

PERFORMANCE SPECIFICATION SHEET

SEMICONDUCTOR DEVICE, DIODE, TYPES 1N3644,
1N3645, 1N3646, AND 1N3647, JAN AND JANTX

Inactive for new design after 7 June 1999. However,
it is still valid for use as of 24 March 2004.

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

The requirements for acquiring the product described herein
shall consist of this specification sheet and MIL-PRF-19500.

1. SCOPE

1.1 Scope. This specification covers the detail requirements for 0.1 ampere silicon rectifiers. Two levels of product assurance are provided for each device type as specified in MIL-PRF-19500.

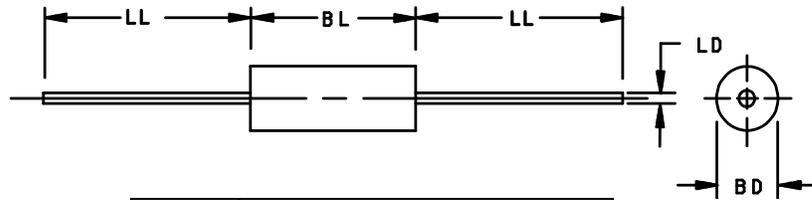
1.2 Physical dimensions. See figure 1 (axial).

1.3 Maximum ratings. Unless otherwise specified $T_A = +25^\circ\text{C}$.

Type	V_{RWM}	V_R	I_O	I_O	$I(\text{surge})$	T_J	Altitude
	V	V	mA	$T_A = 100^\circ\text{C}$ mA	at V_R $T_A = 25^\circ\text{C}$ A	T_{STG} °C	
1N3644	1,500	1,050	250	100	14	-65 to +175	40,000
1N3645	2,000	1,400	250	100	14	-65 to +175	40,000
1N3646	2,500	1,750	250	100	14	-65 to +175	40,000
1N3647	3,000	2,100	250	100	14	-65 to +175	40,000

* Comments, suggestions, or questions on this document should be addressed to DLA Land and Maritime, ATTN: VAC, P.O. Box 3990, Columbus, OH 43218-3990, or emailed to Semiconductor@dsc.dla.mil. Since contact information can change, you may want to verify the currency of this address information using the ASSIST Online database at <https://assist.daps.dla.mil>.

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Symbol	Dimensions			
	Inches		Millimeters	
	Min	Max	Min	Max
BD	.065	.110	1.65	2.79
BL	.190	.215	4.83	5.46
LD	.029	.033	0.74	0.84
LL	1.00	1.25	25.40	31.75

NOTES:

1. Dimensions are in inches. Millimeters are given for general information only.
2. In accordance with ASME Y14.5M, diameters are equivalent to Φ x symbology.

FIGURE 1. Physical dimensions.

2. APPLICABLE DOCUMENTS

2.1 General. The documents listed in this section are specified in sections 3, 4, or 5 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 of documents cited in sections 3, 4, or 5 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 cited in the solicitation or contract.

DEPARTMENT OF DEFENSE SPECIFICATIONS

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

DEPARTMENT OF DEFENSE STANDARDS

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

(Copies of these documents are available online at <https://assist.daps.dla.mil/quicksearch/> or <https://assist.daps.dla.mil> or from the Standardization Document Order Desk, 700 Robbins Avenue, Building 4D, Philadelphia, PA 19111-5094.)

2.3 Order of precedence. Unless otherwise noted herein or in the contract, 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.

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3. REQUIREMENTS

3.1 General. The individual item requirements shall be as specified in MIL-PRF-19500 and as modified herein.

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 manufacturers 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.

3.4 Interface and physical dimensions. Interface and physical dimensions shall be as specified in MIL-PRF-19500, and on figure 1.

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 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.

* 3.4.3 Diode construction. All devices shall be metallurgically bonded, double plug construction in accordance with the requirements of category I, II, or III (see MIL-PRF-19500).

3.5 Marking. Marking shall be in accordance with MIL-PRF-19500. The prefixes JAN and JANTX may be abbreviated as J and JX, respectively. The part number may be reduced to J3644 or JX3644. No color coding will be permitted for part numbering.

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

3.7 Electrical test requirements. The electrical test requirements shall be as specified in table I herein.

3.8 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.

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

Screening (see table E-IV of MIL-PRF-19500)	JANTX level
2	48 hours, $T_A = 175^\circ\text{C}$
3a	Required. $T_{\text{high}} = 175^\circ\text{C}$ minimum, ten continuous cycles, exposure time at temperature extremes shall be 15 minutes minimum.
9	Not required
10	Not required
11	I_R and V_F , see 4.3.1
12	See 4.3.2
13	Subgroup 2 of table I herein; $\Delta I_R = \pm 100$ percent of initial value or 250 nA dc, whichever is greater; $\Delta V_F = \pm 10$ percent of initial reading.

4.3.1 Pre burn-in tests. The parameters V_F and I_R shall be measured and the data recorded for all devices in the lot. All devices shall be handled or identified such that the delta end points can be determined after the burn-in test. All devices which fail to meet these requirements shall be removed from the lot and the quantity removed shall be noted on the lot history.

4.3.2 Burn-in test. Power burn-in conditions are as follows: Method 1038 of MIL-STD-750, condition B for 164 hours (minimum) under the following conditions: $T_A = 25^\circ\text{C}$, $V_{RWM} = \text{full rated}$ (see 1.3); $I_O = 100$ mA dc, $f = 60$ Hz. Electrical measurements (end-points) shall be in accordance with screen 13, and table I, subgroup 2 herein.

4.3.3 Burn-in and 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

4.3.4 Burn-in test failure (screening). All devices that exceed the delta limits of screen 13 herein and the maximum limits specified in table I subgroup 2 shall be removed from the inspection lot and the quantity removed shall be noted on the lot history. Where the quantity removed after burn-in exceeds 10 percent of the total inspection lot on burn-in test the lot may be resubmitted one time with a maximum PDA of 3 percent. A lot that fails the exceeds 20 percent failure or 3 percent resubmission PDA on the initial burn-in, the entire lot shall be unacceptable as JAN product.

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 table E-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 table E-VIb (JAN and JANTX) of MIL-PRF-19500. Electrical measurements (end-points) shall be in accordance with table I, subgroup 2 herein.

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4.4.2.1 Group B inspection, table E-VIb (JAN and JANTX) of MIL-PRF-19500.

<u>Subgroup</u>	<u>Method</u>	<u>Condition</u>
B2	1056	Condition A, except $T_{low} = -40^{\circ}\text{C}$, ten cycles.
B2	1051	Condition C, 25 cycles.
B2	4066	Ten 8 ms surges. See 1.3 herein.
B3	1026	$I_O = .1 \text{ A}$, $V_{RWM} = \text{rated } V_{RWM}$, $T_A = 100^{\circ}\text{C}$ minimum, 340 hours duration, $f = 50\text{-}60 \text{ Hz}$.
B5		Not applicable.

4.4.3 Group C inspection. Group C inspection shall be conducted in accordance with the conditions specified for subgroup testing in table E-VII of MIL-PRF-19500. Electrical measurements (end-points) shall be in accordance with table I, subgroup 2 herein.

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

<u>Subgroup</u>	<u>Method</u>	<u>Condition</u>
C2	1056	0°C to $+100^{\circ}\text{C}$, 10 cycles.
C2	1051	-55°C to $+175^{\circ}\text{C}$, 25 cycles.
C2	2036	Lead fatigue: Test condition E; weight 8 ounces.
C4		Not applicable.
C5		Not applicable.
C6	1027	$I_O = .1 \text{ A}$, $V_{RWM} = \text{rated } V_{RWM}$, $T_A = 100^{\circ}\text{C}$ minimum, 1,000 hours duration, $f = 50\text{-}60 \text{ Hz}$.
C7	1001	Barometric pressure, reduced: 40,000 feet; $n = 22$, $c = 0$. Monitor the rated V_R , $I_R = 5 \mu\text{A}$ maximum.

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

4.6 Process-conditioning, testing, and screening JANTX types. The procedure for process-conditioning, testing, and screening the JANTX types shall be in accordance with MIL-PRF-19500 and 4.3 herein. Process-conditioning shall be conducted on 100 percent of the lot prior to submission of the lot to the tests specified in 4.3 through 4.4.3.1 herein.

4.6.1 High-temperature storage. All devices shall be stored for at least 48 hours at $(T_A) = +175^{\circ}\text{C}$ minimum.

4.6.2 Thermal shock (temperature cycling). All devices shall be subjected to thermal shock (temperature cycling) in accordance with method 1051 of MIL-STD-750, test condition C, except that $T_{high} = +175^{\circ}\text{C}$ and cycling duration shall be ten continuous cycles and exposure time at temperature extremes shall be 15 minutes minimum.

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4.6.3 Pre burn-in tests. The parameters V_F and I_R shall be measured and the data recorded for all devices in the lot. All devices shall be handled or identified such that the delta end-points can be determined after the burn-in test. All devices which fail to meet these requirements shall be removed from the lot and the quantity removed shall be noted on the lot history.

4.6.4 Burn-in test. Power burn-in conditions are as follows: Method 1038 of MIL-STD-750, condition B for 164 hours (minimum) under the following conditions:

- a. $T_A = 25^\circ\text{C}$, $V_{RWM} = \text{full rated}$ (see 1.2).
- b. $I_O = 100 \text{ mA dc}$, $f = 60 \text{ Hz}$.

4.6.5 Post burn-in tests. The parameters V_F and I_R shall be retested (within 24 hours) after burn-in and the data recorded for all devices in the lot. The parameters measured shall not have changed during the burn-in test from the initial value by more than the specified amount as follows:

- a. $\Delta V_F = 10 \text{ percent maximum}$.
- b. $\Delta I_R = +250 \text{ nanoamperes or } 100 \text{ percent maximum}$.

4.6.6 Burn-in test failure (screening). All devices that exceed the delta limits of 4.6.5 or the limits of those tests performed, shall be removed from the inspection lot and the quantity removed shall be noted on the lot history. Where the quantity removed after burn-in exceeds ten percent of the total inspection lot on burn-in test, the entire lot shall be unacceptable as JANTX types.

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TABLE I. Group A inspection.

Inspection	Conditions		Symbol	Limits		Unit
	Method	Conditions		Min	Max	
<u>Subgroup 1</u>						
Visual and mechanical examination	2071					
<u>Subgroup 2</u>						
Forward voltage	4011	$I_F = 250\text{mA}$	V_F		5	V dc
Reverse current	4016					
1N3644		$V_{RWM} = 1,500\text{ V dc}$	I_R		5	$\mu\text{A dc}$
1N3645		$V_{RWM} = 2,000\text{ V dc}$	I_R		5	$\mu\text{A dc}$
1N3646		$V_{RWM} = 2,500\text{ V dc}$	I_R		5	$\mu\text{A dc}$
1N3647		$V_{RWM} = 3,000\text{ V dc}$	I_R		5	$\mu\text{A dc}$
1N3644		$I_R = 50\text{ }\mu\text{A}$	V_{BR}	1,800		V dc
1N3645			V_{BR}	2,400		V dc
1N3646			V_{BR}	3,000		V dc
1N3647			V_{BR}	3,600		V dc
<u>Subgroup 3</u>						
High temperature operation		$T_A = +100^\circ\text{C};$ $I_O = 100\text{ mA dc}$				
Reverse current average	4046					
1N3644		$V_R = 1,050\text{ V ac}$	I_{RO}		100	$\mu\text{A dc}$
1N3645		$V_R = 1,400\text{ V ac}$	I_{RO}		100	$\mu\text{A dc}$
1N3646		$V_R = 1,750\text{ V ac}$	I_{RO}		100	$\mu\text{A dc}$
1N3647		$V_R = 2,100\text{ V ac}$	I_{RO}		100	$\mu\text{A dc}$

5. PACKAGING

5.1 Packaging. For acquisition purposes, the packaging requirements shall be as specified in the contract or order (see 6.2). When packaging of materiel is to be performed by DoD or in-house contractor personnel, these personnel need to contact the responsible packaging activity to ascertain packaging requirements. Packaging requirements are maintained by the Inventory Control Point's packaging activities within the Military Service or Defense Agency, or within the Military Service's system commands. 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. The notes specified in MIL-PRF-19500 are applicable to this specification.)

6.1 Intended use. Semiconductors conforming to this specification are intended for original equipment design applications and logistic support of existing equipment.

6.2 Acquisition requirements. Acquisition documents should specify the following:

- a. Title, number, and date of this specification.
- b. Packaging requirements (see 5.1).
- c. Lead finish (see 3.4.1).
- d. Product assurance level and type designator.
- e. Destructive physical analysis when requested.

* 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 19500) 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 DLA Land and Maritime, ATTN: VQE, P.O. Box 3990, Columbus, OH 43218-3990 or e-mail vqe.chief@dla.mil. An online listing of products qualified to this specification may be found in the Qualified Products Database (QPD) at <https://assist.daps.dla.mil>.

* 6.4 Amendment notations. The margins of this specification are marked with asterisks to indicate modifications generated by this amendment. 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.

Custodians:
Navy - EC
DLA - CC

Preparing activity:
DLA - CC

Review activities:
Navy - OS, SH

(Project 5961-2010-098)

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