

The documentation and process conversion measures necessary to comply with this revision shall be completed by 25 February 2021.

INCH-POUND

MIL-PRF-19500/745E
W/AMENDMENT 2
25 November 2020
SUPERSEDING
MIL-PRF-19500/745E
W/AMENDMENT 1
30 October 2019

PERFORMANCE SPECIFICATION SHEET

TRANSISTOR, FIELD EFFECT TRANSISTOR, P-CHANNEL, RADIATION HARDENED, LOGIC-LEVEL SILICON, TYPES 2N7626, JANTXV AND JANS

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

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

1. SCOPE

1.1 Scope. This specification covers the performance requirements for a P-channel, enhancement-mode, radiation hardened (total dose and single event effects (SEE), low-threshold logic level, MOSFET, transistor. Two levels of product assurance (JANTXV and JANS) are provided for each encapsulated device, with avalanche energy maximum rating (E_{AS}) and maximum avalanche current (I_{AS}). Provisions for radiation hardness assurance (RHA) to two radiation levels ("R" and "F") are provided for JANTXV and JANS product assurance levels. See 6.7 for JANHC and JANKC die versions.

1.2 Package outlines. The device package outlines are as follows: UB and UBC (UB with ceramic lid) in accordance with [figure 1](#) for all encapsulated device types.

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

Type	P _T (1) T _A =+25°C	P _T (infinite sink) T _{IS} =+25°C	R _{θJA} (2)	R _{θJSP} (2)	V _{DS}	V _{GS}	I _{D1} (3) (4)	I _{D2} T _A =+100°C (3) (4)	I _S	I _{DM} (5)	T _J and T _{STG}
	<u>mW</u>	<u>W</u>	<u>°C/W</u>	<u>°C/W</u>	<u>V dc</u>	<u>V dc</u>	<u>A dc</u>	<u>A dc</u>	<u>A dc</u>	<u>A (pk)</u>	<u>°C</u>
2N7626UB,UBC, UBN, UBCN	570	1.25	220	40	-60	±10	-0.53	-0.33	-0.53	-2.12	-55 to +150

(1) Derate linearly by 4.5 mW/°C for T_A > +25°C

(2) See [figure 2](#), and [figure 3](#) for thermal impedance curves.

(3) The following formula derives the maximum theoretical I_D limit. I_D is limited by package and internal construction:

$$I_D = \sqrt{\frac{T_{JM} - T_A}{(R_{θJA}) \times (R_{DS(on)} \text{ at } T_{JM})}}$$

(4) See [figure 4](#), maximum drain current graph.

(5) I_{DM} = 4 X I_{D1} as calculated in note (3).

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

Type	Min $V_{(BR) DSS}$ $V_{GS} = 0\text{ V}$ $I_D = -250\ \mu\text{A dc}$	$V_{GS} (th)_1$ $V_{DS} = V_{GS}$ $I_D = -250\ \mu\text{A dc}$		Max I_{DSS1} $V_{GS} = 0\text{ V}$ $V_{DS} = 80\%$ rated V_{DS}	Max $r_{DS(on)}$ (1)		E_{AS}	I_{AS}
					$V_{GS} = -4.5\text{ V dc}$			
					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>$\mu\text{A dc}$</u>	<u>Ohm</u>	<u>Ohm</u>	<u>mJ</u>	<u>A dc</u>
2N7626UB,UBC, UBN, UBCN	-60	-1.0	-2.0	-1.0	1.40	2.03	33.5	-0.53

(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 6.4 for PIN construction example and 6.5 for a list of available PINs.

1.5.1 JAN certification mark and quality level for encapsulated devices. 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 Radiation hardness assurance (RHA) designator. The RHA levels that are applicable for this specification sheet from lowest to highest are as follows: "R" and "F".

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

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

1.5.3.2 Second number symbols. The second number symbols for the transistors covered by this specification sheet are as follows: "7626".

1.5.3.3 Suffix letters. The suffix letters "UB", "UBC", "UBN" and "UBCN" are used on devices that are packaged in the surface mount package of figure 1.

1.5.4 Lead finish. The lead finishes applicable to this specification sheet are listed on QPDSIS-19500.

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* 1.6 Radiation features:

Maximum total ionizing dose (TID) available (Dose rate = 50-300 rad(Si)/s):

For device type 2N7626 300 krads(Si) 1/

Heavy Ion Single Event Effect (SEE) SEB and SEGR test:

For device types 2N7626:

No SEB and SEGR were observed at surface LET (see table IV) $\leq 85 \text{ MeV}\cdot\text{cm}^2/\text{mg}$ 2/
(In-situ Bias $V_{DS} = -60 \text{ V}$ and $V_{GS} = 6 \text{ V}$)

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- 1/ Manufacturer supplying device types 2N7626 has performed characterization testing in accordance with MIL-STD-750, method 1019, condition A (dose rate = 50 - 300 rad(Si)/s). The radiation end point limits are guaranteed only for the conditions as specified in MIL-STD-750, method 1019, condition A to a maximum total ionizing dose level of 300 krads(Si).
- 2/ Manufacturer also performed heavy ion SEB and SEGR test at TAMU Radiation Effects Facility for the MOSFET technology devices in accordance with TM1080 of MIL-STD-750. Limits are characterized at initial qualification and after any design or process changes which may affect the SEE (SEB/SEGR) characteristics. For more information on SEE (SEB/SEGR) test results, customers are requested to contact the manufacturer.

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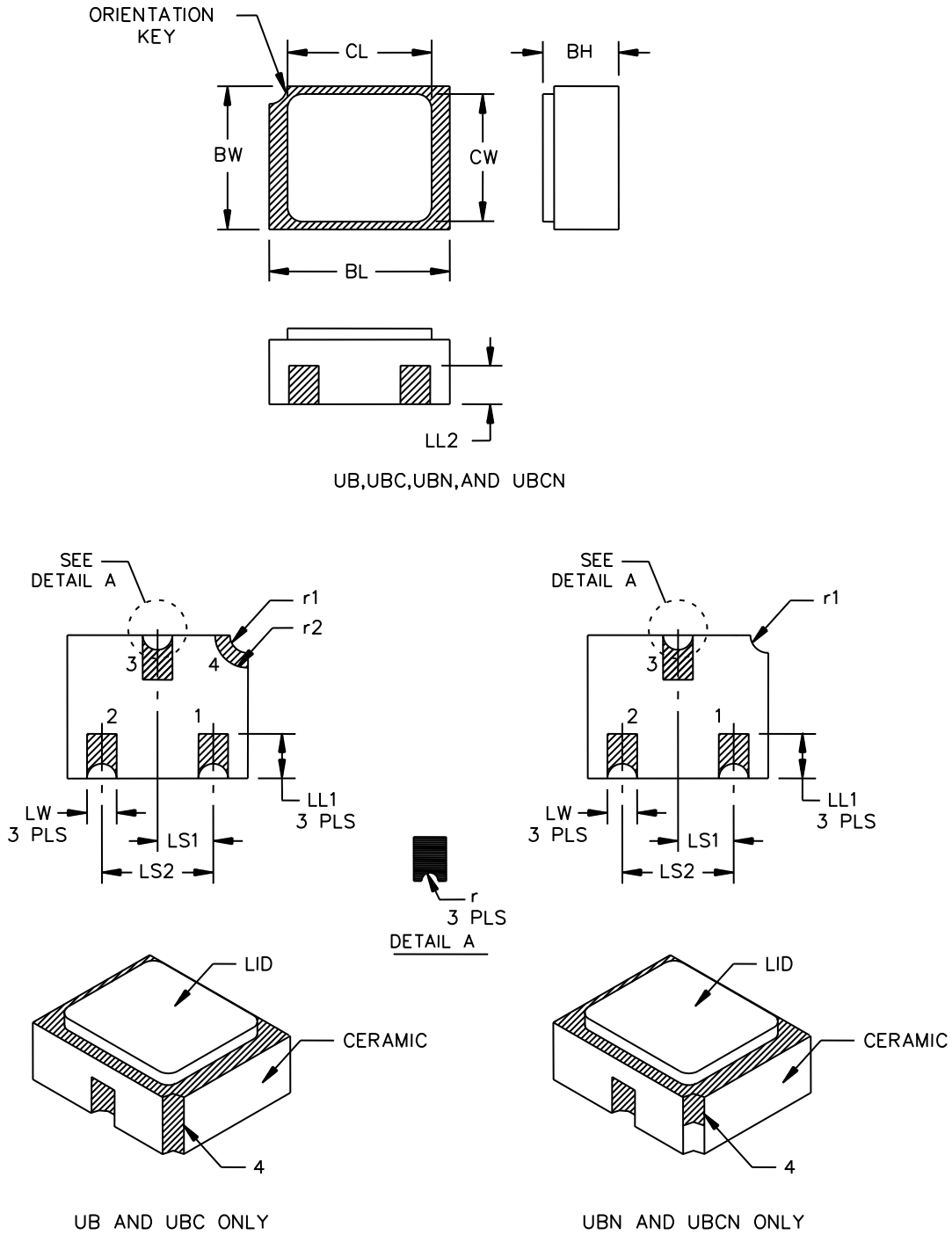


FIGURE 1. Physical dimensions, surface mount (UB, UBN, UBC and UBCN versions).

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Symbol	Dimensions				Note
	Inches		Millimeters		
	Min	Max	Min	Max	
BL	.115	.128	2.92	3.25	
BW	.095	.108	2.41	2.74	
BH	.046	.056	1.17	1.42	UB only, 4
BH	.046	.056	1.17	1.42	UBN only, 5
BH	0.050	.069	1.40	1.75	UBC only, 6
BH	0.050	.069	1.40	1.75	UBCN only, 7
CL		.128		3.25	
CW		.108		2.74	
LL1	.022	.038	0.56	0.97	3 PLS
LL2	.014		0.356		3 PLS
LS ₁	.035	.039	0.89	0.99	
LS ₂	.071	.079	1.80	2.01	
LW	.016	.024	0.41	0.61	
r		.008		0.20	6
r1		.012		0.30	8
r2		.022		0.56	UB & UBC only, 8

*
*

NOTES:

1. Dimensions are in inches.
2. Millimeters are given for general information only.
3. Hatched areas on package denote metallized areas.
4. UB only: Pad 1 = Gate, Pad 2 = Source, Pad 3 = Drain, Pad 4 = Shielding connected to the metal lid.
5. UBN only: Pad 1 = Gate, Pad 2 = Source, Pad 3 = Drain, Isolated lid with 3 pads only.
6. UBC (ceramic lid) only: Pad 1 = Gate, Pad 2 = Source, Pad 3 = Drain, Pad 4 = Connected to the lid braze ring.
7. UBCN (ceramic lid) only: Pad 1 = Gate, Pad 2 = Source, Pad 3 = Drain, Isolated lid with 3 pads only.
8. For design reference only.
9. In accordance with ASME Y14.5M, diameters are equivalent to ϕx symbology.

* FIGURE 1. Physical dimensions, surface mount (UB, UBN, UBC and UBCN versions) - Continued.

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

[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://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 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](#) (UB, UBN, UBC and UBCN) 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](#). Marking on the UB package shall consist of an abbreviated part number, the date code, and the manufacturer's symbol or logo. The prefixes JANTXV and JANS can be abbreviated as JV and JS respectively. The "2N" prefix and the "UB" suffix can also be omitted. The radiation hardened designator R, F, G, or H shall immediately precede (or replace) the device "2N" identifier (depending upon degree of abbreviation required).

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3.6 Electrostatic discharge sensitive (ESDS). The devices covered by this specification sheet have been classified as ESDS. The devices shall be handled in accordance with the ESD program established to comply with the requirements of [MIL-PRF-19500](#) **Error! Reference source not found.** 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 (SEB/SEGR) 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(SEB/SEGR) characterization data shall be made available upon request of the qualifying or acquiring activity.

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4.3 Screening (JANS, 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 _{AS} (see 4.3.2)	Method 3470 of MIL-STD-750, E _{AS} (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	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. $\Delta I_{GSSF1} = \pm 20$ nA dc or ± 100 percent of initial value, whichever is greater. $\Delta I_{GSSR1} = \pm 20$ nA dc or ± 100 percent of initial value, whichever is greater. $\Delta I_{DSS1} = \pm 0.2$ μ A dc or ± 100 percent of initial value, whichever is greater.	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 $\Delta I_{GSSF1} = \pm 20$ nA dc or ± 100 percent of initial value, whichever is greater. $\Delta I_{GSSR1} = \pm 20$ nA dc or ± 100 percent of initial value, whichever is greater. $\Delta I_{DSS1} = \pm 0.2$ μ A dc or ± 100 percent of initial value, whichever is greater. $\Delta r_{DS(ON)1} = \pm 20$ percent of initial value. $\Delta V_{GS(TH)1} = \pm 20$ percent of initial value.	Subgroup 2 of table I herein $\Delta I_{GSSF1} = \pm 20$ nA dc or ± 100 percent of initial value, whichever is greater. $\Delta I_{GSSR1} = \pm 20$ nA dc or ± 100 percent of initial value, whichever is greater. $\Delta I_{DSS1} = \pm 0.2$ μ A dc or ± 100 percent of initial value, whichever is greater. $\Delta r_{DS(ON)1} = \pm 20$ percent of initial value. $\Delta V_{GS(TH)1} = \pm 20$ percent of initial value.

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

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4.3.1 Gate stress test. Apply $V_{GS} = -15$ V minimum for $t = 250$ μ s minimum.

4.3.2 Single pulse avalanche energy (E_{AS}).

- a. Peak current (I_{AS}).....-0.53 A.
- b. Peak gate voltage (V_{GS}).....-10 V dc (up to max rated V_{GS}).
- c. Gate to source resistor (R_{GS})..... $25 \leq R_{GS} \leq 200 \Omega$.
- d. Initial case temperature+25°C, +10°C, -5°C.
- e. Inductance: $\left[\frac{2E_{AS}}{(I_{DI})^2} \right] \left[\frac{V_{BR} - V_{DD}}{V_{BR}} \right]$ mH minimum.
- f. Number of pulses to be applied 1 pulse minimum.
- g. Supply voltage (V_{DD}).....-25 V dc (up to max V_{DS}).

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_{MD} , t_{SW} , (and V_H where appropriate). 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.

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.

4.4.2.1 Quality level JANS, table E-VIA of [MIL-PRF-19500](#).

<u>Subgroup</u>	<u>Method</u>	<u>Condition</u>
B3	1051	Test condition G, 100 cycles.
B3	2077	SEM, see 4.5.2 .
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	Condition D.

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4.4.2.2 Quality level JANTXV, 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	Intermittent operation life, condition D, 2,000 cycles.

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.

<u>Subgroup</u>	<u>Method</u>	<u>Condition</u>
C2	2036	Terminal strength is not applicable.
C5	3161	See 4.3.3, $R_{\theta JA}$ = (see 1.3).
C6	1042	Intermittent operation life, condition D, 6,000 cycles.

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 SEM exception. For devices with die using a repeating grid design, the oxide step coverage acceptance criteria provided in [MIL-STD-750](#), test method 2077, paragraph 3.7.1.2 shall not apply. Instead, the minimum active metal thickness (cross section) shall provide for the maximum allowable current density of 5×10^5 amps/cm² in accordance with [MIL-PRF-19500](#) paragraph H.3.6. The source metallization thickness at the oxide step shall be verified for the overall thickness, which corresponds to the applicable device channel width at the maximum rated continuous current ($I_{D\text{MAX}}$). The maximum allowable current density may be found using the following equation; Current Density (A/cm²) = $I_{D\text{MAX}}$ / Step metal thickness (cm) * Channel width (cm).

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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	$Z_{\theta JA}$			°C/W
Breakdown voltage drain to source	3407	$V_{GS} = 0$, $I_D = -250 \mu A$ dc, bias condition C	$V_{(BR)DSS}$	-60		V dc
Gate to source voltage (threshold)	3403	$V_{DS} \geq V_{GS}$, $I_D = -250 \mu A$ dc	$V_{GS(TH)1}$	-1.0	-2.0	V dc
Gate current	3411	$V_{GS} = -10$ V dc, bias condition C, $V_{DS} = 0$	I_{GSSF1}		-100	nA dc
Gate current	3411	$V_{GS} = +10$ 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}		-1.0	μA dc
Static drain to source on-state resistance	3421	$V_{GS} = -4.5$ V dc, condition A, pulsed (see 4.5.1), $I_D = I_{D2}$	$r_{DS(ON)1}$		1.40	Ω
Forward voltage	4011	$V_{GS} = 0$, condition A, $I_D = I_{D1}$	V_{SD}		-5.0	V (pk)
<u>Subgroup 3</u>						
High temperature operation:		$T_C = T_J = +125^\circ C$				
Gate current	3411	$V_{GS} = \pm 10$ 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}		-10	μA dc
Static drain to source on-state resistance	3421	$V_{GS} = -4.5$ V dc, condition A, pulsed (see 4.5.1), $I_D = I_{D2}$	$r_{DS(ON)2}$		1.93	Ω
Gate to source voltage (threshold)	3403	$V_{DS} = V_{GS}$, $I_D = -250 \mu A$ dc	$V_{GS(TH)2}$	-0.5		V dc
Low temperature operation:		$T_C = T_J = -55^\circ C$				
Gate to source voltage (threshold)	3403	$V_{DS} \geq V_{GS}$, $I_D = -250 \mu A$ dc	$V_{GS(TH)3}$		-3.0	V dc

See footnotes at end of table.

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TABLE I. Group A inspection - Continued.

Inspection <u>1/</u>	MIL-STD-750		Symbol	Limits		Unit
	Method	Condition		Min	Max	
<u>Subgroup 4</u>						
Forward transconductance	3475	$V_{DS} = -10$ V dc, $I_D = I_{D2}$, pulsed (see 4.5.1)	g_{FS}	0.8		S
Switching time test	3472	$I_D = I_{D1}$, $V_{GS} = -5$ V dc, $R_G = 24\Omega$, $V_{DD} = 50$ percent rated V_{DS}				
Turn on delay time			$t_{d(on)}$		22	ns
Rise-time			t_r		22	ns
Turn-off delay time			$t_{d(off)}$		27	ns
Fall time			t_f		27	ns
<u>Subgroup 5</u>						
Safe operating area test	3474	$V_{DS} = 80$ percent of rated V_{DS} (see 1.3) $t_P = 10$ ms, I_D as specified on figure 5				
Electrical measurements		See table I , subgroup 2				
<u>Subgroup 6</u>						
Not applicable						
<u>Subgroup 7</u>						
Gate charge	3471	Condition B, $I_D = I_{D1}$, $V_{DD} = 50$ percent rated V_{DS}				
On-state gate charge			$Q_{G(on)}$		3.6	nC
On Gate to source charge			Q_{GS}		1.5	nC
On Gate to drain charge			Q_{GD}		1.8	nC
Turn-off gate charge			$Q_{G(off)}$		3.6	nC
Off Gate to source charge			Q_{GS}		1.5	nC
Off Gate to drain charge			Q_{GD}		1.8	nC
Reverse recovery time	3473	Condition A, $di/dt = -100$ A/ μ s, $V_{DD} \leq -25$ V, $I_D = I_{D1}$	t_{rr}		50	ns

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

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

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TABLE II. Group D inspection.

Inspection 1/ 2/ 3/	MIL-STD-750		Symbol	Pre-irradiation limits		Post-irradiation limits		Post-irradiation limits		Unit
	Method	Conditions		R & F		R		F		
				Min	Max	Min	Max	Min	Max	
<u>Subgroup 1</u>										
Not applicable										
<u>Subgroup 2</u>		T _C = + 25°C								
* Steady-state total dose irradiation (V _{GS} bias) 4/	1019	Condition A V _{GS} = -10 V V _{DS} = 0								
* Steady-state total dose irradiation (V _{DS} bias) 4/	1019	Condition A V _{GS} = 0; V _{DS} = 80 percent of rated V _{DS} (preirradiation)								
End-point electricals:										
Breakdown voltage, drain to source	3407	V _{GS} = 0; I _D = -250 μA; bias condition C	V _{(BR)DSS}	-60		-60		-60		V dc
Gate to source voltage (threshold)	3403	V _{DS} ≥ V _{GS} I _D = -250 μA	V _{GS(th)1}	-1.0	-2.0	-1.0	-2.0	-1.0	-2.0	V dc
Gate current	3411	V _{GS} = -10 V, V _{DS} = 0, bias condition C	I _{GSSF1}		-100		-100		-100	nA dc
Gate current	3411	V _{GS} = +10 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 percent of rated V _{DS} (preirradiation)	I _{DSS}		-1.0		-1.0		-1.0	μA dc
Static drain to source on-state voltage	3405	V _{GS} = -4.5 V; condition A, pulsed (see 4.5.1), I _{D1} = I _{D2}	V _{DS(on)}		0.449		0.449		0.449	V dc
Forward voltage source drain diode	4011	V _{GS} = 0; I _D = I _{D1} bias condition A	V _{SD}		-5.0		-5.0		-5.0	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.

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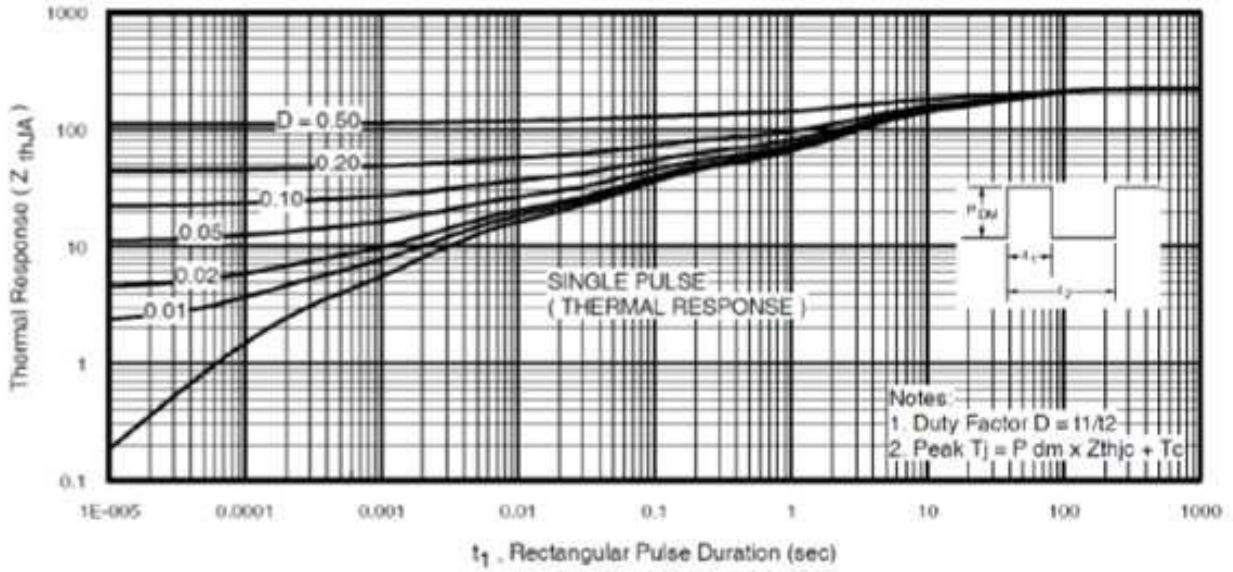
TABLE III. Group E inspection (all quality levels) - for qualification or re-qualification only.

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	1071		
Fine leak			
Gross leak			
Electrical measurements		See table I , subgroup 2	
<u>Subgroup 2 1/</u>			45 devices c = 0
Steady-state gate bias	1042	Condition B, 1,000 hours	
Electrical measurements		See table I , subgroup 2	
Steady-state reverse bias	1042	Condition A, 1,000 hours	
Electrical measurements		See table I , subgroup 2	
<u>Subgroup 4</u>			Sample size N/A
Thermal impedance curves	3161	See MIL-PRF-19500 .	
<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 2/ 3/	1080	See figure 6	

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

2/ 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.

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



* FIGURE 2. Thermal impedance graph ($R_{\theta JA}$).

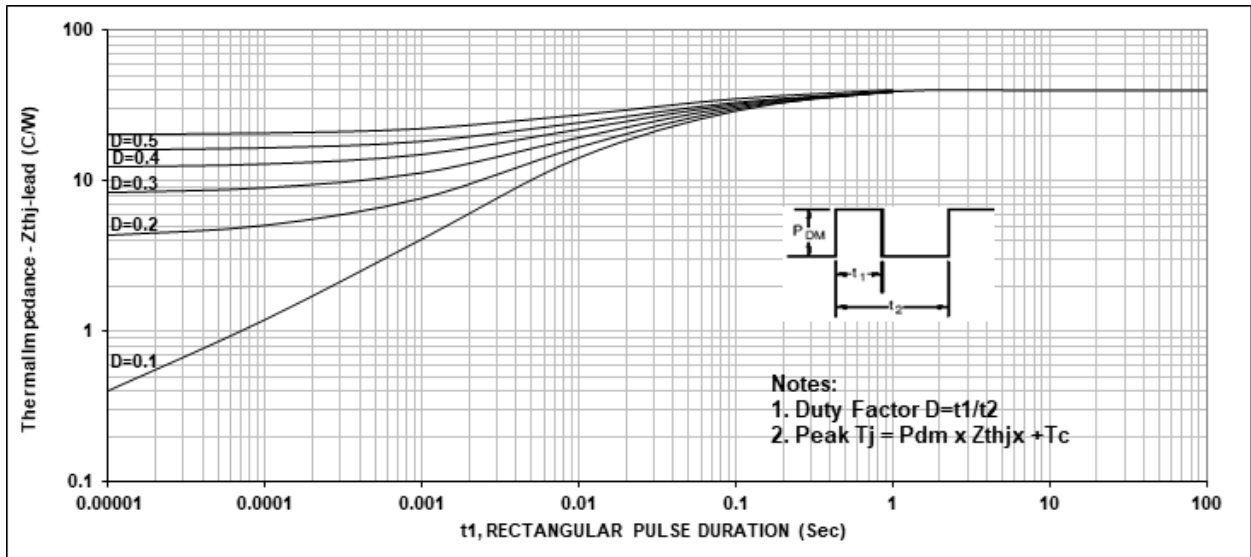
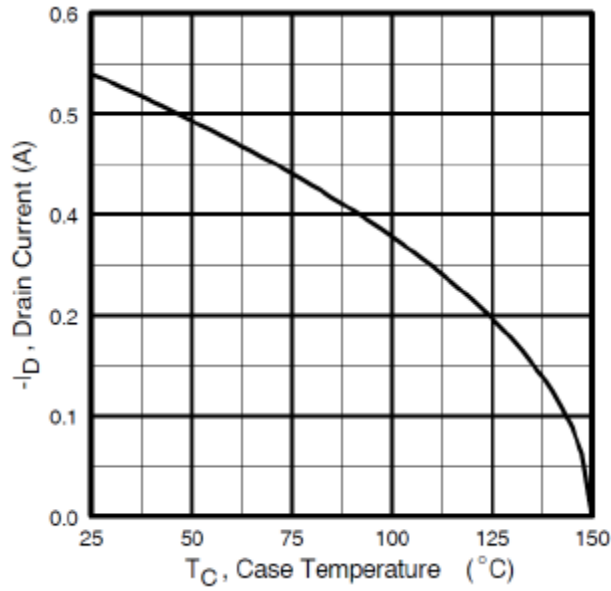


FIGURE 3. Thermal impedance graph ($R_{\theta JSP}$).



* FIGURE 4. Derating drain current.

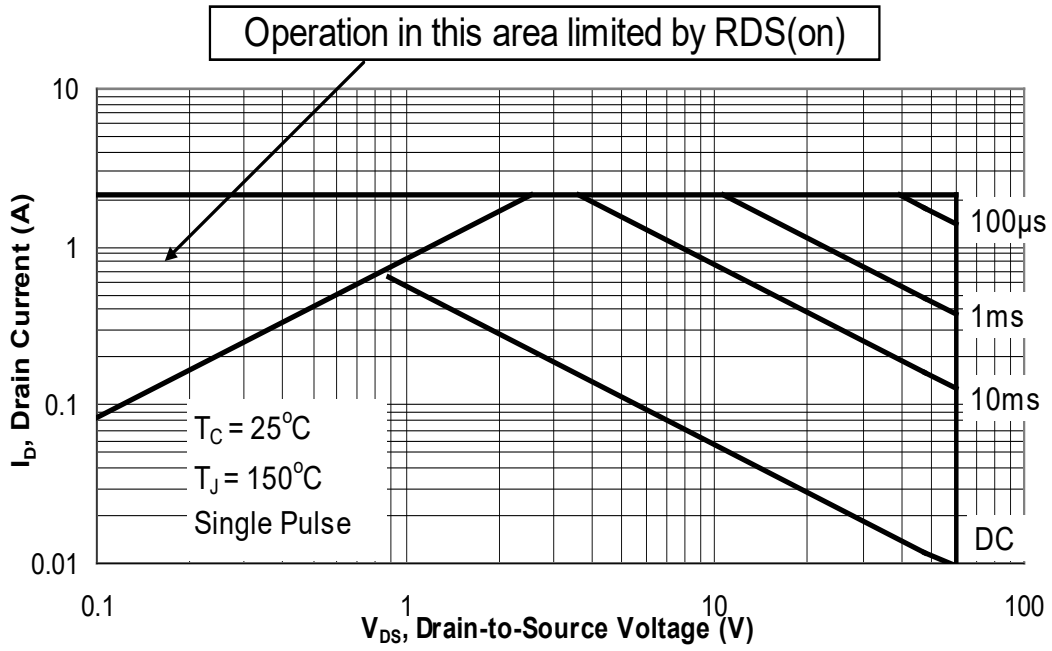


FIGURE 5. Safe-operating-area graph.

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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.)

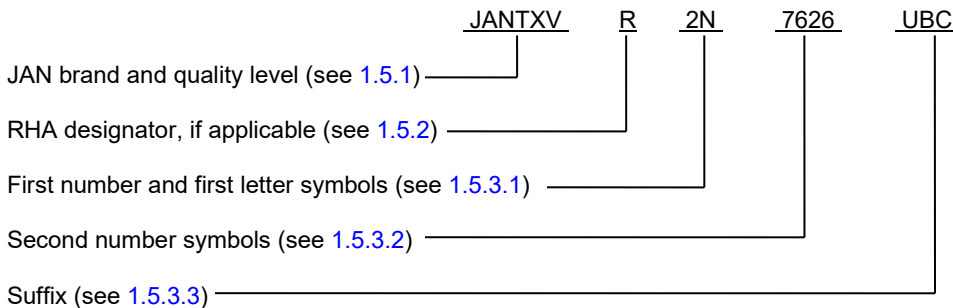
6.1 Intended use. Semiconductors conforming to this specification are intended for original equipment design applications and logistic support of existing equipment.

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. 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 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.
- 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. 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 PIN construction example. The PINs for encapsulated devices are construction using the following form.



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

PINs for devices of the "TXV" quality level	PINs for devices of the "TXV" quality level with RHA	PINs for devices of the "S" quality level	PINs for devices of the "S" quality level with RHA
JANTXV2N7626UB	JANTXVR2N7626UB	JANS2N7626UB	JANSR2N7626UB
JANTXV2N7626UBC	JANTXVR2N7626UBC	JANS2N7626UBC	JANSR2N7626UBC
JANTXV2N7626UBN	JANTXVR2N7626UBN	JANS2N7626UBN	JANSR2N7626UBN
JANTXV2N7626UBCN	JANTXVR2N7626UBCN	JANS2N7626UBCN	JANSR2N7626UBCN
	JANTXVF2N7626UB		JANSF2N7626UB
	JANTXVF2N7626UBC		JANSF2N7626UBC
	JANTXVF2N7626UBN		JANSF2N7626UBN
	JANTXVF2N7626UBCN		JANSF2N7626UBCN

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

Generic P/N	Military P/N	Package & Termination Configuration
IRHLUB7970Z4	2N7626UB	4-pad, Metal Lid (Shield) connected to 4th pad
IRHLUBN7970Z4	2N7626UBN	3-pad, Isolated Metal Lid
IRHLUBC7970Z4	2N7626UBC	4-pad, Ceramic Lid, lid braze ring connected to 4th pad
IRHLUBCN7970Z4	2N7626UBCN	3-pad, Isolated Ceramic Lid

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.

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*

TABLE IV. Manufacturers characterization conditions

Manufacturers CAGE	Inspection	MIL-STD-750		Sample plan
		Method	Conditions	
69210 (Applicable to devices with a date code of July 2013 and older)	SEE <u>1</u> / Pre SEB and SEGR Electrical measurements SEB and SEGR heavy ion characteristics: 2N7626	1080	See MIL-STD-750 method 1080 IGSS1 and IDSS1 in accordance with table I , subgroup 2 Fluence = 3E5 ions/cm ² , Flux = 2E3 to 2E4 ions/cm ² /sec, Temperature = 25 ±5°C Surface LET = 37 MeV-cm ² /mg, range = 36 μm, Kr ion energy = 285 MeV In-situ bias conditions: V _{DS} = -60 V and V _{GS} = 6 V V _{DS} = -50 V and V _{GS} = 7 V (typical 3.61 MeV/nucleon at Texas A & M Cyclotron) Surface LET = 60 MeV-cm ² /mg, range = 32.7 μm, Xe ion energy = 345 MeV In-situ bias conditions: V _{DS} = -60 V and V _{GS} = 6 V (typical 2.72 MeV/nucleon at Texas A & M Cyclotron) Surface LET = 82 MeV-cm ² /mg, Range = 28.5 μm, Au ion energy = 357 MeV In-situ bias conditions: V _{DS} = -60 V and V _{GS} = 5 V (typical 1.89 MeV/nucleon at Texas A & M Cyclotron)	3 devices
	Post SEB/SEGR Electrical Measurements		IGSSF1, IGSSR1, and IDSS1 in accordance with table I , subgroup 2	
69210 (Applicable to devices with a date code of August 2013 and newer)	SEE <u>1</u> / Pre SEB and SEGR Electrical measurements SEB and SEGR heavy ion characteristics: 2N7626	1080	See MIL-STD-750 method 1080 IGSS1 and IDSS1 in accordance with table I , subgroup 2 Fluence = 3E5 ions/cm ² , Flux = 2E3 to 2E4 ions/cm ² /sec, Temperature = 25 ±5°C Surface LET = 38 MeV-cm ² /mg, range = 38 μm, Kr ion energy = 300 MeV In-situ bias conditions: V _{DS} = -60 V and V _{GS} = 6 V V _{DS} = -50 V and V _{GS} = 7 V (typical 3.58 MeV/nucleon at Texas A & M Cyclotron) Surface LET = 62 MeV-cm ² /mg, range = 33 μm Xe ion energy = 355 MeV In-situ bias conditions: V _{DS} = -60 V and V _{GS} = 6 V (typical 2.75 MeV/nucleon at Texas A & M Cyclotron) Surface LET = 85 MeV-cm ² /mg, Range = 29 μm, Au ion energy = 380 MeV In-situ bias conditions: V _{DS} = -60 V and V _{GS} = 5 V (typical 1.93 MeV/nucleon at Texas A & M Cyclotron)	3 devices

See footnotes at end of table.

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TABLE IV. Manufacturers characterization conditions - continued

Manufacturers CAGE	Inspection	MIL-STD-750		Sample plan
		Method	Conditions	
	Post SEB/SEGR Electrical measurements		I_{GSSF1} , I_{GSSR1} , and I_{DSS1} in accordance with table I , subgroup 2	
Upon qualification, all manufacturers will provide the verification test conditions to be added to this table.				

1/ I_{GSSF1} and I_{DSS1} was examined before and following SEB/SEGR heavy ion 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.

* 2/ Manufacturer performed heavy ion SEE(SEB/SEGR) test at TAMU Radiation Effects Facility for the MOSFET technology devices in accordance with TM1080 of MIL-STD-750. No single event burnout (SEB) and Single event gate rupture (SEGR) were observed to surface LET as stated above table IV and safe operating area (see figure 6). Limits are characterized at initial qualification and after any design or process changes which may affect the SEE(SEB/SEGR) characteristics. For more information on SEE (SEB/SEGR) test results, customers are requested to contact the manufacturer.

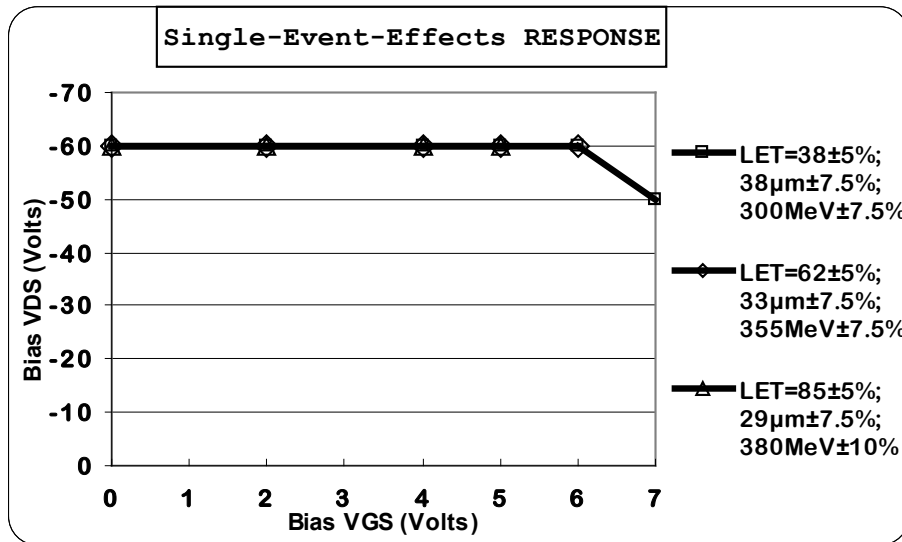


FIGURE 6. Typical single-event-effects (SEB/SEGR) safe-operating-area graph.

6.9 Request for new types and configurations. Requests for new device types or configurations for inclusions in this specification sheet should be submitted to: DLA Land and Maritime, ATTN: VAC, Post Office Box 3990, Columbus, OH 43218-3990 or by electronic mail at Semiconductor@dla.mil or by facsimile (614) 692-6939 or DSN 850-6939.

6.10 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 - SH
 Air Force - 85
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Review activity:
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Preparing activity:
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 (Project 5961-2020-084)

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>.