

Exemption No. 7a Consultation Questionnaire (renewal request)

RoHS Exemption for „Lead in high melting temperature type solders (i.e. lead-based alloys containing 85 % by weight or more lead)“

Acronyms and Definitions

DCB direct copper bonding, sometimes also “direct bonded copper (DBC)” with metal bonded alumina or AlN ceramic isolator substrates

HMPS high melting point solder

LHMPS lead-containing high melting point solder

Pb lead

SMT surface mount technology

The Oeko-Institut and Fraunhofer IZM have evaluated the RoHS exemption 7a applications for the renewal of RoHS Directive Annex III, exemption 7a. Bourns, Freescale and IXYS Semiconductor each submitted applications and responses to follow-up questions.

They have subsequently initiated a [public consultation](#) to collect and to evaluate information and evidence according to the criteria listed in Art. 5 (1) (a) of Directive 2011/65/EU (RoHS II). The consultation covers six questions as summarized below or available in full context at [Oeko public consultation for RoHS Ex 7a](#).

Summarized Public Consultation Questions

1. Please comment on Ixys’ claim that DCB can be a lead-free alternative to LHMPS.
2. Please provide information concerning possible other substitutes or developments ...
3. ...[R]enewal of exemption No. 7a of Annex III with the same wording ...
4. Please provide information as to research initiatives ...
5. ... [P]lease explain whether the above application specification is exhaustive...
6. Are there any other aspects you deem to be of importance for the requested exemption?

The public has been invited to respond to these questions by not later than October 16, 2015.

ROHS EXEMPTION 7A RESPONSE TO CONSULTATION

15-Oct-2015 Final Version for Delivery to Oeko

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Name and contact details of responsible person for this application & response:

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This response to the August-October 16, 2015 public consultation questions is being submitted on behalf of myself and the participating industry associations and companies listed below.

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|---|---|---|---|
| <p>European Passive Components Industry Association (EPCIA) ID number: 22092908193-23</p>  | <p>European Semiconductor Industry Association (ESIA) is part of the European Electronic Component Manufacturers Association ID Number: 22092908193-23</p>  | <p>Japan Electronics and Information Technology Industries Association (JEITA) ID number: 519590015267-92</p>  | <p>Avago Technologies</p>  |
| <p>Communications and Information network Association of Japan (CIAJ)</p> <p>マークカラー 黒×100%</p>  | <p>Information Technology Industry Council (ITI) ID number: 061601915428-87</p>  | <p>LIGHTINGEUROPE ID number: 29789243712-03</p>  | <p>Diodes Incorporated</p>  |
| <p>DIGITALEUROPE ID number: 64270747023-20</p>  | <p>IPC – Association Connecting Electronics Industries</p>  | <p>Japan Electrical Manufacturers Association (JEMA)</p>  | <p>Knowles (UK) Ltd</p>  |

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| <p>European Committee of Domestic Equipment Manufacturers (CECED) ID number: 04201463642-88</p>  | <p>Japan Business Council in Europe (JBCE) ID number: 68368571120-55</p>  | | |
| <p>European Garden Machinery Industry Federation (EGMF) ID number: 82669082072-33</p>  | <p>Japan Business Machine and Information System Industries Association (JBMA) ID number: 246330915180-10</p>  | <p>European Coordination Committee of the Radiological, Electromedical and Healthcare IT Industry (COCIR) ID number: 05366537746-69</p>  | <p>ON SEMICONDUCTOR</p>  |

Freescale et.al, with members of the endorsing industry associations and other stakeholder companies, reviewed the consultation questions and believe that questions 2-6 have been answered within our previous renewal documents. Question 1 shall be addressed below.

Oeko Question 1

Please comment on Ixys' claim that DCB can be a lead-free alternative to LHMPs.

Selected Oeko Comments from the Public Consultation questionnaire:

- "There are hints that HMP solders are used where alternative solutions reducing the amounts of lead are available."
- "Ixys, one of the applicants for the continuation of exemption 7a), states that electrically isolated package versions in DCB technology with metal bonded alumina or AlN ceramic isolator substrates have a better CTE match and more SAC type solders can be used. This technology combines copper with ceramics like alumina without any interface material..."

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Our Response:

We agree with IXYS Semiconductor that "... high lead content soft solder alloys remain the most effective material to avoid excess mechanical stress when combining brittle materials like monocrystalline silicon, silicon carbide or III-V semiconductor dies with highly conductive metals like copper."^{^1} We also agree with IXYS that "because of the highly ductile ("soft") properties of high lead soft solders the build-up of excess mechanical stress is avoided after establishing the electrical contact to the outer connectors of the device. This scenario is especially important when combining large power dies with copper base plates (headers). ... No other soft solder material has this property."^{^2}

The IXYS alternative DBC solution appears to have a very narrow scope. It is limited to:

1) Die attach materials

- This DBC solution with AuSi die attach material does not address any HMPS applications besides die attach. AuSi eutecticum die attach on a bare copper leadframe may become brittle and unreliable.

2) Non-SMT package technologies

- SMT packages are not addressed by the IXYS solution. The diode package with pressure contacts as shown in the IXYS RoHS application form is a very special case, which cannot be used for other applications or package types.

3) Operating power

- IXYS only suggests converting LHMPs customers to their DBC alternative in low and medium power ranges.^{^3} We are not aware of a standard industry definition for medium, high and low power products. The IXYS power definition may be specific to their technologies.

4) Very small die size

- We agree that the IXYS solution may be reliable for certain applications with very small die size. The 3x3mm die size lacks industry consensus. Vishay tested a AuSi solder process and determined the maximum reliable die size to be 0.5x0.5mm rather than 3x3mm as indicated by IXYS.^{^4} Reliable die size for DBC may vary by manufacturing process, equipment, materials and/or power range. Failure points for power and die size are not known.

RoHS 7a has broad usage for critical applications, but the DBC bonding method can only be adapted to limited applications. It is not obvious that these applications are easily categorized or that they represent a substantial volume of LHMPs reduction. More important, it is very difficult to determine whether a narrowed exemption scope would affect the applications which really require LHMPs exemption. Thus the exemption wording should be kept in its present form.

^{^1}: IXYS Semiconductor RoHS Exemption 7a renewal submission, 22-Dec-2014, section 3, page 2.

^{^2}: IXYS Semiconductor RoHS Exemption 7a renewal submission, 22-Dec-2014, section 4, page 2.

^{^3}: IXYS Semiconductor RoHS Exemption 7a renewal submission, 22-Dec-2014, section 7B, page 6.

^{^4}: IXYS Applicant [further information](#), August 2015, section 4A, page 2.