ATMXT1296M1 Family

maXTouch 1296-node Touchscreen Controller
Product Brief

Description

The members of the ATMXT1296M1 Family are automotive-grade touchscreen controllers with up to 72 fully reconfigurable touchscreen channels. The ATMXT1296M1 Family 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 ATMXT1296M1 Family 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 for family variant selection.

Automotive Applications

- AEC-Q100 Automotive Qualified (see)
- CISPR 25 compliant (for Standard Mutual, Smart Mutual and Self Capacitance modes)
- Separate RC oscillators for CPU and watchdog
- Embedded flash with Error Correcting Code (ECC)
- ASIL-B related FMEDA processes applied

Microchip/Panasonic Knob Technology

- 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

- 72 configurable sensor lines, which can be configured as either X or Y lines to allow full flexibility in achievable aspect ratios
- Configurations up to 48 X ✕ 60 Y lines (1296 nodes) possible
- Touchscreen size 11.29 inches (16:10 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 and LCD
- 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 ≥100 Hz (subject to configuration)
  - Initial touch latency <20 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 simple 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 Encryption

- Encrypted configuration parameters and touch coordinate reports (OBP messages) using customer's own security key

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 client interface for separate messaging. 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)
- 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
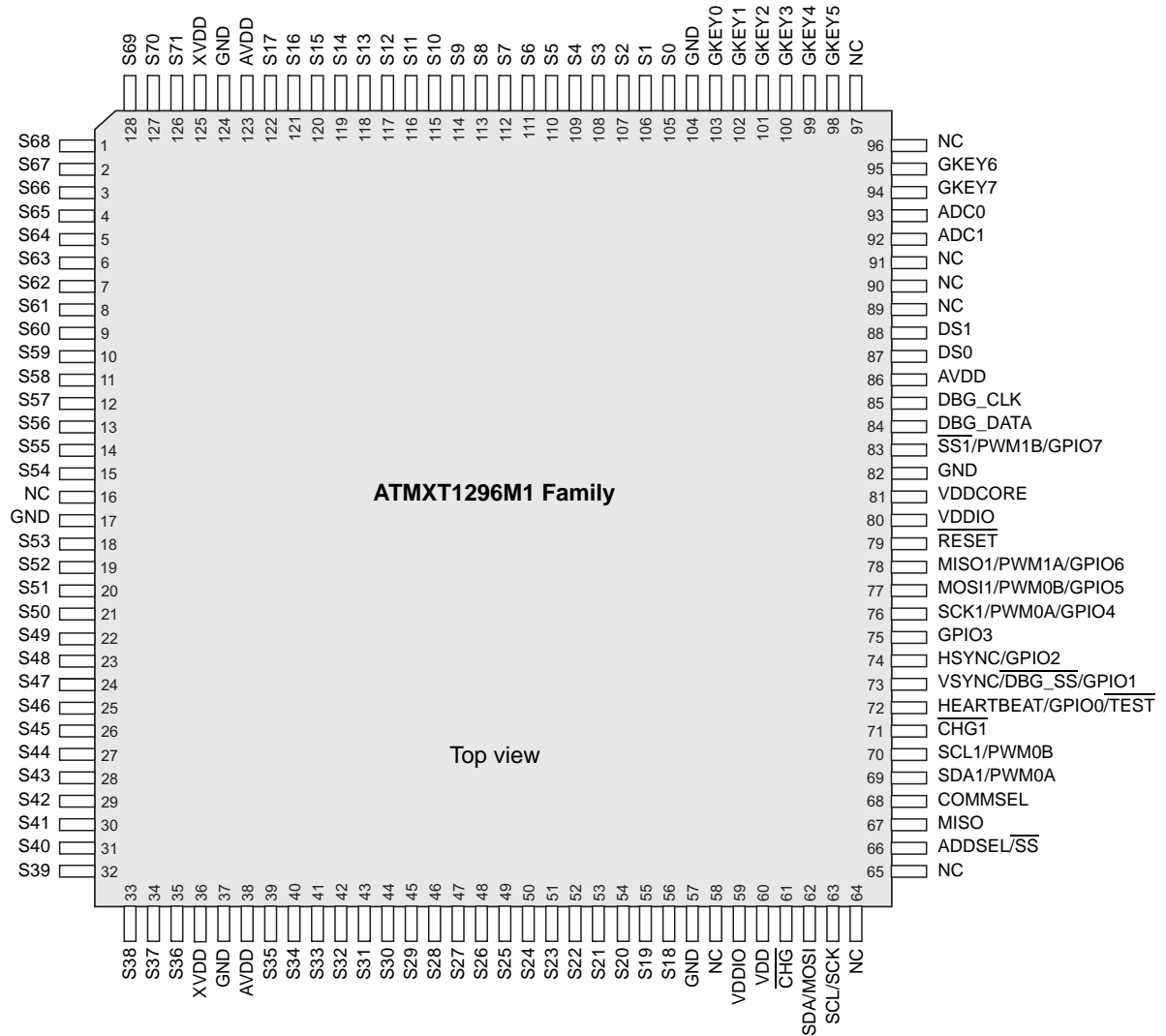
ATMXT1296M1 Family

FEATURE SUMMARY

The table below lists the main features available on the ATMXT1296M1 Family variant devices for comparison purposes.

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

Feature	ATMXT1296M1E	ATMXT1296M1E-AMK	ATMXT1296M1T
Device Communications			
Number of Communication Interfaces	2	2	1
Primary Host Communications Interface (Supports Firmware Update)	I^{2}C or SPI	I^{2}C or SPI	I^{2}C or SPI
Secondary Host Communications Interface	I^{2}C or SPI	I^{2}C or SPI	–
Security and Functional Safety			
Device Encryption	Yes (Configuration Data and Messages)	Yes (Configuration Data and Messages)	No
Power, Pin Fault and Signal Limit Self Tests	Yes	Yes	Yes
Additional Hardware Self Tests	Yes	Yes	No
ASIL-B Ready	Yes	Yes	No
Human Machine Interface (HMI)			
Touchscreen Channels	72 Sense Lines	72 Sense Lines	72 Sense Lines
Microchip Knob-on-Display (KoD)	Yes	No	No
Microchip Panasonic Magic Knob (MPMK)	No	Yes	No
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	2 (subject to configuration)	2 (subject to configuration)	None
Constant PWM	Yes	Yes	–
Automated Pattern PWM	Yes	Yes	–
Shape Event Trigger (Haptics)	Yes	Yes	No
One-touch Gestures	Yes if knob is not present	Yes if knob is not present	Yes
Two-touch Gestures	Yes if knob is not present	Yes if knob is not present	Yes
Touch Performance			
Enhanced Finger Separation	Yes	Yes	Yes
Display Noise Equalization	Yes	Yes	Yes
Moisture/Water Compensation	Condensation only if knob is present; full support otherwise	Condensation only if knob is present; full support otherwise	Full support
General Purpose ADC	Yes	Yes	No
Smart Mutual Measurements	Yes	Yes	Yes
Self Capacitance Measurements	Yes, but only if knob is not present	Yes, but only if knob is not present	Yes
Debug Features			
SPI Debug Interface	Yes	Yes	Yes
Configurable High Speed SPI	Yes (includes DBG_SS line)	Yes (includes DBG_SS line)	No

Product Brief

PIN CONFIGURATION

128-lead TQFP

ATMXT1296M1 Family

Top view

Left side pins (top to bottom):
1 S68
2 S67
3 S66
4 S65
5 S64
6 S63
7 S62
8 S61
9 S60
10 S59
11 S58
12 S57
13 S56
14 S55
15 S54
16 NC
17 GND
18 S53
19 S52
20 S51
21 S50
22 S49
23 S48
24 S47
25 S46
26 S45
27 S44
28 S43
29 S42
30 S41
31 S40
32 S39

Top side pins (left to right):
128 S69
127 S70
126 S71
125 XVDD
124 GND
123 AVDD
122 S17
121 S16
120 S15
119 S14
118 S13
117 S12
116 S11
115 S10
114 S9
113 S8
112 S7
111 S6
110 S5
109 S4
108 S3
107 S2
106 S1
105 S0
104 GND
103 GKEY0
102 GKEY1
101 GKEY2
100 GKEY3
99 GKEY4
98 GKEY5
97 NC

Right side pins (top to bottom):
96 NC
95 GKEY6
94 GKEY7
93 ADC0
92 ADC1
91 NC
90 NC
89 NC
88 DS1
87 DS0
86 AVDD
85 DBG_CLK
84 DBG_DATA
83 $\overline{SS1}$/PWM1B/GPIO7
82 GND
81 VDDCORE
80 VDDIO
79 $\overline{RESET}$
78 MISO1/PWM1A/GPIO6
77 MOSI1/PWM0B/GPIO5
76 SCK1/PWM0A/GPIO4
75 GPIO3
74 HSYNC/GPIO2
73 VSYNC/$\overline{DBG\_SS}$/GPIO1
72 HEARTBEAT/GPIO0/$\overline{TEST}$
71 $\overline{CHG1}$
70 SCL1/PWM0B
69 SDA1/PWM0A
68 COMMSEL
67 MISO
66 ADDSEL/$\overline{SS}$
65 NC

Bottom side pins (left to right):
33 S38
34 S37
35 S36
36 XVDD
37 GND
38 AVDD
39 S35
40 S34
41 S33
42 S32
43 S31
44 S30
45 S29
46 S28
47 S27
48 S26
49 S25
50 S24
51 S23
52 S22
53 S21
54 S20
55 S19
56 S18
57 GND
58 NC
59 VDDIO
60 VDD
61 $\overline{CHG}$
62 SDA/MOSI
63 SCL/SCK
64 NC

Product Brief

ATMXT1296M1 Family

1.0   PACKAGING INFORMATION

1.1   Package Marking Information

1.1.1   128-LEAD TQFP

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                                      MICROCHIP

Abbreviation of Part Number  ──────▶  MXT1296M1

Lot Traceability Code  ──────▶  yywwNNN

Pin 1 ID  ──────▶  ●
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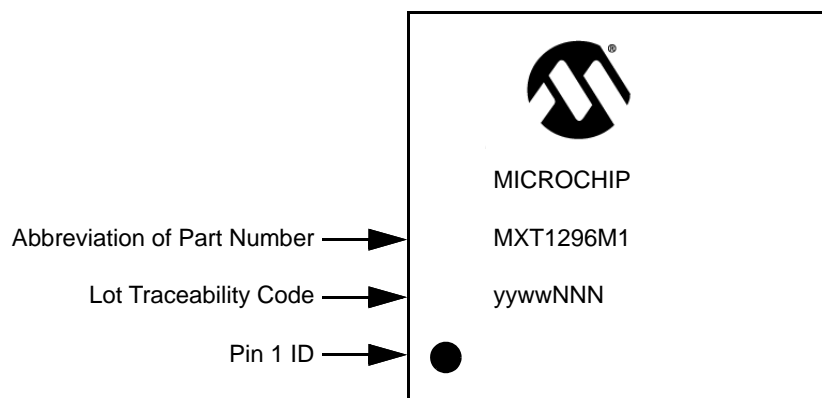
1.1.2   ORDERABLE PART NUMBERS

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.

Product Brief

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
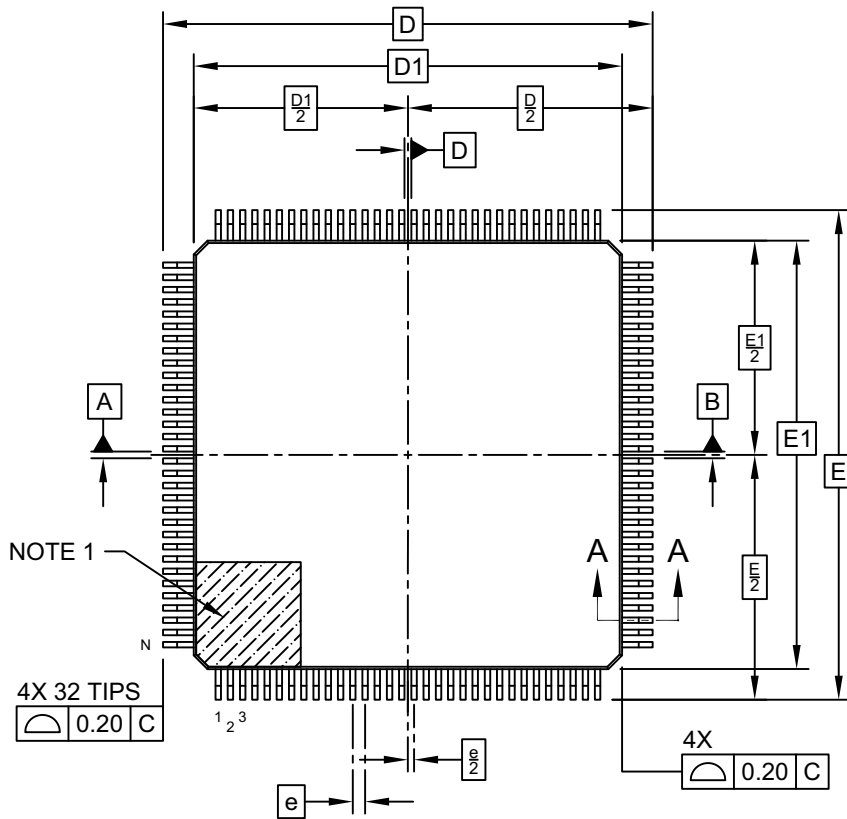
TOP VIEW
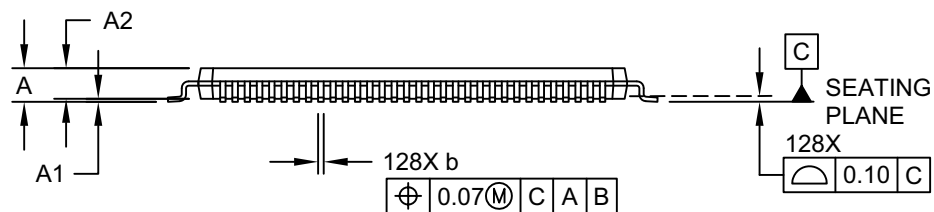
SIDE VIEW

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

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

SECTION A-A
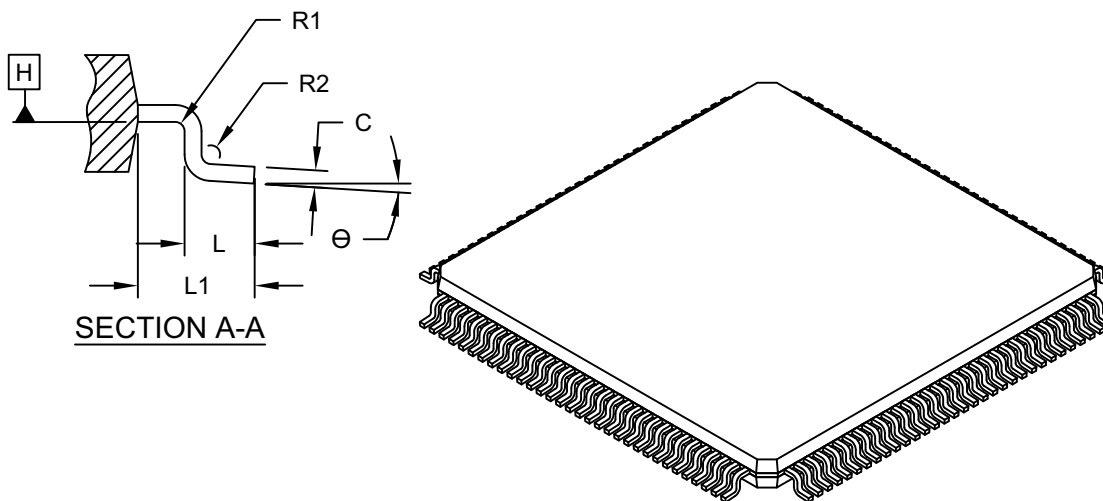
	Units	MILLIMETERS		
Dimension Limits		MIN	NOM	MAX
Number of Leads	N		128	
Lead Pitch	e		0.40 BSC	
Overall Height	A	-	-	1.20
Standoff	A1	0.05	0.10	0.15
Molded Package Thickness	A2	0.95	1.00	1.05
Foot Length	L	0.45	0.60	0.75
Footprint	L1		1.00 REF	
Foot Angle	θ	0°	-	7°
Overall Width	E		16.00 BSC	
Overall 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.

Microchip Technology Drawing C04-181 Rev C Sheet 2 of 2

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

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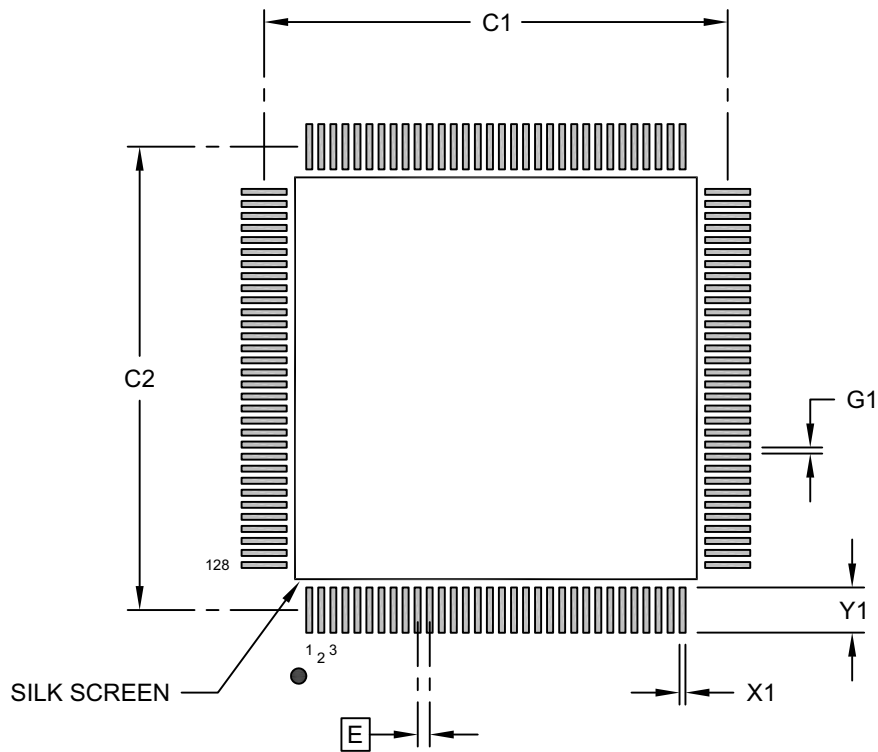
RECOMMENDED LAND PATTERN

	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 (March 2024)

Initial edition for firmware revision 2.0.AB – Release

Product Brief

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 ATMXT1296M1 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)	Operating Range and Temperature Grade	Firmware Revision	Family ID	Variant ID	Media Packing
ATMXT1296M1E-AVAO	ATMXT1296M1E variant feature set	−40°C to +105°C (Grade 2)	2.0.AB	0xA7	0x02	Tray
ATMXT1296M1E-ARVAO						Tape and reel
ATMXT1296M1E-AMKVAO	ATMXT1296M1E-AMK variant feature set				0x06	Tray
ATMXT1296M1E-ARMKVAO						Tape and reel
ATMXT1296M1T-AVA2	ATMXT1296M1T variant feature set				0x00	Tray
ATMXT1296M1T-ARVA2						Tape and reel

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

Previous Versions – Not recommended for new designs

Orderable Part Number	Description	Operating Range and Temperature Grade	Firmware Revision	Family ID	Variant ID	Media Packing
ATMXT1296M1T-ATVA1	Legacy firmware without Smart Mutual	−40°C to +85°C (Grade 3)	1.1.AA	0xA7	0x00	Tray
ATMXT1296M1T-ATRVA1						Tape and reel
ATMXT1296M1T-ABVA1		−40°C to +105°C (Grade 2)				Tray
ATMXT1296M1T-ABRVA1						Tape and reel
ATMXT1296M1T-ATVAO		−40°C to +85°C (Grade 3)	1.0.AA	0xA7	0x00	Tray
ATMXT1296M1T-ATRVAO						Tape and reel
ATMXT1296M1T-ABVAO		−40°C to +105°C (Grade 2)				Tray
ATMXT1296M1T-ABRVAO						Tape and reel

NOTES:

Product Brief

Note the following details of the code protection feature on Microchip products:

- 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, within operating specifications, and under normal conditions.

- Microchip values and aggressively protects its intellectual property rights. Attempts to breach the code protection features of Microchip products is strictly prohibited and may violate the Digital Millennium Copyright Act.

- Neither Microchip nor any other semiconductor manufacturer can guarantee the security of its code. Code protection does not mean that we are guaranteeing the product is "unbreakable". Code protection is constantly evolving. Microchip is committed to continuously improving the code protection features of our products.

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Taiwan - Taipei
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Poland - Warsaw
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Romania - Bucharest
Tel: 40-21-407-87-50

Spain - Madrid
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Fax: 34-91-708-08-91

Sweden - Gothenberg
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Sweden - Stockholm
Tel: 46-8-5090-4654

UK - Wokingham
Tel: 44-118-921-5800
Fax: 44-118-921-5820

Product Brief