

TPS653860/61-Q1 适用于安全相关应用的电源管理 IC

1 特性

- 符合汽车应用要求
- 具有符合 AEC-Q100 的下列结果：
 - 器件温度等级 1：-40°C 至 +125°C 环境工作温度范围
 - 器件温度等级 0：-40°C 至 +150°C 环境工作温度范围
 - 器件 HBM ESD 分类等级 2
 - 器件 CDM ESD 分类等级 C4B
- 功能安全合规型 (目标, 在器件发布时确认)
 - 专为功能安全应用开发
 - 可提供帮助使 ISO 26262 系统设计符合 ASIL D 的文档
 - 可满足 ASIL D 要求的系统功能和硬件完整性
- 输入电压范围
 - 初始上电电压为 5V 至 36V
 - 初始上电后正常运行电压为 3.5V 至 36V, 工作电压限制为 2.3V
- 输出电源轨
 - 同步降压/升压前置稳压器具有可配置的展频, 4.3V、5V 或 6V 以及低 IQ 模式, 具有以下选项：
 - 降压模式下为 2.8A (选项 0 型号)
 - 降压模式下为 1.5A (选项 1 型号)
 - 四 LDO：1.0V 至 1.8V (阶跃为 50mV)、2.5V、3.0V、3.3V、5V, 旁路或电压监控模式。每个 LDO 都具有独立的可配置电流限值。
 - LDO1 和 LDO2：低 IQ, 高达 600mA
 - LDO3 和 LDO4：低噪声、低 IQ、1% 精度, 高达 200mA
 - 用于传感器或外设电源的两个受保护 LDO：PLDO1 和 PLDO2
 - 可配置为跟踪模式或固定输出：1.0V 至 1.8V (阶跃为 50mV)、2.5V、3.0V、3.3V 或 5V, 电流高达 200mA
 - 机箱短路 (-2V) 和电源 (+36V) 保护
- 电源序列控制：
 - 可配置的上电和断电序列 (NVM 默认值包括输出电压)
 - 可包括输出轨、外部电压监控器和外部使能信号
- 监控、保护和诊断
 - 监控所有稳压器输出、电池电压和内部电源的欠压和过压情况

- 两个外部电压监控器 (引脚)
- 通过独立的电流限值对所有稳压器输出进行保护
- 所有稳压器均具有独立的过热预警和关断保护
- 看门狗：可配置为打开和关闭窗口或问答
- 错误信号监视器 (ESM) 用于监控 MCU 错误输出 (PWM 和电平模式)
- 用于器件和系统保护的 SAFE 状态
- 用于内部振荡器的时钟监视器
- 模拟和逻辑内置自检 (BIST)
- 对非易失性存储器 (NVM)、器件配置寄存器和 SPI 通信进行 CRC
- 诊断输出引脚：将模拟和数字信号多路复用至 MCU ADC 和输入
- 比较模块：2 个通道可配置为通用比较器, 或多达 4 个通道用于电压监控
- 用于唤醒和测量的计时器 (低 IQ), 范围为 64 μ s 至 203.6 天
- 用于配置、状态和错误报告的 SPI
- 复位输出 (NRST)、两个可配置安全输出 (SAFE_OUTx), 用于在检测到故障中断输出 (NINT) 时指示系统安全状态, 以及电源正常输出 (PGOOD)
- 两个可配置唤醒引脚 (WAKEx)
- 48 引脚散热薄型小外形尺寸 (HTSSOP) PowerPAD™ IC 封装

2 应用

- 安全相关汽车应用

3 说明

TPS65386x-Q1 器件是一款多轨电源, 旨在为安全相关应用中的微控制器、传感器、收发器和外设供电。

封装信息

器件型号 ⁽²⁾	前置稳压器	封装 ⁽¹⁾
TPS653860-Q1	降压/升压 2.8A	DCA (HTSSOP, 48)
TPS653861-Q1	降压/升压 1.5A	DCA (HTSSOP, 48)

- 如需了解所有可用封装及更多信息, 请参阅数据表末尾的节 6, 机械封装和可订购信息。
- 有关器件子系列型号和 NVM 默认配置选项的更多详细信息, 请参阅器件比较表。



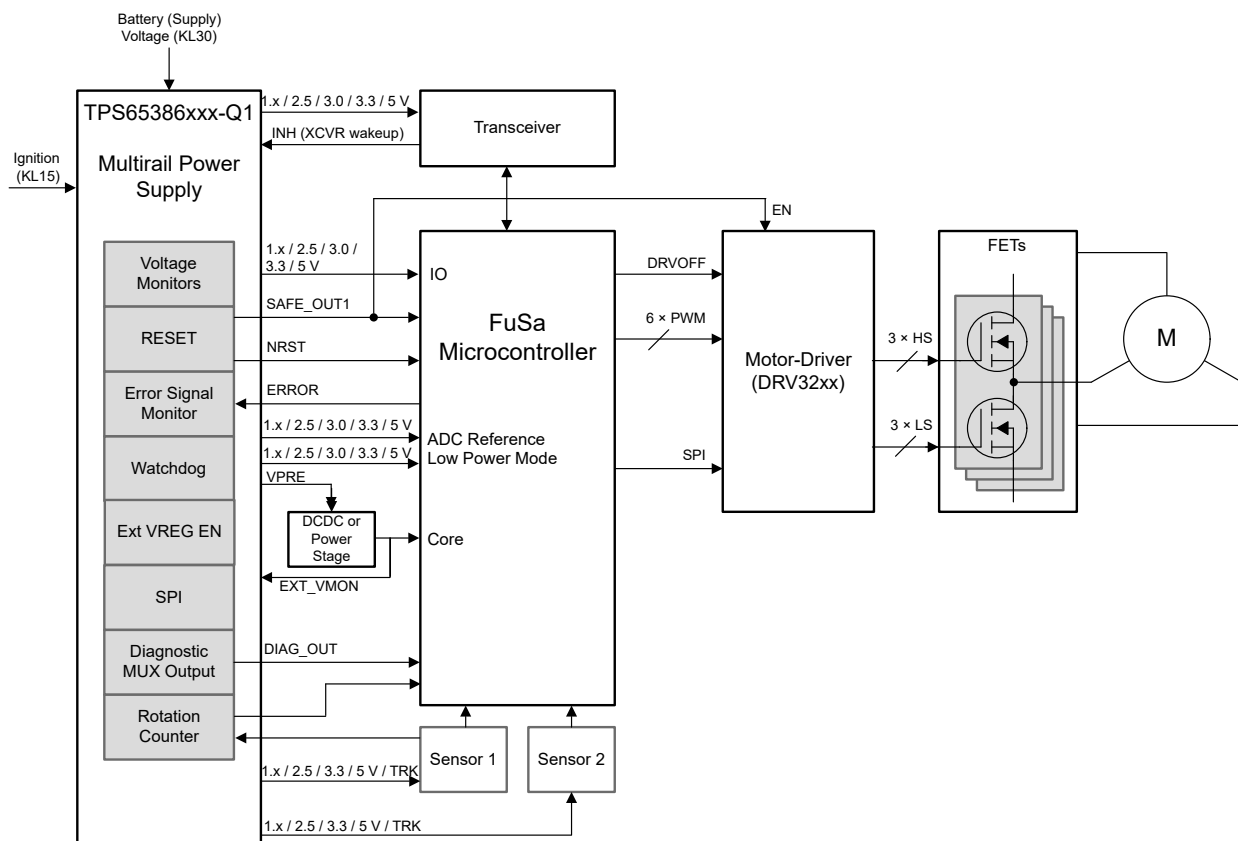


图 3-1. 典型应用图

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4 Device and Documentation Support

4.1 Documentation Support

4.1.1 Related Documentation

For related documentation see the following:

- Texas Instruments, full data sheet, application notes and functional safety information such as the Functional Safety Manual for TPS65386zyz-Q1 Multirail Power Supply, are available under non-disclosure agreement. Request more information using the link on the www.ti.com product folder, [TPS653860-Q1](#) or [TPS653861-Q1](#).
- Texas instruments, [A Guide to Board Layout for Best Thermal Resistance for Exposed Packages application report](#)
- Texas instruments, [PowerPAD™ Made Easy application report](#)
- Texas instruments, [PowerPAD™ Thermally Enhanced Package application report](#)

4.1.2 Related Links

The table below lists quick access links. Categories include technical documents, support and community resources, tools and software, and quick access to order now.

4.2 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 [通知](#) 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。

4.3 支持资源

[TI E2E™ 中文支持论坛](#) 是工程师的重要参考资料，可直接从专家处获得快速、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，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](#)。

4.4 Trademarks

PowerPAD™ and TI E2E™ are trademarks of Texas Instruments.

所有商标均为其各自所有者的财产。

4.5 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。

4.6 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 Revision History

注：以前版本的页码可能与当前版本的页码不同

表 5-1. Revision History

DATE	REVISION	NOTES
October 2023	*	Advance Information

6 Mechanical, Packaging, and Orderable Information

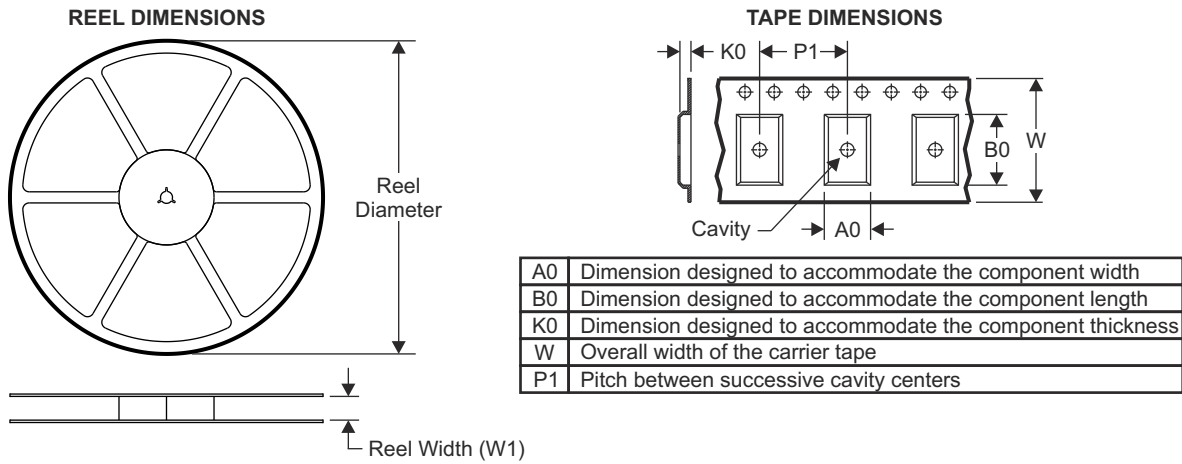
The following pages include mechanical packaging and orderable information. This information is the most current data available for the designated devices. This data is subject to change without notice and revision of this document. For browser-based versions of this data sheet, refer to the left-hand navigation.

6.1 Package Option Addendum

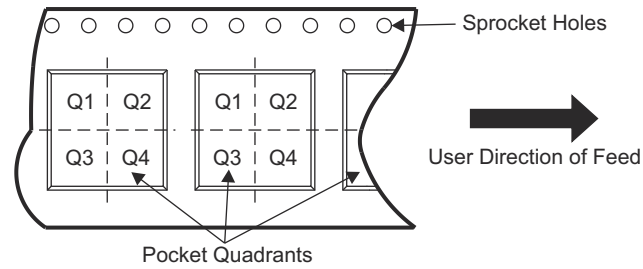
Orderable Device	Status ⁽¹⁾	Package Type	Package Drawing	Pins	Package Qty	Eco Plan ⁽²⁾	Lead/Ball Finish	MSL Peak Temp ⁽³⁾	Op Temp (°C)	Device Marking ^{(4) (5)}
See Device TRM for Grade 1 Device	See Device TRM	HTSSOP	DCA	48	2000	Green (RoHS & no Sb/Br)	CU NiPdAu	Level-3-260C-168 HR	-40 to 125	See Device TRM
See Device TRM for Grade 0 Device	See Device TRM	HTSSOP	DCA	48	2000	Green (RoHS & no Sb/Br)	CU NiPdAu	Level-3-260C-168 HR	-40 to 150	See Device TRM

- (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 <http://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 on 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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6.2 Tape and Reel Information

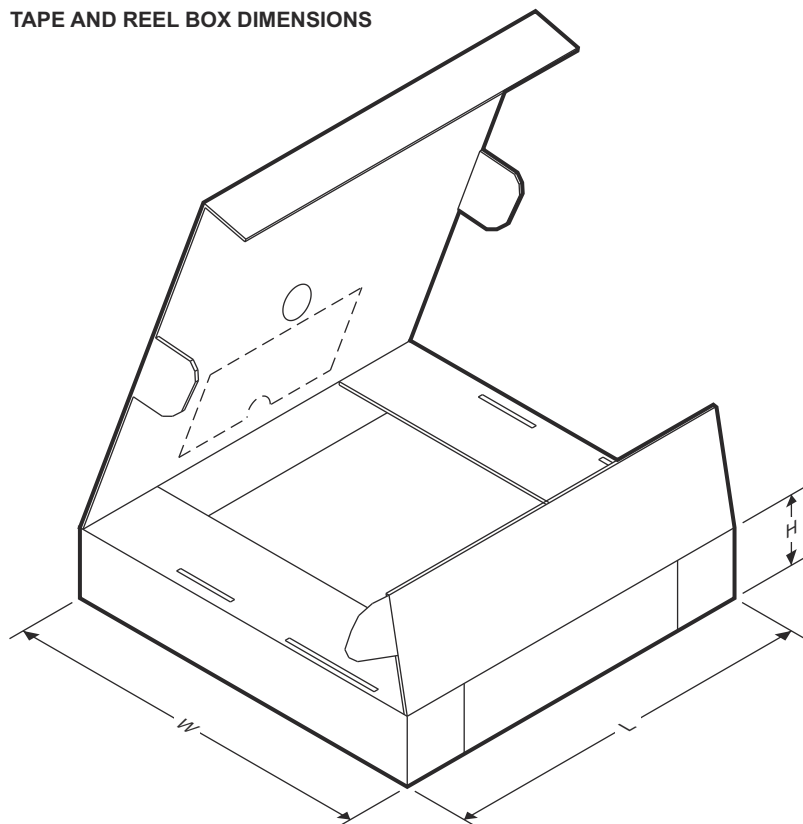


QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE



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
O386003QDCARQ1	HTSSOP	DCA	48	2000	330	24.4	8.6	15.8	1.8	12	24	1

TAPE AND REEL BOX DIMENSIONS



Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
TPS6538600QDCARQ1	HTSSOP	DCA	48	2000	367	367	45
TPS6538600EDCARQ1	HTSSOP	DCA	48	2000	367	367	45

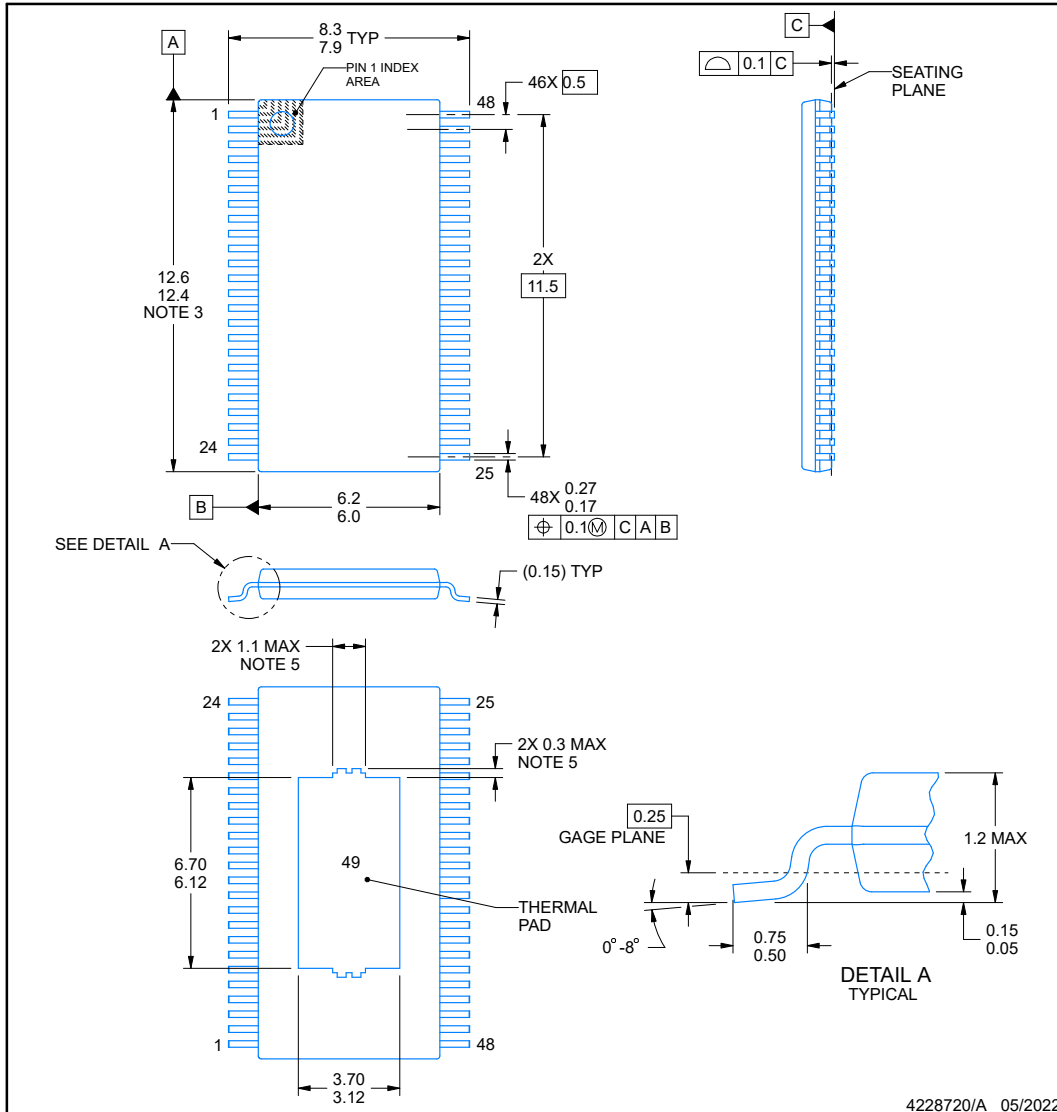


PACKAGE OUTLINE

DCA0048J

PowerPAD™ TSSOP - 1.2 mm max height

SMALL OUTLINE PACKAGE



NOTES:

PowerPAD is a trademark of Texas Instruments.

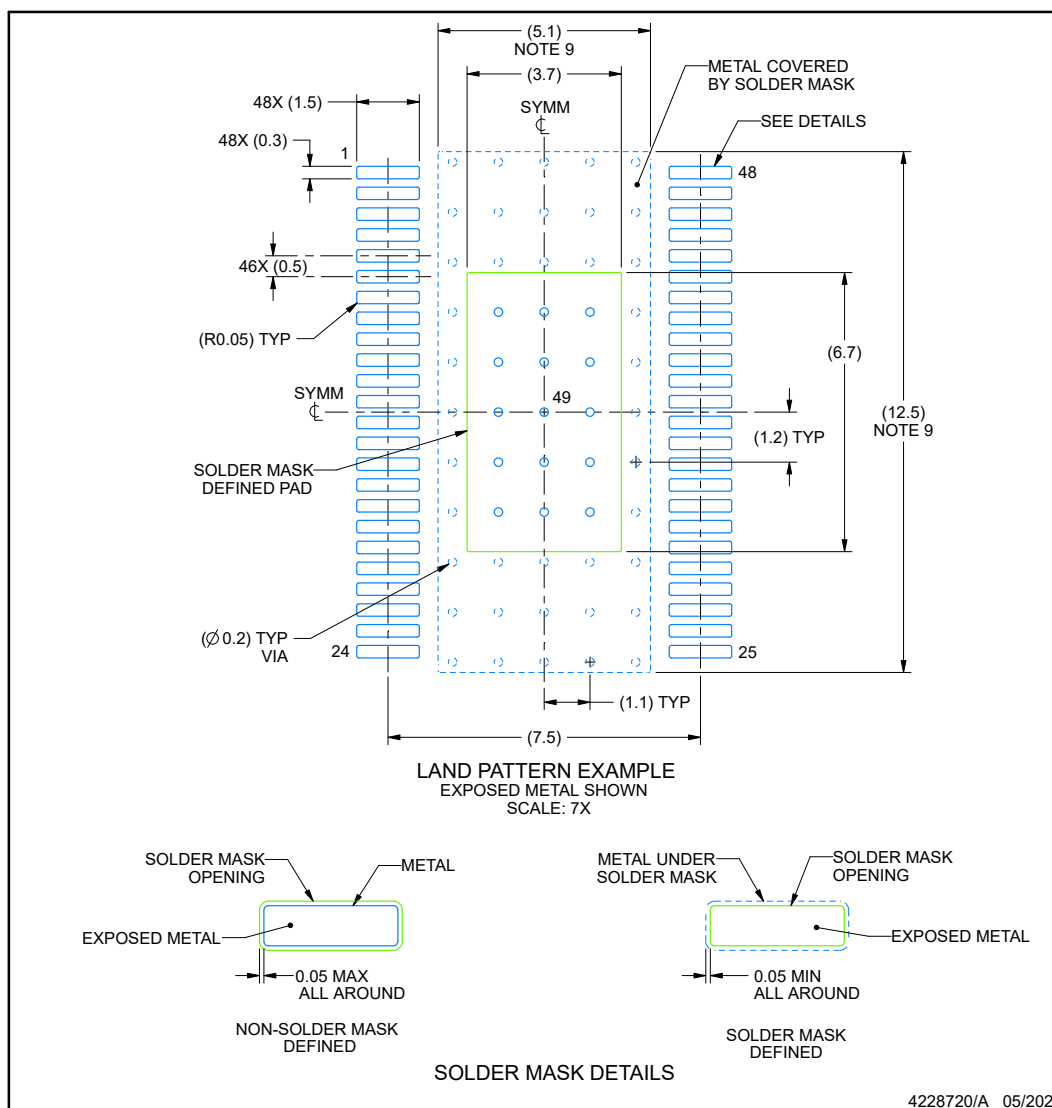
1. All linear dimensions are in millimeters. Any dimensions in parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.
3. This dimension does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed 0.15 mm per side.
4. Reference JEDEC registration MO-153.
5. Features may differ or may not be present.

EXAMPLE BOARD LAYOUT

DCA0048J

PowerPAD™ TSSOP - 1.2 mm max height

SMALL OUTLINE PACKAGE



NOTES: (continued)

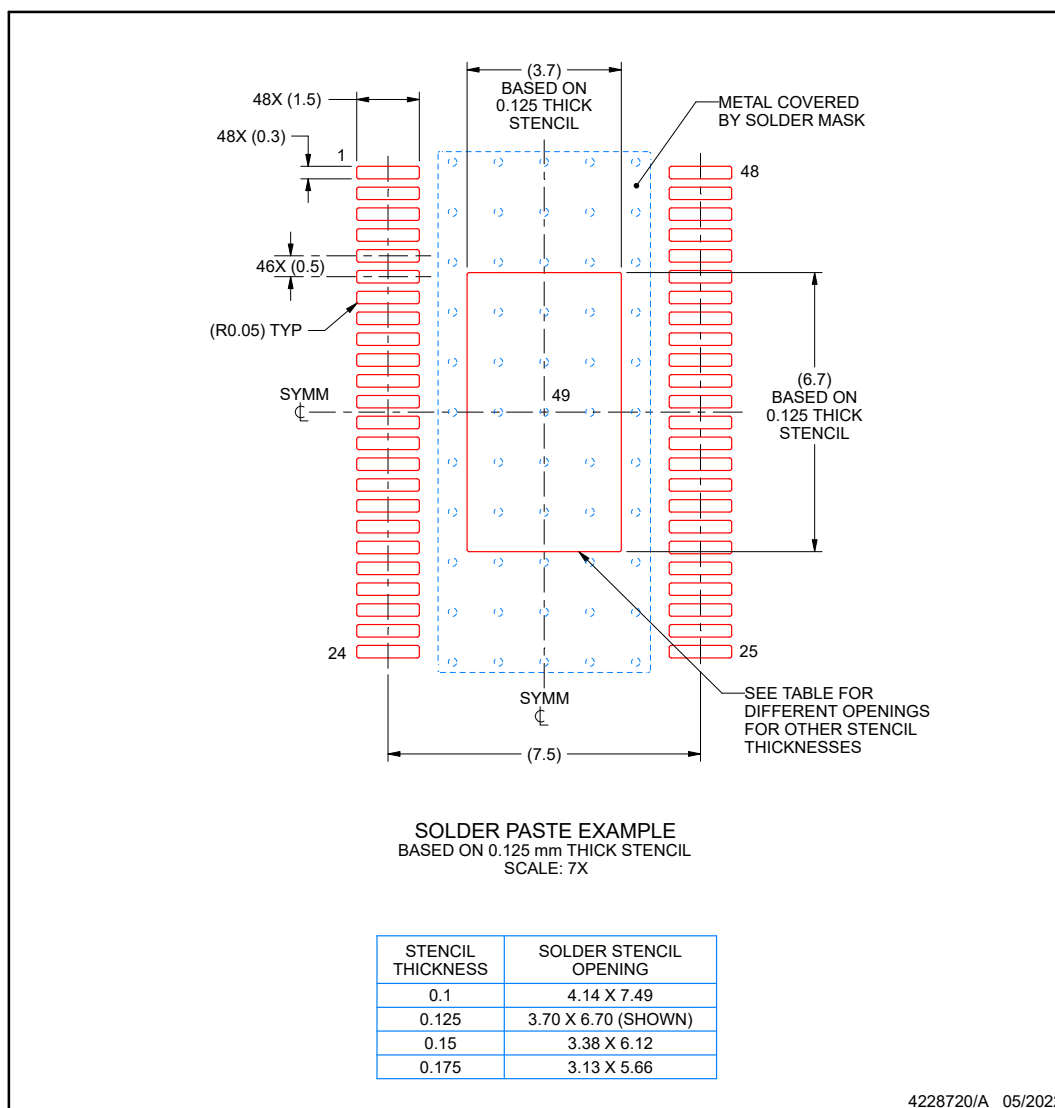
6. Publication IPC-7351 may have alternate designs.
7. Solder mask tolerances between and around signal pads can vary based on board fabrication site.
8. This package is designed to be soldered to a thermal pad on the board. For more information, see Texas Instruments literature numbers SLMA002 (www.ti.com/lit/slma002) and SLMA004 (www.ti.com/lit/slma004).
9. Size of metal pad may vary due to creepage requirement.
10. Vias are optional depending on application, refer to device data sheet. It is recommended that vias under paste be filled, plugged or tented.

EXAMPLE STENCIL DESIGN

DCA0048J

PowerPAD™ TSSOP - 1.2 mm max height

SMALL OUTLINE PACKAGE



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.

REVISIONS				
REV	DESCRIPTION	ECR	DATE	ENGINEER / DRAFTER
A	RELEASE NEW DRAWING	2199680	05/10/2022	J. MILLER / K. SINCERBOX

SCALE

SIZE

4228720

REV

PAGE

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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
PO386003QDCARQ1	ACTIVE	HTSSOP	DCA	48	2500	TBD	Call TI	Call TI	-40 to 125		Samples

(1) The marketing status values are defined as follows:

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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.

(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.

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GENERIC PACKAGE VIEW

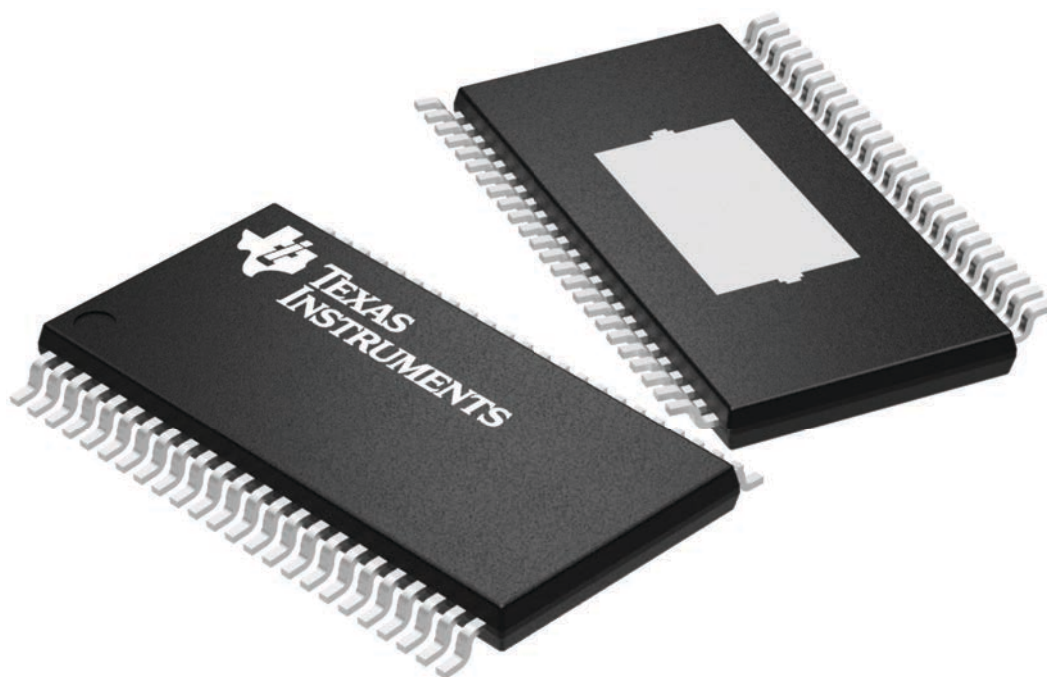
DCA 48

HTSSOP - 1.2 mm max height

12.5 x 6.1, 0.5 mm pitch

SMALL OUTLINE PACKAGE

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



4224608/A

重要声明和免责声明

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