

TPS92530-Q1 汽车类 3 通道、恒流、恒压同步降压 LED 驱动器

1 特性

- 符合面向汽车应用的 AEC-Q100 标准
 - 1 级: -40°C 至 125°C 的工作环境温度范围
 - 器件 HBM 分类等级 H1C
 - 器件 CDM 分类等级 C5
- 功能安全型
 - 可帮助进行功能安全系统设计的文档
- 4.5V 到 65V 的宽输入电压范围
- 可配置恒压和恒流运行
 - 持续输出电流高达 2A
 - 4% 调节精度 (电压和电流模式)
- 自适应导通时间平均电流控制
- 可编程开关频率范围为 100kHz 至 1.2MHz
- 高级调光操作
 - 10 位精密模拟调光
 - 10 位精密内部 PWM 调光
 - 支持外部 PWM 调光输入
 - 针对外部分流调光 (包括 LED 矩阵管理器) 进行优化
- 开关逐周期过流保护
- 开关过热保护
- 串行外设接口 (SPI)
 - 可配置模拟基准、开关频率和 PWM 调光占空比
 - 故障监控和报告
- 支持跛行回家 (LH) 和独立模式运行

2 应用

汽车前照灯和自适应 LED 驱动模块

3 说明

TPS92530-Q1 是一款单片 3 通道同步降压 LED 驱动器, 具有 4.5V 至 65V 宽工作输入电压范围, 可独立为三串串联的 LED 供电。TPS92530-Q1 实施自适应导通时间平均电流模式控制功能, 经设计可生成恒压或恒流输出。自适应导通时间控制功能可提供近乎恒定的开关频率, 频率设置范围为 100kHz 至 1.2MHz。在恒流模式下, 该器件与分流 FET 调光技术和基于 LED 矩阵管理器的动态光束前照灯兼容。在恒压模式下, 自适应导通时间控制功能支持高带宽运行并提供快速瞬态响应。电感器电流检测和闭环反馈功能可在宽的输入电压、输出电压和环境温度范围内实现优于 $\pm 4\%$ 的精度。

在恒流模式下, 高性能 LED 驱动器可使用模拟调光或 PWM 调光技术来单独调制 LED 电流。通过 SPI 对 10 位基准值 (CHxREF) 进行编程可获得高于 16:1 的线性模拟调光响应。通过借助所需占空比直接调制相应的 UDIM 输入引脚或通过启用内部 PWM 发生器电路, 来实现 LED 电流的 PWM 调光。通过比较 10 位 PWM

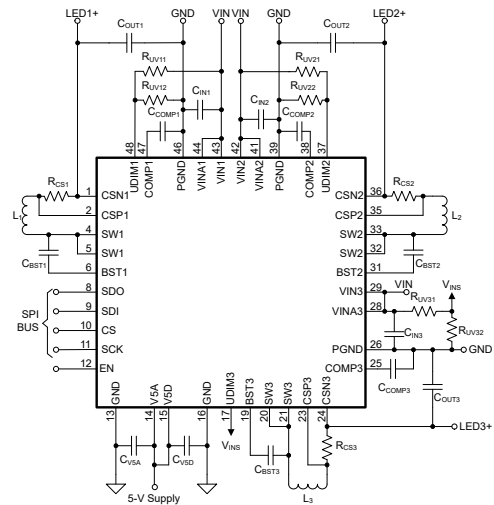
寄存器与可编程数字计数器的数值, PWM 发生器可将 10 位 PWM 寄存器值转化为相应的占空比。

TPS92530-Q1 整合了高级 SPI 可编程诊断和故障保护功能, 其中涉及: 逐周期电流限制、自举欠压保护、LED 开路、LED 短路、热警告和热关断功能。板载 10 位 ADC 对监测和诊断系统运行状况所需的重要输入参数进行采样。

封装信息

器件型号 ⁽¹⁾	封装	封装尺寸 (标称值)
TPS92530-Q1	PKD (HTQFP, 48)	7.00mm × 7.00mm

(1) 有关所有的可用封装, 请参阅数据表末尾的可订购产品附录。



简化版原理图



内容

1 特性.....	1	4.3 支持资源.....	3
2 应用.....	1	4.4 商标.....	3
3 说明.....	1	4.5 术语表.....	3
4 器件和文档支持.....	3	5 修订历史记录.....	3
4.1 文档支持.....	3	6 机械、封装和可订购信息.....	3
4.2 接收文档更新通知.....	3		

4 器件和文档支持

4.1 文档支持

4.1.1 相关文档

请参阅以下相关文档：

德州仪器 (TI)，[TPS92530-Q1 LaunchPad 评估模块 用户指南](#)

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.cn 上的器件产品文件夹。点击右上角的 [提醒我](#) 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 商标

TI E2E™ is a trademark of Texas Instruments.

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4.5 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 修订历史记录

注：以前版本的页码可能与当前版本的页码不同

日期	修订版本	说明
2023 年 12 月	*	初始发行版

6 机械、封装和可订购信息

下述页面包含机械、封装和订购信息。这些信息是指定器件可用的最新数据。数据如有变更，恕不另行通知，且不会对此文档进行修订。有关此数据表的浏览器版本，请查阅左侧的导航栏。

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
TPS92530QPKDRQ1	ACTIVE	HTQFP	PKD	48	1000	RoHS & Green	NIPDAU	Level-3-260C-168 HR	-40 to 125	TPS92530	Samples

(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.

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PowerPAD™ HTQFP - 1.15 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:

- Pin 1 ID (Pin 1 Identification mark)
- Pin numbers: 1, 12, 13, 24, 25, 36, 37, 48
- Dimensions: 7.2 (183 mm), 6.8 (173 mm), 5.00 (127 mm), 4.23 (107 mm), 4X (0.25) (10 mm) NOTE 5
- NOTE 3

Side View:

- SEE DETAIL A
- Pin numbers: 13, 24
- Dimensions: 1.15 MAX, 0.08, 0.13 TYP
- SEATING PLANE

Detail A (Typical):

- Pin numbers: 12, 25, 36, 48
- Dimensions: 44X 0.5, 4X 5.5, 0.27, 0.17, 9.2 (233 mm), 8.8 (224 mm), 0.75 (19 mm), 0.45 (11 mm), 0.15 (3.8 mm), 0.05 (1.3 mm), 0.25 (6.4 mm)
- GAGE PLANE
- 0° - 7°
- (1)

Feature Control Frame:

0.08 (0.0025) C A B

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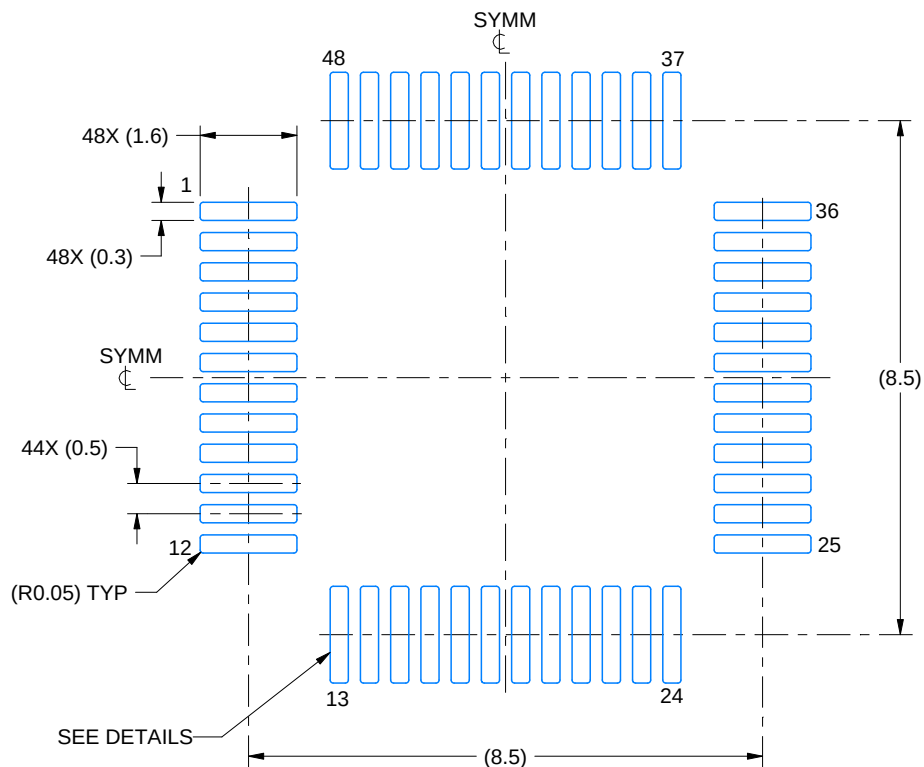
1. All linear dimensions are in millimeters. Any dimensions in parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.
3. This dimension does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or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

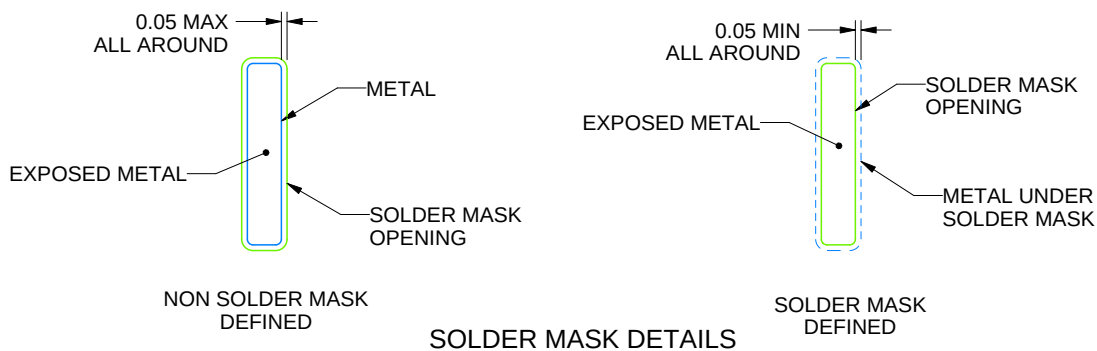
PKD0048A

PowerPAD™ HTQFP - 1.15 mm max height

PLASTIC QUAD FLATPACK



LAND PATTERN EXAMPLE
EXPOSED METAL SHOWN
SCALE:8X



SOLDER MASK DETAILS

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NOTES: (continued)

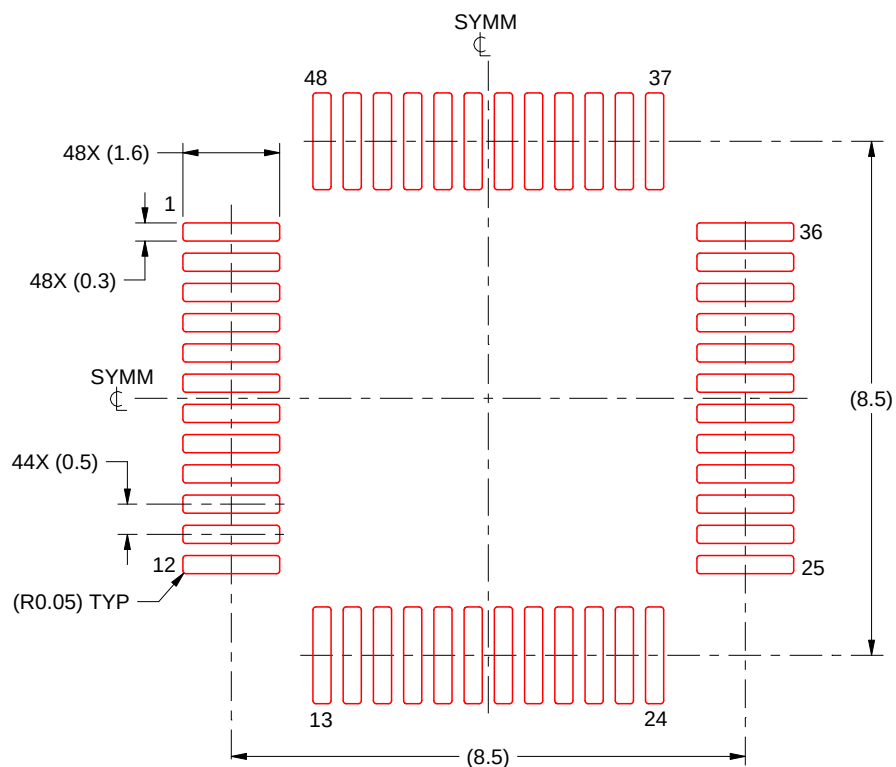
6. Publication IPC-7351 may have alternate designs.
7. Solder mask tolerances between and around signal pads can vary based on board fabrication site.
8. This package is designed to be soldered to a thermal pad on the board. See technical brief, Powerpad thermally enhanced package, Texas Instruments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

PKD0048A

PowerPAD™ HTQFP - 1.15 mm max height

PLASTIC QUAD FLATPACK



SOLDER PASTE EXAMPLE
SCALE:8X

4226971/B 05/2022

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.

重要声明和免责声明

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