Allegro® MicroSystems Pb-Free, RoHS Compliance, and Green Initiatives

Frequently Asked Questions

- What are the common restrictions on materials in IC packages?
- When did the RoHS regulations come into effect?
- What does "RoHS" mean?
- What does it mean to be "exempt" from the RoHS restrictions, and are any Allegro products exempt?
- Does Allegro observe the SONY Green Partner program?
- What about quality; do the new standards allow Pb-free IC devices to be any less reliable than the traditional devices?
- What leadframe plating does Allegro use in its Pb-free products?
- What are the electrical and mechanical effects of switching to matte tin leadframe plating?
- What is the scope of a "constituent element?"
- What is the typical thickness of the matte tin leadfame plating?
- Is undercoating used with the matte tin leadfame plating?
- What is the base metal of the leadframes?
- What about tin whisker growth?
- Is bismuth (Bi) or its alloys used in Allegro products?
- Is there an industry standard or guideline for Pb-free processes?
- What are MSL ratings?
- What is the Pb-free reflow profile recommended by Allegro?
- How do I determine if an Allegro device is Pb-free?
- At what level is the Allegro Pb-free classification?
- How do I determine which Allegro device variants match my soldering process?
- When will Pb-free variants be available?
- Are traditional Pb-based devices still available?
- Are the Allegro Pb-free devices backwardly compatible with traditional SnPb-based processes?
- Are the Allegro SnPb devices compatible with Pb-free solder pastes?
- What are green molding compounds?
- When will green variants be available?

What are the common restrictions on materials in IC packages?

Each nation or group of nations can declare their own standards. Observe the standards for the area into which your products will be sold.

The European Community RoHS standards are frequently referenced or emulated in other national standards. Click here to view Allegro RoHS compliance policy.

The RoHS restrictions and other commonly-accepted thresholds are noted in the following table. In particular, the RoHS limit on Pb is generally accepted as the definition of "lead-free" in electronic materials.

Table of Definitions		
Standard	**Constituent Material**	**Maximum Concentration (ppm)**
RoHS Compliant	Cadmium (Cd)	100
	Hexavalent Chromium (Cr^{+6})	1000
	Mercury (Hg)	1000
	Lead (Pb)	1000
	Octobromo Diphenyl Ether	

	Polybrominated Biphenyl (PBB) Polybrominated Diphenyl Ether (PBDE) Polybromo Diphenyl Ether	1000
"Green" (Common Practice, RoHS Compliant)	Halides, Including:	
	Bromine (Br)	900
	Chlorine (Cl)	900
	Phosphorus (P)	Not Present
	Antimony Trioxide (Sb203)	900
	Tributyltin Oxide (TBTO)	Not Present

When did the RoHS regulations come into effect?

The RoHS Directive was adopted by the European Union in January of 2003. Its strictures must be met by newly-designed products sold into the EU after the beginning of July 2006.

What does "RoHS" mean?

RoHS means *Reduction of Hazardous Substances*. The RoHS directive is formally known as *DIRECTIVE 2002/95/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 27 January 2003 on the restriction of the use of certain hazardous substances in electrical and electronic equipment*. It has been amended to accommodate additional exemptions (18 August 2005; *amending Directive 2002/95/EC of the European Parliament and of the Council for the purpose of establishing the maximum concentration values for certain hazardous substances in electrical and electronic equipment)*.

What does it mean to be "exempt" from the RoHS restrictions, and are any Allegro products exempt?

A product that strictly meets all of the standard requirements of RoHS is considered to "comply" with RoHS. The RoHS directive also provides a defined set of exemption categories, such as for critical applications, manufacturing technologies for which there is no current substitute, and materials which could contain extremely low concentrations of restricted materials as constituent elements. Products that are included in these categories are considered "exempt" from the standard RoHS restrictions, and are permitted to be used.

With regard to low-concentration exemptions, Allegro maintains a rigorous program to ensure that our products fall below the allowable concentration levels.

With regard to technology exemptions, internal flip-chips, an advanced technology that uses high-temperature Pb-alloy solder bumps sealed inside of the device package, are used in certain device families, such as the Allegro ACS704 through ACS708, and the ACS760 device families (refer to the individual product datasheets for this information). Flip-chips are explicitly exempted by RoHS because there is currently no substitute technology. Allegro provides these devices in packages with 100% matte tin leadframe plating, thus avoiding any other significant use of Pb in these packages.

In addition, there is a general RoHS exemption for high-temperature solder. High-temperature solder does contain Pb, but RoHS exempts it (in concentrations of Pb >85% by weight) because there is currently no substitute technology. Certain Sanken packages include exempted high-temperature solder (refer to the individual product datasheets for this information).

Does Allegro observe international business environment partnership programs?

Allegro has mad a strong commitment to membership in leading industry partnership programs. Click here for information on Allegro partnering and certifications.

What about quality; do the new standards allow Pb-free IC devices to be any less reliable than the traditional devices?

The Pb-free devices have the same quality and reliability standards as traditional products. Additional attention to handling may be required to ensure compliance with MSL protocols due to the elevated temperatures used in Pb-free processes.

What leadframe plating does Allegro use in its Pb-free products?

The preferred plating used by Allegro is 100% matte tin.

What are the electrical and mechanical effects of switching to matte tin leadframe plating?

There have been no detected effects of matte tin plating.

What is the scope of a "constituent element"?

The interpretation of the homogeneous materials phrasing of the RoHS directive, as applying to modules, discrete components, or composite materials, has a significant impact on the design and manufacture of Allegro products. When assessing its products, Allegro applies the directive to the materials that comprise its products, and has taken the initiative to perform detailed chemical analyses of the various constituent elements of those materials. This study has been extensive, and has included close cooperation between third-party suppliers of materials to Allegro, process engineering at the various Allegro captive manufacturing and development facilities, process engineering at subcontracting manufacturers, and procurement.

What is the thickness of the matte tin leadfame plating?

The specification range thickness of the matte tin is 300 micro inches to 800 micro inches. The target mean thickness is 450 micro inches. This thickness has been shown to retard tin whiskers, in conjunction with other process steps.

Is undercoating used with the matte tin leadfame plating?

No undercoating is used under the plating on the leadframe.

What is the base metal of the leadframes?

The leadframes are composed of copper alloy.

What about tin whisker growth?

All tin-plated devices are susceptible to tin whisker growth. No guarantees can be made for a tin whisker free product with tin-plated devices. Allegro continually keeps up and actively participates in the iNEMI and JEDEC industry tin whiskers task forces. All Allegro 100% matte tin, low organics, plated devices are mitigated for tin whisker growth with a 1 hour at 150° C anneal process performed within 24 hours of plating.

Allegro and Allegro partners have been conducting tin whisker monitoring of 100% tin plated devices for the past five years. Assembly locations where Allegro matte tin plating is done have plated over 1 billion devices since 1999. To date, there has been no reports of failures attributed to tin whiskers.

Is bismuth (Bi) or its alloys used in Allegro products?

Allegro does not use Bi or its alloys in its products. Trace quantities may be found as impurities in constituent materials, but not in significant amounts.

Is there an industry standard or guideline for Pb-free processes?

The IPC standard J-STD-001D covers soldering materials and processes. In this revision it includes information about Pb-free manufacturing.

What are MSL ratings?

MSLs (moisture sensitivity level) comprise a rating system for determining the proper handling protocols for surface mount packages, in order to avoid damage during the solder reflow process. The MSLs are provided in industry standard J-STD-020. Handling procedures are described in J-STD-033.

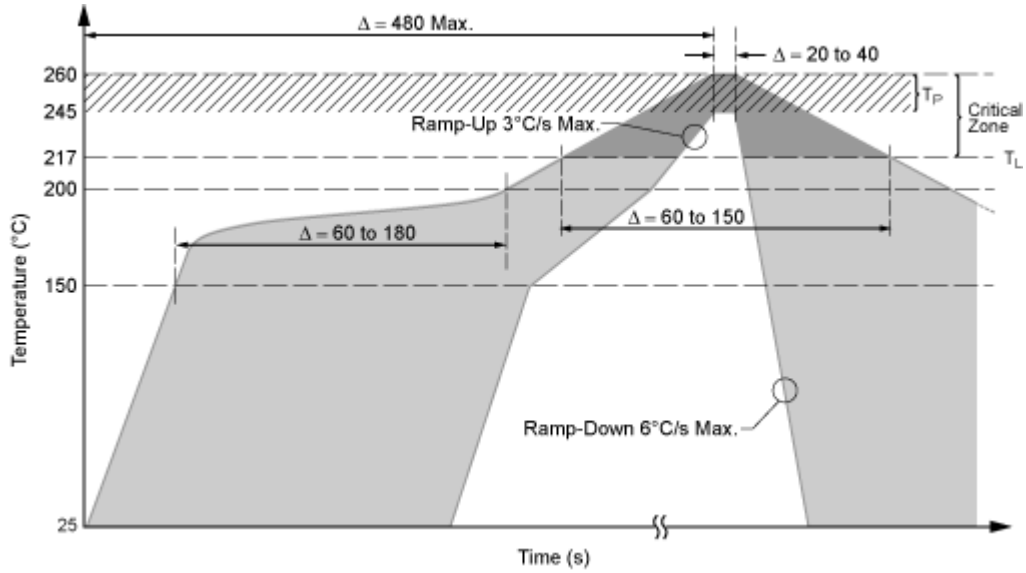
To avoid delamination from vaporization effects, take care to avoid exceeding the maximum floor life of the

devices. In this context, floor life is linked to the rate at which the device absorbs atmospheric moisture, represented by the MSL rating, with MSL 1 being the most resistant to delamination. MSL ratings are linked to peak process temperatures. If processing near maximum temperature levels, it may be necessary to handle devices according to protocols for lower MSL levels.

Allegro testing follows J-STD-020, using 260° C for peak reflow temperature. Information on the MSL rating is provided on the device packing labels.

What is the Pb-free reflow profile recommended by Allegro?

All Allegro testing requiring Pb-Free reflow uses the J-STD-020 industry standard profile (shown below). As long as the optimized Pb-free reflow profile being used falls inside this profile, Allegro testing results apply. Due to the large number of parameters that must be optimized and factors that must be taken into account, the optimal Pb-free reflow profile for any given component needs to be determined by the end user in the context of the final application configuration and of the manufacturing or rework conditions.



How do I determine if an Allegro device is Pb-free?

Pb actually has a limited presence in semiconductor devices. The only place where it has been commonly present in significant concentrations, as defined by RoHS, is in the SnPb alloy plating material that has traditionally been used to enhance leadframe solderability. By using 100% matte tin leadframe plating, Allegro eliminates even this contributor of Pb.

Pb is also present in the high-temperature solders used to bond flip-chips. There is currently no substitute for this technology, and flip-chip devices are exempted by RoHS. Allegro does supply some flip-chip devices, however, even though high-temperature solder may be present in the interior of the device, 100% matte tin leadframe plating is used, eliminating Pb from the exposed areas of the devices.

The Pb-free status of a particular Allegro device variant can be determined by referring to the documentation for the device. Most Allegro products have very small physical dimensions, so for reasons such as legibility or customer processing requirements, branding codes on individual device packages generally cannot display complete identifying information, and device documentation is the best source.

At what level is the Allegro Pb-free classification?

The category used is "e3" for most standard Allegro devices. This is a reference to the industry standard JESD97 for second level interconnect (device-to-PCB) connection for tin-plated devices.

How do I determine which Allegro device variants match my soldering process?

Currently, Allegro supplies both Pb-free (100% matte tin) leadframe plating as well as SnPb plating. Device

variants with 100% matte tin leadframe plating generally are indicated by a " – T" suffix, appended to the end of the complete part number for the variant. (The best source for the complete part number is the documentation for the device, because the complete part number generally does not appear in the individual device markings.) The exceptions are the ACS704 through ACS707, and the ACS75x device families, which have 100% matte-tin leadframe plating, but do not use the " – T" notation.

When will Pb-free variants be available?

Allegro has been producing Pb-free devices for several years. For availability in a particular device, consult the datasheet for the device type, and contact your local Allegro representative for lead times.

Are traditional Pb-based devices still available?

Allegro continues to provide traditional Pb-base devices available, however, we recommend conversion to Pb-free variants as they become available.

Are the Allegro Pb-free devices backwardly compatible with traditional SnPb-based processes?

Allegro has selected 100% matte tin leadframe plating, a technology which has been widely demonstrated to be backwardly-compatible with existing SnPb-based processes.

Are the Allegro SnPb devices compatible with Pb-free solder pastes?

SnPb leadframe plating can be used with certain Pb-free solder pastes, as shown in the following table:

Comparison of Typical Solder Paste and Wave Solders

Common Name	Typical Composition	Comment
BiSn	Bi 58% / Sn 42%	Melting point 138° C; Not recommended – relatively weak joint s subject to temperature cycling; compatible with 100% matte tin fin not compatible with existing SnPb finishes
SnPb (Eutectic)	Sn 60% / Pb 40%	Melting point 183° C; common use for electronic applications; co 100% matte tin finishes; shiny appearance
SAC305	Sn 96.5% / Ag 3.0% / Cu 0.5%	Melting point 219° C; compatible with existing SnPb finishes and tin finishes; dull appearance
SnAg	Sn 96.5% / Ag 3.5%	Melting point 221° C; compatible with 100% matte tin finishes; n with existing SnPb finishes
SnCu	Sn 99.3% / Cu 0.5 %	Melting point 227° C; compatible with existing SnPb finishes and tin finishes; dull appearance
SN100	Sn >98% / Cu <1.0% / Ni <1.0%	Melting point 232° C; compatible with existing SnPb finishes and tin finishes; shiny appearance
SnPb (High-Temperature)	Sn 5% / Pb 95%	Melting point 300° C, common use for flip-chip and similar applic compatible with 100% matte tin finishes and existing SnPb finishes

What are green molding compounds?

The term "green" is used generally to refer to products that have been designed with a goal of compatibility with the natural environment.

"Molding compounds" are the materials which are used to create the casing that surrounds and isolates the active elements of an integrated circuit package.

Current industry practice defines a green molding compound as one that is not only free of halogens and antimony trioxide, but also complies with RoHS (refer to the FAQ with the Table of Definitions for maximum allowable levels). Allegro is continually evaluating environment-friendly green molding compounds, while testing for equivalent or better performance and long-term reliability.

When will green variants be available?

Allegro has been providing Pb-Free packages for several years. The following Allegro packages are already

green: eSOIC and FCOL SOICs, eLQFP, TSSOPs and eTSSOPs, TQFPs and eTQFPs, MLPs (QFNs) and MSOPs. This list is being updated as more packages are qualified with green molding compounds.