

INCH POUND

MIL-PRF-19500/246G
2 September 1997
SUPERSEDING
MIL-S-19500/246F
14 December 1994

PERFORMANCE SPECIFICATION

SEMICONDUCTOR DEVICE, DIODE, SILICON, POWER RECTIFIER,
TYPES 1N3289, 1N3291, 1N3293, 1N3294, 1N3295, AND R TYPES,
JAN, JANTX, AND JANTXV

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 silicon power rectifiers. Three levels of product assurance are provided for each device type as specified in MIL-PRF-19500.

1.2 Normal and reverse types (reverse types, suffix R). Reverse and normal types are identical except the normal types have the cathode connected to the stud and the reverse types have the anode connected to the stud. Designated values are applicable to both types.

1.3 Physical dimensions. See figure 1 (DO-205AA - formerly DO-8).

1.4 Ratings and characteristics.

Type	V_{RSM}	V_{RVM}	I_o $T_C = 150^\circ\text{C}$	I_o $T_C = 134^\circ\text{C}$	I_{FSM} 1/120 s	Barometric pressure (reduced)	T_J and T_{STG}
	<u>V (pk)</u>	<u>V (pk)</u>	<u>A dc</u>	<u>A dc</u>	<u>A (pk)</u>	<u>mm Hg</u>	<u>°C</u>
1N3289	240	200	75	100	1,600	---	-65
1N3291	480	400	75	100	1,600	8	
1N3293	720	600	75	100	1,600	16	to
1N3294	960	800	75	100	1,600	30	
1N3295	1,200	1,000	75	100	1,600	54	+200

1/ Derate linearly 1.5 A dc/°C for $T_C \geq 134^\circ\text{C}$.

1.5 Thermal resistance characteristic: $R_{\theta JC} = 0.4^\circ\text{C/W}$.

Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: Commander, Defense Supply Center Columbus, ATTN: DSCC-VAT, 3990 East Broad Street, 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

MILITARY

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

(Unless otherwise indicated, copies of the above specifications, standards, and handbooks are available from the Standardization Document Order Desk, 700 Robbins Avenue, Building 4D, 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 (except for related associated specifications or specification sheets), 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 Qualification. Devices furnished under this specification shall be products that are authorized by the qualifying activity for listing on the applicable qualified products list before contract award (see 4.2 and 6.3).

3.2 Associated specification. The individual item performance requirements shall be in accordance with MIL-PRF-19500 and as specified herein.

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

3.4 Design, construction, and physical dimensions. The design, construction, and physical dimensions shall be as specified in MIL-PRF-19500, and on figure 1 herein.

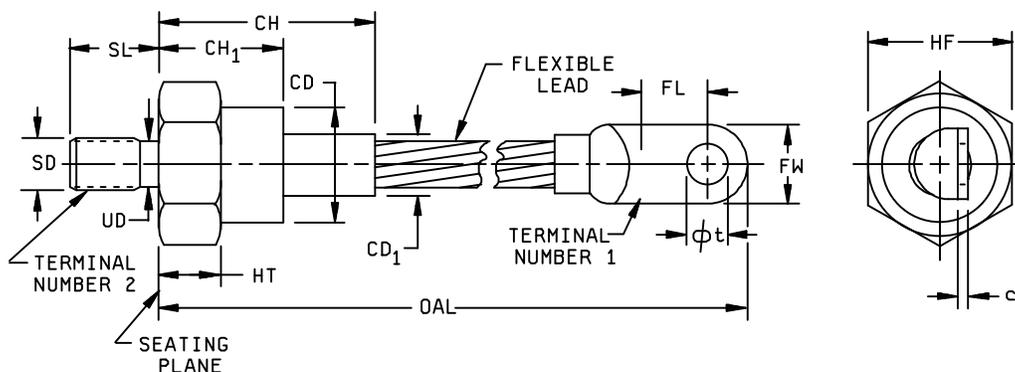
3.5 Marking. Devices shall be marked as specified in MIL-PRF-19500.

3.6 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.

3.7 Interface requirements and physical dimensions. The interface requirements and physical dimensions shall be as specified in MIL-PRF-19500, and figure 1 (DO-205AA) herein.

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

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



Symbol	Dimensions				Notes
	Inches		Millimeters		
	Min	Max	Min	Max	
CD	.625	1.000	15.88	25.40	8
CD ₁	---	.500	---	12.70	
CH	---	1.750	---	44.45	
CH ₁	---	1.140	---	28.96	
c	.050	.120	1.27	3.05	
FL	.300	.450	7.62	11.43	6
FW	---	.670	---	17.02	
HF	1.031	1.063	26.19	27.00	
HT	.125	.500	3.18	12.70	5
OAL	4.300	5.065	109.22	128.65	
SD					4
SL	.605	.645	15.37	16.38	
UD	.343	.373	8.71	9.47	
φt	.250	.310	6.35	7.87	4

NOTES:

1. Dimensions are in inches.
2. Metric equivalents are given for general information only.
3. Complete threads to extend to within 2.5 threads of seating plane.
4. 375-24 UNF-2A. Maximum pitch diameter of plated threads shall be basic pitch diameter (.3479 inch (8.837 mm) reference).
5. A chamfer or undercut on one or both ends of hexagonal portions is optional.
6. Minimum flat.
7. For marking (see 3.1).
8. The body of the device with the exception of the hexagon and flexible lead extensions lies within cylinder defined by CD₁ and CH, CD₁ not to exceed actual HF.
9. Terminal shape is optional.

FIGURE 1. Physical dimensions.

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.

4.3 Screening (JANTX and JANTXV levels 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 and JANTXV levels
1	Method 2073 may be used in lieu of 2074 for compression bonded devices only.
4	5,000 G; performed prior to installation of external lead.
10	Not applicable.
11	I_{RM1} and V_{FM} of subgroup 2 of table I herein.
12	Method 1038, condition A; $V_{RM} = V_{RWM}$ rated (see 1.4), $T_C = 150^\circ\text{C}$; $f = 60$ Hz.
13	Subgroup 2 of table I herein: $\Delta I_{RM1} = \pm 0.5$ mA (pk) or 100 percent of initial value, whichever is greater. $\Delta V_{FM} = \pm 0.1$ V (pk).

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	Pulse method: $I_{FM} = 310 \text{ A (pk)}$; pulse width = 8.3 ms max; duty cycle = 2 percent max	V_{FM1}		1.55	V (pk)
Reverse current	4016	AC method:	I_{RM1}			
1N3289		$V_{RM} = 200 \text{ V (pk)}$			10	mA (pk)
1N3291		$V_{RM} = 400 \text{ V (pk)}$			10	mA (pk)
1N3293		$V_{RM} = 600 \text{ V (pk)}$			10	mA (pk)
1N3294		$V_{RM} = 800 \text{ V (pk)}$			10	mA (pk)
1N3295		$V_{RM} = 1,000 \text{ V (pk)}$			10	mA (pk)
Reverse current at peak reverse voltage	4016	AC method:	I_{RM2}			
1N3289		$V_{RM} = 240 \text{ V (pk)}$			40	mA (pk)
1N3291		$V_{RM} = 480 \text{ V (pk)}$			40	mA (pk)
1N3293		$V_{RM} = 720 \text{ V (pk)}$			40	mA (pk)
1N3294		$V_{RM} = 960 \text{ V (pk)}$			40	mA (pk)
1N3295		$V_{RM} = 1,200 \text{ V (pk)}$			40	mA (pk)
<u>Subgroup 3</u>						
High temperature operation:		$T_C = +200^\circ\text{C}$				
Reverse current	4016	AC method:	I_{RM3}			
1N3289		$V_{RM} = 200 \text{ V (pk)}$			30	mA (pk)
1N3291		$V_{RM} = 400 \text{ V (pk)}$			30	mA (pk)
1N3293		$V_{RM} = 600 \text{ V (pk)}$			30	mA (pk)
1N3294		$V_{RM} = 800 \text{ V (pk)}$			30	mA (pk)
1N3295		$V_{RM} = 1,000 \text{ V (pk)}$			30	mA (pk)

See footnote at end of table.

TABLE I. Group A inspection - Continued. 1/

Inspection 1/	MIL-STD-750		Symbol	Limits		Unit
	Method	Conditions		Min	Max	
<u>Subgroup 3</u> - Continued						
Low temperature operation:		$T_C = -65^\circ\text{C}$				
Forward voltage	4011	Pulse method: $I_{FM} = 310 \text{ A (pk)}$ pulse width = 8.3 ms max; duty cycle = 2 percent maximum	V_{FM2}		1.60	V (pk)
Reverse current:	4016	AC method:	I_{RM4}			
1N3289		$V_{RM} = 200 \text{ V (pk)}$			40	mA (pk)
1N3291		$V_{RM} = 400 \text{ V (pk)}$			40	mA (pk)
1N3293		$V_{RM} = 600 \text{ V (pk)}$			40	mA (pk)
1N3294		$V_{RM} = 800 \text{ V (pk)}$			40	mA (pk)
1N3295		$V_{RM} = 1,000 \text{ V (pk)}$			40	mA (pk)
<u>Subgroup 4</u>						
Not applicable						
<u>Subgroup 5</u>						
Not applicable						
<u>Subgroup 6</u>						
Surge current	4066	$T_C = +150^\circ\text{C};$ $I_{FSM} = 1,600 \text{ A (pk)}$ $I_O = 75 \text{ A dc};$ ten 1/20 s surges; 1 surge/minute $V_{RM} = V_{RWM}$ (see 1.4)				
Electrical measurements		See table IV, steps 1 and 2)				
<u>Subgroup 7</u>						
Not applicable						

1/ For sample plan, see MIL-PRF-19500.

TABLE II. Group B inspection. 1/

Inspection	MIL-STD-750	
	Method	Conditions
<u>Subgroup 1</u>		
Resistance to solvents	1022	
<u>Subgroup 2</u>		
Thermal shock (temperature cycling)	1051	
Hermetic seal	1071	
Gross leak		Test condition C, step 2 or test condition D
Electrical measurements		See table IV, steps 1 and 2
<u>Subgroup 3</u>		
Blocking life	- - -	$T_C = +185^\circ\text{C}$; $V_{RWM} = V_{RM}$ (see 1.4) $I_O = 0$; half-sine wave, 60 Hz; $t = 340$ hours
Electrical measurements		See table IV, steps 1 and 2 (step 2 should be performed before step 1)
<u>Subgroup 4</u>		
Decap internal visual design verification	2075	
<u>Subgroup 5</u>		
Thermal resistance	3151	$R_{\theta JC} = 0.4^\circ\text{C/W}$
<u>Subgroup 6</u>		
High temperature (nonoperating) life	1032	$T_C = +185^\circ\text{C}$
Electrical measurements		See table IV, steps 1 and 2
<u>Subgroup 7</u>		
Power cycling	1037	See 4.5.1, $\Delta T = 85^\circ$ minimum $I_O \geq 75$ A 5,000 cycles
Electrical measurements		See table IV, steps 1, 2, and 3

1/ For sample plan, see MIL-PRF-19500.

TABLE III Group C inspection. 1/

Inspection	MIL-STD-750	
	Method	Conditions
<u>Subgroup 1</u>		
Physical dimensions	2066	See figure 1
<u>Subgroup 2</u>		
Thermal shock (glass strain)	1056	Test condition B
Thermal strength	2036	
Tension (lead)		Test condition A; weight = 100 pounds; t = 15 ±3 s
Torque (terminal)		Test condition D1; 10 inch-pounds; t = 15 ±3 s
Torque (stud)		Test condition D2; 125 inch-pounds; t = 15 ±3 s
Hermetic seal	1071	
Gross leak		Test condition C, step 2, or test condition D
Moisture resistance	1021	
Visual and mechanical inspection	2071	
Electrical measurements		See table IV, steps 1 and 2
<u>Subgroup 3</u>		
Not applicable		Not applicable for solder stud devices
<u>Subgroup 4</u>		
Salt atmosphere (corrosion)	1041	Not applicable
<u>Subgroup 5</u> (For qualification only)		
Barometric pressure, reduced (altitude operation)	1001	t = 60 s See 1.4 for test conditions
1N3291, 1N3293		
1N3294, 1N3295		
Measurement during test		See table IV, step 2

See footnotes at end of table.

TABLE III. Group C inspection - Continued. 1/

Inspection	MIL-STD-750	
	Method	Conditions
<u>Subgroup 6</u>		
Blocking life	---	$T_C = +185^\circ\text{C}$ minimum $V_{RWM} = V_{RM}$ (see 1.4) $I_O = 0$; half-sine wave, $f = 60$ Hz; $t = 1,000$ hours
Electrical measurements		See table IV, steps 1 and 2 (step 2 should be performed before step 1)

1/ For sample plan, see MIL-PRF-19500.

TABLE IV. Groups A, B, and C electrical measurements.

Step	Inspection	MIL-STD-750		Symbol	Limits		Unit
		Method	Conditions		Min	Max	
1.	Forward voltage	4011	Pulse method: $I_{FM} = 310$ A (pk) pulse width = 8.3 ms maximum; duty cycle = 2 percent maximum	V_{FM}		1.55	V (pk)
2.	Reverse current	4016	AC method:	I_{RM1}			
	1N3289		$V_{RM} = 200$ V (pk)			10	mA (pk)
	1N3291		$V_{RM} = 400$ V (pk)			10	mA (pk)
	1N3293		$V_{RM} = 600$ V (pk)			10	mA (pk)
	1N3294		$V_{RM} = 800$ V (pk)			10	mA (pk)
	1N3295		$V_{RM} = 1,000$ V (pk)			10	mA (pk)
3.	Forward voltage (change)	4011	$I_{FM} = 310$ A (pk)	ΔV_{FM}		+0.1	V (pk)

4.4 Conformance inspection. Conformance inspection shall be in accordance with MIL-PRF-19500.

4.4.1 Group A inspection. Group A inspection shall be conducted in accordance with appendix E, table V of MIL-PRF-19500, table I herein, and as specified herein. Electrical measurements (end-points) and delta requirements shall be in accordance with the applicable steps of table IV 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 (JAN, JANTX, and JANTXV) of MIL-PRF-19500 and table II herein. Electrical measurements (end-points) and delta requirements shall be in accordance with applicable steps of table IV herein.

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. Electrical measurements (end-points) shall be in accordance with the applicable steps of table IV herein.

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

4.5.1 Power cycling. One complete test shall be as follows: First, heat the case to the maximum temperature specified by passing the specified amount of forward current through the diode under test. Then, remove the applied current and allow the case temperature to cool to the minimum case temperature specified. No time limit is applicable to any one cycle, but the cycling shall be continuous until the required number of cycles have been completed.

5. PACKAGING

5.1 Packaging. Packaging shall prevent mechanical damage of the devices during shipping and handling and shall not be detrimental to the device. When actual packaging of material 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 Points' packaging activity within the Military Department or Defense Agency, or within the Military Departments' System Command. Packaging data retrieval is available from the managing Military Departments' or Defense Agency's automated packaging files, CD-ROM products, or by contacting the responsible packaging activity.

5.2 Marking. Unless otherwise specified (see 6.2), marking shall be in accordance with MIL-PRF-19500.

6. NOTES

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

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

6.2 Acquisition requirements. Acquisition documents should specify the following:

- a. Issue of DoDISS to be cited in the solicitation and, if required, the specific issue of individual documents referenced (see 2.2.1).
- b. Type designation and product assurance level.
- c. Packaging requirements (see 5.1).

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 Products List QPL No.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 purchase orders for the products covered by this specification. Information pertaining to qualification of products may be obtained from Commander, Defense Supply Center Columbus, DSCC-VQE, Columbus, OH 43216-5000.

6.4 Changes from previous issue. Marginal notations are not used in this revision to identify changes with respect to the previous issue due to the extent of the changes.

Custodians:

Army - CR
Navy - EC
Air Force - 17

Review activities:

Army - AR, MI
Navy - AS, MC
Air Force - 19, 85, 99

Preparing activity:

DLA - CC

(Project 5961-1908)

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.
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I RECOMMEND A CHANGE:

1. DOCUMENT NUMBER
MIL-PRF-19500/246G

2. DOCUMENT DATE
97/09/02

DOCUMENT TITLE SEMICONDUCTOR DEVICE, DIODE, SILICON, POWER RECTIFIER, TYPES 1N3289, 1N3291, 1N3293, 1N3294, 1N3295, AND R TYPES, JAN, JANTX, AND JANTXV

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)
(1) Commercial

(2) AUTOVON
(If applicable)

7. DATE SUBMITTED
(YYMMDD)

8. PREPARING ACTIVITY

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