The documentation and process conversion measures necessary to comply with this revision shall be completed by 22 March 1998.

INCH-POUND

MIL-PRF-19500/564E
22 December 1997
SUPERSEDING
MIL-S-19500/564D
9 December 1994

PERFORMANCE SPECIFICATION SHEET

SEMICONDUCTOR DEVICE, FIELD EFFECT TRANSISTOR, P-CHANNEL, SILICON
TYPES 2N6849, 2N6849U, 2N6851 AND 2N6851U
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 a P-channel, enhancement-mode, MOSFET, power transistor. Four levels of product assurance are provided for each encapsulated device type as specified in MIL-PRF-19500. Two levels of product assurance are provided for each unencapsulated device type.

1.2 Physical dimensions. See figures 1 and 2, TO-205AF (formerly TO-39), 3 (LCC), and figures 4, 5, and 6 for JANHC and JANKC die dimensions.

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

Type 3/	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} 2/ T_C = +100° C	I_S	I_{DM}	T_J and T_{STG}
	W	W	V dc	V dc	V dc	A dc	A dc	A dc	A(pk)	°C
2N6849	25	0.8	-100	-100	±20	-6.5	-4.1	-6.5	-25	-55 to +150
2N6851	25	0.8	-200	-200	±20	-4.0	-2.4	-4.0	-20	-55 to +150

1/ Derate linearly 0.2 W/° C for T_C > +25° C.

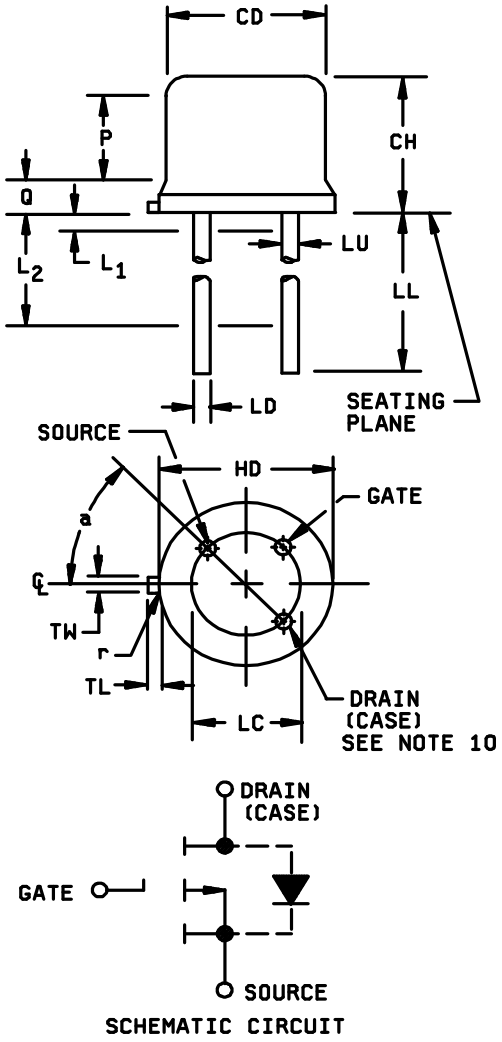
$$P_T = \frac{T_{J\,max} - T_C}{R_{\Theta JC}}$$

2/

$$I_D = \sqrt{\frac{T_{J\,max} - T_C}{(R_{\theta JC}) \times (R_{DS_{on}} \text{ at } T_{Jmax})}}$$

3/ Electrical characteristics for "U" suffix devices are identical to the corresponding non"U" suffix devices unless otherwise specified.

Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: Commander, Defense Supply Center Columbus, ATTN: DSCC-VAT, 3990 East Broad St., Columbus, OH 43216-5000, by using the addressed Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document or by letter.

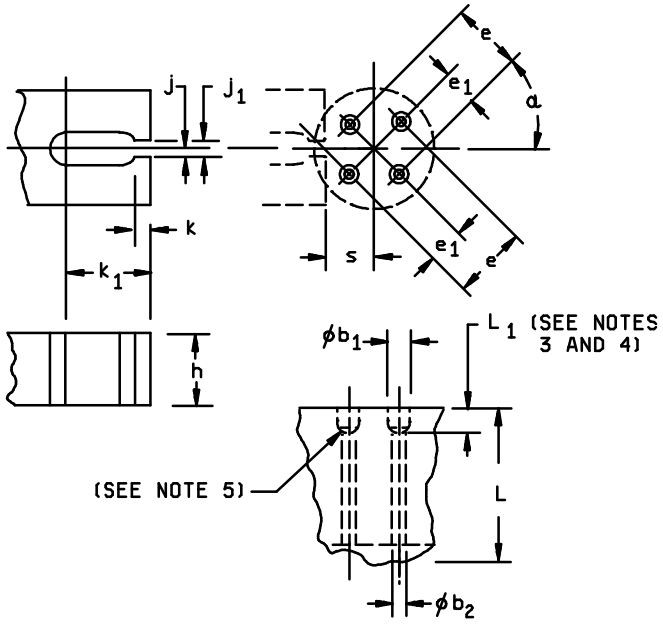


Ltr	Dimensions				Notes
	Inches		Millimeters		
	Min	Max	Min	Max	
CD	.305	.335	7.75	78.51	
CH	.160	.180	4.07	4.57	
LC	.200 TP		5.08 TP		6
LD	.016	.021	0.41	0.53	7,8
LU	.016	.019	0.41	0.48	7,8
HD	.335	.370	8.51	9.40	
CD	.305	.335	7.75	8.51	
TW	.028	.034	0.71	0.86	2
TL	.029	.045	0.74	1.14	3
LL	.500	.750	12.70	19.05	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
a	45 TP		45 TP		6

NOTES:
1. Dimensions are in inches. Metric equivalents are given for general information only.
2. Beyond radius (r) maximum, TW shall be held for a minimum length of .011 inch (0.28 mm).
3. Dimension TL 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 or by the gauge and gauging procedure shown on figure 2.
7. LU applies between L_1 and L_2. LD applies between L_2 and LL 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. In accordance with ANSI Y14.5M, diameters are equivalent to ϕx symbology.

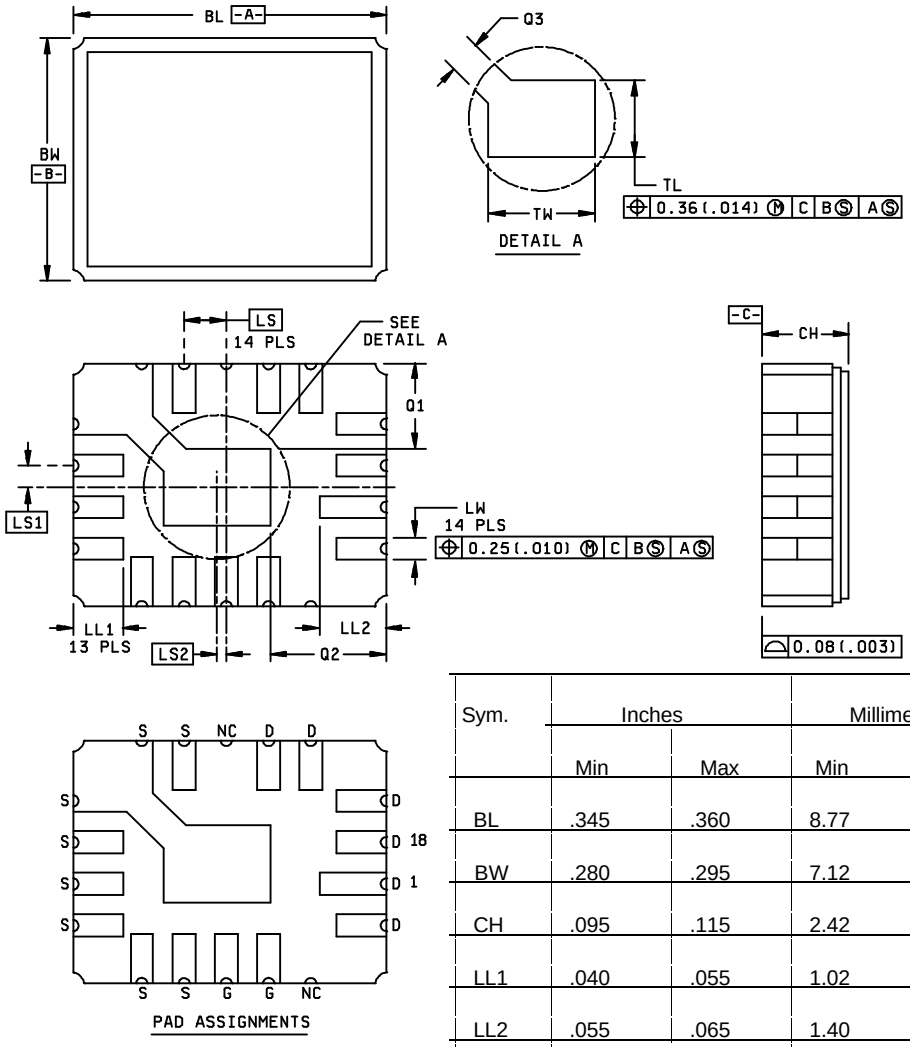
FIGURE 1. Physical dimensions for TO-205AF.

Ltr	Dimensions				Notes
	Inches		Millimeters		
	Min	Max	Min	Max	
ϕb_1	.0595	.0605	1.511	1.537	
ϕb_2	.0325	.0335	0.826	0.851	
e	.1995	.2005	5.067	5.093	
e_1	.0995	.1005	2.527	2.553	
h	.150 Nominal		3.81 Nominal		
j	.0175	.0180	0.444	0.457	
j_1	.0350	.0355	0.889	0.902	
k	.009	.011	0.23	0.28	
k_1	.125 Nominal		3.18 Nominal		
L	.372	.378	9.45	9.60	
L_1	.054	.055	1.37	1.40	
S	.182	.199	4.62	5.05	2
α	44.90°	45.10°	44.90°	45.10°	



NOTES:
1. Dimensions are in inches. Metric equivalents are given for general information only.
2. The location of the tab locator within the limits indicated will be determined by the tab and flange dimensions of the device being checked.
3. Gauging procedure. The device being measured shall be inserted until its seating plane is .125 ±.010 inch (3.18 ±0.25 mm) from the seating surface of the gauge. A force of 8 ±.5 ounces shall then be applied parallel and symmetrical to the device's cylindrical axis. When examined visually after the force application (the force need not be removed), the seating plane of the device shall be seated against the gauge. The use of a pin straightener prior to insertion in the gauge is permissible.
4. Gauging plane.
5. Drill angle.

FIGURE 2. Gauge for lead and tab location.

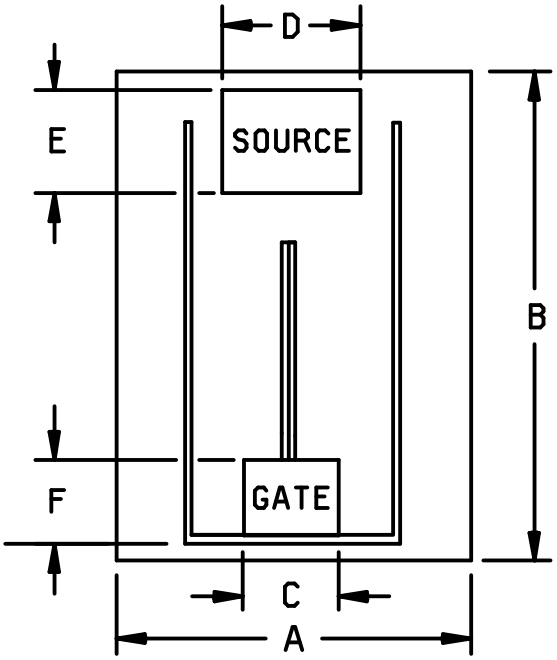


Sym.	Inches		Millimeters	
	Min	Max	Min	Max
BL	.345	.360	8.77	9.14
BW	.280	.295	7.12	7.49
CH	.095	.115	2.42	2.92
LL1	.040	.055	1.02	1.39
LL2	.055	.065	1.40	1.65
LS	.050 BSC		1.27 BSC	
LS1	.025 BSC		0.635 BSC	
LS2	.008 BSC		0.203 BSC	
LW	.020	.030	0.51	0.76
Q1	.105 REF		2.67 REF	
Q2	.120 REF		3.05 REF	
Q3	.045	.055	1.15	1.39
TL	.070	.080	1.78	2.03
TW	.120	.130	3.05	3.30

NOTES:
1. Dimensions are in inches. Metric equivalents are given for information only.
2. In accordance with ANSI Y14.5M, diameters are equivalent to ϕx symbology.

FIGURE 3. Physical dimensions for LCC.

2N6849 and 2N6851

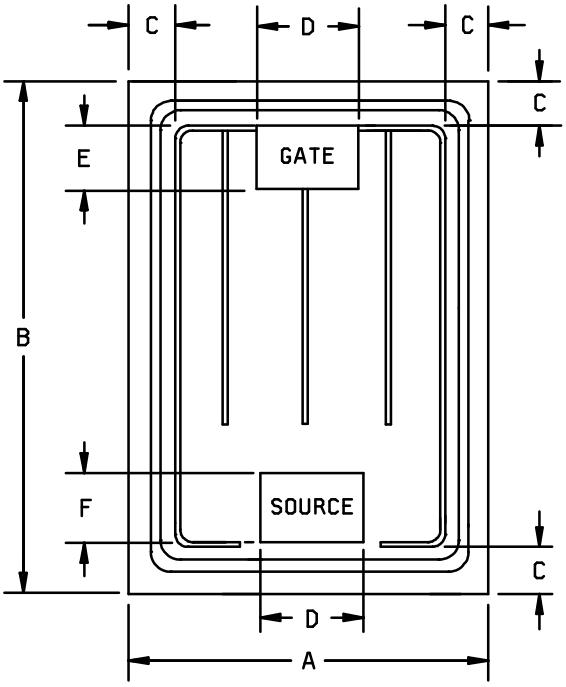


Dimensions								
	2N6849				2N6851			
Ltr	Inches		Millimeters		Inches		Millimeters	
	Min	Max	Min	Max	Min	Max	Min	Max
A	.106	.122	2.69	3.10	.108	.124	2.74	3.15
B	.172	.188	4.37	4.78	.173	.189	4.39	4.80
C	.021	.029	0.53	0.74	.022	.030	0.56	0.76
D	.035	.043	0.89	1.09	.030	.038	0.76	0.97
E	.028	.036	0.71	0.91	.021	.029	0.53	0.74
F	.014	.022	0.36	0.56	.012	.020	0.30	0.51

NOTES:
1. Dimensions are in inches.
2. Metric equivalents are given for general information only.
3. The physical characteristics of the die are: The back metals are chromium, nickel, and silver and comprise the drain. The top metal is aluminum.
4. Die thickness is .0187 inch (0.475 mm), the tolerance is ±.0050 inch (±0.13 mm).

FIGURE 4. JANHCA and JANKCA die dimensions.

2N6849 and 2N6851

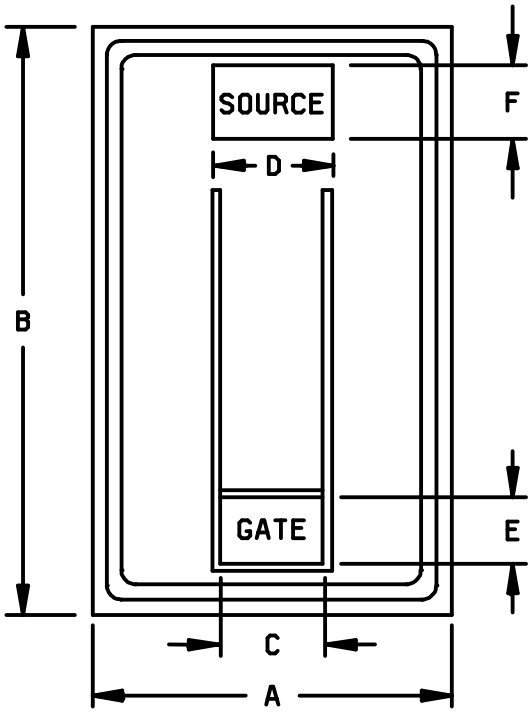


Ltr	Dimensions			
	Inches		Millimeters	
	Min	Max	Min	Max
A	.124	.128	3.15	3.25
B	.180	.182	4.57	4.62
C	.012	.016	0.31	0.41
D	.033	.037	0.84	0.94
E	.025	.029	0.64	0.74
F	.022	.026	0.56	0.66

NOTES:
1. Dimensions are in inches.
2. Metric equivalents are given for general information only.
3. The physical characteristics of the die are: The back metals are chromium, nickel, and silver and comprise the drain. The top metal is aluminum.
4. Die thickness is .014 inch (0.36 mm), the tolerance is ±.0050 inch (±0.13 mm).

FIGURE 5. JANHCB and JANKCB die dimensions.

2N6849 and 2N6851



Dimensions				
Ltr	Inches		Millimeters	
	Min	Max	Min	Max
A	.116	.120	2.94	3.05
B	.178	.182	4.52	4.62
C	.034	.036	0.86	0.91
D	.033	.037	0.84	0.94
E	.020	.024	0.50	0.61
F	.021	.025	0.53	0.64

NOTES:
1. Dimensions are in inches.
2. Metric equivalents are given for general information only.
3. The physical characteristics of the die are: The back metals are chromium, nickel, and silver and comprise the drain. The top metal is aluminum.
4. Die thickness is .018 inch (0.46 mm), the tolerance is ±.0050 inch (±0.13 mm).

FIGURE 6. JANHCC and JANKCC die dimensions.

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

Type 2/	Min $V_{(BR)DSS}$ V_{GS} = 0 V dc I_D = -1.0 mA dc	$V_{GS(th)1}$ $V_{DS} \geq V_{GS}$ I_D = -0.25 mA dc	Max I_{DSS1} V_{GS} = 0 V dc V_{DS} = 80 percent of rated V_{DS}	Max $r_{DS(on)}$ 1/ V_{GS} = -10 V dc T_J = +25° C at I_{D2}	T_J = +150° C at I_{D2}	$R_{\Theta JC}$ maximum
	V dc	V dc Min Max	µA dc	ohm	ohm	° C/W
2N6849	-100	-2.0 -4.0	-25	0.30	0.60	5.0
2N6851	-200	-2.0 -4.0	-25	0.80	1.68	5.0

1/ Pulsed (see 4.5.1).
2/ Electrical characteristics for "U" suffix devices are identical to the corresponding non"U" suffix devices unless otherwise specified.

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 Specifications, standards, and handbooks. The following specifications, standards, and handbooks form a part of this document to the extent specified herein. Unless otherwise specified, the issues of these documents are those listed in the issue of the Department of Defense Index of Specifications and Standards (DODISS) and supplement thereto, cited in the solicitation (see 6.2).

SPECIFICATION

DEPARTMENT OF DEFENSE

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

STANDARD

MILITARY

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

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

2.3 Order of precedence. In the event of a conflict between the text of this document and the references cited herein (except for related associated specifications or specification sheets), the text of this document takes precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

3. REQUIREMENTS

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

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

C	Coulomb.
g_{FS}	DC forward transconductance.
I_S	Source current through drain (forward biased V_{SD}).
$V_{(BR)DSS}$	Drain to source breakdown voltage, all other terminals short-circuited to source.
$I_{(ISO)}$	Source pin to case isolation current.

3.3 Interface requirements and physical dimensions. The Interface requirements and physical dimensions shall be as specified in MIL-PRF-19500, and figures 1 (T0-205AF), 3 (LCC), 4, 5, and 6 (die) herein.

3.3.1 Lead material and finish. Lead material shall be Kovar, Alloy 52, and a copper core is permitted (for T0-205AF). 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 6.3).

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

3.4 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.

3.5 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, whenever bias voltage is to be applied drain to source.

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

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

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

4. VERIFICATION

4.1 Classification of Inspections. The inspection requirements specified herein are classified as follows:

a. Qualification inspection (see 4.2).

b. Screening (see 4.3)

c. Conformance inspection (see 4.4).

4.2 Qualification inspection. Qualification inspection shall be in accordance with MIL-PRF-19500 and table II herein. Alternate flow is allowed for qualification inspection in accordance with figure 4 of MIL-PRF-19500.

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

4.2.2 JANHC and JANKC die. Qualification shall be in accordance with appendix H of MIL-PRF-19500.

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.

4.3.1 Screening (JANHC and JANKC). Screening of die shall be in accordance with MIL-PRF-19500. As a minimum, die shall be 100-percent probed in accordance with group A, subgroup 2.

Screen (see table IV of MIL-PRF-19500)	Measurement	
	JANS level	JANTX and JANTXV levels
1/	Gate stress test (see 4.5.5)	Gate stress test (see 4.5.5)
1/	Method 3161 (see 4.5.3)	Method 3161 (see 4.5.3)
2/	Method 3470 (optional)	Method 3470 (optional)
3	Method 1051, test condition G	Method 1051, test condition G
9 1/	I_{GSS1}, I_{DSS1}, subgroup 2 of table I herein	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 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}, $r_{DS(on)1}$, $V_{GS(th)1}$, subgroup 2 of table I herein.
12	Method 1042, test condition A,	Method 1042, test condition A
13	Subgroups 2 and 3 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.	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/ Shall be performed anytime before screen 10.
2/ Method 3470 is optional if performed as a sample in group A, subgroup 5.

4.4 Conformance inspection. Conformance inspection shall be in accordance with MIL-PRF-19500. 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 MIL-PRF-19500 and table I herein. Electrical measurements (end-points) shall be in accordance with the inspections of table I, group A, subgroup 2 herein.

4.4.2 Group B inspection. Group B inspection shall be conducted in accordance with the conditions specified for subgroup testing in table VIa (JANS) and table VIb (JAN, JANTX, and JANTXV) of MIL-PRF-19500 and herein. Electrical measurements (end-points) shall be in accordance with the inspections of table I, group A, subgroup 2 herein.

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

Subgroup	Method	Condition
3	1051	Test condition G.
4	1042	Test condition D; 2,000 cycles. The heating cycle shall be 1 minute minimum.
5	1042	Accelerated steady-state operation life; test condition A; V_{DS} = rated T_A = +175° C, t = 120 hours. Read and record $V_{(BR)DSS}$ (pre and post) at 1 mA = I_D. Read and record I_{DSS} (pre and post). Deltas for $V_{(BR)DSS}$ shall not exceed 10 percent and I_{DSS} shall not exceed 25 µA.
		Accelerated steady-state gate stress; condition B, V_{GS} = rated, T_A +175° C, t = 24 hours.
5	2037	Bond strength (Al-Au die interconnects only); test condition A.
6	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
2	1051	Test condition G, 25 cycles.
3	1042	Test condition D, 2,000 cycles. The heating cycle shall be 1 minute minimum.
3	2037	Test condition A. All internal bond wires for each device shall be pulled separately.

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 I, group A, subgroup 2 herein.

Subgroup	Method	Condition
2	2036	Test condition E (Not required for LCC).
6	1042	Test condition D, 6,000 cycles. The heating cycle shall be 1 minute minimum.

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. $R_{\Theta JC(max)}$ = 5.0° C/W.

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

b. Drain heating current (I_H) - - - - - - - - - - 1 A minimum (1.3 A minimum for LCC).

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

d. Drain-source heating voltage (V_H) - - - - - - 25 V dc minimum (15 V minimum for LCC).

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

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

4.5.3 Thermal impedance ($Z_{\Theta JC(max)}$ measurements). The $Z_{\Theta JC}$ measurements shall be performed in accordance with MIL-STD-750, method 3161. The maximum limit (not to exceed figure 6, thermal impedance curves and the group A, subgroup 2 limits) for $Z_{\Theta JC}$ in screening (table IV of MIL-PRF-19500) shall be derived by each vendor by means of statistical process control. When the process has exhibited control and capability, the capability data shall be used to establish the fixed screening limit. In addition to screening, once a fixed limit has been established, monitor all future sealing lots using a random five piece sample from each lot to be plotted on the applicable X, R chart. If a lot exhibits an out of control condition, the entire lot shall be removed from the line and held for engineering evaluation and disposition. This procedure may be used in lieu of an in line process monitor.

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

b. Drain heating current (I_H) - - - - - - - - - - - 1 A minimum (1.3 A minimum for LCC).

c. Heating time (t_H) - - - - - - - - - - - - - - - - 10 ms.

d. Drain-source heating voltage (V_H) - - - - - - 25 V dc minimum (15 V minimum for LCC).

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

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

4.5.4 Unclamped inductive switching.

a. Peak current (I_D) - - - - - - - - - - - - - - - - Rated I_{D1}.

b. Peak gate voltage (V_{GS}) - - - - - - - - - - - - -10 V dc.

c. Gate to source resistor (R_{GS}) - - - - - - - - - 25 Ω ≤ R_{GS} ≤ 200 Ω.

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.

4.5.5 Gate stress test.

V_{GS} = ±30 V dc minimum.

t = 250 µs minimum.

TABLE I. Group A inspection.

Inspection 1/, 4/	MIL-STD-750		Symbol	Limits		Unit
	Method	Conditions		Min	Max	
Subgroup 1						
Visual and mechanical inspection	2071					
Subgroup 2						
Thermal impedance 2/	3161	See 4.5.3	$Z_{\Theta JC}$		1.6	°C/W
Breakdown voltage, drain to source	3407	V_{GS} = 0 V dc; I_D = -1.0 mA dc; bias condition C	$V_{(BR)DSS}$			
2N6849				-100		V dc
2N6851				-200		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 dc; V_{GS} = +20 V dc and -20 V dc	I_{GSS1}		±100	nA dc
Drain current	3413	V_{GS} = 0; bias condition C; V_{DS} = 0 V dc; V_{DS} = 80 percent of rated V_{DS}	I_{DSS1}		-25	µA dc
Static drain to source on-state resistance	3421	V_{GS} = -10 V dc; condition A; pulsed (see 4.5.1); $I_D = I_{D2}$	$r_{DS(on)1}$			
2N6849					0.30	Ω
2N6851					0.80	Ω
Drain to source on-state resistance	3421	V_{GS} = -10 V dc; condition A; pulsed (see 4.5.1); $I_D = I_{D1}$	$r_{DS(on)2}$			
2N6849					0.32	Ω
2N6851					0.83	Ω
Forward voltage (source drain diode)	4011	Pulsed (see 4.5.1); V_{GS} = 0 V dc; $I_S = I_{D1}$ (For devices with a multiple diode structure)	V_{SD}			
2N6849					-4.3	V dc
2N6851					-5.6	V dc

See footnote at end of table.

TABLE I. Group A inspection - Continued.

Inspection 1/, 4/	MIL-STD-750		Symbol	Limits		Unit
	Method	Conditions		Min	Max	
Subgroup 3						
High temperature operation:		$T_C = T_J = +125^\circ C$				
Gate current	3411	Bias condition C; $V_{DS} = 0$ V dc; $V_{GS} = +20$ V dc and -20 V dc	I_{GSS2}		±200	nA dc
Drain current	3413	Bias condition C; $V_{GS} = 0$ V dc; V_{DS} = 80 percent rated V_{DS}	I_{DSS2}		-.25	mA dc
Gate to source voltage (threshold)	3403	$V_{DS} \geq V_{GS}$; $I_D = -.25$ mA	$V_{GS(th)2}$	-1.0		V dc
Static drain to source on-state resistance	3421	$V_{GS} = -10$ V dc; pulsed (see 4.5.1); $I_D = I_{D2}$	$r_{DS(on)3}$			
2N6849					0.54	ohms
2N6851					1.60	ohms
Low temperature operation:		$T_C = T_J = -55^\circ C$				
Gate to source voltage (threshold)	3403	$V_{DS} \geq V_{GS}$; $I_D = -.25$ mA	$V_{GS(th)3}$		-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 = 7.5 Ω				
Turn-on delay time			$t_{d(on)}$			
2N6849		$V_{DD} = -40$ V dc			60	ns
2N6851		$V_{DD} = -75$ V dc			50	ns
Rise time			t_r			
2N6849		$V_{DD} = -40$ V dc			140	ns
2N6851		$V_{DD} = -75$ V dc			100	ns

See footnote at end of table.

TABLE I. Group A inspection - Continued.

Inspection 1/, 4/	MIL-STD-750		Symbol	Limits		Unit
	Method	Conditions		Min	Max	
Subgroup 4 - Continued						
Turn-off delay time			$t_{d(off)}$			
2N6849		V_{DD} = -40 V dc			140	ns
2N6851		V_{DD} = -75 V dc			80	ns
Fall time			t_f			
2N6849		V_{DD} = -40 V dc			140	ns
2N6851		V_{DD} = -75 V dc			80	ns
Subgroup 5						
Single pulse unclamped inductive switching 3/	3470	See 4.5.4				
Electrical measurements		See table I, group A; subgroup 2.				
Safe operating area test	3474	See figure 8; V_{DS} = 80 percent of rated V_{DS}; $V_{DS} \leq$ 200 V dc maximum; t_p = 10 ms				
Electrical measurements		See table I, group A, subgroup 2.				
Subgroup 6						
Not applicable						
Subgroup 7						
Gate charge	3471	Condition B				
Test 1						
On-state gate charge			$Q_{g(on)}$			
2N6849					34.8	nC
2N6851					34.8	nC
Test 2						
Gate to source charge			Q_{gs}			
2N6849					6.8	nC
2N6851					6.1	nC

See footnote at end of table.

TABLE I. Group A inspection - Continued.

Inspection 1/, 4/	MIL-STD-750		Symbol	Limits		Unit
	Method	Conditions		Min	Max	
Subgroup 7 - Continued						
Test 3						
Gate to drain charge			Q_{gd}			
2N6849					23.1	nC
2N6851					20.5	nC
Reverse recovery time	3473	$V_{DD} \leq$ -50 V dc	t_{rr}			
2N6849		di/dt $\leq$ -100 A/µs; I_F = -6.5 A			250	ns
2N6851		di/dt $\leq$ -100 A/µs; I_F = -4.0 A			400	ns

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

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

JANS - group B, subgroups 3 and 4

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

3/ This test is optional if performed as a 100 percent screen.

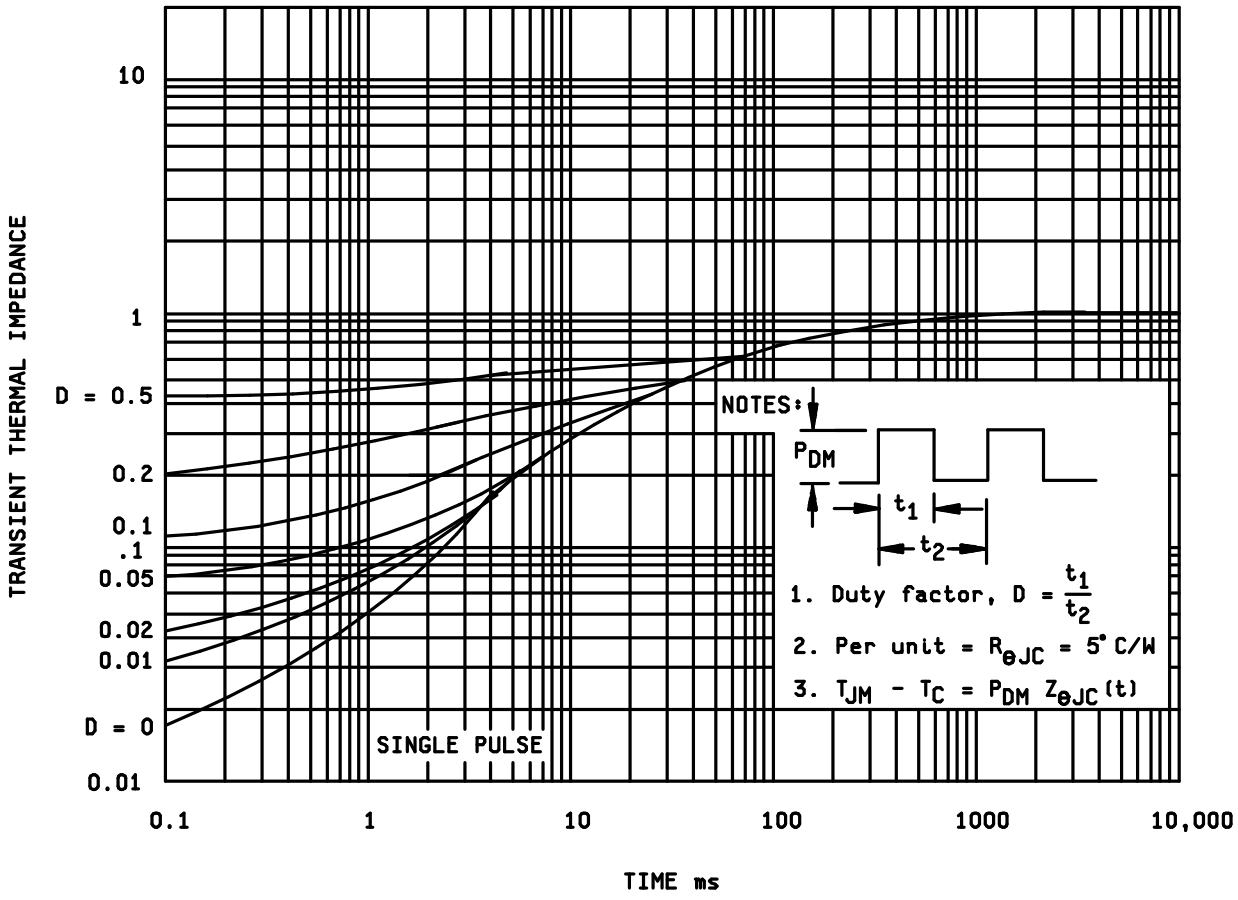
4/ Electrical characteristics for "U" suffix devices are identical to the corresponding non"U" suffix devices unless otherwise specified.

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

Inspection 1/	MIL-STD-750		Qualification conformance inspection
	Method	Conditions	
Subgroup 1			45 devices, c = 0
Thermal shock (temperature cycling)	1051	Condition G, 500 cycles	
Electrical measurements		See table I, group A, subgroup 2.	
Subgroup 2 2/			45 devices, c = 0
Steady-state reverse bias	1042	Condition A; 1,000 hours	
Electrical measurements		See table I, group A, subgroup 2.	
Steady-state gate bias	1042	Condition B; 1,000 hours	
Electrical measurements		See table I, group A, subgroup 2.	
Subgroup 3			
Not applicable			
Subgroup 4			5 devices, c = 0
Thermal resistance	3161	$R_{\Theta JC}$ = 5.0° C/W maximum, see 4.5.2	
Subgroup 5			
Not applicable			

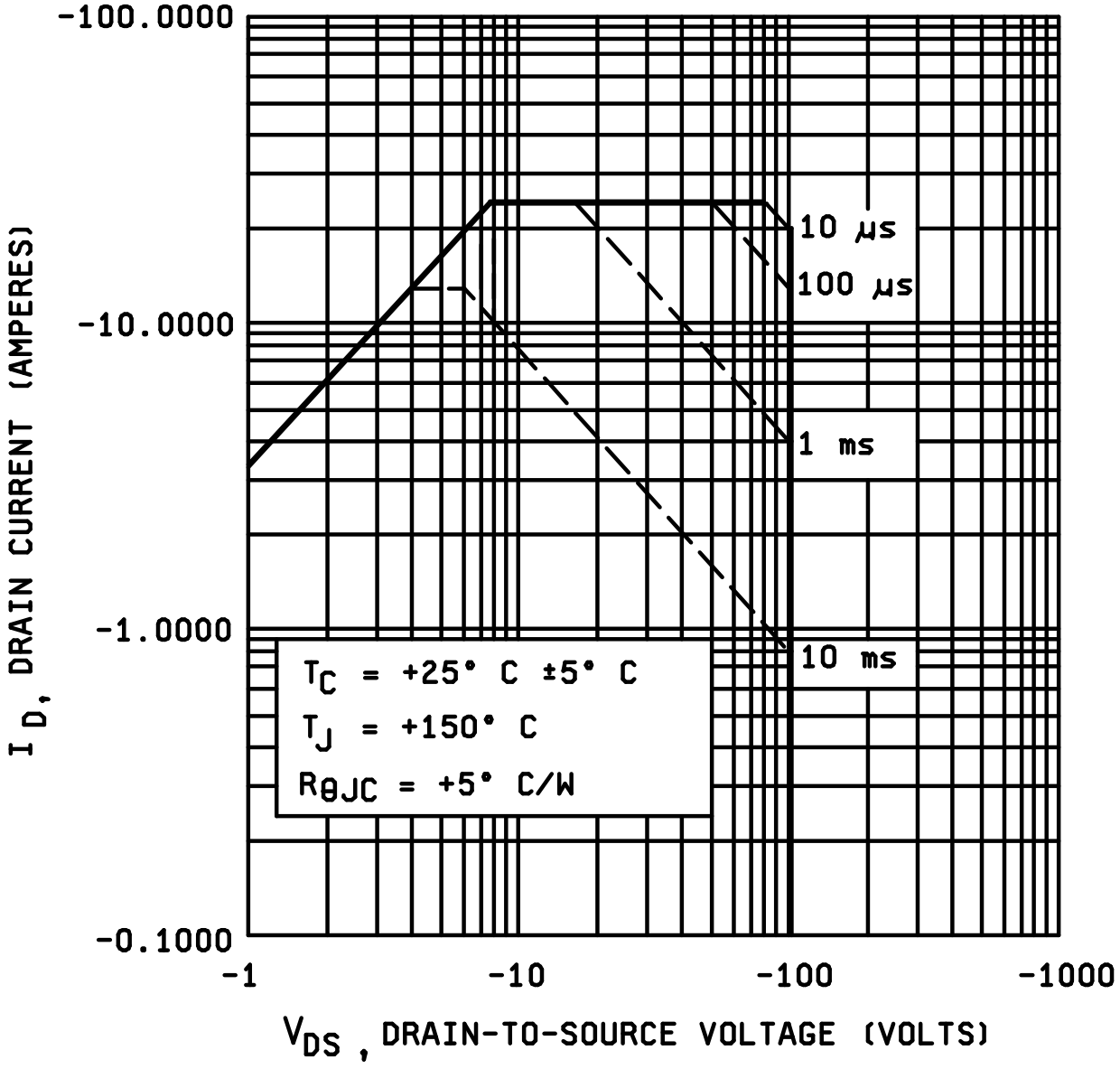
1/ JANHC and JANKC devices are qualified in accordance with MIL-PRF-19500.

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



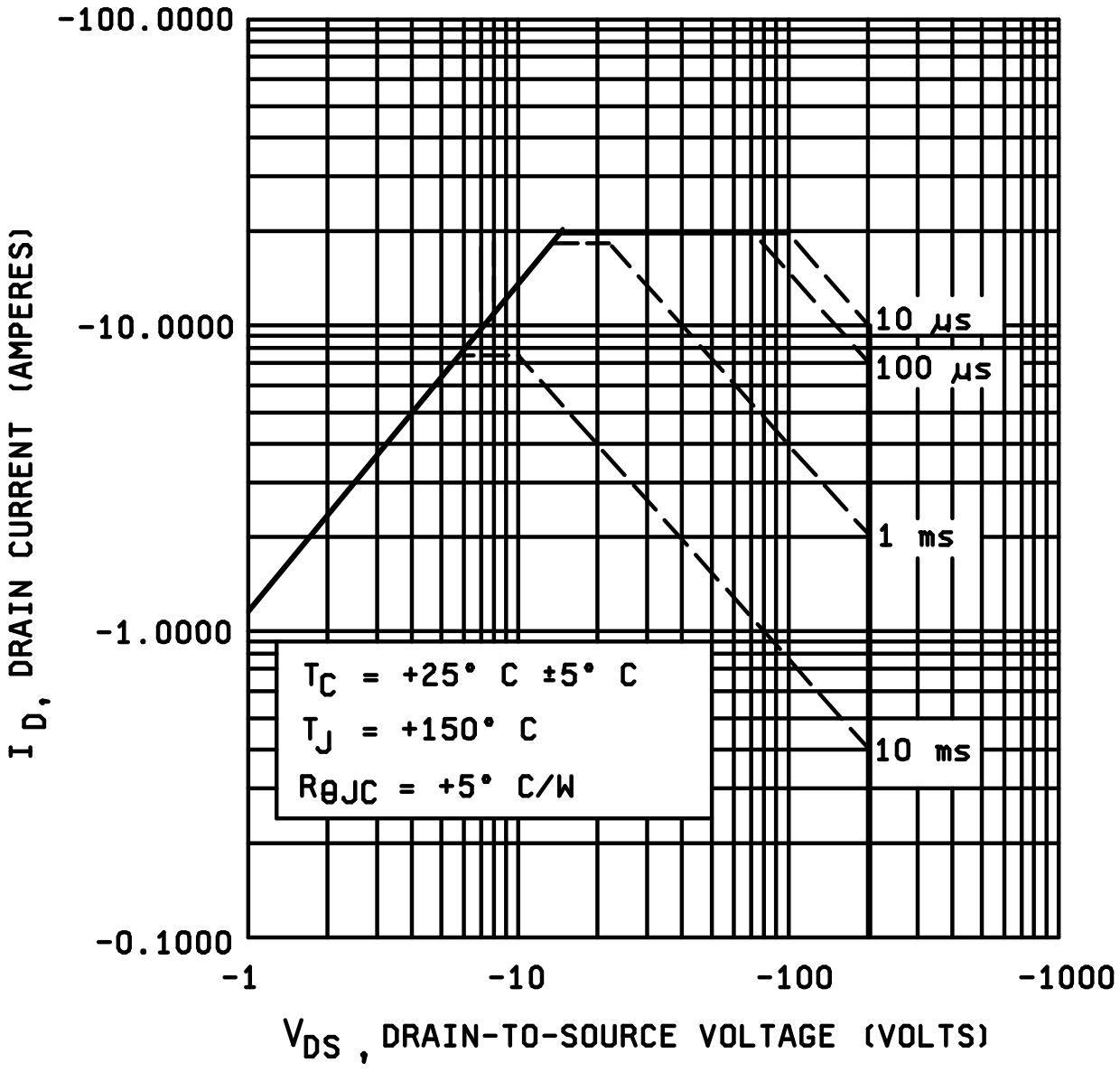
2N6849, 2N6849U, 2N6851, and 2N6851U

FIGURE 7. Normalized Transient thermal impedance.



ACTIVE REGION - 2N6849, 2N6849U

FIGURE 8. Maximum safe operating



ACTIVE REGION - 2N6851, 2N6851U

FIGURE 8. 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 material is to be performed by DoD personnel, these personnel need to contact the responsible packaging activity to ascertain requisite packaging requirements. Packaging requirements are maintained by the Inventory Control Points' packaging activity within the Military Department or Defense Agency, or within the Military Departments' System Command. Packaging data retrieval is available from the managing Military Departments' or Defense Agency's automated packaging files, CD-ROM products, or by contacting the responsible packaging activity.

5.2 Marking. Unless otherwise specified (see 6.2), marking shall be in accordance with MIL-PRF-19500.

6. NOTES

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

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

6.2 Cross-reference and complement list. Parts from this specification may be used to replace the following commercial Part or Identifying Number (PIN's). The term PIN is equivalent to the term part number which was previously used in this specification.

Preferred types	Commercial types 1/
2N6849	IRFF9130, IRFF9131, IRFF9132, IRFF9133
2N6851	IRFF9230, IRFF9231, IRFF9232, IRFF9233
2N6849U	IRFE9130, IRFE9131, IRFE9132, IRFE9133
2N6851U	IRFE9230, IRFE9231, IRFE9232, IRFE9233

1/ Complementary devices can be found on MIL-PRF-19500/557

6.3 Acquisition requirements. Acquisition documents must specify the following:

a. Issue of DODISS to be cited in the solicitation (see 2.1.1 and 2.2).

b. The lead finish as specified (see 3.3.1).

c. For die acquisition, specify the JANHC or JANKC letter version (see figures 3 through 5).

d. Type designation and quality assurance level.

6.4 Suppliers of JANHC and JANKC die. The qualified die suppliers with the applicable letter version (example, JANHCA2N6849) will be identified on the QPL.

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

CONCLUDING MATERIAL

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

Review activities:
Army - AR, MI, SM
Navy - AS, CG, MC, TD
Air Force - 19, 70, 80, 85

Preparing activity:
DLA - CC

(Project 5961-1927)

STANDARDIZATION DOCUMENT IMPROVEMENT PROPOSAL

INSTRUCTIONS

1. The preparing activity must complete blocks 1, 2, 3, and 8. In block 1, both the document number and revision letter should be given.

2. The submitter of this form must complete blocks 4, 5, 6, and 7.

3. The preparing activity must provide a reply within 30 days from receipt of the form.

NOTE: This form may not be used to request copies of documents, nor to request waivers, or clarification of requirements on current contracts. Comments submitted on this form do not constitute or imply authorization to waive any portion of the referenced document(s) or to amend contractual requirements.

I RECOMMEND A CHANGE:	**1. DOCUMENT NUMBER** MIL-PRF-19500/564E	**2. DOCUMENT DATE** 22 December 1997

3. DOCUMENT TITLE
SEMICONDUCTOR DEVICE, FIELD EFFECT TRANSISTOR, P-CHANNEL, SILICON; TYPES 2N6849, 2N6849U; 2N6851, 2N6851U 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	
c. ADDRESS (Include Zip Code)	d. TELEPHONE (Include Area Code) (1) Commercial (2) AUTOVON (If applicable)	7. DATE SUBMITTED (YYMMDD)

8. PREPARING ACTIVITY

a. NAME Alan Barone	b. TELEPHONE (Include Area Code) (1) Commercial 614-692-0510 (2) AUTOVON 850-0510
c. ADDRESS (Include Zip Code) Defense Supply Center Columbus 3990 East Broad St. Columbus, OH 43216-5000	**IF YOU DO NOT RECEIVE A REPLY WITHIN 45 DAYS, CONTACT:** Defense Quality and Standardization Office 5203 Leesburg Pike, Suite 1403, Falls Church, VA 22041-3466 Telephone (703) 756-2340 AUTOVON 289-2340