The documentation and process conversion measures necessary to comply with this revision shall be completed by 10 March 2004.

INCH-POUND

MIL-PRF-19500/565C
10 December 2003
SUPERSEDING
MIL-PRF-19500/565B
21 May 1999

* PERFORMANCE SPECIFICATION SHEET

SEMICONDUCTOR DEVICE, FIELD EFFECT TRANSISTOR, P-CHANNEL, SILICON, TYPES 2N6895, 2N6896, 2N6897, AND 2N6898, JAN, JANTX, JANTXV, AND JANS

This specification is approved for use by all Departments and Agencies of the Department of Defense.

* The requirements for acquiring the product described herein shall consist of this specification sheet and MIL-PRF-19500.

1. SCOPE

1.1 Scope. This specification covers the performance requirements for P-channel, enhancement-mode, MOSFET, power transistors. Four levels of product assurance are provided for each encapsulated device type as specified in MIL-PRF-19500.

1.2 Physical dimensions. See figure 1, TO-205AF (formerly TO-39) for 2N6895, and figure 2, TO-204AA for 2N6896 and 2N6897; and TO-204AE for 2N6898 (formerly TO-3).

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

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_{D2} (2) T_C = +100°C	I_S	I_{DM} (4)	T_J and T_{STG}
	W	W	V dc	V dc	V dc	A dc	A dc	A dc	A(pk)	°C
2N6895	8.33	0.6	100	100	±20	1.16	0.74	1.16	5	-55 to +150
2N6896	60	4	100	100	±20	6.0	3.8	6.0	20	-55 to +150
2N6897	100	4	100	100	±20	12	7.6	12	30	-55 to +150
2N6898	150	4	100	100	±20	25	15.8	25	60	-55 to +150

(1) Derate linearly T_C > +25°C; 2N6895 (0.067 W/°C), 2N6896 (0.48 W/°C), 2N6897 (0.8 W/°C), 2N6898 (1.2 W/°C).

(2) The following formula derives the maximum theoretical I_D limit. I_D is limited by package and internal wires and may be limited by pin diameter:

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

(3) See figure 3, maximum drain current graphs.

(4) I_{DM} = 4 x I_{D1} as calculated in note 2.

* Comments, suggestions, or questions on this document should be addressed to Defense Supply Center, Columbus, ATTN: DSCC-VAC, P.O. Box 3990, Columbus, OH 43216-5000, or emailed to alan.barone@dla.mil. Since contact information can change, you may want to verify the currency of this address information using the ASSIST Online database at www.dodssp.daps.mil.

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

Type	Min $V_{(BR)DSS}$ V_{GS} = 0 V 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	Max $r_{DS(on)}$ (1) V_{GS} = -10 V dc		$R_{\theta JC}$
			V_{DS} = 80 percent of rated V_{DS}	T_J = +25°C at I_{D1}	T_J = +150°C at I_{D2}	
	V dc	V dc Min Max	µA dc	Ω	Ω	°C/W
2N6895	-100	-2.0 -4.0	-1.0	3.65	6.15	15.0
2N6896	-100	-2.0 -4.0	-1.0	0.6	1.67	2.083
2N6897	-100	-2.0 -4.0	-1.0	0.3	0.69	1.25
2N6898	-100	-2.0 -4.0	-1.0	0.2	0.24	0.83

(1) Pulsed (see 4.5.1).

2. APPLICABLE DOCUMENTS

* 2.1 General. The documents listed in this section are specified in sections 3, 4, or 5 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 of documents cited in sections 3, 4, or 5 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 cited in the solicitation or contract.

* DEPARTMENT OF DEFENSE SPECIFICATIONS

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

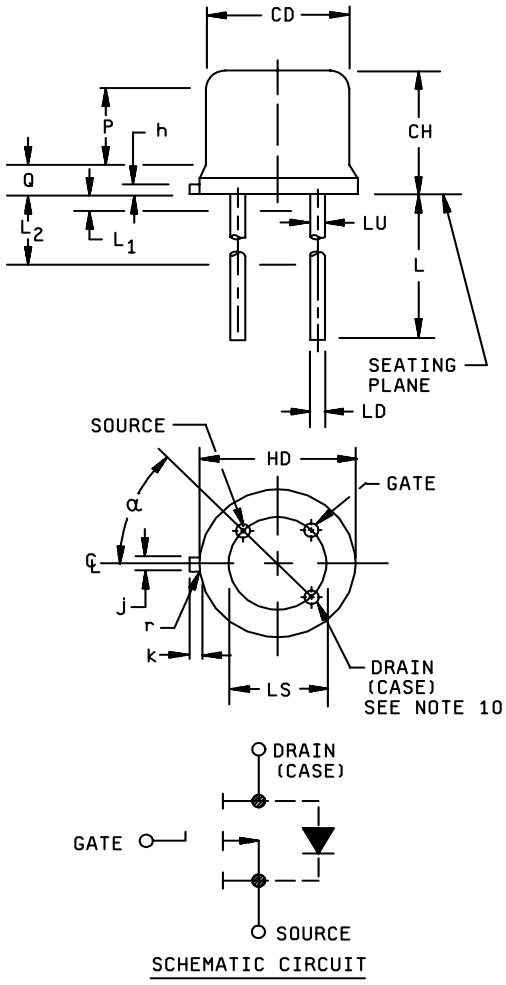
* DEPARTMENT OF DEFENSE STANDARDS

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

* (Copies of these documents are available online at http://assist.daps.dla.mil/quicksearch/ or www.dodssp.dap.mil or 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, the text of this document takes precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

Ltr	Dimensions				Notes
	Inches		Millimeters		
	Min	Max	Min	Max	
CD	.305	.335	7.75	8.51	
CH	.160	.180	4.07	4.57	
HD	.335	.370	8.51	9.40	
h	.009	.041	0.23	1.04	
j	.028	.034	0.71	0.86	2
k	.029	.045	0.74	1.14	3
LD	.016	.021	0.41	0.53	7,8
LL	.500	.750	12.70	19.05	7,8
LS	.200 TP		5.08 TP		6
LU	.016	.019	0.41	0.48	7,8
L_1		.050		1.27	7,8
L_2	.250		6.35		7,8
P	.100		2.54		5
Q		.050		1.27	4
r		.010		0.25	9
α	45 TP		45 TP		6

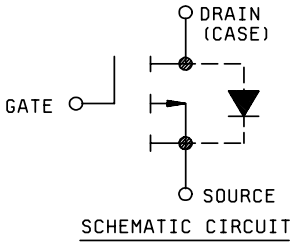


NOTES:

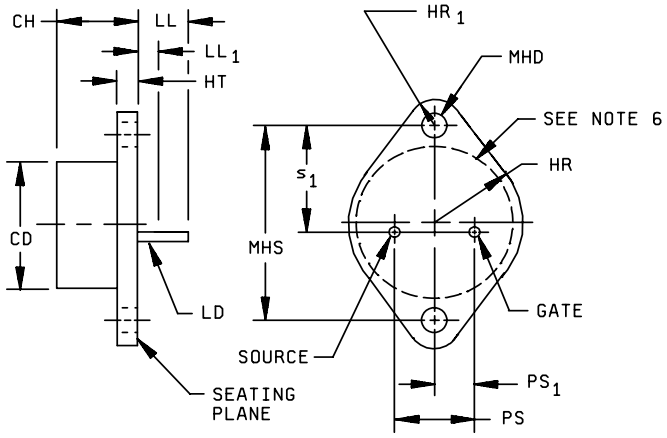
1. Dimensions are in inches. Millimeters are given for general information only.
2. Beyond radius (r) maximum, j shall be held for a minimum length of .011 inch (0.028 mm).
3. Dimension k measured from maximum HD.
4. Outline in this zone is not controlled.
5. Dimension CD shall not vary more than .010 inch (0.25 mm) in zone P. This zone is controlled for automatic handling.
6. Leads at gauge plane .054 +.001, -.000 inch (1.37 +0.03, -0.00 mm) below seating plane shall be within .007 inch (0.18 mm) radius of true position (TP) at maximum material condition (MMC) relative to tab at MMC. The device may be measured by direct methods.
7. LU applies between L_1 and L_2. LD applies between L_2 and L minimum. Diameter is uncontrolled in L_1 and beyond LL minimum.
8. All three leads.
9. Radius (r) applies to both inside corners of tab.
10. Drain is electrically connected to the case.
11. Dimensioning and tolerating are in accordance with ASME Y14.5M.

* FIGURE 1. Physical dimensions for 2N6895 (TO-205AF).

Symbol	Dimensions				Notes
	Inches		Millimeters		
	Min	Max	Min	Max	
CD		.875		22.23	
CH	.250	.360	6.35	9.14	
HR	.495	.525	12.57	13.34	
HR_1	.131	.188	3.33	4.78	
HT	.060	.135	1.52	3.43	
LD 2N6896, 2N6897	.038	.043	0.97	1.09	
LD 2N6898	.057	.063	1.45	1.60	
LL	.312	.500	7.92	12.70	
LL_1		.050		1.27	
MHD	.151	.161	3.84	4.09	
MHS	1.177	1.197	29.90	30.40	
PS	.420	.440	10.67	11.18	3, 5
PS_1	.205	.225	5.21	5.72	3, 5
S_1	.655	.675	16.64	17.15	



SCHEMATIC CIRCUIT



NOTES:
1. Dimensions are in inches.
2. Millimeters are given for general information only.
3. These dimensions should be measured at points .050 inch (1.27 mm) and .055 inch (1.40 mm) below seating plane. 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. Mounting holes shall be deburred on the seating plane side.
6. Drain is electrically connected to the case.
7. Dimensioning and tolerating are in accordance with ASME Y14.5M.

* FIGURE 2. Physical dimensions of transistor 2N6896 and 2N6897 (TO-204AA), and 2N6898 (TO-204AE).

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 manufacturers list 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 and as follows.

nC - nano coulomb

* 3.4 Interface and physical dimensions. Interface and physical dimensions shall be as specified in MIL-PRF-19500, and on figure 1, TO-205AF (formerly TO-39) for 2N6895, and figure 2, TO-204AA for 2N6896 and 2N6897; and TO-204AE for 2N6898 (formerly TO-3).

* 3.4.1 Lead material and finish. Lead material shall be Kovar, Alloy 52 for T0-205AF, and a copper core or plated core is permitted. Lead finish shall be solderable in accordance with MIL-PRF-19500, MIL-STD-750, and herein. Where a choice of lead finish is desired, it shall be specified in the acquisition document (see 6.2).

* 3.4.2 Internal construction. Multiple chip construction shall not be permitted.

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

3.5.1 Handling. MOS devices must be handled with certain precautions to avoid damage due to the accumulation of static charge. The following handling practices shall be followed:

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

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

* 3.6 Marking. Marking shall be in accordance with MIL-PRF-19500. At the option of the manufacturer, marking of country of origin may be omitted from the body of the transistor, but shall be retained on the initial container.

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

* 3.7 Electrical test requirements. The electrical test requirements shall be as specified in table I.

* 3.8 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 and tables I, II, and III).

4.2 Qualification inspection. Qualification inspection shall be in accordance with MIL-PRF-19500 and as specified herein.

* 4.2.1 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 specification sheet that did not request the performance of table III tests, the tests specified in table III herein shall be performed by the first inspection lot of this revision to maintain qualification.

* 4.3 Screening (JANS, JANTX, and JANTXV levels only). Screening shall be in accordance with table IV of MIL-PRF-19500 and as specified herein. The following measurements shall be made in accordance with table I herein. Devices that exceed the limits of table I herein shall not be acceptable.

Screen (see table IV of MIL-PRF-19500) (1) (2)	Measurement	
	JANS level	JANTX and JANTXV levels
(3)	Gate stress test (see 4.3.1)	Gate stress test (see 4.3.1)
(3)	Method 3470 of MIL-STD-750, (see 4.3.2)	Method 3470 of MIL-STD-750, (see 4.3.2)
(3) 3c	Method 3161 of MIL-STD-750, (see 4.3.3)	Method 3161 of MIL-STD-750, (see 4.3.3)
9	I_{GSSF1}, I_{GSSR1}, I_{DSS1}, subgroup 2 of table I herein	Not applicable
10	Method 1042 of MIL-STD-750, test condition B	Method 1042 of MIL-STD-750, test condition B
11	Subgroup 2 of table I herein; I_{GSSF1}, I_{GSSR1}, I_{DSS1}, $r_{DS(on)1}$, $V_{GS(th)1}$ 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} = ± .2 µA dc or ±100 percent of initial value, whichever is greater.	Subgroup 2 of table I herein. I_{GSSF1}, I_{GSSR1}, I_{DSS1}, $r_{DS(on)1}$, $V_{GS(th)1}$
12	Method 1042 of MIL-STD-750, test condition A and test condition C. (see 4.3.4)	Method 1042 of MIL-STD-750, 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} = ± .2 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_{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} = ± .2 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_{GSSF1}, I_{GSSR1}, and I_{DSS1} are measured.
(2) An out-of-family program to characterize I_{GSSF1}, I_{GSSR1}, I_{DSS1}, and $V_{GS(th)1}$ shall be invoked.
(3) Shall be performed anytime before screen 9.

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

* 4.3.2 Unclamped inductive switching.

a. Peak current (I_D)

2N6895	1 A
2N6896	2.7 A
2N6897	5 A
2N6898	5.9 A

b. Peak gate voltage (V_{GS})..... 10 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) ..... 100 µH ±10 percent.

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

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

* 4.3.3 Thermal impedance (ΔV_{SD} measurements). The ΔV_{SD} measurements shall be performed in accordance with method 3161 of MIL-STD-750. The ΔV_{SD} conditions (I_H and V_H) and maximum limit shall be derived by each vendor from the transient thermal response curves (see figure 4) and shall be specified in the certificate of conformance prior to qualification. The following parameter measurements shall apply.

	2N6895	2N6896	2N6897	2N6898
I_M	10 mA	10 mA	10 mA	10 mA
I_H	0.6 A	2 A	3.5 A	4 A
V_H	10 V	20 V	20 V	25 V
t_{MD}	10 – 80 µs	10 – 80 µs	10 – 80 µs	10 – 80 µs
t_{SW}	10 µs max.	10 µs max.	10 µs max.	10 µs max.

* 4.3.4 Power burn-in. Power burn-in conditions are as follows: Method 3161 of MIL-STD-750, condition C, T_A = +25°C, -5°C, +10°C, V_{DS} = 10 V min.; I_D adjusted to meet a junction temperature of +140°C, - 5°C, + 10°C, t = 240 hours.

4.4 Conformance inspection. Conformance inspection shall be in accordance with MIL-PRF-19500. Alternate flow is allowed for quality conformance inspection in accordance with figure 4 of MIL-PRF-19500.

4.4.1 Group A inspection. Group A inspection shall be conducted in accordance with MIL-PRF-19500 and table I herein. Electrical measurements (end-points) shall be in accordance with the inspections of table II herein.

4.4.2 Group B inspection. Group B inspection shall be conducted in accordance with the conditions specified for subgroup testing in table VIa (JANS) and table VIb (JAN, JANTX, and JANTXV) of MIL-PRF-19500 and herein. Electrical measurements (end-points) shall be in accordance with the inspections of table II herein.

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

Subgroup	Method	Conditions
B3	1051	Test condition G.
B4	1042	Test condition D; 2,000 cycles. The heating cycle shall be 1 minute minimum. 2N6895, V_{DS} = -10 V dc, P_T = 4 W at T_A = +25°C ± 3°C. 2N6897, 2N6898, V_{DS} = -20 V dc, P_T = 0.6 W at T_A = +25°C ± 3°C.
B5	1042	Accelerated steady-state operation life; test condition C; T_A = + 25°C, - 5°C, + 10°C, V_{DS} = 10 V min.; I_D adjusted to meet a junction temperature of 140°C, - 0°C, + 10°C, t = 240 hours.
B5	2037	Bond strength, test condition A.
B6	3161	See 4.5.2.

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

Subgroup	Method	Condition
B2	1051	Test condition G, 25 cycles.
B3	1042	Test condition D, 2,000 cycles. The heating cycle shall be 1 minute minimum.

* 4.4.3 Group C inspection. Group C inspection shall be conducted in accordance with the conditions specified for subgroup testing in table VII of MIL-PRF-19500 and as follows. Electrical measurements (end-points) shall be in accordance with the inspections of table II herein.

Subgroup	Method	Condition
C2	2036	Test condition E .
C5	3161	See 4.5.2
C6	1042	Test condition D, 6,000 cycles. 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 III herein. Electrical measurements (end-points) shall be in accordance with the inspections of table II herein.

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

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

4.5.2 Thermal resistance. Thermal resistance measurements shall be performed in accordance with method 3161 of MIL-STD-750. $R_{\theta JC}$(max) = (2N6895 = 15.0°C/W, 2N6896 = 2.083°C/W, 2N6897 = 1.25°C/W, 2N6898 = 0.83°C/W). t_H = steady-state (see method 3161 of MIL-STD-750 for definition).

	2N6895	2N6896	2N6897	2N6898
I_M	10 mA	10 mA	10 mA	10 mA
I_H	0.6 A	2 A	3.5 A	4 A
V_H	10 V	20 V	20 V	25 V
t_{MD}	10 – 80 µs	10 – 80 µs	10 – 80 µs	10 – 80 µs
t_{SW}	10 µs max.	10 µs max.	10 µs max.	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	Bias condition C, V_{GS} = 0 V; I_D = -1.0 mA dc	$V_{(BR)DSS}$	-100		V dc
Gate to source voltage (threshold)	3403	$V_{DS} \geq V_{GS}$; I_D = -0.25 mA dc	$V_{GS(th)1}$	-2.0	-4.0	V dc
Gate current	3411	Bias condition C; V_{DS} = 0 V; V_{GS} = +20 V dc	I_{GSSF1}		+100	nA dc
Gate current	3411	Bias condition C; V_{DS} = 0 V; V_{GS} = -20 V dc	I_{GSSR1}		-100	nA dc
Drain current	3413	V_{GS} = 0; bias condition C; V_{DS} = -80 V	I_{DSS1}		-1.0	µA dc
Static drain to source on-state resistance	3421	V_{GS} = -10 V dc; condition A; pulsed (see 4.5.1)	$r_{DS(on)1}$			
2N6895		I_D = -0.74 A dc			3.65	Ω
2N6896		I_D = -3.8 A dc			0.6	Ω
2N6897		I_D = -7.6 A dc			0.3	Ω
2N6898		I_D = -15.8 A dc			0.2	Ω
Drain to source on-state voltage	3405	V_{GS} = 10 V dc; condition A; pulsed (see 4.5.1)	$V_{DS(on)1}$			
2N6895		I_D = -1.16 A dc			-6.0	V
2N6896		I_D = -6.0 A dc			-6.0	V
2N6897		I_D = -12.0 A dc			-4.8	V
2N6898		I_D = -25.0 A dc			-6.0	V
Forward voltage (source drain diode)	4011	Pulsed (see 4.5.1); V_{GS} = 0 V	V_{SD}			
2N6895		I_D = -1.16 A dc		-0.8	-1.6	V
2N6896		I_D = -6.0 A dc		-0.8	-1.6	V
2N6897		I_D = -12.0 A dc		-0.8	-1.6	V
2N6898		I_D = -25.0 A dc		-0.8	-1.6	V

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 2 - Continued.						
Forward transconductance	3475	Pulsed (see 4.5.1), I_D = rated I_{D2} =(see 1.3).	g_{fs}			
2N6895				0.2		s
2N6896				1.0		s
2N6897				2.0		s
2N6898				4.0		s
Subgroup 3						
High temperature operation:		$T_C = T_J = +125°C$				
Gate to source voltage(threshold)	3403	$V_{DS} \geq V_{GS}$, I_D = -0.25 mA dc	$V_{GS(th)2}$	-1.0		V dc
Gate current	3411	Bias condition C, V_{DS} = 0 V; V_{GS} = +20 V dc and -20 V dc	I_{GSS2}		±200	nA dc
Drain current	3413	Bias condition C, V_{GS} = 0 V, V_{DS} = -80 V	I_{DSS2}		- 50	µA dc
Static drain to source on-state resistance	3421	V_{GS} = -10 V dc, pulsed (see 4.5.1)	$r_{DS(on)2}$			
2N6895		I_D = - 0.74 A dc			5.66	Ω
2N6896		I_D = - 3.8 A dc			0.96	Ω
2N6897		I_D = - 7.6 A dc			0.465	Ω
2N6898		I_D = - 15.8 A dc			0.24	Ω
Low temperature operation:		$T_C = T_J = -55°C$				
Gate to source voltage (threshold)	3403	$V_{DS} \geq V_{GS}$, I_D = -0.25 mA	$V_{GS(th)3}$		-5.0	V dc
Subgroup 4						
Switching time test	3472	I_D = rated I_{D2} (see 1.3); V_{GS} = 10 V dc; R_{gen} =15 Ω; R_{GS} =15 Ω, V_{DD} = 50 percent of rated V_{DS} (see 1.3)				
Turn-on delay time		V_{DD} = -50 V dc	$t_{d(on)}$			
2N6895		I_D = - 0.74 V dc			25	ns
2N6896		I_D = - 3.8 A dc			60	ns
2N6897		I_D = - 7.6 A dc			60	ns
2N6898		I_D = - 15.8 A dc			50	ns

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 4 - Continued.						
Rise time		V_{DD} = -50 V dc	t_r			
2N6895		I_D = - 0.74 V dc			45	ns
2N6896		I_D = - 3.8 V dc			100	ns
2N6897		I_D = - 7.6 V dc			175	ns
2N6898		I_D = - 15.8 V dc			250	ns
Turn-off delay time		V_{DD} = -50 V dc	$t_{d(off)}$			
2N6895		I_D = - 0.74 V dc			45	ns
2N6896		I_D = - 3.8 V dc			150	ns
2N6897		I_D = - 7.6 V dc			275	ns
2N6898		I_D = - 15.8 V dc			400	ns
Fall time		V_{DD} = -50 V dc	t_f			
2N6895		I_D = - 0.74 V dc			50	ns
2N6896		I_D = - 3.8 V dc			100	ns
2N6897		I_D = - 7.6 V dc			175	ns
2N6898		I_D = - 15.8 V dc			250	ns
Subgroup 5						
Safe operating area	3474	See figure 5.				
High voltage test		V_{DS} = 80 percent of rated V_{DS} (see 1.3)				
Electrical measurements		See table II, steps 1, 2, 3, 4, 5, 6, and 7				
Subgroup 6						
Not applicable						
Subgroup 7						
Gate charge	3471	Condition A or B				
Test 1			$Q_{g(on)}$			
On-state gate charge						
2N6895		I_D = - 0.74 V dc		2.2	4.7	nC
2N6896		I_D = - 3.8 V dc		13	24	nC
2N6897		I_D = - 7.6 V dc		31	58	nC
2N6898		I_D = - 15.8 V dc		50	117	nC

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 7 - Continued.						
Test 2						
Gate to source charge			Q_{gs}			
2N6895				0.4	1.2	nC
2N6896				1.1	5.5	nC
2N6897				3	13	nC
2N6898				6	25	nC
Test 3						
Gate to drain charge			Q_{gd}			
2N6895				0.9	2.9	nC
2N6896				5.5	14.5	nC
2N6897				14	36	nC
2N6898				26	69	nC
Reverse recovery time	3473	V_{DD} = ≤ 30 V; di/dt =100A/µs I_F = 4 A	t_{rr}			
2N6895					340	ns
2N6896					375	ns
2N6897					500	ns
2N6898					750	ns

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

* TABLE II. Group A, B, C and E electrical measurements. 1/ 2/ 3/ 4/

Step	Inspection	MIL-STD-750		Symbol	Limit		Unit
		Method	Conditions		Min	Max	
1.	Breakdown voltage drain to source	3407	Bias condition C; I_D = - 1.0 mA dc, V_{GS} = 0 V	$V_{(BR)DSS}$	- 100		V dc
2.	Gate to source voltage (threshold)	3403	$V_{DS} \geq V_{GS}$; I_D = -0.25 mA dc	$V_{GS(th)1}$	-2.0	-4.0	V dc
3.	Gate current	3411	Bias condition C; V_{GS} = + 20 Vdc and -20 V dc; V_{DS} = 0 V	I_{GSS1}		-100	nA dc
4.	Drain current	3413	Bias condition C; V_{DS} = -80 V dc; V_{GS} = 0 V	I_{DSS1}		-50	µA dc
5.	Static drain to source “on”- state resistance	3421	V_{GS} = -10 V dc; condition A, pulsed (see 4.5.1)	$r_{DS(on)1}$			Ohm
	2N6895		I_D = - 0.74 V dc			3.65	
	2N6896		I_D = - 3.8 V dc			0.6	
	2N6897		I_D = - 7.6 V dc			0.3	
	2N6898		I_D = - 15.8 V dc			0.2	
6.	Drain to source “on”- state voltage	3405	V_{GS} = -10 V dc; condition A, pulsed (see 4.5.1)	$V_{DS(on)}$			V dc
	2N6895		I_D = - 1.16 V dc			-6.0	
	2N6896		I_D = - 6.0 V dc			-6.0	
	2N6897		I_D = - 12.0 V dc			-4.8	
	2N6898		I_D = - 25.0 V dc			-6.0	
7.	Forward voltage (source drain diode)	4011	Pulsed (see 4.5.1), V_{GS} = 0	V_{SD}	-0.8	-1.6	V
	2N6895		I_S = -1.16 A dc				
	2N6896		I_S = -6.04.0 A dc				
	2N6897		I_S = -12.0 A dc				
	2N6898		I_S = -25.0 A dc				
8.	Thermal response	3161	See 4.3.3	ΔV_{SD}			

1/ The electrical measurements for appendix E, table VIa (JANS) of MIL-PRF-19500 are as follows:
   a. Subgroup 3, see table II herein, steps 1, 2, 3, 4, 5, 6, and 7.
   b. Subgroup 4, see table II herein, steps 1, 2, 3, 4, 5, 6, 7, and 8.
   c. Subgroup 5, see table II herein, 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, see table II herein, steps 1, 2, 3, 4, 5, 6, and 7.
   b. Subgroups 3 and 6, see table II herein, steps 1, 2, 3, 4, 5, 6, 7, and 8.

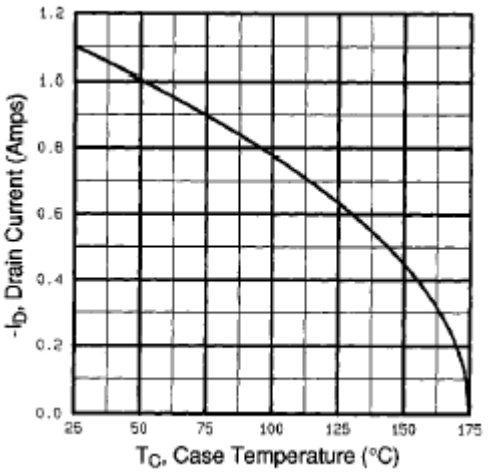
3/ The electrical measurements for appendix E, table VII of MIL-PRF-19500 are as follows:
   a. Subgroups 2 and 3, see table II herein, steps 1, 2, 3, 4, 5, 6, and 7.
   b. Subgroup 6, see table II herein, steps 1, 2, 3, 4, 5, 6, 7, and 8.

4/ The electrical measurements for appendix E, table IX of MIL-PRF-19500 are as follows: Subgroups 1 and 2, see table II herein, all steps.

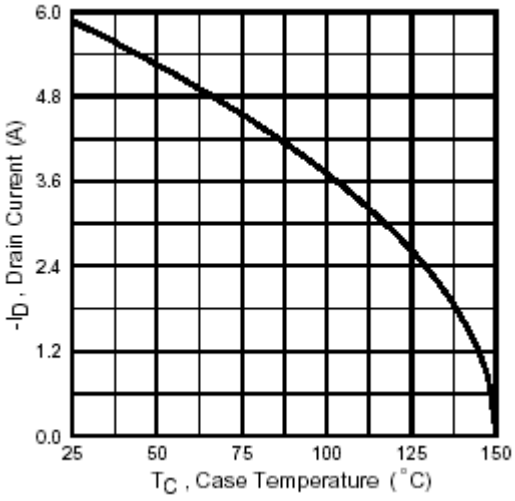
* TABLE III. Group E inspection (all quality levels) for qualification or re-qualification only.

Inspection	MIL-STD-750		Qualification and large lot quality conformance inspection
	Method	Conditions	
Subgroup 1			12 devices c = 0
Temperature cycling	1051	Test condition G.	
Hermetic seal	1071		
Fine leak Gross leak			
Electrical measurements		See table II, all steps.	
Subgroup 2 1/			12 devices c = 0
Steady-state gate bias	1042	Condition B, 1,000 hours.	
Electrical measurements		See table II, all steps.	
Steady-state reverse bias	1042	Condition A, 1,000 hours.	
Electrical measurements		See table II, all steps.	
Subgroup 3			3 devices c = 0
DPA	2102		
Subgroup 4			sample size N/A
Thermal impedance curves		Each supplier shall submit their (typical) maximum design thermal impedance curves. In addition, the optimal test conditions and $Z_{\theta JX}$ limit shall be provided to the qualifying activity in the qualification report.	
Subgroup 5			
Not applicable			
Subgroup 6			3 devices
ESD	1020		
Subgroup 7			22 devices c = 0
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		

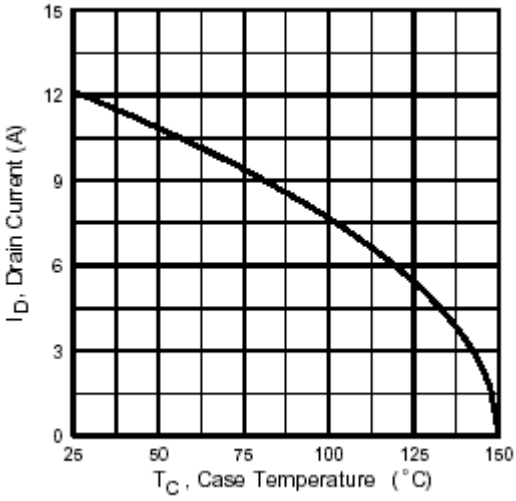
1/ A separate sample may be pulled for each test condition.



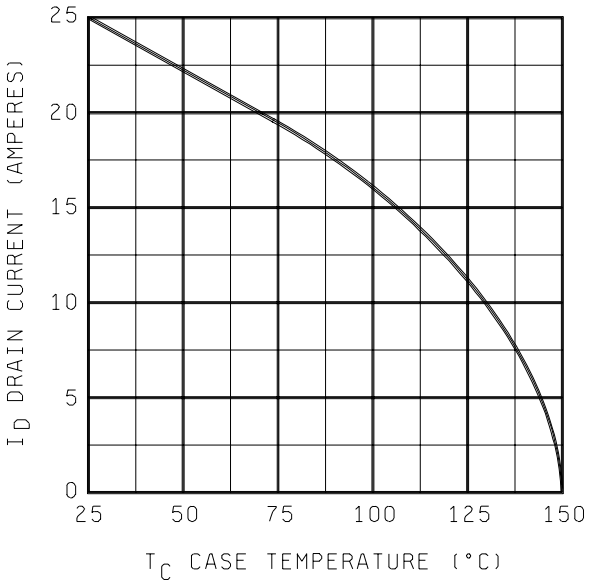
2N6895



2N6896

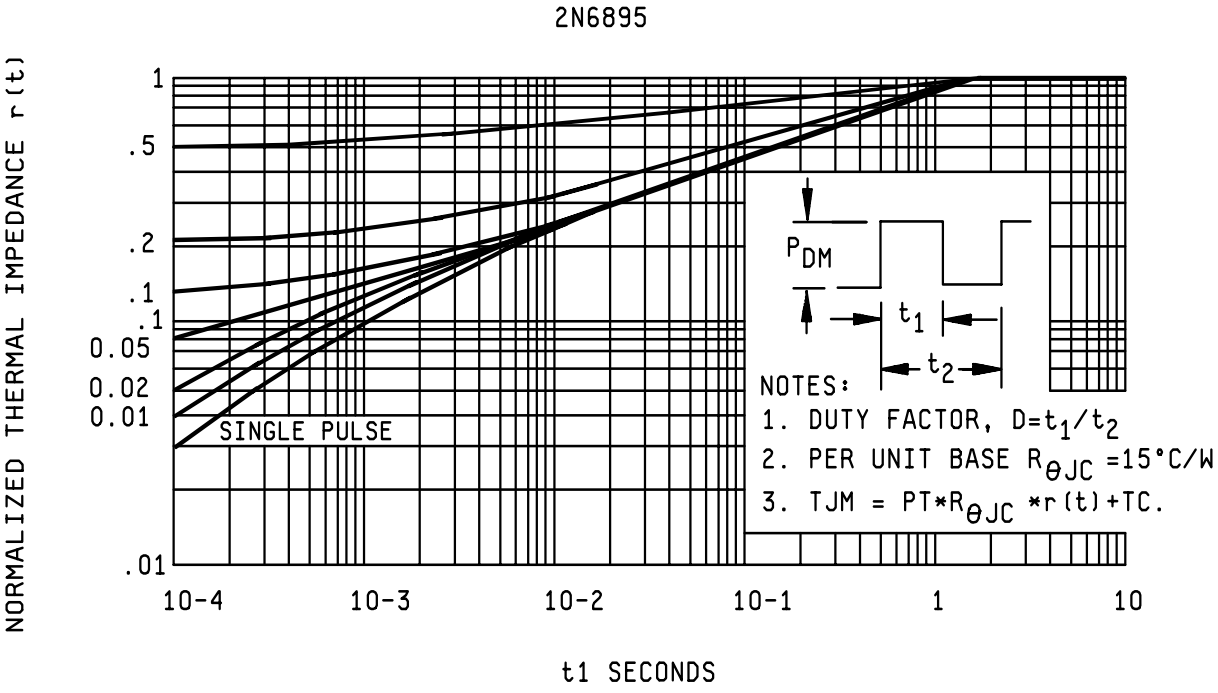


2N6897

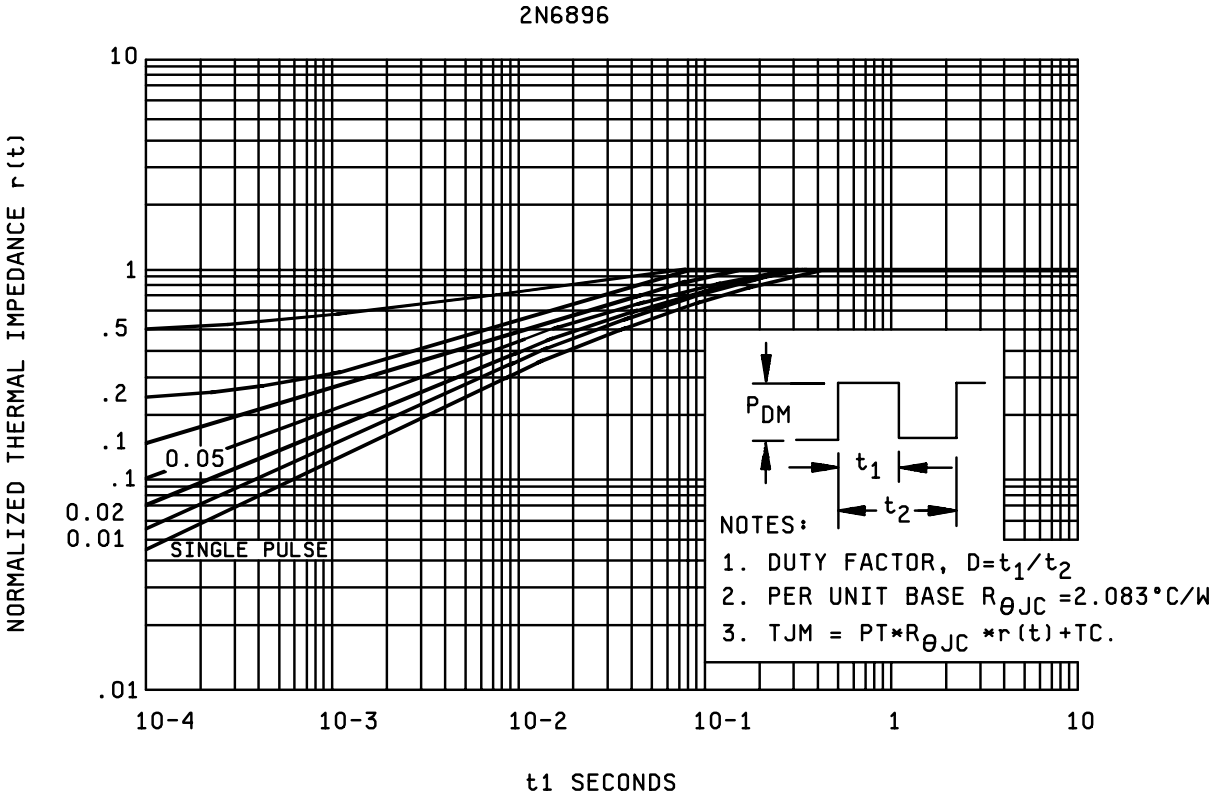


2N6898

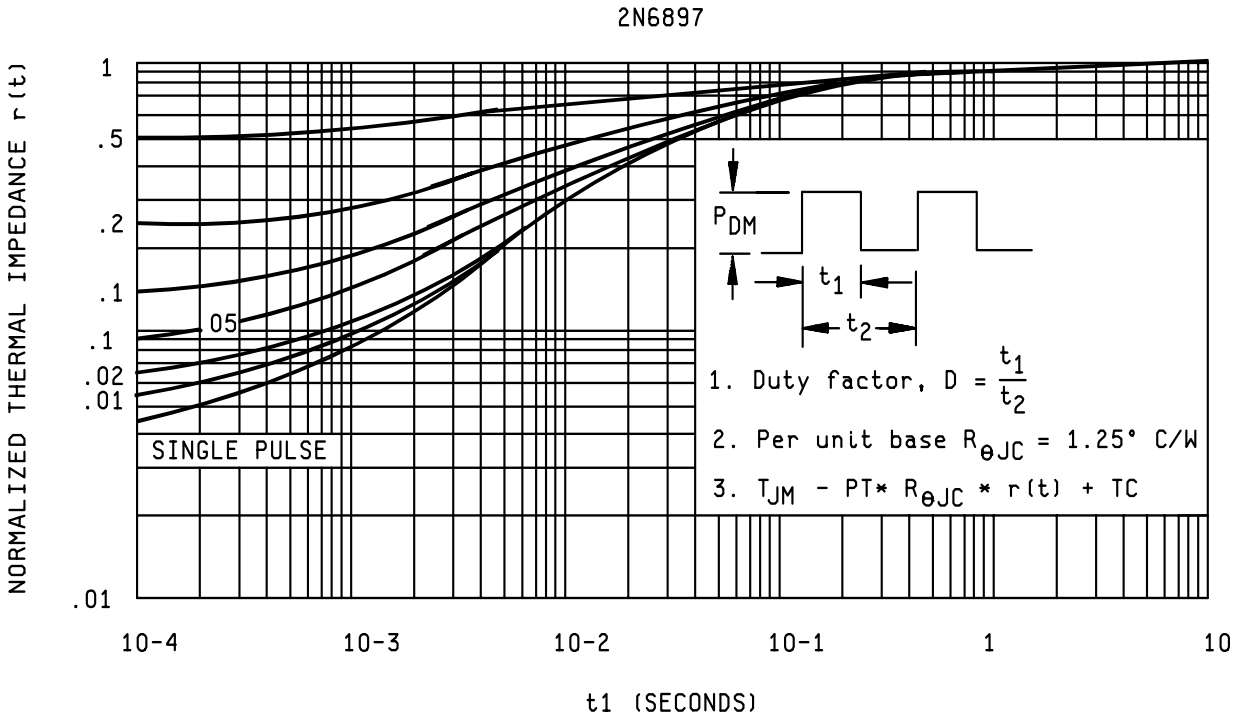
* FIGURE 3. Maximum drain current vs case temperature graphs.



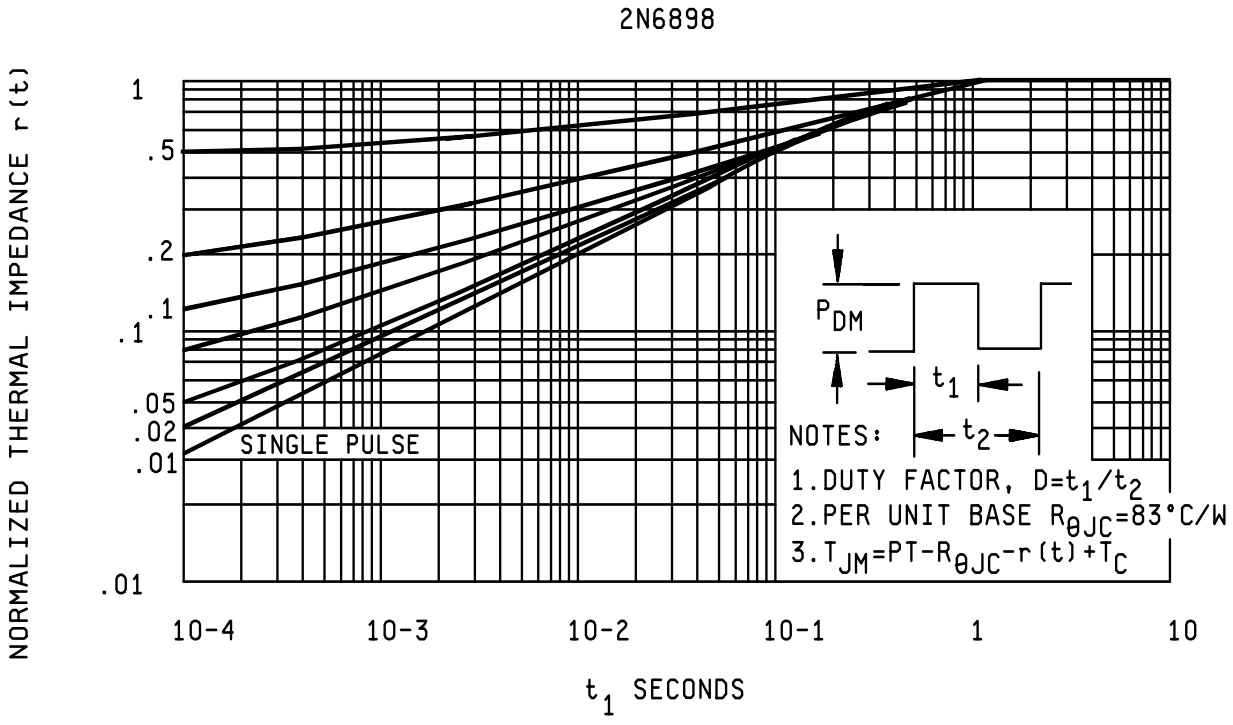
* FIGURE 4. Transient thermal response.



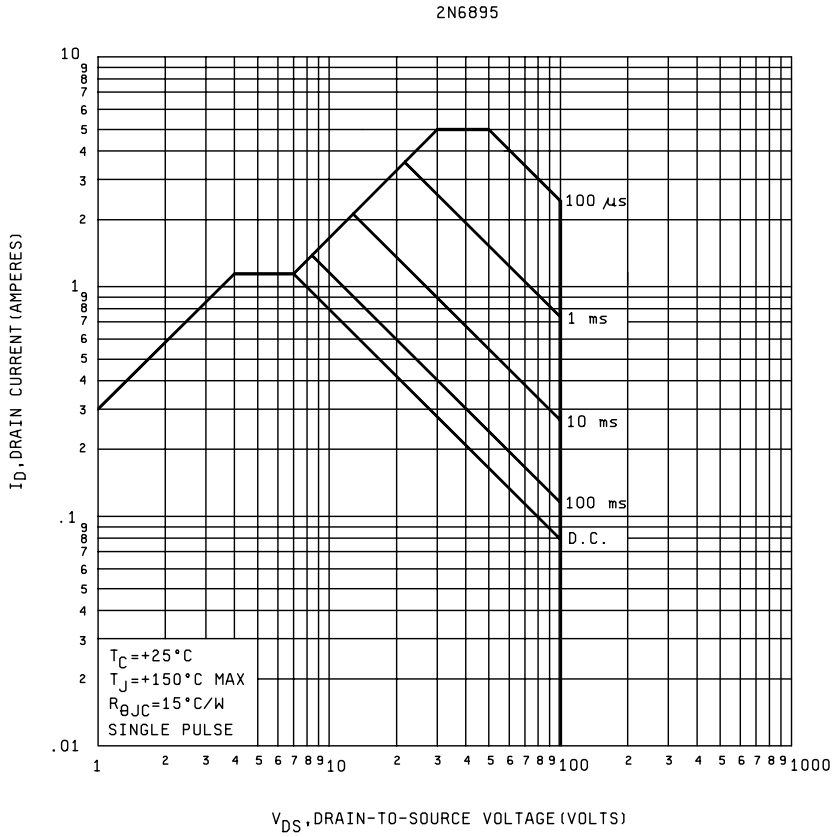
* FIGURE 4. Transient thermal response - Continued.



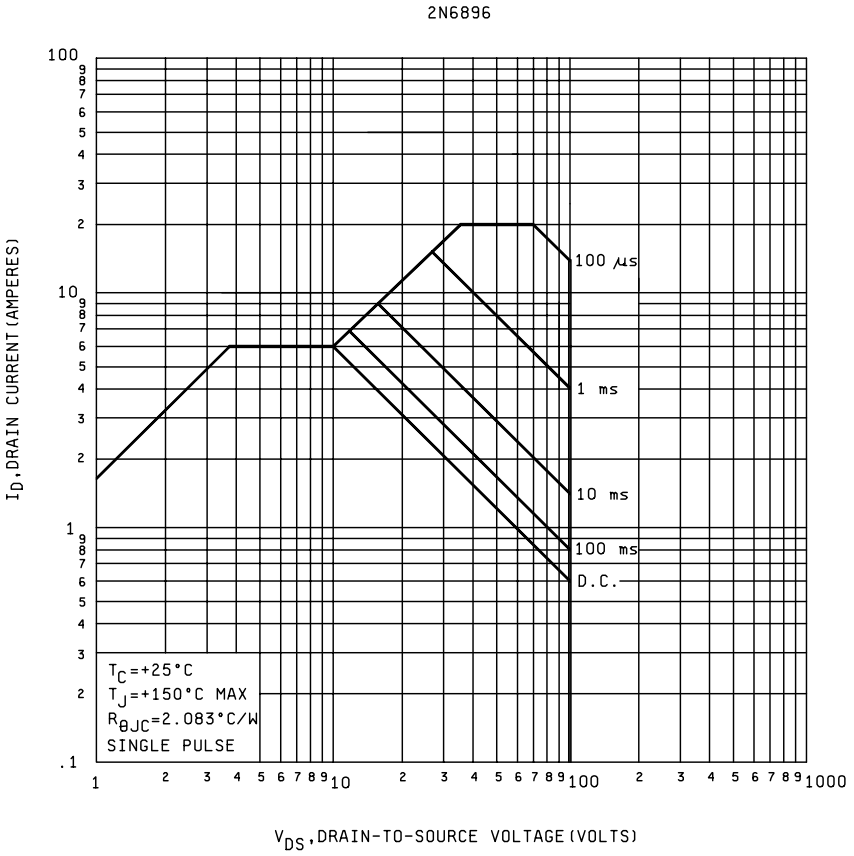
* FIGURE 4. Transient thermal response - Continued.



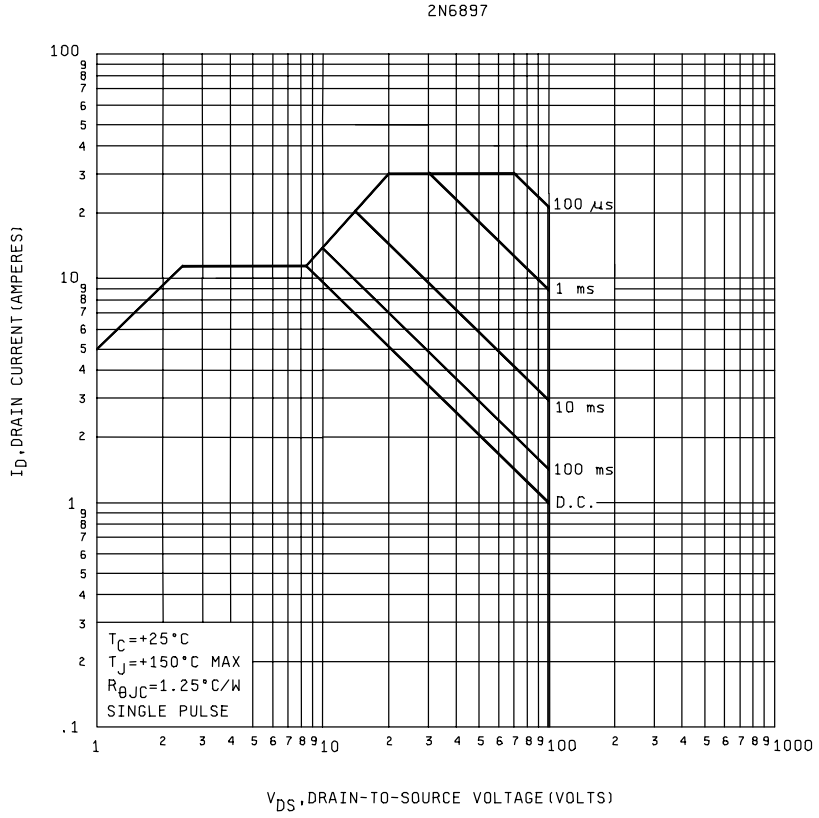
* FIGURE 4. Transient thermal response - Continued.



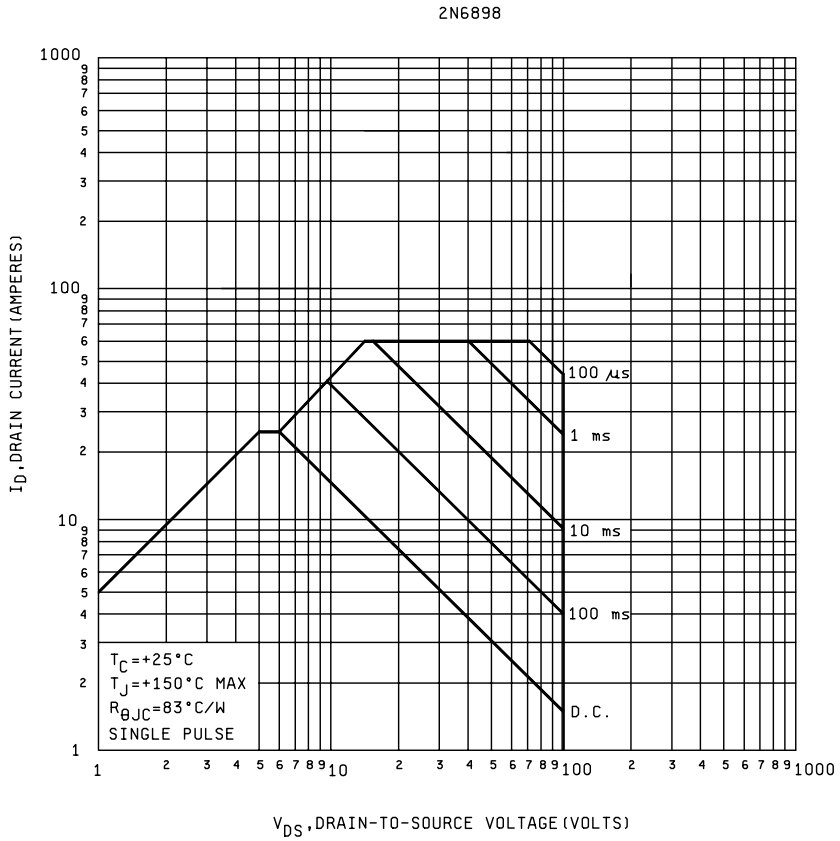
* FIGURE 5. Maximum safe operating area.



* FIGURE 5. Maximum safe operating area – Continued.



* FIGURE 5. Maximum safe operating area – Continued.



* FIGURE 5. Maximum safe operating area – Continued.

5. PACKAGING

* 5.1 Packaging. For acquisition purposes, the packaging requirements shall be as specified in the contract or order (see 6.2). When actual packaging of materiel is to be performed by DoD or in-house contractor personnel, these personnel need to contact the responsible packaging activity to ascertain packaging requirements. Packaging requirements are maintained by the Inventory Control Point's packaging activities within the Military Service or Defense Agency, or within the Military Service's system commands. Packaging data retrieval is available from the managing Military Department's or Defense Agency's automated packaging files, CD-ROM products, or by contacting the responsible packaging activity.

6. NOTES

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

6.1 Intended use. The notes specified in MIL-PRF-19500 are applicable to this specification.

* 6.2 Acquisition requirements. Acquisition documents should specify the following:

a. Title, number, and date of this specification.

b. Packaging requirements (see 5.1).

c. Lead finish (see 3.4.1).

d. Type designation and quality assurance level.

* 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 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 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 or e-mail vqe.chief@dla.mil.

* 6.4 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
NASA - NA
DLA - CC

Review activities:
Army - AR, MI, SM
Navy - AS, MC
Air Force - 19

Preparing activity:
DLA - CC

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* NOTE: The activities listed above were interested in this document as of the date of this document. Since organizations and responsibilities can change, you should verify the currency of the information above using the ASSIST Online database at www.dodssp.daps.mil .