

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°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.

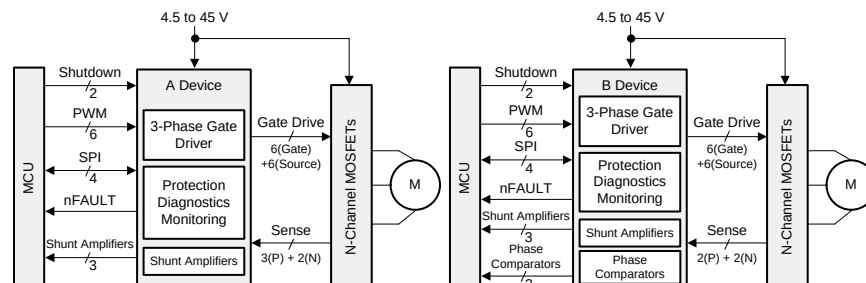
The DRV3245E-Q1 device also integrates diagnostics and protection for each internal block and provides support for common system diagnostic checks each of which can be instantiated and reported through SPI. This flexibility of the integrated features allows the device to integrate seamlessly into a variety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

Device Information ⁽¹⁾

PART NUMBER	PACKAGE	BODY SIZE (NOM)
DRV3245E-Q1	HTQFP (48)	7.00 mm × 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

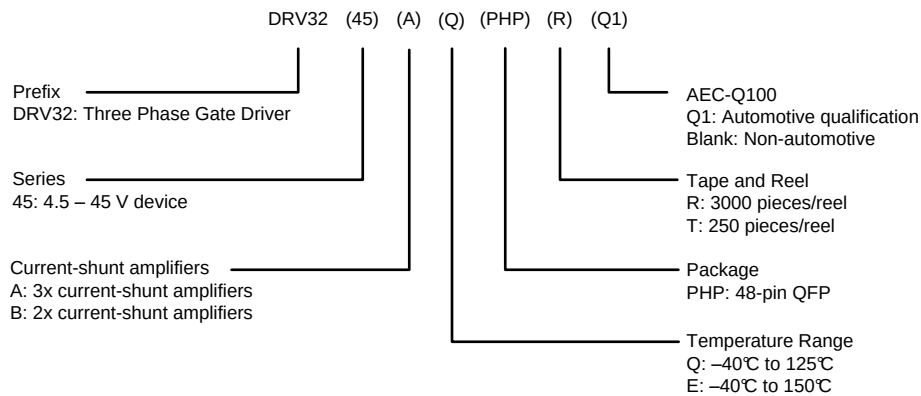


Figure 1. Device Nomenclature

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 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)
DRV3245AEPHPRQ1	Active	Production	HTQFP (PHP) 48	1000 LARGE T&R	Yes	NIPDAU	Level-3-260C-168 HR	-40 to 150	D3245AE
DRV3245AEPHPRQ1.A	Active	Production	HTQFP (PHP) 48	1000 LARGE T&R	Yes	NIPDAU	Level-3-260C-168 HR	-40 to 150	D3245AE
DRV3245BEPHPRQ1	Active	Production	HTQFP (PHP) 48	1000 LARGE T&R	Yes	NIPDAU	Level-3-260C-168 HR	-40 to 150	D3245BE
DRV3245BEPHPRQ1.A	Active	Production	HTQFP (PHP) 48	1000 LARGE T&R	Yes	NIPDAU	Level-3-260C-168 HR	-40 to 150	D3245BE

⁽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.

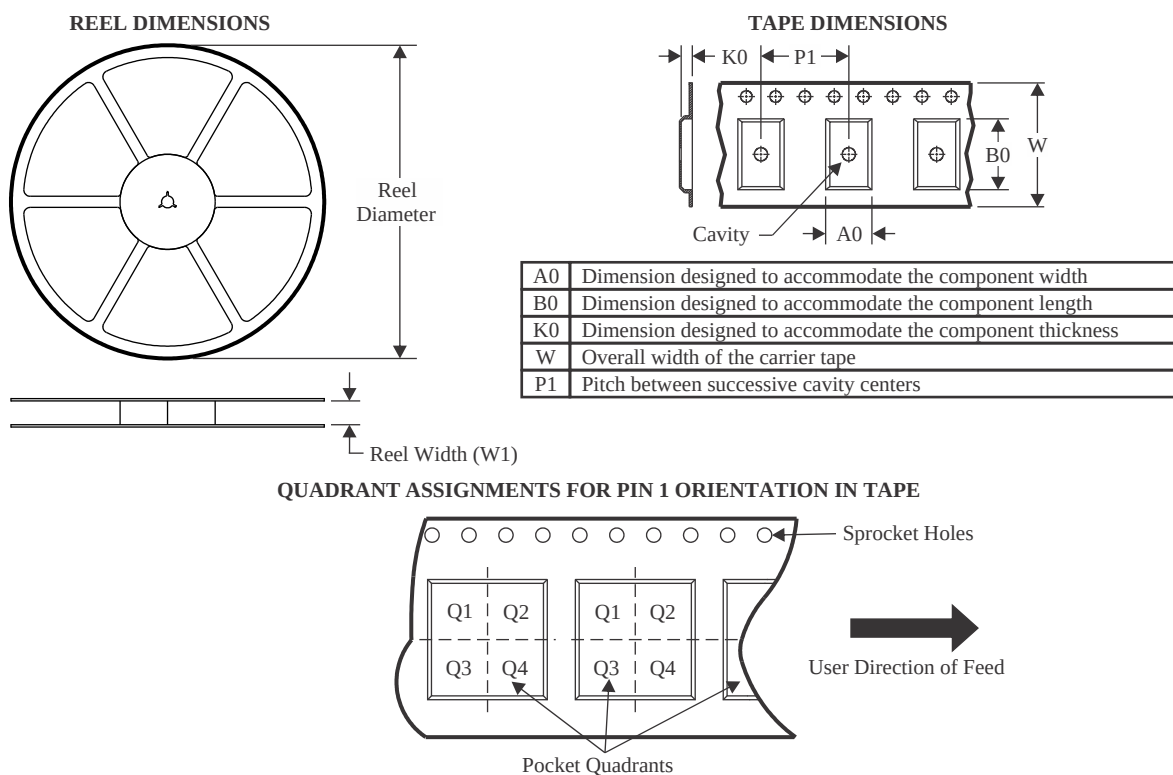
⁽⁶⁾ **Part marking:** There may be an additional marking, which relates to the logo, the lot trace code information, or the environmental category of the part.

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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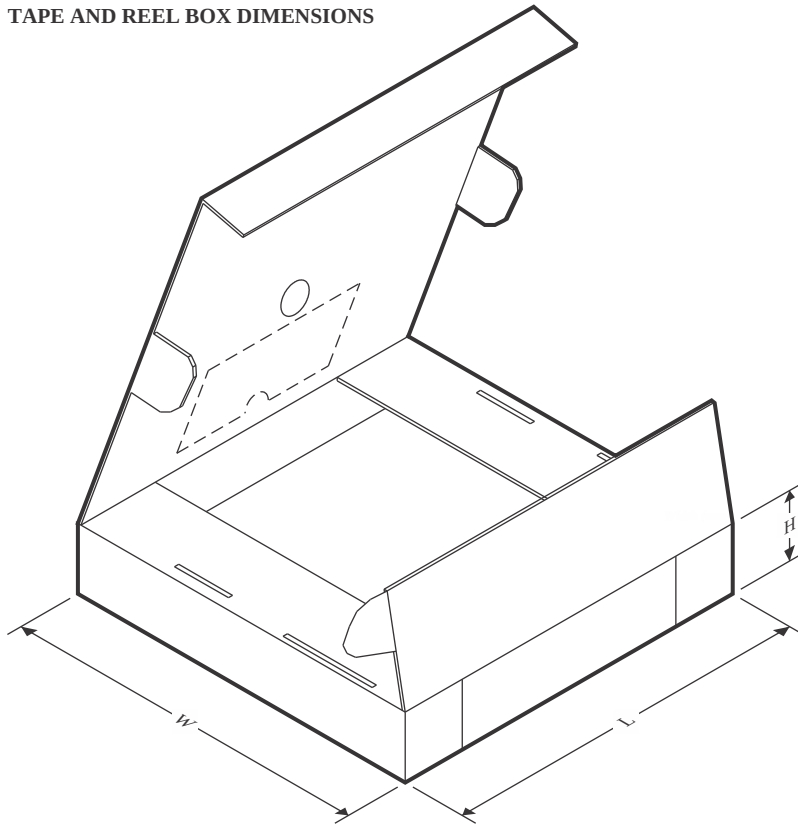
TAPE AND REEL INFORMATION



*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
DRV3245AEPHPRQ1	HTQFP	PHP	48	1000	330.0	16.4	9.6	9.6	1.5	12.0	16.0	Q2
DRV3245AEPHPRQ1	HTQFP	PHP	48	1000	330.0	16.4	9.8	9.8	2.0	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	336.6	336.6	31.8
DRV3245AEPHPRQ1	HTQFP	PHP	48	1000	350.0	350.0	43.0
DRV3245AEPHPRQ1	HTQFP	PHP	48	1000	356.0	356.0	36.0
DRV3245BEPHPRQ1	HTQFP	PHP	48	1000	350.0	350.0	43.0

GENERIC PACKAGE VIEW

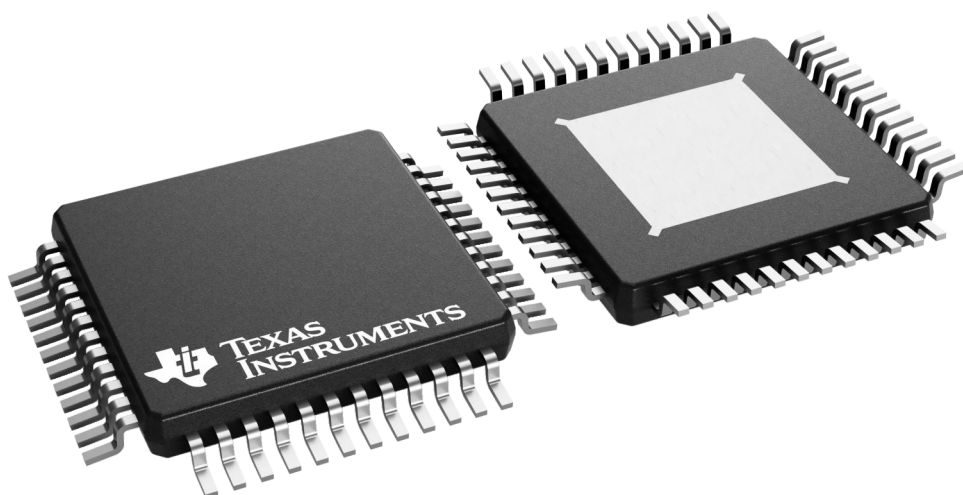
PHP 48

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.

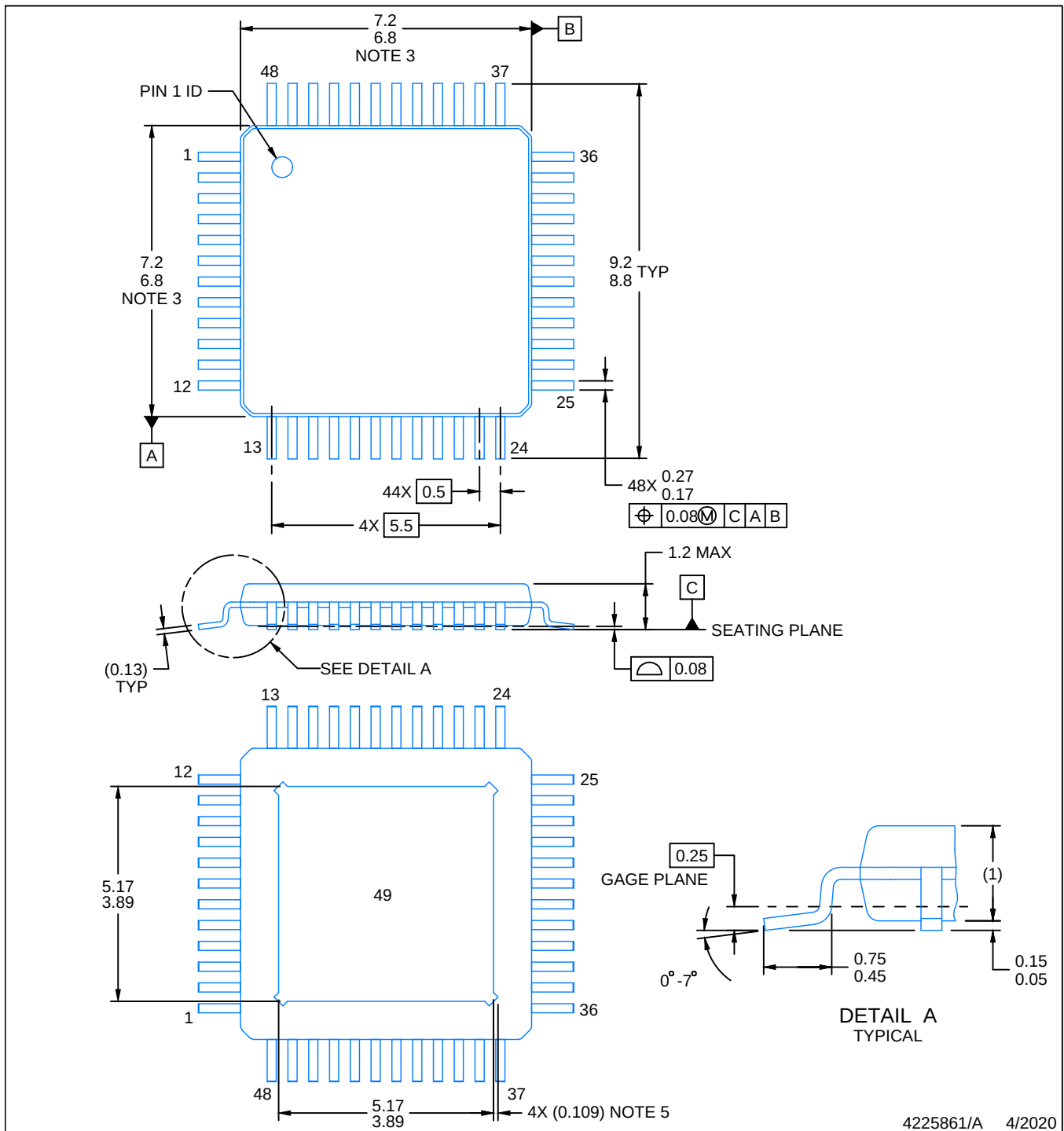


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PHP0048G

PowerPAD™ HTQFP - 1.2 mm max height

PLASTIC QUAD FLATPACK



NOTES:

PowerPAD is a trademark of Texas Instruments.

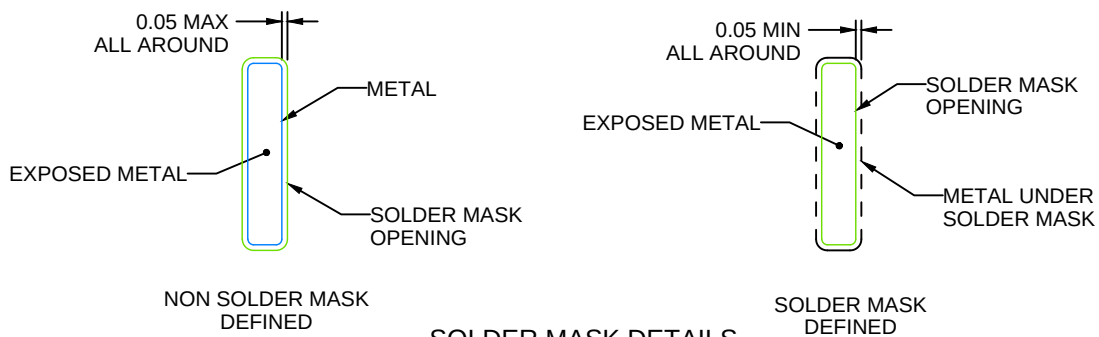
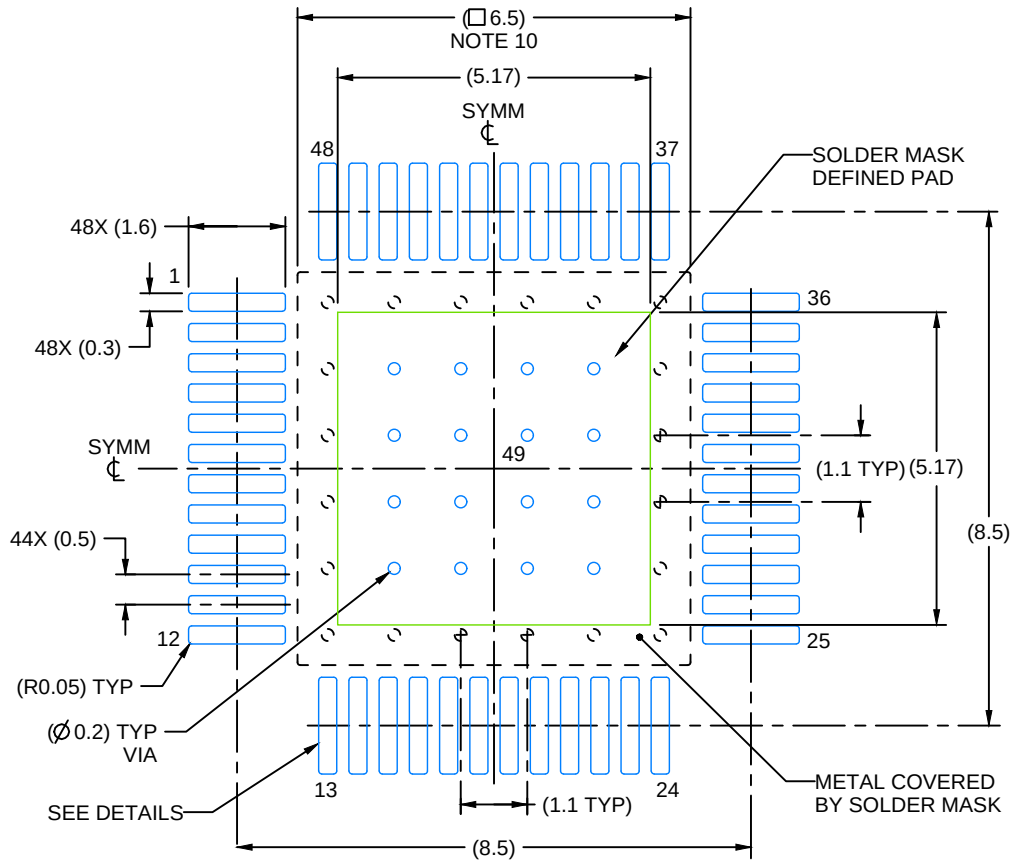
1. All linear dimensions are in millimeters. Any dimensions in parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.
3. This dimension does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or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



4225861/A 4/2020

NOTES: (continued)

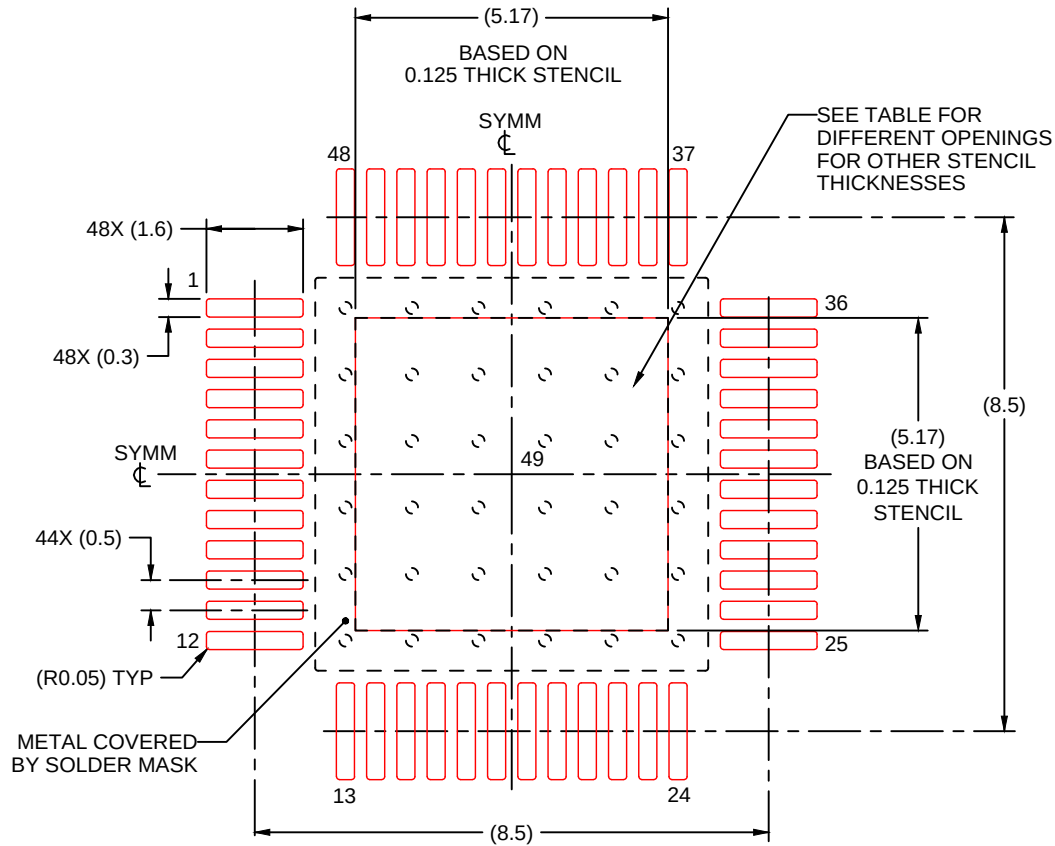
6. Publication IPC-7351 may have alternate designs.
7. Solder mask tolerances between and around signal pads can vary based on board fabrication site.
8. This package is designed to be soldered to a thermal pad on the board. See technical brief, Powerpad thermally enhanced package, Texas Instruments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

PowerPAD™ HTQFP - 1.2 mm max height

Technical drawing of a 48-pin Quad Flat Pack (QFP) component. The drawing includes a top view, a side view, and a detail view (Detail A).

Top View:

- Package width: 7.2 mm (6.8 mm typical)
- Package height: 9.2 mm (8.8 mm typical)
- Pin pitch: 0.5 mm
- Pin 1 ID (Identification Mark)
- Pin numbers: 1, 12, 13, 24, 25, 36, 37, 48
- Feature: 44X 0.5 (4x 5.5)
- Feature: 48X 0.27 0.17
- Feature: 0.08 (0.08) C A B

Side View:

- Maximum height: 1.2 MAX
- Seating Plane
- Feature: 0.08

Detail A (Typical):

- Feature: 0.25
- GAGE PLANE
- Feature: 0.75 0.45
- Feature: 0.15 0.05
- Feature: 0° - 7°
- Feature: (1)

Bottom View:

- Package width: 5.17 mm (4.40 mm typical)
- Package height: 5.17 mm (4.40 mm typical)
- Pin numbers: 1, 12, 13, 24, 25, 36, 37, 48
- Feature: 4X (0.109) NOTE 5

Notes:

- NOTE 3
- NOTE 5

Reference: 4229966/A 09/2023

PowerPAD is a trademark of Texas Instruments.

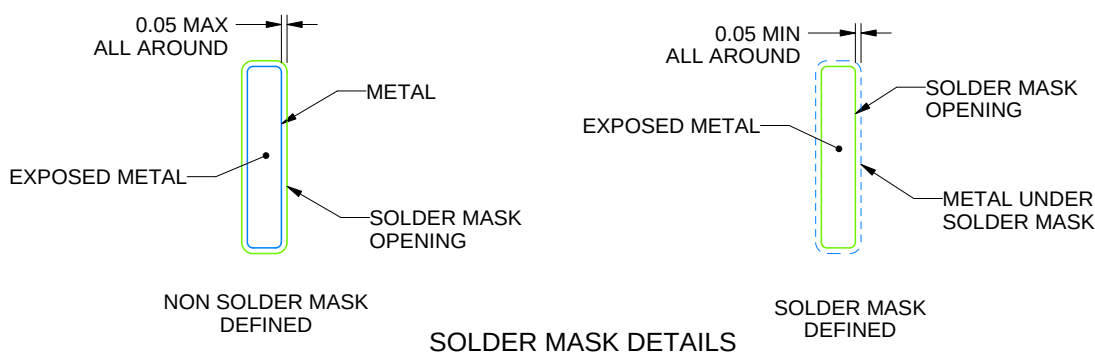
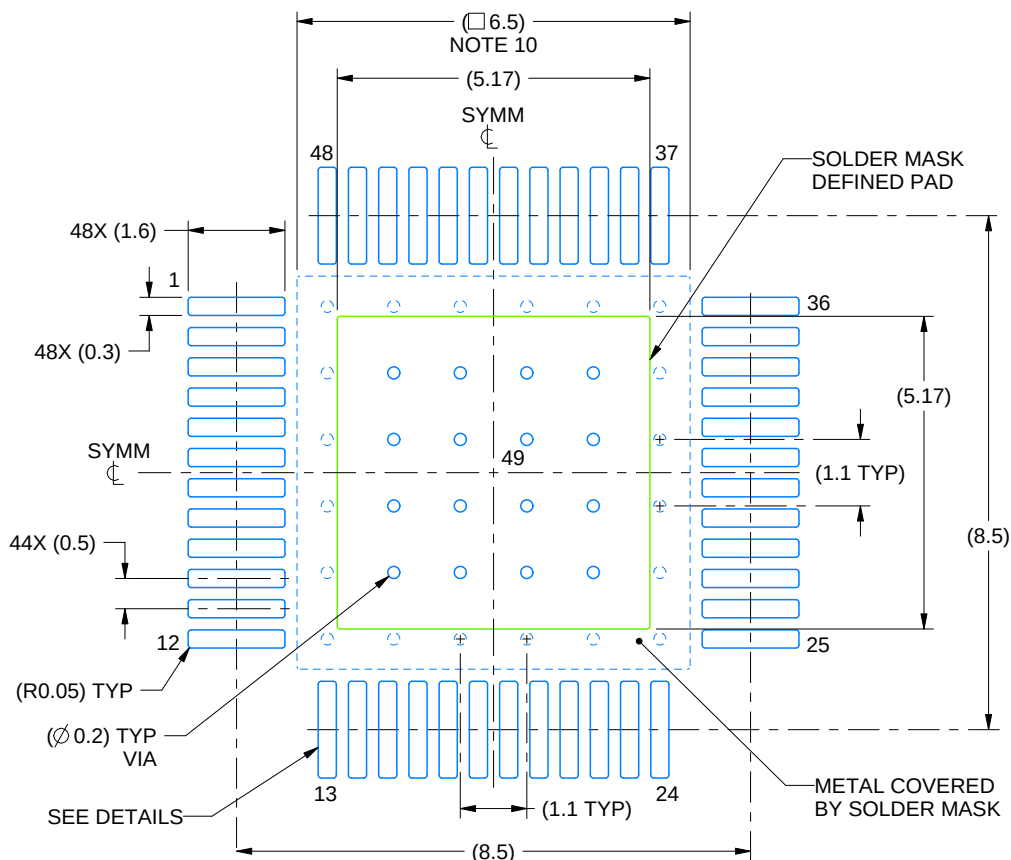
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4. Reference JEDEC registration MS-026.
5. Feature may not be present.

EXAMPLE BOARD LAYOUT

PHP0048N

PowerPAD™ HTQFP - 1.2 mm max height

PLASTIC QUAD FLATPACK



4229966/A 09/2023

NOTES: (continued)

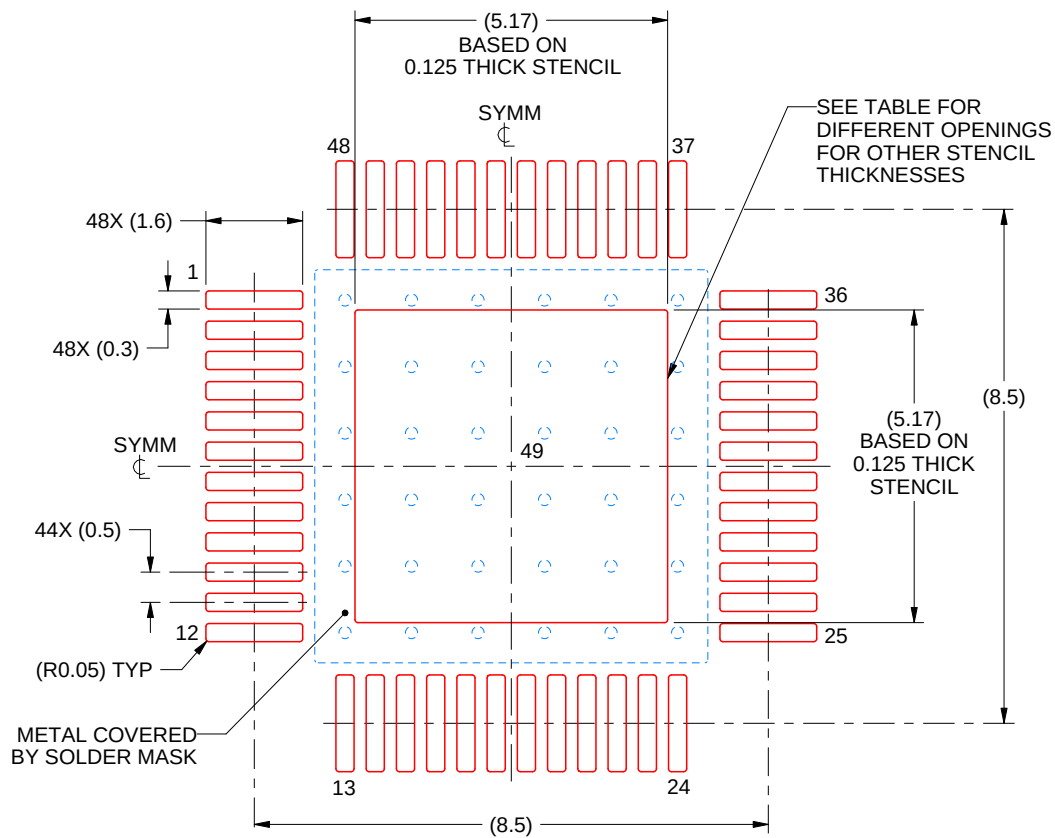
6. Publication IPC-7351 may have alternate designs.
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EXAMPLE STENCIL DESIGN

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
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4229966/A 09/2023

NOTES: (continued)

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12. Board assembly site may have different recommendations for stencil design.

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