

**Automotive Industry Interpretation Guide for ELV Annex II
(2010/115/EU)**

with

IMDS Information added by the IMDS Steering Committee

This guiding principles are common Automotive Industry understanding

Based upon the ACEA / JAMA / KAMA et el documentation.

IMDS Information added by the IMDS Steering Committee

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IMDS REPORTING Preface

The new electrical applications detailed in Annex II of the ELV, require the OEMs to gather additional information (via IMDS) on the uses of lead in electronic modules for new vehicle types, in order to satisfy their legal obligations.

To enable information on the new applications listed in Annex II, additional application codes are available in IMDS (see Table 1).

Automotive manufacturers will provide their Tier 1 suppliers with a list of parts that will be present on "New Vehicle Types", coming in to production after December 31st, 2010.

IMDS entries for carry-over parts identified for these vehicles must be resubmitted, identifying applicable application codes 8a, 8b, 8c, 8d and 8i.

New IMDS entries for these parts must identify ALL applicable application codes.

PLEASE REFER TO TABLE 2 FOR ADDITIONAL GUIDANCE.

The applications must be entered accurately with care as legal compliance is derived from them.

It is the OEMs responsibility to inform their Tier 1 Supplier and Directed Supplier if the intended part is for a "New Vehicle Type".

In general, the OEM should provide a list of affected parts to the Tier 1 supplier at least 6 months before the IMDS record is required (a late request may result in a late submission, due to the time taken to gather this data).

It is the Tier 1 Supplier's responsibility to manage this requirement within their supply chain to ensure that they provide the required information.

The current application code of **"Solder in electronic circuit boards and other electric applications"** will remain valid for parts in current production.

This application code will not be permitted if these parts are subsequently used on a "New Vehicle Type" and therefore, an update of the IMDS information will be required.

Application Code	OLD / NEW	Comments
Solder in electronic circuit boards and other electric applications	OLD	Application code NOT TO BE USED for New Vehicle Types or NEWLY created MDS Modules (refer to handling matrix).
Lead in solder used in electronic circuit board applications.....8a)	NEW	Application must be identified if present on a New Vehicle Type and on a NEWLY created MDS module (refer to handling matrix).
Lead in solders in electrical applications other than soldering on electronic circuit boards or on glass - 8b)	NEW	Application must be identified if present on a New Vehicle Type and on a NEWLY created MDS module (refer to handling matrix).
Lead in finishes on terminals of electrolyte aluminium capacitors - 8c)	NEW	Application must be identified if present on a New Vehicle Type and on a NEWLY created MDS module (refer to handling matrix).
Lead used in soldering on glass in mass airflow sensors - 8d)	NEW	Application must be identified if present on a New Vehicle Type and on a NEWLY created MDS module (refer to handling matrix).
Lead in high melting temperature type solders (i.e. lead-based alloys containing 85 % by weight or more lead) - 8e)	NEW	Application must be identified according to 2010 REC019 (refer to handling matrix)
Lead in compliant pin connector systems - 8f)	NEW	Application must be identified according to 2010 REC019 (refer to handling matrix)
Lead in solders to complete a viable electrical connection between semiconductor die and carrier within integrated circuit flip chip packages - 8g)	NEW	Application must be identified according to 2010 REC019 (refer to handling matrix)
Lead in solder to attach heat spreaders to the heat sink in power semiconductor assemblies.....8h)	NEW	Application must be identified according to 2010 REC019 (refer to handling matrix)
Lead in solders in electrical glazing applications on glass except for soldering in laminated glazing - 8i)	NEW	Application must be identified if present on a New Vehicle Type and on a NEWLY created MDS module (refer to handling matrix).
Lead in solders for soldering in laminated glazing - 8j)	NEW	Application must be identified according to 2010 REC019 (refer to handling matrix)

Table 1: Active IMDS Application Codes for electronic modules.

Case #	Submission Type	IMDS INITIALLY CREATED	Electronic components and PCB's	Comments
	Initial			
A1a	Newly created IMDS Module	Before REC019 2010 release	1) Use Current version of REC019 2) Used newest version of IMDS SC Materials in REC 019 3) The following Application Codes MUST be identified where present: 8a - PCB solders 8b - Non-PCB solders 8c - Lead in terminals of ELKO's 8d - Lead in soldering on glass of mass airflow sensors 8i - Lead in solder in electric glazing applications	If the information is available, suppliers are encouraged to identify the remaining applications where present. Pre - 2010 Application code of "Solder in electronic circuit boards and other electric applications" NOT PERMITTED
A1b	Newly created MDS Module	After REC019 2010 release	1) Use UPDATED REC019 2) No IMDS SC Materials to be used 3) APPLICATION CODES according to 2010 REC019 to be identified.	IMDS SC PCB materials to be deactivated. As the information becomes available, suppliers must identify remaining application codes.
A2	Tier 1 ASSEMBLY - NOT present in New Type Approval from 2011 onwards.	Any time	1) Use REC019 applicable for scenario A1a or A1b. 2) May contain Old Declarations (Pre-2010 application codes for older MDS's) and New Application Codes according to A1	Example: This scenario covers a new seat assembly for a current 2012 model that does not need a new Type Approval. The newly created MDS Modules will comply with A1a. The carry over MDS modules will still be permitted.
A3	Tier 1 ASSEMBLY - PRESENT in New Type Approval from 2011 onwards.	Any time	1) Use REC019 applicable for scenario A1a or A1b. 2) Must NOT contain pre 2010 Application code 3) OLD MDS's be revised according to A1	OEMs to communicate list of Part Numbers to Tier 1 Suppliers. Pre - 2010 Application code of "Solder in electronic circuit boards and other electric applications" NOT PERMITTED Example: For the seat assembly - old MDS's with the above application code will need to be redefined according to A1a or A1b.
	re-submissions			
B1	Carry over MDS Module - PRESENT in New Type Approval from 2011 onwards.	Before REC019 2010 release	Resubmission needed to A1a requirements	Tier 1's to cascade requirement through their responsible supply chain to enable the Tier 1 resubmission. Pre - 2010 Application code of "Solder in electronic circuit boards and other electric applications" NOT PERMITTED
B2	Carry over MDS Module - NOT present in New Type Approval from 2011 onwards.	Before REC019 2010 release	1) no re submission required for application update 2) it will still be allowed to use IMDS SC PCB as currently (2010/03) existing, even after revision of Rec019 has been released	Pre - 2010 Application code of "Solder in electronic circuit boards and other electric applications" IS ALLOWED
B3	Carry over MDS Module - PRESENT in New Type Approval from 2011 onwards.	After REC019 2010 release	This is scenario A1b	

Table 2: Supplier guidance on the handling on new electronic application codes.

Definition/interpretation of - Exemption 8a)

*8(a).Lead in solders to attach **electrical and electronic components** ¹⁾ to **electronic circuit boards** ⁵⁾ and **lead in finishes on terminations of components** ²⁾ other than electrolyte aluminium capacitors, (finishes) **on component pins** ³⁾ and (finishes) **on electronic circuit boards** ⁴⁾.*

>>> **Vehicles type approved before 1 January 2016 and spare parts for these vehicles**

2010_115 EC IMDS APPLICATION CODE:

Lead in solder used in electronic circuit board applications.....8a)

To better understand what is meant here and what is in scope, the single elements of this exemption are defined separately.

1) ... electrical and electronic components ... in this context are all components (elements) which are soldered to the ECB and which cannot be removed mechanically without destroying the board or unsoldering the components.

Examples of such components are:

a) **passive elements**

like inductors, magnetics, ferrite, resistors, thermistors, varistors, polyswitches, capacitors (ceramic, tantalum, electrolytic, film), quartz, resonators, etc.



Fig. 1:Passive Electronic Components

b) active elements

like discrete circuits (diodes, thyristors, transistors, MOS-FET, etc.), integrated circuits, power semiconductors (thyristors, IGBT's, MOS-FET's) any other performance module, etc.

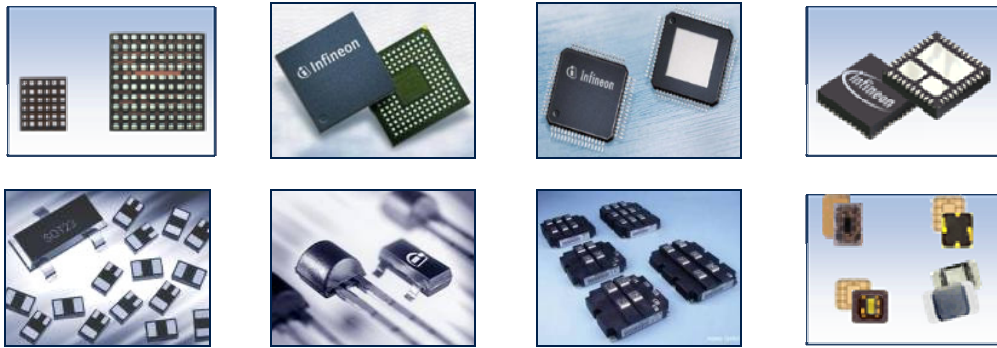


Fig. 2: Active electronic Components

c) and others

like terminals, heat sinks, relays, pins, sockets, plugs, and sensors as well as other electromechanical components /devices suitable to be used on a board .

Components in themselves can have ECB's with components like IC's, resistors, capacitors. Examples of such components are actuators and sensors.

2) ... lead in finishes on terminations of components... are all kind of lead containing coatings/finishes on terminations of these components (e.g. the "legs" of a performance module)

3) ... (lead in finishes) on component pins... are coatings on the pins of these components (e.g. the thin wire "wire legs" of resistors, diodes)

4)... (lead in finishes) on electronic circuit boards are all kind of lead containing coatings on the ECB/PWB itself.

5) Electronic Circuit Board (ECB) is the main term for both **Printed Circuit Board (PCB)** and **Printed wiring Board (PWB)**

See pictures as examples for:

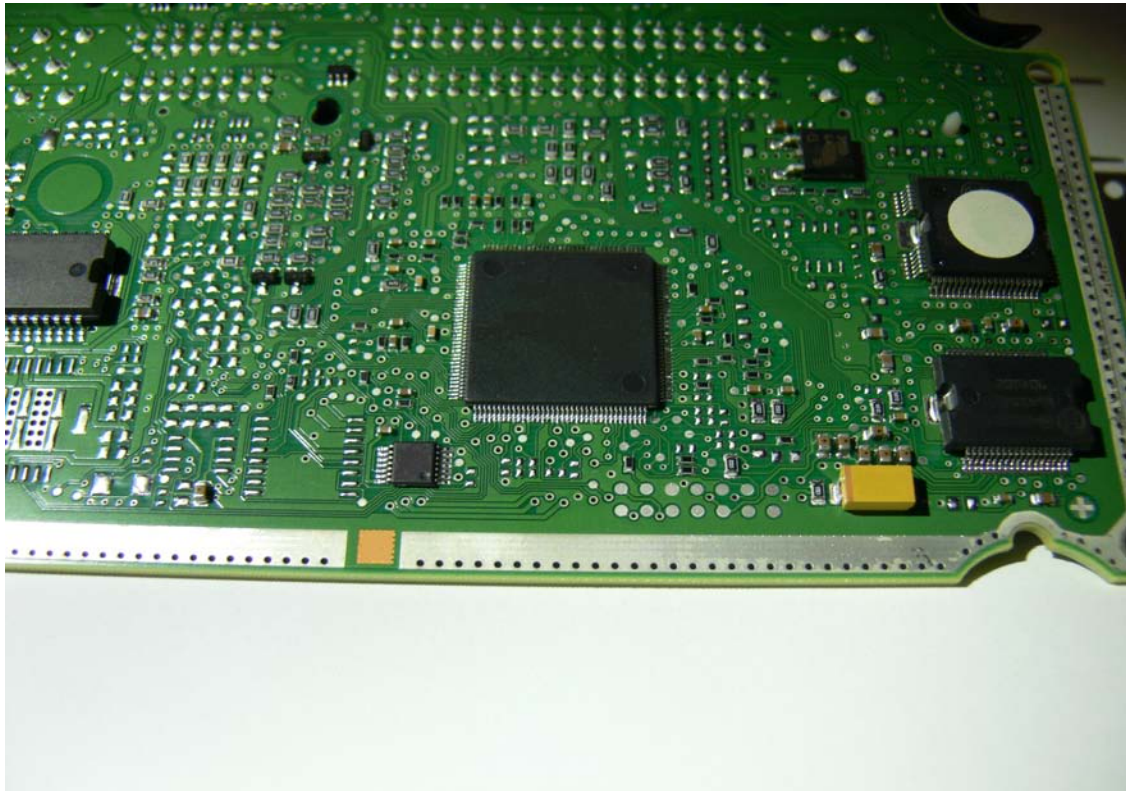


Fig. 3: Typical ECB (separated)

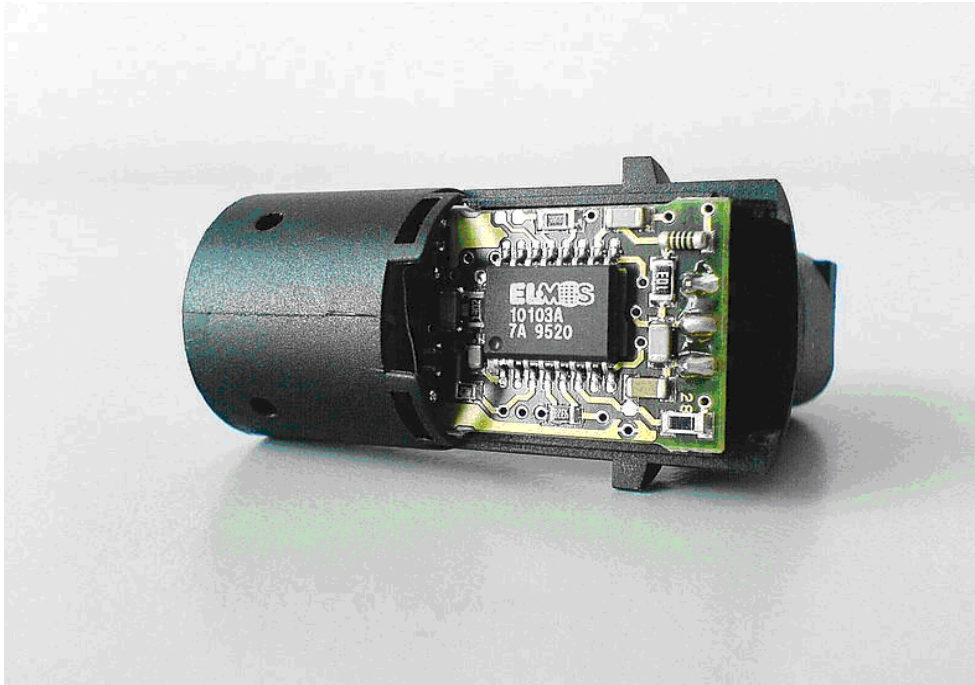


Fig. 4: Small ECB in a part

A **Printed Circuit Board (PCB)** is a printed board used to **mechanically support** and providing both, electrical point to point connections **and printed components** in a predetermined arrangement, using **conductive pathways, or traces**, e.g. etched from copper sheets **laminated onto a non-conductive substrate**.

A **PCB** populated with electronic components (mounted and/or interconnected) is also known as a **Printed Circuit Board Assembly (PCBA)**.

The main **elements of a PCB** as defined as follows:

Printed Board (PB) is the general term for completely processed printed circuit and printed wiring configurations.

This includes single-sided, double-sided and multilayer boards with rigid, flexible, and rigid-flex base materials. **The geometry may be flat or 3D.**

The material used is not a relevant distinguishing criterion.

Printed Circuit is a conductive pattern that is composed of printed components, printed wiring, discrete wiring, or a combination thereof, that is formed in a predetermined arrangement on a common base.

Printed Component is a part (such as an inductor, resistor, capacitor, or transmission line) that is formed as part of the conductive pattern of a printed board.

The following variants belong to the group of ECB's

- FPC (flexible printed Circuits)
- Ceramics:
 - LTCC (low temperature co-fired ceramics)
 - DCB / DBC (direct copper bonding / direct bonding copper)
 - thick film circuits
 - thin film circuits
- leadframes

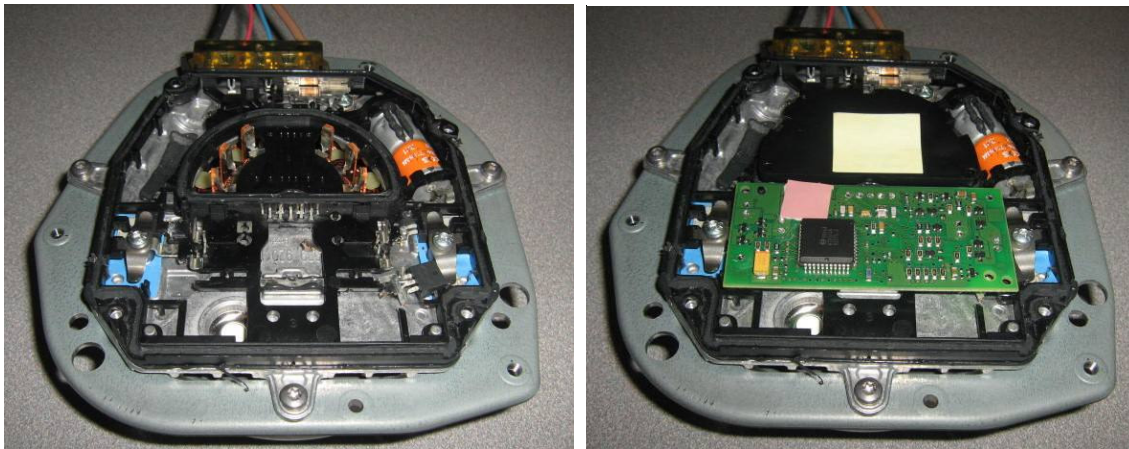


Fig. 5: Lead frame for a brushless motor

left: without the PCB

right: with the PCB



Fig. 6: Lead frame for a control knob to adjust the headlight height

left: topside

right: downside

A **Printed Wiring Board (PWB)** is a printed board used to **mechanically support** and providing electrical point to point connections **but not printed components** in a predetermined arrangement, using **conductive pathways, or traces**, etched from copper sheets **laminated onto a non-conductive substrate**.

A **PWB** populated with electronic components (mounted and/or interconnected) is also known as a **Printed Wiring Board Assembly (PWBA)**.

The main **elements of a PCB** as defined as follows.

Printed Wiring is a conductive pattern that provides point-to-point connections but not printed components in a predetermined arrangement on a common base.

Printed Contacts (portion of a conductive pattern that serves as one part of a contact system) and **Conductive Inks** can be used on both, **PWB** and **PCB** and are therefore covered by the definition of **Electronic Circuit Board (ECB)**.

All components (see description, examples and pictures above) as well as **terminals and sockets** for plug in cables which are soldered to the ECB and which cannot be removed mechanically without destroying the board are also included in the definition of **Electronic Circuit Board (ECB)**.

Housings, detachable connections (e.g. wires, connectors) or flexible flat wirings however, are not covered by the definition of Electronic Circuit Board

Definition/interpretation of - Exemption 8b)

8(b). Lead in solders in *electrical applications other than soldering on electronic circuit boards or on glass*

>>> Vehicles type approved before 1 January 2011 and spare parts for these vehicles

2010_115 EC IMDS APPLICATION CODE:

Lead in solders in electrical applications other than soldering on electronic circuit boards or on glass - 8b)

This exemption is related to electrical/ electronic applications which are not covered by 8a) or any other exemption 8c) to 8j).

It is basically the remaining “rest” for which no exemption has been granted.

It covers at least all discrete electrical/electronic components which are not directly soldered to the ECB. (See definition for 8a)

Roughly spoken, it are “normal” or even simple solder joints, mostly a single or just a few solder joints (most of them hand soldered) whereas a ECB has numerous of solder joints.

Those typical applications are as follows: E.g., wire sets, (pre soldering of) wire ends, actuators (solenoid valves, motors, valves) loudspeakers, Illuminations, switches*), sockets, contacts*), sensors*), transmitters, relays, pushbuttons, solder for attachments, etc. ... unless none of the exemptions 8c) to 8j) could be applied.

*) if on a board then 8a)

Following example may help to explain the difference between 8a) and 8b)

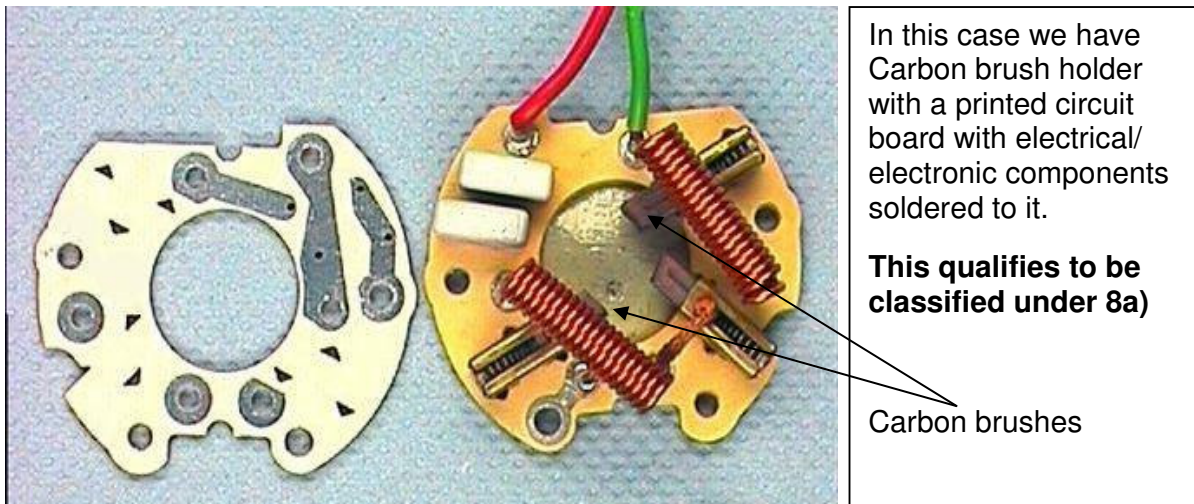


Fig. 7: Carbon Brush holder with a printed Circuit Board

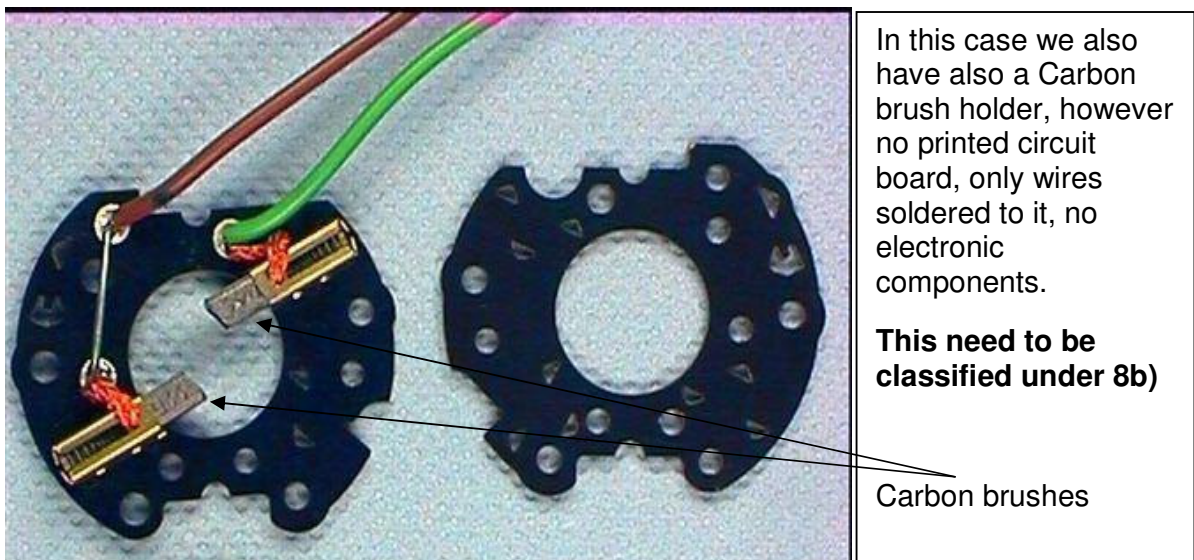


Fig. 8: Carbon Brush holder without a printed Circuit Board

Another example is shown below where the solder joint - pin to the ECB/PCB - falls under exemption 8a) but the simple solder joint - wire to the pin - (most hand soldered) and all other solder joints along the wire fall under exemption 8b).

► If a pin is soldered on a ECB, and c.g. a wire or a component is soldered to the pin

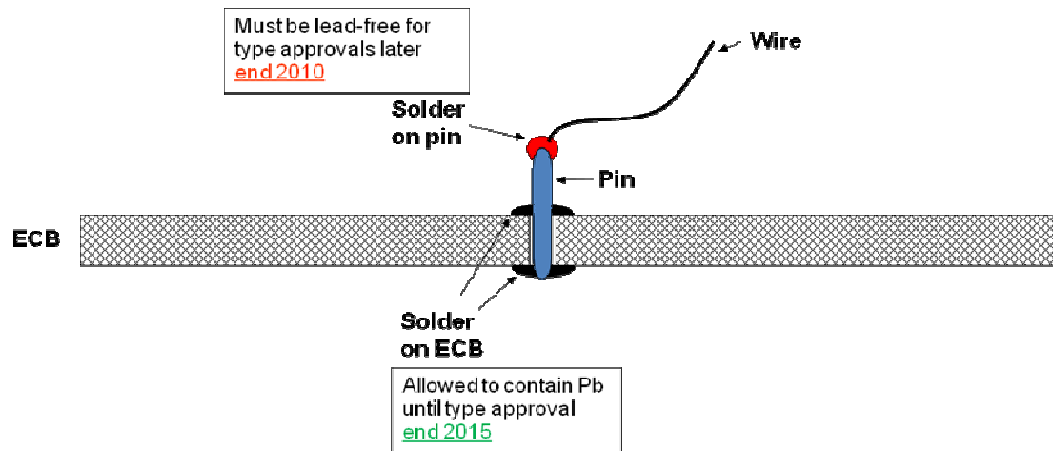


Fig. 9: Pin soldered to an ECB, and wire soldered to a pin

Definition/interpretation of - Exemption 8c)

8(c). *Lead in finishes on terminals of electrolyte aluminium capacitors*

>>> Vehicles type approved before 1 January 2013 and spare parts for these vehicles

2010_115 EC IMDS APPLICATION CODE:

Lead in finishes on terminals of electrolyte aluminium capacitors - 8c)

This is a very specific application and is self-explaining.

These Al-capacitors do also qualify to be covered under the “(lead in finishes) on component pins” of exemption 8a), however as there are lead free Al-capacitors out in the market, mainly for the consumer electronic, and they are not exempted under RoHS, just two more years implementation time have been granted.

See picture

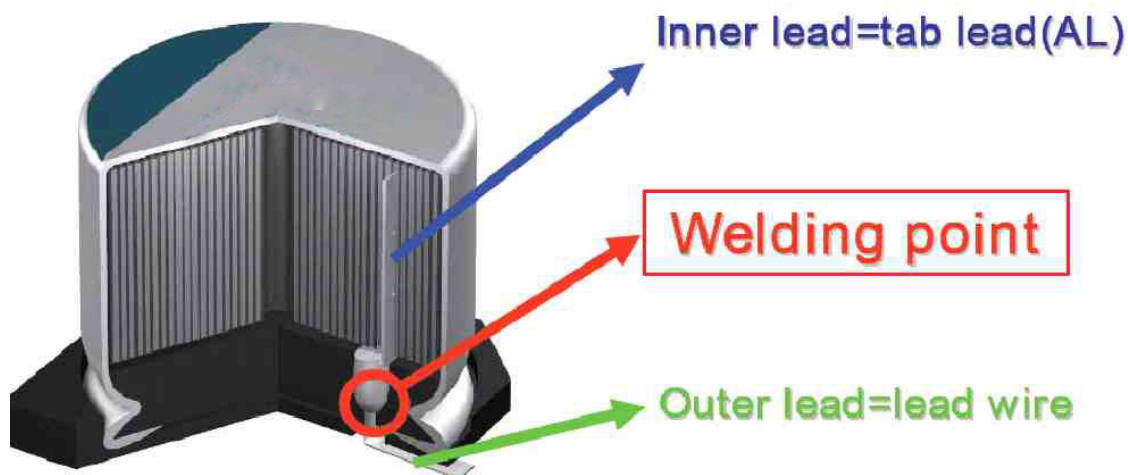


Fig. 10: Typical electrolyte capacitor

Definition/interpretation of - Exemption 8d)

8(d). Lead used in soldering on glass in mass airflow sensors

>>> Vehicles type approved before 1 January 2015 and spare parts of such vehicles

2010_115 EC IMDS APPLICATION CODE:

Lead used in soldering on glass in mass airflow sensors - 8d)

This is a very specific application and is obviously not self-explaining.

The Mass Airflow Sensor is used to measure the mass quantity of air entering an internal combustion engine. This information is used by the engine management system to optimize the combustion process in an engine with regard to fuel efficiency and emissions.

A flow sensing element consisting of an electrically heated hot film or hot-wire is heated to a defined offset temperature relative to the ambient temperature (determined by a separate temperature sensor). The power needed to keep the sensing element at the offset temperature is a measure of the mass air flow passing the sensor

The base material of the flow and temperature sensing elements must fulfill certain requirements. Among other requirements, a low thermal conductivity and the capability of thin film application is of critical importance for thin-film elements.

Glass is the ideal material to meet these requirements.

Due to the mechanical sensitivity of glass, the mechanical connection of the sensing element to a carrier must be chosen carefully, so that the glass is not damaged during processing and in use.

With the soldering process both the mechanical fixation of the element and the electrical connection to the thin-film can be achieved.

A typical application for solder on glass for non-glazing application is a mass airflow sensor.

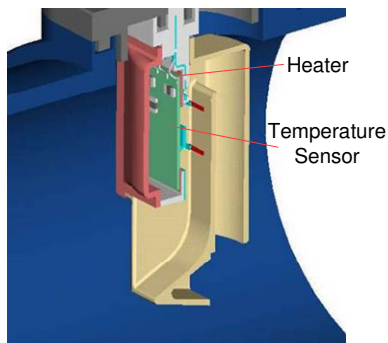
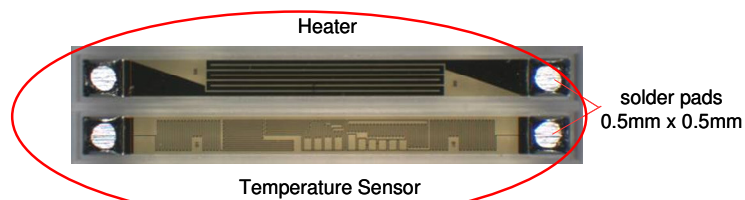


Fig.11: Cross-Section of a Mass Airflow Sensor in a tube

The solder reservoir is applied to the glass chips via solder-paste screen-printing & reflow soldering



The glass chips are soldered onto a carrier via stamp soldering

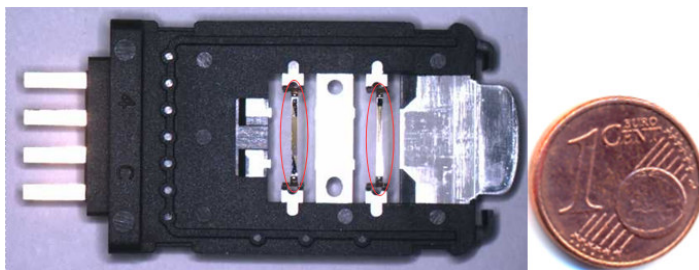


Fig.12: Solder joint on glass

Definition/interpretation of - Exemption 8e)

8(e). Lead in high melting temperature type solders (i.e. lead-based alloys containing 85 % by weight or more lead)

>>> **This exemption shall be reviewed in 2014.**

2010_115 EC IMDS APPLICATION CODE::

Lead in high melting temperature type solders (i.e. lead-based alloys containing 85 % by weight or more lead) - 8e)

This is a broad scope for all “high melting temperature type solder” with a melting point >250 °C. As the 85% lead content is mentioned as a minimum, any other, little lower lead containing solder alloy (e.g. around 80%) would not be covered under this exemption.

Remark: Composition of the solder material is the important, not the lead concentration in the solder joint. The latter one can be lower.

Typical applications are as follows: (As explained in our justifications)

1. Component Internal Connections

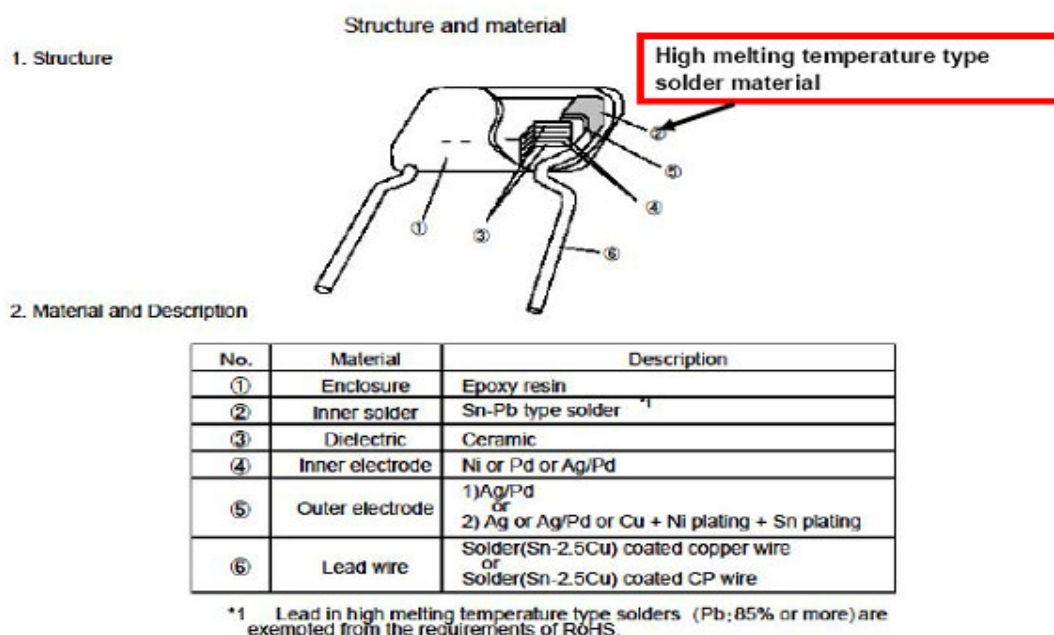


Fig.13: Leaded Capacitor – representative example component

2. Die Attach

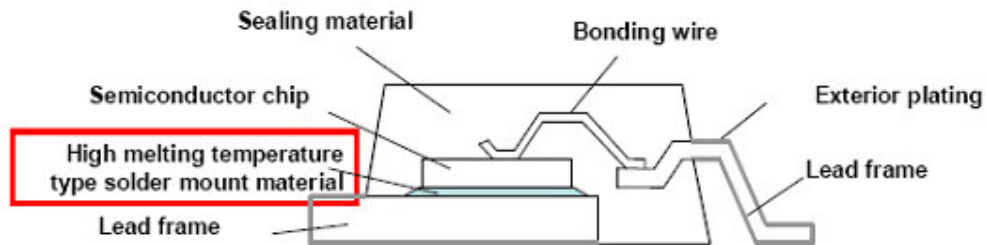


Fig.14: Power Semiconductor - representative example component

3. Hermetic sealing

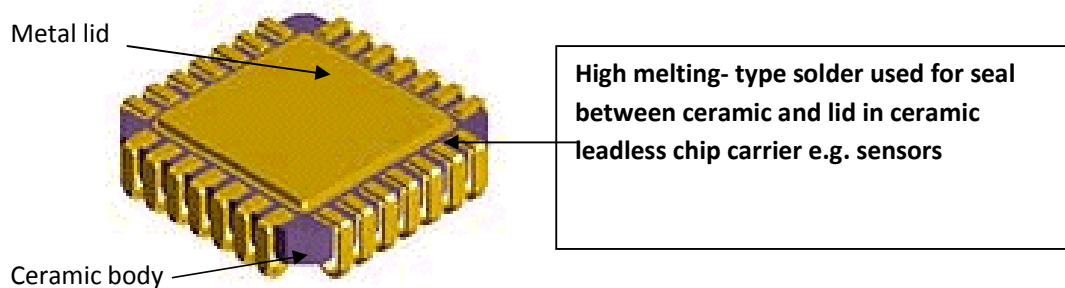


Fig.15: Ceramic Leadless Chip Carrier – representative example component

4. Plastic Overmoulding

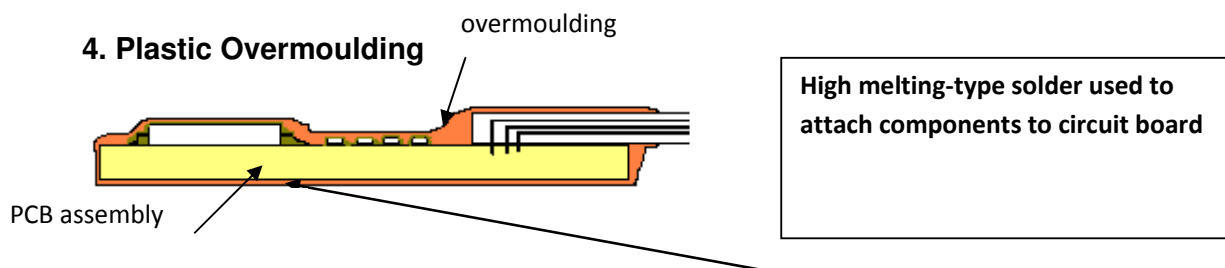


Fig. 16: Example Over moulded Component

5. Ceramic Ball Grid Array (CBGA)

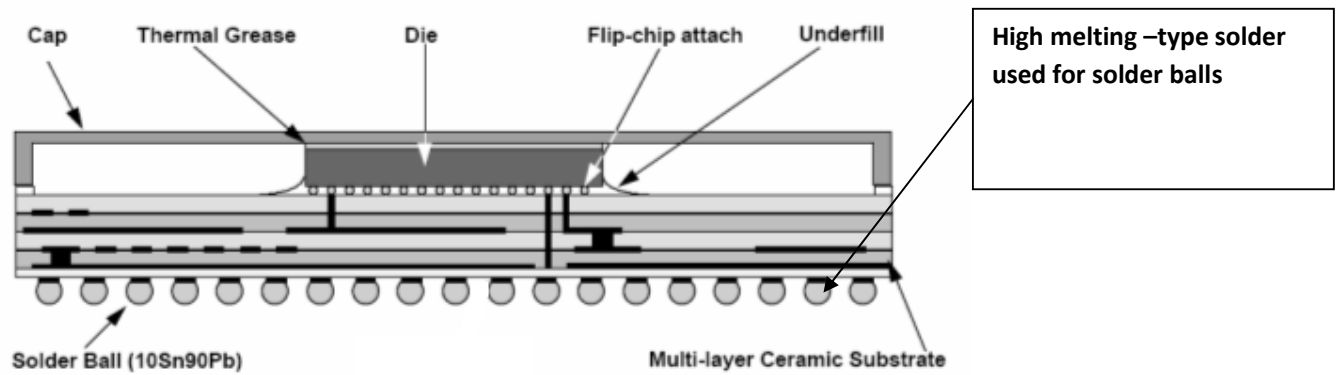


Fig.17: Ceramic Ball Grid Array - representative example component

6. High Power Applications

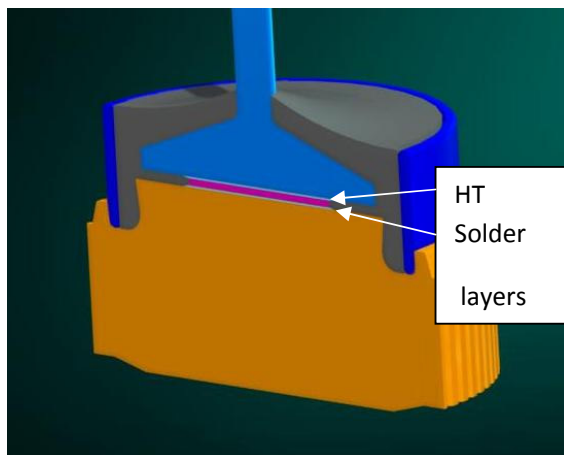


Fig.18: Generator Diode

7. Some other examples

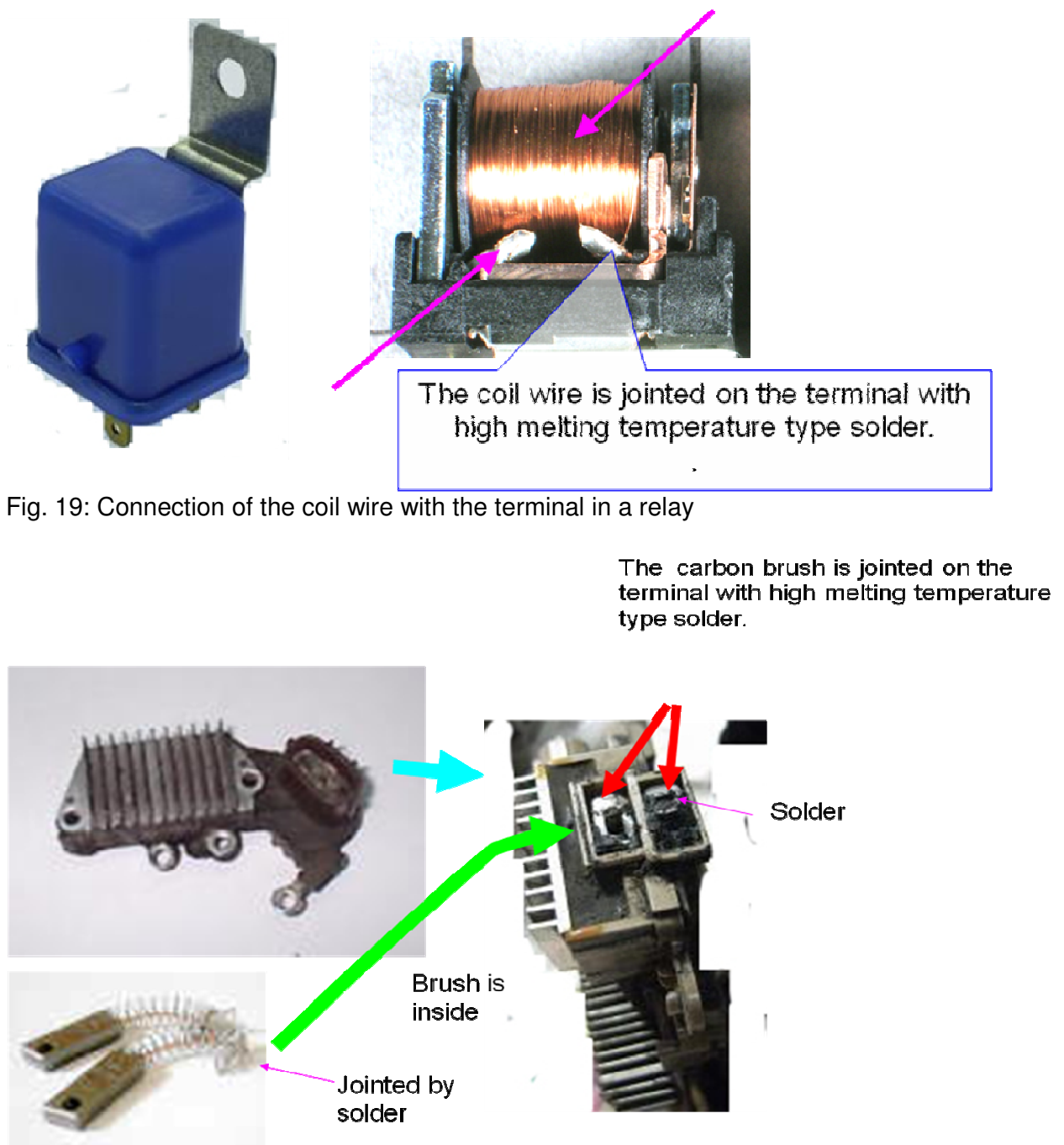


Fig. 20: Joint of carbon brushes in a motor or alternator

Other, not shown applications using HT solder are also covered by this exemption.

Definition/interpretation of - Exemption 8f)

8(f). Lead in compliant pin connector systems

>>> **This exemption shall be reviewed in 2014.**

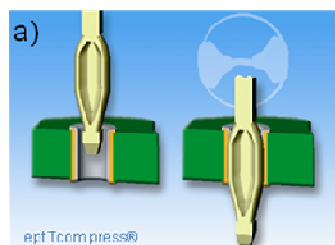
2010_115 EC IMDS APPLICATION CODE:

Lead in compliant pin connector systems - 8f)

Connectors are pressed into an ECB without soldering it. This application however, has a limited scope applicable e.g. it is impossible for high power electronics.

Lead is needed to suppress formation and growth of whiskers. No whiskers observed using galvanized SnPb instead of Sn on the press-fit pin

Press in terminals (with flex zone) are included in this exemption.



Press-Fit Types

- a) Querbinder (bow-tie)
- b) Nadelohr (eye of a needle)
- c) C-Press
- d) Action Pin

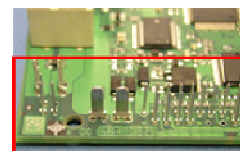
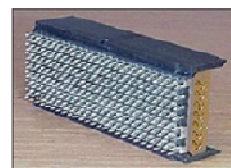
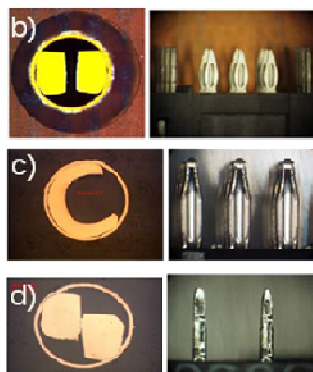


Fig. 21: Compliant pin connector types (press fit)

Fig. 22: Press fit assemblies

The following example is also covered by the “compliant pin connector systems” exemption, meaning the whole pin can have a lead-containing surface.

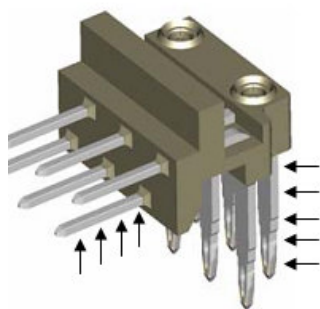


Fig 23: Compliant pin connector system with leaded pins (arrows)

Definition/interpretation of - Exemption 8g)

8(g). Lead in solders to complete a viable electrical connection between semiconductor die and carrier within integrated circuit flip chip packages

>>> This exemption shall be reviewed in 2014.

2010_115 EC IMDS APPLICATION CODE:

Lead in solders to complete a viable electrical connection between semiconductor die and carrier within integrated circuit flip chip packages - 8g)

Flip chip packages is a well proven technology that solves a wide range of micro-electronics packaging problems by mounting the semiconductors with the active side down.

Another feature of flip-chip technology is that it eliminates wire-bonding.

Flip Chips are the heart of new technology solutions that can significantly improve vehicle safety and environmental performance of vehicles. These systems process digital information from sources like digital cameras, lasers, radar and other sensors to perform the tasks as described below. The processed information can be displayed on screens or announced via acoustic warning signals.

Typical applications are e.g.

Electronic Stability Control Systems, Advance Emergency Braking Systems, Distance Control, Lane Departure Warning Systems, Frontal Protection Systems, Pedestrian Protection, TPMS, Hydrogen and Hybrid Vehicles, Vision Systems, Traffic Sign Recognition, Navigation, Head-up Displays,

...

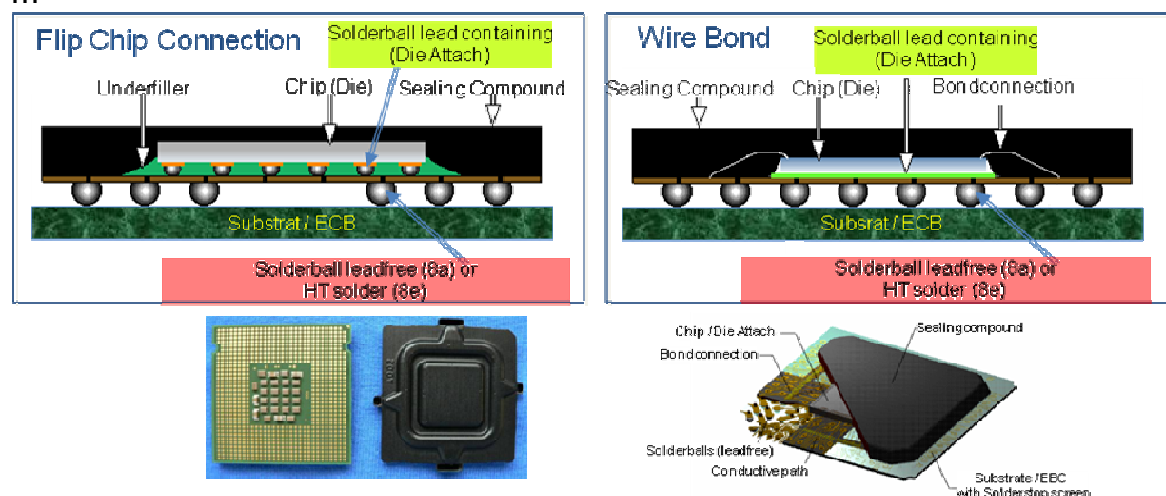


Fig. 24: Cross section and examples of flip chip packages

Definition/interpretation of - Exemption 8h)

8(h). Lead in solder to attach heat spreaders to the heat sink in power semiconductor assemblies with a chip size of at least 1 cm² of projection area and a nominal current density of at least 1 A/mm² of silicon chip area

>>> This exemption shall be reviewed in 2014

2010_115 EC IMDS APPLICATION CODE:

Lead in solder to attach heat spreaders to the heat sink in power semiconductor assemblies.....8h)

The application is the die soldering of Silicon chips (Si chips) of large size, having about 1 cm² of surface area or more, to lead frames. Insulated Gate Bipolar Transistors (IGBT) are Silicone semiconductor chips; they are the main active component in power modules for Hybrid Electric Vehicles (HEV) and Electric Vehicles (EV). The semiconductor chips are converters that control the electric voltage and current between battery and the electric drive motor / alternator of a vehicle. The solder used to join the Silicon chip to the lead frame is containing Lead. The Lead containing Tin-Lead solder (SnPb solder) provides thermal conductivity from the semiconductor chip, over the heat spreader, to the metal lead frame. The design can involve an intermediate heat spreader, as seen in the figure 22.

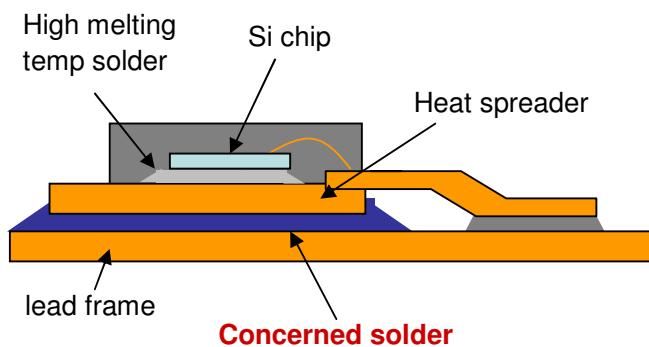


Fig. 25: Semiconductor attachment principle

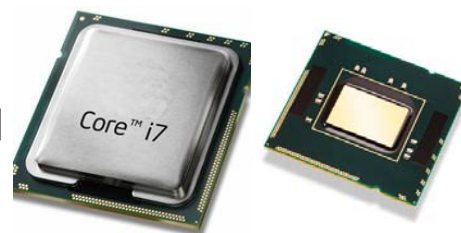


Fig. 26: Power semiconductors

Definition/interpretation of - Exemption 8i)

8(i). Lead in solders in electrical glazing applications on glass except for soldering in laminated glazing

>>> Vehicles type approved before 1 January 2013 and spare parts for these vehicles.

This exemption shall be reviewed before 1 January 2012.

2010_115 EC IMDS APPLICATION CODE:

Lead in solders in electrical glazing applications on glass except for soldering in laminated glazing - 8i)

The solder is used to solder electrical connections to automotive glass products.

The soldered connection provides both an electrical contact and a mechanical contact between the glass product and the wiring harness in the vehicle. The product is used for heating the glass (to aid vision), for alarm systems (for security) and for antennae (communication). It is expected that the soldered connection will remain attached to the glass for the life of the vehicle and that it will not fail in service.

The lead in the solder is a vital component for relieving the stresses in the glass that occur as a consequence of the different expansion coefficients of the metal connector and the glass substrate. The lead containing solders have sufficiently high melting points to meet the high temperature storage and operating conditions required by the Vehicle Manufacturers.

The automotive glass products are usually easily identifiable.

The types of connectors are manifold and may vary from vehicle brands and types.

See some examples below.

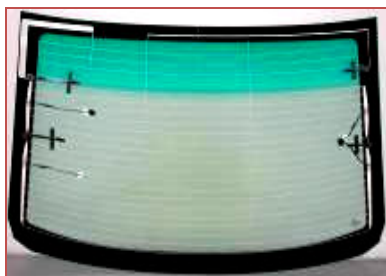


Fig. 27: Location of connectors Fig. 28: Connector types with different footprints



Fig. 29: Soldered braids are another type of connectors

Printing of a silver containing paste (in a wire-like pattern) to the inner surface of a glazing -here a rear window- followed by firing of the paste and contacting by soldering of pre-soldered connectors to the silver print.

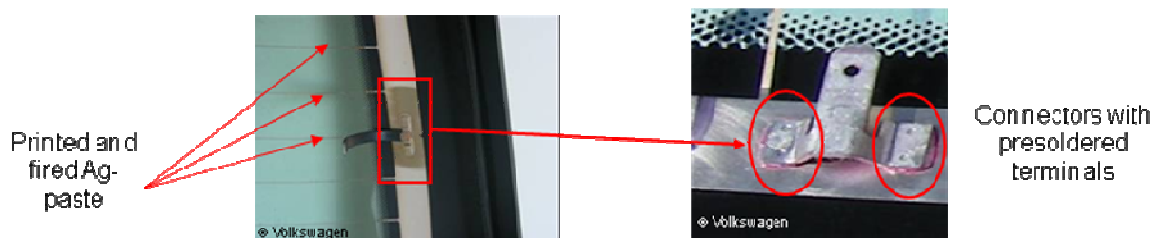


Fig. 30: Area of connectors on the glazing and pre-soldered connectors



Fig. 31: Heated Window connector wires

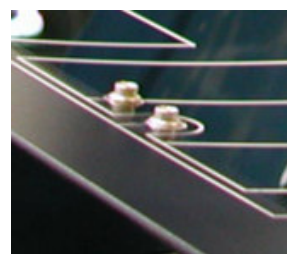


Fig. 32: Antenna connectors

Definition/interpretation of - Exemption 8j)

8(j). Lead in solders for soldering in laminated glazing

>>> This exemption shall be reviewed in 2014

2010_115 EC IMDS APPLICATION CODE:

Lead in solders for soldering in laminated glazing - 8j)

For laminated heated windscreens (fine wire heating grid) the technology is completely different compared to application 8i).

In this product there are fine tungsten wires embedded onto the interlayer materials (e.g.: polyvinyl butyral (PVB)) with solder connections to copper strip bus bars, all of which is assembled between two plies of glass.

This exemption also applies to laminated glass products that have copper wires embedded in them for antenna or sensor requirements.

Soldering to the copper wire is usually done via a connector that is inserted between the two plies of glass during the assembly process.



Fig. 33: Example for soldering in laminated glazing (heated windscreen)