SLOVENSKI STANDARD
oSIST prEN IEC 60749-21:2025

01-januar-2025

Polprevodniški elementi - Metode za mehansko in klimatsko preskušanje - 21. del: Spajkljivost

Semiconductor devices - Mechanical and climatic test methods - Part 21: Solderability

Halbleiterbauelemente - Mechanische und klimatische Prüfverfahren - Teil 21: Lötbarkeit

Dispositifs à semiconducteurs - Méthodes d'essais mécaniques et climatiques - Partie 21: Brasabilité

Ta slovenski standard je istoveten z: **prEN IEC 60749-21:2024**

ICS:

31.080.01	Polprevodniški elementi (naprave) na splošno	Semiconductor devices in general

oSIST prEN IEC 60749-21:2025 **en**

47/2862/CDV

COMMITTEE DRAFT FOR VOTE (CDV)

PROJECT NUMBER: **IEC 60749-21 ED3**	
DATE OF CIRCULATION: **2024-09-06**	CLOSING DATE FOR VOTING: **2024-11-29**
SUPERSEDES DOCUMENTS: **47/2857/RR**	

IEC TC 47 : SEMICONDUCTOR DEVICES	
SECRETARIAT: Korea, Republic of	SECRETARY: Mr Cheolung Cha
OF INTEREST TO THE FOLLOWING COMMITTEES:	HORIZONTAL FUNCTION(S):
ASPECTS CONCERNED:	
☐ SUBMITTED FOR CENELEC PARALLEL VOTING	☒ NOT SUBMITTED FOR CENELEC PARALLEL VOTING

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TITLE:

Semiconductor devices - Mechanical and climatic test methods - Part 21: Solderability

PROPOSED STABILITY DATE: 2030

NOTE FROM TC/SC OFFICERS:

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

SEMICONDUCTOR DEVICES – MECHANICAL AND CLIMATIC TEST METHODS –

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FOREWORD

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International Standard IEC 60749-21 has been prepared by IEC technical committee 47: Semiconductor devices.

This standard cancels and replaces the second edition published in 2011 and constitutes a technical revision. The significant change is revision to certain operating conditions in line with current working practices.

The text of this standard is based on the following documents:

FDIS	Report on voting
47/XXXX/FDIS	47/YYYY/RVD

Full information on the voting for the approval of this standard can be found in the report on voting indicated in the above table.

54 This publication has been drafted in accordance with the ISO/IEC Directives, Part 2.

55 A list of all parts in the IEC 60749 series, under the general title *Semiconductor devices –*
56 *Mechanical and climatic test methods* can be found on the IEC website.

57 The committee has decided that the contents of this publication will remain unchanged until
58 the stability date indicated on the IEC web site under "http://webstore.iec.ch" in the data
59 related to the specific publication. At this date, the publication will be

60 • reconfirmed,
61 • withdrawn,
62 • replaced by a revised edition, or
63 • amended.

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SEMICONDUCTOR DEVICES – MECHANICAL AND CLIMATIC TEST METHODS –

Part 21: Solderability

1 Scope

This part of IEC 60749 establishes a standard procedure for determining the solderability of device package terminations that are intended to be joined to another surface using tin-lead (SnPb) or lead-free (Pb-free) solder for the attachment.

This test method provides a procedure for 'dip and look' solderability testing of through hole, axial and surface mount devices (SMDs) as well as an optional procedure for a board mounting solderability test for SMDs for the purpose of allowing simulation of the soldering process to be used in the device application. The test method also provides optional conditions for ageing.

This test is considered destructive unless otherwise detailed in the relevant specification.

NOTE 1 This test method does not assess the effect of thermal stresses which may occur during the soldering process. Reference should be made IEC 60749-15 or IEC 60749-20.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 61190-1-2:2014, *Attachment materials for electronic assembly – Part 1-2: Requirements for soldering pastes for high-quality interconnects in electronics assembly*

IEC 61190-1-3:2018, *Attachment materials for electronic assembly – Part 1-3: Requirements for electronic grade solder alloys and fluxed and non-fluxed solid solders for electronic soldering applications*

3 Test apparatus and materials

3.1 Solder bath

The solder bath shall be not less than 40 mm in depth and not less than 300 ml in volume such that it can contain at least 1 kg of solder. The apparatus shall be capable of maintaining the solder at the specified temperature within ±5 °C. The solder in solder baths used for solderability testing shall be analysed or replaced to ensure that the composition complies with 3.6.2

3.2 Dipping device

A mechanical dipping device capable of controlling the rates of immersion and emersion of the terminations and providing a dwell time (time of total immersion to the required depth) in the solder bath as specified shall be used.

3.3 Optical equipment

An optical microscope capable of providing magnification inspection from 10× to 20× shall be used.

3.4 Steam ageing equipment

A non-corrodible container and cover of sufficient size to allow the placement of specimens inside the vessel shall be used. The specimens shall be placed such that the lowest portion of the specimen is a minimum of 40 mm above the surface of the water. A suitable method of supporting the specimens shall be improvised using non-contaminating material.

NOTE During steam ageing, the test devices should be located in a manner so as to prevent water (steam condensate) from dripping on them.

3.5 Lighting equipment

A lighting system shall be used that will provide a uniform, non-glare, non-directional illumination of the specimen.

3.6 Materials

3.6.1 Flux

Unless otherwise detailed in the relevant specification, the flux for SnPb solderability tests shall be a standard activated rosin flux (type ROL1 in accordance with IEC 61190-1-3 (2018), Table 2, Flux type and designating symbols) having a composition of 25 % ± 0,5 % by weight of colophony and 0,15 % ± 0,01 % by weight diethylammonium hydrochloride, in 74,85 % ± 0,5 % by weight of in 2-propanol (isopropanol). The specific gravity of the standard activated rosin flux shall be 0,843 ± 0,005 at 25 °C ± 2 °C.

The specification shall be as follows:

Colophony

Colour	To WW colour specification or paler
Acid value (mg KOH/g colophony)	155 (minimum)
Softening point (ball and ring)	70 °C (minimum)
Flow point (Ubbelohde)	76 °C (minimum)
Ash	0,05 % (maximum)
Solubility	A solution of the colophony in an equal part by weight of 2-propanol (isopropanol) shall be clear, and after a week at room temperature there shall be no sign of a deposit.

2-propanol (isopropanol)

Purity	Minimum 99,5 % 2-propanol (isopropanol) by weight
Acidity as acetic acid	Maximum 0,002 % weight (other than carbon dioxide)
Non-volatile matter	Maximum 2 mg per 100 ml.

Unless otherwise detailed in the relevant specification, the flux for Pb-free solderability tests shall be standard activated rosin flux having a composition of 25% ± 0.5% by weight of colophony and 0.39% ± 0.01% by weight diethylammonium hydrochloride, in 74.61% ± 0.5% by weight of isopropyl

3.6.2 Solder

3.6.2.1 Tin-lead

Unless otherwise detailed in the relevant specification, the solder specification for SnPb shall be as follows:

Chemical composition

The composition in percentage by weight shall be as follows:

Tin	59 % to 61 %
Antimony	0,5 % maximum
Copper	0,1 % maximum
Arsenic	0,05 % maximum
Iron	0,02 % maximum
Lead	the remainder.

The solder shall not contain such impurities as aluminium, zinc or cadmium in amounts which will adversely affect the properties of the solder.

Melting temperature range

The melting temperature range of the 60 % solder is as follows:

Completely solid	183 °C
Completely liquid	188 °C.

3.6.2.2 Lead-free

Unless otherwise detailed in the relevant specification, the solder specification for Pb-free shall be as follows:

The composition in percentage by weight shall be as follows:

Tin	95 % to 96,5 %
Silver	3 % to 4 %
Copper	0,5 % to 1 %.

3.7 SMD reflow equipment

3.7.1 Stencil or screen

A stencil or screen with pad geometry opening that is appropriate for the terminals being tested. Unless otherwise agreed upon between vendor and user, nominal stencil thickness should be 0,1 mm for terminals with less than 0,5 mm component lead pitch, 0,15 mm for a component with lead pitch of 0,5 mm to 0,65 mm and 0,2 mm for a component with lead pitch greater than 0,65 mm.

3.7.2 Rubber squeegee or metal spatula

Solder paste shall be applied on to the stencil or screen using a spatula for fine pitch or a squeegee for standard pitch.