

BQ756506-Q1 4S or 6S Standalone Precision Automotive Battery Monitor, Balancer, and Integrated Current Sense

1 Features

- Qualified for automotive applications
- AEC-Q100 Qualified with the following results:
 - Device temperature grade 1: -40°C to $+125^{\circ}\text{C}$ ambient operating temperature range
 - Device HBM ESD classification level 2
 - Device CDM ESD classification level C4B
- **Functional Safety-Compliant**
 - Developed for functional safety applications
 - Documentation to aid ISO 26262 system design
 - Systematic capability up to ASIL D
 - Hardware capability up to ASIL D
- $\pm 1.5\text{-mV}$ ADC accuracy
- Pin-package and software compatible device family:
 - Stackable monitor 16S (BQ79616-Q1, BQ79656-Q1), 14S (BQ79614-Q1, BQ79654-Q1), and 12S (BQ79612-Q1, BQ79652-Q1)
 - Standalone monitor 48-V system (BQ75614-Q1)
- Supports current-sense measurement
- Supports fuse and relay open and close diagnostics
- Built-in redundancy path for voltage and temperature and current diagnostics
- Highly accurate cell voltage measurements within $128\ \mu\text{s}$ for all cell channels
- Integrated post-ADC configurable digital low-pass filters
- Built-in host-controlled hardware reset to emulate POR-like device reset
- Supports internal cell balancing
 - Balancing current at 240 mA
 - Built-in balancing thermal management with automatic pause and resume control
- 5-V LDO output to power external digital isolator
- UART host interface
- Built-in SPI controller

2 Applications

- Automotive 12-V Li-ion battery systems
- E-bikes, E-scooters

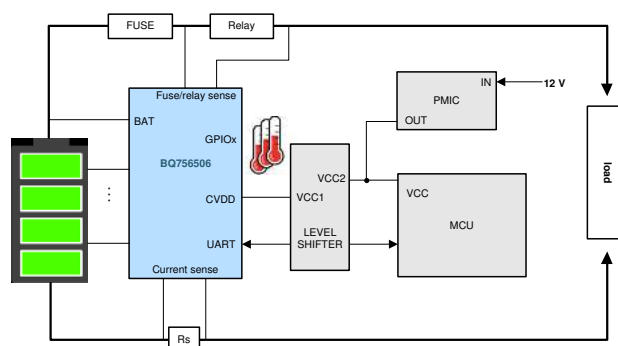
3 Description

The BQ756506-Q1 device provides high-accuracy cell voltage measurements up to 6S battery modules in less than $200\ \mu\text{s}$ while this device also supports shunt-resistor current sense measurement. The integrated front-end filters enable the system to implement with simple, low voltage rated, differential RC filters on the cell input channels. The integrated, post-ADC, low-pass filters enable filtered, DC-like, voltage measurements. This device also supports integrated current sensing capabilities with an option to synchronize with cell voltage measurements for better state of charge (SOC) calculation. The device supports autonomous internal cell balancing with temperature monitoring to auto-pause and resume balancing to avoid an overtemperature condition.

Device Information

| PART NUMBER (1) | PACKAGE | BODY SIZE (NOM) |
|-----------------|----------------|---------------------|
| BQ756506-Q1 | HTQFP (64-pin) | 10.00 mm × 10.00 mm |

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



Simplified System Diagram



4 Description (continued)

This device also includes eight GPIOs or auxiliary inputs that can be used for external thermistor measurements.

Host communication to the BQ756506-Q1 can be connected via the device's dedicated UART interface.

5 Device and Documentation Support

5.1 Device Support

5.1.1 Third-Party Products Disclaimer

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5.2 Receiving Notification of Documentation Updates

To receive notification of documentation updates, navigate to the device product folder on [ti.com](https://www.ti.com). Click on *Subscribe to updates* 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.

5.3 Support 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.

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5.4 Trademarks

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5.5 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.

5.6 Glossary

[TI Glossary](#) This glossary lists and explains terms, acronyms, and definitions.

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 |
|------------------|---------------|--------------|-----------------|------|-------------|-----------------|--------------------------------------|----------------------|--------------|-------------------------|---------|
| BQ756506PAPRQ1 | ACTIVE | HTQFP | PAP | 64 | 1000 | RoHS & Green | NIPDAU | Level-3-260C-168 HR | -40 to 125 | BQ756506 | 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.

OBSELETE: 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.

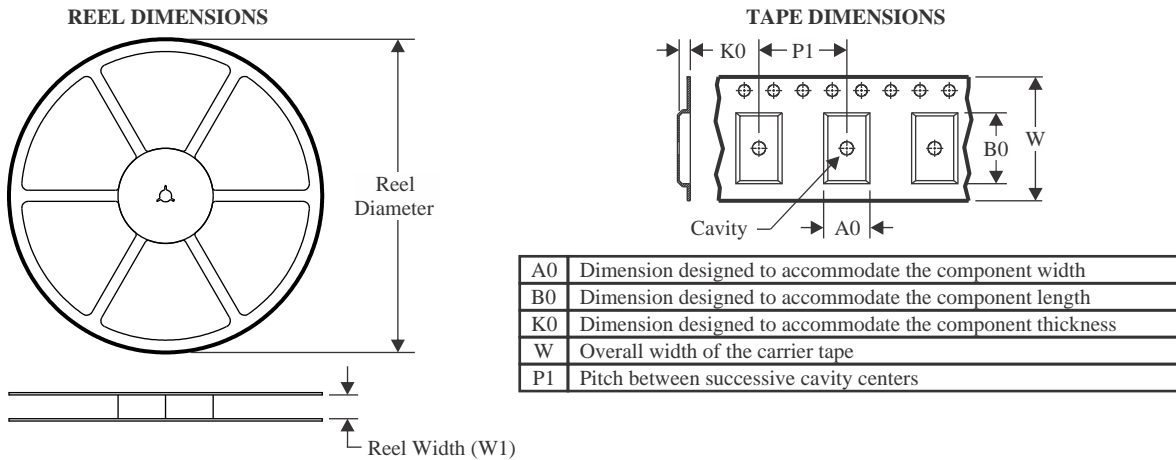
(4) There may be additional marking, which relates to the logo, the lot trace code information, or the environmental category on the device.

(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

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 |
|----------------|--------------|-----------------|------|------|--------------------|--------------------|---------|---------|---------|---------|--------|---------------|
| BQ756506PAPRQ1 | 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) |
|----------------|--------------|-----------------|------|------|-------------|------------|-------------|
| BQ756506PAPRQ1 | HTQFP | PAP | 64 | 1000 | 367.0 | 367.0 | 55.0 |

GENERIC PACKAGE VIEW

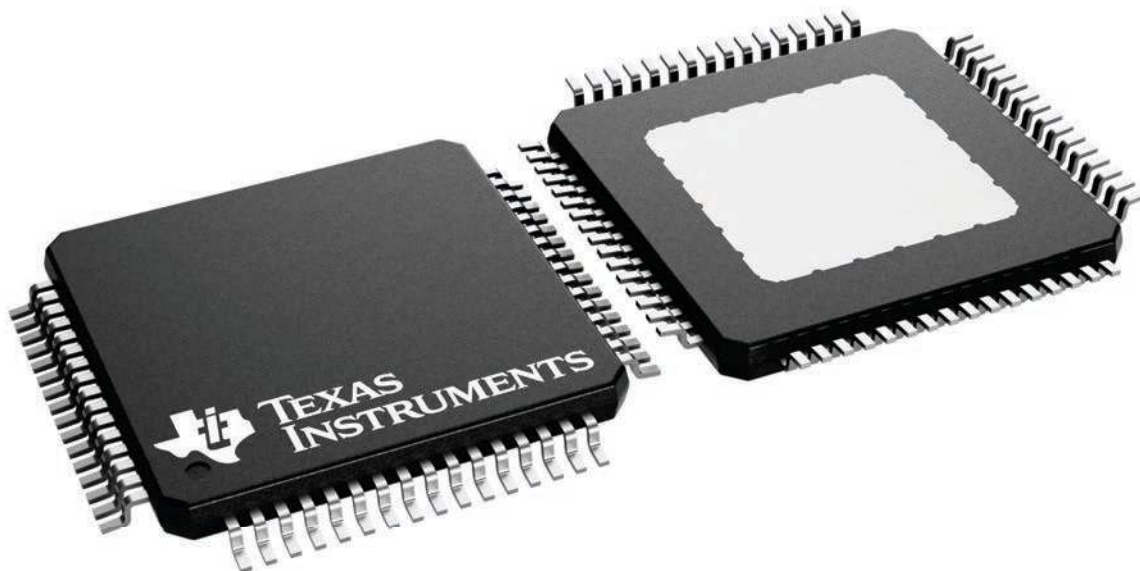
PAP 64

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.



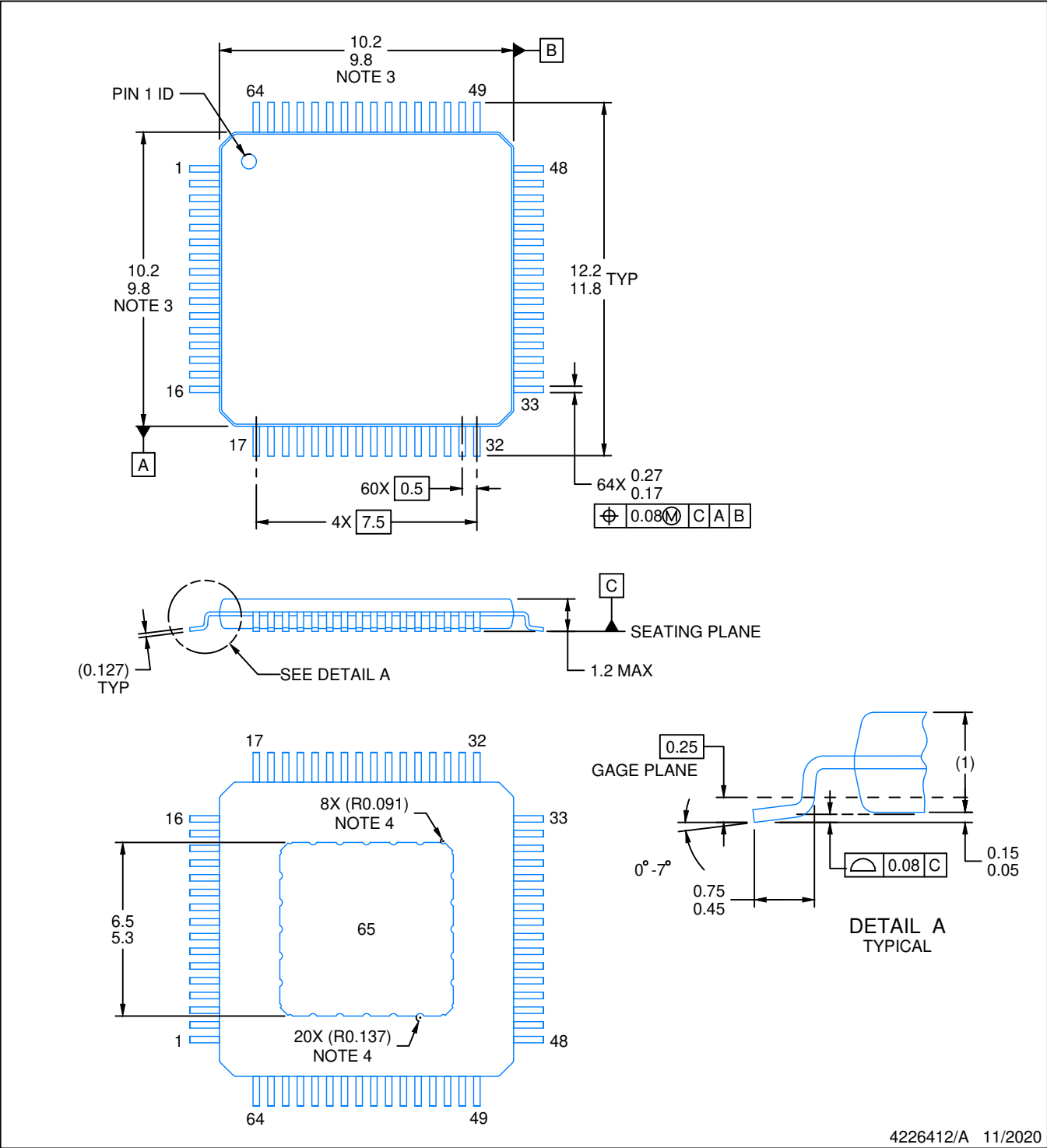
4226442/A

PACKAGE OUTLINE

PAP0064F

PowerPAD™ TQFP - 1.2 mm max height

PLASTIC QUAD FLATPACK



4226412/A 11/2020

NOTES:

PowerPAD is a trademark of Texas Instruments.

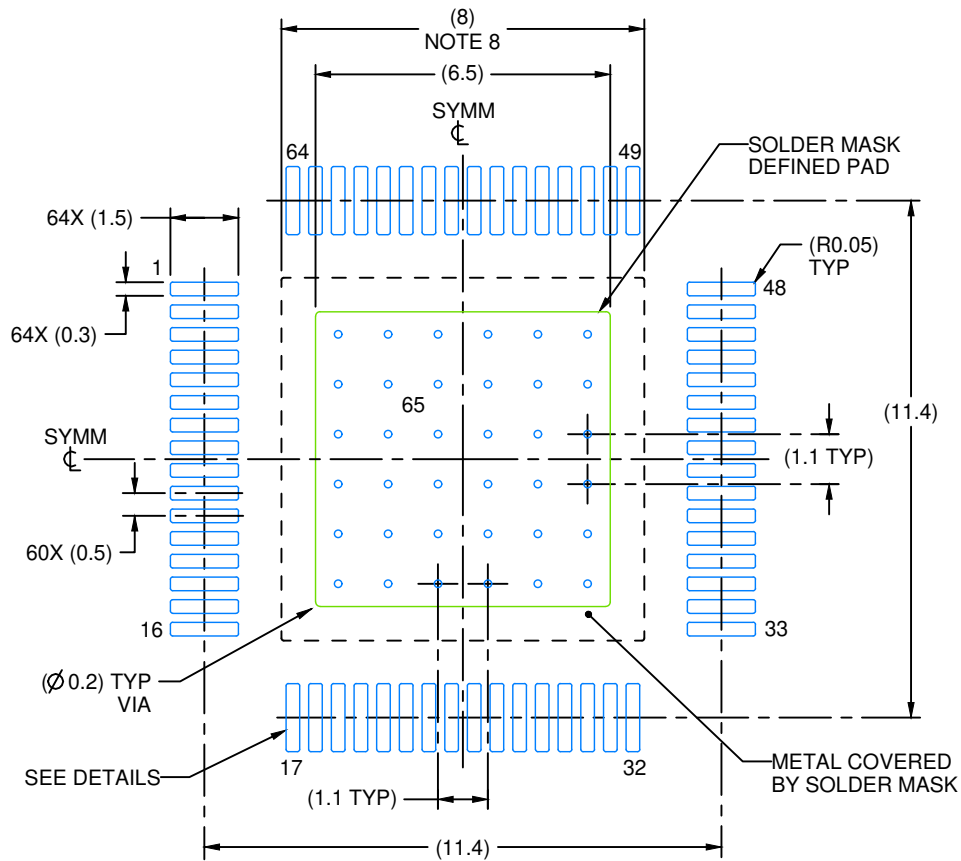
1. All linear dimensions are in millimeters. Any dimensions in parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.
3. This dimension does not include mold flash, protrusions, or gate burrs.
4. Strap features may not be present.
5. Reference JEDEC registration MS-026.

EXAMPLE BOARD LAYOUT

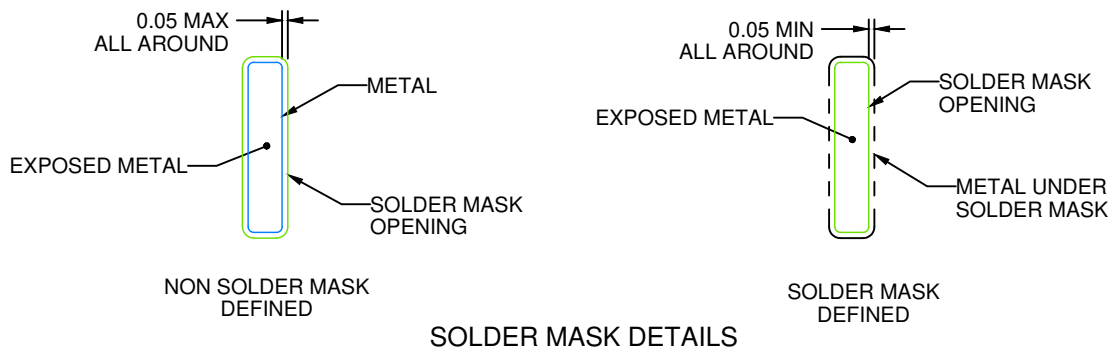
PAP0064F

PowerPAD™ TQFP - 1.2 mm max height

PLASTIC QUAD FLATPACK



LAND PATTERN EXAMPLE
EXPOSED METAL SHOWN
SCALE:6X



SOLDER MASK DETAILS

4226412/A 11/2020

NOTES: (continued)

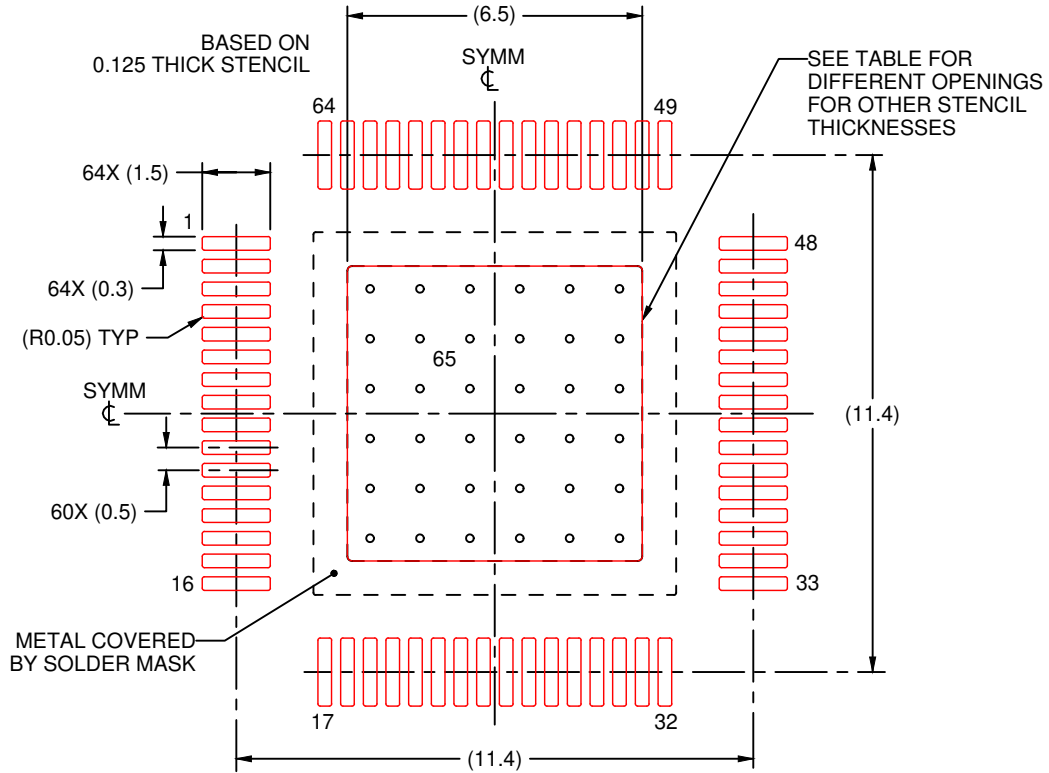
6. Publication IPC-7351 may have alternate designs.
7. Solder mask tolerances between and around signal pads can vary based on board fabrication site.
8. This package is designed to be soldered to a thermal pad on the board. See technical brief, Powerpad thermally enhanced package, Texas Instruments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

PAP0064F

PowerPAD™ TQFP - 1.2 mm max height

PLASTIC QUAD FLATPACK



SOLDER PASTE EXAMPLE
EXPOSED PAD
100% PRINTED SOLDER COVERAGE BY AREA
SCALE:6X

| STENCIL THICKNESS | SOLDER STENCIL OPENING |
|-------------------|------------------------|
| 0.1 | 7.27 X 7.27 |
| 0.125 | 6.5 X 6.5 (SHOWN) |
| 0.15 | 5.93 X 5.93 |
| 0.175 | 5.49 X 5.49 |

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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.

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