

The documentation and process conversion measures necessary to comply with this revision shall be completed by 19 July 2013.

INCH-POUND

MIL-PRF-19500/747B  
 19 April 2013  
 SUPERSEDING  
 MIL-PRF-19500/747A  
 12 August 2010

PERFORMANCE SPECIFICATION SHEET

SEMICONDUCTOR DEVICE, FIELD EFFECT TRANSISTOR, N-CHANNEL,  
 RADIATION HARDENED, SILICON, TYPE 2N7504T2,  
 JANTXVR, JANTXVF, JANTXVG, JANTXVH, JANSF, JANSR, JANSR, AND JANSH

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, transistor. Two levels of product assurance are provided for each device type as specified in [MIL-PRF-19500](#), with avalanche energy maximum rating ( $E_{AS}$ ) and maximum avalanche current ( $I_{AS}$ ).

1.2 Physical dimensions. See [figure 1](#), TO-39 (TO-205AF).

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

Type	$P_T$ (1) $T_C$ $=+25^\circ\text{C}$	$P_T$ $T_A$ $=+25^\circ\text{C}$	$R_{\theta JC}$ (2)	$V_{DS}$	$V_{GS}$	$I_{D1}$ $T_C = +25^\circ\text{C}$ (3) (4)	$I_{D2}$ $T_C = +100^\circ\text{C}$ (3) (4)	$I_S$	$I_{DM}$ (5)	$T_J$ and $T_{STG}$
	<u>W</u>	<u>W</u>	<u><math>^\circ\text{C/W}</math></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><math>^\circ\text{C}</math></u>
2N7504T2	15	0.71	8.3	100	$\pm 20$	3.5	2.2	3.5	14	-55 to +150

- (1) Derate linearly by 0.12 W/ $^\circ\text{C}$  for  $T_C > +25^\circ\text{C}$
- (2) See [figure 2](#), thermal impedance curves.
- (3) The following formula derives the maximum theoretical  $I_D$  limit:

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

- (4) See [figure 3](#), maximum drain current graph.
- (5)  $I_{DM} = 4 \times I_{D1}$  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](mailto: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 Maximum ratings. Unless otherwise specified,  $T_C = +25^\circ\text{C}$ .

Type	Min $V_{(BR) DSS}$  $V_{GS} = 0\text{ V}$ $I_D = 1\text{ mA dc}$	$V_{GS} (th)1$  $V_{DS} = V_{GS}$ $I_D = 1\text{ mA dc}$	Max $I_{DSS1}$  $V_{GS} = 0\text{ V}$ $V_{DS} = 80\text{ percent}$ rated VDS	Max $r_{DS(on)} (1)$ $V_{GS} = 12\text{ V dc}$		$E_{AS}$	$I_{AS}$
				at $I_{D2}$ $T_J = +25^\circ\text{C}$	$T_J = +150^\circ\text{C}$		
	<u>V dc</u>	<u>V dc</u> <u>Min</u> <u>Max</u>	<u><math>\mu\text{A dc}</math></u>	<u>Ohm</u>	<u>Ohm</u>	<u>mJ</u>	<u>A dc</u>
2N7504T2	100	2.0   4.0	25.0	0.60	1.26	68	3.5

(1) Pulsed (see 4.5.1).

## 2. APPLICABLE DOCUMENTS

2.1 General. The documents listed in this section are specified in sections 3, 4, or 5 of this specification. This section does not include documents cited in other sections of this specification or recommended for additional information or as examples. While every effort has been made to ensure the completeness of this list, document users are cautioned that they must meet all specified requirements of documents cited in sections 3, 4, or 5 of this specification, whether or not they are listed.

### 2.2 Government documents.

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

#### DEPARTMENT OF DEFENSE SPECIFICATIONS

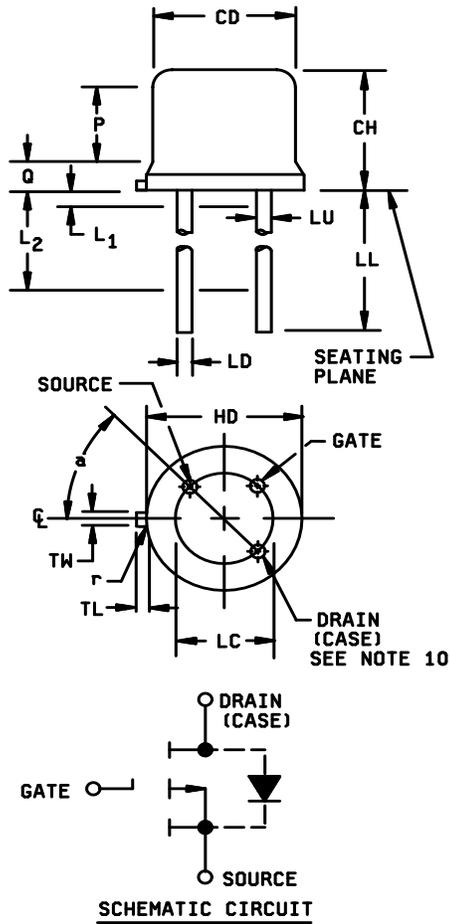
[MIL-PRF-19500](#) - Semiconductor Devices, General Specification for.

#### DEPARTMENT OF DEFENSE STANDARDS

[MIL-STD-750](#) - Test Methods for Semiconductor Devices.

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

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.



Ltr	Dimensions				Notes
	Inches		Millimeters		
	Min	Max	Min	Max	
CD	.305	.335	7.75	8.51	
CH	.160	.180	4.06	4.57	
HD	.335	.370	8.51	9.39	
LC	.200 TP		5.08 TP		6
LD	.016	.021	0.41	0.53	7, 8
LL	.500	.750	12.7	19.05	7, 8
LU	.016	.019	0.41	0.48	7, 8
L <sub>1</sub>		.050		1.27	7, 8
L <sub>2</sub>	.250		6.35		7, 8
P	.100		2.54		5
Q		.050		1.27	4
r		.010		0.25	9
TL	.029	.045	0.74	1.14	3
TW	.028	.034	0.71	0.86	2
α	45° TP		45° TP		6

NOTES:

1. Dimensions are in inches. Millimeters are given for general information only.
2. Beyond radius (r) maximum, TW shall be held for a minimum length of .011 (0.28 mm).
3. Dimension TL measured from maximum HD.
4. Outline in this zone is not controlled.
5. Dimension CD shall not vary more than .010 (0.25 mm) in zone P. This zone is controlled for automatic handling.
6. Leads at gauge plane .054 +.001, -.000 (1.37 +0.03, -0.00 mm) below seating plane shall be within .007 (0.18 mm) radius of true position (TP) at maximum material condition (MMC) relative to tab at MMC.
7. LU applies between L<sub>1</sub> and L<sub>2</sub>. LD applies between L<sub>2</sub> and LL minimum. Diameter is uncontrolled in L<sub>1</sub> 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 φx symbology.

FIGURE 1. Physical dimensions for TO-205AF (2N7504T2).

### 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 before contract award (see [4.2](#) and [6.3](#)).

3.3 Abbreviations, symbols, and definitions. Abbreviations, symbols, and definitions used herein shall be as specified in [MIL-PRF-19500](#).

3.4 Interface and physical dimensions. Interface and physical dimensions shall be as specified in [MIL-PRF-19500](#) and [figure 1](#) (TO-205AF) herein.

3.4.1 Lead finish. 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 protection.

3.6.1 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.

3.7 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 the subgroups specified in [table I](#) herein.

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 tables 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 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	JANTXV
(3)	Gate stress test (see 4.3.1)	Gate stress test (see 4.3.1)
(3)	Method 3470 of MIL-STD-750, E <sub>AS</sub> (see 4.3.2)	Method 3470 of MIL-STD-750, E <sub>AS</sub> (see 4.3.2)
(3) 3c	Method 3161 of MIL-STD-750, thermal impedance, (see 4.3.3)	Method 3161 of MIL-STD-750, thermal impedance, (see 4.3.3)
9	Subgroup 2 of table I herein I <sub>DSS1</sub> , I <sub>GSSF1</sub> , I <sub>GSSR1</sub> as minimum	Not applicable
10	Method 1042 of MIL-STD-750, test condition B	Method 1042 of MIL-STD-750, test condition B
11	I <sub>GSSF1</sub> , I <sub>GSSR1</sub> , I <sub>DSS1</sub> , r <sub>DS(ON)1</sub> , V <sub>GS(TH)1</sub> Subgroup 2 of table I herein.  ΔI <sub>GSSF1</sub> = ±20 nA dc or ±100 percent of initial value, whichever is greater. ΔI <sub>GSSR1</sub> = ±20 nA dc or ±100 percent of initial value, whichever is greater. ΔI <sub>DSS1</sub> = ±25 μA dc or ±100 percent of initial value, whichever is greater.	I <sub>GSSF1</sub> , I <sub>GSSR1</sub> , I <sub>DSS1</sub> , r <sub>DS(ON)1</sub> , V <sub>GS(TH)1</sub> Subgroup 2 of table I herein.
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. ΔI <sub>GSSF1</sub> = ±20 nA dc or ±100 percent of initial value, whichever is greater. ΔI <sub>GSSR1</sub> = ±20 nA dc or ±100 percent of initial value, whichever is greater. ΔI <sub>DSS1</sub> = ±25 μA dc or ±100 percent of initial value, whichever is greater. Δr <sub>DS(ON)1</sub> = ±20 percent of initial value. ΔV <sub>GS(TH)1</sub> = ±20 percent of initial value.	Subgroup 2 of table I herein. ΔI <sub>GSSF1</sub> = ±20 nA dc or ±100 percent of initial value, whichever is greater. ΔI <sub>GSSR1</sub> = ±20 nA dc or ±100 percent of initial value, whichever is greater. ΔI <sub>DSS1</sub> = ±25 μA dc or ±100 percent of initial value, whichever is greater. Δr <sub>DS(ON)1</sub> = ±20 percent of initial value. ΔV <sub>GS(TH)1</sub> = ±20 percent of initial value.

- (1) At the end of the test program, I<sub>GSSF1</sub>, I<sub>GSSR1</sub>, and I<sub>DSS1</sub> are measured.  
(2) An out-of-family program to characterize I<sub>GSSF1</sub>, I<sub>GSSR1</sub>, I<sub>DSS1</sub>, and V<sub>GS(th)1</sub> shall be invoked.  
\* (3) Shall be performed anytime after temperature cycling, screen 3a; JANTXV levels do not need to be repeated in screening requirements.

4.3.1 Gate stress test. Apply  $V_{GS} = 30$  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. Peak gate voltage ( $V_{GS}$ )..... 12 V dc, up to rated  $V_{GS}$ .
- c. Gate to source resistor ( $R_{GS}$ )..... $25 \Omega \leq R_{GS} \leq 200 \Omega$ .
- d. Initial case temperature ..... $+25^{\circ}\text{C}, +10^{\circ}\text{C}, -5^{\circ}\text{C}$ .
- e. Inductance: .....  $\left[ \frac{2E_{AS}}{(I_{D1})^2} \right] \left[ \frac{V_{BR} - V_{DD}}{V_{BR}} \right]$  mH minimum.
- f. Number of pulses to be applied ..... 1 pulse minimum.
- g. Supply voltage ( $V_{DD}$ ).....25 V dc.

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 max. See [table III](#), group E, subgroup 4 herein.

4.4 Conformance inspection. Conformance inspection shall be in accordance with [MIL-PRF-19500](#). Alternate flow is allowed for quality 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](#) 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 herein. Electrical measurements (end-points) shall be in accordance with [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>Condition</u>
B3	1051	Test condition G, 100 cycles.
B5	1042	Accelerated steady-state gate bias, condition B, $V_{GS} =$ rated $V_{GS}$ ; $T_A = +175^{\circ}\text{C}$ , $t = 24$ hours minimum; or $T_A = +150^{\circ}\text{C}$ , $t = 48$ hours minimum.
B5	1042	Accelerated steady-state reverse bias, condition A, $V_{DS} =$ rated $V_{DS}$ ; $T_A = +175^{\circ}\text{C}$ , $t = 120$ hours minimum; or $T_A = +150^{\circ}\text{C}$ , $t = 240$ hours minimum.
B5	2037	Test condition D.

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

<u>Subgroup</u>	<u>Method</u>	<u>Condition</u>
B2	1051	Test condition C, 25 cycles.
B3	1042	Accelerated steady-state gate bias, condition B, $V_{GS} = \text{rated } V_{GS}$ ; $T_A = +175^\circ\text{C}$ , $t = 24$ hours minimum; or $T_A = +150^\circ\text{C}$ , $t = 48$ hours minimum; and accelerated steady-state reverse bias, condition A, $V_{DS} = \text{rated } V_{DS}$ ; $T_A = +175^\circ\text{C}$ , $t = 170$ hours minimum; or $T_A = +150^\circ\text{C}$ , $t = 340$ hours 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 [table I](#), subgroup 2 herein.

<u>Subgroup</u>	<u>Method</u>	<u>Condition</u>
C2	2036	Test condition E.
* C5	3161	See <a href="#">4.3.3</a> , $R_{\theta JC} = 8.3$ °C/W.
C6	1042	Accelerated steady-state gate bias, condition B, $V_{GS} = \text{rated } V_{GS}$ ; $T_A = +175^\circ\text{C}$ , $t = 48$ hours minimum; or $T_A = +150^\circ\text{C}$ , $t = 96$ hours minimum. and accelerated steady-state reverse bias, condition A, $V_{DS} = \text{rated } V_{DS}$ ; $T_A = +175^\circ\text{C}$ , $t = 500$ hours minimum; or $T_A = +150^\circ\text{C}$ , $t = 1,000$ hours minimum.

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 II](#) herein. Electrical measurements (end-points) shall be in accordance with [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.

MIL-PRF-19500/747B

TABLE I. Group A inspection.

Inspection <u>1/</u>	MIL-STD-750		Symbol	Limits		Unit
	Method	Condition		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	$Z_{\theta JC}$			°C/W
Breakdown voltage drain to source	3407	$V_{GS} = 0, I_D = 1.0 \text{ mA dc},$ bias condition C	$V_{(BR)DSS}$	100		V dc
Gate to source voltage (threshold)	3403	$V_{DS} \geq V_{GS}, I_D = 1.0 \text{ mA dc}$	$V_{GS(TH)1}$	2.0	4.0	V dc
Gate current	3411	$V_{GS} = +20 \text{ V dc},$ bias condition C, $V_{DS} = 0$	$I_{GSSF1}$		+100	nA dc
Gate current	3411	$V_{GS} = -20 \text{ V dc},$ bias condition C, $V_{DS} = 0$	$I_{GSSR1}$		-100	nA dc
Drain current	3413	$V_{GS} = 0,$ bias condition C, $V_{DS} = 80$ percent of rated $V_{DS}$	$I_{DSS1}$		25	μA dc
Static drain to source on-state resistance	3421	$V_{GS} = 12 \text{ V dc},$ condition A, pulsed (see 4.5.1), $I_D = I_{D2}$	$r_{DS(ON)1}$		0.60	Ω
Forward voltage	4011	$V_{GS} = 0,$ condition A, pulsed (see 4.5.1), $I_D = I_{D1}$	$V_{SD}$		1.5	V (pk)
<u>Subgroup 3</u>						
High temperature operation:		$T_C = T_J = +125^\circ\text{C}$				
Gate current	3411	$V_{GS} = \pm 20 \text{ V dc},$ bias condition C, $V_{DS} = 0$	$I_{GSS2}$		±200	nA dc
Drain current	3413	$V_{GS} = 0,$ bias condition C, $V_{DS} = 80$ percent of rated $V_{DS}$	$I_{DSS2}$		250	μA dc
Static drain to source on-state resistance	3421	$V_{GS} = 12 \text{ V dc},$ condition A, pulsed (see 4.5.1), $I_D = I_{D2}$	$r_{DS(ON)2}$		1.14	Ω
Gate to source voltage (threshold)	3403	$V_{DS} \geq V_{GS}, I_D = 1.0 \text{ mA dc}$	$V_{GS(TH)2}$	1.0		V dc

See footnotes at end of table.

TABLE I. Group A inspection - Continued.

Inspection <u>1/</u>	MIL-STD-750		Symbol	Limits		Unit
	Method	Condition		Min	Max	
<u>Subgroup 3</u> - Continued						
Low temperature operation:		$T_C = T_J = -55^\circ\text{C}$				
Gate to source voltage (threshold)	3403	$V_{DS} \geq V_{GS}, I_D = 1.0 \text{ mA dc}$	$V_{GS(\text{TH})3}$		5.0	V dc
<u>Subgroup 4</u>						
Forward transconductance	3475	$V_{DS} = 15 \text{ V dc}, I_D = I_{D2}, \text{ pulsed (see 4.5.1)}$	$g_{FS}$	0.8		S
Switching time test	3472	$I_D = I_{D1}, V_{GS} = 12.0 \text{ V dc}, R_G = 7.5 \Omega, V_{DD} = 50 \text{ percent rated } V_{DS}$				
Turn-on delay time			$t_{d(\text{on})}$		20	ns
Rise time			$t_r$		25	ns
Turn-off delay time			$t_{d(\text{off})}$		40	ns
Fall time			$t_f$		40	ns
<u>Subgroup 5</u>						
Safe operating area test	3474	$V_{DS} = 80 \text{ percent of rated } V_{DS} \text{ (see 1.3)}, t_P = 10 \text{ ms}, I_D \text{ as specified in figure 4}$				
Electrical measurements		See <a href="#">table I</a> , subgroup 2				
<u>Subgroups 6</u>						
Not applicable						
<u>Subgroup 7</u>						
Gate charge	3471	Condition B, $I_D = I_{D1}$				
On-state gate charge			$Q_{G(\text{ON})}$		11	nC
Gate to source charge			$Q_{GS1}$		3.0	nC
Gate to drain charge			$Q_{GD1}$		3.3	nC
Reverse recovery time	3473	$di/dt = -100 \text{ A}/\mu\text{s}, V_{DD} \leq 50 \text{ V}, I_D = I_{D1}$	$t_{rr}$		180	ns

1/ For sampling plan, see [MIL-PRF-19500](#).

2/ This test required for the following end-point measurements only:

- Group B, subgroups 3 and 4 (JANS).
- Group B, subgroups 2 and 3 (JANTXV).
- Group C, subgroup 2 and 6.
- Group E, subgroup 1.

TABLE II. Group D inspection.

Inspection  <u>1/ 2/ 3/</u>	MIL-STD-750		Symbol	Pre-irradiation limits		Post-irradiation limits		Post-irradiation limits		Unit
	Method	Conditions		R, F, G, and H		R, F, and G		H		
				Min	Max	Min	Max	Min	Max	
<u>Subgroup 1</u>										
Not applicable										
<u>Subgroup 2</u>		$T_C = +25^\circ\text{C}$								
Steady-state total dose irradiation ( $V_{GS}$ bias) <u>4/</u>	1019	$V_{GS} = 6\text{ V}; V_{DS} = 0$								
Steady-state total dose irradiation ( $V_{DS}$ bias) <u>4/</u>	1019	$V_{GS} = 0; V_{DS} = 80\text{ percent of rated } V_{DS} \text{ (preirradiation)}$								
End-point electricals:										
Breakdown voltage, drain to source	3407	$V_{GS} = 0; I_D = 1.0\text{ mA};$ bias condition C	$V_{(BR)DSS}$	100		100		100		V dc
Gate to source voltage (threshold)	3403	$V_{DS} \geq V_{GS}$ $I_D = 1.0\text{ mA}$	$V_{GS(th)1}$	2.0	4.0	2.0	4.0	1.25	4.5	V dc
Gate current	3411	$V_{GS} = +20\text{ V}, V_{DS} = 0,$ bias condition C	$I_{GSSF1}$		100		100		100	nA dc
Gate current	3411	$V_{GS} = -20\text{ V}, V_{DS} = 0,$ bias condition C	$I_{GSSR1}$		-100		-100		-100	nA dc
Drain current	3413	$V_{GS} = 0,$ bias condition C $V_{DS} = 80\text{ percent of rated } V_{DS} \text{ (preirradiation)}$	$I_{DSS}$		25		25		25	$\mu\text{A dc}$
Static drain to source on-state voltage	3405	$V_{GS} = 12\text{ V};$ condition A, pulsed (see 4.5.1), $I_{D1} = I_{D2}$	$V_{DS(on)}$		1.320		1.320		1.760	V dc
Forward voltage source drain diode	4011	$V_{GS} = 0; I_D = I_{D1}$ bias condition C	$V_{SD}$		1.5		1.5		1.5	V dc

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.

Inspection	MIL-STD-750		Sample plan
	Method	Conditions	
<u>Subgroup 1</u>			45 devices c = 0
Temperature cycling	1051	Condition G, 500 cycles	
Hermetic seal Fine leak Gross leak	1071	As applicable	
Electrical measurements		See <a href="#">table I</a> , subgroup 2	
<u>Subgroup 2</u> <sup>1/</sup>			45 devices c = 0
Steady-state gate bias	1042	Condition B, 1,000 hours	
Electrical measurements		See <a href="#">table I</a> , subgroup 2	
Steady-state reverse bias	1042	Condition A, 1,000 hours	
Electrical measurements		See <a href="#">table I</a> , subgroup 2	
<u>Subgroup 4</u>			Sample size N/A
Thermal impedance curves	3161	See <a href="#">MIL-PRF-19500</a> .	
<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.	
<u>Subgroup 11</u>			3 devices
* SEE <sup>2/</sup> <sup>3/</sup>	1080	See <a href="#">MIL-STD-750</a> method 1080 and <a href="#">6.2</a> .	

<sup>1/</sup> A separate sample for each test shall be pulled.

<sup>2/</sup> Group E qualification of SEE effect testing may be performed prior to lot formation. Qualification may be extended to other specification sheets utilizing the same structurally identical die design.

<sup>3/</sup> Device qualification to a higher level LET is sufficient to qualify all lower level LETs.

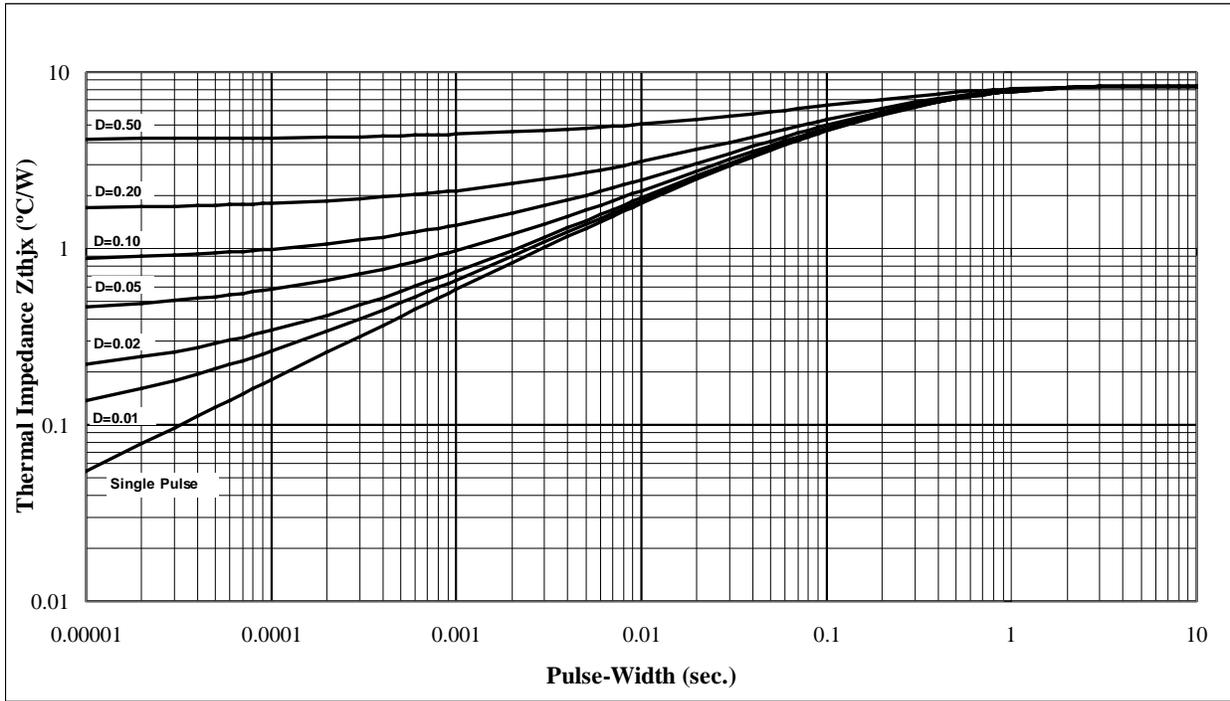


FIGURE 2. Thermal impedance graph.

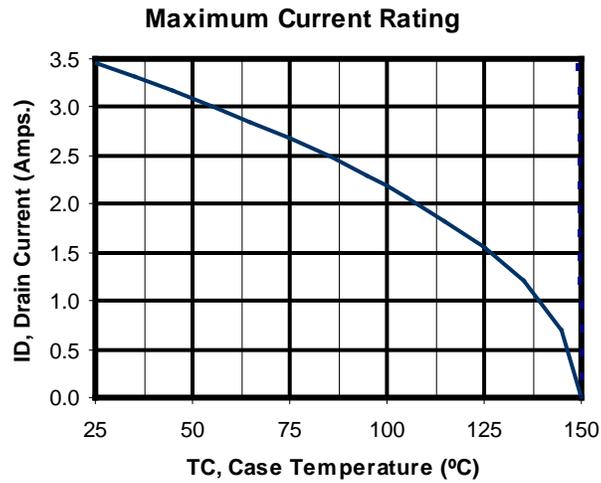
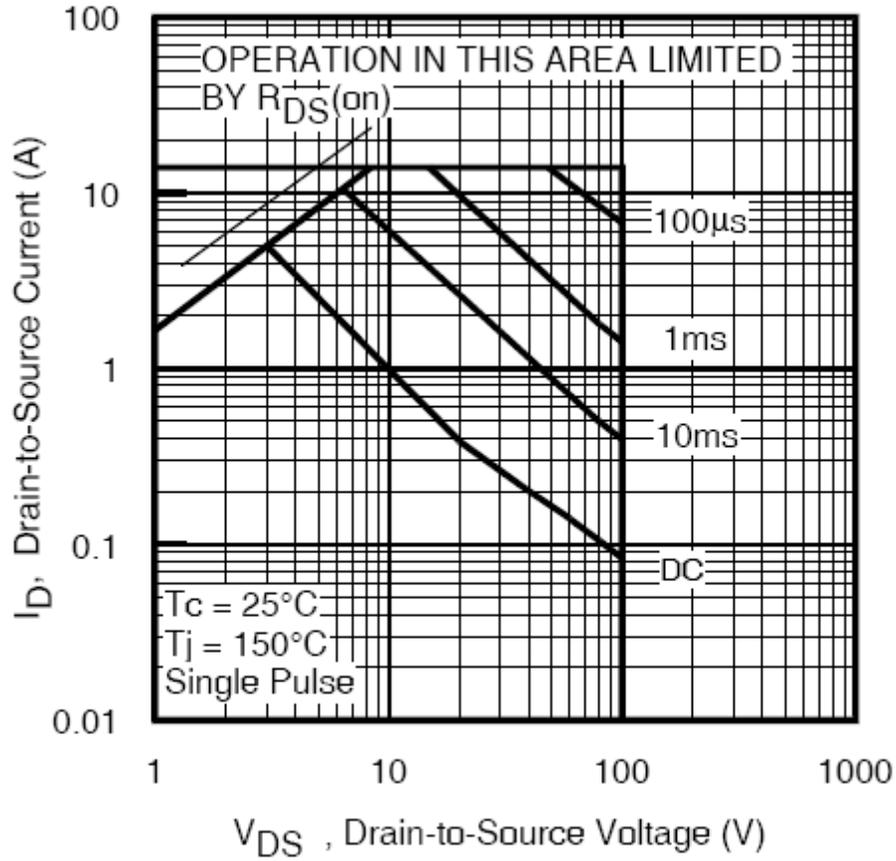


FIGURE 3. Derating drain current.



\* FIGURE 4. Safe operating area graph.

## 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. Product assurance level and type designator.
  - \* 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 or order.
  - \* f. If specific SEE characterization conditions are desired (see section 6.5 and table IV), manufacturer's cage code should be specified in the contract or order.
  - \* g. If SEE testing data is desired, it 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@dla.mil](mailto:vqe.chief@dla.mil). An online listing of products qualified to this specification may be found in the Qualified Products Database (QPD) at <https://assist.dla.mil>.

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

Military P/N	Generic P/N
2N7504T2	IRHF7110

\* 6.5 Application data.

\* 6.5.1 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.

Manufactures cage	Inspection	MIL-STD-750		Sample plan
		Method	Conditions	
No current qualified sources	SEE 1/ Electrical measurements	1080	See MIL-STD-750, method 1080 and SEE graphs. $I_{GSSF1}$ , $I_{GSSR1}$ , and $I_{DSS1}$ in accordance with table I, subgroup 2	3 devices
	Electrical measurements		$I_{GSSF1}$ , $I_{GSSR1}$ , and $I_{DSS1}$ in accordance with table I, subgroup 2	
<div style="border: 1px solid black; padding: 5px; margin: 10px auto; width: 80%;">                     Upon qualification, all manufacturers will provide the verification test conditions to be added to this table.                 </div>				

1/  $I_{GSSF1}$ ,  $I_{GSSR1}$ , and  $I_{DSS1}$  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.

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 - 85  
NASA - NA  
DLA - CC

Preparing activity:

DLA - CC

(Project 5961-2012-057)

Review activity:

Army – AV, MI  
Air Force - 99

\* 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/>.