

MILITARY SPECIFICATION

SEMICONDUCTOR DEVICE, TRANSISTOR, NPN, SILICON, HIGH-POWER TYPES JAN2N2812, JANTX2N2812, JAN2N2814 AND JANTX2N2814

1. SCOPE

1.1 Scope. This specification covers the detail requirements for NPN, silicon, high-power transistors. The prefix "TX" is used on devices submitted to and passing the special process-conditioning, testing, and screening as specified in 4.5 through 4.5.9.1.

1.2 Physical dimensions. See figure 1 (TO-61).

1.3 Maximum ratings.

Type	P _T 1/ T _A = 25°C	P _T 2/ T _C = 100°C	V _{CB} O	V _{EB} O	V _{CE} O	I _C	I _B	T _C
	<u>W</u>	<u>W</u>	<u>Vdc</u>	<u>Vdc</u>	<u>Vdc</u>	<u>Adc</u>	<u>°C</u>	<u>°C</u>
2N2812	4.0	50	80	8.0	60	10	2.0	-65 to +200
2N2814	4.0	50	120	8.0	80	10	2.0	-65 to +200

1/ Derate linearly at 22.8 mW/°C for T_A > 25°C.

2/ Derate linearly at 0.5 W/°C for T_C > 100°C.

1.4 Primary electrical characteristics.

Limit	θ _{J-C}	V _{BE} (sat) I _C = 5.0 Adc I _B = 0.5 Adc	V _{CE} (sat) I _C = 5.0 Adc I _B = 0.5 Adc	C _{obo} V _{CB} = 10 Vdc I _E = 0 100 kHz ≤ f ≤ 1 MHz	h _{FE} V _{CE} = 5.0 Vdc I _C = 5.0 Adc	h _{fe} V _{CE} = 10 Vdc I _C = 1.0 Adc f = 10 MHz
	<u>°C/W</u>	<u>Vdc</u>	<u>Vdc</u>	<u>pf</u>		
Min	---	---	---	---	40	1.5
Max	2.0	1.2	0.5	350	120	7.0

Limit	h _{FE} V _{CE} = 5.0 Vdc I _C = 1.0 Adc	h _{FE} V _{CE} = 5.0 Vdc I _C = 10 Adc	h _{FE} V _{CE} = 5.0 Vdc I _C = 10 mAdc	Switching time		
				t _{on}	t _s	t _f
				<u>nsec</u>	<u>nsec</u>	<u>nsec</u>
Min	50	15	10	---	---	---
Max	150	---	---	350	1000	200

2. APPLICABLE DOCUMENTS

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

SPECIFICATION

MILITARY

MIL-S-19500 - Semiconductor Devices, General Specification for.

STANDARDS

MILITARY

MIL-STD-202 - Test Methods for Electronic and Electrical Component Parts.

MIL-STD-750 - Test Methods for Semiconductor Devices.

(Copies of specifications, standards, drawings, and publications required by suppliers in connection with specific procurement functions should be obtained from the procuring activity or as directed by the contracting officer.)

3. REQUIREMENTS

3.1 General. Requirements shall be in accordance with MIL-S-19500, and as specified herein.

3.2 Abbreviations, symbols, and definitions. The abbreviations, symbols, and definitions used herein are defined in MIL-S-19500.

3.3 Design, construction, and physical dimensions. Transistors shall be of the design, construction, and physical dimensions shown on figure 1.

3.4 Performance characteristics. Performance characteristics shall be as specified in tables I, II, and III, and as follows:

3.4.1 Process-conditioning, testing, and screening for "TX" types. Process-conditioning, testing, and screening for the "TX" types shall be as specified in 4.5.

3.5 Marking. The following marking specified in MIL-S-19500 may be omitted from the body of the transistor at the option of the manufacturer:

- (a) Country of origin.
- (b) Manufacturer's identification.

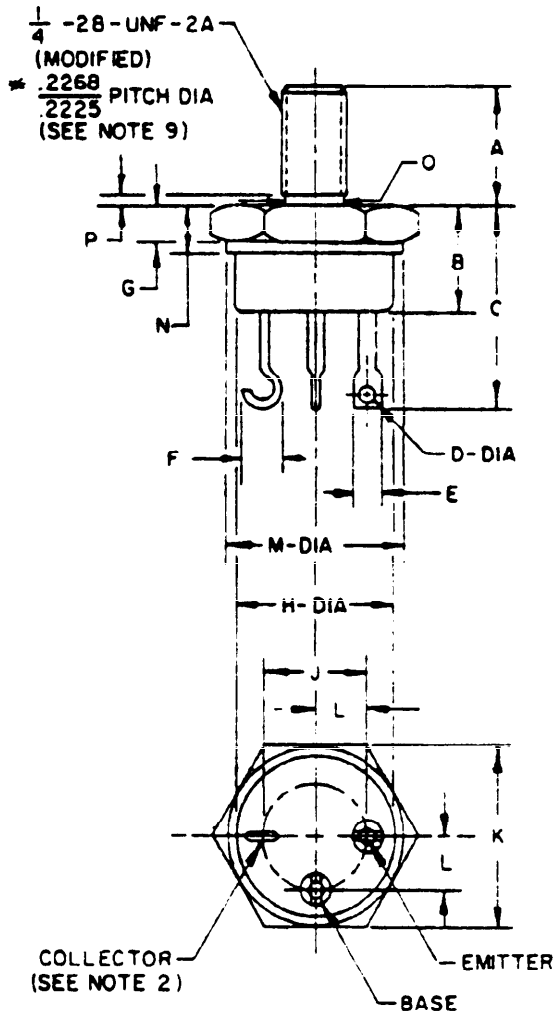
3.5.1 "TX" marking. Devices in accordance with the "TX" requirements shall include the marking "JANTX" preceding the type designation.

4. QUALITY ASSURANCE PROVISIONS

4.1 Sampling and inspection. Sampling and inspection shall be in accordance with MIL-S-19500, and as specified herein.

4.2 Qualification inspection. Qualification inspection shall consist of the examinations and tests specified in tables I, II, and III.

4.2.1 Qualification testing. The non-TX types shall be used for qualification testing. (Upon request to the qualifying activity, qualification will be extended to include the "TX" type of the device.)



DIMENSIONS					N C S
LTR	INCHES		MILLIMETERS		
	MIN	MAX	MIN	MAX	
A	.422	.455	10.72	11.56	
B	.325	.460	8.26	11.68	
C	.640	.875	16.26	22.23	6
D	.047	.072	1.19	1.83	7
E	.095	.115	2.41	2.92	7
F		.150		3.81	
G	.090	.150	2.29	3.81	
H	.570	.610	14.48	15.49	
J	.340	.415	8.64	10.54	
K	.667	.687	16.94	17.45	8
L	.170	.213	4.32	5.41	3
M	.610	.687	15.49	17.45	
N		.270		6.86	
O	.220	.249	5.59	6.32	
P		.090		2.29	

* INCHES mm
 .2225 5.65
 .2268 5.76

NOTES:

1. Metric equivalents (to the nearest .01 mm) are given for general information only and are based upon 1 inch = 25.4 mm.
2. The collector shall be electrically connected to the case.
3. Lead spacing measured at seat only.
4. Position of leads in relation to hex is not controlled.
5. Maximum recommended mounting torque: 20 in-lb.
6. All three leads.
7. Two leads. (Base and emitter).
8. All three locations.
9. Threads in accordance with Handbook H28.

FIGURE 1. Physical dimensions of transistor types JAN2N2812, JAN2N2812, JAN2N2814 and JAN2N2814-70-01.

4.3 Quality conformance inspection. Quality conformance inspection shall consist of groups A, B, and C inspection. When specified in the contract or order, one copy of the quality conformance inspection data, pertinent to the device inspection lot, shall be supplied with each shipment by the device manufacturer (see 6.2).

4.3.1 Group A inspection. Group A inspection shall consist of the examinations and tests specified in table I.

4.3.2 Group B inspection. Group B inspection shall consist of the examinations and tests specified in table II.

4.3.3 Group C inspection. Group C inspection shall consist of the examinations and tests specified in table III. This inspection shall be conducted on the initial lot and thereafter every 6 months during production.

4.3.4 Group B and group C life-test samples. Samples that have been subjected to group B, 340-hours life-test, may be continued on test to 1,000 hours in order to satisfy group C life-test requirements. These samples shall be predesignated, and shall remain subjected to the group C 1,000-hour acceptance evaluation after they have passed the group B, 340-hour acceptance criteria. The cumulative total of failures found during 340-hour test and during the subsequent interval up to 1,000 hours shall be computed for 1,000-hour acceptance criteria (see 4.3.3).

4.4 Methods of examination and test. Methods of examination and test shall be as specified in tables I, II, and III, and as follows:

4.4.1 Pulse measurements. Conditions for pulse measurement shall be as specified in section 4 of MIL-STD-750.

4.4.2 Case-temperature control for $|h_{fe}|$ test. To maintain the case temperature at less than $+40^{\circ}\text{C}$ for this test, the specified DC collector current should be applied for not longer than 10 seconds without employing a heat sink.

4.4.3 Solderability test. The following particular procedural requirements shall apply for this test:

- (a) Immersion depth for both transistor types shall be 0.200 ± 0.025 inches.
- (b) Dwell time (immersion in the solder bath) shall be 7 ± 0.5 seconds.

4.4.4 Resistance to solvents. Transistors shall be subjected to tests in accordance with method 215 of MIL-STD-202. The following details shall apply:

- (a) All areas of the transistor body where marking has been applied shall be brushed.
- (b) After subjection to the tests, there shall be no evidence of mechanical damage to the device and markings shall have remained legible.

TABLE I. Group A Inspection

MIL-S-19500/415(USAF)

Examination or test	MIL-STD-750		LTPD		Symbol	Limits		Unit
	Method	Details	Non TX	TX		Min	Max	
<u>Subgroup 1</u>			10	5				
Visual and mechanical examination	2071				---	---	---	---
<u>Subgroup 2</u>			5	3				
Breakdown voltage, collector to emitter	3011	Bias cond. D; $I_C = 10 \text{ mAdc}$; pulsed (see 4.4.1)			BV_{CEO}			
2N2812						60	---	Vdc
2N2814						80	---	Vdc
Breakdown voltage, collector to emitter	3011	Bias cond. D; $I_C = 100 \text{ mAdc}$; pulsed (see 4.4.1)			BV_{CEO}			
2N2812						60	---	Vdc
2N2814						80	---	Vdc
Breakdown voltage, collector to base	3001	Bias cond. D; $I_C = 10 \text{ } \mu\text{Adc}$			BV_{CBO}			
2N2812						80	---	Vdc
2N2814						120	---	Vdc
Breakdown voltage, emitter to base	3026	Bias cond. D; $I_E = 10 \text{ } \mu\text{Adc}$			BV_{EBO}	6.0	---	Vdc
Collector to emitter cutoff current	3041	Bias cond. D; $V_{CE} = 50 \text{ Vdc}$			I_{CEO}	---	10	μAdc
Collector to emitter cutoff current	3041	Bias cond. A; $V_{EB} = 0.5 \text{ Vdc}$			I_{CEX}			
2N2812		$V_{CE} = 80 \text{ Vdc}$				---	1.0	μAdc
2N2814		$V_{CE} = 120 \text{ Vdc}$				---	1.0	μAdc
Collector to base cutoff current	3036	Bias cond. D			I_{CBO}			
2N2812		$V_{CB} = 60 \text{ Vdc}$				---	0.1	μAdc
2N2814		$V_{CB} = 80 \text{ Vdc}$				---	0.1	μAdc
Emitter to base cutoff current	3061	Bias cond. D; $V_{EB} = 6.0 \text{ Vdc}$			I_{EBO}	---	0.1	μAdc
<u>Subgroup 3</u>			5	3				
Forward-current transfer ratio	3076	$V_{CE} = 5.0 \text{ Vdc}$; $I_C = 1.0 \text{ Adc}$; pulsed (see 4.4.1)			h_{FE}	50	150	---
Forward-current transfer ratio	3076	$V_{CE} = 5.0 \text{ Vdc}$; $I_C = 5.0 \text{ Adc}$; pulsed (see 4.4.1)			h_{FE}	40	120	---
Forward-current transfer ratio	3076	$V_{CE} = 5.0 \text{ Vdc}$; $I_C = 10 \text{ Adc}$; pulsed (see 4.4.1)			h_{FE}	15	---	---

TABLE I. Group A Inspection - Continued

Examination or test	MIL-STD-750		LTPD		Symbol	Limits		Unit
	Method	Details	Non TX	TX		Min	Max	
<u>Subgroup 3 - Continued</u>								
Forward-current transfer ratio	3076	VCE = 5.0 Vdc; IC = 10 mA dc; pulsed (see 4.4.1)			hFE	10	---	---
Base emitter voltage (nonsaturated)	3086	Test cond. B; VCE = 5.0 Vdc; IC = 5.0 A dc; pulsed (see 4.4.1)			VBE	---	1.2	Vdc
Base emitter voltage (saturated)	3086	Test cond. A; IC = 5.0 A dc; IB = 0.5 A dc; pulsed (see 4.4.1)			VBE(sat)	---	1.2	Vdc
Base emitter voltage (saturated)	3086	Test cond. A; IC = 10 A dc; IB = 1.0 A dc; pulsed (see 4.4.1)			VBE(sat)	---	2.0	Vdc
Collector to emitter voltage (saturated)	3071	IC = 5.0 A dc; IB = 0.5 A dc; pulsed (see 4.4.1)			VCE(sat)	---	0.5	Vdc
Collector to emitter voltage (saturated)	3071	IC = 10 A dc; IB = 1.0 A dc; pulsed (see 4.4.1)			VCE(sat)	---	1.5	Vdc
<u>Subgroup 4</u>								
Magnitude of common-emitter small-signal short-circuit forward-current transfer ratio	3306	VCE = 10 Vdc; IC = 1.0 A dc; f = 10 MHz (see 4.4.2)	7	5	hfe	1.5	7.0	---
Small-signal short-circuit forward-current transfer ratio	3206	VCE = 5.0 Vdc; IC = 50 mA dc			hfe	40	150	---
Open-circuit output capacitance	3236	VCE = 10 Vdc; IE = 0; 100 kHz ≤ f ≤ 1 MHz			Cobo	---	350	pf
Pulse response	3251	Test cond. A except test circuit and pulse requirements per figure 2						
Turn-on time		VCC = 25.5 Vdc; VBB = 5.0 Vdc; IC = 5.0 A dc; IB1 = 0.5 A dc			ton	---	350	nsec
Storage time		VCC = 25.5 Vdc; VBB = 5.0 Vdc; IC = 5.0 A dc; IB1 = -IB2 = 0.5 A dc			ts	---	1000	nsec
Fall time		VCC = 25.5 Vdc; VBB = 5.0 Vdc; IC = 5.0 A dc; IB1 = -IB2 = 0.5 A dc			tf	---	200	nsec

TABLE I. Group A inspection - Continued

MIL-S-19500/415(USAF)

Examination or test	MIL-STD-750		LTPD		Symbol	Limits		Unit
	Method	Details	Non TX	TX		Min	Max	
<u>Subgroup 5</u>			10	10				
High-temperature operation:		$T_A = +150^{\circ}\text{C}$						
Collector to emitter cutoff current	3041	Bias cond. A; $V_{EB} = 0.5 \text{ Vdc}$			I_{CEX}			
2N2812		$V_{CE} = 60 \text{ Vdc}$				---	50	μAdc
2N2814		$V_{CE} = 80 \text{ Vdc}$				---	50	μAdc
Low-temperature operation:		$T_A = -65^{\circ}\text{C}$						
Forward-current transfer ratio	3076	$V_{CE} = 5.0 \text{ Vdc};$ $I_C = 5.0 \text{ Adc};$ pulsed (see 4.4.1)			h_{FE}	20	---	---

TABLE II. Group B inspection

Examination or test	MIL-STD-750		LTPD		Symbol	Limits		Unit
	Method	Details	Non TX	TX		Min	Max	
<u>Subgroup 1</u>			20	20				
Physical dimensions	2066	(See figure 1)			---	---	---	---
<u>Subgroup 2</u>			10	10				
Solderability	2026	(see 4.4.3)			---	---	---	---
Thermal shock (temperature cycling)	1051	Test cond. C; 10 cycles; time at temperature ex- tremes = 15 minutes minimum			---	---	---	---
Thermal shock (glass strain)	1056	Test cond. B			---	---	---	---
Terminal strength (tension)	2036	Test cond. A; weight = 10 lbs $\pm$ 10 oz; application time = 15 sec			---	---	---	---
Terminal strength (stud torque)	2036	Test cond. D ₂ ; torque = 20 in-lb; application time = 15 sec			---	---	---	---
Terminal strength (lead torque)	2036	Test cond. D ₁ ; torque = 6 in-oz; application time = 15 sec			---	---	---	---
Seal (leak-rate)	1071	Test cond. G or H for fine leaks; test cond. A, C, D, or F for gross leaks			---	---	5×10^{-7}	atm cc/sec
Moisture resistance	1021	Omit initial conditioning			---	---	---	---

TABLE II. Group B inspection - Continued

Examination or test	MIL-STD-750		LTPD		Symbol	Limits		Unit
	Method	Details	Non TX	TX		Min	Max	
<u>Subgroup 2 - Continued</u>								
End points:								
Breakdown voltage, collector to emitter	3011	Bias cond. D; $I_C = 10$ mAdc; pulsed (see 4.4.1)			BV _{CEO}			
2N2812						60	---	Vdc
2N2814						80	---	Vdc
Collector to base cutoff current	3036	Bias cond. D;			ICBO			
2N2812		VCE = 60 Vdc				---	0.1	μAdc
2N2814		VCE = 80 Vdc				---	0.1	μAdc
Forward current transfer ratio	3076	VCE = 5.0 Vdc; IC = 5.0 Adc; pulsed (see 4.4.1)			hFE	40	120	---
<u>Subgroup 3</u>			10	10				
Shock	2016	Nonoperating; 1,500 G; 0.5 msec, 5 blows in each orientation: X ₁ , Y ₁ , Y ₂ , and Z ₁			---	---	---	---
Vibration, variable frequency	2056	Nonoperating			---	---	---	---
Constant acceleration	2006	10,000 G; in each orienta- tion: X ₁ , Y ₁ , Y ₂ , and Z ₁						
End points: (Same as subgroup 2)								
<u>Subgroup 4</u>			20	20				
Salt atmosphere (corrosion)	1041				---	---	---	---
End points: (Same as subgroup 2)								
<u>Subgroup 5</u>			10	10				
Safe operating area (continuous DC)	3051	T _C = 100°C; time = 60 sec; 1 cycle (see figure 3a)			---			
Test 1		VCE = 5.0 Vdc; IC = 10 Adc				---	---	---
Test 2		VCE = 10 Vdc; IC = 5.0 Adc				---	---	---
Test 3								
2N2812		VCE = 50 Vdc; IC = 0.2 Adc				---	---	---
2N2814		VCE = 70 Vdc; IC = 0.1 Adc				---	---	---

TABLE II. Group B inspection - Continued

MIL-S-19500/415(USAF)

Examination or test	MIL-STD-750		LTPD		Symbol	Limits		Unit
	Method	Details	Non TX	TX		Min	Max	
Subgroup 5 - Continued								
Safe operating area (switching)	3053	Load cond. C; $T_C = 25^\circ\text{C}$ (see figure 3b) Input pulse and bias con- ditions: test duration = 3 sec; $t_p \leq 0.5\text{ msec}$; duty cycle $< 2\%$; t_r and $t_f \leq 3\text{ }\mu\text{sec}$; $R_{BB1} = 5.0\text{ }\Omega$; $V_{BB1} = 13\text{ Vdc}$; $R_{BB2} = 5.0\text{ }\Omega$; $V_{BB2} = 2.5\text{ Vdc}$ Common load and output bias conditions: $V_{CC} = 22.5\text{ Vdc}$; $R_g = 1\text{ }\Omega$; inductor $f_{res} \geq 5\text{ MHz}$;			---			
Test 1		$I_C = 10\text{ Adc}$; $L = 30\text{ }\mu\text{H}$; $R_L = 1\text{ }\Omega$				---	---	---
Test 2		$I_C = 2.0\text{ Adc}$; $L = 125\text{ }\mu\text{H}$; $R_L = 10\text{ }\Omega$				---	---	---
End points: (Same as subgroup 2)								
Subgroup 6			7	$\lambda=7$				
High-temperature life (nonoperating) (TX types only)	1031	$T_{stg} = +200^\circ\text{C}$			---	---	---	---
High-temperature life (nonoperating) (Non-TX types only)	1032	$T_{stg} = +200^\circ\text{C}$; time = 340 hours (see 4.3.4)			---	---	---	---
End points:								
Breakdown voltage, collector to emitter	3011	Bias cond. D; $I_C = 10\text{ mA dc}$; pulsed (see 4.4.1)			BV_{CEO}			
2N2812						60	---	Vdc
2N2814						80	---	Vdc
Collector to base cutoff current	3036	Bias cond. D; $V_{CB} = 60\text{ Vdc}$ $V_{CB} = 80\text{ Vdc}$			I_{CBO}	---	0.15	μAdc
2N2812						---	0.15	μAdc
2N2814								
Forward current transfer ratio	3076	$V_{CE} = 5.0\text{ Vdc}$; $I_C = 5.0\text{ Adc}$; pulsed (see 4.4.1)			Δh_{FE}	---	-20 -10	% of initial group A reading

TABLE II. Group B inspection - Continued

Examination or test	MIL-STD-750		LTPD		Symbol	Limits		Unit
	Method	Details	Non	TX		Min	Max	
			TX	TX				
<u>Subgroup 6 - Continued</u>								
End points - Continued								
Emitter-base cutoff current	3061	Bias cond. D; VEB = 6.0 Vdc			I _{EBO}	---	0.15	μA _{dc}
<u>Subgroup 7</u>								
Steady-state operation life (TX types only)	1026	T _C = +100° C; P _T = 50 W; V _{CE} = 10 Vdc (min)	7	λ=5	---	---	---	---
Steady-state operation life (Non-TX types only)	1027	T _C = +100° C; P _T = 50 W; V _{CE} = 10 Vdc (min); time = 340 hours (see 4.3.4)			---	---	---	---
End points: (Same as subgroup 6)								

TABLE III. Group C inspection

Examination or test	MIL-STD-750		LTPD		Symbol	Limits		Unit
	Method	Details	Non					
			TX	TX				
<u>Subgroup 1</u>								
Thermal resistance	3151		15	15	θ_{J-C}	---	2.0	°C/W
<u>Subgroup 2</u>								
Thermal shock (temperature cycling)	1051	Test cond. C; 25 cycles; time at temperature ex- tremes = 15 minutes (min); total test time = 72 hours max	10	10	---	---	---	---
End points: (Same as subgroup 2 of group B)								
<u>Subgroup 3</u>								
Resistance to solvents	---	Method 215 of MIL-STD-202 (see 4.4.4)	10	10	---	---	---	---
<u>Subgroup 4</u>								
High-temperature life (nonoperating) (Non-TX types only)	1031	T _{stg} = +200° C (see 4.3.4)	$\lambda=10$	--	---	---	---	---
End points: (Same as subgroup 6 of group B)								

TABLE III. Group C inspection - Continued

MIL-S-19500/415(USAF)

Examination or test	MIL-STD-750		LTPD		Symbol	Limits		Unit
	Method	Details	Non TX	TX		Min	Max	
<u>Subgroup 5</u> Steady-state operation life (Non-TX types only) End points: (Same as subgroup 6 of group B)	1026	$T_C = +100^\circ\text{C}$; $P_T = 50\text{ W}$; $V_{CE} = 10\text{ Vdc}$ min (see 4.3.4)	$\lambda = 10$	--	---	---	---	---

4.5 Process-conditioning, testing, and screening for "TX" types. The procedure for process-conditioning, testing, and screening the "TX" types shall be in accordance with 4.5.1 through 4.5.9.1 and figure 4. Process-conditioning shall be conducted on 100 percent of the lot prior to submission of the lot to the tests specified in tables I, II, and III. (At the option of the manufacturer, the non-TX type may be subjected to process-conditioning and testing.)

4.5.1 Quality assurance (lot verification). Quality assurance shall keep lot records for 3 years minimum, monitor for compliance to the prescribed procedures, and observe that satisfactory manufacturing conditions and records on lots are maintained for these devices. The records shall be available for review by the customer at all times. The quality assurance monitoring shall include, but not be limited to: process-conditioning, testing, and screening. (The conditioning and screening tests performed as standard production tests need not be repeated when these are predesignated and acceptable to the Government as being equal to or more severe than the tests specified herein and the relative process-conditioning sequence is maintained.

4.5.2 High-temperature storage. All devices shall be stored for at least 24 hours at a minimum temperature (T_A) of 200°C .

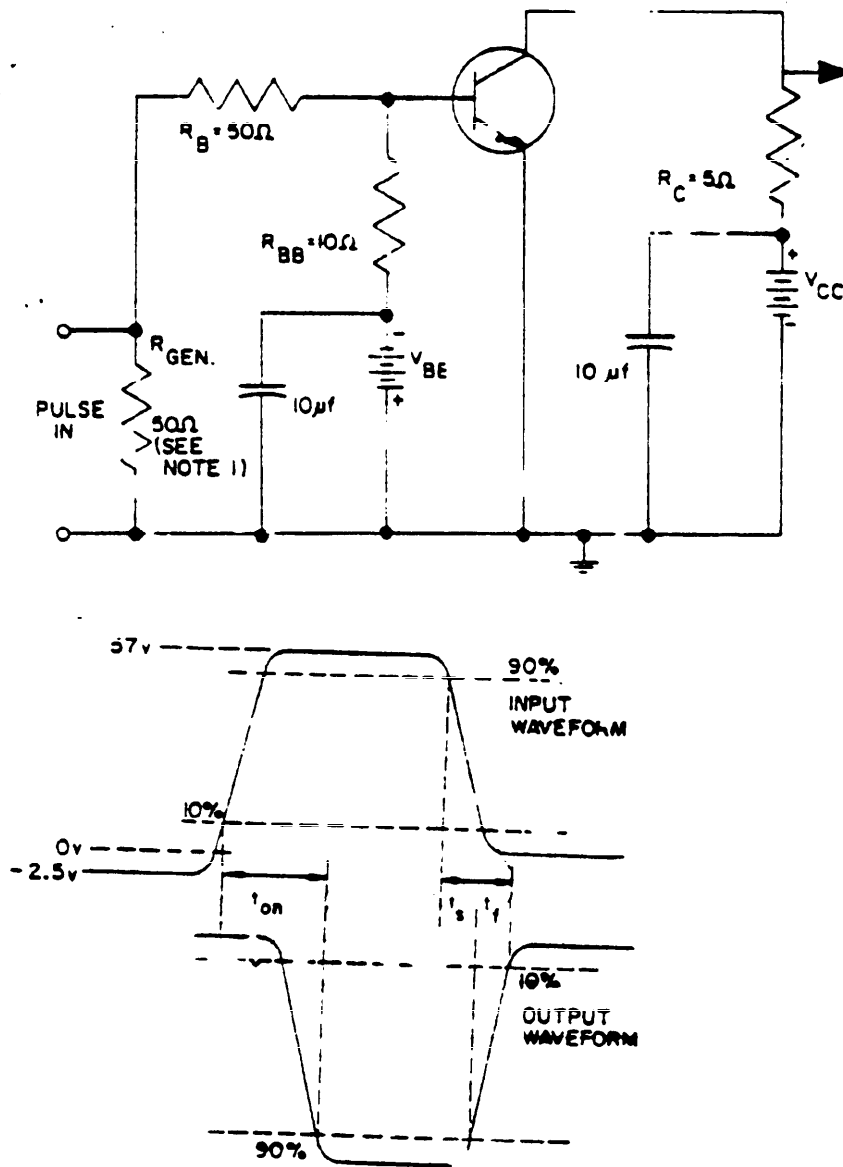
4.5.3 Thermal shock (temperature cycling). All devices shall be subjected to thermal shock (temperature cycling) in accordance with MIL-STD-750, method 1051, test condition C, except that 10 cycles shall be continuously performed, and the time at the temperature extremes shall be 15 minutes, minimum.

4.5.4 Acceleration. All devices shall be subjected to acceleration test in accordance with MIL-STD-750, method 2006, with the following exceptions: The test shall be performed one time in the Y_1 orientation only, at a peak level of 10,000 G minimum. The one minute hold-time requirement shall not apply.

4.5.5 Hermetic seal tests. All devices shall be subjected to hermetic seal tests (fine leak followed by gross leak) with test conditions as specified in 4.5.5.1 and 4.5.5.2. Failed devices from either test shall be removed from the lot.

4.5.5.1 Fine-leak test. All devices shall be fine-leak tested in accordance with MIL-STD-750, method 1071, test condition G or H; except the leak-rate rejection criterion shall be 5×10^{-7} cubic centimeters of helium per second when measured at a differential pressure of one atmosphere.

4.5.5.2 Gross-leak test. All devices shall be tested for gross-leaks in accordance with MIL-STD-750, method 1071, test condition A, C, D, or F.



NOTES:

1. The input waveform is supplied by a generator with the following characteristics:
 $t_r \leq 15$ nsec, $t_f \leq 15$ nsec, $Z_{out} = 50\Omega$, $t_p = 20$ μ sec, duty cycle $\leq 2\%$
2. Waveforms are monitored on an oscilloscope with the following characteristics:
 $t_r \leq 15$ nsec, $R_{in} \geq 10M\Omega$, $C_{in} \leq 11.5$ pf.
3. Resistors must be non-inductive types.
4. The d-c power supplies may require additional by-passing in order to minimize ringing.

FIGURE 2. Pulse response test circuit.

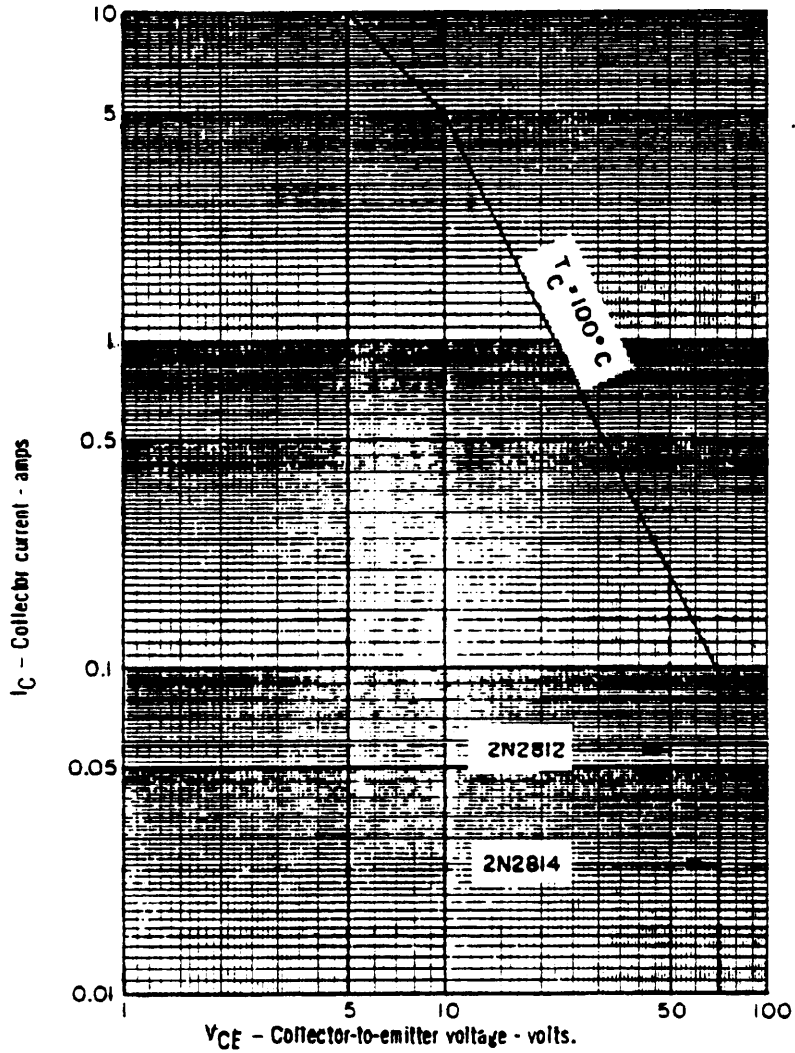


FIGURE 3a. Forward bias continuous DC.

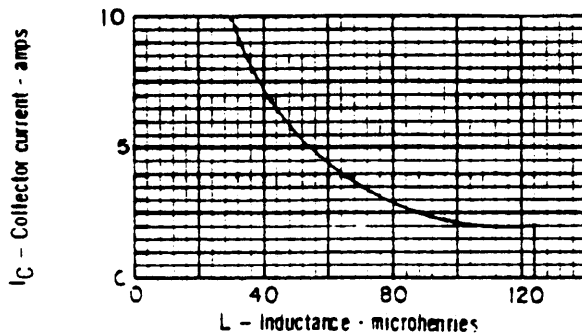


FIGURE 3b. Switching: Unlamped inductive load.

FIGURE 3. Safe operating areas.

4.5.6 Reverse bias burn-in. The transistors shall be operated for 48 ± 4 hours at $T_A = +150^\circ\text{C}$, no heat sink shall be used, under the following test conditions:

2N2812 $V_{CB} = 60 \text{ Vdc}$, $I_E = 0$

2N2814 $V_{CB} = 100 \text{ Vdc}$, $I_E = 0$

At the end of the 48 hour period, the above specified impressed voltage shall be maintained on the transistors until $T_A = +30 \pm 5^\circ\text{C}$ is reached. Post test reading for I_{CBO} of table IV shall be conducted within 4 hours after removal of impressed voltage. Any units not meeting the limits of table IV shall be removed from the lot.

4.5.7 Preburn-in tests. The parameters I_{CBO} , h_{FE} , and I_{EBO} of table IV shall be measured and the data recorded for all devices in the lot. All devices shall be handled or identified such that the delta end points can be determined after the burn-in test. All devices which fail to meet the requirements of table IV shall be removed from the lot and the quantity removed shall be noted on the lot history.

TABLE IV. Burn-in test measurements

Test	MIL-STD-750		Symbol	Limits		Unit
	Method	Details		Min	Max	
Collector to base cutoff current	3036	Bias cond. D	I_{CBO}			
2N2812		$V_{CB} = 60 \text{ Vdc}$		---	0.1	μAdc
2N2814		$V_{CB} = 80 \text{ Vdc}$		---	0.1	μAdc
Forward-current transfer ratio	3076	$V_{CE} = 5.0 \text{ Vdc}$; $I_C = 5.0 \text{ Adc}$; pulsed (see 4.4.1)	h_{FE}	40	120	---
Emitter to base cutoff current	3061	Bias cond. D; $V_{EB} = 6.0 \text{ Vdc}$	I_{EBO}	---	0.1	μAdc

4.5.8 Burn-in test. All devices shall be operated for 168 hours minimum under the following conditions:

$T_C = +100^\circ\text{C}$

$V_{CE} = 10 \text{ Vdc}$ (minimum)

$P_T = 50 \text{ W}$

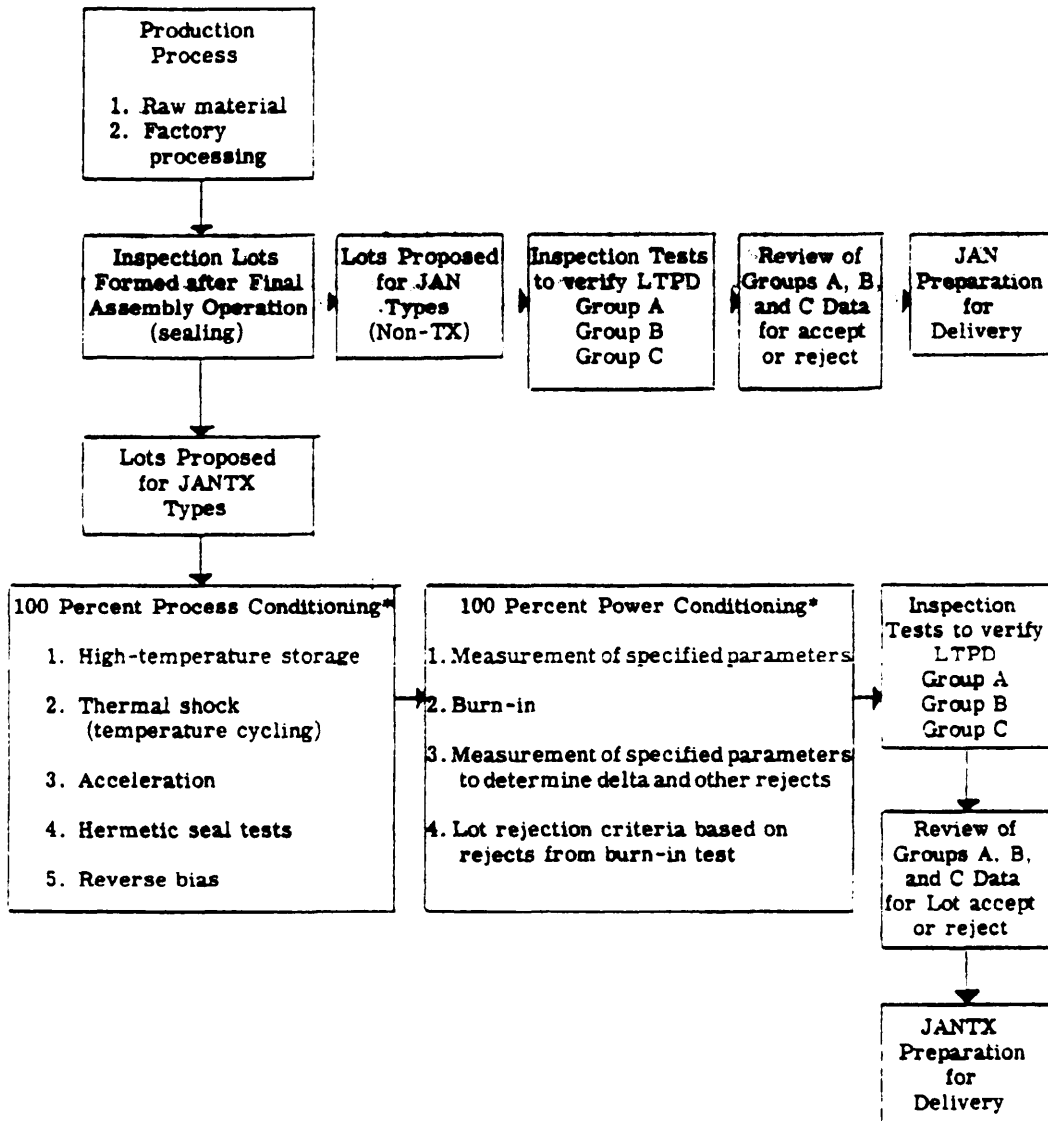
4.5.9 Postburn-in tests. The parameters I_{CBO} , h_{FE} and I_{EBO} of table IV shall be retested after burn-in and the data recorded for all devices in the lot. The parameters measured shall not have changed during the burn-in test from the initial value by more than the specified amount as follows:

$\Delta I_{CBO} = 100$ percent or 10 nano-amperes, whichever is greater.

$\Delta h_{FE} = +20$ percent.
-10

$\Delta I_{EBO} = 100$ percent or 10 nano-amperes, whichever is greater.

4.5.9.1 Burn-in test failures (screening). All devices that exceed the delta (Δ) limits of 4.5.9 or the limits of table IV after burn-in, shall be removed from the inspection lot and the quantity removed shall be noted on the lot history. If the quantity removed after burn-in should exceed 10 percent of the number of devices subjected to the burn-in test, then the entire inspection lot shall be unacceptable for the "TX" type.



*ORDER OF THE TESTS IN THE BLOCKS SHALL BE PERFORMED AS SHOWN

FIGURE 4. Order of procedure diagram for JAN (Non-TX) and JANTX types.

5. PREPARATION FOR DELIVERY

5.1 See MIL-S-19500, section 5.

6. NOTES

6.1 Notes. The notes specified in MIL-S-19500 are applicable to this specification.

6.2 Ordering data. Inspection data (see 4.3).

6.3 The activity responsible for the Qualified Products List is Rome Air Development Center, Attn: EMTSA, Griffiss Air Force Base, New York 13440; however, information pertaining to the qualification of products may be obtained from the Defense Electronics Supply Center, 1507 Wilmington Pike, Dayton, Ohio 45401.

Custodian:
Air Force - 17

Preparing activity:
Air Force - 17

Review activities:
Air Force - 11, 85

Agent: DSA - ES
(Project 5961-F208)

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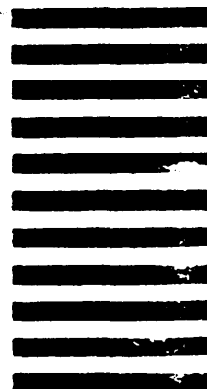
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