The documentation and process conversion measures necessary to comply with this revision shall be completed by 17 March 1998.

INCH-POUND

MIL-PRF-19500/605A
17 December 1997
SUPERSEDING
MIL-S-19500/605
10 November 1992

PERFORMANCE SPECIFICATION SHEET

SEMICONDUCTOR DEVICE, FIELD EFFECT RADIATION HARDENED (TOTAL DOSE ONLY)
TRANSISTORS, N-CHANNEL, SILICON TYPES 2N7292, 2N7294, 2N7296, AND 2N7298
JANTXVM, D, R, H AND JANSM, D AND 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 an N-Channel, enhancement-mode, MOSFET, radiation hardened (total dose only), power transistor intended for use in high density power switching applications. Two levels of product assurance are provided for each device type specified in MIL-PRF-19500.

1.2 Physical dimensions. See figure 1 (similar to TO-254).

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

Type	P_T 1/	P_T	V_{DS}	V_{DG}	V_{GS}	I_{D1} 2/	I_{D2}	I_S	I_{DM}	T_J and	V_{ISO}
	T_C = +25° C	T_A = +25° C				T_C = +25° C	T_C = 100° C	2/		T_{STG}	70,000 feet altitude
	W	W	V dc	V dc	V dc	A dc	A dc	A dc	A (pk)	°C	V dc
2N7292	125	2.5	100	100	±20	25.0	20.0	25.0	75	-55	N/A
2N7294			200	200		23.0	15.0	23.0	69	to	N/A
2N7296			250	250		17.0	11.0	17.0	51		250
2N7298			500	500		9.0	6.0	9.0	27	+150	500

1/ Derate linearly 1.0 W/° C for T_C > +25° C; $P_T = \frac{T_{JM} - T_C}{R_{\theta JC}}$

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

Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: Commander, Defense Supply Center Columbus, ATTN: DSCC-VAT, 3990 East Broad St., 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 = 1.0 mA dc	$V_{GS(th)1}$ $V_{DS} \geq V_{GS}$ I_D = .250 mA dc	Max I_{DSS1} V_{GS} = 0 V_{DS} = 80 percent of rated V_{DS}	Max $r_{DS(on)}$ 1/ V_{GS} = 10 V dc		$R_{\Theta JC}$ max	I_{AS} = I_{DM}	E_{AS} at I_{AS}
				T_J = +25° C at I_{D2}	T_J = +125° C at I_{D2}			
	V dc	V dc Min	Max	ohm	ohm	°C/W	A(pk)	mJ
2N7292	100	2.0	4.0	25	O.070	0.140	1.00	75	281
2N7294	200				0.115	0.253		69	238
2N7296	250				0.185	0.444		51	130
2N7298	500				0.615	1.60		27	36

1/ Pulsed (see 4.5.1).

2. APPLICABLE DOCUMENTS

2.1 Government documents.

2.1.1 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

MILITARY

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

STANDARD

MILITARY

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

(Unless otherwise indicated, copies of federal and military specifications, standards, and handbooks are available from the Standardization Document Order Desk, Building 4D, 700 Robbins Avenue, Philadelphia, PA 19111-5094.)

2.2 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

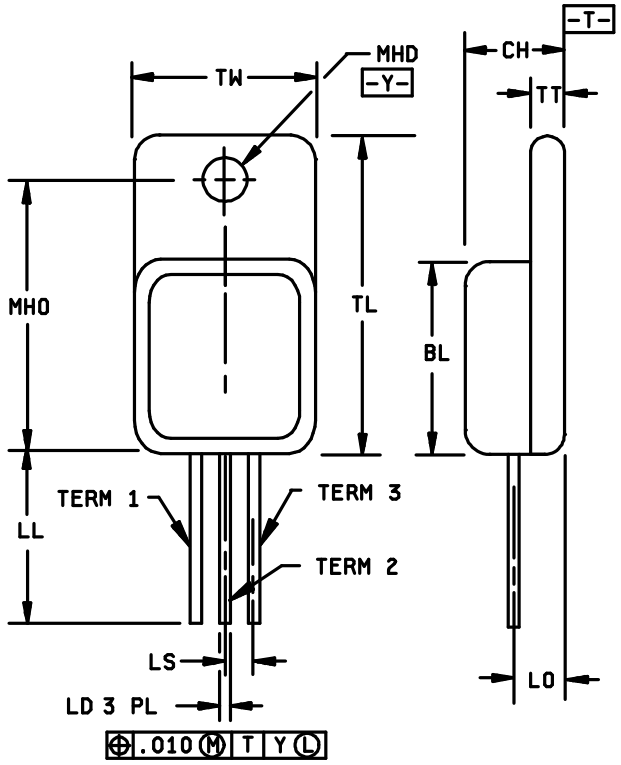
3.1 Associated specification. The individual item requirements shall be in accordance with MIL-PRF-19500 and as specified herein.

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

E_{AS} - Single Pulse Avalanche Energy capability

I_{AS} - Rated Avalanche Current, Non-repetitive

$V_{(ISO)}$ - Source pin to case Isolation Voltage



Ltr	Dimensions			
	Inches		Millimeters	
	Min	Max	Min	Max
BL	.530	.550	13.46	13.97
CH	.249	.260	6.33	6.60
LD	.035	.045	0.89	1.14
LL	.520	.560	13.21	14.22
LO	.150 BSC		.3.81 BSC	
LS	.150 TYP		.3.81 TYP	
MHD	.139	.149	3.34	3.78
MHO	.665	.685	16.90	17.40
TL	.790	.800	20.07	20.32
TT	.040	.050	1.02	1.28
TW	.535	.545	13.59	13.84
Term 1	Drain			
Term 2	Source			
Term 3	Gate			

NOTES:
1. Dimensions are in inches.
2. Metric equivalents are given for general information only.
3. All terminals are isolated from case.
4. The preferred measurements used herein are the metric units. However, this transistor was designed using inch-pound units of measurement. In case of conflicts between the metric and inch-pound units, the inch-pound units shall be the rule.
5. In accordance with ANSI Y14.5M, diameters are equivalent to ϕx symbology.
6. Die to base is BeO isolated, terminals to case ceramic (AL_2O_3) isolated.

FIGURE 1. Dimensions and configuration (T0-254).

3.3 Interface requirements and physical dimensions. The Interface requirements and physical dimensions shall be as specified in MIL-PRF-19500, and figure 1 (T0-254AA) herein.

3.3.1 Lead material and finish. Lead material shall be Kovar or Alloy 52; a copper core or plated core is permitted. Lead finish shall be solderable as defined in MIL-PRF-19500, MIL-STD-750, and herein. Where a choice of lead finish is desired, it shall be specified in the acquisition documents (see 6.2).

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

3.4 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.

3.5 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, $R \leq 100$ kilohms, 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.

3.7 Electrical test requirements. The electrical test requirements shall be the subgroups specified in 4.4.2 and 4.4.3.

3.8 Qualification. Devices furnished under this specification shall be products that are authorized by the qualifying activity for listing on the applicable qualified products list before contract award (see 4.2 and 6.2).

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 IX herein.

4.3 Screening (JANTX, JANTXV, and JANS levels only). Screening shall be in accordance with tables 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 level	JANTX and JANTXV levels
1/	Method 3161 (see 4.5.3)	Method 3161 (see 4.5.3)
1/	Gate stress test (see 4.5.5)	Gate stress test (see 4.5.5)
1/	Method 3470, E_{AS} test (see 4.5.4)	Method 3470, E_{AS} test (see 4.5.4)
2/	Subgroup 2 of table I herein	Subgroup 2 of table I herein
9	I_{GSS}, I_{DSS1}	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 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	MIL-STD-750, method 1042, test condition A	MIL-STD-750, method 1042, condition A or T_A = +175° C and t = 48 hours min 3/
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} = ±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.	Subgroups 2 and 3 of table I herein. ΔI_{GSSF1} = ±20 nA dc or 100 percent of initial value, whichever is greater. ΔI_{GSSR1} = ±20nA 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 any time after screen 10.
2/ Shall be performed after E_{AS} test, method 3161, and gate stress test.
3/ Use of this accelerated screening option requires a 1,000 hour life test in accordance with applicable group E, subgroup 2 life test, and end-points specified herein to be provided to the qualifying activity for review and acceptance.

4.4 Conformance inspection. Conformance inspection shall be in accordance with MIL-PRF-19500, and as specified herein. 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 MIL-PRF-19500 and table I herein. (Endpoint electrical measurements shall be in accordance with the applicable inspections of table I, group A, 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 VIa (JANS) and table VIb (JANTX and JANTXV) of MIL-PRF-19500, and as follows. Electrical measurements (end points) shall be in accordance with the applicable inspections of 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	Condition G, 100 cycles.
4	1042	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	Condition A; V_{DS} = 100 percent of rated; T_A = +175° C, t = 120 hours, or T_A = +150° C, t = 120 hours minimum. 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
5	1042	Condition B; V_{GS} = 100 percent of rated; T_A = +175° C; t = 24 hours minimum.
6	3161	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	The heating cycle shall be 30 seconds minute minimum.
5	----	Not applicable
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 the applicable inspections of table I, group A, subgroup 2 herein.

4.4.3.1 Group C inspection, table VII of MIL-PRF-19500.

Subgroup	Method	Condition
2	2036	Terminal strength, test condition A, weight = 10 lbs., t = 15 sec.
6	1042	Test condition D, 6,000 cycles; 1 cycle = 30 sec. min.

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 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 $R_{\Theta JC(max)}$ = 1.00° C/W. The following parameter measurements shall apply:

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

b. Drain heating current (I_H) - - - - - - - - - - - - 4 A

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

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

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} = 0 V; I_D = 1 mA dc, bias condition C	$V_{(BR)DSS}$			
2N7292				100		V dc
2N7294				200		V dc
2N7296				250		V dc
2N7298				500		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} = +20 and -20 V dc, bias condition C, V_{DS} = 0	I_{GSS1}		±100	nA dc
Drain current	3413	V_{GS} = 0 V 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} = 10 V dc, condition A, pulsed (see 4.5.1), Id = Id2	$r_{DS(on)1}$			
2N7292					0.070	Ω
2N7294					0.115	Ω
2N7296					0.185	Ω
2N7298					0.615	Ω
Static drain to source "ON"-state resistance	3421	V_{GS} = 10 V dc, condition A, pulsed (see 4.5.1), Id = Id1	$r_{DS(on)2}$			
2N7292					0.074	Ω
2N7294					0.121	Ω
2N7296					0.194	Ω
2N7298					0.646	Ω
Forward voltage	4011	Pulsed (see 4.5.1), Id = Id1 V_{GS} = 0 V dc	V_{SD}			
2N7292					1.8	V dc
2N7294					1.8	V dc
2N7294					1.8	V dc
2N7298					1.8	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		$T_C = T_J = +125^\circ C$				
Gate current	3411	V_{GS} = +20 and -20 V dc, bias condition C, V_{DS} = 0	I_{GSS2}		±200	nA dc
Drain current	3413	V_{GS} = 0 V dc, bias condition C	I_{DSS2}		1.0	mA dc
		V_{DS} = 100 percent of rated V_{DS}				
		V_{DS} = 80 percent of rated V_{DS}	I_{DSS3}		0.25	mA dc
Static drain to source "ON"-state resistance	3421	V_{GS} = 10 V dc, pulsed (see 4.5.1), Id = Id2	$r_{DS(on)3}$			
2N7292					0.140	Ω
2N7294					0.253	Ω
2N7296					0.444	Ω
2N7298					1.60	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		$T_C = T_J = -55^\circ C$				
Gate to source voltage (threshold)	3403	$V_{DS} \geq V_{GS}$, I_D = 1 mA dc	$V_{GS(th)3}$		5.0	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 4						
Switching time test	3472	$I_D = I_{D1}$, V_{GS} = 10 V dc, R_G = 25Ω, V_{DD} = 50 percent of rated V_{DS}				
Turn-on delay time			$t_{d(on)}$			
2N7292					134	ns
2N7294					156	ns
2N7296					114	ns
2N7298					148	ns
Rise time			t_r			
2N7292					628	ns
2N7294					510	ns
2N7296					162	ns
2N7298					196	ns
Turn-off delay time			$t_{d(off)}$			
2N7292					642	ns
2N7294					574	ns
2N7296					990	ns
2N7298					800	ns
Fall time			t_f			
2N7292					490	ns
2N7294					280	ns
2N7296					256	ns
2N7298					180	ns
Subgroup 5						
Safe operating area test	3474	See figure 3, 4, 5 t_p = 10 ms minimum V_{DS} = 80 percent of max rated V_{DS} ($V_{DS} \leq 200$)				
Electrical measurements		See table VI, steps 1, 2, 3, 4, 5, 6, and 7				
Subgroup 6						
Not applicable						

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 7						
Gate charge	3471	Condition B				
On-state gate charge		V_{DD} = 0.5 BV_{DSS} $I_D = I_{D1}$	$Q_{g(on)}$			
2N7292		$V_{GS} \leq$ 20V			314	nC
2N7294		$I_{GS1} = I_{GS2}$			298	nC
2N7296					264	nC
2N7298					264	nC
Gate to source charge			Q_{gs}			
2N7292					46	nC
2N7294					66	nC
2N7296					48	nC
2N7298					56	nC
Gate to drain charge			Q_{gd}			
2N7292					164	nC
2N7294					144	nC
2N7296					124	nC
2N7298					126	nC
Reverse Recovery Time	3473	di/dt = 100 A/µs, $V_{DD} \leq$ 30 V, Id = Id1				
2N7292			T_{rr}		1400	ns
2N7294					1700	ns
2N7296					2000	ns
2N7298					2300	ns

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

TABLE IV. Group D inspection.

Inspection 1/	MIL-STD-750		Symbol	Preirradiation limits		Postirradiation limits		Units
	Method	Conditions		M, D, and R		M, D, and R		
				Min	Max	Min	Max	
Subgroup 1								
N/A								
Subgroup 2		T_C = +25° C						
Steady state total dose irradiation	1019	2/ 3/						
End point electricals								
Breakdown voltage, drain to source	3407	V_{GS} = 0; I_D = 1 mA bias cond. C	$V_{BR(DSS)}$					
2N7292				100		100		V dc
2N7294				200		200		V dc
2N7296				250		250		V dc
2N7298				500		500		V dc
Gate to source voltage (threshold)	3403	$V_{DS} \geq V_{GS}$ I_D = 1 mA	$V_{GS(th)1}$					
2N7292				2.0	4.0	2.0	4.0	V dc
2N7294				2.0	4.0	2.0	4.0	V dc
2N7296				2.0	4.0	2.0	4.0	V dc
2N7298				2.0	4.0	2.0	4.0	V dc
Gate current	3411	V_{GS} = 20 V, V_{DS} = 0 bias cond. C	I_{GSSF1}		100		100	nA dc
Gate current	3411	V_{GS} = 20 V, V_{DS} = 0 bias cond. C	I_{GSSR1}		-100		-100	nA dc
Drain current	3413	V_{GS} = 0 bias cond. C V_{DS} = 80 percent of rated V_{DS} (preirradiation)	I_{DSS1}					
2N7292					25		25	µA dc
2N7294					25		25	µA dc
2N7296					25		25	µA dc
2N7298					25		25	µA dc

See footnotes at end of table.

TABLE IV. Group D inspection - Continued.

Inspection 1/	MIL-STD-750		Symbol	Preirradiation limits		Postirradiation limits		Units
	Method	Conditions		M, D, and R		M, D, and R		
				Min	Max	Min	Max	
Subgroup 2 - Continued								
Static drain to source on-state resistance	3421	V_{GS} = 10 V Cond. A pulsed see 4.5.1 $I_D = I_{D2}$	$R_{DS(on)1}$					
2N7292					0.070		0.070	Ω
2N7294					0.115		0.115	Ω
2N7296					0.185		0.185	Ω
2N7298					0.615		0.615	Ω
Drain source on state voltage	3405	V_{GS} = 10V $I_D = I_{D1}$ Cond. A pulsed see 4.5.1	$V_{DS(on)}$					
2N7292					1.84		1.84	V dc
2N7294					2.78		2.78	V dc
2N7296					3.30		3.30	V dc
2N7298					5.81		5.81	V dc

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

2/ Inspection requires all subgroup 2 (group D) measurements after exposure to both of the following insitu bias conditions:

V_{GS} = 10 V; V_{DS} = 0
V_{GS} = 0 V; V_{DS} = 80 percent of rated V_{DS}

3/ Each bias condition requires a separate total dose sample.

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

Inspection	MIL-STD-750		Qualification and large lot quality conformance inspection
	Method	Conditions	
Subgroup 1			12 devices c = 0
Temperature cycling (air to air)	1051	-55° C to +150° C, 500 cycles	
Hermetic seal	1071		
Fine leak Gross leak			
Electrical measurements		See table I, subgroup 2 herein	
Subgroup 2 1/			12 devices c = 0
Steady-state reverse bias	1042	Condition A: 1,000 hours	
Electrical measurements		See table I, subgroup 2 herein	
Steady-state gate bias	1042	Condition B: 1,000 hours	
Electrical measurements		See table I, subgroup 2 herein	
Subgroup 3			
Not applicable			
Subgroup 4			
Thermal resistance	3161	$R_{\Theta JC}$ = 1.0° C/W maximum. See 4.5.2	12 devices c = 0

1/ A separate sample for each test shall be pulled.

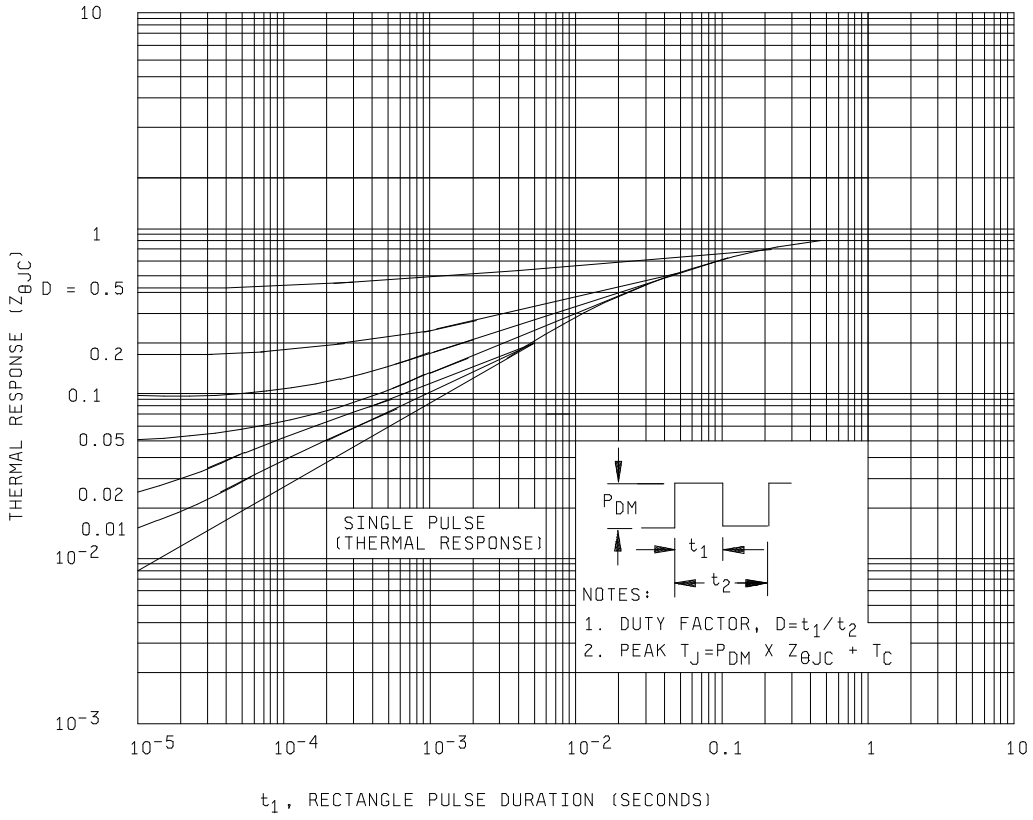


FIGURE 2. Thermal response curves

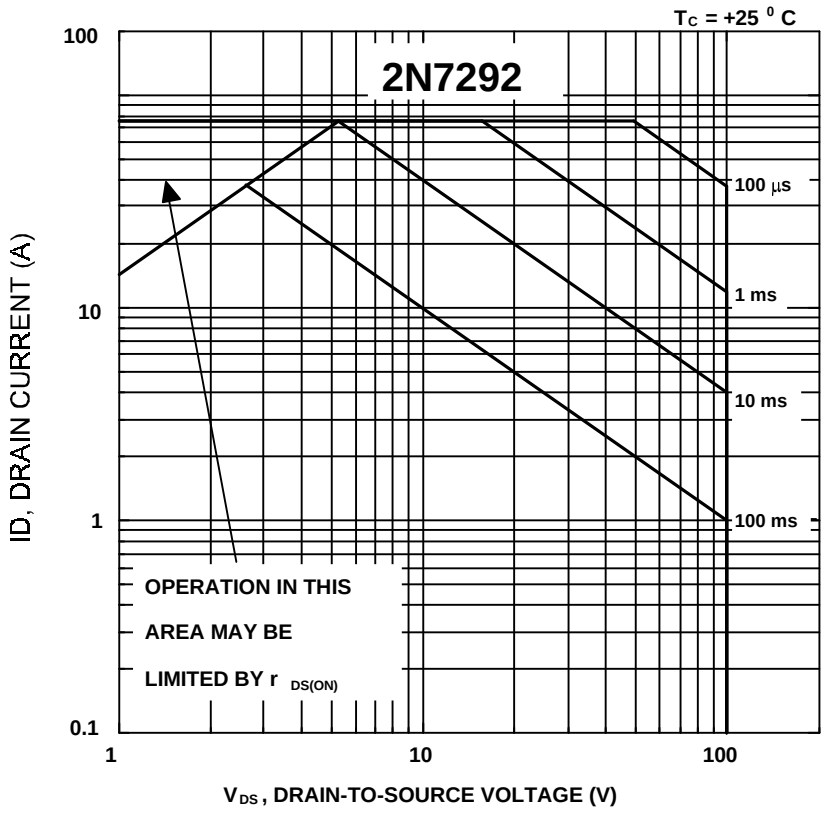


FIGURE 3. Safe operating area graphs.

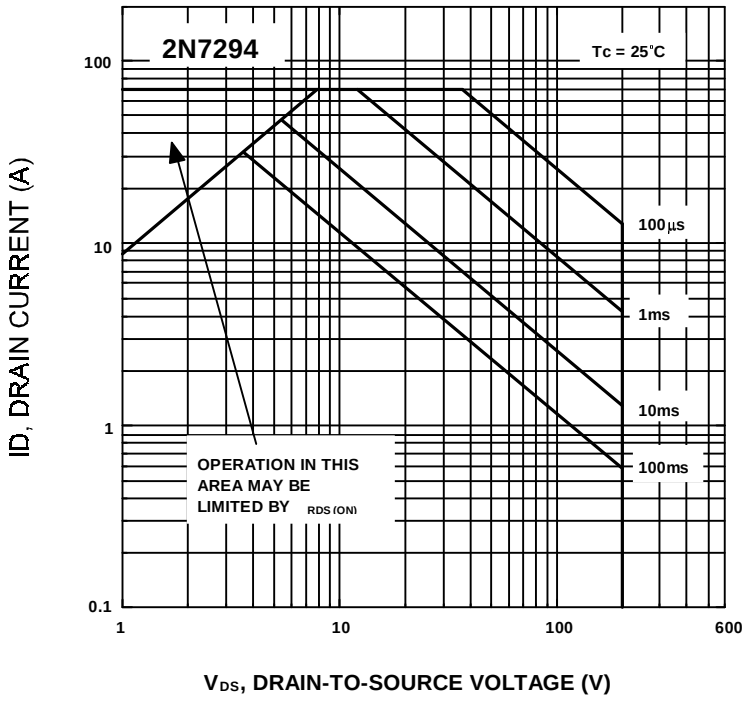


FIGURE 3. Safe operating area graphs - Continued.

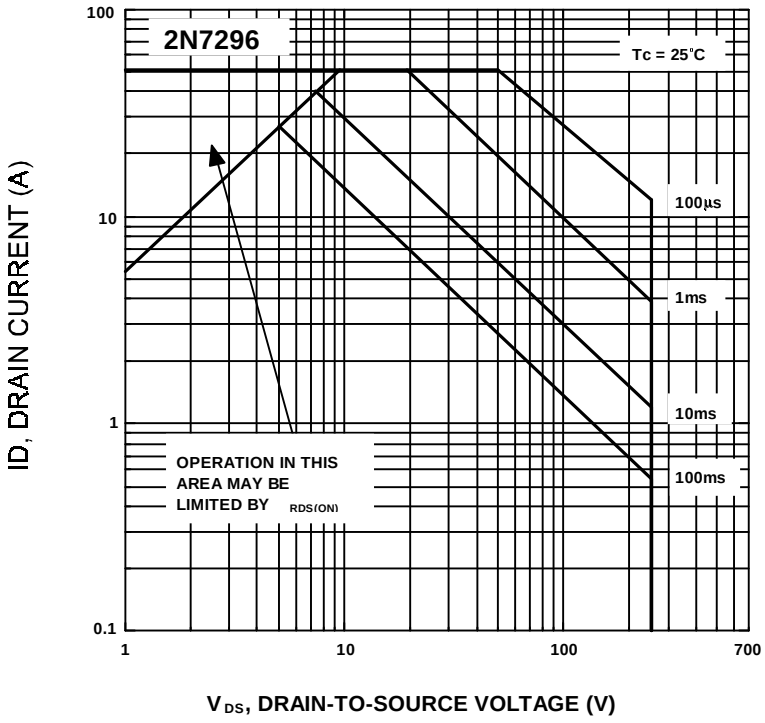


FIGURE 3. Safe operating area graphs - Continued.

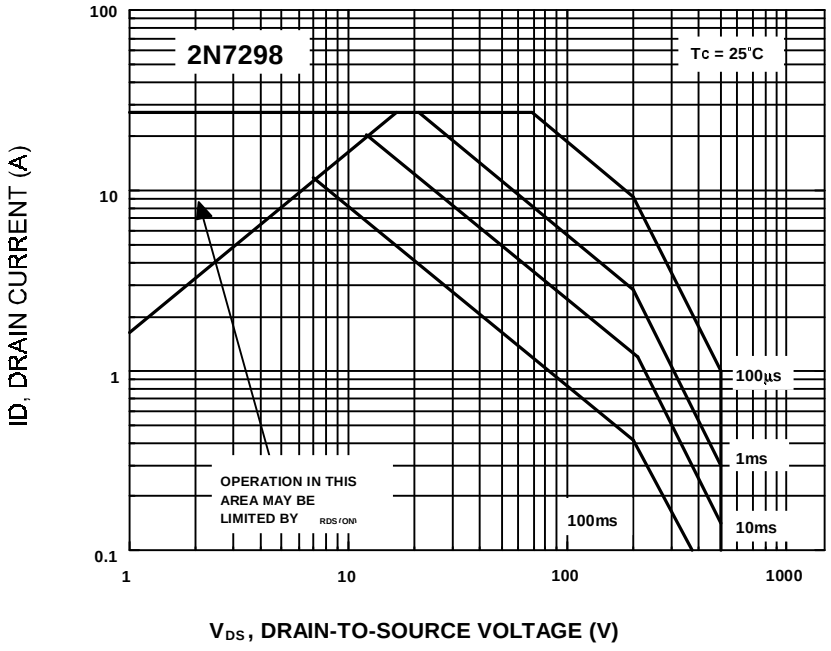


FIGURE 3. Safe operating area graphs - Continued.

4.5.3 Thermal response (ΔV_{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 (I_M) - - - - - - - - - - - - - - 10 mA

b. Drain heating current (I_H) - - - - - - - - - - - - 4 A minimum

c. Heating time (t_H) - - - - - - - - - - - - - - - - - - 100 ms
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

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

a. $I_{AS} = I_{DM}$

b. L = .1 mH

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

d. Initial junction temperature = $+25^{\circ}$ C, -5° C
$+10^{\circ}$ C

4.5.5 Gate stress test.

a. V_{GS} = 30 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 material 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.

5.1 Packaging requirements. The requirements for packaging shall be in accordance with MIL-PRF-19500.

6. NOTES

(This section contains information of a general or explanatory nature that may be helpful, but is not mandatory.)

6.1 Notes. 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 the specification.

b. Issue of DODISS to be cited in the solicitation and, if required, the specific issue of individual documents referenced (see 2.1).

c. Lead finish may be specified (see 3.3.1).

d. Type designation and product assurance level.

6.3 Substitution information. Devices covered by this specification are substitutable for the manufacturer's and user's Part or Identifying Number (PIN). This information in no way implies that manufacturer's PIN's are suitable for the military PIN.

Preferred types	Commercial types
2N7292	FRF150 1/
2N7294	FRF250 1/
2N7296	FRF254 1/
2N7298	FRF450 1/

1/ FRFxxxM, FRFxxxD FRFxxxR, 3 k, 10 k, 100 k RAD(Si)

6.4 Changes from previous issue. Marginal notations are not used in this revision to identify changes with respect to the previous issue due to the extent of the changes.

6.5 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 Products List QPL-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 purchase orders for the products covered by this specification. Information pertaining to qualification of products may be obtained from Defense Supply Center Columbus, DSCC-VQE, Columbus, OH 43216.

CONCLUDING MATERIAL

Custodians:
Army - CR
Navy - EC
Air Force - 17:
NASA - NA

Review activities
Navy - TD
Air Force - 70, 80

Preparing activity:
DLA - CC

(Project 5961-1931)

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-19500/605A	2. DOCUMENT DATE 17 December 1997

3. DOCUMENT TITLE SEMICONDUCTOR DEVICE, FIELD EFFECT RADIATION HARDENED (TOTAL DOSE ONLY) TRANSISTORS, N-CHANNEL, SILICON TYPES 2N7292, 2N7294, 2N7296, AND 2N7298 JANTXVM, D, R, H AND JANSM, D AND 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) (1) Commercial (2) DSN (If applicable)	7. DATE SUBMITTED (YYMMDD)

8. PREPARING ACTIVITY

a. NAME Alan Barone	b. TELEPHONE (Include Area Code) (1) Commercial: 614-692-0510 DSN: 850-0510 FAX: 614-692-6939 EMAIL: alan_barone@dscc.dla.mil
c. ADDRESS (Include Zip Code) Defense Supply Center Columbus ATTN: DSCC-VAT Columbus, OH 43216-5000	**IF YOU DO NOT RECEIVE A REPLY WITHIN 45 DAYS, CONTACT:** Defense Quality and Standardization Office 5203 Leesburg Pike, Suite 1403, Falls Church, VA 22041-3466 Telephone (703) 756-2340 DSN 289-2340

DD Form 1426, OCT 89 Previous editions are obsolete 198/290