用于汽车安全应用的 DRV3201-Q1 三相电机 驱动器 IC

1 特性

- 符合汽车应用 要求
- 具有下列结果的 AEC-Q100 测试指南：
  - 器件温度 1 级：-40°C 至 125°C 的环境工作温度范围
  - 器件人体放电模式 (HBM) 静电放电 (ESD) 分类等级 2
  - 器件 CDM ESD 分类等级 C3
- 针对电机控制的 3 相位桥式驱动器
- 驱动 6 个单独的 N 通道功率 MOSFET（栅极电荷高达 250nC）
- 可编程的 140mA 至 1A 栅极电流驱动能力（拉电流/灌电流），用于轻松调节输出斜率
- 所有 FET 驱动器引脚上的电压均符合 –7V 至 40V 标准以便处理电感下冲和过冲
- 针对每个功率 MOSFET 的单独控制输入
- 脉宽调制 (PWM) 频率高达 30kHz
- 支持 100% 占空比运行
- 运行电压：4.75V 至 30V
- 用于栅极驱动器电压生成的集成升压转换器所带来的正确低电源电压运行
- 逻辑运行电压低至 3V
- 具有 VDS 监视和可调检测电平的短路保护
- 在低负载电流运行时实现更高分辨率的两个集成高精度电流感测放大器（具有两个增益可编程第二级）
- 过压和欠压保护
- 可设定死区时间的击穿保护
- 三个实时相位比较器
- 过热警告和关断
- 通过串行外设接口 (SPI) 进行的精密故障检测和处理
- 睡眠模式功能
- 复位和使能功能
- 封装：64 引脚散热薄型四方扁平封装 (HTQFP) PowerPAD™

2 应用范围

- 汽车安全关键型电机控制 应用
  - 电动助力转向系统（EPS，电动液压助力转向 (EHPS)）
  - 电子制动/刹车辅助
  - 传输
  - 油泵
- 工业安全关键型电机控制 应用

3 说明

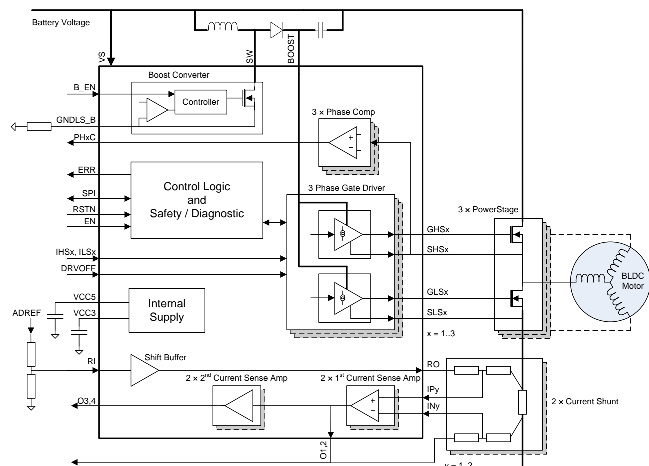
此桥式驱动器专门用于包括安全相关 应用在内的汽车三相位无刷直流电机控制。它提供 6 个用于正常电平 N 通道金属氧化物半导体场效应晶体管 (MOSFET) 晶体管的专用驱动器。此驱动器的功能被设计成处理 250nC 的栅极电荷，并且为了实现轻松的输出斜率调节，可设定此驱动器的拉/灌电流。该器件还通过 SPI 接口集成了先进的诊断、保护和监控 特性 。一个具有集成 FET 的升压转换器提供过驱电压，从而可实现对功率级的完全控制，即使当电池电压低至 4.75V 时也是如此。

器件信息[(1)]

器件型号	封装	封装尺寸（标称值）
DRV3201-Q1	HTQFP (64)	10.00mm x 10.00mm

(1) 如需了解所有可用封装，请参阅产品说明书末尾的可订购产品附录。

典型应用图



An IMPORTANT NOTICE at the end of this data sheet addresses availability, warranty, changes, use in safety-critical applications, intellectual property matters and other important disclaimers. PRODUCTION DATA.

4 器件和文档支持

4.1 文档支持

4.1.1 相关文档

请参阅如下相关文档：

- *《DRV3201 升压转换器》*
- *《DRV3201 电流感应放大器》*
- *《DRV3201EVM》*
- *《PowerPAD™ 散热增强型封装》*

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。单击右上角的*通知我* 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 社区资源

下列链接提供到 TI 社区资源的连接。链接的内容由各个分销商“按照原样”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》。

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设计支持 *TI 参考设计支持* 可帮助您快速查找有帮助的 E2E 论坛、设计支持工具以及技术支持的联系信息。

4.4 商标

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4.5 静电放电警告

这些装置包含有限的内置 ESD 保护。 存储或装卸时，应将导线一起截短或将装置放置于导电泡棉中，以防止 MOS 门极遭受静电损伤。

4.6 Glossary

SLYZ022 — *TI Glossary*.

This glossary lists and explains terms, acronyms, and definitions.

5 机械、封装和可订购信息

以下页面包含机械、封装和可订购信息。这些信息是指定器件的最新可用数据。这些数据如有变更，恕不另行通知和修订此文档。如欲获取此产品说明书的浏览器版本，请参阅左侧的导航。

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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
DRV3201QPAPQ1	ACTIVE	HTQFP	PAP	64	160	RoHS & Green	NIPDAU	Level-3-260C-168 HR	-40 to 125	DRV3201	Samples
DRV3201QPAPRQ1	ACTIVE	HTQFP	PAP	64	1000	RoHS & Green	NIPDAU	Level-3-260C-168 HR	-40 to 125	DRV3201	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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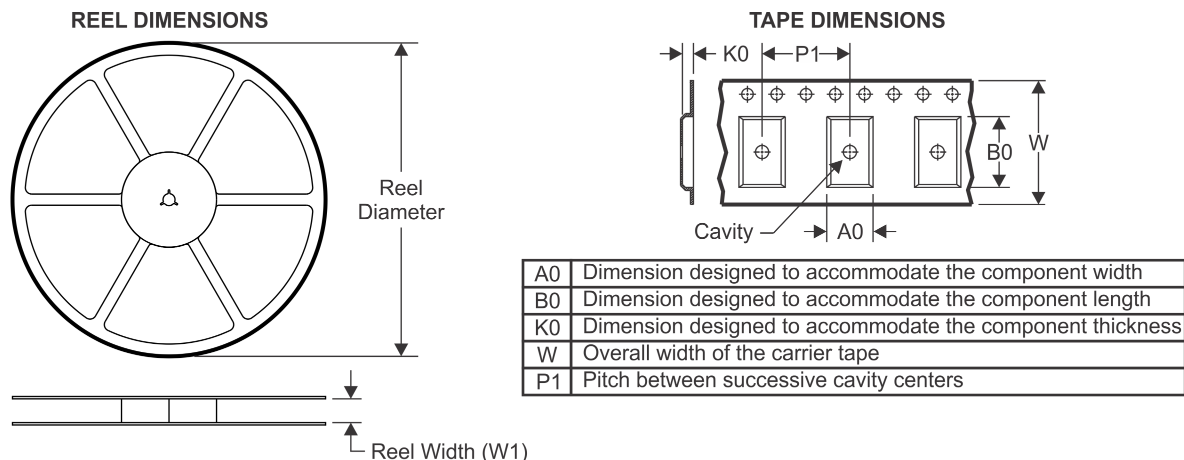
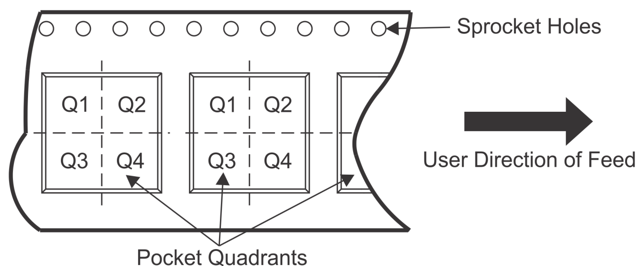
TAPE AND REEL INFORMATION



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

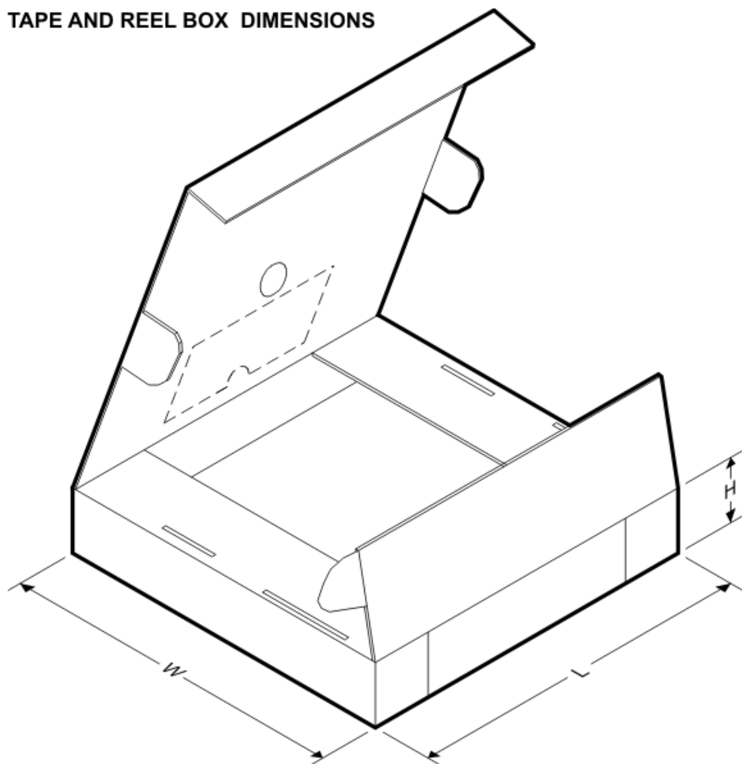
QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE



*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
DRV3201QPAPRQ1	HTQFP	PAP	64	1000	330.0	24.4	13.0	13.0	1.5	16.0	24.0	Q2

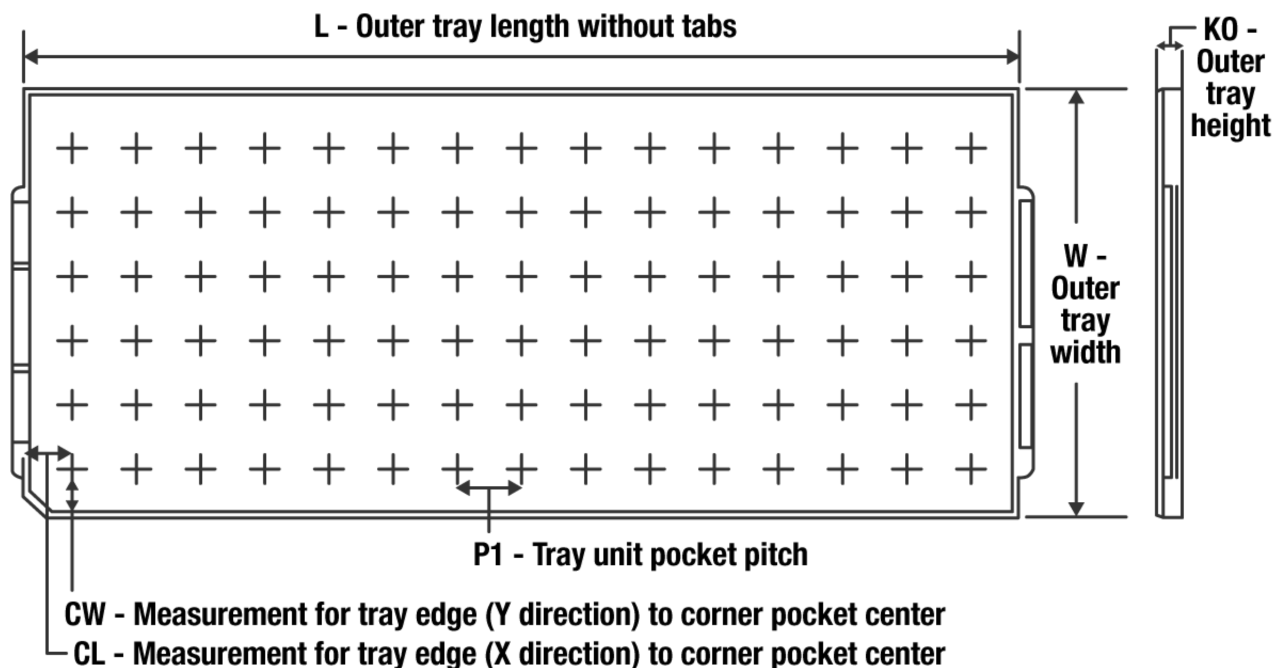
TAPE AND REEL BOX DIMENSIONS



*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
DRV3201QPAPRQ1	HTQFP	PAP	64	1000	367.0	367.0	55.0

TRAY



Chamfer on Tray corner indicates Pin 1 orientation of packed units.

*All dimensions are nominal

Device	Package Name	Package Type	Pins	SPQ	Unit array matrix	Max temperature (°C)	L (mm)	W (mm)	K0 (µm)	P1 (mm)	CL (mm)	CW (mm)
DRV3201QPAPQ1	PAP	HTQFP	64	160	8 X 20	150	322.6	135.9	7620	15.2	13.1	13

GENERIC PACKAGE VIEW

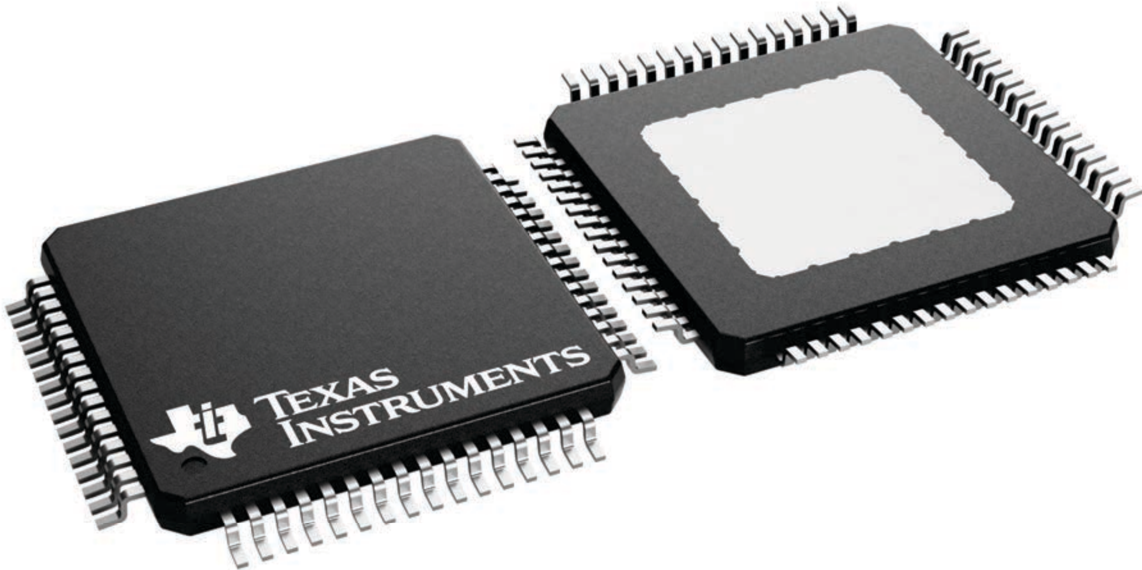
PAP 64

HTQFP - 1.2 mm max height

10 x 10, 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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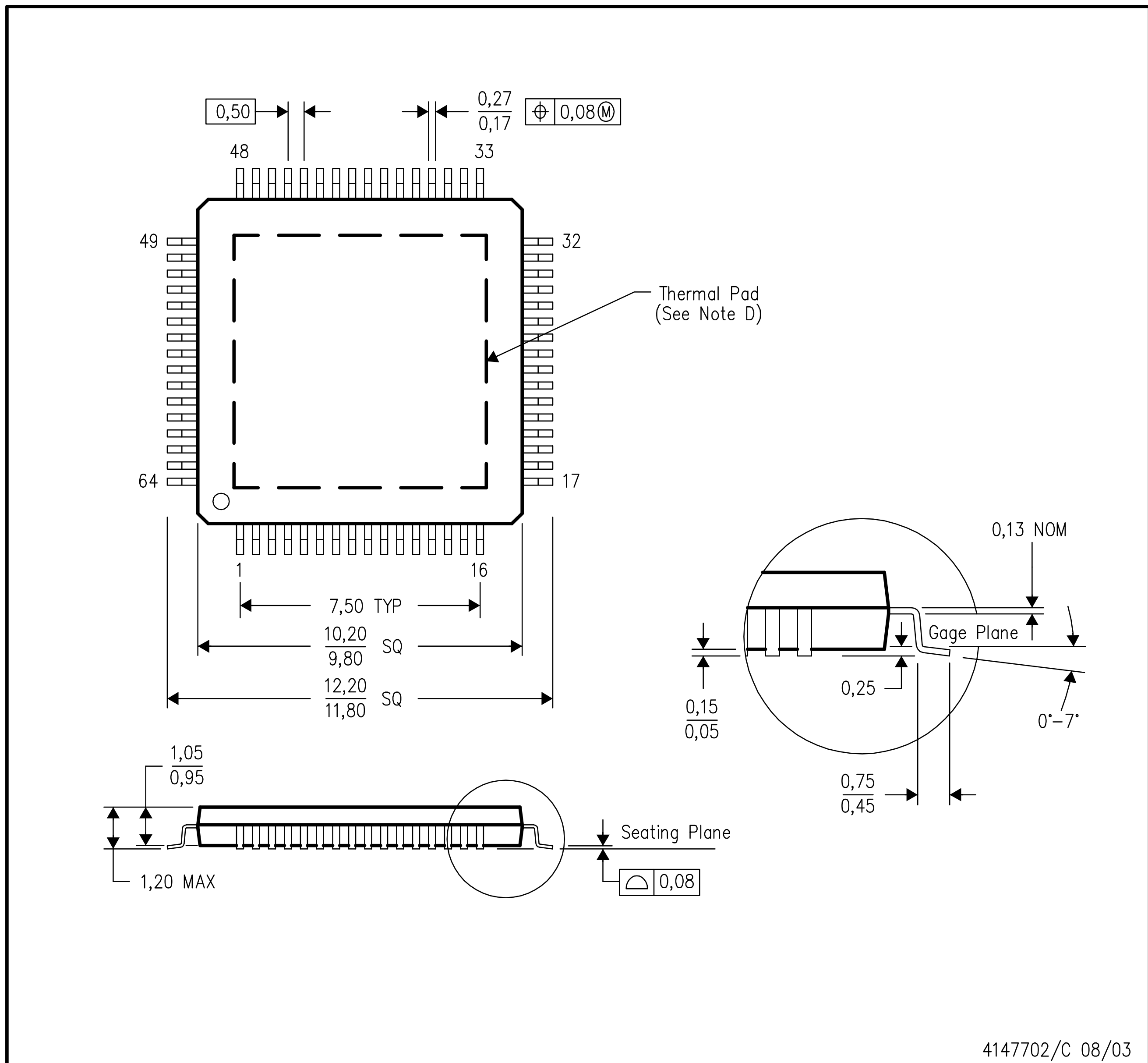
PAP (S-PQFP-G64) PowerPAD™ PLASTIC QUAD FLATPACK



NOTES:
A. All linear dimensions are in millimeters.
B. This drawing is subject to change without notice.
C. Body dimensions do not include mold flash or protrusion
D. This package is designed to be soldered to a thermal pad on the board. Refer to Technical Brief, PowerPad Thermally Enhanced Package, Texas Instruments Literature No. SLMA002 for information regarding recommended board layout. This document is available at www.ti.com <http: //www.ti.com>.
E. Falls within JEDEC MS–026

PowerPAD is a trademark of Texas Instruments.

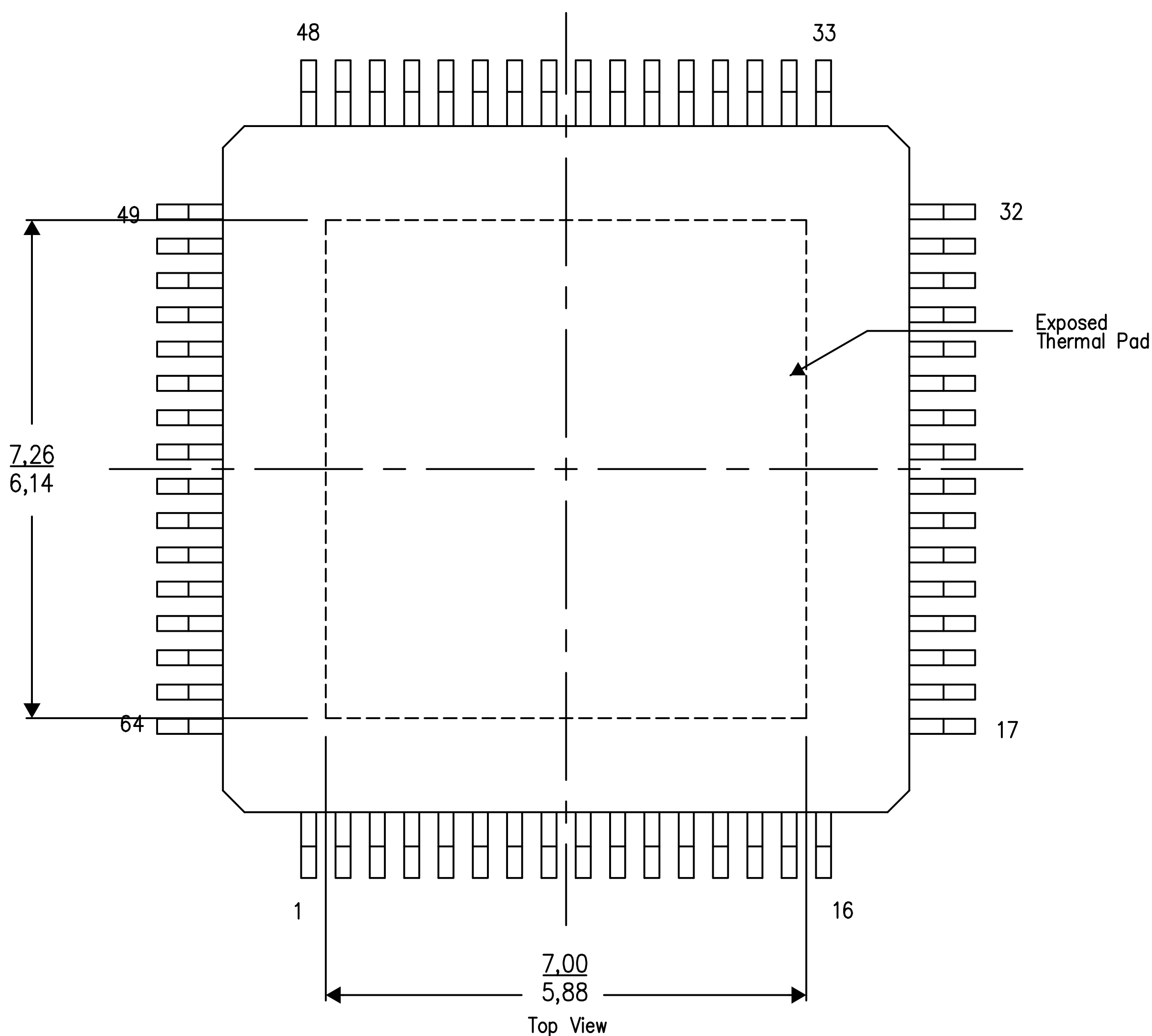
PAP (S-PQFP-G64) PowerPAD™ PLASTIC QUAD FLATPACK

THERMAL INFORMATION

This PowerPAD™ package incorporates an exposed thermal pad that is designed to be attached to a printed circuit board (PCB). The thermal pad must be soldered directly to the PCB. After soldering, the PCB can be used as a heatsink. In addition, through the use of thermal vias, the thermal pad can be attached directly to the appropriate copper plane shown in the electrical schematic for the device, or alternatively, can be attached to a special heatsink structure designed into the PCB. This design optimizes the heat transfer from the integrated circuit (IC).

For additional information on the PowerPAD package and how to take advantage of its heat dissipating abilities, refer to Technical Brief, PowerPAD Thermally Enhanced Package, Texas Instruments Literature No. SLMA002 and Application Brief, PowerPAD Made Easy, Texas Instruments Literature No. SLMA004. Both documents are available at www.ti.com.

The exposed thermal pad dimensions for this package are shown in the following illustration.



Exposed Thermal Pad Dimensions

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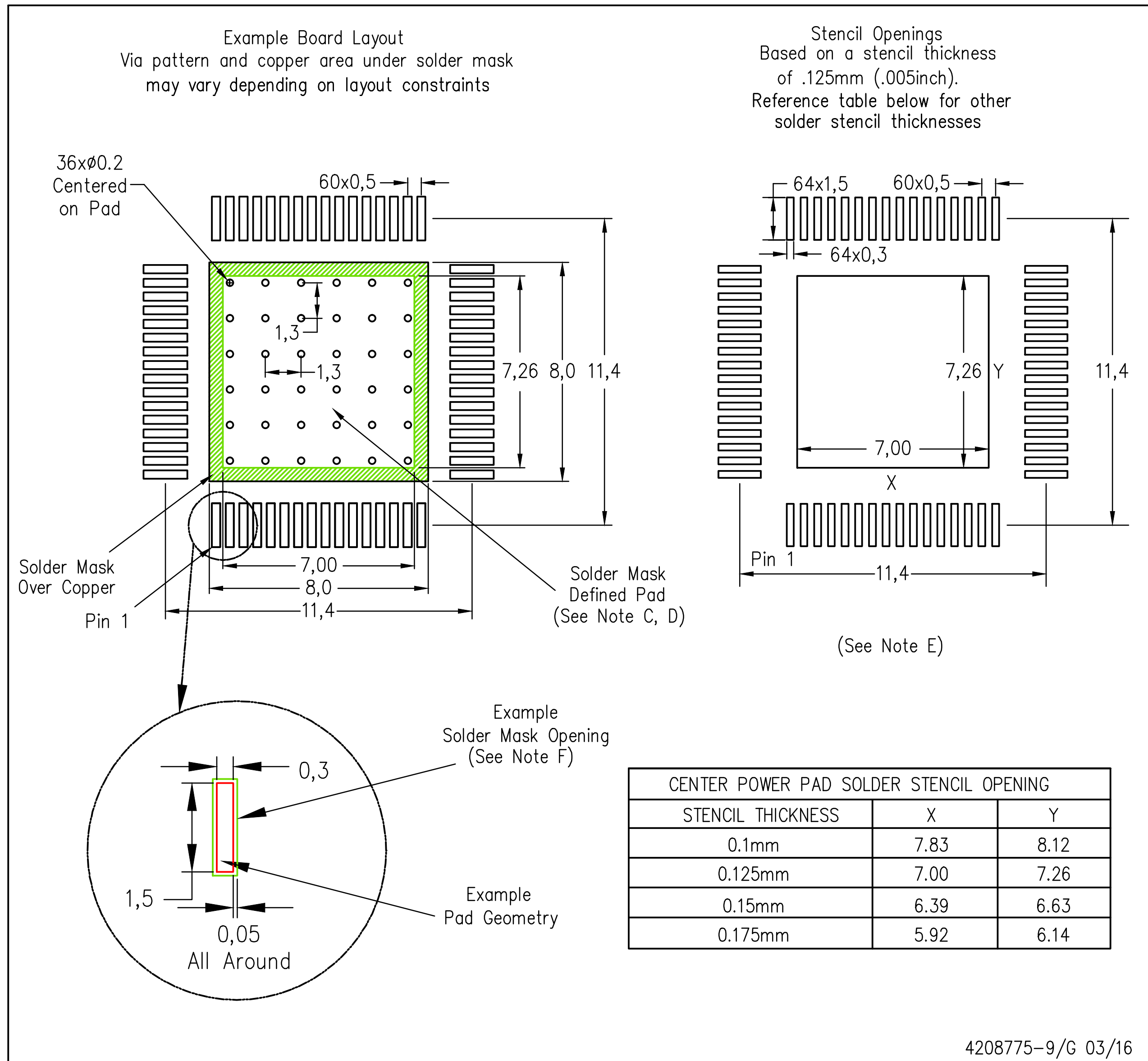
NOTES: A. All linear dimensions are in millimeters

PowerPAD is a trademark of Texas Instruments

PAP (S–PQFP–G64) PowerPAD™ PLASTIC QUAD FLATPACK



CENTER POWER PAD SOLDER STENCIL OPENING		
STENCIL THICKNESS	X	Y
0.1mm	7.83	8.12
0.125mm	7.00	7.26
0.15mm	6.39	6.63
0.175mm	5.92	6.14

PowerPAD is a trademark of Texas Instruments

NOTES:
- A. All linear dimensions are in millimeters.
- B. This drawing is subject to change without notice.
- C. Customers should place a note on the circuit board fabrication drawing not to alter the center solder mask defined pad.
- D. This package is designed to be soldered to a thermal pad on the board. Refer to Technical Brief, PowerPad Thermally Enhanced Package, Texas Instruments Literature No. SLMA002, SLMA004, and also the Product Data Sheets for specific thermal information, via requirements, and recommended board layout. These documents are available at www.ti.com <http: //www.ti.com>. Publication IPC–7351 is recommended for alternate designs.
- E. Laser cutting apertures with trapezoidal walls and also rounding corners will offer better paste release. Customers should contact their board assembly site for stencil design recommendations. Example stencil design based on a 50% volumetric metal load solder paste. Refer to IPC–7525 for other stencil recommendations.
- F. Customers should contact their board fabrication site for solder mask tolerances between and around signal pads.

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