

TSC Lead Free Products Announcement

Date: APR-1-2004

Taiwan Semiconductor Corp.(TSC) committee to be a member of Global Lead-Free Environment

Taiwan Semiconductor Corp. dedicate to research & work out the green product (Lead-Free product) to meet with ROHS(The Restriction of Hazardous Substances) requirement, and preserve our green earth / environment for future generations.

Purpose

Protect human health and the environment by restricted the use of certain hazardous substances in new equipment; and compliance with the WEEE (waste electrical and electronic equipment) Directive.

TSC Lead-Free & ROHS Policy

- TSC announce to produce Green products (Lead-Free products) of whole series products after March 01 2004.
- Research certification of Green product & manufacture environment, TSC achieve the “ Green Partner certification” from Sony on Oct 01 , 2003
- TSC provide the analysis report of Lead- Free & ROHS material by SGS certification center and this analysis report is by yearly base.

TSC environment certification

- TSC manufacture factory has been recognized for ISO14001(TEW,YEW & I-lan) & OHSAS18001(TEW).
- TSC has been certified by “Green Partner Award” (TEW/ YEW)
- TSC had also certified by ROHS for whole series of products family by SGS.

The Restriction of Hazardous Substances in Electrical and Electronic Equipment (ROHS) Directive (2002/95/EC)

Who does it affect?

Manufacturers, sellers, distributors and recyclers of electrical and electronic equipment containing lead, mercury, cadmium, hexavalent chromium, polybrominated biphenyls or polybrominated diphenyl ethers. This Directive covers the same scope as the Directive on waste electrical and electronic equipment (WEEE) except for medical devices and monitoring and control instruments. It also applies to electric light bulbs and light fittings in household industrial level .

Key elements

From 1 July 2006 new electrical and electronic equipment must not contain lead, mercury, cadmium, hexavalent chromium, polybrominated biphenyls (PBBs) or polybrominated diphenyl ethers (PBDEs). These must be replaced by other substances.

Certain applications are exempted from the requirements of the Directive including mercury in certain types of fluorescent lamps, lead in the glass of cathode ray tubes, electronic components and fluorescent tubes, lead in electronic ceramic parts and hexavalent chromium as an anti-corrosion of the carbon steel cooling system in absorption refrigerators. The exemptions will be reviewed every four years.

Before 13 February 2005 the European Commission will review the terms of the Directive to take into account any new scientific evidence.

Time frame

On 30 July 2004 the Government published a final consultation (including draft implementing legislation and non-statutory guidance) which will run until 29 October 2004. The Government expects to bring the Directive into effect through UK law later in the year.

TSC Lead-Free Product Specification

Taiwan Semiconductor Corp.(TSC) dedicate to protect our environment for future generations and TSC offer most of Axial lead diodes series of Green Product (Lead-Free product), which include TS1, A-405, DO-41, DO-15, DO-201AD, R-6.

TSC offer most of Surface Mount Rectifiers of Green Product (Lead-Free Product), which include SMA, SMB, SMC, D2Pak, DPak, DBS, SOD-123, SOD-323, MELF, Mini MELF, Micro MELF.

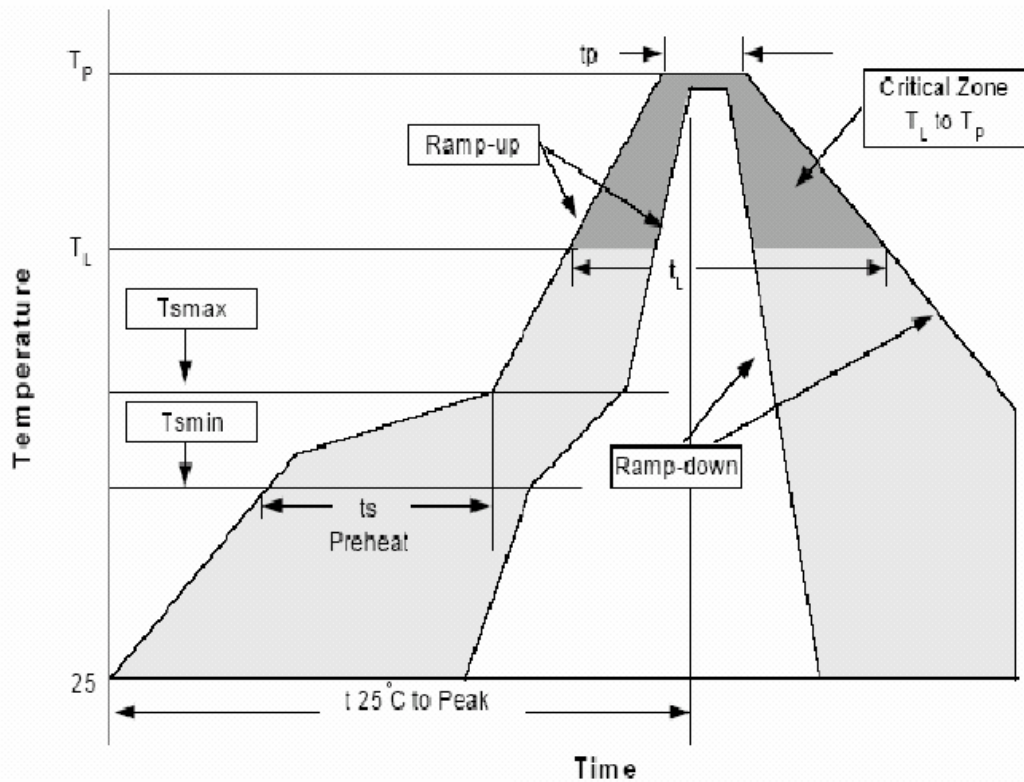
TSC offer most of Bridge Rectifier of Green Products (Lead-Free Product), which include GPP Bridge Rectifier (MBS, RB-15G, WOG, DB, DBS, GBL, KBP-G, GBU, KBU-G, TS4B, TS6P, SB-6G, SB-10G) & Cell Bridge Rectifier (RB-15, WOB, KBP, SB-3, KBL, KBU, SB-6, SB-6T, SB-10, SB-35M, SB-35W).

TSC offer most of Power Pack Rectifier of Green Product (Lead-Free Product), which include TO-220, TO-3P, ITO-220, AR & ARS.

TSC offer most of Analog package of Green Product (Lead-Free Product), which include TO-220, TO-263, TO-252, TO-251, TO-92, SOP-8/-14/-16, DIP-8/-14/-16, SOT-223, SOT-89, SOT-23/-25/-26.

All products will withstand a peak re-flow temperature of 260°C for 10 sec. And in a 230°C for 60 sec. The re-flow zone with a pre-heat of 150°C to 180°C for 60 to 200 sec. The re-flow soldering heat resistance is specified at 260+5/-0°C for 10 sec.

Reflow condition



Classification Reflow Profiles

Profile Feature	Pb-Free Assembly	
	Large body	Small body
Average ramp-up rate (T_L to T_P)	3°C/second max	
Preheat =Temperature Min (T_{smin}) =TemperatureMax (T_{smax}) =Time (min To max) (T_s)	150°C 200°C 60-180 seconds	
T_{smax} to T_L -Ramp-up Rate	3°C/second max	
T_{smax} to T_L = Temperature (T_L) =Time (t_L)	217°C 60-150 seconds	
Peak Temperature (T_P)	245+0/-5°C	260+0/-5°C
Time within 5°C of actual Peak Temperature (T_P)	10-30 seconds	20-40 seconds
Ramp-down Rate	6°C/second max	
Time 25°C to Peak Temperature	8 minutes max	

Whisker growth experiment for Lead-Free Product

1. Product of experiment :

- A. Axial Lead Diode Package.
- B. Bridge Rectifier Package
- C. Power Pack Rectifier package.

2. Whisker spec be followed :

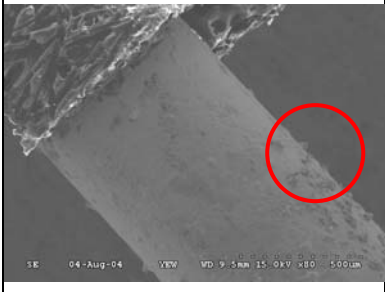
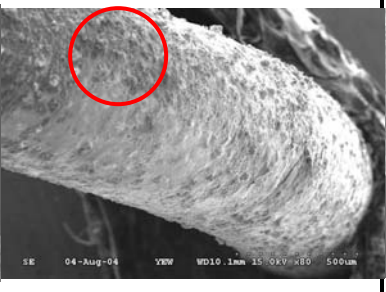
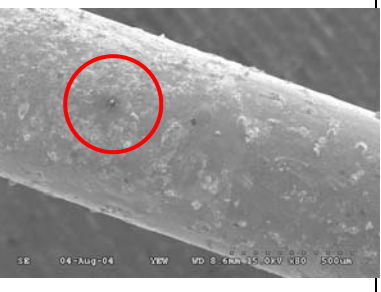



Sony Whisker spec SS-00254-8

3. Experiment condition :

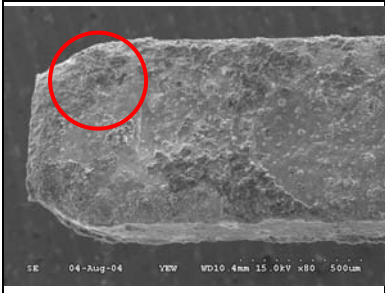
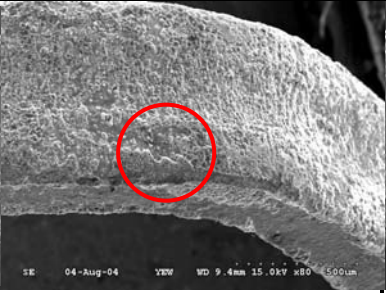
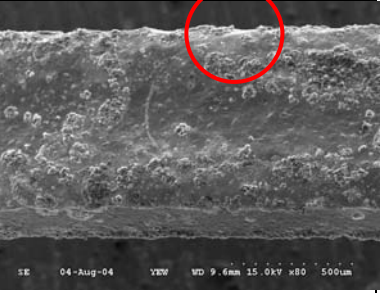



NO	Test Item	Test condition	Reference
1	Thermal Cycling	<ul style="list-style-type: none"> ➤ 1000Cys at -55°C +0/-10°C to 80 °C +10/-0 °C ➤ Cycle time 20minutes, typically ramp 1 minutes and dwell 7 minutes 	
2	Acceptance Criteria	<ul style="list-style-type: none"> ➤ <50um of Sony spec limit. 	SONY SS-00254-8

Note : 1. Review Sony spec of whisker, Sony specify Acceptance criteria is 50um.

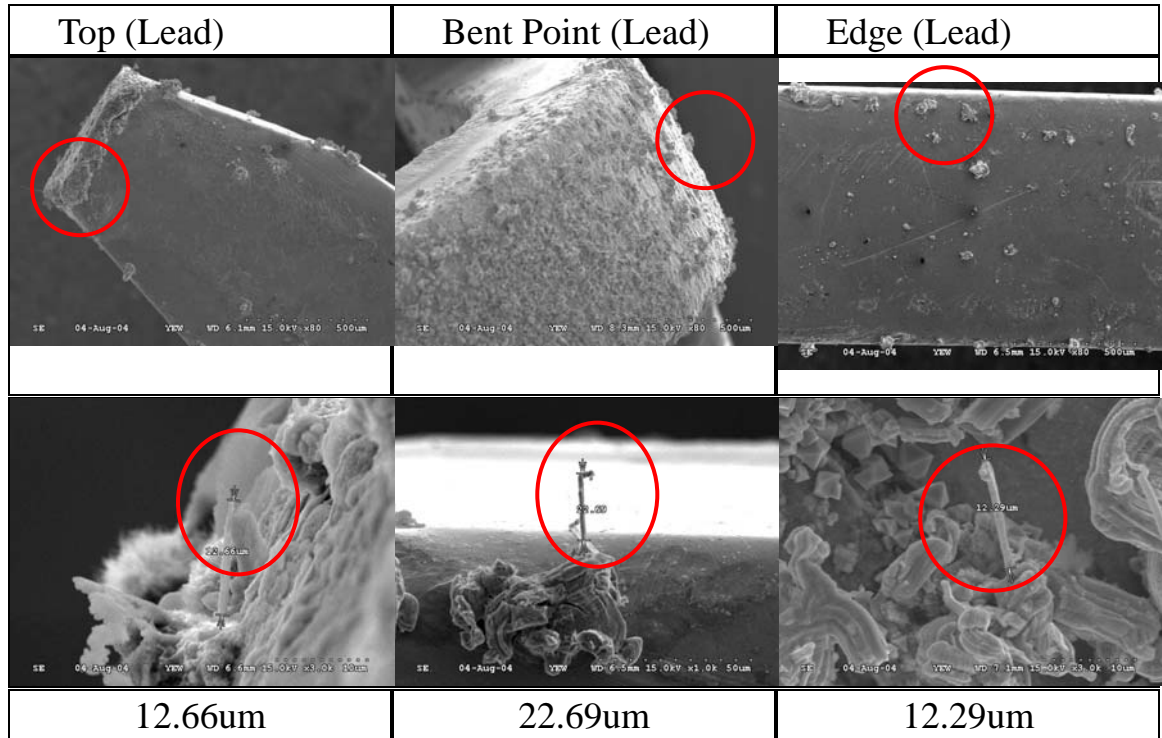
Whisker pictures of Axial lead diode :

Top (Lead)	Bent Point (Lead)	Edge (Lead)
		
		
4.70um	13.69um	9.25um

Whisker pictures of Power Pack Rectifier :

Top (Lead)	Bent Point (Lead)	Edge (Lead)
		
		
7.43um	17.68um	8.50um

Whisker pictures of Power Pack Rectifier :



Whisker crystalline length after grown-up results :

Product	Top	Bend	Edge
Axial Diode	4.70um	13.69um	9.25um
Power pack	7.43um	17.68um	8.50um
TS6P Bridge	12.66um	22.69um	12.29um