# mXT2113TD-ATKD/ mXT2113TD-ABKD 1.0

## maXTouch 2112-node Touchscreen Controller Product Brief

## Description

The mXT2113TD-ATKD/mXT2113TD-ABKD 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.

## Automotive Applications

- AEC-Q100 Qualified
- CISPR 25 compliant

## Knob-on-Display™ 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

## maXTouch® Adaptive Sensing Technology

- Up to 33 X (transmit) lines and 64 Y (receive) lines for use by a touchscreen and/or 2 key arrays
- A maximum of 2112 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. 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

## 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
- 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
- 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 (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
- Scan Speed
  - Typical report rate for 10 touches ≥120 Hz (subject to configuration)
  - Initial touch latency <20 ms for first touch from idle (subject to configuration)
  - Microchip Knob-on-Display rotation speed >120 rpm
  - 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

## 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

## 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

- 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)
  - SPI 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 (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

## Package

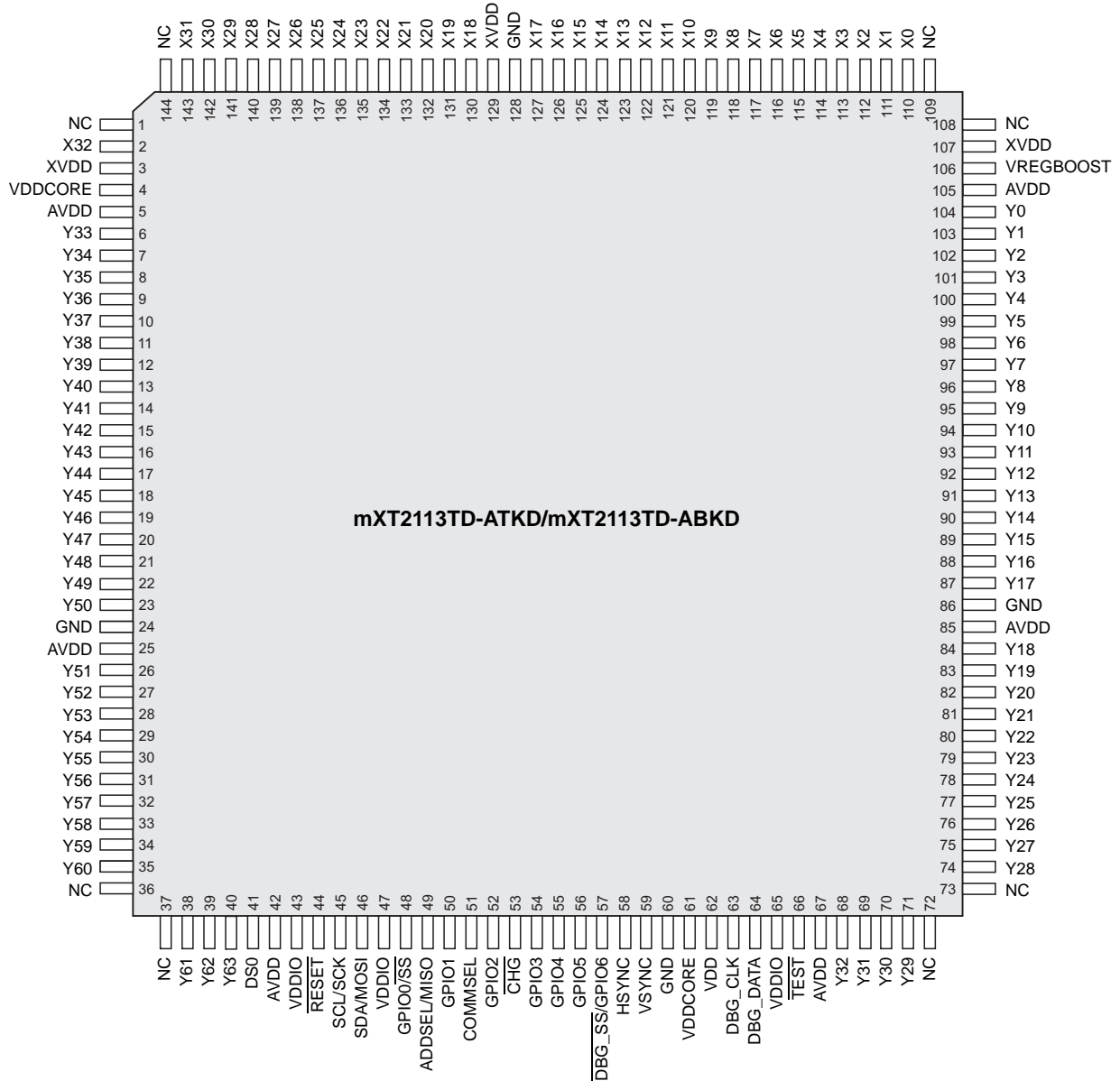- 144-lead LQFP 20 × 20 × 1.4 mm, 0.5 mm pitch

## Operating Temperature

- ATMXT2113TD-ATKD: −40°C to +85°C (Grade 3)
- ATMXT2113TD-ABKD: −40°C to +105°C (Grade 2)

## Design Services

- Review of device configuration, stack-up and sensor patterns
- Specific design and tuning tools available as maXTouch Studio plug-ins

## PIN CONFIGURATION

### 144-lead LQFP

Top view

*Left side pins (top to bottom):* NC (1), X32 (2), XVDD (3), VDDCORE (4), AVDD (5), Y33 (6), Y34 (7), Y35 (8), Y36 (9), Y37 (10), Y38 (11), Y39 (12), Y40 (13), Y41 (14), Y42 (15), Y43 (16), Y44 (17), Y45 (18), Y46 (19), Y47 (20), Y48 (21), Y49 (22), Y50 (23), GND (24), AVDD (25), Y51 (26), Y52 (27), Y53 (28), Y54 (29), Y55 (30), Y56 (31), Y57 (32), Y58 (33), Y59 (34), Y60 (35), NC (36)

*Top side pins (left to right):* NC (144), X31 (143), X30 (142), X29 (141), X28 (140), X27 (139), X26 (138), X25 (137), X24 (136), X23 (135), X22 (134), X21 (133), X20 (132), X19 (131), X18 (130), XVDD (129), GND (128), X17 (127), X16 (126), X15 (125), X14 (124), X13 (123), X12 (122), X11 (121), X10 (120), X9 (119), X8 (118), X7 (117), X6 (116), X5 (115), X4 (114), X3 (113), X2 (112), X1 (111), X0 (110), NC (109)

*Right side pins (top to bottom):* NC (108), XVDD (107), VREGBOOST (106), AVDD (105), Y0 (104), Y1 (103), Y2 (102), Y3 (101), Y4 (100), Y5 (99), Y6 (98), Y7 (97), Y8 (96), Y9 (95), Y10 (94), Y11 (93), Y12 (92), Y13 (91), Y14 (90), Y15 (89), Y16 (88), Y17 (87), GND (86), AVDD (85), Y18 (84), Y19 (83), Y20 (82), Y21 (81), Y22 (80), Y23 (79), Y24 (78), Y25 (77), Y26 (76), Y27 (75), Y28 (74), NC (73)

*Bottom side pins (left to right):* NC (37), Y61 (38), Y62 (39), Y63 (40), DS0 (41), AVDD (42), VDDIO (43), RESET (44), SCL/SCK (45), SDA/MOSI (46), VDDIO (47), GPIO0/SS (48), ADDSEL/MISO (49), GPIO1 (50), COMMSEL (51), GPIO2 (52), CHG (53), GPIO3 (54), GPIO4 (55), GPIO5 (56), DBG_SS/GPIO6 (57), HSYNC (58), VSYNC (59), GND (60), VDDCORE (61), VDD (62), DBG_CLK (63), DBG_DATA (64), VDDIO (65), TEST (66), AVDD (67), Y32 (68), Y31 (69), Y30 (70), Y29 (71), NC (72)

Center label: **mXT2113TD-ATKD/mXT2113TD-ABKD**

## 1.0    PACKAGING INFORMATION

### 1.1    Package Marking Information

#### 1.1.1    144-LEAD LQFP
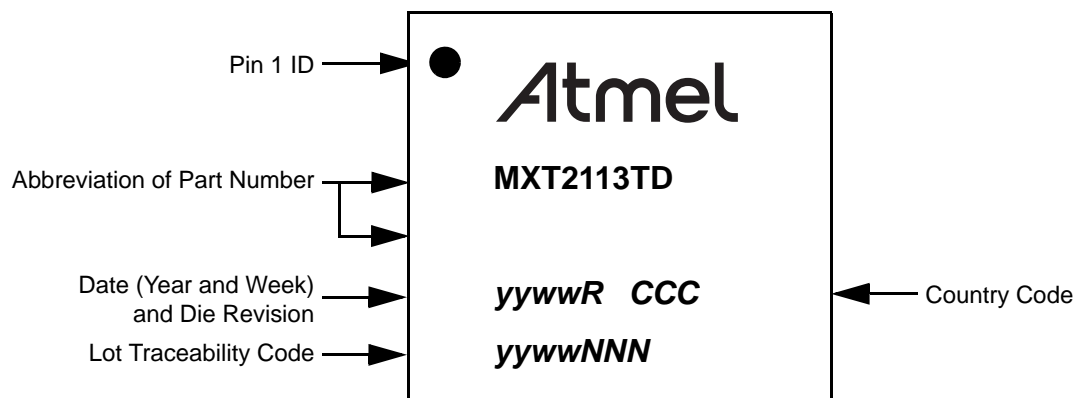


#### 1.1.2    ORDERABLE PART NUMBERS

The product identification system for maXTouch devices is described in "Product Identification System" on page 9. That section also lists example part numbers for the device.

### 1.2    Package Details

**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



TOP VIEW

SIDE VIEW

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**Product Brief**

**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 |
|---|---|



SECTION A-A
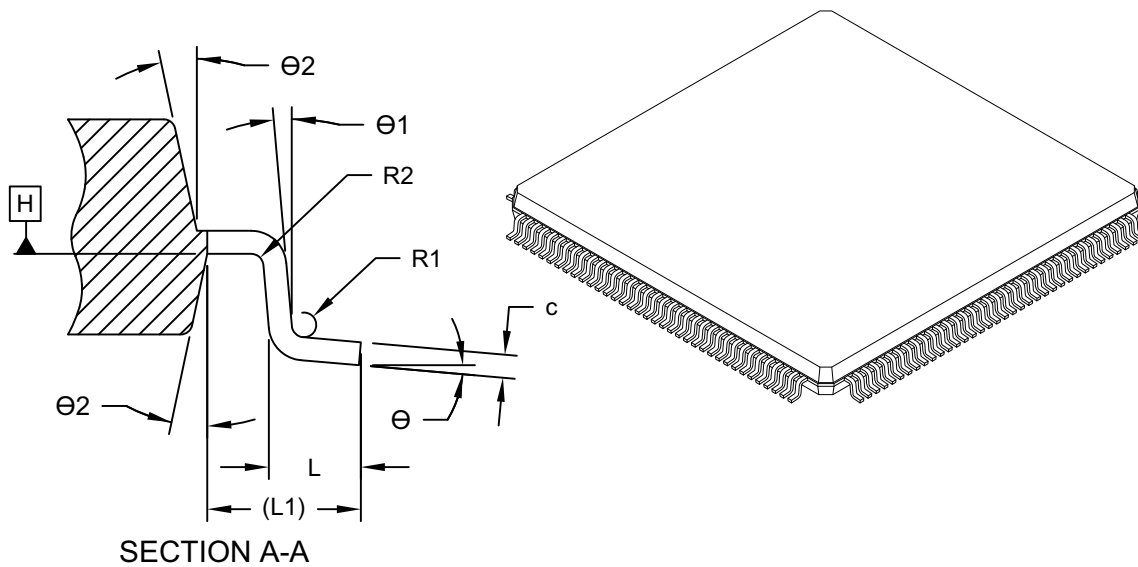
| | Units | MILLIMETERS | | |
|---|---|---|---|---|
| Dimension Limits | | MIN | NOM | MAX |
| Number of Terminals | N | | 144 | |
| Pitch | e | | 0.50 BSC | |
| Overall Height | A | - | - | 1.60 |
| Standoff | A1 | 0.05 | 0.02 | 0.15 |
| Molded Plastic Height | A2 | 1.35 | 1.40 | 1.45 |
| Overall Length | 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:

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  C04-21010 Rev A Sheet 2 of 2

**Product Brief**

**144-Lead Plastic Quad Flatpack (2SB) - 20x20x1.4 mm Body [LQFP]**
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> **Note:** For the most current package drawings, please see the Microchip Packaging Specification located at
> http://www.microchip.com/packaging
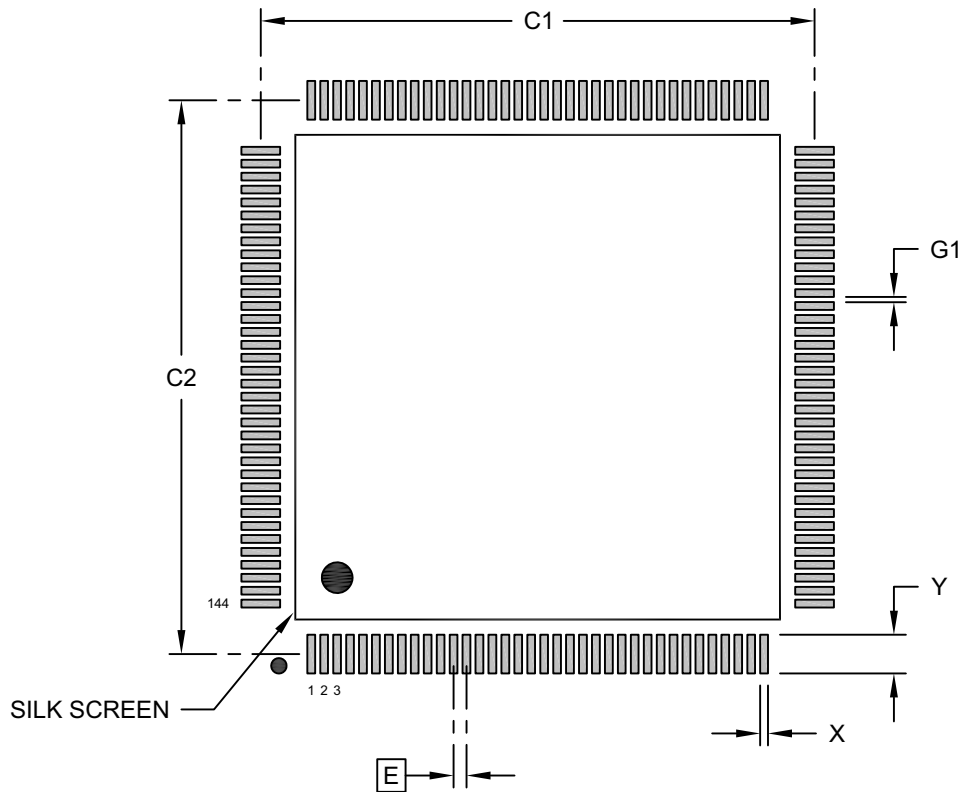


## RECOMMENDED LAND PATTERN

| | Units | MILLIMETERS | | |
|---|---|---|---|---|
| Dimension Limits | | 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:

1. 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 (June 2022)

Initial edition for firmware revision 1.0.AA – Release

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## 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 mXT2113TD-ATKD/mXT2113TD-ABKD.

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

| PART NO. | –XXX | [X] | [X] | [XXX] |
|----------|------|-----|-----|-------|
| 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 |
|-----------------------|-------------------|-------------|
| ATMXT2113TD-ATKDVAO (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) |
| ATMXT2113TD-ATRKDVAO (Supplied in tape and reel) | | |
| ATMXT2113TD-ABKDVAO (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) |
| ATMXT2113TD-ABRKDVAO (Supplied in tape and reel) | | |

**NOTES:**

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**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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