The documentation and process conversion measures necessary to comply with this shall be completed by 16 Aug 94.

INCH-POUND

MIL-S-19500/406C
16 May 1994
SUPERSEDING
MIL-S-19500/406B
19 June 1992

MILITARY SPECIFICATION

SEMICONDUCTOR DEVICES, DIODE, SILICON, VOLTAGE REGULATOR
TYPES 1N4460, 1N4460C, 1N4460D THROUGH 1N4496, 1N4496C, 1N4496D AND
1N6485, 1N6485C, 1N6485D THROUGH 1N6491, 1N6491C, 1N6491D
1N4460US, 1N4460CUS, 1N4460DUS THROUGH 1N4496US, 1N4496CUS, 1N4496DUS AND
1N6485US, 1N6485CUS, 1N6485DUS THROUGH 1N6491US, 1N6491CUS, 1N6491DUS
PLUS C AND D TOLERANCE SUFFIX; JAN, JANTX, JANTXV, JANS, JANHC, AND JANKC

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

1. SCOPE

1.1 Scope. This specification covers the detail requirements for microminiature 1.5 watt silicon, low leakage, voltage regulator diodes with tolerances of 5 percent, 2 percent, and 1 percent. Four levels of product assurance are provided for each device type as specified in MIL-S-19500, and two level of product assurance for die.

1.2 Physical dimensions. See figures 1 (similar to DO-41), 2, and 3.

1.3 Maximum ratings. Maximum ratings are as shown in columns 8 and 10 of table III herein and as follows:

P_T = 1.5 W (derate at 10 mW/°C above T_A = +25°C) -55°C < T_{op} < +175°C; -65°C < T_{STG} < +175°C

1.4 Primary electrical characteristics. Primary electrical characteristics are as shown in columns 2, 9, 12, and 14 of table III herein and as follows:

3.3 V dc ≤ V_Z ≤ 200 V dc

1N4460D through 1N4496D and 1N6485D through 1N6491D are 1 percent voltage tolerance.
1N4460C through 1N4496C and 1N6485C through 1N6491C are 2 percent voltage tolerance.
1N4460 through 1N4496 and 1N6485 through 1N6491 are 5 percent voltage tolerance.

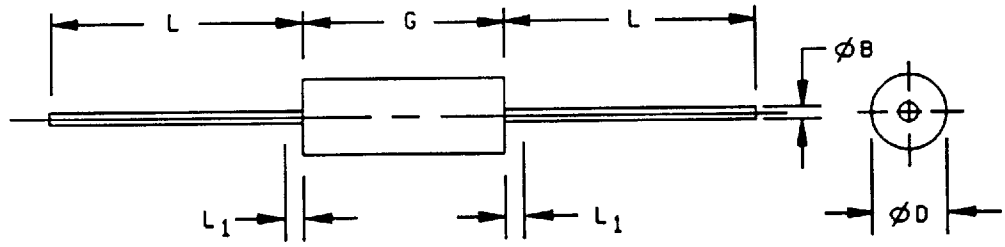
$R_{\theta JL}$ = 42°C/W (max) at L = .375 inch (9.52 mm) (nonsurface mount)

$R_{\theta JEC}$ = 20°C/W (max) (surface mount)

Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: Defense Electronics Supply Center, DESC-ELD, 1507 Wilmington Pike, Dayton, OH 45444-5765 by using the Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document or by letter.

FSC 5961

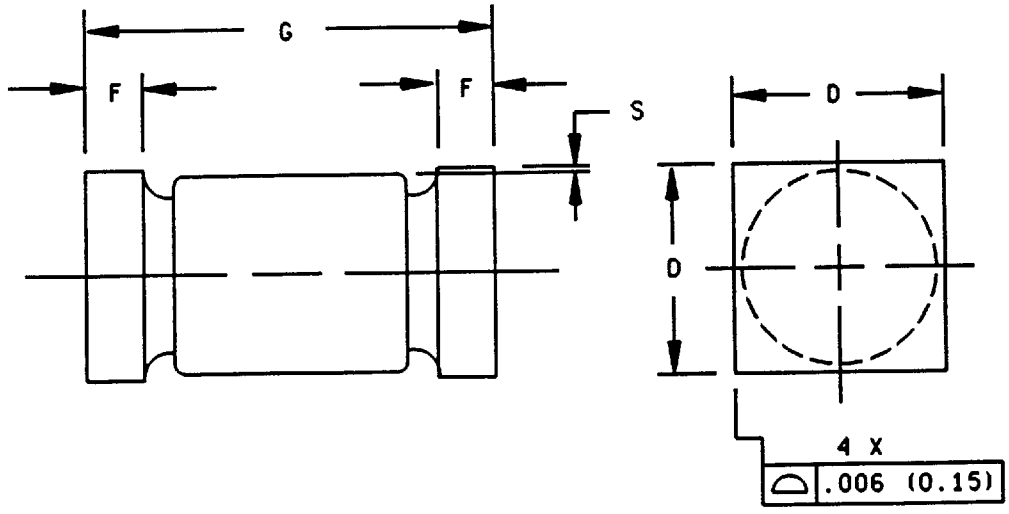
AMSC N/A
DISTRIBUTION STATEMENT A. Approved for public release; distribution is unlimited.



Ltr	Dimensions				Notes
	Inches		Millimeters		
	Min	Max	Min	Max	
G	.106	.160	2.69	4.06	3
ØD	.060	.085	1.52	2.16	3
L	.800	1.300	20.32	33.02	
ØB	.028	.032	0.71	0.81	
L_1		.050		1.27	4

NOTES:
1. Dimensions are in inches.
2. Metric equivalents are given for general information only.
3. Package contour optional with ØD and length G. Heat slugs, if any, shall be included within this cylinder but shall not be subject to minimum limit of ØD.
4. The specified lead diameters apply in the zone between .050 inch (1.27 mm) from the diode body and the end of the lead.

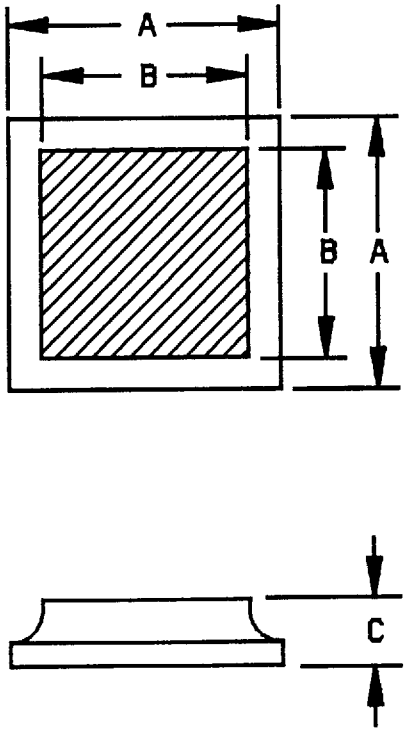
FIGURE 1. Physical dimensions of nonsurface mount device.



Ltr	Dimensions				Notes
	Inches		Millimeters		
	Min	Max	Min	Max	
G	.168	.200	4.28	5.08	
F	.019	.028	0.48	0.71	
S	.003		0.08		
D	.091	.103	2.31	2.62	

NOTES:
1. Dimensions are in inches.
2. Metric equivalents are given for general information only.

FIGURE 2. Physical dimensions of surface mount device, "US".



Symbol	Dimension			
	Inches		Millimeters	
	Min	Max	Min	Max
A	0.030	0.036	0.813	0.914
B	0.022	0.027	0.584	0.686
C	0.006	0.012	0.152	0.305

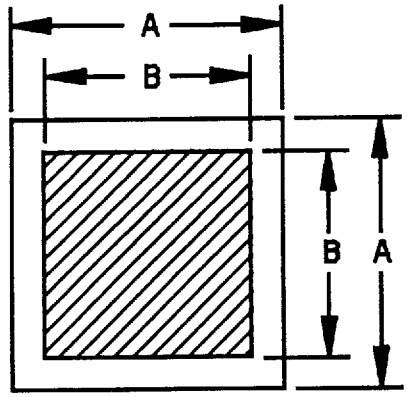
DESIGN DATA

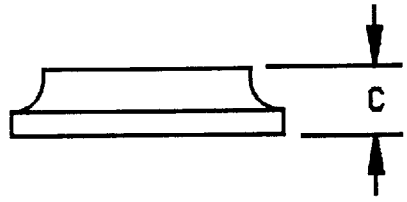
Metallization:

Top: (Cathode)	Aluminum
Back (Anode).	Gold

NOTES:
1. Dimensions are in inches.
2. Metric equivalents are given for general information only.

FIGURE 3. Physical dimensions for JANHCA and JANKCA (die).





Symbol	Dimension			
	Inches		Millimeters	
	Min	Max	Min	Max
A	0.030	0.036	0.813	0.914
B	0.022	0.027	0.584	0.686
C	0.006	0.012	0.152	0.305

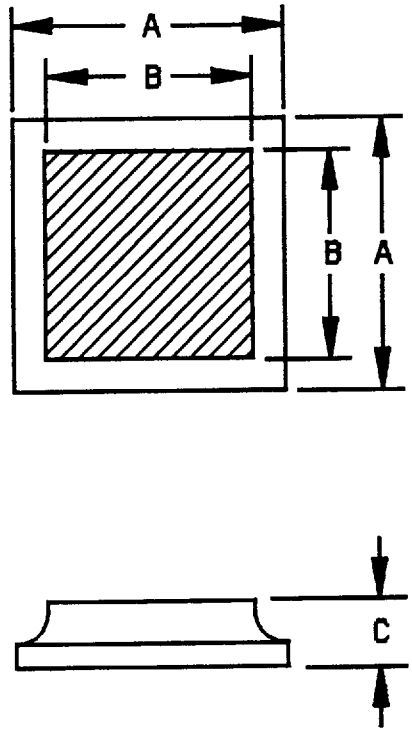
DESIGN DATA

Metallization:

Top: (Cathode)	Aluminum
Back (Anode).	Silver

NOTES:
1. Dimensions are in inches.
2. Metric equivalents are given for general information only.

FIGURE 4. Physical dimensions for JANHCB and JANKCB (die).



Symbol	Dimension			
	Inches		Millimeters	
	Min	Max	Min	Max
A	0.030	0.036	0.813	0.914
B	0.022	0.027	0.584	0.686
C	0.006	0.012	0.152	0.305

DESIGN DATA

Metallization:

Top: (Cathode)	Silver
Back (Anode).	Silver

NOTES:
1. Dimensions are in inches.
2. Metric equivalents are given for general information only.

FIGURE 5. Physical dimensions for JANHCC and JANKCC (die).

2. APPLICABLE DOCUMENTS

2.1 Government documents.

2.1.1 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 listed in the issue of the Department of Defense Index of Specifications and Standards (DODISS) and supplement thereto, cited in the solicitation (see 6.2).

SPECIFICATION

MILITARY

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

STANDARD

MILITARY

MIL-STD-750 - Test Methods for Semiconductor Devices.

(Unless otherwise indicated, copies of federal and military specifications, standards, and handbooks are available from the Standardization Documents Order Desk, Building 4D, 700 Robbins Avenue, Philadelphia, PA 19111-5094.)

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

3. REQUIREMENTS

3.1 Associated detail specification. The individual item requirements shall be in accordance with MIL-S-19500, and as specified herein.

3.2 Abbreviations, symbols, and definitions. The abbreviations, symbols, and definitions used herein shall be as specified in MIL-S-19500, and as follows:

EC	Endcap.
US	Surface mount case outline, square endcap.

3.3 Design, construction, and physical dimensions. The design, construction, and physical dimensions shall be as specified in MIL-S-19500, and on figures 1, 2, and 3 herein.

3.3.1 Construction except for JANHC an JANKC. Devices shall be metallurgically bonded-thermally matched-noncavity-double plug construction in accordance with MIL-S-19500, 3.3.1.1, and 3.3.1.2 herein. The "US" version shall be structurally identical to the axial lead type except for lead configuration.

3.3.1.1 Metallurgical bond for diodes with V_Z > 6.8 V dc. Category I metallurgical bonds as defined in MIL-S-19500 shall be utilized.

3.3.1.2 Metallurgical bond for diodes with $V_Z \leq 6.8$ V dc. Category I and category III bonds as defined in MIL-S-19500 may be utilized.

3.4 Marking. Marking shall be in accordance with MIL-S-19500.

3.4.1 Marking of US version devices. For "US" version devices only, all marking (except polarity) may be omitted from the body, but shall be retained on the initial container.

3.4.2 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 may be used.

3.5 Selection of tighter tolerance devices. The C and D suffix devices shall be selected from JAN, JANTX, JANTXV, or JANS devices, which have successfully completed all applicable screening, and groups A, B, and C testing as 5 percent tolerance devices. All sublots of C and D suffix devices shall pass group A, subgroup 2, at tighter tolerances. Tighter tolerances for mounting clip temperature shall be maintained for reference purpose to establish correlation. For C and D tolerance levels, T_L = 25°C ± 2°C at 0.375" from body or equivalent.

4. QUALITY ASSURANCE PROVISIONS

4.1 Sampling and inspection. Sampling and inspection shall be in accordance with MIL-S-19500, and as specified herein. Lot accumulation period shall be 6 months in lieu of 6 weeks. This applies to JAN, JANTX and JANTXV quality levels only.

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

4.2.1 Group E inspection. Group E inspection shall be conducted in accordance with MIL-S-19500 and table II herein.

4.2.2 JANHC and JANKC devices. Qualification for JANC devices shall be as specified in appendix H of MIL-S-19500.

4.3 Screening (all levels). Screening shall be in accordance with table II of MIL-S-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.

4.3.1 Screening (JANHC and JANKC). Screening of die shall be in accordance with MIL-S-19500, appendix H.

Screen (see table II of MIL-S-19500)	Measurements	
	JANS level	JANTX and JANTXV levels
1/	Thermal impedance, see 4.5.4	Thermal impedance, see 4.5.4
7	Hermetic seal, gross leak	Hermetic seal, gross leak
9	I_{R1} and VZ (1N4465 thru 1N4496 only)	Not applicable
11	I_{R1} and V_Z (1N4465 thru 1N4496 only); ΔI_{R1} ≤ ±100 percent of initial reading or 50 nA dc, whichever is greater. ΔV_Z ≤ ±2 percent of initial reading.	I_{R1} and V_Z (1N4465 thru 1N4496 only)
12	See 4.3.2	See 4.3.2
13 2/ 3/	Subgroups 2 and 3 of table I herein; ΔI_{R1}(max) ≤ ±100 percent of initial reading or 50 nA, whichever is greater; ΔV_Z ≤ ±2 percent of initial reading.	Subgroup 2 of table I herein; ΔI_{R1}(max) ≤ ±100 percent initial reading or 50 nA, whichever is greater; ΔV_Z ≤ ±2 percent of initial reading.

1/ This test shall be performed anytime after screen 3.
2/ Thermal impedance not applicable, if already performed 100%.
3/ Delta limits applicable to 1N4465 thru 1N4496 only.

4.3.2 Power burn-in conditions. Power burn-in conditions are as follows:

The diode shall be suspended by its leads (nonsurface mount only) with the mounting clips at a minimum of .375 inch (9.52 mm) from the device body in a room ambient as defined in (see 4.5) general requirements of MIL-STD-750. The test current I_Z shall be adjusted to produce a junction temperature of +175°C maximum and I_Z minimum shall be equal to 50 percent of column 8 of table III. For surface mount devices, the mounting clips shall contact the endcaps and the ambient temperature may be elevated in order to achieve the specified junction temperature.

4.4 Quality conformance inspection. Quality conformance inspection shall be in accordance with MIL-S-19500 and as specified herein. Group A inspection shall be performed on each sublot.

4.4.1 Group A inspection. Group A inspection shall be in accordance with MIL-S-19500 and table I herein. Thermal impedance conditions are as follows:

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

b. I_H forward heating current . . . . . 3A to 10 A.

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

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

The maximum limit for $Z_{\theta JX}$ under these test conditions are $Z_{\theta JX(max)}$ = 4.5°C/W for category I bonds and $Z_{\theta JX(max)}$ = 7.5°C/W for category III bonds (see 3.3.1.1 and 3.3.1.2).

4.4.2 Group B inspection. Group B inspection shall be conducted in accordance with the conditions specified for subgroup testing in tables IVa and IVb of MIL-S-19500. Electrical measurements (end-points) shall be in accordance with the applicable inspections of table I, group A, subgroup 2 herein except $Z_{\theta JX}$ need not to be performed. See subgroup conditions for delta limits when applicable.

4.4.2.1 Group B inspection, table IVa (JANS) of MIL-S-19500.

Subgroup	Method	Condition
3	1056	25 cycles, condition A
3	1071	Test condition E NOTE: For non-transparent devices, hermetic seal may be performed after electrical measurements.
4	1037	I_Z = column 8 of table III at T_A = room ambient as defined in the general requirements of paragraph 4.5 of MIL-STD-750; $t_{on} = t_{off}$ = 3 minutes minimum for 2,000 cycles. Mounting conditions in accordance with 4.5.2. No forced air cooling on the device shall be permitted. Leaded samples from this lot may be used in lieu of surface mount devices.
4	Endpoints:	I_R endpoints in accordance with table III, column 13.
5	1027	I_Z = column 8 of table III for 96 hours; P_T = 1.5 W; T_A = +125°C or adjusted as required by the chosen T_A to give an average lot T_J = +275°C. Leaded samples from this lot may be used in lieu of surface mount devices.
5	Endpoints:	I_R endpoints in accordance with table III, column 13.
6	3101 or 4081	$R_{\theta JL}$ = 42°C/W maximum; $R_{\theta JEC}$ = 20°C/W maximum; +25°C < T_A +35°C; reference temperature measuring point is the inside of mounting clip on lead or endcap (see 4.5.7).

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

Subgroup	Method	Condition
1	2026	Immersion depth to within 0.10 inch (2.54 mm) of device body (leaded devices only).
2	4066	I_{ZSM} = column 10 of table III at T_A +25°C (see 4.5.1).
2	1071	Test condition E only NOTE: For non-transparent devices, hermetic seal may be performed after electrical measurements.
3	1027	I_Z(min) = 50 percent of column 8 of table III (conditions in accordance with 4.3.2); T_A = room ambient as defined in the general requirements of paragraph 4.5 of MIL-STD-750.
3	Endpoints:	I_R endpoints in accordance with table III, column 13.

4.4.3 Group C inspection. Group C inspection shall be conducted in accordance with the conditions specified for subgroup testing in table V of MIL-S-19500 and herein. Electrical measurements (end-points) shall be in accordance with the applicable inspections of table I, group A, subgroup 2 herein except $Z_{\theta JX}$ need not to be performed. See subgroup conditions for delta limits when applicable.

4.4.3.1 Group C inspection, table V of MIL-S-19500.

Subgroup	Method	Condition
2	2036	Tension - test condition A; 10 lbs; t = 15 s ± 3 s. Lead fatigue - Test condition E. NOTE: Not applicable to US versions.
2	1071	Test condition E only NOTE: For non-transparent devices, hermetic seal may be performed after electrical measurements.
6	1027	I_Z(min) = 50 percent of column 8 of table III (conditions in accordance with 4.3.2); T_A = room ambient as defined in the general requirements of paragraph 4.5 of MIL-STD-750.
6	Endpoints:	I_R endpoints in accordance with table III, column 13.
7	4071	Temperature coefficient for JAN, JANTX and JANTXV only; I_Z = column 5 of table III; T_{A1} = +25°C ±5°C; T_{A2} = +100°C ±5°C; limit = column 14 of table III (see paragraph 4.5.3).
8	1056	Liquid N_2 (-195°C) to +150°C fluoro bath. The DUT shall be stabilized at the temperature extremes for 20 s minimum, transfer time ≤ 5 s, continuously monitor for discontinuities during the last five cycles, V_t = 200 mA dc; 20 cycles for group C.
8	----	Visual inspection - cracks in package shall be cause for rejection.
8	Endpoints:	ΔV_F at 200 mA = ±20 mV or 2 percent of initial readings, whichever is greater.

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

4.5.1 Surge current (I_{ZSM}). The peak currents specified in column 10 of table III shall be applied in the reverse direction and shall be superimposed on the current (I_Z = column 5 of table III) a total of five surges at 1 minute intervals. Each individual surge shall be at one-half square wave pulse of 8.3 millisecond duration or an equivalent sine wave with the same effective (rms) current.

4.5.2 Voltage regulation (V_Z (reg)). A current of 10 percent of I_Z (column 8) shall be maintained until thermal equilibrium is attained and the V_Z shall be noted. The current shall then be increased to a level of 50 percent of I_Z (column 8) and maintained at this level until thermal equilibrium is attained at which time the voltage change shall not exceed column 9 of table III. For this test, the diode shall be suspended by its leads (nonsurface mount) with mounting clips whose inside edge is located at 0.375 ±0.010 inch (9.52 ±0.25 mm) from the body and the lead temperature at inside edge of the mounting clips shall be maintained at a temperature between +23°C and +33°C. For surface mount packages, the diode shall be suspended by the endcaps with the temperature of the endcaps being maintained between +23°C and +33°C. For JANC, the die shall be stabilized at +25°C and the test shall be performed utilizing pulse condition. This measurement may be performed after a shorter time interval following application of the test current than that which provides thermal equilibrium if correlation can be established to the satisfaction of the qualifying activity.

4.5.3 Temperature coefficient of regulator voltage (α_{VZ}). The device shall be temperature stabilized with current applied prior to reading regulator voltage at the specified ambient temperature. For JANC, this test shall be made with the chip resting on a metal heat sink maintained at +25°C ±3°C, utilizing pulse condition.

4.5.4 Thermal impedance ($Z_{\theta JX}$ measurements). The $Z_{\theta JX}$ measurements shall be performed in accordance with MIL-STD-750, method 3101. The maximum limit shall not to exceed the Group A, Subgroup 2 limit for $Z_{\theta JX}$ in screening (table II of MIL-S-19500).

4.5.4.1 Thermal impedance ($Z_{\theta JX}$ measurements) for initial qualification or requalification. The $Z_{\theta JX}$ measurements shall be performed in accordance with MIL-STD-750, method 3101 (read and record date $Z_{\theta JX}$). $Z_{\theta JX}$ shall be supplied on one lot (500 devices minimum and a thermal response curve shall be submitted). Twenty two of these samples shall be serialized and provided to the qualifying activity for correlation prior to shipment of parts. Measurements conditions shall be in accordance with 4.4.1.

4.5.5 Regulator voltage. The test current (column 5 of table III) shall be applied until thermal equilibrium is attained prior to reading the regulator voltage. For this test, the diode shall be suspended by its leads (nonsurface mount) with mounting clips whose inside edge is located at 0.375 ±0.010 inch (9.52 ±0.25 mm) from the body and the lead temperature at inside edge of the mounting clips shall be maintained at a temperature of +23°C to +33°C. For surface mount diodes, the diode shall be suspended by the endcaps with the temperature of the endcaps being maintained at +23°C to +33°C. For JANC, this measurement shall be made with the chip resting on a metal heat sink maintained at +25°C ±3°C. This measurement may be performed after a shorter time following application of the test current than that which provides thermal equilibrium if correlation to stabilized readings can be established to the satisfaction of the qualifying activity.

4.5.6 Pulse measurements. Conditions for pulse measurements shall be as specified in paragraph 4.3.2.1 of MIL-STD-750.

TABLE I. Group A inspection.

Inspection 1/	MIL-STD-750		Symbol	Limits 2/		Unit
	Method	Conditions		Min	Max	
Subgroup 1						
Visual and mechanical examination	2071					
Subgroup 2						
Thermal impedance 4/	3101	Category I bond Category III bond (See 4.4.1)	$Z_{\theta JX}$		4.5 7.5	°C/W °C/W
Forward voltage	4011	I_F = 200 mA dc	V_{F1}		1.0	V dc
Forward voltage	4011	I_F = 1 A dc	V_{F2}		1.5	V dc
Reverse current leakage	4016	DC method; V_R = column 11 of table III	I_{R1}		Column 12	µA dc
Regulator voltage 3/	4022	I_Z = column 5 of table III (see 4.5.5)	V_Z	Column 3 -5, -2, -1 percent	Column 4 +5, +2, +1 percent	V dc
Subgroup 3						
High temperature operation		T_A = +150°C				
Reverse current leakage	4016	DC method; V_R = column 11 of table III	I_{R2}		Column 16	µA dc
Subgroup 4						
Small-signal reverse breakdown impedance	4051	I_Z = column 5 of table III I_{sig} = 10 percent I_Z	Z_Z		Column 6	Ω
Knee impedance	4051	I_{ZK} = column 15 of table III I_{sig} = 10 percent I_{ZK}	Z_{ZK}		Column 7	Ω
Subgroup 5						
Not applicable						
Subgroup 6						
Surge current	4066	JANS only I_{ZSM} = column 10 of table III (see 4.5.1)	I_{ZSM}			
End-point electrical measurements		See table I, group A, subgroup 2 except $Z_{\theta JX}$				

See footnotes at end of table.

TABLE I. Group A inspection - Continued.

Inspection 1/	MIL-STD-750		Symbol	Limits 2/		Unit
	Method	Conditions		Min	Max	
Subgroup 7						
Voltage regulation 3/		See 4.5.2	$V_{Z(reg)}$		Column 9	V dc
Temperature coefficient of regulator voltage	4071	JANS level only I_Z = column 5 of table III T_{A1} = +25°C ±5°C, T_{A2} = 120°C ≤ T_2 ≤ 130°C	α_{VZ}		Column 14	%/°C

1/ For sampling plan, see MIL-S-19500.
2/ Column references are to table III.
3/ For JANC, test using pulse conditions.
4/ Not require for JANHC and JANKC

TABLE II. Group E inspection (all quality levels).

Inspection	MIL-STD-750		Sampling plan
	Method	Conditions	
Subgroup 1			22 devices c = 0
Temperature cycling	1051	500 cycles	
Electrical measurements		See table I, group A, subgroup 2	
Subgroup 2			22 devices c = 0
Steady-state intermittent operating life	1037	$I_Z = I_{Z2}$ (column 8 of table III) at T_A = +25°C; $T_{on} = T_{off}$ = 3 minutes minimum for 10,000 cycles. No forced air cooling on the device shall be permitted. (Mounting conditions in accordance with 4.5.2.)	
Electrical measurements		See table I, group A, subgroup 2	
Subgroup 3			22 devices c = 0
Not applicable			
Subgroup 4			
Thermal resistance (see 4.5.7)	3101 or 4081	$R_{\theta JL}$ = 42°C/W (max) at L = 3/8"; $R_{\theta JEC}$ = 20°C/W max for US types,	

TABLE III. Electrical characteristics and test conditions (all case outlines).

Col 1	Col 2	Col 3	Col 4	Col 5	Col 6	Col 7	Col 8	Col 9	Col 10	Col 11	Col 12	Col 13	Col 14	Col 15	Col 16
Device type	V_Z Nom	V_Z Min 1/ 2/	V_Z Max 1/ 2/	I_Z test current T_A = +25°C	Z_Z Impedance	Z_K Knee impedance	I_Z Max dc current T_A = +25°C	V_Z(reg) voltage regulation 3/	I_{ZSM} T_A = +25°C 4/	V_R Reverse voltage	I_R Reverse current dc I_{R1}	I_R Reverse current dc, I_{R1} post test	α_{VZ} Temperature coefficient 5/	I_{ZK} Test current	I_R Reverse current dc T_A = +150°C I_{R2}
	V	V	V	mA	Ω	Ω	mA	V	A	V	µA	µA	%/°C	mA	µA
1N6485	3.3	3.14	3.46	76	10	400	433	0.9	4.2	1.0	50.00	75.00	-.075	1.00	500
1N6486	3.6	3.42	3.78	69	10	400	397	0.8	3.9	1.0	50.00	75.00	-.070	1.00	200
1N6487	3.9	3.71	4.09	64	9	400	366	.75	3.6	1.0	35.00	50.00	-.060	1.00	100
1N6488	4.3	4.09	4.51	58	9	400	332	.70	3.3	1.0	5.00	7.50	+.050	1.00	100
1N6489	4.7	4.47	4.93	53	8	500	304	.60	3.0	1.0	4.00	6.00	±.025	1.00	100
1N6490	5.1	4.85	5.35	49	7	500	280	.5	2.7	1.0	1.00	2.00	±.030	1.00	100
1N6491	5.6	5.32	5.88	45	5	600	255	.40	2.5	2.0	0.50	1.00	±.040	1.00	100
1N4460	6.2	5.89	6.51	40	4	200	230	.35	2.3	3.72	10.00	20.00	+.050	1.00	50
1N4461	6.8	6.46	7.14	37	2.5	200	210	.30	2.1	4.08	5.00	10.00	+.057	1.00	20
1N4462	7.5	7.13	7.87	34	2.5	400	191	.35	1.9	4.50	1.00	2.00	+.061	0.50	10
1N4463	8.2	7.79	8.61	31	3.0	400	174	.40	1.7	4.92	0.50	1.00	+.065	0.50	5
1N4464	9.1	8.65	9.55	28	4.0	500	157	.45	1.6	5.46	0.30	0.60	+.068	0.50	3
1N4465	10	9.50	10.50	25	5.0	500	143	.50	1.4	8.0	0.30	0.60	+.071	0.25	3
1N4466	11	0.45	11.55	23	6.0	550	130	.55	1.3	8.8	0.30	0.60	+.073	0.25	2
1N4467	12	1.40	12.60	21	7.0	550	119	.60	1.2	9.6	0.20	0.40	+.076	0.25	2
1N4468	13	12.35	13.65	19	8.0	550	110	.65	1.1	10.4	0.05	0.10	+.079	0.25	2
1N4469	15	14.25	15.75	17	9.0	600	95	.75	.95	12.0	0.05	0.10	+.082	0.25	2
1N4470	16	15.20	16.80	15.5	10.0	600	90	.80	.90	12.8	0.05	0.10	+.083	0.25	2
1N4471	18	17.10	18.90	14	11.0	650	79	.83	.79	14.4	0.05	0.10	+.085	0.25	2
1N4472	20	19.00	21.00	12.5	12.0	650	71	.95	.71	16.0	0.05	0.10	+.086	0.25	2
1N4473	22	20.90	23.10	11.5	14	650	65	1.0	.65	17.6	0.05	0.10	+.087	0.25	2
1N4474	24	22.80	25.20	10.5	16	700	60	1.1	.60	19.2	0.05	0.10	+.088	0.25	2
1N4475	27	25.70	28.30	9.5	18	700	53	1.3	.53	21.6	0.05	0.10	+.090	0.25	2
1N4476	30	28.50	31.50	8.5	20	750	48	1.4	.48	24.0	0.05	0.10	+.091	0.25	2
1N4477	33	31.40	34.60	7.5	25	800	43	1.5	.43	26.4	0.05	0.10	+.092	0.25	2

See footnotes at end of table.

TABLE III. Electrical characteristics and test conditions (all case outlines) - Continued.

Col 1	Col 2	Col 3	Col 4	Col 5	Col 6	Col 7	Col 8	Col 9	Col 10	Col 11	Col 12	Col 13	Col 14	Col 15	Col 16
Device type	V_Z Nom	V_Z Min 1/ 2/	V_Z Max 1/ 2/	I_Z test current T_A = +25°C	Z_Z Impedance	Z_K Knee impedance	I_Z Max dc current T_A = +25°C	V_Z(reg) voltage regulation 3/	I_{ZSM} T_A = +25°C 4/	V_R Reverse voltage	I_R Reverse current dc I_{R1}	I_R Reverse current dc, I_{R1} post test	α_{VZ} Temperature coefficient 5/	I_{ZK} Test current	I_R Reverse current dc T_A = +150°C I_{R2}
	V	V	V	mA	Ω	Ω	mA	V	A	V	µA	µA	%/°C	mA	µA
1N4478	36	34.2	37.8	7.0	27	850	40	1.7	.40	28.8	.05	.10	+.093	0.25	2
1N4479	39	37.1	40.9	6.5	30	900	37	1.8	.37	31.2	.05	.10	+.094	0.25	2
1N4480	43	40.9	45.1	6.0	40	950	33	1.9	.33	34.4	.05	.10	+.095	0.25	2
1N4481	47	44.7	49.3	5.5	50	1000	30	2.1	.30	37.6	.05	.10	+.095	0.25	2
1N4482	51	48.5	53.5	5.0	60	1100	28	2.3	.28	40.8	.05	.10	+.096	0.25	2
1N4483	56	53.2	58.8	4.5	70	1300	26	2.5	.26	44.8	.25	.25	+.096	0.25	10
1N4484	62	58.9	65.1	4.0	80	1500	23	2.7	.23	49.6	.25	.25	+.097	0.25	10
1N4485	68	64.6	71.4	3.7	100	1700	21	3.0	.21	54.4	.25	.25	+.097	0.25	10
1N4486	75	71.3	78.7	3.3	130	2000	19	3.3	.19	60.0	.25	.25	+.098	0.25	10
1N4487	82	77.9	86.1	3.0	160	2500	17	3.6	.17	65.6	.25	.25	+.098	0.25	10
1N4488	91	86.5	95.5	2.8	200	3000	16	4.0	.16	72.8	.25	.25	+.099	0.25	10
1N4489	100	95.0	105.0	2.5	250	3100	14	4.4	.14	80.0	.25	.25	+.100	0.25	10
1N4490	110	104.5	115.5	2.3	300	4000	13	5.0	.13	88.0	.25	.25	+.100	0.25	10
1N4491	120	114.0	126.0	2.0	400	4500	12	5.5	.12	96.0	.25	.25	+.100	0.25	10
1N4492	130	123.5	136.5	1.9	500	5000	11	6.0	.11	104	.25	.25	+.100	0.25	10
1N4493	150	142.5	157.5	1.7	700	6000	9.5	7.0	.095	120	.25	.25	+.100	0.25	10
1N4494	160	152	168	1.6	1000	6500	8.9	8.0	.089	128	.25	.25	+.100	0.25	10
1N4495	180	171	189	1.4	1300	7000	7.9	10.0	.079	144	.25	.25	+.100	0.25	10
1N4496	200	190	210	1.2	1500	8000	7.2	12.0	.072	160	.25	.25	+.100	0.25	10

1/ See 4.5.5. Voltages shown are for 5 percent tolerance devices. Voltages for 2 and 1 percent tolerances devices shall be calculated accordingly.

2/ 1N4460D through 1N4496D and 1N6485D through 1N6491D are 1 percent voltage tolerance.
1N4460C through 1N4496C and 1N6485C through 1N6491C are 2 percent voltage tolerance.
1N4460 through 1N4496 and 1N6485 through 1N6491 are 5 percent voltage tolerance.

3/ See 4.5.2.

4/ See 4.5.1.

5/ See 4.5.3.

4.5.7 Thermal resistance. Thermal resistance measurements shall be conducted in accordance with test method 3101 of MIL-STD-750. The following details shall apply:

I_H = 2.0 A dc minimum
I_M = 1 to 10 mA
t_{MD} = 100 µs maximum
t_H = thermal equilibrium

The device shall be allowed to reach thermal equilibrium at current I_H before the measurement shall be made.

Lead spacing: LS = 3/8 inches for leaded devices.
LS = 0 (endcap mount) for US devices.

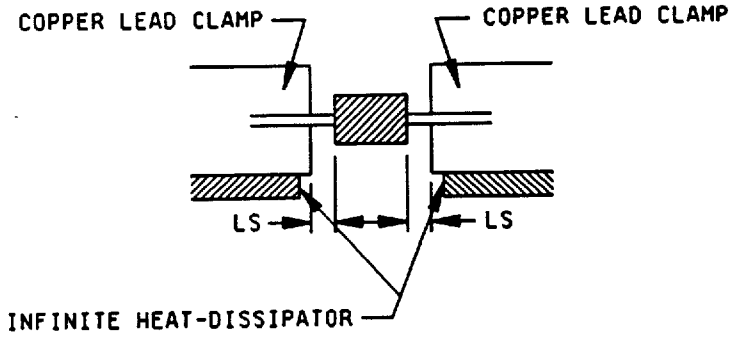


FIGURE 4.
Mounting arrangement.

5. PACKAGING

5.1 Packaging requirements. The requirements for packaging shall be in accordance with MIL-S-19500.

6. NOTES

(This section contains information of a general or explanatory nature that may be helpful, but is not mandatory.)

6.1 Notes. The notes specified in MIL-S-19500 are applicable to this specification.

6.2 Acquisition requirements. Acquisition documents must specify the following:

a. Issue of DODISS to be cited in the solicitation.

b. Lead finish as specified.

c. Product assurance level, type designator, and for die acquisition, the JANHC and JANKC identification (see figure 3 and 6.3), top and bottom metallization.

6.3 Suppliers of die. The qualified die suppliers with the applicable letter version (example JANHCA1N4461) will be identified on the QPL.

JANC ordering information		
	Manufacturer	
PIN	12969	--
1N4461 thru 1N4496	JANHCA1N4461 thru JANHCA1N4496	--
1N4461 thru 1N4496	JANHCB1N4461 thru JANHCB1N4496	--
1N4461 thru 1N4496	JANHCC1N4461 thru JANHCC1N4496	--

6.4 Changes from previous issue. Marginal notations are not used in this revision to identify changes with respect to the previous issue due to the extensiveness of the changes.

CONCLUDING MATERIAL

Custodians:
Army - ER
Navy - EC
Air Force - 17
NASA - NA

Review activities:
Army - AR, MI, SM
Navy - AS, CG, MC
Air Force - 13, 19, 85

Preparing activity:
DLA - ES

(Project 5961-1544)