The documentation and process conversion measures necessary to comply with this document shall be completed by 6 March, 2002.

INCH-POUND
MIL-PRF-19500/700
6 December 2001

PERFORMANCE SPECIFICATION

SEMICONDUCTOR DEVICE, FIELD EFFECT RADIATION HARDENED
(TOTAL DOSE AND SINGLE EVENT EFFECTS) TRANSISTOR, N-CHANNEL,
SILICON TYPES 2N7494U5, 2N7495U5 AND 2N7496U5
JANTXVR, F, G AND H AND JANSR, F, G AND H

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

1.2 Physical dimensions. See figure 1, (surface mount, LCC-18).

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

Type	P_T (1) T_C = +25°C	P_T (1) T_A = +25°C	V_{DS}	V_{DG}	V_{GS}	I_{D1} (2) T_C =+25°C	I_{D2} T_C = +100°C	I_S	I_{DM} (3)	T_J and T_{STG}	V_{ISO} 70,000 ft. altitude
	W	W	V dc	V dc	V dc	A dc	A dc	A dc	A (pk)	°C	V dc
2N7494U5	25	2.5	30	30	±20	12	8	12	48	-55 to +150	N/A
2N7495U5			60	60		11.7	7.4	12	46.8		
2N7496U5			100	100		10	6.5	10	40		

(1) Derate linearly 0.2 W/°C for T_C > +25°C; $P_T = (T_{jmax} - T_C)/R_{\theta JC}$.

(2) $I_D = ((T_{jmax} - T_C)/((R_{\theta JC})X (r_{DS(on)} \text{ at } T_{jmax})))^{1/2}$.

(3) I_{DM} = 4 X I_{D1}; I_{D1} as calculated by footnote (2).

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.

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

Type	Min $V_{(BR)DSS}$ V_{GS} = 0 I_D = 1.0mA dc	$V_{GS(TH)1}$ $V_{DS} \geq V_{GS}$ I_D = 1.0 mA dc		Max I_{DSS1} V_{GS} = 0 V_{DS} = 80% of rated V_{DS}	Max $r_{DS(on)}$ (1) V_{GS} = 12V, $I_D = I_{D2}$		$R_{\theta JC}$ Max	E_{AS}
					T_J = +25°C	T_J = +150°C		
	V dc	V dc Min	V dc Max	µA dc	Ω	Ω	°C/W	mJ
2N7494U5	30				0.070	0.140		350
2N7495U5	60	2.0	4.0	10	0.080	0.160	5.0	320
2N7496U5	100				0.110	0.220		105

(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 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

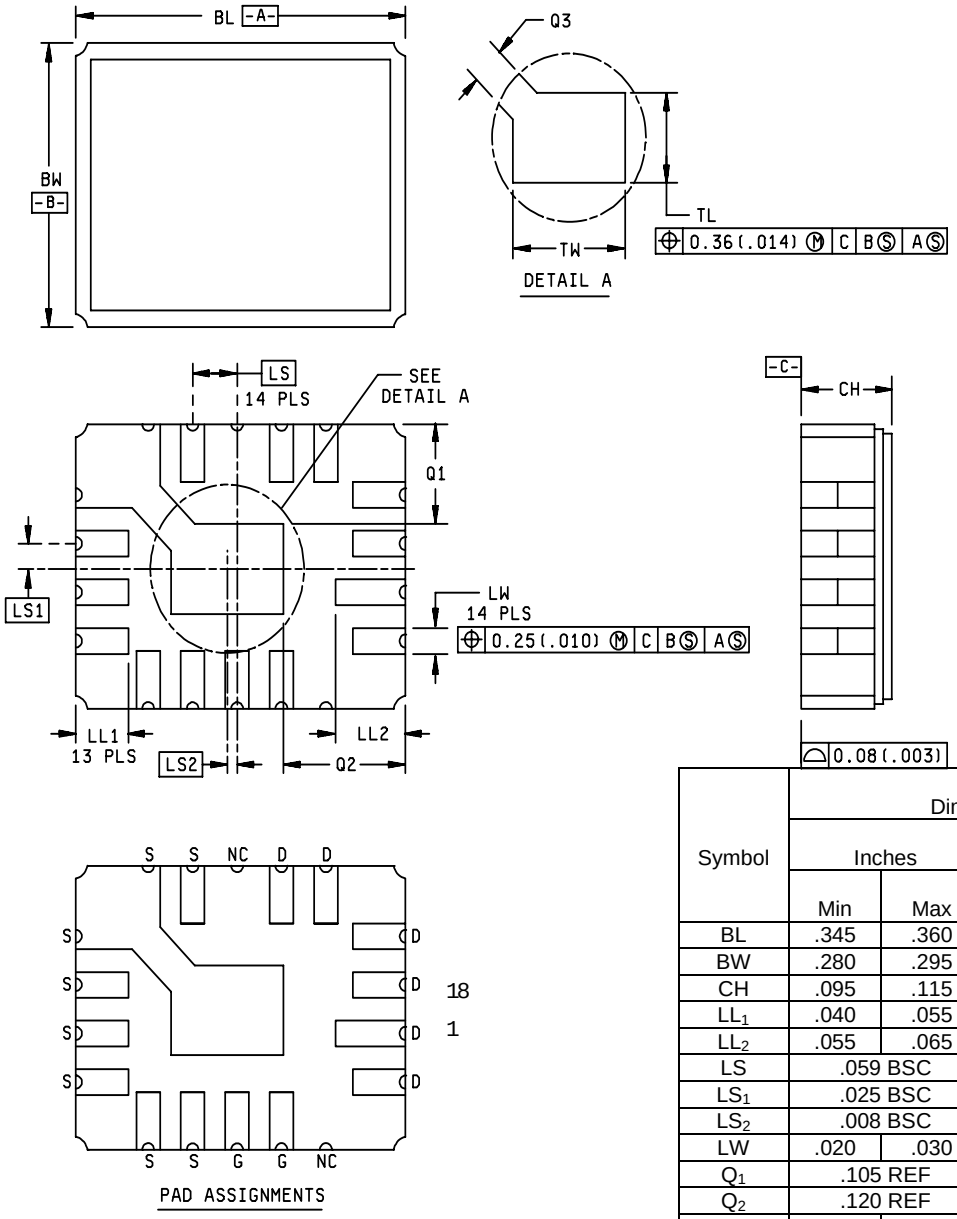
MIL-PRF-19500 - Semiconductor Devices, General Specification for.

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.)



Symbol	Dimensions			
	Inches		Millimeters	
	Min	Max	Min	Max
BL	.345	.360	8.76	9.14
BW	.280	.295	7.11	7.49
CH	.095	.115	2.41	2.92
LL_1	.040	.055	1.02	1.40
LL_2	.055	.065	1.40	1.65
LS	.059 BSC		1.50 BSC	
LS_1	.025 BSC		.635 BSC	
LS_2	.008 BSC		.203 BSC	
LW	.020	.030	0.51	0.76
Q_1	.105 REF		2.67 REF	
Q_2	.120 REF		3.05 REF	
Q_3	.045	.055	1.14	1.40
TL	.070	.080	1.78	2.03
TW	.120	.130	3.05	3.30

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.

FIGURE 1. Physical dimensions for LCC (2N7494U5, 2N7495U5, and 2N7496U5).

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. Interface and physical dimensions shall be as specified in MIL-PRF-19500, and on figure 1 (LCC-18) 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).

3.5 Electrostatic discharge protection. The devices covered by this specification require electrostatic discharge protection (see 6.2).

3.5.1 Handling. Metal oxide semiconductor (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, $R \leq$ or 100 kΩ, whenever bias voltage is applied drain to source.

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

3.7 Electrical test requirements. The electrical test requirements shall be the subgroups as specified in group A, 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).

4.2 Qualification inspection. Qualification inspection shall be in accordance with MIL-PRF-19500. Alternate flow is allowed for qualification inspection in accordance with figure 4 of MIL-PRF-19500.

4.3 Screening (JANS, JANTX, and JANTXV). 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	JANTX and 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, thermal impedance (see 4.5.3)	Method 3161 of MIL-STD 750, thermal impedance (see 4.5.3)
(1)	Gate stress test (see 4.5.5)	Gate stress test (see 4.5.5)
(2) 9	Subgroup 2 of table I herein I_{DSS1} , I_{GSS} as a minimum	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}, $r_{DS(ON)}$, $V_{GS(TH)}$ 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} = ±10 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	Method 1042 of MIL-STD-750, test condition A
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} = ±10 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.	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} = ±10 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.

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

4.4 Conformance inspection. Conformance inspection shall be in accordance with MIL-PRF-19500. Alternate flow is allowed for 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 table VIb (JANTX and JANTXV) of MIL-PRF-19500, and as follows. Electrical measurements (end-points) shall be in accordance with table I, group A, subgroup 2 herein.

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

Subgroup	Method	Condition
3	1051	Test condition G, 100 cycles
3	2077	Scanning electron microscope (SEM).
4	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.
5	1042	Accelerated steady-state gate bias, condition B, V_{GS} = rated; T_A = +175°C, t = 24 hours minimum; or T_A = +150°C, t = 48 hours minimum.
5	1042	Accelerated steady-state reverse bias, condition A, V_{DS} = rated; T_A = +175°C, t = 120 hours minimum; or T_A = +150°C, t = 240 hours minimum.
5	2037	Bond strength (Al-Au die interconnects only), Test condition A
6	3161	Thermal resistance, see 4.5.2.

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

Subgroup	Method	Condition
2	1051	Test condition G, 25 cycles.
3	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.
5 and 6	----	Not applicable.

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 I, group A, subgroup 2 herein.

Subgroup	Method	Condition
2	2036	Terminal strength is not applicable.
6	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.

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.

4.4.5 Group E inspection. Group E inspection shall be conducted in accordance with MIL-PRF-19500, and table III herein.

4.4.5.1 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 figure. End-point measurements shall be in accordance with table III.

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. Drain heating current (I_H)..... 1.39 A.

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

c. Drain-source heating voltage (V_H)..... 12 V.

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

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

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

4.5.3 Thermal response ($Z_{\theta JC}$ measurement). The $Z_{\theta JC}$ measurement (or equivalent ΔV_{SD} measurement) shall be performed in accordance with method 3161 of MIL-STD-750. The maximum limit (not to exceed figure 2, thermal impedance curves and the group A, subgroup 2 limits) for $Z_{\theta JC}$ in screening (table IV of MIL-PRF-19500) shall be derived by each vendor by means of statistical process control. When the process has exhibited control and capability, the capability data shall be used to establish the fixed limit. In addition to screening, once a fixed limit has been established, monitor all future sealing lots using a random five piece sample from each lot, to be plotted on the applicable X and R chart. If a lot exhibits an out of control condition, the entire lot shall be removed from the line and held for engineering evaluation and disposition. This procedure may be used in lieu of an in line process monitor.

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

b. Drain heating current (I_H)..... 1.39 A.

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

d. Drain-source heating voltage (V_H)..... 12 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. Peak current, $I_{AS} = I_{D1}$.

b. Inductance, $L = (2*E_{AS}/(I_{D1})^2)*((V_{BR}-V_{DD})/V_{BR})$ mH minimum.

c. Gate to source resistor, R_{GS}: 25 Ω ≤ R_{GS} ≤ 200 Ω.

d. Supply voltage, V_{DD} = 25 V dc, except V_{DD} = 50 V dc for 2N7496U5.

e. Initial case temperature, T_C = +25° C, -5° C, +10° C.

f. Gate voltage, V_{GS} = 12 V dc.

g. Number of pulses to be applied: 1 pulse minimum.

4.5.5 Gate stress test.

a. V_{GS} = 24 V, minimum.

b. t = 250 µS, minimum.

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 4.5.3	$Z_{\theta JC}$	1.34		°C/W
Breakdown voltage drain to source	3407	V_{GS} = 0V, I_D = 1 mA dc, Bias condition C	$V_{(BR)DSS}$			
2N7494U5				30		V dc
2N7495U5				60		V dc
2N7496U5				100		V dc
Gate to source voltage (threshold)	3403	$V_{DS} \geq V_{GS}$, I_D = 1 mA dc	$V_{GS(TH)1}$	2.0	4.0	V dc
Gate current	3411	V_{GS} = ±20V 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}		10	µA dc
Static drain to source "ON" state resistance	3421	V_{GS} = 12V dc, condition A, pulsed (see 4.5.1), $I_D = I_{D2}$	$r_{DS(ON)1}$			
2N7494U5					0.070	Ω
2N7495U5					0.080	Ω
2N7496U5					0.110	Ω
Forward voltage	4011	V_{GS} = 0V dc, condition A, pulsed (see 4.5.1), $I_D = I_{D1}$	V_{SD}		1.8	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		$T_C = T_J = +125°C$				
Gate current	3411	$V_{GS} = \pm 20V$ 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}		25	µA dc
Static drain to source "ON"-state resistance	3421	$V_{GS} = 12V$ dc, condition A, pulsed (see 4.5.1), $I_D = I_{D2}$	$r_{DS(ON)3}$			
2N7494U5					0.140	Ω
2N7495U5					0.160	Ω
2N7496U5					0.220	Ω
Gate to source voltage (threshold)	3403	$V_{DS} \geq V_{GS}$, $I_D = 1$ mA dc	$V_{GS(TH)2}$	1.0		V dc
Low temperature operation		$T_C = T_J = -55°C$				
Gate to source voltage (threshold)	3403	$V_{DS} \geq V_{GS(TH)3}$, $I_D = 1$ mA dc	$V_{GS(TH)3}$		5.0	V dc
Subgroup 4						
Forward Transconductance	3475	$I_D = I_{D2}$, $V_{DD} = 15$ V dc (See 4.5.1)	g_{FS}			
2N7494U5				8.0		S
2N7495U5				7.0		S
2N7496U5				5.0		S
Switching time test	3472	$I_D = I_{D2}$, $V_{GS} = 12$ V dc, $R_G = 2.35\ \Omega$, V_{DD} = 50 percent of rated V_{DS}				
Turn-on delay time			$t_{D(on)}$		25	ns
Rise time			t_r		100	ns
Turn-off delay time			$t_{D(off)}$		35	ns
Fall time			t_f		30	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 5						
Safe operating area test (high voltage)	3474	See figures 3, 4, 5 and 6 t_p = 10 ms min. V_{DS} = 80 percent of max. rated V_{DS}				
Electrical measurements		See table I, group A, subgroup 2				
Subgroup 6						
Not applicable						
Subgroup 7						
Gate charge	3471	Condition B. $I_D = I_{D2}$, V_{GS} = 12 V dc V_{DD} = 50 percent of rated V_{DS}				
On-state gate charge			$Q_{G(ON)}$			
2N7494U5					65	nC
2N7495U5					45	nC
2N7496U5					50	nC
Gate to source charge			Q_{GS}			
2N7494U5					20	nC
2N7495U5					15	nC
2N7496U5					7.4	nC
Gate to drain charge			Q_{GD}			
2N7494U5					10	nC
2N7495U5					20	nC
2N7496U5					20	nC
Reverse recovery time	3473	di/dt = -100 A/µs, $V_{DD} \leq$ 50 V $I_D = I_{D2}$	t_{rr}			
2N7494U5					102	ns
2N7495U5					125	ns
2N7496U5					200	ns

1/ For sampling plan, see MIL-PRF-19500.
2/ This test required for the following endpoint measurements only:
Group B Subgroups 2 and 3 (JANTX/JANTXV).
Group B Subgroups 3 and 4 (JANS).
Group C, subgroup 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
				R, F, G and H		R, F and G		H 4/		
	Method	Conditions		Min	Max	Min	Max	Min	Max	
Subgroup 1										
Not applicable										
Subgroup 2		T_C = + 25°C								
Steady-state total dose irradiation (VGS bias) 5/	1019	V_{GS} = 12 V; V_{DS} = 0 V								
Steady-state total dose irradiation (VDS bias) 5/	1019	V_{GS} = 0 V; V_{DS} = 80 percent of rated V_{DS}(preirradiation)								
End-point electricals										
Breakdown voltage, drain to source	3407	V_{GS} = 0 V; I_D = 1 mA; Bias condition C	$V_{(BR)DSS}$							
2N7494U5				30		30		30		V dc
2N7495U5				60		60		60		V dc
2N7496U5				100		100		100		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	2.0	4.0	1.5	4.0	V dc
Gate current	3411	V_{GS} = +20 V; V_{DS} = 0 V bias condition C	I_{GSSF1}		100		100		100	nA dc
Gate current	3411	V_{GS} = -20 V; V_{DS} = 0 V bias condition C	I_{GSSR1}		-100		-100		-100	nA dc
Drain current	3413	V_{GS} = 0 V V_{DS} = 80 percent of rated V_{DS} (preirradiation) bias condition C	I_{DSS}		10		10		10	µA dc
Static drain to source on-state voltage	3405	V_{GS} = 12 V; I_D = I_{D2} Condition A pulsed (see 4.5.1)	$V_{DS(on)}$							
2N7494U5					0.192		0.192		0.240	V dc
2N7495U5					0.252		0.252		0.318	V dc
2N7496U5					0.416		0.416		0.520	V dc
Forward voltage source drain diode	4011	V_{GS} = 0 V; I_D = I_{D1} Bias condition C	V_{SD}		1.8		1.8		1.8	V dc

See footnotes at end of table.

TABLE II. Group D inspection - Continued.

1/ For sampling plan see MIL-PRF-19500
2/ Group D qualification may be performed prior to lot formation. Wafers qualified to these group D QCI requirements may be used for any other detail specification utilizing the same die design.
3/ At the manufacturer's option, group D samples need not be subjected to the screening tests, and may be assembled in it's qualified package or in any qualified package that the manufacturer has data to correlate the performance to the designated package.
4/ The H designation represents devices which pass end-points at all 100K, 300K and 600K rads (Si).
5/ Separate samples shall be pulled for each bias.

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

Inspection	MIL-STD-750		Qualification inspection
	Method	Conditions	
Subgroup 1			12 devices c = 0
Temperature cycling	1051	Test condition G, 500 cycles	
Hermetic seal	1071		
Fine leak Gross leak			
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			12 devices c = 0
Thermal resistance	3161	$R_{\theta JC}$ = 5.0°C/W maximum. See 4.5.2	
Subgroup 5			
Not applicable			
Subgroup 6			3 devices c = 0
ESD	1020		
Electrical measurements		See table I, group A, subgroup 2	

See footnotes at end of table.

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

Inspection	MIL-STD-750		Qualification and large lot quality conformance inspection
	Method	Conditions	
Subgroup 7			3 devices
SEE 2/ 3/ 4/	1080	See figure 3.	
Electrical measurements 5/		IGSS1 and IDSS1 in accordance with table I, group A, subgroup 2	
SEE irradiation		Fluence = 3E5 ± 20 percent ions/cm^2 Flux = 2E3 to 2E4 ions/cm^2/sec, Temperature = 25 ± 5 °C	
		LET = 37 MeV-cm^2/mg, range = 39 microns, Energy = 305 MeV	
2N7494U5		Insitu bias conditions: VDS = 30V & VGS = -10V VDS = 25V & VGS = -15V VDS = 20V & VGS = -20V	
2N7495U5		Insitu bias conditions: VDS = 60V & VGS = -10V VDS = 52V & VGS = -15V VDS = 34V & VGS = -20V	
2N7496U5		Insitu bias conditions: VDS = 100V & VGS = -20V	
		LET = 60 MeV-cm^2/mg, range = 32 microns, Energy = 340 MeV	
2N7494U5		Insitu bias conditions: VDS = 25V & VGS = -5V VDS = 20V & VGS = -10V VDS = 15V & VGS = -15V VDS = 10V & VGS = -20V	
2N7495U5		Insitu bias conditions: VDS = 46V & VGS = -5V VDS = 35V & VGS = -10V VDS = 25V & VGS = -15V VDS = 15V & VGS = -20V	
2N7496U5		Insitu bias conditions: VDS = 100V & VGS = -10V VDS = 35V & VGS = -15V VDS = 25V & VGS = -20V	
		LET = 82 MeV-cm^2/mg, range = 28 microns, Energy = 350 MeV	
2N7494U5		Insitu bias conditions: VDS = 22.5V & VGS = -5V VDS = 15V & VGS = -10V VDS = 10V & VGS = - 15V	
2N7495U5		Insitu bias conditions: VDS = 35V & VGS = -5V VDS = 27V & VGS = -10V VDS = 20V & VGS = - 15V VDS = 14V & VGS = - 20V	
2N7496U5		Insitu bias conditions: VDS = 100V & VGS = -5V VDS = 80V & VGS = -10V VDS = 25V & VGS = -15V	
Electrical measurements 5/		IGSS1 and IDSS1 in accordance with table I, group A, subgroup 2	

See footnotes at end of table.

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

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 performance specifications utilizing the same structurally identical die design.
3/ Device qualification to a higher level Linear Energy Transfer (LET) is sufficient to qualify all lower level LET's.
4/ The sampling plan applies to each bias condition.
5/ Examine IGSS1 and IDSS1 before and following SEE irradiation to determine acceptability for each bias condition. Other test conditions per table I, group A, subgroup 2, may be performed at the manufacturer's option.

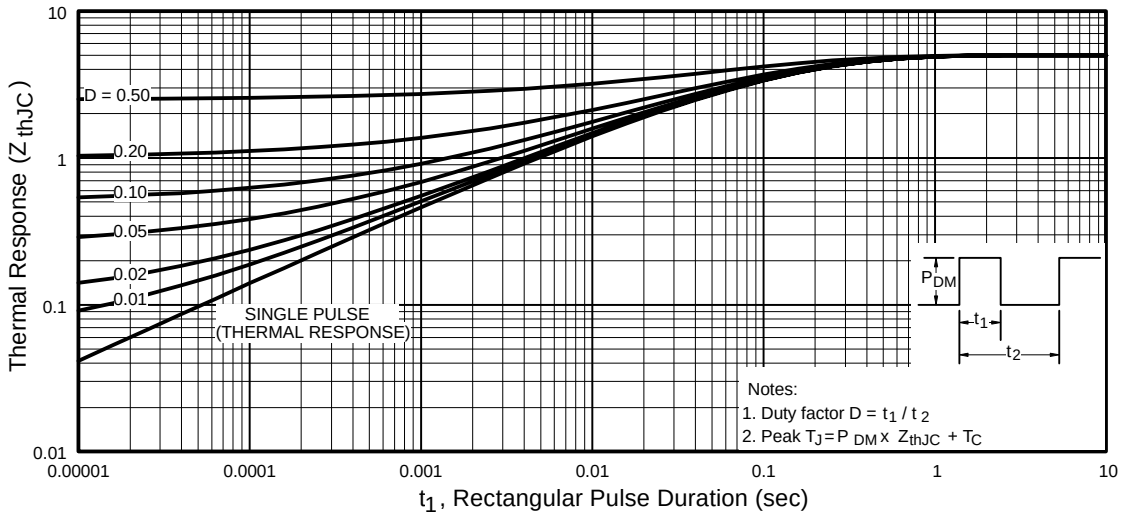
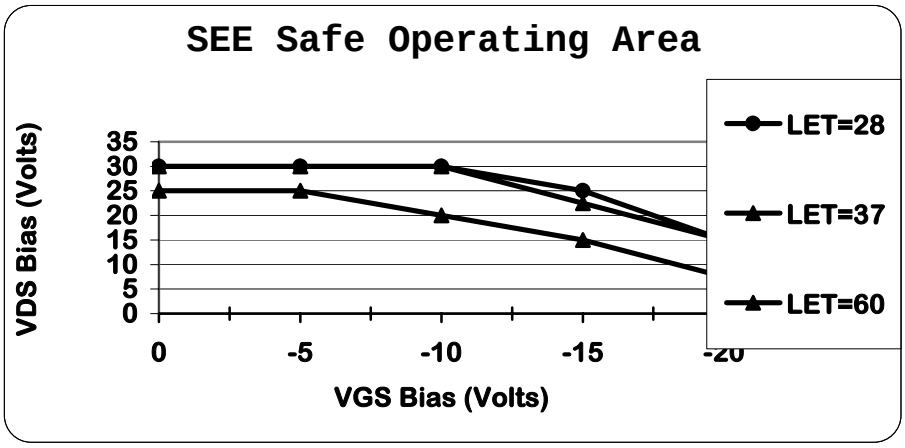
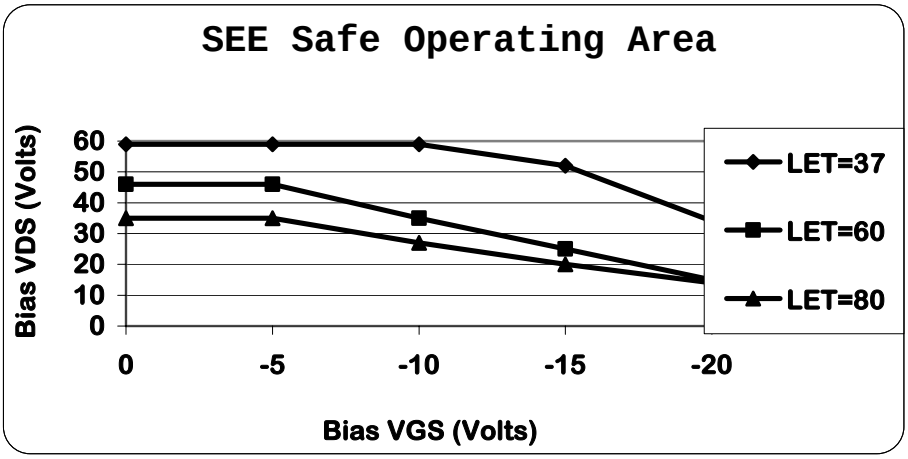


FIGURE 2. Thermal response curve.

2N7494U5



2N7495U5



2N7496U5

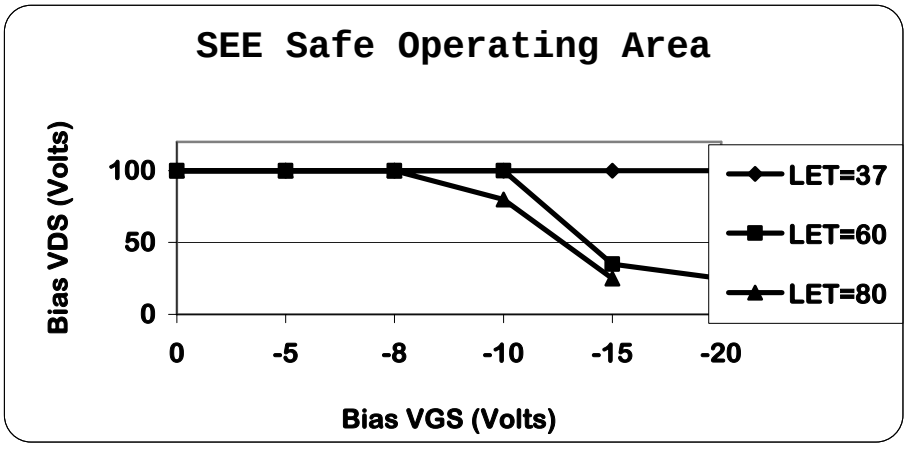


FIGURE 3. Safe operating area graph.

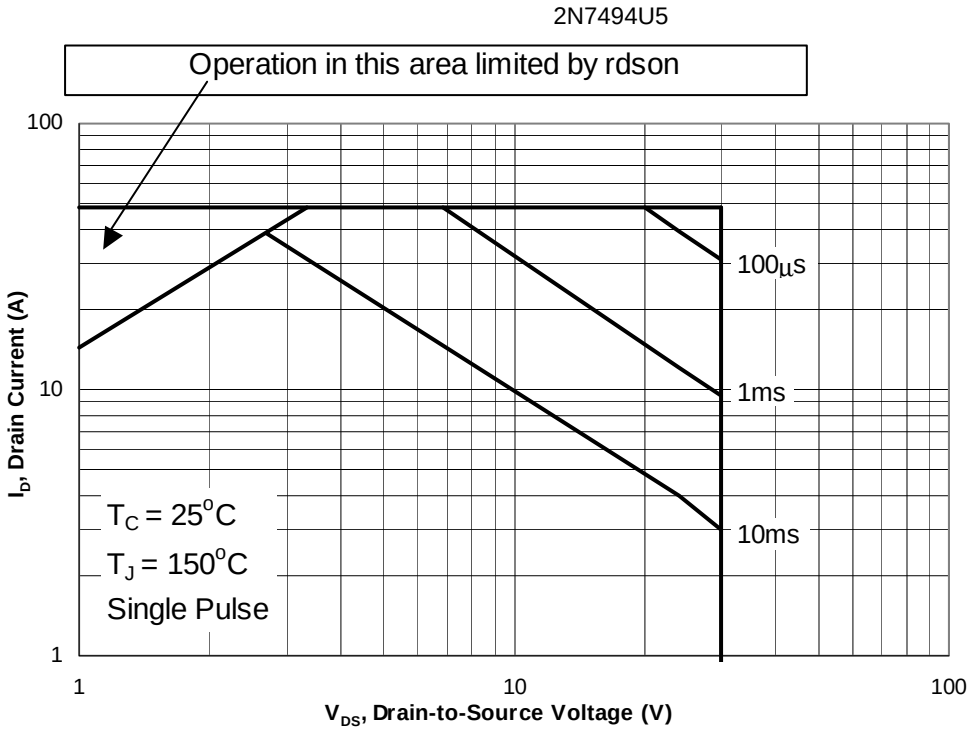


FIGURE 4. Safe operating area graph.

2N7495U5

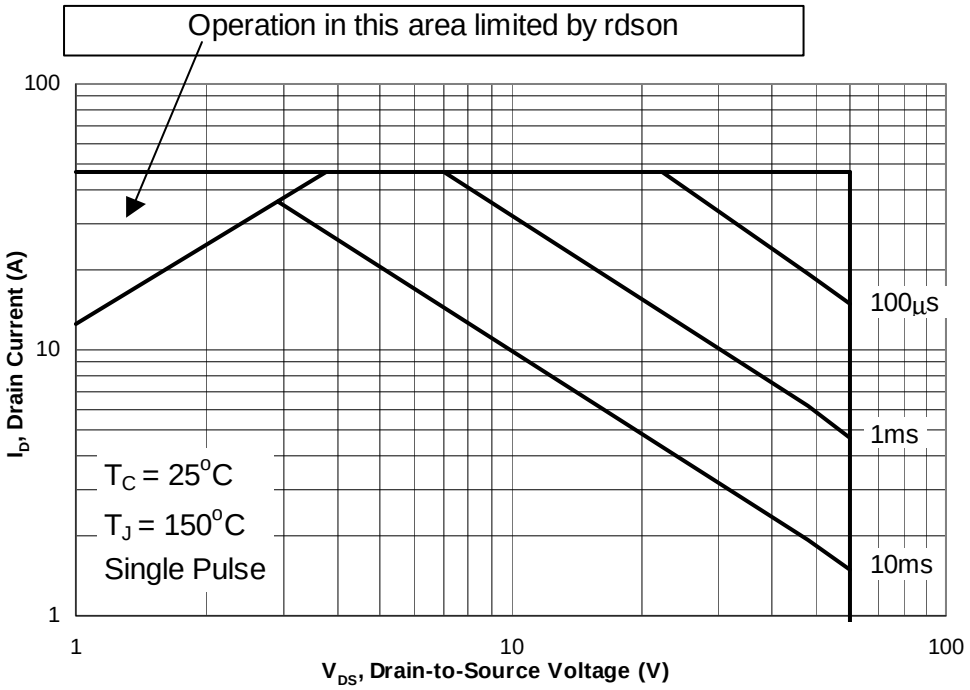


FIGURE 5. Safe operating area graph.

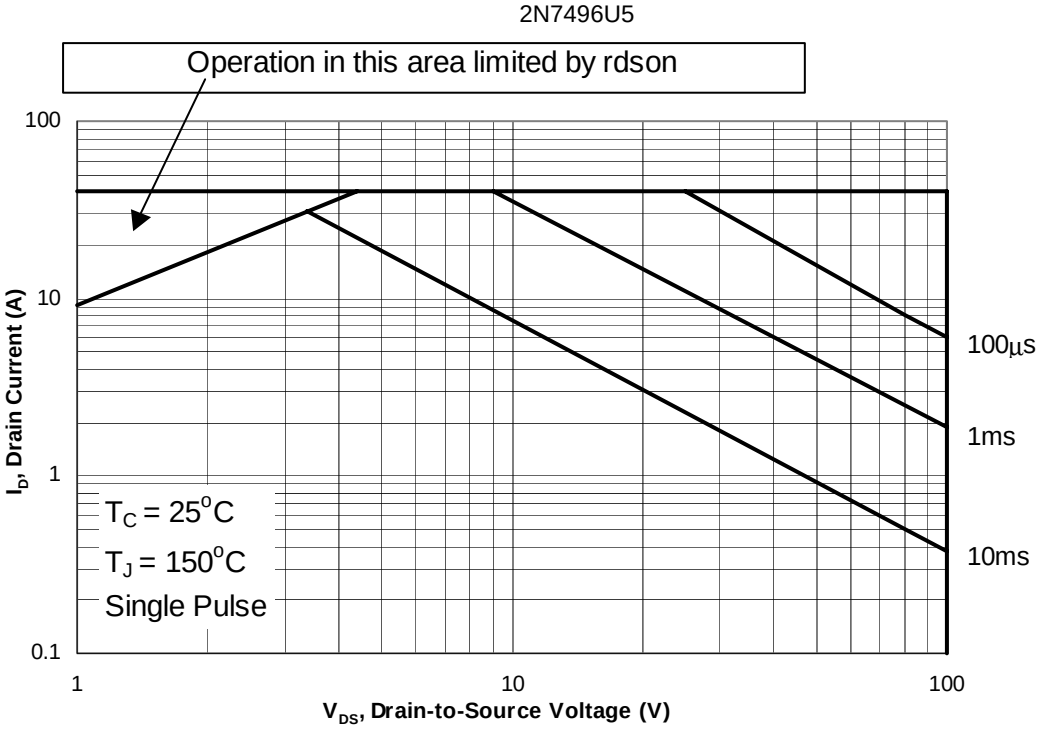


FIGURE 6. Safe operating area graph.

5. PACKAGING

5.1 Packaging. For acquisition purposes, the packaging requirements shall be as specified in the contract or order (see 6.2). When 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 Points' packaging activity within the Military Department or Defense Agency, or within the Military Departments' System Command. Packaging data retrieval is available from the managing Military Departments' 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).

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).

Generic P/N	Military P/N
IRHE57Z30	2N7494U5
IRHE57034	2N7495U5
IRHE57130	2N7496U5

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

Review activities:
Army - AV, MI
Navy - MC

Preparing activity:
DLA - CC

(Project 5961-2515)

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-19500/700	2. DOCUMENT DATE 6 December 2001

3. **DOCUMENT TITLE**
SEMICONDUCTOR DEVICE, FIELD EFFECT RADIATION HARDENED (TOTAL DOSE AND SINGLE EVENT EFFECTS) TRANSISTOR, N-CHANNEL, SILICON TYPES 2N7494U5, 2N7495U5, AND 2N7496U5 JANTXVR, F, G AND H AND JANSR, F, G AND H

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 614-692-0510	DSN 850-0510	FAX 614-692-6939	EMAIL 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			