The Institute for Interconnecting and Packaging Electronic Circuits
2215 Sanders Road • Northbrook, IL 60062

IPC-TM-650
TEST METHODS MANUAL

Number **2.5.17.2**	
Subject **Volume Resistivity of Conductive Materials Used in High Density Interconnection (HDI) and Microvias, Two-Wire Method**	
Date **11/98**	Revision
Originating Task Group **HDI Test Methods Task Group (D-42a)**	

1 Scope This test method covers the two-wire resistance test for the determination of the volume resistivity of polymer-based conductive pastes and other conductive materials used in HDI. This test is valid for conductive materials with volume resistivity on the order of 10^{-5} Ω-cm or higher. For measuring resistivity on highly conductive materials or any material that cannot be patterned into a circuit pattern, a four-wire (Kelvin Probe) test method, such as IPC-TM-650, Method 2.5.14, is recommended.

1.1 Definition Volume resistivity is a material property that can be utilized to calculate the resistance in a circuit design. For materials with high resistivity, a two-wire resistance test may be used to measure the volume resistivity.

The resistance in any sample (R in units of Ω) is related to the dimensions of the test circuit and the volume resistivity (ρ) inherent in the material (see Figure 1).

$$R = \rho\left(\frac{L}{tW}\right)$$

L, W, and t are the length, width, and thickness respectively of the test circuit (in cm). The quantity L/W is called a square, (□). The volume resistivity can then be expressed as:

$$\rho = \frac{Rt}{\left(\frac{L}{W}\right)} = \frac{Rt}{\square}$$

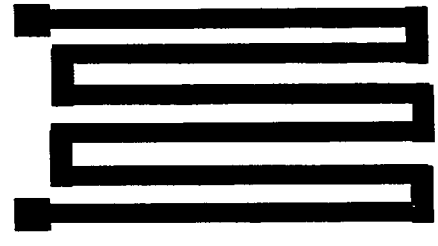
with units of ohms-cm (Ω-cm).

2 Applicable Documents

IPC-TM-650 Test Methods Manual

2.5.14 Resistivity of Copper Foil

3 Test Specimen The test specimen is a 0.5 mm wide serpentine circuit pattern (see Figure 2) with a length of between 200 □ and 1000 □ (length equal to 200 to 1000 times the width) prepared by screen printing or other methods. Specimens may be prepared by other methods, as long as they have measurable dimensions. If materials cannot be prepared in a circuit pattern, see 6.2.



Example test pattern. 0.5 mm lines and spaces. Total length of 10 cm to 50 cm (200 squares to 1000 squares)

IPC-25172-2

Figure 2 Serpentine Pattern

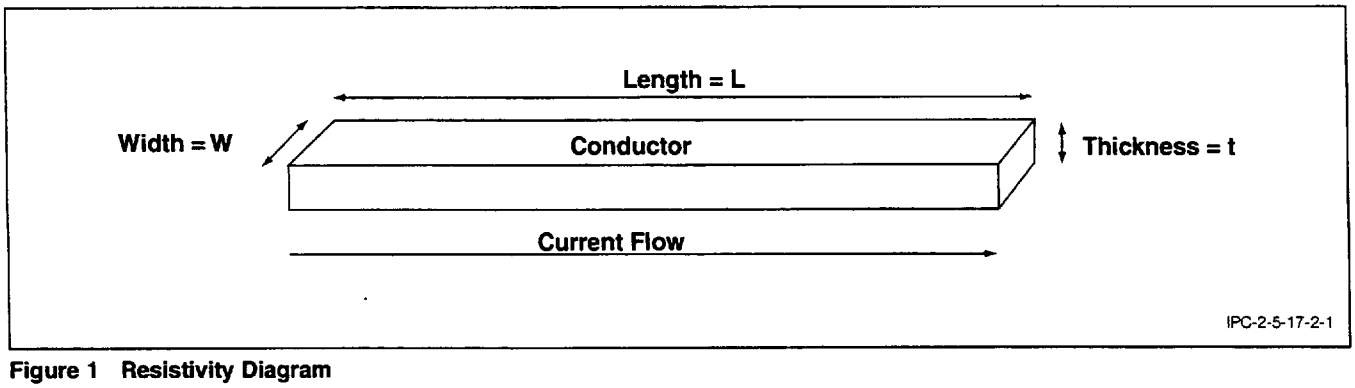


Figure 1 Resistivity Diagram