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Standards

Irish Standard
I.S. EN IEC 60749-28:2022

Semiconductor devices - Mechanical and climatic test methods - Part 28:
Electrostatic discharge (ESD) sensitivity testing - Charged device model (CDM) - device level

I.S. EN IEC 60749-28:2022

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This document is based on:

EN IEC 60749-28:2022

Published:

2022-04-08

This document was published under the authority of the NSAI and comes into effect on:

2022-04-25

ICS number:

31.080.01

NOTE: If blank see CEN/CENELEC cover page

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I.S. EN IEC 60749-28:2022 is the adopted Irish version of the European Document EN IEC 60749-28:2022, Semiconductor devices - Mechanical and climatic test methods - Part 28: Electrostatic discharge (ESD) sensitivity testing - Charged device model (CDM) - device level

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EN IEC 60749-28

NORME EUROPÉENNE

EUROPÄISCHE NORM

April 2022

ICS 31.080.01

Supersedes EN 60749-28:2017 and all of its
amendments and corrigenda (if any)

English Version

**Semiconductor devices - Mechanical and climatic test methods -
Part 28: Electrostatic discharge (ESD) sensitivity testing -
Charged device model (CDM) - device level
(IEC 60749-28:2022)**

Dispositifs à semiconducteurs - Méthodes d'essai
mécaniques et climatiques - Partie 28: Essai de sensibilité
aux décharges électrostatiques (DES) - Modèle de dispositif
chargé (CDM) - niveau du dispositif
(IEC 60749-28:2022)

Halbleiterbauelemente - Mechanische und klimatische
Prüfverfahren - Teil 28: Prüfung der Empfindlichkeit gegen
elektrostatische Entladungen (ESD) - Charged Device
Model (CDM) - Device Level
(IEC 60749-28:2022)

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Comité Européen de Normalisation Electrotechnique
Europäisches Komitee für Elektrotechnische Normung

CEN-CENELEC Management Centre: Rue de la Science 23, B-1040 Brussels

EN IEC 60749-28:2022 (E)

European foreword

The text of document 47/2746/FDIS, future edition 2 of IEC 60749-28, prepared by IEC/TC 47 "Semiconductor devices" was submitted to the IEC-CENELEC parallel vote and approved by CENELEC as EN IEC 60749-28:2022.

The following dates are fixed:

- latest date by which the document has to be implemented at national level by publication of an identical national standard or by endorsement (dop) 2023-01-05
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IEC 60749-26 NOTE Harmonized as EN IEC 60749-26



IEC 60749-28

Edition 2.0 2022-03

INTERNATIONAL STANDARD

NORME INTERNATIONALE



**Semiconductor devices – Mechanical and climatic test methods –
Part 28: Electrostatic discharge (ESD) sensitivity testing – Charged device model
(CDM) – device level**

**Dispositifs à semiconducteurs – Méthodes d’essais mécaniques et
climatiques –
Partie 28: Essai de sensibilité aux décharges électrostatiques (DES) – Modèle de
dispositif chargé (CDM) – niveau du dispositif**



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IEC 60749-28

Edition 2.0 2022-03

INTERNATIONAL STANDARD

NORME INTERNATIONALE



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Part 28: Electrostatic discharge (ESD) sensitivity testing – Charged device
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dispositif chargé (CDM) – niveau du dispositif**

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

COMMISSION
ELECTROTECHNIQUE
INTERNATIONALE

ICS 31.080.01

ISBN 978-2-8322-1082-9

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CONTENTS

FOREWORD	6
INTRODUCTION	8
1 Scope	9
2 Normative references	9
3 Terms and definitions	9
4 Required equipment	10
4.1 CDM ESD tester	10
4.1.1 General	10
4.1.2 Current-sensing element	11
4.1.3 Ground plane	11
4.1.4 Field plate/field plate dielectric layer	11
4.1.5 Charging resistor	11
4.2 Waveform measurement equipment	12
4.2.1 General	12
4.2.2 Cable assemblies	12
4.2.3 Equipment for high-bandwidth waveform measurement	12
4.2.4 Equipment for 1,0 GHz waveform measurement	12
4.3 Verification modules (metal discs)	12
4.4 Capacitance meter	12
4.5 Ohmmeter	12
5 Periodic tester qualification, waveform records, and waveform verification requirements	13
5.1 Overview of required CDM tester evaluations	13
5.2 Waveform capture hardware	13
5.3 Waveform capture setup	13
5.4 Waveform capture procedure	13
5.5 CDM tester qualification/requalification procedure	14
5.5.1 CDM tester qualification/requalification procedure	14
5.5.2 Conditions requiring CDM tester qualification/requalification	14
5.5.3 1 GHz oscilloscope correlation with high bandwidth oscilloscope	14
5.6 CDM tester quarterly and routine waveform verification procedure	15
5.6.1 Quarterly waveform verification procedure	15
5.6.2 Routine waveform verification procedure	15
5.7 Waveform characteristics	15
5.8 Documentation	17
5.9 Procedure for evaluating full CDM tester charging of a device	17
6 CDM ESD testing requirements and procedures	18
6.1 Tester and device preparation	18
6.2 Test requirements	18
6.2.1 Test temperature and humidity	18
6.2.2 Device test	18
6.3 Test procedures	19
6.4 CDM test recording / reporting guidelines	19
6.4.1 CDM test recording	19
6.4.2 CDM Reporting Guidelines	19
6.5 Testing of Devices in Small Packages	19

7	CDM classification criteria	20
	Annex A (normative) Verification module (metal disc) specifications and cleaning guidelines for verification modules and testers	21
	A.1 Tester verification modules and field plate dielectric	21
	A.2 Care of verification modules	21
	Annex B (normative) Capacitance measurement of verification modules (metal discs) sitting on a tester field plate dielectric	22
	Annex C (normative) Testing of small package integrated circuits and discrete semiconductors (ICDS)	23
	C.1 Testing rationale	23
	C.2 Procedure for Determining C_{small}	23
	C.3 ICDS Technology requirements	24
	Annex D (informative) CDM test hardware and metrology improvements	25
	Annex E (informative) CDM tester electrical schematic	27
	Annex F (informative) Sample oscilloscope setup and waveform	28
	F.1 General	28
	F.2 Settings for the 1 GHz bandwidth oscilloscope	28
	F.3 Settings for the high-bandwidth oscilloscope	28
	F.4 Setup	28
	F.5 Sample waveforms from a 1 GHz oscilloscope	28
	F.6 Sample waveforms from an 8 GHz oscilloscope	29
	Annex G (informative) Field-induced CDM tester discharge procedures	31
	G.1 General	31
	G.2 Single discharge procedure	31
	G.3 Dual discharge procedure	31
	Annex H (informative) Waveform verification procedures	33
	H.1 Factor/offset adjustment method	33
	H.2 Software voltage adjustment method	36
	H.3 Example parameter recording tables	38
	Annex I (informative) Determining the appropriate charge delay for full charging of a large module or device	40
	I.1 General	40
	I.2 Procedure for charge delay determination	40
	Annex J (informative) Electrostatic discharge (ESD) sensitivity testing direct contact charged device model (DC-CDM)	42
	J.1 General	42
	J.2 Standard test module	42
	J.3 Test equipment (CDM simulator)	42
	J.3.1 Test equipment design	42
	J.3.2 DUT (device under test) support	43
	J.3.3 Metal bar/board	43
	J.3.4 Equipment setup	43
	J.4 Verification of test equipment	44
	J.4.1 General description of verification test equipment	44
	J.4.2 Instruments for measurement	45
	J.4.3 Verification of test equipment, using a current probe	45
	J.5 Test procedure	46
	J.5.1 Initial measurement	46

J.5.2	Tests	47
J.5.3	Intermediate and final measurement	47
J.6	Failure criteria.....	47
J.7	Classification criteria.....	47
J.8	Summary	47
Bibliography.....		49
Figure 1	– Simplified CDM tester hardware schematic	11
Figure 2	– CDM characteristic waveform and parameters	17
Figure E.1	– Simplified CDM tester electrical schematic.....	27
Figure F.1	– 1 GHz TC 500, small verification module.....	29
Figure F.2	– 1 GHz TC 500, large verification module	29
Figure F.3	– 8 GHz TC 500, small verification module (oscilloscope adjusts for attenuation)	30
Figure F.4	– GHz TC 500, large verification module (oscilloscope adjusts for attenuation)	30
Figure G.1	– Single discharge procedure (field charging, I_{CDM} Pulse, and slow discharge).....	31
Figure G.2	– Dual discharge procedure (field charging, 1 st I_{CDM} pulse, no field, 2 nd I_{CDM} pulse)	32
Figure H.1	– An example of a waveform verification flow for qualification and quarterly checks using the factor/offset adjustment method	34
Figure H.2	– An example of a waveform verification flow for the routine checks using the factor/offset adjustment method	35
Figure H.3	– Example of average I_{peak} for the large verification module – high bandwidth oscilloscope	36
Figure H.4	– An example of a waveform verification flow for qualification and quarterly checks using the software voltage adjustment method	37
Figure H.5	– An example of a waveform verification flow for the routine checks using the software voltage adjustment method	38
Figure I.1	– An example characterization of charge delay vs. I_p	41
Figure J.1	– Examples of discharge circuit where the discharge is caused by closing the switch	43
Figure J.2	– Verification test equipment for measuring the discharge current flowing to the metal bar/board from the standard test module	44
Figure J.3	– Current waveform.....	44
Figure J.4	– Measurement circuit for verification method using a current probe.....	46
Table 1	– CDM waveform characteristics for a 1 GHz bandwidth oscilloscope.....	16
Table 2	– CDM waveform characteristics for a high-bandwidth (≥ 6 GHz) oscilloscope.....	16
Table 3	– CDM ESDS device classification levels	20
Table A.1	– Specification for CDM tester verification modules (metal discs).....	21
Table H.1	– Example waveform parameter recording table for the factor/offset adjustment method	39
Table H.2	– Example waveform parameter recording table for the software voltage adjustment method	39
Table J.1	– Dimensions of the standard test modules	42

Table J.2 – Specified current waveform	45
Table J.3 – Range of peak current I_{p1} for test equipment	45
Table J.4 – Specification of peak current I_{p1} for the current probe verification method	46

INTERNATIONAL ELECTROTECHNICAL COMMISSION

SEMICONDUCTOR DEVICES – MECHANICAL AND CLIMATIC TEST METHODS –

Part 28: Electrostatic discharge (ESD) sensitivity testing – Charged device model (CDM) – device level

FOREWORD

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IEC 60749-28 has been prepared by IEC technical committee 47: Semiconductor devices, in collaboration with IEC technical committee 101: Electrostatics. It is an International Standard.

ANSI/ESDA/JEDEC JS-002-2018 has served as a basis for the elaboration of this standard. It is used with permission of the copyright holders, ESD Association and JEDEC Solid state Technology Association. ANSI/ESDA/JEDEC JS-002-2018 describes the field-induced (FI) method. An alternative, the direct contact (DC) method (not based on JS-002-2018), is described in Annex J.

This second edition cancels and replaces the first edition published in 2017. This edition constitutes a technical revision.

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

- a) a new subclause and annex relating to the problems associated with CDM testing of integrated circuits and discrete semiconductors in very small packages;
- b) changes to clarify cleaning of devices and testers.

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

Draft	Report on voting
47/2746/FDIS	47/2754/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/standardsdev/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.

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INTRODUCTION

The earliest electrostatic discharge (ESD) test models and standards simulate a charged object approaching a device and discharging through the device. The most common example is IEC 60749-26, the human body model (HBM). However, with the increasing use of automated device handling systems, another potentially destructive discharge mechanism, the charged device model (CDM), becomes increasingly important. In the CDM, a device itself becomes charged (e.g. by sliding on a surface (tribocharging) or by electric field induction) and is rapidly discharged (by an ESD event) as it closely approaches a conductive object. A critical feature of the CDM is the metal-metal discharge, which results in a very rapid transfer of charge through an air breakdown arc. The CDM test method also simulates metal-metal discharges arising from other similar scenarios, such as the discharging of charged metal objects to devices at different potential.

Accurately quantifying and reproducing this fast metal-metal discharge event is very difficult, if not impossible, due to the limitations of the measuring equipment and its influence on the discharge event. The CDM discharge is generally completed in a few nanoseconds, and peak currents of tens of amperes have been observed. The peak current into the device will vary considerably depending on a large number of factors, including package type and parasitics. The typical failure mechanism observed in MOS devices for the CDM model is dielectric damage, although other damage has been noted.

The CDM charge voltage sensitivity of a given device is package dependent. For example, the same integrated circuit (IC) in a small area package can be less susceptible to CDM damage at a given voltage compared to that same IC in a package of the same type with a larger area. It has been shown that CDM damage susceptibility correlates better to peak current levels than charge voltage.

SEMICONDUCTOR DEVICES – MECHANICAL AND CLIMATIC TEST METHODS –

Part 28: Electrostatic discharge (ESD) sensitivity testing – Charged device model (CDM) – device level

1 Scope

This part of IEC 60749 establishes the procedure for testing, evaluating, and classifying devices and microcircuits according to their susceptibility (sensitivity) to damage or degradation by exposure to a defined field-induced charged device model (CDM) electrostatic discharge (ESD). All packaged semiconductor devices, thin film circuits, surface acoustic wave (SAW) devices, opto-electronic devices, hybrid integrated circuits (HICs), and multi-chip modules (MCMs) containing any of these devices are to be evaluated according to this document. To perform the tests, the devices are assembled into a package similar to that expected in the final application. This CDM document does not apply to socketed discharge model testers. This document describes the field-induced (FI) method. An alternative, the direct contact (DC) method, is described in Annex J.

The purpose of this document is to establish a test method that will replicate CDM failures and provide reliable, repeatable CDM ESD test results from tester to tester, regardless of device type. Repeatable data will allow accurate classifications and comparisons of CDM ESD sensitivity levels.

2 Normative references

There are no normative references in this document.

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- IEC Electropedia: available at <http://www.electropedia.org/>
- ISO Online browsing platform: available at <http://www.iso.org/obp>

3.1

CDM ESD

charged device model electrostatic discharge

electrostatic discharge (ESD) using the charged device model (CDM) to simulate the actual discharge event that occurs when a charged device is quickly discharged to another object at a lower electrostatic potential through a single pin or terminal

3.2

CDM ESD tester

charged device model electrostatic discharge tester

equipment that simulates the device level CDM ESD event using the non-socketed test method

Note 1 to entry: "Equipment" is referred to as "tester" in this document.

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