# MICROCHIP

## Wireless Product Solutions

## Wireless Connectivity for Your Application

Wireless technologies enrich our everyday lives. They provide convenience and peace of mind by providing access and control to people and things from across the globe.

### How Does Microchip Make Wireless Connectivity Easy?

MPLAB® and Studio IDEs provide an easy to use environment with ample documentation, free software libraries and numerous application examples.

Microchip is committed to providing you with continuous innovation, robust operation and superior manufacturing quality. We continually evolve our product firmware to enhance security, convenience and features. Our products are extensively interoperability tested to ensure compliance to industry standards as well as seamless operation in a wide variety of environments. Finally, we qualify our products against our rigorous reliability standards to ensure long operating life and our customer-driven EOL policy ensures a lengthy and stable supply to your applications.

### Microchip Solutions are Designed to Address Multiple Markets

- Internet of Things
- Home/building automation
- Smart energy
- Smartphone to devices
- Remote equipment monitoring
- Asset tracking and telemetry
- Security
- Wireless audio
- Industrial sensors and controls
- Medical devices

### Microchip's Wireless Portfolio

- Wi-Fi®
- Bluetooth®
- LoRa®
- IEEE 802.15.4
- Sub-GHz
- Remote Controls

Robust, reliable and safe connections are what you can expect when you use Microchip's Wi-Fi devices in your application. We extensively test our products for interoperability against hundreds of Access Points (APs) with our in-house test lab providing you with the confidence that your product will work wherever it's deployed. Whether you're looking for a chip-down solution or a plug-and-play module, our portfolio of Wi-Fi solutions has you covered. We make it easy to start developing immediately with our development kits, libraries, and individualized support. We're continuously deploying improvements to our firmware to provide additional features and functions while keeping your designs protected from the latest security threats.

## Wi-Fi Connectivity Offers

- Ease of control with a smartphone/tablet
- Connection to the Cloud
- Support for the Internet of Things (IoT)
- Standards-based technology

## Microchip is a trusted provider in embedded Wi-Fi

- Easy to Use Low Power Modules
- Best in class security for IoT/Cloud applications
- WFA and Regulatory Certified Modules
- Linux Support

## Alexa/Google

Voice control (usage of voice assistants) is becoming increasingly popular as the preferred way to control home automation devices and perform different tasks. Voice enabled speakers like Amazon Echo and Google Home are becoming the control center of the home. Using voice control reduces the need for complicated GUI (touch screens) and complex mobile apps.

Accelerate adding voice control with Alexa to your existing application with the Wi-Fi Smart Device Enablement Kit. The kit allows you to use an Alexa-compatible smart speaker or the Alexa App to control the board's General-Purpose Input/Outputs (GPIOs) to interface with your application, interrogate the sensors and change the LED colors. Use our open-source firmware, along with the open-source Lambda Functions and Alexa Skills, to create custom skills that will provide your customers with more engaging ways to interact with your application.
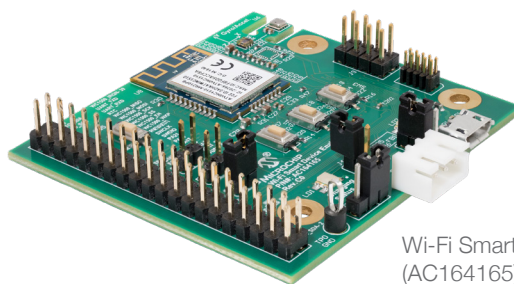
Wi-Fi Smart Device Enablement Kit (AC164165)

| Product | Radio | Antenna | System | Supported Host OS | Power Output (dBm) | Security | Interface | Packages (Dimensions) |
|---|---|---|---|---|---|---|---|---|
| WFI32E01PC | 802.11 b/g/n | PCB, U.FL | Standalone | | 20.5 | WEP, WPA, WPA2, WPA3, TLS & SSL | N/A | 132/Module (24.5 x 20.5 mm) |
| ATWINC15x0-MR | 802.11 b/g/n | Chip, PCB, U.FL | Network Controller- TCP/IP Stack on Device | – | 17 | Enterprise, WEP, WPA, WPA2, TLS, SSL | SPI | 28/Module (21.7 × 14.7 mm) |
| ATWINC3400-MR | 802.11 b/g/n and BLE 5.0 | Chip | | – | 4 (BLE), 14 (Wi-Fi®) | WEP, WPA, WPA2 | SPI | Module (22.4 × 14.7 mm) |
| ATWILC1000-MR | 802.11 b/g/n | PCB | Link Controller - TCP/IP Stack on Host | Linux® and FreeRTOS | 15 | WEP, WPA, WPA2 | SPI, SDIO | Module (21.5 × 14.5 mm) |
| ATWILC3000-MR | 802.11 b/g/n and BLE 5.0 | Chip | | Linux and FreeRTOS | 4 (BLE), 14 (Wi-Fi) | WEP, WPA, WPA2 | SPI, SDIO, UART | Module (22.4 × 14.7 mm) |

## Wi-Fi Development Tools

| Part # | Name and Description | Photo |
|---|---|---|
| EV12F11A | The PIC32WFI32E Curiosity Board is an easy-to-use evaluation tool to evaluate the performance of WFI32E01PC Wi-Fi® MCU module, which contains the PIC32MZW1, a highly integrated IoT system core supporting smart Wi-Fi functionalities and premium MCU. | |
| ATWINC1500-XPRO | The ATWINC1500-XPRO extension board allows you to evaluate the ATWINC1500 low cost, low power 802.11 b/g/n Wi-Fi network controller module. It is supported by the Atmel Studio integrated development platform | |
| ATWINC3400-XSTK | The ATWINC3400-XSTK evaluation kit is a hardware platform to evaluate the Wi-Fi® and BLE WINC3400-MR210CA module. | |
| AC164160 | The AVR-IoT WG development board combines a powerful 8-bit ATmega4808 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 Google's Cloud IoT core platform. | |
| AC164158 | The ATWILC3000 SD is a Secure Digital (SD) card interface board that supports IEEE 802.11 b/g/n standard and Bluetooth Low Energy (BLE) 5.0 and is designed to demonstrate the features of the low power consumption ATWILC3000-MR110CA link controller module. | |
| ATWILC1000-SD | The ATWILC1000-SD evaluation kit is a hardware platform to evaluate the ATWILC1000-MR110PB module. IEEE 802.11 b/g/n link controller module. | |
| 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. | |
| AC164165 | Wi-Fi Smart Device Enablement Kit helps you add Alexa Voice Control to your existing application, enabling rapid prototyping. | |

The Bluetooth market has taken off and found a home in many new applications, thanks to the smartphone and other mobile devices that make it incredibly easy to connect point to point over Bluetooth.

## Bluetooth Connectivity Offers

- Ease of control with a smartphone/tablet
- Short-range, personal connections
- Standards-based technology
- Easy connect and disconnect
- Low power for long battery life

## Target Applications

- Battery-powered sensor devices
- Wearables
- Smart appliances
- Health and fitness trackers
- Home automation
- Consumer electronics
- Retail beacons

## Bluetooth Low Energy

Microchip's approach to Bluetooth Low Energy (BLE) is simple. Remove as many barriers as possible so you can focus on your design. Our BLE solutions are certified to the Bluetooth 5.0 standard which eliminates the need to spend time and money certifying your BLE design.

- Our BLE solutions are designed to be easy-to-use with free mobile app source code
- Application examples
- Turnkey reference designs
- Fully-certified, highly-integrated module solutions

Our pre-programmed Bluetooth Network Processor solutions abstract and separate the complexity of managing Bluetooth from your application, reducing risk and time to market.

### Bluetooth Network Processor

- Easy to use and low support required
- Application runs on host MCU
- Flexibility by offloading Bluetooth stack processing
- Simple ASCII or Binary interface over UART
- Enhanced security and throughput

## Bluetooth Audio

Microchip offers high-value and high-quality Bluetooth audio silicon and module solutions. They are compliant with the latest Bluetooth specifications and are proven for interoperability. Low power and small form factor with a built-in Bluetooth stack, Microchip's audio solutions provide excellent audio quality (SNR), sound level and sound effects (DSP). They also support digital audio, a variety of audio sources and value-added features such as support for multiple speakers and high-resolution Bluetooth audio with LDAC technology.

### Typical Audio Applications

- Headsets
- Speakers
- Premium audio
- Audio with BLE
- Soundbars
- Gaming with audio/voice
- Smart home with audio/voice

## Bluetooth Products

| | | | | |
|---|---|---|---|---|
| **Easy To Use** | **RN4870/71**<br>BLE<br>ASCII Interface<br>LE Security, Limited DLE | **RN4678**<br>BLE + BT Classic<br>ASCII Interface<br>MFi Available | Can be used with or without external host using ASCII scripting engine | |
| **Can be Customized** | **BM70/71**<br>BLE<br>Binary UART Interface<br>Full DLE | **BM78**<br>BLE + BT Classic<br>Binary UART Interface<br>DLE or SPP | Can be configured with Windows® GUI tools to use less host MCU resources | |
| **Linux** | **WILC3000**<br>Wi-Fi® + BLE<br>BlueZ compatibility | Link Controller with Wi-Fi and BLE capabilities using BlueZ, official Bluetooth® protocol stack | | |

**Bluetooth Audio**

| | | | | |
|---|---|---|---|---|
| **Dual Mode** | **BM/IS2063/64**<br>BT 5 + BLE<br>8 x 8 LGA IC, EE<br>Flash | **IS2064S/B**<br>BT 5 + BLE<br>8 x 8 QFN; 5 x 5 BGA<br>ROM | **IS2066**<br>BT5 + BLE<br>3.5 x 5 BGA<br>Flash | **BM83/IS2083**<br>BT 5 + BLE<br>32 x 15 x 2.5 mm (BM83 module)<br>5.5 x 5.5 BGA (IS2083) Flash |
| **Classic** | **IS2008**<br>BT 4.1<br>EE, Analog Output<br>ROM | **IS201x**<br>BT 4.1<br>EE, Analog Output<br>ROM | **BM/IS2020**<br>BT 5<br>EE, Analog Output<br>ROM | **BM/IS2023**<br>BT 5<br>EE, I²S<br>ROM |

## Bluetooth Development Tools

### Bluetooth Data Boards

| Part # | Name | Photo |
|---|---|---|
| BM-71-XPRO | BM71 Xplained Pro Evaluation Kit | |
| BM-70-PICTAIL | BM70 PICtail™/PICtail Plus Daughter Board | |
| RN-4870-SNSR | RN4870 Sensor Board | |
| ATAVRBLE-IOT | Secure AVR® BLE IoT Node | |
| DT100111 | AVR-BLE Development Board | |
| DT100112 | PIC-BLE Development Board | |

### Bluetooth Audio Boards

| Part # | Name | Photo |
|---|---|---|
| BM-62-EVB | BM62 Bluetooth® Audio Evaluation Board | |
| BM-64-EVB-C1 | BM64 Bluetooth Audio Evaluation Board for the Class 1 BM64 | |
| BM-64-EVB-C2 | BM64 Bluetooth Audio Evaluation Board for the Class 2 BM64 | |
| DM164152 | BM83 Bluetooth Audio Development Board | |

## LoRa Technology

LoRa technology is a wireless modulation for long-range, low-power low data-rate applications. By achieving a range of more than 15 kilometers in a suburban environment and more than 2 kilometers in a dense urban environment, LoRa solutions target multiple application domains, such as Internet of Things (IoT), smart cities, smart agriculture and supply chain and tracking.
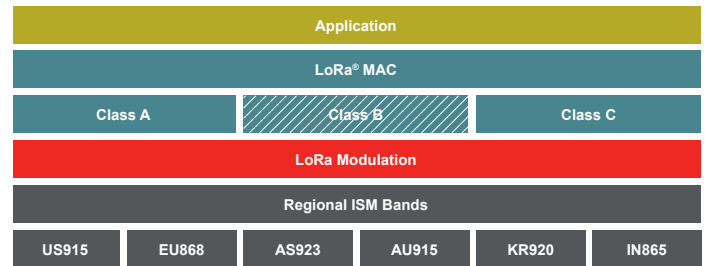
### LoRa Modules

- Ultra-low power, fully certified turnkey WLR089U0 module
- On-board LoRaWAN stack
- Up to 14 GPIO for control and status
- Simple ASCII command to communicate with the host via UART
- Castellated SMT pads for easy and reliable PCB mounting

### LoRa SiP

- Industry's lowest power SAM R34/35 LoRa SiP device family with sleep currents down to 790 nA
- Integrated 32-bit Cortex M0+ MCU, sub-GHz radio and proven LoRaWAN software stack
- FCC, IC and RED certified development board and reference designs
- Detailed certified chip-down design package with schematics, BOM and hardware design guidelines
- Up to 256 KB Flash and 40 KB RAM in compact 6 x 6 mm BGA package

## SAM R34/35 LoRa Software Block Diagram

| Application | | | | | |
|---|---|---|---|---|---|
| LoRa® MAC | | | | | |
| Class A | | Class B | | Class C | |
| LoRa Modulation | | | | | |
| Regional ISM Bands | | | | | |
| US915 | EU868 | AS923 | AU915 | KR920 | IN865 |

## LoRa Products

| Part # | Photo | Output Power (dBm) | Frequency (MHz) | Package | Sensitivity (dBm) | Range | Size (mm) | Certification |
|---|---|---|---|---|---|---|---|---|
| WLR089U0 | | +18.59 dBm | 863-928 MHz (multiple regions) | Surface mount module | −136 | >15 km (suburban) | 17.0 × 13.5 | FCC, IC, RED |
| RN2483 | | +10 at 433 MHz +14 at 868 MHz | 433, 858 (Europe) | Surface mount module | −148 | >15 km (suburban) | 17.8 × 26.7 × 3 | RED |
| RN2903 | | +20 dBm | 915 (North America) | Surface mount module | −148 | >15 km (suburban) | 17.8 × 26.7 × 3 | FCC |
| SAMR34 | | +20 dBm | 862–1020 MHz (Multiple regions) | System-in-Package (SiP) | −148 | >15 km (suburban) | 6 x 6 BGA | FCC, IC and RED Certified reference designs available |

## LoRa Development Tools

| Development Tool | Photo | Part # | Description |
|---|---|---|---|
| WLR089 Xplained Pro Development Kit | | EV23M25A | The WLR Xplained Pro Development Kit integrates the fully-certified WLR089U0 module. With Atmel Studio support, software examples and LoRaWAN stack, this development board greatly simplifies the development of LoRa technology end nodes. |
| RN2483 and RN2903 LoRa® technology Motes | | DM164138 (RN2483 Mote) DM164139 (RN2903 Mote) | The Motes provide a convenient platform to quickly demonstrate the long-range capabilities of the RN2483 and RN2903 modules, as well as to verify inter-operability when connecting to LoRaWAN compliant gateways and infrastructure. |
| RN2483 and RN2903 PICtail™/PICtail Plus Development Boards | | RN-2483-PICTAIL RN-2903-PICTAIL | These demonstration boards showcase the LoRa Sub-GHz modems. (RN-2483-PICTAIL: European version, 433/868 MHz) (RN-2903-PICTAIL: North American version, 915 MHz) |
| SAM R34 Xplained Pro Evaluation Kit | | DM3201111 | The SAM R34 Xplained Pro is a hardware platform designed to evaluate the SAM R34 family of LoRa devices. |

Created to support low-cost, low-power networks, the IEEE's 802.15.4 standard defines the MAC and PHY layer used by, but not limited to, networking specifications such as zigbee, 6LoWPAN, Thread, WiSUN and MiWi™ protocols.

IEEE 802.15.4-based products from Microchip are deployed today in a wide range of applications from battery-free, energy-harvesting wireless light switches, to alarm sensors with several years of battery life, to high-performance mesh utility networks supporting smart meters and street lighting. Our complete line of IEEE 802.15.4 transceivers, RF microcontrollers (MCUs) and regulatory-certified modules help you deliver the functionality you need with the low-power performance demanded by your customers.

## Flexible Development Options

### RF MCUs

Integrated MCU with RF transceiver solutions combine a low-power MCU with a 2.4 GHz or Sub-GHz RF transceiver in a single QFN package.
- Perfect for space-constrained coin-cell powered sensors or lighting solutions
- Sub-GHz or 2.4 GHz devices
- Supports application and communications code
- zigbee and MiWi demo code for jumpstarting development

### RF Transceivers

High-performing 802.15.4-compliant RF ICs for flexible pairing with most host MCUs.
- Sub-GHz and/or 2.4 GHz band coverage
- Simultaneous dual-band solution certified to zigbee 2017
- FSK, O-QPSK and OFDM modulations for superior noise immunity
- Easy-to-use serial interface

### Modules

Our regulatory certified modules offer combination MCU and transceiver or transceiver-only versions.
- No RF experience required
- Supports application and communication code
- FCC, ISED certified and EU RED assessed modules
- Sub-GHz and/or 2.4 GHz band coverage
- Easy-to-use serial interface
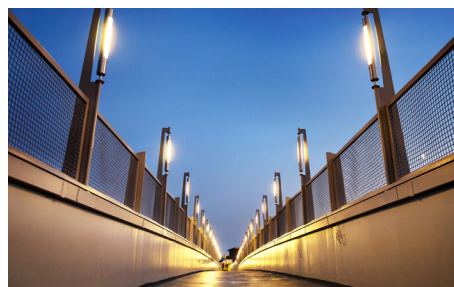
## Software

### zigbee Compliant Platform

zigbee 3.0 (zigbee PRO 2015 Feature Set and Green Power) is the latest standard released by the zigbee Alliance. The BitCloud® Software Development Kit (SDK) is a full-featured, production grade, embedded software development platform that provides a framework with reference applications and libraries for creating zigbee compliant products.

### MiWi Protocol

Microchip's MiWi Mesh Stack is now available for Atmel Studio 7, the Integrated Development Platform (IDP) for developing and debugging all AVR® and SAM micrcocontroller applications. The MiWi mesh code is part of the latest Advanced Software Framework (ASF) release for Studio.

### Atmel Studio 7

Atmel Studio 7 IDP gives you a seamless and easy-to-use environment to write, build and debug your application written in C/C++ or assembly code. It also connects seamlessly to the debuggers, programmer and development kits that support AVR and SAM devices.

## 802.15.4 product

| | P/N | Type | Module | Software** | Market |
|---|---|---|---|---|---|
| **Transceivers** | AT86RF212B | RFIC | ✓ | 802.15.4 MAC, MiWi™ | Thermostats, Home Lighting, Smart Door Locks, Water Meters |
| | AT86RF233 | RFIC | ✓ | 802.15.4 MAC, zigbee®*, MiWi | Light Sensors, Smart Home, Metering, Boiler Control, Solar Power Units |
| | MRF24J40 | RFIC | ✓ | 802.15.4 MAC, MiWi | Temp and Water Sensors, Garage door, SPA Control |
| | AT86RF215 | RFIC | Not Planned | 802.15.4 MAC | Smart Meters, Smart Home, Critical Apps – Flight Recorders, Avalanche Rescue devices |
| **RF MCUs** | ATSAMR30* | SiP | ✓ | 802.15.4 MAC, MiWi | Security, Irrigation Control, Wireless Switches and Plugs, Meters |
| | ATSAMR21 | SiP | ✓ | 802.15.4 MAC, zigbee*, MiWi | zigbee Lighting, Smart Home, Smart Plugs, Thermostats, Outdoor Lighting |
| | ATMEGA256(4)RFR2 | SoC | ✓ | 802.15.4 MAC, zigbee* | zigbee lighting, Outdoor Lighting, PIR Sensors, Operator Interfaces |
| | ATMEGA128(4)RFR2 | SoC | ✓ | 802.15.4 MAC, zigbee* | Access Control, Fume hoods, Healthcare patient tags, AC Control, Industrial Control |
| | ATMEGA64(4)RFR2 | SoC | ✓ | 802.15.4 MAC | Wireless race timer control, Water heater control |

*NSCAR Required      **For Transceivers, protocols are supported on host MCU
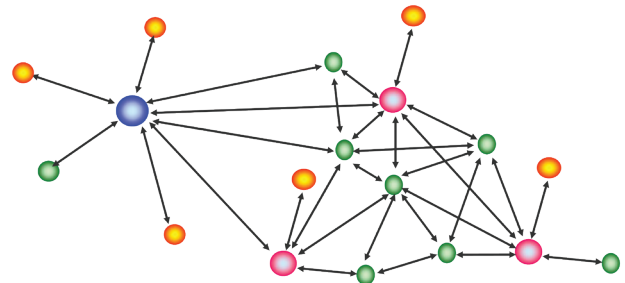
Sub-GHz

2.4GHz

Dual Band

## zigbee and MiWi Stacks

**Microchip's own zigbee stack**
- zigbee 3.0 (zigbee Pro + Green Power)
- 1st Platform certified by the Alliance
- Lighting and Zigbee Green Power Switch and Sensor support
- SAMR21 (2.4GHz) platform developed with 250+ Node test network
- IAR Toolchain

**MiWi - Microchip's Compact, Royalty-Free Wireless Protocol Designed for 802.15.4 Networks**
- Only 20 to 32 KB code
- Point-to-Point, Star and Mesh network topologies
- SAMR21 (2.4 GHz) and SAMR30 (Sub-GHz) SiP support
- Legacy version for support of PIC® MCUs and transceivers
- Same Stack 2.4 GHz or Sub-GHz

The Industrial, Scientific and Medical (ISM) unlicensed Sub-GHz radio frequency bands are used for many short-range, low-data rate, and low-power wireless applications. Microchip provides stand-alone transceivers and receiver products along with our family of rfPIC transmitter with embedded PIC microcontroller.

These radio solutions are ideal for AMR metering, consumer electronics, home, business, industrial automation, automotive, toys and medical applications

## Sub-GHz Embedded MCU + Transmitter

- PIC12LF1840T39A
- PIC12F529T39A
- PIC16LF1824T39A

### Benefits of the Embedded Transmitter Family

- Frequency-Agile Operation in 310, 433, 868 and 915 MHz Bands
- Supports Modulation FSK/ASK
- Low Operating Voltage 1.8V to support Single Cell Battery and Low Power-Saving Sleep mode (175nA) for longer battery lifespan
- Optional built-in Keeloq (Advance and Ultimate)
- Programmable Code Protection
- Various Option for GPIOs for more button counts.
- Configurable Tx Power to 10 dBm

## Sub-GHz Transmitter Solution

- MICRF112
- MICRF113
- ATA8403

### Benefits of the Transmitter Family

- Low power consumption
  - 0.05-0.2 μA sleep or shut down mode
- Small form factor and low pin counts
  - Tx: 6-10 pins, Rx: 16 pins
  - Tx: smallest 2 x 2 mm, Rx: 5 x 6 mm
- Low Cost FSK by Crystal Polling
- Extended temperature range
  - Extended 105°C, or 125°C for certain devices

## Sub-GHz Receiver Solution

- MICRF219A/229
- MICRF220/230
- MICRF221
- ATA8203/4/5
- ATA8210
- ATA8215

### Benefits of the Receiver Family

- Auto-Polling Reduces Average Supply Current of Receiver; 15 μA auto-polling current
- Improved Automatic Gain Control
- Improved XTAL Oscillator
- 60dB RSSI
- RF Power Level Lock—rejects competing noise signals
- Squelch-decrease activity on data out put till RF signal is detected

## Sub-GHz Transceiver Solution

- MRF89XA
- ATA8510/5
- MICRF505/505L
- MICRF506

### Benefits of the Transceiver Family

- Superior RF functionalities (e.g., blocking capabilities, power management, and more) enable an extremely low current consumption
- High-sensitivity and high-output power allow for extended RF transmission distances
- Perfect for industrial and consumer applications such as:
  - RF remote control such as garage door openers
  - Smart metering
  - Home automation
  - Building security systems
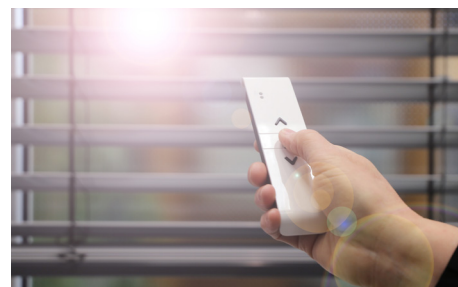
## Support

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:

- Technical Support: www.microchip.com/support
- Evaluation samples of any Microchip device: www.microchip.com/sample
- Knowledge base and peer help: www.microchip.com/forums
- Sales and Global Distribution: 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.

- Overview of Technical Training Resources: www.microchip.com/training
- MASTERs Conferences: www.microchip.com/masters
- Developer Help Website: www.microchip.com/developerhelp
- Technical Training Centers: www.microchip.com/seminars

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