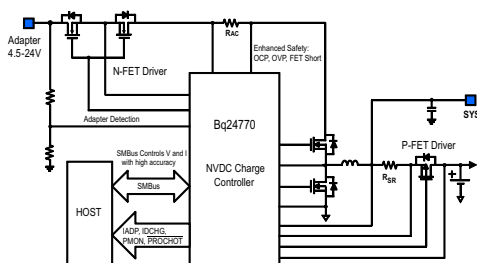


# bq2477x NVDC Battery Charge Controller With System Power Monitor and Processor Hot Indicator

## 1 Features

- Host-controlled NVDC-1 1S-4S Battery Charge Controller with 4.5-24 V Input Range
  - Support SMBus (bq24770) and I2C (bq24773)
  - System Instant-on Operation with no Battery or Deeply Discharged Battery
  - Supplement Mode with Synchronous BATFET Control when Adaptor is fully loaded
- Ultra Fast Input Current DPM at 100  $\mu$ s
- Ultra Low Quiescent Current of 600  $\mu$ A and High PFM Light Load Efficiency >80% at 20 mA Load to Meet Energy Star and ErP Lot6.
- High Accuracy Power / Current Monitor for CPU Throttling
  - Comprehensive PROCHOT Profile
  - Input and Battery Current Monitor (IADP/IBAT)
  - System Power Monitor (PMON)
- Programmable Input Current Limit, Charge Voltage, Charge Current and Minimum System Voltage Regulation
  - $\pm 0.5\%$  Charge Voltage (16 mV/step)
  - $\pm 2\%$  Input/charge Current (64 mA/step)
  - $\pm 2\%$  40x Input / 16x Discharge / 20x Charge Current Monitor
- Support Battery LEARN Function
- High Integration
  - NMOS ACFET and RBFET Driver
  - PMOS battery FET Gate Driver
  - Internal Loop Compensation
  - Independent Comparator
  - Automatic Trickle Charge to Wake up Gas Gauge
- 600kHz to 1.2MHz Programmable Switching Frequency

## 4 Simplified Schematic



## 2 Applications

- Ultrabook, Notebook, Detachable, and Tablet PC
- Handheld Terminal
- Industrial, Medical, Portable Equipment

## 3 Description

The bq2477x is high-efficiency, synchronous, NVDC-1 battery charge controllers, offering low component count for space-constraint, multi-chemistry battery charging applications.

The power path management allows the system to be regulated at battery voltage but does not drop below system minimum voltage (programmable). With this feature, the system keeps operating even when the battery is completely discharged or removed. The power path management allows the battery to provide supplement current to the system to keep the input supply from being overloaded.

The bq2477x provides drivers and power path management for N-channel ACFET and reverse blocking FET. The devices provides driver to control NVDC operation of external P-channel battery FET. It also drives high-side and low-side MOSFETs of the switching regulator.

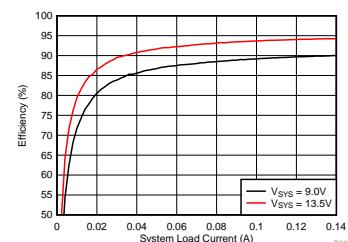
The bq2477x monitors adapter current (IADP), battery charge/discharge current (IBAT) and system power (PMON). The flexibly programmed PROCHOT output goes directly to CPU for throttle back when needed.

### Device Information<sup>(1)</sup>

PART NUMBER	PACKAGE	BODY SIZE (NOM)
bq24770	WQFN (28-Pin)	4.00mm x 4.00mm <sup>2</sup>
bq24773		

(1) For all available packages, see the orderable addendum at the end of the datasheet.

### Light Load Efficiency ( $V_{IN} = 19.5$ V)



## 5 Revision History

DATE	REVISION	NOTES
May 2015	*	Initial Release

## 6 Device and Documentation Support

### 6.1 Related Links

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

**Table 1. Related Links**

PARTS	PRODUCT FOLDER	SAMPLE & BUY	TECHNICAL DOCUMENTS	TOOLS & SOFTWARE	SUPPORT & COMMUNITY
bq24770	<a href="#">Click here</a>	<a href="#">Click here</a>	<a href="#">Click here</a>	<a href="#">Click here</a>	<a href="#">Click here</a>
bq24773	<a href="#">Click here</a>	<a href="#">Click here</a>	<a href="#">Click here</a>	<a href="#">Click here</a>	<a href="#">Click here</a>

### 6.2 Trademarks

All trademarks are the property of their respective owners.

### 6.3 Electrostatic Discharge Caution



These devices have limited built-in ESD protection. The leads should be shorted together or the device placed in conductive foam during storage or handling to prevent electrostatic damage to the MOS gates.

### 6.4 Glossary

[SLYZ022](#) — *TI Glossary*.

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

## 7 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.

**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)	Samples
BQ24770RUYR	ACTIVE	WQFN	RUY	28	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-2-260C-1 YEAR	-40 to 85	BQ 24770	<a href="#">Samples</a>
BQ24770RUYT	ACTIVE	WQFN	RUY	28	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-2-260C-1 YEAR	-40 to 85	BQ 24770	<a href="#">Samples</a>
BQ24773RUYR	PREVIEW	WQFN	RUY	28	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-2-260C-1 YEAR	-40 to 85	BQ 24773	
BQ24773RUYT	PREVIEW	WQFN	RUY	28	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-2-260C-1 YEAR	-40 to 85	BQ 24773	

(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.

**OBSELETE:** 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 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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**TAPE AND REEL INFORMATION**

**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
BQ24770RUYR	WQFN	RUY	28	3000	330.0	12.4	4.25	4.25	1.15	8.0	12.0	Q2
BQ24770RUYT	WQFN	RUY	28	250	180.0	12.4	4.25	4.25	1.15	8.0	12.0	Q2
BQ24773RUYR	WQFN	RUY	28	3000	330.0	12.4	4.25	4.25	1.15	8.0	12.0	Q2
BQ24773RUYT	WQFN	RUY	28	250	180.0	12.4	4.25	4.25	1.15	8.0	12.0	Q2

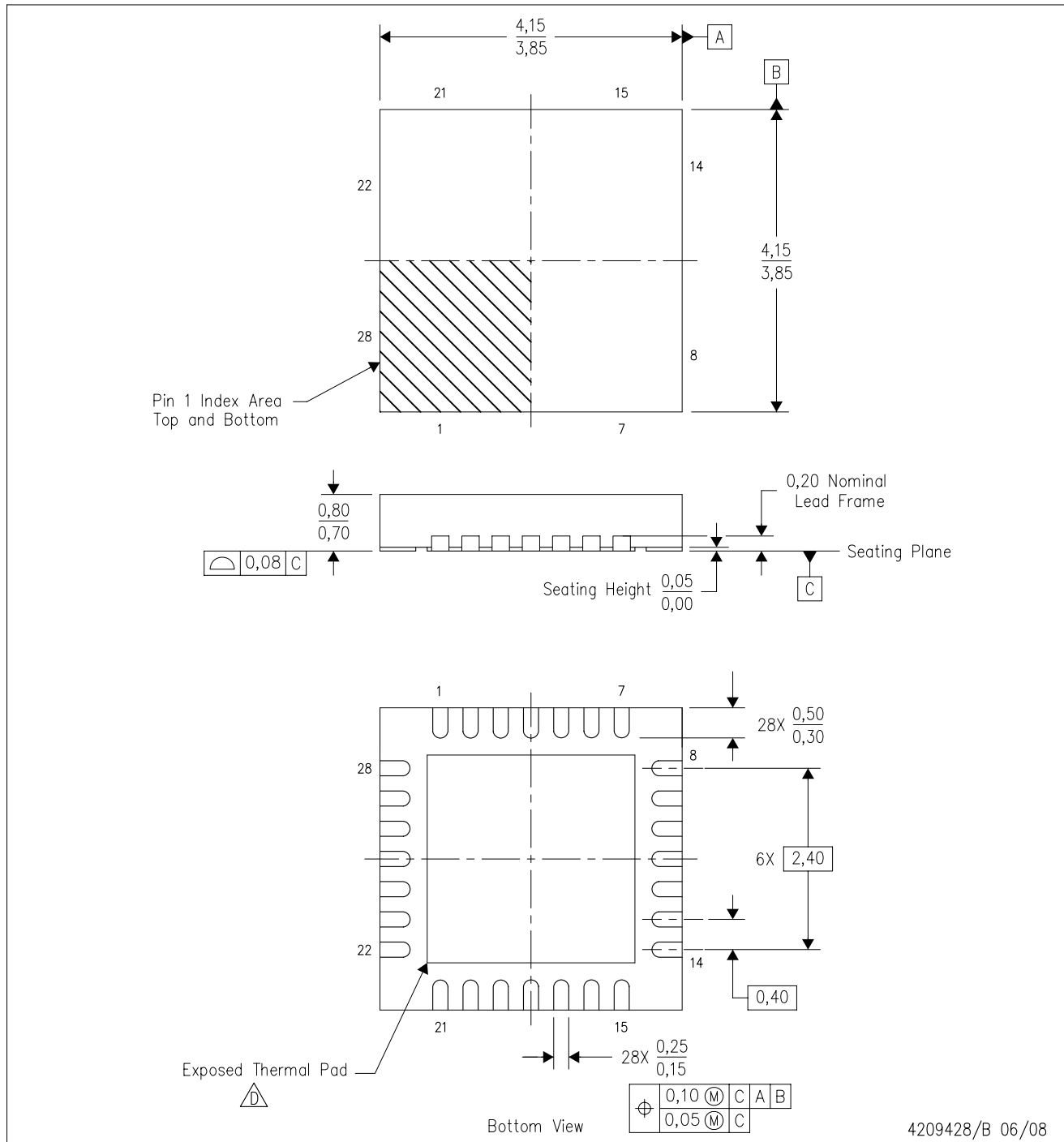
**TAPE AND REEL BOX DIMENSIONS**



\*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
BQ24770RUYR	WQFN	RUY	28	3000	367.0	367.0	35.0
BQ24770RUYT	WQFN	RUY	28	250	210.0	185.0	35.0
BQ24773RUYR	WQFN	RUY	28	3000	367.0	367.0	35.0
BQ24773RUYT	WQFN	RUY	28	250	210.0	185.0	35.0

RUY (S-PWQFN-N28)

PLASTIC QUAD FLATPACK NO-LEAD



- 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. QFN (Quad Flatpack No-Lead) package configuration.
  -  D. The package thermal pad must be soldered to the board for thermal and mechanical performance. See the Product Data Sheet for details regarding the exposed thermal pad dimensions.



## THERMAL PAD MECHANICAL DATA

RUY (S-PWQFN-N28)

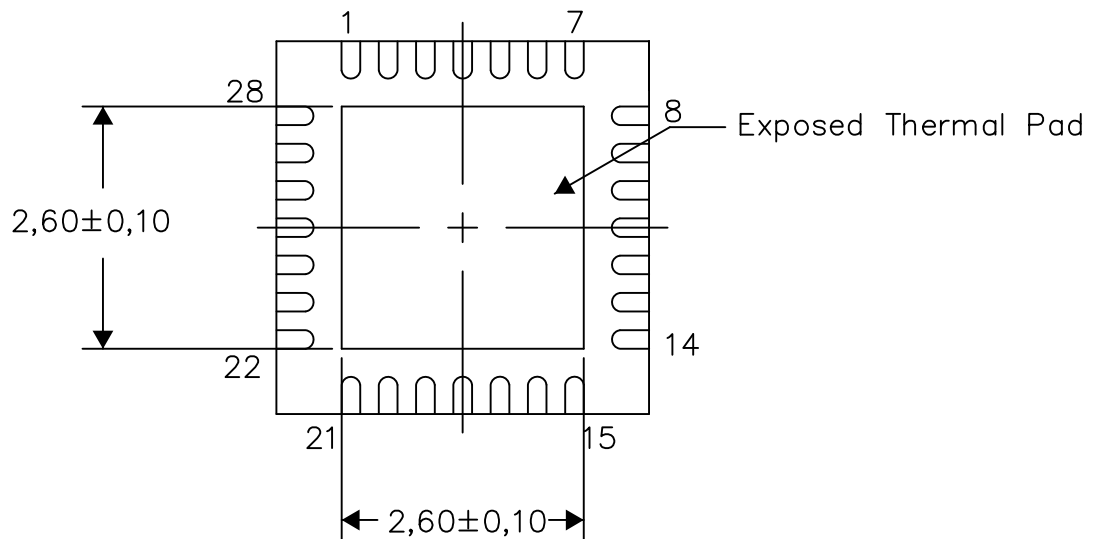
PLASTIC QUAD FLATPACK NO-LEAD

### 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

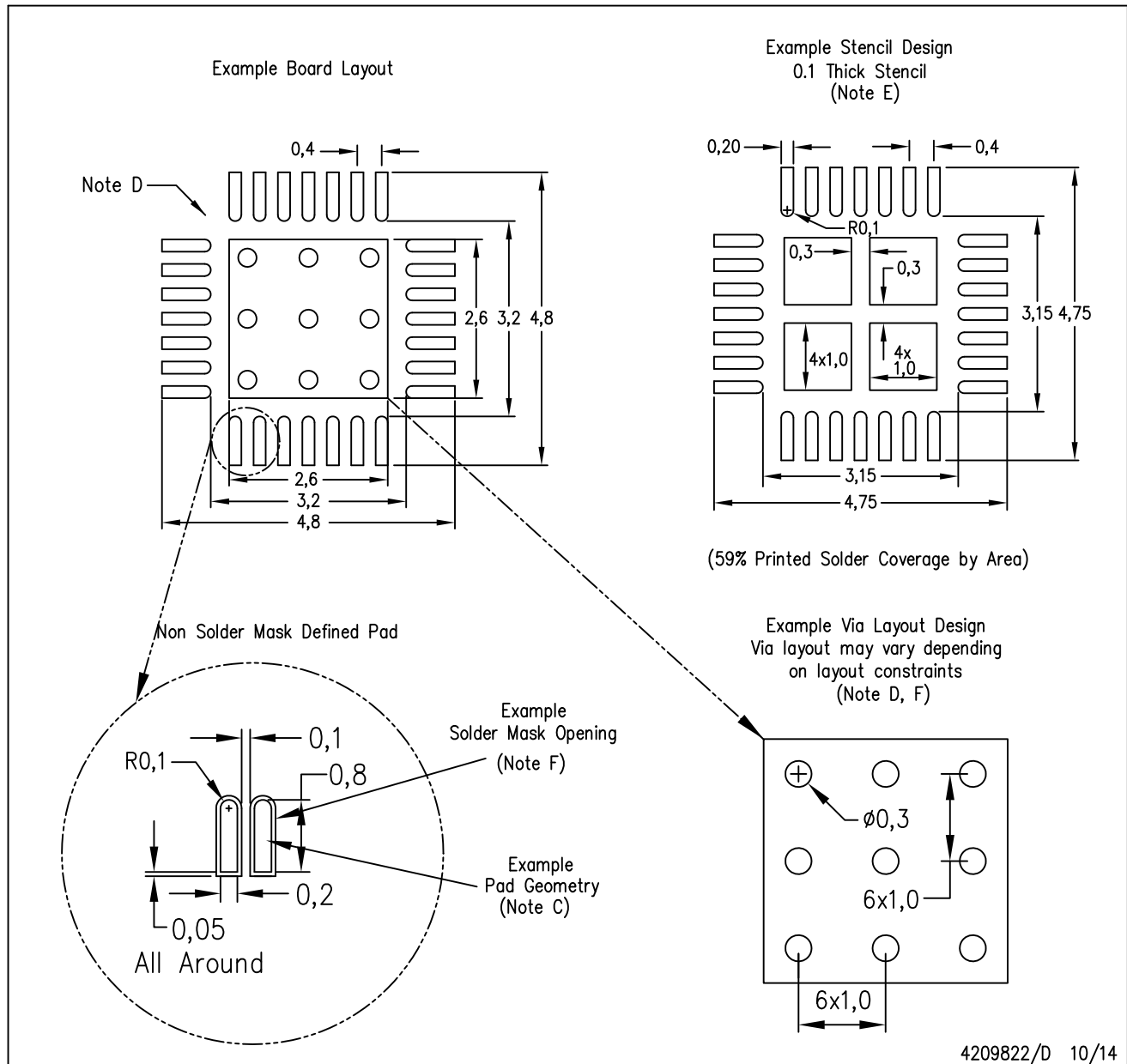
Exposed Thermal Pad Dimensions

4209490/E 10/14

NOTE: All linear dimensions are in millimeters

RUY (S-PWQFN-N28)

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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