The documentation and process conversion measures necessary to comply with this revision shall be completed by 3 December 2004.

METRIC

MIL-PRF-19500/620E
3 September 2004
SUPERSEDING
MIL-PRF-19500/620D
22 June 2001

* PERFORMANCE SPECIFICATION SHEET

* SEMICONDUCTOR DEVICE, HERMETIC, DIODE, SILICON, RECTIFIER, SCHOTTKY BARRIER, TYPES 1N5822 AND 1N5822US, 1N6864 AND 1N6864US 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, Schottky barrier rectifier diodes. Four levels of product assurance are provided for each device type as specified in MIL-PRF-19500, and two levels of product assurance for die (element evaluation).

1.2 Physical dimensions. See figures 1, 2, and 3 (JANC die) dimensions.

* 1.3 Maximum ratings.

Types	V_{RWM} (1) (2)	I_{O1} (1) (2)	I_{FSM}	T_{STG}	T_J (2)
	V(pk)	A dc	A(pk)	°C	°C
1N5822, 1N5822US	40	3.0	80	-65 to +150	-65 to +125
1N6864, 1N6864US	80	3.0	80	-65 to +150	-65 to +125

(1) For derating, see figures 4, 5, 6, and 7.
(2) The maximum TJ depends on the voltage applied. See figures 4, 5, 6, and 7.

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

Types	Max V_{FM1} I_{FM} = 1.0 A	Max V_{FM2} I_{FM} = 3.0 A	Max V_{FM3} I_{FM} = 9.4 A	Max I_{RM} V_{RM} = 40 V dc pulsed method (see 4.5.1) T_J = +25 °C I_{RM1}	Max I_{RM} V_{RM} = 40 V dc pulsed method (see 4.5.1) T_J = +100 °C I_{RM2}	Max $R_{\theta JL}$ or $R_{\theta JEC}$ 9.52 mm (3.75 inch) lead length or end cap	Max $Z_{\theta JX}$
	V (pk)	V (pk)	V (pk)	mA	mA	°C/W	°C/W
1N5822	0.40	0.50	0.70	0.10	12.5	30	3.0
1N5822US	0.40	0.50	0.70	0.10	12.5	10	3.0
1N6864	0.50	0.70	N/A	0.15	18.0	30	3.0
1N6864US	0.50	0.70	N/A	0.15	18.0	10	3.0

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@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://www.dodssp.daps.mil.

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 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://www.dodssp.daps.mil or from the Standardization Document Order Desk, 700 Robbins Avenue, Building 4D, Philadelphia, PA 19111-5094.)

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

3. REQUIREMENTS

* 3.1 General. The individual item requirements shall be as specified in MIL-PRF-19500 and as modified herein.

3.2 Qualification. Devices furnished under this specification shall be products that are manufactured by a manufacturer authorized by the qualifying activity for listing on the applicable qualified manufacturer's list before contract award (see 4.2 and 6.3).

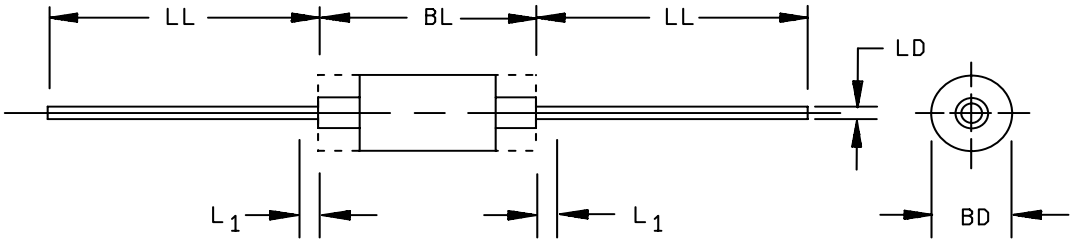
3.3 Abbreviations, symbols, and definitions. Abbreviations, symbols, and definitions used herein shall be as specified in MIL-PRF-19500.

3.4 Interface and physical dimensions. Interface and physical dimensions shall be as specified in MIL-PRF-19500, and on figures 1 (axial package), 2 (surface mount), and 3 (die). The US Government's preferred system of measurement is the metric SI system. However, since this item was originally designed using inch-pound units of measurement, in the event of conflict between the metric and inch-pound units, the inch-pound units shall take precedence.

3.4.1 Lead material and finish. Lead material shall be copper clad steel with a minimum of 70 percent copper by weight. Lead finish shall be solderable in accordance with MIL-PRF-19500, MIL-STD-750, and herein. Where a choice of lead finish is desired, it shall be specified in the acquisition document (see 6.2).

* 3.4.2 Diode construction. All devices shall be in accordance with the requirements of MIL-PRF-19500.

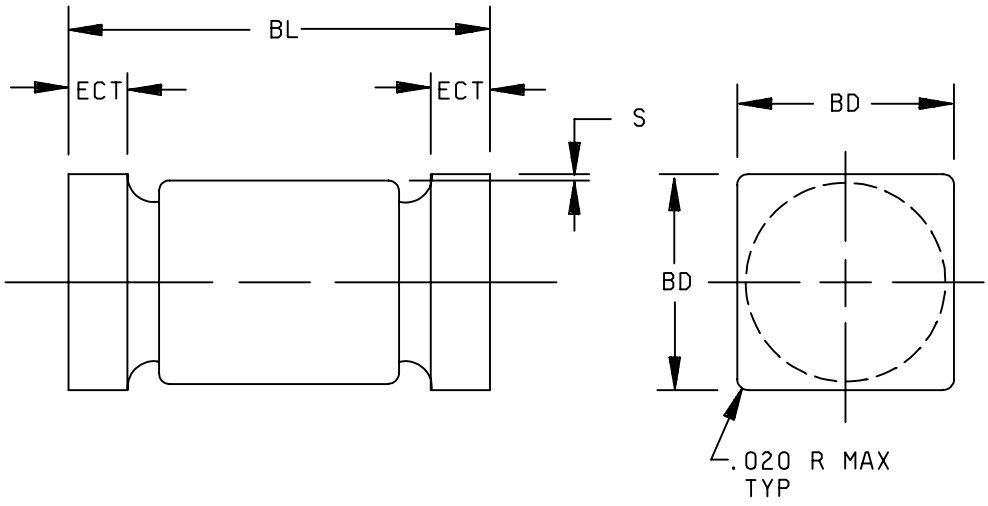
3.4.2.1 Surface mount. The surface mount (US) version shall be considered structurally identical to the non-surface mount version except for lead attach.



Symbol	Dimensions				Notes
	Millimeters		Inches		
	Min	Max	Min	Max	
LD	0.91	1.07	.036	.042	
BD	2.92	3.68	.115	.145	3
BL	3.30	4.95	.130	.195	
LL	22.86	33.02	.900	1.300	
L_1		0.76		.030	4

NOTES:
1. Dimensions are in millimeters.
2. Inch-pound equivalents are given for general information only.
3. Symbol BD shall be measured at the largest diameter.
4. Lead diameter is not controlled in this zone to allow for flash, lead finish build-up, and mirror irregularities other than heat slugs.

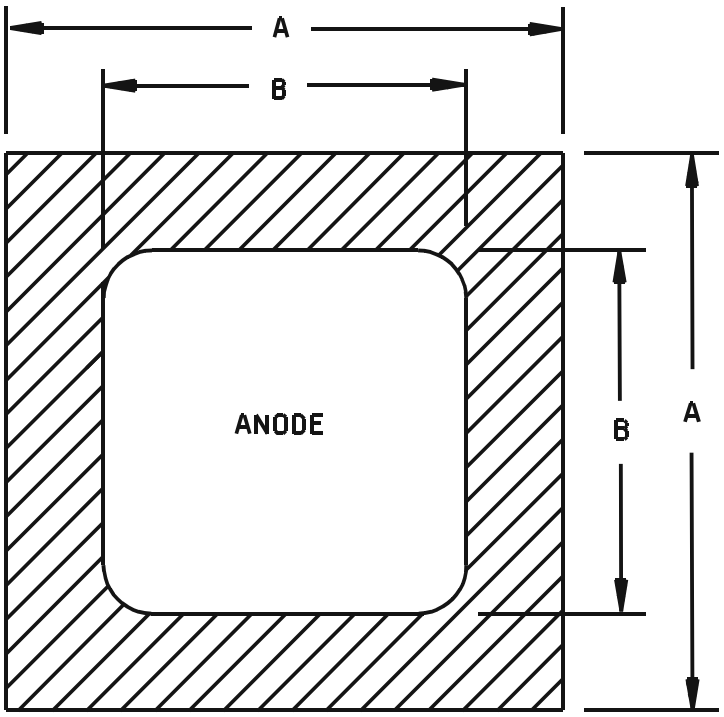
*FIGURE 1. Physical dimensions of 1N5822, and 1N6864.



Symbol	Dimensions			
	Millimeters		Inches	
	Min	Max	Min	Max
BL	5.08	5.72	.200	.225
BD	3.48	3.76	.137	.148
ECT	0.48	0.71	.019	.028
S	0.08		.003	

NOTES:
1. Dimensions are in millimeters.
2. Inch-pound equivalents are given for general information only.

*FIGURE 2. Physical dimensions of surface mount family, 1N5822US, and 1N6864US (D-5B).



Symbol	Dimensions			
	Millimeters		Inches	
	Min	Max	Min	Max
A	1.57	1.63	.062	.064
B	1.32	1.37	.052	.054

Design data

Metallization:
Top: (Anode).....AL
Back: (Cathode).....Au

AL thickness .....25,000 Å minimum.
Gold thickness .....4,000 Å minimum.
Chip thickness .....0.254 mm (10 mils) ±. .051 (± 2 mils).

FIGURE 3. JANC (A-version) die dimensions.

3.5 Marking. Marking shall be in accordance with MIL-PRF-19500. At the option of the manufacturer, marking may be omitted from the body, but shall be retained on the initial container.

3.5.1 Marking for surface mount (US) devices. Surface mount (US) suffix parts are to be marked with the polarity identification. Initial container package marking will be in accordance with MIL-PRF-19500.

* 3.6 Electrical performance characteristics. Unless otherwise specified herein, the electrical performance characteristics are as specified in 1.3, 1.4, and table I.

* 3.7 Electrical test requirements. The electrical test requirements shall be as 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).

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

4.2.1 Group E inspection. Group E inspection shall be conducted in accordance with MIL-PRF-19500 and 4.4.4 herein.

4.2.2 JANHC and JANKC devices. Qualification for JANHC and JANKC devices shall be in accordance with MIL-PRF-19500. This testing may be performed in a TO-5 package in lieu of the axial leaded package.

* 4.3 Screening (JANTX, JANTXV, and JANS levels only). Screening shall be in accordance with table 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 table IV of MIL-PRF-19500)	Measurement	
	JANS level	JANTXV and JANTX level
1a 1b	Required Required	Not required Required (JANTXV only)
2	Not required	Not required
3a 3b (1) 3c	Required Not applicable Required (see 4.3.3)	Required Not applicable Required (see 4.3.3)
4, 5, 6 and 7a	Not applicable	Not applicable
7b	Optional	Optional
8	Required	Not required
9	Required I_{R1} and V_{F2}	Not applicable
(2) 10	Required T_A = +90°C; V_{RWM} = 40 V(pk); 1N5822 T_A = +80°C; V_{RWM} = 80 V(pk); 1N6864 I_O = 0, half sine wave, f = 60 Hz	Required T_A = +90°C; V_{RWM} = 40 V(pk); 1N5822 T_A = +80°C; V_{RWM} = 80 V(pk); 1N6864 I_O = 0, half sine wave, f = 60 Hz
11	Required $\Delta I_{R1} \leq$ 100 percent of initial reading or 0.05 mA whichever is greater. $\Delta V_{FM2} \leq \pm$ 50 mV dc.	Required I_{R1} and V_{FM2}
12	Required See 4.3.2.	Required See 4.3.2, t = 48 hours
13	Required Subgroup 2 of table I herein; $\Delta I_{R1} \leq$ 100 percent of initial reading or 0.05 mA whichever is greater; $\Delta V_{FM2} \leq \pm$ 50 mV dc	Required Subgroup 2 of table I herein; $\Delta I_{R1} \leq$ 100 percent of initial reading or 0.05 mA whichever is greater; $V_{FM2} \leq \pm$ 50 mV dc;
14a 14b	Not applicable Required (3)	Not applicable Required (3)
15 and 16	Required	Not required

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

(2) Junction temperature (T_J) is not to exceed 115°C at V_{RWM}. T_J is affected by the device mounting thermal resistance when parasitic power is generated by the temperature dependent leakage current. Until this leakage becomes significant near thermal runaway, T_J remains approximately equal to T_A or T_J for I_O = 0.

* (3) For clear glass diodes gross leak seal test may be performed anytime after temperature cycling.

4.3.1 Screening (JANHC or JANKC). Screening of die shall be in accordance with MIL-PRF-19500.

* 4.3.1.1 JAN testing. JAN level product will have temperature cycling and thermal impedance testing performed in accordance with MIL-PRF-19500, JANTX level screening level requirements.

* 4.3.2 Burn-in conditions. Burn-in conditions are as follows: IF = Io = 3 A dc minimum. TA = room ambient as defined in the general requirements of MIL-STD-750. Mounting and test conditions shall be in accordance with method 1038 of MIL-STD-750, test condition B.

4.3.3 Thermal impedance. Thermal impedance $Z_{\theta JX}$ measurements shall be performed in accordance with method 3101 of MIL-STD-750, to identify and remove atypical devices.

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 table V of MIL-PRF-19500, and table I herein. The following test conditions shall be used for $Z_{\theta JX}$, group A inspection:

a. I_M measurement current.....1 mA to 10 mA.

b. I_H forward heating current .....10 A to 20 A.

c. t_H heating time.....10 ms.

d. t_{MD} measurement delay time.....100 μs maximum.

4.4.2 Group B inspection. Group B inspection shall be conducted in accordance with the conditions specified for subgroup testing in tables VIa and VIb (JANS, JAN, JANTX, and JANTXV) of MIL-PRF-19500 and as follows. Electrical measurements (end-points) shall be in accordance with table I, subgroup 2 herein.

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

Subgroup	Method	Condition
B3	1056	-55°C to 100°C, 25 cycles, n = 22, c = 0.
	1051	-55°C to 150°C, 100 cycles, n = 22, c = 0.
B3	4066	I_{FSM} = 80 A (pk), condition A 2, I_O = 3 A dc; T_A = room ambient as defined in 4.5 of MIL-STD-750; five surges of 8.3 ms each at 1 minute intervals.
B4	1036	I_F = 3.0 A dc; T_A = room ambient as defined in the general requirements of MIL-STD-750; $t_{on} = t_{off}$ = 3 minutes minimum for 2,000 cycles.
B5	1027	I_F = 3 A dc minimum, adjust I_F or T_A to achieve T_J = + 125°C minimum.

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

Subgroup	Method	Condition
B2	1056	-55°C to 100°C, 10 cycles, n = 22, c = 0.
	1051	-55°C to 150°C, 25 cycles, n = 22, c = 0.
B2	4066	I_{FSM} = 80 A (pk), condition A 2, I_O = 3 A dc; T_A = room ambient as defined in 4.5 of MIL-STD-750; five surges of 8.3 ms each at 1 minute intervals.
B3	1027	I_F = 3 A dc minimum, adjust I_F or T_A to achieve T_J = + 125°C.
B4	2075	As specified.

* 4.4.3 Group C inspection. Group C inspection shall be conducted in accordance with the conditions specified for subgroup testing in table 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, table VII of MIL-PRF-19500.

Subgroup	Method	Condition
C2	2036	Tension: Test condition A; weight = 20 pounds; t = 15 seconds. Lead fatigue: Test condition E; weight 1 pound. NOTE: Both tension and lead fatigue are not applicable for US devices.
C5	3101	See 4.4.5 herein
C6	1027	I_F = 3 A dc minimum, adjust I_F or T_A to achieve T_J = + 125°C minimum.

* 4.4.4 Group E inspection. Group E inspection shall be conducted in accordance with MIL-PRF-19500 and the conditions for subgroup testing in table II herein. Electrical measurements (end-points) shall be in accordance with table I, subgroup 2 herein.

* 4.4.5 Thermal resistance. Thermal resistance measurement shall be in accordance with method 3101 or 4081 of MIL-STD-750. Forced moving air or draft shall not be permitted across the device during test. The maximum limit for $R_{\theta JL}$ under these test conditions shall be $R_{\theta JL}$ (max) = 30°C/W, $R_{\theta JEC}$ (max) = 10°C/W. The following conditions shall apply when using method 3101:

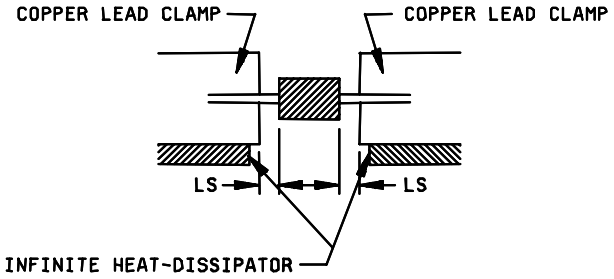
a. I_M 1mA to 10mA.

b. I_H 3A minimum.

c. t_H 25 seconds minimum.

d. t_{MD} 100µs maximum.

* LS = lead spacing = 9.53 mm (.375 inch) for non-surface mount devices and 0 mm (0 inch) for surface mount devices as defined as follows:



4.5 Methods of inspection. Methods of inspection shall be as 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 Steady-state operation life. This test shall be conducted with a half-sine wave 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 not be greater than 180 degrees nor less than 150 degrees.

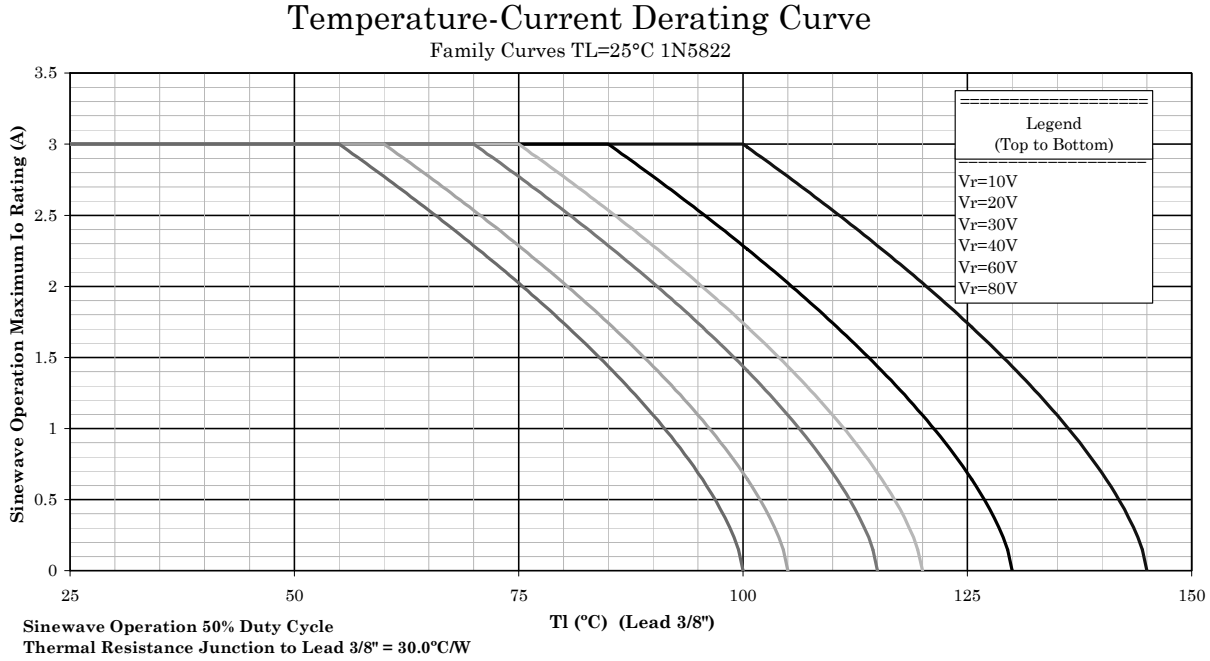
* TABLE I. Group A inspection.

Inspection 1/	MIL-STD-750		Symbol	Limits		Unit
	Method	Conditions		Min	Max	
Subgroup 1						
Visual and mechanical examination	2071					
Subgroup 2						
Thermal impedance	3101	See 4.3.3	$Z_{\theta JX}$		3.0	°C/W
Forward voltage	4011	I_{FM} = 1.0 A (pk) pulse method	V_{FM1}			
1N5822, 1N5822US		(see 4.5.1)			0.40	V
1N6864, 1N6864US					0.50	V
1N5822, 1N5822US	4011	I_{FM} = 3.0 A (pk) pulse method	V_{FM2}		0.50	V
1N6864, 1N6864US		(see 4.5.1)			0.70	V
1N5822, 1N5822US	4011	I_{FM} = 9.4 A (pk) pulse method (see 4.5.1)	V_{FM3}		0.70	V
Reverse current leakage	4016		I_{RM1}			
1N5822, 1N5822US		V_{RM} = 40 V (pk) pulse method			0.10	mA
1N6864, 1N6864US		V_{RM} = 80 V (pk) pulse method (see 4.5.1)			0.15	mA
Subgroup 3						
High temperature operation:		T_A = +100°C				
Reverse current leakage	4016		I_{RM2}			
1N5822, 1N5822US		V_{RM} = 40 V (pk) pulse method			12.5	mA
1N6864, 1N6864US		V_{RM} = 80 V (pk) pulse method (see 4.5.1)			18.0	mA
Forward voltage	4011	I_F = 3.0 A (pk) pulse method, (see 4.5.1)	V_{FM4}			
1N5822, 1N5822US					0.47	V
1N6864, 1N6864US					0.65	V
Low temperature operation:		T_A = -55°C				
Reverse current leakage	4016		I_{RM3}			
1N5822, 1N5822US		V_{RM} = 40 V (pk) pulse method			0.40	mA
1N6864, 1N6864US		V_{RM} = 80 V (pk) pulse method (see 4.5.1)			0.55	mA
Forward voltage	4011	I_F = 3.0 A (pk) pulse method (see 4.5.1)	V_{FM5}			
1N5822, 1N5822US					0.62	V
1N6864, 1N6864US					0.80	V
Subgroup 4						
Not applicable						
Subgroups 5, 6, and 7						
Not applicable						

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

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

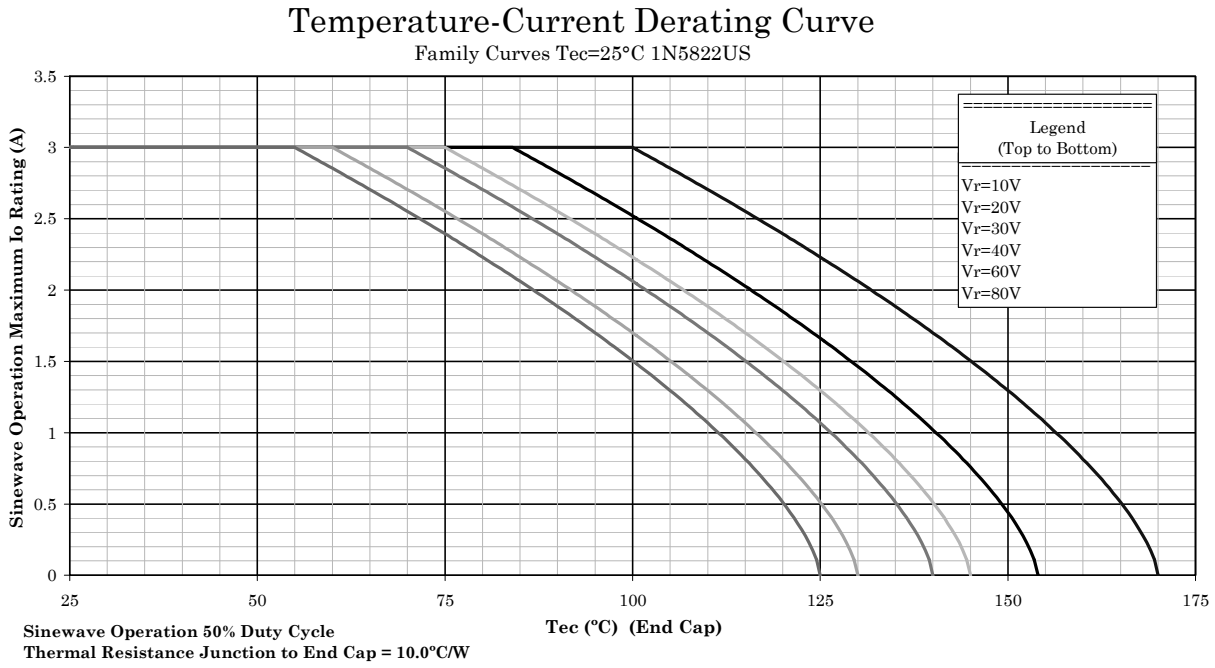
Inspection	MIL-STD-750		Sampling plan
	Method	Conditions	
Subgroup 1			22 devices c = 0
Thermal shock (temperature cycling)	1051	-65°C to 150°C, 500 cycles	
Hermetic seal	1071	Test condition E	
Electrical measurement		See table I, subgroup 2.	
Subgroup 2			22 devices c = 0
Steady-state reverse bias	1049	1,000 hours	
Electrical measurement		See table I, subgroup 2	
Subgroup 4			
Thermal impedance curves		Each supplier shall submit their (typical) maximum design thermal impedance curves to the qualifying activity. In addition, the optimal test conditions and $Z_{\theta JX}$ limit shall be provided to the qualifying activity in the qualification report.	
Subgroup 5			
Not applicable			
Subgroup 6			3 devices
ESD	1020		
Subgroup 8			45 devices c = 0
Resistance to glass cracking	1057	Test to destruction or 25 cycles max, whichever comes first.	



* NOTES:

1. This is the true inverse of the worst case thermal resistance value. All devices are capable of operating at $\leq T_J$ specified on this curve. Any parallel line to this curve will intersect the appropriate power for the desired maximum T_J allowed.
2. This temperature-current derating curve varies with applied voltage.

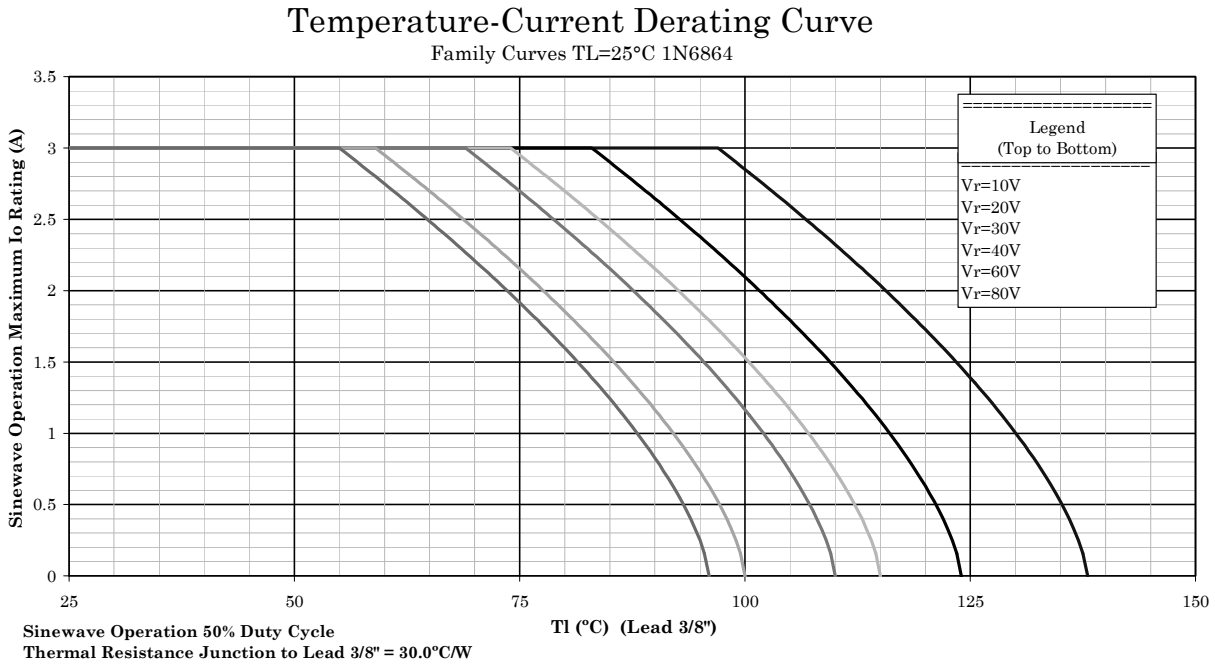
* FIGURE 4. Temperature current derating for 1N5822.



* NOTES:

1. This is the true inverse of the worst case thermal resistance value. All devices are capable of operating at $\leq T_J$ specified on this curve. Any parallel line to this curve will intersect the appropriate power for the desired maximum T_J allowed.
2. This temperature-current derating curve varies with applied voltage.

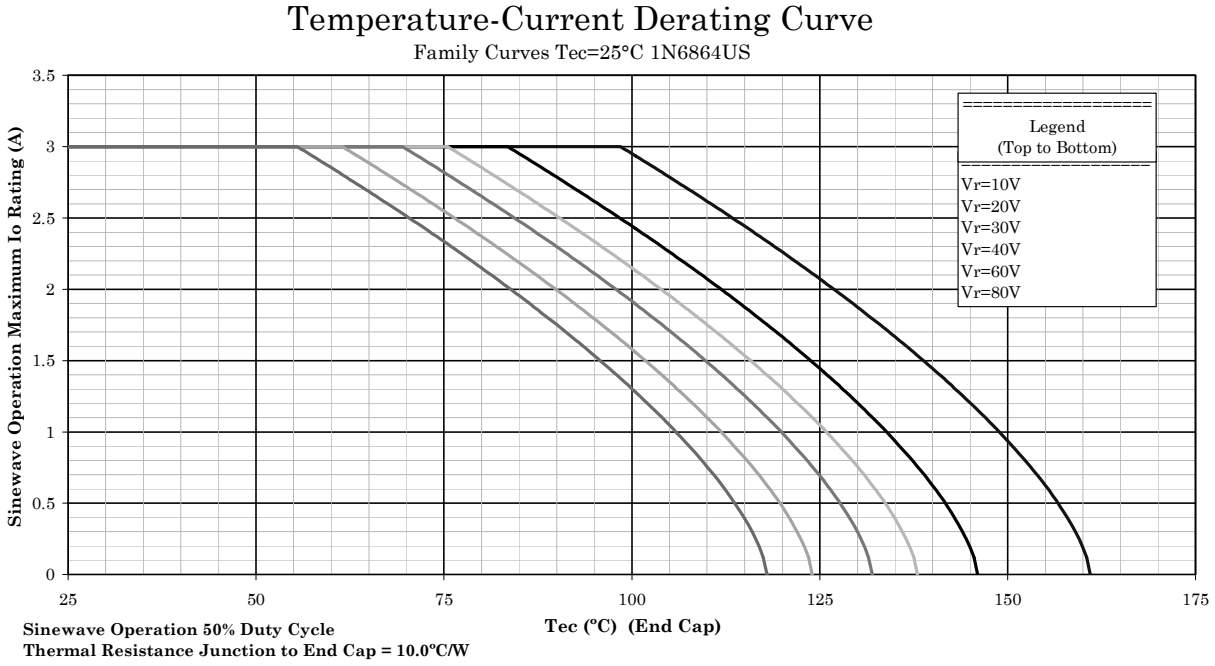
* FIGURE 5. Temperature current derating for 1N5822US.



* NOTES:

1. This is the true inverse of the worst case thermal resistance value. All devices are capable of operating at $\leq T_J$ specified on this curve. Any parallel line to this curve will intersect the appropriate power for the desired maximum T_J allowed.
2. This temperature-current derating curve varies with applied voltage.

* FIGURE 6. Temperature current derating for 1N6864.



* NOTES:

1. This is the true inverse of the worst case thermal resistance value. All devices are capable of operating at $\leq T_J$ specified on this curve. Any parallel line to this curve will intersect the appropriate power for the desired maximum T_J allowed.
2. This temperature-current derating curve varies with applied voltage.

* FIGURE 7. Temperature current derating for 1N6864US.

5. PACKAGING

* 5.1 Packaging. For acquisition purposes, the packaging requirements shall be as specified in the contract or order (see 6.2). When actual 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.)

6.1 Intended use. The notes specified in MIL-PRF-19500 are applicable to this specification.

* 6.2 Acquisition requirements. The acquisition requirements 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.

6.4 Suppliers of die. The qualified die suppliers with the applicable letter version (e.g., JANHCA1N5822) will be identified on the QML.

JANC ordering information	
	Manufacturer
PIN	43611
1N5822	JANHCA1N5822 JANKCA1N5822
1N6864	JANHCA1N6864 JANKCA1N6864

* 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 - 11
NASA - NA
DLA - CC

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

Preparing activity:
DLA - CC

(Project 5961-2722)