The documentation and process conversion measures necessary to comply with this revision shall be completed by 15 February 1998

INCH-POUND

MIL-PRF-19500/603C
15 November 1997
SUPERSEDING
MIL-PRF-19500/603B
3 May 1996

PERFORMANCE SPECIFICATION SHEET

SEMICONDUCTOR DEVICE, FIELD EFFECT RADIATION HARDENED
(TOTAL DOSE ONLY) TRANSISTORS, N-CHANNEL, SILICON
TYPES 2N7268, 2N7269, 2N7270, 2N7394, 2N7268U, 2N7269U, 2N7270U, AND 2N7394U
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 an N-channel, enhancement-mode, MOSFET, radiation hardened (total dose only), power. Two levels of product assurance are provided for each device type 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, TO-254AA and figure 2 (surface mount).

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

Type 5/	P_T 1/	P_T T_A = +25°C	V_{DS}	V_{DG}	V_{GS}	I_{D1} 2/ 3/	I_{D2} T_C = +100°C	I_S 2/	I_{DM} 4/	T_{op} 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
2N7394	150	4	60	60	±20	35.0	30.0	35.0	200	-55	N/A
2N7268	150	4	100	100	±20	34.0	21.0	34.0	136	to	N/A
2N7269	150	4	200	200	±20	26.0	16.0	26.0	104		N/A
2B6270	150	4	500	500	±20	11.0	7.0	11.0	44	+150	500

1/ Derate linearly 1.2 W/°C for T_C > +25°C;

2/ $I_D = \sqrt{\frac{T_J \max - T_C}{(R_{\theta JC}) x (r_{DSon} \text{ at } T_J \max)}}$

3/ I_{D1} may be limited by pin diameter.

4/ I_{DM} + 4 X I_{D1}; as calculated by footnote 2/.

5/ Electrical characteristics, ratings and conditions for "U" suffix devices (surface mount) are identical to the corresponding non-"U" suffix devices unless otherwise noted.

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 Street, 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

DISTRIBUTION STATEMENT A. Approved for public release; distribution is unlimited.

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 = 1.0 mA dc		Max I_{DSS1} V_{GS} = 0 V_{DS} = 80 percent of rated V_{DS}	Max $r_{DS(ON)}$ 1/ V_{GS} = 12 V dc		$R_{\theta JC}$ max	E_{AS} at I_{D1}	I_{AS}
					T_J = +25°C at I_{D2}	T_J = +150°C at I_{D2}			
	V dc	V dc		µA dc	ohm	ohm	°C/W	mJ	A
		Min	Max						
2N7394	60	2.0	4.0	25	0.027	0.030	0.83	500	35.0
2N7268	100	2.0	4.0	25	0.065	0.132	0.83	500	34.0
2N7269	200	2.0	4.0	25	0.100	0.230	0.83	500	26.0
2N7270	500	2.0	4.0	50	0.450	1.260	0.83	500	11.0

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

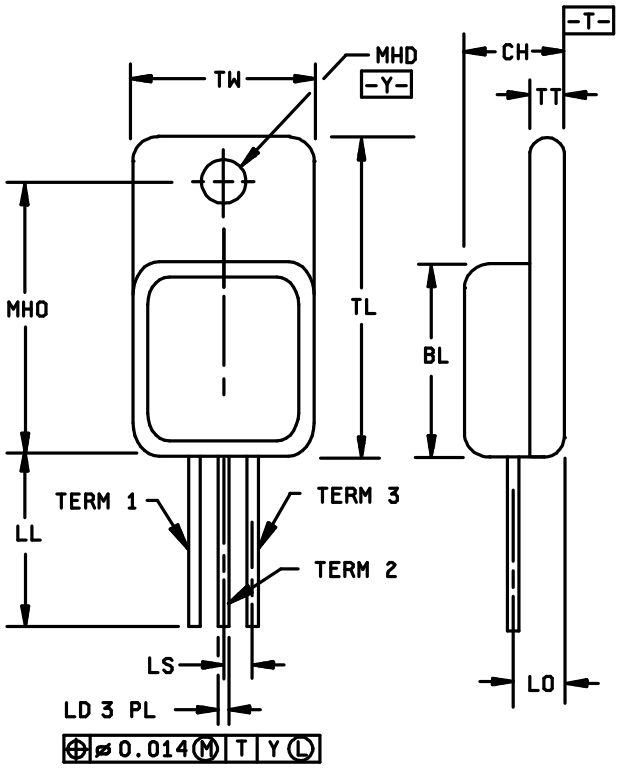
MILITARY

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

(Unless otherwise indicated, copies of the above specifications, standards, and handbooks are available from the Standardization Document Order Desk, 700 Robbins Avenue, Building 4D, 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 (except for related associated specifications or specification sheets), the text of this document takes precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

Symbol	Dimensions			
	Inches		Millimeters	
	Min	Max	Min	Max
BL	.535	.545	13.59	13.89
CH	.249	.260	6.32	6.60
LD	.035	.045	0.89	1.14
LL	.510	.570	12.95	14.48
LO	.150 BSC		3.81 BSC	
LS	.150 BSC		3.81 BSC	
MHD	.139	.149	1.53	3.78
MHO	.665	.685	16.89	17.40
TL	.790	.800	20.07	20.32
TT	.040	.050	1.02	1.27
TW	.535	.545	13.59	13.89
Term 1	Drain			
Term 2	Source			
Term 3	Gate			



NOTES:
1. Dimensions are in inches.
2. Millimeters equivalents are given for general information only.
3. Refer to applicable symbol list.
4. Dimensioning and tolerating are in accordance with ANSI Y14.5M.
5. All terminals are isolated from case.

FIGURE 1. Physical dimensions for TO-254AA.

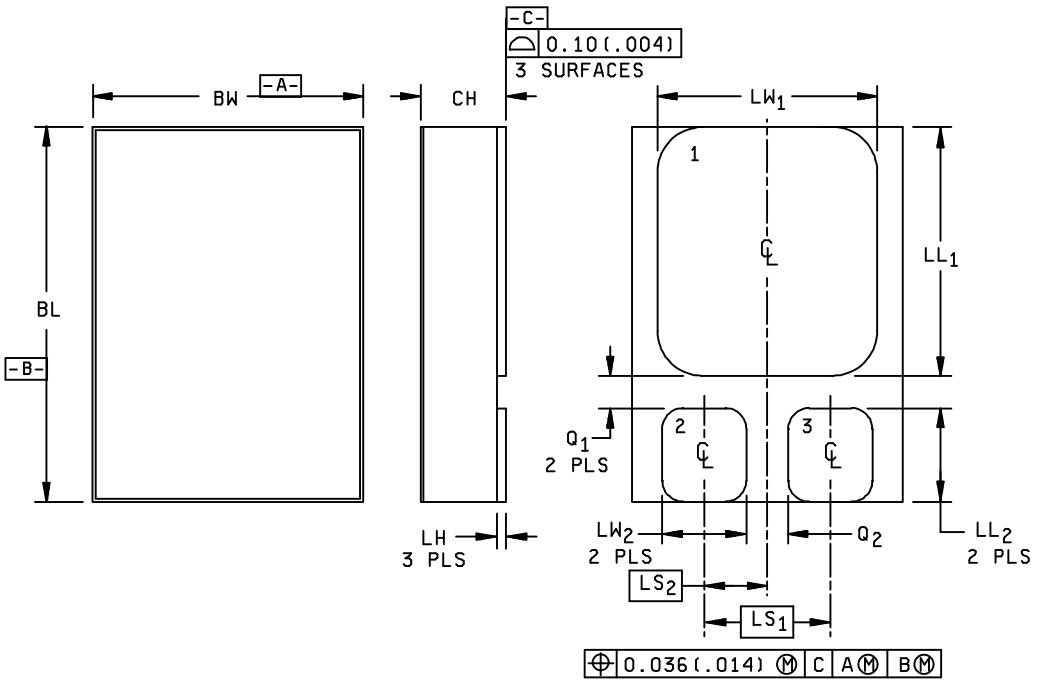


FIGURE 2. Dimensions and configuration of surface mount package outline.

Dimensions				
Symbol	SMD-1			
	Inches		Millimeters	
	Min	Max	Min	Max
BL	.619	.631	15.73	16.02
BW	.444	.456	11.28	11.58
CH	- - -	.142	- - -	3.60
LH	.010	.020	0.26	0.50
LL_1	.409	.421	10.39	10.69
LL_2	.151	.163	3.84	4.14
LS_1	.210 BSC		5.33 BSC	
LS_2	.105 BSC		2.67 BSC	
LW_1	.369	.381	9.38	9.67
LW_2	.134	.146	3.41	3.70
Q_1	.030	- - -	0.76	- - -
Q_2	.035	- - -	0.89	- - -
Term 1	Drain			
Term 2	Gate			
Term 3	Source			

NOTES:
1. Controlling dimension: Inch.
2. Metric equivalents are given for information only.
3. The lid shall be electrically isolated from the drain, gate and source.
4. Dimensioning and Tolerancing shall be in accordance with ANSI Y14.5M 1982.

FIGURE 2. Dimensions and configuration of surface mount package outline - Continued.

3. REQUIREMENTS

3.1 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 6.3).

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

I_{AS} - Rated avalanche current, nonrepetitive

3.3 Interface requirements and physical dimensions. The interface requirements and physical dimensions shall be as specified in MIL-PRF-19500 and on figures 1 and 2 herein. Methods used for electrical isolation of the terminal feedthroughs shall employ materials that contain a minimum of 90 percent AL_2O_3 (ceramic). Examples of such construction techniques are metallized ceramic eyelets or ceramic walled packages.

3.3.1 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 in accordance with MIL-PRF-19500 and herein. Where a choice of lead material or finish is desired, it shall be specified in the contract or purchase order (see 6.5).

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.

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 4.4.2 and 4.4.3 herein.

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.

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

4.3 Screening (JANTXV and JANS levels only). Screening shall be in accordance with appendix E, 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 appendix E, table IV of MIL-PRF-19500)	Measurement	
	JANS level	JANTXV levels
1/	Method 3470 (see 4.5.4)	Method 3470 (see 4.5.4)
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)
9 1/	Subgroup 2 of table II herein. I_{GSS}, I_{DSS1}	Subgroup 2 of table I herein
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} = ± 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	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 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.

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 appendix E, of MIL-PRF-19500.

4.4.1 Group A inspection. Group A inspection shall be conducted in accordance with appendix E, table V of MIL-PRF-19500 and table I herein. End-point electrical measurements shall be in accordance with 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 appendix E, table VIa (JANS) and table VIb (JANTX and JANTXV) of MIL-PRF-19500, and herein. Electrical measurements (end-points) and delta requirements shall be in accordance with table I, group A, subgroup 2 herein.

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

Subgroup	Method	Condition
B3	1051	Test condition G, 100 cycles.
B3	2075	See 3.3.2.
B3	2077	SEM qualification may be performed anytime prior to lot formation.
B4	1042	The heating cycle shall be 30 seconds minimum.
B5	1042	Accelerated steady-state reverse bias, condition B, V_{GS} = rated, T_A = +175°C, t = 24 hours minimum; or, T_A = +150°C, t = 48 hours minimum.
B5	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.
B5	2037	Bond strength (Al-Au die interconnects only); test condition A.
B6	3161	See 4.5.2.

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

Subgroup	Method	Condition
B2	1051	Test condition G, 25 cycles.
B3	1042	The heating cycle shall be 30 seconds minimum.
B4	2075	See 3.3.2.
B4	2037	Test condition A. All internal bond wires for each device shall be pulled separately.
B5 and B6	----	Not applicable.

4.4.3 Group C inspection. Group C inspection shall be conducted in accordance with the conditions specified for subgroup testing in appendix E, table VII of MIL-PRF-19500 and as follows. Electrical measurements (end-points) and delta requirements shall be in accordance with the applicable of table I, group A, subgroup 2 herein.

Subgroup	Method	Condition
C2	2036	Test condition A; weight = 10 pounds; t = 15 s (applicable to TO-254AA only).
C5	1001	Test condition C. For device type 2N7270: V_{DS} = 500 V; $I_{(ISO)}$ < 0.25 mA.
C6	1042	The heating cycle shall be 30 seconds minimum.

4.4.4 Group D Inspection. Group D inspection shall be conducted in accordance with appendix E, table VII 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 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 $R_{\theta JC(max)}$ = 0.83°C/W. 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) ..... Steady-state (see MIL-STD-750, method 3161for definition).

d. Drain-source heating voltage (V_H) ..... 25 V (20 V for “U” suffix devices).

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

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

4.5.3 Thermal impedance ($Z_{\theta JC}$ measurements). The $Z_{\theta JC}$ measurements shall be performed in accordance with MIL-STD-750, method 3161. The maximum limit (not to exceed figure 3, thermal impedance curves and the group A, subgroup 2 limits) for $Z_{\theta JC}$ in screening (appendix E, table VI 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 screening 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, 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 monitor.

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

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

c. Heating time (t_H) ..... 100 ms (30 ms for “U” suffix devices).

d. Drain-source heating voltage (V_H) ..... 25 V (20 V for “U” suffix devices).

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. Peak current (I_{AS}) ..... $I_{AS(max)}$.

b. Peak gate voltage (V_{GS}) ..... 12 V.

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

d. Initial case temperature (T_C) ..... +25°C +10°C, -5°C.

e. Inductance (L) ..... $\dfrac{\left[\dfrac{2E_{AS}}{(I_{D1})^2}\right]\left[(V_{BR}-V_{DD})\right]}{V_{BR}}\ mH\ \text{minimum.}$

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

g. Supply voltage (V_{DD}) ..... 25 V for 2N7268 and 2N7394, 50 V for 2N7269 and 2N7270.

4.5.5 Gate stress test.

a. V_{GS} = 30 V minimum.

b. t = 250 µs minimum.

TABLE I. Group A inspection.

Inspection 1/ 3/	MIL-STD-750		Symbol	Limits		Unit
	Method	Conditions		Min	Max	
Subgroup 1						
Visual and mechanical inspection	2071					
Subgroup 2						
Thermal impedance 2/	3161	See 4.5.3 TO-254 Surface mount device	$Z_{\theta JC}$		0.60 0.45	°C/W °C/W
Breakdown voltage, drain to source	3407	V_{GS} = 0 V; I_D = 1 mA dc Bias condition C	$V_{(BR)DSS}$			
2N7394				60		V dc
2N7268				100		V dc
2N7269				200		V dc
2N7270				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 V_{DS} = 80 percent of rated V_{DS}	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}			
2N7394					25	µA dc
2N7268					25	µA dc
2N7269					25	µA dc
2N7270					50	µA dc
Static drain to source "ON"-state resistance	3421	V_{GS} = 12 V dc, condition A pulsed (see 4.5.1), I_D = I_{D2}	$r_{DS(on)1}$			
2N7394					0.027	ohm
2N7268					0.065	ohm
2N7269					0.100	ohm
2N7270					0.450	ohm
Static drain to source "ON"-state resistance	3421	V_{GS} = 12 V dc, condition A pulsed (see 4.5.1), I_D = I_{D1}	$r_{DS(on)2}$			
2N7394					0.030	ohm
2N7268					0.070	ohm
2N7269					0.110	ohm
2N7270					0.500	ohm
Forward voltage	4011	Pulsed (see 4.5.1), , I_D = I_{D1} V_{GS} = 0 V dc	V_{SD}			
2N7394					1.4	V
2N7268					1.4	V
2N7269					1.4	V
2N7270					1.6	V

See footnotes at end of table.

TABLE I. Group A inspection - Continued.

Inspection 1/ 3/	MIL-STD-750		Symbol	Limits		Unit
	Method	Conditions		Min	Max	
Subgroup 3						
High temperature operation:		$T_C = T_J = +125°C$				
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; bias condition C V_{DS} = 100 percent of rated V_{DS}	I_{DSS2}		1.0	mA dc
		V_{DS} = 80 percent of rated V_{DS}	I_{DSS3}		0.25	mA dc
Static drain to source "ON"-state resistance	3421	V_{GS} = 12 V dc pulsed (see 4.51), $I_D = I_{D2}$	$r_{DS(on)3}$			
2N7394					0.060	ohm
2N7268					0.132	ohm
2N7269					0.200	ohm
2N7270					1.000	ohm
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	$V_{DS} \geq V_{GS}$, I_D = 1 mA dc	$V_{GS(TH)3}$		5.0	V dc
Subgroup 4						
Forward transconductance	3475	I_D = rated I_{D2}, V_{DD} = 15 V (see 4.5.1)	g_{FS}			
2N7394				12		S
2N7268				8		S
2N7269				8		S
2N7270				4		S
Switching time test	3472	$I_D = I_{D1}$, V_{GS} = 12 V dc R_G = 2.35Ω, V_{DD} = 50 percent of rated V_{DS}				
Turn-on delay time			$t_{d(on)}$			
2N7394					27	ns
2N7268					45	ns
2N7269					33	ns
2N7270					45	ns

See footnotes at end of table.

TABLE I. Group A inspection - Continued.

Inspection 1/ 3/	MIL-STD-750		Symbol	Limits		Unit
	Method	Conditions		Min	Max	
Subgroup 4 - Continued						
Rise time			t_r			
2N7394					100	ns
2N7268					190	ns
2N7269					140	ns
2N7270					190	ns
Turn-off delay time			$t_{d(off)}$			
2N7394					75	ns
2N7268					170	ns
2N7269					140	ns
2N7270					190	ns
Fall time			t_f			
2N7394					75	ns
2N7268					130	ns
2N7269					140	ns
2N7270					130	ns
Subgroup 5	3474					
Safe operating area test (high voltage)		See figures 4, 5, 6 and 7 t_p = 10 ms minimum V_{DS} = 80 percent of maximum rated V_{DS}, ($V_{DS} \leq 200$)				
Electrical measurements		See table I, group A, subgroup 2				
Subgroup 6						
Not applicable						
Subgroup 7						
Gate charge	3471	Condition B				
On-state gate charge			$Q_{g(on)}$			
2N7394					200	nC
2N7268					160	nC
2N7269					170	nC
2N7270					150	nC

See footnotes at end of table.

TABLE I. Group A inspection - Continued.

Inspection 1/ 3/	MIL-STD-750		Symbol	Limits		Unit
	Method	Conditions		Min	Max	
Subgroup 7 - Continued						
Gate to source charge			Q_{gs}			
2N7394					60	nC
2N7268					35	nC
2N7269					30	nC
2N7270					30	nC
Gate to drain charge			Q_{gd}			
2N7394					75	nC
2N7268					65	nC
2N7269					60	nC
2N7270					75	nC
Reverse recovery time	3473	di/dt ≤ 100 A/µs, V_{DD} ≤ 30 V, $I_D = I_{D1}$	t_{rr}			
2N7394					280	ns
2N7268					570	ns
2N7269					820	ns
2N7270					1,100	ns

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

2/ This test is required for the following end-point measurements only (not intended for screen 13):

JANS - group B, subgroups 3 and 4

JANTX and JANTXV - group B, subgroups 2 and 3;
group C, subgroup 6;
group E, subgroup 1

3/ Electrical characteristics and conditions for “U” suffix devices (surface mount) are identical to the corresponding non- “U” suffix devices unless otherwise noted.

TABLE II. Group D inspection.

Inspection 1/ 2/ 5/	MIL-STD-750		Symbol	Preirradiation limits				Postirradiation limits				Unit
	Method	Conditions		R		3/ F, G, and H		R		3/ F, G, and H		
				Min	Max	Min	Max	Min	Max	Min	Max	
Subgroup 1												
Not applicable												
Subgroup 2		T_C = +25°C										
Steady-state total dose irradiation (V_{GS} bias) 4/	1019	V_{GS} = 12 V V_{DS} = 0										
Steady-state total dose irradiation (V_{DS} bias) 4/	1019	V_{GS} = 0 V_{DS} = 80 percent of rated V_{DS} (pre-irradiation)										
End-point electricals												
Breakdown voltage, drain to source	3407	V_{GS} = 0; I_D = 1 mA bias cond. C	V_{BRDSS}									
2N7394				60		60		60		60		V dc
2N7268				100		100		100		100		V dc
2N7269				200		200		200		200		V dc
2N7270				500		500		500		500		V dc
Gate to source voltage (threshold)	3403	$V_{DS} \geq V_{GS}$ I_D = 1 mA	V_{GSth}									
2N7394				2	4	2	4	2	4	1.25	4.50	V dc
2N7268				2	4	2	4	2	4	1.25	4.50	V dc
2N7269				2	4	2	4	2	4	1.25	4.50	V dc
2N7270				2	4	2	4	2	4	1.25	4.50	V dc
Gate current	3411	V_{GS} = 20 V V_{DS} = 0 bias cond. C	I_{GSSF1}		100		100		100		100	nA dc
Gate current	3411	V_{GS} = 20 V V_{DS} = 0 bias cond. C	I_{GSSR1}		-100		-100		-100		-100	nA dc

See footnotes at end of table.

TABLE II. Group D inspection - Continued.

Inspection 1/ 2/ 5/	MIL-STD-750		Symbol	Preirradiation limits				Postirradiation limits				Unit
	Method	Conditions		R		3/ F, G, and H		R		3/ F, G, and H		
				Min	Max	Min	Max	Min	Max	Min	Max	
Subgroup 2 - Continued												
Drain current	3413	V_{GS} = 0 Bias cond. C V_{DS} = 80 percent of rated V_{DS} (pre-irradiation)	I_{DSS}									
2N7394					25		25		25		50	µA dc
2N7268					25		25		25		50	µA dc
2N7269					25		25		25		50	µA dc
2N7270					50		50		50		100	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_{DSon1}									
2N7394					0.81		0.81		0.81		1.2	Vdc
2N7268					1.365		1.365		1.365		1.89	Vdc
2N7269					1.6		1.6		1.6		2.48	Vdc
2N7270					3.15		3.15		3.15		4.2	Vdc
Forward voltage source drain diode	4011	V_{GS} = 0 V $I_D = I_{D1}$	V_{SD}									
2N7394					1.4		1.4		1.4		1.4	Vdc
2N7268					1.4		1.4		1.4		1.4	Vdc
2N7269					1.4		1.4		1.4		1.4	Vdc
2N7270					1.6		1.6		1.6		1.6	Vdc

1/ For sampling plan, see MIL-PRF-19500.
2/ Group D qualification may be performed anytime prior to lot formation. Wafers qualified to these group D QCI requirements may be used for any other detail specification utilizing the same die design.
3/ The F designation represent devices which pass end-points at both 100 k and 300 k rads (Si). The G designation represents devices which pass 100 k, 300 k, and 600 k rad (Si) end-points. H must meet end-points for 100 k, 300 k, 600 k and 1,000 k RAD (Si).
4/ Separate samples shall be pulled for each bias.
5/ 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.

TABLE III. 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
Thermal shock (temperature cycling)	1051	Test condition G.	
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	Condition B, 1,000 hours.	
Electrical measurements		See table I, group A, subgroup 2.	
Steady-state reverse bias	1042	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	$R_{\theta JC}$ = 0.83 °C/W maximum. See 4.5.2.	

1/ A separate sample may be pulled for each test condition.

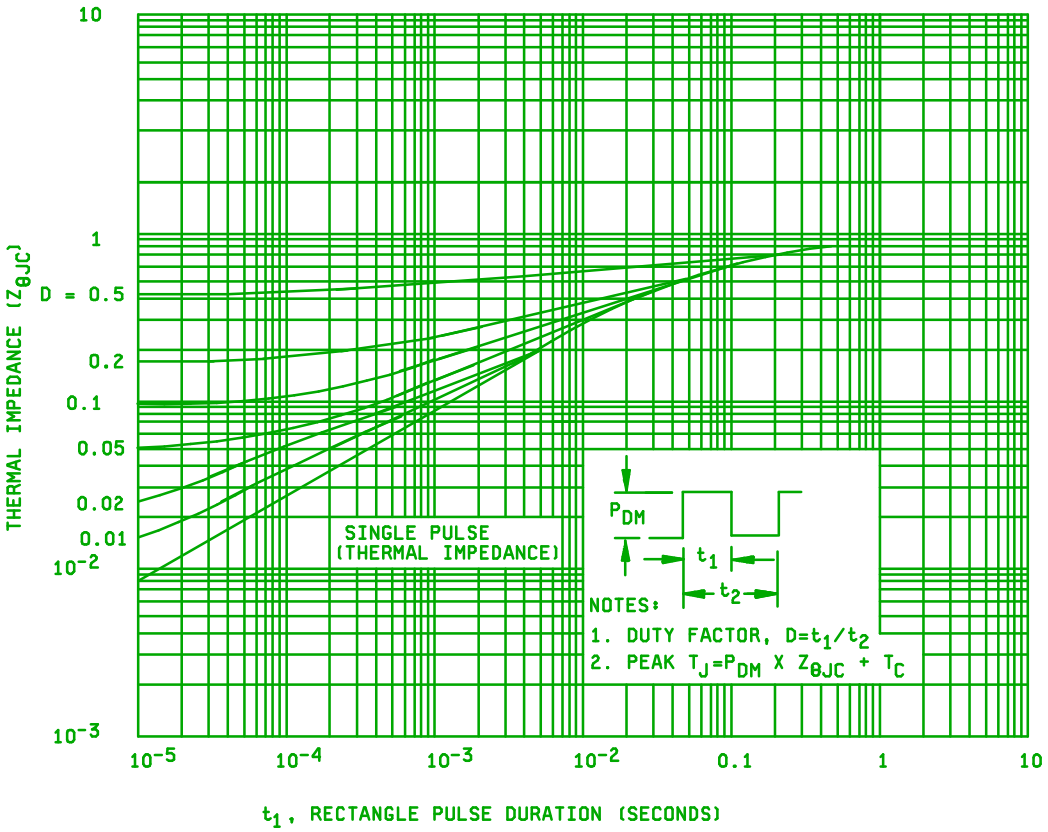


FIGURE 3. Thermal impedance curves.

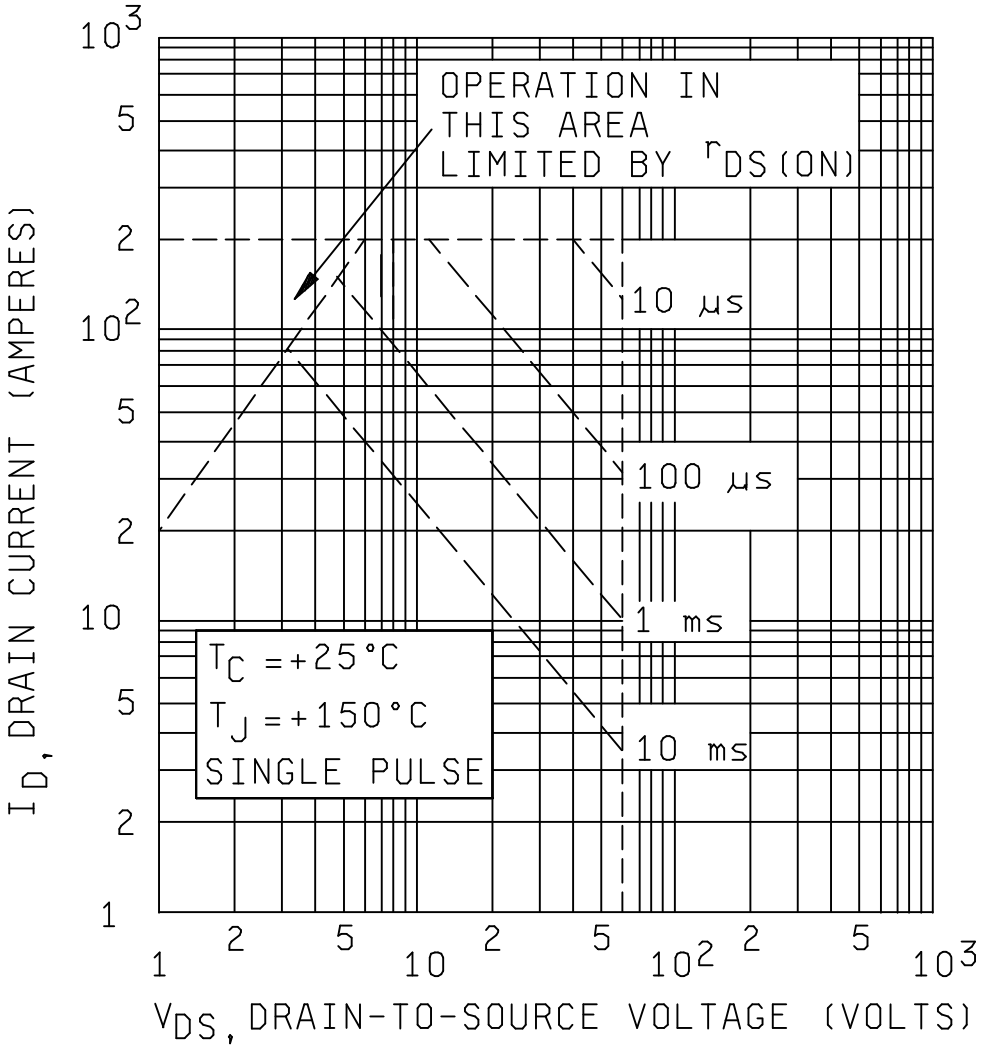


FIGURE 4. Safe operating area graph.

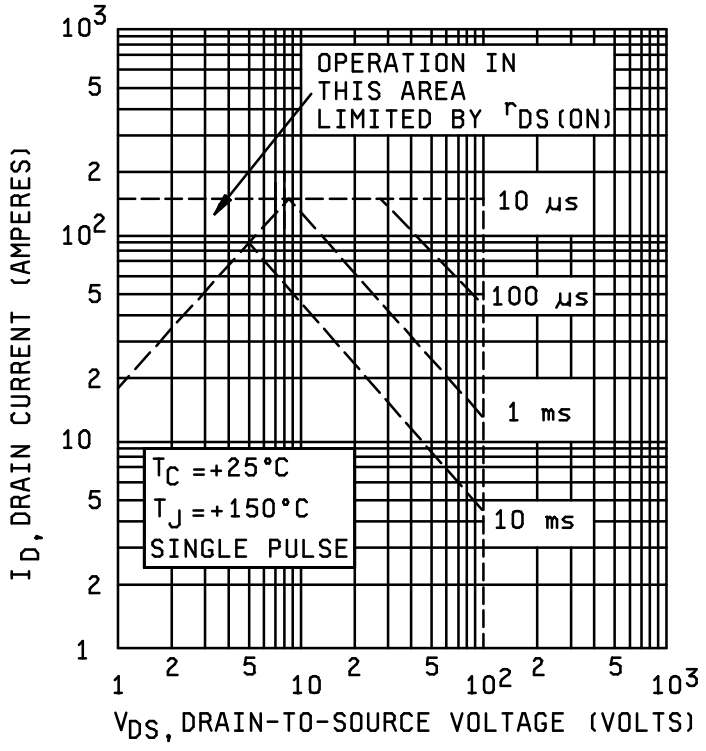


FIGURE 5. Safe operating area graph.

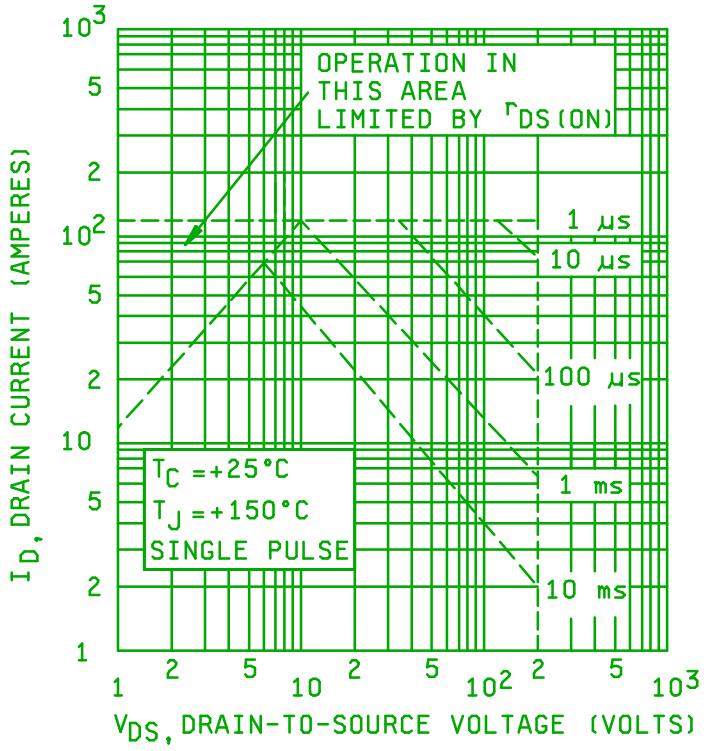


FIGURE 6. Safe operating area graph.

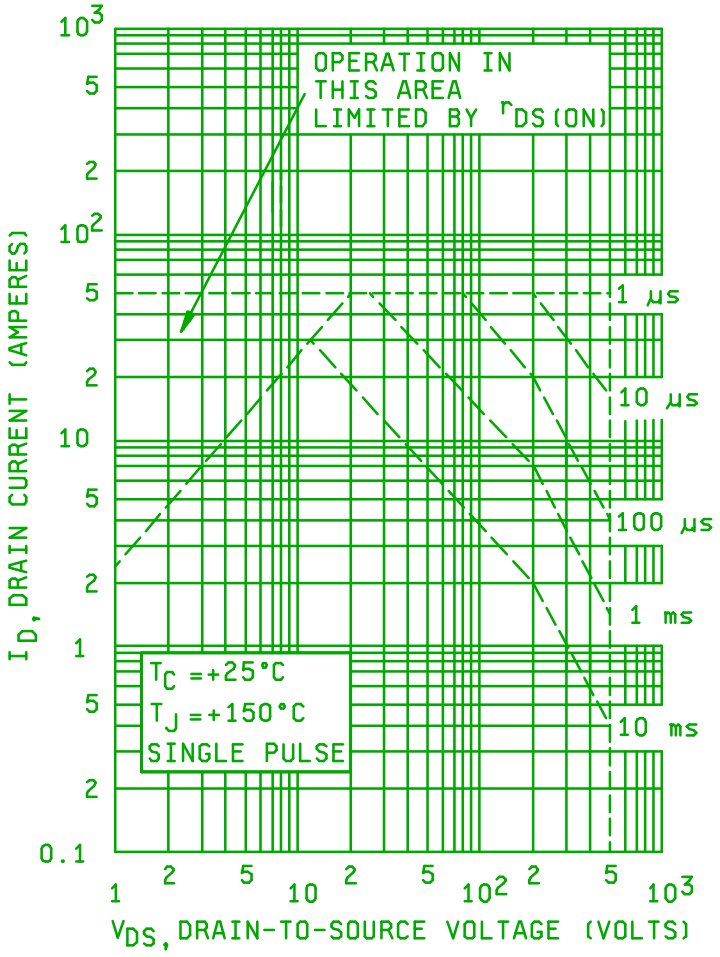


FIGURE 7. Safe operating area graph.

5. PACKAGING

5.1 Packaging. Packaging shall prevent mechanical damage of the devices during shipping and handling and shall not be detrimental to the device. 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.

5.2 Marking. Unless otherwise specified (see 6.2), marking shall be in accordance with MIL-STD-129.

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. See MIL- PRF-19500.

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 Products List QPL No.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, ATTN: DSCC-VQE, 3990 East Broad Street, Columbus, OH 43216-5000.

6.4 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 1/	
	TO254-AA	“U”
2N7394	IRHM7054	IRHN 054
2N7268	IRH7150	IRHN 150
2N7269	1RH7250	IRHN 250
2N7270	1RH7450	IRHN 450

1/ IRH 7: 100k RAD (Si)
IRH 3: 300k RAD (Si)
IRH 4: 600k RAD (Si)
IRH 8: 1,000k RAD (Si)

6.5 Ordering data. Acquisition documents may specify the material and finish (see 3.3.1).

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.

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

Review activities:
Navy - TD
Air Force - 19, 70, 80

Preparing activity:
DLA - CC

(Project 5961- 1951)

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.

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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-19500/603C	**2. DOCUMENT DATE (YYMMDD)** 971115

3. DOCUMENT TITLE SEMICONDUCTOR DEVICE, FIELD EFFECT RADIATION HARDENED (TOTAL DOSE ONLY) TRANSISTOR, N-CHANNEL, SILICON TYPES 2N7268, 2N7269, 2N7270, 2N7394, 2N7268U, 2N7269U, 2N7270U AND 2N7394U, 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) (1) Commercial (2) AUTOVON (If applicable)	7. DATE SUBMITTED (YYMMDD)

8. PREPARING ACTIVITY

a. NAME Alan Barone	b. TELEPHONE (Include Area Code) (1) Commercial (614)692-0510 (2) AUTOVON 850-0510
c. ADDRESS (Include Zip Code) Defense Supply Center Columbus, ATTN: DSCC-VAT, 3990 East Broad Street, 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 AUTOVON 289-2340