

TPS92662A-Q1 High Brightness LED Matrix Manager with EMI Mitigation Techniques

1 Features

- AEC-Q100 qualified for automotive applications
 - Grade 1: -40°C to 125°C ambient operating temperature
 - Device HBM classification level H1C
 - Device CDM classification level C5
- Input voltage range: 4.5 V to 60 V
- 12 Integrated bypass switches
- Multi-drop UART communication interface
 - Compatible with TPS92662-Q1 and TPS92663-Q1 devices
 - Compatible with CAN physical layer
- Eight-bit ADC with two MUXed inputs
- Programmable crystal oscillator driver and clock buffer strength
 - Improved radiated and conducted EMI performance
- External EEPROM I²C interface
- Programmable 10-bit PWM dimming
- LED open and short detection and protection
- Supports multi-LMM synchronization for more than 12-LED string via time division multiplexing

2 Applications

- [Automotive headlight systems](#)
- [ADB or glare-free high beam](#)
- [Sequential turn/animated daytime running lights](#)

3 Description

The TPS92662A-Q1 LED matrix manager device enables fully dynamic adaptive lighting solutions by providing individual pixel-level LED control. The device includes four sub-strings of three series-connected integrated switches for bypassing individual LEDs. The individual sub-strings allow the device to accept either single or multiple current sources.

The TPS92662A-Q1 features a programmable Pierce crystal oscillator driver. Optimal performance is achieved by selecting the driver strength based on the quartz crystal or ceramic resonator manufacturers recommendations. The device also incorporates a selectable drive strength clock buffer. The rise and fall times and the EMI generated by clock signal is controlled by varying the drive strength of the clock buffer. When necessary, the clock buffer can be disabled to eliminate the noise generated by the clock signal and provide the lowest EMI performance.

The TPS92662A-Q1 supports the multi-drop universal asynchronous receiver transmitter (UART) serial interface and is compatible with TPS92662-Q1 and TPS92663-Q1 devices. The I²C communication interface can be used to read from and write to an external EEPROM that can store system calibration data.

An on-board 8-bit ADC with two multiplexed inputs can be used for system temperature compensation and used to measure a binning value which allows for LED binning and coding.

Device Information⁽¹⁾

PART NUMBER	PACKAGE	BODY SIZE (NOM)
TPS92662A-Q1	PHP (48)	7.00 mm x 7.00 mm

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

Simplified Application

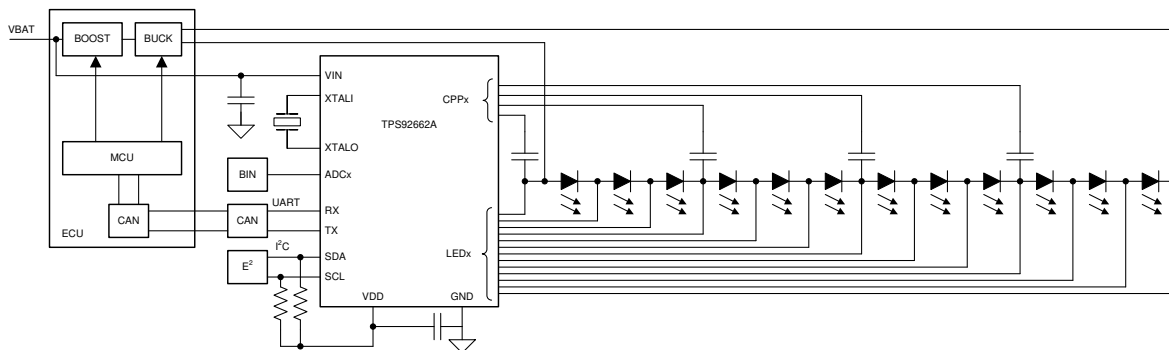


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4 Revision History

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

Changes from Original (October 2019) to Revision A	Page
• Changed device status from Advance Information to Production Data	1

5 Description (continued)

The internal charge pump rail supplies the gate drive voltage for the LED bypass switches. The low on-resistance ($R_{DS(on)}$) of the bypass switch minimizes conduction loss and power dissipation.

The TPS92662A-Q1 and TPS92662-Q1 both incorporate identical register settings for programming phase shift and pulse width of each individual LED in the string and for reporting LED open and short circuit faults.

6 Device and Documentation Support

6.1 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.

6.2 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](#).

6.3 Trademarks

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

6.4 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.

6.5 Glossary

[SLYZ022](#) — *TI Glossary*.

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

7 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)
TPS92662AQPHPRQ1	Active	Production	HTQFP (PHP) 48	1000 LARGE T&R	Yes	NIPDAU	Level-3-260C-168 HR	-40 to 125	92662AQ
TPS92662AQPHPRQ1.A	Active	Production	HTQFP (PHP) 48	1000 LARGE T&R	Yes	NIPDAU	Level-3-260C-168 HR	-40 to 125	92662AQ

(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.

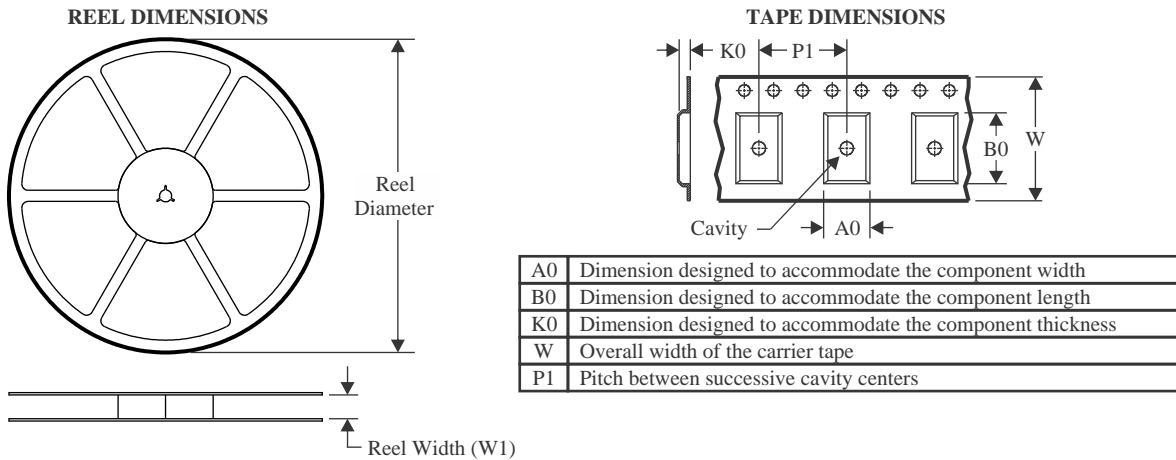
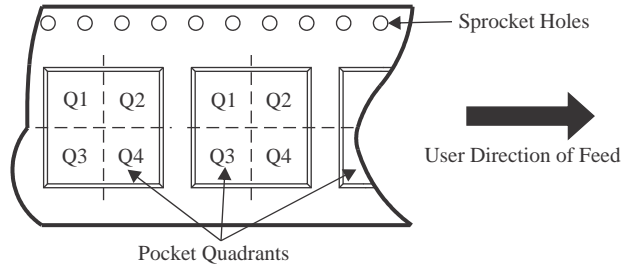
(5) **MSL rating/Peak reflow:** The moisture sensitivity level ratings and peak solder (reflow) temperatures. In the event that a part has multiple moisture sensitivity ratings, only the lowest level per JEDEC standards is shown. Refer to the shipping label for the actual reflow temperature that will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

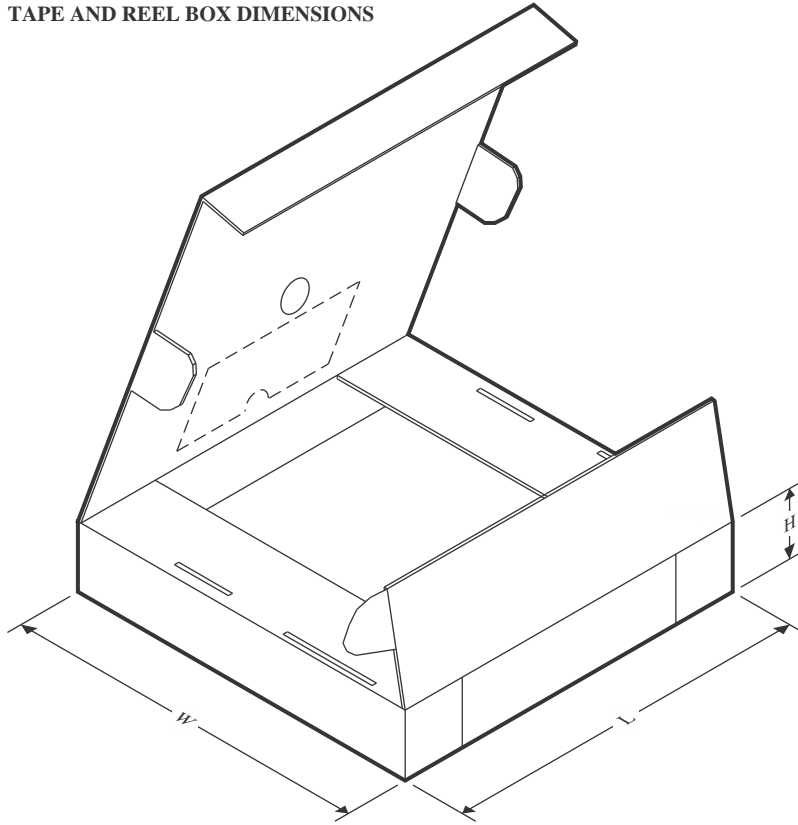
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TAPE AND REEL INFORMATION

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
TPS92662AQPHPRQ1	HTQFP	PHP	48	1000	330.0	16.4	9.6	9.6	1.5	12.0	16.0	Q2

TAPE AND REEL BOX DIMENSIONS


*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
TPS92662AQPHPRQ1	HTQFP	PHP	48	1000	336.6	336.6	31.8

GENERIC PACKAGE VIEW

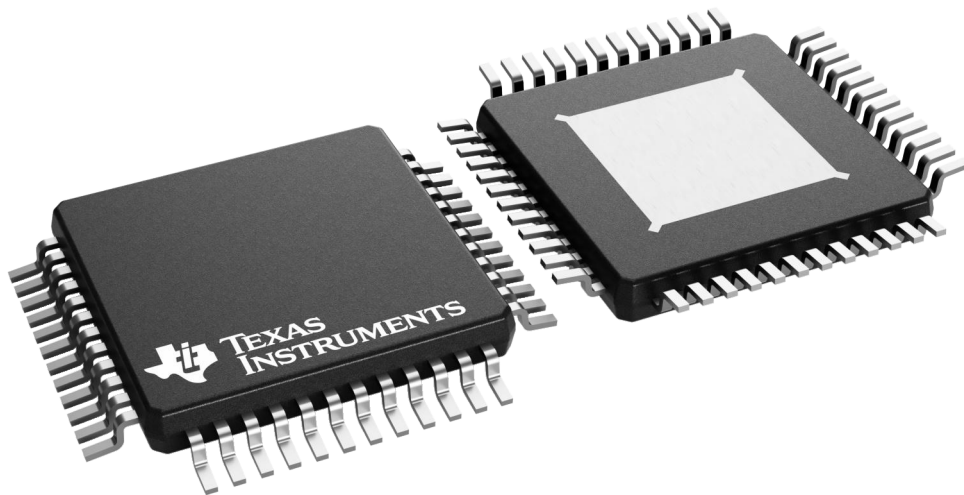
PHP 48

TQFP - 1.2 mm max height

7 x 7, 0.5 mm pitch

QUAD FLATPACK

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



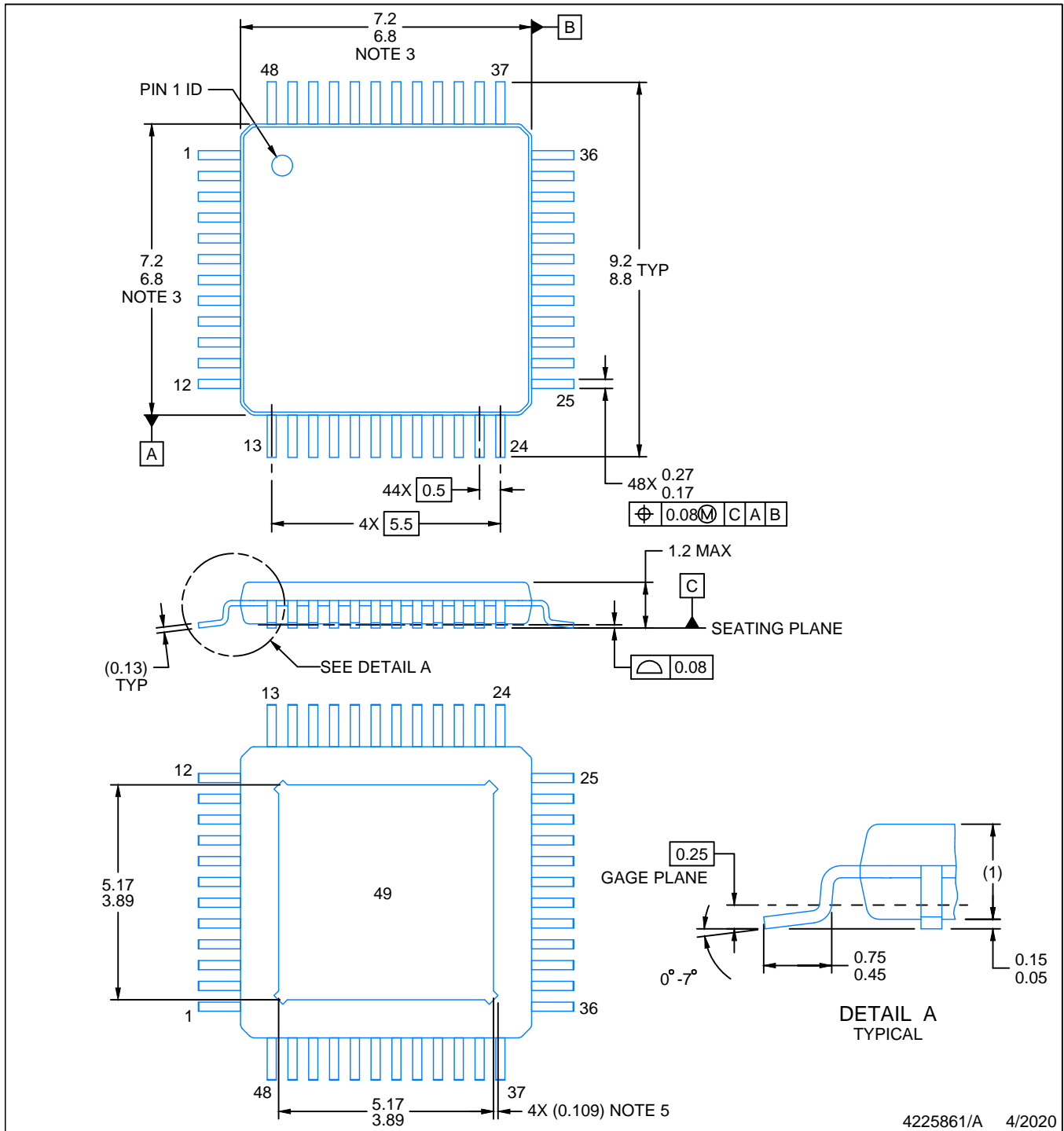
4226443/A

PACKAGE OUTLINE

PHP0048G

PowerPAD™ HTQFP - 1.2 mm max height

PLASTIC QUAD FLATPACK



NOTES:

PowerPAD is a trademark of Texas Instruments.

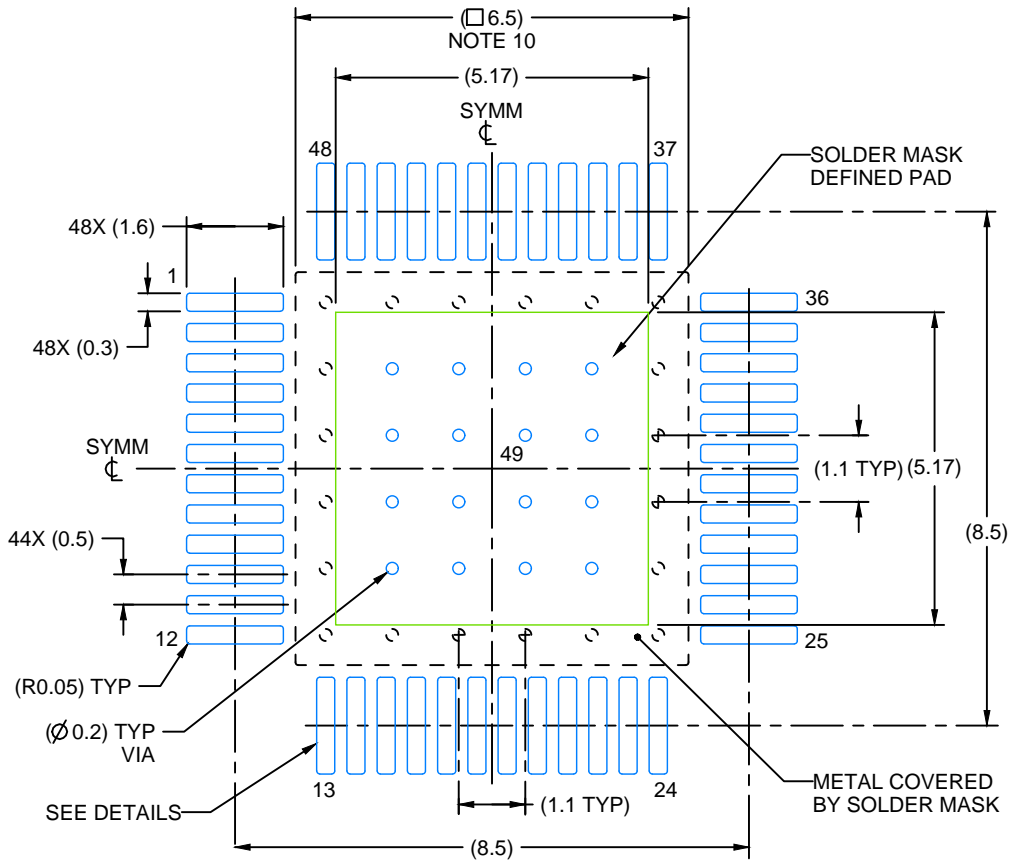
1. All linear dimensions are in millimeters. Any dimensions in parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.
3. This dimension does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed 0.15 mm per side.
4. Reference JEDEC registration MS-026.
5. Feature may not be present.

EXAMPLE BOARD LAYOUT

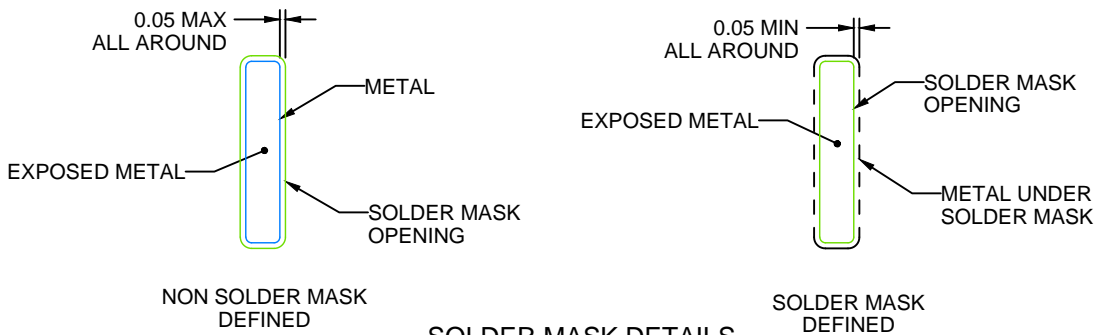
PHP0048G

PowerPAD™ HTQFP - 1.2 mm max height

PLASTIC QUAD FLATPACK



LAND PATTERN EXAMPLE
EXPOSED METAL SHOWN
SCALE:8X



SOLDER MASK DETAILS

4225861/A 4/2020

NOTES: (continued)

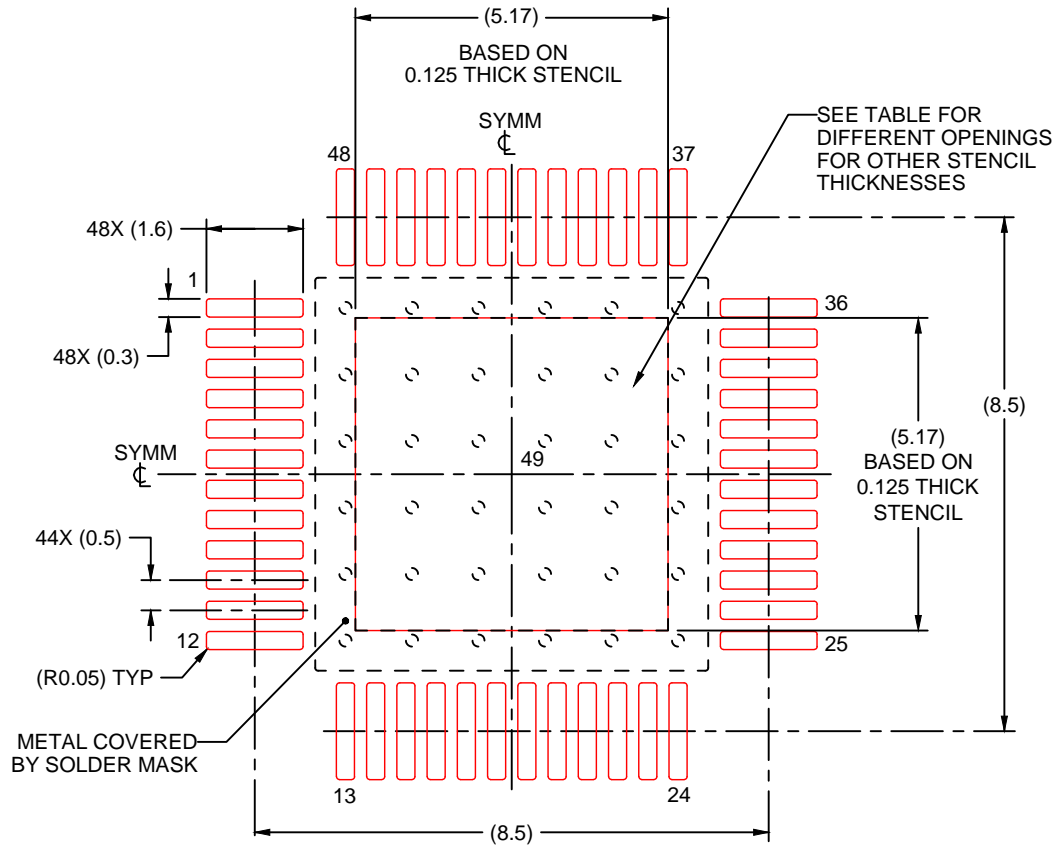
6. Publication IPC-7351 may have alternate designs.
7. Solder mask tolerances between and around signal pads can vary based on board fabrication site.
8. This package is designed to be soldered to a thermal pad on the board. See technical brief, Powerpad thermally enhanced package, Texas Instruments 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.

EXAMPLE STENCIL DESIGN

PHP0048G

PowerPAD™ HTQFP - 1.2 mm max height

PLASTIC QUAD FLATPACK



SOLDER PASTE EXAMPLE
EXPOSED PAD
100% PRINTED SOLDER COVERAGE BY AREA
SCALE:8X

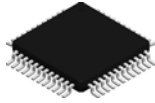
STENCIL THICKNESS	SOLDER STENCIL OPENING
0.1	5.78 X 5.78
0.125	5.17 X 5.17 (SHOWN)
0.150	4.72 X 4.72
0.175	4.37 X 4.37

4225861/A 4/2020

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.

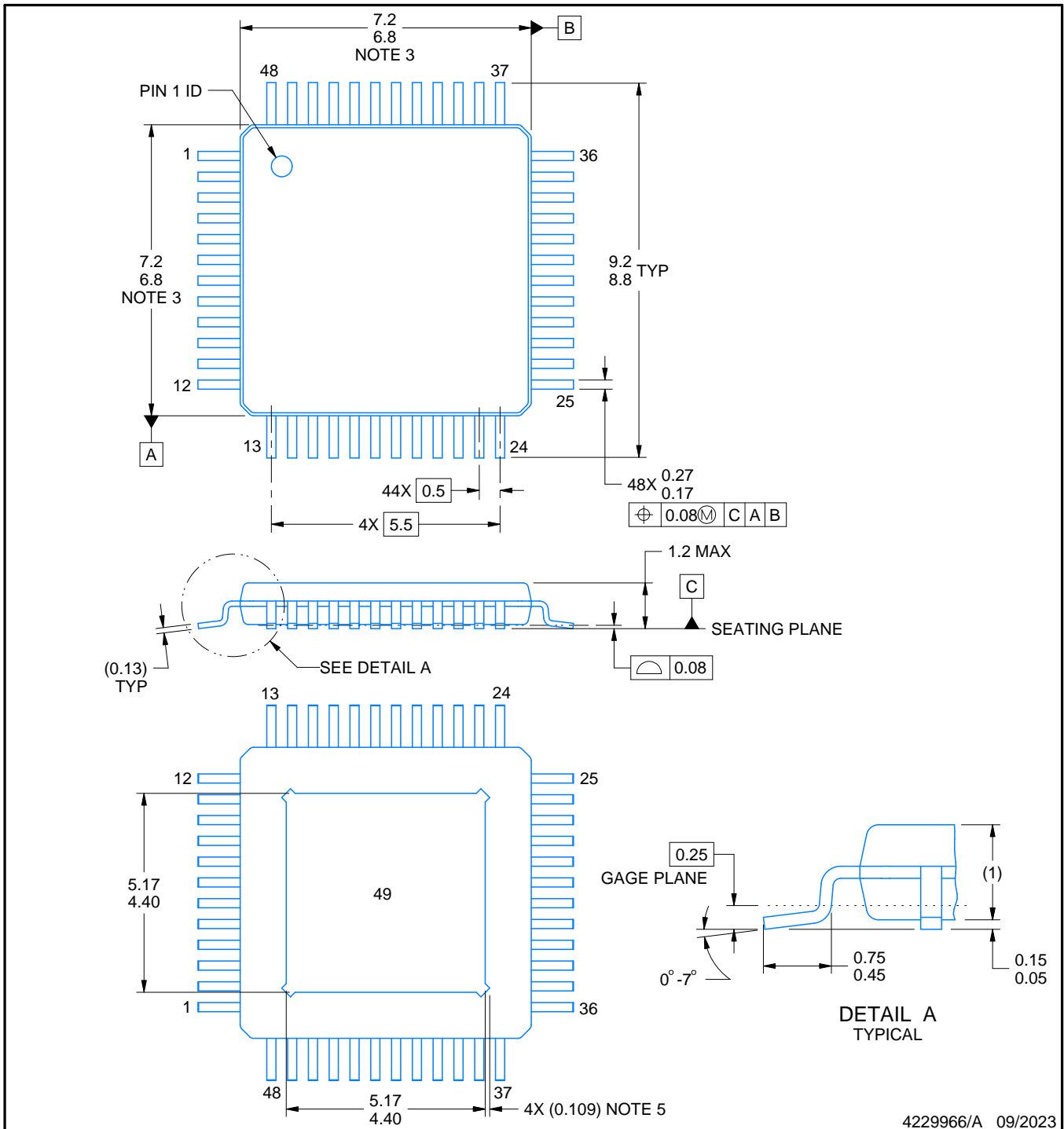
PHP0048N



PACKAGE OUTLINE

PowerPAD™ HTQFP - 1.2 mm max height

PLASTIC QUAD FLATPACK



4229966/A 09/2023

PowerPAD is a trademark of Texas Instruments.

NOTES:

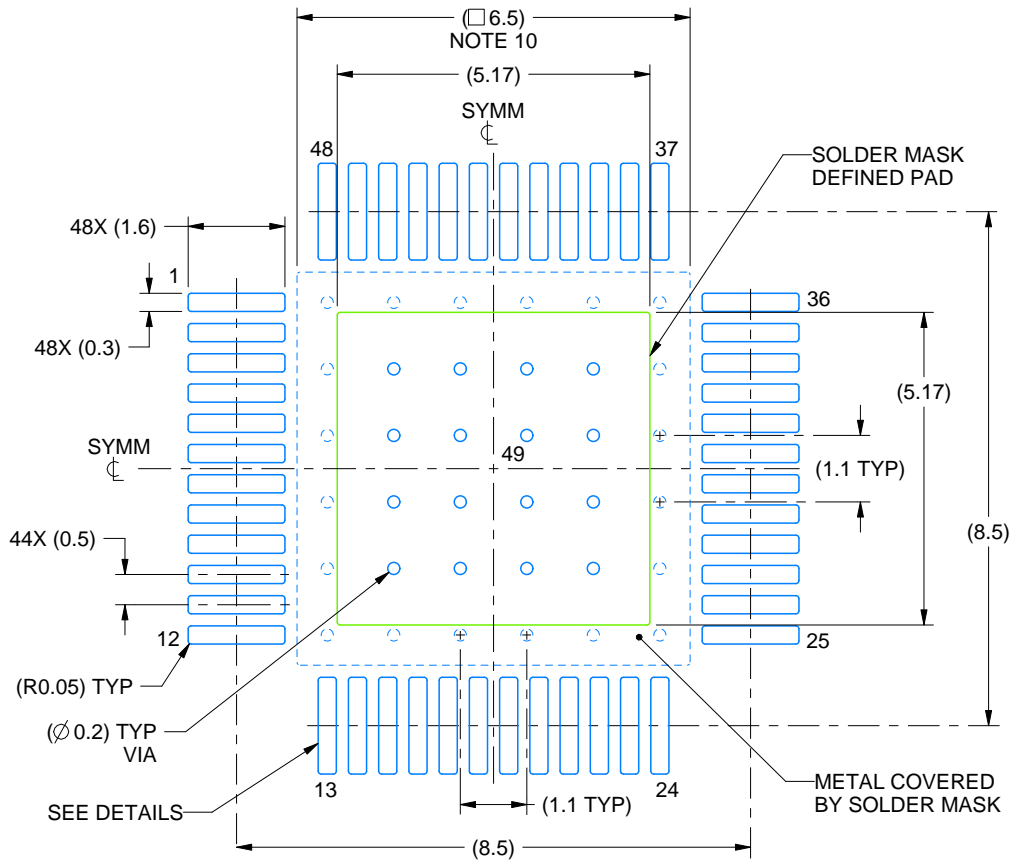
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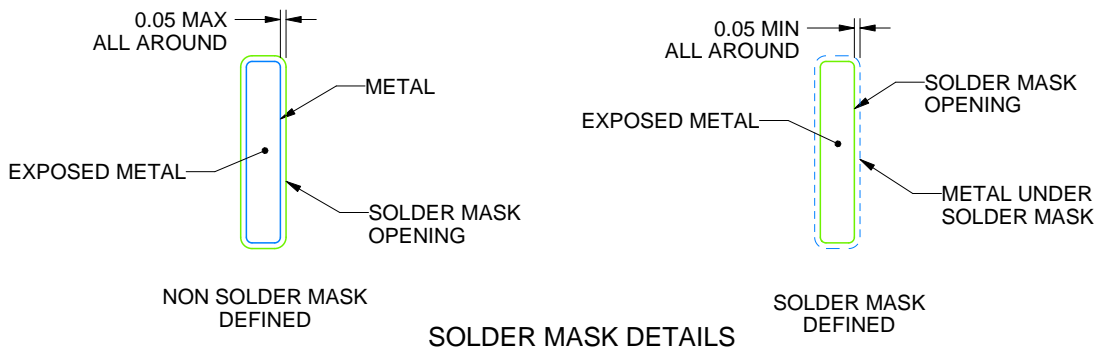
PHP0048N

PowerPAD™ HTQFP - 1.2 mm max height

PLASTIC QUAD FLATPACK



LAND PATTERN EXAMPLE
EXPOSED METAL SHOWN
SCALE:8X



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NOTES: (continued)

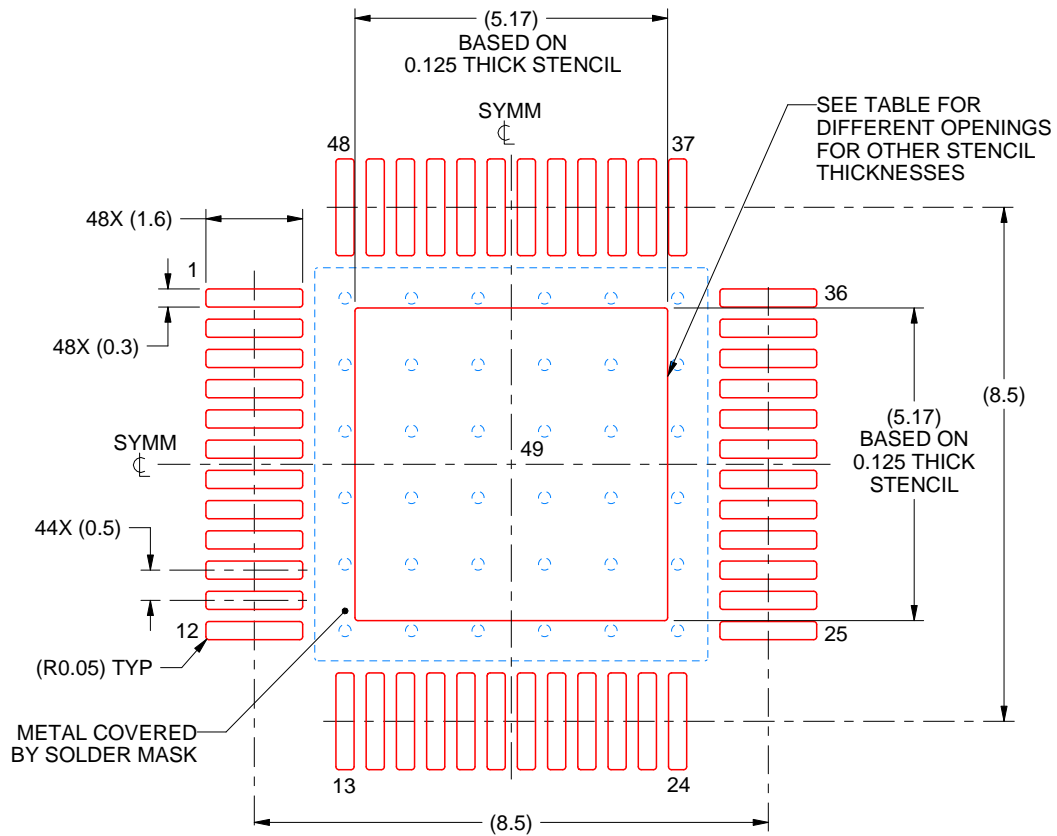
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PLASTIC QUAD FLATPACK



SOLDER PASTE EXAMPLE
EXPOSED PAD
100% PRINTED SOLDER COVERAGE BY AREA
SCALE:8X

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4229966/A 09/2023

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Last updated 10/2025