1006323 C

REVISIONS						
SYM	ZONE	DESCRIPTION	DR	CHK	DATE	APPROVED
-		INITIAL RELEASE CLASS A PER TDRR 17476			10 Mar 65	WK
A		REVISED PER TDRR 20619			6/17/65	WK
B		REVISED PER TDRR 24263			11/30/65	WK
C		REVISED PER TDRR 25023			1/11/66	WK

REQUIREMENTS:

1. GENERAL:

A. INTERPRET DRAWING IN ACCORDANCE WITH STANDARDS PRESCRIBED BY MIL-D-70327.

B. UNITS SHALL MEET THE REQUIREMENTS OF MIL-S-19500 EXCEPT AS, AND IN ADDITION TO THE REQUIREMENTS, SPECIFIED HEREIN.

C. SUPPLIER SHALL CONFORM TO THE QUALITY ASSURANCE PROVISIONS CONTAINED IN ND 1015404, CLASS 2.

D. UNITS SHALL BE CAPABLE OF MEETING THE QUALIFICATION REQUIREMENTS OF ND 1002051.

E. MARKING:

(1) PARTS SHALL BE PERMANENTLY AND LEGIBLY MARKED, IN ACCORDANCE WITH ND 1002019, WITH THE NASA PART NUMBER (DRAWING NUMBER AND REVISION LETTER) OR AS MANY SIGNIFICANT DIGITS AS POSSIBLE (E.G. 6323). OTHER MARKING SUCH AS MANUFACTURER'S IDENTIFICATION AND TYPE NUMBER IS PERMISSIBLE.

F. PREPARATION FOR DELIVERY SHALL BE IN ACCORDANCE WITH ND 1002215, CLASS I, CODE 2.

(1) MARKING OF SHIPPING CONTAINERS SHALL CONFORM TO THE MARKING OF UNIT AND INTERMEDIATE PACKAGES AND THE METHODS OF MARKING AS SPECIFIED IN ND 1002215.

2. ACCEPTANCE AND INSPECTION:

A. MECHANICAL PROPERTIES:

(1) DIMENSIONS: AS DELINEATED HEREIN.

B. SEAL TEST: THE UNITS SHALL BE SUBJECTED TO A HELIUM OR RADIFLO LEAK DETECTION TEST WITH A SENSITIVITY OF AT LEAST 1×10^{-8} CC/ATM/SEC AND A HOT GLYCERINE BUBBLE TEST FOR GROSS LEAKS. THE LEAK TEST SHALL BE PERFORMED IN ACCORDANCE WITH MIL-STD-202C METHOD 112. TEST CONDITION C SHALL BE USED FOR THE HELIUM OR RADIFLO TEST. TEST CONDITION A SHALL BE USED FOR THE GROSS LEAK TEST EXCEPT THAT GLYCERINE SHALL REPLACE THE MINERAL OIL. A LEAKAGE RATE OF 1×10^{-8} CC-ATM-SEC OR GREATER SHALL CONSTITUTE A FAILURE.

C. ELECTRICAL CHARACTERISTICS: PER TABLES I, II, AND III AS LISTED BELOW:

(1) PRE-ELECTRICAL TEST PROCESSING: ON LOTS OF 500 OR LESS, THE TESTS OF TABLE I SHALL BE PERFORMED IN THE SEQUENCE INDICATED BEFORE THE TESTS OF TABLE II.

(2) ELECTRICAL TESTING: THE TESTS LISTED IN TABLE II SHALL BE PERFORMED AS LISTED BELOW:

- COLLECTOR CUTOFF CURRENT
- COLLECTOR-BASE BREAKDOWN VOLTAGE
- EMITTER-BASE BREAKDOWN VOLTAGE
- EMITTER-BASE REVERSE CURRENT
- COLLECTOR-EMITTER SUSTAINING VOLTAGE
- COLLECTOR-EMITTER CURRENT
- COLLECTOR-EMITTER THRESHOLD CURRENT
- DIRECT CURRENT GAIN
- BASE-EMITTER SATURATION VOLTAGE
- COLLECTOR-EMITTER SATURATION VOLTAGE
- COLLECTOR CAPACITANCE
- TURN-ON AND TURN-OFF TIME

(3) QUALITY DEMONSTRATION TESTING:

PER TABLE III ON LOTS MORE THAN 500 UNITS USING ACCEPTABLE UNITS FROM SUBGROUP 2 OF TABLE II FOR SUBGROUP 2,3, & 4 OF TABLE III. SUBGROUPS 1 & 5 MAY USE ELECTRICAL REJECTS FROM THE SAME LOT.

D. VENDOR SUPPLIED DATA: EACH SHIPMENT OF PARTS SHALL BE ACCOMPANIED BY THE FOLLOWING DOCUMENTATION.

(1) CERTIFICATE OF COMPLIANCE WITH LEAD MATERIAL REQUIREMENT.

(2) CERTIFICATE OF COMPLIANCE WITH ND 1015404, CLASS 2.

(3) "A CERTIFICATE OF COMPLIANCE WITH PARA 2.C (1) OR 2.C(3). UNITS USED IN QUALITY DEMONSTRATION TESTS OF TABLE III WILL NOT BE SHIPPED AS PART OF THE DELIVERY SCHEDULE BUT WILL BE FORWARDED UNDER SEPARATE COVER WITH TEST DATA FOR EACH LOT SHIPMENT.

3. DESIGN:

A. STORAGE LIFE: INDEFINITE WHEN STORED AT TEMPERATURES BETWEEN -65°C AND +150°C.

B. ABSOLUTE MAXIMUM RATINGS AT 25°C AMBIENT.

(1) COLLECTOR-EMITTER VOLTAGE (V_{CEO}): 35 VDC

(2) COLLECTOR-BASE VOLTAGE (V_{CBO}): 60 VDC

(3) EMITTER-BASE VOLTAGE (V_{EBO}): 5 VDC

(4) COLLECTOR CURRENT (I_C): 600 MILLIAMPERES

(5) THERMAL RESISTANCE, JUNCTION-CASE (θ_{JC}): 50°C/WATT

(6) THERMAL RESISTANCE, JUNCTION-AMBIENT (θ_{JA}): 350°C/WATT

(7) TEMP. RANGE, JUNCTION, OPERATING: -65°C TO +150°C

(8) TEMP. RANGE, STORAGE: -65°C TO +150°C

C. CONSTRUCTION:

(1) SEMICONDUCTOR: SILICON PLANAR EPITAXIAL NPN

(2) CASE: METAL CASE AND METAL HEADER HERMETICALLY SEALED (JEDEC TO -18)

(3) COLLECTOR SHALL BE ELECTRICALLY CONNECTED TO THE CASE INTERNALLY.

(4) LEAD MATERIAL: WELDABLE, GOLD PLATED, ANNEALED IRON-NICKEL-COBALT (KOVAR) ALLOY IN ACCORDANCE WITH ND 1015402.

D. QUALITY ASSURANCE REQUIREMENTS:

(1) LOT DEFINITION: A GROUP OF PARTS IN A SINGLE PROCUREMENT SELECTED FROM A SINGLE CONTINUOUS PRODUCTION RUN USING LIKE MATERIALS WHICH ARE CONTROLLED USING A PROCESS WHICH IS THE SAME FROM THE BEGINNING TO THE END OF THE RUN.

(2) INSPECTION CONDITIONS: UNLESS OTHERWISE SPECIFIED, ALL INSPECTIONS SHALL BE MADE AT AN AMBIENT TEMPERATURE OF +25° ± 3°C.

MASTER

PROCURE ONLY FROM APPROVED SOURCES LISTED IN ND 1002034 FOR THIS DRAWING.

QTY REQD	PART OR IDENTIFYING NO.	MATERIAL OR NOTES	NOMENCLATURE OR DESCRIPTION	FIND NO.

LIST OF MATERIALS

NEXT ASSY	USED ON
APPLICATION	

UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES
CAPACITOR VALUES ARE IN μf
RESISTOR VALUES ARE IN OHMS
TOLERANCES ON
FRACTIONS ± DECIMALS ± ANGLES ±
DO NOT SCALE THIS DRAWING
MATERIAL

MIT INSTRUMENTATION LAB
CAMBRIDGE, MASS.

DRAWN 10 Feb 65
CHECKED 10 Feb 65
APPROVED
APPROVED 18 Mar 65
APPROVED MIT 18 Mar 65
APPROVED MSC 3/1/65
DATE

MANNED SPACECRAFT CENTER
HOUSTON, TEXAS

TRANSISTOR, SILICON, TYPE NPN, SWITCHING

SPECIFICATION CONTROL DRAWING

CODE IDENT NO. 80230 | SIZE C | DRAWING NO. 1006323

SCALE | SHEET 1 OF 4

REVISIONS

SYM	DESCRIPTION	DATE	APPROVAL
—	INITIAL RELEASE CLASS A PER TDRR 17476	18 Mar 65	WK
A	REVISED PER TDRR 20619	6/17/65	WK
B	REVISED PER TDRR 24263	11/30/65	WK
C	REVISED PER TDRR 25023	1/11/66	WK

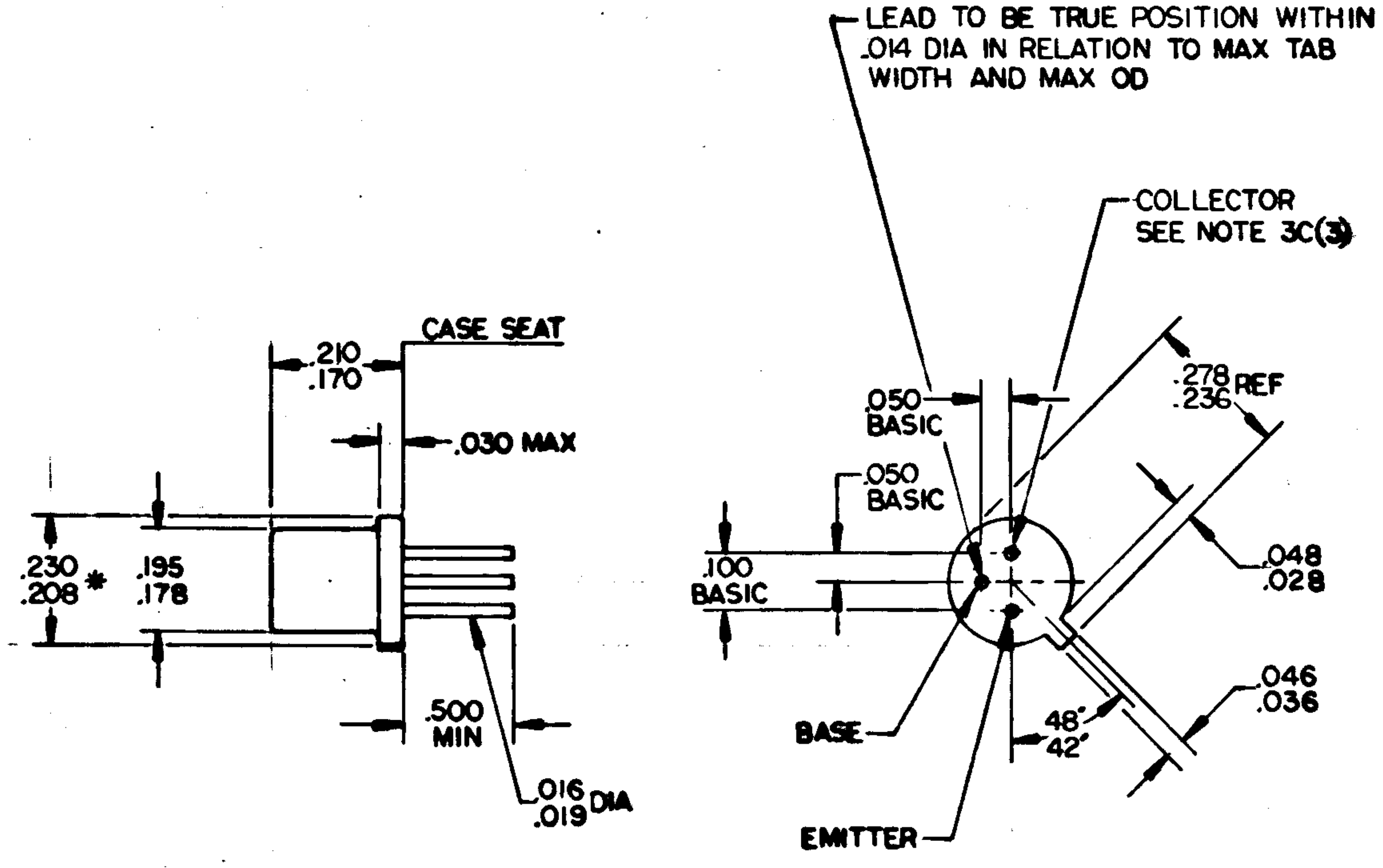
TABLE I

PRE-ELECTRICAL TEST PROCESSING

TEST	MIL-STD-750 TEST CONDITIONS	LOT 1 TO 500	LOT OVER 500
THERMAL SHOCK *	METHOD 1056, CONDITION B (+150°C TO -65°C, 3 CYCLES)	100%	NO REQUIREMENT
STORAGE LIFE * (HIGH TEMPERATURE STABILIZATION)	METHOD 1031, Tstg = 150° ± 5°C, 72 $^{+8}_{-4}$ HOURS	↓	↓
CONSTANT ACCELERATION *	METHOD 2006 (20,000 G) Y AXIS	↓	↓
POWER, BURN-IN *	METHOD 1026 P = 350 MILLIWATTS V_{CE} = +20.0 VOLTS MINIMUM T_A = +22°C MIN IN FREE AMBIENT AIR t = 168 $^{+12}_{-6}$ HOURS	↓	↓
SEAL TEST *	SEE NOTE 2.B	↓	↓

*TEST TO BE PERFORMED IN ORDER INDICATED
**PULSE ≤ 300u SECS AT ≤ 2% DUTY CYCLE.
***LTPD OR λPER MIL-S-19500D, TABLE CI OR CII
****THE PARAMETER MEASURED MAY NOT CHANGE ANY GREATER THAN THE PERCENTAGE SPECIFIED BETWEEN THE INITIAL VALUE AND THE END OF TEST VALUE. VALUES OF COLLECTOR AND EMITTER CUTOFF CURRENTS LESS THAN 10 NANOAMPERES MAY BE CONSIDERED TO BE 10 NANOAMPERES FOR CALCULATING PERCENTAGE CHANGE.

@ CURRENTS TO WITHIN ±10%



QTY REQD	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION	FIND NO.

LIST OF MATERIALS

NEXT ASSY	USED ON
APPLICATION	

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES ON FRACTIONS ± DECIMALS ± ANGLES ±
DO NOT SCALE THIS DRAWING
MATERIAL: SEE NOTE
HEAT TREATMENT: NONE
FINAL FINISH: NONE

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DWG. NO. CONTRACT
DRAWN [signature] DATE
CHECKED [signature] 8 FEB 65
APPROVAL
APPROVAL Eldon C. Hall 18 Mar 65
NASA APPROVAL [signature]
MIT APPROVAL [signature] 18 Mar 65
MIT APPROVAL

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TRANSISTOR, SILICON, TYPE NPN, SWITCHING
SPECIFICATION CONTROL DRAWING

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SCALE NONE | WT | SHEET 2 OF 4

C 1006323

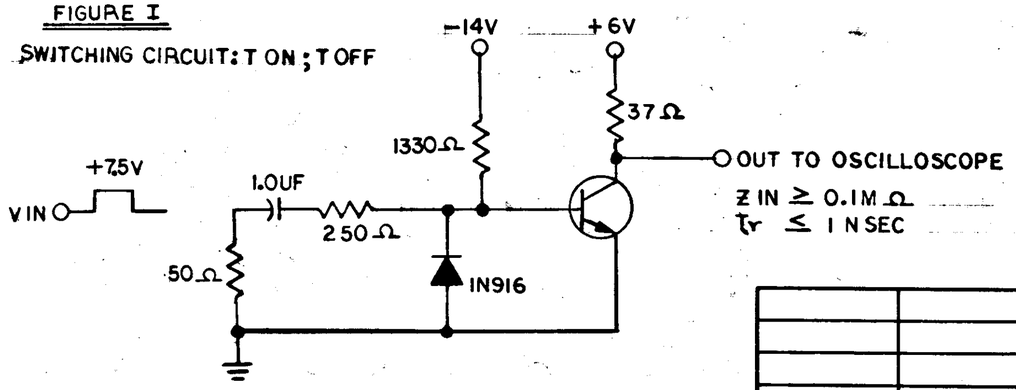
REVISIONS					
SYM	DESCRIPTION	DR	CHK	DATE	APPROVED
-	INITIAL RELEASE CLASS A PER TDRR 17476			4/14/65	WR
A	REVISED PER TDRR 20619	[illegible]		8/17/65	WR
B	REVISED PER TDRR 24263	[illegible]		11/30/65	WR
C	REVISED PER TDRR 25023			1/11/66	WR

TABLE II

ACCEPTANCE INSPECTION							
TEST	SYMBOL	MIL-STD-750 TEST CONDITIONS T_A = 25° ± 3°C UNLESS SPECIFIED	LIMIT MIN	LIMIT MAX	UNITS	LOT 1 TO 500	LOT OVER 500
SUBGROUP 1							
VISUAL AND MECHANICAL EXAMINATION		METHOD 2071				LTPD**= 10 MAX ACC NO.= 3	LTPD**= 10 MAX ACC NO. = 3
SUBGROUP 2							
COLLECTOR CUTOFF CURRENT	I_{CBO}	V_{CB} = 30 V; I_E = 0		50	nA	100%	LTPD**= 2 (COMBINED) MAX ACC NO.= 3
COLLECTOR CUTOFF CURRENT 150°C	I_{CBO}	V_{CB} = 30 V; I_E =0, T_A = +150°C		200	uA		
COLLECTOR-BASE BREAKDOWN VOLTAGE	BV_{CBO}	I_C = 100uA; I_E = 0	60		V		
EMITTER-BASE REVERSE CURRENT	I_{EBO}	V_{EB} = 3 V; I_C = 0		100	nA		
EMITTER-BASE BREAKDOWN VOLTAGE	BV_{EBO}	I_E = 100uA; I_C = 0	5		V		
COLLECTOR-EMITTER SUSTAINING VOLTAGE**	V_{CEO} SUST	I_C = 30mA PULSED I_B = 0	35		V		
COLLECTOR-EMITTER CURRENT RES. RETURN	I_{CER}	V_{CE} = 30 V: R_{BE} = 100 K		10	uA		
COLLECTOR-EMITTER THRESHOLD CURRENT	I_{CEX}	V_{BE} = +0.4V: V_{CE} =40V		10	uA		
DC CURRENT GAIN **	h_{FE}	I_C = +500 mA; V_{CE} = +10 V	25				
DC CURRENT GAIN **	h_{FE}	I_C = +150 mA; V_{CE} = +10 V	40	120			
DC CURRENT GAIN **	h_{FE}	I_C = +10 mA; V_{CE} = +10 V	30				
BASE-EMITTER SATURATION VOLTAGE **	V_{BE} SAT	I_C = 500 mA; I_B = 50 mA	1.10	1.30	V		
COLLECTOR-EMITTER SATURATION VOLTAGE**	$V_{CE(sat)}$	I_C = 150 mA; I_B = 15 mA		0.40	V		
COLLECTOR-EMITTER SATURATION VOLTAGE**	$V_{CE(sat)}$	I_C = 500 mA; I_B = 50 mA		1.0	V		
COLLECTOR CAPACITANCE	C_{ob}	V_{CB} = -10 V; I_E = 0; F = 0.14 mc		8	PF		
TURN ON TIME } TEST IN CIRCUIT OF FIGURE I	t_{on}	I_{B1} ≈ 15 mA; I_C ≈ 150 mA t_w > 400 nsec 2% DUTY CYCLE		25	NSEC	LTPD***=5 MAX ACC NO =0	LTPD***=5 MAX ACC NO =0
TURN OFF TIME }	t_{off}	I_{B1} = I_{B2} ≈ 15 mA; I_C ≈ 150 mA t_w > 400 nsec 2% DUTY CYCLE		80	NSEC		

FIGURE I

SWITCHING CIRCUIT: T ON ; T OFF



VOLTAGE IN: VIN = +7.5V
PULSE WIDTH: PW = 0.5 USEC
TOTAL RISE, FALL: $t_r + t_f \leq 6$ NSEC
IMPEDANCE IN: Z IN = 50 Ω

MASTER

NEXT ASSY	USED ON
APPLICATION	

UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES
CAPACITOR VALUES ARE IN μf
RESISTOR VALUES ARE IN OHMS
TOLERANCES ON
FRACTIONS DECIMALS ANGLES
± ± ±
DO NOT SCALE THIS DRAWING

MATERIAL

QTY REQD	PART OR IDENTIFYING NO.	MATERIAL OR NOTES	NOMENCLATURE OR DESCRIPTION	FIND NO.

LIST OF MATERIALS

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DRAWN	PMS	9 FEB 65
CHECKED		10 Feb 65
APPROVED		
APPROVED		15 March 65
APPROVED MIT		17 March 65
APPROVED MSC		3/17/66

TRANSISTOR, SILICON, TYPE NPN, SWITCHING
SPECIFICATION CONTROL DRAWING

CODE IDENT NO. 80230 | SIZE C | DRAWING NO. 1006323

SCALE | SHEET 3 OF 4

C 1006323

REVISIONS						
SYM	ZONE	DESCRIPTION	DR	CHK	DATE	APPROVED
-		INITIAL RELEASE CLASS A PER TDRR 17476			10 Feb 65	WH
A		REVISED PER TDRR 20619			8/17/65	WH
B		REVISED PER TDRR 20263			11/30/65	WH
C		REVISED PER TDRR 25023			1/11/66	WH

TABLE III

TEST	QUALITY DEMONSTRATION TESTS MIL-STD-750 TEST CONDITIONS	LOT 1 TO 500	LOT OVER 500
SUBGROUP 1 PHYSICAL DIMENSIONS	METHOD 2066	NO REQUIREMENTS	*** LTPD = 20 MAX ACC NO. = 1
SUBGROUP 2* THERMAL SHOCK SEAL TEST	METHOD 1056.1 (+150 °C TO -65°C, 5 CYCLES) SEE NOTE 2.B		*** LTPD = 10 (COMBINED) MAX ACC NO.= 3
SUBGROUP 3* STORAGE LIFE SHOCK VIBRATION VARIABLE FREQUENCY CONSTANT ACCELERATION	METHOD 1031.1 Tstg = 150 ° ± 5°C, 1000 HOURS METHOD 2016.1 1500 G, 0.5 MSEC 5 BLOWS EACH IN X1, Y1, Y2, Z1 DIRECTIONS, 20 BLOWS TOTAL METHOD 2056, 30 G FROM 5 TO 2000 CPS LIMITED TO 0.12 DOUBLE AMPLITUDE, 3 CYCLES, 15 MINUTES PER CYCLE MINIMUM. METHOD 2006, 20,000 G Y AXIS		*** LTPD = 10 (COMBINED) MAX ACC NO.= 3
SUBGROUP 4 OPERATION LIFE	METHOD 1026.1 P = 350 MILLIWATTS V_{CE} = +20 VOLTS MINIMUM T_A = +22°C MIN IN FREE AMBIENT AIR t = 1000 HOURS		** * = 10 MAX ACC NO.= 3
SUBGROUP 5* LEAD TENSION (COND. A) LEAD FATIGUE (COND. E)	METHOD 2036.1 4 POUND LOAD FOR 10 SECONDS 3 ARCS		*** LTPD = 20 (COMBINED) MAX ACC NO.= 3

TABLE III (CONTINUED)

TEST	SYMBOL	TEST CONDITION	LIMIT
END POINTS FOR SUBGROUP 2 COLLECTOR CUTOFF CURRENT EMITTER-BASE REVERSE CURRENT DC CURRENT GAIN	I_{CBO} I_{EBO} hFE	V_{CB} = 30 V, I_E = 0 V_{EB} = +3 V, I_C = 0 V_{CE} = +10 V, I_C = 150 mA	±50% **** ±50% **** ±10% ****
END POINTS FOR SUBGROUPS 3 & 4 COLLECTOR CUTOFF CURRENT EMITTER-BASE REVERSE CURRENT DC CURRENT GAIN	I_{CBO} I_{EBO} hFE	V_{CB} = +30 V, I_E = 0 V_{EB} = +3 V, I_C = 0 V_{CE} = +10 V, I_C = 150 mA	±100% **** ±100% **** ±20% ****
COLLECTOR CUTOFF CURRENT EMITTER CUTOFF CURRENT DC CURRENT GAIN	I_{CBO} I_{EBO} hFE	V_{CB} = +30 V, I_E = 0 V_{EB} = +3 V, I_C = 0 V_{CE} = +10 V, I_C = 150 mA	±100% * ±100% * ±20% *

* THE CHANGE IN MEASURED VALUE MAY NOT CHANGE BY GREATER THAN THE PERCENTAGE SPECIFIED FROM THE INITIAL VALUE AND THE END OF [illegible] OF COLLECTOR TO EMITTER CUTOFF CURRENTS LESS THAN [illegible] MAY BE DISREGARDED TO BE NOT APPLICABLE FOR THE PERCENTAGE CHANGE.

MASTER

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CHECKED		10 Feb 65
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APPROVED		13 [illegible] 65
APPROVED MIT		[illegible] 65
APPROVED MSC		3/11/65

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SPECIFICATION CONTROL DRAWING

CODE IDENT NO. 80230 | SIZE C | DRAWING NO. 1006323

SCALE | SHEET 4 OF 4