INCH-POUND

The documentation and process conversion measures necessary to comply with this revision shall be completed by 22 September 2007.

MIL-PRF-19500/477H
22 June 2007
SUPERSEDING
MIL-PRF-19500/477G
22 March 2006

PERFORMANCE SPECIFICATION SHEET

SEMICONDUCTOR DEVICE, DIODE, SILICON, ULTRAFAST RECOVERY, POWER RECTIFIER, TYPES 1N5802, 1N5804, 1N5806, 1N5807, 1N5809, AND 1N5811, 1N5802US, 1N5804US, 1N5806US, 1N5807US, 1N5809US, AND 1N5811US, 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 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 Physical dimensions. See figures 1 through 4.

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
Types	V_{RWM}	$I_{O(L)}$ T_L = +75°C L = .375 in. (9.52 mm) (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}	$R_{\theta JL}$ at L = .375 in. (9.52 mm)	$R_{\theta JEC}$ (7)	$R_{\theta JX}$ (4)
		A	A	A(pk)	ns	°C/W	°C/W	°C/W
1N5802, US	50	2.5	1.0	35	25	36	13	154
1N5804, US	100	2.5	1.0	35	25	36	13	154
1N5806, US	150	2.5	1.0	35	25	36	13	154
1N5807, US	50	6.0	3.0	125	30	22	6.5	52
1N5809, US	100	6.0	3.0	125	30	22	6.5	52
1N5811, US	150	6.0	3.0	125	30	22	6.5	52

See notes on next page.

* Comments, suggestions, or questions on this document should be addressed to Defense Supply Center, Columbus, ATTN: DSCC-VAC, P.O. Box 3990, Columbus, OH 43218-3990, 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://assist.daps.dla.mil.

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* 1.3.2 Ratings applicable to individual types - Continued.

(1) $T_{EC} = T_L$ 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 $R_{\theta JX} \leq$ 154ºC/W for the 1N5802 - 1N5806 and $R_{\theta JX} \leq$ 52ºC/W for the 1N5807 - 1N5811 in col. 9 of 1.3.2. Also, see application notes in 6.5.1 thru 6.5.4 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.

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 $V_R \leq$ 20 ms	I_{R2} at $V_R = V_{RWM}$ T_A = +125°C, pulsed $V_R \leq$ 20 ms
	V	µA	µA
1N5802, US	60	1.0	175
1N5804, US	110	1.0	175
1N5806, US	160	1.0	175
1N5807, US	60	5.0	525
1N5809, US	110	5.0	525
1N5811, US	160	5.0	525

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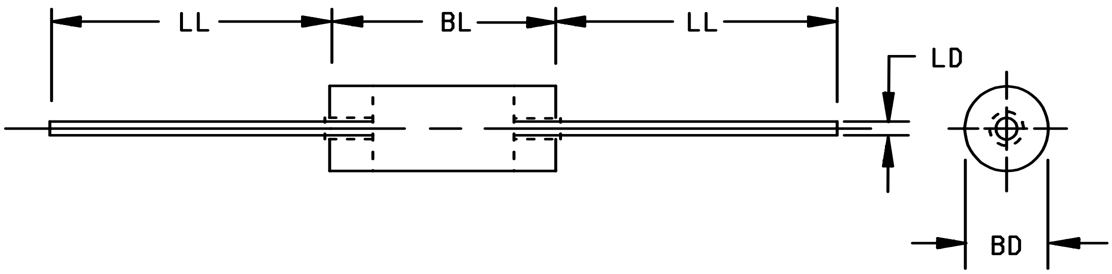

Ltr.	Dimensions								Notes
	1N5802, 1N5804, 1N5806				1N5807, 1N5809, 1N5811				
	Inches		Millimeters		Inches		Millimeters		
	Min	Max	Min	Max	Min	Max	Min	Max	
BD	.065	.085	1.65	2.16	.115	.142	2.92	3.61	4
BL	.125	.250	3.18	6.35	.130	.300	3.30	7.62	3
LD	.027	.032	0.69	0.81	.036	.042	0.91	1.07	3
LL	.700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

FIGURE 1. Physical dimensions.

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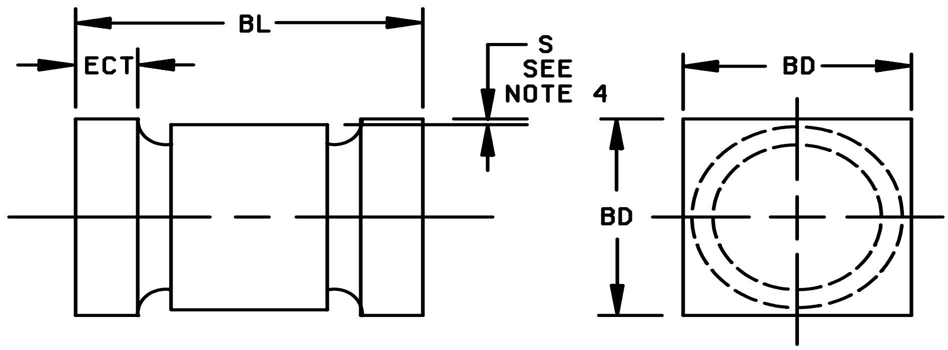

Ltr.	Dimensions								Notes
	1N5802US, 1N5804US, 1N5806US				1N5807US, 1N5809US, 1N5811US				
	Inches		Millimeters		Inches		Millimeters		
	Min	Max	Min	Max	Min	Max	Min	Max	
BD	.091	.103	2.31	2.62	.137	.148	3.48	3.76	
BL	.168	.200	4.27	5.08	.200	.225	5.08	5.72	
ECT	.019	.028	0.48	0.71	.019	.028	0.48	0.71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

FIGURE 2. Physical dimensions of surface mount family.

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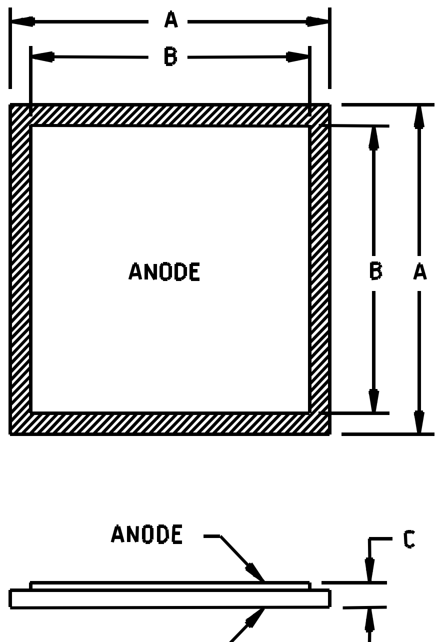

1N5802, 1N5804, 1N5806

Ltr	Dimensions			
	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

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 3. JANC (E- version) die dimensions.

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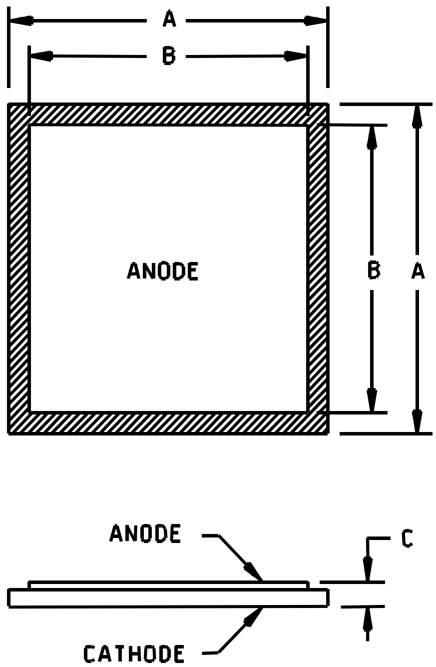

1N5807, 1N5809, 1N5811

Ltr	Dimensions			
	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 4. JANC (E-version) die dimensions.

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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 http://assist.daps.dla.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.
$I_{(BR)}$ . . . . .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 4 herein.

* 3.4.1 Diode construction. These 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. US version devices shall be structurally identical to the non-surface mount devices except for lead terminations.

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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 version. For US version only, all marking may be omitted from the device except for the cathode marking. All marking which is omitted from the body of the device 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.

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.

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* 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 (see appendix E, table E-IV of MIL-PRF-19500)	JANS level	JANTXV and JANTX level
(1) 3c	Thermal impedance (see 4.3.1)	Thermal impedance (see 4.3.1)
9	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	Required I_{R1}, V_{FM1}, and V_{FM4}; ΔI_{R1} ±100 percent of initial reading or ±150 nA dc (1N5802, 1N5804, 1N5806) or ±500 nA dc (1N5807, 1N5809, 1N5811), whichever is greater. $\Delta V_{FM} \leq \pm 0.05$ V dc.	Required I_{R1}, V_{FM1}, and 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. $\Delta V_{FM} \leq \pm 0.05$ V dc. Scope display evaluation (see 4.5.2)	Subgroup 2 of table I herein;ΔI_{R1} ±100 percent of initial reading or ± 250 nA dc (1N5802, 1N5804, 1N5806) or ±1 µA dc (1N5807, 1N5809, 1N5811), whichever is greater. $\Delta V_{FM} \leq \pm 0.05$ V dc. Scope-display evaluation (see 4.5.2).

(1) Shall be performed anytime after temperature cycling, screen 3a; and does 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.

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* 4.3.2 Free air power burn-in conditions. Power burn-in conditions are as follows (see 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. Electrical measurements (end-points) shall be in accordance with table I, subgroup 2 herein. See table III herein for delta limits when applicable.

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

Subgroup	Method	Condition
B3	4066	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 4.5.4); 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 to achieve T_J = 175°C minimum; n = 45, c = 0; t = 1,000 hours; f = 50 - 60 Hz. T_A = 55°C max. For irradiated devices, include t_{rr} as an end-point measurement.
B8	4065	Peak reverse power: For 1N5802 - 1N5806, $P_{RM} \geq$ 318 W for square wave in accordance with TM 4065 ($P_{RM} \geq$ 500 W for half sine-wave). For 1N5807 - 1N5811, $P_{RM} \geq$ 636 W for square wave in accordance with TM 4065 ($P_{RM} \geq$ 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 Group B inspection, appendix E, table E-VIb (JAN, JANTX, and JANTXV 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 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). T_A = 55°C (max). For irradiated devices, include t_{rr} as an end-point measurement.

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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. Electrical measurements (end-points) shall be in accordance with table I, subgroup 2 herein. See table III herein for delta limits 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, 4 pounds, t = 15s for 1N5802, 1N5804, 1N5806. Condition A, 12 pounds, t = 15s for - 1N5807, 1N5809, 1N5811. Fatigue: Condition E for all types, 2 pounds. (Lead fatigue is not applicable to US diodes).
*	C2	2036	US devices – Tension: Test condition A; weight = 12 pounds; t = 15 seconds. Suitable fixtures may be used to pull the end-caps in a manner which does not aid construction. Reference to axial lead may be interpreted as end-cap with fixtures used for mounting (see figure 5 herein). (Lead fatigue is not applicable to US diodes).
	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.
	C6	1027	$I_O = I_{O1}$ rated minimum (see col. 4 of 1.3.2); adjust I_O 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). T_A = 55°C (max). 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. Electrical measurements (end-points) shall be in accordance with table I, subgroup 2 herein. See table III herein for delta limits 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. Measurement delay time t_{MD} = 70 μs max. See table E-IX of MIL-PRF-19500, subgroup 4, and figures 6, 7, 8, and 9 herein. Forced moving air or draft shall not be permitted across the devices during test.

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* TABLE I. Group A inspection.

Inspection 1/	MIL-STD-750 Method	MIL-STD-750 Conditions	Symbol	Limit Min	Limit Max	Unit
Subgroup 1						
Visual and mechanical examination	2071					
Subgroup 2						
Thermal impedance 2/	3101	See 4.3.1	$Z_{\theta JX}$			
1N5802, 1N5802US 1N5804, 1N5804US 1N5806, 1N5806US						°C/W
1N5807, 1N5807US 1N5809, 1N5809US 1N5811, 1N5811US						°C/W
Forward voltage	4011	Duty cycle ≤ 2 percent (pulsed see 4.5.1); t_p = 8.3 ms (max)				
1N5802, 1N5802US 1N5804, 1N5804US 1N5806, 1N5806US		I_{FM} = 1.0 A	V_{FM1}		0.875	V
1N5802, 1N5802US 1N5804, 1N5804US 1N5806, 1N5806US		I_{FM} = 2.5 A	V_{FM2}		0.975	V
Forward voltage	4011	Duty cycle ≤ 2 percent (pulsed see 4.5.1); t_p = 8.3 ms (max)				
1N5807, 1N5807US 1N5809, 1N5809US 1N5811, 1N5811US		I_{FM} = 3.0 A	V_{FM3}		0.865	V
1N5807, 1N5807US 1N5809, 1N5809US 1N5811, 1N5811US		I_{FM} = 4.0 A	V_{FM4}		0.875	V
1N5807, 1N5807US 1N5809, 1N5809US 1N5811, 1N5811US		I_{FM} = 6.0 A	V_{FM5}		0.925	V

See footnotes at end of table.

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* 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, 1N5802US 1N5804, 1N5804US 1N5806, 1N5806US		V_R = 50 V V_R = 100 V V_R = 150 V			1.0 1.0 1.0	µA µA µA
1N5807, 1N5807US 1N5809, 1N5809US 1N5811, 1N5811US		V_R = 50 V V_R = 100 V V_R = 150 V			5.0 5.0 5.0	µA µA µA
Breakdown voltage	4021	$I_{(BR)}$ = 100 µA pulse ≤20 ms	$V_{(BR)1}$			
1N5802, 1N5802US 1N5807, 1N5807US				60		V
1N5804, 1N5804US 1N5809, 1N5809US				110		V
1N5806, 1N5806US 1N5811, 1N5811US				160		V
Subgroup 3						
High temperature operation:		T_A = +125°C-minimum.				
Reverse current	4016	DC or equivalent pulse method	I_{R2}			
1N5802, 1N5802US 1N5804, 1N5804US 1N5806, 1N5806US		V_R = 50 V V_R = 100 V V_R = 150 V			175 175 175	µA µA µA
1N5807, 1N5807US 1N5809, 1N5809US 1N5811, 1N5811US		V_R = 50 V V_R = 100 V V_R = 150 V			525 525 525	µA µA µA

See footnotes at end of table.

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* TABLE I. Group A inspection - Continued.

Inspection 1/	MIL-STD-750		Symbol	Limit		Unit
	Method	Conditions		Min	Max	
Subgroup 3 - continued						
Forward voltage	4011	Duty cycle ≤ 2 percent (pulsed see 4.5.1); t_p = 8.3 ms (max)				
1N5802, 1N5802US 1N5804, 1N5804US 1N5806, 1N5806US		I_{FM} = 1.0 A	V_{FM6}		0.800	V
1N5807, 1N5807US 1N5809, 1N5809US 1N5811, 1N5811US		I_{FM} = 4.0 A	V_{FM7}		0.800	V
Low-temperature operation:		T_A = -65°C minimum.				
Forward voltage	4011	Duty cycle ≤ 2 percent (pulsed see 4.5.1); t_p = 8.3 ms (max)	V_{FM8}			
1N5802, 1N5802US 1N5804, 1N5804US 1N5806, 1N5806US		I_{FM} = 1.0 A			1.075	V
1N5807, 1N5807US 1N5809, 1N5809US 1N5811, 1N5811US		I_{FM} = 4.0 A			1.075	V
Breakdown voltage	4021	$I_{(BR)}$ = 100 µA dc	$V_{(BR)2}$			
1N5802, 1N5802US 1N5807, 1N5807US				50		V dc
1N5804, 1N5804US 1N5809, 1N5809US				100		V dc
1N5806, 1N5806US 1N5811, 1N5811US				150		V dc

See footnotes at end of table.

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* 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, 1N5802US 1N5804, 1N5804US 1N5806, 1N5806US		$I_F = I_{RM} = 0.5$ A $i_{(REC)} = 0.05$ A di/dt = 65 A/µs (min)			25	ns
1N5807, 1N5807US 1N5809, 1N5809US 1N5811, 1N5811US		$I_F = I_{RM} = 1.0$ A $i_{(REC)} = 0.1$ A di/dt = 100 A/µs (min)			30	ns
Capacitance	4001	$V_R = 10$ V; f = 1 Mhz; $V_{sig} = 50$ mV (p-p)	C_J			
1N5802, 1N5802US 1N5804, 1N5804US 1N5806, 1N5806US					25	pF
1N5807, 1N5807US 1N5809, 1N5809US 1N5811, 1N5811US					60	pF
Forward recovery voltage	4026	$t_r = 8$ ns	$V_{(peak)}$			
1N5802, 1N5802US 1N5804, 1N5804US 1N5806, 1N5806US		$I_F = 250$ mA			2.2	V
1N5807, 1N5807US 1N5809, 1N5809US 1N5811, 1N5811US		$I_F = 500$ 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, 1N5802US 1N5804, 1N5804US 1N5806, 1N5806US		$I_F = 250$ mA			15	ns
1N5807, 1N5807US 1N5809, 1N5809US 1N5811, 1N5811US		$I_F = 500$ mA			15	ns
Scope display evaluation	4023	See 4.5.2, n = 116, c = 0				

See footnotes at end of table.

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* 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	I_{FSM} = rated (see 1.3.2); ten surges of 8.3 ms each at 1 minute intervals superimposed on I_O = I_{O2} 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.

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

Inspection	MIL-STD-750		Sampling plan
	Method	Conditions	
Subgroup 1A			45 devices c = 0
Temperature cycling (air to air)	1051	20 cycles, except high temperature shall be 150°C and low temperature shall be -195°C.	
Hermetic seal	1071		
Electrical measurement		See table I, subgroup 2 and table III, steps 1 and 2.	
Subgroup 1B			
Temperature cycling (air to air)	1051	-65°C to +175°C, 500 cycles.	
Hermetic seal	1071		
Electrical measurement		See table I, subgroup 2 and table III, steps 1 and 2.	
Subgroup 2			22 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, except $Z_{\theta JX}$ need not to be performed, and table III, steps 1 and 2. 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 and 6			
Not applicable			
Subgroup 7			n = 45
Resistance to glass cracking	1057	Step stress to destruction by increasing cycles or up to a maximum of 25 cycles.	

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

Inspection	MIL-STD-750		Sampling plan
	Method	Conditions	
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 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_{O2} rated (see 1.3.2); V_{RWM} = rated (see 1.3.2); T_A = + 25°C.	
Electrical measurement		See table I, subgroup 2.	

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* 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	Duty cycle ≤ 2 percent (pulsed see 4.5.1); t_p = 8.3 ms (max)	ΔV_{FM1}		
	1N5802, 1N5802US, 1N5804, 1N5804US, 1N5806, 1N5806US		I_{FM} = 1.0 A(pk)		±50 mV dc change from of initial value	
	1N5807, 1N5807US, 1N5809, 1N5809US, 1N5811, 1N5811US		I_{FM} = 4.0 A(pk)			
2.	Reverse current	4016	DC method	ΔI_{R1}		
	1N5802,1N5802US 1N5804,1N5804US 1N5806,1N5806US		V_R = 50 V dc V_R = 100 V dc V_R = 150 V dc		100-percent or ±150 nA dc change from initial reading, whichever is greater.	
	1N5807,1N5807US 1N5809,1N5809US 1N5811,1N5811US		V_R = 50 V dc V_R = 100 V dc 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.

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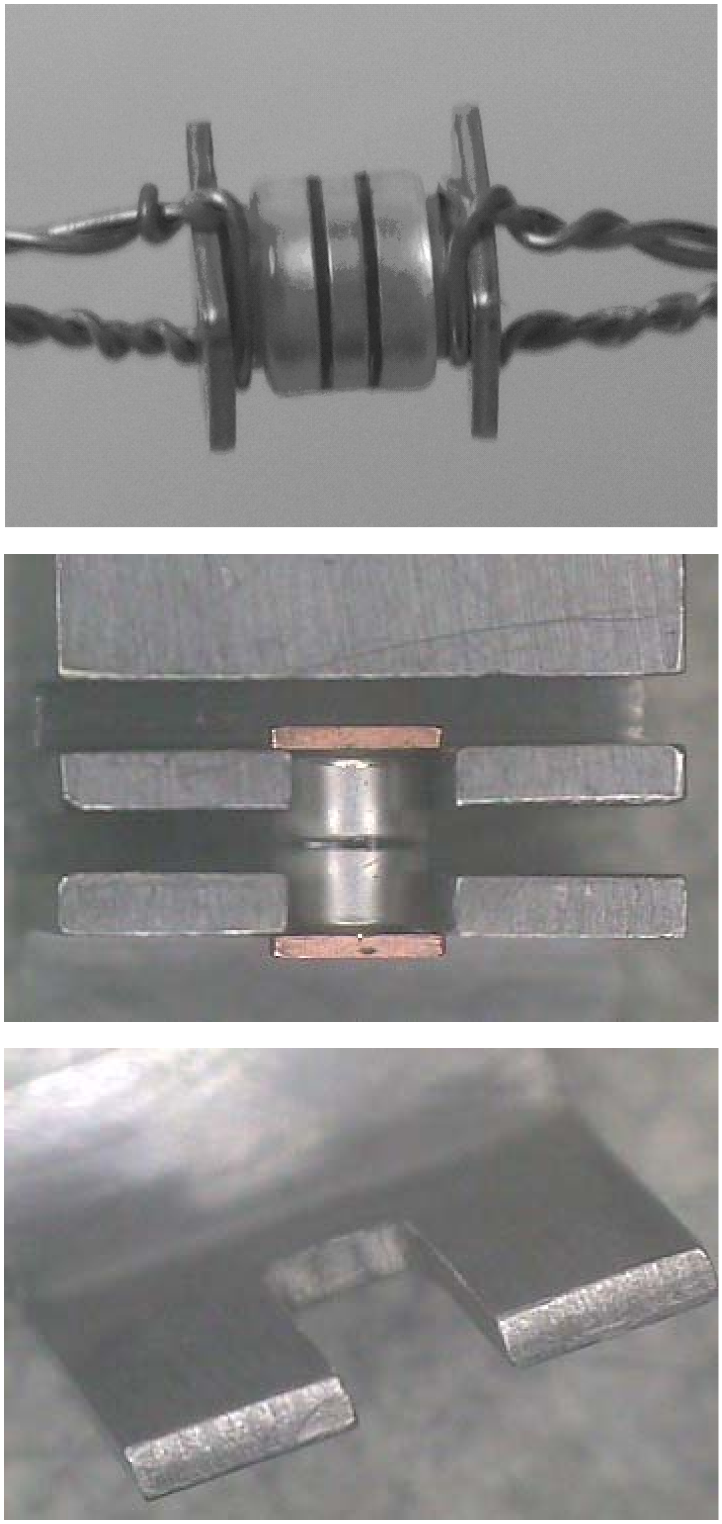

* FIGURE 5. US terminal strength mounting.

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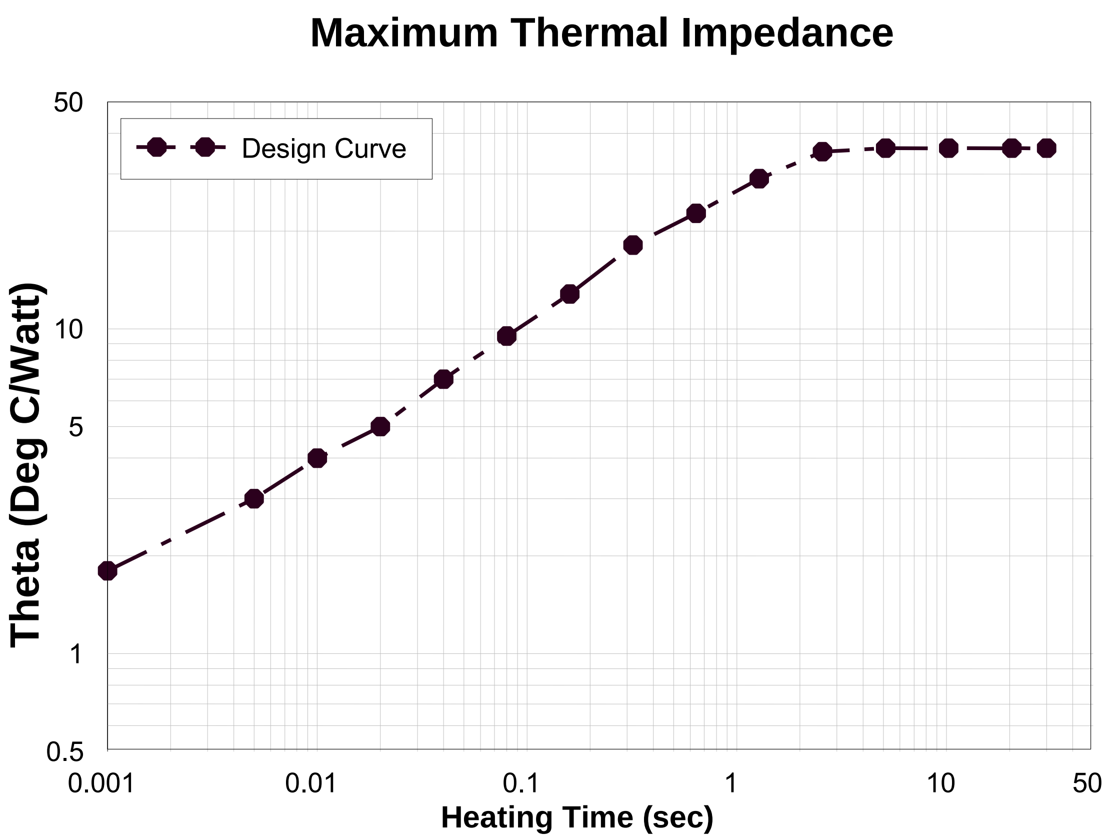

$Z_{\theta JX}$ = 4°C/W at 10 ms.

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

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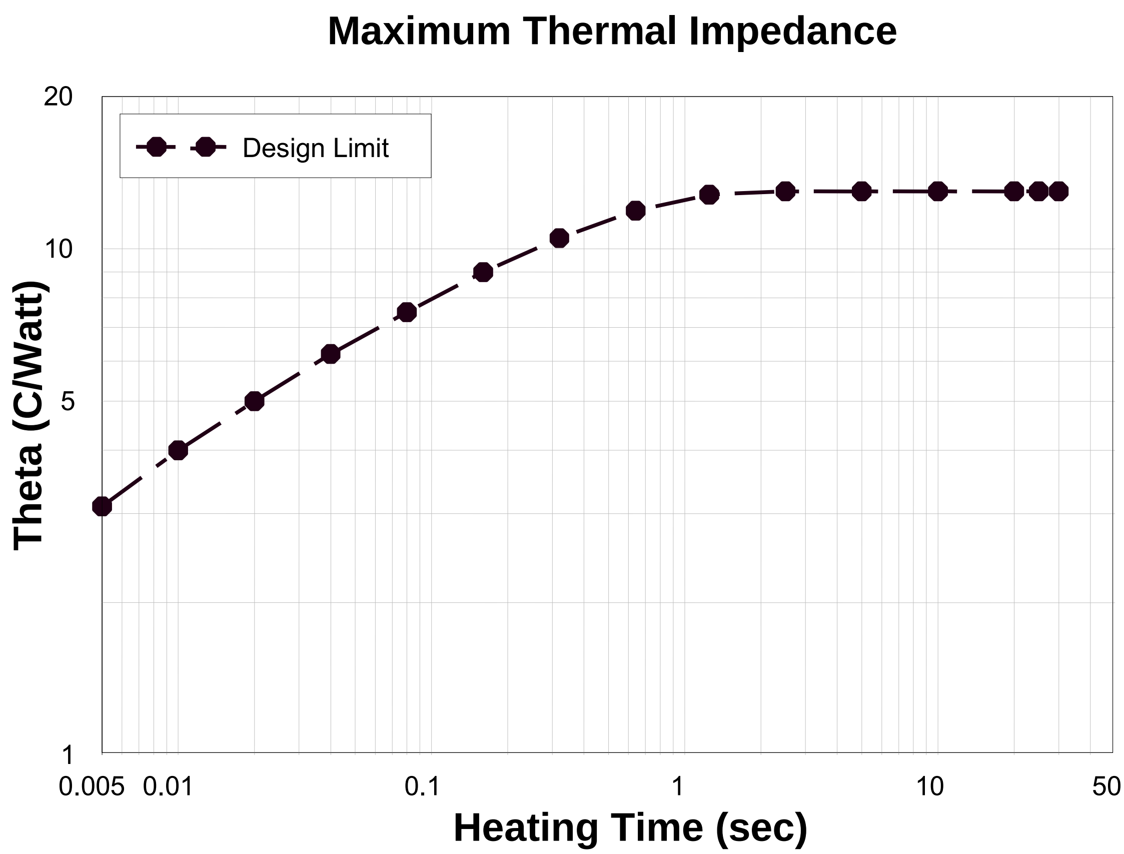

$Z_{\theta JX}$ = 4°C/W at 10 ms.

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

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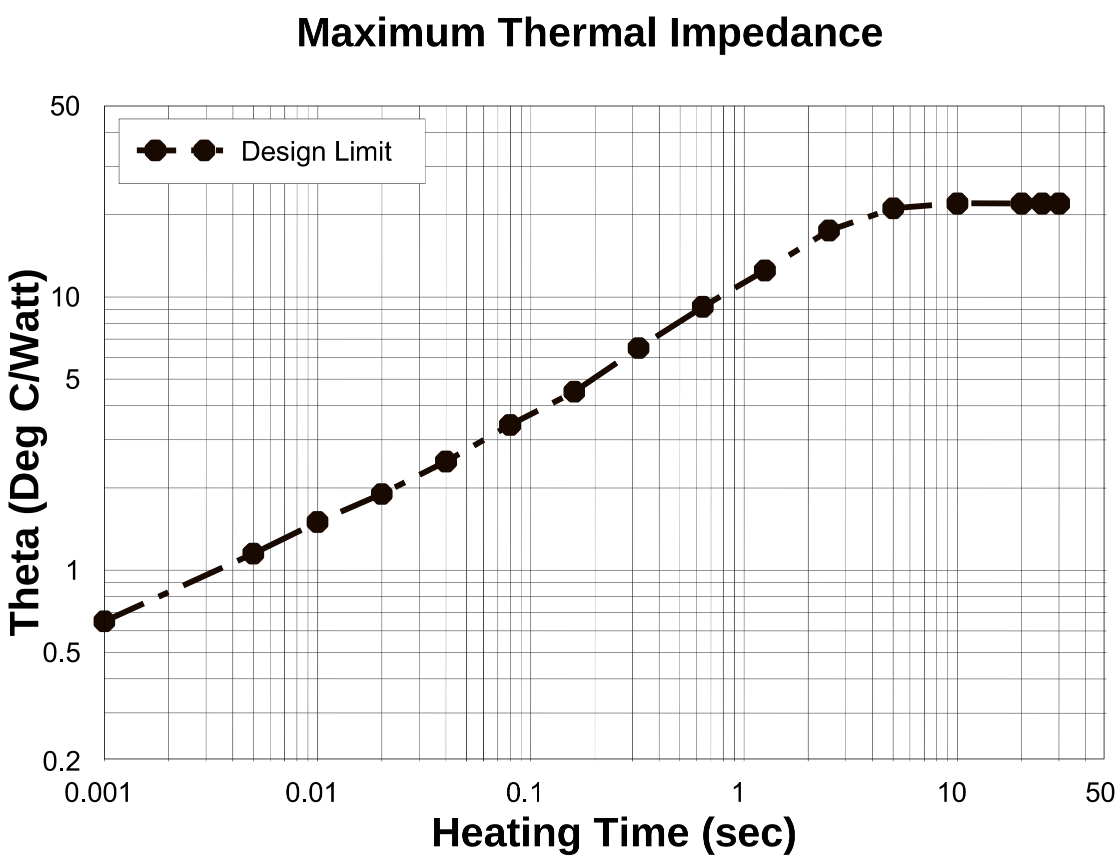

$Z_{\theta JX}$ = 1.5°C/W at 10 ms.

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

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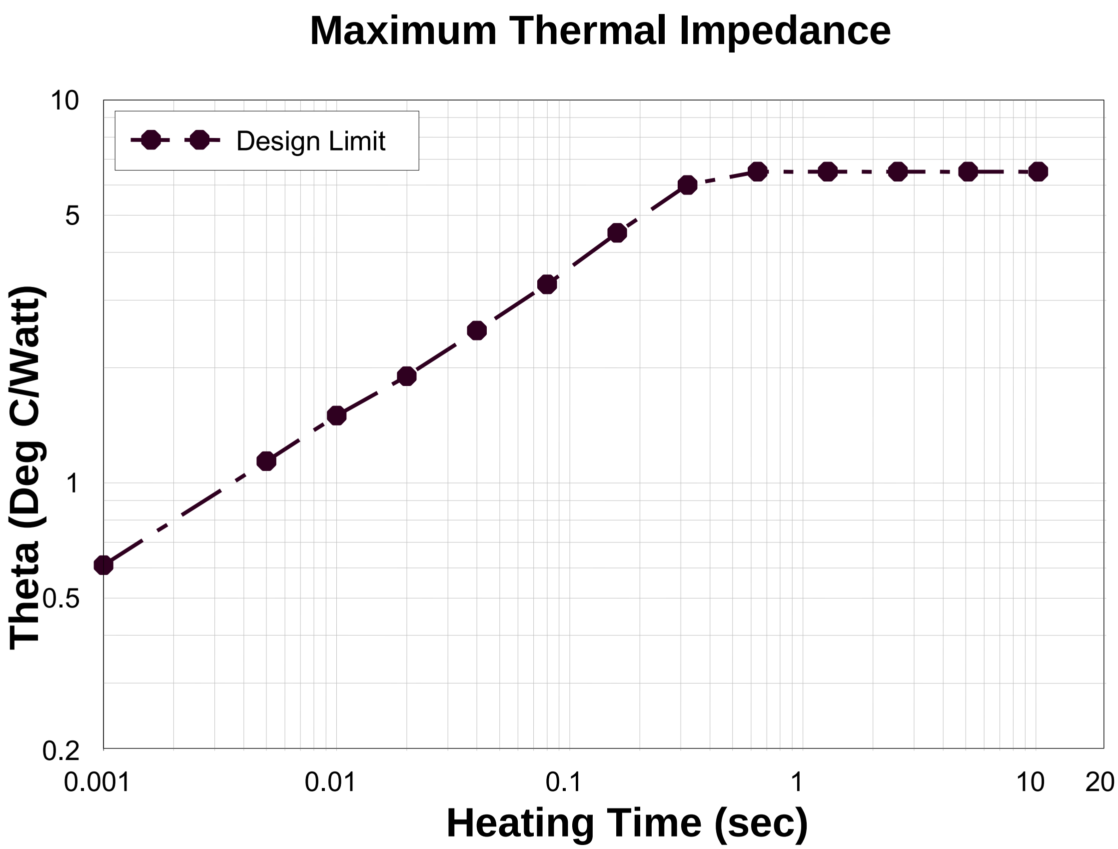

$Z_{\theta JX}$ = 1.5°C/W at 10 ms.

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

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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. Product assurance level and type designator.

e. For die acquisition, the JANHC or JANKC letter version shall be specified (see figures 3 and 4).

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 43218-3990 or e-mail vqe.chief@dla.mil.

6.4 Suppliers of die. The qualified die suppliers with the applicable letter version (example; JANHCE1N5802) will be identified on the QML.

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* 6.5 Applications data.

* 6.5.1 Half-sine-wave application with 1N5807(US) to 1N5811(US). For a PCB mounting example with FR4 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 PCB pad size will need to be with 1 oz, 2 oz, and 3 oz copper for 1N5807 to 1N5811 or 1N5807(US) to 1N5811US. 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 6.5.3 for the smaller example devices 1N5802 to 1N5806 or 1N5802(US) to 1N5806US.

a. Use the I_O versus Po curve on figure 10 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 pad area plot on one of the three curves on figure 11 for different weights of copper cladding and then intersect curve horizontally to get the answer. These curves assume still air, horizontal position.

d. In this example, the answer is: 1 oz PCB = .50 in^2 (1.27 mm^2), 2 oz PCB = .30 in^2 (0.76 mm^2), 3 oz PCB = .20 in^2 (0.51 mm^2) for each pad.

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

* 6.5.2 Square-wave application with 1N5807(US) to1N5811(US). For a PCB mounting example with FR4 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 PCB pad size will need to be with 1 oz, 2 oz, and 3 oz copper.

a. Find size of copper pads on standard FR4 PCB 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 12 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 pad area plot on one of the three curves on figure 11 for different weights of copper cladding and then intersect curve horizontally to get the answer. Curves assume still air, horizontal position.

g. In this example, the answer is: 1oz PCB = .058 in^2 (1.4732 mm^2), 2oz PCB = .038 in^2 (0.9652 mm^2), 3oz PCB = .024 in^2 (0.6096 mm^2) for each pad.

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

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* 6.5.3 Half-sine-wave application with 1N5802(US) to 1N5806(US). For a PCB mounting example with FR4 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 PCB pad size will need to be with 1 oz, 2 oz, and 3 oz copper for a 1N5802 to 1N5806 or 1N5802(US) to 1N5806US. 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 13 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 pad area plot on one of the three curves on figure 14 for different weights of copper cladding and then intersect curve horizontally to get the answer. These curves assume still air, horizontal position.

d. In this example, the answer is: 1 oz PCB = .013 in^2 (0.3302 mm^2), 2 oz PCB = .0080 in^2 (0.2032 mm^2), 3 oz PCB = .0053 in^2 (0.13462 mm^2) for each pad.

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

* 6.5.4 Square-wave application with 1N5802(US) to1N5806(US). For a PCB mounting example with FR4 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 PCB pad size will need to be with 1 oz, 2 oz, and 3 oz copper.

a. Find size of copper pads on standard FR4 PCB 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 15 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 pad area plot on one of the three curves on figure 14 for different weights of copper cladding and then intersect curve horizontally to get the answer. Curves assume still air, horizontal position.

g. In this example, the answer is : 1oz PCB = .084 in^2 (2.1336 mm^2), 2oz PCB = .051 in^2 (1.2954 mm^2), 3oz PCB = .034 in^2 (0.8636 mm^2) for each pad.

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

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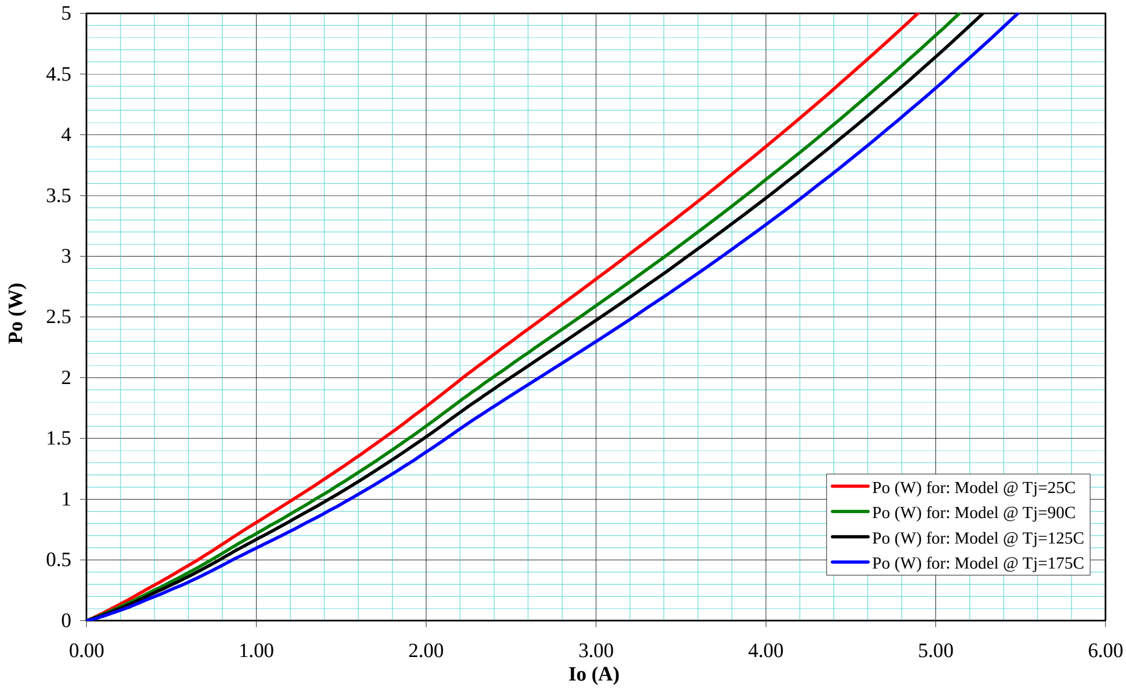

* FIGURE 10. Rectifier power versus I_O (average forward current) for 1N5807(US) to 1N5811(US).

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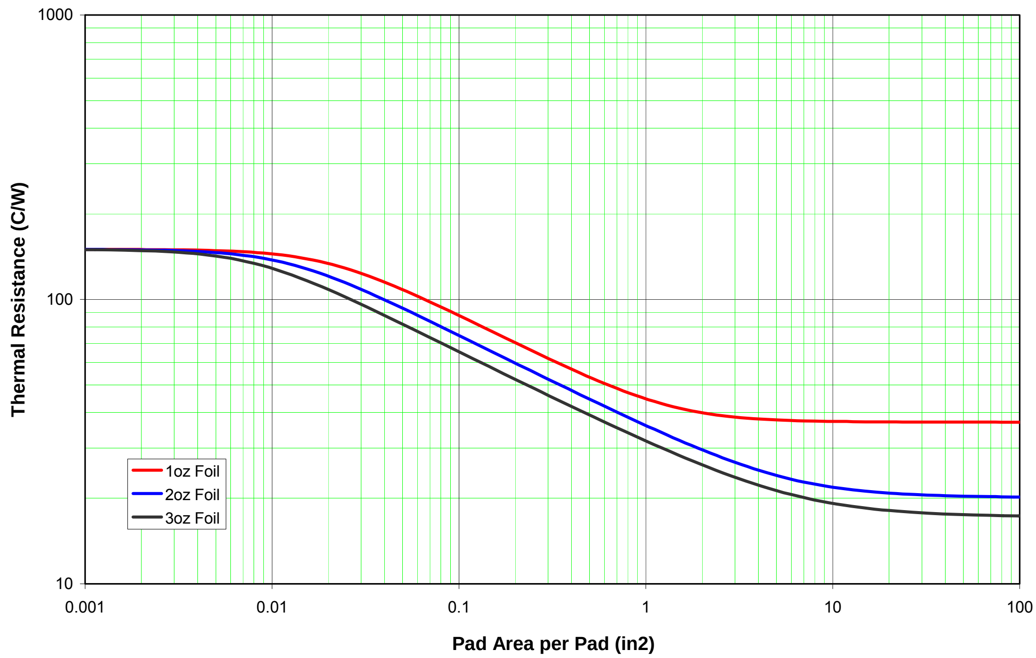

* FIGURE 11. Thermal resistance versus pad area still air, PCB horizontal, (for each pad) with 1, 2, and 3 oz copper for 1N5807(US) to 1N5811(US).

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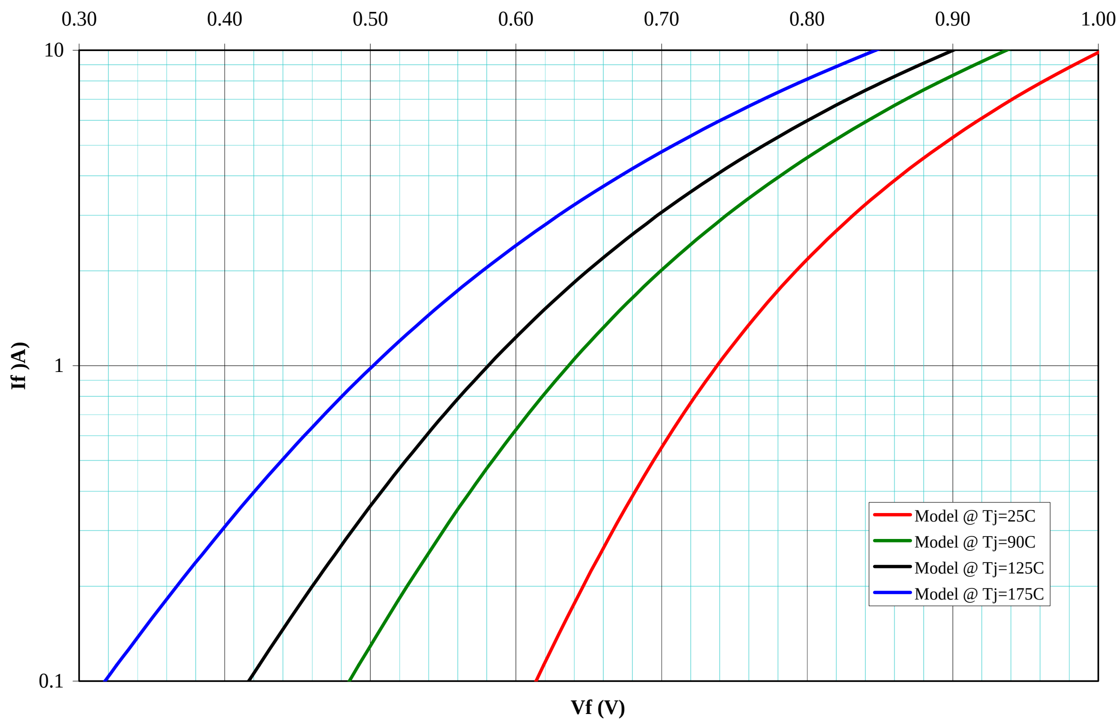

* FIGURE 12. Forward voltage versus forward current for 1N5807(US) to 1N5811(US).

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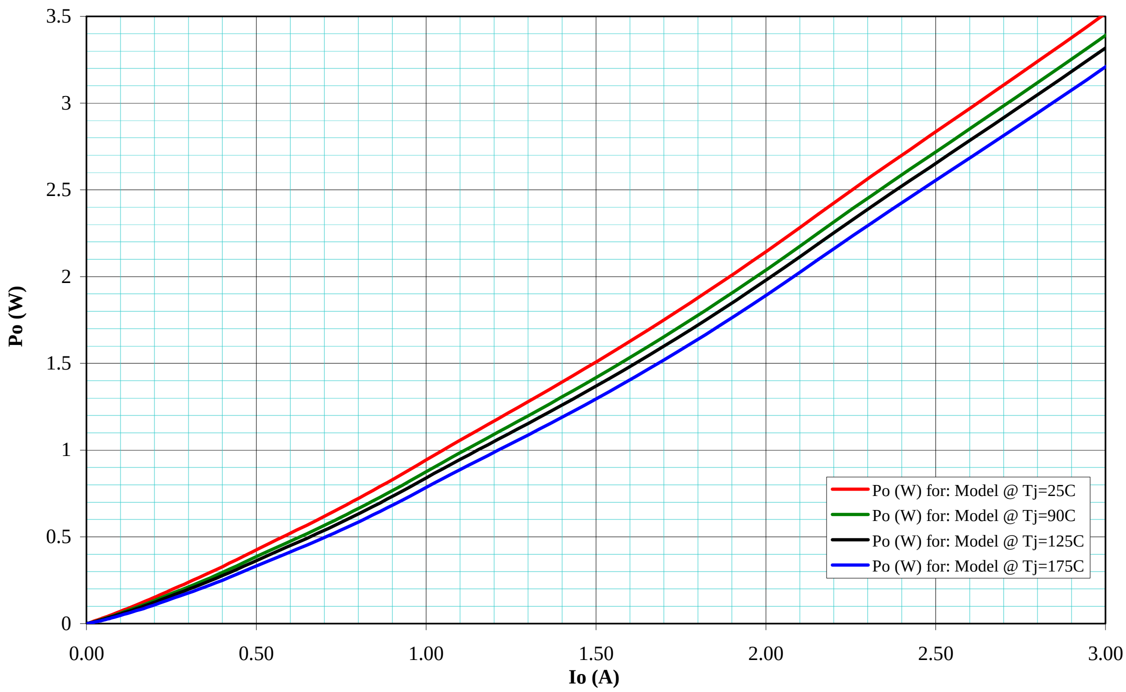

* FIGURE 13. Rectifier power versus I_O (average forward current) for 1N5802(US) to 1N5806(US).

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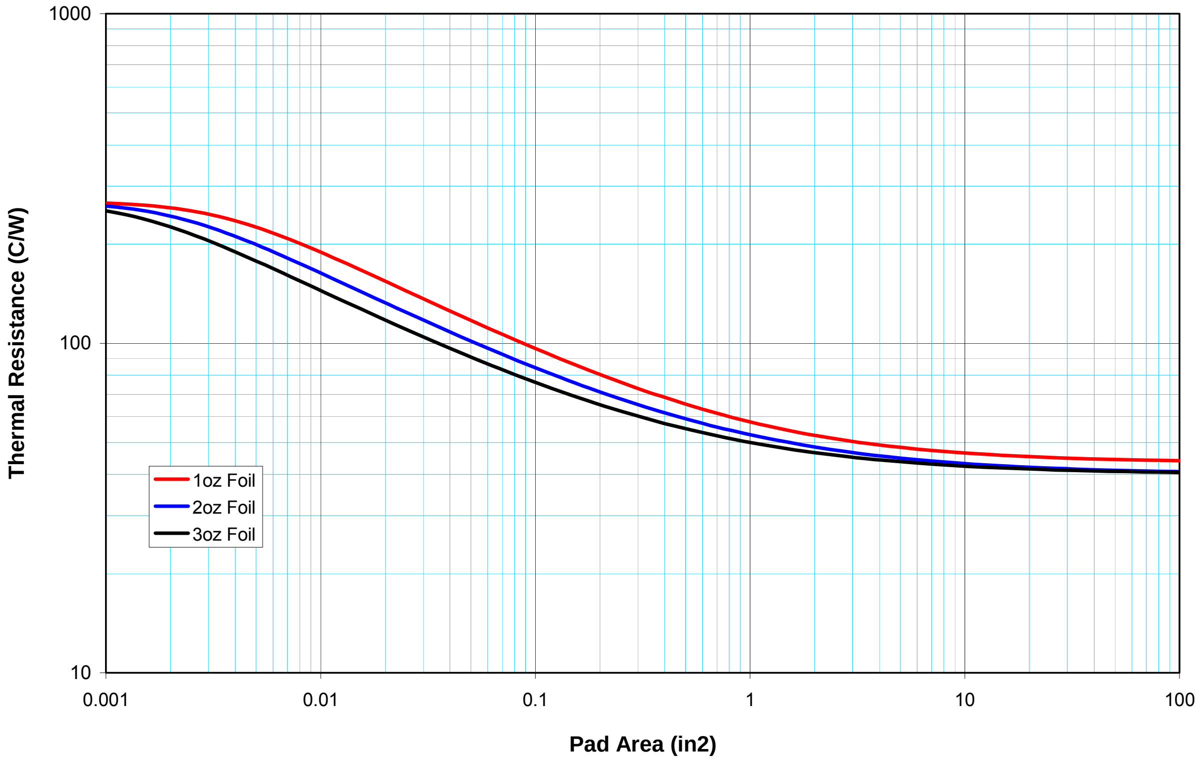

* FIGURE 14. Thermal resistance versus FR4 pad area still air, PCB horizontal (for each pad) with 1, 2, and 3 oz copper for 1N5802(US) to 1N5806(US).

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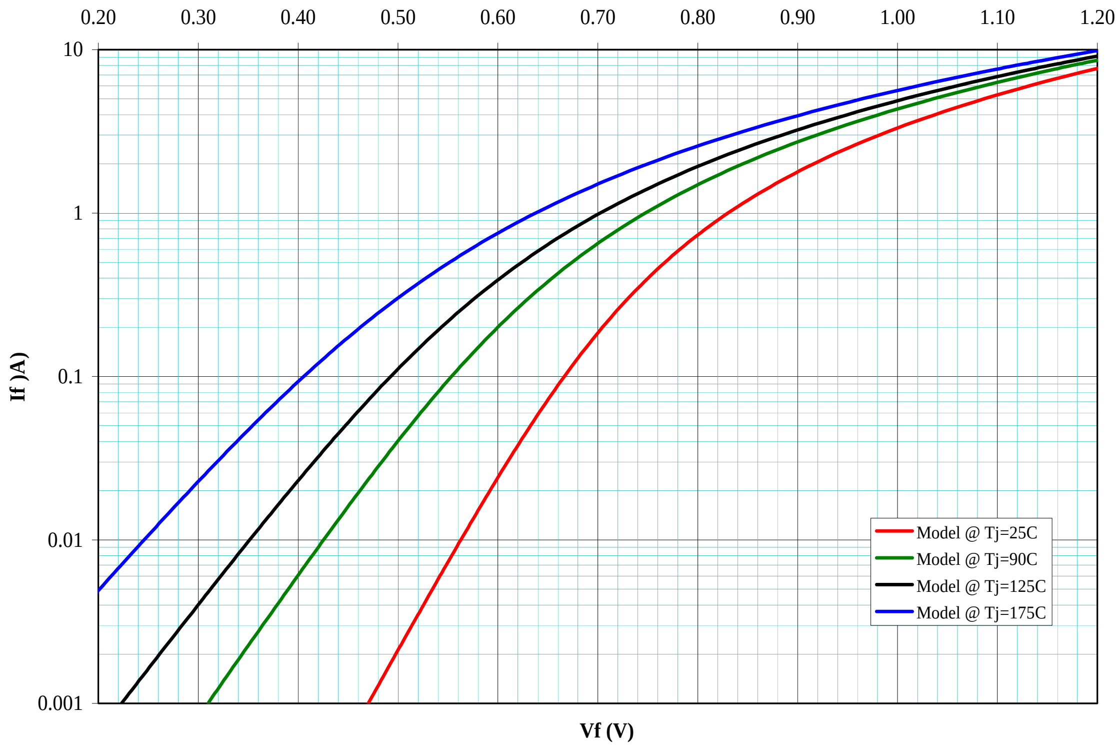

* FIGURE 15. Forward voltage versus forward current for 1N5802(US) to 1N5806(US).

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6.6 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.

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

Preparing activity:
DLA - CC

(Project 5961-2006-083)

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

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

Source: https://assist.dla.mil -- Downloaded: 2016-12-04T11:07Z
Check the source to verify that this is the current version before use.