

TPS99000-Q1 System Management and Illumination Controller

1 Features

- Qualified for Automotive Applications
- AEC-Q100 Qualified With the Following Results:
 - Device Temperature Grade 2: –40°C to 105°C Ambient Operating Temperature
 - Device HBM ESD Classification Level 2
 - Device CDM ESD Classification Level C4B
- Automotive System Management Device for DLP® Products:
 - Advanced Power Monitoring, Sequencing, and Protection Circuits
 - Two Die Temperature Monitors, MCU External Watchdog Timer, Clock Frequency Monitor
 - System Over-Brightness Detection
 - SPI Port With Parity, Checksum, and Password Register Protection
 - Second SPI Port for Independent System Monitoring
- On-Chip DMD Mirror Voltage Regulators
 - Generates +16-V, +8.5-V and –10-V DMD Control Voltages
- High Dynamic Range Dimming and Color Control, Enabling > 5000:1 Dimming Range With High Bit Depth and White Color Balance:
 - Two Transimpedance Amplifiers (TIA) With Wide Dynamic Range Supporting Numerous Optical Designs
 - 12-bit ADC With up to 64 Time Sequence Samples per Frame
 - DAC and Comparator Functions for Color and Pulse Control
 - FET Drivers for LED and Shunt Control

2 Applications

- Wide Field of View and Augmented Reality Head-Up Display (HUD) Systems
- Automotive Advanced Lighting Applications (High Resolution Headlight)
- Adaptive Driving Beam (ADB)

3 Description

The TPS99000-Q1 system management and illumination controller is part of the DLPC230-Q1 DMD display controller chipset, which includes the DLP553x-Q1. The chipset provides all functions needed to support and exceed typical 5000:1 display dimming requirements for Head-Up Display (HUD) applications, with typical requirements of 3 to 15,000 nits brightness range and tight color point control.

The TPS99000-Q1 illumination controller integrates a 12-bit ADC, two DACs (12-bit and 10-bit), and two high-performance photodiode signal conditioning transimpedance amplifiers (TIAs) as the core components of the illumination control system. The ADC is capable of automatic sampling up to 64 events per video frame.

An integrated DMD high-voltage regulator supplies DMD mirror reference voltages, meeting the required tight tolerances. The power supply sequencer and monitor provide robust coordination of power-up and power-down events for the entire chipset.

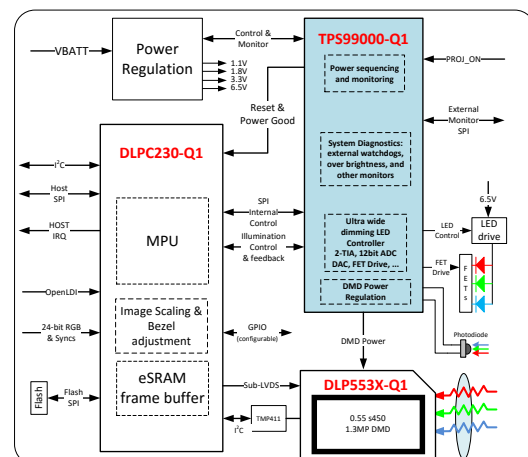
Advanced system status monitoring circuits provide real-time visibility into display sub-system operational condition, including two processor watchdog circuits, two die temperature monitors, comprehensive supply monitoring for overvoltage and undervoltage detection, checksum and password register protection with byte-level parity on SPI bus transactions, an excessive brightness monitor circuit, and other built-in test functions.

Device Information⁽¹⁾

PART NUMBER	PACKAGE	BODY SIZE (NOM)
TPS99000-Q1	HTQFP (100)	14.00 mm × 14.00 mm

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

TPS99000-Q1 Chip-Level Diagram



4 Device and Documentation Support

4.1 Device Support

4.1.1 Third-Party Products Disclaimer

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4.2 Trademarks

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4.3 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.

4.4 Glossary

[SLYZ022](#) — *TI Glossary*.

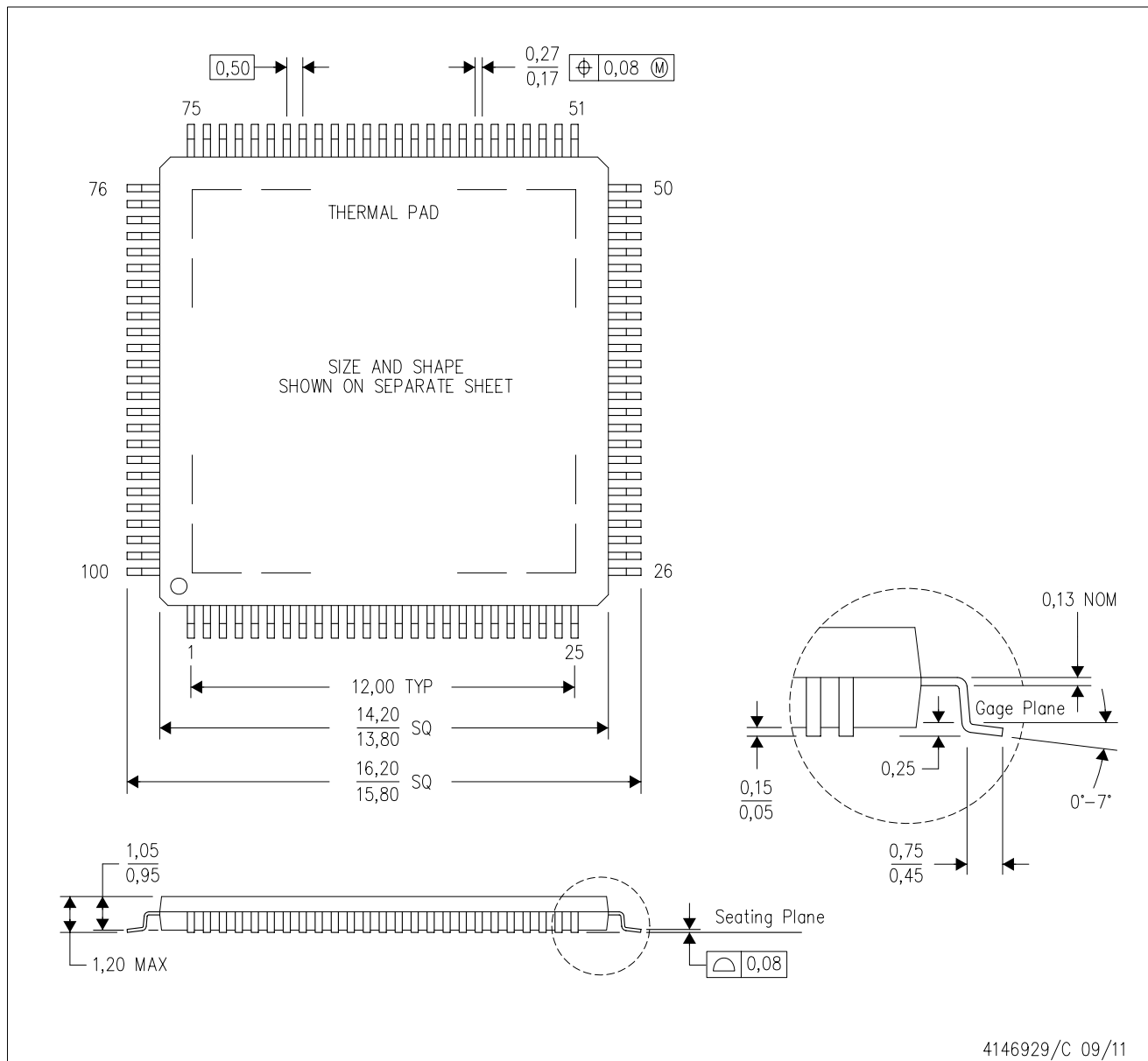
This glossary lists and explains terms, acronyms, and definitions.

5 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.

PZP (S-PQFP-G100)

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. See the additional figure in the Product Data Sheet for details regarding the exposed thermal pad features and dimensions.
 - F. Falls within JEDEC MS-026

PowerPAD is a trademark of Texas Instruments.

THERMAL PAD MECHANICAL DATA

PZP (S-PQFP-G100)

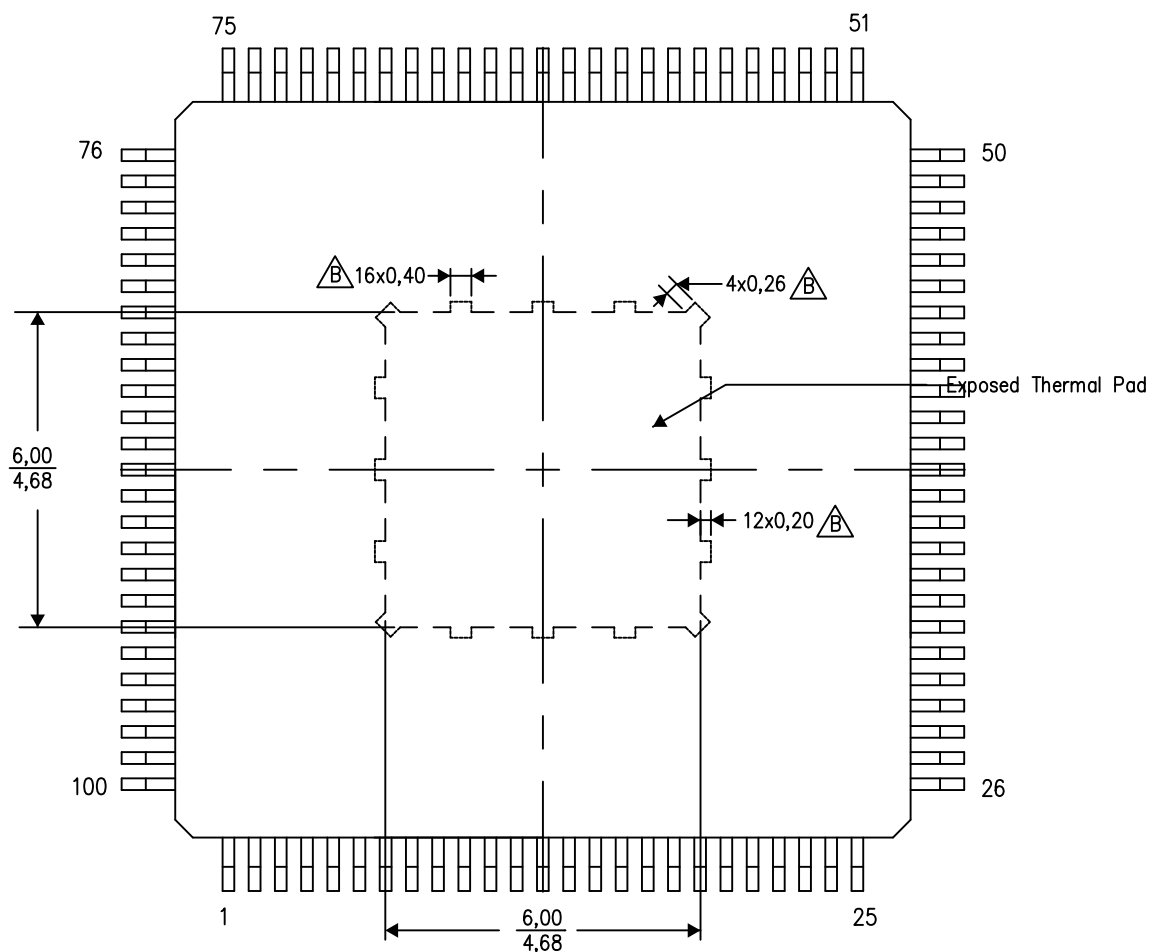
PowerPAD™ PLASTIC QUAD FLATPACK

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.



Top View

Exposed Thermal Pad Dimensions

4206333-6/L 05/14

NOTE: A. All linear dimensions are in millimeters

 Tie strap features may not be present.

PowerPAD is a trademark of Texas Instruments

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
PTP99000ACPZPR	ACTIVE	HTQFP	PZP	100		TBD	Call TI	Call TI	-40 to 105		Samples
TPS9900TPZPRQ1	PREVIEW	HTQFP	PZP	100	1000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-3-260C-168 HR	-40 to 105	TPS9900TPZP	

(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.

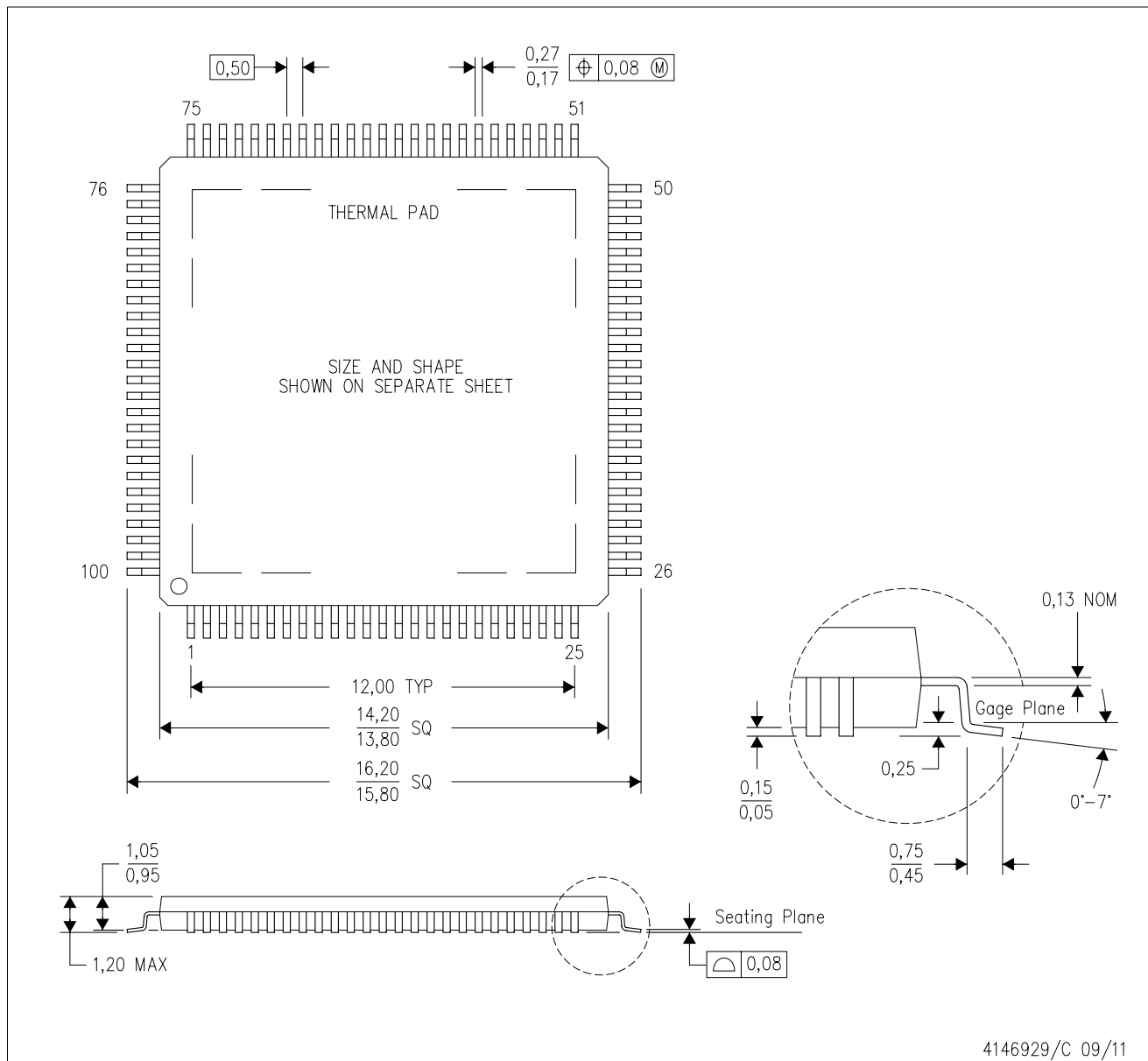
(6) Lead/Ball Finish - Orderable Devices may have multiple material finish options. Finish options are separated by a vertical ruled line. Lead/Ball Finish values may wrap to two lines if the finish value exceeds the maximum column width.

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PZP (S-PQFP-G100)

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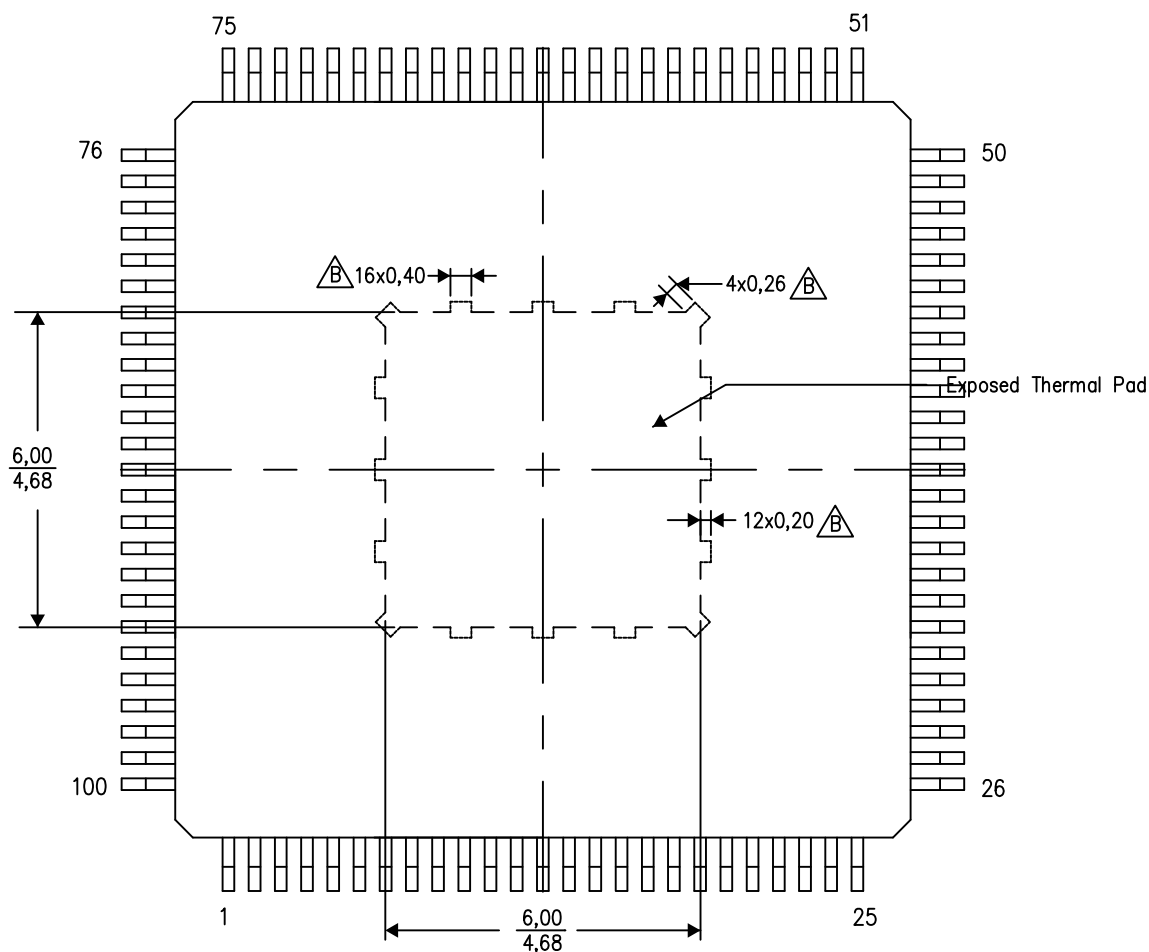
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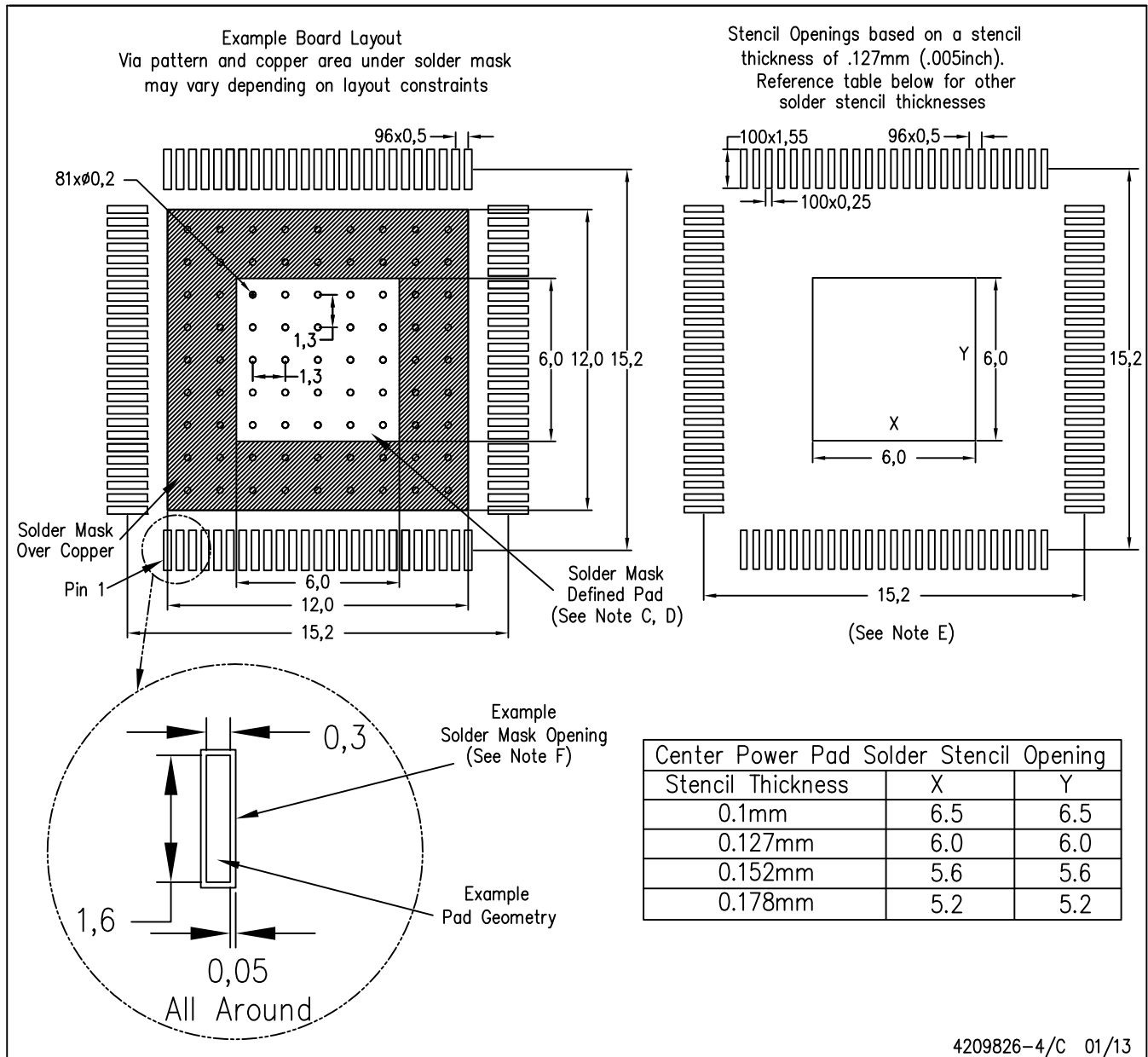
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 - Customers should place a note on the circuit board fabrication drawing not to alter the center solder mask defined pad.
 - This package is designed to be soldered to a thermal pad on the board. Refer to Technical Brief, PowerPAD Thermally Enhanced 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.
 - 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.
 - Customers should contact their board fabrication site for solder mask tolerances between and around signal pads.

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