

---

**Polprevodniški elementi - Mehanske in klimatske preskusne metode - 34-1. del:  
Preskus močnostnega polprevodniškega modula s cikliranjem električnega  
napajanja (IEC 60749-34-1:2025)**

Semiconductor devices - Mechanical and climatic test methods - Part 34-1: Power cycling test for power semiconductor module (IEC 60749-34-1:2025)

Halbleiterbauelemente - Mechanische und klimatische Prüfverfahren - Teil 34-1:  
Leistungszzyklusprüfung für Leistungshalbleitermodule (IEC 60749-34-1:2025)

Dispositifs à semiconducteurs - Méthodes d'essais mécaniques et climatiques - Partie 34  
-1: Essai de cycles en puissance pour modules de puissance à semiconducteurs (IEC  
60749-34-1:2025)

**Ta slovenski standard je istoveten z: EN IEC 60749-34-1:2025**

---

**ICS:**

31.080.01	Polprevodniški elementi (naprave) na splošno	Semiconductor devices in general
-----------	---	-------------------------------------

**SIST EN IEC 60749-34-1:2025**                      **en**

# Sample Document

get full document from [standards.iteh.ai](https://standards.iteh.ai)

EUROPEAN STANDARD  
NORME EUROPÉENNE  
EUROPÄISCHE NORM

**EN IEC 60749-34-1**

August 2025

ICS 31.080.01

English Version

**Semiconductor devices - Mechanical and climatic test methods -  
Part 34-1: Power cycling test for power semiconductor module  
(IEC 60749-34-1:2025)**

Dispositifs à semiconducteurs - Méthodes d'essais  
mécaniques et climatiques - Partie 34-1: Essai de cycles en  
puissance pour modules de puissance à semiconducteurs  
(IEC 60749-34-1:2025)

Halbleiterbauelemente - Mechanische und klimatische  
Prüfverfahren - Teil 34-1: Leistungszyklusprüfung für  
Leistungshalbleitermodule  
(IEC 60749-34-1:2025)

This European Standard was approved by CENELEC on 2025-07-25. 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, Türkiye 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**

© 2025 CENELEC All rights of exploitation in any form and by any means reserved worldwide for CENELEC Members.

Ref. No. EN IEC 60749-34-1:2025 E

## EN IEC 60749-34-1:2025 (E)

### European foreword

The text of document 47/2902/FDIS, future edition 1 of IEC 60749-34-1, prepared by TC 47 "Semiconductor devices" was submitted to the IEC-CENELEC parallel vote and approved by CENELEC as EN IEC 60749-34-1:2025.

The following dates are fixed:

- latest date by which the document has to be implemented at national (dop) 2026-08-31 level by publication of an identical national standard or by endorsement
- latest date by which the national standards conflicting with the (dow) 2028-08-31 document have to be withdrawn

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.

Any feedback and questions on this document should be directed to the users' national committee. A complete listing of these bodies can be found on the CENELEC website.

### Endorsement notice

The text of the International Standard IEC 60749-34-1:2025 was approved by CENELEC as a European Standard without any modification.

In the official version, for Bibliography, the following notes have to be added for the standard indicated:

- IEC 60747 (series) NOTE Approved as EN IEC 60747 (series)
- IEC 60747-15:2024 NOTE Approved as EN IEC 60747-15:2024 (not modified)
- IEC 60749 (series) NOTE Approved as EN 60749 (series)
- IEC 60749-23 NOTE Approved as EN 60749-23

## 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.cencenelec.eu](http://www.cencenelec.eu).

<u>Publication</u>	<u>Year</u>	<u>Title</u>	<u>EN/HD</u>	<u>Year</u>
IEC 60191-4	-	Mechanical standardization of semiconductor devices - Part 4: Coding system and classification into forms of package outlines for semiconductor device packages	EN 60191-4	-
IEC 60747-2	2016	Semiconductor devices - Part 2: Discrete devices - Rectifier diodes	-	-
IEC 60747-6	2016	Semiconductor devices - Part 6: Discrete devices - Thyristors	-	-
IEC 60747-8	2010	Semiconductor devices - Discrete devices - Part 8: Field-effect transistors	-	-
+ A1	2021			
IEC 60747-9	2019	Semiconductor devices - Part 9: Discrete devices - Insulated-gate bipolar transistors (IGBTs)	-	-
IEC 60749-34	-	Semiconductor devices - Mechanical and climatic test methods - Part 34: Power cycling	EN 60749-34	-

# Sample Document

get full document from [standards.iteh.ai](https://standards.iteh.ai)



IEC 60749-34-1

Edition 1.0 2025-06

# INTERNATIONAL STANDARD

## NORME INTERNATIONALE

---

**Semiconductor devices - Mechanical and climatic test methods -  
Part 34-1: Power cycling test for power semiconductor module**

**Dispositifs à semiconducteurs - Méthodes d'essais mécaniques et climatiques -  
Partie 34-1: Essai de cycles en puissance pour modules de puissance à  
semiconducteurs**

## CONTENTS

FOREWORD .....	3
INTRODUCTION .....	5
1 Scope .....	6
2 Normative references .....	6
3 Terms and definitions .....	6
4 Test apparatus and structure of DUT .....	8
5 Procedure .....	12
5.1 General .....	12
5.2 Determination of $T_{vj(\min)}$ , $T_{vj(\max)}$ and $R_{th(j-c)}$ .....	15
5.2.1 General .....	15
5.2.2 Real-time temperature measurement .....	15
5.2.3 Temperature calculation method .....	17
6 Test conditions .....	17
6.1 General .....	17
6.2 Power cycling test (short-time test) .....	18
6.3 Power cycling test (long-time test) .....	18
6.4 Test conditions and objectives .....	19
6.4.1 Certification test .....	19
6.4.2 Lifetime model validation test .....	19
7 Measurements .....	20
8 Failure criteria .....	20
Annex A (informative) Estimation of the power cycling capability .....	22
A.1 Simple Weibull regression method (the "mean of $m$ method") .....	22
A.1.1 General .....	22
A.1.2 Improve estimation accuracy under small sample size conditions .....	22
A.1.3 Lifetime estimation using the "mean of $m$ method" .....	22
A.1.4 Estimation of the power cycling capability .....	23
A.2 Least square regression method .....	24
Bibliography .....	28
Figure 1 – Example of the basic structure of a power semiconductor module (schematic diagram) (case type module for industrial use) .....	9
Figure 2 – A basic test circuit for the power cycling test (for IGBT module) .....	9
Figure 3 – A basic test circuit for power MOSFET module .....	11
Figure 4 – A basic test circuit for diode module .....	11
Figure 5 – A basic test circuit for thyristor module .....	12
Figure 6 – A basic circuit of 6-in-1 IGBT module .....	13
Figure 7 – Temperature change profile and on/off cycle of the power cycling test (short-time) .....	14
Figure 8 – Temperature change profile and on/off cycle of the power cycling test (long- time) .....	15
Figure A.1 – Lifetime estimation by the mean of $m$ method .....	23
Figure A.2 – Power cycling capability in the power cycling test (short-time) .....	23
Figure A.3 – Power cycling capability in the power cycling test (long-time) .....	24

## IEC 60749-34-1:2025 © IEC 2025

Figure A.4 – Power cycling tests at a minimum of 2 $\Delta T$ conditions .....	26
Figure A.5 – Curve fitting by the regression analysis and determination of the parameter of the lifetime model.....	26
Figure A.6 – Normalization of the number of cycles to one $\Delta T_{\text{norm}}$ and $T_{\text{norm}}$ by the $N_f = f(\Delta T, T)$ -model .....	26
Figure A.7 – Fit procedure for the Weibull graph for the normalized cycle numbers .....	26
Figure A.8 – Deduction of the lifetime curve for the product that crosses the specified failure rate percentage $x$ .....	27
Table 1 – Test conditions .....	18
Table 2 – Failure criteria for long-time and short-time tests.....	21
Table A.1 – The sample size $N$ for power cycling tests .....	22

# Sample Document

get full document from [standards.iteh.ai](https://standards.iteh.ai)