ATMXT2496M1

maXTouch 100 Channel Touchscreen Controller Product Brief

Description

The ATMXT2496M1 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 ATMXT2496M1 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 ATMXT2496M1 Family allows for one or more physical knobs to be affixed to the touchscreen. As a knob is rotated, the ATMXT2496M1 Family detects the resulting touches.

Automotive Applications

- AEC-Q100 Automotive Qualified (see "Product Identification System" on page 11)
- 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

- (ATMXT2496M1E and ATMXT2496M1E-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

- 100 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.
- Touchscreen size of 15.9 inches (16:9 aspect ratio), assuming a sensor electrode pitch of 5.5 mm. The achievable touchscreen size depends on the knob requirements
- 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:
  - I^2C 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 I^2C client interface for separate messaging, 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)
- 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 (Vdd) 3.3V nominal
- Digital I/O (VddIO) 3.3V nominal
- Analog (AVdd) 3.3V nominal
- High voltage external X line drive (XVdd) up to 8.5V (Smart Mutual mode 3.3V only)

Package

- 128-lead TQFP 14 × 14 × 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

FEATURE SUMMARY

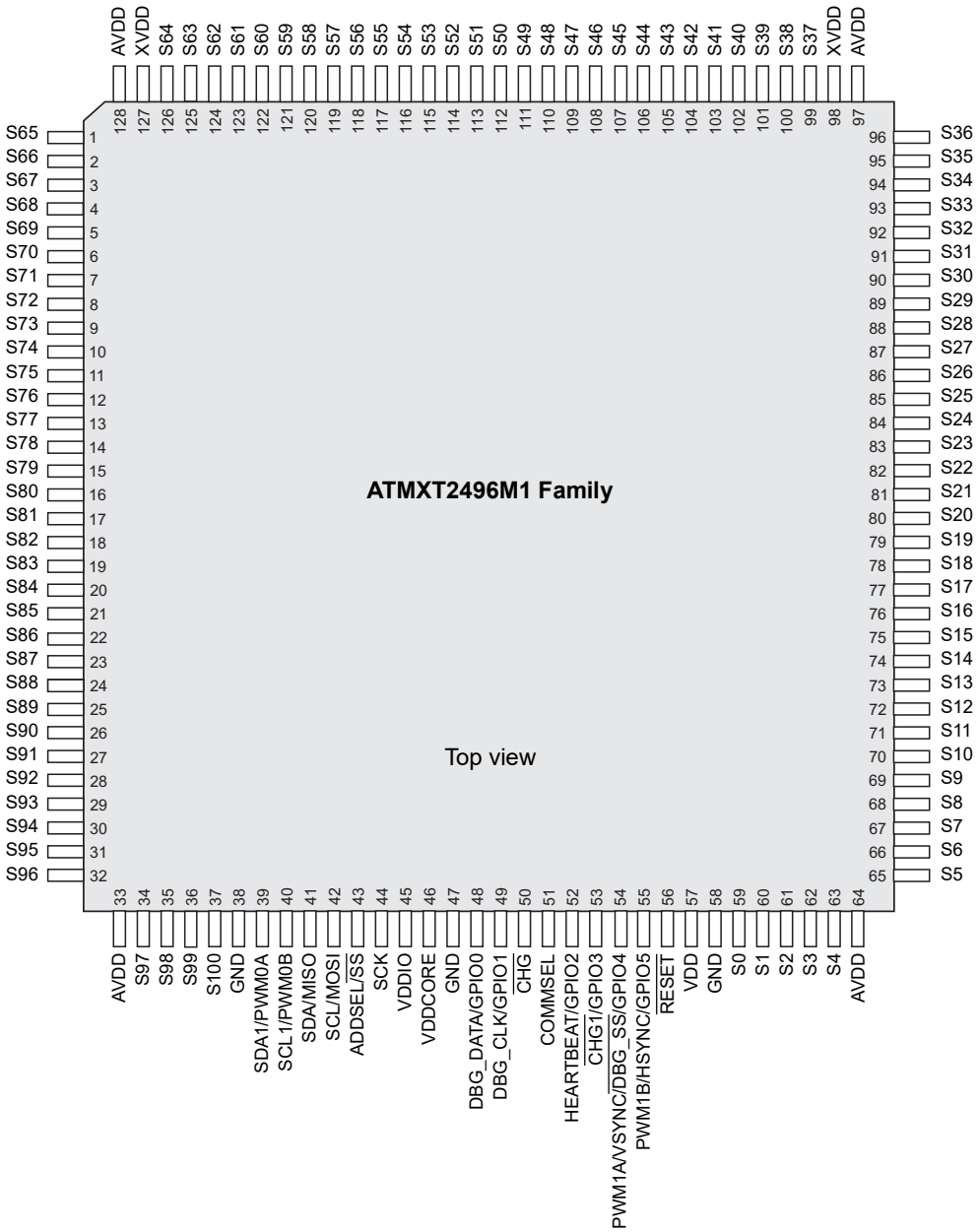
The table below lists the main features available on the ATMXT2496M1 Family variant devices for comparison purposes.

See “Product Identification System” on page 11 for the orderable part numbers for each variant.

Feature	ATMXT2496M1T	ATMXT2496M1E	ATMXT2496M1E-AMK
Device Communications			
Number of Communication Interfaces	1	2	2
Primary Host Communications Interface	I^2C or SPI	I^2C or SPI	I^2C or SPI
Secondary Host Communications Interface	No	I^2C	I^2C
Security and Functional Safety			
Device Encryption	No	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
Power, Pin Fault and Signal Limit Self Tests	Yes	Yes	Yes
Additional Hardware Self Tests	No	Yes	Yes
ISO26262 ASIL-A/B	No	Compliant	No
Human Machine Interface (HMI)			
Touchscreen Channels	100 Sense Lines	100 Sense Lines	100 Sense Lines
Ultrawide Touchscreen	No	No	No
Microchip Knob-on-Display (KoD)	No	Yes	No
Microchip Panasonic Magic Knob (MPMK)	No	No	Yes
Generic Keys	8 (Mutual Key Array or Self Capacitance Keys)	8 (Mutual Key Array or Self Capacitance Keys)	8 (Mutual Key Array or Self Capacitance Keys)
Number of PWM Interfaces	None	2 (subject to configuration)	2 (subject to configuration)
Constant PWM	No	Yes	Yes
Pattern PWM	No	Yes	Yes
Shape Event Trigger (Haptics)	No	Yes	Yes
One-touch Gestures	Yes	Yes, but only if knob is not present	Yes, but only if knob is not present
Two-touch Gestures	Yes	Yes, but only if knob is not present	Yes, but only if knob is not present
Touch Performance			
Enhanced Finger Separation	Yes	Yes	Yes
Display Noise Equalization	Yes	Yes	Yes
Moisture/Water Compensation	Full support	If Knob present: Condensation only. Full support otherwise	If Knob present: Condensation only. Full support otherwise
General Purpose ADC	No	Yes	Yes
Smart Mutual Measurements	Yes	Yes	Yes
Self Capacitance Measurements	Yes	Yes, but only if knob is not present	Yes, but only if knob is not present
Debug Features			
SPI Debug Interface	Yes	Yes	Yes
Configurable High Speed SPI	No	Yes (includes $\overline{\text{DBG\_SS}}$ line)	Yes (includes $\overline{\text{DBG\_SS}}$ line)

PIN CONFIGURATION

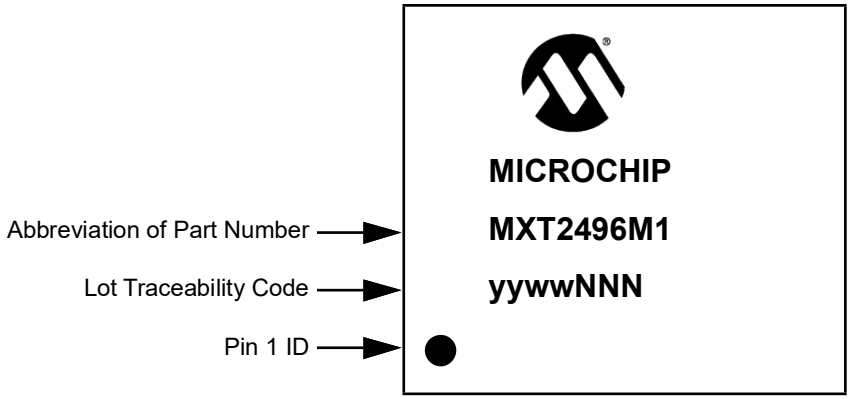
128-lead TQFP



1.0 PACKAGING INFORMATION

1.1 Package Marking Information

1.1.1 128-LEAD TQFP



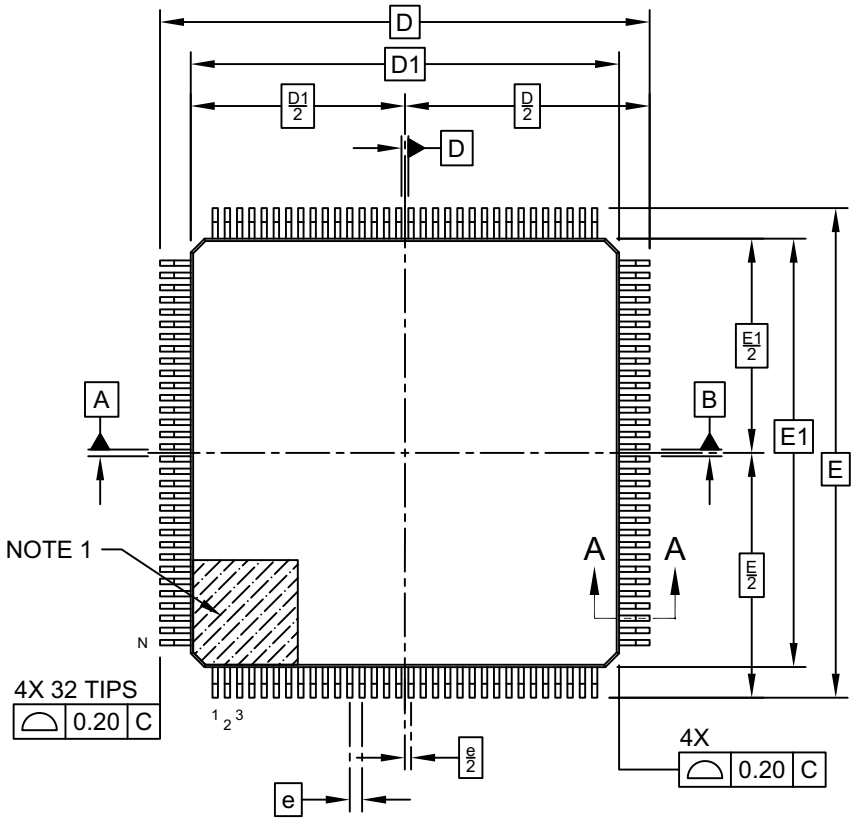
1.1.2 ORDERABLE PART NUMBERS

The product identification system for maXTouch devices is described in “Product Identification System” on page 11. That section also lists example part numbers for the device.

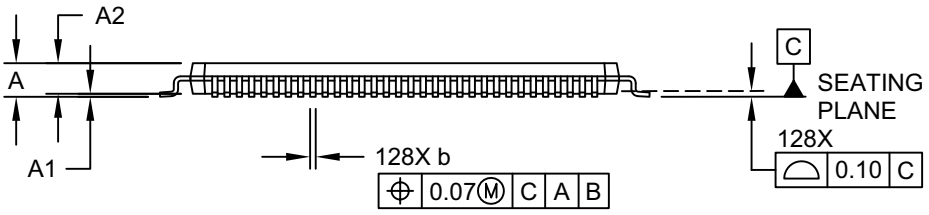
1.2 Package Details

128-Lead Thin Plastic Quad Flatpack (ZA) - 14x14 mm Body [TQFP]
SMSC Legacy VTQE3; Atmel Legacy Global Package Code APL

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



TOP VIEW



SIDE VIEW

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128-Lead Thin Plastic Quad Flatpack (ZA) - 14x14 mm Body [TQFP]
SMSC Legacy VTQE3; Atmel Legacy Global Package Code APL

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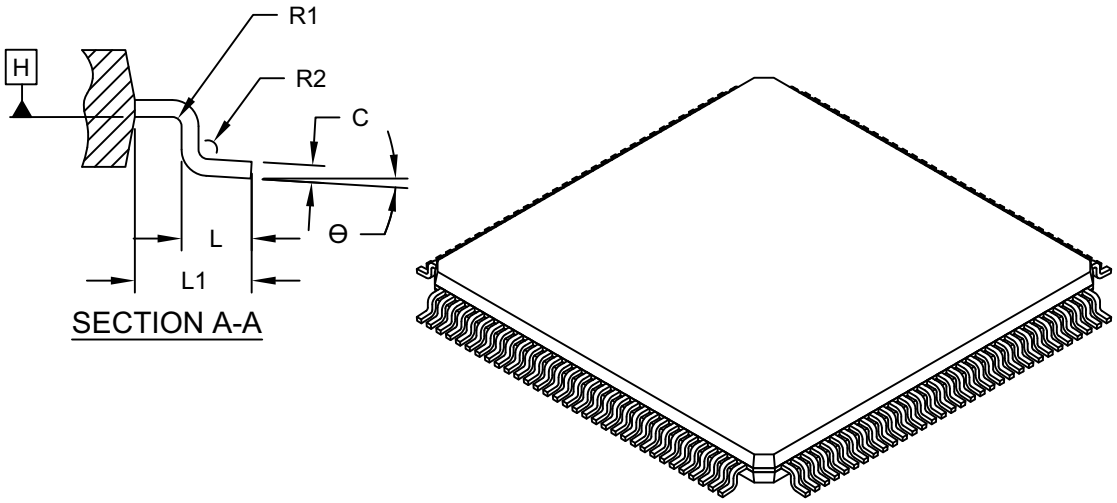

Units		MILLIMETERS		
Dimension Limits		MIN	NOM	MAX
Number of Leads	N		128	
Lead Pitch	e		0.40 BSC	
Overall Height	A	-	-	1.20
Standoff	A1	0.05	0.10	0.15
Molded Package Thickness	A2	0.95	1.00	1.05
Foot Length	L	0.45	0.60	0.75
Footprint	L1		1.00 REF	
Foot Angle	θ	0°	-	7°
Overall Width	E		16.00 BSC	
Overall Length	D		16.00 BSC	
Molded Package Width	E1		14.00 BSC	
Molded Package Length	D1		14.00 BSC	
Lead Width	b	0.13	0.16	0.23
Mold Draft Angle Top	C	0.09	-	0.20
Lead Bend Radius	R1	0.08	-	-
Lead Bend Radius	R2	0.08	-	0.20

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.

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128-Lead Thin Plastic Quad Flatpack (ZA) - 14x14 mm Body [TQFP]
SMSC Legacy VTQE3; Atmel Legacy Global Package Code APL

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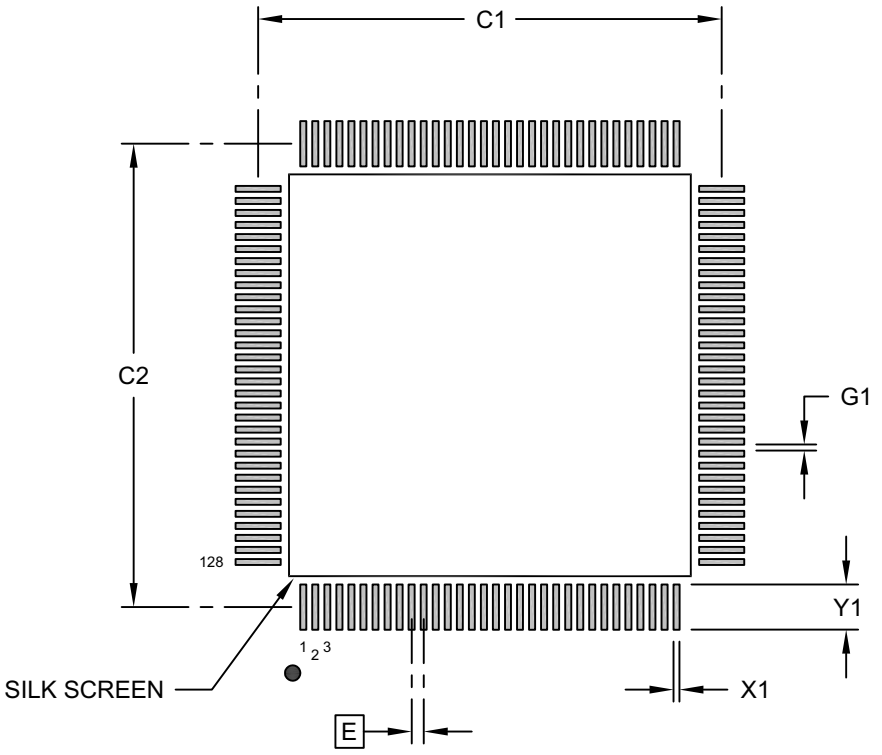

RECOMMENDED LAND PATTERN

Units		MILLIMETERS		
Dimension Limits		MIN	NOM	MAX
Contact Pitch	E	0.40 BSC		
Contact Pad Spacing	C1		15.40	
Contact Pad Spacing	C2		15.40	
Contact Pad Width (X20)	X1			0.20
Contact Pad Length (X20)	Y1			1.50
Contact Pad to Contact Pad (X124)	G1	0.20		

Notes:

1. Dimensioning and tolerancing per ASME Y14.5M

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

Microchip Technology Drawing C04-2181 Rev C

APPENDIX A: REVISION HISTORY

Revision A (February 2025)

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 ATMXT2496M1 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:	VA*x*	=	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
ATMXT2496M1T-AVAO	ATMXT2496M1T variant feature set (1)	128-lead TQFP 14 × 14 × 1 mm, RoHS compliant, Operating range –40°C to +105°C (Grade 2)	1.0.AA	0xA7	0x05	Trays
ATMXT2496M1T-ARVAO						Tape and reel
ATMXT2496M1E-AVAO	ATMXT2496M1E variant feature set (1)				0x04	Trays
ATMXT2496M1E-ARVAO						Tape and reel
ATMXT2496M1E-AMKVAO	ATMXT2496M1E-AMK variant feature set (1)				0x0A	Trays
ATMXT2496M1E-ARMKVAO						Tape and reel

Note 1: See "Feature Summary" on page 4 for the main functional features on each variant device listed.

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