



IEC 60747-16-4

Edition 1.1 2011-04

# INTERNATIONAL STANDARD



---

**Semiconductor devices –  
Part 16-4: Microwave integrated circuits – Switches**

INTERNATIONAL  
ELECTROTECHNICAL  
COMMISSION

PRICE CODE **CL**

---

ICS 31.080.99

ISBN 978-2-88912-417-6

## CONTENTS

FOREWORD.....	3
1 Scope.....	5
2 Normative references .....	5
3 Terms and definitions .....	6
4 Essential ratings and characteristics.....	7
4.1 Circuit identification and types.....	7
4.2 Application description .....	8
4.3 Specification of the function .....	8
4.4 Limiting values (absolute maximum rating system) .....	10
4.5 Operating conditions (within the specified operating temperature range) .....	11
4.6 Electrical characteristics.....	12
4.7 Mechanical and environmental ratings, characteristics and data.....	12
4.8 Additional information.....	13
5 Measuring methods .....	13
5.1 General .....	13
5.2 Insertion loss ( $L_{ins}$ ).....	14
5.3 Isolation ( $L_{iso}$ ) .....	16
5.4 Return loss ( $L_{ret}$ ).....	17
5.5 Input power at 1 dB compression ( $P_{i(1dB)}$ ) and output power at 1 dB compression ( $P_{o(1dB)}$ ).....	19
5.6 Turn-on time ( $t_{on}$ ), turn-off time ( $t_{off}$ ), rise time ( $t_{r(out)}$ ), and fall time ( $t_{f(out)}$ ).....	20
5.7 Adjacent channel power ratio ( $P_{o(mod)}/P_{adj}$ ) .....	22
5.8 $n$ th order harmonic distortion ratio <del>(<math>P_{nth}/P_1</math>)</del> ( $P_1/P_{nth}$ ).....	26
<b>Bibliography.....</b>	<b>28</b>
Figure 1 – Circuit diagram for the measurement of the insertion loss $L_{ins}$ .....	14
Figure 2 – Circuit diagram for the measurement of the isolation $L_{iso}$ .....	16
Figure 3 – Circuit for the measurements of the return loss .....	17
Figure 4 – Circuit for the measurements of switching time .....	20
Figure 5 – Input and output waveforms .....	21
Figure 6 – Circuit for the measurement of the adjacent channel power ratio.....	23
Figure 7 – Circuit diagram for the n-th order harmonic distortion ratio .....	26

## INTERNATIONAL ELECTROTECHNICAL COMMISSION

## SEMICONDUCTOR DEVICES –

Part 16-4: Microwave integrated circuits –  
Switches

## 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.

**This consolidated version of IEC IEC 60747-16-4 consists of the first edition (2004) [documents 47E/256/FDIS and 47E/261/RVD] and its amendment 1 (2009) [documents 47E/358/CDV and 47E/373/RVC]. It bears the edition number 1.1.**

**The technical content is therefore identical to the base edition and its amendment and has been prepared for user convenience. A vertical line in the margin shows where the base publication has been modified by amendment 1. Additions and deletions are displayed in red, with deletions being struck through.**

International Standard IEC 60747-16-4 has been prepared by subcommittee 47E: Discrete semiconductor devices, of IEC technical committee 47: Semiconductor devices.

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

The committee has decided that the contents of the base publication and its amendments will remain unchanged until the stability date indicated on the IEC web site 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.

**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 publication using a colour printer.**

## SEMICONDUCTOR DEVICES –

### Part 16-4: Microwave integrated circuits – Switches

#### 1 Scope

This part of IEC 60747 provides new measuring methods, terminology and letter symbols, as well as essential ratings and characteristics for integrated circuit microwave switches.

There are many combinations for RF ports in switches, such as SPST (single pole single throw), SPDT (single pole double throw), SP3T (single pole triple throw), DPDT (double pole double throw), etc. Switches in this standard are based on SPDT. However, this standard is applicable to the other types of switches.

#### 2 Normative references

The following referenced documents are indispensable for the application 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 60617-12, Graphical symbols for diagrams – Part 12: Binary logic elements~~

~~IEC 60617-13, Graphical symbols for diagrams – Part 13: Analogue elements~~

IEC 60617, Graphical symbols for diagrams

~~IEC 60747-1(1983), Semiconductor devices – Discrete devices and integrated circuits – Part 1: General~~  
Amendment 3 (1996)

IEC 60747-1:2006, Semiconductor devices – Part 1: General

IEC 60747-4, Semiconductor devices – Discrete devices – Part 4: Microwave devices

IEC 60747-16-1:2001, Semiconductor devices – Part 16-1: Microwave integrated circuits – Amplifiers  
Amendment 1 (2007)<sup>1</sup>

IEC 60748-2, Semiconductor devices – Integrated circuits – Part 2: Digital integrated circuits

IEC 60748-3, Semiconductor devices – Integrated circuits – Part 3: Analogue integrated circuits

IEC 60748-4, Semiconductor devices – Integrated circuits – Part 4: Interface integrated circuits

IEC 61340-5-1:2007, Electrostatics – Part 5-1: Protection of electronic devices from electrostatic phenomena – General requirements

IEC/TR 61340-5-2:2007, Electrostatics – Part 5-2: Protection of electronic devices from electrostatic phenomena – User guide

<sup>1</sup> There exists a consolidated edition 1.1 published in 2007, including the base publication (2001) and its Amendment 1 (2007).