Soldering and Mounting Guidelines for the LGA Accelerometer Sensor to a PC Board

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INTRODUCTION

MEMS based sensors are sensitive to Printed Circuit Board (PCB) reflow processes. For optimal zero-g offset after PCB mounting, care must be taken to PCB layout and reflow conditions. This application note is a guideline for soldering and mounting the LGA package inertial sensors. The purpose of these guidelines is to minimize the stress on the package after board mounting. Both the MMA73x1L 3-axis analog output family of accelerometers and the MMA745xL digital output accelerometer use the Land Grid Array (LGA) package platform. This application note describes suggested methods of soldering these devices to the PC board for consumer applications. Figure 1 shows the bottom view of LGA 14 lead, 3 x 5 mm individual sensor device. Figure 2 shows the recommended PCB land pattern for the package.

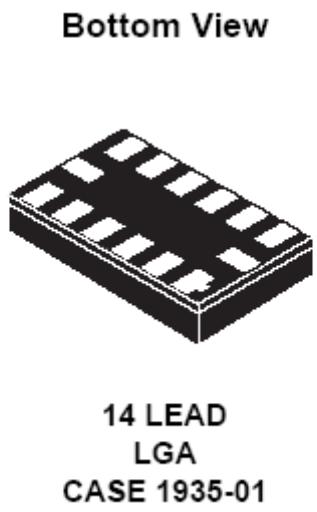

Figure 1. LGA 14-Lead, 5 x 3 mm Die Sensor

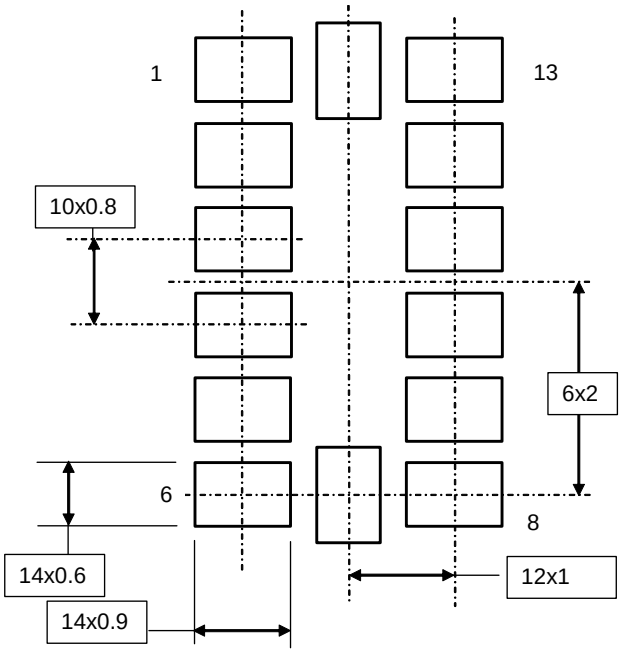

Figure 2. Recommended PCB Land Pattern for the 5 x 3 mm LGA Package

OVERVIEW OF SOLDERING CONSIDERATIONS

Information provided here is based on experiments executed on LGA devices. They do not represent exact conditions present at a customer site. Hence, information herein should be used as a guidance only and process and design optimizations are recommended to develop an application specific solution. It should be noted that with the proper PCB footprint and solder stencil designs the package will self-align during the solder reflow process.

The following are the recommended guidelines to follow for mounting LGA sensors for consumer applications.

PCB Mounting Recommendations

1. The PCB land should be designed with Non Solder Mask Defined (NSMD) as shown in Figure 5.
2. No additional metal pattern underneath package as shown in Figure 4.

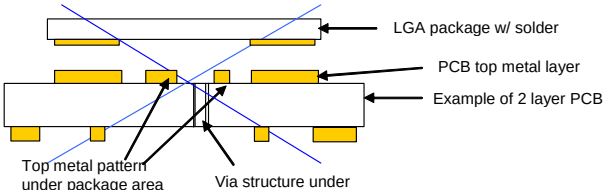

Figure 3. Incorrect PCB Top Metal Pattern Under Package

3. PCB land pad is 0.9mm x 0.6mm which is the size of the package pad plus 0.1mm as shown below in Figure 5.

Figure 4. Correct PCB Top Metal Pattern Under Package

4. The solder mask opening is equal to the size of the PCB land pad plus an extra 0.1mm as shown in Figure 5.
5. The stencil aperture size is equal to the PCB land pad – 0.025mm. Also note that for the 4 corner pads the aperture size must be larger for solder balancing as shown in Figure 6 and Figure 7. A 6mil thick stencil is recommended.

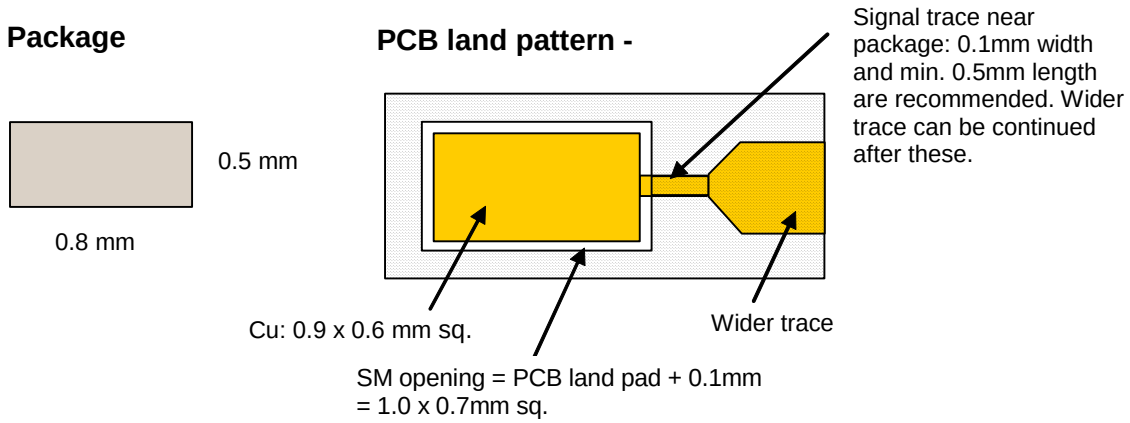

Figure 5. Recommended PCB Land Pad, Solder Mask, and Signal Trace Near Package Design

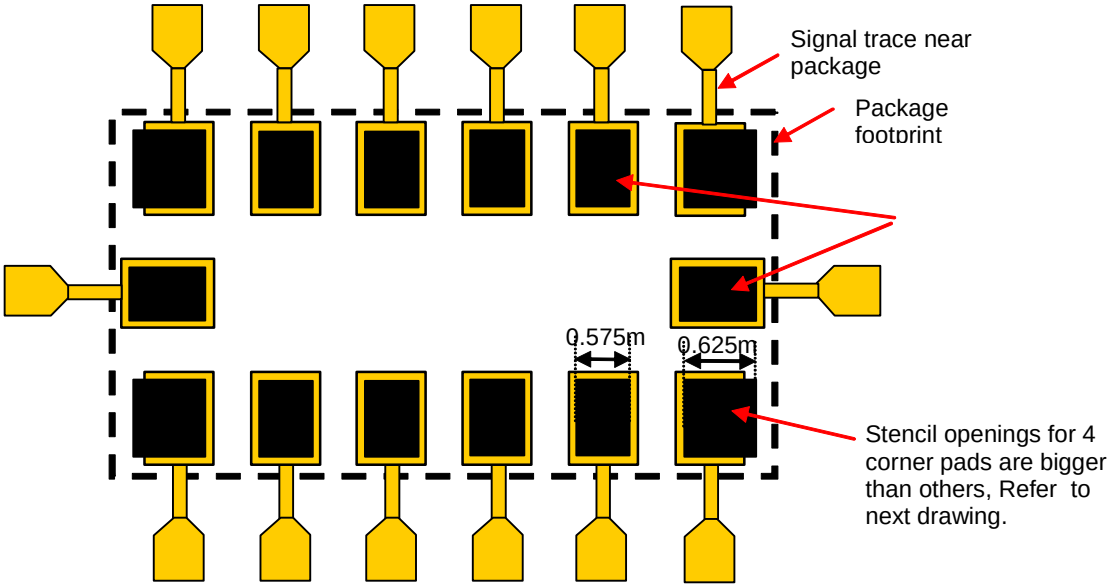

Figure 6. Stencil Design Guidelines

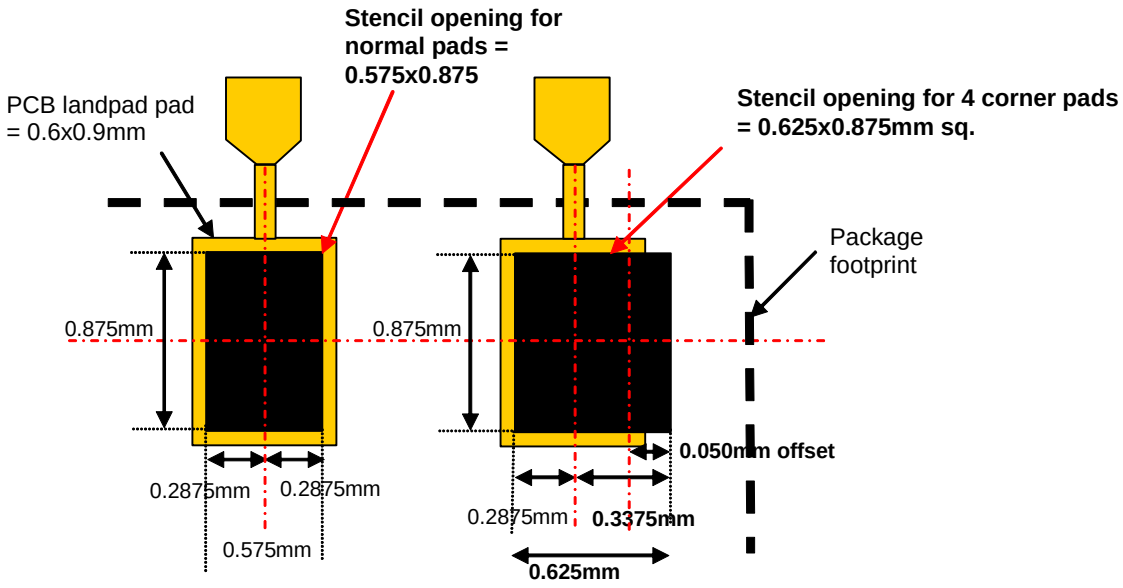

Figure 7. Stencil Design Guidelines (detailed dimensions for corner pads)

6. Do not place any components or vias at a distance less than 2mm from the package land area. This may cause additional package stress if it is too close to the package land area.
7. Signal traces connected to pads should be as symmetric as possible. Put dummy traces on N/C pads in order to have same length of exposed trace for all pads. Signal traces with 0.1mm width and min. 0.5mm length for all PCB land pads near the package are recommended as shown in Figure 5, Figure 6, and Figure 7. Wider trace can be continued after the 0.5mm zone.
8. Use a standard pick and place process and equipment. Do not us a hand soldering process.
9. It is recommended to use a cleanable solder paste with an additional cleaning step after SMT mount.
10. Do not use a screw down or stacking to fix the PCB into an enclosure because this could bend the PCB putting stress on the package.
11. The PCB should be rated for the multiple lead-free reflow condition with max 260°C temperature.
12. The recommended peak temperature for the solder paste for lead free (Pb-free) is 245°C - 250°C and for the tin-lead (Sn-Pb), 215°C - 225°C.

Please cross reference with the device data sheet for mounting guidelines specific to the exact device used.

Freescale LGA sensors are compliant with Restrictions on Hazardous Substances (RoHS), having halide free molding compound (green) and lead-free terminations. These terminations are compatible with tin-lead (Sn-Pb) as well as tin-silver-copper (Sn-Ag-Cu) solder paste soldering processes. Reflow profiles applicable to those processes can be used successfully for soldering the devices.

SUMMARY

There are many new applications being designed using LGA die accelerometers. This document suggests soldering methods for the MMA73x1L family and the MMA745xL accelerometers.

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