

The documentation and process conversion measures necessary to comply with this revision shall be completed by 1 February 2008.

INCH-POUND

MIL-PRF-19500/565E
1 November 2007
SUPERSEDING
MIL-PRF-19500/565D
30 June 2005

PERFORMANCE SPECIFICATION SHEET

SEMICONDUCTOR DEVICE, FIELD EFFECT TRANSISTOR, P-CHANNEL,
SILICON, TYPES 2N6895, 2N6896, 2N6897, AND 2N6898,
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 P-channel, enhancement-mode, MOSFET, power transistors. Four levels of product assurance are provided for each encapsulated device type as specified in MIL-PRF-19500.

1.2 Physical dimensions. See figure 1, TO-205AF (formerly TO-39) for 2N6895, figure 2, TO-204AA for 2N6896 and 2N6897; and TO-204AE for 2N6898 (formerly TO-3).

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

| Type | P_T (1) $T_C = +25^\circ\text{C}$ | P_T $T_A = +25^\circ\text{C}$ | $R_{\theta JC}$ | V_{DS} | V_{DG} | V_{GS} | I_{D1} (2) (3) $T_C = +25^\circ\text{C}$ | I_{D2} (2) (3) $T_C = +100^\circ\text{C}$ | I_S | I_{DM} | T_J and T_{STG} |
|--------|--|------------------------------------|-----------------|-------------|-------------|-------------|---|--|-------------|--------------|------------------------|
| | <u>W</u> | <u>W</u> | <u>°C/W</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>A(pk)</u> | <u>°C</u> |
| 2N6895 | 8.33 | 0.6 | 15.0 | 100 | 100 | ±20 | 1.16 | 0.74 | 1.16 | 5 | -55 to +150 |
| 2N6896 | 60 | 4 | 2.083 | 100 | 100 | ±20 | 6.0 | 3.8 | 6.0 | 20 | -55 to +150 |
| 2N6897 | 100 | 4 | 1.25 | 100 | 100 | ±20 | 12 | 7.6 | 12 | 30 | -55 to +150 |
| 2N6898 | 150 | 4 | 0.83 | 100 | 100 | ±20 | 25 | 15.8 | 25 | 60 | -55 to +150 |

(1) Derate linearly $T_C > +25^\circ\text{C}$; 2N6895 (0.067 W/°C), 2N6896 (0.48 W/°C), 2N6897 (0.8 W/°C), 2N6898 (1.2 W/°C).

(2) The following formula derives the maximum theoretical I_D limit. I_D is limited by package and internal wires and may be limited by pin diameter:

$$I_D = \sqrt{\frac{T_{JM} - T_C}{(R_{\theta JC}) \times (R_{DS(on)} \text{ at } T_{JM})}}$$

(3) See figure 3, maximum drain current graphs.

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@dsc.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/>.

1.4 Primary electrical characteristics at $T_C = +25^\circ\text{C}$.

| Type | Min $V_{(BR)DSS}$ $V_{GS} = 0\text{ V}$ $I_D = -1.0\text{ mA dc}$ | $V_{GS(th)1}$ $V_{DS} \geq V_{GS}$ $I_D = -1.0\text{ mA dc}$ | Max I_{DSS1} $V_{GS} = 0\text{ V}$ | Max $r_{DS(on)}$ (1) $V_{GS} = -10\text{ V dc}$ | | |
|--------|---|--|---|--|--|---|
| | | | | $V_{DS} = 80$ percent of rated V_{DS} | $T_J = +25^\circ\text{C}$ at I_{D1} | $T_J = +150^\circ\text{C}$ at I_{D2} |
| | <u>V dc</u> | <u>V dc</u> <u>Min</u> <u>Max</u> | | <u>$\mu\text{A dc}$</u> | <u>Ω</u> | <u>Ω</u> |
| 2N6895 | -100 | -2.0 | -4.0 | -1.0 | 3.65 | 6.15 |
| 2N6896 | -100 | -2.0 | -4.0 | -1.0 | 0.6 | 1.67 |
| 2N6897 | -100 | -2.0 | -4.0 | -1.0 | 0.3 | 0.69 |
| 2N6898 | -100 | -2.0 | -4.0 | -1.0 | 0.2 | 0.24 |

(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.

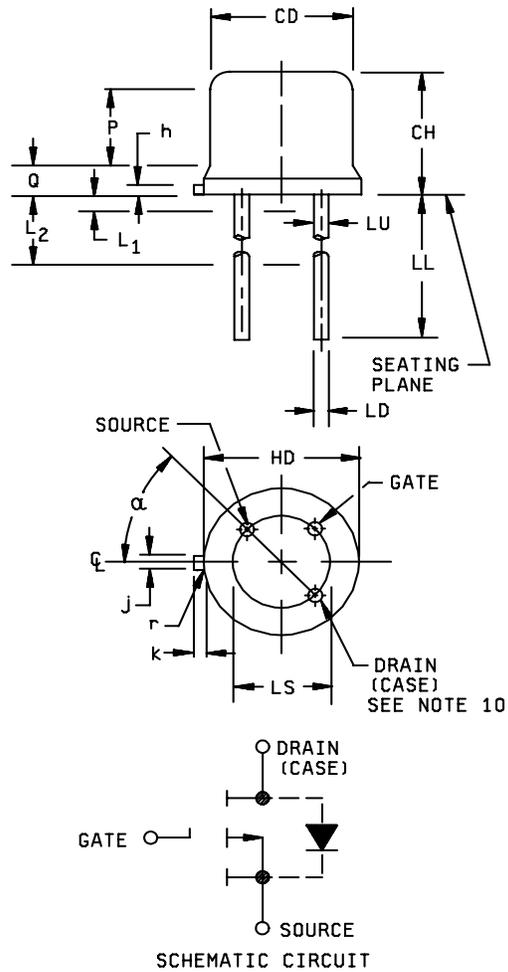
DEPARTMENT OF DEFENSE STANDARDS

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.

| Ltr | Dimensions | | | | Notes |
|----------------|------------|------|-------------|-------|-------|
| | Inches | | Millimeters | | |
| | Min | Max | Min | Max | |
| CD | .305 | .335 | 7.75 | 8.51 | |
| CH | .160 | .180 | 4.07 | 4.57 | |
| HD | .335 | .370 | 8.51 | 9.40 | |
| h | .009 | .041 | 0.23 | 1.04 | |
| j | .028 | .034 | 0.71 | 0.86 | 2 |
| k | .029 | .045 | 0.74 | 1.14 | 3 |
| LD | .016 | .021 | 0.41 | 0.53 | 7,8 |
| LL | .500 | .750 | 12.70 | 19.05 | 7,8 |
| LS | .200 TP | | 5.08 TP | | 6 |
| LU | .016 | .019 | 0.41 | 0.48 | 7,8 |
| L ₁ | | .050 | | 1.27 | 7,8 |
| L ₂ | .250 | | 6.35 | | 7,8 |
| P | .100 | | 2.54 | | 5 |
| Q | | .050 | | 1.27 | 4 |
| r | | .010 | | 0.25 | 9 |
| α | 45 TP | | 45 TP | | 6 |

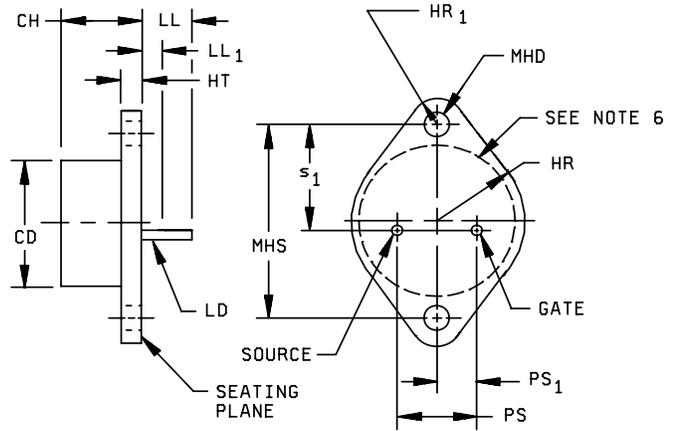
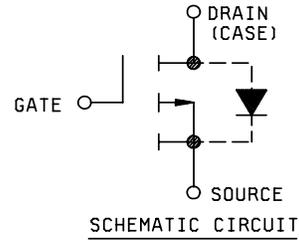


NOTES:

1. Dimensions are in inches. Millimeters are given for general information only.
2. Beyond radius (r) maximum, j shall be held for a minimum length of .011 inch (0.28 mm).
3. Dimension k measured from maximum HD.
4. Outline in this zone is not controlled.
5. Dimension CD shall not vary more than .010 inch (0.25 mm) in zone P. This zone is controlled for automatic handling.
6. 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.
7. LU applies between L₁ and L₂. LD applies between L₂ and L minimum. Diameter is uncontrolled in L₁ and beyond LL minimum.
8. All three leads.
9. Radius (r) applies to both inside corners of tab.
10. Drain is electrically connected to the case.
11. In accordance with ASME Y14.5M, diameters are equivalent to ϕ x symbology.

FIGURE 1. Physical dimensions for 2N6895 (TO-205AF).

| Symbol | Dimensions | | | | Notes |
|-------------------------|------------|-------|-------------|-------|-------|
| | Inches | | Millimeters | | |
| | Min | Max | Min | Max | |
| CD | | .875 | | 22.23 | |
| CH | .250 | .360 | 6.35 | 9.14 | |
| HR | .495 | .525 | 12.57 | 13.34 | |
| HR ₁ | .131 | .188 | 3.33 | 4.78 | |
| HT | .060 | .135 | 1.52 | 3.43 | |
| LD 2N6896, 2N6897 | .038 | .043 | 0.97 | 1.09 | |
| LD 2N6898 | .057 | .063 | 1.45 | 1.60 | |
| LL | .312 | .500 | 7.92 | 12.70 | |
| LL ₁ | | .050 | | 1.27 | |
| MHD | .151 | .161 | 3.84 | 4.09 | |
| MHS | 1.177 | 1.197 | 29.90 | 30.40 | |
| PS | .420 | .440 | 10.67 | 11.18 | 3, 5 |
| PS ₁ | .205 | .225 | 5.21 | 5.72 | 3, 5 |
| S ₁ | .655 | .675 | 16.64 | 17.15 | |



NOTES:

1. Dimensions are in inches.
2. Millimeters are given for general information only.
3. These dimensions should be measured at points .050 inch (1.27 mm) and .055 inch (1.40 mm) below seating plane. Measurement will be made at the seating plane.
4. 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.
5. Mounting holes shall be deburred on the seating plane side.
6. Drain is electrically connected to the case.
7. In accordance with ASME Y14.5M, diameters are equivalent to ϕ x symbology.

FIGURE 2. Physical dimensions of transistor 2N6896 and 2N6897 (TO-204AA), and 2N6898 (TO-204AE).

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 and as follows.

nC - nano Coulomb

3.4 Interface and physical dimensions. Interface and physical dimensions shall be as specified in MIL-PRF-19500, and on figure 1, TO-205AF (formerly TO-39) for 2N6895, and figure 2, TO-204AA for 2N6896 and 2N6897; and TO-204AE for 2N6898 (formerly TO-3).

3.4.1 Lead material and finish. Lead material shall be Kovar, Alloy 52 for TO-205AF, and a copper core or plated core is permitted. Lead finish shall be solderable in accordance with MIL-PRF-19500, MIL-STD-750, and herein. Where a choice of lead finish is desired, it shall be specified in the acquisition document (see 6.2).

3.4.2 Internal construction. Multiple chip construction shall not be permitted.

3.5 Electrostatic discharge protection. The devices covered by this specification require electrostatic protection.

3.5.1 Handling. MOS devices must be handled with certain precautions to avoid damage due to the accumulation of static charge. The following handling practices shall be followed:

- a. Devices shall be handled on benches with conductive handling devices.
- b. Ground test equipment, tools, and personnel handling devices.
- c. Do not handle devices by the leads.
- d. Store devices in conductive foam or carriers.
- e. Avoid use of plastic, rubber, or silk in MOS areas.
- f. Maintain relative humidity above 50 percent if practical.
- g. Care shall be exercised, during test and troubleshooting, to apply not more than maximum rated voltage to any lead.
- h. Gate must be terminated to source, $R \leq 100 \text{ k}\Omega$, whenever bias voltage is to be applied drain to source.

3.6 Marking. Marking shall be in accordance with MIL-PRF-19500. At the option of the manufacturer, marking of country of origin may be omitted from the body of the transistor, but shall be retained on the initial container.

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

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 table I).

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.

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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) (1) (2) | Measurement | |
|---|---|--|
| | JANS level | JANTX and JANTXV levels |
| (3) | Gate stress test (see 4.3.1) | Gate stress test (see 4.3.1) |
| (3) | Method 3470 of MIL-STD-750, (see 4.3.2) | Method 3470 of MIL-STD-750, (see 4.3.2) |
| (3) 3c | Method 3161 of MIL-STD-750, (see 4.3.3) | Method 3161 of MIL-STD-750, (see 4.3.3) |
| 9 | I_{GSSF1} , I_{GSSR1} , I_{DSS1} , subgroup 2 of table I herein | Not applicable |
| 10 | Method 1042 of MIL-STD-750, test condition B | Method 1042 of MIL-STD-750, test condition B |
| 11 | Subgroup 2 of table I herein; I_{GSSF1} , I_{GSSR1} , I_{DSS1} , $r_{DS(on)1}$, $V_{GS(th)1}$ $\Delta I_{GSSF1} = \pm 20$ nA dc or ± 100 percent of initial value, whichever is greater. $\Delta I_{GSSR1} = \pm 20$ nA dc or ± 100 percent of initial value, whichever is greater. $\Delta I_{DSS1} = \pm 2$ μ A dc or ± 100 percent of initial value, whichever is greater. | Subgroup 2 of table I herein. I_{GSSF1} , I_{GSSR1} , I_{DSS1} , $r_{DS(on)1}$, $V_{GS(th)1}$ |
| 12 | Method 1042 of MIL-STD-750, test condition A and test condition C. (see 4.3.4) | Method 1042 of MIL-STD-750, test condition A |
| 13 | Subgroups 2 and 3 of table I herein; $\Delta I_{GSSF1} = \pm 20$ nA dc or ± 100 percent of initial value, whichever is greater. $\Delta I_{GSSR1} = \pm 20$ nA dc or ± 100 percent of initial value, whichever is greater. $\Delta I_{DSS1} = \pm 2$ μ A dc or ± 100 percent of initial value, whichever is greater. $\Delta r_{DS(on)1} = \pm 20$ percent of initial value. $\Delta V_{GS(th)1} = \pm 20$ percent of initial value. | Subgroup 2 of table I herein; $\Delta I_{GSSF1} = \pm 20$ nA dc or ± 100 percent of initial value, whichever is greater. $\Delta I_{GSSR1} = \pm 20$ nA dc or ± 100 percent of initial value, whichever is greater. $\Delta I_{DSS1} = \pm 2$ μ A dc or ± 100 percent of initial value, whichever is greater. $\Delta r_{DS(on)1} = \pm 20$ percent of initial value. $\Delta V_{GS(th)1} = \pm 20$ percent of initial value. |

- (1) At the end of the test program, I_{GSSF1} , I_{GSSR1} , and I_{DSS1} are measured.
- (2) An out-of-family program to characterize I_{GSSF1} , I_{GSSR1} , I_{DSS1} , and $V_{GS(th)1}$ shall be invoked.
- (3) Shall be performed anytime after temperature cycling, screen 3a; and does not need to be repeated in screening requirements.

4.3.1 Gate stress test. Apply $V_{GS} = -30$ V minimum for $t = 250$ μ s minimum.

4.3.2 Unclamped inductive switching.

- a. Peak current (I_D)

| | |
|--------|-------|
| 2N6895 | 1 A |
| 2N6896 | 2.7 A |
| 2N6897 | 5 A |
| 2N6898 | 5.9 A |
- b. Peak gate voltage (V_{GS})..... 10 V.
- c. Gate to source resistor (R_{GS}) $25\Omega \leq R_{GS} \leq 200\Omega$.
- d. Initial case temperature (T_C) $+25^\circ\text{C}, +10^\circ\text{C}, -5^\circ\text{C}$.
- e. Inductance (L)..... $100 \mu\text{H} \pm 10$ percent.
- f. Number of pulses to be applied..... 1 pulse minimum.
- g. Pulse repetition rate..... None.

* 4.3.3 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 μ s max. See table II, group E, subgroup 4 herein.

4.3.4 Power burn-in. Power burn-in conditions are as follows: Method 1042 of MIL-STD-750, condition C, $T_A = +25^\circ\text{C}, -5^\circ\text{C}, +10^\circ\text{C}$, $V_{DS} = 10$ V min.; I_D adjusted to meet a junction temperature of $+140^\circ\text{C}, -5^\circ\text{C}, +10^\circ\text{C}$, $t = 240$ hours.

4.4 Conformance inspection. Conformance inspection shall be in accordance with MIL-PRF-19500. Alternate flow is allowed for conformance inspection in accordance with figure 4 of MIL-PRF-19500.

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

4.4.2 Group B inspection. Group B inspection shall be conducted in accordance with the conditions specified for subgroup testing in table E-VIA (JANS) and table E-VIB (JAN, JANTX, and JANTXV) of MIL-PRF-19500 and herein. Electrical measurements (end-points) shall be in accordance with the inspections of table I, subgroup 2 herein.

* 4.4.2.1 Group B inspection table E-VIA (JANS) of MIL-PRF-19500.

| <u>Subgroup</u> | <u>Method</u> | <u>Conditions</u> |
|-----------------|---------------|--|
| B3 | 1051 | Test condition G. |
| B3 | 2077 | SEM. |
| * B4 | 1042 | Test condition D; 2,000 cycles. The heating cycle shall be 1 minute minimum. 2N6895, $V_{DS} = -10$ V dc, $P_T = 0.6$ W at $T_A = +25^\circ\text{C} \pm 3^\circ\text{C}$. 2N6896, 2N6897, 2N6898, $V_{DS} = -20$ V dc, $P_T = 4$ W at $T_A = +25^\circ\text{C} \pm 3^\circ\text{C}$. |
| B5 | 1042 | Accelerated steady-state operation life; test condition C; $T_A = +25^\circ\text{C}, -5^\circ\text{C}, +10^\circ\text{C}$, $V_{DS} = 10$ V min.; I_D adjusted to meet a junction temperature of $+140^\circ\text{C}, -0^\circ\text{C}, +10^\circ\text{C}$, $t = 240$ hours. |
| B5 | 2037 | Bond strength, test condition A. |

4.4.2.2 Group B inspection, table E-VIB (JAN, JANTX, and JANTXV) of MIL-PRF-19500.

| <u>Subgroup</u> | <u>Method</u> | <u>Condition</u> |
|-----------------|---------------|--|
| B2 | 1051 | Test condition G, 25 cycles. |
| B3 | 1042 | Test condition D, 2,000 cycles. The heating cycle shall be 1 minute minimum. |

* 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 the inspections of table I, subgroup 2 herein.

| <u>Subgroup</u> | <u>Method</u> | <u>Condition</u> |
|-----------------|---------------|---|
| C2 | 2036 | Test condition E for TO-205AF (figure 1); test condition A, 10 lbs, 15 s for TO-3 (figure 2). |
| * C5 | 3161 | See 4.3.3, $R_{\theta JC} =$ see 1.3. |
| C6 | 1042 | Test condition D, 6,000 cycles. The heating cycle shall be 1 minute minimum. |

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 the inspections of table I, subgroup 2 herein.

4.5 Methods 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.

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* 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 inspection | 2071 | | | | | |
| <u>Subgroup 2</u> | | | | | | |
| * Thermal impedance <u>2/</u> | 3161 | See 4.3.3 | $Z_{\theta JX}$ | | | °C/W |
| Breakdown voltage, drain to source | 3407 | Bias condition C; $V_{GS} = 0$ V; $I_D = -1.0$ mA dc | $V_{(BR)DSS}$ | -100 | | V dc |
| Gate to source voltage (threshold) | 3403 | $V_{DS} \geq V_{GS}$; $I_D = -0.25$ mA dc | $V_{GS(th)1}$ | -2.0 | -4.0 | V dc |
| Gate current | 3411 | Bias condition C; $V_{DS} = 0$ V; $V_{GS} = +20$ V dc | I_{GSSF1} | | +100 | nA dc |
| Gate current | 3411 | Bias condition C; $V_{DS} = 0$ V; $V_{GS} = -20$ V dc | I_{GSSR1} | | -100 | nA dc |
| Drain current | 3413 | $V_{GS} = 0$; bias condition C; $V_{DS} = -80$ V | I_{DSS1} | | -1.0 | μA dc |
| Static drain to source on-state resistance | 3421 | $V_{GS} = -10$ V dc; condition A; pulsed (see 4.5.1) | $r_{DS(on)1}$ | | | |
| 2N6895 | | $I_D = -0.74$ A dc | | | 3.65 | Ω |
| 2N6896 | | $I_D = -3.8$ A dc | | | 0.6 | Ω |
| 2N6897 | | $I_D = -7.6$ A dc | | | 0.3 | Ω |
| 2N6898 | | $I_D = -15.8$ A dc | | | 0.2 | Ω |
| Drain to source on-state voltage | 3405 | $V_{GS} = 10$ V dc; condition A; pulsed (see 4.5.1) | $V_{DS(on)1}$ | | | |
| 2N6895 | | $I_D = -1.16$ A dc | | | -6.0 | V |
| 2N6896 | | $I_D = -6.0$ A dc | | | -6.0 | V |
| 2N6897 | | $I_D = -12.0$ A dc | | | -4.8 | V |
| 2N6898 | | $I_D = -25.0$ A dc | | | -6.0 | V |
| Forward voltage (source drain diode) | 4011 | Pulsed (see 4.5.1); $V_{GS} = 0$ V | V_{SD} | | | |
| 2N6895 | | $I_D = -1.16$ A dc | | -0.8 | -1.6 | V |
| 2N6896 | | $I_D = -6.0$ A dc | | -0.8 | -1.6 | V |
| 2N6897 | | $I_D = -12.0$ A dc | | -0.8 | -1.6 | V |
| 2N6898 | | $I_D = -25.0$ A dc | | -0.8 | -1.6 | V |

See footnotes at end of table.

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* TABLE I. Group A inspection - Continued.

| Inspection 1/ | MIL-STD-750 | | Symbol | Limits | | Unit |
|--|-------------|--|---------------|--------|-----------|------------------|
| | Method | Conditions | | Min | Max | |
| <u>Subgroup 2</u> - Continued. | | | | | | |
| Forward transconductance | 3475 | Pulsed (see 4.5.1), $I_D = \text{rated } I_{D2}$ (see 1.3). | g_{fs} | | | |
| 2N6895 | | | | 0.2 | | s |
| 2N6896 | | | | 1.0 | | s |
| 2N6897 | | | | 2.0 | | s |
| 2N6898 | | | | 4.0 | | s |
| <u>Subgroup 3</u> | | | | | | |
| High temperature operation: | | $T_C = T_J = +125^\circ\text{C}$ | | | | |
| Gate to source voltage(threshold) | 3403 | $V_{DS} \geq V_{GS}$, $I_D = -0.25 \text{ mA dc}$ | $V_{GS(th)2}$ | -1.0 | | V dc |
| Gate current | 3411 | Bias condition C, $V_{DS} = 0 \text{ V}$; $V_{GS} = +20 \text{ V dc}$ and -20 V dc | I_{GSS2} | | ± 200 | nA dc |
| Drain current | 3413 | Bias condition C, $V_{GS} = 0 \text{ V}$, $V_{DS} = -80 \text{ V}$ | I_{DSS2} | | - 50 | $\mu\text{A dc}$ |
| Static drain to source on-state resistance | 3421 | $V_{GS} = -10 \text{ V dc}$, pulsed (see 4.5.1) | $r_{DS(on)2}$ | | | |
| 2N6895 | | $I_D = - 0.74 \text{ A dc}$ | | | 5.66 | Ω |
| 2N6896 | | $I_D = - 3.8 \text{ A dc}$ | | | 0.96 | Ω |
| 2N6897 | | $I_D = - 7.6 \text{ A dc}$ | | | 0.465 | Ω |
| 2N6898 | | $I_D = - 15.8 \text{ A dc}$ | | | 0.24 | Ω |
| Low temperature operation: | | $T_C = T_J = -55^\circ\text{C}$ | | | | |
| Gate to source voltage (threshold) | 3403 | $V_{DS} \geq V_{GS}$, $I_D = -0.25 \text{ mA}$ | $V_{GS(th)3}$ | | -5.0 | V dc |
| <u>Subgroup 4</u> | | | | | | |
| Switching time test | 3472 | $I_D = \text{rated } I_{D2}$ (see 1.3); $V_{GS} = 10 \text{ V dc}$; $R_{gen} = 15 \Omega$; $R_{GS} = 15 \Omega$, $V_{DD} = 50 \text{ percent of rated } V_{DS}$ (see 1.3) | | | | |
| Turn-on delay time | | $V_{DD} = -50 \text{ V dc}$ | $t_{d(on)}$ | | | |
| 2N6895 | | $I_D = - 0.74 \text{ A dc}$ | | | 25 | ns |
| 2N6896 | | $I_D = - 3.8 \text{ A dc}$ | | | 60 | ns |
| 2N6897 | | $I_D = - 7.6 \text{ A dc}$ | | | 60 | ns |
| 2N6898 | | $I_D = - 15.8 \text{ A dc}$ | | | 50 | ns |

See footnotes at end of table.

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* TABLE I. Group A inspection - Continued.

| Inspection 1/ | MIL-STD-750 | | Symbol | Limits | | Unit | |
|--------------------------------|--------------------|---|--------------|--------------------|-----|------|----|
| | Method | Conditions | | Min | Max | | |
| <u>Subgroup 4</u> - Continued. | | | | | | | |
| Rise time | | $V_{DD} = -50$ V dc | t_r | | | | |
| 2N6895 | | $I_D = -0.74$ A dc | | | 45 | ns | |
| 2N6896 | | $I_D = -3.8$ A dc | | | 100 | ns | |
| 2N6897 | | $I_D = -7.6$ A dc | | | 175 | ns | |
| 2N6898 | | $I_D = -15.8$ A dc | | 250 | ns | | |
| Turn-off delay time | | $V_{DD} = -50$ V dc | $t_{d(off)}$ | | | | |
| 2N6895 | | $I_D = -0.74$ A dc | | | 45 | ns | |
| 2N6896 | | $I_D = -3.8$ A dc | | | 150 | ns | |
| 2N6897 | | $I_D = -7.6$ A dc | | | 275 | ns | |
| 2N6898 | | $I_D = -15.8$ A dc | | 400 | ns | | |
| Fall time | | $V_{DD} = -50$ V dc | t_f | | | | |
| 2N6895 | | $I_D = -0.74$ A dc | | | 50 | ns | |
| 2N6896 | $I_D = -3.8$ A dc | | | 100 | ns | | |
| 2N6897 | $I_D = -7.6$ A dc | | | 175 | ns | | |
| 2N6898 | $I_D = -15.8$ A dc | | 250 | ns | | | |
| <u>Subgroup 5</u> | | | | | | | |
| Safe operating area | 3474 | See figure 4. | | | | | |
| High voltage test | | $V_{DS} = 80$ percent of rated V_{DS} (see 1.3) | | | | | |
| Electrical measurements | | See table I, subgroup 2 | | | | | |
| <u>Subgroup 6</u> | | | | | | | |
| Not applicable | | | | | | | |
| <u>Subgroup 7</u> | | | | | | | |
| Gate charge | 3471 | Condition A or B | | | | | |
| <u>Test 1</u> | | | | | | | |
| On-state gate charge | | | $Q_{g(on)}$ | | | | |
| 2N6895 | | | | $I_D = -0.74$ A dc | 2.2 | 4.7 | nC |
| 2N6896 | | | | $I_D = -3.8$ A dc | 13 | 24 | nC |
| 2N6897 | | | | $I_D = -7.6$ A dc | 31 | 58 | nC |
| 2N6898 | | | | $I_D = -15.8$ A dc | 50 | 117 | nC |

See footnotes 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 7</u> - Continued. | | | | | | |
| <u>Test 2</u> | | | | | | |
| Gate to source charge | | | Q_{gs} | | | |
| 2N6895 | | | | 0.4 | 1.2 | nC |
| 2N6896 | | | | 1.1 | 5.5 | nC |
| 2N6897 | | | | 3 | 13 | nC |
| 2N6898 | | | | 6 | 25 | nC |
| <u>Test 3</u> | | | | | | |
| Gate to drain charge | | | Q_{gd} | | | |
| 2N6895 | | | | 0.9 | 2.9 | nC |
| 2N6896 | | | | 5.5 | 14.5 | nC |
| 2N6897 | | | | 14 | 36 | nC |
| 2N6898 | | | | 26 | 69 | nC |
| Reverse recovery time | 3473 | $V_{DD} = \leq 30 \text{ V}; di/dt = 100 \text{ A}/\mu\text{s}$ $I_F = 4 \text{ A}$ | t_{rr} | | | |
| 2N6895 | | | | | 340 | ns |
| 2N6896 | | | | | 375 | ns |
| 2N6897 | | | | | 500 | ns |
| 2N6898 | | | | | 750 | ns |

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

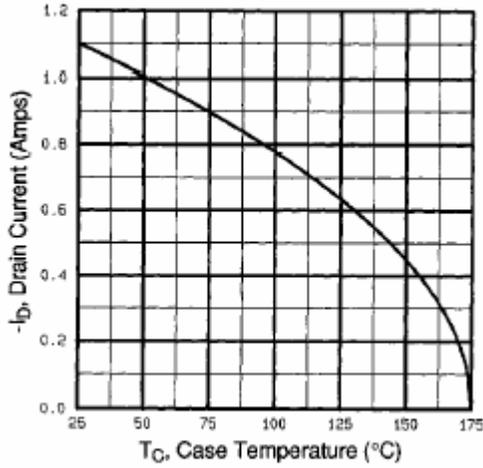
2/ This test required for the following end-point measurements only:
 Group B, subgroups 2 and 3 (JANTXV).
 Group B, subgroups 3 and 4 (JANS).
 Group C, subgroup 2 and 6.
 Group E, subgroup 1.

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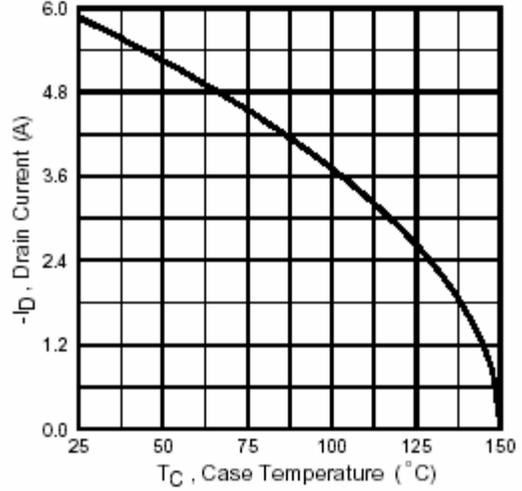
* TABLE II. Group E inspection (all quality levels) for qualification or re-qualification only.

| Inspection | MIL-STD-750 | | Sample Plan |
|--|-------------|--|---------------------|
| | Method | Conditions | |
| <u>Subgroup 1</u> | | | 45 devices c = 0 |
| Temperature cycling | 1051 | Test condition G. | |
| Hermetic seal | 1071 | Test conditions G or H | |
| Fine leak | | Test conditions C or D | |
| Gross leak | | | |
| Electrical measurements | | See table I, subgroup 2. | |
| <u>Subgroup 2 1/</u> | | | 45 devices c = 0 |
| Steady-state gate bias | 1042 | Condition B, 1,000 hours. | |
| Electrical measurements | | See table I, subgroup 2. | |
| Steady-state reverse bias | 1042 | Condition A, 1,000 hours. | |
| Electrical measurements | | See table I, subgroup 2. | |
| <u>Subgroup 4</u> | | | Sample size N/A |
| Thermal impedance curves | | See MIL-PRF-19500. | |
| <u>Subgroup 6</u> | | | 3 devices |
| ESD | 1020 | Not required for devices classified as ESD class 1. | |
| <u>Subgroup 10</u> | | | 22 devices c = 0 |
| Commutating diode for safe operating area test procedure for measuring dv/dt during reverse recovery of power MOSFET transistors or insulated gate bipolar transistors | 3476 | Test conditions shall be derived by the manufacturer | |

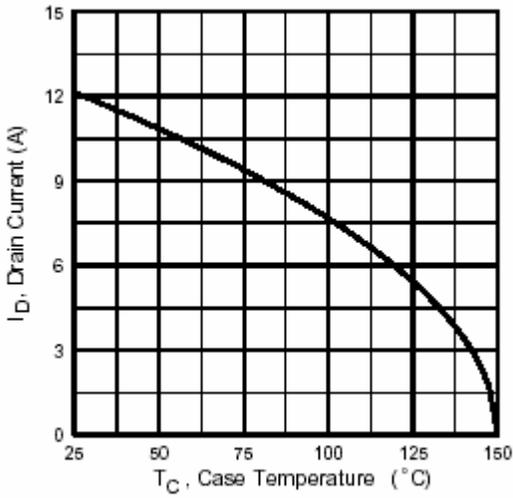
1/ A separate sample may be pulled for each test condition.



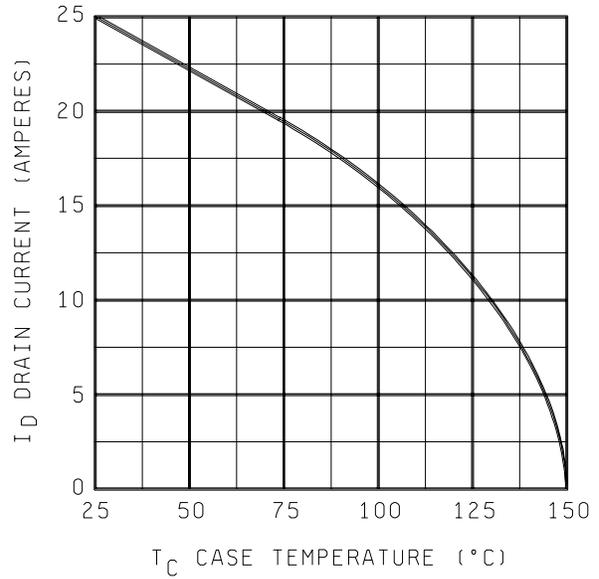
2N6895



2N6896



2N6897



2N6898

FIGURE 3. Maximum drain current vs case temperature graphs.

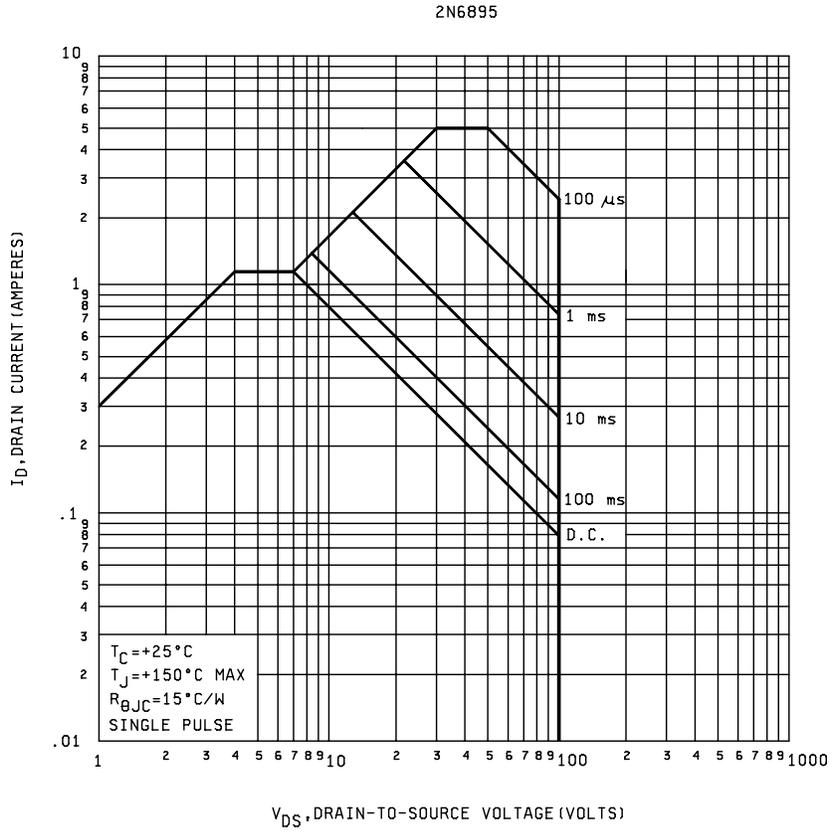


FIGURE 4. Maximum safe operating area.

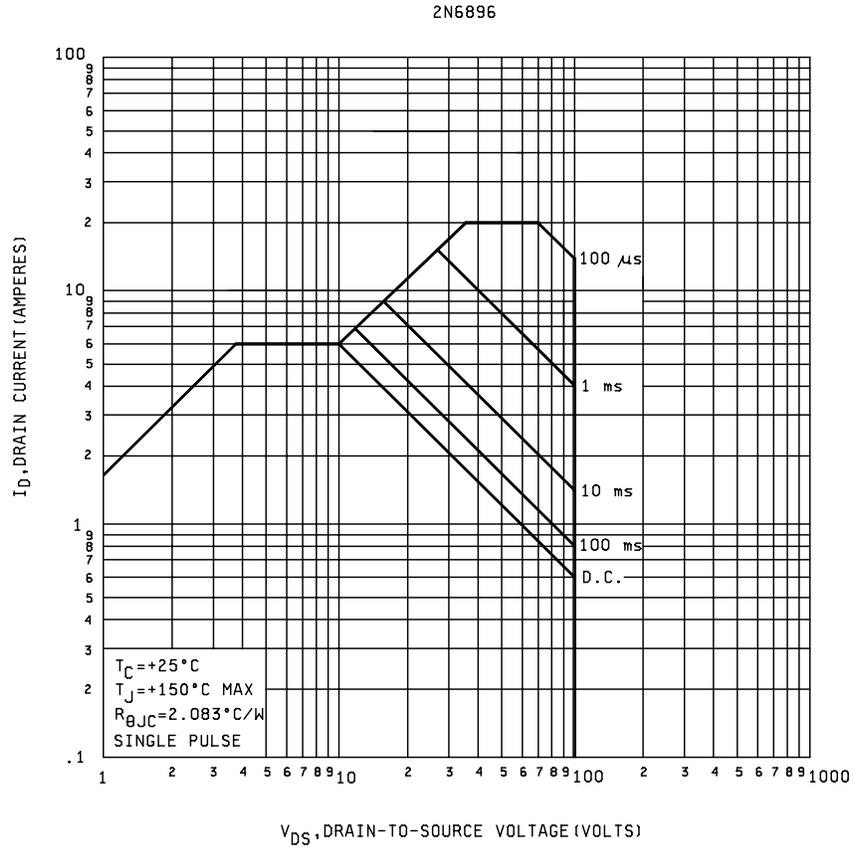


FIGURE 4. Maximum safe operating area – Continued.

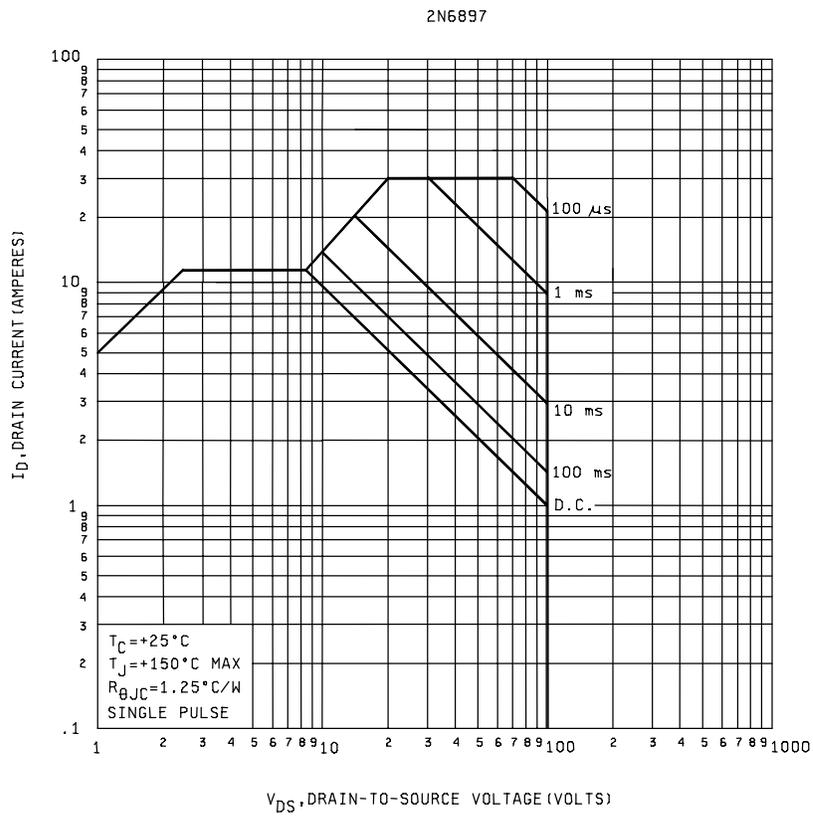


FIGURE 4. Maximum safe operating area – Continued.

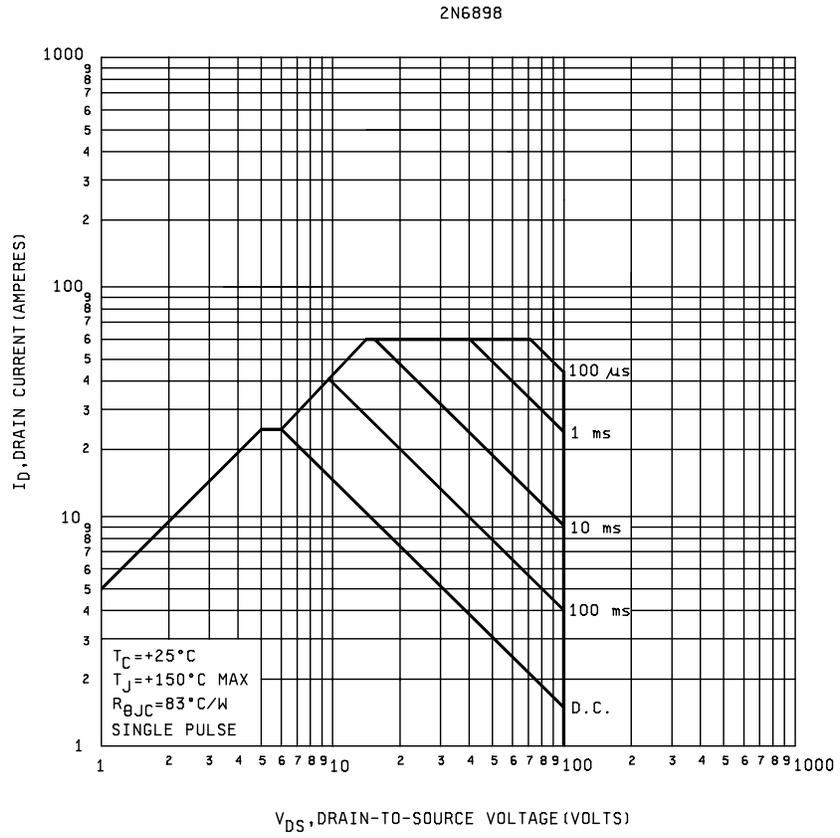


FIGURE 4. Maximum safe operating area – Continued.

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. Type designation and quality assurance level.

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.

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