JEDEC STANDARD

Hybrids/MCM

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JEDEC SOLID STATE TECHNOLOGY ASSOCIATION

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HYBRIDS/MCM

Contents

Foreword

This standard was created to define requirements for and facilitate procurement of commercial grade non-QML MIL-PRF-38534 hybrid microcircuits, RF/microwave hybrid microcircuits, and multichip modules (MCMs). This document provides both requirements and guidance for device manufacturers regarding necessary controls and disciplines to design, manufacture, and characterize product.

This standard also reflects an understanding on the part of hybrid, RF/microwave and MCM manufacturers that quality and reliability cannot always be assured in the same fashion. As such, rather than dictating a singular flow, this document emphasizes communication of best practices for addressing critical segments of the design and manufacturing process.

HYBRIDS/MCM

(From JEDEC Board ballot JCB-03-63, formulated under the cognizance of the JC-13.5 Subcommittee on hybrid, RF/Microwave, and MCM Technology.)

1 Scope

This specification establishes the general requirements for hybrid microcircuits, RF/microwave hybrid microcircuits and MCMs (hereafter referred to as devices). Detailed performance requirements for a specific device are specified in the applicable device acquisition document. In the event of a conflict between this document and the device acquisition document, the device acquisition document will take precedence.

The purpose of this specification is to define requirements for and facilitate manufacturing and procurement of hybrid microcircuits, Radio Frequency (RF)/microwave hybrid microcircuits and multichip modules (MCMs) for a wide range of applications. This document is intended as a tool, for both device users and producers; which if properly used will result in the successful manufacture and delivery of devices that perform properly in the intended application.

2 General requirements

The general requirements for design and manufacturing of hybrid microcircuits, RF/microwave devices and MCMs are provided in the following paragraphs. This specification is intended for hermetic, cavity packaged devices. Devices delivered in accordance with this specification shall meet both the following general requirements and requirements specified by the device acquisition document, with the exception of those requirements specifically identified as deviations by either the device acquisition document or contract.

3 Terms and definitions

active element: A circuit element that contributes qualities to a circuit function other than those contributed by a passive circuit element, e.g., rectification, switching, gain, or conversion of energy from one form to another.

NOTE Examples include diodes, transistors, active integrated circuits, and light-sensing or light-emitting devices.

alternative method: For a device requirement that has a prescribed method to verify compliance, another method that has been verified through test and analysis to adequately verify compliance of the device with that requirement.

critical node: A node or step in the process flow whose output has a significant impact on the process.

3 Terms and definitions (cont'd)

device: For the purposes of this standard, a hybrid microcircuit, RF/microwave hybrid microcircuit, or multichip module (MCM).

device type: A single specific device design.

NOTE Within this standard, the term is meant to include only hybrid microcircuits, RF/microwave hybrid microcircuits, and MCM configurations.

element, (circuit): Any constituent part of a circuit that contributes directly to its operation and performs a definable function.

NOTE Examples include microcircuits, transistors, resistors, capacitors, and interconnections.

film microcircuit; film integrated circuit: A microcircuit consisting exclusively of elements that are films formed in situ upon an insulating substrate.

hybrid microcircuit: A microcircuit that contains two or more of a single type or a combination of types of the following elements, with at least one of the elements being active: film microcircuit, monolithic microcircuit, discrete semiconductor device, passive chip, or passive element printed or deposited on a substrate.

industry: For the purposes of this standard, the hybrid/MCM industry.

monolithic microcircuit; single-chip microcircuit: An integrated circuit or microcircuit consisting exclusively of elements formed in situ on or within a single semiconductor substrate with at least one of the elements formed within the substrate. (MIL-PRF-38535 definition)

multichip module (MCM): A multichip integrated circuit or hybrid microcircuit that contains two or more microcircuits.

passive element: A circuit element primarily contributing resistance, capacitance, inductance, ohmic interconnection, or a combination of these to a circuit function.

NOTE Examples include resistors, capacitors, inductors, passive filters, and interconnections.

radiofrequency (RF)/microwave hybrid: A hybrid microcircuit that meets one or more of the following criteria:

— it contains input and output terminals or connectors with matched impedance;

— it uses specific impedance transmission lines on an insulating substrate;

— its RF performance characteristics are affected by conductor length, width, or topology.

3 Terms and definitions (cont'd)

similar devices: For the purpose of periodic sample testing and design qualification, devices that meet any the following conditions:

— they are designed and manufactured with the same basic process flow, using the same or fewer fabrication and assembly processes and materials as a primary parent device type;

— they are assembled with the same active elements and the same passive elements, using no greater quantity of either;

— they are subject to the same process and material control monitoring, e.g., device screening, process control, reliability assessment, etc.;

— they are designed to generate the same or fewer functions using the same or less functional circuitry; e.g., a 4-bit A/D converter may be considered to be similar to a 10-bit A/D converter, but not vice versa.

4 Product conformance

4.1 Responsibility for conformance

The manufacturer shall be responsible for ensuring that inspections and tests are performed and comply with the requirements of the device acquisition document. The manufacturer may perform such inspections and tests, or use other facilities deemed suitable for the performance of the individual inspection or test.

4.2 Quality management program

The device manufacturer shall have an established quality management program that ensures that all activities related to producing devices are planned and communicated in a predetermined manner. The system shall be designed to assure accurate conversion of the customer's requirements into instructions and procedures that meet or exceed those requirements. The customer's requirements comprise all requirements herein except those specifically deviated from or altered by the acquisition document, and all requirements of the acquisition document.

4.3 Design and manufacturing documentation

Design, manufacturing, acceptance, and process control documentation shall be sufficient to depict the physical and electrical construction of the device being supplied. The quality management program shall establish procedures for configuration control. All changes in design, substitution of materials or processes, or modification to base-lined documentation shall be processed in accordance with established change control procedures.

4 Product conformance (cont'd)

4.4 Material performance

Material performance requirements shall be based on the quality and reliability requirements of the device in the device's intended application. The manufacturer shall be responsible for the approval of the performance requirements of all purchased and internally fabricated material. The manufacturer shall document material performance requirements, in accordance with the manufacturer's established design control program, to the extent necessary to ensure the requirements are met. Document EIA 623, Procurement Quality of Solid State Components by Government Contractors may be used by the manufacturer as a guideline for establishment of a system for parts selection, supplier management, and receiving inspection/test.

4.5 Self assessment

The quality management program plan shall provide for self assessment audits of the manufacturer's quality system. The manufacturer shall evaluate the system effectiveness and its ability to provide timely corrective and preventive measures based on the results of the audits.

4.6 Records

The manufacturer shall establish and maintain documented procedures for the identification, collection, retention period, and disposition of quality records. The minimum retention period for quality records shall be 5 years, unless otherwise specified.

4.7 Alternative methods

The manufacturer may use the alternative method option for any requirement herein, including process monitors, screening or qualification.

5 Device application classifications

The device application classifications are shown in Table 1. Typical applications are for reference only. The acquisition document shall specify the required classification as determined by the customer as being appropriate for their intended application. The suggested operating temperature in Table 1 is provided for guidance only. The confidence level is a relative measure of the criticality of the application. Environment severity is a relative measure of the mechanical, thermal, and chemical environment of the application.

5 Device application classifications (cont'd)

Table 1 — Device application guideline

Classification	Typical Applications (For Reference Only)	Case Operating Temperature Range	Environment Severity	Operating Life (Years)	Confidence Level*
I	Spacecraft	-40 °C to + 85 °C	Benign	8 to 15	1
II	Missiles, Space Launch/Reentry Vehicles, Uninhabited areas of Aircraft	-55 °C to + 125 °C	Severe	8 to 15	2
III	Inhabited areas of Aircraft	-40 °C to + 70 °C	Benign	8 to 15	2
IV	Uninhabited Vehicle	-55 °C to + 125 °C	Severe	5 to 8	3
V	Inhabited Vehicle, Fixed Ground Equipment	-40 °C to + 70 °C	Benign	5 to 8	3
VI	Non-critical Applications	0 °C to + 70 °C	Benign	3 to 5	4
Reference MIL-HDBK-217 *Reliability Prediction of Electronic Equipment* for Selection of Confidence Levels.					

6 Design and construction

The manufacturer shall have a design review and release process as part of initial product design or redesign.

6.1 Design Guidelines

a) The manufacturer shall generate a set of released design guidelines. A method for adding and/or updating the guidelines shall exist for incorporation of new technologies.

b) The manufacturer shall document any specific tailoring or waivers to design guidelines during initial product release or redesign.

6.2 Design for manufacturing

The manufacturer shall use processes that comply with their internal practices, as reflected in the manufacturer's design guidelines. The manufacturer shall ensure the use of appropriately verified materials (see clause 7) which support the design guidelines and process control (see clause 8).

6.2.1 Design control

The manufacturer shall exercise control of the baseline design such that any change affecting the guaranteed qualification or device end item performance is documented.

6.2 Design for manufacturing (cont'd)

6.2.2 Design analysis

Refer to the clause/subclause indicated in Table 2.

Table 2 – Design analysis references

Design analysis item	Reference clause/subclause
Product Qualification	9
Process Control	8.1
Thermal Design Analysis	6.3
Worst-Case Electrical Analysis	6.4
Mechanical Analysis	6.5
Radiation Evaluation	6.6

6.3 Thermal design

Thermal design analysis shall be performed and shall establish as a minimum that functional device elements are operating within design temperature ratings when the device is operated at the specified maximum operating electrical case temperature and conditions. Finite element analysis is an acceptable thermal design analysis technique.

6.4 Worst-case electrical circuit design analysis

Worst-case electrical circuit design analysis shall be performed and include the following evaluations as a minimum (applicable to the design).

a) Electrical element stress over the specified operating temperature range shall be within the specified derating criteria under worst case temperature conditions.

b) Evaluation to the device test limits, as specified in the acquisition document, at worst case temperature and input power conditions, as applicable.

6.5 Mechanical analysis

The device/design shall be evaluated to determine its capability to meet the required environmental and mechanical stress conditions. These considerations shall include (but are not limited to) the following:

NOTE These considerations are highly interrelated and should not be considered individually.

– Package integrity
– Component construction and adhesion
– Selection of material
– Process analysis & capability
– Temperature coefficient of expansion (an analysis of the mechanical stresses caused by thermal conditions)

6.6 Radiation evaluation

The device/design shall be evaluated to determine its capability to meet any required radiation specifications such as total ionizing dose, neutron fluence, dose rate effects, and single event effects. The evaluation may include radiation simulation testing, analysis, or a combination of these; as agreed by the purchaser. JEP133, Guide for Production and Acquisition of Radiation-Hardness Assured MCMs and Hybrid Microcircuits may be used as a guideline.

7 Material & subcontractor management

7.1 Material evaluation

The manufacturer shall be responsible for the evaluation of material to the degree necessary to ensure specified performance requirements are met. The evaluations shall be carried out in accordance with the manufacturer's established material purchasing program.

7.2 Supplier & subcontractor management

The manufacturer shall be responsible for evaluating and selecting suppliers and subcontractors based on their ability to consistently deliver products and services that meet subcontract/supplier requirements. The manufacturer shall select suppliers and subcontractors in accordance with its established supplier / subcontractor management program.

8 Device acceptance & verification

8.1 Process control

The manufacturer shall identify and monitor the key processes in their device assembly flow. This identification shall include selection of critical characteristics of each key process. The monitor plan is based on measurement and/or control of the critical characteristics within the key process (es). Critical characteristics shall be controlled by any combination of in-line process control, periodic end-of-line sample testing/inspection, control of hardware/equipment, operator training and work instructions. The manufacturer shall determine the appropriate methods of controlling their key processes, and document these within their manufacturing instructions. JESD132, Process Characterization Guideline may be used.

8.2 Process monitors

Process monitors shall be performed periodically (frequency to be determined and documented by the manufacturer for adequate detection) by either end of line or in-line testing. Samples to be tested shall be randomly selected from among the entire population of the designated group of devices to be tested. Nonfunctional devices may be used for process monitors, provided they have been time/temperature preconditioned such that they are representative of the deliverable devices in the lot. When a failure occurs, the manufacturer will perform analysis and take appropriate corrective action. The manufacturer has the choice of performing these tests either by the end of line method described in Table 3, or by using in-line tests per paragraph 8.2.2.

8.2 Process monitors (cont'd)

8.2.1 End of line tests

Tests in accordance with Table 3.

Table 3 — Process monitors

Sub-Group	Test	Device Classification						MIL-STD-883 Method/Condition	Quantity (Accept No.)
		I	II	III	IV	V	VI		
1	Physical Dimensions	X	X	X	X	X	X	2016	2(0)
2	Bond Strength Wire bonds Flip-Chip Beam Lead	X	X	X	X	X	X	2011 Condition C or D Condition F Condition H	45(0) wires or all wires if less than 45 from 2 devices*†.
3	Resistance to Solvents	X	X	X	X	X	X	2015	3(0)
4	Seal Fine & Gross					X	X	1014	22(0)‡

* Shall include at least 3 wires from each element type and each wire bond process / material.

† The devices shall be preconditioned for a minimum of one hour at +300 °C minimum in air or an inert atmosphere. Applies to non-monometallic wire bonded devices only.

‡ Seal test process monitor is not applicable if performed 100% after final electrical (see Table 4).

8.2.2 In-line testing option

Alternately, individual subgroups may be done in-line as follows. Successful completion of the in-line test qualifies that aspect of the product for the specified period between tests.

8.2.2.1 In-line physical dimensions

Each month, randomly selected devices at final inspection shall be selected such that a minimum of two devices of each package configuration presented for inspection are inspected. These samples shall then be subjected to MIL-STD-883, Test Method 2016. Critical dimensions unaffected by assembly processes may be inspected here or as part of incoming (receiving) inspection.

8.2.2.2 In-line wire bond strength

Each wire bond process (i.e., thermosonic gold, ultrasonic aluminum, etc.) shall be tested periodically on each wire bond machine that is in service. The manufacturer shall determine the appropriate frequency. Where more than one machine exists on a given process, the test sample shall be rotated between the different machines such that each machine is tested once per 13 weeks. A minimum of two sample devices, which represent the metallization systems of the devices in production, shall each have 15 (or all wires if the finished product has less than 15 wires total) wires minimum bonded onto them. For non-monometallic bonding systems (example aluminum wires to gold bonding pads), the devices shall be preconditioned for a minimum of one hour at +300 °C minimum in air or inert atmosphere. The wires shall then be destructively pulled in accordance with MIL-STD-883, Test Method 2011, condition C or D. No failures are allowed.

8.2.2 In-line testing option (cont'd)

8.2.2.3 In-Line Resistance to Solvents

Each inspection lot of marking ink shall be tested prior to acceptance in accordance with MIL-STD-883, Test Method 2015. Testing shall be performed on each type of surface used as the marking surface on completed devices. One piece of each surface type shall be tested in each solvent. Each week one device or element representative of each of the marking surfaces of each devices marked during the week shall be tested in accordance with MIL-STD-883, Test Method 2015, except only solvent "D" is required.

8.2.2.4 In-Line Seal Testing (Applicable to Classification V and VI only)

Each month, randomly selected devices at final inspection shall be selected such that a minimum of 15 devices of each package configuration presented for inspection are seal tested. These samples shall then be subjected to MIL-STD-883, Test Method 1014, fine and gross leak seal testing.

8.3 Device screening

Screening of devices, as a minimum shall be performed on each device as specified in Table 4. Tests are to be performed in the order given (Table 4), unless alternative methods are implemented. The manufacturer may use Alternative Test methods (see 8.6), provided compliance to the device requirements can be demonstrated.

8.3.1 Burn-in lot acceptance

When burn-in percent defective allowable (PDA) applies, burn-in lots shall be formed. A burn-in lot shall consist of all devices of a single type submitted to burn-in during a one-week period. The manufacturer shall not conduct burn-in in addition to that specified. Delta limits shall be defined in the device acquisition document when required. The delta parameter values measured after burn-in shall be compared with those measured prior to burn-in, only ambient temperature measurements apply. Any device with the delta parameters shifted beyond the allowed limits is considered a failure. When PDA applies, the lot is rejected when the number of failed devices exceeds the PDA. Unless otherwise specified, PDA shall be calculated against all subgroup 1 (DC Static parameters @ +25 °C).

8.3 Device screening (cont'd)

Table 4 — Device screening requirements

Test	Device Classification						MIL-STD-883, Test Method/Condition
	I	II	III	IV	V	VI	
Internal Visual	x						2017, K criteria.
		x	x				2017, H criteria
				x	x		2017, H criteria, low magnification only.
Temperature Cycling	x		x		x		1010, Condition B
		x		x			1010, Condition C
Constant Acceleration or Mechanical Shock	x		x		x		2001, 3000g or 2002 (Y1, either method. 1 ms pulse duration.)
		x		x			2001, Condition A, or 2002, 1500g (Y1, either method)
PIND	x						2020, Condition A or B.
Electrical	x	x	x				Per device specification†.
Burn-in	x						1015, 160 hours at +125 °C*. Lot acceptance applies, maximum 2% PDA (or one device).
		x	x				1015, 72 hours at +125 °C*. Lot acceptance applies, maximum 10% PDA (or one device).
				x			1015, 72 hours at +125 °C*.
					x	x	1015, 48 hours at +125 °C*.
Final Electrical	x	x		x			Per device specification @ $T_{ambient}$ or T_{case} for power devices, T_{max}, T_{min}
			x		x		Per device specification @ $T_{ambient}$ or T_{case} for power devices & T_{max} ADD Tmin?
						x	Per device specification @ $T_{ambient}$ or T_{case} for power devices, or T_{max} ADD Tmin?
Seal	x						1014, fine and gross. Must be performed after final electrical test.
		x	x	x			1014, fine and gross‡.
External Visual	x	x	x				2009
				x	x	x	2009, marking and gross damage only

* Or equivalent, or time/temperature regression in accordance with MIL-STD-883 TM1015, or as specified in the acquisition document, or as determined by the manufacturer to eliminate infant mortality failures.

† $T_{ambient}$ only. This test is optional for all devices except those with delta parameters specified in the acquisition document.

‡ The manufacturer may perform this test any time after Constant Acceleration and before External Visual. Seal Integrity must be assured after lead shear or form.

8.3 Device screening (cont'd)

8.3.2 Burn-in lot failure

A burn-in lot that has failed PDA may be subsequently accepted based on pattern failure analysis (when it has been established that there are no pattern failures within the lot). All burn-in failures must be analyzed to determine root cause. If there are multiple device failures with the same root cause within the lot, a pattern is established and the lot fails. If a pattern does not exist, the lot is accepted. The number of failures that establish a pattern and fails a lot is dependent on lot size. The lot fails if there are:

Table 5 — Burn-in lot failure criteria

Lot size	Pattern failure criteria
< 40 devices	Two or more failures with the same root cause.
41 - 100 devices	Three or more failures with the same root cause.
101 - 300 devices	Four or more failures with the same root cause.
301 - 500 devices	Five or more failures with the same root cause.
> 501 devices	Six or more failures with the same root cause.

8.4 General rework and repair provisions

a) All wire bonds shall be placed on at least 50% undisturbed metal excluding probe marks that do not expose underlying material.

b) The use of a repair procedure (i.e., the use of a process that is not part of planned reworked using established reworked procedures) requires customer approval.

8.5 Re-screening

Any screens performed prior to any rework or repair shall be repeated except as follows:

a) Pre-seal visual inspection. There shall be an inspection of the area affected by the rework or repair. The entire device shall be inspected for damage and contamination, as a minimum.

b) Repeating burn-in is not required for devices de-lidded to rework package seal failures. Devices with active elements replaced or wire bonded or re-wire bonded require re-burn-in. Re-burn-in is optional for passive element replacement rework.

8.6 Alternative methods

An alternative method may be used in place of any requirement of paragraph 9 herein. The device shall be capable of passing all required tests and inspections that an alternative method replaces. In the case of design and construction alternative methods, the method shall ensure that design-related failure mechanisms and performance problems are precluded to at least the same extent as with the standard requirement. The manufacturer shall ensure that once an alternative method is implemented it continues to meet the minimum requirements. Alternative methods include, but are not restricted to, the following:

8.6 Alternative methods (cont'd)

a) Design analysis to evaluate the critical performance parameters and or design data to determine a design/process/material combination that guarantees compliance to a specific requirement without testing.

b) Design of experiments (DOE) where a formal plan for conducting experiments is used to make achievement of a specific requirement less sensitive to process/material variability.

c) Design robustness where a design is made to be insensitive to uncontrollable variation so that it does not adversely affect the product or process once in operation.

d) Off-line reliability assessment where statistically based methods are used to monitor reliability data. This data may be used to control future adjustments to the design/process/materials.

e) Periodic capability certification where equipment and or process steps are calibrated and certified for a parameter(s) such that passing a detection test is guaranteed without actually performing the test.

f) Quality function deployment (QFD) where an analysis of the interrelationships between different requirements is performed and their interrelationships are evaluated in a decision matrix developed through concurrent engineering.

g) Standard evaluation circuit (SEC) testing where a representative test coupon/device is tested in lieu of testing actual product.

h) Statistical process control (SPC), or other methods of process control where statistical methods are used to monitor process or product parameters to provide early warning of a process fluctuation or shift. Appropriate actions are taken to maintain a state of statistical control.

9 Qualification

The manufacturer shall perform Qualification to validate a new product or process and subsequent significant major changes to the prescribed design or process. The validation for the release of new processes or products (or redesigns to existing ones), demonstrates that construction, material selection, manufacturing processes and procedures do not exhibit failure mechanisms for the product life cycle in the intended use. It also facilitates an understanding of the design for new processes and design rules.

9.1 Design qualification

Design qualification shall be performed in accordance with Table 6 on the first lot of a device type, and repeated in whole or in part when there are major design, material, or process changes. Nonfunctional devices may be used for design qualification subgroups 3, 4, 5, and 6 provided that they have been time/temperature preconditioned (screened devices) such that they are representative of the deliverable devices.

9 Qualification (cont'd)

9.1 Design qualification (cont'd)

When a failure occurs, the manufacturer may resubmit double the sample size, using an accept number of zero. Design qualification is not required for a device type that is similar to another device that has already successfully passed design qualification.

Table 6 — Design qualification requirements

Sub-group	Test	Device Classification						MIL-STD-883 Method / Condition	Quantity (Accept No.)
		I	II	III	IV	V	VI		
1	Temp Cycle or Thermal Shock	x		x		x	x	1010, Condition B, 150 cycles	8(0)
			x		x			1010, Condition C, 150 cycles.	
			x					1011, Condition B, 15 cycles.	
	Constant Acceleration or Mechanical Shock	x		x		x	x	2001, 3000 g's or 2002, 1000g's, 1 ms pulse duration. Y1 direction.	
			x		x			2001, 5000g's or 2002, Cond B, Y1 direction.	
	Seal	x	x	x	x	x	x	1014, Fine & Gross	
	PIND	x	x	x				2020 Condition A or B	
	Radiographic	x						2012, Y, and X or Z axes.	
	End-Point Electrical	x	x	x	x	x	x	Per device specification @ $T_{ambient}$ or T_{case} for power devices.	
2	Steady State Life Test	x	x	x	x	x		1005, 1000 hrs @ Tmax case temp.	8(0)*¶
							x	1005, 240 hrs @ T_{max} case temp.	
	End-Point Electrical	x	x	x	x	x	x	Per device specification @ $T_{ambient}$ or T_{case} for power devices	
3	Internal Visual & Mechanical	x	x	x	x	x		2014	3(0)
	Internal Visual						x	2017, H criteria, Low Mag only.	
4	Wire Bond Strength	x	x	x	x	x	x	2011	3(0) on 45(0) wires or all wires from 3 devices if < 45†.
5	Die Shear Strength or Stud Pull	x	x	x	x	x	x	2019 or 2027	3(0) of each element type, from a minimum of 2 devices‡.
6	Internal Water Vapor Content	x	x	x	x	x		1018, @ +100 °C. 5000 ppm max.	3(0) §

* This subgroup testing is considered non-destructive.
† The devices shall be preconditioned for a minimum of one hour @ +300 °C minimum in air or an inert atmosphere.
‡ The accept/reject limit shall be based on a Y1 directional force equal to the weight of the element times 50,000.
§ Samples from Subgroup 6 must be selected from devices that have completed Subgroup 1.
¶ Or equivalent, or time/temperature regression in accordance with MIL-STD-883 TM1005, or as specified in the acquisition document.

10 Change management

The manufacturer shall implement a system to manage changes to process, design, materials and suppliers utilized in their product.

10.1 Implementation

Change Management should be implemented after a specified point in the Design Process and should address established change control procedures for implementation and control of changes in design, materials, flowcharts, baseline documentation, cost reduction, continuous improvement and shall be documented by the manufacturer and available for review. Changes are categorized into three classifications.

Class	Description
I	Major Change
II	Minor Change
III	Editorial

10.2 Classification

Class I - Class I changes are those changes that may affect the performance, quality, reliability or interchangeability of the product. Customer procuring activity notification may be required if specified by contract.

Class II - Class II changes are all changes except Class I and Class III changes.

Class III - Class III changes are editorial changes to documentation necessary to ensure the understanding and execution of the affected documentation.

11 Reference publications

Publications referenced by this document are provided below.

11.1 Industry standards

JESD132, *Process Characterization Guideline*

JEP133, *Guide for Production and Acquisition of Radiation-Hardness-Assured MCMs and Hybrid Microcircuits*

EIA-557, *Statistical Process Control Systems*

EIA-599, *National Electronic Process Certification Standard*

EIA 623, *Procurement Quality of Solid State Components by Government Contractors*

ANSI/ASQC Q9000 Quality Systems, *Quality Management and Quality Assurance Standards - Guidelines for Selection and Use*

11 Reference publications (cont'd)

11.2 Other standards

ISO-9000, *Model for Quality Assurance*

MIL-PRF-38534, *Performance Specification, Hybrid Microcircuits, General Spec for*

MIL-STD-883, *Test Methods Standards for Microcircuits*

MIL-HDBK-217, *Reliability Prediction of Electrical Equipment*

12 Device packaging for shipment

Devices shall be packaged in a manner to provide adequate protection against handling damage during shipment. If necessary, such protection shall include protection against electrostatic discharge (ESD).

13 Ordering requirements

Ordering documents must specify the following in the acquisition document

– Part Number

– Title and number of applicable device acquisition specification.

– Device lead finish.

14 Optional acquisition data

The following items are optional and are only applicable when specified in the acquisition documents.

– Requirements for failure analysis.

– Special requirements.

– Disposition of samples.

– Requirement for qualification.

Standard Improvement Form

JEDEC JESD93

The purpose of this form is to provide the Technical Committees of JEDEC with input from the industry regarding usage of the subject standard. Individuals or companies are invited to submit comments to JEDEC. All comments will be collected and dispersed to the appropriate committee(s).

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1. I recommend changes to the following:

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☐ Test method number _____ Clause number _____

The referenced clause number has proven to be:

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☐ Other _____

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