

The documentation process conversion measures necessary to comply with this revision shall be completed by 10 December 1999

INCH-POUND

MIL-PRF-19500/527B  
10 September 1999  
SUPERSEDING  
MIL-S-19500/527A  
1 July 1993

PERFORMANCE SPECIFICATION SHEET  
SEMICONDUCTOR DEVICE, DARLINGTON TRANSISTOR, PNP, SILICON, POWER  
TYPES 2N6648, 2N6649 and 2N6650 JAN, JANTX AND JANTXV

This specification is approved for use by all Departments and Agencies of the Department of Defense.

1. SCOPE

1.1 Scope. This specification covers the performance requirements for PNP silicon, darlington power transistor. Three levels of product assurance are provided as specified in MIL-PRF-19500.

1.2 Physical dimensions. See figure 1 (TO - 3).

1.3 Maximum ratings.

|        | $P_T$ 1/<br>$T_A = +25^\circ\text{C}$ | $P_T$ 2/<br>$T_C = +25^\circ\text{C}$ | $V_{CBO}$   | $V_{CEO}$   | $V_{EBO}$   | $I_B$       | $I_C$       | $T_J$ and $T_{STG}$ | $R_{\theta JC}$ |
|--------|---------------------------------------|---------------------------------------|-------------|-------------|-------------|-------------|-------------|---------------------|-----------------|
|        | <u>W</u>                              | <u>W</u>                              | <u>V dc</u> | <u>V dc</u> | <u>V dc</u> | <u>A dc</u> | <u>A dc</u> | <u>°C</u>           | <u>°C/W</u>     |
| 2N6648 | 5.0                                   | 85                                    | -40         | -40         | -5.0        | -0.25       | -10         | -65 to +175         | 1.76            |
| 2N6649 | 5.0                                   | 85                                    | -60         | -60         | -5.0        | -0.25       | -10         | -65 to +175         | 1.76            |
| 2N6650 | 5.0                                   | 85                                    | -80         | -80         | -5.0        | -0.25       | -10         | -65 to +175         | 1.76            |

1/ Derate linearly 33.3 mW/°C above  $T_A > +25^\circ\text{C}$ .

2/ Derate linearly 567 mW/°C above  $T_C > +25^\circ\text{C}$ .

Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: Commander, Defense Supply Center Columbus, ATTN: DSCC-VAC, 3990 East Broad Street, Columbus, OH 43216-5000, by using the Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document or by letter.

1.4 Primary electrical characteristics.

|            | $h_{FE1}$ 1/                          | $h_{FE2}$ 1/                          | $V_{CE(SAT)1}$ 1/                      | $V_{CE(SAT)2}$ 1/                   | $V_{BE(ON)1}$ 1/                          |
|------------|---------------------------------------|---------------------------------------|--|-------------------------------------|---|
|            | $V_{CE} = -3$ V dc<br>$I_C = -1$ A dc | $V_{CE} = -3$ V dc<br>$I_C = -5$ A dc | $I_C = -5.0$ A dc<br>$I_B = -10$ mA dc | $I_C = 10$ A dc<br>$I_B = 0.1$ A dc | $V_{CE} = -3.0$ V dc<br>$I_C = -5.0$ A dc |
|            |                                       |                                       | <u>V dc</u>                            | <u>V dc</u>                         | <u>V dc</u>                               |
| Min<br>Max | 300                                   | 1,000<br>20,000                       | -2.0                                   | -3.0                                | -2.8                                      |

| $C_{obo}$  | $ h_{fe} $   | Pulse response |           |
|--|--|----------------|-----------|
| $V_{CB} = 10$ V dc<br>$I_E = 0$<br>$100 \text{ kHz} \leq f \leq 1 \text{ MHz}$ | $V_{CE} = -5.0$ V dc<br>$I_C = -1.0$ A dc<br>$f = 1 \text{ MHz}$ | $t_{on}$       | $t_{off}$ |
| <u>pF</u>  |  | <u>μs</u>      | <u>μs</u> |
| 300  | 50<br>400  | 2.5            | 10.0      |

1/ Pulsed (see 4.5.1).

## 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 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 listed in the issue of the Department of Defense Index of Specifications and Standards (DODISS) and supplement thereto, cited in the solicitation (see 6.2).

## SPECIFICATION

## DEPARTMENT OF DEFENSE

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

## STANDARD

## MILITARY

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

(Unless otherwise indicated, copies of the above specifications, standards, and handbooks are available from the Defense Automated Printing Service, Building 4D (DPM-DODSSP), 700 Robbins Avenue, Philadelphia, PA 19111-5094.)

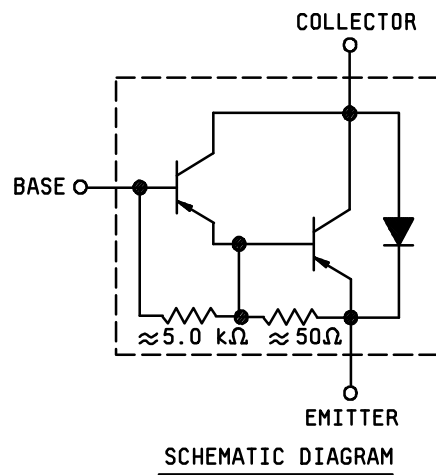
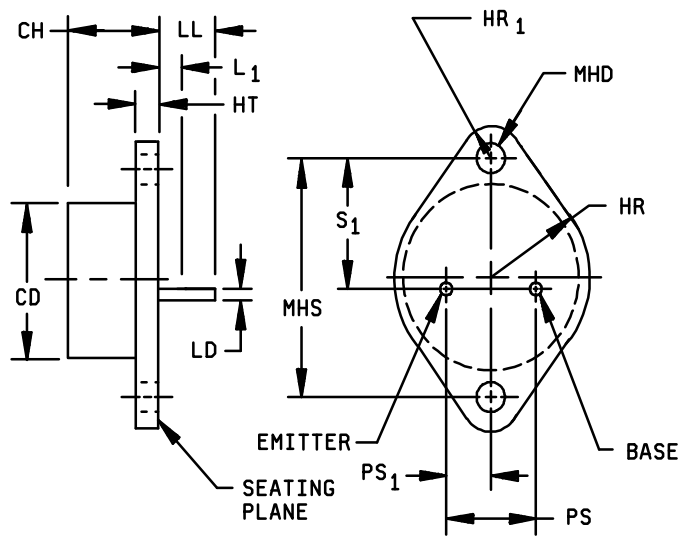


FIGURE 1. Dimensions and configuration (T0-3).

| Symbol          | Dimensions |       |             |       | Notes |
|-----------------|------------|-------|-------------|-------|-------|
|                 | Inches     |       | Millimeters |       |       |
|                 | Min        | Max   | Min         | Max   |       |
| CD              |            | 0.875 |             | 22.23 |       |
| CH              | 0.250      | 0.450 | 6.35        | 11.43 |       |
| HR              | 0.495      | 0.525 | 12.57       | 13.34 |       |
| HR <sub>1</sub> | 0.131      | 0.188 | 3.33        | 4.78  |       |
| HT              | 0.050      | 0.135 | 1.27        | 3.43  |       |
| LD              | 0.038      | 0.043 | 0.97        | 1.09  |       |
| LL              | 0.312      |       | 7.92        |       |       |
| LL <sub>1</sub> |            | 0.050 |             | 1.27  |       |
| MHD             | 0.151      | 0.161 | 3.84        | 4.09  |       |
| MHS             | 1.177      | 1.197 | 29.90       | 30.40 |       |
| PS              | 0.420      | 0.440 | 10.67       | 11.18 | 3     |
| PS <sub>1</sub> | 0.205      | 0.225 | 5.21        | 5.72  | 3     |
| s <sub>1</sub>  | 0.655      | 0.675 | 16.64       | 17.15 |       |

## NOTES:

1. Dimensions are in inches.
2. Metric equivalents are given for general information only.
3. These dimensions should be measured at points 0.050 inch (1.27 mm) and 0.055 inch (1.40 mm) below seating plane. When gauge is not used measurement will be made at the seating plane.
4. The seating plane of the header shall be flat within 0.001 inch (0.03 mm) concave to 0.004 inch (0.10 mm) convex inside a 0.930 inch (23.62 mm) diameter circle on the center of the header and flat within 0.001 inch (0.03 mm) concave to 0.006 inch (0.15 mm) convex overall.
5. Mounting holes shall be deburred on the seating plane side.
6. Collector is electrically connected to the case.

FIGURE 1. Dimensions and configuration (T0-3) - Continued.

2.3 Order of precedence. In the event of a conflict between the text of this document and the references cited herein (except for related associated specifications or specification sheets), 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 Qualification. Devices furnished under this specification shall be products that are authorized by the qualifying activity for listing on the applicable qualified manufacturer's list before contract award (see 4.2 and 6.3).

3.2 Associated specification. The individual item requirements shall be in accordance with MIL-PRF-19500 and as specified herein.

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

3.4 Interface requirements and physical dimensions. The interface requirements and physical dimensions shall be as specified in MIL-PRF-19500 and on figure 1 herein. The preferred measurements used herein are the metric units. However, this transistor was designed using inch-pound units of measurement. In case of conflicts between the metric and inch-pound units, the inch-pound units shall rule.

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

3.5 Marking. Marking shall be in accordance with MIL-PRF-19500.

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

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

### 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).

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

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

| Screen (table IV) of<br>MIL-PRF-19500) | Measurement  |
|--|--|
|  | JANTX and JANTXV levels  |
| 3c 1/                                  | Thermal impedance (see 4.3.2)  |
| 11                                     | $I_{CEX1}$ and $h_{FE1}$   |
| 12                                     | See 4.3.1  |
| 13                                     | Subgroup 2 of table I herein;<br>$\Delta I_{CEX1}$ = 100 percent of initial value or 100 $\mu$ A dc,<br>whichever is greater.<br>$\Delta h_{FE1}$ = $\pm$ 25 percent of initial value. |

1/ May be performed anytime before screen 9.

4.3.1 Power burn-in conditions. Power burn-in conditions are as follows:

$$T_J = 162.5 \pm 12.5^\circ\text{C}, 2\text{N6648} = V_{CB} = -30 \text{ V dc}, 2\text{N6649} = V_{CB} = -40 \text{ V dc}, 2\text{N6650} = V_{CB} = -60 \text{ V dc},$$

4.3.2 Thermal impedance  $Z_{\theta JX}$  measurements for screening. The  $Z_{\theta JX}$  measurements shall be performed in accordance with MIL-STD-750, method 3131. The maximum limit and conditions for  $Z_{\theta JX}$  in screening (table IV of MIL-PRF-19500) shall be derived by each vendor by means of process control of actual measurements which characterizes the die attach process. When three lot date codes have exhibited control, the data from these three lots will be used to establish a fixed screening limit (not to exceed the end point limit). Once a fixed limit has been established, monitor all future sealing lots using a sample from each lot to be plotted on the applicable X and R chart.

4.3.2.1 Thermal impedance  $Z_{\theta JX}$  measurements for initial qualification or requalification. The  $Z_{\theta JX}$  measurements shall be performed in accordance with MIL-STD-750, method 3131, (read and record data  $Z_{\theta JX}$ ) derived conditions, limits, and thermal response curve shall be supplied to the qualifying activity on the qualification lot prior to qualification approval.

4.4 Conformance inspection. Conformance inspection shall be in accordance with MIL-PRF-19500, and as specified herein.

4.4.1 Group A inspection. Group A inspection shall be conducted in accordance with table V of MIL-PRF-19500, and table I herein. Electrical measurements (end-points) shall be in accordance with table I, subgroup 2 herein.

4.4.2 Group B inspection. Group B inspection shall be conducted in accordance with the conditions specified for subgroup testing in table VIb of MIL-PRF-19500 and herein Electrical measurements (end-points) shall be in accordance with table I, subgroup 2 herein.

4.4.2.1 Group B inspection, appendix E, table VIb (JAN, JANTX and JANTXV) of MIL-PRF-19500

| Subgroup | Method | Conditions  |
|----------|--------|---|
| B3       | 1027   | For solder die attach: $V_{CB} \geq 10 \text{ V dc}$ , 2,000 cycles, $T_A \leq 35^\circ\text{C}$ .  |
| B3       | 1026   | For eutectic die attach: $V_{CB} \geq 10 \text{ V dc}$ , $T_A \leq 35^\circ\text{C}$ adjust $P_T$ to achieve $T_J = 150^\circ\text{C}$ minimum. |
| B5       | 3131   | See 4.5.2 herein.   |
| B6       | 1032   | $T_{STG} = +175^\circ\text{C}$  |

4.4.3 Group C inspection. Group C inspection shall be conducted in accordance with the conditions specified for subgroup testing in table VII of MIL-PRF-19500 Electrical measurements (end-points) shall be in accordance with table I, subgroup 2 herein.

4.4.3.1 Group C inspection, appendix E, table VII of MIL-PRF-19500.

| Subgroup | Method | Conditions  |
|----------|--------|---|
| C2       | 2036   | Test condition A, weight = 10 pounds, $t = 15 \text{ s}$ .  |
| C6       | 1027   | For solder die attach: $V_{CB} \geq 10 \text{ V dc}$ , 6,000 cycles, $T_A \leq 35^\circ\text{C}$ .  |
| C6       | 1026   | For eutectic die attach: $V_{CB} \geq 10 \text{ V dc}$ , $T_A \leq 35^\circ\text{C}$ adjust $P_T$ to achieve $T_J = 150^\circ\text{C}$ minimum. |

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.

4.5.2 Thermal resistance. Thermal resistance measurements shall be conducted in accordance with test method 3131 of MIL-STD-750. The following details shall apply:

- a. Collector current magnitude during power application shall be 1.0 A dc.
- b. Collector to emitter voltage magnitude shall be  $\geq 5$  V dc.
- c. Reference temperature measuring point shall be the case.
- d. Reference point temperature shall be  $+25^{\circ}\text{C} \leq T_R \leq +75^{\circ}\text{C}$  and recorded before the test is started.
- e. Mounting arrangement shall be with heat sink to header.
- f. Maximum limit of  $R_{\theta JC}$  shall be  $1.76^{\circ}\text{C/W}$ .

4.5.3 Thermal impedance  $Z_{\theta JX}$  limit for end point measurements. The following test conditions shall be used for  $Z_{\theta JX}$  end point measurements:  $Z_{\theta JX} = 1.4^{\circ}\text{C/W}$ .

- a.  $I_M$  ..... 10 mA.
- b.  $V_{CE}$  measurement voltage ..... 10 V (same as  $V_H$ ).
- c.  $I_H$  collector heating current ..... 4 A (minimum).
- d.  $V_H$  collector-emitter heating voltage ..... 10 V (minimum).
- e.  $t_H$  heating time ..... 100 ms.
- f.  $t_{MD}$  measurement delay time ..... 50  $\mu\text{s}$  to 80  $\mu\text{s}$ .
- g.  $t_{sw}$  sample window time ..... 10  $\mu\text{s}$  (maximum).

TABLE I. Group A inspection.

| Inspection <u>1</u> /                 | MIL-STD-750 |   | Symbol        | Limits |      | Unit  |
|---------------------------------------|-------------|---|---------------|--------|------|-------|
|                                       | Method      | Conditions  |               | Min    | Max  |       |
| <u>Subgroup 1</u>                     |             |   |               |        |      |       |
| Visual and mechanical Examination     | 2071        |   |               |        |      |       |
| <u>Subgroup 2</u>                     |             |   |               |        |      |       |
| Collector – emitter breakdown voltage | 3011        | Bias condition D; $I_C = 200$ mA dc pulsed (see 4.5.1)                      | $V_{(BR)CEO}$ |        |      | V dc  |
| 2N6648                                |             |   |               | -40    |      |       |
| 2N6649                                |             |   |               | -60    |      |       |
| 2N6650                                |             |   |               | -80    |      |       |
| Collector – emitter breakdown voltage | 3011        | Bias condition B; $I_C = 200$ mA dc $R_{BB} = 100$ ohms, pulsed (see 4.5.1) | $V_{(BR)CER}$ |        |      | V dc  |
| 2N6648                                |             |   |               | -40    |      |       |
| 2N6649                                |             |   |               | -60    |      |       |
| 2N6650                                |             |   |               | -80    |      |       |
| Collector – emitter cutoff current    | 3041        | Bias condition D;   | $I_{CEO}$     |        | -1   | mA dc |
| 2N6648                                |             | $V_{CE} = -40$ V dc   |               |        |      |       |
| 2N6649                                |             | $V_{CE} = -60$ V dc   |               |        |      |       |
| 2N6650                                |             | $V_{CE} = -80$ V dc   |               |        |      |       |
| Emitter – base cutoff current         | 3061        | Bias condition D; $V_{EB} = 5$ V dc   | $I_{EBO}$     |        | -10  | mA dc |
| Collector – emitter cutoff current    | 3041        | Bias condition D; $V_{BE} = 1.5$ V dc                                       | $I_{CEX1}$    |        | -0.3 | mA dc |
| 2N6648                                |             | $V_{CE} = -40$ V dc   |               |        |      |       |
| 2N6649                                |             | $V_{CE} = -60$ V dc   |               |        |      |       |
| 2N6650                                |             | $V_{CE} = -80$ V dc   |               |        |      |       |
| Collector – base cutoff current       | 3036        | Bias condition D;   | $I_{CBO}$     |        | -1   | mA dc |
| 2N6648                                |             | $V_{CE} = -40$ V dc   |               |        |      |       |
| 2N6649                                |             | $V_{CE} = -60$ V dc   |               |        |      |       |
| 2N6650                                |             | $V_{CE} = -80$ V dc   |               |        |      |       |

See footnote at end of table.



TABLE I. Group A inspection - Continued.

| Inspection 1/                          | MIL-STD-750 |   | Symbol                | Limits |        | Unit  |
|--|-------------|---|-----------------------|--------|--------|-------|
|  | Method      | Conditions  |                       | Min    | Max    |       |
| <u>Subgroup 2</u> - Continued          |             |   |                       |        |        |       |
| Base - emitter voltage (non saturated) | 3066        | Test condition B; V <sub>CE</sub> = -3.0 V dc, I <sub>C</sub> = -5.0 A dc; pulsed (see 4.5.1) | V <sub>BE(on)1</sub>  |        | -2.8   | V dc  |
| Base - emitter voltage (non saturated) | 3066        | Test condition B; V <sub>CE</sub> = -3.0 V dc, I <sub>C</sub> = -10 A dc; pulsed (see 4.5.1)  | V <sub>BE(on)2</sub>  |        | -4.5   | V dc  |
| Collector - emitter saturated voltage  | 3071        | I <sub>C</sub> = -5.0 A dc; I <sub>B</sub> = -10 mA dc  | V <sub>CE(sat)1</sub> |        | -2.0   | V dc  |
| Collector - emitter saturated voltage  | 3071        | I <sub>C</sub> = -10 A dc; I <sub>B</sub> = -0.1 mA dc, pulsed (see 4.5.1)                    | V <sub>CE(sat)2</sub> |        | -3.0   | V dc  |
| Forward - current transfer ratio       | 3076        | V <sub>CE</sub> = -3.0 V dc; I <sub>C</sub> = -1.0 A dc pulsed (see 4.5.1)                    | h <sub>FE1</sub>      | 300    |        |       |
| Forward - current transfer ratio       | 3076        | V <sub>CE</sub> = -3.0 V dc; I <sub>C</sub> = -5 A dc pulsed (see 4.5.1)                      | h <sub>FE2</sub>      | 1,000  | 20,000 |       |
| Forward - current transfer ratio       | 3076        | V <sub>CE</sub> = -3.0 V dc; I <sub>C</sub> = -10 A dc pulsed (see 4.5.1)                     | h <sub>FE3</sub>      | 100    |        |       |
| <u>Subgroup 3</u>                      |             |   |                       |        |        |       |
| High - temperature operation:          |             | T <sub>A</sub> = +150°C   |                       |        |        |       |
| Collector to emitter cutoff current    |             | Bias condition A; V <sub>BE</sub> = 1.5 V dc  | I <sub>CEX2</sub>     |        | -3.0   | MA dc |
| 2N6648                                 |             | V <sub>CE</sub> = -40 V dc  |                       |        |        |       |
| 2N6649                                 |             | V <sub>CE</sub> = -60 V dc  |                       |        |        |       |
| 2N6650                                 |             | V <sub>CE</sub> = -80 V dc  |                       |        |        |       |
| Low - temperature operation:           |             | T <sub>A</sub> = -65°C  |                       |        |        |       |
| Forward - current transfer ratio       | 3076        | V <sub>CE</sub> = -3.0 V dc I <sub>C</sub> = -5.0 A dc pulsed (see 4.5.1)                     | h <sub>FE4</sub>      | 200    |        |       |

See footnote at end of table.

TABLE I. Group A inspection - Continued.

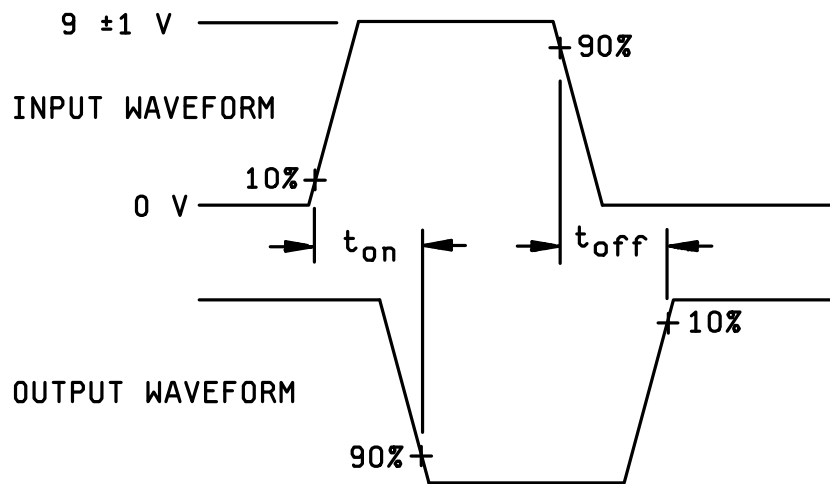
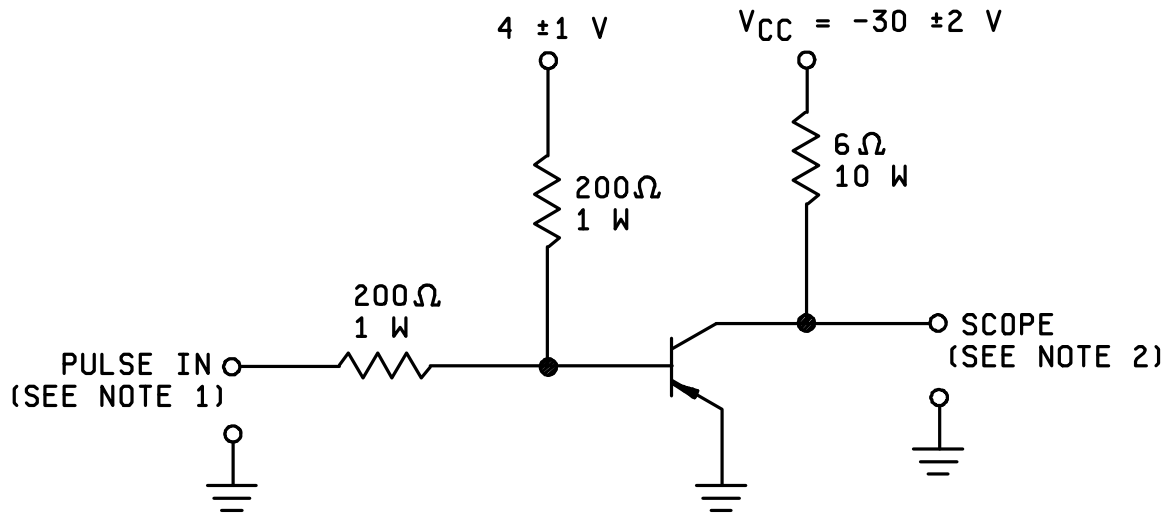
| Inspection 1/  | MIL-STD-750 |   | Symbol     | Limits |      | Unit    |
|--|-------------|---|------------|--------|------|---------|
|  | Method      | Conditions  |            | Min    | Max  |         |
| <u>Subgroup 4</u>  |             |   |            |        |      |         |
| Pulse response:  | 3251        | Test condition A, except test circuit and pulse requirements in accordance with figure 2. |            |        |      |         |
| Turn-on time   |             | $V_{CE} = -30 \text{ V dc}; I_C = -5.0 \text{ A dc}; I_{B1} = -20 \text{ mA dc}$          | $t_{on}$   |        | 2.5  | $\mu s$ |
| Turn-off time  |             | $V_{CE} = -30 \text{ V dc}; I_C = -5.0 \text{ A dc}; I_{B1} = -I_{B2} = 20 \text{ mA dc}$ | $t_{off}$  |        | 10.0 | $\mu s$ |
| Magnitude of small-signal short-circuit forward-current transfer ratio | 3306        | $V_{CE} = -5.0 \text{ V dc } I_C = -1.0 \text{ A dc}, f = 1.0 \text{ MHz}$                | $ h_{fe} $ | 50     | 400  |         |
| Open circuit output capacitance  | 3236        | $V_{CB} = 10 \text{ V dc}, I_E = 0, 100 \text{ kHz} \leq f \leq 1 \text{ MHz}$            | $C_{obo}$  |        | 300  | pF      |
| <u>Subgroup 5</u>  |             |   |            |        |      |         |
| Safe operating area (continuous dc)                                    | 3051        | $T_C = 25^{\circ}C; t = 1 \text{ s}; 1 \text{ cycle};$ (see figure 3)                     |            |        |      |         |
| Test 1   |             | $V_{CE} = 8.5 \text{ V dc}; I_C = -10 \text{ A dc}$                                       |            |        |      |         |
| Test 2   |             | $V_{CE} = 25 \text{ V dc}; I_C = -3.4 \text{ A dc}$                                       |            |        |      |         |
| Test 3   |             | $V_{CE} = -40 \text{ V dc}; I_C = -0.9 \text{ A dc}$                                      |            |        |      |         |
| 2N6648   |             | $V_{CE} = -60 \text{ V dc}; I_C = -0.3 \text{ A dc}$                                      |            |        |      |         |
| 2N6649   |             | $V_{CE} = -80 \text{ V dc}; I_C = -0.14 \text{ A dc}$                                     |            |        |      |         |
| 2N6650   |             |   |            |        |      |         |
| Electrical measurements  |             | See table I, subgroup 2   |            |        |      |         |

See footnote at end of table.

TABLE I. Group A inspection - Continued.

| Inspection <u>1</u> /           | MIL-STD-750 |   | Symbol | Limits |     | Unit |
|---------------------------------|-------------|---|--------|--------|-----|------|
|                                 | Method      | Conditions  |        | Min    | Max |      |
| <u>Subgroup 5</u> - Continued   |             |   |        |        |     |      |
| Safe operating area (switching) | 3053        | Load condition C (unclamped inductive load) (see figure 4);<br>$T_C = +25^\circ\text{C}$ ; duty cycle $\leq 10$ percent; $R_S \leq 0.1$ ohms.   |        |        |     |      |
| Test 1                          |             | $t_p = 1$ ms; (vary to obtain $I_C$ );<br>$R_{BB1} = 1$ k ohms; $V_{BB1} = -10$ V dc;<br>$R_{BB2} = \infty$ ;<br>$V_{BB2} = 0$ ; $I_C = -10$ A dc;<br>$V_{CC} = -30$ V dc; $R_L = 0.5$ ohms;<br>$L = 0.25$ mH at 10 A dc                                      |        |        |     |      |
| Test 2                          |             | $t_p = 1$ ms; (vary to obtain $I_C$ );<br>$R_{BB1} = 10$ k ohms; $V_{BB1} = -10$ V dc; $R_{BB2} = \infty$ ;<br>$V_{BB2} = 0$ ; $I_C = -0.2$ A dc;<br>$V_{CC} = -30$ V dc; $R_L = 0.5$ ohms;<br>$L = 20$ mH at 0.2 A dc  |        |        |     |      |
| Safe operating area (switching) |             | Load condition B (clamped inductive load) (see figure 5);<br>$T_A = +25^\circ\text{C}$ ; $t_r + t_f \leq 1.0$ $\mu\text{s}$ ; duty cycle $\leq 10$ percent; $t_p = 5$ ms; (vary to obtain $I_C$ ); $R_S = 0.1$ ohms;<br>$V_{CC} = -10$ V dc; $I_C = -10$ A dc |        |        |     |      |
| 2N6648<br>2N6649<br>2N6650      |             | Clamp voltage = -40 V dc<br>Clamp voltage = -60 V dc<br>Clamp voltage = -80 V dc<br><br>Device fails if clamp voltage not reached.  |        |        |     |      |
| Electrical measurements         |             | See table I, subgroup 2   |        |        |     |      |
| <u>Subgroups 6 and 7</u>        |             |   |        |        |     |      |
| Not applicable                  |             |   |        |        |     |      |

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



## NOTES:

1. The rise time ( $t_r$ ) and fall time ( $t_f$ ) of the applied pulse shall be each  $< 20$  ns; duty cycle  $< 2$  percent; generator source impedance shall be  $50\Omega$ ; pulse width =  $20$  ns.
2. Output sampling oscilloscope:  $Z_{IN} > 100$  k $\Omega$ ;  $C_{IN} < 50$  pF; rise time  $< 20$  ns.

FIGURE 2. Pulse response test circuit.

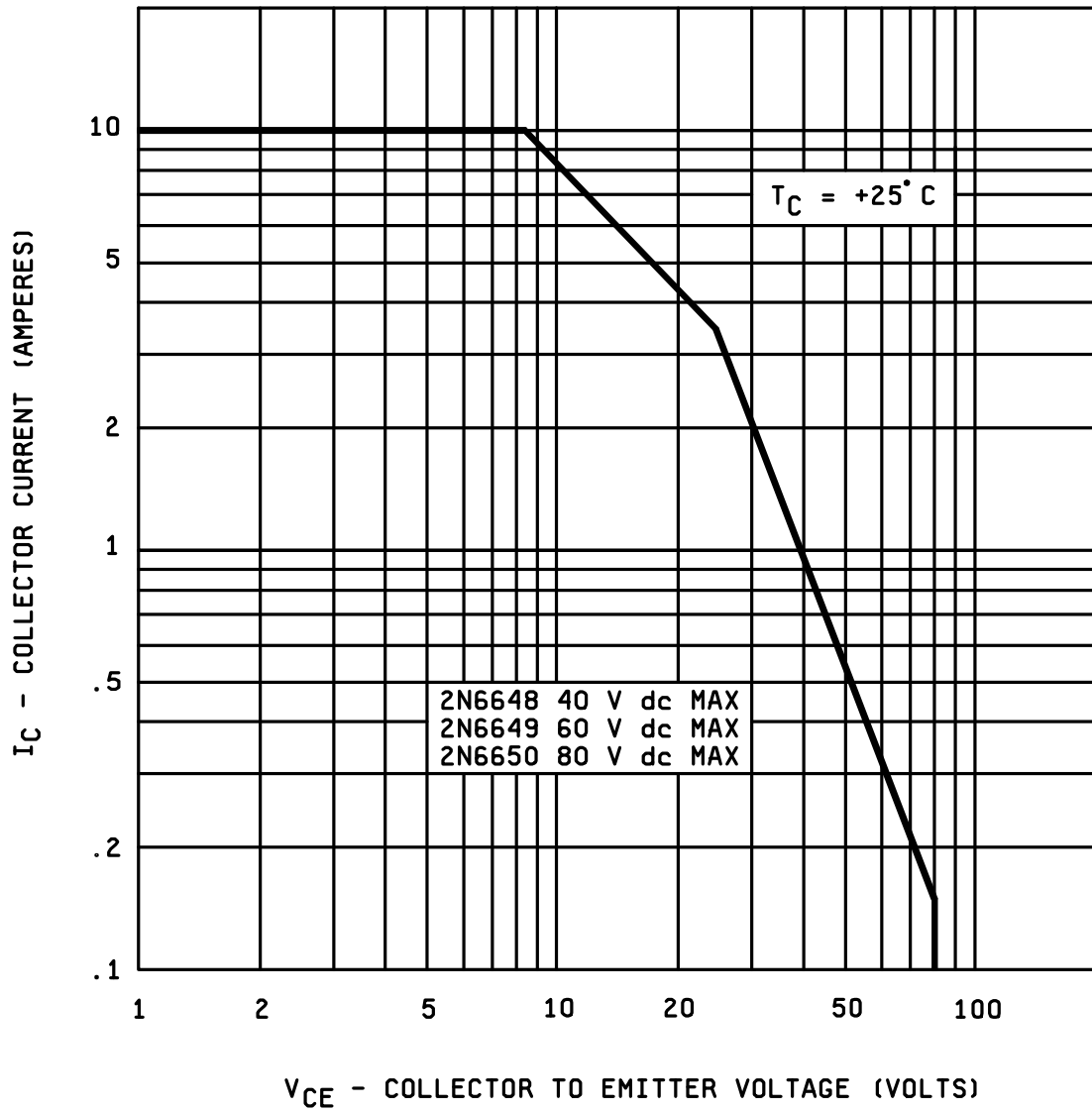


FIGURE 3. Maximum safe operating area graph (continuous dc).

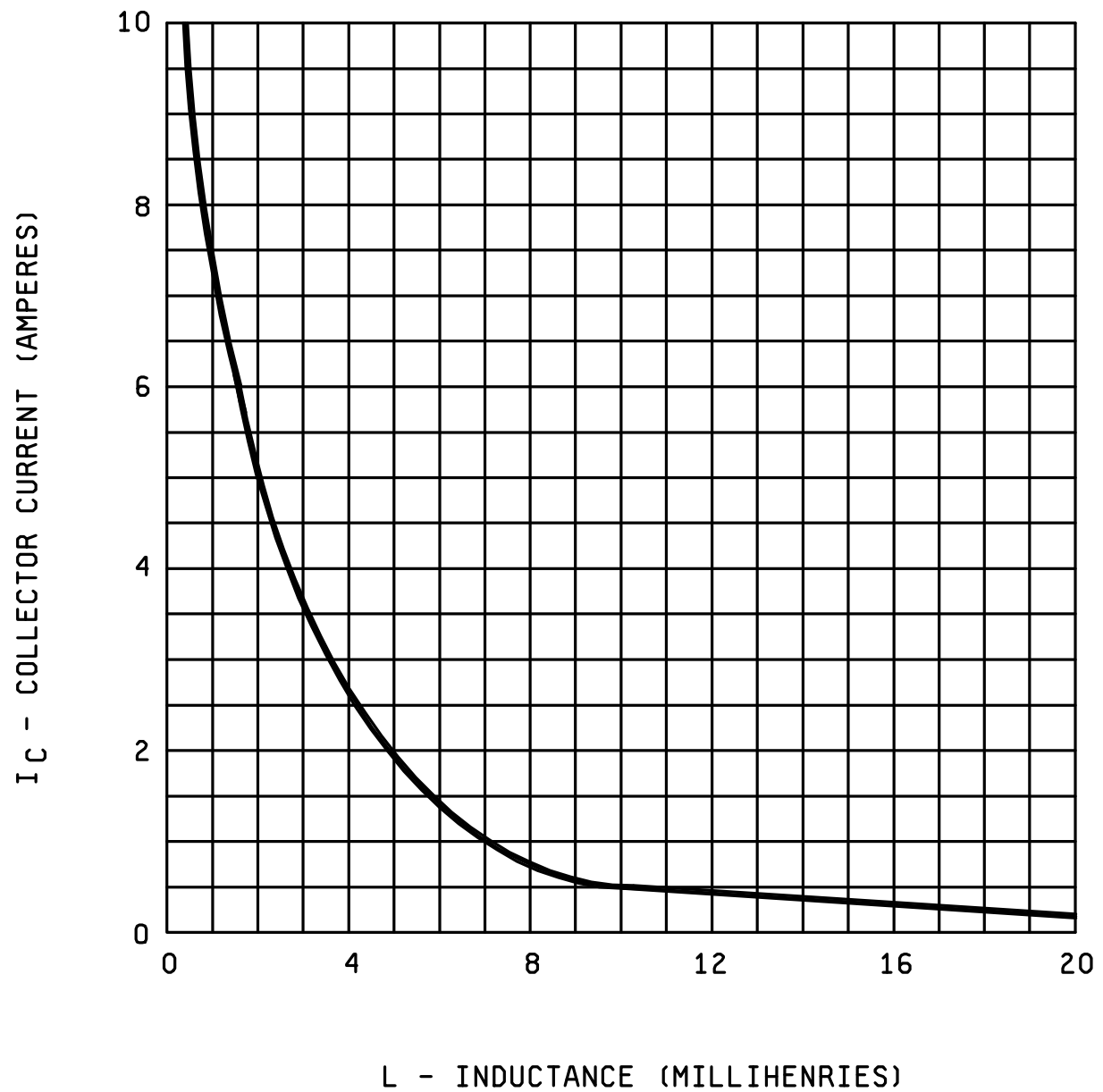
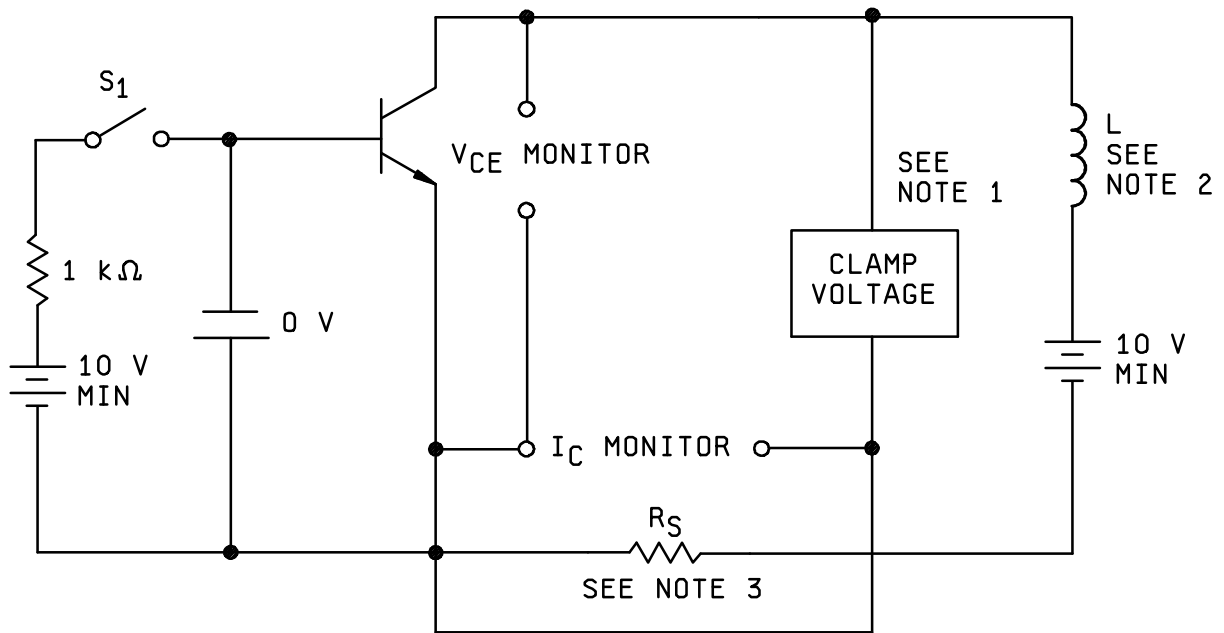


FIGURE 4. Safe operating area for switching between saturation and cutoff (unclamped inductive load).



## Procedures:

1. With switch S1 closed, set the specified test conditions.
2. Open S1. Device fails if clamp voltage not reached and maintained until the current returns to zero.
3. Perform specified end-point tests.

## NOTES:

1. Either a clamping circuit or clamping diode may be used.
2. The coil used shall provide a minimum inductance of 0.25 mH at 10 A with a maximum dc resistance of 0.1Ω.
3.  $R_S \leq 0.1\Omega$ . 12 W, 1 percent tolerance maximum (noninductive).

FIGURE 5. Clamped inductive sweep test circuit.

## 5. PACKAGING

5.1 Packaging. Packaging shall prevent mechanical damage of the devices during shipping and handling and shall not be detrimental to the device. When actual packaging of material is to be performed by DoD personnel, these personnel need to contact the responsible packaging activity to ascertain requisite packaging requirements. Packaging requirements are maintained by the Inventory Control Points' packaging activity within the Military Department or Defense Agency, or within the Military Departments' System Command. Packaging data retrieval is available from the managing Military Departments' or Defense Agency's automated packaging files, CD-ROM products, or by contacting the responsible packaging activity.

## 6. NOTES

(This section contains information of a general or explanatory nature that may be helpful, but is not mandatory.)

6.1 Notes. The notes specified in MIL-PRF-19500 are applicable to this specification.

6.2 Acquisition requirements. Acquisition documents must specify the following:

- a. Issue of DODISS to be cited in the solicitation (see 2.2.1).
- b. The lead finish as specified (see 3.4.1).
- c. Type designation and quality assurance level.
- d. Packaging requirements (see 5.1).

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 Manufacturer's List QML No.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 purchase orders for the products covered by this specification. Information pertaining to qualification of products may be obtained from Defense Supply Center Columbus, ATTN: DSCC-VQE, 3990 East Broad Street, Columbus, OH 43216-5000.

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

### Custodians:

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

### Preparing activity:

DLA - CC  
  
(Project 5961-2077)

### Review activities:

Navy - MC  
Air Force - 13, 19



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1. DOCUMENT NUMBER  
MIL-PRF-19500/527B

2. DOCUMENT DATE  
990910

### 3. DOCUMENT TITLE

SEMICONDUCTOR DEVICE, DARLINGTON TRANSISTOR, PNP, SILICON, POWER TYPES 2N6648, 2N6649 AND 2N6650 JAN, JANTX AND JANTXV

4. NATURE OF CHANGE (Identify paragraph number and include proposed rewrite, if possible. Attach extra sheets as needed.)

5. REASON FOR RECOMMENDATION

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