Environmentally Friendly Devices

MICROCHIP

Lead (Pb)-Free, RoHS-Compliant Solutions

Microchip Technology is converting from tin-lead (SnPb)-plated product packaging to lead (Pb)-free product packaging across our entire portfolio of 8-bit PIC® microcontrollers, 16-bit dsPIC® digital signal controllers, serial EEPROMs, stand-alone analog and other devices.

This enables our customers to achieve early compliance with new regulations around the world, such as the European Union Restrictions on Hazardous Substances in Electrical and Electronic Equipment (RoHS) directive limiting the amount of Pb in electronic equipment.

For the most current information on Microchip's Pb-free conversion and products, visit: www.microchip.com/pbfree

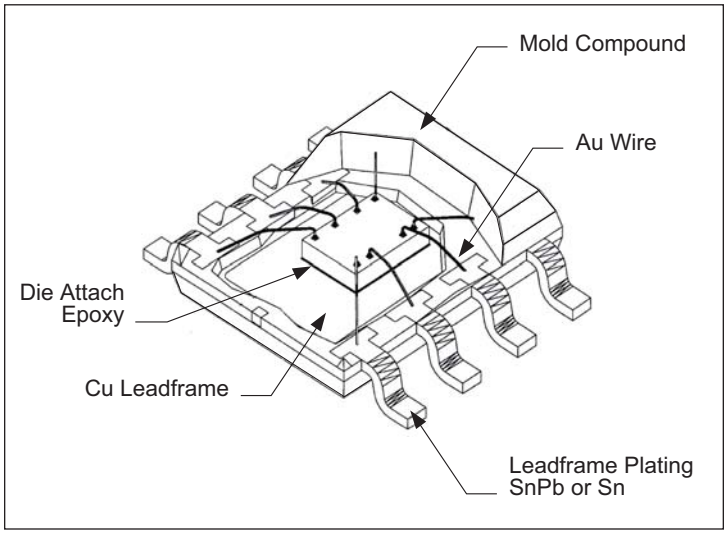
Planned Lead (Pb)-Free Milestones

- **January 2005:**
  Microchip manufacturing is converted to Pb-free plating.
- **January 2005-July 2006:**
  Microchip product shipments contain either SnPb or Pb-free plated devices as our SnPb inventories transition to Pb-free devices.
- **July 2006:**
  SnPb-plated products are no longer anticipated in standard product inventories; Microchip standard product shipments and inventories are expected to be Pb-free.
- **July 2006:**
  Required compliance with European Union RoHS directive.

IMPLEMENTING Pb-FREE PLATING

To convert to Pb-free packaging Microchip is using matte tin (Sn) as the new plating material.* The semiconductor industry has had more than 10 years of experience with matte tin, and Microchip has shipped millions of Pb-free devices using matte-tin plating, ensuring a mature, proven solution.

The manufacturing process has been refined to provide a reliable and high-quality solderable finish. Matte-tin-plated leadframes and SnPb-plated leadframes wet and solder equally well.



Base leadframe metal does not change. Only the final plating finish is changing: from SnPb solder plate to matte tin (Sn).

**Please note: certain ceramic packages utilize gold plating, which is already Pb-free. These packages will not convert to matte-tin plating.*

Seamless Compatibility Between SnPb and Pb-Free Plating

Microchip selected matte tin to provide forward and backward compatibility with both the current industry-standard SnPb-based soldering processes and higher-temperature Pb-free processes. Converting to Microchip's Pb-free devices is seamless and effortless.

Microchip's extensive testing and customer experience show that matte tin is backward compatible to standard 215°C to 225°C Tin/Lead (SnPb) reflow processes and compatible with up to 260°C Pb-free reflow processes. Use a Microchip Pb-free device with any of the following:

Standard boards with SnPb devices and SnPb solder paste.

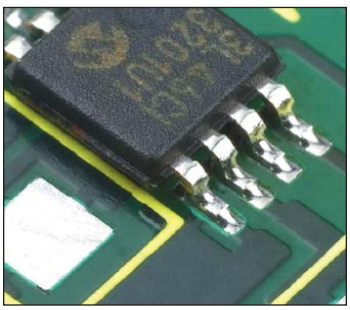
Hybrid boards using any mix of SnPb or Pb-free components and SnPb or Pb-free solder paste.

Pure Pb-free boards using all Pb-free components and high temperature Pb-free solder paste such as Tin/Silver/Copper (Sn/Ag/Cu).

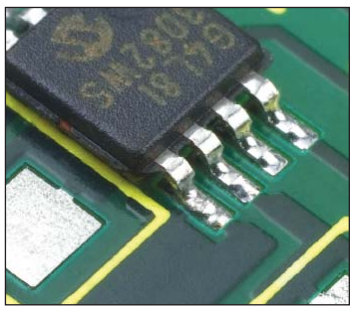
Same Price for Pb-Free Packaging

Microchip's new Pb-free products are priced the same as standard SnPb-plated products. This helps reduce overall conversion cost and enables our customers to ship hybrid or Pb-free boards immediately.

SnPb Wetting



Matte Sn Wetting



The photos above show that SnPb-plated leads and matte-tin-plated leads both wet equally using low-temperature SnPb solder.

THREE EASY CONVERSION OPTIONS

Microchip is committed to easing the transition from SnPb to Pb-free packaging by providing flexible options that meet the needs of our customers:

1. I need confirmed Pb-free plating prior to January 2006.

Good news – it's available now. More than 90% of our standard products are available and shipping in Pb-free plating today.

If you need only Pb-free devices prior to July 2006, contact your local sales representative.

A list of Pb-free devices is provided on www.microchip.com/pbfree. Contact your local Microchip sales office or authorized distributor for assistance with products not listed.

2. I don't need Pb-free plating yet.

We have a solution for you. Microchip plans to continue shipping SnPb-plated product until SnPb inventories are depleted. As our standard production transitions from SnPb to matte tin (which began January 2005), customers should expect to receive either SnPb or Pb-free plating while our inventories are converted. By July 2006, only Pb-free devices are expected to be shipped. Currently, customers should expect to receive Pb-free devices even when using the same standard part numbers.

Because matte tin is backward compatible to existing production reflow processes, the conversion to Pb-free devices is expected to be transparent to users. Our Pb-free standard products are easily identifiable by the JEDEC-compliant (e3) logo on the product, where space is available, or on the carton and by date codes supplied by Microchip on www.microchip.com/pbfree. This provides a simple, no-cost and hassle-free conversion.

MPC	A7AW1YCBH	LOT NO.	MTAI051700067.000				
MCHP P/N	PIC12C671T-10E/SM			CUST P/N		Pb	e3
LEAD	8	PKG	SOIJ	RETEST D/C			
QTY	4200	MASK REV	-	DATE CODE	0430/0428		
WAFER LOT	-			ASSY SITE	MTAI	MADE IN THAILAND	
TRACEABILITY CODE							
(001)	BOX ID						

Sample Carton Label

Sample Topside Mark

* (e3) will be marked on standard products where space permits.

3. I have a requirement for SnPb plating beyond 2005.

For those customers who choose to receive SnPb-plated product, Microchip plans to make these devices available as long as commercially available from our suppliers by using a custom part number when ordering. Because these SnPb products will then be the exception to our standard Pb-free production, special terms and conditions of sale will apply.

SOLID QUALIFICATION DATA

Microchip has pursued careful and robust qualification for Pb-free conversion. Testing includes:

- JEDEC MSL temperature/humidity pre-conditioning
- High-temperature JEDEC reflow profiles to 260°C
- Bond shear and bond wire pull strength
- HAST (Highly Accelerated Stress Test)
- Moisture resistance
- Autoclave
- Temperature cycling
- Thermal shock
- Dynamic life testing
- Endurance cycling and retention bake
- Whisker testing to NEMI recommendations
- Solder wettability/solderability at low and high temperatures
- Solder wettability/solderability with SnPb and Pb-free solders
- Testing across all applicable package types
- Testing across all semiconductor processes

Find complete details in Microchip's *Pb-Free Summary Qualification Report*, which is available on our web site at www.microchip.com/pbfree.

Sample of Package Test Results

Test / Package	Precond	Bond Sheer	Bond Pull	External Visual	HAST	Moisture Resistance	Autoclave	Temp. Cycle	Therm Shock	SnPb 220°C Solderability	SnAgCu 265°C Solderability	MSL 260°C	Whisker	DLT	Endurance Cycling	Retention Bake
SOT-223	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass
SOT-23	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass
SOIC-8	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass
SOIC (large)	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass
SSOP	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass
MSOP	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass
TSSOP	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass
MQFP	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass
PLCC	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass
TQFP	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass
DFN	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass
QFN	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass
PDIP	N/A	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	N/A	Pass	Pass	Pass	Pass

WORLD-CLASS MANUFACTURING

Microchip maintains a very high level of control over quality and production capacity by owning and operating virtually all of our wafer fabrication and test/assembly facilities. The Company achieves high production yields and employs proprietary statistical process control techniques. Direct control over manufacturing resources allows shortened design and production cycles. Recent manufacturing milestones (as of September 2005) include:

- Delivered the 4 billionth PIC microcontroller, reflecting the popularity of our PIC microcontrollers and ensuring strong manufacturing throughput is available to support growing customer demand.
- Shipped the 300,000th development system. Microchip has one of the largest bases of installed development tools in the industry, indicating broad engineering support for our silicon products. These tools significantly reduce development time and enable faster time to market. A vast amount of technical material and resources is also available to support this large infrastructure.
- Pb-free shipments to date: **1.0 billion units**.
- Implemented an innovative strip-testing methodology at our test and assembly facility, significantly increasing production throughput and reducing costs.

CONSISTENT QUALITY AND RELIABILITY

At Microchip, every organization, business unit and individual is responsible for the quality of outputs, whether it is a product, software, process or service. Our guiding value, "quality comes first," is deeply rooted in all worldwide employees, fostering a company culture dedicated to continuous improvement, allowing us to exceed customer expectations.

Microchip's quality systems are certified according to the International Organization for Standards/Technical Specification (ISO/TS)-16949:2002 requirements, which demonstrates that our quality systems meet the newest and most stringent industry quality-management system standards. Our production facilities are ISO/TS registered while our development tools are designed, manufactured and certified to ISO-9001:2000 requirements.

In addition to these quality system standards, Microchip's qualification and reliability process conforms to the Automotive Electronics Council AEC-Q100 qualifications. Microchip performs ongoing die and packaging reliability monitoring with results published on Microchip's web site. The Company conducts numerous qualification tests to confirm product performance to design objectives and monitor tests to confirm continued product performance attributes (see the *Microchip Overview*, *Quality Systems and Customer Interface Systems Handbook* on our web site for more information about the specific tests).

Microchip's Quality Policy:
In order to meet or exceed customer expectations at a reduced cost, we encourage our employees to support continuous improvement, anticipate problems and implement root-cause solutions.

Tempe, Arizona: Microchip's 170,000-square-foot wafer fabrication facility manufactures 8-inch wafers.

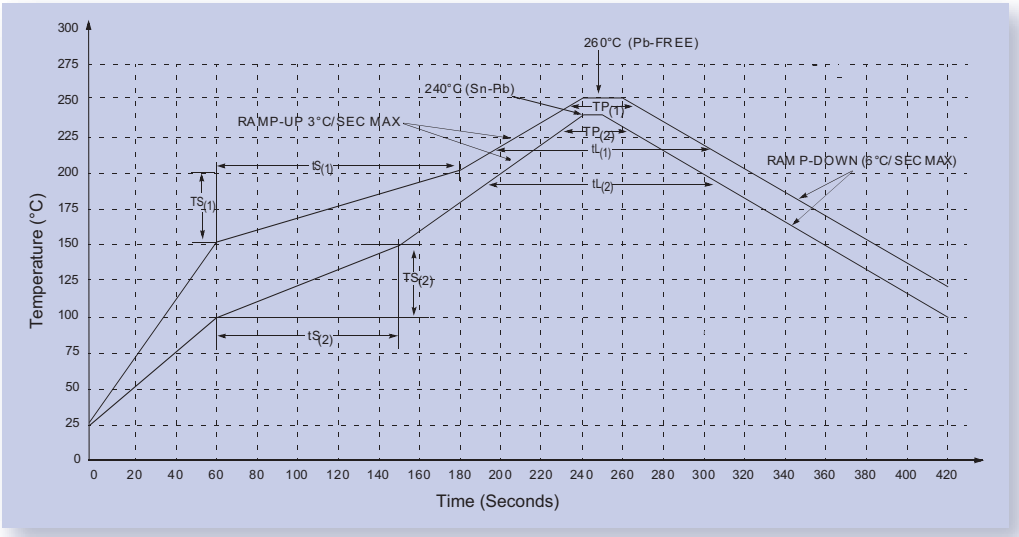
Gresham, Oregon: With more than 200,000 square feet of clean room space, this is Microchip's most technically advanced manufacturing facility. Today, the facility produces 8 inch wafers on 0.5 micron process technology with the capability to support process technologies down to 0.13 micron.

Bangkok, Thailand: Microchip's 140,000 square-foot manufacturing facility houses the technology and assembly/test equipment for high-speed testing and packaging.

COMPATIBLE REFLOW PROFILES

JEDEC Reflow Profiles for SnPb and Pb-Free Assemblies

JEDEC (J-STD-020C) specifies the following profiles for SnPb and Pb-free assemblies. The lower line is for 225°C-240°C, SnPb solders. The upper line is for 245°C-260°C, Pb-free solders, such as SnAgCu.

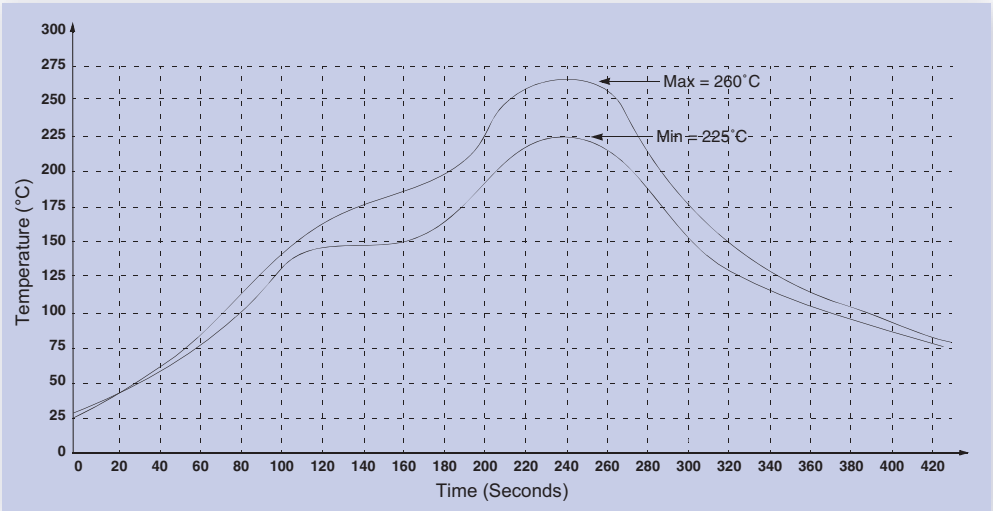


Time and Temperature Parameters for JEDEC Profiles

Symbol	Minimum	Maximum	Units	Test Conditions
Ts(1)	150	200	°C	Pb-Free
Ts(2)	100	150	°C	SnPb
ts(1)	60	180	Sec	Pb-Free
ts(2)	60	120	Sec	SnPb
tl(1)	60	150	Sec	Pb-Free
tl(2)	60	150	Sec	SnPb
Tp(1)	245	260	°C	Pb-Free
Tp(2)	225	240	°C	SnPb

Microchip's Pb-Free Profile Recommendation

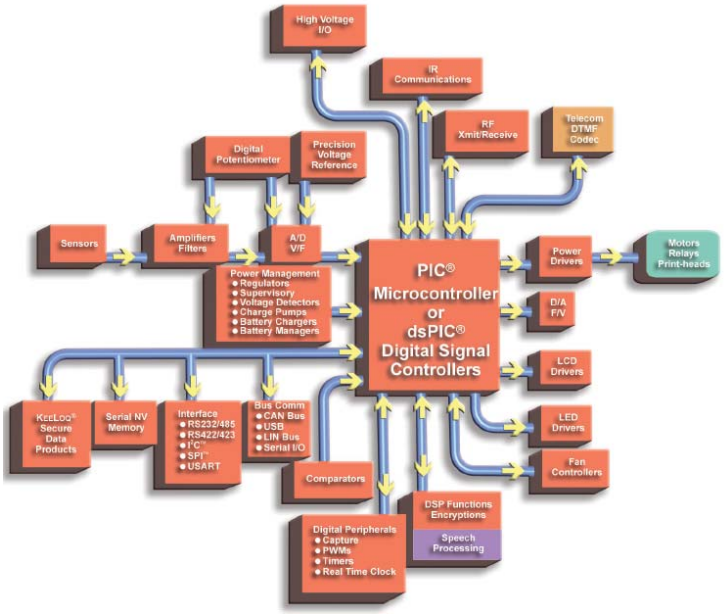
The recommended profile for Microchip's new Pb-free, matte-tin plating is compatible with both JEDEC curves. Therefore it is also compatible with existing 225°C SnPb reflow processes, as well as the new 260°C, Pb-free reflow processes. Microchip's new Pb-free products can be inserted seamlessly into your current production flow.



Blank Page for Folder /Business Card Flap

Worldwide Sales and Service

At Microchip, we know that it takes more than product specifications to create loyal customers. In addition to a broad product portfolio, we understand the value of a complete design solution. That's why we maintain a worldwide network of sales and support. Our global network of experienced field application engineers and technical support personnel are ready to provide product and system assistance to help you further streamline your design, prototype and production activities.



Sales Office Listing

Technical Support: http://support.microchip.com

AMERICAS

Atlanta
Tel: 770-640-0034
Boston
Tel: 774-760-0087
Chicago
Tel: 630-285-0071
Dallas
Tel: 972-818-7423
Detroit
Tel: 248-538-2250
Kokomo
Tel: 765-864-8360
Los Angeles
Tel: 949-462-9523
San Jose
Tel: 650-215-1444
Toronto
Mississauga, Ontario
Tel: 905-673-0699

ASIA/PACIFIC

Australia - Sydney
Tel: 61-2-9868-6733
China - Beijing
Tel: 86-10-8528-2100
China - Chengdu
Tel: 86-28-8676-6200
China - Fuzhou
Tel: 86-591-8750-3506
China - Hong Kong SAR
Tel: 852-2401-1200
China - Qingdao
Tel: 86-532-8502-7355
China - Shanghai
Tel: 86-21-5407-5533
China - Shenyang
Tel: 86-24-2334-2829
China - Shenzhen
Tel: 86-755-8203-2660
China - Shunde
Tel: 86-757-2839-5507
China - Wuhan
Tel: 86-27-5980-5300
China - Xian
Tel: 86-29-8833-7250

ASIA/PACIFIC

India - Bangalore
Tel: 91-80-2229-0061
India - New Delhi
Tel: 91-11-5160-8631
India - Pune
Tel: 91-20-2566-1512
Japan - Yokohama
Tel: 81-45-471- 6166
Korea - Gumi
Tel: 82-54-473-4301
Korea - Seoul
Tel: 82-2-554-7200
Malaysia - Penang
Tel: 604-646-8870
Philippines - Manila
Tel: 632-634-9065
Singapore
Tel: 65-6334-8870
Taiwan - Hsin Chu
Tel: 886-3-572-9526
Taiwan - Kaohsiung
Tel: 886-7-536-4818
Taiwan - Taipei
Tel: 886-2-2500-6610
Thailand - Bangkok
Tel: 66-2-694-1351

EUROPE

Austria - Wels
Tel: 43-7242-2244-399
Denmark - Copenhagen
Tel: 45-4450-2828
France - Paris
Tel: 33-1-69-53-63-20
Germany - Munich
Tel: 49-89-627-144-0
Italy - Milan
Tel: 39-0331-742611
Netherlands - Drunen
Tel: 31-416-690399
Spain - Madrid
Tel: 34-91-352-30-52
UK - Wokingham
Tel: 44-118-921-5869

MICROCHIP

www.microchip.com

Microchip Technology Inc. • 2355 W. Chandler Blvd. • Chandler, AZ 85224-6199

Microcontrollers • Digital Signal Controllers • Analog • Serial EEPROMs

DS00961C