Electric/Electronic (E/E) components and assemblies

Purpose

The IMDS Steering Committee encourages all suppliers to submit IMDS data according to Rec. IMDS 001 for electronic components and materials at all levels of the supply chain. Only under the special conditions described below, is it acceptable to deviate from Rec. IMDS 001 processes for the reporting of E/E components and assemblies.

This recommendation describes the general requirements for the creation of Material Data Sheets (MDSs) for E/E components, assembled printed circuit boards (PCB/PWB, including flexible circuit boards (FCP)), and hybrid electronics (standard LTCC$^1$) used in automotive applications.

This recommendation does not cover parts connected to E/E components such as housings or mounting plates, which must be reported according to IMDS Recommendation 001. Compositional data on modules to create widely used E/E assemblies are available as published material data sheets (as semi-component MDSs as described in section 4).

If the modules described in this Recommendation are to be used in an MDS, the supplier must have obtained evidence per Rec. IMDS 001 Section 3.1 (General Reporting) from the sub-tier suppliers that all materials meet the predefined material descriptions and ranges of the standard materials. Upon special request by the customer, the supplier utilizing the IMDS reporting has to prove per evidence that he has collected all material data from its sub-tier levels (Rec. 001 Rule 5.2.D). Any use of standard materials does not substitute the supplier's mandate to track and gather all necessary material information along the total sub-tier supply chain. This mandatory process of material tracking and obtaining of information must be proven to be in full compliance with legal requirements.

References

- IMDS001 General Structure
- Global Automotive Declarable Substance List (www.gadsl.org)
- EC Directive 2000/53/EC with latest version of Annex II with its exemptions with regard to E/E (Electric/Electronic) components and assemblies
- EC Directive 2005/64/EC (RRR-Type Approval Directive)
- Regulation EC 1907/2006 REACH
- Automotive Industry Interpretation Guide for ELV Annex II (2010/115/EU) with IMDS Information added by the IMDS Steering Committee

$^1$ Low Temperature Co-fired Ceramic
Definitions

Printed circuit boards (hereinafter PCBs) or hybrid electronics are complex assemblies which sometimes consist of more than 100 components, often with very small weights. To facilitate the material data reporting process, a number of standard modules (described as semi-component type datasheets) have been developed (see Section 4). These specific modules and compounds can be found by searching for Company ID 102677 (ZVEI-Rec019) within IMDS published semi-component MDSs.

There are four main types of modules:

- **Standard** – which describes the materials, substances, and percentages of most PCB assemblies based on an in-depth analysis of previously reported components. This composition is independent of the laminate layer count and can be used for most assemblies. This standard PCB composition will contain a leaded ceramic material according to ELV 2011 Annex II (10a) representing the most widely used leaded ceramics components found in a PCB.

- **Standard without Leaded Ceramics** – which describes the materials, substances, and percentages of newer technology PCB assemblies not containing any leaded ceramic components.

- **High Component Load** – which contains a higher percentage by weight of components (typically >45% of assembly weight). These assemblies generally have a higher percentage of large components (e.g. electrolytic capacitors and Inductors). This indicates a slightly different material composition, based on more special metals and other slight differences from the standard main module. This module also contains a leaded ceramic material according to ELV 2011 Annex II (10a) representing the most widely used leaded ceramics components found in a PCB.

- **High Component Load without Leaded Ceramics** – which describes the materials, substances, and percentages of newer technology PCB with a higher percentages by weight of components AND not containing any leaded ceramic components.

If the substance composition of a component is not covered by one of the standard modules, the respective component must be reported individually. The addition of new application codes for leaded ceramic applications will require analysis of PCB components used in the assembly. This separate reporting must also be done if GADSL substances are present above the appropriate thresholds that are not disclosed in the standard module. Additionally, mechanical parts (such as screws, cooling sheets, wiring, etc.) are usually present and must be reported separately according to Rec. IMDS 001. Concerning substances and material range rules, naming conventions, the modules prepared by ZVEI Company ID 102677 undergo the same rule checks (4.4.3.B, and 4.5.4.B) as the IMDS SC published modules.

*This recommendation will be reviewed yearly and also if the relevant legislations are revised. During these reviews, necessary updates to the recommendation will be made. As the legislative situation changes, this recommendation may become deactivated in the future and full reports according to Recommendation 001 will then have to be made.*
Standard modules for E/E PCB assemblies

This chapter describes how the modules for E/E assemblies can be used. *This recommendation does not reflect all possible E/E) PCB assembly applications and ELV Annex II exemptions (e.g. 8b, 8d…).*

Flow Chart and Structure of an assembly created with the help of the prepared modules

In order to create a PCB, the IMDS user should select the appropriate modules to describe their part. Main module semi-components are released within the ZVEI-REC019 IMDS Company ID (102677) for use in describing the materials used within printed circuit boards. **These modules do not contain the solder materials, which must be added separately.** The ZVEI-REC019 is not responsible for the accuracy of individual company declarations. As stated above, use of the ZVEI-REC019 semi-components and materials does not substitute for the supplier’s mandate to track and gather all necessary material information along the total sub-tier supply chain and verification of material composition.

IMDS IDs of ZVEI-REC019 modules are given in the table below as well as examples for process solder. Process solder is used to solder the components and mechanical parts (e.g. connector) to the PCB. Other Lead based solders are to be added to the assembly, as appropriate and applicable, for identification of other ELV exemptions per the flowchart below. The application codes for modules, process solder, and component solders cannot be identified until the ZVEI-REC019 and other semi-components and materials are inserted into an MDS as a child node to the PCB assembly component.
Main Modules
Materials of the PCB, without process-solder and containing only 10a leaded ceramics
Names: **PCB-Standard, PCB-High Component Load** ID: 137422066, 137422285
Range: Rest

**PCB process solder**
ID: see table below for typical solders - Reference to Committee-ID's of typical solders is accepted (e.g. ID 138438221, 138438130). If alternative solders are used, they must be defined by the establishing company.
Range: typically 1.5 to 2.5%

**Component surface with Lead (8a)**
ID: 138438130
Range: 0.01%...0.05%

**Capacitor surface (8c)**
ID: 138470815
Range: 0.01%...0.05%

**High Temperature (8e)**
ID: 138511816
Range: 0.01%...0.05%

**Compliant pin surface (8f)**
ID: 141147808
Range: 0.01%...0.05%

**Flip Chip (8g)**
ID: 141147978
Range: 0.01%...0.05%

**Power Heat sink (8h)**
ID: 141148068
Range: 0.01%...0.05%

**PZT ceramics for IC's (10b)**
ID: 164373158
Range: 0.05%...0.1%

**Ceramic capacitors <125 V AC, <250 V DC (10c), Standard and High Component Load**
ID: 164373451, 164373810
Range: 0.1%...0.5%

**Temperature compensating C's for ultrasonic systems (10d), Standard and High Component Load**
ID: 164374558, 164374808
Range: 0.05%...0.2%

Components not covered by Rec. 019 …must be added as separate component MDSs to the overall electronic assembly datasheet.
Main Modules
Materials of the PCB, without process-solder and lead containing ceramics
Names: PCB-Standard without Lead Ceramics, PCB-High Component Load without Lead Ceramics ID: 161333793, 164375805

PCB process solder
ID: see table below for typical solders - Reference to Committee-ID’s of typical solders is accepted (e.g. ID 138438221, 138438130). If alternative solders are used, they must be defined by the establishing company.
Range: typically 1.5 to 2.5%

Component surface with Lead (8a)
ID: 138438130
Range: 0.01%...0.05%

Capacitor surface (8c)
ID: 138470815
Range: 0.01%...0.05%

High Temperature (8e)
ID: 138511816
Range: 0.01%...0.05%

Compliant pin surface (8f)
ID: 141147808
Range: 0.01%...0.05%

Flip Chip (8g)
ID: 141147978
Range: 0.01%...0.05%

Power Heat sink (8h)
ID: 141148068
Range: 0.01%...0.05%

PZT ceramics for IC’s (10b)
ID: 164373158
Range: 0.05%...0.1%

Ceramic capacitors <125 V AC, <250 V DC (10c), Standard and High Component Load
ID: 164373451, 164373810
Range: 0.1%...0.5%

Temperature compensating C’s for ultrasonic systems (10d), Standard and High Component Load
ID: 164374558, 164374808
Range: 0.05%...0.2%

Components not covered by Rec. 019
...must be added as separate component MDSs to the overall electronic assembly datasheet.
## IMDS Recommendation

**IMDS 019**

### Description of standard modules and additional available semi-component MDSs

<table>
<thead>
<tr>
<th>MDS name</th>
<th>MDS ID</th>
<th>MDS name IMDS</th>
</tr>
</thead>
<tbody>
<tr>
<td>“Main module” - Standard</td>
<td>137422066</td>
<td>PCB-Standard</td>
</tr>
<tr>
<td>“Main module” – High Component Load</td>
<td>137422285</td>
<td>PCB-High Component Load</td>
</tr>
<tr>
<td>“Main module” – Standard without Leaded Components</td>
<td>161333793</td>
<td>PCB-Standard without Leaded Ceramics</td>
</tr>
<tr>
<td>“Main module” - High Component Load without Leaded Components</td>
<td>164375805</td>
<td>PCB-High Component Load without Leaded Ceramics</td>
</tr>
<tr>
<td>Process solders (typical)</td>
<td>138438221 141149865</td>
<td>PCB-Solder S-Sn96Ag3Cu1 (Sn96.5Ag3Cu0.5) PBC-Solder S-Sn63Pb37</td>
</tr>
<tr>
<td>Component solders (typical) to be used for additional needed references of Lead uses below:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Component surface with lead (8a)</td>
<td>138438130</td>
<td>PCB-Component surface with Lead (8a)</td>
</tr>
<tr>
<td>- Capacitor surface (8c)</td>
<td>138470815</td>
<td>PCB-Capacitor surface (8c)</td>
</tr>
<tr>
<td>- High Melting Temperature (8e)</td>
<td>138511816</td>
<td>PCB-High Temp solder (8e)</td>
</tr>
<tr>
<td>- Compliant pin surface (8f)</td>
<td>141147808</td>
<td>PCB-Compliant pin surface (8f)</td>
</tr>
<tr>
<td>- Flip chip (8g)</td>
<td>141147978</td>
<td>PCB-Flip Chip (8g)</td>
</tr>
<tr>
<td>- Power heatsink (8h)</td>
<td>141148068</td>
<td>PCB-Power Heat sink (8h)</td>
</tr>
<tr>
<td>Typical content range of Lead containing ceramics is defined in the flow chart</td>
<td></td>
<td>Others to be created by IMDS user individually</td>
</tr>
<tr>
<td>Component leaded ceramics (typical) to be used for additional needed references of Lead uses below (excepting 10a per main modules)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- PZT ceramics for IC’s (10b)</td>
<td>164373158</td>
<td>PCB-PZT ceramics for IC’s (10b)</td>
</tr>
<tr>
<td>- Ceramic capacitors &lt;125 V AC, &lt;250 V DC (10c), Standard</td>
<td>164373451</td>
<td>PCB-Ceramic capacitors &lt;125 V AC, &lt;250 V DC (10c), <strong>Standard</strong></td>
</tr>
<tr>
<td>- Ceramic capacitors &lt;125 V AC, &lt;250 V DC (10c), High Component Load</td>
<td>164373810</td>
<td>PCB-Ceramic capacitors &lt;125 V AC, &lt;250 V DC (10c), <strong>High Component Load</strong></td>
</tr>
<tr>
<td>- Temperature compensating C’s for ultrasonic systems (10d), Standard</td>
<td>164374558</td>
<td>PCB-Temperature compensating C’s for ultrasonic systems (10d), <strong>Standard</strong></td>
</tr>
<tr>
<td>- Temperature compensating C’s for ultrasonic systems (10d), High Component Load</td>
<td>164374808</td>
<td>PCB-Temperature compensating C’s for ultrasonic systems (10d), <strong>High Component Load</strong></td>
</tr>
<tr>
<td>Typical content range of Lead containing ceramics is defined in the flow chart</td>
<td></td>
<td>Others to be created by IMDS user individually</td>
</tr>
</tbody>
</table>

### Components not covered by Rec 019 (see Section 3, 2nd paragraph)

Mechanical parts such as screws, cooling sheets, etc. must be reported according to Rec. IMDS 001. It is important to remember Rec. IMDS 001 Rule 4.1.A concerning child nodes of the same parent node must be of the same type.

### Standard rules and guidelines for E/E (PCB components)

Suppliers of electrical and electronic components that are mounted to the PCB or Hybrid Assembly, including active and passive elements, must deliver a full Bill of Material (BOM), including full disclosure of all substances, to the assembly supplier with the qualification of the product. Substances that are not
IMDS Recommendation

Materials of small electronics components. This applies to electronics parts weighing less than 5g².

- may be reported using material class 8.1
- Standard Material Numbers, Symbols, and Norms/Standards can be simplified per Rec. IMDS 001 as shown in Section 4.4.2.E, 4.4.2F and 4.4.2I.

Hybrid Electronics

Standard modules for E/E (Electric/Electronic) hybrids

For assembled standard hybrid electronics the following modules are available in IMDS. To facilitate the search function, please search the IMDS database for published semi-components, enter the article name “Hybrid-St” and choose IMDS Company ID 102677.

Hybrid-St (e.g. for sensor applications)

Thick and thin film circuits on ceramic base material

Hybrid-St-Cu (e.g. for power applications)

DCB / DBC (direct copper bonding / direct bonding copper)

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² These requirements will be reviewed during the REC019 annual analysis.
Base materials for Ceramic Hybrid Electronics (LTCC Hybrids)

For assembled ceramic hybrids (LTCC = Low Temperature Co-fired Ceramic) the following three standard semi-components in three versions (two leaded, one lead-free) are available in IMDS. To facilitate the search function, please search the IMDS database for semi-components, enter the article name "Hybrid-LTCC" and choose supplier-ID IMDS Company ID 102677.

Search Criteria: Name=hybrid-ltcc*, published MDSs=Yes
3 items found. Ordered ascending by "Article Name"

<table>
<thead>
<tr>
<th>No.</th>
<th>Article Name</th>
<th>Item-/Mat.-Id</th>
<th>ID / Version</th>
<th>Supplier</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Hybrid-LTCC-ceramic(0%Pb)</td>
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<td>1385188777 / 1</td>
<td>ZVEI-Rec019</td>
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<tr>
<td>2</td>
<td>Hybrid-LTCC-ceramic(1%Pb)</td>
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<td>138518445 / 1</td>
<td>ZVEI-Rec019</td>
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<tr>
<td>3</td>
<td>Hybrid-LTCC-ceramic(9%Pb)</td>
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<td>138518457 / 1</td>
<td>ZVEI-Rec019</td>
</tr>
</tbody>
</table>

Glossary

<table>
<thead>
<tr>
<th>Component</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Component</td>
<td>Electronic component like e.g. capacitor, IC, resistor, that typically populate a PCB</td>
</tr>
<tr>
<td>Assembly</td>
<td>Populated printed circuit board or hybrid</td>
</tr>
<tr>
<td>Electric</td>
<td>Relating to the flow of electricity</td>
</tr>
<tr>
<td>Electronic</td>
<td>A device constructed using one or more electric elements that make it possible to manage the flow of electricity</td>
</tr>
<tr>
<td>Full Bill of Material (BOM)</td>
<td>Full list of components and materials for product</td>
</tr>
<tr>
<td>Hybrid</td>
<td>Electronic circuit assembly, typically ceramic substrate</td>
</tr>
<tr>
<td>PCB, PWB</td>
<td>Printed circuit board, printed wiring board</td>
</tr>
<tr>
<td>Umbrella Spec</td>
<td>Data Format created by the German Association of Electric and Electronic Industry (ZVEI) based on IEC PAS 61906 to support a full Material Information of product classes (see also Umbrella Specs - Guideline and Form (ZVEI) Ver. 4.1)</td>
</tr>
</tbody>
</table>

Transition Period

This Recommendation IMDS 019 shall enter into force 3 months after publication. After this transition period all previous versions of Rec. IMDS 019 will be invalid and only this version will be effective.

Release and Revisions

Release

The proposal was first approved and released on October 30 th, 2003
<table>
<thead>
<tr>
<th>Rev.</th>
<th>Date</th>
<th>Description/ Reason</th>
<th>Released by</th>
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<tr>
<td>1</td>
<td>2005/04</td>
<td>Was Issue November 2003&lt;br&gt;Editorial changes Hybrids (standard and LTCC), wire harnesses added</td>
<td>IMDS-SC</td>
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<tr>
<td>2</td>
<td>2007/02</td>
<td>Was Issue April 2005&lt;br&gt;Paragraph 1: reworked&lt;br&gt;Paragraph 4: Example removed, following paragraphs renumbered&lt;br&gt;Paragraph 4.3: updated&lt;br&gt;Paragraph 5: added&lt;br&gt;Paragraph 6: added&lt;br&gt;Paragraph 7: removed, following paragraph renumbered</td>
<td>IMDS-SC</td>
</tr>
<tr>
<td>3</td>
<td>2010/08</td>
<td>Rework of content of the whole document</td>
<td>IMDS-SC</td>
</tr>
<tr>
<td>4</td>
<td>2011/08</td>
<td>Add content specific to new ELV Annex II with respect to Exemption 10 Lead in Ceramics&lt;br&gt;Paragraphs about modules&lt;br&gt;Annex changes</td>
<td>IMDS-SC</td>
</tr>
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</table>
Annex

The following examples are shown to illustrate the use of the modules and additional information as needed.

Preferred structure:

The semi-component modules, as defined in the flow chart and in chapter 4.1, are to be added to an additional semi-component (“PCBA” in below examples) created by the user. The weight of this created semi-component can be entered as the weight of the parent PCB created component (“Printed circuit board assembly” in below examples).

When semi-component attached to a component:

- Enter “weight” only.
- DO NOT specify “Specific weight”.

Additional semi-components were created for the Annex II Lead in Ceramics with example below. As for other lead in solder applications (e.g. 8e Lead in High Melting Temp Solder), the use of the other exemption 10 application codes must be evaluated on a case by case basis for your particular assembly.
An example of a complete electronic product is shown below with additional components added by usage.

Semi-component Specific Density:

The user will be required to enter a specific weight (density) prior to the release of the company created semi-component. We suggest 2000 kg/m³. Please note that the ZVEI components contain an approximate value for a specific weight, as this is required by IMDS Recommendation 001.
When adding the ZVEI semi-components as child nodes to the company created semi-component, please use weight percentages as shown in the flowchart section 4.2. A manual calculation of the volume (e.g. adding amounts as m³) is not to be used. Based on this IMDS structure, the values of the other ZVEI modules (e.g. PCB-Solder S-Pb90Sn10) can be added directly by weight percentage as defined in the flow chart. The value of the main module "PCB-Standard" is defined as "Rest".

**ZVEI semi-components added by weight percentage to the user created “PCBA” semi-component.**

<table>
<thead>
<tr>
<th>Semi-component (MDS)</th>
<th>Type</th>
<th>ID / Version</th>
<th>MDS Supplier</th>
<th>Article Name</th>
<th>Item-Material-No.</th>
<th>Development Sample</th>
<th>Report</th>
<th>Specific weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>PCB-Standard</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ZVEI-Rc013</td>
<td></td>
<td>137422066 / 1</td>
<td>ZVEI-Rec013</td>
<td>PCB-Standard</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Details**

- ZVEI semi-components added by weight percentage to the user created “PCBA” semi-component.

<table>
<thead>
<tr>
<th>Specific weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>2000 kg/m³ for volume</td>
</tr>
</tbody>
</table>

- ZVEI semi-components added by weight percentage to the user created “PCBA” semi-component.
ECU Example 2 – Additional non-typical solder created which is added by the user.

Additional solders are added by user as required, including the necessary Application Codes

Application Codes:
Application codes for all lead and other uses must be identified by the user prior to release of their printed circuit board assembly. ZVEI semi-components DO NOT contain application codes. You must assign them when the modules are attached to a component. Some ZVEI materials contain more than one substance requiring an application code. Please see below for an example of typical selections for lead in ceramics found within a module.
New application codes for the exemption 10 lead in ceramics will have to be entered for each of the lead compounds. Generally, these will be 10a -, but again you will have to evaluate the uses of your lead ceramic applications. The example below is for a 10a component found within the PCB-Standard.

If you have a Lead-free ceramic PCB assembly, you will have to use the new PCB-Standard without Leaded Ceramics.
If you also have 10b through 10d ceramic applications you will have to add those ceramic material semi-components separately.