

MILITARY SPECIFICATION

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

TYPE 2N174A

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 high-power, PNP germanium transistor and is in accordance with MIL-S-19500 except as otherwise specified herein.

1.2 Physical dimensions. See figure 1 (TO-6).

1.3 Absolute-maximum ratings:

P_C $I/$ $T_{MB} = 25^\circ C$	I_E	I_B	V_{CBO}	V_{EBO}	V_{CEO}	T_{atg}
(W)	(Ade)	(Ade)	(Vde)	(Vde)	(Vde)	(°C)
75	14	4	-80	-60	-40	-65 to +100

$I/$ Derate 1.0 W/°C for $T_{MB} > 25^\circ C$.

1.4 Primary electrical characteristics.

	h_{FE} at $V_{CE} = -2$ Vdc		$V_{CE(sat)}$ $I_C = -12$ Adc $I_B = -2$ Adc	f_{hfb}	θ_{JC}
	$I_C = -1.2$ Adc	$I_C = -5$ Adc	(Vde)	(mc)	(°C/W)
Min	40	25	—	0.1	—
Max	80	—	0.7	—	0.5

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 the specification to the extent specified herein:

SPECIFICATION

Military

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

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 and as follows:

T_{MB} Mounting-base temperature.

3.3 Design and construction. Transistors shall be of the design, construction, and physical dimensions specified 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 Barometric pressure, reduced (altitude operation). Transistors shall operate satisfactorily without voltage derating (see table III).

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

- (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 six months during production.

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 Salt spray (corrosion). The transistor shall be examined for evidence of corrosion and legibility of marking before the specified measurements are made (see table II).

4.4.2 Inspection conditions. All measurements are to be made at $T_C = 25^\circ\text{C}$ unless otherwise specified.

4.4.3 Test measurement. Test measurement shall be made after thermal equilibrium has been reached at the temperature specified.

4.4.4 Pulse testing. Pulse measurements shall be used in accordance with Section 4 of MIL-STD-750.

4.4.5 Solderability. The solderability test shall apply to the two flexible leads only. The insulating sleeve shall be removed during this test. The depth of immersion is to be within 1 inch of the seating plane. Acceptance criteria shall be that the determination is 95% covered by a continuous new solder coating to within $1-1/4$ inch $\pm$ $1/8$ inch of the seating plane.

4.4.6 Moisture resistance. The insulation may be removed from the emitter and base leads prior to making the end-point measurement.

4.4.7 Terminal strength (stud torque). Acceptance criteria after the stud torque test shall be dimensions D and H of figure 1. Elongation will be allowed within these limits.

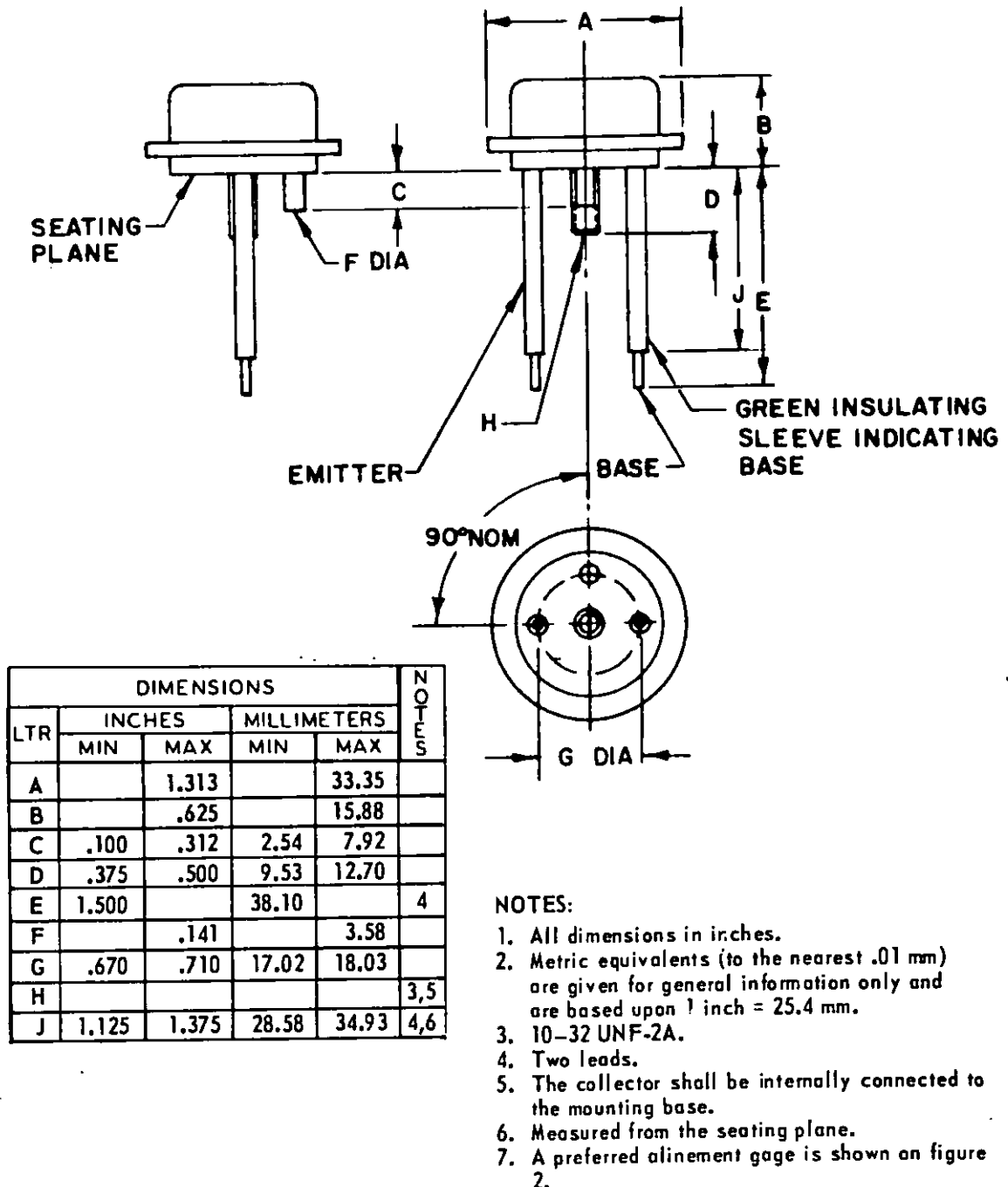
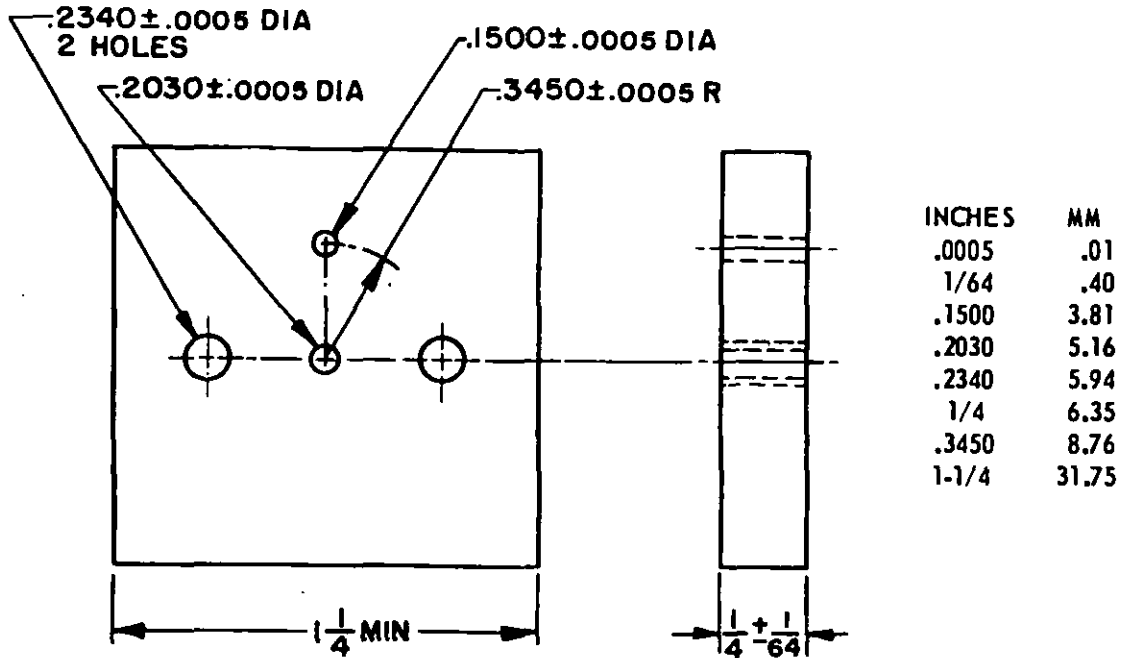


Figure 1. Physical dimensions of transistor type 2N174A.



NOTES:

1. Metric equivalents (to the nearest .01 mm) are given for general information only and are based upon 1 inch = 25.4 mm.

Figure 2. Alinement gage for transistor type 2N174A.

Table I. Group A inspection.

Examination or test	MIL-STD-750		L T P D	Symbol	Limits		
	Method	Details			Min	Max	Unit
<u>Subgroup 1</u>			10				
Visual and mechanical examination	2071						
<u>Subgroup 2</u>			5				
Breakdown voltage, emitter to base	3026	Bias cond. D; $I_E = -10 \text{ mA dc}$		BV_{EBO}	-60	---	Vdc
Collector to base cutoff current	3036	Bias cond. D; $V_{CB} = -2 \text{ Vdc}$		I_{CBO}	---	-200	$\mu\text{A dc}$
Breakdown voltage, collector to base	3001	Bias cond. D; $I_C = -15 \text{ mA dc}$		BV_{CBO}	-80	---	Vdc
Floating potential	3020	$V_{CB} = -80 \text{ Vdc}$; Voltmeter input resistance = 10 Meg. min.		V_{EEF}	---	-1.0	Vdc
Collector to emitter voltage (saturated)	3071	$I_C = -12 \text{ A dc}$; $I_B = -2 \text{ A dc}$		$V_{CE(sat)}$	---	-0.7	Vdc
Base emitter voltage (nonsaturated)	3066	Test cond. B; $V_{CE} = -2 \text{ Vdc}$; $I_C = -5 \text{ A dc}$		V_{BE}	---	-0.9	Vdc
Forward-current transfer ratio	3076	$V_{CE} = -2 \text{ Vdc}$; $I_C = -1.2 \text{ A dc}$; pulsed (see 4.4.4)		h_{FE}	40	80	---
Forward-current transfer ratio	3076	$V_{CE} = -2 \text{ Vdc}$; $I_C = -5 \text{ A dc}$; pulsed (see 4.4.4)		h_{FE}	25	---	---
Breakdown voltage, collector to emitter	3011	Bias cond. D; $I_C = -250 \text{ mA dc}$		BV_{CEO}	-40	---	Vdc
<u>Subgroup 3</u>			10				
Small-signal short-circuit forward-current transfer-ratio cutoff frequency	3301	$V_{CE} = -12 \text{ Vdc}$; $I_C = -1.2 \text{ A dc}$		f_{hfb}	0.1	---	mc
High-temperature operation:		$T_{MB} = +71^\circ\text{C min}$					
Collector to base cutoff current	3036	Bias cond. D; $V_{CB} = -30 \text{ Vdc}$		I_{CBO}	---	-6	mA dc

Table II. Group B inspection.

Examination or test	MIL-STD-750		L T P D	Symbol	Limits		
	Method	Details			Min	Max	Unit
<u>Subgroup 1</u>			20				
Physical dimensions	2066	(See figure 1)					
<u>Subgroup 2</u>			15				
Solderability	2026	(See 4.4.5)		---	---	---	---
Temperature cycling	1051	Test cond. B, except step 3, $t_{max} = +95 \begin{smallmatrix} +5 \\ -0 \end{smallmatrix} ^\circ C$		---	---	---	---
Thermal shock (glass strain)	1056	Test cond. B		---	---	---	---
Moisture resistance	1021	Omit initial conditioning (see 4.4.6)		---	---	---	---
End points:							
Collector to base cutoff current	3036	Bias cond. D; $V_{CB} = -80$ Vdc		I_{CBO}	---	-15	mAdc
Emitter to base cutoff current	3061	Bias cond. D; $V_{EB} = -60$ Vdc		I_{EBO}	---	-10	mAdc
<u>Subgroup 3</u>			15				
Shock	2016	Nonoperating; 1500 G, approx. 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	Nonoperating		---	---	---	---
Constant acceleration	2006	2000 G, in each orientation: X_1 , Y_1 , Y_2 and Z_1		---	---	---	---
End points: (Same as subgroup 2)							
<u>Subgroup 4</u> 1/			15				
Terminal strength (tension)	2036	Test cond. A; 2 lbs.-10 sec.		---	---	---	---
Terminal strength (stud torque)	2036	Test cond. C; 12 in.-lbs. $t = 30$ sec. (see 4.4.7)		---	---	---	---
<u>Subgroup 5</u>			20				
Salt spray (corrosion)	1046	Test cond. B (48 hrs); salt solution shall be 5% con- centration		---	---	---	---
End points: (Same as subgroup 2)							
<u>Subgroup 6</u>			$\lambda = 10$				
High temperature life (nonoperating)	1031	$T_{atg} = 100 ^\circ C$		---	---	---	---
End points:							
Collector to base cutoff current	3036	Bias cond. D; $V_{CB} = -80$ Vdc		I_{CBO}	---	-22	mAdc
Emitter to base cutoff current	3061	Bias cond. D; $V_{EB} = -60$ Vdc		I_{EBO}	---	-22	mAdc

See footnote at end of table.

Table II. Group B inspection. - Continued

Examination or test	MIL-STD-750		L T P D	Symbol	Limits		
	Method	Details			Min	Max	Unit
End points: (Cont)							
Forward-current transfer ratio	3076	$V_{CE} = -2 \text{ Vdc}$; $I_C = -1.2 \text{ Adc}$, pulsed (see 4.4.4)	$\lambda = 10$	hFE	30	100	---
Subgroup 7							
Steady state operation life	1026	$T_{MB} = +75 \text{ }^\circ\text{C min}$; $P_C = 20 \text{ W min}$.		---	---	---	---
End points: (Same as subgroup 6)							

1/ Electrical rejects from the same lot may be used for this test.

Table III. Group C inspection.

Examination or test	MIL-STD-750		L T P D	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; (see 3.4.1)		---	---	---	---
Measurement during test: Collector to base cutoff current	3036	Bias cond. D; $V_{CB} = -80 \text{ Vdc}$		I_{CBO}	---	15	mAdc
Thermal resistance (junction to cas.)	3151			θ_{J-C}	---	0.5	$^\circ\text{C/W}$

5. PREPARATION FOR DELIVERY

5.1 Preparation for delivery and the quality assurance provisions for preparation for delivery shall conform to MIL-S-19500.

6. NOTES

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

Custodians:

Army - EL
Navy - SH
Air Force - 11

Preparing activity:
Navy - SH

(Project 5960-2023)

Review activities:

Army - EL, MU, SM, MI
Navy - SH
Air Force - 11, 17, 85

User activities:

Army - None
Navy - CG, MC, WP
Air Force - None