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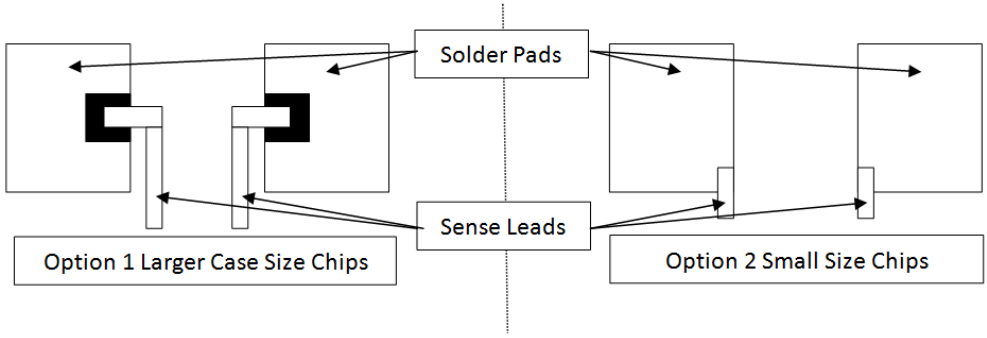
Surface Mount Current Sense Shunt Usage Recommendations

Accurate sensing using a current sense resistor requires two important things. First, the sense resistor itself must be chosen with the proper precision in terms of resistance value, resistance tolerance, and TCR. The second aspect, which is commonly overlooked, is the board design and layout by the end user. In this application note, we will discuss some design and solder pads recommendations for maximizing the accuracy and reliability of a current sensing circuit utilizing sense resistors.

High Power Handling Design

Because of how they are used, current sense resistors are subjected to high currents and as a result are required to continuously dissipate large amounts of power. They are typically designed to withstand the inherent high temperatures associated with those large amounts of power, but caution is still needed to ensure the resistors remain within their operating temperature range. It is recommended that a higher copper weight of at least 2 oz. / ft2 be specified; it's usually not significantly more expensive than the standard 1 oz. coper and provides a definite improvement in thermal resistance. For thermal considerations it is beneficial to maximize the size of the conductor pad for the current sense resistors. It should be noted that the conductor for the pad can be much larger than the recommended solder pad itself since the pad is the solderable window in the solder mask on the PCB which allows the resistor to be attached. Simply making the solder pad itself very large can cause large variations in sensing repeatability. Other heat reduction techniques, including additional heat conduction layers, wider conductor traces, thermal vias through the board, and airflow, should be used as needed. It is critical to maintain safe operating temperatures for the sense resistors to achieve long term reliability.



Solder Pad Layout

For optimal current sensing, the layout shown in Option 1 above is preferred for all chip sizes 0805 and larger and anywhere there is sufficient room under the part. This layout provides the most accurate sensing for any two terminal resistor chip. The sense leads should be as close as possible to the resistive element and near the center of the solder pad to minimize the variation in sensing due to soldering. The sense leads connection can be isolated to minimize the TCR effects on the sensing operation. Option 2 above should be used for small case size chips and for designs where the space between the solder pads must be used for trace routing for other critical components. The sense leads should again be as close as possible to the resistive element.

More Information and Data Sheets Available At: www.seielect.com

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