

MILITARY SPECIFICATION

TRANSISTOR, PNP, GERMANIUM
TYPE 2N2273

1. SCOPE

1.1 Scope.— This document covers the detail requirements for a germanium, PNP, transistor for use in VHF circuit applications and having the following particular characteristics at $T_A = 25^\circ\text{C}$. (See 3.2 and 6.2 herein.):

	h_{FE} (at: $V_{CE} = 10\text{Vdc}$ $I_C = 1\text{mA dc}$)	h_{fe}		NF (at: $V_{CB} = 10\text{Vdc}$ $I_C = 1\text{mA dc}$ $f = 10\text{ mc}$)	C_{ob} (at: $V_{CB} = 10\text{Vdc}$ $I_E = 0$ $f = 0.1\text{ to }1\text{ mc}$)
		(at: $V_{CE} = 6\text{ Vdc}$ $I_C = 1\text{mA dc}$ $f = 10\text{ mc}$)	(at: $V_{CE} = 6\text{ Vdc}$ $I_C = 1\text{mA dc}$ $f = 100\text{ mc}$)		
	---	(db)	---	db	μuf
Minimum	20	20	2.5	--	---
Maximum	75	28	---	12	3.5

1.2 Maximum ratings.— (At 25°C unless otherwise specified.)

P_C ^{1/} (at: $T_A = 25^\circ\text{C}$)	BV_{CBO} (at: $I_C = 100\text{ }\mu\text{A dc}$ $I_E = 0$)	BV_{EBO} (at: $I_E = 100\text{ }\mu\text{A dc}$)	BV_{CES} (at: $I_C = 200\text{ }\mu\text{A dc}$)	T_{stg}
mW	Vdc	Vdc	Vdc	$^\circ\text{C}$
100	25	1.0	25	-65 to +100

^{1/}For power dissipation values in ambient temperatures up to 100°C , see Figure 1 herein.

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-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 General.— Requirements for the transistor 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 in Figure 2 herein.

3.3.1 Lead arrangement.— The lead arrangement on the transistor shall be as indicated in Figure 2 herein.

3.3.2 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 and II herein.

3.5 Marking.— Except as otherwise specified herein, marking shall be in accordance with Specification MIL-S-19500. If any specification-requirements waiver has been granted, the product-identification marking shall consist of the 'classification' type designation only. The 'manufacturer's identification' and 'country of origin' may, at option of the manufacturer, be omitted from being marked on the body of 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.

4.1.1 Inspection lot.- Applicable to the semiconductor device(s) covered herein, the term "inspection lot" shall be as defined in paragraph 4.3.2.1 of Specification MIL-S-19500 except that the 6-week-period time limitation stipulated therein shall be considered as not compulsory.

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

4.2.1 Specified LTPD for subgroups.- The LTPD specified for a subgroup in Tables I and II herein shall apply for all of the tests, combined, in the subgroup.

4.2.2 Disposition of sample units.- Sample units that have been subjected to Group B, Subgroup 4 and 5 tests shall not be delivered on the contract or order. Sample units that have been subjected to and have passed Group B, Subgroups 1, 2, 3, 6 and 7 tests, these tests to be considered non-destructive, may be delivered on the contract or order provided that, after Group B 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.

4.2.3 Interval for End-Point Test measurements.- All applicable End-Point Test measurements shall be performed, after sample units have been subjected to required physical-mechanical or environmental test(s), in accordance with the following time-delay limitations:

(a) For Qualification inspection: within 16 hours.

(b) For Quality Conformance inspection: within 72 hours; however, at discretion of the Government inspector, a more protracted interval may be allowed.

4.2.4 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 Groups A or B tests.

Table I. Group A Inspection.

Test Method per MIL-STD-750	Examination or Test	Conditions	LTPD	Symbol	Limits		Unit
					Min.	Max.	
2071	Visual and mechanical examination	---	5	---	---	---	---
3026	Emitter-base breakdown voltage	Bias Cond. D $I_E = 100 \text{ } \mu\text{Adc}$	5	BV_{EBO}	1.0	---	Vdc
3011	Collector-emitter breakdown voltage	Bias Cond. C $I_C = 200 \text{ } \mu\text{Adc}$		BV_{CES}	25	---	Vdc
3001	Collector-base breakdown voltage	Bias Cond. D $I_C = 100 \text{ } \mu\text{Adc}$ $I_E = 0$		BV_{CBO}	25	---	Vdc
3036	Collector-base cutoff current	Bias Cond. D $V_{CB} = 12 \text{ Vdc}$ $I_E = 0$		I_{CBO}	---	10	μAdc
3306	Small-signal short- circuit forward- current transfer ratio	$I_C = 1 \text{ mAdc}$ $V_{CE} = 6 \text{ Vdc}$ $f = 10 \text{ mc}$		h_{fe}	20	28	(db)
3076	Forward-current transfer ratio	$V_{CE} = 10 \text{ Vdc}$ $I_C = 1 \text{ mAdc}$		h_{FE}	20	75	---

Table I. Group A Inspection - (Cont'd).

Test Method per MIL-STD-750	Examination or Test	Conditions	LTPD	Symbol	Limits		Unit
					Min.	Max.	
<u>Subgroup 3</u>							
3236	Output capacitance	$V_{CB} = 10 \text{ Vdc}$ $I_E = 0$ $f = 0.1 \text{ to } 1.0 \text{ mc}$	10	C_{ob}	---	3.5	uuf
3266	Base spreading resistance	$I_C = 1 \text{ mAdc}$ $V_{CE} = 10 \text{ Vdc}$ $f = 250 \text{ mc}$		r_b	---	250	ohms
3306	Small-signal short-circuit forward-current transfer ratio	$I_C = 1 \text{ mAdc}$ $V_{CE} = 6 \text{ Vdc}$ $f = 100 \text{ mc}$		h_{fe}	2.5	---	---
3246	Noise figure	$V_{CB} = 10 \text{ Vdc}$ $I_C = 1 \text{ mAdc}$ $f = 10 \text{ mc}$ $R_{(gen)} = 50 \text{ ohms}$		NF	---	12	db

Table II. Group B Inspection

Test Method per MIL-STD-750	Examination or Test	Conditions	LTPD	Symbol	Limits Min. Max.	Unit
	Subgroup 1		10			
2066	Physical dimensions	---		---	---	---
	Subgroup 2		10			
2026	Solderability	---		---	---	---
1051	Temperature cycling	Test Cond. B $T_{(high)} = 100^{\circ} +3^{\circ}\text{C}$ -8°C 10 cycles		---	---	---
1056	Thermal shock (glass strain)	Test Cond. A		---	---	---
1021	Moisture resistance	---		---	---	---
	End-point tests:					
3036	Collector-base cutoff current	Bias Cond. D $V_{CB} = 12\text{ Vdc}$ $I_E = 0$		I_{CBO}	20	μAdc
3076	Forward-current transfer ratio	$V_{CE} = 10\text{ Vdc}$ $I_C = 1\text{ mAdc}$		h_{FE}	15	---

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

Test Method per MIL-STD-750	Examination or Test	Conditions	LTPD	Symbol	Limits		Unit
					Min.	Max.	
	<u>Subgroup 3</u>		10				
2016	Shock	Non-operating G = 500 5 blows of 1.0 msec duration ea. in orientations X1, Y1, Y2, Z1 (total = 20 blows)		---	---	---	---
2006	Constant acceleration (centrifuge)	G = 10,000		---	---	---	---
2056	Variable-frequency vibration	G = 10		---	---	---	---
	<u>End-point tests:</u>						
	Same as for Subgroup 2, above						
	<u>Subgroup 4</u>		10				
2036	Lead fatigue	Test Cond. E; 1/		---	---	---	---

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

Test Method per MIL-STD-750	Examination or Test	Conditions	LTPD	Symbol	Limits		Unit
					Min.	Max.	
<u>Subgroup 5</u>							
2/	High-temperature operation:	$T_A = 70 \pm 3^\circ\text{C}$	10				
3036	Collector-base cutoff current	Bias Cond. D $V_{CB} = 12 \text{ Vdc}$ $I_E = 0$		I_{CBO}	---	-100	μAdc
2/	Low-temperature operation:	$T_A = -55^\circ \pm 3^\circ\text{C}$					
3076	Forward-current transfer ratio	$V_{CE} = 10 \text{ Vdc}$ $I_C = 1 \text{ mAdc}$		h_{FE}	8	---	---
1041	Salt atmosphere (corrosion)	---		---	---	---	---
<u>End-point tests:</u>							
Same as for Subgroup 2, above							
<u>Subgroup 6</u>							
1031	High temperature life (non-operating)	$T_{stg} = 100^\circ \pm 5^\circ\text{C}$	$\lambda = 10$	---	---	---	---

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

Test Method per MIL-STD-750	Examination or Test	Conditions	LTPD	Symbol	Limits		Unit
					Min.	Max.	
<u>Subgroup 6 - (Contd)</u>							
<u>End-point tests:</u>							
Same as for Subgroup 2, above							
<u>Subgroup 7</u>							
$\lambda=10$							
1026	Steady state operation life	$T_A = 55^{+3}_{-0}^{\circ}\text{C}$					
		$V_{CB} = 10 \text{ Vdc}$					
		$P_C = 60 \text{ mw}$					
<u>End-point tests:</u>							
Same as for Subgroup 2, above							

1/ Rejects from prior electrical tests from the same lot may be used for this test. At conclusion of this test, any glass fracture other than of the miniscus, or any broken lead, shall be considered a failure.

2/ Test measurement shall be made after thermal equilibrium has been reached at the temperature specified.

5. PREPARATION FOR DELIVERY

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

6. NOTES

6.1 Notes.- The notes included in Specification MIL-S-19500, with the following additions or exceptions, are applicable to this specification.

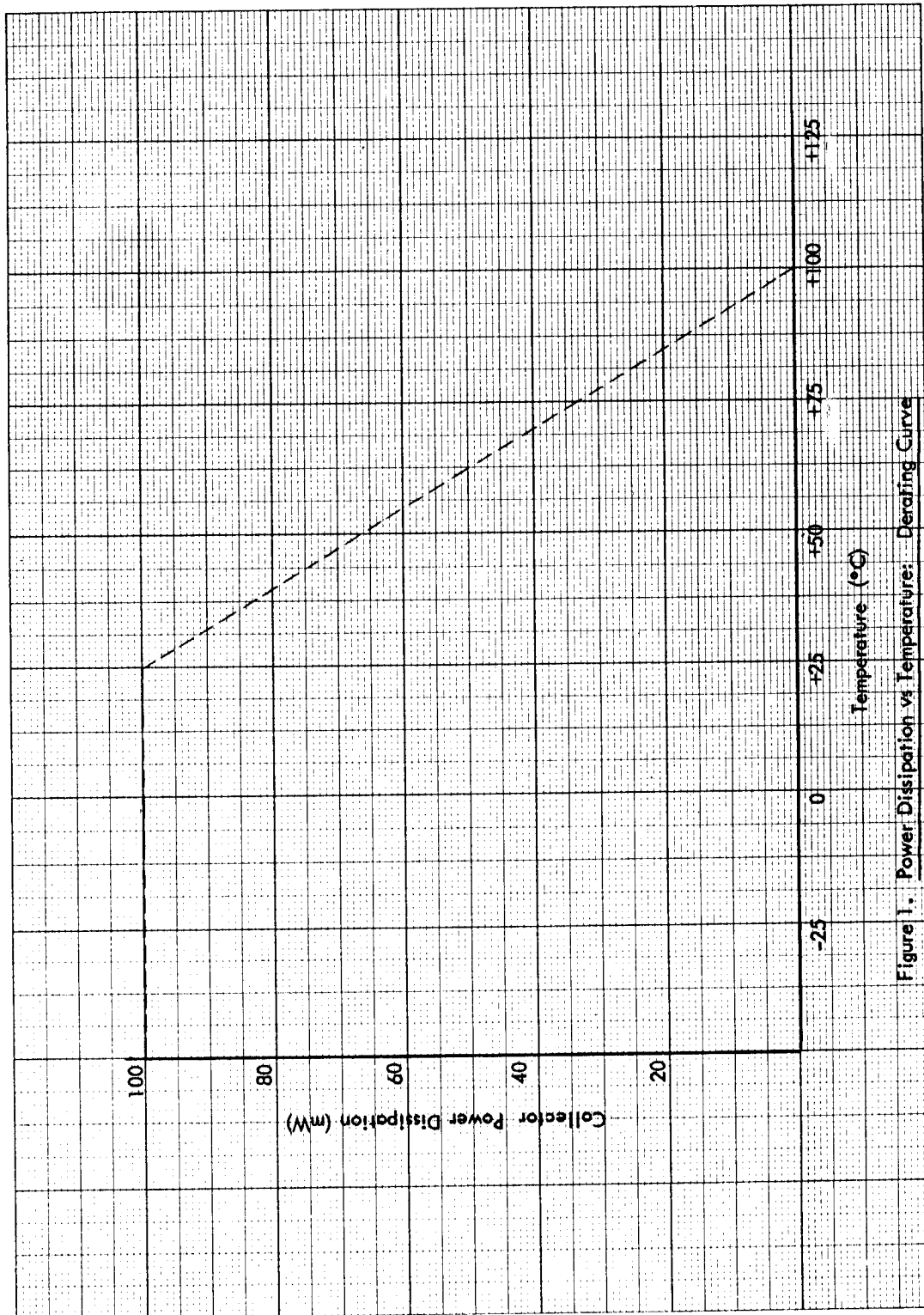
6.2 Type-designation change.- A change of type designation, from "2N2273M" as established in the original issue of this detail specification, to "2N2273" for the item covered herein is reflected in the title of this document. This type-designation change in no way affects the complete compatibility of specified technical or application requirements between the previously designated transistor 2N2273M and newly (herein) designated transistor 2N2273.

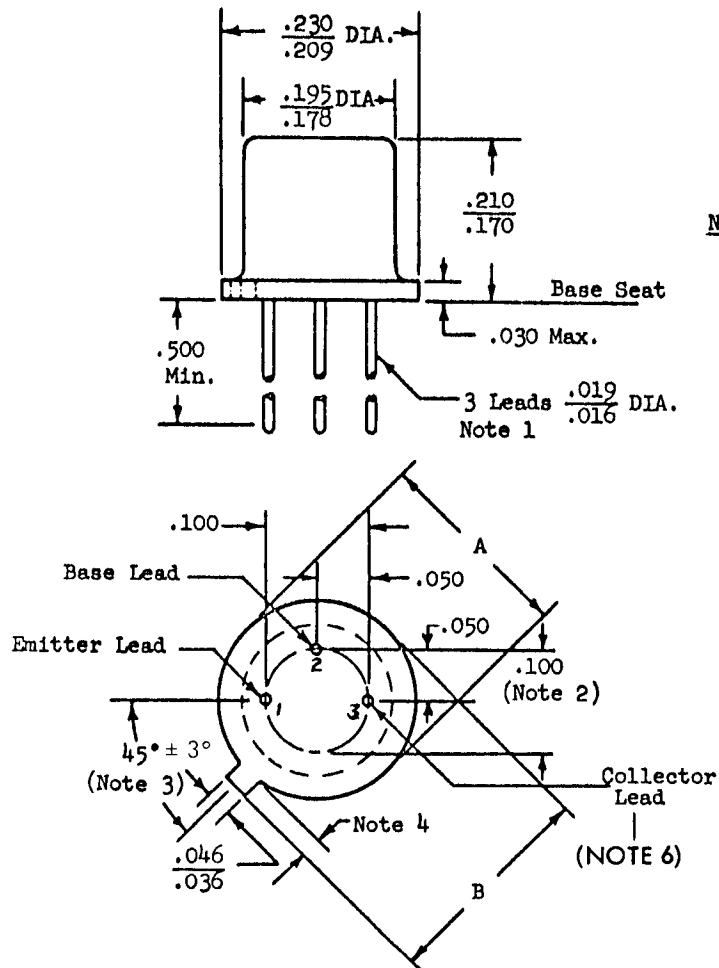
6.3 Qualification.- With respect to products requiring qualification, awards will be made only for such products as have, prior to the time set for opening of bids, been tested and approved for inclusion in Qualified Products List (QPL)-19500, whether or not such products have actually been so listed by that date. Information pertaining to qualification of products covered by this specification should be requested from the Chief, Components And Materials Standardization Division, Procurement And Production Directorate, Fort Monmouth, New Jersey 07703, ATTN: AMSEL-PP-CMD-2.

Custodian:
Army-EL

Preparing activity:
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Project No. 5960-A585





Notes:

1. The specified lead diameter applies to the zone between .050 and .250 from the base seat. Between .250 and end of lead a maximum of .021 is held. Outside of these zones the lead diameter is not controlled.
2. Maximum diameter leads at a gaging plane .054 +.001 -.000 below base seat to be within .007 of their true location relative to Max. width tab and to the maximum .230 diameter measured with a suitable gage. When gage is not used, measurement will be made at base seat.
3. Index tab for visual orientation only.
4. Tab length to be .028 minimum -- .048 maximum, and will be determined by subtracting diameter A from dimension B.
5. All dimensions in inches.
6. Collector is internally connected to the case.

Figure 2. Outline and dimensions.

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