BQ25306 Standalone 17-V, 3.0-A Single Cell and Dual Cell Buck Battery Charger

1 Features

- High-efficiency, 1.2-MHz, synchronous switch-mode buck charger
  - 92.5% Charge efficiency at 2 A from 5-V input for 1-cell battery
  - 91.5% Charge efficiency at 2 A from 9-V input for 1-cell battery
  - 94% Charge efficiency at 2 A from 12-V input for 2-cell battery
- Single input to support USB input and adjustable high voltage adaptors
  - Support 4.0-V - 17-V input voltage range with 28-V absolute maximum input voltage rating
  - Input Voltage Dynamic Power Management (VINDPM) from 4.0 V up to 1.0834*VBAT – 50 mV
- High integration
  - Synchronous switching MOSFET
  - Internal lossless input and charge current sense
  - Internal loop compensation
  - Integrated bootstrap diode
- 3.0-A Input current limit
- 3.0-A Maximum fast charge current
- 1-µA Low battery leakage current at 4.5-V battery
- 4-µA VBUS Supply current in IC disable mode
- Charge current thermal regulation at 120ºC
- Precharge current: 10% of fast charge current
- Termination current: 10% of fast charge current
- Charge accuracy
  - ±0.5% Charge voltage regulation
  - ±10% Charge current regulation
- Safety
  - Thermal regulation and thermal shutdown
  - Input Under Voltage Lockout (UVLO) and Over Voltage Protection (OVP)
  - Battery overcharge protection
  - Safety timer for precharge and fast charge
  - No charge at current setting pin ICHG open or short
  - No charge at battery feedback pin FB open or short
  - Cold/hot battery temperature protection
- Available in WQFN 3x3-16 package

2 Applications

- Portable audio speaker
- EPOS
- Portable internet devices
- Wearables
- Accessory
- Power tools

3 Description

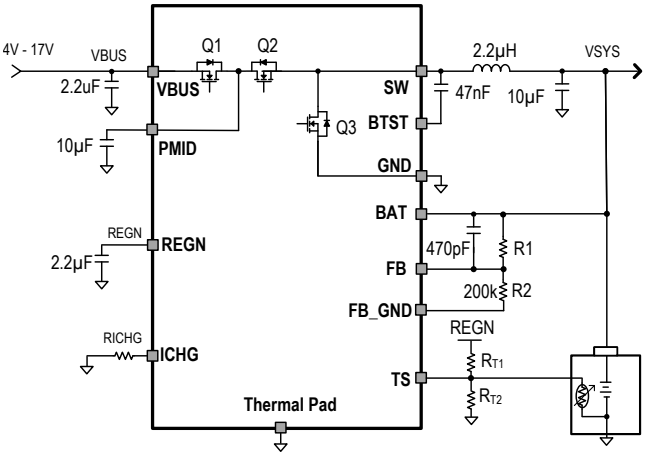
The BQ25306 is a highly-integrated standalone switch-mode battery charger for single cell and dual cell Li-Ion, Li-polymer, and LiFePO4 batteries. The BQ25306 supports a 4.0-V to 17-V input voltage for fast charging. The device's sensorless topology enables high charge efficiency and low BOM cost. The device's best-in-class 1-uA low quiescent current conserves battery energy and maximizes the shelf time for portable devices. The BQ25306 is available in a 3x3 WQFN package for easy 2-layer layout and space limited applications.

Device Information(1)

PART NUMBER	PACKAGE	BODY SIZE (NOM)
BQ25306	WQFN (16)	3.00mm x 3.00mm

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

Simplified Application



ADVANCE INFORMATION

4 Description (continued)

The BQ25306 supports a 4-V to 17-V input to charge either single cell batteries or dual batteries in series with charge voltage from 3.4 V to 9.0 V programmable by resistor divider. The device features fast charging for portable devices. Its input voltage and current regulation delivers maximum charging power to the battery. The solution is highly integrated with an input reverse-blocking FET (RBFET, Q1), high-side switching FET (HSFET, Q2), and low-side switching FET (LSFET, Q3).

The BQ25306 features lossless current sensing to reduce power loss and BOM cost with minimized component count. It also integrates a bootstrap diode for the high-side gate drive and battery temperature monitor to simplify system design. The device initiates a charge and completes a charging cycle without host control. The BQ25306 charge voltage and charger current are set by external resistors. The BQ25306 charge voltage is programmed by an external resister divider and it charges the battery in three phases: pre-conditioning, constant current, and constant voltage. At the end of the charging cycle, the charger automatically terminates if the charge current is below the termination current threshold and the battery voltage is above the recharge threshold. When the battery voltage falls below the recharge threshold, the charger will automatically start another charging cycle. The charger provides various safety features for battery charging and system operations, including battery temperature monitoring based on negative temperature coefficient (NTC) thermistor, charge safety timer, input over voltage and over current protections, as well as battery over voltage protection. Pin open and short protection is also built in to protect the charge current setting pin or battery voltage feedback pin if accidently opened or shorted to GND. The thermal regulation regulates charge current to limit die temperature during high power operation or high ambient temperature conditions.

The STAT pin output reports charging status and fault conditions. The BQ25306 provides up to 3-A continuous charge current to a single cell (1S) battery or dual cell batteries in series (2S). When the input voltage is removed, the device automatically enters a low current HiZ mode with very low battery leakage current to the charger device. The BQ25306 is available in a 3 mm x 3 mm thin WQFN package.

5 Device and Documentation Support

5.1 Device Support

5.1.1 Third-Party Products Disclaimer

TI'S PUBLICATION OF INFORMATION REGARDING THIRD-PARTY PRODUCTS OR SERVICES DOES NOT CONSTITUTE AN ENDORSEMENT REGARDING THE SUITABILITY OF SUCH PRODUCTS OR SERVICES OR A WARRANTY, REPRESENTATION OR ENDORSEMENT OF SUCH PRODUCTS OR SERVICES, EITHER ALONE OR IN COMBINATION WITH ANY TI PRODUCT OR SERVICE.

5.2 Documentation Support

5.2.1 Related Documentation

For related documentation see the following: *BQ25306 Evaluation Module User's Guide*

5.3 Receiving Notification of Documentation Updates

To receive notification of documentation updates, navigate to the device product folder on ti.com. In the upper right corner, click on *Alert me* to register and receive a weekly digest of any product information that has changed. For change details, review the revision history included in any revised document.

5.4 Community Resources

TI E2E™ support forums are an engineer's go-to source for fast, verified answers and design help — straight from the experts. Search existing answers or ask your own question to get the quick design help you need.

Linked content is provided "AS IS" by the respective contributors. They do not constitute TI specifications and do not necessarily reflect TI's views; see TI's Terms of Use.

5.5 Trademarks

E2E is a trademark of Texas Instruments.

5.6 Electrostatic Discharge Caution

This integrated circuit can be damaged by ESD. Texas Instruments recommends that all integrated circuits be handled with appropriate precautions. Failure to observe proper handling and installation procedures can cause damage.

ESD damage can range from subtle performance degradation to complete device failure. Precision integrated circuits may be more susceptible to damage because very small parametric changes could cause the device not to meet its published specifications.

5.7 Glossary

SLYZ022 — *TI Glossary*.

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

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.

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
BQ25306RTER	PREVIEW	WQFN	RTE	16	3000	Green (RoHS & no Sb/Br)	NIPDAU	Level-2-260C-1 YEAR	-40 to 85	B25306	
PQ25306RTET	ACTIVE	WQFN	RTE	16	250	TBD	Call TI	Call TI	-40 to 85		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.

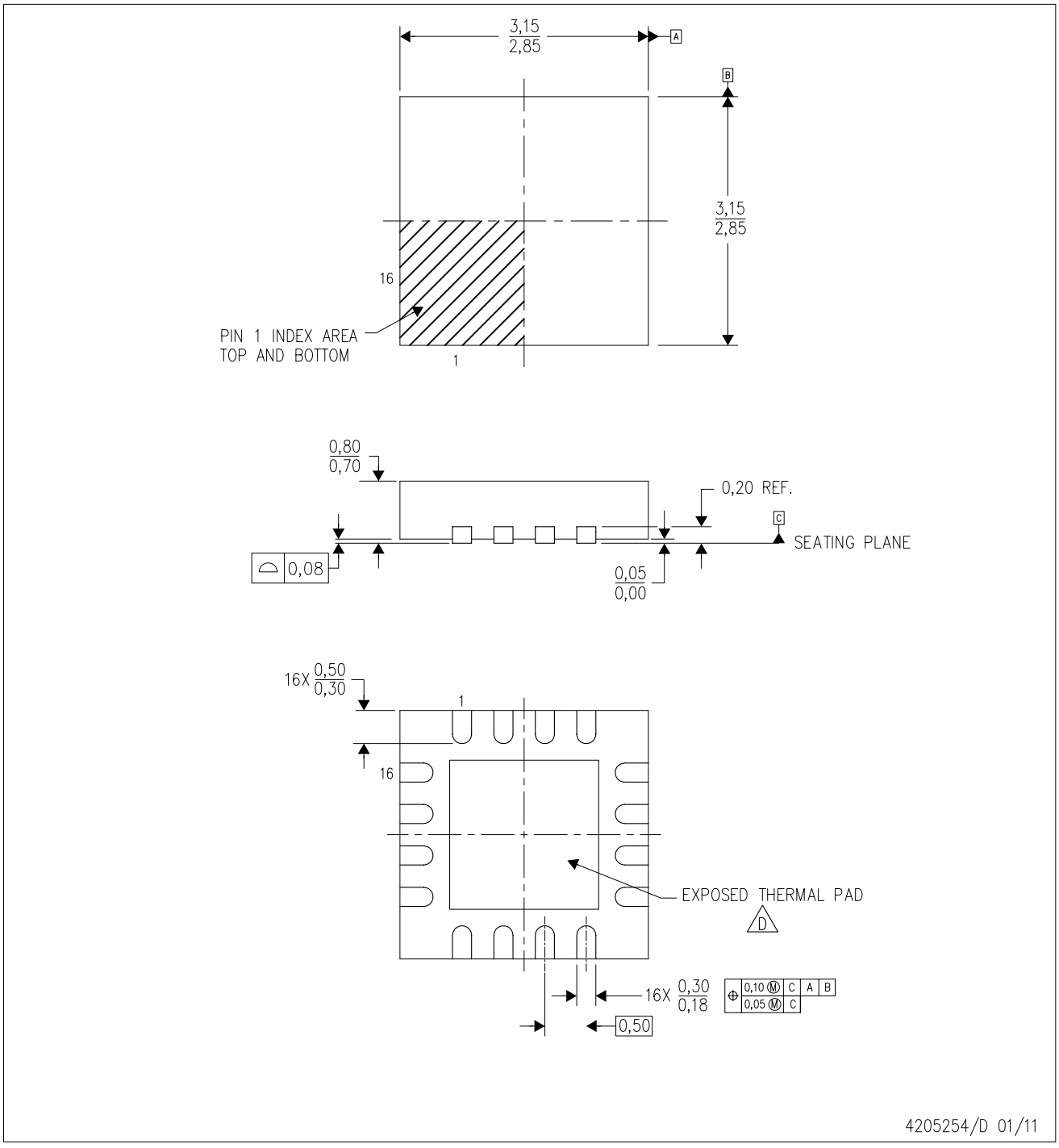
(3) MSL, Peak Temp. - The Moisture Sensitivity Level rating according to the JEDEC industry standard classifications, and peak solder temperature.

(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.

RTE (S–PWQFN–N16) 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. Quad Flatpack, No–leads (QFN) 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.
E. Falls within JEDEC MO–220.

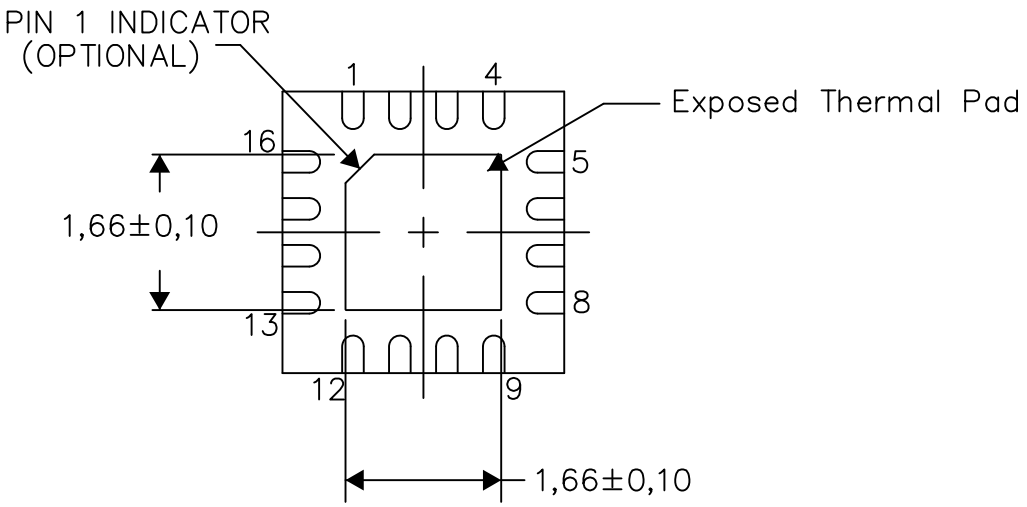
RTE (S–PWQFN–N16) PLASTIC QUAD FLATPACK NO–LEAD

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.

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



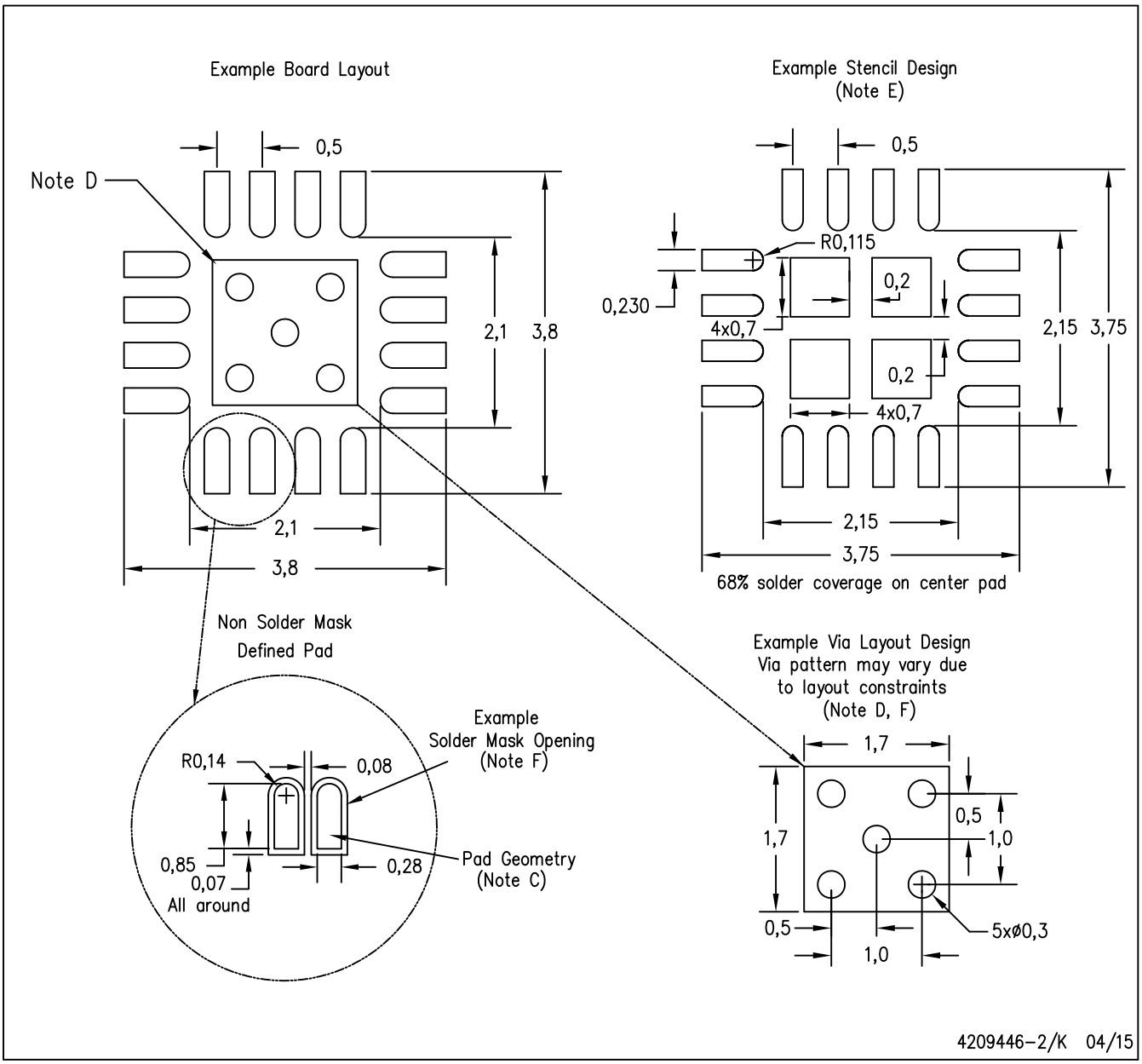
Bottom View

Exposed Thermal Pad Dimensions

4206446–8/U 08/15

NOTE: A. All linear dimensions are in millimeters

RTE (S–PWQFN–N16) PLASTIC QUAD FLATPACK NO–LEAD



NOTES:
A. All linear dimensions are in millimeters.
B. This drawing is subject to change without notice.
C. Publication IPC–7351 is recommended for alternate designs.
D. 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>.
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. Refer to IPC 7525 for stencil design considerations.
F. Customers should contact their board fabrication site for minimum solder mask web tolerances between signal pads.

IMPORTANT NOTICE AND DISCLAIMER

TI PROVIDES TECHNICAL AND RELIABILITY DATA (INCLUDING DATASHEETS), DESIGN RESOURCES (INCLUDING REFERENCE DESIGNS), APPLICATION OR OTHER DESIGN ADVICE, WEB TOOLS, SAFETY INFORMATION, AND OTHER RESOURCES “AS IS” AND WITH ALL FAULTS, AND DISCLAIMS ALL WARRANTIES, EXPRESS AND IMPLIED, INCLUDING WITHOUT LIMITATION ANY IMPLIED WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE OR NON-INFRINGEMENT OF THIRD PARTY INTELLECTUAL PROPERTY RIGHTS.

These resources are intended for skilled developers designing with TI products. You are solely responsible for (1) selecting the appropriate TI products for your application, (2) designing, validating and testing your application, and (3) ensuring your application meets applicable standards, and any other safety, security, or other requirements. These resources are subject to change without notice. TI grants you permission to use these resources only for development of an application that uses the TI products described in the resource. Other reproduction and display of these resources is prohibited. No license is granted to any other TI intellectual property right or to any third party intellectual property right. TI disclaims responsibility for, and you will fully indemnify TI and its representatives against, any claims, damages, costs, losses, and liabilities arising out of your use of these resources.

TI’s products are provided subject to TI’s Terms of Sale (www.ti.com/legal/termsofsale.html) or other applicable terms available either on ti.com or provided in conjunction with such TI products. TI’s provision of these resources does not expand or otherwise alter TI’s applicable warranties or warranty disclaimers for TI products.

Mailing Address: Texas Instruments, Post Office Box 655303, Dallas, Texas 75265