

MIL-S-19500/178B(NAVY)
 29 May 1964
 SUPERSEDING
 MIL-S-19500/178A(NAVY)
 13 October 1961
 (See 6.2)

MILITARY SPECIFICATION
 TRANSISTOR, PNP, GERMANIUM
 TYPE 2N1165

1. SCOPE

1.1 Scope.- This specification covers the detail requirements for a germanium, PNP transistor and is in accordance with MIL-S-19500, except as otherwise specified herein.

1.2 Mechanical dimensions and outline.- See figure 1.

1.3 Absolute maximum ratings.-

P_C $T_{Base} = 25^\circ C$	T_j	T_{stg}	V_{CBO}	V_{CES}	I_E	V_{EBO}
W	$^\circ C$	$^\circ C$	Vdc	Vdc	Adc	Vdc
90	+100	-65 to +100	-80	-60	25	40

1 For power ratings above $T_{Base} = 25^\circ C$, derate 1.2 W/ $^\circ C$.

1.4 Primary electrical characteristics.-

	h_{FE} (at $I_C = 5.0$ Adc)	h_{FE} (at $I_C = 25.0$ Adc)
Minimum	25	15
Maximum	125	65

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.

SPECIFICATIONS

MILITARY

MIL-S-19500 - Semiconductor Devices, General Specification for.

STANDARD

MILITARY

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.)

FSC 5960

3. REQUIREMENTS

3.1 General. - Transistors shall be in accordance with MIL-S-19500 and as specified herein.

3.2 Design, construction and physical dimensions. - Transistors shall be of the design, construction and physical dimensions shown on figure I.

3.3 Performance characteristics. - Performance characteristics shall be as specified in 4.3, 4.4, and 4.5.

3.4 Marking. - Transistors shall be marked with the "USN" prefix in lieu of the "JAN" prefix and the type number shall be directly on the body. No color coding shall be allowed. Country of origin may be omitted.

4. QUALITY ASSURANCE PROVISIONS

4.1 Qualification tests - Qualification tests shall be conducted at a laboratory satisfactory to the Bureau of Ships. Qualification tests shall consist of the tests specified in 4.3, 4.4 and 4.5 (Application for Qualification tests shall be made in accordance with "Provisions Governing Qualification" (see 6.1)).

4.2 Quality conformance inspection. - Quality conformance inspection shall consist of the examinations and tests specified in 4.3, 4.4 and 4.5.

4.3 Group A inspection. - Group A inspection shall consist of the examinations and tests shown in table I. A device having one or more defects shall be counted as one defective.

4.4 Group B inspection. - Group B inspection shall consist of the examinations and tests shown in table II.

4.4.1 Salt atmosphere (corrosion). - Transistors shall be examined for legibility of marking and destructive corrosion.

4.4.2 Tests listed in subgroups 2 and 4 of group B inspection are considered destructive.

4.5 Group C inspection - Group C inspection shall consist of the tests shown in table III. Devices shall be subjected to the test initially and at least once every 6 months, in lieu of the operating life test in Group B inspection shown in table II.

4.6 Inspection conditions. - Unless otherwise specified herein, all inspection shall be made at a T_{Base} of 25 ± 3°C.

5. PREPARATION FOR DELIVERY

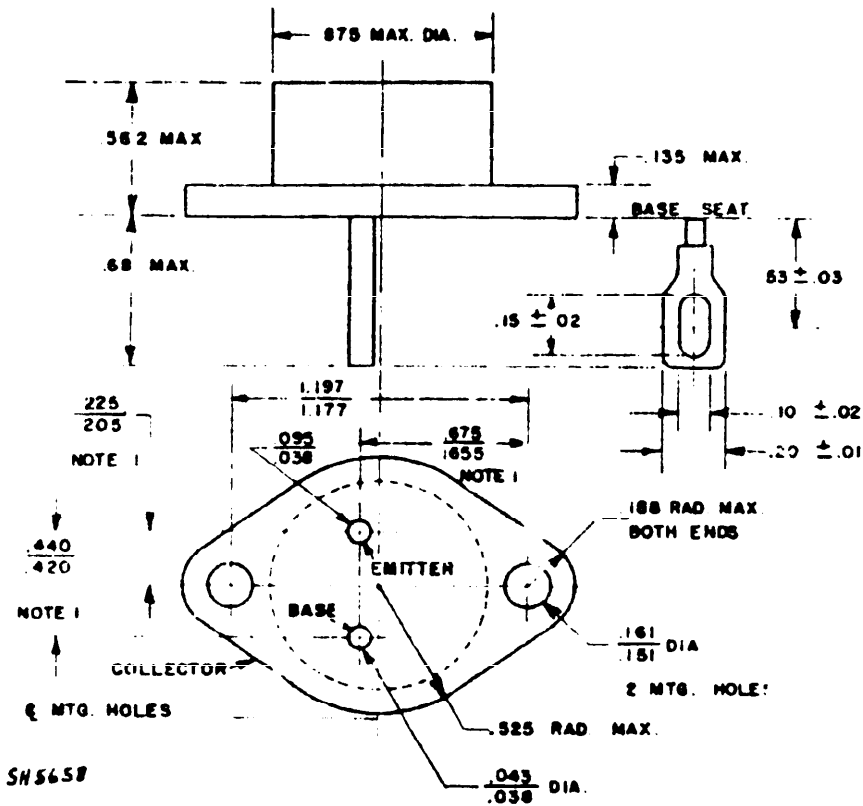
5.1 See MIL S-19500

6. NOTES

6.1 The activity responsible for the qualified products list is the Bureau of Ships, Department of the Navy, Washington, D. C. 20360, and information pertaining to qualification of products may be obtained from that activity. Application for Qualification tests shall be made in accordance with "Provisions Governing Qualification" (Copies of "Provisions Governing Qualification" may be obtained upon application to Commanding Officer, Naval Supply Depot, 5801 Tabor Avenue, Philadelphia 20, Pa.)

6.2 CHANGES FROM PREVIOUS ISSUE. THE EXTENT OF CHANGES (DELETIONS, ADDITIONS, ETC.) PRECLUDE THE ANNOTATION OF THE INDIVIDUAL CHANGES FROM THE PREVIOUS ISSUE OF THIS DOCUMENT.

Preparing activity:
Navy - Ships
(Project 5960-N437(NAVY))



- NOTE 1: THESE DIMENSIONS SHALL BE MEASURED AT POINTS .090 TO .095 BELOW SEATING PLANE. WHEN GAGE IS NOT USED, MEASUREMENT SHALL BE MADE AT BASE SEAT.
- NOTE 2: UNLESS OTHERWISE SPECIFIED, TOLERANCES ARE $\pm .008$
- NOTE 3: ALL DIMENSIONS ARE IN INCHES.

Figure 1 - Outline dimensions of transistor type 2N1165.

Table I - Group A Inspection.

Examination or Test	Conditions		LTPD	Symbol	Limits		Unit
	MIL-STD-750 Method	Specific Conditions			Min	Max	
<u>Subgroup 1</u> Visual and mechanical examination	2071		10				
<u>Subgroup 2</u> Emitter to base cutoff current	3061 Cond. D	$V_{EB} = -12V$ $I_C = 0$	5	I_{EBO}	---	-1.2	mAdc
Collector to base cutoff current	3036 Cond. D	$V_{CB} = -2V_{dc}$ $I_E = 0$		I_{CBO}	---	-225	μ Adc
Collector to base cutoff current	3036 Cond. D	$V_{CB} = -80V_{dc}$ $I_E = 0$		I_{CBO}	---	-15	nAdc
Collector to emitter cutoff current	3041 Cond. A	$V_{CE} = -80V_{dc}$, $V_{BE} = 1V_{dc}$		I_{CEX}	---	-20	mAdc
Collector to emitter breakdown voltage	3011 Cond. C	$I_C = 500 \text{ mA}/$ $V_{EB} = 0$		BV_{CES}	-60	---	Volts
Collector to emitter breakdown voltage	3011 Cond. D	$I_C = -250 \text{ mA}/$ $I_B = 0$		BV_{CEO}	-40	---	Volts
<u>Subgroup 3</u> Forward current transfer ratio	3076	$V_{CE} = -1V_{dc}$ $I_C = -5.0A_{dc}$	5	h_{FE}	25	125	
Forward current transfer ratio	3076	$V_{CE} = -1V_{dc}$ $I_C = -25A_{dc}/$		h_{FE}	15	65	
Base to emitter saturation voltage	3068 Cond. A	$I_B = -1.6A_{dc}$ $I_C = -25A_{dc}/$		$V_{BE(sat)}$	---	-1.5	Volts
Base to emitter saturation voltage	3068 Cond. A	$I_B = -1A_{dc}$ $I_C = -10A_{dc}/$		$V_{BE(sat)}$	---	-1.0	Volts
Collector to emitter saturation voltage	3071	$I_B = -1.6A_{dc}$ $I_C = -25A_{dc}/$		$V_{CE(sat)}$	---	-1.0	Volts
Collector to emitter saturation voltage	3071	$I_B = -1A_{dc}$ $I_C = -10A_{dc}/$		$V_{CE(sat)}$	---	-0.7	Volts
Full-signal short-circuit forward current transfer ratio cutoff frequency	3206	$V_{CE} = 2V_{dc}$ $I_C = 5A_{dc}$		f_{ae}	3	---	KC
<u>Subgroup 4</u> Collector to base cutoff current	3036 Cond. D	$V_{CB} = -30V$, $I_E = 0$ $T_B = 90^\circ C \text{ min}$	15	I_{CBO}	---	-20	mAdc
Forward-transfer conductance	3091	$V_{CE} = 2V$ $I_C = 10A$		g_{FE}	10	40	
Forward current transfer ratio	3076	$V_{CE} = -1V_{dc}$ $I_C = -5.0A_{dc}$ $T_A = -55^\circ C$		h_{FE}	15	---	

∇ Pulse testing technique may be used. Pulse width = 300 μ sec. Duty cycle = 2 percent.

Table II - Group B inspection.

Examination or Test	Conditions		LTPD	Symbol	Limits		Unit
	MIL-STD-750 Method	Specific Conditions			Min	Max	
<u>Subgroup 1</u>							
Physical dimensions	2066	Figure 1	20				
<u>Subgroup 2</u>							
Solderability	2026		5				
Temperature cycling	1051 Cond. B	5 cycles $T = +100^{\circ}\text{C.}$					
Moisture resistance	1021	Omit initial conditioning					
<u>Subgroup 3</u>							
Shock	2016	1 msec, 3 major axis, $P_J = 0$, 500G, 5 blows	15				
Vibration (fatigue)	2046	(Nonoperating)					
Thermal shock		$T_1 = 100^{\circ}\text{C.}$ $T_2 = 0^{\circ}\text{C.}$					
Constant acceleration	2016	2000 G					
<u>Subgroup 4</u>							
Salt atmosphere (corrosion)	1041		15				
<u>Subgroup 5</u>							
High temperature life (nonoperating)	1031	$T_{stg} = 100^{+0}_{-3}^{\circ}\text{C}$	$\lambda = 10$				
<u>Subgroup 6</u>							
Steady State Operation life	1026	$V_{CB} = 30\text{Vdc}$ $I_C = 1\text{Adc}$ $T_{Base} = 75^{\circ} \pm 3^{\circ}\text{C.}$	$\lambda = 20$				
End points: for subgroups 2, 3, 4, 5 and 6							
Emitter to base cutoff current	3061 Cond. D	$V_{EB} = -12\text{Vdc}$ $I_C = 0$		I_{E1}	---	2.0	mAdc
Collector to base cutoff current	3036 Cond. D	$V_{CB} = 2\text{Vdc}$ $I_E = 0$		I_{CB}	---	350	μAdc
Forward current transfer ratio	3076	$V_{CE} = 1\text{Vdc}$ $I_C = -25\text{Adc}$		Δh_{FE}	---	+15 -25	% of initial recorded values

Table III - Group C Inspection.

Examination or Test	Conditions		LTPD	Symbol	Limits		Unit
	MIL-S Method	Specific Conditions			Min	Max	
<u>Subgroup 1</u>							
Steady state operation life	10 6	$V_{CB} = 30Vdc$ $I_C = 1A dc$ $T_{ase} = 75^\circ \pm 3^\circ C.$	$\lambda = 10\%$				
End Points:							
Emitter to base cutoff current	3061 Cond. D	$V_{EB} = -12Vdc$ $I_C = 0$		I_{EBO}	---	2.0	$\mu A dc$
Collector to base cutoff current	3036 Cond. D	$V_{CB} = 2Vdc$ $I_E = 0$		I_{CBO}	---	350	$\mu A dc$
Forward current transfer ratio	3076	$V_{CE} = 1Vdc$ $I_C = -25A dc$		Δh_{FE}	---	+15% -25%	% of initially recorded values
<u>Subgroup 2</u>							
Barometric pressure, reduced	1001	$CB = 80V$ 15mm Hg	15				
(Monitor collector to base cutoff current)	3036 Cond. D			I_{CBO}	---	-15	$\mu A dc$
Thermal resistance	3151			θ_{J-C}	---	0.8	$^\circ C/W$

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