

5 April 1972

SUPERSEDING

MIL-S-19500/179 (EL)

17 August 1961

MILITARY SPECIFICATION

SEMICONDUCTOR DEVICE, TRANSISTOR, PNP,
SILICON TYPE 2N1234

1. SCOPE

1.1 Scope. - This specification covers the detail requirements for Silicon, PNP, transistors for use in low power amplifier applications.

1.2 Outline and dimension. - See Figure 1 (TO-5).

1.3 Maximum ratings. -

P_T 1/	V_{CBO}	V_{EBO}	V_{CEO}	I_C	T_J	$T_{(stg)}$
$\frac{mW}{400}$	$\frac{V_{dc}}{-110}$	$\frac{V_{dc}}{-110}$	$\frac{V_{dc}}{-110}$	$\frac{mA_{dc}}{-100}$	$^{\circ}C$ -65 to +160	$^{\circ}C$ -65 to +200

1/ For $T_A > +25^{\circ}C$, derate linearly at 3.0 mW/ $^{\circ}C$

1.4 Particular electrical characteristics. - (At $T_A = +25^{\circ}C$, unless otherwise specified):

	h_{FE}	h_{fe}	$ h_{fe} $	$V_{CE(sat)}$	$V_{BE(sat)}$	C_{obo}
	$V_{CE} = -2V_{dc}$ $I_C = -10mA_{dc}$	$V_{CB} = -5V_{dc}$ $I_E = 1mA_{dc}$	$V_{CE} = 5V_{dc}$ $I_C = 1mA_{dc}$ $f = .05 MHz$	$I_C = -10mA_{dc}$ $I_B = -2mA_{dc}$	$I_C = -10mA_{dc}$ $I_B = -2mA_{dc}$	$V_{CB} = -5V_{dc}$ $f \approx 0.1MHz$ $\leq 1.0MHz$
MIN	10	14	6	$\frac{V_{dc}}{---}$	$\frac{V_{dc}}{---}$	$\frac{p}{f}$
MAX	35	32	80	0.2	1.3	150

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 this specification to the extent specified herein:

SPECIFICATIONS

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 contractors in connection with specific procurement functions should be obtained from the procuring activity or as directed by the contracting officer. Both the title and number or symbol should be stipulated when requesting copies.)

3. REQUIREMENTS

3.1 Requirements.- Requirements for the transistors shall be in accordance with Specification MIL-S-19500, and as otherwise specified herein.

3.2 Abbreviations and symbols.- The abbreviations and symbols used herein are defined in Specification MIL-S-19500.

3.3 Design and construction.- The transistor shall be of the design, construction, and physical dimensions specified on Figure 1 herein.

3.3.1 Terminal arrangement.- The terminal arrangement on the transistor shall be as indicated in Figure 1.

3.3.2 Terminal-lead length.- Terminal-lead length(s) other than that specified in Figure 1 may be furnished when specified in the contract or order (see 6.2 herein) where the devices covered herein are required directly for particular equipment-circuit installation. Where such other lead lengths are required and provided, it shall not be construed as affecting adversely the Qualified-product status of the device, or applicable "JAN" marking.

3.3.3 Operating position. - The transistor shall be capable of proper operation in any position.

3.4 Performance characteristics. - The transistor performance characteristics shall be as specified in Tables I, II, and III herein.

3.5 Marking. - Except as otherwise specified herein, marking shall be in accordance with Specification MIL-S-19500. The "manufacturer's identification" may, at option of the manufacturer, be omitted from being marked directly on the semiconductor device covered herein.

4. QUALITY ASSURANCE PROVISIONS

4.1 General. - Except as otherwise specified herein, the responsibility for inspection, general procedures for acceptance, classification of inspection, and inspection conditions and methods of test shall be in accordance with Specification MIL-S-19500, Quality Assurance Provisions.

4.2 Qualification and Quality Conformance inspection. - Qualification and Quality Conformance inspection shall be in accordance with Specification MIL-S-19500, Quality Assurance Provisions, and as otherwise specified herein, Groups A, B, and C inspection shall consist of the examinations and tests specified in Tables I, II and III, respectively, herein. Quality Conformance inspection shall include inspection of Preparation for Delivery (see 5.1 herein).

4.2.1 Special Group A criteria for Qualification inspection. - For Qualification inspection, only 10 failures will be permitted for all Group A tests combined. Hereto, where the manufacturer deems that the data in paragraph 4.4.2 of Specification MIL-S-19500 are invokable, notification shall be made to the Chief, Components and Material Standardization Branch, Procurement and Production Directorate, Fort Monmouth, New Jersey 07703, Attention: AMSEL-PP-EM-2.

4.2.2 Group B-Group C life test samples. - Samples that have been subjected to Group B, 340-hour life test may be continued on test for 1000 hours in order to satisfy Group C life test requirements. These samples shall be predesignated, and shall remain subjected to the Group C 1000-hour 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 1000 hours on these samples shall be computed for 1000-hour acceptance criteria.

4.2.3 Group C testing. - Group C tests shall be performed on a lot every 6 months. (See Table III herein.) The contractor shall, throughout the course of a contract or order, permit the Government representative to scrutinize all test data and findings covering manufacturer's test program on Group C characteristics and parameters for the product concerned. Upon determination by the Government inspector (in advance of Group C, 6-month, test results) that Group C parameters are not being adequately met, the Government inspector may require lot-by-lot inspection normally for a minimum of 3 consecutive lots, to be performed for required Group C tests.

4.2.4 Disposition of sample units. - Sample units that have been subjected to Group B, Subgroup 2 and 5 tests shall not be delivered on the contract or order. Sample units that have been subjected to and have passed Group B, Subgroup 1, 3, 4, 6, 7, 8, 9 and 10, and all Group C tests (these tests to be considered non-destructive), may be delivered on the contract or order provided that, after Group B and C inspection is terminated, those sample units are subjected to and pass Group A inspection. Defective units from any sample group that may have passed group inspection shall not be delivered on the contract or order until the defect(s) has been remedied to the satisfaction of the Government.

4.3 Particular examination and test requirements. -

4.3.1 "Pulsed" - conditions measurements. - Measurements required herein to be effected under pulsed conditions, shall be made in accordance with "Pulse Measurements" requirements in Section 4 of Standard MIL-STD-750.

4.3.2 Mechanical damage resulting from tests. - Except for intentionally deforming, mutilating, or dismembering mechanical-stress tests to which samples are subjected, there shall be no evidence of mechanical damage to any sample unit as a result of any of the Group A, B, or C tests.

4.3.3 Seal (leak-rate) test. - The transistors shall be subjected to hermetic-seal test(s) in accordance with requirements of Method 1071 in Standard MIL-STD-750 except that the following test conditions therein shall apply hereto:

- a. Fine-leak test: per Test Condition G or H. Where Condition H is employed, a maximum leakage rate of 1×10^{-7} atm/cc/sec shall be effective for acceptance.
- b. Gross-leak test: per Test Condition A, C, D, or F.

4.3.4 Marking resistance to solvents test. - The device samples shall be subjected to test per Method 215 in Standard MIL-STD-202. The following details shall apply:

- a. All surface areas on the body of the device where marking has been applied shall be brushed.
- b. All marking shall have remained legible, and there shall be no evidence of mechanical damage to the device, upon examination after test.

Tabel 1. Group A Inspection

Test Method per MIL-STD-750	Examination or Test	Conditions	LTPD	Symbol	Limits		Units
					Min	Max	
2071	<u>Subgroup 1</u> Visual and mechanical examination	- - -	10	---	---	---	---
3011	<u>Subgroup 2</u> Collector-emitter breakdown voltage:	Bias Cond. D Pulsed; $I_C = -100 \mu\text{A dc}$	7	BV_{CEO}	-110	---	Vdc
3001	Collector-to-base breakdown voltage	Bias Cond. D $I_C = -100 \mu\text{A dc}$		BV_{CBO}	-110	---	Vdc
3026	Emitter-to-base breakdown voltage	Bias Cond. D $I_E = -100 \mu\text{A dc}$		BV_{EBO}	-110	---	Vdc
3036	Collector-to-base cutoff current	Bias Cond. D $V_{CB} = -90 \text{ Vdc}$		I_{CBO}	---	-0.1	$\mu\text{A dc}$
3061	Emitter-to-base cutoff current	Bias Cond. D $V_{EB} = -90 \text{ Vdc}$		I_{EBO}	---	-0.1	$\mu\text{A dc}$
3071	Collector-to-emitter saturation voltage	$I_C = -10 \text{ mA dc}$ $I_B = -2 \text{ mA dc}$		$V_{CE(sat)}$	---	-0.2	Vdc
3071	Collector-to-emitter saturation voltage	$I_C = -100 \text{ mA dc}$ $I_B = -33 \text{ mA dc}$		$V_{CE(sat)}$	---	-2.0	Vdc
3066	Base-to-emitter voltage (non-sat.)	Test Cond. B $I_C = -10 \text{ mA dc}$ $I_B = -2 \text{ mA dc}$		V_{BE}	---	-1.3	Vdc
3066	Base-to-emitter voltage (non-sat.)	Test Cond. B $I_C = -100 \text{ mA dc}$ $I_B = -33 \text{ mA dc}$		V_{BE}	---	-3.0	Vdc
3206	Small-signal short- circuit for-current transfer ratio	$V_{CB} = -5 \text{ Vdc}$ $I_E = 1 \text{ mA dc}$		h_{fe}	14	32	---

Table I. Group A Inspection (Cont'd)

Test Method per MIL-STD-750	Examination or Test	Conditions	LTPD	Symbol	Limits		Units
					Min	Max	
	Subgroup 3		7				
3076	Forward-current transfer ratio	$I_C = -10 \text{ mA dc}$ $V_{CE} = -2 \text{ V dc}$		h_{fe}	10	35	---
3201	Small-signal short- circuit input impedance (common base)	$V_{CB} = -5 \text{ V dc}$ $I_E = -1 \text{ mA dc}$		h_{ib}	---	60	ohms
3211	Small-signal open- circuit reverse-voltage transfer ratio (common base):	$V_{CB} = -5 \text{ V dc}$ $I_E = 1 \text{ mA dc}$		h_{rb}	---	10	---
3216	Small-signal short- circuit output admitt- ance (common base)	$V_{CB} = -5 \text{ V dc}$ $I_E = 1 \text{ mA dc}$		h_{ob}	---	2	umhos
3306	Magnitude of common-emitter small-signal short- circuit transfer ratio:	$V_{CE} = -5 \text{ V dc}$ $I_E = 1 \text{ mA dc}$ $f_C = 50 \text{ KHz}$		$ h_{fe} $	6	80	---
3236	Output capacitance	$V_{CB} = -5 \text{ V dc}$ $I_E = 0$ $f = 0.1 \text{ MHz} \leq f \leq 1.0 \text{ MHz}$		C_{obo}	---	150	pf

Table II. Group B Inspection.

Test Method per MIL-STD-750	Examination or test	Conditions	LTPD	Symbol	Limits		Units
					Min	Max	
	<u>Subgroup 1</u>		10				
2066	Physical dimensions	See Figure 1		---	---	---	---
	<u>Subgroup 2</u>		15				
2026	Solderability	---		---	---	---	---
1051	Temperature cycling	Test Cond. C		---	---	---	---
1056	Thermal shock (glass strain)	Test Cond. A		---	---	---	---
1021	Moisture resistance			---	---	---	---
	<u>End-Point tests:</u>						
3036	Collector-to-base cutoff current	Bias Cond. D $V_{CB} = -90 \text{ Vdc}$		I_{CBO}	---	-0.1	$\mu\text{A dc}$
3061	Emitter-to-base cutoff current	Bias Cond. D $V_{EB} = -90 \text{ Vdc}$		I_{EBO}	---	-0.1	$\mu\text{A dc}$
3076	Forward-current transfer ratio	$I_C = -10 \text{ mA dc}$ $V_{CE} = -2 \text{ Vdc}$		h_{fe}	10	35	---

Table II. Group B Inspection. (Cont'd)

Test Method per MIL-STD-750	Examination or Test	Conditions	LTPD	Symbol	Limits		Units
					Min	Max	
	<u>Subgroup 3</u>		15				
2016	Shock	Non-operating 1500G, 5 blows of 0.5 msec ea. in orientations X1, Y1, Y2, Z1 (total = 20 blows)					
2056	Vibration, variable frequency	10G		---	---	---	---
2006	Constant accelera- tion	20,000G orientations X1, Y1, Y2, Z1		---	---	---	---
	<u>End-Point tests:</u> Same as for Subgroup 2, above						
	<u>Subgroup 4</u> ^{1/}		20				
2036	Terminal strength (lead fatigue)	Test Cond.E		---	---	---	---
1071 ^{2/}	Seal (leak rate) ^{1/}	---		---	---	1X10 ⁻⁷	atm/ cc/sec
	<u>Subgroup 5</u>		20				
1041	Salt atmosphere (corrosion)			---	---	---	---

Table II. Group B inspection. (Cont'd)

Test Method per MIL-STD-750	Examination or Test	Conditions	LTPD	Symbol	Limits		Units
					Min	Max	
	<u>Subgroup 6</u>		15				
<u>3/</u>	High-temperature operation	$T_A = +125^\circ\text{C}$		---	---	---	---
3036	Collector-to- base cutoff current	Bias Cond.D $V_{CB} = -90\text{Vdc}$		I_{CBO}	---	-20	μAdc
<u>3/</u>	Low-temperature operation	$T_A = -65^\circ\text{C}$		---	---	---	---
3076	Forward-Current transfer ratio	$I_C = -10\text{mAdc}$ $V_{CE} = -2\text{Vdc}$		h_{FE}	4	---	---
	<u>Subgroup 7</u>		7				
1032	High-temperature life(non-operating)	$T_{stg} = +200^\circ\text{C}$ $t = 340$ hrs. <u>4/</u>		---	---	---	---
	<u>End-point tests:</u>						
3036	Collector-to-base cutoff current	Bias Cond.D $V_{CB} = -90\text{Vdc}$		I_{CBO}	---	-0.2	μAdc
3061	Emitter-to-base cutoff current	Bias Cond.D $V_{EB} = -90\text{Vdc}$		I_{EBO}	---	-0.2	μAdc
3076	Forward-current transfer ratio	$I_C = -10\text{mAdc}$ $V_{CE} = -2\text{Vdc}$		h_{FE}	8	42	---

Table II. Group B inspection. (Cont'd)

Test Method per MIL-STD-750	Examination or Test	Conditions	LTPD	Symbol	Limits		Units
					Min	Max	
1027	<u>Subgroup 8</u>		7				
	Steady state operation life	$T_A = +25^\circ\text{C}$ $P_T = 400 \text{ mW}$ $I_C = -5 \text{ mA dc}$ $V_{CE} = -80 \text{ V dc}$ $t = 340 \text{ hrs.}$ <u>4/</u>		---	---	---	---
	<u>End-Point tests:</u> Same as for subgroup 7, above						

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

2/
See 4.3.3 herein.

3/
Measurement(s) shall be made after thermal equilibrium has been reached at the temperature specified.

4/
See 4.2.2 herein.

Table III. Group C inspection. ^{1/}

Test Method per MIL-STD-750	Examination or Test	Conditions	LTPD	Symbol	Limits		Units
					Min	Max	
	<u>Subgroup 1</u>		15				
<u>2/</u>	Marking resistance to solvents	<u>3/</u>		---	---	---	---
	<u>Subgroup 2</u>		$\lambda=10$				
1031	High-temperature life, (non-operat- ing)	$T_{stg}=+200^{\circ}\text{C}$ $t=1,000$ hrs. <u>4/</u>		---	---	---	---
3036	<u>End-point tests:</u> Collector-to-base cutoff current	Bias Cond.D $V_{CB}=-90\text{Vdc}$		I_{CBO}	---	-0.2 μAdc	
3061	Emitter-to-base cutoff current	Bias Cond.D $V_{EB}=-90\text{Vdc}$		I_{EBO}	---	-0.2 μAdc	
3076	Forward-current transfer ratio	$I_C=-10\text{mAdc}$ $V_{CE}=-2\text{Vdc}$		h_{FE}	8	42	---
1026	<u>Subgroup 3</u> Steady state	$T_A=+25^{\circ}\text{C}$ $P_T=400\text{mW}$ $I_C=-5\text{mAdc}$ $V_{CE}=-80\text{Vdc}$ $t=1,000$ hrs. <u>4/</u>	$\lambda=10$	---	---	---	---
	<u>End-Point tests:</u> Same as for subgroup 3 above						

1/
See 4.2.3 herein.

2/
See 4.3.4 herein.

3/
Electrical rejects from the same lot under evaluation may be used for this test.

4/
See 4.2.2 herein.

5. PREPARATION FOR DELIVERY

5.1 Preparation for delivery.- Preparation for delivery and the inspection of of Preparation For Delivery shall be in accordance with Specification MIL-S-19500,

6. NOTES

6.1 Ordering data:

Terminal-lead length See 3.3.2 herein.

6.2 Qualification.- With respect to products requiring qualification, awards will be made only for such products as have, prior to the time set for opening of bids, been tested and approved for inclusion in Qualified Products List (QPL)-19500, whether or not such products have actually been so listed by that date. Information pertaining to qualification of products covered by this specification should be requested from the Commanding General, US Army Electronics Command, Fort Monmouth, New Jersey 07703, Attention: AMSEL-PP-EM-2.

6.3 Revision (document) changes.- Revision-letter symbols are not used in this revision to identify changes with respect to the previous issue, due to the extensiveness of the changes.

Custodian:
Army-EL

Preparing activity:
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Project No. 5961-A452

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SPECIFICATION MIL-S-19500/179A(EL) SEMI CONDUCTOR DEVICE, TRANSISTOR, PNP, SILICON TYPE 2N1234		
ORGANIZATION		
CITY AND STATE		CONTRACT NUMBER
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)		
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