



RoHS / Lead-Free Initiative

Microsemi Analog Mixed Signal Group



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RoHS / Pb-Free Initiative

Microsemi Analog Mixed Signal Group (MSC-AMSG) is committed to taking an active role in protecting the environment. We are dedicated to developing and maintaining products, processes, and environmental management systems that meet government regulations, international standards, and our customer's expectations. As part of this commitment, we have qualified and transitioned our product line to meet these requirements following a different strategy for our plastic encapsulated, inverter and hermetic product lines.

MSC-AMSG RoHS / lead-free (Pb-free) plastic encapsulated packages include the following characteristics:

- RoHS / Pb-free finish (100% matte tin plating in most cases, a few NiPdAg)
- Mold compounds and die attach material qualified for use with peak (260°C +0 / -5°C) reflow profiles typically used with RoHS / Pb-free solder
- Backwards compatibility to PbSn solders
- MSL level 1 rating unless otherwise stated in datasheet
- "Green" mold compounds and die attach materials (i.e., meets the RoHS requirements and no antimony based flame retardants)
- Some higher power packages (TO-220, TO-263 and Powerflex) continue to use high Pb solder die attach and are RoHS compliant only by exemption.

MSC-AMSG has discontinued production of the non RoHS / Pb-free plastic encapsulated products. Since these plastic encapsulated devices were transitioned to Pb-free and/or RoHS compliance the part numbers were not changed; rather the transaction was controlled by date code. This date code can be found in the order block on page one of each individual datasheet and by package type in the "[RoHS / Pb-Free Package Availability Plan](#)" on page 4.

The MSC-AMSG inverter product line is also available as RoHS compliant. In the case of the inverters, the part numbers did change because both types are still in production. The newer RoHS compliant inverters have the addition of a G in the part number prefix, as in LXMG1623-12-41, rather than the original LXM1623-12-41. Our current plans include building both versions through the end of calendar year 2006, and then ceasing production on the non RoHS LXM version. The new inverters are form, fit and functional equivalents to the older non-compliant versions.

Many of the hermetic products manufactured by MSC-AMSG are processed in accordance with the requirements specified by government and defense contractors, which have specific guidelines regarding lead finish. These requirements mandate the use of Pb/Sn lead finishes at this time; therefore we will continue to build these hermetic products as before, using the same part numbers. In addition we have qualified new versions of these hermetic packages with a RoHS compliant SnAgCu lead finish. These new hermetic devices will be numbered with a suffix of e1; for example, SG1524BJe1.

Additional information is included in the following sections of this document:

- "[RoHS / Pb-Free Transition Strategy](#)" on page 4
- "[RoHS / Pb-Free Package Availability Plan](#)" on page 4
- "[RoHS / Pb-Free Package Characteristics](#)" on page 5
- "[RoHS / Pb-Free Qualification Plan](#)" on page 6
- "[RoHS / Pb-Free FAQ](#)" on page 7

RoHS / Pb-Free Transition Strategy

MSC-AMSG began the transition to RoHS / Pb-free packages in 2003. All new products released to market since 2/1/04 are qualified as RoHS / Pb-free and the datasheets for these products reflect this status.

We are now in the process of transitioning older products to RoHS / Pb-free. The transition strategy is based on package families and not product part number. The first step in the transition began in 2003 with the start of the Pb-free qualification of specific package families. As each qualification is completed, a Process Change Notice (PCN) is sent to all customers of record for all products that use that specific package family. The PCN identifies which package types are covered by the PCN, the type of Pb-free finish that has been adopted for each package type, a copy of the Qualification Report for the package family and a planned Pb-free implementation date.

The planned implementation date will be 90 days after the date of the PCN. Customers will be requested to respond to the PCN within 30 days of receipt of the PCN. This leaves ample time for questions, sampling, customer qualification, etc., prior to the implementation date. Our intent is to have all customers for a specific package family transition to the RoHS / Pb-free package at the same time.

Unless a PCN is returned, specifically requesting a delay in the implementation of the RoHS / Pb-free package, MSC-AMSG will begin shipping RoHS / Pb-free packages soon after the implementation date. In some cases inventory of the non RoHS / Pb-free product may remain in the supply chain after the planned implementation date and this product will continue to be shipped until the inventory is depleted. However, customers will be notified when shipment of RoHS / Pb-free product has begun to be delivered by clear marking on all packing labels.

If a customer must have a predetermined RoHS / Pb-free implementation date, this date must be identified on the PCN response.

Since the RoHS / Pb-free qualified packages will be qualified for elevated reflow profiles, they will also be backward compatible with the lower reflow profiles that are traditionally used for tin-lead solders.

Therefore, after the implementation of a RoHS / Pb-free package, we will discontinue shipment of non Pb-free product.

RoHS / Pb-Free Package Availability Plan

MSC-AMSG will phase in products with RoHS / Pb-free finishes during calendar year 2004 and early 2005. With the introduction of each package type with Pb-free lead finish, the manufacture of tin-lead finish for that package type will discontinue. The conversion to Pb-free lead finish will be timed to occur at the beginning of a date code period, with all manufacturing sites converted at the same time. Our Process Change Notice (PCN) system will inform our current customers of conversions to RoHS / Pb-free product.

RoHS / Pb-Free Package Characteristics

Lead Finish

For the vast majority of our products we have chosen a 100% matte tin plating with 150°C post bake as our RoHS / Pb-free lead finish of choice. This finish has already been qualified and is shipping in some MSC-AMSG packages.

The 100% tin lead finish provides excellent wettability to conventional SnPb surface mount solder, providing products that are a drop-in replacement for existing SnPb finish components. To demonstrate backward compatibility, standard SnPb solder was used during solderability testing. In addition, 100% tin is compatible with RoHS / Pb-free solders used in board assembly. Although there is no industry consensus on a single RoHS / Pb-free solder, most have higher melting temperatures than traditional tin-lead solders. In response to this requirement, we characterize all RoHS / Pb-free packages using elevated temperature (260°C +0, -5°C) reflow profiles consistent with RoHS / Pb-free board assembly environments. If a RoHS / Pb-free finish package cannot meet this elevated reflow temperature, it will be clearly identified.

RoHS Compliant

The European RoHS Directive bans new electrical and electronic equipment containing more than agreed levels of lead, cadmium, mercury, hexavalent chromium, polybrominated biphenyl (PBB) and polybrominated diphenyl ether (PBDE) flame retardants effective 1 July 2006. Manufacturers must ensure that their products—and components of these products—comply with this standard. With the exception of lead, MSC-AMSG products currently comply with the RoHS directive. All RoHS / Pb-free components will comply fully with the RoHS directive; in the case of a few power packages that use soft solder die attach containing Pb (lead), these parts rely on RoHS exemption. Although these packages will have a RoHS / Pb-free finish and use green molding compounds, they will not be RoHS / Pb-free; that is, they will not contain less than 0.1% Pb. We are investigating alternative die attach methods and will announce availability in the future.

Mold Compound and Die Attach Materials – MSL Rating

RoHS / Pb-free solders such as SnAgCu require higher reflow temperatures to facilitate good flow to the solder joints, generally increasing the typical soldering temperatures by 20 to 30 degrees. During the MSC-AMSG RoHS / Pb-free transition, many of the molding compounds and die attach materials have been changed to withstand 260°C peak temperatures. In addition, the elevated temperature capable molding compounds eliminate flame retardants that some regulations define as hazardous.

With the switch to RoHS / Pb-free lead finish and green molding compounds, the majority of the moisture sensitivity level (MSL) ratings will remain unchanged from the current MSL 1 classification. The MSL classification is a way of rating devices that are sensitive to moisture-induced stress. Proper device packing, storage and handling is required, based on its MSL level, to avoid subsequent thermal and/or mechanical damage during the assembly solder reflow process. The highest rating of MSL 1 means that the component does not require special dry packaging or preconditioning prior to solder reflow. Customer notification will occur if there is a change in the MSL rating of a package and appropriate packing precautions instituted before shipping.

Product Marking

Since there will be no difference in form, fit or function and the parts will be qualified for SnPb and RoHS / Pb-free solder reflow manufacturing process, once the conversion is complete there will be no distinction in the product marking. However, the external packaging will be clearly marked indicating RoHS / Pb-free and or RoHS compatible.

RoHS / Pb-Free Qualification Plan

We will qualify all new devices or existing devices in new packages using RoHS / Pb-free and/or RoHS compliant package materials. Existing qualified devices will be requalified in RoHS / Pb-free packaging. These requalifications will follow the normal plan for using qualified devices in new packages/assembly processes. In this case, the assembly process and materials are changed. The requirement is for one lot of High Temperature Lifetest and Construction Analysis and three lots of Thermal Shock, Temperature Cycle, Autoclave, Physical Dimension, Solderability, and Moisture Sensitivity. The package vendor can supply information for two of the three lots.

In most cases, a family of devices consisting of a package type with multiple sizes and/or number of leads will be qualified using one or two packages in the family, typically the largest and smallest or highest and lowest pin count. In this case, the qualification data for the remaining package types in the family will consist of the qualification data for the tested packages.

A blank qualification report form is posted on the Microsemi website:

www.microsemi.com/qualreports/pdfs/blankqualreport.pdf

RoHS / Pb-Free FAQ

1. What is driving Microsemi Analog Mixed Signal Group to migrate to Pb-free processes?

MSC-AMSG is making this change in response to concerns about the environmental impact of lead (Pb) used in solder finishes and other hazardous substances and to meet our customers requirements. Although Tin-Lead (SnPb) solder has good electrical and mechanical characteristics and is widely utilized, regulatory groups around the world have initiated legislation calling for companies to convert to RoHS / Pb-free manufacturing processes. These new regulations and stricter bans on the content of hazardous materials have prompted the semiconductor industry to develop environmentally friendly products.

2. What is Microsemi's definition of a RoHS / Pb-free product?

Microsemi considers a device to be RoHS / Pb-free if the lead finish contains no Pb (lead) or Pb bearing materials purposely introduced during the manufacture of the product. Each device will contain less than 0.1% Pb in any homogeneous material. A small number of power devices in the DD TO-263, DT TO-252 and DF MO-169 or P TO-220 packages use a high Pb soft solder die attach. These devices will not be RoHS / Pb-free by the above definition but will be RoHS compatible and rely on the high Pb (greater than 85%) exemption.

3. Will Microsemi's RoHS / Pb-free products also be "Green" products?

At the same time that Microsemi is removing Pb (lead) from lead finishes, new molding compounds are required to conform to the higher reflow temperature solder processes. These new molding compounds also remove fire retardants that some regulations define as hazardous materials.

4. What RoHS / Pb-free finishes are currently used by MSC-AMSG?

The primary RoHS / Pb-free finish used by MSC-AMSG is pure matte tin that has received a one-hour 150°C post bake. Some packages may use nickel-palladium with a gold flash (NiPdAu).

5. What changes will be necessary in the customer's process to use RoHS / Pb-free devices?

None. Numerous studies indicate that RoHS / Pb-free components are compatible with board assembly processes using either SnPb (tin-lead) or SnAgCu (tin, silver, copper) solders. These RoHS / Pb-free devices are interchangeable in either board assembly method with no process changes required. However, due to the higher melting points of many RoHS / Pb-free solders, higher reflow temperatures may be required if the board assembly process is using a RoHS / Pb-free solder paste. MSC-AMSG has tested all RoHS / Pb-free devices to ensure robustness at these elevated reflow temperatures while maintaining a moisture sensitivity level of one (MSL 1). Any devices not meeting an MSL of 1 will be clearly identified.

6. What details are available regarding conversion strategy, product availability, and qualification time schedule?

We are in the process of converting all non-hermetic packages to a RoHS / Pb-free finish. Availability of a particular device will occur based on the completion of its package family qualification. Devices will be available according to the MSC-AMSG RoHS / Pb-free package timeline. Please see the ["RoHS / Pb-Free Package Availability Plan"](#) on page 4. Customer notification will occur by Microsemi's Process Change Notification (PCN) system prior to any changes.

7. What if I need a RoHS / Pb-free product prior to the published RoHS / Pb-free schedule?

Please contact your Microsemi Analog Mixed Signal Group sales representative.

8. When is the RoHS / Pb-free conversion expected to be complete?

We will be converting many of our products to RoHS / Pb-free lead finish by third quarter 2004. Most products should be converted by Q1 of calendar year 2005.

9. Will device part marking change? What will distinguish RoHS / Pb-free products from current SnPb finish products?

No, our intention is that the new RoHS / Pb-free finish devices will completely replace those currently offered with tin-lead. Once a product is converted, it will only be available with a RoHS / Pb-free finish. Since there will be no difference in form, fit or function and the parts will be qualified for either solder reflow manufacturing process, once the conversion is complete there will be no distinction in the product marking. The only distinction will be the manufacturing date code. All products in a given package built after a certain date code will be RoHS / Pb-free finish devices.

10. What testing has been performed to evaluate and qualify RoHS / Pb-free platings?

Qualification testing included the following areas:

Packages are qualified to 260°C +0°C -5°C reflow profiles per JEDEC standard J-STD-020B.

- Life Test
- Thermal Shock
- Temperature Cycle
- Autoclave
- Physical Dimension
- Marking Permanency (where applicable)
- Moisture Sensitivity
- Solderability

11. Will parts with tin/lead solder still be available after the transition to RoHS / Pb-free? If so, for how long?

No, we are replacing the lead finish on plastic products, not providing an alternative finish. It is our intention to provide only RoHS / Pb-free products and we encourage our customers to accept this change for the health of our environment.

12. Why has Microsemi chosen 100% Matte Tin (Sn) lead finish in spite of concerns regarding whisker growth?

100% Matte Tin (Sn) plating with a one hour 150°C post bake has been chosen due to its good solderability/compatibility with existing PbSn and RoHS / Pb-free board finishes. It is the most common RoHS / Pb-free component finish in the industry.

100% Matte Tin (Sn) plating has been known to be susceptible to tin whisker growth. This phenomenon is typically associated with high stress or bright tin plated finishes. Therefore Microsemi has selected a low stress or matte tin plating chemistry. Several IC manufacturers have shown that the 100% Matte Tin (Sn) finish is much less prone to whisker formation. Microsemi has initiated an extensive tin whisker characterization test on all 100% Matte Tin (Sn) plated packages. Results will be posted on this website as they become available.

For general information on tin whiskers see the following sites:

NASA website on tin whiskers: <http://nepp.nasa.gov/whisker>

NEMI Tin Whisker Activities: www.nemi.org/projects/ese/tin_whisker_activities.html

CALCE Tin Whisker Working Group: www.calce.umd.edu/lead-free/tin-whiskers

13. What is Microsemi's RoHS compliant strategy for its CCFL inverters?

Microsemi has qualified its CCFL inverter products for RoHS compliance. At this time the inverters will not be Pb-free; they will be RoHS compliant only, since some of the components (chip resistors) contain lead. This lead is exempted by the RoHS legislation (Pb in glass, annex 5) but it means that the inverters cannot be Pb-free by the definition of less than 0.1% per homogenous material.

14. Will the RoHS compliant CCFL inverters part number marking change?

Yes, we are adding G in the prefix of the RoHS compliant inverter part numbers. As an example, the current LXM1623-12-61 inverter will become LXMG1623-12-61.

15. Will the RoHS compliant CCFL inverters be form, fit and function compatible replacements to the previous non-compliant versions?

Yes, the only difference will be the complete use of RoHS compliant components in the bill-of-materials. In addition to the part marking number change, the new inverters will look different. The PCB board traces use a gold flash finish and the RoHS compliant SnAgCu solder paste makes for somewhat different looking solder joints.

16. Will Microsemi continue to make both RoHS compliant and the older non-compliant CCFL inverters?

Yes, for some brief transition period, allowing our customers to complete any qualification of the new inverters. Following this period only the new RoHS compliant versions will continue to be produced.

17. Will Microsemi's conversion to RoHS compliant inverters result in the obsolescence of any inverter modules?

Yes, some of our older inverter products will be not be converted to new RoHS compliant versions. In these cases we will send a notice of obsolescence and lifetime buy to our distributors and direct customers explaining the timetable.

18. When will the new RoHS compliant inverter modules become available?

RoHS compliant versions of all converted inverters are now available.

19. What about Microsemi's CCFL transformers?

CCFL inverter transformers are now available qualified for RoHS compliance and are also Pb-free. The compliant transformers include a G suffix in the part number (i.e., SGE2692-3G). The lead finish of the new compliant transformers will be SnCu, 99.3% tin and 0.7% copper.



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