



RoHS-Compliant/Lead-Free Packaging

April, 2007



Agenda

- **Introduction**
- **RoHS-compliant vs. Lead-free**
- **GSI RoHS-compliant/Lead-free strategy**
- **RoHS-compliant package qualification**
- **RoHS-compliant package roadmap**



Introduction

- **Jan 27th, 2003 EU passed two Directives**
 - **Restriction of the use of certain Hazardous Substances (RoHS) in electrical and electronic equipment**
 - **Waste Electrical and Electronic Equipment (WEEE)**
- **August 13th, 2005 onwards**
 - **Producers are required to finance the collection, treatment, recycling, and recovery of all WEEE**
- **July 1, 2006, Electrical and Electronic Equipment will no longer be sold in EU if it contains lead(Pb), cadmium(Cd), mercury(Hg), hexavalent chromium(Cr⁺), polybrominated biphenyls(PBB), and polybrominated diphenyl ethers(PBDE) exceeding the prescribed concentrations**



RoHS-Compliant vs. Lead-Free

- **Lead-Free Definition**
 - **Terminals:**
 - ✓ **Leaded package:** pure matt tin
 - ✓ **BGA package:** Sn4.0Ag0.5Cu
 - **Lead (Pb) < 1000 ppm**
- **RoHS-Compliant Definition**
 - **Terminals:**
 - ✓ **Leaded package:** pure matt tin
 - ✓ **BGA package:** Sn4.0Ag0.5Cu
 - **Lead (Pb) < 1000 PPM**
 - **Mercury (Hg) < 1000 PPM**
 - **Hexavalent Chromium (Cr⁺⁶) < 1000 PPM**
 - **Cadium (Cd) < 100 PPM**
 - **PBB < 1000 PPM**
 - **PBDE < 1000 PPM**



GSI RoHS-Compliant/Lead-Free Strategy

- Offer only fully (6/6) RoHS-compliant (green) packages (except flip chip BGA devices)
- Work with assembly subcontractors on qualifying Pb-free plating process and Pb-free solder balls
- All RoHS-compliant packages are JEDEC MSL level 3 at 260°C reflow
- Offer both standard (5/6 RoHS-compliant) and fully (6/6) RoHS-compliant products until customers are fully converted
- 6/6 RoHS-compliant (green) samples are currently available—“G” character is added to package designator and is marked on the package
 - Ex: GS832032T (standard) GS832032GT (RoHS-compliant)



RoHS-Compliant Package Qualification

<u>Test Method</u>	<u>S.S.</u>	<u>Duration</u>	<u>Test Condition</u>
Preconditioning (MSL 3)	336/lot, 3 lots	N/A	30°C/60% RH/192 hrs + IR x 3 (260°C)
HTOL	105/lot, 3 lots	1000 hours	125°C
Temp Cycle	77/lot, 3 lots	1000 cycles	-55°C/125°C
HAST	77/lot, 3 lots	264 hrs	110°C/85% RH
Autoclave	77/lot, 3 lots	96 hrs	121°C/100% RH/15psig
Thermal Shock	15/lot, 3 lots	300 cycles	-55°C to 125°C

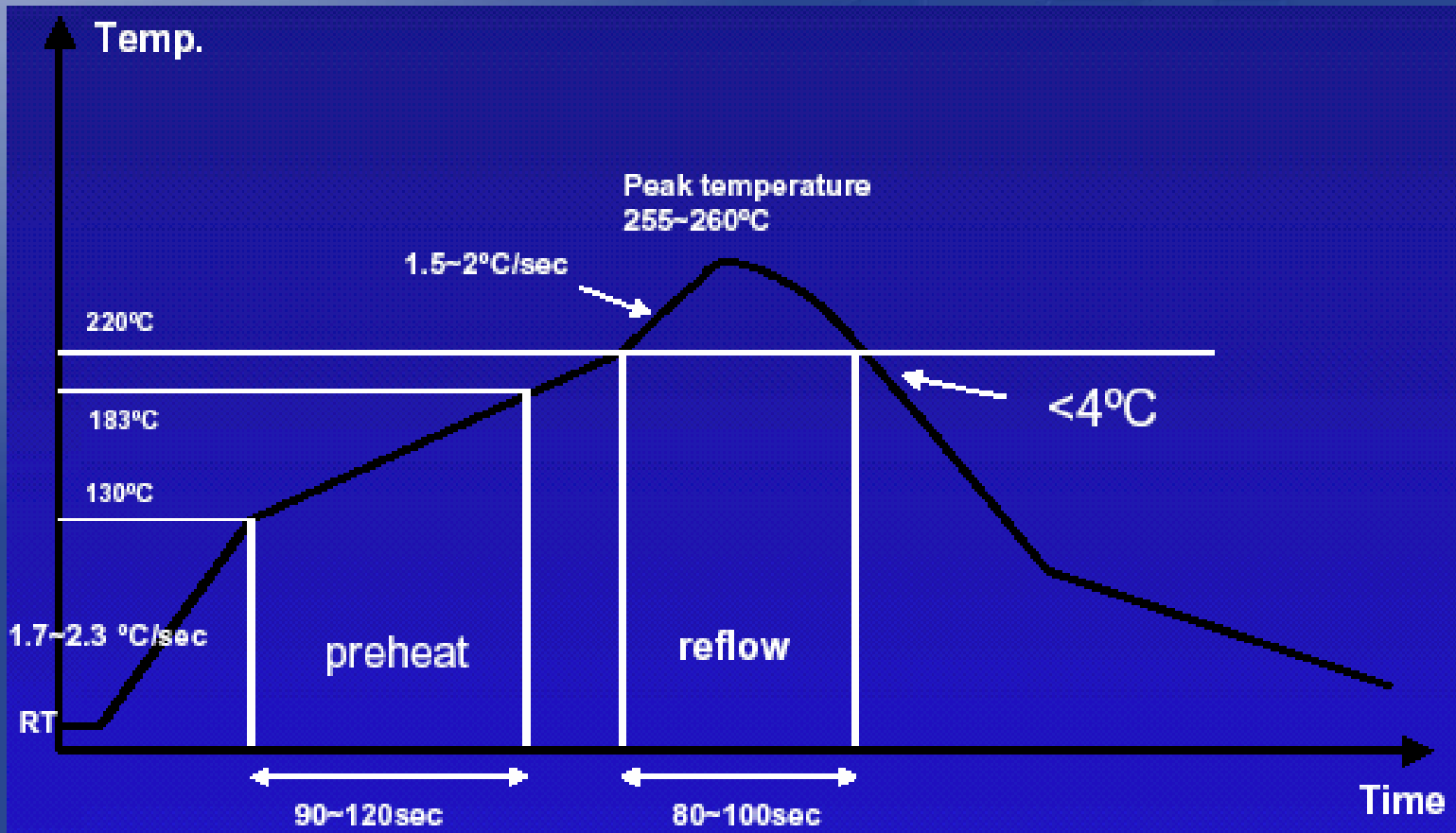


RoHS-Compliant Package Qualification (cont.)

- **Solderability**
 - GSI does not perform a solderability test in-house; the RoHS-compliant package solderability is evaluated based on the data conducted by assembly subcontractor per J-STD-002B
- **Sn Whisker**
 - GSI does not perform a tin whisker test in-house
 - RoHS-compliant package tin whisker is evaluated based on data conducted by assembly subcontractor
 - GSI's tin whisker criteria: < 50um w/ any L/F type



Recommended* Reflow Profile at MSL3 Preconditioning



*Per JEDEC Recommendations

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RoHS-Compliant Package Roadmap

Activities	2004				2005				2006			
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Leadframe based packages: TSOP II	Development & Qual				Cust Qual/Sample				Production			
Leadframe based packages: TQFP	Development & Qual				Cust Qual/Sample				Production			
Leadframe based packages: SOJ (all lead counts)	Development & Qual				Cust Qual/Sample				Production			
Array packages: uBGA (48 "U", 48 "X")	Development & Qual				Cust Qual/Sample				Production			
Array packages: TFBGA (119, 209, 165 "D", 165 "E")	Development & Qual				Cust Qual/Sample				Production			

Note:

No RoHS-compliant/Pb-free packages will be offered for flip chip BGA devices.

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