

# INTERNATIONAL STANDARD

# NORME INTERNATIONALE



**Semiconductor devices –  
Part 16-5: Microwave integrated circuits – Oscillators**

**Dispositifs à semiconducteurs –  
Partie 16-5: Circuits intégrés hyperfréquences – Oscillateurs**

<https://standards.iteh.ai/catalog/standards/sist/f8558f63-2a50-4f92-a84b-f5a4b0c4f25d/iec-60747-16-5-2013>



**THIS PUBLICATION IS COPYRIGHT PROTECTED**  
**Copyright © 2020 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 Central Office  
3, rue de Varembe  
CH-1211 Geneva 20  
Switzerland

Tel.: +41 22 919 02 11  
[info@iec.ch](mailto:info@iec.ch)  
[www.iec.ch](http://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](http://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 It also gives information on projects, replaced and withdrawn publications.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](http://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](http://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](mailto:sales@iec.ch).

#### **Electropedia - [www.electropedia.org](http://www.electropedia.org)**

The world's leading online dictionary on electrotechnology, containing more than 22 000 terminological entries in English and French, with equivalent terms in 16 additional languages. Also known as the International Electrotechnical Vocabulary (IEV) online.

#### **IEC Glossary - [std.iec.ch/glossary](http://std.iec.ch/glossary)**

67 000 electrotechnical terminology entries in English and French extracted from the Terms and definitions clause of IEC publications issued between 2002 and 2015. Some entries have been collected from earlier publications of IEC TC 37, 77, 86 and CISPR.

#### **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](http://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](http://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](http://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](mailto:sales@iec.ch).

#### **Electropedia - [www.electropedia.org](http://www.electropedia.org)**

Le premier dictionnaire d'électrotechnologie en ligne au monde, avec plus de 22 000 articles terminologiques en anglais et en français, ainsi que les termes équivalents dans 16 langues additionnelles. Egalement appelé Vocabulaire Electrotechnique International (IEV) en ligne.

#### **Glossaire IEC - [std.iec.ch/glossary](http://std.iec.ch/glossary)**

67 000 entrées terminologiques électrotechniques, en anglais et en français, extraites des articles Termes et définitions des publications IEC parues entre 2002 et 2015. Plus certaines entrées antérieures extraites des publications des CE 37, 77, 86 et CISPR de l'IEC.



IEC 60747-16-5

Edition 1.1 2020-07  
CONSOLIDATED VERSION

# INTERNATIONAL STANDARD

# NORME INTERNATIONALE



**Semiconductor devices –  
Part 16-5: Microwave integrated circuits – Oscillators**

**Dispositifs à semiconducteurs –  
Partie 16-5: Circuits intégrés hyperfréquences – Oscillateurs**

<https://standards.iteh.ai/catalog/standards/sist/f8558f63-2a50-4f92-a84b-f5a4b0c4f25d/iec-60747-16-5-2013>

INTERNATIONAL  
ELECTROTECHNICAL  
COMMISSION

COMMISSION  
ELECTROTECHNIQUE  
INTERNATIONALE

ICS 31.080.99

ISBN 978-2-8322-8864-1

**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.**



## REDLINE VERSION

## VERSION REDLINE



**Semiconductor devices –**  
**Part 16-5: Microwave integrated circuits – Oscillators**

**Dispositifs à semiconducteurs –**  
**Partie 16-5: Circuits intégrés hyperfréquences – Oscillateurs**

<https://standards.iteh.ai/catalog/standards/sist/f8558f63-2a50-4f92-a84b-f5a4b0c4f25d/iec-60747-16-5-2013>

## CONTENTS

FOREWORD	6
1 Scope	8
2 Normative references	8
3 Terms and definitions	9
4 Essential ratings and characteristics	11
4.1 General requirements	11
4.1.1 Circuit identification and types	11
4.1.2 General function description	11
4.1.3 Manufacturing technology	11
4.1.4 Package identification	12
4.2 Application description	12
4.2.1 Conformance to system and/or interface information	12
4.2.2 Overall block diagram	12
4.2.3 Reference data	12
4.2.4 Electrical compatibility	12
4.2.5 Associated devices	12
4.3 Specification of the function	12
4.3.1 Detailed block diagram – Functional blocks	12
4.3.2 Identification and function of terminals	13
4.3.3 Function description	14
4.4 Limiting values (absolute maximum rating system)	14
4.4.1 Requirements	14
4.4.2 Electrical limiting values	14
4.4.3 Temperatures	15
4.5 Operating conditions (within the specified operating temperature range)	15
4.6 Electrical characteristics	16
4.7 Mechanical and environmental ratings, characteristics and data	16
4.8 Additional information	17
5 Measuring methods	17
5.1 General	17
5.1.1 General precautions	17
5.1.2 Characteristic impedance	17
5.1.3 Handling precautions	17
5.1.4 Types	17
5.2 Oscillation frequency ( $f_{osc}$ )	17
5.2.1 Purpose	17
5.2.2 Circuit diagram	18
5.2.3 Principle of measurement	18
5.2.4 Circuit description and requirements	18
5.2.5 Precautions to be observed	18
5.2.6 Measurement procedure	18
5.2.7 Specified conditions	18
5.3 Output power ( $P_{O,osc}$ )	18
5.3.1 Purpose	18
5.3.2 Circuit diagram	19
5.3.3 Principle of measurement	19

5.3.4	Circuit description and requirements	19
5.3.5	Precautions to be observed	19
5.3.6	Measurement procedure	19
5.3.7	Specified conditions	19
5.4	Phase noise ( $\mathcal{S}(f)$ )	19
5.4.1	Purpose	19
5.4.2	Measuring methods	19
5.5	Tuning sensitivity ( $S_{f,v}$ )	24
5.5.1	Purpose	24
5.5.2	Circuit diagram	24
5.5.3	Principle of measurement	24
5.5.4	Circuit description and requirements	25
5.5.5	Precautions to be observed	25
5.5.6	Measurement procedure	25
5.5.7	Specified conditions	25
5.6	Frequency pushing ( $f_{osc,push}$ )	25
5.6.1	Purpose	25
5.6.2	Circuit diagram	25
5.6.3	Principle of measurement	25
5.6.4	Circuit description and requirements	25
5.6.5	Precautions to be observed	25
5.6.6	Measurement procedure	25
5.6.7	Specified conditions	26
5.7	Frequency pulling ( $f_{osc,pull}$ )	26
5.7.1	Purpose	26
5.7.2	Circuit diagram	26
5.7.3	Principle of measurement	26
5.7.4	Circuit description and requirements	27
5.7.5	Precautions to be observed	27
5.7.6	Measurement procedure	27
5.7.7	Specified conditions	27
5.8	n-th order harmonic distortion ratio ( $P_{nth}/P_1$ )	27
5.8.1	Purpose	27
5.8.2	Circuit diagram	27
5.8.3	Principle of measurement	27
5.8.4	Circuit description and requirements	28
5.8.5	Measurement procedure	28
5.8.6	Specified conditions	28
5.9	Output power flatness ( $\Delta P_{O,osc}$ )	28
5.9.1	Purpose	28
5.9.2	Circuit diagram	29
5.9.3	Principle of measurement	29
5.9.4	Circuit description and requirements	29
5.9.5	Precautions to be observed	29
5.9.6	Measurement procedure	29
5.9.7	Specified conditions	29
5.10	Tuning linearity	29
5.10.1	Purpose	29
5.10.2	Circuit diagram	29

5.10.3	Principle of measurement .....	29
5.10.4	Circuit description and requirements.....	30
5.10.5	Precautions to be observed .....	30
5.10.6	Measurement procedure .....	30
5.10.7	Specified conditions .....	31
5.11	Frequency temperature coefficient ( $\alpha_{f,temp}$ ) .....	31
5.11.1	Purpose.....	31
5.11.2	Circuit diagram .....	31
5.11.3	Principle of measurement .....	31
5.11.4	Circuit description and requirements.....	32
5.11.5	Precautions to be observed .....	32
5.11.6	Measurement procedure .....	32
5.11.7	Specified conditions .....	32
5.12	Output power temperature coefficient ( $\alpha_{P,temp}$ ).....	32
5.12.1	Purpose.....	32
5.12.2	Circuit diagram .....	32
5.12.3	Principle of measurement .....	32
5.12.4	Circuit description and requirements.....	33
5.12.5	Precautions to be observed .....	33
5.12.6	Measurement procedure .....	33
5.12.7	Specified conditions .....	33
5.13	Spurious distortion ratio ( $P_S/P_1$ ).....	33
5.13.1	Purpose.....	33
5.13.2	Circuit diagram .....	33
5.13.3	Principle of measurement .....	33
5.13.4	Circuit description and requirements.....	34
5.13.5	Measurement procedure .....	34
5.13.6	Specified conditions .....	34
5.14	Modulation bandwidth ( $B_{mod}$ ).....	34
5.14.1	Purpose.....	34
5.14.2	Circuit diagram .....	34
5.14.3	Principle of measurement .....	35
5.14.4	Circuit description and requirements.....	35
5.14.5	Precautions to be observed .....	36
5.14.6	Measurement procedure .....	36
5.14.7	Specified conditions .....	36
5.15	Sensitivity flatness .....	36
5.15.1	Purpose.....	36
5.15.2	Circuit diagram .....	36
5.15.3	Principle of measurement .....	36
5.15.4	Circuit description and requirements.....	37
5.15.5	Precautions to be observed .....	37
5.15.6	Measurement procedure .....	37
5.15.7	Specified conditions .....	38
6	Verifying methods.....	38
6.1	Load mismatch tolerance ( $\Psi_L$ ).....	38
6.1.1	Purpose.....	38
6.1.2	Verifying method 1 (spurious intensity).....	38



6.1.3	Verifying method 2 (no discontinuity of frequency tuning characteristics of VCO).....	39
6.2	Load mismatch ruggedness ( $\psi_R$ ) .....	39
6.2.1	Purpose.....	39
6.2.2	Circuit diagram .....	39
6.2.3	Circuit description and requirements.....	39
6.2.4	Precautions to be observed .....	40
6.2.5	Test Procedure .....	40
6.2.6	Specified conditions .....	40
	Bibliography.....	41
	Figure 1 – Circuit diagram for the measurement of the oscillation frequency $f_{osc}$ .....	18
	Figure 2 – Circuit diagram for the measurement of the phase noise $\mathcal{L}(f)$ (method 1) .....	20
	Figure 3 – Circuit diagram for the measurement of the phase noise $\mathcal{L}(f)$ (method 2) .....	22
	Figure 4 – Circuit diagram for the measurement of the phase noise $\mathcal{L}(f)$ (method 3) .....	23
	Figure 5 – Circuit diagram for the measurement of the frequency pulling $f_{osc,pull}$ .....	26
	Figure 6 – Tuning linearity .....	30
	Figure 7 – Circuit diagram for the measurement of the oscillation frequency temperature coefficient $\alpha_{f,temp}$ .....	31
	Figure 8 – Circuit diagram for the measurement of the modulation bandwidth $B_{mod}$ .....	35
	Figure 9 – Sensitivity flatness .....	37
	Table 1 – Comparison of phase noise measuring methods.....	20

IEC 60747-16-5:2013

<https://standards.iteh.ai/catalog/standards/sist/f8558f63-2a50-4f92-a84b-f5a4b0c4f25d/iec-60747-16-5-2013>

## INTERNATIONAL ELECTROTECHNICAL COMMISSION

---

### SEMICONDUCTOR DEVICES –

#### Part 16-5: Microwave integrated circuits – Oscillators

#### 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 the official IEC Standard and its amendment has been prepared for user convenience.**

**IEC 60747-16-5 edition 1.1 contains the first edition (2013-06) [documents 47E/452/FDIS and 47E/454/RVD] and its amendment 1 (2020-07) [documents 47E/673/CDV and 47E/705/RVC] and its corrigendum (2020-09) (applying only to the English version).**

**In this Redline version, a vertical line in the margin shows where the technical content is modified by amendment 1. Additions are in green text, deletions are in strikethrough red text. A separate Final version with all changes accepted is available in this publication.**

International Standard IEC 60747-16-5 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.

A list of all parts of the IEC 60747 series, published under the general title *Semiconductor devices*, can be found on the IEC website.

The committee has decided that the contents of the base publication and its amendment 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.

**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 document using a colour printer.**

(standards.iteh.ai)

[IEC 60747-16-5:2013](https://standards.iteh.ai/catalog/standards/sist/f8558f63-2a50-4f92-a84b-f5a4b0c4f25d/iec-60747-16-5-2013)

<https://standards.iteh.ai/catalog/standards/sist/f8558f63-2a50-4f92-a84b-f5a4b0c4f25d/iec-60747-16-5-2013>

## SEMICONDUCTOR DEVICES –

### Part 16-5: Microwave integrated circuits – Oscillators

#### 1 Scope

This part of IEC 60747 specifies the terminology, essential ratings and characteristics, and measuring methods of microwave integrated circuit oscillators.

This standard is applicable to the fixed and voltage-controlled semiconductor microwave oscillator devices, except the oscillator modules such as synthesizers which require external controllers.

NOTE This document is not applicable to the quartz crystal controlled oscillators. They are specified by IEC 60679-1.

#### 2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 60617, *Graphical symbols for diagrams* (available from <<http://std.iec.ch/iec60617>>)

IEC 60747-1:2006, *Semiconductor devices – Part 1: General* <sup>1)</sup>  
Amendment 1:2010

IEC 60747-4:2007, *Semiconductor devices – Discrete devices – Part 4: Microwave diodes and transistors*  
IEC 60747-4:2007/AMD 1:2017

IEC 60747-16-3:2002, *Semiconductor devices – Part 16-3: Microwave integrated circuits – Frequency converters*  
IEC 60747-16-3:2002/AMD 1:2009<sup>2)</sup>  
IEC 60747-16-3:2002/AMD 2:2017

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

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

<sup>1)</sup> A consolidated edition (2010) exists, including IEC 60747-1:2006 and its Amendment 1.

~~<sup>2)</sup> A consolidated edition (2010) exists, including IEC 60747-16-3:2002 and its Amendment 1.~~

### 3 Terms and definitions

#### 3.1

##### oscillation frequency

$f_{\text{osc}}$   
frequency measured at the output port

#### 3.2

##### output power

$P_{\text{o,osc}}$   
power measured at the output port

#### 3.3

##### phase noise

~~$\mathcal{L}(f)$   
frequency-domain measure of the short-term frequency stability of an oscillator, normally expressed as the power spectral density of the phase fluctuations,  $S_{\phi}(f)$ , where the phase fluctuation function is  $\phi(t) = 2\pi Ft - 2\pi F_0 t$~~

~~Note 1 to entry: The spectral density of phase fluctuation can be directly related to the spectral density of frequency fluctuation by~~

~~$$S_{\phi}(f) = \left(\frac{F_0}{f}\right)^2 S_y(f) \text{ rad}^2/\text{Hz}$$~~

~~where~~

~~$F$  is the oscillator frequency;~~

~~$F_0$  is the average oscillator frequency;~~

~~$f$  is the Fourier frequency.~~

~~Note 2 to entry:  $\mathcal{L}(f)$  is pronounced "script-ell of f".~~

~~[SOURCE: IEC 60679-1:2007, 3.2.25, modified – A symbol and two notes have been added. The explanation of the spectral density of phase fluctuation has been moved to a note]~~

$\mathcal{L}(f)$

frequency-domain measure of the short-term frequency stability of an oscillator

Note 1 to entry: This phase noise is normally expressed as the power spectral density of the phase fluctuations,  $S_{\phi}(f)$ , where the phase fluctuation function is  $\phi(t) = 2\pi Ft - 2\pi F_0 t$ . The spectral density of phase fluctuation can be directly related to the spectral density of frequency fluctuation by the following formula:

$$S_{\phi}(f) = \left(\frac{F_0}{f}\right) S_y(f) \text{ rad}^2/\text{Hz}$$

where

$F$  is the oscillator frequency;

$F_0$  is the average oscillator frequency;

$f$  is the Fourier frequency.

Note 2 to entry:  $\mathcal{L}(f)$  is pronounced "script-ell of f".

[SOURCE: IEC 60050-561:2014, 561-03-22, modified – A symbol and Note 2 to entry have been added.]

**3.4  
tuning sensitivity**

$S_{f,v}$   
ratio of the change of oscillation frequency to the variation of the control voltage

**3.5  
frequency pushing**

$f_{osc,push}$   
change of the oscillation frequency with the variation of the bias voltage

**3.6  
frequency pulling**

$f_{osc,pull}$   
change of the oscillation frequency with all phase angles for constant load reflection coefficient

**3.7  
n-th order harmonic distortion ratio**

$P_{nth}/P_1$   
ratio of the power of the n-th order harmonic component at the output port to the output power at the oscillation frequency

**3.8  
oscillation frequency range**  
difference between the oscillation frequencies at the maximum control voltage and at the minimum control voltage

**3.9  
output power flatness**

$\Delta P_{o,osc}$   
difference between the maximum and the minimum output power within the control voltage range

**3.10  
tuning linearity**  
ratio of the maximum departure of the oscillation frequency from an ideal straight line between its values at the minimum and maximum control voltages to the oscillation frequency range

**3.11  
oscillation frequency temperature coefficient**

$\alpha_{f,temp}$   
ratio of the change in oscillation frequency to the corresponding change in temperature

**3.12  
output power temperature coefficient**

$\alpha_{P,temp}$   
ratio of the change in output power to the corresponding change in temperature

**3.13  
spurious distortion ratio**

$P_s/P_1$   
ratio of the power of the maximum spurious component at the output port to the output power at the oscillation frequency

**3.14****load mismatch tolerance** ~~$\psi_L$~~ ~~maximum load VSWR (voltage standing wave ratio) in the range where the device oscillates with no unexpected spurious intensity and/or no discontinuity of frequency tuning characteristics (in case of VCO) at all phase angles~~ $\psi_L$ 

maximum load VSWR in the range where the device oscillates with no unexpected spurious intensity and/or no discontinuity of frequency tuning characteristics (in case of VCO) at all phase angles

Note 1 to entry: "VSWR" is an abbreviation of "voltage standing wave ratio".

Note 2 to entry: "VCO" is an abbreviation of "voltage controlled oscillator".

**3.15****load mismatch ruggedness** $\psi_R$ 

maximum load VSWR in the range where the device withstand load mismatch with no degradation at all phase angles with specified conditions

[SOURCE: IEC 60747-4:2007, 7.2.22]

**3.16****modulation bandwidth** $B_{\text{mod}}$ 

modulating frequency at which (the frequency deviation decreases by 3 dB from its dc value

**3.17****sensitivity flatness**

ratio of the maximum departure of the tuning sensitivity from an ideal straight line between its values at the minimum and maximum control voltages to the oscillation frequency range

**4 Essential ratings and characteristics****4.1 General requirements****4.1.1 Circuit identification and types**

The identification of type (device name), the category of circuit and technology applied shall be given.

Microwave oscillators are divided into two categories:

- type A: fixed oscillator;
- type B: voltage controlled oscillator.

**4.1.2 General function description**

A general description of the function performed by the integrated circuit microwave oscillators and the features for the application shall be made.

**4.1.3 Manufacturing technology**

The manufacturing technology, e.g. semiconductor monolithic integrated circuit, thin film integrated circuit, micro-assembly, etc. shall be stated. This statement shall include details of the semiconductor technologies such as Schottky barrier diode, MESFET, Si bipolar transistor, etc.