The documentation and process conversion measures necessary to comply with this revision shall be completed by 2 October 2015.

INCH-POUND

MIL-PRF-19500/614K
2 July 2015
SUPERSEDING
MIL-PRF-19500/614J
18 April 2014

PERFORMANCE SPECIFICATION SHEET

* TRANSISTOR, FIELD EFFECT RADIATION HARDENED
N-CHANNEL, SILICON, TYPES 2N7380, AND 2N7381,
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 an N-channel, radiation hardened, enhancement mode, MOSFET, power transistors intended for use in high density power switching applications. Two levels of product assurance (JANTXV and JANS) 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 6.7 for JANHC and JANKC die versions.

* 1.2 Package outlines. The device package outlines are as follows: TO-257AA in accordance with figure 1 and SMD-0.5 TO-276AA (U3) in accordance with figure 2 for all encapsulated device types. The dimensions and topography for JANHC and JANKC unencapsulated die are as listed in slash sheet MIL-PRF-19500/657.

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

Type	P_T (1) T_C = +25°C	P_T T_A = +25°C (free air)	$R_{\theta JC}$ (2)	Min $V_{(BR)DSS}$ V_{GS} = 0 V I_D = 1.0 mA dc	I_{D1} (3) (4) T_C = +25°C	I_{D2} (3) (4) T_C = +100°C	T_J and T_{STG}
	W	W	°C/W	V dc	A dc	A dc	°C
2N7380, 2N7380U3	75	2	1.67	100	14.4	9.1	-55 to +150
2N7381	75	2	1.67	200	9.4	6.0	-55 to +150

Type	I_S	I_{DM} (5)	V_{GS}	E_{AS} max	I_{AS}
	A dc	A(pk)	V dc	mJ	A dc
2N7380, 2N7380U3	14.4	57.6	±20	150	14.4
2N7381	9.4	37.6	±20	150	9.4

(See notes 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. 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) Derate linearly by 0.6 W/°C for T_C > +25°C.
(2) See figure 3, thermal impedance curves.
(3) The following formula derives the maximum theoretical I_D limit. I_D is limited by package and device construction.

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

(4) See figure 4, maximum drain current graph.
(5) I_{DM} = 4 X I_{D1} as calculated in note (3).

* 1.4 Primary electrical characteristics. Unless otherwise specified, T_C = +25°C.

Type	Min $V_{(BR)DSS}$ V_{GS} = 0 I_D = 1.0 mA dc	$V_{GS(th)1}$ $V_{DS} \geq V_{GS}$ I_D = 1.0 mA dc		I_{DSS} max V_{GS} = 0	Max $r_{DS(on)1}$ (1) V_{GS} = 12 V; $I_D = I_{D2}$	
				V_{DS} = 80 percent of rated V_{DS}	T_J = +25°C	T_J = +150°C
	V dc	V dc		µA dc	Ω	Ω
		Min	Max			
2N7380, 2N7380U3	100	2.0	4.0	25	0.18	0.36
2N7381	200	2.0	4.0	25	0.40	0.84

(1) Pulsed (see 4.5.1).

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

* 1.5.1 JAN certification mark and quality level 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 JAN brand and quality level designators for unencapsulated devices (die). See 6.7 for unencapsulated devices.

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

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

* 1.5.4.1 First number and first letter symbols. The transistors of this specification sheet are identified by the first number and letter symbols "2N".

* 1.5.4.2 Second number symbols. The second number symbols for the transistor covered by this specification sheet are as follows: "7380” and “7381”.

* 1.5.4.3 Suffix letters. No suffix letters are used on devices that are packaged in the TO-257AA package of figure 1. The suffix letters "U3" are used on devices that are packaged in the SMD-0.5 TO-276AA package of figure 2.

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

* 1.5.6 Unencapsulated devices. See 6.7 for JANHC and JANKC die versions.

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

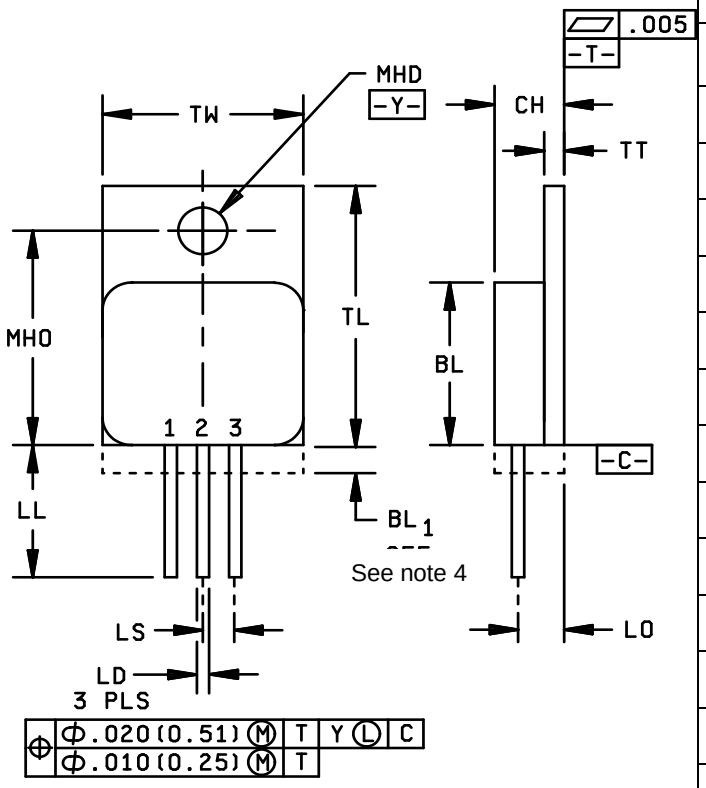
MIL-PRF-19500 - Semiconductor Devices, General Specification for.

DEPARTMENT OF DEFENSE STANDARDS

MIL-STD-750 - Test Methods for Semiconductor Devices.

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

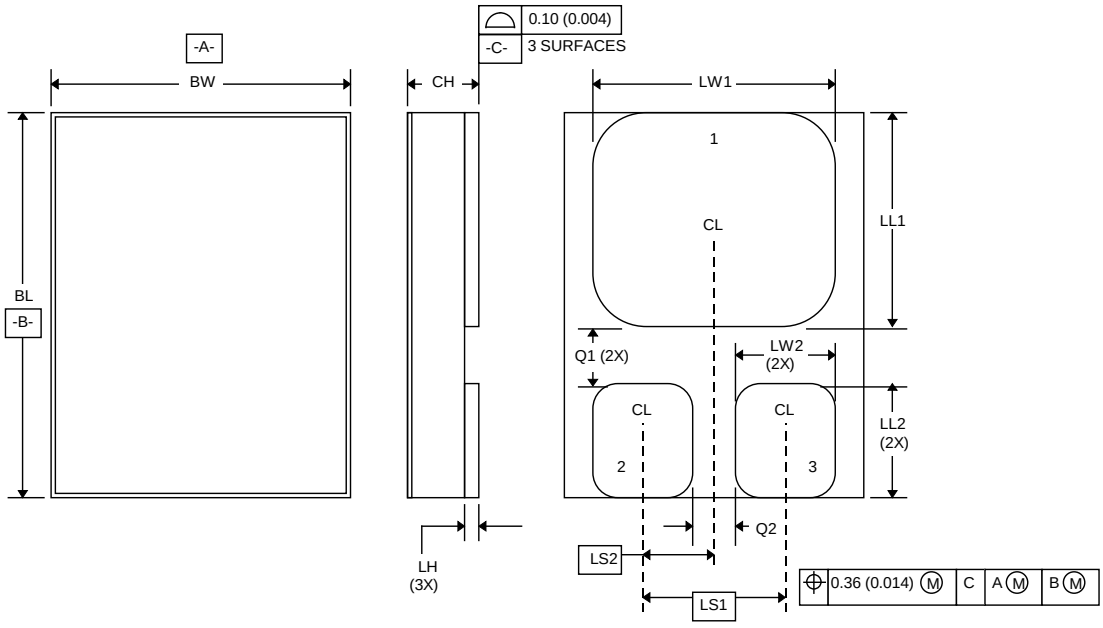
2.3 Order of precedence. Unless otherwise noted herein or in the contract, in the event of a conflict between the text of this document and the references cited herein, the text of this document takes precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific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



Ltr	Inches		Millimeters	
	Min	Max	Min	Max
BL	.410	.430	10.41	10.92
BL_1		.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-through eyelets (configuration is optional, but will not extend beyond this zone).
5. In accordance with ASME Y14.5M, diameters are equivalent to ϕx symbology.

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



Symbol	Dimensions			
	Inches		Millimeters	
	Min	Max	Min	Max
BL	.395	.405	10.04	10.28
BW	.291	.301	7.40	7.64
CH		.124		3.15
LH	.010	.020	0.25	0.51
LW1	.281	.291	7.14	7.39
LW2	.090	.100	2.29	2.54
LL1	.220	.230	5.59	5.84
LL2	.115	.125	2.93	3.17
LS1	.150 BSC		3.81 BSC	
LS2	.075 BSC		1.91 BSC	
Q1	.030		0.762	
Q2	.030		0.762	
TERM 1	Drain			
TERM 2	Gate			
TERM 3	Source			

NOTES:
1. Dimension are in inches.
2. Millimeters are given for information only.
3. The lid shall be electrically isolated from the drain, gate, and source.
4. In accordance with ASME Y14.5M, diameters are equivalent to ϕx symbology.

FIGURE 2. Dimensions and configuration (TO-276AA, SMD-0.5).

3. REQUIREMENTS

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

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

3.3 Abbreviations, symbols, and definitions. Abbreviations, symbols, and definitions used herein shall be as specified in MIL-PRF-19500 and as follows.

I_{AS} ..... Rated avalanche current, nonrepetitive.
nC .....nano Coulomb.

* 3.4 Interface and physical dimensions. Interface and physical dimensions shall be as specified in MIL-PRF-19500, and on figure 1 (TO-257AA) and figure 2 (TO-276AA) 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 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 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 discharge 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 procedures 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. $R \leq 100\ k\Omega$, 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 table I as specified 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 level	JANTXV level
(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)	Method 3470 of MIL-STD-750. (see 4.3.2)
(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	Not applicable
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. ΔI_{GSSF1} = ±20 nA dc or ±100 percent of initial value, whichever is greater. ΔI_{GSSR1} = ±20 nA dc or ±100 percent of initial value, whichever is greater. ΔI_{DSS1} = ±25 µA dc or ±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	Method 1042 of MIL-STD-750, test condition A
13	Subgroup 2 and 3 of table I herein. ΔI_{GSSF1} = ±20 nA dc or ±100 percent of initial value, whichever is greater. ΔI_{GSSR1} = ±20 nA dc or ±100 percent of initial value, whichever is greater. ΔI_{DSS1} = ±25 µA dc or ±100 percent of initial value, whichever is greater. $\Delta r_{DS(on)1}$ = ±20 percent of initial value. $\Delta V_{GS(th)1}$ = ±20 percent of initial value.	Subgroup 2 of table I herein. ΔI_{GSSF1} = ±20 nA dc or ±100 percent of initial value, whichever is greater. ΔI_{GSSR1} = ±20 nA dc or ±100 percent of initial value, whichever is greater. ΔI_{DSS1} = ±25 µA dc or ±100 percent of initial value, whichever is greater. $\Delta r_{DS(on)1}$ = ±20 percent of initial value. $\Delta V_{GS(th)1}$ = ±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) 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} = ±30 V minimum for t = 250 μs 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.

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 ..... $\left[\frac{2E_{AS}}{(I_{D1})^2}\right]\left[\frac{V_{BR} - V_{DD}}{V_{BR}}\right]$ mH minimum.

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

g. Supply voltage .....V_{DD} = 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 μs max. See table III, group E, subgroup 4 herein.

4.3.4 Dielectric withstanding voltage.

* a. Magnitude of test voltage.....800 V dc for TO-257AA, 600 V dc for TO-276AA.

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 and as specified herein.

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 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.

* 4.4.2.1 Quality level JANS, table E-VIA of MIL-PRF-19500.

Subgroup	Method	Condition
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°C, t = 120 hours or T_A = +150°C, t = 240 hours; read and record $V_{BR(DSS)}$ (pre and post) at I_D = 1 mA; read and record I_{DSS} (pre and post), in accordance with table I, subgroup 2.
B5	1042	Condition B; V_{GS} = 100 percent of rated T_A = +175°C, t = 24 or T_A = +150°C, t = 48 hours.
* B6	3161	$R_{\Theta JC}$(max) = 1.67°C/W (not applicable for U3 device)

* 4.4.2.2 Quality levels JAN, JANTX and JANTXV, table E-VIB (JAN, JANTX, and JANTXV) of MIL-PRF-19500.

Subgroup	Method	Condition
B2	1051	Condition G.
B3	1042	The heating cycle shall be 1 minute 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.

Subgroup	Method	Condition
* C2	2036	Test condition A, weight = 10 lbs, t = 10 seconds (TO-257AA package only).
* C5	3161	See 4.3.3, $R_{\theta JC(max)}$ = 1.67°C/W (not required if test was performed in group B)
C6	1042	The heating cycle shall be 1 minute minimum. No heat sink nor forced air cooling on the device shall be permitted.

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 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.

* TABLE I. Group A inspection.

Inspection 1/	MIL-STD-750		Symbol	Limits		Unit
	Method	Condition		Min	Max	
Subgroup 1						
Visual and mechanical inspection	2071					
Subgroup 2						
Thermal impedance 2/	3161	See 4.3.3	$Z_{\theta JC}$			°C/W
Breakdown voltage drain to source	3407	V_{GS} = 0, I_D = 1 mA dc, bias condition C	$V_{(BR)DSS}$			
2N7380, 2N7380U3				100		V dc
2N7381				200		V dc
Gate to source voltage (threshold)	3403	$V_{DS} \geq V_{GS}$, I_D = 1.0 mA	$V_{GS(th)1}$	2.0	4.0	V dc
Gate current	3411	V_{GS} = +20 V dc, V_{DS} = 0, bias condition C	I_{GSSF1}		+100	nA dc
Gate current	3411	V_{GS} = -20 V dc, V_{DS} = 0, bias condition C	I_{GSSR1}		-100	nA dc
Drain current	3413	V_{GS} = 0, V_{DS} = 80 percent of rated V_{DS}, bias condition C	I_{DSS1}		25	µA dc
Static drain to source on-state resistance	3421	V_{GS} = 12 V dc, condition A, pulsed (see 4.5.1), I_D = rated I_{D2} (see 1.3)	$r_{DS(on)1}$			
2N7380, 2N7380U3					0.18	Ω
2N7381					0.40	Ω
Static drain to source on-state resistance	3421	V_{GS} = 12 V dc, condition A, pulsed (see 4.5.1), I_D = rated I_{D1} (see 1.3)	$r_{DS(on)2}$			
2N7380, 2N7380U3					0.20	Ω
2N7381					0.49	Ω
* Forward voltage (source drain diode)	4011	Condition C, V_{GS} = 0, I_D = rated I_{D1} pulsed (see 4.5.1)	V_{SD}			
2N7380					1.8	V dc
2N7380U3					1.5	V dc
2N7381					1.4	V dc

See footnotes at end of table.

* TABLE I. Group A inspection - Continued.

	Inspection 1/	MIL-STD-750		Symbol	Limits		Unit
		Method	Condition		Min	Max	
	Subgroup 3						
	High temperature operation:		T_A = +125°C				
	Gate current	3411	Bias condition C, V_{GS} = ±20 V dc, V_{DS} = 0	I_{GSS2}		±200	nA dc
*	Drain current	3413	Bias condition C, V_{GS} = 0, V_{DS} = 80 percent of rated V_{DS}	I_{DSS2}		0.25	mA dc
*	Static drain to source on-state	3421	Condition A, V_{GS} = 12 V dc, pulsed (see 4.5.1), I_D = rated I_{D2}	$r_{DS(on)3}$			
	2N7380, 2N7380U3					0.36	Ω
	2N7381					0.75	Ω
	Gate to source voltage (threshold)	3403	$V_{DS} \geq V_{GS}$, I_D = 1.0 mA dc	$V_{GS(th)2}$	1.0		V dc
	Low temperature operation:		T_A = -55°C				
	Gate to source voltage (threshold)	3403	$V_{DS} \geq V_{GS}$, I_D = 1.0 mA dc	$V_{GS(th)3}$		5.0	V dc
	Subgroup 4						
	Switching time test	3472	I_D = rated I_{D1}, V_{GS} = 12 V dc, gate drive impedance = 7.5 Ω, V_{DD} = 50 percent of $V_{BR(DSS)}$				
	Turn-on delay time			$t_{d(on)}$			
	2N7380, 2N7381					25	ns
	2N7380U3					35	ns
	Rise time			t_r			
	2N7380					60	ns
	2N7380U3					75	ns
	2N7381					50	ns
	Turn-off delay time			$t_{d(off)}$			
	2N7380, 2N7380U3					40	ns
	2N7381					70	ns
	Fall time			t_f			
	2N7380, 2N7380U3					30	ns
	2N7381					60	ns

See footnotes at end of table.

* TABLE I. Group A inspection - Continued.

Inspection 1/	MIL-STD-750		Symbol	Limits		Unit
	Method	Condition		Min	Max	
Subgroup 4 - Continued.						
Forward transconductance	3475	$I_D = I_{D2}$, V_{DD} = 15 V dc see 4.5.1	g_{fs}	2.5		s
Subgroup 5						
Safe operating area test (high voltage)	3474	See figure 5, t_p = 10 ms, V_{DS} = 80 percent of rated $V_{BR(DSS)}$, $V_{DS} \leq$ 200 V maximum				
Electrical measurements		See table I, subgroup 2				
Subgroup 6						
Not applicable						
Subgroup 7						
Gate charge	3471	Condition B				
On-state gate charge			$Q_{g(on)}$			
2N7380, 2N7380U3					40	nC
2N7381					50	nC
Gate to source charge			Q_{gs}		10	nC
Gate to drain charge			Q_{gd}			
2N7380, 2N7380U3					20	nC
2N7381					25	nC
Reverse recovery time	3473	$d_i/d_t \leq$ 100 A/µs, $V_{DD} \leq$ 50 V, $I_D = I_{D1}$	t_{rr}			
2N7380, 2N7380U3					275	ns
2N7381					460	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 1/ 2/ 3/	MIL-STD-750		Symbol	Pre-irradiation limits				Post-irradiation limits				Unit
	Method	Conditions		M, D, P, L, and R		F, G, and H 4/		M, D, P, L, and R		F, G, and H 4/		
				Min	Max	Min	Max	Min	Max	Min	Max	
Subgroup 2		T_C = +25°C										
Steady-state total dose irradiation (V_{GS} bias)	1019	V_{GS} = 12 V, V_{DS} = 0										
Steady-state total dose irradiation (V_{DS} bias)	1019	V_{GS} = 0, V_{DS} = 80 percent of rated V_{DS} (pre-irradiation)										
End-point electrical:												
Breakdown voltage, drain to source	3407	V_{GS} = 0, I_D = 1 mA, bias condition C	$V_{(BR)DSS}$									
2N7380,				100		100		100		100		V dc
2N7380U3				100		100		100		100		V dc
2N7381				200		200		200		200		V dc
Gate to source voltage (threshold) 4/	3403	$V_{DS} \geq V_{GS}$, I_D = 1 mA	$V_{GS(th)}$	2.0	4.0	2.0	4.0	2.0	4.0	1.25	4.5	V dc
Gate current	3411	V_{GS} = 20 V, V_{DS} = 0 V, bias condition C	I_{GSSF1}		100		100		100		100	nA dc
* Gate current	3411	V_{GS} = -20 V, V_{DS} = 0, bias condition C	I_{GSSR1}		-100		-100		-100		-100	nA dc

See footnotes at end of table.

* TABLE II. Group D inspection - Continued.

Inspection 1/ 2/ 3/	MIL-STD-750		Symbol	Pre-irradiation limits				Post-irradiation limits				Unit
	Method	Conditions		M, D, P, L, and R		F, G, and H 4/		M, D, P, L, and R		F, G, and H 4/		
				Min	Max	Min	Max	Min	Max	Min	Max	
Subgroup 2 - Continued		T_C = +25°C										
Drain current	3413	V_{GS} = 0, bias condition C, V_{DS} = 80 percent of rated V_{DS} (pre-irradiation)	I_{DSS}									
2N7380, 2N7380U3					25		25		25		50	µA dc
2N7381					25		25		25		50	µA dc
Static drain to source on-state voltage	3405	V_{GS} = 12 V, condition A pulsed, see 4.5.1. $I_D = I_{D2}$	$V_{DS(ON)}$									
2N7380, 2N7380U3					1.638		1.638		1.638		2.184	V dc
2N7381					2.4		2.4		2.4		3.18	V dc
Forward voltage source drain diode	4011	V_{GS} = 0, $I_D = I_{D1}$, bias condition C	V_{SD}									
2N7380,					1.8		1.8		1.8		1.8	V
2N7380U3					1.8		1.8		1.8		1.5	V
2N7381					1.4		1.4		1.4		1.4	V

1/ For sampling plan, see MIL-PRF-19500.
2/ Separate samples shall be pulled for each bias.
3/ 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 sheet utilizing the same die design.
4/ The “H” designation represents devices which pass end-points at M, D, P, L, R, F, G, and H designated total-ionizing-dose (TID).

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

Inspection	MIL-STD-750		Sample plan
	Method	Conditions	
Subgroup 1			45 devices, c = 0
Temperature cycling	1051	Test condition G, 500 cycles	
Hermetic seal Fine leak Gross leak	1071		
Electrical measurements		See table I, subgroup 2	
Subgroup 2 1/			45 devices, c = 0
Steady-state reverse bias	1042	Condition A, 1,000 hours	
Electrical measurements		See table I, subgroup 2	
Steady-state gate bias	1042	Condition B, 1,000 hours	
Electrical measurements		See table I, subgroup 2	
Subgroup 4			Sample size N/A
Thermal impedance curves		See MIL-PRF-19500.	
Subgroup 10			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	
Subgroup 11			3 devices
SEE 2/ 3/	1080	See method 1080 of MIL-STD-750.	

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

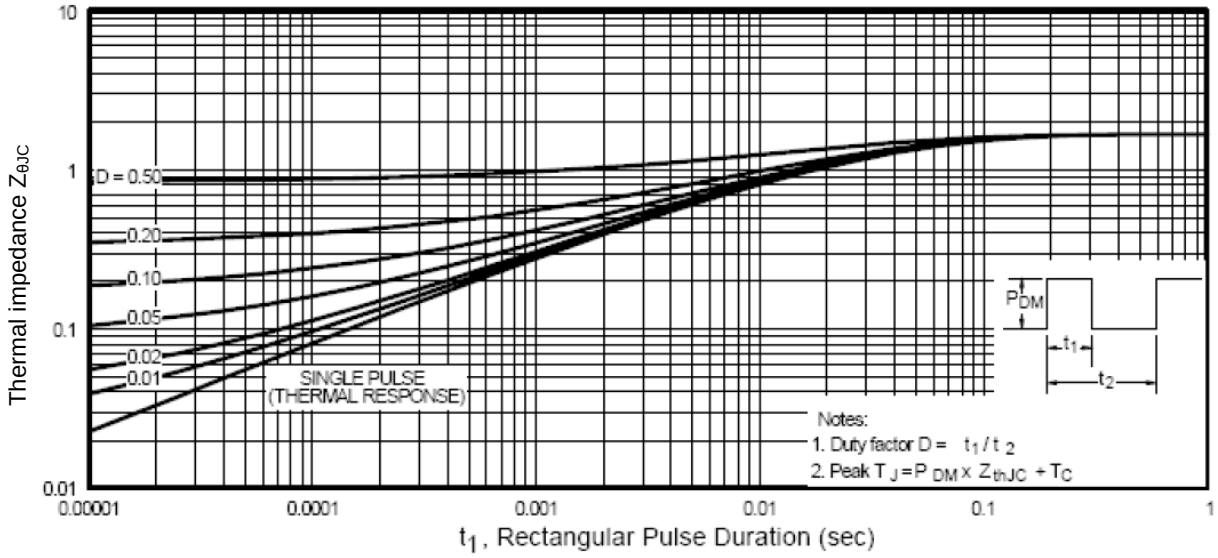
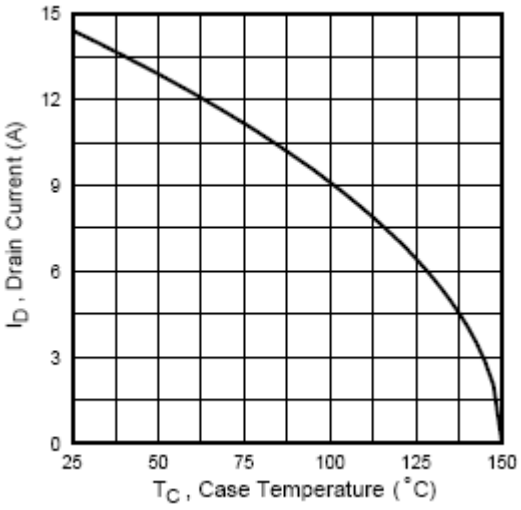


FIGURE 3. Thermal impedance curves.



2N7381

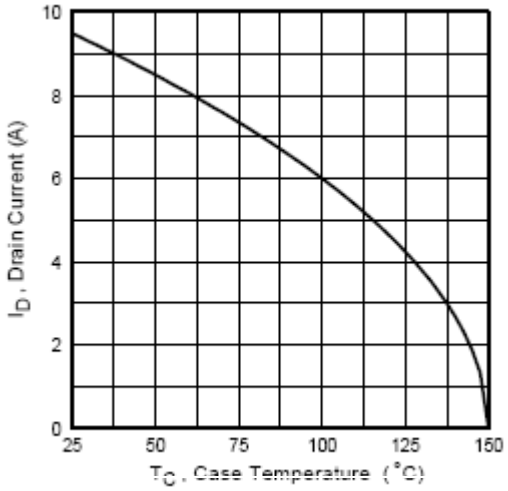
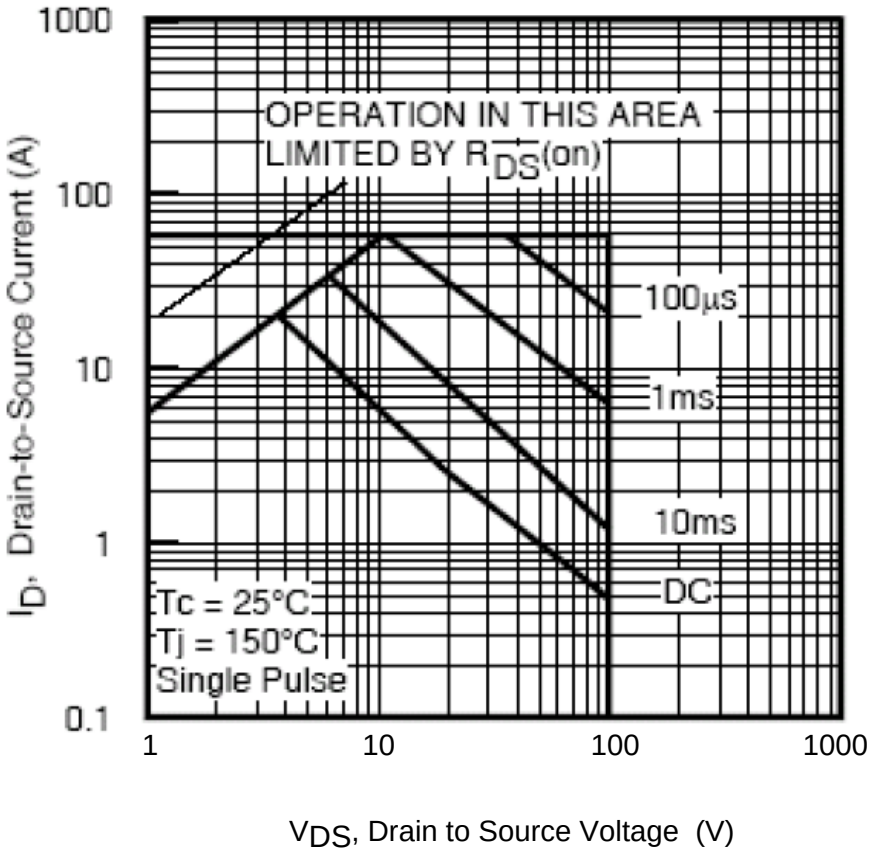
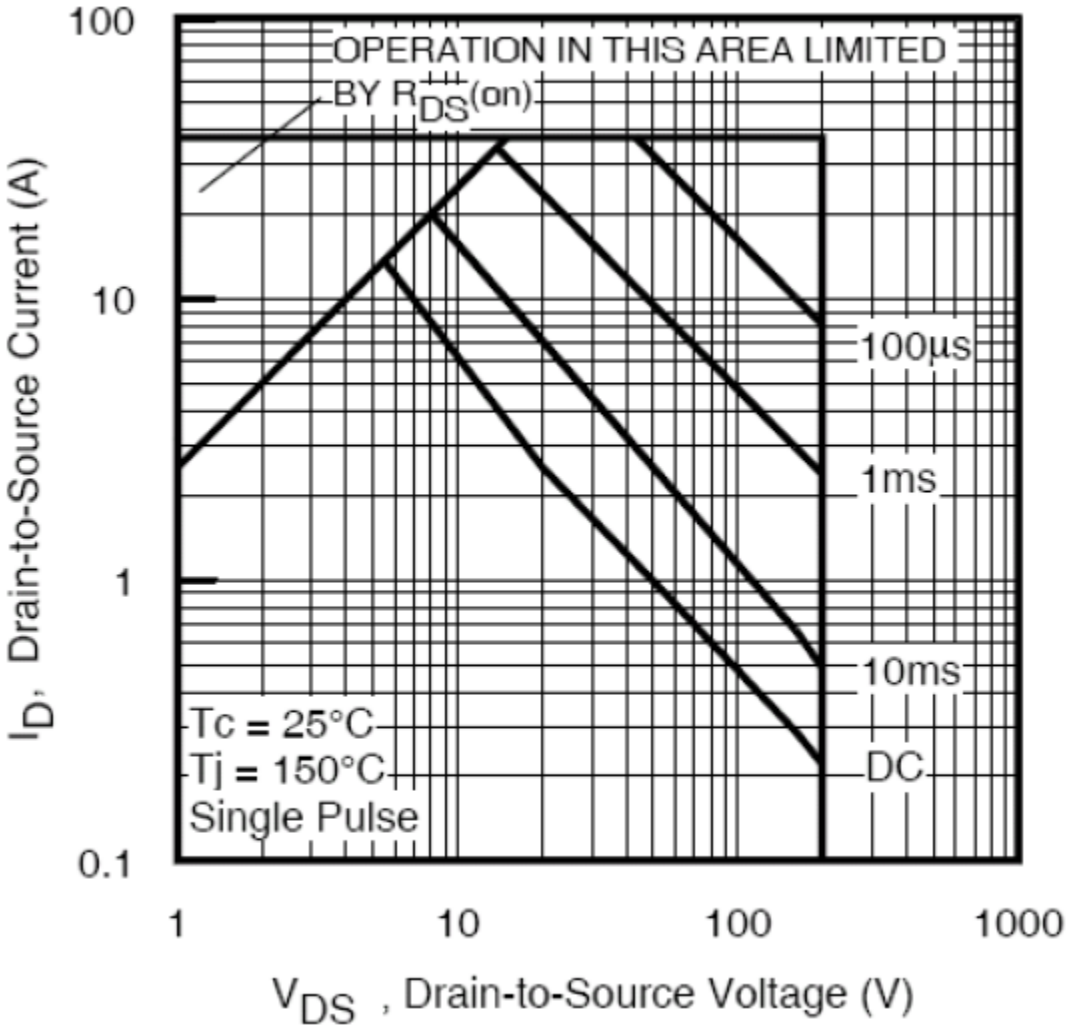


FIGURE 4. Derating drain current graphs.



2N7380, 2N7380U3

* FIGURE 5. Safe operating area graphs.



2N7381

* FIGURE 5. Safe operating area graphs - Continued.

5. PACKAGING

5.1 Packaging. For acquisition purposes, the packaging requirements shall be as specified in the contract or order (see 6.2). When 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 Part or Identifying Number (PIN), see 1.5 and 6.5.

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

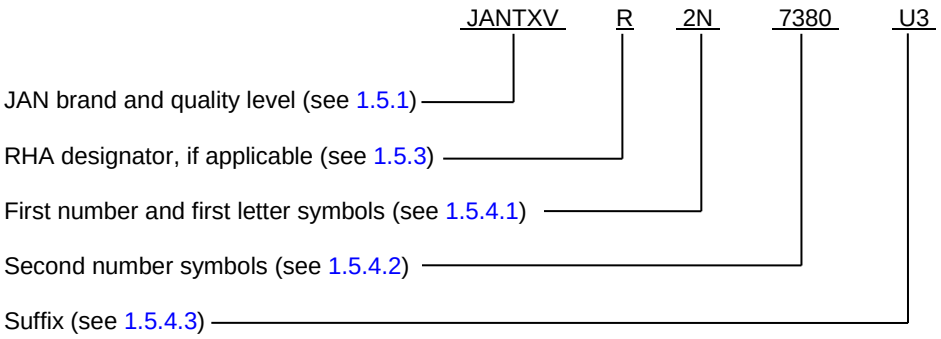
f. If SEE testing data is desired, it should be specified in the contract or order.

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

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



* 6.6 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 (1)	PINs for devices of the "S" quality level	PINs for devices of the "S" quality level with RHA (1)
JANTXV2N7380	JANTXV#2N7380	JANS2N7380	JANS#2N7380
JANTXV2N7380U3	JANTXV#2N7380U3	JANS2N7380U3	JANS#2N7380U3
JANTXV2N7381	JANTXV#2N7381	JANS2N7381	JANS#2N7381

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

6.7 JANC die versions. The JANHC and JANKC die versions of these devices are covered under specification sheet MIL-PRF-19500/657.

6.8 Application data.

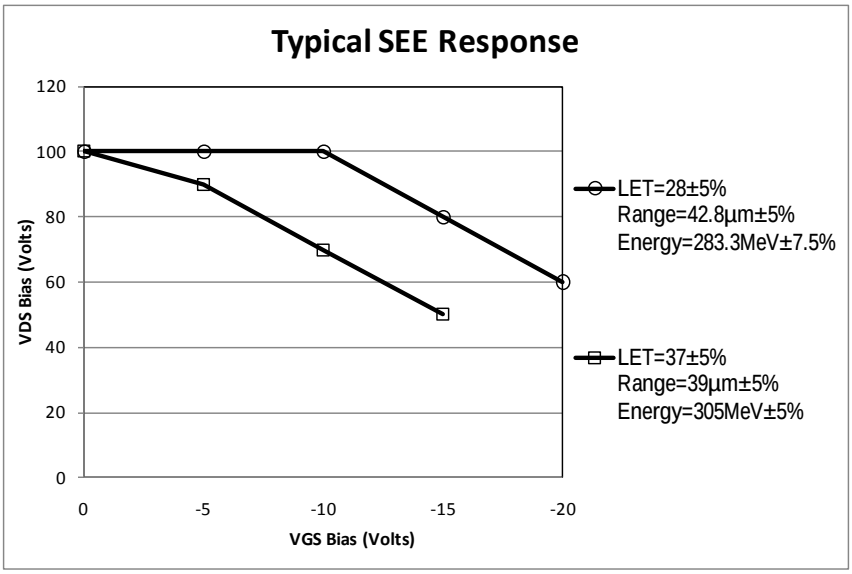
6.8.1 Manufacturer specific irradiation data. Each manufacturer qualified to this slash sheet has characterized its devices to the requirements of MIL-STD-750 method 1080 and as specified herein. Since each manufacturer's characterization conditions can be different and can vary by the version of method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

TABLE IV. Manufacturers characterization conditions.

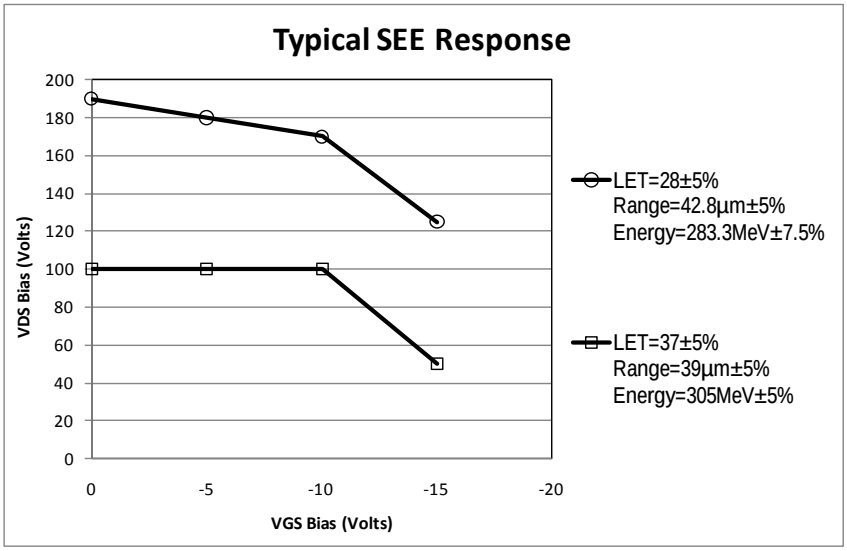
Manufactures cage	Inspection	MIL-STD-750		Sample plan
		Method	Conditions	
69210 (Applicable to devices with a date code of 16 June 1998 and older)	SEE 1/	1080	See MIL-STD-750E method 1080.0 dated 20 November 2006. See figure 6	
	Electrical measurements		I_{GSSF1}, I_{GSSR1}, and I_{DSS1} in accordance with table I, subgroup 2	3 devices
	SEE irradiation:		Fluence = 3E5 ±20 percent ions/cm^2 Flux = 2E3 to 2E4 ions/cm^2/sec, temperature = 25º ±5 °C	
	2N7380, 2N7380U3		Surface LET = 28 MeV-cm^2/mg ±5% range = 42.8 µm ±7.5%, energy = 283.3 MeV ±7.5% In-situ bias conditions: V_{DS} = 100 V and V_{GS} = -10 V V_{DS} = 80 V and V_{GS} = -15 V V_{DS} = 60 V and V_{GS} = -20 V (typical 4.53 MeV/nucleon at Brookhaven National Lab Accelerator)	
	2N7381		In-situ bias conditions: V_{DS} = 190 V and V_{GS} = 0 V V_{DS} = 180 V and V_{GS} = -5 V V_{DS} = 170 V and V_{GS} = -10 V V_{DS} = 125 V and V_{GS} = -15 V (nominal 4.53 MeV/nucleon at Brookhaven National Lab Accelerator)	
	2N7380, 2N7380U3		Surface LET = 37 MeV-cm^2/mg ±5%, range = 39 µm ±5%, energy = 305 MeV ±5% In-situ bias conditions: V_{DS} = 100 V and V_{GS} = 0 V V_{DS} = 90 V and V_{GS} = -5 V V_{DS} = 70 V and V_{GS} = -10 V V_{DS} = 50 V and V_{GS} = -15 V (typical 3.77 MeV/nucleon at Brookhaven National Lab Accelerator)	
	2N7381		In-situ bias conditions: V_{DS} = 100 V and V_{GS} = -10 V V_{DS} = 50 V and V_{GS} = -15 V (typical 3.77 MeV/nucleon at Brookhaven National Lab Accelerator)	
	Electrical measurements		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.

2N7380, 2N7380U3



2N7381



* FIGURE 6. Single event effects safe operating area graphs.

6.9 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

Review activities:
Army - SM
Navy - AS, MC, OS
Air Force - 19, 99

Preparing activity:
DLA - CC

(Project 5961-2015-068)

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.