

The documentation and process conversion measures necessary to comply with the revision shall be completed by 20 January 1998

INCH-POUND

MIL-PRF-19500/616A
 20 October 1997
 SUPERSEDING
 MIL-S-19500/616
 8 March 1994

PERFORMANCE SPECIFICATION SHEET

SEMICONDUCTOR DEVICE, DIODE, SILICON, POWER RECTIFIER, DUAL,
 COMMON CATHODE OR ANODE CENTER TAP, ULTRAFAST, TYPES 1N6657 THROUGH 1N6659
 AND 1N6657R THROUGH 1N6659R, JAN, JANTX, JANTXV, AND JANS

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 a silicon, dual high voltage, ultrafast power rectifier diodes. Four levels of product assurance are provided for each device type as specified in MIL-PRF-19500.

1.2 Physical dimensions. See figure 1 (TO-254AA isolated).

1.3 Maximum ratings. (per leg)

Types	V_{RWM}	I_{FSM} ^{1/} $t_p = 8.3 \text{ ms}$	I_F $T_C = 100^\circ\text{C}$ ^{1/} ^{2/} ^{3/}	t_{rr} ^{1/}	$R_{\theta JC}$ ^{1/}	$R_{\theta JA}$ ^{1/}	T_{STG} and T_J
	<u>V dc</u>	<u>A (pk)</u>	<u>A dc</u>	<u>ns</u>	<u>°C/W</u>	<u>°C/W</u>	<u>°C</u>
1N6657, 1N6657R	100						
1N6658, 1N6658R	150	150	15	35	2.3	40	-65 to +200
1N6659, 1N6659R	200						

^{1/} Each individual diode.

^{2/} Derate linearly at 150 mA/°C from +100°C to +150°C.

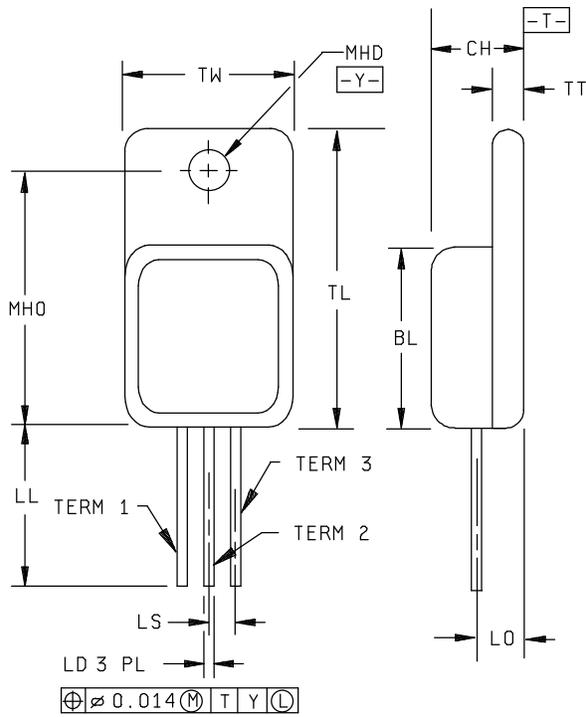
^{3/} Total package current is limited to 30A dc.

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.

AMSC N/A

FSC 5961

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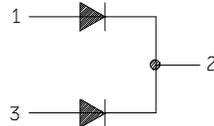


Ltr	Dimensions			
	Inches		Millimeters	
	Min	Max	Min	Max
BL	.535	.545	13.59	13.89
CH	.249	.260	6.32	6.60
LD	.035	.045	0.89	1.43
LL	.530	.550	13.46	13.97
LO	.150 BSC		3.81 BSC	
LS	.150 BSC		3.81 BSC	
MHD	.139	.149	3.53	3.78
MHO	.665	.685	16.89	17.40
TL	.790	.800	20.07	20.32
TT	.040	.050	1.02	1.27
TW	.535	.545	13.59	13.89

SCHEMATIC

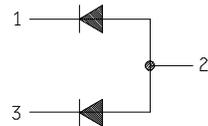
1N6667, 1N6658, 1N6659

TERM 1 = ANODE 1
 TERM 2 = CATHODE
 TERM 3 = ANODE 2



1N6657R, 1N6658R, 1N6659R

TERM 1 = CATHODE 1
 TERM 2 = ANODE
 TERM 3 = CATHODE 2



NOTES:

1. Dimensions are in inches.
2. Metric equivalents are given for general information only.
3. All terminals are isolated from case.

FIGURE 1. Dimensions and configuration (T0-254AA).

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 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 requirements shall be in accordance with MIL-PRF-19500 and as specified herein.

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

3.4 Interface requirements and physical dimensions. The interface requirements and physical dimensions shall be as specified in MIL-PRF-19500, and on figure 1 (TO-254AA) herein. Methods used for electrical isolation of the terminal feedthroughs shall employ materials that contain a minimum of 90 percent AL_2O_3 (ceramic). Examples of such construction techniques are metallized ceramic eyelets or ceramic walled packages. The US government's preferred system of measurement is the metric SI system. However, since this item was originally designed using inch-pound units of measurement, in the event of conflict between the metric and inch-pound units, the inch-pound units shall take precedence.

3.4.1 Lead formation and finish. Lead finish shall be solderable as defined in MIL-PRF-19500, MIL-STD-750, and herein. Where a choice of lead finish or formation is desired, it shall be specified in the acquisition requirements (see 6.2). When lead formation is performed, as a minimum, the vendor shall perform 100 percent hermetic seal in accordance with screen 14, of MIL-PRF-19500.

3.4.2 Polarity. Polarity and terminal configuration shall be in accordance with figure 1 herein.

3.5 Marking. Marking shall be in accordance with MIL-S-19500.

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

3.7 Electrical test requirements. The electrical test requirements shall be the subgroups specified in 4.42 and 4.4.3.

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 (JANS, JANTX, and JANTXV levels only). Screening shall be in accordance with MIL-PRF-19500 (Appendix E, table IV), 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	
	JANS level	JANTX and JANTXV levels
3c <u>1/</u>	Thermal impedance (see 4.3.2)	Thermal impedance (see 4.3.2)
9	Not applicable	Not applicable
10	Not applicable	Not applicable
11	V_{F1} and I_{R1}	V_{F1} and I_{R1}
12	MIL-STD-750, method 1038; test condition A; $t = 240$ hours; $V_R = 80$ percent of rated V_R ; $T_A = +125^\circ\text{C}$	MIL-STD-750, method 1038; test condition A; $t = 48$ hours; $V_R = 80$ percent of rated V_R ; $T_A = +125^\circ\text{C}$
13	Subgroup 2 of table I herein; V_{F1} and I_{R1} ; $\Delta V_{F1} = \pm 0.1$ V (pk); $\Delta I_{R1} = \pm 2$ μA dc or 100 percent from the initial value; whichever is greater.	Subgroup 2 of table I herein; V_{F1} and I_{R1} ; $\Delta V_{F1} = \pm 0.1$ V (pk); $\Delta I_{R1} = \pm 2$ μA dc or 100 percent from the initial value; whichever is greater.

1/ Thermal impedance shall be performed any time after screen 3.

4.3.1 Burn-in conditions. Burn-in conditions are as follows: T_A = room ambient as defined in the general requirements of MIL-STD-750 (see 4.5). $V_R = 0.8$ to 0.85 rated V_R (see 1.3)

4.3.2 Thermal impedance $Z_{\theta JX}$ measurements for screening. The $Z_{\theta JX}$ measurements shall be performed in accordance with MIL-STD-750, method 3101. The maximum limit (not to exceed the group A, subgroup 2 limit) for $Z_{\theta JX}$ in screening (appendix E, table II of MIL-PRF-19500) shall be derived by each vendor by means of statistical process control. When the process has exhibited control and capability, the capability data shall be used to establish the fixed screening limit. In addition to screening, once a fixed limit has been established, monitor all future sealing lots using a random five piece sample from each lot to be plotted on the applicable X, R chart. If a lot exhibits an out of control condition, the entire lot shall be removed from the line and held for Engineering evaluation and disposition.

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 MIL-STD-750, method 3101 (read and record date $Z_{\theta JX}$). $Z_{\theta JX}$ shall be supplied on one lot (500 pieces minimum) and a thermal response curve shall be submitted. Twenty-two of these samples shall be serialized and provided to the qualifying activity for correlation prior to shipment of parts. Measurements conditions shall be in accordance with 4.4.1 herein.

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, and table I herein. The following test conditions shall be used for $Z_{\theta JX}$, group A inspection:

- a. I_M measure current ----- 10 mA
- b. I_H forward heating current ----- 5 - 50 A
- c. t_M heating time ----- 50 ms
- d. t_{MS} measurement delay time ----- 100 μ s minimum

The maximum limit for $Z_{\theta JX}$ under these test conditions are $Z_{\theta JX}(\max) = 1.8^\circ\text{C/W}$.

4.4.2 Group B inspection. Group B inspection shall be conducted in accordance with the conditions of appendix E, tables VIa (JANS) and VIb (JANTX and JANTXV) of MIL-PRF-19500. Electrical measurements (endpoints) and delta requirements shall be in accordance with the applicable steps of table I, group A, subgroup 2 herein.

4.4.2.1 Group B inspection, appendix E, table VIa (JANS of MIL-PRF-19500).

<u>Subgroup</u>	<u>Method</u>	<u>Condition</u>
B2	1037	T_A = room ambient as defined in the general requirements of MIL-STD-750 (see 4.5). I_F or $I_O = 1.25$ to 10 A. Minimum for 2,000 cycles.

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

<u>Subgroup</u>	<u>Method</u>	<u>Condition</u>
B3	1037	T_A = room ambient as defined in the general requirements of MIL-STD-750 (see 4.5). I_F or $I_O = 1.25$ to 10 A. Minimum for 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 VII of MIL-PRF-19500. Electrical measurements (endpoints) and delta requirements shall be in accordance with the applicable steps of table I, group A, subgroup 2 herein.

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

<u>Subgroup</u>	<u>Method</u>	<u>Condition</u>
C2	2036	Test condition A, weight = 10 pounds, $t = 15$ seconds.
C6	1037	T_A = room ambient as defined in the general requirements of MIL-STD-750 (see 4.5). I_F or $I_O = 1.25$ to 10 A for 6,000 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 IX of MIL-PRF-19500. Electrical measurements (end points) and delta requirements shall be in accordance with the applicable steps and footnotes of table I, group A, subgroup 2 herein.

4.4.4.1 Group E inspection, appendix E, table IX of MIL-PRF-19500.

<u>Subgroup</u>	<u>Method</u>	<u>Condition</u>	<u>Sampling plan</u>
E1	1051	500 cycles.	22 devices, c = 0
E2	1038	Condition A, t = 1,000 hours $V_R = 80$ percent V_{rated}	22 devices, c = 0
E3		Not applicable	
E4	3101	$T_A = +25^\circ\text{C}$; $R_{\theta JC} = \text{rated}$ $R_{\theta JC}$ (see 1.3).	5 devices, c = 0
E5	1016	$V_R = \text{rated } V_R$ (see 1.3); pressure = 33 mmHg; t = 1 minute (minimum), $R_{ISO} =$ 2.0×10^6 ohm max.	5 devices, c = 0

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

4.5.1 Pulse measurements. Conditions for pulse measurement shall be as specified in 4.3.2.1 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 examination	2071					
<u>Subgroup 2</u>						
Thermal impedance	3101	See 4.4.1	$Z_{\theta JX}$		1.8	°C/W
Breakdown voltage	4022	$I_R = 500 \mu\text{A}$ dc pulsed (see 4.5.1) 1N6657, 1N6657R 1N6658, 1N6658R 1N6659, 1N6659R	V_{BR}	100 150 200		V dc
Forward voltage	4011	$I_F = 10 \text{ A}$ (pk); pulsed (see 4.5.1)	V_{F1}		1.0	V dc
		$I_F = 20 \text{ A}$ (pk); pulsed (see 4.5.1)	V_{F2}		1.2	V dc
Reverse current leakage	4016	DC method; $V_R = \text{rated } V_R$ (see 1.3); pulsed (see 4.5.1)	I_{R1}		10	μA dc
<u>Subgroup 3</u>						
High temperature operation		$T_C = +100^\circ\text{C}$				
Reverse current leakage	4016	DC method; $V_R = \text{rated } V_R$ (see 1.3); pulsed (see 4.5.1)	I_{R2}		1.0	mA dc
Low temperature operation:		$T_A = -65^\circ\text{C}$				
Forward voltage	4011	$I_F = 10 \text{ A}$ (pk); pulsed (see 4.5.1)	V_{F3}		1.15	V dc
<u>Subgroup 4</u>						
Scope display evaluation	<u>2/</u>					
Reverse recovery time	4031	Condition B; $I_F = 1 \text{ A}$ dc, $I_R = 1 \text{ A}$ $I_{RR} = 100 \text{ mA}$	t_{rr}		35	ns
Junction capacitance	4001	$V_R = 10 \text{ V}$ dc, $f = 1 \text{ MHz}$ $V_{SIG} = 50 \text{ mV}$ (p-p) (max)	C_J		150	
<u>Subgroups 5, 6, and 7</u>						
Not applicable						

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

^{2/} The reverse breakdown characteristics shall be viewed on an oscilloscope with display calibration factors of 50 to 100 $\mu\text{A}/\text{division}$ and 20 to 50V/division. Reverse current over the knee shall be at least 500 μA . Each device may exhibit a slightly rounded characteristic and any discontinuity or dynamic instability of the trace shall be cause for rejection.

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-STD-129.

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. See MIL- PRF-19500.

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 Defense Supply Center Columbus, ATTN: DSCC-VAT, 3990 East Broad Street, 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.

6.5 Interchangeability information. MIL-PRF-19500/616 is a dual T0-254 package version of MIL-S-19500/478, which is a stud package version.

Custodians:

Army - CR
Navy - EC
Air Force - 17
NASA - NA

Preparing activity:
DLA - CC

(Project 5961-1899-08)

Review activities:

Army - AR, MI, SM
Navy - AS, CG, MC
Air Force - 19, 85, 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-19500/616A

2. DOCUMENT DATE (YYMMDD)

971020

3. DOCUMENT TITLE

SEMICONDUCTOR DEVICE, DIODE, SILICON, POWER RECTIFIER, DUAL, COMMON CATHODE OR ANODE CENTER TAP, ULTRAFAST, TYPES 1N6657, THROUGH 1N6659, AND 1N6657R THROUGH 1N6659R, JANTX, JANTXV, AND JANS

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)

7. DATE SUBMITTED (YYMMDD)

(1) Commercial

(2) AUTOVON
(If applicable)

8. PREPARING ACTIVITY

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c. ADDRESS (Include Zip Code) Defense Supply Center Columbus, ATTN: DSCC-VAT, 3990 East Broad Street, Columbus, OH 43216-5000

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