

TLC69699-Q1 Automotive SPI-Compatible Connectivity for TLC696xx-Q1 Device Family

1 Features

- AEC-Q100 qualified for automotive applications
 - Grade 1: –40°C to 125°C ambient temperature
 - Device HBM classification level H3A
 - Device CDM classification level C5
- Functional Safety-Capable:
 - Documentation available to aid functional safety system design
- Operating voltage V_{CC} range: 2.5V to 5.5V
- SPI peripheral
 - Data transfer rate up to 20MHz
 - Support multiple peripherals with one controller
- Continuous Clock Serial Interface (CCSI) Controller and Peripheral
 - Data transfer rate up to 20MHz
 - Programmable clock jitter for EMI enhancement
- Diagnostics
 - Open-drain FAULT pin
 - SPI communication loss detection
 - CRC for SPI communication
 - Continuous clock watchdog
 - CCSI data integrity
- Data ready interrupt for availability of data

2 Applications

- SPI compatible connectivity for TLC696x0/1/2/4/8-Q1

3 Description

The TLC69699-Q1 SPI-compatible connectivity enables TLC696xx-Q1 device family to be controlled using a standard SPI controller. The device features an internal oscillator to generate the continuous clock required by the TLC696xx-Q1 device family. Jitter can be added to the continuous clock for EMI enhancement. The transmitted data is aligned to the continuous clock to maintain the timing requirements of the CCSI interface.

TLC69699-Q1 incorporates reporting of faults in both the TLC696xx-Q1 daisy chain and TLC69699-Q1 internal. Data transmission of register and brightness to the TLC696xx-Q1 daisy chain is CRC protected by TLC69699-Q1. In addition, both the data and continuous clock lines are guarded by TLC69699-Q1 for stuck-at faults.

Package Information

PART NUMBER	PACKAGE ⁽¹⁾	PACKAGE SIZE ⁽²⁾
TLC69699-Q1	SOT-23-THN (14)	4.20mm x 2.00mm
	WSON (12) Wettable flank	3.00mm x 3.00mm

- (1) For all available packages, see the orderable addendum at the end of the data sheet.
- (2) The package size (length × width) is a nominal value.

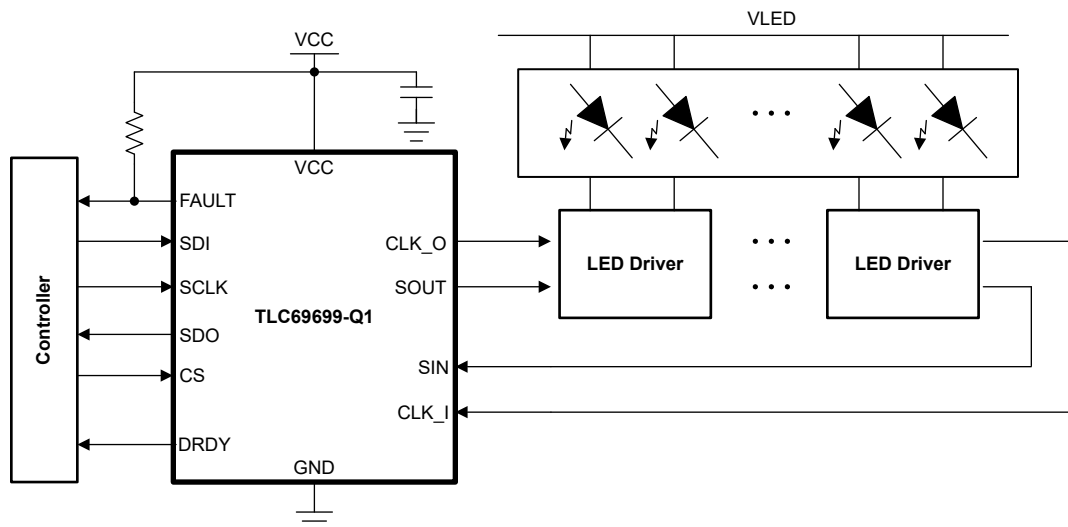


Figure 3-1. Typical Application Diagram



Table of Contents

1 Features	1	6.4 Support Resources.....	4
2 Applications	1	6.5 Trademarks.....	4
3 Description	1	6.6 Electrostatic Discharge Caution.....	4
4 Device Comparison	3	6.7 Glossary.....	4
5 Pin Configuration and Functions	3	7 Revision History	4
6 Device and Documentation Support	4	8 Mechanical, Packaging, and Orderable Information	4
6.1 Device Support.....	4	8.1 Tape and Reel Information.....	5
6.2 Documentation Support.....	4	8.2 Mechanical Data.....	7
6.3 Receiving Notification of Documentation Updates.....	4		

4 Device Comparison

Table 4-1. Device Comparison

PART NUMBER	MATERIAL	PACKAGE
TLC69699-Q1	TLC69699QDYRQ1	SOT-23-THN (14)
	TLC69699QDRRRQ1	WSON (12)

5 Pin Configuration and Functions

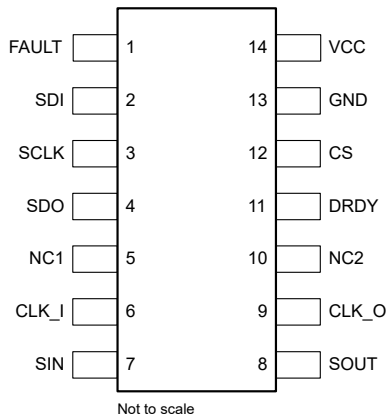


Figure 5-1. TLC69699-Q1 DYY Package 14-pin SOT-23-THN Top View

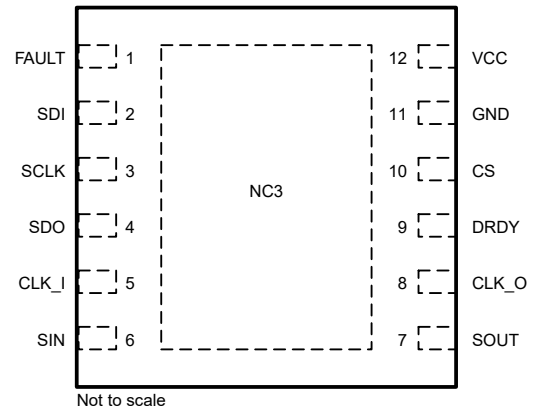


Figure 5-2. TLC69699-Q1 DRR Package 12-pin WSON with Exposed Thermal Pad Top View

Table 5-1. Pin Functions

NAME	PIN		TYPE ⁽¹⁾	DESCRIPTION
	DYY NO.	DRR NO.		
FAULT	1	1	O	Fault indicator pin
SDI	2	2	I	SPI Serial Data Input
SCLK	3	3	I	SPI Serial Clock Input
SDO	4	4	O	SPI Serial Data Output
NC1	5	-	NC	No connection. Can be used for signal routing.
CLK_I	6	5	I	CCSI continuous clock input
SIN	7	6	I	CCSI Serial Data Input
SOUT	8	7	O	CCSI Serial Data Output
CLK_O	9	8	O	CCSI Serial Clock Output
NC2	10	-	NC	No connection. Can be used for signal routing.
DRDY	11	9	O	Data ready interrupt.
CS	12	10	I	SPI Chip Select
GND	13	11	G	Ground pin (must connect to Ground)
VCC	14	12	P	VCC Power Supply Input
NC3	-	Exposed Pad	NC	No connection. Need to be electrically isolated from any signal except Ground.

(1) I = Input, O = Output, G = Ground, P = Power, NC = Not Connected.

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 Device Support

6.2 Documentation Support

6.2.1 Related Documentation

6.3 Receiving Notification of Documentation Updates

To receive notification of documentation updates, navigate to the device product folder on [ti.com](https://www.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.

6.4 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.

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](#).

6.5 Trademarks

TI E2E™ is a trademark of Texas Instruments.
All trademarks are the property of their respective owners.

6.6 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.

6.7 Glossary

[TI Glossary](#) This glossary lists and explains terms, acronyms, and definitions.

7 Revision History

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

DATE	REVISION	NOTES
October 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.

8.1 Tape and Reel Information



QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE



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
TLC69699QDYRQ1	SOT-23-THN	DYY	14									
TLC69699QDRRQ1	WSON	DRR	12									

TAPE AND REEL BOX DIMENSIONS



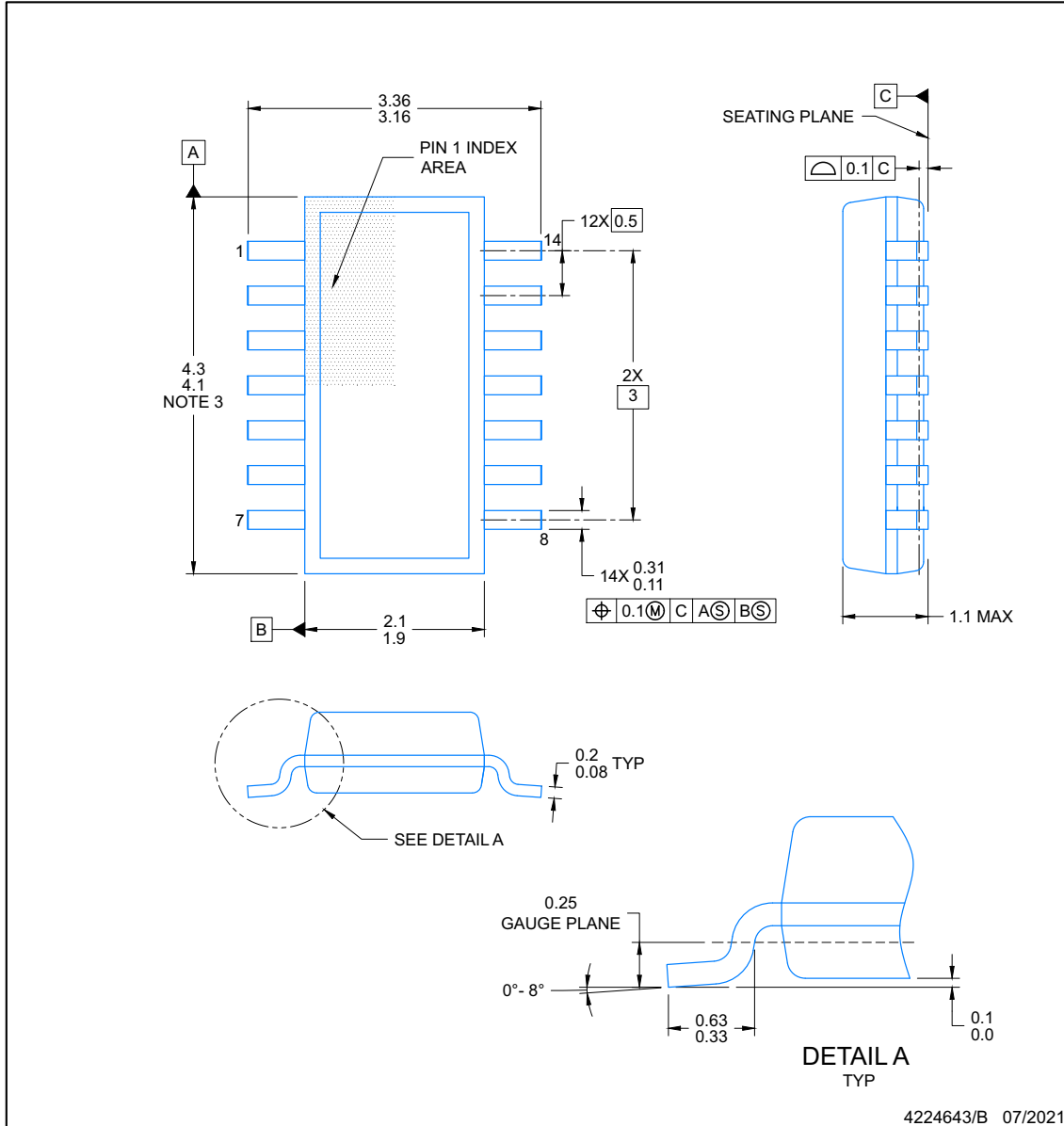
Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
TLC69699QDYRQ1	SOT-23-THN	DYY	14				
TLC69699QDRRRQ1	WSON	DRR	12				

8.2 Mechanical Data

DYY0014A

PACKAGE OUTLINE
SOT-23-THIN - 1.1 mm max height

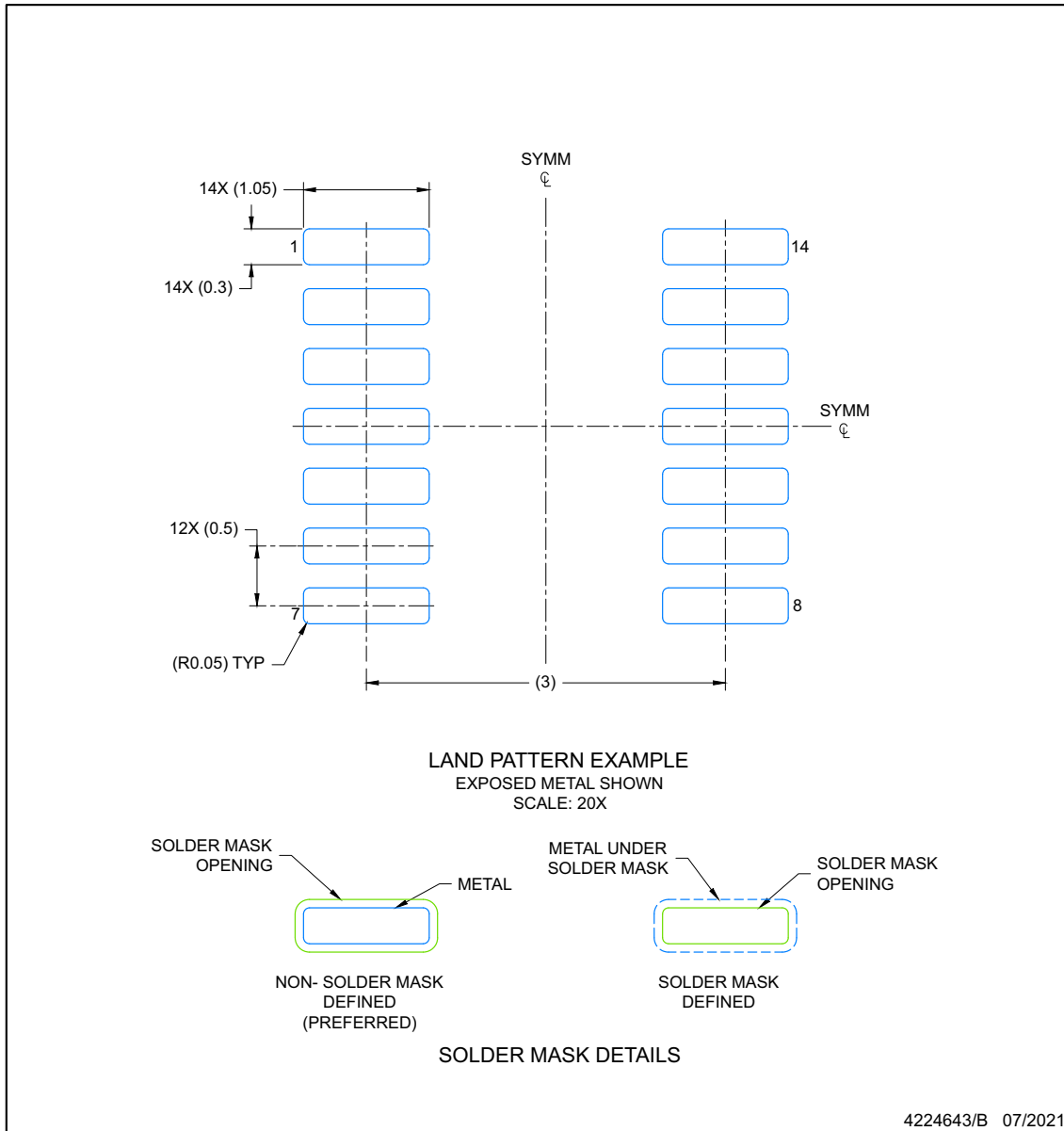
PLASTIC SMALL OUTLINE



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. Mold flash, protrusions, or gate burrs shall not exceed 0.15 per side.
4. This dimension does not include interlead flash. Interlead flash shall not exceed 0.50 per side.
5. Reference JEDEC Registration MO-345, Variation AB

DYY0014A **EXAMPLE BOARD LAYOUT**
SOT-23-THIN - 1.1 mm max height
 PLASTIC SMALL OUTLINE



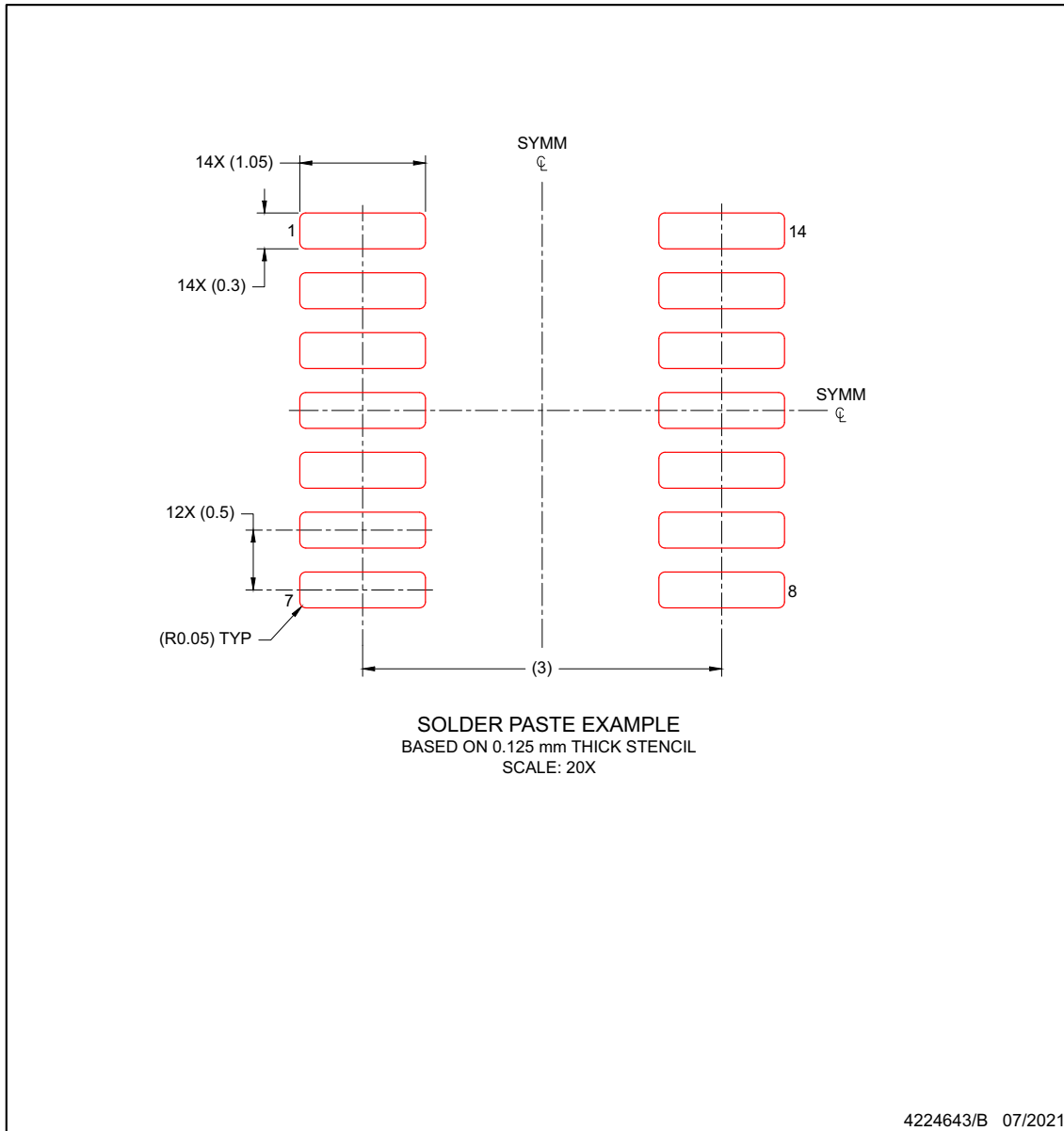
NOTES: (continued)

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

EXAMPLE STENCIL DESIGN
SOT-23-THIN - 1.1 mm max height

DYY0014A

PLASTIC SMALL OUTLINE



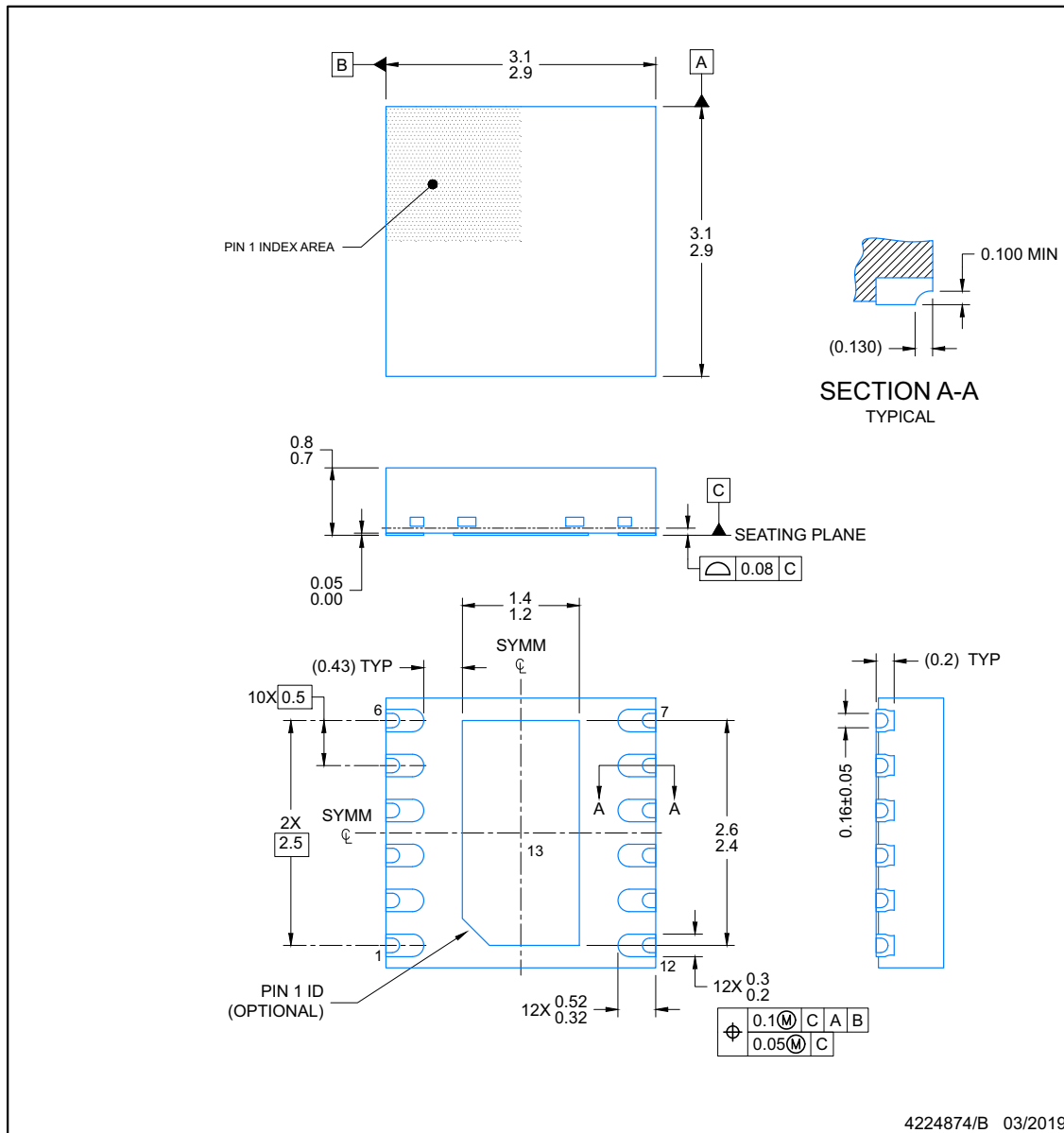
NOTES: (continued)

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

DRR0012E

PACKAGE OUTLINE
WSON - 0.8 mm max height

PLASTIC QUAD FLAT PACK- NO LEAD



NOTES:

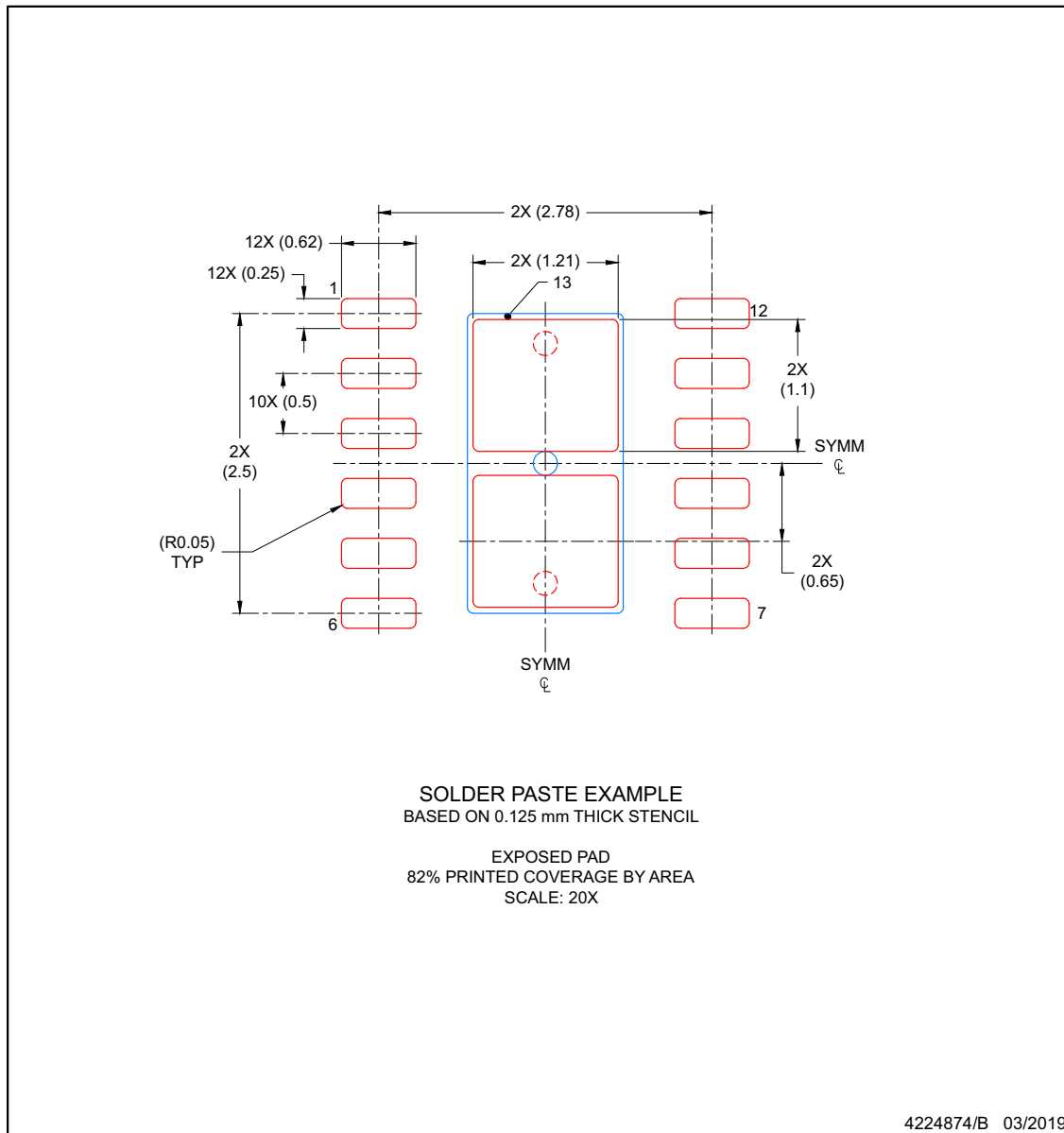
1. All linear dimensions are in millimeters. Any dimensions in parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.
3. The package thermal pad must be soldered to the printed circuit board for optimal thermal and mechanical performance.

EXAMPLE STENCIL DESIGN

DRR0012E

WSON - 0.8 mm max height

PLASTIC QUAD FLAT PACK- NO LEAD



NOTES: (continued)

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

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
TLC69699QDRRRQ1	ACTIVE	WSON	DRR	12	3000	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	-40 to 125	9699NQ	Samples
TLC69699QDYRQ1	ACTIVE	SOT-23-THIN	DYY	14	3000	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	-40 to 125	69699TQ	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.

OBSELETE: 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.

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.

In no event shall TI's liability arising out of such information exceed the total purchase price of the TI part(s) at issue in this document sold by TI to Customer on an annual basis.

GENERIC PACKAGE VIEW

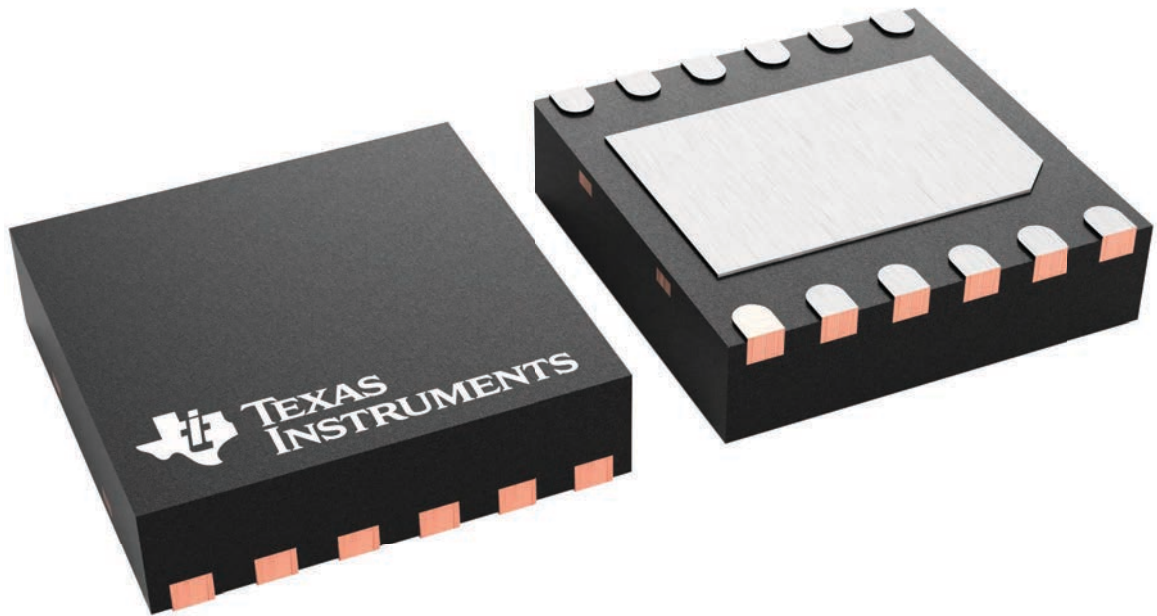
DRR 12

WSON - 0.8 mm max height

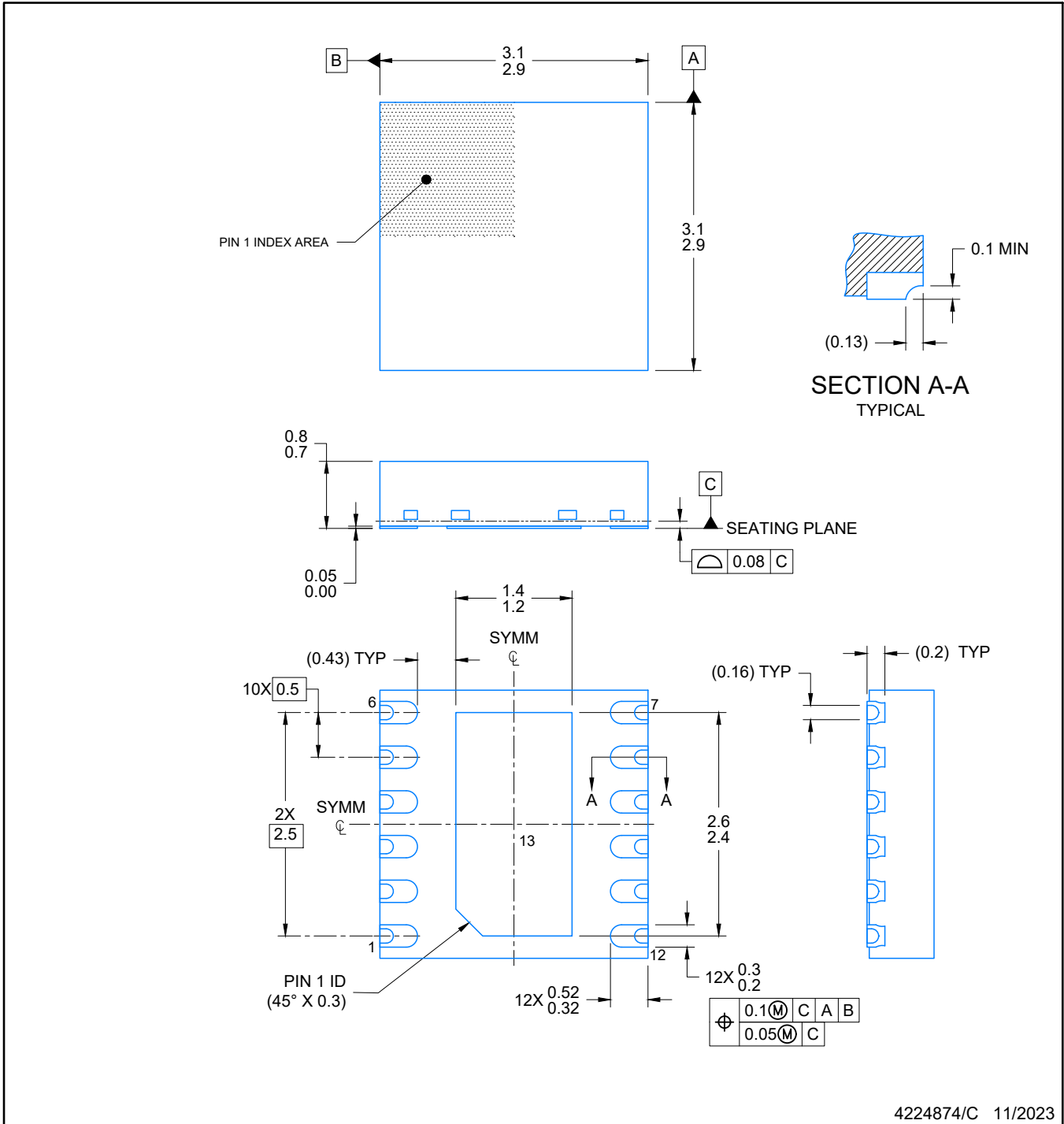
3 x 3, 0.5 mm pitch

PLASTIC SMALL OUTLINE - NO LEAD

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



4223490/B



NOTES:

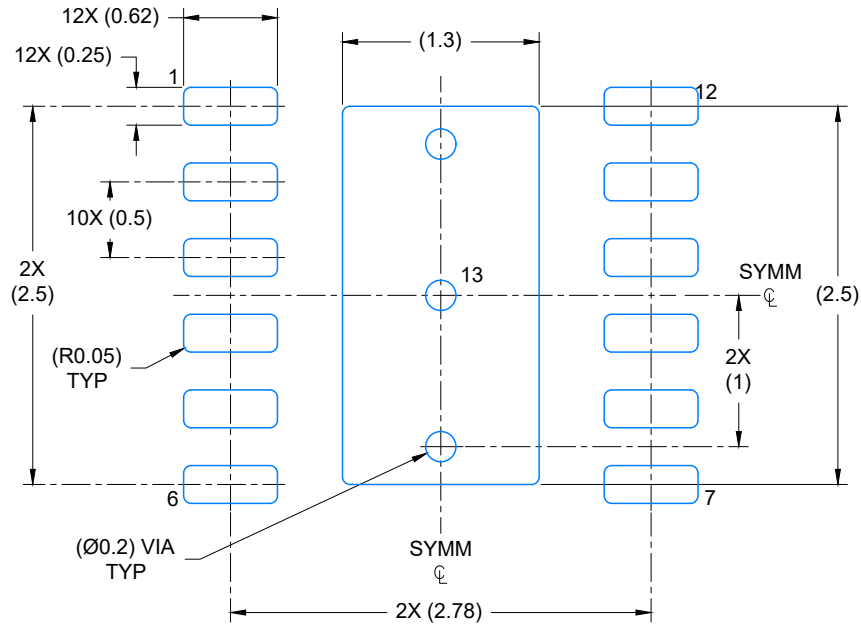
1. All linear dimensions are in millimeters. Any dimensions in parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.
3. The package thermal pad must be soldered to the printed circuit board for optimal thermal and mechanical performance.

EXAMPLE BOARD LAYOUT

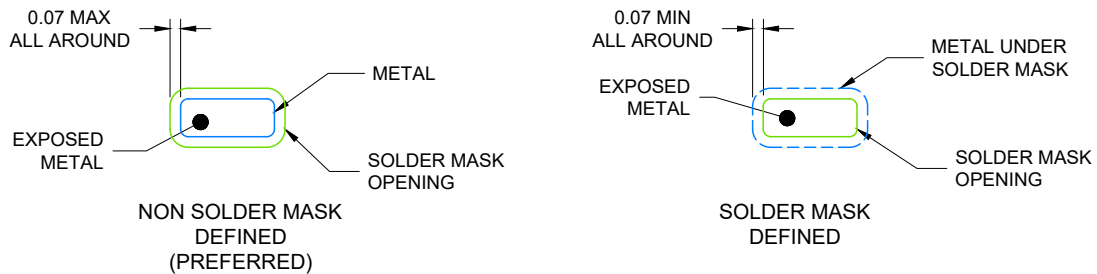
DRR0012E

WSON - 0.8 mm max height

PLASTIC QUAD FLAT PACK- NO LEAD



LAND PATTERN EXAMPLE
EXPOSED METAL SHOWN
SCALE: 20X



SOLDER MASK DETAILS

4224874/C 11/2023

NOTES: (continued)

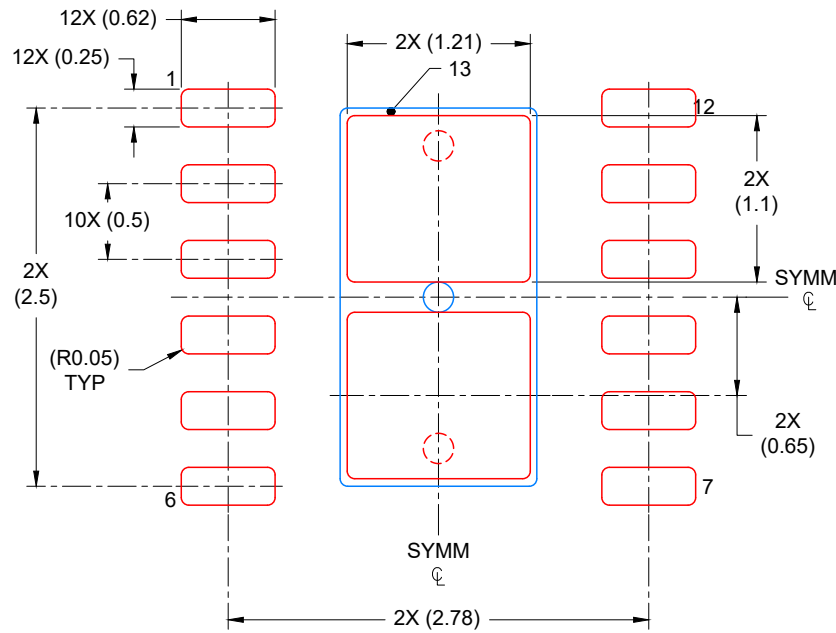
4. This package is designed to be soldered to a thermal pad on the board. For more information, see Texas Instruments literature number SLUA271 (www.ti.com/lit/slua271).
5. Vias are optional depending on application, refer to device data sheet. If any vias are implemented, refer to their locations shown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

EXAMPLE STENCIL DESIGN

DRR0012E

WSON - 0.8 mm max height

PLASTIC QUAD FLAT PACK- NO LEAD



SOLDER PASTE EXAMPLE
BASED ON 0.125 mm THICK STENCIL

EXPOSED PAD
82% PRINTED COVERAGE BY AREA
SCALE: 20X

4224874/C 11/2023

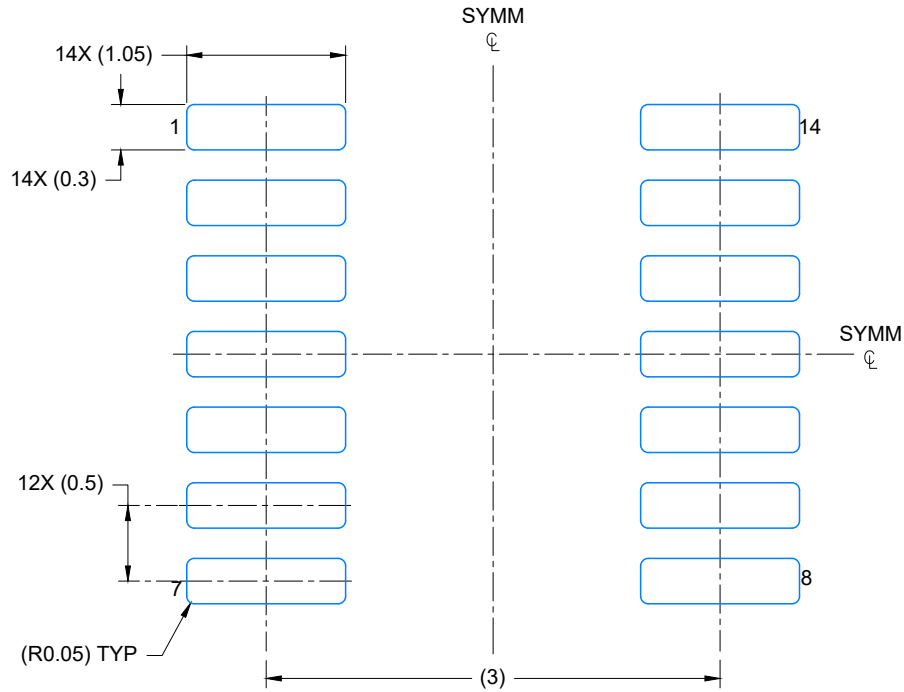
NOTES: (continued)

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

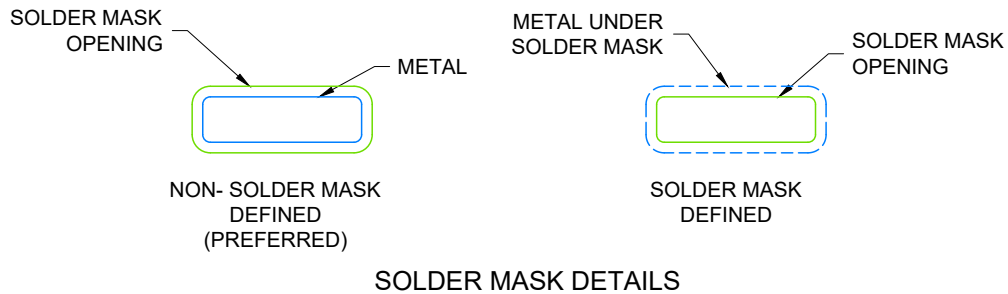


NOTES:

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. Mold flash, protrusions, or gate burrs shall not exceed 0.15 per side.
4. This dimension does not include interlead flash. Interlead flash shall not exceed 0.50 per side.
5. Reference JEDEC Registration MO-345, Variation AB



LAND PATTERN EXAMPLE
EXPOSED METAL SHOWN
SCALE: 20X



4224643/D 07/2024

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.



NOTES: (continued)

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

IMPORTANT NOTICE AND DISCLAIMER

TI PROVIDES TECHNICAL AND RELIABILITY DATA (INCLUDING DATA SHEETS), DESIGN RESOURCES (INCLUDING REFERENCE DESIGNS), APPLICATION OR OTHER DESIGN ADVICE, WEB TOOLS, SAFETY INFORMATION, AND OTHER RESOURCES "AS IS" AND WITH ALL FAULTS, AND DISCLAIMS ALL WARRANTIES, EXPRESS AND IMPLIED, INCLUDING WITHOUT LIMITATION ANY IMPLIED WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE OR NON-INFRINGEMENT OF THIRD PARTY INTELLECTUAL PROPERTY RIGHTS.

These resources are intended for skilled developers designing with TI products. You are solely responsible for (1) selecting the appropriate TI products for your application, (2) designing, validating and testing your application, and (3) ensuring your application meets applicable standards, and any other safety, security, regulatory or other requirements.

These resources are subject to change without notice. TI grants you permission to use these resources only for development of an application that uses the TI products described in the resource. Other reproduction and display of these resources is prohibited. No license is granted to any other TI intellectual property right or to any third party intellectual property right. TI disclaims responsibility for, and you will fully indemnify TI and its representatives against, any claims, damages, costs, losses, and liabilities arising out of your use of these resources.

TI's products are provided subject to [TI's Terms of Sale](#) or other applicable terms available either on [ti.com](https://www.ti.com) or provided in conjunction with such TI products. TI's provision of these resources does not expand or otherwise alter TI's applicable warranties or warranty disclaimers for TI products.

TI objects to and rejects any additional or different terms you may have proposed.

Mailing Address: Texas Instruments, Post Office Box 655303, Dallas, Texas 75265
Copyright © 2024, Texas Instruments Incorporated