APPLICATION NOTE

Attaching Thermocouples to a PCB for Reflow Profiling

Introduction

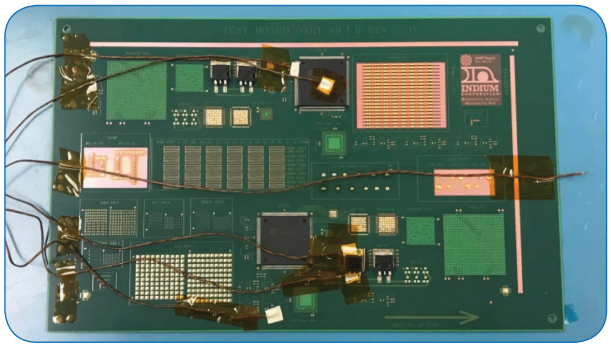
In order to get an accurate reflow profile of a Printed Circuit Board (PCB), it is important to keep best practices in mind for attaching thermocouples.

The first thing to remember is that a thermocouple is made of two wires welded together at the tip. This welded tip is where the temperature measurement is taken. It is important to ensure that wires are not twisted around each other because the temperature reading will be at the first junction of the wires and not at the tip where expected.

It is important to note that using a populated board is the only way to accurately measure resulting assembly temperatures when running a reflow profile on a PCB. There can be temperature differences up to 10°C or more when comparing the reflow profile of a bare board versus a populated board. That said, using a bare, unpopulated board for reflow profiling is not recommended.

Best Practices for Attachment of Thermocouples

1. Recommended thermocouple locations:
   - Make sure the thermocouple tip is touching the solder joint, not the component or the board.
   - Solder joints that are in areas of high thermal mass, such as large and high-density components, densely populated areas, and the middle of the board.
   - Solder joints that are in areas of low thermal mass, such as small components, lower populated areas, and the edge of the board.
   - Any components or solder joints of concern.
   - Drill a hole under bottom termination components and attach the thermocouple through the hole if the solder joint is underneath the body of the component.



2. Recommended attachment method:
   - Soldering thermocouples to the solder joint with a high melting temperature solder is the preferred method of attachment.
   - If the thermocouples cannot be soldered, the next best method for attachment is to use thermally conductive epoxy or aluminum tape. Be careful not to poke holes in the tape.
   - Kapton tape is not recommended for attaching thermocouples because it is an insulator and generally does not produce accurate temperature readings. However, Kapton tape can be used to window pane around aluminum tape for extra security. Make sure the Kapton does not cover the tip of the thermocouple where the temperature reading is taking place.

3. It is best that the thermocouple wires are similar in length so that they do not get tangled when going into the reflow oven. Thermocouple wires can be fed through a sleeve to ensure they do not become entangled.
4. Make sure the profiler is at least a full board's length away from the board so that the thermal mass of the profiler does not affect the temperature results.

Happy Profiling!

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