
maXTouch 112 Channel Touchscreen Controller Product Brief

Description

The members of the ATMXT3072M1 are automotive-grade touchscreen controllers with up to 112 fully reconfigurable touchscreen channels. The ATMXT3072M1 ensures detection and tracking of multi-finger thick gloves over a variety of overlays and display technologies, including on-cell OLED.

In addition to the patented maXTouch[®] differential and self-capacitance sensing schemes, the ATMXT3072M1 supports the Smart Mutual acquisition method, which improves the signal-to-noise ratio by up to +15 dB.

Several innovative features are available, such as Knob-on-Display technology, automated PWM for low latency haptics, and ISO26262 ASIL-B readiness. See [“Feature Summary” on page 4](#) for family variant selection.

Automotive Applications

- AEC-Q100 Automotive Qualified (see [“Product Identification System” on page 12](#))
- CISPR 25 Class 5 compliant
- Separate RC oscillators for CPU and watchdog
- Embedded flash with Error Correcting Code (ECC)
- ISO26262 ASIL-A/B compliant

Microchip/Panasonic Knob Technology

- (ATMXT3072M1E and ATMXT3072M1E-AMK only) Detect and report the detent (click position) of specific capacitive mechanical rotary encoders (knobs) mounted on the touch panel
- Support for up to 4 Knob instances with different size and number of detents (64 detents maximum)
- Position and size of each knob is individually configurable. No specific touch pattern required
- Report absolute or relative detent position as well as the direction of rotation
- Configurable suppression area around the knob to suppress accidental touches from fingers holding the knob
- Optional push/release function
- Design guidance, tools and other services available from Microchip and Panasonic

maXTouch[®] Adaptive Sensing Technology

- 112 configurable sensor lines, plus a driven shield line, which can be configured as an X/Y matrix to allow full flexibility in achievable aspect ratios.
- Standard Touchscreen size of 17.65 inches (16:9 aspect ratio), assuming a sensor electrode pitch of 5.5 mm. Other sizes are possible with different electrode pitches and appropriate sensor material. The achievable touchscreen size depends on the knob requirements

- (ATMXT3072M1E-AUW only) Patented solution for ultrawide touchscreen mode for extra wide aspect ratios, allowing touchscreen size up to 34 inches (7:1 aspect ratio), assuming a sensor electrode pitch of 6 mm
- Multiple touch support with up to 16 concurrent touches tracked in real time depending on the number of knobs implemented

Touch Sensor Technology

- On-cell/touch-on display support including OLED, LCD and micro-LED
- Discrete/out-cell support including glass and PET film-based sensors
- 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 and Design

- Works with PET or glass (dependent on sensor size, touch size, configuration, stack-up, and dimension and number of detents of the knob)
- KoD[™] Knob Designer tool provides guidance on material and thickness
- Configuration and stack-up to be approved by Microchip or a Microchip-qualified touch sensor module partner
- Support for non-rectangular sensor designs (for example, circular, rounded or with cutouts)

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
- Multiple acquisition schemes for robust and sensitive multi-touch sensing, including:
 - Standard Mutual capacitance and Smart Mutual capacitance measurements
 - Self Capacitance measurements
 - P2P Mutual Capacitance measurements
- 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
 - 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 ≥ 120 Hz (subject to configuration)
 - Initial touch latency <25 ms for first touch from idle (subject to configuration)
 - Configurable for power and speed optimization
- Touch panel/knob 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
 - Presence of knob detected
 - Configurable test limits

Keys

- Support for generic keys in addition to the touchscreen (subject to other configurations):
 - Mutual Capacitance Keys: Up to 16 keys in a grid (Key Array)
 - Self Capacitance Keys: Up to 8 individual keys
- Adjacent Key Suppression (AKS) technology is supported for false key touch prevention

PWM Signal Generation with Haptics

- PWM Output for display backlight control, audible speaker/buzzer output, or haptic feedback
- Dedicated PWM pins provide configurable PWM output as single-ended or differential signals
- Constant output PWM supported with configurable output frequency and duty cycle
- Stored patterns can be triggered for output, based on shape search information, using smart haptic triggers

ADC Measurements

- Two pins can be configured to provide general-purpose ADC measurements
- Single-ended and differential modes of operation supported
- Example uses are temperature and voltage monitoring

Enhanced Algorithms

- Dedicated drift calibration algorithm for the knob locations
- Lens bending algorithms to remove display noise
- Touch suppression algorithms to remove unintentional large touches
- Palm Recovery Algorithm for quick restoration to normal state
- Display Noise Equalization to support free-form display shapes, such as rounded or circular shapes
- Enhanced Touch Separation algorithm for improved two touch separation/tracking in all directions.

On-chip Gestures

- Reports one-touch and two-touch gestures

Data Store

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

Device Security

- Encrypted configuration parameters and touch coordinate reports (OBP messages) using customer's own security key
- Firmware Authentication mechanism to ensure the authenticity of the application firmware in the device

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

- Primary client interface for main communication with the device. Can be one of:
 - I²C interface, with support for Standard mode (up to 100 kHz), Fast mode (up to 400 kHz), Fast-mode Plus (up to 1 MHz), High Speed mode (up to 3.4 MHz)
 - SPI interface (up to 8 MHz)
- Optional secondary client interface for separate messaging. Can be one of:
 - I²C interface, with support for Standard mode (up to 100 kHz), Fast mode (up to 400 kHz), Fast-mode Plus (up to 1 MHz), High Speed mode (up to 3.4 MHz)
 - SPI interface (up to 8 MHz)
- Two separate interrupts to indicate when messages are available on the corresponding interfaces
- 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 (Smart Mutual mode 3.3V only)

Package

- 144-lead TQFP Exposed Pad 16 × 16 × 1 mm, 0.4 mm pitch

Operating Temperature

- -40°C to +105°C (Grade 2)

Design Services

- Specific design and tuning tools available as maXTouch Studio plug-ins

ATMXT3072M1

FEATURE SUMMARY

The table below lists the main features available on the ATMXT3072M1 Family variant devices for comparison purposes.

See “[Product Identification System](#)” on page 12 for the orderable part numbers for each variant.

Feature	ATMXT3072M1T	ATMXT3072M1E	ATMXT3072M1E-AUW	ATMXT3072M1E-AMK
Device Communications				
Number of Communication Interfaces	1	2	2	2
Primary Host Communications Interface	I ² C or SPI	I ² C or SPI	I ² C or SPI	I ² C or SPI
Secondary Host Communications Interface	No	I ² C or SPI	I ² C or SPI	I ² C or SPI
Security and Functional Safety				
Device Encryption	No	Yes (Configuration Data and Messages)	Yes (Configuration Data and Messages)	Yes (Configuration Data and Messages)
Firmware Authentication	Yes; with SHA-512 signature	Yes; with SHA-512 signature	Yes; with SHA-512 signature	Yes; with SHA-512 signature
Power, Pin Fault and Signal Limit Self Tests	Yes	Yes	Yes	Yes
Additional Hardware Self Tests	No	Yes	Yes	Yes
ISO26262 ASIL-A/B	No	Compliant	Compliant	No
Human Machine Interface (HMI)				
Touchscreen Channels	112 Sense Lines	112 Sense Lines	162 Sense Lines (7:1 aspect ratio)	112 Sense Lines
Ultrawide Touchscreen	No	No	Yes	No
Microchip Knob-on-Display (KoD)	No	Yes	No	No
Microchip Panasonic Magic Knob (MPMK)	No	No	No	Yes
Generic Keys	8 (Mutual Key Array or Self Capacitance Keys)	8 (Mutual Key Array or Self Capacitance Keys)	None	8 (Mutual Key Array or Self Capacitance Keys)
Number of PWM Interfaces	None	2 (subject to configuration)	2 (subject to configuration)	2 (subject to configuration)
Constant PWM	No	Yes	Yes	Yes
Pattern PWM	No	Yes	Yes	Yes
Shape Event Trigger (Haptics)	No	Yes	Yes	Yes
One-touch Gestures	Yes	Yes, but only if knob is not present	Yes	Yes, but only if knob is not present
Two-touch Gestures	Yes	Yes, but only if knob is not present	Yes	Yes, but only if knob is not present
Touch Performance				
Enhanced Finger Separation	Yes	Yes	Yes	Yes
Display Noise Equalization	Yes	Yes	Yes	Yes
Moisture/Water Compensation	Full support	If Knob present: Condensation only. Full support otherwise	Full support	If Knob present: Condensation only. Full support otherwise
General Purpose ADC	No	Yes	Yes	Yes
Smart Mutual Measurements	Yes	Yes	Yes	Yes
Self Capacitance Measurements	Yes	Yes, but only if knob is not present	Yes	Yes, but only if knob is not present

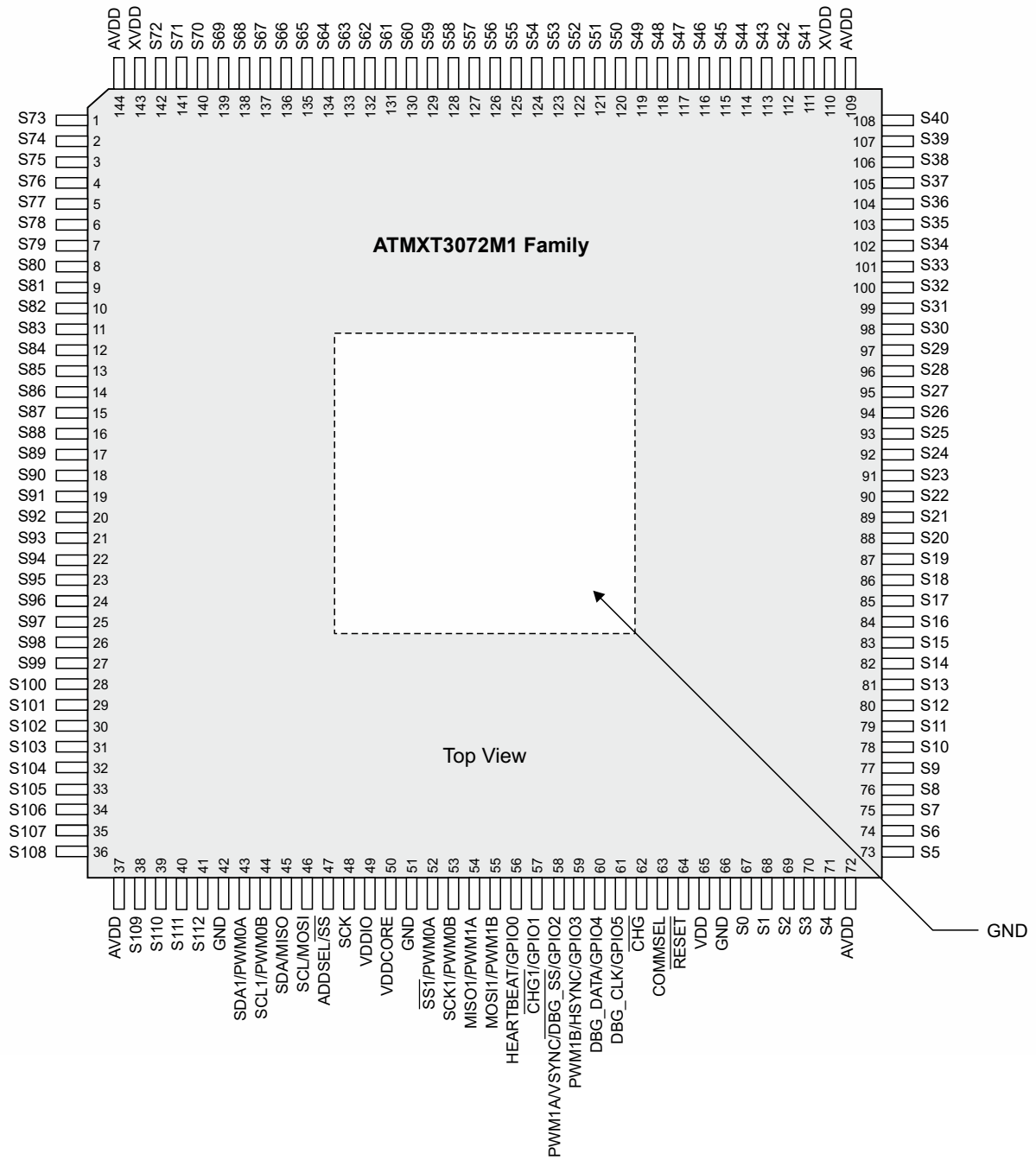
ATMXT3072M1

Feature	ATMXT3072M1T	ATMXT3072M1E	ATMXT3072M1E-AUW	ATMXT3072M1E-AMK
Debug Features				
SPI Debug Interface	Yes	Yes	Yes	Yes
Configurable High Speed SPI	No	Yes (includes $\overline{\text{DBG_SS}}$ line)	Yes (includes $\overline{\text{DBG_SS}}$ line)	Yes (includes $\overline{\text{DBG_SS}}$ line)

ATMXT3072M1

PIN CONFIGURATION

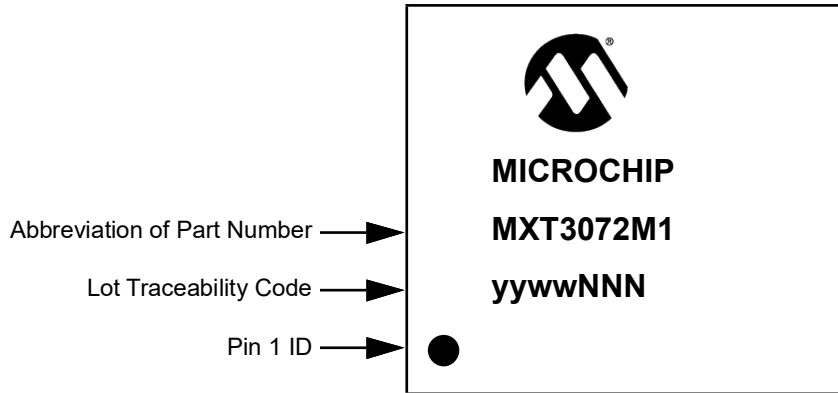
144-lead TQFP



1.0 PACKAGING INFORMATION

1.1 Package Marking Information

1.1.1 144-LEAD TQFP



1.1.2 ORDERABLE PART NUMBERS

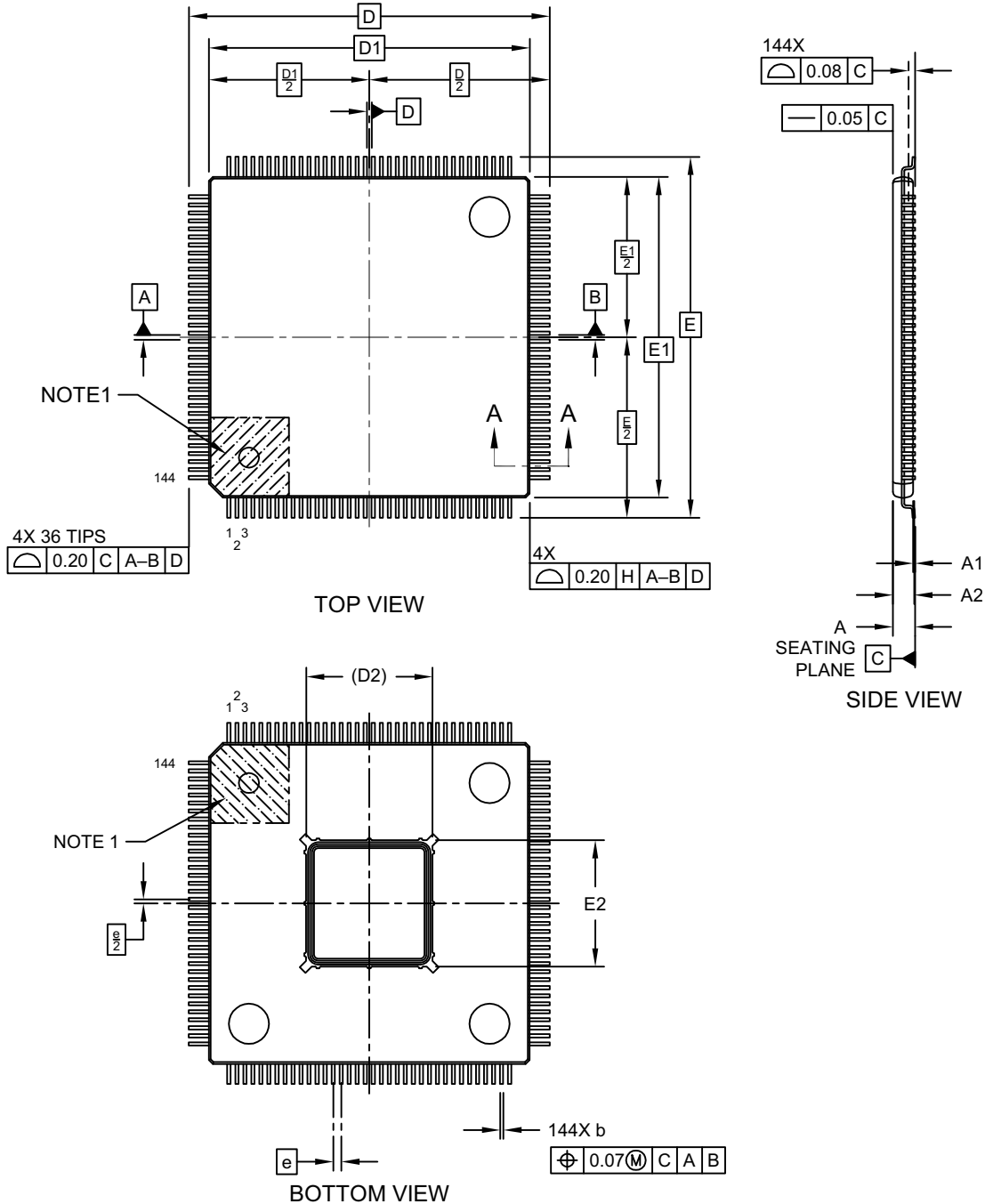
The product identification system for maXTouch devices is described in [“Product Identification System” on page 12](#). That section also lists example part numbers for the device.

ATMXT3072M1

1.2 Package Details

144-Lead Plastic Thin Quad Flatpack (4KB) - 16x16 mm Body [TQFP] With 6.3 mm Grooved Exposed Pad

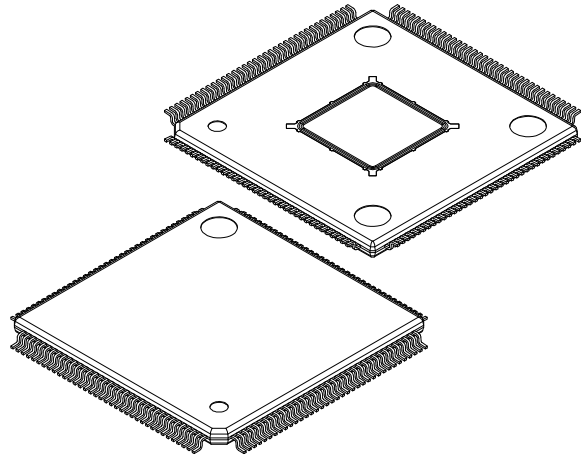
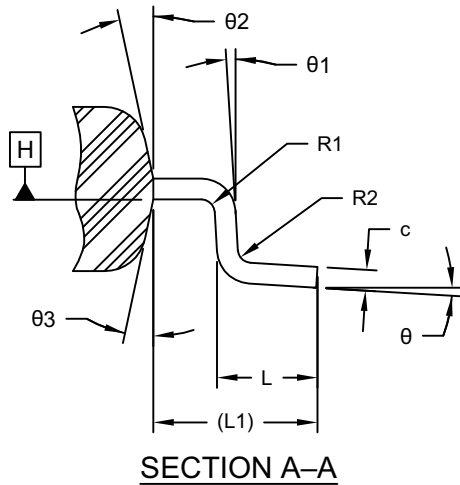
Note: For the most current package drawings, please see the Microchip Packaging Specification located at <http://www.microchip.com/packaging>



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144-Lead Plastic Thin Quad Flatpack (4KB) - 16x16 mm Body [TQFP] With 6.3 mm Grooved Exposed Pad

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



Dimension Limits	Units	MILLIMETERS		
		MIN	NOM	MAX
Number of Terminals	N	144		
Pitch	e	0.40 BSC		
Overall Height	A	-	-	1.20
Standoff	A1	0.05	-	0.15
Molded Package Thickness	A2	0.95	1.00	1.05
Overall Length	D	18.00 BSC		
Molded Package Length	D1	16.00 BSC		
Exposed Pad Length	D2	6.30 REF		
Overall Width	E	18.00 BSC		
Molded Package Width	E1	16.00 BSC		
Exposed Pad Width	E2	6.30 REF		
Terminal Width	b	0.13	0.16	0.23
Terminal Thickness	c	0.09	.127	0.20
Terminal Length	L	0.45	0.60	0.75
Footprint	L1	1.00 REF		
Lead Bend Radius	R1	0.08	-	-
Lead Bend Radius	R2	0.08	-	0.20
Foot Angle	θ	0°	3.5°	7°
Lead Angle	θ_1	0°	-	-
Mold Draft Angle	θ_2	11°	12°	13°
Mold Draft Angle	θ_3	11°	12°	13°

Notes:

- Pin 1 visual index feature may vary, but must be located within the hatched area.
- Package is saw singulated
- Dimensioning and tolerancing per ASME Y14.5M

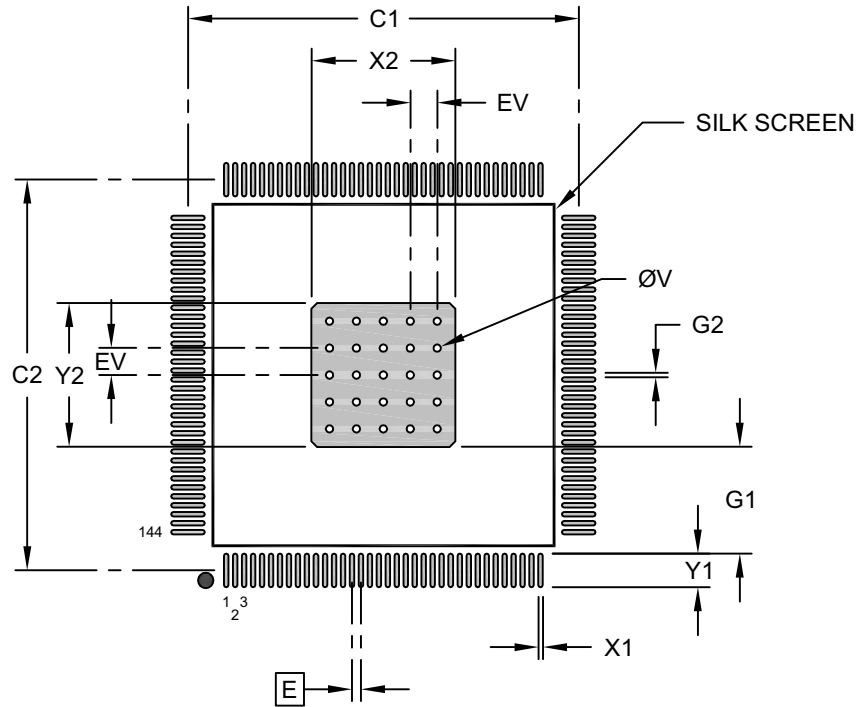
BSC: Basic Dimension. Theoretically exact value shown without tolerances.

REF: Reference Dimension, usually without tolerance, for information purposes only.

ATMXT3072M1

144-Lead Plastic Thin Quad Flatpack (4KB) - 16x16 mm Body [TQFP] With 6.3 mm Grooved Exposed Pad

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	0.40 BSC		
Optional Center Pad Width	X2			6.40
Optional Center Pad Length	Y2			6.40
Contact Pad Spacing	C1		17.40	
Contact Pad Spacing	C2		17.40	
Contact Pad Width (Xnn)	X1			0.20
Contact Pad Length (Xnn)	Y1			1.50
Contact Pad to Center Pad (Xnn)	G1	4.75		
Contact Pad to Contact Pad (Xnn)	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 C04-23546 Rev A

APPENDIX A: REVISION HISTORY

Revision A (February 2025)

Initial edition for firmware revision 1.0.AA – Release

ATMXT3072M1

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 ATMXT3072M1 Family.

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

PART NO.	-XXX	[X]	[XXXX]	[XXX]
Device	Package	Tape and Reel Option	Variant	Qualification
Device:	Base device name			
Package:	A	=	QFP (Plastic Quad Flatpack)	
Tape and Reel Option: ⁽¹⁾	Blank	=	Standard Packaging (Tube or Tray)	
	R	=	Tape and Reel	
Variant:	Text	=	Product Variant Code	
Qualification:	VAx	=	AEC-Q100 Automotive Qualified	
	Other Text	=	Industrial (Non-automotive) Part	

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	Description ⁽¹⁾	Package and Temperature Grade	Firmware Revision	Family ID	Variant ID	Media Packing
ATMXT3072M1T-AVAO	ATMXT3072M1T variant feature set ⁽¹⁾	144-lead TQFP Exposed Pad 16 × 16 × 1 mm, RoHS compliant, Operating range -40°C to +105°C (Grade 2)	1.0.AA	0xA7	0x03	Trays
ATMXT3072M1T-ARVAO						Tape and reel
ATMXT3072M1E-AVAO	ATMXT3072M1E variant feature set ⁽¹⁾				0x01	Trays
ATMXT3072M1E-ARVAO						Tape and reel
ATMXT3072M1E-AUWVAO	ATMXT3072M1E-AUW variant feature set ⁽¹⁾				0x0C	Trays
ATMXT3072M1E-ARUWVAO						Tape and reel
ATMXT3072M1E-AMKVAO	ATMXT3072M1E-AMK variant feature set ⁽¹⁾				0x09	Trays
ATMXT3072M1E-ARMKVAO						Tape and reel

Note 1: See [“Feature Summary”](#) on page 4 for the main functional features on each variant device listed.

NOTES:

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