BQ79631-Q1 UIR Sensor with Voltage, Current, and Insulation Resistance Monitoring in EV/BMS HV Automotive Applications

1 Features

- Qualified for automotive applications
- AEC-Q100 Qualified with the following results:
  - Device temperature grade 1: –40°C to +125°C ambient operating temperature range
  - Device HBM ESD classification level 2
  - Device CDM ESD classification level C4B
- Functional Safety-Compliant
  - Developed for functional safety applications
  - Documentation to aid ISO 26262 system design
  - Systematic capability up to ASIL D
  - Hardware capability up to ASIL D
- Differential voltage measurements with integrated filtering
  - Pack+ , Fuse, Link±, Charge± measure
  - Isolation resistance voltage measurement
- Integrated precision current measurement
  - Support low-side shunt resistor
- Insulation resistance monitoring capability
- 8 GPIO inputs as IO, SPI, ADC, and temperature sense
- Isolated differential daisy-chain communication with optional ring architecture
  - Simplifies BJB/BDU system by eliminating safety MCU, CAN transceivers, and multi-wire interface
- UART host interface
- Synchronized current and voltage measurements
- Stackable as well as syncs with other cell and UI monitors 16S (BQ79616-Q1, BQ79656-Q1), 14S (BQ79614-Q1, BQ79654-Q1), 12S (BQ79612-Q1, BQ79652-Q1) and BQ79631
- Built-in SPI master

2 Applications

- Full Electric, Plug-In Hybrid, and Hybrid Vehicles

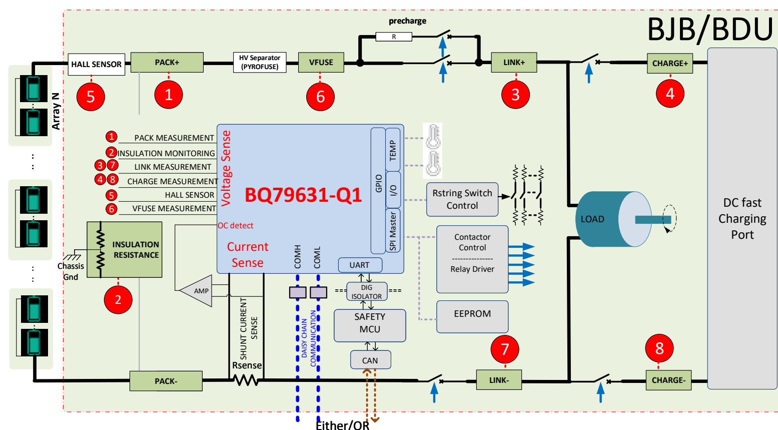
3 Description

BQ79631-Q1 provides high-accuracy measurement capable of measuring divided down voltages from high voltage nodes such as Pack+ (HV Battery Positive terminal), Fuse, Charge (Port), Link (Load) in a battery junction box (BJB) or battery disconnect unit (BDU) system. Key voltage measurements can make use of the integrated digital low-pass filters. The device has a highly accurate integrated current sense ADC capable of measuring current in low-side shunt resistor. The device is capable of measuring the insulation resistance with internal ADC and able to control any switching scheme needed for this measurement. There are eight GPIOs/auxillary inputs that can be used for thermistor measurement, driving relays, measuring voltages, and being a master SPI interface to peripheral SPI devices. The isolated bi-directional daisy-chain ports support both capacitor or transformer based isolation. The device also supports communication over UART.

Device Information

PART NUMBER	PACKAGE(1)	BODY SIZE (NOM)
BQ79631-Q1	HTQFP (64-pin)	10.00 mm x 10.00 mm

(1) For all available packages, see the orderable addendum at the end of the data sheet.



Simplified System Diagram

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.

4 Description (continued)

Host communication to the BQ79631-Q1 can be connected via the device's dedicated UART interface or through a communication bridge device, BQ79600-Q1. Additionally, an isolated, differential daisy-chain communication interface allows the host to communicate with the other UIR monitors and even cell monitors over a single interface. In the event of a communication line break, the daisy-chain communication interface is configurable to a ring architecture that allows the host to talk to devices at either end of the stack.

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5 Device and Documentation Support

5.1 Device Support

5.1.1 Third-Party Products Disclaimer

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5.2 Receiving Notification of Documentation Updates

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5.3 Support Resources

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5.4 Trademarks

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5.5 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.

5.6 Glossary

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

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6 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 Device	Status (1)	Package Type	Package Drawing	Pins	Package Qty	Eco Plan (2)	Lead finish/ Ball material (6)	MSL Peak Temp (3)	Op Temp (°C)	Device Marking (4/5)	Samples
BQ79631PAPRQ1	ACTIVE	HTQFP	PAP	64	1000	RoHS & Green	NIPDAU	Level-3-260C-168 HR	-40 to 125	BQ79631	Samples

(1) The marketing status values are defined as follows:
ACTIVE: Product device recommended for new designs.
LIFEBUY: TI has announced that the device will be discontinued, and a lifetime-buy period is in effect.
NRND: Not recommended for new designs. Device is in production to support existing customers, but TI does not recommend using this part in a new design.
PREVIEW: Device has been announced but is not in production. Samples may or may not be available.
OBSOLETE: TI has discontinued the production of the device.

(2) **RoHS:** TI defines "RoHS" to mean semiconductor products that are compliant with the current EU RoHS requirements for all 10 RoHS substances, including the requirement that RoHS substance do not exceed 0.1% by weight in homogeneous materials. Where designed to be soldered at high temperatures, "RoHS" products are suitable for use in specified lead-free processes. TI may reference these types of products as "Pb-Free".
RoHS Exempt: TI defines "RoHS Exempt" to mean products that contain lead but are compliant with EU RoHS pursuant to a specific EU RoHS exemption.
Green: TI defines "Green" to mean the content of Chlorine (Cl) and Bromine (Br) based flame retardants meet JS709B low halogen requirements of <=1000ppm threshold. Antimony trioxide based flame retardants must also meet the <=1000ppm threshold requirement.

(3) MSL, Peak Temp. - The Moisture Sensitivity Level rating according to the JEDEC industry standard classifications, and peak solder temperature.

(4) There may be additional marking, which relates to the logo, the lot trace code information, or the environmental category on the device.

(5) Multiple Device Markings will be inside parentheses. Only one Device Marking contained in parentheses and separated by a "~" will appear on a device. If a line is indented then it is a continuation of the previous line and the two combined represent the entire Device Marking for that device.

(6) Lead finish/Ball material - Orderable Devices 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.

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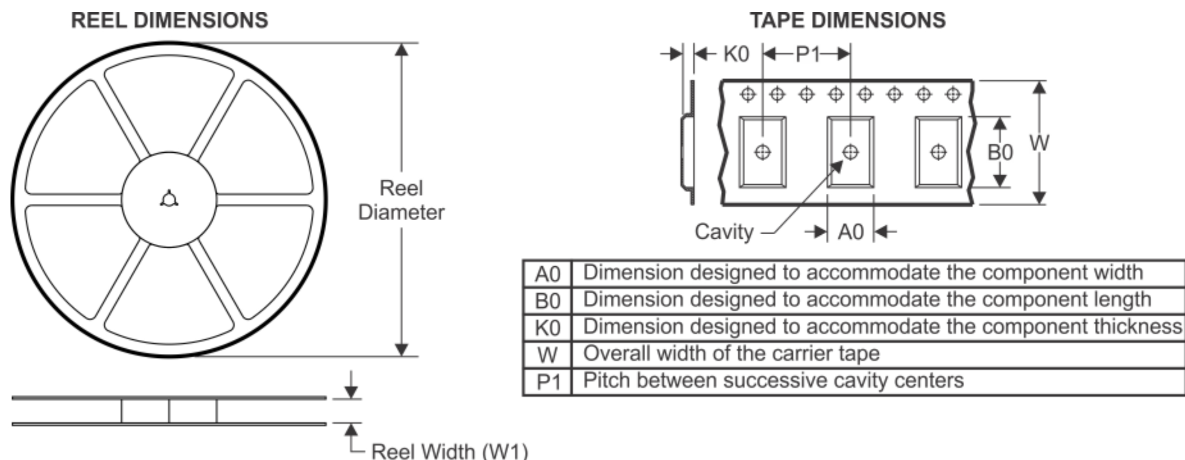
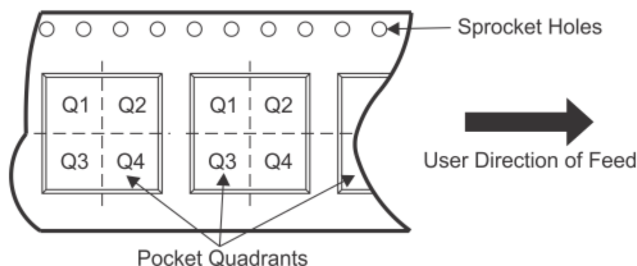
TAPE AND REEL INFORMATION



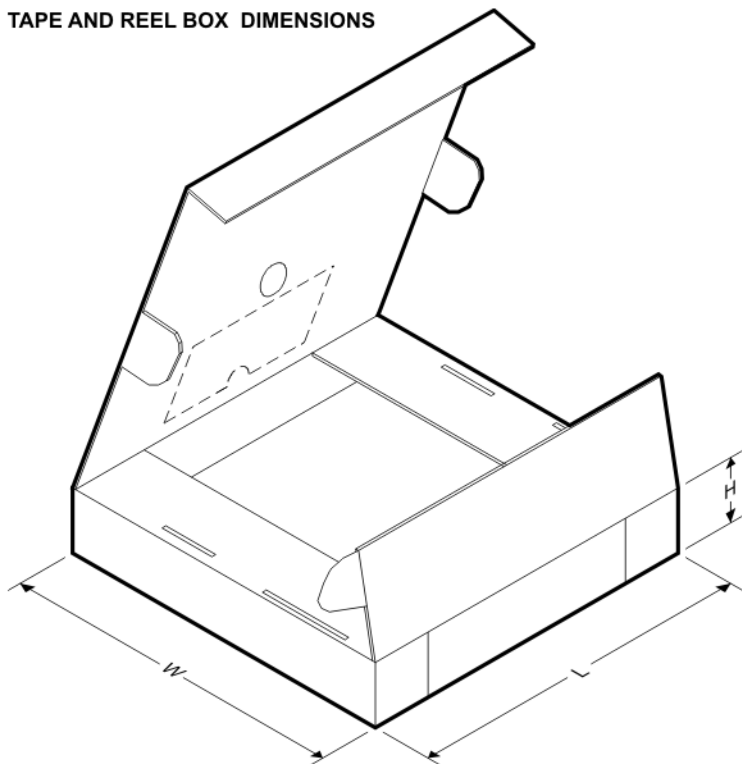
QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE



*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
BQ79631PAPRQ1	HTQFP	PAP	64	1000	330.0	24.4	13.0	13.0	1.5	16.0	24.0	Q2

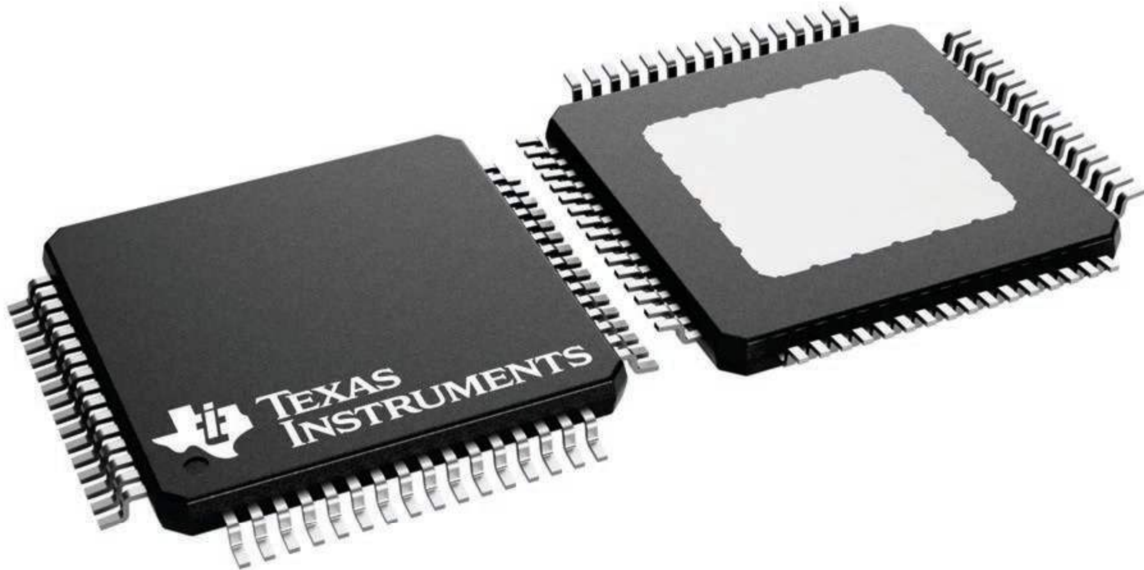
TAPE AND REEL BOX DIMENSIONS

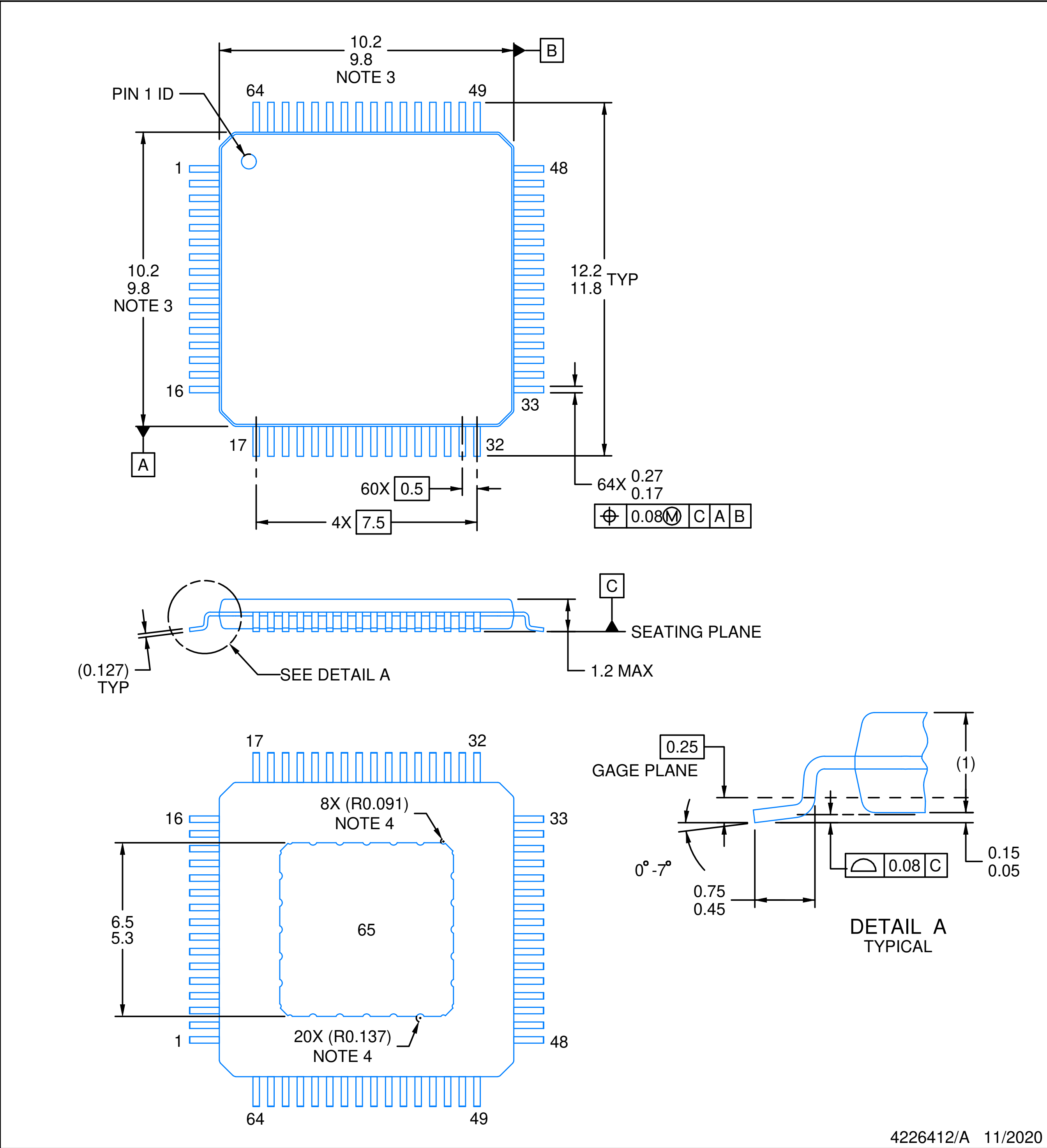


*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
BQ79631PAPRQ1	HTQFP	PAP	64	1000	367.0	367.0	55.0

This image is a representation of the package family, actual package may vary.
Refer to the product data sheet for package details.

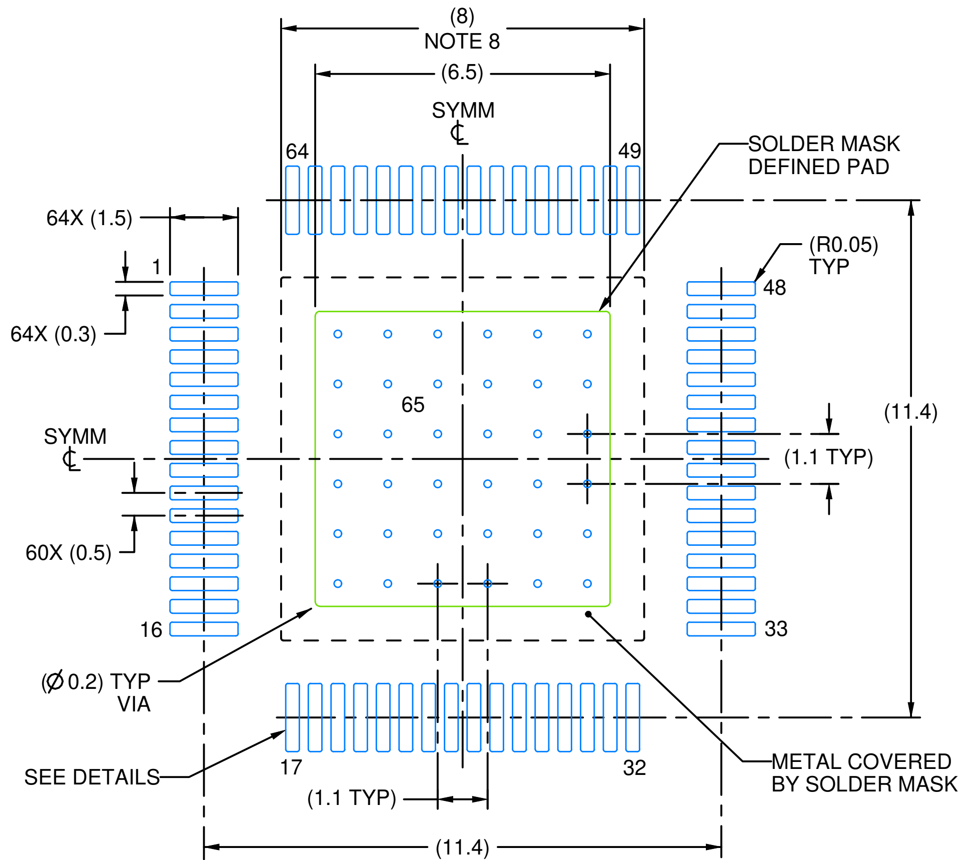




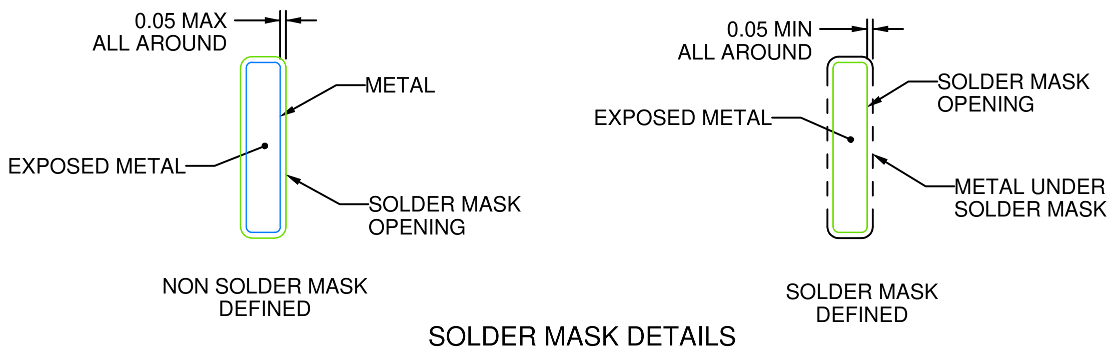
PowerPAD is a trademark of Texas Instruments.

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. This dimension does not include mold flash, protrusions, or gate burrs.
4. Strap features may not be present.
5. Reference JEDEC registration MS-026.



LAND PATTERN EXAMPLE
EXPOSED METAL SHOWN
SCALE:6X

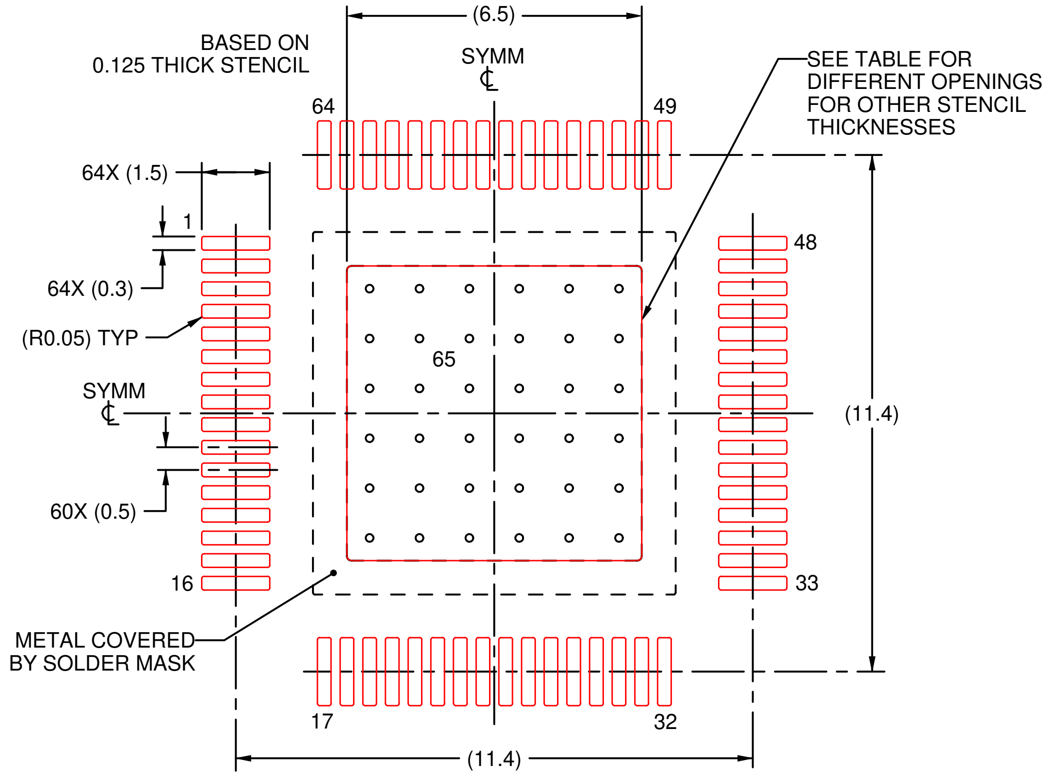


SOLDER MASK DETAILS

4226412/A 11/2020

NOTES: (continued)

6. Publication IPC-7351 may have alternate designs.
7. Solder mask tolerances between and around signal pads can vary based on board fabrication site.
8. This package is designed to be soldered to a thermal pad on the board. See technical brief, Powerpad thermally enhanced package, Texas Instruments Literature No. SLMA002 (www.ti.com/lit/slma002) and SLMA004 (www.ti.com/lit/slma004).
9. Vias are optional depending on application, refer to device data sheet. It is recommended that vias under paste be filled, plugged or tented.
10. Size of metal pad may vary due to creepage requirement.



SOLDER PASTE EXAMPLE
EXPOSED PAD
100% PRINTED SOLDER COVERAGE BY AREA
SCALE:6X

STENCIL THICKNESS	SOLDER STENCIL OPENING
0.1	7.27 X 7.27
0.125	6.5 X 6.5 (SHOWN)
0.15	5.93 X 5.93
0.175	5.49 X 5.49

4226412/A 11/2020

NOTES: (continued)

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

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