INTERNATIONAL STANDARD

IEC 60747-4-2

QC 750116

First edition
2000-04

Semiconductor devices – Discrete devices –

Part 4-2:
Microwave diodes and transistors – Integrated-circuit microwave amplifiers – Blank detail specification

Dispositifs à semiconducteurs – Dispositifs discrets –

Partie 4-2:
Diodes et transistors hyperfréquences – Amplificateurs hyperfréquences pour circuits intégrés – Spécification particulière-cadre

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Consolidated publications

Consolidated versions of some IEC publications including amendments are available. For example, edition numbers 1.0, 1.1 and 1.2 refer, respectively, to the base publication, the base publication incorporating amendment 1 and the base publication incorporating amendments 1 and 2.

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- **IEC web site***
- **Catalogue of IEC publications**
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Terminology, graphical and letter symbols

For general terminology, readers are referred to IEC 60050: *International Electrotechnical Vocabulary* (IEV).

For graphical symbols, and letter symbols and signs approved by the IEC for general use, readers are referred to publications IEC 60027: *Letter symbols to be used in electrical technology*, IEC 60417: *Graphical symbols for use on equipment. Index, survey and compilation of the single sheets* and IEC 60617: *Graphical symbols for diagrams*.

* See web site address on title page.

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

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SEMICONDUCTOR DEVICES – DISCRETE DEVICES –

Part 4-2: Microwave diodes and transistors – Integrated-circuit microwave amplifiers – Blank detail specification

FOREWORD

1) The IEC (International Electrotechnical Commission) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of the 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, the IEC publishes International Standards. 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. The 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 the 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 National Committees.
3) The documents produced have the form of recommendations for international use and are published in the form of standards, technical specifications, technical reports or guides and they are accepted by the National Committees in that sense.
4) In order to promote international unification, IEC National Committees undertake to apply IEC International Standards transparently to the maximum extent possible in their national and regional standards. Any divergence between the IEC Standard and the corresponding national or regional standard shall be clearly indicated in the latter.
5) The IEC provides no marking procedure to indicate its approval and cannot be rendered responsible for any equipment declared to be in conformity with one of its standards.
6) Attention is drawn to the possibility that some of the elements of this International Standard may be the subject of patent rights. The IEC shall not be held responsible for identifying any or all such patent rights.

International Standard IEC 60747-4-2 has been prepared by subcommittee 47E: Discrete semiconductor devices, of IEC technical committee 47: Semiconductor devices.

This standard is a blank detail specification for integrated-circuit microwave amplifiers.

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

FDIS	Report on voting
47E/142/FDIS	47E/148/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 not been drafted in complete accordance with the ISO/IEC Directives, Part 3.

The QC number that appears on the front cover of this publication is the specification number in the IEC Quality Assessment System for Electronic Components (IECQ).

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

The committee has decided that the contents of this publication will remain unchanged until 2005. At this date, the publication will be

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

Other IEC publications quoted in this standard:

Publication Nos. IEC 60068-2-17:1994, *Basic environmental testing procedures – Part 2: Tests – Test Q: Sealing*

IEC 60747-1:1983, *Semiconductor devices – Discrete devices – Part 1: General*

IEC 60747-4:1991, *Semiconductor devices – Discrete devices – Part 4: Microwave diodes and transistors*

IEC 60747-10:1991, *Semiconductor devices – Part 10: Generic specification for discrete devices and integrated circuits*

IEC 60748-1:1984, *Semiconductor devices – Integrated circuits – Part 1: General*

IEC 60748-11:1990, *Semiconductor devices – Integrated circuits – Part 11: Sectional specification for semiconductor integrated circuit excluding hybrid circuits*

IEC 60749:1996, *Semiconductor devices – Mechanical and climatic test methods*

IEC QC 001002:1986, *Rules of Procedure of the IEC Quality Assessment System for Electronic Components (IECQ)*

SEMICONDUCTOR DEVICES – DISCRETE DEVICES –

Part 4-2: Microwave diodes and transistors – Integrated-circuit microwave amplifiers – Blank detail specification

INTRODUCTION

The IEC Quality Assessment System for Electronic Components is operated in accordance with the statutes of the IEC and under the authority of the IEC. The object of this system is to define quality assessment procedures in such a manner that electronic components released by one participating country as conforming with the requirements of an applicable specification are equally acceptable in all other participating countries without the need for further testing.

This blank detail specification is one of a series of blank detail specifications for semiconductor devices and shall be used with the following IEC publications:

IEC 60747-10/QC 700000:1991, *Semiconductor devices – Part 10: Generic specification for discrete devices and integrated circuits*

IEC 60748-11/QC 790100:1990, *Semiconductor devices – Integrated circuits – Part 11: Sectional specification for semiconductor integrated circuits excluding hybrid circuits*

Required information

Numbers shown in brackets on this and the following pages correspond to the following items of required information, which should be entered in the spaces provided.

Identification of the detail specification

[1] The name of the national standards organization under whose authority the detail specification is issued.

[2] The IECQ number of the detail specification.

[3] The numbers and issue numbers of the generic and sectional specifications.

[4] The national number of the detail specification, date of issue and any further information required by the national system.

Identification of the component

[5] Main function and type number.

[6] Information on typical construction (materials, main technology) and package. If the device has several kinds of derivative products, these differences shall be indicated, for example features in the comparison table.
For electrostatic sensitive devices, a note of caution regarding electrostatic sensitivity shall be added in the detail specification.

[7] Outline drawing, terminal identification, marking and/or reference to the relevant document for outlines.

[8] Category of assessed quality according to 2.6 of the generic specification.

[9] Reference data.

[Throughout this standard, the texts given in square brackets are intended to serve as guidance for the specification writer and shall not be included in the detail specification.]

[When confusion may arise as to whether a paragraph is meant as an instruction to the writer or not, it shall be given in brackets.]

<table>
<tr><td>[Name (address) of responsible NAI (and possibly of the body from which the specification is available.)] [1]</td><td>[Number of IECQ detail specification, plus issue number and/or date.] [2]
QC 750116</td></tr>
<tr><td>ELECTRONIC COMPONENT OF ASSESSED QUALITY IN ACCORDANCE WITH: [3]
Generic specification: 60747-10/QC 700000
Sectional specification: 60748-11/QC 790100
[and national references if different.]</td><td>National number of detail specification [4]
[This box need not be used if national number repeats IECQ number.]</td></tr>
<tr><td colspan="2">BLANK DETAIL SPECIFICATION FOR: INTEGRATED-CIRCUIT MICROWAVE AMPLIFIERS [5]
[Type number(s) of the relevant device(s).]
Ordering information: see 1.2 of this standard.</td></tr>
<tr><td>Mechanical description [7]
Outline references:
[Standard package reference should be given, IEC number (mandatory, if available) and/or national number.]

Outline drawing:
[May be transferred to or given with more details in clause 8 of this standard.]

Terminal identification:
[Drawing showing pin assignments, including graphical symbols.]

Marking: [Letters and figures, or color code.]
[The detail specification shall prescribe the information to be marked on the device, if any.]
[See 2.5 of the generic specification and/or 1.1 of this standard.]</td><td>Short description [6]
Monolithic microwave-integrated circuits
Semiconductor material: [GaAs, Si]
Encapsulation: [cavity or non-cavity].
Application(s): see clause 5 of this standard.
Caution: observe precautions for handling ELECTROSTATIC-SENSITIVE DEVICES [if applicable]

Categories of assessed quality [8]
[To be chosen from 2.6 of the generic specification.]

Reference data [9]
[Reference data on the most important properties to permit comparison between component types.]</td></tr>
<tr><td colspan="2">Information about manufacturers who have components qualified to this detail specification is available in the current Qualified Products List.</td></tr>
</table>

1 Marking and ordering information

1.1 Marking

[See 2.5 of generic specification.

The detail specification shall state the information marked for the relevant types, such as letters, figures and/or codes.

When the marking contains items other than those specified in 2.5 of the generic specification, such as used for the manufacturer's internal use, this should be indicated.

If all the information has already appeared in box [7] on the front page, this shall be indicated.]

1.2 Ordering information

[The following minimum information is necessary to order a specific device, unless otherwise specified:

– precise type reference (and nominal voltage value, if required);
– IECQ reference of detail specification with issue number and/or date when relevant;
– category of assessed quality as defined in clause 9 of the sectional specification and, if required, screening sequence as defined in clause 8 of the same;
– packaging for delivery;
– any other particulars.]

2 Application-related description

[Information regarding application in equipments or in circuits, and the relation with the associated devices shall be given here. See IEC 60748-1, Chapter VI.]

3 Specification of the function

[Information regarding the function of the device shall be given here. Items to be given here shall be selected from IEC 60748-1, Chapter VI.]

4 Limiting values (absolute maximum rating system)

These values apply over the operating temperature range, unless otherwise specified.

[Repeat only subclause numbers used, together with title. Any additional values shall be given at the appropriate place, but without subclause number.]

[Curves shall preferably be given in clause 9 of the detail specification.]

Categories Type A: low-noise
Type B: auto-gain control
Type C: limiting
Type D: power

Subclause	Limiting value	Symbol	Type A		Type B		Type C		Type D	
			Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.
4.1	Ambient or case temperature	T_{amb} or T_{case}	×	×	×	×	×	×	×	×
4.2	Storage temperature	T_{stg}	×	×	×	×	×	×	×	×
4.3	Power supply voltage(s) [note 1]	V_{xxi}		×		×		×		×
4.4	Power supply current(s) [note 1]	I_{xxi}		×		×		×		×
4.5	Terminal voltage(s) [notes 1 and 2]	V_{xxi}		×		×		×		×
4.6	Terminal current(s) [notes 1 and 2]	I_{xxi}		×		×		×		×
4.7	Input power	P_{in}		×		×		×		×
4.8	Channel temperature	T_{ch}; T_j		×		×		×		×
4.9	Power dissipation [note 3]	P_{tot}		×		×		×		×

NOTE 1 'xx' is the symbol of a terminal and 'i' is the terminal number of the same kind, such as V_{GG1} for the voltage of the first gate terminal and I_{DD2} for the current of the second drain terminal.

NOTE 2 Where appropriate.

NOTE 3 Maximum value over the specified range of operating ambient or reference-point temperatures. Any special requirements for ventilation and/or mounting shall be stated.

5 Operating conditions (within the specified operating ambient or case temperature range)

Operating conditions are specified in the relevant measuring methods.

See 13.2 of this standard for inspection requirements.

5.1 Power supply voltage

5.2 Power supply current

5.3 Input power (where appropriate)

5.4 Voltage and/or current at another or other terminal(s) (where appropriate)

5.5 External element(s) (where appropriate)

5.6 Operating frequency range

5.7 Operating temperature range

6 Electrical characteristics

[Repeat only subclause numbers used, with title. Any additional characteristics shall be given at the appropriate place but without subclause number.]

[When several devices are defined in the same detail specification, the relevant values shall be given on successive lines whilst avoiding the repetition of identical values.]

[Curves should preferably be given under clause 9 of the detail specification.]

The following characteristics apply over the full operating ambient temperature range, unless otherwise stated.

[Where the stated performance of the circuit varies over the operating ambient temperature range, the values of the appropriate characteristics shall be stated at 25 °C and at the extremes of the operating temperature range.]

6.1 Static characteristics

Sub-clause	Characteristics and conditions at T_{amb} or T_{case} = 25 °C, unless otherwise specified (see clause 4 of the generic specification)	Symbol	Type A		Type B		Type C		Type D		Tested
			Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	
6.1.1	Power supply current(s): value(s) at specified supply voltage(s)	I_{xxi}	×	×	×	×	×	×	×	×	A3
6.1.2	Thermal resistance channel to case: value at specified T_{case}	$R_{th(j-c)}$						×		×	C2d

6.2 AC characteristics

Sub-clause	Characteristics and conditions at T_{amb} or T_{case} = 25 °C, unless otherwise specified (see clause 4 of the generic specification)	Symbol	Type A		Type B		Type C		Type D		Tested
			Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	
6.2.1	Linear gain: value at specified bias conditions and f	G_{lin}	×		×				×		A4
6.2.2	Linear gain flatness: value at specified bias conditions and specified frequency range	ΔG_{lin}		×		×				×	A4
6.2.3	Power gain: value at specified bias conditions, f and P_{in}	G_p			×				×		A4
6.2.4	Power gain flatness: value at specified bias conditions, specified frequency range and P_{in}	ΔG_p				×				×	A4
6.2.5	Gain reduction: value at specified bias conditions, f and AGC bias	ΔG_{red}			×						A4
6.2.6	Limiting output power: value at specified bias conditions, f, P_{imin} and P_{imax}	$P_{o(ltg)}$					×	×			A4

6.2 *(continued)*

Sub-clause	Characteristics and conditions at T_{amb} or T_{case} = 25 °C, unless otherwise specified (see clause 4 of the generic specification)	Symbol	Type A		Type B		Type C		Type D		Tested
			Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	
6.2.7	Limiting output power flatness: value at specified bias conditions, specified frequency range, P_{imin} and P_{imax}	$\Delta P_{o(ltg)}$						×			A4
6.2.8	Output power: value at specified bias conditions, f and P_{in}	P_o			×				×		A4
6.2.9	Output power at 1 dB-gain compression: value at specified bias conditions, f	$P_{o(1dB)}$	×*		×				×		A4
6.2.10	Noise figure: value at specified bias conditions and f	F		×							A4
6.2.11	Intermodulation distortion: value at specified bias conditions, f and P_{in}	P_n/P_1						×		×	C2a
6.2.12	Power at the intercept point: value at specified bias conditions, f and P_{in}	$P_{n(IP)}$	×*						×		C2a
6.2.13	Magnitude of the input reflection coefficient (input return loss): value at specified bias conditions, f and P_{in}	$\lvert s_{11}\rvert$	×		×		×		×		A4
6.2.14	Magnitude of the output reflection coefficient (output return loss): value at specified bias conditions, f and P_{in}	$\lvert s_{22}\rvert$	×		×						A4
6.2.15	Magnitude of the reverse transmission coefficient (isolation): value at specified bias conditions, f and P_{in}	$\lvert s_{12}\rvert$	×		×		×		×		C2a
6.2.16	Conversion coefficient of amplitude modulation to phase modulation: value at specified bias conditions, f and P_{in}	$\alpha_{(AM-PM)}$						×		×	C2a
6.2.17	Group delay time: value at specified bias conditions, f and P_{in}	$t_{d(grp)}$				×		×		×	C2a

NOTE For types B and D, either the parameter set of 6.2.1, 6.2.2 and 6.2.8 or that of 6.2.3, 6.2.4 and 6.2.9 shall be selected.

* Where appropriate.

7 Programming

Not applicable.

8 Mechanical and environmental ratings, characteristics and data

[Any specific mechanical and/or environmental ratings applicable shall be in accordance with IEC 60748-1, Chapter VI, 10.8 (see also IEC 60747-1, Chapter VI, clause 7).]

9 Additional information

The information given here is not for inspection purposes.

The information given hereinafter may be seen to constitute minimum design data.

9.1 Block diagram

[A block diagram, or equivalent circuit information, for the integrated circuit shall be given.]

9.2 Recommendation for any associated device(s)

[Where required, any associated device(s), for example decoupling of power supply to high-frequency device, shall be given.]

9.3 Effects of temperature

[Variations of linear gain, power gain, output power, output power at 1 dB gain compression and noise figure in relation to temperature shall be given.]

9.4 Handling precautions, or electrostatic-sensitive device(s)

[Any limiting mechanical or environmental conditions shall be included, for example regarding the handling of high-power amplifiers.]

9.5 Internal protection

[A statement shall be given to indicate whether the integrated circuit contains internal protection against high static voltage or electrical fields.]

9.6 Application data

10 Screening

[Where required, the blank detail specification shall make reference to clause 8 of the sectional specification and give any additional technical requirements.]

11 Quality assessment procedures

The blank detail specification shall specify whether the qualification approval procedure or capability approval procedure is applicable.

11.1 Qualification approval procedure

See the generic specification, clause 3 and 5.1 of the sectional specification.

11.2 Capability approval procedure

See IEC 60747-10.

12 Structural similarity procedures

See clause 6 of the sectional specification.

13 Test conditions and inspection requirements

13.1 General

The blank detail specification is used to maintain a uniform presentation of tests in the detail specification.

Wherever possible, reference is made to higher-order documents (sectional specification, generic specification). This avoids duplication of text and has the advantage that modifications in the higher-order documents automatically apply to all the blank detail specifications (avoiding the subsequent updating of all blank detail specifications, following a modification in the sectional or generic specifications).

13.2 Sampling requirements and formation of inspection lots

For the sampling requirements, the blank detail specification shall make reference to clause 9 of the sectional specification and to 3.7 of the generic specification.

The blank detail specification shall state that, for group A, the choice between the AQL and LTPD systems shall be made in the detail specification.

Regarding the formation of inspection lots, the blank detail specification shall make reference to 5.1.1 of the sectional specification and to 12.2 of IEC QC 001002.

If the procedure for structurally similar devices is to be applied, the blank detail specification shall make reference to clause 6 of the sectional specification and to 8.5.3 of IEC QC 001002.

If for qualification approval it is permitted to use method a) of 11.3.1 of IEC QC 001002, the blank detail specification shall give the sampling requirements (see also clause 9 of the sectional specification).

13.3 Inspection tables

[In the following tables, the values and exact test conditions to be used shall be specified as required for a given type, and as required by the relevant test in the relevant publication. Only those characteristics listed in clause 6 for the given application(s) shall be tested.]

[The choice between alternative tests or test methods shall be made when a detail specification is written.]

[When several devices are included in the same detail specification, the relevant conditions and/or values should be given on successive lines, if possible avoiding repetition of identical conditions and/or values.]

Throughout the following text, reference to a subclause number is made with respect to the generic specification unless otherwise stated, and test methods are quoted from clause 4 of the sectional specification.

GROUP A
Lot-by-lot

All tests are non-destructive (see 3.6.6 of the generic specification)

Inspection or test	Symbol	Reference	Conditions at T_{amb} or T_{case} = 25 °C, unless otherwise specified (see clause 4 of the generic specification)	Inspection requirement limit							
				Type A		Type B		Type C		Type D	
				Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.
Sub-group A1 External visual examination		60747-10 4.2.1.1									
Sub-group A2a Inoperative devices											
Sub-group A3 Power supply current(s)	I_{xxi}		See clause 6	×	×	×	×	×	×	×	×
Sub-group A4		60747-4, IX, 3	See clause 6								
Linear gain	G_{lin}			×		×				×	
Linear gain flatness	ΔG_{lin}				×		×				×
Power gain	G_p					×				×	
Power gain flatness	ΔG_p						×				×
Gain reduction	ΔG_{red}					×					
Limiting output power	$P_{o(ltg)}$							×	×		
Limiting output power flatness	$\Delta P_{o(ltg)}$								×		
Output power	P_o					×				×	
Output power at 1 dB-gain compression	$P_{o(1dB)}$			×*		×				×	
Noise figure	F				×						
Magnitude of the input reflection coefficient (input return loss)	$\lvert S_{11}\rvert$			×		×		×		×	
Magnitude of the output reflection coefficient (output return loss)	$\lvert S_{22}\rvert$			×		×					

* Where appropriate.

GROUP B
Lot-by-lot

[(in the case of category 1, see 2.6 of the generic specification)]

LSL = lower specification limit from group A
USL = upper specification limit

Only tests marked (D) are destructive (3.6.6)

Inspection or test	Symbol	Reference	Conditions at T_{amb} or T_{case} = 25 °C, unless otherwise specified (see clause 4 of the generic specification)	Inspection requirement limit							
				Type A		Type B		Type C		Type D	
				Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.
Sub-group B1 Dimensions		60747-10, 4.2.2, and Appendix B									
Sub-group B3 Robustness of terminations where applicable: - Bending (D)		60749, II, 1.2	Force = [see 60749, II, 1.2]								
				No damage							
Sub-group B4 Solderability		60749, II, 2.1	[Solder bath preferred]								
				Good wetting							
Sub-group B8 Electrical endurance with final measurement			168 h High-temperature reverse bias or operating life								
				[to be specified]							
Sub-group CRRL	Attribute information for B3, B4 and B8.										

GROUP C
Periodic

LSL = lower specification limit from group A
USL = upper specification limit

Only tests marked (D) are destructive (3.6.6)

Inspection or test	Symbol	Reference	Conditions at T_{amb} or T_{case} = 25 °C, unless otherwise specified (see clause 4 of the generic specification)	Inspection requirement limit							
				Type A		Type B		Type C		Type D	
				Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.
Sub-group C1 Dimensions		60747-10, 4.2.2 and appendix B									
Sub-group C2a		60747-4, IX, 3	See clause 6								
Intermodulation distortion	P_n/P_1								×		×
Power at the intercept point	$P_{n(IP)}$			×*				×		×	
Magnitude of the reverse transmission coefficient (isolation)	$\|s_{12}\|$			×		×		×		×	
Conversion coefficient of amplitude modulation to phase modulation	$\alpha_{(AM-PM)}$								×		×
Group delay time	$t_{d(grp)}$						×		×		×
Sub-group C2c Transient energy rating			[note]	[to be specified]							
Sub-group C2d Thermal resistance	$R_{th(j-c)}$		[to be specified]						×		×
Sub-group C3 Robustness of terminations where applicable: – tensile and/or – torque (D)		60749, II, 1.1 60749, II, 1.4		>> No damage							

* Where appropriate.

GROUP C – *Periodic* (*continued*)

Inspection or test	Symbol	Reference	Conditions at T_{amb} or T_{case} = 25 °C, unless otherwise specified (see clause 4 of the generic specification)	Inspection requirement limit							
				Type A		Type B		Type C		Type D	
				Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.
Sub-group C4											
Resistance to soldering heat (D)		60749, II, 2.2	Periodicity = 6 months								
with final measurements				[to be specified]							
Sub-group C5			[note]								
Rapid change of temperature:											
a) Cavity packages											
Rapid change of temperature followed by:		60749, III, 1.1	10 cycles								
– electrical tests		[see sub-group A2]	[to be selected from A2]	[to be specified]							
– sealing, fine leak detection		60749, III, 5.2, 5.3	[to be specified]								
and:											
– sealing, gross leak detection		60068-2-17, test Qc	[to be specified]								
b) Non-cavity and epoxy-sealed cavity devices											
Rapid change of temperature followed by:		60749, III, 1.1	500 cycles								
– external visual examination		60747-10, 4.2.1.1									
– damp heat, steady state		60749, III, 4A	Severity 3 24 h								
– electrical tests		[see sub-group A2]	[to be selected from A2]	[to be specified]							
Sub-group C6			[note]								
Acceleration, steady-state [for cavity devices only]		60749, II, 5	[to be specified]								
with final measurements				[to be specified]							

GROUP C – *Periodic* (*continued*)

Inspection or test	Symbol	Reference	Conditions at T_{amb} or T_{case} = 25 °C, unless otherwise specified (see clause 4 of the generic specification)	Inspection requirement limit							
				Type A		Type B		Type C		Type D	
				Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.
Sub-group C7			[note]								
Damp heat, steady-state (D)											
a) for cavity packages		60749, III, 4A	Severity: 56 days for categories II and III, 21 days for category I								
b) for non-cavity and epoxy-sealed cavity packages		60749, III, 4A	Severity 3 for categories II and III, Severity 2 for category I								
followed by: – electrical tests		[see sub-group A2]	[to be selected from A2]	[to be specified]							
Sub-group C8											
Electrical endurance		see 60748-11, 12.3, 12.4	1 000 h [high-temperature reverse bias or operating life]								
with final measurement				[to be specified]							
Sub-group C9											
Storage at high temperature (D)		60749, III, 2	1 000 h min, at [T_{stg} max.]								
with final measurement				[to be specified]							
Sub-group CRRL	Attributes information for C3, C4, C5 C6, C7 and C9. Measurement information before and after C8.										

NOTE After the three successful consecutive tests, the periodicity may be reduced to once per year.

GROUP D
Qualification approval tests

When required, these tests shall be prescribed in the detail specification for qualification approval only.

Inspection or test	Symbol	Reference	Conditions at T_{amb} or T_{case} = 25 °C, unless otherwise specified (see clause 4 of the generic specification)	Inspection requirement limit							
				Type A		Type B		Type C		Type D	
				Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.
Sub-group D8 Electrical endurance (D) with final measurement		60748-11, 12.3, 12.4	Category I: not applicable Category II: 2 000 h Category III: 3 000 h [note 1] Conditions: [note 2]	[to be specified]							

NOTE 1 The endurance duration shown is the accumulated time for Group C and Group D endurance.

NOTE 2 The conditions under which endurance tests are carried out shall be determined as follows:

the choice of power dissipation, operating temperature and supply voltage shall be made in the following order of precedence:

a) the mean power dissipation in each functionally accessible section of the circuit shall be the maximum permitted by the detail specification;

b) the ambient temperature shall be the maximum permitted by the detail specification at the power dissipation of a);

c) the supply voltages shall be the maximum permitted by the detail specification unless limited by a) or b).

13.4 Delayed delivery

See 3.6.7 of IEC 60747-10, unless otherwise specified.

14 Additional measurement method

See 4.3.1.1 of the generic specification.