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APPLICATION NOTE 5604

Soldering Guidelines for MEMS Inertial Sensors

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Abstract: Standard PCB design and mounting processes can adversely influence MEMS inertial sensors. This application note contains guidelines for the layout, soldering, and mounting of MEMS inertial sensors in LGA packages in order to reduce stresses and improve functionality.

Introduction

MEMS inertial sensors can be sensitive to printed circuit board (PCB) design and PCB mounting processes such as reflow. Reducing stresses on a MEMS package can help ensure the best performance for the entire inertial sensing application.

This application note contains guidelines for the layout, soldering, and mounting of MEMS inertial sensors, such as those in accelerometers and gyroscopes, in a land grid array (LGA) package.

This document (including dimensions, notes, and specifications) provides recommendations based on typical circuit board manufacturing parameters. However, since land pattern design depends on many unknown factors (e.g., the user's board manufacturing specs), the user needs to determine the suitability of the guidelines for a particular case .

Guidelines

In addition to common PCB design rules and industrial practices, some simple layout and process guidelines should be applied for LGA sensor soldering.

Layout Guidelines

PCB design and layout is essential to consider in order to reduce stress and to increase the functionality of the device.

The following are layout recommendations and requirements.

- It is recommended to design a PCB land pattern as non-solder-mask defined (NSMD).
- The area covered by the LGA package *must* be defined as a "keep out" area.
- It is strongly recommended not to place metal patterns (e.g., traces, pours) or vias underneath the

LGA package (**Figure 1**). These structures can cause irregular mechanical stress to the internal mass.

- Components near the MEMS land area can cause additional stress. It is strongly recommended not to place large insertion components (e.g., shields, buttons, cover insertions, screws) at a distance of less than 2mm from the sensor package.
- The pin 1 indicator *must* be left unconnected for proper device functionality.
- To obtain the best package self-alignment on the designed PCB footprint during solder reflow, care *must* be taken for symmetry on pad traces (e.g., use dummy traces even on pads not internally connected).

To properly design a PCB land and solder mask, refer to the specific component's data sheet and Maxim's Packaging and Reliability page for information about package outline design.

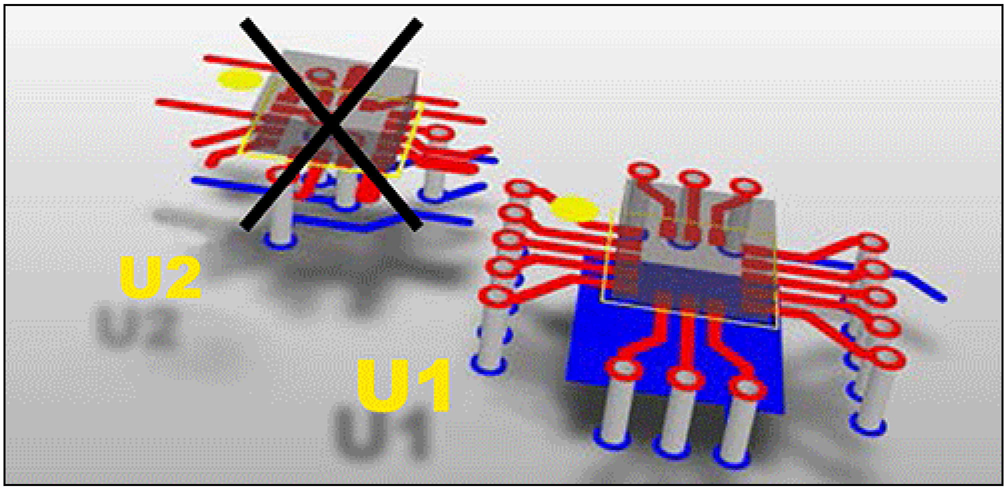

Figure 1. U1 shows optimal routing for sensors in LGA packages, whereas U2 shows that the layout rules have not been respected.

Process Guidelines

The pattern design, the thickness of the soldering paste, and the reflow process profiles should be considered for proper device soldering.

The following are process recommendations and requirements.

- The stencil thickness and the aperture for the soldering paste should be properly dimensioned to allow proper cleaning of flux residuals and to allow clearance between the PCB and the package.
- Soldering material *must not* reflow on package sides in order to prevent short circuits on the lateral metal traces inside the LGA package.
- An additional cleaning of the PCB after soldering is strongly recommended to avoid leakage between adjacent pads due to flux residues.

Maxim's inertial sensor LGA packages are qualified for soldering heat resistance in accordance with the JEDEC J-STD-020D Moisture Sensitivity Level 3 standards. For more information on the soldering heat resistance as well as details about the lead-free and RoHS status of a device, refer to the specific component's data sheet. Contact technical support with any further questions.

Conclusion

Although MEMS inertial sensors are very sensitive to stresses produced in PCB design and mounting processes, following best practices during layout and processing can eliminate them and ensure optimal performance.

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MAX21000	Ultra-Accurate, Low Power, 3-Axis Digital Output Gyroscope	Free Samples

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