

**1. RoHS compliant definition**

ADI defines RoHS compliant to mean Pb, Hg, Cd, Cr(+6), PBB, and PBDE are not intentionally added during the manufacturing process and have upper concentration limits as defined below. In addition, RoHS compliant indicates the packages can withstand a peak reflow temperature of 255 +5/-0 deg C.

<u>RoHS Banned Substance</u>	<u>CAS Number</u>	<u>Maximum Concentration Value</u>
Hg (Mercury)	7439-92-1	1000 ppm
Pb (Lead)	7439-97-6	1000 ppm
Cd (Cadmium)	7440-43-9	100 ppm
Cr(+6) (Hexavalent Chromium)	18540-29-9	1000 ppm
PBB (Polybrominated Biphenyl)	-	1000 ppm
PBDE (Polybrominated Diethyl Ether)	-	1000 ppm

**2. RoHS compliant package materials and terminal finishes**

ADI offers RoHS compliant solutions for most of its products. Material sets have been qualified to withstand a +255°C (+5/-0°C) peak reflow temperature. The primary terminal finishes for plastic encapsulated and hermetic products are matte Sn plating with a post plating bake (1 hour at 150°C within 24 hours of plating, implemented between EIA date code 0518-0522), SnAgCu solder spheres, and Au plating. NiPdAu is also available for select products.

**3. Part naming convention for RoHS compliance**

The standard naming convention for RoHS compliant products requires the letter "Z" as a suffix to the existing part number. The Z suffix generally appears at the end of the part name (i.e. after the character that denotes the package style). For example:

<u>Standard Part Name</u>	<u>RoHS Compliant Part Name</u>
ADM1024ARU-REEL	ADM1024ARUZ-REEL
AD648KR	AD648KRZ
AD7528KP-REEL7	AD7528KPZ-REEL7
ADP3522ACP-1.8-RL7	ADP3522ACPZ-1.8RL7

Certain products introduced to the market as RoHS compliant only (i.e. there is no standard SnPb or SnPbAg finish on these parts) do not carry a "Z" suffix, but the data sheet, web product page, part marking, and labeling clearly indicate these products as RoHS compliant.






All models intended to be offered as RoHS compliant are visible to customers through the WWW ordering guide. Customers should contact Local Sales or Distributors with any new product transition requests.

#### 4. Part marking convention for RoHS compliance

RoHS compliant devices have a "#" symbol marked on the top or bottom of the package. Smaller packages, such as SOT23, SC70 and TSOT, are too small to accommodate an additional character, and as a result, there is no "#" marking on the package. For these smaller packages, a unique brand code is used to denote RoHS compliance.

#### 5. Labeling for RoHS compliance

Shipping containers for products compliant with RoHS regulations are labeled with "RoHS Compliant" and China environment-friendly logos. The labels also contain the Pb free external finish code (i.e., e3, e1, etc) as specified in JEDEC JESD97 standard and MSL ratings.

<b>Shipping Label LOGOS</b>	<u>RoHS</u>	<u>China Environment-Friendly or EFUP *</u>																											
<u>RoHS Compliant</u>																													
<u>RoHS Exempt</u>	<div style="border: 1px solid black; padding: 5px; display: inline-block;">RoHS Exempt 2011/65/EU</div>	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td rowspan="2" style="text-align: center; vertical-align: middle;"></td> <td colspan="6" style="text-align: center;">Toxic or Hazardous Substances and Elements 有毒或有害物质和元素</td> </tr> <tr> <td style="text-align: center;">Lead (Pb)</td> <td style="text-align: center;">Mercury (Hg)</td> <td style="text-align: center;">Cadmium (Cd)</td> <td style="text-align: center;">Hexavalent Chromium 六价铬 (Cr(VI))</td> <td style="text-align: center;">Polybrominated Biphenyls 多溴联苯 (PBB)</td> <td style="text-align: center;">Polybrominated Diphenyl Ethers 多溴二苯醚 (PBDE)</td> </tr> <tr> <td style="text-align: center;">Contents 含量</td> <td style="text-align: center;">X</td> <td style="text-align: center;">O</td> <td style="text-align: center;">O</td> <td style="text-align: center;">O</td> <td style="text-align: center;">O</td> <td style="text-align: center;">O</td> </tr> <tr> <td colspan="7" style="font-size: small;">           O: Contains substance in all homogeneous materials below the limit required by S.J/T11363-2006.            O: 在全部同类材料中该物质含量低于S.J/T11363-2006标准规定值            X: Contains substance in at least one homogeneous material above the limit required by S.J/T11363-2006.            X: 至少在一种同类材料中该物质含量超过S.J/T11363-2006标准规定值         </td> </tr> </table> <p style="text-align: center; margin-top: 10px;">Example</p>		Toxic or Hazardous Substances and Elements 有毒或有害物质和元素						Lead (Pb)	Mercury (Hg)	Cadmium (Cd)	Hexavalent Chromium 六价铬 (Cr(VI))	Polybrominated Biphenyls 多溴联苯 (PBB)	Polybrominated Diphenyl Ethers 多溴二苯醚 (PBDE)	Contents 含量	X	O	O	O	O	O	O: Contains substance in all homogeneous materials below the limit required by S.J/T11363-2006. O: 在全部同类材料中该物质含量低于S.J/T11363-2006标准规定值 X: Contains substance in at least one homogeneous material above the limit required by S.J/T11363-2006. X: 至少在一种同类材料中该物质含量超过S.J/T11363-2006标准规定值						
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\* EFUP = environment-friendly-use-period, 50 years for components and 25 years for components containing a PCB

**6. RoHS compliance transition history**

ADI transitioned products to RoHS compliance under PCN #02\_0011 and #04\_0065.

PCN #02\_0011 (closed 2004): LFCSP, LQFP, MQFP, miniSO, PDIP, QSOP, SOIC, SOT-23, SSOP, TQFP, TSSOP

PCN #04\_0065 (closed 2007): CSP\_BGA, Header, LQFP 24x24, LQFP integrated heat sink, MQFP 32x32, MQFP integrated heat sink, PBGA, PLCC, PSOP, QSOP exposed pad, SBDIP, SBGA, SC70, SOIC exposed pad, SOT-143, SOT-223, TO-92, TQFP exposed pad, TSSOP exposed pad, TSOT, WLCSP

**7. Support for materials with Pb**

ADI encourages customers to transition to RoHS compliant products but will continue to support SnPb plating and SnPbAg solder spheres where manufacturing capability exists at our supplier base. ADI has no plan to make cerdip or cerpack packages RoHS compliant.

ADI continues to use Pb in die attach adhesives, glass, and flip chip interconnection where regulations allow an exemption until reliable alternatives are available.

**8. Reflow profile**

ADI advises reflow profiles should conform to JEDEC J-STD-020 standard which can be downloaded from the JEDEC website under "Free Standards".

<http://www.jedec.org/>

**9. Backward and forward compatibility**

Backward compatibility for matte Sn, NiPdAu and Au: ADI products with matte Sn, NiPdAu, and Au finishes are backward compatible with optimized SnPb reflow processes.

Backward compatibility for SnAgCu: ADI products with SnAgCu solder finishes are not backward compatible with SnPb reflow processes.

Forward compatibility for SnPb: ADI products with SnPb finish are not forward compatible with +255°C (+5/-0°C) reflow processes. Concerns include weak solder joints caused by Bi in the solder paste reacting with Pb delamination resulting from package material sets that are not +255°C (+5/-0°C) compatible, and solder ball voiding caused by Pb free solder paste outgassing into the solder ball.

### 10. Matte Sn whisker data

Matte Sn is a widely available industry standard that has been in production for many years with excellent quality and reliability. All matte Sn plated devices undergo a post plating bake for 1 hour at 150 degrees C within 24 hours of plating to mitigate Sn whisker growth. Sn whisker testing is done based on the test methodology outlined in JEDEC JESD22A121 standard (Test Method for Measuring Whisker Growth on Tin and Tin Alloy Surface Finishes) with read-point intervals of 1000 hours or 500 cycles. Test results are in the table below.

<u>Criteria →</u>		<u>Maximum 20 um (Class 1a)</u>	<u>Maximum 40 um (Class 2)</u>	<u>Maximum 45 um (Class 2)</u>
<u>Package</u>	<u>Preconditioning</u>	<u>Temperature Humidity Storage (30/60%RH, 4000 Hrs)</u>	<u>High Temperature Humidity Storage (55°C/85%RH, 4000 Hrs)</u>	<u>Temperature Cycle (-55/+85°C, 1500 Cvc)</u>
LFCSP	No precon	Acceptable	Acceptable	Acceptable
	Precon @ 215-220°C	Acceptable	Acceptable	Acceptable
	Precon @ 260°C	Acceptable	Acceptable	Acceptable
LQFP	No precon	Acceptable	Acceptable	Acceptable
	Precon @ 215-220°C	Acceptable	Acceptable	Acceptable
	Precon @ 260°C	Acceptable	Acceptable	Acceptable
MQFP	No precon	Acceptable	Acceptable	Acceptable
	Precon @ 215-220°C	Acceptable	Acceptable	Acceptable
	Precon @ 260°C	Acceptable	Acceptable	Acceptable
MINISO	No precon	See QSOP results	See QSOP results	See QSOP results
	Precon @ 215-220°C	See QSOP results	See QSOP results	See QSOP results
	Precon @ 260°C	Acceptable	Acceptable	Acceptable
PDIP	No precon	Acceptable	Acceptable	Acceptable
	Precon @ 215-220°C	Acceptable	Acceptable	Acceptable
	Precon @ 260°C	Acceptable	Acceptable	Acceptable
PLCC	No precon	Acceptable	Acceptable	Acceptable
	Precon @ 215-220°C	Acceptable	Acceptable	Acceptable
	Precon @ 260°C	Acceptable	Acceptable	Acceptable
PSOP	No precon	Acceptable	Acceptable	Acceptable
	Precon @ 215-220°C	Acceptable	Acceptable	Acceptable
	Precon @ 260°C	Acceptable	Acceptable	Acceptable
QSOP	No precon	Acceptable	Acceptable	Acceptable
	Precon @ 215-220°C	Acceptable	Acceptable	Acceptable
	Precon @ 260°C	Acceptable	Acceptable	Acceptable
SC70/ SOT143/ SOT23-3Ld	No precon	Acceptable	Acceptable	Acceptable
	Precon @ 215-220°C	Acceptable	Acceptable	Acceptable
	Precon @ 260°C	Acceptable	Acceptable	Acceptable
SOIC_N	No precon	Acceptable	Acceptable	Acceptable
	Precon @ 215-220°C	Acceptable	Acceptable	Acceptable
	Precon @ 260°C	Acceptable	Acceptable	Acceptable
SOIC_W	No precon	Acceptable	Acceptable	Acceptable
	Precon @ 215-220°C	Acceptable	Acceptable	Acceptable
	Precon @ 260°C	Acceptable	Acceptable	Acceptable
SOT223	No precon	Acceptable	Acceptable	Acceptable
	Precon @ 215-220°C	Acceptable	Acceptable	Acceptable
	Precon @ 260°C	Acceptable	Acceptable	Acceptable
SOT23	No precon	See QSOP results	See QSOP results	See QSOP results

Criteria →		Maximum 20 um (Class 1a)	Maximum 40 um (Class 2)	Maximum 45 um (Class 2)
<u>Package</u>	<u>Preconditioning</u>	<u>Temperature Humidity Storage (30/60%RH, 4000 Hrs)</u>	<u>High Temperature Humidity Storage (55°C/85%RH, 4000 Hrs)</u>	<u>Temperature Cycle (-55/+85°C, 1500 Cyc)</u>
	Precon @ 215-220°C	See QSOP results	See QSOP results	See QSOP results
	Precon @ 260°C	Acceptable	Acceptable	Acceptable
SSOP	No precon	Acceptable	Acceptable	Acceptable
	Precon @ 215-220°C	Acceptable	Acceptable	Acceptable
	Precon @ 260°C	Acceptable	Acceptable	Acceptable
TQFP	No precon	Acceptable	Acceptable	Acceptable
	Precon @ 215-220°C	Acceptable	Acceptable	Acceptable
	Precon @ 260°C	Acceptable	Acceptable	Acceptable
TSSOP	No precon	Acceptable	Acceptable	Acceptable
	Precon @ 215-220°C	Acceptable	Acceptable	Acceptable
	Precon @ 260°C	Acceptable	Acceptable	Acceptable

### 11. Pentabromodiphenylether and octabromodiphenylether

ADI products do not contain pentabromodiphenylether and octabromodiphenylether.

### 12. Bromine and chlorine free material sets

ADI is going beyond RoHS compliance to improve product recyclability by converting to bromine (Br) free and chlorine (Cl) free material sets. Bromine free and chlorine free is also referred to in the industry as halogen free or low halogen. ADI defines halogen free within a homogeneous material to mean the maximum concentration of Br is 900 ppm, the maximum concentration of Cl is 900 ppm, and the maximum concentration of total Br + Cl is 1500 ppm.

All new products are released with halogen free material sets.

Customers are notified by PCN for products undergoing conversion to halogen free material sets. ADI is close to completing the transition for lead-framed packages. Nearly all laminate based products are assembled with halogen free die attach adhesives and mold compounds, but older laminate designs might contain bromine and chlorine.

### 13. RoHS Compliance for Evaluation Boards

Analog Devices evaluation boards are specifically designed solely for the purpose of research and development and are made available solely on a business-to-business basis and therefore are excluded from the scope of the RoHS 2 Directive.