MIL-S-19500/36C
9 March 1967
SUPERSEDING
MIL-S-19500/36B
15 April 1963

MILITARY SPECIFICATION

SEMICONDUCTOR DEVICE, TRANSISTOR, PNP, GERMANIUM, HIGH-POWER

TYPE 2N297A

This specification is mandatory for use by all Departments and Agencies of the Department of Defense.

1. SCOPE

1.1 Scope. This specification covers the detail requirements for a PNP, germanium, high-power transistor.

1.2 Physical dimensions. See figure 1.

1.3 Maximum ratings.

P_T 1/	V_{CBO}	V_{EBO}	V_{CES}	V_{CEO}	I_E	T_{stg}
W	Vdc	Vdc	Vdc	Vdc	Adc	°C
50	-80	-40	-70	-40	5.0	-65 to +100

1/ Derate 0.67 W/°C for $T_{MB} > 25°$ C.

1.4 Primary electrical characteristics.

	h_{FE} V_{CE} = -2.0 Vdc I_C = -0.5 Adc	h_{FE} V_{CE} = -2.0 Vdc I_C = -2.0 Adc	$V_{CE}(sat)$ I_C = -2.0 Adc I_B = -200 mAdc	θ_{J-C}	f_{hfe} V_{CE} = -14 Vdc I_C = -0.5 Adc
			Vdc	°C/W	kHz
Min	40	30	---	---	5.0
Max	100	---	-0.7	1.5	---

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 this specification to the extent specified herein.

SPECIFICATION

MILITARY

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

FSC 5961

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, and as follows:

T_{MB} . . . . . Mounting base temperature

3.3 Design, construction, and physical dimensions. The transistor shall be of the design, construction, and physical dimensions specified in figure 1.

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

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.

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.

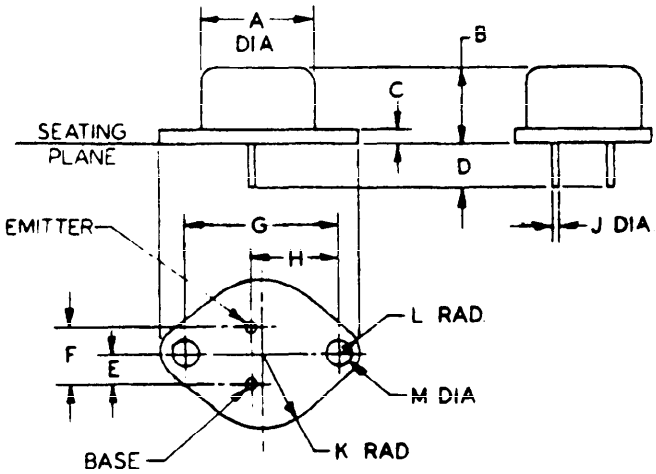
4.3 Quality conformance inspection. Quality conformance inspection shall consist of groups A, B, and C inspections.

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 for 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.



LTR	DIMENSIONS				NOTES
	INCHES		MILLIMETERS		
	MIN	MAX	MIN	MAX	
A	---	.875	---	22.23	
B	---	.562	---	14.27	
C	---	.135	---	3.43	
D	.312	---	7.92	---	3
E	.205	.225	5.21	5.72	
F	.420	.440	10.67	11.18	
G	1.177	1.197	29.90	30.40	
H	.655	.675	16.64	17.15	2
J	.038	.043	.97	1.09	3
K	---	.525	---	13.34	
L	---	.188	---	4.78	
M	.151	.161	3.84	4.09	

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. This dimension should be measured at points .050 (1.27 mm) to .055 (1.40 mm) below seating plane. When gage is not used, measurement will be made at seating plane.
3. Two leads.
4. Collector shall be electrically connected to the case.

FIGURE 1. Physical dimensions of transistor type 2N297A.

TABLE I. Group A inspection

Examination or test	MIL-STD-750		LTPD	Symbol	Limits		
	Method	Details			Min	Max	Unit
Subgroup 1			5				
Visual and mechanical examination	2071			---	---	---	---
Subgroup 2			5				
Breakdown voltage, collector to emitter	3011	Bias cond. D; I_C = -300 mAdc		BV_{CEO}	-40	---	Vdc
Breakdown voltage, collector to emitter	3011	Bias cond. C; I_C = -300 mAdc		BV_{CES}	-70	---	Vdc
Collector to base cutoff current	3036	Bias cond. D; V_{CB} = -2.0 Vdc		I_{CBO}	---	-150	μAdc
Collector to base cutoff current	3036	Bias cond. D; V_{CB} = -80 Vdc		I_{CBO}	---	-3.0	mAdc
Emitter to base cutoff current	3061	Bias cond. D; V_{EB} = -40 Vdc		I_{EBO}	---	-1.0	mAdc
Subgroup 3			5				
Forward-current transfer ratio	3076	V_{CE} = -2.0 Vdc; I_C = -0.5 Adc		h_{FE}	40	100	---
Forward-current transfer ratio	3076	V_{CE} = -2.0 Vdc; I_C = -2.0 Adc		h_{FE}	30	---	---
Collector to emitter voltage (saturated)	3071	I_C = -2.0 Adc; I_B = -200 mAdc		$V_{CE}(sat)$	---	-0.7	Vdc
Base-emitter voltage (saturated)	3066	Test cond. A; I_C = -2.0 Adc; I_B = -200 mAdc		$V_{BE}(sat)$	---	-1.0	Vdc
Base-emitter voltage (nonsaturated)	3066	Test cond. B; V_{CE} = -2.0 Vdc; I_C = -2.0 Adc		V_{BE}	---	-1.5	Vdc
Subgroup 4			15				
Small-signal short-circuit forward-current transfer ratio cutoff frequency	3301	V_{CE} = -14 Vdc; I_C = -0.5 Adc		f_{hfe}	5.0	---	kHz
High-temperature operation:		T_{MB} = + 85° C					
Collector to base cutoff current	3036	Bias cond. D; V_{CB} = -40 Vdc		I_{CBO}	---	-8.0	mAdc
Low-temperature operation:		T_{MB} = -55° C					
Forward-current transfer ratio	3076	V_{CE} = -2.0 Vdc; I_C = -0.5 Adc		h_{FE}	30	---	---

TABLE II. Group B inspection

Examination or test	MIL-STD-750		LTPD	Symbol	Limits		
	Method	Details			Min	Max	Unit
Subgroup 1			20				
Physical dimensions	2066	(See figure 1)		---	---	---	---
Subgroup 2			15				
Solderability	2026	Omit aging		---	---	---	---
Thermal shock (temperature cycling)	1051	Test cond. A		---	---	---	---
Thermal shock (glass strain)	1056	Test cond. B		---	---	---	---
Terminal strength (tension)	2036	Test cond. A; weight = 21 lbs; time = 15 sec to each terminal		---	---	---	---
Terminal strength (terminal torque)	2036	Test cond. D1; torque = 6 in.-oz.; t = 15 sec to each terminal		---	---	---	---
Seal (leak-rate)	---	Method 112, MIL-STD-202, test cond. C, procedure III; test cond. B for gross leaks		---	---	5×10^{-7}	atm cc/sec
isture resistance	1021	Omit initial conditioning		---	---	---	---
End points:							
Emitter to base cutoff current	3061	Bias cond. D; V_{EB} = -40 Vdc		I_{EBO}	---	-1.0	mAdc
Collector to base cutoff current	3036	Bias cond. D; V_{CB} = -80 Vdc		I_{CBO}	---	-3.0	mAdc
Forward-current transfer ratio	3076	V_{CE} = -2.0 Vdc; I_C = -2.0 Adc		h_{FE}	30	---	---
Subgroup 3			15				
Shock	2016	Nonoperating; 1500 G; 0.5 msec; 5 blows in each orientation: X_1, Y_1, Y_2, and Z_1		---	---	---	---
Vibration fatigue	2046	Nonoperating		---	---	---	---
Vibration, variable frequency	2056			---	---	---	---
Constant acceleration	2006	10,000 G; in each orientation: X_1, Y_1, Y_2, and Z_1		---	---	---	---
End points: (Same as subgroup 2)							
Subgroup 4			15				
Salt atmosphere (corrosion)	1041			---	---	---	---
nd point: (Same as subgroup 2)							

TABLE II. Group B inspection - Continued

Examination or test	MIL-STD-750		LTPD	Symbol	Limits		
	Method	Details			Min	Max	Unit
Subgroup 5			7				
High-temperature life (nonoperating)	1031	T_{stg} = + 100°C; time = 340 hours (see 4.3.4)		---	---	---	---
End points:							
Emitter to base cutoff current	3061	Bias cond. D; V_{EB} = -40 Vdc		I_{EBO}	---	-2.0	mAdc
Collector to base cutoff current	3036	Bias cond. D; V_{CB} = -80 Vdc		I_{CBO}	---	-6.0	mAdc
Forward-current transfer ratio	3076	V_{CE} = -2.0 Vdc; I_C = -2.0 Adc		h_{FE}	22	---	---
Subgroup 6			10				
Steady state operation life	1026	V_{CB} = -20 Vdc; T_{MB} = + 85° C; P_T = 10 W; time = 340 hours (see 4.3.4)			---	---	---
End points: (Same as subgroup 5)							

TABLE III. Group C inspection

Examination or test	MIL-STD-750		LTPD	Symbol	Limits		
	Method	Details			Min	Max	Unit
Subgroup 1			20				
Barometric pressure, reduced (altitude operation)	1001	Normal mounting; pressure = 8 mm Hg for 60 sec min		---	---	---	---
Measurement during test:							
Collector to base cutoff current	3036	Bias cond. D; V_{CB} = -80 Vdc		I_{CBO}	---	-3.0	mAdc
Thermal resistance	3151			θ_{J-C}	---	1.5	°C/W
Floating potential	3020	V_{CB} = -80 Vdc; voltmeter input resistance $\geq$ 10 megohms		V_{EBF}	---	-0.18	Vdc
Subgroup 2			λ = 10				
High-temperature life (nonoperating)	1031	T_{stg} = + 100° C (see 4.3.4)		---	---	---	---
End points: (same as subgroup 5 of group B)							

TABLE III. Group C inspection - Continued

Examination or test	MIL-STD-750		LTPD	Symbol	Limits		
	Method	Details			Min	Max	Unit
Subgroup 3			$\lambda = 15$				
Steady state operation life	1026	$V_{CB} = -20$ Vdc; $T_{MB} = +85°$ C; $P_T = 10$ W (see 4.3.4)		---	---	---	---
End points: (Same as subgroup 5 of group B)							

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 Changes from previous issue. Asterisks are not used in this revision to identify changes with respect to the previous issue, due to the extensiveness of the changes.

Custodians
Army - EL
Navy - SH
Air Force - 11

Review activities:
Army - EL, MU, MI
Navy - SH
Air Force - 11, 17, 85

User activities:
Army - EL, SM
Navy - CG, MC, AS, OS
Air Force - 14, 19

Preparing activity:
Army - EL

(Project 5961-0008-11)

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