Technical Report

MOLEX AND SAMTEC
High Density Mezzanine
(HDM-Plug/HDM-Receptacle)
Connector Processing Trial
SMT Assembly Report

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3. Assembly Materials

PCB: PCTB #251 RevA
SIDE 1 – TOP (Receptacle)
SIDE 2 – Bottom (PLUG)

Components: Connectors and FABS supplied by MOLEX.

Solder Paste: (SnPb) Kester HM531 , **Water Soluble**

Assembly Part #'s; SnPb HDM-Receptacle: 1001-0002-3121
SnPb HDM-Plug: 1001-0002-3120

4. SMT Equipment

Screener Printer:	MPM UP3000
Paste Inspection:	Koh Young KY3030VAXL
Fine Pitch Placement:	Universal GSM
Reflow Oven:	BTU Pyramax 150N (10 zone)
Temperature Profiler:	Datapaq 9000
X-Ray:	Agilent 5DX Series 5000
Hydro-wash:	Stoelting
Stencil/ Wash:	AAT-X40A

5. Environmental Conditions

The following info is from the Site Wide Humidity and temp sensors That is in each MFG module;

Date:	3/14/07
Temperature in Assembly Area	
Beginning of Build	73 deg F
End of Build	73 deg F
Relative Humidity in Assembly Area	
Beginning of Build	23%
End of Build	23%

Table 1: Environmental Conditions

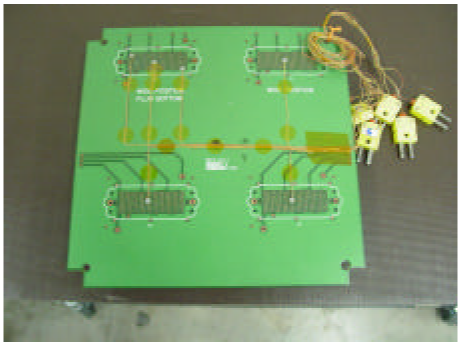
6. Test Vehicle Components

Figure 1: HDM-Receptacle / HDM-Plug Conn

7. Reflow Profile

Type K, special limits of error (+/- 1.1º C @ 200ºC), thermocouples were used. Thermocouples were attached by first drilling down through the pads of a bare board using a 13-mil drill bit. Care was taken to not sever the trace connections to the associated fan-out vias. Backside counter bore holes were drilled to provide clearance for the thermocouple insulation. Thermocouples were inserted and secured with thermal epoxy; welds positioned 5-6 mils above the fab top surface. Solder paste was then screened onto the board and components were placed and reflowed. Using this method ensures that the thermocouple weld is in contact with the solder joint precisely at the contact-pad interface. Three thermocouples were attached in this manner—leading corner, middle or the array, and trailing corner.
Dage transmissive X-Ray is then used to verify that the thermocouple weld has remained in position.

Figure 2: Profile Cards - Receptacle / Plug :



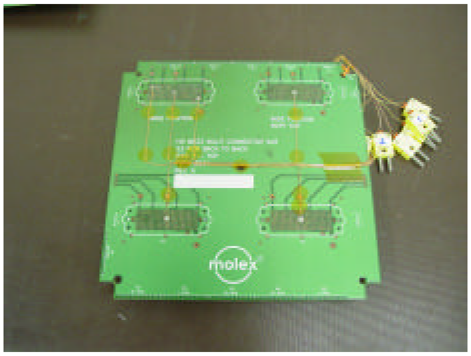
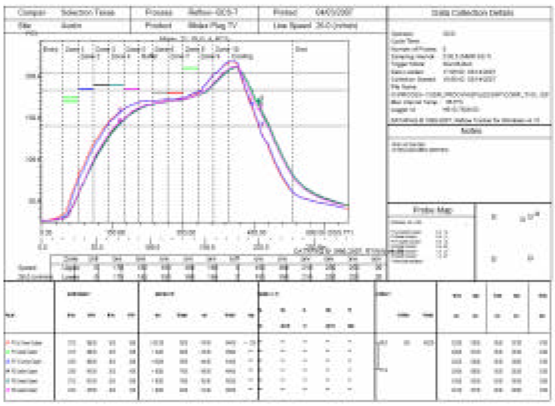
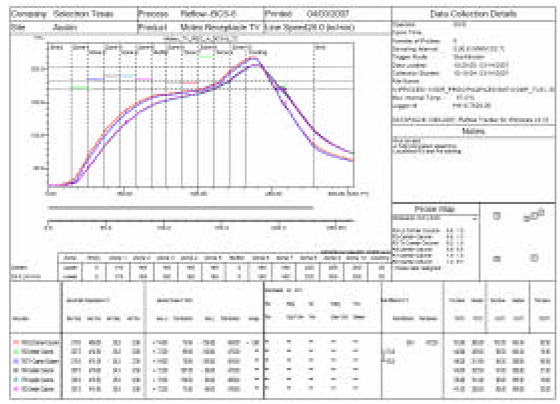


Figure 3: Reflow Oven Profile - Plug / Receptacle





8. Solder Paste Printer, Squegee and Stencil

Effective settings for the MPM UP3000 screener were found to be as follows:

Squeegee:	10-mil thickness JNJ metal, 12 inches in length
Blade Angle:	60º
Total Force:	14 lbs. (1.1 lb per blade inch)
Downstop:	0.070
Print Speed:	1.5 inches/sec
Snap-off Speed:	0.010 inch/sec

A laser-cut, electro-polished, single thickness stencil was designed—apertures 35- mil diameter;

RECEPTACLE:
We used both a foil thickness of 5-mils and 6-mils on the Receptacle (top side) .
The 5mil foil was initially used for the first 5 cards which produced less than desirable yields. We then switched over to the 6 mil which ran very well.

PLUG:
Since the 6 mil stencil gave us better yields on the Recpetacle it was determined to use the 6 mil stencil made for the Plug which ran very well with it.

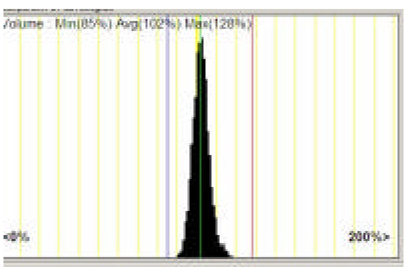
9. Paste Volume Measurements

Assessment of volumetric data is typically based upon an idealized view of stencil apertures, regarding both board side and squeegee side dimensions as the same. The true volume capability of stencil apertures should be based upon lab measurements and take into account the trapezoidal characteristics of the apertures. Delivered volume also assumes a perfectly flat and smooth board surface. As shown in Section 7, this was not the case for this test vehicle.

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. The system uses bi-directional, white light, phase shift interferometry to provide true 3D volumetric results. A fab surface pre-scan is used to collect data on the fab topography prior to the inspection of pasted boards. The pre-scan allows the system to effectively "map" the solder mask reference plane to pad relationship. The system provides results on volume, height, offset, bridging, and shape of each paste deposit. Since volume data is the most pertinent print attribute and volume data was readily available, paste volume for all deposits is typically presented.

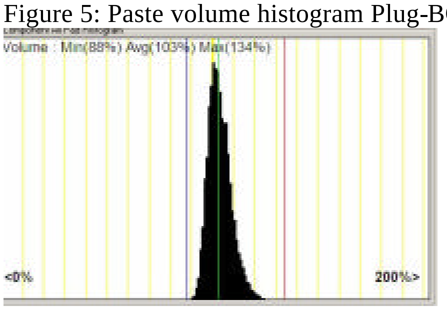
Stencil # 11452 5 mil
Nominal Volume 6185.5
Max printed 9217(149%)
Min printed 4082 (76%)

Figure 4: Paste volume histogram Receptacle-TOP Stencil# 11446 6 mil



nominal volume 7422.5
max printed 9946 (134%)
min printed 6532 (88%)

Figure 5: Paste volume histogram Plug-BOT Stencil# 11447 6 mil



nominal volume 7422.5
max printed 9946 (134%)
min printed 6532 (88%)

10. Wash Process

Misprint Process;

Solder paste applied to boards used while determining optimum printer parameters must be removed at some point. The same is true of any board that fails to meet 3D in-line solder paste inspection limits.
There were no miss-print washes recorded during this build.

After SMT placement all cards are taken thru Wash Process. Cards are loaded on to the conveyor and washed.

11. SMD Placement

Placement was isolated to the use of Universal GSM fine pitch placement equipment. A sturdy 0.5 inch cap is needed to allow the use of a 0.4 inch nozzle. We used a 400XF nozzle (0.4 inch).

Parts were received from MOLEX with pick up covers. However, modification will need to be made to the Receptacle Component's vacuum cap due to the fact that the height of this connector is outside of the machine limits and during pick and place the component was picked up slightly off-center. With the vac caps having only solid metal in the center of the connector we had to add tape to these covers. The Plug Connector worked fine as is.

Connector Self-Centering and Orientation Control:
The locator pins do provide orientation control. One of the two locator pins is elongated in the long axis to allow for thermal expansion during reflow. The locator pegs on these connectors were off center of each other (one peg in one corner with the other being in the opposite corner on the other end) this did not appear to be a problem for machine placement. Self-Centering is not a problem on this connector due to the locator pins being present.

Placement accuracy:
During the initial placement of the connectors on the first several cards of the HDMezz-Receptacle Connector there were many problems with the rejection rate and placement . At the time we were running with a BGA camera profile. Adjustment were made and the remainder of the run was without issues. There were no issues with the subsequent HDMezz-Plug placement.

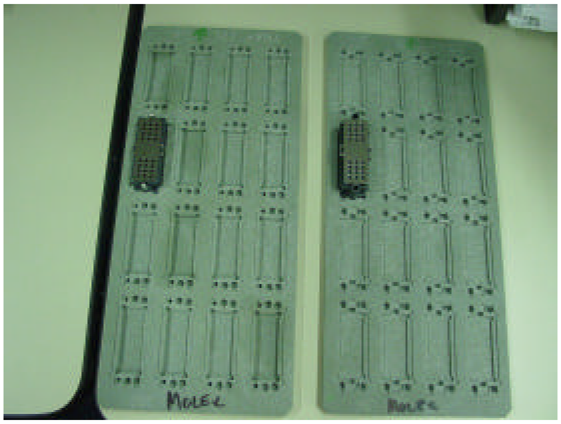
Placement pressure was also set to 300 grams as specified in the original quote for the outline of the run.

Trays used for pick up of parts were built by machine shop ; 1 tray for each style of conn. Each tray held 16 connectors and were set up for proper orientation. Parts were loaded into trays and then set into the GSM placement Machine. Attention was given to insure that connectors were picked up using proper orientation according to how the program was written.

Machine Type: Universal GSM
Nozzle Type: 400XF (0.4 in)
Force: 300 Grams

Table 2; GSM Parameters

Figure 6; Trays for Placement



12. Rework / Repair Process;

It was requested to take 20 Receptacle Connectors and 20 Plug Connectors thru the Removal/Replace Repair Process In the BGA REPAIR AREA; The following picture (Figure 8) are the Mini Stencils used;
Also below (Figure 9 & 10) are the profiles used for the Connectors. We also used a nozzle for this part;

Placement machine is: SRT 1100 LX;

Cards/Connnectors were taken thru the Repair process for Removal and Replacement of the connectors. All connectors are then taken thru the X-Ray process to insure proper pin to pad solder.

Process is as follows;
Run profile – Remove part – Inspect site - paste card using mini stencil-inspect – place new part on card – X-ray

All repaired cards went back thru X-RAY; (Cards do not go back thru wash since no clean flux is used)

These cards ran fine thru the BGA rework Process;

Figure 7; Mini Stencil Plug/Receptacle for Repair (6 mil)

Figure 8; Rework Profile for Receptacle

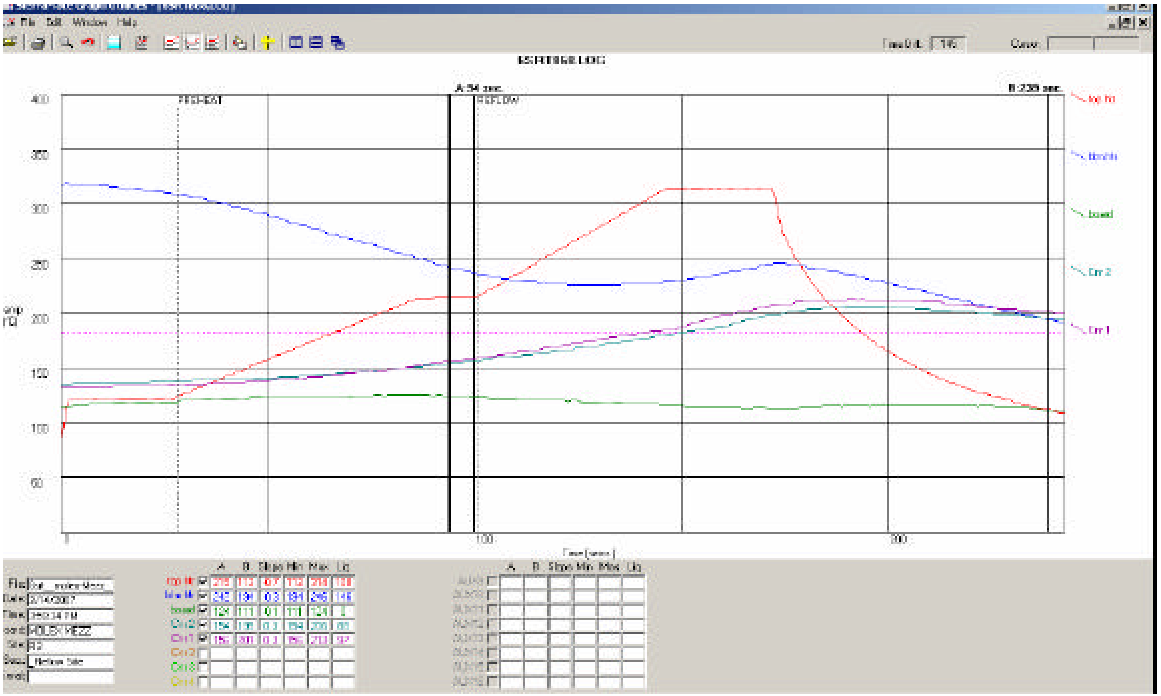
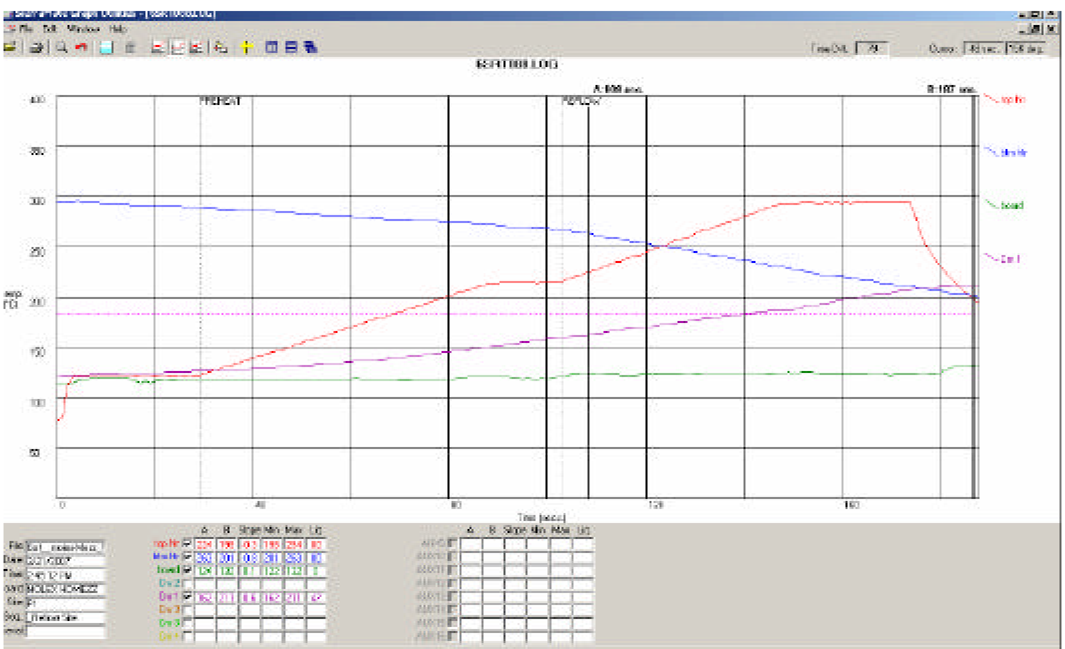


Figure 9; Rework Profile for Plug



13. SMT Inspection and X-Ray Results

X-Ray inspection was performed using an Agilent 5DX, Series 5000. The program used a CCGA algorithm, which compares each pin to its nearest neighbors within the field-of-view. A single slice was taken of each pin, seven mils above the board top surface.

5DX results overall were good.

X-ray can be very effective, but it is only as good as the program it is given. More work with the 5DX program would be needed in a MFG environment. In order to program the X-Ray machine Solectron Would need an "ODB+ or .brd" file for programming.

Table 3: 5DX results by serial number for SnPb Paste

MOLEX RUN ;
SERIAL NUMBER LISTING FOR CARD RUNS;
SnPb Paste

	Receptacle	1001-0002-3821	QTY = 17	Plug	1001-0002-3820	QTY = 17
	SERIAL # :	X-RAY:	BGA REPAIR	SERIAL # :	X-RAY:	BGA REPAIR
1	SAD111100XB	FAIL-5mil	Repair	SAD111100WU	PASS	
2	SAD111100WX	FAIL- 5mil		SAD111100WD	PASS	Repair
3	SAD111100X6	FAIL-5mil	Repair	SAD111100WN	PASS	Repair
4	SAD111100XC	FAIL-5mil	Repair	SAD111100WV	PASS	
5	SAD111100X2	FAIL-5mil		SAD111100WJ	PASS	Repair
6	SAD111100X1	PASS		SAD111100WH	PASS	
7	SAD111100WW	PASS		SAD111100WC	PASS	
8	SAD111100X3	PASS		SAD111100WK	PASS	
9	SAD111100X4	PASS		SAD111100WL	PASS	
10	SAD111100X5	PASS	Repair	SAD111100WM	PASS	
11	SAD111100WZ	PASS		SAD111100WF	PASS	
12	SAD111100X7	PASS	Repair	SAD111100WP	PASS	Repair
13	SAD111100X8	PASS		SAD111100WR	PASS	Repair
14	SAD111100X9	PASS		SAD111100WS	PASS	
15	SAD111100XA	PASS		SAD111100WT	PASS	
16	SAD111100WY	PASS		SAD111100WE	PASS	
17	SAD111100X0	PASS		SAD111100WG	PASS	

Note:

1. On the RECEPTACLE cards we started off with a 5mil stencil. The first 5 cards (4 connectors per chard) had some, but not all connectors, with visually identified failed solder joints. We switched to a 6mil stencil on the remaining Receptacles as well as a 6mil on all PLUG Connectors.

Figure 10; Good Solder Joints

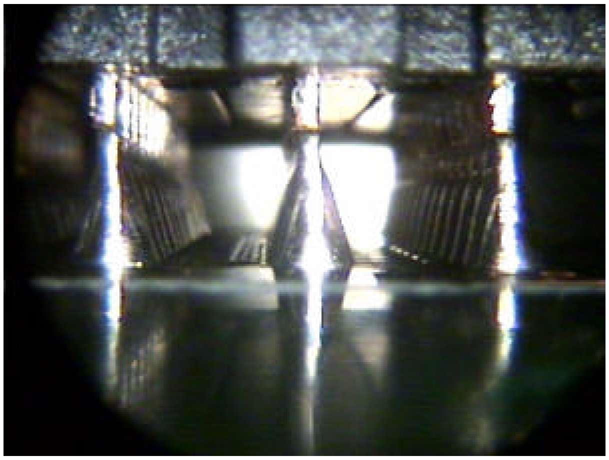


Figure 11: X-Ray Image Good Solder Joints

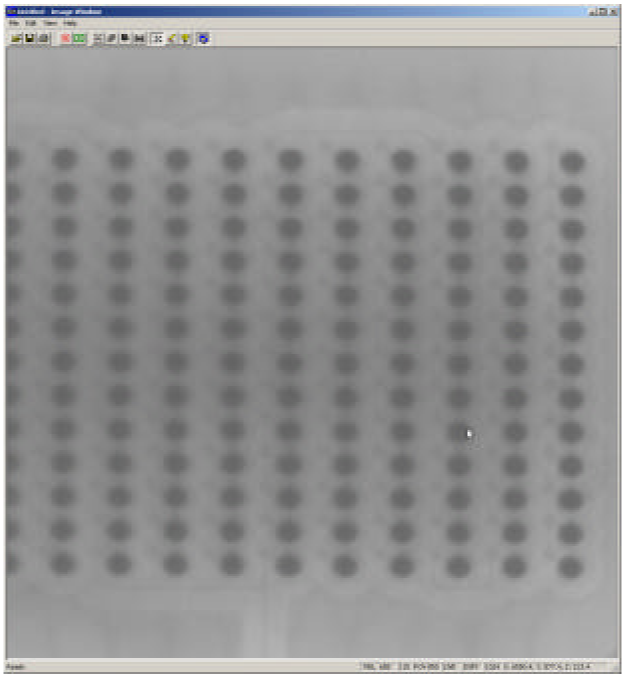


Figure 12; Bad Solder Joints

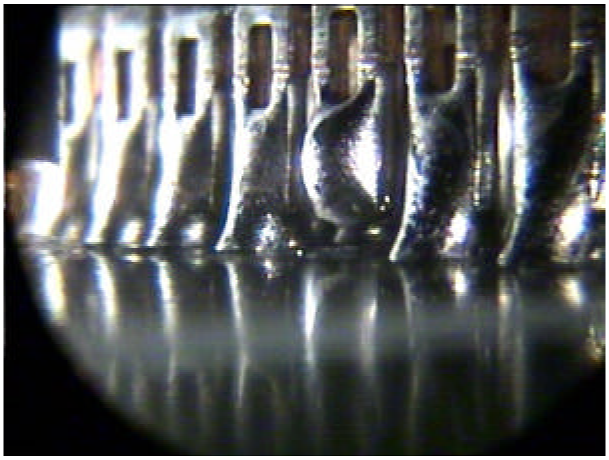


Figure 13; Bad Solder Joint X-Ray Image