

The documentation and process conversion measures necessary to comply with this revision shall be completed by 1 June 2014.

INCH-POUND

MIL-PRF-19500/615G  
1 April 2014  
SUPERSEDING  
MIL-PRF-19500/615F  
10 July 2013

PERFORMANCE SPECIFICATION SHEET

SEMICONDUCTOR DEVICE, FIELD EFFECT RADIATION HARDENED  
TRANSISTORS, P-CHANNEL, SILICON, TYPES 2N7382 AND 2N7383,  
JANTXV M, D, R, AND F AND JANS M, D, R, AND F

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, radiation hardened, enhancement mode, MOSFET, power transistor intended for use in high density power switching applications. Two levels of product assurance are provided for each device type as specified in [MIL-PRF-19500](#), with avalanche energy ratings ( $E_{AS}$ ) and maximum avalanche current ( $I_{AS}$ ). See 6.5 for JANHC and JANKC die versions.

1.2 Physical dimensions. See [figure 1](#) (TO-257AA).

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

Type	$P_T$ (1)	$P_T$ $T_A = +25^\circ\text{C}$ (free air)	$R_{\theta JC}$ (2)	Min $V_{(BR)DSS}$ $V_{GS} = 0\text{ V}$ $I_D = -1.0\text{ mA dc}$	$I_{D1}$ (3) (4)	$I_{D2}$ (3) (4) $T_C = +100^\circ\text{C}$	$T_J$ and $T_{STG}$
	<u>W</u>	<u>W</u>	<u><math>^\circ\text{C/W}</math></u>	<u>V dc</u>	<u>A dc</u>	<u>A dc</u>	<u><math>^\circ\text{C}</math></u>
2N7382	75	2	1.67	-100	-11.0	-7.0	-55 to +150
2N7383	75	2	1.67	-200	-6.5	-4.1	-55 to +150

Type	$I_S$	$I_{DM}$ (5)	$E_{AS}$	$I_{AS}$	$V_{GS}$
	<u>A dc</u>	<u>A (pk)</u>	<u>mJ</u>	<u>A dc</u>	<u>V dc</u>
2N7382	-11.0	-44	150	-11.0	$\pm 20$
2N7383	-6.5	-26	165	-6.5	$\pm 20$

See notes on next page.

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>.

1.3 Maximum ratings - Continued.

- (1) Derated linearly by 0.6 W/°C for T<sub>C</sub> > +25°C.
- (2) See [figure 2](#), thermal impedance curves.
- (3) The following formula derives the maximum theoretical I<sub>D</sub> limit. I<sub>D</sub> is limited by package and internal construction.

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

- (4) See [figure 3](#), maximum drain current graph.
- (5) I<sub>DM</sub> = 4 x I<sub>D1</sub> as calculated in note 3.

1.4 Primary electrical characteristics. Unless otherwise specified, T<sub>C</sub> = +25°C.

Type	V <sub>GS(th)1</sub> V <sub>DS</sub> ≥ V <sub>GS</sub> I <sub>D</sub> = -1.0 mA	Max I <sub>DSS</sub> V <sub>GS</sub> = 0 V V <sub>DS</sub> = 80 percent of rated V <sub>DS</sub>	Max r <sub>DS(on)1</sub> (1) V <sub>GS</sub> = 12 V dc I <sub>D</sub> = I <sub>D2</sub>	
			T <sub>J</sub> = +25°C	T <sub>J</sub> = +150°C
	<u>V dc</u> <u>Min</u> <u>Max</u>	<u>µA dc</u>	<u>ohms</u>	
2N7382	2.0   4.0	-25	0.30	0.615
2N7383	2.0   4.0	-25	0.80	1.76

(1) Pulsed, (see [4.5.1](#)).

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

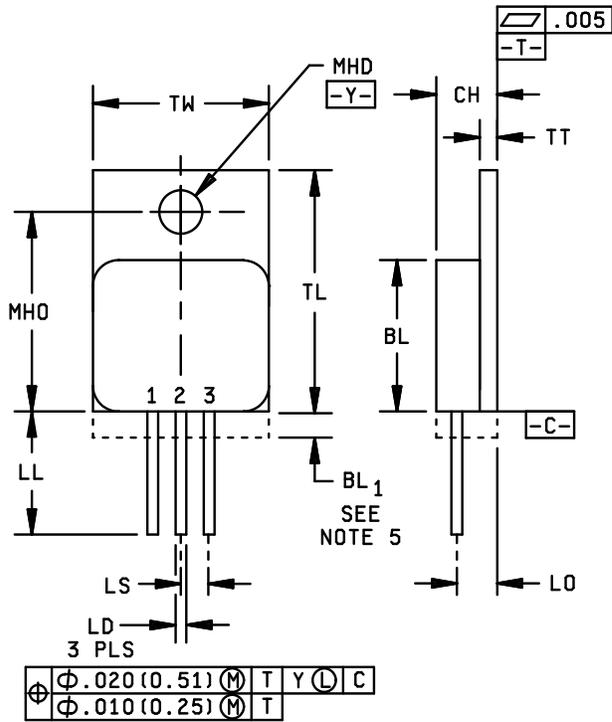
[MIL-PRF-19500](#) - Semiconductor Devices, General Specification for.

DEPARTMENT OF DEFENSE STANDARDS

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

\* (Copies of these documents are available online at <http://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.



Ltr	Dimensions			
	Inches		Millimeters	
	Min	Max	Min	Max
BL	.410	.430	10.41	10.92
BL1		.028		0.71
CH	.190	.200	4.83	5.08
LD	.025	.035	0.64	0.89
LL	.500	.625	12.70	15.88
LO	.120 BSC		3.05 BSC	
LS	.100 BSC		2.54 BSC	
MHD	.140	.150	3.56	3.81
MHO	.527	.537	13.39	13.64
TL	.645	.665	16.38	16.89
TT	.035	.045	0.89	1.14
TW	.410	.420	10.41	10.67
Term 1	Drain			
Term 2	Source			
Term 3	Gate			

NOTES:

1. Dimensions are in inches.
2. Millimeters are given for general information only.
3. All terminals are isolated from case.
4. This area is for the lead feed-thru eyelets (configuration is optional, but will not extend beyond this zone).
5. In accordance with ASME Y14.5M, diameters are equivalent to  $\phi x$  symbology.

FIGURE 1. Dimensions and configuration (TO-257AA).

### 3. REQUIREMENTS

3.1 General. The individual item requirements shall be as specified in [MIL-PRF-19500](#) and as modified herein.

3.2 Qualification. Devices furnished under this specification shall be products that are manufactured by a manufacturer authorized by the qualifying activity for listing on the applicable qualified manufacturer's list (QML) before contract award (see [4.2](#) and [6.3](#)).

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

3.4 Interface and physical dimensions. Interface and physical dimensions shall be as specified in [MIL-PRF-19500](#) and on [figure 1](#) herein. Methods used for electrical isolation of the terminal feedthroughs shall employ materials that contain a minimum of 90 percent  $AL_2O_3$  (ceramic). Examples of such construction techniques are metallized ceramic eyelets or ceramic walled packages.

3.4.1 Lead material and finish. Lead material shall be Kovar, Alloy 52, and a copper core is permitted. Lead finish shall be solderable in accordance with [MIL-PRF-19500](#), [MIL-STD-750](#), and herein. Where a choice of lead finish is desired, it shall be specified in the acquisition requirement (see [6.2](#)).

3.4.2 Internal construction. Multiple chip construction is not permitted to meet the requirements of this specification.

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 electrostatic 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](#) herein.

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 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.

4.2.2 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 III. SEE characterization data shall be made available upon request of the qualifying or acquiring activity.

\* 4.3 Screening (JANS and JANTXV levels). Screening shall be in accordance with table E-IV of MIL-PRF-19500, and as specified herein. The following measurements shall be made in accordance with table I herein. Devices that exceed the limits of table I herein shall not be acceptable.

Screen (see table E-IV of MIL-PRF-19500) (1) (2)	Measurement	
	JANS level	JANTXV levels
(3)	Gate stress test (see 4.3.1)	Gate stress test (see 4.3.1).
(3)	Method 3470 of MIL-STD-750, (see 4.3.2) optional	Method 3470 of MIL-STD-750, (see 4.3.2) optional
(3) 3c	Method 3161 of MIL-STD-750, (see 4.3.3)	Method 3161 of MIL-STD-750, (see 4.3.3)
9	$I_{GSSF1}$ , $I_{GSSR1}$ , $I_{DSS1}$ , subgroup 2 of table I herein.	Subgroup 2 of table I herein.
10	Method 1042 of MIL-STD-750, test condition B	Method 1042 of MIL-STD-750, test condition B
11	$I_{GSSF1}$ , $I_{GSSR1}$ , $I_{DSS1}$ , $r_{DS(on)1}$ , $V_{GS(th)1}$ subgroup 2 of table I herein:  $\Delta I_{GSSF1} = \pm 20$ nA dc or $\pm 100$ percent of initial value, whichever is greater. $\Delta I_{GSSR1} = \pm 20$ nA dc or $\pm 100$ percent of initial value, whichever is greater. $\Delta I_{DSS1} = \pm 25$ $\mu$ A dc or $\pm 100$ percent of initial value, whichever is greater.	$I_{GSSF1}$ , $I_{GSSR1}$ , $I_{DSS1}$ , $r_{DS(on)1}$ , $V_{GS(th)1}$ , subgroup 2 of table I herein.
12	Method 1042 of MIL-STD-750, test condition A, t = 240 hours	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 $\pm 100$ percent of initial value, whichever is greater. $\Delta I_{GSSR1} = \pm 20$ nA dc or $\pm 100$ percent of initial value, whichever is greater. $\Delta I_{DSS1} = \pm 25$ $\mu$ A dc or $\pm 100$ 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 $\pm 100$ percent of initial value, whichever is greater. $\Delta I_{GSSR1} = \pm 20$ nA dc or $\pm 100$ percent of initial value, whichever is greater. $\Delta I_{DSS1} = \pm 25$ $\mu$ A dc or $\pm 100$ 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.
17	For TO-257AA packages: Method 1081 of MIL-STD-750 (see 4.3.4), Endpoints: Subgroup 2 of table I herein.	For TO-257AA packages: Method 1081 of MIL-STD-750 (see 4.3.4), Endpoints: Subgroup 2 of table I herein.

(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) Screening 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  $V_{GS} = \pm 24$  V min. for  $t = 250$   $\mu$ s min.

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

- a. Peak current ( $I_{AS}$ ) .....  $I_{D1}$ .
- b. Peak gate voltage ( $V_{GS}$ ) ..... -12 V.
- c. Gate to source resistor ( $R_{GS}$ ) .....  $25 \leq R_{GS} \leq 200 \Omega$ .
- d. Initial case temperature .....  $+25^\circ\text{C} +10^\circ\text{C}, -5^\circ\text{C}$ .
- e. Inductance .....  $(2E_{AS}/(I_{AS})^2)((V_{BR} - V_{DD})/V_{BR})$  mH minimum.
- f. Number of pulses to be applied ..... 1 pulse minimum.
- g. Supply voltage .....  $V_{DD} = -50$  V, or -25 V for 100 V devices.

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.

\* 4.3.4 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.

4.4 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 [MIL-PRF-19500](#), and [table I](#) herein. Electrical measurements (end-points) shall be in accordance with the inspections of [table I](#), subgroup 2 herein.

4.4.2 Group B inspection. Group B inspection shall be conducted in accordance with the conditions specified for subgroup testing in table E-VIA (JANS) and table E-VIB (JANTXV) of [MIL-PRF-19500](#), and as follows. 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	Condition G.
B4	1042	The heating cycle shall be 1 minute minimum.
B5	1042	Condition A; $V_{DS} = 100$ percent of rated; $T_A = +175^\circ\text{C}$ ; $t = 120$ hours or $T_A = +150^\circ\text{C}$ ; $t = 240$ hours (manufacturers option).
B5	1042	Condition B; $V_{GS} = 100$ percent of rated; $T_A = +175^\circ\text{C}$ ; $t = 24$ hours or $T_A = +150^\circ\text{C}$ ; $t = 48$ hours (manufacturers option).

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 G.
B3	1042	The heating cycle shall be 1 minute minimum.
B3	2037	Test condition D.

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 A, weight = 10 lbs. (4.54 Kg), $t = 10$ seconds.
C5	3161	See <a href="#">4.3.3</a> , $R_{\theta JC(max)} = 1.67^\circ\text{C/W}$ .
C6	1042	The heating cycle shall be 1 minute 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 III](#) 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 appropriate tables and as follows.

4.5.1 Pulse measurements. Conditions for pulse measurements shall be as specified in section 4 of [MIL-STD-750](#).

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TABLE I. Group A inspection.

Inspection <u>1/</u>	MIL-STD-750		Symbol	Limits		Unit
	Method	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	$Z_{\theta JC}$			$^{\circ}C/W$
Breakdown voltage, drain to source 2N7382 2N7383	3407	Bias condition C, $V_{GS} = 0V$ , $I_D = -1$ mA dc	$V_{(BR)DSS}$	-100 -200		V dc V dc
Gate to source voltage (threshold)	3403	$V_{DS} \geq V_{GS}$ , $I_D = -1$ mA	$V_{GS(th)1}$	-2.0	-4.0	V dc
Gate current	3411	Bias condition C, $V_{GS} = +20$ V dc $V_{DS} = 0$ V dc	$I_{GSSF1}$		+100	nA dc
Gate current	3411	Bias condition C, $V_{GS} = -20$ V dc $V_{DS} = 0$ V dc	$I_{GSSR1}$		-100	nA dc
Drain current	3413	Bias condition C, $V_{GS} = 0$ V dc, $V_{DS} = 80$ percent of rated $V_{DS}$	$I_{DSS1}$		-25	$\mu A$ dc
Static drain to source on-state resistance 2N7382 2N7383	3421	$V_{GS} = -12$ V dc, condition A, pulsed (see 4.5.1), $I_D =$ rated $I_{D2}$ (see 1.3)	$r_{DS(on)1}$		0.30 0.80	$\Omega$ $\Omega$
Static drain to source on-state resistance 2N7382 2N7383	3421	$V_{GS} = -12$ V dc, condition A, pulsed (see 4.5.1), $I_D =$ rated $I_{D1}$ , (see 1.3)	$r_{DS(on)2}$		0.35 0.92	$\Omega$ $\Omega$
Forward voltage 2N7382 2N7383	4011	$V_{GS} = 0$ V dc, $I_D =$ rated $I_{D1}$ , pulsed (see 4.5.1)	$V_{SD}$		-3.0 -5.0	V V

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 3</u>						
High temperature operation:						
Gate current	3411	Bias condition C, $V_{GS} = \pm 20$ V dc, $V_{DS} = 0$ V dc,	$I_{GSS2}$		$\pm 200$	nA dc
Drain current	3413	Bias condition C, $V_{GS} = 0$ V dc, $V_{DS} = 80$ percent of rated $V_{DS}$	$I_{DSS2}$		-0.25	mA dc
Static drain to source on-state resistance	3421	$V_{GS} = -12$ V dc, pulsed (see 4.5.1), $I_D =$ rated $I_{D2}$	$r_{DS(on)3}$			
2N7382					0.54	$\Omega$
2N7383					1.60	$\Omega$
Gate to source voltage (threshold)	3403	$V_{DS} \geq V_{GS}$ , $I_D = -1$ mA	$V_{GS(th)2}$	-1.0		V dc
Low temperature operation:						
Gate to source voltage (threshold)	3403	$V_{DS} \geq V_{GS}$ , $I_D = -1$ mA	$V_{GS(th)3}$		-5.0	V dc
<u>Subgroup 4</u>						
Switching time test						
Turn-on delay time	3472	$I_D =$ rated $I_{D1}$ ; $V_{GS} = -12$ V dc; Gate drive impedance = 7.5 $\Omega$ ; $V_{DD} = 50$ percent of $V_{(BR)DSS}$	$t_{d(on)}$		30	ns
Rise time			$t_r$		50	ns
Turn-off delay time			$t_{d(off)}$		70	ns
2N7382					75	ns
2N7383						
Fall time			$t_f$		70	ns
2N7382					65	ns
2N7383						
Forward transconductance	3475	$I_D = I_{D2}$ ; $V_{DD} = -15$ V dc, pulsed (see 4.5.1)	$g_{fs}$			
2N7382					2.5	S
2N7383					2.0	S

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 5</u>						
Safe operating area test (high voltage)	3474	See <a href="#">figures 4 and 5</a> $t_p = 10 \text{ ms}$ , $V_{DS} = 80$ percent of rated $V_{(BR)DSS}$				
Electrical measurements		See <a href="#">table I</a> , subgroup 2				
<u>Subgroup 6</u>						
Not applicable						
<u>Subgroup 7</u>						
Gate charge	3471	Condition B				
On-state gate charge 2N7382			$Q_{g(on)}$		45	nC
2N7383					45	nC
Gate to source charge 2N7382			$Q_{gs}$		10	nC
2N7383					10	nC
Gate to drain charge 2N7382			$Q_{gd}$		25	nC
2N7383					25	nC
Reverse recovery time	3473	$di/dt \leq -100 \text{ A}/\mu\text{s}$ , $V_{DD} \leq -50 \text{ V}$ , $I_D = I_{D1}$ , (see <a href="#">1.3</a> )	$t_{rr}$			
2N7382					250	ns
2N7383					400	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, subgroups 2 and 6.  
Group E, subgroup 1.

TABLE II. Group D inspection.

Inspection <u>1/ 2/</u>	MIL-STD-750		Symbol	Pre-irradiation limits		Post-irradiation limits		Post-irradiation limits		Units
	Method	Conditions		M, D, R, and F		M, D, and R		F <u>4/</u>		
				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>3/</u>	1019	$V_{GS} = -12\text{ V};$ $V_{DS} = 0\text{ V}$								
Steady-state total dose irradiation ( $V_{DS}$ bias) <u>3/</u>	1019	$V_{GS} = 0\text{ V}; V_{DS} = 80\text{ percent of rated } V_{DS}$ (pre-irradiation)								
End-point electricals		See <a href="#">table I</a> , subgroup 2								
Breakdown voltage, drain to source 2N7382 2N7383	3407	$V_{GS} = 0\text{ V};$ $I_D = -1\text{ mA};$ bias condition C	$V_{(BR)DSS}$	-100 -200		-100 -200		-100 -200		V dc V dc
Gate to source voltage (threshold) <u>3/</u> 2N7382 2N7383	3403	$V_{DS} \geq V_{GS};$ $I_D = -1\text{ mA}$	$V_{GS(th)}$	-2.0 -2.0	-4.0 -4.0	-2.0 -2.0	-4.0 -4.0	-2.0 -2.0	-5.0 -5.0	V dc V dc
Gate current	3411	Bias condition C $V_{GS} = -20\text{ V};$ $V_{DS} = 0\text{ V};$	$I_{GSSF1}$		-100		-100		-100	nA dc
Gate current	3411	Bias condition C $V_{GS} = +20\text{ V};$ $V_{DS} = 0\text{ V};$	$I_{GSSR1}$		100		100		100	nA dc
Drain current	3413	Bias condition C $V_{GS} = 0\text{ V};$ $V_{DS} = 80\text{ percent of rated } V_{DS}$ (pre-irradiation)	$I_{DSS}$		-25		-25		-25	$\mu\text{A dc}$

See footnotes at end of table.

TABLE II. Group D inspection - Continued.

Inspection <u>1/</u> <u>2/</u>	MIL-STD-750		Symbol	Pre-irradiation limits		Post-irradiation limits		Post-irradiation limits		Units
	Method	Conditions		M, D, R, and F		M, D, and R		F <u>4/</u>		
				Min	Max	Min	Max	Min	Max	
<u>Subgroup 2</u> - Continued										
Static drain to source on- state resistance 2N7382 2N7383	3421	$V_{GS} = -12\text{ V}$ , condition A pulsed (see 4.5.1) $I_D = I_{D2}$	$r_{DSon1}$		0.30 0.80		0.30 0.80		0.30 0.80	$\Omega$ $\Omega$
Forward voltage source drain diode 2N7382 2N7383	4011	$V_{GS} = 0\text{ V}$ , condition A $I_D = I_{D1}$	$V_{SD}$		-3.0 -5.0		-3.0 -5.0		-3.0 -5.0	V V

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

2/ Group D qualification may be performed anytime prior to lot formation. Wafers qualified to these group D QCI requirements may be used for any other specification utilizing the same die design.

3/ Separate samples shall be pulled for each bias.

4/ The "F" designation represents devices which pass end-points at M, D, R, and F designated total-ionizing dose (TID).

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

Inspection	MIL-STD-750		Sampling plan
	Method	Conditions	
<u>Subgroup 1</u>			45 devices c = 0
Temperature cycling	1051	Test condition G; 500 cycles.	
Hermetic seal Fine leak Gross leak	1071		
Electrical measurements		See <a href="#">table I</a> , subgroup 2.	
<u>Subgroup 2 1/</u>			45 devices c = 0
Steady-state reverse bias	1042	Condition A, 1,000 hours.	
Electrical measurements		See <a href="#">table I</a> , subgroup 2.	
Steady-state gate bias	1042	Condition B, 1,000 hours.	
Electrical measurements		See <a href="#">table I</a> , subgroup 2.	
<u>Subgroup 4</u>			sample size N/A
Thermal impedance curves		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 <a href="#">2/</a> <a href="#">3/</a>	1080	See method 1080 of <a href="#">MIL-STD-750</a> and <a href="#">6.2</a> herein.	

[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.

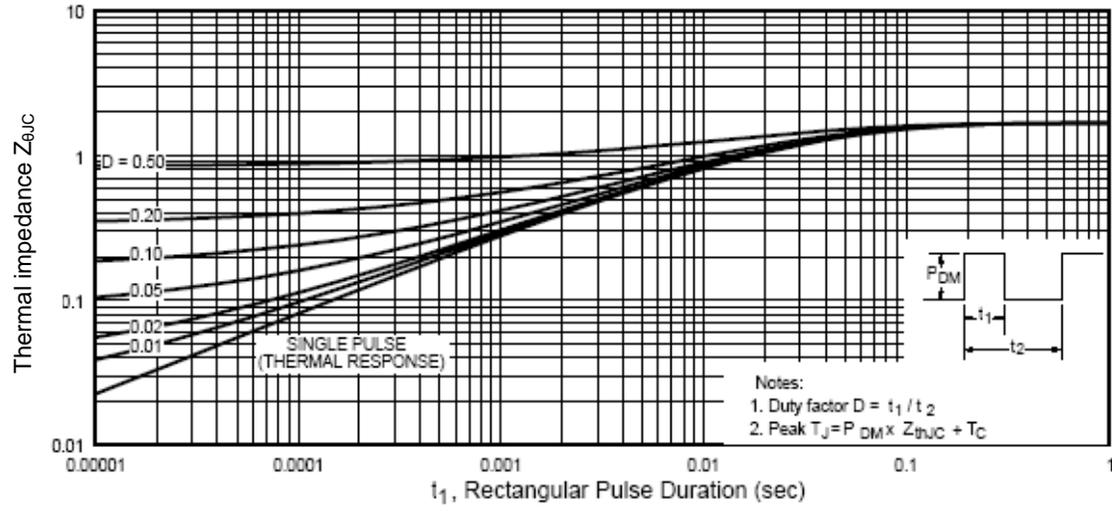
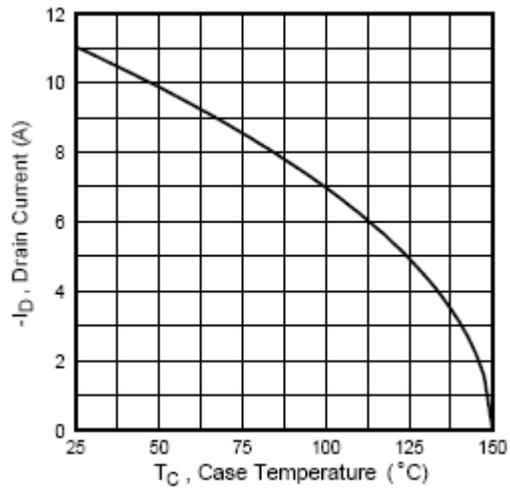


FIGURE 2. Thermal impedance curves.

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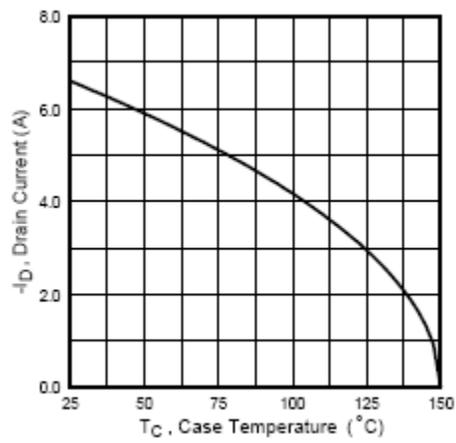


FIGURE 3. Maximum drain current versus case temperature graphs.

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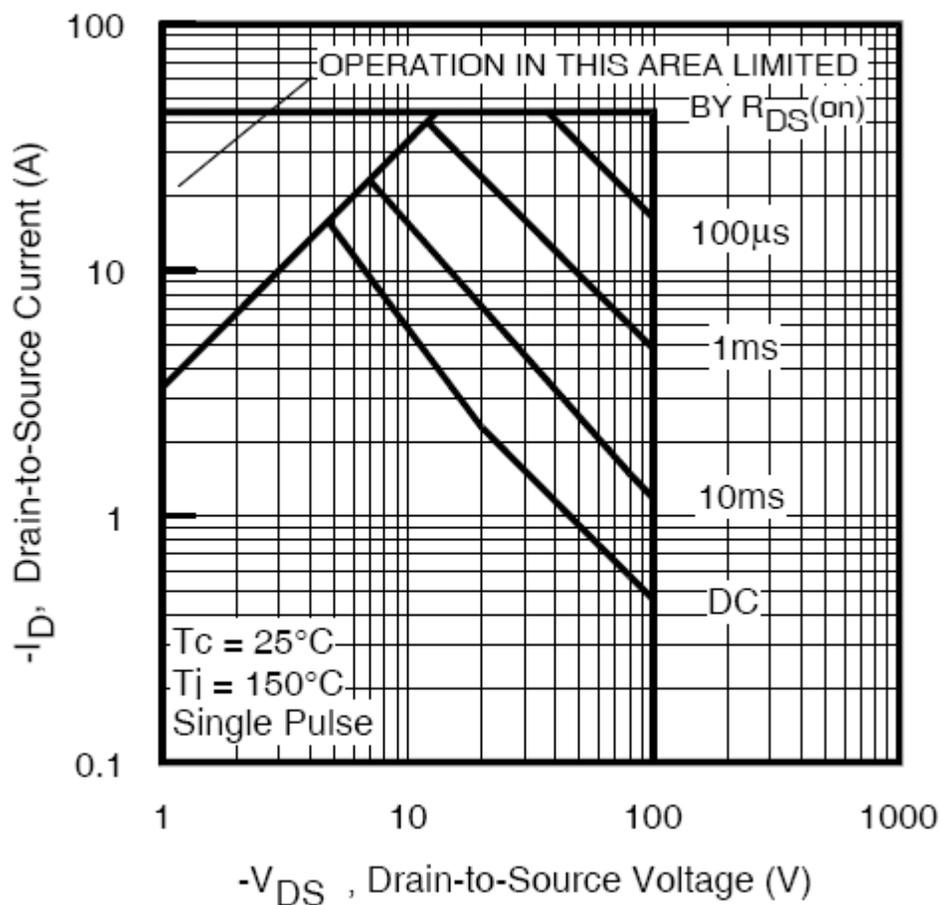


FIGURE 4. Safe operating area graphs.

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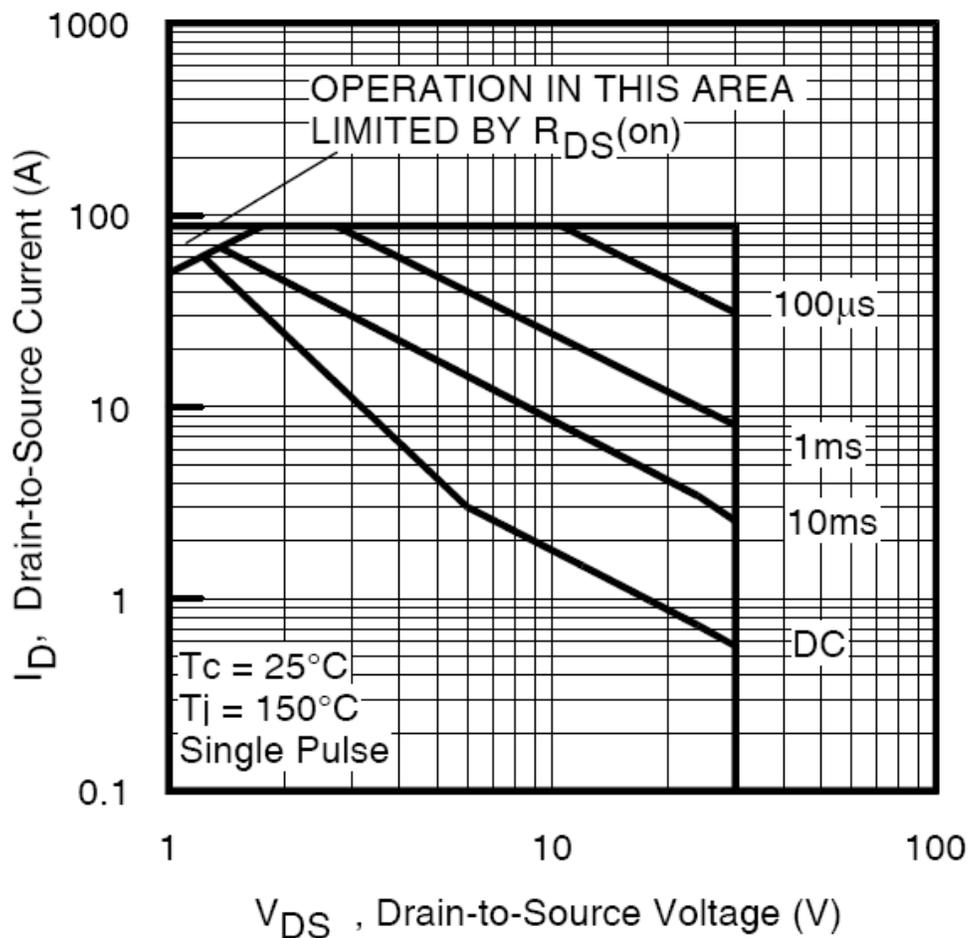


FIGURE 5. Safe operating area graphs.

## 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 material and finish (see [3.4.1](#)).
- d. The complete Part of Identifying Number (PIN), see title and section 1.
- 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 [6.6](#) 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@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 Supersession data. This specification supersedes DESC drawing 89009, dated 19 December 1989.

6.5 JANC die versions. The JANHC and JANKC die versions of these devices are covered under performance specification sheet [MIL-PRF-19500/657](#).

6.6 Application data.

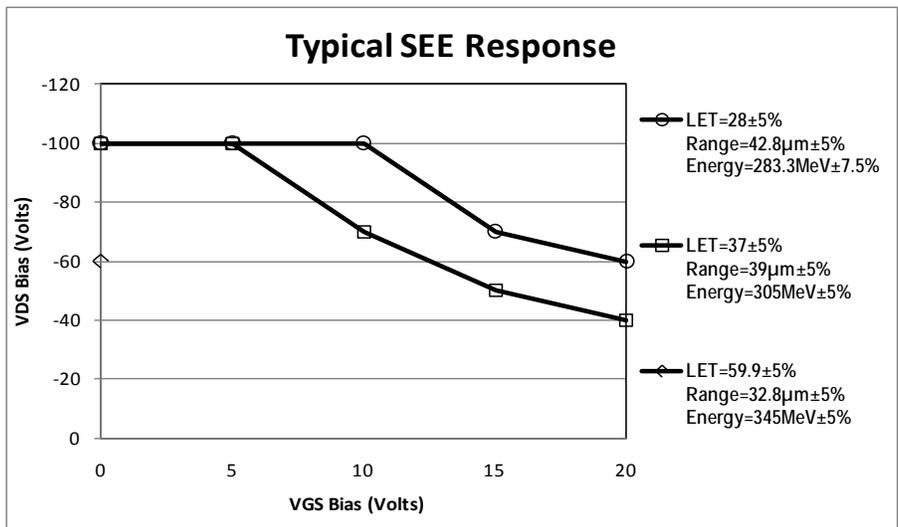
6.6.1 Manufacturer specific irradiation data. Each manufacturer qualified to this slash sheet has characterized its devices to the requirements of [MIL-STD-750](#) method 1080 and as specified herein. Since each manufacturer's characterization conditions can be different and can vary by the version of 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.

Manufacture's Cage	Inspection	MIL-STD-750		Sample plan
		Method	Conditions	
69210 (Applicable to devices with a date code of June 1998 and older)	SEE <u>1/</u>	1080	See MIL-STD-750E method 1080.0 dated 20 November 2006. See figure 6	3 devices
	Electrical measurements		$I_{GSSF1}$ , $I_{GSSR1}$ , and $I_{DSS1}$ in accordance with table I, subgroup 2	
	SEE irradiation:		Fluence = $3E5 \pm 20$ percent ions/cm <sup>2</sup> Flux = $2E3$ to $2E4$ ions/cm <sup>2</sup> /sec, temperature = $+25^{\circ}C \pm 5^{\circ}C$	
			Surface LET = $28 \text{ MeV-cm}^2/\text{mg} \pm 5\%$ , range = $42.8 \mu\text{m} \pm 7.5\%$ , energy = $283.3 \text{ MeV} \pm 7.5\%$	
	2N7382		In-situ bias conditions: $V_{DS} = -100 \text{ V}$ and $V_{GS} = +10 \text{ V}$ $V_{DS} = -70 \text{ V}$ and $V_{GS} = +15 \text{ V}$ $V_{DS} = -60 \text{ V}$ and $V_{GS} = +20 \text{ V}$ (typical 4.53 MeV/nucleon at Brookhaven National Lab Accelerator)	
	2N7383		In-situ bias conditions: $V_{DS} = -200 \text{ V}$ and $V_{GS} = +15 \text{ V}$ (nominal 4.53 MeV/nucleon at Brookhaven National Lab Accelerator)	
			Surface LET = $37 \text{ MeV-cm}^2/\text{mg} \pm 5\%$ , range = $39 \mu\text{m} \pm 5\%$ , energy = $305 \text{ MeV} \pm 5\%$	
	2N7382		In situ bias conditions: $V_{DS} = -100 \text{ V}$ and $V_{GS} = +5 \text{ V}$ $V_{DS} = -70 \text{ V}$ and $V_{GS} = +10 \text{ V}$ $V_{DS} = -50 \text{ V}$ and $V_{GS} = +15 \text{ V}$ $V_{DS} = -40 \text{ V}$ and $V_{GS} = +20 \text{ V}$ (typical 3.77 MeV/nucleon at Brookhaven National Lab Accelerator)	
	2N7383	In situ bias conditions: $V_{DS} = -200 \text{ V}$ and $V_{GS} = +5 \text{ V}$ $V_{DS} = -160 \text{ V}$ and $V_{GS} = +10 \text{ V}$ $V_{DS} = -75 \text{ V}$ and $V_{GS} = +15 \text{ V}$ (nominal 3.77 MeV/nucleon at Brookhaven National Lab Accelerator)		
	2N72382	Surface LET = $59.9 \text{ MeV-cm}^2/\text{mg} \pm 5\%$ , range = $32.8 \mu\text{m} \pm 7.5\%$ , energy = $345 \text{ MeV} \pm 7.5\%$		
	Electrical measurements	In situ bias conditions: $V_{DS} = -60 \text{ V}$ and $V_{GS} = 0 \text{ V}$ (typical 2.72 MeV/nucleon at Brookhaven National Lab Accelerator)		
			$I_{GSSF1}$ , $I_{GSSR1}$ , and $I_{DSS1}$ in accordance with table I, subgroup 2	
Upon qualification, all manufacturers should provide the verification test conditions to be added to this table.				

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

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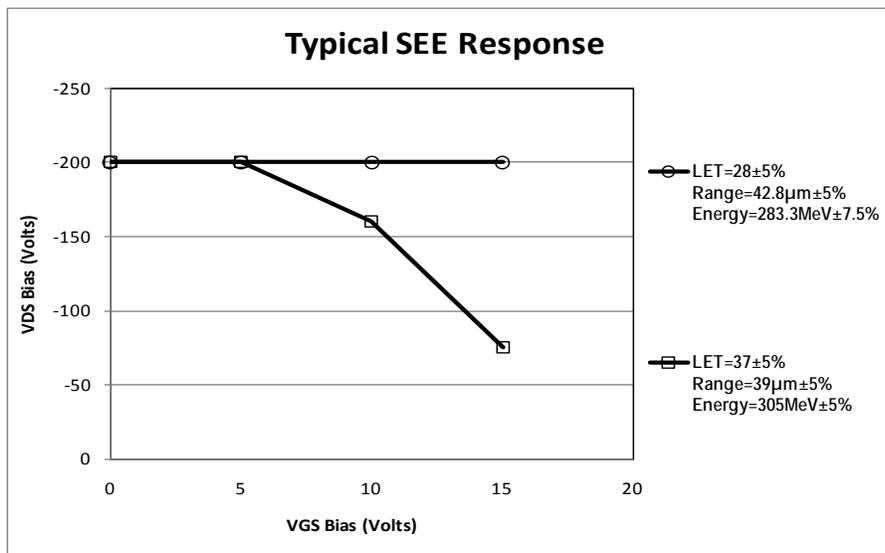


FIGURE 6. Cage 68210 typical SEE response graph.

- \* 6.7 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 previous issue.

Custodians:

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

Preparing activity:

DLA - CC

(Project 5961-2014-043)

Review activities:

Army - SM  
Navy - AS, MC  
Air Force - 19, 71, 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>.