Description
The mXT2912TD-AT/mXT2912TD-AB 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 mXT2912TD-AT/mXT2912TD-AB 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.

maXTouch® Adaptive Sensing Touchscreen Technology
- Up to 41 X (transmit) lines and 71 Y (receive) lines for use by touchscreens, keys and sliders.
- A maximum of 2911 nodes can be allocated to a touchscreen
- Touchscreen size 16.82 inches (16:10 aspect ratio), assuming a sensor electrode pitch of 5.5 mm. Other sizes are possible with different electrode pitches and appropriate sensor material
- Multiple touch support with up to 16 concurrent touches tracked in real time on a single touchscreen

Multiple Touch Slider
- Supports implementation of a multiple touch slider
- If required, the slider can use a different electrode material to that used for the touchscreen sensor

Keys
- Up to 32 nodes can be allocated as mutual capacitance sensor keys (subject to other configurations)
- Adjacent Key Suppression (AKS) technology is supported for false key touch prevention

Automotive Applications
- AEC-Q100 Qualified
- Developed following Automotive SPICE® Level 3 certified processes
- CISPR 25 compliant (for both mutual and self capacitance measurements)

Touch Sensor Technology
- Discrete/out-cell support including glass and PET film-based sensors
- On-cell/touch-on display support including TFT, 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)
- Glass 0.4 mm to 4.0 mm (dependent on screen size, touch size, configuration and stack-up)
- Plastic 0.2 mm to 3.0 mm (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
- Hover Support
  - Supports one-finger hover up to 20 mm detection and 15 mm tracking range
  - Supports multiple finger hover detection
- Glove Support
  - Glove touches up to 5 mm thickness (subject to stack-up design)
- Mutual capacitance and self capacitance measurements supported for robust touch detection
- P2P mutual capacitance measurements supported for extra sensitive touch sensing
- Noise suppression technology to combat ambient and power-line noise
  - Up to 240 VPP between 1 Hz and 1 kHz sinusoidal waveform
  - Up to 20 VPP 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
  - Firmware-controlled Tx waveform shaping to reduce emissions
• Scan Speed
  - Up to 100 Hz reporting rate for one finger (subject to configuration)
  - Typical report rate for 5 touches ≥95 Hz (subject to configuration)
  - Initial touch latency <20 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

Product Data Store Area
• Up to 60 bytes of user-defined data can be stored during production

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 slave with support for Standard mode (up to 100 kHz), Fast mode (up to 400 kHz),
  Fast-mode Plus (up to 1 MHz)
• SPI slave (up to 8 MHz)
• Interrupt to indicate when a message is available
• SPI Debug Interface to read the raw data for tuning and debugging purposes

Power Supply
• Digital (Vdd) 3.3 V nominal
• Digital I/O (VddI/O) 3.3 V nominal
• Analog (AVdd) 3.3 V nominal
• High voltage external X line drive (XVdd) up to 8.5 V

Package
• 176-lead LQFP 24 × 24 × 1.4 mm, 0.5 mm pitch

Operating Temperature
• mXT2912TD-AT: −40°C to +85°C (Grade 3)
• mXT2912TD-AB: −40°C to +105°C (Grade 2)

Design Services
• Review of device configuration, stack-up and sensor patterns
• Custom firmware versions can be considered
• Contact your Microchip representative for more information
PIN CONFIGURATION

Pin Configuration – 176-lead LQFP

mXT2912TD-AT/mXT2912TD-AB

Top view
1.0 PACKAGING INFORMATION

176-Lead Plastic Quad Flatpack (2VB) - 24x24x1.4 mm Body [LQFP]
Atmel Legacy Global Package Code AGR

Note: For the most current package drawings, please see the Microchip Packaging Specification located at http://www.microchip.com/packaging
176-Lead Plastic Quad Flatpack (2VB) - 24x24x1.4 mm Body [LQFP]
Atmel Legacy Global Package Code AGR

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>Dimension Limits</th>
<th>MILLIMETERS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of Terminals</td>
<td>N</td>
<td>176</td>
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<tr>
<td>Pitch</td>
<td>e</td>
<td>0.50 BSC</td>
</tr>
<tr>
<td>Overall Height</td>
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<td>- - 1.60</td>
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<td>Standoff</td>
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<td>0.05 - 0.15</td>
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<td>Molded Package Thickness</td>
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<td>24.00 BSC</td>
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<tr>
<td>Overall Width</td>
<td>E</td>
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<td>24.00 BSC</td>
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<tr>
<td>Terminal Width</td>
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<td>0.17 - 0.22 - 0.27</td>
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<tr>
<td>Terminal Thickness</td>
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<td>0.09 - 0.20</td>
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<tr>
<td>Terminal Length</td>
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<tr>
<td>Footprint</td>
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<td>1.00 REF -</td>
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<tr>
<td>Lead Bend Radius</td>
<td>R</td>
<td>0.08 - - 0.20</td>
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<tr>
<td>Lead Bend Radius</td>
<td>R2</td>
<td>0.08 - - 0.20</td>
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<tr>
<td>Foot Angle</td>
<td>θ</td>
<td>0° - 3.5° - 7°</td>
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<tr>
<td>Lead Angle</td>
<td>θ1</td>
<td>0° - - -</td>
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<tr>
<td>Terminal-to-Exposed-Pad</td>
<td>θ2</td>
<td>11° - 12° - 13°</td>
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</table>

Notes:
1. Pin 1 visual index feature may vary, but must be located within the hatched area.
2. 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.
RECOMMENDED LAND PATTERN

<table>
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<tr>
<th>Units</th>
<th>Dimension Limits</th>
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<th>NOM</th>
<th>MAX</th>
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<td>Contact Pitch</td>
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<td>0.50 BSC</td>
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<td></td>
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<tr>
<td>Contact Pad Spacing</td>
<td>C1</td>
<td>25.40</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Contact Pad Spacing</td>
<td>C2</td>
<td>25.40</td>
<td></td>
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<tr>
<td>Contact Pad Width (X176)</td>
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<td>0.30</td>
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<tr>
<td>Contact Pad Length (X176)</td>
<td>Y1</td>
<td></td>
<td>1.50</td>
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<tr>
<td>Contact Pad to Center Pad (X172)</td>
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<td>0.20</td>
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Notes:
1. Dimensioning and tolerancing per ASME Y14.5M
   BSC: Basic Dimension. Theoretically exact value shown without tolerances.
APPENDIX A: REVISION HISTORY

Revision A (October 2018)
Initial edition for firmware revision 1.0 – 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 mXT2912TD-AT/mXT2912TD-AB.

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>Sample Type</th>
<th>Tape and Reel Option</th>
<th>Pattern</th>
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</thead>
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<tr>
<td>ATMXT2912TD-ATVAO</td>
<td>AT</td>
<td>A</td>
<td>–40°C to +85°C (Grade 3)</td>
<td>Blank</td>
<td>Blank</td>
<td></td>
</tr>
<tr>
<td>ATMXT2912TD-ATRVAO</td>
<td>AT</td>
<td>AM</td>
<td>–40°C to +105°C (Grade 2)</td>
<td>ES</td>
<td>R</td>
<td></td>
</tr>
<tr>
<td>ATMXT2912TD-ABVAO</td>
<td>AB</td>
<td>A</td>
<td>–40°C to +85°C (Grade 3)</td>
<td>Blank</td>
<td>Blank</td>
<td></td>
</tr>
<tr>
<td>ATMXT2912TD-ABRVAO</td>
<td>AB</td>
<td>AM</td>
<td>–40°C to +105°C (Grade 2)</td>
<td>ES</td>
<td>R</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.

Orderable Part Numbers

<table>
<thead>
<tr>
<th>Orderable Part Number</th>
<th>Firmware Revision</th>
<th>Description</th>
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</thead>
<tbody>
<tr>
<td>ATMXT2912TD-ATVAO (Supplied in trays)</td>
<td>1.0.AA</td>
<td>176-lead LQFP 24 x 24 x 1.4 mm, RoHS compliant Operating temperature range –40°C to +85°C (Grade 3)</td>
</tr>
<tr>
<td>ATMXT2912TD-ATRVAO (Supplied in tape and reel)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ATMXT2912TD-ABVAO (Supplied in trays)</td>
<td>1.0.AA</td>
<td>176-lead LQFP 24 x 24 x 1.4 mm, RoHS compliant Operating temperature range –40°C to +105°C (Grade 2)</td>
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</table>
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ISBN: 978-1-5224-3602-7