

**TI Customer Material Specification
(Controlled Chemicals and Materials)**

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1.0 PURPOSE

This specification sets forth the requirements controlling the content of TI Customer Materials procured by Texas Instruments Incorporated ("TI") for use in Semiconductor operations.

2.0 SCOPE

These requirements are based upon both regulatory and TI customer requirements. The requirements of this specification should be viewed as a minimum expectation for suppliers to TI's Semiconductor operations. Suppliers shall strive to eliminate the listed chemicals and materials from products sold to TI.

- 2.1 This document applies to all suppliers of TI Customer Materials as defined in section 4.12 for TI Semiconductor Products as defined in Section 4.13.
- 2.2 This document does not apply to Evaluation Modules, Module Products or finished TI Education Technology Products, except as provided by Section 6.
- 2.3 TI generally follows the IEC 62474 Database (Formerly JIG-101, *Joint Industry Guide (JIG), Material Composition Declaration for Electrotechnical Products*).
- 2.4 This document is not intended to be a comprehensive list of all environmental product requirements that may be established by TI or by law. Supplier's compliance with this document does not relieve or diminish supplier's obligation to comply with any other TI product specification or its obligation to comply with all applicable laws.
- 2.5 TI expects any supplier providing chemicals or materials to TI operations in the European Union to register those substances in accordance with the provisions of Title II of REACH if the supplier manufactures or imports the substance in quantities of one tonne or more per year.
- 2.6 TI Customer Materials used in TI manufacturing operations located in the United States shall contain only substances listed in the TSCA Inventory. This requirement concerns the introduction of new chemical substances into materials used in TI products. The primary focus is on new organic compounds. Naturally occurring substances and substances commonly used in commerce can be assumed to be on the TSCA Inventory. The TSCA Inventory can be obtained from the Superintendent of Documents, Government Printing Office, Washington, D.C. 20402.
 - 2.6.1 Substances subject to TSCA low volume or R&D exemptions may be used only if specifically approved in advance by TI.

3.0 REFERENCES

- 3.1 (EU) Directive 94/62/EC on Packaging and Packaging Waste
- 3.2 (EU) Directive 2000/53/EC on End-of-life Vehicles
- 3.3 (EU) Directives 2002/95/EC and 2011/65/EU on Restriction of Certain Hazardous Substances in Electrical and Electronic Equipment
- 3.4 (EU) Directive 2002/96/EC on Waste Electrical and Electronic Equipment
- 3.5 (Germany) ChemVerbotsV
- 3.6 (Japan) The Law Concerning the Examination and Regulation of the Manufacture etc. of Chemicals Substances
- 3.7 (Netherlands) Act on Substances Harmful to the Environment (WMS)
- 3.8 The Montreal Protocol on Substances that Deplete the Ozone Layer
- 3.9 (US) Clean Air Act, Title VI and 40CFR 82
- 3.10 (US) Toxic Substances Control Act, Inventory, and 40CFR 700-799
 - 3.10.1 PFAS SNURs, March 11, 2002, December 9, 2002 and October 9, 2007

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- 3.11 (UN) International Standards for Phytosanitary Measures (ISPM) 15, Guidelines for Regulating Wood Packaging Material in International Trade
- 3.12 (China) Management Methods for Controlling Pollution by Electronic Information Products and supporting standards (China RoHS)
- 3.13 (EU) Directive 2006/122/EC amending Council Directive 76/769/EEC ... relating to the restriction on the marketing and use of certain dangerous substances and preparations (Perfluorooctane sulfonates)
- 3.14 (EU) Regulation (EC) No 1907/2006 concerning the Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH)
- 3.15 (EU) Commission Decision 2009/251/EC requiring member States to ensure that products containing the biocide dimethylfumarate are not placed or made available on the market.
- 3.16 IEC 61249-2-21, International Electrotechnical Commission's Definition of Halogen-Free
- 3.17 IEC 62474, International Electrotechnical Commission's Restricted and Declarable Substances List
- 3.18 Edge Spec # 6494169, TI Restricted Chemicals and Materials List
- 3.19 JEDEC/ECA JS709A-2012, Defining "Low-Halogen" Electronic Products

4.0 DEFINITIONS

- 4.1 **Analytical Report** – Data generated by laboratory analysis using defined test methodologies to quantify concentration values of the RoHS substances and Halogens. Analysis must be performed at the Homogeneous Level. Commonly called the ICP Report, but may include testing techniques other than ICP to test for the RoHS substances of Cadmium (Cd), Mercury (Hg), Hexavalent Chromium (Cr-VI), Lead (Pb), Polybrominated biphenyls (PBB), Polybrominated Diphenyl Ethers (PBDE), Bis (2-Ethylhexyl) Phthalate (DEHP), Butyl Benzyl Phthalate (BBP), Dibutyl Phthalate (DBP) and Diisobutyl Phthalate (DIBP).
- 4.2 **CAC - Compliance and Analysis Certificate** – A web-based certification required from all suppliers furnishing TI Customer Material.
- 4.3 **Halogens** – For the purposes of this specification Halogens are defined as total Bromine and total Chlorine as contained in brominated flame retardants (BFRs), chlorinated flame retardants (CFRs) and polyvinyl chloride (PVC).
- 4.4 **Homogeneous Level** – The level at which there is a uniform structure or composition throughout. A semiconductor device is made up of many homogeneous materials. The Homogenous Level of a lead frame semiconductor device generally includes the mold compound, die attach, bond wire, lead frame, lead finish and integrated circuit. The Homogenous Level of a Ball Grid Array (BGA) device generally includes bond wires, die attach, mold compound, substrate(s), solder balls and integrated circuit (die or wafer).
- 4.5 **Material Declaration** – Composition of Packaging Material.
- 4.6 **Material Declaration Form** – Format provided by TI to document the composition of packaging materials.
- 4.7 **Packaging Materials** – Any component, substances or products used to connect, contain, insulate, mark, and protect the silicon device (e.g., external marking inks, lead frames, encapsulant, organic and ceramic substrate, stress modifiers, underfill, solder, mold compound, die attach).
- 4.8 **Packing Materials** – The substance or product used to protect TI products during transportation to TI customers (e.g., Trays, Moisture barrier bags, Carrier tapes, Cover tapes, Reels, Pins, Plugs, and tubes).
- 4.9 **Module Products** - Products that contain both semiconductor(s) and other components such as other ICs, discrete components, printed circuit board(s), etc.
- 4.10 **Restricted Chemicals and Materials (RCM)** – TI Customer Materials provided to TI by suppliers must not contain the chemicals and materials on TI's RCM list (EDGE 6494169 at <http://wpl.ext.ti.com>), except in accordance with any exemptions, thresholds or other qualifiers contained in the list or in the case TI grants a written exception based on full knowledge that the TI Customer Material contains a listed substance. Even if a RCM is below a threshold or subject to an exception or exemption, in this specification TI is requiring

suppliers to report all concentrations of RCMs so that TI can adequately inform regulators and customers of the actual content of TI products that contain such substances.

- 4.11 **RoHS** – Restriction on the Use of Certain Hazardous Substances in Electrical and Electronic Equipment, DIRECTIVE 2002/95/EC and DIRECTIVE 2011/65/EU OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL. This term may also be used to describe similar laws of other jurisdictions as they are promulgated, including China and California.
- 4.12 **TI Customer Material** – Chemicals, substances, parts, components, devices or items used to manufacture semiconductors that become part of TI’s final product including Packaging Material and Packing Material. TI Customer Material may also include chemicals and materials that touch TI’s product during manufacturing that are specifically identified by TI and communicated to suppliers from time to time. This definition does not include Modules, Evaluation Modules and MEMS (MicroElectroMechanicalSystems) devices.
- 4.13 **Semiconductor Products** – Products consisting of one or more semiconductor dies and the materials used to protect them from the outside environment and allow them to communicate to the application in which they are being used such as mold compound, die attach, leadframe, leadframe plating, substrate, bond wire, etc.

5.0 REPORTING REQUIREMENTS for TI CUSTOMER MATERIALS:

Suppliers which furnish a TI Customer Material are required to certify compliance with TI’s Restricted Chemicals and Materials List, EDGE 6494169 and complete and submit to TI a CAC and the associated data to support the certification in accordance with the following instructions. This certification is separate from other lot-related certifications that may be required for quality control purposes.

5.1 Controlled Chemicals and Materials Compliance and Analysis Certificate (CAC) and Data:

Suppliers shall certify by submittal of a CAC:

- 5.1.1 Yes or No: Does the TI Customer Material provided to TI contain, at the Homogeneous Level, any detectable amount of a Chemical or Material included on the RCM list located at TI’s website <http://wpl.ext.ti.com> under Controlled Chemicals. If Yes, Supplier shall list such substances and concentrations on the CAC. If there is a range or variance in the amount of the substance, the maximum value shall be reported.

Concentrations of substances reported to TI must be at the Homogenous Level. For example, if lead (Pb) is contained in an integrated circuit device sold to, assembled, or manufactured for TI, supplier must report the concentration of Pb in the mold compound, not in the integrated circuit device as a whole. For plating materials, since they cannot be disjointed or separated into different materials for verification purposes it is acceptable to receive test results from plating applied to its end application such as NiPdAu plated onto a copper leadframe. Please see additional examples in the definition of Homogenous Level above.

- 5.1.2 Accredited Lab: That an ISO/IEC 17025 or equivalent independent accredited lab has performed the specified lab analyses at the Homogenous Level using the below analytical test methods for the RoHS substances per IEC 62321(or equivalent) and the Halogens Chlorine (Cl) and Bromine (Br):

Substance	Required test method
Cadmium and Lead	ICP-AES or as defined in IEC 62321
Hexavalent Chromium	(1) UV-Vis method, or (2) As defined by IEC 62321: USEPA Method 6020 (ICP/MS Method) or USEPA Method 6010 (ICP method). If Chromium is detected above the RCM list threshold, then supplier shall test for Hexavalent Chromium using the UV-Vis test method.
Mercury	ICP-AES (OES) or as defined in IEC 62321

Polybrominated Biphenyl (PBB) and Polybrominated Diphenyl Ether (PBDE)	GC/MS by EPA Method 8260B or as defined by IEC 62321
Bromine (Br) and Chlorine (Cl)	IPC-TM-650 2.3.41 or EN14582
Bis (2-ethylhexyl) Phthalate (DEHP)	EN 14372: 2004, GC-MS or as defined by IEC 62321
Butyl Benzyl Phthalate (BBP)	EN 14372: 2004, GC-MS or as defined by IEC 62321
Dibutyl Phthalate (DBP)	EN 14372: 2004, GC-MS or as defined by IEC 62321
Diisobutyl Phthalate (DIBP)	EN 14372: 2004, GC-MS or as defined by IEC 62321

5.1.2.1 Typical materials sets requiring Halogen testing are plastics and polymers including mold compounds, encapsulant, underfill, lid attach, die attach, substrates, protective overcoat, solder flux, solder paste, plastics, polymers and inks contained as part of the final IC product.

5.1.2.2 Typical material sets not requiring Halogen testing are lead frames, bond wires, solder balls, target, virgin wafers, inks, paper based materials (e.g. paper bags, cardboard ship boxes), and packing materials (e.g. trays, tubes/magazines, carrier/cover tapes, boxes, wafer containers).

5.1.3 Concentration Values: For all non-RoHS substances reported in accordance with this specification concentrations shall be reported according to either or a combination of the actual measurement values, theoretical values, calculated values, or designed values.

5.2 Analytical results

5.2.1 Suppliers shall provide an electronic copy of the Analytical Report together with the CAC as follows:

5.2.1.1 The analysis shall include Cadmium, Lead, Hexavalent Chromium, Mercury, Polybrominated Biphenyls (PBB), Polybrominated Diphenyl Ethers (PBDE), Bis (2-Ethylhexyl) Phthalate (DEHP), Butyl Benzyl Phthalate (BBP), Dibutyl Phthalate (DBP), and Diisobutyl Phthalate (DIBP) for all direct materials. Analysis must also include halogens chlorine (Cl) and bromine (Br), for certifications of plastics and polymers as referenced in 5.1.2 of this specification for TI Customer Materials.

5.2.1.2 The analysis shall include Lead, Cadmium, Mercury and Hexavalent Chromium for all Packing Material certifications. Packing Material is excluded from chlorine (Cl) and bromine (Br) testing per JEDEC/ECA JS709C-2018, defining "Low-Halogen" for Electronic Products.

5.2.1.3 The Analytical Report shall include the following information:

- 5.2.1.3.1 Name of the lab
- 5.2.1.3.2 Name of responsible person at lab including their signature
- 5.2.1.3.3 Lab certification
- 5.2.1.3.4 Date of the analysis
- 5.2.1.3.5 Clearly defined sample (e.g. Raw Material Mfr Part Number, Common Name, etc.)
- 5.2.1.3.6 Test method used for each substance

- 5.2.1.3.7 RoHS substances analyzed and final concentration results
- 5.2.1.3.8 Detection limits of each constituent
- 5.2.1.3.9 Measurement flowchart

5.3 **Material Declaration**

- 5.3.1 Direct Material Suppliers shall provide the composition of all Packaging Materials to TI using the Material Declaration Form located at <http://wpl.ext.ti.com>.
- 5.3.2 A Material Declaration shall be completed and loaded to the Compliance & Analysis Certificate (CAC) for:
 - 5.3.2.1 All Packaging materials for which TI has assigned a TI part number.
 - 5.3.2.2 When new Packaging Materials are introduced for manufacturing at a TI site.
 - 5.3.2.3 When a change notice has been provided indicating composition change has occurred
Note: Annual updates of this information are not required.

5.4 **TI Website Submission Process:**

- 5.4.1 Suppliers shall submit the Compliance & Analysis Certificate (CAC), analytical data and Material Declaration Form by going to TI's Website <http://wpl.ext.ti.com> click on Controlled Chemicals, and entering the required information in the form labeled "Compliance and Analysis Certificate." **Please note** that there is a separate CAC for external manufacturing suppliers (subcon and foundry) and material/chemical suppliers.

5.5 **Frequency of Certification and Analysis Data:**

- 5.5.1 Supplier shall complete and submit a CAC and supporting analytical data upon initial qualification of chemical or material, then annually, and any time there is a process change that potentially changes the content of any TI Customer Material sold to TI by a supplier. It is the supplier's responsibility to submit the certification based on the most current version of this specification. This revision controlled specification can be found at <http://wpl.ext.ti.com>
 - 5.5.1.1 The test date for Analytical Reports for initial qualifications of a chemical or material shall not be older than nine (9) months and must be reanalyzed and submitted to TI before the Analytical Report is one (1) year old.

5.6 **Records Retention:** Supplier shall retain copies of Analytical Reports and other documents or data necessary to support any CAC submitted by supplier to TI for a minimum period of ten (10) years.

- 5.6.1 Because this requirement began at TI on November 1, 2006 TI understands that records prior to this date may be unavailable.

5.7 **Waiver of Confidentiality:** The information required under this specification is based on regulatory requirements (i.e., RoHS) and TI customer requirements. TI intends, and supplier expressly authorizes TI, to provide such information to regulatory authorities and TI customers as necessary to show compliance with applicable laws and customer requirements. Whether or not so marked, supplier waives all claims that such information is confidential or covered by any confidentiality or non-disclosure agreement.

6.0 REPORTING REQUIREMENTS FOR TI PRODUCT MODULES AND EVALUATION MODULES (EVMs)

- 6.1 Product Modules or components used in the manufacture of Product Modules and EVMs shall comply with the requirements of the RCM list located at TI's website <http://wpl.ext.ti.com> under Controlled Chemicals
 - 6.1.1 TI requires that its products meet worldwide substance restrictions summarized in [EDGE Spec 6494169](#). Beginning on October 1, 2016, all components in Modules and EVMs assembled by or for TI, including alternate components, listed in a Bill of Material (BOM) must be identified by manufacturer and part number. This information will be used to validate TI supplier conformance to [EDGE Spec 6494169](#).
- 6.2 Suppliers of all Product Modules or components used in the manufacture of Product Modules shall provide a declaration of content using IPC-1752 format or other formats upon request as agreed upon by TI or its

designated supplier or consultant consolidating information for the purposes of customer product information sharing. .

7.0 ACCEPTANCE CRITERIA:

- 7.1 Conformance with this specification will be an important factor in TI's future purchasing decisions. TI has the right to reject TI Customer Material from suppliers that contain any Chemical or Material listed on TI's website <http://wpl.ext.ti.com> which is not in compliance with the qualifiers or does not meet the requirements set forth in this specification unless otherwise agreed to in writing by TI.
- 7.2 The obligations under this specification are in addition to all other applicable quality requirements and other specifications and requirements.
- 7.3 Supplier shall not make any changes to processes or products in response to this specification without TI's prior written approval.

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Revision	Description
A	ECM #2041053, 11/18/03, M. Murray, Y. Shaw; Formal release.
B	ECM #2042672, 12/08/03, M. Murray, Y. Shaw; Correct email address from controlledmaterials@ti.itg.com to controlledmaterials@list.ti.com .
C	ECM #2042788, 12/11/03, M. Murray, L. Foster; Correct spec number in Appendix B and C, Section 2 from 6543792 to 6453792.
D	ECO #2043923, 01/28/04, M. Murray, L. Foster; Multiple changes per LeRoy and banned material team.
E	ECM #2045091, 03/09/04, M. Murray, L. Foster; Removed Appendix B and C from specification.
F	ECM #2050158, 11/01/05, M. Murray, L. Foster; Update specification.
G	ECM #2054865, 02/21/05, M. Murray, L. Foster; Update 4.1
H	ECM #2062585, 10/04/05, S. Harmon, L. Foster; Update Paragraph 3
I	ECM #2068135, 03/28/06, S. Harmon, L. Foster; Update Paragraph 3
J	ECM #2071210, 07/18/06, J. Foster, L. Foster; Update Paragraph 2.0 (Banned)
K	ECM #2074746, 10/31/06, S. Harmon, L. Foster; 1) Added RoHS paragraph to DEFINITIONS section 2) Added Paragraphs 3.11 thru 3.14 & 3.21 thru 3.6
L	ECO #2078542, 03/30/07, M. Murray, Bing Shen; Corrected 3.5
M	ECO #2083371, 09/18/07, M. Murray, Bing Shen; Updates to spec.
N	ECO #2089414, 05/05/08, M. Murray, Tim Yeakley; Added 1) Halogen to DEFINITIONS section and 2) Halogen reporting requirements to REPORTING section of the spec.
O	ECO #2092511, 08/27/08, M. Murray, Tim Yeakley; Corrected 3.1.2.1.1.5.2 to reflect removal of shipping and packing materials.
P	ECO #2105180, 02/10/10, M. Murray, Tim Yeakley; Modified the Definition of Halogen
Q	ECO #2126413, 07/31/12, M. Murray, Tim Yeakley, Chris Lee; Added a Reference section and several clarifying requirements to align Silicon Valley Analog requirements into the specification.
R	ECO #2128746, 11/09/12, M. Murray, Tim Yeakley, Mark Frimann Added references to international testing standards in 5.1 and Material Declaration definitions and form requirements section 5.3. The provisions for 5.3 Material Declaration becomes effective on January 1, 2013.
S	ECO #2143105, 07/09/14, M. Murray, Tim Yeakley, Mark Frimann and W. Nisperos; Added reference 3.17 and clarification of the definition of RCM in 4.10 and its application in 5.0.
T	ECO #2147152, 12/08/14, M. Murray, Tim Yeakley; Updated examples in definition 4.8 and added example of inks and paper products to example in 5.1.2.1.
U	ECO # 2155997, 1/22/2016 T Yeakley, M. Frimann, B. Baker Updated several sections of the document to add four new RoHS regulated phthalates.
W	10/02/2018, T. Yeakley, M. Frimann Updated several areas of the document to include testing requirements for phthalate compounds.

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V	ECO# , 6/17/2016 T. Yeakley and RCM Steering Team. Added: Reference in 2.1 to section 4.12, New 3.19 Reference, Clarification of testing requirements for plated leads in 5.1.1., clarification of testing scope in 5.1.2.1 and 5.1.2.2., clarified testing requirements in 5.2.1.1. and 5.2.1.2 added 6.1.1. to further define requirements for Modules and Evaluation Modules.
W	ECO #2177311, 10/18/18, V. Orpilla, Tim Yeakley; 1) Updating standard to include testing requirements for phthalates.