The mXT144UD-AMT/mXT144UD-AMB 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 mXT144UD-AMT/mXT144UD-AMB 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
- 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 144 nodes can be allocated to the touch sensor
- Touchscreen size of 4.34 inches (16:9 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
- 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 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)

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_p_p between 1 Hz and 1 kHz sinusoidal waveform
  - Up to 20 V_p_p between 1 kHz and 1 MHz sinusoidal waveform

Keys
- Keys available on mXT144UD-AMT/mXT144UD-AMB SPI Variant only
- Up to 32 nodes can be allocated as mutual capacitance sensor keys in addition to 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
• 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
• (mXT144UD-AMT/mXT144UD-AMB I2C 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
• mXT144UD-AMT/mXT144UD-AMB I2C Variant: I2C slave with support for Standard mode (up to 100 kHz), Fast mode (up to 400 kHz), Fast-mode Plus (up to 1 MHz)
• mXT144UD-AMT/mXT144UD-AMB SPI Variant: SPI slave (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
• mXT144UD-AMT I2C and SPI Variants: −40°C to +85°C (Grade 3)
• mXT144UD-AMB I2C 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 (I²C Variant)
56-pin VQFN (SPI Variant)
1.0 PACKAGING INFORMATION

1.1 Package Marking Information

1.1.1 56-PIN VQFN

The product identification system for maXTouch devices is described in “Product Identification System”. That section also lists example part numbers for the device.

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
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

<table>
<thead>
<tr>
<th>Units</th>
<th>MILLIMETERS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dimension Limits</td>
<td>MIN</td>
</tr>
<tr>
<td>Number of Terminals</td>
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</tr>
<tr>
<td>Pitch</td>
<td>e</td>
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<td>Overall Height</td>
<td>A</td>
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<tr>
<td>Standoff</td>
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<tr>
<td>Terminal Thickness</td>
<td>A3</td>
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<tr>
<td>Overall Length</td>
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<tr>
<td>Exposed Pad Length</td>
<td>D2</td>
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<tr>
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<tr>
<td>Optional Index Chamfer</td>
<td>CH</td>
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<tr>
<td>Terminal Width</td>
<td>b</td>
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<tr>
<td>Terminal Length</td>
<td>L</td>
</tr>
<tr>
<td>Terminal-to-Exposed-Pad</td>
<td>K</td>
</tr>
<tr>
<td>Wettable Flank Step Length</td>
<td>D3</td>
</tr>
<tr>
<td>Wettable Flank Step Height</td>
<td>A4</td>
</tr>
</tbody>
</table>

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.

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 C04-21494 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

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**RECOMMENDED LAND PATTERN**

<table>
<thead>
<tr>
<th>Units</th>
<th>MILLIMETERS</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Dimension Limits</strong></td>
<td>MIN NOM MAX</td>
</tr>
<tr>
<td>Contact Pitch</td>
<td>E 0.40 BSC</td>
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<tr>
<td>Optional Center Pad Width</td>
<td>X2 4.70</td>
</tr>
<tr>
<td>Optional Center Pad Length</td>
<td>Y2 4.70</td>
</tr>
<tr>
<td>Contact Pad Spacing</td>
<td>C1 6.90</td>
</tr>
<tr>
<td>Contact Pad Spacing</td>
<td>C2 6.90</td>
</tr>
<tr>
<td>Contact Pad Width (X56)</td>
<td>X1 0.20</td>
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<tr>
<td>Contact Pad Length (X56)</td>
<td>Y1 0.80</td>
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<tr>
<td>Contact Pad to Center Pad (X56)</td>
<td>G1 0.30</td>
</tr>
<tr>
<td>Contact Pad to Contact Pad (X52)</td>
<td>G2 0.20</td>
</tr>
<tr>
<td>Thermal Via Diameter</td>
<td>V 0.33</td>
</tr>
<tr>
<td>Thermal Via Pitch</td>
<td>EV 1.20</td>
</tr>
</tbody>
</table>

**Notes:**
1. Dimensioning and tolerancing per ASME Y14.5M
2. 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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Microchip Technology Drawing C04-23494 Rev B
APPENDIX A: REVISION HISTORY

Revision A (November 2019)
Initial edition for firmware revision 1.0.AA – Release

Revision B (June 2020)
• HSYNC pin renamed to SYNC
• Section 1.1 “Package Marking Information” added
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-AMT/mXT144UD-AMB.

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

<table>
<thead>
<tr>
<th>PART NO.</th>
<th>Device</th>
<th>Package</th>
<th>Temperature Range</th>
<th>Tape and Reel Option</th>
<th>Pattern</th>
</tr>
</thead>
<tbody>
<tr>
<td>ATMXT144UD-AMTI2CVAO</td>
<td>1.0.AA</td>
<td>56-pin VQFN 7 × 7 × 0.9 mm, RoHS compliant</td>
<td>Operating temperature range –40°C to +85°C (Grade 3)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ATMXT144UD-AMTRI2CVAO</td>
<td>1.0.AA</td>
<td>56-pin VQFN 7 × 7 × 0.9 mm, RoHS compliant</td>
<td>Operating temperature range –40°C to +105°C (Grade 2)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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.

MXT144UD-AMT/MXT144UD-AMB I2C VARIANT

<table>
<thead>
<tr>
<th>Orderable Part Number</th>
<th>Firmware Revision</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ATMXT144UD-AMT12CVAO</td>
<td>1.0.AA</td>
<td>56-pin VQFN 7 × 7 × 0.9 mm, RoHS compliant Operating temperature range –40°C to +85°C (Grade 3)</td>
</tr>
<tr>
<td>ATMXT144UD-AMTR12CVAO</td>
<td>1.0.AA</td>
<td>56-pin VQFN 7 × 7 × 0.9 mm, RoHS compliant Operating temperature range –40°C to +105°C (Grade 2)</td>
</tr>
</tbody>
</table>

MXT144UD-AMT/MXT144UD-AMB SPI VARIANT

<table>
<thead>
<tr>
<th>Orderable Part Number</th>
<th>Firmware Revision</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ATMXT144UD-AMTSPIVAO</td>
<td>1.0.AA</td>
<td>56-pin VQFN 7 × 7 × 0.9 mm, RoHS compliant Operating temperature range –40°C to +85°C (Grade 3)</td>
</tr>
<tr>
<td>ATMXT144UD-AMTRSPIVAO</td>
<td>1.0.AA</td>
<td>56-pin VQFN 7 × 7 × 0.9 mm, RoHS compliant Operating temperature range –40°C to +105°C (Grade 2)</td>
</tr>
<tr>
<td>ATMXT144UD-AMBSPIVAO</td>
<td>1.0.AA</td>
<td>56-pin VQFN 7 × 7 × 0.9 mm, RoHS compliant Operating temperature range –40°C to +105°C (Grade 2)</td>
</tr>
</tbody>
</table>
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