



IEC 62899-402-8

Edition 1.0 2026-06

INTERNATIONAL STANDARD

**Printed electronics -
Part 402-8: Printability - Measurement of qualities - Shape pattern dimension**

Sample Document

get full document from standards.iteh.ai



THIS PUBLICATION IS COPYRIGHT PROTECTED

Copyright © 2026 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.

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 It also gives information on projects, replaced and withdrawn publications.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, graphical symbols and the glossary. 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 22 500 terminological entries in English and French, with equivalent terms in 25 additional languages. Also known as the International Electrotechnical Vocabulary (IEV) online.

Warning! Make sure that you obtained this publication from an authorized distributor.

CONTENTS

FOREWORD	3
INTRODUCTION	5
1 Scope	6
2 Normative references	6
3 Terms and definitions	6
4 Atmospheric conditions for evaluation and conditioning	7
5 Measuring methods and instruments	7
5.1 Measuring instrument	7
5.2 Preparation of imaging (specimen).....	7
5.3 Overview of measuring method	8
5.4 Measuring method for basic shape patterns	8
5.4.1 Measuring method for a circle/a part of circle pattern.....	8
5.4.2 Measuring method for square or rectangle pattern	11
5.4.3 Measuring method for line pattern	14
5.5 Measuring methods for a combination of basic shape patterns.....	14
6 Report of results	14
6.1 Measurement identification information	14
6.2 Atmospheric conditions	14
6.3 Instrument system and its specification	14
6.4 Information of specimen.....	15
6.5 Results	15
Annex A (informative) Examples and guidelines for finding the centre of the circle pattern.....	16
A.1 Examples for finding the centre of the circle pattern.....	16
A.1.1 Using a rectangle passing the outmost edges	16
A.1.2 Using two or more lines passing any two points of edge	17
A.2 Guidelines for finding the centre of an arc (a part of a circle) or a circle pattern with large defects.....	18
A.2.1 Examples of a part of circle and a circle pattern with large defects	18
A.2.2 Method to find centre.....	18
Annex B (informative) Calculation of dimensions of a circle pattern	21
B.1 Calculation of variations of radius and diameter	21
B.2 Calculation of variations of radius and diameter relative to designed dimension	22
Annex C (informative) Calculation of dimensions of a rectangle pattern	24
Annex D (informative) Examples of measuring method for a combination of basic shape patterns.....	26
D.1 Measuring method for a combination of circle and lines	26
D.1.1 Examples of circle and lines	26
D.1.2 Measuring method	26
D.2 Measuring method for a combination of rectangle and lines	26
D.2.1 Examples of a combination of rectangle and lines.....	26
D.2.2 Measurement method	27
D.3 Measuring method for angle bracket	27
D.3.1 Examples of angle bracket.....	27
D.3.2 Measuring method for angle bracket.....	28

Bibliography.....	29
Figure 1 – Original image and a circle drawn	8
Figure 2 – Recognized edges of circle pattern and estimated centre of the circle	10
Figure 3 – Edges of square image and a rectangle drawn	11
Figure 4 – Identified edges and reference sides of the rectangle.....	13
Figure A.1 – Method to find the centre of a circle pattern using vertical and horizontal lines passing the outmost edges	16
Figure A.2 – Method to find the centre of a circle pattern using a rectangle passing the outmost edges	17
Figure A.3 – Estimation of the centre of a circle pattern using multiple sets of rectangles.....	17
Figure A.4 – Method to find the centre of a circle pattern using two or more lines passing two points of the edge.....	18
Figure A.5 – Example of a part of circle and circle patterns with large defects	18
Figure A.6 – Estimated centre of a circle pattern including defect part	19
Figure A.7 – Estimated centre of a circle pattern excluding defect part	20
Figure B.1 – Definition of position of pixel of edge of a circle in polar coordinate	21
Figure B.2 – Definition of position of pixel of edge of a part of circle in polar coordinate	21
Figure B.3 – Variations of radius of the circle pattern.....	22
Figure B.4 – Variations of diameter of the circle pattern.....	22
Figure B.5 – Variations of diameter of the circle pattern and original diameter of a circle.....	23
Figure B.6 – Variation of diameter relative to the original dimension	23
Figure C.1 – Definition of reference vertical and horizontal lines to calculate dimensions of rectangle	24
Figure C.2 – Variations of lengths and widths of the rectangle	25
Figure D.1 – Example of combination of circle and lines	26
Figure D.2 – Measurement method for pattern dimensions of a combination of circle and line.....	26
Figure D.3 – Combination of rectangle and lines	27
Figure D.4 – Measurement method for pattern dimensions of combination of rectangle and lines	27
Figure D.5 – Example of angle bracket pattern in circuit (a) and enlarged picture of angle bracket pattern (b).....	28
Figure D.6 – Measurement method for angle bracket pattern	28
Table 1 – Example of reporting items	15

INTERNATIONAL ELECTROTECHNICAL COMMISSION

**Printed electronics -
Part 402-8: Printability - Measurement of qualities - Shape pattern
dimension**

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) IEC draws attention to the possibility that the implementation of this document may involve the use of (a) patent(s). IEC takes no position concerning the evidence, validity or applicability of any claimed patent rights in respect thereof. As of the date of publication of this document, IEC had not received notice of (a) patent(s), which may be required to implement this document. However, implementers are cautioned that this may not represent the latest information, which may be obtained from the patent database available at <https://patents.iec.ch>. IEC shall not be held responsible for identifying any or all such patent rights.

IEC 62899-402-8 has been prepared by IEC technical committee 119: Printed Electronics. It is an International Standard.

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

Draft	Report on voting
119/532/CDV	119/563A/RVC

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 62899 series, published under the general title *Printed electronics*, 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.

Sample Document

get full document from standards.iteh.ai

INTRODUCTION

This document specifies the measurement of dimensions of the shape patterns in printed electronics. The shape patterns include various patterns with shapes such as circle, ellipse, square, rectangle, etc., as well as a combination of two or more of these, which are commonly used as parts of printed electronics devices. Various shape patterns constitute printed electronics devices, and consequently, the printability of patterns including dimension, gain, loss and distortion affects device performance. Therefore, it is important to measure the dimensions of shape patterns from the viewpoint of printability.

Some parts of pattern measurement have been specified for line pattern width, edge, and voids in IEC 62899-402-1, IEC 62899-402-2, and IEC 62899-402-3, respectively. The IEC 62899-403 series includes basic patterns for evaluation of printing machine, basic patterns for plating, etc., and moreover, IEC 62899-301-2 deals with the measurement of plate master pattern dimension. However, there is no standard for the measurement of printed patterns with general shapes. Therefore, this document is used to measure the dimensions of printed patterns as the result of the pattern design of the IEC 62899-403 series and plate patterns of IEC 62899-301-2 as well as to compare the dimensions of printed patterns with the pattern design for evaluating the printability.

This document includes two methods for the measurement of dimensions of the shape patterns: The first one is to simply specify the dimension of the shape and compare with the original design, and the second one is to specify the dimension as well as to quantify the related attributes such as variation of dimension. For more accurate measurement of dimensions of the shape patterns, it is recommended to apply the second method which requires the proper software to recognize the boundaries or edges differentiating the pattern area from the non-pattern area of the captured image as well as to identify the two-dimensional coordinates of pixels that constitute the image. This document does not specify the software to recognize the edge nor the edge detection algorithm. Depending on the user's concern and purpose, the first method or the second method can be used, or both.

This document excludes the standardization of the measurement system. It specifies the properties related to the shaped patterns of the printed pattern obtained from the optical measurement system.

1 Scope

This part of IEC 62899 specifies the measurement methods of the dimensions of the shape patterns in printed electronics. These printed patterns are treated as two-dimensional on a substrate. When the patterns are definitely affected by three-dimensional configurations, these are specified in measurement methods for vertical variance in IEC TR 62899-402-4 in printed electronics.

NOTE The measurement methods of dimensions of the shape patterns considering three-dimensional characteristics can be developed later after the measurement methods for vertical variance are established.

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.

ISO 187, *Paper, board and pulps - Standard atmosphere for conditioning and testing and procedure for monitoring the atmosphere and conditioning of samples*

ISO 291, *Plastics - Standard atmospheres for conditioning and testing*

3 Terms and definitions

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

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

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

3.1

shape pattern

two-dimensional pattern figure with various shapes

3.2

basic shape pattern

pattern with shapes of circle and rectangle as well as line pattern

3.3

shape pattern dimension

two-dimensional dimension of shape pattern

3.4

reference side

line that best fits each edge of a rectangle

3.5

reference length line

vertical reference side of a rectangle

3.6

reference width line

horizontal reference side of a rectangle

3.7**average length**

distance between two reference length lines of a rectangle

3.8**average width**

distance between two reference width lines of a rectangle

3.9**region of interest****ROI**

area (inside defined boundaries) that the user wants to analyse

[SOURCE: ISO 19262:2015, 3.211]

4 Atmospheric conditions for evaluation and conditioning

The standard atmosphere for evaluation (test and measurement) and storage of the specimen shall be a temperature of $(23 \pm 2) ^\circ\text{C}$ and relative humidity of $(50 \pm 10) \%$, conforming to standard atmosphere class 2 specified in ISO 291. For a plastic test piece which is a polymer substrate with printed patterns, the standard atmosphere for evaluation (test and measurement) and storage of the specimen shall be a temperature of $(23 \pm 1) ^\circ\text{C}$ and relative humidity of $(50 \pm 5) \%$, conforming to standard atmosphere class 1 specified in ISO 291. For a test piece which is a paper substrate with printed patterns, the standard atmosphere for evaluation (test and measurement) and storage of the specimen shall be a temperature of $(23 \pm 1) ^\circ\text{C}$ and relative humidity of $(50 \pm 2) \%$, conforming to standard atmosphere specified in ISO 187.

These atmospheric conditions can be changed to give a larger tolerance for temperature ($(23 \pm 2) ^\circ\text{C}$) and humidity ($(50 \pm 10) \%$) by agreement of the consumer and supplier. In this case, the atmospheric conditions with a larger tolerance shall be reported.

5 Measuring methods and instruments**5.1 Measuring instrument**

The measurement of dimensions of the shape pattern shall be carried out with an instrument that can obtain the image of patterns. The repeatability and accuracy of the measuring instrument should be less than 10 % of the tolerance specification of the pattern dimension. From the measurement system, the image of the pattern should be converted to an image file. The image should include the information of pixel size as well as image size converted to an image file.

5.2 Preparation of imaging (specimen)

The specimen for measuring dimensions of the shape pattern shall be prepared as the original image file from the measuring instrument without re-sizing and cropping and shall contain the whole image of the pattern to be measured. The measurer should report the resolution of the measurement system and pixel size of the image.