

MILITARY SPECIFICATION

SEMICONDUCTOR DEVICE, DIODE, GERMANIUM, MIXER  
TYPE 1N1838

This specification is mandatory for use by all Departments and Agencies of the Department of Defense.

1. SCOPE

1.1 Scope. This specification covers the detail requirements for a germanium semiconductor mixer diode for low-noise performance in doppler-radar receivers at ku-band or below, employing audio frequency IF amplifiers.

1.2 Ratings and characteristics.

	$\overline{F}_O$	1/G	VSWR
	<u>db</u>	<u>ohms</u>	<u>ratio</u>
Minimum	---	450	---
Maximum	32	750	3.0

OPERATING AMBIENT TEMPERATURE: -65° to + 90° C.

STORAGE TEMPERATURE: -65° to + 90° C.

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.

STANDARDS

MILITARY

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

DRAWINGS

Defense Electronics Supply Center

C66053 - Mixer Holder, Narrow Band, for 1N1838.

C66058 - Burnout Tester for Microwave Diodes, 1N21B, 1N23B, 1N23C, 1N23CR, 1N26, 1N28, 1N53, and 1N78.

(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 5961

3. REQUIREMENTS

3.1 General. Requirements for semiconductor diodes shall be in accordance with MIL-S-19500, and as specified herein.

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

- $e_o$  - - - - - Open-circuit voltage of the pulse generator.
- $F_i$  - - - - - Average noise figure of IF amplifier.
- $F_o$  - - - - - Overall (receiver) average noise figure.
- $1/G$  - - - - - IF conductance.
- $N$  - - - - - Output noise ratio (noise temperature ratio).
- $R_g$  - - - - - Internal resistance of the generator.

3.3 Design and construction. The semiconductor diode shall be of symmetrical construction and shall consist of a cylindrical body having pins at both ends. The body outline shall conform to figure 1.

3.3.1 Base adapter. The base adapter shall be of the design, construction, and physical dimensions shown in figure 2 (see 6.2).

3.4 Performance characteristics. Performance characteristics shall be as specified in tables I and II.

3.5 Marking. The following marking specified in MIL-S-19500 may be omitted at the option of the manufacturer:

- (a) Country of origin.
- (b) Manufacturer's identification.

3.6 Burnout by single pulse. At the end of manufacturing processes and prior to selecting samples for testing, all diodes shall be subjected to 100 percent burnout by single pulse test, only once, and this test shall be performed in accordance with Method 4146, MIL-STD-750, using Drawings C66053 and C66058, and  $E = 100$  Vdc, minimum.

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 Test conditions. Unless otherwise specified herein, the test conditions, when applicable, shall be as follows:

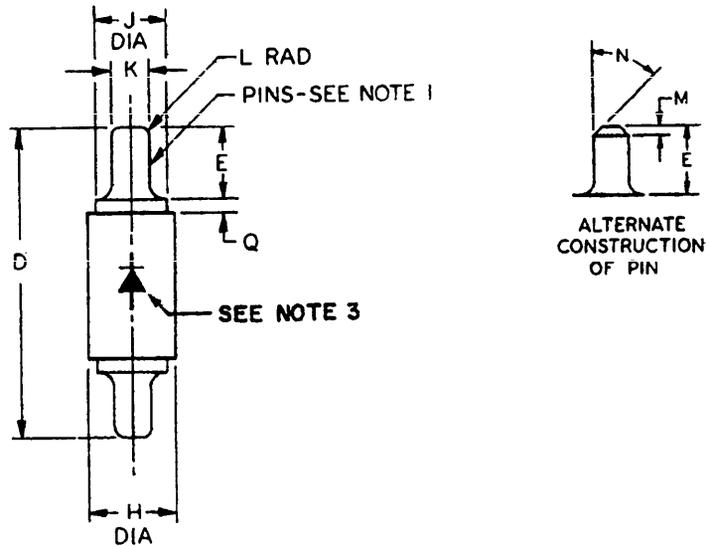
- RF test frequency = 13.3 GHz ( $G_c$ )  $\pm$  50 MHz ( $M_c$ )
- IF test frequency = 20 KHz ( $K_c$ )
- Local oscillator = 0.5 mW
- AC load = 680 ohms
- DC load = 680 ohms
- Drawings C66053, C66058

4.3 Qualification inspection. Qualification inspection shall consist of the examinations and tests specified in tables I and II.

4.4 Quality conformance inspection. Quality conformance inspection shall consist of the examinations and tests specified in groups A and B.

4.4.1 Group A inspection. Group A inspection shall consist of the examinations and tests specified in table I.

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

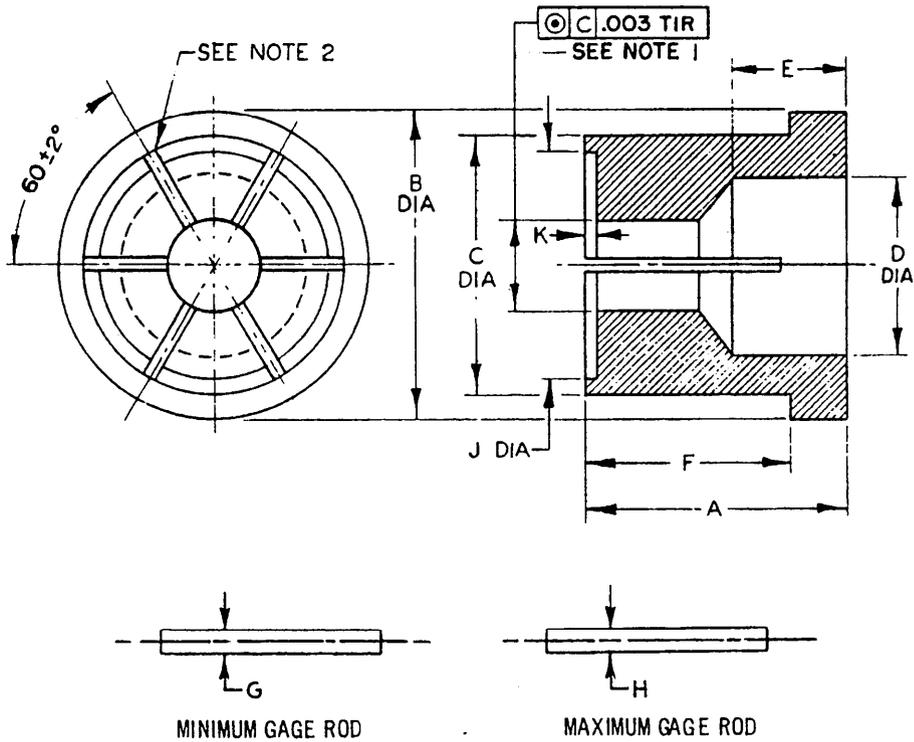


Ltr	Dimensions in inches with metric equivalents (mm) in parentheses (see note 5)	
	Minimum	Maximum
D	.753 (19.13)	.792 (20.12)
E	.180 (4.58)	.190 (4.82)
H	---	.240 (6.09)
J	.195 (4.96)	.215 (5.46)
K	.092 (2.34)	.094 (2.38)
L	.030 (.77)	.046 (1.16)
M	.010 (.26)	.030 (.76)
N	10°	45°
Q	---	.030 (.76)

NOTES:

1. Both pins must have convex ends.
2. Metal parts shall be silver plated min 20 milligrams per square inch (msi) or gold plated min 10 msi.
3. The polarity shall be indicated by an arrow pointing in the direction of easier current flow.
4. Base adapter details are shown on figure 2.
5. Metric equivalents (to the nearest .01 mm) are given for general information only and are based upon 1 inch = 25.4 mm

FIGURE 1. Semiconductor device, diode, type 1N1838.



Ltr	Dimensions in inches with metric equivalents (mm) in parentheses (see note 7)	
	Minimum	Maximum
A	.246 (6.25)	.254 (6.35)
B	.292 (7.42)	.296 (7.51)
C	.246 (6.25)	.250 (6.35)
D	---	.187 (4.75)
E	---	.100 (2.54)
F	.195 (4.96)	.199 (5.05)
G	.0915 (2.324)	.0920 (2.336)
H	.0940 (2.387)	.0945 (2.400)
J	.216 (5.48)	.221 (5.61)
K	.012 (.30)	.018 (.40)

NOTES:

1. This diameter should be .095 (2.41) min, .097 (2.46) max diameter before closing jaws. This diameter shall then be sufficiently closed, and the adapter so tempered that it will fit on the minimum gage rod and also on the maximum gage rod, in each case with a snug fit (for hand assembly).
2. Each slot shall be .008 (.20) min, .012 (.30) max wide by .185 (4.70) deep before closing. The 6 slots are equally spaced.
3. The material for the adapter shall be beryllium copper and the finish is gold plated 10 msi minimum.
4. Eccentricity between pin and base shall not exceed .0075 (.19).
5. All burrs and sharp edges shall be removed.
6. Base adapter supplied only when specified in contract or order.
7. Metric equivalents (to the nearest .01 mm) are given for general information only and are based upon 1 inch = 25.4 mm.

FIGURE 2. Removable adapter for type 1N1838.

4.5 Method of examination and test. Methods of examination and test shall be as specified in tables I and II, and as follows:

4.5.1 High-temperature operation. The semiconductor diode shall be placed in the mixer holder. The ambient temperature of the diode, with test conditions specified for the overall noise figure, shall be raised to + 90° C and maintained at this temperature until equilibrium is reached. The  $\bar{F}_O$  shall then be determined and shall be less than 45 db. The temperature shall then be returned to  $25 \pm 3^\circ$  C at which time  $\bar{F}_O$  shall be less than the specified limit.

4.5.2 Microwave parameters. The L, N, and  $\bar{F}_O$  parameters may be determined by any suitable combination of measured parameters selected from among the following: L, N,  $\bar{F}_1$  (actual), and  $\bar{F}_O$  (actual). A measurement of either L or N, but not both, is required.  $\bar{F}_O$  shall be determined for an assumed or actual intermediate-frequency noise figure ( $\bar{F}_1$ ) of  $1.5 \pm 0.25$  db.

4.5.3 Time limit for end points. End point tests for qualification and quality conformance inspection shall be completed within 96 hours after completion of the last test in the subgroup.

TABLE I. Group A inspection

Examination or test	MIL-STD-750		L T P D	Symbol	Limits		
	Method	Details			Min	Max	Un
<u>Subgroup 1</u>							
Visual and mechanical examination	2071		7	---	---	---	---
<u>Subgroup 2</u>							
Voltage standing wave ratio	4136	Dwg C66053	5	VSWR	---	3.0	tim
Overall noise figure (see 4.5.2)	4126	Test cond. A		$\bar{F}_O$	---	32	db
<u>Subgroup 3</u>							
IF conductance	4116	Dwg C66053	5	1/G	450	750	ohr
<u>Subgroup 4</u>							
Forward voltage	4011	$I_F = 1.0$ mA dc	5	$V_F$	---	0.4	V dc
Reverse current	4016	$V_R = 1.0$ V dc		$I_R$	---	300	$\mu$ A

TABLE II. Group B inspection

Examination or test	MIL-STD-750		L T P D	Symbol	Limits		
	Method	Details			Min	Max	Ur
<u>Subgroup 1</u>							
Physical dimensions	2066	(See figures 1 and 2.)					
		Dim. H, J, and K of Fig. 1	7	---	---	---	---
		Dim. D, E, L, and Q of Fig. 1 (Dim. N, and M and note 2 of Fig. 1 and note 3 of Fig. 2 are for qualification only.)	20	---	---	---	---

TABLE II. Group B inspection - Continued

Examination or test	MIL-STD-750		L T P D	Symbol	Limits		
	Method	Details			Min	Max	Unit
<u>Subgroup 2</u>			15				
Thermal shock (temperature cycling)	1051	Test cond. B; T(high) = + 90° C					
Terminal strength: Tension	2036	Test cond. A; 1 lb; t = 30 sec		---	---	---	---
Torque		Test cond. D; t = 30 sec		---	---	---	---
Moisture resistance	1021	Omit initial conditioning		---	---	---	---
End points: (See 4.5.3) Overall noise figure (see 4.5.2)	4126	Test cond. A		$\bar{F}_O$	---	36	db
<u>Subgroup 3</u>			15				
Burnout by repetitive pulsing	4141	$e_o = 10$ v; $R_g = 50$ ohms; 60,000 pulses, min; $t_p = 0.05$ $\mu$ sec; PRF optional		---	---	---	---
End points: (Same as subgroup 2)							
<u>Subgroup 4</u>			15				
Shock	2016	Nonoperating; 500 G; t = 1.0 msec; 5 blows in each orientation: X <sub>1</sub> , Y <sub>1</sub> , and Y <sub>2</sub>		---	---	---	---
Vibration, variable frequency	2056	Nonoperating; 15 G; 50 to 2,000 Hz (cps)		---	---	---	---
Constant acceleration	2006	Nonoperating; 20,000 G; X <sub>1</sub> , Y <sub>1</sub> , and Y <sub>2</sub> orientations		---	---	---	---
End points: (Same as subgroup 2)							
<u>Subgroup 5</u>			10				
High-temperature operation: (see 4.5.1)		T <sub>A</sub> = 90° C		---	---	---	---
Overall noise figure (see 4.5.2)	4126	Test cond. A		$\bar{F}_O$	---	36	db
End points: (Same as subgroup 2)							
<u>Subgroup 6</u>			$\lambda = 15$				
High-temperature life (nonoperating) End points: (Same as subgroup 2)	1031	T <sub>A</sub> = 90° C		---	---	---	---

5. PREPARATION FOR DELIVERY

5.1 Preparation for delivery. Preparation for delivery shall be in accordance with MIL-S-19500.

6. NOTES

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

6.2 Base adapter. The base adapter shall be supplied only when it is specified in the contract or order (see 3.3.1).

6.3 Handling precautions. The following handling precautions should be observed:

- (a) Ground all equipment.
- (b) Handle the unit by the cathode end only. Make contact to the equipment through this end before touching the top, and maintain hand contact with the equipment until the unit is in place.
- (c) Keep units in protective shields until they are inserted in the equipment or until necessary to remove for test.

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

Preparing activity:  
Navy - SH  
(Project 5961-0001-5)

Review activities:  
Army - EL, MU, MI  
Navy - SH, EC  
Air Force - 11, 17, 85

User activities:  
Army - EL, MI, SM  
Navy - MC, CG, AS, OS  
Air Force - 14, 19

**SPECIFICATION ANALYSIS SHEET**

Form Approved  
Budget Bureau No. 119-R004

INSTRUCTIONS

This sheet is to be filled out by personnel either Government or contractor, involved in the use of the specification in procurement of products for ultimate use by the Department of Defense. This sheet is provided for gaining information on the use of this specification which will insure that suitable products can be procured with minimum amount of delay and at the least cost. Comments and the return of this form will be appreciated. Fold lines on reverse side, staple in corner, and send to preparing activity (as indicated on reverse hereof).

SPECIFICATION

ORGANIZATION (Of submitter) \_\_\_\_\_ CITY AND STATE \_\_\_\_\_

CONTRACT NO. \_\_\_\_\_ QUANTITY OF ITEMS PROCURED \_\_\_\_\_ DOLLAR AMOUNT \_\_\_\_\_  
\$ \_\_\_\_\_

MATERIAL PROCURED UNDER A

DIRECT GOVERNMENT CONTRACT       SUBCONTRACT

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.

COMMENTS ON ANY SPECIFICATION REQUIREMENT CONSIDERED TOO RIGID

IS THE SPECIFICATION RESTRICTIVE?

YES       NO IF "YES", IN WHAT WAY?

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)

SUBMITTED BY (Printed or typed name and activity)

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