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Semiconductor devices - Mechanical and climatic test methods - Part 22-1: Bond strength - wire bond pull test methods

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FOREWORD

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IEC 60749-22-1 has been prepared by IEC technical committee 47: Semiconductor devices. It is an International Standard.

This International Standard is to be used in conjunction with IEC 60749-22-2:2025.

This first edition, together with the first edition of IEC 60749-22-2:2025, cancels and replaces the first edition of IEC 60749-22 published in 2002. It is based on JEDEC document JESD22-B120. It is used with permission of the copyright holder, JEDEC Solid State Technology Association.

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

a) Major update, including new techniques and use of new materials (e.g. copper wire) involving a complete rewrite as two separate subparts (this document and IEC 60749-22-2).

The text of this International Standard is based on the following documents:

Draft	Report on voting
47/2954/FDIS	47/2975/RVD

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

The language used for the development of this International Standard is English.

This document was drafted in accordance with ISO/IEC Directives, Part 2, and developed in accordance with ISO/IEC Directives, Part 1 and ISO/IEC Directives, IEC Supplement, available at www.iec.ch/members_experts/refdocs. The main document types developed by IEC are described in greater detail at www.iec.ch/publications.

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

The committee has decided that the contents of this document will remain unchanged until the stability date indicated on the IEC website under webstore.iec.ch in the data related to the specific document. At this date, the document will be

– reconfirmed,
– withdrawn, or
– revised.

1 Scope

This part of IEC 60749 provides a means for determining the strength and failure mode of a wire bonded to, and the corresponding interconnects on, a die or package bonding surface and can be performed on unencapsulated or decapsulated devices. This test method can be performed on gold alloy, copper alloy, and silver alloy thermosonic (ball and stitch) bonds made of wire ranging in diameter from 15 µm to 76 µm (0,000 6" to 0,003"); and on gold alloy, copper alloy, and aluminium alloy ultrasonic (wedge) bonds made of wire ranging in diameter from 18 µm to 600 µm (0,000 7" to 0,024").

This wire bond pull test method is destructive. It is appropriate for use in process development, process control, or quality assurance.

This test method allows for two distinct methods of pulling wires:

a) One method incorporates the use of a hook that is placed under the wire and is then pulled.
b) One method requires that after the wire be cut, a clamp is placed on the wire connected to the bond to be tested, and this clamp is used to pull the wire.

This test method defines three pull tests. The wire pull test (WPT) is appropriate for all bonded wires. The ball pull test (BPT) and stitch pull test (SPT) are appropriate for thermosonically bonded wires.

This test method can also be used on the following four applications of thermosonic and ultrasonic bonds, though each requires special considerations when performing the test method:

a) Pulling aluminium wires and aluminium ribbons that are bonded with multiple ultrasonic bonds. See 5.3.2.2.2 for special considerations. Multiloop wires and ribbons are used in some high-power device packages.
b) Pulling wires of reverse bonds which are also known as "stitch on ball". These types of bonds can include gold stitch on gold ball, copper stitch on copper ball, and copper stitch on gold ball. See Clause A.1 in Annex A for additional information.
c) Pulling a thermosonically bonded wire that has a security bond (see 3.9) or security loop (see 3.19) placed on top of the stitch bond (see 3.3) in order to provide additional strength. See Clause A.2 for additional information.
d) Pulling thermosonic wire bonds on stacked die when wires or bonds, or both, are not accessible to allow for proper pull testing. See 5.3.2.2.4 for special considerations

This test method does not include bond strength testing using wire bond shear testing. Wire bond shear testing is described in IEC 60749-22-2.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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 60749-22-2, *Semiconductor devices - Mechanical and climatic test methods - Part 22-2: Bond strength testing - Wire bond shear test methods*