The document and process conversion measures necessary to comply with this revision shall be completed by 16 April 2001.

INCH-POUND

MIL-PRF-38535E
Amendment 5
16 January 2001
SUPERSEDING
Amendment 4
18 February 2000

PERFORMANCE SPECIFICATION

INTEGRATED CIRCUITS (MICROCIRCUITS) MANUFACTURING,
GENERAL SPECIFICATION FOR

This amendment forms a part of MIL-PRF-38535E, dated 1 December 1997, and is approved for use by all Departments and Agencies of the Department of Defense.

The attached insertable replacement pages listed below are replacements for the stipulated pages. When the new pages have been entered in the document, insert the amendments as the cover sheet to the specification.

Replacement Pages	Pages replaced
33	33
34	without change

Page 1

1.1, add to end of paragraph, “Class T is not for use in NASA manned, satellite, or launch vehicle programs without written permission from the applicable NASA Project Office (i.e., cognizant EEE parts authority).”

Page 2

2.3 add JEDEC publication to EIA listing
JESD 22-A114 - Electrostatic Discharge (ESD) Sensitivity Testing Human Body Model (HBM).

Page 3

3.2.1a add
9. If applicable, the certificate shall include a statement indicating that alternate die/fab requirements are being used (”QD” certification mark, see 3.6.3).

Page 7

3.4.1.4.1, add sentence, “Manufacturer’s package element material and finish shall be in accordance with A.3.5.6 unless otherwise specified in the manufacturer’s QM plan.”

3.4.3, line 2, delete (class N, Q, or V) and substitute (class N, Q, V or T).

Page 8

Add new RHA designator as follows:

RHA level designator	Total dose (Rad (Si))
P	3×10^4

AMSC N/A FSC 5962

Add last sentence to paragraph as follows:

3.4.8 Performance requirements for Class T devices. The manufacturer of a Class T device shall be a certified and qualified QML manufacturer approved by the qualifying activity. The Class T devices shall be manufactured on a certified and qualified QML line as defined in 3.4 herein. The Class T flow shall be developed and approved through the manufacturer's TRB; shall be qualified; shall be defined in the manufacturer's QM plan; and be approved by the qualifying activity. Each technology flow (e.g., wafer fabrication, assembly, screening, qualification, TCI, etc) shall be developed and documented taking into account the application requirements of the customers. The device manufacturer shall demonstrate that the failure mode and mechanisms of the technologies are considered when developing the technology flow. Copies of each technology flow including supporting documentation shall be reviewed and approved by the qualifying activity prior to listing as an approved source of supply. Any modification to the approved technology flow shall be reviewed and approved by the TRB and the qualifying activity. The technology flow and supporting documentation shall be made available to the systems manufacturers, the government, and customers for review. The customer shall be notified of major changes which affect form, fit, or function of the device defined within the device specification and the manufacturer's QM plan. Class T is not for use in NASA manned, satellite, or launch vehicle programs without written permission from the applicable NASA Project Office (i.e., cognizant EEE parts authority).

3.4.8.1 Class T radiation requirements. The device specification shall define all the radiation features offered by the QML manufacturer for the Class T device. QML manufacturers supplying Class T devices shall meet the requirements of MIL-STD-883 TM 1019 and shall document in the QM Plan the radiation hardness assurance level specified for the device offered. All devices supplied to this product class shall be marked with a rad hard designator as specified in 3.4.3 herein. Traceability shall be established such that there is a technical basis for compliance to the specified RHA level designator as marked on the device.

3.6c, delete and replace as follows:
3.6c "Q", "QML" or "QD" certification mark (see 3.6.3)

3.6.2a, add "T" to list of Device class designators.

3.6.2a, add "P" to list of RHA designators.

3.6.2.1, line 1, delete "Letters M, D, L, R, F, G, or H..." and substitute "Letters M, D, P, L, R, F, G, or H..."

3.6.2.3, delete Example PIN "5962-XXXXXZZ(N, Q, V (B or S))YY" and substitute as follows:
"5962-XXXXXZZ(N, Q, V, T (B or S))YY"

3.6.3 Add after 1st sentence.
QML manufacturers shall request qualifying activity approval for DMS product using the alternate die/fab requirements of A.3.2.2 or other alternatives. Upon approval the manufacturer shall use the "QD" certification mark in lieu of the "Q" or "QML" mark.

Delete 3.6.7.2 and replace as follows:

* 3.6.7.2 Electrostatic Discharge Sensitivity (ESD) identifier. ESD classification marking is not required. The manufacturer will have an option of no ESD marking, marking a single ESD triangle or marking in accordance with the ESD device classification (i.e., class 1 - one Δ; class 2 - two Δ's; class 3 - no marking) defined in test method 3015 of MIL-STD-883. Because it may no longer be possible to determine the ESD classification from the part marking, the Device Discharge Sensitivity classification, will have to be obtained through MIL-HDBK-103 or QML-38535.

Page 12

Delete 4.2.3 and replace as follows:

* 4.2.3 Electrostatic discharge sensitivity. Electrostatic discharge sensitivity testing shall be done in accordance with test method 3015 of MIL-STD-883 and the device specification. The testing procedure defined within JESD-22-A114 may be used as an option in lieu of method 3015 provided the manufacturer is able to demonstrate correlation between the 2 methods. In addition the reported sensitivity classification levels shall be the ones defined within test method 3015 (see 3.6.7.2). Unless otherwise specified, tests shall be performed for initial qualification and product redesign as a minimum.

Page 13

Add last sentence to paragraph:

6.1.1 Class T. As the requirements for class level T are specified in the manufacturer's Quality Management (QM) Plan for each technology, the user is cautioned to review the manufacturer's QM Plan to assure that the part being acquired meets the requirements/reliability of the system application. Class T is not for use in NASA manned, satellite, or launch vehicle programs without written permission from the applicable NASA Project Office (i.e., cognizant EEE parts authority).

Page 18

Add last sentence to paragraph:

6.2.31 Class T. Class T is a quality level whose requirements are defined by paragraph 3.4.8 herein and as documented on an SMD. Class T is not for use in NASA manned, satellite, or launch vehicle programs without written permission from the applicable NASA Project Office (i.e., cognizant EEE parts authority).

Page 22

*
A.2.2.1 Delete MIL-I-23011 in its entirety.
Delete MIL-STD-973 in its entirety.
Delete MIL-STD-1835 title and replace as follows:
MIL-STD-1835 – Interface Standard Electronic Component Case Outlines

Page 23

* A.2.3 Non-Government publications, add
SOCIETY OF AUTOMOTIVE ENGINEERS

SAE-AMS-I-23011 - Iron-Nickel Alloys for Sealing to Glasses and Ceramics.

(Applications for copies of SAE publications should be addressed to the Society of Automotive Engineers, 400 Commonwealth Dr., Warrendale, PA 15096-0001)

Page 27

Delete A.3.2.2 and replace as follows:

A.3.2.2 Alternate Die/fabrication requirements. When deemed necessary by the preparing or acquiring activity, (e.g., a class M SMD device, a DSCC drawing device, an 883 compliant device or a QPL/QML device or a unique package/die combination is not available from a DSCC drawing, SMD, QML, or QPL source that meets the full wafer fabrication requirements of this appendix), the DSCC drawing, SMD, JAN slash sheet or other procurement document may be modified to provide a source for logistics support. This modification will allow either a detailed certificate of compliance (itemized listing of die fabrication requirements from this appendix - see example in A.3.2.2.1 herein) or a die evaluation as defined by paragraph A.3.2.2.2 herein to be used in lieu of meeting the full die/fabrication requirements of this appendix. The manufacturer that meets the die/fabrication requirements of A.3.2.2.1 or A.3.2.2.2 is required to perform QCI testing of Groups C and D (and E if applicable) on the first inspection lot of each wafer lot and shall replace the "C" certification mark with a "D" certification mark. An additional complete Group D test is not required if the manufacturer already has Group D coverage on the package family, however, Subgroups D3 and D4 shall be required on the first inspection lot of the wafer lot. For excess die from the evaluated wafer lot, an additional Group C and Group D (subgroups D3 and D4 only) tests are not required for subsequent inspection lots built solely from die from that wafer lot. If the product is built in full compliance to the requirements of this appendix (the alternate die/fab allowance of this paragraph is not being used), the "C" certification mark shall be used on the device.

A.3.3.1a Add

(9). If applicable, the certificate shall include a statement indicating that alternate die/fab requirements are being used, see A.3.2.2 (”D” cert mark).

A.3.4.1.3 Add new RHA designator as follows:

RHA level designator	Total dose (Rad (Si))
P	3×10^4

*

A.3.4.1.4 Modify paragraphs A.3.4.1.4 to add reference to JESD-22-A114:

from: “…test method 3015 of MIL-STD-883 …”

to: “…test method 3015 of MIL-STD-883. The test procedure defined within JESD-22-A114 (see A.4.4.2.8) may be used but the classification levels defined below must be reported.”

Delete A.3.4.2 and replace as follows:

*

A.3.4.2 Changes and notification of change to product or quality assurance program. The manufacturer shall be responsible for the implementation of any major changes(s) or Class 1 changes of the product or quality assurance program which may affect performance, quality, reliability, radiation hardness assurance (when specified), ESDS class or interchangeability (see table A-1). The information needed to support these changes shall include acceptable engineering data, quality conformance inspection data, or a test plan sufficient to demonstrate that the changes(s) will not adversely affect performance, quality, reliability, interchangeability, radiation hardness, or electrostatic discharge sensitivity and that the product will continue to meet the specification requirements. Notification to the acquiring activity of change of product involving devices acquired to any detail specification/drawing/data sheet is required for class 1 changes. Class 1 changes are those changes that may affect the performance, quality, reliability, or interchangeability of the product. Major changes as defined in Table A-1 shall as a minimum be reviewed to determine whether notification to the users is required. This notification to the acquiring activity shall be made at the time of acceptance of a new order or delivery of an existing order by the manufacturer. The manufacturer may make notification of this change of product through the GIDEP using the Product Change Notice, in any case the manufacturer shall assure that all acquiring activities for this product are notified.

Delete A.3.4.2.1 in its entirety.

*

A.3.5.6.2 Lead or terminal material, delete type A, B and G and replace as follows:

a. Type A: Iron-Nickel-Cobalt alloy: SAE-AMS-I-23011, class 1, ASTM F15
b. Type B: Iron-nickel alloy (41 percent nickel): SAE-AMS-I-23011, class 5, ASTM F30
g. Type G: Iron-nickel alloy (50.5 percent nickel): SAE-AMS-I-23011, class 2, ASTM F30

A.3.6.2.2, line 1, delete “Letters M, D, L, R, F, G, or H...” and substitute “Letters M, D, P, L, R, F, G, or H...”

A.3.6.2.7, delete “or H” 4 places under “Lead frame or terminal material and finish”.

Page 42

Delete A.3.6.9.2 and replace as follows:

* A.3.6.9.2 Electrostatic discharge sensitivity identifier. Microcircuits shall be ESDS classified in accordance with A.3.4.1.4, however, ESD classification marking is not required. The manufacturer will have an option of no ESD marking, marking a single ESD triangle or marking in accordance with the ESD device classification (i.e., class 1 - one Δ; class 2 - two Δ's; class 3 - no marking) defined in test method 3015 of MIL-STD-883. Because it may no longer be possible to determine the ESD classification from the part marking, the device Discharge Sensitivity Classification will have to be obtained through MIL-HDBK-103 or QML-38535.

Page 48

Delete A.4.4.2.8 and replace as follows:

* A.4.4.2.8 Electrostatic discharge sensitivity. Electrostatic discharge sensitivity classification testing shall be done in accordance with test method 3015 of MIL-STD-883 (The testing procedure defined within JESD-22-A114 may be used as an alternate with acceptable correlation data), and the applicable device specification or drawing (see A.3.6.9.2). Devices shall be handled in accordance with the manufacturer's in-house control documentation. Handling documentation shall be maintained by the manufacturer. Guidance for device handling is available in EIA-STD-625.

Page 65

A.4.9.3.7, Add footnote 1/,

1/ The self-audit shall include any activities performed by a subcontractor, and shall ensure full compliance by the subcontractor to this appendix and the device specification or drawing. Any deviations or questionable areas shall be brought to the attention of the qualifying activity.

* A.5.1 Modify paragraph to delete reference to JESD-22-A114:

from: "…class 1 or 2 by test method 3015 of MIL-STD-883 or JESD-22-A114 (see A.4.4.2.8) …"
to: "…class 1 or 2 by test method 3015 of MIL-STD-883…"

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* Table H-IIA, Group number 5, Add "JESD-22-A114 1/ " as alternate method to TM3015.
1/ ESD classification level is as defined within test method 3015

* Table H-IIB, Group number 9, Add "JESD-22-A114 4/ " as alternate method to TM3015.
4/ ESD classification level is as defined within test method 3015

The margins of this amendment are marked with an asterisk to indicate where changes from the previous amendment were made. This was done as a convenience only and the Government assumes no liability whatsoever for any inaccuracies in these notations. Bidders and contractors are cautioned to evaluate the requirements of this document based on the entire content irrespective of the marginal notations and relationship to the last previous amendment.

CONCLUDING MATERIAL

Custodians:
Army - CR
Navy - EC
Air Force – 11
NASA - NA
DLA - CC

Civil agency coordinating activity:
DOT-FAA(RD-650)

Preparing activity:
DLA - CC

Review activities:
Army - MI, SM
Navy - MC, TD, AS, CG, OS, SH
Air Force - 19, 99

(Project 5962-1882)

APPENDIX A

TABLE A-I. Testing guidelines for changes identified as major.

Major changes		Testing, MIL-STD-883, test method 5005 (All electrical parameters in accordance with the device specification or drawing 1/)
a.	Doping material source concentration Process technique	Group A and C-1 deltas (variables only when deltas are required)
b.	Diffusion profile	Group A and C-1 deltas (variables only when deltas are required)
c.	Die structure	Group A and C-1 deltas (variables only when deltas are required)
d.	Mask changes affecting die size or active element	Variable group A, C-1 prior to shipment, and notify qualifying activity if new area is smaller/larger in applicable package than previously qualified.
	Wafer diameter	Group A, C-1 prior to shipment
	Final die thickness	Group D-3
e.	Passivation/glassivation	Group A, C-1 and glass integrity test if current density is over 2×10^5
f.	Metallization changes	Group A, C-1, and B-5
g.	Die attach method	D-3 and D-4
h.	Die attach process	D-3 and D-4
i.	Bond process	B-5 and D-3
j.	Bond wire material/dimension	B-5 and D-3
k.	Package or lid structure	D-1 (variables), D-3, D-4, D-8 (lid torque) (variables)
	Package or lid material	D-3, D-4, D-5, D-6 (variables), and D-8 (lid torque) (variables)
	Package or lid dimension	D-1 (variables), D-2, and D-8 (lid torque) (variables)
	Lead frame material	See A.4.4.2.7
	Lead frame dimension	D-1 (variables) and D-2
	Cavity dimension	B-5, D-2, D-6 (variables), and D-8 (lid torque) (variables)
l.	Sealing profile	D-3, D-4, D-6 (variables), and D-8 (lid torque) (variables)
	Sealing material	D-3, D-4, D-6 (variables), and D-8 (lid torque) (variables)
	Frame attach	B-3, D-3, D-4, D-6 (variables), and D-7 (adhesion of lead finish) (variables)
	Frame cleaning	B-3, D-2, D-3, and D-7 (adhesion of lead finish)
m.	Implementation of test methods	Notify qualifying activity (may involve test demonstration)
n.	Critical documents (see A.4.8.1.3b)	Notify qualifying activity (may involve test demonstration)
o.	Fab move	Group A and C
p.	Assembly move	Group D per each package family (see A.3.1.3.30) prior to ship

Supersedes page 33 of MIL-PRF-38535E, dated 1 December 1997.

APPENDIX A

TABLE A-I. Testing guidelines for changes identified as major - Continued.

Major changes		Testing, MIL-STD-883, test method 5005 (All electrical parameters in accordance with the device specification or drawing 1/)
q.	Test facility move	Notify qualifying activity
r.	Scribe/die separation	5 SEM photographs of randomly selected die showing one full edge of die front and back
s.	Qualification/QCI procedures	Notify qualifying activity
t.	Passivation for RHA	Group A, E, C-1, and glass integrity test if current density is over 2×10^5
u.	Diffusion profile for RHA	Group A, E, and C-1 deltas (variables only when deltas are required).
v.	Sinter/anneal for RHA	Group A, E, C-1, and B-5

1/ This table is for class level B subgroups only. For class level S, use the equivalent class level S subgroups.

The current density shall be calculated at the point(s) of maximum current density (i.e., greatest current (see A.3.5.5a) per unit cross section) for the specific device type and schematic or configuration. Individual device calculations are not required when appropriate documented design rules or requirements have been used, which limit or control the current density in the resulting design.

a. Use a current value equal to the maximum continuous current (at full fanout for digitals or at maximum load for linears) or equal to the simple time-averaged current obtained at maximum rated frequency and duty cycle with maximum load, whichever results in the greater current value at the point(s) of maximum current density. This current value shall be determined at the maximum recommended supply voltage(s) and with the current assumed to be uniform over the entire conductor cross-sectional area.

b. Use the minimum allowed metal thickness in accordance with manufacturing specifications and controls including appropriate allowance for thinning experienced in the metallization step. The thinning factor over a metallization step is not required unless the point of maximum current density is located at the step.

c. Use the minimum actual design conductor widths (not mask widths) including appropriate allowance for narrowing or undercutting experienced in metal etching.

d. Areas of barrier metals, not intended by design to contribute to current carrying capacity, and nonconducting material shall not be included in the calculation of conductor cross section.

Thick film conductors multichip substrates (metallization strips, bonding interfaces, etc.) shall be designated so that no properly fabricated conductor shall dissipate more than 4 watts/cm^2 when carrying, maximum design current.

A.3.5.5.1 Metallization thickness. For class level S microcircuits, the minimum metallization thickness shall be 8,000 Å (800 nm) for single level metal and for the top level of multi-level metal, and 5,000 Å (500 nm) for the lower level(s) of multi-level metal. In all cases, the current density requirements of A.3.5.5 shall also be satisfied.

A.3.5.5.2 Internal wire size and material. For class level S microcircuits, the internal wire diameter shall be .001 inch minimum (0.03 mm) and the internal lead wire shall be of the same metal as the die metallization.

A.3.5.5.3 Internal lead wires. Internal lead wires or other conductors which are not in thermal contact with a substrate along their entire length (such as wire or ribbon conductors) shall be designed to experience, at maximum rated current, a continuous current for direct current, or an RMS current (peak current divided by $\sqrt{2}$), for alternating or pulsed current, not to exceed the values established by the following relationship:

STANDARDIZATION DOCUMENT IMPROVEMENT PROPOSAL

INSTRUCTIONS

1. The preparing activity must complete blocks 1, 2, 3, and 8. In block 1, both the document number and revision letter should be given.

2. The submitter of this form must complete blocks 4, 5, 6, and 7, and send to the preparing activity.

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I RECOMMEND A CHANGE:	**1. DOCUMENT NUMBER** MIL-PRF-38535 Rev E Amendment 5	**2. DOCUMENT DATE** *(YYMMDD)* 01/01/16

3. DOCUMENT TITLE
INTEGRATED CIRCUITS (MICROCIRCUITS) MANUFACTURING, GENERAL SPECIFICATION FOR

4. NATURE OF CHANGE *(Identify paragraph number and include proposed rewrite, if possible. Attach extra sheets as needed.)*

5. REASON FOR RECOMMENDATION

6. SUBMITTER

a. NAME *(Last, First, Middle initial)*	b. ORGANIZATION	
c. ADDRESS *(Include Zip Code)*	d. TELEPHONE *(Include Area Code)* (1) Commercial (2) DSN *(If applicable)*	7. DATE SUBMITTED *(YYMMDD)*

8. PREPARING ACTIVITY

a. NAME DEFENSE SUPPLY CENTER, COLUMBUS ATTN: DSCC-VAC	b. TELEPHONE *(Include Area Code)* (1) Commercial 614-692-0547 (2) DSN 850-0547
c. ADDRESS *(Include Zip Code)* P.O. BOX 3990 COLUMBUS, OH 43216-5000	**IF YOU DO NOT RECEIVE A REPLY WITHIN 45 DAYS, CONTACT:** Defense Standardization Program Office (DLSC-LM) 8725 John J. Kingman Road, Suite 2533 Fort Belvoir, Virginia 22060-6221 Telephone (703) 767-6888 DSN 427-6888

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