Motorola PowerQUICC II™ MPC8250A Pb-Free Packaging Information

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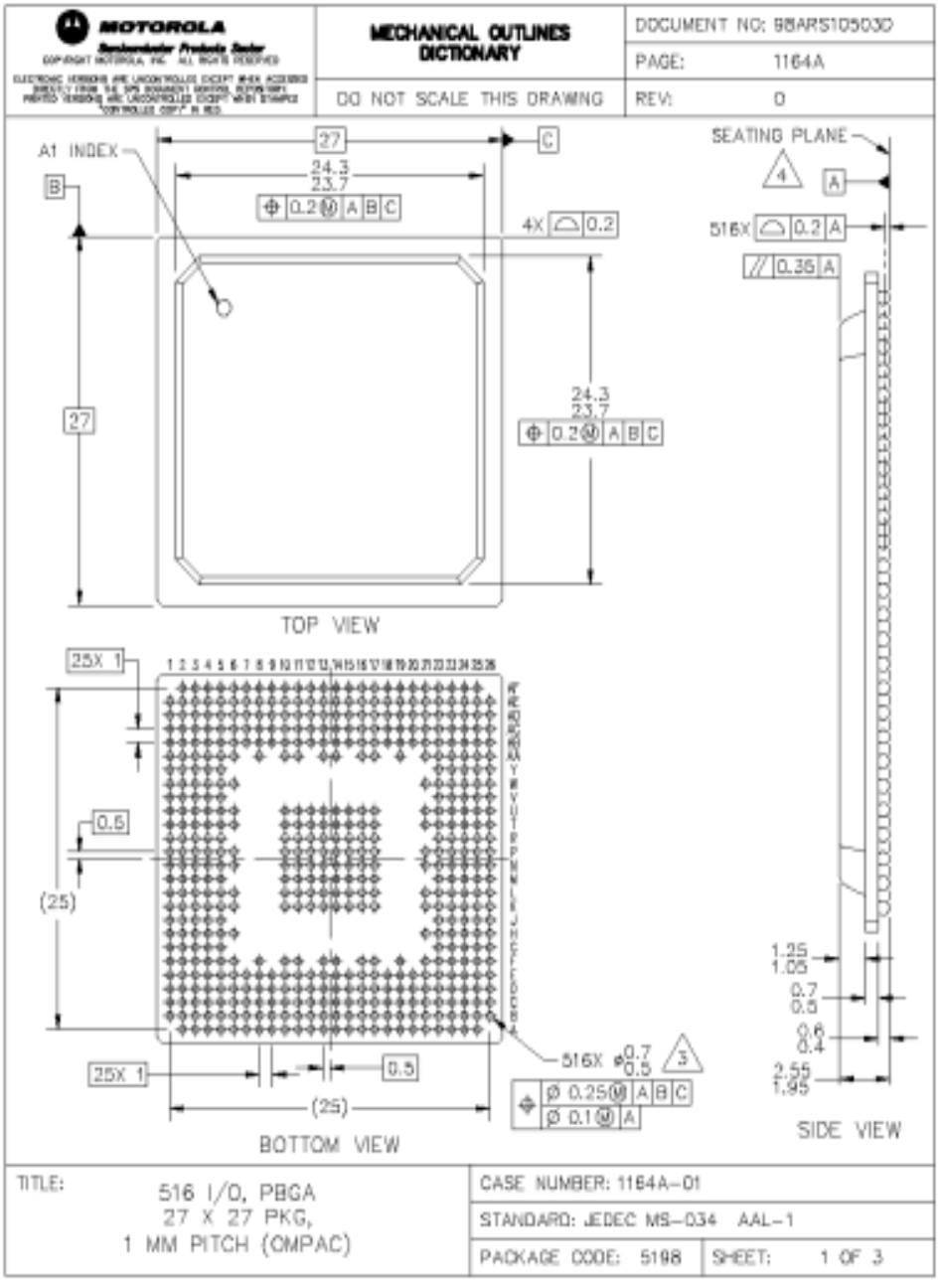
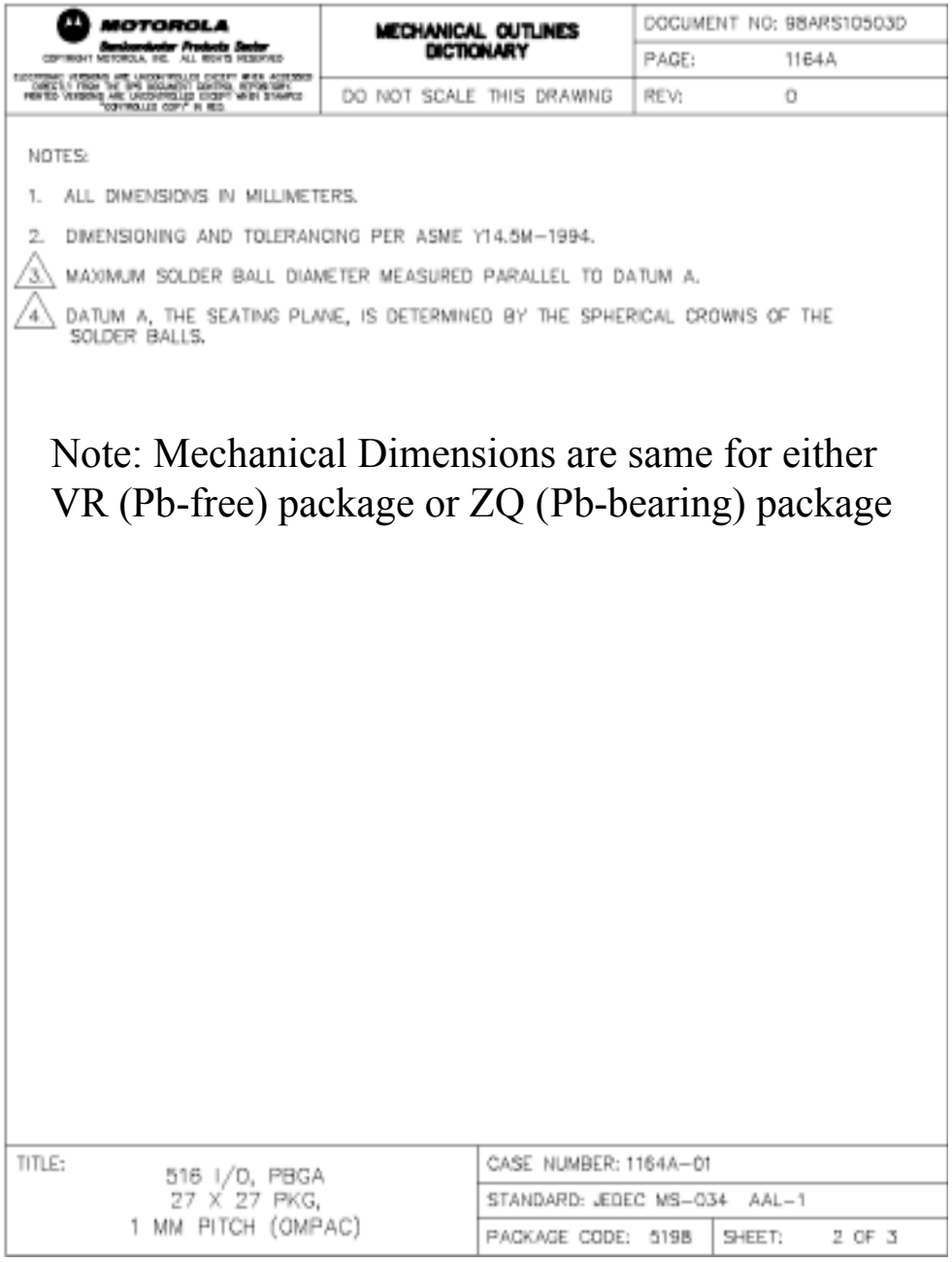
MPC8250A Pb-Free Packaging Info

- MPC8250A PowerQUICC II integrated communications processor packaged in a 516-pin Plastic Ball Grid Array (PBGA)
  - 27x27 mm body (See package drawing next page)
  - 26x26 array of 0.6 mm diameter solder spheres at 1.0 mm pitch
    - 8x8 array of ground spheres in the center of the package
    - Corner spheres and three rows around ground spheres depopulated
- To support a cleaner environment, meet market demands and comply with future legislative requirements, MPC8250A is being offered with optional Pb-free solder spheres
  - Pb-free version designated as MPC8250A**VR***
  - Pb-free sphere composition is 95.5Sn4.0Ag0.5Cu % by weight
  - Most common industry Pb-free composition
  - MPC8250A**ZQ**** has Motorola standard 62Sn36Pb2Ag sphere
- Both versions have high temperature reflow capability to withstand Pb-free soldering
  - MSL or moisture sensitivity level 3 at 245°C peak reflow temperature
  - Pb-free spheres have a melt temp ≈40°C hotter than Pb bearing

***VR** is a Pb-free package designator
****ZQ** is a Pb-bearing designator

MPC8250A 516 PBGA Package Dwg





Note: Mechanical Dimensions are same for either VR (Pb-free) package or ZQ (Pb-bearing) package

MPC8250A Pb-Free Packaging Info

- Melting properties of Pb-free versus Pb-bearing solders:

		Composition (Weight %)		
		95.5Sn4.0Ag0.5Cu (Pb-free Sphere)	62Sn36Pb2Ag (Std Pb Bearing Sphere)	63Sn37Pb (Typical Pb Bearing Pastes)
Temp (°C)	Solidus	216	179	183
	Liquidus (Approx. Melt)	222	189	

Source: NIST at http://www.nist.gov

- Two options for reflow soldering the Pb-free MPC8250AVR:
  - Recommended to solder with Sn-based, Pb-free solder paste
    - 230 to 245°C peak reflow temperature profiles commonly used in conjunction with most Pb-free solder pastes will fully melt the paste and sphere resulting in a reliable interconnection
  - Traditional Pb-bearing solder pastes such as 63Sn37Pb may be used
    - Minimum peak reflow temperature of 220°C required for substantial reflow of the Pb-free sphere
      - Reflow temperatures below 220°C may result in poor assembly yields and/or inadequate interconnect reliability
    - For increased margin, >225°C to 245°C peak temperature preferred to ensure full reflow, collapse of the sphere and joining
- *Ensure that all components are rated for the peak temp used*

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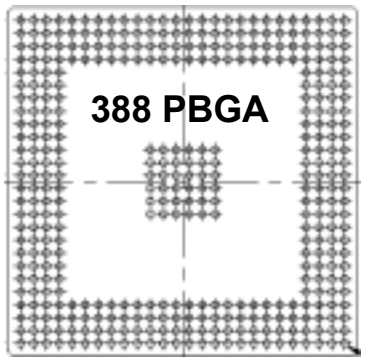
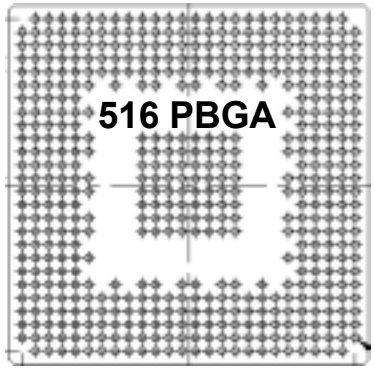
- Motorola has performed board-level interconnect reliability testing on a variety of BGAs with standard SnPbAg versus SnAgCu spheres
- Extensive assembly process study performed using the 388 PBGA:
  - 1 mm pitch, 27mm body, 0.6 mm sphere, 4 perimeter rows with 6x6 array of center balls
    - Similar in configuration to the 516 PBGA





  - -40 to 125°C thermal cycling used
    - 15 min dwells and 15 min controlled ramps at 11°C/min
    - Cycle used for automotive under-hood testing with typical industry requirements of 1-2K cycles
    - SnPbAg sphere and SnPb solder paste with peak reflow of 215°C
    - SnPbAg sphere and SnAgCu solder paste with peak reflow of 241°C
    - SnAgCu sphere and solder paste with peak reflow of 241°C
    - SnAgCu sphere with SnPb solder paste with various peak reflows:
      - 203, 210, 217 and 225°C peak temperatures
  - All peak temperatures are the coolest measured on the board
    - Thermocouple embedded into the center sphere for profiling

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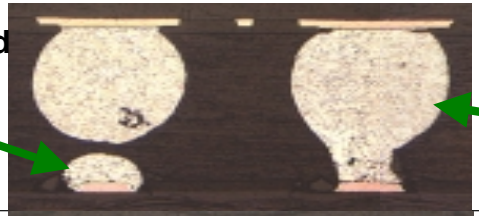
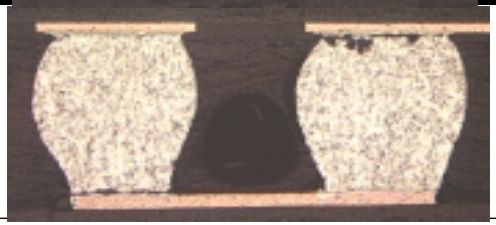
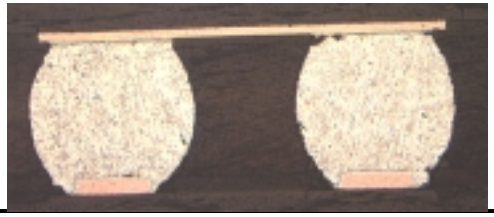
MPC8250A Pb-Free Packaging Info

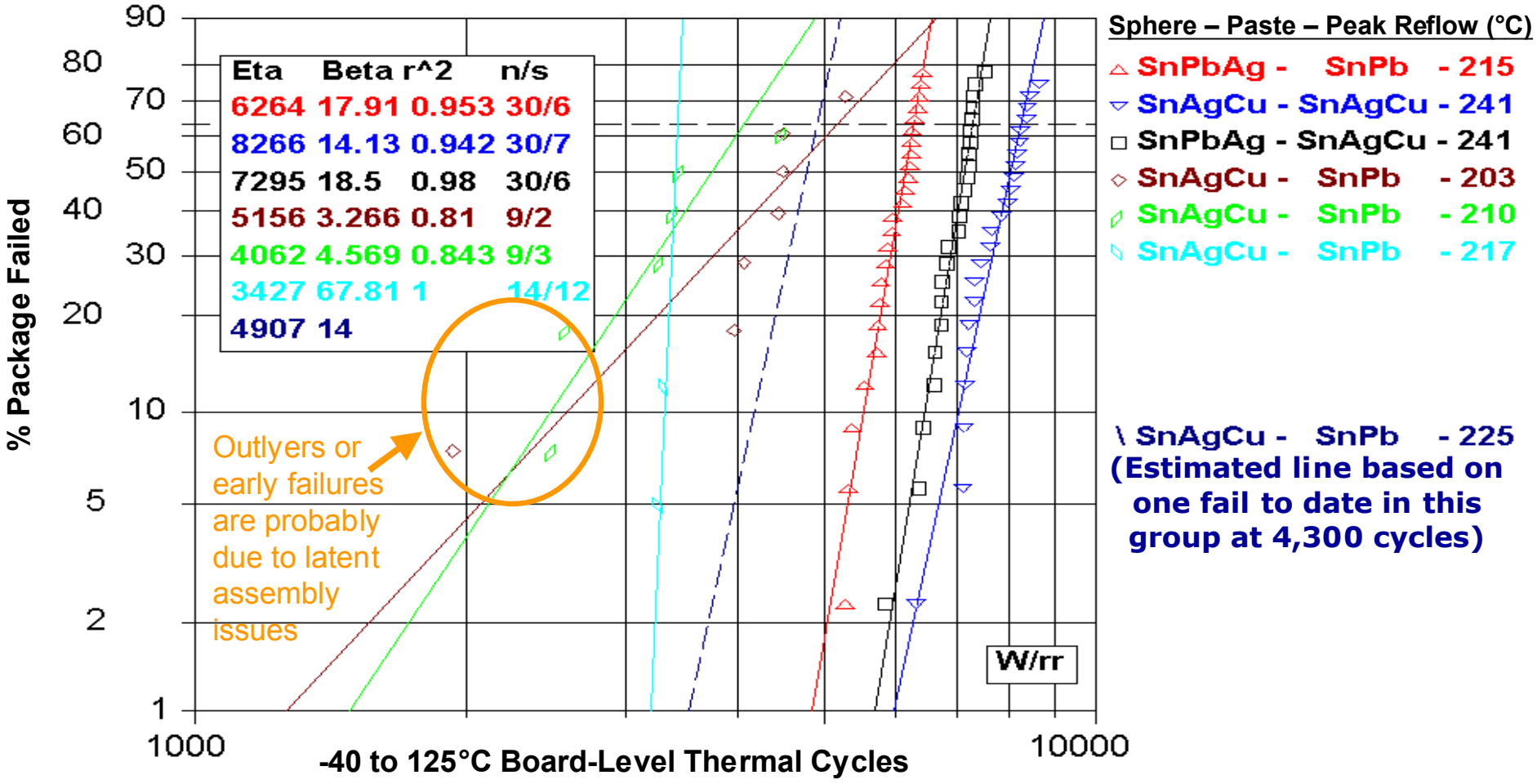
- Assembly and reliability summary with Pb-free spheres and 63Sn37Pb paste at various peak reflow temperatures:

Peak Temp (°C)	Comment	Example Solder Joints*
203	- No sphere collapse - No alloy mixing - Poor assembly yield (opens) - Early failures in temp cycling	Reflowed SnPb Solder Paste  SnAgCu (Pb-free) Solder Sphere
210	- Minimal sphere collapse - Minimal alloy mixing - Poor assembly yield (opens) - Early failures in temp cycling	
217	- Partial sphere collapse - Partial alloy mixing - 100% assembly yield on small sample - Consistent interconnect reliability	
225	- Complete sphere collapse - Complete alloy mixing - Consistent 100% assembly yield - Excellent interconnect reliability	

* Solder joints cross-sections shown are post-thermal cycling and show some evidence of typical fracturing

MPC8250A Pb-Free Packaging Info

- -40 to 125°C board-level temp cycling of 388 PBGA with SnAgCu vs. SnPbAg spheres assembled with different solder paste at various peak reflow temps



MPC8250A Pb-Free Packaging Summary

- Pb-free MPC8250A recommended to be assembled with Pb-free solder paste
  - Motorola studies on other PBGAs have demonstrated Pb-free interconnect reliability similar to or better than Pb bearing
  - Solder joint reliability studies with standard Pb-free and SnPbAg 516 PBGA MPC8250A assembled with Pb-free and SnPb solder paste are ongoing – completion expected by Q4 2003
- When PbSn solder paste must be used with the Pb-free MPC8250A, ensure that reflow temperature is high enough to provide a reliable interconnection
  - 220°C peak temperature minimum recommended
  - >225°C up to component qualified maximum of 245°C preferred
- In all cases, ensure correct reflow profiling and MSL rating of all components in the assembly
- Please direct any questions through your Motorola Sales or distributor contact