# ESD2CAN27-Q1 Automotive 2-Channel, 27V ESD Protection Diode for In-Vehicle Networks

## 1 Features

- 27V working voltage
- IEC 61000-4-2 ESD protection:
  - ±30kV contact and ±30kV air-gap discharge
- ISO 10605 (330pF, 330Ω) ESD protection:
  - ±21kV contact and ±21kV air-gap discharge
- IEC 61000-4-5 surge protection (8/20µs):
  - 4.3A
- Bidirectional ESD protection
- I/O capacitance = 3.0pF typical
- Low clamping voltage protects downstream components
- AEC-Q101 qualified for automotive applications
- Leaded packages to allow for automatic optical inspection (AOI)

## 2 Applications

- Automotive in-vehicle networks:
  - Controller area network (CAN)
  - Low, fault tolerant CAN
  - High-speed CAN

## 3 Description

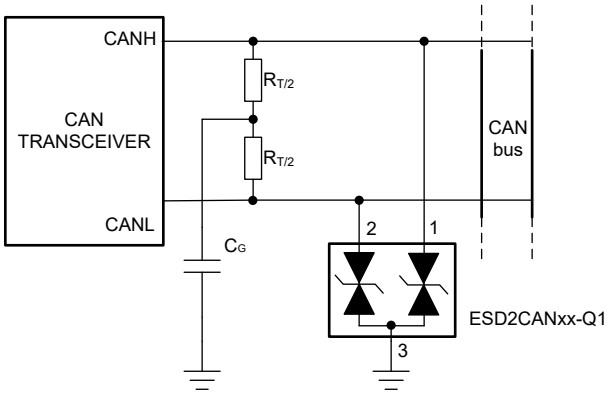
The ESD2CAN27-Q1 is a bidirectional ESD protection diode for controller area network (CAN) interface protection. The ESD2CAN27-Q1 is rated to dissipate contact ESD strikes specified in the ISO 10605 automotive standard. The low dynamic resistance and low clamping voltage enables system level protection against transient events. This protection is key as automotive systems require a high level of robustness and reliability for safety applications.

This device features a low IO capacitance per channel and a pin-out to suit two automotive CAN bus lines (CANH and CANL) from the damage caused by electrostatic discharge (ESD) and other transients. Additionally, the 3.0pF (typical) or less line capacitance of the ESD2CAN27-Q1 is an excellent choice for CAN, CAN-FD, and CAN SiC applications.

**Package Information**

| PART NUMBER | PACKAGE(1) | PACKAGE SIZE |
|---|---|---|
| ESD2CAN27-Q1 | DBZ (SOT-23, 3) | 2.92mm × 2.37mm |

(1) For more information, see Section 10




**ESD2CAN27-Q1 Typical Application**

An IMPORTANT NOTICE at the end of this data sheet addresses availability, warranty, changes, use in safety-critical applications, intellectual property matters and other important disclaimers. PRODUCTION DATA.

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# 4 Pin Configuration and Functions

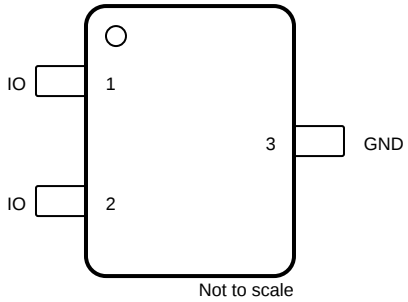



**Figure 4-1. DBZ Package, 3-Pin SOT-23 (Top View)**

**Table 4-1. Pin Functions**

| PIN | | TYPE[1] | DESCRIPTION |
|---|---|---|---|
| NAME | NO. | | |
| IO | 1, 2 | I/O | ESD protected IO |
| GND | 3 | G | Connect to ground. |

(1) I/O = Input or Output, G = Ground

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# 5 Specifications

## 5.1 Absolute Maximum Ratings

over operating free-air temperature range (unless otherwise noted)(1)

| | | MIN | MAX | UNIT |
|---|---|---|---|---|
| Peak pulse | IEC 61000-4-5 Power ($t_p$ - 8/20 µs) at 25°C | | 175 | W |
| | IEC 61000-4-5 current ($t_p$ - 8/20 µs) at 25°C | | 4.3 | A |
| $T_A$ | Operating free-air temperature | -55 | 150 | °C |
| TJ | Junction temperature | -55 | 150 | °C |
| $T_{stg}$ | Storage temperature | -65 | 155 | °C |

(1) Operation outside the Absolute Maximum Ratings may cause permanent device damage. Absolute Maximum Ratings do not imply functional operation of the device at these or any other conditions beyond those listed under Recommended Operating Conditions. If used outside the Recommended Operating Conditions but within the Absolute Maximum Ratings, the device may not be fully functional, and this may affect device reliability, functionality, performance, and shorten the device lifetime.

## 5.2 ESD Ratings - AEC Specification

| | | | VALUE | UNIT |
|---|---|---|---|---|
| $V_{(ESD)}$ | Electrostatic discharge | Human body model (HBM), per AEC Q101-001(1) | ± 2500 | V |
| | | Charged device model (CDM), per AEC Q101-005(2) | ± 1000 | |

(1) JEDEC document JEP155 states that 500V HBM allows safe manufacturing with a standard ESD control process.
(2) JEDEC document JEP157 states that 250V CDM allows safe manufacturing with a standard ESD control process.

## 5.3 ESD Ratings - IEC Specification

| | | | VALUE | UNIT |
|---|---|---|---|---|
| $V_{(ESD)}$ | Electrostatic discharge | IEC 61000-4-2 Contact Discharge, all pins | ±30 | kV |
| | | IEC 61000-4-2 Air-gap Discharge, all pins | ±30 | |

## 5.4 ESD Ratings - ISO Specification

| | | | | VALUE | UNIT |
|---|---|---|---|---|---|
| $V_{(ESD)}$ | Electrostatic discharge | ISO 10605, C = 150pF, R = 330Ω | Contact discharge | ±30 | kV |
| | | | Air-gap discharge | ±30 | |
| | | ISO 10605, C = 330pF, R = 330Ω | Contact discharge | ±21 | |
| | | | Air-gap discharge | ±21 | |

## 5.5 Recommended Operating Conditions

over operating free-air temperature range (unless otherwise noted)

| | | MIN | NOM | MAX | UNIT |
|---|---|---|---|---|---|
| $V_{IN}$ | Input voltage | -27 | | 27 | V |
| $T_A$ | Operating free-air temperature | -55 | | 150 | °C |


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## 5.6 Thermal Information

| THERMAL METRIC[1] | | ESD2CAN27-Q1 DBZ (SOT-23) 3 PINS | UNIT |
|---|---|---|---|
| $R_{\theta JA}$ | Junction-to-ambient thermal resistance | 222.5 | °C/W |
| $R_{\theta JC(top)}$ | Junction-to-case (top) thermal resistance | 116.8 | °C/W |
| $R_{\theta JB}$ | Junction-to-board thermal resistance | 70.5 | °C/W |
| $\Psi_{JT}$ | Junction-to-top characterization parameter | 19.9 | °C/W |
| $\Psi_{JB}$ | Junction-to-board characterization parameter | 70.0 | °C/W |
| $R_{\theta JC(bot)}$ | Junction-to-case (bottom) thermal resistance | NA | °C/W |

(1) For more information about traditional and new thermal metrics, see the *Semiconductor and IC Package Thermal Metrics* application note.

## 5.7 Electrical Characteristics

over $T_A$ = 25°C (unless otherwise noted)

| PARAMETER | | TEST CONDITIONS | MIN | TYP | MAX | UNIT |
|---|---|---|---|---|---|---|
| $V_{RWM}$ | Reverse stand-off voltage | Both Postive and Negative | | | 27 | V |
| $V_{BR}$ | Breakdown voltage | $I_{IO}$ = ±10mA, IO to GND, Both Postive and Negative | 28 | | 37 | V |
| $I_{LEAK}$ | Leakage current, any IO pin to GND | $V_{IO}$ = ±27V, Both Postive and Negative | | 1 | 50 | nA |
| $V_{CLAMP}$ | Clamping voltage[1] | $I_{PP}$ = 1A, $t_p$ = 8/20µs, from IO to GND | | 34 | | V |
| $V_{CLAMP}$ | Clamping voltage[1] | $I_{PP}$ = 4.3A, $t_p$ = 8/20µs, from IO to GND | | 40 | | V |
| $V_{CLAMP}$ | Clamping voltage[2] | $I_{PP}$ = 16A, TLP, from IO to GND, Both Postive and Negative | | 39 | | V |
| $R_{DYN}$ | Dynamic resistance[2] | IO to GND and GND to IO | | 0.4 | | Ω |
| $C_L$ | Line capacitance, any IO to GND | $V_{IO}$ = 0V, f = 1MHz, $V_{p-p}$ = 30mV | | 3 | | pF |

(1) Device stressed with 8/20µs exponential decay waveform according to IEC 61000-4-5.
(2) Non-repetitive current pulse, Transmission Line Pulse (TLP); square pulse; ANSI / ESD STM5.5.1-2008

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# 6 Typical Characteristics

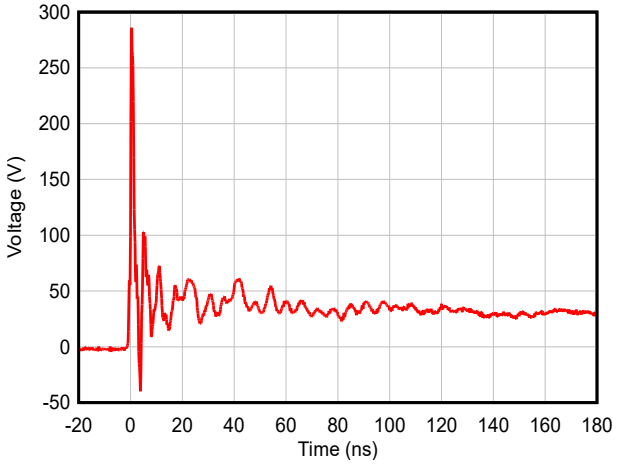



Figure 6-1. +8kV Clamped IEC Waveform

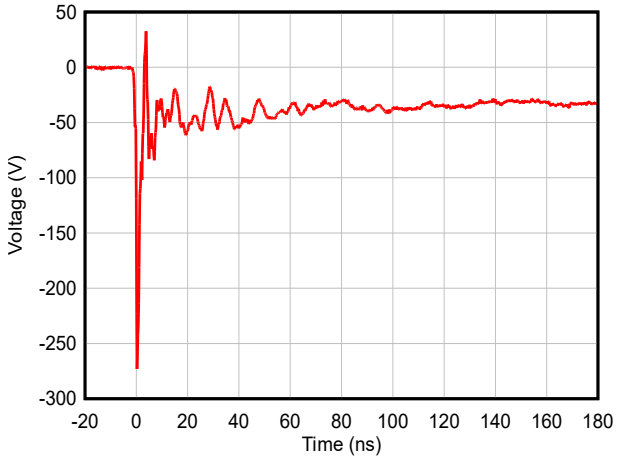



Figure 6-2. -8kV Clamped IEC Waveform

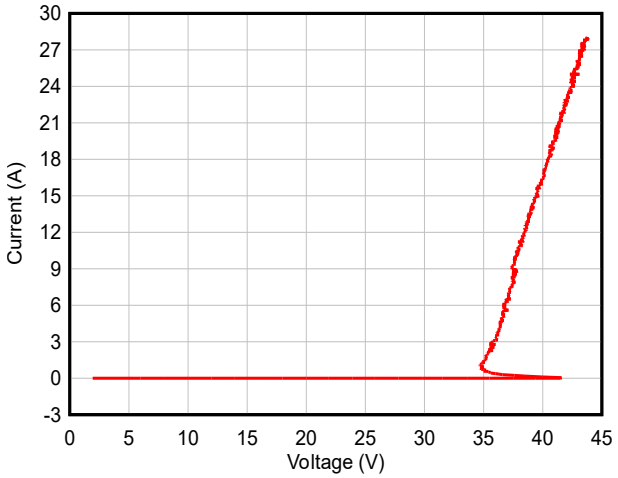



Figure 6-3. Positive TLP Curve

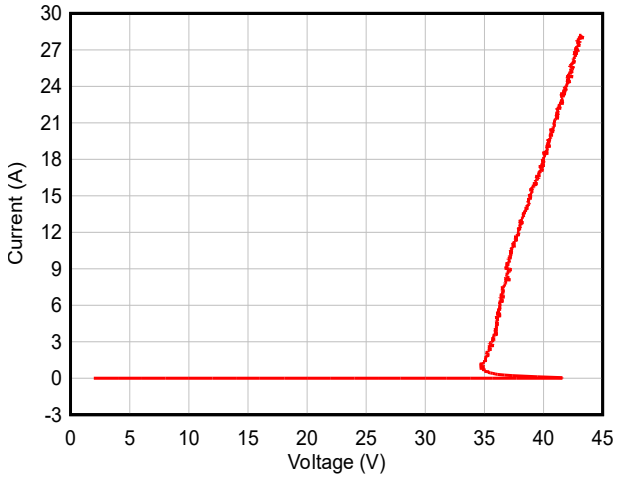



Figure 6-4. Negative TLP Curve

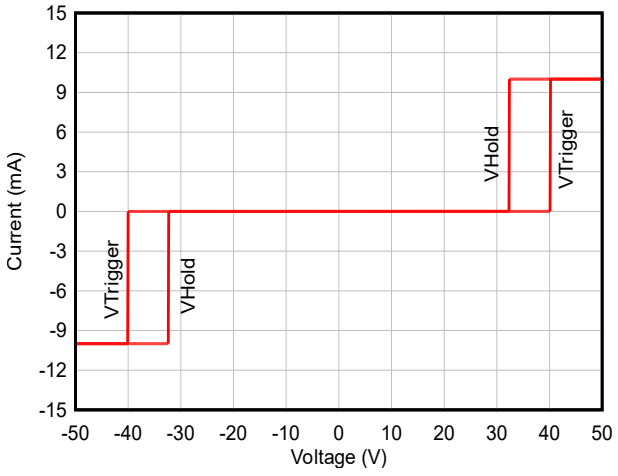



Figure 6-5. DC IV Curve

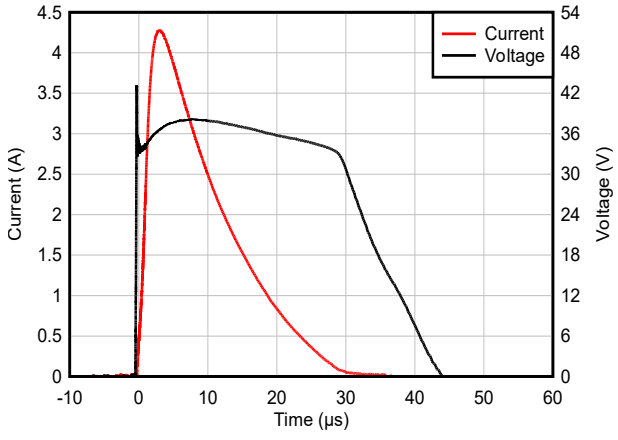



Figure 6-6. 8/20µs Surge Response at 4.3A


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## 6 Typical Characteristics (continued)

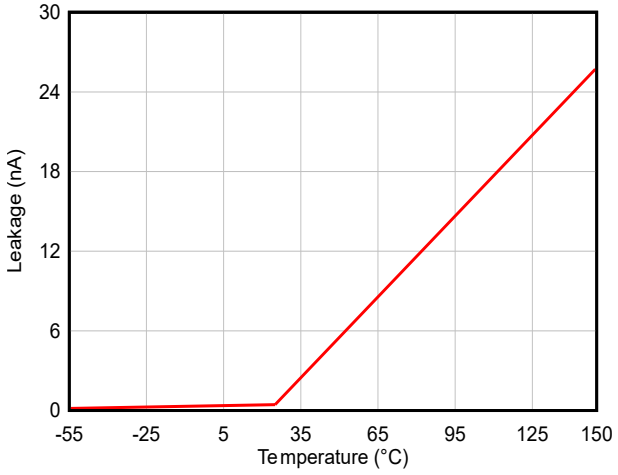



**Figure 6-7. Leakage vs Temperature**

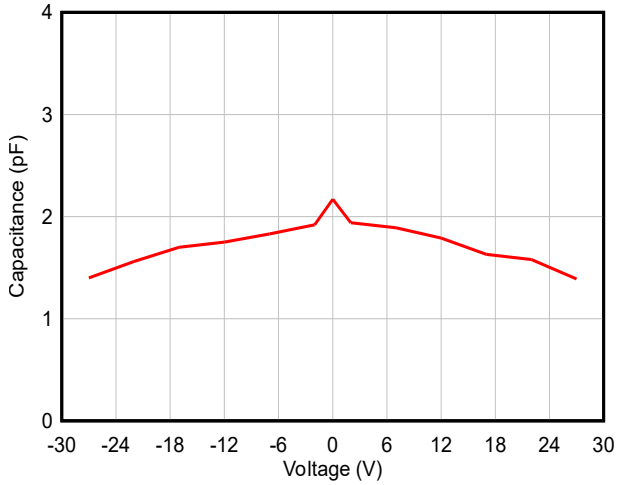



**Figure 6-8. Bias Voltage vs Capacitance**

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# 7 Application and Implementation

**Note**

Information in the following applications sections is not part of the TI component specification, and TI does not warrant its accuracy or completeness. TI's customers are responsible for determining suitability of components for their purposes, as well as validating and testing their design implementation to confirm system functionality.

## 7.1 Application Information

The ESD2CAN27-Q1 is a dual channel TVS diode that provides a path to ground for dissipating ESD events on differential CAN signal lines. The CAN signal lines are typically routed throughout the automobile to connect between the different ECUs. As the current from ESD passes through the TVS, only a small voltage drop is present across the diode. This is the voltage presented to the protected IC. The low $R_{DYN}$ of the triggered TVS holds this voltage ($V_{CLAMP}$) to a safe level for the protected IC.

# 8 Device and Documentation Support

TI offers an extensive line of development tools. Tools and software to evaluate the performance of the device, generate code, and develop solutions are listed below.

## 8.1 Documentation Support

### *8.1.1 Related Documentation*

For related documentation, see the following:

- Texas Instruments, *ESD Layout Guide* user's guide
- Texas Instruments, *ESD Protection Diodes EVM* user's guide
- Texas Instruments, *Generic ESD Evaluation Module* user's guide
- Texas Instruments, *Reading and Understanding an ESD Protection* data sheet

## 8.2 Receiving Notification of Documentation Updates

To receive notification of documentation updates, navigate to the device product folder on ti.com. Click on *Notifications* to register and receive a weekly digest of any product information that has changed. For change details, review the revision history included in any revised document.

## 8.3 Support Resources

TI E2E™ support forums are an engineer's go-to source for fast, verified answers and design help — straight from the experts. Search existing answers or ask your own question to get the quick design help you need.

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## 8.4 Trademarks

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## 8.5 Electrostatic Discharge Caution



This integrated circuit can be damaged by ESD. Texas Instruments recommends that all integrated circuits be handled with appropriate precautions. Failure to observe proper handling and installation procedures can cause damage.

ESD damage can range from subtle performance degradation to complete device failure. Precision integrated circuits may be more susceptible to damage because very small parametric changes could cause the device not to meet its published specifications.

## 8.6 Glossary

| | |
|---|---|
| TI Glossary | This glossary lists and explains terms, acronyms, and definitions. |


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## 9 Revision History

NOTE: Page numbers for previous revisions may differ from page numbers in the current version.

| DATE | REVISION | NOTES |
|---|---|---|
| October 2026 | * | Initial Release |

## 10 Mechanical, Packaging, and Orderable Information

The following pages include mechanical, packaging, and orderable information. This information is the most current data available for the designated devices. This data is subject to change without notice and revision of this document. For browser-based versions of this data sheet, refer to the left-hand navigation.

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## PACKAGING INFORMATION

| Orderable part number | Status (1) | Material type (2) | Package \| Pins | Package qty \| Carrier | RoHS (3) | Lead finish/ Ball material (4) | MSL rating/ Peak reflow (5) | Op temp (°C) | Part marking (6) |
|---|---|---|---|---|---|---|---|---|---|
| ESD2CAN27DBZRQ1 | Active | Production | SOT-23 (DBZ) \| 3 | 3000 \| LARGE T&R | Yes | NIPDAU | Level-1-260C-UNLIM | - | 4DM8 |

(1) **Status:** For more details on status, see our product life cycle.

(2) **Material type:** When designated, preproduction parts are prototypes/experimental devices, and are not yet approved or released for full production. Testing and final process, including without limitation quality assurance, reliability performance testing, and/or process qualification, may not yet be complete, and this item is subject to further changes or possible discontinuation. If available for ordering, purchases will be subject to an additional waiver at checkout, and are intended for early internal evaluation purposes only. These items are sold without warranties of any kind.

(3) **RoHS values:** Yes, No, RoHS Exempt. See the TI RoHS Statement for additional information and value definition.

(4) **Lead finish/Ball material:** Parts may have multiple material finish options. Finish options are separated by a vertical ruled line. Lead finish/Ball material values may wrap to two lines if the finish value exceeds the maximum column width.

(5) **MSL rating/Peak reflow:** The moisture sensitivity level ratings and peak solder (reflow) temperatures. In the event that a part has multiple moisture sensitivity ratings, only the lowest level per JEDEC standards is shown. Refer to the shipping label for the actual reflow temperature that will be used to mount the part to the printed circuit board.

(6) **Part marking:** There may be an additional marking, which relates to the logo, the lot trace code information, or the environmental category of the part.

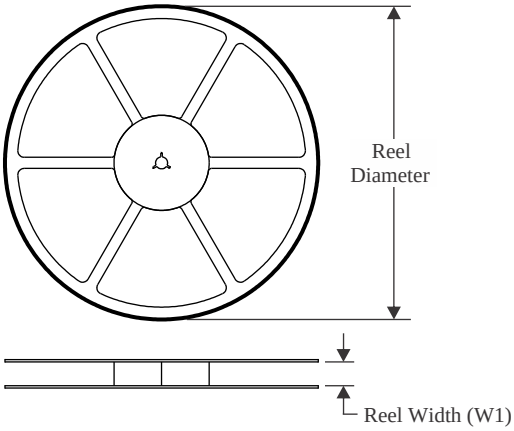
Multiple part markings will be inside parentheses. Only one part marking contained in parentheses and separated by a "~" will appear on a part. If a line is indented then it is a continuation of the previous line and the two combined represent the entire part marking for that device.

**Important Information and Disclaimer:**The information provided on this page represents TI's knowledge and belief as of the date that it is provided. TI bases its knowledge and belief on information provided by third parties, and makes no representation or warranty as to the accuracy of such information. Efforts are underway to better integrate information from third parties. TI has taken and continues to take reasonable steps to provide representative and accurate information but may not have conducted destructive testing or chemical analysis on incoming materials and chemicals. TI and TI suppliers consider certain information to be proprietary, and thus CAS numbers and other limited information may not be available for release.

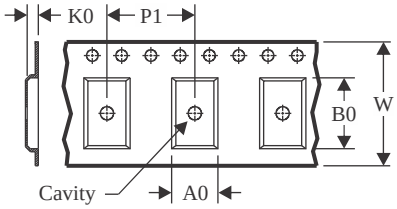
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## TAPE AND REEL INFORMATION

**REEL DIMENSIONS**

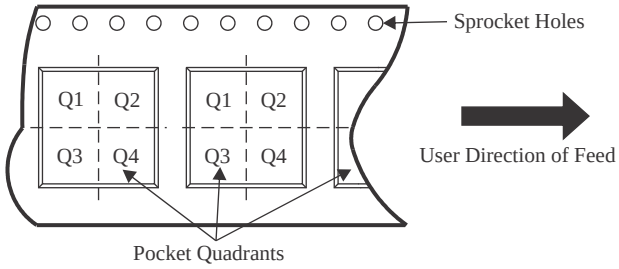



**TAPE DIMENSIONS**




| | |
|---|---|
| A0 | Dimension designed to accommodate the component width |
| B0 | Dimension designed to accommodate the component length |
| K0 | Dimension designed to accommodate the component thickness |
| W | Overall width of the carrier tape |
| P1 | Pitch between successive cavity centers |

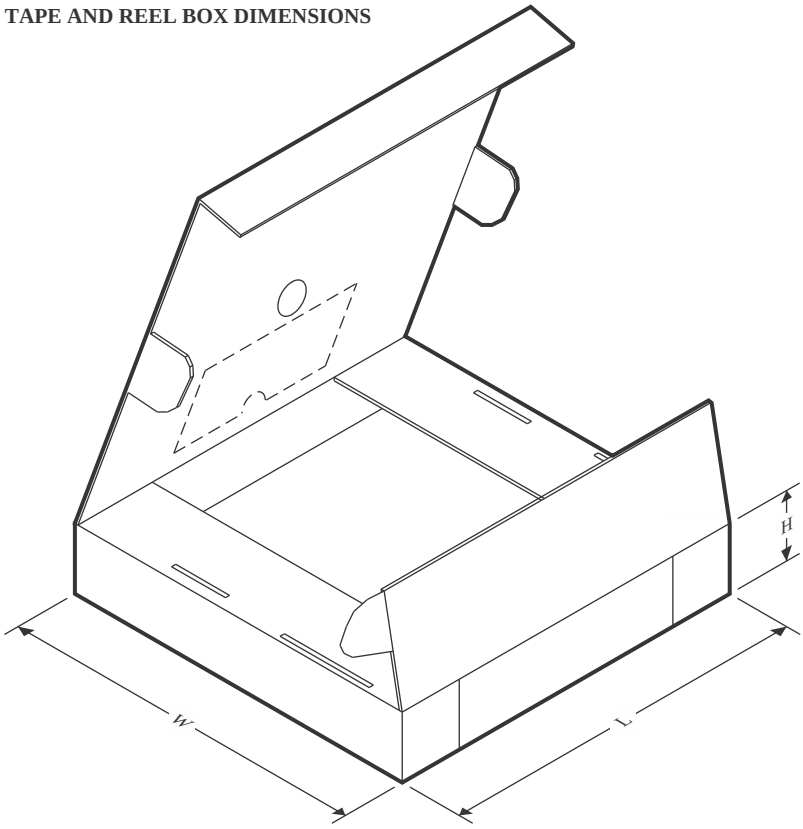
**QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE**




*All dimensions are nominal

| Device | Package Type | Package Drawing | Pins | SPQ | Reel Diameter (mm) | Reel Width W1 (mm) | A0 (mm) | B0 (mm) | K0 (mm) | P1 (mm) | W (mm) | Pin1 Quadrant |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ESD2CAN27DBZRQ1 | SOT-23 | DBZ | 3 | 3000 | 180.0 | 8.4 | 2.9 | 3.35 | 1.35 | 4.0 | 8.0 | Q3 |

TAPE AND REEL BOX DIMENSIONS




*All dimensions are nominal

| Device | Package Type | Package Drawing | Pins | SPQ | Length (mm) | Width (mm) | Height (mm) |
|---|---|---|---|---|---|---|---|
| ESD2CAN27DBZRQ1 | SOT-23 | DBZ | 3 | 3000 | 210.0 | 185.0 | 35.0 |

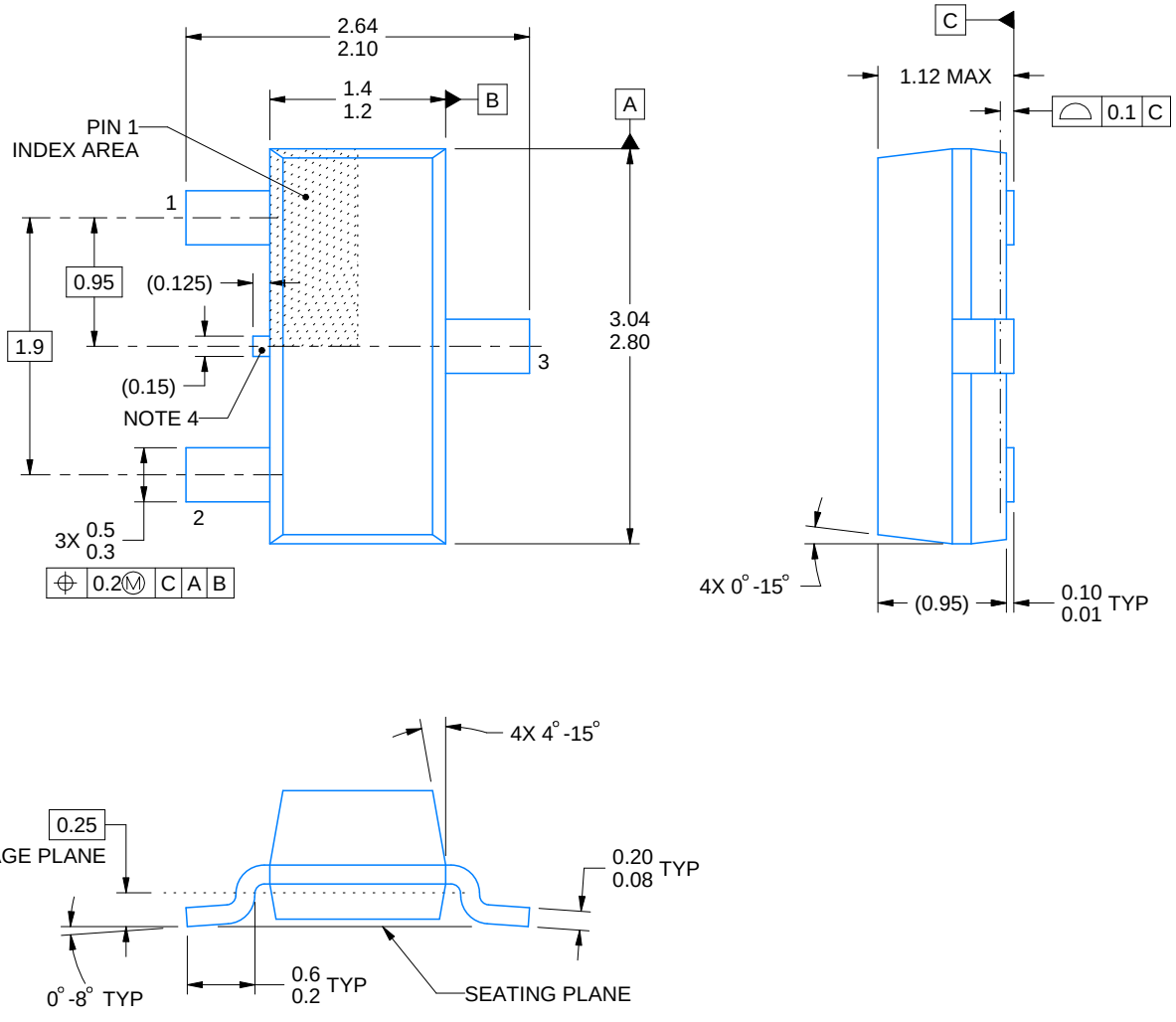
# PACKAGE OUTLINE

## DBZ0003A



## SOT-23 - 1.12 mm max height

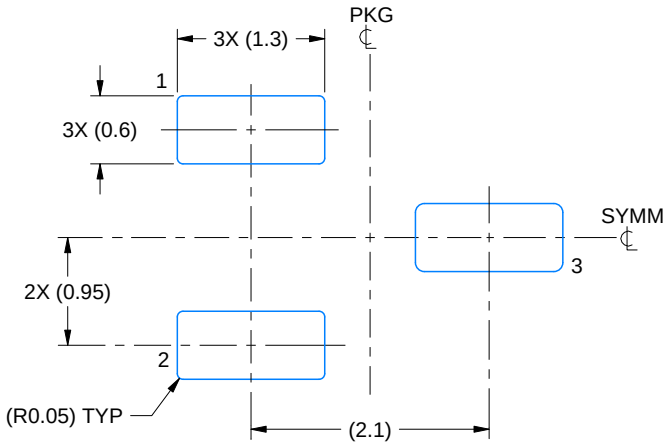
SMALL OUTLINE TRANSISTOR



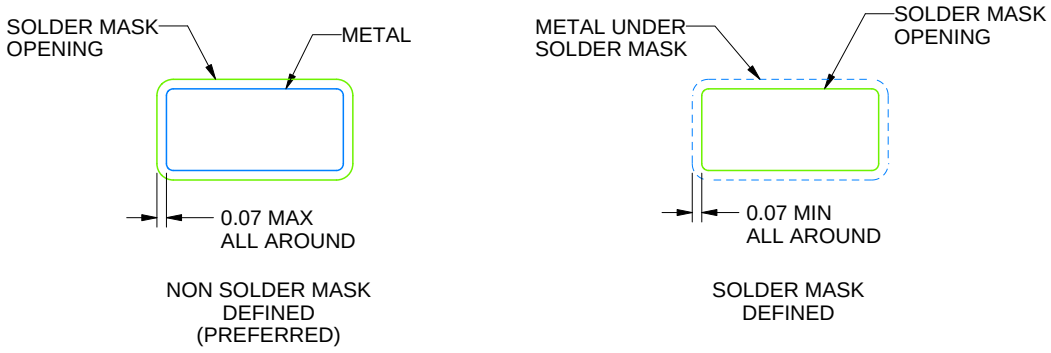

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NOTES:

1. All linear dimensions are in millimeters. Any dimensions in parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.
3. Reference JEDEC registration TO-236, except minimum foot length.
4. Support pin may differ or may not be present.
5. Body dimensions do not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed 0.25mm per side




LAND PATTERN EXAMPLE
SCALE:15X

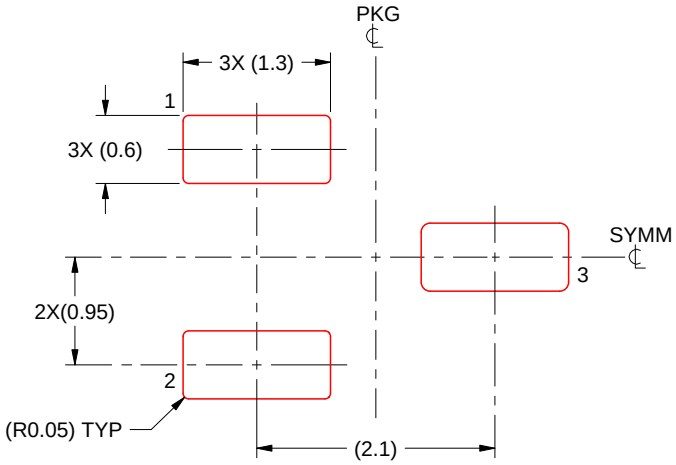



SOLDER MASK DETAILS

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NOTES: (continued)

5. Publication IPC-7351 may have alternate designs.
6. Solder mask tolerances between and around signal pads can vary based on board fabrication site.




SOLDER PASTE EXAMPLE
BASED ON 0.125 THICK STENCIL
SCALE:15X

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NOTES: (continued)

7. Laser cutting apertures with trapezoidal walls and rounded corners may offer better paste release. IPC-7525 may have alternate design recommendations.
8. Board assembly site may have different recommendations for stencil design.

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