The documentation and process conversion measures necessary to comply with this revision shall be completed by 19 February 2005.

INCH-POUND

MIL-PRF-19500/435F
19 November 2004
SUPERSEDING
MIL-PRF-19500/435E
26 January 2000

* PERFORMANCE SPECIFICATION SHEET

* SEMICONDUCTOR DEVICE, DIODE, SILICON, LOW-NOISE VOLTAGE REGULATOR, TYPES 1N4099-1 THROUGH 1N4135-1, 1N4614-1 THROUGH 1N4627-1, 1N4099UR-1 THROUGH 1N4135UR-1, 1N4614UR-1 THROUGH 1N4627UR-1, PLUS C AND D TOLERANCE SUFFIX DEVICES, 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 500 milliwatt, silicon, low-noise, voltage regulator diodes with voltage tolerances of 5 percent, 2 percent, and 1 percent. Four levels of product assurance are provided for each encapsulated device type as specified in MIL-PRF-19500, and two levels of product assurance for each unencapsulated device type (die). For JANHC and JANKC quality levels see 6.5.

1.2 Physical dimensions. See figure 1 (DO-7 and DO-35), figure 2 (DO-213AA), and figure 3 (JANHC and JANKC).

* 1.3 Maximum ratings Unless otherwise specified T_C = 25°C. Maximum ratings are as shown in maximum test ratings herein (see 3.8), and as follows:

a. P_T = 500 mW (DO-7, DO-35) at T_L = 50°C, L = .375 inch (9.53 mm); both ends of case or diode body to heat sink at L = .375 inch (9.53 mm). (Derate I_Z to 0.0 mA dc at +175°C).

b. P_T = 500 mW (DO-213AA) at T_{EC} = 125°C. (Derate to 0 at 175°C). -65°C ≤ T_J ≤ +175°C; -65°C ≤ T_{STG} ≤ +175°C.

* 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.

* 1.4 Primary electrical characteristics. Primary electrical characteristic see 3.8 herein and as follows:

a. 1.8 V dc ≤ V_Z ≤ 100 V dc.

b. $R_{\theta JL}$ = 250°C/W (maximum) at L = .375 inch (9.53 mm) (DO-7 and DO-35) mounting conditions (see figure 4).

c. $R_{\theta JEC}$ = 100°C/W (maximum) junction to end-caps (DO-213AA).

d. Noise density see 4.5.5 and figure 5.

e. For derating see figures 6 and 7.

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 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.

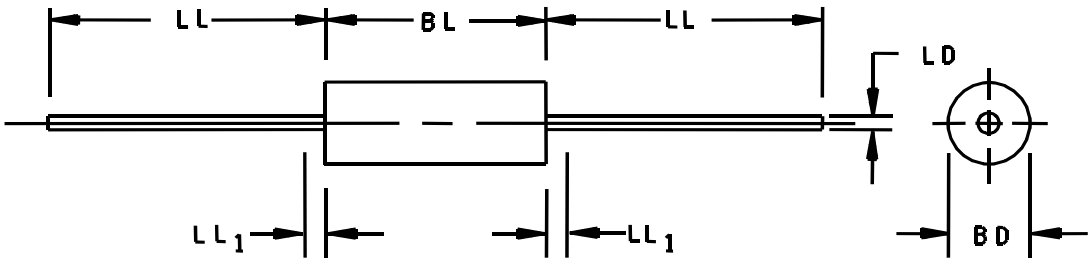
3. REQUIREMENTS

* 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 (QML) before contract award (see 4.2 and 6.3).

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

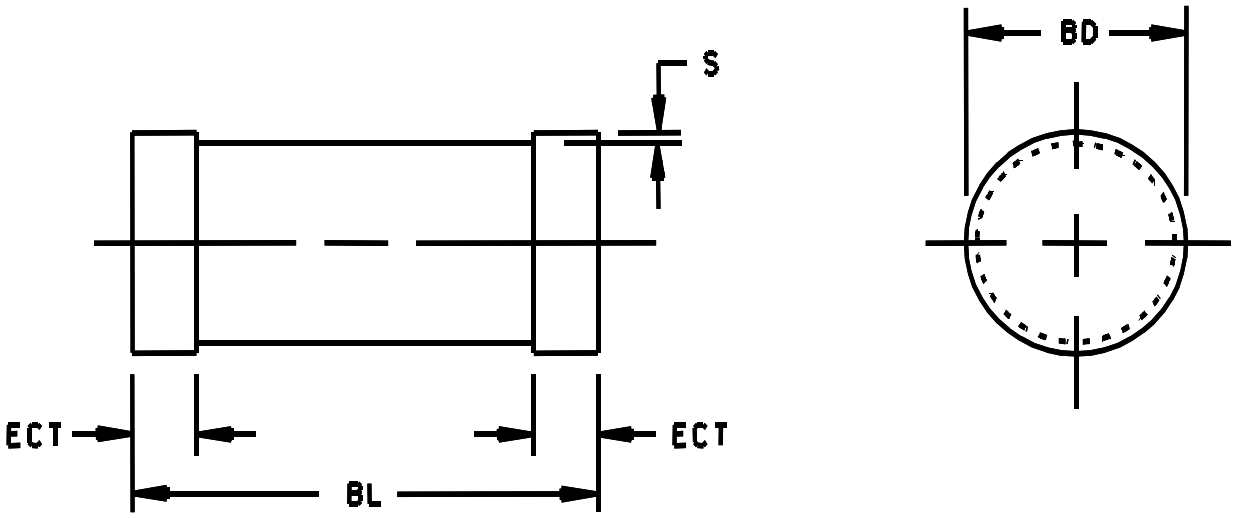
C ..... 2 percent voltage tolerance.
D ..... 1 percent voltage tolerance.
TEC ..... Temperature of end-cap.



Ltr	Dimensions				Notes
	Inches		Millimeters		
	Min	Max	Min	Max	
BD	.055	.107	1.40	2.72	3
BL	.120	.300	3.05	7.62	3
LD	.018	.022	0.46	0.56	
LL	1.000	1.500	25.40	38.10	
LL_1		.050		1.27	4

NOTES:
1. Dimensions are in inches.
2. Millimeter equivalents are given for general information only.
3. Package contour optional within BD and length BL. Heat slugs, if any, shall be included within this cylinder but shall not be subject to minimum limit of BD.
4. Within this zone lead, diameter may vary to allow for lead finishes and irregularities other than heat slugs.
5. In accordance with ASME Y14.5M, diameters are equivalent to ϕx symbology.

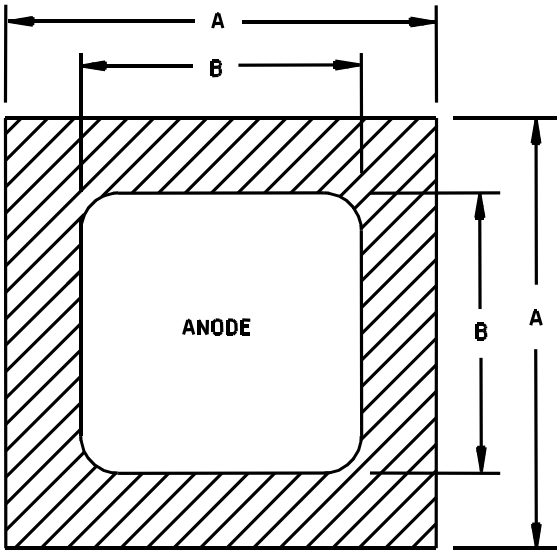
FIGURE 1. Semiconductor device, diode, types 1N4099-1 through 1N4135-1 and 1N4614-1 through 1N4627-1 (DO-35 or DO-7).



Symbol	Dimensions			
	Inches		Millimeters	
	Min	Max	Min	Max
BD	.063	.067	1.60	1.70
ECT	.016	.022	0.41	0.55
BL	.130	.146	3.30	3.70
S	.001 min		0.03 min	

NOTES:
1. Dimensions are in inches.
2. Millimeter equivalents are given for general information only.
3. In accordance with ASME Y14.5M, diameters are equivalent to ϕx symbology.

FIGURE 2. Physical dimensions 1N4099UR-1 through 1N4135UR-1 and 1N4614UR-1 through 1N4627UR-1 (DO-213AA).



BACKSIDE IS CATHODE

JANHCA and JANKCA die dimensions				
Ltr	Inches		Millimeters	
	Min	Max	Min	Max
A	.021	.025	0.53	0.63
B	.013	.017	0.33	0.43

JANHCB and JANKCB die dimensions				
Ltr	Inches		Millimeters	
	Min	Max	Min	Max
A	.024	.028	0.61	0.71
B	.017	.021	0.43	0.53

NOTES:
1. Dimensions are in inches.
2. Millimeter equivalents are given for general information only.
3. The JANHCA and JANKCA die thickness is .010 (0.25 mm) ± .002 inches (0.05 mm). Anode metallization: Al, thickness = 25,000 Å minimum; cathode metallization: Au, thickness = 4000 Å minimum.
4. The JANHCB and JANKCB die thickness is .010 (0.25 mm) ± .002 inches (0.05 mm). Anode metallization: Al, thickness = 40,000 Å minimum; cathode metallization: Au, thickness = 5,000 Å minimum.
5. Circuit layout data: For zener operation, cathode must be operated positive with respect to anode.

FIGURE 3. Physical dimensions JANHC and JANKC die.

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

3.4.1 Lead finish. Lead finish shall be solderable as defined in 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.

3.4.3 Dash one construction. Dash one (-1) diodes shall be of metallurgically bonded double plug construction or straight through construction in accordance with the requirements of category I, II, or III (see MIL-PRF-19500).

3.4.4 JANS construction. Construction shall be dash one or straight through construction, category I or II metallurgical bond in accordance with MIL-PRF-19500.

* 3.4.5 Package outline. This specification contains two standard packages; DO-7 and DO-35. Any user of this specification that has a specific package outline requirement shall specify their preference in the acquisition order. If package style is not specified, the manufacturer may supply either package. Surface mount devices are in a DO-213AA package.

3.5 Marking. Marking shall be in accordance with MIL-PRF-19500 and as specified herein.

3.5.1 Polarity. The polarity shall be indicated with a contrasting color band to denote the cathode end. Alternately, for surface mount (UR) 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.

* 3.5.2 DO-7 packages. All DO-7 package devices shall be marked with a "D7" on the device within the marking area.

3.5.3 Marking of UR suffix version devices. For UR suffix (surface mount) devices only, all marking (except polarity) may be omitted from the body of the device, but shall be retained on the initial container.

* 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.

* 3.6.1 Selection of tight 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 table I and groups B, and C testing as 5 percent tolerance devices. All sublots of C and D suffix devices shall pass table I, subgroup 2 at the tightened tolerances. The T_L or T_{EC} for C and D suffix devices shall be maintained at 30°C ±2°C for V_Z correlation on tight tolerances.

* 3.7 Electrical test requirements. The electrical test requirements shall be the subgroups specified in 4.4.2, 4.4.3 and tables II and III.

* 3.8 Maximum and primary electrical characteristics test requirements. Maximum test ratings for voltage regulator diodes are specified in table III, columns 5 and 10 herein. Primary electrical characteristics are in columns 2, 4, 7, 8 and 9.

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, tables I and II).

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 as specified herein.

4.2.2 JANHC and JANKC devices. JANHC and JANKC devices shall be qualified in accordance with MIL-PRF-19500.

4.2.3 Construction verification. Cross sectional photos from three devices shall be submitted in the qualification report.

* 4.3 Screening (JAN, 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	JAN level
1a 1b	Required Required	Not required Required (JANTXV only)	Not required Not required
2	Not required	Not required	Not required
3a	Required	Required	Required in accordance with MIL-PRF-19500, JANTX level.
3b (1) 3c	Not applicable Required (see 4.3.2)	Not applicable Required (see 4.3.2)	Not applicable Required (see 4.3.2)
4, 5, 6 and 7a	Not applicable	Not applicable	Not applicable
7b	Optional	Optional	Not applicable
8	Required	Not required	Not applicable
9	Required on Nom V_Z > 10 V, I_{R1} and V_Z	Not applicable	Not applicable
10	Required on Nom V_Z > 10 V	Not applicable	Not applicable
11	Required $\Delta I_{R1} \leq$ 100 percent of initial reading or 10 nA whichever is greater. $\Delta V_Z \leq$ 2 percent of initial reading.	Required I_{R1} and V_Z	Not applicable
12	Required, see 4.3.3 t = 240 hours.	Required, See 4.3.3, t = 48 hours	Not applicable
(2) 13	Subgroup 2 of table I herein; $\Delta I_{R1} \leq$ 100 percent of initial reading or 10 nA whichever is greater; $\Delta V_Z \leq$ 2 percent of initial reading.	Required Subgroup 2 of table I herein; $\Delta I_{R1} \leq$ 100 percent of initial reading or 10 nA whichever is greater; $\Delta V_Z \leq$ 2 percent of initial reading.	Not applicable
14a 14b	Not applicable Required	Not applicable Required	Not required
15	Required	Not required	Not required
16	Required	Not required	Not required

(1) Thermal impedance may 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) PDA = 5 percent for screen 13, applies to ΔI_{R1}, ΔV_Z, I_{R1} and V_Z (JANS only).

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

4.3.2 Thermal impedance ($Z_{\theta JX}$ measurements). The $Z_{\theta JX}$ measurements shall be performed in accordance with method 3101 of MIL-STD-750, to remove atypical devices. The supplier shall develop $Z_{\theta JX}$ screening limits using statistical methods and it shall not exceed the group A $Z_{\theta JX}$ limit.

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

b. I_H forward heating current ..... 0.5 A to 1.0 A.

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

d. t_{MD} measurement delay time ..... 70 μs maximum.

* 4.3.3 Power burn-in conditions. Power burn-in conditions are as follows: I_{ZM} = column 10 of table III. Mounting and test conditions in accordance with method 1038 of MIL-STD-750, condition B. Adjust I_Z or T_A to achieve the required T_J. T_J = 125°C minimum. T_A = 50°C maximum.

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. End-point electrical measurements shall be in accordance with table I, subgroup 2 herein.

* 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-PRF19500 and herein. Electrical measurements (end-points) requirements 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
B4	1037	2,000 cycles
B5	1027	I_{ZM} = column 10 of table III minimum for 1,000 hours; adjust I_Z or T_A to achieve T_J = +175°C minimum. Marking legibility requirements shall not apply.
B6	3101 or 4081	$R_{\theta JEC}$ = 100°C/W (max) at zero lead length (DO-213AA), +25°C ≤ T_R ≤ +35°C (see 4.5.4). $R_{\theta JL}$ = 250°C/W (max) at L = .375 inch (9.53 mm), (DO-7 and DO-35).

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

Subgroup	Method	Condition
B2	1056	0°C to +100°C, 10 cycles.
B2	1051	-55°C to +175°C, 25 cycles.
B3	1027	I_{ZM} = column 10 of table III herein minimum. Adjust I_Z or T_A to ensure a T_J = +150°C (min).
B5		Not applicable.
B6	1032	T_A = +175°C.

* 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 and as follows. Electrical measurements (end-points) requirements shall be in accordance with table I, subgroup 2 herein.

Subgroup	Method	Condition
C2	1056	0°C to +100°C, 10 cycles.
C2	2036	Tension: condition A; 4 pounds; t = 15 seconds (not applicable to "UR" suffix devices). Lead fatigue: condition E, (not applicable to "UR" suffix devices).
C2	1071	Test condition E.
C3		Not applicable.
C5	3101 or 4081	See 4.5.4.
C6	1027	I_{ZM} = column 10 of table III minimum. Adjust I_Z or T_A to ensure a T_J = +150°C (min).
C7		Not applicable.
C8	4071	I_Z = 250 μA dc, T_A = +25°C ± 5°C, T_2 = +125°C, αV_Z = column 8 of table III, sampling plan = 22 devices, c = 0.

* 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 and in table II herein. Electrical measurements (end-points) requirements shall be in accordance with table I, subgroup 2 herein.

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

4.5.1 Surge current (I_{ZSM}). The peak currents shown in column 5 of table III shall be applied in the reverse direction and these shall be superimposed on the current (I_Z = 250 μA dc) a total of 5 surges at 1 minute intervals. Each individual surge shall be one-half square-wave-pulse of 1/120 second duration or an equivalent one-half sinewave with the same effective rms current.

4.5.2 Regulator voltage measurements. The test current shall be applied until thermal equilibrium is attained (20 ± 2 seconds maximum) prior to reading the breakdown voltage. For this test, the diode shall be suspended by its leads with mounting clips whose inside edge is located at .375 inch (9.53 mm) from the body and the mounting clips shall be maintained at a temperature of +25°C +8°C, -2°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. The breakdown voltage on JANHC and JANKC shall be read with a pulse measurement of 10 ms (max).

4.5.3 Temperature coefficient of regulator voltage (αV_Z). The device shall be temperature stabilized with current applied prior to reading regulator voltage at the specified ambient temperature as specified in table I herein, subgroup 7.

4.5.4 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) = 250°C/W, $R_{\theta JEC}$ (max) = 100°C/W. The following conditions shall apply when using method 3101:

a. I_M ..... 1 mA to 10 mA.

b. I_H ..... 200 mA to 400 mA.

c. t_H ..... 25 seconds minimum.

d. t_{MD} ..... 70 µs maximum.

LS = lead spacing = .375 inch (9.53 mm) for non-surface mount devices and 0 inch for surface mount devices as defined on figure 4 below:

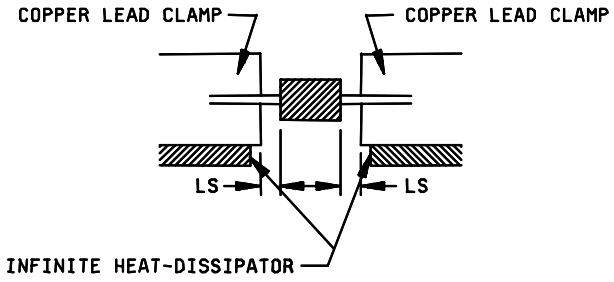
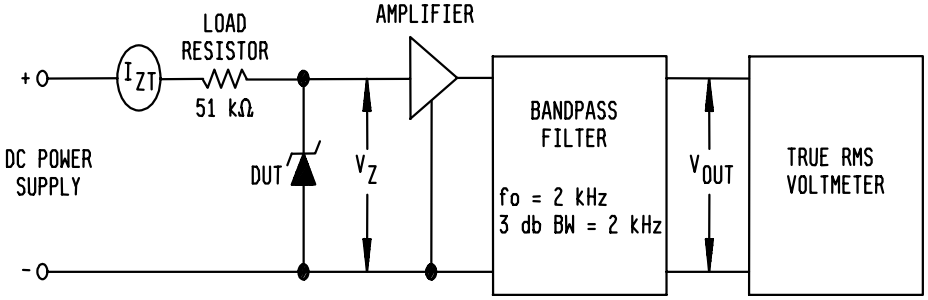


FIGURE 4. Mounting conditions.

* 4.5.4.1 For initial qualifications and requalifications. Read and record data for thermal impedance curves in accordance with table II herein shall be included in the qualification report.

* 4.5.5 Noise density. Noise density shall be measured using a noise density test circuit as shown on Figure 5 below. Place a low-noise resistor, equivalent in value to the dynamic impedance of the diode under test, in the test clips and adjust test current (I_{ZT}) and measure output-noise voltage. Remove resistor, insert diode under test in test clips, readjust test current to 250 μA dc and measure output-noise voltage again. To obtain noise density (N_D), subtract rms resistor output-noise voltage from rms diode output-noise voltage and divide by product of overall system gain and square root of bandwidth. All measurements shall be made at +25°C.



NOTES:
1. Input voltage and lead resistance should be high so that zener can be driven from a constant current source.
2. Input impedance of band pass filter should be high compared with the dynamic impedance of the diode under test.
3. Filter bandwidth characteristics shall be as follows:
   a. f_o = 2,000 Hz.
   b. Shape factor, -40 db to -3 dB, approximately 2.
   c. Passband at the -3 dB is 1,000 Hz ± 50 Hz to 3,000 Hz ± 150 Hz.
   d. Passband at the -40 dB is 500 Hz ± 50 Hz to 6,000 Hz ± 600 Hz.

FIGURE 5. Circuit for determination of noise density.

* 4.5.6 Decap internal visual scribe and break. Scratch glass at cavity area with diamond scribe. Carefully snap open. Using 30X magnification examine the area where die (or bonding material) are in contact with the plugs, verify metallurgical bonding area. If the verification of the metallurgical bonding area is in question with MIL-STD-750, test method 3101 and test condition; and limits herein, ($Z_{\theta JX}$) shall be used to determine suitability for use.

* 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						
Forward voltage	4011	I_F = 200 mA dc	V_F		1.1	V dc
Reverse current leakage	4016	DC method; V_R = column 6 of table III	I_{R1}		Column 7	µA dc
Regulator voltage (see 4.5.2)	4022	I_Z = 250 µA dc	V_Z		Column 2	V dc
Thermal impedance	3101	See 4.3.2	$Z_{\theta JX}$		35	°C/W
Subgroup 3						
High-temperature operation		T_A = +150°C				
Reverse current	4016	DC method; V_R = column 6 of table III	I_{R2}		Column 3	µA dc
Subgroup 4						
Small-signal reverse breakdown impedance	4051	I_Z = 250 µA dc I_{SIG} = 25 µA ac rms	Z_{ZT}		Column 4	Ohms
Noise density (see 4.5.5)		I_Z = 250 µA dc	N_D		Column 9	µV/√ Hz
Subgroup 5						
Not applicable						
Subgroup 6						
Surge current	4066	See 4.5.1				
Electrical measurements		Table I, subgroup 2				
Subgroup 7						
JANS only						
Temperature coefficient of regulator voltage (see 4.5.3)	4071	I_Z = 250 µA dc; T_1 = +25°C, ± 5°C; T_2 = T_1 +100°C	αV_Z		Column 8	%/°C

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

* 2/ Column references are to table III herein.

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

Inspection 1/	MIL-STD-750		Qualification conformance inspection (sampling plan)
	Method	Conditions	
Subgroup 1			22 devices, c = 0
Temperature cycling	1051	500 cycles.	
Electrical measurements		See table I, subgroup 2.	
Subgroup 2			22 devices, c = 0
Intermittent life	1037	6,000 cycles. I_Z = column 8 of table III.	
Electrical measurements		See table I, subgroup 2.	
Subgroup 4			N/A
Thermal impedance, curves		Each supplier shall submit their qual-lot average and 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.	
Subgroups 5 and, 6			
Not applicable			
Subgroup 8			n = 45
Resistance to glass cracking	1057	Condition B. Cool down after solder immersion is permitted. Test until failure occurs on all devices or to a maximum of 25 cycles, whichever comes first.	

* 1/ A separate sample may be pulled for each test.

* TABLE III. Test ratings, primary electrical characteristics. 1/

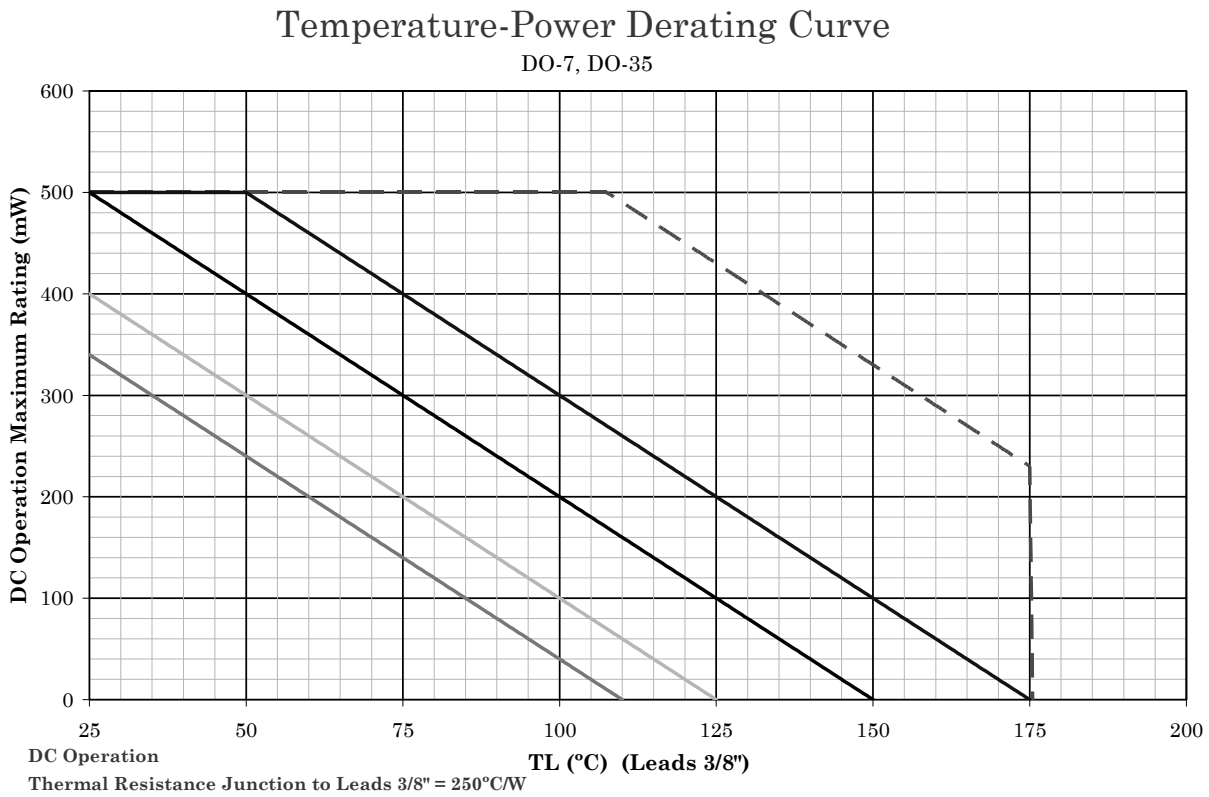
Col 1	Col 2	Col 3	Col 4	Col 5	Col 6	Col 7	Col 8	Col 9	Col 10
2/	V_Z Nom	I_R at +150°C	Z_{ZT} Max	I_{ZSM} (surge)	V_R	I_R	αV_Z T_1 = +25°C T_2 = +125°C	N_D	I_{ZM}
	Volts	µA dc	ohm	mA	Volts	µA dc	%/°C	µV/°C	mA
1N4614-1	1.8	10.0	1,200	1,600	1.0	3.5	-0.075	1	120
1N4615-1	2.0	8.0	1,250	1,500	1.0	2.5	-0.075	1	110
1N4616-1	2.2	6.0	1,300	1,350	1.0	2.0	-0.075	1	100
1N4617-1	2.4	4.0	1,400	1,250	1.0	1.0	-0.075	1	95
1N4618-1	2.7	2.0	1,500	1,100	1.0	0.5	-0.075	1	90
1N4619-1	3.0	1.0	1,600	1,025	1.0	0.4	-0.075	1	87
1N4620-1	3.3	7.0	1,650	950	1.5	3.5	-0.075	1	85
1N4621-1	3.6	10.0	1,700	875	2.0	3.5	-0.065	1	83
1N4622-1	3.9	5.0	1,650	825	2.0	2.5	-0.060	1	80
1N4623-1	4.3	4.0	1,600	800	2.0	2.0	-0.050	1	77
1N4624-1	4.7	10.0	1,550	750	3.0	5.0	+.020,-.050	1	75
1N4625-1	5.1	10.0	1,500	725	3.0	5.0	+.030,-.045	2	70
1N4626-1	5.6	10.0	1,400	700	4.0	5.0	+.040,-.020	4	65
1N4627-1	6.2	10.0	1,200	650	5.0	5.0	+.050,-.010	5	61
1N4099-1	6.8	5.0	200	650	5.2	1.0	+.060	40	56
1N4100-1	7.5	5.0	200	650	5.7	1.0	+.065	40	51
1N4101-1	8.2	5.0	200	650	6.3	0.5	+.070	40	46
1N4102-1	8.7	5.0	200	650	6.7	0.5	+.075	40	44
1N4103-1	9.1	5.0	200	650	7.0	0.5	+.080	40	42
1N4104-1	10.0	5.0	200	650	7.6	0.5	+.080	40	38
1N4105-1	11.0	5.0	200	590	8.5	0.05	+.080	40	35
1N4106-1	12.0	5.0	200	540	9.2	0.05	+.080	40	32
1N4107-1	13.0	5.0	200	500	9.9	0.05	+.080	40	29
1N4108-1	14.0	5.0	200	464	10.7	0.05	+.085	40	27
1N4109-1	15.0	5.0	100	433	11.4	0.05	+.085	40	25

See footnotes at end of table.

* TABLE III. Test ratings, primary electrical characteristics - Continued. 1/

Col 1	Col 2	Col 3	Col 4	Col 5	Col 6	Col 7	Col 8	Col 9	Col 10
2/	V_Z Nom	I_R at + 150°C	Z_{ZT} Max	I_{ZSM} (surge)	V_R	I_R	αV_Z T_1 = +25°C T_2 = +125°C	N_D	I_{ZM}
	Volts	µA dc	Ohms	mA	volts	µA dc	%/°C	µV/°C	mA
1N4110-1	16.0	5.0	100	406	12.2	0.05	+.085	40	24
1N4111-1	17.0	5.0	100	382	13.0	0.05	+.090	40	22
1N4112-1	18.0	5.0	100	361	13.7	0.05	+.090	40	21
1N4113-1	19.0	2.5	150	342	14.5	0.05	+.090	40	20
1N4114-1	20.0	2.5	150	325	15.2	0.01	+.090	40	19
1N4115-1	22.0	2.5	150	295	16.8	0.01	+.090	40	17
1N4116-1	24.0	2.5	150	271	18.3	0.01	+.090	40	16
1N4117-1	25.0	2.5	150	260	19.0	0.01	+.090	40	15
1N4118-1	27.0	2.5	150	240	20.5	0.01	+.090	40	14
1N4119-1	28.0	2.5	200	232	21.3	0.01	+.095	40	14
1N4120-1	30.0	2.5	200	216	22.8	0.01	+.095	40	13
1N4121-1	33.0	2.5	200	197	25.1	0.01	+.095	40	12
1N4122-1	36.0	2.5	200	180	27.4	0.01	+.095	40	11
1N4123-1	39.0	2.5	200	166	29.7	0.01	+.095	40	9.8
1N4124-1	43.0	2.5	250	151	32.7	0.01	+.095	40	8.9
1N4125-1	47.0	4.0	250	138	35.8	0.01	+.095	40	8.1
1N4126-1	51.0	5.0	300	127	38.8	0.01	+.100	40	7.5
1N4127-1	56.0	5.0	300	116	42.6	0.01	+.100	40	6.7
1N4128-1	60.0	5.0	400	108	45.6	0.01	+.100	40	6.4
1N4129-1	62.0	5.0	500	105	47.1	0.01	+.100	40	6.1
1N4130-1	68.0	7.0	700	95	51.7	0.01	+.100	40	5.6
1N4131-1	75.0	7.0	700	86	57.0	0.01	+.100	40	5.1
1N4132-1	82.0	8.0	800	79	62.4	0.01	+.100	40	4.6
1N4133-1	87.0	8.0	1,000	75	66.2	0.01	+.100	40	4.4
1N4134-1	91.0	10.0	1,200	71	69.2	0.01	+.100	40	4.2
1N4135-1	100.0	10.0	1,600	65	76.0	0.01	+.100	40	3.8

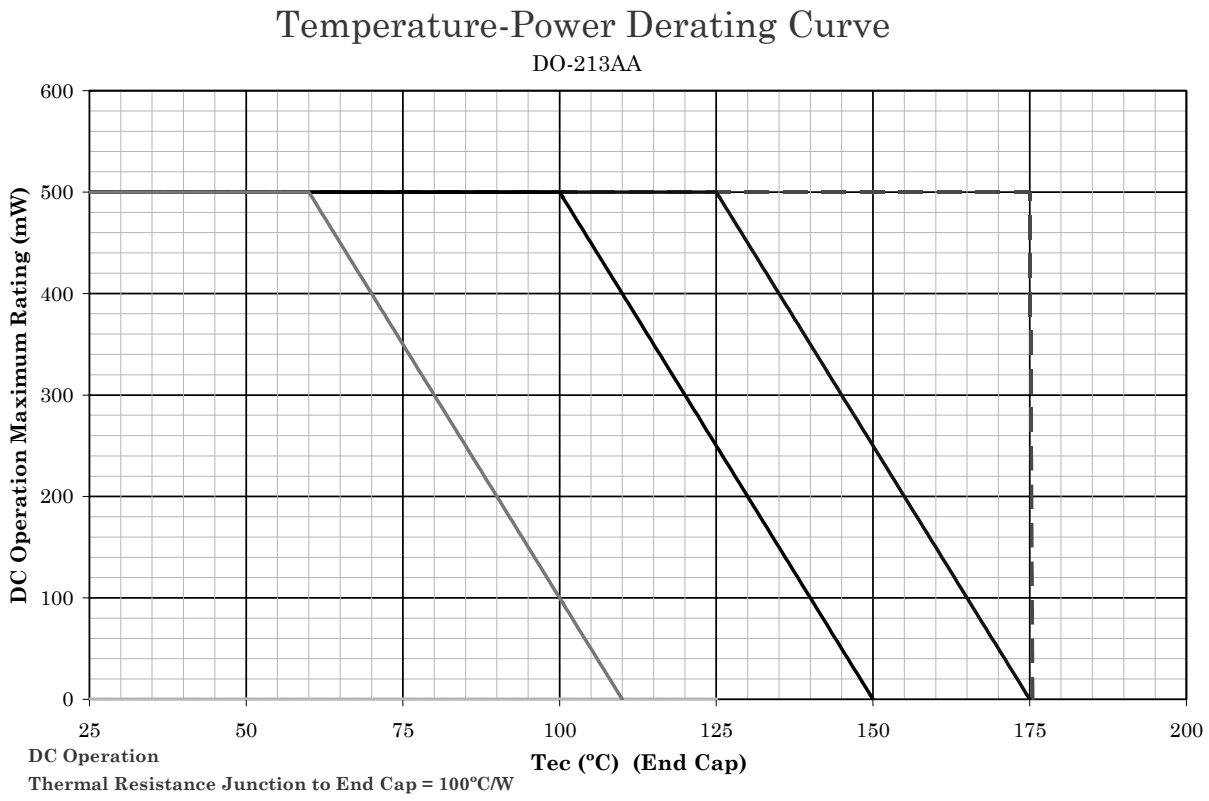
1/ Unless otherwise specified T_C = 25°C.
2/ Applies to all voltage tolerance devices (example: 1N4099-1 is ± 5 percent, 1N4099C-1 is ± 2 percent, and 1N4099D-1 is ± 1 percent tolerance).



NOTES:

1. Top curve is thermal runaway loci and cannot be used as a derate design curve since it exceeds the maximum ratings for this part. Operating under this curve using these mounting conditions assures device will not have a thermal runaway. This is the true inverse of the worst case thermal resistance value extrapolated out to the thermal runaway point.
2. Derate design curve constrained by the maximum junction temperature ($T_J \leq 175°C$) and power rating specified. (See 1.3 herein.)
3. Derate design curve chosen at $T_J \leq 150°C$, where the maximum temperature of electrical test is performed.
4. Derate design curve chosen at $T_J \leq 125°C$, and 110°C to show power rating where most users want to limit T_J in their application.

* FIGURE 6. Temperature-power derating curve (DO-35, DO-7).



NOTES:

1. Top curve is thermal runaway loci and cannot be used as a derate design curve since it exceeds the maximum ratings for this part. Operating under this curve using these mounting conditions assures device will not have a thermal runaway. This is the true inverse of the worst case thermal resistance value extrapolated out to the thermal runaway point.
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3. Derate design curve chosen at $T_J \leq 150°C$, where the maximum temperature of electrical test is performed.
4. Derate design curve chosen at $T_J \leq 125°C$, and 110°C to show power rating where most users want to limit T_J in their application.

* FIGURE 7. Temperature-power derating curve (DO-213AA).

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 3.4.1).

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 43216-5000 or e-mail vqe.chief@dla.mil.

6.4 Substitution information.

6.4.1 Substitutability of 2 percent and 1 percent tolerance devices. Devices of tighter tolerance are a direct one way substitute for the looser tolerance devices (example: JANTX1N4614D-1 substitutes for JANTX1N4614-1).

* 6.5 Suppliers of JANHC and JANKC die. The qualified JANHC and JANKC suppliers with the applicable letter version (example: JANHCA1N4614) will be identified on the QML.

JANC ordering information						
PIN (1)	Manufacturer CAGE			PIN (1)	Manufacturer CAGE	
	43611 (2)	12954 (2)			43611 (2)	12954 (2)
1N4099-1	JANHCA1N4099	JANHCB1N4099		1N4124-1	JANHCA1N4124	JANHCB1N4124
1N4100-1	JANHCA1N4100	JANHCB1N4100		1N4125-1	JANHCA1N4125	JANHCB1N4125
1N4101-1	JANHCA1N4101	JANHCB1N4101		1N4126-1	JANHCA1N4126	JANHCB1N4126
1N4102-1	JANHCA1N4102	JANHCB1N4102		1N4127-1	JANHCA1N4127	JANHCB1N4127
1N4103-1	JANHCA1N4103	JANHCB1N4103		1N4128-1	JANHCA1N4128	JANHCB1N4128
1N4104-1	JANHCA1N4104	JANHCB1N4104		1N4129-1	JANHCA1N4129	JANHCB1N4129
1N4105-1	JANHCA1N4105	JANHCB1N4105		1N4130-1	JANHCA1N4130	JANHCB1N4130
1N4106-1	JANHCA1N4106	JANHCB1N4106		1N4131-1	JANHCA1N4131	JANHCB1N4131
1N4107-1	JANHCA1N4107	JANHCB1N4107		1N4132-1	JANHCA1N4132	JANHCB1N4132
1N4108-1	JANHCA1N4108	JANHCB1N4108		1N4133-1	JANHCA1N4133	JANHCB1N4133
1N4109-1	JANHCA1N4109	JANHCB1N4109		1N4134-1	JANHCA1N4134	JANHCB1N4134
1N4110-1	JANHCA1N4110	JANHCB1N4110		1N4135-1	JANHCA1N4135	JANHCB1N4135
1N4111-1	JANHCA1N4111	JANHCB1N4111		1N4614-1	JANHCA1N4614	JANHCB1N4614
1N4112-1	JANHCA1N4112	JANHCB1N4112		1N4615-1	JANHCA1N4615	JANHCB1N4615
1N4113-1	JANHCA1N4113	JANHCB1N4113		1N4616-1	JANHCA1N4616	JANHCB1N4616
1N4114-1	JANHCA1N4114	JANHCB1N4114		1N4617-1	JANHCA1N4617	JANHCB1N4617
1N4115-1	JANHCA1N4115	JANHCB1N4115		1N4618-1	JANHCA1N4618	JANHCB1N4618
1N4116-1	JANHCA1N4116	JANHCB1N4116		1N4619-1	JANHCA1N4619	JANHCB1N4619
1N4117-1	JANHCA1N4117	JANHCB1N4117		1N4620-1	JANHCA1N4620	JANHCB1N4620
1N4118-1	JANHCA1N4118	JANHCB1N4118		1N4621-1	JANHCA1N4621	JANHCB1N4621
1N4119-1	JANHCA1N4119	JANHCB1N4119		1N4622-1	JANHCA1N4622	JANHCB1N4622
1N4120-1	JANHCA1N4120	JANHCB1N4120		1N4623-1	JANHCA1N4623	JANHCB1N4623
1N4121-1	JANHCA1N4121	JANHCB1N4121		1N4624-1	JANHCA1N4624	JANHCB1N4624
1N4122-1	JANHCA1N4122	JANHCB1N4122		1N4625-1	JANHCA1N4625	JANHCB1N4625
1N4123-1	JANHCA1N4123	JANHCB1N4123		1N4626-1	JANHCA1N4626	JANHCB1N4626
				1N4627-1	JANHCA1N4627	JANHCB1N4627

(1) C and D tolerance suffix are applicable to JANC chips.
(2) For JANKC level, replace "JANHC" with "JANKC".

6.6 Changes from previous issue. The margins of this specification are marked with asterisks to indicate where changes from the previous issue were made. This was done as a convenience only and the Government assumes no liability whatsoever for any inaccuracies in these notations. Bidders and contractors are cautioned to evaluate the requirements of this document based on the entire content irrespective of the marginal notations and relationship to the last previous issue.

Custodians:
Army - CR
Navy - EC
Air Force - 11
NASA – NA
DLA - CC

Review activities:
Army - AR, AV, MI, SM
Air Force - 19, 70, 80
Navy - AS, MC

Preparing activity:
DLA - CC

(Project 5961-2731)

* 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.