

STN	Konektory pre elektrické a elektronické zariadenia Skúšky a merania Časť 28-100: Skúšky integrity signálu do 2 000 MHz Skúšky 28a až 28g	STN EN IEC 60512-28-100 35 4055
------------	---	---

Connectors for electrical and electronic equipment - Tests and measurements - Part 28-100: Signal integrity tests up to 2 000 MHz - Tests 28a to 28g

Táto norma obsahuje anglickú verziu európskej normy.
This standard includes the English version of the European Standard.

Táto norma bola oznámená vo Vestníku ÚNMS SR č. 03/20

Obsahuje: EN IEC 60512-28-100:2019, IEC 60512-28-100:2019

Oznámením tejto normy sa od 19.12.2022 ruší
STN EN 60512-28-100 (35 4055) zo septembra 2013

130651

EUROPEAN STANDARD

EN IEC 60512-28-100

NORME EUROPÉENNE

EUROPÄISCHE NORM

December 2019

ICS 31.220.10

Supersedes EN 60512-28-100:2013 and all of its amendments and corrigenda (if any)

English Version

**Connectors for electrical and electronic equipment - Tests and measurements - Part 28-100: Signal integrity tests up to 2 000 MHz - Tests 28a to 28g
(IEC 60512-28-100:2019)**

Connecteurs pour équipements électriques et électroniques
- Essais et mesures - Partie 28-100: Essais d'intégrité des signaux jusqu'à 2 000 MHz - Essais 28a à 28g
(IEC 60512-28-100:2019)

Steckverbinder für elektronische Einrichtungen - Mess- und Prüfverfahren - Teil 28-100: Signalintegritätsprüfungen bis 2 000 MHz - Prüfungen 28a bis 28g
(IEC 60512-28-100:2019)

This European Standard was approved by CENELEC on 2019-12-19. 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 CEN-CENELEC Management Centre 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 CEN-CENELEC Management Centre has the same status as the official versions.

CENELEC members are the national electrotechnical committees of Austria, Belgium, Bulgaria, Croatia, Cyprus, the Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, the Netherlands, Norway, Poland, Portugal, Republic of North Macedonia, Romania, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.



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

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

EN IEC 60512-28-100:2019 (E)**European foreword**

The text of document 48B/2756/FDIS, future edition 2 of IEC 60512-28-100, prepared by SC 48B "Electrical connectors" of IEC/TC 48 "Electrical connectors and mechanical structures for electrical and electronic equipment" was submitted to the IEC-CENELEC parallel vote and approved by CENELEC as EN IEC 60512-28-100:2019.

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) 2020-09-19
- latest date by which the national standards conflicting with the document have to be withdrawn (dow) 2022-12-19

This document supersedes EN 60512-28-100:2013 and all of its amendments and corrigenda (if any).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CENELEC shall not be held responsible for identifying any or all such patent rights.

Endorsement notice

The text of the International Standard IEC 60512-28-100:2019 was approved by CENELEC as a European Standard without any modification.

Annex ZA (normative)

Normative references to international publications with their corresponding European publications

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.

NOTE 1 Where an International Publication has been modified by common modifications, indicated by (mod), the relevant EN/HD applies.

NOTE 2 Up-to-date information on the latest versions of the European Standards listed in this annex is available here: www.cenelec.eu.

<u>Publication</u>	<u>Year</u>	<u>Title</u>	<u>EN/HD</u>	<u>Year</u>
IEC 60050-581	-	International Electrotechnical Vocabulary - - Part 581: Electromechanical components for electronic equipment		-
IEC 60169-15	-	Radio-frequency connectors. Part 15: R.F. - coaxial connectors with inner diameter of outer conductor 4.13 mm (0.163 in) with screw coupling - Characteristic impedance 50 ohms (Type SMA)		-
IEC 60512-1	-	Connectors for electronic equipment – Tests and measurements - Part 1: Generic specification	EN IEC 60512-1	-
IEC 60512-26-100	-	Connectors for electronic equipment - Tests and measurements - Part 26-100: Measurement setup, test and reference arrangements and measurements for connectors according to IEC 60603-7 - Tests 26a to 26g	EN 60512-26-100	-
IEC 60512-27-100	-	Connectors for electronic equipment - Tests and measurements - Part 27-100: Signal integrity tests up to 500 MHz on 60603-7 series connectors - Tests 27a to 27g	EN 60512-27-100	-
IEC 60512-27-200	-	Connecteurs for electrical and electronic equipment - Tests and measurements - Part 27-200: Additional specifications for signal integrity tests up to 2 000 MHz on IEC 60603-7 series connectors - Tests 27a to 27g		-
IEC 60512-29-100	-	Connectors for electronic equipment - Tests and measurements - Part 29-100: Signal integrity tests up to 500 MHz on M12 style connectors - Tests 29a to 29g	EN 60512-29-100	-

EN IEC 60512-28-100:2019 (E)

<u>Publication</u>	<u>Year</u>	<u>Title</u>	<u>EN/HD</u>	<u>Year</u>
IEC 60603-7	-	Connectors for electronic equipment - Part EN 60603-7 7: Detail specification for 8-way, unshielded, free and fixed connectors		-
IEC 60603-7-1	-	Connectors for electronic equipment - Part EN 60603-7-1 7-1: Detail specification for 8-way, shielded, free and fixed connectors		-
IEC 60603-7-2	-	Connectors for electronic equipment - Part EN 60603-7-2 7-2: Detail specification for 8-way, unshielded, free and fixed connectors, for data transmissions with frequencies up to 100 MHz		-
IEC 60603-7-3	-	Connectors for electronic equipment - Part EN 60603-7-3 7-3: Detail specification for 8-way, shielded, free and fixed connectors, for data transmission with frequencies up to 100 MHz		-
IEC 60603-7-4	-	Connectors for electronic equipment - Part EN 60603-7-4 7-4: Detail specification for 8-way, unshielded, free and fixed connectors, for data transmissions with frequencies up to 250 MHz		-
IEC 60603-7-5	-	Connectors for electronic equipment - Part EN 60603-7-5 7-5: Detail specification for 8-way, shielded, free and fixed connectors, for data transmissions with frequencies up to 250 MHz		-
IEC 60603-7-7	-	Connectors for electronic equipment - Part EN 60603-7-7 7-7: Detail specification for 8-way, shielded, free and fixed connectors for data transmission with frequencies up to 600 MHz		-
IEC 60603-7-41	-	Connectors for electronic equipment - Part EN 60603-7-41 7-41: Detail specification for 8-way, unshielded, free and fixed connectors, for data transmissions with frequencies up to 500 MHz		-
IEC 60603-7-51	-	Connectors for electronic equipment - Part EN 60603-7-51 7-51: Detail specification for 8-way, shielded, free and fixed connectors, for data transmissions with frequencies up to 500 MHz		-
IEC 60603-7-71	-	Connectors for electronic equipment - Part EN 60603-7-71 7-71: Detail specification for 8-way, shielded, free and fixed connectors, for data transmission with frequencies up to 1 000 MHz		-
IEC 60603-7-81	-	Connectors for electronic equipment – Part EN 60603-7-81 7-81: Detail specification for 8-way, shielded, free and fixed connectors, for data transmissions with frequencies up to 2 000 MHz		-

EN IEC 60512-28-100:2019 (E)

<u>Publication</u>	<u>Year</u>	<u>Title</u>	<u>EN/HD</u>	<u>Year</u>
IEC 60603-7-82	-	Connectors for electronic equipment - Part 7-82: Detail specification for 8-way, 12 contacts, shielded, free and fixed connectors, for data transmission with frequencies up to 2 000 MHz	EN 60603-7-82	-
IEC 61076-1	-	Connectors for electronic equipment - Product requirements - Part 1: Generic specification	EN 61076-1	-
IEC 61076-2	-	Connectors for electronic equipment - Product requirements - Part 2: Sectional specification for circular connectors	EN 61076-2	-
IEC 61076-2-109	-	Connectors for electronic equipment - Product requirements - Part 2-109: Circular connectors - Detail specification for connectors with M 12 x 1 screw-locking, for data transmission frequencies up to 500 MHz	EN 61076-2-109	-
IEC 61076-3	-	Connectors for electronic equipment - Product requirements - Part 3: Rectangular connectors - Sectional specification	EN 61076-3	-
IEC 61076-3-104	-	Connectors for electrical and electronic equipment - Product requirements - Part 3-104: Detail specification for 8-way, shielded free and fixed connectors for data transmissions with frequencies up to 2 000 MHz	EN 61076-3-104	-
IEC 61076-3-110	-	Connectors for electronic equipment - Product requirements - Part 3-110: Detail specification for free and fixed connectors for data transmission with frequencies up to 3 000 MHz	EN 61076-3-110	-
IEC 61156-1	-	Multicore and symmetrical pair/quad - cables for digital communications - Part 1: Generic specification		-
IEC 61156-9	-	Multicore and symmetrical pair/quad - cables for digital communications - Part 9: Cables for channels with transmission characteristics up to 2 GHz - Sectional specification		-
IEC 61156-10	2016	Multicore and symmetrical pair/quad - cables for digital communications - Part 10: Cables for cords with transmission characteristics up to 2 GHz - Sectional specification		-
IEC 61169-16	-	Radio-frequency connectors - Part 16: Sectional specification - RF coaxial connectors with inner diameter of outer conductor 7 mm (0,276 in) with screw coupling - Characteristics impedance 50 ohms (75 ohms) (type N)	EN 61169-16	-

EN IEC 60512-28-100:2019 (E)

<u>Publication</u>	<u>Year</u>	<u>Title</u>	<u>EN/HD</u>	<u>Year</u>
IEC 62153-4-12	-	Metallic communication cable test methods - - Part 4-12: Electromagnetic compatibility (EMC) - Coupling attenuation or screening attenuation of connecting hardware - Absorbing clamp method		-
ISO/IEC 11801-1	2017	Information technology - Generic cabling - for customer premises - Part 1: General requirements		-



IEC 60512-28-100

Edition 2.0 2019-11

INTERNATIONAL STANDARD

NORME INTERNATIONALE



**Connectors for electrical and electronic equipment –
Tests and measurements –
Part 28-100: Signal integrity tests up to 2 000 MHz – Tests 28a to 28g**

**Connecteurs pour équipements électriques et électroniques –
Essais et mesures –
Partie 28-100: Essais d'intégrité des signaux jusqu'à 2 000 MHz – Essais
28a à 28g**

**THIS PUBLICATION IS COPYRIGHT PROTECTED****Copyright © 2019 IEC, Geneva, Switzerland**

All rights reserved. Unless otherwise specified, no part of this publication may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying and microfilm, without permission in writing from either IEC or IEC's member National Committee in the country of the requester. If you have any questions about IEC copyright or have an enquiry about obtaining additional rights to this publication, please contact the address below or your local IEC member National Committee for further information.

Droits de reproduction réservés. Sauf indication contraire, aucune partie de cette publication ne peut être reproduite ni utilisée sous quelque forme que ce soit et par aucun procédé, électronique ou mécanique, y compris la photocopie et les microfilms, sans l'accord écrit de l'IEC ou du Comité national de l'IEC du pays du demandeur. Si vous avez des questions sur le copyright de l'IEC ou si vous désirez obtenir des droits supplémentaires sur cette publication, utilisez les coordonnées ci-après ou contactez le Comité national de l'IEC de votre pays de résidence.

IEC Central Office
3, rue de Varembe
CH-1211 Geneva 20
Switzerland

Tel.: +41 22 919 02 11
info@iec.ch
www.iec.ch

About the IEC

The International Electrotechnical Commission (IEC) is the leading global organization that prepares and publishes International Standards for all electrical, electronic and related technologies.

About IEC publications

The technical content of IEC publications is kept under constant review by the IEC. Please make sure that you have the latest edition, a corrigendum or an amendment might have been published.

IEC publications search - webstore.iec.ch/advsearchform

The advanced search enables to find IEC publications by a variety of criteria (reference number, text, technical committee,...). It also gives information on projects, replaced and withdrawn publications.

IEC Just Published - webstore.iec.ch/justpublished

Stay up to date on all new IEC publications. Just Published details all new publications released. Available online and once a month by email.

IEC Customer Service Centre - webstore.iec.ch/csc

If you wish to give us your feedback on this publication or need further assistance, please contact the Customer Service Centre: sales@iec.ch.

Electropedia - www.electropedia.org

The world's leading online dictionary on electrotechnology, containing more than 22 000 terminological entries in English and French, with equivalent terms in 16 additional languages. Also known as the International Electrotechnical Vocabulary (IEV) online.

IEC Glossary - std.iec.ch/glossary

67 000 electrotechnical terminology entries in English and French extracted from the Terms and Definitions clause of IEC publications issued since 2002. Some entries have been collected from earlier publications of IEC TC 37, 77, 86 and CISPR.

A propos de l'IEC

La Commission Electrotechnique Internationale (IEC) est la première organisation mondiale qui élabore et publie des Normes internationales pour tout ce qui a trait à l'électricité, à l'électronique et aux technologies apparentées.

A propos des publications IEC

Le contenu technique des publications IEC est constamment revu. Veuillez vous assurer que vous possédez l'édition la plus récente, un corrigendum ou amendement peut avoir été publié.

Recherche de publications IEC -**webstore.iec.ch/advsearchform**

La recherche avancée permet de trouver des publications IEC en utilisant différents critères (numéro de référence, texte, comité d'études,...). Elle donne aussi des informations sur les projets et les publications remplacées ou retirées.

IEC Just Published - webstore.iec.ch/justpublished

Restez informé sur les nouvelles publications IEC. Just Published détaille les nouvelles publications parues. Disponible en ligne et une fois par mois par email.

Service Clients - webstore.iec.ch/csc

Si vous désirez nous donner des commentaires sur cette publication ou si vous avez des questions contactez-nous: sales@iec.ch.

Electropedia - www.electropedia.org

Le premier dictionnaire d'électrotechnologie en ligne au monde, avec plus de 22 000 articles terminologiques en anglais et en français, ainsi que les termes équivalents dans 16 langues additionnelles. Egalement appelé Vocabulaire Electrotechnique International (IEV) en ligne.

Glossaire IEC - std.iec.ch/glossary

67 000 entrées terminologiques électrotechniques, en anglais et en français, extraites des articles Termes et Définitions des publications IEC parues depuis 2002. Plus certaines entrées antérieures extraites des publications des CE 37, 77, 86 et CISPR de l'IEC.



IEC 60512-28-100

Edition 2.0 2019-11

INTERNATIONAL STANDARD

NORME INTERNATIONALE



**Connectors for electrical and electronic equipment –
Tests and measurements –
Part 28-100: Signal integrity tests up to 2 000 MHz – Tests 28a to 28g**

**Connecteurs pour équipements électriques et électroniques –
Essais et mesures –
Partie 28-100: Essais d'intégrité des signaux jusqu'à 2 000 MHz – Essais
28a à 28g**

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

COMMISSION
ELECTROTECHNIQUE
INTERNATIONALE

ICS 31.220.10

ISBN 978-2-8322-7590-0

**Warning! Make sure that you obtained this publication from an authorized distributor.
Attention! Veuillez vous assurer que vous avez obtenu cette publication via un distributeur agréé.**

CONTENTS

FOREWORD	6
1 Scope	8
2 Normative references	8
3 Terms, definitions and abbreviated terms	10
3.1 Terms and definitions.....	10
3.2 Abbreviated terms.....	11
4 Overall test arrangement	11
4.1 General.....	11
4.2 Test instrumentation	11
4.2.1 General	11
4.2.2 Vector network analyser	11
4.2.3 RF switching unit.....	12
4.2.4 Reference loads and termination loads	12
4.3 Measurement precautions	12
4.4 Mixed mode S-parameter nomenclature	13
4.5 Coaxial cables and interconnect for network analyzers	14
4.6 Characteristic for switching matrices	14
4.7 Test fixture requirements	15
4.7.1 Test fixture types	15
4.8 Requirements for termination performance at calibration plane	15
4.9 Reference loads for calibration	15
4.10 Calibration	16
4.10.1 General	16
4.10.2 Calibration test interface.....	16
4.10.3 Calibration at end of coaxial test cables.....	16
4.11 Termination loads for termination of conductor pairs	17
4.11.1 General	17
4.11.2 Impedance matching resistor termination networks	17
4.12 Termination of screens	17
4.13 Test specimen and reference planes.....	18
4.13.1 General	18
4.13.2 Interconnections between device under test (DUT) and the calibration plane	18
4.14 Overall test setup requirements	20
5 Connector measurements up to 2 000 MHz	21
5.1 General.....	21
5.2 Insertion loss, test 28a.....	21
5.2.1 Object.....	21
5.2.2 Connecting hardware insertion loss	21
5.2.3 Test method	21
5.2.4 Test set-up	21
5.2.5 Procedure.....	21
5.2.6 Test report.....	22
5.2.7 Accuracy	22
5.3 Return loss, test 28b.....	22
5.3.1 Object.....	22

5.3.2	Connecting hardware return loss	22
5.3.3	Test method	22
5.3.4	Test set-up	23
5.3.5	Procedure.....	23
5.3.6	Test report.....	23
5.3.7	Accuracy	23
5.4	Near-end crosstalk (NEXT), test 28c	23
5.4.1	Object.....	23
5.4.2	Connecting hardware NEXT	23
5.4.3	Test method	24
5.4.4	Test set-up	24
5.4.5	Procedure.....	24
5.4.6	Test report.....	25
5.4.7	Accuracy	25
5.5	Far-end crosstalk (FEXT), test 28d	25
5.5.1	Object.....	25
5.5.2	Connecting hardware FEXT	25
5.5.3	Test method	25
5.5.4	Test set-up	25
5.5.5	Procedure.....	26
5.5.6	Test report.....	26
5.5.7	Accuracy	26
5.6	Transverse conversion loss (TCL), test 28f	27
5.6.1	Object.....	27
5.6.2	Connecting hardware TCL	27
5.6.3	Test method	27
5.6.4	Test set-up	27
5.6.5	Procedure.....	28
5.6.6	Test report.....	28
5.6.7	Accuracy	28
5.7	Transverse conversion transfer loss (TCTL), test 28g	28
5.7.1	Object.....	28
5.7.2	Connecting hardware TCTL	29
5.7.3	Test method	29
5.7.4	Test set-up	29
5.7.5	Procedure.....	29
5.7.6	Test report.....	29
5.7.7	Accuracy	30
5.8	Shield transfer impedance (Z_T), test 26e	30
5.8.1	Object.....	30
5.8.2	Connecting hardware Ttransfer impedance (Z_T).....	30
5.8.3	Test method	30
5.8.4	Test set-up	30
5.8.5	Procedure.....	30
5.8.6	Test report.....	31
5.8.7	Accuracy	31
5.9	Coupling attenuation (a_C)	31
5.9.1	Object.....	31
5.9.2	Connecting hardware coupling attenuation (a_C).....	31

5.9.3	Test method	31
5.9.4	Test set-up	31
5.9.5	Procedure.....	31
5.9.6	Test report.....	32
5.9.7	Accuracy	32
Annex A (informative) Derivation of mixed mode parameters using the modal decomposition technique		33
A.1	General.....	33
A.2	Example of a calculation	33
Annex B (normative) Indirect-reference test fixtures.....		36
B.1	General.....	36
B.2	Requirements	36
B.2.1	General requirements	36
B.2.2	Specific requirements	36
Annex C (normative) Direct-probe test fixtures.....		38
C.1	General.....	38
C.2	Requirements	38
C.2.1	General requirements	38
C.2.2	Specific requirements	38
Annex D (normative) Specialized test fixtures		40
D.1	General.....	40
D.2	Requirements	40
D.2.1	General requirements	40
D.2.2	Specific requirements	40
Annex E (informative) Symmetry verification of resistors used for calibration		41
Bibliography.....		44
Figure 1 – Diagram of a single ended 4-port device		13
Figure 2 – Diagram of a balanced 2-port device		13
Figure 3 – Calibration of reference loads		16
Figure 4 – Resistor termination networks		17
Figure 5 – Definition of reference planes.....		18
Figure 6 – Insertion loss and TCTL measurement		22
Figure 7 – NEXT measurement		24
Figure 8 – FEXT measurement		26
Figure 9 – Return loss and TCL measurement		27
Figure A.1 – Voltage and current on balanced DUT.....		33
Figure A.2 – Voltage and current on unbalanced DUT.....		34
Figure E.1 – Example of 50 Ω SMA termination comparison (1 MHz – 100 MHz).....		42
Figure E.2 – Comparison of phase selected and only magnitude selected terminations.....		42
Table 1 – Mixed mode S-parameter nomenclature		14
Table 2 – Switch performance requirements		14
Table 3 – Requirements for terminations at calibration plane		15
Table 4 – Interconnection DM return loss requirements.....		20
Table 5 – Overall test setup requirements		20

Table B.1 – IEC 60603-7 series, 8-pole connector types detail specifications and respective detail connector test procedures standards	36
Table B.2 – Reference connector crosstalk (NEXT) vector	37
Table C.1 – Direct-probe test fixture requirements	38

INTERNATIONAL ELECTROTECHNICAL COMMISSION

CONNECTORS FOR ELECTRICAL AND ELECTRONIC EQUIPMENT – TESTS AND MEASUREMENTS –

Part 28-100: Signal integrity tests up to 2 000 MHz – Tests 28a to 28g

FOREWORD

- 1) The International Electrotechnical Commission (IEC) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of 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, IEC publishes International Standards, Technical Specifications, Technical Reports, Publicly Available Specifications (PAS) and Guides (hereafter referred to as "IEC Publication(s)"). 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. 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 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 IEC National Committees.
- 3) IEC Publications have the form of recommendations for international use and are accepted by IEC National Committees in that sense. While all reasonable efforts are made to ensure that the technical content of IEC Publications is accurate, IEC cannot be held responsible for the way in which they are used or for any misinterpretation by any end user.
- 4) In order to promote international uniformity, IEC National Committees undertake to apply IEC Publications transparently to the maximum extent possible in their national and regional publications. Any divergence between any IEC Publication and the corresponding national or regional publication shall be clearly indicated in the latter.
- 5) IEC itself does not provide any attestation of conformity. Independent certification bodies provide conformity assessment services and, in some areas, access to IEC marks of conformity. IEC is not responsible for any services carried out by independent certification bodies.
- 6) All users should ensure that they have the latest edition of this publication.
- 7) No liability shall attach to IEC or its directors, employees, servants or agents including individual experts and members of its technical committees and IEC National Committees for any personal injury, property damage or other damage of any nature whatsoever, whether direct or indirect, or for costs (including legal fees) and expenses arising out of the publication, use of, or reliance upon, this IEC Publication or any other IEC Publications.
- 8) Attention is drawn to the Normative references cited in this publication. Use of the referenced publications is indispensable for the correct application of this publication.
- 9) Attention is drawn to the possibility that some of the elements of this IEC Publication may be the subject of patent rights. IEC shall not be held responsible for identifying any or all such patent rights.

International Standard IEC 60512-28-100 has been prepared by subcommittee 48B: Electrical connectors, of IEC technical committee 48: Electrical connectors and mechanical structures for electrical and electronic equipment.

This second edition cancels and replaces the first edition, issued in 2013, and constitutes a technical revision.

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

- The title is revised from 1 000 MHz to 2 000 MHz to reflect the range of frequencies which may be tested.
- All tables and requirements have been revised up to 2 000 MHz.

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

FDIS	Report on voting
48B/2756/FDIS	48B/2766/RVD

Full information on the voting for the approval of this International Standard can be found in the report on voting indicated in the above table.

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

Future standards in this series will carry the new general title as cited above. Titles of existing standards in this series will be updated at the time of the next edition.

A list of all parts of IEC 60512 series, under the general title *Connectors for electrical and electronic equipment – Tests and measurements* 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 "<http://webstore.iec.ch>" in the data related to the specific document. At this date, the document will be

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

IMPORTANT – The 'colour inside' logo on the cover page of this publication indicates that it contains colours which are considered to be useful for the correct understanding of its contents. Users should therefore print this document using a colour printer.

CONNECTORS FOR ELECTRICAL AND ELECTRONIC EQUIPMENT – TESTS AND MEASUREMENTS –

Part 28-100: Signal integrity tests up to 2 000 MHz – Tests 28a to 28g

1 Scope

This part of IEC 60512 specifies the test methods for signal integrity and transmission performance for connectors specified in respective parts of IEC 60603-7, IEC 61076-1, IEC 61076-2, and IEC 61076-3 standards for connecting hardware applications up to 2 000 MHz. It is also suitable for testing lower frequency connectors, however, the test methodology specified in the detail specification for any given connector remains the reference conformance test for that connector. The above list of connector series of standards does not preclude referencing this document in other connector manufacturer's specifications or published standards.

Test procedures provided herein are:

- insertion loss, test 28a;
- return loss, test 28b;
- near-end crosstalk (NEXT) test 28c;
- far-end crosstalk (FEXT), test 28d;
- transverse conversion loss (TCL), test 28f;
- transverse conversion transfer loss (TCTL), test 28g.

Other test procedures referenced herein are:

- transfer impedance (Z_T), see IEC 60512-26-100, test 26e.
- for coupling attenuation (a_C), see IEC 62153-4-12.

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 60050-581, *International Electrotechnical Vocabulary (IEV) – Part 581: Electromechanical components for electronic equipment*

IEC 60169-15, *Radio-frequency connectors – Part 15: R.F. coaxial connectors with inner diameter of outer conductor 4,13 mm (0.163 in) with screw coupling – Characteristic impedance 50 ohms (Type SMA)*

IEC 60512-1, *Connectors for electronic equipment – Tests and measurements – Part 1: Generic specification*

IEC 60512-26-100, *Connectors for electronic equipment – Tests and measurements – Part 26-100: Measurement setup, test and reference arrangement and measurements for connectors according to IEC 60603-7 – Tests 26a to 26g*

IEC 60512-27-100, *Connectors for electronic equipment – Tests and measurements – Part 27-100: Signal integrity tests up to 500 MHz on 60603-7 series connectors – Tests 27a to 27g*

IEC PAS 60512-27-200, *Connecteurs for electrical and electronic equipment – Tests and measurements – Part 27-200: Additional specifications for signal integrity tests up to 2 000 MHz on IEC 60603-7 series connectors – Tests 27a to 27g*

IEC 60512-29-100, *Connectors for electronic equipment – Tests and measurements – Part 29-100: Signal integrity tests up to 500 MHz on M12 style connectors – Tests 29a to 29g*

IEC 60603-7, *Connectors for electronic equipment – Part 7: Detail specification for 8-way, unshielded, free and fixed connectors*

IEC 60603-7-1, *Connectors for electronic equipment – Part 7-1: Detail specification for 8-way, shielded, free and fixed connectors*

IEC 60603-7-2, *Connectors for electronic equipment – Part 7-2: Detail specification for 8-way, unshielded, free and fixed connectors, for data transmissions with frequencies up to 100 MHz*

IEC 60603-7-3, *Connectors for electronic equipment – Part 7-3: Detail specification for 8-way, shielded, free and fixed connectors, for data transmission with frequencies up to 100 MHz*

IEC 60603-7-4, *Connectors for electronic equipment – Part 7-4: Detail specification for 8-way, unshielded, free and fixed connectors, for data transmissions with frequencies up to 250 MHz*

IEC 60603-7-5, *Connectors for electronic equipment – Part 7-5: Detail specification for 8-way, shielded, free and fixed connectors, for data transmissions with frequencies up to 250 MHz*

IEC 60603-7-7, *Connectors for electronic equipment – Part 7-7: Detail specification for 8-way, shielded, free and fixed connectors for data transmission with frequencies up to 600 MHz*

IEC 60603-7-41, *Connectors for electronic equipment – Part 7-41: Detail specification for 8-way, unshielded, free and fixed connectors, for data transmissions with frequencies up to 500 MHz*

IEC 60603-7-51, *Connectors for electronic equipment – Part 7-51: Detail specification for 8-way, shielded, free and fixed connectors, for data transmissions with frequencies up to 500 MHz*

IEC 60603-7-71, *Connectors for electronic equipment – Part 7-71: Detail specification for 8-way, shielded, free and fixed connectors, for data transmission with frequencies up to 1 000 MHz*

IEC 60603-7-81, *Connectors for electronic equipment – Part 7-81: Detail specification for 8-way, shielded, free and fixed connectors, for data transmissions with frequencies up to 2 000 MHz*

IEC 60603-7-82, *Connectors for electronic equipment – Part 7-82: Detail specification for 8-way, 12 contacts, shielded, free and fixed connectors, for data transmission with frequencies up to 2 000 MHz*

IEC 61076-1, *Connectors for electronic equipment – Product requirements – Part 1: Generic specification*

IEC 61076-2, *Connectors for electronic equipment – Product requirements – Part 2: Sectional specification for circular connectors*

IEC 61076-2-109, *Connectors for electronic equipment – Product requirements – Part 2-109: Circular connectors – Detail specification for connectors with M 12 x 1 screw-locking, for data transmission frequencies up to 500 MHz*

IEC 61076-3, *Connectors for electronic equipment – Product requirements – Part 3: Rectangular connectors – Sectional specification*

IEC 61076-3-104, *Connectors for electronic equipment – Product requirements – Part 3-104: Detail specification for 8-way, shielded free and fixed connectors for data transmissions with frequencies up to 2 000 MHz*

IEC 61076-3-110, *Connectors for electronic equipment – Product requirements – Part 3-110: Detail specification for free and fixed connectors for data transmission with frequencies up to 3 000 MHz*

IEC 61156-1, *Multicore and symmetrical pair/quad cables for digital communications – Part 1: Generic specification*

IEC 61156-9, *Multicore and symmetrical pair/quad cables for digital communications – Part 9: Cables for channels with transmission characteristics up to 2 GHz – Sectional specification*

IEC 61156-10:2016, *Multicore and symmetrical pair/quad cables for digital communications – Part 10: Cables for cords with transmission characteristics up to 2 GHz – Sectional specification*

IEC 61169-16, *Radio-frequency connectors – Part 16: RF coaxial connectors with inner diameter of outer conductor 7 mm (0,276 in) with screw coupling – Characteristic impedance 50 ohms (75 ohms) (Type N)*

IEC 62153-4-12, *Metallic communication cable test methods – Part 4-12: Electromagnetic compatibility (EMC) – Coupling attenuation or screening attenuation of connecting hardware – Absorbing clamp method*

ISO/IEC 11801-1:2017, *Information technology – Generic cabling for customer premises – Part 1: General requirements*

koniec náhľadu – text ďalej pokračuje v platenej verzii STN