

The documentation and process conversion measures necessary to comply with this document shall be completed by 15 December 2024.

INCH-POUND

MIL-PRF-19500/472G  
w/AMENDMENT 1  
15 July 2024  
SUPERSEDING  
MIL-PRF-19500/472G  
26 April 2019

## PERFORMANCE SPECIFICATION SHEET

TRANSISTOR, NPN, SILICON, POWER DARLINGTON,  
TYPES 2N6350, 2N6351, 2N6352, AND 2N6353,  
QUALITY LEVELS JAN, JANTX, JANTXV, AND JANHC

Inactive for new design after 7 June 1999

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 NPN silicon power Darlington transistors. Three levels of product assurance (JAN, JANTX, and JANTXV) are provided for each encapsulated device type as specified in [MIL-PRF-19500](#). One level of product assurance (JANHC) is provided for each unencapsulated device type as specified in [MIL-PRF-19500](#).

### 1.2 Physical dimensions.

1.2.1 Package outlines. The device package outlines are as follows: 4-pin TO-33 in accordance with [figure 1](#) for device types 2N6350 and 2N6351 and 3-pin TO-66 in accordance with [figure 2](#) for device types 2N6352 and 2N6353.

1.2.2 Unencapsulated die. The dimensions and topography for JANHC unencapsulated die (A-version) is in accordance with [figure 3](#).

### 1.3 Maximum ratings. Unless otherwise specified, $T_A = +25^\circ\text{C}$ .

| Types  | $P_T$                     |                            | $R_{\theta JC}$<br>Max               | $V_{EB1}$   | $V_{EB2}$   | $V_{CB01}$<br>and $V_{CER}$ | $I_C$       | $I_C$ (1)   | $I_{B1}$    | $T_J$ and<br>$T_{STG}$             |
|--------|---------------------------|----------------------------|--------------------------------------|-------------|-------------|-----------------------------|-------------|-------------|-------------|------------------------------------|
|        | $T_A = +25^\circ\text{C}$ | $T_C = +100^\circ\text{C}$ |                                      |             |             |                             |             |             |             |                                    |
|        | <u>W</u>                  | <u>W</u>                   | <u><math>^\circ\text{C/W}</math></u> | <u>V dc</u> | <u>V dc</u> | <u>V dc</u>                 | <u>A dc</u> | <u>A dc</u> | <u>A dc</u> | <u><math>^\circ\text{C}</math></u> |
| 2N6350 | 1.0 (2)                   | 5 (3)                      | 20                                   | 12          | 6           | 80                          | 5           | 10          | 0.5         | -65 to +200                        |
| 2N6351 | 1.0 (2)                   | 5 (3)                      | 20                                   | 12          | 6           | 150                         | 5           | 10          | 0.5         | -65 to +200                        |
| 2N6352 | 2.0 (4)                   | 25 (5)                     | 4.0                                  | 12          | 6           | 80                          | 5           | 10          | 0.5         | -65 to +200                        |
| 2N6353 | 2.0 (4)                   | 25 (5)                     | 4.0                                  | 12          | 6           | 150                         | 5           | 10          | 0.5         | -65 to +200                        |

- (1) Applies for  $t_p \leq 10$  ms, duty cycle  $\leq 50$  percent.
- (2) Derate linearly 5.72 mW/ $^\circ\text{C}$  for  $T_A > +25^\circ\text{C}$ .
- (3) Derate linearly 50 mW/ $^\circ\text{C}$  for  $T_C > +100^\circ\text{C}$ .
- (4) Derate linearly 11.4 mW/ $^\circ\text{C}$  for  $T_A > +25^\circ\text{C}$ .
- (5) Derate linearly 250 mW/ $^\circ\text{C}$  for  $T_C > +100^\circ\text{C}$ .

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](mailto: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>.

AMSC N/A

DISTRIBUTION STATEMENT A. Approved for public release. Distribution is unlimited.

FSC 5961



MIL-PRF-19500/472G  
w/AMENDMENT 1

1.4 Primary electrical characteristics. Unless otherwise specified,  $T_A = +25^\circ\text{C}$ .

| Limits | $h_{FE}$ (1)<br>$V_{CE} = 5\text{ V dc}$<br>$I_C = 5\text{ A dc}$ |                  | $ h_{fe} $ (1)<br>$V_{CE} = 10\text{ V dc}$<br>$I_C = 1\text{ A dc}$<br>$f = 10\text{ MHz}$ | $V_{BE(ON)1}$<br>$V_{CE} = 5\text{ V dc}$<br>$I_C = 5\text{ A dc}$ | $C_{OBO}$<br>$V_{CB1} = 10\text{ V dc}$ ,<br>$100\text{ kHz} \leq f \leq 1\text{ MHz}$<br>base 2 open |
|--------|-------------------------------------------------------------------|------------------|---------------------------------------------------------------------------------------------|--------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------|
|        | 2N6350<br>2N6352                                                  | 2N6351<br>2N6353 |                                                                                             |                                                                    |                                                                                                       |
| Min    | 2,000                                                             | 1,000            | 5                                                                                           | <u>V dc</u>                                                        | <u>pF</u>                                                                                             |
| Max    | 10,000                                                            | 10,000           | 25                                                                                          | 2.5                                                                | 120                                                                                                   |

| Limits | $V_{CE(SAT)}$<br>$R_{B2E} = 100\ \Omega$<br>$I_C = 5\text{ A dc}$<br>$I_{B1} = 5\text{ mA dc}$<br>2N6350<br>2N6352 |             | Pulse response (2)<br>$V_{CC} = 30\text{ V dc}$<br>$I_C = 5\text{ A dc}$ |                                 |
|--------|--------------------------------------------------------------------------------------------------------------------|-------------|--------------------------------------------------------------------------|---------------------------------|
|        | $R_{B2E} = 100\ \Omega$<br>$I_C = 5\text{ A dc}$<br>$I_{B1} = 10\text{ mA dc}$<br>2N6351<br>2N6353                 |             | $t_{on}$                                                                 | $t_{off}$                       |
| Min    | <u>V dc</u>                                                                                                        | <u>V dc</u> | <u><math>\mu\text{s}</math></u>                                          | <u><math>\mu\text{s}</math></u> |
| Max    | 1.5                                                                                                                | 2.5         | 0.5                                                                      | 1.2                             |

(1) Pulsed (see 4.5.1).

(2) See figures 4 and 5 for pulse response circuits.

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.

1.5.1.1 Quality level designators 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", and "JANTXV".

1.5.1.2 Quality level designators for unencapsulated devices (die). The quality level designators for unencapsulated devices that are applicable for this specification sheet are "JANHC".

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

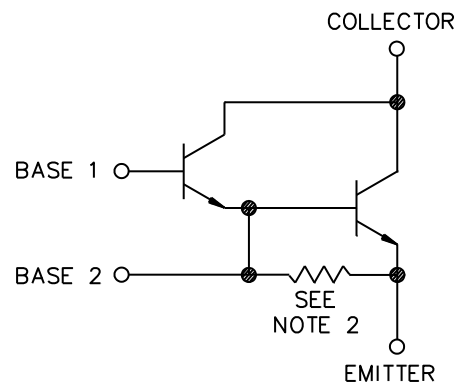
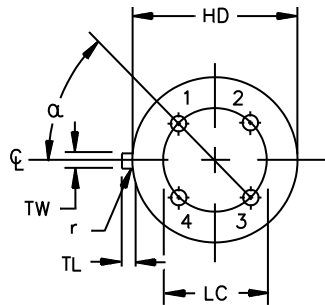
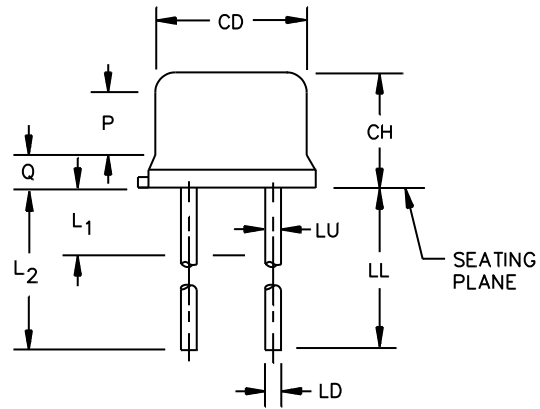
1.5.2.1 First number and first letter symbols. The devices of this specification sheet use the first number and letter symbols "2N".

1.5.2.2 Second number symbols. The second number symbols for the devices covered by this specification sheet are as follows: "6350", "6351", "6352", and "6353".

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

1.5.4 Die identifiers for unencapsulated devices. The manufacturer die identifier applicable for this specification sheet is "A" (see figure 3 and 6.5).

MIL-PRF-19500/472G  
w/AMENDMENT 1



SCHEMATIC CIRCUIT

FIGURE 1. Physical dimensions for TO-33 package and schematic circuit for 2N6350 and 2N6351.

MIL-PRF-19500/472G  
w/AMENDMENT 1

| Symbol         | Dimensions |       |             |       | Notes |
|----------------|------------|-------|-------------|-------|-------|
|                | Inches     |       | Millimeters |       |       |
|                | Min        | Max   | Min         | Max   |       |
| CD             | .305       | .335  | 7.75        | 8.51  | 3     |
| CH             | .184       | .260  | 4.67        | 6.60  |       |
| HD             | .335       | .370  | 8.51        | 9.40  |       |
| LC             | 0.200 TP   |       | 5.080 TP    |       | 4     |
| LD             | .016       | .021  | 0.407       | 0.533 | 5, 6  |
| LL             | 1.500      | 1.750 | 38.10       | 44.45 | 5, 6  |
| L <sub>1</sub> |            | .050  |             | 1.27  | 5, 6  |
| L <sub>2</sub> | .250       |       | 6.35        |       | 5, 6  |
| LU             | .016       | .019  | 0.407       | 0.482 | 5, 6  |
| TL             | .029       | .045  | 0.74        | 1.14  | 7     |
| TW             | .028       | .034  | 0.712       | 0.863 | 8     |
| P              | .100       |       | 2.54        |       | 3     |
| Q              |            | .050  |             | 1.27  | 9     |
| r              |            | .010  |             | 0.254 | 10    |
| $\alpha$       | 45° TP     |       | 45° TP      |       | 4     |

NOTES:

1. Dimensions are in inches. Millimeters are given for general information only.
2. Internal resistance (typically 750 ohms). This resistor is optional.
3. Dimension CD shall not vary more than .010 inch (0.25 mm) in zone P. This zone is controlled for automatic handling.
4. 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.
5. Dimension LU applies between dimension L<sub>1</sub> and dimension L<sub>2</sub>. Dimension LD applies between L<sub>2</sub> and LL minimum. Diameter is uncontrolled in dimension L<sub>1</sub> and beyond dimension LL minimum.
6. All terminals.
7. Dimension TL measured from maximum HD.
8. Beyond r (radius) maximum, dimension TW shall be held for a minimum length of .011 inch (0.28 mm).
9. Outline in this zone is not controlled.
10. The-radius (dimension r) applies to both inside corners of the tab.
11. Terminal designation is as follows: 1 – emitter, 2 – base 2 (B2), 3 – base 1 (B1), 4 – collector. The collector shall be connected to the case.

\* FIGURE 1. Physical dimensions for 3-pin TO-66 package and schematic circuit for 2N6352 and 2N6353  
– Continued.

MIL-PRF-19500/472G  
w/AMENDMENT 1

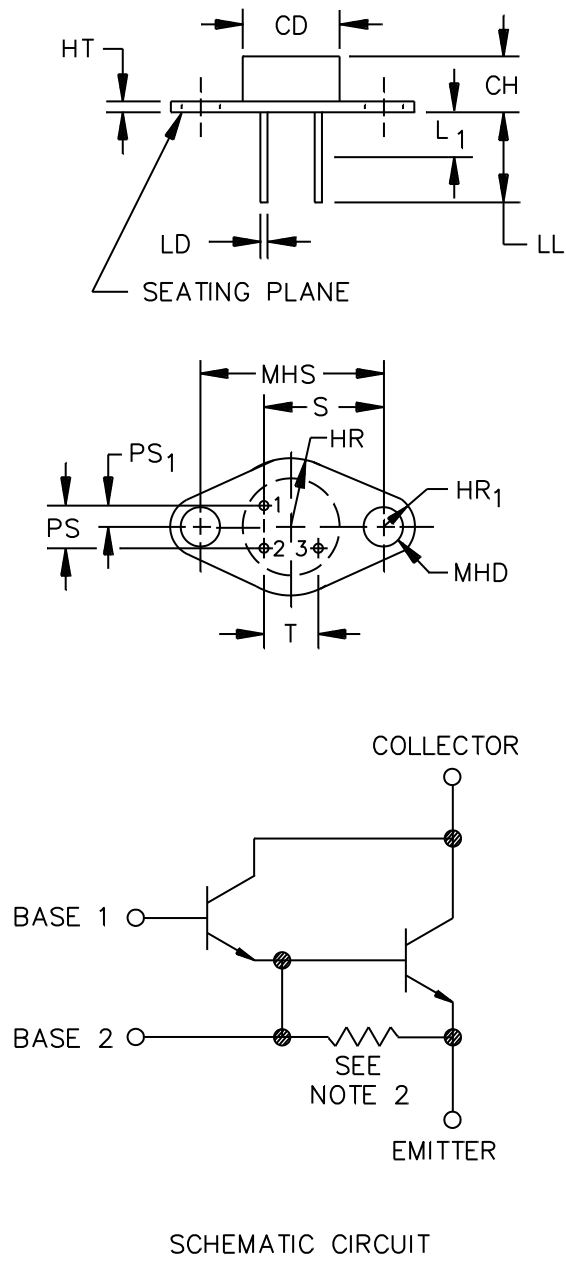


FIGURE 2. Physical dimensions for 3-pin TO-66 package and schematic circuit for 2N6352 and 2N6353.

MIL-PRF-19500/472G  
w/AMENDMENT 1

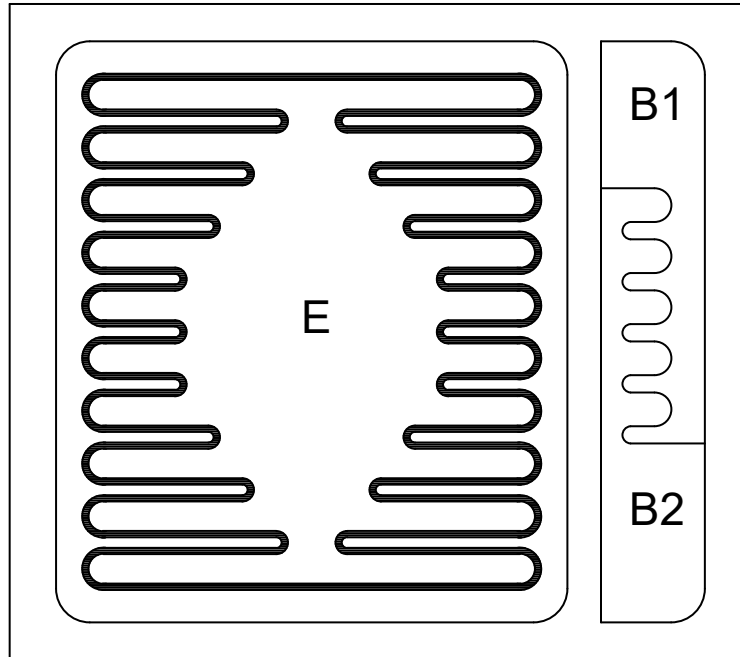
| Symbol          | Dimensions |      |             |       | Notes |
|-----------------|------------|------|-------------|-------|-------|
|                 | Inches     |      | Millimeters |       |       |
|                 | Min        | Max  | Min         | Max   |       |
| CD              |            | .620 |             | 15.75 |       |
| CH              | .250       | .340 | 6.35        | 8.64  |       |
| HT              | .050       | .075 | 1.27        | 1.91  | 3     |
| HR              |            | .350 |             | 8.89  |       |
| HR <sub>1</sub> | .115       | .145 | 2.92        | 3.68  |       |
| LD              | .028       | .034 | 0.711       | 0.863 | 4     |
| LL              | .360       | .500 | 9.14        | 12.70 | 4     |
| L <sub>1</sub>  |            | .050 |             | 1.27  | 4     |
| MHD             | .142       | .152 | 3.61        | 3.86  |       |
| MHS             | .958       | .962 | 24.33       | 24.43 |       |
| PS              | .190       | .210 | 4.83        | 5.33  |       |
| PS <sub>1</sub> | .093       | .105 | 2.36        | 2.67  |       |
| S               | .570       | .590 | 14.48       | 14.99 |       |
| T               | .190       | .210 | 4.83        | 5.33  |       |

NOTES:

1. Dimensions are in inches. Millimeters are given for general information only.
2. Internal resistance (typically 750 ohms). This resistor is optional.
3. The outline contour is optional.
4. Dimension does not include sealing flanges.
5. All leads.
6. Terminal designation is as follows: 1 – emitter, 2 – base 1 (B1), 3 – base 2 (B2). The collector shall be connected to the case.
7. Shape of capweld flange is optional and cannot extend beyond dimension HR.

FIGURE 2. Physical dimensions for 3-pin TO-66 package and schematic circuit for 2N6352 and 2N6353 – Continued.

MIL-PRF-19500/472G  
w/AMENDMENT 1



NOTES:

1. Die size: .087 x .100 inch  $\pm$ .002 inch (2.2098 x 2.54 mm  $\pm$ 0.0508 mm).
2. Die thickness: .010  $\pm$ .0015 inch (0.254  $\pm$ 0.0381 mm) nominal.
3. Top metal: Aluminum 30,000Å minimum, 33,000Å nominal.
4. Backside metal: A. Al / Ti / Ni / Ag: 12kÅ / 3kÅ / 7kÅ / 7kÅ minimum, 15kÅ / 5kÅ / 10kÅ / 10kÅ nominal.  
B. Gold: 2,500Å minimum, 3,000Å nominal.
5. Backside: Collector.
6. Bonding pads: B1 = .016 x .014 inch (0.4064 x 0.3556 mm),  
B2 = .016 x .018 inch (0.4064 x 0.4572 mm),  
E = .040 x .008 inch (1.016 x 0.2032 mm).

FIGURE 3. Physical dimensions for unencapsulated die JANHC (A-version).

## 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 (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.

|          |                                                                                            |
|----------|--------------------------------------------------------------------------------------------|
| $I_M$    | The measurement current applied to forward bias the junction for measurement of $V_{BE}$ . |
| $I_H$    | The collector current applied to the device under test during the heating period.          |
| $t_H$    | The duration of the applied heating power pulse.                                           |
| $t_{SW}$ | Sample window time during which final $V_{BE}$ measurement is made.                        |

3.4 Interface requirements and physical dimensions. The interface requirements and physical dimensions shall be as specified in MIL-PRF-19500 and figure 1 (4-pin TO-33) for device types 2N6350 and 2N6351, figure 2 (3-pin TO-66) for device types 2N6352 and 2N6353, and figure 3 for unencapsulated die JANHC herein.

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 or formation is desired, it shall be specified in the acquisition document (see 6.2).

MIL-PRF-19500/472G  
w/AMENDMENT 1

3.4.2 Polarity. The polarity of the device types shall be as shown on [figures 1, 2, and 3](#). For device types 2N6350 and 2N6351 (TO-33), terminal 1 is the emitter, terminal 2 is base 2 (B2), terminal 3 is base 1 (B1), and terminal 4 is the collector. The collector shall be also electrically connected to the case. For device types 2N6352 and 2N6353 (TO-66), terminal 1 is the emitter, terminal 2 is base 1 (B1), terminal 3 is base 2 (B2), and the collector shall be electrically connected to the case. The connections for unencapsulated die shall be as depicted on [figure 3](#).

3.5 Marking. Marking shall be in accordance with [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 as specified in [table I](#).

3.8 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 and II](#)).
- d. Element evaluation (see [4.6](#)).

4.2 Qualification inspection. Qualification inspection shall be in accordance with [MIL-PRF-19500](#), and as specified herein.

4.2.1 Qualification of unencapsulated die. Qualification inspection for unencapsulated die shall be in accordance with appendix G of [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 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.

MIL-PRF-19500/472G  
w/AMENDMENT 1

\* 4.3 Screening of packaged devices (quality levels JANTX and JANTXV 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 | Measurements for<br>JANTX and JANTXV levels only                                                                                                                               |
|--------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 3c (1) | Thermal impedance, see 4.3.1                                                                                                                                                   |
| 11     | $I_{CEX1}$ and $h_{FE1}$                                                                                                                                                       |
| 12     | Power burn-in, see 4.3.2                                                                                                                                                       |
| 13     | See table I, subgroup 2 herein<br>$\Delta I_{CEX1} = \pm 100$ percent of initial value or 20 nA dc, whichever is greater<br>$\Delta h_{FE1} = \pm 25$ percent of initial value |

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

4.3.1 Thermal impedance. The thermal impedance measurements shall be performed in accordance with test method 3131 of MIL-STD-750 using the guidelines in that test method for determining  $I_M$ ,  $I_H$ ,  $t_H$ ,  $t_{MD}$ ,  $t_{SW}$ , (and  $V_H$  where appropriate). Measurement delay time ( $t_{MD}$ ) = 70  $\mu$ s maximum. The thermal impedance limit used in screen 3c and table I, subgroup 2 herein shall be set statistically by the supplier. See table II, subgroup 4 herein.

4.3.2 Power burn-in conditions. Power burn-in conditions shall be as follows:  $T_A = +25^\circ\text{C}$  minimum; power shall be applied to achieve  $T_J = +135^\circ\text{C}$  minimum and power dissipation of  $P_D \geq 75$  percent of maximum rated  $P_T$  as defined in 1.3. The following details shall apply:

- a.  $V_{CE} = 60$  V dc for device types 2N6350 and 2N6352.
- b.  $V_{CE} = 100$  V dc for device types 2N6351 and 2N6353.

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-V 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-VIB (JAN, JANTX, and JANTXV) of MIL-PRF-19500 and as follows herein. Delta measurements shall be in accordance with the applicable step of 4.7 herein.

| Subgroup | Method | Conditions                                                                                                                                                                                                                                                   |
|----------|--------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| B3       | 1027   | For 2N6350 and 2N6352; $V_{CE} = +40$ V dc.<br>For 2N6351 and 2N6353; $V_{CE} = +100$ V dc.<br>Power shall be applied to achieve $T_J = +150^\circ\text{C}$ minimum and power dissipation of $P_D \geq 75$ percent of maximum rated $P_T$ as defined in 1.3. |

MIL-PRF-19500/472G  
w/AMENDMENT 1

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 herein.

| Subgroup | Method | Conditions                                                                                                                                                                                                                                                     |
|----------|--------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| C2       | 2036   | Test condition E for 2N6350 and 2N6351.<br>Test condition A for 2N6352 and 2N6353, weight = 3 lbs (1.36 Kg), t = 15s.                                                                                                                                          |
| C5       | 3131   | Base 1 shorted to base 2 (see 1.3).                                                                                                                                                                                                                            |
| C6       | 1026   | For 2N6350 and 2N6352; $V_{CE} = +40$ V dc.<br>For 2N6351 and 2N6353; $V_{CE} = +100$ V dc.<br>Power shall be applied to achieve $T_J = +150^{\circ}\text{C}$ minimum and power dissipation of $P_D \geq 75$ percent of maximum rated $P_r$ as defined in 1.3. |

4.4.4 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 II herein. Delta measurements shall be in accordance with the applicable step of 4.7 herein.

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

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

4.6 Element evaluation of unencapsulated die. The element evaluation of unencapsulated die shall be in accordance with appendix G of MIL-PRF-19500. For subgroup 4, the burn-in duration for the JANHC shall follow the JANTX requirements.

4.7 Delta measurements. The delta measurements for groups B and E inspection shall be as specified below. (1)  
(2)

| Step | Inspection                     | MIL-STD-750 |                                                                                     | Symbol           | Limit                                         |
|------|--------------------------------|-------------|-------------------------------------------------------------------------------------|------------------|-----------------------------------------------|
|      |                                | Method      | Conditions                                                                          |                  |                                               |
| 1    | Forward-current transfer ratio | 3076        | $V_{CE} = 5$ V dc; $I_C = 5.0$ A dc;<br>pulsed see 4.5.1,<br>$R_{B2E} = 100 \Omega$ | $\Delta h_{FE2}$ | $\pm 25$ percent change from initial reading. |

- (1) The delta measurements for group B, product assurance levels JAN, JANTX, and JANTXV shall be as follows: In addition to the measurements specified for subgroup 3 of table E-VIB of MIL-PRF-19500, the measurements of step 1 herein shall also be taken.
- (2) The delta measurements for group E shall be as follows: In addition to the measurements specified for subgroups 1 and 2 of table E-IX of MIL-PRF-19500, the measurements of step 1 herein shall also be taken.

MIL-PRF-19500/472G  
w/AMENDMENT 1

TABLE I. Group A inspection.

| Inspection <u>1/</u>                   | MIL-STD-750 |                                                                                                               | Symbol          | Limit | Limit | Unit       |
|----------------------------------------|-------------|---------------------------------------------------------------------------------------------------------------|-----------------|-------|-------|------------|
|                                        | Method      | Conditions                                                                                                    |                 | Min   | Max   |            |
| <u>Subgroup 1</u>                      |             |                                                                                                               |                 |       |       |            |
| Visual and mechanical examination      | 2071        |                                                                                                               |                 |       |       |            |
| <u>Subgroup 2</u>                      |             |                                                                                                               |                 |       |       |            |
| Thermal impedance <u>2/</u>            | 3131        | See 4.3.1                                                                                                     | $Z_{\theta JX}$ |       |       | °C/W       |
| Collector to emitter breakdown voltage | 3011        | Bias condition B, $I_C = 25$ mA dc; pulsed (see 4.5.1); $R_{B1E} = 2.2$ k $\Omega$ ; $R_{B2E} = 100$ $\Omega$ | $V_{(BR)CER}$   |       |       |            |
| 2N6350, 2N6352                         |             |                                                                                                               |                 | 80    |       | V dc       |
| 2N6351, 2N6353                         |             |                                                                                                               |                 | 150   |       | V dc       |
| Emitter to base 1, breakdown voltage   | 3026        | Bias condition D, $I_E = 12$ mA dc; base 2 open                                                               | $V_{(BR)EBO1}$  | 12    |       | V dc       |
| Emitter to base 2, breakdown voltage   | 3026        | Bias condition D, $I_E = 12$ mA dc; base 1 open                                                               | $V_{(BR)EBO2}$  | 6     |       | V dc       |
| Collector to emitter cutoff current    | 3041        | Bias condition A, $V_{EB1} = 2$ V dc; $R_{B2E} = 100$ $\Omega$                                                | $I_{CEX1}$      |       |       |            |
| 2N6350, 2N6352                         |             | $V_{CE} = 80$ V dc                                                                                            |                 |       | 1.0   | $\mu$ A dc |
| 2N6351, 2N6353                         |             | $V_{CE} = 150$ V dc                                                                                           |                 |       | 1.0   | $\mu$ A dc |
| Saturation voltage and resistance      | 3071        | $I_C = 5.0$ A dc; $R_{B2E} = 100$ $\Omega$                                                                    | $V_{CE(sat)1}$  |       |       |            |
| 2N6350, 2N6352                         |             | $I_B = 5$ mA dc; pulsed (see 4.5.1)                                                                           |                 |       | 1.5   | V dc       |
| 2N6351, 2N6353                         |             | $I_B = 10$ mA dc; pulsed (see 4.5.1)                                                                          |                 |       | 2.5   | V dc       |
| Base emitter voltage (nonsaturated)    | 3066        | Condition B, $V_{CE} = 5$ V dc; $I_C = 5.0$ A dc; pulsed (see 4.5.1); $R_{B2E} = 100$ $\Omega$                | $V_{BE(on)1}$   |       | 2.5   | V dc       |
| Forward-current transfer ratio         | 3076        | $V_{CE} = 5$ V dc; $I_C = 1.0$ A dc; pulsed (see 4.5.1); $R_{B2E} = 1$ k $\Omega$                             | $h_{FE1}$       |       |       |            |
| 2N6350, 2N6352                         |             |                                                                                                               |                 | 2,000 |       |            |
| 2N6351, 2N6353                         |             |                                                                                                               |                 | 1,000 |       |            |

See footnotes at end of table.

MIL-PRF-19500/472G  
w/AMENDMENT 1

TABLE I. Group A inspection – Continued.

| Inspection <u>1</u> /                                                   | MIL-STD-750 |                                                                                                                                    | Symbol     | Limit          | Limit            | Unit                           |
|-------------------------------------------------------------------------|-------------|------------------------------------------------------------------------------------------------------------------------------------|------------|----------------|------------------|--------------------------------|
|                                                                         | Method      | Conditions                                                                                                                         |            | Min            | Max              |                                |
| <u>Subgroup 2</u> – Continued.                                          |             |                                                                                                                                    |            |                |                  |                                |
| Forward-current transfer ratio<br>2N6350, 2N6352<br>2N6351, 2N6353      | 3076        | $V_{CE} = 5 \text{ V dc}; I_C = 5.0 \text{ A dc};$<br>pulsed (see 4.5.1); $R_{B2E} = 100 \Omega$                                   | $h_{FE2}$  | 2,000<br>1,000 | 10,000<br>10,000 |                                |
| Forward-current transfer ratio<br>2N6350, 2N6352<br>2N6351, 2N6353      | 3076        | $V_{CE} = 5 \text{ V dc}; I_C = 10 \text{ A dc};$<br>pulsed (see 4.5.1); $R_{B2E} = 100 \Omega$                                    | $h_{FE3}$  | 400<br>200     |                  |                                |
| <u>Subgroup 3</u>                                                       |             |                                                                                                                                    |            |                |                  |                                |
| High temperature operation:                                             |             | $T_A = +150^{\circ}\text{C}$                                                                                                       |            |                |                  |                                |
| Collector to emitter cutoff current<br>2N6350, 2N6352<br>2N6351, 2N6353 | 3041        | Bias condition A,<br>$V_{EB1} = 2 \text{ V dc}; R_{B2E} = 100 \Omega$<br>$V_{CE} = 80 \text{ V dc}$<br>$V_{CE} = 150 \text{ V dc}$ | $I_{CEX2}$ |                | 1.0<br>1.0       | mA dc<br>mA dc                 |
| Low temperature operation:                                              |             | $T_A = -65^{\circ}\text{C}$                                                                                                        |            |                |                  |                                |
| Forward-current transfer ratio<br><br>2N6350, 2N6352<br>2N6351, 2N6353  | 3076        | $V_{CE} = 5 \text{ V dc}; I_C = 5.0 \text{ A dc};$<br>pulsed (see 4.5.1);<br>$R_{B2E} = 100 \Omega$                                | $h_{FE4}$  | 400<br>200     |                  |                                |
| <u>Subgroup 4</u>                                                       |             |                                                                                                                                    |            |                |                  |                                |
| Small-signal, short-circuit forward-current transfer ratio              | 3306        | $V_{CE} = 10 \text{ V dc}; I_C = 1.0 \text{ A dc};$<br>$f = 10 \text{ MHz}; R_{B2E} = 100 \Omega$                                  | $ h_{fe} $ | 5              | 25               |                                |
| Open-circuit output capacitance                                         | 3236        | $V_{CB1} = 10 \text{ V dc}; 100 \text{ kHz} \leq f \leq 1 \text{ MHz};$ base 2 open                                                | $C_{obo}$  |                | 120              | pF                             |
| Pulse response                                                          |             |                                                                                                                                    |            |                |                  |                                |
| Turn-on time<br><br>2N6350, 2N6352<br>2N6351, 2N6353                    | 3251        | Test condition A, $V_{CC} = 30 \text{ V dc};$<br>$I_C = 5.0 \text{ A dc}$<br>See figure 4<br>See figure 5                          | $t_{on}$   |                | 0.5<br>0.5       | $\mu\text{s}$<br>$\mu\text{s}$ |

See footnotes at end of table.

MIL-PRF-19500/472G  
w/AMENDMENT 1

TABLE I. Group A inspection – Continued.

| Inspection <u>1/</u>                                                            | MIL-STD-750 |                                                                                                                                                           | Symbol    | Limit | Limit | Unit          |
|---------------------------------------------------------------------------------|-------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|-------|-------|---------------|
|                                                                                 | Method      | Conditions                                                                                                                                                |           | Min   | Max   |               |
| <u>Subgroup 4</u> – Continued.                                                  |             |                                                                                                                                                           |           |       |       |               |
| Turn-off time                                                                   | 3251        | Test condition A, $V_{CC} = 30 \text{ V dc}$ ;<br>$I_C = 5.0 \text{ A dc}$                                                                                | $t_{off}$ |       |       |               |
| 2N6350, 2N6352                                                                  |             | See <a href="#">figure 4</a>                                                                                                                              |           |       | 1.2   | $\mu\text{s}$ |
| 2N6351, 2N6353                                                                  |             | See <a href="#">figure 5</a>                                                                                                                              |           |       | 1.2   | $\mu\text{s}$ |
| <u>Subgroup 5</u>                                                               |             |                                                                                                                                                           |           |       |       |               |
| Safe operating area<br>(continuous dc)<br>(for types 2N6350 and<br>2N6351 only) | 3051        | $T_C = +100^\circ\text{C}$ ; $t \geq 1.0 \text{ s}$ , 1 cycle;<br>$t_r + t_f = 10 \mu\text{s}$ (see <a href="#">figure 6</a> );<br>$R_{B2E} = 100 \Omega$ |           |       |       |               |
| <u>Test 1</u><br>(2N6350, 2N6351)                                               |             | $V_{CE} = 1.5 \text{ V dc}$ ; $I_C = 3.3 \text{ A dc}$                                                                                                    |           |       |       |               |
| <u>Test 2</u><br>(2N6350, 2N6351)                                               |             | $V_{CE} = 30 \text{ V dc}$ ; $I_C = 167 \text{ mA dc}$                                                                                                    |           |       |       |               |
| <u>Test 3</u><br>(2N6350)                                                       |             | $V_{CE} = 80 \text{ V dc}$ ; $I_C = 35 \text{ mA dc}$                                                                                                     |           |       |       |               |
| <u>Test 4</u><br>(2N6351)                                                       |             | $V_{CE} = 150 \text{ V dc}$ ; $I_C = 13 \text{ mA dc}$                                                                                                    |           |       |       |               |
| Safe operating area<br>(continuous dc)<br>(for types 2N6352 and<br>2N6353 only) | 3051        | $T_C = +100^\circ\text{C}$ ; $t \geq 1.0 \text{ s}$ , 1 cycle;<br>$t_r + t_f = 10 \mu\text{s}$ (see <a href="#">figure 7</a> );<br>$R_{B2E} = 100 \Omega$ |           |       |       |               |
| <u>Test 1</u><br>(2N6352, 2N6353)                                               |             | $V_{CE} = 5.0 \text{ V dc}$ ; $I_C = 5 \text{ A dc}$                                                                                                      |           |       |       |               |
| <u>Test 2</u><br>(2N6352, 2N6353)                                               |             | $V_{CE} = 10 \text{ V dc}$ ; $I_C = 2.5 \text{ A dc}$                                                                                                     |           |       |       |               |
| <u>Test 3</u><br>(2N6352)                                                       |             | $V_{CE} = 80 \text{ V dc}$ ; $I_C = 95 \text{ mA dc}$                                                                                                     |           |       |       |               |
| <u>Test 4</u><br>(2N6353)                                                       |             | $V_{CE} = 150 \text{ V dc}$ ; $I_C = 35 \text{ mA dc}$                                                                                                    |           |       |       |               |

See footnotes at end of table.

MIL-PRF-19500/472G  
w/AMENDMENT 1

TABLE I. Group A inspection – Continued.

| Inspection <u>1/</u>                                                                                                                                                                                   | MIL-STD-750 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Symbol | Limit |     | Unit |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------|-------|-----|------|
|                                                                                                                                                                                                        | Method      | Conditions                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |        | Min   | Max |      |
| <u>Subgroup 5</u> – Continued.<br><br>Electrical measurements<br><br>Safe operating area<br>(switching)<br><br><br><br><br><br><br><br>2N6350, 2N6352<br>2N6351, 2N6353<br><br>Electrical measurements | 3053        | See subgroup 2 of <a href="#">table I</a><br><br>Load condition B (clamped inductive load) see <a href="#">figure 8</a> ;<br>$T_A = + 100^{\circ}\text{C}$ ; $t_r + t_f \leq 1.0 \mu\text{s}$ ;<br>duty cycle $\leq 2$ percent;<br>$t_p = 8 \text{ ms}$ (vary to obtain $I_c$ );<br>$R_s = 0.1 \Omega$ ; $R_{BB1} = 200 \Omega$ ;<br>$V_{BB1} = 10 \text{ V dc}$ ; $R_{BB2} = 2.2 \text{ k}\Omega$ ;<br>$V_{BB2} = -4 \text{ V dc}$ ; $I_c = 5 \text{ A dc}$ ;<br>$V_{CC} = 25 \text{ V dc}$ ; $R_L \leq 2.5 \Omega$ ;<br>$L = 40 \text{ mH}$ (Triad c-48U, or equivalent); $R_{B2E} = 100 \Omega$<br><br>Clamp voltage = $50 +0, -5 \text{ V dc}$<br>Clamp voltage = $90 +0, -5 \text{ V dc}$<br><br>See subgroup 2 of <a href="#">table I</a> |        |       |     |      |

1/ For sampling plan, see [MIL-PRF-19500](#).

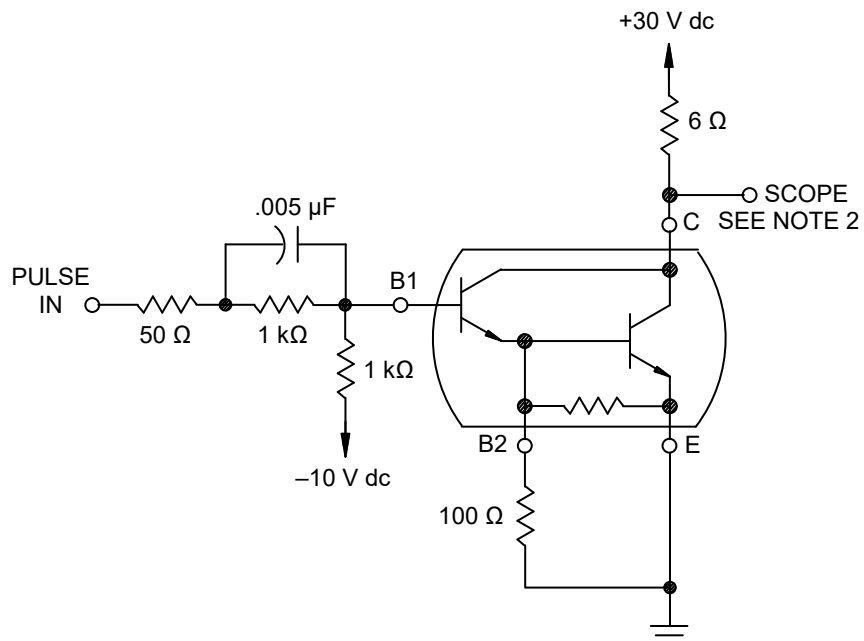
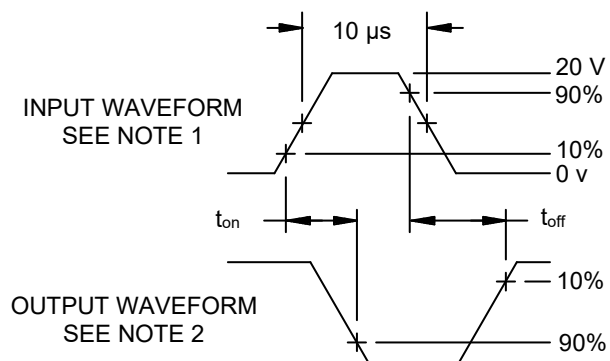
2/ This test required for the following end-point measurements only:  
Group B, subgroups 2 and 3 (JAN, JANTX, and JANTXV).  
Group C, subgroup 2 and 6.  
Group E, subgroup 1.

MIL-PRF-19500/472G  
w/AMENDMENT 1

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

| Inspection                               | MIL-STD-750 |                                                                         | Sample plan         |
|------------------------------------------|-------------|-------------------------------------------------------------------------|---------------------|
|                                          | Method      | Conditions                                                              |                     |
| <u>Subgroup 1</u>                        |             |                                                                         | 45 devices<br>c = 0 |
| Temperature cycling<br>(air to air)      | 1051        | Test condition C, 500 cycles                                            |                     |
| Hermetic seal<br>Fine leak<br>Gross leak | 1071        |                                                                         |                     |
| End-point electrical<br>measurements     |             | See <a href="#">table I</a> , subgroup 2 and <a href="#">4.7</a> herein |                     |
| <u>Subgroup 2</u>                        |             |                                                                         | 45 devices<br>c = 0 |
| Intermittent operation life              | 1037        | V <sub>CB</sub> = 10 V dc, 6,000 cycles                                 |                     |
| End-point electrical<br>measurements     |             | See <a href="#">table I</a> , subgroup 2 and <a href="#">4.7</a> herein |                     |
| <u>Subgroup 4</u>                        |             |                                                                         | Sample size N/A     |
| Thermal impedance curves                 |             | See <a href="#">MIL-PRF-19500</a>                                       |                     |
| <u>Subgroup 6</u>                        |             |                                                                         |                     |
| Electrostatic discharge<br>sensitivity   | 1020        | Testing required for non-sensitive listing to prove<br>capability.      |                     |
| <u>Subgroup 8</u>                        |             |                                                                         | 45 devices<br>c = 0 |
| Reverse voltage leakage<br>stability     | 1033        | Condition B                                                             |                     |

MIL-PRF-19500/472G  
w/AMENDMENT 1

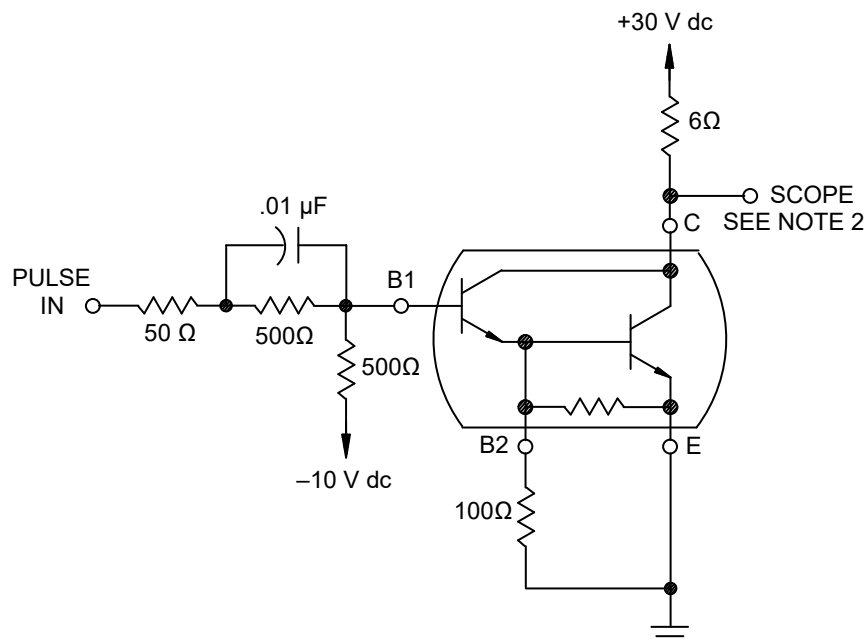
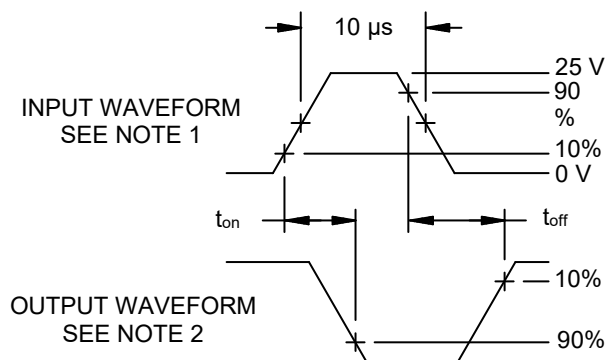


NOTES:

1. The input waveform is supplied by a pulse generator with the following characteristics:  
 $t_r \leq 15 \text{ ns}$ ,  $t_f \leq 15 \text{ ns}$ ,  $Z_{OUT} = 50 \Omega$ ,  $PW = 10 \mu\text{s}$ , duty cycle  $\leq 2$  percent.
2. Output waveforms are monitored on an oscilloscope with the following characteristics:  
 $t_r \leq 15 \text{ ns}$ ,  $Z_{IN} \geq 10 \text{ M}\Omega$ ,  $C_{IN} \leq 11.5 \text{ pF}$ .
3. Resistors shall be non-inductive types.
4. The dc power supplies may require additional by-passing in order to minimize ringing.

FIGURE 4. Pulse response test circuit for device types 2N6350 and 2N6352.

MIL-PRF-19500/472G  
w/AMENDMENT 1



NOTES:

1. The input waveform is supplied by a pulse generator with the following characteristics:  
 $t_r \leq 15$  ns,  $Z_{OUT} = 50$  Ω,  $PW = 10$  μs, duty cycle  $\leq 2$  percent.
2. Output waveforms are monitored on an oscilloscope with the following characteristics:  
 $t_r \leq 15$  ns,  $Z_{IN} \geq 10$  MΩ,  $C_{IN} \leq 11.5$  pF.
3. Resistors shall be non-inductive types.
4. The dc power supplies may require additional by-passing in order to minimize ringing.

FIGURE 5. Pulse response test circuit for device types 2N6351 and 2N6353.

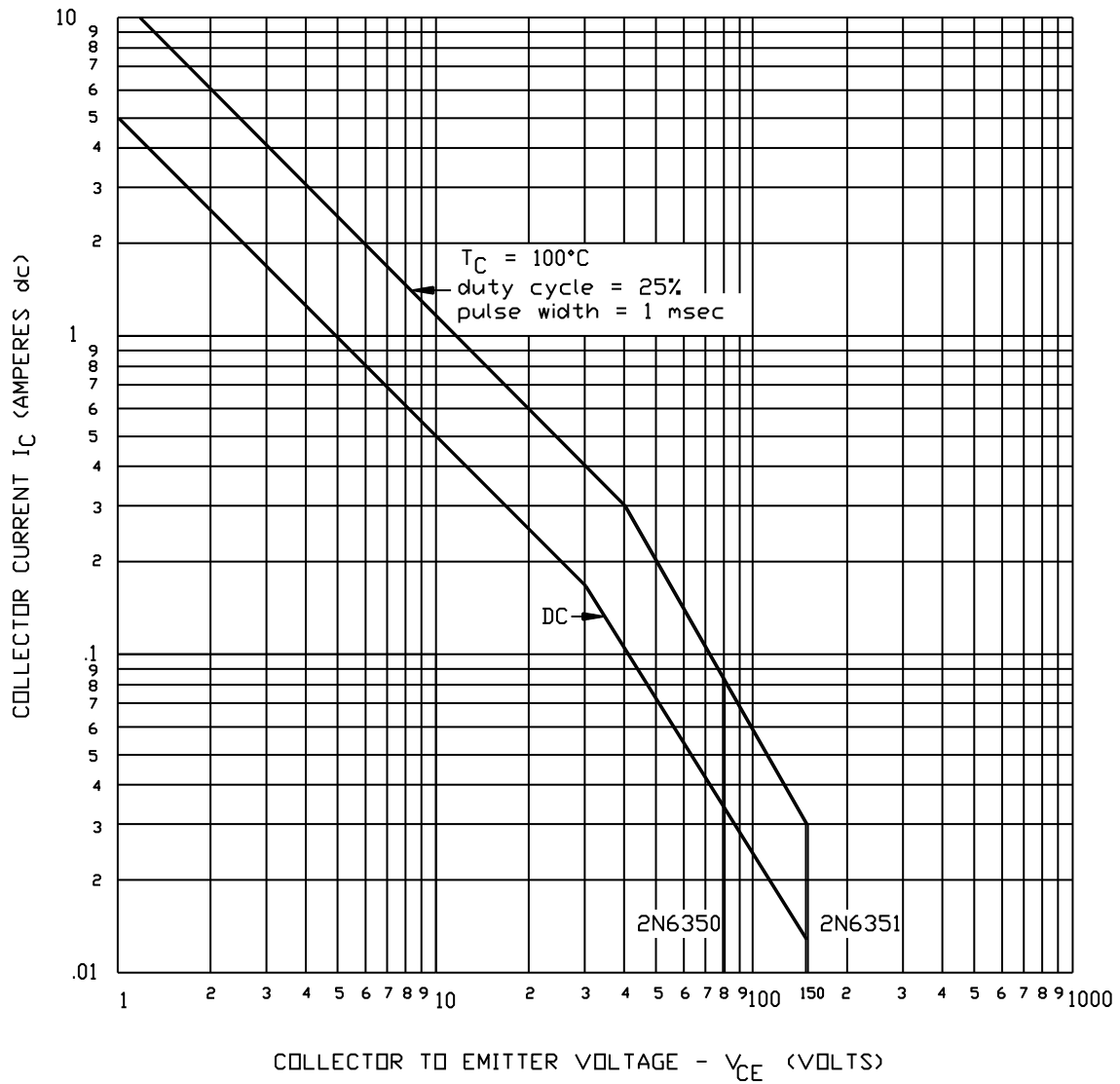


FIGURE 6. Maximum safe operating area graph for device types 2N6350 and 2N6351.

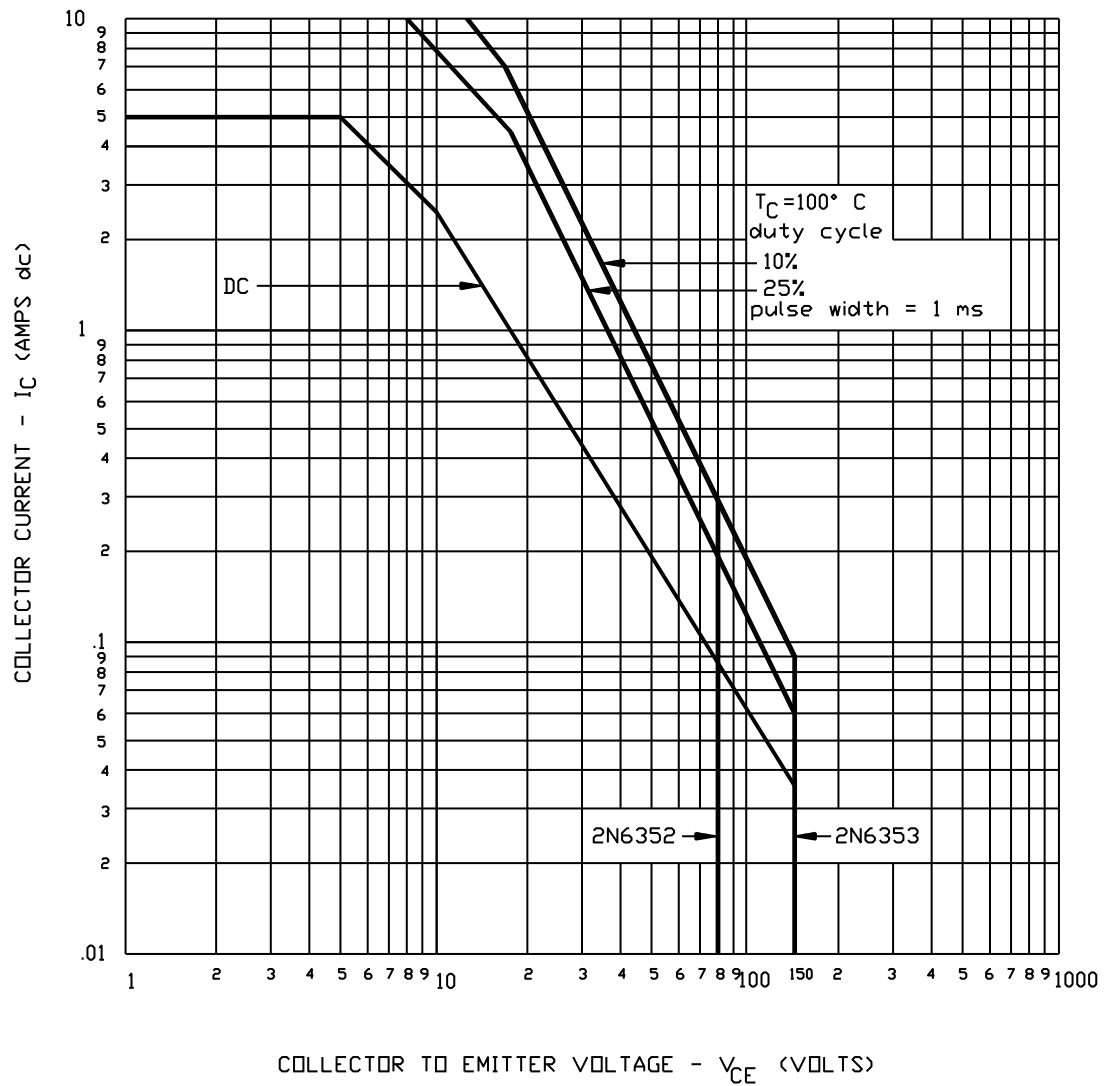


FIGURE 7. Maximum safe operating area graph for device types 2N6352 and 2N6353.

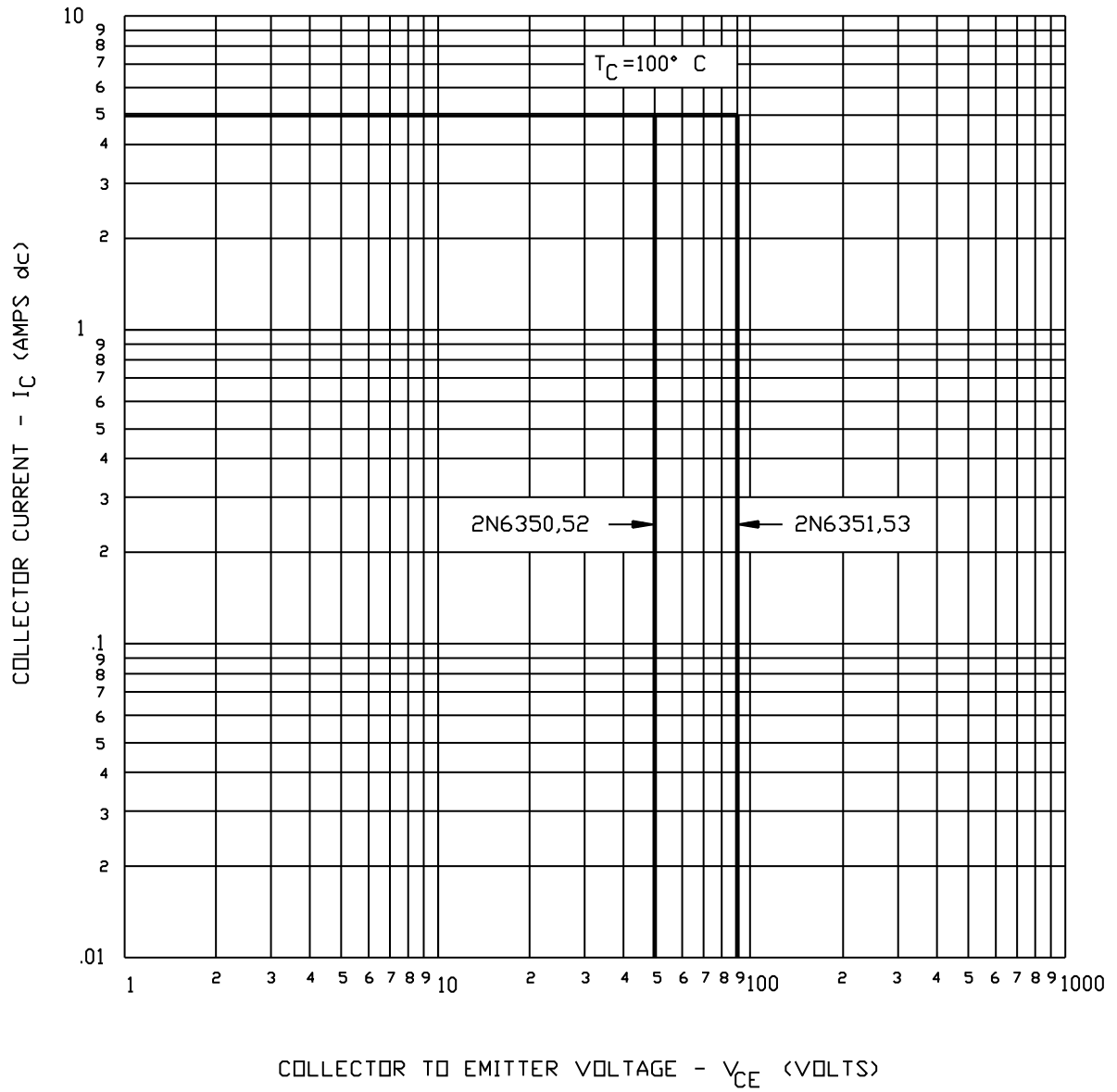


FIGURE 8. Safe operating area for switching between saturation and cutoff – (clamped inductive load).

## 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.

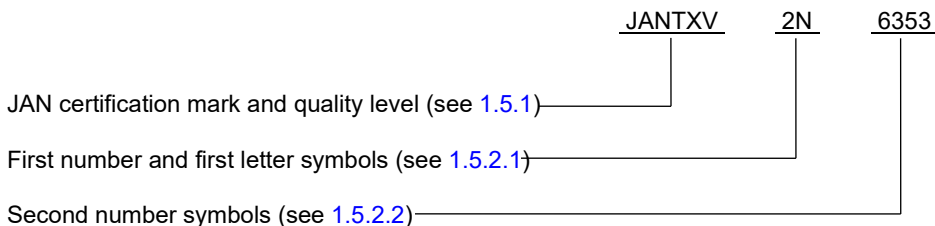
6.2 Acquisition requirements. Acquisition documents should specify the following:

- 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](mailto:vqe.chief@dla.mil). An online listing of products qualified to this specification may be found in the Qualified Products Database (QPD) at <https://qpldocs.dla.mil>.

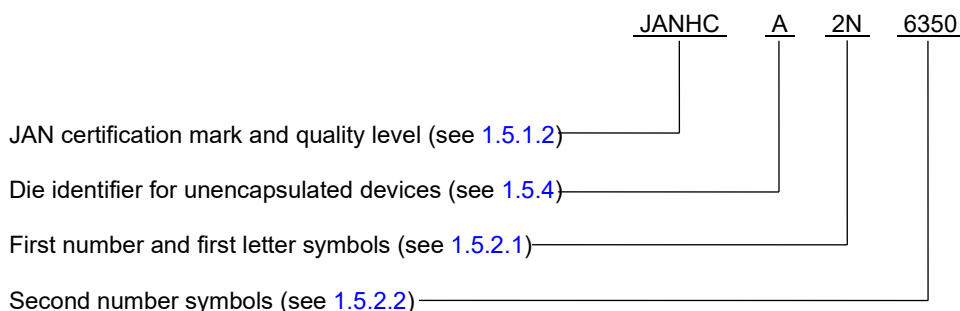
6.4 PIN construction example. The PINs for encapsulated and unencapsulated devices and are constructed using the following forms.

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



MIL-PRF-19500/472G  
w/AMENDMENT 1

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



6.5 List of PINs. The following is a list of possible PINs available for encapsulated devices and unencapsulated die covered by this specification sheet.

| Quality level JAN | Quality level JANTX | Quality level JANTXV | Quality level JANHC |
|-------------------|---------------------|----------------------|---------------------|
| JAN2N6350         | JANTX2N6350         | JANTXV2N6350         | JANHCA2N6350        |
| JAN2N6351         | JANTX2N6351         | JANTXV2N6351         | JANHCA2N6351        |
| JAN2N6352         | JANTX2N6352         | JANTXV2N6352         | JANHCA2N6352        |
| JAN2N6353         | JANTX2N6353         | JANTXV2N6353         | JANHCA2N6353        |

6.6 Suppliers of JANHC die. The qualified die suppliers with the applicable letter version (example, JANHCA2N6350) will be identified on the QML.

| JANC ordering information |              |
|---------------------------|--------------|
| Device type               | Manufacturer |
|                           | 43611        |
| 2N6350                    | JANHCA2N6350 |

6.7 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](mailto:Semiconductor@dla.mil).

\* 6.8 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 and relationship to the previous issue.

MIL-PRF-19500/472G  
w/AMENDMENT 1

Custodians:

Army - CR  
\* Navy - SH  
NASA - NA  
DLA - CC

Preparing activity:

DLA – CC

(Project 5961-2024-066)

Review activities:

Army - AV

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>.