

SEPTEMBER 18, 2002

TEST REPORT #202269

DESIGN VERIFICATION TEST  
SMT SOLDERBALL FOR 0.046 HOLE

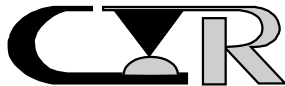
AUTOSPLICE, INC.



APPROVED BY: MAX PEEL  
PRESIDENT  
CONTECH RESEARCH, INC.

REVISION HISTORY

DATE	REV. NO.	DESCRIPTION	ENG.
9/18/2002	1.0	Initial Issue	MP



## CERTIFICATION

This is to certify that the evaluation described herein was designed and executed by personnel of Contech Research, Inc. It was performed in concurrence of Autosplice, Inc., of Garnerville, NY who was the test sponsor.

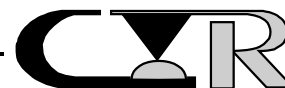
All equipment and measuring instruments used during testing were calibrated and traceable to NIST according to ISO 10012-1 and ANSI/NCSL Z540-1, as applicable.

All data, raw and summarized, analysis and conclusions presented herein are the property of the test sponsor. No copy of this report, except in full, shall be forwarded to any agency, customer, etc., without the written approval of the test sponsor and Contech Research.



Max Peel  
President  
Contech Research, Inc.

MP:js



## SCOPE

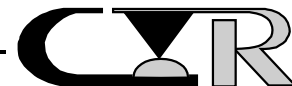
To perform design verification testing on SMT Solderball as manufactured and submitted by the test sponsor Autosplice, Inc.

## APPLICABLE DOCUMENTS

1. Unless otherwise specified, the following documents of issue in effect at the time of testing performed form a part of this report to the extent as specified herein. The requirements of sub-tier specifications and/or standards apply only when specifically referenced in this report.
2. Standards:
  - a) EIA Publication 364
  - b) IPC-TM-650

## TEST SAMPLES AND PREPARATION

1. The following test samples were submitted by the test sponsor, Autosplice, Inc., for the evaluation to be performed by Contech Research, Inc.
  - a) Seven assemblies. Each assembly composed of six pins soldered to two parallel boards. The pins were located on the 4 corners and in the middle of the longitudinal length of the boards. All pins were located along the periphery of the test boards.
2. Unless otherwise indicated, all materials were certified by the manufacturer to be in accordance with the applicable product specification.
3. The test samples as submitted were certified by the manufacturer as being fabricated and assembled utilizing normal production techniques common for this type of product and inspected in accordance with the quality criteria as established for the product involved.
4. Test samples were supplied assembled and terminated test boards by the test sponsor.
5. The test samples were tested in their 'as received' condition.

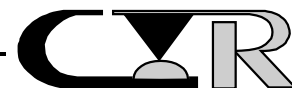


## TEST SAMPLES AND PREPARATION

6. Unless otherwise specified in the test procedures used, no further preparation was used.
7. All equipment and measuring instruments used during testing were calibrated and traceable to NIST according to ISO 10012-1 and ANSI/NCSL Z540-1, as applicable.

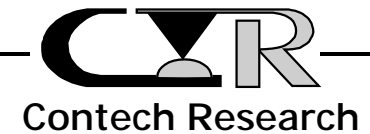
## TEST SELECTION

1. All tests were performed in accordance with the applicable procedures as specified in AutosplICE Test Plan 9-B14641154TAA. The interchangeability (dimensional inspection) was not performed by Contech Research.
2. The following tests were performed:
  - a) Humidity
  - b) Shear Test
  - c) Pull Test
  - d) Current Carrying Capacity
3. Test set ups and/or procedures which are standard or common are not detailed or documented herein provided they are certified as being performed in accordance with the applicable industry test methods, standards and/or drawings as specified in the detail specification.

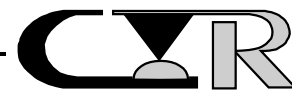


## EQUIPMENT LIST

ID#	Next Cal	Last Cal	Equipment Name	Manufacturer	Model #	Serial #	Accuracy	Freq.Cal
38	12/4/02	12/4/01	Universal Test Stand	Chatillon	UTSM-SS	1030	±.05 in.	12 mon.
294	10/25/02	4/25/02	Steady State Chamber	Blue M Co.	AC7402HA-1	A-3933	See Cal Cert	6mon
315			X-Y Table	NE Affiliated Tech.	XY-6060	N/A	N/A	N/A
398	10/2/02	4/2/02	500 Pound Force Gage	Chatillon	DFI-500	11792	±1.25 LBS	6mon
420	8/7/03	8/7/02	Digital Multimeter	Hewlett Packard	34401A	3146A04414	See Cal Cert	12 mon.
462			Switch System	Keithley Co.	7002	0553244	See Manual	Each Test
689	4/18/03	4/18/02	DC Power Supply 30Amps	Hewlett Packard	6033A	2548A01848	See Cal.Cert.	12 mon.
1041	2/28/03	8/28/02	Force Gage	Chatillon	DFIS-50	B34054	± .15%	12 mon.
1276			Computer	ARC.Co.	Pent-450	N/A	N/A	N/A
1315	9/23/02	2/25/02	Data Aquisition Multimeter	Keithley Co.	2700	0862680	See Manual	6 mon.



# TEST RESULTS



PROJECT NO.: 202269

SPECIFICATION: Autosplice  
Test Plan

PART NO.: 9-B14641154TAA

PART DESCRIPTION: SMT Solderball

SAMPLE SIZE: Four Bd.Assy's

TECHNICIAN: LL

START DATE: 7-26-02

COMPLETE DATE: 9-6-02

ROOM AMBIENT: 20°C

RELATIVE HUMIDITY: 54%

EQUIPMENT ID#: 294, 1315

HUMIDITY (STEADY STATE)

PROCEDURE:

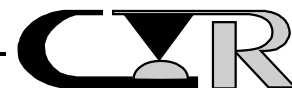
1. The test environment was performed in accordance with Paragraph 5.4 of Specification 9-B14641154TAA and EIA 364, Test Procedure 31, with the following conditions:
2. Test Conditions:
  - a) Relative Humidity : 95%
  - b) Preconditioning (24 hours) : 100°C
  - c) Duration : 1000 hours
3. Prior to performing variable measurements, the test samples were allowed to recover to room ambient conditions.

REQUIREMENTS:

There shall be no evidence of physical deterioration of the test samples as tested when examined under 10X magnification.

RESULTS:

1. The test samples as tested showed no evidence of physical deterioration.
2. The test samples were returned to the test sponsor for further evaluation.



PROJECT NO.: 202269

SPECIFICATION: Autosplice  
Test Plan

PART NO.: 9-B14641154TAA

PART DESCRIPTION: SMT Solderball

SAMPLE SIZE: One Bd.Assy

TECHNICIAN: LL

START DATE: 7-31-02

COMPLETE DATE: 7-31-02

ROOM AMBIENT: 20°C

RELATIVE HUMIDITY: 61%

EQUIPMENT ID#: 38, 398

PULL TEST

PROCEDURE:

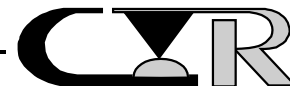
1. The test was performed in accordance with Paragraph 5.2.1 of Specification 9-B14641154TAA and IPC-TM-650.
2. Test Conditions:
  - a) Rate : 1.0 inch/minute
  - b) Direction : Axial
3. The "large" board was fixtured to the test stand and X-Y free floating table of the motorized test unit. A special grip was attached to the "small" test board and the movable head of the test unit.
4. The X-Y free floating table was used to assure axial alignment and to prevent eccentric loading.
5. The special grip was attached to all four sides of the "small" test board to assure uniform loading.
6. Axial load was applied until fracture of the solder joints occurred.

REQUIREMENTS:

The load which fractured the solder joints was measured and recorded.

RESULTS:

The force which resulted in fracture was 77.4 lbs.



PROJECT NO.: 202269

SPECIFICATION: Autosplice  
Test Plan

PART NO.: 9-B14641154TAA

PART DESCRIPTION: SMT Solderball

SAMPLE SIZE: One Bd. Assy

TECHNICIAN: LL

START DATE: 8-8-02

COMPLETE DATE: 8-8-02

ROOM AMBIENT: 20°C

RELATIVE HUMIDITY: 54%

EQUIPMENT ID#: 38, 315, 1041

SHEAR TEST

PROCEDURE:

1. The test was performed in accordance with Paragraph 5.2.2 of Specification 9-B14641154TAA.
2. Test Conditions:
  - a) Rate : 1.0 inch/minute
  - b) Direction : Force applied to the solderball parallel to the plane of the substrate
3. The shearing probe was placed on the solder fillet between 0.002/0.005 from the pcb surface.

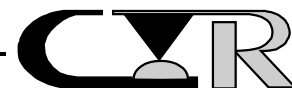
REQUIREMENTS:

The shearing force shall be measured and recorded.

RESULTS:

The following is a summary of the observed data:

	SHEAR FORCE (Pounds)
Ball #1	43.1
Ball #2	31.8
Ball #3	38.1
Ball #4	35.7
Ball #5	34.9



PROJECT NO.: 202269

SPECIFICATION: Autosplice  
Test Plan

PART NO.: 9-B14641154TAA

PART DESCRIPTION: SMT Solderball

SAMPLE SIZE: One Bd. Assy

TECHNICIAN: LL

START DATE: 8-8-02

COMPLETE DATE: 8-14-02

ROOM AMBIENT: 20°C

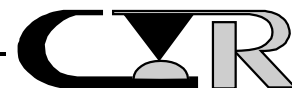
RELATIVE HUMIDITY: 54%

EQUIPMENT ID#: 420, 462, 689, 1276

TEMPERATURE RISE

PROCEDURE:

1. The test was performed in accordance with Paragraph 4.4.1 of Specification 9-B14641154TAA and EIA 364, Test Procedure 70.
2. The test samples were prepared to accept thermocouples at the appropriate locations.
3. Thermocouple locations:
  - a) Thermocouple #1 - On the outside of the small board as close to the contact as possible
  - b) Thermocouple #2 - On the contact between the pcb
  - c) Thermocouple #3 - On the outside of the large board as close to the contact as possible
4. An additional thermocouple was placed 2" outside of the test samples adjacent to the locations to be monitored. This is accomplished to evaluate the impact of ambient conditions.
5. The thermocouples were attached to a data acquisition/scanner system which in turn was interconnected to a plotter.
6. The test specimen was placed in a chamber or room which prevents air currents and the like from influencing the observations.



PROCEDURE: - Continued

7. The current was increased at the incremental steps indicated in the result section and allowed to reach stabilization prior to performing the next step.
8. Temperature stabilization is defined as no change in T-Rise greater than  $\pm 1^\circ\text{C}$  over a 15 minute interval.

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REQUIREMENTS:

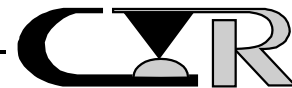
The maximum temperature rise shall not exceed  $30^\circ\text{C}$  at any one thermocouple.

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RESULTS:

The following is a summary of the data observed:

<u>Current Level</u>	<u>TEMPERATURE RISE (<math>^\circ\text{C}</math>)</u>				
	<u>Contact No.1</u>	<u>Contact No.2</u>	<u>Contact No.3</u>	<u>Contact No.4</u>	<u>Contact No.5</u>
A) <u>Top Bd (Thermo #1)</u>					
0.5	+0.2	-0.2	+0.2	+0.6	+0.2
1.0	+0.4	---	---	---	---
1.5	+0.3	---	---	---	---
2.5	+0.9	+0.4	+0.5	+1.2	+0.5
3.5	+1.6	---	---	---	---
5.0	+3.8	+1.9	+2.1	+4.1	+2.2
8.0	+9.3	+5.2	+6.2	+11.5	+6.7
10.0	+14.9	+9.0	+9.1	+17.8	+10.7
12.0	+18.2	+13.4	+14.6	+25.7	+15.5
13.0	+24.1	+16.0	+16.8	+29.3	+18.5
13.5	+26.9	+17.8	+17.9	---	+20.3
14.0	+30.1	+19.0	+19.5	---	+21.7
14.5	---	+21.4	+20.6	---	+23.3
15.0	---	+22.2	+22.4	---	+24.6
15.5	---	+24.0	+23.7	---	+26.5



RESULTS: Continued

TEMPERATURE RISE (°C)

<u>Current Level</u>	<u>Contact No.1</u>	<u>Contact No.2</u>	<u>Contact No.3</u>	<u>Contact No.4</u>	<u>Contact No.5</u>
B) <u>On Contact (Thermo #2)</u>					
0.5	+0.2	-0.3	+0.1	+0.8	+0.2
1.0	+0.3	---	---	---	---
1.5	+0.3	---	---	---	---
2.5	+0.8	+0.6	+0.6	+1.1	+0.6
3.5	+1.5	---	---	---	---
5.0	+3.5	+2.5	+2.5	+3.7	+2.6
8.0	+8.9	+6.6	+7.1	+9.8	+7.5
10.0	+13.9	+11.2	+10.6	+15.2	+12.0
12.0	+16.9	+16.5	+16.8	+21.6	+17.4
13.0	+23.0	+19.7	+19.4	+24.8	+20.3
13.5	+25.5	+21.5	+20.7	---	+22.3
14.0	+27.7	+22.9	+22.7	---	+23.9
14.5	---	+25.5	+24.5	---	+25.4
15.0	---	+26.6	+26.1	---	+26.9
15.5	---	+28.6	+27.8	---	+29.0

C) On Bottom Bd (Thermo #3)

0.5	+0.1	-0.3	+0.1	+0.8	+0.2
1.0	+0.3	---	---	---	---
1.5	+0.3	---	---	---	---
2.5	+1.0	+0.4	+0.4	+0.8	+0.5
3.5	+1.7	---	---	---	---
5.0	+4.1	+2.0	+1.9	+2.5	+2.1
8.0	+10.1	+5.6	+5.4	+6.9	+6.3
10.0	+16.4	+9.6	+8.1	+10.7	+10.1
12.0	+19.9	+14.2	+13.0	+15.4	+14.8
13.0	+26.8	+16.9	+15.1	+17.9	+17.4
13.5	+29.7	+18.3	+16.1	---	+19.2
14.0	+33.2	+19.7	+17.6	---	+20.6
14.5	---	+21.7	+19.2	---	+22.1
15.0	---	+22.7	+20.6	---	+23.6
15.5	---	+24.6	+21.4	---	+25.5

2. See data files 20226901 thru 20226955 for individual data points.

