

# INTERNATIONAL STANDARD

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**Printed electronics –  
Part 401: Printability – Overview**

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INTERNATIONAL  
ELECTROTECHNICAL  
COMMISSION

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## PRINTED ELECTRONICS –

## Part 401: Printability – Overview

## FOREWORD

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International Standard IEC 62899-401 has been prepared by IEC technical committee 119: Printed electronics.

The text of this standard is based on the following documents:

FDIS	Report on voting
119/137/FDIS	119/144/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 2.

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 publication will remain unchanged until the stability date indicated on the IEC website under "<http://webstore.iec.ch>" in the data related to the specific publication. At this date, the publication will be

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- withdrawn,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

A bilingual version of this publication may be issued at a later date.

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## INTRODUCTION

This part of IEC 62899 contains an overview of measurements of and requirements for printability in printed electronics. This document provides highly reliable measurements for the comparable evaluation and the necessary specifications for the quality and reproducibility of printed patterns.

The requests from industry for this document are the guarantee of both the quality and reproducibility in order to facilitate international trade and enhance user value in the field of the printed electronics.

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## PRINTED ELECTRONICS –

### Part 401: Printability – Overview

#### 1 Scope

This part of IEC 62899 provides an introduction to the rest of the IEC 62899-4XX series and explains its modular structure. The IEC 62899-4XX series establishes requirements for the printability of printed electronics. These requirements are stated as measurement of quality, reproducibility, analysis and compliance test methods, as well as measuring methods for environmental conditions.

The IEC 62899-4XX series specifies the measurements and the requirements of both the quality and the reproducibility of printed patterns as the result of the interaction of printing media, inks, substrate, and environmental conditions.

#### 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 (all parts), *International Electrotechnical Vocabulary (IEV)* (available at [www.electropedia.org](http://www.electropedia.org))

#### 3 Terms and definitions

For the purposes of this document, the terms and definitions given in IEC 60050 and the following 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

##### **printed electronics**

technology for the creation and production of electrotechnical products by means of printing methods

Note 1 to entry: This technology has potentially a number of application fields.

##### 3.2

##### **printability**

interrelationship of inks, other functional materials and substrates in conjunction with printing equipment in order to achieve the desired electrotechnical function

##### 3.3

##### **printed pattern**

set of electric and electronic device, parts, and circuits, which is printed with electronic functional inks on the surface of substrates by means of various printing techniques

**3.4****printing media**

parts involved in the printing process such as plate, cliché, blanket, nozzle, etc, excluding ink and substrate

**3.5****pattern width**

average stroke width, where the stroke width is measured from edge to edge along a line perpendicular to the center line of the image element

[SOURCE: ISO/IEC TS 24790:2012, 3.22, modified – the word “normal” in the definition of line width has been replaced by “perpendicular”]

**3.6****edge waviness**

degree to which a pattern edge conforms to a measurement plane

[SOURCE: ISO 12635:2008, 2.5, modified – the word “plate” in the original definition has been replaced by “pattern”]

**3.7****void**

absence of ink outside the printed edge zone and outside the segment end zones in an area that should be inked

[SOURCE: ISO 1004-2:2013, 3.1.3, modified – the word “magnetic” in the original definition has been removed]

**3.8****surface roughness**

surface topology of an area of top surface of the pattern

Note 1 to entry: The surface roughness comprises roughness and microroughness.

**3.9****thickness**

distance between the top surface and bottom side of the printed pattern

**3.10****basic pattern**

pattern prepared in a basic way for the inspection of the requirements for reproducibility of the printed pattern

**3.11****qualities in printed patterns**

conformity to the specified requirements of the shape and uniformity of printed patterns

**3.12****reproducibility of printed patterns**

fidelity of the individual quality of the printed pattern to that of the design data

**3.13****plating**

plate making

**3.14****surface profile**

surface characteristics comprised of form and waviness

#### 4 Overview of the IEC 62899-4XX series

The IEC 62899-4xx series shall be constructed in such a way as to extend the series in the future and to cover new technologies in printed electronics.

- IEC 62899-401 specifies the overview of this series.
- IEC 62899-402-1 specifies the measurement method of the width of the printed patterns in printed electronics.
- IEC 62899-402-2 specifies the measurement method of the edge waviness of the printed patterns in printed electronics.
- IEC 62899-402-3 specifies the measurement method of the void of the printed patterns in printed electronics.
- IEC 62899-402-4 specifies the measurement method of the surface roughness of the printed patterns in printed electronics.
- IEC 62899-402-5 specifies the measurement method of the thickness of the printed patterns in printed electronics.
- IEC 62899-402-6 specifies the measurement method of the surface profile of the printed patterns in printed electronics.
- IEC 62899-403-1 specifies the requirements for reproducibility of basic patterns using printing machine.
- IEC 62899-403-2 specifies the requirements for reproducibility of basic patterns using plating.
- IEC 62899-403-3 specifies the requirements for reproducibility of basic application patterns in printed electronics.
- IEC 62899-404 specifies the analysis and compliance test methods for printability in printed electronics.
- IEC 62899-405 specifies the environmental condition for the measurements of printed patterns in printed electronics.

IEC 62899-4XX consists of the parts listed in this Clause, under the general title *Printed electronics – Printability* as shown in Table 1. Whenever necessary, outdated methods can be replaced by state-of-the-art technology.

**Table 1 – Structure of IEC 62899-4XX series**

Structure of IEC 62899-4XX series				Projected document numbering (and development stage at the time of publication)
IEC 62899 Printed electronics	Part 401: Printability – Overview			IEC 62899-401
	Part 402: Printability – Measurement of qualities	(Horizontal variance)	-1: Pattern width	IEC 62899-402-1
			-2: Edge waviness	IEC 62899-402-2
			-3: Void	IEC 62899-402-3
		(Vertical variance)	-4: Surface roughness	IEC 62899-402-4
			-5: Thickness	IEC 62899-402-5
			-6: Surface profile	IEC 62899-402-6
	Part 403: Printability – Requirements for reproducibility	-1: Basic patterns for evaluation of printing machine		IEC 62899-403-1
		-2: Basic patterns for plating		IEC 62899-403-2
		-3: Basic patterns for applications		IEC 62899-403-3
	Part 404: Printability – Analysis and compliance test methods			IEC 62899-404
	Part 405: Printability – Measuring methods for environmental conditions			IEC 62899-405
	<p>NOTE The numbering of IEC 62899-4xx (including planned projects) is as follows:</p> <p>The IEC 62899 bit of IEC 62899-4xx shows that it is the series entitled <i>Printed electronics</i>.</p> <p>The 4 bit of IEC 62899-4xx shows that it is part of the <i>Printability</i> series.</p> <p>The 4xx bit of IEC 62899-4xx indicates the part number.</p>			

## 5 Outlines of the standardization of printability in printed electronics

### 5.1 Outline of measurements of qualities

The print pattern on the surface of the substrate has a three-dimensional structure. Therefore, the quality factors of shape are classified into horizontal and vertical elements to the surface.

The quality factors in the horizontal position are described as variances of:

- 1) width,
- 2) edge waviness, and
- 3) void.

The quality factors in the vertical position are described as

- a) thickness,
- b) surface roughness, and
- c) surface profile.

In order to prepare the comparable evaluation on printed patterns, the suitable measurement methods shall be provided for the measurement of the quality factors to compare the printed patterns.

## **5.2 Outline of requirement for printability**

Most of the printed patterns for the electronic devices consist of the combination of basic patterns, such as straight line, angular line, and circular line.

In order to guarantee the printability for printed electronics, it is necessary to specify or define the patterns which are adequate for evaluating both the quality and reproducibility for the printing machine, plate, and products.

In order to determine the quality and reproducibility of printed patterns, three kinds of basic patterns shall be prepared for

- 1) printing machine accuracy,
- 2) plating resolution, and
- 3) target product (application).

## **5.3 Outline of the analysis and compliance test methods**

In the future, it will be important to define the analysis and compliance test methods to estimate the grades or pass/fail of the printability for each application in terms of conformity.

## **5.4 Outline of the measuring methods for environmental conditions**

In order to evaluate the printability, the measuring methods for environmental conditions shall be provided.

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