

The documentation and process conversion measures necessary to comply with this revision shall be completed by 28 November 2009.

INCH-POUND

MIL-PRF-19500/742A
 28 August 2009
 SUPERSEDING
 MIL-PRF-19500/742
 1 June 2007

PERFORMANCE SPECIFICATION SHEET

* SEMICONDUCTOR DEVICE, DIODE, SILICON, ULTRAFAST RECOVERY, POWER RECTIFIER, TYPES 1N5802CB, 1N5804CB, 1N5806CB, 1N5807CB, 1N5809CB, AND 1N5811CB, 1N5802CBUS, 1N5804CBUS, 1N5806CBUS, 1N5807CBUS, 1N5809CBUS, AND 1N5811CBUS, JAN, JANTX, AND JANTXV

* Inactive for new design after 28 September 2009. For new design use - 1N5802, 1N5804, 1N5806, 1N5807, 1N5809, AND 1N5811, 1N5802US, 1N5804US, 1N5806US, 1N5807US, 1N5809US, AND 1N5811US on MIL-PRF-19500/477.

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 (noncavity double plug diodes utilizing category 3 metallurgical bonding) device types as specified in MIL-PRF-19500. This category 3 metallurgical bonding is also known as compression bonds (CB).

* 1.2 Physical dimensions. See figures 1(similar to a DO-7) and 2 (square end-cap surface mount).

1.3 Maximum ratings. Unless otherwise specified, $T_A = +25^\circ\text{C}$.

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

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 (1)	V_{RWM}	$I_{O(L)}$ $T_L = +75^\circ\text{C}$ $L = .25$ in. (6.35 mm) (2) (3)	I_{O1} $T_A = +55^\circ\text{C}$ (4) (5) (6)	I_{FSM} at $+25^\circ\text{C}$ 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)	$R_{\theta JX}$ (6)
		A	A	A(pk)	ns	$^\circ\text{C/W}$	$^\circ\text{C/W}$	$^\circ\text{C/W}$
1N5802CB, CBUS	50	2.5	1.0	35	25	36	13	154
1N5804CB, CBUS	100	2.5	1.0	35	25	36	13	154
1N5806CB, CBUS	150	2.5	1.0	35	25	36	13	154
1N5807CB, CBUS	50	6.0	3.0	125	30	22	6.5	52
1N5809CB, CBUS	100	6.0	3.0	125	30	22	6.5	52
1N5811CB, CBUS	150	6.0	3.0	125	30	22	6.5	52

See notes on next page.

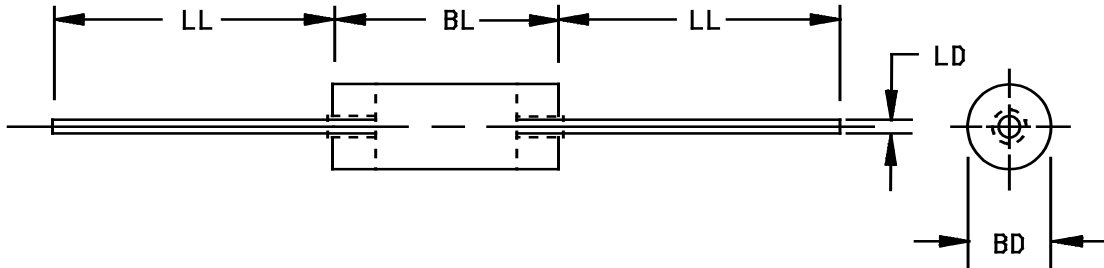
Comments, suggestions, or questions on this document should be addressed to Defense Supply Center, Columbus, ATTN: DSCC-VAC, P.O. Box 3990, Columbus, OH 43218-3990, or emailed to Semiconductor@dsc.dla.mil. Since contact information can change, you may want to verify the currency of this address information using the ASSIST Online database at <http://assist.daps.dla.mil>.

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 24 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) Derate at 8.33 mA/°C for T_A above +55 °C for 1.0 amp ratings.
- (5) Derate at 25 mA/°C for T_A above +55 °C for 3.0 amp ratings
- (6) 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 and where 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 $R_{\theta JX} \leq 154^\circ\text{C/W}$ for the 1N5802CB-1N5806CB and $R_{\theta JX} \leq 52^\circ\text{C/W}$ for the 1N5807CB-1N5811CB in col. 9. Also see application notes in 6.4.1 thru 6.4.4.
- (7) US suffix devices only.

1.4 Primary electrical characteristics. Unless otherwise specified, $T_A = +25^\circ\text{C}$.

Types	V_{BR} at 100 μA Pulse ≤ 20 ms	I_{R1} at $V_R = V_{RWM}$ $T_A = +25^\circ\text{C}$ Pulsed $V_R \leq 20\text{ms}$,	I_{R2} at $V_R = V_{RWM}$ $T_A = +125^\circ\text{C}$ Pulsed $V_R \leq 20\text{ms}$
	<u>V</u>	<u>μA</u>	<u>μA</u>
1N5802CB, CBUS	60	1.0	175
1N5804CB, CBUS	110	1.0	175
1N5806CB, CBUS	160	1.0	175
1N5807CB, CBUS	60	5.0	525
1N5809CB, CBUS	110	5.0	525
1N5811CB, CBUS	160	5.0	525

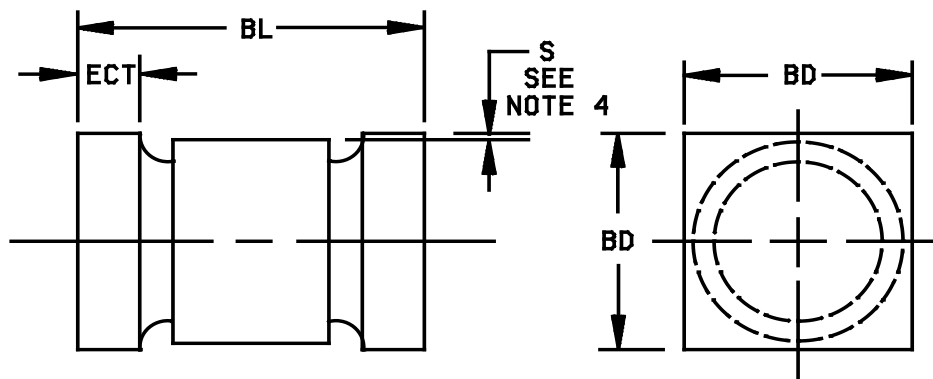


Ltr.	Dimensions								Notes
	1N5802CB, 1N5804CB, 1N5806CB				1N5807CB, 1N5809CB, 1N5811CB				
	Inches		Millimeters		Inches		Millimeters		
	Min	Max	Min	Max	Min	Max	Min	Max	
BD	.065	.085	1.65	2.16	.115	.142	2.92	3.61	4
BL	.125	.250	3.18	6.35	.130	.300	3.30	7.62	3
LD	.027	.032	0.69	0.81	.037	.042	0.94	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 ϕ x symbology.

* FIGURE 1. Physical dimensions (similar to a DO-7).



Ltr.	Dimensions								Notes
	D-5A 1N5802CBUS, 1N5804CBUS, 1N5806CBUS				D-5B 1N5807CBUS, 1N5809CBUS, 1N5811CBUS				
	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 (square body surface mount).

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. 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 and 2 herein.

3.4.1 Diode construction. These devices shall be metallurgically bonded-thermally-matched-noncavity-double plug construction, utilizing a category III bond, in accordance with MIL-PRF-19500. Full area metallurgical bond is required. (i.e. slug tungsten or moly to die). No point contacts are allowed. Silver button dumet design is prohibited. US version devices shall be structurally identical to the non-surface mount devices except for lead terminations.

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 and II herein.

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

4.2.1 Group E qualification. Group E inspection shall be performed for qualification or re-qualification 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 (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)	JANTXV and JANTX level
(1) 3c	Thermal impedance (see 4.3.1)
9	Not required
10	Method 1038 of MIL-STD-750, condition A
11	Required I_{R1} and V_{FM1}
12	Required, see 4.3.2
(2) 13	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 μ A dc (1N5807, 1N5809, 1N5811), whichever is greater. $\Delta V_{FM1} \leq \pm 0.05$ 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}) = 70 μ s max. The limits will be statistically derived. See table E-IX of MIL-PRF-19500, group E, subgroup 4 and table II, subgroup 4 herein. See figures 3, 4, 5, and 6 for thermal impedance.

* 4.3.2 Free air power burn-in conditions. Power burn-in conditions (ACOL or dc) as follows: Test conditions shall be in accordance with method 1038 of MIL-STD-750, condition B (see 4.5.3, 4.5.3.1). Adjust T_A , I_O , or I_F to achieve $T_J = 135^\circ\text{C}$ minimum, 175°C maximum.

- a. ACOL: $V_R = \text{rated } V_{RWM}$; $f = 60$ Hz; I_O (min) = col. 4 of 1.3.2, (see 4.5.3).
- b. DC: I_F (min) = col. 4 of 1.3.2.

With approval of the qualifying activity and preparing activity, alternate burn-in criteria (hours, bias conditions, T_J , mounting conditions) may be used. 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.

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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.

* 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-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.

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

<u>Subgroup</u>	<u>Method</u>	<u>Condition</u>
B3	1027	$I_O = I_{O1}$ rated minimum (see col. 4 of 1.3.2); adjust I_O to achieve $T_J = 150^\circ\text{C}$ minimum, apply $V_R =$ rated V_{RWM} (see col. 2 of 1.3.2), $f = 50 - 60\text{ Hz}$ (see 4.5.3.1). $T_A = 55^\circ\text{C}$ max. For irradiated devices, include t_{ir} 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. Electrical measurements (end-points) shall be in accordance with table I, subgroup 2 herein.

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

<u>Subgroup</u>	<u>Method</u>	<u>Condition</u>
C2	2036	Axial devices – Tension: Condition A, 4 pounds, $t = 15\text{s}$ - 1N5802, 1N5804, 1N5806. 12 pounds - 1N5807, 1N5809, 1N5811. Fatigue: Condition E, 2 pounds. (Lead fatigue is not applicable to US diodes).
* C2	2036	US devices – Tension: condition A; 4 pounds, $t = 15\text{s}$ for 1N5802US, 1N5804US, 1N5806US. Condition A, 12 pounds, $t = 15\text{s}$ for 1N5807US, 1N5809US, 1N5811US. 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 7 herein). (Lead fatigue is not applicable to US diodes).
C5	4081	$R_{\theta JL}$ (maximum) see col. 7 of 1.3.2 and 4.3.1 herein; $L = .375\text{ inch}$ (9.53 mm). For surface mount devices (US version), $R_{\theta JEC}$ see col. 8 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 $T_J = 150^\circ\text{C}$ minimum, apply $V_R =$ rated V_{RWM} (see col. 2 of 1.3.2), $f = 50 - 60\text{ Hz}$ (see 4.5.3.1). $T_A = 55^\circ\text{C}$ max. For irradiated devices, include t_{ir} 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.

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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 μ A 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 Free air burn-in and life tests. The use of a current limiting or ballast resistor is permitted provided that each DUT still sees the minimum I_O or I_F and that the minimum applied voltage, where applicable, is maintained through-out the burn-in period. Use method 3100 of MIL-STD-750 to measure T_J .

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 $t_{MD} = 70$ μ s max. See table E-IX of MIL-PRF-19500, subgroup 4, and figures 3, 4, 5, and 6 herein. Forced moving air or draft shall not be permitted across the device during test.

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TABLE I. Group A inspection.

Inspection <u>1/</u>	MIL-STD-750		Symbol	Limit		Unit
	Method	Conditions		Min	Max	
<u>Subgroup 1</u>						
Visual and mechanical examination	2071					
<u>Subgroup 2</u>						
Thermal impedance <u>2/</u>	3101	See 4.3.1	Z _{θJX}			°C/W
Forward voltage	4011	Duty cycle ≤ 2 percent (pulsed see 4.5.1); t _p = 8.3 ms (max)				
1N5802CB, CBUS, 1N5804CB, CBUS, 1N5806CB, CBUS		I _{FM} = 1.0 A	V _{FM1}		0.875	V
1N5802CB, CBUS, 1N5804CB, CBUS, 1N5806CB, CBUS		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)				
1N5807CB, CBUS, 1N5809CB, CBUS, 1N5811CB, CBUS		I _{FM} = 3.0 A	V _{FM3}		0.865	V
1N5807CB, CBUS, 1N5809CB, CBUS, 1N5811CB, CBUS		I _{FM} = 4.0 A	V _{FM4}		0.875	V
1N5807CB, CBUS 1N5809CB, CBUS 1N5811CB, CBUS		I _{FM} = 6.0 A	V _{FM5}		0.925	V
Reverse current	4016	DC or equivalent pulse method	I _{R1}			
1N5802CB, CBUS		V _R = 50 V			1.0	μA
1N5804CB, CBUS		V _R = 100 V			1.0	μA
1N5806CB, CBUS		V _R = 150 V			1.0	μA
1N5807CB, CBUS		V _R = 50 V			5.0	μA
1N5809CB, CBUS		V _R = 100 V			5.0	μA
1N5811CB, CBUS		V _R = 150 V			5.0	μA

See footnotes at end of table.

TABLE I. Group A inspection - Continued.

Inspection <u>1/</u>	MIL-STD-750		Symbol	Limit		Unit
	Method	Conditions		Min	Max	
<u>Subgroup 2</u> - continued						
Breakdown voltage	4021	$I_{(BR)} = 100 \mu\text{A}$	$V_{(BR)1}$			
1N5802CB, CBUS, 1N5807CB, CBUS				60		V
1N5804CB, CBUS, 1N5809CB, CBUS				110		V
1N5806CB, CBUS, 1N5811CB, CBUS				160		V
<u>Subgroup 3</u>						
High temperature operation:		$T_A = +125^\circ\text{C}$ minimum.				
Reverse current	4016	DC or equivalent pulse method	I_{R2}			
1N5802CB, CBUS				$V_R = 50 \text{ V}$	175	μA
1N5804CB, CBUS				$V_R = 100 \text{ V}$	175	μA
1N5806CB, CBUS				$V_R = 150 \text{ V}$	175	μA
1N5807CB, CBUS				$V_R = 50 \text{ V}$	525	μA
1N5809CB, CBUS				$V_R = 100 \text{ V}$	525	μA
1N5811CB, CBUS	$V_R = 150 \text{ V}$	525	μA			
Forward voltage	4011	Duty cycle ≤ 2 percent (pulsed see 4.5.1); $t_p = 8.3 \text{ ms}$ (max)				
1N5802CB, CBUS, 1N5804CB, CBUS, 1N5806CB, CBUS			$I_{FM} = 1.0 \text{ A}$	V_{FM6}	0.800	V
1N5807CB, CBUS, 1N5809CB, CBUS, 1N5811CB, CBUS			$I_{FM} = 4.0 \text{ A}$	V_{FM7}	0.800	V

See footnotes at end of table.

TABLE I. Group A inspection - Continued.

Inspection <u>1/</u>	MIL-STD-750		Symbol	Limit		Unit
	Method	Conditions		Min	Max	
Low-temperature operation:		$T_A = -65^\circ\text{C}$ minimum.				
Forward voltage	4011	Duty cycle \leq 2 percent (pulsed see 4.5.1); $t_p = 8.3$ ms (max)				
1N5802CB, CBUS, 1N5804CB, CBUS, 1N5806CB, CBUS		$I_{FM} = 1.0$ A	V_{FM8}		1.075	V
1N5807CB, CBUS, 1N5809CB, CBUS, 1N5811CB, CBUS		$I_{FM} = 4.0$ A	V_{FM9}		1.075	V
Breakdown voltage	4021	$I_{(BR)} = 100$ μA	$V_{(BR)2}$			
1N5802CB, CBUS, 1N5807CB, CBUS				50		V
1N5804CB, CBUS, 1N5809CB, CBUS				100		V
1N5806CB, CBUS, 1N5811CB, CBUS				150		V
<u>Subgroup 4</u>						
Reverse recovery time	4031	Condition B	t_{rr}			
1N5802CB, CBUS, 1N5804CB, CBUS, 1N5806CB, CBUS		$I_F = I_{RM} = 0.5$ A I_R (REC) = 0.05 A(pk) $di/dt = 65$ A/ μs (min)			25	ns
1N5807CB, CBUS, 1N5809CB, CBUS, 1N5811CB, CBUS		$I_F = I_{RM} = 1.0$ A I_R (REC) = 0.1 A(pk) $di/dt = 100$ A/ μs (min)			30	ns
Capacitance	4001	$V_R = 10$ V; $f = 1$ MHz; $V_{sig} = 50$ mV (p-p)	C_J			
1N5802CB, CBUS, 1N5804CB, CBUS, 1N5806CB, CBUS					25	pF
1N5807CB, CBUS, 1N5809CB, CBUS, 1N5811CB, CBUS					60	pF

See footnotes at end of table.

TABLE I. Group A inspection - Continued.

Inspection <u>1/</u>	MIL-STD-750		Symbol	Limit		Unit
	Method	Conditions		Min	Max	
<u>Subgroup 4</u> - continued						
Forward recovery voltage 1N5802CB, CBUS, 1N5804CB, CBUS, 1N5806CB, CBUS 1N5807CB, CBUS, 1N5809CB, CBUS, 1N5811CB, CBUS	4026	$t_r = 8 \text{ ns}$ $I_F = 250 \text{ mA}$ $I_F = 500 \text{ mA}$	$V_{(\text{peak})}$		2.2 2.2	V (pk) V (pk)
Forward recovery time 1N5802CB, CBUS, 1N5804CB, CBUS, 1N5806CB, CBUS 1N5807CB, CBUS, 1N5809CB, CBUS, 1N5811CB, CBUS	4026	$t_p \geq 20 \text{ ns}$, $t_r = 8 \text{ ns}$, the test is measured at $V_{FR} = 1.1 \times V_F$ $I_{FM} = 250 \text{ mA}$ $I_{FM} = 500 \text{ mA}$	t_{fr}		15 15	ns ns
Scope display evaluation	4023	See 4.5.2, $n = 116$, $c = 0$				
<u>Subgroup 5</u>						
Not applicable						
<u>Subgroup 6</u>						
Forward surge	4066	$I_{FSM} = \text{rated}$ (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); $V_{RWM} = \text{rated}$ (see 1.3.2); $T_A = + 25^\circ\text{C}$.				
Electrical measurements		See table I, subgroup 2 except Z_{0JX} .				
<u>Subgroup 7</u>						
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.

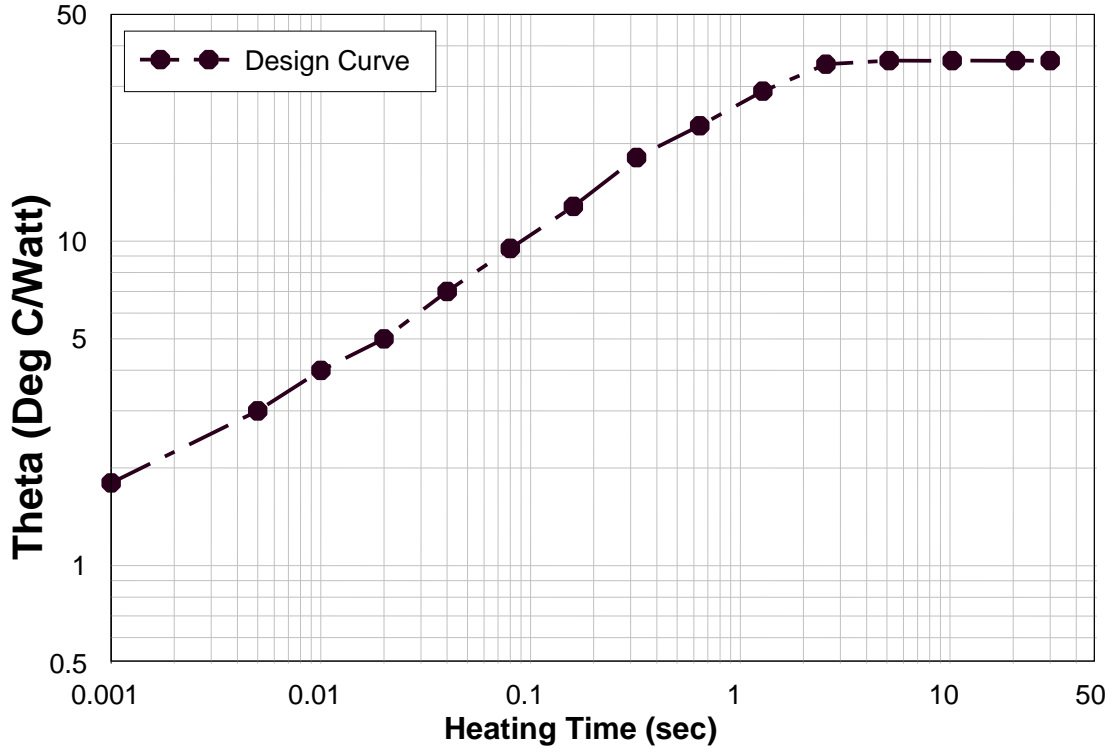
Inspection	MIL-STD-750		Sampling plan
	Method	Conditions	
<u>Subgroup 1A</u>			45 devices c = 0
Temperature cycling (air to air)	1051	20 cycles, except high temperature shall be 150°C and low temperature shall be -195°C.	
Hermetic seal	1071		
Electrical measurement		See table I, subgroup 2.	
<u>Subgroup 1B</u>			45 devices c = 0
Temperature cycling (air to air)	1051	-65°C to +175°C, 500 cycles.	
Hermetic seal	1071		
Electrical measurement		See table I, subgroup 2.	
<u>Subgroup 2</u>			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 _{θJX} need not to be performed. For irradiated devices, include t _{rr} , V _F , and I _R as end-point measurements.	
<u>Subgroup 4</u>			Sample size N/A
Thermal impedance curves		See MIL-PRF-19500.	
<u>Subgroups 5 and 6</u>			
Not applicable			

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

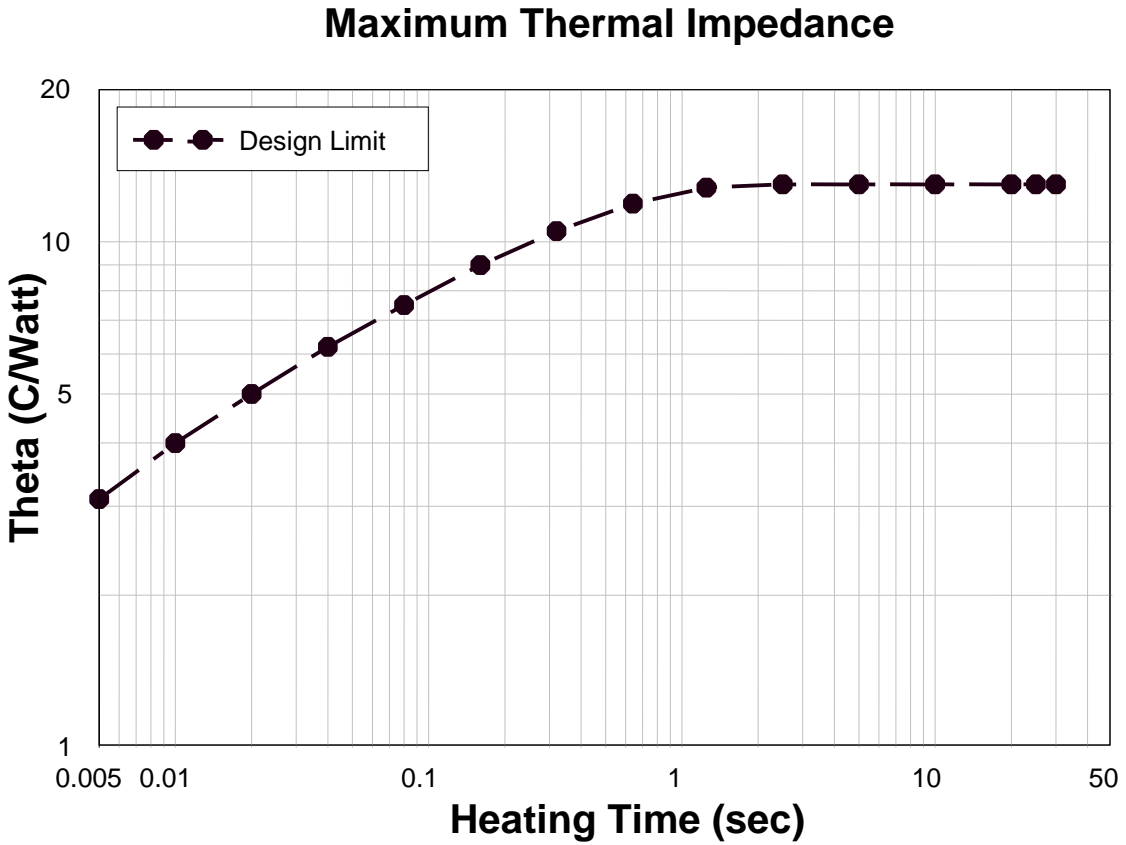
Inspection	MIL-STD-750		Sampling plan
	Method	Conditions	
<u>Subgroup 8</u> Peak reverse power Electrical measurement	4065	Peak reverse power, (P_{RM}) = shall be characterized by the supplier and this data shall be available to the Government. Test shall be performed on each subplot. During the P_{RM} 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.	n = 45
<u>Subgroup 9</u> Resistance to glass cracking	1057	Step stress to destruction by increasing cycles or up to a maximum of 25 cycles.	n = 45
<u>Subgroup 10</u> Forward surge Electrical measurement	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); $T_A = + 25^\circ\text{C}$. See table I, subgroup 2.	22 devices $c = 0$

Maximum Thermal Impedance



$Z_{\theta JX} = 4^{\circ}\text{C/W}$ at 10 ms.

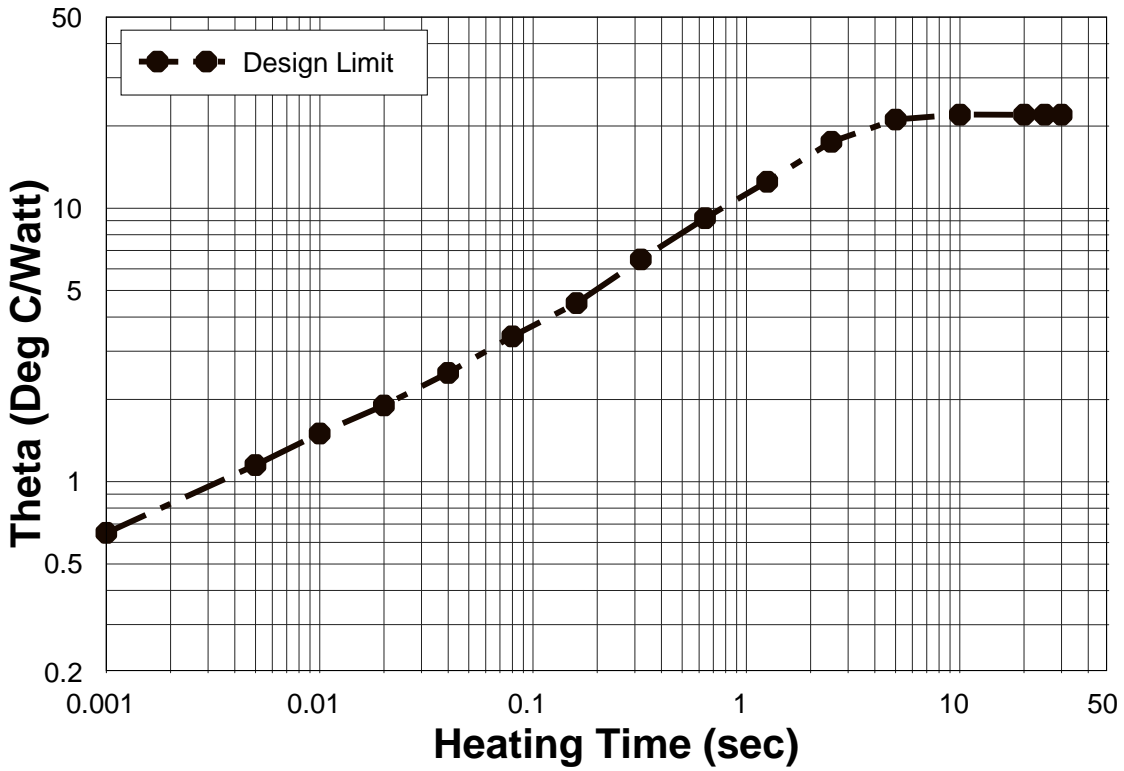
FIGURE 3. Thermal impedance curve, $R_{\theta JL} = 36^{\circ}\text{C/W}$ for 1N5802CB, 1N5804CB, 1N5806CB.



$Z_{\theta JX} = 4^{\circ}\text{C/W}$ at 10 ms.

FIGURE 4. Thermal impedance curve $R_{\theta JEC} = 13^{\circ}\text{C/W}$ for 1N5802CBUS, 1N5804CBUS, 1N5806CBUS.

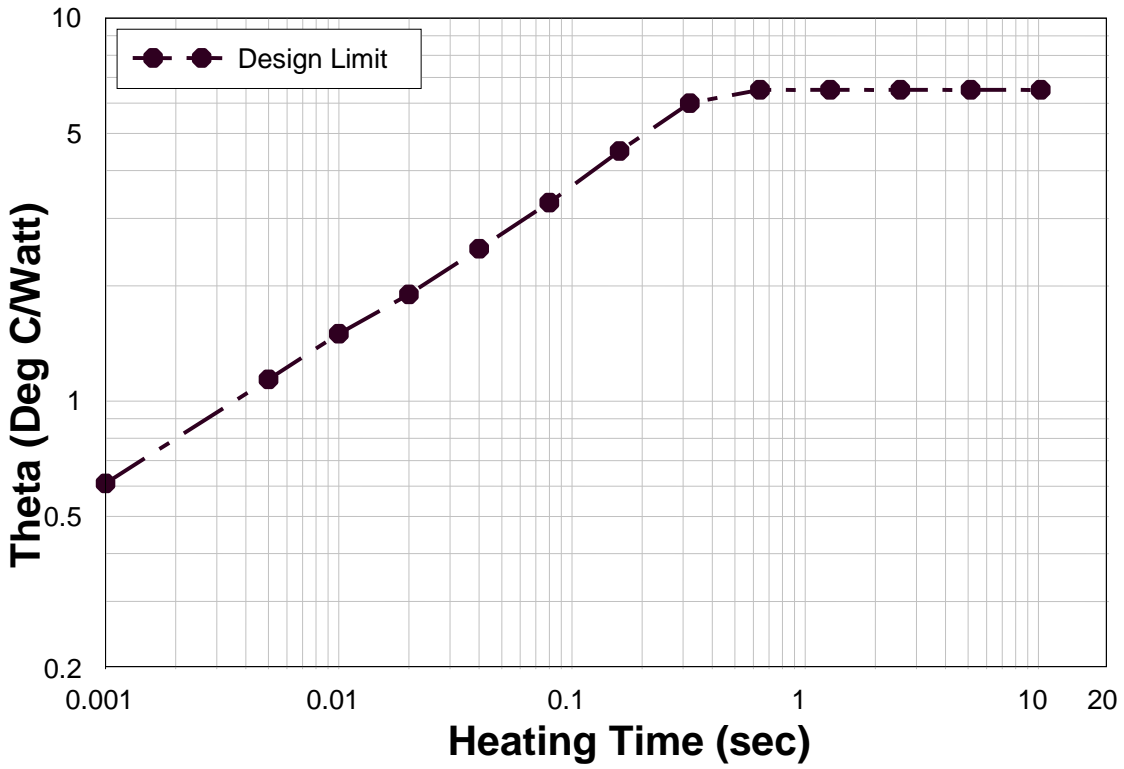
Maximum Thermal Impedance



$Z_{\theta JX} = 1.5^{\circ}\text{C/W}$ at 10 ms.

FIGURE 5. Thermal impedance curve $R_{\theta JL} = 22^{\circ}\text{C/W}$ for 1N5807CB, 1N5809CB, 1N5811CB.

Maximum Thermal Impedance



$Z_{\theta JX} = 1.5^{\circ}\text{C/W}$ at 10 ms.

FIGURE 6. Thermal impedance curve $R_{\theta JEC} = 6.5^{\circ}\text{C/W}$ for 1N5807CBUS, 1N5809CBUS, 1N5811CBUS.

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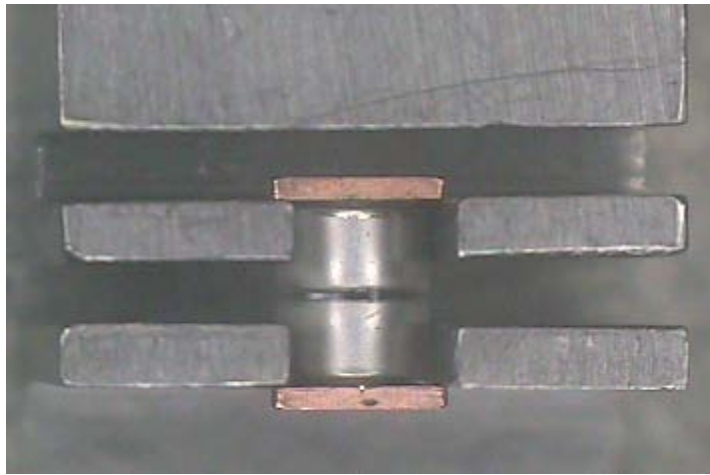


FIGURE 7. US terminal strength mounting.

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.

* 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. An online listing of products qualified to this specification may be found in the Qualified Products Database (QPD) at <http://assist.daps.dla.mil>.

6.4 Applications data.

6.4.1 Half-sine-wave application with 1N5807CB(US) to 1N5811CB(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 175°C and ambient temperature of 55°C, 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 1N5807CB to 1N5811CB or 1N5807CBUS to 1N5811CBUS. 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 6.4.3 for the smaller example devices 1N5802CB to 1N5806CB or 1N5802CB(US) to 1N5806CB(US).

- a. Use the I_O versus P_o curve on figure 8 to look up 3 amps (X-axis) and follow up to the $T_J=175^\circ\text{C}$ curve (lower) for 2.30 watts.
- b. Calculate maximum thermal resistance needed $(175^\circ\text{C} - 55^\circ\text{C}) / 2.30 \text{ W} = 52^\circ\text{C/W}$.
- c. Look up thermal resistance of 52°C/W on Y-axis using a thermal resistance versus pad area plot on one of the three curves on figure 9 for different weights of copper cladding and then intersect curve horizontally to get answer. These curves assume still air, horizontal position.
- d. In this example, the answer is: 1 oz PCB = .5 in² (1.27 mm²), 2 oz PCB = .3 in² (0.76 mm²), 3 oz PCB = .2 in² (0.51 mm²) for each pad.
- e. Add a conservative guard-band to the pad size (larger) to keep T_J below 175°C.

6.4.2 Square-wave application with 1N5807CB(US) to 1N5811CB(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 $T_J = 125^\circ\text{C}$ and ambient temperature of 55°C , 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 $T_J = 125^\circ\text{C}$ with $T_A = 55^\circ\text{C}$.
- b. Calculate peak $I_F = 1 \text{ A} / 0.50 \text{ duty factor} = 2 \text{ amps}$.
- c. Use the V_F versus I_F curve on figure 10 to look up $I_F = 2 \text{ A}$ (Y-axis) and follow across to the $T_J = 125^\circ\text{C}$ curve (middle) for $V_F = 0.65 \text{ V}$.
- d. Calculate power = $I_F * V_F * \text{duty factor} = 2 * 0.65 * 0.50 = 0.65 \text{ W}$.
- e. Calculate maximum thermal resistance needed $(125^\circ\text{C} - 55^\circ\text{C}) / 0.65 \text{ W} = 107^\circ\text{C/W}$.
- f. Look up thermal resistance of 107°C/W on the Y-axis using a thermal resistance versus pad area plot on one of the three curves on figure 9 for different weights of copper cladding and then intersect curve horizontally to get answer. Curves assume still air, horizontal position.
- g. In this example, the answer is: 1 oz PCB = $.058 \text{ in}^2$ (1.4732 mm^2), 2 oz PCB = $.038 \text{ in}^2$ (0.9652 mm^2), 3 oz PCB = $.024 \text{ in}^2$ (0.6096 mm^2) for each pad.
- h. A conservative pad guard-band is optional since T_J is only 125°C . NOTE: Multilayer PCBs, forced air cooling will improve performance. Closed confinement of the PCB will do the opposite. Use sound thermal management.

6.4.3 Half-sine-wave application with 1N5802CB(US) to 1N5806CB(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 175°C and ambient temperature of 55°C , 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 1N5802CB to 1N5806CB or 1N5802CB(US) to 1N5806CB(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 P_o curve on figure 11 to look up 1 amp (X-axis) and follow up to the $T_J = 175^\circ\text{C}$ curve (lower) for 0.78 watts.
- b. Calculate maximum thermal resistance needed $(175^\circ\text{C} - 55^\circ\text{C}) / 0.78 \text{ W} = 154^\circ\text{C/W}$.
- c. Look up thermal resistance of 154°C/W on Y-axis using a thermal resistance versus pad area plot on one of the three curves on figure 12 for different weights of copper cladding and then intersect curve horizontally to get answer. These curves assume still air, horizontal position.
- d. In this example, the answer is: 1 oz PCB = $.013 \text{ in}^2$ (0.3302 mm^2), 2 oz PCB = $.008 \text{ in}^2$ (0.2032 mm^2), 3 oz PCB = $.0053 \text{ in}^2$ (0.13462 mm^2) for each pad.
- e. Add a conservative guard-band to the pad size (larger) to keep T_J below 175°C .

6.4.4 Square-wave application with 1N5802CB(US) to 1N5806CB(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 $T_J = 125^\circ\text{C}$ and ambient temperature of 55°C , 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 $T_J = 125^\circ\text{C}$ with $T_A = 55^\circ\text{C}$.
- b. Calculate peak $I_F = 0.5\text{A} / 0.50$ duty factor = 1 amp.
- c. Use the V_F versus I_F curve on figure 13 to look up $I_F = 1$ A (Y-axis) and follow across to the $T_J = 125^\circ\text{C}$ curve (middle) for $V_F = 0.70$ V.
- d. Calculate power = $I_F * V_F * \text{duty factor} = 2 * 0.70 * 0.50 = 0.70$ W.
- e. Calculate maximum thermal resistance needed $(125^\circ\text{C} - 55^\circ\text{C}) / 0.70$ W = $100^\circ\text{C}/\text{W}$.
- f. Look up thermal resistance of $100^\circ\text{C}/\text{W}$ on the Y-axis using a thermal resistance versus pad area plot on one of the three curves on figure 12 for different weights of copper cladding and then intersect curve horizontally to get answer. Curves assume still air, horizontal position.
- g. In this example, the answer is: 1 oz PCB = $.084$ in² (2.1336 mm²), 2 oz PCB = $.051$ in² (1.2954 mm²), 3 oz PCB = $.034$ in² (0.8636 mm²) for each pad.
- h. A conservative pad guard-band is optional since T_J is only 125°C . NOTE: Multilayer PCBs, forced air cooling, will improve performance. Closed confinement of the PCB will do the opposite. Use sound thermal management.

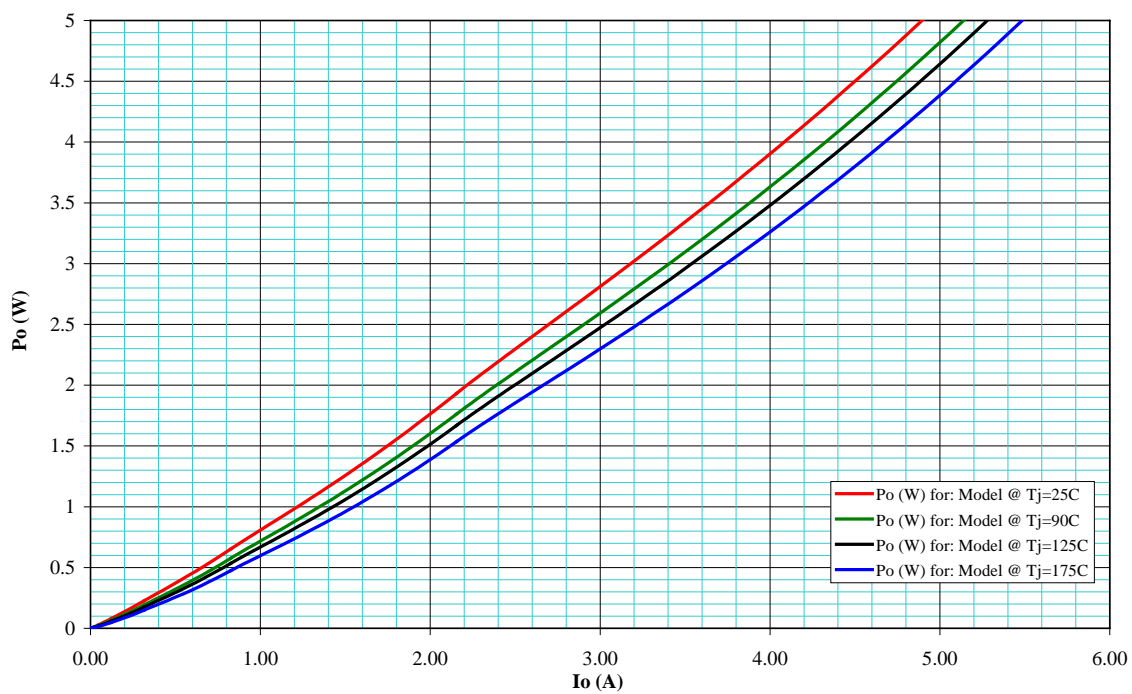


FIGURE 8. Rectifier power versus I_o (average forward current) for 1N5807CB(US) to 1N5811CB(US).

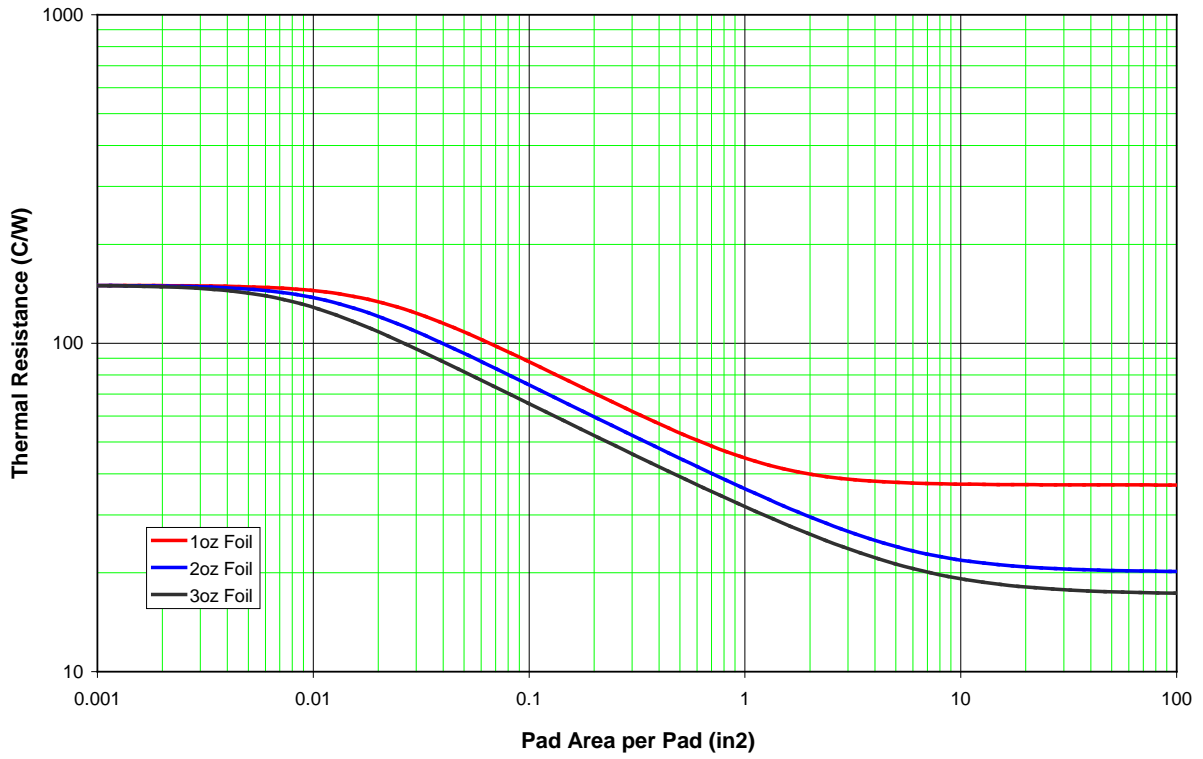


FIGURE 9. Thermal resistance versus pad area still air, PCB horizontal (for each pad) with 1, 2, and 3 oz copper for 1N5807CB(US) to 1N5811CB(US).

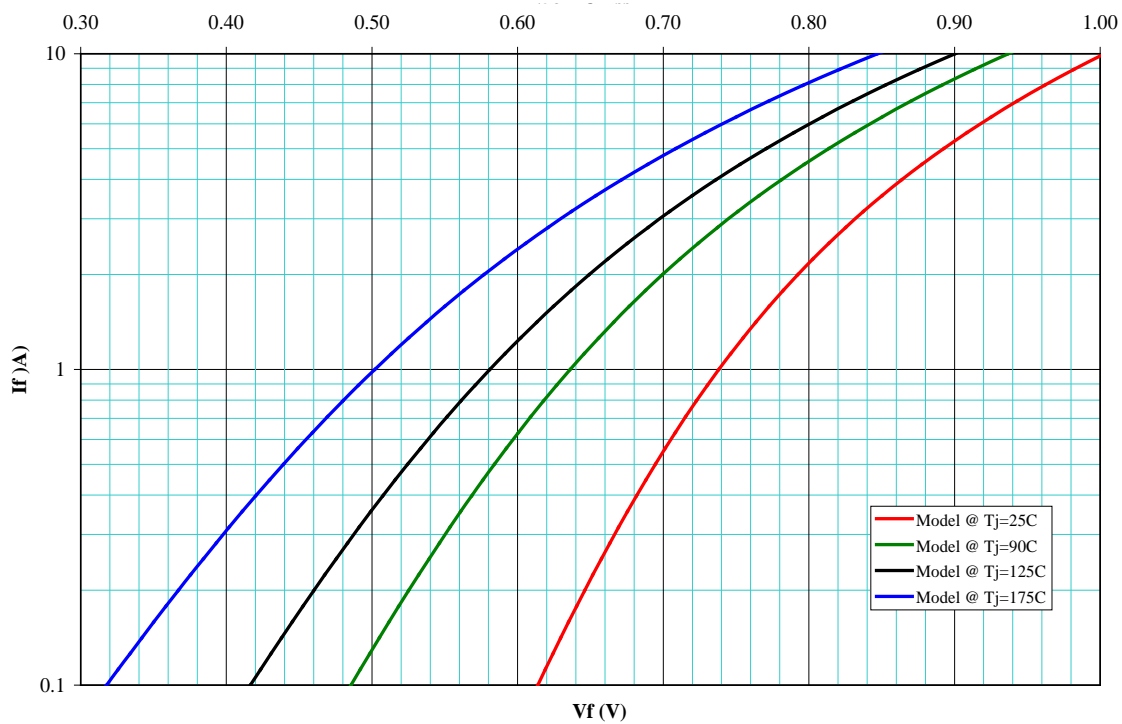


FIGURE 10. Forward voltage versus forward current for 1N5807CB(US) to 1N5811CB(US).

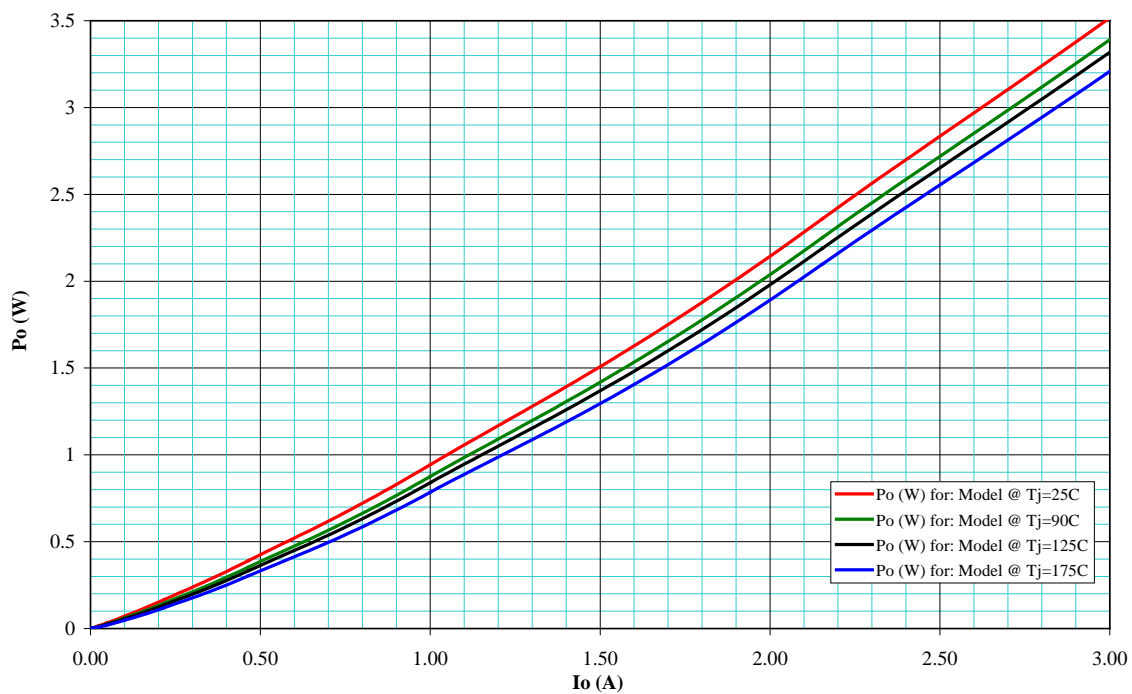


FIGURE 11. Rectifier power versus I_o (average forward current) for 1N5802CB(US) to 1N5806CB(US).

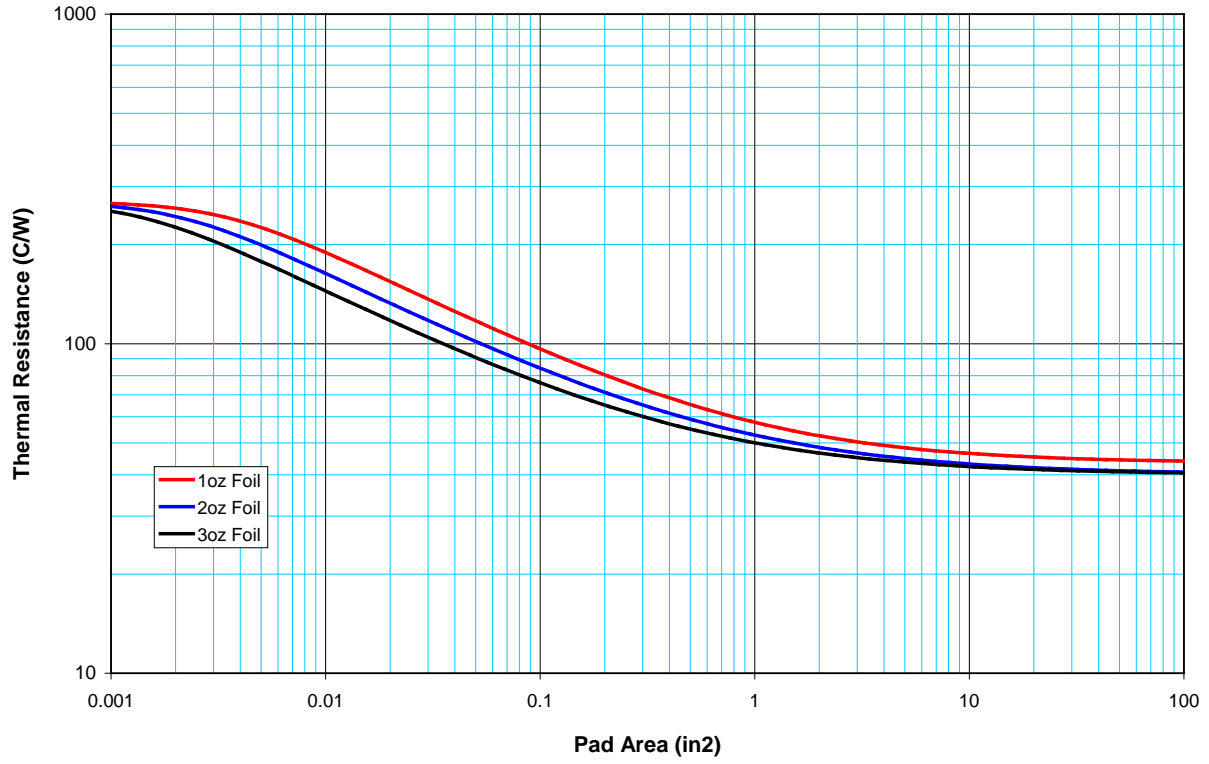


FIGURE 12. Thermal resistance versus pad area still air, PCB horizontal (for each pad) with 1, 2, and 3 oz copper for 1N5802CB(US) to 1N5806CB(US).

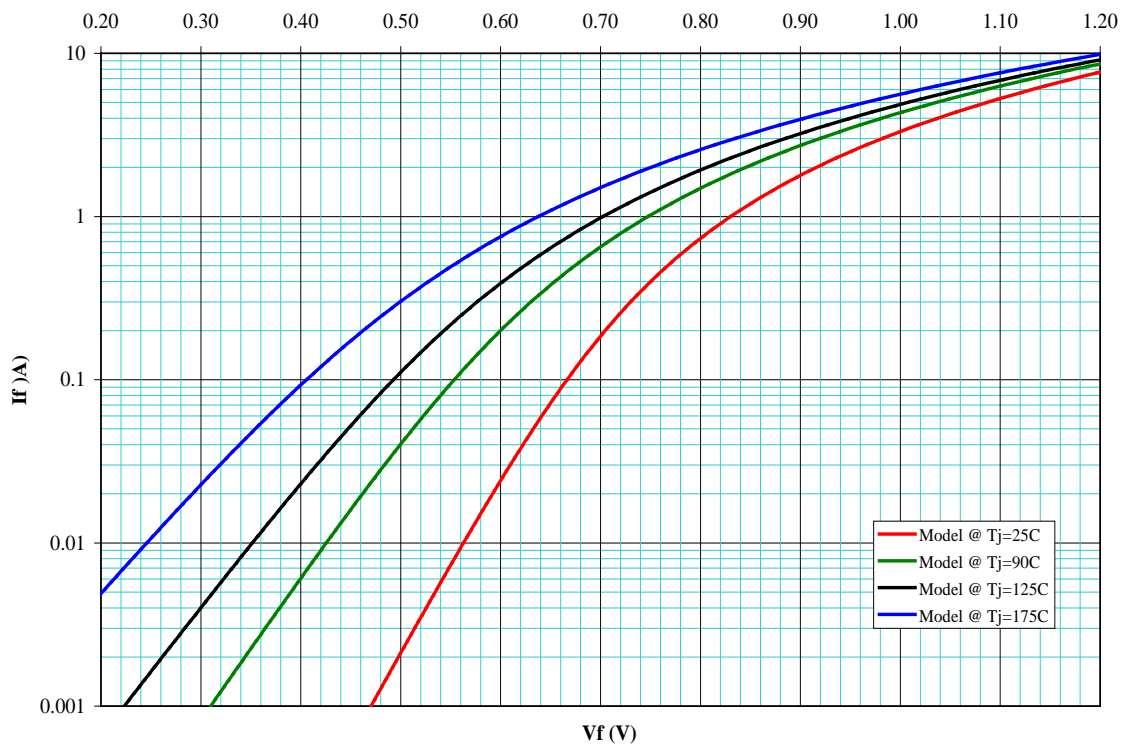


FIGURE 13. Forward voltage versus forward current for 1N5802CB(US) to 1N5806CB(US).

6.5 Changes from previous issue. The margins of this specification are marked with asterisks to indicate where changes from the previous issue were made. This was done as a convenience only and the Government assumes no liability whatsoever for any inaccuracies in these notations. Bidders and contractors are cautioned to evaluate the requirements of this document based on the entire content irrespective of the marginal notations and relationship to the last previous issue.

Custodians:

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

Preparing activity:

DLA - CC

(Project 5961-2008-091)

Review activities:

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

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