

INCH-POUND

The documentation and process conversion measures necessary to comply with this revision shall be completed by 7 September 2004.

MIL-PRF-19500/477F  
7 June 2004  
SUPERSEDING  
MIL-PRF-19500/477E  
30 December 2002

PERFORMANCE SPECIFICATION SHEET

\* SEMICONDUCTOR DEVICE, DIODE, SILICON, ULTRAFAST RECOVERY, POWER RECTIFIER, TYPES 1N5802, 1N5804, 1N5806, 1N5807, 1N5809, AND 1N5811, 1N5802US, 1N5804US, 1N5806US, 1N5807US, 1N5809US, AND 1N5811US, JAN, JANTX, JANTXV, JANS, JANHC, AND JANKC

This specification is approved for use by all Departments and Agencies of the Department of Defense.

\* The requirements for acquiring the product described herein shall consist of this specification sheet and MIL-PRF-19500.

1. SCOPE

\* 1.1 Scope. This specification covers the performance requirements for silicon, fast recovery, power rectifier diodes. Four levels of product assurance are provided for each encapsulated device types as specified in PRF-19500. Two levels of product assurance are provided for each unencapsulated device type. MIL-

1.2 Physical dimensions. See figures 1 through 6.

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).  $T_{STG} = T_{J(max)} = -65^\circ\text{C}$  to  $+175^\circ\text{C}$ ; (sinewave operation includes package limitation).

1.3.2 Ratings applicable to individual types.

Col. 1	Col. 2	Col. 3	Col. 4	Col. 5	Col. 6	Col. 7	Col. 8	Col. 9
Types	$V_{RWM}$	$I_{O1}$ $T_L = +75^\circ\text{C}$ $L = .375$ in. (9.52 mm) (1)	$I_{O2}$ $T_A = +55^\circ\text{C}$ (2)	$I_{FSM}$ at $+25^\circ\text{C}$ Operating at $I_{O2}$ $t_p = 8.3$ ms	$t_{rr}$	$R_{\theta JL}$ at $L = .375$ in. (9.52 mm)	$R_{\theta JEC}$ (3)	$Z_{\theta JX}$
1N5802, 1N5802US 1N5804, 1N5804US 1N5806, 1N5806US	50 100 150	2.5 A (4) 2.5 A (4) 2.5 A (4)	1.0 A (5) 1.0 A (5) 1.0 A (5)	35 A(pk) 35 A(pk) 35 A(pk)	25 ns 25 ns 25 ns	36°C/W 36°C/W 36°C/W	20°C/W 20°C/W 20°C/W	4.5°C/W 4.5°C/W 4.5°C/W
1N5807, 1N5807US 1N5809, 1N5809US 1N5811, 1N5811US	50 100 150	6.0 A (6) 6.0 A (6) 6.0 A (6)	3.0 A (7) 3.0 A (7) 3.0 A (7)	125 A(pk) 125 A(pk) 125 A(pk)	30 ns 30 ns 30 ns	22°C/W 22°C/W 22°C/W	10°C/W 10°C/W 10°C/W	1.5°C/W 1.5°C/W 1.5°C/W

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](mailto: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://www.dodssp.daps.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) This rating is typical for PC boards where thermal resistance from mounting point to ambient is sufficiently controlled where  $T_{STG}$  and  $T_{J(max)}$  in 1.3.1 are not exceeded.
- (3) US suffix devices only.
- (4) Derate at 25 mA/°C for  $T_L$  above +75°C.
- (5) Derate at 8.33 mA/°C for  $T_A$  above +55°C.
- (6) Derate at 60 mA/°C for  $T_L$  above +75°C.
- (7) Derate at 25 mA/°C for  $T_A$  above +55°C.

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

Types	$V_{BR}$	$I_{R1}$ at $V_R = V_{RWM}$	$I_{R2}$ at $V_R = V_{RWM}$
		$T_A = +25^\circ\text{C}$	$T_A = +100^\circ\text{C}$
	(V dc)	$\mu\text{A dc}$	$\mu\text{A dc}$
1N5802, 1N5802US	60	1.0	50
1N5804, 1N5804US	110	1.0	50
1N5806, 1N5806US	160	1.0	50
1N5807, 1N5807US	60	5.0	150
1N5809, 1N5809US	110	5.0	150
1N5811, 1N5811US	160	5.0	150

## 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

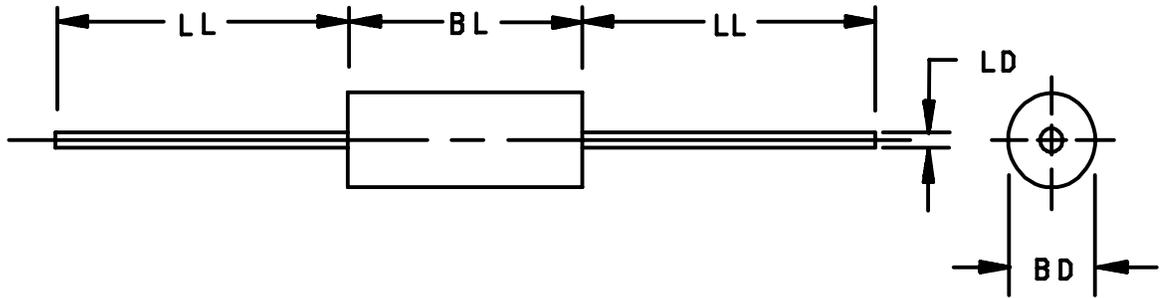
MIL-PRF-19500 - Semiconductor Devices, General Specification for.

## \* 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://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.

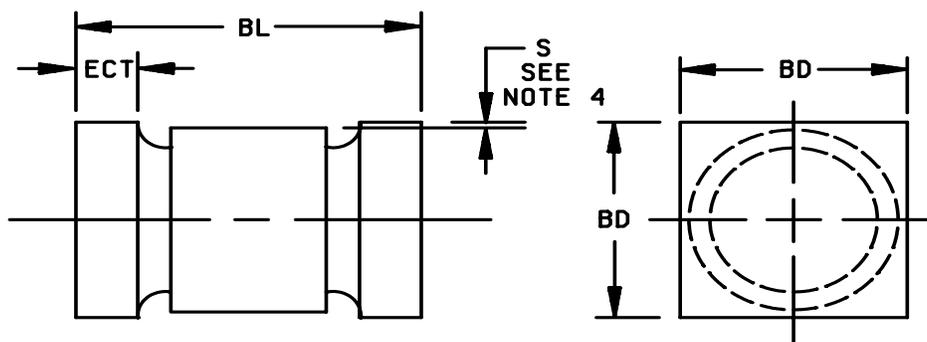


Ltr.	Dimensions								Notes
	1N5802, 1N5804, 1N5806				1N5807, 1N5809, 1N5811				
	Inches		Millimeters		Inches		Millimeters		
	Min	Max	Min	Max	Min	Max	Min	Max	
BD	.065	.085	1.65	2.16	.115	.165	2.92	4.19	4
BL	.125	.250	3.18	6.35	.130	.300	3.30	7.62	3
LD	.027	.032	0.69	0.81	.037	.042	0.94	1.07	3
LL	.700	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 LD shall include the 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  $\phi x$  symbology.

\* FIGURE 1. Physical dimensions.

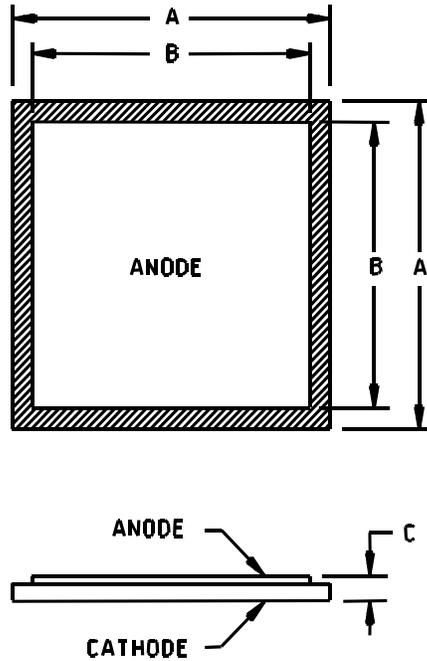


Ltr.	Dimensions								Notes
	D-5A 1N5802US, 1N5804US, 1N5806US				D-5B 1N5807US, 1N5809US, 1N5811US				
	Inches		Millimeters		Inches		Millimeters		
	Min	Max	Min	Max	Min	Max	Min	Max	
BD	.091	.103	2.31	2.62	.137	.148	3.48	3.76	
BL	.168	.200	4.27	5.08	.200	.225	5.08	5.72	
ECT	.019	.028	0.48	0.71	.019	.028	0.48	0.71	
S	.003		0.80		.003		0.80		

NOTES:

1. Dimensions are in inches.
2. Millimeters are given for general information only.
3. Gap not controlled, shape of body and gap not controlled.
4. Dimensions are pre-solder dip.
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  $\phi x$  symbology.

\* FIGURE 2. Physical dimensions of surface mount family.



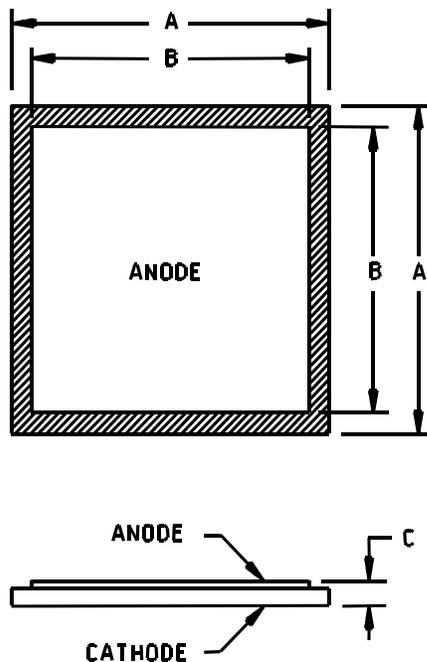
1N5802, 1N5804, 1N5806

Ltr	Dimensions			
	Inches		Millimeters	
	Min	Max	Min	Max
A	.039	.043	1.00	1.09
B	.031	.035	0.79	0.89
C	.008	.012	0.20	0.30

NOTES:

1. Dimensions are in inches.
2. Millimeters are given for general information only.
3. Anode is aluminum at 45,000 Å minimum.
4. Cathode is gold at 2,500 Å minimum.

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



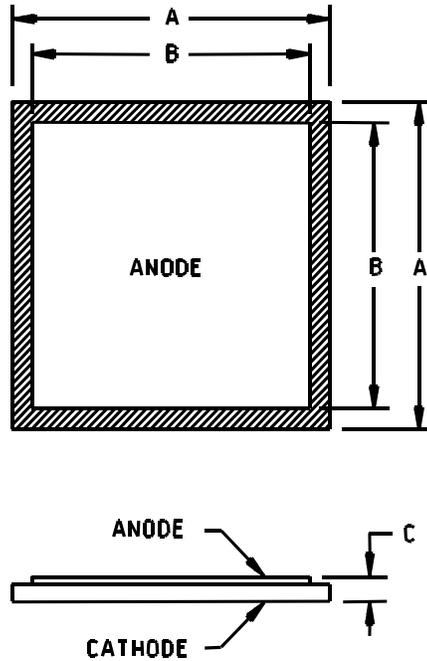
1N5807, 1N5809, 1N5811

Ltr	Dimensions			
	Inches		Millimeters	
	Min	Max	Min	Max
A	.066	.070	1.68	1.78
B	.057	.061	1.45	1.55
C	.008	.012	0.20	0.30

NOTES:

1. Dimensions are in inches.
2. Millimeters are given for general information only.
3. Anode is aluminum at 55,000 Å minimum.
4. Cathode is gold at 5,000 Å minimum.

FIGURE 4. JANC (E-version) die dimensions.



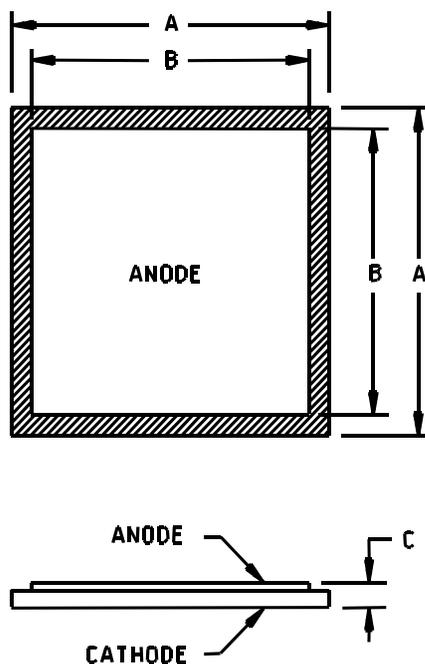
1N5802, 1N5804, 1N5806

Ltr	Dimensions			
	Inches		Millimeters	
	Min	Max	Min	Max
A	.039	.043	1.00	1.09
B	.031	.035	0.79	0.89
C	.008	.012	0.20	0.30

NOTES:

1. Dimensions are in inches.
2. Millimeters are given for general information only.
3. Anode is aluminum at 45,000 Å minimum.
4. Cathode is silver at 2,500 Å minimum.

FIGURE 5. JANC (F-version) die dimensions.



1N5807, 1N5809, 1N5811

Ltr	Dimensions			
	Inches		Millimeters	
	Min	Max	Min	Max
A	.066	.070	1.68	1.78
B	.057	.061	1.45	1.55
C	.008	.012	0.20	0.30

NOTES:

1. Dimensions are in inches.
2. Millimeters are given for general information only.
3. Anode is aluminum at 60,000 Å minimum.
4. Cathode is silver at 2,500 Å minimum.

FIGURE 6. JANC (F-version) die dimensions.

3. REQUIREMENTS

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

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

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

- EC . . . . . End cap.
- $I_{(BR)}$  . . . . . Current for testing breakdown voltage.
- $V_{fr}$  . . . . . Forward recovery voltage.

3.4 Interface and physical dimensions. The interface and physical dimensions shall be as specified in MIL-PRF-19500, and figures 1 through 6 herein.

3.4.1 Diode construction. These devices shall be constructed utilizing non-cavity double plug construction with high temperature metallurgical bonding between both sides of the silicon die and terminal pins (see MIL-PRF-19500). Metallurgical bond shall be in accordance with the requirements of category I in MIL-PRF-19500. 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, II and III.

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

\* 4.2.2 Group E qualification. Group E qualification shall be performed herein for qualification or requalification only. In case qualification was awarded to a prior revision of the specification sheet that did not request the performance of table III tests, the tests specified in table III 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 (JANS, JANTXV and JANTX 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)	JANS level	JANTXV and JANTX level
1a	Required	Not required
1b	Required	Required (JANTXV only)
2	Not required	Not required
3a	Required	Required
(1) 3c	Thermal impedance (see 4.3.1 and 4.4.1)	Thermal impedance (see 4.3.1 and 4.4.1)
4	Not applicable	Not applicable
5	Not applicable	Not applicable
6	Not applicable	Not applicable
7a	Not applicable	Not applicable
7b	Optional	Optional
8	Required	Not required
9	$I_{R1}$ and $V_{FM1}$	Not required
10	Method 1038 of MIL-STD-750, condition A	Method 1038 of MIL-STD-750, condition A
11	Required $I_{R1}$ and $V_{FM1}$ ; $\Delta I_R \pm 100$ percent of initial reading or $\pm 150$ nA dc (1N5802, 1N5804, 1N5806) or $\pm 500$ nA dc (1N5807, 1N5809, 1N5811), whichever is greater. $\Delta V_{FM1} \leq \pm 0.05$ V dc.	Required $I_{R1}$ and $V_{FM1}$
12	Required See 4.3.2	Required See 4.3.2
(2) 13	Subgroups 2 and 3 of table I herein; $\Delta I_R \leq 100$ percent of initial reading or $\pm 150$ nA dc (1N5802, 1N5804, 1N5806) or $\pm 500$ nA dc (1N5807, 1N5809, 1N5811), whichever is greater. $\Delta V_{FM1} \leq \pm 0.05$ V dc. Scope display evaluation (see 4.5.3)	Subgroup 2 of table I herein; $\Delta I_{R1} \pm 100$ percent of initial reading or $\pm 250$ nA dc (1N5802, 1N5804, 1N5806) or $\pm 1$ $\mu$ A dc (1N5807, 1N5809, 1N5811), whichever is greater. $\Delta V_{FM1} \leq \pm 0.05$ V dc. Scope-display evaluation (see 4.5.3).
14a	Not applicable	Not applicable
14b	Required	Required
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. Thermal impedance  $Z_{\theta JX}$  measurements shall be performed in accordance with method 3101 of MIL-STD-750. The maximum limit for  $Z_{\theta JX}$  in screening (table IV of MIL-PRF-19500) shall be derived by each vendor by means of statistical process control and applied in screening of all subsequent lots. This limit shall not exceed the table I, subgroup 2 limit. See 4.4.1 for test conditions.

4.3.1.1 For initial qualification and requalification. Read and record data ( $Z_{\theta JX}$ ) shall be supplied to the qualifying activity on one lot (random sample of 500 devices minimum) prior to shipment. Twenty-two samples shall be serialized and provided to the qualifying activity for test correlation.

\* 4.3.2 Power burn-in conditions. Power burn-in conditions shall be in accordance with method 1038 of MIL-STD-750 and as follows (see 4.5.5, 4.5.5.1) adjust  $I_O$  to achieve the required  $T_J$ .  $I_O = I_{O2}$  rated as a minimum.

4.3.3 Screening (JANHC and JANKC). Screening of die shall be in accordance with appendix G of MIL-PRF-19500. As a minimum, die shall be 100-percent probed to ensure compliance with table I, subgroup 2. Burn-in duration for the JANKC level follows JANS requirements; the JANHC follows JANTX requirements.

4.4 Conformance inspection. Conformance inspection shall be in accordance with MIL-PRF-19500 and as specified herein.

\* 4.4.1 Group A inspection. Group A inspection shall be conducted in accordance with MIL-PRF-19500, and table I herein. The following test conditions shall be used for  $Z_{\theta JX}$  in table I, subgroup 2 inspection:

- a.  $I_H = 5$  A minimum.
- b.  $t_H = 10$  ms.
- c.  $I_M = 1$  mA to 10 mA.
- d.  $t_{MD} = 100$   $\mu$ s maximum.

\* 4.4.2 Group B inspection. Group B inspection shall be conducted in accordance with the conditions specified for subgroup testing in table VIa (JANS) and table VIb (JAN, JANTX, and JANTXV) of MIL-PRF-19500. Electrical measurements (end-points) shall be in accordance with table I, subgroup 2 herein. See table III herein for delta limits when applicable.

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

<u>Subgroup</u>	<u>Method</u>	<u>Condition</u>
B3	1056	Thermal shock, 0°C to +100°C, 25 cycles.
B3	1051	Temperature cycling, -55°C to +175°C, 100 cycles.
* B3	4066	$I_{FSM} =$ rated $I_{FSM}$ (see col. 5 of 1.3); 10 surges of 8.3 ms each at 1 minute intervals, superimposed on $I_O = 0$ , $V_{RWM} = 0$ .
B4	1037	$I_O = I_{O2}$ rated minimum (see 1.3.2); $V_R =$ rated $V_{RWM}$ (see 1.3.2 and 4.5.5); 2,000 cycles.
* B5	1027	$I_O = I_{O2}$ rated minimum (see col. 4 of 1.3.2); apply $V_R =$ rated $V_{RWM}$ (see col. 2 of 1.3.2, and 4.5.5) adjust $I_O$ to achieve $T_J$ minimum; $f = 50$ -60 Hz.  Option 1: $T_J = 225^\circ\text{C}$ minimum; $n = 45$ , $c = 0$ , $t = 216$ hours (see 4.5.5.1).  or Option 2: $T_J = 200^\circ\text{C}$ minimum; $n = 45$ , $c = 0$ , $t = 1,000$ hours.
* B6	3101 or 4081	$R_{\theta JL}$ (maximum) see col. 7 of 1.3.2 and 4.5.2 herein $L = .375$ inch (9.53 mm). For surface mount devices (US version), $R_{\theta JEC}$ see col. 8 of 1.3.2 and 4.5.2 herein.
* B7		Peak reverse power, see 4.5.4. $P_{RM} \geq 1,000$ W. Test shall be performed on each subplot; sampling plan $n = 10$ , $c = 0$ , electrical end-points, see table I, subgroup 2 herein.

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

<u>Subgroup</u>	<u>Method</u>	<u>Condition</u>
B2	1056	Thermal shock, 0°C to +100°C, 10 cycles.
B2	1051	Temperature cycling, -55°C to +175°C, 25 cycles.
B3	1027	$I_O = I_{O2}$ rated minimum (see col. 4 of 1.3.2); adjust $I_O$ to achieve the required $T_J$ apply $V_R =$ rated $V_{RWM}$ (see col. 2 of 1.3.2), $f = 50-60$ Hz (see 4.5.5.1).
B5		Not applicable.

\* 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. See table III herein for delta limits when applicable.

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

<u>Subgroup</u>	<u>Method</u>	<u>Condition</u>
C2	1056	Thermal shock, 0°C to +100°C, 10 cycles.
C2	1051	Temperature cycling, -55°C to +175°C, 20 cycles.
C2	2036	Tension: condition A, 4 pounds, $t = 15s$ - 1N5802, 1N5804, 1N5806. 5 pounds - 1N5807, 1N5809, 1N5811 Fatigue: Condition E, 2 pounds. NOTE: Not applicable for US devices.
* C5	3101 or 4081	$R_{\theta JL}$ (maximum) (see col. 7 of 1.3.2 and 4.5.2). $R_{\theta JEC} \leq$ surface mount devices (US version), (see col. 8 of 1.3 and 4.5.2).
C6	1027	$I_O = I_{O2}$ rated minimum (see col. 4 of 1.3.2); adjust $I_O$ to achieve the required $T_J$ apply $V_R =$ rated $V_{RWM}$ (see col. 2 of 1.3.2), $f = 50-60$ Hz (see 4.5.5.1).

4.4.4 Group E inspection. Group E inspection shall be conducted in accordance with the tests and conditions specified for subgroup testing in appendix E, table IX of MIL-PRF-19500 and as specified herein. See table IV for delta limits when applicable.

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

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

4.5.2 Thermal resistance. Thermal resistance shall be measured in accordance with method 3101 or 4081 of MIL-STD-750. Read and record data in accordance with table II herein shall be included in the qualification report. Forced moving air or draft shall not be permitted across the device during test. The maximum limit for  $R_{\theta JL}$  or  $R_{\theta JEC}$  under these test conditions shall be as specified in 1.3.2. The following conditions shall apply:

- a.  $I_H = 2.0$  A dc minimum.
- b.  $t_H =$  thermal equilibrium.
- c.  $I_M = 10$  mA.
- d.  $t_{MD} = 250$   $\mu$ s maximum.

The device shall be allowed to reach thermal equilibrium at current  $I_H$  before the measurement shall be made. Lead spacing:  $L = .375$  inch (9.52 mm) for leaded devices;  $L = 0$  (end cap mount) for -US devices (see figure 7).

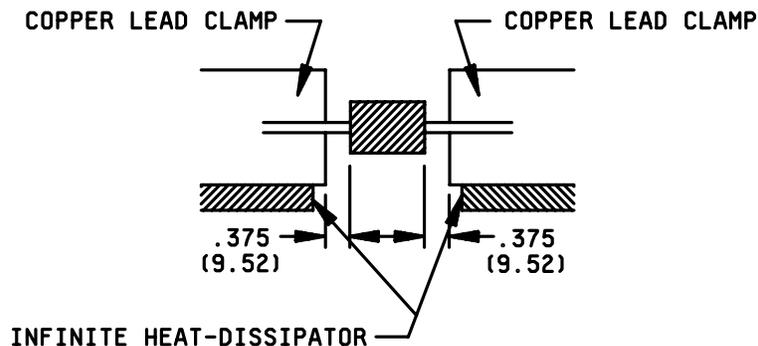


FIGURE 7. Mounting arrangement.

4.5.3 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 scope. The reverse current ( $I_{BR}$ ) over the knee shall be 500  $\mu$ A peak.

4.5.4 Peak reverse power test. A 20 microsecond half-sine waveform of current shall be used and peak reverse power shall be determined by the product of peak reverse voltage and peak reverse current. A 20 microsecond square waveform may also be used with the approval of the qualifying activity (see figure 8).

4.5.5 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.

\* 4.5.5.1 Free air burn-in. Deliberate heat sinking baffles to create an oven or forced air-cooling is prohibited unless otherwise approved by the qualifying activity. The use of a current limiting or ballast resistor is permitted provided that each DUT still sees the full  $P_t$  (minimum) and that the minimum applied voltage, where applicable, is maintained through out the burn-in period.  $T_J = 135^\circ\text{C}$  minimum for 96 hours. Use method 3100 of MIL-STD-750 to measure  $T_J$ .

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	$Z_{\theta JX}$			
1N5802, 1N5802US 1N5804, 1N5804US 1N5806, 1N5806US					4.5	°C/W
1N5807, 1N5807US 1N5809, 1N5809US 1N5811, 1N5811US					1.5	°C/W
Forward voltage	4011	Duty cycle $\leq$ 2 percent (pulsed see 4.5.1); $t_p = 8.3$ ms (max)	$V_{FM1}$			
1N5802, 1N5802US 1N5804, 1N5804US 1N5806, 1N5806US		$I_{FM} = 1.0$ A(pk)			0.875	V (pk)
1N5807, 1N5807US 1N5809, 1N5809US 1N5811, 1N5811US		$I_{FM} = 4.0$ A(pk)			0.875	V (pk)
Forward voltage	4011	Duty cycle $\leq$ 2 percent (pulsed see 4.5.1); $t_p = 8.3$ ms (max)	$V_{FM2}$			
1N5802, 1N5802US 1N5804, 1N5804US 1N5806, 1N5806US		$I_{FM} = 2.5$ A(pk)			0.975	V (pk)
1N5807, 1N5807US 1N5809, 1N5809US 1N5811, 1N5811US		$I_{FM} = 6.0$ A(pk)			0.925	V(pk)
Reverse current	4016	DC method	$I_{R1}$			
1N5802, 1N5802US 1N5804, 1N5804US 1N5806, 1N5806US		$V_R = 50$ V dc $V_R = 100$ V dc $V_R = 150$ V dc			1.0 1.0 1.0	$\mu$ A dc $\mu$ A dc $\mu$ A dc
1N5807, 1N5807US 1N5809, 1N5809US 1N5811, 1N5811US		$V_R = 50$ V dc $V_R = 100$ V dc $V_R = 150$ V dc			5.0 5.0 5.0	$\mu$ A dc $\mu$ A dc $\mu$ A dc

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	$I_{(BR)} = 100 \mu\text{A dc}$	$V_{(BR)1}$			
1N5802, 1N5802US 1N5807, 1N5807US				60		V dc
1N5804, 1N5804US 1N5809, 1N5809US				110		V dc
1N5806, 1N5806US 1N5811, 1N5811US				160		V dc
<u>Subgroup 3</u>						
High temperature operation:		$T_A = +100^\circ\text{C}$ minimum.				
Reverse current	4016	DC method	$I_{R2}$			
1N5802, 1N5802US				$V_R = 50 \text{ V dc}$	50	$\mu\text{A dc}$
1N5804, 1N5804US				$V_R = 100 \text{ V dc}$	50	$\mu\text{A dc}$
1N5806, 1N5806US				$V_R = 150 \text{ V dc}$	50	$\mu\text{A dc}$
1N5807, 1N5807US				$V_R = 50 \text{ V dc}$	150	$\mu\text{A dc}$
1N5809, 1N5809US 1N5811, 1N5811US				$V_R = 100 \text{ V dc}$ $V_R = 150 \text{ V dc}$	150 150	$\mu\text{A dc}$ $\mu\text{A dc}$
Forward voltage	4011	Duty cycle $\leq 2$ percent (pulsed see 4.5.1); $t_p = 8.3 \text{ ms (max)}$	$V_{FM3}$			
1N5802, 1N5802US 1N5804, 1N5804US 1N5806, 1N5806US				$I_{FM} = 1.0 \text{ A(pk)}$	0.800	V (pk)
1N5807, 1N5807US 1N5809, 1N5809US 1N5811, 1N5811US				$I_{FM} = 4.0 \text{ A(pk)}$	0.800	V (pk)
Low-temperature operation:		$T_A = -65^\circ\text{C}$ minimum.				
Forward voltage	4011	Duty cycle $\leq 2$ percent (pulsed see 4.5.1); $t_p = 8.3 \text{ ms (max)}$	$V_{FM4}$			
1N5802, 1N5802US 1N5804, 1N5804US 1N5806, 1N5806US				$I_{FM} = 1.0 \text{ A(pk)}$	1.075	V (pk)
1N5807, 1N5807US 1N5809, 1N5809US 1N5811, 1N5811US				$I_{FM} = 4.0 \text{ A(pk)}$	1.075	V (pk)

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 3</u> – Continued.						
Breakdown voltage 1N5802, 1N5802US 1N5807, 1N5807US	4021	$I_{(BR)} = 100 \mu\text{A dc}$	$V_{(BR)2}$	50		V dc
1N5804, 1N5804US 1N5809, 1N5809US				100		V dc
1N5806, 1N5806US 1N5811, 1N5811US				150		V dc
<u>Subgroup 4</u>						
Reverse recovery time 1N5802, 1N5802US 1N5804, 1N5804US 1N5806, 1N5806US	4031	Condition B $I_F = I_R = 0.5 \text{ A}$ $I_{RM(REC)} = 0.05 \text{ A(pk)}$ $di/dt = 65 \text{ A}/\mu\text{s (min)}$	$t_{rr}$		25	ns
1N5807, 1N5807US 1N5809, 1N5809US 1N5811, 1N5811US		$I_F = I_R = 1.0 \text{ A}$ $I_{RM(REC)} = 0.1 \text{ A(pk)}$ $di/dt = 100 \text{ A}/\mu\text{s (min)}$			30	ns
Capacitance 1N5802, 1N5802US 1N5804, 1N5804US 1N5806, 1N5806US	4001	$V_R = 10 \text{ V}; f = 1 \text{ Mhz};$ $V_{sig} = 50 \text{ mV (p-p)}$	$C_J$		25	pF
1N5807, 1N5807US 1N5809, 1N5809US 1N5811, 1N5811US					60	pF
Forward recovery voltage 1N5802, 1N5802US 1N5804, 1N5804US 1N5806, 1N5806US	4026	$t_r = 8 \text{ ns}$ $I_{FM} = 250 \text{ mA}$	$V_{FRM}$		2.2	V (pk)
1N5807, 1N5807US 1N5809, 1N5809US 1N5811, 1N5811US		$I_{FM} = 500 \text{ mA}$			2.2	V (pk)

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 time	4026	$t_p \geq 20$ ns, $t_r = 8$ ns, the test is measured at $V_{FR} = 1.1 \times V_F$	$t_{fr}$			
1N5802, 1N5802US 1N5804, 1N5804US 1N5806, 1N5806US		$I_{FM} = 250$ mA			15	ns
1N5807, 1N5807US 1N5809, 1N5809US 1N5811, 1N5811US		$I_{FM} = 500$ mA			15	ns
Scope display evaluation	4023	See 4.5.3, $n = 116$ , $c = 0$				
<u>Subgroup 5</u>						
Not applicable						
<u>Subgroup 6</u>						
Forward surge	4066	$I_{FSM} =$ rated (see 1.3.2); 10 surges of 8.3 ms each at 1 minute intervals superimposed on $I_O = I_{O2}$ rated (see 1.3.2); $V_{RWM} =$ rated (see 1.3.2); $T_A = + 25^\circ\text{C}$ .				
Electrical measurements		See table I, subgroup 2 except $Z_{\theta JX}$ .				
<u>Subgroup 7</u>						
Not applicable						

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

2/ Not applicable to JANHC and JANKC devices.

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

Inspection	MIL-STD-750		Sampling plan
	Method	Conditions	
<u>Subgroup 1</u>			45 devices c = 0
Thermal shock (liquid to liquid)	1056	20 cycles, condition D except low temperature shall be achieved using liquid nitrogen (-195°C). Perform a visual for cracked glass.	
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 <sub>A</sub> = +150°C; V <sub>R</sub> DC = 80 - 85 percent rated V <sub>RWM</sub> (see 1.3.2)	
Electrical measurement		See table I, subgroup 2, except Z <sub>0JX</sub> need not to be performed.	
* <u>Subgroup 3</u>			3 devices, c = 0
DPA	2101	Cross section and scribe and break. Separate samples shall be used for each test.	
<u>Subgroup 4</u>			N/A
Thermal impedance curves	3101 or 4081	Each supplier shall submit their (typical) maximum design thermal impedance curves. In addition, optional test conditions and Z <sub>0JX</sub> limit shall be provided to the qualifying activity in the qualification report.	
<u>Subgroup 5, 6, and 7</u>			
Not applicable			
<u>Subgroup 8</u>			
Peak reverse power		See 4.5.4 and figure 8 herein. Peak reverse power, (P <sub>RM</sub> )= shall be characterized by the supplier and this data shall be available to the Government. Test shall be performed on each subplot.	
Electrical measurement		During the P <sub>RM</sub> test, the voltage (V <sub>BR</sub> ) shall be monitored to verify it has not collapsed. Any collapse in V <sub>BR</sub> during or after the P <sub>RM</sub> test or rise in leakage current (I <sub>R</sub> ) after the test that exceeds I <sub>R1</sub> in table I shall be considered a failure to that level of applied P <sub>RM</sub> . Progressively higher levels of P <sub>RM</sub> shall be applied until failure occurs on all devices within the chosen sample size to characterize each subplot.	

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

Inspection	MIL-STD-750		Sampling plan
	Method	Conditions	
<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	4066	Condition A, $I_{FSM}$ = rated (see 1.3.2); 10 surges of 8.3 ms each at 1 minute intervals superimposed on $I_O = I_{O2}$ rated (see 1.3.2); $V_{RWM}$ = rated (see 1.3.2); $T_A = + 25^\circ\text{C}$ .	22 devices c = 0
Electrical measurement		See table I, subgroup 2.	

\* TABLE III. Groups A, B, and C delta measurements. 1/ 2/ 3/ 4/ 5/

Step	Inspection	MIL-STD-750		Symbol	Limit	Unit
		Method	Conditions			
1.	Forward voltage  1N5802, 1N5804, 1N5806, 1N5802US, 1N5804US, 1N5806US  1N5807, 1N5809, 1N5811, 1N5807US, 1N5809US, 1N5811US	4011	Duty cycle $\leq$ 2 percent (pulsed see 4.5.1); $t_p =$ 8.3 ms (max)  $I_{FM} = 1.0$ A(pk)  $I_{FM} = 4.0$ A(pk)	$\Delta V_{FM1}$	$\pm 50$ mV dc change from of initial value	
2.	Reverse current 1N5802, 1N5802US 1N5804, 1N5804US 1N5806, 1N5806US  1N5807, 1N5807US 1N5809, 1N5809US 1N5811, 1N5811US	4016	DC method $V_R = 50$ V dc $V_R = 100$ V dc $V_R = 150$ V dc  $V_R = 50$ V dc $V_R = 100$ V dc $V_R = 150$ V dc	$\Delta I_{R1}$	100 percent or $\pm 150$ nA dc change from initial reading, whichever is greater.  100 percent or $\pm 500$ nA dc change from initial reading, whichever is greater.	

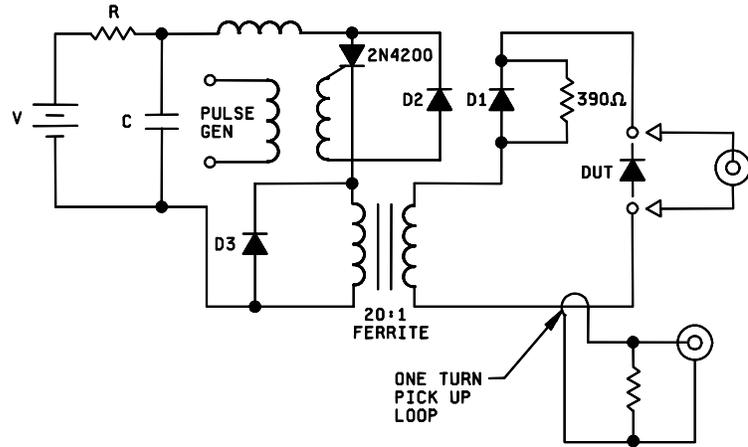
1/ Devices which exceed the table I limits for this test shall not be accepted.

2/ The delta measurements for group B, table VIa (JANS) of MIL-PRF-19500 are as follows: Subgroups 4 and 5, see table III herein, steps 1 and 2.

3/ The delta measurements for group B, table VIb (JAN, JANTX, and JANTXV) of MIL-PRF-19500 are as follows: Subgroup 3, see table III herein, steps 1 and 2.

4/ The delta measurements for group C, table VII of MIL-PRF-19500 are as follows: Subgroup 6, see table III herein, steps 1 and 2.

5/ The electrical measurements for table IX of MIL-PRF-19500 are as follows: Subgroup 2 and 6, see table III herein, step 1 and 2.



NOTES: \*

- L = 13T H22 on 1inch (25.4 mm) diameter form (air core).
- C ~ 1 to 10  $\mu$ fd to give 20  $\mu$ s pulse width.
- V - Adjustable to 200 volts for power desired in DUT.
- D1 - 3 kV; 600 mA (1N3647 or equivalent).
- D2, D3 - 600 V; 3A (1N5552 or equivalent).
- \* Values not stated are determined at the time of test.

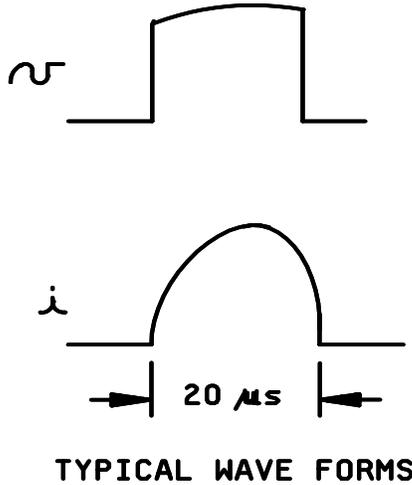


FIGURE 8. Peak reverse power measurement circuit and waveform.

## 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. 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.
- f. For die acquisition, the JANHC or JANKC letter version shall be specified (see figures 3, 4, 5, and 6).

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 43216-5000 or e-mail [vqe.chief@dla.mil](mailto:vqe.chief@dla.mil).

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

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

Preparing activity:  
DLA - CC

(Project 5961-2758)

Review activities:

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

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