

The documentation and process conversion measures necessary to comply with this document shall be completed by 2 December 2014.

INCH-POUND

MIL-PRF-19500/162E
 2 September 2014
 SUPERSEDING
 MIL-PRF-19500/162D
 2 October 2007

PERFORMANCE SPECIFICATION SHEET

SEMICONDUCTOR DEVICES, DIODE, SILICON, POWER RECTIFIER,
 TYPES 1N1614, 1N1615, 1N1616, 1N4458, 1N4459, 1N1614R, 1N1615R, 1N1616R,
 1N4458R, 1N4459R, JAN AND JANTX

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 performance requirements for silicon, power rectifier diodes. Two levels of product assurance are provided for each device as specified in [MIL-PRF-19500](#).

1.2 Reverse types, (suffix R). Reverse and standard types are identical except: The standard types have the cathode connected to the stud; the reverse types have the anode connected to the stud. Designated values are applicable to both types. Reversed (anode to stud) units will be marked with an R following the last digit in the type number.

1.3 Physical dimensions. See [figure 1](#) (DO-4).

1.4 Maximum ratings.

Types	V _{RWM}	I _O		I _F	T _J and T _{STG}	I _{FSM} at: t = 1/120 s T _C = +150°C	Barometric Pressure (reduced)
		T _C = +25°C (1)	T _C = +150°C				
	V (pk)	A dc	A dc	A dc	°C	A	mm Hg
1N1614, R	200	10	5	15	-65 to +175	100	8
1N1615, R	400	10	5	15	-65 to +175	100	8
1N1616, R	600	10	5	15	-65 to +175	100	16
1N4458, R	800	10	5	15	-65 to +175	100	30
1N4459, R	1,000	10	5	15	-65 to +175	100	54

(1) Derate linearly at 66.67 mA dc/°C above T_C = +25°C.

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@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.dla.mil>.

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 of 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 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 <http://quicksearch.dla.mil>.)

* 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.

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 manufacturer's list (QML) before contract award (see 4.2 and 6.3).

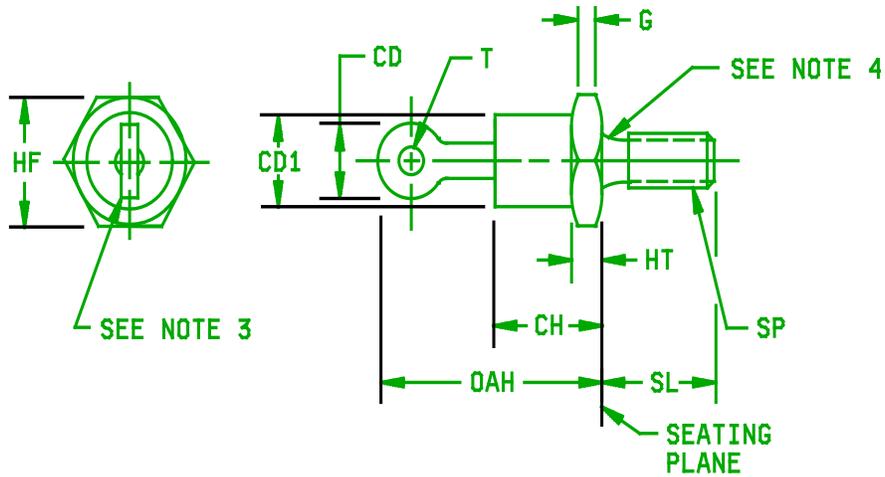
3.3 Abbreviations, symbols, and definitions. Abbreviations, symbols, and definitions used herein shall be as specified in [MIL-PRF-19500](#).

3.4 Interface and physical dimensions. The interface and physical dimensions shall be as specified in [MIL-PRF-19500](#) and on [figure 1](#) herein.

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

3.4.2 Construction. These devices shall be constructed in a manner and using materials which enable the devices to meet the applicable requirements on [MIL-PRF-19500](#) and this document.

3.5 Marking. Marking shall be in accordance with [MIL-PRF-19500](#). The polarity shall be indicated by a graphic symbol with the arrow pointing to the cathode end for forward bias. The reversed units shall also be marked with an R following the last digit in the type number.



Symbol	Dimensions				Notes
	Inches		Millimeters		
	Min	Max	Min	Max	
CD		.250		6.35	9
CD1		.424		10.77	
CH		.405		10.29	
G	.060		1.52		
HF	.424	.437	10.77	11.10	
HT	.075	.175	1.91	4.45	
OAH		.800		20.32	
SP					6,7,8
SL	.422	.453	10.72	11.51	
T	.060		1.52		

NOTES:

1. Dimensions are in inches.
2. Millimeter equivalents are given for general information only.
3. Angular orientation of this terminal is undefined.
4. Diameter of unthreaded portion .189 inch (4.80 mm) maximum; .163 inch (4.14 mm) minimum.
5. The A.S.A. thread reference is 10-32UNF2A (unplated).
6. The maximum diameter of plated threads shall be basic pitch diameter .169 inch (4.29 mm).
7. Unit shall not be damaged by torque of 15 inch-pound applied to 10-32NF2B nut assembled on thread.
8. Complete threads shall extend to within 2.5 threads of the seating plane.
9. Terminal end shape is unrestricted.
10. In accordance with ASME Y14.5M, diameters are equivalent to ϕ x symbology.

FIGURE 1. Physical dimensions.

3.7 Electrical performance characteristics. Unless otherwise specified herein, the electrical performance characteristics are as specified in 1.3, 1.4, and table I.

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

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. Tests in either polarity shall be sufficient to obtain qualification approval of both polarities.

4.3 Screening (JANTX and JANTXV levels only). Screening shall be in accordance with appendix E, table E-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.

Screening (see appendix E, table E-IV of MIL-PRF-19500)	Measurement
	JANTX and JANTXV levels
(1) 3b	Surge, (see 4.3.1)
(1) 3c	Thermal impedance (see 4.3.2)
9	Not applicable
11	I_{R1} and V_F
12	See 4.3.3
13	Subgroup 2 of table I herein: $\Delta I_{R1} \leq 100$ percent of initial reading or $\pm 5.0 \mu A$ dc, whichever is greater, $\Delta V_F \leq \pm 0.1$ V dc.

(1) Surge shall precede thermal impedance and shall be performed any time after sealing provided temperature cycling is performed in accordance with MIL-PRF-19500, screen 3 prior to this thermal test.

4.3.1 Surge current. Surge current, see method 4066 of MIL-STD-750. $I_O = 0$; $V_{RM(W)} = 0$; $I_{FSM} = 100$ A; six surges; T_A = room ambient as defined in the general requirements of 4.5 of MIL-STD-750. One surge per minute maximum. $t_p = 8.3$ ms.

4.3.2 Thermal impedance $Z_{\theta JX}$ measurements for screening. The $Z_{\theta JX}$ measurements shall be performed in accordance with method 3101 of MIL-STD-750. The maximum limit and conditions for $Z_{\theta JX}$ in screening (appendix E, table E-IV of MIL-PRF-19500) shall be derived by each vendor by means of process control of actual measurements which characterizes the die attach process. When three lot date codes have exhibited control, the data from these three lots will be used to establish a fixed screening limit (not to exceed the group A limit). Once a fixed limit has been established, monitor all future sealing lots using a sample from each lot.

4.3.2.1 Thermal impedance ($Z_{\theta JX}$ measurements) for initial qualification or requalification. The $Z_{\theta JX}$ measurements shall be performed in accordance with method 3101 of MIL-STD-750, (read and record value $Z_{\theta JX}$). Derived conditions, limits, and thermal response curve shall be supplied to the qualifying activity on the qualification lot prior to qualification approval.

4.3.3 Power burn-in conditions. Power burn-in conditions are as follows: Method 1038, condition A of MIL-STD-750, $T_A = +150^\circ\text{C}$; $V_{RWM} = V_{RWM}$ (see 1.3); $I_O = 0$; $t = 48$ 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 E-V of MIL-PRF-19500, and table I herein. The following test conditions shall be used for $Z_{\theta JX}$ in a group A, subgroup 2 inspection:

- a. I_M measuring current..... 50 to 250 mA.
- b. I_H forward heating current 3 to 10 A.
- c. t_H heating time 150 to 400 ms.
- d. t_{MD} measurement delay time..... 50 to 300 μs maximum.

The maximum limit for $Z_{\theta JX}$ in group A, subgroup 2 is $Z_{\theta JX}$ (maximum) = 4.5°C/W .

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 E-VIb (JANTX and JANTXV) of MIL-PRF-19500 and herein. Electrical measurements (end-points) shall be I_{R1} and V_F in accordance with table I, subgroup 2 herein.

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

	<u>Subgroup</u>	<u>Method</u>	<u>Condition</u>
*	B2	4066	$I_{FSM} = 100$ A (pk); ten surges of 8.3 ms each at 1 minute intervals, superimposed on $I_O = 5$ A dc; $V_{RWM} = \text{rated } V_{RWM}$ (see 1.4); $T_C = +150^\circ\text{C}$.
	B3	1037	.25 rated $I_O \leq I_O \text{ applied} \leq \text{rated } I_O$; 2,000 cycles.

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 E-VII of MIL-PRF-19500 and as follows. Electrical measurements (end-points) shall be I_{R1} and V_F in accordance with table I, subgroup 2 herein.

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

	<u>Subgroup</u>	<u>Method</u>	<u>Condition</u>
	C2	2036	Test condition A, 10 pounds, $t = 15 \pm 3$ s.
	C2	2036	Test condition D1, 10 ounce/inch, $t = 15 \pm 3$ s.
	C2	2036	Test condition F, method B, 5 pounds, $t = 15 \pm 3$ s.
	C2	2036	Test condition D2, method B, 15 pounds, $t = 15 \pm 3$ s.
	C6	1037	.25 rated $I_O \leq I_O \text{ applied} \leq \text{rated } I_O$; 2,000 cycles.

4.4.4 Group E inspection. Group E inspection shall be conducted in accordance with the conditions specified for subgroup testing in appendix E, table E-IX of [MIL-PRF-19500](#) and as follows. Electrical measurements (end-points) shall be I_{R1} and V_F in accordance with [table I](#), subgroup 2 herein.

4.4.4.1 Group E inspection, appendix E, table E-IX of [MIL-PRF-19500](#).

<u>Subgroup</u>	<u>Method</u>	<u>Condition</u>
E5	1001	$H_g = \text{rated } H_g, t = 60\text{s},$ (see 1.4), $V_R = \text{rated } V_{RWM}.$

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

4.5.1 Pulse measurements. Conditions for pulse measurement shall be as specified in section 4 of [MIL-STD-750](#).

4.5.2 Inspection of conditions. Unless otherwise specified, all inspections shall be conducted at an ambient temperature, $T_A = +25^\circ\text{C} \pm 3^\circ\text{C}.$

4.5.3 Thermal resistance. Thermal resistance measurement shall be performed in accordance with method 3101 or 4081 of [MIL-STD-750](#). Forced moving air or draft shall not be permitted across the device during test.

TABLE I. Group A inspection. ^{1/}

Inspection ^{1/}	MIL-STD-750		Symbol	Limits		Unit
	Method	Conditions		Min	Max	
<u>Subgroup 1</u>						
Visual and mechanical examination	2071					
<u>Subgroup 2</u>						
Forward voltage	4011	$I_F = 15 \text{ A(pk)}$, $t_P \leq 8.3 \text{ ms}$, duty cycle ≤ 2 percent, pulsed (see 4.5.1)	V_F		1.5	V (pk)
Reverse current leakage	4016	DC method; $V_R = \text{rated V}$ RWM (see 1.4)	I_{R1}		50	$\mu\text{A dc}$
Thermal impedance	3101	See 4.3.2	$Z_{\theta JX}$		4.5	$^{\circ}\text{C/W}$
<u>Subgroup 3</u>						
Reverse current leakage	4016	DC method; $V_R = \text{rated V}$ RWM (see 1.4) $T_C = +150^{\circ}\text{C}$	I_{R2}		500	$\mu\text{A dc}$
<u>Subgroups 4, 5, 6, and 7</u>						
Not applicable						

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

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. The complete Part or Identifying Number (PIN), see title and section 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 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.dla.mil/>.

* 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 previous issue.

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

Preparing activity:
DLA - CC

(Project 5961-2014-103)

Review activities:
Army - AR, MI
Navy - AS, MC, SH
Air Force - 19, 99

* NOTE: The activities listed above were interested in this document as of the date of this document. Since organizations and responsibilities can change, you should verify the currency of the information above using the ASSIST Online database at <https://assist.dla.mil>.