mXT288UD-AMT/mXT288UD-AMB 2.0

maXTouch 288-node Touchscreen Controller Product Brief

Description

The mXT288UD-AMT/mXT288UD-AMB 2.0 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 mXT288UD-AMT/mXT288UD-AMB 2.0 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
- Developed following Automotive SPICE® Level 3 certified processes
- CISPR 25 compliant (for both mutual and self capacitance measurements)

maXTouch® Adaptive Sensing Touchscreen Technology

- Up to 12 X (transmit) lines and 24 Y (receive) lines for use by a touchscreen and 2 key arrays
- A maximum of 288 nodes can be allocated to the touch sensor
- Touchscreen size 6.34 inches (2:1 aspect ratio), assuming a sensor electrode pitch of 6 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

Keys

- Keys available on mXT288UD-AMT/mXT288UD-AMB SPI Variant only
- Up to 32 nodes can be allocated as mutual capacitance sensor keys in addition to the touchscreen, defined as 2 key arrays (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

- 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 and power-line noise
  - Up to 240 V_{PP} between 1 Hz and 1 kHz sinusoidal waveform
  - Up to 20 V_{PP} between 1 kHz and 1 MHz sinusoidal waveform

- Burst Frequency
  - Flexible and dynamic Tx burst frequency selection to reduce EMC disturbance
  - Controlled Tx burst frequency drift over process and temperature range
  - Configurable Tx waveform shaping to reduce emissions
- Scan Speed
  - Typical report rate for 5 touches ≥70 Hz (subject to configuration)
  - Initial touch latency <12 ms for first touch from idle (subject to configuration)
  - Configurable to allow 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

On-chip Gestures

- Reports one-touch and two-touch gestures

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
- (mXT288UD-AMT/mXT288UD-AMB I^2C Variant only) 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

- mXT288UD-AMT/mXT288UD-AMB I^2C Variant: I^2C interface with support for Standard mode (up to 100 kHz), Fast mode (up to 400 kHz), Fast-mode Plus (up to 1 MHz)
- mXT288UD-AMT/mXT288UD-AMB SPI Variant: SPI interface (up to 8 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 VQFN 7 × 7 × 0.9 mm, 0.4 mm pitch

Operating Temperature

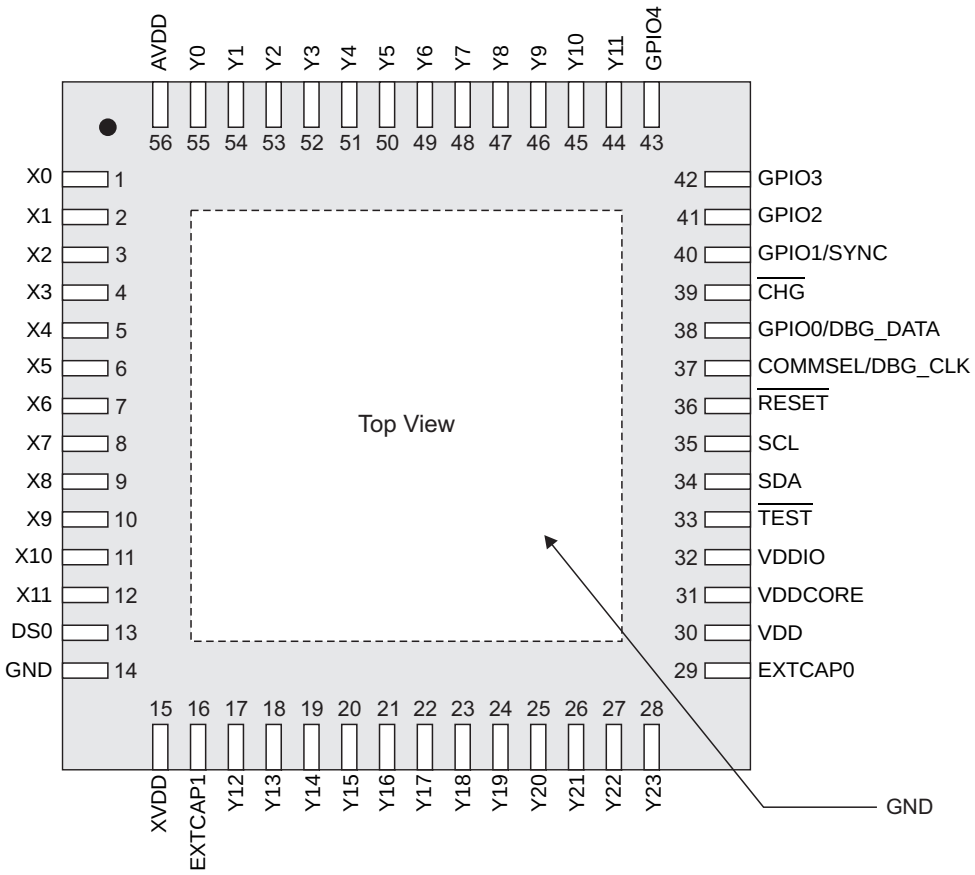
- mXT288UD-AMT I^2C and SPI Variants: –40°C to +85°C (Grade 3)
- mXT288UD-AMB I^2C and SPI Variants: –40°C to +105°C (Grade 2)

Design Services

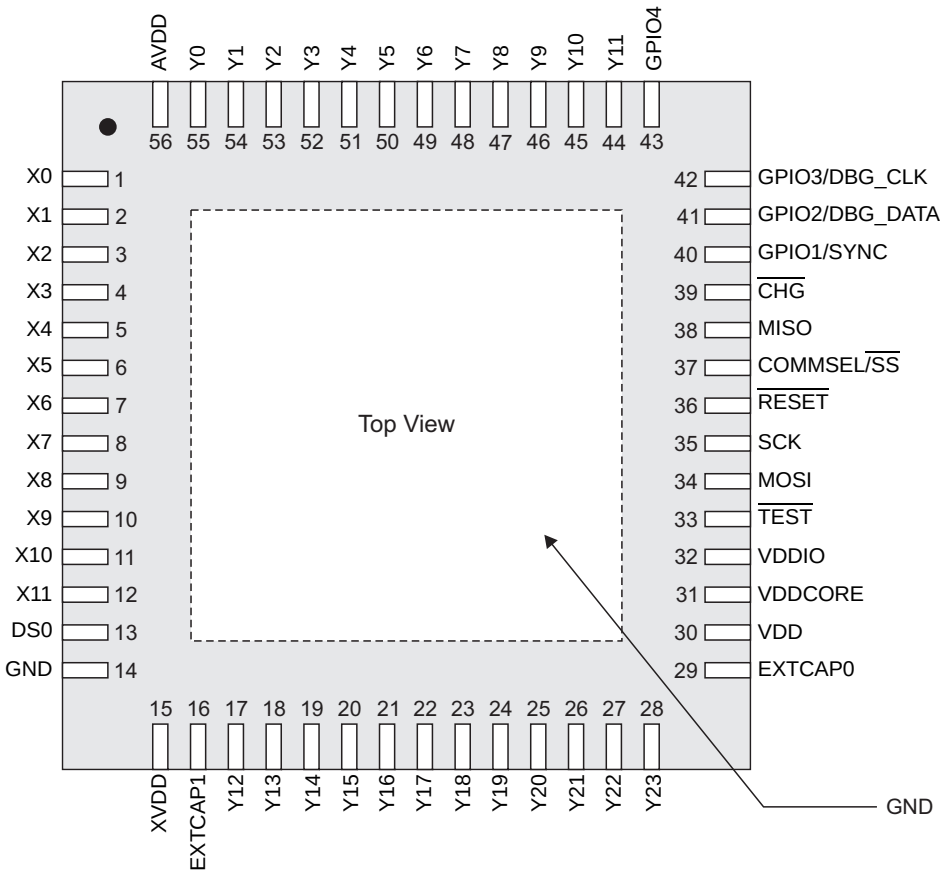
- Review of device configuration, stack-up and sensor patterns
- Custom firmware versions can be considered

PIN CONFIGURATION

56-pin VQFN (I^2C Variant)



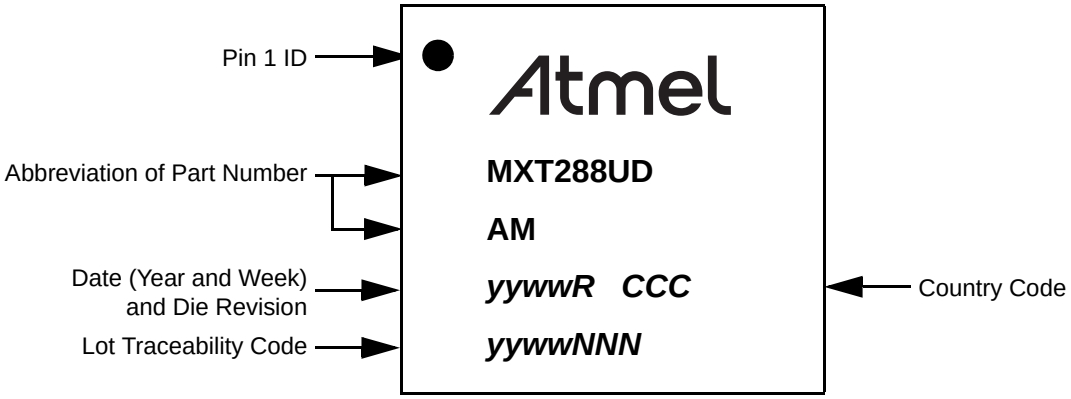
56-pin VQFN (SPI Variant)



1.0 PACKAGING INFORMATION

1.1 Package Marking Information

1.1.1 56-PIN VQFN



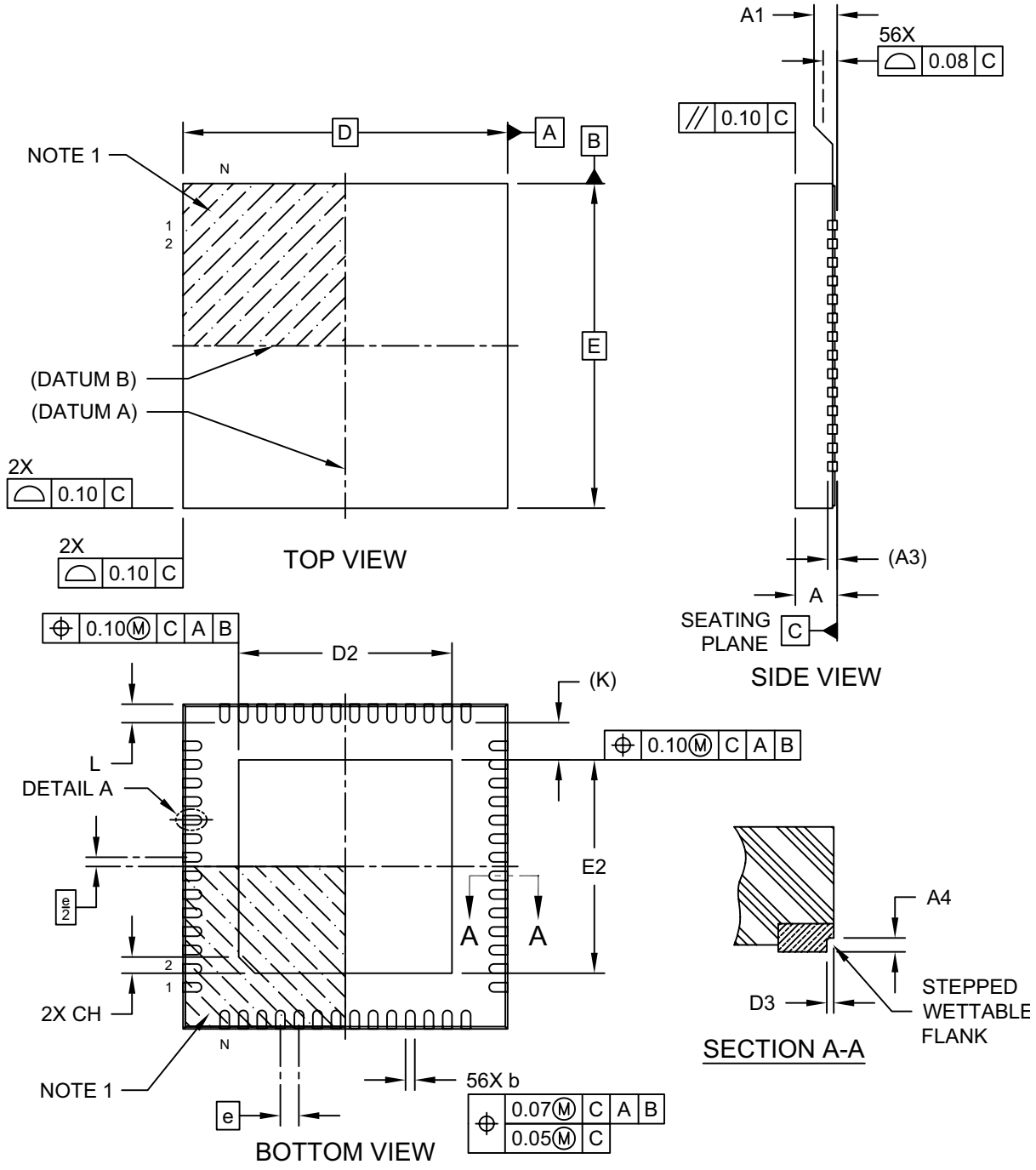
1.1.2 ORDERABLE PART NUMBERS

The product identification system for maXTouch devices is described in "Product Identification System". 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

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

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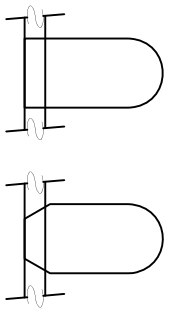
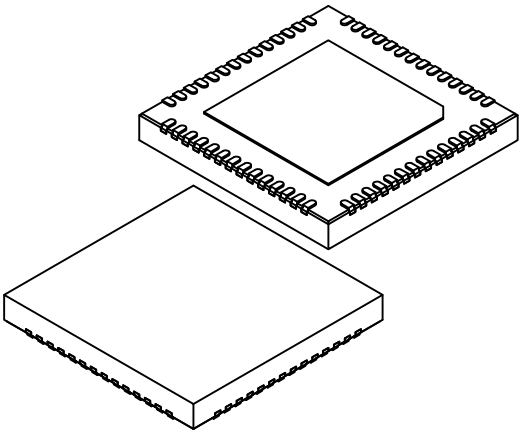


DETAIL 1
ALTERNATE TERMINAL CONFIGURATIONS



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:

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.

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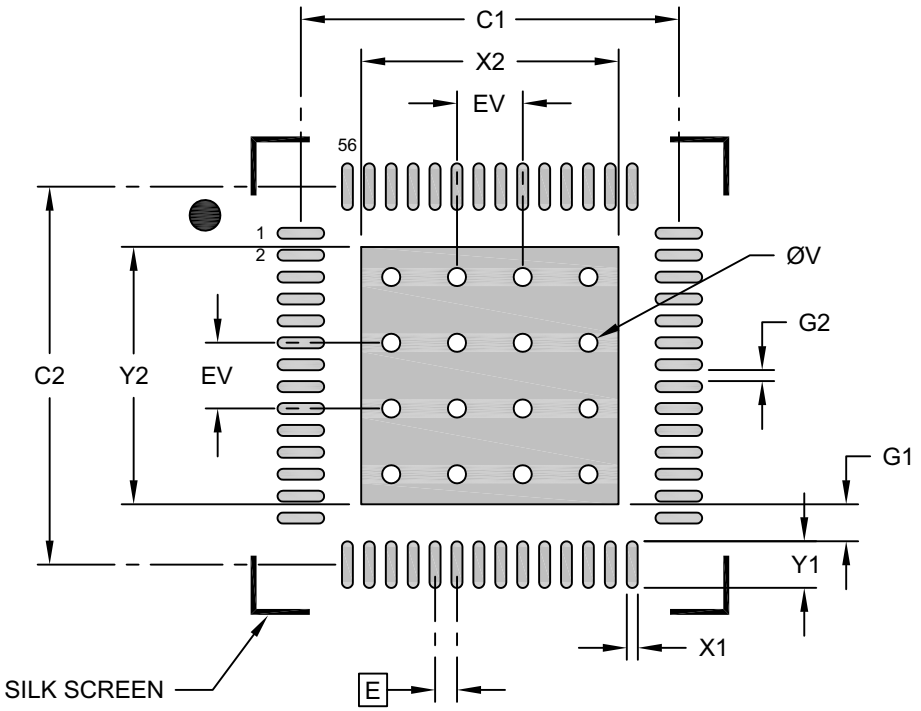
56-Lead Very Thin Plastic Quad Flat, No Lead Package (TYB) - 7x7 mm Body [VQFN] With 4.60 mm Exposed Pad and Stepped Wettable Flanks

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:

1. Dimensioning and tolerancing per ASME Y14.5M
   BSC: Basic Dimension. Theoretically exact value shown without tolerances.
2. 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 (November 2020)

Initial edition for firmware revision 2.0.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 mXT288UD-AMT/mXT288UD-AMB.

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)
	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 (1)
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

MXT288UD-AMT/MXT288UD-AMB I^2C VARIANT

Orderable Part Number	Firmware Revision	Description
ATMXT288UD-AMTI2CVA1 (Supplied in trays)	2.0.AA	56-pin VQFN 7 × 7 × 0.9 mm, RoHS compliant Operating temperature range –40°C to +85°C (Grade 3)
ATMXT288UD-AMTRI2CVA1 (Supplied in tape and reel)		
ATMXT288UD-AMBI2CVA1 (Supplied in trays)	2.0.AA	56-pin VQFN 7 × 7 × 0.9 mm, RoHS compliant Operating temperature range –40°C to +105°C (Grade 2)
ATMXT288UD-AMBRI2CVA1 (Supplied in tape and reel)		

MXT288UD-AMT/MXT288UD-AMB SPI VARIANT

Orderable Part Number	Firmware Revision	Description
ATMXT288UD-AMTSPIVA1 (Supplied in trays)	2.0.AA	56-pin VQFN 7 × 7 × 0.9 mm, RoHS compliant Operating temperature range –40°C to +85°C (Grade 3)
ATMXT288UD-AMTRSPIVA1 (Supplied in tape and reel)		
ATMXT288UD-AMBSPIVA1 (Supplied in trays)	2.0.AA	56-pin VQFN 7 × 7 × 0.9 mm, RoHS compliant Operating temperature range –40°C to +105°C (Grade 2)
ATMXT288UD-AMBRSPIVA1 (Supplied in tape and reel)		

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.

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