INCH-POUND

MIL-PRF-19500/699
15 September 2001

PERFORMANCE SPECIFICATION

SEMICONDUCTOR DEVICE, FIELD EFFECT RADIATION HARDENED
(TOTAL DOSE AND SINGLE EVENT EFFECTS) TRANSISTOR, N-CHANNEL
SILICON TYPES 2N7527U3, 2N7528U3, AND 2N7529U3
JANTXVD, R AND JANSD, R

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

1. SCOPE

1.1 Scope. This specification covers the performance requirements for a N-Channel, enhancement-mode, MOSFET, radiation hardened (total dose and Single Event Effects (SEE) characterization), power transistor. Two levels of product assurance are provided for each device type as specified in MIL-PRF-19500.

1.2 Physical dimensions. See figure 1 (surface mount, U3 (SMD.5)).

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

Type	P_T T_C = +25°C	V_{DS}	V_{DG}	V_{GS}	I_{D1} (1) T_C =+25°C	I_{D2} (1) T_C = +100°C	I_S (1)	I_{DM}	T_J and T_{STG}	V_{ISO} 70,000 ft. altitude
	W	V dc	V dc	V dc	A dc	A dc	A dc	A (pk)	°C	V dc
2N7527U3	42 (2)	100	100	±30	20	19	20	80	-55 to +150	N/A
2N7528U3	42 (2)	200	200	±30	12	7	12	40	-55 to +150	N/A
2N7529U3	42 (2)	250	250	±30	9	6	9	32	-55 to +150	250

(1) $I_D = ((T_{jmax} - T_C)/((R_{\theta JC})X (r_{DS(on)} \text{ at } T_{jmax})))^{1/2}$.
(2) Derate linearly 0.20 W/°C for T_C > +25°C; $P_T = (T_{jmax} - T_C)/R_{\theta JC}$.

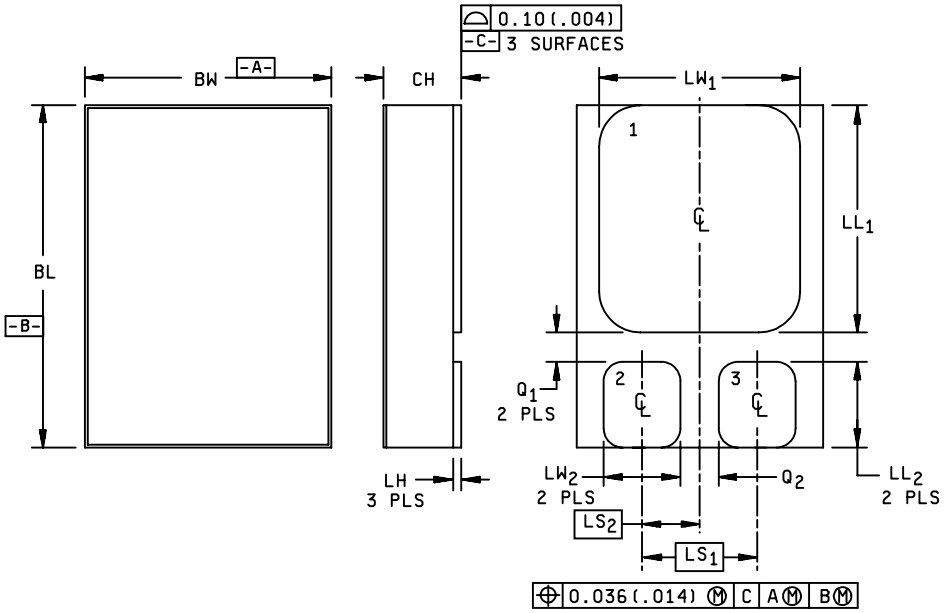
1.4 Primary electrical characteristics at T_C = +25°C.

Type	Min $V_{(BR)DSS}$ V_{GS} = 0 I_D = 1.0 mA dc	$V_{GS(TH)1}$ $V_{DS} = V_{GS}$ I_D = 1.0 mA dc	Max I_{DSS1} V_{GS} = 0 V_{GS} = 80 percent of rated V_{DS}	Max $r_{DS(on)}$ (1) V_{GS} = 12V		$R_{\theta JC}$ Max	I_{AS}
				T_J = +25°C at I_{D2}	T_J = +125°C at I_{D2}		
	V dc	V dc Min Max	µA dc	Ω	Ω	°C/W	A (pk)
2N7527U3	100	2.0 4.5	25	0.048	0.083	1.67	54
2N7528U3	200			0.150	0.285		36
2N7529U3	250			0.225	0.432		30

(1) Pulsed (see 4.5.1).

Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: Defense Supply Center, Columbus, ATTN: DSCC-VAC, P.O. Box 3990, Columbus, OH 43216-5000, by using the Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document or by letter.

AMSC N/A FSC 5961



Symbol	Dimensions			
	Inches		Millimeters	
	Min	Max	Min	Max
BL	0.395	0.405	10.04	10.28
BW	0.291	0.301	7.40	7.64
CH	0.1085	0.1205	2.76	3.06
LH	0.010	0.020	0.25	0.51
LW1	0.281	0.291	7.14	7.41
LW2	0.090	0.100	2.29	2.54
LL1	0.220	0.230	5.59	5.84
LL2	0.115	0.125	2.93	3.17
LS1	0.150 BSC		3.81 BSC	
LS2	0.075 BSC		1.91 BSC	
Q1	0.030		0.762	
Q2	0.030		0.762	
TERM 1	Drain			
TERM 2	Gate			
TERM 3	Source			

NOTES:
1. Dimensions are in inches.
2. Metric equivalents are given for general information only.
3. Dimensions and tolerancing shall be in accordance with ANSI Y14.5M-1982.
4. Terminal 1 – Drain, Terminal 2 – Gate, Terminal 3 – Source

FIGURE 1. Physical dimensions for SMD.5.

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 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 listed in the issue of the Department of Defense Index of Specifications and Standards (DoDISS) and supplement thereto, cited in the solicitation (see 6.2).

SPECIFICATION

DEPARTMENT OF DEFENSE

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

STANDARD

DEPARTMENT OF DEFENSE

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

(Unless otherwise indicated, copies of the above specifications, standards, and handbooks are available from the Document Automation and Production Services (DAPS), Building 4D (DPM-DODSSP), 700 Robbins Avenue, Philadelphia, PA 19111-5094.)

2.3 Order of precedence. 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 requirements for acquiring the product described herein shall consist of this document and MIL-PRF-19500.

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. The interface and physical dimensions shall be as specified in MIL-PRF-19500 and on figure 1 (U3, surface mount) 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 Lead material. Nominal weight percent of lead material shall be 99.80 percent copper (Cu) and 0.20 percent zirconium (Zr).

3.5 Electrostatic discharge protection. The devices covered by this specification require electrostatic discharge protection.

3.5.1 Handling. MOS devices must be handled with certain precautions to avoid damage due to the accumulation of static charge. However, the following handling practices are recommended (see 3.5).

a. Devices should be handled on benches with conductive handling devices.

b. Ground test equipment, tools, and personnel handling devices.

c. Do not handle devices by the leads.

d. Store devices in conductive foam or carriers.

e. Avoid use of plastic, rubber, or silk in MOS areas.

f. Maintain relative humidity above 50 percent if practical.

g. Care should be exercised during test and troubleshooting to apply not more than maximum rated voltage to any lead.

h. Gate must be terminated to source, $R \leq 100$ k, whenever bias voltage is to be applied drain to source.

3.6 Electrical performance characteristics. Unless otherwise specified herein, the electrical performance characteristics are as specified in 1.3, 1.4, and table I herein.

3.7 Electrical test requirements. The electrical test requirements shall be the subgroups specified in table I herein.

3.8 Marking. Marking shall be in accordance with MIL-PRF-19500. At the option of the manufacturer, marking of the country of origin may be omitted from the body of the transistor, but shall be retained on the initial container.

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 inspection. Group E inspection shall be conducted in accordance with MIL-PRF-19500 and table III herein. End-point electrical measurements shall be in accordance with the applicable tests of table I, group A, subgroup 2 herein.

4.2.1.1 SEE. Design capability shall be tested on the initial qualification and thereafter whenever a major die design or process change is introduced. See the design safe operation area figures herein.

4.3 Screening. Screening shall be in accordance with table 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 IV of MIL-PRF-19500)	Measurement	
	JANS	JANTXV
(1)	Method 3470 of MIL-STD-750, E_{AS} test (see 4.5.4).	Method 3470 of MIL-STD-750, E_{AS} test (see 4.5.4).
(1)	Method 3161 of MIL-STD-750, (see 4.5.3).	Method 3161 of MIL-STD-750, (see 4.5.3).
(1)	Gate stress test (see 4.5.5).	Gate stress test (see 4.5.5).
(2)	Subgroup 2 of table I herein.	Subgroup 2 of table I herein.
9	I_{GSS}, I_{DSS1} as a minimum.	I_{GSS}, I_{DSS1} as a minimum.
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}, $r_{DS(ON)}$, $V_{GS(TH)}$ 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}, $r_{DS(ON)}$, $V_{GS(TH)}$ Subgroup 2 of table I herein.
12	Method 1042 of MIL-STD-750, test condition A, 240 hours minimum.	Method 1042 of MIL-STD-750, test condition A, 160 hours minimum.
13	Subgroups 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} = ±25µA 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 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} = ±25µA 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.

(1) Shall be performed anytime before screen 10.
(2) Shall be performed after E_{AS} test, method 3161, and gate stress test.

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 figure 4 of MIL-PRF-19500.

4.4.1 Group A inspection. Group A inspection shall be conducted in accordance with table V of MIL-PRF-19500 and table I herein.

4.4.2 Group B inspection. Group B inspection shall be conducted in accordance with the conditions specified for subgroup testing in table VIa (JANS) and in table VIb (JANTXV) of MIL-PRF-19500, and 4.4.2.1 and 4.4.2.2 herein. Electrical measurements (end-points) shall be in accordance with table 1, group A, subgroup 2 herein. Delta V_{SD} measurements shall be in accordance with table IV herein (JANS only).

4.4.2.1 Group B inspection, table VIa (JANS) of MIL-PRF-19500.

Subgroup	Method	Condition
B3	1051	Test condition F or G, 100 cycles.
B4	1042	Intermittent operation life, condition D, 2,000 cycles. No heat sink or forced-air cooling on the device shall be permitted during the on cycle. T_{on} = 30 seconds minimum.
B5	1042	Accelerated steady-state reverse bias, condition A.
B5	1042	Accelerated steady-state gate bias, condition B.
B5	2037	Bond strength (Al – Au die interconnects only), test condition A.
B6	3161	Thermal resistance, see 4.5.2.

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

Subgroup	Method	Condition
B3	1042	Intermittent operation life, condition D, 2,000 cycles. No heat sink or forced-air cooling on the device shall be permitted during the on cycle. T_{on} = 30 seconds minimum.
B5	3161	Thermal resistance, see 4.5.2.

4.4.3 Group C inspection. Group C inspection shall be conducted in accordance with the conditions specified for subgroup testing in table VII of MIL-PRF-19500 and as follows. Electrical measurements (end-points) shall be in accordance with table 1, group A, subgroup 2 herein. Delta V_{SD} measurements shall be in accordance with table IV herein.

Subgroup	Method	Condition
C2	2036	Terminal strength, test condition E, weight = 8 ounces., 3 arcs.
C6	1042	Intermittent operation life, condition D, 6,000 cycles. No heat sink or forced-air cooling on the device shall be permitted during the on cycle. T_{on} = 30 seconds minimum.

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

4.4.4.1 Design parameters. Not tested on a per lot basis. Design shall be such that the devices shall be capable of meeting the requirements herein.

4.5 Methods of inspection. Methods of inspection shall be as specified in the appropriate tables and as follows.

4.5.1 Pulse measurements. Conditions for pulse measurement shall be as specified in section 4 of MIL-STD-750.

4.5.2 Thermal resistance. Thermal resistance measurements shall be performed in accordance with method 3161 of MIL-STD-750. The maximum limit of $R_{\theta JC}$ = 5.0°C/W. The following parameters shall apply:

a. Measuring current(I_M)..... 10 mA.

b. Drain heating current (I_H)..... 1 A.

c. Heating time (t_H)..... Steady-state (see method 3161 of MIL-STD-750).

d. Drain-source heating voltage (V_H)..... 25 V.

e. Measurement time delay (t_{MD})..... 30 to 60 µs.

f. Sample window time (t_{SW})..... 10 µs maximum.

4.5.3 Thermal response (V_{SD} measurement). The delta V_{SD} measurement shall be performed in accordance with method 3161 of MIL-STD-750. The delta V_{SD} conditions (I_H and V_H) and maximum limit shall be derived by each vendor from the thermal response curves (see figure 2) and shall be specified in the certificate of conformance prior to qualification. The following parameter measurements shall apply:

a. Measuring current (IM)..... 10 mA.

b. Drain heating current (I_H)..... 1 A.

c. Heating time (t_H)..... 10 ms.

d. Drain-source heating voltage (V_H)..... 25 V.

e. Measurement time delay (t_{MD})..... 30 - 60 µs.

f. Sample window time (t_{SW})..... 10 µs maximum.

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

a. I_{AS} shall be as specified in 1.4.

b. L = 0.1 mH.

c. Gate to source resistor ($25 \leq R_{GS} \leq 200\Omega$).

d. $E_{AS} = 1/2\ LI_{AS}^2$.

e. V_{DD} = 50 V to 150 V dc.

f. Initial junction temperature = +25°C, -5°C, +10°C.

4.5.5 Gate stress test.

a. V_{GS} = 45 V.

b. t = 250 µs, minimum.

TABLE I. Group A inspection.

Inspection 1/	MIL-STD-750		Symbol	Limits		Units
	Method	Conditions		Min	Max	
Subgroup 1						
Visual and mechanical inspection	2071					
Subgroup 2						
Breakdown voltage drain to source	3407	V_{GS} = 0V, I_D = 1 mA dc, bias condition C	$V_{(BR)DSS}$			
2N7527U3				100		V dc
2N7528U3				200		V dc
2N7529U3				250		V dc
Gate to source voltage (threshold)	3403	V_{DS} = V_{GS}, I_D = 1 mA dc	$V_{GS(TH)1}$	2.0	4.5	V dc
Gate current	3411	V_{GS} = ±30V dc, bias condition C, V_{DS} = 0V	I_{GSS1}		±100	nA dc
Drain current	3413	V_{GS} = 0V dc, bias condition C, V_{DS} = 80 percent of rated V_{DS}	I_{DSS1}		25	µA dc
Static drain to source "ON" state resistance	3421	V_{GS} = 12V dc, condition A, pulsed (see 4.5.1), I_D = I_{D2}	$r_{DS(ON)1}$			
2N7527U3					0.048	Ω
2N7528U3					0.150	Ω
2N7529U3					0.225	Ω
Static drain to source "ON" state voltage	3405	V_{GS} = 12V dc, condition A, pulsed (see 4.5.1), I_D = I_{D1}	$V_{DS(ON)}$			
2N7527U3					0.980	V dc
2N7528U3					1.86	V dc
2N7529U3					2.07	V dc
Forward voltage	4011	V_{GS} = 0V dc, condition A, pulsed (see 4.5.1), I_D = I_{D1}	V_{SD}		1.2	V dc

See footnote at end of table.

TABLE I. Group A inspection - Continued.

Inspection 1/	MIL-STD-750		Symbol	Limits		Units
	Method	Conditions		Min	Max	
Subgroup 3						
High temperature operation		$T_C = T_J = +125°C$				
Gate current	3411	$V_{GS} = \pm 30V$ dc, bias condition C, $V_{DS} = 0V$	I_{GSS2}		±200	nA dc
Drain current	3413	$V_{GS} = 0V$ dc, bias condition C, V_{DS} = 80 percent of rated V_{DS}	I_{DSS2}		0.250	mA dc
Static drain to source "ON"-state resistance	3421	V_{GS} = 12V dc, condition A, pulsed (see 4.5.1), $I_D = I_{D2}$	$r_{DS(ON)2}$			
2N7527U3					0.083	Ω
2N7528U3					0.285	Ω
2N7529U3					0.432	Ω
Gate to source voltage (threshold)	3403	$V_{DS} = V_{GS}$, I_D = 1 mA dc	$V_{GS(TH)2}$	1.0		V dc
Low temperature operation		$T_C = T_J = -55°C$				
Gate to source voltage (threshold)	3472	$V_{DS} = V_{GS}$, I_D = 1 mA dc	$V_{GS(TH)3}$		5.5	V dc
Subgroup 4						
Switching time test		$I_D = I_{D1}$, V_{GS} = 12 V dc, R_G = 7.5 Ω, V_{DD} = 50 percent of rated V_{DS}				
Turn-on delay time			$t_{D(on)}$		20	ns
Rise time			t_R			
2N7527U3					30	ns
2N7528U3					25	ns
2N7529U3					25	ns
Turn-off delay time			$t_{D(off)}$			
2N7527U3					35	ns
2N7528U3					30	ns
2N7529U3					30	ns
Fall time			t_f		15	ns

See footnote at end of table.

TABLE I. Group A inspection - Continued.

Inspection 1/	MIL-STD-750		Symbol	Limits		Units
	Method	Conditions		Min	Max	
Subgroup 5						
Safe operating area test (high voltage)	3474	See figure 3, t_p = 10 ms min. V_{DS} = 80 percent of max. rated V_{DS} ($V_{DS} \leq 200$ V)				
Electrical measurements		See table I, group A, subgroup 2				
Subgroup 6						
Not applicable						
Subgroup 7						
Gate charge	3471	Condition A or B				
On-state gate charge			$Q_{G(ON)}$			
2N7527U3					35	nC
2N7528U3					28	nC
2N7529U3					28	nC
Gate to source charge			Q_{GS}			
2N7527U3					13	nC
2N7528U3					12	nC
2N7529U3					12	nC
Gate to drain charge			Q_{GD}			
2N7527U3					12	nC
2N7528U3					10	nC
2N7529U3					10	nC
Reverse recovery time	3473	di/dt = 100 A/µs, $V_{DD} \leq 50$ V, $I_D = I_{D1}$	t_{rr}			
2N7527U3					220	ns
2N7528U3					210	ns
2N7529U3					310	ns

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

TABLE II. Group D inspection.

Inspection 1/ 2/ 3/ 4/ 5/	MIL-STD-750		Symbol	Pre-irradiation limits		Post irradiation limits		Units
	Method	Conditions		Min.	Max.	Min.	Max.	
Subgroup 1								
Not applicable								
Subgroup 2		T_C = +25°C						
Steady-state total dose irradiation (V_{GS} bias)	1019	V_{GS} = 12V, V_{DS} = 0V						
Steady-state total dose irradiation (V_{DS} bias)	1019	V_{GS} = 0V, V_{DS} = 80 percent of rated V_{DS}						
Breakdown voltage drain to source	3407	V_{GS} = 0V, I_D = 1 mA dc, bias condition C	$V_{(BR)DSS}$					
2N7527U3				100		100		V dc
2N7528U3				200		200		V dc
2N7529U3				250		250		V dc
Gate to source voltage (threshold)	3403	V_{DS} = V_{GS}, I_D = 1 mA dc	$V_{GS(TH)1}$	2.0	4.5	2.0	4.5	V dc
Gate current	3411	V_{GS} = ±30V dc, V_{DS} = 0V, bias condition C	I_{GSS1}		±100		±100	nA dc
Drain current	3413	V_{GS} = 0V, V_{DS} = 80 percent of rated V_{DS}, bias condition C	I_{DSS1}		25		25	µA dc
Static drain to source "ON"-state resistance	3421	V_{GS} =12V dc, condition A, pulsed (see 4.5.1), I_D = I_{D2}	$r_{DS(ON)1}$					
2N7527U3					0.048		0.048	Ω
2N7528U3					0.150		0.150	Ω
2N7529U3					0.225		0.225	Ω
Static drain to source "ON"-state voltage	3405	V_{GS} = 12V dc, condition A, pulsed (see 4.5.1), I_D = I_{D1}	$V_{DS(ON)}$					
2N7527U3					0.980		0.980	Ω
2N7528U3					1.86		1.86	Ω
2N7529U3					2.07		2.07	Ω

1/ For sampling plan see MIL-PRF-19500
2/ Electrical specifications are for 'D' and 'R' rad levels.
3/ Group D qualification may be performed prior to lot formation. Wafers qualified to these group D QCI requirements may be used for any other performance specification utilizing the same die design.
4/ Separate samples shall be pulled for each bias.
5/ At the manufacturer's option, group D samples need not be subjected to all the screening tests, but shall be assembled in its qualified package or in any qualified package that the manufacturer has data to correlate the performance to the designated package.

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

Inspection 1/ 2/ 3/ 4/ 5/	MIL-STD-750		Qualification and large lot conformance inspection
	Method	Conditions	
Subgroup 1			12 devices c = 0
Temperature cycling (air to air)	1051	Test condition F or G, 500 cycles	
Hermetic seal Fine leak Gross leak	1071		
Electrical measurements		See table I, group A, subgroup 2	
Subgroup 2 1/			12 devices c = 0
Steady-state gate bias	1042	Test condition B; 1,000 hours	
Electrical measurements		See table I, group A, subgroup 2	
Steady-state reverse bias	1042	Test condition A; 1,000 hours	
Electrical measurements		See table I, group A, subgroup 2	
Subgroup 3			
Not applicable			
Subgroup 4			22 devices c = 0
Thermal resistance	3161	$R_{\theta JC}$ = 1.67°C/W maximum. See 4.5.2.	
Subgroup 5			15 devices c = 0
Barometric pressure test (not required for $V_{BR(DSS)} \leq 200$ V)	1001	Test condition C	
2N7529U3		V_{DS} = 250 V; $I_{(ISO)}$ < 0.25 mA	

See footnotes at end of table.

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

Inspection 1/ 2/ 3/ 4/ 5/	MIL-STD-750		Qualification and large lot conformance inspection
	Method	Conditions	
Subgroup 6			3 devices 5/ c = 0
Electrical measurements 3/		I_{GSS1} and I_{DSS1} in accordance with table I, group A, subgroup 2	
SEE testing 4/	1080	Fluence = 3e5 ± 20 percent ions/cm^2 Flux = 5e3 to 2e4 ions/cm^{2}sec Beam energy = 260 to 360 MeV Temperature = 25°C ± 5°C See figure 4 for reference only	
2N7527U3		LET = 36 to 40 MeV-cm^2/mg Ion range = 35 to 40 microns Insitu bias conditions: V_{DS} = 100 V and V_{GS} = -10 V LET = 56 to 60 MeV-cm^2/mg Ion range = 30 to 35 microns Insitu bias conditions: V_{DS} = 100 V and V_{GS} = -5 V V_{DS} = 50 V and V_{GS} = -8 V LET = 80 to 84 MeV-cm^2/mg Ion range = 25 to 30 microns Insitu bias conditions: V_{DS} = 80 V and V_{GS} = 0 V V_{DS} = 50 V and V_{GS} = -5 V	
2N7528U3		LET = 36 to 40 MeV-cm^2/mg Ion range = 35 to 40 microns Insitu bias conditions: V_{DS} = 200 V and V_{GS} = -20 V LET = 56 to 60 MeV-cm^2/mg Ion range = 30 to 35 microns Insitu bias conditions: V_{DS} = 200 V and V_{GS} = -10 V LET = 80 to 84 MeV-cm^2/mg Ion range = 25 to 30 microns Insitu bias conditions: V_{DS} = 160 V and V_{GS} = -5 V V_{DS} = 120 V and V_{GS} = -10 V	
2N7529U3		LET = 36 to 40 MeV-cm^2/mg Ion range = 35 to 40 microns Insitu bias conditions: V_{DS} = 250 V and V_{GS} = -20 V LET = 56 to 60 MeV-cm^2/mg Ion range = 30 to 35 microns Insitu bias conditions: V_{DS} = 250 V and V_{GS} = -10 V LET = 80 to 84 MeV-cm^2/mg Ion range = 25 to 30 microns Insitu bias conditions: V_{DS} = 200 V and V_{GS} = -5 V V_{DS} = 150 V and V_{GS} = -10 V	

See footnotes at end of table.

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

Inspection 1/ 2/ 3/ 4/ 5/	MIL-STD-750		Qualification and large lot conformance inspection
	Method	Conditions	
Subgroup 6 - Continued. Electrical measurements 3/ ESD (Electrostatic Discharge Protection)	 1020	 I_{GSS1} and I_{DSS1} in accordance with table I, group A, subgroup 2	3 devices c = 0

1/ A separate sample for each test may be pulled.
2/ Group E qualification of SEE testing may be performed prior to lot formation. Wafers qualified to these group E QCI requirements may be used for any other performance specification utilizing the same die design.
3/ As a minimum, gate to source leakages and drain to source leakage are to be examined to verify the electrical performance of the DUT prior to and after test. At the manufacturer's option, the remaining static tests in table I, group A, subgroup 2.
4/ Devices passing a given combination of drain and gate voltage for an LET of 80 to 84 MeV-cm^2/mg qualify the same conditions for an LET of 56 to 60 MeV-cm^2/mg or an LET of 36 to 40 MeV-cm^2/mg.
5/ This sampling plan applies to each bias condition specified.

TABLE IV. Group B and C delta measurements.

Step	Inspection 1/ 2/	MIL-STD-750		Symbol	Limits		Units
		Method	Conditions		Min	Max	
1.	Thermal response	3161	See 4.5.3	ΔV_{SD}		165	mV

1/ The electrical measurements for table VIa (JANS) of MIL-PRF-19500 are as follows: Subgroup 4, see table IV herein, step 1.
2/ The electrical measurements for table VII of MIL-PRF-19500 are as follows: Subgroup 6, see table IV herein, step 1.

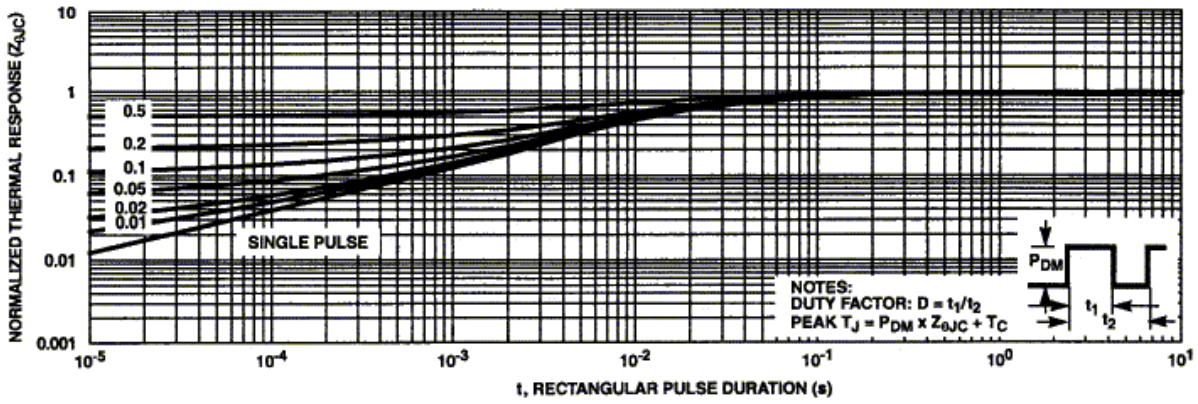


FIGURE 2. Thermal response curves.

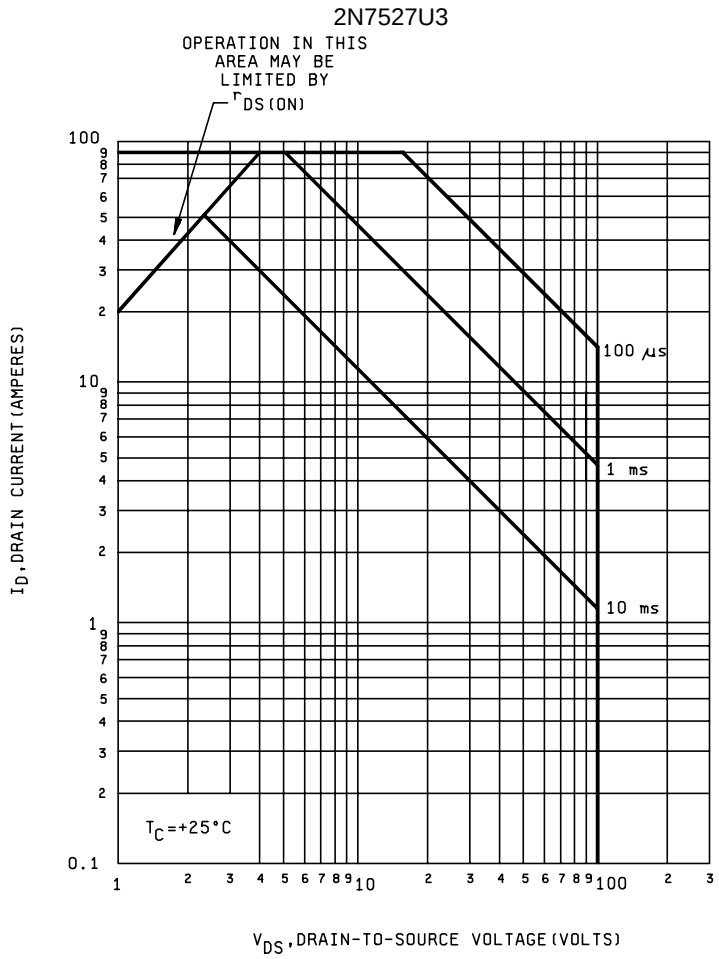


FIGURE 3. Safe operating area graphs.

2N7528U3

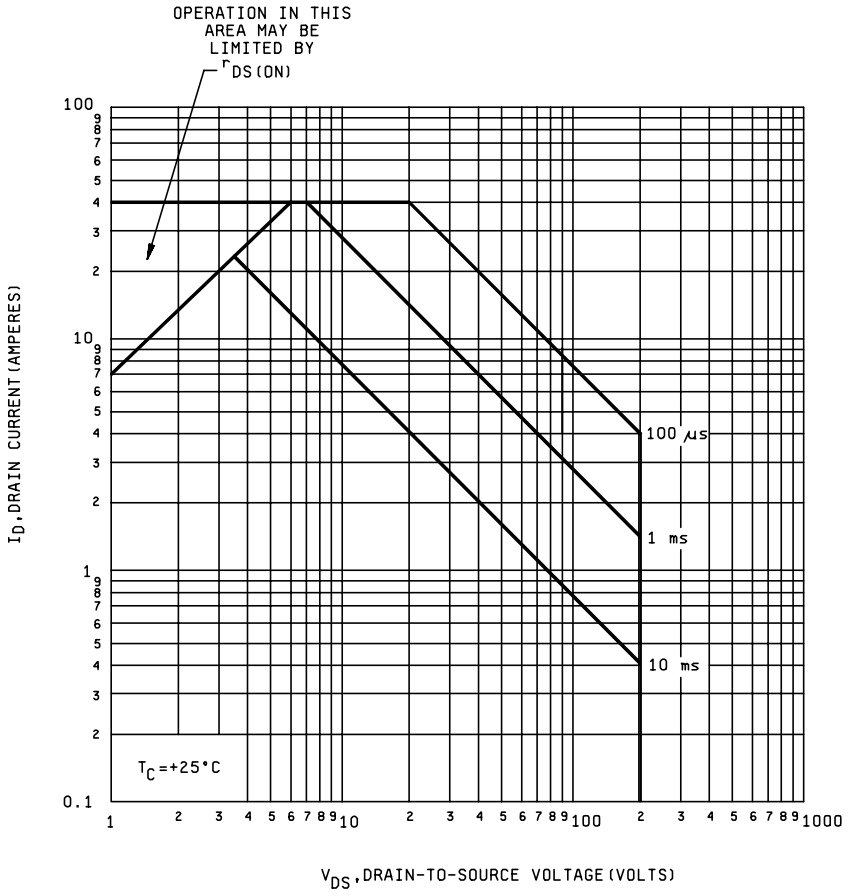


FIGURE 3. Safe operating area graphs - Continued.

2N7529U3

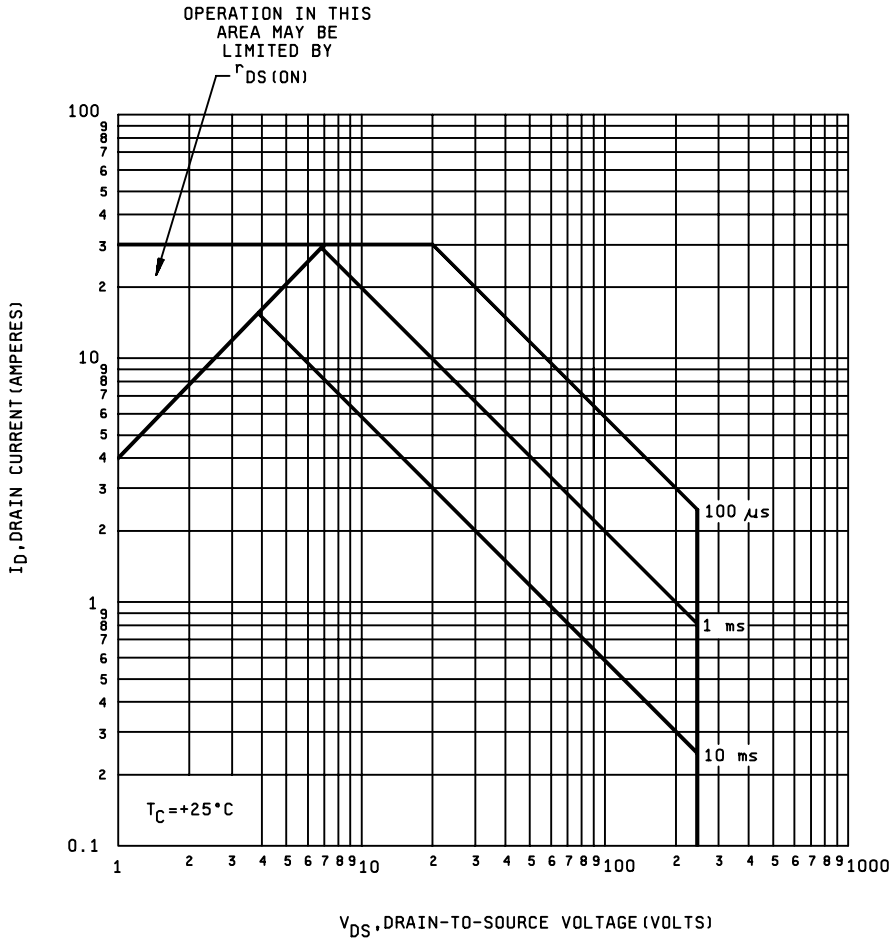


FIGURE 3. Safe operating area graphs - Continued.

2N7527U3

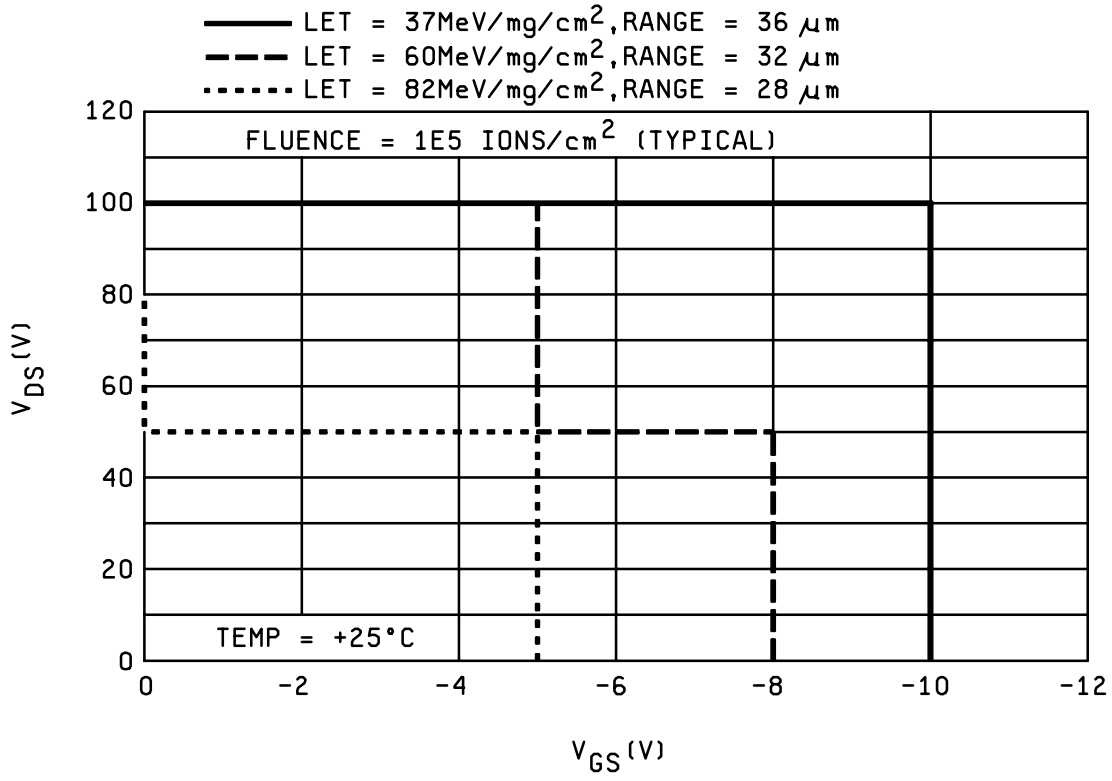


FIGURE 4. SEE safe operating area graphs.

2N7528U3

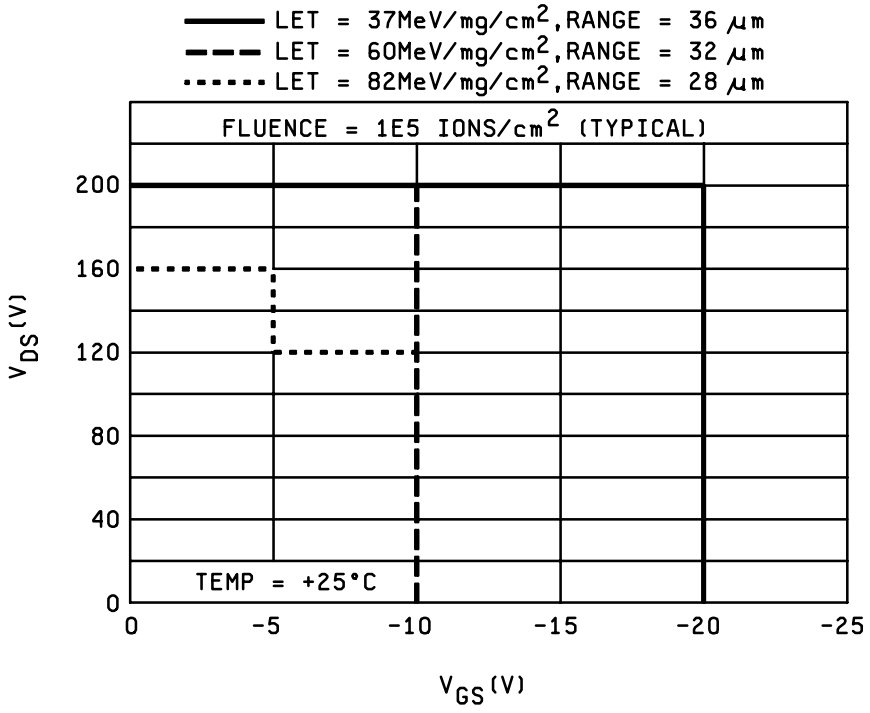


FIGURE 4. SEE safe operating area graphs - Continued.

2N7529U3

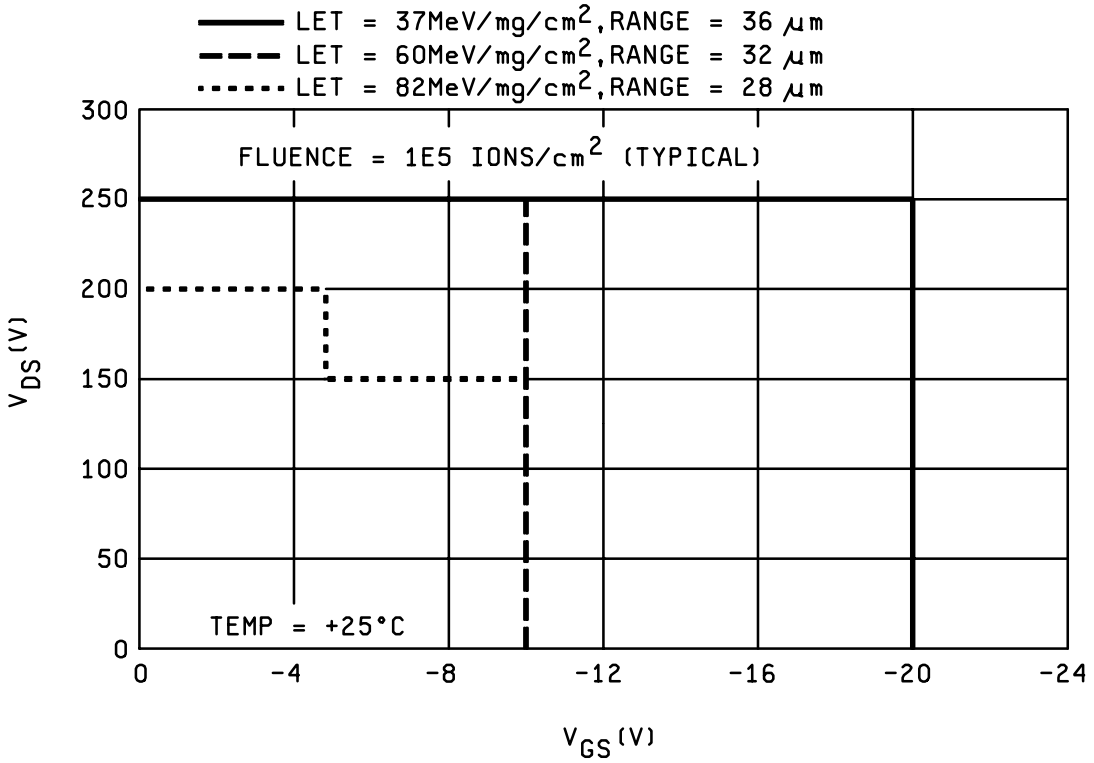


FIGURE 4. SEE safe operating area graphs - Continued.

5. PACKAGING

5.1 Packaging. For acquisition purposes, the packaging requirements shall be as specified in the contract or order (see 6.2). When actual packaging of materiel is to be performed by DoD personnel, these personnel need to contact the responsible packaging activity to ascertain requisite packaging requirements. Packaging requirements are maintained by the Inventory Control Point's packaging activity within the Military Department or Defense Agency, or within the Military Department's System Command. 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.)

6.1 Intended use. The notes specified in MIL-PRF-19500 are applicable to this specification.

6.2 Acquisition requirements. Acquisition documents must specify the following:

a. Title, number, and date of this specification.

b. Issue of DoDISS to be cited in the solicitation and, if required, the specific issue of individual documents referenced (see 2.2.1).

c. Packaging requirements (see 5.1).

d. Lead finish (see 3.4.1).

e. Type designation and product assurance level.

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) 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 Defense Supply Center, Columbus, ATTN: DSCC/VQE, P.O. Box 3990, Columbus, OH 43216-5000.

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

TABLE V. Cross-reference list.

Generic P/N	Military P/N
FSGYE130 FSGYE230 FSGYE234	2N7527U3 2N7528U3 2N7529U3

Custodians:
Army - CR
Navy - NW
Air Force - 11
NASA - NA

Review activities:
Army - AV, MI

Preparing activity:
DLA - CC

(Project 5961-2484)

STANDARDIZATION DOCUMENT IMPROVEMENT PROPOSAL

INSTRUCTIONS

1. The preparing activity must complete blocks 1, 2, 3, and 8. In block 1, both the document number and revision letter should be given.

2. The submitter of this form must complete blocks 4, 5, 6, and 7.

3. The preparing activity must provide a reply within 30 days from receipt of the form.

NOTE: This form may not be used to request copies of documents, nor to request waivers, or clarification of requirements on current contracts. Comments submitted on this form do not constitute or imply authorization to waive any portion of the referenced document(s) or to amend contractual requirements.

I RECOMMEND A CHANGE:	1. DOCUMENT NUMBER MIL-PRF-19500/699	2. DOCUMENT DATE 15 September 2001

3. **DOCUMENT TITLE** SEMICONDUCTOR DEVICE, FIELD EFFECT RADIATION HARDENED (TOTAL DOSE AND SINGLE EVENT EFFECTS) TRANSISTOR, N-CHANNEL SILICON TYPES 2N7527U3, 2N7528U3, AND 2N7529U3 JANTXVD, R AND JANSD, R

4. NATURE OF CHANGE (Identify paragraph number and include proposed rewrite, if possible. Attach extra sheets as needed.)

5. REASON FOR RECOMMENDATION

6. SUBMITTER

a. NAME (Last, First, Middle initial)	b. ORGANIZATION	
c. ADDRESS (Include Zip Code)	d. TELEPHONE (Include Area Code) COMMERCIAL DSN FAX EMAIL	7. DATE SUBMITTED

8. PREPARING ACTIVITY

a. Point of Contact Alan Barone	b. TELEPHONE Commercial DSN FAX EMAIL 614-692-0510 850-0510 614-692-6939 alan.barone@dscc.dla.mil
c. ADDRESS Defense Supply Center, Columbus ATTN: DSCC-VAC P.O. Box 3990 Columbus, OH 43216-5000	IF YOU DO NOT RECEIVE A REPLY WITHIN 45 DAYS, CONTACT: Defense Standardization Program Office (DLSC-LM) 8725 John J. Kingman, Suite 2533, Fort Belvoir, VA 22060-6221 Telephone (703) 767-6888 DSN 427-6888