



1701 McCarthy Blvd.  
Milpitas CA 95035

Phone: 408-577-0100  
Fax: 408-577-0123  
[WWW.Si-Micro.Com](http://WWW.Si-Micro.Com)

## ENGINEERING REPORT

Date:

Subject: RoHS Qualification test for the SOIC-8 package

From: Matt Pestana/ Kamlesh Patel

### 1. Introduction/Background

The RoHS Directive aim is simple – to restrict the use of [six substances](#) (See Figure 1 Below) within electrical and electronic equipment (EEE), thereby contributing to the protection of human health and the environment. While this is often called a Lead-Free Initiative, the other compounds listed below may also be present in electronic assemblies.

**Figure 1 – Restricted Materials under RoHS Directive**

Substance	Maximum Concentration
Lead – Pb	0.1 %
Mercury - Hg	0.1 %
Cadmium - Cd	0.01%
Hexavalent Chromium Cr (VI)	0.1 %
Polybrominated biphenyls – PBB	0.1 %
Polybrominated diphenyl ethers - PBDE	0.1 %

*Article 1 of Commission decision 2005/618/EC states: 'For the purposes of Article 5(1)(a), a maximum concentration value of 0.1% by weight in homogeneous materials for lead, mercury, hexavalent chromium, polybrominated biphenyls (PBB) and polybrominated diphenyl ethers (PBDE) and 0.01% by weight in homogeneous materials for cadmium shall be tolerated'*

Although RoHS is a European Union (EU) Directive, manufacturers of EEE outside Europe must also abide by this legislation if the equipment they produce is ultimately imported into a EU member state.

The biggest impact for most assemblers of electronic product is that lead (Pb) is no longer an acceptable component in solder. The solution has been to use a solder without lead, but this alternate solder melts at a higher temperature. This requires a higher temperature reflow during soldering. While conventional tin-lead can be reflowed at 230 to 235 C, the reflow temperature for lead-free components needs to be in the 260 C range (depending on package size and thickness). The agreed upon temperature ramp for soldering is found in [IPC/JEDEC J-STD-020C - Moisture/Reflow Sensitivity Classification for Nonhermetic Solid State Surface Mount Devices](#).

For some SMI Pressure Sensing products, this higher temperature has required a change in some housing plastics to withstand the higher reflow conditions.

## 2. Objective

The objective of this report is to document the findings of the qualification test of the SOIC-8 package in a lead free solder reflow profile. Since all SOIC-8 packaged parts are already fully RoHS compliant, the packaged needs to be tested to ensure it could withstand the higher reflow temperature.

## 3. Executive Summary

- a) Visual Inspection – There is no visible deformation of the package due to the increase in temperature. The solder bonds look clean and solid. It does not appear that there is an issue with the SOIC-8 package in the elevated temperature.
- b) Electrical Test – All the parts that were tested operated within the stated specifications indicating that the inside of the package is able to withstand the higher reflow temperature as well.

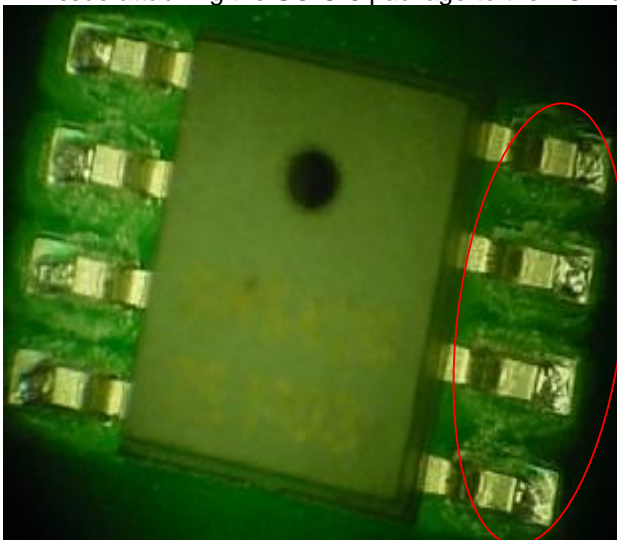
## 4. Test Method

Several different steps were performed to ensure that the SOIC-8 package was able to withstand a standard lead free solder reflow profile.

- 1) Currently the only SOIC-8 packaged parts manufactured by SMI are the SM5420. A sample of 5420s were selected and tested to ensure that only functional parts were included in the qualification sample.
- 2) A lead free solder reflow was preformed using the SM5420 and a RoHS compliant PCB. (see Attachment 1)
- 3) Parts were visually inspected under a microscope. The package was inspected for deformation and the quality of the solder bonds were inspected as well.
- 4) Parts were tested on the Audit Tester using productions standard testing program. This was done to ensure that there was no internal failure of the package resulting in a failure of the part.

## 5. Results

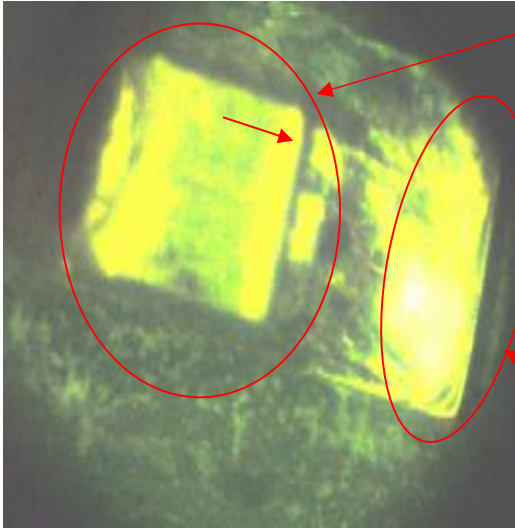
- a) Visual Inspection – There is no visible deformation of the package due to the increase in temperature. The solder bonds look clean and solid. It does not appear that there is an issue attaching the SOIC-8 package to the PCB using a lead free profile.



Picture 1

There was no change in the package during the reflow. The plastic is still in the same form after the test.

You can see the solder pins bonded to the solder pads of the PCB. The solder has bonded to the underside of the pins, forming a solid connection. Please refer to Picture 2 to see a closer image.



This close up of the solder bond shows the solder pin attached to the pad. The solder has crept up the edge of the pin forming a good solid bond.

The solder has flowed over this bond pad resulting in a good connection between the part and the board.

- b) Electrical Test – All the parts that were tested operated within the stated specifications and passed on the Audit Tester. Please refer to Table 1, which presents that data that was collected during the retest of the parts using the Audit Tester.

#### **6. Actions as a result of these findings**

As a result of the preceding test SMI finds the SOIC-8 package able to withstand a typical lead free solder reflow and is therefore acceptable for use where lead free solder processes are required. Since the SOIC-8 is already in standard production and RoHS compliant, there is no need to change the production process on this package.



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Table 1 – Test Data

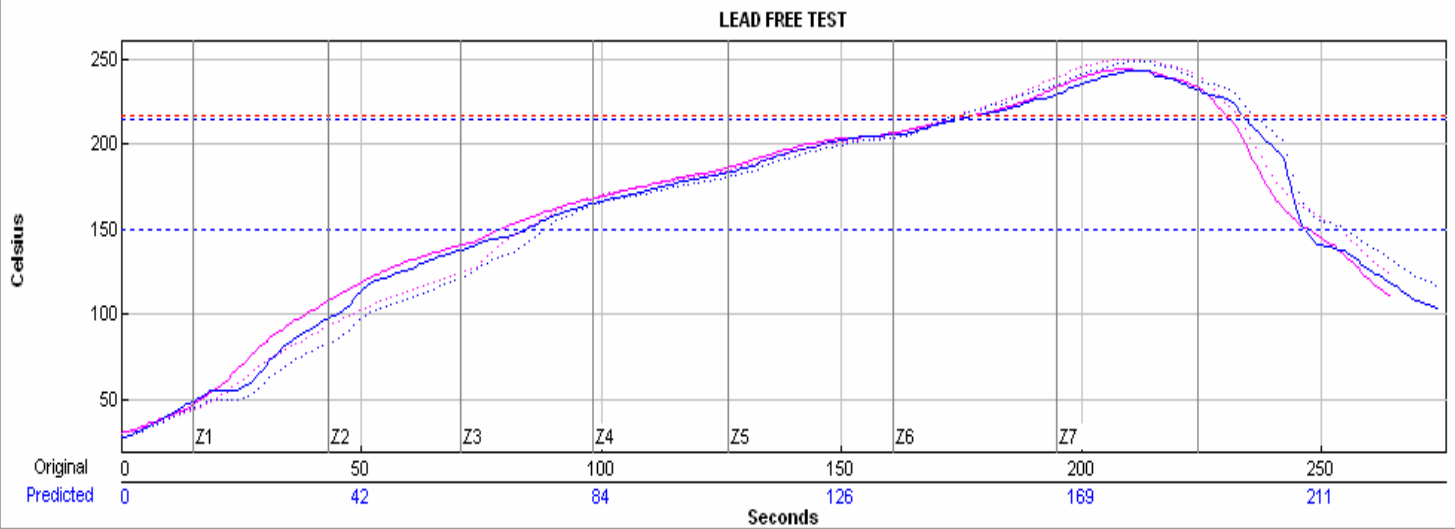
Part #	Lot_Num	Date	Resistance	Offset	Offset_WP1	Offset_WP2	Offset_Delta	Span	Leakage	Code	Status
1	2D_ROHS_10242005	10/24/05	4983.7	0.070497	0.14319	0.142677	0.00051	72.693	3.59E-03	00	Pass
2	2D_ROHS_10242005	10/24/05	4990.5	0.059888	0.129755	0.129267	0.00049	69.867	3.77E-03	00	Pass
3	2D_ROHS_10242005	10/24/05	4991.5	0.060366	0.131982	0.131447	0.00053	71.616	4.06E-03	00	Pass
4	2D_ROHS_10242005	10/24/05	4997.6	0.052393	0.122947	0.122492	0.00045	70.554	3.71E-03	00	Pass
5	2D_ROHS_10242005	10/24/05	4996.6	0.057903	0.129023	0.128534	0.00049	71.12	3.80E-03	00	Pass
6	2D_ROHS_10242005	10/24/05	4995.6	0.050801	0.121942	0.121368	0.00057	71.141	4.72E-03	00	Pass
7	2D_ROHS_10242005	10/24/05	4996.5	0.066994	0.139111	0.13863	0.00048	72.117	3.46E-03	00	Pass
8	2D_ROHS_10242005	10/24/05	4996.1	0.054882	0.126049	0.125469	0.00058	71.167	4.61E-03	00	Pass
9	2D_ROHS_10242005	10/24/05	4995.1	0.064225	0.133195	0.132691	0.0005	68.97	3.79E-03	00	Pass
10	*	*	*	*	*	*	*	*	*	*	*

\* One parts was broken due to improper handling during the testing process and therefore could not be tested.

**Attachment 1  
Lead Free Solder Profile**

Fri Aug 20 2004 11:36:53

General | Description | Optimization



TCs	Max Rising Slope	Soak Time 150-215C	Reflow Time /217C	Peak Temp
TEST1	2.4 78%	95.2 17%	52.7 -49%	244.7 -3%
TEST2	2.2 50%	89.9 -0%	55.3 -31%	244.1 -9%
Delta	0.14	5.31	2.65	0.67
P.TEST1	2.1 24%	73.4 -55%	49.8 -68%	250.7 57%
P.TEST2	2.3 63%	70.6 -65%	52.1 -53%	249.5 45%
Delta	0.19	2.81	2.24	1.20

	P.W.I.	inch/min	Zone 1	Zone 2	Zone 3	Zone 4	Zone 5	Zone 6	Zone 7
Original Top	78%	30.0	130.0	155.0	185.0	190.0	215.0	230.0	255.0
Original Bottom			130.0	155.0	185.0	190.0	215.0	230.0	255.0
Predicted Top	68%	35.6	117.2	140.9	202.0	188.7	215.6	242.2	263.1
Predicted Bottom			117.2	140.9	202.0	188.7	215.6	242.2	263.1

Top and Bottom are the same