

MIL-S-19500/2B
 14 June 1968
 SUPERSEDING
 MIL-S-19500/2A
 28 May 1963
 MIL-S-19500/35B(NAVY)
 3 January 1966
 (See 6.2.)

MILITARY SPECIFICATION

SEMICONDUCTOR DEVICE, TRANSISTOR, NPN, SILICON, LOW-POWER TYPES 2N117, 2N118, AND 2N119

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, low power, medium frequency, NPN transistors.

1.2 Physical dimensions. See figure 1.

1.3 Maximum ratings.

$P_T \frac{1}{T_A = 25^\circ C}$	V_{CBO}	V_{EBO}	T_{stg}
<u>mW</u>	<u>Vdc</u>	<u>Vdc</u>	<u>°C</u>
150	30	1.0	-65 to +150

$\frac{1}{}$ Derate linearly 1.2 mW/°C for $T_A > 25^\circ C$.

* 1.4 Primary electrical characteristics.

Limits	$V_{CE(sat)}$ $I_B = 2.2 \text{ mAdc}$ $I_C = 5 \text{ mAdc}$	f_{hfb} $V_{CB} = 5 \text{ Vdc}$ $I_E = -1 \text{ mAdc}$			h_{fe} $V_{CB} = 5 \text{ Vdc}$ $I_E = -1 \text{ mAdc}$			h_{ob} $V_{CB} = 5 \text{ Vdc}$ $I_E = -1 \text{ mAdc}$
		2N117	2N118	2N119	2N117	2N118	2N119	
	<u>Vdc</u>	<u>MHz</u>	<u>MHz</u>	<u>MHz</u>				<u>μmhos</u>
Min	---	1	2	2	9	18	37	0.1
Max	1.2	---	---	---	20	41	90	1.5

Limits	h_{ib} $V_{CB} = 5 \text{ Vdc}$ $I_E = -1 \text{ mAdc}$	C_{obo} $V_{CB} = 5 \text{ Vdc}$ $I_E = 0$ $100 \text{ kHz} \leq f \leq 1 \text{ MHz}$	NF $V_{CB} = 5 \text{ Vdc}$ $I_E = -1 \text{ mAdc}$ $R_g = 500 \Omega$
	<u>ohms</u>	<u>pf</u>	<u>db</u>
Min	30	---	---
Max	90	20	30

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, and as follows:

V_{sig} Generator output voltage (a.c., r.m.s.).

3.3 Design, construction, and physical dimensions. Transistors shall be of the design, construction, and physical dimensions shown on 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

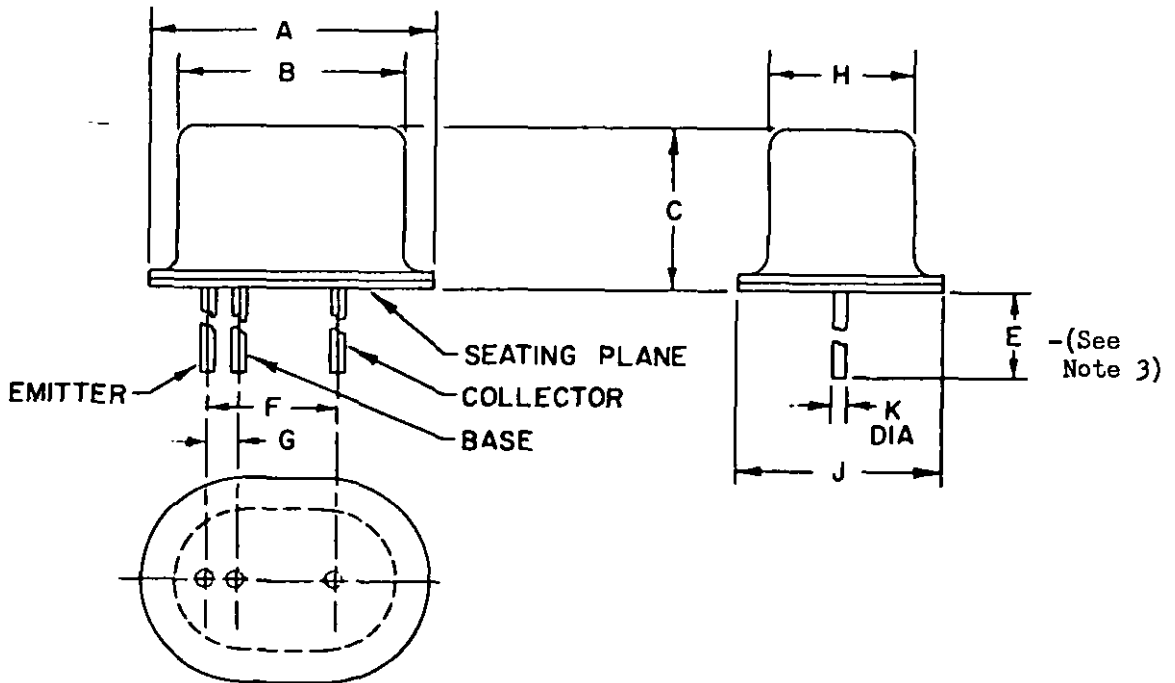
4.1 Sampling and inspection. Sampling and inspection shall be in accordance with MIL-S-19500, and as specified herein.

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 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.



LTR	DIMENSIONS			
	INCHES		MILLIMETERS	
	MIN.	MAX	MIN	MAX
A	.390	.496	9.91	12.60
B	.355	.382	9.02	9.70
C	.290	.365	7.37	9.27
E	1.468	1.532	37.29	38.91
F	.187	.197	4.75	5.00
G	.043	.053	1.09	1.35
H	.160	.190	4.06	4.83
J	.195	.300	4.95	7.62
K	.016	.019	0.41	0.48

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. All leads electrically insulated from the case.
3. All three leads.

FIGURE 1. Physical dimensions of transistor types 2N117, 2N118 and 2N119. (OV-6).

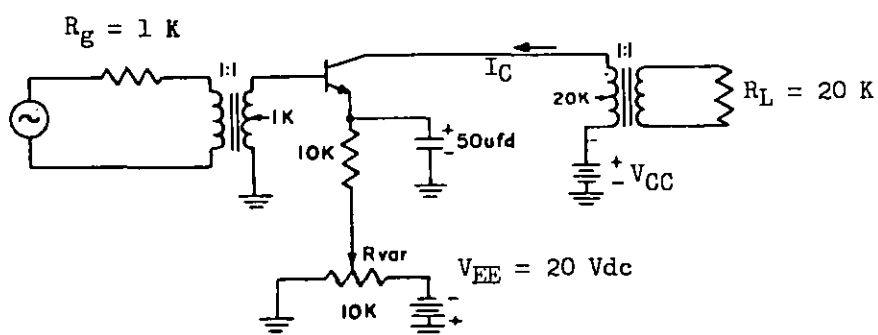


FIGURE 2. Power-gain test circuit.

* 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.

4.4 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 Power gain. The transistor shall be operated in the circuit (see figure 2). The power gain shall then be computed as follows:

$$P_G = 10 \log 10 \frac{\text{ac power delivered to load}}{\text{maximum available ac power to input}}$$

* 4.4.2 Time limit for end-point test measurements. End-point tests for qualification and quality conformance inspection shall be completed within 96 hours after completion of the last test in the subgroup.

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>			10				
Emitter to base cutoff current	3061	Bias cond. D; $V_{EB} = 1 \text{ Vdc}$		I_{EBO}	---	100	μAdc
Collector to base cutoff current	3036	Bias cond. D; $V_{CB} = 30 \text{ Vdc}$		I_{CBO}	---	1	μAdc
Small-signal open-circuit output admittance	3216	$V_{CB} = 5 \text{ Vdc}$; $I_E = -1 \text{ mAdc}$		h_{ob}	0.1	1.5	μmhos
Small-signal open-circuit reverse-voltage transfer ratio	3211	$V_{CB} = 5 \text{ Vdc}$; $I_E = -1 \text{ mAdc}$					
2N117				h_{rb}	25	500	$\times 10^{-6}$
2N118				h_{rb}	25	1000	$\times 10^{-6}$
2N119				h_{rb}	50	1500	$\times 10^{-6}$
Small-signal short-circuit input impedance	3201	$V_{CB} = 5 \text{ Vdc}$; $I_E = -1 \text{ mAdc}$		h_{ib}	30	90	ohms
Small-signal short-circuit forward-current transfer ratio	3206	$V_{CB} = 5 \text{ Vdc}$; $I_E = -1 \text{ mAdc}$					
2N117				h_{fe}	9	20	---
2N118				h_{fe}	18	41	---
2N119				h_{fe}	37	90	---

TABLE I. Group A inspection - Continued

Examination or test	MIL-STD-750		LTPD	Symbol	Limits		Unit
	Method	Details			Min	Max	
* <u>Subgroup 3</u>			10				
High-temperature operation:		$T_A = +150^\circ\text{C}$					
Collector to base cutoff current	3036	Bias cond. D; $V_{CB} = 5\text{ Vdc}$		I_{CBO}	---	50	μAdc
Low-temperature operation:		$T_A = -55^\circ\text{C}$					
Power gain	---	$V_{sig} = 6.32\text{ mVac}$; $I_C = 1.85\text{ mAdc}$; (see 4.4.1)		P_G	30	---	db
* <u>Subgroup 4</u>			10				
Open-circuit output capacitance	3236	$V_{CB} = 5\text{ Vdc}$; $I_E = 0$; $100\text{ kHz} \leq f \leq 1\text{ MHz}$		C_{obo}	---	20	pf
Noise figure	3246	$V_{CB} = 5\text{ Vdc}$; $I_E = -1\text{ mAdc}$; $R_g = 500\text{ ohms}$		NF	---	30	db
Collector to emitter voltage (saturated)	3071	$I_C = 5\text{ mAdc}$; $I_B = 2.2\text{ mAdc}$		$V_{CE(sat)}$	---	1.2	Vdc
Small-signal short-circuit forward-current transfer-ratio cutoff frequency	3301	$V_{CB} = 5\text{ Vdc}$; $I_E = -1\text{ mAdc}$		f_{hfb}			
2N117					1	---	MHz
2N118, 2N119					2	---	MHz

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. F		---	---	---	---
Thermal shock (glass strain)	1056	Test cond. A		---	---	---	---
Moisture resistance	1021			---	---	---	---
End points: (See 4.4.2.)							
Collector to base cutoff current	3036	Bias cond. D; $V_{CB} = 30\text{ Vdc}$		I_{CBO}	---	1	μAdc
Small-signal open-circuit output admittance	3216	$V_{CB} = 5\text{ Vdc}$; $I_E = -1\text{ mAdc}$		h_{ob}	---	1.5	μmhos
Small-signal short-circuit forward-current transfer ratio	3206	$V_{CB} = 5\text{ Vdc}$; $I_E = -1\text{ mAdc}$					
2N117				h_{fe}	9	20	---
2N118				h_{fe}	18	41	---
2N119				h_{fe}	37	90	---

TABLE II. Group B inspection - Continued

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Examination or test	MIL-STD-750		LTPD	Symbol	Limits		Unit
	Method	Details			Min	Max	
* <u>Subgroup 3</u>			15				
Shock	2018	Nonoperating; 1,500 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	2058			---	---	---	---
Constant acceleration	2006	20,000 G; in each orienta- tion: X_1 , Y_1 , Y_2 , and Z_1		---	---	---	---
End points: (Same as subgroup 2)							
* <u>Subgroup 4</u>			15				
Terminal strength (lead fatigue)	2036	Test cond. E		---	---	---	---
* <u>Subgroup 5</u>			15				
Salt atmosphere (corrosion)	1041			---	---	---	---
End points: (Same as subgroup 2)							
* <u>Subgroup 6</u>			$\lambda = 10$				
High-temperature life (nonoperating)	1031	$T_{stg} = +150^\circ\text{C}$		---	---	---	---
End points: (See 4.4.2.)							
Collector to base cutoff current	3036	Bias cond. D; $V_{CB} = 30\text{ Vdc}$		I_{CBO}	---	2	μAdc
Small-signal open-circuit output admittance	3216	$V_{CB} = 5\text{ Vdc}$; $I_E = -1\text{ mAdc}$		h_{ob}	---	2	μmhos
Small-signal short-circuit forward-current transfer ratio	3206	$V_{CB} = 5\text{ Vdc}$; $I_E = -1\text{ mAdc}$		h_{fe}			
2N117					8	22	---
2N118					16	45	---
2N119					33	99	---
* <u>Subgroup 7</u>			$\lambda = 10$				
Steady-state operation life	1026	$T_A = +25^\circ\text{C}$; $P_C = 150\text{ mW}$; $V_{CB} = 30\text{ Vdc}$		---	---	---	---
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>			20				
Barometric pressure, reduced (altitude operation)	1001	Pressure = 15 mm Hg; normal mounting; time = 60 sec		---	---	---	---
Measurement during above test:							
Collector to base cutoff current	3036	Bias cond. D; $V_{CB} = 30 \text{ V}_{dc}$		I_{CBO}	---	2	μAdc

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. The margins of this specification are marked with an asterisk to indicate where changes (additions, modifications, 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 - 11

Preparing activity:

Navy - EC
(Project 5961-0083-5)

Review activities:

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

User activities:

Army - EL SM
Navy - CG, MC, OS, AS
Air Force - 19