

# INTERNATIONAL STANDARD



Environmental testing – iTeh Standards  
Part 2-58: Tests – Test Td: Test methods for solderability, resistance to  
dissolution of metallization and to soldering heat of surface mounting devices  
(SMD)

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## INTERNATIONAL ELECTROTECHNICAL COMMISSION

### ENVIRONMENTAL TESTING –

#### Part 2-58: Tests – Test Td: Test methods for solderability, resistance to dissolution of metallization and to soldering heat of surface mounting devices (SMD)

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**IEC 60068-2-58 edition 4.1 contains the fourth edition (2015-03) [documents 91/1222/FDIS and 91/1250/RVD] and its amendment 1 (2017-07) [documents 91/1445/FDIS and 91/1451/RVD].**

**In this Redline version, a vertical line in the margin shows where the technical content is modified by amendment 1. Additions are in green text, deletions are in strikethrough red text. A separate Final version with all changes accepted is available in this publication.**

International Standard IEC 60068-2-58 has been prepared by IEC technical committee 91: Electronics assembly technology.

This fourth edition constitutes a technical revision.

This edition includes the following significant technical changes with respect to the previous edition:

- the addition of Sn-Bi low temperature solder alloy;
- the addition of several reflow test conditions in Table 7 – Resistance to soldering heat – Test conditions and severity, reflow method;
- introduction of reflow test method for Test T<sub>d3</sub>: Dewetting and resistance to dissolution of metallization;
- implementation of guidance for the choice of a test severity in Clause B.3.

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

A list of all parts in the IEC 60068, published under the general title *Environmental testing*, can be found on the IEC website.

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## ENVIRONMENTAL TESTING –

### Part 2-58: Tests – Test Td: Test methods for solderability, resistance to dissolution of metallization and to soldering heat of surface mounting devices (SMD)

#### 1 Scope

This part of IEC 60068 outlines test Td, applicable to surface mounting devices (SMD).

This ~~standard~~ document provides procedures for determining the solderability, **resistance to dissolution of metallization** and resistance to soldering heat of devices in applications using solder alloys, which are eutectic or near eutectic tin lead (Pb), or lead-free alloys.

The procedures use either a solder bath or reflow method and are applicable only to specimens or products designed to withstand short term immersion in molten solder or limited exposure to reflow systems.

The solder bath method is applicable to SMDs designed for flow soldering and SMDs designed for reflow soldering when the solder bath (dipping) method is appropriate.

The reflow method is applicable to the SMD designed for reflow soldering, to determine the suitability of SMDs for reflow soldering and when the solder bath (dipping) method is not appropriate.

The objective of this standard is to ensure solderability of component lead or termination. In addition, test methods are provided to ensure that the component body can resist against the heat load to which it is exposed during soldering.

This standard covers tests Td<sub>1</sub>, Td<sub>2</sub> and Td<sub>3</sub> as listed below:

Number of Td	Test	Method
Td <sub>1</sub>	Solderability of terminations	Method 1: Solder bath Method 2: Reflow
Td <sub>2</sub>	Resistance to soldering heat	Method 1: Solder bath Method 2: Reflow
Td <sub>3</sub>	Dewetting and resistance to dissolution of metallization	Method 1: Solder bath Method 2: Reflow

NOTE 1 For specific components other test methods may exist.

NOTE 2 Test Td does not apply to printed wiring board (PWB), see IEC 61189-3.

NOTE 3 Specific through-hole devices (where the device supplier has specifically documented support for reflow soldering) are also included in this standard.

#### 2 Normative references

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

IEC 60068-1, *Environmental testing – Part 1: General and guidance*

IEC 60068-2-20:2008, *Environmental testing – Part 2-20: Tests – Test T: Test methods for solderability and resistance to soldering heat of devices with leads*

IEC 60194, *Printed board design, manufacture and assembly – Terms and definitions*

IEC 61190-1-1, *Attachment materials for electronic assemblies – Part 1-1: Requirements for soldering fluxes for high-quality interconnections in electronics assembly*

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

IEC 61190-1-3:2007, *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*

IEC 61190-1-3:2007/AMD1:2010

IEC 61191-2, *Printed board assemblies – Part 2: Sectional specification – Requirements for surface mount soldered assemblies*

IEC 61249-2-22, *Materials for printed boards and other interconnecting structures – Part 2-22: Reinforced base materials clad and unclad – Modified non-halogenated epoxide woven E-glass laminated sheets of defined flammability (vertical burning test), copper-clad*

IEC 61249-2-35, *Materials for printed boards and other interconnecting structures – Part 2-35: Reinforced base materials, clad and unclad – Modified epoxide woven E-glass laminate sheets of defined flammability (vertical burning test), copper-clad for lead-free assembly*

IEC 61760-1, *Surface mounting technology – Part 1: Standard method for the specification of surface mounting components (SMDs)*

ISO 9454-2:1998, *Soft soldering fluxes – Classification and requirements – Part 2: Performance requirements*

### 3 Terms and definitions

For the purposes of this document, the terms and definitions given in IEC 60068-1, IEC 60068-2-20, IEC 60194, and the following apply.

#### 3.1 solderability

ability of the termination or electrode of the SMD to be wetted by solder at the temperature of the termination or electrode, which is assumed to be the lowest temperature in the soldering process, within the applicable temperature range of the solder alloy

#### 3.2 resistance to soldering heat

ability of the component to withstand the highest temperature stress in terms of temperature gradient, peak temperature and duration of the soldering process, within the applicable temperature range of the solder alloy

#### 3.3 flow soldering

wave, drag or dip soldering process where the product is brought into contact with molten solder in order to attach electronic components to the interconnecting surface

#### 3.4 reflow soldering

joining of surfaces that have been tinned and/or have solder between them, placing them together, heating them until the solder flows, and allowing the surface and the solder to cool in the joined position

#### 3.5 wetting

formation of an adherent coating of solder on a surface indicated by a small contact angle

### 3.6

#### **dewetting**

retraction of molten solder on a solid area that it has initially wetted

Note 1 to entry: In some cases an extremely thin film of solder may remain. As the solder retracts the contact angle increases.

### 3.7

#### **non-wetting**

inability to form an adherent coating of solder on a surface indicated by a contact angle greater than 90°

### 3.8

#### **dissolution of metallization**

process of dissolving metal, usually by introduction of chemicals

### 3.9

#### **pinhole**

small hole that penetrates from the surface of a solder to base material

## 4 Grouping of soldering processes and related test severities

The melting temperatures of lead-free solder alloys selected for industrial processes are significantly different from those for Sn-Pb solder alloy. Moreover, the melting temperatures of lead-free solder alloys are different from each other but can be clustered in groups.

The following groups of soldering processes as indicated in Table 1, are given as a guideline to select the severities for the wetting and resistance tests against the specified soldering heat:

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**Table 1 – Grouping of soldering processes and typical test severities – Overview**

Process temperature group <sup>a</sup>		1 Low	2 Medium	3 Medium-high	4 High
Typical solder alloy group		Sn-Bi	Sn-Pb	Sn-Ag-Cu	Sn-Cu
Typical process temperature	Flow	–	235 °C to 250 °C	250 °C to 260 °C	250 °C to 260 °C <sup>c</sup>
	Reflow	170 °C to 210 °C	210 °C to 240 °C	235 °C to 250 °C	–
Test method	Test property	Temperature / Duration			
Solder bath	Solderability (6.5)	175 °C / 3 s	235 °C / 2 s	245 °C / 3 s	250 °C / 3 s
	Resistance to soldering heat (7.5)	230 °C / 10 s	260 °C / 5 s	260 °C / 5 s	260 °C / 10 s
			260 °C / 10 s	260 °C / 10 s	
	Dewetting (8.2)	–	260 °C / 5 s	–	–
260 °C / 10 s			–	–	
Resistance to dissolution of metallization (8.2)	–	260 °C / 30 s			
Reflow	Solderability <sup>b</sup> (6.6)	170 °C / 10 s	215 °C / 10 s	235 °C / 10 s	–
	Resistance to soldering heat (7.6)	–	235 °C / 20 s	230 °C / 30 s	–
				245 °C / 30 s	
	Dewetting (8.2)	–	–	250 °C / 30 s	
260 °C / 30 s					
<sup>a</sup> Refer to the appropriate subclauses for the detailed test conditions. <sup>b</sup> Measured at the solder joint. <sup>c</sup> 255 °C to 265 °C may be an applicable soldering temperature range for boards with high thermal demand.					

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The following statements shall be applied in Table 1;

- Flow soldering applies to both wave soldering and dip soldering.
- Typical process temperatures for flow soldering are identical to the solder temperature. Typical process temperatures for reflow soldering are the terminal and top surface temperature of the SMDs.
- The basic solder alloys listed in Table 1 present tin-lead solder and compositions that are currently preferred for lead-free soldering processes. However, other solder alloys when matching with the specified group should not be excluded.

## 5 Test equipment

### 5.1 Solder bath

As given in IEC 60068-2-20:2008, 5.2.1, the solder bath shall be not less than 40 mm in depth and not less than 300 ml in volume.

In case of high thermal capacity components, the volume of the solder bath shall be given by the relevant specification.

The material of the solder bath container shall be resistant to the liquid solder alloy.

### 5.2 Reflow equipment

As long as the test conditions are fulfilled, any reflow equipment may be used. The following two methods are preferred: