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® 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_{PP} between 1 Hz and 1 kHz sinusoidal waveform (no touches)
  - 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
  - Configurable Tx waveform shaping to reduce emissions
- Scan Speed
  - Typical report rate for 5 touches ≥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^2C 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
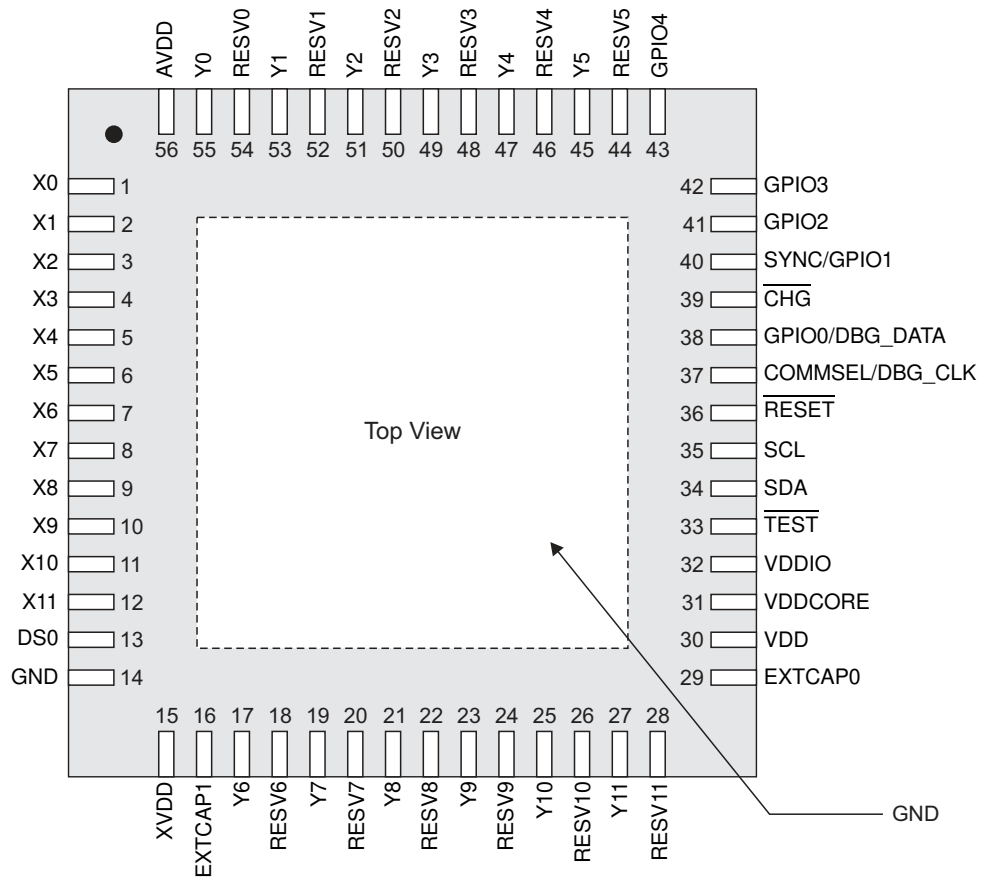
Operating Temperature

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

Design Services

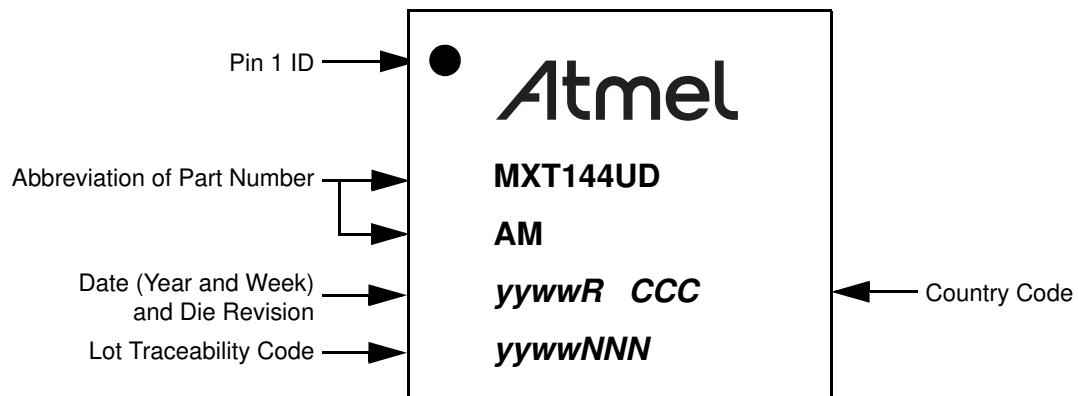- Review of device configuration, stack-up and sensor patterns

PIN CONFIGURATION

56-pin VQFN

Top View

1.0 PACKAGING INFORMATION

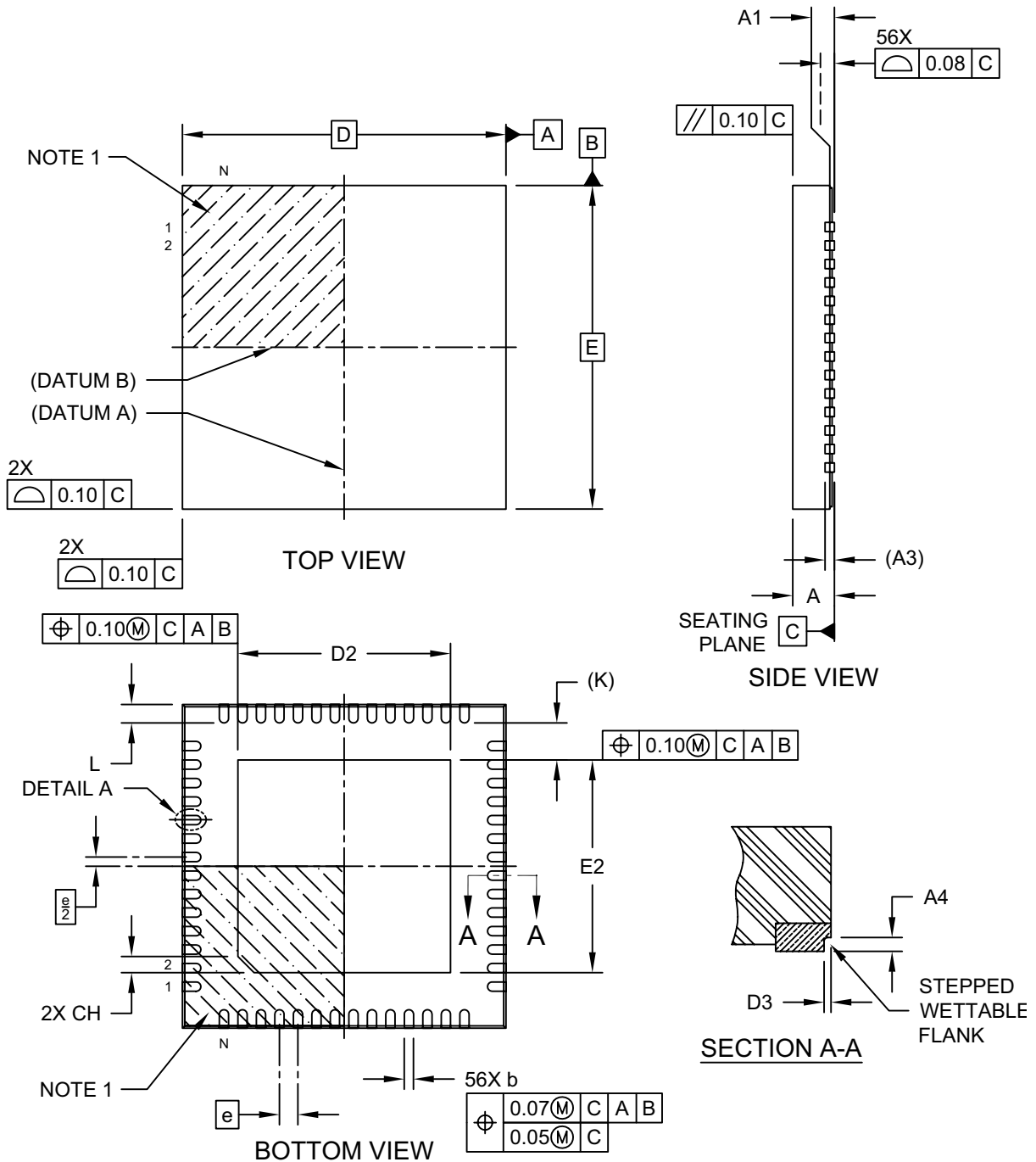### 1.1 Package Marking Information

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

TOP VIEW

SIDE VIEW

SEATING PLANE

DETAIL A

BOTTOM VIEW

SECTION A-A

STEPPED WETTABLE FLANK

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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
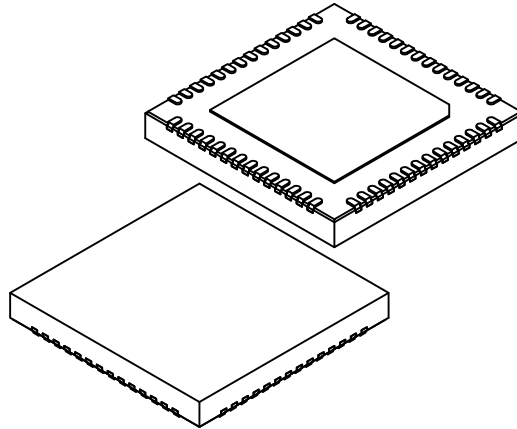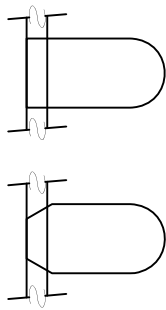
DETAIL 1
ALTERNATE TERMINAL
CONFIGURATIONS

	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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Product Brief

**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
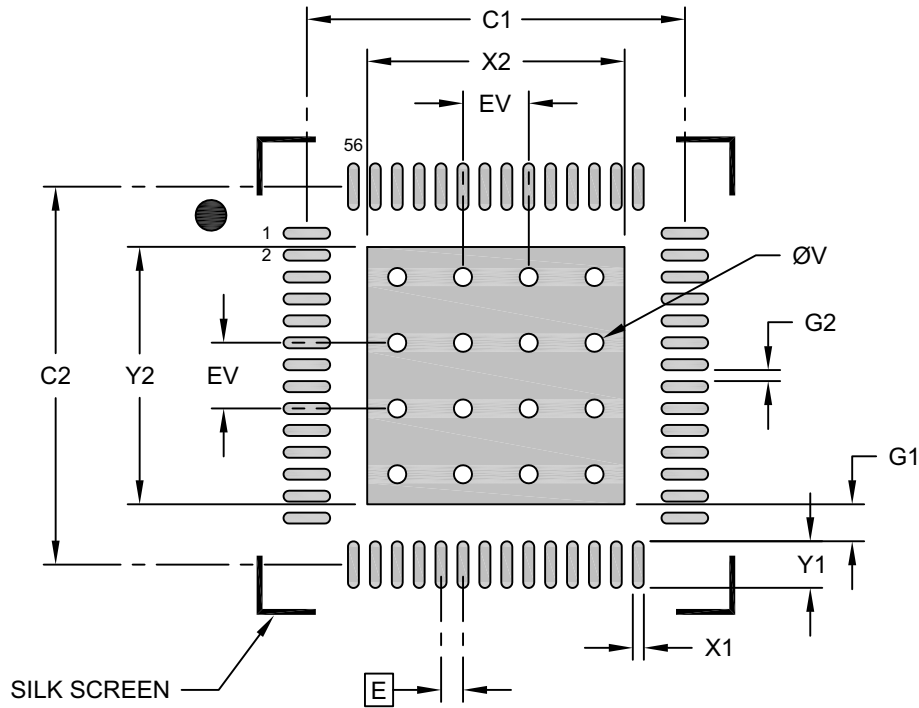
RECOMMENDED LAND PATTERN

	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 (October 2022)

Initial edition for firmware revision 1.0.AA – Release

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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.

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

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

NOTES:

Product Brief

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.

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