MMBZ30VCL Dual Channel ESD Protection

1 Features

- Ultra Low I/O capacitance = 4.5pF (typical)
- Low leakage current <25nA
- Unidirectional ESD protection for 2 channels or Bidirectional for 1 channel
- IEC 61000-4-2 ESD protection:
  - ±30kV contact discharge
  - ±30kV air-gap discharge
- Temperature range: –55°C to +150°C
- Leaded packages used for automatic optical inspection (AOI)

2 Applications

- General Purpose IO Protection
- Industrial control networks:
  - DeviceNet
  - Smart distribution systems
- Audio
- Telecommunications

3 Description

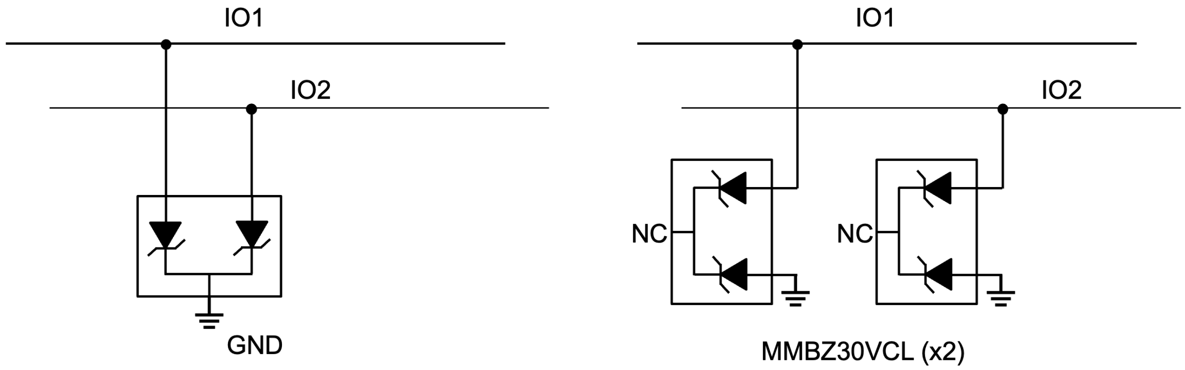
The MMBZ30VCL is a dual channel unidirectional or single channel bidirectional ESD in a common cathode configuration. The device's low capacitance and low leakage features enable use in high speed applications. The low dynamic resistance allows low clamping voltage to help protect systems against transient events.

The MMBZ30VCL is packaged in the SOT-23, providing two channels of robust transient protection in one space-efficient form factor.

Package Information

PART NUMBER	PACKAGE (1)	PACKAGE SIZE (2)
MMBZ30VCL	DBZ (SOT-23, 3)	2.92mm × 2.37mm

(1) For more information, see Section 8.
(2) The package size (length × width) is a nominal value and includes pins, where applicable.



Typical Application

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4 Pin Configuration and Functions

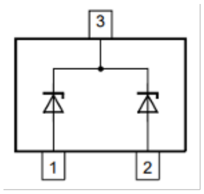

Figure 4-1. DBZ Package, 3-Pin SOT-23 (Top View)

Table 4-1. Pin Functions

PIN		DESCRIPTION
NAME	NO.	
AN1	1	Anode of diode 1
AN2	2	Anode of diode 2
CC	3	Common Cathode

5 Specifications

5.1 Absolute Maximum Ratings

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

		MIN	MAX	UNIT
P_{PP}	IEC 61643-321 Power (t_p - 10/1000µs) at 25°C		20	W
I_{PP}	IEC 61643-321 Current (t_p - 10/1000µs) at 25°C		0.5	A
T_A	Operating free-air temperature	-55	150	°C
T_J	Junction temperature	-55	150	
T_{stg}	Storage temperature	-65	155	

(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—JEDEC Specification

			VALUE	UNIT
$V_{(ESD)}$	Electrostatic discharge	Human body model (HBM), per ANSI/ESDA/ JEDEC JS-001 (1)	± 2500	V
		Charged device model (CDM), per JEDEC specification JS-002 (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	±30000	V
		IEC 61000-4-2 Air-gap Discharge, all pins	±30000	

5.4 Recommended Operating Conditions

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

		MIN	NOM	MAX	UNIT
T_A	Operating free-air temperature	-55		150	°C

5.5 Thermal Information

THERMAL METRIC (1)		MMBZ30VCL	UNIT
		DBZ (SOT-23)	
		3 PINS	
$R_{\theta JA}$	Junction-to-ambient thermal resistance	262.6	°C/W
$R_{\theta JC(top)}$	Junction-to-case (top) thermal resistance	147.0	°C/W
$R_{\theta JB}$	Junction-to-board thermal resistance	96.1	°C/W
Ψ_{JT}	Junction-to-top characterization parameter	33.5	°C/W
Ψ_{JB}	Junction-to-board characterization parameter	95.4	°C/W
$R_{\theta JC(bot)}$	Junction-to-case (bottom) thermal resistance	N/A	°C/W

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

5.6 Electrical Characteristics

over T_A = 25°C (unless otherwise noted)

PARAMETER		TEST CONDITIONS	MIN	TYP	MAX	UNIT
V_F	Forward Voltage	I_F = 10mA, T_A = 25°C			1.1	V
V_{RWM}	Reverse stand-off voltage	T_A = 25°C			24	V
V_{BR}	Breakdown voltage (1)	I_T = 10mA, T_A = 25°C	24.8		34.8	V
V_{CLAMP}	Clamping voltage (2)	I_{PPM} = 0.5A, t_p = 10/1000µs		31	40	V
I_{LEAK}	Leakage current	V_{IO} = ±24V		1	25	nA
S_Z	Temperature Coefficient	I_Z = 10mA		13		mV/C
C_L	Line capacitance	V_{IO} = 0V, f = 1MHz, V_{pp} = 30mV		4.5		pF

(1) V_{BR} is defined as the voltage when 10mA is applied and before the device enters into the shallow snapback state
(2) Device stressed with 10/1000 µs exponential decay waveform according to IEC 61643-321

5.7 Typical Characteristics

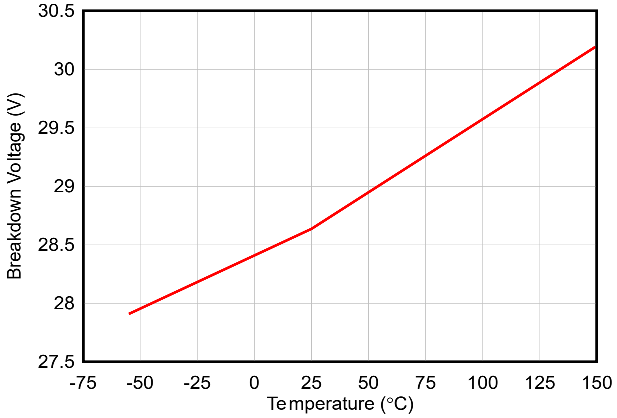

Figure 5-1. Breakdown Voltage vs Temperature

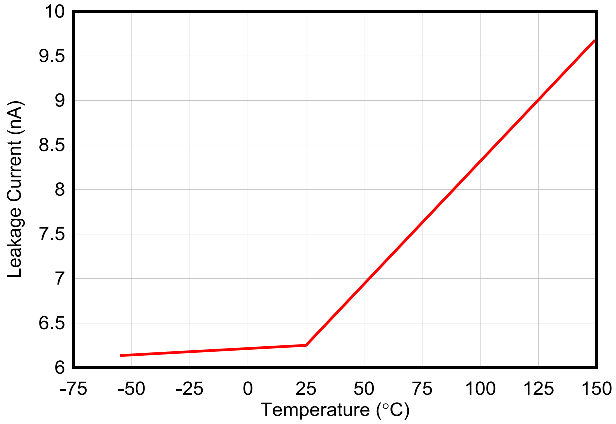

Figure 5-2. Leakage Current vs Temperature

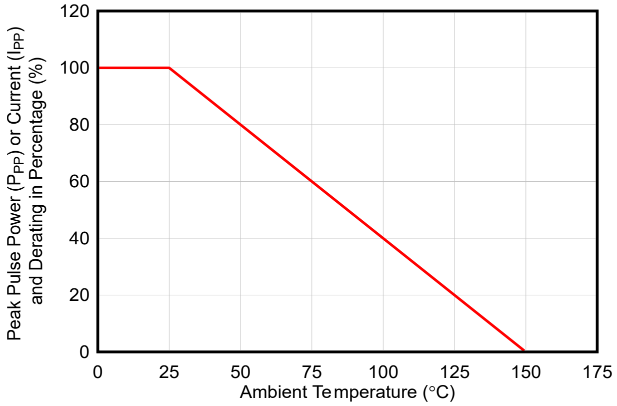

Figure 5-3. Peak Pulse Power Derating Curve

6 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.

6.1 Documentation Support

6.1.1 Related Documentation

For related documentation, see the following:

- Texas Instruments, *ESD Layout Guide* application reports
- Texas Instruments, *Generic ESD Evaluation Module* user's guide
- Texas Instruments, *Picking ESD Diodes for Ultra High-Speed Data Lines* application reports
- Texas Instruments, *Reading and Understanding an ESD Protection* data sheet

6.2 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.

6.3 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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6.4 Trademarks

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6.5 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.

6.6 Glossary

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

7 Revision History

DATE	REVISION	NOTES
November 2024	*	Initial Release

8 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.

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)
MMBZ30VCLDBZR	Active	Production	SOT-23 (DBZ) | 3	3000 | LARGE T&R	Yes	SN	Level-1-260C-UNLIM	-55 to 150	3ICG
MMBZ30VCLDBZR.B	Active	Production	SOT-23 (DBZ) | 3	3000 | LARGE T&R	Yes	SN	Level-1-260C-UNLIM	-55 to 150	3ICG

(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.

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OTHER QUALIFIED VERSIONS OF MMBZ30VCL :

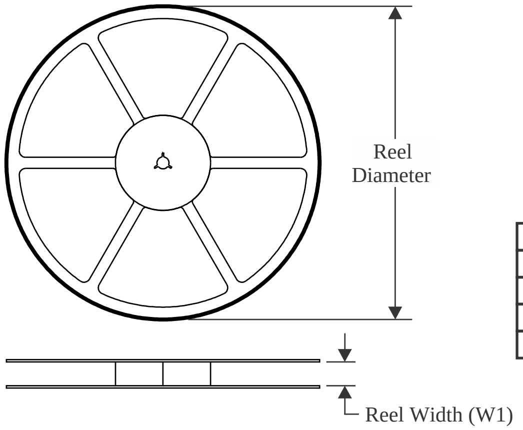
- Automotive : MMBZ30VCL-Q1

NOTE: Qualified Version Definitions:

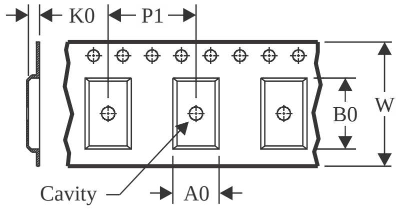
- Automotive - Q100 devices qualified for high-reliability automotive applications targeting zero defects

TAPE AND REEL INFORMATION

REEL DIMENSIONS

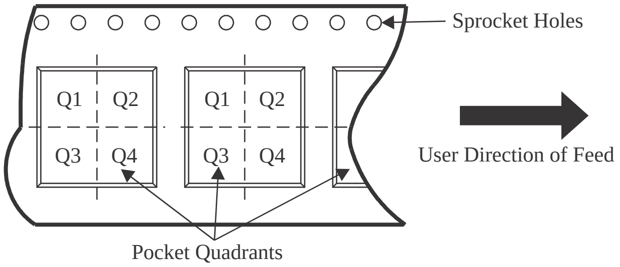


TAPE DIMENSIONS



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

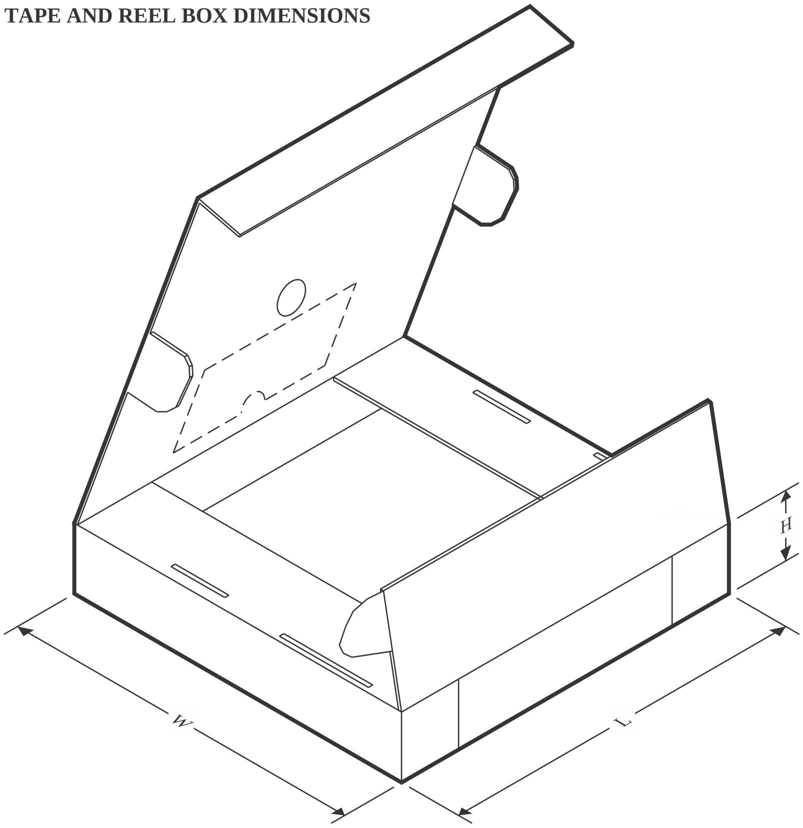
QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE



*All dimensions are nominal

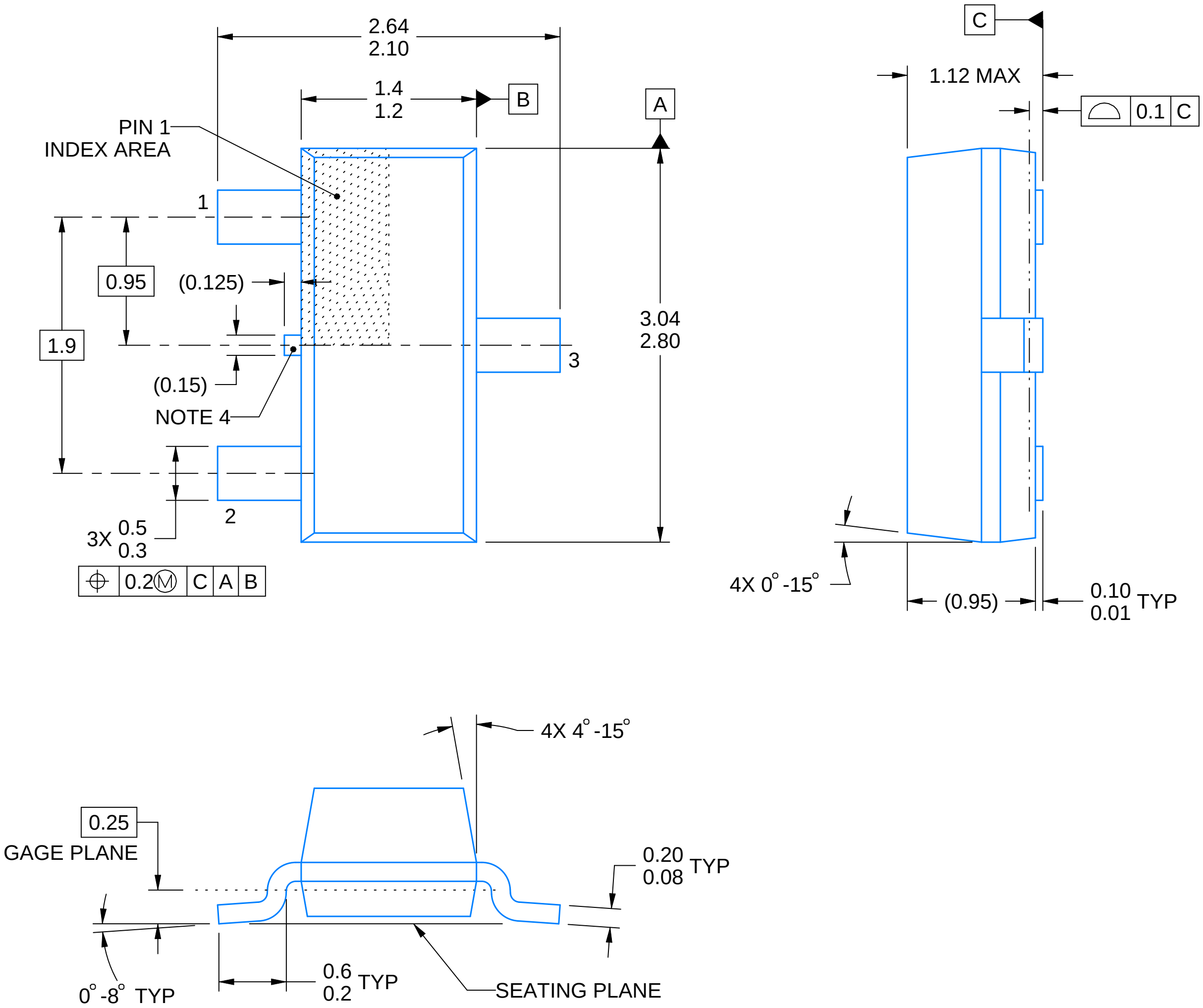
Device	Package Type	Package Drawing	Pins	SPQ	Reel Diameter (mm)	Reel Width W1 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P1 (mm)	W (mm)	Pin1 Quadrant
MMBZ30VCLDBZR	SOT-23	DBZ	3	3000	180.0	8.4	3.2	2.85	1.3	4.0	8.0	Q3

TAPE AND REEL BOX DIMENSIONS



*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
MMBZ30VCLDBZR	SOT-23	DBZ	3	3000	210.0	185.0	35.0



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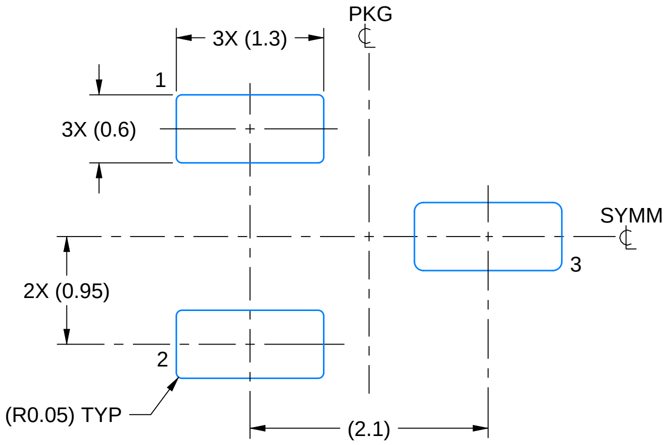
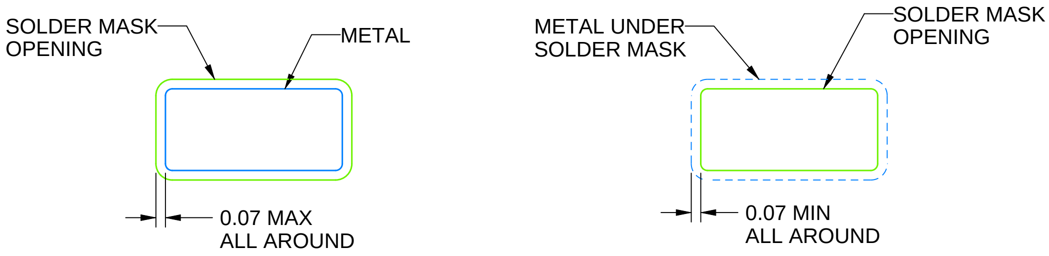
NOTES:

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



NON SOLDER MASK DEFINED (PREFERRED)

SOLDER MASK DEFINED

SOLDER MASK DETAILS

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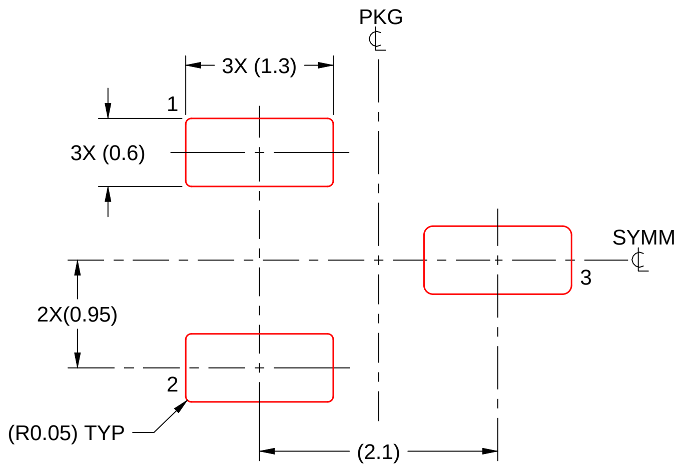
NOTES: (continued)

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

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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