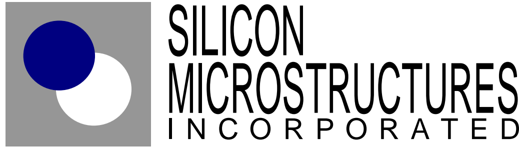

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ENGINEERING REPORT

Date:

Subject: RoHS Qualification test for the SOIC-16 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 Commision 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 biphenals (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-16 package in a lead free solder reflow profile. Since all SOIC-16 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-16 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-16 package was able to withstand a standard lead free solder reflow profile.

1) 10 SM5430 packaged parts acted as the representative sample of SOIC-16 packages. These parts will show any problems with the package and are fairly easy to test. A sample of 5430s were selected and tested to ensure that only functional parts were included in the qualification sample.

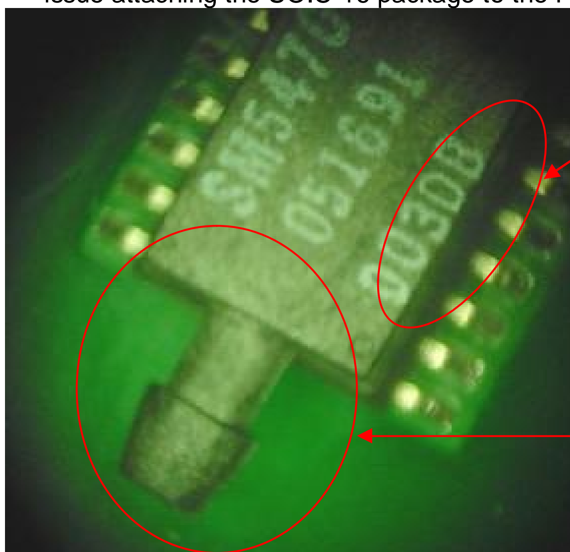
2) A lead free solder reflow was preformed using the SM5430 and a RoHS compliant PCB. (see attachment 1)

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-16 package to the PCB using a lead free profile.



Observe how the edge of the part is still very defined. There is no visible deformation of the plastic cap due to the increased temperature of the lead free solder reflow.

The nozzle of the cap maintained the same shape without any drooping. If the material couldn't withstand the temperature we would expect to see the nozzle drooping, which is not present here.

Picture 1

Picture 2

This picture shows the solder pins of the part connected to the solder pad of the PCB

The solder pad of the PCB has been completely covered by the solder. The bond is very smooth indicating a very solid bond.

The solder pin of the part has been completely covered by the solder. This paired with the quality of the bond on the PCB results in a very sound solder bond between the part and the PCB

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-16 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-16 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 #	Voltage unpressurized	Input Resistance	P/F	Output Resistance	P/F	RS	P/F	Output Voltage	P/F	Voltage pressurized	Input Resistance Pressurized	P/F	Output Resistance Pressurized	P/F	Span	P/F
1	4.9926	3465.137	P	3462.065	P	0	/	-6.91E-03	P	4.9927	3470.855	P	3471.862	P	0.194268	P
2	4.9925	3403.908	P	3406.343	P	0	/	2.40E-03	P	4.9927	3417.057	P	3419.083	P	0.198599	P
3	4.9925	3408.512	P	3410.146	P	0	/	8.01E-04	P	4.9925	3423.113	P	3423.672	P	0.200172	P
4	4.9922	3281.772	P	3292.09	P	0	/	5.11E-03	P	4.9921	3303.017	P	3304.361	P	0.212058	P
5	4.9927	3409.297	P	3415.702	P	0	/	-2.80E-03	P	4.9926	3428.964	P	3429.19	P	0.203719	P
6	4.9926	3372.27	P	3372.541	P	0	/	1.20E-03	P	4.9921	3373.266	P	3373.433	P	0.19377	P
7	4.9925	3385.229	P	3387.996	P	0	/	2.90E-03	P	4.9927	3395.353	P	3396.656	P	0.205436	P
8	4.9927	3395.616	P	3401.887	P	0	/	-4.01E-03	P	4.9925	3414.694	P	3414.862	P	0.204166	P
9	4.9925	3357.606	P	3359.968	P	0	/	2.80E-03	P	4.9926	3360.564	P	3361.353	P	0.192495	P
10	4.9925	3379.967	P	3388.973	P	0	/	2.40E-03	P	4.9925	3395.753	P	3396.132	P	0.197641	P

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Attachment 1
Lead Free Solder Profile

General | Description | Optimization

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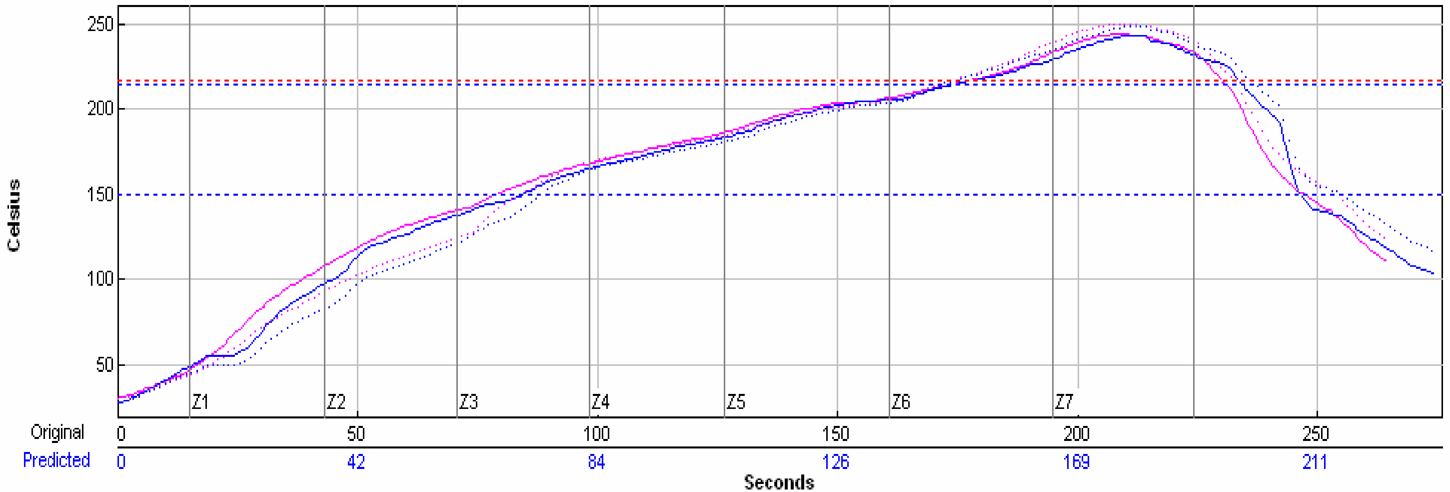

TCs	Max Rising Slope		Soak Time 150-215C		Reflow Time /217C		Peak Temp	
TEST1	2.4	78%	95.2	17%	52.7	-49%	244.7	-3%
TEST2	2.2	50%	89.9	-0%	55.3	-31%	244.1	-9%
Delta	0.14		5.31		2.65		0.67	
P.TEST1	2.1	24%	73.4	-55%	49.8	-68%	250.7	57%
P.TEST2	2.3	63%	70.6	-65%	52.1	-53%	249.5	45%
Delta	0.19		2.81		2.24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