

BQ79731-Q1 具有电压、电流和绝缘电阻监测功能、适用于 EV/BMS 高压汽车类应用的 UIR 传感器

1 特性

- 符合 AEC-Q100 标准, -40°C 至 $+125^{\circ}\text{C}$
- 以功能安全合规型为目标
 - 可提供用于 ISO 26262 系统设计的文档
 - 系统可满足 ASIL D 等级要求
 - 硬件可满足 ASIL D 等级要求
- 17 个单端电压通道
 - 高压电池包、链路、电荷测量精度 $< 0.2\%$
 - 电池包和电池 VI 同步至 64 μS
- 2 个独立的电流检测 ADC (BQ79731-Q1)
 - $\pm 0.05\%$ 增益误差漂移
 - 输入范围 = $\pm 275\text{mV}$
- 2 个过流检测比较器 (BQ79731-Q1)
 - $\pm 1\%$ 精度
 - 可选择的双向阈值
 - 可编程 OC
- 集成库仑计数 (BQ79731-Q1)
- 15 个具有 IO、I2C、SPI、ADC 和温度检测功能的 GPIO 输入
- 专用 MOSFET 开关驱动引脚
- 智能 SPI 控制器 HUB
 - 支持多个 SPI 外围器件
 - 用于触发接触器驱动器和热熔丝驱动器的 HW 引脚
- 与电池监测器 (如 18 节串联, BQ79718) 兼容的可堆叠和寄存器映射

2 应用

- 全电动、插电式混合动力和混合动力汽车

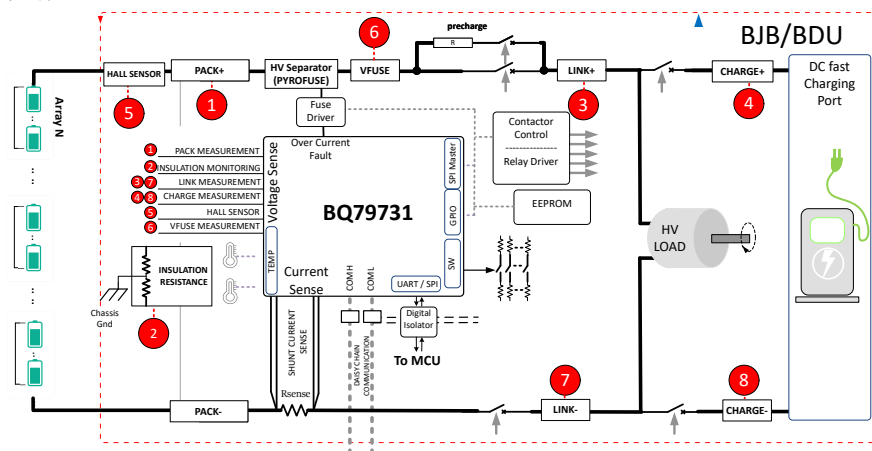
3 说明

该器件可用于测量电池系统中的高电压分压节点。它可以测量保险丝和接触器两端的电压,并检查电池接线盒 (BJB) 系统中的隔离电压。该器件具有两条支持低侧分流电阻器的集成式电流检测 (BQ79731-Q1) 路径。库仑计数 (BQ79731-Q1) 功能可用于进行精确的 SOC 计算。有 15 个 GPIO/辅助输入可用于高压测量、热敏电阻测量和驱动继电器。有 4 个 SW 输出可用于驱动测量路径中的 MOSFET 开关管。该器件可用作 SPI 集线器并与多达 8 个独立的 SPI 器件/组进行连接。可以使用 HW 引脚自主实现过流保护响应,以便在危险的过流事件中提供快速保护。隔离式双向菊花链端口支持基于电容器和变压器的隔离。该器件还可以通过 SPI 与 MCU 通信。

器件信息

器件型号	封装 ⁽¹⁾	封装尺寸 (标称值)
BQ79731-Q1	HTQFP (48 引脚)	7mm × 7mm
BQ79735-Q1 ⁽²⁾	HTQFP (48 引脚)	7mm × 7mm

- 如需了解所有可用封装,请参阅数据表末尾的可订购产品附录。
- 预发布



简化版系统图



4 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.

4.1 Device Support

4.1.1 第三方产品免责声明

TI 发布的与第三方产品或服务有关的信息，不能构成与此类产品或服务或保修的适用性有关的认可，不能构成此类产品或服务单独或与任何 TI 产品或服务一起的表示或认可。

4.2 Documentation Support

4.2.1 Related Documentation

4.3 接收文档更新通知

要接收文档更新通知，请导航至 ti.com 上的器件产品文件夹。点击 [订阅更新](#) 进行注册，即可每周接收产品信息更改摘要。有关更改的详细信息，请查看任何已修订文档中包含的修订历史记录。

4.4 支持资源

[TI E2E™ 支持论坛](#) 是工程师的重要参考资料，可直接从专家获得快速、经过验证的解答和设计帮助。搜索现有解答或提出自己的问题可获得所需的快速设计帮助。

链接的内容由各个贡献者“按原样”提供。这些内容并不构成 TI 技术规范，并且不一定反映 TI 的观点；请参阅 TI 的《使用条款》。

4.5 Trademarks

TI E2E™ is a trademark of Texas Instruments.

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4.6 静电放电警告



静电放电 (ESD) 会损坏这个集成电路。德州仪器 (TI) 建议通过适当的预防措施处理所有集成电路。如果不遵守正确的处理和安装程序，可能会损坏集成电路。

ESD 的损坏小至导致微小的性能降级，大至整个器件故障。精密的集成电路可能更容易受到损坏，这是因为非常细微的参数更改都可能会导致器件与其发布的规格不相符。

4.7 术语表

TI 术语表

本术语表列出并解释了术语、首字母缩略词和定义。

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.

5.1 Package Option Addendum

Packaging Information

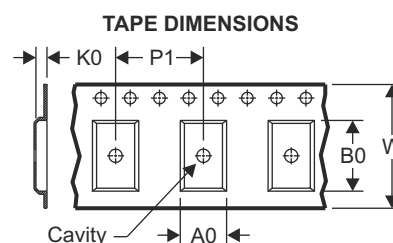
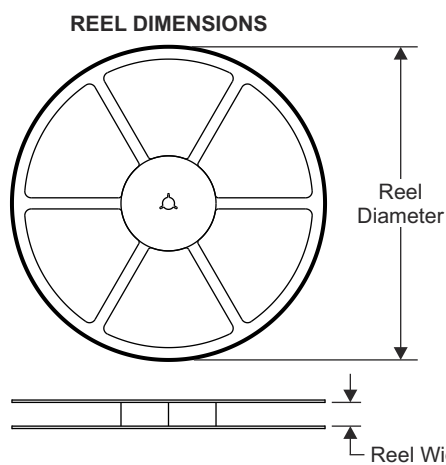
Orderable Device	Status ⁽¹⁾	Package Type	Package Drawing	Pins	Package Qty	Eco Plan ⁽²⁾	Lead/Ball Finish ⁽⁶⁾	MSL Peak Temp ⁽³⁾	Op Temp (°C)	Device Marking ^{(4) (5)}
PBQ79731PHP TQ1	PRE_PROD	HTQFP	PHP	48	250	RoHS & Green	NiPdAu	MSL-3-260C-16 8 HR	-40 to 125C	PBQ79731A0
PBQ79735PHP TQ1	PREVIEW	HTQFP	PHP	48	250	RoHS & Green	NiPdAu	MSL-3-260C-16 8 HR	-40 to 125C	

- (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.
PRE_PROD Unannounced device, not in production, not available for mass market, nor on the web, samples not available.
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) Eco Plan - The planned eco-friendly classification: Pb-Free (RoHS), Pb-Free (RoHS Exempt), or Green (RoHS & no Sb/Br) - please check www.ti.com/productcontent for the latest availability information and additional product content details.
TBD: The Pb-Free/Green conversion plan has not been defined.
Pb-Free (RoHS): TI's terms "Lead-Free" or "Pb-Free" mean semiconductor products that are compatible with the current RoHS requirements for all 6 substances, including the requirement that lead not exceed 0.1% by weight in homogeneous materials. Where designed to be soldered at high temperatures, TI Pb-Free products are suitable for use in specified lead-free processes.
Pb-Free (RoHS Exempt): This component has a RoHS exemption for either 1) lead-based flip-chip solder bumps used between the die and package, or 2) lead-based die adhesive used between the die and leadframe. The component is otherwise considered Pb-Free (RoHS compatible) as defined above.
Green (RoHS & no Sb/Br): TI defines "Green" to mean Pb-Free (RoHS compatible), and free of Bromine (Br) and Antimony (Sb) based flame retardants (Br or Sb do not exceed 0.1% by weight in homogeneous material).
- (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/Ball Finish - Orderable Devices may have multiple material finish options. Finish options are separated by a vertical ruled line. Lead/Ball Finish values may wrap to two lines if the finish value exceeds the maximum column width.

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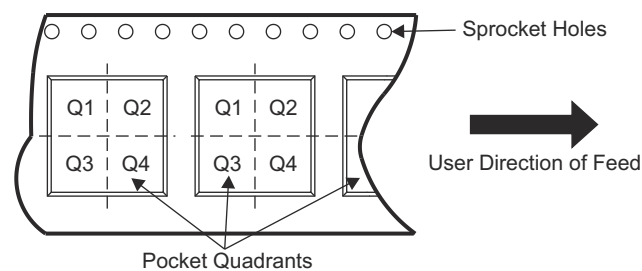
In no event shall TI's liability arising out of such information exceed the total purchase price of the TI part(s) at issue in this document sold by TI to Customer on an annual basis.

5.2 Tape and Reel Information



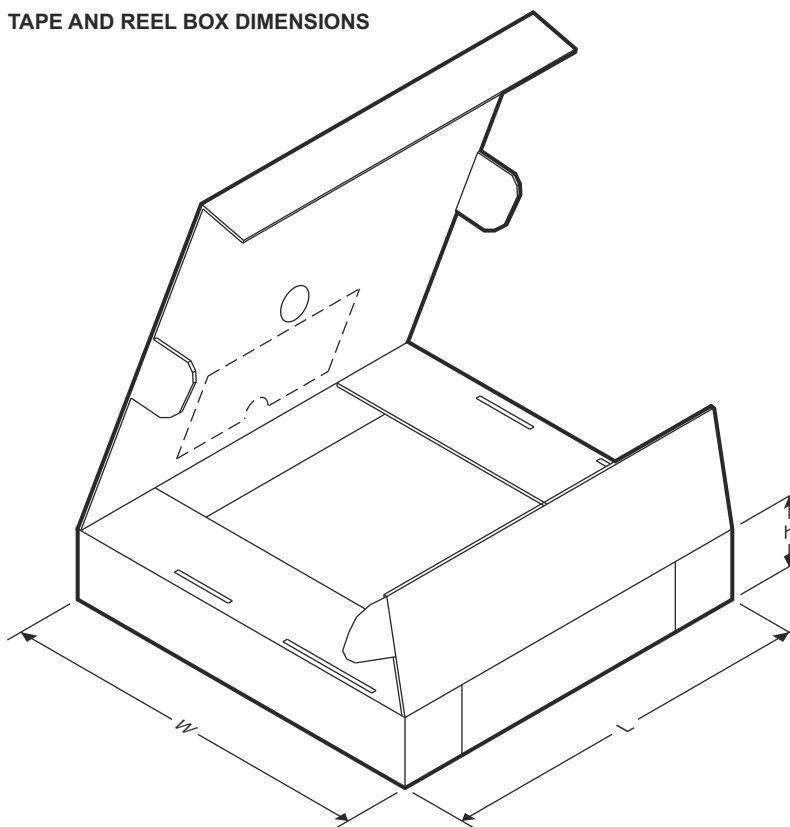
A0	Dimension designed to accommodate the component width
B0	Dimension designed to accommodate the component length
K0	Dimension designed to accommodate the component thickness
W	Overall width of the carrier tape
P1	Pitch between successive cavity centers

QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE



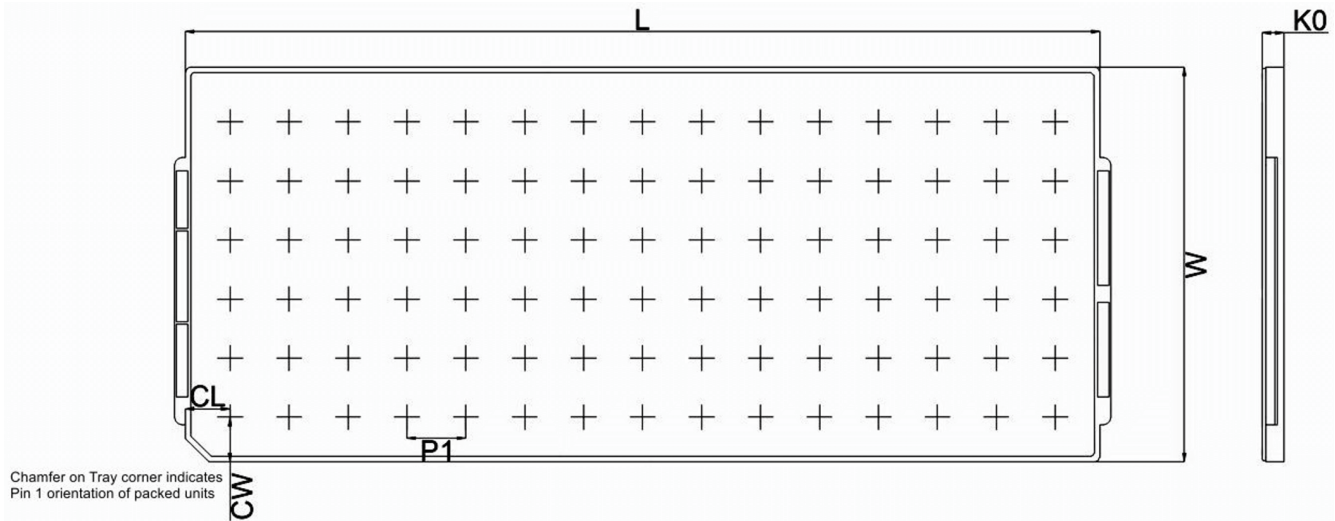
Device	Package Type	Package Drawing	Pins	SPQ	Reel Diameter (mm)	Reel Width W1 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P1 (mm)	W (mm)	Pin1 Quadrant
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TAPE AND REEL BOX DIMENSIONS



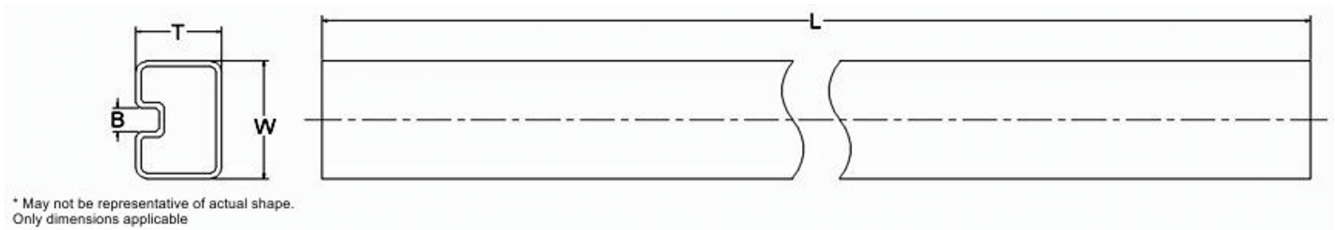
Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
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5.3 Tray Information



Device	Package Type	Package Name	Pins	SPQ	Configuration	Unit Array Matrix	Max Temp. (Deg C)	L (mm)	W (mm)	K0 (mm)	P1 (mm)	CL (mm)	CW (mm)
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5.4 Tube Information



Device	Package Type	Package Name	Pins	SPQ	L (mm)	W (mm)	T (mm)	B (mm)
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5.5 Mechanical Data

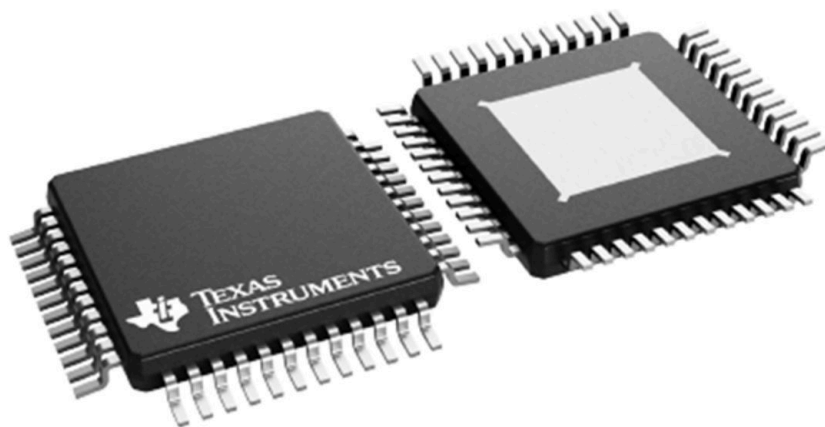
PHP 48

7 x 7, 0.5 mm pitch

TQFP - 1.2 mm max height

QUAD FLATPACK

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



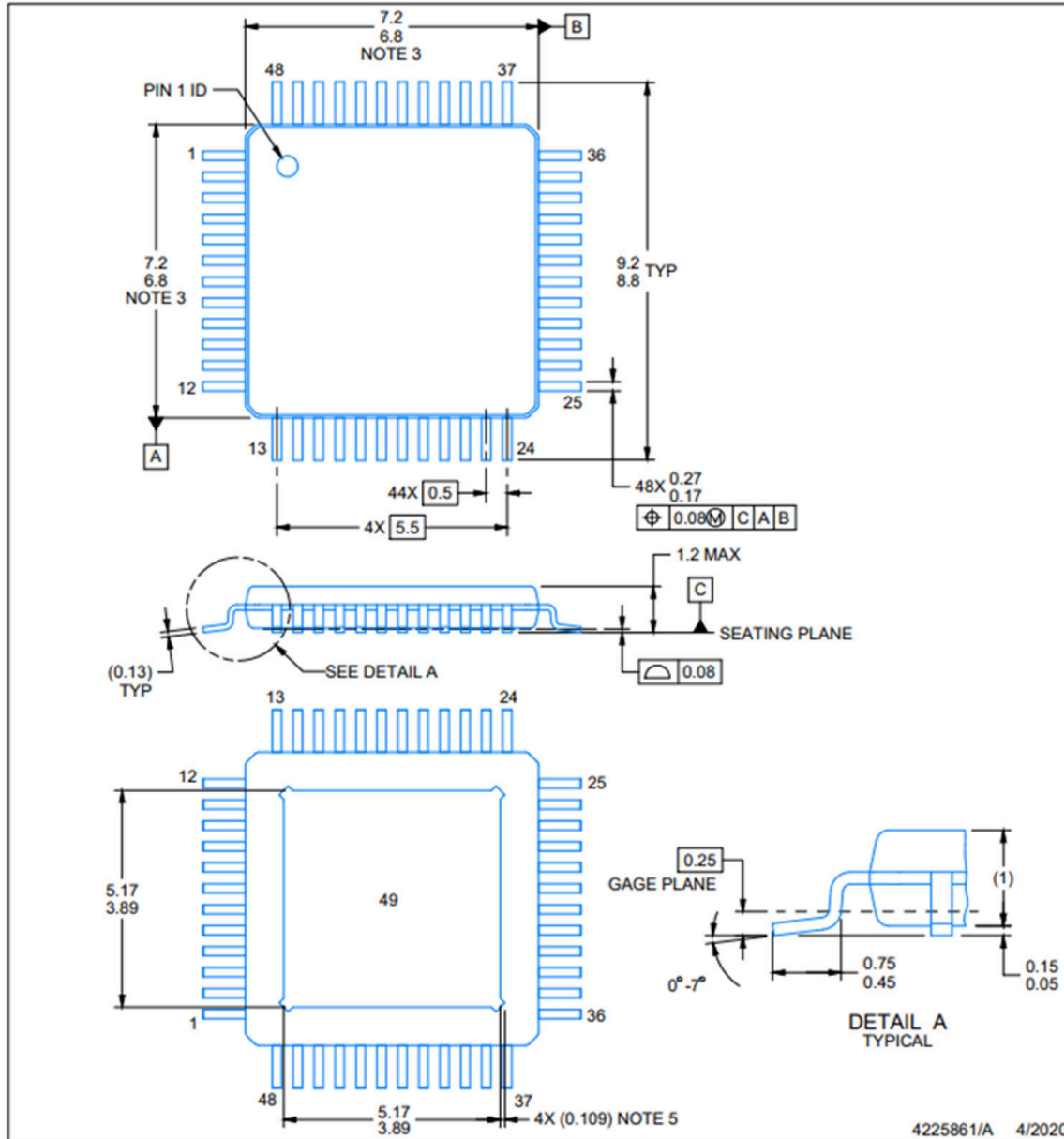
ADVANCE INFORMATION

PACKAGE OUTLINE

PHP0048G

PowerPAD™ HTQFP - 1.2 mm max height

PLASTIC QUAD FLATPACK



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

PowerPAD is a trademark of Texas Instruments.

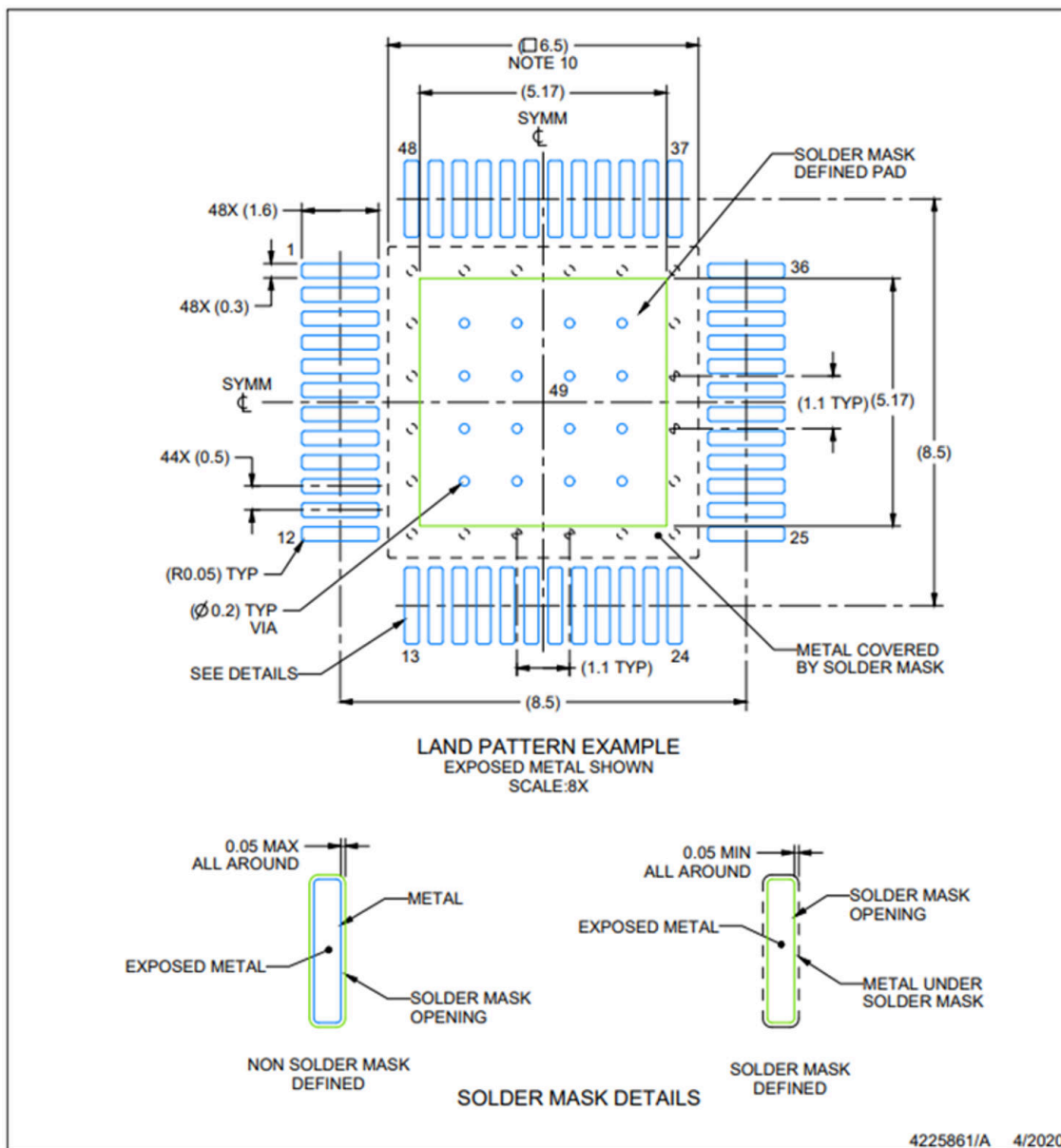
4225861/A 4/2020

EXAMPLE BOARD LAYOUT

PHP0048G

PowerPAD™ HTQFP - 1.2 mm max height

PLASTIC QUAD FLATPACK



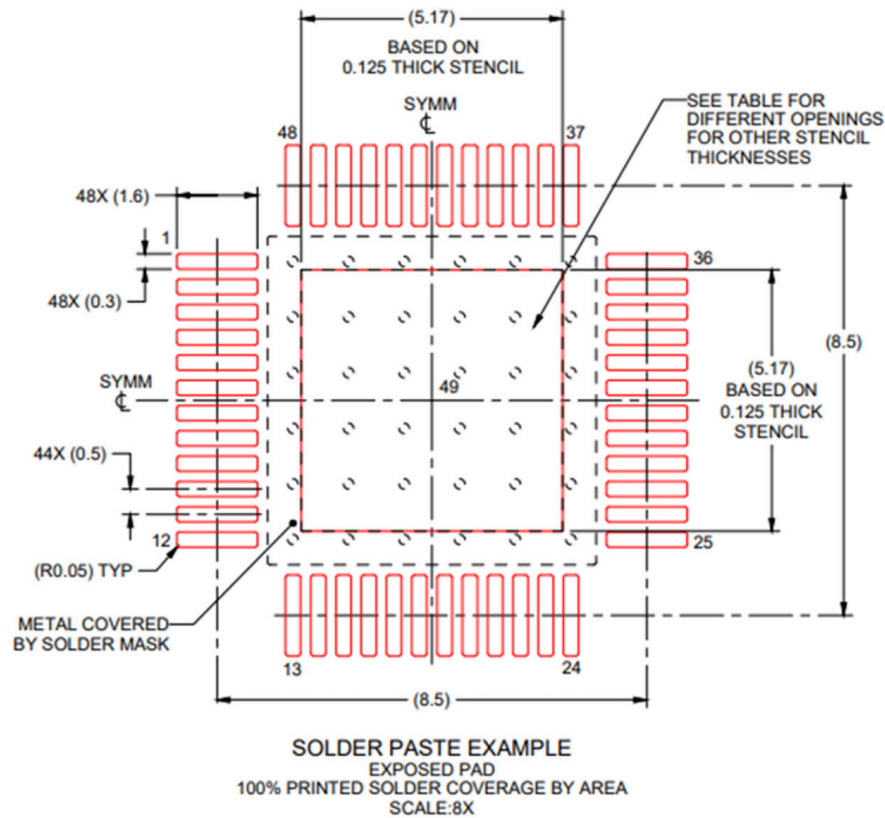
NOTES: (continued)

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.

ADVANCE INFORMATION

EXAMPLE STENCIL DESIGN**PHP0048G****PowerPAD™ HTQFP - 1.2 mm max height**

PLASTIC QUAD FLATPACK



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.

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
BQ79731PHPRQ1	ACTIVE	HTQFP	PHP	48	1000	RoHS & Green	NIPDAU	Level-3-260C-168 HR	-40 to 125	BQ79731Q	Samples

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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.

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GENERIC PACKAGE VIEW

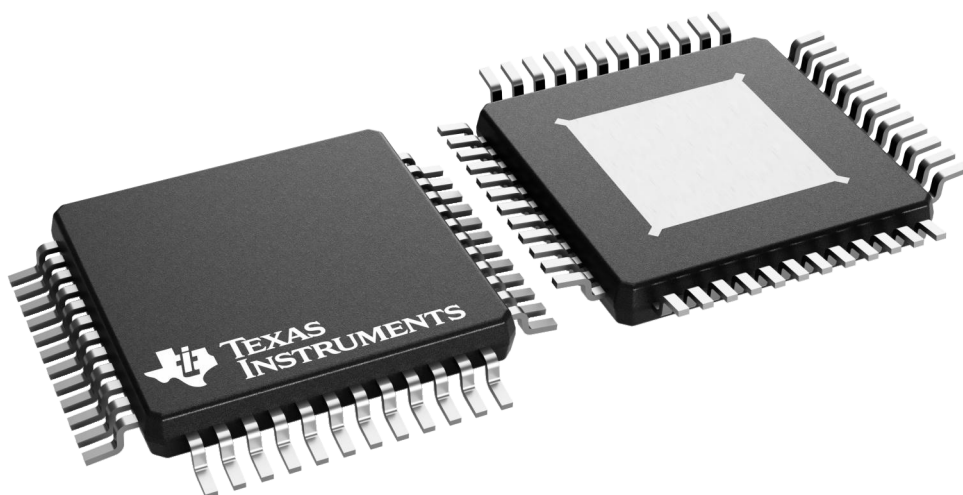
PHP 48

TQFP - 1.2 mm max height

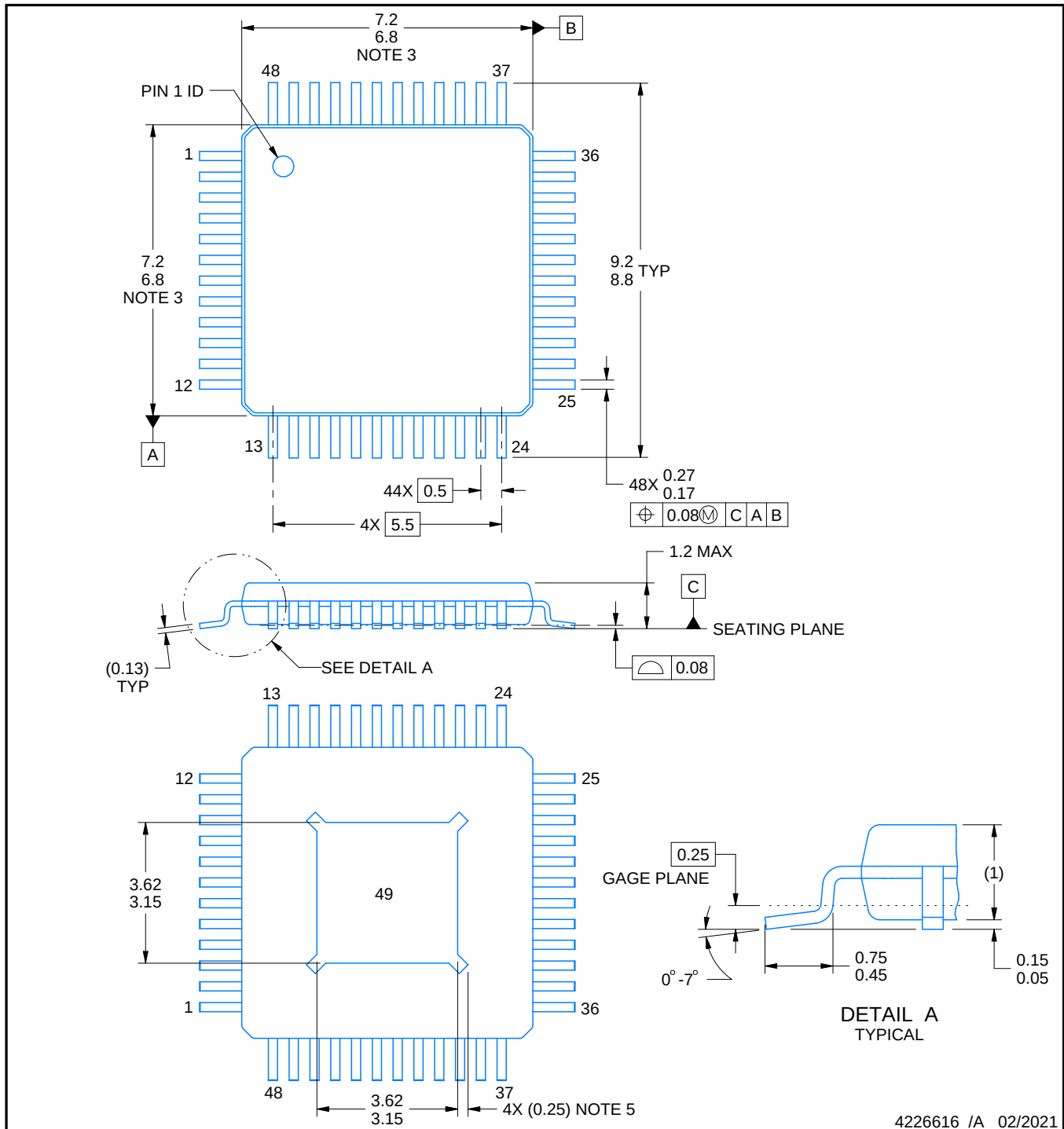
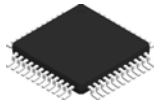
7 x 7, 0.5 mm pitch

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



4226616 /A 02/2021

NOTES:

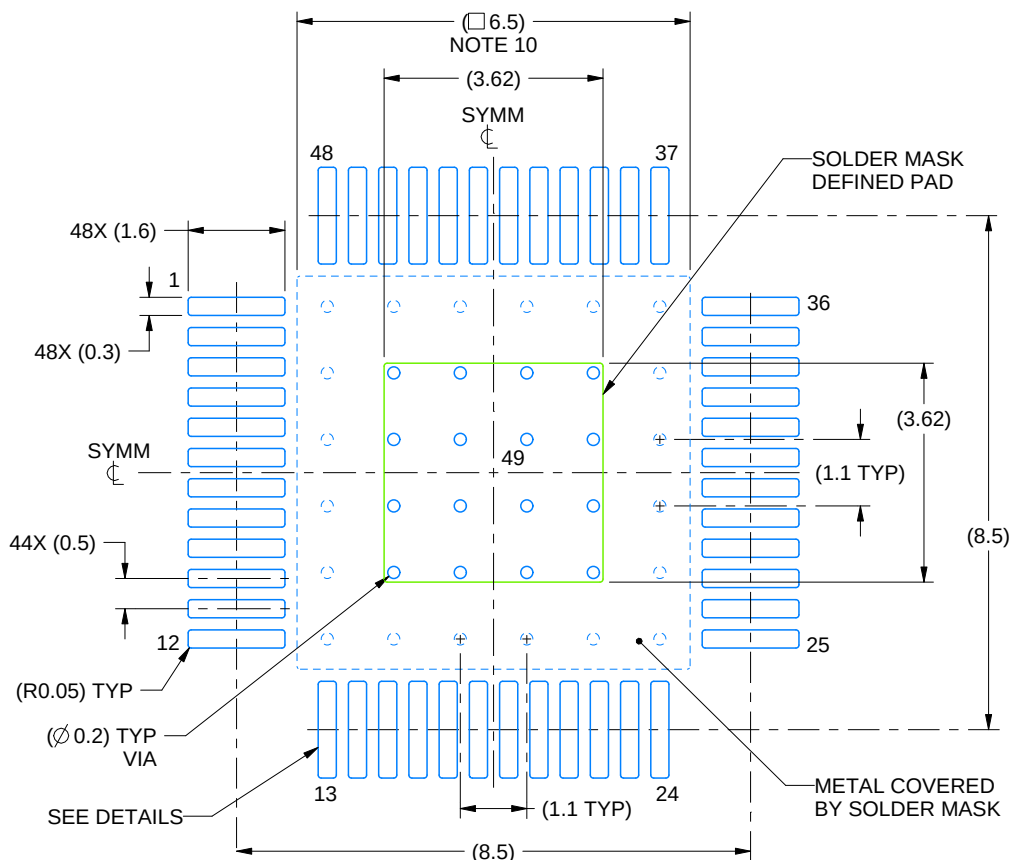
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1. All linear dimensions are in millimeters. Any dimensions in parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.
3. This dimension does not include mold flash, protrusions,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

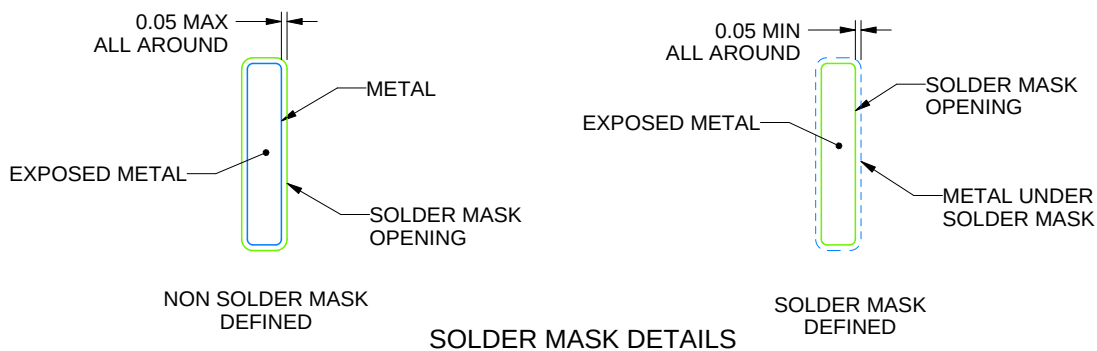
EXAMPLE BOARD LAYOUT

PHP0048E

PowerPAD™ HTQFP - 1.2 mm max height



LAND PATTERN EXAMPLE
EXPOSED METAL SHOWN
SCALE:8X



SOLDER MASK DETAILS

4226616 /A 02/2021

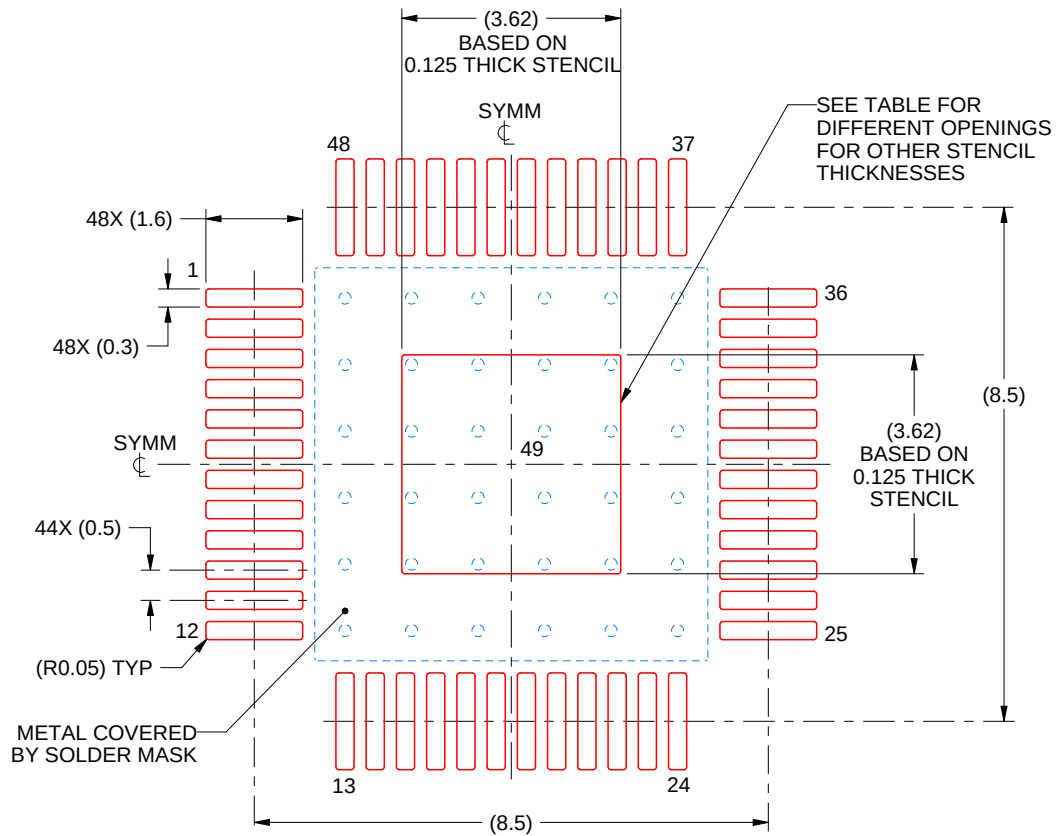
NOTES: (continued)

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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

PHP0048E

PowerPAD™ HTQFP - 1.2 mm max height



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

STENCIL THICKNESS	SOLDER STENCIL OPENING
0.1	4.05 X 4.05
0.125	3.62 x 3.62 (SHOWN)
0.150	3.30 x 3.30
0.175	3.06 x 3.06

4226616 /A 02/2021

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.

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