The documentation and process conversion measures necessary to comply with this revision shall be completed by 15 January 2008.

INCH-POUND

MIL-PRF-19500/427L
15 October 2007
SUPERSEDING
MIL-PRF-19500/427K
7 April 2004

PERFORMANCE SPECIFICATION SHEET

SEMICONDUCTOR DEVICE, DIODE, SILICON, POWER RECTIFIER,
TYPES 1N5614, 1N5616, 1N5618, 1N5620, 1N5622, 1N5614US, 1N5616US,
1N5618US, 1N5620US, 1N5622US, 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, hermetically sealed power rectifier diodes. Four levels of product assurance are provided for each encapsulated device as specified in MIL-PRF-19500. Two levels of product assurance are provided each unencapsulated device type.

* 1.2 Physical dimensions. See figures 1 (axial lead), figure 2 (surface mount), and figure 3 (JANHC and JANKC).

* 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 (1)	I_{O1} T_A = +55°C	I_{O2} T_A = +100°C	V_{RWM} (2)	I_{FSM} T_A = +100°C I_F = 750 mA t_p = 8.3 ms	t_{rr}	$R_{\theta JL}$ at L = .375 inch (9.53 mm) (4)	$R_{\theta JEC}$ (4)	$R_{\theta JX}$ (4)
	A	mA	V	A	µs	°C/W	°C/W	°C/W
1N5614, US	1	750	200	30	2	36	13	133
1N5616, US	1	750	400	30	2	36	13	133
1N5618, US	1	750	600	30	2	36	13	133
1N5620, US	1	750	800	30	2	36	13	133
1N5622, US	1	750	1,000	30	2	36	13	133

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.

* 1.3 Maximum ratings – Continued.

(1) Barometric pressure reduced: 1N5614, 1N5615, and 1N5618 = 8 mm Hg, 1N5620 and 1N5622 = 33 mm Hg.
(2) From 1 A at T_A = +55°C, to 0.75 A at T_A = +100°C, derate linearly at 5.56 mA/°C.
(3) From 0.75 A at T_A = +100°C, to 0 A at T_A = +175°C, derate linearly at 10 mA/°C.
(4) For the 1 A rating at 55°C ambient and the 750 mA rating at 100°C ambient, these I_O ratings are for a thermally (PC boards or other) mounting methods where the lead or end cap temperatures cannot be maintained, 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 $R_{\theta JX} \leq 133$ºC/W in col. 9. Also see application notes in 6.5.1.

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

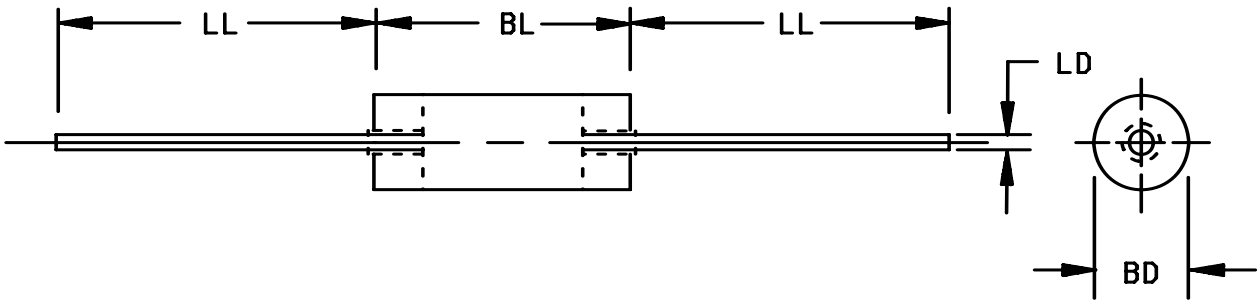
MIL-PRF-19500 - Semiconductor Devices, General Specification for.

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.)

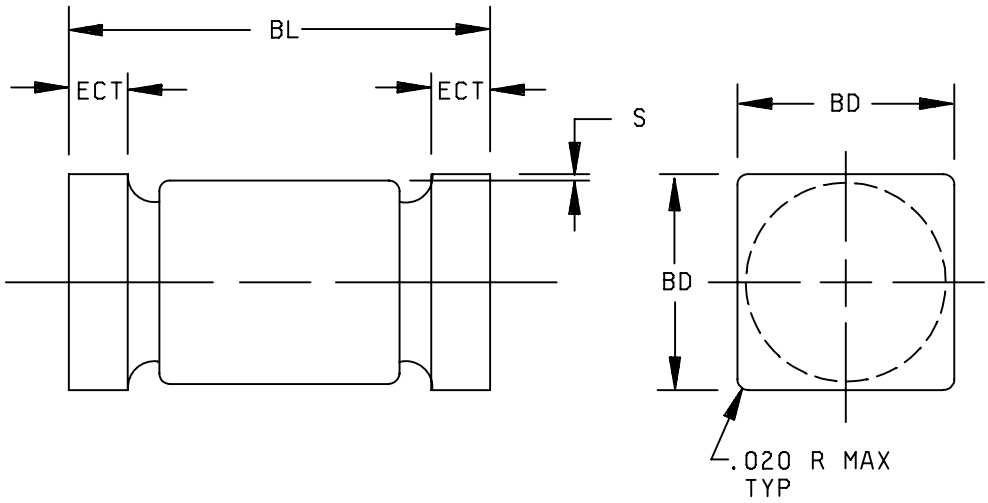
2.3 Order of precedence. In the event of a conflict between the text of this document and the references cited herein, the text of this document takes precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.



Symbol	Dimensions				Notes
	Inches		Millimeters		
	Min	Max	Min	Max	
BD	.065	.110	1.65	2.79	3
BL	.130	.225	3.30	5.72	4
LD	.026	.033	0.66	0.84	
LL	1.00	1.30	25.4	33.02	

NOTES:
1. Dimensions are in inches.
2. Millimeters are given for general information only.
3. Dimension BD shall be measured at the largest diameter.
4. The BL dimension shall include the entire body including slugs and sections of the leads 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.
5. The shape of the body, within the bounds of the dimensions is optional.
6. In accordance with ASME Y14.5M, diameters are equivalent to ϕx symbology.

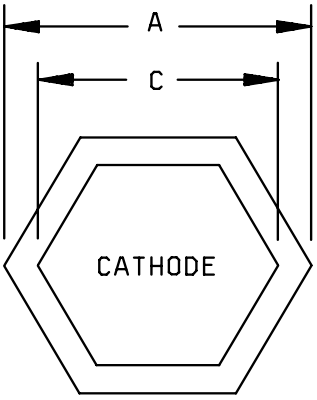
* FIGURE 1. Physical dimensions for axial leaded devices only.

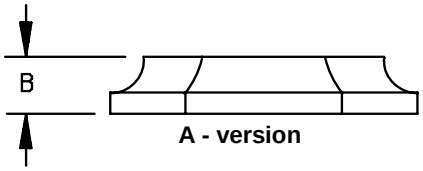


Symbol	Dimensions			
	Inches		Millimeters	
	Min	Max	Min	Max
BD	.091	.103	2.31	2.62
BL	.168	.200	4.27	5.08
ECT	.019	.028	0.48	0.71
S	.003		0.08	

NOTES:
1. Dimensions are in inches.
2. Millimeters are given for general information only.
3. Dimensions are pre-solder dip.
4. The S dimension is minimum clearance of glass body to mounting surface on all orientations.
5. In accordance with ASME Y14.5M, diameters are equivalent to ϕx symbology.

* FIGURE 2. Physical dimensions types 1N5614US, 1N5616US, 1N5618US, 1N5620US, and 1N5622US (surface mount devices).





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

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

* FIGURE 3. Physical dimension, JANHCA AND JANKCA die.

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.
US	Short-body unleaded or surface mounted diodes (square end-caps).

* 3.4 Interface and physical dimensions. The interface and physical dimensions shall be as specified in MIL-PRF-19500, and in figures 1, 2, and 3 herein.

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

* 3.4.2 Diode construction. These devices shall be metallurgically bonded-thermally-matched-noncavity-double plug construction, utilizing a category I bond, in accordance with MIL-PRF-19500, except for JANHC and JANKC. US version devices shall be structurally identical to the nonsurface mount version devices except for lead configuration.

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

* 3.5.1 Marking of US version devices. For US version devices only, all marking (except as stated in 3.6) may be omitted from the body, but shall be retained on the initial container.

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

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

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

3.9 Workmanship. Semiconductor devices shall be processed in such a manner as to be uniform in quality and shall be free from other defects that will affect life, serviceability, or appearance.

4. VERIFICATION

4.1 Classification of inspections. The inspection requirements specified herein are classified as follows:

a. Qualification inspection (see 4.2).

b. Screening (see 4.3).

c. Conformance inspection (see 4.4).

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

* 4.2.1 Group E qualification. Group E 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.

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

* 4.3 Screening (JANTX, JANTXV and JANS 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.

Screening (see appendix E, table E-IV of MIL-PRF-19500)	JANS level	JANTXV and JANTX level
3a (1) 3c	Required Thermal impedance (see 4.3.1).	Required Thermal impedance (see 4.3.1).
9	I_{R1} and V_F	Not required
10	Method 1038 of MIL-STD-750, condition A	Method 1038 of MIL-STD-750, condition A
11	I_{R1} and V_F, $\Delta I_{R1} \leq$ 100 percent of initial reading or $\pm$ 100 nA dc, whichever is greater. $\Delta V_F \leq \pm$ 0.1 V dc.	I_{R1} and V_F
12	Required, see 4.3.2	Required, see 4.3.2
(2) 13	Subgroups 2 and 3 of table I herein: $\Delta I_{R1} \leq$ 100 percent of initial reading or $\pm$ 100 nA dc, whichever is greater. $\Delta V_F \leq \pm$ 0.1 V dc. Scope display evaluation (see 4.5.2)	Subgroup 2 of table I herein: $\Delta I_{R1} \leq$ 100 percent of initial reading or $\pm$ 100 nA dc, whichever is greater. $\Delta V_F \leq \pm$ 0.1 V dc. Scope display evaluation (see 4.5.2)
15	Required	Not required
16	Required	Not required

(1) Thermal impedance shall be performed any time after sealing provided temperature cycling is performed in accordance with MIL-PRF-19500, screen 3 prior to this thermal test.
(2) $Z_{\theta JX}$ is not required in screen 13, if already previously performed.

* 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 μs max. The limits will be statistically derived. See table II, group E, subgroup 4 herein.

* 4.3.2 Power burn-in conditions. Power burn-in conditions are as follows (see 4.5.3, 4.5.3.1). I_O(min) = 1 A minimum; T_A = 55ºC maximum. Test conditions 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 = 135ºC minimum and 175ºC maximum. 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 group A, subgroup 2 of MIL-PRF-19500. Burn-in duration for the JANKC level follows JANS requirements; the JANHC follows JANTX requirements.

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

* 4.4.1 Group A inspection. Group A inspection shall be conducted in accordance with appendix E, table E-V of 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. The $Z_{\theta JX}$ 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 conditions specified for subgroup testing in appendix E, table E-VIa (JANS) and table E-VIb (JANTX and JANTXV) of MIL-PRF-19500, appendix E, and as follows. Electrical measurements (end-points) shall be in accordance with the applicable inspections of table I, subgroup 2 herein. Delta measurements shall be as specified in table III herein. Leaded samples may be used in lieu of surface mount devices (US version) for life tests.

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

Subgroup	Method	Conditions
B3	4066	I_{FSM} = rated I_{FSM} (see col. 5 of 1.3); ten surges of 8.3 ms each at 1 minute intervals, superimposed on I_O = 0, V_{RWM} = 0.
B4	1037	I_O = 1 A minimum for applicable mounting and required delta temperature in method 1037 of MIL-STD-750; V_R = V_{RWM} (see 1.3). 2,000 cycles.
B5	1027	I_O = 1 A minimum; apply V_R = rated V_{RWM} (see col. 4 of 1.3.2, 4.5.3 and 4.5.3.1) adjust I_O to achieve T_J minimum; f = 50-60 Hz; n = 45, c =0. T_A = + 55°C max. ; T_J = 175°C minimum; t = 1,000 hours.
B8	4065	Peak reverse power. $P_{RM} \geq 318$ W. Test shall be performed on each sublot; sampling plan n = 10, c = 0, end-points, see 4.4.2.

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

Subgroup	Method	Conditions
B3	1027	I_O = 1A minimum (see col. 4 of 1.3.2). Adjust I_O to achieve the required T_J; T_A = +55°C maximum, f = 50-60 Hz, apply V_R = rated V_{RWM} (see col. 4 of 1.3.2), 4.5.3, and 4.5.3.1.

* 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, and as follows. Electrical measurements (end-points) shall be in accordance with the applicable inspections of table I, subgroup 2 herein. Delta measurements shall be as specified in table III herein. Leaded samples may be used in lieu of surface mount devices (US version) for life tests.

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

Subgroup	Method	Conditions
C2	2036	Axial devices – Tension: Test condition A; weight = 4 pounds; t = 15 seconds, Lead fatigue: Test condition E; weight = 2 pounds.
C2	2036	US devices – Tension: Test condition A; weight = 4 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) ≤36°C/W, L= .375 inch (9.53 mm). For surface mount devices (US version), $R_{\theta JEC}$ ≤ 13°C/W.
C6	1026	I_O = 1 A minimum (see col. 2 of 1.3.2). Adjust I_O to achieve the required T_J; T_A = +55°C maximum,f = 50-60 Hz; apply V_R = rated V_{RWM} (see col. 4 of 1.3.2), 4.5.3, and 4.5.3.1.
C8	2031	n = 22, c = 0. One cycle.

4.4.4 Group E inspection. Group E inspection shall be conducted in accordance with the conditions specified for subgroup testing in table IX of MIL-PRF-19500, appendix E, and as specified herein. Electrical measurements (end-points) shall be in accordance with table I, subgroup 2 herein; except, $Z_{\theta JX}$ need not be performed. See table III for delta limits when applicable.

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

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

4.5.2 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 table I, subgroup 4 shall be performed on a scope. 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 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 full required T_J and I_O and that the minimum required voltage, where applicable, is maintained through out the burn-in period. Use test method 3100 of MIL-STD-750 to measure T_J. T_J = 135°C minimum for screening and 150°C minimum for life tests. T_A = 55°C maximum.

* 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 5 and 6 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	Limits		Unit
	Method	Conditions		Min	Max	
Subgroup 1						
Visual and mechanical inspection	2071					
Subgroup 2						
Thermal impedance	3101	See 4.3.1	$Z_{\theta JX}$			°C/W
Forward voltage	4011	I_F = 3 A, pulsed (see 4.5.1) t_p = 300 μs, 2 maximum duty cycle	V_F	0.8	1.3	V
Reverse current leakage	4016	DC method or equivalent pulse; V_R = rated V_{RWM} (see 1.3.2 col 4)	I_{R1}		0.5	μA dc
Breakdown voltage	4021	I_R = 50 μA dc	V_{BR}			
1N5614, US				220		V
1N5616, US				440		V
1N5618, US				660		V
1N5620, US				880		V
1N5622, US				1,100		V
Subgroup 3						
High temperature operation:		T_A = +125°C				
Reverse current leakage	4016	DC method or equivalent pulse; V_R = rated V_{RWM} (see col. 4 of 1.3)	I_{R2}		25	μA dc
Subgroup 4						
Reverse recovery time	4031	Condition B1	t_{rr}		2	μs
Scope display	4023	See 4.5.2; n = 116, c = 0				
Subgroup 5						
Not applicable						

See footnote at end of table.

* TABLE I. Group A inspection - Continued.

Inspection 1/	MIL-STD-750		Symbol	Limits		Unit
	Method	Conditions		Min	Max	
Subgroup 6						
Forward surge	4066	I_{FSM} = 30 A (pk); ten surges of 8.3 ms each at 1 minute intervals, superimposed on I_O = 0 A; V_{RWM} = 0; T_A = +25°C.				
Electrical end-points		See table I, subgroup 2				
Subgroup 7						
Not applicable						

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

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

Inspection	MIL-STD-750		Sampling plan
	Method	Conditions	
Subgroup 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 1/	1071		
Electrical measurement		See table I, subgroup 2 and table III, steps 1 and 2.	
Subgroup 1B			
Temperature cycling (air to air)	1051	500 cycles, condition C, -65°C to +175°C.	
Hermetic seal 1/	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_A = +150°C; t = 1,000 hours +65, -0 hours; dc = 80 - 85 percent rated V_{RWM} (see column 4 of 1.3.2).	
Electrical measurement		See table I, subgroup 2 and table III, steps 1 and 2.	
Subgroup 4			
Thermal impedance curves		See MIL-PRF-19500	
Subgroup 5			22 devices c = 0
Barometric pressure (reduced)	1001	1N5614, 1N5616 and 1N5618 at 8 mm Hg 1N5620 and 1N5622 at 33 mm Hg	
Subgroup 6			22 devices c = 0
ESD	1020	Testing not required for class 3 listing. Test is required for non-sensitive listing to prove capability.	

See footnote at end of table.

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

Inspection	MIL-STD-750		Sampling plan
	Method	Conditions	
Subgroup 8			
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, herein shall be considered a failure to that level of applied P_{RM}. Progressively higher levels of P_{RM} shall be applied until failure occurs on all devices within the chosen sample size.	
Subgroup 9			n = 45
Resistance to glass cracking	1057	Test condition B. Step stress to destruction by increasing cycles or up to a maximum of 25 cycles.	
Subgroup 10			22 devices c = 0
Forward surge	4066	I_{FSM} = rated (see col. 5 of 1.3.2); ten surges of 8.3 ms each at 1 minute intervals superimposed on I_O = 1.0 A (see col. 2 of 1.3.2); V_{RWM} = rated (see col. 4 of 1.3.2); T_A = + 25°C.	
Electrical measurement		See table I, subgroup 2.	

1/ For opaque glass diodes use test method 2068 of MIL-STD-750.

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

Step	Inspection	MIL-STD-750		Symbol	Limits		Unit
		Method	Conditions		Min	Max	
1.	Reverse current leakage change	4016	DC method	ΔI_{R1} 5/		For JANTX and JANTXV, ≤ 250 nA or 100 percent, whichever is greater, For JANS ≤ 100 nA or 100 percent, whichever is greater.	
2.	Forward voltage change	4011	I_F = 3 A; pulsed (see 4.5.1)	ΔV_F 5/		± 50 mV maximum change from previous measured value.	

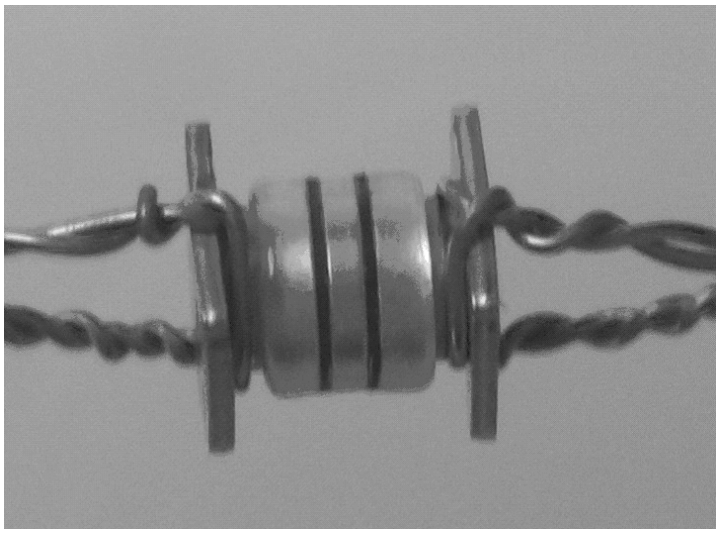
1/ The delta measurements for group B inspections in table VIa (JANS) of MIL-PRF-19500, appendix E, are as follows:
   a. Subgroup 3, see table III herein, step 2.
   b. Subgroup 4, see table III herein, step 2.
   c. Subgroup 5, see table III herein, steps 1 and 2.

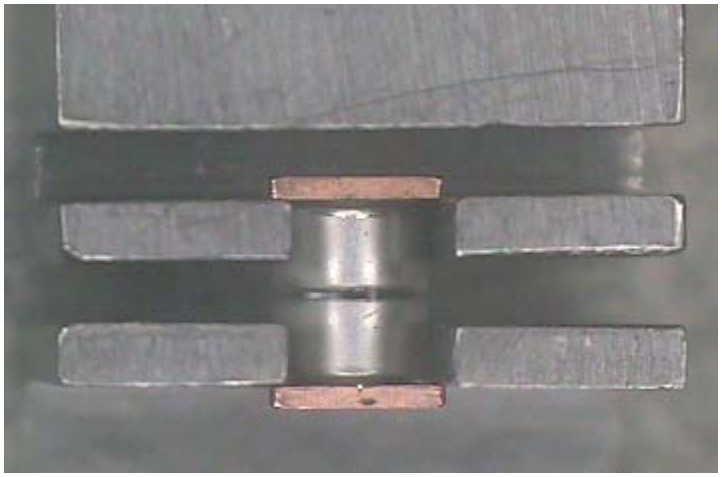
2/ The delta measurements for group B inspections in table VIb (JANTX and JANTXV) of MIL-PRF-19500, appendix E are as follows:
   a. Subgroup 3, see table III herein, step 1.
   b. Subgroup 6, see table III herein, step 1.

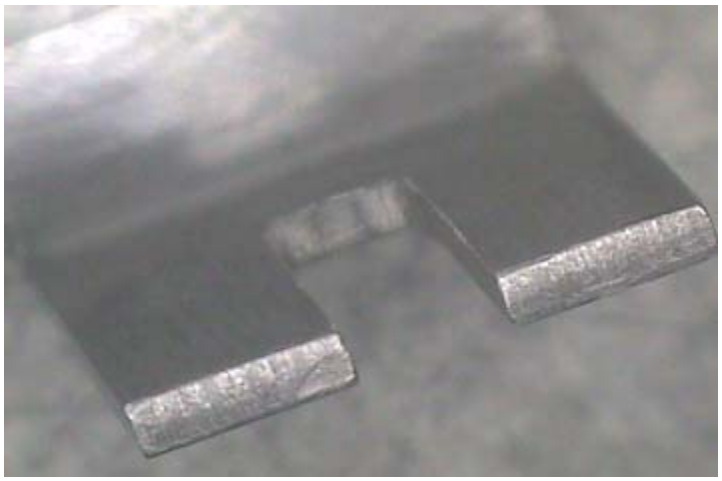
3/ The delta measurements for group C inspections in table VII of MIL-PRF-19500, appendix E, are as follows:
   a. Subgroup 2, see table III herein, steps 1 and 2 (JANS).
   b. Subgroup 6, see table III herein, steps 1 and 2 (JANS), step 1 (JANTX and JANTXV).

4/ The delta measurements for table IX of MIL-PRF-19500, appendix E, are as follows: Subgroups 1 and 2, see table III herein, steps 1 and 2.

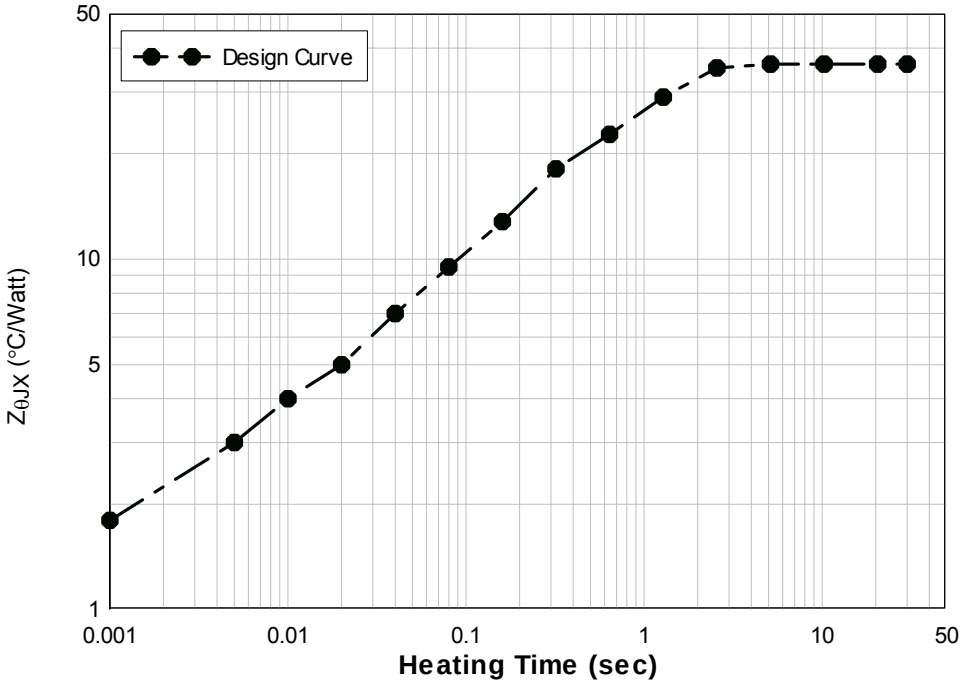
5/ Devices which exceed the table I limits for this test shall not be accepted.



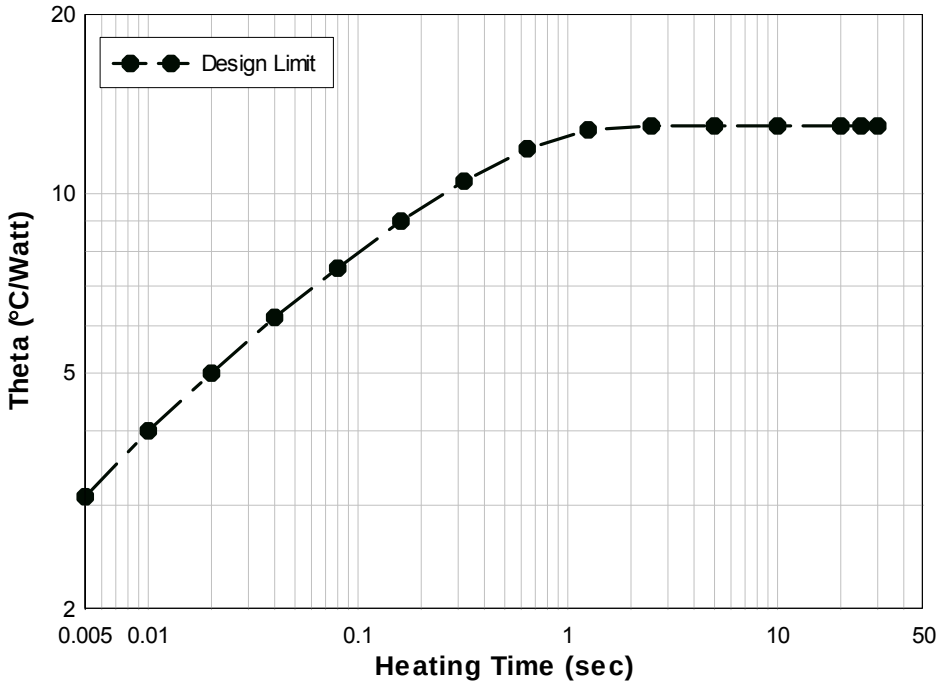




* FIGURE 4. US terminal strength mounting.



* FIGURE 5. Thermal impedance graph $R_{\theta JL}$, 36°C/W.



* FIGURE 6. Thermal impedance graph $R_{\theta JEC}$, 13°C/W.

5. PACKAGING

5.1 Packaging. For acquisition purposes, the packaging requirements shall be as specified in the contract or order (see 6.2). When packaging of materiel is to be performed by DoD or in-house contractor personnel, these personnel need to contact the responsible packaging activity to ascertain packaging requirements. Packaging requirements are maintained by the Inventory Control Point's packaging activities within the Military Service or Defense Agency, or within the Military Service's system commands. Packaging data retrieval is available from the managing Military Department's or Defense Agency's automated packaging files, CD-ROM products, or by contacting the responsible packaging activity.

6. NOTES

* (This section contains information of a general or explanatory nature that may be helpful, but is not mandatory. The notes specified in MIL-PRF-19500 are applicable to this specification.)

* 6.1 Intended use. Semiconductors conforming to this specification are intended for original equipment design applications and logistic support of existing equipment.

6.2 Acquisition requirements. Acquisition documents should specify the following:

a. Title, number, and date of this specification.

b. Packaging requirements (see 5.1).

c. Lead finish (see 3.4.1).

d. Product assurance level and type designator.

6.3 Qualification. With respect to products requiring qualification, awards will be made only for products which are, at the time of award of contract, qualified for inclusion in Qualified Manufacturers List (QML 19500) whether or not such products have actually been so listed by that date. The attention of the contractors is called to these requirements, and manufacturers are urged to arrange to have the products that they propose to offer to the Federal Government tested for qualification in order that they may be eligible to be awarded contracts or orders for the products covered by this specification. Information pertaining to qualification of products may be obtained from Defense Supply Center, Columbus, ATTN: DSCC/VQE, P.O. Box 3990, Columbus, OH 43218-3990 or e-mail vqe.chief@dla.mil.

6.4 Supersession data. The following MIL-PRF-19500/427 types supersede MIL-PRF-19500/228, MIL-PRF-19500/286, and MIL-PRF-19500/365 types, which are inactive for new design:

Preferred	Replaces	Replaces	Replaces
427	228	286	365
1N5614	1N3611	1N4245	1N4383
1N5616	1N3612	1N4246	1N4384
1N5618	1N3613	1N4247	1N4385
1N5620	1N3614	1N4248	1N4585
1N5622	1N3957	1N4249	1N4586

6.5 Applications data.

* 6.5.1 Half-Sine-Wave application with 1N5614-1N5622 (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 1N5614 to 1N5622 or 1N5614US to 1N5622US. For axial-leaded, the lead length for mounting will be 0.187 inch (4.76 mm) or less from body to entry point on PCB surface.

a. Use the I_O vs Po curve in Figure 7 to look up 1 Amp (X-axis) and follow up to the T_J =175ºC curve (lower) for 0.90 Watts.

b. Calculate maximum thermal resistance needed (175ºC – 55ºC) / 0.90W = 133ºC/W.

c. Look up thermal resistance of 133ºC/W on Y-axis using a Thermal Resistance vs Pad Area plot on one of the 3 curves in Figure 8 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 = 0.030 in^2 , 2 oz PCB = 0.018 in^2 , 3 oz PCB = 0.011 in^2 per pad.

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

* 6.5.2 Square-Wave application with 1N5614-1N5622 (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% 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 vs I_F curve in Figure 9 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.

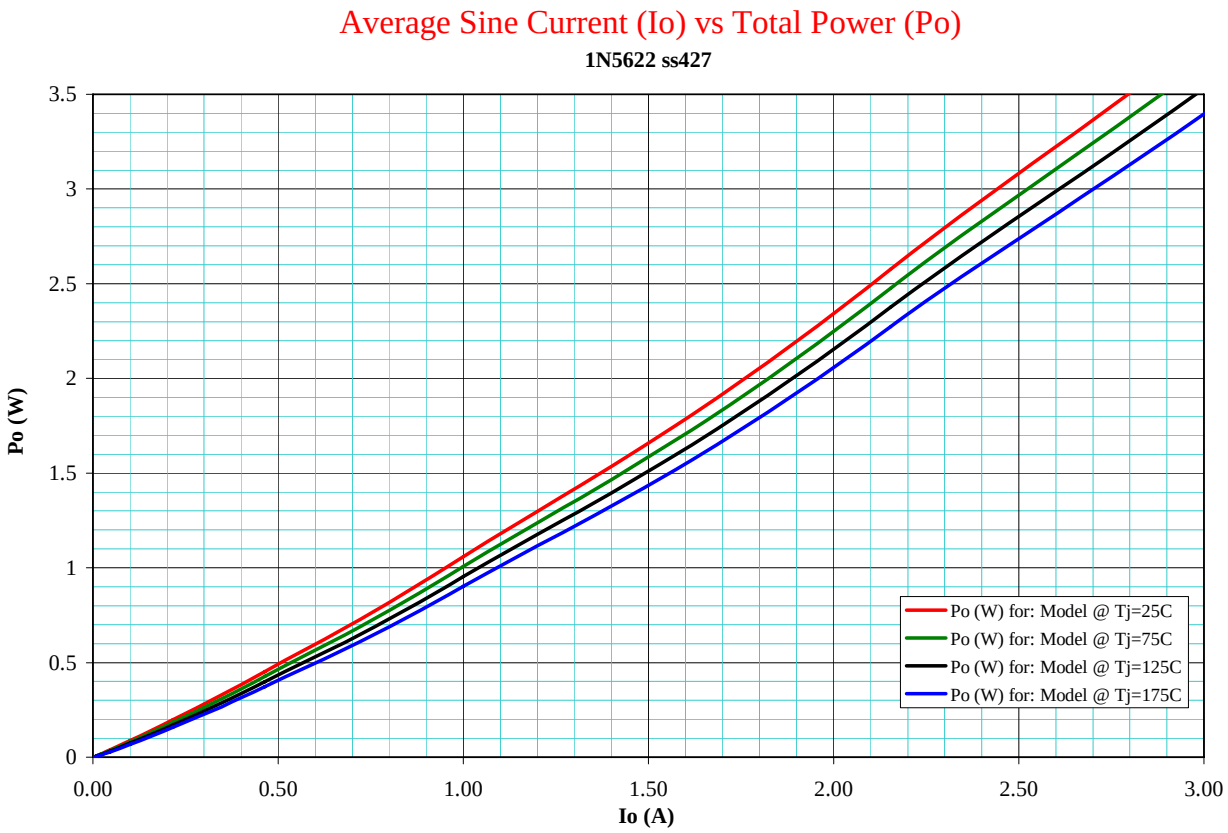
d. Calculate power = I_F * V_F * Duty Factor = 1 * 0.85 * 0.50 = 0.425 W.

e. Calculate maximum thermal resistance needed (125ºC – 55ºC) / 0.425W = 165ºC/W.

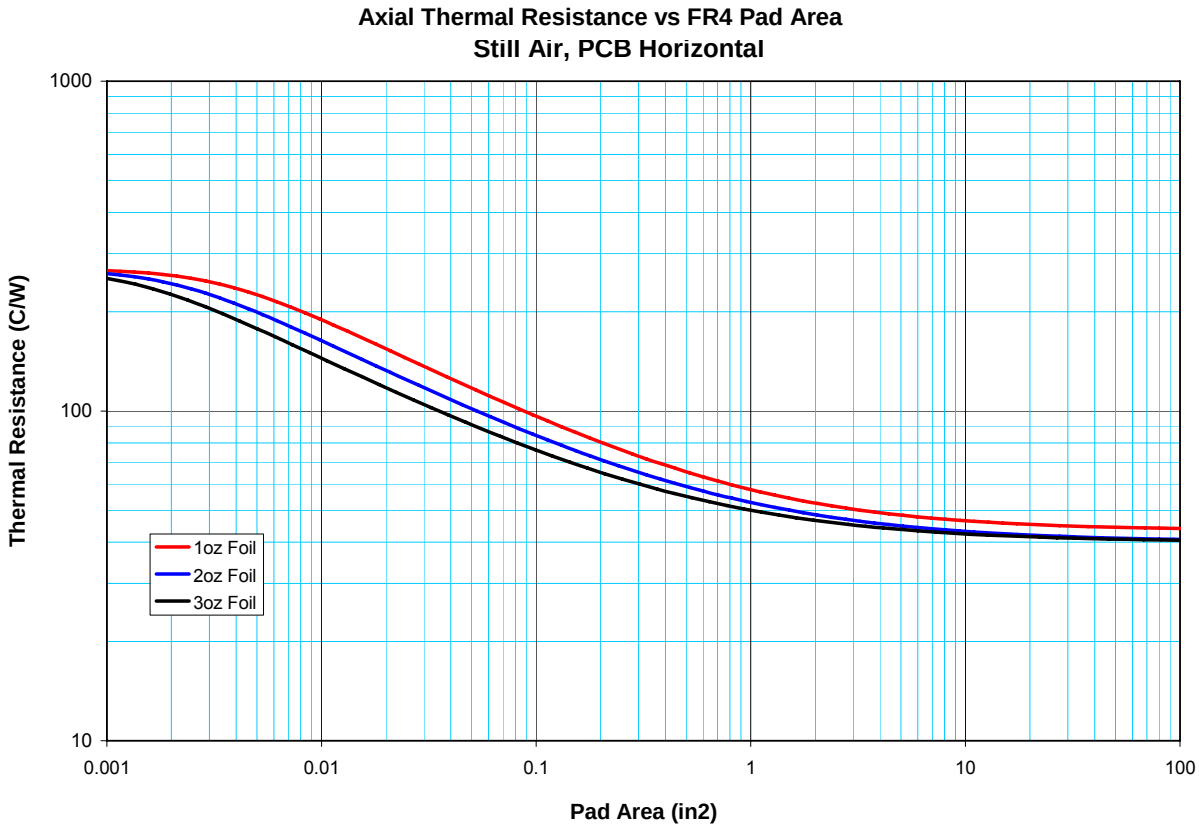
f. Look up thermal resistance of 165ºC/W on the Y-axis using a Thermal Resistance vs. Pad Area plot on one of the 3 curves in Figure 8 for different weights of copper cladding and then intersect curve horizontally to get answer. Curves assume still air, horizontal position.

g. Answer: 1oz PCB = 0.015 in^2, 2oz PCB = 0.009 in^2, 3oz PCB = 0.0061 in^2 per pad.

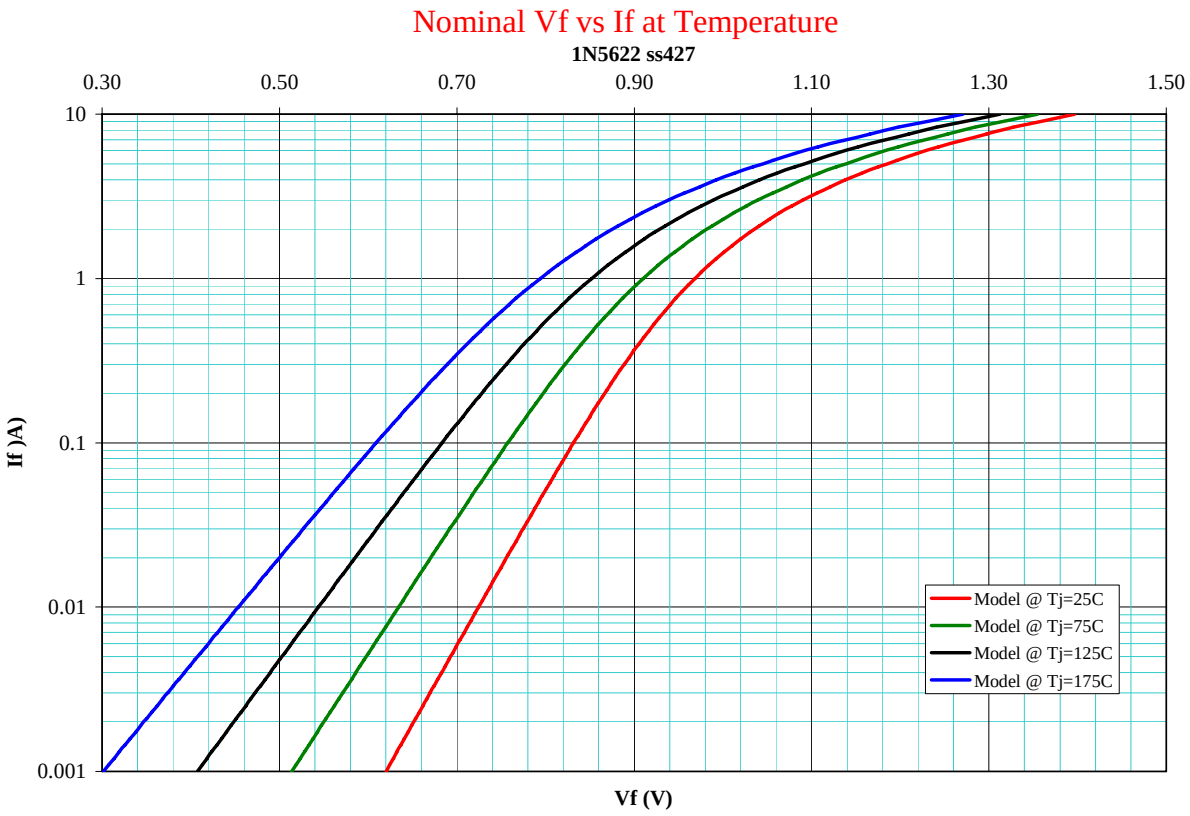
h. A conservative pad guard-band is optional since T_J is only 125ºC. Note: Multilayer PCB's, forced air cooling, etc. will improve performance. Closed confinement of the PCB will do the opposite. Please use sound thermal management.



* FIGURE 7. Rectifier Power vs I_O (Average Forward Current) for 1N5614-1N5622(US).



* FIGURE 8. Thermal Resistance vs Pad Area (per pad) with 1, 2, and 3 oz Copper for 1N5614-1N5622(US).



* FIGURE 9. Forward Voltage vs Forward Current for 1N5614-1N5622(US).

6.6 Suppliers of die. The qualified die suppliers with the applicable letter version (e.g., JANHCA1N5614) will be identified on the QML.

JANHC and JANKC ordering information	
PIN	Manufacturer
	14552
1N5614	JANHCA1N5614 JANKCA1N5614
1N5616	JANHCA1N5616 JANKCA1N5616
1N5618	JANHCA1N5618 JANKCA1N5618
1N5620	JANHCA1N5620 JANKCA1N5620
1N5622	JANHCA1N5622 JANKCA1N5622

6.7 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

Review activities:
Army - AR, MI, SM
Navy - AS, MC
Air Force – 19

Preparing activity:
DLA - CC

(Project 5961-2007-058)

* 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.