

**MICROCHIP**

mXT2113TG-AT/mXT2113TG-AB 1.0

maXTouch 2048-node Touchscreen Controller Product Brief

Description

The mXT2113TG-AT/mXT2113TG-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 mXT2113TG-AT/mXT2113TG-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.

The mXT2113TG-Ax touch controller operates seamlessly with the MXG3141 3D gesture device to provide both 2-dimensional (2D) gestures on the touchscreen surface and 3-dimensional (3D) gestures in the space above the touchscreen. Full multiplexing allows the total system to process both 3D gestures from an approaching hand and 2D touch gestures once a surface touch has been detected.

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 32 X (transmit) lines and 64 Y (receive) lines for use by a touchscreen and 2 key arrays
- A maximum of 2048 nodes can be allocated to the touch sensor
- Touchscreen size of 16.9 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 16 concurrent touches tracked in real time

Keys

- 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

- 3D (air) gestures supported with additional electrodes
- 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_{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 10 touches ≥ 100 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

- 3D (air) gestures supported in conjunction with the MXG3141 3D gesture device
- Reports one-touch and two-touch 2D gestures, processed natively by the mXT2113TG-Ax touch controller

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)

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 with support for Standard mode (up to 100 kHz), Fast mode (up to 400 kHz), Fast-mode Plus (up to 1 MHz)
- SPI client 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 (V_{dd}) 3.3V nominal
- Digital I/O (V_{ddIO}) 3.3V nominal
- Analog (AV_{dd}) 3.3V nominal
- High voltage external X line drive (XV_{dd}) up to 8.5V

Package

- 144-lead LQFP 20 × 20 × 1.4 mm, 0.5 mm pitch

Operating Temperature

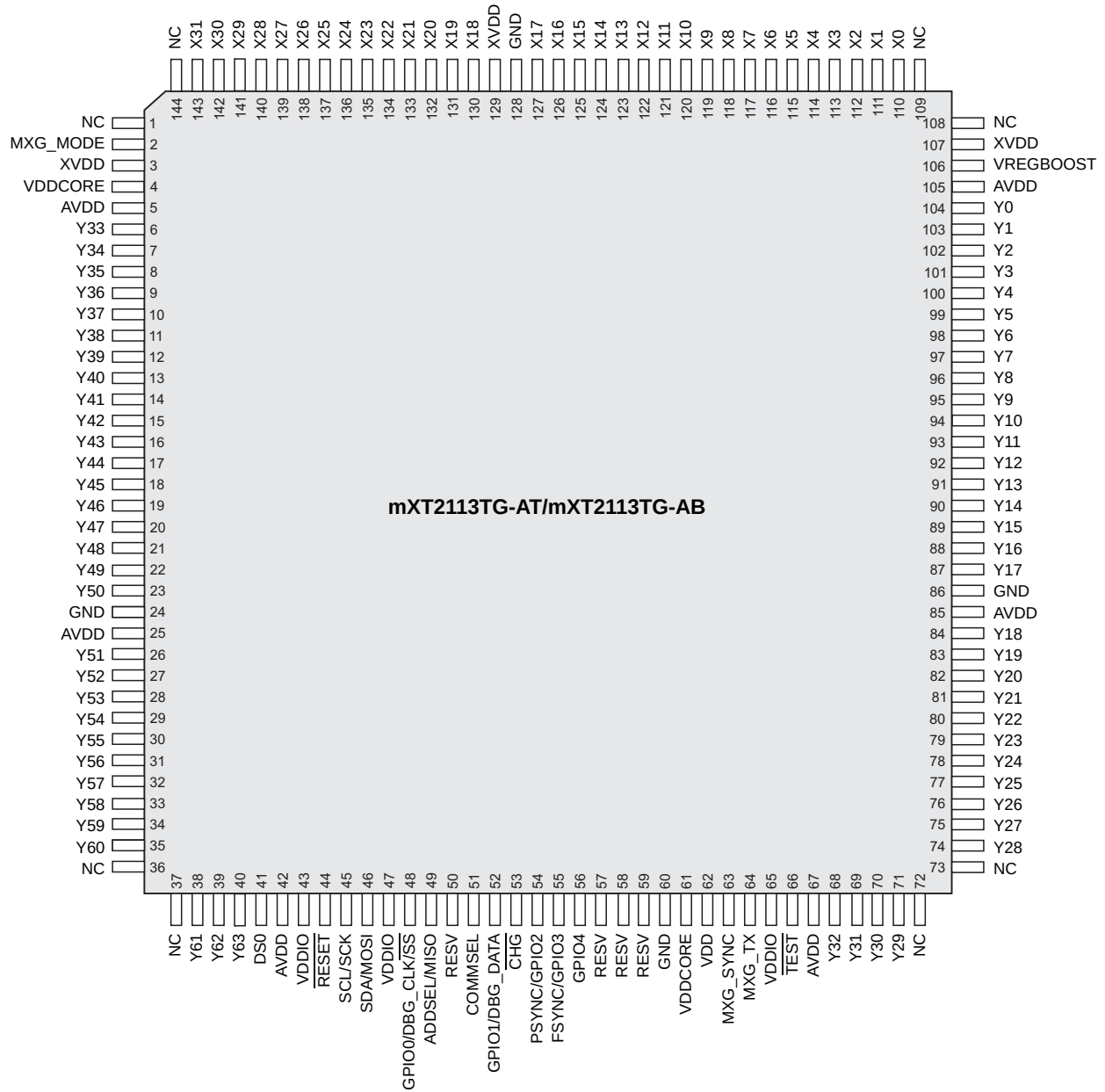
- mXT2113TG-AT: -40°C to $+85^{\circ}\text{C}$ (Grade 3)
- mXT2113TG-AB: -40°C to $+105^{\circ}\text{C}$ (Grade 2)

Design Services

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

PIN CONFIGURATION

144-lead LQFP



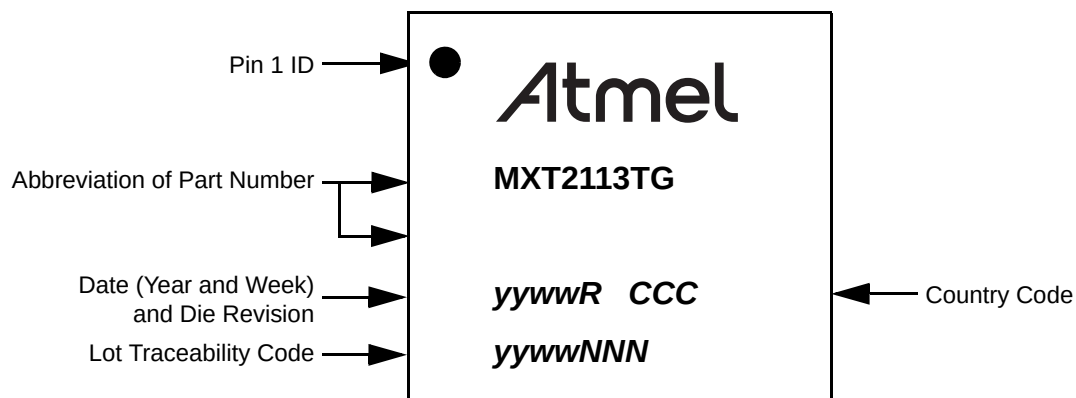
Top view

mXT2113TG-AT/mXT2113TG-AB 1.0

1.0 PACKAGING INFORMATION

1.1 Package Marking Information

1.1.1 144-LEAD LQFP



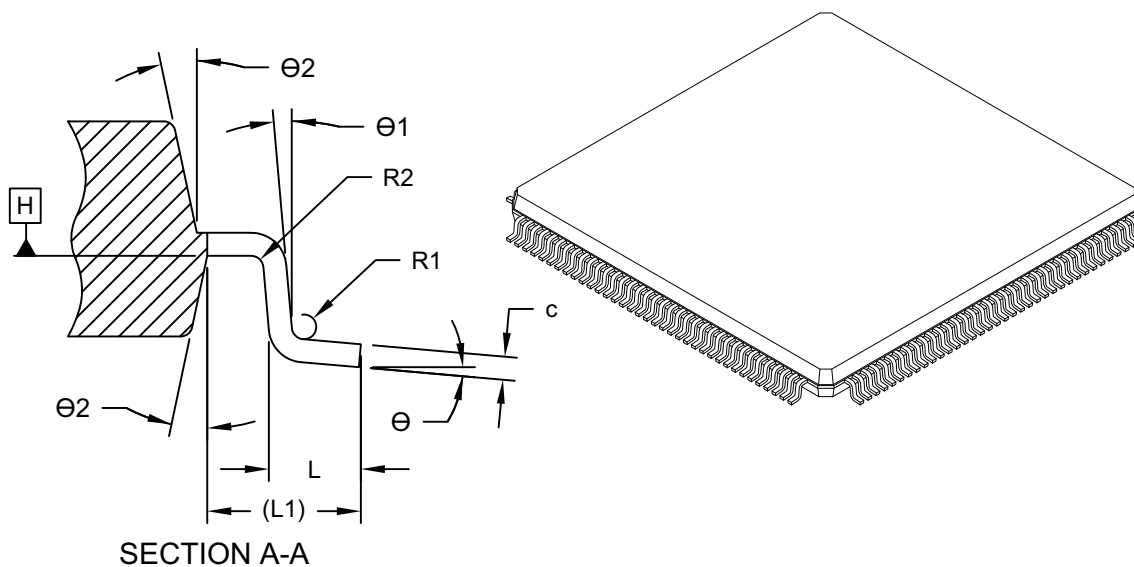
1.1.2 ORDERABLE PART NUMBERS

The product identification system for maXTouch devices is described in ["Product Identification System"](#). That section also lists example part numbers for the device.

mXT2113TG-AT/mXT2113TG-AB 1.0

144-Lead Plastic Quad Flatpack (2SB) - 20x20x1.4 mm Body [LQFP] Atmel Legacy Global Package Code AEI

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	144		
Pitch	e	0.50 BSC		
Overall Height	A	-	-	1.60
Standoff	A1	0.05	0.02	0.15
Molded Plastic Height	A2	1.35	1.40	1.45
Overall Length	D	22.00 BSC		
Exposed Pad Length	D1	20.00 BSC		
Overall Width	E	22.00 BSC		
Exposed Pad Width	E1	20.00 BSC		
Terminal Width	b	0.17	0.22	0.27
Terminal Width	c	0.09	0.15	0.20
Terminal Length	L	0.45	0.60	0.75
Footprint	L1	1.00 REF		
Terminal Bend Radius	R1	0.08	-	-
Terminal Bend Radius	R2	0.08	-	0.20
Terminal Angle	Θ	0°	3.5°	7°
Terminal Angle	Θ1	0°	-	-
Mold Draft Angle	Θ2	11°	12°	13°

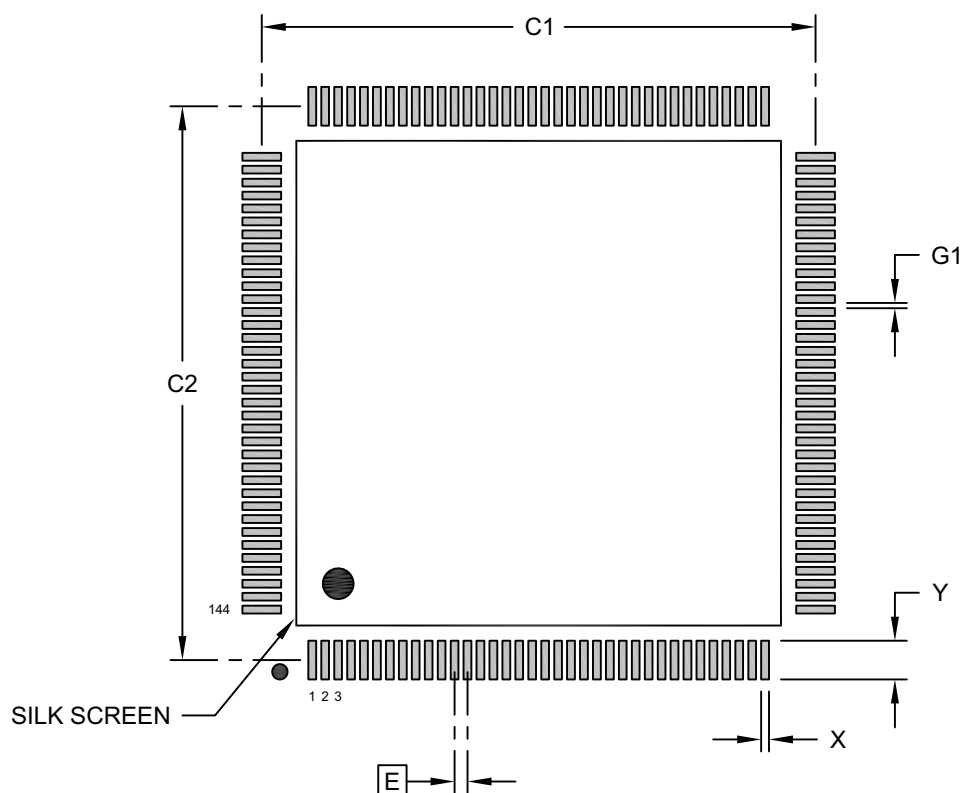
Notes:

- Pin 1 visual index feature may vary, but must be located within the hatched area.
- 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 C04-21010 Rev A Sheet 2 of 2

144-Lead Plastic Quad Flatpack (2SB) - 20x20x1.4 mm Body [LQFP] Atmel Legacy Global Package Code AEI

Note: For the most current package drawings, please see the Microchip Packaging Specification located at <http://www.microchip.com/packaging>



RECOMMENDED LAND PATTERN

Dimension Limits	Units	MILLIMETERS		
		MIN	NOM	MAX
Contact Pitch	E	0.50 BSC		
Contact Pad Spacing	C1		21.40	
Contact Pad Spacing	C2		21.40	
Contact Pad Width (X144)	X1			0.30
Contact Pad Length (X144)	Y1			1.50
Contact Pad to Contact Pad (X140)	G1	0.20		

Notes:

- Dimensioning and tolerancing per ASME Y14.5M
BSC: Basic Dimension. Theoretically exact value shown without tolerances.

Microchip Technology Drawing C04-23010 Rev A

APPENDIX A: REVISION HISTORY

Revision A (February 2021)

Initial edition for firmware revision 1.0.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 mXT2113TG-AT/mXT2113TG-AB.

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:	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
ATMXT2113TG-ATVAO (Supplied in trays)	1.0.AA	144-lead LQFP 20 × 20 × 1.4 mm, RoHS compliant Operating temperature range –40°C to +85°C (Grade 3)
ATMXT2113TG-ATRVAO (Supplied in tape and reel)		
ATMXT2113TG-ABVAO (Supplied in trays)	1.0.AA	144-lead LQFP 20 × 20 × 1.4 mm, RoHS compliant Operating temperature range –40°C to +105°C (Grade 2)
ATMXT2113TG-ABRVAO (Supplied in tape and reel)		

NOTES:

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- 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.
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