



# mXT144UD-AMTSL/ mXT144UD-AMBSL 1.0

---

## maXTouch 144-node Touch Slider Controller Product Brief

---

### Description

The mXT144UD-AMxSL 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 sensor 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 mXT144UD-AMxSL 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.

### Automotive Applications

- AEC-Q100 Qualified
- CISPR 25 compliant (for both mutual and self capacitance measurements)

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

- Up to 12 X (transmit) lines and 12 Y (receive) lines for use by a slider and/or key array
- A maximum of 144 nodes can be allocated to the touch sensor
- Slider length 936 mm, assuming a sensor electrode pitch of 6.5 mm. Other lengths are possible with different electrode pitches and appropriate sensor material
- Multiple touch support with up to 10 concurrent touches tracked in real time

### Keys

- Up to 16 nodes can be allocated as mutual capacitance sensor keys in addition to the slider, defined as 1 key array (subject to availability of X and Y lines and other configurations)
- Adjacent Key Suppression (AKS) technology is supported for false key touch prevention

### Touch Sensor Technology

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

### Front Panel Material

- 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 sensor 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 sensor size, touch size, configuration and stack-up)

### 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 and power-line noise
  - Up to 240 V<sub>PP</sub> between 1 Hz and 1 kHz sinusoidal waveform (no touches)
  - Up to 20 V<sub>PP</sub> between 1 kHz and 1 MHz sinusoidal waveform
- Burst Frequency
  - Flexible and dynamic Tx burst frequency selection to reduce EMC disturbance
  - Configurable Tx waveform shaping to reduce emissions
- Scan Speed
  - Typical report rate for 5 touches  $\geq 120$  Hz (subject to configuration)
  - Initial touch latency  $< 6$  ms for first touch from idle (subject to configuration)

- Configurable for power and speed optimization
- Touch panel failure detection
  - Automatic touch sensor diagnostics during run time to support the implementation of safety critical features
  - Diagnostics reported using dedicated output pin or by standard Object Protocol messages
  - Configurable test limits

### Enhanced Algorithms

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

### Data Store

- 64-byte data area for user's custom data (not CRC checksummed)

### Power Saving

- Programmable timeout for automatic transition from Active to Idle state
- Pipelined analog sensing detection and digital processing to optimize system power efficiency
- Low power idle mode reduces measurements to the minimum required to detect touches, at which point the device enters active mode to perform full measurement and touch processing

### Application Interfaces

- I<sup>2</sup>C client interface for main communication with the device, 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

### Package

- 56-pin VQFN 7 × 7 × 0.9 mm, 0.4 mm pitch, with exposed pad and stepped wettable flanks

### Operating Temperature

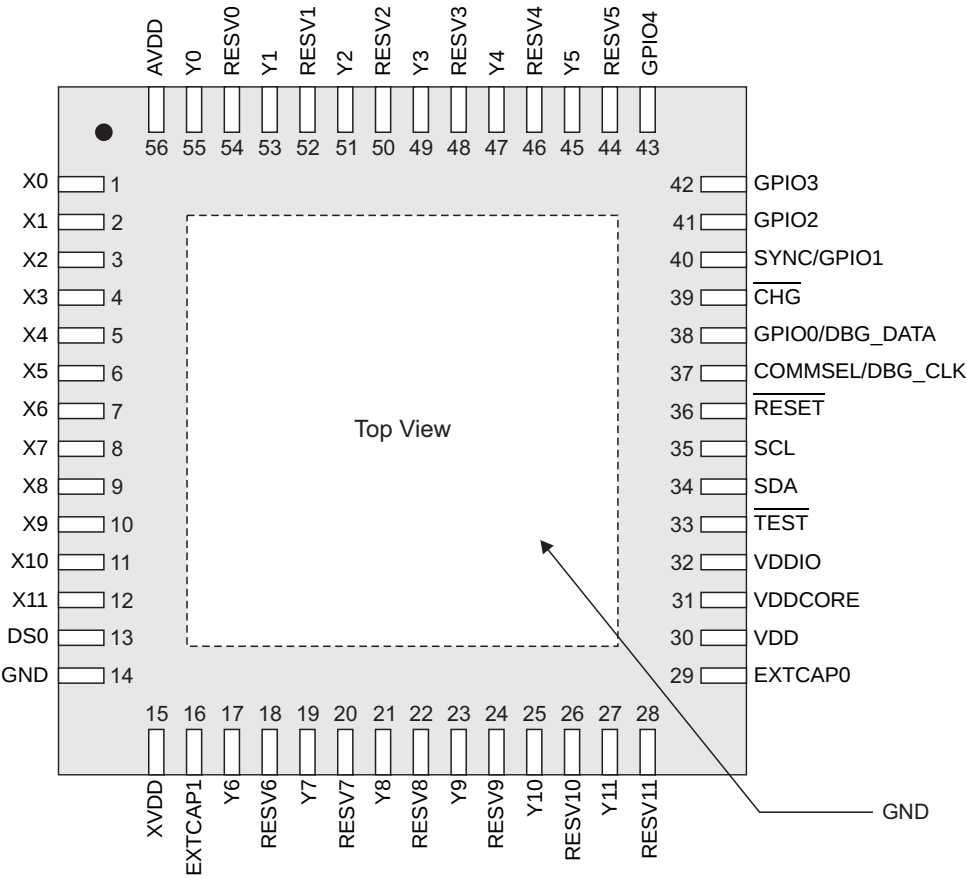
- mXT144UD-AMTSL: –40°C to +85°C (Grade 3)
- mXT144UD-AMBSL: –40°C to +105°C (Grade 2)

### Design Services

- Review of device configuration, stack-up and sensor patterns

PIN CONFIGURATION

56-pin VQFN



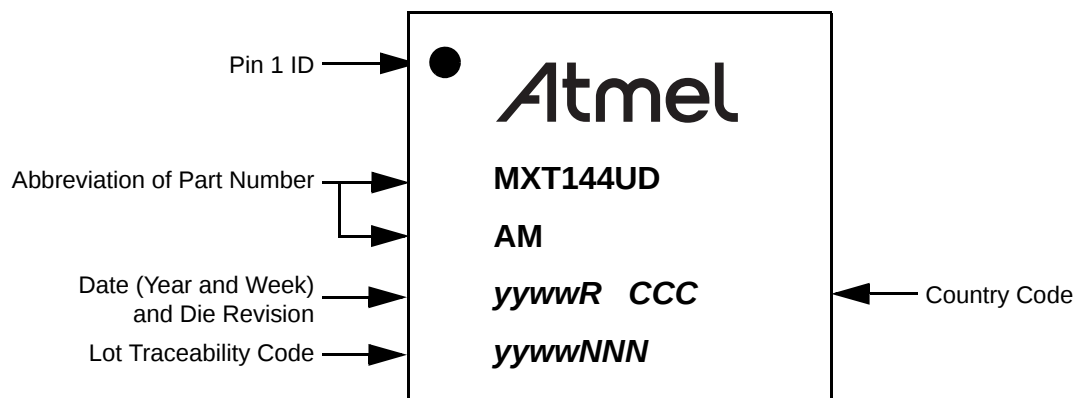
# mXT144UD-AMxSL 1.0

---

## 1.0 PACKAGING INFORMATION

### 1.1 Package Marking Information

#### 1.1.1 56-PIN VQFN



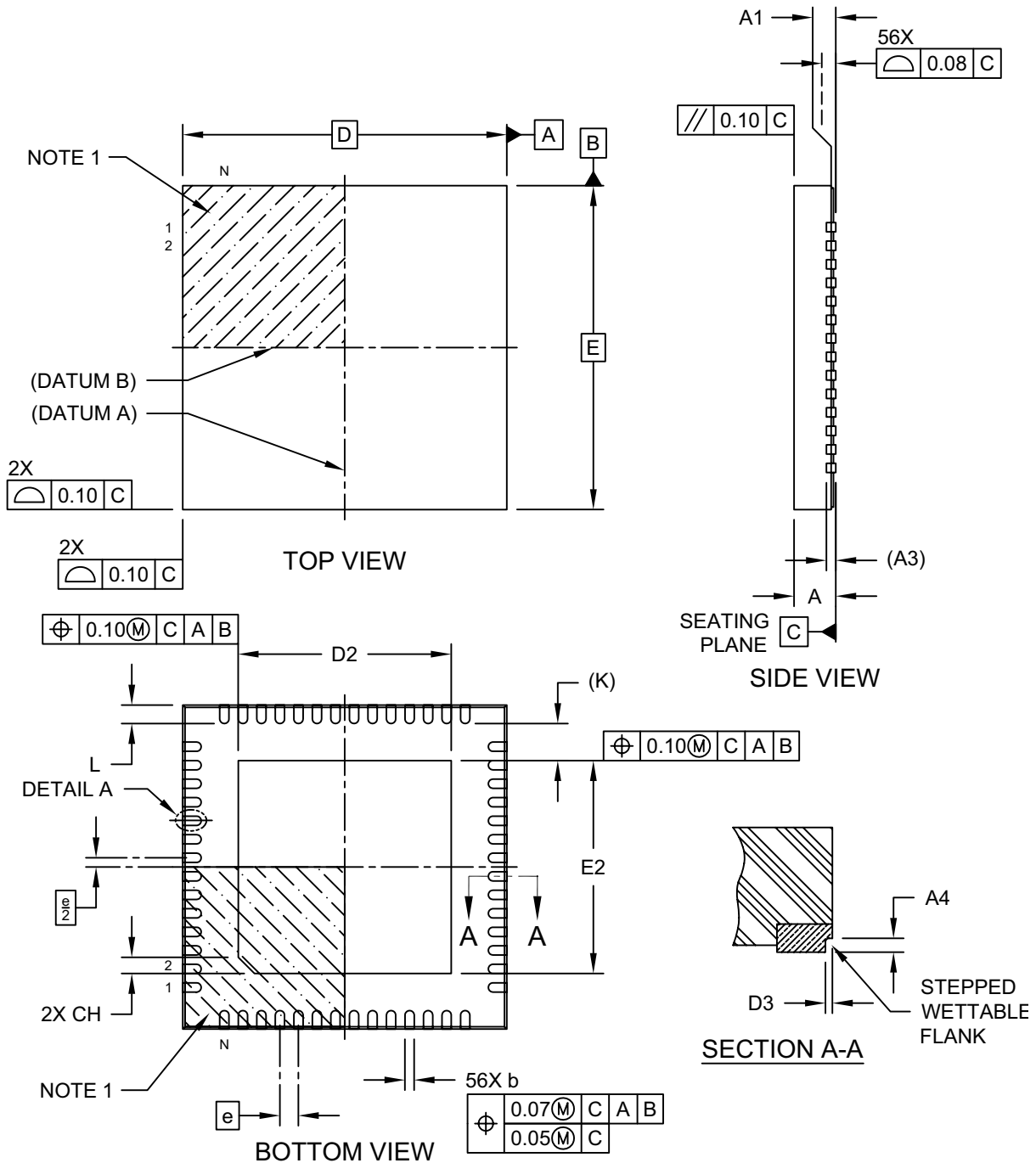
#### 1.1.2 ORDERABLE PART NUMBERS

The product identification system for maXTouch devices is described in ["Product Identification System" on page 9](#). That section also lists example part numbers for the device.

## 1.2 Package Details

### 56-Lead Very Thin Plastic Quad Flat, No Lead Package (TYB) - 7x7 mm Body [VQFN] With 4.60 mm Exposed Pad and Stepped Wettable Flanks

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

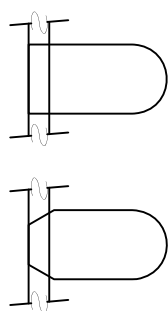


Microchip Technology Drawing C04-21494 Rev B Sheet 1 of 2

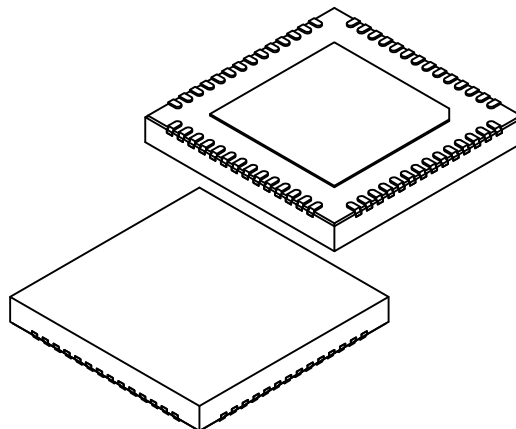
# mXT144UD-AMxSL 1.0

## 56-Lead Very Thin Plastic Quad Flat, No Lead Package (TYB) - 7x7 mm Body [VQFN] With 4.60 mm Exposed Pad and Stepped Wettable Flanks

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



**DETAIL 1**  
ALTERNATE TERMINAL  
CONFIGURATIONS



|                            |    | Units | MILLIMETERS |      |       |
|----------------------------|----|-------|-------------|------|-------|
| Dimension Limits           |    |       | MIN         | NOM  | MAX   |
| Number of Terminals        | N  |       | 56          |      |       |
| Pitch                      | e  |       | 0.40 BSC    |      |       |
| Overall Height             | A  |       | 0.80        | 0.85 | 0.90  |
| Standoff                   | A1 |       | 0.00        | 0.02 | 0.05  |
| Terminal Thickness         | A3 |       | 0.203 REF   |      |       |
| Overall Length             | D  |       | 7.00 BSC    |      |       |
| Exposed Pad Length         | D2 |       | 4.50        | 4.60 | 4.70  |
| Overall Width              | E  |       | 7.00 BSC    |      |       |
| Exposed Pad Width          | E2 |       | 4.50        | 4.60 | 4.70  |
| Optional Index Chamfer     | CH |       | -           | 0.35 | -     |
| Terminal Width             | b  |       | 0.15        | 0.20 | 0.25  |
| Terminal Length            | L  |       | 0.35        | 0.40 | 0.45  |
| Terminal-to-Exposed-Pad    | K  |       | 0.80 REF    |      |       |
| Wettable Flank Step Length | D3 |       | -           | -    | 0.085 |
| Wettable Flank Step Height | A4 |       | 0.10        | -    | 0.19  |

Dimensions D3 and A4 above apply to all new products released after November 1, and all products shipped after January 1, 2019, and supersede dimensions D3 and A4 below.

No physical changes are being made to any package; this update is to align cosmetic and tolerance variations from existing suppliers.

|                            |    |       |      |       |
|----------------------------|----|-------|------|-------|
| Wettable Flank Step Length | D3 | 0.035 | 0.06 | 0.085 |
| Wettable Flank Step Height | A4 | 0.10  | -    | 0.19  |

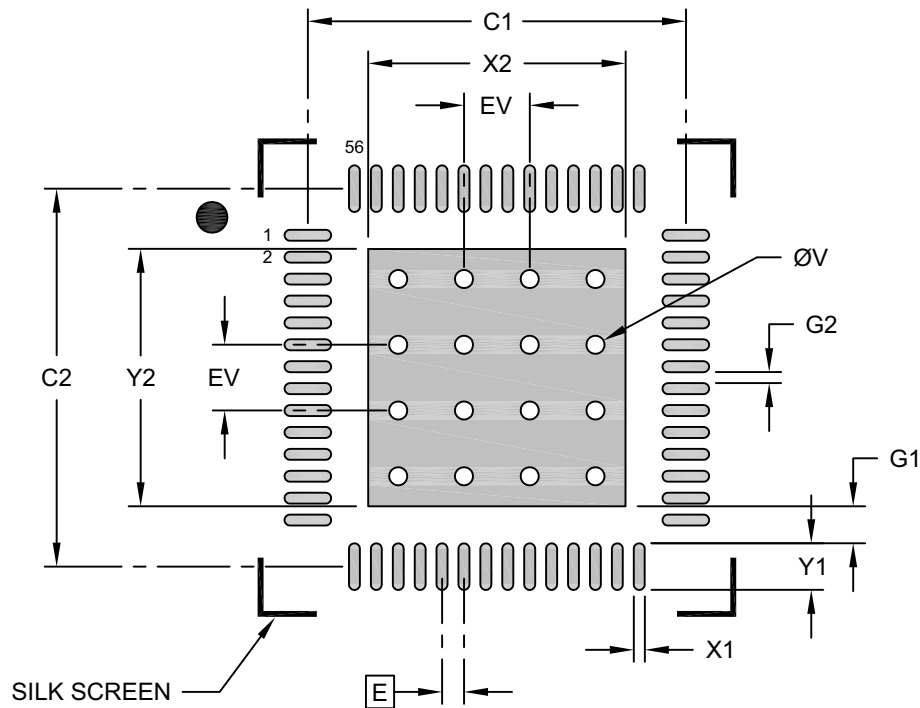
### Notes:

- Pin 1 visual index feature may vary, but must be located within the hatched area.
- Package is saw singulated
- 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 C04-21494 Rev B Sheet 2 of 2

# 56-Lead Very Thin Plastic Quad Flat, No Lead Package (TYB) - 7x7 mm Body [VQFN] With 4.60 mm Exposed Pad and Stepped Wettable Flanks

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



## RECOMMENDED LAND PATTERN

| Units                            |    | MILLIMETERS |      |      |
|----------------------------------|----|-------------|------|------|
| Dimension Limits                 |    | MIN         | NOM  | MAX  |
| Contact Pitch                    | E  | 0.40 BSC    |      |      |
| Optional Center Pad Width        | X2 |             |      | 4.70 |
| Optional Center Pad Length       | Y2 |             |      | 4.70 |
| Contact Pad Spacing              | C1 |             | 6.90 |      |
| Contact Pad Spacing              | C2 |             | 6.90 |      |
| Contact Pad Width (X56)          | X1 |             |      | 0.20 |
| Contact Pad Length (X56)         | Y1 |             |      | 0.80 |
| Contact Pad to Center Pad (X56)  | G1 | 0.30        |      |      |
| 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 C04-23494 Rev B

## APPENDIX A: REVISION HISTORY

### Revision A (October 2022)

Initial edition for firmware revision 1.0.AA – 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 mXT144UD-AMTSL/mXT144UD-AMBSL.

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

|                 |             |                   |                      |              |
|-----------------|-------------|-------------------|----------------------|--------------|
| <u>PART NO.</u> | <u>-XXX</u> | <u>[X]</u>        | <u>[X]</u>           | <u>[XXX]</u> |
| Device          | Package     | Temperature Range | Tape and Reel Option | Pattern      |

Device:

Base device name

Package:

A

=

QFP (Plastic Quad Flatpack)

AM

=

VQFN (Plastic Very Thin Quad Flat No Lead)

Temperature Range:

T

=

-40°C to +85°C (Grade 3)

B

=

-40°C to +105°C (Grade 2)

Tape and Reel Option:

Blank

=

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                                                                                         |
|--------------------------------------------------------|-------------------|-----------------------------------------------------------------------------------------------------|
| ATMXT144UD-AMTSLI2CVAO<br>(Supplied in trays)          | 1.0.AA            | 56-pin VQFN 7 × 7 × 0.9 mm, RoHS compliant<br>Operating temperature range –40°C to +85°C (Grade 3)  |
| ATMXT144UD-AMTRSLI2CVAO<br>(Supplied in tape and reel) |                   |                                                                                                     |
| ATMXT144UD-AMBSLI2CVAO<br>(Supplied in trays)          | 1.0.AA            | 56-pin VQFN 7 × 7 × 0.9 mm, RoHS compliant<br>Operating temperature range –40°C to +105°C (Grade 2) |
| ATMXT144UD-AMBRSLI2CVAO<br>(Supplied in tape and reel) |                   |                                                                                                     |

NOTES:

---

## Note the following details of the code protection feature on Microchip products:

- 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, within operating specifications, and under normal conditions.
  - Microchip values and aggressively protects its intellectual property rights. Attempts to breach the code protection features of Microchip products is strictly prohibited and may violate the Digital Millennium Copyright Act.
  - 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. Microchip is committed to continuously improving the code protection features of our products.
- 

This publication and the information herein may be used only with Microchip products, including to design, test, and integrate Microchip products with your application. Use of this information in any other manner violates these terms. Information regarding device applications 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. Contact your local Microchip sales office for additional support or, obtain additional support at <https://www.microchip.com/en-us/support/design-help/client-support-services>.

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, AVR, AVR logo, AVR Freaks, BesTime, BitCloud, CryptoMemory, CryptoRF, dsPIC, flexPWR, HELDO, IGLOO, JukeBlox, KeeLoq, Kleer, LANCheck, LinkMD, maxStylus, maxTouch, MediaLB, megaAVR, Microsemi, Microsemi logo, MOST, MOST logo, MPLAB, OptoLyzer, 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, Libero, motorBench, mTouch, Powermite 3, Precision Edge, ProASIC, ProASIC Plus, ProASIC Plus logo, Quiet-Wire, SmartFusion, SyncWorld, Temux, TimeCesium, TimeHub, TimePictra, TimeProvider, TrueTime, 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, Clockstudio, CodeGuard, CryptoAuthentication, CryptoAutomotive, CryptoCompanion, CryptoController, dsPICDEM, dsPICDEM.net, Dynamic Average Matching, DAM, ECAN, Espresso T1S, EtherGREEN, GridTime, IdealBridge, In-Circuit Serial Programming, ICSP, INICnet, Intelligent Paralleling, IntelliMOS, Inter-Chip Connectivity, JitterBlocker, Knob-on-Display, KoD, 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, SmartHLS, SMART-I.S., storClad, SQL, SuperSwitcher, SuperSwitcher II, Switchtec, SynchroPHY, Total Endurance, Trusted Time, 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.

© 2022, Microchip Technology Incorporated and its subsidiaries.

All Rights Reserved.

ISBN: 978-1-6683-1305-3

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