

INTERNATIONAL STANDARD

NORME INTERNATIONALE

**Fixed capacitors for use in electronic equipment –
Part 23: Sectional specification – Fixed metallized polyethylene naphthalate film
dielectric surface mount DC capacitors**

**Condensateurs fixes utilisés dans les équipements électroniques –
Partie 23: Spécification intermédiaire – Condensateurs fixes pour montage en
surface pour courant continu à diélectrique en film de polynaphtalate d'éthylène
métallisé**



THIS PUBLICATION IS COPYRIGHT PROTECTED

Copyright © 2023 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 Secretariat
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 It also gives information on projects, replaced and withdrawn publications.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.

IEC Products & Services Portal - products.iec.ch

Discover our powerful search engine and read freely all the publications previews. With a subscription you will always have access to up to date content tailored to your needs.

Electropedia - www.electropedia.org

The world's leading online dictionary on electrotechnology, containing more than 22 300 terminological entries in English and French, with equivalent terms in 19 additional languages. Also known as the International Electrotechnical Vocabulary (IEV) online.

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.

IEC Products & Services Portal - products.iec.ch

Découvrez notre puissant moteur de recherche et consultez gratuitement tous les aperçus des publications. Avec un abonnement, vous aurez toujours accès à un contenu à jour adapté à vos besoins.

Electropedia - www.electropedia.org

Le premier dictionnaire d'électrotechnologie en ligne au monde, avec plus de 22 300 articles terminologiques en anglais et en français, ainsi que les termes équivalents dans 19 langues additionnelles. Egalement appelé Vocabulaire Electrotechnique International (IEV) en ligne.

INTERNATIONAL STANDARD

NORME INTERNATIONALE

**Fixed capacitors for use in electronic equipment –
Part 23: Sectional specification – Fixed metallized polyethylene naphthalate film
dielectric surface mount DC capacitors**

**Condensateurs fixes utilisés dans les équipements électroniques –
Partie 23: Spécification intermédiaire – Condensateurs fixes pour montage en
surface pour courant continu à diélectrique en film de polynaphtalate d'éthylène
métallisé**

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

COMMISSION
ELECTROTECHNIQUE
INTERNATIONALE

ICS 31.060.10

ISBN 978-2-8322-6341-9

**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.....	5
1 Scope.....	7
2 Normative references	7
3 Terms and definitions	8
4 Preferred ratings and characteristics	8
4.1 Preferred climatic categories.....	8
4.2 Preferred values of ratings.....	8
4.2.1 Nominal capacitance (C_N)	8
4.2.2 Tolerance on nominal capacitance.....	9
4.2.3 Rated voltage (U_R).....	9
4.2.4 Category voltage (U_C).....	9
4.2.5 Rated temperature.....	9
5 Test and measurement procedures.....	10
5.1 General.....	10
5.2 Mounting.....	10
5.2.1 Initial inspections.....	10
5.2.2 Mounting method.....	10
5.2.3 Final inspections after mounting	10
5.3 Visual examination and check of dimensions	10
5.3.1 General	10
5.3.2 Visual examination and check of dimensions	10
5.3.3 Requirements	10
5.4 Electrical tests	10
5.4.1 Voltage proof.....	10
5.4.2 Capacitance	11
5.4.3 Tangent of loss angle ($\tan \delta$)	11
5.4.4 Insulation resistance.....	12
5.5 Shear test	13
5.5.1 General	13
5.5.2 Final inspections.....	13
5.6 Substrate bending test.....	14
5.6.1 General	14
5.6.2 Initial inspections.....	14
5.6.3 Final inspections and requirements.....	14
5.7 Resistance to soldering heat.....	14
5.7.1 General	14
5.7.2 Initial inspections.....	14
5.7.3 Test conditions	14
5.7.4 Recovery	14
5.7.5 Final inspections and requirements.....	14
5.8 Solderability.....	14
5.8.1 General	14
5.8.2 Test conditions	15
5.8.3 Final inspections and requirements.....	15
5.9 Rapid change of temperature	15
5.9.1 General	15

5.9.2	Initial inspections	15
5.9.3	Test conditions	15
5.9.4	Final inspections and requirements	15
5.10	Climatic sequence	15
5.10.1	General	15
5.10.2	Initial inspections	15
5.10.3	Dry heat	15
5.10.4	Damp heat, cyclic, test Db, first cycle	16
5.10.5	Cold	16
5.10.6	Damp heat, cyclic, test Db, remaining cycles	16
5.10.7	Recovery	16
5.10.8	Final inspections and requirements	16
5.11	Damp heat, steady state	16
5.11.1	General	16
5.11.2	Initial inspections	16
5.11.3	Test conditions	16
5.11.4	Recovery	16
5.11.5	Final inspections and requirements	16
5.12	Endurance	17
5.12.1	General	17
5.12.2	Initial inspections	17
5.12.3	Test conditions	17
5.12.4	Final inspections and requirements	17
5.13	Charge and discharge	17
5.13.1	General	17
5.13.2	Initial inspections	18
5.13.3	Test conditions	18
5.13.4	Recovery	18
5.13.5	Final inspections and requirements	18
5.14	Component solvent resistance (if required)	18
5.14.1	General	18
5.14.2	Final inspections and requirements	18
5.15	Solvent resistance of marking (if applicable)	18
5.15.1	General	18
5.15.2	Final inspections and requirements	18
6	Marking	18
6.1	General	18
6.2	Information for marking	19
6.3	Marking on capacitors	19
6.4	Marking on packaging	19
7	Information to be given in a detail specification	19
7.1	General	19
7.2	Outline drawing and dimensions	19
7.3	Mounting	20
7.4	Ratings and characteristics	20
7.4.1	General	20
7.4.2	Nominal capacitance range	20
7.4.3	Particular characteristics	20
7.4.4	Soldering	20

7.5	Marking.....	20
8	Quality assessment procedures	20
8.1	Primary stage of manufacture	20
8.2	Structurally similar components	20
8.3	Certified test records of released lots.....	21
8.4	Qualification approval procedures.....	21
8.4.1	General	21
8.4.2	Qualification approval on the basis of the fixed sample size procedure	21
Annex A	(normative) Quality conformance inspection.....	29
A.1	Formation of inspection lots	29
A.1.1	Groups A and B inspection	29
A.1.2	Group C inspection	29
A.2	Test schedule	29
A.3	Delayed delivery	29
A.4	Assessment levels	29
Annex X	(informative) Cross-references to the previous edition of this document.....	36
Bibliography		37
Table 1	– Percentage limit of the rated voltage at AC voltage frequency	9
Table 2	– Test voltages.....	11
Table 3	– Tangent of loss angle limits.....	12
Table 4	– Requirements regarding insulation resistance	13
Table 5	– Correction factor dependent on temperature.....	13
Table 6	– Endurance test conditions for Grade 1 and Grade 2 capacitors	17
Table 7	– Endurance test conditions for Grade 3 capacitors.....	17
Table 8	– Test and sampling plan for qualification approval Assessment level EZ.....	22
Table 9	– Test schedule for qualification approval.....	23
Table A.1	– Lot-by-lot inspection.....	30
Table A.2	– Periodic inspection.....	31
Table X.1	– Cross-reference	36

INTERNATIONAL ELECTROTECHNICAL COMMISSION

FIXED CAPACITORS FOR USE IN ELECTRONIC EQUIPMENT –**Part 23: Sectional specification –
Fixed metallized polyethylene naphthalate film
dielectric surface mount DC capacitors**

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.

IEC 60384-23 has been prepared by IEC technical committee 40: Capacitors and resistors for electronic equipment. It is an International Standard.

This third edition cancels and replaces the second edition published in 2015. This edition constitutes a technical revision.

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

- a) this edition includes the following significant technical changes with respect to the previous edition: revision of all parts of the document based on the ISO/IEC Directives, Part 2:2021, and harmonization with other similar kinds of documents;
- b) the document structure has been organized to follow new sectional specification structure decided in TC 40;
- c) revised tables and Clause 5 so as to prevent duplications and contradictions;

- d) in Subclause 5.2 (Mounting), the Subclauses 5.2.1, 5.2.2 and 5.2.3 have been added;
- e) in Subclause 5.5 (Shear test), the Subclauses 5.5.1 and 5.5.2 have been added;
- f) in Subclause 5.14 (Component solvent resistance), the Subclauses 5.14.1 and 5.14.2 have been added. In Table 8 and Table A.2, test 5.14 has been moved before 5.7.5 (Final inspections and requirements) in Group 1A and in Subgroup C1;
- g) In Subclause 5.15 (Solvent resistance of marking), the Subclauses 5.15.1 and 5.15.2 have been added;
- h) tangent of loss angle measurement has been added to the resistance to soldering heat test;
- i) lot-by-lot and periodical inspection tables including requirements have been moved to Annex A;
- j) revised Inspection Level (IL) of A1 subgroup.

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

Draft	Report on voting
40/2983/FDIS	40/3019/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.

The list of all parts of the IEC 60384 series, under the general title *Fixed capacitors for use in electronic equipment*, can be found on the IEC web site.

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.

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

FIXED CAPACITORS FOR USE IN ELECTRONIC EQUIPMENT –

Part 23: Sectional specification – Fixed metallized polyethylene naphthalate film dielectric surface mount DC capacitors

1 Scope

This part of IEC 60384 is applicable to fixed surface mount capacitors for direct current, with metallized electrodes and polyethylene naphthalate dielectric for use in electronic equipment. These capacitors have metallized connecting pads or soldering strips and are intended to be mounted directly onto printed boards or onto substrates for hybrid circuits. These capacitors can have "self-healing properties" depending on conditions of use. They are primarily intended for applications where the AC component is small with respect to the rated voltage.

This part of IEC 60384 specifies preferred ratings and characteristics, selects from IEC 60384-1:2021 the appropriate quality assessment procedures, tests and measuring methods and gives general performance requirements for this type of capacitor. Test severities and requirements specified in detail specifications referring to this sectional specification are of an equal or higher performance level. Lower performance levels are not permitted.

Capacitors for electromagnetic interference suppression are not included, but are covered by IEC 60384-14.

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 60062, *Marking codes for resistors and capacitors*

IEC 60063, *Preferred number series for resistors and capacitors*

IEC 60068-1:2013, *Environmental testing – Part 1: General and guidance*

IEC 60384-1:2021, *Fixed capacitors for use in electronic equipment – Part 1: Generic specification*

IEC 61193-2:2007, *Quality assessment systems – Part 2: Selection and use of sampling plans for inspection of electronic components and packages*

ISO 3, *Preferred numbers – Series of preferred numbers*