



# **Environmental Packaging**

**FAQs**

---

March 2004

---

## Table of Contents

1. Why is the movement to remove lead (Pb) from electronics gaining global momentum? . . . .	3
2. Is there existing legislation that bans the use of lead (Pb) in electronics? . . . . .	3
3. Where can I read the details of the European restrictions about lead (Pb) in electronic equipment? . . . . .	3
4. Are there costs and risks associated with the migration to lead (Pb)-free products? . . . . .	3
5. Does Actel offer lead (Pb)-free products today? . . . . .	3
6. Did Actel qualify a lead (Pb)-free solution? . . . . .	3
7. What does Actel mean by "green" packages? . . . . .	3
8. What does "halogen-free" mean? . . . . .	4
9. How can lead (Pb)-free packages from Actel be identified from standard Actel packages that contain lead? . . . . .	4
10. Are the molding compound and die-attach material different on lead (Pb)-free packages than on the standard packages? . . . . .	4
11. What is the lead (Pb) finish material used on Actel's lead (Pb)-free packages? . . . . .	4
12. What is the Moisture Sensitivity Level (MSL) of Actel's lead (Pb)-free packages? . . . . .	4
13. What is the suggested reflow procedure for Actel's lead (Pb)-free packages? . . . . .	4
14. Actel has selected a pure tin (Sn) lead finish for select lead (Pb)-free devices. Are there still concerns regarding tin whisker growth? . . . . .	5
15. Can standard and lead (Pb)-free packages be used on the same PCB board? . . . . .	5

## **1. Why is the movement to remove lead (Pb) from electronics gaining global momentum?**

Lead (Pb) is a highly toxic metal that was used for many years in products found in and around our homes. Exposure to lead (Pb) has been tied to a number of negative health effects. Even though there is no exposure to humans from using electronic products and there is little data to suggest a link between human health impacts and pollution from trace amounts of lead (Pb) in electronics waste, Actel is committed to reducing all hazardous materials in our products. Actel believes this position aligns with our Corporate Environmental Policy and is a positive step as a responsible corporate citizen.

## **2. Is there existing legislation that bans the use of lead (Pb) in electronics?**

A variety of jurisdictions around the globe have proposed regulations that would restrict the use of lead (Pb) in electronic products. The European Community has established a phase-out date of July 1, 2006 for lead (Pb) in electronic products. There are two European directives:

- **RoHS** (Reduction of Hazardous Substances) bans the use of lead (Pb), mercury (Hg), cadmium (Cd), hexavalent chromium (Cr(VI)), polybrominated biphenyls (PBB), and polybrominated diphenyl ethers (PBDE) in electronics products.
- **WEEE** (Waste of Electrical and Electronic Equipment) establishes guidelines for the collection, treatment, recycling, and recovery of waste of electrical and electronic equipment.

## **3. Where can I read the details of the European restrictions about lead (Pb) in electronic equipment?**

More information on the Directive of the [European Parliament](http://www.europa.eu.int) is available at: <http://www.europa.eu.int> and <http://www.europarl.eu.int>.

## **4. Are there costs and risks associated with the migration to lead (Pb)-free products?**

There are many complex problems and significant risks that will need to be addressed in the industry's migration to lead (Pb)-free products and solders. Associated costs for materials development, testing, and manufacturing will impact the industry during the transition. In addition to the costs, the risks include product-reliability concerns associated with manufacturing, and environmental and health concerns associated with lead (Pb)-free alternatives. In spite of these concerns, no insurmountable barriers have been identified that will impact the global migration to lead (Pb)-free alternatives.

## **5. Does Actel offer lead (Pb)-free products today?**

Yes, Actel is already shipping a number of lead-free package options. Actel also plans to offer our entire portfolio of plastic-leaded packages in "green" lead (Pb)-free and Halogen-free packages by the end of Q1, 2004. Actel also plans to offer lead (Pb)-free versions of our plastic BGA package portfolio by the end of Q1, 2004. Refer to Actel's ["Green" Roadmap](http://www.actel.com/documents/LeadFreeRoadmap.pdf) ([www.actel.com/documents/LeadFreeRoadmap.pdf](http://www.actel.com/documents/LeadFreeRoadmap.pdf)) for detailed information and changes.

## **6. Did Actel qualify a lead (Pb)-free solution?**

Yes. Actel and their assembly vendors ran separate qualifications on the lead (Pb)-free packages. Data is available by contacting Actel's technical support department. Implementation is subject to demand, so communicate all future requirements and schedules to your local sales representative to ensure a timely supply of lead (Pb)-free material.

## **7. What does Actel mean by "green" packages?**

"Green" packages from Actel include the elimination of lead (Pb) and halogen compounds.

## 8. What does "halogen-free" mean?

"Halogen-free" means that the packages are free of halogenated compounds: bromine (Br), chlorine (Cl) and antimony oxide.

## 9. How can lead (Pb)-free packages from Actel be identified from standard Actel packages that contain lead?

Lead (Pb)-free packages will have an "X79" marked on the bottom right-hand corner. The X79 designation signifies leaded packages as lead (Pb)-free and halogen-free, and currently identifies Ball Grid Array Packages as lead (Pb)-free, though Actel is working to offer BGAs in halogen-free options in the future as well. When ordering lead (Pb)-free packages, note on the order that lead (Pb)-free packages are required.

## 10. Are the molding compound and die-attach material different on lead (Pb)-free packages than on the standard packages?

The molding compound and die-attach material are different from Actel's standard packaging material lead (Pb)-free packages. Extensive qualification was done on lead (Pb)-free devices in order to ensure that there are no significant changes in the reliability of the packages.

## 11. What is the lead finish material used on Actel's lead (Pb)-free packages?

- Leaded lead (Pb)-free package lead finish is 100% pure tin (Sn)
- Ball Grid Array lead (Pb)-free packages solder ball composition is 95.5% tin (Sn) - 4.0% silver (Ag) - 0.5% copper (Cu)

## 12. What is the Moisture Sensitivity Level (MSL) of Actel's lead (Pb)-free packages?

Actel has qualified its lead (Pb)-free package solution. During the qualification phase, it was determined that the MSL values do not change between Actel's standard and lead (Pb)-free packages. See Actel's website for details on [MSL values](http://www.actel.com/documents/Moisture_Sensitivity.pdf) at [www.actel.com/documents/Moisture\\_Sensitivity.pdf](http://www.actel.com/documents/Moisture_Sensitivity.pdf).

## 13. What is the suggested reflow procedure for Actel's lead (Pb)-free packages?

Actel suggests that the customer follow IPC/JEDEC J-Std-020B for standard and lead (Pb)-free packages.

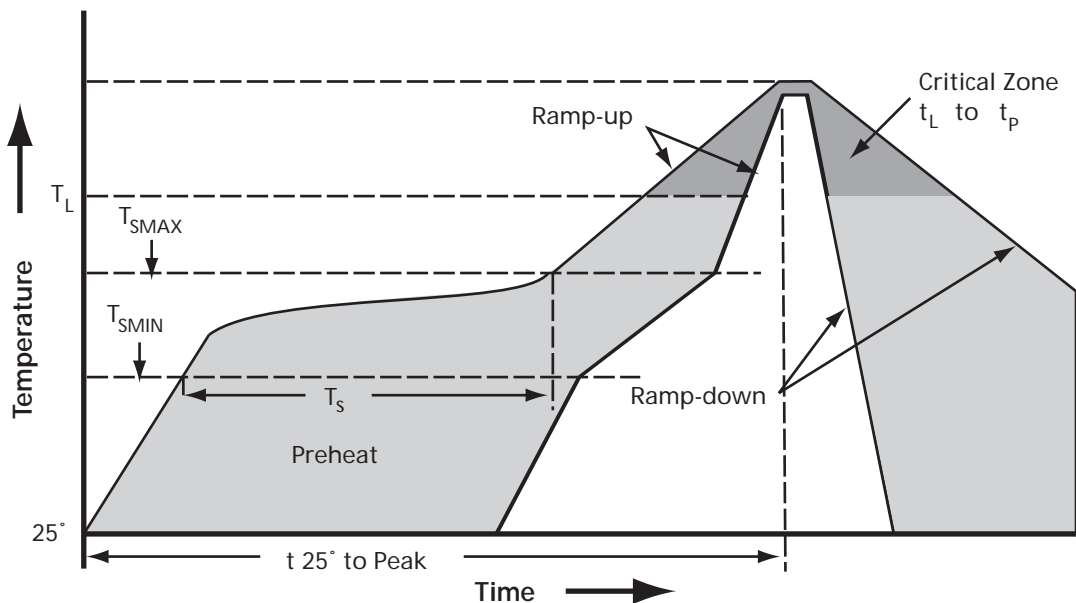


Figure 1: Solder Reflow Profile for Lead (Pb)-Free Packages

Table 1: Package Peak Reflow Temperatures

Reflow Conditions	Pkg. Thickness > 2.5mm or Pkg. Volume > 350mm <sup>3</sup>	Pkg. Thickness < 2.5 mm and Pkg. Volume 350mm <sup>3</sup>
Tin-lead (Sn-Pb) eutectic	Convection 225 +0/-5°C	Convection 240 +0/-5°C
Lead (Pb) free	Convection 245 +0/-5°C	Convection 250 +0/-5°C

*Package volume excludes external terminals (balls, bumps, lands, leads) and/or non-integral heat sinks.*

Table 2: Classification Reflow Profiles

Profile Feature	Tin-Lead (Sn-Pb) Eutectic Assembly		Pb-Free Assembly	
	Large Body	Small Body	Large Body	Small Body
Average ramp-up rate (TL to Tp)	3°C/second max.		3°C/second max.	
Preheat- Temperature Min (T <sub>min</sub> ) - Temperature Max (T <sub>max</sub> )- Time (min to max) (ts)	100°C 150°C 60-120 seconds		150°C 200°C 60-180 seconds	
T <sub>max</sub> to TL- Ramp-up Rate			3°C/second max	
Time maintained above:- Temperature (TL) - Time (tL)	183°C60-150 seconds		217°C60-150 seconds	
Peak Temperature (Tp)	225 +0/-5°C 240 +0/-5°C		245 +0/-5°C 250 +0/-5°C	
Time within 5°C of actual Peak Temperature (tp)	10-30 seconds 10-30 seconds		10-30 seconds 20-40 seconds	
Ramp-down	Rate 6°C/second max.		6°C/second max.	
Time 25°C to Peak Temperature	6 minutes max.		8 minutes max.	

**14. Actel has selected a pure tin (Sn) lead finish for select lead (Pb)-free devices. Are there still concerns regarding tin whisker growth?**

The 100% tin (Sn) plating was selected because it is compatible with existing tin-lead (Sn-Pb) and lead (Pb)-free board assembly processes. It also has a higher melting point than other lead (Pb)-free alternatives, which makes it acceptable for high reliability applications like military and automotive systems. While tin (Sn)-lead (Pb) finish has historically been susceptible to tin whisker growth, reliability studies were done on Actel's lead (Pb)-free package offering and no issues were found.

**15. Can standard and lead (Pb)-free packages be used on the same PCB board?**

Lead (Pb)-free packages require a higher reflow temperature than standard packages. Using the higher reflow temperature for standard packages could result in reliability issues.

For more information, visit our website at <http://www.actel.com>



[www.actel.com](http://www.actel.com)

**Actel Corporation**

2061 Stierlin Court  
Mountain View, CA  
94043-4655 USA  
**Phone** 650.318.4200  
**Fax** 650.318.4600

**Actel Europe Ltd.**

Dunlop House, Riverside Way  
Camberley, Surrey GU15 3YL  
United Kingdom  
**Phone** +44 (0)1276.401450  
**Fax** +44 (0)1276.401490

**Actel Japan**

EXOS Ebisu Building 4F  
1-24-14 Ebisu Shibuya-ku  
Tokyo 150, Japan  
**Phone** +81.03.3445.7671  
**Fax** +81.03.3445.7668

**Actel Hong Kong**

39<sup>th</sup> Floor, One Pacific Place  
88 Queensway, Admiralty  
Hong Kong  
**Phone** +852.227.35712  
**Fax** +852.227.35999

© 2004 Actel Corporation. All rights reserved. Actel and the Actel logo are trademarks of Actel Corporation. All other brand or product names are the property of their respective owners.