

## MILITARY SPECIFICATION

## SEMICONDUCTOR DEVICE, TRANSISTOR, PNP, GERMANIUM, HIGH-FREQUENCY

## TYPE 2N384

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-frequency transistor.

1.2 Physical dimensions. See figure 1 (TO-44).

1.3 Maximum ratings.

$P_T \frac{1}{T_A = 25^\circ C}$	$V_{CBO}$	$V_{EBO}$	$V_{CEO}$	$I_C$	$T_{stg}$
mW	Vdc	Vdc	Vdc	mAdc	$^\circ C$
120	-40	-0.5	-20	-10	-65 to +100

<sup>1/</sup> Derate linearly 1.6 mW/ $^\circ C$  for  $T_A > 25^\circ C$ .

1.4 Primary electrical characteristics.

Limits	$C_{obo}$ $V_{CB} = -12 Vdc$ $I_E = 0$ $100 kHz \leq f \leq 1 MHz$	$h_{fe}$ $V_{CE} = -12 Vdc$ $I_E = 1.5 mAdc$	NF $V_{CB} = -12 Vdc$ $I_E = 1.5 mAdc$ $f = 50 MHz$
	pf		db
Min	---	20	---
Max	3	175	10

## 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.

FSC 5961

**STANDARD**

**MILITARY**

**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. The transistors 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.

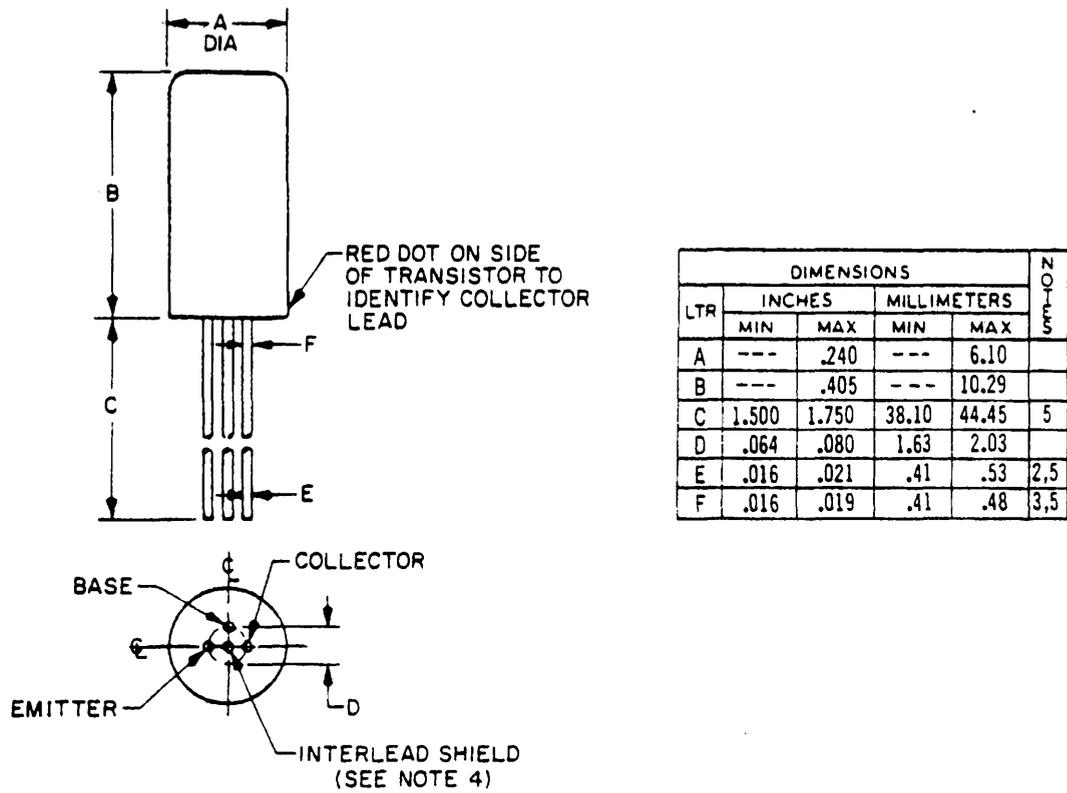
4.3.1 Group A inspection. Group A inspection shall consist of the examinations and tests specified in table I.

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 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.

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



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. Measured in the zone beyond .250 (6.35 mm) from the seating plane.
3. Measured in the zone .050 (1.27 mm) and .250 (6.35 mm) from the seating plane.
4. This lead is electrically connected to the case.
5. All four leads.

FIGURE 1. Physical dimensions of transistor type 2N384 (TO-44).

4.4.1 Collector saturation current. The specified reverse dc voltage shall be applied between the collector and base terminals. The emitter shall be dc open-circuited. The collector saturation current shall then be measured.

TABLE I. Group A inspection

Examination or test	MIL-STD-750		LTPD	Symbol	Limits		Unit
	Method	Details			Min	Max	
<u>Subgroup 1</u>			10				
Visual and mechanical examination	2071			---	---	---	
<u>Subgroup 2</u>			5				
Breakdown voltage, collector to base	3001	Bias cond. D; $I_C = -50 \mu\text{Adc}$		$BV_{CBO}$	-40	---	Vdc
Collector to emitter cutoff current	3041	Bias cond. D; $V_{CE} = -20 \text{Vdc}$		$I_{CEO}$	---	-1.0	mAdc
Breakdown voltage, emitter to base	3026	Bias cond. D; $I_E = -12 \mu\text{Adc}$		$BV_{EBO}$	0.5	---	Vdc
Collector to base cutoff current	3036	Bias cond. D; $V_{CB} = -12 \text{Vdc}$		$I_{CBO}$	---	-12	$\mu\text{Adc}$
Small-signal short-circuit forward-current transfer ratio	3206	$V_{CE} = -12 \text{Vdc}$ ; $I_E = 1.5 \text{mAdc}$		$h_{fe}$	20	175	---
Collector saturation current	---	$V_{CB} = 1.5 \text{Vdc}$ (see 4.4.1)		$I_{CB}(\text{sat})$	---	-8.0	$\mu\text{Adc}$
<u>Subgroup 3</u>			10				
Noise figure	3246	$V_{CB} = -12 \text{Vdc}$ ; $I_E = 1.5 \text{mAdc}$ ; $f = 50 \text{MHz}$ ; $R_g = 30 \text{ohms}$ ; $R_L = 2,000 \text{ohms}$		NF	---	10	db
Open-circuit output capacitance	3236	$V_{CB} = -12 \text{Vdc}$ ; $I_E = 0$ ; $100 \text{kHz} \leq f \leq 1 \text{MHz}$		$C_{obo}$	---	3	pf
Magnitude of small-signal short-circuit forward-current transfer ratio	3306	$V_{CE} = -12 \text{Vdc}$ ; $I_E = 1.5 \text{mAdc}$ ; $f = 10 \text{MHz}$		$ h_{fe} $	2.5	8	---
Small-signal power gain	3256	$V_{CB} = -12 \text{Vdc}$ ; $I_E = 1.5 \text{mAdc}$ ; $f = 50 \text{MHz}$ ; $R_g = 30 \text{ohms}$ ; $R_L = 2,000 \text{ohms}$		$G_{pe}$	13	---	db
Small-signal power gain	3256	$V_{CB} = -4 \text{Vdc}$ ; $I_E = 1.5 \text{mAdc}$ ; $f = 50 \text{MHz}$ ; $R_g = 30 \text{ohms}$ ; $R_L = 2,000 \text{ohms}$		$G_{pe}$	11	---	db

TABLE II. Group B inspection

MIL-S-19500/27E

Examination or test	MIL-STD-750		LTPD	Symbol	Limits		Unit
	Method	Details			Min	Max	
<u>Subgroup 1</u>			20				
Physical dimensions	2066	(see figure 1)		---	---	---	---
<u>Subgroup 2</u>			15				
Solderability	2026			---	---	---	---
Thermal shock (temperature cycling)	1051	Test cond. B except $T_{max} = 95^{\circ}C$ and time at temperature extremes = 15 minutes min.		---	---	---	---
Thermal shock (glass strain)	1056	Test cond. A except $T_{max} = 95^{\circ}C$ .		---	---	---	---
Moisture resistance	1021	Omit initial conditioning		---	---	---	---
End points: Collector to base cutoff current	3036	Bias cond. D; $V_{CB} = -40 V_{dc}$		$I_{CBO}$	---	-50	$\mu A_{dc}$
Small-signal short-circuit forward-current transfer ratio	3206	$V_{CE} = -12 V_{dc}$ ; $I_E = 1.5 mA_{dc}$		$h_{fe}$	20	175	---
<u>Subgroup 3</u>			15				
Shock	2016	Nonoperating: 500 G; 1.0 msec, 5 blows in each orientation: $X_1$ , $Y_1$ , $Y_2$ , and $Z_1$		---	---	---	---
Vibration, variable frequency	2056			---	---	---	---
Constant acceleration	2006	5,000 G, in each orientation: $X_1$ , $Y_1$ , $Y_2$ , and $Z_1$		---	---	---	---
End points: (Same as subgroup 2)							
<u>Subgroup 4</u>			20				
Terminal strength (lead fatigue)	2036	Test cond. E		---	---	---	---
End points: Seal (leak-rate)	1071	Test cond. G or H for fine leaks; test cond. A, C, D, or F for gross leaks		---	---	$1 \times 10^{-7}$	atm cc/sec
<u>Subgroup 5</u>			15				
Salt atmosphere	1041			---	---	---	---
End points: (Same as subgroup 2)							
<u>Subgroup 6</u>			7				
High-temperature life (nonoperating)	1032	$T_{stg} = +100^{\circ}C$ ; time = 340 hours (see 4.3.4)		---	---	---	---

TABLE II. Group B inspection - Continued

Examination or test	MIL-STD-750		LTPD	Symbol	Limits		Unit
	Method	Details			Min	Max	
<b>Subgroup 6 - Continued</b>							
End points: Collector to base cutoff current	3036	Bias cond. D; V <sub>CB</sub> = -40 Vdc	7	I <sub>CBO</sub>	---	-100	μAdc
Small-signal short-circuit forward-current transfer ratio	3208	V <sub>CE</sub> = -12 Vdc; I <sub>E</sub> = 1.5 mAdc		h <sub>fe</sub>	15	220	
<b>Subgroup 7</b>							
Steady-state operation life	1027	T <sub>A</sub> = +25° C; P <sub>T</sub> = 120 mW; V <sub>CB</sub> = -12 Vdc; 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			Min	Max	
<b>Subgroup 1</b>							
High-temperature life (nonoperating)	1031	T <sub>stg</sub> = +100° C (see 4.3.4)	λ = 10	---	---	---	
End points: (Same as subgroup 6 of group B)							
<b>Subgroup 2</b>							
Steady-state operation life	1026	T <sub>A</sub> = +25° C; P <sub>T</sub> = 120 mW; V <sub>CB</sub> = -12 Vdc (see 4.3.4)	λ = 10	---	---	---	---
End points: (Same as subgroup 6 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 - EC  
Air Force - 17

**Review activities:**

Army - MU, MI  
Navy - SH  
Air Force - 11, 85  
DSA - ES

**User activities:**

Army - SM  
Navy - CG, MC, OS, AS  
Air Force - 13, 15, 19, 70, 80

**Preparing activity:**

Army - EL

**Agent:**

DSA - ES

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