

# DRV3245E-Q1 3-Phase Grade 0 Automotive Gate Driver Unit (GDU) With High Performance Sensing, Protection and Diagnostics

## 1 Features

- AEC-Q100 qualified for automotive applications:
  - Device temperature grade 0:  $-40^{\circ}\text{C}$  to  $+150^{\circ}\text{C}$ ,  $T_A$
- SafeTI™ semiconductor component
  - Developed according to the applicable requirements of ISO 26262
- 4.5-V to 45-V operating voltage
- Programmable peak gate drive currents up to 1A
- Charge-pump gate driver for 100% Duty Cycle
- Current-shunt amplifiers and phase comparators
  - A Device: 3 current-shunt amplifiers and 3-phase comparators with status through SPI
  - B Device: 2 current-shunt amplifiers and 3-phase comparators with real-time monitor through digital pins
- 3-PWM or 6-PWM input control up to 20 kHz
- Single PWM-mode commutation capability
- Supports both 3.3-V and 5-V digital interface
- Serial peripheral interface (SPI)
- Thermally-enhanced 48-Pin HTQFP
- Protection features:
  - Internal regulators, battery voltage monitor
  - SPI CRC
  - Clock monitor
  - Analog built-in self test
  - Programmable dead-time control
  - MOSFET shoot-through prevention
  - MOSFET  $V_{DS}$  overcurrent monitors
  - Gate-source voltage real time monitor
  - Overtemperature warning

## 2 Applications

- High temperature 12-V automotive applications
  - Automated manual transmission and dual clutch transmission
  - Shift by wire
  - Transfer case and pumps

## 3 Description

The DRV3245E-Q1 device is a FET gate driver IC for three-phase motor-drive applications. The device is intended for high-temperature automotive applications and is designed according to the applicable requirements of ISO 26262 for functional safety applications. The device provides three half-bridge drivers each capable of driving a high-side and low-side N-channel MOSFET while also providing sophisticated protection and monitoring of the FETs. A charge-pump driver enables 100% duty cycle and supports low battery voltages during cold-crank operation. The integration of current-sense amplifiers, integrated phase comparators, and SPI-based configuration enable reduction of the bill of materials (BOM) and space on the printed circuit board (PCB) because of the elimination of most external and passive components.

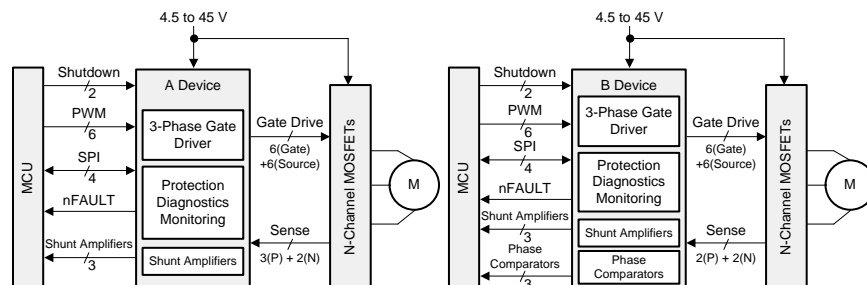
The DRV3245E-Q1 device also integrates diagnostics and protection for each internal block and provides support for common system diagnostic checks each of which can be instantiated and reported through SPI. This flexibility of the integrated features allows the device to integrate seamlessly into a variety of safety architectures.

### Device Information (1)

PART NUMBER	PACKAGE	BODY SIZE (NOM)
DRV3245E-Q1	HTQFP (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 Schematic



## 4 Device and Documentation Support

### 4.1 Device Support

#### 4.1.1 Device Nomenclature

Figure 1 shows a legend for reading the complete orderable device name for the DRV3245E-Q1 device

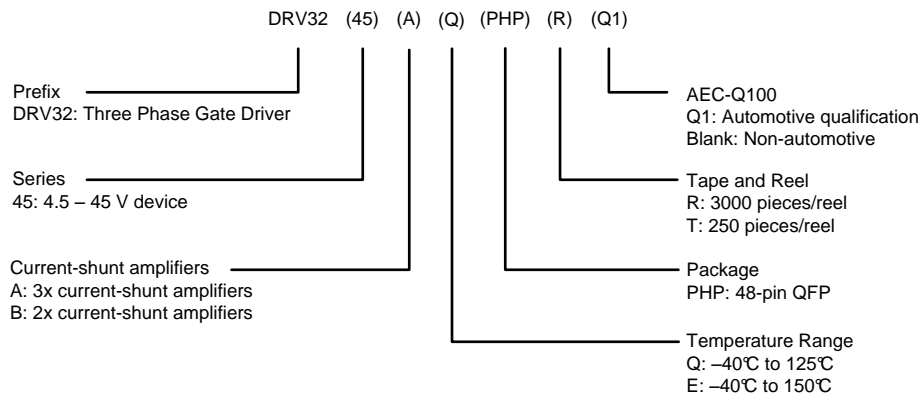


Figure 1. Device Nomenclature

### 4.2 Documentation Support

For related documentation see the following:

- Texas Instruments, [PowerPAD™ Thermally Enhanced Package application report](#)
- Texas Instruments, [PowerPAD™ Made Easy application report](#)
- Texas Instruments, [Sensored 3-Phase BLDC Motor Control Using MSP430 application report](#)
- Texas Instruments, [Understanding IDRIVE and TDRIVE in TI Motor Gate Drivers application report](#)

### 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.

### 4.4 Community Resources

The following links connect to TI community resources. Linked contents are 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](#).

**TI E2E™ Online Community** *TI's Engineer-to-Engineer (E2E) Community*. Created to foster collaboration among engineers. At e2e.ti.com, you can ask questions, share knowledge, explore ideas and help solve problems with fellow engineers.

**Design Support** *TI's Design Support* Quickly find helpful E2E forums along with design support tools and contact information for technical support.

### 4.5 Trademarks

SafeTI, E2E are trademarks of Texas Instruments. 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.

**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
DRV3245AEPHRQ1	ACTIVE	HTQFP	PHP	48	1000	RoHS & Green	Call TI   NIPDAU	Level-3-260C-168 HR	-40 to 150	D3245AE	<a href="#">Samples</a>
DRV3245BEPHRQ1	ACTIVE	HTQFP	PHP	48	1000	RoHS & Green	NIPDAU	Level-3-260C-168 HR	-40 to 150	D3245BE	<a href="#">Samples</a>

(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.

**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.



**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
DRV3245AEPHPRQ1	HTQFP	PHP	48	1000	330.0	16.4	9.6	9.6	1.5	12.0	16.0	Q2
DRV3245BEPHPRQ1	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)
DRV3245AEPHPRQ1	HTQFP	PHP	48	1000	350.0	350.0	43.0
DRV3245BEPHPRQ1	HTQFP	PHP	48	1000	350.0	350.0	43.0

## GENERIC PACKAGE VIEW

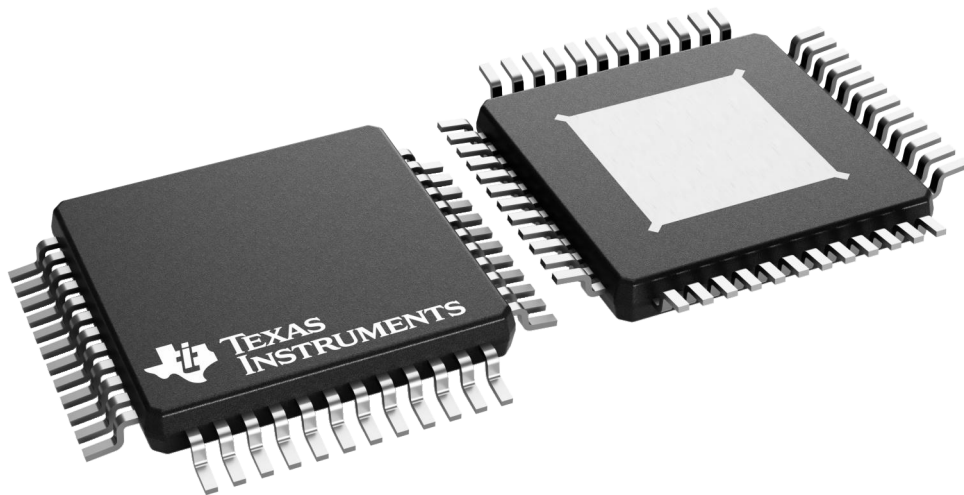
**PHP 48**

**TQFP - 1.2 mm max height**

7 x 7, 0.5 mm pitch

QUAD FLATPACK

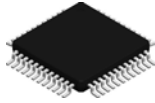
This image is a representation of the package family, actual package may vary.  
Refer to the product data sheet for package details.



4226443/A



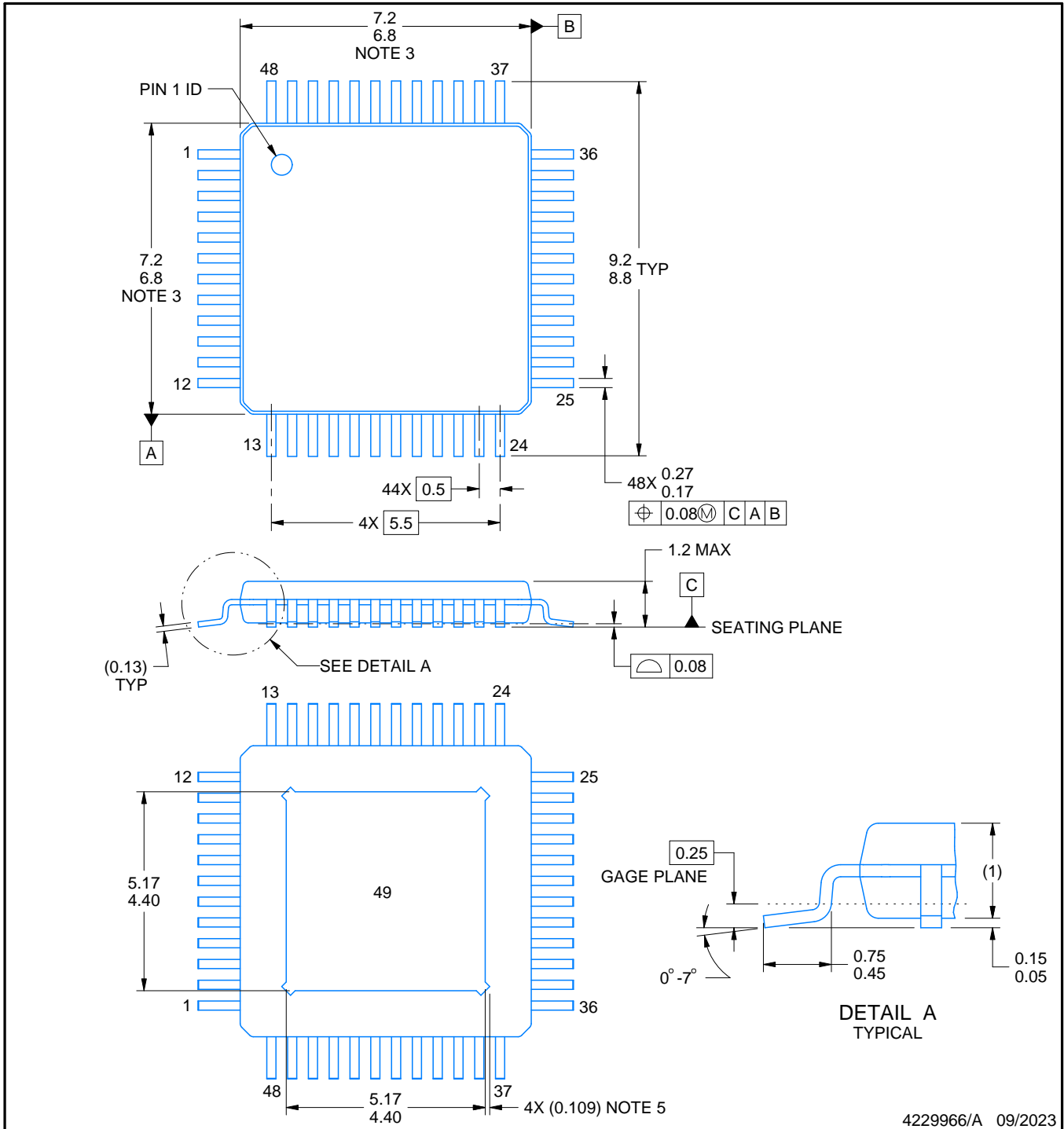
# PHP0048N



# PACKAGE OUTLINE

## PowerPAD™ HTQFP - 1.2 mm max height

PLASTIC QUAD FLATPACK



4229966/A 09/2023

**NOTES:**

PowerPAD is a trademark of Texas Instruments.

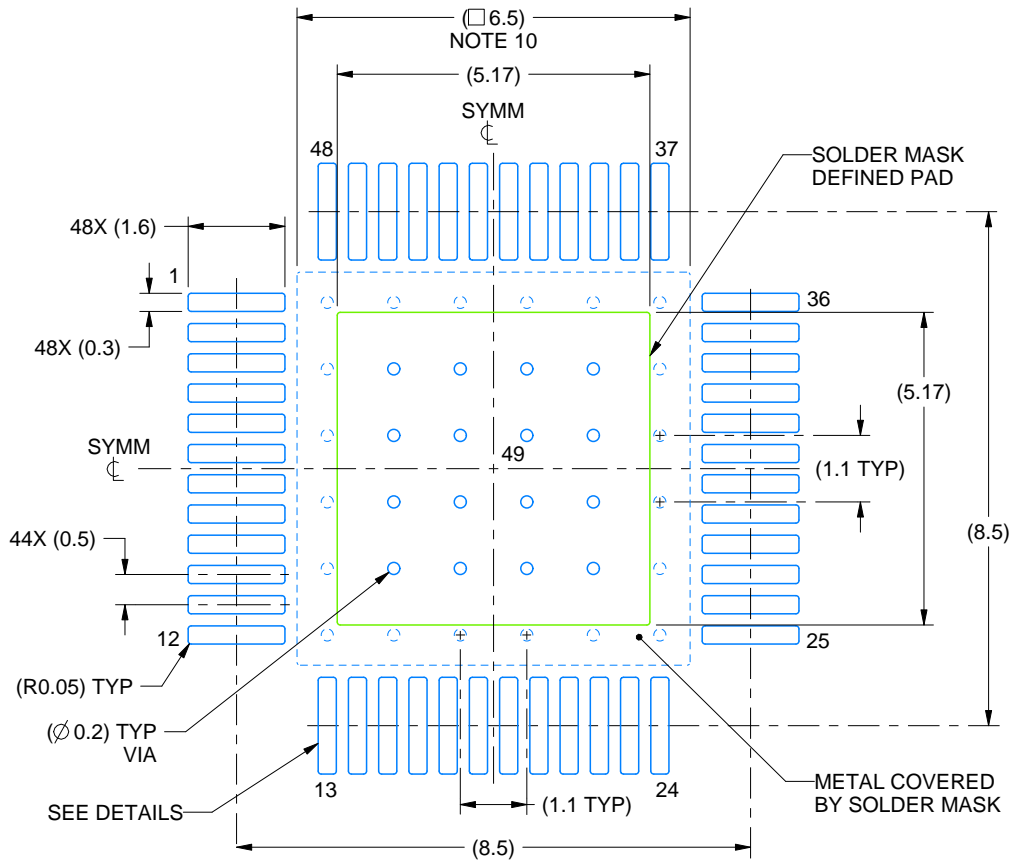
1. All linear dimensions are in millimeters. Any dimensions in parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.
3. This dimension does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or 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

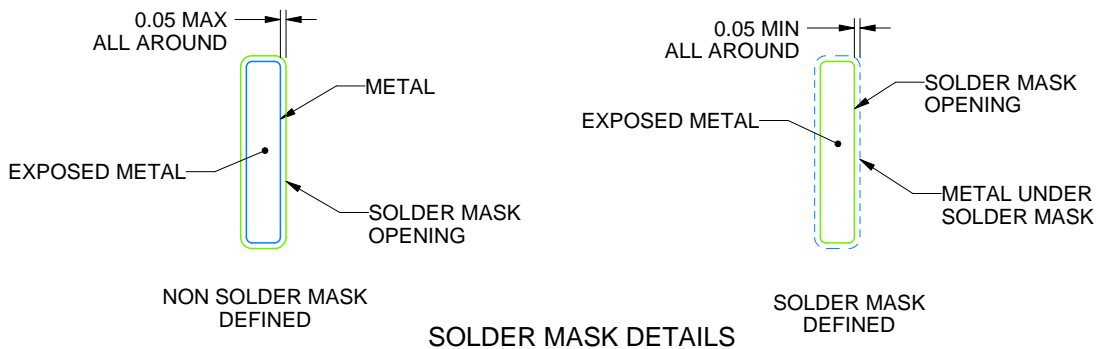
PHP0048N

PowerPAD™ HTQFP - 1.2 mm max height

PLASTIC QUAD FLATPACK



LAND PATTERN EXAMPLE  
EXPOSED METAL SHOWN  
SCALE:8X



4229966/A 09/2023

NOTES: (continued)

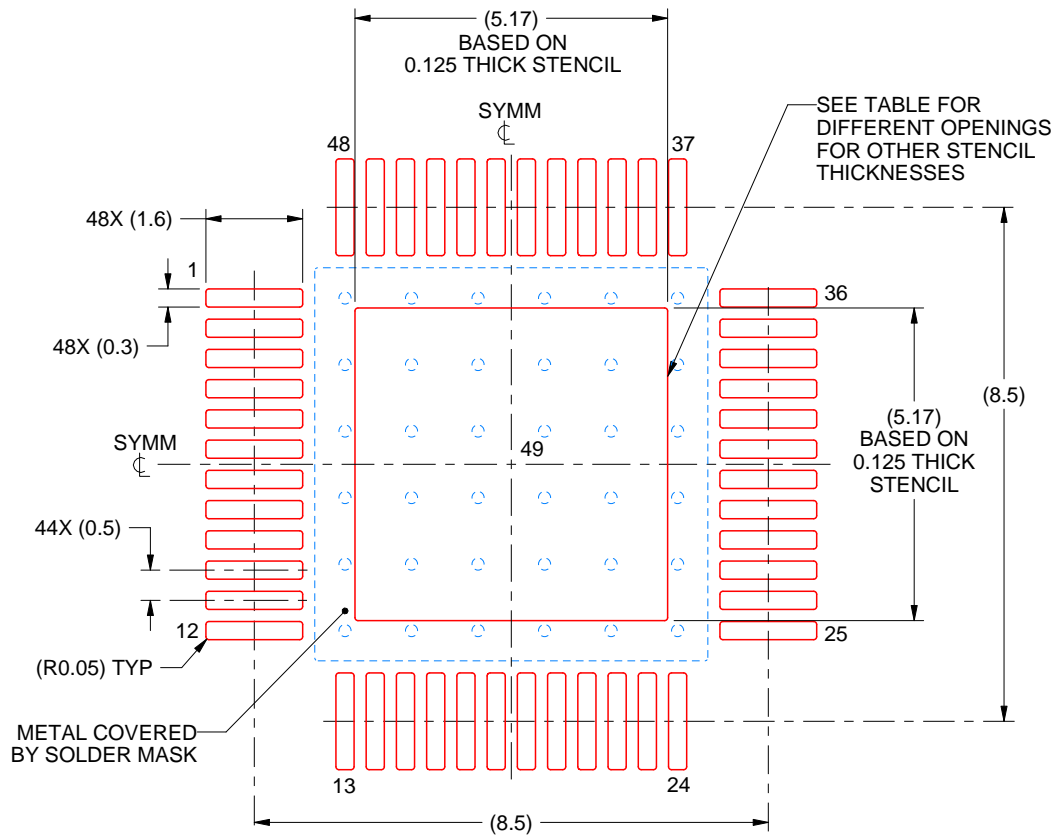
6. Publication IPC-7351 may have alternate designs.
7. Solder mask tolerances between and around signal pads can vary based on board fabrication site.
8. This package is designed to be soldered to a thermal pad on the board. See technical brief, Powerpad thermally enhanced package, Texas Instruments Literature No. SLMA002 ([www.ti.com/lit/slma002](http://www.ti.com/lit/slma002)) and SLMA004 ([www.ti.com/lit/slma004](http://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

PHP0048N

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

4229966/A 09/2023

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.

## 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