TCAN114x-Q1 Enhanced CAN FD and High Speed CAN Transceiver with Selective Wake

ADVANCE INFORMATION

1 Features

- AEC-Q100 (Grade 1) Qualified for automotive applications
- Meets the requirements of ISO 11898-2:2016
- TCAN1145-Q1 and TCAN1146-Q1 support selective wake, partial networking
- CAN FD transceiver supporting communication rates up to 8 Mbps
- Classical CAN backwards compatible
- Operating modes programmable through SPI command
  - Normal mode
  - Low power standby mode
  - Low power selective wake mode
  - Low power sleep mode
- 1.8 V, 3.3 V to 5 V MCU support
- Wide operating range:
  - ±58 V Bus fault protection
  - ±12 V Common mode
- TCAN1144-Q1 and TCAN1146-Q1 support timeout, window and question and answer watchdog
- Programmable INH/LIMP pin
- TCAN1144-Q1 and TCAN1146-Q1 support advanced bus fault diagnostics and reporting
- 14-Pin SOIC, VSON and SOT23 package

2 Applications

- Body electronics and lighting
- Automotive infotainment and cluster
- Hybrid, electric & powertrain systems
- Industrial transportation

3 Description

The TCAN114x-Q1 is a family of enhanced high-speed CAN FD transceivers supporting data rates up to 8 Mbps. These devices are configured using serial peripheral interface (SPI) in order to use all the features available. The TCAN114x-Q1 supports 1.8 V to 5 V processors by applying the appropriate voltage to the V_{IO} pin, allowing lower power processors to be utilized. The family of devices are register compatible enabling the system designer the flexibility to implement the features needed with minimal if any hardware and software changes.

The TCAN1144-Q1 and TCAN1146-Q1 are full featured devices supporting watchdog and advanced bus diagnostics. For ease of debug, the advanced bus fault diagnostics and communication feature can be used to pinpoint bus faults when used with other devices supporting this feature. The inhibit (INH) pin can be used to enable node power but if this is not required, the pin can be configured as a limp home pin when a watchdog error takes place.

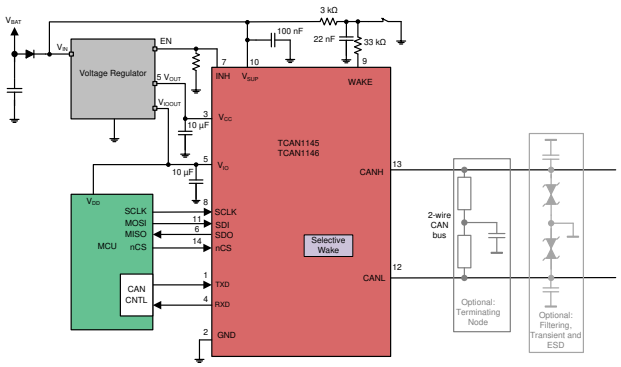
The TCAN1145-Q1 and TCAN1146-Q1 support selective wake, also known as partial networking, used in systems containing nodes that can be placed into sleep mode and reducing overall power of the system. The transceiver and selective wake function meets the specifications of the ISO11898-2:2016 standard. If a watchdog and advanced bus diagnostics are not needed then the TCAN1145-Q1 is the device to select.

Device Information[1]

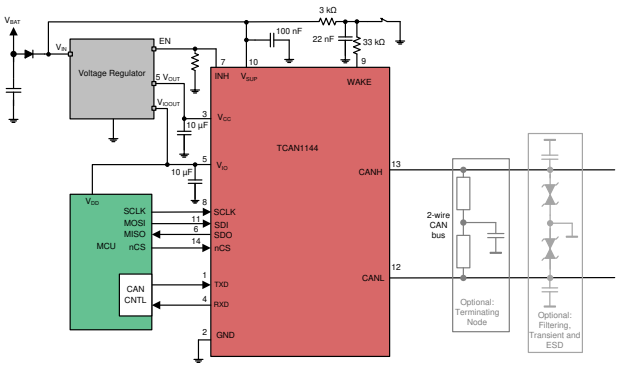
PART NUMBER	PACKAGE	BODY SIZE (NOM)
TCAN114xD-Q1	SOIC	9.90 mm x 3.91 mm
TCAN114xDMT-Q1	VSON	4.5 mm x 3.0 mm
TCAN114xDYY-Q1	SOT	4.2 mm x 2.0 mm

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

Simplified Schematics



Simplified Schematics



4 Device and Documentation Support

This device will conform to the following CAN standards. The core of what is needed is covered within this system spec, however reference should be made to these standards and any discrepancies pointed out and discussed. This document should provide all the basics of what is needed. However for a full understanding of CAN including the protocol these additional sources will be very helpful as the scope of CAN protocol in detail is outside the scope of this physical layer (transceiver) specification.

4.1 Documentation Support

4.1.1 CAN Transceiver Physical Layer Standards:

- ISO 11898-2:2016: High speed medium access unit with low power mode (super sets -2 standard electrically in several specs and adds the original wake up capability via the bus in low power mode)
- ISO 8802-3: CSMA/CD – referenced for collision detection from ISO11898-2
- CAN FD 1.0 Spec and Papers
- Bosch “Configuration of CAN Bit Timing”, Paper from 6th International CAN Conference (ICC), 1999. This is repeated a lot in the DCAN IP CAN Controller spec copied into this system spec.
- GMW3122: GM requirements for HS CAN
- SAE J2284-2: High Speed CAN (HSC) for Vehicle Applications at 250 kbps
- SAE J2284-3: High Speed CAN (HSC) for Vehicle Applications at 500 kbps
- Bosch M_CAN Controller Area Network Revision 3.2.1.1 (3/24/2016)

4.1.2 EMC Requirements:

- SAEJ2962-2: US3 requirements for CAN Transceivers (-2, -5, GM will propose updates to address -6 + FD, but this is the best place for a working start)
- HW Requirements for CAN, LIN,FR V1.3: German OEM requirements for HS CAN

4.1.3 Conformance Test Requirements:

- HS_TRX_Test_Spec_V_1_0: GIFT / ICT CAN test requirements for High Speed Physical Layer

4.1.4 Related Documentation

- “A Comprehensible Guide to Controller Area Network”, Wilfried Voss, Copperhill Media Corporation
- “CAN System Engineering: From Theory to Practical Applications”, 2nd Edition, 2013; Dr. Wolfhard Lawrenz, Springer.

4.2 Related Links

The table below lists quick access links. Categories include technical documents, support and community resources, tools and software, and quick access to order now.

Table 1. Related Links

PARTS	PRODUCT FOLDER	ORDER NOW	TECHNICAL DOCUMENTS	TOOLS & SOFTWARE	SUPPORT & COMMUNITY
TCAN1144-Q1	Click here	Click here	Click here	Click here	Click here
TCAN1145-Q1	Click here	Click here	Click here	Click here	Click here
TCAN1146-Q1	Click here	Click here	Click here	Click here	Click here

4.3 Receiving Notification of Documentation Updates

To receive notification of documentation updates, navigate to the device product folder on ti.com. In the upper right corner, click on *Alert me* 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.

ADVANCE INFORMATION

4.4 Community 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.

Linked content is provided "AS IS" by the respective contributors. They do not constitute TI specifications and do not necessarily reflect TI's views; see TI's Terms of Use.

4.5 Trademarks

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All other trademarks are the property of their respective owners.

4.6 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.

4.7 Glossary

SLYZ022 — *TI Glossary*.

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

5 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.

ADVANCE INFORMATION

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
PTCAN1144DMTQ1	ACTIVE	VSON	DMT	14	250	TBD	Call TI	Call TI	-40 to 150		Samples
PTCAN1144DQ1	ACTIVE	SOIC	D	14	50	TBD	Call TI	Call TI	-40 to 150		Samples
PTCAN1145DMTQ1	ACTIVE	VSON	DMT	14	250	TBD	Call TI	Call TI	-40 to 150		Samples
PTCAN1145DQ1	ACTIVE	SOIC	D	14	50	TBD	Call TI	Call TI	-40 to 150		Samples
PTCAN1146DMTQ1	ACTIVE	VSON	DMT	14	250	TBD	Call TI	Call TI	-40 to 150		Samples
PTCAN1146DQ1	ACTIVE	SOIC	D	14	50	TBD	Call TI	Call TI	-40 to 150		Samples
TCAN1144DMTRQ1	PREVIEW	VSON	DMT	14	3000	TBD	Call TI	Call TI	-40 to 150		
TCAN1144DRQ1	PREVIEW	SOIC	D	14	2500	TBD	Call TI	Call TI	-40 to 150		
TCAN1144DYYRQ1	PREVIEW	SOT-23-THN	DYY	14	3000	TBD	Call TI	Call TI	-40 to 150		
TCAN1145DMTRQ1	PREVIEW	VSON	DMT	14	3000	TBD	Call TI	Call TI	-40 to 150		
TCAN1145DRQ1	PREVIEW	SOIC	D	14	2500	TBD	Call TI	Call TI	-40 to 150		
TCAN1145DYYRQ1	PREVIEW	SOT-23-THN	DYY	14	3000	TBD	Call TI	Call TI	-40 to 150		
TCAN1146DMTRQ1	PREVIEW	VSON	DMT	14	3000	TBD	Call TI	Call TI	-40 to 150		
TCAN1146DRQ1	PREVIEW	SOIC	D	14	2500	TBD	Call TI	Call TI	-40 to 150		
TCAN1146DYYRQ1	PREVIEW	SOT-23-THN	DYY	14	3000	TBD	Call TI	Call TI	-40 to 150		

(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.

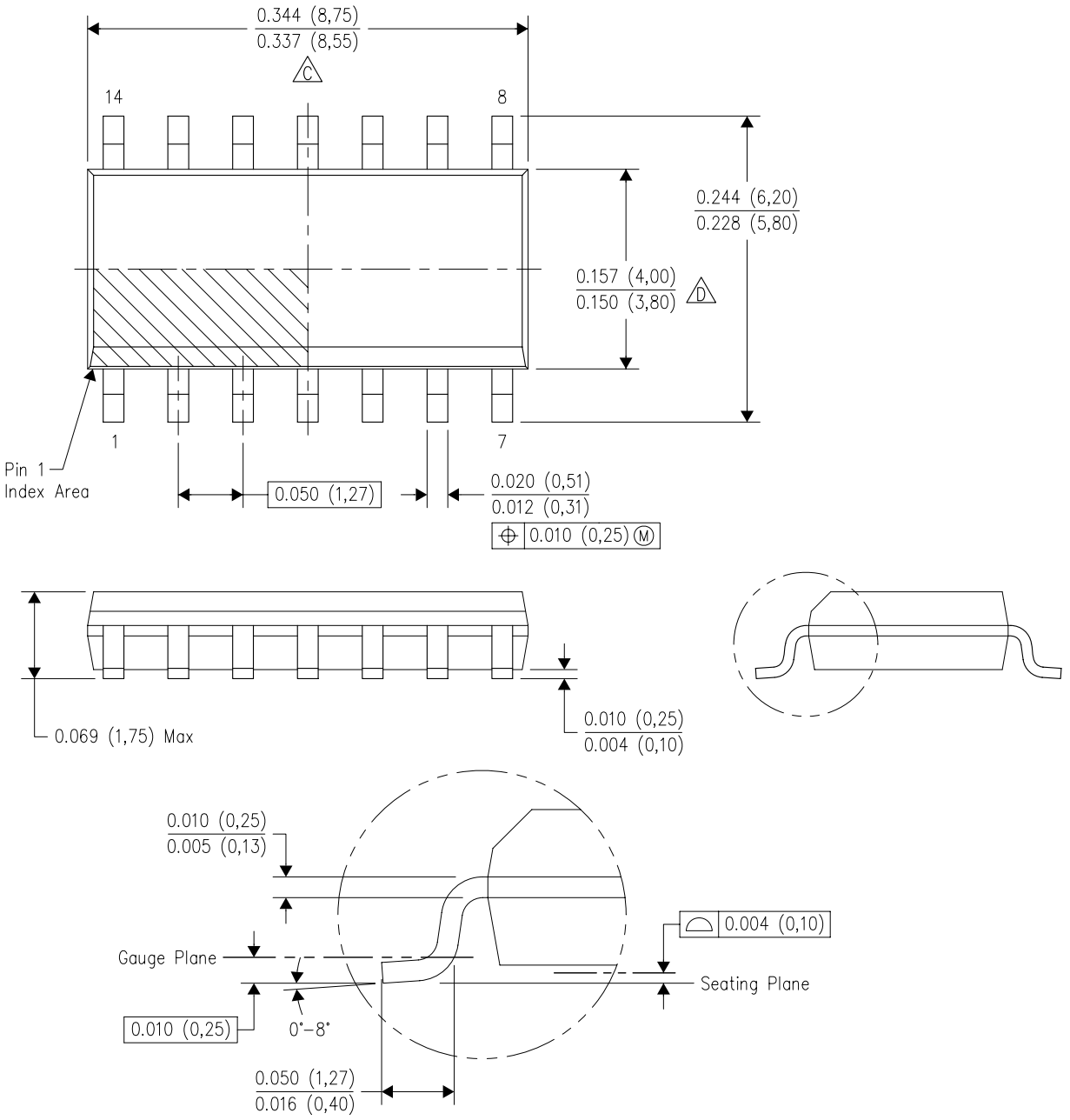
(3) MSL, Peak Temp. - The Moisture Sensitivity Level rating according to the JEDEC industry standard classifications, and peak solder temperature.

(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.

D (R–PDSO–G14) PLASTIC SMALL OUTLINE



4040047–5/M 06/11

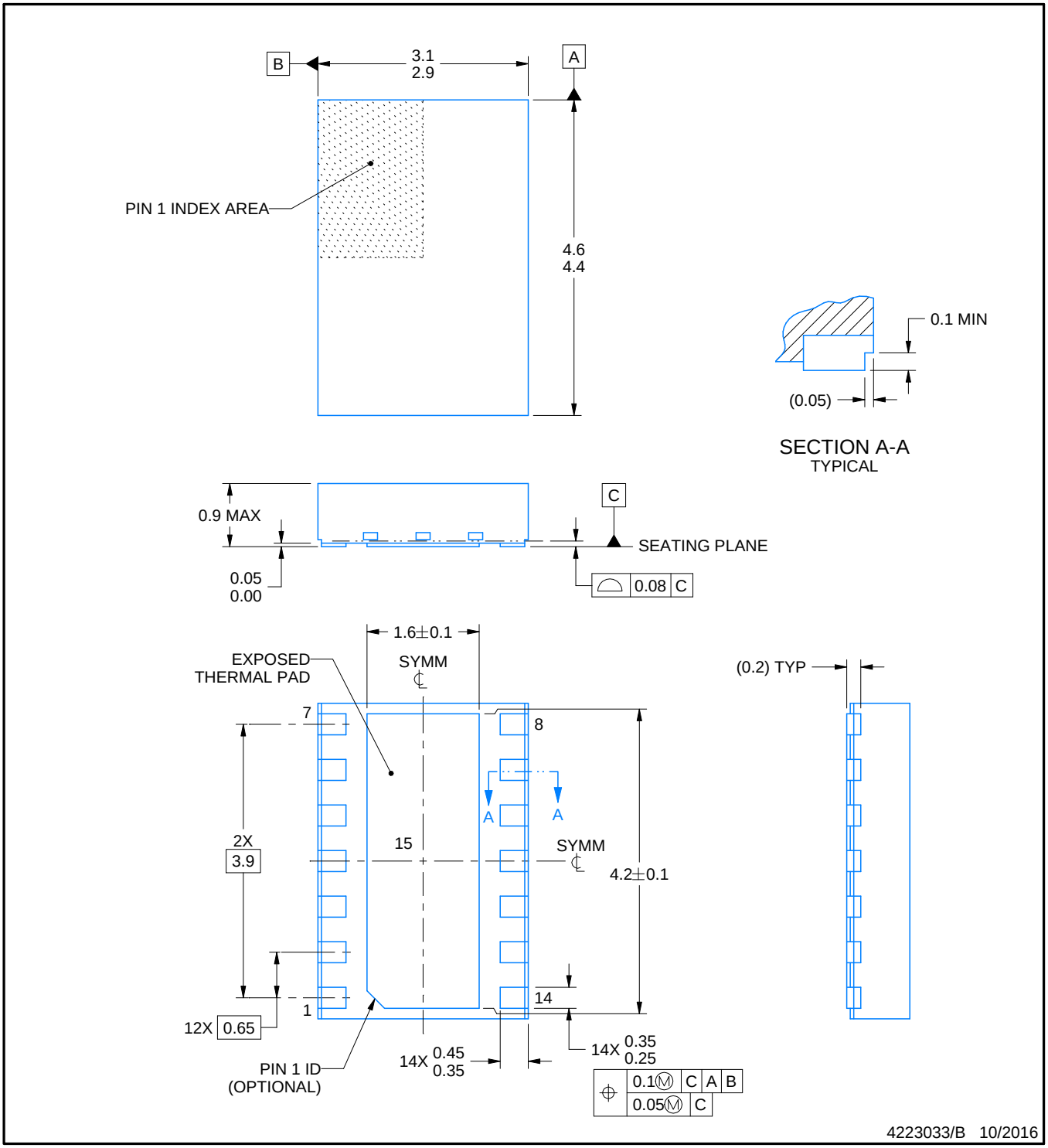
NOTES:
A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.
C. Body length does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed 0.006 (0,15) each side.
D. Body width does not include interlead flash. Interlead flash shall not exceed 0.017 (0,43) each side.
E. Reference JEDEC MS–012 variation AB.

PACKAGE OUTLINE

DMT0014A

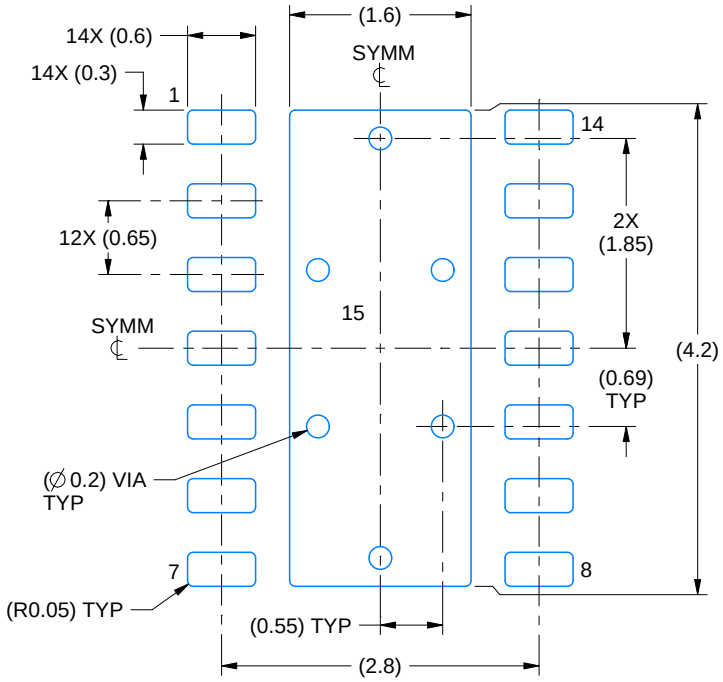
VSON - 0.9 mm max height

PLASTIC SMALL OUTLINE - NO LEAD

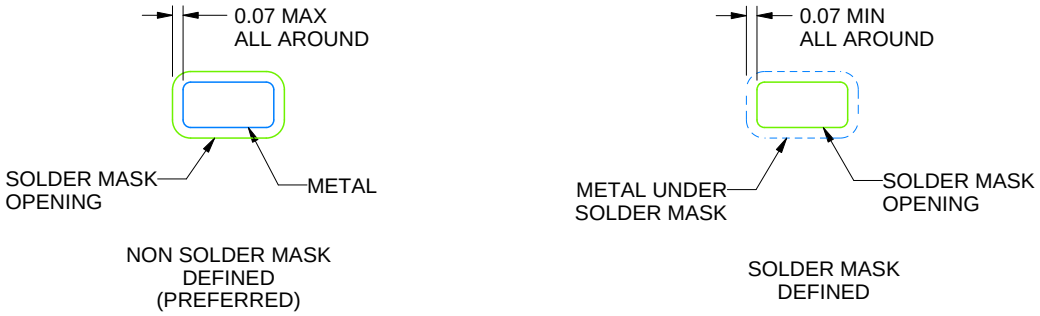


NOTES:

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. The package thermal pad must be soldered to the printed circuit board for thermal and mechanical performance.



LAND PATTERN EXAMPLE
SCALE:15X



SOLDER MASK DETAILS

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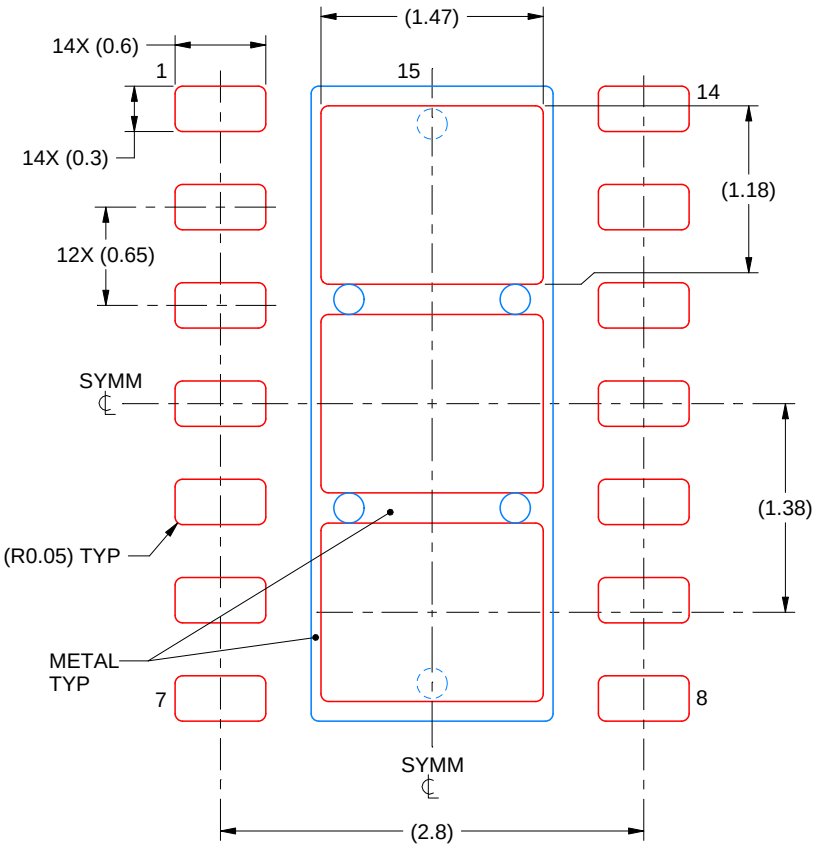
NOTES: (continued)

4. This package is designed to be soldered to a thermal pad on the board. For more information, see Texas Instruments literature number SLUA271 (www.ti.com/lit/slua271).
5. Vias are optional depending on application, refer to device data sheet. If any vias are implemented, refer to their locations shown on this view. It is recommended that vias under paste be filled, plugged or tented.



SOLDER PASTE EXAMPLE
BASED ON 0.125 mm THICK STENCIL

EXPOSED PAD 15
77.4% PRINTED SOLDER COVERAGE BY AREA
SCALE:20X

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NOTES: (continued)

6. Laser cutting apertures with trapezoidal walls and rounded corners may offer better paste release. IPC-7525 may have alternate design recommendations.

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