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Upgrade Screening, Space Station Program Electrical, Electronic, & Electromechanical (EEE) Parts Requirements

International Space Station Program

SSQ 25001 Revision C
June 10, 1996

National Aeronautics and Space Administration
Space Station Program Office
Johnson Space Center, Houston, Texas

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REVISIONS

REV LTR		PUB DATE
New	BASELINE ISSUE	3/14/94
A	Reason: Limit upgrade screening to hermetic parts correct typograhical errors	4/4/94
B	Clarification Of Table I And Improve Sequence Testing In Tables II and III	10/27/94
C	Official PCB Release Version(include CR 25001-003)	06/11/96

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PREFACE

SSQ 25001, Space Station Program Electrical, Electronic, & Electromechanical Parts Upgrade Screening Requirements is a procedure which defines the upgrade screening for hermetic package active parts for Space Station Parts as required by SSP 30312

____ ____________
Program Manager (or delegated authority) Date
Space Station Program

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SPACE STATION PROGRAM
UPGRADE SCREENING, SPACE STATION PROGRAM ELECTRICAL, ELECTRONIC, & ELECTROMECHANICAL (EEE) PARTS REQUIREMENTS

June 10, 1996
CONCURRENCE

PREPARED BY: ________________________________ ______________
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SPACE STATION PROGRAM
UPGRADE SCREENING, SPACE STATION PROGRAM
ELECTRICAL, ELECTRONIC, & ELECTROMECHANICAL (EEE) PARTS REQUIREMENTS

LIST OF CHANGES

MARCH 26, 1996

All changes to this document are shown below:

SSCBD	ENTRY DATE	CHANGE	PARAGRAPH
TBD	1/20/95	REVISION A	All

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TABLE OF CONTENTS

PARAGRAPH		PAGE
1.0	SCOPE	1-1
2.0	APPLICABLE DOCUMENTS	2-1
2.1	SPECIFICATIONS	2-1
2.2	STANDARDS	2-1
2.3	NASA DOCUMENTS	2-1
3.0	REQUIREMENTS	3-1
3.1	GENERAL	3-1
3.1.1	CONTROL UNITS	3-1
3.2	RADIATION HARDNESS ASSURANCE	3-1
3.3	PRE-SCREENING DESTRUCTIVE PHYSICAL ANALYSIS	3-1
3.4	SERIALIZATION AND MARKING	3-1
3.5	SCREENING	3-2
3.6	PERCENT DEFECTIVE ALLOWABLE	3-2
3.7	SAMPLE LIFE TEST	3-2
3.8	POST-SCREENING DESTRUCTIVE PHYSICAL ANALYSIS	3-3
4.0	QUALITY ASSURANCE PROVISIONS	4-1
4.1	TEST FACILITY QUALITY PROGRAM	4-1
4.2	DATA RETENTION AND ACCESS	4-1
4.3	TEST EQUIPMENT	4-1
4.4	LOT AND INSPECTION LOT DEFINITION	4-1
4.5	RESPONSIBILITY FOR INSPECTION	4-1
4.5.1	DETAILED TEST PROCEDURE APPROVAL	4-1
4.6	FAILURE ANALYSIS	4-1
4.7	DOCUMENTATION	4-1
5.0	PREPARATION FOR DELIVERY	4-1
5.1	PACKING AND PACKAGING	5-1
5.1.1	REJECTED PARTS	5-1
5.2	ELECTROSTATIC DISCHARGE SENSITIVITY	5-1

LIST OF TABLES

Table I.	DPA SAMPLE PER SINGLE LOT DATE CODE	5-2
Table II.	100% Screening/Test Requirement for Monolithic Microcircuit Devices	5-3
Table III.	100% Screening/Test Requirement for Semiconductor Devices	5-4

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1.0 SCOPE

This procedure defines the upgrade screening requirements for hermetic packaged JANTXV semiconductors; MIL-I-38535 Class Q; MIL-M-38510 Class B, and Standard Military Drawings (SMD)/883 Class B monolithic microcircuit devices intended for use in the Space Station Program and other high reliability applications.

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2.0 APPLICABLE DOCUMENTS

The following documents of the issue in effect on date of invitation for bids, or request for proposal or product manufacture, form a part of this specification to the extent specified herein.

2.1 Specifications

Military

MIL-S-19491	Semiconductor Devices, Packaging of
MIL-S-19500	Semiconductor Devices, General Specification For
MIL-S-19500/XXX	Semiconductor Devices, (Applicable Slash Sheets)
MIL-M-38510	Microcircuits, General Specification for
MIL-M-38510/XXXXX	Microcircuits, (Applicable Slash Sheets)
MIL-I-38535	Integrated Circuits Manufacturing, General Specification for
MIL-M-55565	Microcircuits, Packaging of

2.2 Standards

Military

MIL-STD-129	Marking for Shipment and Storage
MIL-STD-750	Test Methods for Semiconductor Devices
MIL-STD-883	Test Methods and Procedures for Microelectronics
MIL-STD-1686	Electrostatic Discharge Control Program for Protection of Electrical and Electronic Parts, Assemblies, and Equipment

2.3 NASA Documents

SSQ 25000	Destructive Physical Analysis (DPA) Specification for the Space Station Program

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3.0 REQUIREMENTS

3.1 General. Devices shall be upgrade screened to the requirements of this procedure in the order shown. Upgrade screening shall consist of the following sequence of tests: (a) Radiation Hardness Assurance inspection (may be required and shall be verified by the International Space Station Alpha {ISSA} Parts Control Board {PCB} Analysis and Integration Team {AIT}), (b) pre-screening destructive physical analysis (DPA), (c) screening inspections, (d)sample life testing, (e) post-screening DPA (external & internal visual inspection and bond pull).

3.1.1 Control Units. Prior to any upgrade screening three parts shall be designated as control units. Control units shall be maintained at room temperature storage and are not to be subjected to any screening/testing. The control unit devices shall be measured when necessary correlation is required. After the lot from which the control units were removed completes upgrade screening, the control units are to be shipped in a separate container marked ”Control Units”.

3.2 Radiation Hardness Assurance. Radiation Hardness Assurance Inspection, if required, shall be performed as directed by the PCB AIT at an approved facility.

3.3 Pre-Screening Destructive Physical Analysis. ”Pre-screening DPA” shall be performed on each lot-date-code of parts prior to commencing the upgrade screening in accordance with sample sizes in Table I utilizing a PCB AIT approved test laboratory.

3.4 Serialization and Marking. Devices to be screened shall be serialized in such a manner to identify each part with the screening test data. When a part is too small for marking the body with a serial number, the lead shall be labeled with an adhesive-backed serial number or equivalent. When devices are re-marked , the following shall be included:

a. Original manufacturer’s marking shall remain as is.

b. Serial number

c. A green dot shall be added to the original part number to identify that the part and lot has passed all upgrade screening requirements.

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d. All part marking shall meet the requirements for mark permanency and outgassing in accordance with the applicable military specifications.

3.5 Screening. Screening shall be performed on the entire lot (100%) of devices per Table II or III, (as appropriate) at the EEE parts manufacturer or at a PCB AIT approved screening laboratory. The first order of precedence shall be the original EEE part manufacturer.

3.6 Percent Defective Allowable. Percent Defective Allowable (PDA) for microcircuits shall be as follows:

a. A 5% PDA on the reverse bias shall include all failures during reverse bias burn-in, all interim post reverse bias burn-in electrical parameters, post reverse bias deltas, and final electrical parameters and deltas (if applicable). Re-submission of the lot for reverse bias burn-in shall be allowed on a one time basis with a tightened PDA of 2%.

b. A PDA of 5% maximum for burn-in failures shall include all failures during burn-in, interim post burn-in electrical parameters and deltas, and final electrical parameters and deltas (if applicable) Re-submission of the lot for burn-in shall be allowed on a one time basis with a tightened PDA of 2%.

PDA for semiconductors shall be as follows:

a. A PDA of 5% maximum for High Temperature Reverse Bias (HTRB) shall include all failures during HTRB, all post HTRB electrical failures, and all post HTRB delta failures. Re-submission of the lot for HTRB shall be allowed on a one time basis with a tightened PDA of 2%.

b. A PDA of 5% maximum for Power-Burn-in failures shall include all the failures during Power-Burn-in, all final electrical failures, and all post Power-Burn-in deltas. Re-submission of the lot for Power-Burn-in shall be allowed on a one time basis with a tightened PDA of 2%.

3.7 Sample Life Test. Upon completion of screening, a 22 piece sample, with an accept number of zero rejects, shall be subjected to a 1000 hour, life test per the nearest applicable military space flight specification. Life test may be omitted for all lots which have received life testing as part of the

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military specification, military standard processing, or performed by the manufacturer from the exact lot. Attributes and variables data shall be recorded for each lot.

3.8 Post-Screening Destructive Physical Analysis. DPA (Post-screening) shall be performed in accordance with the sample sizes of Table I and utilizing a PCB AIT approved test laboratory.

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4.0 QUALITY ASSURANCE PROVISIONS

4.1 Test Facility Quality Program. The parts test/screening facility or laboratory shall provide for and maintain a quality program which shall ensure that adequate screening controls and consistent quality is maintained throughout all phases of testing and handling of parts.

4.2 Data Retention and Access. The test/screening laboratory shall retain all test data for a minimum of two years. The test laboratory shall notify the procuring activity and obtain their approval prior to the destruction of screening/test data.

4.3 Test Equipment. All test equipment used in the manufacture, processing, screening, and testing of parts to this procedure shall conform to the requirements of MIL-STD-45662.

4.4 Lot and Inspection Lot Definition. A lot or an inspection lot for purposes of this procedure is: "all devices (parts) marked with the same part number and the same lot date code". Lots or inspection lots shall not be split during screening without prior approval of the product group.

4.5 Responsibility for Inspection. The screening/test laboratory is responsible for the upgrade-screening and sample life test requirements specified herein. The procuring activity reserves the right to witness or perform any of the specified tests and inspections set forth herein and to audit the data resulting from the screening/test inspections or laboratory's performance of these tests and inspections.

4.5.1 Detailed Test Procedure Approval. The detailed upgrade-screening and sample life test procedure prepared by the screening/test laboratory shall be approved by the procuring activity prior to the start of testing/inspections.

4.6 Failure Analysis. Catastrophic failures (opens, shorts, and non-functional devices) that occurred subsequent to Burn-In, shall be reported to the procuring activity. Failure analysis if required by the product group shall be performed at a PCB AIT approved laboratory.

4.7 Documentation. The screening/test laboratory shall provide with each lot of parts screened/tested the following:

a. Screening inspection attributes summary data

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b. Screening inspection variables data; serialized electrical test data, identifiable to each part including delta calculations;

c. Certificate of Conformance.

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5.0 PREPARATION FOR DELIVERY

5.1 Packing and Packaging. Each part shall be packed and packaged in accordance with MIL-STD-129, MIL-S-19491 and MIL-M-55565, Level C. In addition, first level package marking shall include device type with the letters “RS” added as suffix (i.e. JANTXV1N4141-RS, or M38510/63032BXA-RS). This is to re-identify parts with a different part number which have successfully passed upgrade screening.

5.1.1 Rejected Parts. Parts that have been rejected for not meeting any portion of the specified requirements herein shall be identified and packaged separately.

5.2 Electrostatic Discharge Sensitivity. Electrostatic damage preventative packaging and handling is mandatory whether or not the parts are classified as Electrostatic Discharge Sensitive (ESDS). Packages containing ESDS parts shall be identified per the requirements of MIL-STD 1686.

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Table I DPA SAMPLE PER SINGLE LOT DATE CODE	
JANTXV, MIL-I-38535 CLASS Q MIL-M-38510 CLASS B	MIL-STD-883 CLASS B
QPL / QML	DESC/SMD/SCD/Supplier Class ”B”
Pre-screening DPA Shall Be Per SSQ25000 Except As Follows: 1/ 2/ RGA: 3 Parts/0 Accept Number RGA and/or SEM do not have to be re-performed if traceability shows the evaluation(s) were performed on this lot of material 11 Parts/0 Accept Number	Pre-screening DPA Shall Be Per SSQ25000 Except As Follows: 1/ 2/ RGA: 3 Parts/0 Accept Number RGA and/or SEM do not have to be re-performed if traceability shows the evaluation(s) were performed on this lot of material 22 Parts/0 Accept Number
Post-screening DPA Shall Be Per SSQ25000 Except As Follows: Sample Size Of 2, Performing Only External & Internal Visual And Destructive Bond Pull/0 Accept Number	Post-screening DPA Shall Be Per SSQ25000 Except As Follows: Sample Size Of 2, Performing Only External & Internal Visual And Destructive Bond Pull/0 Accept Number

NOTES:

1/ If traceability documentation demonstrates lot homogeneity (single wafer run and single assembly lot as defined in MIL-I-38535) the pre-screening DPA sample size shall be per SSQ25000.

2/ Photo Documentation not required unless anomalies are noted.

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Table II

100% Screening/Test Requirement for Monolithic Microcircuit Devices

SCREEN		MIL-STD 883 METHOD
1.	Temperature Cycle	1010, Test Condition C
2.	PIND	2020, Test Condition A
3.	Serialization	Per paragraph. 3.4 herein
4.	Pre Burn-In Electrical Parameters	As Specified in 5004 for a Class “S” Device, perform all tests per the applicable device specification
5.	Reverse Bias/Static Burn-In (if required per Class ”S” specification)	1015, 72 hours per applicable Class “S” specification
6.	Interim Electrical Parameters	As Specified in 5004 for a Class “S” Device, perform all tests per the applicable device specification
7.	Burn-In Test	1015, 240 hours minimum as specified for Class “S”
8.	Final Electrical Tests and Delta Measurements	As Specified in 5004 for a Class “S” Device, except perform all Class “S” subgroups
9.	Percent Defective Allowable	See paragraph. 3.6 herein
10.	Seal (Fine and Gross Leak)	As specified in 5004 for a Class “S” Device
11.	Life Test 1/	As specified in 5005 for a Class “S” Device

NOTES:

1/ See paragraph 3.7. Seal (fine and gross leak) shall be repeated on the life test sample.

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Table III

100% Screening/Test Requirement for Semiconductor Devices

SCREEN		MIL-STD 750 METHOD
1.	Temperature Cycle	1051 Test Condition C per Table II, MIL-S-19500
2.	Surge 1/	4066, Test Condition B, 10 pulses
3.	PIND	2052, Test Condition A
4.	Serialization	Per paragraph. 3.4 herein
5.	Pre-HTRB Electrical Parameters	Per MIL-S-19500 detail slash sheet for a JANS device(JANTXV with deltas where JANS does not exist)
6.	High Temp Rev. Bias (HTRB) (a) Transistors (b) Power FETs (c) Diodes and Rectifiers	48 hours minimum as specified for a JANS device 1039, 80 percent of rated V_{CB}, V_{GS} or V_{DS}, Test Condition A (as applicable) Gate stress (method 1042 Condition B) 1038, 80% of rated VR, Test Condition A
7.	Interim Electrical Parameters	Per MIL-S-19500 detail slash sheet for a JANS device (JANTXV with deltas where JANS does not exist)
8.	Power Burn-In (a) Bipolar Transistors (b) Power FETS (c) Diodes, Zeners and Rectifiers (d) Thyristors	240 hours, JANS requirement 1039, Test Condition B 1042, Test Condition C (240 hours) and Test Condition A (160 hours) 1038, Test Condition B 1040

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TABLE III (continued)

9.	Final Electrical Tests and Delta Measurements	Per MIL-S-19500 detail slash sheet for a JANS DEVICE (all JANS subgroups) (JANTXV with deltas where JANS does not exist)
10.	PDA	Per 3.6
11.	Seal (Fine and Gross)	1071
12.	Life Test 3/	Per MIL-S-19500 for a JANS device

NOTES:

1/ Surge shall be performed on rectifiers and reverse surge on transient suppressors. Surge shall not apply to axial lead devices.

2/ Perform final electrical measurements within 96 hours after removal of bias.

3/ See paragraph 3.7. Seal (fine and gross leak) shall be repeated on the life test sample.