The documentation and process conversion measures necessary to comply with this revision shall be completed by 17 October 2001.

INCH-POUND

MIL-PRF-19500/601D
17 July 2001
SUPERSEDING
MIL-PRF-19500/601C
12 October 1997

PERFORMANCE SPECIFICATION

SEMICONDUCTOR DEVICE, FIELD EFFECT RADIATION HARDENED (TOTAL DOSE ONLY)
TRANSISTORS, N-CHANNEL, SILICON TYPES 2N7261 AND 2N7262 AND U SUFFIXES
JANTXVR, F, G, AND H AND JANSR, F, G, AND H

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

1. SCOPE

1.1 Scope. This specification covers the performance requirements for an N-channel, enhancement-mode, MOSFET, radiation hardened (total dose only), power transistor. Two levels of product assurance are provided for each device type as specified in MIL-PRF-19500, with avalanche energy maximum rating (E_{AS}) and maximum avalanche current (I_{AS}).

1.2 Physical dimensions. See figure 1, (TO-205AF) and figure 2 (LCC).

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

Type (1)	P_T (2) T_C = +25°C	P_T T_A = +25°C (free air)	V_{DS}	V_{DG}	V_{GS}	I_{D1}(3) T_C = +25°C	I_{D2} T_C = +100°C	I_S (3)	I_{DM} (4)	T_{op} and T_{STG}	V_{ISO} 70,000 foot altitude
	W	W	V dc	V dc	V dc	A dc	A dc	A dc	A(pk)	°C	V dc
2N7261	25	0.8	100	100	±20	8 .0	5 .0	8 .0	32	-55 to	N/A
2N7262	25	0.8	200	200	±20	5.5	3.5	5.5	22	+150	N/A

(1) Unless otherwise specified, electrical characteristics, ratings and conditions for “U” suffix devices (surface mount LCC) are identical to the corresponding non “U” suffix devices.

(2) Derate linearly 0.2 W/°C for T_C > +25°C;

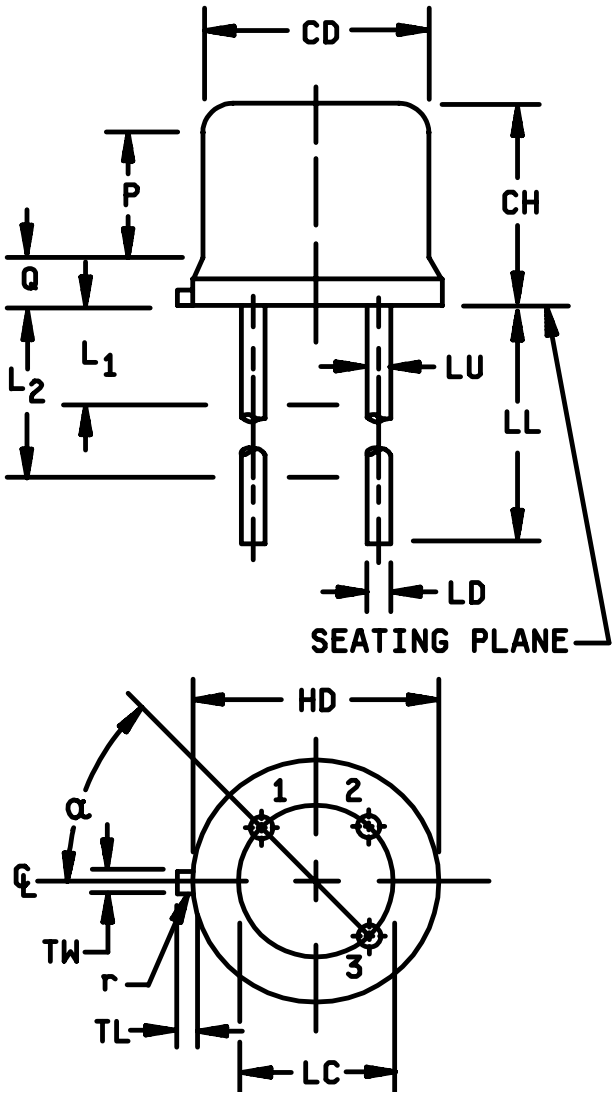
(3)

$$I_D = \sqrt{\frac{T_J \max - T_C}{(R_{\theta JC}) x (r_{DSon} \text{ at } T_J \max)}} \quad 1$$

(4) I_{DM} = 4 X I_{D1} as calculated in footnote (2).

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

Symbol (see note 3)	Dimensions			
	Inches		Millimeters	
	Min	Max	Min	Max
CD	.315	.355	8.01	9.01
CH	.160	.180	4.07	4.57
H	.009	.041	0.23	1.04
HD	.340	.370	8.64	9.39
LC	.200 BSC		5.08 BSC	
LD	.016	.021	0.41	0.53
LL	.500	.750	12.70	19.05
LU	.016	.019	0.41	0.48
L_1		.050		1.27
L_2	.250		6.35	
P	.070		1.78	
Q		.050		1.27
TL	.029	.045	0.74	1.14
TW	.028	.034	0.72	0.86
α	45° BSC			
Term 1	Source			
Term 2	Gate			
Term 3	Drain			



NOTES:
1. Dimensions are in inches.
2. Metric equivalents are given for general information only.
3. Refer to applicable symbol list.
4. The US Government preferred system of measurement is the metric SI system. However, this item was originally designed using inch-pound units of measurement. In the event of a conflict between the metric and inch-pound units, the inch-pound units shall take precedence.
5. Lead number 1 is the source, lead number 2 is the gate, lead number 4 is omitted from this outline. The drain is number 3 and is electrically connected to the case.

FIGURE 1. Physical dimensions for TO-205AF (2N7261 and 2N7262).

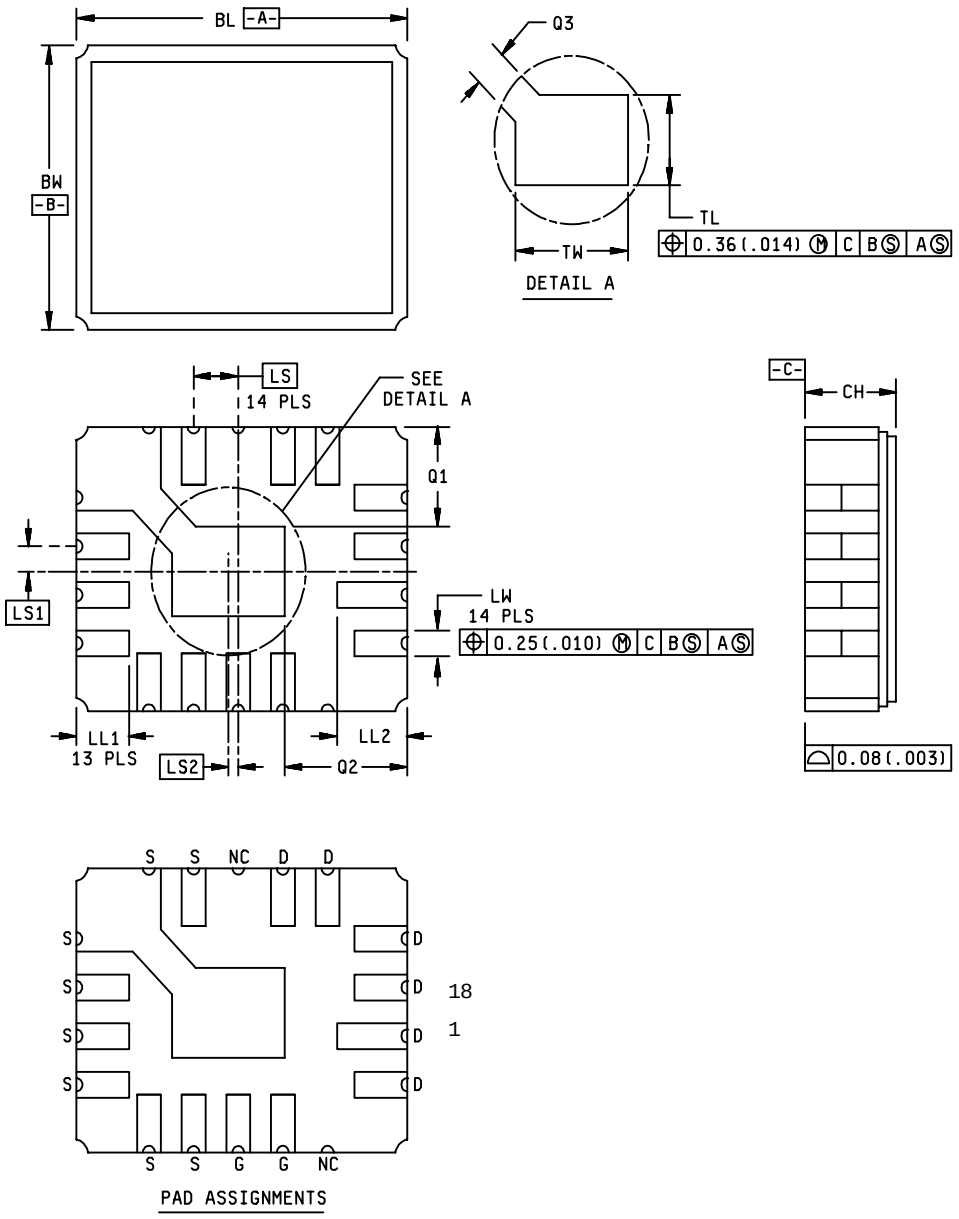


FIGURE 2. Physical dimensions for LCC (2N7261U and 2N7262U).

Symbol	Dimensions			
	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
LL_1	.040	.055	1.02	1.39
LL_2	.055	.065	1.40	1.65
LS	.059 BSC		1.27 BSC	
LS_1	.025 BSC		.635 BSC	
LS_2	.008 BSC		.203 BSC	
LW	.020	.030	0.51	0.76
Q_1	.105 REF		2.67 REF	
Q_2	.120 REF		3.05 REF	
Q_3	.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.
2. Metric equivalents are given for general information only.
3. Dimensions and tolerancing shall be in accordance with ANSI Y14.5M-1982.

FIGURE 2. Physical dimensions for LCC (2N7261U and 2N7262U) - Continued.

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

Type	Min $V_{(BR)DSS}$ V_{GS} = 0 I_D = 1.0 mA dc	$V_{GS(TH)}$ $V_{DS} \geq V_{GS}$ I_D = 1.0 mA dc		Max I_{DSS1} V_{GS} = 0 V_{DS} = 80 percent of rated V_{DS}	Max $r_{DS(ON)}$ (1) V_{GS} = 12 V dc		$R_{\theta JC}$ max	E_{AS} at I_{D1}	I_{AS}
					T_J = 25°C at I_{D2}	T_J = 150°C at I_{D2}			
	V dc	V dc		µA dc	ohm	ohm	°C/W	mJ	A
		Min	Max						
2N7261	100	2.0	4.0	25	0.180	0.390	5.0	130	8.0
2N7262	200	2.0	4.0	25	0.350	0.840	5.0	240	5.5

(1) Pulsed (see 4.5.1).

2. APPLICABLE DOCUMENTS

2.1 General. The documents listed in this section are specified in sections 3 and 4 of this specification. This section does not include documents cited in other sections of this specification or recommended for additional information or as examples. While every effort has been made to ensure the completeness of this list, document users are cautioned that they must meet all specified requirements documents cited in sections 3 and 4 of this specification, whether or not they are listed.

2.2 Government documents.

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

SPECIFICATION

DEPARTMENT OF DEFENSE

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

STANDARD

DEPARTMENT OF DEFENSE

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

(Unless otherwise indicated, copies of the above specifications, standards, and handbooks are available from the Document Automation and Production Services (DAPS), Building 4D (DPM-DODSSP), 700 Robbins Avenue, Philadelphia, PA 19111-5094.)

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

3. REQUIREMENTS

3.1 General. The requirements for acquiring the product described herein shall consist of this document and MIL-PRF-19500.

3.2 Qualification. Devices furnished under this specification shall be products that are manufactured by a manufacturer authorized by the qualifying activity for listing on the applicable qualified manufacturer's list (QML) before contract award (see 4.2 and 6.3).

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

I_{AS} - Rated avalanche current, nonrepetitive.

3.4 Interface and physical dimensions. The interface and physical dimensions shall be as specified in MIL-PRF-19500 and on figures 1 (TO-205AF) and 2 (LCC) herein.

3.4.1 Lead material and finish. Lead material shall be Kovar or Alloy 52 for the TO - 205AF; a copper core or plated core is permitted. Lead finish shall be solderable as defined in MIL-PRF-19500, MIL-STD-750, and herein. Where a choice of lead material or finish is desired, it shall be specified in the acquisition document (see 6.5).

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

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

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

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

a. Devices should be handled on benches with conductive handling devices.

b. Ground test equipment, tools, and personnel handling devices.

c. Do not handle devices by the leads.

d. Store devices in conductive foam or carriers.

e. Avoid use of plastic, rubber, or silk in MOS areas.

f. Maintain relative humidity above 50 percent if practical.

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

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

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

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

3.9 Workmanship. Semiconductor devices shall be processed in such a manner as to be uniform in quality and shall be free from other defects that will affect life, serviceability, or appearance.

4. VERIFICATION

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

a. Qualification inspection (see 4.2).

b. Screening (see 4.3)

c. Conformance inspection (see 4.4 and tables I, II and III herein).

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

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

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

Screen (see table IV of MIL-PRF-19500)	Measurement	
	JANS level	JANTXV level
(1)	Method 3470 (see 4.5.4)	Method 3470 (see 4.5.4)
(1)	Method 3161 (see 4.5.3)	Method 3161 (see 4.5.3)
(1)	Gate stress test (see 4.5.5)	Gate stress test (see 4.5.5)
9 (1)	Subgroup 2 of table I herein; I_{GSS}, I_{DSS1}	Not applicable
10	Method 1042, test condition B of MIL-STD-750	Method 1042, test condition B of MIL-STD-750
11	I_{GSSF1}, I_{GSSR1}, I_{DSS1}, $r_{DS(on)}$, $V_{GS(TH)}$ Subgroup 2 of table I herein; ΔI_{GSSF1} = ± 20 nA dc or ±100 percent of initial value, whichever is greater. ΔI_{GSSR1} = ± 20 nA dc or ± 100 percent of initial value, whichever is greater. ΔI_{DSS1} = ± 10 μA dc or ± 100 percent of initial value, whichever is greater.	I_{GSSF1}, I_{GSSR1}, I_{DSS1}, $r_{DS(on)}$, $V_{GS(TH)}$ Subgroup 2 of table I herein
12	Method 1042, test condition A of MIL-STD-750	Method 1042, test condition A of MIL-STD-750
13	Subgroups 2 and 3 of table I herein ΔI_{GSSF1} = ± 20 nA dc or ±100 percent of initial value, whichever is greater. ΔI_{GSSR1} = ± 20 nA dc or ± 100 percent of initial value, whichever is greater. ΔI_{DSS1} = ± 10 μA dc or ± 100 percent of initial value, whichever is greater. $\Delta r_{DS(on)1}$ = ± 20 percent of initial value $\Delta V_{GS(TH)1}$ = ± 20 percent of initial value	Subgroups 2 and 3 of table I herein ΔI_{GSSF1} = ± 20 nA dc or ±100 percent of initial value, whichever is greater. ΔI_{GSSR1} = ± 20 nA dc or ± 100 percent of initial value, whichever is greater. ΔI_{DSS1} = ± 10 μA dc or ± 100 percent of initial value, whichever is greater. $\Delta r_{DS(on)1}$ = ± 20 percent of initial value $\Delta V_{GS(TH)1}$ = ± 20 percent of initial value

(1) Shall be performed anytime before screen 10.

4.4 Conformance inspection. Conformance inspection shall be in accordance with MIL-PRF-19500 and as specified herein. Alternate flow is allowed for quality conformance inspection in accordance with of MIL-PRF-19500.

4.4.1 Group A inspection. Group A inspection shall be conducted in accordance with table V of MIL-PRF-19500. End-point electrical measurements shall be in accordance with table I, group A, subgroup 2 herein.

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

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

Subgroup	Method	Condition
B3	1051	Test condition G, 100 cycles.
B3	2075	See 3.4.2 herein.
B3	2077	Scanning electron microscope (SEM) qualification may be performed anytime prior to lot formation.
B3	2037	Test condition A, all internal wired for each device shall be pulled separately.
B4	1042	Condition D, 2,000 cycles. No heat sink nor forced-air cooling on the device shall be permitted during the on cycle. The heating cycle shall be 30 seconds minimum.
B5	1042	Test condition A, V_{DS} = rated T_A = +175°C, t = 120 hours.
B5	1042	Condition B, V_{GS} = rated; T_A = 175°C; t = 24 hours.
B5	2037	Bond strength (Al-Au die interconnects only); test condition A.
B6	3161	See 4.5.2 herein.

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

Subgroup	Method	Condition
B2	1051	Test condition G, 25 cycles.
B3	1042	Test condition D, 2,000 cycles; The heating cycle shall be 30 seconds minimum.
B4	2075	See 3.4.2 herein.
B4	2037	Test condition A. All internal bond wires for each device shall be pulled separately.
B5 and B6		Not applicable.

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

Subgroup	Method	Condition
C2	1056	Test condition B.
C2	2036	Test condition E; weight = 8 ounces, 3 arcs of 90° (applicable to TO - 205AF only).
C2	1021	Omit initial conditioning.
C5	1001	Test condition C. For device type 2N7270: V_{DS} = 500 V; $I_{(ISO)}$ < 0.25 mA.
C6	1042	Test condition D, 6,000 cycles. The heating cycle shall be 30 seconds minimum.

4.4.4 Group D Inspection. Group D inspection shall be conducted in accordance with table VIII of MIL-PRF-19500 and table II herein.

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

4.5.1 Pulse measurements. Conditions for pulse measurement shall be as specified in 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. The maximum limit of $R_{\theta JC(max)}$ = 5.0°C/W. The following parameter measurements shall apply:

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

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

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

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

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

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

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

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 (15 V for LCC).

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

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

4.5.4 Single pulse avalanche energy (E_{AS}).

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

b. Peak gate voltage (V_{GS}) ..... 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) ..... $\left[\frac{2E_{AS}}{(I_{D1})^2}\right]\frac{[(V_{BR} - V_{DD})]}{V_{BR}}$ *mH minimum* 2.

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

g. Supply voltage (V_{DD}) ..... 25 V for 2N7261, 50 V for 2N7262.

4.5.5 Gate stress test.

a. V_{GS} = 30 V minimum.

b. t = 250 µs minimum.

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						
Thermal impedance 2/	3161	See 4.5.3	$Z_{\theta JC}$		1.40	°C/W
Breakdown voltage, drain to source	3407	V_{GS} = 0 V dc, I_D = 1 mA dc, bias condition C	$V_{(BR)DSS}$			
2N7261				100		V dc
2N7262				200		V dc
Gate to source voltage (threshold)	3403	$V_{DS} \geq V_{GS}$ I_D = 1 mA dc	$V_{GS(TH)1}$	2.0	4.0	V dc
Gate current	3411	V_{GS} = +20 V dc and -20 V dc, bias condition C, V_{DS} = 0	$I_{GSS(TH)1}$		± 100	nA dc
Drain current	3413	V_{GS} = 0 V dc, bias condition C, V_{DS} = 80 percent of rated V_{DS}	I_{DSS1}		25	µA dc
Static drain to source on-state resistance	3421	V_{GS} = 12 V dc, condition A, pulsed (see 4.5.1), $I_D = I_{D2}$	$r_{DS(on)1}$			
2N7261					0.180	ohm
2N7262					0.350	ohm
Static drain to source on-state resistance	3421	V_{GS} = 12 V dc, condition A, pulsed (see 4.5.1), $I_D = I_{D1}$	$r_{DS(on)2}$			
2N7261					0.185	ohm
2N7262					0.364	ohm
Forward voltage	4011	Pulsed (see 4.5.1), $I_D = I_{D1}$, V_{GS} = 0 V dc	V_{SD}			
2N7261					1.5	V
2N7262					1.4	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 3						
High-temperature operation:		$T_C = T_J = +125°C$				
Gate current	3411	V_{GS} = +20 V dc and -20 V dc, bias condition C, V_{DS} = 0	I_{GSS2}		± 200	nA dc
Drain current	3413	V_{GS} = 0 V dc, bias condition C, V_{DS} = 100 percent of rated V_{DS}	I_{DSS2}		1.0	mA dc
		V_{DS} = 80 percent of rated V_{DS}	I_{DSS3}		0.25	mA dc
Static drain to source on-state resistance	3421	V_{GS} = 12 V dc, pulsed (see 4.5.1), $I_D = I_{D2}$	$r_{DS(on)3}$			
2N7261					0.350	ohm
2N7262					0.6	ohm
Gate to source voltage (thresholds)	3403	$V_{DS} \geq V_{GS}$, I_D = 1 mA dc	$V_{GS(TH)2}$	1.0		V dc
Low-temperature operation:		$T_C = T_J = -55°C$				
Gate to source voltage (threshold)	3403	$V_{DS} \geq V_{GS}$, I_D = 1 mA dc	$V_{GS(TH)3}$		5.0	V dc
Subgroup 4						
Forward transconductance	3475	I_D = rated I_{D2}, V_{DD} = 15 V (see 4.5.1)	g_{FS}			
2N7261				2.5		S
2N7262				2.5		S
Switching time test	3472	$I_D = I_{D1}$, V_{GS}= 12 V dc, R_G = 2.35Ω, V_{DD} = 50 percent of rated V_{DS}				
Turn-on delay time			$t_{d(on)}$			
2N7261					25	ns
2N7262					25	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			t_r			
2N7261					32	ns
2N7262					40	ns
Turn-off delay time			$t_{d(off)}$			
2N7261					40	ns
2N7262					60	ns
Fall time			t_f			
2N7261					40	ns
2N7262					45	ns
Subgroup 5						
Safe operating area test (high voltage)	3474	See figure 4 and 5; t_p = 10 ms minimum, V_{DS} = 80 percent of maximum rated V_{DS}, ($V_{DS} \leq$ 200)				
Electrical measurements		See table I, subgroup 2 herein.				
Subgroup 6						
Not applicable						
Subgroup 7						
Gate charge	3471	Condition B				
On-state gate charge			$Q_{G(on)}$			
2N7261					50	nC
2N7262					50	nC
Gate to source charge			Q_{GS}			
2N7261					10	nC
2N7262					10	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						
Gate to drain charge			Q_{GD}			
2N7261					20	nC
2N7262					25	nC
Reverse recovery time	3473	$d_i/ d_t \leq 100$ A/μs, $V_{DD} \leq 30$ V, $I_D = I_{D1}$	t_{rr}			
2N7261					270	ns
2N7262					400	ns

1/ For sampling plan, see MIL-PRF-19500.
2/ This test is required for the following end-point measurements only (not intended for screen 13).
JANS - group B, subgroups 3 and 4. JANTX and JANTXV - group B, subgroups 2 and 3; group C, subgroup 6; group E, subgroup 1.

TABLE II. Group D inspection.

Inspection 1/ 2/ 3/	MIL-STD-750		Symbol	Pre-irradiation limits				Post-irradiation limits				Unit
	Method	Conditions		R		4/ F, G, and H		R		4/ F, G, and H		
				Min	Max	Min	Max	Min	Max	Min	Max	
Subgroup 1												
Not applicable												
Subgroup 2		T_C = +25°C										
Steady-state total dose irradiation (V_{GS} bias) 5/	1019	V_{GS} = 12 V, V_{DS} = 0										
Steady-state total dose irradiation (V_{DS} bias) 5/	1019	V_{GS} = 0, V_{DS} = 80 percent of rated V_{DS} (preirradiation)										
End-point electrical												
Breakdown voltage, drain to source	3407	V_{GS} = 0, I_D = 1 mA, bias condition C	V_{BRDSS}									
2N7261				100		100		100		100		V dc
2N7262				200		200		200		200		V dc
Gate to source Voltage (threshold)	3403	$V_{DS} \geq V_{GS}$, I_D = 1 mA	V_{GSth}									
2N7261				2	4	2	4	2	4	1.25	4.50	V dc
2N7262				2	4	2	4	2	4	1.25	4.50	V dc
Gate current	3411	V_{GS} = 20 V, V_{DS} = 0, bias condition C	I_{GSSF1}		100		100		100		100	nA dc
Gate current	3411	V_{GS} = -20 V, V_{DS} = 0, bias condition C	I_{GSSR1}		-100		-100		-100		-100	nA dc

See footnotes at end of table.

TABLE II. Group D inspection - Continued.

Inspection 1/ 2/ 3/	MIL-STD-750		Symbol	Pre-irradiation limits				Post-irradiation limits				Unit
	Method	Conditions		R		4/ F, G, and H		R		4/ F, G, and H		
				Min	Max	Min	Max	Min	Max	Min	Max	
Subgroup 2 - Continued												
Drain current	3413	V_{GS} = 0 Bias condition C V_{DS} = 80 percent of rated V_{DS} (preirradiation)	I_{DSS}									
2N7261					25		25		25		50	µA dc
2N7262					25		25		25		50	µA dc
Static drain to source on-state Voltage	3405	V_{GS} = 12 V Condition A pulsed (see 4.51) $I_D = I_{D2}$	V_{DSon1}									
2N7261					0.9		0.9		0.9		1.2	V dc
2N7262					1.225		1.225		1.225		1.68	V dc
Forward voltage Source drain diode	4011	V_{GS} = 0 V $I_D = I_{D1}$	V_{SD}									
2N7261					1.5		1.5		1.5		1.5	V dc
2N7262					1.4		1.4		1.4		1.4	V dc

1/ For sampling plan, see MIL-PRF-19500.
2/ Group D qualification may be performed anytime prior to lot formation. Wafers qualified to these group D QCI requirements may be used for any other detail specification utilizing the same die design.
3/ At the manufacturers option, group D samples need not be subjected to the screening tests, and may be assembled in it's qualified package or in any qualified package that the manufacturer has data to correlate the performance to the designated package.
4/ The F designation represent devices which pass end-points at both 100K and 300K rad (Si). The G designation represents devices which pass 100K, 300K, and 600K rad (Si) end-points. The H designation represents devices which pass 100k, 300k, 600k and 1000k rad (Si).
5/ Separate samples shall be pulled for each bias.

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

Inspection	MIL-STD-750		Qualification and large lot quality conformance inspection
	Method	Conditions	
Subgroup 1			12 devices c = 0
Thermal shock (temperature cycling)	1051	Test condition G, 500 cycles	
Hermetic seal	1071		
Fine leak Gross leak			
Electrical measurements		See table I, group A, subgroup 2	
Subgroup 2 1/			12 devices c = 0
Steady-state reverse bias	1042	Condition B, 1,000 hours	
Electrical measurements		See table I, group A, subgroup 2	
Steady-state gate bias	1042	Condition A, 1,000 hours	
Electrical measurements		See table I, group A, subgroup 2	
Subgroup 3			
Not applicable			
Subgroup 4			
Thermal resistance	3161	$R_{\theta JC}$ = 5.0 °C/W maximum. See 4.5.2	12 devices c = 0

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

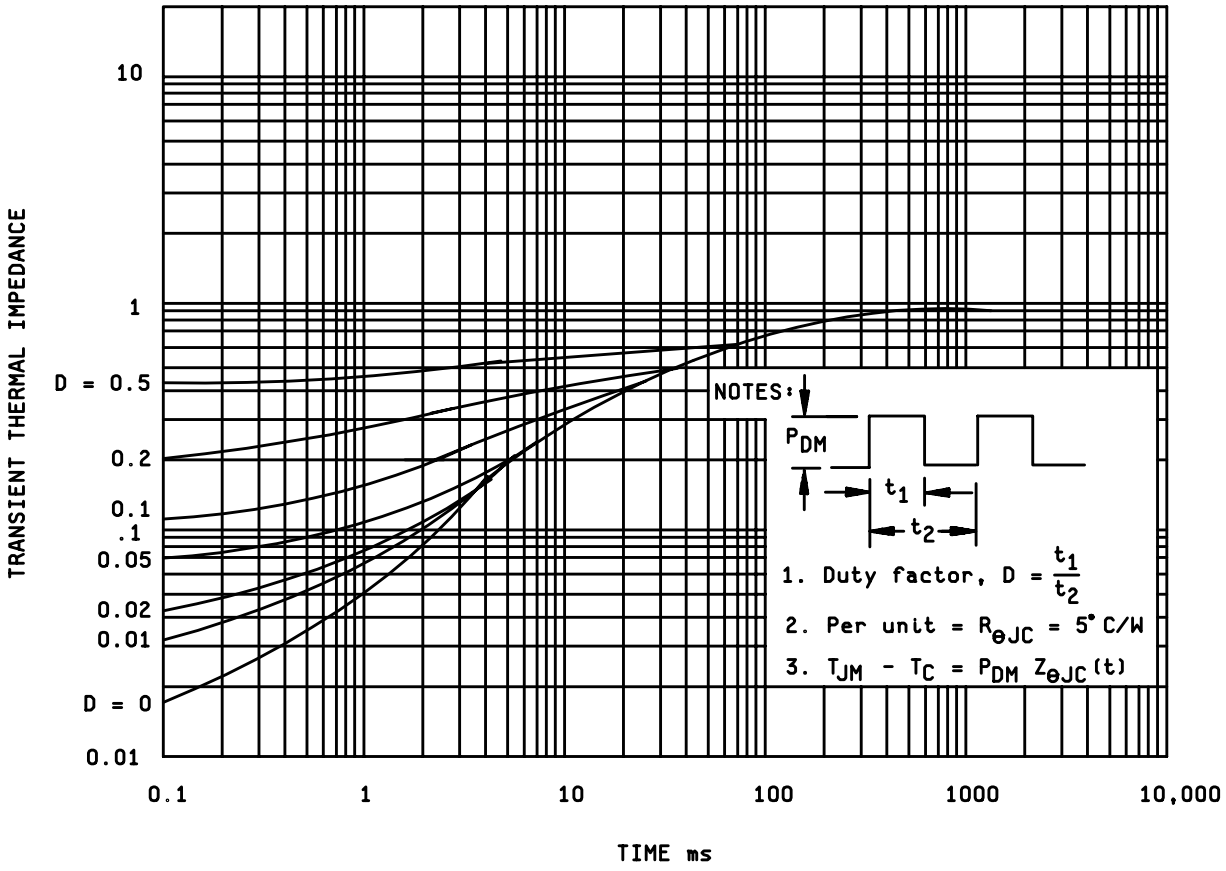


FIGURE 3. Thermal impedance curves.

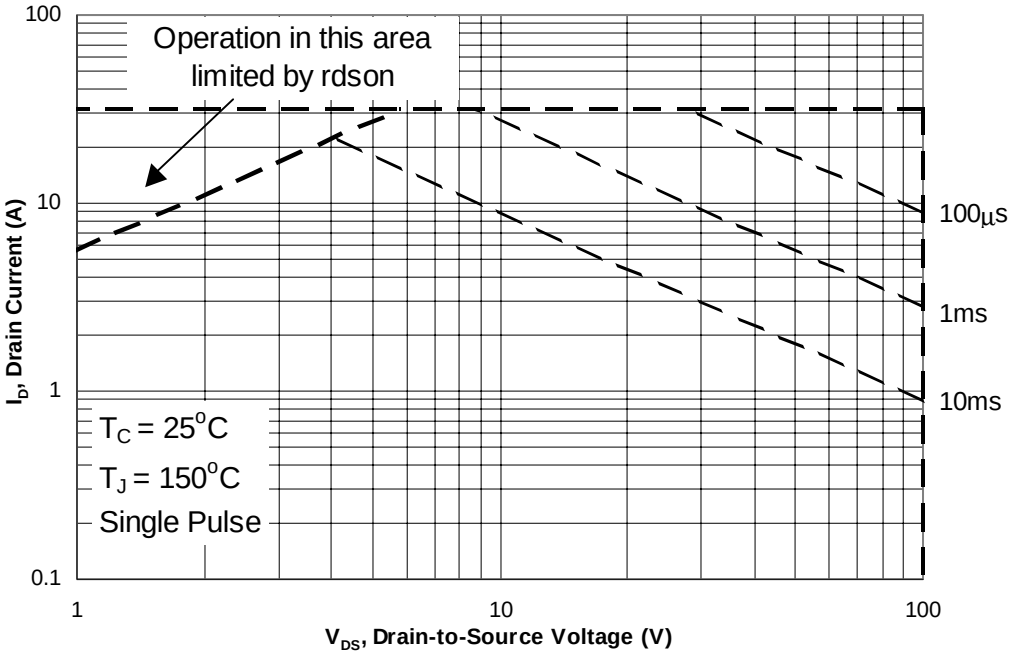


FIGURE 4. Safe operating area graph.

2N7262

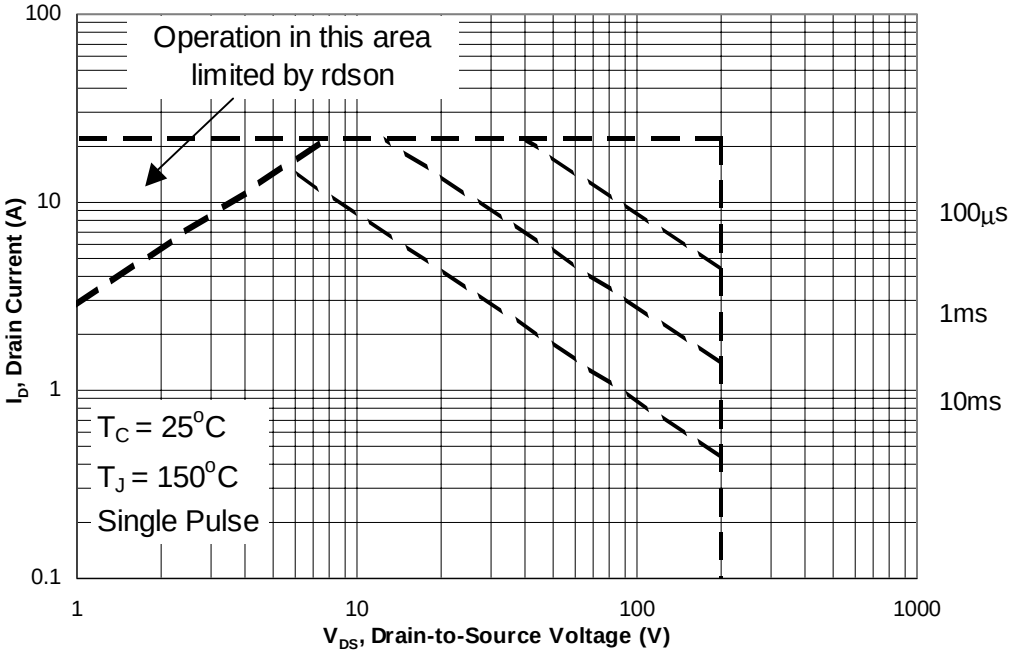


FIGURE 5. Safe operating area graph.

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 personnel, these personnel need to contact the responsible packaging activity to ascertain requisite packaging requirements. Packaging requirements are maintained by the Inventory Control Point's packaging activity within the Military Department or Defense Agency, or within the Military Department's System Command. 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 must specify the following:

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

b. Issue of DoDISS to be cited in the solicitation and if required, the specific issue of individual documents referenced (see 2.2.1).

c. The lead finish as specified (see 3.4.1).

d. Type designation and quality assurance level.

e. Packaging requirements (see 5.1).

f. For die acquisition, the JANHC or JANKC letter version shall be specified (see figure 2).

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 Manufacturer’s List whether or not such products have actually been so listed by that date. The attention of the contractors is called to these requirements, and manufacturers are urged to arrange to have the products that they propose to offer to the Federal Government tested for qualification in order that they may be eligible to be awarded contracts or orders for the products covered by this specification. Information pertaining to qualification of products may be obtained from Defense Supply Center, Columbus, ATTN: DSCC-VQE, P.O. Box 3990, Columbus, OH 43216-5000.

6.4 Substitution information. Devices covered by this specification are substitutable for the manufacturer's and user's Part or Identifying Number (PIN). This information in no way implies that manufacturer's PIN's are suitable for the military PIN.

Preferred types	Commercial types	
	TO-205AF	LCC
2N7261, U	IRHFX130 (1)	IRHEX130 (1)
2N7262, U	IRHFX230 (1)	IRHEX230 (1)

(1) Replace “X” with number indicating qualified Radiation Hardness follows:

7 = 100K Rad Si
3 = 300K Rad Si
4 = 600K Rad Si
8 = 1000K Rad Si

6.5 Ordering data. Acquisition documents may specify the material and finish (see 3.4.1).

6.6 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.

Custodians:
Army - CR
Navy - NW
Air Force - 11
NASA – NA
DLA - CC

Review activities:
Air Force - 19, 70

Preparing activity:
DLA - CC

(Project 5961-2258)

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-19500/601D	2. DOCUMENT DATE 010717

3. **DOCUMENT TITLE**
SEMICONDUCTOR DEVICE, FIELD EFFECT RADIATION HARDENED (TOTAL DOSE ONLY) TRANSISTORS, N-CHANNEL, SILICON TYPES 2N7261 AND 2N7262 AND U SUFFIXES JANTXVR, F, G, AND H AND JANSR, F, G, AND H

4. NATURE OF CHANGE (Identify paragraph number and include proposed rewrite, if possible. Attach extra sheets as needed.)

5. REASON FOR RECOMMENDATION

6. SUBMITTER

a. NAME (Last, First, Middle initial)	b. ORGANIZATION	
c. ADDRESS (Include Zip Code)	d. TELEPHONE (Include Area Code) COMMERCIAL DSN FAX EMAIL	7. DATE SUBMITTED

8. PREPARING ACTIVITY

a. Point of Contact Alan Barone	b. TELEPHONE Commercial 614-692-0510	DSN 850-0510	FAX 614-692-6939	EMAIL alan.barone@dscc.dla.mil
c. ADDRESS Defense Supply Center Columbus ATTN: DSCC-VAC P.O. Box 3990 Columbus, OH 43216-5000	IF YOU DO NOT RECEIVE A REPLY WITHIN 45 DAYS, CONTACT: Defense Standardization Program Office (DLSC-LM) 8725 John J. Kingman, Suite 2533 Fort Belvoir, VA 22060-6221 Telephone (703) 767-6888 DSN 427-6888			