
maXTouch 228-node Touchscreen Controller

Product Brief

Description

The mXT228UD-MAU002 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 mXT228UD-MAU002 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.

maXTouch[®] Adaptive Sensing Technology

- Up to 14 X (transmit) lines and 24 Y (receive) lines for use by a touchscreen and/or key array
- A maximum of 228 nodes can be allocated to the touch sensor
- Touchscreen size of 5.75 inches (3:2 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

Keys

- Up to 16 nodes can be allocated as mutual capacitance sensor keys in addition to the touchscreen, 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

- 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

- 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)
 - IEC 61000-4-6, 7 Vrms, Class A (normal touch operation) conducted noise immunity
- Stylus Support
 - Supports passive stylus with 1.5 mm contact diameter, subject to configuration, stack-up, and sensor design
- Scan Speed
 - Typical report rate for 10 touches ≥90 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

- 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, such as palm
- Palm Recovery Algorithm for quick restoration to normal state

Data Store

- 60-byte CRC-checksummed data area for use as a run-time Product Data Store Area
- Up to 64 bytes of user's custom data (not CRC checksummed)

Device Encryption

- Encrypted configuration parameters and touch coordinate reports (OBP messages) using customer's own security key

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

- I²C 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 (V_{dd}) 3.3V nominal
- Digital I/O (V_{ddIO}) 3.3V nominal
- Analog (AV_{dd}) 3.3V nominal
- High voltage internal X line drive (XV_{dd}) 6.6V with internal voltage pump

Package

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

Operating Temperature

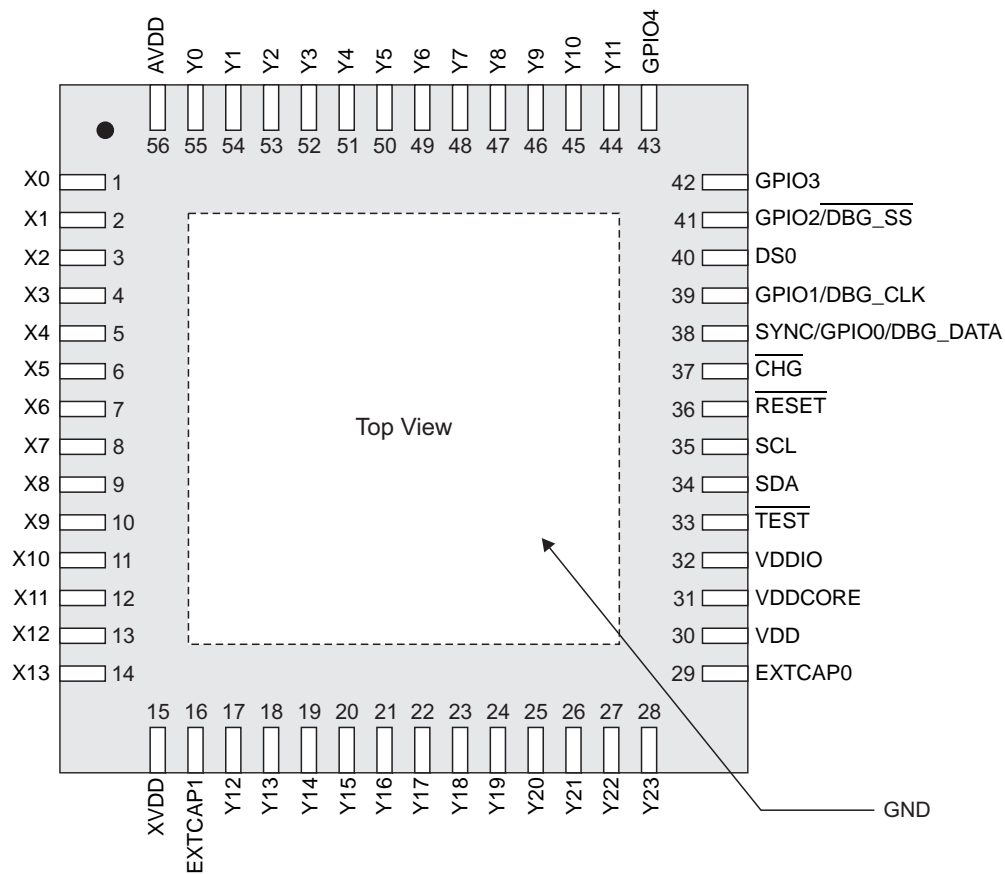
- –40°C to +85°C

Design Services

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

PIN CONFIGURATION

Pin Configuration – 56-pin XQFN

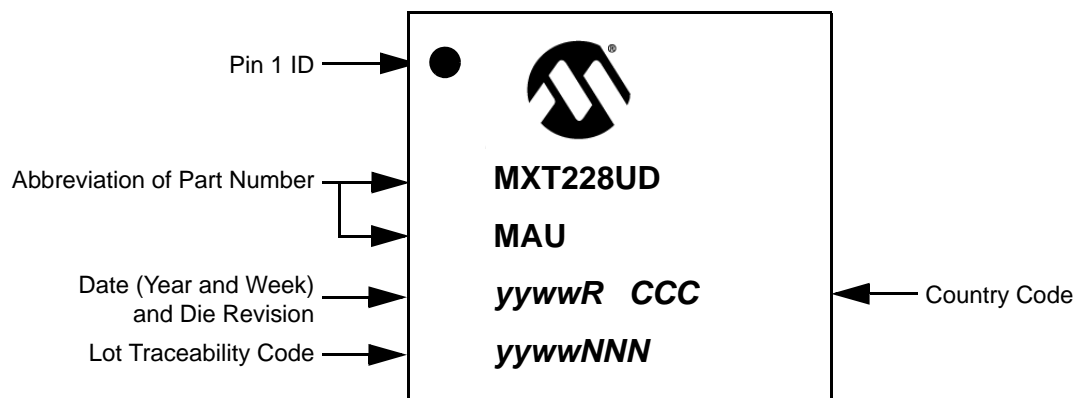


mXT228UD-MAU002 2.0

1.0 PACKAGING INFORMATION

1.1 Package Marking Information

1.1.1 56-PIN XQFN



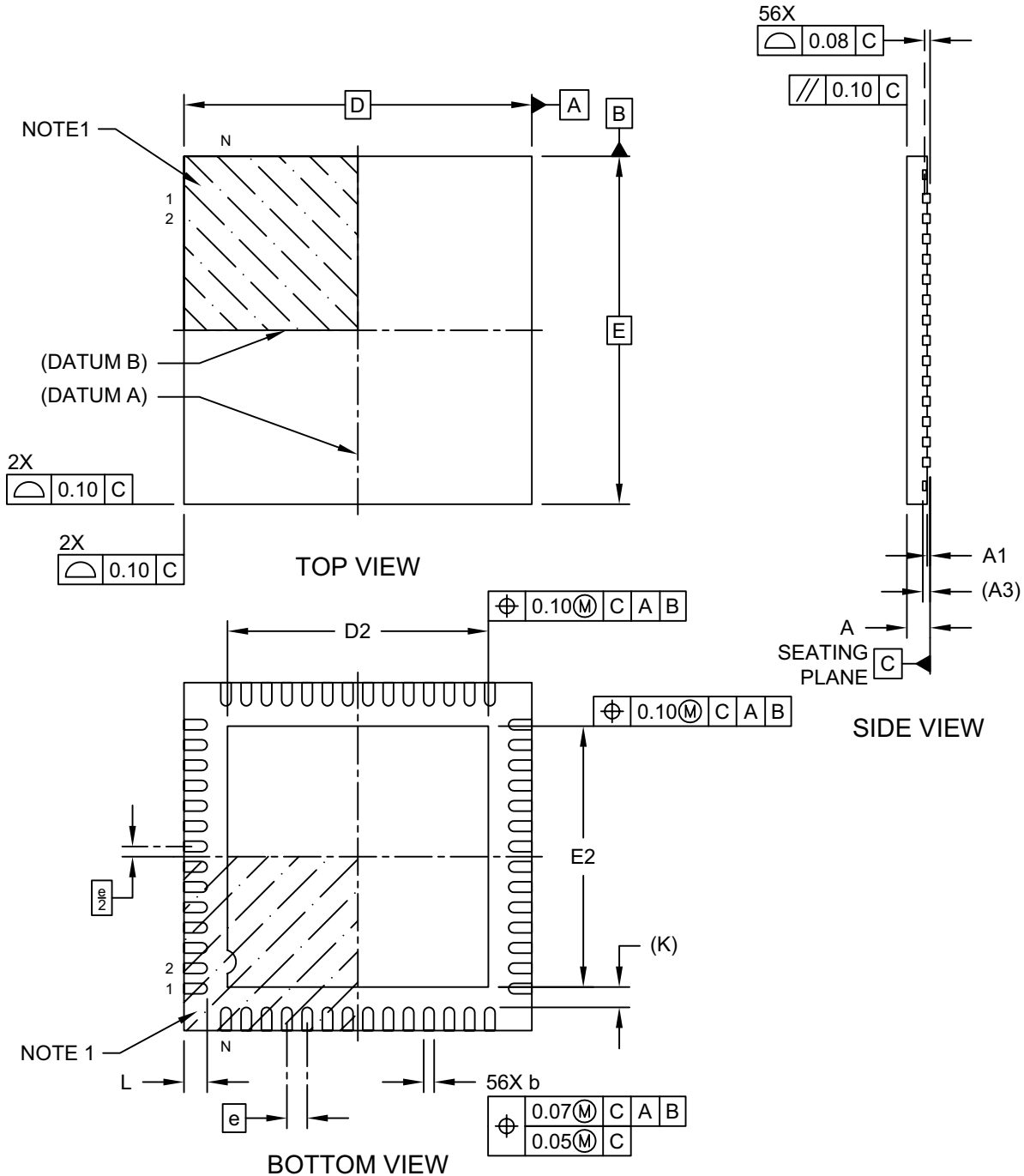
1.1.2 ORDERABLE PART NUMBERS

The product identification system for maXTouch devices is described in [“Product Identification System” on page 9](#). 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>

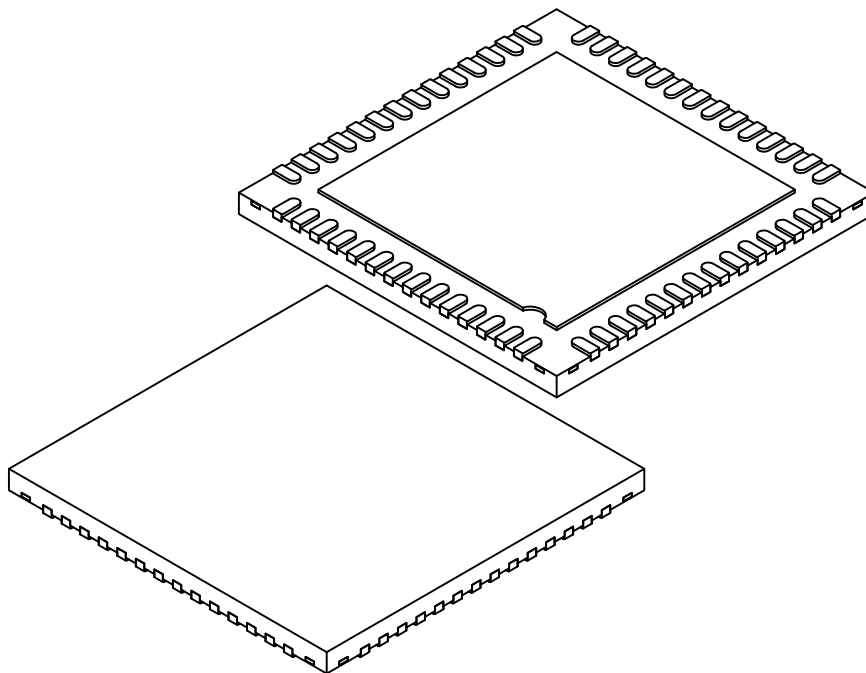


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56-Lead Extremely Thin Quad Flatpack No-Lead Package (TWB) - 6x6x0.4 mm Body [XQFN] With 4.5x4.5 mm Exposed Pad; Atmel Legacy Global Package Code ZIX

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 | | |

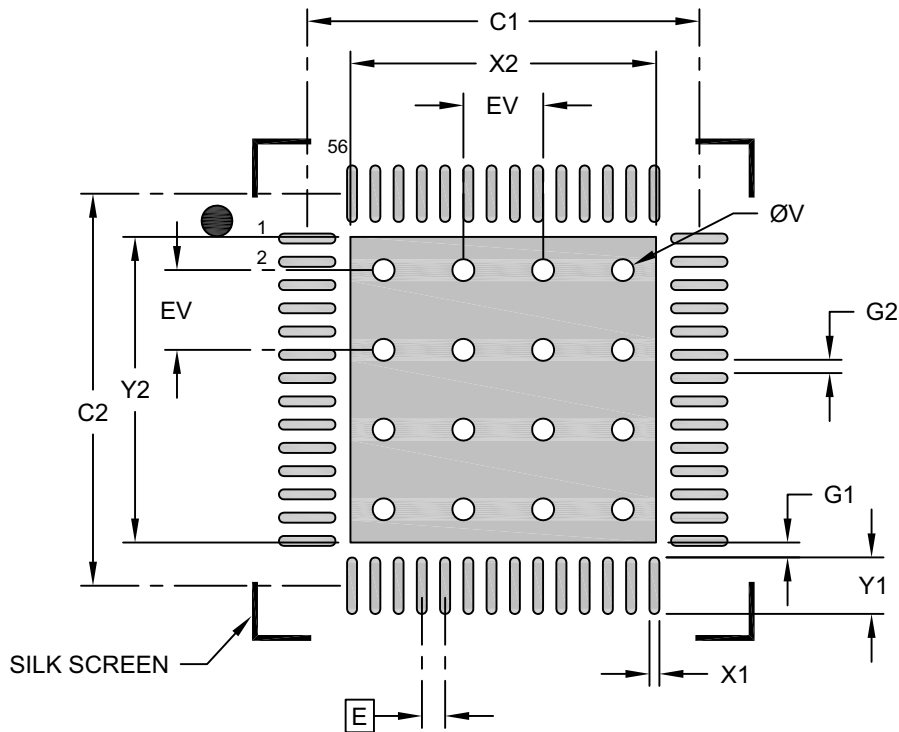
Notes:

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.

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**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

| Units | | MILLIMETERS | | |
|----------------------------------|----|-------------|------|------|
| Dimension Limits | | 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

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APPENDIX A: REVISION HISTORY

Revision A (March 2022)

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 mXT228UD-MAU002.

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: | 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: | 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 |
|---|-------------------|--|
| ATMXT228UD-MAU002 (Supplied in trays) | 2.0.AA | 56-pin XQFN 6 × 6 × 0.4 mm, RoHS compliant Industrial grade; not suitable for automotive characterization |
| ATMXT228UD-MAUR002 (Supplied in tape and reel) | | |

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