INCH-POUND

MIL-PRF-19500/684
6 October 2000

PERFORMANCE SPECIFICATION

SEMICONDUCTOR DEVICE, TRANSISTOR, FIELD EFFECT, SILICON, N-CHANNEL,
RADIATION HARDENED (TOTAL DOSE AND SINGLE EVENT EFFECTS)
TYPES 2N7472U2, 2N7473U2 AND 2N7474U2
JANTXVR AND JANSR

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 an N-channel, enhancement-mode power MOSFET transistor with radiation hardened total dose and single event effects (SEE) ratings, with avalanche energy maximum rating (E_{AS}) and maximum avalanche current (I_{AS}). 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, SMD-2).

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
2N7472U2	250	2.5	130	130	±20	75	45	75	300	-55 to +150	N/A
2N7473U2			200	200		53.5	34	53.5	214		
2N7474U2			250	250		44.5	28	44.5	178		

(1) Derate linearly 2.0 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 addressed Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document or by letter.

AMSC N/A FSC 5961

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 Max	µA dc	Ω	Ω	°C/W	mJ
2N7472U2	130	2.5 4.5	10	0.0135	0.026	0.50	280
2N7473U2	200			0.038	0.080		380
2N7474U2	250			0.060	0.126		222

(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

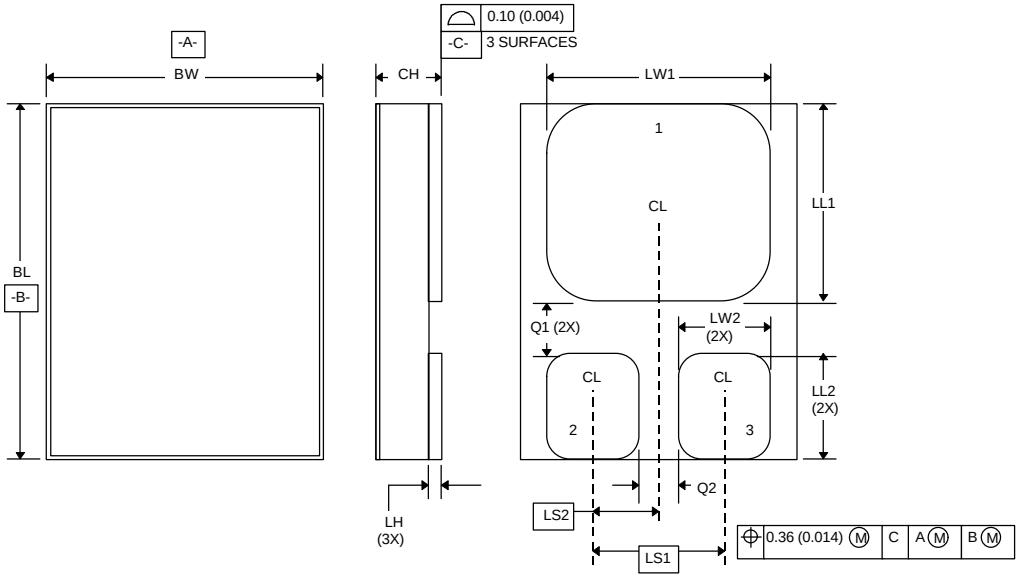
MIL-PRF-19500 - Semiconductor Devices, General Specification for.

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 Service (DAPS), Building 4D (NPM-DODSSP), 700 Robbins Avenue, Philadelphia, PA 19111-5094.)



Symbol	Dimensions			
	Inches		Millimeters	
	Min	Max	Min	Max
BL	0.684	0.696	17.38	17.67
BW	0.519	0.531	13.19	13.48
CH	---	0.142	---	3.60
LH	0.010	0.020	0.26	0.50
LW1	0.434	0.446	11.03	11.32
LW2	0.134	0.146	3.41	3.70
LL1	0.469	0.481	11.92	12.21
LL2	0.151	0.163	3.84	4.14
LS1	0.240 BSC		6.10 BSC	
LS2	0.120 BSC		3.05 BSC	
Q1	0.035	---	0.89	---
Q2	0.050	---	1.27	---
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 surface mount (SMD2).

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 figure 1 (SMD2) herein. Methods used for electrical isolation of the terminals shall employ materials that contain a minimum of 90 percent Al_2O_3 (ceramic).

3.4.1 Lead finish. Unless otherwise specified, 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 Marking. Marking shall be in accordance with MIL-PRF-19500. At the option of the manufacturer, marking may be omitted from the body, but shall be retained on the initial container.

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. However, the following handling practices are recommended (see 3.6).

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.

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

3.8 Electrical test requirements. The electrical test requirements shall be the subgroups as specified in group A, table I herein.

3.9 Workmanship. Semiconductor devices shall be processed in such a manner as to be uniform in quality and shall be free from other defects that will affect life, serviceability, or appearance.

4. VERIFICATION

4.1 Classification of inspections. The inspection requirements specified herein are classified as follows:

a. Qualification inspection (see 4.2).

b. Screening (see 4.3).

c. Conformance inspection (see 4.4).

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

4.2.1 Group E inspection. Group E inspection shall be conducted in accordance with MIL-PRF-19500 and table II 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. Figure 6 illustrates the design safe operation area. End-point measurements shall be in accordance with table II.

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, E_{AS} test (see 4.5.4)	Method 3470, E_{AS} test (see 4.5.4)
(1)	Method 3161, thermal impedance (see 4.5.3)	Method 3161, 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	MIL-STD-750, method 1042, test condition B	MIL-STD-750, method 1042, 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% of initial value, whichever is greater. ΔI_{GSSR1} = ±20 nA dc or ±100% of initial value, whichever is greater. ΔI_{DSS1} = ±10 µA dc or ±100% 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	MIL-STD-750, method 1042, test condition A	MIL-STD-750, method 1042, test condition A
13	Subgroups 2 and 3 of table I herein ΔI_{GSSF1} = ±20 nA dc or ±100% of initial value, whichever is greater. ΔI_{GSSR1} = ±20 nA dc or ±100% of initial value, whichever is greater. ΔI_{DSS1} = ±10 µA dc or ±100% of initial value, whichever is greater. $\Delta r_{DS(ON)1}$ = ±20% of initial value. $\Delta V_{GS(TH)1}$ = ±20% of initial value.	Subgroup 2 of table I herein ΔI_{GSSF1} = ±20 nA dc or ±100% of initial value, whichever is greater. ΔI_{GSSR1} = ±20 nA dc or ±100% of initial value, whichever is greater. ΔI_{DSS1} = ±10 µA dc or ±100% of initial value, whichever is greater. $\Delta r_{DS(ON)1}$ = ±20% of initial value. $\Delta V_{GS(TH)1}$ = ±20% 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 and as specified herein. 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	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. ton = 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. ton = 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.

4.5 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 $R_{\theta JC}$ = 0.50 °C/W. The following parameters shall apply:

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

b. Drain heating current (I_H)..... 13.33 A.

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

d. Drain-source heating voltage (V_H)..... 15 V.

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

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

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	$Z_{\theta JC}$	0.37		°C/W
Breakdown voltage drain to source	3407	V_{GS} = 0V, I_D = 1 mA dc, bias condition C	$V_{(BR)DSS}$			
2N7472U2				130		V dc
2N7473U2				200		V dc
2N7474U2				250		V dc
Gate to source voltage (threshold)	3403	$V_{DS} \geq V_{GS}$, I_D = 1 mA dc	$V_{GS(TH)1}$	2.5	4.5	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 % 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), $I_D = I_{D2}$	$r_{DS(ON)1}$			
2N7472U2					0.0135	Ω
2N7473U2					0.038	Ω
2N7474U2					0.060	Ω
Forward voltage	4011	V_{GS} = 0V dc, condition A, pulsed (see 4.5.1), $I_D = I_{D1}$	V_{SD}			
2N7472U2					1.2	V dc
2N7473U2					1.2	V dc
2N7474U2					1.2	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% 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), $I_D = I_{D2}$	$r_{DS(ON)3}$			
2N7472U2					0.026	Ω
2N7473U2					0.080	Ω
2N7474U2					0.126	Ω
Gate to source voltage (threshold)	3403	$V_{DS} \geq V_{GS}$, I_D = 1 mA dc	$V_{GS(TH)2}$	1.5		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	$V_{GS(TH)3}$		5.5	V dc
Subgroup 4 Forward transconductance	3475	$I_D = I_{D2}$, V_{DD} = 15 V dc, (see 4.5.1)	g_{FS}			
2N7472U2				39		S
2N7473U2				35		S
2N7474U2				27		S
Switching time test	3472	$I_D = I_{D2}$, V_{GS} = 12 V dc R_G = 2.35 Ω, V_{DD} = 50 percent of rated V_{DS}				
Turn-on delay time			$t_{D(on)}$			
2N7472U2					35	ns
2N7473U2					35	ns
2N7474U2					35	ns
Rise time			t_r			
2N7472U2					125	ns
2N7473U2					125	ns
2N7474U2					125	ns
Turn-off delay time			$t_{D(off)}$			
2N7472U2					80	ns
2N7473U2					80	ns
2N7474U2					80	ns
Fall time			t_f			
2N7472U2					50	ns
2N7473U2					50	ns
2N7474U2					65	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 and 5 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 $I_D = I_{D2}$				
On-state gate charge			$Q_{G(ON)}$			
2N7472U2					160	nC
2N7473U2					155	nC
2N7474U2					165	nC
Gate to source charge			Q_{GS}			
2N7472U2					55	nC
2N7473U2					45	nC
2N7474U2					45	nC
Gate to drain charge			Q_{GD}			
2N7472U2					75	nC
2N7473U2					75	nC
2N7474U2					75	nC
Reverse recovery time	3473	di/dt = -100 A/µs, $V_{DD} \leq 50$ V $I_D = I_{D2}$	t_{rr}			
2N7472U2					300	ns
2N7473U2					450	ns
2N7474U2					775	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 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	$R_{\theta JC}$ = 0.50°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 II. 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
Single Event Effects (SEE) 2/ 3/ 4/	1080		
Electrical measurements 5/		IGSS1 and IDSS1 per table I, group A, subgroup 2	
SEE irradiation		Fluence = 3E5 ± 20% 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	
2N7472U2		Insitu bias conditions: VDS = 130V & VGS = -20V	
2N7473U2		Insitu bias conditions: VDS = 200V & VGS = -20V	
2N7474U2		Insitu bias conditions: VDS = 250V & VGS = -20V	
		LET = 60 MeV-cm^2/mg, Range = 32 microns, Energy = 340 MeV	
2N7472U2		Insitu bias conditions: VDS = 130V & VGS = -10V VDS = 100V & VGS = -15V VDS = 50V & VGS = -20V	
2N7473U2		Insitu bias conditions: VDS = 200V & VGS = -10V VDS = 185V & VGS = -15V VDS = 120V & VGS = -20V	
2N7474U2		Insitu bias conditions: VDS = 250V & VGS = -15V VDS = 240V & VGS = -20V	
		LET = 82 MeV-cm^2/mg, Range = 28 microns, Energy = 350 MeV	
2N7472U2		Insitu bias conditions: VDS = 130V & VGS = 0V VDS = 120V & VGS = -5V VDS = 30V & VGS = - 10V	
2N7473U2		Insitu bias conditions: VDS = 200V & VGS = -5V VDS = 150V & VGS = -10V VDS = 50V & VGS = -15V VDS = 25V & VGS = -20V	
2N7474U2		Insitu bias conditions: VDS = 250V & VGS = -5V VDS = 225V & VGS = -10V VDS = 175V & VGS = -15V VDS = 50V & VGS = -20V	
Electrical measurements 5/		IGSS1 and IDSS1 in accordance with table I, group A, subgroup 2	

1/ A separate sample for each test shall be pulled.
2/ Group E qualification of SEE effect testing may be performed prior to lot formation. Qualification may be extended to other performance specifications utilizing the same structurally identical die design.
3/ Device qualification to a higher level 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 in accordance with table I, group A, subgroup 2, may be performed at the manufacturer's option.

TABLE III. Group D inspection.

Inspection 1/ 2/ 3/	MIL-STD-750		Symbol	Pre-irradiation limits		Post-irradiation limits		Unit
				R		R		
	Method	Conditions		Min	Max	Min	Max	
Subgroup 1 Not applicable								
Subgroup 2		T_C = + 25°C						
Steady-state total dose irradiation (VGS bias) 4/	1019	V_{GS} = 12 V; V_{DS} = 0 V						
Steady-state total dose irradiation (VDS bias) 4/	1019	V_{GS} = 0 V; V_{DS} = 80 % 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	$V_{(BR)DSS}$					
2N7472U2				130		130		V dc
2N7473U2				200		200		V dc
2N7474U2				250		250		V dc
Gate to source voltage (threshold)	3403	V_{DS} V_{GS} I_D = 1 mA	$V_{GS(th)1}$					
2N7472U2				2.5	4.5	2.0	4.5	V dc
2N7473U2				2.5	4.5	2.0	4.5	V dc
2N7474U2				2.5	4.5	2.0	4.5	V dc
Gate current	3411	V_{GS} = +20 V V_{DS} = 0 V Bias condition C	I_{GSSF1}		100		100	nA dc
Gate current	3411	V_{GS} = -20 V V_{DS} = 0 V Bias condition C	I_{GSSR1}		-100		-100	nA dc
Drain current	3413	V_{GS} = 0 V V_{DS} = 80% of rated V_{DS} (preirradiation) Bias condition C	I_{DSS}		10		10	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}	$V_{DS(on)}$					
2N7472U2					0.630		0.630	V dc
2N7473U2					1.326		1.326	V dc
2N7474U2					1.708		1.708	V dc
Forward voltage source drain diode	4011	V_{GS} = 0 V; I_D = I_{D2} Bias condition C	V_{SD}					
2N7472U2					1.2		1.2	V dc
2N7473U2					1.2		1.2	V dc
2N7474U2					1.2		1.2	V dc

1/ For sampling plan see MIL-PRF-19500.
2/ Group D qualification may be performed prior to lot formation. Wafers qualified to these group D QCI requirements may be used for any other 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 its' qualified package or in any qualified package that the manufacturer has data to correlate the performance to the designated package.
4/ Separate samples shall be pulled for each bias.

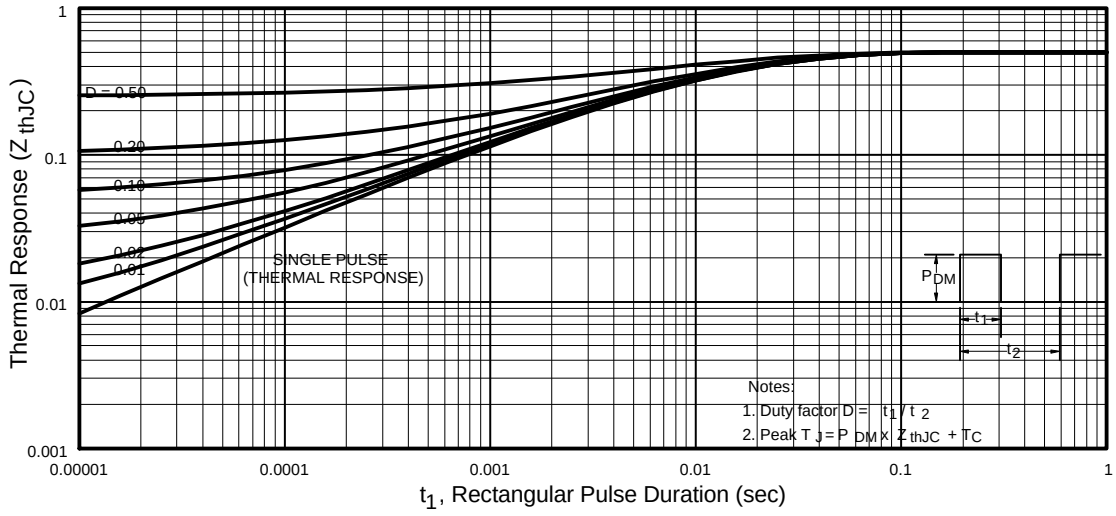


FIGURE 2. Thermal response curve.

2N7472U2

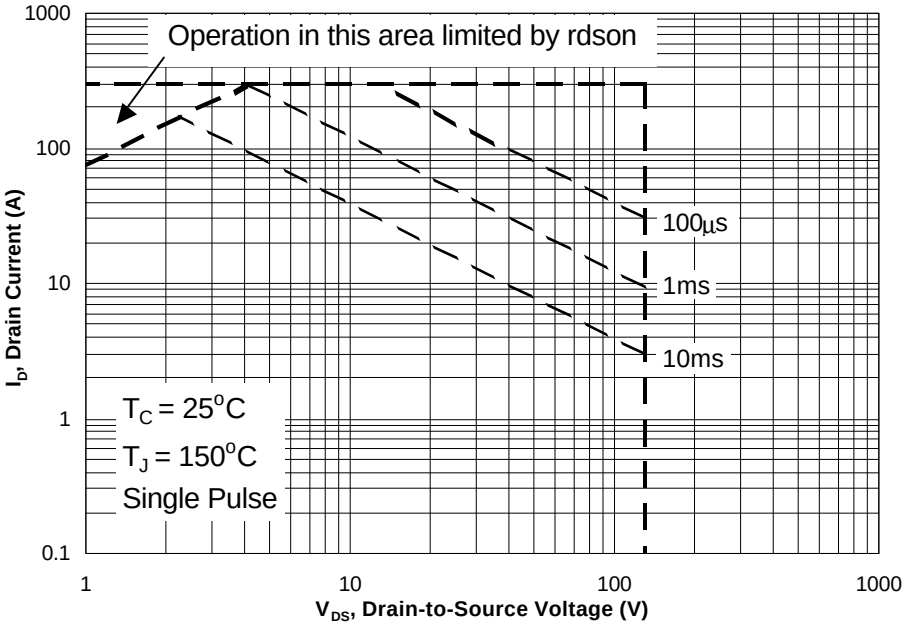


FIGURE 3. Safe operating area graph.

2N7473U2

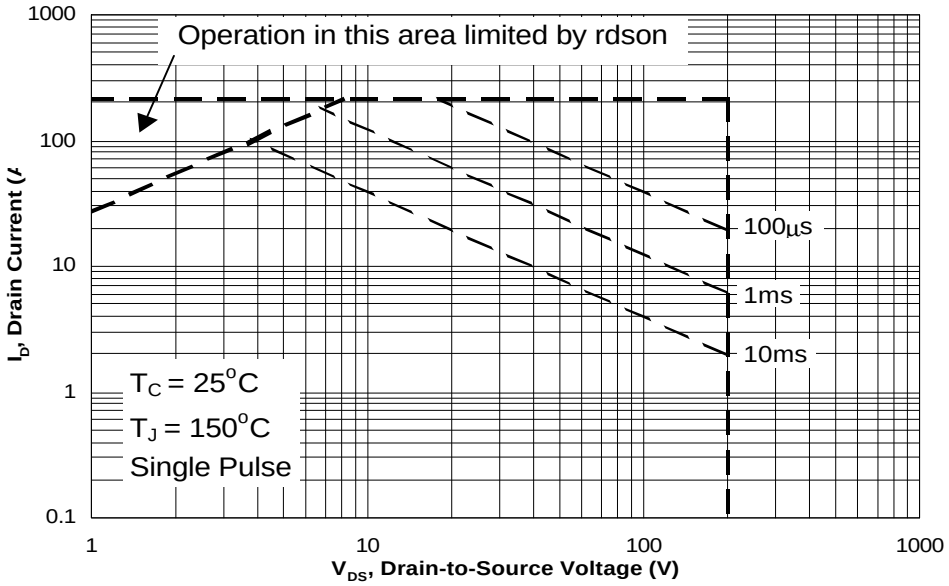


FIGURE 4. Safe operating area graph.

2N7474U2

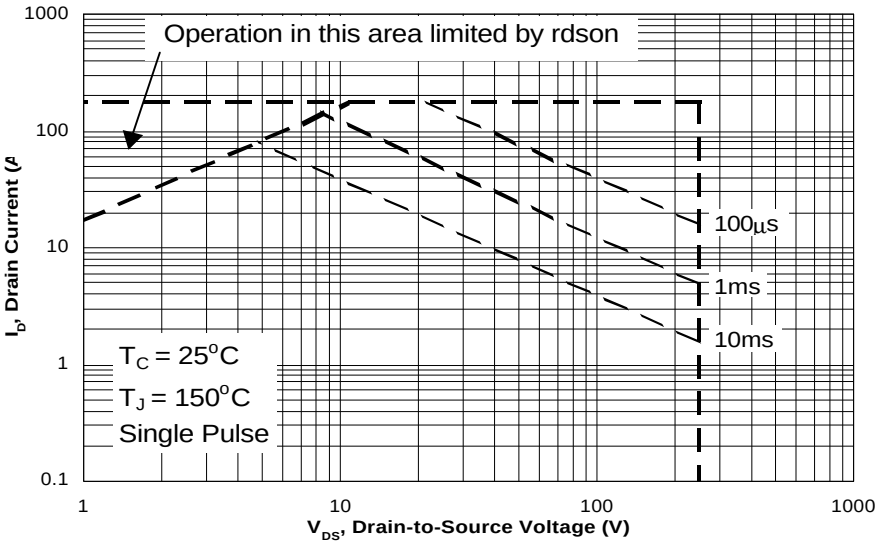
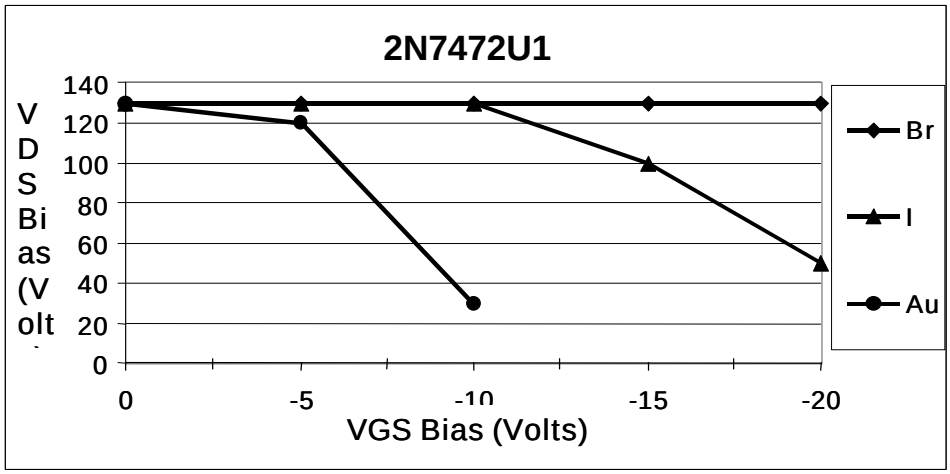
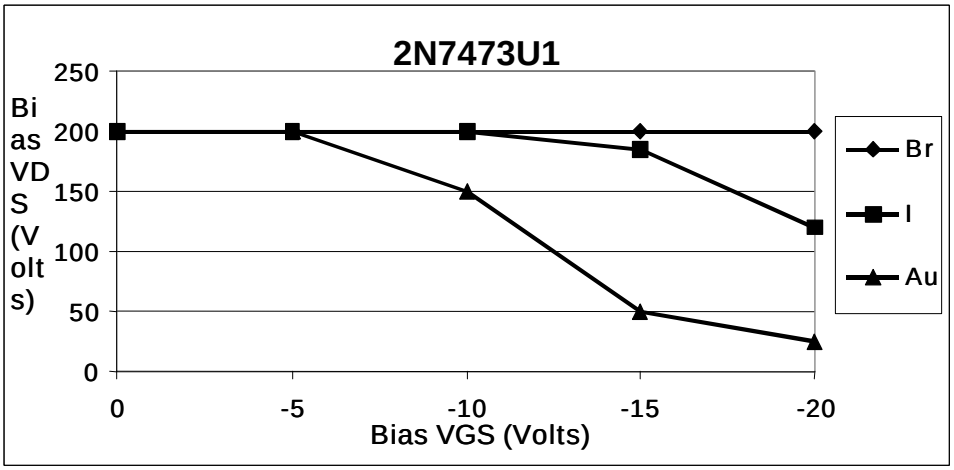


FIGURE 5. Safe operating area graph.





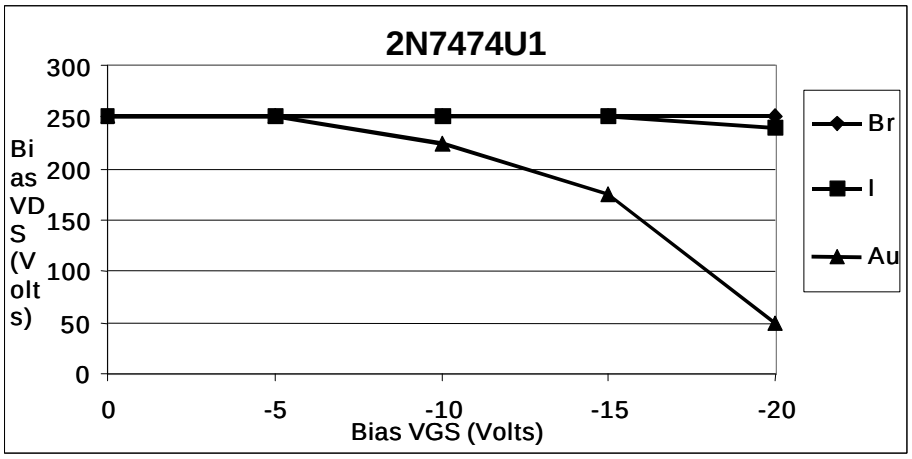


FIGURE 6. SEE safe operating area graph.

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)..... 13.33 A.

c. Heating time (t_H)..... 20 ms.

d. Drain-source heating voltage (V_H)..... 15 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}: $25\ \Omega \leq R_{GS} \leq 200\ \Omega$.

d. Supply voltage, V_{DD} = Rated VDS.

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.

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 should 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. Terminal finish (see 3.3.1).

d. Type designation and product assurance level.

e. Packaging requirements (see 5.1).

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-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 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
IRHNA57163SE	2N7472U2
IRHNA57260SE	2N7473U2
IRHNA57264SE	2N7474U2

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

Preparing activity:
DLA - CC

(Project 5961-2325)

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-19500/684	2. DOCUMENT DATE 6 October 2000

3. **DOCUMENT TITLE**
SEMICONDUCTOR DEVICE, TRANSISTOR, FIELD EFFECT, SILICON, N-CHANNEL, RADIATION HARDENED (TOTAL DOSE AND SINGLE EVENT EFFECTS) TYPES 2N7472U2, 2N7473U2 AND 2N7474U2 JANTXVR AND JANSR

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