

Goal- Measure trace resistance and blow traces up

For a uniform trace on the circuit board, the series resistance can be calculated as

$$R = \rho * L / A.$$

Where A can be represented as $t * w$, so $R = R_{sq} * n$ where R_{sq} is the sheet resistance with units as the resistance per square. And n is the number of squares down the trace.

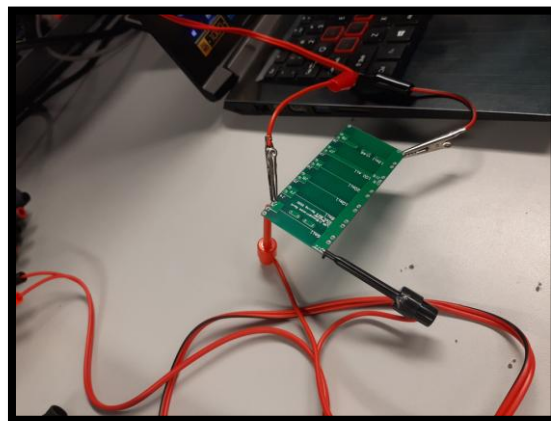
Here, $\rho = 1.7 * 10^{-8}$ ohm-m, so for 1 oz copper the R_{sq} will be 0.5m ohms.

Hence by theoretically calculating the values of different trace width using the formula,

Later the value was also determined by using the 2-wire method and practical method of Kelvin 4-wire method.

<u>Traces</u>	<u>Resistances (Theoretical calculation)</u>	<u>2wire practical method calculation</u>	<u>4wire practical method calculation</u>
6mil	83.33 m ohms	1.36 ohms	87 m ohms
8mil	62.5 m ohms	1.29 ohms	61 m ohms
10mil	50 m ohms	1.27 ohms	48.2 m ohms
20mil	25 m ohms	1.25 ohms	23 m ohms
100mil	5 m ohms	1.24 ohms	4.7 m ohms

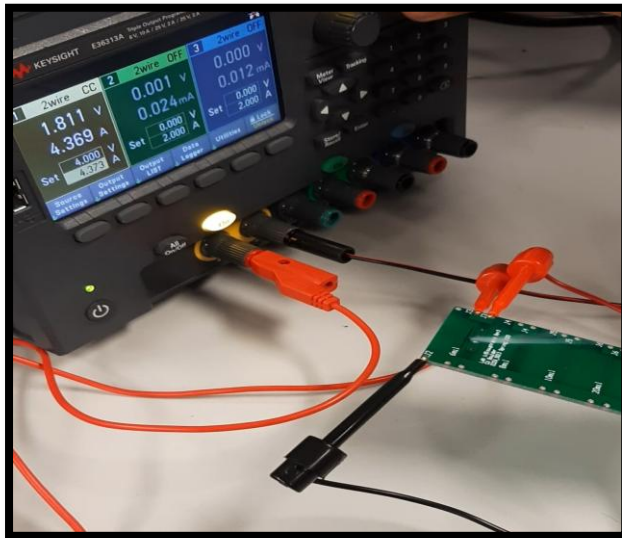
As the values of the resistance are too less using two wire methods would not be enough to get those values, instead the Kelvin 4 wire method is used to measure those sub-m ohm resistances as the forcing current and measured voltage drop are with separate leads and contact points. In 2 wire method the lead resistance and contact resistance could go as much as 1 ohm artifacts.



4-wire method

While blowing up the traces, according to the IPC 2152 the current requirement for 6 mils is estimated to be 1A however as per the practical experiment the safe values would come under 3A for 6mils where the traces were very mild hot, and at around 4.2A smoke fumes comes out of the trace and it blew up the resistance.

For 6mils trace, at 2.0 Amps the trace was barely warm, at 3.2 Amps it got hot and finally at 4.369 Amps smoke was coming out and within a few seconds it blew out.



Blowing up the 6mils trace

Recommendation for max current to be put into 6 mils trace would be 1 Amps.

According to the IPC, for 8 mils, 10 mils, 20 mils, and 100 mils the estimated current it can withstand is around 1.5 Amps, 1.7 Amps, 3 Amps, 7 Amps respectively which can also be recommended as the maximum current for the traces mentioned.