The Constituents of Semiconductor Components

Responsible electronic component and equipment manufacturers are already preparing for the time when the lifespan of their products comes to an end by scrutinizing the materials incorporated and their future recyclability. Recycling laws have already come into force in Germany (“Kreislauf-Wirtschaftsgesetz”) and guidelines for electronic scrap are in preparation.

The aim is a suitable waste disposal program and – as a preventative measure – a reduction in the content of hazardous damaging materials in such components. In order to conform to this procedure, detailed information about the materials and their quantities is needed.

This overview answers questions put forward by customers as to the constituents and their function in the most important of Vishay Semiconductors’s semiconductor products. Special significance is given to so-called “Hazardous Substances”. It demonstrates that Vishay Semiconductors products under normal operating conditions do not expose the user or environment to any hazard. However, most products nevertheless contain small but necessary quantities of “Hazardous Substances” which can – if not treated correctly or through accidents – be released on a small scale into the environment.

The present information was produced with the greatest possible care. Any suggestions for improvement of this brochure are welcome.

Definitions

Vishay Semiconductors offers a wide range of semiconductor components including transistors, diodes and opto-electronic components. These have been manufactured in various standard packages.

On the following pages, these packages are listed together with their materials shown in weight percentages. In order to limit the number of tables, all components whose structure and composition are the same have been compiled in families. In many cases, different lead frames together with chips of different sizes may be used for the one package. This usually means that there may be slight differences in the quantities of the declared material. The weight percent is, however, valid for a representative sample of the relevant family. In order to sensibly reduce the number and quantities of materials contained in the respective components, quantities smaller than 0.1% by weight have been stated in the following list as traces. This is the case unless lower limits are forced by law, e.g., cadmium < 75 ppm and PCDD as well as PCDF (known as dioxin) < 2 ppb. In the lists themselves, details of content and composition are separated into the individual parts of the semiconductor component. The most important of these are:

Active element: The active element is either a silicon chip or for optoelectronic components a chip containing combinations of Ga (Al) (As, P). These are doped with very small amounts of boron, arsenic, phosphorus, zinc and germanium etc. The metallisation consists of thin layers of aluminium, gold or titanium. The chips are generally bonded to the lead frame with a silver epoxy and have gold or aluminium wires bonded to the lead frame.

Lead frame: For electrical connection, a metal lead frame made from alloys such as FeNi (42) or CuFe (2) and partly or totally plated with silver is commonly used. The metal alloys contain traces of silver, zinc and phosphorus. Part of the lead frame is also coated with tin/ lead.

Case: The semiconductor chip is protected from the environment by a case of glass, plastic or metal. The glass is composed of oxides of silicon and lead together with boron and aluminium. Plastic cases are composed of an epoxy resin filled with up to 70% by weight of quartz particles. Antimony trioxide and brominated epoxy resin (no TBA) are added as flame retardants. Antimony and bromine amount to about 1.6 and 1.0% respectively.

In use: In use, it is the content of hazardous substances which is of importance. In Germany, there are a series of lists which give the materials which are potentially hazardous to people and the environment, for example:

Appendix II and IV of the “Hazardous Materials Regulations”, the TRGS 900 (“MAK-Wert-Liste”) and the “Catalog of Materials Hazardous to the Water Supply”. These lists, however, are only partially consistent.

The names used are often different for materials with the same chemical composition. Furthermore, the use of trivial and trade names often adds to the confusion. Vishay Semiconductors therefore for their descriptions use that proposed by the Zentralverband Elektrotechnik und Elektronikindustrie e.V. (ZVEI; Central Association of Electrical Engineering and Electronic Industry) for the harmonization of the nomenclature of hazardous substances.

Statements are made on the safety precautions to be used during storage and disposal by mechanical, chemical and thermal means of the more important chemicals (so-called “Leichemikalien”). These are listed in the tables in the order of their potential risk.
Their effect upon people and the environment are also listed and any special precautions emphasized.

Notes: The following information has been prepared to be as exact and reliable as possible.
The manufacture of semiconductor components is, however, subject to regular change without special notification.
The publication of this brochure excludes any responsibility resulting from its use.

Explanation of Abbreviations
While the information on weight percent is believed correct, discrepancies depending upon component type may be possible.

1) Material information etc. Material listed as “Material Hazardous in Production”
2) S: Trace material < 0.1% by weight; Cd < 75 ppm; concerning Cd see ***)
   PCDD and PCDF < 2 ppb
*) Dioxin content – lies below agreed limits
**) No. 85 “Rules for Hazardous Materials”, to be replaced as soon as a technically suitable alternative material is available
***) Traces of cadmium can only be found in lead frames made of copper
CMT: Material containing carcinogens, mutagens or terratogens
Tox: Material is toxic or very toxic
S Material with allergy producing characteristics
HAL Halogen containing material
WKG Material hazardous to the water supply
L Storage, suitable for disposal
D Disposable
M Mechanical disposal
N Chemical disposal
T Thermal disposal
H Handling

Ozone Depleting Substances
The use of Ozone Depleting Substances has been totally eliminated by Vishay Semiconductors and by doing so meets the legal requirements as defined in the following documents.

1. The “Montreal Protocol” together with the “London Amendments” Appendix A, B, and the “List of Transitional Substances”
2. “Clean Air Act”, Amendments 1990, “Environmental Protection Agency” (EPA), USA, Class I and II – Ozone Depleting Substances

Vishay Semiconductors guarantees that its components do not contain and are manufactured without the use of Ozone Depleting Substances.
The Constituents of Package Forms

Package form 1:

Total weight 30 mg

**Epoxy resin** (10.0%)
- 50% resin
- 50% hardener

**Reflector** (47.8%)
- 66.7% amodel
- 33.3% glass fibre

**Lead frame** (42.0%)
- 95% copper
- 2% iron
- 2% Silver
- 1% SnPb
- Traces of Ni, Zn, P, Cd***

**Silver epoxy** (< 0.1%)
- 80% silver
- 10% resin
- 10% hardener
- Traces of Cl, Na, K

**LED chip** (< 0.1%)
- 50% gallium
- 50% arsenic and phosphorus
- Traces of Al, Au, Zn, Ge, In, Ti

**IR chip** (0.17%)
- 50% gallium
- 50% arsenic
- Traces of Al, Au, Zn, Ge, Ti

**Detector chip** (0.2%)
- 99% silicon
- Traces of Ag, Al, Au, Sb, Ti, SiO₂

**Bond wire** (< 0.1%)
- 99.99% gold
- Traces of Be, Mg

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Significant Materials for Disposal

<table>
<thead>
<tr>
<th>No.</th>
<th>Material and/or Group</th>
<th>Available in the Compound Used for</th>
<th>Part in Weight Percent</th>
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<tr>
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<td>Lead and lead compounds</td>
<td>Lead plating</td>
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Package form 2:

Total weight 84 mg

**Mold** (38%)
- 50% resin
- 50% hardener
- Traces of Fe, C, Cl

**Lead frame** (55%)
- 94% copper
- 2% iron
- 2% tin
- 2% silver
- Traces of Ni, Zn, P, Cd***

**Silver epoxy** (< 0.1%)
- 80% silver
- 10% resin
- 10% hardener
- Traces of Cl, Na, K

**Detector chip** (7%)
- 99% silicon
- Traces of Ag, Al, Ni, Ti, V

**Bond wire** (< 0.1%)
- 99.99% gold
- Traces of Be, Mg

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Significant Materials for Disposal

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<th>Material and/or Group</th>
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Note: *) , **) , ***) , 1) , 2) , CMT , T etc.: see ‘Explanation of Abbreviations’, page 2
Package form 3:

Total weight 200 mg

Epoxy resin (58%)
50% resin
50% hardener
Traces of Fe, C, Cl

Lead frame (39%)
96% copper
2% iron
2% silver
Traces of Ni, Zn, P, Cd***)

Bond wire (< 0.1%)
99.99% gold
Traces of Be, Mg

Detector chip
(2.9%)
99% silicon
Traces of Ag, Al, Ni, Ti, V

Silver epoxy (< 0.1%)
80% silver
10% resin
10% hardener
Traces of Cl, Na, K

Significant Materials for Disposal

<table>
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<tr>
<th>No.</th>
<th>Material and/or Group 1)</th>
<th>C</th>
<th>T</th>
<th>M</th>
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<th>X</th>
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Package form 4:

Total weight 219 mg

Epoxy resin (58%)
50% resin
50% hardener
Traces of Fe, C, Cl

Lead frame (39%)
96% copper
2% iron
2% silver
Traces of Ni, Zn, P, Cd***)

Bond wire (< 0.1%)
99.99% gold
Traces of Be, Mg

Detector chip
(2.9%)
99% silicon
Traces of Ag, Al, Ni, Ti, V

Silver epoxy (< 0.1%)
80% silver
10% resin
10% hardener
Traces of Cl, Na, K

Significant Materials for Disposal

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<th>No.</th>
<th>Material and/or Group 1)</th>
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Note: *) , **), ***, 1), 2), CMT, T etc.: see ‘Explanation of Abbreviations’, page 2
Package form 5:

**Epoxy resin** (46%)
- 50% resin
- 50% hardener
- Traces of Fe, C, Cl

**Lead frame** (51%)
- 96% copper
- 2% iron
- 2% silver
- Traces of Ni, Zn, P, Cd

**Bond wire** (< 0.1%)
- 99.99% gold
- Traces of Be, Mg

**Detector chip**
- (2.9%)
- 99% silicon
- Traces of Ag, Al, Ni, Ti, V

**Silver epoxy** (< 0.1%)
- 80% silver
- 10% resin
- 10% hardener
- Traces of Cl, Na, K

Significant Materials for Disposal

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<th>Material and/or Group 1)</th>
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Note: *) , **) , ***) , 1) , 2) , CMT , T etc.: see ‘Explanation of Abbreviations’, page 2

Package form 6:

**Epoxy resin** (40%)
- 50% resin
- 50% hardener
- Traces of Fe, C, Cl

**Lead frame** (60%)
- 92% copper
- 2% iron
- 2% silver
- 4% SnPb
- Traces of Ni, Zn, P, Cd

**Bond wire** (< 0.1%)
- 99.99% gold
- Traces of Be, Mg

**Detector chip** (< 0.1%)
- 99% silicon
- Traces of Ag, Al, Au, Sb, Ti, SiO₂

**Capacitor** (< 0.1%)
- 98% aluminium trioxide
- Traces of Ag, Pd, Ni

**Silver epoxy** (< 0.1%)
- 80% silver
- 10% resin
- 10% hardener
- Traces of Cl, Na, K

Significant Materials for Disposal

<table>
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<th>No.</th>
<th>Material and/or Group 1)</th>
<th>C</th>
<th>T</th>
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</table>

Note: *) , **) , ***) , 1) , 2) , CMT , T etc.: see ‘Explanation of Abbreviations’, page 2
Package form 7:

**Epoxy resin** (55.0%)
50% resin
50% hardener

**Lead frame** (44.7%)
96% copper
2% iron
2% silver
Traces of Ni, Ag, Zn, P, Cd ***)

**Silver epoxy** (< 0.1%)
80% silver
10% resin
10% hardener
Traces of Cl, Na, K

**IR chip** (< 0.1%)
50.0% gallium
50.0% arsenic
Traces of Al, Au, Zn, Ge, Ti

**Detector chip** (< 0.1%)
99.9% silicon
Traces of Ag, Al, Au, Sb, Ti, SiO₂

**Bond wire** (< 0.1%)
99.99% gold
Traces of BE, Mg

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**Package form 8:**

**Epoxy resin** (58%)
50% resin
50% hardener

**Lead frame** (42%)
93% iron
2% copper
2% silver
3% SnPb
Traces of Ni, Zn, P, Cd ***)

**Silver epoxy** (< 0.1%)
80% silver
10% resin
10% hardener

**LED chip** (< 0.1%)
50% gallium
50% arsenic and phosphorus
Traces of Al, Au, Zn, Ge, In, Ti

**IR chip** (0.1%)
50% gallium
50% arsenic
Traces of Al, Au, Zn, Ge, Ti

**Bond wire** (< 0.1%)
99.99% gold
Traces of BE, Mg

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**Significant Materials for Disposal**

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<th>No.</th>
<th>Material and/or Group ¹</th>
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<th>T O</th>
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</table>

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Note: *) , **), ***) , ¹), ²), CMT, T etc.: see ‘Explanation of Abbreviations’, page 2
Vishay Semiconductors

Package form 9:

**Epoxy resin** (50%)
- 50% resin
- 50% hardener
- Traces of Fe, C, Cl

**Lead frame** (50%)
- 96% copper
- 2% iron
- 2% silver
- Traces of Ni, Zn, P, Cd

**Bond wire** (< 0.1%)
- 99.99% gold
- Traces of Be, Mg

Detector chip (< 0.1%)
- 99% silicon
- Traces of Ag, Al, Ni, Ti, V

Silver epoxy (< 0.1%)
- 80% silver
- 10% resin
- 10% hardener
- Traces of Cl, Na, K

Total weight (5mm) 310 mg

Significant Materials for Disposal

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<th>No.</th>
<th>Material and/or Group 1)</th>
<th>C M T</th>
<th>O X S</th>
<th>H A G</th>
<th>W L K</th>
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<td>Lead plating</td>
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</table>

Note: *) , **) , ***) , 1) , 2) , CMT , T etc.: see ‘Explanation of Abbreviations’, page 2

Package form 10:

**Epoxy resin** (25%)
- 50% resin
- 50% hardener
- Traces of Fe, C, Cl

**Lead frame** (75%)
- 96% copper
- 2% iron
- 2% silver
- Traces of Ni, Zn, P, Cd

**Detector chip** (< 0.1%)
- 99% silicon
- Traces of Ag, Al, Au, Sb, Ti, SiO₂

**Silver epoxy** (< 0.1%)
- 80% silver
- 10% resin
- 10% hardener
- Traces of Cl, Na, K

**Bond wire** (< 0.1%)
- 99.99% gold
- Traces of Be, Mg

Total weight (3mm)132 mg

Significant Materials for Disposal

<table>
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<tr>
<th>No.</th>
<th>Material and/or Group 1)</th>
<th>C M T</th>
<th>O X S</th>
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</table>

Note: *) , **) , ***) , 1) , 2) , CMT, T etc.: see ‘Explanation of Abbreviations’, page 2
Package form 11:

Epoxy resin (30%)
50% resin
50% hardener
Traces of Fe, C, Cl

Lead frame (70%)
90% iron
4% copper
5% silver
4% SnPb
Traces of Ni, Zn, P, Cd***

Silver epoxy (< 0.1%)
80% silver
10% resin
10% hardener
Traces of Cl, Na, K

Bond wire (< 0.1%)
99.99% gold
Traces of Be, Mg

LED chip (< 0.1%)
50% gallium
50% arsenic and phosphorus
Traces of Al, Au, Zn, Ge, In, Ti

IR chip (0.1%)
50% gallium
50% arsenic
Traces of Al, Au, Zn, Ge, Ti

Detector chip (< 0.1%)
99% silicon
Traces of Ag, Al, Au, Sb, Ti, SiO2

Significant Materials for Disposal

<table>
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<tr>
<th>No.</th>
<th>Material and/or Group 1)</th>
<th>C</th>
<th>T</th>
<th>H</th>
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</tbody>
</table>

Note: *) , **) , ***) , 1) , 2) , CMT , T etc.: see ‘Explanation of Abbreviations’, page 2

Package form 12:

Header & cap
(99.9%)
37.5% iron
20.5% nickel
12.5% cobalt
29.0% glass
0.5% gold
Traces of K, P

Silver epoxy (< 0.1%)
80.0% silver
10.0% resin
10.0% hardener
Traces of Cl, Na, K

Bond wire (< 0.1%)
99.99% gold
Traces of Be, Mg

IR chip (<0.1%)
50% gallium
50% arsenic
Traces of Al, Au, Zn, Ge, Ti

Photo trans. chip (< 0.1%)
99.0% silicon
Traces of Ag, Al, Au, Sb, Ti, SiO2

Photo diode chip (< 0.1%)
99.0% silicon
Traces of Ag, Al, Ni, Ti, V

Significant Materials for Disposal

<table>
<thead>
<tr>
<th>No.</th>
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<th>C</th>
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</tbody>
</table>

Note: *) , **) , ***) , 1) , 2) , CMT, T etc.: see ‘Explanation of Abbreviations’, page 2
Vishay Semiconductors

Package form 13:

Header & cap
(99.9%)
37.5% iron
20.5% nickel
12.5% cobalt
29.0% glass
0.5% gold
Traces of K, P

Silver epoxy (< 0.1%)
80.0% silver
10.0% resin
10.0% hardener
Traces of Cl, Na, K

Bond wire (< 0.1%)
99.99% gold
Traces of Be, Mg

Photo diode chip (< 0.1%)
99.0% silicon
Traces of Ag, Al, Ni, Ti, V

Total weight 850 mg

Significant Materials for Disposal

<table>
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<tr>
<th>No.</th>
<th>Material and/or Group 1)</th>
<th>C</th>
<th>T</th>
<th>H</th>
<th>W</th>
<th>Available in the Compound Used for</th>
<th>Part in 2) Weight Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Lead and lead compounds</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>Lead plating</td>
<td>0.1</td>
</tr>
</tbody>
</table>

Package form 14:

Epoxy resin (42.9%)
44.0% resin
48.0% hardener
8.0% diffuser

Reflector (39.8%)
73.0% Pocan
27.0% TiO2

Lead frame (17.3%)
98.8% copper
1.2% iron
Traces of Ni, Ag, Zn, Cd

LED chip (< 0.1%)
50.0% gallium
50.0% arsenic and phosphorus
Traces of Al, Au, Zn, Ge, In, Ti

Bond wire (< 0.1%)
99.99% gold
Traces of Be, Mg

Silver epoxy (< 0.1%)
80.0% silver
10.0% resin
10.0% hardener
Traces of Cl, Na, K

Case | Weight/ mg
-----|-------------------
7 mm | 700               
10 mm| 1150              
13 mm| 2090              

Significant Materials for Disposal

<table>
<thead>
<tr>
<th>No.</th>
<th>Material and/or Group 1)</th>
<th>C</th>
<th>T</th>
<th>H</th>
<th>W</th>
<th>Available in the Compound Used for</th>
<th>Part in 2) Weight Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Arsenic</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>Chip</td>
<td>43.0</td>
</tr>
<tr>
<td>2</td>
<td>Epoxy resin</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>Mold</td>
<td></td>
</tr>
</tbody>
</table>

Note: 1), **), ***, 1), 2), CMT, T etc.: see ‘Explanation of Abbreviations’, page 2
Package form 15:

**Epoxy resin** (55.0%)
55.5%resin
44.5%hardener

**Lead frame** (43.7%)
98.8%copper
1.2% iron
Traces of Ni, Ag, Zn, P, Cd

**Capacitor** (< 0.1%)
98.0%aluminium trioxide
Traces of Ag, Pd, Ni

**Resistor** (< 0.1%)
99.0%aluminium trioxide
Traces of Ag, Pd, Ni

**Photo diode** (< 0.1%)
99.0%silicon
Traces of As, Al, Ni, Ti, V

**IC chip** (< 0.1%)
99.0%silicon
Traces of SiO₂, Al, Al₃N₄

**Bond wire** (< 0.1%)
99.99% gold
Traces of Be, Mg

**Silver epoxy** (< 0.1%)
80% silver
10% resin
10% hardener
Traces of Cl, Na, K

Significant Materials for Disposal

<table>
<thead>
<tr>
<th>No.</th>
<th>Material and/or Group ¹)</th>
<th>C T H W</th>
<th>Available in the Compound Used for</th>
<th>Part in ²)</th>
<th>Weight Percent</th>
<th>L D M N T H</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>Epoxy resin</td>
<td>Mold</td>
<td></td>
<td>54.5</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: *) , **) , ***) , ¹) , ²) , CMT , T etc.: see ‘Explanation of Abbreviations’, page 2

Package form 16:

**Epoxy resin** (63.3%)
55.5%resin
44.5%hardener

**Lead frame** (36.3%)
98.8%copper
1.2% iron
Traces of Ni, Ag, Zn, P, Sn, Pb, Cd

**Silver epoxy** (< 0.1%)
80% silver
10% resin
10% hardener
Traces of Cl, Na, K

**Photo diode** (< 0.1%)
99.0%silicon
Traces of As, Al, Ni, Ti, V

**IC chip** (< 0.1%)
99.0%silicon
Traces of SiO₂, Al, Al₃N₄

**Bond wire** (< 0.1%)
99.99% gold
Traces of Be, Mg

Significant Materials for Disposal

<table>
<thead>
<tr>
<th>No.</th>
<th>Material and/or Group ¹)</th>
<th>C T H W</th>
<th>Available in the Compound Used for</th>
<th>Part in ²)</th>
<th>Weight Percent</th>
<th>L D M N T H</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Epoxy resin</td>
<td>Mold</td>
<td></td>
<td>54.5</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: *) , **) , ***) , ¹) , ²) , CMT, T etc.: see ‘Explanation of Abbreviations’, page 2
Vishay Semiconductors

Package form 17:

Total weight 503 mg

Mold (62.0%)
71.4%SiO₂
26.0%epoxy resin
1.6% Sb (as antimony trioxide) **)
1.0% bromine (no TBA *)
Traces of N, Fe, C, Cl

Lead frame (27.5%)
98.0%copper
2.0% iron
Traces of Ni, Ag, Zn, P, Cd ***)

Solder plating (0.4%)
85.0%In
15.0%lead

Reflector (7.6%)
100.0% poca

Epoxy resin (2.4%)
50.0%resin
50.0%hardener

Emitter chip (0.1%)
50.0%gallium
50.0%arsenic
Traces of Al, Au, Zn, Ge, In, Ti

Detector chip (< 0.1%)
99.0%silicon
Traces of Ag, Al, Au, Sb, Ti, SiO₂

Bond wire (< 0.1%)
99.99% gold
Traces of Be, Mg

Silver epoxy (< 0.1%)
80% silver
10% resin
10% hardener
Traces of Cl, Na, K

Significant Materials for Disposal

<table>
<thead>
<tr>
<th>No.</th>
<th>Material and/or Group ¹)</th>
<th>C</th>
<th>T</th>
<th>M</th>
<th>O</th>
<th>H</th>
<th>W</th>
<th>Available in the Compound Used for</th>
<th>Part in ²)</th>
<th>Weight Percent</th>
<th>L</th>
<th>D</th>
<th>M</th>
<th>N</th>
<th>T</th>
<th>H</th>
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<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>Mold</td>
<td>0.6</td>
<td>● ● ●</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Antimony and -compounds</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>Mold</td>
<td>1.0</td>
<td>● ● ●</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
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Note: *, **, ***, ¹, ², CMT, T etc.: see ‘Explanation of Abbreviations’, page 2
Package form 18:

<table>
<thead>
<tr>
<th>Type</th>
<th>Weight/ mg</th>
</tr>
</thead>
<tbody>
<tr>
<td>DIP4</td>
<td>250</td>
</tr>
<tr>
<td>DIP8</td>
<td>550</td>
</tr>
<tr>
<td>DIP16</td>
<td>1100</td>
</tr>
</tbody>
</table>

Mold (64.5%)
27.0%SiO₂
36.0%epoxy resin
30.0%TiO₂
3.0% Al (OH₃)
2.5% antimony **
1.5% Br (no TBA *)
Traces of N, Fe, C, Cl

Lead frame (29.0%)
98.0%copper
2.0% iron
Traces of Ni, Ag, Zn, P, Cd ***

Emitter chip (< 0.1%)
50.0%gallium
50.0%arsenic
Traces of Al, Au, Ge, Si₃N₄

Detector chip (< 0.1%)
99.0%silicon
Traces of Al, SiO₂, Al₃N₄

Solder plating (0.4%)
80.0%tin
20.0%lead

Silicon (6.1%)
90.9%resin
9.1% hardener

Bond wire (< 0.1%)
99.99% gold
Traces of Be, Mg

Silver epoxy (< 0.1%)
80% silver
10% resin
10% hardener
Traces of Cl, Na, K

Significant Materials for Disposal

<table>
<thead>
<tr>
<th>No.</th>
<th>Material and/or Group 1)</th>
<th>C</th>
<th>T</th>
<th>H</th>
<th>W</th>
<th>Available in the Compound Used for</th>
<th>Part in 2)</th>
<th>Weight Percent</th>
<th>L</th>
<th>D</th>
<th>M</th>
<th>N</th>
<th>T</th>
<th>H</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Halide compounds</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>Mold</td>
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<tr>
<td>2</td>
<td>Antimony and -compounds</td>
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<td>●</td>
<td>●</td>
<td>●</td>
<td>Mold</td>
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<td></td>
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Package form 19:

<table>
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<tr>
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<th>Weight/ mg</th>
</tr>
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<tbody>
<tr>
<td>CNY64</td>
<td>730</td>
</tr>
<tr>
<td>CNY65</td>
<td>1400</td>
</tr>
<tr>
<td>CNY66</td>
<td>1700</td>
</tr>
</tbody>
</table>

Epoxy resin (56.0%)
50.0%resin
49.5%hardener
0.5% Br (no TBA *)

Case (25.0%)
70.0%Crastin
30.0%SiO₂

Bushing (7.0%)
73.0%Lexan
30.0%TiO₂

Lead frame (12.0%)
98.8%copper
1.2% iron
Traces of Ni, Ag, Zn, P, Cd ***

Detector chip (< 0.1%)
99.0%silicon
Traces of SiO₂, Al, Al₃N₄

Emitter chip (< 0.1%)
50.0%gallium
50.0%arsenic
Traces of Al, Au, Si₃N₄

Silver epoxy (< 0.1%)
80% silver
10% resin
10% hardener
Traces of Cl, Na, K

Significant Materials for Disposal

<table>
<thead>
<tr>
<th>No.</th>
<th>Material and/or Group 1)</th>
<th>C</th>
<th>T</th>
<th>H</th>
<th>W</th>
<th>Available in the Compound Used for</th>
<th>Part in 2)</th>
<th>Weight Percent</th>
<th>L</th>
<th>D</th>
<th>M</th>
<th>N</th>
<th>T</th>
<th>H</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Halide compounds</td>
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<td>●</td>
<td>●</td>
<td>●</td>
<td>Mold</td>
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<tr>
<td>2</td>
<td>Arsenic</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>Chip</td>
<td>Traces</td>
<td>●●●</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: *, **, ***, 1), 2), CMT, T etc.: see ‘Explanation of Abbreviations’, page 2
Package form 20:

- **IR emitting diode**
  - **Epoxy resin** (55.0%)
    - 55.5% resin
    - 45.5% hardener
  - **Lead frame** (44.7%)
    - 98.8% copper
    - 1.2% iron
    - Traces of Ni, Ag, Zn, P, Cd ***)
  - **Emitter chip** (< 0.1%)
    - 50.0% gallium
    - 50.0% arsenic and phosphorus
    - Traces of Al, Au, Zn, Ge, Si₃N₄
  - **Silver epoxy** (< 0.1%)
    - 80% silver
    - 10% resin
    - 10% hardener
    - Traces of Cl, Na, K
  - **Bond wire** (< 0.1%)
    - 99.99% gold

- **IR photodetector**
  - **Epoxy resin** (54.0%)
    - 55.5% resin
    - 45.5% hardener
  - **Lead frame** (45.7%)
    - 98.8% copper
    - 1.2% iron
    - Traces of Ni, Ag, Zn, P, Cd ***)
  - **Detector chip** (< 0.1%)
    - 50.0% silicon
    - Traces of SiO₂, Al, Al₃N₄
  - **Silver epoxy** (< 0.1%)
    - 80% silver
    - 10% resin
    - 10% hardener
    - Traces of Cl, Na, K
  - **Bond wire** (< 0.1%)
    - 99.99% gold

- **Housing**
  - 100% Polycarbonate

### Significant Materials for Disposal

<table>
<thead>
<tr>
<th>No.</th>
<th>Material and/or Group ¹)</th>
<th>C</th>
<th>T</th>
<th>H</th>
<th>W</th>
<th>Available in the Compound Used for</th>
<th>Part in ²)</th>
<th>Weight Percent</th>
<th>L</th>
<th>D</th>
<th>M</th>
<th>N</th>
<th>T</th>
<th>H</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Arsenic</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>Chip</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: *) , **) , ***) , ¹) , ²) , CMT, T etc.: see ‘Explanation of Abbreviations’, page 2
Package form 21:

Total weight 150 mg

**Epoxy resin (31.1%)**
- 47.0% resin
- 50.0% hardener
- 3.0% filter color

**Mold (20.1%)**
- 70.0% PBTP
- 30.0% glass fiber

**Lead frame (48.8%)**
- 98.8% copper
- 1.2% iron
- Traces of Ni, Ag, Zn, P, Cd

**Bond wire (< 0.1%)**
- 99.99% gold

**Emitter chip (< 0.1%)**
- 50.0% gallium
- 50.0% arsenic and phosphorus
- Traces of Al, Au, Zn, Ge, Si₃N₄

**Detector chip (< 0.1%)**
- 99.0% silicon
- Traces of Al, SiO₂, Si₃N₄

**Silver epoxy (< 0.1%)**
- 80% silver
- 10% resin
- 10% hardener
- Traces of Cl, Na, K

### Significant Materials for Disposal

<table>
<thead>
<tr>
<th>No.</th>
<th>Material and/or Group 1)</th>
<th>C</th>
<th>T</th>
<th>H</th>
<th>W</th>
<th>Available in the Compound Used for</th>
<th>Part in 2) Weight Percent</th>
<th>L</th>
<th>D</th>
<th>M</th>
<th>N</th>
<th>T</th>
<th>H</th>
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</thead>
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<td></td>
<td></td>
<td></td>
<td>Chip</td>
<td>Traces</td>
<td></td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>

Note: *) , **), ***) , 1) , 2) , CMT, T etc.: see ‘Explanation of Abbreviations’, page 2
### Package form 22:

![Package form 22](image)

- **Housing**
  - 100% Polycarbonate
- **IR emitting diode**
  - **Epoxy resin** (34.5%)
  - 50.0% resin
  - 50.0% hardener
  - Traces of N, Fe, C, Cl
- **Lead frame** (65.2%)
  - 98.8% copper
  - 1.2% iron
  - Traces of Ni, Ag, Zn, P, Cd ***)
- **IR emitting diode** (0.2%)
  - 50.0% gallium
  - 50.0% arsenic and phosphorus
  - Traces of Al, Au, Zn, Ge, Si₃N₄
- **Silver epoxy** (< 0.1%)
  - 80% silver
  - 10% resin
  - 10% hardener
  - Traces of Cl, Na, K

- **IR photodetector**
  - **Epoxy resin** (29%)
  - 50.0% resin
  - 50.0% hardener
  - Traces of Fe, C, Cl
- **Lead frame** (70.7%)
  - 89.0% iron
  - 4.1% copper
  - 2.4% silver
  - 4.5% SnPb
  - Traces of Ni, Zn, P
- **Bond wire** (< 0.1%)
  - 99.99% gold
  - Traces of Be, Mg
- **IR Photodetector** (< 0.1%)
  - 99.0% silicon
  - Traces of Ag, Al, Au, Sb, Ti, SiO₂
- **Silver epoxy** (< 0.1%)
  - 80.0% silver
  - 10.0% resin
  - 10.0% hardener
  - Traces of Cl, Na, K

### Significant Materials for Disposal

<table>
<thead>
<tr>
<th>No.</th>
<th>Material and/or Group ¹)</th>
<th>C T</th>
<th>H W</th>
<th>Available in the Compound Used for</th>
<th>Part in ²)</th>
<th>Weight Percent</th>
<th>L D</th>
<th>M N</th>
<th>T H</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>Arsenic</td>
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<td>●</td>
<td>Chip</td>
<td>Traces</td>
<td>● ● ●</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Lead and -compounds</td>
<td>●</td>
<td>●</td>
<td>Lead frame</td>
<td>0.4</td>
<td>● ● ●</td>
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<td></td>
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</tbody>
</table>

Note: *)**, ***)**, ¹), ²), CMT, T etc.: see ‘Explanation of Abbreviations’, page 2
Package form 23:

**Epoxy resin (40%)**
- 50% resin
- 50% hardener
- Traces of Fe, C, Cl

**Lead frame (39%)**
- 79% copper
- 17% Ni
- 4% Au
- Traces of Ag, Fe, Co, Zu, Su, Al

**Bond wire (< 0.1%)**
- 99.99% gold
- Traces of Be, Mg

**Detector chip (17%)**
- 99% silicon
- Traces of Ag, Al, Ni, Ti, V

**Silver epoxy (< 0.1%)**
- 80% silver
- 10% resin
- 10% hardener
- Traces of Cl, Na, K

**Fibreglas (21%)**
- 63% oxygen
- 19% silicon
- 8% calcium
- 6% aluminum
- 4% carbon

**Significant Materials for Disposal**

<table>
<thead>
<tr>
<th>No.</th>
<th>Material and/or Group 1)</th>
<th>C</th>
<th>T</th>
<th>H</th>
<th>W</th>
<th>L</th>
<th>K</th>
<th>Available in the Compound Used for</th>
<th>Part in 2) Weight Percent</th>
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</thead>
<tbody>
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<td>Lead and lead compounds</td>
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<td></td>
<td></td>
<td></td>
<td>Lead plating</td>
<td>0.1</td>
</tr>
</tbody>
</table>

Note: *) , **) , ***) , 1) , 2), CMT, T etc.: see ‘Explanation of Abbreviations’, page 2
Package form 24:

- **Housing**: 100% Polycarbonate
- **Connector** (10%): 40% polyamide, 59% copper, 1% SnPb (60/40)
- **IR emitting diode**
  - **Epoxy resin** (34.5%)
  - 50.0% resin
  - 50.0% hardener
  - Traces of N, Fe, C, Cl
- **Lead frame** (65.2%)
  - 98.8% copper
  - 1.2% iron
  - Traces of Ni, Ag, Zn, P, Cd
- **IR photodetector**
  - **Epoxy resin** (29%)
  - 50.0% resin
  - 50.0% hardener
  - Traces of Fe, C, Cl
- **Lead frame** (70.7%)
  - 89.0% iron
  - 4.1% copper
  - 2.4% silver
  - 4.5% SnPb
  - Traces of Ni, Zn, P
- **Bond wire** (< 0.1%)
  - 99.99% gold
  - Traces of Be, Mg
- **IR Photodetector** (< 0.1%)
  - 99.0% silicon
  - Traces of Ag, Al, Au, Sb, Ti, SiO₂
- **Silver epoxy** (< 0.1%)
  - 80.0% silver
  - 10% resin
  - 10% hardener
  - Traces of Cl, Na, K

---

**Significant Materials for Disposal**

<table>
<thead>
<tr>
<th>No.</th>
<th>Material and/or Group ¹)</th>
<th>C</th>
<th>T</th>
<th>H</th>
<th>W</th>
<th>Available in the Compound Used for</th>
<th>Part in ²)</th>
<th>Weight Percent</th>
<th>L</th>
<th>D</th>
<th>M</th>
<th>N</th>
<th>T</th>
<th>H</th>
</tr>
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<tbody>
<tr>
<td>1</td>
<td>Arsenic</td>
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<td>●</td>
<td>●</td>
<td>●</td>
<td>Chip</td>
<td></td>
<td></td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>2</td>
<td>Lead and -compounds</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>Lead frame</td>
<td></td>
<td></td>
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</tbody>
</table>

Note: ¹), ²), ³¹), ³²), CMT, T etc.: see ‘Explanation of Abbreviations’, page 2
Package form 25:

- **Housing**
  100% Polycarbonate
- **IR emitting diode**
  - **Epoxy resin** (34.5%)
  50.0% resin
  50.0% hardener
  Traces of N, Fe, C, Cl
  - **Lead frame** (65.2%)
  98.8% copper
  1.2% iron
  Traces of Ni, Ag, Zn, P, Cd
- **IR emitting diode**
  (0.2%)
  50.0% gallium
  50.0% arsenic and phosphorus
  Traces of Al, Au, Zn, Si₃N₄
  - **Silver epoxy** (< 0.1%)
  80% silver
  10% resin
  10% hardener
  Traces of Cl, Na, K
- **IR photodetector**
  - **Epoxy resin** (29%)
  50.0% resin
  50.0% hardener
  Traces of Fe, C, Cl
  - **Lead frame** (70.7%)
  89.0% iron
  4.1% copper
  2.4% silver
  4.5% SnPb
  Traces of Ni, Zn, P
  - **Bond wire** (< 0.1%)
  99.9% gold
  Traces of Be, Mg
  - **IR Photodetector** (< 0.1%)
  99.0% silicon
  Traces of Ag, Al, Sb, Ti, SiO₂
  - **Silver epoxy** (< 0.1%)
  80.0% silver
  10.0% resin
  10.0% hardener
  Traces of Cl, Na, K

**Significant Materials for Disposal**

<table>
<thead>
<tr>
<th>No.</th>
<th>Material and/or Group ¹)</th>
<th>C</th>
<th>T</th>
<th>H</th>
<th>W</th>
<th>Available in the Compound Used for</th>
<th>Part in ²)</th>
<th>Weight Percent</th>
<th>L</th>
<th>D</th>
<th>M</th>
<th>N</th>
<th>T</th>
<th>H</th>
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<tbody>
<tr>
<td>1</td>
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<td>Traces</td>
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<tr>
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</table>

Note: ¹), ²), ³), ⁴), ⁵), CMT, T etc.: see ‘Explanation of Abbreviations’, page 2
Package form 26:

Molding Compound (77.6%)
71.4% SiO₂
26% Epoxy resin
1.6% Sb
(as antimony trioxide)
Traces of
N,F,Fe,C,Cl

Lead frame (65.2%)
58% copper
42% nickel
Traces of
Ag, Zn, P, Cd

Emitter – Chip (<0.1%)
50.0% gallium
50.0% arsenic and phosphorus
Traces of
Al, Au, Zn, Ge, Si₃N₄

Significant Materials for Disposal

<table>
<thead>
<tr>
<th>No.</th>
<th>Material and/or Group</th>
<th>C</th>
<th>T</th>
<th>H</th>
<th>W</th>
<th>Available in the Compound</th>
<th>Part in Weight Percent</th>
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<td>Antimony and -compounds</td>
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<td>●</td>
<td>●</td>
<td>Mold</td>
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</tr>
</tbody>
</table>

Package form 27:

Epoxy resin (25%)
50% resin
50% hardener
Traces of Fe, C, Cl

Lead frame (75%)
96% copper
2% iron
2% silver
Traces of Ni, Zn, P, Cd

Detector chip (<0.1%)
99% silicon
Traces of Ag, Al, Au, Sb, Ti, SiO₂

Significant Materials for Disposal

<table>
<thead>
<tr>
<th>No.</th>
<th>Material and/or Group</th>
<th>C</th>
<th>T</th>
<th>H</th>
<th>W</th>
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<th>Part in Weight Percent</th>
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<td>●</td>
<td>Lead plating</td>
<td>0.1</td>
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</tbody>
</table>

Note: *) , **) , ***) , 1) , 2) , CMT , T etc.: see ‘Explanation of Abbreviations’, page 2
Package form 28:

Vishay Semiconductors

Epoxy resin (30%)
50% resin
50% hardener
Traces of Fe, C, Cl

Lead frame (70%)
90% iron
4% copper
2% silver
4% SnPb
Traces of Ni, Zn, P, Cd***

Silver epoxy (< 0.1%)
80% silver
10% resin
10% hardener
Traces of Cl, Na, K

LED chip (< 0.1%)
50% gallium
50% arsenic and phosphorus
Traces of Al, Au, Zn, Ge, In, Ti

IR chip (0.1%)
50% gallium
50% arsenic
Traces of Al, Au, Zn, Ge, Ti

Detector chip (< 0.1%)
99% silicon
Traces of Ag, Al, Au, Sb, Ti, SiO2

Bond wire (< 0.1%)
99.99% gold
Traces of Be, Mg

Significant Materials for Disposal

<table>
<thead>
<tr>
<th>No.</th>
<th>Material and/or Group 1)</th>
<th>Available in the Compound Used for</th>
<th>Part in 2) Weight Percent</th>
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<th>D</th>
<th>M</th>
<th>N</th>
<th>T</th>
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<td>● Lead plating</td>
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<td>●</td>
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</tbody>
</table>

Package form 29:

Epoxy resin (55.0%)
50% resin
50% hardener

Lead frame (44.7%)
96% copper
2% iron
2% silver
Traces of Ni, Ag, Zn, P, Cd***

Silver epoxy (< 0.1%)
80% silver
10% resin
10% hardener
Traces of Cl, Na, K

IR chip (< 0.1%)
50.0% gallium
50.0% arsenic
Traces of Al, Au, Zn, Ge, Ti

Detector chip (< 0.1%)
99.9% silicon
Traces of Ag, Al, Au, Sb, Ti, SiO2

Bond wire (< 0.1%)
99.99% gold
Traces of Be, Mg

Significant Materials for Disposal

<table>
<thead>
<tr>
<th>No.</th>
<th>Material and/or Group 1)</th>
<th>Available in the Compound Used for</th>
<th>Part in 2) Weight Percent</th>
<th>L</th>
<th>D</th>
<th>M</th>
<th>N</th>
<th>T</th>
<th>H</th>
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<td>● Lead plating</td>
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</tbody>
</table>

Note: *) , **) , ***) , 1) , 2) , CMT , T etc.: see ‘Explanation of Abbreviations’, page 2
Package form 30:

**Epoxy resin (50%)**
- 50% resin
- 50% hardener
- Traces of Fe, C, Cl

**Lead frame (50%)**
- 96% copper
- 2% iron
- 2% silver
- Traces of Ni, Zn, P, Cd

**Bond wire (< 0.1%)**
- 99.99% gold
- Traces of Be, Mg

**Detector chip (< 0.1%)**
- 99% silicon
- Traces of Ag, Al, Ni, Ti, V

**Silver epoxy (< 0.1%)**
- 80% silver
- 10% resin
- 10% hardener
- Traces of Cl, Na, K

Total weight 400 mg

**Significant Materials for Disposal**

<table>
<thead>
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<th>No.</th>
<th>Material and/or Group 1)</th>
<th>C</th>
<th>T</th>
<th>H</th>
<th>W</th>
<th>Available in the Compound Used for</th>
<th>Part in 2)</th>
<th>Weight Percent</th>
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</thead>
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<td></td>
<td></td>
<td>Lead plating</td>
<td>0.1</td>
<td>● ● ● ● ● ●</td>
</tr>
</tbody>
</table>

Note: *) , **) , ***) , 1) , 2) , CMT , T etc.: see ‘Explanation of Abbreviations’, page 2

Package form 31:

**Epoxy resin (55.0%)**
- 55.5% resin
- 44.5% hardener

**Lead frame (43.7%)**
- 98.8% copper
- 1.2% iron
- Traces of Ni, Ag, Zn, P, Cd

**Photo diode chip (< 0.1%)**
- 99.0% silicon
- Traces of As, Al, Ni, Ti, V

**IR chip (< 0.1%)**
- 50% gallium
- 50% arsenic
- Traces of Al, Au, Zn, Ge, Ti

**Bond wire (< 0.1%)**
- 99.99% gold
- Traces of Be, Mg

**Silver epoxy (< 0.1%)**
- 80% silver
- 10% resin
- 10% hardener
- Traces of Cl, Na, K

Total weight 120 mg

**Significant Materials for Disposal**

<table>
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<th>No.</th>
<th>Material and/or Group 1)</th>
<th>C</th>
<th>T</th>
<th>H</th>
<th>W</th>
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<th>Part in 2)</th>
<th>Weight Percent</th>
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<td>M</td>
<td>O</td>
<td>A</td>
<td>G</td>
<td>Mold</td>
<td>54.5</td>
<td>● ● ● ● ● ●</td>
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</tbody>
</table>

Note: *) , **) , ***) , 1) , 2) , CMT , T etc.: see ‘Explanation of Abbreviations’, page 2
Package form 32:

Total weight 102 mg

Epoxy molding compound (74%)
Lead frame (26%)
98.8% copper
1.2% Fe
Traces of Ni, Ag, Zn, P, Cd***
Emitter (0.001%)
50.0% Ga
50.0% Al + As
Traces of Au
Bond wire (< 0.1%)
99.99% gold

Conductive Epoxy
(< 0.1%)
78.0% silver
22.0% epoxy
IC chip (0.02%)
99.0% silicon
Traces of Al, Si₃N₄, SiO₂
Detector chip (0.01%)
99% silicon
Traces of Al, Si₃N₄, SiO₂

Significant Materials for Disposal

<table>
<thead>
<tr>
<th>No.</th>
<th>Material and/or Group</th>
<th>C</th>
<th>T</th>
<th>H</th>
<th>W</th>
<th>Available in the Compound</th>
<th>Part in Weight</th>
<th>L</th>
<th>D</th>
<th>M</th>
<th>N</th>
<th>T</th>
<th>H</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>Lead and lead compounds</td>
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<td>•</td>
<td>•</td>
<td>•</td>
<td>Lead plating</td>
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<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
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</tbody>
</table>

Package form 33:

Total weight 203 mg

Epoxy molding compound (73.5%)
Lead frame (26.4%)
98.8% copper
1.2% Fe
Traces of Ni, Ag, Zn, P, Cd***
Emitter chip (0.001%)
54.0% As
43.0% Ga
3.0% Al
Traces of Au
Bond wire (< 0.1%)
99.99% gold

Conductive Epoxy
(< 0.1%)
78.0% silver
22.0% epoxy
IC chip (0.02%)
99.0% silicon
Traces of Al, Si₃N₄, SiO₂
Detector chip (0.01%)
99% silicon
Traces of Al, Si₃N₄, SiO₂

Significant Materials for Disposal

<table>
<thead>
<tr>
<th>No.</th>
<th>Material and/or Group</th>
<th>C</th>
<th>T</th>
<th>H</th>
<th>W</th>
<th>Available in the Compound</th>
<th>Part in Weight</th>
<th>L</th>
<th>D</th>
<th>M</th>
<th>N</th>
<th>T</th>
<th>H</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Lead and lead compounds</td>
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<td>•</td>
<td>•</td>
<td>•</td>
<td>Lead plating</td>
<td>0.1</td>
<td>•</td>
<td>•</td>
<td>•</td>
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<td>•</td>
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</tbody>
</table>

Note: *) , **) , ***) , 1) , 2) , CMT, T etc.: see ‘Explanation of Abbreviations’, page 2
Package form 34:  
TFDT4xxx, TFDT5xxx, TFDT6xxx  
Top View

Epoxy molding compound (73.5%)  
Bond wire (< 0.1%)  
99.99% gold

Lead frame (26.4%)  
98.8% copper  
1.2% Fe  
Traces of Ni, Ag, Zn, P, Cd***

Emitter chip (0.001%)  
54.0% As  
43.0% Ga  
3.0% Al  
Traces of Au

Conductive Epoxy (< 0.1%)  
78.0% silver  
22.0% epoxy

IC chip (0.02%)  
99.0% silicon  
Traces of Al, Si₃N₄, SiO₂

Detector chip (0.01%)  
99% silicon  
Traces of Al, Si₃N₄, SiO₂

Significant Materials for Disposal

<table>
<thead>
<tr>
<th>No.</th>
<th>Material and/or Group 1)</th>
<th>C M T H W</th>
<th>Available in the Compound Used for</th>
<th>Part in 2)</th>
<th>Weight Percent L D M N T H</th>
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<tbody>
<tr>
<td>1</td>
<td>Lead and lead compounds</td>
<td>●</td>
<td>Lead plating</td>
<td>0.1</td>
<td>● ● ●</td>
</tr>
</tbody>
</table>

Note: *, **, ***, 1), 2), CMT, T etc.: see ‘Explanation of Abbreviations’, page 2

Package form 35:  
TFDS4xxx, TFDS5xxx, TFDS6xxx  
Side View

Epoxy molding compound (73.5%)  
Bond wire (< 0.1%)  
99.99% gold

Lead frame (26.4%)  
98.8% copper  
1.2% Fe  
Traces of Ni, Ag, Zn, P, Cd***

Emitter chip (0.001%)  
54.0% As  
43.0% Ga  
3.0% Al  
Traces of Au

Conductive Epoxy (< 0.1%)  
78.0% silver  
22.0% epoxy

IC chip (0.02%)  
99.0% silicon  
Traces of Al, Si₃N₄, SiO₂

Detector chip (0.01%)  
99% silicon  
Traces of Al, Si₃N₄, SiO₂

Significant Materials for Disposal

<table>
<thead>
<tr>
<th>No.</th>
<th>Material and/or Group 1)</th>
<th>C M T H W</th>
<th>Available in the Compound Used for</th>
<th>Part in 2)</th>
<th>Weight Percent L D M N T H</th>
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</thead>
<tbody>
<tr>
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<td>Lead and lead compounds</td>
<td>●</td>
<td>Lead plating</td>
<td>0.1</td>
<td>● ● ●</td>
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</tbody>
</table>

Note: *, **, ***, 1), 2), CMT, T etc.: see ‘Explanation of Abbreviations’, page 2
Package form 36:

TFDS–Dracula Side View

Total weight 224 mg

Epoxy molding compound (73.5%)
Lead frame (26.4%)
98.8% copper
1.2% Fe
Traces of Ni, Ag, Zn, P, Cd
Emitter chip (0.001%)
54.0% As
43.0% Ga
3.0% Al
Traces of Au

Bond wire (< 0.1%)
99.99% gold
Conductive Epoxy (< 0.1%)
78.0% silver
22.0% epoxy
IC chip (0.02%)
99.0% silicon
Traces of Al, Si₃N₄, SiO₂
Detector chip (0.01%)
99% silicon
Traces of Al, Si₃N₄, SiO₂

Significant Materials for Disposal

<table>
<thead>
<tr>
<th>No.</th>
<th>Material and/or Group 1)</th>
<th>C T H W</th>
<th>Available in the Compound Used for</th>
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<td>Lead and lead compounds</td>
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<td>• Lead plating</td>
</tr>
</tbody>
</table>

Note: *) , **) , ***) , 1) , 2) , CMT , T etc.: see ‘Explanation of Abbreviations’, page 2

Package form 37:

TOIM3000, TOIM3232 SO16 Package

Total weight 150 mg

Epoxy molding compound (55.0%)
72.0% SiO₂
25.5% epoxy resin
1.5% Sb (as anti-
mony trioxide) **
1.0% Br (no TBA) ”
Lead frame (40.1%)
98.8% copper
2.0% iron
Traces of Pb, Sn, Cd

Silver epoxy (1.4%)
70.0% silver
30.0% epoxy resin
Silicon chip (3.2%)
99% silicon
0.7% SiO₂, Si₃N₄
0.3% aluminium
Traces of As, B, P, Ti
Bond wire (<0.1%)
99.99% gold

Significant Materials for Disposal

<table>
<thead>
<tr>
<th>No.</th>
<th>Material and/or Group 1)</th>
<th>C M T H W</th>
<th>Available in the Compound Used for</th>
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<tbody>
<tr>
<td>1</td>
<td>Antimony and –compounds</td>
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<td>2</td>
<td>Orgo–bromide compounds</td>
<td>•</td>
<td>• Mold</td>
</tr>
</tbody>
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Note: *) , **) , ***) , 1) , 2) , CMT , T etc.: see ‘Explanation of Abbreviations’, page 2