MIL-S-19500/86A
20 March 1964
SUPERSEDING
MIL-S-19500/86(NAVY)
6 June 1960

MILITARY SPECIFICATION

TRANSISTOR, PNP, GERMANIUM

TYPE 2N705

This specification has been approved by the Department of Defense and is mandatory for use by the Departments of the Army, the Navy, and the Air Force.

1. SCOPE

1.1 Scope. This specification covers the detail requirements for a PNP diffused base, germanium, mesa transistor, for use in high speed switching applications, and shall be in accordance with Specification MIL-S-19500 except as otherwise specified herein.

1.2 Physical dimensions and outline. See figure 1 (TO-18).

1.3 Absolute maximum values.

P_C 1/	P_C 2/	T_J	T_{stg}	V_{CB}	V_{EB}	V_{CES}
---	$T_C = 25°C$	---	---	---	---	---
(mW)	(mW)	(°C)	(°C)	Vdc	Vdc	Vdc
150	300	+100	-65 to 100	-15	-3.5	-15

1/ Derate 2 mW/°C for ambient temperatures $\geq$ 25°C.

2/ Derate 4 mW/°C for case temperatures $\geq$ 25°C.

1.4 Primary electrical characteristics.

	h_{FE} $V_{CE} = -0.3$ Vdc $I_C = -10$ mAdc	$t_d + t_r$	t_s	t_f	$V_{CE}(sat)$ $I_B = -0.4$ mAdc $I_C = -10$ mAdc
		(nsec)	(nsec)	(nsec)	Vdc
Minimum	25	---	---	---	---
Maximum	---	75	100	100	-0.30

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.

SPECIFICATIONS

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

STANDARD

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

FSC 5960

(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 Specification MIL-S-19500, and as specified herein.

3.1.1 Abbreviations and symbols. The abbreviations and symbols used herein are defined in Specification MIL-S-19500, and as follows:

V_{CC} = Collector supply voltage.

P_C = Collector power dissipation.

3.2 Design and construction. Transistors shall be of the design, construction, and physical dimensions shown on figure 1.

3.3 Performance characteristics. Performance characteristics shall be as specified in tables I, II, and III, and as follows:

3.3.1 Salt atmosphere (corrosion). The transistor shall be examined for evidence of corrosion and legibility of marking before the specified measurements are made (see 4.4.1).

3.3.2 Barometric pressure, reduced (altitude operation). Transistors shall operate satisfactorily without voltage derating. (See table III.)

3.4 Marking. The following marking specified in Specification MIL-S-19500 may be omitted from the body of the transistor:

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 Specification 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.

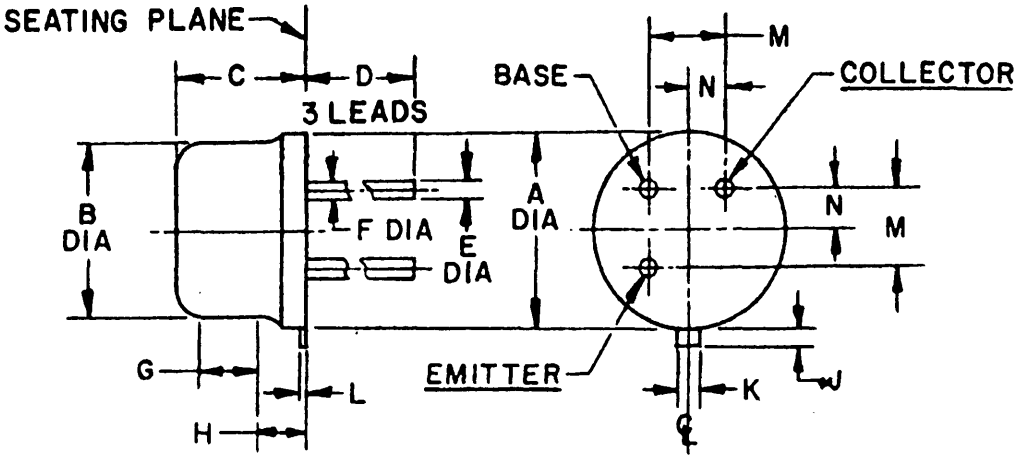
4.3.2 Group B inspection. Group B inspection shall consist of the examinations and tests specified in table II.

4.3.3 Group C inspection. Group C inspection shall consist of the tests specified in table III. This test shall be conducted on the initial lot and thereafter every six months during production.

4.3.4 Acceptance procedure. When a second sample is chosen, the total sample shall be associated with the minimum rejection numbers specified in tables I, II, and III.

4.4 Methods of examination and test. Methods of examination and test shall be as specified in tables I, II, and III.

4.4.1 Salt atmosphere. The markings shall be legible after the test. There shall be no evidence (when examined with no magnification) of flaking or pitting of the finish or corrosion that will interfere with the mechanical and electrical application of the device (see 3.3.1).



DIMENSIONS					
	INCHES		MILLIMETERS		NOTES
	MIN.	MAX.	MIN	MAX	
A	.209	.230	5.31	5.84	
B	.178	.195	4.52	4.95	
C	.170	.210	4.32	5.33	
D	.500	---	12.70	---	
E	---	.021	---	.53	2
F	.016	.019	.41	.48	3
G	N/A	N/A			
H	N/A	N/A			
J	.028	.048	.71	1.22	5
K	.036	.046	.91	1.17	
L	---	.020	---	.51	
M	.0707 Nom.		1.80 Nom.		4
N	.0354 Nom.		.90 Nom.		4

NOTES:

1. Metric equivalents are for information only and are based upon 1 inch = 25.4 mm.
2. Measured in the zone beyond .250 from the seating plane. 3 leads.
3. Measured in the zone .050 and .250 from the seating plane. 3 leads.
4. When measured in a gaging plane .054 $^{+.001}_{-.000}$ below the seating plane of the transistor, maximum diameter leads shall be within .007 of their true location relative to a maximum width tab. Small diameter leads shall fall within the outline of the maximum diameter lead tolerance.
5. Measured from the maximum diameter of the actual device.
6. The collector shall be internally connected to the case.

Figure 1. Physical dimensions for transistor type 2N705.

Table I. Group A Inspection[1/]

Examination or test	MIL-STD-750		LTPD	Min Rej No.	Symbol	Limits		
	Method	Details				Min	Max	Unit
Subgroup 1			10	5				
Visual and mechanical examination	2071							
Subgroup 2			5	4				
Collector to emitter cutoff current	3041	Bias cond A; $V_{CE} = -7$ Vdc $V_{BE} = +0.2$ Vdc			I_{CEX}	---	-3	uAdc
Collector to base cutoff current	3036	Bias cond D; $V_{CB} = -5$ Vdc $I_E = 0$			I_{CBO}	---	-3	uAdc
Breakdown voltage, collector to base	3001	Bias cond D; $I_C = -0.1$ mAdc $I_E = 0$			BV_{CBO}	-15	---	Vdc
Breakdown voltage, collector to emitter	3011	Bias cond C; $I_C = -0.1$ mAdc $V_{EB} = 0$			BV_{CES}	-15	---	Vdc
Breakdown voltage, emitter to base	3026	Bias cond D; $I_E = -0.1$ mAdc $I_C = 0$			BV_{EBO}	-3.5	---	Vdc
Base emitter voltage (saturated)	3066	Test cond A; $I_C = -10$ mAdc $I_B = -0.4$ mAdc			$V_{BE}(sat)$	-0.34	-0.44	Vdc
Forward-current transfer ratio	3076	$V_{CE} = -0.3$ Vdc $I_C = -10$ mAdc			h_{FE}	25	---	---
Saturation voltage	3071	$I_B = -0.4$ mAdc $I_C = -10$ mAdc			$V_{CE}(sat)$	---	-0.3	Vdc
Subgroup 3			15	5				
High temperature operation	---	$T_A = +55^{+5}_{-0}$ °C						
Collector to base cutoff current	3036	Bias cond D; $V_{CB} = -5$ Vdc $I_E = 0$			I_{CBO}	---	-48	uAdc
Low temperature operation	---	$T_A = -55^{+0}_{-5}$ °C						
Forward-current transfer ratio	3076	$V_{CE} = -0.3$ Vdc $I_C = -10$ mAdc			h_{FE}	10	---	---
Subgroup 4			10	5				
Pulse response (Turn-on-time)	3251	Test cond A; $V_{BE}(0) = 0.5$ Vdc $V_{CC} = -3.5$ Vdc $I_B(1) = -1.0$ mAdc $R_C = 300\ \Omega$			t_d+t_r	---	75	nsec
Pulse response (Storage time)	3251	Test cond A; $V_{CC} = -3.5$ Vdc $I_B(1) = -1.0$ mAdc $I_B(2) = 0.25$ mAdc $R_C = 300\Omega$			t_s	---	100	nsec
Pulse response (Fall time)	3251	Test cond A; $V_{CC} = -3.5$ Vdc $I_B(1) = -1.0$ mAdc $I_B(2) = 0.25$ mAdc $R_C = 300\ \Omega$			t_f	---	100	nsec

[1/] All measurements are to be made at $T_A = 25°C$, unless otherwise specified.

Table II. Group B Inspection.

Examination or test	MIL-STD-750		LTPD	Min Rej No.	Symbol	Limits		
	Method	Details				Min	Max	Unit
Subgroup 1			20	4				
Physical dimensions	2066					(See figure 1)		
Subgroup 2 1/			15	5				
Solderability	2026							
Temperature cycling	1051	Test cond B; except in step 3: $T_A = 95° \pm 5°C$						
Thermal shock (glass strain)	1056	Test cond A						
Moisture resistance	1021							
End points:								
Collector to base cutoff current	3036	Bias cond D; $V_{CB} = -5.0$ Vdc $I_E = 0$			I_{CBO}	---	-6	uAdc
Breakdown voltage, collector to base	3001	Bias cond D; $I_C = -0.1$ mAdc $I_E = 0$			BV_{CBO}	-12	---	Vdc
Forward-current transfer ratio	3076	$V_{CE} = -0.3$ Vdc $I_C = -10$ mAdc			h_{FE}	20	---	---
Subgroup 3 1/			15	5				
Shock	2016	Nonoperating; 500 G; 1.0 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	10,000 G in each orientation X_1, Y_1, Y_2, and Z_1						
End points: (Same as subgroup 2)								
Subgroup 4 1/			15	5				
Terminal strength (lead fatigue)	2036	Test cond E						
Subgroup 5 1/			15	5				
Salt atmosphere (corrosion)	1041							
End points: (Same as subgroup 2)								
Subgroup 6			$\lambda = 7$	5				
High-temperature life (nonoperating)	1031	$T_{stg} = +95 \, ^{+5}_{-0}$ °C						
End points: (Same as subgroup 2)								

See footnote at end of table II.

Table II. Group B Inspection. (Cont)

Examination or test	MIL-STD-750		LTPD	Min Rej No.	Symbol	Limits		
	Method	Details				Min	Max	Unit
Subgroup 7			$\lambda = 7$	5				
Steady state operation life	1026	$T_A = +55\ ^{+5}_{-0}$°C $V_{CE} = -7$ Vdc $V_{BE} = +0.2$ Vdc						
End points: (Same as subgroup 2)								

1/ Destructive tests.

Table III. Group C Inspection.

Examination or test	MIL-STD-750		LTPD	Min Rej No.	Symbol	Limits		
	Method	Details				Min	Max	Unit
Subgroup 1			10	3				
Barometric pressure, reduced (altitude operation)	1001	8 mm Hg; t = 60 seconds						
Measurement during test:								
Collector to base cutoff current	3036	Bias cond D; $V_{CB} = -15$ Vdc $I_E = 0$			I_{CBO}	---	-100	uAdc
Thermal resistance	3151				θ_{J-C}	---	0.25	°C/mW

5. PREPARATION FOR DELIVERY

5.1 Preparation for delivery and the quality assurance provisions for preparation for delivery shall conform to Specification MIL-S-19500.

6. NOTES

6.1 Notes. The notes specified in Specification MIL-S-19500 are applicable to this specification.

Custodians:
Army - EL
Navy - Ships
Air Force - 11

Reviewers:
Army - EL
Navy - SH
Air Force - 11, 17, 85

Users:
Army - MI, MU
Navy - WP, MC, CG

Preparing activity:
Navy - Ships

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Note: Review/user information is current as of the date of this document. For future coordination of changes to the document, draft circulation should be based on the information in the current DODISS.