

TECHNICAL SPECIFICATION

**Process management for avionics – Electronic components for aerospace,
defence and high performance (ADHP) applications –
Part 2: General requirements for passive components**

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**Process management for avionics – Electronic components for aerospace,
defence and high performance (ADHP) applications –
Part 2: General requirements for passive components**

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

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CONTENTS

FOREWORD.....	5
INTRODUCTION.....	7
1 Scope.....	8
2 Normative references	8
3 Terms, definitions and abbreviated terms	8
3.1 Terms and definitions.....	8
3.2 Abbreviated terms.....	11
4 Technical requirements	12
4.1 General.....	12
4.1.1 Overview	12
4.1.2 Equivalent methods	13
4.2 Procedures	13
4.2.1 General	13
4.2.2 Product discontinuance	14
4.2.3 ESD protection during manufacture	14
4.2.4 Traceability.....	14
4.3 Shipment controls	14
4.3.1 General	14
4.3.2 Unit pack container.....	14
4.3.3 Intermediate packing	14
4.3.4 Date codes	15
4.3.5 Moisture sensitivity level (MSL).....	15
4.3.6 Lead-free marking	15
4.3.7 Labels	15
4.3.8 Electrostatic discharge (ESD)	16
4.4 Product or process change notification (PCN).....	16
4.4.1 General	16
4.4.2 Notification	17
4.4.3 Notification details	17
4.5 Electrical.....	17
4.5.1 General	17
4.5.2 Electrical test.....	17
4.6 Mechanical	17
4.6.1 General	17
4.6.2 Device marking.....	18
4.6.3 Lead-free components	18
4.6.4 Moisture sensitivity	18
4.6.5 Termination finishes	18
4.6.6 Termination finish notification of change	19
4.7 Audit capability	19
4.7.1 General	19
4.7.2 Internal quality audits	19
4.7.3 Subcontract manufacturing	19
4.8 Quality assurance	19
4.8.1 General	19
4.8.2 Quality system	20
4.8.3 Sampling plans	20

4.8.4	Failure analysis support.....	20
4.8.5	Outgoing quality	20
4.9	Qualification.....	20
4.9.1	General	20
4.9.2	Methodology.....	21
4.9.3	Test samples	24
4.9.4	Qualification categories	24
4.9.5	Maintenance of qualification standard.....	24
4.9.6	In-process test results	25
4.9.7	Test references	25
4.9.8	Qualification report	25
4.9.9	Archiving	25
4.9.10	Qualification of device changes	25
4.9.11	Similarity assessment.....	25
4.10	Product monitoring in the production line	26
4.10.1	General	26
4.10.2	Monitoring programme.....	26
4.10.3	Problem notification	26
4.10.4	Data reporting.....	26
4.11	Environmental health and safety (EHS).....	26
4.11.1	General	26
4.11.2	General EHS compliance.....	27
4.11.3	Device handling	27
4.11.4	Device materials and substances.....	27
Annex A	(informative) Test code (TC) information for guidance.....	28
A.1	General.....	28
A.2	TC1 – Electrical test.....	28
A.3	TC2 – External visual.....	28
A.4	TC3 – Package dimensions.....	29
A.5	TC4 – High temperature exposure (storage)	30
A.6	TC5 – Temperature cycling	30
A.7	TC6 – Moisture resistance	30
A.8	TC7 – Biased humidity.....	30
A.9	TC8 – High temperature operating life.....	30
A.10	TC9 – Terminal strength (lead).....	31
A.11	TC10-Resistance to solvents	31
A.12	TC11 – Mechanical shock	31
A.13	TC12 – Vibration.....	31
A.14	TC13 – Resistance to heat.....	31
A.15	TC14 – Thermal shock	32
A.16	TC15 – Board flex (SMD)	32
A.17	TC16 – Beam load	32
A.18	TC17 – Solderability	32
A.19	TC18 – Electrostatic discharge	32
A.20	TC19 – Flammability	32
A.21	TC20 – Terminal strength (SMD).....	32
A.22	TC21 – Surge voltage	32
A.23	TC22 – Hermeticity	33
A.24	TC23 – Tin whisker	33

Annex B (informative) Typical IECQ-CECC approved components	34
Annex C (informative) Typical USA military specified passive components.....	36
Annex D (informative) Typical automotive components	37
Annex E (informative) Typical IEC specified passive components	39
E.1 Typical IEC passive component specifications	39
E.2 IEC passive component environmental test methods.....	39
Annex F (informative) Verification requirements matrix for IEC TS 62686-2	46
Bibliography.....	55
Table 1 – Label requirements.....	16
Table 2 – Internal quality audit areas	19
Table 3 – Technology/family qualification and device qualification	22
Table 4 – Qualification tests for device types	23
Table D.1 – AEC-Q200 temperature grades	37
Table E.1 – IEC passive specifications' environmental test methods compared to those specified in Table 3	40
Table F.1 – Verification requirements matrix for IEC TS 62686-2	46

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

**PROCESS MANAGEMENT FOR AVIONICS – ELECTRONIC
COMPONENTS FOR AEROSPACE, DEFENCE AND
HIGH PERFORMANCE (ADHP) APPLICATIONS –****Part 2: General requirements for passive components**

FOREWORD

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

IEC TS 62686-2 which is a technical specification, has been prepared by IEC technical committee 107: Process management for avionics.

This first edition cancels and replaces the first edition of IEC PAS 62686-2 published in 2016. This edition constitutes a technical revision.

The text of this technical specification is based on the following documents:

Enquiry draft	Report on voting
107/302/DTS	107/343/RVDTS

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 document 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 document will remain unchanged until the stability date indicated on the IEC website under "<http://webstore.iec.ch>" in the data related to the specific document. At this date, the document will be

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

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

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INTRODUCTION

This part IEC 62686 includes all the requirements of the obsolete STACK Specification S/0003 issue 2 related to passive components and contains revisions for alternative qualification test methods and additional test information for the aerospace, defence and high performance (ADHP) industries. This document is typically used in conjunction with IEC TS 62239-1.

NOTE With the addition of alternative methods, it is possible for manufacturers to be audited by IECQ under the new IECQ automotive scheme or IECQ approved component scheme.

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

Part 2: General requirements for passive components

1 Scope

This part of IEC 62686 defines the minimum requirements for general purpose "off-the-shelf" COTS (commercial off-the-shelf) passive components for aerospace, defence and high performance (ADHP) applications.

This document applies to all passive components that can be operated in ADHP applications within the manufacturers' publicly available data sheet limits in conjunction with IEC TS 62239-1. This document can be used by other high performance and high reliability industries, at their discretion.

ADHP application requirements are not necessarily fulfilled by this document alone. ADHP original equipment manufacturers (OEMs) could consider redesigning their products or conducting further testing to verify suitability in ADHP applications using their procedures for satisfying their electronic component management plan (ECMP) (see IEC TS 62239-1).

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

JESD48, *Product discontinuance*

J-STD-609B, *Marking, symbols, and labels of leaded and lead-free terminal finished materials used in electronic assembly*

3 Terms, definitions and abbreviated terms

3.1 Terms and definitions

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

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- IEC Electropedia: available at <http://www.electropedia.org/>
- ISO Online browsing platform: available at <http://www.iso.org/obp>.

3.1.1

calendar days, pl.

continuous days, including weekends and holidays

3.1.2**container**

outer shipping container consisting of one or more inner containers

3.1.3**data sheet**

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

3.1.4**deviation**

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

Note 1 to entry: This is considered equivalent to concession for the purposes of this document.

3.1.5**device specification**

document written by a user and agreed by the supplier

3.1.6**form**

shape, size, dimensions, and other physically measurable parameters that uniquely characterize a product

[SOURCE: IEC TS 62239-2:2017, 3.1.23]

3.1.7**fit**

ability to physically interface or connect with

3.1.8**function**

action or actions that a product is designed to perform

[SOURCE: IEC TS 62239-2:2017, 3.1.25]

3.1.9**incoming lot**

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

3.1.10**inner container**

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

3.1.11**magazine**

shipping container that feeds into automatic placement machines

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

3.1.12**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.

3.1.13

manufacturing lot

definite quantity of devices tracked at each manufacturing operation

Note 1 to entry: A manufacturing lot is associated with a travel log and constitutes a group homogeneously processed through all manufacturing operations under uniform manufacturing conditions.

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

[SOURCE: IEC TS 62668-1:2016, 3.1.13]

3.1.16

OEM

original equipment manufacturer

manufacturer which defines the electronic subassembly that includes the electronic components or defines the components used in an assembly and/or test specification

[SOURCE: IEC TS 62668-1:2016, 3.1.14]

3.1.17

passive component

component that does not require electrical power to operate (for example not capable of power gain)

Note 1 to entry: For the purposes of this document, the term 'passive' is restricted to capacitors and resistors.

3.1.18

room temperature

temperature identified at $25\text{ °C} \pm 5\text{ °C}$ in a room

3.1.19

shipping lot

single lot of one or more containers received by a user

3.1.20

supplier

company which provides to another an electronic component which is identified by the logo or name marked on the device

Note 1 to entry: A supplier can be the OCM, a franchised distributor or agent, a non-franchised distributor, broker, reseller, OEM, CEM and EMS etc.

[SOURCE: IEC TS 62686-1:2015, 3.1.19]

3.1.21**termination**

element of a component that connects it electrically and mechanically to the next level of assembly

3.2 Abbreviated terms

AC	alternating current
ADHP	aerospace, defence and high performance
AEC	Automotive Electronics Council
AOQ	average out-going quality
AQEC	aerospace qualified electronic component
AQL	acceptable quality level
CB	certification body
CECC	CENELEC electronic components committee
CFC	chlorofluorocarbon
COTS	commercial off-the-shelf
DC	direct current
DFMEA	design failure modes and effect analysis
DLA	Defense Logistics Agency (see http://www.dscc.dla.mil/)
DPM	defects per million
DVP&R	design verification plan and report
ECMP	electronic component management plan
EHS	environmental health and safety
EMAS	Eco-Management and Audit Scheme (established by the European Union)
ESD	electrostatic discharge
FFF	form, fit and function
FIT	failures in time
GR&R	gage repeatability and reproducibility analysis
h	hour
HAST	highly accelerated stress test
HBM	human body model
HTOL	high temperature operating life
IATF	International Automotive Task Force
IECQ	International Electrotechnical Commission Quality Assessment System for Electronic Components
I/O	input and output
IR	infra-red
LTB	last time buy
LTPD	lot tolerance percent defective
min	minute
MSA	measurements system analysis
MSL	moisture sensitivity level
OCM	original component manufacturer
OEM	original equipment manufacturer
PC	preconditioning

PCB	printed circuit board
PCN	product or process change notification
PFMEA	process failure modes and effects analysis
Pkg	package
PPAP	part production approval process
QA	quality assurance
QPL	qualified parts list
REACH	registration, evaluation, authorization and restriction of substances
RoHS	restriction of hazardous substances
SMD	surface mount device
SPC	statistical process control
T_{amb}	ambient temperature
TC	test code
T_{opmin}	minimum operating temperature
T_{opmax}	maximum operating temperature
UCT	upper category temperature

4 Technical requirements

4.1 General

4.1.1 Overview

The supplier, preferably the franchised distributor or original component manufacturer (OCM), as defined in 3.1.20 and 3.1.15, shall have an appropriate quality management system and shall provide the following minimum technical requirements. Other proposed equivalent test methods, rationale and supporting data shall be reviewed and shall achieve the same end objectives as specified herein (see 4.4.4). The supplier or OCM shall provide a high-level statement summarising how compliance to the specification is achieved including the use of equivalent test methods (see 4.1.2), when they are used.

NOTE 1 ISO 9001 or AS/EN/JISQ 9100 can assist with compliance to this clause.

NOTE 2 In case the COTS passive components cannot be procured directly from the OCM (for example if too small a quantity), the franchised distribution network is usually privileged with regard to potential risks (for example lack of traceability and counterfeiting).

Informative annexes are provided at the end of this document and their contents are subject to change. Users of this document are encouraged to review the latest data available whenever referencing the content of these annexes:

- Informative Annex A: Test code (TC) information;
- Informative Annex B: Typical IECQ-CECC approved passive components;
- Informative Annex C: Typical USA military specified passive components;
- Informative Annex D: Typical automotive component;
- Informative Annex E: Typical IEC specified passive components;
- Informative Annex F: Verification requirements matrix for IEC TS 62686-2.

4.1.2 Equivalent methods

4.1.2.1 General

Use of such equivalent tests shall not be considered to be deviations or waivers to the requirements of this document and are based on:

- IECQ-CECC approved components, see 4.1.2.2;
- automotive components see 4.1.2.3;
- IEC passive components see 4.1.2.4.

4.1.2.2 IECQ-CECC approved components

IECQ approved components to CECC specifications meet the requirements of this specification, see the guidance in Annex C.

NOTE 1 The IECQ assesses and approves manufacturers to CECC specifications, which are listed on the IECQ on-line certificate system for 'Approved Component' under the 'Component' section.

NOTE 2 USA military specified components are considered equivalent to the IECQ-CECC approved components where the DLA assesses and approves manufacturers which are listed on qualified parts lists (QPLs), see annex A for more guidance.

4.1.2.3 Automotive components

Automotive components which are typically manufactured on IATF 16949 certified manufacturing lines and qualified to AEC-Q200, for temperature grades 0, 1, 2, and 3, with the outgoing quality requirements typically included in a production part approval process (PPAP) process and with the obsolescence and product change notification as specified herein may meet the requirements of this specification, see Annex D for guidance.

NOTE 1 The IECQ automotive qualification programme can be expanded to cover this category of automotive component.

NOTE 2 The VDA 6 series assessment, particularly VDA 6.3, Process audit, can be used for the PPAP element of the IECQ assessment process.

4.1.2.4 IEC passive component specifications

Passive components specified by IEC meet most of the qualification requirements of this specification, see the guidance in Annex E. However, the qualification test method durations and sample sizes may be different and the other requirements of Clause 4 may not always be met. An assessment and closure of any gaps in requirements will be required before claiming compliance to this specification.

NOTE 1 These components are controlled by zero defect test schedules and are 100 % tested as finished components.

NOTE 2 Currently there is no IECQ assessment scheme for these components.

4.2 Procedures

4.2.1 General

The OCM shall have the following procedures:

- product discontinuance (4.2.2);
- ESD protection during manufacture (4.2.3);
- specification control (4.2.4);
- traceability including anti-counterfeit measures (4.2.5).

4.2.2 Product discontinuance

Notification shall be made for example in accordance with JESD48 or equivalent, with the exception of timing as described in a) and b) below:

- a) the OCM or supplier shall provide to the user a notice of last order dates:
 - a minimum of 12 months before these dates for single-source devices, and
 - a minimum of 6 months before these dates for multi-sourced devices;
- b) the OCM or supplier may give less than the specified notice period provided a mutually acceptable extension (up to the specification limit) is negotiated with any user needing a different period.

4.2.3 ESD protection during manufacture

Many passive components are considered to be sensitive to static and shall be protected through the OCM's manufacturing operation. The OCM and supplier shall ensure that devices are not exposed to static damage and are not degraded or damaged due to static discharge. IEC 61340-3-1, IEC 61340-5-1, IEC TR 61340-5-2, JESD625 or AEC-Q200-002 are examples of suitable documents for ESD precautions. OCMs and suppliers holding current certification for compliance with IEC 61340-5-1 are deemed to have satisfied this requirement.

4.2.4 Traceability

Traceability shall be managed as follows:

- a) the OCM and supplier shall have traceability for any device in a shipping lot through a route code, lot code or other marking on the device or magazine or inner container to identify the manufacturing route, for example manufacturing location, assembly location, test location, date code and lot code;
- b) the information needed to interpret the code shall be available for example according to IEC 60062;
- c) the procedure shall be available for inspection during audit.

The OCMs and suppliers shall use anti-counterfeit measures to protect their intellectual property, such as use of registered trademarks, logos, patents, etc. The OCM and supplier shall also assist the user in determining if the product is genuine when requested and in identifying the franchised distributors.

4.3 Shipment controls

4.3.1 General

The OCM's name, logo and trademark shall be marked on the shipping container where it is practical to do so.

4.3.2 Unit pack container

The packing for shipment needs to preserve the integrity of goods inside:

- a) unit pack container configurations should be in accordance with existing industry practices;
- b) components should be oriented in the same direction, in all unit pack containers.

NOTE Industry standards such as EIA-481, EIA-468, EIA-296, EIA-948, EIA-960 can be used to provide guidance for 4.3.2.

4.3.3 Intermediate packing

An intermediate container packing process should be designed to eliminate the presence of partial quantities.

4.3.4 Date codes

4.3.4.1 Mixing

As a preferred methodology, there should be no more than one date code per unit pack container. If this is not possible, then there should be no more than two date codes in one unit pack container. If two date codes are used, the unit pack container should be clearly labelled as having mixed date codes and labels need to indicate the quantity for each date code.

If possible, there should be no more than three date codes per sealed intermediate by date code. The label on the intermediate container should list all date codes and quantities by date code.

4.3.4.2 Remarking

If the date of assembly and test are both marked, the test date can be remarked if the device is re-tested at a later date. If only one date is marked to represent the manufacturing date and initial electrical test it shall not be changed unless it is necessary to correct poor quality marking or incorrect information and provided that the time delta between the original mark and the remark is less than 6 weeks.

4.3.4.3 Age on delivery

Date code age on delivery shall be as follows where shipped directly from the OCM or supplier:

- a) the date codes of devices shall not be older than 48 months upon users' receipt date;
- b) the exception is for aluminium electrolytic capacitors which shall not be older than 24 months.

4.3.5 Moisture sensitivity level (MSL)

The labelling and inner container, used for example for shipping, shall be in accordance with IEC 61760-4 or J-STD-033 or equivalent standard.

4.3.6 Lead-free marking

The shipping container and date code marking shall be in accordance with J-STD-609B or equivalent.

4.3.7 Labels

In general, labels shall include the requirements mentioned in Table 1 and exhibit:

- a) human readable content: the content shown for each label shall be available in human readable form on the outside of the relevant package;
- b) machine readable content: bar codes for those items specified shall be included in 3 of 9 codes (bar code 39) according to IEC 62090 or ANSI/EIA-556 or equivalent compatible standard;
- c) warning notice: any necessary warning notices or symbols to ensure the safety of the contents shall be included as appropriate.

Table 1 – Label requirements

Dry pack label:	Bar code
• Date of sealing and sealed life or expiration date. • Time and storage condition limits after opening. • Bake conditions if usage conditions after opening are violated. • Moisture sensitivity classification according to IEC 61760-4 or J-STD-020.	
Outer container label: this label is typically implemented as a shipping note or packing list attached to the outer container: • Delivery address. • Purchase order number. • User part number. • OCM's device type number ^a. • OCM's name ^a. • Export Control Certification number and controlling authority ^b. • Quantities enclosed of each device type ^a.	* * * *
Inner container label: • OCM's device type number. • User part number ^b. • Purchase order number ^b. • Quantity of devices. • Date code. • Lot number. • Assembly location ^b. • Test location ^b.	* * * * * *
^a For security reasons, can be omitted by agreement of the user. ^b Preferred but not mandatory.	

4.3.8 Electrostatic discharge (ESD)

The symbols and labelling used for marking shall be in accordance with IEC 61340-5-3 or ANSI/EIA-471 or equivalent standard.

For their ESD protection, all devices shall be supplied in suitable protective packaging with electrostatic properties meeting the requirements of IEC 61340-5-3 or ANSI/EIA-541.

All packaging should be static safe (non-generative as a minimum) to safeguard sensitive products occupying the same manufacturing areas.

4.4 Product or process change notification (PCN)

4.4.1 General

The OCM shall provide the following:

- notification (4.4.2);
- notification details (4.4.3).

4.4.2 Notification

In the event of the OCM proposing or making a change to a device, then:

- a) the OCM and/or supplier shall give at least 90 calendar days' written notice prior to shipping the changed product. The user will respond to confirm the date on which the changed product shipments can begin (this could be less than 90 calendar days), advise that the changed product is not acceptable, or request further information;
- b) where an event beyond the control of the OCM occurs, where the 90 calendar days' notice cannot be given, the OCM or supplier shall reach a mutually agreed lesser notice period with any user affected by the change

NOTE AEC-Q200 process change notification satisfies this requirement.

4.4.3 Notification details

The PCN shall include the following items:

- a) title of change;
- b) OCM's type number(s) affected;
- c) OCM's notification identification number;
- d) estimated last order and shipment dates for unchanged devices to be supplied on request;
- e) estimated earliest shipment date of changed devices;
- f) manufacturing location and product line affected;
- g) thorough description of the proposed change;
- h) means of distinguishing changed devices from unchanged devices. This may be a date code, lot code, date code range or distinguishing marking or feature that is visible to the user at point of receipt of shipment;
- i) sufficient engineering and/or qualification test data, including details of any qualification test vehicle used and its applicability to the product change. These shall be available on request to demonstrate that the change will not adversely affect device form, fit, function, quality or reliability, and that the changed product will continue to meet the specified requirements;
- j) user part number of the affected device (preferred item but not mandatory).

4.5 Electrical

4.5.1 General

Operating conditions shall be as defined in the device specification or data sheet, as explained in 4.5.2.

4.5.2 Electrical test

All shipped packaged devices shall have passed a production electrical test program, or in the case of user-specific devices, a test program approved by the user. IEC, JEDEC, MIL standard or AEC test methods shall be used wherever possible.

4.6 Mechanical

4.6.1 General

Passive component package dimensions shall meet the OCM's data sheet or specification requirements. Passive component package dimensions specified in industry standard outlines (for example JEDEC outlines), will be met as specified, if the package is stated as compliant with these outlines.

4.6.2 Device marking

4.6.2.1 General

All the specified markings on the device or shipping container shall be clearly legible.

4.6.2.2 Top surface

Marking is according to IEC 60062 or the following: All of the following required markings shall be marked on the top side, except where otherwise indicated below:

- a) pin 1 or polarity indicator identifiable either by a mark or by reference to a physical feature of the device;
- b) OCM's name or logo;
- c) OCM's part number or individual user part number as required;
- d) date code of assembly or test. Formats per IEC 60062 or YYWW, or YWW or YM are acceptable (Y = year numeral, W = week numeral, M = month character). If both assembly and test date codes are marked, the assembly code may be bottom marked.

4.6.2.3 Case of small packages

If the marking area available on the device is too small to do the marking described in 4.6.2.2, then the unit container shall include all the required marking.

4.6.3 Lead-free components

Lead-free components and/or packaging are to conform to J-STD-609B for marking, symbols and labels for identification of lead (Pb)-free components.

4.6.4 Moisture sensitivity

The moisture sensitivity of all non-hermetic surface mount components shall be tested and classified according to IEC 61760-4 or J-STD-020. The MSL classification shall be included on the device or the container marking if appropriate.

4.6.5 Termination finishes

The following termination finishes are for information only and intended to be representative of common finish types utilized for passive components:

- "Non-RoHS": Tin-lead (Sn-Pb) containing a minimum of 3 % lead (Pb) applied over a suitable barrier metal to prevent leaching (tin-lead alloys with 60 % tin – 40 % lead and 63 % tin – 37 % lead are the most common).
- "RoHS": Tin over nickel (Sn-Ni), tin over copper (Sn-Cu), nickel over palladium (Ni-Pd), nickel over gold (Ni/Au), nickel over palladium over gold (Ni-Pd-Au), tin-bismuth (Sn-Bi), tin-copper (Sn-Cu), tin-silver-copper (Sn-Ag-Cu) or 100 % tin (Sn) are examples. Termination finishes claimed to be RoHS compliant shall not contain lead or other restricted substances.
- Other (special) termination finishes: Termination finishes for special conditions or applications such as high temperature solder or gold plating for bonding shall be fully disclosed on the product data sheet.

The use of bright tin or any other pure tin without a suitable tin whisker mitigation method such as under-plating is prohibited. All finish types shall be compatible with any conventional soldering assembly process.

When applicable an appropriate tin whisker mitigation plan or process shall be in place for finishes with potential for whiskering (for example accelerated tin whisker testing to

IEC 60068-2-82 or JESD201 Class 2 limits or JESD22-A121, proper annealing, or under plating) and be demonstratable. Documented results shall be made available on request.

NOTE 1 The RoHS Directive is a document from the European Parliament (see Bibliography).

NOTE 2 IEC TS 62647-2 or GEIA-STD-0005-2 can be used to provide guidance for considering tin whisker mitigation.

4.6.6 Termination finish notification of change

The supplier and/or OCM shall provide notification of changes, via the PCN process, to the termination finish materials, thickness, or to the plating process chemistry.

4.7 Audit capability

4.7.1 General

The OCM shall be able to carry out the following:

- internal quality audits (4.7.2); and
- sub-contract manufacturing (4.7.3).

4.7.2 Internal quality audits

If not already covered by the OCM's quality management certification, the OCM shall periodically audit each internal area listed in Table 2 to assess their compliance with internal standards.

Table 2 – Internal quality audit areas

Areas		
Quality system	Calibration	Failure analysis
Shipment and container	Stores and dispatch	ESD control
Contract review	Customer service	Production test
Design management	Process control	Subcontract controls
Purchasing	Incoming materials	Assembly
OCM audits	Documentation control	Reliability monitor
Training	Product qualification	

The results of these audits and the audit acceptance criteria shall be available for onsite inspection during an audit. The internal quality audit documentation shall be available upon request.

NOTE ISO 9001, AS/EN/JISQ 9100 and IATF 16949 Third Party certification can assist with the requirements of 4.7.2.

4.7.3 Subcontract manufacturing

The OCM shall qualify and periodically audit all subcontracted operations to a standard equivalent to the OCM's internal operations.

4.8 Quality assurance

4.8.1 General

The OCM shall have the following quality assurance system:

- quality system (4.8.2);

- sampling plans (4.8.3);
- failure analysis support (4.8.4); and
- outgoing quality (4.8.5).

4.8.2 Quality system

The OCM quality system shall meet the following requirements:

- a) satisfy an appropriate quality registration for example one (or more) of ISO 9001, TL 9000, AS/EN/JISQ 9100 is preferred. IATF 16949 is acceptable;
- b) ensure that the requirements of this document are met;
- c) provide for the prevention and ready detection of discrepancies and for timely and positive corrective action.

4.8.3 Sampling plans

Appropriate and statistically valid sampling plans in production shall be used and documented for example by the respective IECQ-CECC, AEC-Q200 or IEC component specifications.

4.8.4 Failure analysis support

OCM failure analysis support shall meet the following requirements:

- a) maintain an adequate failure analysis capability and provide a timely response to failures returned for failure verification or failure analysis;
- b) analyse representative samples of devices returned as failures and issue a failure analysis report to the originating user, typically within 30 calendar days of the receipt by the analytical facility of such returns;
- c) for failure returns relating to a critical problem at a user, issue the failure analysis report typically within 7 calendar days of receipt by the analytical facility.

4.8.5 Outgoing quality

4.8.5.1 General

Outgoing quality shall be measured according to 4.8.5.2.

NOTE 1 IEC components specifications are controlled by zero defect test schedules and 100 % testing of finished components and therefore meet these requirements

NOTE 2 IECQ approved CECC components meet the requirements of 4.8.5.

NOTE 3 Automotive components have their outgoing quality managed by their PPAP process.

4.8.5.2 Defects per million (DPM) levels

The OCM shall measure average outgoing quality (AOQ) in DPM from uniform manufacturing processes, and either the OCM or supplier can make this available on request. The measurement of outgoing quality via in-process measurements is acceptable in principle. The number of defects will include all devices non-conforming to any functional, electrical, visual or mechanical specification requirement of a device and shall be made available on request.

4.9 Qualification

4.9.1 General

The OCM shall manage the following:

- methodology (4.9.2);
- procedures and methods (4.9.2.2);

- alternative procedures (4.9.2.3);
- use of product similarity data (4.9.2.4);
- test samples (4.9.3);
- test failures (4.9.3.2);
- additional samples (4.9.3.3);
- consolidation of lots (4.9.3.4);
- reduced sample sizes (4.9.3.5);
- qualification categories (4.9.4);
- maintenance of qualification standard (4.9.5);
- in-process test results (4.9.6).

4.9.2 Methodology

4.9.2.1 General

The OCM shall use appropriate methodologies to qualify new technology, new devices and device changes, to demonstrate that the device under qualification is capable of meeting the specified electrical, quality and reliability requirements. If applicable the use of qualification from families should be performed.

NOTE The IECQ-CECC and IEC component schemes qualify components by generic families and AEC-Q200:2010, Appendix 1, provides rules for qualifying by generic families.

4.9.2.2 Procedures and methods

Procedures and methods shall be according to Table 3 and Table 4 unless alternative procedures are used.

Table 3 – Technology/family qualification and device qualification

Test code (TC) information, see Annex A	Title	Test reference – See Annex A for more information, particularly for IEC equivalent specifications marked with *	Number of lots for device qualification	Sample size per lot	Number of lots for family qualification	Destructive (D) or non-destructive (N)
TC1	Electrical test	Data sheet or IEC or IECQ-CECC sectional specification	1	100 %	1	N
TC2	External visual	Data sheet or IEC or IECQ-CECC sectional specification	1	15	3	N
TC3	Package dimensions	JESD22-B100 or IEC or IECQ-CECC sectional specification	1	30	3	N
TC4	High temperature exposure	MIL-STD-202:2015 Method 108 or IEC 60068-2-38*	1	76	3	D
TC5	Temperature cycling	JESD22-A104, 1,000 cycles or IEC 60068-2-14*	1	76	3	D
TC6	Moisture resistance	MIL-STD-202: 2015 Method 106 or IEC 60068-2-38* or IEC 60068-2-30*	1	76	3	D
TC7	Biased humidity	JESD22-A101 or MIL-STD-202:2015 Method 103, 1000 h or IEC 60068-2-67*	1	76	1	D
TC8	High temperature operating life	MIL-STD-202:2015 Method 108 or IEC 60115-1:2008 procedure 4.25.1*	1	76	1	D
TC9	Terminal strength (lead)	IEC 60068-2-21 or MIL-STD-202:2015 Method 211	1	30	3	D
TC10	Resistance to solvents	IEC 60068-2-45 or MIL-STD-202:2015 Method 215	1	5	3	D
TC11	Mechanical shock	MIL-STD-202:2015 Method 213 or IEC 60068-2-27*	1	30	1	D
TC12	Vibration	MIL-STD-202:2015 Method 204 or IEC 60068-2-6*	1	30	1	D
TC13	Resistance to solder heat	IEC 60068-2-14 or IEC 60068-2-58 or MIL-STD-202:2015 Method 210	1	30	1	D
TC14	Thermal shock	MIL-STD-202:2015 Method 207 300 cycles or IEC 60068-2-14*	1	30	1	D
TC15	Board flex (SMD)	IEC 60068-2-21 or AEC-Q200-005	1	30	1	D
TC16	Beam lead	IEC 60068-2-77 or AEC-Q200-003	1	30	1	D
TC17	Solderability	IEC 60068-2-20 or IEC 60068-2-5 or IPC/JEDEC/ECA-J-STD-002	1	15	-	D
TC18	ESD – human body model	IEC 61340-3-1 or AEC-Q200-002	1	15	1	D
TC19	Flammability	IEC 60695-11-5 or UL94	-	-	-	-
TC20	Terminal strength (SMD)	IEC 60068-2-21 or AEC-Q200-006	1	30	1	D
TC21	Surge voltage	IEC 60384-1 or AEC-Q200-007	1	30	-	D
TC22	Hermeticity (hermetic package)	IEC 60068-2-17 or MIL-STD-202:2015 Method 112	-	-	-	D
TC23	Tin whisker	IEC 60068-2-82 or JESD201	-	-	-	N

Table 4 – Qualification tests for device types

Test code (TC)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
Capacitors:																							
– Ceramic chip (SM)	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x		x		x	x
– Ceramic (TH)	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x		x		x	x
– Tantalum (dry) (solid)	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x		x		x	x
– Tantalum (wet)	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x		x		x	x
– Aluminium electrolytic	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x		x	x
– Film	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x		x	x
Resistors:																							
– Bulk metal	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x		x	x
– Metal clad	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x		x	x
– Metal film – SM	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x		x	x
– Metal film – TH	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x		x	x
– Wirewound	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x		x	x
– Thermal (thermistor)	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x		x	x
– Variable	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x		x	x
– Varistors	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x		x	x
– Networks	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x		x	x

NOTE 1 IECQ-CECC approved components and the equivalent USA military components contain specific information on how to qualify these components, see 4.1.2.2 and Annexes B and C.

NOTE 2 AEC-Q200 and the respective IEC sectional specifications contain specific information on how to qualify specific device types, see 4.1.2.3 and 4.1.2.4.

4.9.2.3 Alternative procedures

Alternative procedures and methods are acceptable according to 4.1.2.

4.9.2.4 Use of product similarity data

If existing data based on product similarity arguments are re-used, the OCM shall demonstrate and document their relevance, and perform additional testing if needed.

4.9.3 Test samples

4.9.3.1 General

The OCM shall use the test samples described in Table 3.

4.9.3.2 Test failures

The general acceptance level for all stress test qualification is zero rejects in the tested sample size.

Test failures attributed to extraneous factors not related to the qualification stress applied shall not be counted against acceptance criteria. If excessive failures from non-qualification test-related mechanisms are generated, the test shall be repeated.

If a larger sample size than specified in Table 3 is used and failures allowed, then the result shall meet an LTPD = 3 % for a specified sample size of 76. In Table 3, lower sample quantities are allowed where the particular stress tests are not intended for statistical extrapolation, but for characterisation or package evaluation.

4.9.3.3 Additional samples

Users reserve the right to take additional samples for a qualification test result confirmation.

4.9.3.4 Consolidation of lots

Where production volumes of a device are low and the sample sizes specified are not economically feasible from one manufacturing lot, consolidation of lots is permissible. If consolidation of lots is performed, the combining of parts shall follow the similarity rules according to 4.9.11 (similarity assessment).

4.9.3.5 Reduced sample sizes

The OCM's qualification procedures may allow devices to be released to the market after testing them to a qualification schedule which does not fully meet the requirements herein, in terms of reduced sample size, reduced test time, etc. This shall be acceptable providing test data continue to be accumulated according to 4.10 and corrective actions or repeat testing are performed as necessary until the qualification level is reached or exceeded in a target of 90 calendar days.

4.9.4 Qualification categories

The qualification may be conducted on a specific device type. Alternatively, qualification may be accomplished by using generic family qualification data, provided similarity rules are followed (see 4.9.11).

4.9.5 Maintenance of qualification standard

The OCM shall maintain a regime of "maintenance of qualification" in order to ensure that reliability sensitive processes are routinely tracked and sample tested (see 4.10).

4.9.6 In-process test results

In-process test results, coming from the production monitoring programme, shall be managed as follows:

- a) if any of the inspection or package qualification tests are performed on a regular basis in the manufacturing line, these tests need not be repeated in new device qualification testing;
- b) if qualification tests are not performed, manufacturing inspection results showing the current quality level shall be included in the qualification report. Manufacturing package test results shall be available.

4.9.7 Test references

Test references in Table 3 can be modified by alternative procedures, see 4.1.2. Reference to the test methods in Table 3 shall always be to its latest revision unless otherwise stated and made to the appropriate test code information for full test details.

4.9.8 Qualification report

The qualification report shall be available upon request.

4.9.9 Archiving

The qualification report and the test specification (not the test program), used in the qualification shall be archived for a minimum of 10 years.

4.9.10 Qualification of device changes

Device changes shall be investigated and documented with regard to their potential risk, and qualified if necessary:

- a) a change shall be qualified if there is a potential effect on performance, quality or reliability, or if there is any degree of uncertainty about the effect of the change;
- b) the OCM shall perform the tests defined in Table 3 and Table 4 that are appropriate, or relevant, to the change;
- c) up on request, the OCM shall provide data for any device transferred to a new process to prove that no design deficiencies (for example mechanical, electrical performance, reliability, single-event effects, etc.) were introduced by the process transfer.

4.9.11 Similarity assessment

4.9.11.1 General

The principle of similarity may be extrapolated across a device family and applied in qualification, qualification of changes and product monitor testing.

The OCM shall document and manage:

- process changes (4.9.11.2);
- package/assembly changes (4.9.11.3).

4.9.11.2 Process changes

Devices shall be assigned to a qualification family which shall share the same critical processes and material elements.

NOTE See the IECQ-CECC or IEC specifications or AEC-Q200:2010, Appendix 1.

4.9.11.3 Package/assembly changes

Package/assembly changes shall be managed as follows:

- a) passive component package families shall be grouped by construction and materials of construction, provided the assembly process technology is identical;
- b) packages shall be qualified according to the worst-case conditions under which current production devices are designed to operate.

4.10 Product monitoring in the production line

4.10.1 General

The OCM shall have:

- a monitoring programme (4.10.2);
- problem notifications (4.10.3);
- data reporting (4.10.4).

4.10.2 Monitoring programme

The monitoring programme shall be as follows:

- a) the OCM shall have a continuous product monitoring programme to demonstrate that the requirements of this document are met, on an ongoing basis, for each manufacturing operation or product process;
- b) statistical process control: the OCM shall control wafer production, assembly process and final test using statistical analysis. When anomalies are observed, parametric and yield data from probe and final tests shall be analysed against in-line or electrical process control data. The root cause of the deviation shall be determined and the consequent corrective actions implemented.

NOTE IECQ-CECC and automotive components include periodic testing.

4.10.3 Problem notification

The OCM and supplier shall have a process to notify the users and distributors in cases where failures were detected and where the possibility of failed parts may have been shipped or may be in the process of being shipped to the user.

NOTE This is usually part of the PCN system as described in J-STD-46.

4.10.4 Data reporting

Reliability monitor data accumulated over the preceding two full quarters shall be available, at one month's notice.

4.11 Environmental health and safety (EHS)

4.11.1 General

The OCM and supplier shall ensure the following health and safety precautions are in place:

- EHS compliance (4.11.2);
- device handling (4.11.3); and
- device materials (4.11.4).

4.11.2 General EHS compliance

The OCM and supplier shall be expected to comply with all applicable national, regional, state and local laws and regulations governing environment, health and safety. The OCM and supplier registration to industry-recognized EHS standards such as ISO 14001, RC14001 or audit scheme EMAS, is encouraged, but not mandatory.

4.11.3 Device handling

Devices shall not produce any toxic effects to personnel as a result of handling, storage or disposal, or when operated according to the OCM's data sheet.

4.11.4 Device materials and substances

Materials and substances used in the manufacture of devices shall satisfy environmental regulations or directives, for example RoHS and REACH. The component manufacturer should establish and provide a composition declaration on the substances used in the provided component. The component manufacturer should periodically update their declarations in view of the changing restriction lists.

NOTE IEC 62474 provides a system for the declaration of substances used in an electrotechnical or electronic product and maintains a database summarizing all substances banned, under suspicion of being hazardous, or being under high concern

Materials and substances should be non-flammable and shall not emit harmful levels of toxic materials as a result of electrical overload or stress, or fault within the device.

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Annex A (informative)

Test code (TC) information for guidance

A.1 General

Annex A provides guidance and summarises the content of the quoted standards or specifications at the time of publication. The original qualification test methods were based on USA military standards or JEDEC standards. Where IEC test method standards are fully interchangeable with the stated USA military or JEDEC test methods, the IEC standards are listed first before the original USA military standards or JEDEC standards. Where IEC test methods are shown as being 'equivalent test methods', signified by * in Table 3, the durations, number of cycles or test conditions shall be reviewed and if necessary changed to be the same as the original USA military standards or JEDEC standards. The latest version of referenced standards should be used unless otherwise stated.

A.2 TC1 – Electrical test

An electrical test is performed at the worst still air ambient temperature in the range of T_{opmin} to T_{opmax} and the device should be stabilized at the test temperature. Devices should meet their data sheet requirements before and after being subjected to stress tests as shown in Table 1.

The temperature coefficient of resistance can be performed according to MIL-STD-202:2015 Method 304 or IEC 60115-1:2008, 4.8.

Insulation resistance (IR) can be performed according to IEC 60115-1:2008, 4.6 for fixed resistors.

Dielectric withstand voltage (DWV) can be performed according to IEC 60115-1:2008, 4.7, for fixed resistors.

For IECQ-CECC specifications, the electrical test is according to the respective specification.

For automotive components, electrical testing is according to the data sheet using AEC-Q300 test methods.

For IEC generic specifications the electrical test is according to the sectional and detailed specification based on the generic test as follows:

- capacitance according to IEC 60384-1:2016, 4.7;
- resistance according to IEC 60115-1:2008, 4.5;
- zero-power resistance according to IEC 60539-1:2016, 5.6;
- zero-power resistance according to IEC 60738-1:2006, 7.5;
- element resistance according to IEC 60393-1:2008, 4.6; or
- nominal varistor voltage according to IEC 61051-1:2007, 4.5.

A.3 TC2 – External visual

Test method: The device is examined at 1,5X to 10X magnification using the published data sheet or the respective IECQ-CECC or IEC specification.

Devices fail if they exhibit any of the following:

- illegible marking, or marking content or placement not in accordance with the applicable specification;
- foreign/displaced material;
- construction defects;
- defective finish (peeling, flaking, pitting, blistering, or corrosion);
- leads or terminals that are not intact or aligned in their normal location;
- leads with pits and/or depressions that exceed 10 % of the width (diameter for round leads) and are greater than 10 % of the lead thickness in depth;
- leads with burrs exceeding a height greater than 10 % of the lead thickness;
- metallization (including solder lead finish) in which the isolation between leads or between lead and other package metallization is reduced to less than 10 % of lead separation;
- scratches or indentations that expose base metal over more than 5 % of the lead surface area. Exposed base metal on the cut lead ends is acceptable and does not count in the 5 %;
- evidence of cracks, delamination, separation, or voiding.

For IEC specifications external visual examination is according to the sectional and detailed specification based on the generic test as follows:

- for fixed capacitors: IEC 60384-1:2016, 4.4.1;
- for fixed resistors: IEC 60115-1:2008, 4.4.1;
- for NTC thermistors: IEC 60539-1:2016, 5.5.1;
- for PTC thermistors: IEC 60738-1:2006, 7.4.1;
- for variable resistors: IEC 60393-1:2008, 4.4.1;
- and for varistors: IEC 61051-1: 2007, 4.4.1.

A.4 TC3 – Package dimensions

Test method: JESD22-B100, verify package dimensions meet their data sheet requirements.

For IECQ-CECC specifications, package dimensions are verified according to the specification.

For automotive components, the package dimensions are verified against the data sheet.

For IEC specifications the package dimensions are measured according to the sectional and detailed specification based on the generic test as follows:

- for fixed capacitors: IEC 60384-1:2016, 4.4.3;
- for fixed resistors: IEC 60115-1:2008, 4.4.3;
- for NTC thermistors: IEC 60539-1:2016, 5.5.2;
- for PTC thermistors: IEC 60738-1:2006, 7.4.4;
- for variable resistors: IEC 60393-1:2008, 4.4.3;
- for varistors: IEC 61051-1:2007, 4.4.4.

A.5 TC4 – High temperature exposure (storage)

Test method: MIL-STD-202:2015 Method 108, 1 000 h at maximum rated operating temperature; unpowered, followed by electrical test (TC1).

Equivalent test method: IEC 60068-2-38 for 1 000 h at maximum rated operating temperature; unpowered, followed by electrical test (TC1). For IEC specified components, high temperature exposure (storage) is measured according to the sectional and detailed specification based on the following generic tests, which with additional testing may achieve 1 000 h duration testing using the sample size of Table 3:

- for fixed capacitors: IEC 60384-1:2016, 4.25.1;
- for fixed resistors: IEC 60115-1:2008, 4.25.3;
- for NTC thermistors: IEC 60539-1:2016, 5.25.5;
- for PTC thermistors: IEC 60738-1:2006, 7.24.2;
- for variable resistors: IEC 60393-1:2008, 4.43.3;
- for varistors: IEC 61051-1:2007:2007, 4.21.

A.6 TC5 – Temperature cycling

Test method: JESD22-A104 (method A104), 1 000 cycles at rated operating temperature; unpowered, followed by electrical test (TC1). Equivalent test method: IEC 60068-2-14 for 1 000 cycles at rated operating temperature; unpowered, followed by electrical test (TC1).

A.7 TC6 – Moisture resistance

Test method: MIL-STD-202:2015 Method 106, 10 cycles, each cycle 24 h (steps 7a and 7b are not required); unpowered, followed by electrical test (TC1).

Equivalent test method: IEC 60068-2-38 or IEC 60068-2-30 for 10 cycles per each period of 24 h, unpowered, followed by electrical test (TC1).

A.8 TC7 – Biased humidity

Test method: JESD22-A101, 1 000 h 85°C/85 %RH, rated voltage, followed by electrical test (TC1).

Equivalent test method: IEC 60068-2-67 for 1 000 hours at 85°C/85 %RH and rated voltage, followed by electrical test (TC1).

A.9 TC8 – High temperature operating life

Test method: MIL-STD-202:2015 Method 108, 1 000 h at rated voltage and maximum temperature, followed by electrical test.

Equivalent test method: IEC 60115-1:2008, 4.25.1 for 1 000 h at rated voltage and maximum temperature, followed by electrical test.

For IEC specifications the duration of high temperature operating life needs to be checked, to determine if it is for 1 000 h, and is measured according to the sectional and detailed specification based on the generic test as follows:

- for fixed capacitors: IEC 60384-1:2016, 4.23;

- for fixed resistors: IEC 60115-1:2008, 4.25;
- for NTC thermistors: IEC 60539-1:2016, 5.25;
- for PTC thermistors: IEC 60738-1:2006, 7.24;
- for variable resistors: IEC 60393-1:2008, 4.43;
- for varistors: IEC 61051-1:2007, 4.21.

A.10 TC9 – Terminal strength (lead)

Test method: IEC 60068-2-21 or MIL-STD-202:2015 Method 211, test lead device lead integrity only.

A.11 TC10-Resistance to solvents

Test method: IEC 60068-2-45 or MIL-STD-202:2015 Method 215, to verify that markings and colour coding will not become illegible or discoloured and that protective coatings and encapsulant materials are not degraded when subjected to solvents used during normal cleaning processes

A.12 TC11 – Mechanical shock

Test method: MIL-STD-202:2015 Method 213, Figure 1, Condition C; unpowered, followed by electrical test (TC1) or IEC 60068-2-27.

Equivalent test method: IEC 60068-2-27 to MIL-STD-202:2015 Method 213, Figure 1, Condition C; unpowered, followed by electrical test (TC1).

For IEC specified components: test acceptance is based on change in resistance as stated in the generic, sectional and detail specifications.

A.13 TC12 – Vibration

Test method: MIL-STD-202:2015 Method 204, 5 g for 20 min, 12 cycles each of 3 orientations, test from 10 Hz to 2 000 Hz; unpowered, followed by electrical test (TC1) or IEC 60068-2-6.

Equivalent test method: IEC 60068-2-6 based on MIL-STD-202:2015 Method 204, 5 g for 20 min, 12 cycles each of 3 orientations, test from 10 Hz to 2 000 Hz; unpowered, followed by electrical test (TC1).

For IEC specified components: test acceptance is based on change in resistance as stated in generic, sectional and detail specifications.

A.14 TC13 – Resistance to heat

Test method: MIL-STD-202:2015 Method 210, test condition B; unpowered, followed by electrical test (TC1) or IEC 60068-2-20 or IEC 60068-2-58. Test acceptance: Change in resistance as stated in the system of IECQ-CECC or automotive or IEC component specifications, including generic, sectional and detail specification.

A.15 TC14 – Thermal shock

Test method: MIL-STD-202:2015 Method 107, 300 cycles at rated operating temperature, air to air, maximum transfer time: 20 s, dwell time: 15 min; unpowered, followed by electrical test or IEC 60068-2-14.

Equivalent test method: IEC 60068-2-14 for 300 cycles at rated operating temperature, air to air, maximum transfer time: 20 s, dwell time: 15 min; unpowered, followed by electrical test.

For IEC specified components: test acceptance is based on change in resistance as stated in the generic, sectional and detail specifications.

A.16 TC15 – Board flex (SMD)

Test method: IEC 60068-2-21 or IEC 60115-1:2008, 4.23, or AEC-Q200-005; unpowered, followed by electrical test (TC1).

For IEC specified components: test acceptance is based on change in resistance as stated in the generic, sectional and detail specifications.

A.17 TC16 – Beam load

Test method: IEC 60068-2-77 or AEC-Q200-003; unpowered, followed by electrical test, ceramic parts only.

A.18 TC17 – Solderability

Test method: IEC 60068-2-20 or IEC 60068-2-58 or IPC/JEDEC/ECA-J-STD-002, followed by external visual test.

A.19 TC18 – Electrostatic discharge

Test method: IEC 61340-3-1 or AEC-Q200-002, human body model (HBM). The purpose of this test is to determine the passive component HBM's ESD sensitivity.

A.20 TC19 – Flammability

Test method: IEC 60695-11-5 or UL94; fire class V-0 or V-1 acceptable.

A.21 TC20 – Terminal strength (SMD)

Test method: IEC 60068-2-21 or AEC-Q200-006. The purpose of this test is to verify that the component terminations can withstand axial stresses that are likely to be applied during normal manufacturing and handling of a finished printed circuit board (PCB) assembly.

A.22 TC21 – Surge voltage

Test method: IEC 60384-1 or for resistors IEC 60115-1:2008, 4.13 or AEC-Q200-007. The purpose of this test is to ensure a device will withstand voltage surges at the surge voltage rating of the device's specification.

A.23 TC22 – Hermeticity

Test method: IEC 60068-2-17 or MIL-STD-202:2015 Method 112. The purpose of this test method is to determine the effectiveness of the seal of a component part which has an internal cavity which is either evacuated or contains air or gas.

A.24 TC23 – Tin whisker

Test method: IEC 60068-2-82 or JESD201. Environmental acceptance requirements for tin whisker susceptibility of tin and tin alloy surface finishes.

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Annex B (informative)

Typical IECQ-CECC approved components

The IECQ-CECC approved component on-line certification scheme can be viewed at webpage

http://certificates.iecq.org/iecq/iecqweb.nsf/VI_CertificateApprovedComponentByCategory?OpenView&Start=1&Count=1000&Expand=3#3

The following passive components are currently listed on this webpage. Note that the user should verify the following information is still accurate:

- CECC 30 201-001, *Fixed tantalum capacitors with solid electrolyte, porous anode*
- CECC 30 201-002, *Tantalum capacitors with solid electrolyte and porous anode*
- CECC 30 201-003, *Tantalum capacitors with solid electrolyte and porous anode*
- CECC 30 201-005, *Tantalum capacitors with solid electrolyte and porous anode*
- CECC 30 201-019, *Tantalum capacitors with solid electrolyte and porous anode*
- CECC 30 201-025, *Tantalum capacitors with solid electrolyte and porous anode*
- CECC 30 201-026, *Tantalum capacitors with solid electrolyte and porous anode*
- CECC 30 201-029, *Fixed tantalum capacitors with solid electrolyte, porous anode*
- CECC 30 201-037, *Tantalum capacitors with solid electrolyte and porous anode (sub-family 3)*
- CECC 30 201-040, *Tantalum capacitors with solid electrolyte*
- CECC 30 201-801, *Fixed capacitors tantalum with non-solid electrolyte*
- CECC 30 202-001, *Fixed tantalum capacitors with non-solid electrolyte and porous anode*
- CECC 30 202-002, *Fixed tantalum capacitors with non-solid electrolyte and porous anode and cathode*
- CECC 30 202-004, *Tantalum capacitors with solid electrolyte and porous anode*
- CECC 30 202-005, *Fixed tantalum capacitors with non-solid electrolyte – porous anode*
- CECC 30 202-801, *Fixed tantalum capacitors with non-solid electrolyte, porous anode*
- CECC 30 701-011, *Fixed capacitors with ceramic dielectric*
- CECC 30 801-001, *Tantalum surface mounting capacitor with solid electrolyte and porous anode*
- CECC 30 801-013, *Tantalum surface mounting capacitors with solid electrolyte and porous anode*

CECC 32 101-801, *Fixed multilayer ceramic chip capacitors*

CECC 40 101-001, *Fixed low power non wirewound resistors*

CECC 40 101-002, *Fixed low power non wirewound resistors*

CECC 40 101-044, *Fixed low power non wirewound resistors*

CECC 40 101-802, *Fixed low power non wirewound insulated resistors*

CECC 40 101-803, *Fixed low power non wirewound insulated resistors*

CECC 40 201-005, *Fixed precision power wirewound insulated resistors*

CECC 40 201-006, *Fixed precision power wirewound insulated resistors*

CECC 40 203-006, *Fixed power resistors, wirewound insulated heat sink resistors with rigid terminations*

CECC 40 302-001, *Fixed precision resistors*

CECC 40 302-004, *Fixed precision resistors*

CECC 40 401-003, *Fixed LP non-wirewound chip resistors with rectangular base without leads*

CECC 40 401-004, *Fixed LP non-wirewound surface mounting (chip) resistors*

CECC 40 401-008, *Fixed LP non-wirewound chip resistors with rectangular base without leads*

CECC 40 401-010, *Fixed low power non-wirewound surface mounting resistors*

QC 400 101 US 0001, *Fixed low power non-wirewound insulated resistors*

QC 300201-FR 0001, *Tantalum capacitors with solid electrolyte and porous anode*

QC 42201-A002, *Assessment Specification for Thermally Protected Varistors*

QC 42201-C002, *Component Specification for Thermally Protected Varistors*

Annex C (informative)

Typical USA military specified passive components

These USA specified components are equivalent to the IECQ-CECC approved component scheme and can be accessed at the 'Quick Search Assist' on-line webpage located at <http://quicksearch.dla.mil/qsSearch.aspx> and include the following typical electronic assembly style passives (which is not an exhaustive list and only provided for guidance) and their Qualified Product Lists (QPL):

MIL-PRF-123, *Capacitors, Fixed, Ceramic Dielectric, (Temperature Stable and General Purpose), High Reliability, General Specification for*

MIL-PRF-39003, *Capacitor, Fixed, Electrolytic (Solid Electrolyte), Tantalum, Established Reliability, General Specification for*

MIL-PRF-39006, *Capacitor, Fixed, Electrolytic (Nonsolid Electrolyte), Tantalum, Established Reliability, General Specification for*

MIL-PRF-39007, *Resistors, Fixed, Wirewound (Power Type), Non-established Reliability, Established Reliability, and Space Level General Specification for*

MIL-PRF-55182, *Resistor, Fixed, Film, Non-established Reliability, Established Reliability, and Space Level, General Specification for*

MIL-PRF-55342, *Resistor, Chip, Fixed, Film, Non-established Reliability, Established Reliability, Space Level, General Specification for*

MIL-PRF-55365, *Capacitors, Chip, Fixed, Tantalum, Polarized Established Reliability, Non-Established Reliability, and High Reliability Styles CWR06 and CWR09*

MIL-PRF-55681, *Capacitor, Chip, Multiple Layer, Fixed Ceramic Dielectric, Established Reliability and Non-Established Reliability, General Specification for*

MIL-PRF-83401, *Resistor Network, Fixed, Film, and Capacitor- Resistor Network, Ceramic Capacitor and Fixed, Film, Resistor, General Specification for*

Annex D (informative)

Typical automotive components

Automotive components are typically:

- a) Designed and manufactured in a facility with a Third Party audited IATF 16949 quality management system.
- b) Qualified to AEC-Q200 to the temperature grades of Table D.1.

Table D.1 – AEC-Q200 temperature grades

AEC-Q200 Grade	Temperature range		Passive component type – Maximum capability unless otherwise specified and qualified
	Minimum	Maximum	
0	-50 °C	+150 °C	Flat chip ceramic resistors, X8R ceramic capacitors
1	-40 °C	+125 °C	Capacitor networks, resistors, inductors, transformers, thermistors, resonators, crystals and varistors, all other ceramic and tantalum capacitors
2	-40 °C	+105 °C	Aluminium electrolytic capacitors
3	-40 °C	+85 °C	Film capacitors, ferrites, R/R-C networks and trimmer capacitors

- c) Processed using a part production and approval process (PPAP) which manages the qualification, requalification and outgoing quality of the components. A typical PPAP consists of:
 - 1) design documentation, containing material composition;
 - 2) engineering change documentation;
 - 3) customer engineering approval (for automotive customers);
 - 4) design failure mode and effects analysis (DFMEA);
 - 5) process flow diagram;
 - 6) process failure modes and effects analysis (PFMEA);
 - 7) control plan using the outputs of the PFMEA to include specific steps to ensure the quality issues in the PFMEA will not be present in the final product;
 - 8) measurement systems analysis (MSA) which includes a gage repeatability and reproducibility (GR&R) analysis;
 - 9) dimensional results;
 - 10) records of material/performance test report including a design verification plan and report (DVP&R);
 - 11) initial process studies including statistical process control (SPC) charts on the critical characteristics;
 - 12) qualified laboratory documentation for any laboratory involved in completing testing;
 - 13) appearance approval report;
 - 14) sample production parts (only available to the customer, see NOTE 3);
 - 15) master sample used by manufacturer to train operators and acts as a benchmark for comparison purposes;
 - 16) checking aids used by production;
 - 17) customer specific requirements.

NOTE 1 VDA 6.3 can satisfy requirements 1) to 17) above for automotive customers.

NOTE 2 This is not an inclusive list of PPAP requirement as automotive customers vary on the exact requirements. OCMs can offer a generic PPAP data package to ADHP customers to avoid non-disclosure issues based on 1) to 17), excluding 3), possibly 11), 14), 15) and 17).

NOTE 3 Official PPAP samples are typically only available to the automotive customer, although other samples are made available to the ADHP customer.

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Annex E (informative)

Typical IEC specified passive components

E.1 Typical IEC passive component specifications

The following is a list of IEC passive components specifications available currently. Users are requested to verify this information:

- capacitance according to IEC 60384-1;
- resistance according to IEC 60115-1;
- zero-power resistance according to IEC 60539-1;
- zero-power resistance according to IEC 60738-1;
- element resistance according to IEC 60393-1; or
- nominal varistor voltage according to IEC 61051-1.

E.2 IEC passive component environmental test methods

See Table E.1 for a summary of the IEC environmental test methods and equivalent test methods.

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Table E.1 – IEC passive specifications' environmental test methods compared to those specified in Table 3

Test code (TC)	Test scope	Original Table 3 test method	Range of applicability	Nearest IEC test method (see Annex A for details)	Is IEC test method fully interchangeable?	Destructive or non-destructive (ND) or destructive (D)?
TC1	Electrical test	Data sheet	Fixed capacitors	IEC 60384-1:2016, 4.7: Capacitance	Yes	ND
			Fixed resistors	IEC 60115-1:2008, 4.5: Resistance IEC 60115-1:2008, 4.8: Variation of resistance with temperature		
			Thermistors, NTC	IEC 60539-1:2016, 5.6: Zero-power resistance		
			Thermistors, PTC	IEC 60738-1:2006, 7.5: Zero-power resistance		
			Variable resistors	IEC 60393-1:2008, 4.6: Element resistance		
			Varistors	IEC 61051-1:2007, 4.5: Nominal varistor voltage		
TC2	External visual	See Clause A.3	Fixed capacitors	IEC 60384-1:2016, 4.4.1: Visual examination	Yes	ND
			Fixed resistors	IEC 60115-1:2008, 4.4.1: Visual examination		
			Thermistors, NTC	IEC 60539-1:2016, 5.5.1: Visual examination		
			Thermistors, PTC	IEC 60738-1:2006, 7.4.1: Visual examination		
			Variable resistors	IEC 60393-1:2008, 4.4.1: Visual examination		
			Varistors	IEC 61051-1:2007, 4.4.1: Visual examination		
TC3	Package dimensions	JESD 22-B100	Fixed capacitors	IEC 60384-1:2016, 4.4.3: Dimensions (detail)	Yes	ND
			Fixed resistors	IEC 60115-1:2008, 4.4.3: Dimensions (detail)		
			Thermistors, NTC	IEC 60539-1:2016, 5.5.2: Dimensions		
			Thermistors, PTC	IEC 60738-1:2006, 7.4.4: Dimensions (detail)		
			Variable resistors	IEC 60393-1:2008, 4.4.3: Dimensions (detail)		

Test code (TC)	Test scope	Original Table 3 test method	Range of applicability	Nearest IEC test method (see Annex A for details)	Is IEC test method fully interchangeable?	Destructive or non-destructive (ND) or destructive (D)?
			Varistors	IEC 61051-1:2007, 4.4.4: Dimensions (detail)		
TC4	High temperature exposure	MIL-STD-202:2015 Method 108, 1 000 h	Fixed capacitors	IEC 60384-1:2016, 4.25.1: Storage at high temperature	*If duration is 1 000 h and sample size according to Table 3	D
			Fixed resistors	IEC 60115-1:2008, 4.25.3: Endurance at UCT		
			Thermistors, NTC	IEC 60539-1:2016, 5.25.5: Endurance at UCT		
			Thermistors, PTC	IEC 60738-1:2006, 7.24.2: Endurance at UCT		
			Variable resistors	IEC 60393-1:2008, 4.43.3: Electrical endurance UCT		
			Varistors	IEC 61051-1:2007, 4.21: Endurance at UCT		
TC5	Temperature cycling	JESD 22-A104, 1 000 cycles	All components	IEC 60068-2-14, Test Na: Rapid change of temperature with prescribed time of transfer	*If for 1 000 cycles and sample size according to Table 3	D
TC6	Moisture resistance	MIL-STD-202:2015 Method 106	All components	IEC 60068-2-38, Test Z/AD: Composite temperature	*If for 10 cycles and sample size according to Table 3	D
TC7	Biased humidity	JESD 22-A101 MIL-STD-202:2015 Method 103	All components	IEC 60068-2-67, Test Cy: Damp heat, steady state, accelerated test primarily intended for components IEC 60115-1:2008, 4.24	*If for 1 000 h and sample size according to Table 3	D

Test code (TC)	Test scope	Original Table 3 test method	Range of applicability	Nearest IEC test method (see Annex A for details)	Is IEC test method fully interchangeable?	Destructive or non-destructive (ND) or destructive (D)?
TC8	High temperature operating life	MIL-STD-202:2015 Method 108, 1 000 hs	Fixed capacitors	IEC 60384-1:2016, 4.23: Endurance	*If for 1 000 h and sample size according to Table 3	D
			Fixed resistors	IEC 60115-1:2008, 4.25: Endurance		
			Thermistors, NTC	IEC 60539-1:2016, 5.25: Endurance		
			Thermistors, PTC	IEC 60738-1:2006, 7.24: Endurance		
			Variable resistors	IEC 60393-1:2008, 4.43: Electrical endurance		
			Varistors	IEC 61051-1:2007, 4.21: Endurance at UCT		
TC9	Terminal strength (lead)	— Test not applicable —	SMD components	— Test not applicable —	Yes	D
		MIL-STD-202:2015 Method 211	Components with wire terminations	IEC 60068-2-21, Test Ua ₁ : Tensile IEC 60068-2-21, Test Ub: Bending IEC 60068-2-21, Test Uc: Torsion		
			Components with lug terminations	IEC 60068-2-21, Test Ua ₁ : Tensile IEC 60068-2-21, Test Ub: Bending		
			Components with threaded stud or screw terminations	IEC 60068-2-21, Test Ud: Torque		
TC10	Resistance to solvents	MIL-STD-202:2015 Method 215	All components	IEC 60068-2-45, Test XA: Immersion in cleaning solvents	Yes	D
TC11	Mechanical shock	MIL-STD-202:2015 Method 213	All components	IEC 60068-2-27, Test Ea: Shock	*If according to MIL-STD-202:2015 Method 213, Figure 1 condition C, and sample size according to Table 3	D

Test code (TC)	Test scope	Original Table 3 test method	Range of applicability	Nearest IEC test method (see Annex A for details)	Is IEC test method fully interchangeable?	Destructive or non-destructive (ND) or destructive (D)?
TC12	Vibration	MIL-STD-202:2015 Method 204, which is specifically tailored for typical harsh avionics environments	All components	IEC 60068-2-6, Test Fc: Vibration (sinusoidal)	*If according to MIL-STD-202 Method 204, 5 g for 20 min, 12 cycles each of 3 orientations, test from 10 Hz to 2 000 Hz; unpowered and sample size according to Table 3	D
TC13	Resistance to solder heat	MIL-STD-202:2015 Method 210	SMD components	IEC 60068-2-58, Test Td ₂ : Resistance to soldering heat	Yes	D
		— Test not applicable —	Components with wire or lug terminations	IEC 60068-2-20, Test Tb: Resistance to soldering heat		
		— Test not applicable —	Components not intended for soldering	— Test not applicable —		
TC14	Thermal shock (air)	MIL-STD-202:2015 Method 107	All components	IEC 60068-2-14, Test Na: Rapid change of temperature with prescribed time of transfer	*If 300 cycles at rated operating temperature, air to air, maximum transfer time: 20 s, dwell time: 15 min; unpowered and sample size according to Table 3	D
TC15	Board flex (SMD)	AEC-Q200-005	SMD components	IEC 60068-2-21, Test Ue ₁ : Substrate bending test	Yes	D
		— Test not applicable —	Components not intended for SMD assembly	— Test not applicable —		
TC16	Beam load	AEC-Q200-003	SMD ceramic capacitors	IEC 60068-2-77, method 1: Body strength test	Yes	D
		— Test not applicable —	Other capacitors	— Test not applicable —		

Test code (TC)	Test scope	Original Table 3 test method	Range of applicability	Nearest IEC test method (see Annex A for details)	Is IEC test method fully interchangeable?	Destructive or non-destructive (ND) or destructive (D)?
TC17	Solderability		Resistors, fixed / variable	IEC 60068-2-58, Test Td ₁ : Solderability of terminations IEC 60068-2-20, Test Ta: Solderability of wire and tag terminations — Test not applicable —		
			Thermistors, PTC, NTC			
			Varistors			
TC18	ESD – human body model	J-STD-002	SMD components	IEC 61340-3-1: Human body model (HBM) electrostatic discharge test — Test not applicable —	Yes	D
			Components with wire or lug terminations			
		— test not applicable —	Components not intended for soldering			
TC19	Flammability	AEC-Q200-002	All components	IEC 60695-11-5: Needle flame test method	Yes	D
		— Test not applicable —	Ceramic capacitors		Yes	D
			Tantalum capacitors			
		UL94	Other capacitors			
			Resistors, fixed / variable			
			Thermistors, PTC / NTC			
TC20	Terminal strength (SMD)		Varistors	IEC 60068-2-21, Test Ue ₃ : Shear (adhesion) test — Test not applicable —		
		AEC-Q200-006	SMD components		Yes	D
		— Test not applicable —	Components not intended for SMD assembly			
TC21	Surge voltage or short-term overload	AEC-Q200-007	Electrolytic capacitors	IEC 60384-1:2016, 4.26: Surge IEC 60115-1:2008, 4.13 — Test not applicable —	Yes	D
		— Test not applicable —	Other capacitors			
			Resistors, fixed/variable			
			Thermistors, PTC / NTC			
			Varistors			

Test code (TC)	Test scope	Original Table 3 test method	Range of applicability	Nearest IEC test method (see Annex A for details)	Is IEC test method fully interchangeable?	Destructive or non-destructive (ND) or destructive (D)?
TC22	Hermeticity (hermetic package end point only)	— Test not applicable — MIL-STD-202:2015 Method 112	Standard components	— Test not applicable —	Yes	D
			Components in hermetic package	IEC 60068-2-17, Test Q: Sealing		
TC23	Tin whisker	JESD 201	All components	IEC 60068-2-82, Test XW ₁ Whisker test methods for electronic and electric components	Yes	D

NOTE "See Annex A" where "*" indicates in column "Is IEC test method fully interchangeable?" that the IEC test method is considered 'equivalent' provided the number of cycles or test hours and number of samples according to Table 3 are the same as the original MIL standard or JEDEC test method.

Annex F (informative)

Verification requirements matrix for IEC TS 62686-2

Table F.1 – Verification requirements matrix for IEC TS 62686-2

IEC TS 62686-2 (edition 1.0), clause/subclause number	IEC TS 62686-2 (edition 1.0), clause/subclause , title or paragraph content	Requirements	Demonstrated by (supporting document references and brief descriptions)
None	Introduction		
1	Scope		
2	Normative references		
3	Terms, definitions and abbreviated terms		
4	Technical requirements		
4.1	General	The supplier, preferably, the franchised distributor or original component manufacturer (OCM), as defined in 3.1.20 and 3.1.15, shall have an appropriate quality management system and shall provide the following minimum technical requirements. Other proposed equivalent test methods, rationale and supporting data shall be reviewed and shall achieve the same end objectives as specified herein (see 4.4.4). The supplier or OCM shall provide a high-level statement summarising how compliance to the specification is achieved including the use of equivalent test methods (see 4.1.2), when they are used	
4.1.2.1	Equivalent methods	Use of such equivalent tests shall not be considered to be deviations or waivers to the requirements of this document and are based on: • IECQ-CECC approved components, see 4.1.2.2; • Automotive components see 4.1.2.3; • IEC passive components see 4.1.2.4	
4.1.2.2	IECQ-CECC approved components		
4.1.2.3	Automotive components		
4.1.2.4	IEC passive component specifications		
4.2	Procedures		
4.2.1	General	The OCM shall have the following procedures: • product discontinuance (4.2.2); • ESD protection during manufacture (4.2.3); • specification control (4.2.4); • traceability including anti-counterfeit measures (4.2.5).	

IEC TS 62686-2 (edition 1.0), clause/subclause number	IEC TS 62686-2 (edition 1.0), clause/subclause , title or paragraph content	Requirements	Demonstrated by (supporting document references and brief descriptions)
4.2.2	Product discontinuance	Notification shall be made for example in accordance with JESD48 or equivalent, with the exception of timing as described in a) and b) below: a) the OCM or supplier shall provide to the user a notice of last order dates: - a minimum of 12 months before these dates for single-source devices, and - a minimum of 6 months before these dates for multi-sourced devices; b) the OCM or supplier may give less than the specified notice period provided a mutually acceptable extension (up to the specification limit) is negotiated with any user needing a different period.	
4.2.3	ESD protection during manufacture	Many passive components are considered to be sensitive to static and shall be protected through the OCM's manufacturing operation. The OCM and supplier shall ensure that devices are not exposed to static damage and are not degraded or damaged due to static discharge. IEC 61340-3-1, IEC 61340-5-1, IEC TR 61340-5-2, JESD625 or AEC-Q200-002 are examples of suitable documents for ESD precautions. OCMs and suppliers holding current certification for compliance with IEC 61340-5-1 are deemed to have satisfied this requirement.	
4.3	Shipment controls		
4.3.1	General	The OCM's name, logo and trademark shall be marked on the shipping container where it is practical to do so.	
4.3.2	Unit pack container		
4.3.3	Intermediate packing		
4.3.4	Date codes		
4.3.4.1	Mixing		
4.3.4.2	Remarking	If only one date is marked to represent the manufacturing date and initial electrical test it shall not be changed unless it is necessary to correct poor quality marking or incorrect information and provided that the time delta between the original mark and the remark in less than 6 weeks.	
4.3.4.3	Age on delivery	Date code age on delivery shall be as follows where shipped directly from the OCM or supplier: a) the date codes of devices shall not be older than 48 months upon users' receipt date; b) the exception is for aluminium electrolytic capacitors which shall not be older than 24 months.	
4.3.5	Moisture sensitivity level (MSL)	The labelling and inner container, used for example for shipping, shall be in accordance with IEC 61760-4 or J-STD-033 or equivalent standard.	
4.3.6	Lead-free marking	The shipping container and date code marking shall be in accordance with J-STD-609B or equivalent.	

IEC TS 62686-2 (edition 1.0), clause/subclause number	IEC TS 62686-2 (edition 1.0), clause/subclause , title or paragraph content	Requirements	Demonstrated by (supporting document references and brief descriptions)
4.3.7	Labels	In general, labels shall include the requirements mentioned in Table 1 and exhibit: a) human readable content: the content shown for each label shall be available in human readable form on the outside of the relevant package; b) machine readable content: bar codes for those items specified shall be included in 3 of 9 codes (bar code 39) according to IEC 62090 or ANSI/EIA-556 or equivalent compatible standard; c) warning notice: any necessary warning notices or symbols to ensure the safety of the contents shall be included as appropriate.	
4.3.8	Electrostatic discharge (ESD)	The symbols and labelling used for marking shall be in accordance with IEC 61340-5-3 or ANSI/EIA-471 or equivalent standard. For their ESD protection, all devices shall be supplied in suitable protective packaging with electrostatic properties meeting the requirements of IEC 61340-5-3 or ANSI/EIA-541.	
4.4	Product or process change notification (PCN)		
4.4.1	General	The OCM shall provide the following: • notification (4.4.2); • notification details (4.4.3).	
4.4.2	Notification	In the event of the OCM proposing or making a change to a device, then: a) the OCM and/or supplier shall give at least 90 calendar days' written notice prior to shipping the changed product. The user will respond to confirm the date on which the changed product shipments can begin (this could be less than 90 calendar days), advise that the changed product is not acceptable, or request further information; b) where an event beyond the control of the OCM occurs, where the 90 calendar days' notice cannot be given, the OCM or supplier shall reach a mutually agreed lesser notice period with any user affected by the change	

IEC TS 62686-2 (edition 1.0), clause/subclause number	IEC TS 62686-2 (edition 1.0), clause/subclause , title or paragraph content	Requirements	Demonstrated by (supporting document references and brief descriptions)
4.4.3	Notification details	The PCN shall include the following items: a) title of change; b) OCM's type number(s) affected; c) OCM's notification identification number; d) estimated last order and shipment dates for unchanged devices to be supplied on request; e) estimated earliest shipment date of changed devices; f) manufacturing location and product line affected; g) thorough description of the proposed change; h) means of distinguishing changed devices from unchanged devices. This may be a date code, lot code, date code range or distinguishing marking or feature that is visible to the user at point of receipt of shipment; i) sufficient engineering and/or qualification test data, including details of any qualification test vehicle used and its applicability to the product change. These shall be available on request to demonstrate that the change will not adversely affect device form, fit, function, quality or reliability, and that the changed product will continue to meet the specified requirements; j) user part number of the affected device (preferred item but not mandatory).	
4.5	Electrical		
4.5.1	General	Operating conditions shall be as defined in the device specification or data sheet, as explained in 4.5.2.	
4.5.2	Electrical test	All shipped packaged devices shall have passed a production electrical test program, or in the case of user-specific devices, a test program approved by the user. IEC, JEDEC, MIL standard or AEC test methods shall be used wherever possible.	
4.6	Mechanical		
4.6.1	General	Passive component package dimensions shall meet data sheet or specification requirements	
4.6.2	Device marking		
4.6.2.1	General	All the specified markings on the device or shipping container shall be clearly legible.	
4.6.2.2	Top surface	Marking is according to IEC 60062 or the following: All of the following required markings shall be marked on the top side, except where otherwise indicated below: a) pin 1 or polarity indicator identifiable either by a mark or by reference to a physical feature of the device; b) OCM's name or logo; c) OCM's part number or individual user part number as required; d) date code of assembly or test. Formats per IEC 60062 or YYWW, or YWW or YM are acceptable (Y = year numeral, W = week numeral, M = month character). If both assembly and test date codes are marked, the assembly code may be bottom marked.	