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IPC-TM-650
TEST METHODS MANUAL

Number	
2.4.1.2	
Subject	
Adhesion of Conductors on Hybrid Substrates	
Date	Revision
12/87	
Originating Task Group	
N/A	

1.0 Scope This method is to determine the adhesion or bonding quality of conductors on hybrid substrates.

2.0 Applicable Documents None

3.0 Test Samples Test samples shall be x thickness 25.4 mm x 25.4 mm [1 in x 1 in] on which the conductor test pattern is applied. Sufficient samples should be made to provide at least 15 data points. Measuring bond strength of three conductor lands on each of five substrates will provide the required data points.

4.0 Apparatus

4.1 Equipment A power-driven test machine with fixed and movable gripping devices and an instrument for recording maximum tensile force shall be used. The movable gripping device should travel at a uniform rate of 1.2 cm [0.5 in]/minute. The range of the recording instrument should be such that adhesion values will always be between 15 and 85% of rated capacity.

4.2 Lead wires AWG #20 gauge tinned copper wire 0.081 cm [0.032 in] diameter. The wire should be free of oil, grease and tarnish.

5.0 Test

5.1 Preparation

5.1.1 Soldering the Lead Wire A lead wire is placed across the surface of each column of conductor lands as shown in Figure 1. The end of the wire should be bent around the edge of the substrate to hold the wire in place temporarily until the solder boards are formed.

5.1.2 The sample is fluxed, preheated and soldered using standard soldering techniques. One method is to immerse the samples into molten solder for 5 to 10 seconds.

5.1.3 Bending the Wire Leads Carefully place a straightedge rule across the lead wire in line with the first row of wire bend marks in the test pattern. Bend one wire to a position perpendicular with the surface of the substrate 1.25 mm [0.050 in] from the edge of the conductor land (Figure 2).

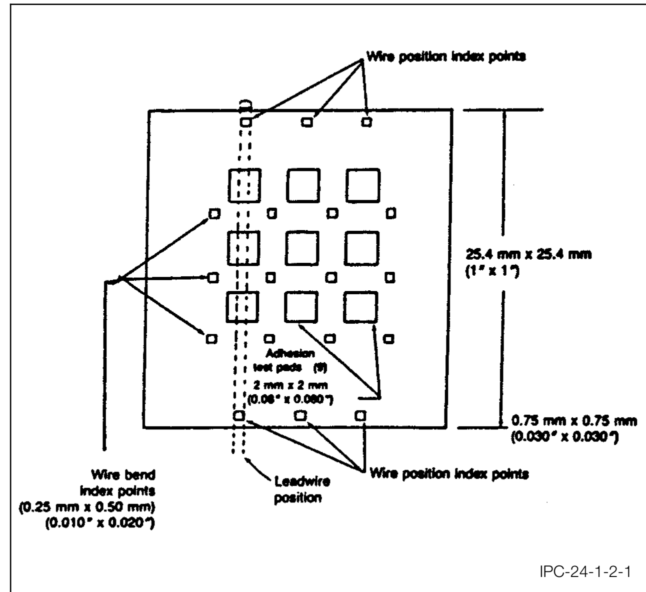

Figure 1

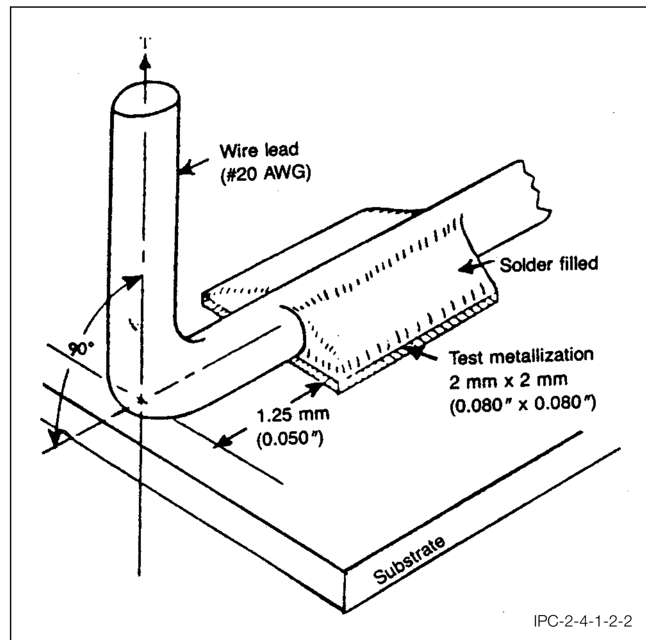

Figure 2

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After each wire is pulled the bending procedure is repeated with the next lead wire.

5.2 Procedure

5.2.1 Measuring Adhesion Mount substrate in the stationary gripping fixture of the test machine.

5.2.2 Attach wire to the movable gripping fixture and turn on the machine.

5.2.3 After the bond failure, stop gripping fixture. Remove specimen and return fixture to its starting position.

5.2.4 The bending and measuring processes are repeated with the next wire. The practice is to measure bond strength of only one conductor land in each column; more may be measured if care is taken to avoid stressing neighboring conductor lands in a column.

5.3 Evaluation The conductor square area should be examined with 10x to 30x magnification to determine failure mode. Each conductor land shall be classified into one of the following categories:

A. *Failure at the conductor-substrate interface.* Small amounts of conductor film may remain on the substrate surface. That provides a true measurement of conductor adhesion to the substrate.

B. *Failure at the solder-conductor interface.* That may indicate that the solder has not wet the conductor surface adequately.

C. *Failure between the wire and the solder fillet.*

5.4 Data Analysis Average adhesion value, x, standard deviation and coefficient of variation, cv, are calculated for n data points as follows:

$$\bar{x} = \frac{X_1 + X_2 + ------ X_n}{n} \quad \text{Newtons}$$

$$\delta = \left[\sum_{1}^{n} \frac{(x_i - \bar{x})^2}{n-1} \right]^{1/2} \quad \text{Newtons}$$

$$cv = \frac{100\,\delta}{\bar{x}} \quad \%$$