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MS2 on Lead Free Wave Electromigration Testing

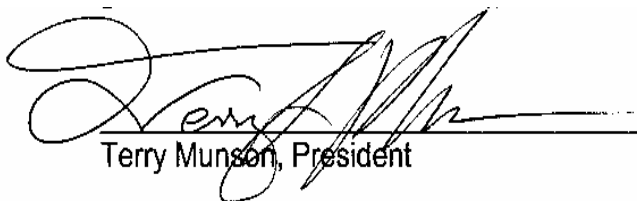
PK Metal
Project #:1741-10
PO #: On File

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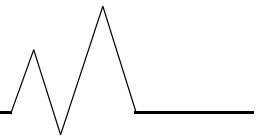
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MS2 on Lead Free Wave Electromigration Testing Project # 1741-10

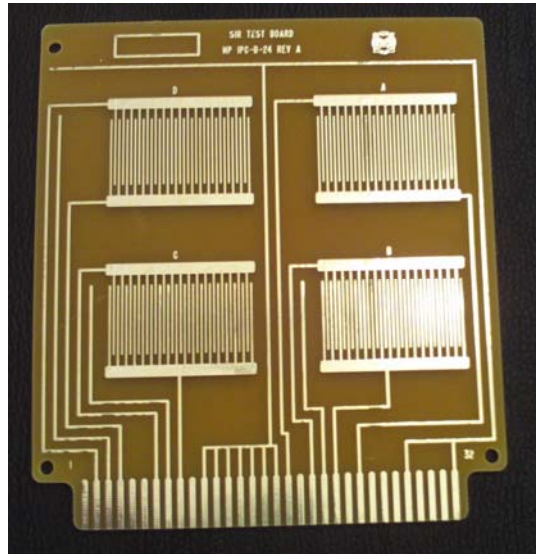
Larry Kay



PROJECT GOAL

The goal of this project is to qualify the use of MS2 on lead free wave solder (Yakoda) using electromigration using characterization IPC-TM-650, method 2.6.3.3A for a 596 hour investigation. The boards used in this study are IPC B-24 boards.

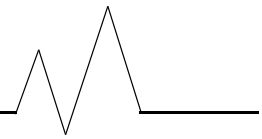
TEST BOARD – IPC B-24



Executive Summary

Electromigration Conclusions and Data Summary

All samples tested pass the electromigration test conditions. The unprocessed bare copper control, the soldered group with no MS2 and the soldered group with MS2 all passed the IPC limits of the electromigration testing above the level of $1.0e + 8$ ohms of resistance.



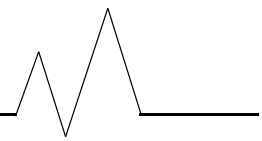
Process Conditions and Testing Protocol

Electromigration testing was conducted on 4 sites on these 10 boards gives an accurate electrical assessment to the condition of the boards in an 85C / 85%RH with a 50 volt bias and 100 volt measurement.

Five B-24 coupons were processed on the Yakoda wave solder using a SAC 305 solder alloy at 540 F with a chip and lamda wave. Each board was processed with the comb pattern face down. MS2 was added to the wave and allowed to condition for 3 hours with the wave pumps running. The amount of the dross on the solder pot before the MS2 was added showed a typical level of uniform dross across the surface and the MS2 converted the dross to usable solder. Five B-24 coupons were processed on the Yakoda wave solder after the MS2 was allowed to condition for 3 hours. Each of the test coupons were then placed into the humidity chamber at 85C/85%RH for the 596 hours.

Brd # Sample Conditions

A1	SAC 305 wave No MS2
A2	SAC 305 wave No MS2
A3	SAC 305 wave No MS2
A4	SAC 305 wave No MS2
A5	SAC 305 wave No MS2
B1	SAC 305 - MS2 on pot for 3 hours
B2	SAC 305 - MS2 on pot for 3 hours
B3	SAC 305 - MS2 on pot for 3 hours
B4	SAC 305 - MS2 on pot for 3 hours
B5	SAC 305 - MS2 on pot for 3 hours
C1	Control Unprocessed (no exposure to wave)
C2	Control Unprocessed (no exposure to wave)
C3	Control Unprocessed (no exposure to wave)



Electromigration Test Environment

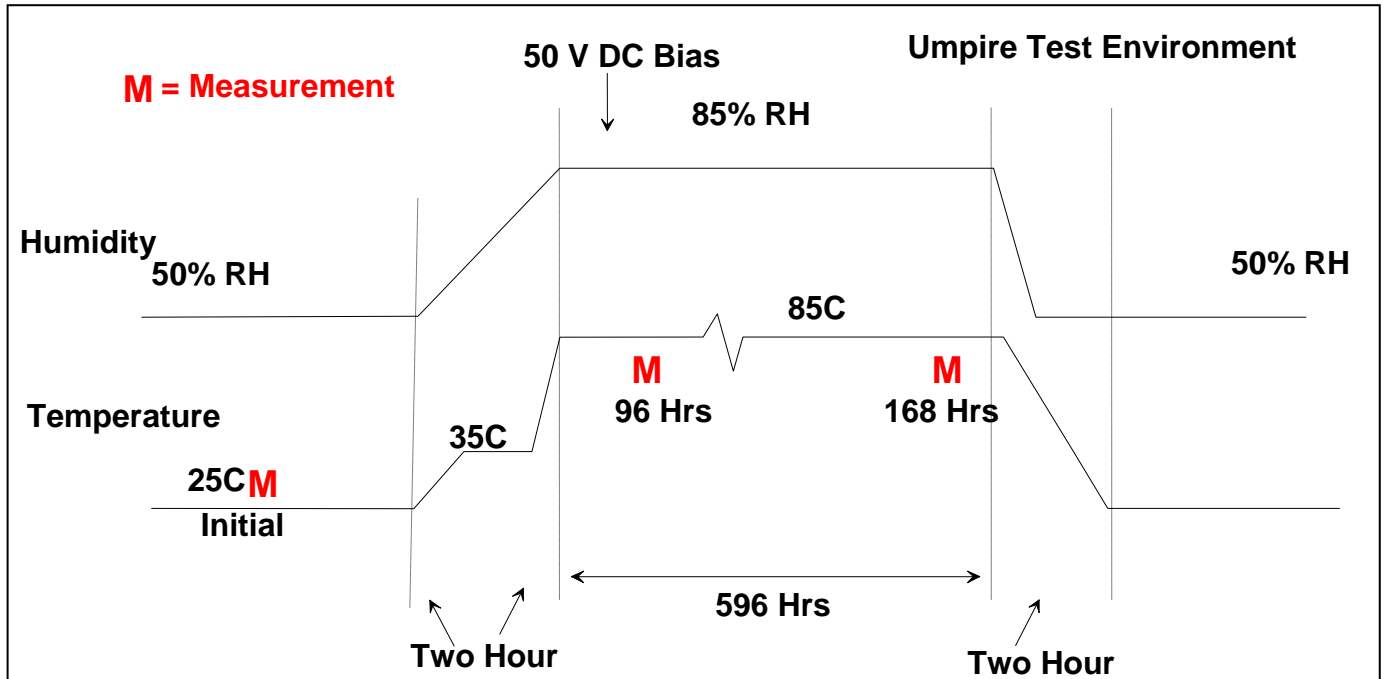
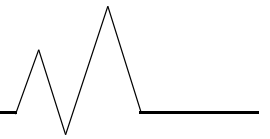


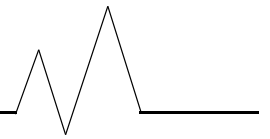
Figure 5: Test Environment

All of the ramp steps were programmed to proceed by first raising temperature to the specified level, while allowing humidity to drop, over the course of a 30 minute period. The final 30 minutes of the ramp were used to slowly bring up the relative humidity to the specified level. In this manner, condensation on the part surface is avoided. In most IPC documentation, this is referred to as a non-condensing test method. For the ramp-down steps, the reverse of the process was performed. These steps were taken because the presence of liquid water on the surface of an energized test pattern violates the intent of testing and invalidates the data for that pattern.



PK Metal 1741-10 Electromigration

Bd/Pos	E - 96 hrs	E- 596 hrs @ 85C
A1 - B-24--1	8.71E+09	3.49E+09
A1 - B-24--2	1.58E+09	7.64E+09
A1 - B-24--3	2.19E+09	1.01E+09
A1 - B-24--4	1.91E+09	1.10E+09
A2 - B-24--1	1.15E+09	7.74E+09
A2 - B-24--2	2.40E+09	1.62E+09
A2 - B-24--3	2.82E+09	2.62E+09
A2 - B-24--4	1.10E+09	7.74E+09
A3 - B-24--1	1.48E+10	1.07E+10
A3 - B-24--2	2.51E+10	1.12E+10
A3 - B-24--3	3.09E+09	4.13E+09
A3 - B-24--4	2.24E+09	4.66E+09
A4 - B-24--1	3.72E+09	2.51E+09
A4 - B-24--2	2.14E+09	1.58E+09
A4 - B-24--3	2.08E+09	4.67E+09
A4 - B-24--4	1.10E+09	8.11E+09
A5 - B-24--1	6.46E+09	6.15E+09
A5 - B-24--2	2.57E+09	1.90E+09
A5 - B-24--3	3.72E+09	2.68E+09
A5 - B-24--4	1.78E+09	1.38E+09
B1 - B-24--1	3.47E+09	2.45E+09
B1 - B-24--2	9.77E+09	7.06E+09
B1 - B-24--3	4.27E+09	2.94E+09
B1 - B-24--4	3.55E+09	2.34E+09
B2 - B-24--1	1.38E+09	1.81E+09
B2 - B-24--2	4.17E+09	6.29E+09
B2 - B-24--3	1.70E+09	2.39E+10
B2 - B-24--4	6.46E+09	7.57E+09
B3 - B-24--1	1.41E+09	3.15E+09
B3 - B-24--2	1.00E+09	1.42E+09
B3 - B-24--3	6.61E+09	4.77E+09
B3 - B-24--4	1.91E+09	1.77E+09



Bd/Pos	E - 96 hrs	E- 596 hrs @ 85C
B4 - B-24--1	5.37E+09	8.89E+09
B4 - B-24--2	2.69E+09	1.65E+09
B4 - B-24--3	1.86E+09	2.37E+09
B4 - B-24--4	1.66E+09	7.39E+09
B5 - B-24--1	1.62E+09	2.75E+09
B5 - B-24--2	3.89E+09	5.61E+10
B5 - B-24--3	2.24E+09	2.94E+10
B5 - B-24--4	2.34E+09	7.23E+09
C1 - B-24--1	1.70E+10	3.38E+10
C1 - B-24--2	6.46E+09	1.90E+09
C1 - B-24--3	6.31E+09	9.75E+10
C1 - B-24--4	6.17E+09	6.29E+09
C2 - B-24--1	7.24E+09	2.88E+10
C2 - B-24--2	7.41E+09	2.62E+10
C2 - B-24--3	7.24E+09	2.29E+10
C2 - B-24--4	7.24E+09	1.04E+10
C3 - B-24--1	4.79E+09	1.04E+09
C3 - B-24--2	4.57E+09	2.56E+10
C3 - B-24--3	4.57E+09	2.18E+10
C3 - B-24--4	4.57E+09	5.48E+10