Application Report
SNOA404B–May 2004–Revised May 2004

AN-1201 8-Lead LLP Thermal Performance and Design Guidelines

ABSTRACT

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.

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1 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.

2 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

3 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.

Figure 1. PCB Top Copper Pattern

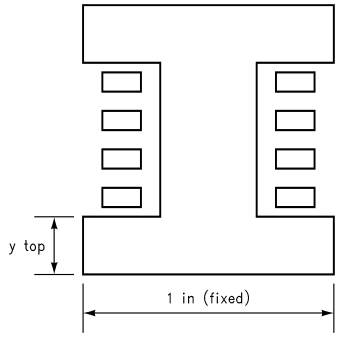
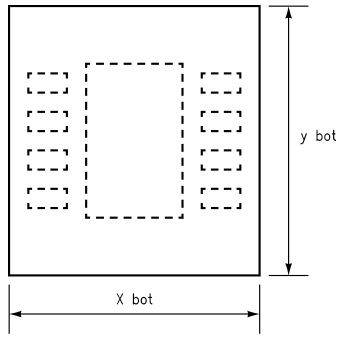


Figure 2. PCB Bottom Copper Pattern



4 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):

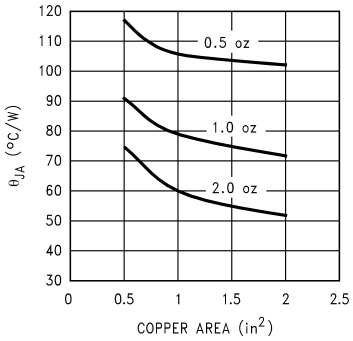


Figure 3. Thermal Data for Top Layer only

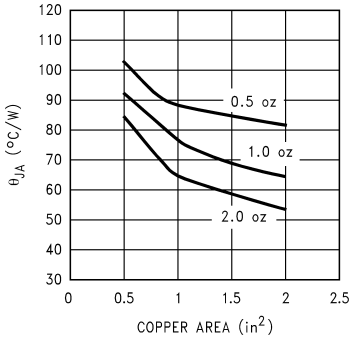


Figure 4. Thermal Data for Bottom Layer only

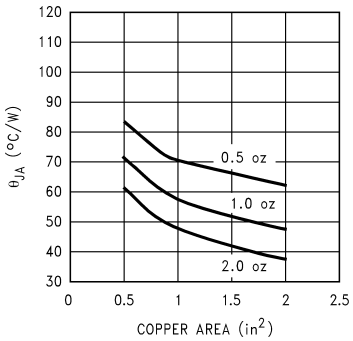


Figure 5. Thermal Data for Top and Bottom Layers

5 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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