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INTERNATIONAL STANDARD

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



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CONTENTS

FOREWORD	5
1 Scope	7
2 Normative references	7
3 Terms and definitions	8
4 Apparatus and material	11
4.1 Inspection equipment	11
4.2 Workholder	11
4.3 Wire bond pull equipment	11
4.4 Pulling hook	11
4.5 Bond pull clamp	12
5 Procedure	12
5.1 Calibration	12
5.2 Visual examination of bonds to be tested after decapsulation	12
5.2.1 Applicability	12
5.2.2 Bond pad examination and acceptability criteria for both aluminium and copper bond pad metallization	13
5.2.3 Examination and acceptability criteria for Cu and Ag wire and connections (all bonds)	13
5.3 Performing the wire bond pull test	13
5.3.1 Wire bond pull test used	13
5.3.2 Hook pull method	13
5.3.3 Clamp pull method of single bond (cut wire)	21
5.4 Examination of pulled wire bonds	23
5.5 Wire bond pull failure codes	24
5.5.1 Tabulation of codes	24
5.5.2 Defining code 6 versus Code 7 for thermosonic stitch bonds	31
5.5.3 Discussion on the significance of failure codes	32
5.6 Wire bond pull data	33
5.6.1 Recording wire bond pull data	33
5.6.2 Determining equivalent wire diameter for ribbon bonds	33
5.6.3 Effective pull force versus the actual force on a bond	34
6 Summary	34
Annex A (informative) Guidance for performing pull testing on stacked bonds (reverse, security and others)	35
A.1 Reverse bonds	35
A.2 Security bonds	37
A.3 Other stacked bonds	37
Annex B (informative) Guidance for performing decapsulation on devices prior to bond pull testing	39
B.1 Rationale	39
B.2 Warning regarding ultrasonic cleaning of exposed wire bonds	39
B.3 Concerns with decapsulation processes for devices with copper and silver wire bonds	39
B.4 Concern with undercutting bonds due to over etching of the silver plating on leadframes	41
B.5 Techniques for assessing if excessive etching of ag plating has occurred	43
B.6 Concern with decapsulating packages with stitch bonds on multiple planes	44

B.7	Concern with not removing all encapsulation material around the bonded wire prior to pull testing	45
Annex C (informative)	Correlation between pull failure codes in this document versus pull failure codes in Mil-Std 883, Method 2011.9	46
Annex D (informative)	Images to aid in determining appropriate failure codes	48
D.1	Illustration of failure codes	48
D.2	Failure in deformed portion of wire above thermosonic stitch bond – Code 6	49
D.3	Failure in thermosonic stitch bond – Code 7	50
D.4	Additional guidance for breaks in thermosonic stitch bonds – Code 6 versus code 7	51
Annex E (informative)	Additional guidance regarding minimum pull force specification values and process control requirements	55
Annex F (informative)	Factors that can affect wire pull outcome	56
F.1	Important factors	56
F.2	How bond angle affects pull force	57
F.3	Pull angle affects pull force and fail mode	58
Annex G (informative)	Background and reasons for choice of minimum pull specification values	60
Bibliography	61
Figure 1	– Definition of midspan	9
Figure 2	– Depiction of eight outliers, seven of which are outlier products	10
Figure 3	– Place hook under wire	14
Figure 4	– Orientation of hook with respect to the wire (viewed from above)	14
Figure 5	– Hook placement for wire pull test (WPT) for different types of wire bonds	16
Figure 6	– Wires with low bond angles	17
Figure 7	– Device with slots to allow for hook placement	17
Figure 8	– Reverse "shingle" stack	18
Figure 9	– Vertical stack of die of the same size	18
Figure 10	– Hook placement for ball pull test (BPT) for different types of wire bonds	20
Figure 11	– Hook placement for stitch pull test (SPT) for different types of wire bonds	21
Figure 12	– Examples of acceptable and unacceptable placement of clamp on wire	22
Figure 13	– Clamp placement for ball pull test	23
Figure 14	– Clamp placement for stitch pull test	23
Figure 15	– General description of wire bond pull failure codes for all bond types	24
Figure 16	– Detailed pull failure codes for standard thermosonically bonded wires	25
Figure 17	– Detailed pull failure codes for reverse thermosonically bonded wires	26
Figure 18	– Detailed pull failure codes for die to die thermosonically bonded wires	27
Figure 19	– Detailed pull failure codes for standard ultrasonically bonded wires	28
Figure 20	– Detailed pull failure codes for die to die ultrasonically bonded wires	29
Figure 21	– Detailed pull failure codes for substrate to substrate ultrasonically bonded wires	30
Figure 22	– Detailed pull failure codes for multi-loop ultrasonically bonded wires / ribbons	31
Figure 23	– Location of breaks in the stitch neckdown region versus in the stitch bond	32
Figure A.1	– Top view image of reverse bond	35

Figure A.2 – Side view image of reverse bond	35
Figure A.3 – Examples of different electrical connections made with reverse bonds	36
Figure A.4 – The bump of a security bond	37
Figure A.5 – The ball bond of a security loop	37
Figure A.6 – Example of another type of stacked bonds.....	38
Figure B.1 – Images of copper ball bonds showing severe damage from etching process	39
Figure B.2 – Comparison images showing degree of cu attack due to two different etchants	40
Figure B.3 – Copper wire stitch bond fully decapsulated using laser ablation	41
Figure B.4 – Laser ablation damage	41
Figure B.5 – Drawn, optical and SEM images of break where metallurgical bond begins	42
Figure B.6 – Undercutting of stitch bond due to excessive etching of silver plating	42
Figure B.7 – Ag plating removed by the decapsulation process, underlying cu is visible.....	43
Figure B.8 – Plated Ag visible in the area around the stitch bonds, cu only visible at edges.....	43
Figure B.9 – Assessing if excessive etching of Ag plating has occurred.....	44
Figure B.10 – SEM and optical image examples of a reasonable amount of remaining encapsulant material for pull testing of very low angle bonds	45
Figure C.1 – Pull failure code locations for this document and Mil-Std 883, Method 2011.9.....	46
Figure C.2 – Failure code diagram from Mil-Std 883, Method 2011.9	47
Figure D.1 – Gold stitch bond (unencapsulated) before and after wire pull testing	49
Figure D.2 – Examples of break occurring within the neckdown region	49
Figure D.3 – Copper stich bonds before and after wire pull testing.....	50
Figure D.4 – SEM image of a break within the neckdown region of a gold stitch bond.....	50
Figure D.5 – Break occurring within gold stitch bonds.....	50
Figure D.6 – Break occurring within neckdown region of copper stich bonds	51
Figure D.7 – SEM images of where the breaks are designated code 7	51
Figure D.8 – Gold stitch bond on a Ni/Au plated cu land on an organic substrate	52
Figure D.9 – Images from construction analysis report of gold stitch bond	52
Figure D.10 – Stitch bonds made with Pd coated Cu wire on a Ag plated Cu alloy leadframe	52
Figure D.11 – Ag splash.....	53
Figure D.12 – Gaps between Cu wire and NiPdAu plated leadframe	53
Figure D.13 – Stitch bond made with Cu wire on a Ag plated Cu alloy leadframe.....	54
Figure D.14 – Images from construction analysis report of stitch bond made with Cu wire on a Ag plated Cu alloy leadframe.....	54
Figure F.1 – Force diagram and detailed force equations 5.3.4 and 5.3.5 from NBS Technical note 726	56
Figure F.2 – Pull force versus tension in wire, an example of very low bond angles.....	57
Figure F.3 – Various bond angles with respect to their bonding surfaces	58
Figure F.4 – How pull angle affects tension	59
Table 1 – Guidance for the minimum diameter of the pulling hook	12

Table C.1 – Conversion from (new) this document pull codes to (old) Mil-Std 883, Method 2011.9	46
Table D.1 – Failure code illustrations.....	48
Table F.1 – Compensation for minimum pull force for various bond angles	58
Table F.2 – How pull angle Φ affects force applied to each bond	59

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

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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*