The documentation and process conversion measures necessary to comply with this document shall be completed by 13 October 2021.

INCH-POUND

MIL-PRF-19500/350M
W/AMENDMENT 2
13 July 2021
SUPERSEDING
MIL-PRF-19500/350M
W/AMENDMENT 1
28 January 2016

PERFORMANCE SPECIFICATION SHEET

# TRANSISTOR, PNP, SILICON, LOW POWER ENCAPSULATED (THROUGH-HOLE AND SURFACE MOUNT PACKAGES) AND UN-ENCAPSULATED (DIE), RADIATION AND NON-RADIATION HARDENED, TYPES 2N3867, 2N3868, 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 PNP, silicon, switching transistor. Four levels of product assurance (JAN, JANTX, JANTXV, and JANS) are provided for each device type as specified in MIL-PRF-19500. Two levels of product assurance (JANHC and JANKC) are provided for each unencapsulated device type. Provisions for radiation hardness assurance (RHA) to eight radiation levels is provided for JANTXV, JANS, JANHC, and JANKC product assurance levels.

1.2 Package outlines. The device package outlines are as follows: TO- 5, TO-39 in accordance with figure 1, U4 (SMD .22) suffix in accordance with figure 2 for all encapsulated device types. See figure 3 and figure 4 for unencapsulated devices.

1.3 Maximum ratings. Unless otherwise specified, $T_A$ = +25°C.

| Types | $P_T$ (1) $T_A$ = +25°C | $P_T$ (1) $T_{PCB}$ = +25°C | $P_T$ (2) $T_C$ = +25°C | $R_{\theta JA}$ | $R_{\theta JPCB}$ | $R_{\theta JC}$ | $V_{CBO}$ | $V_{CEO}$ | $V_{EBO}$ | $I_C$ | $T_J$ and $T_{STG}$ |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | W | W | W | °C/W | °C/W | °C/W | V dc Min | V dc Min | V dc | A dc | °C |
| 2N3867, S | 1.0 | | 10 | 175 | | 17.5 | -40 | -40 | -4.0 | -3.0 | -65 to +200 |
| 2N3868, S | 1.0 | | 10 | 175 | | 17.5 | -60 | -60 | -4.0 | -3.0 | -65 to +200 |
| 2N3867U4 | | 1.0 | 35 | | 175 | 5 | -40 | -40 | -4.0 | -3.0 | -65 to +200 |
| 2N3868U4 | | 1.0 | 35 | | 175 | 5 | -60 | -60 | -4.0 | -3.0 | -65 to +200 |

(1) For derating, see figures 5, 6, 7 and 8.
(2) For thermal curves, see figures 9, 10, 11 and 12.

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.

1.4 Primary electrical characteristics.

| | $h_{FE}$ | | | | $C_{obo}$ $I_E = 0$ | \|hfe\| $I_C$ = -100 mA dc | $I_C$ = -1.5 A dc | | $V_{CE(sat)}2$ $I_C$ = -1.5 A dc |
|---|---|---|---|---|---|---|---|---|---|
| | $I_C$ = -1.5 A dc $V_{CE}$ = -2 V dc | | $I_C$ = -3.0 A dc $V_{CE}$ = -5 V dc | | $V_{CB}$ = -10 V dc 100 kHz ≤ f ≤ 1 MHz | $V_{CE}$ = -5 V dc f = 20 MHz | $I_B$ = 150 mA dc | | $I_B$ = -150 mA dc |
| | | | | | | | $t_{on}$ | $t_{off}$ | |
| | 2N3867 2N3867S 2N3867U4 | 2N3868 2N3868S 2N3868U4 | 2N3867 2N3867S 2N3867U4 | 2N3868 2N3968S 2N3968U4 | pF | | ns max | ns max | V dc |
| Min | 40 | 30 | 20 | 20 | | 3 | | | |
| Max | 200 | 150 | | | 120 | 12 | 100 | 600 | -0.75 |

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 and 6.5 for a list of available PINs.

1.5.1 JAN certification mark and quality level for encapsulated devices. 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 JAN certification mark and quality level for unencapsulated devices (die). The quality level designators for unencapsulated devices (die) that are applicable for this specification sheet from the lowest to the highest level are as follows: "JANHC" and "JANKC".

1.5.3 Radiation hardness assurance (RHA) designator. The RHA levels that are applicable for this specification sheet from lowest to highest are as follows: "M", "D", "P", "L", "R", "F", "G", and "H".

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

1.5.4.1 First number and first letter symbols. The transistors of this specification sheet use the first number and letter symbols "2N".

1.5.4.2 Second number symbols. The second number symbols for the transistors covered by this specification sheet are as follows: "3867" and "3868".

1.5.4.3 Suffix letters. Devices with no suffix are packaged in the TO-5 package of figure 1 and have standard length leads of 1.5 inches (38.10 mm) min. and 1.75 inches (44.45 mm) max. The suffix letter "S" is used on devices that are packaged in the TO-39 package of figure 1 that have a short lead length: .5 inch (12.70 mm) min. and .750 inch (19.05 mm) max. The suffix letter "U4" is used on devices that are packaged in the surface mount package of figure 2.

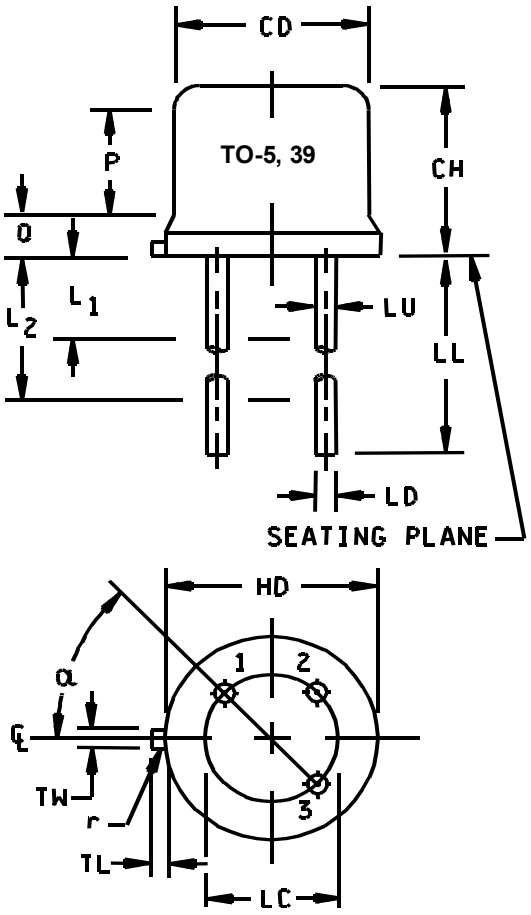
1.5.5 Lead finish. The lead finishes applicable to this specification sheet are listed on QPDSIS-19500.

1.5.6 Die identifier for unencapsulated devices (manufacturers and critical interface identifiers). The manufacturer die identifier that is applicable for this specification sheet is "B" or "C" (see figure 3, figure 4, and 6.5).

1.6 Radiation features: Maximum total ionizing dose (TID) available (Dose rate = 50-300 rad(Si)/s)):
For device type 2N3867, 2N3867S, 2N3867U4, 2N3868, 2N3868S, 2N3868U4:..... 100 krads(Si) 1/

1/ Manufacturer supplying these device types have performed characterization testing in accordance with MIL-STD-750, method 1019, condition A (dose rate = 50 - 300 rad(Si)/s). The radiation end point limits are guaranteed only for the conditions as specified in MIL-STD-750, method 1019, condition A to a maximum total ionizing dose level of 100 krads(Si).

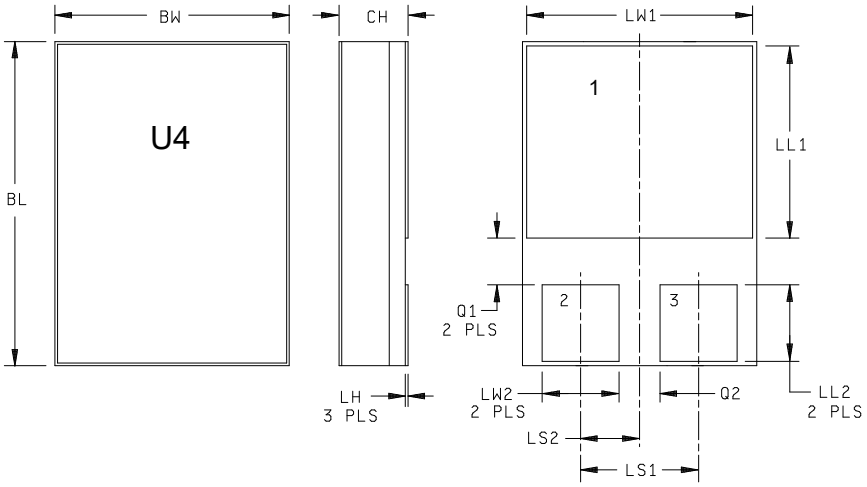
| Symbol | Dimensions | | | | Note |
|---|---|---|---|---|---|
| | Inches | | Millimeters | | |
| | Min | Max | Min | Max | |
| CD | .305 | .335 | 7.75 | 8.51 | 5, 6 |
| CH | .240 | .260 | 6.10 | 6.60 | |
| HD | .335 | .370 | 8.51 | 9.40 | 4, 5 |
| LC | .200 TP | | 5.08 TP | | 7 |
| LD | .016 | .019 | 0.41 | 0.48 | 8,9 |
| LL | See note 8, 14 | | | | |
| LU | .016 | .019 | 0.41 | 0.48 | 8,9 |
| $L_1$ | | .050 | | 1.27 | 8,9 |
| $L_2$ | .250 | | 6.35 | | 8,9 |
| P | .100 | | 2.54 | | 7 |
| Q | | .030 | | 0.76 | 5 |
| TL | .029 | .045 | 0.74 | 1.14 | 3,4 |
| TW | .028 | .034 | 0.71 | 0.86 | 3 |
| r | | .010 | | 0.25 | 10 |
| $\alpha$ | 45° TP | | 45° TP | | 7 |
| 1, 2, 10, 12, 13, 14 | | | | | |




NOTES:

1. Dimensions are in inches.
2. Millimeters are given for general information only.
3. Beyond r (radius) maximum, TW shall be held for a minimum length of .011 (0.28 mm).
4. Dimension TL measured from maximum HD.
5. Body contour optional within zone defined by HD, CD, and Q.
6. CD shall not vary more than .010 inch (0.25 mm) in zone P. This zone is controlled for automatic handling.
7. Leads at gauge plane .054 +.001 -.000 inch (1.37 +0.03 -0.00 mm) below seating plane shall be within .007 inch (0.18 mm) radius of true position (TP) at maximum material condition (MMC) relative to tab at MMC. The device may be measured by direct methods or by gauging procedure.
8. Dimension LU applies between $L_1$ and $L_2$. Dimension LD applies between $L_2$ and LL minimum. Diameter is uncontrolled in and beyond LL minimum.
9. All three leads.
10. The collector shall be internally connected to the case.
11. Dimension r (radius) applies to both inside corners of tab.
12. * In accordance with ASME Y14.5, diameters are equivalent to $\phi$x symbology.
13. Lead 1 = emitter, lead 2 = base, lead 3 = collector.
14. For non-S-suffix devices (TO-5), dimension LL = 1.5 inches (38.10 mm) min. and 1.75 inches (44.45 mm) max. For S-suffix types (TO-39), dimension LL = .5 inch (12.70 mm) min. and .750 inch (19.05 mm) max.

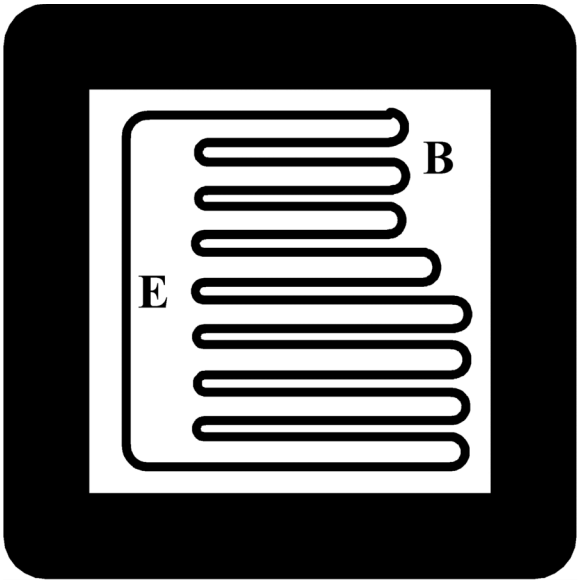
FIGURE 1. Physical dimensions (similar to TO-5, TO-39).




| Symbol | Dimensions | | | |
|---|---|---|---|---|
| | Inches | | Millimeters | |
| | Min | Max | Min | Max |
| BL | .215 | .225 | 5.46 | 5.72 |
| BW | .145 | .155 | 3.68 | 3.94 |
| CH | .049 | .075 | 1.24 | 1.91 |
| LH | | .020 | | 0.51 |
| LW1 | .135 | .145 | 3.43 | 3.68 |
| LW2 | .047 | .057 | 1.19 | 1.45 |
| LL1 | .085 | .125 | 2.16 | 3.17 |
| LL2 | .045 | .075 | 1.14 | 1.9 |
| LS1 | .070 | .095 | 1.78 | 2.41 |
| LS2 | .035 | .048 | 0.89 | 1.21 |
| Q1 | .03 | .070 | 0.76 | 1.78 |
| Q2 | .02 | .035 | 0.51 | 0.89 |
| TERM 1 | Collector | | | |
| TERM 2 | Base | | | |
| TERM 3 | Emitter | | | |

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

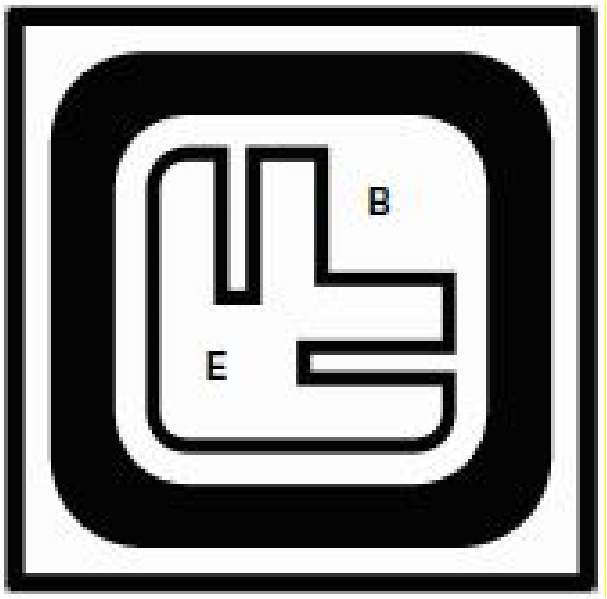
FIGURE 2. Physical dimensions and configuration (SMD.22, U4).




B version

1. Chip size: .075 x .075 inch ±.002 inch (1.905 x 1.905 mm ±0.051 mm).
2. Chip thickness: .010 inch ±.0015 inch nominal (0.254 mm ±0.0381 mm).
3. Top metal: Aluminum 30,000 Å minimum, 33,000 Å nominal.
4. Back metal: Gold 3,500Å minimum, 5,000Å nominal.
5. Backside: Collector.
6. Bonding pad: B = .023 x .008 inch (0.5842 x 0.2032 mm).
   E = .049 x .008 inch (1.2446 x 0.2032 mm).

FIGURE 3. JANHCB and JANKCB die dimensions.




C version

| | | |
|---|---|---|
| 1. | Chip size | .065 x .065 inch ±.002 inch (1.651 X 1.651 ±0.0508 millimeter). |
| 2. | Chip thickness | .0134 inch ±.0008 inch (0.34036 ±0.02032 millimeter). |
| 3. | Top metal | Aluminum, 54,000 Å minimum, 60,000 Å nominal. |
| 4. | Back metal | Al/Ti/Ni/Au 10,000 Å minimum, 12,000 Å nominal. |
| 5. | Backside | Collector. |
| 6. | Bonding pad | B = .017 inch x .017 inch (0.4318 X 0.4318 millimeter).<br>E = .015 inch x .015 inch (0. 381 X 0.381 millimeter). |

FIGURE 4. JANHCC and JANKCC die dimensions.

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 https://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.

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 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.

* 3.4 Interface and physical dimensions. The interface and physical dimensions shall be as specified in MIL-PRF-19500 and on figures 1, 2, 3 and 4.

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 Construction. These devices shall be constructed in a manner and using materials which enable the devices to meet the applicable requirements of MIL-PRF-19500 and this document.

3.5 Radiation hardness assurance (RHA). Radiation hardness assurance requirements, PIN designators, and test levels shall be as defined in MIL-PRF-19500.

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

3.7 Electrical test requirements. The electrical test requirements shall be the subgroups specified in table I and II herein.

3.8 Marking. Marking shall be in accordance with MIL-PRF-19500. The radiation hardened designator M, D, P, L, R, F, G, or H shall immediately precede (or replace) the device "2N" identifier (depending upon degree of abbreviation required).

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 and tables I, II, III, and IV).

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

4.2.1 JANHC and JANKC qualification. JANHC and JANKC qualification inspection shall be in accordance with MIL-PRF-19500.

4.2.2 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.

* 4.3.1 Screening (JANS, JANTX, and JANTXV levels only). Screening of packaged devices 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 | |
|---|---|---|
| | JANS level | JANTX and JANTXV levels |
| (1) 3c | Thermal impedance, method 3131 of MIL-STD-750 (see 4.3.1.1) | Thermal impedance, method 3131 of MIL-STD-750 (see 4.3.1.1) |
| 9 | $I_{CEX1}$ and $h_{FE2}$ | Not applicable |
| 10 | 24 hours minimum | 24 hours minimum |
| 11 | $I_{CEX1}$; $h_{FE2}$;<br>$\Delta I_{CEX1}$ = 100 percent of initial value or -200 nA dc, whichever is greater;<br>$\Delta h_{FE2}$ = ±15 percent of initial value | $I_{CEX1}$; $h_{FE2}$ |
| 12 | See 4.3.1.2 | See 4.3.1.2 |
| 13 | Subgroup 2 and 3 of table I herein;<br>$\Delta I_{CEX1}$ = 100 percent of initial value or -200 nA dc, whichever is greater;<br>$\Delta h_{FE2}$ = ±15 percent of initial value | Subgroup 2 of table I herein;<br>$\Delta I_{CEX1}$ = 100 percent of initial value or -200 nA dc, whichever is greater;<br>$\Delta h_{FE2}$ = ±15 percent of initial value |

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

4.3.1.1 Thermal impedance. The thermal impedance measurements shall be performed in accordance with method 3131 of MIL-PRF-19500 using the guidelines in that method for determining $I_M$, $I_H$, $t_H$, $t_{MD}$ (and $V_C$ and $V_H$ where appropriate). See table III, group E, subgroup 4 herein.

* 4.3.1.2 Power burn-in conditions. Power burn-in conditions are as follows: $V_{CB}$ = -10 through -30 V dc. Power shall be applied to achieve $T_J$ = +135°C minimum using a minimum $P_D$ = 75 percent of $P_T$ maximum rated as defined in 1.3. With approval of the qualifying activity and preparing activity, alternate burn-in criteria (hours, bias conditions, $T_J$, and mounting conditions) may be used for JANTX and JANTXV quality levels. A justification demonstrating equivalence is required. In addition, the manufacturing site's burn-in data and performance history will be essential criteria for burn-in modification approval.

4.3.2 Screening of unencapsulated die (JANHC and JANKC). Screening of JANHC and JANKC unencapsulated die shall be in accordance with appendix G of MIL-PRF-19500. Burn-in duration for the JANKC level follows JANS requirements; the JANHC follows JANTX requirements.

4.4 Conformance inspection. Conformance inspection shall be in accordance with MIL-PRF-19500 and as specified herein. If alternate screening is being performed in accordance with MIL-PRF-19500, a sample of screened devices shall be submitted to and pass the requirements of subgroup 1 and 2 of table I herein, inspection only (table E-VIB, group B, subgroup 1 is not required to be performed since solderability and resistance to solvents testing is performed in table I herein).

4.4.1 Group A inspection. Group A inspection shall be conducted in accordance with MIL-PRF-19500 and table I herein. Electrical measurements (end-points) shall be in accordance with the applicable inspections of 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 E-VIA (JANS) and 4.4.2.1 herein. Delta measurements for JANS shall be after subgroups B4 and B5 and in accordance with table IV herein. See 4.4.2.2 for JAN, JANTX, and JANTXV group B testing. Delta measurements for JAN, JANTX, and JANTXV shall be after each step in 4.4.2.2 and shall be in accordance with table IV herein.

4.4.2.1 Quality level JANS, table E-VIA of MIL-PRF-19500.

| Subgroup | Method | Condition |
|---|---|---|
| B4 | 1037 | $V_{CB}$ = -10 V dc; 2,000 cycles adjust device current, or power, to achieve a minimum $\Delta T_J$ of +100°C. |
| B5 | 1027 | (NOTE: If a failure occurs, resubmission shall be at the test conditions of the original sample.) $V_{CB}$ = -10 V dc, $P_D \geq$ 100 percent of maximum rated $P_T$ (see 1.3).<br><br>Option 1: For 96 hours minimum sample size in accordance with table E-VIA of MIL-PRF-19500, adjust $T_A$ or $P_D$ to achieve $T_J$ = +275°C minimum.<br><br>Option 2: For 216 hours minimum, sample size = 45, c = 0; adjust $T_A$ or $P_D$ to achieve $T_J$ = +225°C minimum. |
| B6 | 3131 | Not applicable. |

4.4.2.2 Quality levels JAN, JANTX and JANTXV (see table E-VIC of MIL-PRF-19500). Separate samples may be used for each step. In the event of a lot failure, the resubmission requirements of MIL-PRF-19500 shall apply. In addition, all catastrophic failures during conformance inspection shall be analyzed to the extent possible to identify root cause and corrective action.

| Step | Method | Condition |
|---|---|---|
| 1 | 1026 | Steady-state life: 1,000 hours minimum, $V_{CB}$ = -10 V dc, power shall be applied to achieve $T_J$ = +150°C minimum using a minimum of $P_D$ = 75 percent of maximum rated $P_T$ as defined in 1.3. n = 45 devices, c = 0. The sample size may be increased and the test time decreased as long as the devices are stressed for a total of 45,000 device hours minimum, and the actual time of test is at least 340 hours. |
| 2 | 1048 | Blocking life, $T_A$ = +150°C, $V_{CB}$ = 80 percent of rated voltage, 48 hours minimum. n = 45 devices, c = 0. |
| 3 | 1032 | High-temperature life (non-operating), t = 340 hours, $T_A$ = +200°C. n = 22, c = 0. |

4.4.2.3 Group B sample selection. Samples selected from group B inspection shall meet all of the following requirements:

a. For JAN, JANTX, and JANTXV samples shall be selected randomly from a minimum of three wafers (or from each wafer in the lot) from each wafer lot. For JANS, samples shall be selected from each inspection lot. See MIL-PRF-19500.

b. Shall be chosen from an inspection lot that has been submitted to and passed table I, subgroup 2, conformance inspection. When the final lead finish is solder or any plating prone to oxidation at high temperature, the samples for life test (subgroups B4 and B5 for JANS, and group B for JAN, JANTX, and JANTXV) may be pulled prior to the application of final lead finish.

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 in 4.4.3.1 (JANS) and 4.4.3.2 (JAN, JANTX, and JANTXV) herein for group C testing. Delta measurements shall be in accordance with table IV herein for JANS only and only apply to subgroup C6.

4.4.3.1 Quality level JANS (see table E-VII of MIL-PRF-19500).

| Subgroup | Method | Condition |
|---|---|---|
| C2 | 2036 | Test condition E, not applicable for U4 devices. |
| C5 | 3131 | $R_{\theta JA}$ and $R_{\theta JC}$ only, as applicable (see 1.3) and in accordance with thermal impedance curves. |
| C6 | 1026 | 1,000 hours at $V_{CB}$ = -10 V dc; power shall be applied to achieve $T_J$ = +150°C minimum and a minimum of $P_D$ = 75 percent of maximum rated $P_T$ as defined in 1.3 n = 45, c = 0. The sample size may be increased and the test time decreased as long as the devices are stressed for a total of 45,000 device hours minimum, and the actual time of test is at least 340 hours. |

4.4.3.2 Quality levels JAN, JANTX and JANTXV (see table E-VII of MIL-PRF-19500).

| Subgroup | Method | Condition |
|---|---|---|
| C2 | 2036 | Test condition E, not applicable for U4 devices. |
| C5 | 3131 | $R_{\theta JA}$ and $R_{\theta JC}$ only, as applicable (see 1.3) and in accordance with thermal impedance curves. |
| C6 | | Not applicable. |

4.4.3.3 Group C sample selection. Samples for subgroups in group C shall be chosen at random from any lot containing the intended package type and lead finish procured to the same specification which is submitted to and passes group A tests for conformance inspection. When the final lead finish is solder or any plating prone to oxidation at high temperature, the samples for C6 life test may be pulled prior to the application of final lead finish. Testing of a subgroup using a single device type enclosed in the intended package type shall be considered as complying with the requirements for that subgroup.

4.4.4 Group D inspection. Conformance inspection for hardness assured JANS and JANKC types shall include the group D tests specified in table II herein. These tests shall be performed as required in accordance with MIL-PRF-19500 and method 1019 of MIL-STD-750, for total ionizing dose or method 1017 of MIL-STD-750 for neutron fluence as applicable (see 6.2 herein), except group D, subgroup 2 may be performed separate from other subgroups. Alternate package options may also be substituted for the testing provided there is no adverse effect to the fluence profile.

4.4.5 Group E inspection. Group E inspection shall be conducted in accordance with the conditions specified for subgroup testing in appendix E, table E-IX of MIL-PRF-19500 and as specified in table III herein. Delta measurements shall be in accordance with table IV herein.

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

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

TABLE I. Group A inspection.

| Inspection 1/ | MIL-STD-750 | | Symbol | Limit | | Unit |
|---|---|---|---|---|---|---|
| | Method | Conditions | | Min | Max | |
| Subgroup 1 2/ | | | | | | |
| Visual and mechanical examination 3/ | 2071 | | | | | |
| Solderability 3/ 4/ | 2026 | n = 15 leads, c = 0 | | | | |
| Resistance to solvent 3/ 4/ 5/ | 1022 | n = 15 devices, c = 0 | | | | |
| Salt atmosphere (corrosion) (Laser marked devices only. Not required for non-corrosive base metals.) 4/ | 1041 | n = 6 devices, c = 0 | | | | |
| Temperature cycling 3/ 4/ | 1051 | Test condition C, 25 cycles. n = 22 devices, c = 0 | | | | |
| Hermetic seal 5/ | 1071 | n = 22 devices, c = 0 | | | | |
| Fine leak<br>Gross leak | | | | | | |
| Electrical measurements 4/ | | Table I, subgroup 2 | | | | |
| Bond strength 3/ 4/ | 2037 | Precondition $T_A$ = +250°C at t = 24 hrs or $T_A$ = +300°C at t = 2 hrs, n = 11 wires, c = 0. | | | | |
| Decap internal visual (design verification) 4/ | 2075 | n = 4 devices, c = 0. | | | | |
| Subgroup 2 | | | | | | |
| Thermal impedance | 3131 | See 4.3.1.1 | $Z_{\theta JX}$ | | | °C/W |
| Collector to base cutoff current | 3036 | Condition D | $I_{CBO1}$ | | | |
| 2N3867, 2N3867S, 2N3867U4 | | $V_{CB}$ = -40 V dc | | | -100 | µA dc |
| 2N3868, 2N3868S, 2N3868U4 | | $V_{CB}$ = -60 V dc | | | -100 | µA dc |
| Emitter to base cutoff current | 3061 | Bias condition D; $V_{EB}$ = -4 V dc | $I_{EBO1}$ | | -100 | µA dc |
| Breakdown voltage, collector to emitter | 3011 | Bias condition D; $I_C$ = -20 mA dc; pulsed (see 4.5.1) | $V_{(BR)CEO}$ | | | |
| 2N3867, 2N3867S, 2N3867U4 | | | | -40 | | V dc |
| 2N3868, 2N3868S, 2N3868U4 | | | | -60 | | V dc |

See footnotes at end of table.

TABLE I. Group A inspection - Continued.

| Inspection 1/ | MIL-STD-750 | | Symbol | Limit | | Unit |
|---|---|---|---|---|---|---|
| | Method | Conditions | | Min | Max | |
| Subgroup 2 - Continued | | | | | | |
| Collector to emitter cutoff current | 3041 | Bias condition A; $V_{EB}$ = +2.0 V dc | $I_{CEX1}$ | | -1.0 | µA dc |
| 2N3867, 2N3867S, 2N3867U4<br>2N3868, 2N3868S, 2N3868U4 | | $V_{CE}$ = -40 V dc,<br>$V_{CE}$ = -60 V dc | | | | |
| Forward-current transfer ratio | 3076 | $V_{CE}$ = -1.0 V dc, $I_C$ = -500 mA dc, pulsed (see 4.5.1) | $h_{FE1}$ | | | |
| 2N3867, 2N3867S, 2N3867U4<br>2N3868, 2N3868S, 2N3868U4 | | | | 50<br>35 | | |
| Forward-current transfer ratio | 3076 | $V_{CE}$ = -2.0 V dc, $I_C$ = -1.5 A dc, pulsed (see 4.5.1) | $h_{FE2}$ | | | |
| 2N3867, 2N3867S, 2N3867U4<br>2N3868, 2N3868S, 2N3868U4 | | | | 40<br>30 | 200<br>150 | |
| Forward-current transfer ratio | 3076 | $V_{CE}$ = -3.0 V dc, $I_C$ = -2.5 A dc, pulsed (see 4.5.1) | $h_{FE3}$ | | | |
| 2N3867, 2N3867S, 2N3867U4<br>2N3868, 2N3868S, 2N3868U4 | | | | 25<br>20 | | |
| Forward-current transfer ratio | 3076 | $V_{CE}$ = -5.0 V dc, $I_C$ = -3.0 A dc, pulsed (see 4.5.1) | $h_{FE4}$ | 20 | | |
| Collector to emitter voltage (saturated) | 3071 | $I_C$ = -500 mA dc; $I_B$ = -50 mA dc, pulsed (see 4.5.1) | $V_{CE(sat)1}$ | | -0.5 | V dc |
| Collector to emitter voltage (saturated) | 3071 | $I_C$ = -1.5 A dc; $I_B$ = -150 mA dc; pulsed (see 4.5.1) | $V_{CE(sat)2}$ | | -0.75 | V dc |
| Collector to emitter voltage (saturated) | 3071 | $I_C$ = -2.5 A dc; $I_B$ = -250 mA dc; pulsed (see 4.5.1) | $V_{CE(sat)3}$ | | -1.5 | V dc |
| Base emitter voltage (saturated) | 3066 | Test condition A; $I_C$ = -500 mA dc; $I_B$ = -50 mA dc; pulsed (see 4.5.1) | $V_{BE(sat)1}$ | | -1.0 | V dc |
| Base emitter voltage (saturated) | 3066 | Test condition A; $I_C$ = -1.5 A dc; $I_B$ = -150 mA dc; pulsed (see 4.5.1) | $V_{BE(sat)2}$ | | | |
| 2N3867, 2N3867S, 2N3868, 2N3868S | | | | -0.9 | -1.4 | V dc |
| 2N3867U4, 2N3868U4 | | | | -0.85 | -1.4 | V dc |

See footnotes at end of table.

TABLE I. Group A inspection - Continued.

| Inspection 1/ | MIL-STD-750 | | Symbol | Limit | | Unit |
|---|---|---|---|---|---|---|
| | Method | Conditions | | Min | Max | |
| Subgroup 2 - continued. | | | | | | |
| Base emitter voltage (saturated) | 3066 | Test condition A; $I_C$ = -2.5 A dc; $I_B$ = -250 mA dc; pulsed (see 4.5.1) | $V_{BE(sat)3}$ | | -2.0 | V dc |
| Subgroup 3 | | | | | | |
| High temperature operation: | | $T_A$ = +150°C | | | | |
| Collector to emitter cutoff current | 3041 | Bias condition A, $V_{EB}$ = +2.0 V dc | $I_{CEX2}$ | | -50 | µA dc |
| 2N3867, 2N3867S, 2N3867U4 | | $V_{CE}$ = -40 V dc | | | | |
| 2N3868, 2N3868S, 2N3868U4 | | $V_{CE}$ = -60 V dc | | | | |
| Low temperature operation: | | $T_A$ = -55°C | | | | |
| Forward-current transfer ratio | 3076 | $V_{CE}$ = -1.0 V dc, $I_C$ = -500 mA dc, pulsed (see 4.5.1) | $h_{FE5}$ | | | |
| 2N3867, 2N3867S, 2N3867U4 | | | | 25 | | |
| 2N3868, 2N3868S, 2N3868U4 | | | | 17 | | |
| Subgroup 4 | | | | | | |
| Magnitude of common-emitter small-signal short-circuit forward-current transfer ratio | 3306 | $V_{CE}$ = -5 V dc, $I_C$ = -100 mA dc, f = 20 MHz | $\|h_{fe}\|$ | 3 | 12 | |
| Open circuit output capacitance | 3236 | $V_{CB}$ = 10 V dc, $I_E$ = 0, 100 kHz ≤ f ≤ 1 MHz | $C_{obo}$ | | 120 | pF |
| Input capacitance (output open-circuited) | 3240 | $V_{EB}$ = -3.0 V dc, $I_C$ = 0, 100 kHz ≤ f ≤ 1 MHz | $C_{ibo}$ | | 800 | pF |
| Subgroup 5 | | | | | | |
| Pulse response | 3251 | Test condition A | | | | |
| Delay time | | $V_{CC}$ = -30 V dc, $V_{EB}$ = 0, $I_C$ = -1.5 A dc, $I_{B1}$ = -150 mA dc, See figure 13 | $t_d$ | | 35 | ns |

See footnotes at end of table.

TABLE I. Group A inspection - Continued.

| Inspection 1/ | MIL-STD-750 | | Symbol | Limit | | Unit |
|---|---|---|---|---|---|---|
| | Method | Conditions | | Min | Max | |
| Subgroup 5 - Continued | | | | | | |
| Pulse response | 3251 | Test condition A | | | | |
| Rise time | | $V_{CC}$ = -30 V dc, $V_{EB}$ = 0 V dc, $I_C$ = -1.5 A dc, $I_{B1}$ = -150 mA dc, See figure 13 | $t_r$ | | 65 | ns |
| Storage time | | $V_{CC}$ = -30 V dc, $V_{EB}$ = 0 V dc, $I_C$ = -1.5 A dc, $I_{B1}$ = $I_{B2}$ = -150 mA dc, See figure 14 | $t_s$ | | 500 | ns |
| Fall time | | $V_{CC}$ = -30 V dc, $V_{EB}$ = 0 V dc, $I_C$ = -1.5 A dc, $I_{B1}$ = $I_{B2}$ = -150 mA dc, See figure 14 | $t_f$ | | 100 | ns |
| SOA (continuous dc) | 3051 | $T_C$ = +25°C, 1 cycle, t = 1.0 s, (see figure 15) | | | | |
| Test 1 | | $V_{CE}$ = -3.33 V dc, $I_C$ = -3 A dc | | | | |
| Test 2 | | | | | | |
| 2N3867, 2N3867S, 2N3867U4 | | $V_{CE}$ = -40 V dc, $I_C$ = -160 mA dc | | | | |
| 2N3868, 2N3868S, 2N3868U4 | | $V_{CE}$ = -60 V dc, $I_C$ = -80 mA dc | | | | |
| Electrical measurements | | See table 1 subgroup 2 and table IV, steps 1 and 2. | | | | |

1/ For sampling plan see MIL-PRF-19500.
2/ For resubmission of failed subgroup 1, double the sample size of the failed test or sequence of tests. A failure in table I, subgroup 1 shall not require retest of the entire subgroup. Only the failed test shall be rerun upon submission.
3/ Separate samples may be used.
4/ Not required for JANS devices.
5/ Not required for laser marked devices.

* TABLE II. Group D inspection.

| Inspection 1/ 2/ 3/ | MIL-STD-750 | | Symbol | Limit | | Unit |
|---|---|---|---|---|---|---|
| | Method | Conditions | | Min | Max | |
| Subgroup 1 4/ | | | | | | |
| Neutron Irradiation | 1017 | Neutron exposure Vces = 0 V | | | | |
| Collector to base cutoff current | 3036 | Condition D | $I_{CBO1}$ | | | |
| 2N3867, 2N3867S, 2N3867U4 | | $V_{CB}$ = -40 V dc | | | -200 | µA dc |
| 2N3868, 2N3868S, 2N3868U4 | | $V_{CB}$ = -60 V dc | | | -200 | µA dc |
| Emitter to base cutoff current | 3061 | Bias condition D; $V_{EB}$ = -4 V dc | $I_{EBO1}$ | | -200 | µA dc |
| Breakdown voltage, collector to emitter | 3011 | Bias condition D; $I_C$ = -20 mA dc; pulsed (see 4.5.1) | $V_{(BR)CEO}$ | | | |
| 2N3867, 2N3867S, 2N3867U4 | | | | -40 | | V dc |
| 2N3868, 2N3868S, 2N3868U4 | | | | -60 | | V dc |
| Collector to emitter cutoff current | 3041 | Bias condition A; $V_{EB}$ = 2.0 V dc | $I_{CEX1}$ | | -2.0 | µA dc |
| 2N3867, 2N3867S, 2N3867U4 | | $V_{CE}$ = -40 V dc, | | | | |
| 2N3868, 2N3868S, 2N3868U4 | | $V_{CE}$ = -60 V dc | | | | |
| Forward-current transfer ratio | 3076 | $V_{CE}$ = -1.0 V dc, $I_C$ = -500 mA dc, pulsed (see 4.5.1) | [$h_{FE1}$] 5/ | | | |
| 2N3867, 2N3867S, 2N3867U4 | | | | [25] | | |
| 2N3868, 2N3868S, 2N3868U4 | | | | [17.5] | | |
| Forward-current transfer ratio | 3076 | $V_{CE}$ = -2.0 V dc, $I_C$ = -1.5 A dc, pulsed (see 4.5.1) | [$h_{FE2}$] 5/ | | | |
| 2N3867, 2N3867S, 2N3867U4 | | | | [20] | 200 | |
| 2N3868, 2N3868S, 2N3868U4 | | | | [15] | 150 | |
| Forward-current transfer ratio | 3076 | $V_{CE}$ = -3.0 V dc, $I_C$ = -2.5 A dc, pulsed (see 4.5.1) | [$h_{FE3}$] 5/ | | | |
| 2N3867, 2N3867S, 2N3867U4 | | | | [12.5] | | |
| 2N3868, 2N3868S, 2N3868U4 | | | | [10] | | |
| Forward-current transfer ratio | 3076 | $V_{CE}$ = -5.0 V dc, $I_C$ = -3.0 A dc, pulsed (see 4.5.1) | [$h_{FE4}$] 5/ | [10] | | |

See footnotes at end of table.

* TABLE II Group D inspection - Continued.

| Inspection 1/ 2/ 3/ | MIL-STD-750 | | Symbol | Limit | | Unit |
|---|---|---|---|---|---|---|
| | Method | Conditions | | Min | Max | |
| Subgroup 1 - Continued 4/ | | | | | | |
| Collector to emitter voltage (saturated) | 3071 | $I_C$ = -500 mA dc; $I_B$ = -50 mA dc, pulsed (see 4.5.1) | $V_{CE(sat)1}$ | | -0.575 | V dc |
| Collector to emitter voltage (saturated) | 3071 | $I_C$ = -1.5 A dc; $I_B$ = -150 mA dc; pulsed (see 4.5.1) | $V_{CE(sat)2}$ | | -0.86 | V dc |
| Collector to emitter voltage (saturated) | 3071 | $I_C$ = -2.5 A dc; $I_B$ = -250 mA dc; pulsed (see 4.5.1) | $V_{CE(sat)3}$ | | -1.73 | V dc |
| Base emitter voltage (saturated) | 3066 | Test condition A; $I_C$ = -500 mA dc; $I_B$ = -50 mA dc; pulsed (see 4.5.1) | $V_{BE(sat)1}$ | | -1.15 | V dc |
| Base emitter voltage (saturated) | 3066 | Test condition A; $I_C$ = -1.5 A dc; $I_B$ = -150 mA dc; pulsed (see 4.5.1) | $V_{BE(sat)2}$ | | | |
| 2N3867, 2N3867S, 2N3868, 2N3868S | | | | -0.9 | -1.61 | V dc |
| 2N3867U4, 2N3868U4 | | | | -0.85 | -1.61 | V dc |
| Base emitter voltage (saturated) | 3066 | Test condition A; $I_C$ = -2.5 A dc; $I_B$ = -250 mA dc; pulsed (see 4.5.1) | $V_{BE(sat)3}$ | | -2.3 | V dc |
| Subgroup 2 | | | | | | |
| * Total dose irradiation | 1019 | Gamma exposure, Condition A. | | | | |
| 2N3867 | | Vces = -32V | | | | |
| 2N3868 | | Vces = -48V | | | | |
| Collector to base cutoff current | 3036 | Condition D | $I_{CBO1}$ | | | |
| 2N3867, 2N3867S, 2N3867U4 | | $V_{CB}$ = -40 V dc | | | -200 | µA dc |
| 2N3868, 2N3868S, 2N3868U4 | | $V_{CB}$ = -60 V dc | | | -200 | µA dc |
| Emitter to base cutoff current | 3061 | Bias condition D; $V_{EB}$ = -4 V dc | $I_{EBO1}$ | | -200 | µA dc |
| Breakdown voltage, collector to emitter | 3011 | Bias condition D; $I_C$ = -20 mA dc; pulsed (see 4.5.1) | $V_{(BR)CEO}$ | | | |
| 2N3867, 2N3867S, 2N3867U4 | | | | -40 | | V dc |
| 2N3868, 2N3868S, 2N3868U4 | | | | -60 | | V dc |

See footnotes at end of table.

* TABLE II Group D inspection - Continued.

| Inspection 1/ 2/ 3/ | MIL-STD-750 | | Symbol | Limit | | Unit |
|---|---|---|---|---|---|---|
| | Method | Conditions | | Min | Max | |
| Subgroup 2 - Continued | | | | | | |
| Collector to emitter cutoff current | 3041 | Bias condition A; $V_{EB}$ = +2.0 V dc | $I_{CEX1}$ | | -2.0 | µA dc |
| 2N3867, 2N3867S, 2N3867U4<br>2N3868, 2N3868S, 2N3868U4 | | $V_{CE}$ = -40 V dc,<br>$V_{CE}$ = -60 V dc | | | | |
| Forward-current transfer ratio | 3076 | $V_{CE}$ = -1.0 V dc, $I_C$ = -500 mA dc, pulsed (see 4.5.1) | [$h_{FE1}$] 5/ | | | |
| 2N3867, 2N3867S, 2N3867U4<br>2N3868, 2N3868S, 2N3868U4 | | | | [25]<br>[17.5] | | |
| Forward-current transfer ratio | 3076 | $V_{CE}$ = -2.0 V dc, $I_C$ = -1.5 A dc, pulsed (see 4.5.1) | [$h_{FE2}$] 5/ | | | |
| 2N3867, 2N3867S, 2N3867U4<br>2N3868, 2N3868S, 2N3868U4 | | | | [20]<br>[15] | 200<br>150 | |
| Forward-current transfer ratio | 3076 | $V_{CE}$ = -3.0 V dc, $I_C$ = -2.5 A dc, pulsed (see 4.5.1) | [$h_{FE3}$] 5/ | | | |
| 2N3867, 2N3867S, 2N3867U4<br>2N3868, 2N3868S, 2N3868U4 | | | | [12.5]<br>[10] | | |
| Forward-current transfer ratio | 3076 | $V_{CE}$ = -5.0 V dc, $I_C$ = -3.0 A dc, pulsed (see 4.5.1) | [$h_{FE4}$] 5/ | [10] | | |
| Collector to emitter voltage (saturated) | 3071 | $I_C$ = -500 mA dc; $I_B$ = -50 mA dc, pulsed (see 4.5.1) | $V_{CE(sat)1}$ | | -0.575 | V dc |
| Collector to emitter voltage (saturated) | 3071 | $I_C$ = -1.5 A dc; $I_B$ = -150 mA dc; pulsed (see 4.5.1) | $V_{CE(sat)2}$ | | -0.86 | V dc |
| Collector to emitter voltage (saturated) | 3071 | $I_C$ = -2.5 A dc; $I_B$ = -250 mA dc; pulsed (see 4.5.1) | $V_{CE(sat)3}$ | | -1.73 | V dc |
| Base emitter voltage (saturated) | 3066 | Test condition A; $I_C$ = -500 mA dc; $I_B$ = -50 mA dc; pulsed (see 4.5.1) | $V_{BE(sat)1}$ | | -1.15 | V dc |
| Base emitter voltage (saturated) | 3066 | Test condition A; $I_C$ = -1.5 A dc; $I_B$ = -150 mA dc; pulsed (see 4.5.1) | $V_{BE(sat)2}$ | | | |
| 2N3867, 2N3867S, 2N3868, 2N3868S | | | | -0.9 | -1.61 | V dc |
| 2N3867U4, 2N3868U4 | | | | -0.85 | -1.61 | V dc |
| Base emitter voltage (saturated) | 3066 | Test condition A; $I_C$ = -2.5 A dc; $I_B$ = -250 mA dc; pulsed (see 4.5.1) | $V_{BE(sat)3}$ | | -2.3 | V dc |

See footnotes at end of table.

* TABLE II Group D inspection - Continued.

1/ Tests to be performed on all devices receiving radiation exposure.
2/ For sampling plan, see MIL-PRF-19500.
3/ Electrical characteristics apply to all device types unless otherwise noted.
4/ See 6.2.e herein.
5/ See method 1019, of MIL-STD-750, for how to determine [$h_{FE}$] by first calculating the delta($1/h_{FE}$) from the pre and post radiation $h_{FE}$. The [$h_{FE}$] is not the same as $h_{FE}$ and cannot be measured directly. The [$h_{FE}$] value can never exceed the pre-radiation minimum $h_{FE}$ that it is based upon.

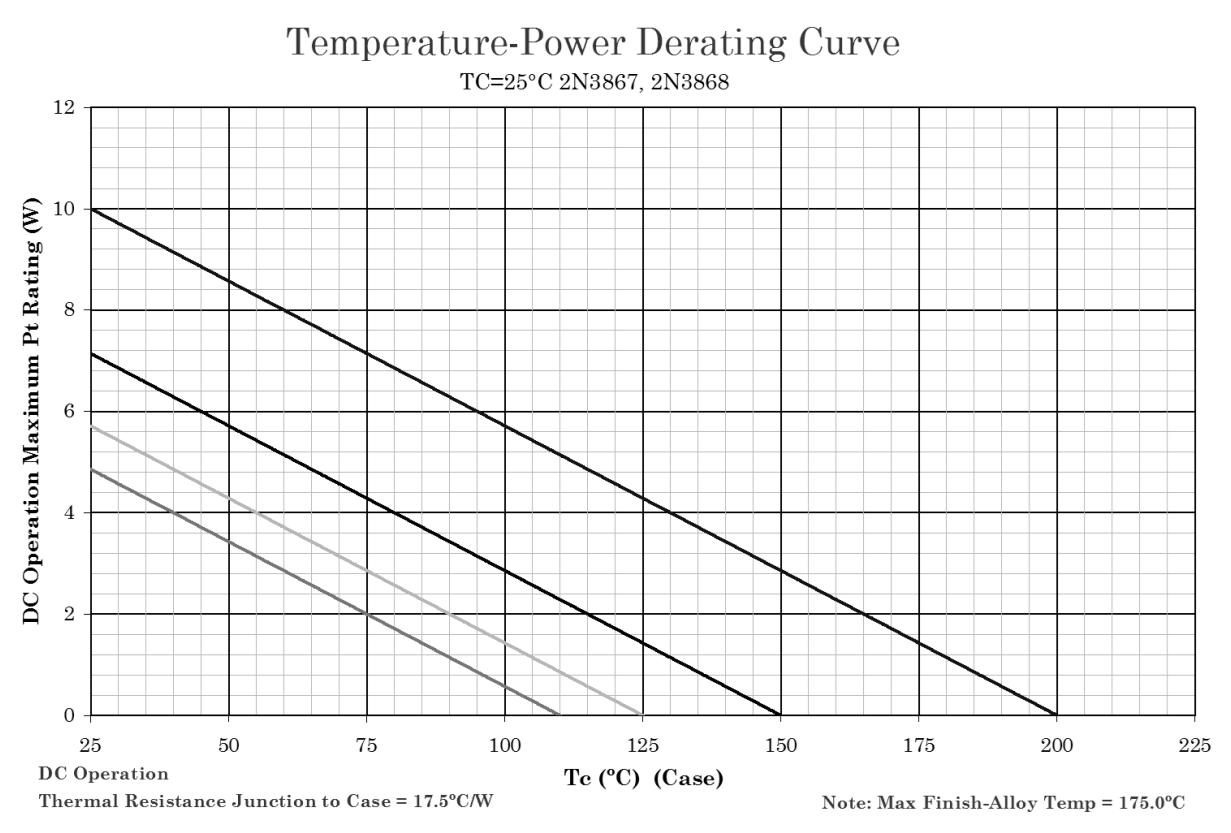
TABLE III. Group E inspection (all quality levels) - for qualification and re-qualification only.

| Inspection | MIL-STD-750 | | Qualification |
|---|---|---|---|
| | Method | Conditions | |
| Subgroup 1 | | | 45 devices<br>c = 0 |
| Temperature cycling (air to air) | 1051 | Test condition C, 500 cycles | |
| Hermetic seal | 1071 | | |
| Fine leak<br>Gross leak | | | |
| Electrical measurements | | See table I, subgroup 2 and table III herein. | |
| Subgroup 2 | | | 45 devices<br>c = 0 |
| Intermittent life | 1037 | $V_{CB}$ = -10 V dc, 6,000 cycles, adjust device current, or power, to achieve a minimum $\Delta T_J$ of +100°C. Forced air cooling allowed on cooling cycle only. | |
| Electrical measurements | | See table I, subgroup 2 and table III herein. | |
| Subgroup 4 | | | |
| Thermal impedance curves | | See MIL-PRF-19500. table E-IX, group E, subgroup 4. | Sample size N/A |
| Subgroups 5 | | | |
| Not applicable | | | |
| Subgroup 8 | | | 45 devices<br>c = 0 |
| Reverse stability | 1033 | Condition B. | |

TABLE IV. Delta measurements.

| Step | Inspection | MIL-STD-750 | | Symbol | Limit | Unit |
|---|---|---|---|---|---|---|
| | | Method | Conditions | | | |
| 1 | Collector-base cutoff current | 3041 | Bias condition A, $V_{EB}$ = +2.0 V dc | $\Delta I_{CEX1}$ 1/ | 100 percent of initial value or -200 nA dc, whichever is greater. | |
| | 2N3867, 2N3867S, 2N3867U4<br>2N3868, 2N3868S, 2N3868U4 | | $V_{CE}$ = -40 V dc<br>$V_{CE}$ = -60 V dc | | | |
| 2 | Forward current transfer ratio | 3076 | $V_{CE}$ = -2 V dc; $I_C$ = -1.5 A dc; pulsed see 4.5.1 | $\Delta h_{FE2}$ 1/ | 15 percent change from initial reading. | |

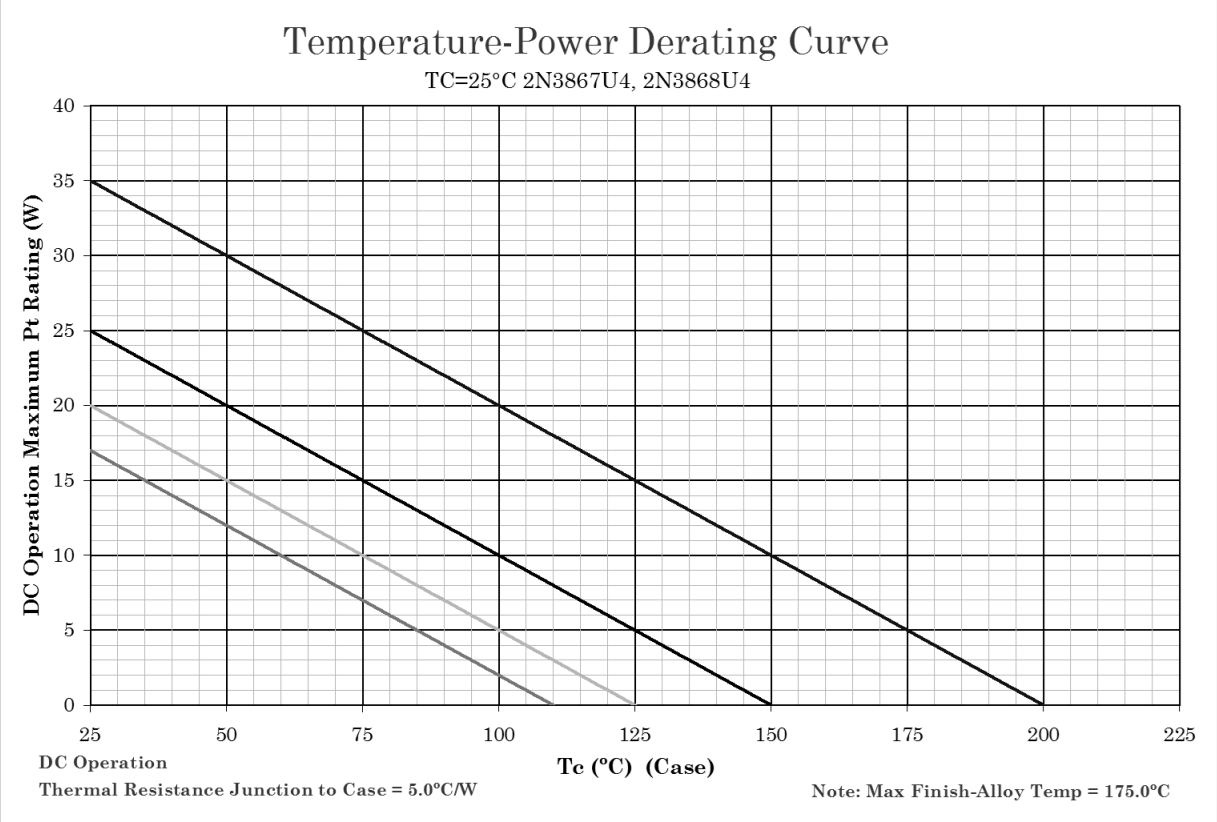
1/ Devices which exceed the table I limits for this test shall not be accepted.




NOTES:

1. All devices are capable of operating at ≤ $T_J$ specified on this curve. Any parallel line to this curve will intersect the appropriate power for the desired maximum $T_J$ allowed.
2. Derate design curve constrained by the maximum junction temperatures 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.

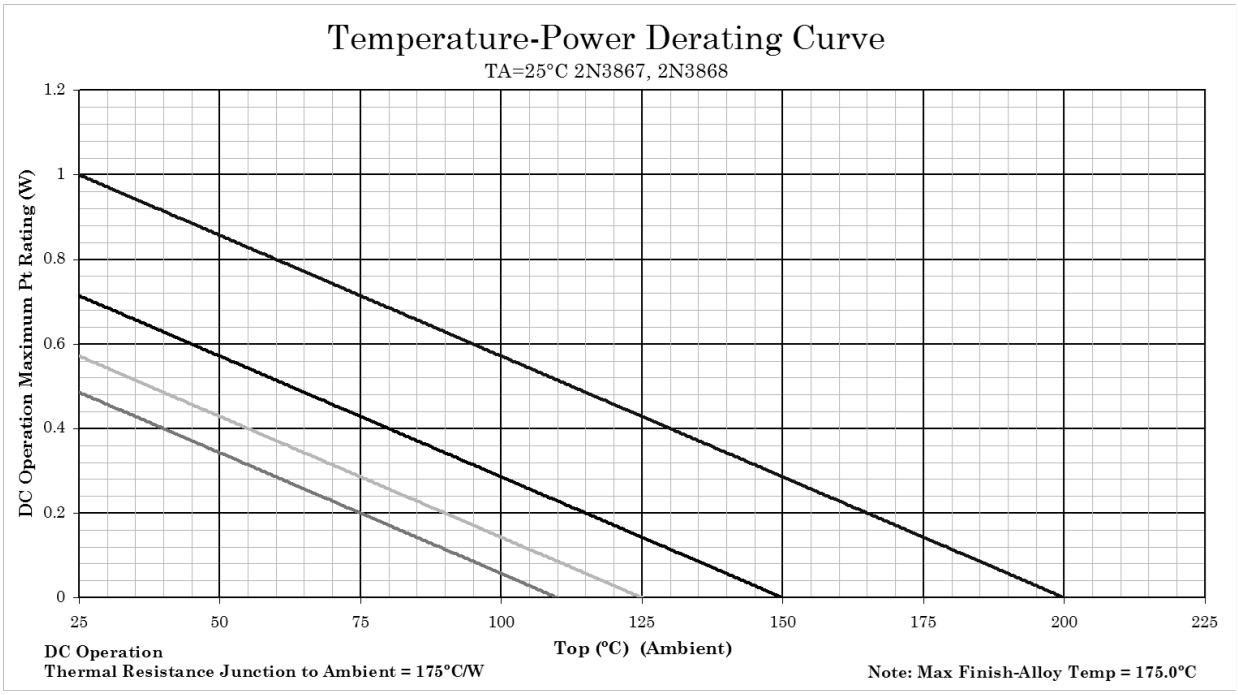
FIGURE 5. Derating for 2N3867, 2N3868 (TO-5, TO-39).




NOTES:

1. All devices are capable of operating at ≤ $T_J$ specified on this curve. Any parallel line to this curve will intersect the appropriate power for the desired maximum $T_J$ allowed.
2. Derate design curve constrained by the maximum junction temperatures 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.

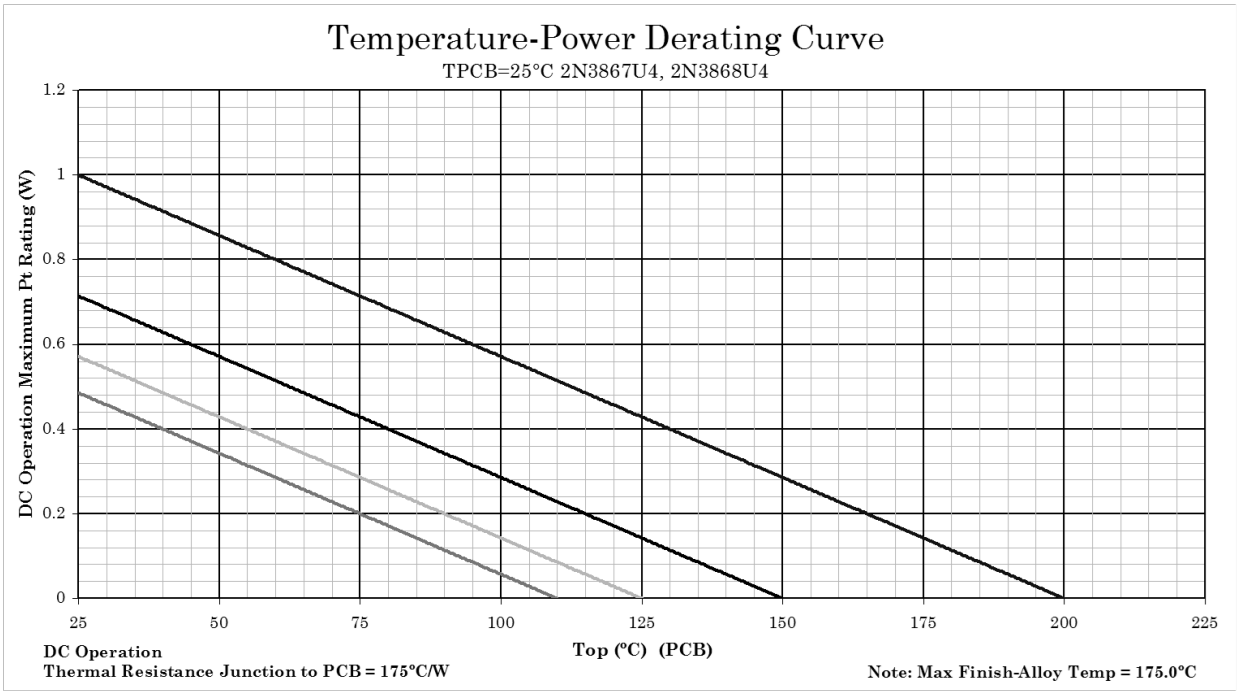
FIGURE 6. Derating for 2N3867U4, 2N3868U4.




NOTES:

1. All devices are capable of operating at ≤ $T_J$ specified on this curve. Any parallel line to this curve will intersect the appropriate power for the desired maximum $T_J$ allowed.
2. Derate design curve constrained by the maximum junction temperatures 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.

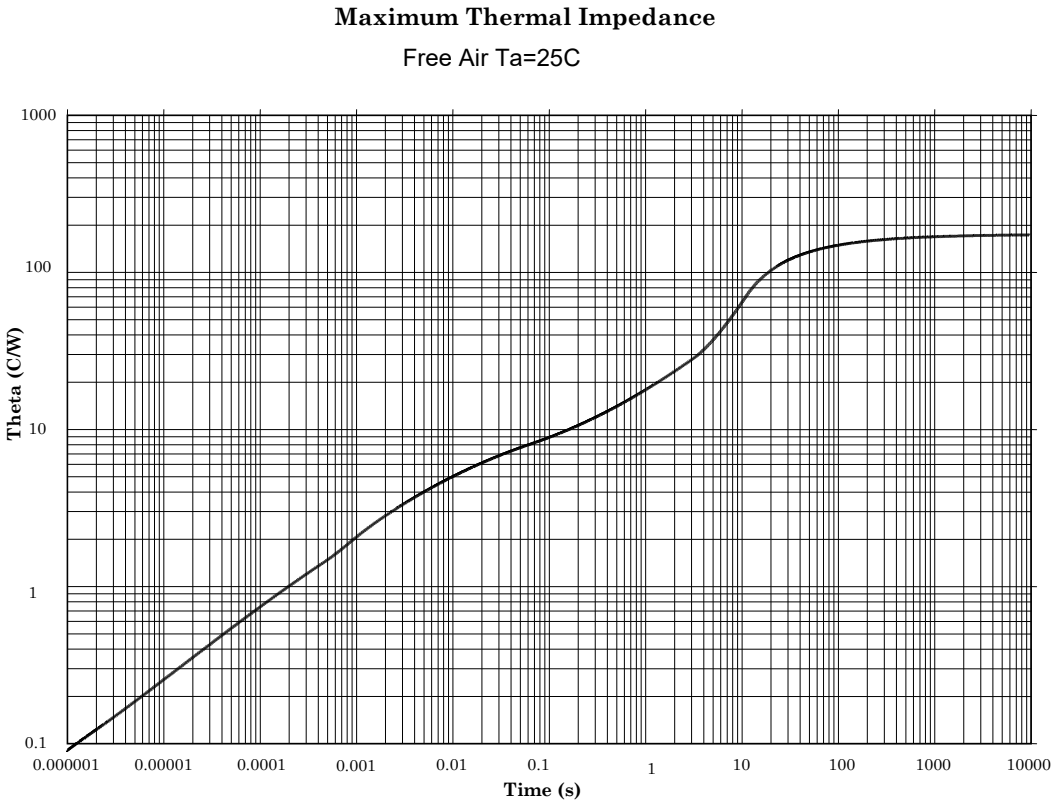
FIGURE 7. Derating for 2N3867, 2N3868.




NOTES:

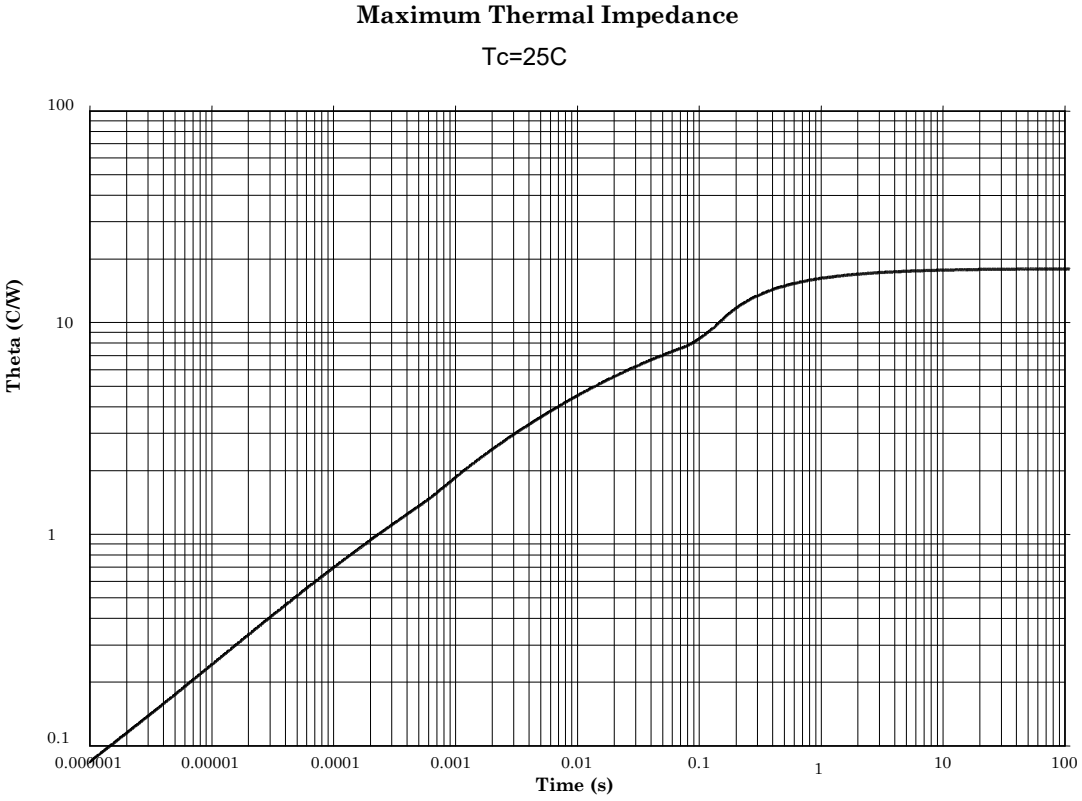
1. All devices are capable of operating at ≤ $T_J$ specified on this curve. Any parallel line to this curve will intersect the appropriate power for the desired maximum $T_J$ allowed.
2. Derate design curve constrained by the maximum junction temperatures and power rating specified. (See 1.3 herein.)
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 8. Derating for 2N3867U4, 2N3868U4.




$R_{\theta JA}$ = 175 °C/W

FIGURE 9. Thermal impedance for 2N3867 and 2N3868 (TO-5 and TO-39).




$R_{\theta JC}$ = 17.5 °C/W

FIGURE 10. Thermal impedance for 2N3867 and 2N3868 (TO-5 and TO-39).

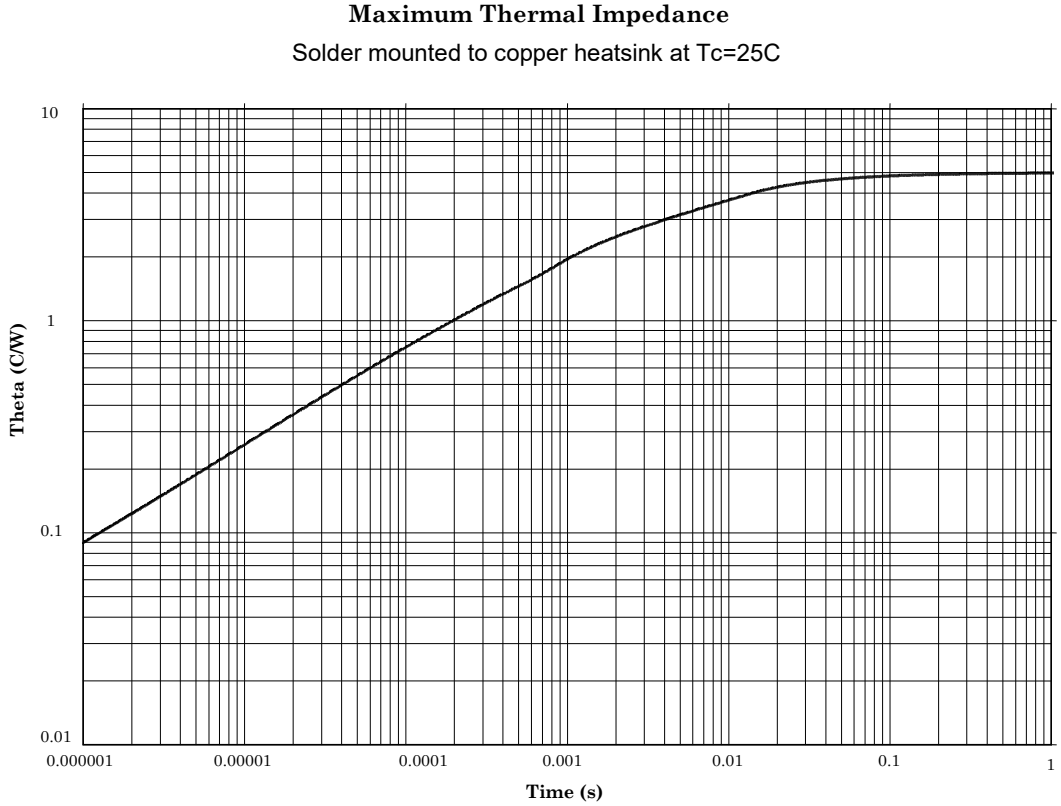



FIGURE 11. Thermal impedance for 2N3867U4, 2N3868U4.

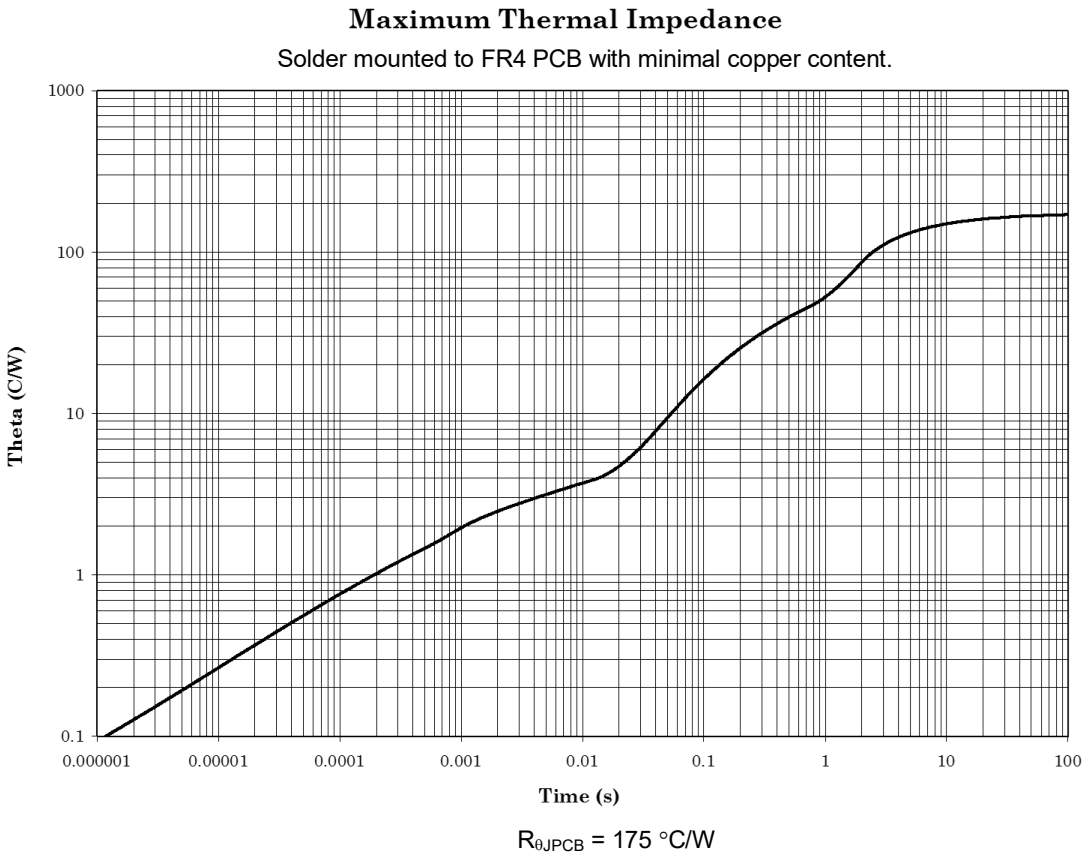



FIGURE 12. Thermal impedance for 2N3867U4, 2N3868U4.

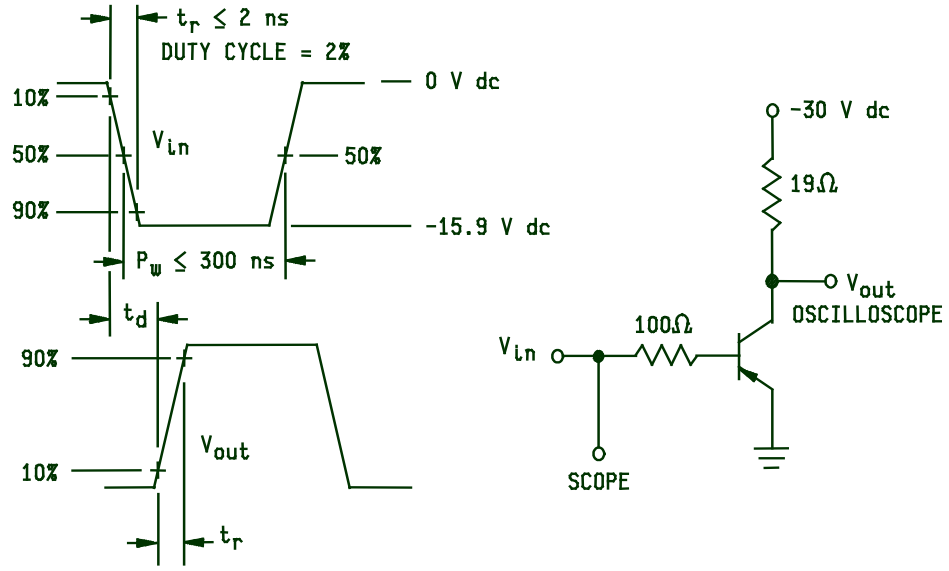



FIGURE 13. Equivalent circuit for measuring delay and rise times.

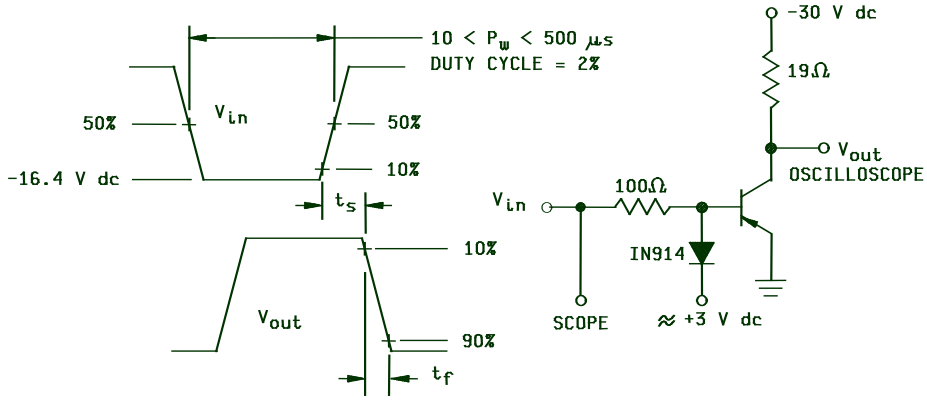



FIGURE 14. Equivalent circuit for measuring storage and fall times.

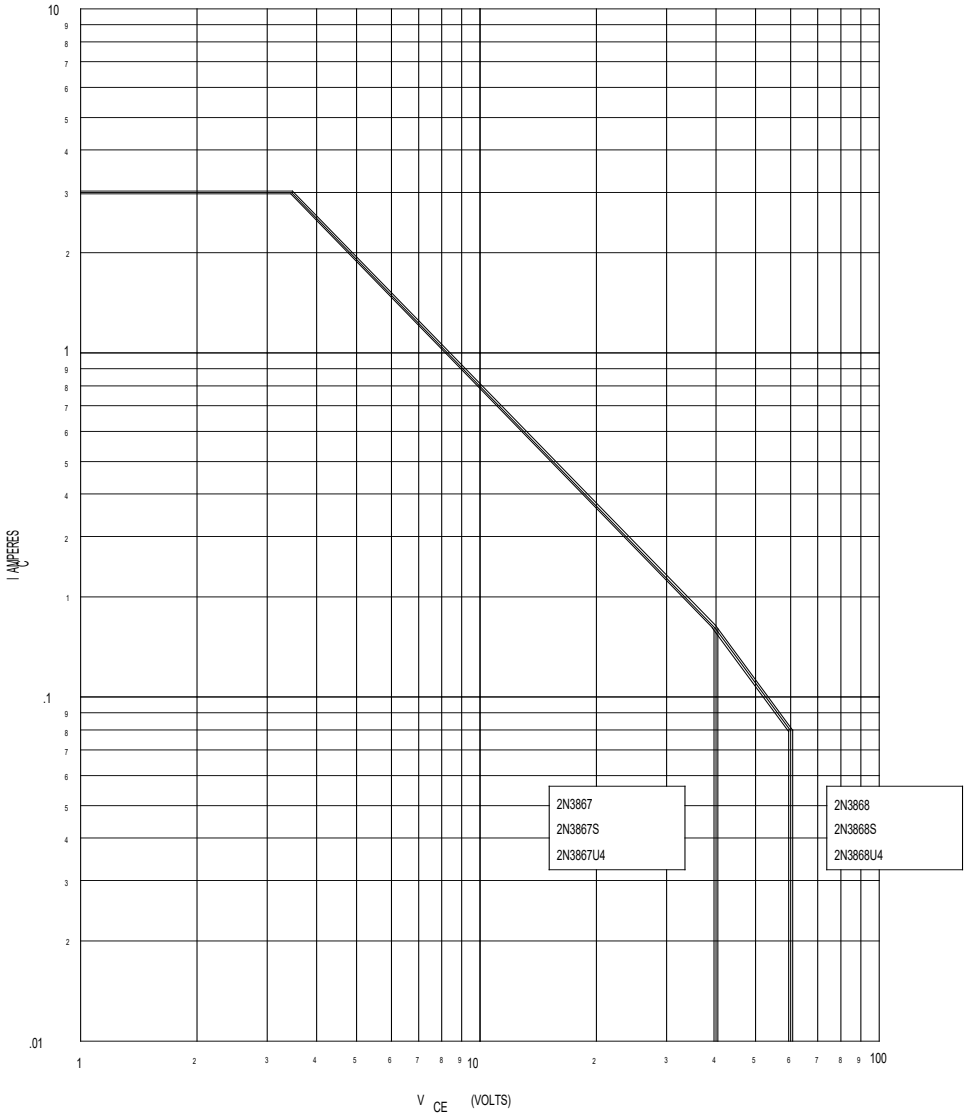



FIGURE 15. Maximum SOA graph (continuous dc).

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).

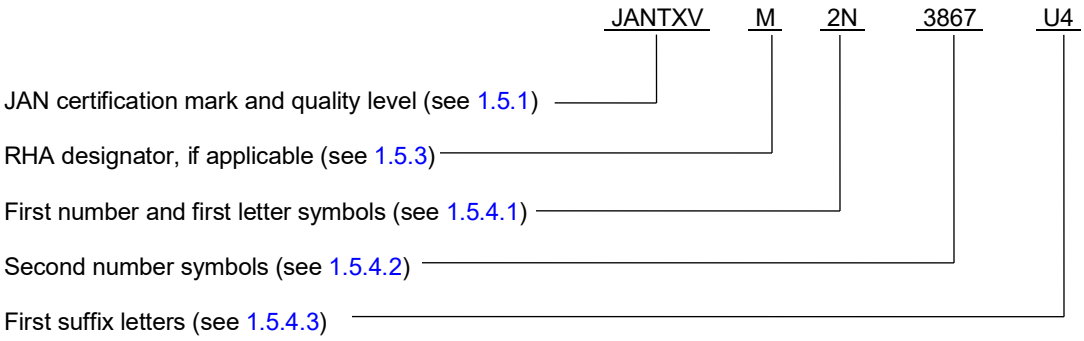
d. The complete PIN, see 1.5 and 6.5.

e. For acquisition of RHA designated devices, table II, subgroup 1 testing of group D is optional. If subgroup 1 testing is desired, it should be specified in the contract.

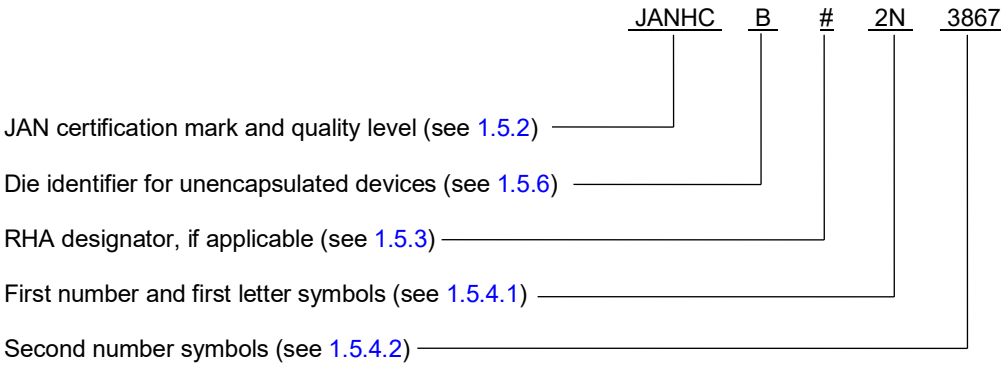
6.3 Qualification. With respect to products requiring qualification, awards will be made only for products which are, at the time of award of contract, qualified for inclusion in Qualified Manufacturers List (QML-19500) whether or not such products have actually been so listed by that date. The attention 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.dla.mil.

6.4 PIN construction example.

6.4.1 Encapsulated devices The PINs for encapsulated devices are constructed using the following form.




6.4.2 Un-encapsulated devices. The PINs for un-encapsulated devices are constructed using the following form.




6.5 List of PINs.

6.5.1 List of PINs for encapsulated devices. The following is a list of possible PINs for encapsulated devices available on this specification sheet.

| PINs for devices of the base quality level | PINs for devices of the "TX" quality level | PINs for devices of the "TXV" quality level | PINs for devices of the "S" quality level |
|---|---|---|---|
| JAN2N3867 | JANTX2N3867 | JANTXV#2N3867 | JANS#2N3867 |
| JAN2N3867S | JANTX2N3867S | JANTXV#2N3867S | JANS#2N3867S |
| JAN2N3867U4 | JANTX2N3867U4 | JANTXV#2N3867U4 | JANS#2N3867U4 |
| JAN2N3868 | JANTX2N3868 | JANTXV#2N3868 | JANS#2N3868 |
| JAN2N3868S | JANTX2N3868S | JANTXV#2N3868S | JANS#2N3868S |
| JAN2N3868U4 | JANTX2N3868U4 | JANTXV#2N3868U4 | JANS#2N3868U4 |

(1) The number sign (#) represent one of eight RHA designators available (M, D, P, L, R, F, G, or H) if desired. Remove for no RHA.

6.5.2 List of PINs for unencapsulated devices. The following is a list of possible PINs available on this specification sheet for unencapsulated die. The qualified JANHC and JANKC suppliers with the applicable letter version (example, JANHCB2N3867) will be identified on the QML.

| JANHC and JANKC ordering information | | |
|---|---|---|
| PIN | Manufacturers | |
| | 43611 | 52GC4 |
| 2N3867 | JANHCB#2N3867, JANKCB#2N3867 | JANHCC#2N3867, JANKCC#2N3867 |
| 2N3868 | JANHCB#2N3868, JANKCB#2N3868 | JANHCC#2N3868, JANKCC#2N3868 |

(1) The number sign (#) represent the RHA designators available "M", "D", "P", "L", "R", "F", "G", and "H" if desired. Remove for no RHA.

6.6 Amendment notations. The margins of this specification are marked with asterisks to indicate modifications generated by this amendment. 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.

Custodians:
Army - CR
* Navy - SH
Air Force - 85
* NASA - NA
DLA - CC

Review activities:
Army - AR, MI, SM
Navy - AS, MC
* Air Force - 19, 71

Preparing activity:
DLA - CC

(Project 5961-2021-047)

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.