

TECHNICAL SPECIFICATION

**Process management for avionics – Electronic components for aerospace, defence and high performance (ADHP) applications –
Part 1: General requirements for high reliability integrated circuits and discrete semiconductors**

IEC/TS 62686-1:2012

<https://standards.iteh.ai/catalog/standards/sist/9745011b-e108-4c45-a619-f7c505eea552/iec-ts-62686-1-2012>



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INTERNATIONAL ELECTROTECHNICAL COMMISSION

**PROCESS MANAGEMENT FOR AVIONICS –
ELECTRONIC COMPONENTS FOR AEROSPACE, DEFENCE
AND HIGH PERFORMANCE (ADHP) APPLICATIONS –****Part 1: General requirements for high reliability
integrated circuits and discrete semiconductors**

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.
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- the required support cannot be obtained for the publication of an International Standard, despite repeated efforts, or
- the subject is still under technical development or where, for any other reason, there is the future but no immediate possibility of an agreement on an International Standard.

Technical specifications are subject to review within three years of publication to decide whether they can be transformed into International Standards.

IEC/TS 62686-1 which is a Technical Specification, has been prepared by IEC technical committee 107: Process management for avionics.

This Technical Specification cancels and replaces IEC/PAS 62686-1. It includes the following significant technical changes with respect to IEC/PAS 62686-1:

- a) adoption and modification of STACK Specification S/0001 revision 14, *General requirements for integrated circuits and discrete semiconductors*;
- b) addition of alternative IEC semiconductor test methods;
- c) update of JEDEC semiconductor test methods;
- d) update of Annex A additional JEDEC and IEC test information;
- e) certification of the OCM according to ISO 9001;
- f) addition of lead-free termination finish requirements;
- g) addition of request for OCMs to make the data for device lifetime calculations available;
- h) update of the IEC and JEDEC test methods for the following semiconductor wear-out mechanisms: TDD, electro-migration, HCL and NBTI;
- i) addition of request for OCMs to provide single event effects (SEE) data;
- j) update of moisture sensitivity level (MSL) marking requirements.

The text of this Technical Specification is based on the following documents:

Enquiry draft	Report on voting
107/167/DTS	107/184/RVC

Full information on the voting for the approval of this technical specification can be found in the report on voting indicated in the above table.

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

A list of all the parts in the IEC 62686 series, published under the general title *Process management for avionics – Electronic components for aerospace, defence and high performance (ADHP) applications*, can be found on the IEC website.

The committee has decided that the contents of this publication 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

- transformed into an International standard,
- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

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

INTRODUCTION

This part of IEC 62686 includes all the requirements of STACK Specification S/0001 revision 14 and contains revisions for alternative IEC qualification test methods and additional test information.

This Technical Specification complements IEC/TS 62564-1 which is used for ADHP applications when additional manufacturer's data is required beyond the publicly available manufacturer published datasheets (e.g. when additional thermal performance data is required for thermally challenging applications or when additional verification data are needed for example to comply with the requirements of RTCA DO-254/EUROCAE ED-80 for complex components for flight critical applications, etc.).

This Technical Specification can also be used to comply with the typical qualification requirements of IEC/TS 62564-1. Further guidance is given in IEC/TS 62239-1.

NOTE With the adoption of the STACK Specification S/0001 revision 14 it will be possible for all existing STACK certified manufacturers to be audited by IECQ under the new STACK-IECQ joint venture.

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PROCESS MANAGEMENT FOR AVIONICS – ELECTRONIC COMPONENTS FOR AEROSPACE, DEFENCE AND HIGH PERFORMANCE (ADHP) APPLICATIONS –

Part 1: General requirements for high reliability integrated circuits and discrete semiconductors

1 Scope

This part of IEC 62686 defines the minimum requirements for general purpose "off the shelf" COTS (commercial off-the-shelf) integrated circuits and discrete semiconductors for ADHP (Aerospace, Defence and High Performance) applications.

This Technical Specification applies to all components that can be operated in ADHP applications within the manufacturers' publicly available datasheet limits in conjunction with IEC/TS 62239-1. It may be used by other high performance and high reliability industries, at their discretion.

ADHP application requirements may not necessarily be fulfilled by this specification alone. ADHP OEMs (original equipment manufacturers) may need to consider redesigning their products or conducting further testing to verify suitability in ADHP applications using their IEC/TS 62239-1 ECMP procedures. Alternatively a component in accordance with IEC/TS 62564-1 may be more suitable.

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 60749-3, *Semiconductor devices – Mechanical and climatic test methods – Part 3: External visual inspection*

IEC 60749-4, *Semiconductor devices – Mechanical and climatic test methods – Part 4: Damp heat, steady state, highly accelerated stress test (HAST)*

IEC 60749-5, *Semiconductor devices – Mechanical and climatic test methods – Part 5: Steady-state temperature humidity bias life test*

IEC 60749-6, *Semiconductor devices – Mechanical and climatic test methods – Part 6: Storage at high temperature*

IEC 60749-7, *Semiconductor devices – Mechanical and climatic test methods – Part 7: Internal moisture content measurement and the analysis of other residual gases*

IEC 60749-8, *Semiconductor devices – Mechanical and climatic test methods – Part 8: Sealing*

IEC 60749-9, *Semiconductor devices – Mechanical and climatic test methods – Part 9: Permanence of marking*

IEC 60749-14, *Semiconductor devices – Mechanical and climatic test methods – Part 14: Robustness of terminations (lead integrity)*

IEC 60749-15, *Semiconductor devices – Mechanical and climatic test methods – Part 15: Resistance to soldering temperature for through hole mounted devices*

IEC 60749-17, *Semiconductors devices – Mechanical and climatic tests – Part 17: Neutron irradiation*

IEC 60749-19, *Semiconductor devices – Mechanical and climatic test methods – Part 19: Die shear strength*

IEC 60749-20, *Semiconductor devices – Mechanical and climatic test methods – Part 20: Resistance of plastic encapsulated SMDs to the combined effects of moisture and soldering heat*

IEC 60749-20-1, *Semiconductor devices – Mechanical and climatic test methods – Part 20-1: Handling, packing, labelling and shipping of surface-mount devices sensitive to the combined effect of moisture and soldering heat*

IEC 60749-21, *Semiconductor devices – Mechanical and climatic test methods – Part 21: Solderability*

IEC 60749-22, *Semiconductor devices – Mechanical and climatic test methods – Part 22: Bond strength*

IEC 60749-23, *Semiconductor devices – Mechanical and climatic test methods – Part 23: High temperature operating life*

IEC 60749-25, *Semiconductor devices – Mechanical and climatic test methods – Part 25: Temperature cycling*

IEC 60749-26, *Semiconductor devices – Mechanical and climatic test methods – Part 26: Electrostatic discharge (ESD) sensitivity testing – Human body model (HBM)*

IEC 60749-29, *Semiconductor devices – Mechanical and climatic test methods – Part 29: Latch-up test*

IEC 60749-32, *Semiconductor devices – Mechanical and climatic test methods – Part 32: Flammability of plastic encapsulated devices (externally induced)*

IEC 60749-33, *Semiconductor devices – Mechanical and climatic test methods – Part 33: Accelerated moisture resistance – Unbiased autoclave*

IEC 60749-34, *Semiconductor devices – Mechanical and climatic test methods – Part 34: Power cycling*

IEC 60749-38, *Semiconductor devices – Mechanical and climatic test methods – Part 38: Soft error test method for semiconductor devices with memory*

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

IEC/TS 62239-1, *Process management for avionics – Management plan – Part 1: Preparation and maintenance of an electronic components management plan*

IEC 62374, *Semiconductor devices – Time dependent dielectric breakdown (TDDB) test for gate dielectric films*

IEC 62374-1, *Semiconductor devices – Part 1: Time dependent dielectric breakdown (TDDB) test for inter-metal layers*

IEC 62415, *Semiconductor devices – Constant current electromigration test*

IEC 62416, *Semiconductor devices – Hot carrier test on MOS transistors*

IEC 62417, *Semiconductor devices – Mobile ion tests for metal-oxide semiconductor field effect transistors (MOSFETs)*

IEC/PAS 62483, *Test method for measuring whisker growth on tin and tin alloy finishes*

ISO 9001, *Quality management systems – Requirements*

ISO 14001, *Environmental management systems – Requirements with guidance for use*

ISO/TS 16949, *Quality management systems – Particular requirements for the application of ISO 9001:2008 for automotive production and relevant service part organizations*

AS/EN/JISQ 9100, *Aerospace series – Quality management systems – Requirements for aviation, space and defense organisations*

TL 9000, *Quality management system¹*

STACK S/0001 revision 14, *General requirements for integrated circuits and discrete semiconductors*

EIA-471, *Symbol and label for electrostatic sensitive devices*

EIA-541, *Packaging material standards for ESD sensitive items*

ANSI/EIA-556, *Outer shipping container label standard*

JP001.01, *Foundry process qualification guidelines (Wafer fabrication manufacturing sites)*

JEP130A, *Guidelines for packing and labeling of integrated circuits in unit container packing*

JEP119, *A procedure for executing SWEAT*

JEP154, *Guideline for characterizing solder bump electromigration under constant current and temperature stress*

JESD6, *Measurement of small values of transistor capacitance*

JESD201, *Environmental acceptance requirements for tin whisker susceptibility of tin and tin alloy surface finishes*

¹ For the telecommunications industry.

JESD202, *Method for characterising the electromigration failure time distribution of interconnects under constant-current and temperature stress*

JESD22-A101, *Steady state temperature humidity bias life test*

JESD22-A102, *Accelerated moisture resistance – Unbiased autoclave*

JESD22-A103, *High temperature storage life*

JESD22-A104, *Temperature cycling*

JESD22-A108, *Temperature bias and operating life*

JESD22-A109, *Hermeticity*

JESD22-A110, *Highly accelerated temperature and humidity stress test (HAST)*

JESD22-A117, *Electrically erasable programmable ROM (EEPROM) program/erase endurance and data retention test*

JESD22-B100, *Physical dimension*

JESD22-B101, *External visual*

JESD22-B102, *Solderability*

JESD22-B105, *Lead integrity*

JESD22-B106, *Resistance to solder shock for through-hole mounted devices*

JESD22-B107, *Marking permanency*

JESD22-B116, *Wire bond shear test*

JESD46, *Customer notification of product/process changes by solid state suppliers.*

JESD47, *Stress test driven qualification of integrated circuits*

JESD48, *Product discontinuance*

JESD78, *IC Latchup test*

JESD85, *Methods for calculating failure rates in units of FITS*

JESD86, *Electrical parameters assessment*

JESD89, *Measurement and reporting of alpha particle and terrestrial cosmic ray-induced soft errors in semiconductor devices*

JESD94, *Application specific qualification using knowledge based test methodology*

JESD213, *Standard test method utilizing X-RAY-Fluorescence (XRF) for analyzing component finishes and solder alloys to determine Tin (Sn)-Lead (Pb) content*

JESD625, *Requirements for handling electrostatic discharge sensitive (ESDS) devices*

J-STD-020, *Moisture/reflow sensitivity classification for non-hermetic solid state surface mount devices*

J-STD-033, *Handling, packing, shipping and use of moisture/reflow sensitive surface mount-devices*

J-STD-609A.01, *Marking and labeling of components, PCBs and PCBA's to identify lead (Pb), lead-free (Pb-Free) and other attributes*

ANSI/ESDA/JEDEC JS-001, *Electrostatic discharge sensitivity testing – Human body model (HBM) – Component level*

MIL-STD-1580, *Destructive physical analysis (DPA) for electronic, electromagnetic and electromechanical parts*

UL94, *Tests for flammability of plastic materials for parts in devices and appliances*

AEC-Q100, *Stress test qualification for integrated circuits*

AEC-Q101, *Stress test qualification for automotive grade discrete semiconductors*

RTCA DO-254/EUROCAE ED-80, *Design assurance guidance for airborne electronic hardware*

3 Terms, definitions and abbreviations

For the purposes of this document, the following terms, definitions and abbreviations apply.

3.1 Terms and definitions

3.1.1

calendar days

continuous days, including weekends and holidays

3.1.2

container

outer shipping container consisting of one or more inner containers

3.1.3

customer

user

original equipment manufacturer (OEM) who procures integrated circuits and/or semiconductor devices compliant to this technical specification and uses them to design, produce, and maintain systems

3.1.4

data sheet

document prepared by the manufacturer that describes the electrical, mechanical, and environmental characteristics of the component

3.1.5

deviation

user agreement to allow the delivery of a shipping lot which does not fully meet the requirements of this specification

Note 1 to entry: Considered equivalent to concession for the purposes of this document.

3.1.6
device specification

document written by a user and agreed by the supplier or OCM

3.1.7
form

shape, arrangement of parts, visible aspect, mode in which a part exists or manifests itself, the material an item is constructed from

3.1.8
fit

qualified and competent, correct size and scale

3.1.9
function

work that an item is designed to do without degrading reliability

3.1.10
incoming lot

one or more shipments of a device, grouped together for the purpose of incoming inspection

3.1.11
inner container

box or bag containing devices, either in magazines or bulk packaged

3.1.12
magazine

shipping container that feeds into automatic placement machines

EXAMPLE Sticks, tubes, matrix trays, tape/reel, etc.

3.1.13
**microcircuit
component
device**

electrical or electronic device that is not subject to disassembly without destruction or impairment of design use and is a small circuit having a high equivalent circuit element density

Note 1 to entry: It is considered as a single part composed of interconnected elements on or within a single substrate to perform an electronic circuit function.

Note 2 to entry: This excludes printed wiring boards/printed circuit boards, circuit card assemblies and modules composed exclusively of discrete electronic components.

3.1.14
moisture sensitivity level

MSL

rating indicating a component's susceptibility to damage due to absorbed moisture when subjected to reflow soldering

3.1.15
original component manufacturer
OCM

company specifying and manufacturing the electronic component