

---

---

## maXTouch 112-node Touchscreen Controller Product Brief

---

---

### Description

The mXT112UD-MAUHA1 1.0 uses a unique charge-transfer acquisition engine to implement Microchip's patented capacitive sensing method. Coupled with a state-of-the-art CPU, the entire touchscreen sensing solution can measure, classify and track a number of individual finger touches with a high degree of accuracy in the shortest response time. The mXT112UD-MAUHA1 1.0 allows for both mutual and self capacitance measurements, with the self capacitance measurements being used to augment the mutual capacitance measurements to produce reliable touch information.

### Functional Safety

- UL/IEC 60730 Class B support
- Self diagnostics at power-on and as periodic tests during operation
- Heartbeat (alive) signal output to host
- Safety manual available

### maXTouch<sup>®</sup> Adaptive Sensing Touchscreen Technology

- Up to 14 X (transmit) lines and 24 Y (receive) lines for use by a touchscreen
- A maximum of 112 nodes can be allocated to the touch sensor
- Touchscreen size of 4.47 inches (2:1 aspect ratio), assuming a sensor electrode pitch of 6.5 mm. Other sizes are possible with different electrode pitches and appropriate sensor material
- Multiple touch support with up to 10 concurrent touches tracked in real time

### Touch Sensor Technology

- Discrete/out-cell support including glass and PET film-based sensors
- On-cell/touch-on display support including TFT, LCD (ITPS, IPS) and OLED
- Synchronization with display refresh timing capability
- Support for standard (for example, Diamond) and proprietary sensor patterns (review of designs by Microchip or a Microchip-qualified touch sensor module partner is recommended)

### Front Panel Material and Design

- Works with PET or glass, including curved profiles (configuration and stack-up to be approved by Microchip or a Microchip-qualified touch sensor module partner)
- 10 mm glass (or 5 mm PMMA) with bare finger (dependent on screen size, touch size, configuration and stack-up)
- 6 mm glass (or 3 mm PMMA) with multi-finger 5 mm glove (2.7 mm PMMA equivalent) (dependent on screen size, touch size, configuration and stack-up)
- Support for non-rectangular sensor designs (for example, circular, rounded or with cutouts)

### Touch Performance

- Moisture/Water Compensation
  - No false touch with condensation or water drop up to 22 mm diameter
  - One-finger tracking with condensation or water drop up to 22 mm diameter
- Mutual capacitance and self capacitance measurements supported for robust touch detection
- P2P mutual capacitance measurements supported for extra sensitive multi-touch sensing
- Noise suppression technology to combat ambient, charger, and power-line noise
  - Up to 240 V<sub>PP</sub> between 1 Hz and 1 kHz sinusoidal waveform
  - Up to 20 V<sub>PP</sub> between 1 kHz and 1 MHz sinusoidal waveform
- Burst Frequency
  - Controlled Tx burst frequency drift over process and temperature range

# MXT112UD-MAUHA1 1.0

---

- Scan Speed
  - Typical report rate for 10 touches  $\geq 70$  Hz (subject to configuration)
  - Initial touch latency  $< 18$  ms for first touch from idle (subject to configuration)
  - Configurable to allow for power and speed optimization

## Enhanced Algorithms

- Lens bending algorithms to remove display noise
- Touch suppression algorithms to remove unintentional large touches, such as palm
- Palm Recovery Algorithm for quick restoration to normal state

## Power Saving

- Programmable timeout for automatic transition from Active to Idle state
- Pipelined analog sensing detection and digital processing to optimize system power efficiency

## Application Interfaces

- I<sup>2</sup>C interface with support for Standard mode (up to 100 kHz), Fast mode (up to 400 kHz), Fast-mode Plus (up to 1 MHz)
- Interrupt to indicate when a message is available
- Additional SPI Debug Interface to read the raw data for tuning and debugging purposes

## Power Supply

- Digital (Vdd) 3.3V nominal
- Digital I/O (VddIO) 3.3V nominal
- Analog (AVdd) 3.3V nominal
- High voltage internal X line drive (XVdd) 6.6V with internal voltage pump (XVdd connected to AVdd if voltage pump not used)

## Package

- 56-pin XQFN 6 × 6 × 0.4 mm, 0.35 mm pitch

## Operating Temperature

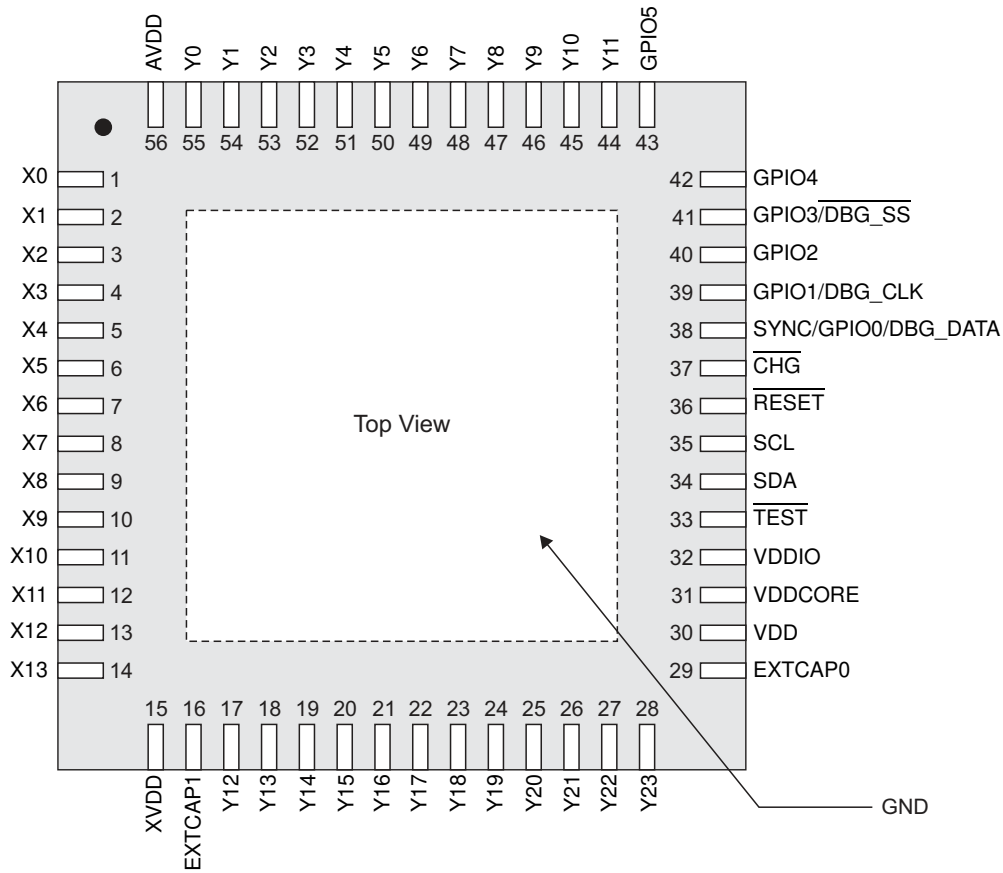
- $-40^{\circ}\text{C}$  to  $+85^{\circ}\text{C}$

## Design Services

- Review of device configuration, stack-up and sensor patterns
- Custom firmware versions can be considered

PIN CONFIGURATION

Pin Configuration – 56-pin XQFN



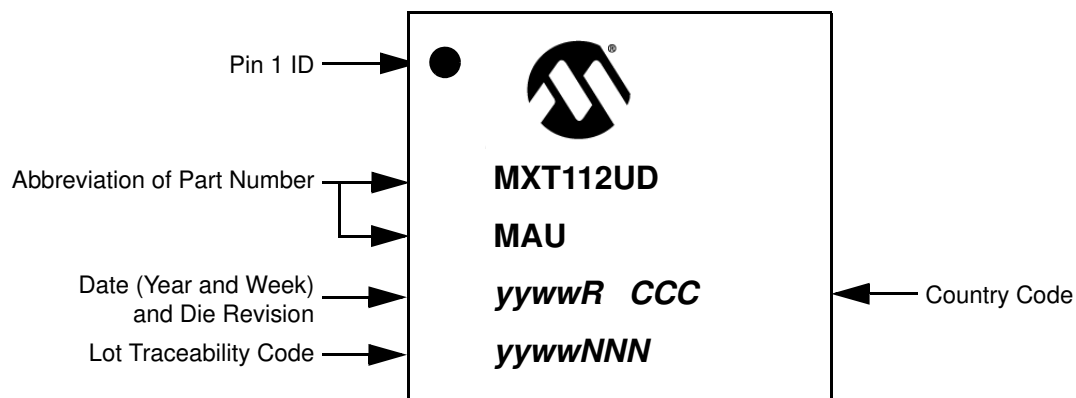
# mXT112UD-MAUHA1 1.0

---

## 1.0 PACKAGING INFORMATION

### 1.1 Package Marking Information

#### 1.1.1 56-PIN XQFN



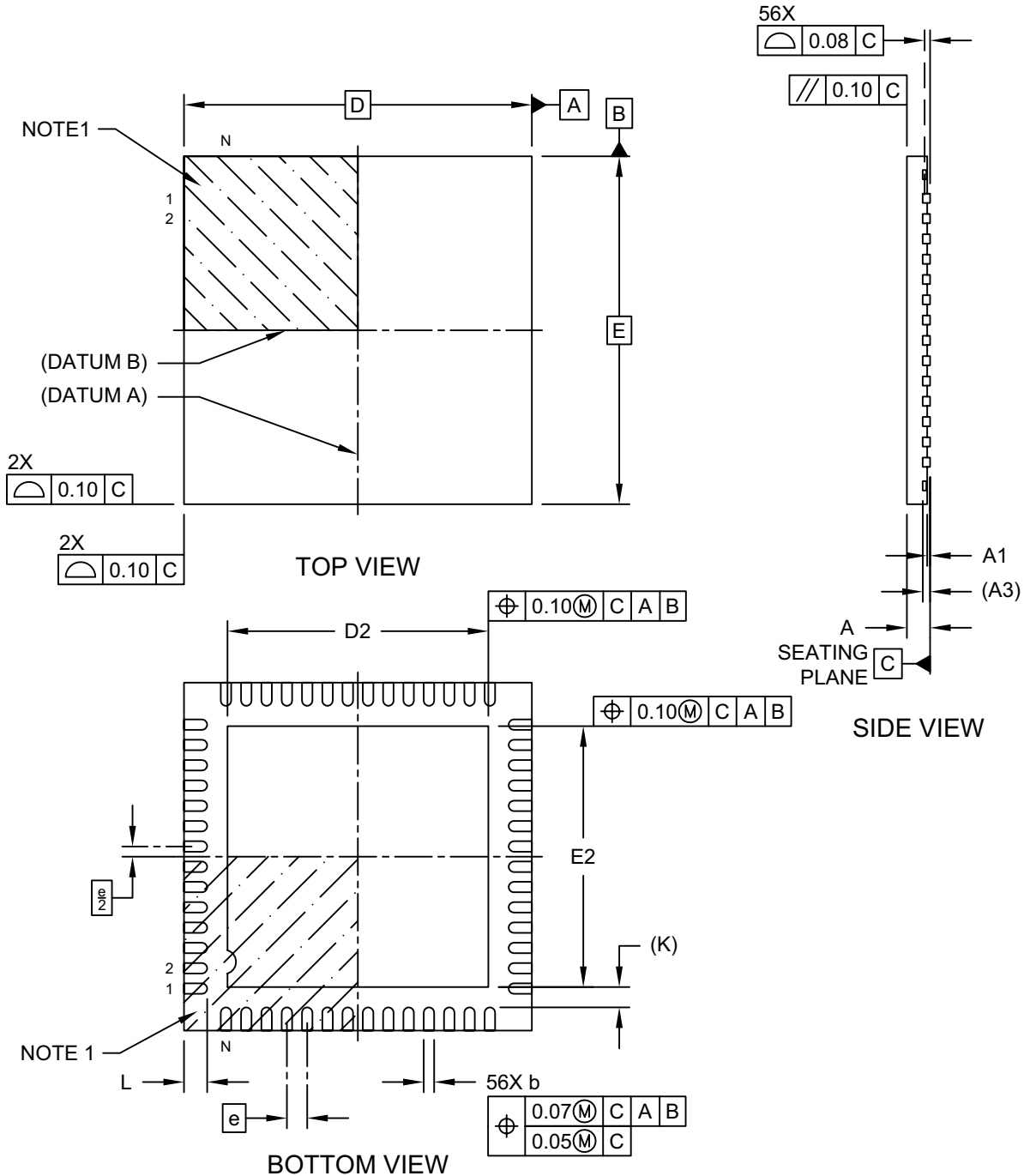
#### 1.1.2 ORDERABLE PART NUMBERS

The product identification system for maXTouch devices is described in ["Product Identification System"](#). That section also lists example part numbers for the device.

1.2 Package Details

**56-Lead Extremely Thin Quad Flatpack No-Lead Package (TWB) - 6x6x0.4 mm Body [XQFN] With 4.5x4.5 mm Exposed Pad; Atmel Legacy Global Package Code ZIX**

**Note:** For the most current package drawings, please see the Microchip Packaging Specification located at <http://www.microchip.com/packaging>

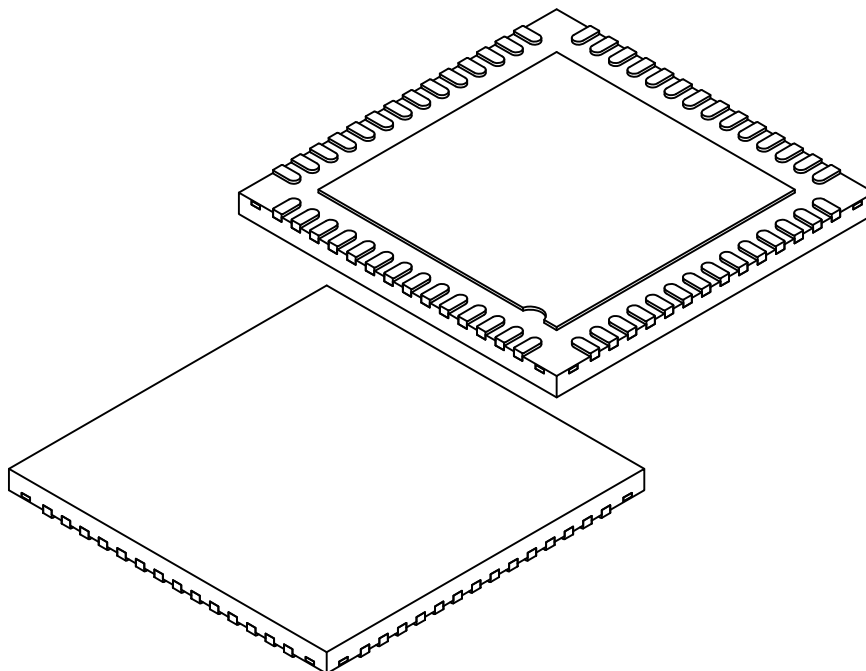


Microchip Technology Drawing C04-21448 Rev A Sheet 1 of 2

# mXT112UD-MAUHA1 1.0

## 56-Lead Extremely Thin Quad Flatpack No-Lead Package (TWB) - 6x6x0.4 mm Body [XQFN] With 4.5x4.5 mm Exposed Pad; Atmel Legacy Global Package Code ZIX

**Note:** For the most current package drawings, please see the Microchip Packaging Specification located at <http://www.microchip.com/packaging>



Units		MILLIMETERS		
Dimension Limits		MIN	NOM	MAX
Number of Terminals	N	56		
Pitch	e	0.35 BSC		
Overall Height	A	–	–	0.400
Standoff	A1	0.00	–	0.05
Terminal Thickness	A3	0.127 REF		
Overall Length	D	6.00 BSC		
Exposed Pad Length	D2	4.40	4.50	4.60
Overall Width	E	6.00 BSC		
Exposed Pad Width	E2	4.40	4.50	4.60
Terminal Width	b	0.13	0.18	0.23
Terminal Length	L	0.35	0.40	0.45
Terminal-to-Exposed-Pad	K	0.35 REF		

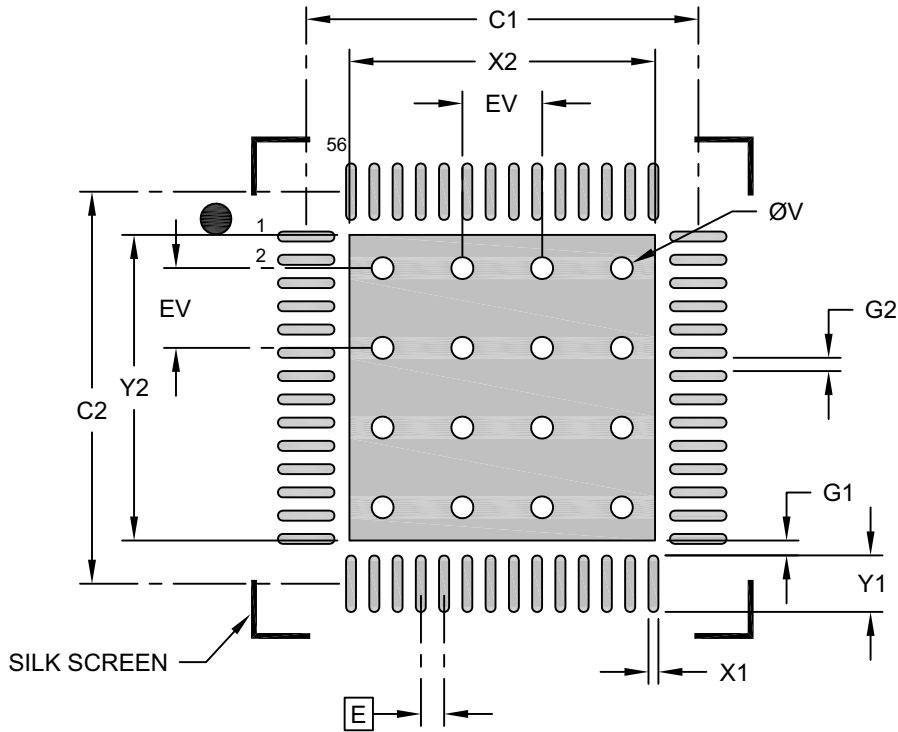
**Notes:**

1. Pin 1 visual index feature may vary, but must be located within the hatched area.
2. Package is saw singulated
3. Dimensioning and tolerancing per ASME Y14.5M  
BSC: Basic Dimension. Theoretically exact value shown without tolerances.  
REF: Reference Dimension, usually without tolerance, for information purposes only.

Microchip Technology Drawing C04-21448 Rev A Sheet 2 of 2

**56-Lead Extremely Thin Quad Flatpack No-Lead Package (TWB) - 6x6x0.4 mm Body [XQFN] With 4.5x4.5 mm Exposed Pad; Atmel Legacy Global Package Code ZIX**

**Note:** For the most current package drawings, please see the Microchip Packaging Specification located at <http://www.microchip.com/packaging>



**RECOMMENDED LAND PATTERN**

Dimension Limits	Units	MILLIMETERS		
		MIN	NOM	MAX
Contact Pitch	E	0.35 BSC		
Optional Center Pad Width	X2			4.60
Optional Center Pad Length	Y2			4.60
Contact Pad Spacing	C1		5.90	
Contact Pad Spacing	C2		5.90	
Contact Pad Width (X56)	X1			0.15
Contact Pad Length (X56)	Y1			0.85
Contact Pad to Center Pad (X56)	G1	0.23		
Contact Pad to Contact Pad (X52)	G2	0.20		
Thermal Via Diameter	V		0.33	
Thermal Via Pitch	EV		1.20	

**Notes:**

- Dimensioning and tolerancing per ASME Y14.5M  
BSC: Basic Dimension. Theoretically exact value shown without tolerances.
- For best soldering results, thermal vias, if used, should be filled or tented to avoid solder loss during reflow process

Microchip Technology Drawing C04-23448 Rev A

## APPENDIX A: REVISION HISTORY

### Revision A (October 2020)

Initial edition for firmware revision 1.0.AB – Release



## PRODUCT IDENTIFICATION SYSTEM

The table below gives details on the product identification system for maXTouch devices. See [“Orderable Part Numbers”](#) below for example part numbers for the mXT112UD-MAUHA1.

To order or obtain information, for example on pricing or delivery, refer to the factory or the listed sales office.

PART NO.	-XXX	[X]	[X]	[XXX]
Device	Package	Temperature Range	Tape and Reel Option	Pattern
Device:	Base device name			
Package:	A	=	QFP (Plastic Quad Flatpack)	
	CC	=	UFBGA (Ultra Thin Fine-pitch Ball Grid Array)	
	C2	=	UFBGA (Ultra Thin Fine-pitch Ball Grid Array)	
	NH	=	UFBGA (Ultra Thin Fine-pitch Ball Grid Array)	
	C4	=	X1FBGA (Extra Thin Fine-pitch Ball Grid Array)	
	MA	=	XQFN (Super Thin Quad Flat No Lead Sawn)	
	MA5	=	XQFN (Super Thin Quad Flat No Lead Sawn)	
Temperature Range:	U	=	-40°C to +85°C (Grade 3)	
	T	=	-40°C to +85°C (Grade 3)	
	B	=	-40°C to +105°C (Grade 2)	
Tape and Reel Option:	<i>Blank</i>	=	Standard Packaging (Tube or Tray)	
	R	=	Tape and Reel <sup>(1)</sup>	
Pattern:	Extension, QTP, SQTP, Code or Special Requirements (Blank Otherwise)			

**Note 1:** Tape and Reel identifier only appears in the catalog part number description. This identifier is used for ordering purposes and is not printed on the device package. See [“Orderable Part Numbers”](#) below or check with your Microchip Sales Office for package availability with the Tape and Reel option.

## Orderable Part Numbers

Orderable Part Number	Firmware Revision	Description
ATMXT112UD-MAUHA1 (Supplied in trays)	1.0.AB	56-pin XQFN 6 × 6 × 0.4 mm, RoHS compliant Industrial grade; not suitable for automotive characterization
ATMXT112UD-MAURHA1 (Supplied in tape and reel)		

# mXT112UD-MAUHA1 1.0

---

NOTES:

---

---

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

- Microchip products meet the specifications contained in their particular Microchip Data Sheet.
- Microchip believes that its family of products is secure when used in the intended manner and under normal conditions.
- There are dishonest and possibly illegal methods being used in attempts to breach the code protection features of the Microchip devices. We believe that these methods require using the Microchip products in a manner outside the operating specifications contained in Microchip's Data Sheets. Attempts to breach these code protection features, most likely, cannot be accomplished without violating Microchip's intellectual property rights.
- Microchip is willing to work with any customer who is concerned about the integrity of its code.
- Neither Microchip nor any other semiconductor manufacturer can guarantee the security of its code. Code protection does not mean that we are guaranteeing the product is "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 is provided for the sole purpose of designing with and using Microchip products. Information 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.

THIS INFORMATION IS PROVIDED BY MICROCHIP "AS IS". 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 ANY IMPLIED WARRANTIES OF NON-INFRINGEMENT, MERCHANTABILITY, AND FITNESS FOR A PARTICULAR PURPOSE OR WARRANTIES RELATED TO ITS CONDITION, QUALITY, OR PERFORMANCE.

IN NO EVENT WILL MICROCHIP BE LIABLE FOR ANY INDIRECT, SPECIAL, PUNITIVE, INCIDENTAL OR CONSEQUENTIAL LOSS, DAMAGE, COST OR EXPENSE OF ANY KIND WHATSOEVER RELATED TO THE INFORMATION OR ITS USE, HOWEVER CAUSED, EVEN IF MICROCHIP HAS BEEN ADVISED OF THE POSSIBILITY OR THE DAMAGES ARE FORESEEABLE. TO THE FULLEST EXTENT ALLOWED BY LAW, MICROCHIP'S TOTAL LIABILITY ON ALL CLAIMS IN ANY WAY RELATED TO THE INFORMATION OR ITS USE WILL NOT EXCEED THE AMOUNT OF FEES, IF ANY, THAT YOU HAVE PAID DIRECTLY TO MICROCHIP FOR THE INFORMATION. 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.

**Trademarks**

The Microchip name and logo, the Microchip logo, Adaptec, AnyRate, AVR, AVR logo, AVR Freaks, BesTime, BitCloud, chipKIT, chipKIT logo, CryptoMemory, CryptoRF, dsPIC, FlashFlex, flexPWR, HELDO, IGLOO, JukeBlox, KeeLoq, Kleer, LANCheck, LinkMD, maXStylus, maXTouch, MediaLB, megaAVR, Microsemi, Microsemi logo, MOST, MOST logo, MPLAB, OptoLyzer, PackeTime, PIC, picoPower, PICSTART, PIC32 logo, PolarFire, Prochip Designer, QTouch, SAM-BA, SenGenuity, SpyNIC, SST, SST Logo, SuperFlash, Symmetricom, SyncServer, Tachyon, TimeSource, tinyAVR, UNI/O, Vectron, and XMEGA are registered trademarks of Microchip Technology Incorporated in the U.S.A. and other countries.

AgileSwitch, APT, ClockWorks, The Embedded Control Solutions Company, EtherSynch, FlashTec, Hyper Speed Control, HyperLight Load, IntelliMOS, Libero, motorBench, mTouch, Powermite 3, Precision Edge, ProASIC, ProASIC Plus, ProASIC Plus logo, Quiet-Wire, SmartFusion, SyncWorld, Temux, TimeCesium, TimeHub, TimePictra, TimeProvider, WinPath, and ZL 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, Augmented Switching, BlueSky, BodyCom, CodeGuard, CryptoAuthentication, CryptoAutomotive, CryptoCompanion, CryptoController, dsPICDEM, dsPICDEM.net, Dynamic Average Matching, DAM, ECAN, Espresso T1S, EtherGREEN, IdealBridge, In-Circuit Serial Programming, ICSP, INICnet, Intelligent Paralleling, Inter-Chip Connectivity, JitterBlocker, maxCrypto, maxView, memBrain, MINDI, MiWi, MPASM, MPF, MPLAB Certified logo, MPLIB, MPLINK, MultiTRAK, NetDetach, Omniscient Code Generation, PICDEM, PICDEM.net, PICkit, PICtail, PowerSmart, PureSilicon, QMatrix, REAL ICE, Ripple Blocker, RTAX, RTG4, SAM-ICE, Serial Quad I/O, simpleMAP, SimpliPHY, SmartBuffer, SMART-I.S., storClad, SQL, SuperSwitcher, SuperSwitcher II, Switchtec, SynchroPHY, Total Endurance, TSHARC, USBCheck, VariSense, VectorBlox, VeriPHY, ViewSpan, WiperLock, XpressConnect, 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.

The Adaptec logo, Frequency on Demand, Silicon Storage Technology, and Symmcom are registered trademarks 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.

© 2020, Microchip Technology Incorporated, All Rights Reserved.

ISBN: 978-1-5224-6965-0

For information regarding Microchip's Quality Management Systems, please visit [www.microchip.com/quality](http://www.microchip.com/quality).

---

---

## 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](http://www.microchip.com/support)  
Web Address:  
[www.microchip.com](http://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: 45-4485-5910  
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: 49-7131-72400

**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: 47-7288-4388

**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