The documentation and process conversion measures necessary to comply with this revision shall be completed by 01 December 2017.

INCH-POUND

MIL-PRF-19500/477L
w/AMENDMENT 2
01 September 2017
SUPERSEDING
MIL-PRF-19500/477L
w/AMENDMENT 1
22 September 2016

PERFORMANCE SPECIFICATION SHEET

# SEMICONDUCTOR DEVICE, DIODE, SILICON, ULTRAFAST RECOVERY, POWER RECTIFIER, TYPES 1N5802, 1N5804, 1N5806, 1N5807, 1N5809, AND 1N5811, 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. Four levels of product assurance (JAN, JANTX, JANTXV, and JANS) are provided for each encapsulated device types as specified in MIL-PRF-19500. Two levels of product assurance are provided for each unencapsulated device type.

* 1.2 Package outlines and die topography. The device package for the encapsulated device type are as follows: Axial in accordance with figure 1, surface mount version US in accordance with figure 2, surface mount versions URS in accordance with figure 3, and surface mount versions UMC in accordance with figure 4. The dimensions and topography for JANHC and JANKC unencapsulated die are as follows: E version die in accordance with figure 5, F version die in accordance with figure 6, and G version die in accordance with figure 7.

1.3 Maximum ratings. Unless otherwise specified, $T_A$ = +25°C.

1.3.1 Ratings applicable to all Part or Identifying Numbers (PIN). $T_{STG}$ = $T_{J(max)}$ = -65°C to +175°C.

* 1.3.2 Ratings applicable to individual types.

| Col. 1 | Col. 2 | Col. 3 | Col. 4 | Col. 5 | Col. 6 | Col. 7 | Col. 8 | Col. 9 | Col. 10 | Col. 11 |
|---|---|---|---|---|---|---|---|---|---|---|
| Types | $V_{RWM}$ | $I_{O(L)}$ $T_L$ = +75°C (1) (2) (3) | $I_{O1}$ $T_A$ = +55°C (4) (5) (6) | $I_{FSM}$ at +25°C operating at $I_{O1}$ $t_p$ = 8.3 ms | $t_{rr}$ | $R_{\theta JL}$ (1) | $R_{\theta JEC}$ (1) (7) | $R_{\theta JX}$ (4) | $R_{\theta JA}$ (8) | $R_{\theta JSP}$ (8) |
| | V | A | A | A(pk) | ns | °C/W | °C/W | °C/W | °C/W | °C/W |
| 1N5802, US, URS | 50 | 2.5 | 1.0 | 35 | 25 | 36 | 13 | 154 | | |
| 1N5804, US, URS | 100 | 2.5 | 1.0 | 35 | 25 | 36 | 13 | 154 | | |
| 1N5806, US, URS | 150 | 2.5 | 1.0 | 35 | 25 | 36 | 13 | 154 | | |
| 1N5802UMC | 50 | 2.5 | 1.0 | 35 | 25 | | | | 44 | 10 |
| 1N5804UMC | 100 | 2.5 | 1.0 | 35 | 25 | | | | 44 | 10 |
| 1N5806UMC | 150 | 2.5 | 1.0 | 35 | 25 | | | | 44 | 10 |
| 1N5807, US, URS | 50 | 6.0 | 3.0 | 125 | 30 | 22 | 6.5 | 52 | | |
| 1N5809, US, URS | 100 | 6.0 | 3.0 | 125 | 30 | 22 | 6.5 | 52 | | |
| 1N5811, US, URS | 150 | 6.0 | 3.0 | 125 | 30 | 22 | 6.5 | 52 | | |

See notes on next page.

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AMSC N/A

FSC 5961

1.3.2 Ratings applicable to individual types - Continued.

(1) $T_L$ at L = .375 in. (9.52 mm), $T_{EC}$ = $T_L$ at L = 0 or $T_{end\ tab}$ for US suffix devices.
(2) Derate at 25 mA/°C for $T_L$ above +75°C for 2.5 amp ratings.
(3) Derate at 60 mA/°C for $T_L$ above +75°C for 6.0 amp ratings.
(4) For the 1 and 3 amp ratings at 55°C, these $I_O$ ratings are for a thermally (PC boards or other) mounting methods where the lead or end-cap temperatures cannot be maintained as shown in col. 3 of 1.3.2 and where the thermal resistance from mounting point to ambient is still sufficiently controlled where $T_{J(MAX)}$ in 1.3.1 is not exceeded. This equates to $R_{\theta JX}$ ≤ 154ºC/W for the 1N5802 - 1N5806 and $R_{\theta JX}$ ≤ 52ºC/W for the 1N5807 - 1N5811 in col. 9 of 1.3.2. Also, see application notes in 6.6.1 thru 6.6.4 herein.
(5) Derate at 8.33 mA/°C for $T_A$ above +55°C for 1.0 amp ratings.
(6) Derate at 25 mA/°C for $T_A$ above +55°C for 3.0 amp ratings.
(7) US suffix devices only.
* (8) PCB Size: 1.5” x 1.5”, FR4, 1.0 oz Copper.

* 1.4 Primary electrical characteristics. Unless otherwise specified, $T_A$ = +25°C.

| Types | $V_{BR}$ at 100 µA, pulse ≤ 20 ms | $I_{R1}$ at $V_R$ = $V_{RWM}$ $T_A$ = +25°C, pulsed $V_R$ ≤ 20 ms | $I_{R2}$ at $V_R$ = $V_{RWM}$ $T_A$ = +125°C, pulsed $V_R$ ≤ 20 ms |
|---|---|---|---|
| | V | µA | µA |
| 1N5802, US, URS, UMC | 60 | 1.0 | 175 |
| 1N5804, US, URS, UMC | 110 | 1.0 | 175 |
| 1N5806, US, URS, UMC | 160 | 1.0 | 175 |
| 1N5807, US, URS, UMC | 60 | 5.0 | 525 |
| 1N5809, US, URS, UMC | 110 | 5.0 | 525 |
| 1N5811, US, URS, UMC | 160 | 5.0 | 525 |

1.5 Part or Identifying Number (PIN). The PIN is in accordance with MIL-PRF-19500MIL-PRF-19500, and as specified herein. See 6.4 for PIN construction example and 6.5 for a list of available PINs.

1.5.1 JAN certification mark and quality level.

1.5.1.1 Quality level designators for encapsulated devices. The quality level designators for encapsulated devices that are applicable for this specification sheet from the lowest to the highest level are as follows: "JAN", "JANTX", "JANTXV", and "JANS".

1.5.1.2 Quality level designators for unencapsulated devices (die). The quality level designators for unencapsulated devices (die) that are applicable for this specification sheet from the lowest to the highest level are as follows: "JANHC" and "JANKC".

1.5.2 Device type. The designation system for the device types of semiconductors covered by this specification sheet are as follows.

1.5.2.1 First number and first letter symbols. The semiconductors of this specification sheet use the first number and letter symbols "1N".

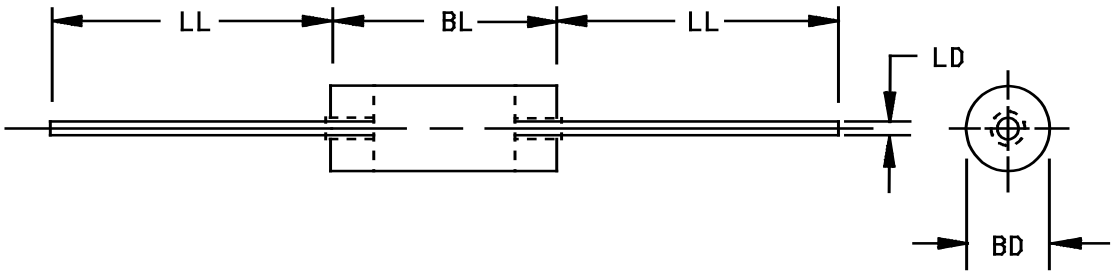
1.5.2.2 Second number symbols. The second number symbols for the semiconductors covered by this specification sheet are as follows: "5802", "5804", "5806", 5807", "5809", and "5811".

* 1.5.3 Suffix symbols. The following suffix symbols are incorporated in the PIN as applicable.

| | |
|---|---|
| | A blank suffix symbol indicates a through-hole mount axial package (see figure 1). |
| US | Indicates a surface mount package with square endcaps (see figure 2). |
| URS | Indicates a surface mount package with one round endcap and one square endcap (see figure 3). |
| UMC | Indicates a surface mount package (see figure 4). |

1.5.4 Lead finish. The lead finishes applicable to this specification sheet are listed on QPDSIS-19500.

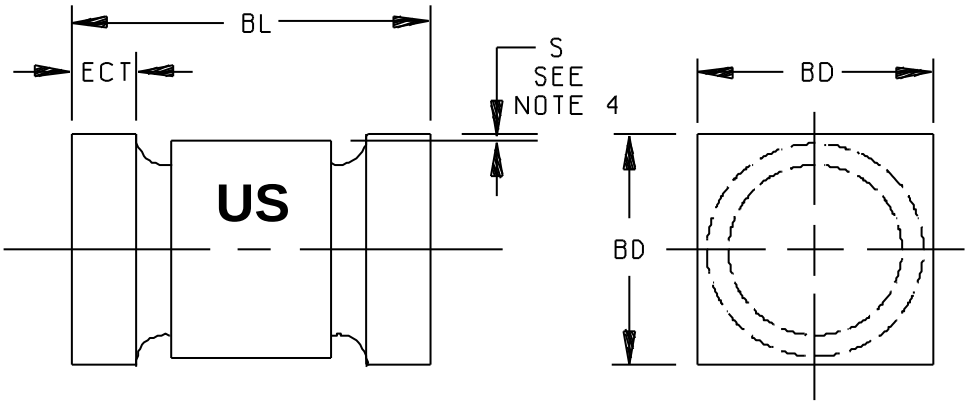
* 1.5.5 Die identifiers for unencapsulated devices (manufacturers and critical interface identifiers). The manufacturer die identifiers that are applicable for this specification sheet are "E", and "F" (see figure 5 through figure 7 and 6.5).




| Ltr. | Dimensions | | | | | | | | Notes |
|---|---|---|---|---|---|---|---|---|---|
| | 1N5802, 1N5804, 1N5806 | | | | 1N5807, 1N5809, 1N5811 | | | | |
| | Inches | | Millimeters | | Inches | | Millimeters | | |
| | Min | Max | Min | Max | Min | Max | Min | Max | |
| BD | .065 | .085 | 1.65 | 2.16 | .115 | .142 | 2.92 | 3.61 | 4 |
| BL | .125 | .250 | 3.18 | 6.35 | .130 | .300 | 3.30 | 7.62 | 3 |
| LD | .027 | .032 | 0.69 | 0.81 | .036 | .042 | 0.91 | 1.07 | 3 |
| LL | .700 | 1.30 | 17.78 | 33.02 | .900 | 1.30 | 22.86 | 33.02 | |

NOTES:
1. Dimensions are in inches.
2. Millimeters are given for general information only.
3. Dimension BL shall include the entire body including slugs and sections of the lead over which the diameter is uncontrolled. This uncontrolled area is defined as the zone between the edge of the diode body and extending .050 inch (1.27 mm) onto the leads.
4. Dimension BD shall be measured at the largest diameter.
5. In accordance with ASME Y14.5M, diameters are equivalent to $\phi$x symbology.

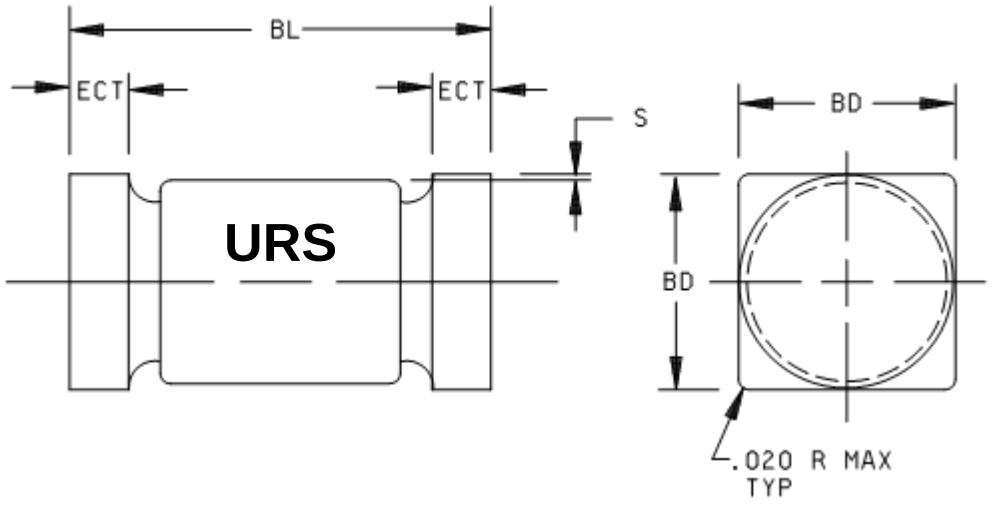
FIGURE 1. Physical dimensions.




| Ltr. | Dimensions | | | | | | | | Notes |
|---|---|---|---|---|---|---|---|---|---|
| | 1N5802US, 1N5804US, 1N5806US | | | | 1N5807US, 1N5809US, 1N5811US | | | | |
| | Inches | | Millimeters | | Inches | | Millimeters | | |
| | Min | Max | Min | Max | Min | Max | Min | Max | |
| BD | .091 | .103 | 2.31 | 2.62 | .137 | .148 | 3.48 | 3.76 | |
| BL | .168 | .200 | 4.27 | 5.08 | .200 | .225 | 5.08 | 5.72 | |
| ECT | .019 | .028 | 0.48 | 0.71 | .019 | .028 | 0.48 | 0.71 | |
| S | .003 | | 0.08 | | .003 | | 0.08 | | |

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. Cathode marking to be either in color band, three dots spaced equally, or a color dot on the face of the end tab.
6. Color dots will be .020 inch (0.51 mm) diameter minimum and those on the face of the end tab shall not lie within .020 inch (0.51 mm) of the mounting surface.
7. In accordance with ASME Y14.5M, diameters are equivalent to $\phi$x symbology.

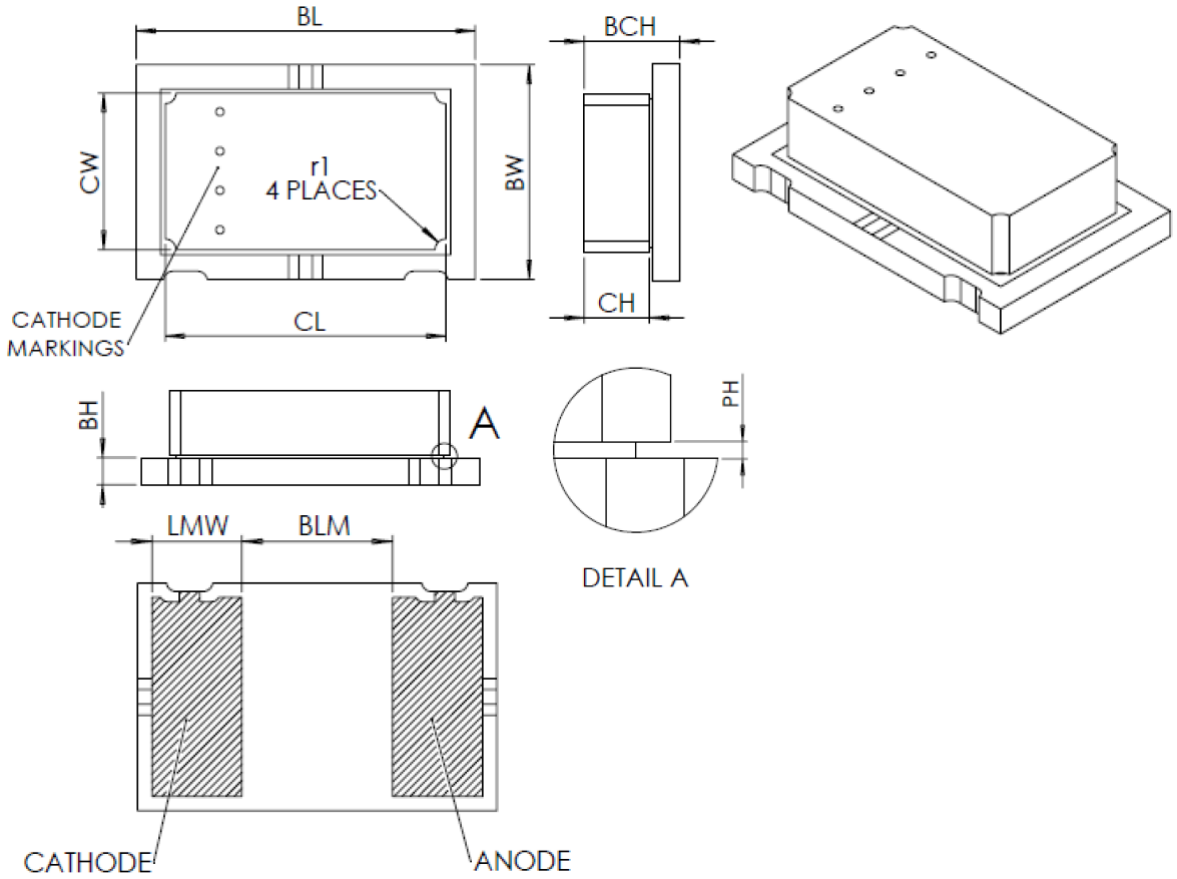
FIGURE 2. Physical dimensions of US surface mount family.




| Ltr. | Dimensions | | | | | | | | Notes |
|---|---|---|---|---|---|---|---|---|---|
| | 1N5802URS, 1N5804URS, 1N5806URS | | | | 1N5807URS, 1N5809URS, 1N5811URS | | | | |
| | Inches | | Millimeters | | Inches | | Millimeters | | |
| | Min | Max | Min | Max | Min | Max | Min | Max | |
| BD | .091 | .103 | 2.31 | 2.62 | .137 | .148 | 3.48 | 3.76 | 8 |
| BL | .168 | .200 | 4.27 | 5.08 | .200 | .225 | 5.08 | 5.72 | |
| ECT | .019 | .028 | 0.48 | 0.71 | .019 | .028 | 0.48 | 0.71 | 8 |
| S | .003 | | 0.08 | | .003 | | 0.08 | | |

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. Cathode marking to be either in color band, three dots spaced equally, or a color dot on the face of the end tab.
6. Color dots will be .020 inch (0.51 mm) diameter minimum and those on the face of the end tab shall not lie within .020 inch (0.51 mm) of the mounting surface.
7. In accordance with ASME Y14.5M, diameters are equivalent to $\phi$x symbology.
8. One endcap shall be square and the other end-cap shall be round.

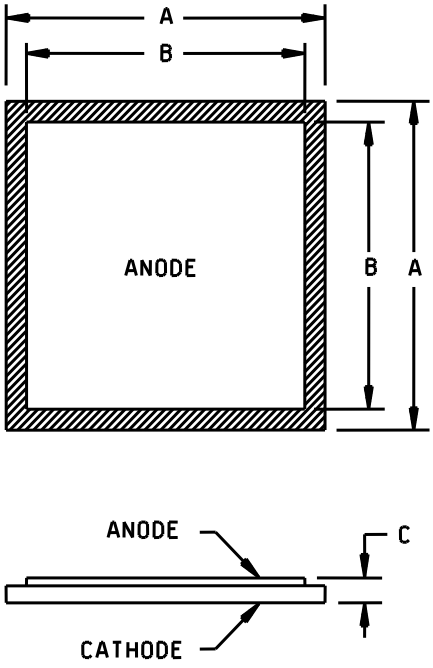
FIGURE 3. Physical dimensions of URS surface mount family.




| Ltr. | Dimensions | | | |
|---|---|---|---|---|
| | Inches | | Millimeters | |
| | Min | Max | Min | Max |
| CL | .199 | .211 | 5.06 | 5.36 |
| CW | .109 | .120 | 2.76 | 3.06 |
| BL | .246 | .250 | 6.25 | 6.35 |
| BW | .155 | .159 | 3.94 | 4.04 |
| r1 | .002 | .014 | 0.05 | 0.35 |
| BCH | .052 | .070 | 1.32 | 1.78 |
| CH | .033 | .045 | 0.84 | 1.14 |
| BH | .018 | .022 | 0.46 | 0.56 |
| BLM | .102 | .106 | 2.59 | 2.69 |
| LMW | .060 | .064 | 1.52 | 1.63 |
| PH | .001 | .003 | 0.03 | 0.07 |

NOTES:
1. Dimensions are in inches.
2. Millimeters are given for general information only.
3. Hatched areas denote metallized areas.
4. For design reference only.
5. In accordance with ASME Y14.5M, diameters are equivalent to ϕx symbology.

* FIGURE 4. Physical dimensions of UMC surface mount.

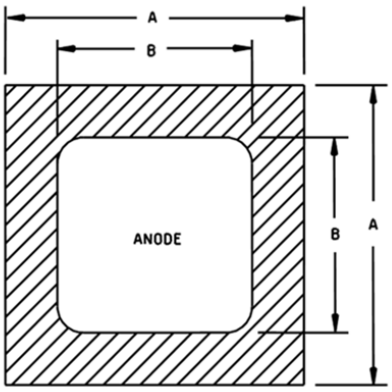



| Ltr | Dimensions 1N5802, 1N5804, 1N5806 | | | |
|---|---|---|---|---|
| | Inches | | Millimeters | |
| | Min | Max | Min | Max |
| A | .043 | .047 | 1.10 | 1.20 |
| B | .032 | .036 | 0.82 | 0.92 |
| C | .008 | .012 | 0.20 | 0.30 |

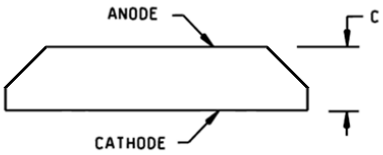
| Ltr | Dimensions 1N5807, 1N5809, 1N5811 | | | |
|---|---|---|---|---|
| | Inches | | Millimeters | |
| | Min | Max | Min | Max |
| A | .068 | .072 | 1.73 | 1.83 |
| B | .057 | .061 | 1.45 | 1.55 |
| C | .008 | .012 | 0.20 | 0.30 |

NOTES:
1. Dimensions are in inches.
2. Millimeters are given for general information only.
3. Anode is aluminum at 38,000 Å minimum.
4. Cathode is gold at 3,500 Å minimum.

FIGURE 5. JANC (E- version) die dimensions.




BACKSIDE IS CATHODE

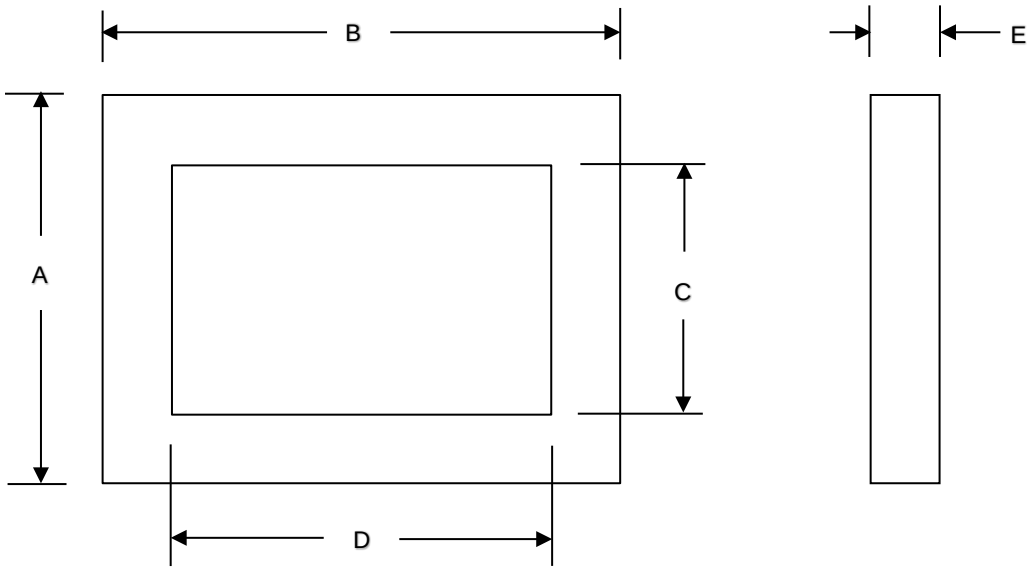



| Ltr | Dimensions 1N5802, 1N5804, 1N5806, | | | |
|---|---|---|---|---|
| | Inches | | Millimeters | |
| | Min | Max | Min | Max |
| A | .043 | .047 | 1.09 | 1.19 |
| B | .031 | .035 | 0.79 | 0.89 |
| C | .008 | .012 | 0.20 | 0.30 |

| Ltr | Dimensions 1N5807, 1N5809, 1N5811 | | | |
|---|---|---|---|---|
| | Inches | | Millimeters | |
| | Min | Max | Min | Max |
| A | .062 | .068 | 1.57 | 1.73 |
| B | .046 | .052 | 1.17 | 1.32 |
| C | .008 | .012 | 0.20 | 0.30 |

NOTES:
1. Dimensions are in inches.
2. Millimeter equivalents are given for general information only.
3. Anode is aluminum at 34,000 Å minimum.
4. Cathode is gold at 3,600 Å minimum.

FIGURE 6. JANC (F-version) die dimensions.




Backside is Cathode

| Ltr | Dimensions 1N5802, 1N5804, 1N5806 | | | |
|---|---|---|---|---|
| | Inches | | Millimeters | |
| | Min | Max | Min | Max |
| A | .040 | .050 | 1.016 | 1.270 |
| B | .055 | .065 | 1.397 | 1.651 |
| C | .024 | .034 | 0.610 | 0.864 |
| D | .039 | .049 | 0.991 | 1.245 |
| E | .003 | .013 | 0.076 | 0.330 |

NOTES:
1. Dimensions are in inches.
2. Millimeters are given for general information only.
3. Anode is aluminum at 30,000 Å ± 5,000 Å.
4. Cathode is gold at 6,500 Å ± 1,500 Å.

* FIGURE 7. JANC (G- version) die dimensions.

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 and as follows:

EC. . . . . End-cap.
$I_{(BR)}$ . . . . . .Current for testing breakdown voltage.
$V_{fr}$ . . . . . Forward recovery voltage.

* 3.4 Interface and physical dimensions. The interface and physical dimensions shall be as specified in MIL-PRF-19500, and figures 1 through 7 herein.

* 3.4.1 Diode construction. The axial devices shall be constructed utilizing non-cavity double plug construction with high temperature metallurgical bonding between both sides of the silicon die and terminal pins. Metallurgical bond shall be in accordance with the requirements of category I, appendix A, MIL-PRF-19500. No point contacts. Silver button dumet design is prohibited.

* 3.4.1.1 Surface mount. US and URS version devices shall be structurally identical to the non-surface mount devices except for lead terminations. The surface mount ‘URS’ version shall be considered structurally identical to the US version except for end-cap shape. One end-cap shall be square and the other end-cap shall be round. The UMC version devices shall be eutectically mounted and wire bonded.

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

3.5.1 Marking of US and URS versions. For US versions only, all marking may be omitted from the device except for the cathode marking. For URS versions only, all marking may be omitted from the device. All marking which is omitted from the body of the devices shall appear on the label of the initial container.

* 3.5.2 Polarity. The polarity shall be indicated with a contrasting color band to denote the cathode end. Alternately, for surface mount (US) devices, a minimum of three evenly spaced contrasting color dots around the periphery of the cathode end may be used. No color coding will be permitted. For URS surface mount parts only, cathode shall be connected to the round end-cap. For surface mount UMC devices polarity shall consist as a minimum of 4 contrasting dots marked on the lid.

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 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 and tables I, II, and III).

4.2 Qualification inspection. Qualification inspection shall be in accordance with MIL-PRF-19500 and as specified herein.

4.2.1 Group E inspection. Group E inspection shall be performed 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 that were not performed in the prior revision shall be performed on 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, JANTXV and JANTX 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.

| Screen | JANS level | JANTXV and JANTX level |
|---|---|---|
| (1) 3c | Thermal impedance (see 4.3.1) | Thermal impedance (see 4.3.1) |
| 9 | $I_{R1}$, $V_{FM1}$ or $V_{FM4}$. | Not required |
| 10 | Method 1038 of MIL-STD-750, condition A | Method 1038 of MIL-STD-750, condition A |
| 11 | Required<br>$I_{R1}$, $V_{FM1}$, or $V_{FM4}$; $\Delta I_{R1} \leq \pm 100$ percent of initial reading or ±150 nA dc (1N5802, 1N5804, 1N5806) or ±500 nA dc (1N5807, 1N5809, 1N5811), whichever is greater.<br>$\Delta V_{FM} \leq \pm 0.05$ V dc. | Required<br>$I_{R1}$, $V_{FM1}$, or $V_{FM4}$ |
| 12 | Required, see 4.3.2 | Required, see 4.3.2 |
| (2) 13 | Subgroups 2 and 3 of table I herein; $\Delta I_{R1} \leq$ ±100 percent of initial reading or ±150 nA dc (1N5802, 1N5804, 1N5806) or ±500 nA dc (1N5807, 1N5809, 1N5811), whichever is greater.<br>$\Delta V_{FM} \leq \pm 0.05$ V dc. Scope display evaluation (see 4.5.2) | Subgroup 2 of table I herein; $\Delta I_{R1} \leq \pm 100$ percent of initial reading or ± 250 nA dc (1N5802, 1N5804, 1N5806) or ±1 µA dc (1N5807, 1N5809, 1N5811), whichever is greater.<br>$\Delta V_{FM} \leq \pm 0.05$ V dc. Scope-display evaluation (see 4.5.2). |

(1) Shall be performed anytime after temperature cycling, screen 3a; TX and TXV levels do not need to be repeated in screening requirements.
(2) $Z_{\theta JX}$ is not required in screen 13, if already previously performed.

4.3.1 Thermal impedance. The thermal impedance measurements shall be performed in accordance with method 3101 of MIL-STD-750 using the guidelines in that method for determining $I_M$, $I_H$, $t_H$, and K factor where appropriate. Measurement delay time ($t_{MD}$) shall be 70 µs maximum. The limits will be statistically derived. See table E-IX of MIL-PRF-19500, group E, and table II, subgroup 4 herein.

4.3.2 Free air power burn-in conditions. Power burn-in conditions are as follows (see 4.5.3 and 4.5.3.1): $I_{O(min)} = I_{O1}$. $T_A = 55°C$ maximum. Test conditions shall be in accordance with method 1038 of MIL-STD-750, condition B. Adjust $I_O$ or $T_A$ to achieve the required $T_J$. $T_J = 135°C$ minimum. With approval of the qualifying activity and preparing activity, alternate burn-in criteria (hours, bias conditions, $T_J$, mounting conditions) may be used for JANTX and JANTXV quality levels. A justification demonstrating equivalence is required. In addition, the manufacturing site's burn-in data and performance history will be essential criteria for burn-in modification approval.

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.

4.4.1 Group A inspection. Group A inspection shall be conducted in accordance with MIL-PRF-19500, and table I herein. The $Z_{\theta JX}$ end-point shall be derived by the supplier and approved by the qualifying activity. This $Z_{\theta JX}$ end-point shall also be documented in the qualification report.

4.4.2 Group B inspection. Group B inspection shall be conducted in accordance with the tests and conditions specified for subgroup testing in appendix E, table E-VIa (JANS) and table E-VIb (JAN, JANTX, and JANTXV) of MIL-PRF-19500 and herein. See table III herein for delta measurements when applicable.

4.4.2.1 Quality level JANS (see table E-VIA of MIL-PRF-19500).

| | Subgroup | Method | Condition |
|---|---|---|---|
| | B3 | 4066 | Condition A, $I_{FSM}$ = rated $I_{FSM}$ (see col. 5 of 1.3.2); ten surges of 8.3 ms each at 1 minute intervals, superimposed on $I_{O1}$ (See col. 4 of 1.3.2), $V_{RWM}$ = rated, see col. 2 of 1.3.2. $T_A$=25°C. |
| | B4 | 1037 | $I_O$ = $I_{O1}$ rated minimum (see 1.3.2); $V_R$ = rated $V_{RWM}$ (see 1.3.2 and 4.5.3 and 4.5.3.1); 2,000 cycles. |
| * | B5 | 1027 | $I_O$ = $I_{O1}$ rated minimum (see col. 4 of 1.3.2); apply $V_R$ = rated $V_{RWM}$ (see col. 2 of 1.3.2, and 4.5.3 and 4.5.3.1) adjust $I_O$ or $T_A$ to achieve $T_J$ = 175°C minimum; n = 45, c = 0; t = 1,000 hours; f = 50 - 60 Hz. For irradiated devices, include $t_{rr}$ as an end-point measurement. |
| | B8 | 4065 | Peak reverse power: For 1N5802 - 1N5806, $P_{RM}$ ≥ 318 W for square wave in accordance with TM 4065 ($P_{RM}$ ≥ 500 W for half sine-wave). For 1N5807 - 1N5811, $P_{RM}$ ≥ 636 W for square wave in accordance with TM 4065 ($P_{RM}$ ≥ 1,000 W for half sine-wave). Test shall be performed on each sublot; sampling plan: n = 10, c = 0, electrical end-points, see table I, subgroup 2 herein. |

4.4.2.2 Quality levels JAN, JANTX and JANTXV (see table E-VIB of MIL-PRF-19500).

| | Subgroup | Method | Condition |
|---|---|---|---|
| * | B3 | 1027 | $I_O$ = $I_{O1}$ rated minimum (see col. 4 of 1.3.2); adjust $I_O$ or $T_A$ to achieve $T_J$ = 150°C minimum, apply $V_R$ = rated $V_{RWM}$ (see col. 2 of 1.3.2), f = 50 - 60 Hz (see 4.5.3 and 4.5.3.1). For irradiated devices, include $t_{rr}$ as an end-point measurement. |

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. See table III herein for delta measurements when applicable.

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

| Subgroup | Method | Condition |
|---|---|---|
| * C2 | 2036 | Axial devices − Tension: Condition A, 8 pounds (silver leads), 12 pounds (copper leads) (5.44 Kg), t = 15s for 1N5802, 1N5804, 1N5806. Condition A, 12 pounds (silver leads), 20 pounds (copper leads) (9.07 Kg), t = 15s for - 1N5807, 1N5809, 1N5811. Fatigue: Condition E for all types, 2 pounds (0.91 Kg). (Lead fatigue is not applicable to US diodes). |
| * C2 | 2038 | US, URS devices – Tension: Condition B, 8 pounds (silver tabs), 12 pounds (copper leads) (5.44 Kg), t = 15s for 1N5802US, 1N5804US, 1N5806US. Condition B, 12 pounds (silver tabs), 20 pounds (copper leads) (9.07 Kg), t = 15s for 1N5807US, 1N5809US, 1N5811US. Test method 2038 not required for UMC devices. |
| * C5 | 4081 | $R_{\theta JL}$(maximum) see col. 8 of 1.3.2 and 4.3.1 herein. L = .375 inch (9.53 mm). For surface mount devices (US version), $R_{\theta JEC}$, see col. 9 of 1.3.2 and 4.3.1 herein. For surface mount devices (UMC version) $R_{\theta JA}$ see col. 10 and $R_{\theta JC(PCB)}$ see col. 11 of 1.3 and 4.3.1 herein. |
| * C6 | 1027 | $I_O = I_{O1}$ rated minimum (see col. 4 of 1.3.2); adjust $I_O$ or $T_A$ to achieve $T_J$ = 150° C minimum, apply $V_R$ = rated $V_{RWM}$ (see col. 2 of 1.3.2), f = 50 - 60 Hz (see 4.5.3 and 4.5.3.1). For irradiated devices, include $t_{rr}$ as an end-point measurement. |

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 specified herein. See table III herein for delta measurements when applicable.

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 section 4 of MIL-STD-750.

4.5.2 Scope display evaluation. Scope display evaluation shall be stable in accordance with method 4023 of MIL-STD-750, condition A. 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 curve tracer. The reverse current ($I_{BR}$) over the knee shall be 500 μA peak.

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 Burn-in. The use of a current limiting or ballast resistor is permitted provided that each DUT still sees the $I_O$ and that the minimum required voltage, where applicable, is maintained through-out the burn-in period. Use method 3100 of MIL-STD-750 to measure $T_J$. $T_J$ = 135°C minimum for screening and 150ºC minimum for life tests. $T_A$ = 55°C max

* 4.5.4 Thermal resistance. Thermal resistance measurement shall be performed in accordance with method 4081 of MIL-STD-750 using the guidelines in that method for determining $I_M$, $I_H$, and $t_H$. See table E-IX of MIL-PRF-19500, subgroup 4, and figures 6, 7, 8, and 9, 10 and 11 herein. Forced moving air or draft shall not be permitted across the devices during test.

TABLE I. Group A inspection.

| Inspection 1/ | MIL-STD-750 | | Symbol | Limit | | Unit |
|---|---|---|---|---|---|---|
| | Method | Conditions | | Min | Max | |
| Subgroup 1 | | | | | | |
| Visual and mechanical examination | 2071 | | | | | |
| Subgroup 2 | | | | | | |
| Thermal impedance 2/ | 3101 | See 4.3.1 | $Z_{\theta JX}$ | | | |
| 1N5802, US, URS, UMC<br>1N5804, US, URS, UMC<br>1N5806, US, URS, UMC | | | | | | °C/W |
| 1N5807, US, URS, UMC<br>1N5809, US, URS, UMC<br>1N5811, US, URS, UMC | | | | | | °C/W |
| Forward voltage | 4011 | Condition B, Duty cycle ≤ 2 percent (pulsed see 4.5.1); $t_p$ = 8.3 ms (max) | | | | |
| 1N5802, US, URS, UMC<br>1N5804, US, URS, UMC<br>1N5806, US, URS, UMC | | $I_{FM}$ = 1.0 A | $V_{FM1}$ | | 0.875 | V |
| 1N5802, US, URS, UMC<br>1N5804, US, URS, UMC<br>1N5806, US, URS, UMC | | $I_{FM}$ = 2.5 A | $V_{FM2}$ | | 0.975 | V |
| Forward voltage | 4011 | Condition B, Duty cycle ≤ 2 percent (pulsed see 4.5.1); $t_p$ = 8.3 ms (max) | | | | |
| 1N5807, US, URS, UMC<br>1N5809, US, URS, UMC<br>1N5811, US, URS, UMC | | $I_{FM}$ = 3.0 A | $V_{FM3}$ | | 0.865 | V |
| 1N5807, US, URS, UMC<br>1N5809, US, URS, UMC<br>1N5811, US, URS, UMC | | $I_{FM}$ = 4.0 A | $V_{FM4}$ | | 0.875 | V |
| 1N5807, US, URS, UMC<br>1N5809, US, URS, UMC<br>1N5811, US, URS, UMC | | $I_{FM}$ = 6.0 A | $V_{FM5}$ | | 0.925 | V |

See footnotes at end of table.

TABLE I. Group A inspection - Continued.

| Inspection 1/ | MIL-STD-750 | | Symbol | Limit | | Unit |
|---|---|---|---|---|---|---|
| | Method | Conditions | | Min | Max | |
| Subgroup 2 - continued | | | | | | |
| Reverse current | 4016 | DC or equivalent pulse method | $I_{R1}$ | | | |
| 1N5802, US, URS, UMC | | $V_R$ = 50 V | | | 1.0 | µA |
| 1N5804, US, URS, UMC | | $V_R$ = 100 V | | | 1.0 | µA |
| 1N5806, US, URS, UMC | | $V_R$ = 150 V | | | 1.0 | µA |
| 1N5807, US, URS, UMC | | $V_R$ = 50 V | | | 5.0 | µA |
| 1N5809, US, URS, UMC | | $V_R$ = 100 V | | | 5.0 | µA |
| 1N5811, US, URS, UMC | | $V_R$ = 150 V | | | 5.0 | µA |
| Breakdown voltage | 4021 | $I_{(BR)}$ = 100 µA pulse ≤20 ms | $V_{(BR)1}$ | | | |
| 1N5802, US, URS, UMC<br>1N5807, US, URS, UMC | | | | 60 | | V |
| 1N5804, US, URS, UMC<br>1N5809, US, URS, UMC | | | | 110 | | V |
| 1N5806, US, URS, UMC<br>1N5811, US, URS, UMC | | | | 160 | | V |
| Subgroup 3 | | | | | | |
| High temperature operation: | | $T_A$ = +125°C minimum. | | | | |
| Reverse current | 4016 | DC or equivalent pulse method | $I_{R2}$ | | | |
| 1N5802, US, URS, UMC | | $V_R$ = 50 V | | | 175 | µA |
| 1N5804, US, URS, UMC | | $V_R$ = 100 V | | | 175 | µA |
| 1N5806, US, URS, UMC | | $V_R$ = 150 V | | | 175 | µA |
| 1N5807, US, URS, UMC | | $V_R$ = 50 V | | | 525 | µA |
| 1N5809, US, URS, UMC | | $V_R$ = 100 V | | | 525 | µA |
| 1N5811, US, URS, UMC | | $V_R$ = 150 V | | | 525 | µA |

See footnotes at end of table.

TABLE I. Group A inspection - Continued.

| Inspection 1/ | MIL-STD-750 | | Symbol | Limit | | Unit |
|---|---|---|---|---|---|---|
| | Method | Conditions | | Min | Max | |
| Subgroup 3 - continued | | | | | | |
| Forward voltage | 4011 | Condition B, Duty cycle ≤ 2 percent (pulsed see 4.5.1); $t_p$ = 8.3 ms (max) | | | | |
| 1N5802, US, URS, UMC<br>1N5804, US, URS, UMC<br>1N5806, US, URS, UMC | | $I_{FM}$ = 1.0 A | $V_{FM6}$ | | 0.800 | V |
| 1N5807, US, URS, UMC<br>1N5809, US, URS, UMC<br>1N5811, US, URS, UMC | | $I_{FM}$ = 4.0 A | $V_{FM7}$ | | 0.800 | V |
| Low-temperature operation: | | $T_A$ = -65°C minimum. | | | | |
| Forward voltage | 4011 | Condition B, Duty cycle ≤ 2 percent (pulsed see 4.5.1); $t_p$ = 8.3 ms (max) | $V_{FM8}$ | | | |
| 1N5802, US, URS, UMC<br>1N5804, US, URS, UMC<br>1N5806, US, URS, UMC | | $I_{FM}$ = 1.0 A | | | 1.075 | V |
| 1N5807, US, URS, UMC<br>1N5809, US, URS, UMC<br>1N5811, US, URS, UMC | | $I_{FM}$ = 4.0 A | | | 1.075 | V |
| Breakdown voltage | 4021 | $I_{(BR)}$ = 100 μA dc | $V_{(BR)2}$ | | | |
| 1N5802, US, URS, UMC<br>1N5807, US, URS, UMC | | | | 50 | | V dc |
| 1N5804, US, URS, UMC<br>1N5809, US, URS, UMC | | | | 100 | | V dc |
| 1N5806, US, URS, UMC<br>1N5811, US, URS, UMC | | | | 150 | | V dc |

See footnotes at end of table.

TABLE I. Group A inspection - Continued.

| Inspection 1/ | MIL-STD-750 | | Symbol | Limit | | Unit |
|---|---|---|---|---|---|---|
| | Method | Conditions | | Min | Max | |
| Subgroup 4 | | | | | | |
| Reverse recovery time | 4031 | Condition B | $t_{rr}$ | | | |
| 1N5802, US, URS, UMC<br>1N5804, US, URS, UMC<br>1N5806, US, URS, UMC | | $I_F = I_{RM} = 0.5$ A<br>$i_{(REC)} = 0.05$ A<br>di/dt = 65 A/μs (min) | | | 25 | ns |
| 1N5807, US, URS, UMC<br>1N5809, US, URS, UMC<br>1N5811, US, URS, UMC | | $I_F = I_{RM} = 1.0$ A<br>$i_{(REC)} = 0.1$ A<br>di/dt = 100 A/μs (min) | | | 30 | ns |
| Capacitance | 4001 | $V_R = 10$ V; f = 1 Mhz;<br>$V_{sig} = 50$ mV (p-p) | $C_J$ | | | |
| 1N5802, US, URS, UMC<br>1N5804, US, URS, UMC<br>1N5806, US, URS, UMC | | | | | 25 | pF |
| 1N5807, US, URS, UMC<br>1N5809, US, URS, UMC<br>1N5811, US, URS, UMC | | | | | 60 | pF |
| Forward recovery voltage | 4026 | $t_r = 8$ ns | $V_{(peak)}$ | | | |
| 1N5802, US, URS, UMC<br>1N5804, US, URS, UMC<br>1N5806, US, URS, UMC | | $I_F = 250$ mA | | | 2.2 | V |
| 1N5807, US, URS, UMC<br>1N5809, US, URS, UMC<br>1N5811, US, URS, UMC | | $I_F = 500$ mA | | | 2.2 | V |
| Forward recovery time | 4026 | $t_p \geq 20$ ns, $t_r = 8$ ns, the test is measured at $V_{FR} = 1.1 \times V_F$ | $t_{fr}$ | | | |
| 1N5802, US, URS, UMC<br>1N5804, US, URS, UMC<br>1N5806, US, URS, UMC | | $I_F = 250$ mA | | | 15 | ns |
| 1N5807, US, URS, UMC<br>1N5809, US, URS, UMC<br>1N5811, US, URS, UMC | | $I_F = 500$ mA | | | 15 | ns |
| Scope display evaluation | 4023 | See 4.5.2, n = 116, c = 0 | | | | |

See footnotes at end of table.

TABLE I. Group A inspection - Continued.

| Inspection 1/ | MIL-STD-750 | | Symbol | Limit | | Unit |
|---|---|---|---|---|---|---|
| | Method | Conditions | | Min | Max | |
| Subgroup 5 | | | | | | |
| Not applicable | | | | | | |
| Subgroup 6 | | | | | | |
| Forward surge | 4066 | Condition A, $I_{FSM}$ = rated (see 1.3.2); ten surges of 8.3 ms each at 1 minute intervals superimposed on $I_O = I_{O1}$ rated (see 1.3.2); $V_{RWM}$ = rated (see 1.3.2); $T_A$ = + 25°C. | | | | |
| Electrical measurements | | See table I, subgroup 2 except $Z_{\theta JX}$. | | | | |
| Subgroup 7 | | | | | | |
| Not applicable | | | | | | |

1/ For sampling plan, see MIL-PRF-19500.
2/ Not applicable to JANHC and JANKC devices. This test required for the following end-point measurements only:
Group B, subgroups 3, 4 and 5 (JANS).
Group B, subgroups 2 and 3 (JAN, JANTX, JANTXV).
Group C, subgroups 2 and 6.
Group E, subgroup 1.

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

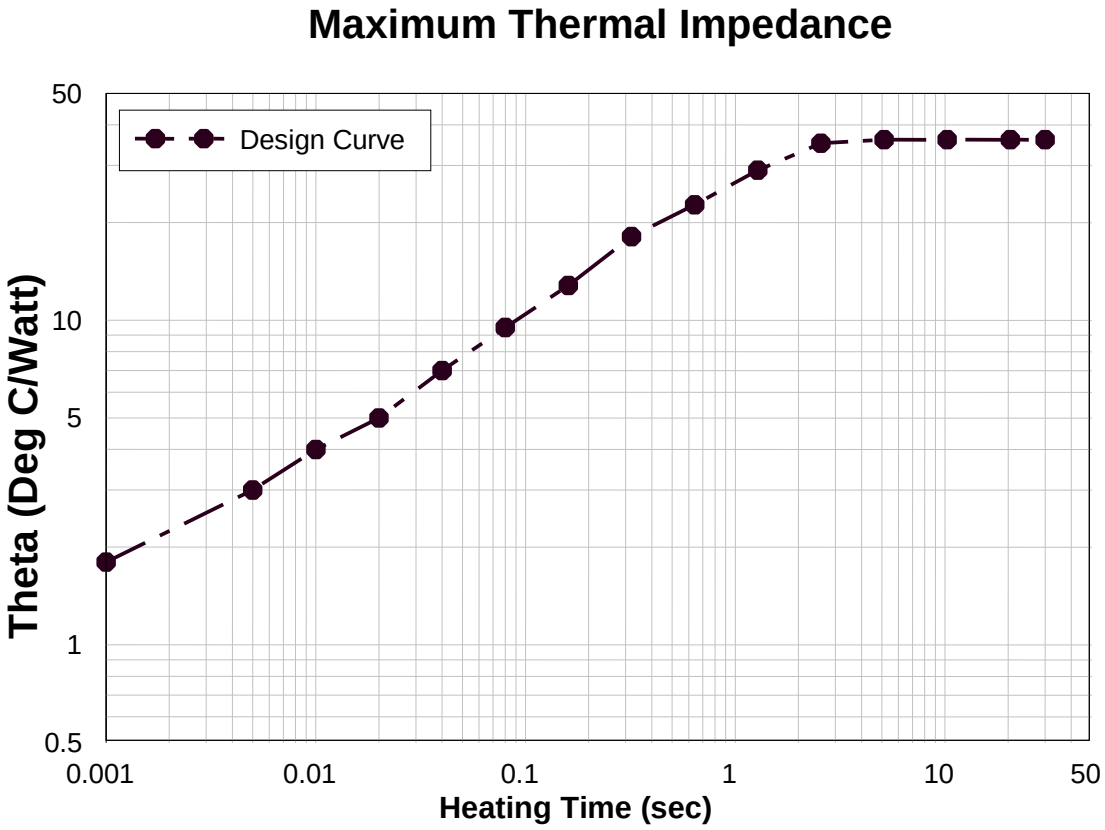
| | Inspection | MIL-STD-750 | | Sampling plan |
|---|---|---|---|---|
| | | Method | Conditions | |
| | Subgroup 1 | | | 45 devices c = 0 |
| * | Thermal shock (liquid to liquid) | 1056 | 20 cycles, except low temperature shall be achieved using liquid nitrogen (-195°C). Perform a visual for cracked glass. (Not applicable for UMC package.). | |
| | Temperature cycling (air to air) | 1051 | -65°C to +175°C, 500 cycles. | |
| | Hermetic seal 1/ | 1071 | | |
| | Electrical measurement | | See table I, subgroup 2 and table III, steps 1 and 2. | |
| | Subgroup 2 | | | 45 devices c = 0 |
| | Steady-state dc blocking life | 1048 | t = 1,000 hours; $T_A$ = +150°C; $V_R$ dc = 80 - 85 percent rated $V_{RWM}$ (see 1.3.2). | |
| | Electrical measurement | | See table I, subgroup 2 herein, except $Z_{\theta JX}$ need not be performed, and table III, steps 1 and 2 herein. For irradiated devices, include $t_{rr}$ as an end-point measurement. | |
| | Subgroup 4 | | | Sample size N/A |
| | Thermal impedance curves | | See MIL-PRF-19500. | |
| | Subgroup 5 | | | |
| | Not applicable | | | |
| | Subgroup 8 | | | n = 45 |
| | Peak reverse power | 4065 | 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 measurement | | 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. | |
| | Subgroup 9 | | | n = 45 |
| * | Resistance to glass cracking | 1057 | Step stress to destruction by increasing cycles or up to a maximum of 25 cycles. Not applicable for UMC package. | |
| | Subgroup 10 | | | 22 devices c = 0 |
| | Forward surge | 4066 | Condition A, $I_{FSM}$ = rated (see 1.3.2); ten surges of 8.3 ms each at 1 minute intervals superimposed on $I_O$ = $I_{O1}$ rated (see 1.3.2); $V_{RWM}$ = rated (see 1.3.2); $T_A$ = + 25°C. | |
| | Electrical measurement | | See table I, subgroup 2. | |

1/ Opaque glass double plug non-cavity axial lead diodes may use test method 2068 in lieu of test method 1071 of MIL-STD-750.

TABLE III. Group A, B, C, and E delta requirements. 1/ 2/ 3/ 4/ 5/

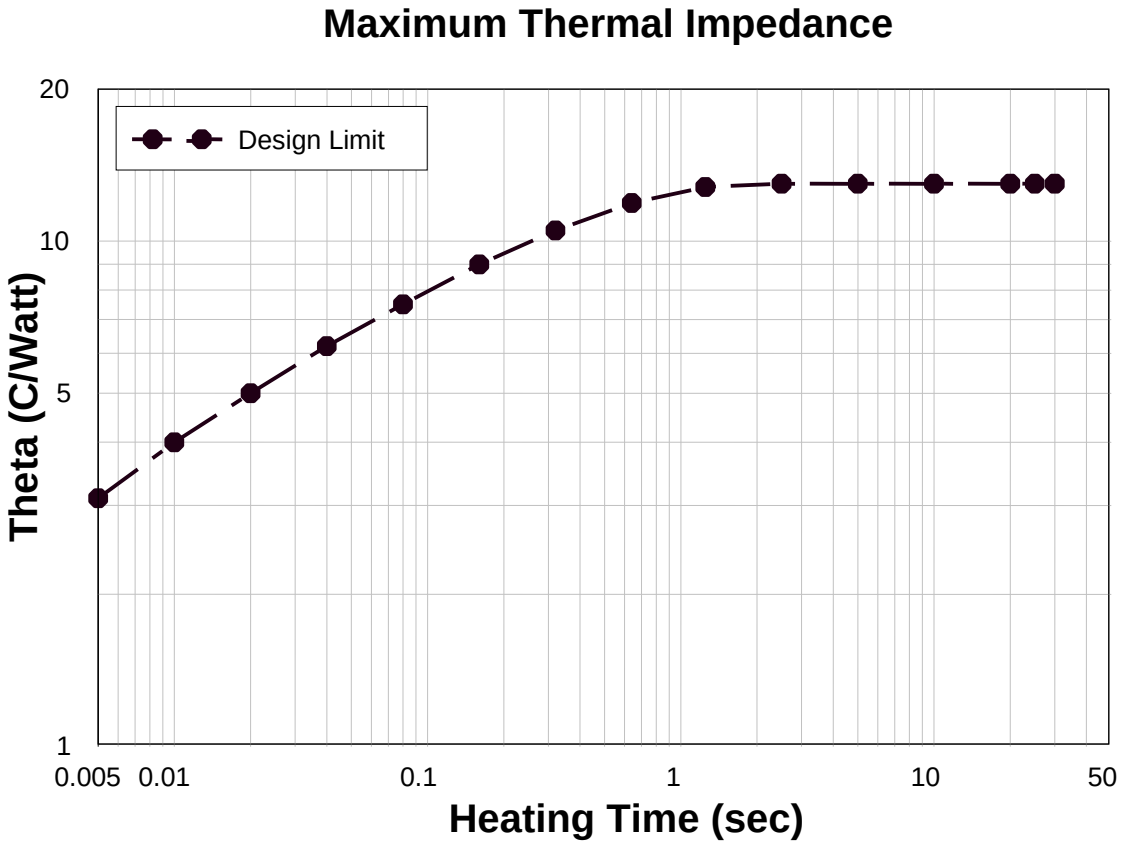
| Step | Inspection | MIL-STD-750 | | Symbol | Limit | Unit |
|---|---|---|---|---|---|---|
| | | Method | Conditions | | | |
| 1. | Forward voltage | 4011 | Condition B, Duty cycle ≤ 2 percent (pulsed see 4.5.1); $t_p$ = 8.3 ms (max) | | | |
| | 1N5802, US, URS, UMC<br>1N5804, US, URS, UMC<br>1N5806, US, URS, UMC | | $I_{FM}$ = 1.0 A(pk) | $\Delta V_{FM1}$ | ±50 mV dc change from initial value | |
| | 1N5807, US, URS, UMC<br>1N5809, US, URS, UMC<br>1N5811, US, URS, UMC | | $I_{FM}$ = 4.0 A(pk) | $\Delta V_{FM4}$ | ±50 mV dc change from initial value | |
| 2. | Reverse current | 4016 | DC method | $\Delta I_{R1}$ | | |
| | 1N5802, US, URS, UMC<br>1N5804, US, URS, UMC<br>1N5806, US, URS, UMC | | $V_R$ = 50 V dc<br>$V_R$ = 100 V dc<br>$V_R$ = 150 V dc | | 100-percent or ±150 nA dc change from initial reading, whichever is greater. | |
| | 1N5807, US, URS, UMC<br>1N5809, US, URS, UMC<br>1N5811, US, URS, UMC | | $V_R$ = 50 V dc<br>$V_R$ = 100 V dc<br>$V_R$ = 150 V dc | | 100-percent or ±500 nA dc change from initial reading, whichever is greater. | |

1/ Devices which exceed the table I limits for this test shall not be accepted.
2/ The electrical measurements for group B inspections in table E-VIa (JANS) of MIL-PRF-19500 are as follows: Subgroups 4 and 5, see table III herein, steps 1 and 2.
3/ The electrical measurements for group B inspections in table E-VIb (JAN, JANTX, and JANTXV) of MIL-PRF-19500 are as follows: Subgroup 3, see table III herein, steps 1 and 2.
4/ The electrical measurements for group C inspections in table E-VII (all quality levels) of MIL-PRF-19500 are as follows: Subgroup 6, see table III herein, steps 1 and 2.
5/ The electrical measurements for group E inspections in table E-IX of MIL-PRF-19500 are as follows: Subgroups 1 and 2, see table III herein, steps 1 and 2.



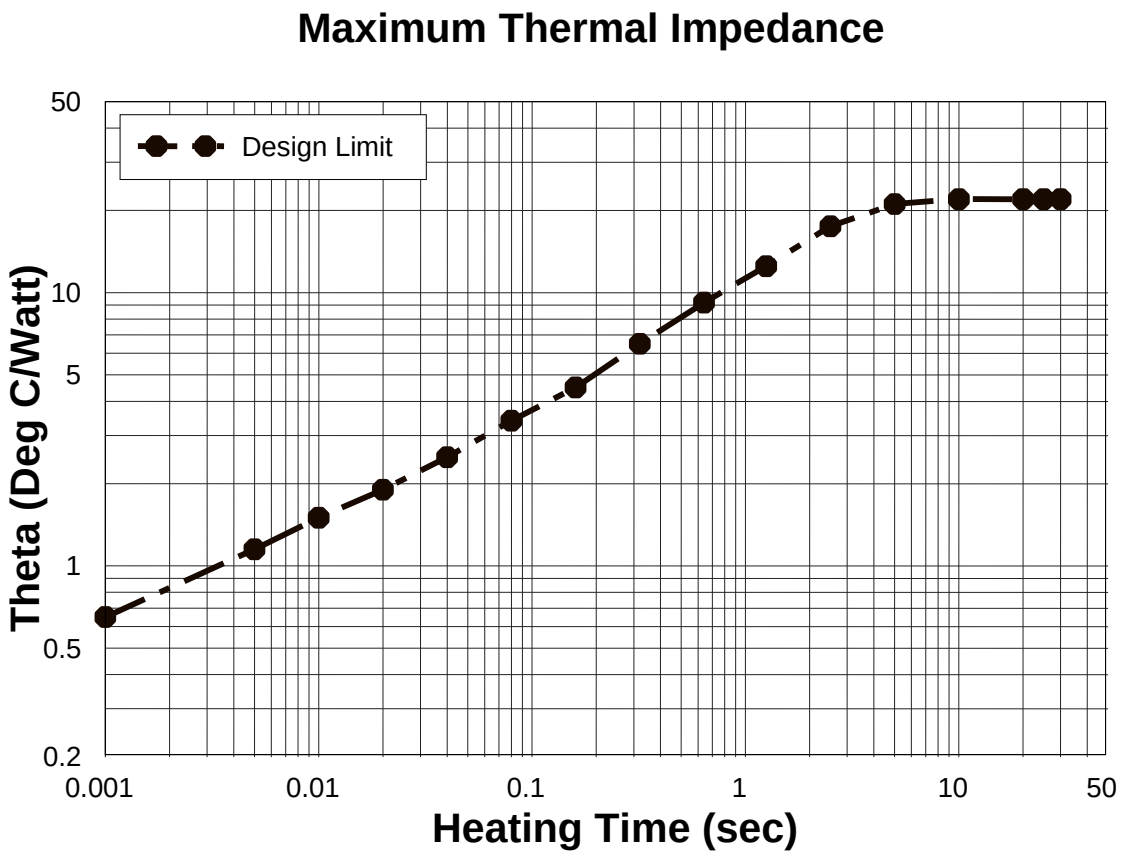

$Z_{\theta JX}$ = 4°C/W at 10 ms.

FIGURE 6. Thermal impedance curve, $R_{\theta JL}$ = 36°C/W for 1N5802, 1N5804, and 1N5806.



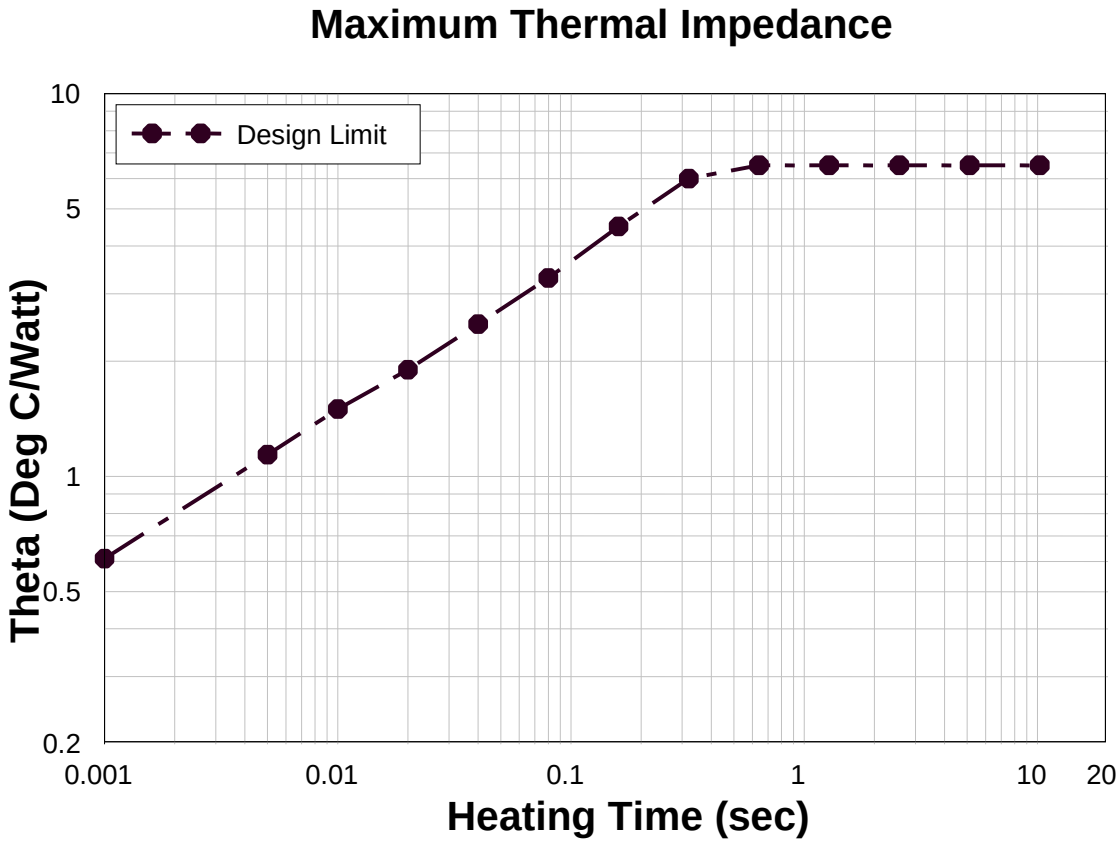

$Z_{\theta JX}$ = 4°C/W at 10 ms.

FIGURE 7. Thermal impedance curve $R_{\theta JEC}$ = 13°C/W for 1N5802US, 1N5804US, and 1N5806US.



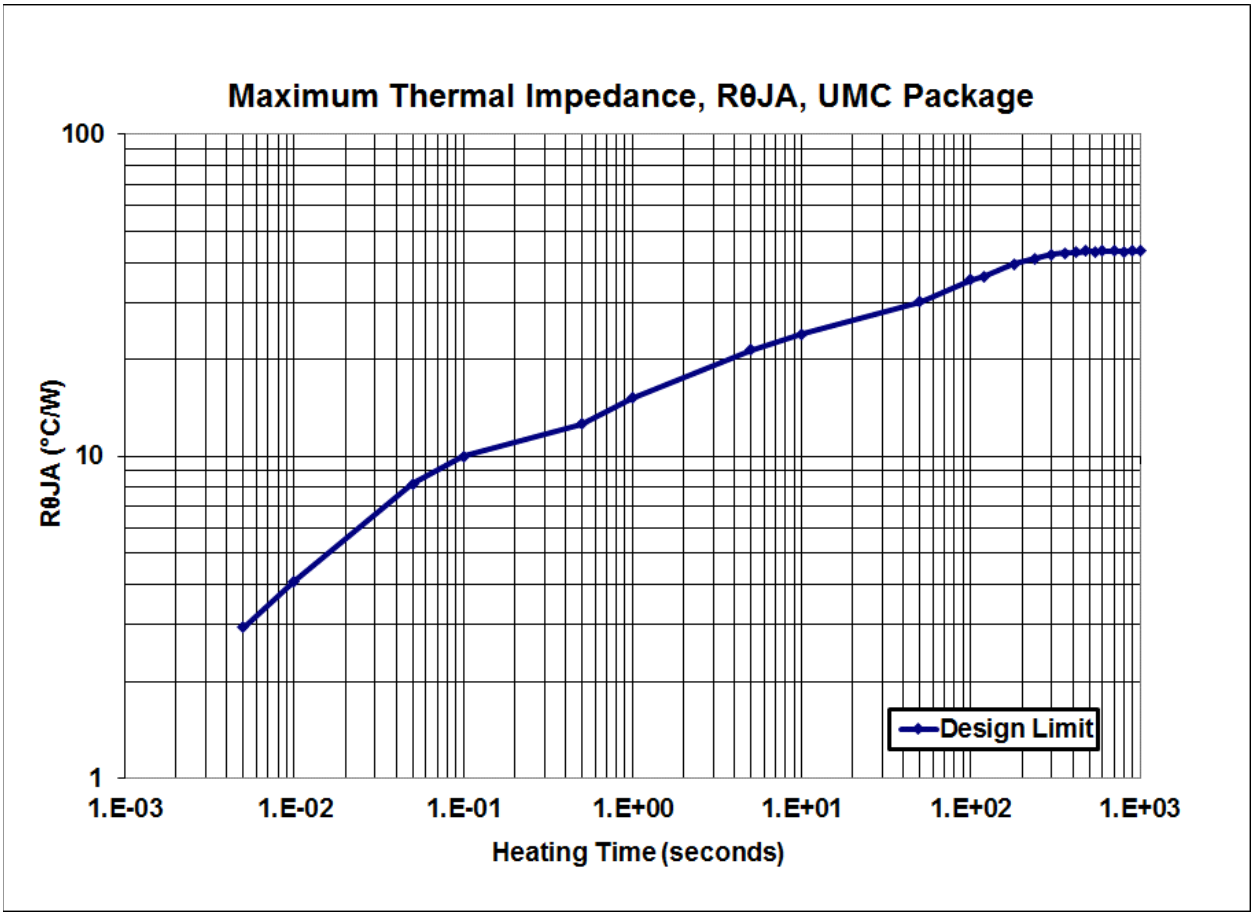

$Z_{\theta JX}$ = 1.5°C/W at 10 ms.

FIGURE 8. Thermal impedance curve $R_{\theta JL}$ = 22°C/W for 1N5807, 1N5809, and 1N5811.




$Z_{\theta JX}$ = 1.5°C/W at 10 ms.

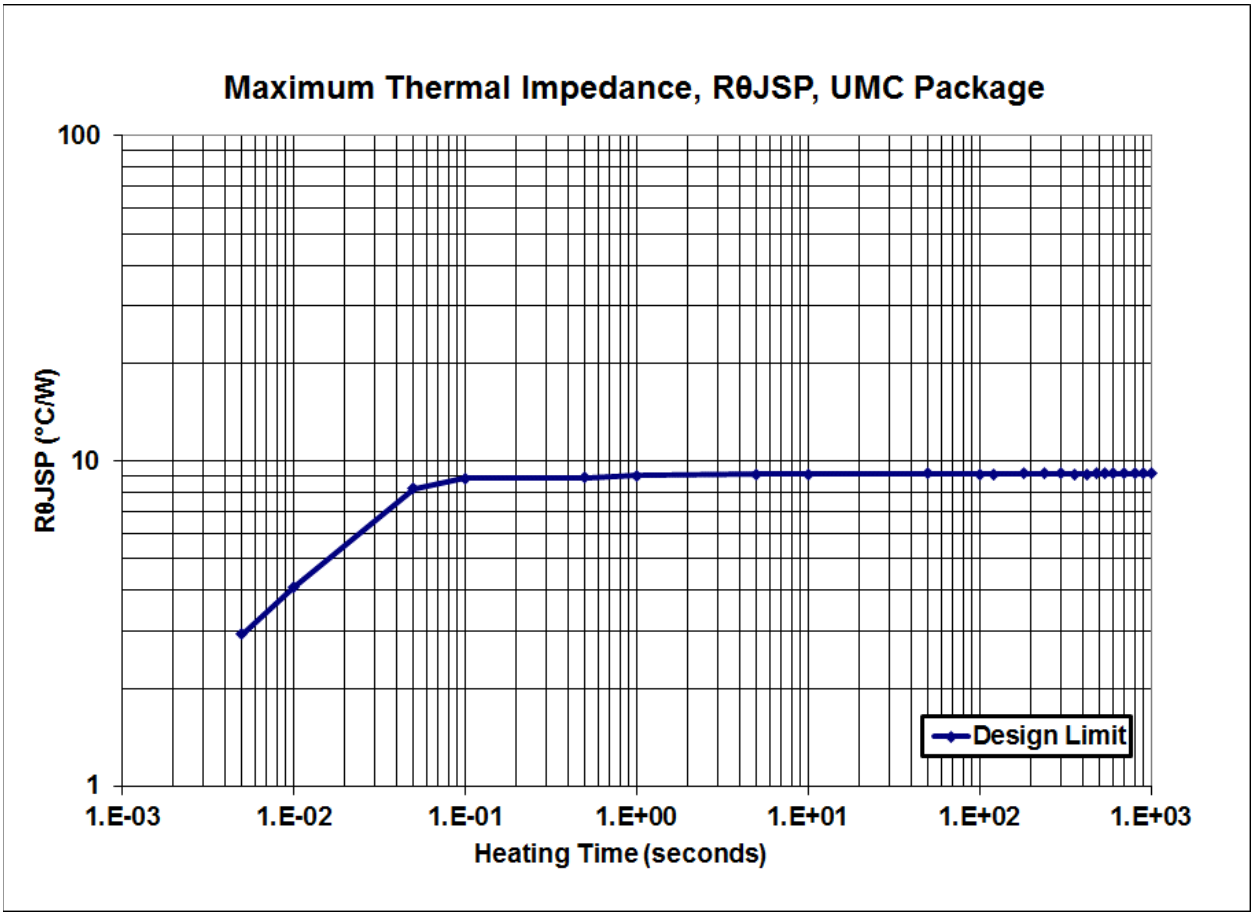
FIGURE 9. Thermal impedance curve $R_{\theta JEC}$ = 6.5°C/W for 1N5807US, 1N5809US, and 1N5811US.




$Z_{\theta JX}$ = 4.08°C/W at 10 ms.

| | |
|---|---|
| PCB Size: | 1.5” x 1.5” |
| Type: | FR4 |
| Copper size: | 1.0 oz |

* FIGURE 10. Thermal impedance curve $R_{\theta JA}$ = 44°C/W.




$Z_{\theta JX}$ = 4.08°C/W at 10 ms.

| | |
|---|---|
| PCB Size: | 1.5” x 1.5” |
| Type: | FR4 |
| Copper size: | 1.0 oz |

* FIGURE 11. Thermal impedance curve $R_{\theta JC(PCB)}$ = 10°C/W.

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 3.4.2).

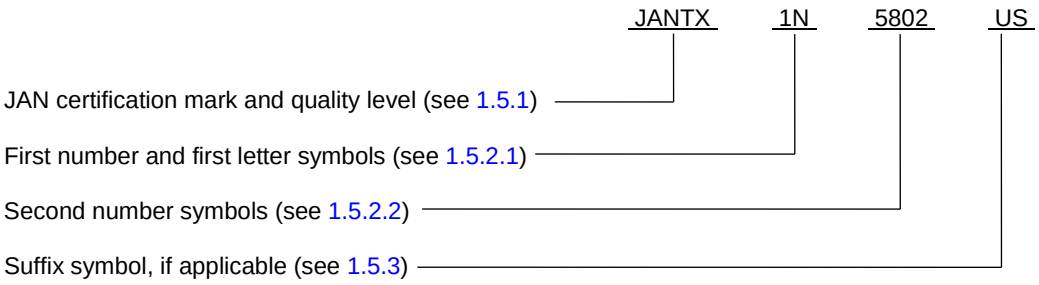
* d. The complete PIN, see 1.5 and 6.4.

* e. For die acquisition, the JANHC or JANKC letter version shall be specified (see figures 5 through 7).

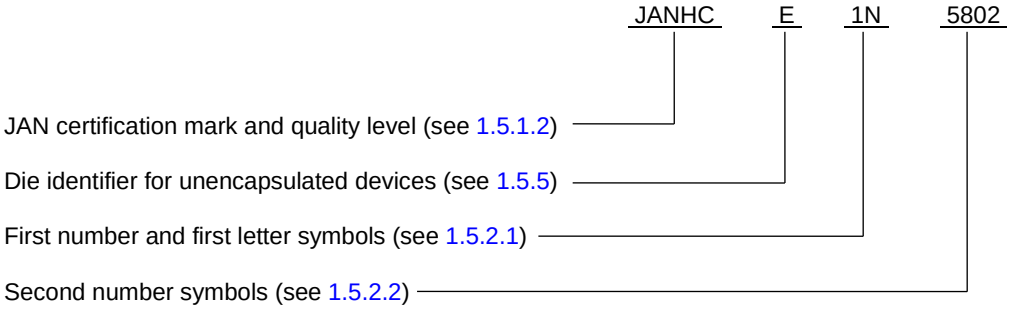
6.3 Qualification. With respect to products requiring qualification, awards will be made only for products which are, at the time of award of contract, qualified for inclusion in Qualified Manufacturers List (QML 19500) whether or not such products have actually been so listed by that date. The attention 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 PIN construction example.

6.4.1 Encapsulated devices The PINs for encapsulated devices are constructed using the following form.




* 6.4.2 Un-encapsulated devices. The PINs for un-encapsulated devices are constructed using the following form.



6.5 List of PINs. The following is a list of possible PINs available on this specification sheet.

| PINs for devices in a axial package | | | |
|---|---|---|---|
| JAN1N5802 | JANTX1N5802 | JANTXV1N5802 | JANS1N5802 |
| JAN1N5804 | JANTX1N5804 | JANTXV1N5804 | JANS1N5804 |
| JAN1N5806 | JANTX1N5806 | JANTXV1N5806 | JANS1N5806 |
| JAN1N5807 | JANTX1N5807 | JANTXV1N5807 | JANS1N5807 |
| JAN1N5809 | JANTX1N5809 | JANTXV1N5809 | JANS1N5809 |
| JAN1N5811 | JANTX1N5811 | JANTXV1N5811 | JANS1N5811 |

| PINs for devices in a US package | | | |
|---|---|---|---|
| JAN1N5802US | JANTX1N5802US | JANTXV1N5802US | JANS1N5802US |
| JAN1N5804US | JANTX1N5804US | JANTXV1N5804US | JANS1N5804US |
| JAN1N5806US | JANTX1N5806US | JANTXV1N5806US | JANS1N5806US |
| JAN1N5807US | JANTX1N5807US | JANTXV1N5807US | JANS1N5807US |
| JAN1N5809US | JANTX1N5809US | JANTXV1N5809US | JANS1N5809US |
| JAN1N5811US | JANTX1N5811US | JANTXV1N5811US | JANS1N5811US |

| PINs for devices in a URS package | | | |
|---|---|---|---|
| JAN1N5802URS | JANTX1N5802URS | JANTXV1N5802URS | JANS1N5802URS |
| JAN1N5804URS | JANTX1N5804URS | JANTXV1N5804URS | JANS1N5804URS |
| JAN1N5806URS | JANTX1N5806URS | JANTXV1N5806URS | JANS1N5806URS |
| JAN1N5807URS | JANTX1N5807URS | JANTXV1N5807URS | JANS1N5807URS |
| JAN1N5809URS | JANTX1N5809URS | JANTXV1N5809URS | JANS1N5809URS |
| JAN1N5811URS | JANTX1N5811URS | JANTXV1N5811URS | JANS1N5811URS |

*

| PINs for devices in a UMC package | | | |
|---|---|---|---|
| JAN1N5802UMC | JANTX1N5802UMC | JANTXV1N5802UMC | JANS1N5802UMC |
| JAN1N5804UMC | JANTX1N5804UMC | JANTXV1N5804UMC | JANS1N5804UMC |
| JAN1N5806UMC | JANTX1N5806UMC | JANTXV1N5806UMC | JANS1N5806UMC |

* 6.5.2 List of PINs for unencapsulated devices. The following is a list of possible PINs available on this specification sheet for unencapsulated die. The qualified JANHC and JANKC suppliers with the applicable letter version (example, JANHCE1N5802) will be identified on the QML.

| JANHC and JANKC ordering information | | | |
|---|---|---|---|
| PIN | Manufacturers | | |
| | 43611, 52GC4 | 13409 | 34156 |
| 1N5802 | JANHCE1N5802, JANKCE1N5802 | JANHCF1N5802, JANKCF1N5802 | JANHCG1N5802, JANKCG1N5802 |
| 1N5804 | JANHCE1N5804, JANKCE1N5804 | JANHCF1N5804, JANKCF1N5804 | JANHCG1N5804, JANKCG1N5804 |
| 1N5806 | JANHCE1N5806, JANKCE1N5806 | JANHCF1N5806, JANKCF1N5806 | JANHCG1N5806, JANKCG1N5806 |
| 1N5807 | JANHCE1N5807, JANKCE1N5807 | JANHCF1N5807, JANKCF1N5807 | |
| 1N5809 | JANHCE1N5809, JANKCE1N5809 | JANHCF1N5809, JANKCF1N5809 | |
| 1N5811 | JANHCE1N5811, JANKCE1N5811 | JANHCF1N5811, JANKCF1N5811 | |

6.6 Applications data.

6.6.1 Half-sine-wave application with 1N5807(US), 1N5809(US), 1N5811(US). For a printed board mounting example with FR4 base material where the full 3 amp $I_O$ rating (half-sine-wave) is used at a $T_J$ of 175ºC and ambient temperature of 55ºC, the following steps guide the user in what the printed board copper mounting pad size will need to be with 1 ounce, 2 ounce, and 3 ounce copper for 1N5807(US), 1N5809(US), and 1N5811(US). For axial-leaded, the lead length for mounting will be .187 inch (4.76 mm) or less from body to entry point on PCB surface. See 6.6.3 for the smaller example devices 1N5802 to 1N5806 or 1N5802(US) to 1N5806US.

a. Use the $I_O$ versus Po curve on figure 12 to look up 3 amps (X-axis) and follow up to the $T_J$ =175ºC curve (lower) for 2.30 watts.

b. Calculate maximum thermal resistance needed (175ºC – 55ºC) / 2.30 W = 52ºC/W.

c. Look up thermal resistance of 52ºC/W on Y-axis using a thermal resistance versus copper mounting pad area plot on one of the three curves on figure 13 for different weights of copper foil and then intersect curve horizontally to get the answer. These curves assume still air and horizontal printed board position.

d. In this example, the copper mounting pad sizes for the different copper foil weights would be as follows:

1) .50 $in^2$ (1.27 $mm^2$) for 1 ounce copper foil.
2) .30 $in^2$ (0.76 $mm^2$) for 2 ounce copper foil.
3) .20 $in^2$ (0.51 $mm^2$) for 3 ounce copper foil.

e. Add a conservative guard-band to the copper mounting pad size (larger) to keep $T_J$ below 175ºC.

6.6.2 Square-wave application with 1N5807(US), 1N5809(US), 1N5811(US). For a printed board mounting example with FR4 base material to support a 1 amp $I_O$ square wave switching at a 0.50 duty factor (50 percent duty cycle) at $T_J$=125ºC and ambient temperature of 55ºC, the following steps guide the user in what the printed board copper mounting pad size will need to be with 1 ounce, 2 ounce, and 3 ounce copper.

a. Find size of copper mounting pads on standard FR4 base material to support operation at 1 amp $I_O$ square wave switching at a 0.50 duty factor (50 percent duty cycle) at $T_J$=125ºC with $T_A$ = 55ºC.

b. Calculate peak $I_F$ = 1 A / 0.50 duty factor = 2 amps.

c. Use the $V_F$ versus $I_F$ curve on figure 14 to look up $I_F$ = 2 A (Y-axis) and follow across to the $T_J$ = 125ºC curve (middle) for $V_F$ = 0.65 V.

d. Calculate power = $I_F$ * $V_F$ * duty factor = 2 * 0.65 * 0.50 = 0.65 W.

e. Calculate maximum thermal resistance needed (125ºC – 55ºC) / 0.65 W = 107ºC/W.

f. Look up thermal resistance of 107ºC/W on the Y-axis using a thermal resistance versus copper mounting pad area plot on one of the three curves on figure 13 for different weights of copper foil cladding and then intersect curve horizontally to get the answer. Curves assume still air and horizontal printed board position.

g. In this example, the copper mounting pad sizes for the different copper foil weights would be as follows:

1) .058 $in^2$ (1.4732 $mm^2$) for 1 ounce copper foil.
2) .038 $in^2$ (0.9652 $mm^2$) for 2 ounce copper foil.
3) .024 $in^2$ (0.6096 $mm^2$) for 3 ounce copper foil.

h. A conservative pad guard-band is optional since $T_J$ is only 125ºC. NOTE: Multilayer printed boards or forced air cooling will improve performance. Closed confinement of the printed boards or will do the opposite. Use sound thermal management.

6.6.3 Half-sine-wave application with 1N5802(US), 1N5804(US), 1N5806(US). For a printed board mounting example with FR4 base material where the full 1 amp $I_O$ rating (half-sine-wave) is used at a $T_J$ of 175ºC and ambient temperature of 55ºC, the following steps guide the user in what the printed board copper mounting pad size will need to be with 1 ounce, 2 ounce, and 3 ounce copper for a 1N5802(US), 1N5804(US), and 1N5806(US). For axial-leaded, the lead length for mounting will be .187 inch (4.76 mm) or less from body to entry point on PCB surface.

a. Use the $I_O$ versus Po curve on figure 15 to look up 1 amp (X-axis) and follow up to the $T_J$=175ºC curve (lower) for 0.78 watts.

b. Calculate maximum thermal resistance needed (175ºC – 55ºC) / 0.78 W = 154ºC/W.

c. Look up thermal resistance of 154ºC/W on Y-axis using a thermal resistance versus copper mounting pad area plot on one of the three curves on figure 16 for different weights of copper foil and then intersect curve horizontally to get the answer. These curves assume still air and horizontal printed board position.

d. In this example, the copper mounting pad sizes for the different copper foil weights would be as follows:

1) .013 $in^2$ (0.3302 $mm^2$) for 1 ounce copper foil.
2) .0080 $in^2$ (0.2032 $mm^2$) for 2 ounce copper foil.
3) .0053 $in^2$ (0.13462 $mm^2$) for 3 ounce copper foil.

e. Add a conservative guard-band to the copper mounting pad size (larger) to keep $T_J$ below 175ºC.

6.6.4 Square-wave application with 1N5802(US) , 1N5804(US), 1N5806(US). For a printed board mounting example with FR4 base material to support a 0.5 amp $I_O$ square wave switching at a 0.50 duty factor (50 percent duty cycle) at $T_J$=125ºC and ambient temperature of 55ºC, the following steps guide the user in what the printed board copper mounting pad size will need to be with 1 ounce, 2 ounce, and 3 ounce copper.

a. Find size of copper mounting pads on standard FR4 base material to support operation at 0.5 Amp $I_O$ square wave switching at a 0.50 duty factor (50 percent duty cycle) at $T_J$=125ºC with $T_A$=55ºC.

b. Calculate peak $I_F$ = 0.5A / 0.50 duty factor = 1 amp.

c. Use the $V_F$ versus $I_F$ curve on figure 17 to look up $I_F$ = 1 A (Y-axis) and follow across to the $T_J$ = 125ºC curve (middle) for $V_F$ = 0.70 V.

d. Calculate power = $I_F$ * $V_F$ * duty factor = 2 * 0.70 * 0.50 = 0.70 W.

e. Calculate maximum thermal resistance needed (125ºC – 55ºC) / 0.70 W = 100ºC/W.

f. Look up thermal resistance of 100ºC/W on the Y-axis using a thermal resistance versus copper mounting pad area plot on one of the three curves on figure 16 for different weights of copper foil cladding and then intersect curve horizontally to get the answer. Curves assume still air and, horizontal printed board position.

g. In this example, the. copper mounting pad sizes for the different copper foil weights would be as follows:

1) .084 $in^2$ (2.1336 $mm^2$) for 1 ounce copper foil.
2) .051 $in^2$ (1.2954 $mm^2$) for 2 ounce copper foil.
3) .034 $in^2$ (0.8636 $mm^2$) for 3 ounce copper foil.

h. A conservative pad guard-band is optional since $T_J$ is only 125ºC. NOTE: Multilayer printed boards or, forced air cooling will improve performance. Closed confinement of the printed boards or will do the opposite. Use sound thermal management.

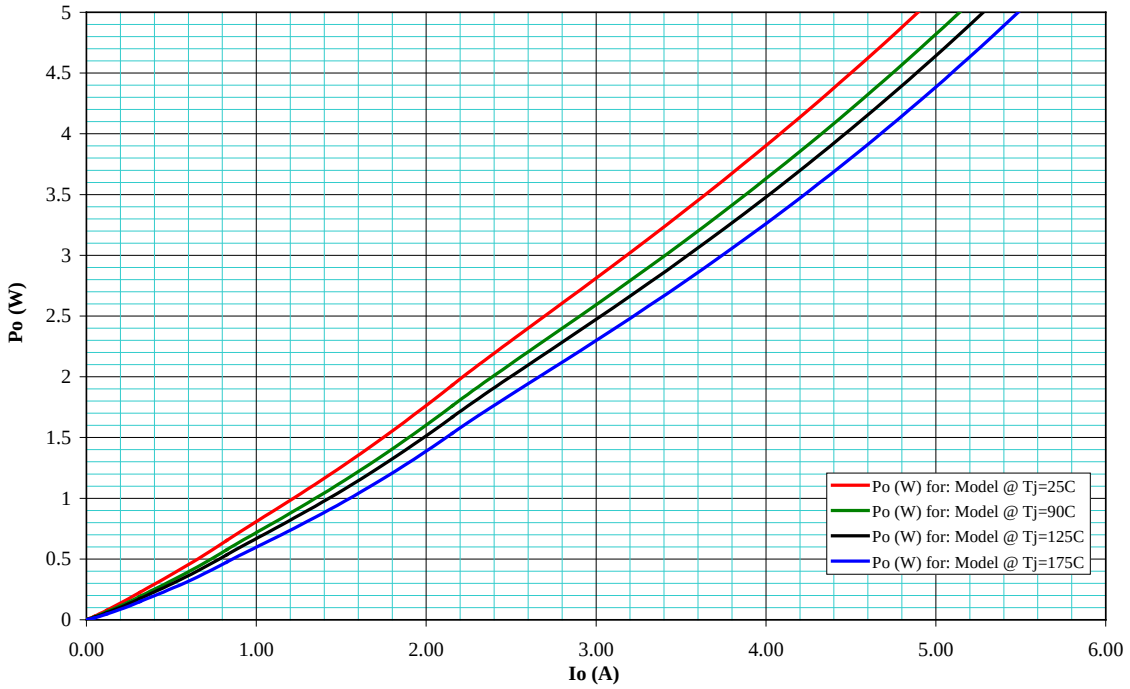



FIGURE 12. Rectifier power versus $I_O$ (average forward current) for 1N5807(US), 1N5809(US), 1N5811(US).

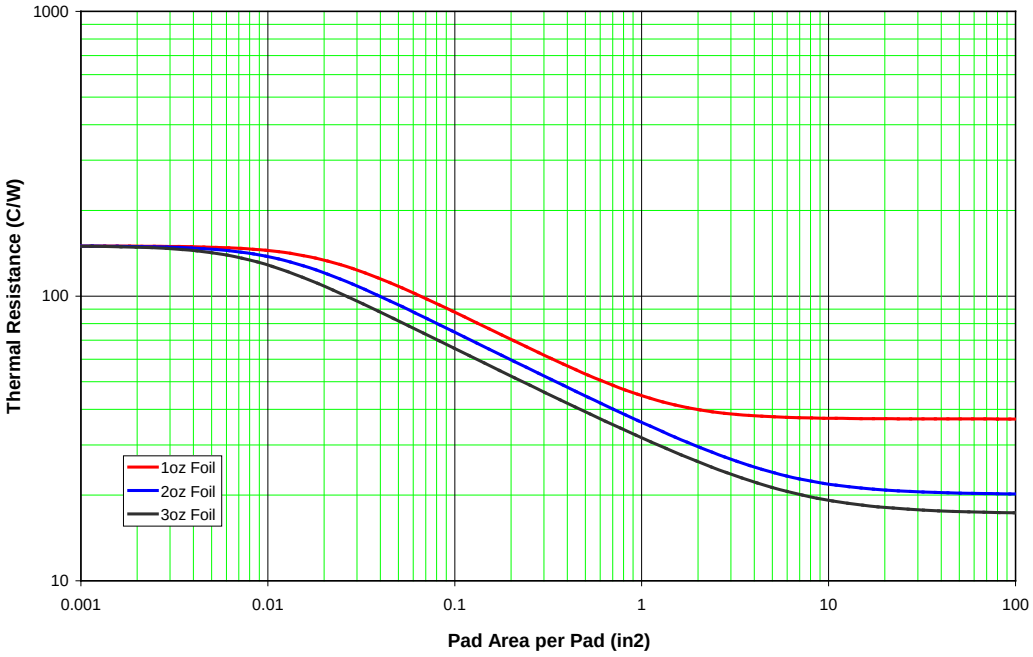



FIGURE 13. Thermal resistance versus pad area still air, PCB horizontal, (for each pad) with 1, 2, and 3 oz copper for 1N5807(US), 1N5809(US), 1N5811(US).

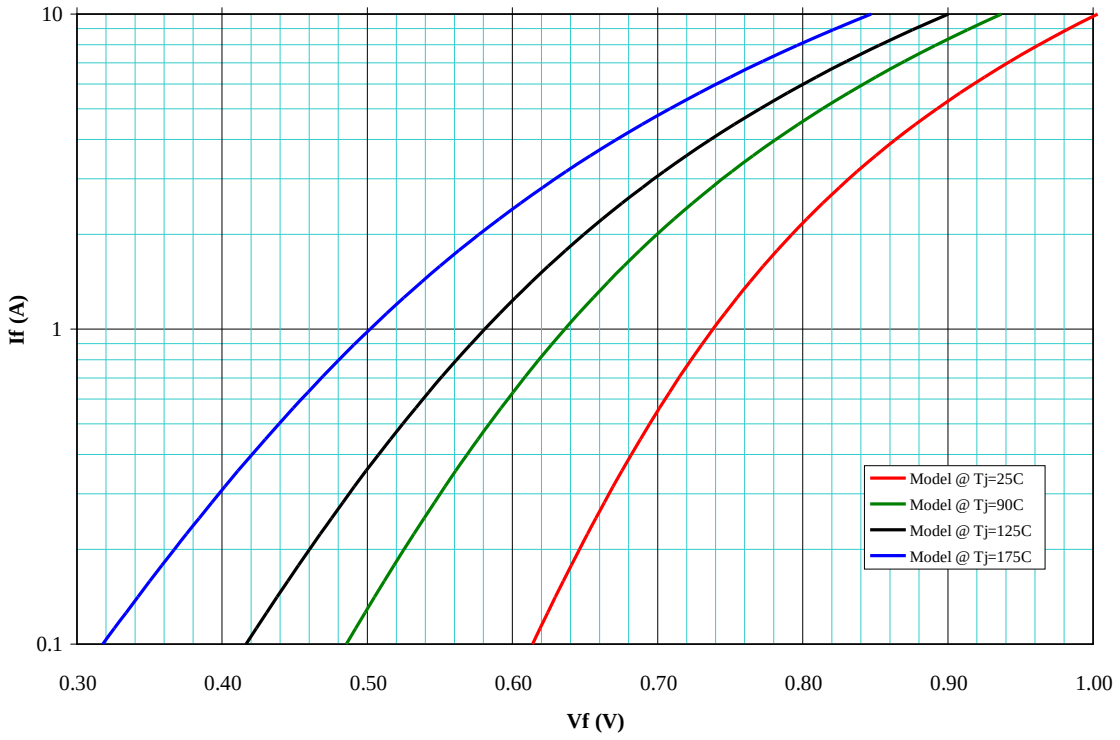



FIGURE 14. Forward voltage versus forward current for 1N5807(US), 1N5809(US), 1N5811(US).

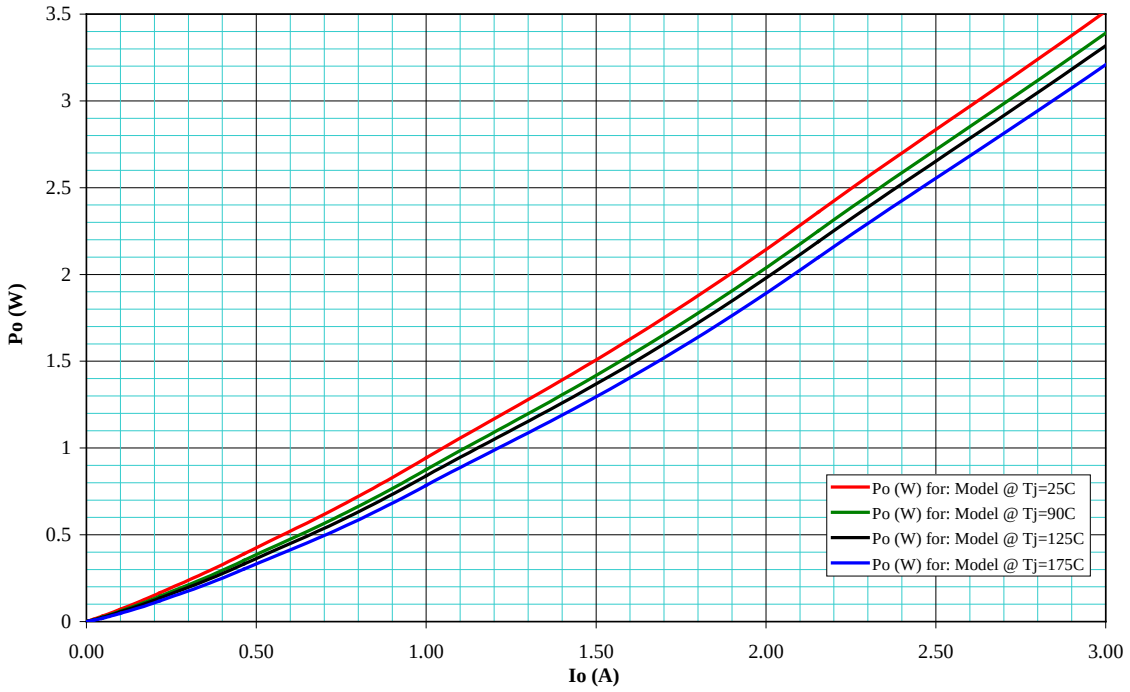



FIGURE 15. Rectifier power versus $I_O$ (average forward current) for 1N5802(US), 1N5804(US), 1N5806(US).

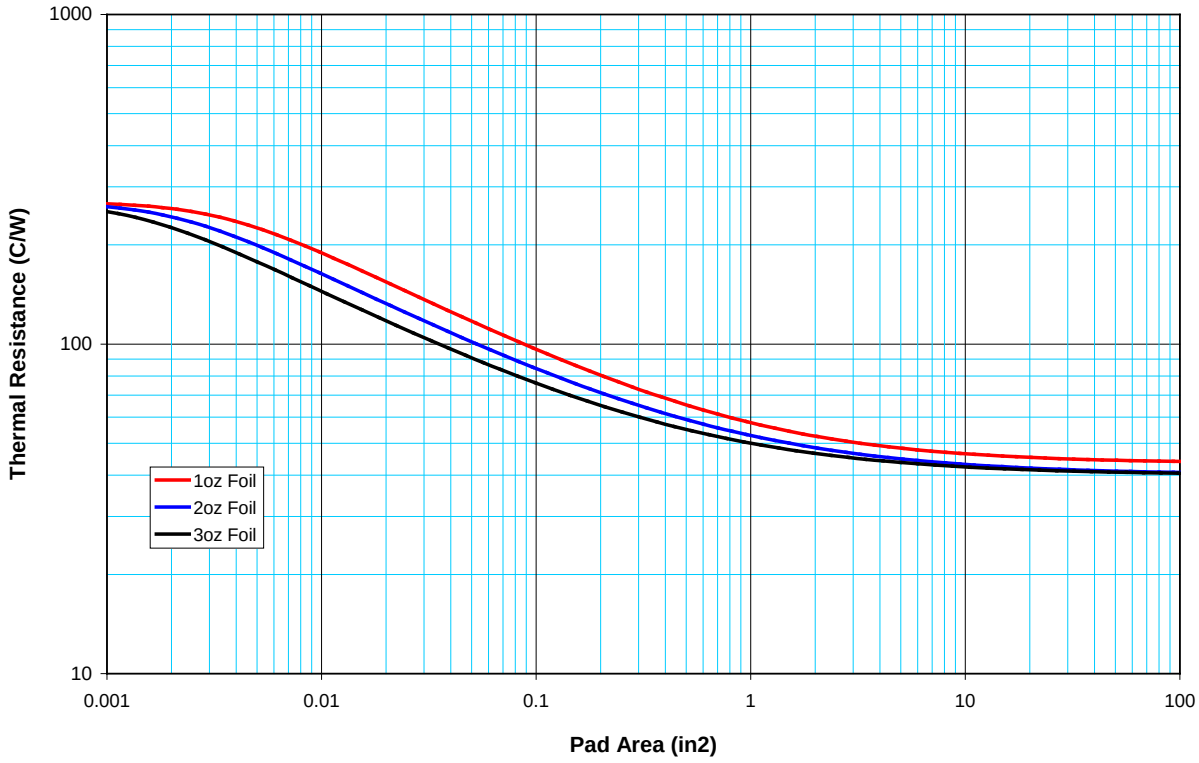



FIGURE 16. Thermal resistance versus FR4 pad area still air, PCB horizontal (for each pad) with 1, 2, and 3 oz copper for 1N5802(US), 1N5804(US), 1N5806(US).

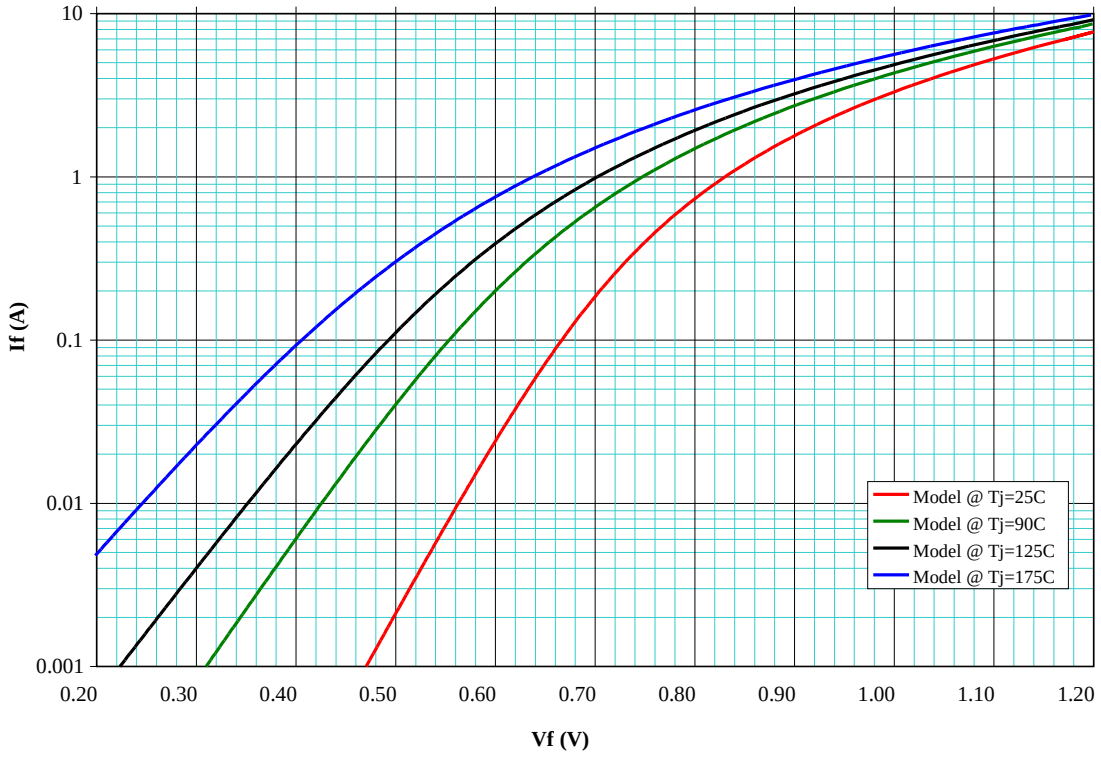



FIGURE 17. Forward voltage versus forward current for 1N5802(US), 1N5804(US), 1N5806(US).

6.7 Request for new types and configurations. Requests for new device types or configurations for inclusions in this specification sheet should be submitted to: DLA Land and Maritime, ATTN: VAC, Post Office Box 3990, Columbus, OH 43218-3990 or by electronic mail at Semiconductor@dla.mil or by facsimile (614) 693-1642 or DSN 850-6939.

6.8 Amendment notations. 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.

Custodians:
Army - CR
Navy - EC
Air Force - 85
NASA - NA
DLA - CC

Preparing activity:
DLA - CC

(Project 5961-2017-034)

Review activities:
Army - AR, AV, MI, SM
Navy - AS, MC
Air Force - 19, 71, 99

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