

MCP2021A/2A to ATA6632XX Migration

Author: Daniel Yordanov
Microchip Technology Inc.

INTRODUCTION

The MCP2021A/2A and the ATA6632XX are LIN transceivers with integrated voltage regulators. They have similar features as well as a few differences. For new designs, it is recommended to use the ATA6632XX devices and wherever possible migrate from the MCP2021A/2A to the ATA6632XX. The differences must be taken into account and a decision made about whether migration is possible and what must be changed in the application in order to make a perfect switch from MCP2021A/2A to ATA6632XX.

HARDWARE DIFFERENCES

There are some differences between the MCP2021A/2A and the ATA6632XX devices, such as a different pinout, as shown in [Figure 1](#), and different pin functionality, which is described in [Table 1](#) and in the following sections.

FIGURE 1: PINOUT DIFFERENCES

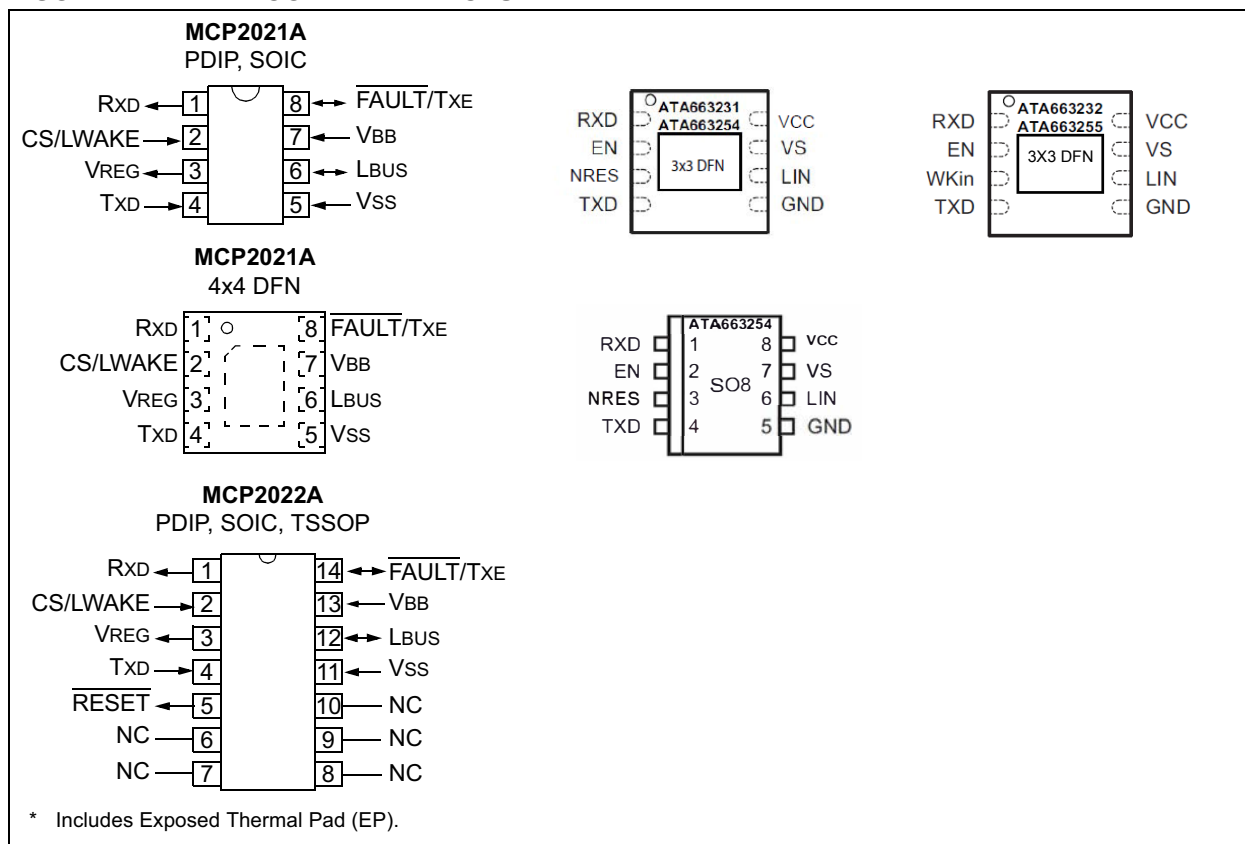


TABLE 1: PIN FUNCTION DIFFERENCES

Pin Name	MCP2021A	MCP2022A	ATA663231/54	ATA663232/55	Pin Description
RXD	1	1	1	1	Receive data output
CS/LWAKE	2	2	—	—	Chip Select and Local Wake-up Input
EN	—	—	2	2	Enables normal mode if the input is high
VREG/VCC	3	3	8	8	Voltage Regulator Output
RSET/NRES	—	5	3	—	Reset Output
WKin	—	—	—	3	Wake-up Input
TXD	4	4	4	4	Transmit data input
VSS/GND	5	11	5	5	Ground
RESET	—	5	—	—	Reset Output
LBUS/LIN	6	12	6	6	LIN bus line input/output
NC	—	6, 7, 8, 9, 10	—	—	Not connected
VBB/VS	7	13	7	7	Supply voltage
FAULT/TXE	8	14	—	—	Fault Detect Output/Transmitter Enable Input
VCC	—	—	8	8	Output voltage regulator 3.3V/5V/85 mA

RESET Pin (MCP2022A) and NRES Pin (ATA663231/54)

The RESET and NRES output pins of the MCP2022A and ATA663231/54 have the same function. They are both open-drain outputs and both indicate proper function of the voltage regulator. They switch to low when the voltage of the internal regulator has fallen below the undervoltage threshold.

The Reset pin of the MCP2022A has a ~90 kΩ internal pull-up to VREG, while the ATA663231/54 has no internal pull-up resistor. Therefore with the ATA663231/54, an external ~10 kΩ resistor to VCC needs to be connected.

In the ATA663231/54, an undervoltage delay is implemented, which keeps NRES low for $t_{\text{Reset}} = 4 \text{ ms}$ after VCC has reached its nominal value.

CS/LWAKE (MCP2021A/2A) and WKin (ATA663232/55)

The Chip Select and Local Wake-up Input pin (TTL level, high-voltage tolerant) of the MCP2021A/2A controls the device state transition. It may also be used as a local wake-up input so an external switch or another source can wake up the transceiver.

The CS/LWAKE input of the MCP2021A/2A is level-sensitive, not edge-triggered.

The ATA663232/55 has also a local wake-up pin (WKin pin), which is a high-voltage input. It is usually connected to an external switch in the application to

generate a local wake-up. A pull-up current source with typically 10 μA is implemented. The voltage threshold for a wake-up signal is typically 2V below the VS voltage. If a local wake-up is not needed in the application, the WKin pin can be connected directly to the VS pin.

A falling edge at the WKin pin followed by a low level maintained for a given time period ($> t_{\text{WKin}}$) results in a local wake-up request.

FAULT/TXE (MCP2021A/2A)

The MCP2021A/2A has a Fault Detect Output/Transmitter Enable Input pin. The output section is a HV-tolerant open-drain (up to 30V). The input section is identical to the TXD section (TTL level, HV-compliant, adaptive pull-up). The internal pull-up resistor may be too weak for some applications. A 10 kΩ external pull-up resistor is recommended to ensure a logic high level.

The Fault Detect Output signals the following malfunctions:

- LBUS shorted to VBB or
- LBUS/TXD permanent dominant detected and Transmit time-out shutdown, or
- Transceiver is in thermal shutdown.

The device is placed in Transmitter Off mode whenever this pin is low ('0'), either from an internal fault condition or by external drive. If CS/LWAKE is high ('1'), the FAULT/TXE signals a mismatch between the TXD input and the LBUS level. This can be used to detect a bus

contention. After the device wakes up, the FAULT/TXE indicates what wakes the device if CS/LWAKE remains low ('0').

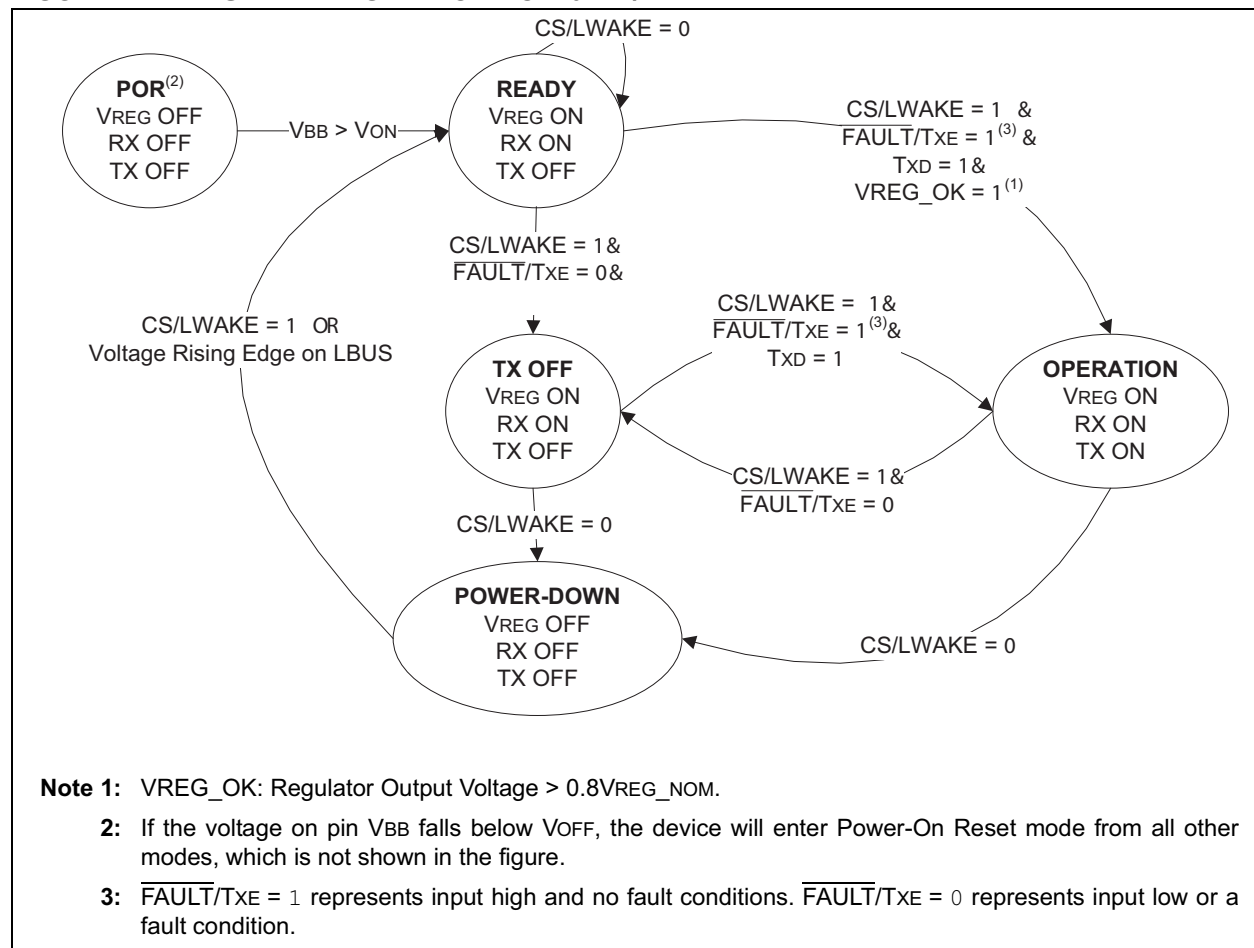
The exact functionality is not implemented in the ATA6632XX device, but the wake-up source recognition is implemented. The device can distinguish between different wake-up sources. The wake-up source can be read on the TXD and RXD pin in fail-safe

mode. These flags are immediately reset if the microcontroller sets the EN pin to high and the IC is in normal mode.

As the FAULT pin is not available in the ATA6632XX device the mismatch signaling between the TXD input and the LIN bus level can be achieved in software by comparing the TXD and RXD signals.

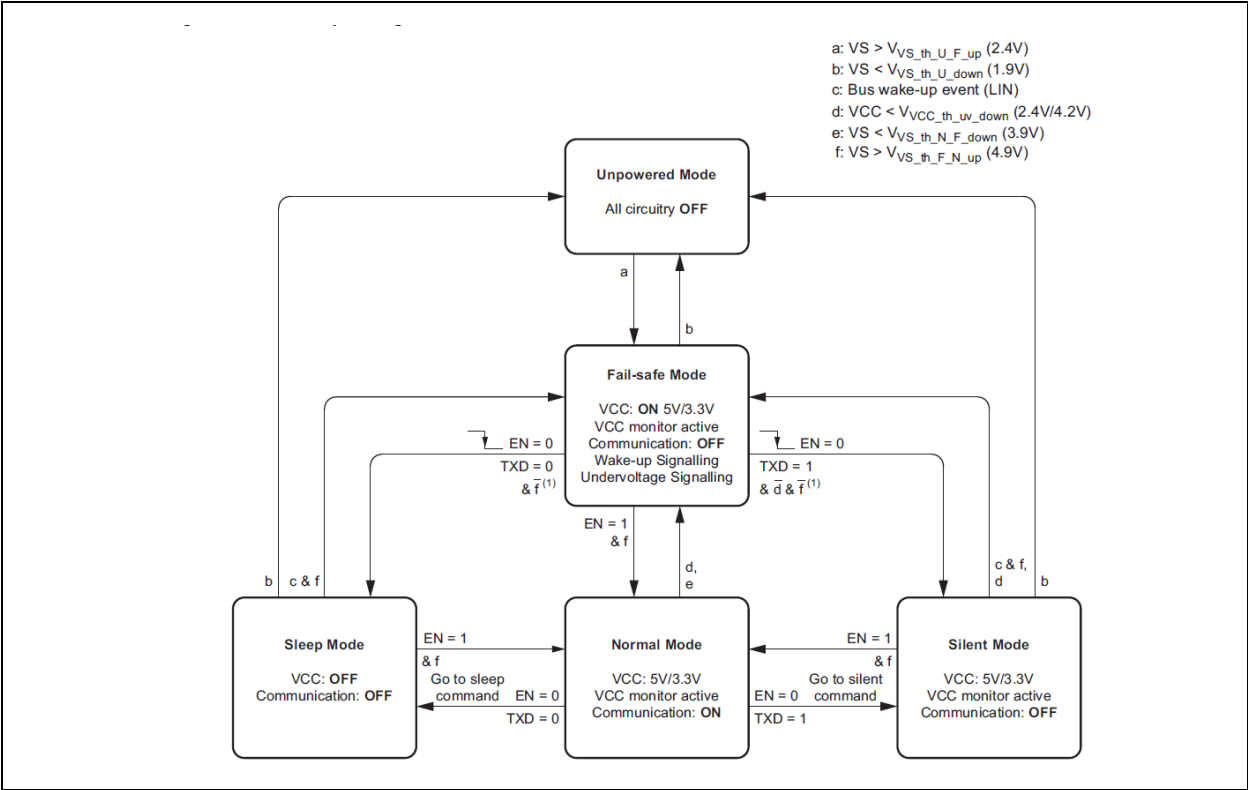
STATES AND STATE TRANSITION DIFFERENCES

FIGURE 2: STATE DIAGRAM OF MCP2021A/2A



For the MCP2021A/2A, most state transitions are controlled with CS/LWAKE, FAULT/TXE and TXD.

FIGURE 3: STATE DIAGRAM OF ATA6632XX



DIFFERENCES BETWEEN THE INTEGRATED VOLTAGE REGULATORS

The main difference of the integrated voltage regulators in the ATA6632XX and in the MCP2021A/2A is the current capability.

The ATA6632XX can deliver up to 85 mA with an accuracy of +/-2%. The MCP2021A/2A has an accuracy of +/-3% and is able to deliver 70 mA.

The ATA6632XX has also lower ESR restrictions for the output capacitor.

TABLE 2: MAIN DIFFERENCES BETWEEN THE INTEGRATED VOLTAGE REGULATORS

	Output Voltage	Voltage Regulator Ready after POR	Thermal shutdown	Current capability	Load capacitor
MCP2021A/2A	3.3V / 5.0V $\pm 3\%$	1.2 ms	150°C	70 mA	Min 4 μF (MLC) or min 1 μF (Tantalum/Electrolytic)
ATA663231/54 ATA663232/55	3.3V / 5.0V $\pm 2\%$	1.5 ms	165°C	85 mA	Min 1.8 μF (MLC) Min 3.5 μF (MLC)

The following figures show the differences in schematics between the MCP2021A/2A and the ATA6632XX devices.

Note 1: CREG, the load capacitor, should be ceramic or tantalum rated for extended temperatures, 1.0 – 22 μ F. See Figure 4 to select the correct ESR.

2: CBAT is the filter capacitor for the external voltage supply. Typically 10 x CREG, with no ESR restriction. The RTP value is added to the line resistance.

3: This diode is only needed if CS/LWAKE is connected to the VBAT supply.

4: ESD protection diode.

5: This component is for additional load dump protection.

6: An external 10 k Ω resistor is recommended for some applications.

FIGURE 5: ATA663231/54

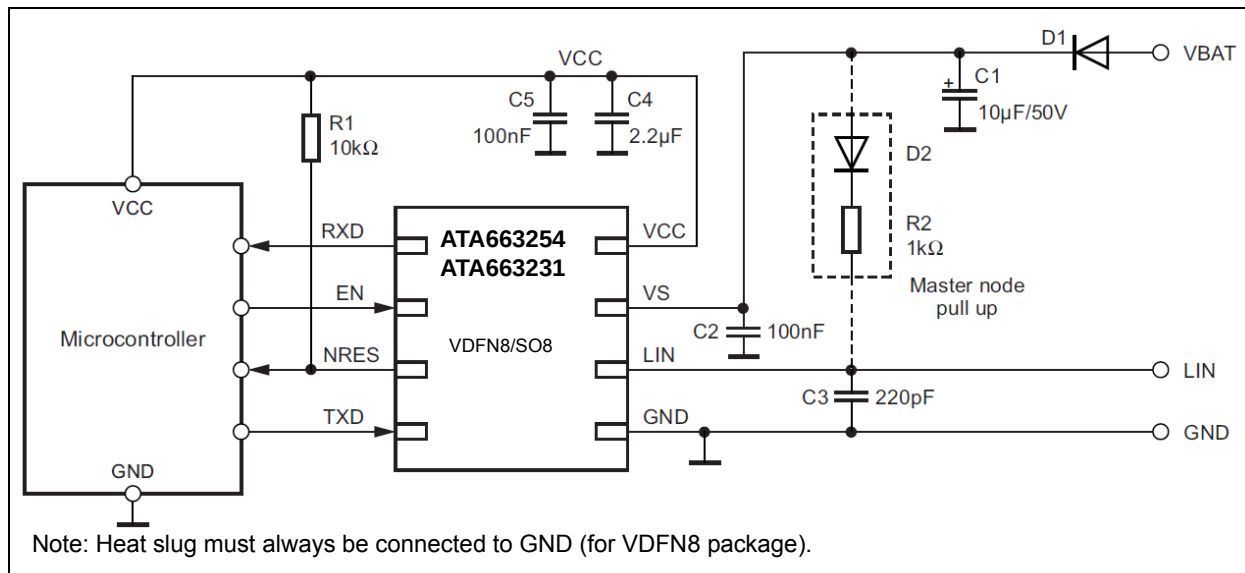
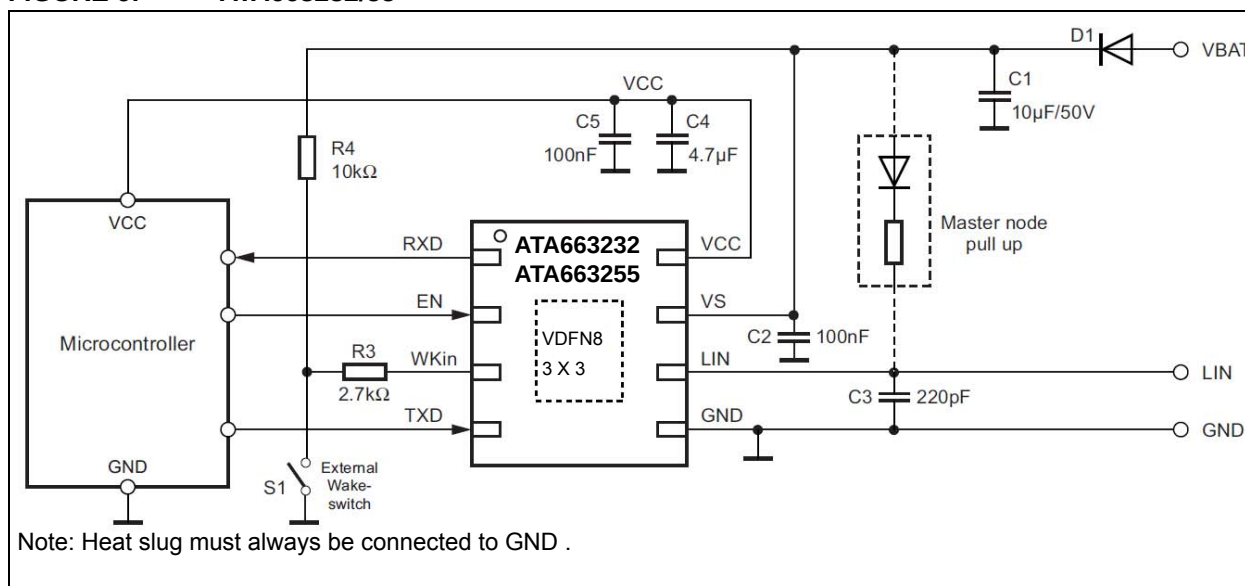


FIGURE 6: ATA663232/55



CONCLUSION

This document describes the aspects that must be taken into account before migrating from the MCP2021A/2A to the ATA6632XX. The ATA6632XX is not a direct replacement for the MCP2021A/2A. The printed circuit board as well as the software need to be modified.

The ATA6632XX has a pinout according the OEM recommendations, and the integrated voltage regulator has a higher current capability (85 mA) and higher accuracy (+/-2%).

Note the following details of the code protection feature on Microchip devices:

- Microchip products meet the specification contained in their particular Microchip Data Sheet.
- Microchip believes that its family of products is one of the most secure families of its kind on the market today, when used in the intended manner and under normal conditions.
- There are dishonest and possibly illegal methods used to breach the code protection feature. All of these methods, to our knowledge, require using the Microchip products in a manner outside the operating specifications contained in Microchip's Data Sheets. Most likely, the person doing so is engaged in theft of intellectual property.
- Microchip is willing to work with the customer who is concerned about the integrity of their code.
- Neither Microchip nor any other semiconductor manufacturer can guarantee the security of their code. Code protection does not mean that we are guaranteeing the product as "unbreakable."

Code protection is constantly evolving. We at Microchip are committed to continuously improving the code protection features of our products. Attempts to break Microchip's code protection feature may be a violation of the Digital Millennium Copyright Act. If such acts allow unauthorized access to your software or other copyrighted work, you may have a right to sue for relief under that Act.

Information contained in this publication regarding device applications and the like is provided only for your convenience and may be superseded by updates. It is your responsibility to ensure that your application meets with your specifications. MICROCHIP MAKES NO REPRESENTATIONS OR WARRANTIES OF ANY KIND WHETHER EXPRESS OR IMPLIED, WRITTEN OR ORAL, STATUTORY OR OTHERWISE, RELATED TO THE INFORMATION, INCLUDING BUT NOT LIMITED TO ITS CONDITION, QUALITY, PERFORMANCE, MERCHANTABILITY OR FITNESS FOR PURPOSE. Microchip disclaims all liability arising from this information and its use. Use of Microchip devices in life support and/or safety applications is entirely at the buyer's risk, and the buyer agrees to defend, indemnify and hold harmless Microchip from any and all damages, claims, suits, or expenses resulting from such use. No licenses are conveyed, implicitly or otherwise, under any Microchip intellectual property rights unless otherwise stated.

Microchip received ISO/TS-16949:2009 certification for its worldwide headquarters, design and wafer fabrication facilities in Chandler and Tempe, Arizona; Gresham, Oregon and design centers in California and India. The Company's quality system processes and procedures are for its PIC® MCUs and dsPIC® DSCs, KEELOQ® code hopping devices, Serial EEPROMs, microperipherals, nonvolatile memory and analog products. In addition, Microchip's quality system for the design and manufacture of development systems is ISO 9001:2000 certified.

QUALITY MANAGEMENT SYSTEM
CERTIFIED BY DNV
== ISO/TS 16949 ==

Trademarks

The Microchip name and logo, the Microchip logo, AnyRate, AVR, AVR logo, AVR Freaks, BeaconThings, BitCloud, CryptoMemory, CryptoRF, dsPIC, FlashFlex, flexPWR, Helder, JukeBlox, KEELOQ, KEELOQ logo, Klear, LANCheck, LINK MD, maxStylus, maxTouch, MediaLB, megaAVR, MOST, MOST logo, MPLAB, OptoLyzer, PIC, picoPower, PICSTART, PIC32 logo, Prochip Designer, QTouch, RightTouch, SAM-BA, SpyNIC, SST, SST Logo, SuperFlash, tinyAVR, UNI/O, and XMEGA are registered trademarks of Microchip Technology Incorporated in the U.S.A. and other countries.

ClockWorks, The Embedded Control Solutions Company, EtherSynch, Hyper Speed Control, HyperLight Load, IntelliMOS, mTouch, Precision Edge, and Quiet-Wire are registered trademarks of Microchip Technology Incorporated in the U.S.A.

Adjacent Key Suppression, AKS, Analog-for-the-Digital Age, Any Capacitor, AnyIn, AnyOut, BodyCom, chipKIT, chipKIT logo, CodeGuard, CryptoAuthentication, CryptoCompanion, CryptoController, dsPICDEM, dsPICDEM.net, Dynamic Average Matching, DAM, ECAN, EtherGREEN, In-Circuit Serial Programming, ICSP, Inter-Chip Connectivity, JitterBlocker, KlearNet, KlearNet logo, Mindi, MiWi, motorBench, MPASM, MPF, MPLAB Certified logo, MPLIB, MPLINK, MultiTRAK, NetDetach, Omniscient Code Generation, PICDEM, PICDEM.net, PICKit, PICtail, PureSilicon, QMatrix, RightTouch logo, REAL ICE, Ripple Blocker, SAM-ICE, Serial Quad I/O, SMART-I.S., SQI, SuperSwitcher, SuperSwitcher II, Total Endurance, TSHARC, USBCheck, VariSense, ViewSpan, WiperLock, Wireless DNA, and ZENA are trademarks of Microchip Technology Incorporated in the U.S.A. and other countries.

SQTP is a service mark of Microchip Technology Incorporated in the U.S.A.

Silicon Storage Technology is a registered trademark of Microchip Technology Inc. in other countries.

GestIC is a registered trademark of Microchip Technology Germany II GmbH & Co. KG, a subsidiary of Microchip Technology Inc., in other countries.

All other trademarks mentioned herein are property of their respective companies.

© 2017, Microchip Technology Incorporated, All Rights Reserved.
ISBN: 978-1-5224-2370-6

Worldwide Sales and Service

AMERICAS

Corporate Office
2355 West Chandler Blvd.
Chandler, AZ 85224-6199
Tel: 480-792-7200
Fax: 480-792-7277
Technical Support:
<http://www.microchip.com/support>
Web Address:
www.microchip.com

Atlanta
Duluth, GA
Tel: 678-957-9614
Fax: 678-957-1455

Austin, TX
Tel: 512-257-3370

Boston
Westborough, MA
Tel: 774-760-0087
Fax: 774-760-0088

Chicago
Itasca, IL
Tel: 630-285-0071
Fax: 630-285-0075

Dallas
Addison, TX
Tel: 972-818-7423
Fax: 972-818-2924

Detroit
Novi, MI
Tel: 248-848-4000

Houston, TX
Tel: 281-894-5983

Indianapolis
Noblesville, IN
Tel: 317-773-8323
Fax: 317-773-5453
Tel: 317-536-2380

Los Angeles
Mission Viejo, CA
Tel: 949-462-9523
Fax: 949-462-9608
Tel: 951-273-7800

Raleigh, NC
Tel: 919-844-7510

New York, NY
Tel: 631-435-6000

San Jose, CA
Tel: 408-735-9110
Tel: 408-436-4270

Canada - Toronto
Tel: 905-695-1980
Fax: 905-695-2078

ASIA/PACIFIC

Australia - Sydney
Tel: 61-2-9868-6733

China - Beijing
Tel: 86-10-8569-7000

China - Chengdu
Tel: 86-28-8665-5511

China - Chongqing
Tel: 86-23-8980-9588

China - Dongguan
Tel: 86-769-8702-9880

China - Guangzhou
Tel: 86-20-8755-8029

China - Hangzhou
Tel: 86-571-8792-8115

China - Hong Kong SAR
Tel: 852-2943-5100

China - Nanjing
Tel: 86-25-8473-2460

China - Qingdao
Tel: 86-532-8502-7355

China - Shanghai
Tel: 86-21-3326-8000

China - Shenyang
Tel: 86-24-2334-2829

China - Shenzhen
Tel: 86-755-8864-2200

China - Suzhou
Tel: 86-186-6233-1526

China - Wuhan
Tel: 86-27-5980-5300

China - Xian
Tel: 86-29-8833-7252

China - Xiamen
Tel: 86-592-2388138

China - Zhuhai
Tel: 86-756-3210040

ASIA/PACIFIC

India - Bangalore
Tel: 91-80-3090-4444

India - New Delhi
Tel: 91-11-4160-8631

India - Pune
Tel: 91-20-4121-0141

Japan - Osaka
Tel: 81-6-6152-7160

Japan - Tokyo
Tel: 81-3-6880-3770

Korea - Daegu
Tel: 82-53-744-4301

Korea - Seoul
Tel: 82-2-554-7200

Malaysia - Kuala Lumpur
Tel: 60-3-7651-7906

Malaysia - Penang
Tel: 60-4-227-8870

Philippines - Manila
Tel: 63-2-634-9065

Singapore
Tel: 65-6334-8870

Taiwan - Hsin Chu
Tel: 886-3-577-8366

Taiwan - Kaohsiung
Tel: 886-7-213-7830

Taiwan - Taipei
Tel: 886-2-2508-8600

Thailand - Bangkok
Tel: 66-2-694-1351

Vietnam - Ho Chi Minh
Tel: 84-28-5448-2100

EUROPE

Austria - Wels
Tel: 43-7242-2244-39
Fax: 43-7242-2244-393

Denmark - Copenhagen
Tel: 45-4450-2828
Fax: 45-4485-2829

Finland - Espoo
Tel: 358-9-4520-820

France - Paris
Tel: 33-1-69-53-63-20
Fax: 33-1-69-30-90-79

Germany - Garching
Tel: 49-8931-9700

Germany - Haan
Tel: 49-2129-3766400

Germany - Heilbronn
Tel: 49-7131-67-3636

Germany - Karlsruhe
Tel: 49-721-625370

Germany - Munich
Tel: 49-89-627-144-0
Fax: 49-89-627-144-44

Germany - Rosenheim
Tel: 49-8031-354-560

Israel - Ra'anana
Tel: 972-9-744-7705

Italy - Milan
Tel: 39-0331-742611
Fax: 39-0331-466781

Italy - Padova
Tel: 39-049-7625286

Netherlands - Drunen
Tel: 31-416-690399
Fax: 31-416-690340

Norway - Trondheim
Tel: 47-7289-7561

Poland - Warsaw
Tel: 48-22-3325737

Romania - Bucharest
Tel: 40-21-407-87-50

Spain - Madrid
Tel: 34-91-708-08-90
Fax: 34-91-708-08-91

Sweden - Gothenberg
Tel: 46-31-704-60-40

Sweden - Stockholm
Tel: 46-8-5090-4654

UK - Wokingham
Tel: 44-118-921-5800
Fax: 44-118-921-5820