

MILITARY SPECIFICATION  
 SEMICONDUCTOR DEVICE, DIODE, TYPES  
 1N3644, 1N3645, 1N3646 AND 1N3647

1. SCOPE

1.1 Scope. This specification covers the detail requirements for 0.1 ampere silicon rectifiers and is in accordance with MIL-S-19500, except as otherwise specified herein.

1.2 Maximum ratings.

Type	V <sub>R</sub>	I <sub>o</sub>	I <sub>o</sub> T <sub>A</sub> = 100°C	i(Surge)	T <sub>stg</sub>	Altitude
	Vdc	mAdc	mAdc	A	°C	Ft.
1N3644	1500	250	100	14	-65 to +175	40,000
1N3645	2000	250	100	14	-65 to +175	40,000
1N3646	2500	250	100	14	-65 to +175	40,000
1N3647	3000	250	100	14	-65 to +175	40,000

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:

SPECIFICATION

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.)

3. REQUIREMENTS

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

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

3.2.1 Encapsulating material(s). Encapsulating material(s) used shall be at the device manufacturer's option. Information concerning the material(s) shall be included with the qualification device design data.

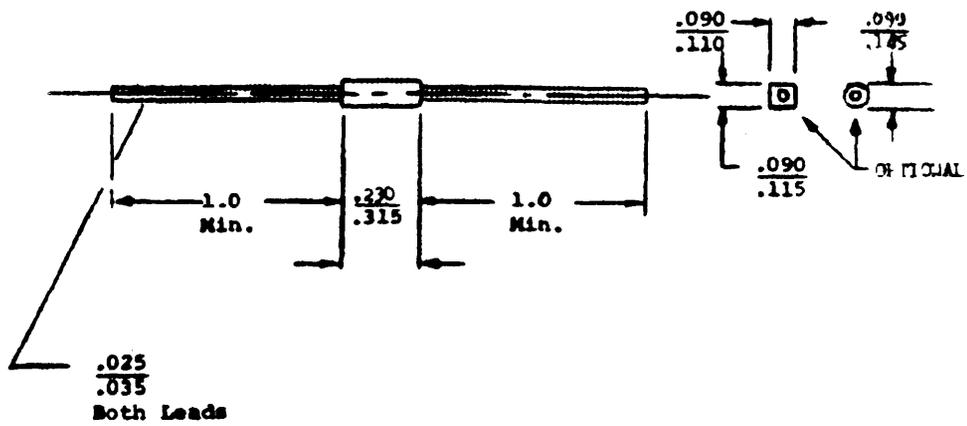


FIGURE 1. Design, construction and physical dimensions of diode, types 1N3644, 1N3645, 1N3646 and 1N3647.

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

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

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

3.4.1 Polarity. The polarity shall be indicated by a contrasting color band or dot to indicate the cathode end.

#### 4. QUALITY ASSURANCE PROVISIONS

4.1 Quality conformance inspection. Quality conformance inspection shall consist of the examinations and tests specified in tables I, II, and III. Group A inspection shall be performed on a subplot basis. Group B inspection, with the exception of subgroups 7 and 8, shall be performed on a lot basis. Group B subgroups 7 and 8 shall be performed on sublots of the highest and lowest voltage types present in the lot. Group C inspection shall be performed on sublots of the highest voltage type for each altitude rating for which qualification applies.

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>			5				
Visual and mechanical examination	2071						
<u>Subgroup 2</u>			5				
Forward voltage	4011	$I_F = 250\text{mA}$		$V_F$	---	5	Vdc
Reverse current	4016						
1N3644		$V_R = 1500\text{Vdc}$		$I_R$	---	5	$\mu\text{Adc}$
1N3645		$V_R = 2000\text{Vdc}$		$I_R$	---	5	$\mu\text{Adc}$
1N3646		$V_R = 2500\text{Vdc}$		$I_R$	---	5	$\mu\text{Adc}$
1N3647		$V_R = 3000\text{Vdc}$		$I_R$	---	5	$\mu\text{Adc}$
Breakdown voltage	4021						
1N3644		$BV = 1800\text{Vdc}$		$I_R$	---	50	$\mu\text{Adc}$
1N3645		$BV = 2400\text{Vdc}$		$I_R$	---	50	$\mu\text{Adc}$
1N3646		$BV = 3000\text{Vdc}$		$I_R$	---	50	$\mu\text{Adc}$
1N3647		$BV = 3600\text{Vdc}$		$I_R$	---	50	$\mu\text{Adc}$
Reverse current average	4046						
		$T_A = +100^\circ\text{C}$					
		$I_O = 100\text{mA}$					
1N3644		$V_R = 1050\text{Vac}$		$I_{RO}$	---	100	$\mu\text{Adc}$
1N3645		$V_R = 1400\text{Vac}$		$I_{RO}$	---	100	$\mu\text{Adc}$
1N3646		$V_R = 1750\text{Vac}$		$I_{RO}$	---	100	$\mu\text{Adc}$
1N3647		$V_R = 2100\text{Vac}$		$I_{RO}$	---	100	$\mu\text{Adc}$

Examination or Test	Conditions		LTPD	Symbol	Limits		Unit
	MIL-STD-750 Method	Specific Conditions			Min	Max	
<u>Subgroup 1</u>							
Physical dimensions	2066		5				
<u>Subgroup 2</u>							
Solderability	2026		10				
Thermal shock (Temperature cycling)	1051	Cond. C except T High = +175°C					
Thermal shock (glass strain)	1056	Cond. A except T = -40°C T = +120°C					
Moisture resistance	1021						
<u>Subgroup 3</u>							
Shock	2016	1,000G 5 Blows X1, Y1, Y2	10				
Vibration fatigue	2046	Non-Operating 20 G 55 Hz					
Vibration, variable frequency	2056						
Constant acceleration	2006	15,000G X1, X2, Y1					
<u>Subgroup 4</u>							
Lead fatigue	2036	Cond. E	10				
<u>Subgroup 5</u>							
Salt atmosphere	1041	48 Hrs.	10				
<u>Subgroup 6</u>							
Surge current	4066	T <sub>A</sub> = +25°C i (Surge) = 14A Ten 8 msec surges; 1 surge/min I <sub>0</sub> = 250mA					

Table II. Group B inspection (Continued).

Examination or Test	Conditions		LTPD	Symbol	Limits		Unit
	MIL-STD-750 Method	Specific Conditions			Min	Max	
<u>Subgroup 7</u>			$\lambda = 10$				
High temperature life (non-operating)	1031	$T_A = 175^\circ\text{C}$					
<u>Subgroup 8</u>			$\lambda = 10$				
Steady State operation life	1026	$T_A = 100^\circ\text{C}$ $I_o = 100\text{mA}$ $V = 1050\text{Vac}$ $V = 1400\text{Vac}$ $V = 1750\text{Vac}$ $V = 2100\text{Vac}$					
1N3644							
1N3645							
1N3646							
1N3647							
<u>End points for subgroups 2 through 8</u>							
Forward voltage	4011	$I_F = 250\text{mA}$		$V_F$	---	5	Vdc
Reverse current	4016						
1N3644		$V_R = 1500\text{Vdc}$		$I_R$	---	5	$\mu\text{A}$
1N3645		$V_R = 2000\text{Vdc}$		$I_R$	---	5	$\mu\text{A}$
1N3646		$V_R = 2500\text{Vdc}$		$I_R$	---	5	$\mu\text{A}$
1N3647		$V_R = 3000\text{Vdc}$		$I_R$	---	5	$\mu\text{A}$
Breakdown voltage	4021						
1N3644		$B_V = 1800\text{Vdc}$		$I_R$	---	50	$\mu\text{A}$
1N3645		$B_V = 2400\text{Vdc}$		$I_R$	---	50	$\mu\text{A}$
1N3646		$B_V = 3000\text{Vdc}$		$I_R$	---	50	$\mu\text{A}$
1N3647		$B_V = 3600\text{Vdc}$		$I_R$	---	50	$\mu\text{A}$
Reverse current average	4046	$T_A = 100^\circ\text{C}$ $I_o = 100\text{mA}$ $V_R = 1050\text{Vac}$ $V_R = 1400\text{Vac}$ $V_R = 1750\text{Vac}$ $V_R = 2100\text{Vac}$					
1N3644				$I_{RO}$	---	100	$\mu\text{A}$
1N3645				$I_{RO}$	---	100	$\mu\text{A}$
1N3646				$I_{RO}$	---	100	$\mu\text{A}$
1N3647				$I_{RO}$	---	100	$\mu\text{A}$

TABLE III. Group C inspection.

Examination or Test	Conditions		LTPD	Symbol	Limits		Unit
	MIL-STD-750 Method	Specific Conditions			Min	Max	
<u>Subgroup 1</u>			10				
Barometric pressure, reduced (altitude operation) (See 4.5.1)	1001	40,000 ft.		---	---	---	---
Measurement during test							
Reverse current	4016						
1N3644		V <sub>R</sub> = 1500V					
1N3645		V <sub>R</sub> = 2000V					
1N3646		V <sub>R</sub> = 2500V					
1N3647		V <sub>H</sub> = 3000V					

4.2 Qualification tests. Qualification tests shall be conducted at a laboratory satisfactory to the Naval Electronic Systems Command. Qualification tests shall consist of the tests specified in 4.2.1. (Application for Qualification tests shall be made in accordance with "Provisions Governing Qualification SD-6" (See 6.1).)

4.2.1 Qualification inspection shall consist of the examinations and tests specified in tables I, II, and III. Group A inspection shall be performed on a subplot basis. Group B subgroups 7 and 8 shall be performed on sublots of the highest and lowest voltage types submitted to qualify those voltage types and all intermediate voltage types. Group C inspection shall be performed on sublots of the highest voltage type for each altitude rating for which qualification is pursued.

4.2.2 Qualification inspection information. When specified in the contract or order, one copy of the qualification inspection data pertinent to the inspection lot shall accompany the shipments. (See 6.3).

4.3 Group A inspection. Group A inspection shall consist of the examinations and tests shown in table I.

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

4.5 Group C inspection. Group C inspection shall consist of the examinations and tests shown in table III.

4.5.1 Barometric pressure, reduced. The devices shall be suitably mounted in the vacuum chamber and the specified reverse voltage applied (see 1.2). Reverse current shall be monitored. Pressure shall be reduced to the value specified herein and maintained for 30 seconds. Evidence of arcing, corona, or reverse current in excess of 100 microamperes shall be considered a defect.

## 5. PREPARATION FOR DELIVERY

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

## 6. NOTES

6.1 The activity responsible for the qualified products list is the NAVAL ELECTRONIC SYSTEMS COMMAND, ELEX 0517, Department of the Navy, Washington, D.C. 20360. Information pertaining to

qualification of products may be obtained from either the NAVAL ELECTRONIC SYSTEMS COMMAND or the Defense Electronics Supply Center (DESC), Dayton, Ohio 45401, agent for administration of the Qualified Products List. Application for qualification tests shall be made in accordance with "Provisions Governing Qualification SD-6". (Copies of "Provisions Governing Qualification SD-6" may be obtained upon application to Commanding Officer, Naval Publications and Forms Center, 5801 Tabor Avenue, Philadelphia, Pennsylvania 19120.)

6.2 Substitution data. Types 1N3643 and 1N3992 have been deleted from this specification. Type 1N3957 of MIL-S-19500/228 may be substituted for type 1N3643. There is no direct replacement for type 1N3992.

6.3 Ordering data.

(a) Qualification inspection information, if required (See 4.2.2).

**User activities:**  
Navy - AS, OS, MC, CG, SH

**Preparing activity:**  
Navy - EC

(Project 5961-N342)

**INSTRUCTIONS:** In a continuing effort to make our standardization documents better, the DoD provides this form for use in submitting comments and suggestions for improvements. All users of military standardization documents are invited to provide suggestions. This form may be detached, folded along the lines indicated, taped along the loose edge (*DO NOT STAPLE*), and mailed. In block 5, be as specific as possible about particular problem areas such as wording which required interpretation, was too rigid, restrictive, loose, ambiguous, or was incompatible, and give proposed wording changes which would alleviate the problems. Enter in block 6 any remarks not related to a specific paragraph of the document. If block 7 is filled out, an acknowledgement will be mailed to you within 30 days to let you know that your comments were received and are being considered.

**NOTE:** This form may not be used to request copies of documents, nor to request waivers, deviations, or clarification of specification requirements on current contracts. Comments submitted on this form do not constitute or imply authorization to waive any portion of the referenced document(s) or to amend contractual requirements.

(Fold along this line)

(Fold along this line)

DEPARTMENT OF THE NAVY



**OFFICIAL BUSINESS**  
PENALTY FOR PRIVATE USE \$300

**BUSINESS REPLY MAIL**  
FIRST CLASS PERMIT NO. 12503 WASHINGTON D. C.

POSTAGE WILL BE PAID BY THE DEPARTMENT OF THE NAVY

Commander  
Naval Electronic Systems Command (ELEX 8111)  
Washington, DC 20360

NO POSTAGE  
NECESSARY  
IF MAILED  
IN THE  
UNITED STATES



# STANDARDIZATION DOCUMENT IMPROVEMENT PROPOSAL

(See Instructions - Reverse Side)

1. DOCUMENT NUMBER		2. DOCUMENT TITLE	
3a. NAME OF SUBMITTING ORGANIZATION		4. TYPE OF ORGANIZATION (Mark one)	
b. ADDRESS (Street, City, State, ZIP Code)		<input type="checkbox"/> VENDOR	
		<input type="checkbox"/> USER	
		<input type="checkbox"/> MANUFACTURER	
		<input type="checkbox"/> OTHER (Specify): _____	
5. PROBLEM AREAS			
a. Paragraph Number and Wording:			
b. Recommended Wording:			
c. Reason/Rationale for Recommendation:			
6. REMARKS			
7a. NAME OF SUBMITTER (Last, First, MI) - Optional		8. WORK TELEPHONE NUMBER (Include Area Code) - Optional	
c. MAILING ADDRESS (Street, City, State, ZIP Code) - Optional		9. DATE OF SUBMISSION (YYMMDD)	