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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

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National foreword

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PUBLICLY AVAILABLE SPECIFICATION

PRE-STANDARD

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

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

ICS 03.100.50; 31.020; 49.060

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

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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

FOREWORD

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STACK specification S/0003 has served as a basis for the development of Part 2 of this publicly available specification.

IEC PAS 62686-2 has been processed by IEC technical committee 107: Process management for avionics.

The text of this PAS is based on the following document:	This PAS was approved for publication by the P-members of the committee concerned as indicated in the following document
Draft PAS	**Report on voting**
107/281/PAS	107/284A/RVD

Following publication of this PAS, which is a pre-standard publication, the technical committee or subcommittee concerned may transform it into an International Standard.

This PAS shall remain valid for an initial maximum period of 3 years starting from the publication date. The validity may be extended for a single 3-year period, following which it shall be revised to become another type of normative document, or shall be withdrawn.

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

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

Part 2: General requirements for passive components

1 Scope

This PAS defines the minimum requirements for general purpose ‘off the shelf’ COTS passive components for ADHP (Aerospace, Defence and High Performance) applications.

This specification is intended to be used wherever possible for components that typically can be applied to operate in high reliability applications within the manufacturers publicly available datasheet limits. This document can be used in conjunction with IEC TS 62239-1 for avionics applications.

This specification is identical to STACK Specification S/0003 issue 02 which is included in Annex A.

NOTE Adoption of the STACK Specification S/0003 issue 02 will enable all existing STACK Certified manufacturers to be audited by IECQ under the STACK-IECQ joint venture.

2 Normative references

The following referenced documents are indispensable for the application 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.

See the referenced documents within Annex A.

3 Terms, definitions and abbreviated terms

For the purposes of this document, the following terms, definitions and abbreviations apply. When the following terms are used in *italics* they have the meaning defined in this clause.

3.1
available
accessible, obtainable

Note 1 to entry: For example technical data, documents, etc. are information that can be requested and made available for consultation or analysis.

3.2
calendar days
continuous days, including weekends and holidays

[SOURCE: IEC 62686-1:2015, 3.1.1]

3.3
component
device
electrical or electronic device that is not subject to disassembly without destruction or impairment of design use

Note 1 to entry: Resistors (for example wire wound resistor) and capacitors (for example ceramic capacitor) are examples of passive components.

[SOURCE: IEC 62239-1:2015, 3.1.19, modified for the purpose of this document]

3.4
customer
user
original equipment manufacturer (OEM) which procures integrated circuits and/or semiconductor devices compliant to this technical specification and uses them to design, produce, and maintain systems

[SOURCE: IEC 62686-1:2015, 3.1.3]

3.5
data sheet
document prepared by the manufacturer that describes the electrical, mechanical, and environmental characteristics of the component

[SOURCE: IEC 62686-1:2015, 3.1.4]

3.6
deviation
user agreement to allow the delivery of a shipping lot which does not fully meet the requirements of a specification

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

[SOURCE: IEC 62686-1:2015, 3.1.5]

3.7
device specification
document written by a user and agreed by the supplier or OCM

[SOURCE: IEC 62686-1:2015, 3.1.6]

3.8
form
shape, arrangement of parts, visible aspect, mode in which a part exists or manifests itself, and the material an item is constructed from

[SOURCE: IEC 62686-1:2015, 3.1.7]

3.9
fit
fitability of an item to physically interface or interconnect with or become an integral part of another item or assembly

Note 1 to entry: Size and scale are examples of considered characteristics.

[SOURCE: IEC 62686-1:2015, 3.1.8]

3.10
function
work to a specification that an item is designed to without degrading reliability

[SOURCE: IEC 62686-1:2015, 3.1.9]

3.11
generic family
group or family of devices with the same basic construction but with differing values, i.e. capacitance, tolerance, voltage rating etc.

3.12
incoming lot
one or more shipments of a device*,* grouped together for the purpose of incoming inspection

[SOURCE: IEC 62686-1:2015, 3.1.10]

3.13
inner container
box or bag containing *devices,* either in *magazines* or bulk packaged

[SOURCE: IEC 62686-1:2015, 3.1.11]

3.14
limitation
restriction with regard to a requirement or a condition or a constraint

Note 1 to entry: Limitations may be identified during a certification audit when suppliers' products or processes do not meet the requirements of a specification. In that event, the supplier is noted as having limitations which are recorded in the audit report and on the certificate. These limitations are applicable to that individual supplier only.

3.15
magazine
shipping container that feeds into automatic placement machines

Note 1 to entry: Sticks, tubes, matrix trays, tape/reel, etc. are examples of magazine.

[SOURCE: IEC 62686-1:2015, 3.1.12]

3.16
manufacturing lot
definite quantity of devices tracked at each manufacturing operation. It is associated with a travel log and constitutes a group, homogeneously processed through all manufacturing operations under uniform manufacturing conditions

3.17
may
indicates a course of action which is permissible within the limits of this document

3.18
original component manufacturer
OCM
company specifying and manufacturing the electronic component

[SOURCE: IEC 62686-1:2015, 3.1.15]

3.19
outer container
outer shipping container, containing one or more *inner boxes*

3.20
room temperature
temperature identified at 25 °C ± 5 °C in a room

[SOURCE: IEC 62686-1:2015, 3.1.16]

3.21
shall
indicates a requirement

3.22
should
offers a guide or recommendation that might be used or helpful to assure compliance to this document

3.23
shipping lot
single lot of one or more *outer boxes* received by a user

[SOURCE: IEC 62686-1:2015, 3.1.18]

3.24
specification
specification together with all other documents referred to as forming part thereof

3.25
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 62686-1:2015, 3.1.19]

3.26
termination
element of a component that connects it electrically and mechanically to the next level of assembly

[SOURCE: IEC 62686-1:2015, 3.1.20]

3.27
T_{op}min
minimum operating temperature

3.28
T_{op}max
maximum operating temperature

3.29
waiver
written notice that a requirement of a document or specification no longer applies or is relaxed

Note 1 to entry: Generally if granted, the waiver is documented on the registration certificate and is applicable to an individual supplier only.

4 Abbreviations and acronyms

AOQ average outgoing quality

AQEC aerospace qualified electronic component

BF	board flex
BL	beam load
COTS	commercial off the shelf
DPM	defects per million (may also be referred as PPM (parts per million))
EHS	environmental, health and safety
EMAS	Eco-Management and Audit Scheme
ET	electrical test
ESD	electrostatic discharge
FL	flammability
HE	hermeticity
HTOL	high temperature operating life
HTS	high temperature exposure (storage)
LTPD	lot tolerance percent defective
MSL	moisture sensitivity level
MR	moisture resistance
MS	mechanical shock
OCM	original component manufacturer
OEM	original equipment manufacturer
PCB	printed circuit board
PCN	Product change notice
PD	package dimensions
RoHS	Restriction of the use of certain Hazardous Substances (European Union directive)
RS	resistance to solvents
RSH	resistance to solder heat
SD	solderability
SM	surface mount
SMD	surface mount device
SV	surge voltage
TC	temperature cycling
THB	biased humidity
TH	through hole
THS	thermal shock
TSL	terminal strength (leaded)
TSS	terminal strength (SMD)
TW	tin whisker
V	vibration
VI	visual (external inspection)

5 Technical requirements

The supplier shall provide the user’s requirements for quality, reliability and general requirements for ‘off the shelf’ COTS passive components not otherwise governed by and supplied to defence specifications, as stated in STACK S/0003 issue 02. STACK S/0003 issue 02 specification is included in Annex A.

NOTE 1 The required information is available to STACK members by a method agreed during registration and to IECQ certified companies from their IECQ certification body (IECQ CB).

NOTE 2 Limitations may be identified during a certification audit were some of suppliers products do not meet the requirements of this specification due to marketing reasons. In that event, the supplier is noted as having limitations which are recorded in the audit report and on the certificate. These limitations are applicable to that individual supplier only.

Annex A
(normative)

STACK Specification S/0003
IEC quality assessment systems
for high reliability passive components

stack International

GENERAL REQUIREMENTS FOR PASSIVE COMPONENTS

STACK 0003
Issue 02

IEC QUALITY ASSESSMENT SYSTEMS FOR HIGH RELIABILITY PASSIVE COMPONENTS

(IECQ System)

GENERAL REQUIREMENTS FOR PASSIVE COMPONENTS

JOINT COMPANY STANDARD

This Specification is issued by:
STACK INTERNATIONAL
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stack International

GENERAL REQUIREMENTS FOR PASSIVE COMPONENTS

STACK 0003
Issue 02

CONTENTS

stack International

GENERAL REQUIREMENTS FOR PASSIVE COMPONENTS

STACK 0003
Issue 02

1. INTRODUCTION

1.1 **Purpose and Scope:** This *specification* defines *user* quality, reliability and general requirements for *passive components*, not otherwise governed by and supplied to Military Specifications. Thus it forms the basis of the Stack Registration and Certification programs.

1.2 **Use of Equivalent Tests:** To comply with the requirements of this *specification,* the *supplier may* use the test methods and methodologies specified herein or any other equivalent test method. Proposed equivalent test methods, rationale and supporting data *shall* be reviewed during the Registration and or Certification processes by the STACK Members or the audit team and *shall* achieve the same end objectives as specified herein. The *user* reserves the right to reject product failing to meet the test methods (or equivalent test methods) specified herein. Use of such equivalent tests *shall* not be considered to be *deviations* or *waivers* to the requirements of this *specification*.

1.3 **Liaison:** Enquiries relating to this *specification*, which concern product deliveries or orders, *shall* be addressed to the *user*. Enquiries relating to registration should be addressed to:

STACK International
94 Lyonsdown Road
Barnet
Herts
EN5 1JL
U.K.
Tel: +44 (0)20 8449 7016

1.4 **Translation:** If translated into other languages the English language version of this *specification shall* prevail.

1.5 **Compliance with Internal Standards:** This document does not exempt the *supplier* of their responsibility to meet their own company internal requirements.

2. REFERENCED STANDARDS

2.1 References to other documents form a part of this *specification* to the extent specified herein. Where no particular document revision is given the latest revision is intended. In case of conflict between this *specification* and the content of any referenced standard (excluding Section 19) the content of this *specification* defines the STACK requirement.

AEC-Q200	Automotive Electronics Council Stress Test Qualification for Passive Components
AEC-Q200-002	- Machine Model (MM) Electrostatic Discharge Test
AEC-Q200-003	- Beam Load (Break Strength) Test
AEC-Q200-005	- Board Flex / Terminal Bond Strength Test
AEC-Q200-006	- Terminal Strength (SMD) / Shear Stress Test
AEC-Q200-007	- Voltage Surge Test
AS9100	Quality Management Systems: Aviation, Space & Defense Organizations
EIA471	Symbol and Labels for Electrostatic Sensitive Devices (ESD)
EIA541	Packaging materials for ESD sensitive items
EIA556	Outer shipping container bar code label standard
EMAS	Eco-Management and Audit Scheme
ISO14001	Environmental Management Systems-Requirements with guidance for use
ISO9000	Quality management systems – Fundamentals and vocabulary
JESD201	Environmental acceptance requirements for tin whisker susceptibility of tin and tin alloy surface finishes
JESD22-A101	Steady state temperature humidity bias life test
JESD22-A104	Temperature cycling
JESD22-A121	Measuring whisker growth on tin and tin alloy surface finishes
JESD22-B100	Physical Dimension
JESD97	Marking, Symbols, and Labels for Identification of Lead (Pb) Free Assemblies, Components, and Devices
J-STD-002	Solderability Tests for Component Leads, Terminations, Lugs, Terminals and Wires
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 PCBAs to Identify Lead (Pb), Lead-Free (Pb-Free) and Other Attributes
MIL202	Department of Defense Test Method Standard Electronic and Electrical Component Parts
MIL202-M103	- Humidity (Steady State)
MIL202-M106	- Moisture Resistance
MIL202-M107	- Temperature Cycling

2.1 Cont.

MIL202-M108	- Life (at elevated ambient temperature)
MIL202-M112	- Seal
MIL202-M204	- Vibration, High Frequency
MIL202-M210	- Resistance to Soldering Heat
MIL202-M211	- Terminal Strength
MIL202-M213	- Shock (Specified Pulse)
MIL202-M215	- Resistance to Solvents
QS9000	Quality System Requirements
RC14001	Responsible care management system
TL9000	Quality Management System Requirements Handbook (Telecoms)
TS16949	Quality Management System (Automotive)
UL-94	Flammability of plastic materials for parts in devices and appliances, tests for

3. TERMS AND DEFINITIONS

3.1 For the purposes of this *specification,* when the following terms are used in *Italics* they have the meaning defined in this section:

Available: The required information is available to STACK Members by a method agreed during registration.

Calendar Days: Continuous days, including weekends and holidays.

Deviation: *User* agreement to allow the delivery of a *shipping lot* which does not fully meet the requirements of this *specification*. Considered equivalent to concession for the purposes of this document.

Data Sheet: A *device specification* written by the *device* manufacturer.

Device: A *passive* component. Examples – “ceramic chip capacitor” or “wire wound resistor”.

Device Specification: A *device* specification written by a *user* and agreed by the *supplier*.

DPM: Defects per million may also be referred as PPM (parts per million).

Form/Fit/Function: As defined in JESD46 i.e.:

Form - Visual appearance including shape, color, marking and surface finish etc.

Fit - External dimensions and associated tolerances etc.

Function - Electrical, mechanical, environmental, and performance characteristics etc.

Generic Family: A group or family of *devices* with the same basic construction but with differing values, i.e. capacitance, tolerance, voltage rating etc.

Incoming Lot: One or more shipments of a *device,* grouped together for the purpose of incoming inspection.

Inner Container: A box or bag containing *devices,* either in *magazines* or bulk packaged.

LTPD: Lot tolerance percent defective.

3.1 Cont.

Manufacturing Lot: A definite quantity of *devices* tracked at each manufacturing operation. It is associated with a travel log and constitutes a group, homogeneously processed through all manufacturing operations under uniform manufacturing conditions.

May: Indicates a course of action which is permissible within the limits of this document.

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

MSL: Moisture Sensitivity Level relating to the packaging and handling precautions needed for moisture sensitive surface mount *devices*, as defined in J-STD-020.

Passive Components: Passive components are those that do not require electrical power to operate (e.g., not capable of power gain). For the purpose of this *specification* restricted to capacitors and resistors.

Package: The single item constructed of a containment material surrounding the *device* with known outlines (physical size).

PCN: Product Change Notification.

Outer Container: An outer shipping container, consisting of one or more *inner containers.*

Room Temperature: $25^{o}C \pm 5^{o}C$

Shall: Indicates a requirement.

Should: Offers a guideline or recommendation that might be used or helpful to assure compliance to this document.

Shipping Lot: A single lot of one or more *outer boxes* received by a *user*.

Specification: This *specification* together with all other documents referred to as forming part thereof.

Supplier: The company identified by the logo or name marked on the *device*.

Termination: Method by which the *device* is attached to a board, includes leads, pads, balls, columns etc.

T_{op}min: Minimum operating temperature.

T_{op}max: Maximum operating temperature.

User: STACK Members or organizations authorized by the STACK Office to use this *specification*.

Waiver: A written notice that a requirement of this *specification* no longer applies or is relaxed as requested during the Registration process. If granted by the STACK Members, the *waiver* shall be documented on the Registration Certificate and is applicable to that individual *supplier* only.

4. ADMINISTRATION

4.1 Registration to this *Specification*:

4.1.1 *Supplier* Registration is a formal *supplier* declaration that the *supplier's* standard qualification procedure, product monitor program and manufacturing processes are in compliance with this *specification* or that compliance will be achieved in a specified time and, that the other requirements of this *specification* will be met when *devices* are purchased to this *specification*. A *waiver may* be granted at the discretion of the STACK Membership.

4.1.2 Suspension of Registration can occur if it is determined that a Registered *supplier,* is not fully compliant with this *specification,* or any *waivers* granted and if after due discussion, an agreement cannot be reached to resolve the problem. Registration may be suspended until the non-compliance is corrected or a corrective action plan has been agreed upon. Suspension of registration may have an impact on any certifications held.

4.2 **Proprietary Data:** Where the information provided for Registration or Certification purposes is considered proprietary, that information *shall* be disseminated from the *supplier* to the STACK Members through the STACK Office. Non Disclosure Agreements can be used, if required.

4.3 **Deviations:**

a) In the event that a *supplier* intends to deviate from the requirements of the purchase order, relevant specifications, or this *specification* for a custom part where the *user* is known, prior written consent must be obtained from the *user*. If *device* specific *deviation* procedures are otherwise specified, those requirements will apply.

b) In the event that a *supplier* deviates from the requirements of the purchase order, relevant specifications, standard *data sheet*, or this *specification* for an "off the shelf" catalogue part where the *user* is unknown, the *supplier shall* distribute this information via their sales teams and/or on their web pages and to all franchised distributors.

c) Applications for *deviations* must contain the following information. If any item is not known at time of request, the request *should* be submitted with the remaining information to follow as soon as practicable:

Supplier type number
Description of deviation(s)
Quantities or time period affected
User part number
Cause of deviations.
Corrective actions being taken to overcome the deviation on subsequent deliveries, as required.
Date code
Part marking on *device* or smallest unit container.
LOT code

d) *Devices* subjected to application for a *deviation shall* be held at the *supplier's* premises pending reply unless otherwise instructed by the *user*.

4.4 **Updates to this Specification:** Updates to this *specification* will be circulated to all STACK registered *suppliers*. A period of time will be defined at each release date depending on the extent of the change to allow *suppliers* to formally accept the new issue.

5. PROCEDURES

5.1 Product Discontinuation: Notification *shall* be as described in paragraphs 5.1.1, 5.1.2 below.

5.1.1 The *supplier shall* provide to the *user* a minimum 12 months notice of last order dates for single source *devices* and 6 months for multi sourced *devices*.

5.1.2 The *supplier may* give less than the specified notice period provided a mutually acceptable extension (up to the specification limit) is negotiated with any STACK Member needing a different period.

5.2 **Specification Control:** The *supplier shall*:
Note: This applies to custom and special order parts only.
a) When applicable have central or local record of the *users* part number and specification, against the product to be delivered.
Note: This applies to direct sales and not for parts sold through franchised distribution.
b) Ensure the specifications on the purchase documents have been reviewed and accepted by personnel authorized to do so.

5.3 **Traceability:**
a) The *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, e.g.: manufacturing location, assembly location, test location, date code and or LOT code.
b) The information needed to interpret the code *shall* be *available*.
c) The procedure *shall* be *available* for inspection during audit.

6. SHIPMENT CONTROLS
The manufacturer's name, logo and/or trademark *shall* be marked on the shipping container where it is practical to do so.

6.1 **Unit Pack Container Packing:**
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.

6.2 **Intermediate Packing:**
Intermediate container packing process *should* be designed to eliminate the presence of partial quantities.

6.3 **Date Codes:**

6.3.1 Mixing
a) 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 (2) date codes in one unit pack container per intermediate packing container. If two (2) date codes are used, the unit pack container *should* be clearly identified as having mixed date codes and labels must indicate the quantity for each date code.
b) If possible, there *should* be no more than three date codes per sealed intermediate container. The label on the intermediate container *should* list all date codes and quantities by date code.

6.3.2 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.

6.3.3 Age on Delivery:
a) The date codes of *devices shall* not be older than 48 months upon *users* receipt date.
b) Exception for Aluminum Electrolytic capacitors which *shall* not be older than 24 months.
c) If the *supplier* wishes to ship *devices* outside the specified limit, the *deviation* procedure *should* be used.

6.4 **MSL:** Labeling and packaging *shall* be in accordance with J-STD-033 or equivalent.

6.5 **Lead-Free Marking:** Shipping container and date code marking *shall* be in accordance with J-STD-609A.01 or equivalent.

6.6 **Labels General:**

a) Human Readable Content: The content shown for each label in this section *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 code (bar code 39) per EIA556 or equivalent compatible standard.
c) Warning notices: Any necessary warning notices or symbols to ensure the safety of the contents *shall* be included as appropriate.

6.6.1 **Label Content:**

Dry pack label (for MSL applicable parts):		**Bar code**
a) Date of sealing and sealed life or expiration date.		
b) Time and storage condition limits after opening.		
c) Bake conditions if usage conditions after opening are violated.		
d) Moisture sensitivity classification per J-STD-020 or per *suppliers* own classification provided a cross reference is provided at registration.		
Outer container label: This label is typically implemented as a shipping note or packing list attached to the *outer container*. For security reasons items d), e) & f) can be omitted with the agreement of the *user*		
a) Delivery address.		
b) Purchase Order number.		*
c) *User* part number.		*
d) *Supplier device* type number.		*
e) The *supplier's* name.		
f) Quantities enclosed of each *device* type.		*
g) Export Control Classification Number	(preferred but not mandatory)	
Inner container label:		
a) *Supplier device* type number.		*
b) *User* part number.	(preferred but not mandatory)	*
c) Purchase order number.	(preferred but not mandatory)	*
d) Quantity of *devices*.		*
e) Date code.		*
f) Lot number.		*
g) Assembly location.	(preferred but not mandatory)	
h) Test location.	(preferred but not mandatory)	

6.7 **ESD:**

a) Protection: All *devices* must be supplied in suitable protective packaging with electrostatic properties meeting the requirements of EIA541.
b) Marking: Symbols used and labeling *shall* be in accordance with EIA471 or equivalent.

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

7. PRODUCT OR PROCESS CHANGE NOTIFICATION (PCN)

7.1 **Notification:** In the event of the *supplier* proposing or making a change to a *device*, then:

a) The *supplier shall* give at least 90 *calendar days* written notice prior to shipping changed product. The *user* will respond to confirm the date that changed product shipments can begin (could be less than 90 *calendar days*), advice that changed product is not acceptable, or request further information.
b) In an event beyond the control of the *supplier* where 90 *calendar days* notice cannot be given, the *supplier shall* reach a mutually agreed lesser notice period with any STACK Member affected by the change.

7.2 **Notification Details:** The *PCN shall* include the following items:

a) Title of change.
b) *Supplier* type number(s) affected.
c) *Supplier* 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) A 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, *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).

8. ELECTRICAL

8.1 **Operating Conditions:** *Shall* be as defined in the *device* specification or *data sheet*.

8.2 **Electrical Test:** All packaged *devices* shipped must have passed a production electrical test, or in the case of *user*-specific *devices*, an electrical test approved by the *user*. JEDEC, Mil Std. and AEC test methods *shall* be used wherever possible.

9. MECHANICAL

9.1 **Device Marking:**

9.1.1 Legibility: All the specified markings on the *device shall* be clearly legible.

9.1.2 Top Surface: All of the following required markings *shall* be marked on the topside except where otherwise indicated below:

a) Pin 1or the Polarity Indicator identifiable either by a mark or by reference to a physical feature of the *device.*
b) The *supplier's* name or logo.
c) The *supplier* part number or individual *user* part number as required.
d) Date code of assembly or test. Formats 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.

9.1.3 Small Packages: If the marking area available on the *device* is too small to do so, then the smallest unit container is to include all the required marking.

9.1.4 Lead-Free components and/or packaging are to conform to JESD97 for Marking, Symbols, and Labels for Identification of Lead (Pb) Free Components.

9.2 **Moisture Sensitivity:** All moisture sensitivity components *shall* be tested and classified according to J-STD-020. The *MSL* classification *shall* be included on the *device* or the container marking if appropriate.

9.3 **Termination Finishes:** The following *termination* finishes are for reference only and intended to be representative of common finish types utilized for passive components. The use of bright tin or any other pure tin without suitable under plating is prohibited. All finish types *shall* be compatible with any conventional soldering assembly process.

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

9.3.3 Non-RoHS: Tin-lead (SnPb) containing a minimum of 3% lead (Pb) applied over a suitable barrier metal to prevent leaching (tin/lead alloy 60/40 and 63/37 are the most common).

9.3.4 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 example. *Termination* finishes claimed to be RoHS compliant *shall* not contain lead or other restricted substances.

9.3.5 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*.

9.4 Tin Whiskering: When applicable an appropriate tin whisker mitigation plan or process *should* be in place for finishes with potential for whiskering (for example accelerated tin whisker testing to JESD201 Class 2 limits or JESD22-A121, proper annealing, or under plating) and demonstrateable. Documented results *shall* be made *available* on request

10. AUDIT CAPABILITY

10.1 **Internal Quality Audits:** The *supplier shall* periodically audit each internal location, to assess compliance with internal standards for the following areas listed below. Note, military or industry standards (e.g., ISO9000, AS9100, TS16949, etc.) or equivalent *shall* be adhered to:

• Quality System	• Calibration	• Failure analysis
• Shipment & Packaging	• Stores & Dispatch	• ESD Control
• Contract review	• Customer Service	• Production Test
• Design Management	• Process Control	• Subcontract Controls
• Purchasing	• Incoming Materials	• Assembly
• *Supplier* 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 a STACK audit. The internal quality audit documentation *shall* be *available* upon request.

10.2 **Sub Contract Manufacturing:** The *supplier shall* qualify and periodically audit all sub contracted operations to a standard equivalent to the *supplier's* internal operations.

11. QUALITY ASSURANCE

11.1 **Quality System:**

a) The *supplier shall* have an appropriate quality registration, e.g. one (or more) of ISO9000-2000, QS9000, TL9000, AS9100 and the *supplier shall* have established and documented a quality management system of equivalent standard.
b) The system *shall* ensure that the requirements of this *specification* are met.
c) The system *shall* provide for the prevention and ready detection of discrepancies and for timely and positive corrective action.

11.2 **Failure Analysis Support:**

a) The *supplier shall* maintain an adequate failure analysis capability and provide a timely response to failures returned for failure verification or failure analysis.
b) Representative samples of *devices* returned as failures, shall be analyzed and a failure analysis report issued 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*, the failure analysis report shall typically be issued within 7 *calendar days* of receipt by the analytical facility.

11.3 **Outgoing Quality:**

11.3.1 DPM levels: The *supplier shall* measure Average Outgoing Quality (AOQ) in defects per million from uniform manufacturing processes, and this *should* be *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*.

12. QUALIFICATION

12.1 **Methodology:** The *supplier shall* use appropriate methodologies to qualify new technology, new *devices* and *device* changes, to demonstrate that the *device* under qualification has the capability to meet the specified electrical, quality and reliability requirements:

12.1.1 Procedures and Methods are per Tables 1 & 2.

12.1.2 Alternate procedures and methods are acceptable as per Para. 1.2.

12.1.3 Perform and document the re-use of existing data based on product similarity arguments.

12.2 **Test Samples:**

12.2.1 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 1 is used and failures allowed, then the result must meet an *LTPD* = 3% for specified sample size of 76. In Table 1, lower sample quantities are allowed where the particular stress tests are not intended for statistical extrapolation, but for characterisation or *package* evaluation.

12.2.2 Additional samples: *Users* reserve the right to take additional samples for a qualification test result confirmation.

12.2.3 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 as per Para. 12.11 (Similarity Assessment).

12.2.4 Reduced sample sizes: The *supplier's* qualification procedures *may* allow *devices* to be released to the market after testing to a qualification schedule which does not fully meet STACK requirements, in terms of reduced sample size, reduced test time etc. This is only acceptable providing test data continues to be accumulated as per Section 13 (Product Monitor) and corrective actions and or repeat testing is performed as necessary until the STACK qualification level is reached or exceeded in a target of 90 *calendar days*.

12.3 **Qualification Categories:** The qualification *may* be conducted on a specific *device* type. Alternatively qualification *may* be accomplished by use of *generic family* qualification data providing similarity rules are followed, see Para. 12.11.

12.4 **Maintenance of Qualification Standard:** It is desirable that the manufacturer maintains a regime of 'Maintenance of Qualification' in order to ensure that reliability sensitive processes are routinely tracked and sample tested, see Para 13.1a.

12.5 **In-Process Test Results:**

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*.

12.6 **Product Monitor Results:** If any Inspection or Package qualification tests are performed on a regular basis in product monitor testing, these tests need not be repeated in new *device* qualification testing.

12.7 **References:** are given for guidance only. Reference shall always be made to the appropriate Test Code information for full test details.

12.8 **Qualification Report:** The qualification report *shall* be *available* upon request.

12.9 **Archiving:** The qualification report and the test specification (not test program), used in the qualification *shall* be archived for a minimum of 5 years.

12.10 **Qualification of changes:**

a) A change must 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 *supplier shall* perform tests defined in the qualification Table 1 that are appropriate, or relevant to the change.
c) Upon request, the *supplier shall* provide data for any *device* transferred to a new process to prove that no design deficiencies (e.g. mechanical, electrical performance, reliability, etc.) were introduced by the process transfer.

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

12.11.1 Process Changes:

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

12.11.2 Package/Assembly Changes:

a) Passive component *package* families *shall* be grouped by configuration and materials of construction, provided the assembly process technology is identical.

b) Passive component *packages should* be qualified with the worst case configuration they are designed to carry that is currently in production.

5.1.1.1 Table 1 Technology/Family Qualification and Device Qualification

Test Code Information	TITLE	Test Reference See Section 15 for full details	# of lots for Device Qual.	SS per lot	# of lots for Family Qual.	Destructive Or Non-Destructive
TC1 (ET)	Electrical Test	Datasheet	1	100%		N
TC2 (VI)	External Visual	S/0003 TC2	1	100%		N
TC3 (PD)	Package Dimension	JESD22-B100	1	30	1	N
TC4 (HTS)	High Temperature Exposure (Storage)	MIL202-M108	1	76	3	D
TC5 (TC)	Temperature Cycling	JESD22-A104	1	76	3	D
TC6 (MR)	Moisture Resistance	MIL202-M106	1	76	3	D
TC7 (THB)	Biased Humidity	MIL202-M103	1	76	3	D
TC8 (HTOL)	High Temperature Operating Life	MIL202-M108	1	76	3	D
TC9 (TSL)	Terminal Strength (Leaded)	MIL202-M211	1	30	1	D
TC10 (RS)	Resistance To Solvents	MIL202-M215	1	5	1	D
TC11 (MS)	Mechanical Shock	MIL202-M213	1	30	3	D
TC12 (V)	Vibration	MIL202-M204	1	30	3	D
TC13 (RSH)	Resistance To Solder Heat	MIL202-M210	1	30	1	D
TC14 (THS)	Thermal Shock	MIL202-M107	1	30	1	D
TC15 (BF)	Board Flex (SMD)	AEC-Q200-005	1	30	1	D
TC16 (BL)	Beam Load	AEC-Q200-003	1	30	1	D
TC17 (SD)	Solderability	J-STD-002	1	15	1	D
TC18 (ESD)	ESD	AEC-Q200-002	1	15	1	D
TC19 (FL)	Flammability	UL94	-	-	-	D
TC20 (TSS)	Terminal Strength (SMD)	AEC-Q200-006	1	30	1	D
TC21 (SV)	Surge Voltage	AEC-Q200-007	1	30	1	D
TC22 (HE)	Hermeticity (hermetic package end point test only)	MIL202-M112	-	-	-	N
TC23 (TW)	Tin Whisker	JESD201	-	-	-	

Table 2 Qualification Tests for Device Types

Test Code:	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	x
– Tantalum (Wet)	x	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
Resistors:																							
– Bulk Metal	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
– Metal Film – SM	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
- Wirewound	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
- Variable	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
- Networks	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x		x	x	x	x		x	x

13. PRODUCT MONITOR

13.1 **Monitor Program:**

a) The *supplier shall* have a continuous monitor program, the results of which can be used to demonstrate that the requirements of this *specification* are met and maintained. This should be for each manufacturing operation or product process but not necessarily related to any particular customer shipment.

b) Statistical Process Control: The *supplier shall* control manufacturing and assembly processes and final test using statistical analysis. When anomalies are observed, parametric and yield data from final tests *shall* be analyzed against in-line or electrical process control data. The root cause of the deviation *shall* be determined and the consequent corrective actions implemented.

13.2 **Problem Notifications:** The *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 Section 7.

13.3 **Data Reporting:** Reliability monitor data accumulated over the preceding two full quarters *shall* be *available*, at one months notice.

14. ENVIRONMENTAL, HEALTH AND SAFETY (EHS)

14.1 **EHS Compliance:** The *supplier shall* be expected to comply with all applicable national, regional, state and local laws and regulations governing environment, health and safety. *Supplier* registration to industry recognized EHS standards, such as ISO14001, RC14001, or EMAS, is encouraged, but not mandatory.

14.2 **Device Handling:** *Devices should* not produce any toxic effects to personnel as a result of handling, storage or disposal, or when operated according to the *supplier's data sheet*.

14.3 **Device Materials:** Materials used in the manufacture of *devices should* be non-flammable, and shall not emit harmful levels of toxic materials as a result due to electrical overload or fault within the *device*.

15. TEST CODE INFORMATION (For Reference only – See 1.2, 1.5, 2.1 and 4.3 herein). See Tables 1 and 2 for test applicability per *device* type.

TC1 – ELECTRICAL TEST (ET)

Electrical test is performed at the worst still air ambient temperature in the range of $T_{op}min$ to $T_{op}max$ and the *device* must be stabilized at the test temperature. *Devices* must meet their datasheet requirements before and after being subjected to stress tests as shown in Table 1.

TC2 – EXTERNAL VISUAL (VI)

Devices shall be examined at 1.5X to 10X magnification.
Devices shall 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

TC3 – PACKAGE DIMENSIONS (PD)

JESD22-B100 – Verify *package* dimensions meet their datasheet requirements.

TC4 – HIGH TEMPERATURE EXPOSURE (STORAGE) (HTS)

MIL-STD-202 Method 108
1000 hours at maximum rated operating temperature – Unpowered, followed by Electrical test (TC1)

TC5 – TEMPERATURE CYCLING (TC)

JESD22 Method A104
1000 cycles at rated operating temperature – Unpowered, followed by Electrical test (TC1)

TC6 – MOISTURE RESISTANCE (MR)

MIL-STD-202 Method 106
10 cycles, each cycle 24 hours (Note: Steps 7a and 7b not required) – Unpowered, followed by Electrical test (TC1)

TC7 – BIASED HUMIDITY (THB)

JESD22-A101
1000 hours 85°C/85%RH. Rated Voltage, followed by Electrical test (TC1)

TC8 – HIGH TEMPERATURE OPERATING LIFE (HTOL)

MIL-STD-202 Method 108
1000 hrs. at Rated Voltage and Max Temperature, followed by Electrical test (TC1)

TC9 – TERMINAL STRENGTH (LEADED) (TSL)

MIL-STD-202 Method 211
Test leaded *device* lead integrity only.

TC10 – RESISTANCE TO SOLVENTS (RS)

MIL-STD-202 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.

TC11 – MECHANICAL SHOCK (MS)

MIL-STD-202 Method 213
Figure 1, Condition C, – Unpowered, followed by Electrical test (TC1)

TC12 – VIBRATION (V)

MIL-STD-202 Method 204
5g's for 20 minutes, 12 cycles each of 3 orientations, test from 10 – 2000 Hz., – Unpowered, followed by Electrical test (TC1)

TC13 – RESISTANCE TO SOLDER HEAT (RSH)

MIL-STD-202 Method 210
Test condition B, – Unpowered, followed by Electrical test (TC1)

TC14 – THERMAL SHOCK (THS)

MIL-STD-202 Method 107
300 cycles at rated operating temperature, air to air, maximum transfer time-20 seconds, dwell time-15 minutes – Unpowered, followed by Electrical test (TC1)

TC15 – BOARD FLEX (SMD) (BF)

AEC-Q200-005 – Unpowered, followed by Electrical test (TC1)

TC16 – BEAM LOAD (BL)

AEC-Q200-003- Unpowered, followed by Electrical test (TC1) – Ceramic parts only

TC17 – SOLDERABILITY (SD)

J-STD-002 – Followed by External Visual (TC2)

TC18 – ELECTROSTATIC DISCHARGE (ESD)

AEC-Q200-002 – Human Body Model (HBM) – The purpose of this test is to determining passive component HBM ESD sensitivity.

TC19 – FLAMMABILITY (FL)

UL-94 – V-0 or V-1 acceptable

TC20 – TERMINAL STRENGTH (SMD) (TSS)

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.

TC21 – SURGE VOLTAGE (SV)

AEC-Q200-007 – The purpose of this *specification* is to assure a *device* will withstand voltage surges at the surge voltage rating of the *device's* specification.

TC22 – HERMETICITY (HE)

MIL-STD-202 Method 112 Seal – 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.

TC23 – TIN WHISKER (TW)

JESD201 – Environmental acceptance requirements for Tin Whisker susceptibility of tin and tin alloy surface finishes.

16. DOCUMENT REVISION HISTORY

S/0003	
Issue 01	2nd August, 2012
Issue 02	7rd October 2014

END OF SPECIFICATION

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