

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_{CE0}	V_{CB0}	V_{EBO}			I_C	T_{stg}
			2N757A	2N759A	2N760A		
<u>mW</u>	<u>Vdc</u>	<u>Vdc</u>	<u>Vdc</u>	<u>Vdc</u>	<u>Vdc</u>	<u>mAdc</u>	<u>° C</u>
500	60	75	6	8	8	100	-65 to +200

$\frac{1}{2}$ Derate linearly 2.86 mW/° 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	2	pf	ohms	μmho	$\times 10^{-6}$
Max	40	90	333	---	6	80	1.0	1,000

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.

FSC 5961

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.

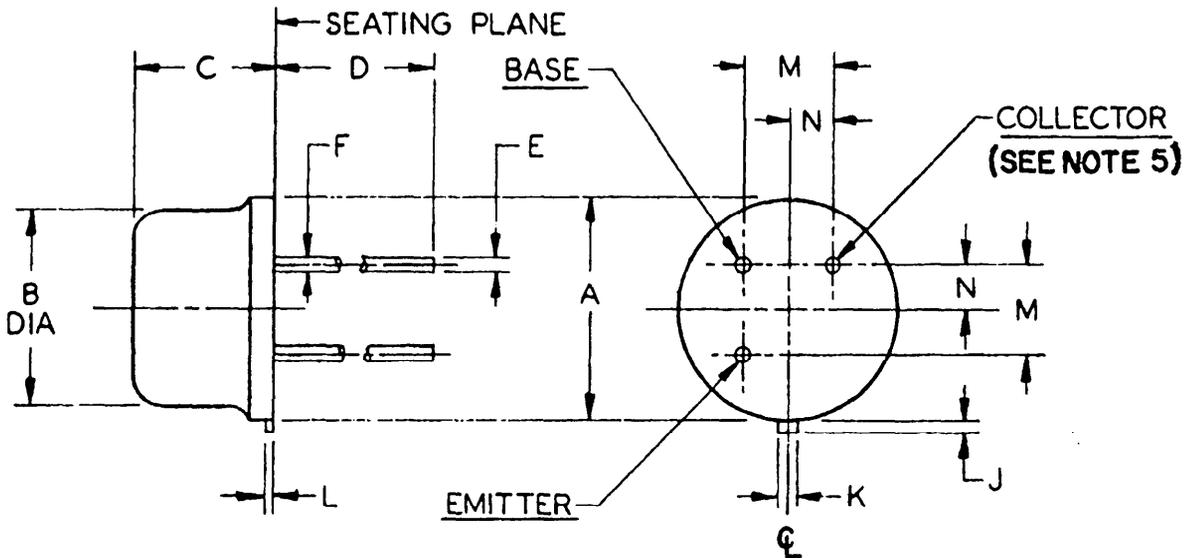
4.2 Qualification inspection. Qualification inspection shall consist of the examinations and tests specified in tables I, II, and III;

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.

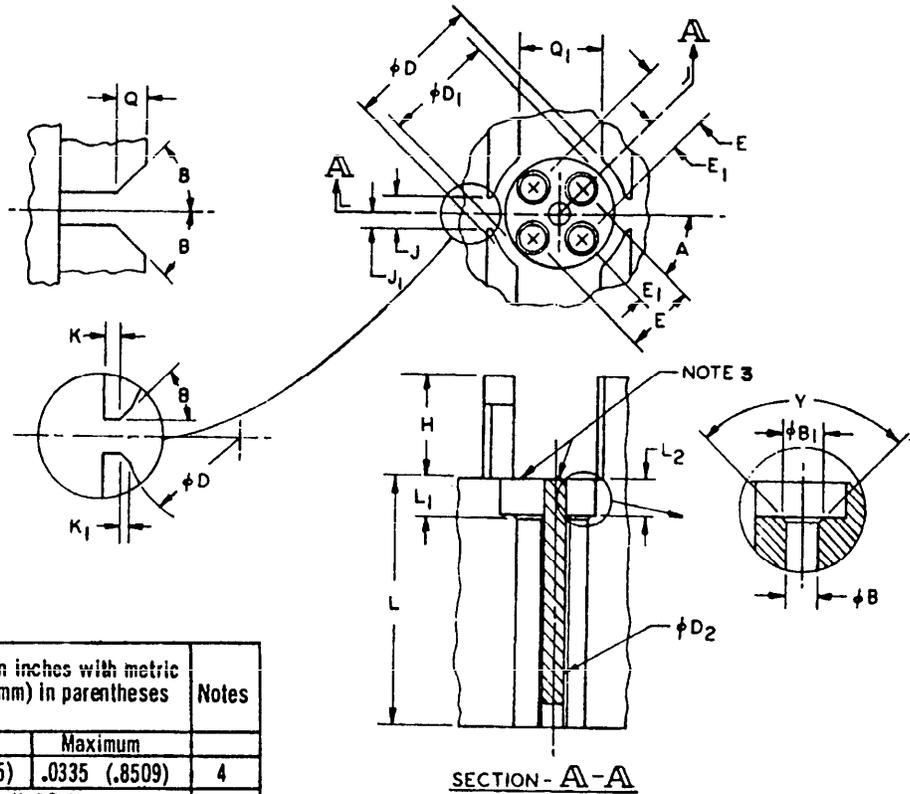


Ltr	Dimensions in inches with metric equivalents (mm) in parentheses (see note 1)		N o t e
	Minimum	Maximum	
A	.209 (5.31)	.230 (5.84)	
B	.178 (4.52)	.195 (4.95)	
C	.170 (4.32)	.210 (5.33)	
D	.500 (12.70)		7
E		.021 (.53)	2,7
F	.016 (.41)	.019 (.48)	3,7
J	.028 (.71)	.048 (1.22)	6
K	.036 (.91)	.046 (1.17)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



Ltr	Dimensions in inches with metric equivalents (mm) in parentheses (see note 1)		Notes
	Minimum	Maximum	
ϕB	.0325 (.8255)	.0335 (.8509)	4
ϕB_1	.043 (1.09) Nom		4
ϕD	.2310 (5.867)	.2315 (5.880)	
ϕD_1	.159 (4.04)	.161 (4.09)	
ϕD_2	.040 (1.02) Nom		5
E	.0995 (2.527)	.1005 (2.553)	
E ₁	.0495 (1.257)	.0505 (1.283)	
H	.145 (3.68)	.155 (3.94)	
J	.0470 (1.194)	.0475 (1.207)	
J ₁	.0235 (.597)	.0245 (.622)	
K	.009 (.229)	.011 (.279)	
K ₁	.005 (.127) Nom		
L	.372 (9.45)	.378 (9.60)	
L ₁	.054 (1.37)	.055 (1.40)	
L ₂	.043 (1.09) Nom		
Q	.040 (1.02) Nom		
Q ₁	.123 (3.12)	.127 (3.23)	
A	44.90°	45.10°	
B	45° Nom		
Y	90° Nom		

- 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. The following gaging procedure shall be used: The device being measured shall be inserted until its seating plane is .125 (3.18 mm) +.010 (.254 mm) from the seating surface of the gage. A force of 8 ±.5 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.
The use of a pin straightener prior to insertion in the gage is permissible.
A spacer may be used to obtain the .125 (3.18 mm) distance from the gage seat prior to force application.
 3. These surfaces to be parallel and in same plane within ±.001 (.025 mm).
 4. Four holes.
 5. Pressed in.

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; $V_{EB} = 5$ Vdc		I_{EBO}	---	10	nAdc
Collector to base cutoff current	3036	Bias cond. D; $V_{CB} = 30$ Vdc		I_{CBO}	---	10	nAdc
Breakdown voltage, collector to base	3001	Bias cond. D; $I_C = 50$ μ Adc		BV_{CBO}	75	---	Vdc
Breakdown voltage, collector to emitter	3011	Bias cond. D; $I_C = 1$ mAdc		BV_{CEO}	60	---	Vdc
Breakdown voltage, emitter to base	3026	Bias cond. D; $I_E = 100$ μ Adc		BV_{EBO}			
					6	---	Vdc
					8	---	Vdc
					8	---	Vdc
Collector to emitter voltage (saturated)	3071	$I_C = 10$ mAdc; $I_B = 1$ mAdc		$V_{CE(sat)}$	---	1.0	Vdc
Base emitter voltage (saturated)	3066	Test cond. A; $I_C = 10$ mAdc; $I_B = 1$ mAdc		$V_{BE(sat)}$	0.6	1.1	Vdc
<u>Subgroup 3</u>			5				
Small-signal open-circuit output admittance	3216	$V_{CB} = 5$ Vdc; $I_E = -1$ mAdc		h_{ob}	---	1.0	μ mho
Small-signal open-circuit reverse-voltage transfer ratio	3211	$V_{CB} = 5$ Vdc; $I_E = -1$ mAdc		h_{rb}	---	1,000	$\times 10^{-6}$
Small-signal short-circuit input impedance	3201	$V_{CB} = 5$ Vdc; $I_E = -1$ 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	3206	VCB = 5 Vdc; I _E = -0.1 mAdc		h _{fe}			
2N757A					9	---	---
2N759A					15	---	---
2N760A					40	---	---
Small-signal short-circuit forward-current transfer ratio	3206	VCB = 5 Vdc; I _E = -1 mAdc		h _{fe}			
2N757A					18	40	---
2N759A					36	90	---
2N760A					76	333	---
Small-signal short-circuit forward-current transfer ratio	3206	VCB = 5 Vdc; I _E = -10 mAdc		h _{fe}			
2N757A					25	---	---
2N759A					50	---	---
2N760A					100	---	---
<u>Subgroup 4</u>							
Magnitude of common-emitter small-signal short-circuit forward-current transfer ratio	3306	VCB = 5 Vdc; I _E = -1 mAdc; f = 30 MHz	5	h _{fe}	2	---	---
Open-circuit output capacitance	3236	VCB = 5 Vdc; I _E = 0; 100 kHz ≤ f ≤ 1 MHz		C _{obo}	---	6.0	pf
Noise figure	3246	VCB = 5 Vdc; I _E = -1 mAdc; R _g = 500 ohms		N _F	---	24	db
<u>Subgroup 5</u>							
High-temperature operation:		T _A = +150° C					
Collector-to-base cutoff current	3036	Bias cond. D; VCB = 30 Vdc		I _{CBO}	---	10	μAdc
Low-temperature operation:		T _A = -55° C					
Small-signal short-circuit forward-current transfer ratio	3206	VCB = 5 Vdc; I _E = -10 mAdc		h _{fe}			
2N757A					12	---	---
2N759A					25	---	---
2N760A					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	nAdc
Small-signal short-circuit forward-current transfer ratio	3206	$V_{CB} = 5$ Vdc; $I_E = -1$ mAdc		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 acceleration	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	$T_{stg} = +200^{\circ}\text{C}$; $t = 340$ 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	$T_A = 25^{\circ}\text{C}$; $V_{CB} = 20$ 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°C (see 4.3.4)	λ = 5	---	---	---	---
<u>Subgroup 3</u> Steady state operation life 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 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.

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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)

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