SLOVENSKI STANDARD

SIST EN 60749-22:2004

julij 2004

Semiconductor devices - Mechanical and climatic test methods - Part 22: Bond strength (IEC 60749-22:2002)

ICS 31.080.01

Referenčna številka
SIST EN 60749-22:2004(en)

EUROPEAN STANDARD **EN 60749-22**

NORME EUROPÉENNE

EUROPÄISCHE NORM June 2003

ICS 31.080.01

English version

Semiconductor devices - Mechanical and climatic test methods Part 22: Bond strength

(IEC 60749-22:2002)

Dispositifs à semiconducteurs - Méthodes d'essais mécaniques et climatiques Partie 22: Robustesse des contacts soudés (CEI 60749-22:2002)

Halbleiterbauelemente - Mechanische und klimatische Prüfverfahren Teil 22: Kontaktfestigkeit (Bond strength) (IEC 60749-22:2002)

This European Standard was approved by CENELEC on 2002-09-24. CENELEC members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration.

Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the Central Secretariat or to any CENELEC member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CENELEC member into its own language and notified to the Central Secretariat has the same status as the official versions.

CENELEC members are the national electrotechnical committees of Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Luxembourg, Malta, Netherlands, Norway, Portugal, Slovakia, Spain, Sweden, Switzerland and United Kingdom.

CENELEC
European Committee for Electrotechnical Standardization
Comité Européen de Normalisation Electrotechnique
Europäisches Komitee für Elektrotechnische Normung

Central Secretariat: rue de Stassart 35, B - 1050 Brussels

Ref. No. EN 60749-22:2003 E

Foreword

The text of the International Standard IEC 60749-22:2002 was approved by CENELEC as EN 60749-22 on 2002-09-24.

The text of this International Standard was reproduced from IEC 60749:1996, chapter 2, clause 6 without change. Therefore, it has not been submitted to vote a second time and is still based on documents 47/1394/FDIS et 47/1477/FDIS.

The following dates were fixed:

– latest date by which the EN has to be implemented at national level by publication of an identical national standard or by endorsement (dop) 2004-01-01

– latest date by which the national standards conflicting with the EN have to be withdrawn (dow) 2005-10-01

Each test method governed by this standard and which is part of the series is a stand-alone document, numbered EN 60749-2, EN 60749-3, etc. The numbering of these test methods is sequential, and there is no relationship between the number and the test method (i.e. no grouping of test methods). The list of these tests will be available in the CENELEC internet site and in the catalogue.

Updating of any of the individual test methods is independent of any other part.
Annexes designated "normative" are part of the body of the standard.
In this standard, annex A is normative.

Endorsement notice

The text of the International Standard IEC 60749-22:2002 was approved by CENELEC as a European Standard without any modification.

_____

NORME INTERNATIONALE

INTERNATIONAL STANDARD

CEI
IEC
60749-22

Première édition
First edition
2002-09

Dispositifs à semiconducteurs –
Méthodes d'essais mécaniques et climatiques –

Partie 22:
Robustesse des contacts soudés

Semiconductor devices –
Mechanical and climatic test methods –

Part 22:
Bond strength

International Electrotechnical Commission, 3, rue de Varembé, PO Box 131, CH-1211 Geneva 20, Switzerland
Telephone: +41 22 919 02 11 Telefax: +41 22 919 03 00 E-mail: inmail@iec.ch Web: www.iec.ch

Commission Electrotechnique Internationale
International Electrotechnical Commission
Международная Электротехническая Комиссия

CODE PRIX
PRICE CODE S

Pour prix, voir catalogue en vigueur
For price, see current catalogue

CONTENTS

INTERNATIONAL ELECTROTECHNICAL COMMISSION

_____

SEMICONDUCTOR DEVICES – MECHANICAL AND CLIMATIC TEST METHODS –

Part 22: Bond strength

FOREWORD

1) The IEC (International Electrotechnical Commission) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of the IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, the IEC publishes International Standards. Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. The IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.

2) The formal decisions or agreements of the IEC on technical matters express, as nearly as possible, an international consensus of opinion on the relevant subjects since each technical committee has representation from all interested National Committees.

3) The documents produced have the form of recommendations for international use and are published in the form of standards, technical specifications, technical reports or guides and they are accepted by the National Committees in that sense.

4) In order to promote international unification, IEC National Committees undertake to apply IEC International Standards transparently to the maximum extent possible in their national and regional standards. Any divergence between the IEC Standard and the corresponding national or regional standard shall be clearly indicated in the latter.

5) The IEC provides no marking procedure to indicate its approval and cannot be rendered responsible for any equipment declared to be in conformity with one of its standards.

6) Attention is drawn to the possibility that some of the elements of this International Standard may be the subject of patent rights. The IEC shall not be held responsible for identifying any or all such patent rights.

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

The text of this test method is reproduced from IEC 60749 Ed.2, chapter 2, clause 6 without change. It has therefore not been submitted to vote a second time and is still based on the following documents:

FDIS	Report on voting
47/1394/FDIS	47/1402/RVD
47/1477/FDIS	47/1518/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.

This publication has been drafted in accordance with the ISO/IEC Directives, Part 3.

Each test method governed by IEC 60749-1 and which is part of the series is a stand-alone document, numbered IEC 60749-2, IEC 60749-3, etc. The numbering of these test methods is sequential, and there is no relationship between the number and the test method (i.e. no grouping of test methods). The list of these tests will be available in the IEC Internet site and in the catalogue.

Updating of any of the individual test methods is independent of any other part.

The committee has decided that the contents of this publication will remain unchanged until 2007. At this date, the publication will be

- reconfirmed;
- withdrawn;
- replaced by a revised edition, or
- amended.

The contents of the corrigendum of August 2003 have been included in this copy.

INTRODUCTION

Activity within IEC technical committee 47, working group 2, includes the generation, coordination and review of climatic, electrical (of which only ESD, latch-up and electrical conditions for life tests are considered), mechanical test methods, and associated inspection techniques needed to assess the quality and reliability of the design and manufacture of semiconductor products and processes.

SEMICONDUCTOR DEVICES – MECHANICAL AND CLIMATIC TEST METHODS –

Part 22: Bond strength

1 Scope and object

This part of IEC 60749 is applicable to semiconductor devices (discrete devices and integrated circuits).

The object of this part is to measure bond strength or determine compliance with specified bond strength requirements.

NOTE This test is identical to the test method contained in clause 6 of chapter 2 of IEC 60749 (1996), amendment 1, apart from changes to this clause and renumbering.

1.1 General description of the test

Seven test methods are described, each having its own purpose, that is:

- methods A and B are intended for testing internal bonds of a device by a direct pulling of the connecting wire;
- method C is intended for bonds external to the device and consists of a peeling stress exerted between the lead or terminal and the board or substrate;
- method D is intended for internal bonds and consists of a shear stress applied between a die and a substrate or similar face-bonded configurations;
- methods E and F are intended for external bonds and consist of a push-off or a pull-off stress exerted between a die and the substrate;
- method G is intended to test the mechanical resistance of wire bonds to a shear force.

1.2 Description of the test apparatus (for all methods)

The apparatus for this test should consist of suitable equipment for applying the specified stress on the bond, lead wire or terminals as required in the specified test method. A calibrated measurement and indication of the applied stress in newtons (N) at the point of failure should be provided by equipment capable of measuring stresses up to and including 100 mN with an accuracy of ±2,5 mN, stresses between 100 mN and 500 mN with an accuracy of ±5 mN, and stresses exceeding 500 mN with an accuracy of ±2,5 % of the indicated value.

2 Methods A and B (see also annex A)

2.1 Scope

This test is intended to be applied to the wire-to-die bond, wire-to-substrate bond, or the wire-to-terminal bond inside the package of wire-connected semiconductor devices bonded by soldering, thermocompression, ultrasonic and other related techniques.

2.2 General description of the test

2.2.1 Method A: Wire pull (applied to bonds separately)

The wire connecting the die or substrate should be cut so as to provide two ends accessible for a pull test. In the case of short wire runs, it may be necessary to cut the wire close to one termination in order to allow the pull test at the opposite termination. The wire should be gripped in a suitable device and simple pulling action applied to the wire or to the device (with the wire clamped) in such a manner that the force is applied within 5° of the parallel to the surface of the die or substrate in the case of a stitch bond.

2.2.2 Method B: Wire pull (applied to two bonds simultaneously)

A hook should be inserted under the lead wire connecting the die or substrate to the terminal, and a pull applied to the hook with the device clamped. The pulling force is applied approximately in the middle of the wire in a direction within 5° of the normal to the die or substrate surface or normal to a straight line between the bonds.

2.2.3 The pulling force should be progressively increased until the wire or a bond breaks (item a) in 2.2.4) or until the minimum force has been reached (item b) in 2.2.4).

2.2.4 Failure criteria

a) For determining acceptance, the value of the pulling force at which the wire or bond breaks should be recorded and compared with that given in table 2 (see note).

   For wire diameters not specified in table 2, the curves of figure 3 should be used to determine the bond pull limit. The curves are only applicable to bond pulls normal to the die.

b) As an alternative procedure, the pulling force is increased to the specified minimum value (see note). If neither the wire nor the bond is broken, the bond is considered to have passed the test.

NOTE The pulling force should be modified where relevant (for example, for method B) by using the information given in the annex.

2.2.5 Classification of failures

When specified, broken wires or bonds should be classified as follows:

a) wire break at neckdown point (reduction of section due to bonding process);

b) wire break at a point other than neckdown;

c) failure in bond (interface between wire and metallization) at the die;

d) failure in bond (interface between wire and metallization) at substrate, package post or any point other than at the die;

e) metallization lifted from the die;

f) metallization lifted from the substrate or package post;

g) fracture of the die;

h) fracture of the substrate.

NOTE Method B is not recommended for the purpose of measuring the absolute value of the bond strength (see annex A). However, it may be used for testing the bond quality on a comparative basis during the manufacturing process.