

10/28/87

INTRODUCTION TO APPENDIX F

THE FOLLOWING CHART SHOWS THE MODE TYPE VERSUS FAILURE MODES AND CAUSES WHICH WERE COMPLETED IN DERIVING THE FAILURE MODES AND EFFECTS ANALYSIS (FMEA'S).

APPENDIX F ITEM NUMBER	#1	#2	#3	#4	#5	#6
FAILURE MODE / Failure Cause	JANIX 1M1148R	JANIX 1M1204RA	JANIX 1M1246	JANIX 1M5551	JANIX 1M1148-1	JANIX 1M1247
OPEN, FAILS TO CONDUCT (a) Structural Failure Mechanical Stress Vibration (c) Electrical Stress (d) Thermal Stress (e) Processing Anomaly	X	X	X	X	X	X
SHORT (END TO END) (a) Structural Failure Mechanical Stress Vibration (b) Contamination (c) Electrical Stress (d) Thermal Stress (e) Processing Anomaly	X	X	X	X	X	X
SHORT TO STRUCTURE (GROUND) (a) Structural Failure Mechanical Stress Vibration (b) Contamination (c) Electrical Stress (d) Thermal Stress (e) Processing Anomaly	X	X				

TABLE 1

NOTE: RATIONALE IS PROVIDED FOR THE JANIX1M1148-1, A METALLURGICAL BOND DIODE, WHICH HAS DEMONSTRATED ITSELF TO BE A RELIABLE PART ON THE ORBITER PROGRAM. THIS RATIONALE SHOULD NOT BE APPLIED TO THE JANIX1M1148 (NO DASH ONE) WHICH HAS HAD A FAILURE HISTORY OF THERMAL COMPRESSION BOND FAILURES.

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APPENDIX F ITEM 3 - DIODE, AXIAL LEAD  
JANTXV1N4246 (1 AMPERE)

RETENTION RATIONALE:

(A) DESIGN, (B) TEST, (C) INSPECTION, (D) FAILURE HISTORY

(A) DESIGN

THE PART IS A ONE AMPERE SILICON SEMICONDUCTOR DIODE. THE SILICON SEMICONDUCTOR CHIP IS INSTALLED IN A HERMETICALLY SEALED CASE. THE PART CASE IS NONCONDUCTIVE, THUS A SHORT TO CASE IS NOT CONSIDERED AS A FAILURE MODE. THE DEVICE IS DESIGNED, QUALIFIED, TESTED AND INSPECTED TO THE REQUIREMENTS OF MIL-S-19500/286. THE PART APPLICATION IS ANALYZED TO ASSURE COMPLIANCE WITH THE 25% DERATING CRITERIA OF THE ORBITER PROJECTS PARTS LIST (OPPL). THIS ANALYSIS ASSURES PROPER ELECTRICAL AND THERMAL APPLICATION.

(B) TEST

THE PART IS SCREENED AND QUALIFIED TO THE REQUIREMENTS OF MIL-S-19500/286. THE FOLLOWING TESTS ARE PERFORMED ON SAMPLE DEVICES REMOVED FROM EACH MANUFACTURING LOT TO DEMONSTRATE QUALIFICATION OF THE LOT:

TEST / INSPECTION	CAUSE CONTROL				
	a	b	c	d	e
PHYSICAL DIMENSIONS	X				X
SOLDERABILITY		X			X
THERMAL CYCLING (150 TO -65 °C)	X			X	X
THERMAL SHOCK (100 TO 0 °C)	X			X	X
TERMINAL STRENGTH	X				X
HERMETIC SEAL (1x10 <sup>-8</sup> CC/SEC)	X	X			X
MOISTURE RESISTANCE	X				X
SHOCK (1,500-G)	X				X
VIBRATION (20-G)	X				X
ACCELERATION (20,000-G)	X				X
SURGE CURRENT (25 AMPERES)					X
HIGH TEMPERATURE LIFE (175 °C, 24 HR)			X		X
OPERATIONAL LIFE (100 °C, 230 HR)	X		X		X
FINAL ELECTRICAL FUNCTIONAL	X	X	X	X	X
		X	X	X	X

QUALIFICATION TESTS (LOT SAMPLE)

## APPENDIX F ITEM 3 CONT'D

TESTS AND INSPECTIONS PERFORMED ON A PERIODIC BASIS TO DEMONSTRATE QUALIFICATION ARE:

TEST / INSPECTION	CAUSE CONTROL				
	a	b	c	d	e
REDUCED BAROMETRIC PRESSURE	X				X
THERMAL RESISTANCE	X		X		X
FINAL ELECTRICAL FUNCTIONAL TESTS		X	X	X	X
SALT ATMOSPHERE (CORROSION)	X				X

## QUALIFICATION TESTS (PERIODIC)

TESTS AND INSPECTIONS ARE PERFORMED ON ALL PARTS TO DEMONSTRATE PROCESSES AND CONTROLS ARE ADEQUATELY PROVIDING A RELIABLE PRODUCT:

TEST / INSPECTION	CAUSE CONTROL				
	a	b	c	d	e
INTERNAL VISUAL INSPECTION	X	X			X
HIGH TEMPERATURE LIFE	X			X	X
THERMAL CYCLING	X			X	X
ACCELERATION	X				X
HERMETIC SEAL ( $1 \times 10^{-8}$ CC/SEC)	X	X			X
BURN-IN (150 °C, 96 HR)		X	X	X	X
ELECTRICAL FUNCTIONAL TESTS		X	X	X	X

## QUALITY CONFORMANCE TESTS (ALL PARTS)

## (C) INSPECTION

THE PART HAS REQUIRED INSPECTIONS DURING MANUFACTURING PROCESS IN ACCORDANCE WITH THE REQUIREMENTS OF MIL-S-19500/286. IN ADDITION, THE PART SUPPLIER IS REQUIRED TO HAVE QUALITY CONTROL (QC) PRACTICES IN ACCORDANCE WITH THE REQUIREMENTS OF MIL-S-19500 APPENDIX D. THE REQUIREMENTS ARE TO ASSURE ADEQUATE PROCESS CONTROLS ARE IMPOSED BY THE PART SUPPLIER ON THE PARTS MANUFACTURING PROCESS. THE PROCESSES AND CONTROLS ARE ROUTINELY REVIEWED AND APPROVED BY THE QUALIFYING AGENCY (DEFENSE ELECTRONIC SUPPLY CENTER).

## APPENDIX F ITEM 3 CONT'D

## RECEIVING INSPECTION (FAILURE CAUSE b,c,e)

INSPECTION OF INCOMING MATERIALS, UTILITIES AND WORK-IN PROCESSES (WAFERS, PACKAGES, WIRE, WATER PURIFICATION) IS REQUIRED OF THE PART SUPPLIER.

## CLEANLINESS CONTROL (FAILURE CAUSE b)

THE PART SUPPLIER IS REQUIRED TO HAVE CLEANLINESS AND ATMOSPHERE CONTROL IN CRITICAL WORK AREAS TO THE REQUIREMENTS OF FED-STD-209.

## ASSEMBLY/INSTALLATION (FAILURE CAUSE a,b,e)

THE PART SUPPLIER IS REQUIRED TO HAVE INSPECTION CRITERIA, FINAL LOT DISPOSITION AND RECORDS RETENTION. THE MANUFACTURER IS ALSO REQUIRED TO SUBMIT A PROGRAM PLAN ESTABLISHING A MANUFACTURING FLOW CHART, INTERNAL AUDIT ACTIVITIES AND EXAMPLES OF DESIGN, MATERIAL EQUIPMENT STANDARDS AND PROCESS INSTRUCTIONS FOR APPROVAL BY THE QUALIFYING AGENCY. THE SUPPLIER IS ALSO REQUIRED TO PERFORM AN INTERNAL VISUAL INSPECTION OF THE DEVICE.

## CRITICAL PROCESSES (FAILURE CAUSE b,e)

THE PART SUPPLIER MUST HAVE REQUIREMENTS AND CONTROLS ON MATERIALS PREPARATION (LAPPING, POLISHING, ETCHING, AND CLEANING); BONDING CRITERIA; REWORK CRITERIA; DIE ATTACHMENT AND SUPPORT; DESIGN, PROCESSING, MANUFACTURING, TESTING, AND INSPECTION DOCUMENTATION AND CHANGE CONTROL; PERSONNEL TRAINING; MASKING; PHOTORESIST REGISTRATION; OXIDATION OR PASSIVATION; METALLIZATION AND FILM DEPOSITION; SEALING PROCESSES, FAILURE / DEFECT ANALYSIS AND CORRECTIVE ACTION; INVENTORY CONTROL; AND VISUAL INSPECTION.

## TESTING (FAILURE CAUSE a,c,d,e)

THE PART SUPPLIER MUST HAVE TEST EQUIPMENT MAINTENANCE AND CALIBRATION CONTROLS WHICH HAVE BEEN APPROVED BY THE QUALIFYING AGENCY. SUPPLIER MUST ALSO MAINTAIN QUALITY CONTROL INSPECTION TEST DOCUMENTATION AND FINAL LOT DISPOSITION.

## HANDLING/PACKAGING (FAILURE CAUSE a)

THE DEVICES ARE PACKAGED AND HANDLED TO THE REQUIREMENTS OF MIL-S-19491. THE SUPPLIER IS REQUIRED TO INCLUDE TRACEABILITY (PRODUCT LOT IDENTIFICATION).

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APPENDIX F ITEM 3 CONT'D

(D) FAILURE HISTORY

SHUTTLE PROGRAM PART FAILURE HISTORY INDICATES NO REPORTED FAILURES FOR THIS DEVICE TYPE. A REVIEW OF GIDEP PRIOR MILITARY PART FAILURE HISTORY REVEALS NO UNCORRECTED GENERIC ISSUES EXIST.

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