The documentation and process conversion measures necessary to comply with this revision shall be completed by 8 March 2004.

INCH-POUND

MIL-PRF-19500/555H
8 December 2003
SUPERSEDING
MIL-PRF-19500/555G
8 December 1997

* PERFORMANCE SPECIFICATION SHEET

SEMICONDUCTOR DEVICE, FIELD EFFECT TRANSISTOR, N-CHANNEL, SILICON,
TYPES 2N6788, 2N6788U, 2N6790, 2N6790U, 2N6792, 2N6792U, 2N6794, AND 2N6794U,
JAN, JANTX, JANTXV, JANS, JANHC, AND JANKC

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

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

1. SCOPE

1.1 Scope. This specification covers the performance requirements for an N-channel, enhancement-mode, MOSFET, power transistor. Four levels of product assurance are provided for each device type as specified in MIL-PRF-19500. Two levels of product assurance are provided for each unencapsulated device type.

* 1.2 Physical dimensions. See figures 1 (TO-205AF), 2 (LCC), and figures 3, 4, 5, and 6 for JANHC and JANKC (die) dimensions.

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

| Type | $P_T$ $T_A$ = +25°C | $V_{DS}$ | $V_{DG}$ | $V_{GS}$ | $V_{DS}$ and $V_{DG}$ 70,000 ft. altitude |
|---|---|---|---|---|---|
| | W | V dc | V dc | V dc | |
| 2N6788, 2N6788U | 0.8 | 100 | 100 | ±20 | |
| 2N6790, 2N6790U | 0.8 | 200 | 200 | ±20 | |
| 2N6792, 2N6792U | 0.8 | 400 | 400 | ±20 | 300 |
| 2N6794, 2N6794U | 0.8 | 500 | 500 | ±20 | 300 |

| Type | $P_T$ (1) $T_C$ = +25°C | $I_{D1}$ (2) (3) $T_C$ = +25°C | $I_{D2}$ $T_C$ = +100°C | $I_S$ | $I_{DM}$ (4) | $T_J$ and $T_{STG}$ | $R_{\theta JC}$ |
|---|---|---|---|---|---|---|---|
| | W | A dc | A dc | A dc | A (pk) | °C | °C/W |
| 2N6788 | 20 | 6.0 | 3.5 | 6.0 | 24 | -55° | 6.25 |
| 2N6790 | 20 | 3.5 | 2.25 | 3.5 | 14 | to | 6.25 |
| 2N6792 | 20 | 2.0 | 1.25 | 2.0 | 8 | +150° | 6.25 |
| 2N6794 | 20 | 1.5 | 1.0 | 1.5 | 6 | | 6.25 |
| 2N6788U | 14 | 4.5 | 2.8 | 4.5 | 18 | | 8.93 |
| 2N6790U | 14 | 2.8 | 1.8 | 2.8 | 11 | | 8.93 |
| 2N6792U | 14 | 1.8 | 1.13 | 1.8 | 7.2 | | 8.93 |
| 2N6794U | 14 | 1.4 | 0.88 | 1.4 | 5.6 | | 8.93 |

See notes next page

* Comments, suggestions, or questions on this document should be addressed to Defense Supply Center, Columbus, ATTN: DSCC-VAC, P.O. Box 3990, Columbus, OH 43216-5000, or emailed to alan.barone@dla.mil. Since contact information can change, you may want to verify the currency of this address information using the ASSIST Online database at www.dodssp.daps.mil.

* 1.3 Maximum ratings. Continued.

(1) Derate linearly 0.16 W/°C for $T_C$ > +25°C for "non-U" suffix versions, 0.11 W/°C for $T_C$ > +25°C for "U" suffix versions.
(2) The following formula derives the maximum theoretical $I_D$ limit. $I_D$ is also limited by package and internal wires and may be limited due to pin diameter.

$$I_D = \sqrt{\frac{T_J(\max) - T_C}{R_{\theta JC} \, x \, (R_{DS(on)} \, at \, T_J(\max)}}$$

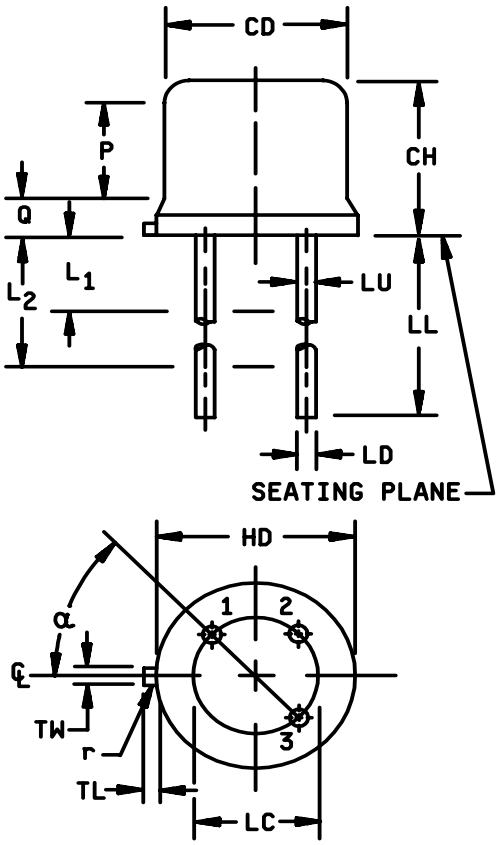
(3) See figure 7, maximum drain current graph.
(4) $I_{DM}$ = 4 $I_{D1}$; $I_{D1}$ as calculated in footnote (2).

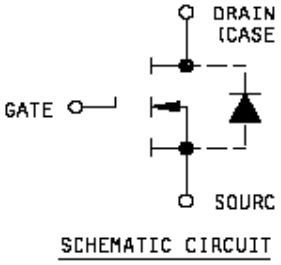
* 1.4 Unless otherwise specified, primary electrical characteristics at $T_C$ = +25°C.

| Type | Min $V_{(BR)DSS}$ $V_{GS}$ = 0 $I_D$ = 1.0 mA dc | $V_{GS(th)1}$ $V_{DS} \geq V_{GS}$ $I_D$ = 0.25 mA | | Max $I_{DSS1}$ $V_{GS}$ = 0 | Max $r_{DS(on)}$ (1) $V_{GS}$ = 10 V dc $I_D = I_{D2}$ | |
|---|---|---|---|---|---|---|
| | | | | $V_{DS}$ = 80 percent of rated $V_{DS}$ | $T_J$ = +25°C | $T_J$ = +150°C |
| | V dc | V dc | | µA dc | Ohms | Ohms |
| | | Min | Max | | | |
| 2N6788, 2N6788U | 100 | 2.0 | 4.0 | 25 | 0.30 | 0.60 |
| 2N6790, 2N6790U | 200 | 2.0 | 4.0 | 25 | 0.80 | 1.80 |
| 2N6792, 2N6792U | 400 | 2.0 | 4.0 | 25 | 1.80 | 4.50 |
| 2N6794, 2N6794U | 500 | 2.0 | 4.0 | 25 | 3.00 | 7.50 |

(1) Pulsed (see 4.5.1).

| Symbol | Dimensions | | | | Note |
|---|---|---|---|---|---|
| | 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 | |
| LC | .200 TP | | 5.08 TP | | 6 |
| LD | .016 | .021 | 0.41 | 0.53 | 7,8 |
| LL | .500 | .750 | 12.70 | 19.05 | 7,8,12 |
| LU | .016 | .019 | 0.41 | 0.48 | 7,8 |
| L1 | | .050 | | 1.27 | 7,8 |
| L2 | .250 | | 6.35 | | 7,8 |
| P | .100 | | 2.54 | | |
| Q | | .050 | | 1.27 | 5 |
| TL | .029 | .045 | 0.74 | 1.14 | 3,4 |
| TW | .028 | .034 | 0.71 | 0.86 | 3 |
| r | | .010 | | 0.25 | 10 |
| α | 45° TP | | 45° TP | | 6 |



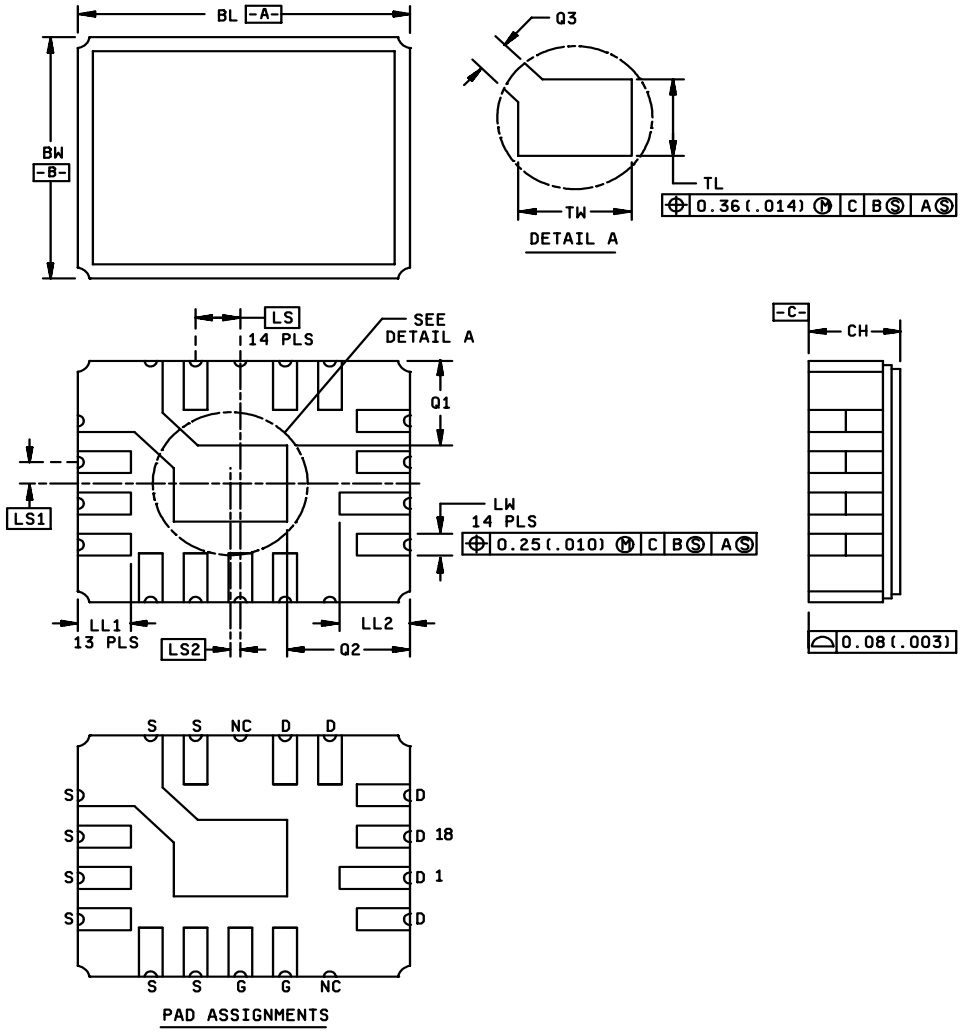




SCHEMATIC CIRCUIT

NOTES:

1. Dimensions are in inches.
2. Millimeters are given for general information only.
3. Beyond r (radius) maximum, TL shall be held for a minimum length of .011 inch (0.28 mm).
4. Dimension TL measured from maximum HD.
5. Body contour optional within zone defined by HD, CD, and Q.
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.
7. Dimension LU applies between $L_1$ and $L_2$. Dimension LD applies between $L_2$ and LL minimum. Diameter is uncontrolled in $L_1$ and beyond LL minimum.
8. All three leads.
9. The collector shall be internally connected to the case.
10. Dimension r (radius) applies to both inside corners of tab.
11. In accordance with ASME Y14.5M, diameters are equivalent to ϕx symbology.
12. Lead 1 = source, lead 2 = gate, lead 3 = drain.

* FIGURE 1. Physical dimensions (similar to TO-205AF) 2N6788, 2N6790, 2N6792, and 2N6794.

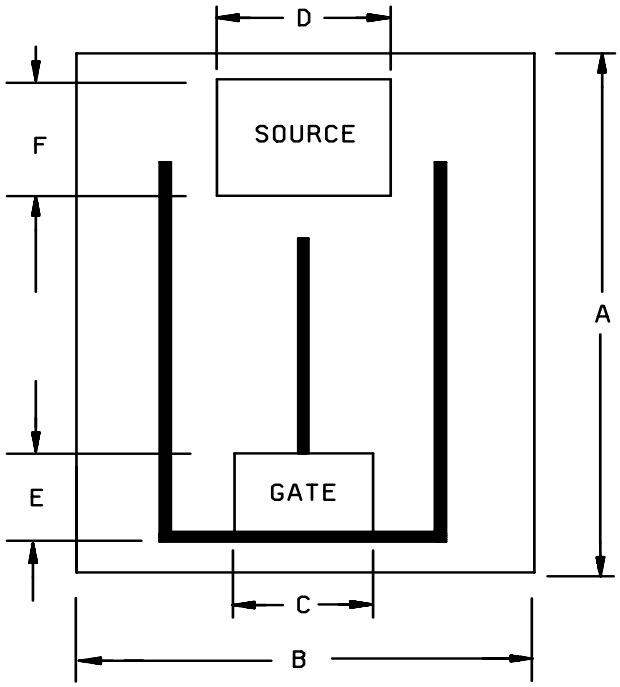



* FIGURE 2. Physical dimensions for LCC (2N6788U, 2N6790U, 2N6792U, and 2N6794U).

| Symbol | Dimensions | | | |
|---|---|---|---|---|
| | Inches | | Millimeters | |
| | Min | Max | Min | Max |
| BL | .345 | .360 | 8.77 | 9.14 |
| BW | .280 | .295 | 7.12 | 7.49 |
| CH | .095 | .115 | 2.42 | 2.92 |
| $LL_1$ | .040 | .055 | 1.02 | 1.39 |
| $LL_2$ | .055 | .065 | 1.40 | 1.65 |
| LS | .050 BSC | | 1.27 BSC | |
| $LS_1$ | .025 BSC | | 0.635 BSC | |
| $LS_2$ | .008 BSC | | 0.203 BSC | |
| LW | .020 | .030 | 0.51 | 0.76 |
| $Q_1$ | .105 REF | | 2.67 REF | |
| $Q_2$ | .120 REF | | 3.05 REF | |
| $Q_3$ | .045 | .055 | 1.15 | 1.39 |
| TL | .070 | .080 | 1.78 | 2.03 |
| TW | .120 | .130 | 3.05 | 3.30 |

NOTES:
1. Dimensions are in inches.
2. Millimeters are given for general information only.
3. Dimensions and tolerancing shall be in accordance with ASME Y14.5M.

* FIGURE 2. Physical dimensions for LCC (2N6788U, 2N6790U, 2N6792U, and 2N6794U) - Continued.

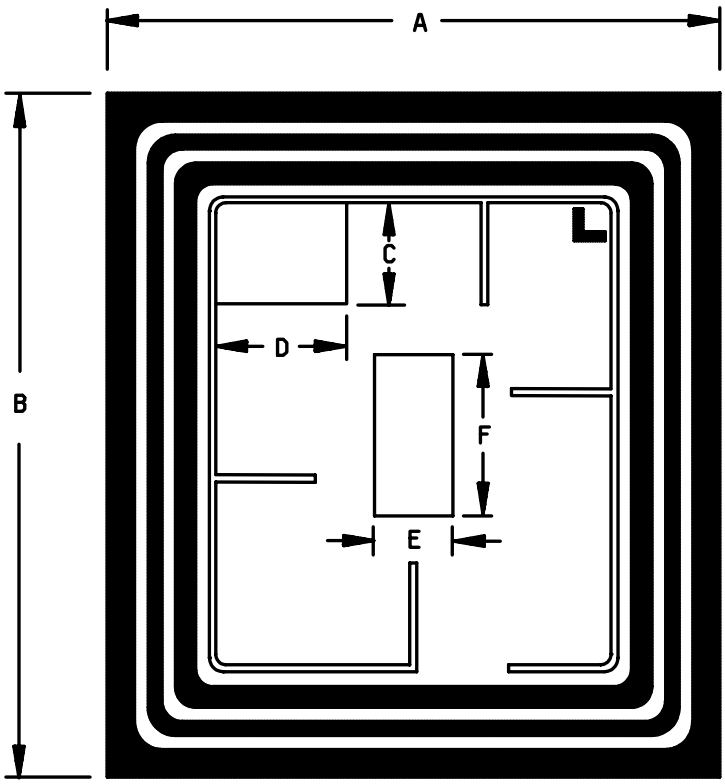



A version

| Ltr | Dimensions - 2N6788 | | | | Dimensions - 2N6790 | | | | Dimensions - 2N6792, 2N6794 | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Inches | | Millimeters | | Inches | | Millimeters | | Inches | | Millimeters | |
| | Min | Max | Min | Max | Min | Max | Min | Max | Min | Max | Min | Max |
| A | .107 | .121 | 2.72 | 3.07 | .094 | .112 | 2.39 | 2.85 | .131 | .147 | 3.33 | 3.73 |
| B | .078 | .088 | 1.98 | 2.24 | .083 | .099 | 2.11 | 2.52 | .090 | .106 | 2.29 | 2.69 |
| C | .020 | .030 | 0.51 | 0.76 | .018 | .028 | 0.46 | 0.71 | .022 | .032 | 0.56 | 0.81 |
| D | .027 | .037 | 0.69 | 0.94 | .028 | .038 | 0.71 | 0.97 | .028 | .038 | 0.71 | 0.97 |
| E | .013 | .023 | 0.33 | 0.58 | .015 | .025 | 0.38 | 0.64 | .015 | .025 | 0.38 | 0.64 |
| F | .019 | .029 | 0.48 | 0.74 | .018 | .028 | 0.46 | 0.71 | .020 | .030 | 0.51 | 0.76 |

NOTES:
1. Dimensions are in inches.
2. Millimeters are given for general information only.
3. Die thickness = .019 ± .005 inch (0.48 ± 0.13 mm).
4. Back metal: Cr - Ni - Ag.
5. Top metal: Al.
6. Back contact: Drain.
7. Layout of gate fingers shown is typical, specific layout register in accordance with DSCC Form 36D.
8. See 6.5.

* FIGURE 3. Physical dimensions JANHCA and JANKCA.

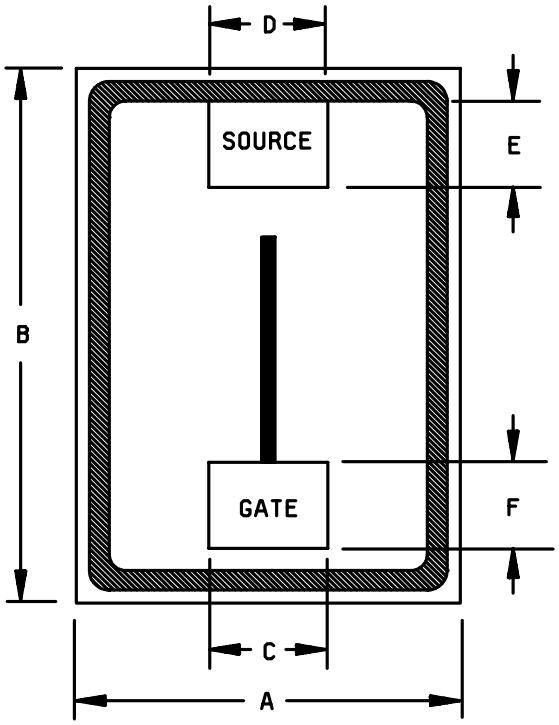



B version

| Ltr | Dimensions | | | |
|---|---|---|---|---|
| | Inches | | Millimeters | |
| | Min | Max | Min | Max |
| A | .114 | .118 | 2.9 | 3.0 |
| B | .120 | .124 | 3.0 | 3.1 |
| C | .018 | .022 | 0.46 | 0.56 |
| D | .028 | .032 | 0.71 | 0.81 |
| E | .018 | .022 | 0.46 | 0.56 |
| F | .029 | .033 | 0.74 | 0.84 |

NOTES:
1. Dimensions are in inches.
2. Millimeters are given for general information only.
3. Die thickness = .014 ±.005 inch (0.36 ±0.13 mm).
4. Back metal: Al - Ti - Ni.
5. Top metal: Al.
6. Back contact: Drain.

* FIGURE 4. Physical dimensions JANHCB and JANKCB.

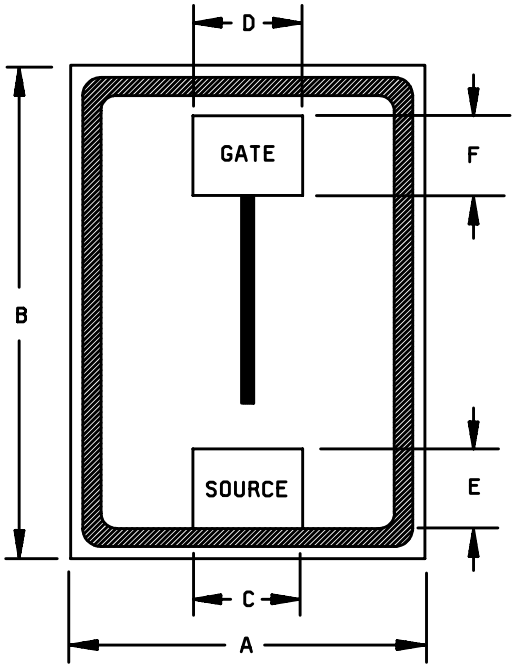



C version

| Ltr | Dimensions 2N6788, 2N6790 | | | |
|---|---|---|---|---|
| | Inches | | Millimeters | |
| | Min | Max | Min | Max |
| A | .0858 | .0898 | 2.18 | 2.28 |
| B | .087 | .091 | 2.21 | 2.31 |
| C | .0258 | .0298 | 0.65 | 0.76 |
| D | .0253 | .0293 | 0.64 | 0.74 |
| E | .017 | .021 | 0.43 | 0.53 |
| F | .016 | .020 | 0.41 | 0.51 |

NOTES:
1. Dimensions are in inches.
2. Millimeters are given for general information only.
3. Die thickness = .015 ± .005 inch (0.38 ± 0.13 mm).
4. Back metal: Ag - Ti - Ni.
5. Top metal: Al.
6. Back contact: Drain.

* FIGURE 5. Physical dimensions JANHCC and JANKCC.




D version

| Ltr | Dimensions 2N6792, 2N6794 | | | |
|---|---|---|---|---|
| | Inches | | Millimeters | |
| | Min | Max | Min | Max |
| A | .093 | .102 | 2.36 | 2.59 |
| B | .140 | .144 | 3.56 | 3.66 |
| C | .025 | .029 | 0.64 | 0.74 |
| D | .026 | .030 | 0.66 | 0.76 |
| E | .016 | .020 | 0.41 | 0.51 |
| F | .017 | .021 | 0.43 | 0.53 |

NOTES:
1. Dimensions are in inches.
2. Millimeters are given for general information only.
3. Die thickness = .015 ± .005 inch (0.38 ± 0.13 mm).
4. Back metal: Ag - Ti - Ni.
5. Top metal: Al.
6. Back contact: Drain.
8. See 6.5.

* FIGURE 6. Physical dimensions JANHCD and JANKCD.

## 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 www.dodssp.dap.mil or from the Standardization Document Order Desk, 700 Robbins Avenue, Building 4D, Philadelphia, PA 19111-5094.)

2.2 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 manufacturer's list (QML) 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.

$I_{AS}$ - Rated avalanche current, nonrepetitive
nC - nano coulomb

* 3.4 Interface and physical dimensions. Interface and physical dimensions shall be as specified in MIL-PRF-19500, and on figures 1 (TO-205AF), 2 (LCC), and figures 3, 4, 5, and 6 for JANHC and JANKC (die) herein.

* 3.4.1 Lead material and finish. Lead material shall be Kovar or Alloy 52; a copper core is permitted (for TO-205AF). 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 Marking. Marking shall be in accordance with MIL-PRF-19500.

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

* 3.6.1 Handling. MOS devices must be handled with certain precautions to avoid damage due to the accumulation of static charge. However, the following handling practices are recommended (see 3.6).

a. Devices should be handled on benches with conductive and grounded surface.

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 should be exercised, during test and troubleshooting, to apply not more than maximum rated voltage to any lead.

h. Gate must be terminated to source. $R \leq 100\ k\Omega$, whenever bias voltage is to be applied drain to source.

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

* 3.8 Electrical test requirements. The electrical test requirements shall be as specified in table I.

* 3.9 Workmanship. Semiconductor devices shall be processed in such a manner as to be uniform in quality and shall be free from other defects that will affect life, serviceability, or appearance.

4. VERIFICATION

4.1 Classification of inspections. The inspection requirements specified herein are classified as follows:

a. Qualification inspection (see 4.2).

b. Screening (see 4.3).

c. Conformance inspection (see 4.4).

4.2 Qualification inspection. Qualification inspection shall be in accordance with MIL-PRF-19500. Alternate flow is allowed for qualification inspection in accordance with MIL-PRF-19500.

* 4.2.1 JANHC and JANKC devices. Qualification for JANHC and JANKC devices shall be as specified in 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 that did not request the performance of table II tests, the tests specified in table II herein shall be performed by 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 appendix E, 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 (see table IV of MIL-PRF-19500) (1) (2) | Measurement | |
|---|---|---|
| | JANS level | JANTX and JANTXV levels |
| (3) | Gate stress test (see 4.3.2) | Gate stress test (see 4.3.2) |
| (3) (4) | Method 3470 of MIL-STD-750 (see 4.3.3) optional | Method 3470 of MIL-STD-750 (see 4.3.3) optional |
| (3) 3c | Method 3161 of MIL-STD-750 (see 4.3.4) | Method 3161 of MIL-STD-750 (see 4.3.4) |
| 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;<br>$I_{GSSF1}$, $I_{GSSR1}$, $I_{DSS1}$, $r_{DS(on)1}$,$V_{GS(TH)1}$,<br>$\Delta I_{GSSF1}$, $\Delta I_{GSSR1}$ = ± 20 nA dc or ±100 percent of initial value, whichever is greater.<br>$\Delta I_{DSS1}$ = ± 25 μA dc or ± 100 percent of initial value, whichever is greater. | Subgroup 2 of table I herein,<br>$I_{GSSF1}$, $I_{GSSR1}$, $I_{DSS1}$, $r_{DS(on)1}$,$V_{GS(TH)1}$ |
| 12 | Method 1042 of MIL-STD-750, test condition A | Method 1042 of MIL-STD-750, test condition A |
| 13 | Subgroups 2 and 3 of table I herein.<br>$\Delta I_{GSSF1}$, $\Delta I_{GSSR1}$ = ± 20 nA dc or ±100 percent of initial value, whichever is greater.<br>$\Delta I_{DSS1}$ = ± 25 μA dc or ± 100 percent of initial value, whichever is greater.<br>$\Delta r_{DS(on)1}$ = ± 20 percent of initial value.<br>$\Delta V_{GS(TH)1}$= ± 20 percent of initial value. | Subgroup 2 of table I herein.<br>$\Delta I_{GSSF1}$, $\Delta I_{GSSR1}$ = ± 20 nA dc or ±100 percent of initial value, whichever is greater.<br>$\Delta I_{DSS1}$ = ± 25 μA dc or ± 100 percent of initial value, whichever is greater.<br>$\Delta r_{DS(on)1}$ = ± 20 percent of initial value.<br>$\Delta V_{GS(TH)1}$= ± 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 before screen 9.
(4) Method 3470 is optional if performed as a sample in group A, subgroup 5.

* 4.3.1 Screening (JANHC and JANKC). Screening of die shall be in accordance with MIL-PRF-19500, as a minimum, die shall be 100 percent probed in accordance with table I, subgroup 2, except test current shall not exceed 20 A.

* 4.3.2 Gate stress test. Apply $V_{GS}$ = +30 V minimum for t = 250 µs minimum.

* 4.3.3 Single pulsed unclamped inductive switching.

a. Peak current, $I_D$ ..... 2.2 A.

b. Peak gate voltage, $V_{GS}$ ..... 10 V.

c. Gate to source resistor, $R_{GS}$ ..... $25 \leq R_g \leq 200\Omega$.

d. Initial case temperature ..... +25°C, +10°C, -5°C.

e. Inductance, L ..... 100 µH ±10 percent.

f. Number of pulses to be applied ..... 1 pulse.

* 4.3.4 Thermal impedance ($Z_{\theta JX}$ measurements). The $Z_{\theta JX}$ measurements shall be performed in accordance with method 3161 of MIL-STD-750. The maximum limit (not to exceed figure 8, thermal impedance curves and the table I, subgroup 2 limits) for $Z_{\theta JX}$ in screening (table IV of MIL-PRF-19500) shall be derived by each vendor by means of statistical process control. When the process has exhibited control and capability, the capability data shall be used to establish the fixed screening limit. In addition to screening, once a fixed limit has been established, monitor all future sealing lots using a random five piece sample from each lot to be plotted on the applicable X bar R chart. If a lot exhibits an out of control condition, the entire lot shall be removed from the line and held for engineering evaluation and disposition. This procedure may be used in lieu of an inline process monitor.

a. $I_M$ measuring current ..... 10 mA.

b. $I_H$ drain heating current ..... 1 A minimum.

c. $t_H$ heating time ..... 10 ms.

d. $V_H$ drain-source heating voltage ..... 14 V minimum.

e. $t_{MD}$ measurement time delay ..... 10 to 80 µs.

f. $t_{SW}$ sample window time ..... 10 µs maximum.

4.4 Conformance inspection. Conformance inspection shall be in accordance with MIL-PRF-19500. Alternate flow is allowed for conformance inspection in accordance with 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 VIa (JANS) and table VIb (JAN, JANTX, and JANTXV) of MIL-PRF-19500 and as follows. 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 VIa (JANS) of MIL-PRF-19500.

| Subgroup | Method | Conditions |
|---|---|---|
| B3 | 1051 | Test condition G. |
| B3 | 2037 | Test condition A. All internal wires for each device shall be pulled separately. If group B3 is to be continued to C6, strength test may be performed after C6. |
| B4 | 1042 | Test condition D, 2,000 cycles. The heating cycle shall be 1 minute minimum. No heat sink nor forced air cooling on the device shall be permitted during the "on" cycle. |
| B5 | 1042 | A separate sample may be pulled for each test. Accelerated steady-state reverse bias; test condition A, $V_{DS}$ = rated, $T_A$ = +175°C, t = 120 hours, read and record $V_{BR(DSS)}$ (pre and post) at $I_D$ = -1 mA. Read and record $I_{DSS}$ (pre and post). |
| B5 | 1042 | Accelerated steady-state gate stress; test condition B, $V_{GS}$ = rated, $T_A$ = +175°C, t = 24 hours. |
| B6 | | See 4.5.2. |

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

| Subgroup | Method | Conditions |
|---|---|---|
| B2 | 1051 | Test condition G. |
| B3 | 1042 | Test condition D, 2,000 cycles. The heating cycle shall be 1 minute minimum. No heat sink nor forced air cooling on the device shall be permitted during the "on" cycle. |
| B3 | 2037 | Test condition A. All internal wires for each device shall be pulled separately. If group B3 is to be continued to C6, bond strength test may be performed after C6. |
| B6 | | Not applicable. |

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 and as follows. Electrical measurements (end-points) shall be in accordance with the inspections of table I, subgroup 2 herein.

* 4.4.3.1 Group C inspection (table VII of MIL-PRF-19500).

| Subgroup | Method | Conditions |
|---|---|---|
| C2 | 2036 | Test condition E (not required for LCC). |
| C5 | 3161 | See 4.5.2. |
| C6 | 1042 | Test condition D, 6,000 cycles. The heating cycle shall be 1 minute minimum. No heat sink nor forced air cooling on the device shall be permitted during the "on" cycle. |

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.

* 4.5.2 Thermal resistance. Thermal resistance measurements shall be performed in accordance with method 3161 of MIL-STD-750. $R_{\theta JC(max)}$ = 6.25°C/W for TO-205AF, $R_{\theta JC(max)}$ = 8.93°C/W for LCC (U suffix devices).

a. $I_M$ measuring current..... 10 mA.

b. $I_H$ drain heating current..... 1 A minimum.

c. $t_H$ heating time ..... Steady-state (see method 3161 of MIL-STD-750).

d. $V_H$ drain-source heating voltage ..... 14 V minimum.

e. $t_{MD}$ measurement time delay..... 30 to 60 µs.

f. $t_{SW}$ sample window time ..... 10 µs maximum.

* TABLE I. Group A inspection.

| Inspection 1/ | MIL-STD-750 | | Symbol | Limits | | Unit |
|---|---|---|---|---|---|---|
| | Method | Conditions | | Min | Max | |
| Subgroup 1 | | | | | | |
| Visual and mechanical inspection | 2071 | | | | | |
| Subgroup 2 | | | | | | |
| Thermal impedance 2/ | 3161 | See 4.3.4 | $Z_{\theta JC}$ | | 2.3 | °C/W |
| Breakdown voltage, drain to source | 3407 | $V_{GS}$ = 0 V dc, $I_D$ = 1 mA dc, condition C | $V_{(BR)DSS}$ | | | |
| 2N6788, 2N6788U | | | | 100 | | V dc |
| 2N6790, 2N6790U | | | | 200 | | V dc |
| 2N6792, 2N6792U | | | | 400 | | V dc |
| 2N6794, 2N6794U | | | | 500 | | 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 | $V_{GS}$ = ± 20 V dc, $V_{DS}$ = 0, bias condition C | $I_{GSS1}$ | | ± 100 | nA dc |
| Drain current | 3413 | $V_{GS}$ = 0 V dc, $V_{DS}$ = 80 percent of rated $V_{DS}$; bias condition C | $I_{DSS1}$ | | 25 | µA dc |
| Static drain to source on-state resistance | 3421 | $V_{GS}$ = 10 V dc, pulsed (see 4.5.1); condition A, $I_D$ = rated $I_{D2}$ (see 1.3) | $r_{DS(on)1}$ | | | |
| 2N6788, 2N6788U | | | | | 0.30 | Ω |
| 2N6790, 2N6790U | | | | | 0.8 | Ω |
| 2N6792, 2N6792U | | | | | 1.8 | Ω |
| 2N6794, 2N6794U | | | | | 3.0 | Ω |
| Static drain to source on-state resistance | 3421 | $V_{GS}$ = 10 V dc, pulsed (see 4.5.1); condition A, $I_D$ = rated $I_{D1}$ (see 1.3) | $r_{DS(on)2}$ | | | |
| 2N6788, 2N6788U | | | | | .35 | Ω |
| 2N6790, 2N6790U | | | | | .85 | Ω |
| 2N6792, 2N6792U | | | | | 1.90 | Ω |
| 2N6794, 2N6794U | | | | | 3.10 | Ω |
| Forward voltage (source drain diode) | 4011 | Pulsed (see 4.5.1), $I_S = I_{D1}$ | $V_{SD}$ | | | |
| 2N6788, 2N6788U | | | | | 1.8 | V |
| 2N6790, 2N6790U | | | | | 1.5 | V |
| 2N6792, 2N6792U | | | | | 1.4 | V |
| 2N6794, 2N6794U | | | | | 1.2 | V |

See footnotes at end of table.

* TABLE I. Group A inspection - Continued.

| Inspection 1/ | MIL-STD-750 | | Symbol | Limits | | Unit |
|---|---|---|---|---|---|---|
| | Method | Conditions | | Min | Max | |
| Subgroup 3 | | | | | | |
| High temperature operation: | | $T_C = T_J = +125°C$ | | | | |
| Gate to source voltage (threshold) | 3403 | $V_{DS} \geq V_{GS}$, $I_D = 0.25$ mA dc | $V_{GS(th)2}$ | 1.0 | | V dc |
| Gate current | 3411 | Bias condition C, $V_{GS} = \pm 20$ V dc, $V_{DS} = 0$ V dc | $I_{GSS2}$ | | ± 200 | nA dc |
| Drain current | 3413 | Bias condition C, $V_{GS} = 0$ V dc, $V_{DS}$ = 80 percent of rated $V_{DS}$ | $I_{DSS2}$ | | 0.25 | mA dc |
| Static drain to source on-state resistance | 3421 | $V_{GS}$ = 10 V dc, pulsed (see 4.5.1); $I_D$ = rated $I_{D2}$ | $r_{DS(on)3}$ | | | |
| 2N6788, 2N6788U | | | | | 0.54 | Ω |
| 2N6790, 2N6790U | | | | | 1.50 | Ω |
| 2N6792, 2N6792U | | | | | 4.00 | Ω |
| 2N6794, 2N6794U | | | | | 6.60 | Ω |
| Low temperature operation: | | $T_C = T_J = -55°C$ | | | | |
| Gate to source voltage threshold | 3403 | $V_{DS} \geq V_{GS}$, $I_D = 0.25$ mA dc | $V_{GS(th)3}$ | | 5.0 | V dc |
| Subgroup 4 | | | | | | |
| Switching time test | 3472 | $I_D$ = rated $I_{D1}$, $V_{GS}$ = 10 V dc, Gate drive impedance = 7.5Ω | | | | |
| Turn-on delay time | | | $t_{d(on)}$ | | | |
| 2N6788, 2N6788U | | $V_{DD}$ = 35 V dc | | | 40 | ns |
| 2N6790, 2N6790U | | $V_{DD}$ = 74 V dc | | | 40 | ns |
| 2N6792, 2N6792U | | $V_{DD}$ = 175 V dc | | | 40 | ns |
| 2N6794, 2N6794U | | $V_{DD}$ = 225 V dc | | | 40 | ns |
| Rise time | | | $t_r$ | | | |
| 2N6788, 2N6788U | | $V_{DD}$ = 35 V dc | | | 70 | ns |
| 2N6790, 2N6790U | | $V_{DD}$ = 74 V dc | | | 50 | ns |
| 2N6792, 2N6792U | | $V_{DD}$ = 175 V dc | | | 35 | ns |
| 2N6794, 2N6794U | | $V_{DD}$ = 225 V dc | | | 30 | ns |
| Turn-off delay time | | | $t_{d(off)}$ | | | |
| 2N6788, 2N6788U | | $V_{DD}$ = 35 V dc | | | 40 | ns |
| 2N6790, 2N6790U | | $V_{DD}$ = 74 V dc | | | 50 | ns |
| 2N6792, 2N6792U | | $V_{DD}$ = 175 V dc | | | 60 | ns |
| 2N6794, 2N6794U | | $V_{DD}$ = 225 V dc | | | 60 | ns |
| Fall time | | | $t_f$ | | | |
| 2N6788, 2N6788U | | $V_{DD}$ = 35 V dc | | | 70 | ns |
| 2N6790, 2N6790U | | $V_{DD}$ = 74 V dc | | | 50 | ns |
| 2N6792, 2N6792U | | $V_{DD}$ = 175 V dc | | | 35 | ns |
| 2N6794, 2N6794U | | $V_{DD}$ = 225 V dc | | | 30 | ns |

See footnotes at end of table.

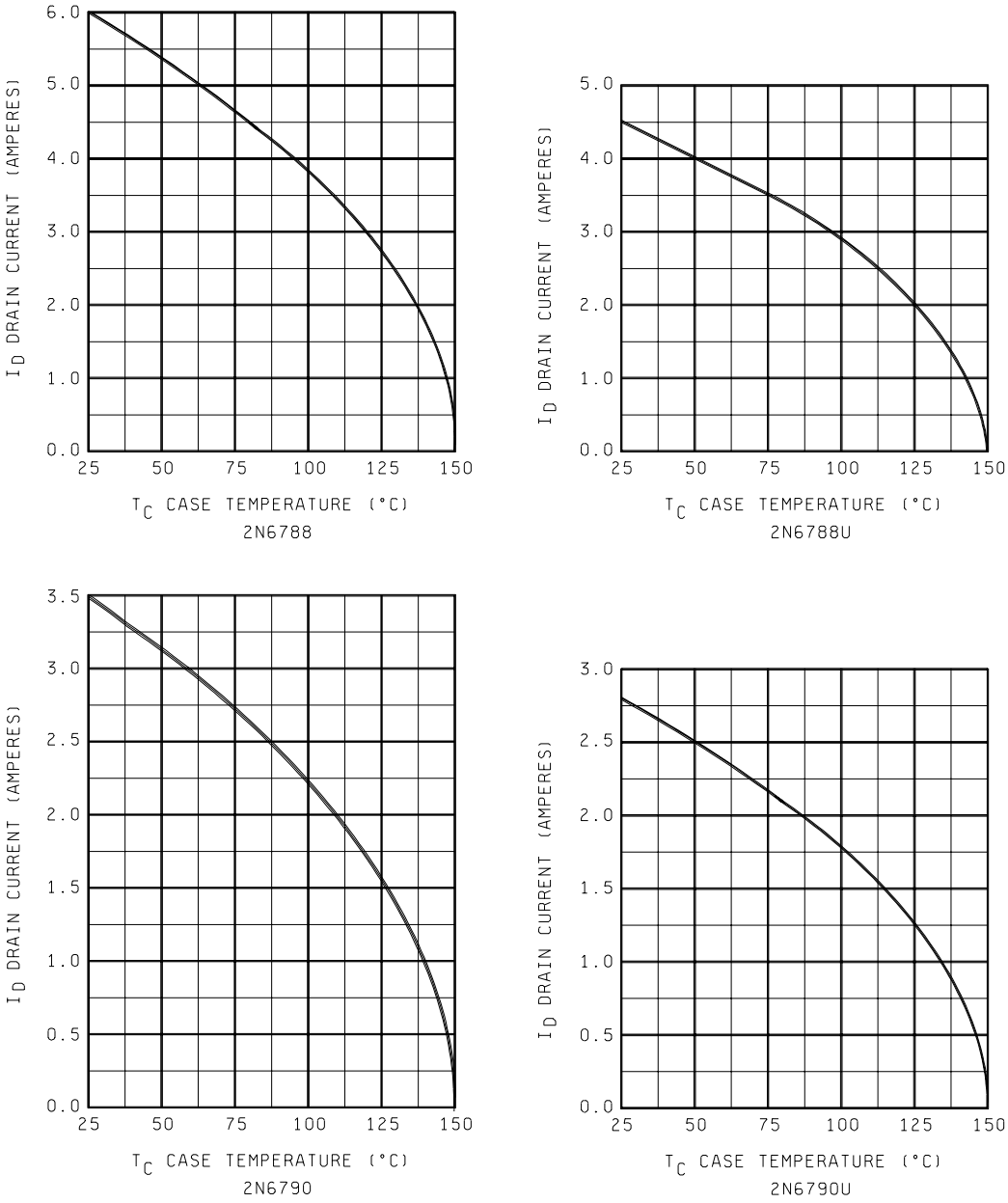
* TABLE I. Group A inspection - Continued.

| Inspection 1/ | MIL-STD-750 | | Symbol | Limits | | Unit |
|---|---|---|---|---|---|---|
| | Method | Conditions | | Min | Max | |
| Subgroup 5 | | | | | | |
| Safe operating area test | 3474 | See figure 9; $V_{DS}$ = 80 percent of rated $V_{BR(DSS)}$, $V_{DS} \leq 200$ V; $t_p$ = 10 ms | | | | |
| Electrical measurements | | See table I, subgroup 2 | | | | |
| Single pulse unclamped inductive switching 3/ | 3470 | See 4.3.3, c = 0, 116 devices | | | | |
| Electrical measurements | | See table I, subgroup 2 | | | | |
| Subgroup 6 | | | | | | |
| Not applicable | | | | | | |
| Subgroup 7 | | | | | | |
| Gate charge | 3471 | Condition B | | | | |
| On-state charge | | | $Q_{g(on)}$ | | | |
| 2N6788, 2N6788U | | | | | 17.0 | nC |
| 2N6790, 2N6790U | | | | | 14.3 | nC |
| 2N6792, 2N6792U | | | | | 15.5 | nC |
| 2N6794, 2N6794U | | | | | 16.7 | nC |
| Gate to source charge | | | $Q_{gs}$ | | | |
| 2N6788, 2N6788U | | | | | 4.0 | nC |
| 2N6790, 2N6790U | | | | | 3.0 | nC |
| 2N6792, 2N6792U | | | | | 2.6 | nC |
| 2N6794, 2N6794U | | | | | 3.0 | nC |
| Gate to drain charge | | | $Q_{gd}$ | | | |
| 2N6788, 2N6788U | | | | | 8.0 | nC |
| 2N6790, 2N6790U | | | | | 9.0 | nC |
| 2N6792, 2N6792U | | | | | 8.3 | nC |
| 2N6794, 2N6794U | | | | | 8.7 | nC |
| Reverse recovery time | 3473 | di/dt = 100 A/µs, $V_{DD} \leq 50$ V, $I_D = I_{D1}$ | $t_{rr}$ | | | |
| 2N6788, 2N6788U | | | | | 240 | ns |
| 2N6790, 2N6790U | | | | | 400 | ns |
| 2N6792, 2N6792U | | | | | 650 | ns |
| 2N6794, 2N6794U | | | | | 900 | ns |

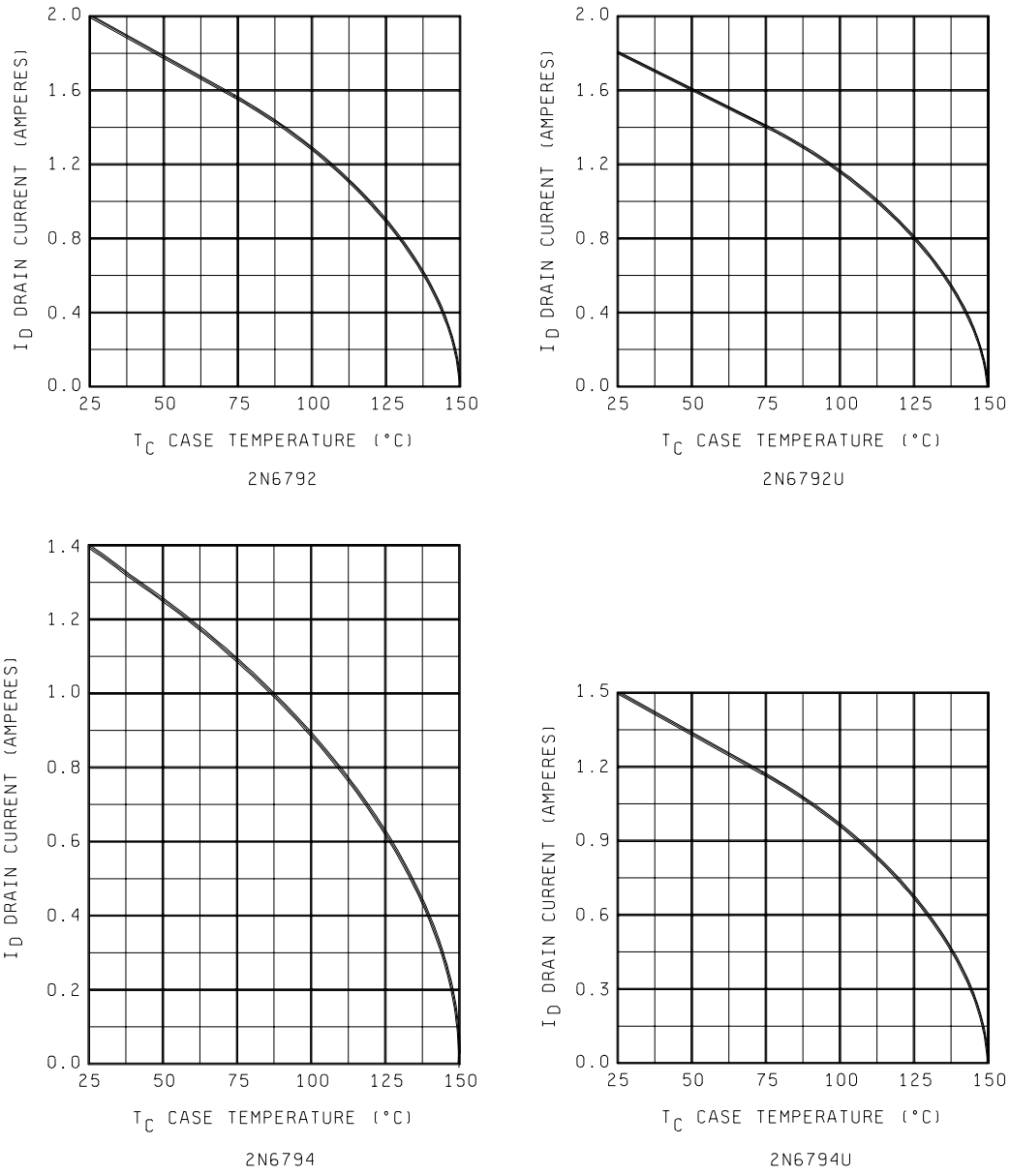
1/ For sampling plan, see MIL-PRF-19500.
2/ This test is required for the following end-point measurement only (not intended for screen 9, 11, or 13): JANS, table VIa of MIL-PRF-19500, group B, subgroups 3 and 4; JAN, JANTX, and JANTXV, table VIb of MIL-PRF-19500, group B, subgroups 2 and 3; and table VII of MIL-PRF-19500, group C, subgroup 6, and table IX of MIL-PRF-19500, group E, subgroup 1.
3/ This test need not be performed in group A when performed as a 100-percent screen.

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

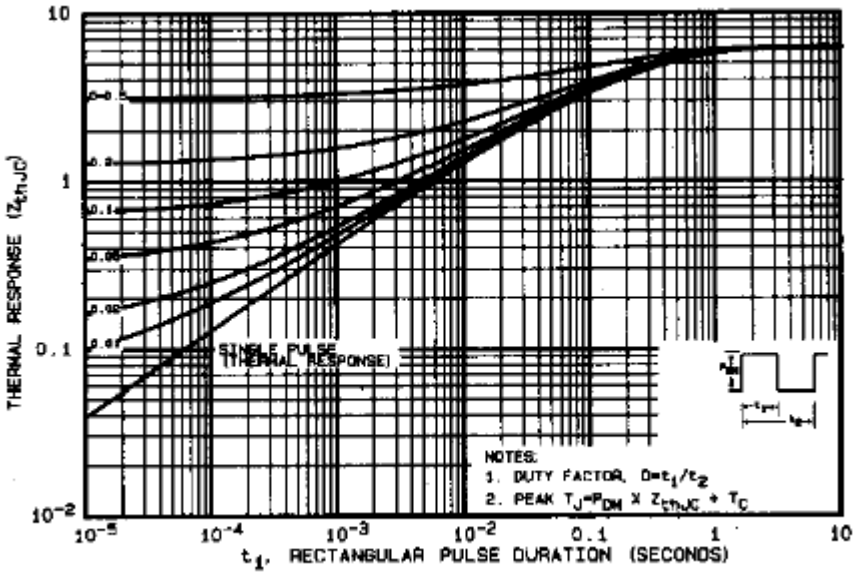
| Inspection | MIL-STD-750 | | Qualification conformance inspection |
|---|---|---|---|
| | Method | Conditions | |
| Subgroup 1 | | | 22 devices<br>c = 0 |
| Temperature cycle | 1051 | Condition G, 200 cycles | |
| Hermetic seal<br>Fine leak<br>Gross leak | 1071 | | |
| Electrical measurements | | See table I, subgroup 2 | |
| Subgroup 2 | | | 22 devices<br>c = 0 |
| Steady-state reverse bias | 1042 | Condition A, 1,000 hours | |
| Electrical measurements | | See table I, subgroup 2 | |
| Steady-state gate bias | 1042 | Condition B, 1,000 hours, $V_{GS}$ = 80 percent of rated (see 1.3) | |
| Electrical measurements | | See table I, subgroup 2 | |
| Subgroup 3 | | | 3 devices,<br>c = 0 |
| DPA | 2102 | | |
| Subgroup 4 | | | sample size<br>N/A |
| Thermal impedance curves | | Each supplier shall submit their (typical) design maximum thermal impedance curves. In addition, the optimal test conditions and $Z_{\theta JX}$ limit shall be provided to the qualifying activity in the qualification report | |
| Subgroup 5 | | | 5 devices<br>c = 0 |
| Barometric pressure (reduced) | 1001 | Test condition C, $V_{ISO} = V_{DS,}$ $I_{(ISO)}$ = .25 mA (max) | |
| 2N6792, 2N6792U<br>2N6794, 2N6794U | | $V_{DS}$ = 300 V<br>$V_{DS}$ = 300 V | |
| Subgroup 6 | | | 3 devices |
| ESD | 1020 | Not required for devices classified as ESD class 1. | |
| Subgroup 7 | | | |
| 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 | | 22 devices<br>c = 0 |




* FIGURE 7. Maximum drain current vs case temperature graphs.

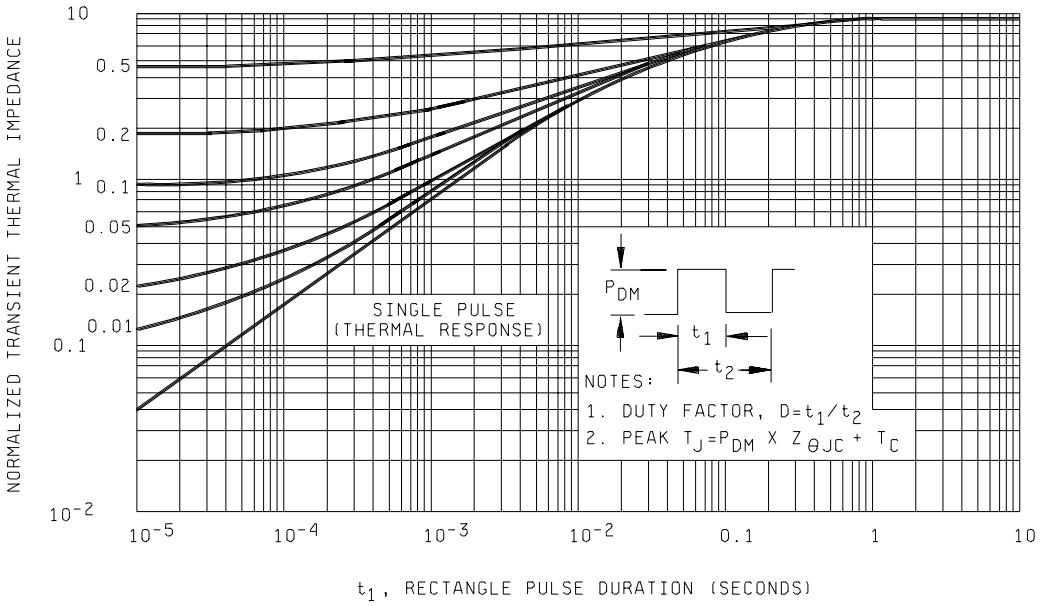



* FIGURE 7. Maximum drain current vs case temperature graphs - Continued.



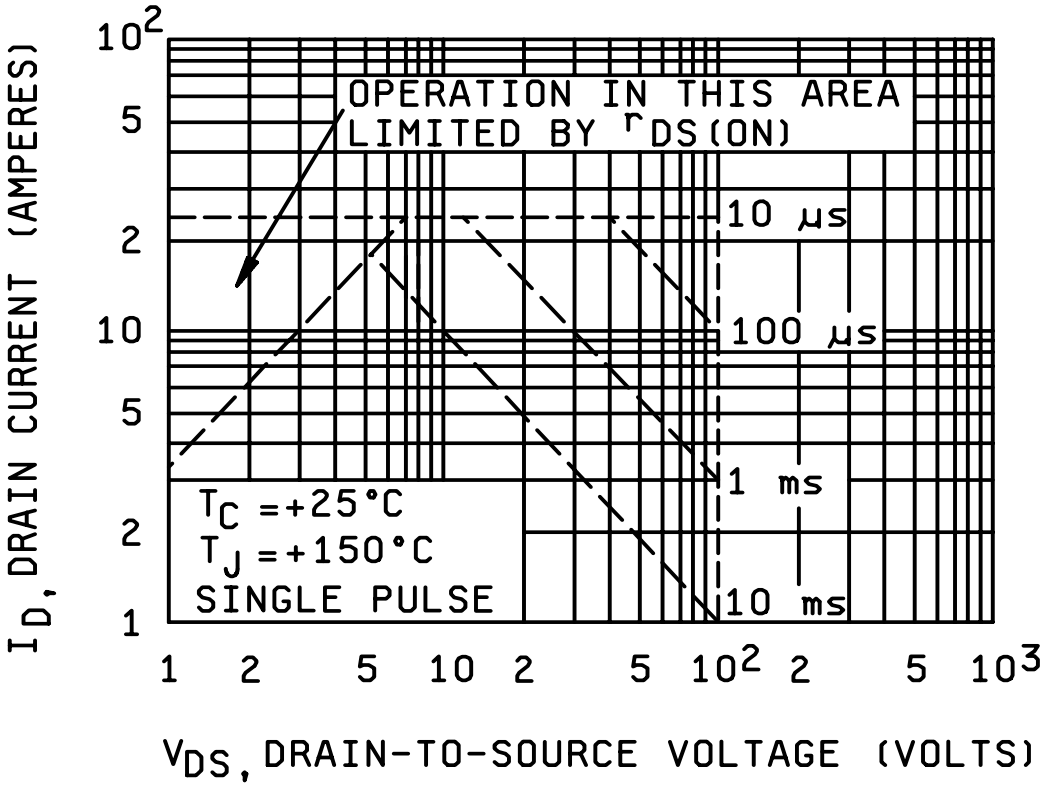

2N6788, 2N6790, 2N6792, and 2N6794 only

* FIGURE 8. Transient thermal response.



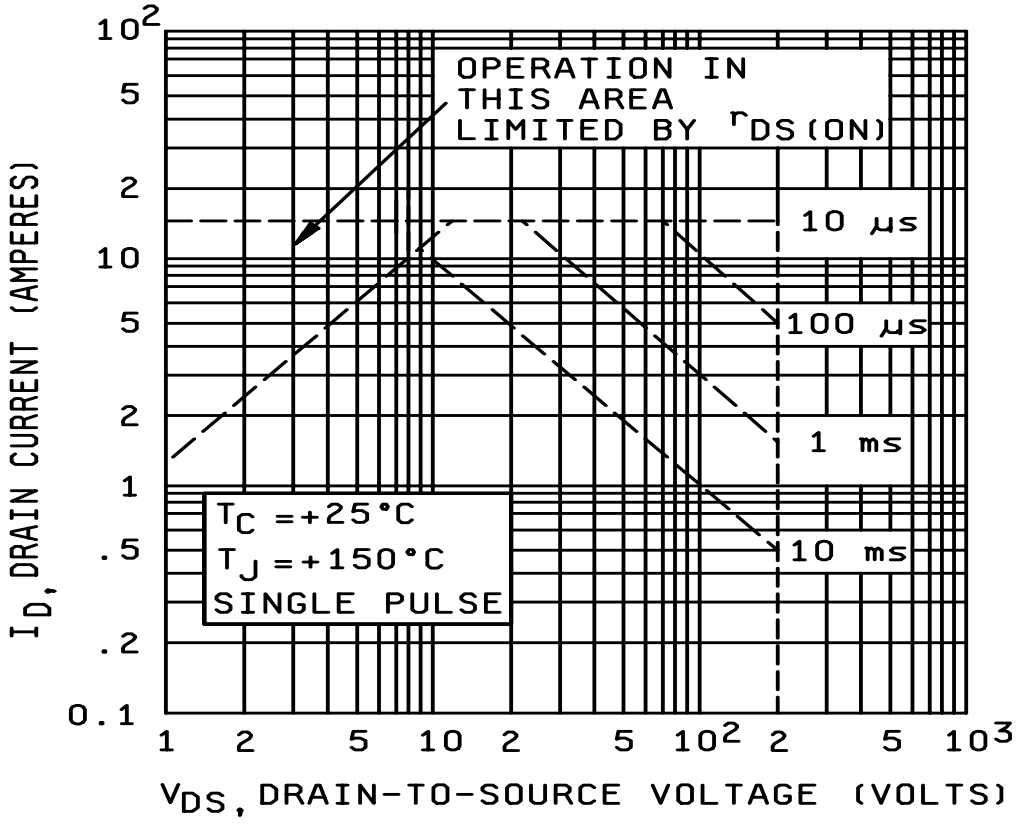

2N6788U, 2N6790U, 2N6792U, and 2N6794U only

* FIGURE 8. Transient thermal response - Continued.



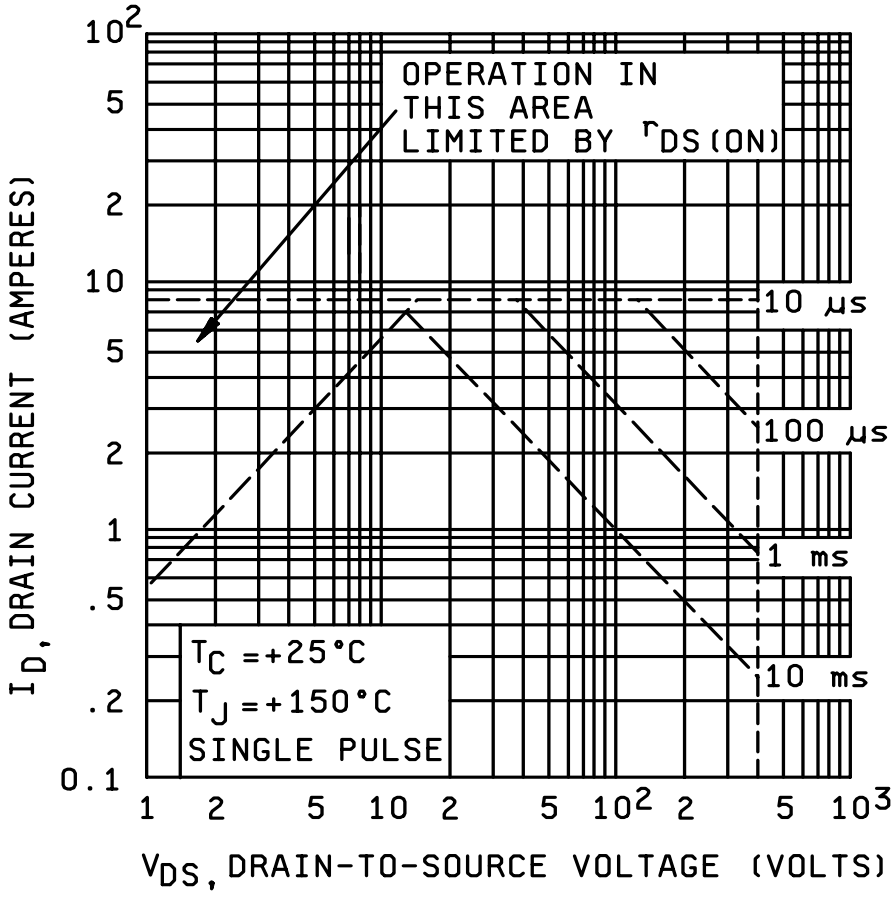

2N6788, 2N6788U

* FIGURE 9. Maximum safe operating area.



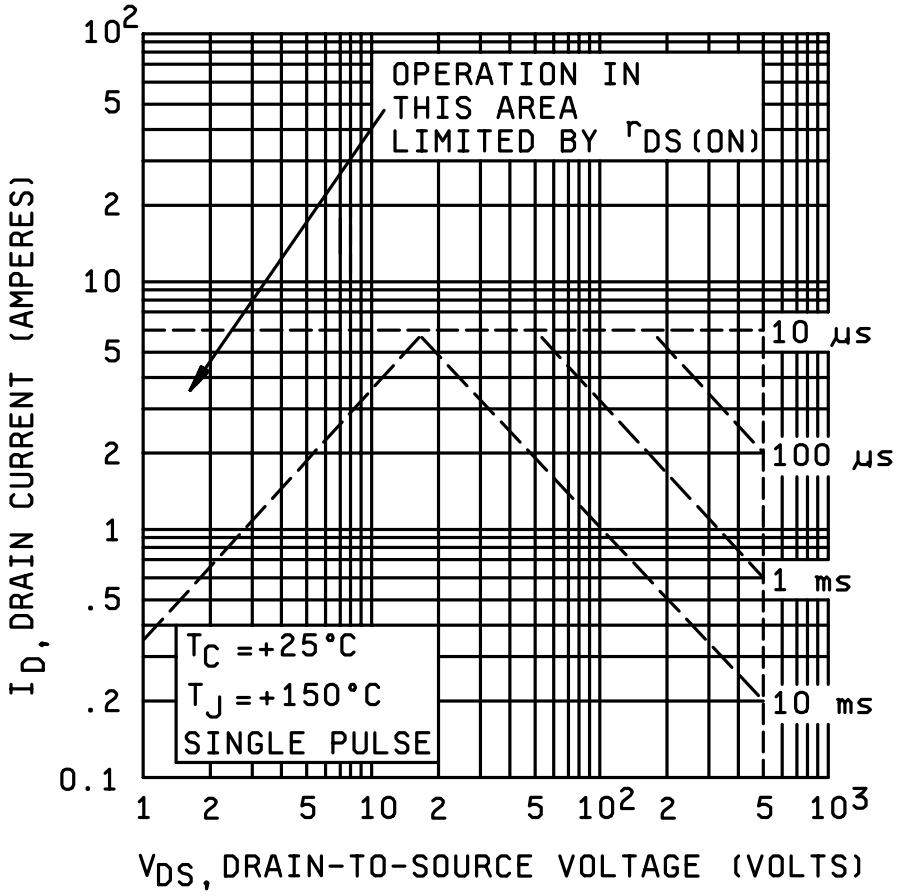

2N6790, 2N6790U

* FIGURE 9. Maximum safe operating area - Continued.




2N6792, 2N6792U

* FIGURE 9. Maximum safe operating area - Continued.




2N6794, 2N6794U

* FIGURE 9. 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 actual 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.

e. For die acquisition, the JANHC or JANKC letter version shall be specified (see figures 3, 4, 5, and 6).

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 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 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 43216-5000 or e-mail vqe.chief@dla.mil.

6.4 Cross-reference complement list. Parts from this specification may be used to supersede the following commercial Part or Identifying Number (PIN) listed below. Complementary transistors are covered by MIL-PRF-19500/564:

| Preferred types (1) | Commercial types |
|---|---|
| 2N6788 | IRFF120 |
| 2N6790 | IRFF220 |
| 2N6792 | IRFF320 |
| 2N6794 | IRFF420 |
| 2N6788U | IRFE120 |
| 2N6790U | IRFE220 |
| 2N6792U | IRFE320 |
| 2N6794U | IRFE420 |

(1) Prefixes are JAN, JANTX, JANTXV, or JANS

* 6.5 Suppliers of JANHC and JANKC die. The qualified die suppliers with the applicable letter version (example, JANHCA2N6788) will be identified on the QML.

| JANC ordering information | | | |
|---|---|---|---|
| PIN | Manufacturer | | |
| | 59993 | 18722 | 17856 |
| 2N6788 | JANHCA2N6788<br>JANKCA2N6788 | JANHCB2N6788<br>JANKCB2N6788 | JANHCC2N6788<br>JANKCC2N6788 |
| 2N6790 | JANHCA2N6790<br>JANKCA2N6790 | JANHCB2N6790<br>JANKCB2N6790 | JANHCC2N6790<br>JANKCC2N6790 |
| 2N6792 | JANHCA2N6792<br>JANKCA2N6792 | JANHCB2N6792<br>JANKCB2N6792 | JANHCD2N6792<br>JANKCD2N6792 |
| 2N6794 | JANHCA2N6794<br>JANKCA2N6794 | JANHCB2N6794<br>JANKCB2N6794 | JANHCD2N6794<br>JANKCD2N6794 |

* 6.6 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 - AR, MI, SM
Navy - AS, MC
Air Force - 19, 71, 99

Preparing activity:
DLA - CC

(Project 5961-2780)

* 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 www.dodssp.daps.mil .