8-Lead LLP Thermal Performance and Design Guidelines

National Semiconductor
Application Note 1201
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Introduction

The new leadless leadframe package (LLP) provides significantly increased power dissipation capability in a tiny surface-mount package. The key feature of the LLP is that it has a center metal area located directly below the die which allows a direct path for heat to flow out, providing very low thermal resistance. When this pad is connected to PC board copper to provide heatsinking, values of total thermal resistance (junction-to-ambient) below 40˚C/W can be obtained in still air environments.

Modelling Assumptions

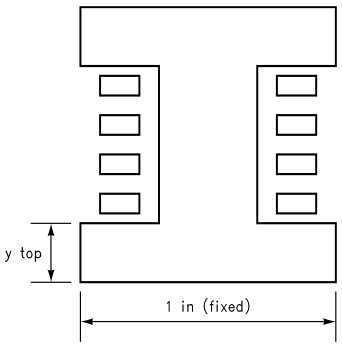
The data listed in this application note is derived from finite element modelling in which the following assumptions are used:

1. DAP (die attach paddle) size = 3.0 mm x 2.2 mm
2. Die size = 2.11 mm x 1.63 mm
3. Package size = 4.0 mm x 4.0 mm x 0.75 mm
4. Power Dissipation = 1W
5. Thermal Vias (0.3 mm diameter) = 8

Copper Patterns

Data is provided for PCB designs using copper patterns which are 'dog-bone' shaped on the top layer and a square pattern directly beneath the part on the bottom layer (see below). In the bottom layer pattern, the X and Y dimensions are equal.

PCB Top Copper Pattern



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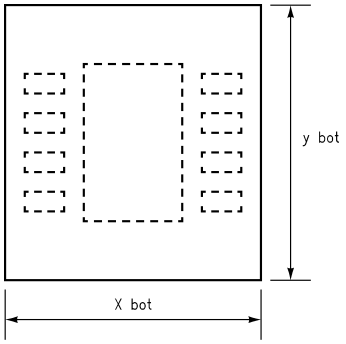
PCB Bottom Copper Pattern



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Performance Data

Curves are provided showing the thermal resistance (junction-to-ambient) values obtained for various size copper patterns using top layer only, bottom layer only, and top + bottom layer for PC boards with 0.5 oz., 1 oz., and 2 oz. copper weights (all data is for still air):

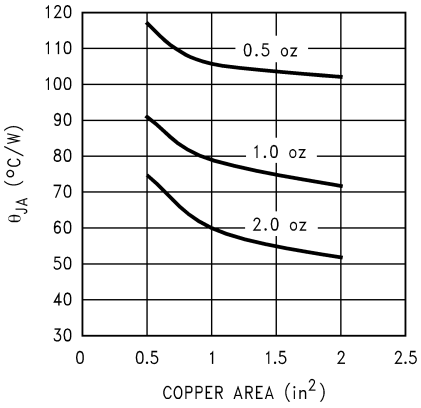

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FIGURE 1. Thermal Data for Top Layer only

Performance Data (Continued)

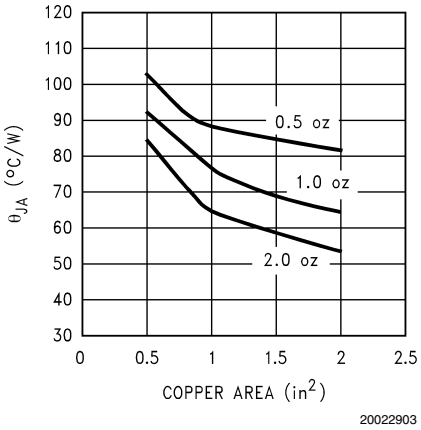

FIGURE 2. Thermal Data for Bottom Layer only

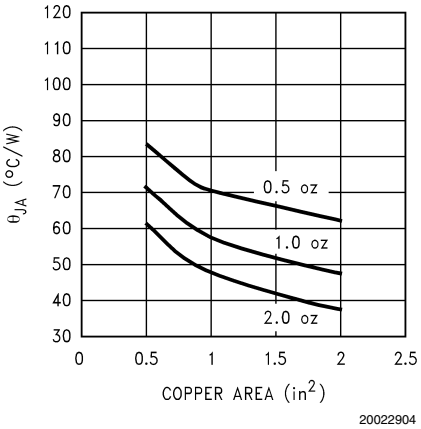

FIGURE 3. Thermal Data for Top and Bottom Layers

Conclusions

It was shown that the still-air thermal resistance value (junction-to-ambient) for the 8-lead LLP will vary from a maximum of 115˚C/W down to about 37˚C/W by increasing the available PCB copper from about 0.5 sq. in. (0.5 oz., top layer only) to about 2 sq. in. (2 oz., top and bottom layers used). This gives the designer the information needed to design a PC board which can provide a thermal resistance value within that range.

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