

Harmonized system of quality assessment for electronic components Semiconductor devices — Integrated circuits — Sectional specification for film integrated circuits and hybrid film integrated circuits on the basis of the capability approval procedures

ICS 31.200

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National foreword

This British Standard reproduces verbatim IEC 60748-22:1997 and implements it as the UK national standard. It supersedes BS QC 760200:1992 which is withdrawn. This standard is a harmonized specification within the IEC system of quality assessment for electronic components (IECQ).

The UK participation in its preparation was entrusted by Technical Committee EPL/47, Semiconductors, to Subcommittee EPL/47/1, Film and hybrid integrated circuits, which has the responsibility to:

- aid enquirers to understand the text;
- present to the responsible international/European committee any enquiries on the interpretation, or proposals for change, and keep the UK interests informed;
- monitor related international and European developments and promulgate them in the UK.

A list of organizations represented on this subcommittee can be obtained on request to its secretary.

The standard is to be used in conjunction with BS QC 760000.

The British Standard which implements the IECQ Rules of Procedure is BS 9000 *General Requirements for a system for electronic components of assessed quality — Part 3:1996 Specification for the national implementation of the IECQ system*.

From 1 January 1997, all IEC publications have the number 60000 added to the old number. For instance, IEC 27-1 has been renumbered as IEC 60027-1. For a period of time during the change over from one numbering system to the other, publications may contain identifiers from both systems.

Cross-references

The British Standards which implement international or European publications referred to in this document may be found in the BSI Standards Catalogue under the section entitled “International Standards Correspondence Index”, or using the “Find” facility of the BSI Standards Electronic Catalogue.

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Summary of pages

This document comprises a front cover, an inside front cover, pages i and ii, the IEC title page, page ii, pages 1 to 46 and a back cover.

This standard has been updated (see copyright date) and may have had amendments incorporated. This will be indicated in the amendment table on the inside front cover.

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**Semiconductor devices –
Integrated circuits –**

**Part 22:
Sectional specification for film integrated circuits
and hybrid film integrated circuits on the basis of
the capability approval procedures**



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1 Scope and object

This sectional specification applies to film integrated circuits and hybrid film integrated circuits manufactured as catalogue circuits or as custom-built circuits whose quality is assessed on the basis of capability approval.

The object of this specification is to present preferred values for ratings and characteristics, to select from the generic specification the appropriate tests and measuring methods, and to give general performance requirements to be used in detail specifications for film integrated circuits and hybrid film integrated circuits derived from this specification.

The concept of preferred values is directly applicable to catalogue circuits but does not necessarily apply to custom built circuits.

Test severities and requirements prescribed in detail specifications referring to this sectional specification are of equal or higher performance level, since lower performance levels are not permitted.

Associated with this specification are one or more blank detail specifications, each referenced by an IEC number. A blank detail specification which has been completed as specified in 2.3 of this specification, forms a detail specification. Such detail specifications are used for the acceptance of a complete circuit, and the granting of capability approval for the boundaries of capability identified by the manufacturer in his capability manual and maintenance of capability approval in accordance with the IECQ system.

NOTE For test procedures two alternatives are available: Method A or method B; however, it is not permitted to change the methods between tests of method A, respectively B.

In general, method A is more suitable for passive component based film integrated circuits, whereas method B is more applicable to semiconductor integrated circuit technology based film integrated circuits.

2 General, preferred characteristics, ratings and severities for environmental tests

2.1 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this part of IEC 60748. At the time of publication, the editions indicated were valid. All normative documents are subject to revision, and parties to agreements based on this part of IEC 60748 are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

IEC 60063:1963, *Preferred number series for resistors and capacitors*.

IEC 60068-1:1988, *Environmental testing — Part 1: General and guidance*.

IEC 60440:1973, *Method of measurement of non-linearity in resistors*.

IEC 60748-20:1988, *Semiconductor devices — Integrated circuits — Part 20: Generic specification for film integrated circuits and hybrid film integrated circuits*.

IEC 60748-20-1:1994, *Semiconductor devices — Integrated circuits — Part 20: Generic specification for film integrated circuits and hybrid film integrated circuits — Section 1: Requirements for internal visual examination*.

IEC 60748-21:1997, *Semiconductor devices — Integrated circuits — Sectional specification for film integrated circuits and hybrid film integrated circuits on the basis of qualification approval procedure*.

IEC 60748-22-1:1997, *Semiconductor devices — Integrated circuits — Part 22-1: Blank detail specification for film integrated circuits and hybrid film integrated circuits on the basis of the capability approval procedures*.

2.2 Preferred rating and characteristics

Preferred values of voltages and currents are given in IEC 60747-1; for resistors and capacitors preferred values are given in IEC 60063; for custom-built circuits, any values and tolerances may be chosen.

The circuits covered by this standard are classified into climatic categories according to the general rules given in IEC 60068-1.

The severities for the cold and dry heat tests are the lower and upper category temperatures respectively. Because of the construction of some circuits, these temperatures will occur between two of the preferred temperatures given in IEC 60068-2. In this event, the nearest preferred temperature within the actual range of the circuit shall be chosen for this severity.

2.3 Information to be given in a detail specification

Detail specifications shall be derived from the relevant blank detail specifications.

Detail specifications shall not specify severities inferior to those of the generic or sectional specification. When more severe requirements are included, they shall be listed in the detail specification and indicated in the test schedules, for example by an asterisk.

NOTE The information given on dimensions, characteristics and ratings may, for convenience, be presented in tabular form.

The following information shall be given in each detail specification and the values quoted shall preferably be selected from those given in the appropriate clause or subclause of this sectional specification.

Each detail specification shall state all the tests and measurements required for lot-by-lot inspection and periodic testing. This shall, as a minimum, include the relevant tests given in this specification with methods and severities.

Environmental tests, measurements, severities, and end-point limits for periodic tests shall be included in the detail specifications for the capability qualifying circuits (CQCs). They shall be in accordance with the applicable parts of the generic specification and this specification.

2.3.1 Outline drawing and dimensions

There shall be an illustration of the circuit as an aid to easy recognition and for comparison of the circuit with others. Dimensions and their associated tolerances, which affect interchangeability and mounting, shall be given in the detail specifications. All dimensions shall be stated in millimetres.

Normally, numerical values shall be given for the length, width and height of the body, and the termination spacing or for cylindrical types, the body diameter, and the length and diameter of the terminations.

When necessary, for example when a detail specification covers more than one package, the dimensions and their associated tolerances shall be placed in a table below the drawing.

When the configuration is other than described above, the detail specification shall state such dimensional information so as to adequately describe the circuit.

2.3.2 Mounting

The detail specification shall prescribe the method of mounting to be applied for normal use, and for the application of the vibration, and the bump or shock tests. The design of the circuit may be such that special mounting fixtures are required in its use. In this case, the detail specification shall prescribe the mounting fixtures and they shall be used in the application of the vibration and bump or shock tests.

2.3.3 Severities for environmental tests

The detail specification shall prescribe the appropriate method of testing and the appropriate severities selected from section 4 of the generic specification.

2.3.4 Marking

The detail specification shall prescribe the content of the marking on the circuit and on the primary package. Deviations from **2.6** of the generic specification shall be specifically stated.

2.3.5 Ordering information

The detail specification shall prescribe that the following information is required when ordering circuits:

- a) circuit type (e.g. hybrid thick film integrated circuit);
- b) number and issue of the detail specification with style reference and assessment level (if appropriate);
- c) function of the circuit (if appropriate);
- d) basic functional characteristics with tolerance (if appropriate).

2.3.6 Additional information (not for inspection purposes)

The detail specification may include information which is not normally required to be verified by the inspection procedure, such as circuit diagrams, curves, drawings and notes needed for clarification.

3 Capability approval procedures

See 3.6 of the generic specification with the following details:

3.1 Selection of capability qualifying circuits (CQCs)

3.1.1 The CQCs for approval testing shall be taken from the following sources:

- a) special circuits designed to qualify the design rules, processes and products;
- and/or
- b) circuits intended for shipment to customers.

Any or all of these CQCs in combination with process test vehicles shall be adequate to assess the complete design rules, material and manufacturing processes, including any subcontracted process.

Terminations of film elements and added components used for assessment shall be individually accessible for electrical measurement without influence from other circuit elements.

3.1.2 The CQCs shall be used to carry out the tests prescribed for capability approval and for periodic testing, and hence to demonstrate to the NSI that for limiting design layouts:

- a) performance limits claimed for individual film element types are achieved;
- b) environmental limits claimed for structures intended for shipment are met;
- and
- c) the electrical function performances claimed in the capability manual and the detail specifications are met.

3.1.3 Circuits which have received qualification approval according to IEC 60748-21 may be counted as CQCs (provided the requirements of 3.1.1 have been met) for the purposes of capability approval, subject to NSI agreement on relevant structural similarity claims.

3.1.4 A manufacturer who has received capability approval is permitted to obtain a separate qualification approval for any individual circuit he makes, provided that all appropriate testing of IEC 60748-21 has been completed successfully.

3.1.5 A manufacturer using customer circuits among those selected as CQCs may vary the types tested according to his production plan. In this case the CQCs need not necessarily assess all the claimed limits of his capability all the time, but they shall be representative of those released during the current maintenance of approval period.

His CQC selection shall be made available to the NSI.

3.1.6 When production material divides into separate processes after a common process, for example, encapsulation, the common or example process can be assessed by a single sample.

3.1.7 Where a manufacturer carries out screening tests on all circuits, as a normal production process, he may use screened CQCs for approval.

Where initial screening is not normally carried out, or is an option, approval will be carried out on unscreened products.

3.2 Structural similarity

- a) The CQCs shall be selected by the manufacturer's chief inspector and agreed by the NSI before commencing the approval programme.
- b) Rules for structural similarity applicable to the grouping of completed circuits for electrical, dimensional and environmental tests are given in Annex A.
- c) These rules shall be used to establish the basis of selection for approval. They shall also be used to determine whether new circuits are within the existing approved capability, or require its extension to enable their release.
- d) Where CQCs are structurally similar for a test sequence, they may be grouped together to form the required numbers in the test tables. Each test sequence has its own structural similarity rules and criteria (see Annex A).

3.3 Capability approval

3.3.1 The procedures for capability approval are given in **3.6** of the generic specification.

The test tables for capability approval by CQCs and quality conformance inspection (lot-by-lot and periodic tests) collectively prescribe the minimum test programme on completed circuits.

The manufacturer may select which assessment level K, L or M he wishes to include, but a manufacturer with approved capability may only release products as follows:

Assessment level	Release assessment levels
K	K, L or M
L	L or M
M	M

NOTE The suffix “N” is used, if necessary, to denote non-qualified components. See **3.6.2.3** of the generic specification.

A manufacturer may upgrade the assessment level of his approval by following the procedures given in the generic specification and he may downgrade without further periodic testing until current test interval dates expire. In either case the NSI shall be notified.

Any additional test required for specific applications shall be given in the detail specification and be subject to agreement between customer and manufacturer.

The post-test electrical limits for the relevant environmental tests shall be given in the detail specification.

3.3.2 Release for delivery before completion of group B tests

Due to the need for extended periods of lot collection from small quantity production batches, a manufacturer may, with the agreement of the customer, release products in advance of group B tests provided that the previous lot of identical circuits passed satisfactorily.

In this case, he shall indicate clearly on relevant release documents that circuits are released under **3.3.2** of this standard and complete the tests within one month of despatch.

In the event of subsequent failure to meet environmental tests, all products which have been released in advance may be subject to recall or quarantine, dependent on the reason for failure.

3.3.3 Capability approval (fixed sample size procedures)

3.3.3.1 Sampling

The sample size and criteria of acceptability depend on the assessment level which is claimed and are detailed in Table 2 or Table 6.

When additional groups are introduced into the test schedule, the number of circuits required for group “0” shall be increased by the same number as that required for the additional groups.

3.3.3.2 Tests

Tests in Table 1 or Table 5 are intended to validate the design rules, materials, processes, piece parts and package range by testing all the CQCs and process test vehicles.

For each test group, different CQCs may be grouped together according to the structural similarity rules given in Annex A, to reach the required number of samples for that group.

The complete series of tests specified in Table 1 or Table 5 is required for the approval of capability covered by the capability manual. The tests in each group shall be carried out in the given order.

The required portions of the sample shall be subjected to the tests of group “0” and then the total sample divided for the other groups.

Circuits found defective during the tests of group “0” shall not be used for the other groups.

One “defective” is counted when a CQC has not satisfied the whole or part of the tests of a group.

The approval is granted when the number of defectives does not exceed the specified number of permissible defectives for each group or subgroup and the total number of permissible defectives.

Table 1 — Test schedule for capability approval for method A

Sample sizes and acceptance criteria are detailed for each assessment level in Table 2
 Subclause numbers refer to section 4 of the generic specification.

Subclause numbers, tests and test sequences	D or ND	Test conditions	Performance requirements
<i>Group 0</i> <i>Subgroup 01</i> 4.3.1 Precap visual examination	ND	^h	
<i>Subgroup 02a</i> 4.3.2 External visual and marking examination	ND		
<i>Subgroup 02b</i> 4.3.3 Dimensions	ND		
<i>Subgroup 03^{eg}</i> 4.5.16 Induced flammability (for information only)	D		
<i>Subgroup 04^a</i> 4.5.9 Sealing	ND		
<i>Subgroup 05</i> 4.4.11 Major static and dynamic electrical characteristics at room temperature	ND		
<i>Subgroup 06</i> 4.4.11 Major static and dynamic electrical characteristics at extreme operating temperatures	ND		
<i>Group 1 — Sequence^{ab}</i> Initial measurements 4.5.6 Vibrations, swept frequency and 4.5.7 Acceleration, steady-state or ^c 4.5.5 Shock and 4.5.7 Acceleration, steady-state Final measurements	D/ND	4.4.11 Subgroup 05 4.5.9 Sealing 4.4.11 Subgroup 05	
<i>Group 2 — Sequence</i> Initial measurements 4.5.11 Resistance to soldering heat 4.5.15.2 Resistance to solvents^g 4.5.8 Change of temperature 4.5.3 Damp heat, steady-state^d Final measurements	D	4.4.11 Subgroup 05 4.5.9 Sealing^a 4.4.11 Subgroup 05 4.3.2 External visual and marking examination	

For the notes, see the end of the table

Table 1 — Test schedule for capability approval for method A

Subclause numbers, tests and test sequences	D or ND	Test conditions	Performance requirements
<i>Group 3 — Sequence^e</i> 4.5.10 Solderability 4.5.12.1 Tensile 4.5.12.3 Bending (wire or strip) Final measurements or ^c 4.5.10 Solderability 4.5.12.1 Tensile 4.5.12.3 Bending (row) 4.5.12.2 Thrust Final measurements	D	4.5.9 Sealing^a 4.5.9 Sealing^a	
<i>Group 4 — Sequence</i> Initial measurements 4.5.2 Cold 4.5.1 Storage at high temperature Final measurements	ND	4.4.11 Subgroup 05 Temperature: ... °C Temperature: ... °C 4.4.11 Subgroup 05	
<i>Group 5</i> Initial measurements 4.5.14 Endurance: 1 000 h Endurance: 2 000 h ^f Final measurements	D	4.4.11 Subgroup 05 4.4.11 Subgroup 05	
^a Cavity circuits only. ^b Mounting conditions as prescribed by the detail specification. ^c The detail specification shall prescribe which option is to be used. ^d The detail specification may omit the damp heat test for unencapsulated circuits. ^e Use of completely processed electrical rejects is permitted. ^f In assessment level K: provisional approval after 1 000 h; definitive approval after 2 000 h. ^g Applicable to encapsulation having organic material used for sealing purposes. ^h Refer to IEC 60748-20-1.			

3.3.4 Maintenance of capability approval

3.3.4.1 Screening and lot-by-lot acceptance tests

The screening and testing on a lot-by-lot basis, for all circuits intended for release to customers are prescribed in the blank detail specification, Table 2 or Table 6.

The inspection lot shall be collected from one week's production, or such other period as declared by the manufacturer up to a maximum of one month.

3.3.4.2 Periodic tests

The periodic tests for CQCs are prescribed in Table 3 or Table 7 and in the blank detail specification.

Where customer circuits are used as CQCs, samples for periodic testing shall be drawn from lots which have passed the tests of screening when appropriate and lot-by-lot inspection.

Provisional capability approval may be granted after 1 000 h.

3.3.4.3 Tests

The complete series of tests specified in the blank detail specification is required for the maintenance of capability approval.

The tests in each group shall be carried out in the order given.

One “defective” is counted when a circuit has not satisfied the whole or a part of the tests of a group.

The approval is maintained when the number of defectives does not exceed the specified number of permissible defectives for each group and the total number of permissible defectives.

3.3.5 Special requirements

Small production lots (under consideration).

3.3.6 Quality conformance inspection

3.3.6.1 Test schedule

The schedule for the lot-by-lot and periodic tests for quality conformance inspection is given in Table 2 or Table 6 and Table 3 or Table 7 of the blank detail specification.

3.3.6.2 Assessment levels

The assessment level(s) for capability approval (see Table 1 or Table 5) and for maintenance of capability approval (see relevant blank detail specification) shall be selected from Table 2 or Table 6 and Table 3 or Table 7 hereafter.

Table 2 — Assessment levels and acceptance criteria for capability approval for method A

In this table:

n = sample size

c = acceptance criterion (permitted number of defectives)

Inspection group or subgroup of Table 1		Assessment level						
		K		L			M	
		n	c	n	c		n	c
01		100 %	—	—	—		—	—
02a		75 ^a	2	64 ^a	2		43	2
02b		8	1	8	1		8	1
03 (for information only)		2	—	2	—		2	—
04		39	1	26	1		13	1
05		71 ^a	1	60 ^a	1	2	39	1
06		26	1	13	1		8	1
1		10	1	8	1		—	—
2 ^b		13	1	10	1		8	1
3		13	1	10	1	2	8	1
4		13	1	10	1		8	1
5	(1 000 h)	—	—	20	1		13	1
	(2 000 h)	20	1	—	—		—	—

^a This number may be reduced by the relevant number of circuits which are not needed when the test in group 1 is not required.
^b A minimum of four circuits shall be used for each solvent specified.

Table 3 — Assessment levels and acceptance criteria for quality conformance inspection for method A

Table 3a — Lot-by-lot tests to be conducted on a sampling basis for method A

In this table:

IL = inspection level^a

AQL = acceptable quality level^a

Subclause numbers refer to section 4 of the generic specification.

Inspection group or subgroup	Assessment level					
	K		L		M	
	Required		Not required		Not required	
	IL	AQL	IL	AQL	IL	AQL
<i>Selection</i> (see Table 4)						
<i>Subgroup A1</i> 4.3.2 External visual and marking examination	II	1	II	2,5	I	2,5
<i>Subgroup A2</i> 4.4.11 Major static and dynamic electrical characteristics at room temperature	II	0,25	II	0,4	II	1
<i>Subgroup A3</i> 4.4.11 Major static and dynamic electrical characteristics at extreme operating temperatures	S4	1	—	—	—	—
<i>Subgroup B1</i> 4.5.10 Solderability	S3	2,5	S3	2,5	S3	2,5
<i>Subgroup B2</i> 4.3.3 Dimensions	S4	1	S4	1	S4	1

^a Refer to IEC 60410.

Table 3b — Periodic tests to be conducted on a sampling basis for method A

In this table:

p = periodicity (in months)

n = sample size

c = acceptance criterion (permitted number of defectives)

Subclause numbers refer to section 4 of the generic specification.

Inspection group or subgroup	Assessment level								
	K			L			M		
	<i>p</i>	<i>n</i>	<i>c</i>	<i>p</i>	<i>n</i>	<i>c</i>	<i>p</i>	<i>n</i>	<i>c</i>
<i>Subgroup C1</i>	—	—	—	6	13	1	6	8	1
4.4.11 Major static and dynamic electrical characteristics at extreme operating temperatures									
<i>Subgroup C2 — Sequence^{ab}</i>	6	10	1	12	8	1	—	—	—
4.5.6 Vibration, swept frequency									
4.5.7 Acceleration, steady-state or^c									
4.5.5 Shock and									
4.5.7 Acceleration, steady state									
<i>Subgroup C3 — Sequence</i>	6	13	1	12	10	1	12	8	1
4.5.11 Resistance to soldering heat									
4.5.15.2 Resistance to solvents^g									
4.5.8 Change of temperature									
4.5.3 Damp heat, steady-state^d									
<i>Subgroup C4 — Sequence</i>	6	13	1	12	10	1	12	8	1
4.5.2 Cold									
4.5.1 Storage at high temperature									
<i>Subgroup D1</i>	—	—	—	6	20	1	6	13	1
4.5.14 Endurance 1 000 h									
Endurance 1 000 h ^f	3	20	1	—	—	—	—	—	—
<i>Subgroup D2 — Sequence^e</i>	12	13	1	12	10	1	12	8	1
4.5.10 Solderability									
4.5.12.1 Tensile									
4.5.12.3 Bending (wire or strip) or^c									
4.5.10 Solderability									
4.5.12.1 Tensile									
4.5.12.3 Bending (row)									
4.5.12.2 Thrust									
4.5.16 Induced flammability^{eg} (for information only)	12	2	—	12	2	—	12	2	—
^a Cavity circuits only. ^b Mounting conditions as prescribed by the detail specification. ^c The detail specification shall prescribe which option is to be used. ^d The detail specification may omit the damp heat test for unencapsulated circuits. ^e Use of completely processed electrical rejects is permitted. ^f In assessment level K: provisional approval after 1 000 h; definitive approval after 2 000 h. ^g Applicable to encapsulation having organic material used for sealing purposes.									

Sequences for screening shall be in accordance with the following Table 4.

Table 4 — Screening

Steps	Examination or test	Generic specification reference	Details and conditions	Sequences				
				A	B	C	D	E
1 ^a	Precap visual examination	4.3.1	^c	×				
2	Storage at high temperature	4.5.1	24 h at maximum storage temperature	×	×	×		×
3	Change of temperature	4.5.8	10 cycles $T_{\text{stg min.}}/T_{\text{stg max.}}$	×	×	×		×
4 ^a	Acceleration, steady-state	4.5.7	In the most critical direction. Acceleration level as specified in the detail specification	×	×	×		
5 ^a	Sealing	4.5.9		×	×	×		
6	Electrical measurements (preburn-in)		Selected parameters Remove rejects	×	×		×	
7	Burn-in		As specified in the detail specification Hours: 168 72 48	×	×		×	
8	Electrical measurements (post screening)		As specified in 6 Remove rejects Reject lot if defects exceed 10 %	×	×	×	×	×

NOTE Screening is normally performed before group A, B and C inspection. When screening is performed after meeting the requirements of group A and B on a lot-by-lot basis and group C on a periodic basis, the solderability, sealing and group A tests shall be repeated.
Additional post-screening tests may be required as specified in the blank detail specification.

^a Not normally applicable to non-cavity devices, unless specified in the detail specification.
^b Record the results of the measurements unless otherwise specified in the detail specification.
^c Refer to IEC 60748-20-1.

3.4 Resubmission of rejected lots (lot-by-lot inspection)

Any lot rejected following electrical tests shall be returned to production for rework or rescreening for the identified defect. No new circuit shall be included in the lot.

The lot shall then be resubmitted and inspected under conditions of tightened inspection.

It will retain the same lot number and details of the new submission will be recorded. The same lot shall not be submitted more than three times.

3.5 Manufacturing stages in a factory of an approved manufacturer in a non-IEC member country

The application of the extension of manufacturer's approval is permitted for the film integrated circuits and hybrid film integrated circuits covered by this specification, provided that the conditions of 3.2 of the generic specification are met.

4 Test and measurement procedures

This clause contains all tests and measurement procedures which are of typical application for film integrated circuits and hybrid film integrated circuits and which are not described in section 4 of the generic specification.

Each detail specification shall prescribe all tests and measurement procedures required for lot-by-lot inspection and periodic testing. It shall, as a minimum, include the relevant tests given in this specification with stated methods and severities.

Environmental tests, measurements, severities and end-point limits for periodic tests of the CQCs shall be included in the detail specification. They shall be in accordance with the applicable numbers of the generic specification and this sectional specification.

5 Tables for method B

Table 5 — Test schedule for capability approval for method B

Sample sizes and acceptance criteria are detailed for each assessment level in Table 6.
Subclause numbers refer to section 4 of the generic specification.

Subgroup numbers and tests	D or ND	Test conditions	Performance requirements
<i>Group 0</i>	ND		
<i>Subgroup 01a</i>			
4.3.2 External visual and marking examination			
<i>Subgroup 01b</i>			
4.3.3 Dimensions			
<i>Subgroup 02</i>	ND		
4.4.11 Functional characteristics 4.2 (if applicable) at 25 °C			
<i>Subgroup 03</i>	ND		
4.4.11 Static characteristics at 25 °C 4.2			
<i>Subgroup 04a</i>	ND		
4.4.11 Static characteristics at maximum operating temperature. <i>Characteristics same as in subgroup 03</i>			
<i>Subgroup 04b</i>	ND		
4.4.11 Static characteristics at minimum operating temperature. <i>Characteristics same as in sub-group 03</i>			
<i>Subgroup 05</i>	ND		
4.4.11 Dynamic characteristics at 25 °C 4.2 <i>unless otherwise specified</i>			
<i>Group 1</i>			
<i>Subgroup 1.1</i>	D		
4.5.12 Robustness of terminations			
<i>Subgroup 1.2</i>	ND		
4.5.10 Solderability			
<i>Subgroup 1.3</i>	D		
4.5.11 Resistance to soldering heat			With final measurements (as in subgroups 02 and 03)