

**Harmonized system of quality  
assessment for electronic components**

# **Film and hybrid film integrated circuits — Generic specification**

ICS 31.200

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# Committees responsible for this British Standard

The preparation of this British Standard was entrusted by the Electronic Components Standards Policy Committee (ECL/-) to Technical Committee ECL/24, upon which the following bodies were represented:

- British Broadcasting Corporation
- British Telecom
- Business Equipment and Information Technology Association
- Electronic Components Industry Federation
- Electronic Engineering Association
- GAMBICA (BEAMA Ltd.)
- Ministry of Defence
- National Supervising Inspectorate
- Telecommunication Engineering and Manufacturing Association

The following bodies were also represented in the drafting of the standard through subcommittees and panels:

- Royal Signals and Radar Establishment
- Society of British Aerospace Companies Ltd.

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| 6754     | September 1991 | Correction to BS QC number only       |
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|          |                |                                       |

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## National foreword

This British Standard has been prepared under the direction of the Electronic Components Standards Policy Committee and is identical with IEC Publication 748-20:1988 (QC 760000) “*Semiconductor devices. Integrated circuits. Part 20: Generic specification for film integrated circuits and hybrid film integrated circuits*” including amendment 1:1995, published by the International Electrotechnical Commission (IEC).

This British Standard is a harmonized specification within the IECQ system of quality assessment for electronic components.

**Cross-references.** The British Standard harmonized with QC 001001 and QC001002 is BS 9000 “*General requirements for a system for electronic components of assessed quality*” Part 1:1981 “*Specification of basic rules and procedures*”.

| International Standard | Corresponding British Standard                                                                                                                                                                                                                      |
|------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| IEC 27                 | No corresponding standard<br>BS 2011 <i>Basic environmental testing procedures</i>                                                                                                                                                                  |
| IEC 68-2-1:1974        | Part 2.1A:1977 <i>Tests A. Cold</i><br>(Identical)                                                                                                                                                                                                  |
| IEC 68-2-2:1974        | Part 2.1B:1977 <i>Tests B. Dry Heat</i><br>(Identical)                                                                                                                                                                                              |
| IEC 68-2-3:1969        | Part 2.1Ca:1977 <i>Test Ca. Damp heat, steady state</i><br>(Identical)                                                                                                                                                                              |
| IEC 68-2-6:1982        | Part 2.1Fc:1983 <i>Test Fc. Vibration (sinusoidal)</i><br>(Identical)                                                                                                                                                                               |
| IEC 68-2-7:1983        | Part 2.1Ga:1984 <i>Test Ga. Acceleration, steady state</i><br>(Identical)                                                                                                                                                                           |
| IEC 68-2-11:1981       | Part 2.1Ka:1982 <i>Test Ka. Salt mist</i><br>(Identical)                                                                                                                                                                                            |
| IEC 68-2-14:1984       | Part 2.1N:1985 <i>Test N. Change of temperature</i><br>(Identical)                                                                                                                                                                                  |
| IEC 68-2-17:1978       | Part 2.1Q:1981 <i>Test Q. Sealing</i><br>(Identical)                                                                                                                                                                                                |
| IEC 68-2-20:1979       | Part 2.1T:1981 <i>Test T. Soldering</i><br>(Identical)                                                                                                                                                                                              |
| IEC 68-2-21:1983       | Part 2.1U:1984 <i>Test U. Robustness of terminations and integral mounting devices</i><br>(Identical)                                                                                                                                               |
| IEC 68-2-27:1972       | Part 2.1Ea:1977 <i>Test Ea. Shock</i><br>(Identical)                                                                                                                                                                                                |
| IEC 68-2-30:1980       | Part 2.1Db:1981 <i>Test Db and guidance: Damp heat, cyclic (12 + 12 hour cycle)</i><br>(Identical)                                                                                                                                                  |
| IEC 68-2-45:1980       | Part 2.1XA:1981 <i>Test XA and guidance. Immersion in cleaning solvents</i><br>(Identical)                                                                                                                                                          |
| IEC 68-3-1:1974        | Part 3A & B:1977 <i>Tests A (cold) and tests B (dry heat)</i><br>(Identical)                                                                                                                                                                        |
| IEC 617                | BS 3939 <i>Guide for graphical symbols for electrical power, telecommunications and electronics diagrams</i><br>Most major parts are identical<br>BS 6458 <i>Fire hazard testing for electrotechnical products</i><br>Part 2 <i>Methods of test</i> |

| International Standard | Corresponding British Standard                                                                                                              |
|------------------------|---------------------------------------------------------------------------------------------------------------------------------------------|
| IEC 695-2-2:1980       | Section 2.2:1984 <i>Needle-flame test</i><br>(Identical)<br>BS 6493 <i>Semiconductor devices</i><br>Part 1. <i>Discrete devices</i>         |
| IEC 747-1:1983         | Section 1.1:1984 <i>General</i><br>(Identical)<br>Part 2. <i>Integrated circuits</i>                                                        |
| IEC 748-1:1984         | Section 2.1:1985 <i>General</i><br>(Identical)                                                                                              |
| IEC 749:1984           | Part 3:1985 <i>Mechanical and climatic test methods</i><br>(Identical)                                                                      |
| ISO 1000               | BS 5555:1981 <i>Specification for SI units and recommendations for the use of their multiples and of certain other units</i><br>(Identical) |

The Technical Committee has reviewed the provisions of IEC 27, IEC 191-1, IEC 191-2, IEC 191-3A, IEC 410 and IEC 617, to which reference is made in the text, and has decided that they are acceptable for use in conjunction with this standard.

A related British Standard for IEC 191-1, IEC 191-2 and IEC 191-3A is BS 3934 “*Specification for dimensions of semiconductor devices and integrated electronic circuits*”. A related British Standard for IEC 410 is BS 6001 “*Sampling procedures for inspection by attributes*” Part 1 “*Specification for sampling plans indexed by acceptable quality level (AQL) for lot by lot inspection*”. A related British Standard for IEC 617 is BS 3939 “*Guide for graphical symbols for electrical power, telecommunications and electronics diagrams*” Part 1 “*General information, general index*”.

A British Standard does not purport to include all the necessary provisions of a contract. Users of British Standards are responsible for their correct application.

**Compliance with a British Standard does not of itself confer immunity from legal obligations.**

### Summary of pages

This document comprises a front cover, an inside front cover, pages i to iv, pages 1 to 26, an inside back cover 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.



## Section 1. Scope, object and classification

### 1.1 Scope

This generic specification is applicable to film integrated circuits and to hybrid film integrated circuits (F and HFICs), both passive and active, as in IEC Publication 748-1, Chapter IV, Sub-clause 2.4.

It applies also to partly-completed F and HFICs supplied to customers for subsequent processing. This specification also applies to chip carrier circuits having more than one chip, provided that they, as separate products, have been interconnected by film interconnection techniques.

This specification is not intended to cover printed circuit boards but is applicable to F and HFICs which may include them.

### 1.2 Object

This specification defines the quality assessment procedures and the methods for electrical, climatic, mechanical and endurance tests.

It outlines the requirements which shall be applied to the release of circuits using either qualification approval procedures or capability approval procedures. The requirements of these procedures are given in Clauses 3.5 and 3.6 respectively.

### 1.3 Technological classification of F and HFICs

F and HFICs are classified according to their structure and technology of manufacture as shown in Table I.

**Table I**

|                       |                                                                                                                                                                 |
|-----------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Film                  | 1) Thick film<br>2) Thin film<br>3) Other                                                                                                                       |
| Circuit structure     | 1) Passive thin and thick film circuits<br>2) Active thin and thick film circuits<br>3) Hybrid film integrated circuits<br>4) Multiple substrate combinations   |
| Added components      | 0) None<br>1) All types of passive and/or encapsulated active devices<br>2) All types of passive and active devices including unencapsulated semiconductor dice |
| Circuit encapsulation | 1) None<br>2) Embedded<br>3) Cavity with any organic seal or wall<br>4) Cavity with inorganic seal and walls                                                    |

## Section 2. General

### 2.1 Order of precedence

Where any discrepancies occur for any reason, documents shall rank in the following order of precedence:

- the detail specification;
- the sectional specification;
- the generic specification;
- rules of procedure (IECQ), IEC Publication QC 001002;
- basic rules (IECQ), IEC Publication QC 001001;
- any other international documents, for example IEC publications to which reference is made.

The same order of precedence shall apply to equivalent national documents.

## 2.2 Related documents

The detail specification shall indicate the applicable documents.

### *IEC publications:*

- Publication 27-1:1971: *Letter symbols to be used in electrical technology*, Part 1: *General*.
- 50: *International Electrotechnical Vocabulary (IEV)*.
- 68: *Basic environmental testing procedures*.
- 68-1:1982: Part 1: *General and guidance*.
- 68-2: Part 2: *Tests*.
- 68-2-1:1974: *Tests A: Cold*.
- 68-2-1A:1976: First supplement to Publication 68-2-1:1974.
- 68-2-2:1974: *Tests B: Dry heat*.
- 68-2-2A:1976: first supplement to Publication 68-2-2:1974.
- 68-2-3:1969: *Test Ca: Damp heat, steady state*.
- 68-2-6:1982: *Test Fc and guidance: Vibration (sinusoidal)*.
- 68-2-7:1983: *Test Ga and guidance: Acceleration, steady state*.
- 68-2-11:1981: *Test Ka: Salt mist*.
- 68-2-14:1984: *Test N: Change of temperature*.
- 68-2-17:1978: *Test Q: Sealing*.
- 68-2-20:1979: *Test T: Soldering*.
- 68-2-21:1983: *Test U: Robustness of terminations and integral mounting devices*.
- 68-2-27:1972: *Test Ea: Shock*.
- 68-2-30:1980: *Test Db and guidance: Damp heat, cyclic (12 + 12-hour cycle)*.
- 68-2-45:1980: *Test XA and guidance: Immersion in cleaning solvents*.
- 68-3-1:1974: Part 3: *Background information*, Section 1 — *cold and dry heat tests*.
- 191-1:1966: *Mechanical standardization of semiconductor devices. Part 1: Preparation of drawings of semiconductor devices*.
- 191-2:1966: Part 2: *Dimensions*.
- 191-3:1974: Part 3: *General rules for the preparation of outline drawings of integrated circuits*.
- 410:1973: *Sampling plans and procedures for inspection by attributes*.
- 695-2-2:1980: *Fire hazard testing*, Part 2: *Test methods. Needle-flame test*.
- 747-1:1983: *Semiconductor devices. Discrete devices and integrated circuits*, Part 1: *General*.
- 748-1:1984: *Semiconductor devices. Integrated circuits*, Part 1: *General*.
- 749:1984: *Mechanical and climatic test methods*.
- QC 001001:1986: *Basic rules for the IEC quality assessment system for electronic components (IECQ)*.
- QC 001002:1986: *Rules of procedure of the IEC quality assessment system for electronic components (IECQ)*.

## 2.3 Units and symbols

Units, graphical symbols and letter symbols shall, whenever possible, be taken from the following publications:

IEC Publication 27: *Letter symbols to be used in electrical technology.*

IEC Publication 617: *Graphical symbols for diagrams.*

ISO Standard 1000:1981: *SI units and recommendations for the use of their multiples and of certain other units.*

Any other units and symbols required shall be derived in accordance with the principles of the publications listed above.

## 2.4 Terminology (for information)

Terminology shall, wherever possible, be taken from:

IEC Publication 50: International Electrotechnical Vocabulary (IEV).

Any other terminology required should be derived in accordance with the principles of this publication.

### 2.4.1

#### **microelectronics** (IEC 748-1)

the concept of the construction and use of highly miniaturized electronic circuits

### 2.4.2

#### **microcircuit** (IEC 748-1)

a microelectronic device, having a high equivalent circuit-element and/or component density, which is considered as a single unit

NOTE A microcircuit may be a micro-assembly or an integrated (micro) circuit.

### 2.4.3

#### **integrated circuit** (IEC 748-1 modified)

a circuit in which a number of circuit elements are inseparably associated and electrically interconnected such that, for the purpose of specification, testing, commerce and maintenance, it is considered indivisible

NOTE For this definition, a circuit element does not have an envelope or external connection and is not specified or sold as a separate item.

### 2.4.4

#### **integrated microcircuit** (IEC 748-1 modified)

a microcircuit in which a number of circuit elements are inseparably associated and electrically interconnected such that, for the purpose of specification and testing and commerce and maintenance, it is considered indivisible

NOTE 1 For this definition, a circuit element does not have an envelope or external connection and is not specified or sold as a separate item.

NOTE 2 Where no misunderstanding is possible, the term "integrated microcircuit" may be abbreviated to "integrated circuit".

NOTE 3 Further qualifying terms may be used to describe the technique used in the manufacture of a specific integrated microcircuit.

Examples of use of qualifying terms:

- semiconductor monolithic integrated circuit;
- semiconductor multi-chip integrated circuit;
- thin film integrated circuit;
- thick film integrated circuit;
- hybrid integrated circuit.

### 2.4.5

#### **micro-assembly** (IEC 748-1 modified)

a microcircuit consisting of various components and/or integrated micro-circuits which are constructed separately and which can be tested before being assembled and packaged

NOTE 1 For this definition, a component has external connections and possibly an envelope as well and it can also be specified and sold as a separate item.

NOTE 2 Further qualifying terms may be used to describe the form of the components and/or the assembly techniques used in the construction of a specific micro-assembly.

Examples of use of qualifying terms:

- semiconductor multi-chip micro-assembly;
- discrete component micro-assembly.

#### **2.4.6**

#### **semiconductor integrated circuit** (IEV 521-10-06 modified)

an integrated circuit whose elements and interconnections are formed within and upon a semiconductor

#### **2.4.7**

#### **multichip microcircuit**

a microcircuit containing chip components for surface mounting which are separately mounted upon a substrate

#### **2.4.8**

#### **film**

a layer of solid formed by any deposition process in-situ upon a solid substrate

#### **2.4.9**

#### **foil**

a solid film which can be handled independent of a substrate

#### **2.4.10**

#### **thin film**

a film deposited upon a substrate by an accretion process such as vacuum evaporation, sputtering and chemical vapour deposition

#### **2.4.11**

#### **thick film**

a film deposited upon a substrate, usually by a screen printing process

#### **2.4.12**

#### **film integrated circuit**

an integrated circuit whose elements and interconnections are films formed on an insulating substrate surface. The film elements may be active or passive

#### **2.4.13**

#### **hybrid integrated circuit**

an integrated circuit formed by any combination of semiconductor and film integrated circuits or by the combination of any of these circuits with discrete elements

#### **2.4.14**

#### **hybrid film integrated circuit**

a film integrated circuit on which at least one component, encapsulated or unencapsulated, has been mounted

#### **2.4.15**

#### **passive hybrid film integrated circuit**

a hybrid film integrated circuit in which all the elements are passive

#### **2.4.16**

#### **active hybrid film integrated circuit**

a hybrid film integrated circuit in which at least one element is active

#### **2.4.17**

#### **semiconductor chip hybrid film integrated circuit**

a hybrid film integrated circuit containing one or more unencapsulated semiconductor devices

#### **2.4.18**

#### **substrate**

a piece of material forming a supporting base for film circuit elements and/or added components

**2.4.19****multilayer film circuit**

a circuit of more than one layer of film interconnection, separated by at least one insulating film or gap

**2.4.20****circuit element**

an element, passive or active, of an integrated circuit that performs an electrical function

**2.4.21****active element**

an element primarily contributing electrical rectification, switching or gain to a circuit function

NOTE Active elements may also be used to contribute resistance and capacitance to a circuit function, or to convert externally applied energy from one form to another.

Examples are diodes, transistors, semiconductor integrated circuits, light-sensing and light-emitting semiconductor devices.

**2.4.22****passive element**

an element primarily contributing resistance, capacitance or inductance or a combination of these to a circuit function

NOTE Examples are resistors, capacitors, inductors, filters, inter-connecting tracks.

**2.4.23****thin-film integrated circuit (IEV 521-10-08)**

a film integrated circuit whose films are formed by vacuum deposition techniques, possibly supplemented by other deposition techniques

**2.4.24****thick-film integrated circuit (IEV 521-10-09)**

a film integrated circuit whose films are formed by printing, serigraphy or other related techniques

**2.4.25****vapour phase deposition technique**

the deposition of conducting, insulating or semiconducting films onto solid substrates from a source material in the vapour phase by physical deposition or chemical reaction

**2.4.26****screen printing technique**

the deposition of films onto substrates by pressing pastes (inks) through screens

**2.4.27****plated film**

film obtained through chemical and/or electrochemical deposition

**2.4.28****termination (terminal)**

conductor (pin, tab, pad, etc.) providing external electrical access to the integrated circuit

**2.4.29****package**

total or partial envelope of an integrated circuit which provides:

- mechanical protection;
- environmental protection;
- outline dimensions.

the package may also contain or provide terminations. It contributes to the thermal characteristics of the integrated circuit

**2.4.30****encapsulation**

encapsulation is the general process of surrounding the circuit or components with a protection medium against mechanical and physical/chemical stresses