The documentation and process conversion measures necessary to comply with this revision shall be completed by 7 July 2004.

INCH-POUND

MIL-PRF-19500/429J
7 April 2004
SUPERSEDING
MIL-PRF-19500/429H
30 December 2002

PERFORMANCE SPECIFICATION SHEET

SEMICONDUCTOR DEVICE, DIODE, SILICON, POWER RECTIFIER, FAST RECOVERY, TYPES 1N5615, 1N5617, 1N5619, 1N5621, 1N5623, 1N5615UL, 1N5617UL, 1N5619UL, 1N5621UL, 1N5623UL, 1N5615US, 1N5617US, 1N5619US, 1N5621US, 1N5623US, JAN, JANTX, JANTXV, JANS, JANHC, AND JANKC

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, fast recovery power rectifier diodes that are hermetic glass encapsulated. Four levels of product assurance are provided for each encapsulated device as specified in MIL-PRF-19500. Two levels of product assurance are provided each unencapsulated device type.

1.2 Physical dimensions. See figure 1 (similar to DO-7), figures 2 and 3 surface mount (D-5A), figures 4 and 5 (JANHC and JANKC).

1.3 Maximum ratings. Unless otherwise specified $T_C$ = 25°C.

| Col. 1 | Col. 2 | Col. 3 | Col. 4 | | Col. 5 | Col. 6 | Col. 7 | Col. 8 | Col. 9 | Col. 10 |
|---|---|---|---|---|---|---|---|---|---|---|
| Types (1) | $V_R$ | $V_{RWM}$ | $I_O$ | | $t_{rr}$ | $T_{STG}$ $T_J$ | $I_{FSM}$ $T_A$ = +100°C $I_O$ = 750 mA dc $t_P$ = 8.3 ms | Barometric pressure (reduced) | $R_{\theta JL}$ $R_{\theta JEC}$ | $Z_{\theta JX}$ |
| | | | $T_A$ = +55°C (2) (3) | $T_A$ = +100°C (3) (4) | | | | | | |
| | V dc | V(pk) | A dc | mA dc | ns | °C | A(pk) | mmHg | (5) | °C/W |
| 1N5615 | 200 | 200 | 1 | 750 | 150 | -65 | 25 | N/A | | 4.5 |
| 1N5617 | 400 | 400 | 1 | 750 | 150 | | 25 | 8 | | 4.5 |
| 1N5619 | 600 | 600 | 1 | 750 | 250 | to | 25 | 8 | | 4.5 |
| 1N5621 | 800 | 800 | 1 | 750 | 300 | | 25 | 33 | | 4.5 |
| 1N5623 | 1,000 | 1,000 | 1 | 750 | 500 | +175 | 25 | 33 | | 4.5 |

(1) Electrical characteristics for UL and US suffix are identical to the corresponding non-suffix device.

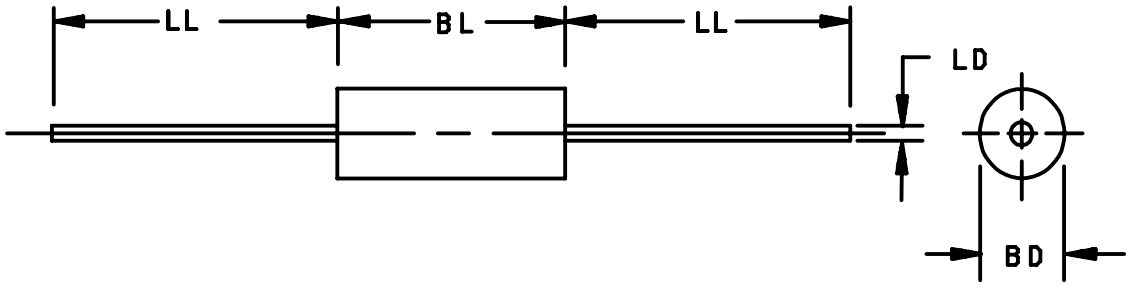
(2) From 1 A dc at $T_A$ = +55°C, to .75 A dc at $T_A$ = +100°C, derate linearly at 5.56 mA/°C.

(3) For the 1 A dc rating at +55°C and the 750 mA dc rating at +100°C, no special mounting, heat sinking, or forced-air flow across exposed areas of the device is required.

(4) From .75 A dc at $T_A$ = +100°C, to 0 A dc at $T_A$ = +175°C, derate linearly at 10 mA/°C.

(5) $R_{\theta JL} \leq$ 38°C/W at L = .375 inch (9.53 mm); for UL and US suffix type devices. $R_{\theta JEC} \leq$ 7.0°C/W.

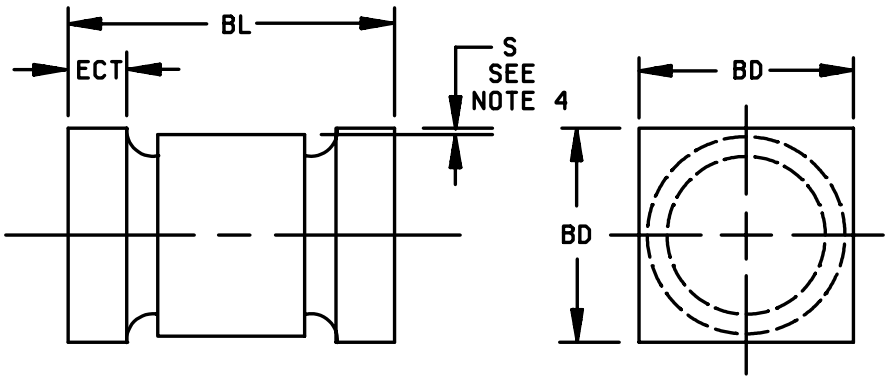
* Comments, suggestions, or questions on this document should be addressed to Defense Supply Center, Columbus, ATTN: DSCC-VAC, P.O. Box 3990, Columbus, OH 43216-5000, or emailed to Semiconductor@dscc.dla.mil. Since contact information can change, you may want to verify the currency of this address information using the ASSIST Online database at http://www.dodssp.daps.mil.




| Ltr | Dimensions | | | | Notes |
|---|---|---|---|---|---|
| | Inches | | Millimeters | | |
| | Min | Max | Min | Max | |
| BD | .065 | .110 | 1.65 | 2.79 | 3 |
| LD | .026 | .033 | .66 | .84 | |
| BL | .130 | .225 | 3.30 | 5.71 | 4 |
| LL | 1.00 | 1.30 | 25.40 | 33.02 | |

NOTES:
1. Dimensions are in inches.
2. Millimeters are given for general information only.
3. Dimension BD shall be measured at the largest diameter.
4. Dimension BL shall include all uncontrolled areas of the device.
5. In accordance with ASME Y14.5M, diameters are equivalent to $\phi$x symbology.

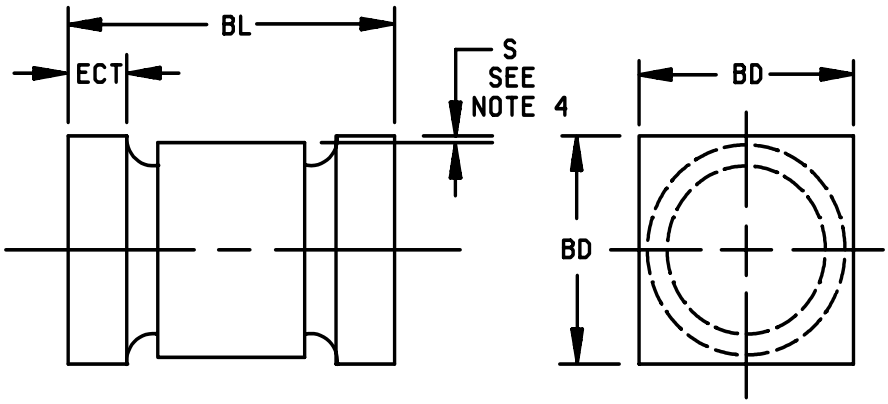
* FIGURE 1. Physical dimensions (for non-UL and non-US suffix devices only) (similar to DO-7).




| Ltr | Dimensions | | | |
|---|---|---|---|---|
| | Inches | | Millimeters | |
| | Min | Max | Min | Max |
| BL | .168 | .225 | 4.27 | 5.72 |
| ECT | .019 | .028 | 0.48 | 0.71 |
| S | .003 | | 0.08 | |
| BD | .091 | .125 | 2.31 | 3.18 |

NOTES:
1. Dimensions are in inches.
2. Millimeters are given for general information only.
3. Dimensions are pre-solder dip.
4. Minimum clearance of glass body to mounting surface on all orientations.
5. In accordance with ASME Y14.5M, diameters are equivalent to $\phi$x symbology.

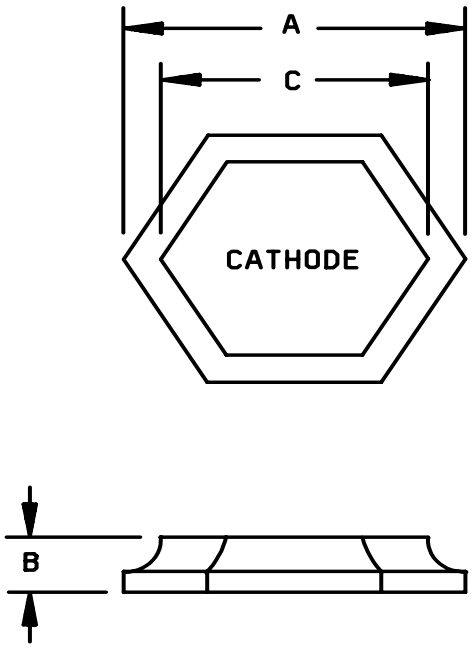
FIGURE 2. Physical dimensions for types 1N5615UL, 1N5617UL, 1N5619UL, 1N5621UL, and 1N5623UL, (surface mount devices) (D-5A).




| Ltr | Dimensions | | | |
|---|---|---|---|---|
| | Inches | | Millimeters | |
| | Min | Max | Min | Max |
| BL | .168 | .200 | 4.27 | 5.08 |
| ECT | .019 | .028 | 0.48 | 0.71 |
| S | .003 | | 0.08 | |
| BD | .091 | .103 | 2.31 | 2.62 |

NOTES:
1. Dimensions are in inches.
2. Millimeters are given for general information only.
3. Dimensions are pre-solder dip.
4. Minimum clearance of glass body to mounting surface on all orientations.
5. In accordance with ASME Y14.5M, diameters are equivalent to $\phi$x symbology.

FIGURE 3. Physical dimensions for types 1N5615US, 1N5617US, 1N5619US, 1N5621US, and 1N5623US, (surface mount devices) (D-5A).

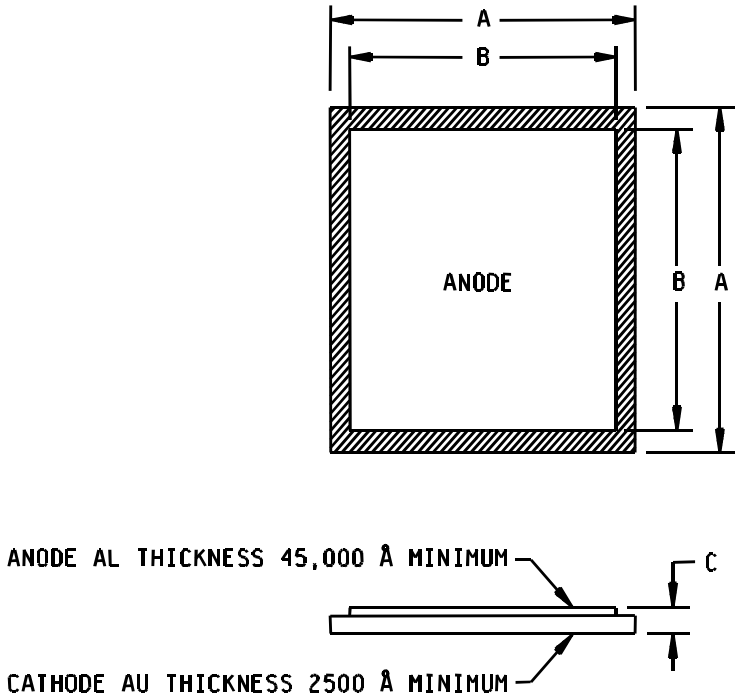



A - version

| Ltr | Dimensions | | | |
|---|---|---|---|---|
| | Inches | | Millimeters | |
| | Min | Max | Min | Max |
| A | .047 | .053 | 1.19 | 1.35 |
| B | .007 | .011 | 0.18 | 0.28 |
| C | .033 | .037 | 0.84 | 0.94 |

NOTES:
1. Dimensions are in inches.
2. Millimeters are given for general information only.
3. The physical characteristics of the die are:
   Top metal: Gold 10,000 Å minimum.
   Back metal: Gold 4,000 Å minimum.
4. In accordance with ASME Y14.5M, diameters are equivalent to $\phi$x symbology.

FIGURE 4. Physical dimensions, JANHCA and JANKCA die.




| Ltr | Dimensions | | | |
|---|---|---|---|---|
| | Inches | | Millimeters | |
| | Min | Max | Min | Max |
| A | .039 | .043 | 1.00 | 1.09 |
| B | .021 | .025 | 0.53 | 0.64 |
| C | .008 | .012 | 0.20 | 0.31 |

NOTES:
1. Dimensions are in inches.
2. Millimeters are given for general information only.
3. The physical characteristics of the die are:
   Top metal: Aluminum (anode) 45,000 Å minimum.
   Back metal: Gold (cathode) 2,500 Å minimum.
4. In accordance with ASME Y14.5M, diameters are equivalent to $\phi$x symbology.

FIGURE 5. Physical dimensions, JANHCB and JANKCB die.

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 http://assist.daps.dla.mil/quicksearch/ or www.dodssp.dap.mil or 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, 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 and as follows:

| | |
|---|---|
| EC | End cap. |
| UL | Long-body unleaded or surface mounted diodes (square end-caps). |
| US | Short-body unleaded or surface mounted diodes (square end-caps). |

3.4 Interface and physical dimensions. The interface and physical dimensions shall be as specified in MIL-PRF-19500 and on figure 1 (similar to DO-7), figures 2 and 3 surface mount (D-5A), figures 4 and 5 (JANHC and JANKC).

3.4.1 Lead finish. Unless otherwise specified, lead or end cap finish shall be solderable in accordance with MIL-PRF-19500, MIL-STD-750, and herein. When solder alloy is used for finish the maximum lead temperature is limited to 175°C maximum. Where a choice of finish is desired, it shall be specified in the acquisition document (see 6.2).

* 3.5 Diode construction. These devices shall be constructed in a manner and using material which enable the diodes to meet the applicable requirements of MIL-PRF-19500 and this document.

3.5.1 Encapsulant material. In addition to those categories of hermetically sealed package requirements specified in MIL-PRF-19500, fused-metal-oxide to metal shall also be acceptable.

3.6 Marking. Marking shall be in accordance with MIL-PRF-19500.

3.6.1 Marking of UL and US version. For UL and US version only, all marking (see 3.6) may be omitted from the body, but shall be retained on the initial container.

3.6.2 Polarity. The polarity of all types shall be indicated with a contrasting color band to denote the cathode end. Alternatively, for UL and US suffix devices, a minimum of three contrasting color dots spaced around the periphery on the cathode end or a contrasting color band may be used.

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

3.8 Electrical test requirements. The electrical test requirements shall be the subgroups specified in table I herein.

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.

4.2.1 Group E qualification. Group E qualification shall be performed herein for qualification or requalification only. In case qualification was awarded to a prior revision of the specification sheet that did not request the performance of table II tests, the tests specified in table II herein shall be performed by the first inspection lot to this revision to maintain qualification.

4.2.2 JANHC and JANKC die. Qualification shall be in accordance with appendix G of MIL-PRF-19500 and as specified herein.

4.3 Screening (JANS, JANTX, and JANTXV levels). Screening shall be in accordance with 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 table IV of MIL-PRF-19500) | Measurement | |
|---|---|---|
| | JANS level | JANTXV and JANTX level |
| 1a<br>1b | Required<br>Required | Not required<br>Required (JANTXV only) |
| 2 | Not required | Not required |
| 3a<br>(1) 3c | Required<br>Thermal impedance (see 4.3.1 and 4.4.1) | Required<br>Thermal impedance (see 4.3.1 and 4.4.1) |
| 4 | Not applicable | Not applicable |
| 5 | Not applicable | Not applicable |
| 6 | Not applicable | Not applicable |
| 7a<br>7b | Not applicable<br>Optional | Not applicable<br>Optional |
| 8 | Required | Not required |
| 9 | Required $I_{R1}$ and $V_{FM1}$ | Not required |
| 10 | Method 1038 of MIL-STD-750, condition A | Method 1038 of MIL-STD-750, condition A |
| 11 | $I_{R1}$ and $V_F$, $\Delta I_{R1} \leq 100$ percent of initial reading or ±100 nA dc, whichever is greater. $\Delta V_F \leq \pm 0.1$ V dc | $I_{R1}$ and $V_F$ |
| 12 | Required, see 4.3.2 | Required, see 4.3.2 |
| (2) 13 | Subgroups 2 and 3 of table I herein:<br>$\Delta I_{R1} \leq 100$ percent of initial reading or ±100 nA dc, whichever is greater.<br>$\Delta V_F \leq \pm 0.1$ V dc. Scope display evaluation (see 4.5.4). | Subgroup 2 of table I herein:<br>$\Delta I_{R1} \leq 100$ percent of initial reading or ±100 nA dc, whichever is greater.<br>$\Delta V_F \leq \pm 0.1$ V dc. Scope display evaluation (see 4.5.4). |
| 14a<br>(3) 14b | Not applicable<br>Required | Not applicable<br>Required |
| 15 | Required | Not required |
| 16 | Required | Not required |

(1) Thermal impedance 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.

(2) $Z_{\theta JX}$ is not required in screen 13, if already previously performed.

(3) For clear glass diodes, the hermetic seal (gross leak) may be performed at any time after temperature cycling.

4.3.1 Thermal impedance. Thermal impedance $Z_{\theta JX}$ measurements shall be performed in accordance with method 3101 of MIL-STD-750. The maximum limit for $Z_{\theta JX}$ in screening (table IV of MIL-PRF-19500) shall be derived by each vendor by means of statistical process control and applied in screening of all subsequent lots. This limit shall not exceed the table I, subgroup 2 limit. See 4.4.1 for test conditions.

4.3.1.1 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 $Z_{\theta JX}$) and shall be supplied to the qualifying activity on a 500 piece sample from the qualification lot prior to qualification approval.

* 4.3.2 Power burn-in conditions. Power burn-in conditions are as follows (see 4.5.3, 4.5.3.1) adjust $I_O$ to achieve the required $T_J$.

4.3.3 Screening (JANHC and JANKC). Screening of die shall be in accordance with appendix G of MIL-PRF-19500. As a minimum, die shall be 100-percent probed to ensure compliance with table I, subgroup 2. Burn-in duration for the JANKC level follows JANS requirements; the JANHC follows JANTX requirements.

4.4 Conformance inspection. Conformance inspection shall be in accordance with MIL-PRF-19500 and as specified herein. If alternate screening is being performed in accordance with E.5.3.1d of MIL-PRF-19500, a sample of screened devices shall be submitted to and pass the requirements of group A1 and A2 inspection only (table VIb, group B, subgroup 1 is not required to be performed again if group B has already been satisfied in accordance with 4.4.2).

4.4.1 Group A inspection. Group A inspection shall be conducted in accordance with MIL-PRF-19500, and table I herein. The following test conditions shall be used for $Z_{\theta JX}$ in table I, subgroup 2 inspection:

a. $I_H$..... 10 A minimum.

b. $t_H$..... 10 ms.

c. $I_M$ ..... 10 mA.

d. $t_{MD}$ ..... 100 µs maximum.

The maximum limit for $Z_{\theta JX}$ in table I, 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 table VIa (JANS) and table VIb (JAN, JANTX, and JANTXV) of MIL-PRF-19500. Electrical measurements (end-points) shall be in accordance with table I, subgroup 2 herein. See table III for delta limits when applicable.

* 4.4.2.1 Group B inspection, table VIa (JANS) of MIL-PRF-19500. For B5, if a failure occurs, resubmission shall be at the test conditions of the original sample.

| | Subgroup | Method | Condition |
|---|---|---|---|
| | B3 | 1056 | 0°C to +100°C, 25 cycles. |
| | B3 | 1051 | -55°C to +175°C, 100 cycles. |
| | B3 | 4066 | $I_{FSM}$ = rated $I_{FSM}$ (see col. 7 of 1.3); 10 surges of 8.3 ms each at 1 minute intervals, superimposed on $I_O$ = 0, $V_{RWM}$ = 0. |
| | B4 | 1037 | $I_O = I_{O2}$ rated minimum (see col. 4 of 1.3); $V_R$ = rated $V_{RWM}$ (see col. 3 of 1.3, and 4.5.3); 2,000 cycles. |
| | B5 | 1027 | $I_O = I_{O2}$ rated minimum (see col. 4 of 1.3); apply $V_R$ = rated $V_{RWM}$ (see col. 3 of 1.3 and 4.5.3) adjust or $I_O$ to achieve $T_J$ minimum; f = 50-60 Hz; n = 45, c = 0. |
| | | | Option 1: $T_A$ = + 30°C max. ; $T_J$ = 225°C minimum; t = 216 hours. |
| | | or | Option 2: $T_A$ = + 30°C max. ; $T_J$ = 200°C minimum; t = 1,000 hours. |
| * | B6 | 3101 | $R_{\theta JL}$ (maximum) ≤ 308°C/W; L = .375 inch (9.53 mm). |
| | | or 4081 | For surface mount devices (UL and US version), $R_{\theta JEC}$ ≤ 7°C/W. |
| * | B7 | | Peak reverse power, see 4.5.6 and figure 6 herein. $P_{RM}$ ≥ 500 W. Test shall be performed on each sublot; sampling plan n = 10, c = 0, end-points, see 4.4.2. |

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

| Subgroup | Method | Condition |
|---|---|---|
| B2 | 1056 | 0°C to +100°C, 10 cycles. |
| B2 | 1051 | -55°C to +175°C, 25 cycles. |
| B3 | 1027 | $I_O = I_O$ rated (see col. 4 of 1.3) minimum; adjust $I_O$ to achieve the required $T_J$ apply $V_R$ = rated $V_{RWM}$ (see col. 3 of 1.3), f = 50-60 Hz (see 4.5.3.1). |
| 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 VII of MIL-PRF-19500. Electrical measurements (end-points) shall be in accordance with table I, subgroup 2 herein. See table III for delta limits when applicable.

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

| | Subgroup | Method | Condition |
|---|---|---|---|
| * | C2 | 1056 | 0°C to +100°C, 10 cycles. |
| * | C2 | 1051 | -55°C to +175°C, 25 cycles. |
| * | C2 | 2036 | Tension: Test condition A; weight = 12 pounds; t = 30 seconds. Lead fatigue: Test condition E; weight 1 pound.<br>NOTE: Both tension and lead fatigue are not applicable for US devices. |
| * | * C5 | 3101 or 4081 | See 4.5.5. |
| | C6 | 1026 | $I_O = I_O$ rated (rated see col. 4 of 1.3) minimum; adjust $I_O$ to achieve the required $T_J$ apply $V_R$ = rated $V_{RWM}$ (see col. 3 of 1.3), f = 50-60 Hz (see 4.5.3.1). |

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 and as specified herein. Electrical measurements (end-points) shall be in accordance with table I, subgroup 2 herein; except, $Z_{\theta JX}$ need not be performed. See table III for delta limits when applicable.

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 conditions. Unless otherwise specified, all inspections shall be conducted at an ambient temperature $T_A$ of +25°C ±3°C.

4.5.3 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.

* 4.5.3.1 Free air burn-in. Deliberate heat sinking, baffles to create an oven, forced air-cooling or heating is prohibited unless otherwise approved by the qualifying activity. The use of a current limiting or ballast resistor is permitted provided that each DUT still sees the full $P_t$ (minimum) and that the minimum applied voltage, where applicable, is maintained through out the burn-in period. $T_J$ = 135°C minimum for screening and $T_J$ = 150°C for 4.4.2 and 4.4.3 life tests. Use method 3100 of MIL-STD-750 to measure $T_J$.

4.5.4 Scope display evaluation. Scope display evaluation shall be stable in accordance with method 4023 of MIL-STD-750. Scope display may be performed on ATE (automatic test equipment) for screening only with the approval of the qualifying activity. Scope display in table I, subgroup 4 shall be performed on a scope. Reverse current ($I_{BR}$) over the knee shall be 500 μA peak.

4.5.5 Thermal resistance. Thermal resistance measurements shall be conducted in accordance with test method 3101 or 4081 of MIL-STD-750. Read and record data in accordance with table II herein and shall be included in the qualification report. Forced moving air or draft shall not be permitted across the devices during test. The maximum limit under these test condition shall be $R_{\theta JL} \leq 38°C/W$ for L = .375 (9.53 mm). $R_{JEC} = 7°C/W$ for UL or US devices, L = 0.

a. $I_H$ = 5 A dc minimum.

b. $t_{H =}$ thermal equilibrium.

c. $I_M$ = 1.0 mA to 10 mA.

d. $t_{MD}$ = 100 µs maximum.

The device shall be allowed to reach equilibrium at current $I_H$ before the measurement shall be made ($t_H \geq 25$ sec).

LS = Lead spacing = .375 inch (9.53) mm minimum for leaded devices and LS = 0 minimum for unleaded devices as defined (see figure 7) (Metric equivalents are given for general information only):

4.5.6 Peak reverse power test. A 20 microsecond half-sine waveform of current shall be used and peak reverse power shall be determined by the product of peak reverse voltage and peak reverse current. A 20 microsecond square waveform may also be used with the approval of the qualifying activity (see figure 6).

* TABLE I. Group A inspection.

| Inspection 1/ | MIL-STD-750 | | Symbol | Limits | | Unit |
|---|---|---|---|---|---|---|
| | Method | Conditions | | Min | Max | |
| | 2071 | | | | | |
| Subgroup 1<br>Visual and mechanical inspection | | | | | | |
| Subgroup 2 | | | | | | |
| Forward voltage | 4011 | $I_F$ = 3 A dc (pulsed); (see 4.5.1) $t_p$ = 300 µs; 2 percent maximum duty cycle | $V_F$ | 0.8 | 1.6 | $V_{pk}$ |
| Reverse current leakage | 4016 | DC method | $I_{R1}$ | | | |
| 1N5615, 1N5615UL, US | | $V_R$ = 200 V dc | | | 0.5 | µA dc |
| 1N5617, 1N5617UL, US | | $V_R$ = 400 V dc | | | 0.5 | µA dc |
| 1N5619, 1N5619UL, US | | $V_R$ = 600 V dc | | | 0.5 | µA dc |
| 1N5621, 1N5621UL, US | | $V_R$ = 800 V dc | | | 0.5 | µA dc |
| 1N5623, 1N5623UL, US | | $V_R$ = 1,000 V dc | | | 0.5 | µA dc |
| Breakdown voltage | 4021 | $I_R$ = 50 µA dc | $V_{BR}$ | | | |
| 1N5615, 1N5615UL, US | | | | 220 | | V dc |
| 1N5617, 1N5617UL, US | | | | 440 | | V dc |
| 1N5619, 1N5619UL, US | | | | 660 | | V dc |
| 1N5621, 1N5621UL, US | | | | 880 | | V dc |
| 1N5623, 1N5623UL, US | | | | 1100 | | V dc |
| Thermal impedance | 3101 | See 4.3.1 and 4.4.1 | $Z_{\theta JX}$ | | 4.5 | °C/W |
| Subgroup 3 | | | | | | |
| High temperature operation: | | $T_A$ = +100°C | | | | |
| Reverse current leakage | 4016 | DC method | $I_{R2}$ | | | |
| 1N5615, 1N5615UL, US | | $V_R$ = 200 V dc | | | 25 | µA dc |
| 1N5617, 1N5617UL, US | | $V_R$ = 400 V dc | | | 25 | µA dc |
| 1N5619, 1N5619UL, US | | $V_R$ = 600 V dc | | | 25 | µA dc |
| 1N5621, 1N5621UL, US | | $V_R$ = 800 V dc | | | 25 | µA dc |
| 1N5623, 1N5623UL, US | | $V_R$ = 1,000 V dc | | | 25 | µA dc |

See footnote at end of table.

* TABLE I. Group A inspection - Continued.

| Inspection 1/ | MIL-STD-750 | | Symbol | Limits | | Unit |
|---|---|---|---|---|---|---|
| | Method | Conditions | | Min | Max | |
| Subgroup 4 | | | | | | |
| Reverse recovery time | 4031 | Condition B1 | $t_{rr}$ | | | |
| 1N5615, 1N5615UL, US | | | | | 150 | ns |
| 1N5617, 1N5617UL, US | | | | | 150 | ns |
| 1N5619, 1N5619UL, US | | | | | 250 | ns |
| 1N5621, 1N5621UL, US | | | | | 300 | ns |
| 1N5623, 1N5623UL, US | | | | | 500 | ns |
| Capacitance | 4001 | $V_R$ = 12 V dc, 0.1 < f < 1.0 MHz | C | | | |
| 1N5615, 1N5615UL, US | | | | | 45 | pF |
| 1N5617, 1N5617UL, US | | | | | 35 | pF |
| 1N5619, 1N5619UL, US | | | | | 25 | pF |
| 1N5621, 1N5621UL, US | | | | | 20 | pF |
| 1N5623, 1N5623UL, US | | | | | 15 | pF |
| Scope display evaluation | 4023 | See 4.5.4; n = 116, c = 0 | | | | |
| Subgroup 5 | | | | | | |
| Not applicable | | | | | | |
| Subgroup 6 | | | | | | |
| Forward surge | 4066 | $I_{FSM}$ = 25 A (pk); 10 surges of 8.3 ms each at 1 minute intervals, $I_O$ = 750 mA dc; $V_R$ = rated $V_{RWM}$ (see col. 3 of 1.3); $T_A$ = +100°C; ($T_{EC}$ = +100°C for surface mount devices (UL and US version)). | | | | |
| Electrical measurement | | See table I, subgroup 2 except thermal impedance. | | | | |
| Subgroup 7 | | | | | | |
| Not applicable | | | | | | |

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

* TABLE II. Group E inspection (all quality levels) for qualification and requalification only.

| Inspection | MIL-STD-750 | | Sampling plan |
|---|---|---|---|
| | Method | Conditions | |
| * Subgroup 1 | | | 45 devices c = 0 |
| Thermal shock | 1056 | 20 cycles, condition D except low temperature shall be achieved using liquid nitrogen (-195°C). Perform a visual for cracked glass. | |
| Temperature cycling | 1051 | 500 cycles, -65°C to +175°C. | |
| Hermetic seal | 1071 | | |
| Gross leak | | | |
| Electrical measurements | | See table I, subgroup 2, and table III, steps 1 and 2. | |
| Subgroup 2 | | | |
| Steady state dc blocking life | 1048 | 1,000 hours, condition A<br>$V_R = V_{RWM}$ (see col. 3 of 1.3). | |
| Electrical measurements | | See table I, subgroup 2 herein except for thermal impedance. | 22 devices c = 0 |
| Subgroup 3 | | | devices, c = 0 |
| Decap analysis (DPA) | 2101 | Cross section and scribe and break.<br>Separate samples shall be used for each test. | |
| Subgroup 4 1/ | | | |
| Thermal impedance curves | | Each supplier shall submit their (typical) maximum design thermal impedance curves. In addition, optional test conditions and $Z_{\theta JX}$ limit shall be provided to the qualifying activity in the qualification report. | |
| Subgroup 5 | | | 22 devices c = 0 |
| Barometric pressure, reduced (altitude operation) | 1001 | Pressure 1N5617, 1N5619 = 8 mm Hg (100,000 ft); 1N5621, 1N5623 = 33 mm Hg (70,000 ft); $V_R = V_{RWM}$ (see col. 3 of 1.3); t = 1 minute (minimum). | |

See footnote at end of table.

* TABLE II. Group E inspection (all quality levels) for qualification and requalification only - Continued.

| Inspection | MIL-STD-750 | | Sampling plan |
|---|---|---|---|
| | Method | Conditions | |
| Subgroup 7 | | | |
| Not applicable | | | |
| Subgroup 8 1/ | | | |
| Peak reverse power | | See 4.5.6 and figure 6 herein. Peak reverse power ($P_{RM}$) shall be characterized by the supplier and this data shall be available to the government. Test shall be performed on each sublot. | |
| Electrical measurements | | During the $P_{RM}$ test, the voltage ($V_{BR}$) shall be monitored to verify it has not collapsed. Any collapse in $V_{BR}$ during or after the $P_{RM}$ test or rise in leakage current ($I_R$) after the test that exceeds $I_{R1}$ in table I shall be considered a failure to that level of applied $P_{RM}$. Progressively higher levels of $P_{RM}$ shall be applied until failure occurs on all devices within the chosen sample size to characterize each sublot. | |
| Subgroup 9 1/ | | | 45 devices<br>c = 0 |
| Resistance to glass cracking | 1057 | Step stress to destruction by increasing cycles or up to a maximum of 25 cycles. | |
| Subgroup 10 | | | 22 devices<br>c = 0 |
| Forward surge | 4066 | Condition A, $I_{FSM}$ = rated (see col. 5 of 1.3.); 10 surges of 8.3 ms each at 1 minute intervals superimposed on $I_O$ = 0; $V_{RWM}$ = 0; $T_A$ = + 25°C. | |
| Electrical measurement | | See table I, subgroup 2. | |

1/ The sample size for this step stress requirement shall be determined by the supplier. A statistically significant sample size is required.

TABLE III. Groups B, C, and E delta measurements. 1/ 2/ 3/ 4/

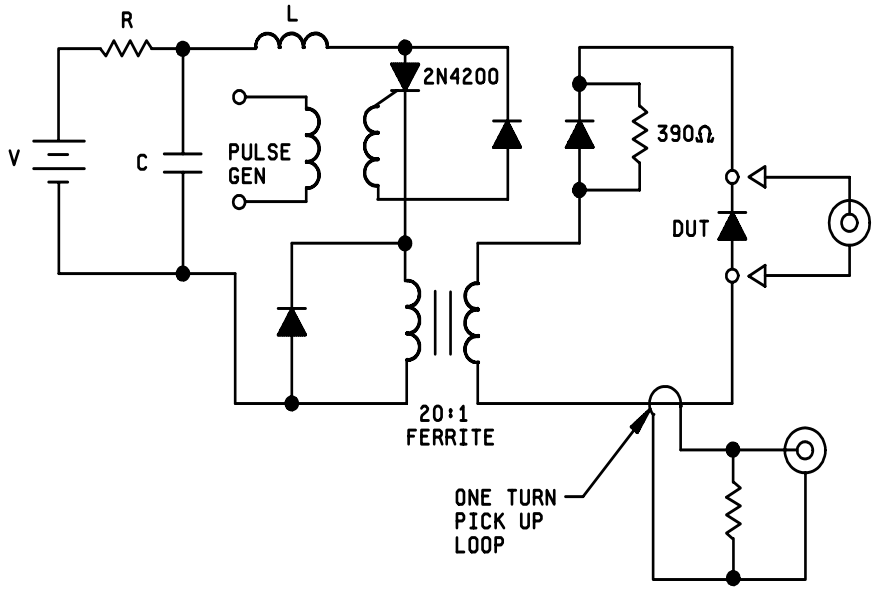
| Step | Inspection | MIL-STD-750 | | Symbol | Limits | | Unit |
|---|---|---|---|---|---|---|---|
| | | Method | Conditions | | Min | Max | |
| 1. | Reverse current leaking change<br>1N5615, 1N5615UL, US<br>1N5617, 1N5617UL, US<br>1N5619, 1N5619UL, US<br>1N5621, 1N5621UL, US<br>1N5623, 1N5623UL, US | 4016 | DC method<br><br>$V_R$ = 200 V dc<br>$V_R$ = 400 V dc<br>$V_R$ = 600 V dc<br>$V_R$ = 800 V dc<br>$V_R$ = 1,000 V dc | $\Delta I_{R1}$ 4/ | | For JAN, JANTX, and JANTXV, ≤ 250 nA dc or 100 percent, whichever is greater; for JANS, ≤ 100 nA dc or 100 percent, whichever is greater. | |
| 2. | Forward voltage change | 4011 | $I_F$ = 3 A dc; Pulsed (see 4.5.1) $t_p$ = 300 µs; 2 percent maximum duty cycle. | $\Delta V_{F1}$ 4/ | | ± 50 mV dc maximum change from previous measured value. | |

1/ The electrical measurements for table VIa (JANS) of MIL-PRF-19500 are as follows:
   a. Subgroup 3, see table III herein, step 2.
   b. Subgroup 4, see table III herein, step 2.
   c. Subgroup 5, see table III herein, step 1.

2/ The electrical measurements for table VIb (JAN, JANTX, and JANTXV) of MIL-PRF-19500 are as follows:
   a. Subgroup 3, see table III herein, step 1.
   b. Subgroup 6, see table III herein, step 1.

3/ The electrical measurements for table VII of MIL-PRF-19500 are as follows:
   a. Subgroup 2, see table III herein, step 1 (JANS).
   b. Subgroup 6, see table III herein, step 1 and 2 (JANS), step 1 (JAN, JANTX, and JANTXV).

4/ Devices which exceed the table I limits for this test shall not be accepted.




NOTES: *
1. L - 13T #22 pm 1 inch (25.4 mm) diameter form (air core).
2. C - 1 to 10 µfd to give a 20 µs pulse width.
3. V - adjustable to 200 volts for power desired in DUT.
   D1 - 3 kV; 600 Ma (1N3647 or equivalent).
   D2, D3 - 600 V; 3A (1N5552 or equivalent).
   * Values not stated are determined at the time of test.

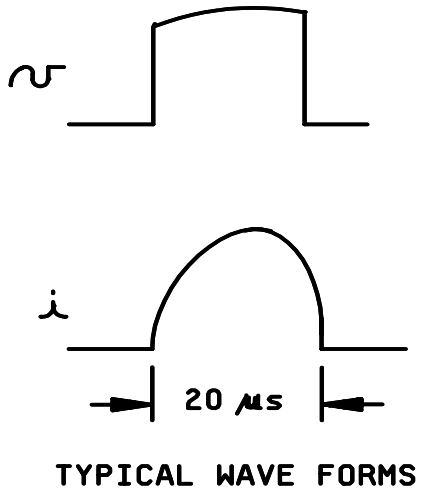



FIGURE 6. Peak reverse power measurement circuit and waveform.

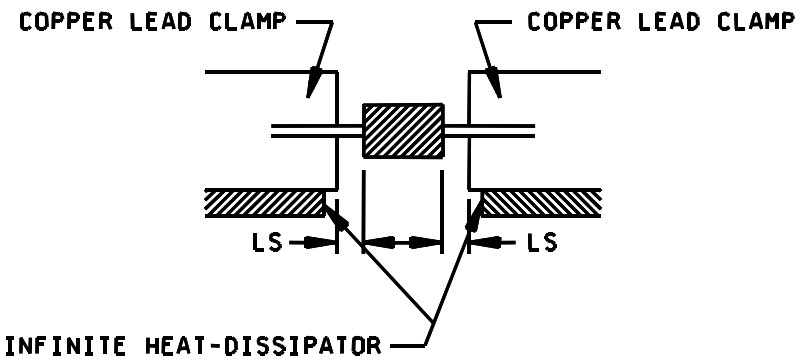



FIGURE 7. Mounting arrangement.

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 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.)

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:

* 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.

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 Defense Supply Center, Columbus, ATTN: DSCC/VQE, P.O. Box 3990, Columbus, OH 43216-5000 or e-mail vqe.chief@dla.mil.

6.4 Suppliers of die. The qualified die suppliers with the applicable letter version (e.g., JANHCA1N5615) will be identified on the Qualified Manufacturers List (QML).

| JANHC and JANKC ordering information | | |
|---|---|---|
| PIN | Manufacturer | |
| | 14552 | 33178 |
| 1N5615 | JANHCA1N5615<br>JANKCA1N5615 | JANHCB1N5615<br>JANKCB1N5615 |
| 1N5617 | JANHCA1N5617<br>JANKCA1N5617 | JANHCB1N5617<br>JANKCB1N5617 |
| 1N5619 | JANHCA1N5619<br>JANKCA1N5619 | JANHCB1N5619<br>JANKCB1N5619 |
| 1N5621 | JANHCA1N5621<br>JANKCA1N5621 | JANHCB1N5621<br>JANKCB1N5621 |
| 1N5623 | JANHCA1N5623<br>JANKCA1N5623 | JANHCB1N5623<br>JANKCB1N5623 |

6.5 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.

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