

The documentation and process conversion measures necessary to comply with this document shall be completed by 16 September, 2001.

INCH POUND

MIL-PRF-19500/228J
 16 July 2001
 SUPERSEDING
 MIL-PRF-19500/228H
 14 September 1997

PERFORMANCE SPECIFICATION SHEET

*

SEMICONDUCTOR DEVICE, DIODE, SILICON, RECTIFIER,
 TYPES 1N3611, 1N3612, 1N3613, 1N3614, 1N3957, 1N3611EG1, 1N3612EG1,
 1N3613EG1, 1N3614EG1, 1N3957EG1, JAN AND JANTX

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

1. SCOPE

1.1 Scope. This specification covers the performance requirements for 1.0 ampere silicon rectifier diodes. Two levels of product assurance are provided for each encapsulated device type as specified in MIL-PRF-19500.

* 1.2 Physical dimensions. See figure 1, similar to DO - 41, and figure 2, epoxy-glass case outline.

* 1.3 Maximum ratings.

Types	V _{RWM}	I _O		I _{FSM}	Barometric pressure (reduced)	T _{STG} and T _J	R _{θJL} L = .375 inch (9.53 mm)
		At: T _A = +100°C (1) (2)	At: T _A = +150°C (1) (2)	T _A = +25°C I _O = 1 A dc t _p = 8.0 ms			
*	V(pk)	A dc	mA dc	A(pk)	mmHg	°C	°C/W
1N3611, EG1 (3)	200	1	300	30	8	-65 to +175	38
1N3612, EG1 (3)	400	1	300	30	8	-65 to +175	38
1N3613, EG1 (3)	600	1	300	30	8	-65 to +175	38
1N3614, EG1 (3)	800	1	300	30	54	-65 to +175	38
1N3957, EG1 (3)	1,000	1	300	30	87	-65 to +175	38

- (1) From I_O rating is independent of heat sinking, special mounting, or leads of the device.
- (2) Derate linearly at 13.3 mA between T_A = +100°C and T_A = +175°C.
- (3) See 3.7 note.

Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: Defense Supply Center, Columbus, ATTN: DSCC-VAC, P.O. Box 3990, Columbus, OH 43216-5000, by using the Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document or by letter.

2. APPLICABLE DOCUMENTS

2.1 General. The documents listed in this section are specified in sections 3 and 4 of this specification. This section does not include documents cited in other sections of this specification or recommended for additional information or as examples. While every effort has been made to ensure the completeness of this list, document users are cautioned that they must meet all specified requirements documents cited in sections 3 and 4 of this specification, whether or not they are listed.

2.2 Government documents.

2.2.1 Specifications, standards, and handbooks. The following specifications, standards, and handbooks form a part of this document to the extent specified herein. Unless otherwise specified, the issues of these documents are those listed in the issue of the Department of Defense Index of Specifications and Standards (DoDISS) and supplement thereto, cited in the solicitation (see 6.2).

SPECIFICATION

DEPARTMENT OF DEFENSE

MIL-PRF-19500 - Semiconductor Devices, General Specification for.

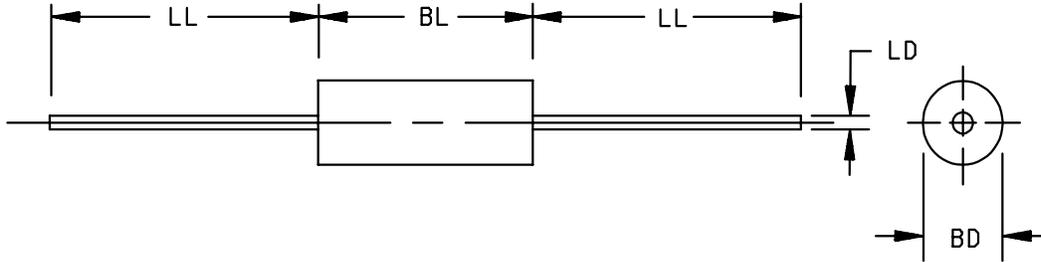
STANDARD

DEPARTMENT OF DEFENSE

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

(Unless otherwise indicated, copies of the above specifications, standards, and handbooks are available from the Document Automation and Production Services (DAPS), Building 4D (DPM-DODSSP), 700 Robbins Avenue, Philadelphia, PA 19111-5094.)

2.3 Order of precedence. In the event of a conflict between the text of this document and the references cited herein, the text of this document takes precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.



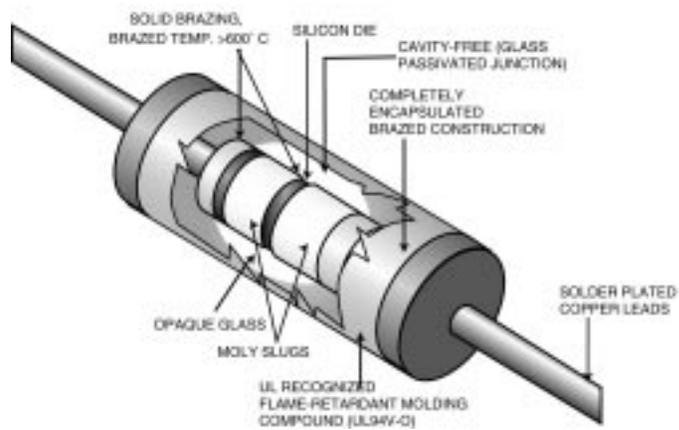
Symbol	Dimensions				Notes
	Inches		Millimeters		
	Min	Max	Min	Max	
BD	.060	.110	1.52	2.79	
BL	.140	.205	3.56	5.21	
LD	.025	.034	0.64	0.86	3
LL	.600	1.500	15.24	38.10	4

NOTES:

1. Dimensions are in inches.
2. Metric equivalents are given for general information only.
3. Dimension LD shall be measured at the largest diameter.
4. Dimension BD shall include the sections of the lead over which the diameter is uncontrolled.
This uncontrolled area is defined as the zone between the edge of the diode body and extending .050 inch (1.27 mm) onto the leads.
5. See 3.7 note.

FIGURE 1. Physical dimensions.

Epoxy Glass (EG) Construction



*FIGURE 2 Epoxy-Glass (EG1 case outline) construction (for reference only) See 3.7 note.

3. REQUIREMENTS

3.1 General. The requirements for acquiring the product described herein shall consist of this document and MIL-PRF-19500.

3.2 Qualification. Devices furnished under this specification shall be products that are manufactured by a manufacturer authorized by the qualifying activity for listing on the applicable qualified manufacturer's list (QML) before contract award (see 4.2 and 6.3).

* 3.3 Abbreviations, symbols, and definitions. Abbreviations, symbols, and definitions used herein shall be as specified in MIL-PRF-19500 and as follows.

EG - Epoxy over Glass hermetically sealed EG1 case.

3.4 Interface and physical dimensions. The interface and physical dimensions shall be as specified in MIL-PRF-19500 and on figure 1 herein. No lead (Pb) shall be used in the construction of the die bonds.

3.4.1 Lead finish. Lead finish shall be solderable in accordance with MIL-PRF-19500, MIL-STD-750, and herein. Where a choice of lead finish is desired, it shall be specified in the acquisition document (see 6.2).

* 3.4.2 Diode construction. These devices shall be constructed utilizing non-cavity double plug construction with high temperature bonding between both sides of the silicon die and terminal pins. Figure 2, Epoxy-Glass (EG1 case outline) construction for reference only.

3.5 Electrical performance characteristics. Unless otherwise specified herein, the electrical performance characteristics are as specified in 1.3, and table I.

3.6 Electrical test requirements. The electrical test requirements shall be the subgroups specified in 4.4.2 and 4.4.3.

3.7 Marking. Devices shall be marked as specified in MIL-PRF-19500.

Note: The EG1 version, Epoxy over Glass construction, in this specification is a construction identifier. It denotes a type of design and not a change in package outline. EG1 is not intended to be a package outline identifier. The EG1 version meets all of the requirements of a non EG1 version including case outline, hermeticity, and electricals parameters. The EG1 may be marked and shipped as a non EG1 part number because it is an equivalent device in terms of form, fit, and function. The EG1 is interchangeable and substitutable for the non EG1 version.

3.8 Polarity. The polarity shall be indicated with a contrasting color band to denote the cathode end or the use of other techniques considered commercial practice.

3.9 Workmanship. Semiconductor devices shall be processed in such a manner as to be uniform in quality and shall be free from other defects that will affect life, serviceability, or appearance.

4. VERIFICATION

4.1 Classification of inspections. The inspection requirements specified herein are classified as follows:

- a. Qualification inspection (see 4.2).
- b. Screening (see 4.3).
- c. Conformance inspection (see 4.4).

4.2 Qualification inspection. Qualification inspection shall be in accordance with MIL-PRF-19500 and as specified herein.

4.3 Screening (JANTX level only). Screening shall be in accordance with (Appendix E, table IV), of MIL-PRF-19500 and as specified herein. The following measurements shall be made in accordance with table I herein. Devices that exceed the limits of table I herein shall not be acceptable.

Screen (see appendix E, table IV of MIL-PRF-19500)	Measurement
	JANTX level
9	Not applicable
11	I_{R1} and V_{F1}
12	See 4.3.1
13	Subgroup 2 of table I herein. $\Delta I_{R1} = 100$ percent of initial reading or ± 50 nA dc, whichever is greater. $\Delta V_{F1} = \pm 0.1$ V dc.

4.3.1 Power burn-in conditions. Power burn-in conditions are as follows: Method 1038, of MIL-STD-750 condition B, T_A = room ambient as defined in the general requirements in 4.5 of MIL-PRF-19500; V_{RWM} = full rated V_{RWM} (see 1.3); $f = 50$ to 60 Hz; $I_O = 1$ A; 96 hours.

4.4 Conformance inspection. Conformance inspection shall be in accordance with MIL-PRF-19500 and as specified herein.

4.4.1 Group A inspection. Group A inspection shall be conducted in accordance with appendix E, table V of MIL-PRF-19500 and table I herein.

4.4.2 Group B inspection. Group B inspection shall be conducted in accordance with the conditions specified for subgroup testing in appendix E, table VIb (JANTX, and JANTXV) of MIL-PRF-19500, and as follows. Electrical measurements (end-points) and delta requirements shall be in accordance with the applicable steps of table II herein.

4.4.2.1 Group B inspection, appendix E, table VIb of MIL-PRF-19500.

<u>Subgroup</u>	<u>Method</u>	<u>Conditions</u>
B2	4066	$I_{FSM} = 30$ A(pk), 10 surges of 8.3 ms each at 1 minute intervals, $I_O = 1$ A dc, $V_{RWM} =$ rated V_{RWM} (see 1.3), $T_A = +25^\circ\text{C}$. Sampling plan = 10.
B3	1026	$T_A = +150^\circ\text{C} \pm 5^\circ\text{C}$, $I_O = 300$ mA, $V_R =$ rated V_{RWM} (see 1.3), $t = 340$ hours, $f = 60$ Hz.
B5	3101 or 4081	$+25^\circ\text{C} \leq T_L \leq +35^\circ\text{C}$ (recorded before test is performed), $R_{\theta JL} \leq$ maximum rated $R_{\theta JL}$ (see 1.3).
B6	1032	$T_A = +175^\circ\text{C}$, $t = 340$ hours.

4.4.3 Group C inspection. Group C inspection shall be conducted in accordance with the conditions specified for subgroup testing in appendix E, table VII of MIL-PRF-19500 and as follows. Electrical measurements (end-points) and delta requirements shall be in accordance with the applicable steps of table II herein.

4.4.3.1 Group C inspection appendix E, table VII of MIL-PRF-19500.

<u>Subgroup</u>	<u>Method</u>	<u>Conditions</u>
C2	2036	Test condition A, weight = 4 pounds, t = 15 s.
C2	2036	Test condition E.
C5	1001	$V_{RWM} = \text{rated } V_{RWM}$ (see 1.3), pressure = rated pressure (see 1.3), t = 1 minute, sampling plan = 15.
C6	1026	$T_A = 150^\circ\text{C} \pm 5^\circ\text{C}$, $I_O = 300 \text{ mA}$, $V_{RWM} = \text{rated } V_{RWM}$ (see 1.3), f = 60 Hz.

4.5 Methods of inspection. Methods of inspection shall be as specified in the appropriate tables and as follows.

4.5.1 Burn-in and steady-state operation life tests. These tests shall be conducted with a half-sine waveform of the specified peak voltage impressed across the diode in the reverse direction followed by a half-sine waveform of the specified average rectified current. The forward conduction angle of the rectified current shall be neither greater than 180 degrees, nor less than 150 degrees.

4.5.2 Pulse measurements. Conditions for pulse measurement shall be as specified in section 4 of MIL-STD-750.

TABLE I. Group A inspection.

Inspection ^{1/}	MIL-STD-750		Symbol	Limits		Unit
	Method	Conditions		Min	Max	
<u>Subgroup 1</u>						
Visual and mechanical inspection	2071					
<u>Subgroup 2</u>						
Forward voltage	4011	$I_F = 1 \text{ A dc (pulsed)}$ (see 4.5.2); duty cycle = 2 percent maximum.	V_{F1}	.6	1.1	V pk
Reverse current leakage	4016	$V_R = \text{rated } V_{RWM}$ (see 1.3) DC method.	I_{R1}		1.0	$\mu\text{A dc}$
<u>Subgroup 3</u>						
High temperature operation:		$T_A = 150^\circ\text{C}.$				
Reverse current leakage	4016	$V_R = \text{rated } V_{RWM}$ (see 1.3) DC method.	I_{R2}		300	$\mu\text{a dc}$
Low temperature operation:		$T_A = -65^\circ\text{C}.$				
Forward voltage	4011	$I_F = 1.0 \text{ A dc (pulsed)}$ (see 4.5.2).	V_{F2}	0.6	1.5	V dc

^{1/} For sampling plan, see MIL-PRF-19500.

TABLE II. Groups A, B, and C electrical measurements. 1/ 2/

Step	Inspection	MIL-STD-750		Symbol	Limits		Unit
		Method	Conditions		Min	Max	
1.	Forward voltage	4011	$I_F = 1.0$ A dc pulse width = 8.3 ms maximum, duty cycle = 2 percent maximum.	V_{F1}	0.6	1.1	V dc
2.	Reverse current	4016	DC method; $V_R =$ rated (see 1.3).	I_{R1}		1.0	μ A dc
3.	Forward voltage	4011	$I_F = 1.0$ A dc pulse width = 8.3 ms maximum; duty cycle = 2 percent maximum.	ΔV_{F2}		± 0.1 V dc maximum	
4.	Reverse current	4016	DC method; $V_R =$ rated (see 1.3).	ΔI_{R1}		± 50 nA dc or 100 percent of initial value, whichever is greater.	

1/ The electrical measurements for appendix E, table VIb (JANTX) of MIL-PRF-19500 are as follows:

- a. Subgroup 2, see table II herein, steps 1 and 2.
- b. Subgroup 3, see table II herein, steps 1, 2, 3, and 4.
- c. Subgroup 6, see table II herein, steps 1 and 2.
- d. Subgroup 7, see table II herein, steps 1 and 2.

2/ The electrical measurements for appendix E, table VII of MIL-PRF-19500 are as follows:

- a. Subgroup 2, see table II herein, steps 1 and 2.
- b. Subgroup 3, see table II herein, steps 1 and 2.
- c. Subgroup 5, see table II herein, step 2.
- d. Subgroup 6, see table II herein, steps 1 and 2.

5. PACKAGING

5.1 Packaging. For acquisition purposes, the packaging requirements shall be as specified in the contract or order (see 6.2). When actual packaging of materiel is to be performed by DoD personnel, these personnel need to contact the responsible packaging activity to ascertain requisite packaging requirements. Packaging requirements are maintained by the Inventory Control Point's packaging activity within the Military Department or Defense Agency, or within the Military Department's System Command. Packaging data retrieval is available from the managing Military Department's or Defense Agency's automated packaging files, CD-ROM products, or by contacting the responsible packaging activity.

6. NOTES

(This section contains information of a general or explanatory nature that may be helpful, but is not mandatory.)

6.1 Intended use. The notes specified in MIL-PRF-19500 are applicable to this specification.

6.2 Acquisition requirements. Acquisition documents must specify the following:

- a. Title, number, and date of this specification.
- b. Issue of DoDISS to be cited in the solicitation, and if required, the specific issue of individual documents referenced (see 2.2.1).
- c. Packaging requirements (see 5.1).
- d. Lead finish (see 3.4.1).

6.3 Qualification. With respect to products requiring qualification, awards will be made only for products which are, at the time of award of contract, qualified for inclusion in Qualified Manufacturers' List (QML) whether or not such products have actually been so listed by that date. The attention of the contractors is called to these requirements, and manufacturers are urged to arrange to have the products that they propose to offer to the Federal Government tested for qualification in order that they may be eligible to be awarded contracts or orders for the products covered by this specification. Information pertaining to qualification of products may be obtained from Defense Supply Center, Columbus, ATTN: DSCC/VQE, P.O. Box 3990, Columbus, OH 43216-5000.

6.4 Changes from previous issue. The margins of this specification are marked with asterisks to indicate where changes from the previous issue were made. This was done as a convenience only and the Government assumes no liability whatsoever for any inaccuracies in these notations. Bidders and contractors are cautioned to evaluate the requirements of this document based on the entire content irrespective of the marginal notations and relationship to the last previous issue.

Custodians:
Army - CR
Navy - NW
Air Force - 11
DLA - CC

Preparing activity:
DLA - CC

(Project 5961-2489)

Review activities:
Army - AR, AV, MI, SM
Navy - AS, MC
Air Force - 19, 70, 99

STANDARDIZATION DOCUMENT IMPROVEMENT PROPOSAL

INSTRUCTIONS

1. The preparing activity must complete blocks 1, 2, 3, and 8. In block 1, both the document number and revision letter should be given.
2. The submitter of this form must complete blocks 4, 5, 6, and 7.
3. The preparing activity must provide a reply within 30 days from receipt of the form.

NOTE: This form may not be used to request copies of documents, nor to request waivers, or clarification of 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.

I RECOMMEND A CHANGE:	1. DOCUMENT NUMBER MIL-PRF-19500/228J	2. DOCUMENT DATE 16 July 2001
	3. DOCUMENT TITLE SEMICONDUCTOR DEVICE, DIODE, SILICON, RECTIFIER, TYPES 1N3611, 1N3612, 1N3613, 1N3614, 1N3957, 1N3611EG1, 1N3612EG1, 1N3613EG1, 1N3614EG1, 1N3957EG1, JAN AND JANTX	

4. NATURE OF CHANGE (Identify paragraph number and include proposed rewrite, if possible. Attach extra sheets as needed.)

5. REASON FOR RECOMMENDATION

6. SUBMITTER

a. NAME (Last, First, Middle initial)	b. ORGANIZATION	
c. ADDRESS (Include Zip Code)	d. TELEPHONE (Include Area Code) COMMERCIAL DSN FAX EMAIL	7. DATE SUBMITTED

8. PREPARING ACTIVITY

a. Point of Contact Alan Barone	b. TELEPHONE Commercial DSN FAX EMAIL 614-692-0510 850-0510 614-692-6939 alan.barone@dscclia.mil
c. ADDRESS Defense Supply Center Columbus ATTN: DSCC-VAC P.O. Box 3990 Columbus, OH 43216-5000	IF YOU DO NOT RECEIVE A REPLY WITHIN 45 DAYS, CONTACT: Defense Standardization Program Office (DLSC-LM) 8725 John J. Kingman, Suite 2533 Fort Belvoir, VA 22060-6221 Telephone (703) 767-6888 DSN 427-6888