFT runs on Windows computers and supports all multimedia boards from MikroElektronika, as well as ten TFT controllers and five different display sizes.

### SOMNIUM® DRT Atmel Studio Extension (TSW1016)

SOMNIUM DRT Atmel Studio Extension enhances the Atmel Studio 7 IDP to provide superior C and C++ code generation quality to help you build smaller, faster, more energy-efficient software for your Microchip SMART MCU without changing your development environment or source code. Achieve the best quality design with reduced costs and reach the market faster.

## Oscilloscopes

### Saleae Logic Pro 8 - USB Logic Analyzer (TSAL0004)

The Saleae Logic devices connect to your PC over USB. Just download the software at [www.saleae.com](http://www.saleae.com). Navigate your data easily and intuitively with Logic's fluid and fully animated mouse-driven interface. The Saleae products support decoding for over 20 different protocols.

- Saleae Logic 8 - USB Logic Analyzer (TSAL0003)
- Saleae Logic Pro 16 - USB Logic Analyzer (TSAL0005)

## OpenScope

### OpenScope MZ Test Instrument (TDGL027)

OpenScope MZ (Digilent 410-324) is a portable multi-function programmable instrumentation module. That means it's a device that you connect to your computer (through Wi-Fi or a USB cable) for the purpose of acquiring, analyzing, visualizing and controlling signals from circuits, sensors and other electronic devices. Unlike typical USB instruments, OpenScope MZ can also be programmed to run standalone like an Arduino or Raspberry Pi®, but with high-speed precision analog and digital I/O. At the core of the OpenScope MZ is a powerful Microchip PIC32 MZ Processor.

## Programmiers and Debuggers

Softlog offers a full line of production-quality in-circuit GANG programmers. These include:

- ICP2GANG-DP 4-Channel GANG Programmer (TPG100004)
- ICP2GANG 4-Channel GANG Programmer (TPG100005)
- ICP2GANG-DS Secure GANG Programmer (TPG100006)

### Softlog SEC-DS Secure Programming Upgrade for ICP2 Programmers (SW500090)

### Softlog SEC4CH-DS Secure Programming Upgrade for ICP2GANG Programmers (SW500091)

The Softlog SEC-DS Secure Programming Upgrade is a secure programming extension for Softlog programmers that provides several layers of protection—utilizing breakthrough technology—dramatically reducing the risk of unauthorized reconstruction of hex data and limiting how many times a hex file can be programmed. Secure programming operates on two levels: the admin level and the user level.

### **Softlog ICP2 Production Quality In-Circuit Programmer (TPG100001)**

The Softlog ICP2 Production Quality In-Circuit Programmer is a cost-effective programmer that operates with a PC or as a standalone unit.

### **Softlog ICP2PORT-P Production Quality In-Circuit Service Programmer (TPG100010)**

The Softlog ICP2PORT-P Production Quality In-Circuit Service Programmer is specially designed to meet your service programming needs. This compact, battery-powered device supports up to six different programming environments, making it an ideal, low-cost solution for field upgrades

### **Softlog ICP2(HC) Production Quality In-Circuit High Current Programmer (TPG100008)**

The Softlog ICP2(HC) Production Quality In-Circuit High Current Programmer is a cost-effective programmer that operates with a PC or as a standalone unit.

### **Softlog ICP2PORT Production Quality In-Circuit Service Programmer (TPG100009)**

The Softlog ICP2PORT Production Quality In-Circuit Service Programmer is specially designed to meet your service programming needs. This compact, battery-powered device supports up to six different programming environments, making it an ideal, low-cost solution for field upgrades.

### **CCS Load-n-Go Handheld In-Circuit Programmer (TPG1LG01)**

Load-n-Go is a low-cost handheld in-circuit programmer that supports PIC10, PIC12, PIC14, PIC16, PIC18, PIC24 MCU and dsPIC DSC families. Running on four AA batteries this mobile programmer can go where no PC or laptop could go before. The simple user interface seamlessly allows for quick field programming of targets with up to four firmware images. Load-n-Go can also be powered via USB or with a 9V AC adapter and used as a regular ICD/ICSP with the CCS IDE compilers.

### **Tag-Connect In-Circuit Cable Legged Version (TC2030-MCP)**

### **Tag-Connect In-Circuit Cable No Legs (TC2030-MCP-NL)**

Tag-Connect cables provide a simple, reliable means of connecting Debuggers and Programmers or other test equipment to your PCB's while lowering board costs and facilitating efficient production programming.



## Protocol Analyzers

### Total Phase

#### Beagle™ USB 480 Protocol Analyzer (TTP100001)

The Beagle USB 480 Protocol Analyzer (Total Phase TP320510) is a low-cost, non-intrusive high-speed USB 2.0 bus monitor that includes real-time USB class-level decoding. The Beagle USB 480 analyzer is capable of capturing and interactively displaying high-speed USB bus-states and traffic in real-time with timing at 16.7 ns resolution and comes complete with software and royalty-free API.

#### Total Phase Beagle USB 12 Protocol Analyzer (TTP100002)

The Beagle USB 12 Protocol Analyzer (Total Phase TP320221) is a non-intrusive full/low-speed USB 2.0 protocol analyzer that includes real-time USB descriptor parsing. Developers can monitor what is happening on the USB bus as it happens with 21 ns resolution.

#### Total Phase Beagle I<sup>2</sup>C/SPI Protocol Analyzer (TTP100003)

The versatile Beagle I<sup>2</sup>C/SPI Protocol Analyzer (Total Phase TP320121) is the ideal tool for the embedded engineer who is developing an I<sup>2</sup>C or SPI based product.

#### Total Phase Aardvark I<sup>2</sup>C/SPI Host Adapter (TTP100005)

The Aardvark I<sup>2</sup>C/SPI Host Adapter (Total Phase TP240141) is a fast and powerful I<sup>2</sup>C bus and SPI bus host adapter through USB. It allows a developer to interface a Windows, Linux, or Mac OS X PC via USB to a downstream embedded system environment and transfer serial messages using the I<sup>2</sup>C and SPI protocols.

#### Total Phase I<sup>2</sup>C Development Kit (TTP100006)

The I<sup>2</sup>C Development Kit by Total Phase (TP120112) is a comprehensive and cost-effective kit that bundles together a complete set of Total Phases industry-leading I<sup>2</sup>C development tools and popular accessories. With this kit, developers can exercise target devices on an I<sup>2</sup>C bus as a master device, simulate an I<sup>2</sup>C master or slave device, program and verify I<sup>2</sup>C-based devices and passively monitor an I<sup>2</sup>C bus in real time with bit-level timing down to 20 ns.

#### Total Phase Komodo™ CAN Duo Interface (TTP100008)

The Komodo CAN Duo Interface (Total Phase TP360110) is a two-channel USB-to-CAN adapter and analyzer. The Komodo interface is an all-in-one tool capable of active CAN data transmission and non-intrusive CAN bus monitoring. The Komodo CAN Duo Interface features two independently customizable CAN channels, a royalty-free API, and cross-platform support for Windows, Linux, and Mac OS X.

### Wi-Fi

#### CCS EZ Web Lynx Wi-Fi Development Kit (TDKEZWIFI-DEV)

This low-cost kit includes all hardware, software and documentation needed to speed integration of EZ Web Lynx Wi-Fi modules into your design. Monitor and control analog and digital I/O on the docking station using custom HTML tags. Use the IDE to develop custom dynamic web pages and send alarm/status emails simply by programming in HTML.

## 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. For more information, please visit [www.microchip.com](http://www.microchip.com):

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- Sales and Global Distribution: [www.microchip.com/sales](http://www.microchip.com/sales)

## Training

If additional training interests you, Microchip offers several resources including in-depth technical training and reference material, self-paced tutorials and significant online resources.

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