The documentation and process conversion measures necessary to comply with this document shall be completed by 25 May 2016.

INCH-POUND

MIL–PRF–19500/358G
25 January 2016
SUPERSEDING
MIL–PR–19500/358F
12 July 2013

PERFORMANCE SPECIFICATION SHEET

# SEMICONDUCTOR DEVICE, DIODE, SILICON, VOLTAGE REGULATOR, STUD MOUNT PACKAGE, STANDARD AND REVERSE POLARITY, TYPES 1N3305B THROUGH 1N3350B AND 1N4549B THROUGH 1N4554B, 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 50 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 modified package consisting of a DO–5 base with a DO–4 cap in accordance with figure 1 for all encapsulated device types.

1.3 Maximum ratings. Unless otherwise specified $T_C$ = 25ºC. The maximum ratings are as shown in columns 3, 7, and 9 of the characteristics and ratings table, 3.7, and as follows:

a. Derate $P_T$ = 50W at $T_C \geq$ +75ºC at 0.5 W/ºC above $T_A \geq$ +75ºC.

b. –65ºC ≤ $T_J$ ≤ +175ºC; –65ºC ≤ $T_{STG}$ ≤ +175ºC.

c. Thermal resistance ($R_{\theta JC}$) = 2.0ºC/W maximum.

1.4 Primary electrical characteristics. The primary electrical characteristics are as shown in columns 1, 8, 11, and 12 of the characteristics and 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.

1.5.1 JAN certification mark and quality level. The quality level designator, if applicable, is in accordance with MIL–PRF–19500. The quality level designators for encapsulated devices that are applicable for this specification sheet from the lowest to the highest level are as follows: "JAN", "JANTX", "JANTXV", and "JANS".

1.5.2 Device type. The designation system for the devices covered by this specification sheet is as follows.

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

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.

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

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 3305 | 3311 | 3317 | 3323 | 3329 | 3335 | 3341 | 3347 | 4549 |
| 3306 | 3312 | 3318 | 3324 | 3330 | 3336 | 3342 | 3348 | 4550 |
| 3307 | 3313 | 3319 | 3325 | 3331 | 3337 | 3343 | 3349 | 4551 |
| 3308 | 3314 | 3320 | 3326 | 3332 | 3338 | 3344 | 3350 | 4552 |
| 3309 | 3315 | 3321 | 3327 | 3333 | 3339 | 3345 | | 4553 |
| 3310 | 3316 | 3322 | 3328 | 3334 | 3340 | 3346 | | 4554 |

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.

| | |
|---|---|
| B | Indicates a modified version of the diode which have a nominal voltage tolerance of ±5 percent over the basic numbered (non-suffix) device. |
| RB | Indicates reverse polarity packaging of the 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

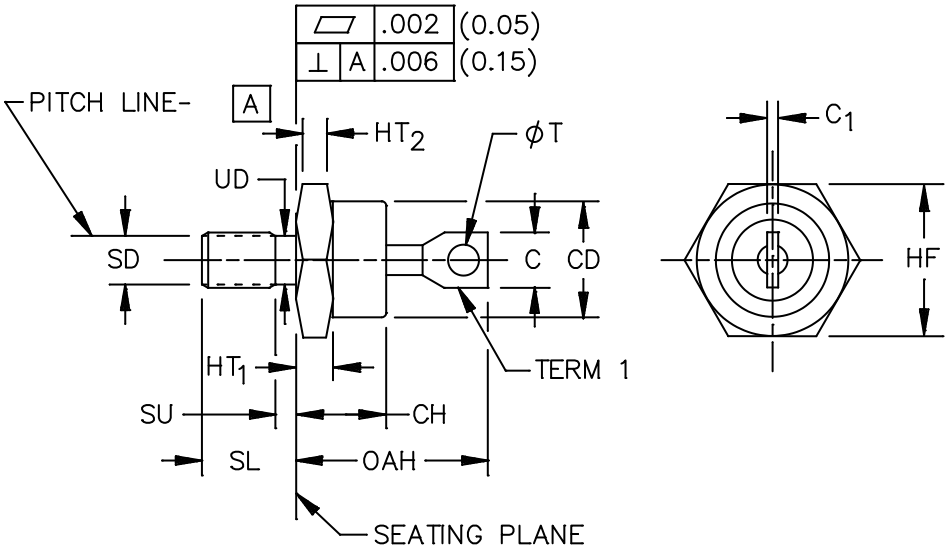
MIL–PRF–19500 – Semiconductor Devices, General Specification for.

DEPARTMENT OF DEFENSE STANDARDS

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

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

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.




modified DO–5 with a DO–4 cap

| Ltr | Dimensions | | | | Notes |
|---|---|---|---|---|---|
| | Inches | | Millimeters | | |
| | Min | Max | Min | Max | |
| C | | .250 | | 6.35 | |
| C1 | .012 | .065 | 0.305 | 1.65 | 3 |
| CD | .255 | .424 | 6.48 | 10.77 | |
| CH | | .450 | | 11.43 | |
| HF | .667 | .687 | 16.94 | 17.45 | |
| $HT_1$ | .115 | .200 | 2.92 | 5.08 | |
| $HT_2$ | .060 | | 1.52 | | |
| OAH | | 1.000 | | 25.4 | |
| SD | .250-28 | | | | |
| SL | .422 | .453 | 10.72 | 11.51 | |
| SU | | | | | 4 |
| UD | .220 | .249 | 5.59 | 6.32 | |
| ΦT | | .175 | | 4.45 | |

NOTES:
1. Dimensions are in inches. Millimeters are given for general information only.
2. Devices with "B" suffix have the anode connected to the case and devices with "RB" suffix (reverse polarity) have the anode connected to the terminal.
3. Angular orientation of this terminal is undefined.
4. Complete threads to extend to within 2.5 threads of seating plane.
5. In accordance with ASME Y14.5M, diameters are equivalent to Φx symbology.

FIGURE 1. Physical dimensions (modified DO–5 with a DO–4 cap).

3. REQUIREMENTS

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

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

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

| | |
|---|---|
| $I_{ZM}$ | Maximum zener current. |
| $I_{ZSM}$ | Maximum zener surge current. |
| $I_{ZT}$ | Zener test current. |
| $V_{Z(reg)}$ | Voltage regulation. |
| $Z_Z$ | Regulator impedance. |
| $Z_K$ | Knee impedance. |
| $\alpha_{VZ}$ | Temperature coefficient of regulator voltage. |

3.4 Interface and physical dimensions. The interface and physical dimensions shall be as specified in MIL–PRF–19500 and herein. Current density of internal conductors shall be as specified in MIL–PRF–19500.

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

3.4.2 Polarity. Standard polarity devices (B suffix) shall have the anode connected to the case stud. Reverse polarity devices (RB suffix) shall have the cathode connected to the case stud.

3.5 Marking. Marking shall be in accordance with MIL–PRF–19500. The PIN shall be in accordance with 1.5.

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 and primary test ratings. The maximum and primary test ratings for voltage regulator diodes shall be as specified in table IV herein.

3.8 Electrical test requirements. The electrical test requirements shall be as specified in table I.

3.9 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, II, and III).

4.1.1 Sampling and inspection. Sampling and inspection shall be in accordance with MIL–PRF–19500, and as specified herein. Lot accumulation period shall be 6 months in lieu of 6 weeks.

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

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 III tests, the tests specified in table III herein that were not performed in the prior revision shall be performed on the first inspection lot of this revision to maintain qualification.

4.3 Screening (quality levels JANTX, JANTXV, and JANS 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 JANTX and JANTXV |
| 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). | Not applicable. |
| 11 | $I_{R1}$ and $V_Z$; $\Delta I_{R1}$ = 100 percent of initial value or 2 μA dc, whichever is greater; $\Delta V_Z$ = ±1 percent of initial value (for devices with $V_{Z(nom)} \geq 10$ V dc; see column 1 of table IV). | $I_{R1}$ and $V_Z$ |
| 12 | See 4.3.1. | See 4.3.1. |
| 13 | Subgroup 2 (except forward voltage test) and subgroup 3 of table I herein; $\Delta I_{R1}$ = 100 percent of initial value or 2 μA dc, whichever is greater, $\Delta V_Z$ = ±1 percent of initial value. | Subgroup 2 (except forward voltage test) of table I herein; $\Delta I_{R1}$ = 100 percent of initial value or 2 μA dc, whichever is greater, $\Delta V_Z$ = ±1 percent of initial value. |

(1) This test shall be performed anytime after screen 3.

4.3.1 Power burn-in conditions. Power burn-in conditions shall be as follows: $I_Z = I_{ZT}$ (see column 4 of table IV) at $T_J$ = +150ºC minimum.

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. Group A inspection shall be performed on each sublot.

4.4.1 Group A inspection. Group A inspection shall be conducted in accordance with MIL–PRF–19500 and table I herein. 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 tests and conditions specified for subgroup testing in table E–VIA (for quality level JANS) or table E–VIB (for quality levels JAN, JANTX, and JANTXV) of MIL–PRF–19500 and herein. Delta electrical measurements for quality level JANS shall be in accordance with table II herein.

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

| Subgroup | Method | Condition |
|---|---|---|
| B4 | 1037 | 2,000 cycles. See 4.5.1. |
| B5 | 1027 | $I_Z$ = column 4 ($I_{ZT}$) of table IV for 168 hours; $T_A$ = 125ºC or adjusted, as required, to give an average lot; $T_J$ = +225ºC.<br><br>Option 1 – $T_J$ = +200ºC, 336 hours.<br><br>Option 2 – $T_J$ = +175ºC, 1,000 hours. |
| B6 | 4081 | $R_{\theta JC}$ = 2.0ºC/W maximum. 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. |

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

| Subgroup | Method | Condition |
|---|---|---|
| B2 | 4066 | $I_{ZSM}$ = column 9 of table IV. |
| B3 | 1027 | $I_{ZT}$ = column 4 of table IV, adjust $T_A$, mounting, or both to achieve $T_J$ = +150ºC minimum. |
| B3 | 1037 | 2,000 cycles. See 4.5.1. |
| B5 | 4081 | $R_{\theta JC}$ = 2.0ºC/W maximum. 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. |

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

| Subgroup | Method | Condition |
|---|---|---|
| C2 | 2036 | Tension: Test condition A, 20 pounds (9.07 Kg), t = 15 seconds; |
| C2 | 2036 | Torque (stud): Test condition D2, 30 lb-in (3.39 newton meter), t = 30 seconds; |
| C2 | 2036 | Bending stress: Test condition F, method B; 3 pounds (1.36 Kg), t = 15 seconds. |
| C5 | | Not applicable. |
| C6 | 1027 | $I_{ZT}$ = column 4 of table IV, adjust $T_A$, mounting, or both to achieve $T_J$ = +150ºC minimum. |
| C6 | 1037 | 6,000 cycles. See 4.5.1. |
| C8 | 4071 | Temperature coefficient of regulator voltage (see 4.5.5)<br>$I_{ZT}$ = column 4 of table IV; $T_{ref}$ = 25ºC±3ºC; $T_{test}$ = $T_{ref}$ +100ºC each sublot;<br>$\alpha_{VZ}$ (column 12 of table IV) = percent/°C; the sample plan shall be n = 22, c = 0;<br>For small lot, the sample plan shall be n = 12 devices, c = 0. |
| C9 | | Voltage regulation (see 4.5.6), each sublot, the sample plan shall be n = 22, c = 0. |

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 +85ºC +15ºC, –5ºC 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, $I_{ZT}$ may be used to achieve heating. The test duration shall be the specified number of cycles specified (see 4.4.2.1, 4.4.2.2, and 4.4.3). 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 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 surges at 1 minute intervals. Each individual surge shall be a one-half square wave pulse of 1/120 second duration or a one-half sine wave with the same effective (rms) current.

4.5.3 Regulator voltage ($V_Z$). The regulator voltage test 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.

4.5.4 Reverse current ($I_R$). The reverse current leakage test shall be performed in accordance with the DC method of test method 4016 of MIL–STD–750. The specified reverse voltage shall be applied to the terminals and the reverse current measured.

4.5.5 Temperature coefficient of regulator voltage ($\alpha_{VZ}$). 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 (see column 12 of table IV).

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 $V_Z$ shall be noted. The current shall then be increased to a level of 50 percent of $I_{ZM}$ and maintained at this level 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 inspection | 2071 | | | | | |
| Subgroup 2 | | | | | | |
| Forward voltage | 4011 | Condition A; $I_F$ = 10 A dc | $V_F$ | | 1.5 | V dc |
| Reverse current (see 4.5.4) | 4016 | DC method<br>$V_R$ = column 10 of table IV; | $I_{R1}$ | | Col. 11 | µA dc |
| Breakdown voltage (regulator voltage) (see 4.5.3) | 4022 | $I_{ZT}$ = column 4 of table IV | $V_Z$ | Col. 2 | Col. 3 | V dc |
| Subgroup 3<br>High temperature operation: | | $T_A$ = +150ºC | | | | |
| Reverse current (see 4.5.4) | 4016 | DC method<br>$V_R$ = column 10 of table IV; | $I_{R2}$ | | Col. 13 | µA dc |
| Subgroup 4 | | | | | | |
| Small-signal reverse breakdown impedance | 4051 | $I_{ZT}$ = column 4 of table IV;<br>$I_{sig}$ = 10 percent of $I_{ZT}$ | $Z_Z$ | | Col. 5 | ohms |
| Knee impedance | 4051 | $I_{ZK}$ = 5 mA dc;<br>$I_{sig}$ = 10 percent of $I_{ZT}$ | $Z_{ZK}$ | | Col. 6 | ohms |
| Subgroup 5<br>Not applicable | | | | | | |
| Subgroup 6 | | JANS level only | | | | |
| Surge current (see 4.5.2) | 4066 | Condition B; $I_{ZSM}$ = column 9 of table IV | | | | |
| End-point electrical measurements | | See table I, subgroup 2 herein | | | | |
| Subgroup 7 | | | | | | |
| Voltage regulation (see 4.5.6) | | JANS level only; n = 22, c = 0 | $V_{Z(reg)}$ | | Col. 8 | V dc |
| Temperature coefficient of regulator voltage (see 4.5.5) | 4071 | $I_{ZT}$ = column 4 of table IV;<br>$T_{ref}$ = 25ºC±3ºC; $T_{test}$ = $T_{ref}$ +100ºC | $\alpha_{VZ}$ | | Col. 12 | %/ºC |

1/ For JANS, all devices required by the specified sampling plan shall be subjected to subgroups 2, 3, and 4 combined.
2/ Column references are from table IV herein.

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

| Step | Inspection | MIL–STD–750 | | Symbol | Limits | | Unit |
|---|---|---|---|---|---|---|---|
| | | Method | Conditions | | Min | Max | |
| 1. | Forward voltage | 4011 | Condition A; $I_F$ = 10 A dc | $\Delta V_F$ 3/ | | ±50 mV dc change from previously measured value. | |

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

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

3/ 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 | | See table I, subgroup 2 herein. | |
| Subgroup 2 | | | n = 45, c = 0 |
| Intermittent operation life | 1037 | 6,000 cycles. See 4.5.1. | |
| End-point electrical measurements | | See table I, subgroup 2 herein. | |
| Subgroup 4 | | | |
| Thermal impedance curves | | See MIL–PRF–19500. | |
| Subgroup 5 and 6 | | | |
| Not applicable | | | |

TABLE IV. Characteristics and tests.

| Device type | 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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | $V_Z$ Nom | $V_Z$ Min | $V_Z$ Max | $I_{ZT}$ 1/ | $Z_Z$ | $Z_K$ | $I_{ZM}$ 1/ | $V_{Z(reg)}$ | $I_{ZSM}$ 1/ | $V_R$ | $I_{R1}$ | $\alpha_{VZ}$ | $I_{R2}$ $T_A$ = 150ºC |
| | V dc | V dc | V dc | mA dc | ohms | ohms | mA dc | V dc | A dc | V dc | µA dc | %/°C | µA dc |
| 1N4549 | 3.9 | 3.71 | 4.09 | 3,200 | 0.16 | 400 | 12,400 | 0.66 | 40.0 | 0.5 | 150 | –.06 | 2/ |
| 1N4550 | 4.3 | 4.09 | 4.51 | 2,900 | 0.16 | 500 | 11,050 | 0.58 | 38.0 | 0.5 | 150 | –.05 | 2/ |
| 1N4551 | 4.7 | 4.47 | 4.93 | 2,650 | 0.12 | 600 | 10,100 | 0.40 | 35.0 | 1.0 | 100 | ±.025 | 2/ |
| 1N4552 | 5.1 | 4.85 | 5.35 | 2,450 | 0.12 | 650 | 9,300 | 0.36 | 32.0 | 1.0 | 20 | ±.030 | 2/ |
| 1N4553 | 5.6 | 5.32 | 5.88 | 2,250 | 0.12 | 900 | 8,500 | 0.34 | 30.0 | 1.0 | 20 | +.050 | 2/ |
| 1N4554 | 6.2 | 5.89 | 6.51 | 2,000 | 0.14 | 1,000 | 7,650 | 0.36 | 25.0 | 2.0 | 20 | +.055 | 2/ |
| 1N3305 | 6.8 | 6.46 | 7.14 | 1,850 | 0.2 | 750 | 7,000 | 0.4 | 37.0 | 4.5 | 300 | +.057 | 1,000 |
| 1N3306 | 7.5 | 7.13 | 7.87 | 1,700 | 0.3 | 350 | 6,360 | 0.5 | 33.0 | 5.0 | 125 | +.067 | 750 |
| 1N3307 | 8.2 | 7.79 | 8.61 | 1,500 | 0.4 | 250 | 5,800 | 0.6 | 29.0 | 5.4 | 50 | +.070 | 500 |
| 1N3308 | 9.1 | 8.65 | 9.55 | 1,370 | 0.5 | 250 | 5,240 | 0.7 | 26.5 | 6.1 | 25 | +.075 | 400 |
| 1N3309 | 10 | 9.50 | 10.50 | 1,200 | 0.6 | 250 | 4,760 | 0.9 | 24.0 | 6.7 | 25 | +.081 | 300 |
| 1N3310 | 11 | 10.45 | 11.55 | 1,100 | 0.8 | 250 | 4,330 | 1.0 | 21.5 | 8.4 | 10 | +.085 | 200 |
| 1N3311 | 12 | 11.40 | 12.60 | 1,000 | 1.0 | 250 | 3,970 | 1.1 | 20.0 | 9.1 | 10 | +.079 | 200 |
| 1N3312 | 13 | 12.35 | 13.65 | 960 | 1.1 | 250 | 3,750 | 1.2 | 18.5 | 9.9 | 10 | +.080 | 200 |
| 1N3313 | 14 | 13.30 | 14.70 | 890 | 1.2 | 250 | 3000 | 1.4 | 17.0 | 11.4 | 10 | +.080 | 200 |
| 1N3314 | 15 | 14.25 | 15.75 | 830 | 1.4 | 250 | 3,170 | 1.5 | 15.5 | 11.4 | 10 | +.082 | 200 |
| 1N3315 | 16 | 15.20 | 16.80 | 780 | 1.6 | 250 | 2,970 | 1.6 | 14.75 | 12.2 | 10 | +.083 | 200 |
| 1N3316 | 17 | 16.15 | 17.85 | 740 | 1.8 | 250 | 2,500 | 1.8 | 13.75 | 13.0 | 10 | +.085 | 200 |
| 1N3317 | 18 | 17.10 | 18.90 | 700 | 2.0 | 250 | 2,640 | 1.9 | 12.75 | 13.7 | 10 | +.085 | 200 |
| 1N3318 | 19 | 18.05 | 19.95 | 660 | 2.2 | 250 | 2,200 | 2.0 | 12.75 | 13.7 | 10 | +.086 | 200 |
| 1N3319 | 20 | 19.00 | 21.00 | 630 | 2.4 | 250 | 2,380 | 2.3 | 11.75 | 15.2 | 10 | +.086 | 200 |
| 1N3320 | 22 | 20.90 | 23.10 | 570 | 2.5 | 250 | 2,160 | 2.5 | 10.5 | 16.7 | 10 | +.087 | 200 |
| 1N3321 | 24 | 22.80 | 25.20 | 520 | 2.6 | 250 | 1,980 | 2.6 | 9.75 | 18.2 | 10 | +.088 | 200 |
| 1N3322 | 25 | 23.75 | 26.25 | 500 | 2.7 | 250 | 1550 | 2.8 | 9.00 | 18.2 | 10 | +.089 | 200 |
| 1N3323 | 27 | 25.65 | 28.35 | 460 | 2.8 | 250 | 1,760 | 2.9 | 8.25 | 20.6 | 10 | +.090 | 200 |
| 1N3324 | 30 | 28.50 | 31.50 | 420 | 3.0 | 300 | 1,590 | 3.0 | 7.75 | 22.8 | 10 | +.091 | 200 |
| 1N3325 | 33 | 31.35 | 34.65 | 380 | 3.2 | 300 | 1,440 | 3.2 | 7.25 | 25.1 | 10 | +.092 | 200 |

See footnotes at end of table.

TABLE IV. Characteristics and tests – Continued.

| Device type | 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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | $V_Z$ Nom | $V_Z$ Min | $V_Z$ Max | $I_{ZT}$ 1/ | $Z_Z$ | $Z_{ZK}$ | $I_{ZM}$ 1/ | $V_{Z(reg)}$ | $I_{ZSM}$ 1/ | $V_R$ | $I_{R1}$ | $\alpha_{VZ}$ | $I_{R2}$ $T_A$ = 150ºC |
| | V dc | V dc | V dc | mA dc | ohms | ohms | mA dc | V dc | A dc | V dc | µA dc | %/°C | µA dc |
| 1N3326 | 36 | 34.20 | 37.80 | 350 | 3.5 | 300 | 1,320 | 3.4 | 6.5 | 27.4 | 10 | +.093 | 200 |
| 1N3327 | 39 | 37.10 | 40.90 | 320 | 4.0 | 350 | 1,220 | 3.6 | 5.88 | 29.7 | 10 | +.094 | 200 |
| 1N3328 | 43 | 40.90 | 45.10 | 290 | 4.5 | 400 | 1,110 | 3.8 | 5.38 | 32.7 | 10 | +.095 | 200 |
| 1N3329 | 45 | 42.75 | 47.25 | 280 | 4.5 | 400 | 930 | 3.9 | 5.14 | 32.7 | 10 | +.095 | 200 |
| 1N3330 | 47 | 44.65 | 49.35 | 270 | 5.0 | 400 | 1,020 | 4.0 | 4.90 | 35.8 | 10 | +.095 | 200 |
| 1N3331 | 50 | 47.50 | 52.50 | 250 | 5.0 | 500 | 830 | 4.2 | 4.76 | 38.8 | 10 | +.096 | 200 |
| 1N3332 | 51 | 48.45 | 53.55 | 245 | 5.2 | 500 | 930 | 4.4 | 4.36 | 38.8 | 10 | +.096 | 200 |
| 1N3333 | 52 | 49.40 | 54.60 | 240 | 5.5 | 500 | 790 | 4.65 | 4.38 | 42.6 | 10 | +.096 | 200 |
| 1N3334 | 56 | 53.20 | 58.80 | 220 | 6 | 500 | 850 | 4.75 | 4.13 | 42.6 | 10 | +.096 | 200 |
| 1N3335 | 62 | 58.90 | 65.10 | 200 | 7 | 600 | 770 | 5.0 | 3.68 | 47.1 | 10 | +.097 | 200 |
| 1N3336 | 68 | 64.60 | 71.40 | 180 | 8 | 600 | 700 | 5.5 | 3.35 | 51.7 | 10 | +.097 | 200 |
| 1N3337 | 75 | 71.25 | 78.75 | 170 | 9 | 600 | 640 | 5.75 | 3.00 | 56.0 | 10 | +.098 | 200 |
| 1N3338 | 82 | 77.90 | 86.10 | 150 | 11 | 700 | 580 | 6.25 | 2.75 | 62.2 | 10 | +.098 | 200 |
| 1N3339 | 91 | 86.45 | 95.55 | 140 | 15 | 800 | 530 | 6.75 | 2.35 | 69.2 | 10 | +.099 | 200 |
| 1N3340 | 100 | 95.00 | 105.0 | 120 | 20 | 900 | 480 | 7.5 | 2.25 | 76.0 | 10 | +.100 | 200 |
| 1N3341 | 105 | 99.75 | 110.25 | 120 | 25 | 1000 | 380 | 8.25 | 2.15 | 83.0 | 10 | +.100 | 200 |
| 1N3342 | 110 | 104.50 | 115.5 | 110 | 30 | 1100 | 430 | 9.0 | 2.05 | 83.0 | 10 | +.100 | 200 |
| 1N3343 | 120 | 114.00 | 126.0 | 100 | 40 | 1200 | 400 | 9.5 | 1.88 | 91.2 | 10 | +.100 | 200 |
| 1N3344 | 130 | 123.50 | 136.5 | 95 | 50 | 1300 | 370 | 10.0 | 1.73 | 98.8 | 10 | +.100 | 200 |
| 1N3345 | 140 | 133.00 | 147.0 | 90 | 60 | 1400 | 325 | 11.00 | 1.61 | 114.0 | 10 | +.100 | 200 |
| 1N3346 | 150 | 142.50 | 157.5 | 85 | 75 | 1500 | 320 | 12.0 | 1.50 | 114.0 | 10 | +.100 | 200 |
| 1N3347 | 160 | 152.00 | 168.0 | 80 | 80 | 1600 | 300 | 13.0 | 1.43 | 121.6 | 10 | +.100 | 200 |
| 1N3348 | 175 | 166.25 | 183.75 | 70 | 85 | 1700 | 230 | 13.75 | 1.34 | 121.6 | 10 | +.100 | 200 |
| 1N3349 | 180 | 171.00 | 189.0 | 68 | 90 | 1800 | 260 | 14.5 | 1.25 | 136.8 | 10 | +.100 | 200 |
| 1N3350 | 200 | 190.00 | 210.0 | 65 | 100 | 2000 | 240 | 16.0 | 1.10 | 152.0 | 10 | +.100 | 200 |

1/ Unless otherwise specified herein, all inspections shall be made at $T_C$ of 25°C ±3°C.
2/ This test is not applicable for devices 1N4549B, RB through 1N4554B, RB.

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.

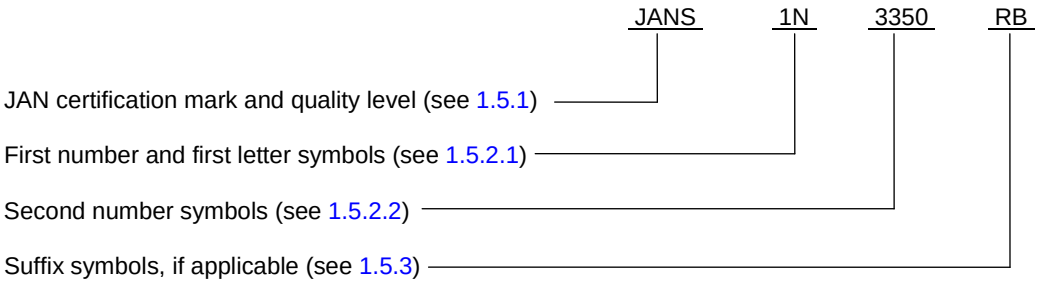
b. Packaging requirements (see 5.1).

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, 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.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 for devices covered by this specification sheet. The reverse polarity devices, suffix RB PINs, are not listed below.

| | | | |
|---|---|---|---|
| JAN1N4549B | JANTX1N4549B | JANTXV1N4549B | JANS1N4549B |
| JAN1N4550B | JANTX1N4550B | JANTXV1N4550B | JANS1N4550B |
| JAN1N4551B | JANTX1N4551B | JANTXV1N4551B | JANS1N4551B |
| JAN1N4552B | JANTX1N4552B | JANTXV1N4552B | JANS1N4552B |
| JAN1N4553B | JANTX1N4553B | JANTXV1N4553B | JANS1N4553B |
| JAN1N4554B | JANTX1N4554B | JANTXV1N4554B | JANS1N4554B |
| JAN1N3305B | JANTX1N3305B | JANTXV1N3305B | JANS1N3305B |
| JAN1N3306B | JANTX1N3306B | JANTXV1N3306B | JANS1N3306B |
| JAN1N3307B | JANTX1N3307B | JANTXV1N3307B | JANS1N3307B |
| JAN1N3308B | JANTX1N3308B | JANTXV1N3308B | JANS1N3308B |
| JAN1N3309B | JANTX1N3309B | JANTXV1N3309B | JANS1N3309B |
| JAN1N3310B | JANTX1N3310B | JANTXV1N3310B | JANS1N3310B |
| JAN1N3311B | JANTX1N3311B | JANTXV1N3311B | JANS1N3311B |
| JAN1N3312B | JANTX1N3312B | JANTXV1N3312B | JANS1N3312B |
| JAN1N3313B | JANTX1N3313B | JANTXV1N3313B | JANS1N3313B |
| JAN1N3314B | JANTX1N3314B | JANTXV1N3314B | JANS1N3314B |
| JAN1N3315B | JANTX1N3315B | JANTXV1N3315B | JANS1N3315B |
| JAN1N3316B | JANTX1N3316B | JANTXV1N3316B | JANS1N3316B |
| JAN1N3317B | JANTX1N3317B | JANTXV1N3317B | JANS1N3317B |
| JAN1N3318B | JANTX1N3318B | JANTXV1N3318B | JANS1N3318B |
| JAN1N3319B | JANTX1N3319B | JANTXV1N3319B | JANS1N3319B |
| JAN1N3320B | JANTX1N3320B | JANTXV1N3320B | JANS1N3320B |
| JAN1N3321B | JANTX1N3321B | JANTXV1N3321B | JANS1N3321B |
| JAN1N3322B | JANTX1N3322B | JANTXV1N3322B | JANS1N3322B |
| JAN1N3323B | JANTX1N3323B | JANTXV1N3323B | JANS1N3323B |
| JAN1N3324B | JANTX1N3324B | JANTXV1N3324B | JANS1N3324B |
| JAN1N3325B | JANTX1N3325B | JANTXV1N3325B | JANS1N3325B |
| JAN1N3326B | JANTX1N3326B | JANTXV1N3326B | JANS1N3326B |
| JAN1N3327B | JANTX1N3327B | JANTXV1N3327B | JANS1N3327B |
| JAN1N3328B | JANTX1N3328B | JANTXV1N3328B | JANS1N3328B |
| JAN1N3329B | JANTX1N3329B | JANTXV1N3329B | JANS1N3329B |
| JAN1N3330B | JANTX1N3330B | JANTXV1N3330B | JANS1N3330B |
| JAN1N3331B | JANTX1N3331B | JANTXV1N3331B | JANS1N3331B |
| JAN1N3332B | JANTX1N3332B | JANTXV1N3332B | JANS1N3332B |
| JAN1N3333B | JANTX1N3333B | JANTXV1N3333B | JANS1N3333B |
| JAN1N3334B | JANTX1N3334B | JANTXV1N3334B | JANS1N3334B |
| JAN1N3335B | JANTX1N3335B | JANTXV1N3335B | JANS1N3335B |
| JAN1N3336B | JANTX1N3336B | JANTXV1N3336B | JANS1N3336B |
| JAN1N3337B | JANTX1N3337B | JANTXV1N3337B | JANS1N3337B |
| JAN1N3338B | JANTX1N3338B | JANTXV1N3338B | JANS1N3338B |
| JAN1N3339B | JANTX1N3339B | JANTXV1N3339B | JANS1N3339B |
| JAN1N3340B | JANTX1N3340B | JANTXV1N3340B | JANS1N3340B |
| JAN1N3341B | JANTX1N3341B | JANTXV1N3341B | JANS1N3341B |
| JAN1N3342B | JANTX1N3342B | JANTXV1N3342B | JANS1N3342B |
| JAN1N3343B | JANTX1N3343B | JANTXV1N3343B | JANS1N3343B |
| JAN1N3344B | JANTX1N3344B | JANTXV1N3344B | JANS1N3344B |
| JAN1N3345B | JANTX1N3345B | JANTXV1N3345B | JANS1N3345B |
| JAN1N3346B | JANTX1N3346B | JANTXV1N3346B | JANS1N3346B |
| JAN1N3347B | JANTX1N3347B | JANTXV1N3347B | JANS1N3347B |
| JAN1N3348B | JANTX1N3348B | JANTXV1N3348B | JANS1N3348B |
| JAN1N3349B | JANTX1N3349B | JANTXV1N3349B | JANS1N3349B |
| JAN1N3350B | JANTX1N3350B | JANTXV1N3350B | JANS1N3350B |

6.6 Supersession information and non-included numerical types.

6.6.1 Re-identification of previous duplicate currents $I_Z$ to currents $I_{ZM}$ and $I_{ZT}$. Previous revisions of this specification used the symbol $I_Z$ in two different columns of table IV. In MIL-PRF-19500/358E (dated 23 July 1999) and earlier revisions, current $I_Z$ was used in columns 4 and 7. These were re-identified as $I_{ZT}$ (column 4) and $I_{ZM}$ (column 7) with the issuance of MIL–PRF–19500/358F; dated 12 July 2013.

6.6.1 Re-identification of the package outline. Previous revisions of this specification identified the device package as a DO–5 diode outline. This issue of the specification has adjusted the dimensions on figure 1 and the description of the package as supplied to a modified DO–5 base with a DO–4 cap.

6.6.2 Numerical diode-types not covered by past revisions. The 10 numerical types listed below were not covered in the specification sheet until they were included in the issuance of MIL–S–19500/358D, dated 26 May 1994. These previous non-included types (all from the 1N33XX series) have intermediate voltage-characteristics, etc., parameter deemed (as overlapping and) that were considered not requisite for military-equipment circuit applications. These 10 numerical types were then removed with the issuance of MIL–PRF–19500/358F; dated 12 July 2013.

Previous non-included numerical types were as follows: 3313, 3316, 3318, 3322, 3329, 3331, 3333, 3341, 3345, and 3348.

6.7 Voltage-range sequence factors for diodes covered herein. The 1N4549 through 1N4555 (both B and RB) series of diodes are designed for applications at a lower range of nominal-voltage levels than the 1N3305 through 1N3350 series of diodes.

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

| | |
|---|---|
| $I_F$ | Forward current, DC value, no alternating component. |
| $I_{R1}$ | Reverse current. |
| $I_{R3}$ | Reverse current, dc max (after life test). |
| $I_{sig}$ | Detector signal current. |
| $I_{ZSM}$ | Maximum zener surge current. |
| $I_Z$ | Maximum dc current. |
| $I_{ZK}$ | Regulator or reference current, dc near breakdown knee. |
| $I_{ZM}$ | Regulator or reference current, dc maximum rated 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. |
| $Z_Z$ | Regulator impedance. |
| $Z_{ZK}$ | Knee impedance. |
| $\alpha_{vz}$ | Temperature coefficient of regulator voltage. |

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
Air Force – 85
NASA – NA
DLA – CC

Review activities:
Army – AR, MR, SM
Air Force – 99

Preparing activity:
DLA – CC

(Project 5961–2015–104)

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.