

## I<sup>2</sup>C Controlled 4.5A Single Cell USB/Adaptor Charger With Narrow VDC Power Path Management and USB OTG

Check for Samples: [bq24190](#)

### FEATURES

- Up to 4.5A Fast Charge Rate and 6A Discharge Rate
- Single Input USB-compliant Charger
  - 3.9V–17V Input Operating Voltage Range
  - Input Current Limit Supports USB2.0 and USB 3.0
  - USB Host/Charging Port Detection Compatible to USB Battery Charger Spec 1.2
  - Support USB OTG
  - Autonomous Charging with or without Host
- Narrow System Bus Voltage Power Path Management
  - Instant-on Works with No Battery or Deeply Discharged Battery
  - Battery Supplements System When Adapter is Fully-Loaded
- 1.5MHz Switching Frequency
- I<sup>2</sup>C Port for Optimal System Performance and Status Reporting
  - Input Current Limit: 100mA, 150mA, 500mA, 900mA, 1.5A, 2A and 3A
  - Input Voltage, Charge Voltage, Charge Current, Minimum System Voltage, etc.

- Accuracy
  - ±0.5% Charge Voltage Regulation
  - ±5% Charge Current Regulation
  - ±5% Input Current Regulation
  - ±2% Input Voltage Regulation
- High Integration
  - Power Path Management
  - Synchronous Switching MOSFETs
  - Integrated Current Sensing
  - Internal Loop Compensation
- Accelerate Charge Time by Battery Path Impedance Compensation
- Charge Status Outputs for LED or Host Processor
- Maximum Power Tracking Capability by Input Voltage Regulation
- 4mm x 4mm QFN-24 Package

### APPLICATIONS

- Tablet PC
- Portable Media Players
- Portable Internet Devices

### DESCRIPTION

The bq24190 is a highly-integrated switch-mode battery charge management and system power path management device for 1 cell Li-Ion and Li-polymer batteries in a wide range of tablet and other portable devices. Its low impedance power path optimizes switch-mode operation efficiency, reduces battery charging time and extends battery life during discharging phase. The I<sup>2</sup>C serial interface with charging and system settings makes the device a truly flexible solution.

The bq24190 supports a wide range of input sources, including standard USB host port, USB charging port, and high power DC adapter. To set the default input current limit, the bq24190 detects the input source following the USB battery charging spec 1.2. The bq24190 is compliant with USB 2.0 and USB 3.0 power spec with input current and voltage regulation. Meanwhile, the bq24190 supports USB On-the-Go operation by supplying 5V on VBUS with current limit up to 1.3A.

The power path management regulates the system slightly above battery voltage but does not drop below 3.5V (programmable). With this feature, the system keeps operating even when the battery is completely depleted or removed. When the input source current or voltage limit is reached, the power path management automatically reduces the charge current to zero and then starts discharging the battery until the system power requirement is met. This supplement mode operation keeps the input source from getting overloaded.



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# bq24190

SLUSAW5 – JANUARY 2012

www.ti.com

## DESCRIPTION (CONTINUED)

The bq24190 can initiate a new charging cycle without host control. It charges the battery in three phases: pre-conditioning, constant current, and constant voltage. In the end, the charger automatically terminates when the charge current is below a preset limit in the constant voltage phase. Later on, when the battery voltage falls below the recharge threshold, the charger automatically starts another charging cycle.

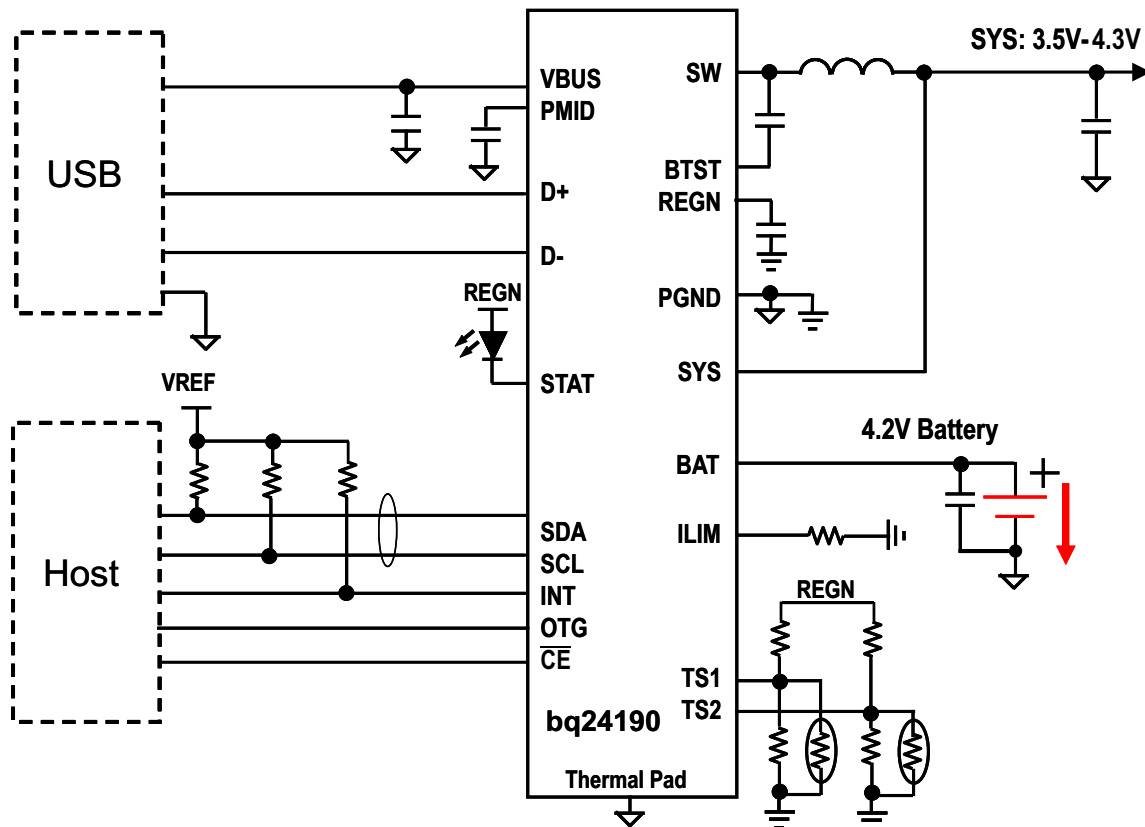
The bq24190 provides various safety features for battery charging and system operation, including dual pack negative thermistor monitoring, charging safety timer, and over-voltage/over-voltage protections. The thermal regulation reduces charge current when the junction temperature exceeds 120°C (programmable).

The STAT output reports the charging status and any fault conditions. The INT immediately notifies the host when a fault occurs. The bq24190 is available in a 24-pin, 4x4 mm<sup>2</sup> thin QFN package.

**bq2419x FAMILY TABLE**

	<b>bq24190</b>	<b>bq24191</b>	<b>bq24192</b>	<b>bq24192I</b>
I <sup>2</sup> C address	6BH	6AH	6BH	6BH
USB OTG	Yes	No	Yes	Yes
USB Detection	D+/D-	PSEL	PSEL	PSEL
Default Battery Voltage	4.2V	4.2V	4.2V	4.1V
Default Charge Current	2A	2A	2A	1A
Maximum Pre-Charge Current	2A	2A	2A </td <td>640mA</td>	640mA
Status Output	STAT	STAT, /PG	STAT, /PG	STAT, /PG
STAT During Fault	Blinking at 1Hz	Blinking at 1Hz	Blinking at 1Hz	10k to ground

## APPLICATION DIAGRAM



PRODUCT PREVIEW

**PACKAGING INFORMATION**

Orderable Device	Status <sup>(1)</sup>	Package Type	Package Drawing	Pins	Package Qty	Eco Plan <sup>(2)</sup>	Lead/ Ball Finish	MSL Peak Temp <sup>(3)</sup>	Samples (Requires Login)
BQ24190RGER	PREVIEW	VQFN	RGE	24	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-2-260C-1 YEAR	
BQ24190RGET	PREVIEW	VQFN	RGE	24	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-2-260C-1 YEAR	
BQ24191RGER	PREVIEW	VQFN	RGE	24	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-2-260C-1 YEAR	
BQ24191RGET	PREVIEW	VQFN	RGE	24	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-2-260C-1 YEAR	
BQ24192RGER	PREVIEW	VQFN	RGE	24	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-2-260C-1 YEAR	
BQ24192RGET	PREVIEW	VQFN	RGE	24	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-2-260C-1 YEAR	

<sup>(1)</sup> 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.

**OBSELETE:** TI has discontinued the production of the device.

<sup>(2)</sup> 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)

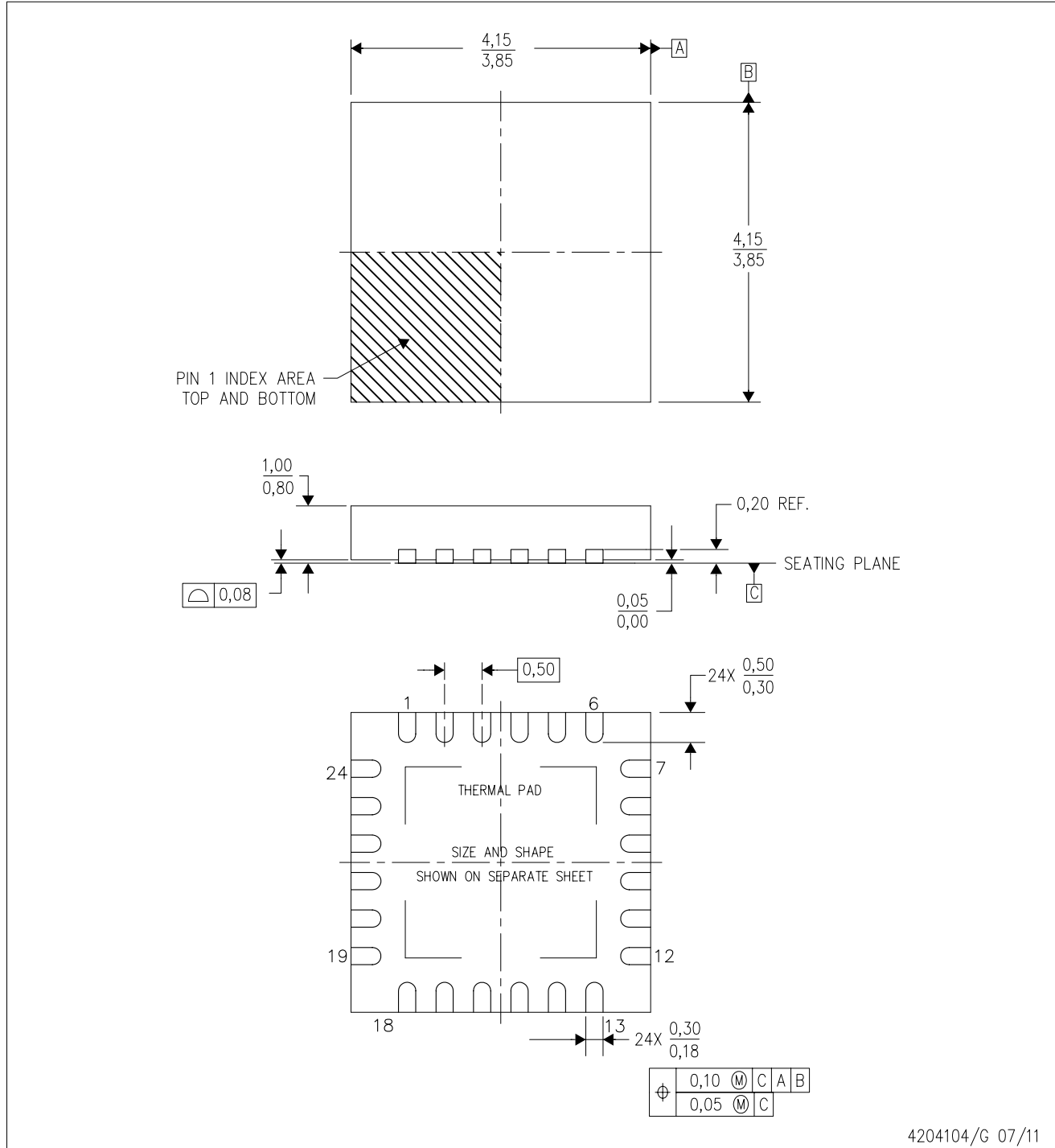
<sup>(3)</sup> MSL, Peak Temp. -- The Moisture Sensitivity Level rating according to the JEDEC industry standard classifications, and peak solder temperature.

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RGE (S-PVQFN-N24)

PLASTIC QUAD FLATPACK NO-LEAD



4204104/G 07/11

- NOTES:
- A. All linear dimensions are in millimeters. Dimensioning and tolerancing per ASME Y14.5M-1994.
  - B. This drawing is subject to change without notice.
  - C. Quad Flatpack, No-Leads (QFN) package configuration.
  - D. The package thermal pad must be soldered to the board for thermal and mechanical performance.
  - E. See the additional figure in the Product Data Sheet for details regarding the exposed thermal pad features and dimensions.
  - F. Falls within JEDEC MO-220.

# THERMAL PAD MECHANICAL DATA

RGE (S-PVQFN-N24)

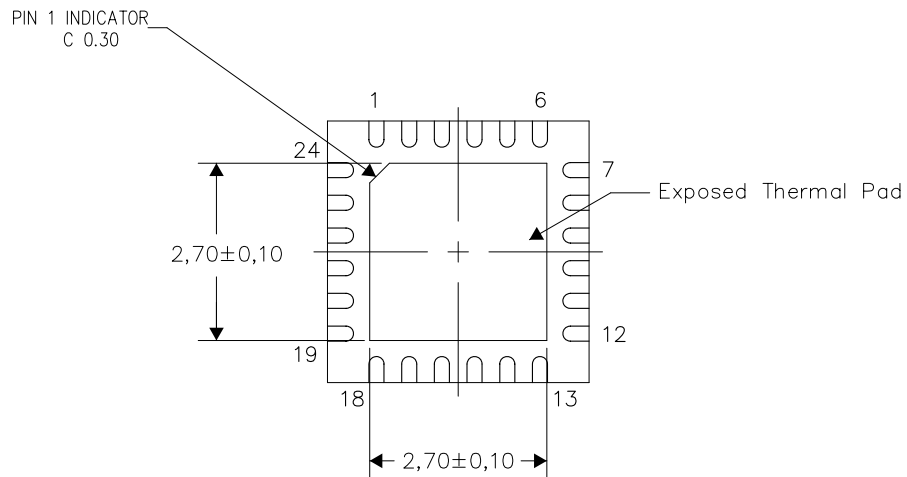
PLASTIC QUAD FLATPACK NO-LEAD

## THERMAL INFORMATION

This package incorporates an exposed thermal pad that is designed to be attached directly to an external heatsink. The thermal pad must be soldered directly to the printed circuit board (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 information on the Quad Flatpack No-Lead (QFN) package and its advantages, refer to Application Report, QFN/SON PCB Attachment, Texas Instruments Literature No. SLUA271. This document is available at [www.ti.com](http://www.ti.com).

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



Bottom View

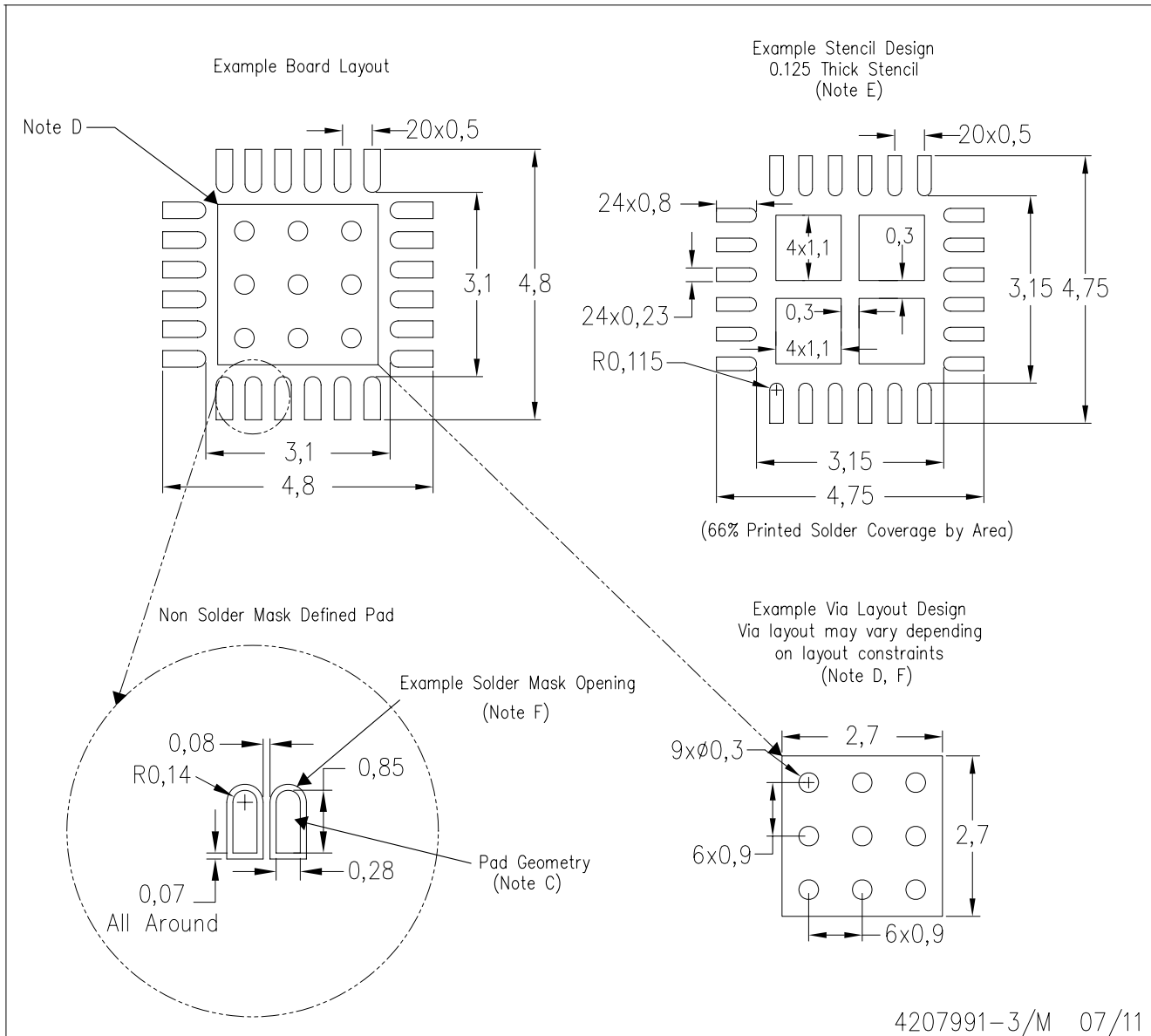
Exposed Thermal Pad Dimensions

4206344-4/Z 01/12

NOTES: A. All linear dimensions are in millimeters

RGE (S-PVQFN-N24)

PLASTIC QUAD FLATPACK NO-LEAD



- NOTES:
- All linear dimensions are in millimeters.
  - This drawing is subject to change without notice.
  - Publication IPC-7351 is recommended for alternate designs.
  - This package is designed to be soldered to a thermal pad on the board. Refer to Application Note, Quad Flat-Pack Packages, Texas Instruments Literature No. SLUA271, 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) <<http://www.ti.com>>.
  - 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. Refer to IPC 7525 for stencil design considerations.
  - Customers should contact their board fabrication site for recommended solder mask tolerances and via tenting recommendations for vias placed in the thermal pad.

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