

MILITARY SPECIFICATION

SEMICONDUCTOR DEVICE, TRANSISTOR, NPN, SILICON, LOW-POWER
TYPES 2N757A, 2N759A AND 2N760A

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 silicon, NPN, low-power transistors.

1.2 Physical dimensions. See figure 1 (TO-18).

1.3 Maximum ratings.

$P_T \frac{1}{T_A = 25^\circ C}$	V_{CEO}	V_{CBO}	V_{EBO}			I_C	T_{stg}
			2N757A	2N759A	2N760A		
mW	Vdc	Vdc	Vdc	Vdc	Vdc	mAdc	$^\circ C$
500	60	75	6	8	8	100	-65 to +200

1/ Derate linearly 2.86 mW/ $^\circ C$ for $T_A > 25^\circ C$.

1.4 Primary electrical characteristics.

	h_{fe} $V_{CB} = 5 Vdc$ $I_E = -1.0 mAdc$			h_{fe} $V_{CB} = 5 Vdc$ $I_E = -1 mAdc$ $f = 30 MHz$	C_{obo} $V_{CB} = 5 Vdc$ $I_E = 0$ $100 kHz \leq f \leq 1 MHz$	h_{ib} $V_{CB} = 5 Vdc$ $I_E = -1 mAdc$	h_{ob} $V_{CB} = 5 Vdc$ $I_E = -1 mAdc$	h_{rb} $V_{CB} = 5 Vdc$ $I_E = -1 mAdc$
	2N757A	2N759A	2N760A					
Min	18	36	76					
Max	40	90	333					

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. Transistor shall be of the design, construction, and physical dimensions shown on figure 1.

3.3.1 Lead material and finish. Lead material and finish shall be gold-plated Kovar. (Leads may be tin-coated if specified in the contract or order, 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.

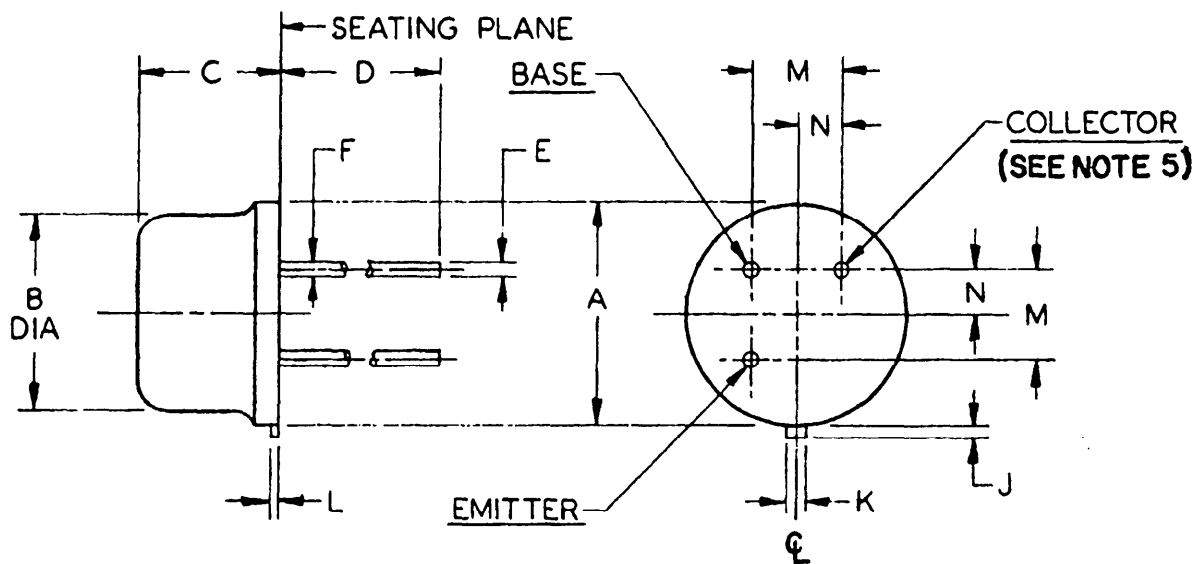
4.2 Qualification inspection. Qualification inspection shall consist of the examinations and tests specified in tables I, II, and III;

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.



Ltr	Dimensions in inches with metric equivalents (mm) in parentheses (see note 1)		N o t e
	Minimum	Maximum	
A	.209 (5.31)	.230 (5.84)	
B	.178 (4.52)	.195 (4.95)	
C	.170 (4.32)	.210 (5.33)	
D	.500 (12.70)		7
E		.021 (.53)	2,7
F	.016 (.41)	.019 (.48)	3,7
J	.028 (.71)	.048 (1.22)	6
K	.036 (.91)	.046 (1.17)	
L		.020 (.51)	
M	.0707 (1.80) Nom		4
N	.0354 (.90) Nom		4

- 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. 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 preferred measured method.
 - 5. The collector shall be internally connected to the case.
 - 6. Measured from the maximum diameter of the actual device.
 - 7. All 3 leads.

FIGURE 1. Physical dimensions of transistor types 2N757A, 2N759A, and 2N760A (TO-18).

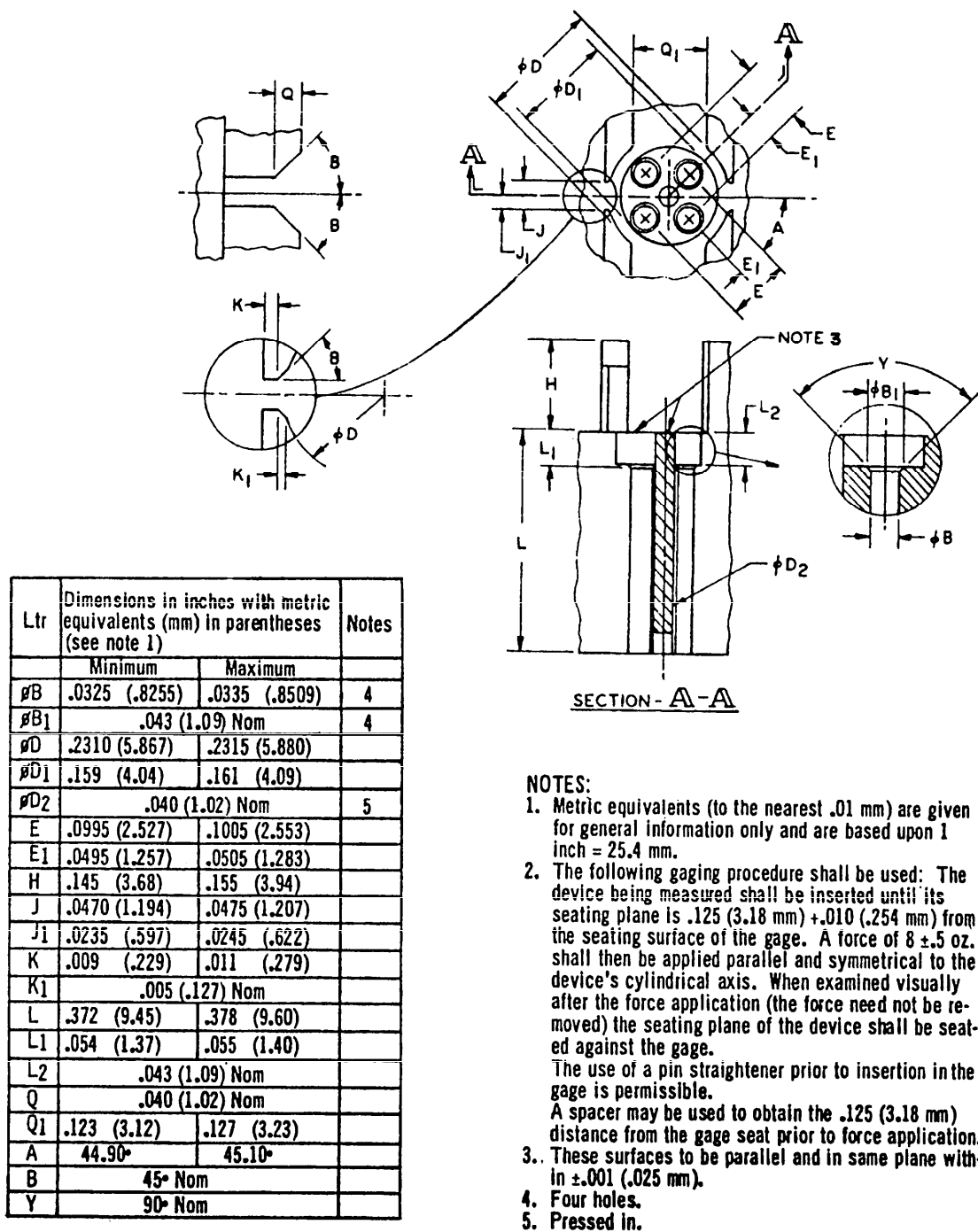


FIGURE 2. Gage for lead-and-tab location for transistor types 2N757A, 2N759A, and 2N760A.

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.

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

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				
Emitter to base cutoff current	3061	Bias cond. D; $V_{EB} = 5 \text{ Vdc}$		I_{EBO}	---	10	nAdc
Collector to base cutoff current	3036	Bias cond. D; $V_{CB} = 30 \text{ Vdc}$		I_{CBO}	---	10	nAdc
Breakdown voltage, collector to base	3001	Bias cond. D; $I_C = 50 \mu\text{Adc}$		BV_{CBO}	75	---	Vdc
Breakdown voltage, collector to emitter	3011	Bias cond. D; $I_C = 1 \text{ mAdc}$		BV_{CEO}	60	---	Vdc
Breakdown voltage, emitter to base	3026	Bias cond. D; $I_E = 100 \mu\text{Adc}$		BV_{EBO}			
2N757A					6	---	Vdc
2N759A					8	---	Vdc
2N760A					8	---	Vdc
Collector to emitter voltage (saturated)	3071	$I_C = 10 \text{ mAdc}; I_B = 1 \text{ mAdc}$		$V_{CE}(\text{sat})$	---	1.0	Vdc
Base emitter voltage (saturated)	3066	Test cond. A; $I_C = 10 \text{ mAdc}; I_B = 1 \text{ mAdc}$		$V_{BE}(\text{sat})$	0.6	1.1	Vdc
<u>Subgroup 3</u>			5				
Small-signal open-circuit output admittance	3216	$V_{CB} = 5 \text{ Vdc}; I_E = -1 \text{ mAdc}$		h_{ob}	---	1.0	μmho
Small-signal open-circuit reverse-voltage transfer ratio	3211	$V_{CB} = 5 \text{ Vdc}; I_E = -1 \text{ mAdc}$		h_{rb}	---	1,000	$\times 10^{-6}$
Small-signal short-circuit input impedance	3201	$V_{CB} = 5 \text{ Vdc}; I_E = -1 \text{ mAdc}$		h_{ib}	---	80	ohms

TABLE I. Group A inspection - Continued

Examination or test	MIL-STD-750		L T P D	Symbol	Limits			
	Method	Details			Min	Max	Unit	
<u>Subgroup 3 - Continued</u>								
Small-signal short-circuit forward-current transfer ratio 2N757A 2N759A 2N760A	3206	$V_{CB} = 5 \text{ Vdc}; I_E = -0.1 \text{ mAdc}$	5	h_{fe}	9 15 40	--- --- ---	--- --- ---	
Small-signal short-circuit forward-current transfer ratio 2N757A 2N759A 2N760A	3206	$V_{CB} = 5 \text{ Vdc}; I_E = -1 \text{ mAdc}$		h_{fe}	18 36 76	40 90 333	--- --- ---	
Small-signal short-circuit forward-current transfer ratio 2N757A 2N759A 2N760A	3206	$V_{CB} = 5 \text{ Vdc}; I_E = -10 \text{ mAdc}$		h_{fe}	25 50 100	--- --- ---	--- --- ---	
<u>Subgroup 4</u>								
Magnitude of common-emitter small-signal short-circuit forward-current transfer ratio	3306	$V_{CB} = 5 \text{ Vdc}; I_E = -1 \text{ mAdc}; f = 30 \text{ MHz}$			$ h_{fe} $	2	---	---
Open-circuit output capacitance	3236	$V_{CB} = 5 \text{ Vdc}; I_E = 0; 100 \text{ kHz} \leq f \leq 1 \text{ MHz}$			Cobo	---	6.0	pf
Noise figure	3246	$V_{CB} = 5 \text{ Vdc}; I_E = -1 \text{ mAdc}; R_g = 500 \text{ ohms}$			NF	---	24	db
<u>Subgroup 5</u>								
High-temperature operation: Collector-to-base cutoff current	3036	$T_A = +150^\circ \text{ C}$ Bias cond. D; $V_{CB} = 30 \text{ Vdc}$			I_{CBO}	---	10	μAdc
Low-temperature operation: Small-signal short-circuit forward-current transfer ratio 2N757A 2N759A 2N760A	3206	$T_A = -55^\circ \text{ C}$ $V_{CB} = 5 \text{ Vdc}; I_E = -10 \text{ mAdc}$			h_{fe}	12 25 50	--- --- ---	--- --- ---

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	Omit aging		---	---	---	---
Thermal shock (temperature cycling)	1051	Test cond. C		---	---	---	---
Thermal shock (glass strain)	1056	Test cond. A		---	---	---	---
Seal (leak-rate)	---	Method 112, MIL-STD-202, test cond. C, procedure III; test cond. A for gross leaks		---	---	5×10^{-7}	atm cc/sec
Moisture resistance	1021			---	---	---	---
End points: Collector to base cutoff current	3036	Bias cond. D; $V_{CB} = 30$ Vdc		I_{CBO}	---	50	nA dc
Small-signal short-circuit forward-current transfer ratio	3206	$V_{CB} = 5$ Vdc; $I_E = -1$ mA dc		h_{fe}			
2N757A					18	40	---
2N759A					36	90	---
2N760A					76	333	---
<u>Subgroup 3</u>			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 occeleation	2006	20,000 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		---	---	---	---
<u>Subgroup 5</u>			20				
Salt atmosphere (corrosion)	1041			---	---	---	---
End points: (Same as subgroup 2)							

TABLE II. Group B inspection - Continued

Examination or test	MIL-STD-750		L T P D	Symbol	Limits		
	Method	Details			Min	Max	Unit
<u>Subgroup 6</u>			5				
High-temperature life (nonoperating)	1031	T _{stg} = +200°C; t = 340 hrs (see 4.3.4)		---	---	---	---
End points:							
Collector to base cutoff current	3036	Bias cond. D; V _{CB} = 30 Vdc		I _{CBO}	---	100	nAdc
Small-signal short-circuit forward-current transfer ratio	3206	V _{CB} = 5 Vdc; I _E = -1 mAdc		h _{fe}			
2N757A					15	48	---
2N759A					30	100	---
2N760A					65	370	---
<u>Subgroup 7</u>			5				
Steady state operation life	1026	T _A = 25°C; V _{CB} = 20 Vdc; P _T = 500 mW; t = 340 hrs (see 4.3.4)			---	---	---
End points:							
(Same as subgroup 6)							

TABLE III. Group C inspection (see 4.3.3).

Examination or test	MIL-STD-750		L T P D	Symbol	Limits		
	Method	Details			Min	Max	Unit
<u>Subgroup 1</u>			15				
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} = 75 Vdc		I _{CBO}	---	50	μAdc

TABLE III. Group C Inspection (see 4.3.3) - Continued

Examination or test	MIL-STD-750		L T P D	Symbol	Limits		
	Method	Details			Min	Max	Unit
<u>Subgroup 2</u> High-temperature life (nonoperating) End points: (Same as subgroup 6 of group B)	1031	$T_{stg} = +200^{\circ}\text{C}$ (see 4.3.4)	$\lambda = 5$	---	---	---	---
<u>Subgroup 3</u> Steady state operation life End points: (Same as subgroup 6 of group B)	1026	$V_{CB} = 20\text{ Vdc};$ $P_T = 500\text{ mW}; T_A = 25^{\circ}\text{C}$ (see 4.3.4)	$\lambda = 5$	---	---	---	---

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) Lead finish if other than gold-plated Kovar. (See 3.3.1.)

6.3 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.

6.4 Substitution criteria. The devices covered herein are unilateral substitutes for the corresponding devices covered by the superseded MIL-S-19500/218 (SigC).

Custodians:
Army - EL
Navy - SH
Air Force - 11

Preparing activity:
Army - EL

(Project 5961-0013-21)

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

Code "C"

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

SPECIFICATION ANALYSIS SHEET

Form Approved
Budget Bureau No. 119-R004

INSTRUCTIONS

This sheet is to be filled out by personnel either Government or contractor, involved in the use of the specification in procurement of products for ultimate use by the Department of Defense. This sheet is provided for obtaining information on the use of this specification which will insure that suitable products can be procured with a minimum amount of delay and at the least cost. Comments and the return of this form will be appreciated. Fold on lines on reverse side, staple in corner, and send to preparing activity.

SPECIFICATION

ORGANIZATION

CITY AND STATE

CONTRACT NO.

QUANTITY OF ITEMS PROCURED

DOLLAR AMOUNT

\$

MATERIAL PROCURED UNDER A

☐ DIRECT GOVERNMENT CONTRACT

☐ SUBCONTRACT

1. HAS ANY PART OF THE SPECIFICATION CREATED PROBLEMS OR REQUIRED INTERPRETATION IN PROCUREMENT USE?

A. GIVE PARAGRAPH NUMBER AND WORDING.

B. RECOMMENDATIONS FOR CORRECTING THE DEFICIENCIES

2. COMMENTS ON ANY SPECIFICATION REQUIREMENT CONSIDERED TOO RIGID

3. IS THE SPECIFICATION RESTRICTIVE?

☐ YES ☐ NO IF "YES", IN WHAT WAY?

4. REMARKS (Attach any pertinent data which may be of use in improving this specification. If there are additional papers, attach to form and place both in an envelope addressed to preparing activity)

SUBMITTED BY (Printed or typed name and activity)

DATE

To detach this form, cut along this line

FOLD

DEPARTMENT OF THE ARMY
HEADQUARTERS
U.S. ARMY ELECTRONICS COMMAND
FORT MONMOUTH, NEW JERSEY 07703

OFFICIAL BUSINESS

POSTAGE AND FEES PAID

DEPARTMENT OF THE ARMY

Commanding General
U. S. Army Electronics Command
ATTN: AMSEL-PP-
Fort Monmouth, New Jersey 07703

FOLD

To detach this form cut along this line