The documentation and process conversion measures necessary to comply with this revision shall be completed by 14 November 2006.

INCH-POUND

MIL-PRF-19500/433H
14 August 2006
SUPERSEDING
MIL-PRF-19500/433G
29 July 2005

PERFORMANCE SPECIFICATION SHEET

SEMICONDUCTOR DEVICE, TRANSISTOR, PNP, SILICON, HIGH-POWER,
TYPES 2N4399 AND 2N5745, JAN, JANTX, JANTXV, AND JANS

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

The requirements for acquiring the product described herein shall consist of this specification sheet and MIL-PRF-19500.

1. SCOPE

1.1 Scope. This specification covers the performance requirements for PNP silicon, high-power transistors. Four levels of product assurance are provided for each device type as specified in MIL-PRF-19500.

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

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

| Type | $P_T$ (1) | $P_T$ (2) $T_C$ = +100°C | $R_{\theta JC}$ | $R_{\theta JA}$ | $V_{CBO}$ | $V_{CEO}$ | $V_{EBO}$ | $I_B$ | $I_C$ | $T_J$ and $T_{STG}$ |
|---|---|---|---|---|---|---|---|---|---|---|
| | W | W | °C/W | °C/W | V dc | V dc | V dc | A dc | A dc | °C |
| 2N4399 | 5 | 115 | 0.875 | 35 | 60 | 60 | 5 | 7.5 | 30 | -55 to +200 |
| 2N5745 | 5 | 115 | 0.875 | 35 | 80 | 80 | 5 | 7.5 | 20 | -55 to +200 |

(1) Derate linearly 28.57 mW/°C above $T_A$ = +25°C.
(2) Derate linearly 1.15 W/°C above $T_C$ = +100°C.

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

AMSC N/A

FSC 5961

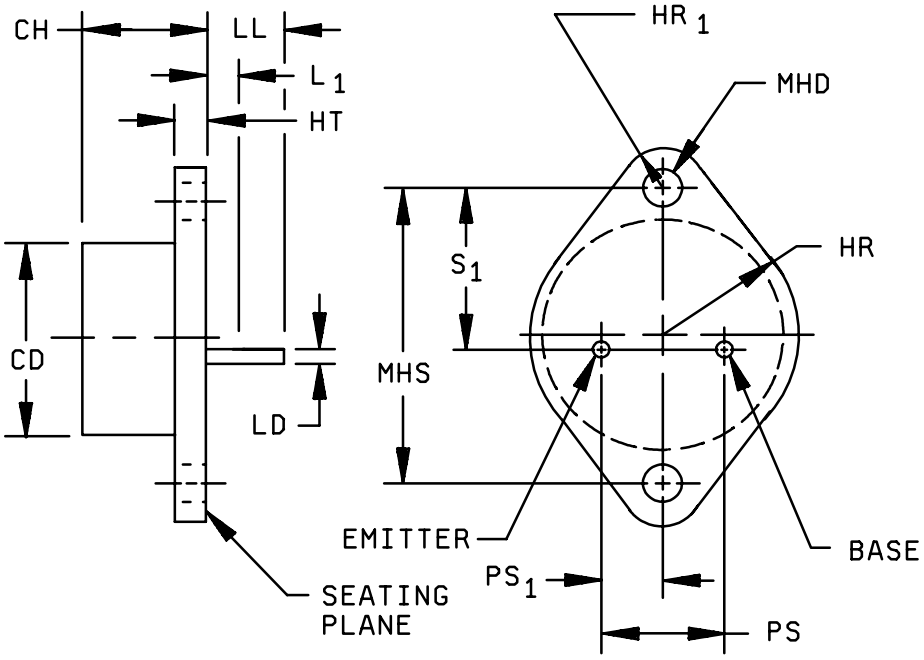



FIGURE 1. Physical dimensions (TO-3).

| Symbol | Dimensions | | | | Notes |
|---|---|---|---|---|---|
| | Inches | | Millimeters | | |
| | Min | Max | Min | Max | |
| CD | | .875 | | 22.23 | |
| CH | .270 | .380 | 6.86 | 9.65 | |
| HT | .060 | .135 | 1.52 | 3.43 | |
| HR | .495 | .525 | 12.57 | 13.34 | |
| $HR_1$ | .131 | .188 | 3.33 | 4.78 | |
| LD | .038 | .043 | 0.97 | 1.09 | 5 |
| LL | .312 | .500 | 7.92 | 12.70 | 5 |
| $L_1$ | | .050 | | 1.27 | 5 |
| MHD | .151 | .161 | 3.84 | 4.09 | |
| MHS | 1.177 | 1.197 | 29.90 | 30.40 | |
| PS | .420 | .440 | 10.67 | 11.18 | 2, 3 |
| $PS_1$ | .205 | .225 | 5.21 | 5.72 | 2, 3 |
| $S_1$ | .655 | .675 | 16.64 | 17.15 | 2 |

NOTES:
1. Dimensions are in inches. Millimeters are given for general information only.
2. These dimensions should be measured at points .050 inch (1.27 mm) to .055 inch (1.40 mm) below seating plane. When gauge is not used, measurement will be made at the seating plane.
3. The seating plane of the header shall be flat within .001 inch (0.03 mm) concave to .004 inch (0.10 mm) convex inside a .930 inch (23.62 mm) diameter circle on the center of the header and flat within .001 inch (0.03 mm) concave to .006 inch (0.15 mm) convex overall.
4. Collector shall be electrically connected to the case.
5. LD applies between L1 and LL. Lead diameter shall not exceed twice LD within $L_1$
6. In accordance with ASME Y14.5M, diameters are equivalent to $\phi$x symbology.

FIGURE 1. Physical dimensions (TO-3) - Continued.

1.4 Primary electrical characteristics at $T_C$ = +25°C.

| Limit | $h_{FE2}$ (1) | | $\|h_{FE}\|$ | $V_{CE(sat)1}$ (1) | | $V_{BE(sat)1}$ (1) | | $C_{obo}$ | Switching | |
|---|---|---|---|---|---|---|---|---|---|---|
| | $V_{CE}$ = 2 V dc<br>$I_C$ = 15 A dc | $V_{CE}$ = 2 V dc<br>$I_C$ = 10 A dc | $V_{CE}$ = 10 V dc<br>$I_C$ = 1 A dc<br>f = 1 MHz | $I_C$ = 10 A dc<br>$I_B$ = 1.0 A dc | | $I_C$ = 15 A dc<br>$I_B$ = 1.5 A dc | | $V_{CB}$ = 10 V dc<br>$I_E$ = 0<br>100 kHz ≤ f ≤ 1 MHz | $t_{on}$ | $t_{off}$ |
| | 2N4399 | 2N5745 | V dc | 2N4399<br>V dc | 2N5745<br>V dc | 2N4399<br>V dc | 2N5745<br>V dc | pF | µs | µs |
| Min | 15 | 15 | 4 | | | | | | | |
| Max | 60 | 60 | 40 | 0.75 | 1.0 | 1.8 | 2.0 | 1,000 | 1.2 | 2.5 |

(1) Pulsed (see 4.5.1).

## 2. APPLICABLE DOCUMENTS

2.1 General. The documents listed in this section are specified in sections 3, 4, or 5 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, 4, or 5 of this specification, whether or not they are listed.

2.2 Government documents.

2.2.1 Specifications, standards, and handbooks. The following specifications, standards, and handbooks form a part of this document to the extent specified herein. Unless otherwise specified, the issues of these documents are those cited in the solicitation or contract.

DEPARTMENT OF DEFENSE SPECIFICATIONS

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

DEPARTMENT OF DEFENSE STANDARDS

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

(Copies of these documents are available online at http://assist.daps.dla.mil/quicksearch/ or http://assist.daps.dla.mil/ or from the Standardization Document Order Desk, 700 Robbins Avenue, Building 4D, Philadelphia, PA 19111-5094.)

2.3 Order of precedence. In the event of a conflict between the text of this document and the references cited herein, the text of this document takes precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

3. REQUIREMENTS

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

3.2 Qualification. Devices furnished under this specification shall be products that are manufactured by a manufacturer authorized by the qualifying activity for listing on the applicable qualified manufacturers list 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. Interface and physical dimensions shall be as specified in MIL-PRF-19500 and on figure 1.

3.4.1 Lead finish. Unless otherwise specified, lead finish shall be solderable in accordance with MIL-STD-750, MIL-PRF-19500, and herein (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 test requirements shall be the subgroups 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 and inspection. 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 table I and II).

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

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

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

| Screen (see table E-IV of MIL-PRF-19500) | Measurement | |
|---|---|---|
| | JANS level | JANTX and JANTXV levels |
| (1) 3c | Thermal impedance (see 4.3.2) | Thermal impedance (see 4.3.2) |
| 9 | $I_{CEX1}$ and $h_{FE2}$ | $I_{CEX1}$ |
| 11 | $I_{CEX1}$ and $h_{FE2}$<br>$\Delta I_{CEX1} \leq$ 100 percent of initial value or 5 nA dc, whichever is greater.<br>$\Delta h_{FE2} \leq \pm$ 15 percent of initial value | $I_{CEX1}$ and $h_{FE2}$;<br>$\Delta I_{CEX1} \leq$ 100 percent of initial value or 100 nA dc, whichever is greater. |
| 12 | See 4.3.1 | See 4.3.1 |
| 13 | Subgroup 2 of table I herein;<br>$\Delta I_{CEX1} \leq$ 100 percent of initial value or 50 nA dc, whichever is greater;<br>$\Delta h_{FE2} \leq \pm$ 15 percent of initial value | Subgroup 2 of table I herein;<br>$\Delta I_{CEX1} \leq$ 100 percent of initial value or 100 nA dc, whichever is greater;<br>$\Delta h_{FE2} \leq \pm$ 15 percent of initial value; |

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

4.3.1 Power burn-in conditions. Power burn-in conditions are as follows: $T_J$ = +187.5 ± 12.5°C; $V_{CE}$ = +30 V dc, ±10 V dc; $T_A$ = room ambient as defined in the general requirements of MIL-STD-750.

* 4.3.2 Thermal impedance. The thermal impedance measurements shall be performed in accordance with method 3161 of MIL-STD-750 using the guidelines in that method for determining $I_M$, $I_H$, $t_H$, $t_{SW}$, (and $V_H$ where appropriate). Measurement delay time ($t_{MD}$) = 70 μs max. See table II, group E, subgroup 4 herein.

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 table I, subgroup 1 and 2 inspection only (table E-VIB, group B, subgroup 1 is not required to be performed again if group B has already been satisfied in accordance with 4.4.2).

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 conditions specified for subgroup testing in table E-VIA (JANS) and table E-VIB (JAN, JANTX, and JANTXV) of MIL-PRF-19500, and as follows. Electrical measurements (end-points) shall be in accordance with table I, subgroup 2 herein.

4.4.2.1 Group B inspection, table E-VIA of MIL-PRF-19500.

| | Subgroup | Method | Conditions |
|---|---|---|---|
| * | B4 | 1037 | $V_{CB}$ = 20 V dc; $P_T$ = 5 W at $T_A$ = room ambient as defined in the general requirements of 4.5 of MIL-STD-750; $t_{on} = t_{off}$ = 3 minutes minimum for 2,000 cycles. No heat sink or forced-air cooling on devices shall be permitted. |
| | B5 | 1027 | $V_{CB}$ = 20 V dc; $T_A$ = +125°C ± 25°C for 96 hours; $P_T$ = 5 W at $T_A$ = +125°C or adjusted as required by the chosen $T_A$ to give an average lot $T_J$ = +275°C. |

4.4.2.2 Group B inspection, table E-VIB of MIL-PRF-19500.

| Subgroup | Method | Conditions |
|---|---|---|
| B3 | 1037 | $V_{CB}$ = 20 V dc; adjust device current or power between cycles to achieve a minimum $\Delta T_J$ of +100°C; $t_{on} = t_{off}$ = 3 minutes minimum for 2,000 cycles. No heat sink or forced-air cooling on the devices shall be permitted. |

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. Electrical measurements (end-points) shall be in accordance with table I, subgroup 2 herein.

| | Subgroup | Method | Conditions |
|---|---|---|---|
| | C2 | 2036 | Test condition A, weight = 10 lbs, t = 15 seconds. |
| * | C5 | 3131 | See 4.3.2, $R_{\theta JC}$ = 0.875. |
| | C6 | 1037 | $V_{CB}$ = 20 V dc; Adjust device current or power between cycles to achieve a minimum $\Delta T_J$ of +100°C; $t_{on} = t_{off}$ = 3 minutes minimum for 6,000 cycles. No heat sink or forced-air cooling on device shall be permitted. |

4.4.4 Group E inspection. Group E inspection shall be conducted in accordance with the conditions specified for subgroup testing in table E-IX of MIL-PRF-19500 and as specified in table II herein. Electrical measurements (end-points) shall be in accordance with table I, subgroup 2 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 | Limits 2/ | | Unit |
|---|---|---|---|---|---|---|---|
| | | Method | Conditions | | Min | Max | |
| | Subgroup 1 | | | | | | |
| | Visual and mechanical inspection | 2071 | | | | | |
| | Subgroup 2 | | | | | | |
| * | Thermal impedance | 3131 | See 4.3.2 | $Z_{\theta JX}$ | | | °C/W |
| | Collector to base breakdown voltage | 3011 | Bias condition D; $I_C$ = 200 mA dc; pulsed (see 4.5.1) | $V_{(BR)CEO}$ | | | |
| | 2N4399 | | | | 60 | | V dc |
| | 2N5745 | | | | 80 | | V dc |
| | Collector to emitter cutoff current | 3041 | Bias condition D | $I_{CEO}$ | | | |
| | 2N4399 | | $V_{CE}$ = 60 V dc | | | 100 | µA dc |
| | 2N5745 | | $V_{CE}$ = 80 V dc | | | 100 | µA dc |
| | Emitter-base cutoff current | 3061 | Bias condition D; $V_{EB}$ = 5 V dc | $I_{EBO}$ | | 5.0 | µA dc |
| | Collector to emitter cutoff current | 3041 | Bias condition A; $V_{BE}$ = 1.5 V dc | $I_{CEX1}$ | | | |
| | 2N4399 | | $V_{CE}$ = 60 V dc | | | 5.0 | µA dc |
| | 2N5745 | | $V_{CE}$ = 80 V dc | | | 5.0 | µA dc |
| | Base emitter saturated voltage | 3066 | Test condition A; $I_C$ = 15 A dc; $I_B$ = 1.5 A dc; pulsed (see 4.5.1) | $V_{BE(sat)1}$ | | | |
| | 2N4399 | | | | | 1.8 | V dc |
| | 2N5745 | | | | | 2.0 | V dc |
| | Base emitter saturated voltage | 3066 | Test condition A; $I_C$ = 10 A dc; $I_B$ = 1.0 A dc; pulsed (see 4.5.1) | $V_{BE(sat)2}$ | | 1.7 | V dc |
| | Collector to emitter saturated voltage | 3071 | Pulsed (see 4.5.1); $I_C$ = 10 A dc; $I_B$ = 1 A dc | $V_{CE(sat)1}$ | | | |
| | 2N4399 | | | | | 0.75 | V dc |
| | 2N5745 | | | | | 1.0 | V dc |
| | Collector to emitter saturated voltage | 3071 | $I_C$ = 5.0 dc; $I_B$ = 0.5 A dc; pulsed (see 4.5.1) | $V_{CE(sat)2}$ | | 0.55 | V dc |
| | Forward-current transfer ratio | 3076 | $V_{CE}$ = 2 V dc; $I_C$ = 1.0 A dc; pulsed (see 4.5.1) | $h_{FE1}$ | 40 | 425 | |

See footnote at end of table.

* TABLE I. Group A inspection - Continued.

| Inspection 1/ | MIL-STD-750 | | Symbol | Limits | | Unit |
|---|---|---|---|---|---|---|
| | Method | Conditions | | Min | Max | |
| Subgroup 2 - Continued | | | | | | |
| Forward-current transfer ratio | 3076 | $V_{CE}$ = 2 V dc; pulsed (see 4.5.1) | $h_{FE2}$ | | | |
| 2N4399 | | $I_C$ = 15 A dc | | 15 | 60 | |
| 2N5745 | | $I_C$ = 10 A dc | | 15 | 60 | |
| Forward-current transfer ratio | 3076 | $V_{CE}$ = 5 V dc; pulsed (see 4.5.1) | $h_{FE3}$ | | | |
| 2N4399 | | $I_C$ = 30 A dc | | 5 | | |
| 2N5745 | | $I_C$ = 20 A dc | | 5 | | |
| Subgroup 3 | | | | | | |
| High-temperature operation: | | $T_A$ = +150°C | | | | |
| Collector to emitter cutoff current | 3041 | Bias condition A; $V_{BE}$ = 1.5 V dc | $I_{CEX2}$ | | | |
| 2N4399 | | $V_{CE}$ = 60 V dc | | | 10 | mA dc |
| 2N5745 | | $V_{CE}$ = 80 V dc | | | 10 | mA dc |
| Low-temperature operation: | | $T_A$ = -55°C | | | | |
| Forward-current transfer ratio | 3076 | $V_{CE}$ = 2 V dc; pulsed (see 4.5.1) | $h_{FE4}$ | | | |
| 2N4399 | | $I_C$ = 15 A dc | | 7 | | |
| 2N5745 | | $I_C$ = 10 A dc | | 7 | | |
| Subgroup 4 | | | | | | |
| Pulse response | 3251 | Test condition A, except test circuit and pulse requirement in accordance with figure 2 | | | | |
| Pulse on time | | See figure 2 | $t_{on}$ | | 1.2 | μs dc |
| Pulse off time | | See figure 2 | $t_{off}$ | | 2.5 | μs 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 | |
| Subgroup 4 - Continued | | | | | | |
| Magnitude of common-emitter small-signal short-circuit forward-current transfer ratio | 3306 | $V_{CE}$ = 10 V dc; $I_C$ = 1.0 A dc; f = 1 MHz | $\|h_{fe}\|$ | 4 | 40 | |
| Open circuit output capacitance | 3236 | $V_{CB}$ = 10 V dc; $I_E$ = 0; 100 kHz ≤ f ≤ 1 MHz | $C_{obo}$ | | 1,000 | pF |
| Small-signal short-circuit forward-current transfer ratio | 3206 | $V_{CE}$ = 10 V dc; $I_C$ = 1.0 A dc; f = 1.0 kHz | $h_{fe}$ | 40 | 425 | |
| Subgroup 5 | | | | | | |
| Safe operating area (dc operation) | 3051 | $T_C$ = +25°C; t = 1 s; 1 cycle, (see figure 3) | | | | |
| Test 1 (Both device type) 2N4399 2N5745 | | $V_{CE}$ = 6.67 V dc; $I_C$ = 30 A dc<br>$V_{CE}$ = 10 V dc; $I_C$ = 20 A dc | | | | |
| Test 2 (Both device types) | | $V_{CE}$ = 20 V dc; $I_C$ = 10 A dc | | | | |
| Test 3 (Both device types) | | $V_{CE}$ = 40 V dc; $I_C$ = 3 A dc | | | | |
| Test 4 (Both device type) 2N4399 2N5745 | | $V_{CE}$ = 50 V dc; $I_C$ = 600 mA dc<br>$V_{CE}$ = 60 V dc; $I_C$ = 600 mA dc | | | | |
| Electrical measurements | | See subgroup 2, herein for $I_{CEX1}$ and $h_{FE2}$ | | | | |

See footnote at end of table.

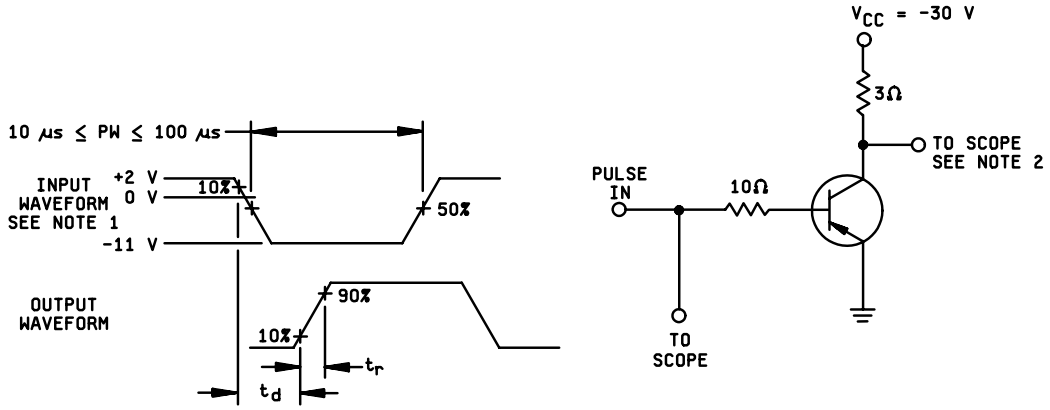
* TABLE I. Group A inspection - Continued.

| Inspection 1/ | MIL-STD-750 | | Symbol | Limits | | Unit |
|---|---|---|---|---|---|---|
| | Method | Conditions | | Min | Max | |
| Subgroup 5 - continued | | | | | | |
| Safe operating area (unclamped inductive load) | 3053 | Load condition C; (see figure 4); $T_C$ = +25°C; duty cycle ≤ 10 percent; $R_s$ = .01Ω; $t_r = t_f \leq 500$ ns. | | | | |
| Test 1 (Both device types) | | $t_p$ = 5 ms (vary to obtain $I_C$); $V_{BB2}$ = 0; $R_{BB1}$ = 10Ω; L = 2 mH; $V_{BB1}$ = 10 V dc; $R_{BB2}$ = infinity; $I_C$ = 10 A dc; $V_{CC}$ = 15 V dc. | | | | |
| Safe operating area (unclamped inductive load) - continued | 3053 | Load condition C; (see figure 4); $T_C$ = +25°C; duty cycle ≤ 10 percent; $R_s$ = .01Ω; $t_r = t_f \leq 500$ ns. | | | | |
| Test 2 (Both device types) | | $t_p$ = 5 ms (vary to obtain $I_C$); $V_{BB2}$ = 0; $V_{BB1}$ = 10 V dc; $R_{BB1}$ = 100Ω; L = 40 mH; $R_{BB2}$ = infinity; $I_C$ = 1 A dc; $V_{CC}$ = 15 V dc. | | | | |
| Safe operating area, clamped (switching destructive) | 3053 | $V_{CC}$ = 55 V dc; $T_A$ = +25°C; L = 20 mH; (see figures 5 and 6) | | | | |
| 2N4399 | | Clamped voltage = 60 V dc; $I_C$ = 30 A dc | | | | |
| 2N5745 | | Clamped voltage = 80 V dc; $I_C$ = 20 A dc | | | | |
| Subgroups 6 and 7 | | | | | | |
| Not applicable | | | | | | |

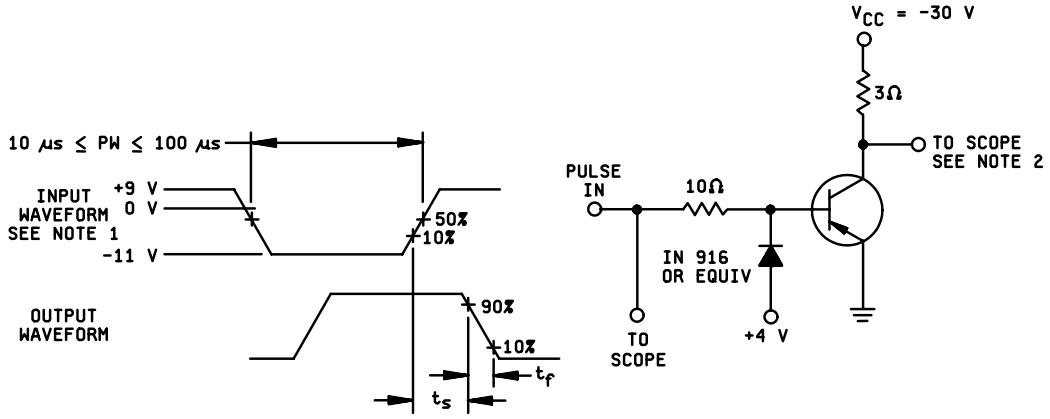
1/ For sampling plan see MIL-PRF 19500.

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

| Inspection | MIL-STD-750 | | Sample plan |
|---|---|---|---|
| | Method | Conditions | |
| Subgroup 1 | | | 45 devices<br>c = 0 |
| Temperature cycling | 1051 | Condition G, 500 cycles | |
| Hermetic seal<br>Fine leak<br>Gross leak | 1071 | <br>Test conditions G or H<br>Test conditions C or D | |
| Electrical measurements | | See table I, subgroup 2. | |
| Subgroup 2 | | | 45 devices<br>c = 0 |
| Blocking life | 1048 | Test temperature = +125°C; T = 1,000 hrs, $V_{CB}$ = 80 percent rated voltage (see 1.3). | |
| Electrical measurements | | See table I, subgroup 2. | |
| Subgroup 4 | | | N/A |
| Thermal impedance curves | | See MIL-PRF-19500. | |
| Subgroup 6 | | | 3 devices |
| ESD | 1020 | Testing not required for class 3 listing. Testing is required for nonsensitive listing to prove capability. | |
| Subgroup 8 | | | 45 devices<br>c = 0 |
| Reverse stability | 1033 | Condition B | |




TURN-ON ($t_{on}$) TIME TEST CIRCUIT A




TURN-OFF ($t_{off}$) TIME TEST CIRCUIT B

NOTES:

1. The input waveform is supplied by a pulse generator with the following characteristics: $t_r \leq 20$ µs, $t_f \leq 1$µs, 10µs ≤ PW ≤ 100µs, $Z_{OUT} = 50\Omega$, duty cycle ≤ 2 percent.
2. Output waveforms are monitored on an oscilloscope with the following characteristics: $t_r \leq 2$ µs, $Z_{IN} \geq 100$ kΩ, $C_{IN} \leq 12$ pF.
3. Test circuit A for $t_d$ and $t_r$; test circuit B for $t_s$ and $t_f$.
4. $t_{on} = t_d + t_r$, $t_{off} = t_s + t_f$

FIGURE 2. Pulse response test circuit.

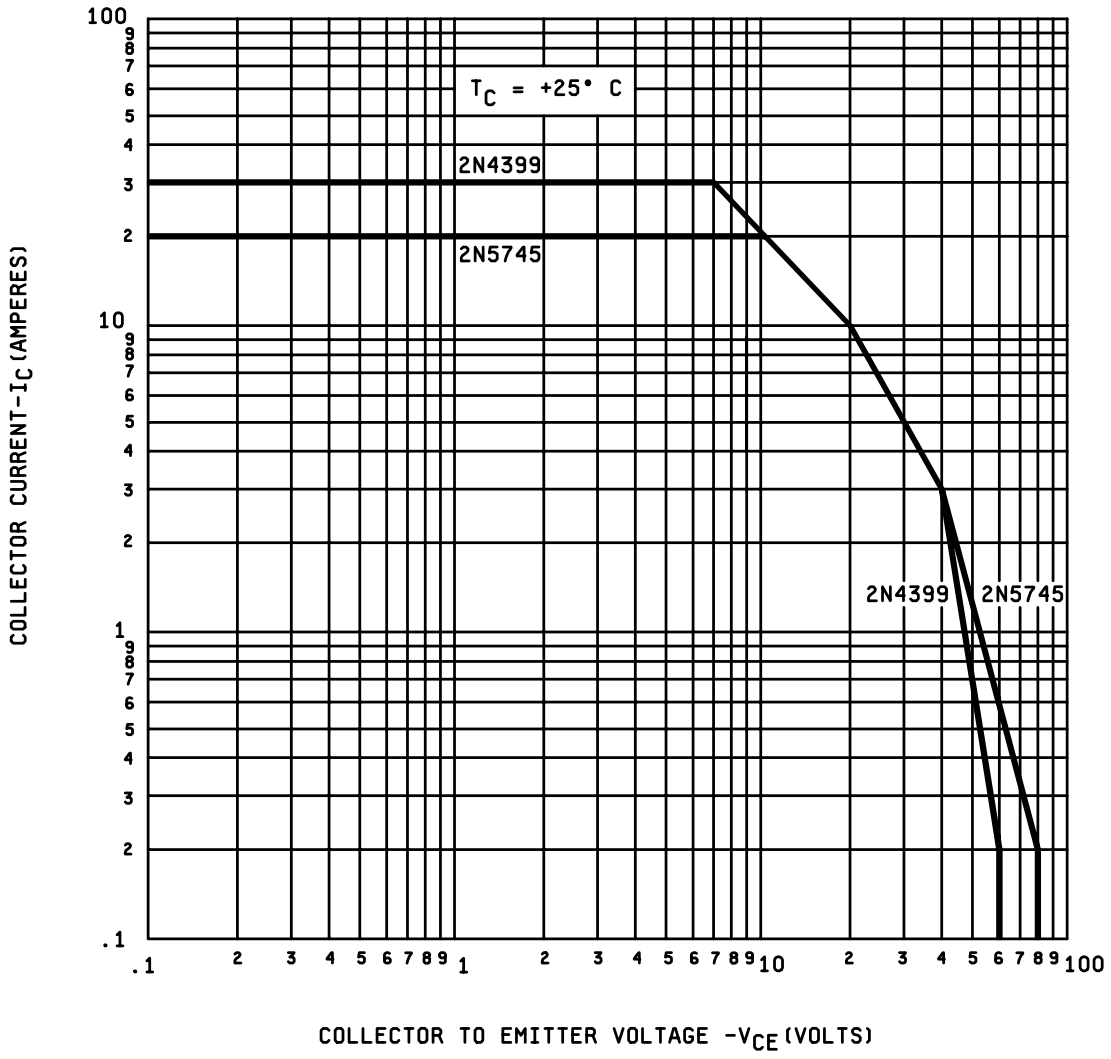



FIGURE 3. Maximum safe operating area graph (continuous dc).

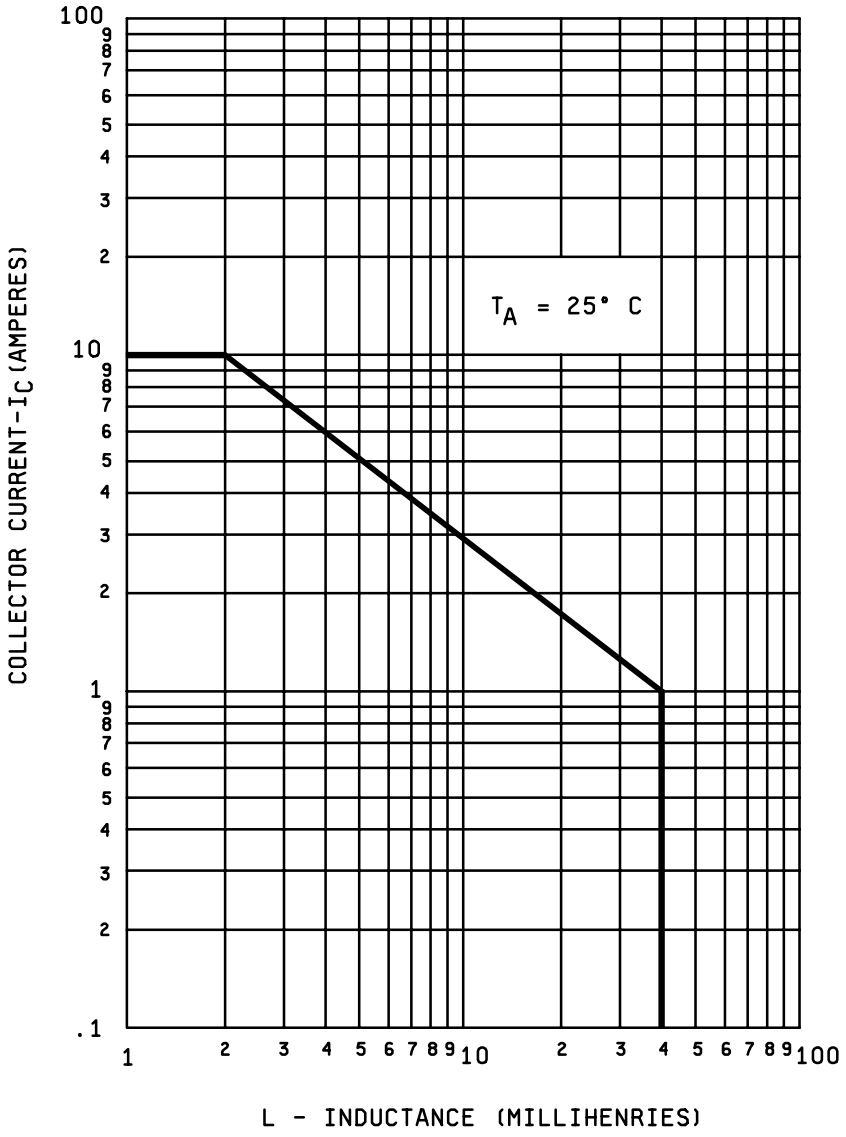
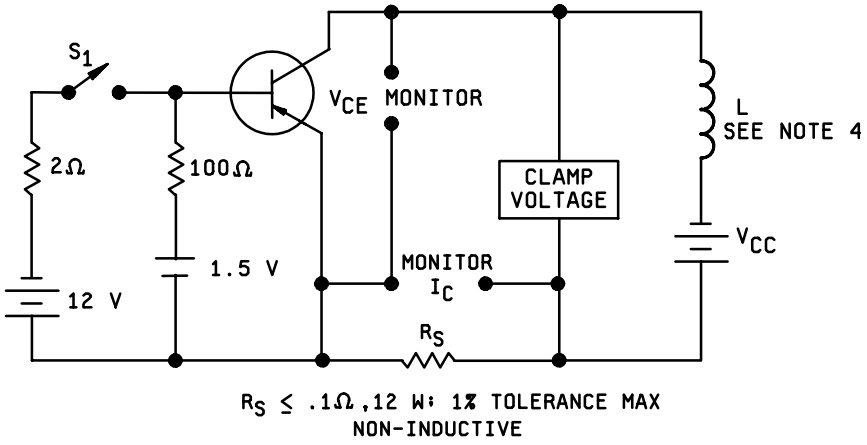



FIGURE 4. Safe operating area for switching between saturation and cutoff (unclamped inductive load).




NOTES:
1. With switch S1 closed, set the specified test conditions.
2. Open S1. Device fails if clamp voltage not reached.
3. Perform specified end-points tests.
4. L = 2.0 mH (2 each 1 mH, 50 A, .001Ω, Sanford Miller CK-50, or equivalent).

FIGURE 5. Clamped inductive sweep test circuit.

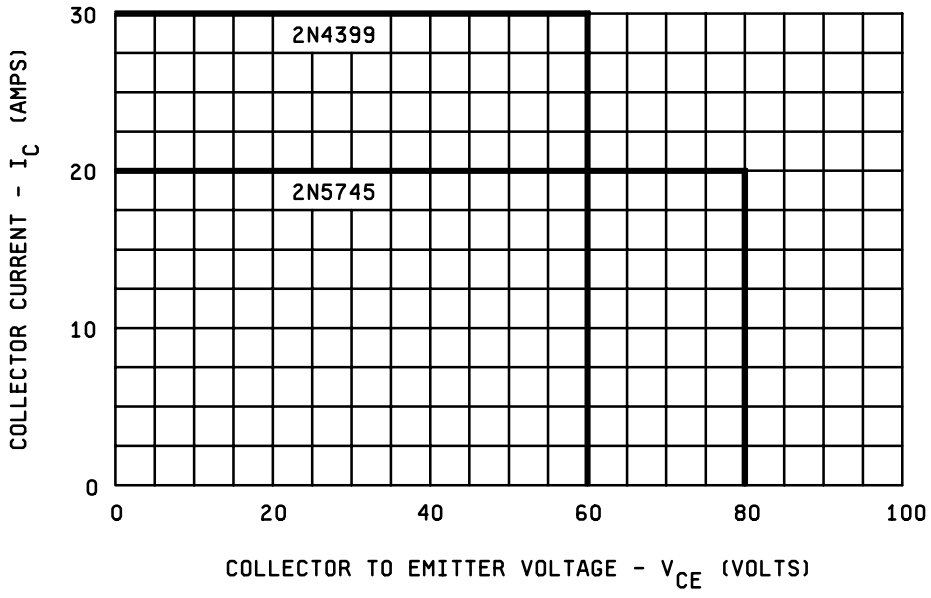



FIGURE 6. Safe operating area for switching between saturation and cutoff (clamped inductive load).

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.)

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

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. Product assurance level and type designator.

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 Defense Supply Center, Columbus, ATTN: DSCC/VQE, P.O. Box 3990, Columbus, OH 43218-3990 or e-mail vqe.chief@dla.mil.

6.4 Changes from previous issue. The margins of this specification are marked with asterisks to indicate where changes from the previous issue were made. 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 last previous issue.

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

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

Preparing activity:
DLA - CC

(Project 5961-2005-051)

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 http://assist.daps.dla.mil/ .