

NOTICE - WHEN GOVERNMENT DRAWINGS, SPECIFICATIONS, OR OTHER DATA ARE USED FOR ANY PURPOSE OTHER THAN IN CONNECTION WITH A DEFINITELY RELATED GOVERNMENT PROCUREMENT OPERATION, THE UNITED STATES GOVERNMENT THEREBY INCURS NO RESPONSIBILITY FOR ANY OBLIGATION WHATSOEVER, AND THE FACT THAT THE GOVERNMENT MAY HAVE FORMULATED, FURNISHED OR IN ANY WAY SUPPLIED THE SAID DRAWINGS, SPECIFICATIONS OR OTHER DATA IS NOT TO BE REGARDED BY IMPLICATION OR OTHERWISE AS AN ENDORSEMENT, LICENSING THE HOLDER OR ANY OTHER PERSON OR CORPORATION, OR CONVEYING ANY RIGHTS OR PERMISSION TO MANUFACTURE, USE, OR SELL ANY PATENTED INVENTION THAT MAY IN ANY WAY BE RELATED THEREBY.

REQUIREMENTS:

1. GENERAL:

- INTERPRET DRAWING IN ACCORDANCE WITH STANDARDS PRESCRIBED BY MIL-D-70327.
- SUPPLIER SHALL CONFORM TO THE QUALITY ASSURANCE PROVISIONS SPECIFIED IN ND 1015404, CLASS 1
- UNITS SHALL BE CAPABLE OF MEETING ALL THE QUALIFICATION REQUIREMENTS OF ND 1002051, UNLESS MODIFIED OR AMENDED BY DESIGN REQUIREMENTS SECTION OF THIS DRAWING.
- PRESERVATION, PACKAGING, PACKING, AND CONTAINER MARKING PER ND-1002215, CLASS I, CODE 2.

2. INSPECTION AND ACCEPTANCE:

A. MECHANICAL REQUIREMENTS:

- LEAD DATA: KOVAR WITH GOLD PLATING PER ND1015402
A CERTIFICATE OF COMPLIANCE WITH THIS REQUIREMENT SHALL ACCOMPANY EACH SHIPMENT.
- MARKING: THE NASA DRAWING NO. (LAST THREE DIGITS REQ'D), DASH NO. AND THE MFR'S NAME, TRADEMARK OR CODE; DATE CODE, LOT CODE, AND SERIAL NO. SHALL BE PERMANENTLY AND LEGIBLY MARKED ON THE PART PER ND-1002019. MARKING OF UNIT PACKAGES AND EXTERIOR SHIPPING CONTAINERS SHALL INCLUDE THE NASA DRAWING NO. THE MFR'S PART NO. MAY APPEAR ON THE PACKAGE.

3) MECHANICAL DIMENSIONS PER OUTLINE SHOWN.

B. ELECTRICAL REQUIREMENTS: PER TABLE II & III

- COLLECTOR CUTOFF CURRENT (I_{CBO}) AT 100°C
- EMITTER CUTOFF CURRENT (I_{EBO})
- SWITCHBACK VOLTAGE (V_{CE0})
- STATIC FORWARD CURRENT TRANSFER RATIO (h_{FE})
- STATIC FORWARD CURRENT TRANSFER RATIO, RATIO.
- BASE VOLTAGE DIFFERENTIAL.

7) COLLECTOR SATURATION VOLTAGE $V_{CE(SAT)}$

3. DESIGN REQUIREMENTS:

- ELECTRICAL RATING: PER TABLE I
- ELECTRICAL CHARACTERISTICS: PER TABLES II & III
- STORAGE AND OPERATING JUNCTION TEMPERATURE: -65°C TO +200°C
- POWER DISSIPATION: (EACH ELEMENT)
 - AT 25°C CASE TEMPERATURE: 1.5 WATTS.
 - AT 100°C CASE TEMPERATURE: 860 MILLIWATTS.
 - AT 25°C AMBIENT TEMPERATURE: 500 MILLIWATTS.
- POWER DISSIPATION (DUAL) TOTAL:
 - AT 25°C CASE TEMPERATURE: 3 WATTS.
 - AT 100°C CASE TEMPERATURE: 1.7 WATTS.
 - AT 25°C AMBIENT TEMPERATURE: 600 MILLIWATTS.

PROCURE ONLY FROM APPROVED SOURCES LISTED ON ND1002034 FOR THIS DRAWING ONLY

4. SPECIAL CONDITIONING BY SUPPLIER:

- ALL UNITS SHALL HAVE SUCCESSFULLY PASSED THE FOLLOWING SCREENING TESTS PERFORMED DURING THE TIME INTERVAL BETWEEN THE FINAL SEAL AND THE 240 HOUR BURN-IN.
 - ACCELERATION AT 20,000 G MINIMUM IN THE Y_1 ORIENTATION PER MIL-STD-750, METHOD 2006, OR IMPACT SHOCK AT 28K G MINIMUM IN THE Y_1 ORIENTATION.
 - HELIUM LEAK PER MIL-STD-202, METHOD 112, TEST CONDITION C, PROCEDURE III a or b. A LEAK RATE OF 1×10^{-8} ATM CC/SEC OR GREATER SHALL CONSTITUTE A FAILURE.
 - GROSS LEAK PER MIL-STD-202, METHOD 112, TEST CONDITION A. GLYCERIN MAY BE USED IN LIEU OF MINERAL OIL.

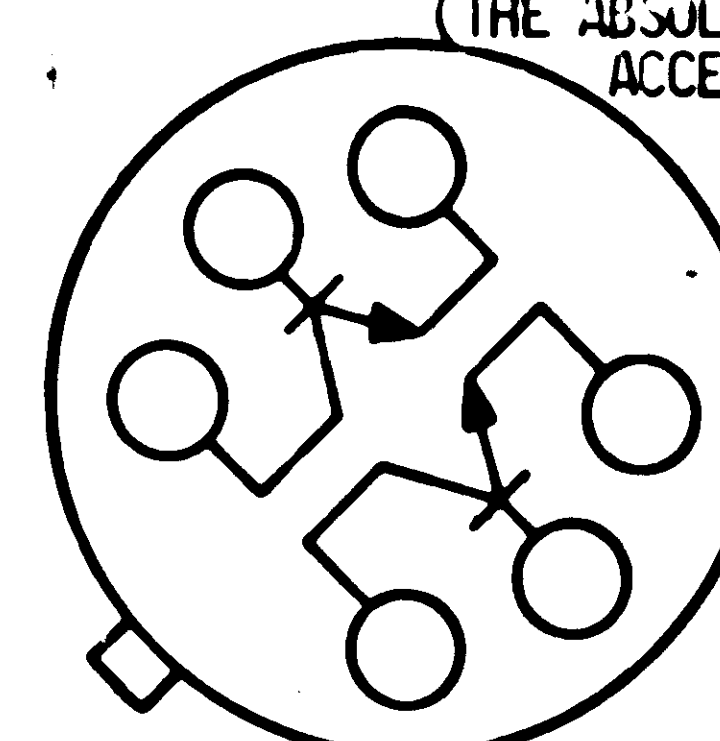
B. BURN-IN: UNITS SHALL BE BURNED-IN FOR 240 HOURS AT THE FOLLOWING CONDITIONS:

- AMBIENT TEMPERATURE: $25^\circ \pm 5^\circ\text{C}$
- COLLECTOR VOLTAGE V_{CE} : 45 ± 5 VDC PER ELEMENT
- POWER DISSIPATION: 150 MW $\pm 10\%$ PER ELEMENT

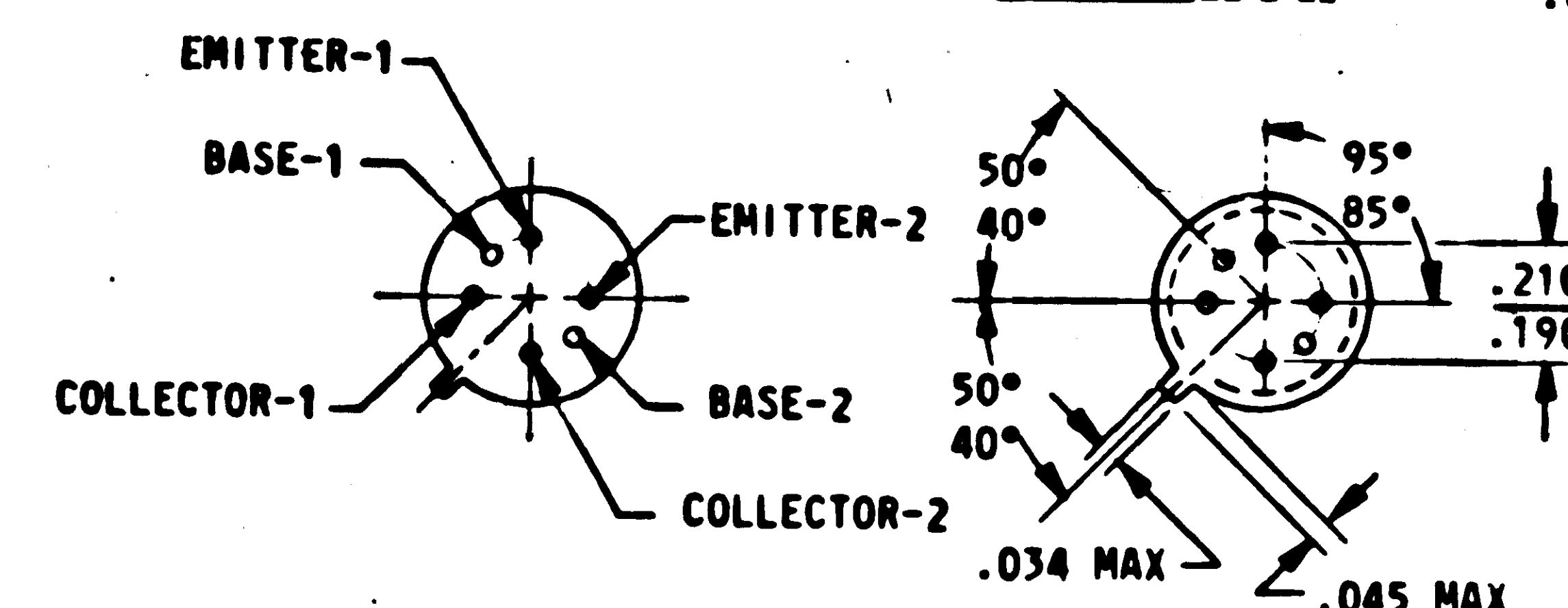
C. THE MANUFACTURER SHALL DETERMINE AND RECORD THE FOLLOWING ELECTRICAL CHARACTERISTICS PRIOR TO AND FOLLOWING BURN-IN:

- EMITTER CUTOFF CURRENT, I_{EBO} .
- COLLECTOR CUTOFF CURRENT, I_{CBO} .
- COLLECTOR SATURATION VOLTAGE, $V_{CE(SAT)}$
- STATIC FORWARD CURRENT TRANSFER RATIO, h_{FE} , SEE NOTE 3.

- THE DATA SHALL BE PRESENTED IN A MANNER THAT PROVIDES POSITIVE IDENTIFICATION OF EACH INDIVIDUAL TRANSISTOR WITH THE INITIAL TEST READING, THE FINAL READING AND THE PERCENT CHANGE BETWEEN THE FINAL AND INITIAL READING. THE TEST DATA SUBMITTED SHALL ALSO IDENTIFY PARTS THAT FAIL TO MEET THE SPECIFIED REQUIREMENTS, UNITS FAILING TO MEET INITIAL DNG. REQUIREMENTS OR HAVING CHANGED MORE THAN 20% IN h_{FE} OR HAVING INCREASED MORE THAN 3 TIMES IN I_{CBO} (THE ABSOLUTE CHANGE MUST BE GREATER THAN 5 NANOMPERE) SHALL NOT BE ACCEPTABLE.



GRAPHICAL SYMBOL
ELEMENTS INSULATED FROM CASE



Ⓕ REPLACES REV(E) WITH CHANGE

		UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ON		MIT INSTRUMENTATION LAB CAMBRIDGE, MASS. CONTRACT 497		MANNED SPACECRAFT CENTER HOUSTON, TEXAS	
		FRACTIONS	DECIMALS	ANGLES	DRAWN <i>[Signature]</i> DATE 29 MAY 63	TRANSISTOR, NPN, SILICON, DUALSECTION	
		±	±	±	CHECKED <i>[Signature]</i> DATE 31 MAY 63	SPECIFICATION CONTROL DRAWING	
		DO NOT SCALE THIS DRAWING			APPROVAL <i>[Signature]</i> DATE 25 JUN 63	CODE IDENT NO. SIZE 80230 C	
		MATERIAL			APPROVAL	NASA DRAWING NO. 1010376	
		HEAT TREATMENT NONE			NASA APPROVAL <i>[Signature]</i>	SCALE NONE WT	
		FINAL FINISH NONE			MIT APPROVAL <i>[Signature]</i> DATE 6-26-63	SHEET 1 OF 4	
NEXT ASSY	USED ON						
APPLICATION							

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TABLE II

ELECTRICAL CHARACTERISTIC AT $T_C = 25^\circ\text{C}$ & 1000 CPS
(UNLESS OTHERWISE SPECIFIED)

PARAMETER	TEST CONDITIONS	SYMBOL	LIMITS		UNITS
			MIN	MAX	
COLLECTOR CUTOFF CURRENT	$I_E=0$ $V_{CB}=80V$	I_{CBO}	--	2	NA
COLLECTOR CUTOFF CURRENT	$I_E=0$ $V_{CB}=80V$ $T_C=150^\circ\text{C}$	I_{CBO}	--	10	UA
EMITTER CUTOFF CURRENT	$I_C=0$ $V_{EB}=5V$	I_{EBO}	--	2	NA
EMITTER TO BASE BREAKDOWN VOLTAGE	$I_E=100\text{UA}$ $I_C=0$	B_{VEBO}	7	--	VOLTS
COLLECTOR TO EMITTER (SEE NOTE 4) BREAKDOWN VOLTAGE	$I_C=10\text{MA}$ $I_{BE}=10\text{A}$	B_{VCER}	80	--	VOLTS
COLLECTOR TO BASE BREAKDOWN VOLTAGE	$I_C=100\text{UA}$ $I_E=0$	B_{VCBO}	100	--	VOLTS
SWITCHBACK VOLTAGE (SEE NOTE 4)	$I_C=30\text{MA}$ $I_B=0$	LV_{CEO}	60	--	VOLTS
STATIC FORWARD CURRENT/SEE TRANSFER RATIO, RATIO (NOTE 1)	$I_C=1\text{MA}$ $V_{CE}=10V$	$h_{FE} 1$ $h_{FE} 2$	.9	1	---
STATIC FORWARD CURRENT/SEE TRANSFER RATIO, RATIO (NOTE 1)	$I_C=100\text{UA}$ $V_{CE}=10V$	$h_{FE} 1$ $h_{FE} 2$	.9	1	---
COLLECTOR SATURATION VOLTAGE	$I_C=50\text{MA}$ $I_B=5\text{MA}$	$V_{CE(SAT)}$	--	1.2	VOLTS
BASE SATURATION VOLTAGE	$I_C=50\text{MA}$ $I_B=5\text{MA}$	$V_{BE(SAT)}$	--	.9	VOLTS
BASE VOLTAGE DIFFERENTIAL (ABSOLUTE VALUE)	$I_C=1\text{MA}$ $V_{CE}=5V$	ΔV_{BE-1} $V_{BE} 21$	--	5	MV
BASE VOLTAGE DIFFERENTIAL (ABSOLUTE VALUE)	$I_C=100\text{UA}$ $V_{CE}=5V$	ΔV_{BE-1} $V_{BE} 21$	--	5	MV
BASE VOLTAGE DIFFERENTIAL CHANGE	$I_C=100\text{UA}$ $V_{CE}=5V$ $T_A=-55^\circ\text{C}$ TO 125°C	ΔV_{BE-1} $V_{BE} 21$	--	10	UV/ $^\circ\text{C}$
SMALL-SIGNAL, SHORT-CIRCUIT INPUT IMPEDANCE	$I_C=1\text{MA}$ $V_{CB}=5V$	h_{ib}	20	30	OHMS
OUTPUT CAPACITANCE	$I_E=0$ $V_{CB}=10V$ $f=140\text{KC}$	C_{ob}	--	15	UUF
INPUT CAPACITANCE	$I_C=0$ $V_{EB}=0.5V$ $f=140\text{KC}$	C_{ib}	--	85	UUF
NOISE FIGURE	$I_C=300\text{UA}$ $V_{CE}=10V$ $BW=1$ $R_g=510\Omega$	NF	--	10	db
SMALL-SIGNAL, SHORT-CIRCUIT FORWARD CURRENT TRANSFER RATIO	$I_C=50\text{MA}$ $V_{CE}=10V$ $f=20\text{MC}$	h_{fe}	3	--	---
COLLECTOR CUTOFF CURRENT	$V_{CB}=80V$ $T_C=100^\circ\text{C}$	I_{CBO}	--	1	UA
NOISE VOLTAGE (SEE NOTE 2)	$V_{CE}=5V$ $I_C=100\text{UA}$ $f=1\text{KC}$ $R_g=1\text{K}\Omega$	--	--	.015	UV/ $\sqrt{\text{Hz}}$

1010376

TABLE I

MAXIMUM RATINGS $T_C=25^\circ\text{C}$
(UNLESS OTHERWISE SPECIFIED)

COLLECTOR VOLTAGE (V_{CEO})	COLLECTOR VOLTAGE (V_{CBO})	EMITTER VOLTAGE (V_{EBO})	POWER DISSIPATION (EACH ELEMENT)	POWER DISSIPATION (DUAL)
VDC	VDC	VDC	WATTS	WATTS
60	100	7	1.5	3

REVISIONS			
SYM	DESCRIPTION	DATE	APPROVAL
F	REPLACES REV E WITH CHANGES AND UPGRADED TO CLASS A RELEASE PER TORR 01775	6-26-63	WR
J	REVISED PER TORR 23247	11/9/65	WR
K	REVISED PER TORR 30783	9/2/66	PH

NOTES:

1. LOWEST VALUE OF h_{FE} SHALL BE h_{FE1} (NUMERATOR).
2. TO BE MEASURED ON QUANTECH NOISE ANALYZER MOD. 310 OR 311 OR EQUIVALENT.
3. AT LOWEST SPECIFIED COLLECTOR CURRENT, I_C
4. PULSE CONDITIONS: LENGTH $\leq 300 \text{ U SEC}$, DUTY CYCLE $\leq 1\%$

Ⓕ REPLACES REV(E) WITH CHANGE

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ON		MIT INSTRUMENTATION LAB CAMBRIDGE, MASS 02139-4347 CONTRACT 697		MANNED SPACECRAFT CENTER HOUSTON, TEXAS	
FRACTIONS	DECIMALS	ANGLES	DRAWN <i>[Signature]</i> DATE 23 MAY 63	TRANSISTOR NPN, SILICON, DUALSECTION	
±	±	±	CHECKED <i>[Signature]</i> DATE 31 MAY 63		
DO NOT SCALE THIS DRAWING			APPROVAL <i>[Signature]</i> DATE 25 JUN 63	SPECIFICATION CONTROL DRAWING	
MATERIAL			APPROVAL	CODE IDENT NO. 80230 SIZE C	
HEAT TREATMENT			NASA APPROVAL <i>[Signature]</i>	NASA DRAWING NO. 1010376	
FINAL FINISH			MIT APPROVAL <i>[Signature]</i> DATE 26 JUN 63	SCALE NONE WT SHEET 2 OF 4	

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TABLE III

ADDITIONAL ELECTRICAL CHARACTERISTIC AT TC = 25°C & 1000 CPS (UNLESS OTHERWISE SPECIFIED)								
NASA PART NUMBER	EIA TYPE DESIGNATION (FOR REF ONLY)	NO. OR ELEMENTS PER DEVICE	PARAMETER	TEST CONDITIONS	SYMBOL	LIMITS		UNIT
						MIN	MAX	
1010376-1	2N2060	2	SMALL-SIGNAL, SHORT-CIRCUIT FORWARD CURRENT TRANSFER RATIO	IC=1MA VCE=5V	hfe	50	150	--
			SMALL-SIGNAL, SHORT-CIRCUIT INPUT IMPEDANCE	IC=1MA VCE=5V	hie	1000	4000	OHMS
			SMALL-SIGNAL, OPEN CIRCUIT OUTPUT ADMITTANCE	IC=1MA VCE=5V	hoe	4	16	UMHO
			STATIC FORWARD CURRENT TRANSFER RATIO	IC=10UA VCE=10V	hFE	25	75	--
			STATIC FORWARD CURRENT TRANSFER RATIO	IC=100UA VCE=10V	hFE	30	90	--
			STATIC FORWARD CURRENT TRANSFER RATIO	IC=1MA VCE=10V	hFE	40	120	--
			STATIC FORWARD CURRENT TRANSFER RATIO	IC=10MA VCE=10V	hFE	50	150	--
1010376-2		2	ALL REQUIREMENTS OF -1. SMALL-SIGNAL SHORT-CIRCUIT FORWARD CURRENT TRANSFER RATIO	IC=1MA VCE=10V	hfe	80	120	--
1010376-3		2	SMALL-SIGNAL, SHORT-CIRCUIT FORWARD CURRENT TRANSFER RATIO	IC=1MA VCE=5V	hfe	75	180	--
			SMALL-SIGNAL, SHORT-CIRCUIT INPUT IMPEDANCE	IC=1MA VCE=5V	hie	--	5000	OHMS
			SMALL-SIGNAL, OPEN CIRCUIT OUTPUT ADMITTANCE	IC=1MA VCE=5V	hoe	--	20	UMHO
			STATIC FORWARD CURRENT TRANSFER RATIO	IC=10UA VCE=10V	hFE	40	100	--
			STATIC FORWARD CURRENT TRANSFER RATIO	IC=100UA VCE=10V	hFE	60	125	--
			STATIC FORWARD CURRENT TRANSFER RATIO	IC=1MA VCE=10V	hFE	80	150	--
			STATIC FORWARD CURRENT TRANSFER RATIO	IC=10MA VCE=10V	hFE	90	180	--
			STATIC FORWARD CURRENT TRANSFER RATIO	IC=300UA VCE=10V	hFE	75	125	--

1010376

REVISIONS			
SYM	DESCRIPTION	DATE	APPROVAL
F	REPLACES REV E WITH CHANGES AND UPGRADED TO CLASS A RELEASE PER TDRR 01775	6-26-63	WJL
J	REVISED PER TDRR 23247	11/19/63	WJL
K	REVISION STATUS CHANGED	9/2/66	PH JT

(F) REPLACES REV (E) WITH CHANGE

MIT INSTRUMENTATION LAB CAMBRIDGE, MASS. CONTRACT 497		MANNED SPACECRAFT CENTER HOUSTON, TEXAS	
DRAWN <i>J. J. J.</i> DATE 25 MAY 63 CHECKED <i>P. R.</i> 31 MAY 63 APPROVAL <i>A. J.</i> 25 JUN 63		TRANSISTOR NPN, SILICON, DUAL SECTION SPECIFICATION CONTROL DRAWING	
NASA APPROVAL <i>[Signature]</i>	CODE IDENT NO. 80230	SIZE C	NASA DRAWING NO. 1010376
MIT APPROVAL <i>[Signature]</i> 26 JUN 63	SCALE NONE	WT	SHEET 3 OF 4

NASA PART NUMBER		TYPE DESIGNATION (FOR REF ONLY)		NO. OR ELEMENTS PER DEVICE		PARAMETER		TEST CONDITIONS		SYMBOL		LIMITS		UNIT	
												MIN		MAX	
1010376-4				2		ALL REQUIREMENTS OF -1									
						SWITCHBACK VOLTAGE		I _C =10MA, I _B =0		LV _{CEO}		80		-	
						STATIC FORWARD CURRENT TRANSFER RATIO		V _{CE} =1.0VDC I _C =5MA		h _{FE}		50		-	
						COLLECTOR TO EMITTER BREAKDOWN VOLTAGE PULSED - SEE NOTE 4		I _C =100MA R _{BE} =10Ω		BV _{CER}		100		-	

REVISIONS			
SYM	DESCRIPTION	DATE	APPD.
F	THIS SHEET ADDED PER TDRR 01775	5/24/63	WIL
G	REVISED PER TDRR 04250	5/24/63	WIL
J	REVISED PER TDRR 23247	11/16/63	WIL
K	REVISION STATUS CHANGED		PH

TABLE III CONTINUED

ADDITIONAL ELECTRICAL CHARACTERISTICS AT TC = 25°C & 1000 CPS (UNLESS OTHERWISE SPECIFIED)

THIS SHEET ADDED

UNLESS OTHERWISE SPECIFIED	
DIMENSIONS ARE IN INCHES TOLERANCES ON	
FRACTIONS	DECIMALS
+	+
-	-
DO NOT SCALE THIS DRAWING	
MATERIAL	
NEXT ASSY	USED ON
APPLICATION	

MIT INSTRUMENTATION LAB		MANNED SPACECRAFT CENTER	
CAMBRIDGE, MASS. NAS 9-CONTRACT 427		HOUSTON, TEXAS	
DRAWN 29 MAY 63		TRANSISTOR	
CHECKED 31 MAY 63		NPN, SILICON, DUALSECTION	
APPROVAL 25 JUN 63		SPECIFICATION CONTROL DRAWING	
APPROVAL			
NASA APPROVAL		CODE IDENT NO. 80230	
MIT APPROVAL		SIZE C	
		1010376	
		SCALE NONE	
		SHEET 4 OF 4	