The documentation and process conversion measures necessary to comply with this revision shall be completed by 3 March 2017.

INCH–POUND

MIL-PRF-19500/124M
4 December 2016
SUPERSEDING
MIL-PRF-19500/124L
24 August 2011

PERFORMANCE SPECIFICATION SHEET

SEMICONDUCTOR DEVICE, DIODE, SILICON, VOLTAGE REGULATOR,
CASE MOUNT STUD PACKAGE, STANDARD AND REVERSE POLARITY,
TYPES 1N2970B THROUGH 1N2977B, 1N2979B, 1N2980B, 1N2982B, 1N2984B THROUGH 1N2986B,
1N2988B THROUGH 1N2993B, 1N2995B, 1N2997B, 1N2999B THROUGH 1N3005B, 1N3007B, 1N3008B,
1N3009B, 1N3011B, 1N3012B, 1N3014B, 1N3015B, 1N3993A THROUGH 1N3998A,
QUALITY LEVELS JAN, JANTX, JANTXV, AND JANS

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 10 watt, silicon voltage regulator diodes in both standard polarity and reverse polarity. Four levels of product assurance (JAN, JANTX, JANTXV, and JANS) are provided for each device type as specified in MIL-PRF-19500.

1.2 Package outline. The device package outline is a DO-04 in accordance with figure 1 for all encapsulated device types.

1.3 Maximum ratings. The maximum ratings are as shown in columns 3, 7, and 9 of the characteristics and test ratings table, 3.7, and as follows:

a. P_T = 10 W at T_C = +55°C; derate at .083 W/°C above +55°C.

b. –65°C ≤ T_J ≤ +175°C; –65°C ≤ T_{STG} ≤ +200°C.

c. Thermal resistance ($R_{\theta JC}$) = 12°C/W maximum.

1.4 Primary electrical characteristics. The primary electrical characteristics are as shown in columns 1, 8, 11, and 13 of the characteristics and test ratings table and 3.7 herein.

1.5 Part or Identifying Number (PIN). The PIN is in accordance with MIL-PRF-19500, and as specified herein. See 6.4 for PIN construction example, 6.5 for a list of available PINs, and 6.6 for supersession information.

1.5.1 JAN certification mark and quality level. The quality level designators for encapsulated devices that are applicable for this specification sheet are "JAN", "JANTX", "JANTXV", and "JANS".

1.5.2 Device type. The designation system for the device types of semiconductors covered by this specification sheet are as follows.

Comments, suggestions, or questions on this document should be addressed to DLA Land and Maritime, ATTN: VAC, P.O. Box 3990, Columbus, OH 43218-3990, or emailed to Semiconductor@dla.mil. Since contact information can change, you may want to verify the currency of this address information using the ASSIST Online database at https://assist.dla.mil.

1.5.2.1 First number and first letter symbols. The semiconductors of this specification sheet use the first number and letter symbols "1N".

1.5.2.2 Second number symbols. The second number symbols for the diodes covered by this specification sheet are as follows:

2970	2976	2985	2992	3001	3008	3993
2971	2977	2986	2993	3002	3009	3994
2972	2979	2988	2995	3003	3011	3995
2973	2980	2989	2997	3004	3012	3996
2974	2982	2990	2999	3005	3014	3997
2975	2984	2991	3000	3007	3015	3998

1.5.3 Suffix symbols. The following suffix letters are incorporated in the PIN for this specification sheet. All devices covered by this specification sheet use a suffix symbol or symbols as follows.

A	Indicates a modified version of the non-suffix device. The "A" suffix symbol is applicable only for second number symbols 3993 through 3998.
B	Indicates a modified version of the non-suffix device. The "B" suffix symbol is applicable only for second number symbols 2970 through 2977, 2979, 2980, 2982, 2984 through 2986, 2988 through 2993, 2995, 2997, 2999 through 3005, 3007, 3008, 3009, 3011, 3012, 3014, and 3015.
RA	Indicates reverse polarity packaging of the "A" suffix modified version of the diode.
RB	Indicates reverse polarity packaging of the "B" suffix modified version of the diode.

1.5.4 Lead finish. The lead finishes applicable to this specification sheet are listed on QPDSIS-19500.

2. APPLICABLE DOCUMENTS

2.1 General. The documents listed in this section are specified in sections 3 and 4 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 and 4 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.

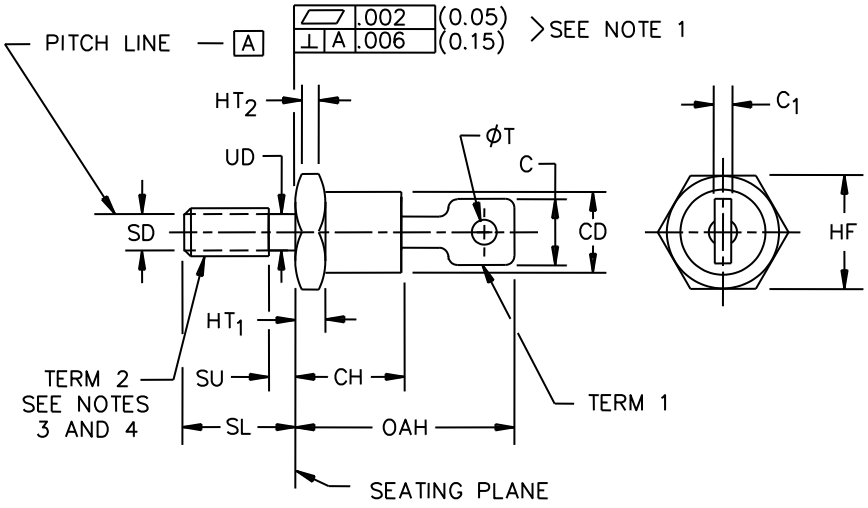
DEPARTMENT OF DEFENSE STANDARDS

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

FEDERAL STANDARDS

FED-STD-H28 – Screw–Thread Standards for Federal Services.

(Copies of these documents are available online at http://quicksearch.dla.mil.)



Symbol	Dimensions				Notes
	Inches		Millimeters		
	Min	Max	Min	Max	
C		.250		6.35	5
CD	.255	.424	6.48	10.77	6
CH	.300	.405	7.62	10.29	
C_1	.012	.065	0.30	1.65	5
HF	.424	.437	10.77	11.1	6
HT_1	.075	.175	1.91	4.45	7
HT_2	.060	.175	1.52	4.45	7
OAH	.600	.800	15.24	20.32	
SD					
SL	.422	.453	10.72	11.51	
SU		.078		1.98	8
UD	.163	.189	4.14	4.80	
ΦT	.060	.095	1.52	2.41	

NOTES:

1. Dimensions are in inches. Millimeters are given for general information only.
2. See 3.4.2 for the polarity of the terminals.
3. Threads shall be 10–32 UNF–2A in accordance with FED-STD-H28. Maximum pitch diameter (SD) of plated threads shall be basic pitch diameter .1697 inch (4.31 mm).
4. Device shall not be damaged by a torque of 15 inch-pounds (1.69 N-m) applied to a 10–32 UNF–2B nut assembled on thread.
5. The angular orientation and peripheral configuration of terminal 1 is undefined, however, the major surfaces over dimension C and C_1 shall be flat.
6. Dimension CD can not exceed dimension HF.
7. A chamfer or undercut on one or both ends of the hex portion is optional; minimum base diameter at seating plane .403 inch (10.24 mm).
8. Length of incomplete or undercut threads UD.
9. In accordance with ASME Y14.5M, diameters are equivalent to Φx symbology.

FIGURE 1. Physical dimensions (DO-4).

2.3 Order of precedence. Unless otherwise noted herein or in the contract, 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 manufacturers 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. The symbols used herein are listed in 6.8.

3.4 Interface and physical dimensions. Interface and physical dimensions shall be as specified in MIL-PRF-19500, and herein on figure 1 (DO-4).

3.4.1 Lead finish. Unless otherwise specified, lead finish shall be solderable in accordance with MIL-PRF-19500, MIL–STD–750, and herein. Where a choice of lead finish is desired, it shall be specified in the contract (see 6.2).

3.4.2 Polarity. The polarity of device types shall be as follows:

a. Device types 1N2970B through 1N3015B and 1N3993RA through 1N3998RA shall have the anode connected to the stud (term 2 of figure 1).

b. Device types 1N2970RB through 1N3015RB and 1N3993A through 1N3998A shall have the cathode connected to the stud (term 2 of figure 1).

3.5 Marking. Devices shall be marked as specified in MIL–PRF–19500. The PIN shall be in accordance with 1.5.

3.5.1 Reverse polarity. Reverse polarity units (see 3.4.2.a and 3.4.2.b) shall be marked with an "R" preceding the "A" or "B" suffix symbol in the PIN, as applicable (see 1.5.3).

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

3.7 Maximum ratings and primary electrical characteristics. The maximum ratings and primary electrical characteristics values for voltage regulator diodes are specified in table IV herein.

3.8 Workmanship. 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 and II).

4.2 Qualification inspection. Qualification inspection shall be in accordance with MIL-PRF-19500.

4.2.1 Group E qualification. Group E inspection shall be performed for qualification or re-qualification only. In case qualification was awarded to a prior revision of the specification sheet that did not request the performance of table II tests, the tests specified in table II herein that were not performed in the prior revision shall be performed on the first inspection lot of this revision to maintain qualification.

4.3 Screening (quality levels JANS, JANTXV, AND JANTX only). Screening shall be in accordance with table E–IV of MIL-PRF-19500, and as specified herein. The following measurements shall be made in accordance with table I herein. Devices that exceed the limits of table I herein shall not be acceptable.

Screen	Measurement	
	Quality level JANS	Quality levels JANTXV and JANTX
3c (1)	Thermal impedance, see 4.3.2.	Thermal impedance, see 4.3.2.
9	I_{R1} and V_Z (for devices with $V_{Z(nom)} \geq 10$ V dc; see column 1 of table IV herein)	Not applicable
11	I_{R1} and V_Z; ΔI_{R1} = 100 percent of initial value or 1 percent of column 11 of table IV herein, whichever is greater, ΔV_Z = ±2.5 percent of initial value (for devices with $V_{Z(nom)} \geq 10$ V dc, see column 1 of table IV herein)	I_{R1} and V_Z
12	See 4.3.1	See 4.3.1
13	Subgroups 2, 3, and 4 of table I herein; ΔI_{R1} = 100 percent of initial value or 1 percent of column 11 of table IV herein, whichever is greater; ΔV_Z = ±2.5 percent of initial value	Subgroup 2 of table I herein; ΔI_{R1} = 100 percent of initial value or 1 percent of column 11 of table IV herein, whichever is greater; ΔV_Z = ±2.5 percent of initial value

(1) This test shall be performed anytime after temperature cycling (screen 3a). JANTX and JANTXV levels do not need to be repeated in screening requirements.

4.3.1 Power burn-in conditions. Power burn-in conditions shall be as follows: $I_Z = I_{ZT}$ (column 4 of table IV herein) at T_J =150°C minimum. V_Z = column 1 of table IV herein.

4.3.2 Thermal impedance. The thermal impedance measurements shall be performed in accordance with method 3101 or 4081 of MIL–STD–750, as applicable, using the guidelines in that method for determining I_M, I_H, t_H, t_{SW} (V_C and V_H where appropriate).

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 E–IV of MIL-PRF-19500 and table I herein.

4.4.2 Group B inspection. Group B inspection shall be conducted in accordance with the tests and conditions specified for subgroup testing in table E–VIA (for quality level JANS) and table E–VIB (for quality levels JAN, JANTX, and JANTXV), of MIL-PRF-19500, and as follows. Delta measurements shall be in accordance with the applicable steps of table II herein.

4.4.2.1 Quality level JANS (see table E–VIA of MIL-PRF-19500).

Subgroup	Method	Condition
B2	2026	Dwell time = 10 ±1 s; immersion to cover flat portion of terminal only.
B4	1037	See 4.5.1. 2,000 cycles.
B5	1027	I_Z = column 4 (I_{ZT}) of table IV herein for 96 hours, T_A = +125°C or adjusted, as required, to give an average lot T_J = +225°C. Option 1 – T_J = +200°C, 336 hours. Option 2 – T_J = +175°C, 1,000 hours.
B6	4081	See 4.5.5. $R_{\theta JC}$ = 12°C/W maximum, T_A = +25°C.

4.4.2.2 Quality levels JAN, JANTX and JANTXV (see table E–VIB of MIL–PRF–19500).

Subgroup	Method	Condition
B2	4066	Test condition B; I_{ZSM} = column 9 of table IV herein.
B3	1027	I_Z = column 4 (I_{ZT}) of table IV herein, adjust T_A, mounting, or both, to achieve T_J = 150°C minimum.
B3	1037	2,000 cycles. See 4.5.6. Separate samples may be used.
B5	4081	See 4.5.5. $R_{\theta JC}$ = 12°C/W maximum; T_A = +25°C.
B6	1032	T_A = +200°C.

4.4.3 Group C inspection. Group C inspection shall be conducted in accordance with the conditions specified for subgroup testing in table E–VII of MIL-PRF-19500 and as follows. Delta measurements shall be in accordance with the applicable steps of table II herein.

Subgroup	Method	Condition
C2	2036	Tension: Test condition A; 20 pounds (9.07 Kg); t = 15 ±3 s.
C2	2036	Torque (terminal): Test condition D_1; 10 inch-ounces (1.13 N-m); t = 15 ±3 s.
C2	2036	Torque (stud): Test condition D_2; 15 inch-pounds (1.69 N-m); t = 30 ±3 s.
C2	2036	Bending stress: Test condition F, method B; 3 pounds (1.36 Kg); t = 15 ±3 s.
C6	1027	Steady–state operation life: I_Z = column 4 (I_{ZT}) of table IV herein. Adjust T_A, mounting, or both, to achieve T_J = 150°C minimum.
C6	1037	DC intermittent operation life, see 4.5.1. 6,000 cycles. Separate samples may be used.
C8	4071	Temperature coefficient of regulator voltage, see 4.5.4. Each sublot. The sample plan shall be n = 22 devices, c = 0, JAN, JANTX, and JANTXV levels only. I_{ZT} = column 4 of table IV herein, T_{ref} = 25°C ±3°C; T_{test} = T_{ref} +100°C; α_{vz} = percent/°C column 13 of table IV herein.
C9		Voltage regulation (see 4.5.6) each sublot. $V_{Z(reg)}$ = V dc, column 8 of table IV herein.

4.5 Methods of inspection. Methods of inspection shall be as specified in the appropriate tables and as follows. Unless otherwise specified herein, all inspections shall be made at a T_C of 25°C ±3°C.

4.5.1 DC intermittent operation life. The DC intermittent operation life test shall be performed in accordance with test method 1037 of MIL-STD-750, except that the procedure shall be as follows: A cycle shall consist of an "on" period, when forward current is applied suddenly, not gradually, to the device for the time necessary to achieve an increase (delta) case temperature of +85°C +15°C, –0°C followed by an "off" period, when the current is suddenly removed for cooling the case through a similar delta temperature. Auxiliary (forced) cooling is permitted during the "off" period only. Forward current and "on" time, within specific limits, and "off" time may be adjusted to achieve the delta case temperature. Heat sinks shall only be used if, and to the degree necessary, to maintain test samples within the desired delta temperature tolerance. The heating time shall be such that 30 s ≤ $t_{heating}$ ≤ 180 s. The forward current may be steady-state dc, full-wave rectified dc, or the equivalent half-sine wave dc, of the specified value. Alternately, I_Z may be used to achieve heating. The test duration shall be the specified number of cycles. Within the time interval of 50 cycles before and 500 cycles after the termination of the test, the sample units shall be removed from the specified test conditions and allowed to reach room ambient conditions. Specified end-point measurements for qualification and quality conformance inspections shall be completed within 96 hours after removal of sample units from the specified test conditions. Additional readings may be taken at the discretion of the manufacturer.

4.5.2 Maximum zener surge current (I_{ZSM}). The maximum zener surge current test shall be performed in accordance with condition B of test method 4066 of MIL–STD–750. I_{ZSM} (see column 9 of table IV) shall be applied in the reverse direction and shall be superimposed on I_{ZT} (see column 4 of table IV) a total of five (5) surges at 1 minute intervals. Each individual surge shall be a one-half square wave pulse of 1/120 second duration or an one-half sine wave with the same effective (rms) current.

4.5.3 Regulator voltage (V_Z). The regulator voltage measurement shall be performed in accordance with test method 4022 of MIL–STD–750. I_{ZT} (see column 4 of table IV) shall be applied until thermal equilibrium is obtained prior to reading the regulator voltage.

4.5.4 Temperature coefficient of regulator voltage (α_{VZ}). The temperature coefficient of regulator voltage test shall be performed in accordance with test method 4071 of MIL–STD–750. The device shall be temperature stabilized with current applied prior to reading regulator voltage at the specified case temperatures.

4.5.5 Thermal resistance. Thermal resistance measurement shall be in accordance with test method 4081 of MIL-STD-750 using the guidelines in that method for determining I_M, I_H, and t_H. See MIL-PRF-19500, table E–IX, subgroup 4. Forced moving air or draft shall not be permitted across the device during test. For purposes of this test “junction to case" shall be used in lieu of "junction to lead" and "$R_{\theta JC}$" shall be used in lieu of "$R_{\theta JL}$". The case shall be the reference point for calculation of junction to case thermal resistance ($R_{\theta JC}$). The mounting arrangement shall be with heat sink to case.

4.5.6 Voltage regulation ($V_{Z(reg)}$). A current at 10 percent of I_{ZM} (see column 7 of table IV) shall be maintained until thermal equilibrium is obtained and the V_Z shall be noted. The current shall then be increased to a level of 50 percent of I_{ZM} and maintained at this level for a period of time until thermal equilibrium is obtained at which time the voltage change shall not exceed $V_{Z(reg)}$ (see column 8 of table IV).

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	Condition A; I_F = 2 A dc	V_F		1.5	V dc
Reverse current	4016	DC method; V_R = column 10 of table IV.	I_{R1}		column 11	µA dc
Regulator voltage (see 4.5.3)	4022	I_{ZT} = column 4 of table IV.	V_Z	column 2	column 3	V dc
Subgroup 3						
High temperature operation		T_A = +150°C				
Reverse current	4016	DC method V_R = column 10 of table IV	I_{R2}		500	µA dc
Subgroup 4						
Small-signal reverse breakdown impedance	4051	I_{ZT} = column 4 of table IV, I_{sig} = 10 of percent I_{ZT}	Z_Z		column 5	ohms
Knee impedance	4051	I_{ZK} = 1 mA dc, I_{sig} = 10 percent of I_{ZK}	Z_{ZK}		column 6	ohms

See footnotes at end of table.

TABLE I. Group A inspection – Continued.

Inspection 1/	MIL-STD-750		Symbol	Limit 2/		Unit
	Method	Conditions		Min	Max	
Subgroups 5						
Not applicable						
Subgroup 6						
Surge current (see 4.5.2)	4066	Condition B; T_C = +25°C; I_{ZSM} = column 9 of table IV				
End-point electrical measurements		Subgroup 2 of table I				
Subgroup 7		JANS level only				
Voltage regulation (see 4.5.6)			$V_{Z(reg)}$		column 8	V dc
Temperature coefficient of breakdown voltage (see 4.5.4)		I_Z = column 4 of table IV; T_{ref} = 25ºC ±3ºC; T_{test} = T_{ref} +100ºC	α_{VZ}		column 13	%/°C

1/ For sampling plan, see MIL–PRF–19500.
2/ Column references are to table IV herein.

TABLE II. Groups B, C and E electrical and delta measurements. 1/ 2/ 3/

Step	Inspection	MIL-STD-750		Symbol	Limits 4/		Unit
		Method	Conditions		Min	Max	
1	Forward voltage	4011	Condition A; I_F = 2.0 A dc	ΔV_F 5/		±50 mV dc change from previously measured value.	

1/ The delta measurements for group B inspection for quality level JANS (table E–VIA) of MIL-PRF-19500) shall be as follows:
   a. In addition to the measurements specified for subgroup 3, the measurement of step 1 of this table shall also be taken.
   b. In addition to the measurements specified for subgroup 4, the measurement of step 1 of this table shall also be taken.
   c. In addition to the measurements specified for subgroup 5, the measurement of step 1 of this table shall also be taken.

2/ The electrical measurements for group B inspection for quality levels JANTX and JANTVX (table E–VIB) of MIL-PRF-19500) shall be as follows:
   a. In addition to the measurements specified for subgroup 2, the measurement of step 1 of this table shall also be taken.
   b. In addition to the measurements specified for subgroup 3, the measurement of step 1 of this table shall also be taken.
   c. In addition to the measurements specified for subgroup 6, the measurement of steps 1 of this table shall also be taken.

3/ The electrical measurements for group C inspection (table E–VII of MIL-PRF-19500) shall be as follows:
   a. In addition to the measurements specified for subgroup 2, the measurement of step 1 (for all quality levels) of this table shall also be taken.
   b. In addition to the measurements specified for subgroup 3, the measurement of step 1 (for all quality levels) this table shall also be taken.
   c. In addition to the measurements specified for subgroup 6, the measurement of step 1 (for all quality levels) of this table shall also be taken.

4/ Column references are to table IV herein.

5/ Devices which exceed the group A limits for this test shall not be accepted.

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

Inspection 1/	MIL–STD–750		Qualification inspection
	Method	Conditions	
Subgroup 1			n = 45, c = 0
Thermal shock	1056		
Hermetic seal	1071		
End-point electrical measurements		Subgroup 2 of table I.	
Subgroup 2			n = 45, c = 0
Intermittent operation life	1037	6,000 cycles, see 4.5.1.	
End-point electrical measurements		Subgroup 2 of table I.	
Subgroup 4			
Thermal impedance curves		See MIL–PRF–19500.	
Subgroup 5 and 6			
Not applicable			

TABLE IV. Characteristics and test ratings. 1/

	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
Type	V_Z	V_Z	V_Z	I_{ZT}	Z_Z	Z_{ZK}	I_{ZM} 2/	$V_{Z(reg)}$	I_{ZSM}	V_R	I_{R1}	I_{R3}	α_{vz}
				Test current	Imped -ance	Knee imped -ance	3/	Voltage regulation	3/	Reverse voltage	Reverse current	Reverse current (after life test)	Temperature coefficient
	Nom	Min	Max	Max			Max dc		Max		dc Max	dc Max	Max
	volts	volts	volts	mA	ohms	ohms	mA	volts	mA	volts	µA	µA	%/°C
1N3993A	3.9	3.70	4.10	640	2.0	400	2,440	0.80	12,000	.5	100	200	–.060
1N3994A	4.3	4.08	4.52	580	1.5	400	2,200	0.72	11,000	.5	100	200	–.050
1N3995A	4.7	4.45	4.94	530	1.2	550	2,000	0.68	10,000	1.0	50	100	+.025
1N3996A	5.1	4.84	5.36	490	1.1	550	1,840	0.64	9,000	1.0	10	20	+.030
1N3997A	5.6	5.32	5.88	445	1.0	600	1,680	0.60	8,000	1.0	10	20	+.040
1N3998A	6.2	5.89	6.51	405	1.1	700	1,520	0.56	7,000	2.0	10	20	+.045
1N2970B	6.8	6.46	7.14	370	1.2	500	1,500	0.4	7,500	5.2	150	300	+.057
1N2971B	7.5	7.13	7.87	335	1.3	250	1,350	0.45	6,750	5.7	100	200	+.067
1N2972B	8.2	7.79	8.61	305	1.5	250	1,180	0.5	5,900	6.2	50	100	+.070
1N2973B	9.1	8.65	9.55	275	2.0	250	1,100	0.55	5,500	6.9	25	50	+.075
1N2974B	10	9.50	10.50	250	3.0	250	980	0.6	4,900	7.6	25	50	+.081
1N2975B	11	10.45	11.55	230	3.0	250	890	0.7	4,450	8.4	10	20	+.085
1N2976B	12	11.40	12.60	210	3.0	250	820	0.8	4,100	9.1	10	20	+.079
1N2977B	13	12.35	13.65	190	3.0	250	750	0.85	3,750	9.9	10	20	+.080
1N2979B	15	14.25	15.75	170	3.0	250	640	1.0	3,200	11.4	10	20	+.082
1N2980B	16	15.20	16.80	155	4.0	250	605	1.1	3,000	12.2	10	20	+.083
1N2982B	18	17.10	18.90	140	4.0	250	525	1.25	2,600	13.7	10	20	+.085
1N2984B	20	19.0	21.0	125	4.0	250	480	1.35	2,400	15.2	10	20	+.086
1N2985B	22	20.9	23.1	115	5.0	250	435	1.5	2,180	16.7	10	20	+.087
1N2986B	24	22.8	25.2	105	5.0	250	400	1.65	2,000	18.2	10	20	+.088
1N2988B	27	25.7	28.3	95	7.0	250	340	1.92	1,700	20.6	10	20	+.090
1N2989B	30	28.5	31.5	85	8.0	300	320	2.15	1,600	22.8	10	20	+.091
1N2990B	33	31.4	34.6	75	9.0	300	300	2.30	1,500	25.1	10	20	+.092

See footnotes at end of table.

TABLE IV. Characteristics and test ratings – Continued. 1/

	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
Type	V_Z	V_Z	V_Z	I_{ZT}	Z_Z	Z_{ZK}	I_{ZM} 2/	$V_{Z(reg)}$	I_{ZSM}	V_R	I_{R1}	I_{R3}	α_{vz}
				Test current	Imped-ance	Knee imped-ance	3/	Voltage regulation	3/	Reverse voltage	Reverse current	Reverse current (after life test)	Temperature coefficient
	Nom	Min	Max	Max	Max		dc Max		Max		dc Max	dc Max	Max
	volts	volts	volts	mA	ohms	ohms	mA	volts	mA	volts	μA	μA	%/°C
1N2991B	36	34.2	37.8	70	10.0	300	260	2.45	1,300	27.4	10	20	+.093
1N2992B	39	37.1	40.9	65	11.0	300	240	2.55	1,200	29.7	10	20	+.094
1N2993B	43	40.9	45.1	60	12.0	400	220	2.75	1,100	32.7	10	20	+.095
1N2995B	47	44.7	49.3	55	14.0	400	200	3.0	1,000	35.8	10	20	+.095
1N2997B	51	48.5	53.5	50	15.0	500	185	3.1	925	38.8	10	20	+.096
1N2999B	56	53.2	58.8	45	16.0	500	170	3.3	850	42.6	10	20	+.096
1N3000B	62	58.9	65.1	40	17	600	150	3.5	750	47.1	10	20	+.097
1N3001B	68	64.6	71.4	37	18	600	137	3.8	685	51.7	10	20	+.097
1N3002B	75	71.3	78.7	33	22	600	125	4.4	625	56.0	10	20	+.098
1N3003B	82	77.9	86.1	30	25	700	115	4.7	575	62.2	10	20	+.098
1N3004B	91	86.5	95.5	28	35	800	97	5.1	485	69.2	10	20	+.099
1N3005B	100	95.0	105.0	25	40	900	91	6.1	450	76.0	10	20	+.110
1N3007B	110	104.5	115.5	23	55	1,100	82	6.9	410	83.6	10	20	+.110
1N3008B	120	114.0	126.0	20	75	1,200	77	7.9	380	91.2	10	20	+.110
1N3009B	130	123.5	136.5	19	100	1,300	71	8.8	350	98.8	10	20	+.110
1N3011B	150	142.5	157.5	17	175	1,500	62	11.0	310	114.0	10	20	+.110
1N3012B	160	152.0	168.0	16	200	1,600	58	11.8	290	121.6	10	20	+.110
1N3014B	180	171.0	189.0	14	260	1,850	52	13.8	260	136.8	10	20	+.110
1N3015B	200	190.0	210.0	12	300	2,000	46	14.8	230	152.0	10	20	+.110

1/ The test ratings are applicable to all devices.
2/ Derate I_Z linearly to 0.0 mA dc at +175°C, for T_C > +55°C.
3/ T_A = +25°C.

5. PACKAGING

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

6. NOTES

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

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

6.2 Acquisition requirements. Acquisition documents should specify the following:

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

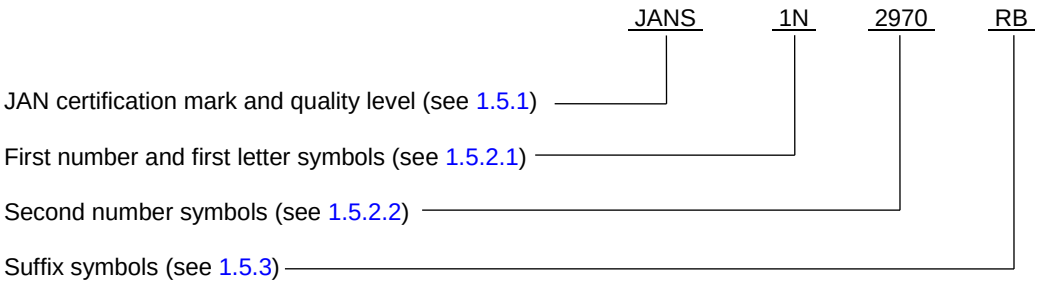
b. Packaging requirements (see 5.1).

c. Lead finish (see 3.4.1).

d. The complete PIN, see 1.5 and 6.4.

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 DLA Land and Maritime, ATTN: VQE, P.O. Box 3990, Columbus, OH 43218-3990 or e-mail vqe.chief@dla.mil. An online listing of products qualified to this specification may be found in the Qualified Products Database (QPD) at https://assist.daps.dla.mil.

6.4 PIN construction example. The PINs for encapsulated devices are constructed using the following form.



6.5 List of PINs. The following is a list of possible PINs available on this specification sheet. The reverse polarity devices, those PINs using suffix "RA" or "RB" are not listed below.

Quality level "JAN"	Quality level "JANTX"	Quality level "JANTXV"	Quality level "JANS"
JAN1N2970B	JANTX1N2970B	JANTXV1N2970B	JANS1N2970B
JAN1N2971B	JANTX1N2971B	JANTXV1N2971B	JANS1N2971B
JAN1N2972B	JANTX1N2972B	JANTXV1N2972B	JANS1N2972B
JAN1N2973B	JANTX1N2973B	JANTXV1N2973B	JANS1N2973B
JAN1N2974B	JANTX1N2974B	JANTXV1N2974B	JANS1N2974B
JAN1N2975B	JANTX1N2975B	JANTXV1N2975B	JANS1N2975B
JAN1N2976B	JANTX1N2976B	JANTXV1N2976B	JANS1N2976B
JAN1N2977B	JANTX1N2977B	JANTXV1N2977B	JANS1N2977B
JAN1N2979B	JANTX1N2979B	JANTXV1N2979B	JANS1N2979B
JAN1N2980B	JANTX1N2980B	JANTXV1N2980B	JANS1N2980B
JAN1N2982B	JANTX1N2982B	JANTXV1N2982B	JANS1N2982B
JAN1N2984B	JANTX1N2984B	JANTXV1N2984B	JANS1N2984B
JAN1N2985B	JANTX1N2985B	JANTXV1N2985B	JANS1N2985B
JAN1N2986B	JANTX1N2986B	JANTXV1N2986B	JANS1N2986B
JAN1N2988B	JANTX1N2988B	JANTXV1N2988B	JANS1N2988B
JAN1N2989B	JANTX1N2989B	JANTXV1N2989B	JANS1N2989B
JAN1N2990B	JANTX1N2990B	JANTXV1N2990B	JANS1N2990B
JAN1N2991B	JANTX1N2991B	JANTXV1N2991B	JANS1N2991B
JAN1N2992B	JANTX1N2992B	JANTXV1N2992B	JANS1N2992B
JAN1N2993B	JANTX1N2993B	JANTXV1N2993B	JANS1N2993B
JAN1N2995B	JANTX1N2995B	JANTXV1N2995B	JANS1N2995B
JAN1N2997B	JANTX1N2997B	JANTXV1N2997B	JANS1N2997B
JAN1N2999B	JANTX1N2999B	JANTXV1N2999B	JANS1N2999B
JAN1N3000B	JANTX1N3000B	JANTXV1N3000B	JANS1N3000B
JAN1N3001B	JANTX1N3001B	JANTXV1N3001B	JANS1N3001B
JAN1N3002B	JANTX1N3002B	JANTXV1N3002B	JANS1N3002B
JAN1N3003B	JANTX1N3003B	JANTXV1N3003B	JANS1N3003B
JAN1N3004B	JANTX1N3004B	JANTXV1N3004B	JANS1N3004B
JAN1N3005B	JANTX1N3005B	JANTXV1N3005B	JANS1N3005B
JAN1N3007B	JANTX1N3007B	JANTXV1N3007B	JANS1N3007B
JAN1N3008B	JANTX1N3008B	JANTXV1N3008B	JANS1N3008B
JAN1N3009B	JANTX1N3009B	JANTXV1N3009B	JANS1N3009B
JAN1N3011B	JANTX1N3011B	JANTXV1N3011B	JANS1N3011B
JAN1N3012B	JANTX1N3012B	JANTXV1N3012B	JANS1N3012B
JAN1N3014B	JANTX1N3014B	JANTXV1N3014B	JANS1N3014B
JAN1N3015B	JANTX1N3015B	JANTXV1N3015B	JANS1N3015B
JAN1N3993A	JANTX1N3993A	JANTXV1N3993A	JANS1N3993A
JAN1N3994A	JANTX1N3994A	JANTXV1N3994A	JANS1N3994A
JAN1N3995A	JANTX1N3995A	JANTXV1N3995A	JANS1N3995A
JAN1N3996A	JANTX1N3996A	JANTXV1N3996A	JANS1N3996A
JAN1N3997A	JANTX1N3997A	JANTXV1N3997A	JANS1N3997A
JAN1N3998A	JANTX1N3998A	JANTXV1N3998A	JANS1N3998A

6.6 Supersession information.

6.6.1 Superseded PINs. The majority of the PINs from canceled MIL-S-19500/272 have been incorporated into this specification sheet. PINs 1N3999A and 1N4000A (and their associated reverse polarity versions) were not carried over, as they were deemed redundant to 1N2970RB and 1N2971RB respectively.

Replacement PIN as specified within MIL-S-19500/124G, dated 15 October 1992	Superseded PIN as specified within MIL-S-19500/272C, dated 26 November 1968	Replacement PIN as specified within MIL-S-19500/124G, dated 15 October 1992	Superseded PIN as specified within MIL-S-19500/272C, dated 26 November 1968
1N3993A	1N3993A	1N3993RA	1N3993RA
1N3994A	1N3994A	1N3994RA	1N3994RA
1N3995A	1N3995A	1N3995RA	1N3995RA
1N3996A	1N3996A	1N3996RA	1N3996RA
1N3997A	1N3997A	1N3997RA	1N3997RA
1N3998A	1N3998A	1N3998RA	1N3998RA
1N2970RB	1N3999A	1N2970B	1N3999RA
1N2971RB	1N4000A	1N2971B	1N4000RA

6.6.2 Obsoleted PINs. The PINs from MIL-S-19500/272, 1N3993A, 1N3993RA, 1N4000A, and 1N4000RA are obsolete. PINs 1N3999A, 1N3993RA, 1N4000A, and 1N4000RA have been deleted, as they are redundant to 1N2970RB, B and 1N2971RB, B respectively.

6.6.3 Diode types not covered. The 10 device types listed below have not been covered in past revisions, nor are they covered in this revision of the specification sheet. The conclusion of the development process for the originally conceived specification sheet resulted in the elimination of the device types listed below. These device types were not needed because of overlapping intermediate parameters that were considered not requisite for military-equipment circuit applications. Thus, only the needed device types were subsequently registered and covered by this specification sheet. The non-included numerical device types are as follows:

1N2978B, 1N2978RB	1N2996B, 1N2996RB
1N2981B, 1N2981RB	1N2998B, 1N2998RB
1N2983B, 1N2983RB	1N3006B, 1N3006RB
1N2987B, 1N2987RB	1N3010B, 1N3010RB
1N2994B, 1N2994RB	1N3013B, 1N3013RB

6.6.4 Re-identification of previous duplicate currents I_Z. Previous revisions of this specification sheet used the symbol I_Z in two different columns of table IV. In MIL-PRF-19500/124H (dated 20 June 1997) and earlier revisions, current I_Z was used in column 4 and the now deleted column 14. The current I_{ZT} as listed in column 4 of table IV was re-identified from I_Z with the issuance of MIL-PRF-19500/124J; dated 20 May 2009.

6.7 Substitution information. Devices covered by this specification are substitutable for the manufacturer's and user's part numbers. This information in no way implies that manufacturer's PINs are substitutable for the military PIN.

Preferred types military PIN	Superseded PIN	Commercial PIN
JAN, JANTX, JANTXV, JANS1N2970B	1N3999RA	1N2970B
JAN, JANTX, JANTXV, JANS1N2970RB	1N3999A	1N2970RB
JAN, JANTX, JANTXV, JANS1N2971B	1N4000RA	1N2971B
JAN, JANTX, JANTXV, JANS1N2971RB	1N4000A	1N2971RB

6.8 Symbols used in this specification sheet. The following symbols are used in this specification sheet. The definition associated with the symbol should be as defined in MIL–PRF–19500 or herein.

α_{VZ}	Temperature coefficient.
I_F	Forward current, DC value, no alternating component.
I_{R1}	Reverse current.
I_{R2}	Reverse current at +150°C.
I_{R3}	Reverse current, dc max (after life test).
I_{sig}	Detector signal current.
$_Z$	Zener current.
I_{ZK}	Regulator or reference current, dc near breakdown knee.
I_{ZM}	Maximum zener current.
I_{ZSM}	Maximum zener surge current.
I_{ZT}	Zener test current.
P_T	Total power dissipation, all terminals.
$R_{\theta JC}$	Thermal resistance, junction to case.
T_A	Ambient or free air temperature.
T_C	Case temperature.
T_J	Junction temperature.
T_{STG}	Storage temperature.
V_F	Forward voltage.
V_R	Reverse voltage.
V_Z	Regulator voltage.
$V_{Z(reg)}$	Voltage regulation.
Z_Z	Impedance.
Z_{ZK}	Knee impedance.

6.9 Request for new types and configurations. Requests for new device types or configurations for inclusions in this specification sheet should be submitted to: DLA Land and Maritime, ATTN: VAC, Post Office Box 3990, Columbus, OH 43218–3990 or by electronic mail at semiconductor@dla.mil or by facsimile (614) 693-1642 or DSN 850-6939

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

Custodians:
Army – CR
Navy – EC
Air Force – 85
NASA – NA
DLA – CC

Review activities:
Army – AR, MI, SM
Navy – AS, MC
Air Force – 19, 99

Preparing activity:
DLA – CC

(Project 5961–2016–070)

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 https://assist.dla.mil.