

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 DICER, 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.

APPENDIX F ITEM 2 - DIODE, POWER - STUD MOUNT
JANTX1N1204RA (12 AMPERE)

RETENTION RATIONALE:

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

(A) DESIGN

THE PART IS A 12 AMPERE SILICON SEMICONDUCTOR DIODE. THE SILICON SEMICONDUCTOR CHIP IS INSTALLED IN A STUD MOUNT CASE WHICH IS MADE OF CORROSION RESISTANT METAL, HERMETICALLY SEALED BY WELDING. THE ANODE OF THE SILICON CHIP IS ELECTRICALLY CONNECTED TO THE CASE. THE CATHODE IS ELECTRICALLY CONNECTED TO THE INSULATED TERMINAL. THIS TERMINAL / CASE ARRANGEMENT RESULTS IN LOSS OF ONLY ONE POWER OR CONTROL SIGNAL PATH, SHOULD THE CASE BE SHORTED TO GROUND, REDUNDANT POWER OR CONTROL SIGNALS WILL NOT BE AFFECTED. THE DEVICE IS DESIGNED, QUALIFIED, TESTED AND INSPECTED TO THE REQUIREMENTS OF MIL-S-19500/260. 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-19500/260. 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
SOLDERABILITY		X			X
RESISTANCE TO SOLVENTS	X				X
THERMAL CYCLING (150 TO -65 °C)	X			X	X
HERMETIC SEAL (5×10^{-8} CC/SEC)	X	X			X
ELECTRICAL FUNCTIONAL		X	X	X	X
OPERATIONAL LIFE (100°C, 500 HR)	X	X	X	X	X
DESTRUCTIVE PHYSICAL ANALYSIS	X	X			X
THERMAL RESISTANCE	X			X	X
HIGH TEMPERATURE LIFE (200 °C, NON-OPERATING)	X			X	X
FINAL ELECTRICAL FUNCTIONAL		X	X	X	X

QUALIFICATION TESTS (LOT SAMPLE)

11/02/87 (8:40am)

APPENDIX F ITEM 2 CONT'D

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

TEST / INSPECTION	CAUSE CONTROL				
	a	b	c	d	e
PHYSICAL DIMENSIONS	X				X
THERMAL SHOCK (100 TO 0 °C)	X			X	X
TERMINAL STRENGTH	X				X
HERMETIC SEAL	X	X			X
MOISTURE RESISTANCE	X				X
EXTERNAL VISUAL AND MECHANICAL INSPECTION	X				X
SHOCK (1,500-G)	X				X
VIBRATION	X				X
ACCELERATION (10,000-G)	X				X
SALT ATMOSPHERE (CORROSION)	X				X
REDUCED BAROMETRIC PRESSURE	X				X
OPERATIONAL LIFE	X	X	X	X	X
FINAL ELECTRICAL FUNCTIONAL		X	X	X	X

QUALIFICATION TESTS (PERIODIC)

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

TEST / INSPECTION	CAUSE CONTROL				
	a	b	c	d	e
HIGH TEMPERATURE LIFE	X			X	X
THERMAL CYCLING	X			X	X
ACCELERATION	X				X
HERMETIC SEAL	X	X			X
BURN-IN (150°C, 96 HR)		X	X	X	X
ELECTRICAL FUNCTIONAL		X	X	X	X

QUALITY CONFORMANCE TESTS (ALL PARTS)

11/03/87

APPENDIX F ITEM 2 CONT'D

(C) INSPECTION

THE PART HAS REQUIRED INSPECTIONS DURING MANUFACTURING PROCESS IN ACCORDANCE WITH THE REQUIREMENTS OF MIL-S-19500/260. 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).

RECEIVING INSPECTION (FAILURE CAUSE a,b)

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 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.

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; AND INVENTORY CONTROL.

11/03/87

APPENDIX F ITEM 2 CONT'D

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).

(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.

PREPARED BY:

DESIGN I. CHASE
RELIABILITY M. HOVE
QUALITY J. COURSEN

APPROVED BY:

DES. I. Chase
REL. M. Hove
QE. J. Coursen

APPROVED BY (NASA):

SSM P. C. ... 11/3/87
REL P. ... 11/3/87
QE ... 11/3/87