

MILITARY SPECIFICATION

SEMICONDUCTOR DEVICE, TRANSISTOR, PNP, SILICON, LOW-POWER  
 TYPES 2N1025, 2N1026 AND 2N1469

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 PNP, silicon, low-power transistors.

1.2 Physical dimensions. See figure 1 (TO-5).

1.3 Maximum ratings.

$P_T$ 1/	$V_{CBO}$	$V_{CEO}$	$V_{EBO}$	$T_{stg}$	$T_{op}$
<u>mW</u>	<u>Vdc</u>	<u>Vdc</u>	<u>Vdc</u>	<u>°C</u>	<u>°C</u>
250	-40	-35	-40	-65 to +200	-55 to +200

1/ Derate linearly 1.42 mW/°C for  $T_A > 25^\circ\text{C}$ .

\* 1.4 Primary electrical characteristics.

Limits	$h_{FE}$			$h_{fe}$			$h_{fb}$		
	$V_{CE} = -0.5 \text{ Vdc}$ $I_C = -1 \text{ mAdc}$			$V_{CB} = -6 \text{ Vdc}$ $I_E = 1 \text{ mAdc}$			$V_{CE} = -6 \text{ Vdc}$ $I_E = 1 \text{ mAdc}$		
	2N1025	2N1026	2N1469	2N1025	2N1026	2N1469	2N1025	2N1026	2N1469
Min	7	12	24	9	18	36	<u>MHz</u>	<u>MHz</u>	<u>MHz</u>
Max	21	36	75	22	44	88	---	---	---

## 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.

\* 3.3.1 Terminal-lead length. Terminal-lead length(s) other than that specified in figure 1 may be furnished when so stipulated in the contract or order where the devices covered herein are required directly for particular equipment-circuit installation or for automatic-assembly-technique programs. Where other lead lengths are required and provided, it shall not be construed as adversely affecting the qualified-product status of the device, or applicable JAN marking (see 6.2).

\* 3.3.2 Lead material and finish. Lead material shall be Kovar or alloy 52. Lead finish shall be gold-plated. (Leads may be tin-plated if specified in the contract or order, and this requirement shall not be construed as adversely affecting the qualified-product status of the device, or applicable JAN marking (see 6.2).

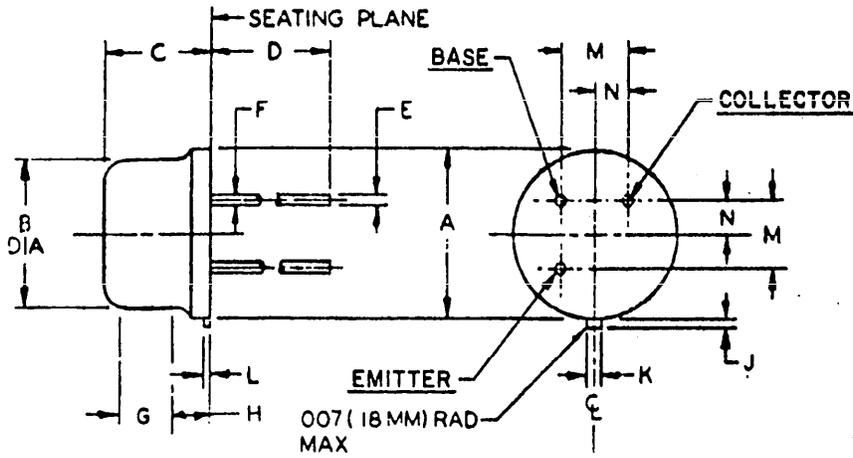
3.4 Performance characteristics. Performance characteristics shall be as specified in tables I, II, and III.

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.

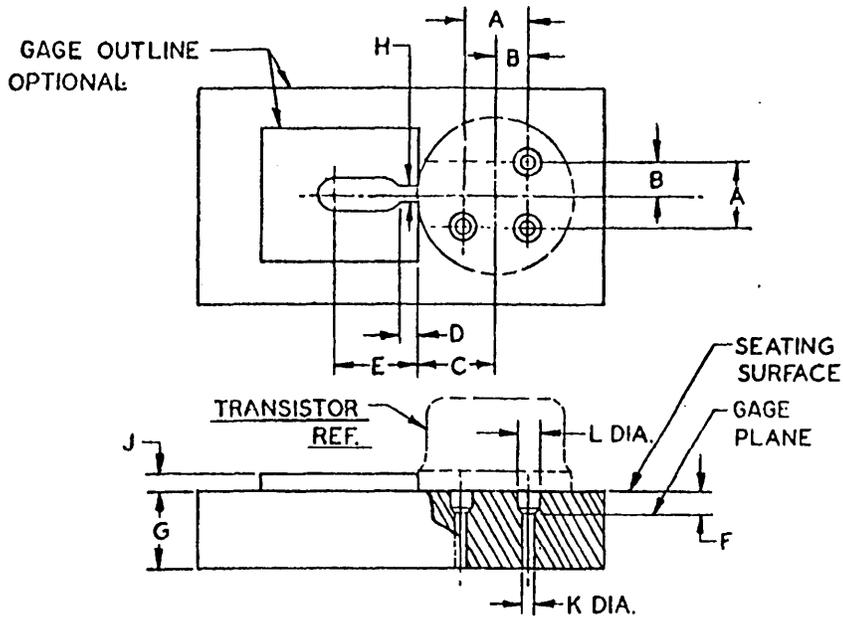


LTR	DIMENSIONS				NOTES
	INCHES		MILIMETERS		
	MIN	MAX	MIN	MAX	
A	.355	.370	8.51	9.40	
B	.305	.335	7.75	8.51	
C	.240	.260	6.10	6.60	
* D	1.500	1.750	38.10	44.45	9
E	.016	.021	.41	.53	2,9
F	.016	.019	.41	.48	3,9
G	.100	---	2.54	---	4
H	---	---	---	---	5
J	.029	.045	.74	1.14	8
K	.028	.034	.71	.86	
* L	.009	.041	.23	1.04	
M	.1414Nom		3.59Nom		6
N	.0707Nom		1.80Nom		6

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. Variations on dimension B in this zone shall not exceed .010(.25mm).
5. Outline in this zone is not controlled.
6. When measured in a gaging plane .054+.001, -.000(1.37+.03, -.00 mm) below the seating plane of the transistor maximum diameter leads shall be within .007 (.18 mm) of their true location relative to a maximum width tab. Smaller diameter leads shall fall within the outline of the maximum diameter lead tolerance. Figure 2 shows the preferred measured method.
7. All leads shall be electrically insulated from the case.
8. Measured from the maximum diameter of the actual device.
9. All 3 leads.

\* FIGURE 1. Physical dimensions of transistor types 2N1025, 2N1026 and 2N1469 (TO-5).



LTR	DIMENSIONS			
	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	.1409	.1419	3.58	3.60
B	.0702	.0712	1.78	1.81
C	.182	.199	4.62	5.05
D	.009	.011	.23	.28
E	.125 Nom		3.18 Nom	
F	.054	.055	1.37	1.40
G	.372	.378	9.45	9.60
H	.0350	.0355	.89	.90
J	.150 Nom		3.81 Nom	
K	.0325	.0335	.83	.85
L	.0595	.0505	1.51	1.54

NOTES:

1. The following gaging procedure shall be used: The use of a pin straightener prior to insertion in the gage is permissible. The device being measured shall be inserted until its seating plane is  $.125 \pm .010$  (3.18  $\pm$  .25 mm) from the seating surface of the gage. A spacer may be used to obtain the .125 (3.18 mm) distance from the gage seat prior to force application. A force of 8 oz  $\pm$  .05 oz shall then be applied parallel and symmetrical to the device's cylindrical axis. When examined visually after the force application (the force need not be removed) the seating plane of the device shall be seated against the gage.
2. The location of the tab locator, within the limits of dim C, will be determined by the tab and flange dimension of the device being checked.
3. Metric equivalents (to the nearest .01 mm) are given for general information only and are based upon 1 inch = 25.4 mm.

FIGURE 2. Gage for lead and tab location for transistor types 2N1025, 2N1026 and 2N1469.

TABLE I. Group A Inspection

MIL-S-18500/78C

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 $I_C = -100 \mu\text{Adc}$		BVCBO	-40	---	Vdc
Breakdown voltage, emitter to base	3026	Bias cond. D $I_E = -100 \mu\text{Adc}$		BVEBO	-40	---	Vdc
Breakdown voltage, collector to emitter	3011	Bias cond. D $I_C = -100 \mu\text{Adc}$		BVCEO	-35	---	Vdc
Collector to base cutoff current	3036	Bias cond. D $V_{CB} = -35 \text{ Vdc}$		ICBO	---	-25	nAdc
Emitter to base cutoff current	3061	Bias cond. D $V_{EB} = -35 \text{ Vdc}$		IEBO	---	-25	nAdc
<u>Subgroup 3</u>			5				
Collector to emitter voltage (saturated)	3071	$I_C = -5 \text{ mAdc}$ $I_B = 2 \text{ mAdc}$		VCE(sat)	---	-0.25	Vdc
Forward-current transfer ratio	3076	$V_{CE} = -0.5 \text{ Vdc}$ $I_C = -1 \text{ mAdc}$					
2N1025				hFE	7	21	---
2N1026					12	36	---
2N1469					24	75	---
Small-signal short-circuit forward-current transfer ratio cutoff frequency	3301	$V_{CB} = -6 \text{ Vdc}$ $I_E = 1 \text{ mAdc}$					
2N1025				f <sub>hfb</sub>	1	---	MHz
2N1026					2	---	MHz
2N1469					2	---	MHz
Noise figure	3246	$V_{CB} = -6 \text{ Vdc}$ $I_E = 1 \text{ mAdc}$ $R_g = 500 \text{ ohms}$		NF	---	25	dB
Open circuit output capacitance	3236	$V_{CB} = -6 \text{ Vdc}; I_E = 0$ $100 \text{ kHz} \leq f \leq 1 \text{ MHz}$		Cobo	---	12	pF
<u>Subgroup 4</u>			5				
Small-signal open-circuit output admittance	3216	$V_{CB} = -6 \text{ Vdc}$ $I_E = 1 \text{ mAdc}$		h <sub>ob</sub>	0.1	2.5	$\mu\text{mho}$
Small-signal open-circuit reverse voltage transfer ratio	3211	$V_{CB} = -6 \text{ Vdc}$ $I_E = 1 \text{ mAdc}$		h <sub>rb</sub>	25	2000	$\times 10^{-6}$
Small-signal short-circuit input impedance	3201	$V_{CB} = -6 \text{ Vdc}$ $I_E = 1 \text{ mAdc}$		h <sub>ib</sub>	25	75	ohms

TABLE I. Group A inspection - Continued

Examination or test	MIL-STD-750		LTPD	Symbol	Limits		Unit	
	Method	Details			Min	Max		
<u>Subgroup 4</u> - Continued								
Small-signal short-circuit forward-current transfer ratio	3206	$V_{CB} = -6 \text{ Vdc}$ $I_E = 1 \text{ mAdc}$	10	hfe	9	22	---	
2N1025					18	44	---	
2N1026					36	88	---	
2N1469								
* <u>Subgroup 5</u>								
High-temperature operation:		$T_A = +150^\circ\text{C}$						
Collector to base cutoff current	3036	Bias cond. D $V_{CB} = -10 \text{ Vdc}$			ICBO	---	-50	$\mu\text{Adc}$
Low-temperature operation:		$T_A = -55^\circ\text{C}$						
Forward-current transfer ratio	3076	$V_{CE} = -0.5 \text{ Vdc}$ $I_C = -1 \text{ mAdc}$			hFE	4	---	---
2N1025				6		---	---	
2N1026			12	---		---		
2N1469								

TABLE II. Group B inspection

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. C; 10 cycles		---	---	---	---
Thermal shock (glass strain)	1056	Test cond. A		---	---	---	---
Moisture resistance	1021			---	---	---	---
End points:							
Collector to base cutoff current	3036	Bias cond. D $V_{CB} = -35 \text{ Vdc}$		ICBO	---	-25	nAdc
Small-signal short-circuit forward-current transfer ratio	3206	$V_{CB} = -6 \text{ Vdc}$ $I_E = 1 \text{ mAdc}$		hfe	9	22	---
2N1025			18		44	---	
2N1026			36		88	---	
2N1469							
Small-signal open-circuit output admittance	3216	$V_{CB} = -6 \text{ Vdc}$ $I_E = 1 \text{ mAdc}$		hob	0.1	2.5	$\mu\text{mho}$

TABLE II. Group B Inspection - Continued

MIL-S-19500/78C

Examination or test	MIL-STD-750		LTPD	Symbol	Limits		Unit
	Method	Details			Min	Max	
* <u>Subgroup 3</u>			10				
Shock	2016	Nonoperating; 1, 500 G; 0.5 ms; 5 blows in each orientation: X <sub>1</sub> , Y <sub>1</sub> , Y <sub>2</sub> , and Z <sub>1</sub>		---	---	---	---
Vibration, variable frequency	2056	10 G		---	---	---	---
Constant acceleration	2006	20,000 G in each orientation: X <sub>1</sub> , Y <sub>1</sub> , Y <sub>2</sub> , and Z <sub>1</sub>		---	---	---	---
End points: (Same as subgroup 2)							
* <u>Subgroup 4</u>			10				
Terminal strength (lead fatigue)	2036	Test cond. E		---	---	---	---
End points:							
Hermetic seal	1071	Test cond. G or H for fine leaks; test cond. A, C, D or F for gross leaks		---	---	1x10 <sup>-7</sup>	atm cc/s
* <u>Subgroup 5</u>			20				
Salt atmosphere (corrosion)	1041			---	---	---	---
* <u>Subgroup 6</u>			7				
High-temperature life (nonoperating)	1032	T <sub>stg</sub> = +200°C time = 340 hours (see 4.3.4)		---	---	---	---
End points:							
Collector to base cutoff current	3036	Bias cond. D V <sub>CB</sub> = -35 Vdc		ICBO	---	-50	μA <sub>dc</sub>
Small-signal short-circuit forward-current transfer ratio	3206	V <sub>CB</sub> = -6 Vdc I <sub>E</sub> = 1 mA <sub>dc</sub>					
2N1025				h <sub>fe</sub>	7	33	---
2N1026					14	66	---
2N1469					28	132	---
Small-signal open-circuit output admittance	3216	V <sub>CB</sub> = -6 Vdc I <sub>E</sub> = 1 mA <sub>dc</sub>		h <sub>ob</sub>	---	3.5	μmho
* <u>Subgroup 7</u>			7				
Steady-state operation life	1027	P <sub>T</sub> = 250 mW V <sub>CB</sub> = -10 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	
* <u>Subgroup 1</u> Resistance to solvents	---	MIL-STD-202, Method 215 (see 4.4.1)	10	---	---	---	---
* <u>Subgroup 2</u> High-temperature life (nonoperating) End points: (Same as subgroup 6 of group B)	1031	T <sub>stg</sub> = +200°C (see 4.3.4)	$\lambda = 10$	---	---	---	---
* <u>Subgroup 3</u> Steady-state operation life End points: (Same as subgroup 6 of group B)	1026	P <sub>T</sub> = 250 mW V <sub>CB</sub> = -10 Vdc (see 4.3.4)	$\lambda = 10$	---	---	---	---

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 group 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 tests specified in table III. This inspection shall be conducted on the initial lot and thereafter every six months during production.

\* 4.3.4 Group B and group C life-test samples. Samples that have been subjected to group B, 340-hour 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 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.

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.

- (a) Terminal-lead length if other than specified in figure 1 (see 3.3.1).
- (b) Lead finish if other than gold-plated (see 3.3.2).

6.3 Changes from previous issue. The margins of this specification are marked with an asterisk to indicate where changes (additions, modification, corrections, deletions) from the previous issue were made. This was done as a convenience only and the Government assumes no liability whatsoever for any inaccuracies in these notations. Bidders and contractors are cautioned to evaluate the requirements of this document based on the entire content irrespective of the marginal notations and relationship to the last previous issue.

Custodians:

Army - EL  
Navy - EC  
Air Force - 17

Review activities:

Army - MU, MI  
Air Force - 11, 70, 80  
DSA - ES

User activities:

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

Preparing activity:

Army - EL

Agent:

DSA - ES

(Project 5961-0235)