

MILITARY SPECIFICATION

SEMICONDUCTOR DEVICE, DIODE, SILICON RF MIXER

TYPES JAN-1N53B, JAN-1N53BR, JAN-1N53BM, AND JAN-1N53BMR

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 silicon semiconductor diodes, types: 1N53B (forward polarity); 1N53BR (reverse polarity); 1N53BM (matched forward pair); and 1N53BMR (matched forward and reverse), for use as a mixer (first detector) in the Ka-band receiver.

1.2 Ratings.

	Type <sup>1/</sup>	Z(IF)	L <sub>c</sub>	NF <sub>0</sub>	VSWR
		<u>ohms</u>	<u>db</u>	<u>db</u>	<u>ratio</u>
Minimum	1N53B	500	---	---	---
Maximum	1N53B	700	6.5	10	1.6

<sup>1/</sup> Ratings for the 1N53B are applicable to the types having additional suffixes.

OPERATING AMBIENT TEMPERATURE: -65° to +150° C  
STORAGE TEMPERATURE: -65° to +150° 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

Armed Services Electro-Standards Agency

- 108-JAN - Burn Out Tester for Crystal Rectifier 1N21B, 1N23B, 1N23C, 1N23CR, 1N26, 1N28, 1N53, and 1N78.
- 173-JAN - Adapter, Test; for Crystal Diode Type 1N53.
- 174-JAN - Mixer, Test; for Crystal Diode Type 1N53.
- 175-JAN - Apparatus, Test, Noise Measurement; for Crystal Diode Type 1N53.

Electronics Command

SC-DL-157896 - Test Holder for Semiconductor Diode Type 1N53B.

(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 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:

Z(IF) ----- Intermediate frequency (IF) impedance  
R<sub>g</sub>----- Input resistance of the generator  
e<sub>o</sub> ----- Open-circuit voltage of the pulse generator

3.3 Design and construction. The semiconductor diodes shall be of the design, construction, and physical dimensions specified in figure 1.

3.3.1 Plating. The diode shall be plated as specified in figure 1.

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

3.5 Marking. The marking shall be placed on each device in accordance with MIL-S-19500.

3.5.1 The manufacturer, at his option, may omit the following markings:

- (a) Country of origin.
- (b) Manufacturer's identification.
- (c) Acceptance date and inspection lot identification.

3.5.2 Diodes meeting the matching requirements (see 4.5.3 and 4.5.4) of this specification will be packaged with a statement to that effect.

3.6 Burnout by single pulse. At the end of all 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 shall be performed in accordance with Method 4146 of MIL-STD-750 and E = 50 Vdc, minimum.

4. QUALITY ASSURANCE PROVISIONS

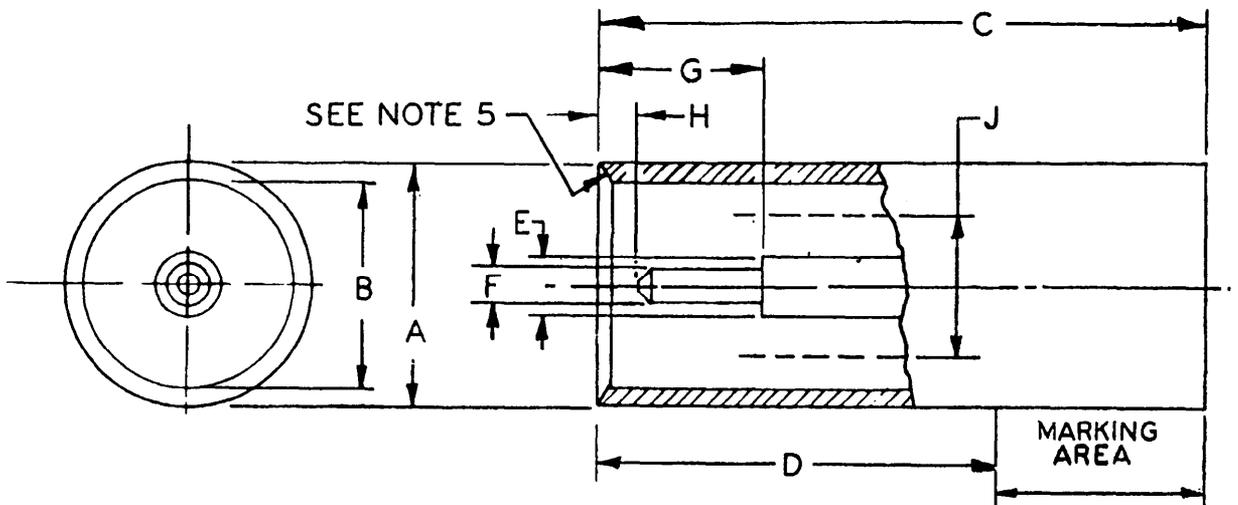
4.1 Sampling and inspection. Sampling and inspection shall be in accordance with MIL-S-19500, and as specified herein.

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

P = 1 mW ± 5%  
f = 34,860 ± 140 mc  
Z<sub>m</sub> = 500 ± 10 ohms; ± j0 ohms  
R<sub>L</sub> = 100 ± 1 ohms

4.2.1 The diode holder specified in Drawing SC-DL-157896 (or the equivalent, 175-JAN), shall be used for all electrical test measurements.

4.3 Qualification inspection. Qualification inspection shall consist of the examinations and tests specified in tables I and II, except the matched pair requirements in subgroup 3 of table I. Qualification testing of either polarity is sufficient to obtain qualification approval of both polarities.

**NOTES:**

1. Finish: .0002 (.005 mm) tin plate over nickel flash, or .0001 (.025 mm) gold plate or .0001 (.0025 mm) silver plate.
2. Axis of center conductor shall not deviate from axis of outer conductor referred to its outside diameter more than .002 (.051 mm).
3. Standard units shall have the cathode connected to the center conductor. Reversed units shall have the anode connected to the center conductor.
4. Outside diameter 'A' applies for length of dimension 'D'.
5. This edge to be sharp and free from burrs.
6. Space for matching transformer when used.
7. Metric equivalents (to the nearest .01 mm) are given for general information only and are based upon 1 inch = 25.4 mm.

LTR	DIMENSIONS				NOTE
	INCHES		MILLIMETERS		
	MIN	MAX	MIN	MAX	
A	.158	.162	4.01	4.11	4
B	.123	.127	3.12	3.23	
C	.545	.555	13.84	14.10	
D	.281		7.14		4
E	.044	.046	1.12	1.17	
F	.019	.021	.48	.53	
G	.099		2.51		
H	.010	.018	.25	.46	
J	.082		2.08		6

Figure 1. Semiconductor device, diode, types 1N53B, 1N53BR, 1N53BM and 1N53BMR.

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.

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

4.5.1 Microwave parameters. The  $L_C$ ,  $NR_O$ , and  $NF_O$  parameters may be determined by any suitable combination of measured parameters selected from among the following:  $L_C$ ,  $NR_O$ ,  $NF_{if}(\text{actual})$ , and  $NF_O$  (actual). A measurement of either  $L_C$  or  $NR_O$ , but not both, is required.  $NF_O$  shall be determined for an assumed or actual intermediate-frequency noise figure ( $NF_{if}$ ) of  $1.5 \pm 0.25$  db.

4.5.2 Output noise ratio ( $NR_O$ ). The plunger in the noise-measuring apparatus (Dwg 175-JAN) shall be set at a position which delivers the maximum power as evidenced by maximum diode current to an average diode from a group of diodes that meet initial conversion-loss, IF impedance and voltage-standing wave-ratio limits.

4.5.3 Matched pair, "M" suffix (forward polarity). The matched forward pair (M suffix) shall consist of two diodes, tested to requirements of subgroup 3, table I, having the cathode connected to the center conductor.

4.5.4 Matched pair, "MR" suffix (forward and reverse polarity). The matched forward and reverse pair (MR suffix) shall consist of two diodes, tested to requirements of subgroup 3, table I: one diode having the cathode connected to the center conductor (forward polarity) and the second diode having the anode connected to the center conductor (reverse polarity).

Table I. Group A inspection.

Examination or test	MIL-STD-750		L T P D	Symbol	Limits		
	Method	Details			Min	Max	Unit
<u>Subgroup 1</u>			10				
Visual and mechanical examination	2071			---	---	---	---
<u>Subgroup 2</u>			10				
Voltage standing wave ratio	4136	Dwg 174-JAN		VSWR	---	1.6	---
Overall noise figure (see 4.5.1)	4126	Test cond. A; Dwg 174-JAN		$NF_O$	---	10	db
<u>Subgroup 3</u>			10				
Conversion loss (see 4.5.1)	4101	Dwg 174-JAN		$L_C$	---	6.5	db
IF impedance	4116	Dwg 174-JAN		Z(IF)	500	700	ohms
Output noise ratio (see 4.5.1 and 4.5.2)	4121	Dwg 175-JAN; $f = 9375 \pm 5$ mc		$NR_O$	---	2.0	times

Table I. Group A inspection. - Continued

Examination or test	MIL-STD-750		L T P D	Symbol	Limits		
	Method	Details			Min	Max	Unit
<u>Subgroup 3 - Continued</u>							
Matched pair requirements: (see 4.5.3 and 4.5.4)							
Conversion loss unbalance	4101			$\Delta L_c$	---	0.3	db
IF impedance unbalance	4116			$\Delta Z(\text{IF})$	---	25	ohms

Table II. Group B inspection.

Examination or test	MIL-STD-750		L T P D	Symbol	Limits		
	Method	Details			Min	Max	Unit
<u>Subgroup 1</u>							
Physical dimensions	2066	(See figure 1) Dim. A, B, E, and G; Dim. C and H, note 2 (Dim. F and note 1 are for qualification only.)	10 20	---	---	---	---
<u>Subgroup 2</u>							
Thermal shock (temperature cycling)	1051	Test cond. A; $T(\text{low}) = -65 \begin{smallmatrix} +0 \\ -5 \end{smallmatrix} ^\circ\text{C}$ $T(\text{high}) = +150 \begin{smallmatrix} +5 \\ -0 \end{smallmatrix} ^\circ\text{C}$	15	---	---	---	---
Moisture resistance	1021	Omit initial conditioning					
End points: Overall noise figure (see 4.5.2)	4126	Test cond. A		$NF_0$	---	11	db
<u>Subgroup 3</u>							
Burnout by repetitive pulsing	4141	$e_0 = 5\text{v}$ ; $R_g = 50$ ohms; 60,000 pulses min, $t_p =$ 1.0 $\mu\text{sec}$ PRF optional	15	---	---	---	---
End points: (Same as for subgroup 2)							
<u>Subgroup 4</u>							
Shock	2016	500 G; $t \approx 1$ msec; 5 blows each orientation: $X_1$ , $Y_1$ , and $Y_2$	15	---	---	---	---
Vibration, variable frequency	2056	15 G; 50 to 2000 cps		---	---	---	---
Constant acceleration	2006	10,000 G; $X_1$ , $Y_1$ , and $Y_2$ orientations		---	---	---	---

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 4 - Continued</u>							
End points: (Same as for subgroup 2)							
<u>Subgroup 5</u>							
High temperature operation:		$T_A = 150 \begin{smallmatrix} +5^\circ\text{C} \\ -0 \end{smallmatrix}$	20	---	---	---	---
Conversion loss (see 4.5.1)	4101	Dwg 174-JAN		$L_c$	---	8.5	db
<u>Subgroup 6</u>							
High-temperature life (nonoperating)	1031	$T_A = 150 \begin{smallmatrix} +5^\circ\text{C} \\ -0 \end{smallmatrix}$	$\lambda = 20$	---	---	---	---
End points: (Same as for subgroup 2)							

5. PREPARATION FOR DELIVERY

5.1 Preparation for delivery shall conform to MIL-S-19500.

6. NOTES

6.1 Notes. In addition to the notes specified herein, the notes specified in MIL-S-19500 are applicable to this specification.

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

Preparing activity:  
 Army - EL  
 (Project 5960-2000)

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

User activities:  
 Army - EL, MU, MI  
 Navy - WP, MC, CG  
 Air Force - None

# 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 obtaining information on the use of this specification which will insure that suitable products can be procured with a minimum amount of delay and at the least cost. Comments and the return of this form will be appreciated. Fold on lines on reverse side, staple in corner, and send to preparing activity.

**SPECIFICATION**

ORGANIZATION

CITY AND STATE

CONTRACT NO.

QUANTITY OF ITEMS PROCURED

DOLLAR AMOUNT

\$

**MATERIAL PROCURED UNDER A**

DIRECT GOVERNMENT CONTRACT

SUBCONTRACT

**1. 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**

**2. COMMENTS ON ANY SPECIFICATION REQUIREMENT CONSIDERED TOO RIGID**

**3. IS THE SPECIFICATION RESTRICTIVE?**

YES

NO

IF "YES", IN WHAT WAY?

**4. 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)

DATE

DD FORM 1426  
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REPLACES NAVSHIPS FORM 4863, WHICH IS OBSOLETE

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