The documentation and process conversion measures necessary to comply with this document shall be completed by 2 January 2011.

INCH-POUND

MIL-PRF-19500/359K
2 October 2010
SUPERSEDING
MIL-PRF-19500/359J
18 February 2009

PERFORMANCE SPECIFICATION SHEET

SEMICONDUCTOR DEVICE, DIODE, SILICON, FAST RECOVERY, POWER RECTIFIER,
1N4942, 1N4944, 1N4946, 1N4947, AND 1N4948,
JAN, JANTX, AND JANTXV

Inactive for new design after 27 February 1992 For new design use - 1N5615, 1N5617, 1N5619, 1N5621, 1N5623 on MIL-PRF-19500/429.

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 a silicon, fast recovery semiconductor power rectifier diode for use in equipment circuits. Three levels of product assurance are provided for each device as specified in MIL-PRF-19500.

1.2 Physical dimensions. See figure 1 axial package.

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

Device type	V_{RWM}	I_O T_A = +55°C (1) (2) (3)	I_O T_A = +100°C (2) (3)	I_{FSM} at t_p = 8.3 ms I_O = .750 A dc T_A = +55°C	$R_{\theta JL}$ L = .375 inch (9.52 mm) (4)	t_{rr1} at I_F = 0.5 A, I_R = 1.0 A I_{REC} = 0.25 A	$R_{\theta JX}$	T_{STG} and T_J
	V	A dc	A dc	A pk	°C /W	ns	°C/W	°C
1N4942	200	1.0	.750	15	38	150	115	-65°C to +175°C
1N4944	400	1.0	.750	15	38	150	115	
1N4946	600	1.0	.750	15	38	250	115	
1N4947	800	1.0	.750	15	38	250	115	
1N4948	1,000	1.0	.750	15	38	500	115	

See notes on next page.

* Comments, suggestions, or questions on this document should be addressed to DLA Land and Maritime, ATTN: 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 https://assist.daps.dla.mil .

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

(1) Derate linearly from 1.0 A at T_A = +55°C to 0.75 A at +100°C. Derate linearly from 0.75 A to 0 A between +100°C and +175°C.
(2) For the 1 amp rating at 55°C ambient or 0.75 amp rating at 100°C ambient, these I_O ratings are for thermal (PC boards or other) mounting methods where thermal resistance from mounting point to ambient is still sufficiently controlled where $T_{J(MAX)}$ in 1.3 is not exceeded. This equates to $R_{\theta JX} \leq 115$ºC/W as shown. Also see application notes in 6.5.
(3) Barometric pressure reduced, 1N4944, 1N4946: 8 mm Hg (100,000 feet); 1N4947, 14948: 33 mm Hg (70,000 feet).
(4) For thermal impedance curve, see figure 2.

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 https://assist.daps.dla.mil/quicksearch or https://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.

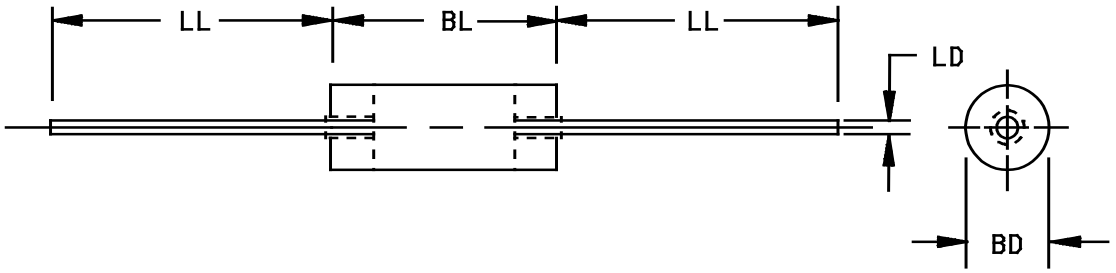
3. REQUIREMENTS

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.

T_{CVF} ..... Temperature coefficient of forward voltage.



Dimensions					
Ltr	Inches		Millimeters		Notes
	Min	Max	Min	Max	
BD	.065	.150	1.65	3.81	3, 4
BL	.140	.250	3.56	6.35	4
LD	.027	.033	0.69	0.84	
LL	1.00	1.50	25.4	38.1	

NOTES:
1. Dimensions are in inches.
2. Millimeter equivalents are given for general information only.
3. Dimension BD shall be measured at the largest diameter.
4. The BL dimension 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 onto the leads .050 inch (1.27 mm).
5. In accordance with ASME Y14.5M, diameters are equivalent to ϕx symbology.

FIGURE 1. Physical dimensions axial package.

3.4 Interface and physical dimensions. Interface and physical dimensions shall be as specified in MIL-PRF-19500, and on figure 1 herein. All devices shall be metallurgically bonded-thermally matched-noncavity-double plug construction as defined in MIL-PRF-19500.

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.

3.4.2 Lead finish. Lead finish shall be solderable in accordance with MIL-PRF-19500, and as specified herein. Where a choice of lead finish is desired, it shall be specified in the acquisition document (see 6.2).

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

3.5.1 Polarity. The polarity of all types shall be indicated with a contrasting color band to denote the cathode end.

3.6 Electrical performance characteristics. Unless otherwise specified herein, the electrical performance characteristics are as specified in 1.3 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).

4.1.1 Sampling and inspection. Sampling and inspection shall be in accordance with MIL-PRF-19500 and herein.

4.2 Qualification inspection. Qualification inspection shall be in accordance with MIL-PRF-19500 and 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 of this revision to maintain qualification.

4.3 Screening (JANTX and JANTXV levels). 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)	Measurement
	JANTX and JANTXV levels
(1) 3c	Thermal impedance (see 4.3.1).
9	Not applicable.
11	I_{R1} and V_{FM1}.
12	See 4.3.2 and 4.5.3.
(2) 13	Subgroup 2 of table I herein: $\Delta I_{R1} \leq \pm 100$ percent of initial reading or ± 50 nA dc whichever is greater. $\Delta V_{FM1} \leq +0.1$ V dc, -0.2 V dc. Scope display evaluation (see 4.5.4).

(1) Thermal impedance shall be performed any time after sealing provided temperature cycling is performed in accordance with MIL-PRF-19500, screen 3 prior to this thermal test.

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

4.3.1 Thermal impedance. The thermal impedance measurements shall be performed in accordance with method 3101 of MIL-STD 750 as applicable, 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 μs max. The thermal impedance limit used in screen 3c and table I, subgroup 2 shall be set statistically by the supplier.

4.3.2 Power burn-in conditions. Power burn-in conditions are as follows (see 4.5.3 and 4.5.3.1): $I_{O(min)}$ = 1 A dc. T_A = +55°C maximum. Test conditions in accordance with method 1038 of MIL-STD-750, condition B. Use method 3100 of MIL-STD-750 to measure T_J. 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.

4.4 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. $Z_{\theta JX}$ endpoint shall be derived by the supplier and approved by the qualifying activity. This $Z_{\theta JX}$ end-point shall be documented in the qualification report

4.4.2 Group B inspection. Group B inspection shall be conducted in accordance with the conditions specified for subgroup testing in appendix E, table E-Vib (JAN, JANTX, and JANTXV) of MIL-PRF-19500. Electrical measurements (end-points) shall be in accordance with table I, group A, subgroup 2 herein. Delta requirement shall be in accordance with table III herein.

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

Subgroup	Method	Condition
B2	4066	I_{FSM} = rated (see 1.3); ten surges of 8.3 ms each at 1 minute intervals; superimposed on I_O = .750 A dc, V_{RWM} = rated (see 1.3 herein). T_A = 55°C
B3	1027	I_O = 1.0 A dc minimum; Adjust I_O to achieve required T_J of 150ºC minimum; f = 50 – 60 Hz; T_A = +55°C max.; V_R = rated V_{RWM} (see 1.3, 4.5.3, and 4.5.3.1); t = 340 hours. For irradiated devices, include t_{rr1} 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, group A, subgroup 2 herein. Delta requirements shall be in accordance with table III herein.

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

	Subgroup	Method	Condition
	C2	1056	Test condition A.
*	C2	2036	Tension: Test condition A, weight = 10 pounds; t = 15 seconds.
	C2	1021	Omit initial conditioning.
	C5	4081	$R_{\theta JL}$ = 38°C/W; L = .375 inch (9.52 millimeters); I_M = 10 mA, see (4.5.6), I_H = 2 A, t_H = thermal equilibrium.
	C6	1026	T_A = +55°C max. f = 50 – 60 Hz; I_O = 1.0 A minimum; Adjust I_O to achieve required T_J of 150ºC minimum; V_R = rated V_{RWM} (see 1.3, 4.5.3, and 4.5.3.1). For irradiated devices, include t_{rr1} 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 in table II herein. Electrical measurements (end-points) shall be in accordance with table I, group A, subgroup 2 herein. Delta requirements shall be in accordance with table III herein.

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

4.5.1 Pulse measurements. Conditions for pulse measurement shall be as specified in section 4 of MIL-STD-750.

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

4.5.3 Burn-in and life tests. These tests shall be conducted with a half-sine waveform of the specified peak voltage impressed across the diode in the reverse direction followed by a half-sine waveform of the specified average rectified current. The forward conduction angle of the rectified current shall be neither greater than 180 degrees nor less than 150 degrees.

4.5.3.1 Burn-in and life tests The use of a current limiting or ballast resistor is permitted provided that each DUT still sees the required T_J and full rated Io and that the minimum required voltage V_{RWM} is maintained throughout the burn-in period. Use method 3100 of MIL-STD-750 to measure T_J.

4.5.3.2 Mounting conditions. At the option of the manufacturer, any clips or heat sink mounting configurations may be utilized provided that I_O is increased such that the junction temperature of each diode is maintained at +135°C minimum for screening and +150°C minimum for life test and that the minimum required voltage V_{RWM} is maintained throughout the burn-in period. Use test method 3100 of MIL-STD-750 to measure T_J.

4.5.4 Scope display evaluation. Scope display evaluation shall be sharp and stable in accordance with method 4023 of MIL-STD-750. Scope display may be performed on ATE (automatic test equipment) for screening only with the approval of the qualifying activity. Scope display in group A shall be performed on a curve tracer. The reverse current (I_{BR}) over the knee shall be 500 μA peak.

4.5.5 Peak reverse power test. Peak reverse power, $P_{RM} \geq 318$ W for square wave in accordance with method 4065 of MIL-STD-750 ($P_{RM} \geq 500$ W for half sine-wave). Test shall be performed on each sublot; sampling plan n = 10, c = 0. Electrical end-points shall be in accordance with table I, subgroup 2 herein.

4.5.6 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 the thermal resistance versus pad area (for each pad) with 1, 2, and 3 oz copper for 1N4942 through 1N4948 figure 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	2071					
Subgroup 2						
Forward voltage	4011	I_{FM1} = 1.0 A dc, pulsed (see 4.5.1).	V_{FM1}	0.6	1.3	V dc
Reverse current leakage	4016	V_R = rated V_{RWM}, (see 1.3), pulsed (see 4.5.1).	I_{R1}		1.0	µA
Breakdown voltage	4021	I_R = 50 µA, pulsed (see 4.5.1).	$V_{(BR)1}$			
1N4942				220		V dc
1N4944				440		V dc
1N4946				660		V dc
1N4947				880		V dc
1N4948				1,100		V dc
Thermal impedance	3101	See 4.3.1.	$Z_{\theta JX}$			°C/W
Subgroup 3						
High temperature operation		T_A = +150°C.				
Reverse current leakage	4016	V_R = rated V_{RWM} (see 1.3), pulsed (see 4.5.1).	I_{R2}		200	µA
Low temperature operation		T_A = -55°C.				
Forward voltage	4011	I_{FM} = 1 A dc, pulsed (see 4.5.1).	V_{FM2}	0.6	1.5	V dc
Reverse current	4016	V_R = rated V_{RWM} (see 1.3); dc method.	I_{R3}		1.0	µA dc

See footnote at end of table.

* TABLE I. Group A inspection – Continued.

Inspection 1/	MIL-STD-750		Symbol	Limit		Unit
	Method	Conditions		Min	Max	
Subgroup 4						
* Forward recovery voltage	4026	I_F = 0.25 A; t_p = 20 ns, (minimum); t_r = 8 ns.	$V_{(PEAK)}$		5.0	V
Capacitance	4001	V_R = 12 V dc, f = 0.1 to 1 MHz.	C_J			
1N4942					45	pF
1N4944					35	pF
1N4946					25	pF
1N4947					20	pF
1N4948					15	pF
Reverse recovery time	4031	Condition B1.	T_{rr1}			
1N4942					150	ns
1N4944					150	ns
1N4946					250	ns
1N4947					250	ns
1N4948					500	ns
Scope display evaluation	4023	Stable, see 4.5.4, n = 116, c = 0.				
Subgroup 5						
Not applicable						
Subgroup 6	4066	I_{FSM} =; ten surges of 15 A, 8.3 ms each at 1 minute intervals; superimposed on I_O = .750 A dc; V_{RWM} = rated (see 1.3 herein). T_A = 55°C				
Electrical measurements		See table I, subgroup 2 except $Z_{\theta JX}$				
Subgroup 7						
Not applicable						

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

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

Inspection	MIL-STD-750		Sampling plan
	Method	Conditions	
Subgroup 1A			45 devices c = 0
Temperature cycling (air to air)	1/ 1051	20 cycles, except high temperature shall be 150°C and low temperature shall be -195°C.	
Hermetic seal 2/	1071		
Electrical measurement		See table I, group A, subgroup 2 and table III, steps 1 and 2. For irradiated devices, include t_{rr1} as an end-point measurement.	
Subgroup 1B			45 devices c = 0
Temperature cycling (air to air)	1051	500 cycles, condition C. -65°C to +175°C	
Hermetic seal 2/	1071		
Electrical measurement		See table I, group A, subgroup 2 and table III, steps 1 and 2. For irradiated devices, include t_{rr1} as an end-point measurement.	
Subgroup 2			22 devices c = 0
Steady-state blocking life	1048	Test condition A, t = 1,000 hours, T_A = +150°C, V_R = 0.8 of rated V_{RWM} (see 1.3).	
Electrical measurement		See table I, group A, subgroup 2 and table III, steps 1 and 2. For irradiated devices, include t_{rr1} as an end-point measurement.	
Subgroup 3			
Not applicable			
Subgroup 4			Sample size N/A
Thermal impedance		See MIL-PRF-19500.	
Subgroup 5			22 devices c = 0
Barometric pressure (reduced)	1001	1N4944, 1N4946 = 8 mm Hg (100,000 ft); 1N4947, 1N4948 = 33 mm Hg (70,000 ft); voltage during test = V_{RWM}; maximum; leakage (I_R) during test shall be 5 μA.	

See footnotes at end of table

TABLE II. Group E inspection (all quality levels) for qualification only. 1/

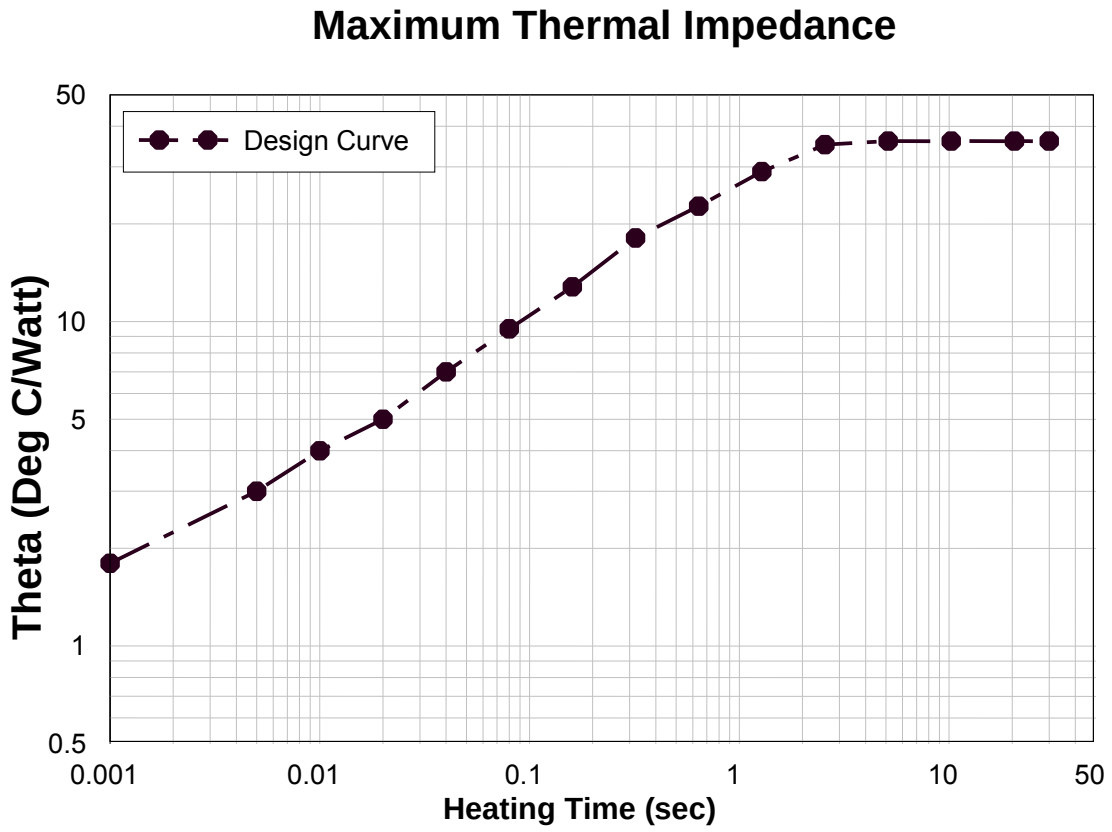
Inspection	MIL-STD-750		Sampling plan
	Method	Conditions	
Subgroup 6			
Not applicable			
Subgroup 7			
Peak reverse power	4065	Peak reverse power (P_{RM})= shall be characterized by the supplier and this data shall be available to the Government.	n = 45
Electrical measurement		During the P_{RM} test, 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 to characterize each sublot.	
Subgroup 10			22 devices c = 0
Forward surge	4066	I_{FSM} = rated (see 1.3); ten surges of 8.3 ms each at 1 minute intervals superimposed on I_O = .750 A dc; V_{RWM} = rated (see 1.3); T_A = + 55°C.	
Electrical measurement		See table I, subgroup 2.	

1/ Test method 1056 of MIL-STD-750, condition D, using liquid nitrogen may be used in lieu of test method 1051.
2/ Non-transparent glass encased double plug, non-cavity axial leaded diodes may use test method 2068 of MIL-STD-750.

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

Step	Inspection	MIL-STD-750		Symbol	Limits		Unit
		Method	Conditions		Min	Max	
1.	Forward voltage	4011	I_{FM1} = 1.0 A dc, pulsed (see 4.5.1).	ΔV_F	-0.2	+0.1	V dc
2.	Reverse current leakage	4016	V_R = rated V_{RWM} , (see 1.3), pulsed (see 4.5.1).	ΔI_R	$\leq$ ±100 percent of initial value or ±50 nA, 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-VIb (JAN, JANTX, and JANTXV) of MIL-PRF-19500 are as follows: Subgroup 3, see table III herein, 1 and 2.
3/ The electrical measurements for group C inspections in, table E-VII of MIL-PRF-19500 are as follows:
   a. Subgroup 2, see table III herein, steps 1 and 2.
   b. Subgroup 6, see table III, steps 1 and 2.
4/ The electrical measurements for group E inspections in, table E-IX of MIL-PRF-19500 are as follows:
   a. Subgroup 1, see table III herein, steps 1 and 2.
   b. Subgroup 2, see table III herein, steps 1 and 2.



$Z_{\theta JX}$ = 4°C/W at 10 ms.

FIGURE 2. Thermal impedance curve, $R_{\theta JL}$ = 38°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 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 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.daps.dla.mil .

6.4 Substitution information. Devices covered by this specification are substitutable for the manufacturer's and user's PIN (Part or Identifying Number). This information in no way implies that manufacturers' PIN's are suitable as substitutes for the military PIN's.

6.5 Applications data.

6.5.1 Half-sine-wave application with 1N4942 through 1N4948. 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 1N4942 to 1N4948. 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 verses Po curve on figure 3 to look up 1 amp (X-axis) and follow up to the T_J =175ºC curve (lower) for 1.04 watts.

b. Calculate maximum thermal resistance needed (175ºC - 55ºC) /1.04 W = 115 ºC/W.

c. Look up thermal resistance of 115ºC/W on Y-axis using a thermal resistance verses pad area plot on one of the three curves on figure 4 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 = .042 in^2 (1.07 mm^2), 2 oz PCB = .025 in^2 (0.64 mm^2), 3 oz PCB = .014 in^2 (0.36 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 1N4942 through 1N4948. 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 = 0.5 A / 0.50 duty factor = 1 amp.

c. Use the V_F verses I_F curve on figure 5 to look up I_F = 1 A (Y-axis) and follow across to the T_J = 125ºC curve (middle) for V_F = 0.96 V.

d. Calculate power = I_F * V_F * duty factor = 1 x 0.96 x 0.50 = 0.48 W.

e. Calculate maximum thermal resistance needed (125ºC - 55ºC) / 0.48 W = 146ºC/W.

f. Look up thermal resistance of 146ºC/W on the Y-axis using a thermal resistance verses pad area plot on one of the three curves on figure 4 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: 1oz PCB = .02 in^2 (0.51 mm^2), 2oz PCB = .012 in^2 (0.30 mm^2), 3oz PCB = .008 in^2 (0.20 mm^2) for each pad.

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

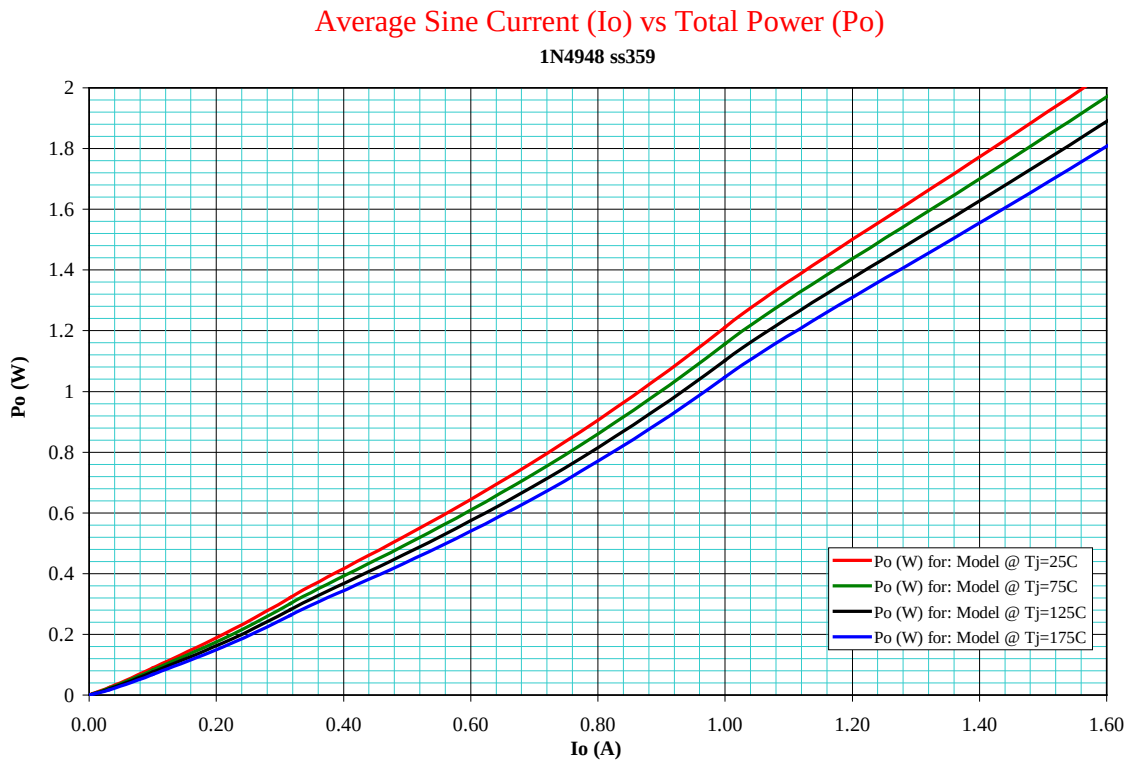


FIGURE 3. Rectifier power versus I_O (average forward current) for 1N4942 through 1N4948.

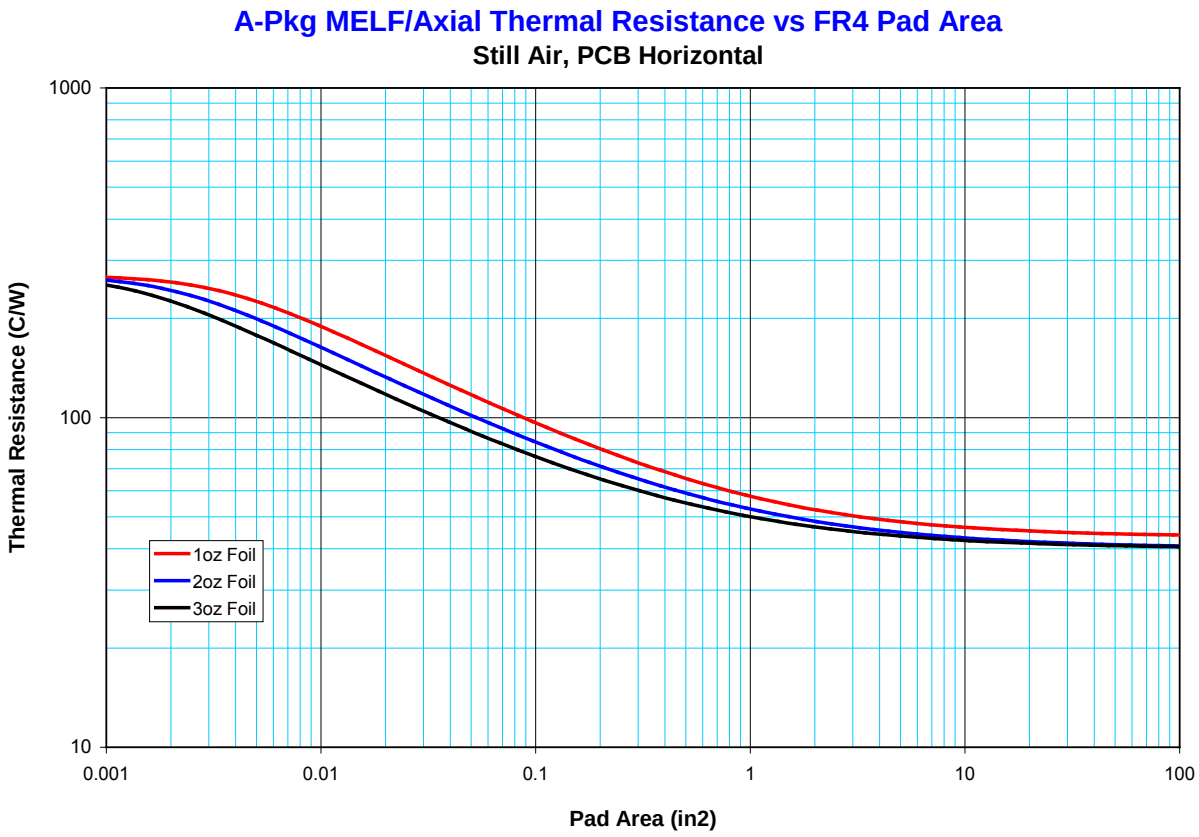


FIGURE 4. Thermal resistance versus pad area (for each pad) with 1, 2, and 3 oz copper for 1N4942 through 1N4948.

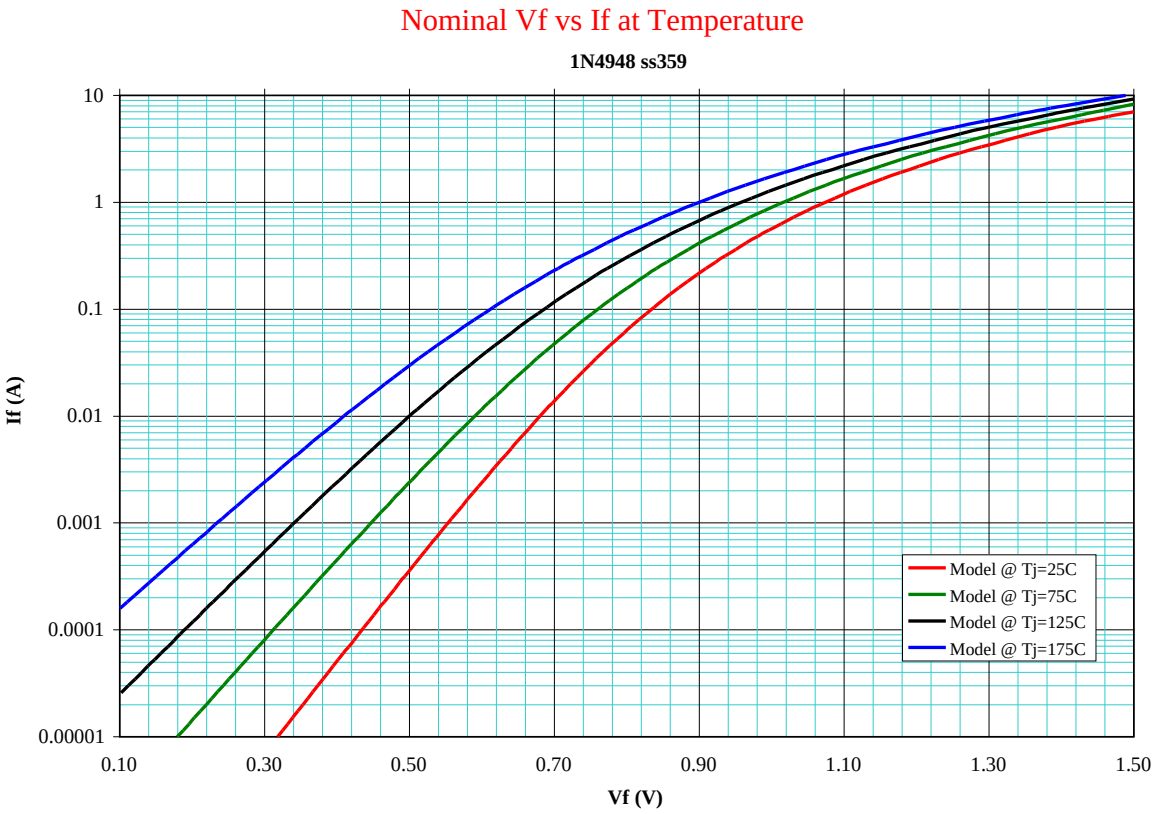


FIGURE 5. Forward voltage versus forward current for 1N4942 through 1N4948.

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 - 85
DLA - CC

Review activities:
Army - AR, MI, SM
Navy - AS, MC
Air Force - 19, 70, 71, 99

Preparing activity:
DLA - CC

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* 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 https://assist.daps.dla.mil.