The documentation and process conversion measures necessary to comply with this revision shall be completed by 19 August 2003.

INCH-POUND

MIL-PRF-19500/543G
19 May 2003
SUPERSEDING
MIL-PRF-19500/543F
7 September 2001

PERFORMANCE SPECIFICATION

SEMICONDUCTOR DEVICE, FIELD EFFECT TRANSISTORS, N-CHANNEL, SILICON
REPETITIVE AVALANCHE TYPES 2N6764, 2N6766, 2N6768, 2N6770,
JAN, JANTX, JANTXV, JANS, JANHC AND JANKC

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 N-channel, enhancement-mode, MOSFET, power transistors. Four levels of product assurance are provided for each encapsulated device type as specified in MIL-PRF-19500 and two levels of product assurance for each unencapsulated die, with avalanche energy ratings (E_{AS} and E_{AR}) and maximum avalanche current (I_{AR}).

1.2 Physical dimensions. See figure 1 (TO-204AE for types 2N6764 and 2N6766; TO-204AA for types 2N6768 and 2N6770 (formerly TO-3)), see figure 2 for JANHC and JANKC (die) dimensions.

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

Type	P_T (1) T_C = +25°C	P_T T_A = +25°C	V_{DS}	V_{DG}	V_{GS}	I_{D1} (2) (3) T_C = +25°C	I_S	I_{D2} (2) T_C = +100°C
	W	W	V dc	V dc	V dc	A dc	A dc	A dc
2N6764	150	4	100	100	± 20	38.0	38.0	24.0
2N6766	150	4	200	200	± 20	30.0	30.0	19.0
2N6768	150	4	400	400	± 20	14.0	14.0	9.0
2N6770	150	4	500	500	± 20	12.0	12.0	7.75

Type	I_{DM} (4)	E_{AS}	E_{AR}	I_{AR}	V_{ISO} 100,000 ft. attitude	T_{STG} and T_J	Max $r_{DS(on)}$ (1); V_{GS} = 10 V dc $I_D = I_{D2}$		$R_{\theta JC}$ max
							T_J = +25°C	T_J = +150°C	
	A pk	A	mJ	mJ		°C	Ω	Ω	°C/W
2N6764	152	150	15	38.0		-55	0.055	0.105	0.83
2N6766	120	500	15	30.0		to	0.085	0.170	0.83
2N6768	56	700	15	14.0	400	+150	0.300	0.750	0.83
2N6770	48	750	15	12.0	500		0.400	1.000	0.83

See notes on next page.

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, Post Office 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.

* 1.3 Maximum ratings - Continued.

(1) Derate linearly 1.2 W/°C for T_C > +25°C.
(2) The following formula derives the maximum theoretical I_D limit. I_D is also limited by package and internal wires:

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

(3) See figure 3, maximum drain current graphs.
(4) I_{DM} = 4 x I_{D1} as calculated in note 2.

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

Type	Min $V_{(BR)DSS}$ V_{GS} = 0V I_D = 1 mA dc	I_{AR} (1)	E_{AS}	E_{AR}	Max $r_{DS(on)}$ V_{GS} = 10 V dc I_D = I_{D2}	V_{GSth1} $V_{DS} \geq V_{GS}$ I_D = 0.25 mA		Max I_{DSS1} VGS = 0 V V_{DS} = 80 percent of rated V_{DS}
	Vdc	A	mJ	mJ	Ω	min	max	µA dc
2N6764	100	38.0	150	15.0	0.055	2.0	4.0	25
2N6766	200	30.0	500	15.0	0.085	2.0	4.0	25
2N6768	400	14.0	700	15.0	0.3	2.0	4.0	25
2N6770	500	12.0	750	15.0	0.4	2.0	4.0	25

(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

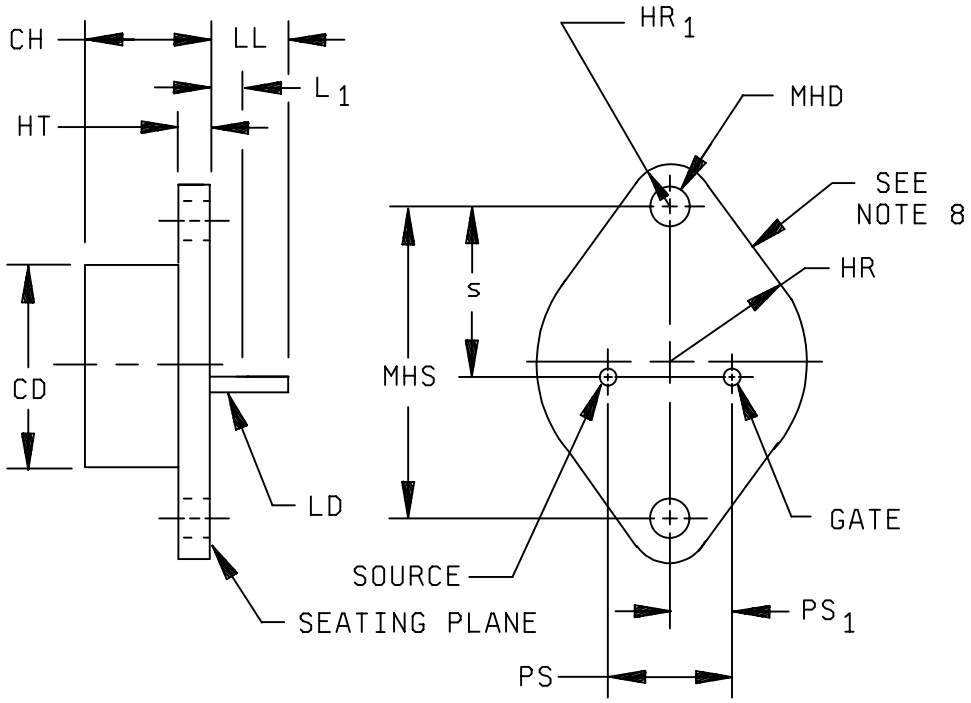
MIL-PRF-19500 - Semiconductor Devices, General Specification for.

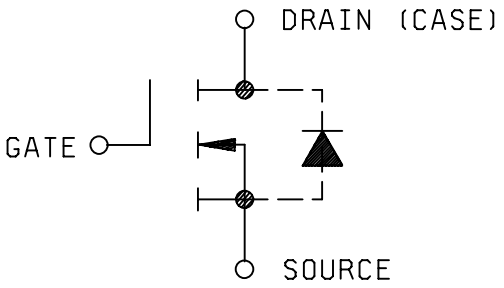
STANDARD

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.)





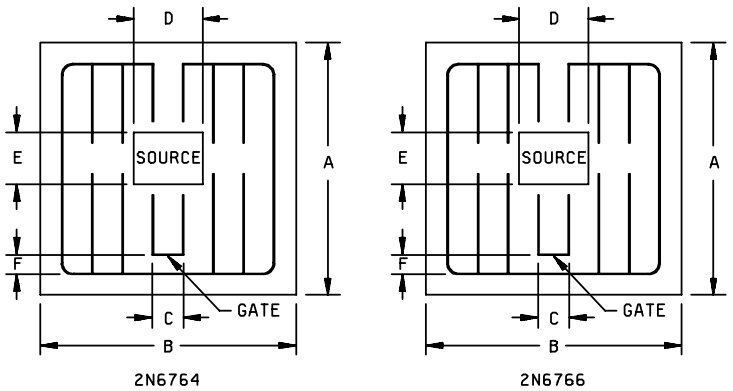
CIRCUIT SCHEMATIC

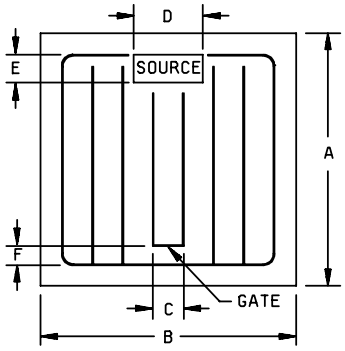
* FIGURE 1. Physical dimensions of transistor types 2N6764 and 2N6766, TO-204AE; for types 2N6768 and 2N6770, TO-204AA.

Dimensions					
Ltr	Inches		Millimeter		Notes
	Min	Max	Min	Max	
CD		.875		22.23	
CH	.250	.360	6.35	9.15	
HR	.495	.525	12.57	13.3	
HR_1	.131	.188	3.33	4.78	
HT	.060	.135	1.52	3.43	
LD	.057	.063	1.45	1.60	5
	.038	.043	0.97	1.10	6
LL	.312	.500	7.92	12.70	
L_1		.050		1.27	3
MHD	.151	.161	3.84	4.09	7
MHS	1.177	1.197	29.90	30.04	
PS	.420	.440	10.67	11.18	
PS_1	.205	.225	5.21	5.72	
s	.655	.675	16.64	17.15	

NOTES:
1. Dimensions are in inches.
2. Metric equivalents are given for general information only.
3. These dimensions shall be measured at points .050 inch (1.27 mm) and .055 inch (1.40 mm) below the seating plane. When gauge is not used, measurement will be made at the seating plane.
4. The seating plane of the header shall be flat within .001 inch (0.03 mm) concave to .004 inch (0.10 mm) convex inside a .930 inch (23.62 mm) diameter circle on the center of the header and flat within .001 inch (0.03 mm) concave to .006 inch (0.15 mm) convex overall.
5. These dimensions pertain to the 2N6764 and 2N6766 types.
6. These dimensions pertain to the 2N6768 and 2N6770 types.
7. Mounting holes shall be deburred on the seating plane side.
8. Drain is electrically connected to the case.
9. In accordance with ASME Y14.5M, diameters are equivalent to ϕx symbology.

* FIGURE 1. Physical dimensions of transistor types 2N6764 and 2N6766 TO-204AE; for types 2N6768 and 2N6770, TO-204AA - Continued.





Ltr	Dimensions 2N6764 and 2N6766				Dimensions 2N6768 and 2N6770			
	Inches		Millimeters		Inches		Millimeters	
	Min	Max	Min	Max	Min	Max	Min	Max
A	.252	.262	6.40	6.65	.252	.262	6.40	6.65
B	.252	.262	6.40	6.65	.252	.262	6.40	6.65
C	.027	.037	0.69	0.94	.025	.035	0.64	0.89
D	.012	.022	0.30	0.56	.043	.053	1.09	1.35
E	.057	.067	1.45	1.70	.032	.042	0.81	1.07
F	.013	.023	0.33	0.58	.015	.025	0.38	0.64

NOTES:
1. Dimensions are in inches.
2. Metric equivalents are given for general information only.
3. Unless otherwise specified, tolerance is ± .005 inch (0.13 mm).
4. The physical characteristics of the die thickness are .0187 inch (0.474 mm). The back metals are chromium, nickel and silver. The top metal is aluminum and the back contact is the drain.

FIGURE 2. JANHC and JANKC A-version die dimensions.

* 2.3 Order of precedence. In the event of a conflict between the text of this document and the references cited herein, the text of this document takes precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

3. REQUIREMENTS

* 3.1 General. The individual item requirements shall be as specified in MIL-PRF-19500 and as modified herein.

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 figures 1 and 2.

3.4.1 Lead material and finish. Lead material shall be Kovar or Alloy 52; a copper core or a plated core is permitted. Lead finish shall be solderable in accordance with MIL-PRF-19500, MIL-STD-750 and herein.

3.4.2 Construction. These devices shall be constructed in a manner and using materials which enable the devices to meet the applicable requirements of MIL-PRF-19500 and herein.

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

3.5 Marking. Marking shall be in accordance with MIL-PRF-19500.

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

3.6.1 Handling. MOS devices must be handled with certain precautions to avoid damage due to the accumulation of static discharge. The following handling practices are recommended (see 3.5)

a. Devices shall be handled on benches with conductive and grounded surface.

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

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

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

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

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.

* 4.2.1 JANHC and JANKC devices. Qualification for JANHC and JANKC devices shall be as specified in MIL-PRF-19500.

* 4.2.2 Group E qualification. Group E inspection shall be performed for qualification or re-qualification only. In case qualification was awarded to a prior revision of the associated specification that did not request the performance of table II tests, the tests specified in table II herein shall be performed by the first inspection lot of this revision to maintain qualification.

* 4.3 Screening (JANS, JANTXV and JANTX 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 shall not be acceptable.

Screen (see MIL-PRF-19500, table IV) (1) (2)	Measurements	
	JANS level	JANTX and JANTXV
(3)	Gate stress test (see 4.3.2)	Gate stress test (see 4.3.2).
(3) (4)	Method 3470 of MIL-STD-750, (see 4.3.3)	Method 3470 of MIL-STD-750, (see 4.3.3)
(3) (5)	Method 3161 of MIL-STD-750, (see 4.3.4)	Method 3161 of MIL-STD-750, (see 4.3.4)
9	I_{GSS1}, I_{DSS1}	Not applicable
10	Method 1042 of MIL-STD-750, test condition B	Method 1042 of MIL-STD-750, test condition B
11	I_{GSS1}, I_{DSS1}, $r_{DS(on)1}$. $V_{GS(th)1}$ of subgroup 2 of table I herein. ΔI_{GSS1} = ± 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_{GSS1}, I_{DSS1}, $r_{DS(on)1}$. $V_{GS(th)1}$ of subgroup 2 of table I herein
12	Method 1042 of MIL-STD-750, test condition A, t = 240 hours	Method 1042 of MIL-STD-750, test condition A, t = 48 hours minimum at T_A = +175° C minimum.
13	Subgroups 2 and 3 of table I. ΔI_{GSS1} = ± 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.	Subgroup 2 of table I herein. ΔI_{GSS1} = ± 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.

(1) At the end of the test program, I_{GSSF} and I_{GSSR} are measured.
(2) An out-of-family program to characterize I_{GSSF} and I_{GSSR} shall be invoked.
(3) Shall be performed anytime before screen 10.
(4) This test method in no way implies a repetitive avalanche energy rating.
(5) This test need not be performed in group A when performed as a screen.

4.3.1 Screening (JANHC and JANKC). Screening shall be in accordance with appendix E, table IV of MIL-PRF 19500. As a minimum, die shall be 100 percent probed in accordance with table I, subgroup 2 except test current shall not exceed 20 A.

* 4.3.2 Gate stress test. Apply V_{GS} = 30 V minimum for t = 250 µs minimum.

* 4.3.3 Single pulsed unclamped inductive switching.

a. Peak current ..... I_{D1}.

b. Peak gate voltage, V_{GS}..... 10 V.

c. Gate to source resistor, R_{GS}..... $25 \leq R_g \leq 200$ ohms.

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

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

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

g. Supply voltage (V_{DD})..... 50 V, (25 V for devices with minimum $V_{(BR)DSS}$ of 100 V).

* .4.3.4 Thermal response (ΔV_{SD} measurements). The delta V_{SD} measurements shall be performed 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 4). The read and record delta V_{SD} measurements and conditions for each device in the qualification lot shall be submitted in the qualification report. The chosen delta V_{SD} shall be considered final after the manufacturer has had the opportunity to test five consecutive lots. The following parameter measurements shall apply:

a. I_M measuring current ..... 10 mA.

b. I_H drain heating current ..... 4 A minimum.

c. t_H heating time ..... 100 ms.

d. V_H drain-source heating voltage..... 25 V minimum.

e. t_{MD} measurement time delay ..... 30 to 60 µs.

f. t_{SW} sample window time ..... 10 µs (max).

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 appendix E, table V of MIL-PRF-19500. End-point electrical and delta measurements shall be in accordance with the applicable tests of table III 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 (JAN, JANTX, and JANTXV) of MIL-PRF-19500 and as follows. End-point electrical and delta measurements shall be in accordance with the applicable steps of table III herein.

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

Subgroup	Method	Conditions
B3	1051	Test condition G.
B4	1042	Test condition D; the heating cycle shall be 1 minute minimum for 2,000 cycles.
B5	1042	Test condition A; V_{DS} = rated V_{DS} (see 1.3), T_A = +175° 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), (see table III).
B5	1042	Test condition B; V_{GS} = rated V_{GS} (see 1.3), T_A = +175° C, t = 24 hours minimum.
B6	3161	See 4.5.2.

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

Subgroup	Method	Conditions
B2	1051	Test condition G.
B3	1042	Test condition D, 2,000 cycles. The heating cycle shall be 1 minute minimum.
B5, 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. End-point electrical and delta measurements shall be in accordance with the applicable steps of table III herein.

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

Subgroup	Method	Conditions
C2	2036	Test condition A; weight = 10 lbs, t = 15 seconds.
C5	3161	See 4.5.2.
C6	1042	Test condition D; 6,000 cycles minimum. The heating cycle shall be 1 minute minimum.

* 4.4.4 Group E inspection. Group E inspection shall be conducted in accordance with the conditions specified for subgroup testing in table IX of MIL-PRF-19500 and as specified in table II herein. Electrical measurements (end-points) shall be in accordance with table I, subgroup 2 herein. Delta measurements shall be in accordance with the applicable steps of 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. $R_{\theta JC}$ max = 0.83° C /W.

a. I_M measuring current ..... 10 mA.

b. I_H drain heating current ..... 4 A minimum.

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

d. V_H drain-source heating voltage ..... 25 V minimum.

e. t_{MD} measurement time delay ..... 30 to 60 µs.

f. t_{SW} sample window time ..... 10 µs (max).

* TABLE I. Group A inspection.

Inspection 1/	MIL-STD-750		Symbol	Limits		Unit
	Method	Conditions		Min	Max	
Subgroup 1						
Visual and mechanical inspection	2071					
Subgroup 2						
Breakdown voltage drain to source	3407	V_{GS} = 0 V dc; I_D = 1 mA dc, bias condition C	$V_{(BR)DSS}$			V dc
2N6764				100		
2N6766				200		
2N6768				400		
2N6770				500		
Gate to source voltage (threshold)	3404	$V_{DS} \geq V_{GS}$; I_D = 0.25 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; V_{DS} = 80 percent of rated V_{DS}, bias condition C	I_{DSS1}		25	µA dc
Static drain to source on-state resistance	3421	V_{GS} = 10 V dc, pulsed (see 4.5.1), condition A I_D = rated I_{D2} (see 1.3) T_C = +25° C.	$r_{DS}(on)1$			
2N6764					0.055	Ω
2N6766					0.085	Ω
2N6768					0.3	Ω
2N6770					0.4	Ω
Static drain to source on-state resistance	3421	V_{GS} = 10 V dc, pulsed (see 4.5.1), condition A I_D = rated I_{D1} (see 1.3)	$r_{DS}(on)2$			
2N6764					0.065	Ω
2N6766					0.09	Ω
2N6768					0.4	Ω
2N6770					0.5	Ω
Forward voltage (source-drain diode)	4011	Pulsed (see 4.5.1) V_{GS} = 0 V, I_D = I_{D1}	V_{SD}			
2N6764					1.9	V dc
2N6766					1.9	V dc
2N6768					1.7	V dc
2N6770					1.7	V dc

See footnote at end of table.

* TABLE I. Group A inspection - Continued.

Inspection 1/	MIL-STD-750		Symbol	Limits		Unit
	Method	Conditions		Min	Max	
Subgroup 3						
High temperature operation:		T_C = +125° C				
Gate current	3411	Bias condition C; V_{GS} = +20 and -20 V dc, V_{DS} = 0 V dc	I_{GSS2}		200	nA dc
Drain current	3413	Bias condition C; V_{GS} = 0 V dc				
		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} = 10 V dc pulsed (see 4.5.1), I_D = rated I_{D2} (see 1.3)	r_{DS}(on)3			
2N6764					0.094	Ω
2N6766					0.153	Ω
2N6768					0.66	Ω
2N6770					0.88	Ω
Gate to source voltage (threshold)	3404	$V_{DS} \geq V_{GS}$; I_D = 0.25 mA dc	V_{GS}(th)2	1.0		V dc
Low temperature operation:		T_C = -55° C				
Gate to source voltage (threshold)	3404	$V_{DS} \geq V_{GS}$; I_D = 0.25 mA dc	V_{GS}(th)3		5.0	V dc
Subgroup 4						
Switching time test	3472	I_D = rated I_{D1} (see 1.3) V_{GS} = 10 V dc Gate drive impedance = 2.35 Ω V_{DD} = 0.5 $V_{BR(DSS)}$				
Turn-on delay time			$t_{d(on)}$		35	ns
Rise time			t_r		190	ns
Turn-off delay time			$t_{d(off)}$		170	ns
Fall time			t_f		130	ns
Subgroup 5						
Safe operating area test	3474	See figure 5, V_{DS} = 80 percent of rated $V_{BR(DSS)}$, t_p = 10 ms, V_{DS} = 200 V max.				
Electrical measurements		See table III, steps, 1, 2, 3, 4, 5 6 and 7.				

See footnote at end of table.

* TABLE I. Group A inspection - Continued.

Inspection 1/	MIL-STD-750		Symbol	Limits		Unit
	Method	Conditions		Min	Max	
Subgroup 6						
Not applicable						
Subgroup 7						
Gate charge	3471	Bias condition B	Q_g(on)			
On-state gate charge						
2N6764					125	nC
2N6766					115	nC
2N6768					110	nC
2N6770					120	nC
Gate to source charge						
2N6764					22	nC
2N6766					22	nC
2N6768					18	nC
2N6770					19	nC
Gate to drain charge						
2N6764					65	nC
2N6766					60	nC
2N6768					65	nC
2N6770					70	nC
Reverse recovery time	3473	di/dt = 100 A/µs $V_{DD} \leq 30$ V dc, $I_D = I_{D1}$	t_{rr}			
2N6764					500	ns
2N6766					950	ns
2N6768					1,200	ns
2N6770					1,600	ns

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

* TABLE II. Group E inspection (all quality levels) for qualification or re-qualification only.

Inspection 1/	MIL-STD-750		Qualification and large lot quality conformance inspection
	Method	Conditions	
Subgroup 1			45 devices, c = 0
Temperature cycling	1051	Test condition G, 500 cycles	
Hermetic seal Fine leak Gross leak	1071		
Electrical measurements		See table III, steps, 1, 2, 3, 4, 5, 6 and 7.	
Subgroup 2 1/			45 devices, c = 0
Steady-state reverse bias	1042	Condition A; 1,000 hours	
Electrical measurements		See table III, steps, 1, 2, 3, 4, 5, 6 and 7.	
Steady-state gate bias	1042	Condition B, 1,000 hours	
Electrical measurements		See table III, steps, 1, 2, 3, 4, 5, 6 and 7.	
Subgroup 3			3 devices, C = 0
DPA	2102		
Subgroup 4			sample size N/A
Thermal resistance, thermal impedance curves	3161	Each supplier shall submit their (typical) design thermal impedance curves. In addition, test conditions and $Z_{\theta JX}$ limit shall be provided to the qualifying activity in the qualification report	
Subgroup 5			5 devices, c = 0
Barometric pressure (reduced) 400 V and 500 V only	1001	Test condition C; $I_{(ISO)}$ = .25 mA (max), $V_{(ISO)} = V_{DS}$	
Subgroup 6			3 devices
ESD	1020		
Subgroup 7			5 devices, c = 0
Repetitive avalanche energy	3469	$I_{AR} = I_D$; V_{GS} = 10 V; 2.5 ≤ R_{GS} ≤ 200 ohms; T_J = +150°C +10, -0 °C; inductance = $\left[\frac{2E_{AR}}{(I_{D1})^2}\right]\left[\frac{V_{BR}-V_{DD}}{V_{BR}}\right]$ $mH\,\min$ number of pulses to be applied = 3.6 X 10^8; (V_{DD}) = 50 V; time in avalanche = 2 μs minimum, 20 μs maximum; f = 1 KHz	

See footnote at end of table.

* TABLE II. Group E inspection (all quality levels) for qualification re-qualification only - Continued.

Inspection 1/	MIL-STD-750		Qualification and large lot quality conformance inspection
	Method	Conditions	
Subgroup 8 Commutating diode for safe operating area test procedure for measuring dv/dt during reverse recovery of power MOSFET transistors or insulated gate bipolar transistors	3476		22 devices, c = 0

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

* TABLE III. Groups A, B, C and E electrical measurements. 1/ 2/ 3/

Step	Inspection	MIL-STD-750		Symbol	Limits		Unit
		Method	Conditions		Min	Max	
1.	Breakdown voltage drain to source 2N6764 2N6766 2N6768 2N6770	3407	V_{GS} = 0, I_D = 1 mA dc bias condition C	$V_{(BR)DSS}$	 100 200 400 500		V dc
2.	Gate to source voltage (threshold)	3404	$V_{DS} \geq V_{GS}$ I_D =0.25 mA dc	$V_{GS(th)1}$	2.0	4.0	V dc
3.	Gate current	3411	V_{GS} = 20 Bias condition C	I_{GSS1}		100	nA dc
4.	Saturation voltage and resistance	3413	V_{GS} = 0, V_{DS} = 80 percent of rated V_D, bias condition C	I_{DSS1}		25	µA dc
5.	Static drain to source on-state resistance 2N6764 2N6766 2N6768 2N6770	3421	V_{GS} = 10 V dc, condition A, pulsed (see 4.5.1). I_D = I_{D2}	$r_{DS(on)1}$		 0.055 0.085 0.300 0.400	 Ω Ω Ω Ω
6.	Static drain to source on-state resistance 2N6764 2N6766 2N6768 2N6770	3421	V_{GS} = 10 V dc, condition A, pulsed (see 4.5.1). I_D = I_{D1}	$r_{DS(on)2}$		 0.065 0.090 0.400 0.500	 Ω Ω Ω Ω
7.	Forward voltage (source-drain diode) 2N6764 2N6766 2N6768 2N6770	4011	V_{GS} = 0 V dc; I_D = I_{D1} pulsed (see 4.5.1)	V_{SD}		 1.9 1.9 1.7 1.7	 V V V V
8.	Thermal response	3161	See 4.3.4	ΔV_{SD}			

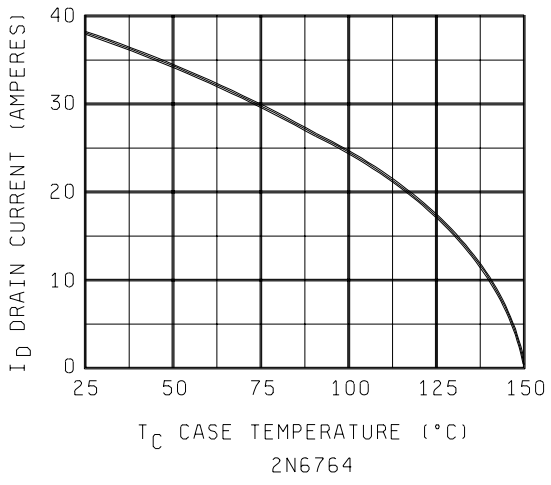
See footnotes on next page

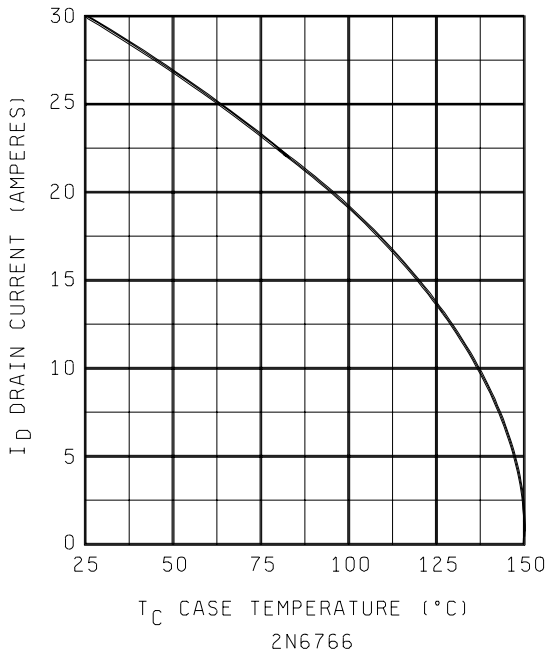
* TABLE III. Groups A, B, C and E electrical measurements. 1/ 2/ 3/ - Continued.

1/ The electrical measurements for appendix E, table VIa (JANS) of MIL-PRF-19500 are as follows:
   a. Subgroup 3, table III, steps 1, 2, 3, 4, 5, 6 and 7.
   b. Subgroup 4, table III, steps 1, 2, 3, 4, 5, 6, 7 and 8.
   c. Subgroup 5, table III, condition A, steps 1, 2, 3, 4, 5, 6 and 7. No more than 15 percent of the sample shall be permitted to have a $\Delta V_{BR(DSS)}$ shift of more than 10 percent and ΔI_{DSS} greater than 50 μA.
      Subgroup 5, table III, condition B, steps 1, 2, 3, 4, 5, 6 and 7.

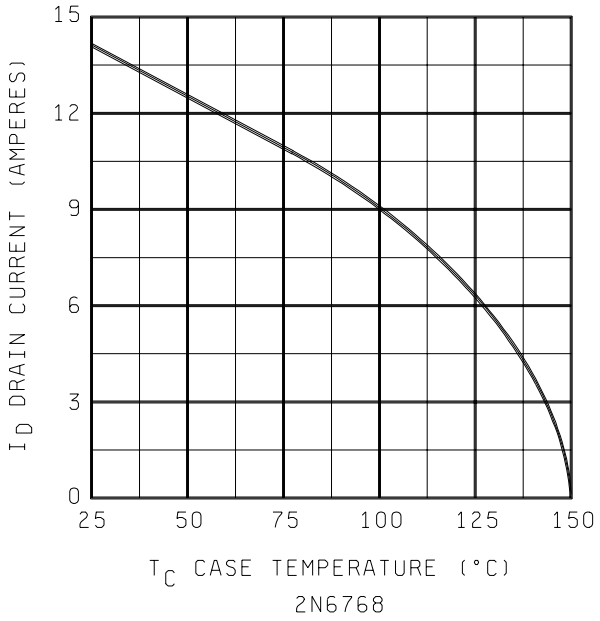
2/ The electrical measurements for appendix E, table VIb (JAN, JANTX, and JANTXV) of MIL-PRF-19500 are as follows:
   a. Subgroup 2, table III, steps 1, 2, 3, 4, 5, 6 and 7.
   b. Subgroup 3, table III, steps 1, 2, 3, 4, 5, 6, 7 and 8.

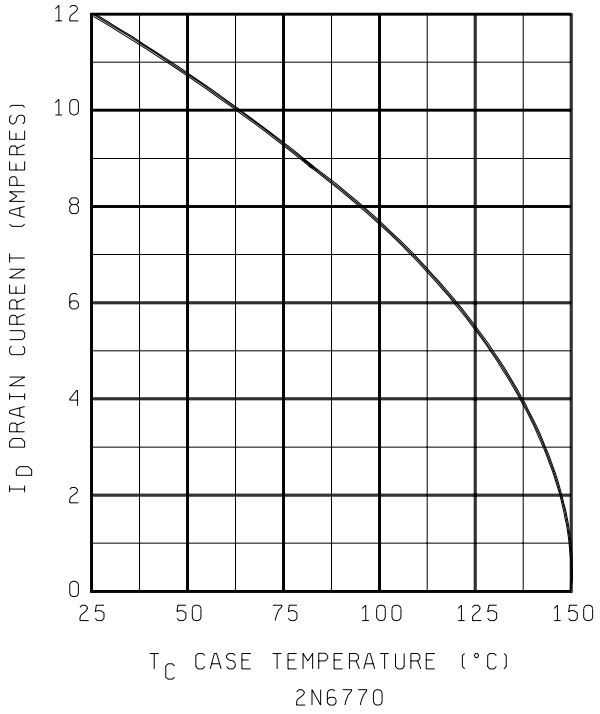
3/ The electrical measurements for appendix E, table VII of MIL-PRF-19500 are as follows:
   a. Subgroup 2, table III, steps 1, 2, 3, 4, 5, 6 and 7.
   b. Subgroup 3, table III, steps 1, 2, 3, 4, 5, 6 and 7.
   c. Subgroup 6, table III, steps 1, 2, 3, 4, 5, 6, 7 and 8.



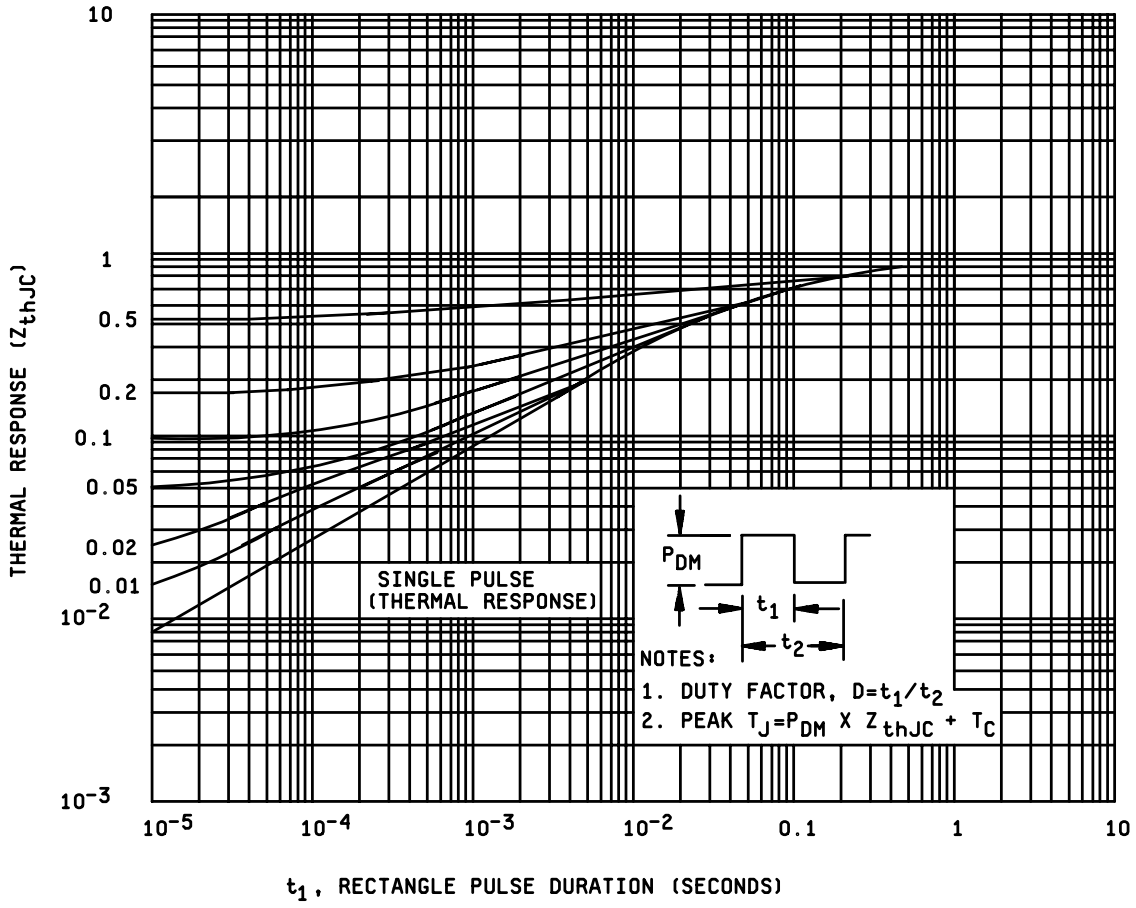


* FIGURE 3. Maximum drain current vs case temperature.

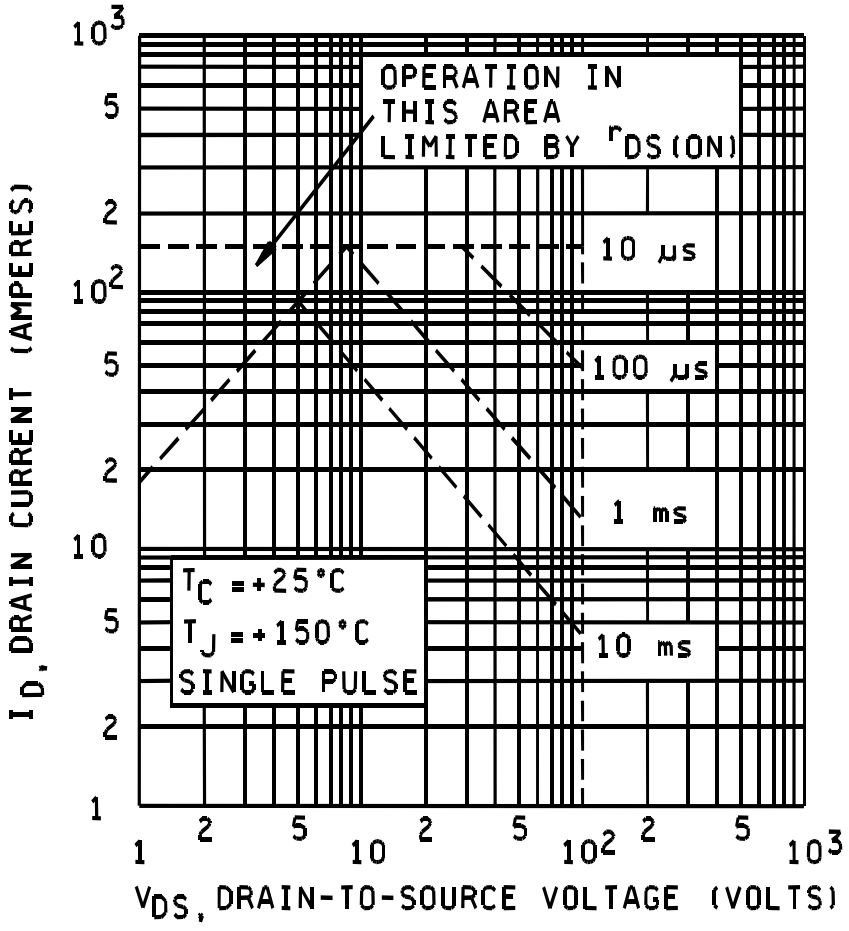




* FIGURE 3. Maximum drain current vs case temperature - Continued.

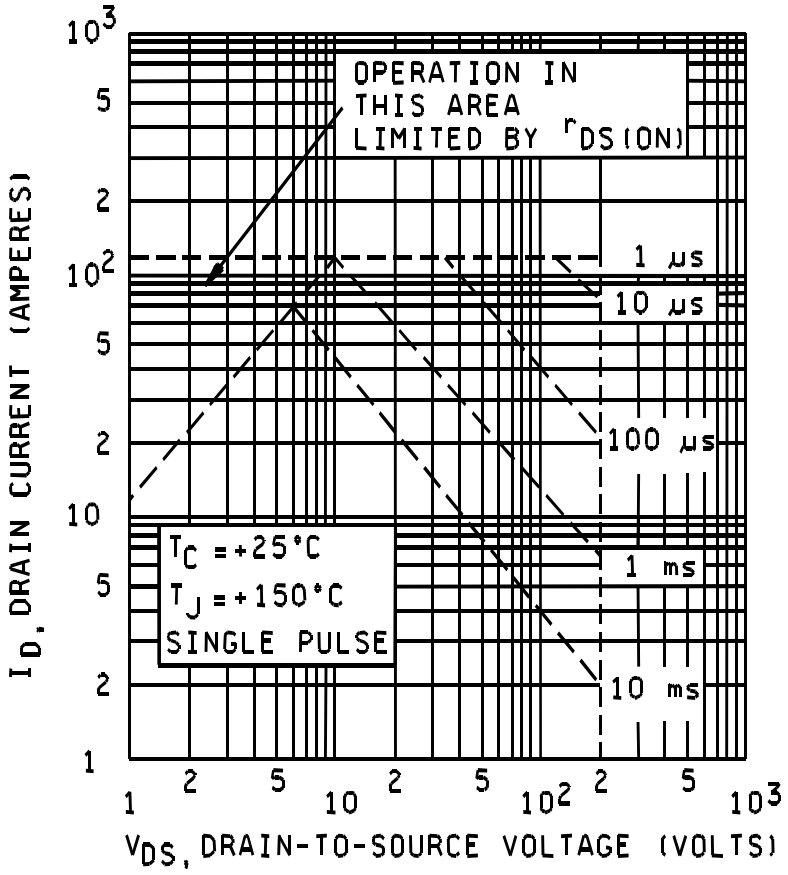


* FIGURE 4. Thermal response curves.



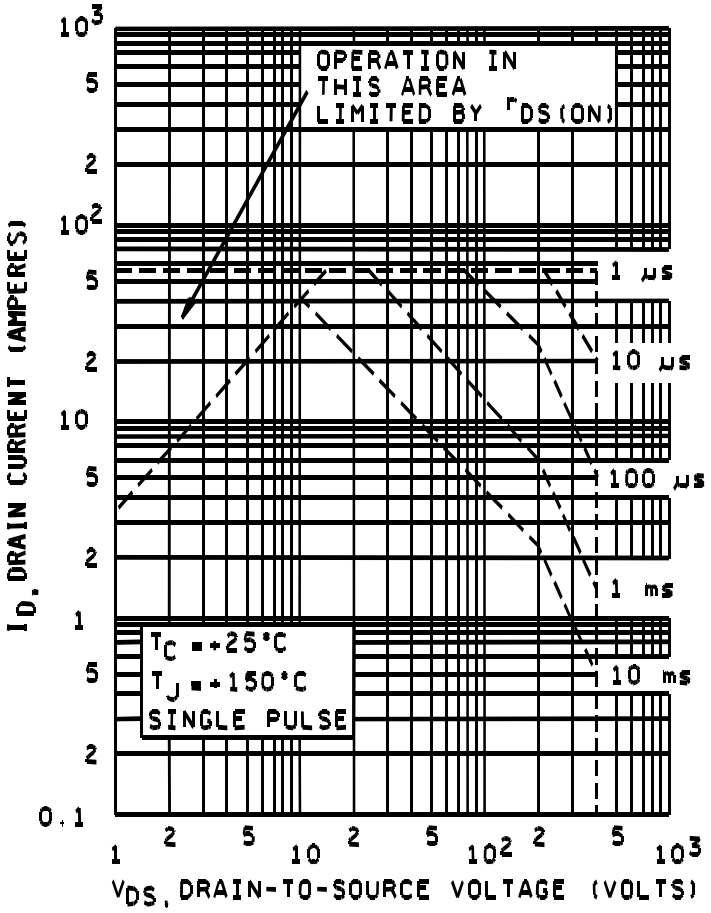
2N6764

* FIGURE 5. Safe operating area graph.



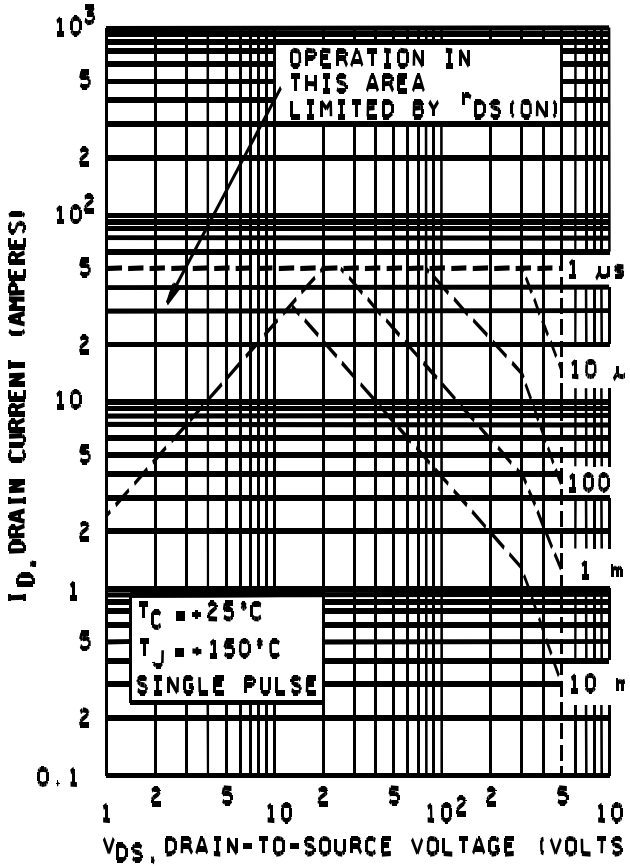
2N6766

* FIGURE 5. Safe operating area graph - Continued.



2N6768

* FIGURE 5. Safe operating area graph - Continued.



2N6770

* FIGURE 5. Safe operating area graph - Continued.

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 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. The acquisition requirements are as specified in 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 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 Substitution information. Devices covered by this specification are substitutable for the manufacturer's and user's PIN. This information in no way implies that manufacturer's PINs are suitable as a substitute for the military Part or Identifying Number (PIN).

PIN	Manufacturer’s CAGE code	Manufacturer’s and user’s PIN
2N6764	59993	IRF150, IRF151, IRF152, IRF153
2N6766	59993	IRF250, IRF251, IRF252, IRF253
2N6768	59993	IRF350, IRF351, IRF352, IRF353
2N6770	59993	IRF450, IRF451, IRF452, IRF453

6.5 Replacement data. JANTX devices shall be a direct one way replacement for JAN devices (example: JANTX2N6764 for JAN2N6764).

* 6.6 Suppliers of JANC die. The qualified JANC suppliers with the applicable letter version (example JANHCAM2N6764) will be identified on the QML.

JANC ordering information	
PIN	Manufacturer
	59993
2N6764	JANHCA2N6764 JANTXHCA2N6764 JANTXVHCA2N6764 JANSHCA2N6764
2N6766	JANHCA2N6766 JANTXHCA2N6766 JANTXVHCA2N6766 JANSHCA2N6766
2N6768	JANHCA2N6768 JANTXHCA2N6768 JANTXVHCA2N6768 JANSHCA2N6768
2N6770	JANHCA2N6770 JANTXHCA2N6770 JANTXVHCA2N6770 JANSHCA2N6770

* 6.7 Changes from previous issue. The margins of this specification are marked with asterisks to indicate where changes from the previous issue were made. This was done as a convenience only and the Government assumes no liability whatsoever for any inaccuracies in these notations. Bidders and contractors are cautioned to evaluate the requirements of this document based on the entire content irrespective of the marginal notations and relationship to the last previous issue.

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

Review activities:
Army - MI
Air Force - 19, 70, 99

Preparing activity:
DLA - CC

(Project 5961-2691)

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3. **DOCUMENT TITLE**
SEMICONDUCTOR DEVICE, FIELD EFFECT TRANSISTORS, N-CHANNEL, SILICON REPETITIVE AVALANCHE TYPES 2N6764, 2N6766, 2N6768, 2N6770, JAN, JANTX, JANTXV, JANS, JANHC AND JANKC

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	
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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@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			