



TEST SUMMARY

**SEARAY™ CONNECTOR SERIES

1.0 SCOPE

This Test Summary covers the IPC-9701A, "Performance test Methods and Qualification Requirements for Surface Mount Attachments"; testing of the SEARAY .050" (1.27mm) by .050" (1.27mm) centerline (pitch) printed circuit board (PCB) connector series with lead free solder charges. Both virgin and rework specimens were evaluated.

2.0 PRODUCT DESCRIPTION

2.1 PRODUCT NAME AND PART NUMBER(S)

SEARAY™ Plug Connector	45970-**** (-4311 tested, 3.5mm, 400ckt)
SEARAY™ Receptacle Connector	45971-**** (-4411 tested, 7.5mm, 400ckt)
SEARAY™ Slim Plug Connector	46556-****
SEARAY™ Slim Receptacle Connector	46557-****

2.2 DIMENSIONS, MATERIALS, PLATINGS AND MARKINGS

Refer to the appropriate sales drawings for information on dimensions, materials, platings and markings.

2.3 PRODUCT SPECIFICATION TITLE AND DOCUMENT NUMBER

Title: Product Specification SEARAY™ Interconnect System
Document No.: PS-45970-001

3.0 APPLICABLE DOCUMENTS AND SPECIFICATIONS

3.1 TESTING SEQUENCES AND PROCEDURES

<u>Group 1 : 26 Mated Sets (52 Connectors)</u>
INITIAL LOOP RESISTANCE
IPC 9701A cycling with Continuous Monitoring Event Detection (0°C to 100°C)
Loop Resistance check every 500 cycles up to 6000 cycles
FINAL LOOP RESISTANCE

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<u>Group 2</u> : 4 Reworked Mated Sets (8 Connectors)
INITIAL LOOP RESISTANCE
IPC 9701 cycling with Continuous Monitoring Event Detection (0°C to 100°C)
Loop Resistance check every 500 cycles up to 6000 cycles
FINAL LOOP RESISTANCE

3.2 OTHER DOCUMENTS AND SPECIFICATIONS

IPC-9701, Temperature Cycling, Rev A, Condition TC-1
EIA-364, TP-46 Microsecond Discontinuity, Rev B

4.0 QUALIFICATION

Laboratory environmental conditions in accordance with IPC-9701 and EIA-364.

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5.0 RESULTS

5.1 SUMMARY OF RESULTS

The lead free SEARAY interconnect system successfully met the requirements for solder joint reliability testing per IPC-9701A, dated February 2006. No discontinuity events greater than 1 microsecond were recorded during the 6000 thermal cycles for any of the virgin or rework samples. Note that measured loop resistance values in below tables are for a mated set.

ITEM	DESCRIPTION	TREATMENT	REQUIREMENT	NUMBER OF FAILURE EVENTS		
GROUP 1	IN-SITU EVENT DETECTION	TC-1 0°C to 100°C 6000 cycles	NO DISCONTINUITY EVENTS (10 Ω or greater change in resistance lasting over 1 microsecond)	0 EVENTS		
	Loop Resistance (Across 53ckt Daisy Chain)			AVG	MIN	MAX
		Initial	1.10 Ω Nominal, No Limit set	1.065 Ω	0.917 Ω	1.164 Ω
		500 cycles	**Delta Resistance Ω	-0.018 Ω	-0.025 Ω	-0.009 Ω
		1000 cycles	**Delta Resistance Ω	-0.023 Ω	-0.031 Ω	-0.014 Ω
		1500 cycles	**Delta Resistance Ω	-0.023 Ω	-0.031 Ω	-0.015 Ω
		2000 cycles	**Delta Resistance Ω	-0.027 Ω	-0.037 Ω	-0.017 Ω
		2500 cycles	**Delta Resistance Ω	-0.029 Ω	-0.040 Ω	-0.020 Ω
		3000 cycles	**Delta Resistance Ω	-0.031 Ω	-0.043 Ω	-0.021 Ω
		3500 cycles	**Delta Resistance Ω	-0.034 Ω	-0.044 Ω	-0.024 Ω
		4000 cycles	**Delta Resistance Ω	-0.030 Ω	-0.039 Ω	-0.020 Ω
		4500 cycles	**Delta Resistance Ω	-0.033 Ω	-0.044 Ω	-0.015 Ω
		5000 cycles	**Delta Resistance Ω	-0.026 Ω	-0.037 Ω	-0.001 Ω
		5500 cycles	**Delta Resistance Ω	-0.033 Ω	-0.044 Ω	-0.017 Ω
		6000 cycles	**Delta Resistance Ω	-0.036 Ω	-0.049 Ω	-0.021 Ω

** change from initial

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ITEM	DESCRIPTION	TREATMENT	REQUIREMENT	NUMBER OF FAILURE EVENTS			
G R O U P 2	IN-SITU EVENT DETECTION	TC-1 0°C to 100°C 6000 cycles	NO DISCONTINUITY EVENTS (10 Ω or greater change in resistance lasting over 1 microsecond)	0 EVENTS			
	Loop Resistance (Across 53ckt Daisy Chain)				AVG	MIN	MAX
		Initial	1.10 Ω Nominal, No Limit set		1.056 Ω	0.988 Ω	1.112 Ω
		500 cycles	**Delta Resistance Ω		-0.010 Ω	-0.016 Ω	-0.004 Ω
		1000 cycles	**Delta Resistance Ω		-0.015 Ω	-0.022 Ω	-0.009 Ω
		1500 cycles	**Delta Resistance Ω		-0.020 Ω	-0.027 Ω	-0.015 Ω
		2000 cycles	**Delta Resistance Ω		-0.021 Ω	-0.028 Ω	-0.016 Ω
		2500 cycles	**Delta Resistance Ω		-0.024 Ω	-0.031 Ω	-0.019 Ω
		3000 cycles	**Delta Resistance Ω		-0.026 Ω	-0.032 Ω	-0.022 Ω
		3500 cycles	**Delta Resistance Ω		-0.028 Ω	-0.035 Ω	-0.024 Ω
		4000 cycles	**Delta Resistance Ω		-0.025 Ω	-0.031 Ω	-0.020 Ω
		4500 cycles	**Delta Resistance Ω		-0.029 Ω	-0.034 Ω	-0.024 Ω
		5000 cycles	**Delta Resistance Ω		-0.023 Ω	-0.029 Ω	-0.016 Ω
		5500 cycles	**Delta Resistance Ω		-0.031 Ω	-0.038 Ω	-0.023 Ω
		6000 cycles	**Delta Resistance Ω		-0.035 Ω	-0.042 Ω	-0.027 Ω

** change from initial

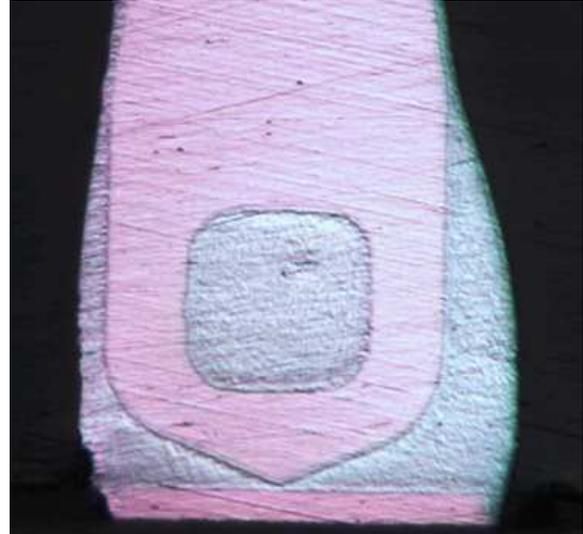
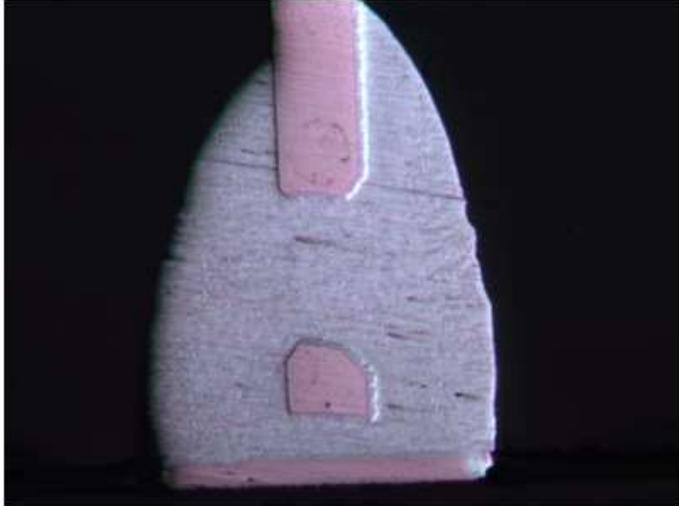
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5.2 TIME-ZERO CROSS SECTIONS (TYPICAL)

Time-zero cross sections were created of representative specimens from each sample group prior to the start of test.



6.0 FIXTURES AND TEST EQUIPMENT

Four board spacers (standoffs) were used per mated set.
Thermatron Temperature-Humidity Chamber used
Analysis Tech Event Detector used

7.0 TEST VEHICLE / SMT PROCESSING

7.1 TEST BOARDS

PCTB #186A is a 4" x 4" x 0.093" FR-406 (High Tg Fr4) card with top and bottom 1 oz copper layers and 4 internal 1/2 oz copper signal layers (see figure 1). The top side daisy chain consists of 53 top side circuits dispersed to cover ends, corners and middle portions of the connector circuit (see figure 2). This board accepts one 400ckt (10 x 40) SEARAY Plug connector. Testing was done with one connector mounted and mated (see figure 3) to an adaptor card (not shown) with a corresponding SEARAY Receptacle connector. Adaptor cards were required in order to daisy chain select circuits together for continuity monitoring.

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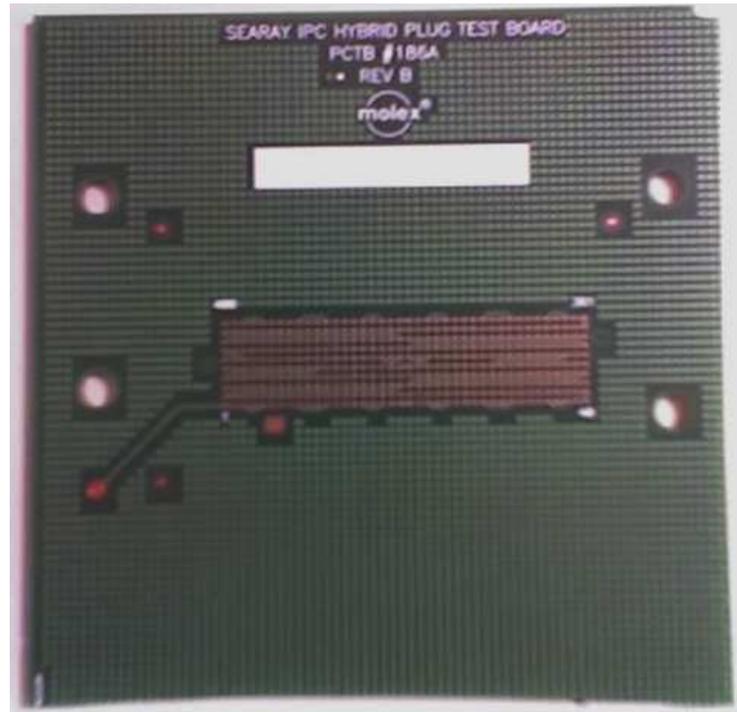


Figure 1: PCTB #186A

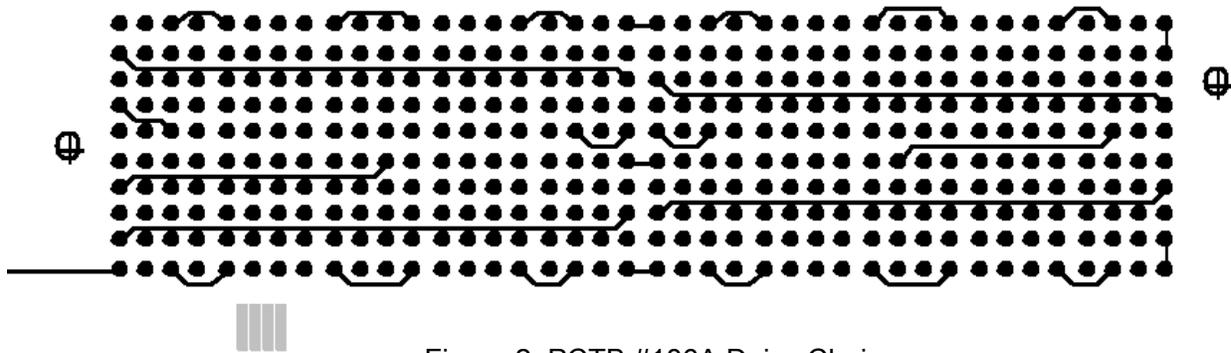


Figure 2: PCTB #186A Daisy Chain

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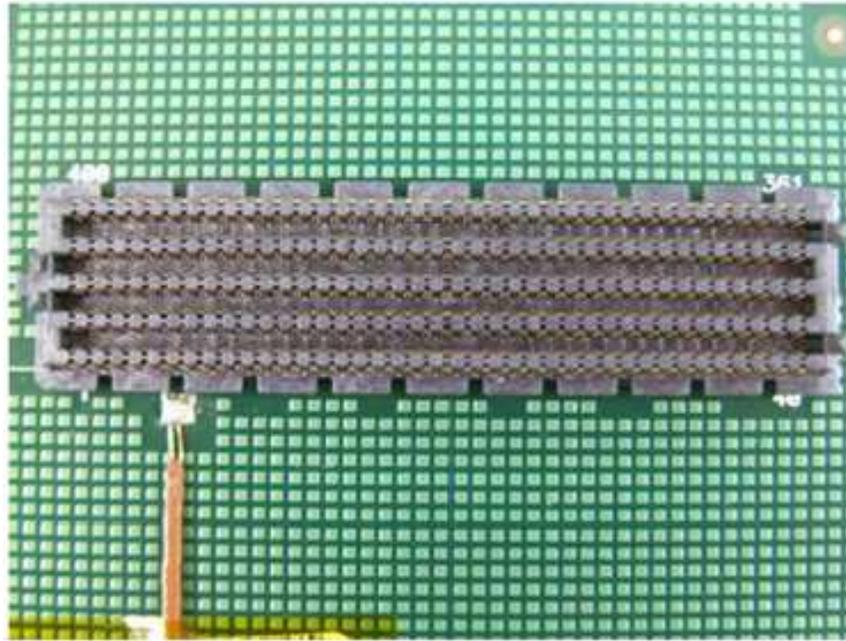


Figure 3: PCTB #186A w/ mounted Plug Connector

PCTB #186B Receptacle is a 4" x 4" x 0.125" FR-406 (High Tg Fr4) card with top and bottom 1 oz copper layers, 2 internal 1/2 oz copper signal layers and 4 internal 1/2 oz copper ground layers (see figure 4). The top side daisy chain consists of 53 top side circuits dispersed to cover ends, corners and middle portions of the connector circuit (see figure 5). The second and third layers contain traces leading to the card edge that can be used for individual circuit contact resistance measurements. This portion of the board was not used in this test sequence. This board accepts one 400ckt (10 x 40) SEARAY Receptacle connector. Testing was done with one connector mounted and mated (see figure 6) to an adaptor card (not shown) with a corresponding SEARAY Plug connector. Adaptor cards were required in order to daisy chain select circuits together for continuity monitoring.

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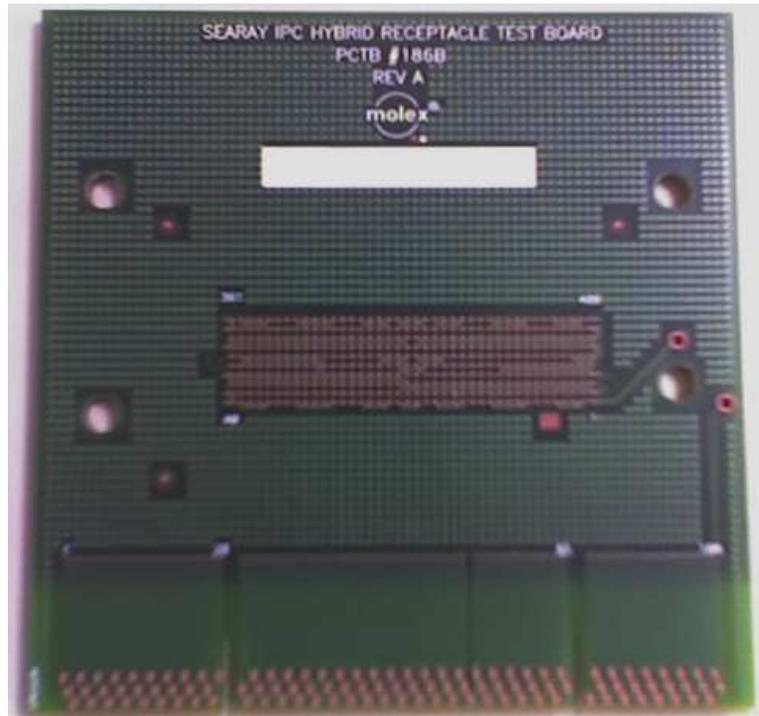


Figure 4: PCTB #186B

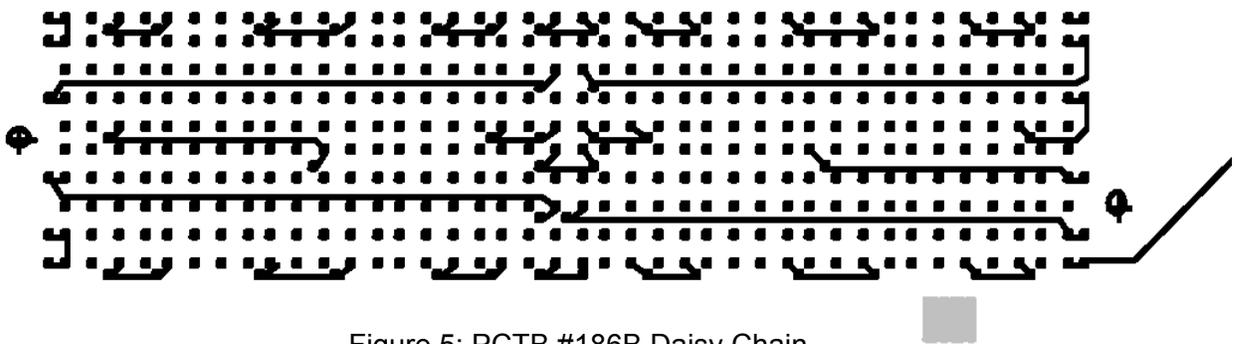


Figure 5: PCTB #186B Daisy Chain

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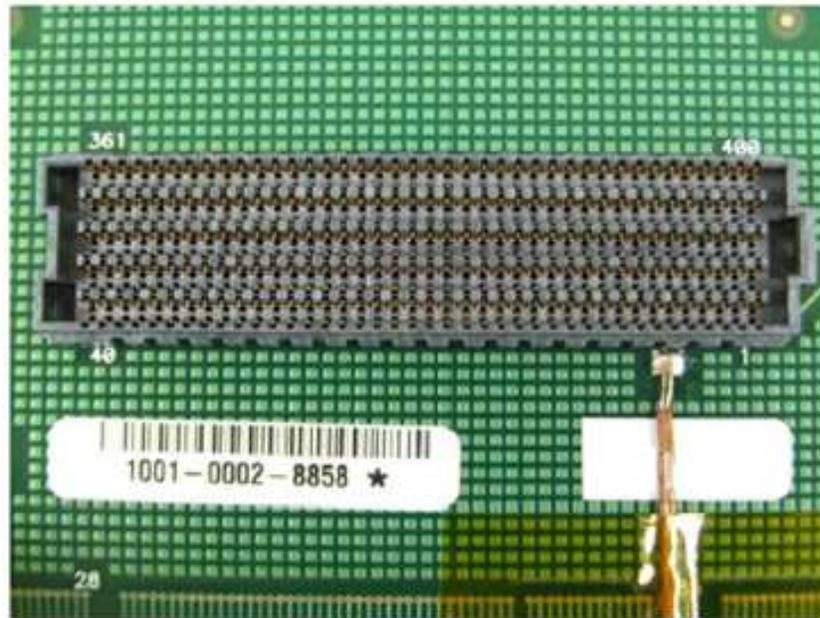


Figure 6: PCTB #186B w/ mounted Receptacle Connector

Each specimen was independently daisy-chained for continuity monitoring. Each daisy chain was designed to wire 106 total contacts and solder joints (53 on the PCTB and 53 on the adaptor card) into a series loop when mated.

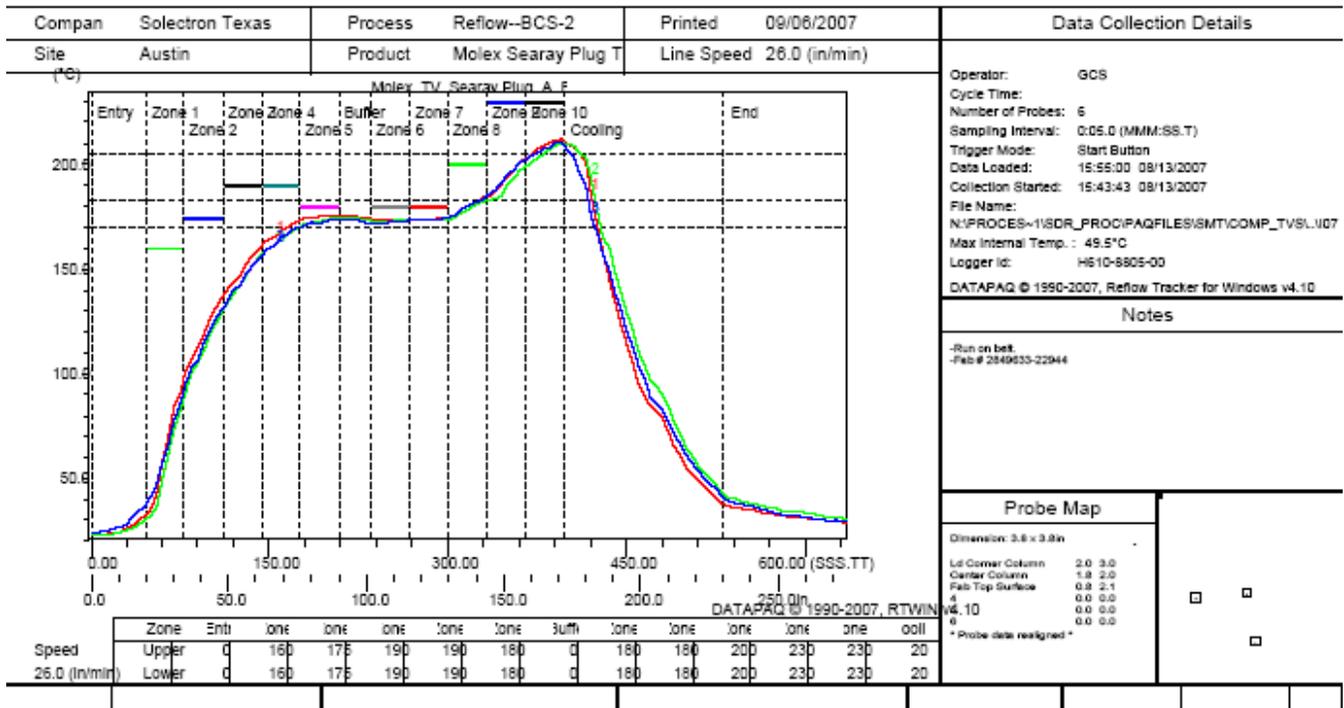
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7.2 SMT PROCESSING

The soldering process of connectors to the PCTB boards was done in Austin, TX at the Flextronics' (Solectron) NPI facility. The soldering process of connectors to the adaptor cards was done in Lisle, IL in Molex's reliability lab. Both processed in a nitrogen inerted environment. Only the product soldered by Flextronics was evaluated was evaluated for solder joint reliability since the adaptor cards were considered an auxiliary component of the interconnect system. At Flextronics, a 5 mil stencil with Senju M705-GRN360-KIMK-VS Lead Free (No Clean) paste was used.

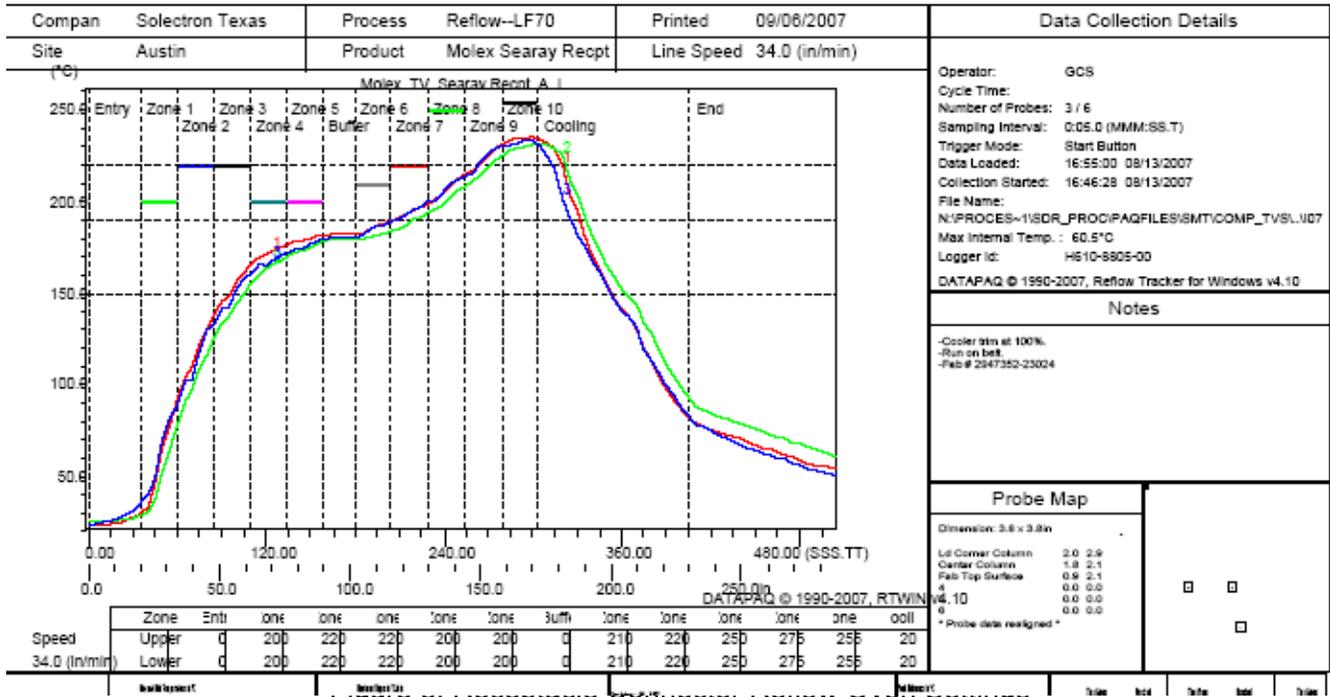


Plug Connector Reflow Profile

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Receptacle Connector Reflow Profile

During the Flextronics processing run, full 3D paste volume measurement was performed on 100% of the paste deposits on all boards using a Koh Young in-line solder 3D solder paste inspection system.

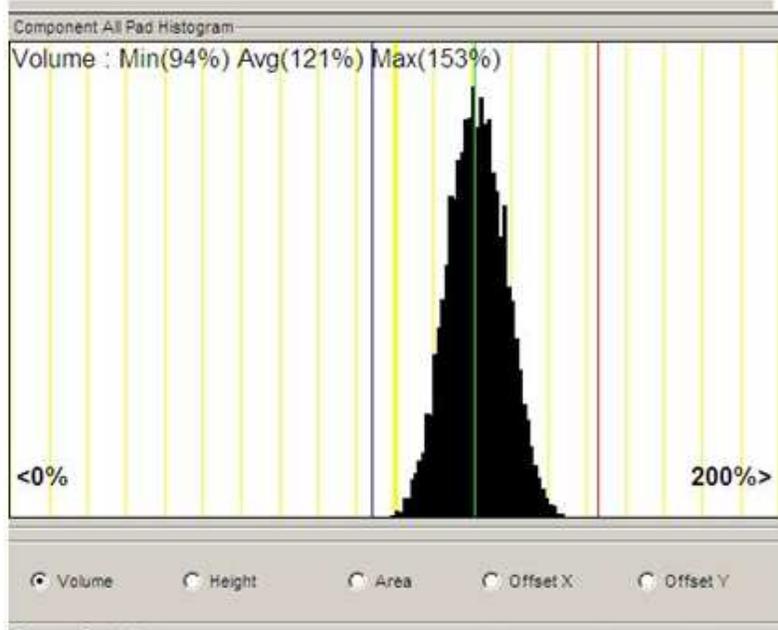
Plug Solder Paste Volume Measurements (cubic mils)		
Nominal	0.079	100%
Average	0.096	121%
Minimum	0.074	94%
Maximum	0.121	153%

Receptacle Solder Paste Volume Measurements (cubic mils)		
Nominal	0.079	100%
Average	0.100	127%
Minimum	0.083	105%
Maximum	0.120	152%

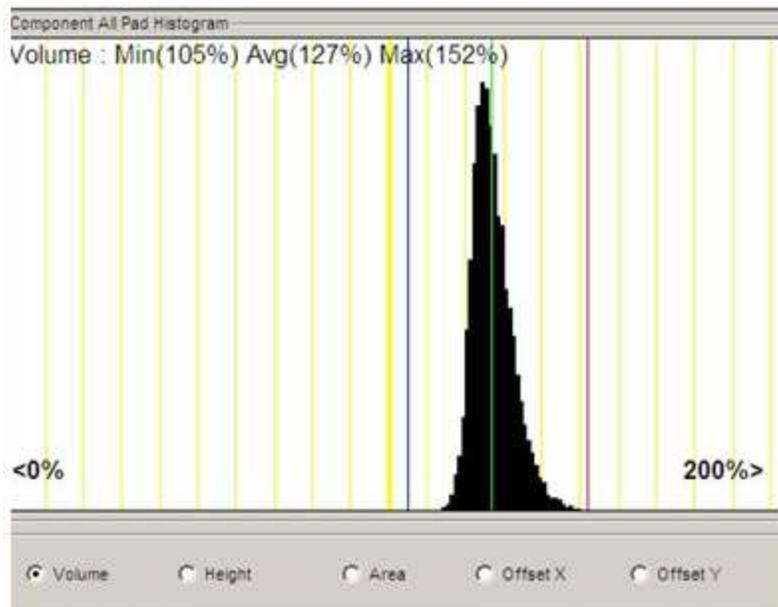
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Typical Plug Solder Paste Volume



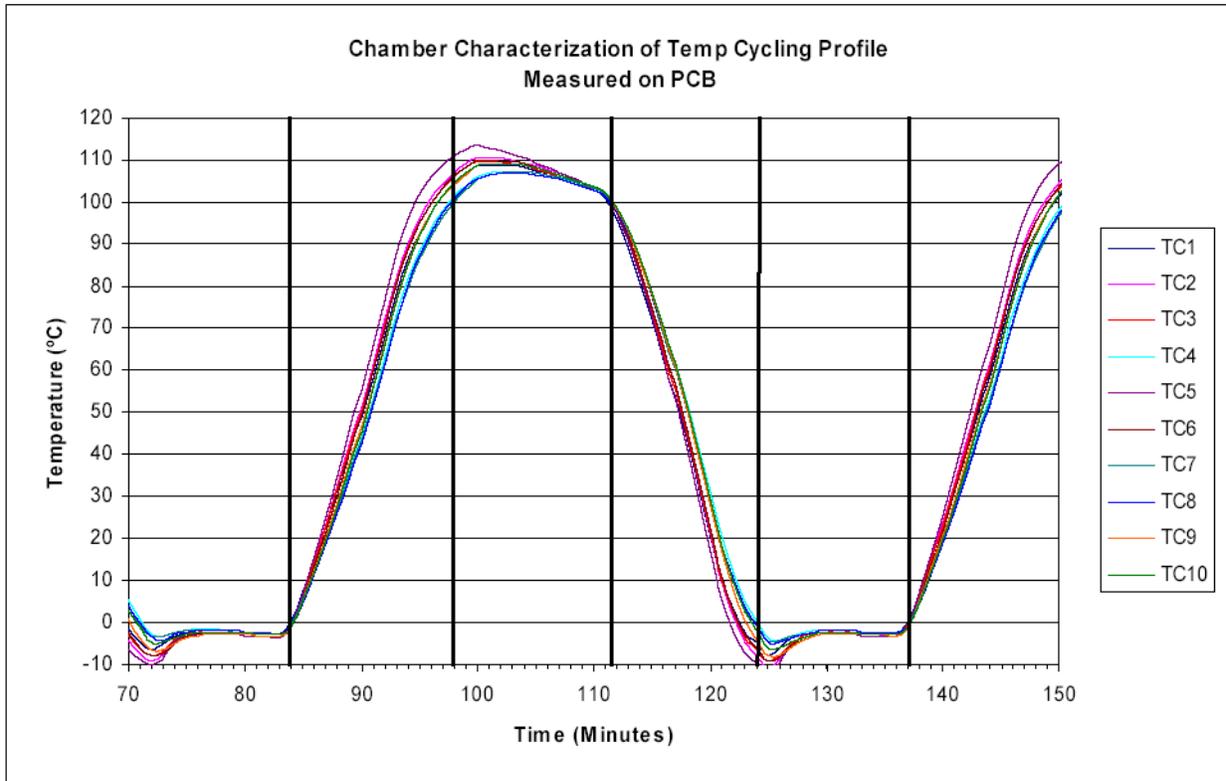
Typical Receptacle Solder Paste Volume

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7.3 TEST CHAMBER CHARACTERIZATION

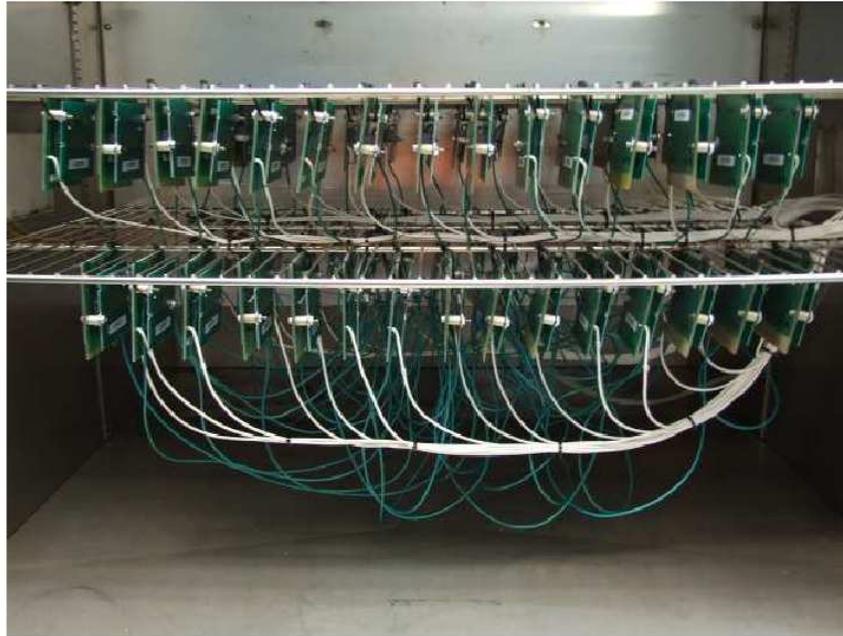


Test Temperature Profile

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Connectors Mated and In Test Chamber

8.0 REVISION HISTORY

Revision Level:	Created / Revised By:	Revision Description:	Date of Revision
1	T. Gregori	Initial Release	8/31/10

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