PERFORMANCE SPECIFICATION SHEET

TRANSISTOR, FIELD EFFECT RADIATION HARDENED, N-CHANNEL, SILICON
DEVICE TYPES 2N7488T3, 2N7489T3, 2N7490T3, AND 2N7556T3 JANTXVR AND JANSR

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 a N-Channel, enhancement-mode, MOSFET, radiation hardened (total dose and single event effects (SEE), power transistor. Two levels of product assurance are provided for each encapsulated device type as specified in MIL-PRF-19500 with avalanche energy maximum rating (EAS) and maximum avalanche current (IAS) for use in particular power-switching applications.

1.2 Package outlines. The device package outlines are as follows: TO-257AA in accordance with figure 1 for all packaged device types. The dimensions and topography for JANHC and JANKC unencapsulated die are as listed in slash sheet MIL-PRF-19500/741.

1.3 Maximum ratings. $T_A = +25^\circ C$, unless otherwise specified.

<table>
<thead>
<tr>
<th>Type</th>
<th>$P_T$ (1)</th>
<th>$P_T$</th>
<th>$R_{\text{jc}}$</th>
<th>$V_{\text{DS}}$</th>
<th>$V_{\text{GS}}$</th>
<th>$I_{\text{D1}}$ (3) (4)</th>
<th>$I_{\text{D2}}$ (3) (4)</th>
<th>$I_{\text{S}}$</th>
<th>$I_{\text{SM}}$ (5)</th>
<th>$T_J$ (6)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2N7488T3</td>
<td>75</td>
<td>1.56</td>
<td>1.67</td>
<td>130</td>
<td>±20</td>
<td>18</td>
<td>12</td>
<td>18</td>
<td>72</td>
<td>-55</td>
</tr>
<tr>
<td>2N7489T3</td>
<td>75</td>
<td>1.56</td>
<td>1.67</td>
<td>200</td>
<td>±20</td>
<td>12</td>
<td>7.6</td>
<td>12</td>
<td>48</td>
<td>to</td>
</tr>
<tr>
<td>2N7490T3</td>
<td>75</td>
<td>1.56</td>
<td>1.67</td>
<td>250</td>
<td>±20</td>
<td>9.6</td>
<td>6.0</td>
<td>9.6</td>
<td>38.4</td>
<td>+150</td>
</tr>
<tr>
<td>2N7556T3</td>
<td>75</td>
<td>1.56</td>
<td>1.67</td>
<td>250</td>
<td>±20</td>
<td>9.6</td>
<td>6.0</td>
<td>9.6</td>
<td>38.4</td>
<td>+150</td>
</tr>
</tbody>
</table>

(1) Derate linearly 0.6 W/$^\circ C$ for $T_C > +25^\circ C$.
(2) See figure 2, thermal impedance curves.
(3) The following formula derives the maximum theoretical $I_D$ specs. $I_D$ is limited to 18 A by package and device construction.

$$I_D = \sqrt{\frac{T_J - T_C}{R_{\text{on}}(T_{\text{on}} \text{ at } T_{\text{on}})}}$$

(4) See figure 3, maximum drain current graphs.
(5) $I_{\text{SM}} = 4 \times I_{\text{D1}}$; $I_{\text{D1}}$ as calculated in note (3).

Comments, suggestions, or questions on this document should be addressed to DLA Land and Maritime, ATTN: VAC, P.O. Box 3990, Columbus, OH 43218-3990, or emailed to Semiconductor@dla.mil. Since contact information can change, you may want to verify the currency of this address information using the ASSIST Online database at https://assist.dla.mil.
1.4 Primary electrical characteristics at TC = +25°C.

<table>
<thead>
<tr>
<th>Type</th>
<th>$V_{BR\text{DSS}}$</th>
<th>$V_{GS(TH)}$</th>
<th>$I_{DSS}$</th>
<th>$r_{DS(\text{on})}$</th>
<th>$E_{AS}$</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$V_{GS} = 0$</td>
<td>$V_{DS} \geq V_{GS}$</td>
<td>$I_{D} = 1.0 \text{ mA dc}$</td>
<td>$V_{GS} = 0$</td>
<td>$V_{DS} = 80$ percent of rated $V_{DS}$</td>
</tr>
<tr>
<td>2N7488T3</td>
<td>130</td>
<td>2.5</td>
<td>4.5</td>
<td>10</td>
<td>0.090</td>
</tr>
<tr>
<td>2N7489T3</td>
<td>200</td>
<td>2.5</td>
<td>4.5</td>
<td>10</td>
<td>0.230</td>
</tr>
<tr>
<td>2N7490T3</td>
<td>250</td>
<td>2.5</td>
<td>4.5</td>
<td>10</td>
<td>0.410</td>
</tr>
<tr>
<td>2N7556T3</td>
<td>250</td>
<td>2.5</td>
<td>4.5</td>
<td>10</td>
<td>0.410</td>
</tr>
</tbody>
</table>

(1) Pulsed (see 4.5.1).

1.5 Part or Identifying Number (PIN). The PIN is in accordance with MIL-PRF-19500, and as specified herein. See 6.5 for PIN construction example and 6.6 for a list of available PINs.

1.5.1 JAN certification mark and quality level. The quality level designators for encapsulated devices that are applicable for this specification sheet from the lowest to the highest level are as follows: "JANTXV" and "JANS".

1.5.2 JAN brand and quality level designators for unencapsulated devices (die). See 6.7 for unencapsulated devices.

1.5.3 Radiation hardness assurance (RHA) designator. The RHA levels that are applicable for this specification sheet from lowest to highest for JANTXV and JANS quality levels are as follows: "M", "D", "P", "L", and "R".

1.5.4 Device type. The designation system for the device types of transistors covered by this specification sheet are as follows.

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

1.5.4.2 Second number symbols. The second number symbols for the transistors covered by this specification sheet are as follows: "7488", "7489", "7490" and "7556".

1.5.5 Suffix letters. The suffix letters "T3" are used on devices that are packaged in the TO-257AA package of figure 1.

1.5.5 Lead finish. The lead finishes applicable to this specification sheet are listed on QML-19500.
NOTES:
1. Dimensions are in inches.
2. Millimeters are given for general information only.
3. The lid shall be electrically isolated from the drain, gate and source.
4. In accordance with ASME Y14.5M, diameters are equivalent to \( \Phi \) x symbology.
5. This area is for the lead feed-thru eyelets (configuration is optional, but will not extend beyond this zone).

FIGURE 1. Physical dimensions for TO-257AA.
2. APPLICABLE DOCUMENTS

2.1 General. The documents listed in this section are specified in sections 3 and 4 of this specification. This section does not include documents cited in other sections of this specification or recommended for additional information or as examples. While every effort has been made to ensure the completeness of this list, document users are cautioned that they must meet all specified requirements of documents cited in sections 3 and 4 of this specification, whether or not they are listed.

2.2 Government documents.

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

DEPARTMENT OF DEFENSE SPECIFICATIONS


DEPARTMENT OF DEFENSE STANDARDS


*MIL-STD-883 - Test Method Standard Microcircuits

(Copies of these documents are available online at https://quicksearch.dla.mil.)

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

3. REQUIREMENTS

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

3.2 Qualification. Devices furnished under this specification shall be products that are manufactured by a manufacturer authorized by the qualifying activity for listing on the applicable qualified 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.

IAS .......... 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 figure 1 (TO-257AA). Methods used for electrical isolation of the terminals shall employ materials that contain a minimum of 90 percent Al2O3 (ceramic).

3.4.1 Lead formation and finish. Lead finish shall be solderable in accordance with MIL-STD-750, MIL-PRF-19500 and herein. Where a choice of finish is desired, it shall be specified in the acquisition document (see 6.2). When lead formation is performed, as a minimum, the vendor shall perform 100 percent hermetic seal in accordance with screen 14 of MIL-PRF-19500 and 100 percent dc testing in accordance with table I, subgroup 2 herein.

3.4.2 Internal construction. Multiple chip construction shall not be permitted to meet the requirements of this specification.
3.4.3 Silicone die coat. The use of a silicone die coat requires a successful completion of MIL-STD-883, method 5011 on each silicone lot for its intended applications, and as part of the full MIL-PRF-19500 qualification process.

3.5 Electrostatic discharge sensitive (ESDS). The devices covered by this specification sheet have been classified as ESDS. The Metal oxide semiconductor (MOS) devices shall be handled in accordance with the ESD program established to comply with the requirements of MIL-PRF-19500 to avoid damage due to the accumulation of static charge. However, the following handling practices are recommended.

a. Devices should 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 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, $R \leq 100 \, \text{k} \Omega$, whenever bias voltage is applied drain to source.

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

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 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 III tests, the tests specified in table III herein that were not performed in the prior revision shall be performed on the first inspection lot of this revision to maintain qualification.
4.2.1.1 Single event effects (SEE). SEE shall be performed at initial qualification and after process or design changes which may affect radiation hardness (see table III and table IV). Upon qualification, manufacturers shall provide the verification test conditions from section 5 of method 1080 of MIL-STD-750 that were used to qualify the device for inclusion into section 6 of the slash sheet. End-point measurements shall be in accordance with table II. SEE characterization data shall be made available upon request of the qualifying or acquiring activity.

4.3 Screening (JANS and JANTXV). 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.

<table>
<thead>
<tr>
<th>Screen (see table E-IV of MIL-PRF-19500)</th>
<th>Measurement</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>JANS</td>
</tr>
<tr>
<td>(3)</td>
<td>Gate stress test (see 4.3.1)</td>
</tr>
<tr>
<td>(3)</td>
<td>Method 3470 of MIL-STD-750, EAS test (see 4.3.2)</td>
</tr>
<tr>
<td>(3) 3c</td>
<td>Method 3161 of MIL-STD-750, thermal impedance (see 4.3.3)</td>
</tr>
<tr>
<td>5</td>
<td>Method 2052 of MIL-STD-750, PIND (see MIL-PRF-19500 and 4.3.5)</td>
</tr>
<tr>
<td>9</td>
<td>Subgroup 2 of table I herein</td>
</tr>
<tr>
<td></td>
<td><img src="https://via.placeholder.com/150" alt="image" /></td>
</tr>
<tr>
<td>10</td>
<td>Method 1042 of MIL-STD-750, test condition B</td>
</tr>
<tr>
<td>11</td>
<td><img src="https://via.placeholder.com/150" alt="image" /></td>
</tr>
<tr>
<td>12</td>
<td>Method 1042 of MIL-STD-750, test condition A</td>
</tr>
<tr>
<td>13</td>
<td><img src="https://via.placeholder.com/150" alt="image" /></td>
</tr>
<tr>
<td>17</td>
<td>For TO-257AA packages: Method 1081 of MIL-STD-750 (see 4.3.4), Endpoints: Subgroup 2 of table I herein</td>
</tr>
</tbody>
</table>

(1) At the end of the test program, $I_{GSSF1}$, $I_{GSSR1}$, and $I_{GSS1}$ are measured.
(2) An out-of-family program to characterize $I_{GSSF1}$, $I_{GSSR1}$, $I_{GSS1}$, and $V_{GS(TH)1}$ shall be invoked.
(3) Shall be performed anytime after temperature cycling, screen 3a. JANTXV level does not need to be repeated in screening requirements.
4.3.1 **Gate stress test.** Apply $V_{GS} = 24$ V, minimum for $t = 250 \mu S$, minimum.

4.3.2 **Single pulse avalanche energy ($E_{AS}$).**
   a. Peak current .............................................................. $I_{AS} = I_{D1}$.
   b. Inductance ............................................................ $\left[ \frac{2E_{SS}}{V_{SS}} \right] \left[ \frac{V_{SS} - V_{CO}}{V_{SS}} \right]$ mH minimum.
   c. Gate to source resistor, $R_{GS}$ ............................... $25 \Omega \leq R_{GS} \leq 200 \Omega$.
   d. Supply voltage ........................................................... $V_{DD} = 25$ V dc, except $V_{DD} = 50$ V dc
      ............................................................................. for 2N7490T3 and 2N7556T3.
   e. Initial case temperature ............................................. $T_c = +25^\circ$ C, $-5^\circ$ C, $+10^\circ$ C.
   f. Gate voltage ............................................................. $V_{GS} = 12$ V dc.
   g. Number of pulses to be applied ................................. 1 pulse minimum.

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 $(t_{MD}) = 70 \mu s$ maximum. See **table III**, group E, subgroup 4 herein.

4.3.4 **Dielectric withstanding voltage.**
   a. Magnitude of test voltage ......................................... 800 V dc.
   b. Duration of application of test voltage ......................... 15 seconds (min).
   c. Points of application of test voltage ......................... All leads to case (bunch connection).
   d. Method of connection ............................................... Mechanical.
   e. Kilovolt-ampere rating of high voltage source .......... $1,200$ V/$1.0$ mA (min).
   f. Maximum leakage current ........................................ $1.0$ mA.
   g. Voltage ramp up time .............................................. $500$ V/second.

* 4.3.5 **PIND.** Not applicable in screening when devices are processed using alternative method and flow requirements approved by the qualifying activity, that includes incorporating the use of certified clean processing and silicone die coat. Instead, the PIND test performance shall be performed in group B3 and group C3, on a lot sample basis. PIND failures detected in group B or C will represent lot jeopardy and shall be evaluated for root cause and lot integrity.

4.4 **Conformance inspection.** Conformance inspection shall be in accordance with **MIL-PRF-19500**.

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 (JANTXV) of **MIL-PRF-19500**, and as follows.
4.4.2.1 **Group B inspection, table E-VIA (JANS) of MIL-PRF-19500.**

<table>
<thead>
<tr>
<th>Subgroup</th>
<th>Method</th>
<th>Condition</th>
</tr>
</thead>
<tbody>
<tr>
<td>B3</td>
<td>1051</td>
<td>Test condition G, 100 cycles.</td>
</tr>
<tr>
<td>B3</td>
<td>2077</td>
<td>Scanning electron microscope (SEM).</td>
</tr>
<tr>
<td>* B3</td>
<td>2052</td>
<td>PIND, required if not performed in screening. (22 devices, c = 0 for large lots, 12 devices, c = 0 for small lots).</td>
</tr>
<tr>
<td>B4</td>
<td>1042</td>
<td>Intermittent operation life, condition D. No heat sink or forced-air cooling on the device shall be permitted during the on cycle. $t_{on} = 30$ seconds minimum.</td>
</tr>
<tr>
<td>B5</td>
<td>1042</td>
<td>Accelerated steady-state gate bias, condition B, $V_{GS} = \text{rated}; T_A = +175^\circ C$, $t = 24$ hours minimum; or $T_A = +150^\circ C$, $t = 48$ hours minimum.</td>
</tr>
<tr>
<td>B5</td>
<td>2037</td>
<td>Bond strength, test condition D.</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Subgroup</th>
<th>Method</th>
<th>Condition</th>
</tr>
</thead>
<tbody>
<tr>
<td>B3</td>
<td>1042</td>
<td>Intermittent operation life, condition D. No heat sink or forced-air cooling on the device shall be permitted during the on cycle. $t_{on} = 30$ seconds minimum.</td>
</tr>
<tr>
<td>B5 and B6</td>
<td></td>
<td>Not applicable.</td>
</tr>
</tbody>
</table>

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.

<table>
<thead>
<tr>
<th>Subgroup</th>
<th>Method</th>
<th>Condition</th>
</tr>
</thead>
<tbody>
<tr>
<td>C2</td>
<td>2036</td>
<td>Test condition A; weight = 10 pounds; $t = 10$ s.</td>
</tr>
<tr>
<td>* C3</td>
<td>2052</td>
<td>PIND, required if not performed in screening. (JANS only, 22 devices, c = 0 for large lots, 12 devices, c = 0 for small lots).</td>
</tr>
<tr>
<td>C5</td>
<td>3161</td>
<td>Thermal resistance, see 4.5.2.</td>
</tr>
<tr>
<td>C6</td>
<td>1042</td>
<td>Intermittent operation life, condition D. No heat sink or forced-air cooling on the device shall be permitted during the on cycle. $t_{on} = 30$ seconds minimum.</td>
</tr>
</tbody>
</table>

4.4.4 **Group D inspection.** Group D inspection shall be conducted in accordance with table E-VIII of MIL-PRF-19500 and table II herein.

4.4.5 **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 III 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.

4.5.2 Thermal resistance. The thermal resistance 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 maximum. See table E-IX of MIL-PRF-19500, group E, subgroup 4.

### TABLE I. Group A inspection

<table>
<thead>
<tr>
<th>Inspection 1/</th>
<th>MIL-STD-750</th>
<th>Symbol</th>
<th>Limits</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Method</td>
<td>Condition</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Subgroup 1</td>
<td>2071</td>
<td>Visual and mechanical inspection</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Subgroup 2</td>
<td>3161</td>
<td>See 4.3.3</td>
<td>$Z_{JUC}$</td>
<td>°C/W</td>
</tr>
<tr>
<td>Thermal impedance 2/</td>
<td>3407</td>
<td>$V_{GS} = 0$, $I_D = 1$ mA dc, bias condition C</td>
<td>$V_{BRIDSS}$</td>
<td></td>
</tr>
<tr>
<td>Breakdown voltage</td>
<td>3407</td>
<td>$V_{GS} = 0$, $I_D = 1$ mA dc, bias condition C</td>
<td>$V_{BRIDSS}$</td>
<td></td>
</tr>
<tr>
<td>Drain to source</td>
<td>3407</td>
<td>$V_{GS} = 0$, $I_D = 1$ mA dc</td>
<td>$V_{GS} \geq V_{GS}$, $I_D = 1$ mA dc</td>
<td></td>
</tr>
<tr>
<td>Gate to source</td>
<td>3411</td>
<td>$V_{GS} = +20$ V dc, bias condition C, $V_{DS} = 0$</td>
<td>$I_{GSSF1}$</td>
<td>+100</td>
</tr>
<tr>
<td>Voltage (threshold)</td>
<td>3411</td>
<td>$V_{GS} = -20$ V dc, bias condition C, $V_{DS} = 0$</td>
<td>$I_{GSSR1}$</td>
<td>-100</td>
</tr>
<tr>
<td>Drain current</td>
<td>3413</td>
<td>$V_{GS} = 0$, bias condition C, $V_{DS} = 80$ percent of rated $V_{DS}$</td>
<td>$I_{DSS1}$</td>
<td>10</td>
</tr>
<tr>
<td>Static drain to source</td>
<td>3421</td>
<td>$V_{GS} = 12$ V dc, condition A, pulsed (see 4.5.1), $I_D = I_{D2}$</td>
<td>$r_{DS(ON1)}$</td>
<td>0.090</td>
</tr>
<tr>
<td>On-state resistance</td>
<td>4011</td>
<td>$V_{GS} = 0$, condition A, $I_D = I_{D1}$</td>
<td>$V_{SD}$</td>
<td>1.2</td>
</tr>
</tbody>
</table>

See footnotes at end of table.
TABLE I. Group A inspection - Continued.

<table>
<thead>
<tr>
<th>Inspection Method</th>
<th>MIL-STD-750 Symbol</th>
<th>Condition</th>
<th>Limits</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Subgroup 3</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>High temperature operation</td>
<td></td>
<td>$T_C = T_J = +125^\circ C$</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gate current</td>
<td>3411</td>
<td>$V_{GS} = \pm 20$ V dc, bias condition C, $V_{DS} = 0$</td>
<td>$I_{GSS2}$</td>
<td>$\pm 200$ nA dc</td>
</tr>
<tr>
<td>Drain current</td>
<td>3413</td>
<td>$V_{GS} = 0$, bias condition C, $V_{DS} = 80$ percent of rated $V_{DS}$</td>
<td>$I_{DSS2}$</td>
<td>25 $\mu$A dc</td>
</tr>
<tr>
<td>Static drain to source on-state resistance</td>
<td>3421</td>
<td>$V_{GS} = 12$ V dc, condition A, pulsed (see 4.5.1), $I_D = I_{D2}$</td>
<td>$r_{DS(ON3)}$</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2N7488T3</td>
<td></td>
<td>0.180</td>
<td>$\Omega$</td>
</tr>
<tr>
<td></td>
<td>2N7489T3</td>
<td></td>
<td>0.483</td>
<td>$\Omega$</td>
</tr>
<tr>
<td></td>
<td>2N7490T3, 2N7556T3</td>
<td></td>
<td>0.780</td>
<td>$\Omega$</td>
</tr>
<tr>
<td>Gate to source voltage (threshold)</td>
<td>3403</td>
<td>$V_{DS} \geq V_{GS}$, $I_D = 1$ mA dc</td>
<td>$V_{GS(TH2)}$</td>
<td>1.5 V dc</td>
</tr>
<tr>
<td>Low temperature operation</td>
<td></td>
<td>$T_C = T_J = -55^\circ C$</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gate to source voltage (threshold)</td>
<td>3403</td>
<td>$V_{DS} \geq V_{GS(TH3)}$, $I_D = 1$ mA dc</td>
<td>$V_{GS(TH3)}$</td>
<td>5.5 V dc</td>
</tr>
<tr>
<td><strong>Subgroup 4</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Forward transconductance</td>
<td>3475</td>
<td>$I_D = I_{D3}$, $V_{DD} = 15$ V dc (see 4.5.1)</td>
<td>$g_{FS}$</td>
<td>8.5 S</td>
</tr>
<tr>
<td></td>
<td>2N7488T3</td>
<td></td>
<td>6</td>
<td>S</td>
</tr>
<tr>
<td></td>
<td>2N7489T3</td>
<td></td>
<td>6</td>
<td>S</td>
</tr>
<tr>
<td></td>
<td>2N7490T3, 2N7556T3</td>
<td></td>
<td>4</td>
<td>S</td>
</tr>
<tr>
<td>Switching time test</td>
<td>3472</td>
<td>$I_D = I_{D1}$, $V_{GS} = 12$ V dc, $R_G = 7.5$ $\Omega$, $V_{DD} = 50$ percent of rated $V_{DS}$</td>
<td>$t_{D(on)}$, $t_f$</td>
<td></td>
</tr>
<tr>
<td>Turn-on delay time</td>
<td>2N7488T3</td>
<td></td>
<td>20 ns</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2N7489T3</td>
<td></td>
<td>25 ns</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2N7490T3, 2N7556T3</td>
<td></td>
<td>25 ns</td>
<td></td>
</tr>
<tr>
<td>Rise time</td>
<td>2N7488T3</td>
<td></td>
<td>70 ns</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2N7489T3</td>
<td></td>
<td>100 ns</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2N7490T3, 2N7556T3</td>
<td></td>
<td>100 ns</td>
<td></td>
</tr>
<tr>
<td>Turn-off delay time</td>
<td>2N7488T3</td>
<td></td>
<td>25 ns</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2N7489T3</td>
<td></td>
<td>35 ns</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2N7490T3, 2N7556T3</td>
<td></td>
<td>35 ns</td>
<td></td>
</tr>
<tr>
<td>Fall time</td>
<td>2N7488T3</td>
<td></td>
<td>35 ns</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2N7489T3</td>
<td></td>
<td>30 ns</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2N7490T3, 2N7556T3</td>
<td></td>
<td>30 ns</td>
<td></td>
</tr>
</tbody>
</table>

See footnotes at end of table.
<table>
<thead>
<tr>
<th>Inspection 1/</th>
<th>MIL-STD-750 Symbol</th>
<th>Limits</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Subgroup 5</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Safe operating area test (high voltage)</td>
<td>3474</td>
<td>See figure 4</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>tᵢ = 10 ms min.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Vᵣ₆ᵦ = 80 percent of max. rated Vᵣ₆ᵦ</td>
<td></td>
</tr>
<tr>
<td>Electrical measurements</td>
<td></td>
<td>See table I, subgroup 2</td>
<td></td>
</tr>
<tr>
<td><strong>Subgroup 6</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Not applicable</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Subgroup 7</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gate charge</td>
<td>3471</td>
<td>Condition B. Iₒ = Iₒ₁, Vᵣ₆ᵦ = 12 V dc</td>
<td></td>
</tr>
<tr>
<td>On-state gate charge</td>
<td></td>
<td>Qₒ₆ᵦ(ₒ₆ᵦ)</td>
<td>48</td>
</tr>
<tr>
<td>2N7488T3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2N7489T3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2N7490T3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2N7556T3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gate to source charge</td>
<td></td>
<td>Qₒ₆ᵦ₆ᵦ</td>
<td>16</td>
</tr>
<tr>
<td>2N7488T3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2N7489T3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2N7490T3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2N7556T3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gate to drain charge</td>
<td></td>
<td>Qₒ₆ᵦ₆ᵦ</td>
<td>18</td>
</tr>
<tr>
<td>2N7488T3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2N7489T3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2N7490T3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2N7556T3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reverse recovery time</td>
<td>3473</td>
<td>Condition A, di/dt = -100 A/µs, Vᵣ₆ᵦ ≤ 50 V, Iₒ = Iₒ₁</td>
<td></td>
</tr>
<tr>
<td>2N7488T3</td>
<td></td>
<td>tᵦ</td>
<td>200</td>
</tr>
<tr>
<td>2N7489T3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2N7490T3, 2N7556T3</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1/ For sampling plan, see MIL-PRF-19500.
2/ For end-point measurements, this test is required for the following subgroups (not intended for 4.3, screen 9 or 11):
   Group B, subgroups 2 and 3 (JANTXV).
   Group B, subgroups 3 and 4 (JANS).
   Group C, subgroups 2 and 6.
   Group E, subgroup 1.
TABLE II. Group D inspection.

<table>
<thead>
<tr>
<th>Inspection</th>
<th>MIL-STD-750</th>
<th>Symbol</th>
<th>Pre-irradiation limits</th>
<th>Post-irradiation limits</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Method</td>
<td>Conditions</td>
<td>R</td>
<td>R</td>
<td>Min</td>
</tr>
<tr>
<td><strong>Subgroup 1</strong></td>
<td></td>
<td>Not applicable</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Subgroup 2</strong></td>
<td></td>
<td>T&lt;sub&gt;c&lt;/sub&gt; = + 25°C</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Steady-state total dose irradiation (&lt;span style='color:red'&gt;V&lt;sub&gt;GS&lt;/sub&gt;&lt;/span&gt; bias)</td>
<td>1019</td>
<td>&lt;span style='color:red'&gt;V&lt;sub&gt;GS&lt;/sub&gt;&lt;/span&gt; = 12 V; &lt;span style='color:red'&gt;V&lt;sub&gt;DS&lt;/sub&gt;&lt;/span&gt; = 0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Steady-state total dose irradiation (&lt;span style='color:red'&gt;V&lt;sub&gt;GS&lt;/sub&gt;&lt;/span&gt; bias)</td>
<td>1019</td>
<td>&lt;span style='color:red'&gt;V&lt;sub&gt;GS&lt;/sub&gt;&lt;/span&gt; = 0; &lt;span style='color:red'&gt;V&lt;sub&gt;DS&lt;/sub&gt;&lt;/span&gt; = 80 percent of rated &lt;span style='color:red'&gt;V&lt;sub&gt;DS&lt;/sub&gt;&lt;/span&gt; (preirradiation)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>End-point electicals:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Breakdown voltage, drain to source</td>
<td>3407</td>
<td>&lt;span style='color:red'&gt;V&lt;sub&gt;GS&lt;/sub&gt;&lt;/span&gt; = 0; &lt;span style='color:red'&gt;I&lt;sub&gt;B&lt;/sub&gt;&lt;/span&gt; = 1 mA; bias condition C</td>
<td>130</td>
<td>130</td>
<td>V dc</td>
</tr>
<tr>
<td>2N7488T3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2N7489T3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2N7490T3, 2N7556T3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gate to source voltage (threshold)</td>
<td>3403</td>
<td>&lt;span style='color:red'&gt;V&lt;sub&gt;DS&lt;/sub&gt;&lt;/span&gt; ≥ &lt;span style='color:red'&gt;V&lt;sub&gt;GS&lt;/sub&gt;&lt;/span&gt;; &lt;span style='color:red'&gt;I&lt;sub&gt;B&lt;/sub&gt;&lt;/span&gt; = 1 mA</td>
<td>V&lt;sub&gt;BR&lt;sub&gt;GS&lt;sub&gt;/DS&lt;/sub&gt;&lt;/sub&gt;&lt;/sub&gt;</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gate current</td>
<td>3411</td>
<td>&lt;span style='color:red'&gt;V&lt;sub&gt;GS&lt;/sub&gt;&lt;/span&gt; = +20 V; &lt;span style='color:red'&gt;V&lt;sub&gt;DS&lt;/sub&gt;&lt;/span&gt; = 0; bias condition C</td>
<td>I&lt;sub&gt;GSF1&lt;/sub&gt;</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td>Gate current</td>
<td>3411</td>
<td>&lt;span style='color:red'&gt;V&lt;sub&gt;GS&lt;/sub&gt;&lt;/span&gt; = -20 V; &lt;span style='color:red'&gt;V&lt;sub&gt;DS&lt;/sub&gt;&lt;/span&gt; = 0; bias condition C</td>
<td>I&lt;sub&gt;GSSR1&lt;/sub&gt;</td>
<td>-100</td>
<td>-100</td>
</tr>
<tr>
<td>Drain current</td>
<td>3413</td>
<td>&lt;span style='color:red'&gt;V&lt;sub&gt;GS&lt;/sub&gt;&lt;/span&gt; = 0, &lt;span style='color:red'&gt;V&lt;sub&gt;DS&lt;/sub&gt;&lt;/span&gt; = 80 percent of rated &lt;span style='color:red'&gt;V&lt;sub&gt;DS&lt;/sub&gt;&lt;/span&gt; (preirradiation); bias condition C</td>
<td>I&lt;sub&gt;DS&lt;/sub&gt;</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>Static drain to source on-state voltage</td>
<td>3405</td>
<td>&lt;span style='color:red'&gt;V&lt;sub&gt;GS&lt;/sub&gt;&lt;/span&gt; = 12 V; &lt;span style='color:red'&gt;I&lt;sub&gt;B&lt;/sub&gt;&lt;/span&gt; = &lt;span style='color:red'&gt;I&lt;sub&gt;D2&lt;/sub&gt;&lt;/span&gt; condition A, pulsed (see 4.5.1)</td>
<td>V&lt;sub&gt;DS(on)&lt;/sub&gt;</td>
<td>1.08</td>
<td>1.08</td>
</tr>
<tr>
<td>2N7488T3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2N7489T3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2N7490T3, 2N7556T3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Forward voltage source drain diode</td>
<td>4011</td>
<td>&lt;span style='color:red'&gt;V&lt;sub&gt;GS&lt;/sub&gt;&lt;/span&gt; = 0; &lt;span style='color:red'&gt;I&lt;sub&gt;B&lt;/sub&gt;&lt;/span&gt; = &lt;span style='color:red'&gt;I&lt;sub&gt;D1&lt;/sub&gt;&lt;/span&gt;, bias condition A</td>
<td>V&lt;sub&gt;SD&lt;/sub&gt;</td>
<td>1.2</td>
<td>1.2</td>
</tr>
</tbody>
</table>

1/ For sampling plan see MIL-PRF-19500.
2/ Group D qualification may be performed prior to lot formation. Wafers qualified to these group D QCI requirements may be used for any other specification sheets utilizing the same die design.
3/ At the manufacturer’s option, group D samples need not be subjected to the screening tests, and may be assembled in its qualified package or in any qualified package that the manufacturer has data to correlate the performance to the designated package.
4/ Separate samples shall be pulled for each bias.
### TABLE III. Group E inspection (all quality levels) for qualification or re-qualification only.

<table>
<thead>
<tr>
<th>Inspection</th>
<th>Method</th>
<th>Conditions</th>
<th>Qualification and large lot quality conformance inspection</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Subgroup 1</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Temperature cycling</td>
<td>1051</td>
<td>Test condition G, 500 cycles</td>
<td>c = 0</td>
</tr>
<tr>
<td>Hermetic seal</td>
<td>1071</td>
<td>As applicable.</td>
<td></td>
</tr>
<tr>
<td>Fine leak</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gross leak</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Electrical measurements</td>
<td></td>
<td>See table I, subgroup 2 herein.</td>
<td></td>
</tr>
<tr>
<td><strong>Subgroup 2 1/</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Steady-state gate bias</td>
<td>1042</td>
<td>Condition B, 1,000 hours.</td>
<td>c = 0</td>
</tr>
<tr>
<td>Electrical measurements</td>
<td></td>
<td>See table I, subgroup 2 herein.</td>
<td></td>
</tr>
<tr>
<td>Steady-state reverse bias</td>
<td>1042</td>
<td>Condition A, 1,000 hours.</td>
<td></td>
</tr>
<tr>
<td>Electrical measurements</td>
<td></td>
<td>See table I, subgroup 2 herein.</td>
<td></td>
</tr>
<tr>
<td><strong>Subgroup 4</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Thermal impedance curves</td>
<td></td>
<td>See MIL-PRF-19500.</td>
<td>N/A</td>
</tr>
<tr>
<td><strong>Subgroup 5</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Barometric pressure</td>
<td>1001</td>
<td>Test condition C, ( V_{DS} = 250 \text{ V};</td>
<td>c</td>
</tr>
<tr>
<td>(2N7490T3 and 2N7556T3 only)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Subgroup 10</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Commutating diode for safe operating area test procedure for measuring dv/dt during reverse recovery of power MOSFET transistors or insulated gate bipolar transistors</td>
<td>3476</td>
<td>Test conditions shall be derived by the manufacturer</td>
<td>c = 0</td>
</tr>
<tr>
<td><strong>Subgroup 11</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1/ A separate sample for each test shall be pulled.
2/ Group E qualification of SEE testing may be performed prior to lot formation. Qualification may be extended to other specification sheets utilizing the same structurally identical die design.
3/ Device qualification to a higher level LET is sufficient to qualify all lower level LETs.
FIGURE 2. Thermal impedance curve.

Notes:
1. Duty factor $D = t_1 / t_2$
2. Peak $T_J = P_{D_M} \times Z_{TH} + T_C$
FIGURE 3. Maximum drain current vs case temperature graphs.
Operation in this area limited by RDS(on)

FIGURE 4. Safe operating area graphs - Continued.
FIGURE 4. Safe operating area graphs - Continued.

Operation in this area limited by RDS(on)

2N7490T3

2N7556T3
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 formation and finish (see 3.4.1).

d. The complete PIN, see 1.5 and 6.5.

e. For acquisition of RHA designated devices, table II, subgroup 1 testing of group D herein is optional. If subgroup 1 is desired, it should be specified in the contract.

f. If SEE testing data is desired, it should be specified in the contract or order.

g. If specific SEE characterization conditions are desired (see section 6.8 and table IV), manufacturer’s CAGE code should be specified in the contract or order.

* 6.3 Qualification. With respect to products requiring qualification, awards will be made only for products which are, at the time of award of contract, qualified for inclusion in Qualified Manufacturers List (QML 19500) whether or not such products have actually been so listed by that date. The attention of the contractors is called to these requirements, and manufacturers are urged to arrange to have the products that they propose to offer to the Federal Government tested for qualification in order that they may be eligible to be awarded contracts or orders for the products covered by this specification. Information pertaining to qualification of products may be obtained from DLA Land and Maritime, ATTN: VQE, P.O. Box 3990, Columbus, OH 43218-3990 or e-mail vqe.chief@dlamil. An online listing of products qualified to this specification may be found in the Qualified Products Database (QPD) at https://qpldocs.dla.mil.

6.4 Cross-reference list. The following table shows the generic P/N and its associated military P/N (without JANTX and RHA prefix).

<table>
<thead>
<tr>
<th>Generic P/N</th>
<th>Military P/N</th>
</tr>
</thead>
<tbody>
<tr>
<td>IRHY57133CMSE</td>
<td>2N7488T3</td>
</tr>
<tr>
<td>IRHY57230CMSE</td>
<td>2N7489T3</td>
</tr>
<tr>
<td></td>
<td>2N7490T3</td>
</tr>
<tr>
<td>IRHY57234CMSE</td>
<td>2N7556T3</td>
</tr>
</tbody>
</table>
6.5 **PIN construction example.** The PINs for encapsulated devices are constructed using the following form.

```
JANTXV  R  2N   7488   T3
```

- JAN brand and quality level (see 1.5.1)
- RHA designator, if applicable (see 1.5.3)
- Component designation (see 1.5.4.1)
- Identification number (see 1.5.4.2)
- Suffix (see 1.5.5)

6.6 **List of PINs.** The following is a list of possible PINs available on this specification sheet.

<table>
<thead>
<tr>
<th>PINs for devices of the &quot;TXV&quot; quality level</th>
<th>PINs for devices of the &quot;TXV&quot; quality level with RHA (1)</th>
<th>PINs for devices of the &quot;S&quot; quality level</th>
<th>PINs for devices of the &quot;S&quot; quality level with RHA (1)</th>
</tr>
</thead>
<tbody>
<tr>
<td>JANTXV2N7488T3</td>
<td>JANTXV#2N7488T3</td>
<td>JANS2N7488T3</td>
<td>JANS#2N7488T3</td>
</tr>
<tr>
<td>JANTXV2N7489T3</td>
<td>JANTXV#2N7489T3</td>
<td>JANS2N7489T3</td>
<td>JANS#2N7489T3</td>
</tr>
<tr>
<td>JANTXV2N7490T3</td>
<td>JANTXV#2N7490T3</td>
<td>JANS2N7490T3</td>
<td>JANS#2N7490T3</td>
</tr>
<tr>
<td>JANTXV2N7556T3</td>
<td>JANTXV#2N7556T3</td>
<td>JANS2N7556T3</td>
<td>JANS#2N7556T3</td>
</tr>
</tbody>
</table>

(1) The number sign (#) represent one of five RHA designators available (M, D, P, L, or R).

6.7 **JANC die versions.** The JANHC and JANKC die versions of these devices are covered under specification sheet MIL-PRF-19500/741.

6.8 **Application data.**

6.8.1 **Manufacturer specific irradiation data.** Each manufacturer qualified to this slash sheet has characterized its devices to the requirements of MIL-STD-750 method 1080 and as specified herein. Since each manufacturer’s characterization conditions can be different and can vary by the version of method 1080 qualified to, the MIL-STD-750 method 1080 revision version date and conditions used by each manufacturer for characterization have been listed here (see table IV) for information only. SEE conditions and figures listed in section 6 are current as of the date of this specification sheet, please contact the manufacturer for the most recent conditions.
### TABLE IV. Manufacturers characterization conditions.

<table>
<thead>
<tr>
<th>Manufacturers CAGE</th>
<th>Inspection</th>
<th>MIL-STD-750 Sample plan</th>
<th>Conditions</th>
</tr>
</thead>
<tbody>
<tr>
<td>69210</td>
<td>SEE 1/</td>
<td>1080</td>
<td>See MIL-STD-750 method 1080.0 dated 20 November 2006. See figure 5</td>
</tr>
<tr>
<td>(Applicable to devices with a date code of 16 June 1998 and older)</td>
<td>Electrical measurements</td>
<td>I_{GSSF1}, I_{GSRR1}, and I_{DBS1} in accordance with table I, subgroup 2</td>
<td>3 devices</td>
</tr>
<tr>
<td>SEE irradiation:</td>
<td>Fluence = 3E5 ±20 percent ions/cm² Flux = 2E3 to 2E4 ions/cm²/sec, temperature = 25 ±5°C Surface LET = 38 MeV-cm²/mg ±5% Range = 38 µm ±7.5%, Energy = 300 MeV ±7.5%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2N7488T3</td>
<td>In-situ bias conditions: V_DS = 130 V and V_GS = -20 V (typical 3.75 MeV/nucleon at Texas A &amp; M Cyclotron)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2N7489T3</td>
<td>In-situ bias conditions: V_DS = 200 V and V_GS = -20 V (nominal 3.86 MeV/nucleon at Brookhaven National Lab Accelerator)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2N7490T3, 2N7556T3</td>
<td>In-situ bias conditions: V_DS = 250 V and V_GS = -20 V (nominal 3.86 MeV/nucleon at Brookhaven National Lab Accelerator)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Surface LET = 61 MeV-cm²/mg ±5% Range = 31 µm ±10%, Energy = 330 MeV ±7.5%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2N7488T3</td>
<td>In-situ bias conditions: V_DS = 130 V and V_GS = -10 V V_DS = 100 V and V_GS = -15 V V_DS = 50 V and V_GS = -20 V (typical 2.70 MeV/nucleon at Texas A &amp; M Cyclotron)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2N7489T3</td>
<td>In-situ bias conditions: V_DS = 200 V and V_GS = -10 V V_DS = 185 V and V_GS = -15 V V_DS = 120 V and V_GS = -20 V (nominal 2.92 MeV/nucleon at Brookhaven National Lab Accelerator)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2N7490T3, 2N7556T3</td>
<td>In-situ bias conditions: V_DS = 250 V and V_GS = -15 V V_DS = 240 V and V_GS = -20 V (nominal 2.92 MeV/nucleon at Brookhaven National Lab Accelerator)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

See footnotes at end of table.
### TABLE IV. Manufacturers characterization conditions - Continued.

<table>
<thead>
<tr>
<th>Manufactures CAGE</th>
<th>Inspection</th>
<th>MIL-STD-750 Conditions</th>
<th>Sample plan</th>
</tr>
</thead>
</table>
| 2N7488T3          | Surface LET = 84 MeV-cm²/mg ±5%  
Range = 28 µm ±7.5%,  Energy = 350 MeV ±10%  
In-situ bias conditions:  
V<sub>DS</sub> = 130 V and V<sub>GS</sub> = 0 V  
V<sub>DS</sub> = 120 V and V<sub>GS</sub> = -5 V  
V<sub>DS</sub> = 30 V and V<sub>GS</sub> = -10 V  
(typical 1.89 MeV/nucleon at Texas A & M Cyclotron) | 3 devices |
| 2N7489T3          | In-situ bias conditions:  
V<sub>DS</sub> = 200 V and V<sub>GS</sub> = -5V  
V<sub>DS</sub> = 150 V and V<sub>GS</sub> = -10 V  
V<sub>DS</sub> = 50 V and V<sub>GS</sub> = -15 V  
V<sub>DS</sub> = 25 V and V<sub>GS</sub> = -20 V  
(nominal 1.98 MeV/nucleon at Brookhaven National Lab Accelerator) | |
| 2N7490T3, 2N7556T3 | In-situ bias conditions:  
V<sub>DS</sub> = 250 V and V<sub>GS</sub> = -5 V  
V<sub>DS</sub> = 225 V and V<sub>GS</sub> = -10 V  
V<sub>DS</sub> = 175 V and V<sub>GS</sub> = -15 V  
V<sub>DS</sub> = 50 V and V<sub>GS</sub> = -20 V  
(nominal 1.98 MeV/nucleon at Brookhaven National Lab Accelerator) | |
|                   | Electrical measurements | I<sub>GSSF1</sub>, I<sub>SGSR1</sub>, and I<sub>DSS1</sub> in accordance with table I, subgroup 2 | |

Upon qualification, all manufacturers should provide the verification test conditions to be added to this table.

1/ I<sub>GSSF1</sub>, I<sub>SGSR1</sub>, and I<sub>DSS1</sub> was examined before and following SEE irradiation to determine acceptability for each bias condition. Other test conditions in accordance with table I, subgroup 2, may be performed at the manufacturer's option.
FIGURE 5. Typical SEE safe operating area graphs.
* 6.9 Amendment notations. The margins of this specification are marked with asterisks to indicate modifications generated by this amendment. This was done as a convenience only and the Government assumes no liability whatsoever for any inaccuracies in these notations. Bidders and contractors are cautioned to evaluate the requirements of this document based on the entire content irrespective of the marginal notations and relationship to the last previous issue.

Custodians: 
Army - CR
Navy - EC
Air Force - 85
NASA - NA
DLA - CC

Preparing activity:
DLA - CC
(Project 5961-2019-062)

Review activity: 
Army - AV, MI
Air Force - 19

NOTE: The activities listed above were interested in this document as of the date of this document. Since organizations and responsibilities can change, you should verify the currency of the information above using the ASSIST Online database at https://assist.dla.mil.