The documentation and process conversion measures necessary to comply with this revision shall be completed by 8 September 1988.

MILITARY SPECIFICATION

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

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 detail requirements for an N-Channel, enhancement-mode, MOSFET, power transistor intended for use in high density power switching applications. Three levels of product assurance are provided for each device type as specified in MIL-S-19500. See note 6.5 for JAN level.

1.2 Physical dimensions. See figure 1. TO-204AE for types 2N6764 and 2N6766; TO-204AA for types 2N6768 and 2N6770 (formerly TO3).

1.3 Maximum ratings.

Type	P_T 1/ T_C = +25°C	P_T T_A = 25°C	V_{DS}	V_{DG}	V_{GS}	I_{D1} 2/ T_C = 25°C	I_{D2} T_C = 100°C	I_S 2/	I_{DM} T_{STG}	Top and	V_{DS} and V_{DG} 100,000 ft altitude
	W	W	V dc	V dc	V dc	A dc	A dc	A dc	A(pk)	°C	
	150	4			±20						
2N6764			100	100		38.0	24.0	38.0	160	-55 to +150	
2N6766			200	200		30.0	19.0	30.0	120		
2N6768			400	400		14.0	9.0	14.0	60		400
2N6770			500	500		12.0	7.75	12.0	52		500

1/ Derate linearly 1.2 W/°C for T_C > 25°C.
2/ Derate above T_C = 25°C according to the formula $I_D = \sqrt{\frac{P(rated)}{K}}$, where

P(rated) = 150 - (T_C-25) (1.2) watts; K = max $r_{DS(on)}$ at T_J = 150°C.

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 = .25 mA dc		Max I_{DSS1} V_{GS} = 0	Max $r_{DS(on)}$ 1/ V_{GS} = 10 V dc		$R_{\theta JC}$ Max
				V_{DS} = 80% of rated V_{DS}	T_J = 25°C at I_{D1}	T_J = 150°C at I_{D2}	
	V dc	V dc		µA dc	ohm	ohm	°C/W
		Min	Max				
		2.0	4.0	25			0.83
2N6764	100				0.055	0.1045	
2N6766	200				0.085	0.17	
2N6768	400				0.3	0.75	
2N6770	500				0.4	1.0	

1/ Pulsed (see 4.5.1)

Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: Rome Air Development Center, (RADC/RBE-2) Griffiss AFB, NY 13441, by using the self-addressed Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document or by letter.

2. APPLICABLE DOCUMENTS

2.1 Government documents.

2.1.1 Specifications and standards. The following specification and standard form a part of this specification to the extent specified herein. Unless otherwise specified, the issues of these documents shall be those listed in the issue of the Department of Defense Index of Specifications and Standards (DODISS) and supplement thereto, cited in the solicitation.

SPECIFICATION

MILITARY

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

STANDARD

MILITARY

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

(Copies of the specification and standards required by manufacturers in connection with specific acquisition functions should be obtained from the contracting activity or as directed by the contracting activity.)

2.2 Order of precedence. In the event of a conflict between the text of this specification and the references cited herein (except for associated detail specifications, specification sheets or MS standards), the text of this specification shall take precedence. Nothing in this specification, however, shall supersede applicable laws and regulations unless a specific exemption has been obtained.

3. REQUIREMENTS

3.1 Detail specification. The individual item requirements shall be in accordance with MIL-S-19500, and as specified herein.

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

$V_{(BR)DSS}$ - - - - Drain to source breakdown voltage, all other terminals short-circuited to source.

I_S - - - - - - - Source current through drain diodes (forward biased V_{SD}).

C- - - - - - - - Coulomb.

g_{FS}- - - - - - DC forward transconductance.

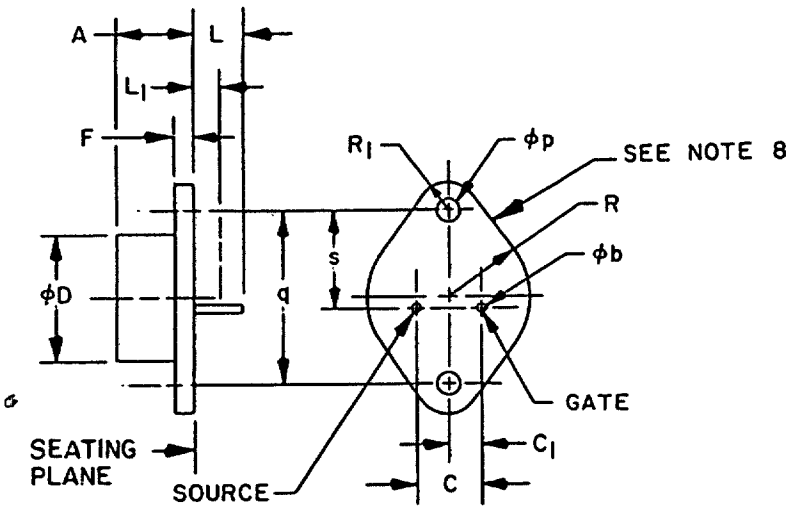
$I_{(ISO)}$ - - - - - Source pin to case isolation current.

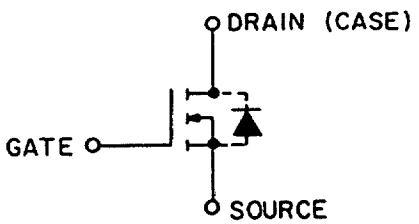
3.3 Design, construction, and physical dimensions. The design, construction, and physical dimensions shall be as specified in MIL-S-19500, and figure 1 herein.

3.3.1 Lead material and finish. Lead material shall be Kovar or Alloy 52; a copper core is permitted. Lead finish shall be gold, or tin, or solder dip. Where a choice of lead material or finish is desired, it shall be specified in the contract or purchase order (see 6.3).

3.3.2 Internal construction. Multiple chip construction shall not be permitted.

3.4 Marking. Marking shall be in accordance with MIL-S-19500. At the option of the manufacturer, the following marking may be omitted from the body of the transistor but shall be retained on the initial container.





Symbol	Dimensions				Notes
	Inches		Millimeters		
	Min	Max	Min	Max	
A	.250	.360	6.35	9.15	
øb	.057	.063	1.45	1.60	5
øb	.038	.043	0.97	1.10	6
øD		.875		22.23	
C	.420	.440	10.67	11.18	1,7
C_1	.205	.225	5.21	5.72	1,7
F	.060	.135	1.52	3.43	
L	.312	.500	7.92	12.70	
L_1		.050		12.70	
øp	.151	.161	3.84	4.09	
q	1.177	1.197	29.90	30.40	
R	.495	.525	12.57	13.34	
R_1	.131	.188	3.33	4.78	
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 should be measured at points .050 (1.27 mm) and .055 (1.40 mm) below seating plane. When guage is not used measurement will be made at the seating plane.
4. The seating plane of the header shall be flat within .001 (0.03 mm) concave to .004 (0.10 mm) convex inside a .930 (23.62 mm) diameter circle on the center of the header and flat within .001 (0.03 mm) concave to .006 (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.

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

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

4. QUALITY ASSURANCE PROVISIONS

4.1 Sampling and inspection. Sampling and inspection shall be in accordance with MIL-S-19500, and as specified herein.

4.2 Qualification inspection. Qualification inspection shall be in accordance with MIL-S-19500. Alternate flow is allowed for qualification inspection in accordance with figure 2 of MIL-S-19500.

4.3 Screening (JANTX, JANTXV, and JANS levels only). Screening shall be in accordance with MIL-S-19500 (table II), 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 II of MIL-STD-19500)	Measurement	
	JANS levels	JANTX and JANTXV levels
3	Test condition F, except T_{low} = -55°C, 20 cycles	Test condition F, except T_{low} = -55°C, 20 cycles
1/ 2/	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)
9	I_{GSS1}, I_{DSS1}, gate stress test (see 4.5.5) subgroup 2 of table I herein	Gate stress test (see 4.5.5) subgroup 2 of table I herein
10	Method 1042, test condition B	Method 1042, test condition B
11	I_{GSS1}, I_{DSS1}, $r_{DS(on)1}$, $V_{GS(th)1}$ Subgroup 2 of table I herein; ΔI_{GSS1} = ±20 nA dc or ±100% of initial value, whichever is greater ΔI_{DSS1} = ±25 µA dc or ±100% of initial value, whichever is greater	I_{GSS1}, I_{DSS1}, $r_{DS(on)1}$, $V_{GS(th)1}$ Subgroup 2 of table I herein
12	Method 1042, test condition A and C (see 4.3.1)	Method 1042, test condition A
13	Subgroups 2 and 3 of table I herein; ΔI_{GSS1} = ±20 nA dc or ±100% of initial value, whichever is greater ΔI_{DSS1} = ±25 µA dc or ±100% of initial value, whichever is greater $\Delta r_{DS(on)1}$ = ±20% of initial value. $\Delta V_{GS(th)1}$ = ±20% of initial value.	Subgroup 2 of table I herein; ΔI_{GSS1} = ±20 nA dc or ±100% of initial value, whichever is greater ΔI_{DSS1} = ±25 µA dc or ±100% of initial value, whichever is greater $\Delta r_{DS(on)1}$ = ±20% of initial value. $\Delta V_{GS(th)1}$ = ±20% of initial value.

1/ Shall be performed anytime before screen 9.
2/ This test method in no way implies a repetitive avalanche energy rating. This is a stress test designed to ensure a rugged product.

4.3.1 Power burn-in. Power burn-in conditions are as follows: T_A = +25°C, -5 +10°C; $V_{DS} \geq 10$ V minimum; I_D adjusted to meet a junction temperature of 140°C -0 +10°C by controlling V_{GS} voltage to obtain a specific I_D current required to apply an appropriate power for the device under stress. Power condition and T_J requirements can be established by ΔV_{SD} measurement technique described in MIL-STD-750 method 3161. t = 240 hours for condition C.

4.4 Quality conformance inspection. Quality conformance inspection shall be in accordance with MIL-S-19500. Alternate flow is allowed for quality conformance inspection in accordance with figure 2 of MIL-S-19500.

4.4.1 Group A inspection. Group A inspection shall be conducted in accordance with MIL-S-19500, and table I herein. (End-point electrical measurements shall be in accordance with the applicable steps of table IV herein.)

4.4.2 Group B inspection. Group B inspection shall be conducted in accordance with the conditions specified for subgroup testing in table IVa (JANS) and table IVb (JANTX and JANTXV) of MIL-S-19500, and table IIa and IIb herein. Electrical measurements (end points) and delta requirements shall be in accordance with the applicable steps of table IV herein.

4.4.3 Group C inspection. Group C inspection shall be conducted in accordance with the conditions specified for subgroup testing in table V of MIL-S-19500, and table III herein. Electrical measurements (end points) and delta requirements shall be in accordance with the applicable steps of table IV herein.

4.5 Methods of inspection. Methods of inspection shall be as specified in the appropriate tables and as follows:

4.5.1 Pulse measurements. Conditions for pulse measurement shall be as specified in section 4 of MIL-STD-750.

4.5.2 Thermal impedance. Thermal impedance measurements shall be performed in accordance with method 3161 of MIL-STD-750. The maximum limit of $R_{\theta JC(max)}$ shall be 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.

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})- - - - 10 to 80 µs.

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

4.5.3 Thermal response (ΔV_{SD} measurement). The delta V_{SD} measurements 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 minimum.

e. Measurement time delay (t_{MD})- - - - 10 to 80 µs.

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

TABLE I. Group A inspection.

Inspection	MIL-STD-750 Method	MIL-STD-750 Conditions	LTPD 1/ JANS	LTPD 1/ JANTX, JANTXV	Symbol	Limits Min	Limits Max	Unit
Subgroup 1								
Visual and mechanical inspection	2071							
Subgroup 2								
Forward transconductance	3475	Pulsed (see 4.5.1)			g_{FS}			
2N6764						9.0	27	S
2N6766						9.0	27	S
2N6768						8.0	24	S
2N6770						8.0	24	S
Breakdown voltage, drain to source	3407	V_{GS} = 0 V; I_D = 1.0 mA; bias condition C			$V_{(BR)DSS}$			
2N6764						100	---	V dc
2N6766						200	---	V dc
2N6768						400	---	V dc
2N6770						500	---	V dc
Gate to source voltage (threshold)	3403	$V_{DS} \geq V_{GS}$; I_D = .25 mA dc			$V_{GS(th)1}$	2.0	4.0	V dc
Gate current	3411	V_{GS} = ±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% 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)			$r_{DS(on)1}$			
2N6764		I_D = 24 A dc				---	0.055	ohm
2N6766		I_D = 19 A dc				---	0.085	ohm
2N6768		I_D = 9 A dc				---	0.3	ohm
2N6770		I_D = 7.75 A dc				---	0.4	ohm
Drain to source "ON"-state voltage	3405	V_{GS} = 10 V dc; condition A, pulsed (see 4.5.1)			$V_{DS(on)}$			
2N6764		I_D = 38 A dc				---	2.49	V
2N6766		I_D = 30 A dc				---	2.7	V
2N6768		I_D = 14 A dc				---	5.6	V
2N6770		I_D = 12 A dc				---	6.0	V
Forward voltage (source drain diode)	4011	Pulsed (see 4.5.1)			V_{SD}			
2N6764		I_S = 38 A dc				0.95	1.9	V
2N6766		I_S = 30 A dc				0.9	1.8	V
2N6768		I_S = 14 A dc				0.85	1.7	V
2N6770		I_S = 12 A dc				0.80	1.6	V

See footnotes at end of table.

TABLE I. Group A inspection - Continued.

Inspection	MIL-STD-750		LTPD 1/		Symbol	Limits		Unit
	Method	Conditions	JANS	JANTX, JANTXV		Min	Max	
Subgroup 3								
High temperature operation:		$T_C = T_J = +125°C$						
Gate current	3411	Bias condition C; $V_{GS} = \pm 20$ V dc $V_{DS} = 0$			I_{GSS2}	---	±200	nA dc
Drain current	3413	Bias condition C; $V_{GS} = 0$ V dc						
		V_{DS} = 100% of rated V_{DS}			I_{DSS2}		1.0	mA dc
		V_{DS} = 80% of rated V_{DS}			I_{DSS3}		.25	mA dc
Static drain to source "ON"-state resistance	3421	V_{GS} = 10 V dc; pulsed (see 4.5.1)			$r_{DS(on)2}$			
2N6764		I_D = 24 A dc				---	0.094	ohm
2N6766		I_D = 19 A dc				---	0.153	ohm
2N6768		I_D = 9 A dc				---	0.66	ohm
2N6770		I_D = 7.75 A dc				---	0.88	ohm
Gate to source voltage (threshold)	3403	$V_{DS} \geq V_{GS}$; I_D = .25 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 = .25 mA dc			$V_{GS(th)3}$	---	5.0	V dc
Subgroup 4								
Switching time test	3472	I_D = half rated I_{D1}, V_{GS} = 10 V dc, $R_{GEN} = 4.7\Omega$, $R_{GS} = 4.7\Omega$, V_{DD} = 50% of rated V_{DS}			$t_{d(on)}$			
Turn-on delay time								
2N6764						---	35	ns
2N6766						---	35	ns
2N6768						---	35	ns
2N6770						---	35	ns

See footnotes at end of table.

TABLE I. Group A inspection - Continued.

Inspection	MIL-STD-750		LTPD 1/		Symbol	Limits		Unit
	Method	Conditions	JANS	JANTX, JANTXV		Min	Max	
Subgroup 4 (continued)								
Rise time					t_r			
2N6764						---	100	ns
2N6766						---	100	ns
2N6768						---	65	ns
2N6770						---	50	ns
⌀ Turn-off delay time					$t_{d(off)}$			
2N6764						---	125	ns
2N6766						---	125	ns
2N6768						---	150	ns
2N6770						---	150	ns
Fall time					t_f			
2N6764						---	100	ns
2N6766						---	100	ns
2N6768						---	75	ns
2N6770						---	70	ns
Subgroup 5								
Safe operating area test	3474	See figure 3 V_{DS} = 80% of rated V_{DS}						
High voltage test								
2N6764								
2N6766								
2N6768								
2N6770								
Electrical measurements		See table IV, steps 1, 2, 3, 4, 5, 6, and 7						

See footnotes at end of table.

TABLE I. Group A inspection - Continued.

Inspection	MIL-STD-750		LTPD 1/		Symbol	Limits		Unit
	Method	Conditions	JANS	JANTX, JANTXV		Min	Max	
Subgroup 6								
Not applicable								
Subgroup 7								
Gate charge	3471	Condition A or B						
Test 1								
Minimum off-state gate charge					$Q_{g(th)}$			nC
2N6764						3.0	8.0	
2N6766						3.0	8.0	
2N6768						4.0	8.0	
2N6770						4.0	8.0	
Test 2								
On-state gate charge					$Q_{g(on)}$			nC
2N6764						48	119	
2N6766						48	118	
2N6768						52	120	
2N6770						55	124	
Test 3								
Maximum on-state gate charge					$Q_{gm(on)}$			nC
2N6764						92	215	
2N6766						88	215	
2N6768						95	225	
2N6770						99	225	
- - -								

See footnotes at end of table.

TABLE I. Group A inspection - Continued.

Inspection	MIL-STD-750		LTPD 1/		Symbol	Limits		Unit
	Method	Conditions	JANS	JANTX, JANTXV		Min	Max	
Subgroup 7 (continued)								
Test 4								
Gate plateau voltage					V_{GP}			V dc
2N6764						4.5	7.4	
2N6766						4.5	7.1	
2N6768						4.3	6.3	
2N6770						4.2	6.2	
Test 5								
Gate to source charge					Q_{gs}			nC
2N6764						6.4	19	
2N6766						6.1	19	
2N6768						5.3	16	
2N6770						5.2	15	
Test 6								
Gate to drain charge					Q_{gd}			nC
2N6764						24	64	
2N6766						24	65	
2N6768						25	56	
2N6770						27	61	
Reverse recovery time	3473	$di/dt = 100$ A/µs, $V_{DD} \leq 30$ V			t_{rr}			ns
2N6764		$I_F = 38$ A					500	
2N6766		$I_F = 30$ A					950	
2N6768		$I_F = 14$ A					1200	
2N6770		$I_F = 12$ A					1600	

1/ LTPD numbers are to be taken from MIL-S-19500.

TABLE IIa. Group B inspection for JANS device.

Inspection	MIL-STD-750 Method	MIL-STD-750 Conditions	Qualification and large lot quality conformance inspection LTPD 1/	Small lot quality conformance inspection 1/ n/c
Subgroup 1				
Physical dimensions	2066	See figure 1		
Subgroup 2				
Solderability	2026			
Resistance to solvents	1022			
Subgroup 3				
Thermal shock (temperature cycling)	1051	Test condition F3, except T_{low} = -55°C		
Hermetic seal	1071			
a. Fine leak				
b. Gross leak				
Electrical measurements		See table IV, steps 1, 2, 3, 4, 5, 6, and 7.		
Decap internal design verification	2075	See 3.3.2		
SEM	2077			
Bond strength	2037	Test condition A; all internal wires for each device shall be pulled separately.		
Die shear	2017			
Subgroup 4				
Intermittent operation life	1042	Condition D, see 4.3.1 Power on time shall be 3 minutes minimum 2,000 cycles. No heat sink nor forced-air cooling on the device shall be permitted, during the on cycle.		
Electrical measurements		See table IV, steps 1, 2, 3, 4, 5, 6, 7, and 8.		
Subgroup 5				
Accelerated steady-state operation life	1042	120 hours; see 4.3.1 T_J = 200°C Marking legibility requirements shall not apply.		

See footnote at end of table.

TABLE IIa. Group B inspection for JANS device - Continued.

Inspection	MIL-STD-750		Qualification and large lot quality conformance inspection LTPD 1/	Small lot quality conformance inspection 1/ n/c
	Method	Conditions		
Subgroup 5 (continued)				
Electrical measurements		See table IV, steps 1, 2, 3, 4, 5, 6, and 7		
Bond strength (Al-Au die interconnects only)	2037	Test condition A		
Subgroup 6				
Thermal impedance	3161	See 4.5.2		

1/ LTPD numbers are to be taken from MIL-S-19500.

TABLE IIb. Group B inspection for JANTX AND JANTXV.

Inspection	MIL-STD-750 Method	MIL-STD-750 Conditions	LTPD 1/
Subgroup 1			
Solderability	2026		
Resistance to solvents	1022		
Subgroup 2			
Thermal shock (temperature cycling)	1051	Test condition F1, except T_{low} = -55°C, 25 cycles.	
Hermetic seal	1071		
a. Fine leak			
b. Gross leak			
Electrical measurements		See table IV, steps 1, 2, 3, 4, 5, 6, and 7	
Subgroup 3			
Intermittent operation life (LTPD)	1042	Test condition D, 2,000 cycles; A cycles shall be 1 minute minimum	
Electrical measurements		See table IV, steps 1, 2, 3, 4, 5, 6, 7, and 8	
Subgroup 4			
Decap, internal visual (design verification)	2075	See 3.3.2	
Bond strength	2037	Test condition A; All internal bond wires for each device shall be pulled separately.	
Subgroup 5			
Qualification only			
Thermal impedance	3161	See 4.5.2	
Subgroup 6			
High temperature life	1032	T_A = +150°C	
Electrical measurements		See table IV, steps 1, 2, 3, 4, 5, 6, and 7	

1/ LTPD numbers are to be taken from MIL-S-19500

TABLE III. Group C inspection.

Inspection	MIL-STD-750 Method	MIL-STD-750 Conditions	LTPD 1/	Symbol	Limits Min	Limits Max	Unit
Subgroup 1							
Physical dimensions	2066	See figure 1					
Subgroup 2							
Thermal shock (glass strain)	1056						
Terminal strength (tension)	2036	Test condition A; weight = 10 lbs; t = 15 s					
Hermetic seal	1071						
a. Fine leak							
b. Gross leak							
Moisture resistance	1021						
Visual and mechanical evaluation	2071						
Electrical measurements		See table IV, steps 1, 2, 3, 4, 5, 6 and 7					
Subgroup 3							
Shock	2016						
Vibration variable frequency	2056						
Constant acceleration	2006						
Electrical measurements		See table IV, steps 1, 2, 3, 4, 5, 6 and 7					
Subgroup 4							
Salt atmosphere (corrosion)	1041						
Subgroup 5							
Barometer pressure test (not required for 2N6764 or 2N6766)	1001	Test condition C		$I_{(ISO)}$		.25	mA dc
2N6768		V_{DS} = 400 V dc			---		
2N6770		V_{DS} = 500 V dc			---		
Subgroup 6			3				
Intermittent operation life (LTPD)	1042	Test condition D, 6,000 cycles A cycle shall be 1 minutes minimum					
Hermetic seal a. Fine leak b. Gross leak	1071						
Electrical measurements		See table IV, steps 1, 2, 3, 4, 5, 6, 7, and 8					

See footnote at end of table.

TABLE III. Group C inspection - Continued.

Inspection	MIL-STD-750 Method	MIL-STD-750 Conditions	LTPD 1/	Symbol	Limits Min	Limits Max	Unit
Subgroup 7			3				
Qualification only							
Thermal shock (temperature cycling) destructive	1051	-55°C to 150°C. 200 cycles					
Hermetic seal a. Fine leak b. Gross leak	1071						
Electrical measurements		See table IV, steps 1, 2, 3, 4, 5, 6, 7, and 8					
Subgroup 8			10				
Qualification only							
Steady-state reverse bias	1042	Test condition A, 1000 hours					
Electrical measurements		See table IV, steps 1, 2, 3, 4, 5, 6, and 7					
Subgroup 9			10				
Qualification only							
Steady-state gate bias	1042	Test condition B, 1000 hours					
Electrical measurements		See table IV steps 1, 2, 3, 4, 5, 6, and 7					

1/ LTPD numbers are to be taken from MIL-S-19500.

TABLE IV. Group A, B, and C electrical measurements.

Step	Inspection	MIL-STD-750 Method	MIL-STD-750 Conditions	Symbol	Limits Min	Limits Max	Unit
1.	Breakdown voltage drain to source	3407	V_{GS} = 0 V; I_D = 1.0 mA dc; bias condition C	$V_{(BR)DSS}$			
	2N6764				100	---	V dc
	2N6766				200	---	V dc
	2N6768				400	---	V dc
	2N6770				500	---	V dc
2.	Gate to source voltage (threshold)	3403	$V_{DS} \geq V_{GS}$; I_D = .25 mA dc	$V_{GS(th)1}$	2.0	4.0	V dc
3.	Gate current	3411	V_{GS} = ±20 V dc; V_{DS} = 0 V; bias condition C	I_{GSS1}	---	±100	nA dc
4.	Drain current	3413	V_{GS} = 0 V dc; bias condition C; V_{DS} = 80% of rated V_{DS}	I_{DSS1}		25	µA dc
5.	Static drain to source "ON"-state resistance	3421	V_{GS} = 10 V dc; condition A, pulsed (see 4.5.1)	$r_{DS(on)1}$			
	2N6764		I_D = 24 A dc		---	0.055	ohm
	2N6766		I_D = 19 A dc		---	0.085	ohm
	2N6768		I_D = 9 A dc		---	0.3	ohm
	2N6770		I_D = 7.75 A dc		---	0.4	ohm
6.	Drain to source "ON"-state voltage	3405	V_{GS} = 10 V dc; condition A, pulsed (see 4.5.1)	$V_{DS(on)}$			
	2N6764		I_D = 38 A dc		---	2.49	V
	2N6766		I_D = 30 A dc		---	2.7	V
	2N6768		I_D = 14 A dc		---	5.6	V
	2N6770		I_D = 12 A dc		---	6.0	V
7.	Forward voltage (source drain diode)	4011	Pulsed (see 4.5.1)	V_{SD}			
	2N6764		I_S = 38 A dc		0.95	1.9	V
	2N6766		I_S = 30 A dc		0.9	1.8	V
	2N6768		I_S = 14 A dc		0.85	1.7	V
	2N6770		I_S = 12 A dc		0.80	1.6	V
8.	Thermal response	3161	See 4.5.3	ΔV_{SD}		1/	

1/ Ten percent degradation in Group B is permitted.
Thirty percent degradation in Group C is permitted.

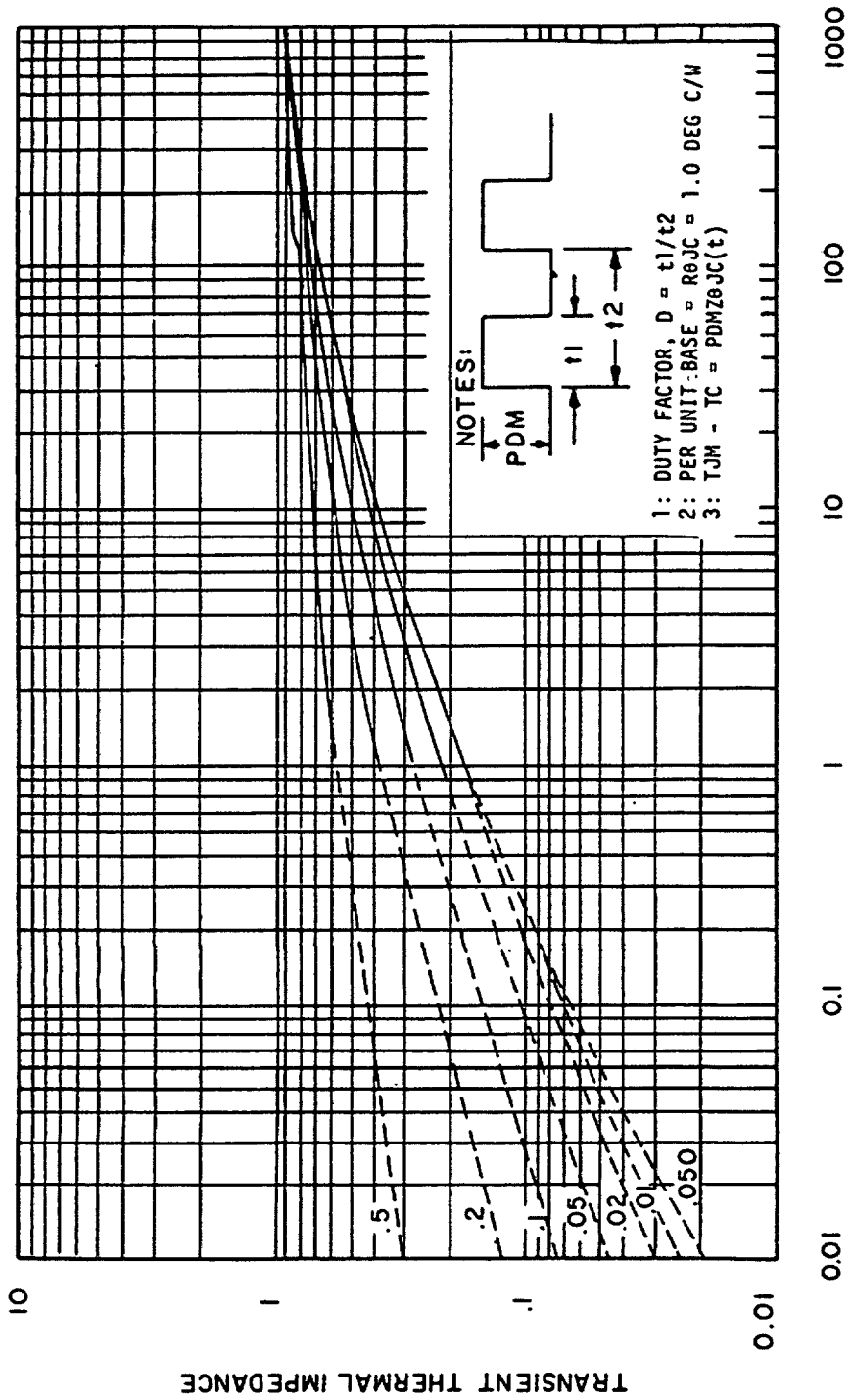


FIGURE 2. Thermal response curve.

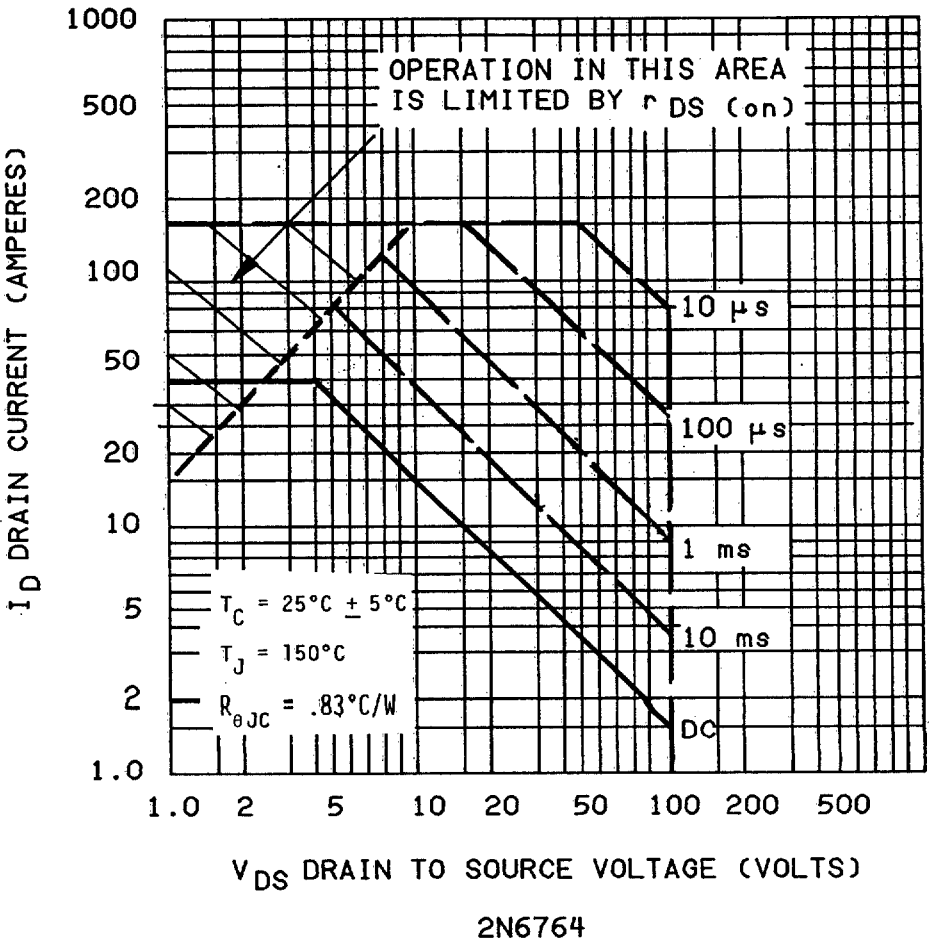


FIGURE 3. Maximum safe operating area - Continued.

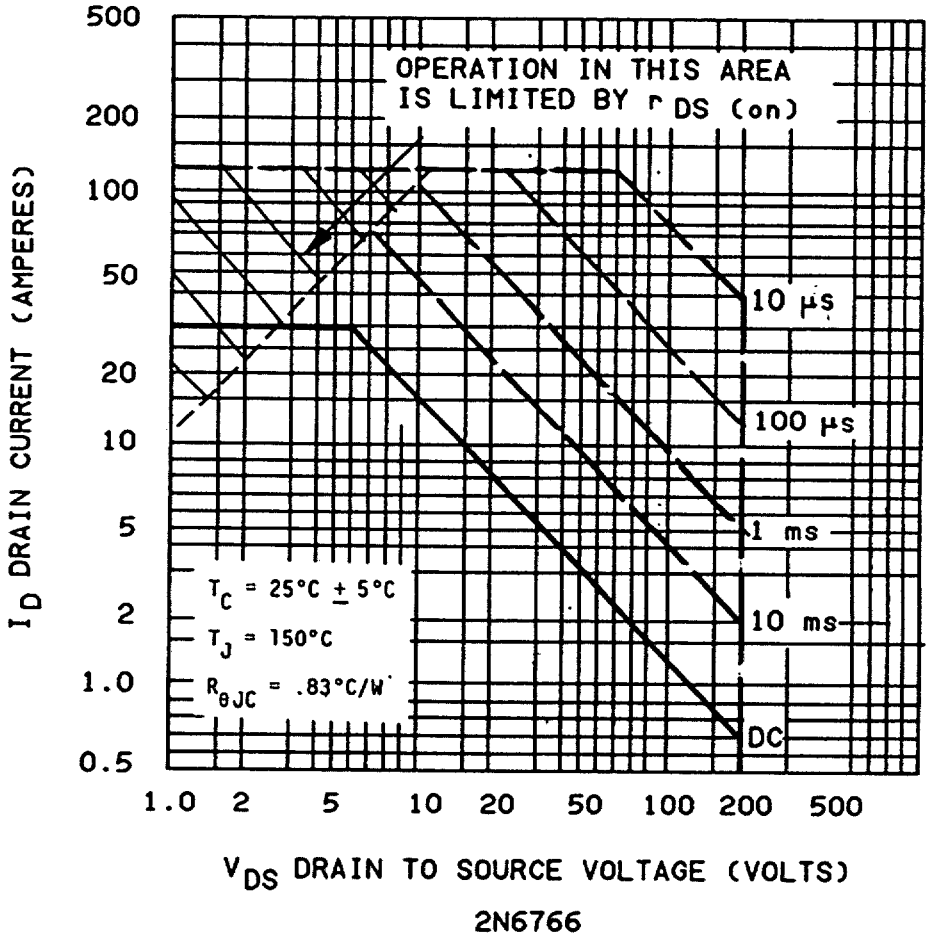


FIGURE 3. Maximum safe operating area - Continued.

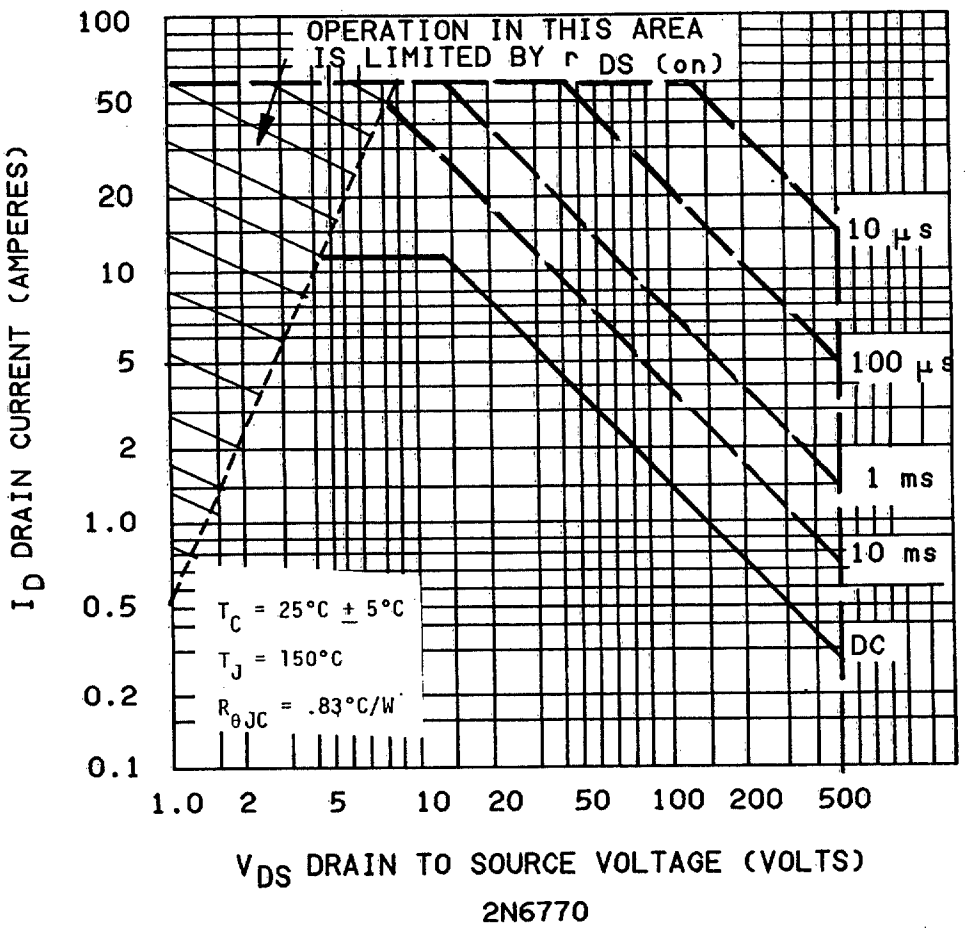


FIGURE 3. Maximum safe operating area - Continued.

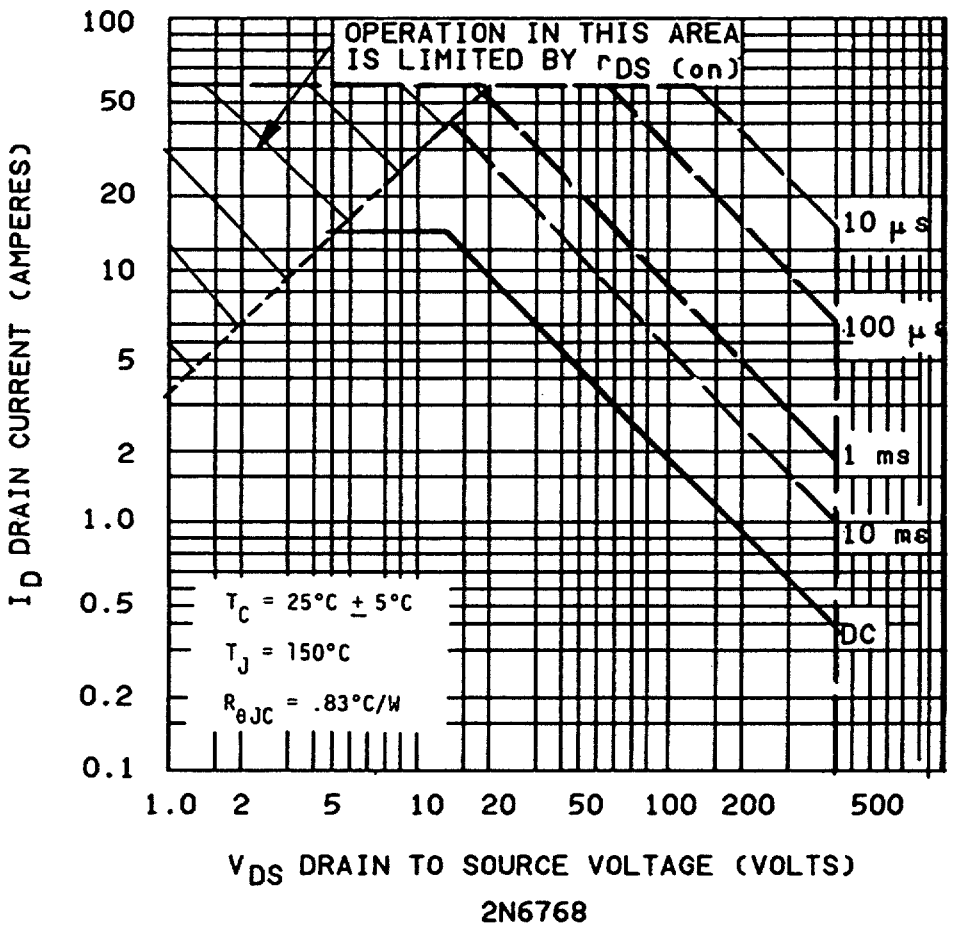


FIGURE 3. Maximum safe operating area - Continued.

4.5.4 Unclamped inductive switching.

a. Peak current, I_D - - - - - - - - - 6 A.

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

c. Gate to source resistor, R_{GS} - -

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

e. Inductance, L - - - - - - - - - - - 100 µH ±10%.

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

g. Pulse repetition rate - - - - - - - None.

4.5.5 Gate stress test.

V_{GS} = 30 V minimum.

t = 250 µs minimum.

5. PACKAGING

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

6. NOTES

6.1 Notes. The notes specified in MIL-S-19500 are applicable to this specification.

6.2 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.

6.3 Cross reference list. Parts from this specification may be used to replace the following commercial part numbers:

Preferred types	Commercial types
2N6764	IRF150, IRF151, IRF152, IRF153
2N6766	IRF250, IRF251, IRF252, IRF253
2N6768	IRF350, IRF351, IRF352, IRF353
2N6770	IRF450, IRF451, IRF452, IRF453

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

6.5 Replacement data. JANTX devices shall be a direct replacement for JAN devices (ex. JANTX2N6764 for JANZN6764). Old contracts negotiated before 24 March 1986 and future spare parts for those contracts, may utilize the JAN branding (100% processing not required) provided all of the A, B and C testing to the latest specification revision is satisfied.

6.6 Changes from previous issue. Asterisks are not used in this revision to identify changes with respect to the previous issue due to the extensiveness of the changes.

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

Review activities:
Navy - TD
Air Force - 11, 70, 80
NASA - EG13
DLA - ES

User activities:
Air Force - 19

Preparing activity:
Air Force - 17

Agent:
DLA - ES

(Project 5961-1021)

STANDARDIZATION DOCUMENT IMPROVEMENT PROPOSAL

(See Instructions – Reverse Side)

1. DOCUMENT NUMBER	2. DOCUMENT TITLE
MIL-S-19500/543C	SEMICONDUCTOR DEVICE, FIELD EFFECT TRANSISTOR, N-CHANNEL, SILICON TYPES 2N6764, 2N6766, 2N6768 AND 2N6770

3a. NAME OF SUBMITTING ORGANIZATION	4. TYPE OF ORGANIZATION *(Mark one)*
	☐ VENDOR
b. ADDRESS *(Street, City, State, ZIP Code)*	☐ USER
	☐ MANUFACTURER
	☐ OTHER *(Specify)*: _____

5. PROBLEM AREAS

a. Paragraph Number and Wording:

G

b. Recommended Wording:

c. Reason/Rationale for Recommendation:

6. REMARKS

7a. NAME OF SUBMITTER *(Last, First, MI)* – Optional	b. WORK TELEPHONE NUMBER *(Include Area Code)* – Optional
c. MAILING ADDRESS *(Street, City, State, ZIP Code)* – Optional	8. DATE OF SUBMISSION *(YYMMDD)*

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