MIL-S-19500/216A(NAVY)
28 April 1969
SUPERSEDING
MIL-S-19500/216(NAVY)
9 November 1961

MILITARY SPECIFICATION

SEMICONDUCTOR DEVICE, TRANSISTOR, NPN, SILICON TYPE 2N1051

1. SCOPE

1.1 Scope. This specification covers the detail requirements for silicon, NPN transistors.

1.2 Physical dimensions. See figure 1.

1.3 Maximum ratings.

P_C 1/ $T_A = +25°C$	I_C	V_{EBO}	V_{CES}	V_{CEO}	T_{stg}
	mAdc	Vdc	Vdc	Vdc	°C
0.5	100	8	80	40	-65 to +150

1/ Derate linearly 4.0 mW/°C for $T_A > +25°C$.

1.4 Primary electrical characteristics.

	h_{fe} $I_E = -5$ mAdc	h_{ib} $I_E = -5$ mAdc	$V_{CE(sat)}$ $I_C = 50$ mAdc $I_B = 2.0$ mAdc	f_t $I_E = -5$ mAdc $V_{CE} = 5$ Vdc $f = 20$ MHz	C_{obo} $V_{CB} = 5$ Vdc $I_E = 0$ 100 kHz $\leq f \leq$ 1 MHz
		Ohms	Vdc	MHz	pf
Min.	30	---	---	80	---
Max.	100	15	3.0	---	7

2. APPLICABLE DOCUMENTS

2.1 The following documents of the issue in effect on the 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.

STANDARD

MILITARY

MIL-STD-750 - Test Methods for Semiconductor Devices.

FSC 5961

(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.

3.4 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.

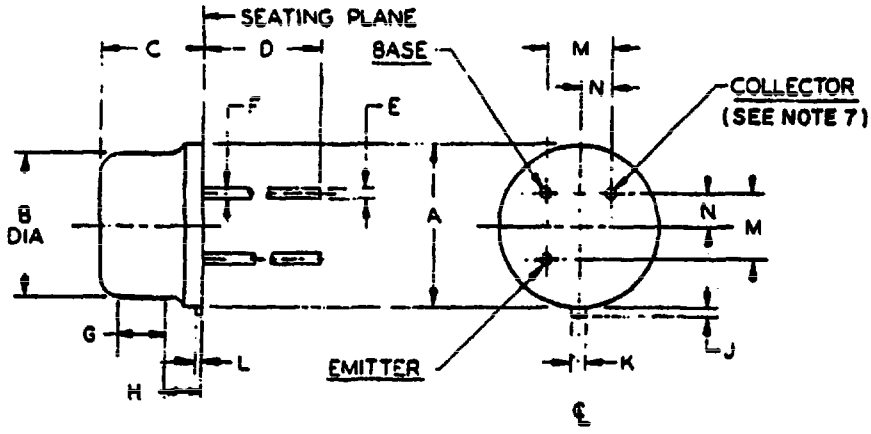
4.3 Quality conformance inspection. Quality conformance inspection shall consist of group A, B, and C inspections.

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.

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.



LTR	DIMENSIONS INCHES MIN	INCHES MAX	MILLIMETERS MIN	MILLIMETERS MAX	NOTES
A		.370		9.40	
B	.275	.335	6.99	8.51	
C	.200	.260	5.08	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	.125	.23	3.18	
M	.1414 Nom		3.59 Nom		6
N	.0707 Nom		1.80 Nom		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 (.25 mm).
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.
7. The collector shall be electrically connected to the case.
8. Measured from the maximum diameter of the actual device.
9. All 3 leads.

FIGURE 1. Physical dimensions of transistor type 2N1051.

TABLE I. Group A inspection

Examination or test	MIL-STD-750		LTPD	Symbol	Limits		Unit
	Method	Details			Min	Max	
Subgroup 1			5				
Visual and mechanical examination	2071			---	---	---	---
Subgroup 2			3				
Breakdown voltage, collector to emitter	3011	Bias cond. C; I_C = 20 μAdc		BV_{CES}	80	---	Vdc
Breakdown voltage, collector to emitter	3011	Bias cond. D; I_C = 1 mAdc		BV_{CEO}	40	---	Vdc
Collector to base cutoff current	3036	Bias cond. D; V_{CB} = 20 Vdc		I_{CBO}	---	0.1	μAdc
Breakdown voltage, emitter to base	3026	Bias cond. D; I_E = 10 μAdc		BV_{EBO}	8	---	Vdc
Subgroup 3			3				
Small-signal short-circuit forward-current transfer ratio	3206	I_E = -5 mAdc; V_{CE} = 5 Vdc		h_{fe}	30	100	---
Small-signal short-circuit input impedance	3201	I_E = -5 mAdc; V_{CE} = 5 Vdc		h_{ib}	---	15	ohms
Collector to emitter voltage (saturated)	3071	I_C = 50 mAdc; I_B = 2.0 mAdc		$V_{CE}(sat)$	---	3.0	Vdc
Extrapolated unity gain frequency	3261	I_E = -5 mAdc; V_{CE} = 5 Vdc; f = 20 MHz		f_t	80	---	MHz
Open circuit output capacitance	3236	I_E = 0; V_{CB} = 5 Vdc; 100 kHz $\leq f \leq$ 1 MHz		C_{obo}	---	7	pf
Subgroup 4			10				
Low temperature operation:		T_A = -40° C					
Small-signal short-circuit forward-current transfer ratio	3206	I_E = -5 mAdc; V_{CE} = 5 Vdc		h_{fe}	20	---	---

TABLE II. Group B inspection

Examination or test	MIL-STD-750			Symbol	Limits		Unit
	Method	Details			Min	Max	
Subgroup 1			15				
Physical dimensions	2066	(See figure 1)		---	---	---	---

TABLE II. Group B inspection - Continued

Examination or test	MIL-STD-750		LTPD	Symbol	Limits		Unit
	Method	Details			Min	Max	
Subgroup 2			10				
Solderability	2026			---	---	---	---
Thermal shock (temperature cycling)	1051	Test cond. F		---	---	---	---
Thermal shock (glass strain)	1056	Test cond. A		---	---	---	---
Moisture resistance	1021			---	---	---	---
End points:							
Collector to base cutoff current	3036	Bias cond. D; V_{CB} = 20 Vdc		I_{CBO}	---	0.2	µAdc
Small-signal short-circuit forward-current transfer ratio	3206	I_E = -5 mAdc; V_{CE} = 5 Vdc		h_{fe}	25	---	---
Breakdown voltage, collector to emitter	3011	Bias cond. C; I_C = 40 µAdc		BV_{CES}	80	---	Vdc
Subgroup 3			10				
Shock	2016	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	2056	Nonoperating		---	---	---	---
Constant acceleration	2006	20,000 G; in each orientation: X_1, Y_1, Y_2 and Z_1		---	---	---	---
End points: (Same as subgroup 2)							
Subgroup 4			10				
Terminal strength (lead fatigue)	2036	Test cond. E		---	---	---	---
Subgroup 5			λ = 5				
High-temperature life (nonoperating)	1031	$T_A = +150\ ^{+0}_{-5}$ °C		---	---	---	---
End points: (Same as subgroup 2)							
Subgroup 6			λ = 5				
Steady-state operation life	1026	T_A = +25°C; I_C = 50 ±5 mAdc; $P_C = 500\ ^{+0}_{-50}$ mW		---	---	---	---
End points: (Same as subgroup 2)							

TABLE III. Group C inspection

Examination or test	MIL-STD-750		LTPD	Symbol	Limits		Unit
	Method	Details			Min	Max	
Subgroup 1			5				
Thermal resistance	3151			θ_{J-A}	---	0.25	°C/mW
Subgroup 2			15				
Salt atmosphere (corrosion)	1041			---	---	---	---
End points: (Same as subgroup 2 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.

Review activities:
Navy - SH

User activities:
Navy - AS, OS, MC, CG

Preparing activity:
Navy - EC
(Project 5961-N179)