Lab report 12

10-5-2024

ECEN5730

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**Introduction**:

There are two methods to collecting information about the resistance of a trace, the two wire method and the four wire method. The two wire method entails connecting a multimeter or measurement device to both ends of a PCB trace and measuring the resistance of the trace. This method is good for a general means of collecting resistances, but its major disadvantage is that for smaller resistances it is less accurate since the resistance of the wires used in the measurement are also recorded in said data.

This is where the four-wire method is used. The four-wire method entails connecting a power supply to the device under test in constant current mode, to produce a voltage drop across the DUT. Afterwards, a multimeter is used to determine the voltage across the DUT. Since the power supply is operating in CC mode, the amperage is known, along with the volage across the DUT. With these two pieces of information, OHMS law can be used to determine the resistance of the DUT.

In this lab, these two methods are used to determine the resistance of traces on a test board. Moreover, the means of calculating the resistance of said traces beforehand is also covered.   
Finally, using the software Saturn PCB toolkit, the maximum allowable current for the traces is determined. With this in mind, said amperage is applied, and then exceeded to observe the effects.

**Equipment/components:**

1xlab11 test pcb   
1xlab bench power supply  
1xlab bench multimeter  
-various conductors.

**PCB test board:**

A green board with white text

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(board used in this lab, notice the burned 6mil trace at the top of the board.)

**Trace resistance estimation:**

Below is a table with the estimated resistances for each of the trace widths. The resistance was calculated with the following equation:

Where P is the resistivity of copper, T is the trace thickness, L is the length of the trace and w is the width of the trace. This data is later compared to the measured resistances of the traces.

A screenshot of a graph

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**Trace measurement data:**

Below Is the data measured in the lab using both the two wire and four wire methods. Notice how the four wire method yields measurements that are of lower resistance overall. This is because the resistance of the measurement probes are not being included in the measurement. The measurements below also somewhat differ from the estimations made earlier. This can be due to a number of factors, such as in adequate contact between the probes and the test vias, or variations in the manufacturing process.

A screenshot of a calculator

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(results from two wire method)

A screenshot of a calculator

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(results from four wire method)

**Current overload test.**

Below is a photo of the burnt PCB test board, which smoked after 7 amps were ran through the 6mil trace. Moreover, below is a table of observations made while working up to 7 amps. The power supply was running in constant current mode throughout this test to ensure that the set amperage stayed constant. The Saturn PCB toolkit only recommended 1 amp be applied to the 6mil trace, however this might be a recommendation for the longevity of the trace. It’s possible that despite not showing immediate signs of malfunction, using higher currents than that suggested by the toolkit may gradually lead to wear on the board.

For this reason, one can conclude that the maximum amount of current that should be routed on a 6mil trace is 1 amp.

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(observations with various tested amperages)

A screenshot of a computer

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(Calculated max current in Saturn PCB Toolkit)

**Conclusion**

This lab dealt with determining the resistances of traces using both the two wire and four wire methods. Moreover, the lab dealt with determining the maximum current permissible in a 6mil trace. These two experiments were very important lessons in designing systems for longevity and reducing risk in design.