The documentation and process conversion measures necessary to comply with this revision shall be completed by 4 December 2003.

INCH-POUND

MIL-PRF-19500/676B
4 September 2003
SUPERSEDING
MIL-PRF-19500/676A
20 February 2001

PERFORMANCE SPECIFICATION

SEMICONDUCTOR DEVICE, FIELD EFFECT RADIATION HARDENED
(TOTAL DOSE AND SINGLE EVENT EFFECTS)
TRANSISTORS, N-CHANNEL, SILICON TYPES 2N7465T3 AND 2N7466T3 AND U3 SUFFIXES
JANTXVR AND JANSR

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 and single event effects (SEE)), 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-257AA and figure 2 (U3, T0-276AA).

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

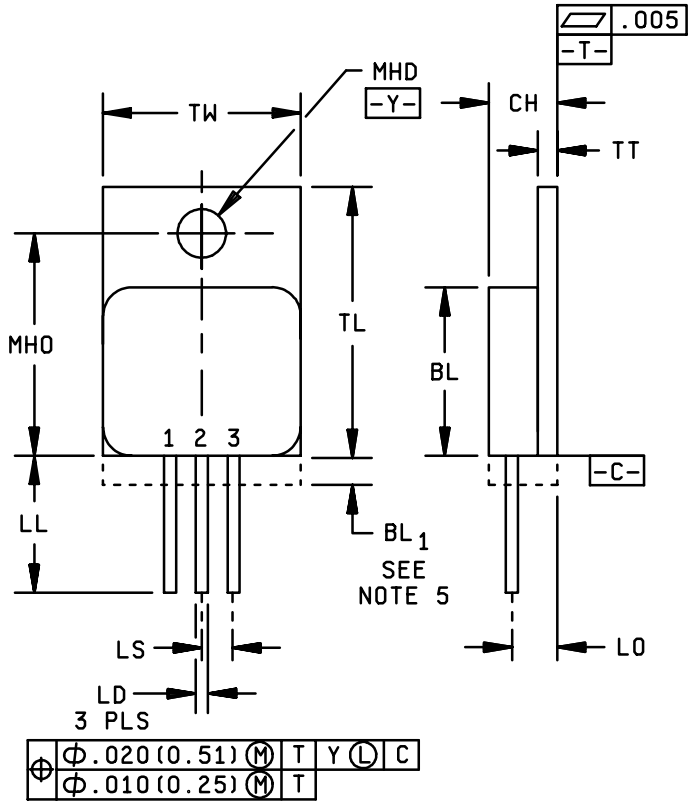
Type	P_T (1) T_C = +25°C	P_T T_A = +25°C (free air)	V_{DS}	V_{DG}	V_{GS}	I_{D1} (2) (3) T_C = +25°C	I_{D2} T_C = +100°C	I_S (2)	I_{DM} (4)	T_{op} and T_{STG}	V_{ISO} 70,000 foot altitude
	W	W	V dc	V dc	V dc	A dc	A dc	A dc	A(pk)	°C	V dc
2N7465T3, U3	75	2	400	400	±20	5.0	3.2	5.3	21.2	-55 to	400
2N7466T3, U3	75	2	500	500	±20	4.4	2.8	4.5	18	+150	500

(1) Derate linearly 0.6 W/°C for T_C > +25°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).

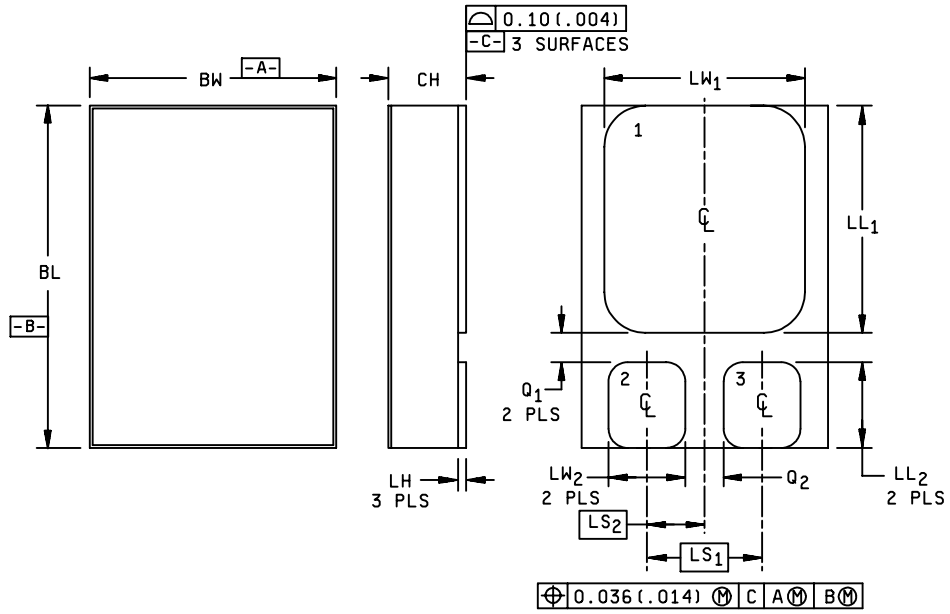
Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: Defense Supply Center, Columbus, ATTN: DSCC-VAC, P.O. Box 3990, Columbus, OH 43216-5000, by using the Standardization Document Improvement Proposal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



Ltr	Inches		Millimeters	
	Min	Max	Min	Max
BL	.410	.420	10.41	10.67
BL_1		.033		0.84
CH	.190	.200	4.83	5.08
LD	.025	.035	0.64	0.89
LL	.600	.650	15.24	16.51
LO	.120 BSC		3.05 BSC	
LS	.100 BSC		2.54 BSC	
MHD	.140	.150	3.56	3.81
MHO	.527	.537	13.39	13.64
TL	.645	.665	16.38	16.89
TT	.035	.045	0.89	1.14
TW	.410	.420	10.41	10.67
Term 1	Drain			
Term 2	Source			
Term 3	Gate			

NOTES:
1. Dimensions are in inches.
2. Millimeters are given for general information only.
3. 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.
4. All terminals are isolated from the case.
5. This area is for the lead feed-thru eyelets (configuration is optional, but will not extend beyond this zone).
6. Dimensions and tolerancing shall be in accordance with ASME Y14.5M.

* FIGURE 1. Physical dimensions for TO-257AA (2N7465T3 and 2N7466T3).



Symbol	Dimensions			
	Inches		Millimeters	
	Min	Max	Min	Max
BL	.395	.405	10.04	10.28
BW	.291	.301	7.40	7.64
CH		.124		3.15
LH	.010	.020	0.25	0.51
LW1	.281	.291	7.14	7.41
LW2	.090	.100	2.29	2.54
LL1	.220	.230	5.59	5.84
LL2	.115	.125	2.93	3.17
LS1	.150 BSC		3.81 BSC	
LS2	.075 BSC		1.91 BSC	
Q1	.030		0.762	
Q2	.030		0.762	
TERM 1	Drain			
TERM 2	Gate			
TERM 3	Source			

NOTES:
1. Dimensions are in inches.
2. Millimeters are given for general information only.
3. Dimensions and tolerancing shall be in accordance with ASME Y14.5M.
4. Terminal 1 – Drain, Terminal 2 – Gate, Terminal 3 – Source

* FIGURE 2. Physical dimensions for T0-276AA (2N7465U3 and 2N7466U3).

* 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						
2N7465T3, U3	400	2.5	4.5	50	1.39	3.0	1.67	150	5.3
2N7466T3, U3	500	2.5	4.5	50	1.77	3.9	1.67	150	4.5

(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 individual item requirements shall be as specified in MIL-PRF-19500 and as modified herein.

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

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

C.....Coulomb.
I_{AS}.....Rated avalanche current, non-repetitive.

* 3.4 Interface and physical dimensions. The interface and physical dimensions shall be as specified in MIL-PRF-19500 and on figures 1 (TO-257AA) and 2 (U3, surface mount, T0-276AA) herein.

3.4.1 Lead finish. 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 Lead material. Lead material shall be Kovar or Alloy 52 for the TO - 257AA; a copper core or plated core is permitted.

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

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

3.5.1 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.

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

3.7 Electrical test requirements. The electrical test requirements shall be the subgroups specified in table I herein.

* 3.8 Marking. Marking shall be in accordance with MIL-PRF-19500. For "U3" suffix devices, at the option of the manufacturer, marking may be omitted from the body, but shall be retained on the initial container.

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).

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 associated specification 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.

4.2.1.1 SEE. Design capability shall be tested on the initial qualification and thereafter whenever a major die design or process change is introduced. See the design safe operation area figures herein. End-point measurements shall be in accordance with table III.

* 4.3 Screening (JANS 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	JANTXV level
(3)	Gate stress test (see 4.3.1)	Gate stress test (see 4.3.1)
(3)	Method 3470 of MIL-STD-750, E_{AS} (see 4.3.2)	Method 3470 of MIL-STD-750, E_{AS} (see 4.3.2)
(3) 3c	Method 3161 of MIL-STD-750, thermal impedance (see 4.3.3)	Method 3161 of MIL-STD-750, thermal impedance (see 4.3.3)
9	Subgroup 2 of table I herein; I_{GSSF1}, I_{GSSR1}, I_{DSS1}	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} = ± 10 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	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} = ± 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) 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 Single pulse avalanche energy (E_{AS}).

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

b. Peak gate voltage (V_{GS})- ..... 12 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*

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

g. Supply voltage (V_{DD}) ..... 50 V.

* 4.3.3 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 4, thermal impedance curves and the table I, 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 bar 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) ..... 2 A minimum.

c. Heating time (t_H) ..... 50 ms, 25 ms for U3 suffix devices.

d. Drain-source heating voltage (V_H)- ..... 15 V, 20 V for U3 suffix devices.

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

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

4.4 Conformance inspection. Conformance inspection shall be in accordance with MIL-PRF-19500, and as specified herein. Alternate flow is allowed for conformance inspection in accordance with 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, 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 (JANTXV) of MIL-PRF-19500, and herein. Electrical measurements (end-points) shall be in accordance with table I, subgroup 2 herein.

4.4.2.1 Group B inspection, 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	2037	Test condition A, all internal wires for each device shall be pulled separately.
B3	2077	Scanning electron microscope (SEM) qualification may be performed anytime prior to lot formation.
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 60 seconds minimum.
B5	1042	Test condition B, V_{GS} = rated T_A = +175°C, t = 24 hours.
B5	1042	Condition A, V_{DS} = rated; T_A = +175°C; t = 120 hours.
B5	2037	Not applicable.
B6	3161	Not applicable.

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

Subgroup	Method	Condition
B2	1051	Test condition G, 25 cycles. (45 total, including 20 cycles performed in screening)
B3	1042	Test 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 60 seconds minimum.
B3	2037	Test condition A. All internal bond wires for each device shall be pulled separately.
B4	2075	See 3.4.2 herein.
B4	2077	Not applicable.
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 table VII of MIL-PRF-19500 and as follows. Electrical measurements (end-points) shall be in accordance with table I, subgroup 2 herein.

Subgroup	Method	Condition
C2	1056	Test condition B.
C2	2036	Test condition A, weight = 10 lbs., t = 10 s (applicable to T0 - 257AA only).
C2	1021	Omit initial conditioning.
C5	3161	See 4.5.2 herein.
C6	1042	Test condition D, 6,000 cycles. No heat sink nor forced-air cooling on the device shall be permitted during the on cycle. The heating cycle shall be 60 seconds minimum.
C6	2037	Test condition A. All internal bond wires for each device shall be pulled separately. (Wire bond pull test performed if devices continued from group B)
C7	1018	No pre-bake required.

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.

* 4.4.5 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 table I, subgroup 2 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 $R_{\theta JC(max)}$ = 1.67°C/W. The following parameter measurements shall apply:

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

b. Drain heating current (I_H) .....2 A.

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

d. Drain-source heating voltage (V_H) .....15 V, 20 V for U3 suffix devices.

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

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

* 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 4.3.3	$Z_{\theta JC}$		1.3	°C/W
Breakdown voltage, drain to source	3407	V_{GS} = 0 V dc, I_D = 1 mA dc, bias condition C	$V_{(BR)DSS}$			
2N7465T3, U3				400		V dc
2N7466T3, U3				500		V dc
Gate to source voltage (threshold)	3403	$V_{DS} \geq V_{GS}$, I_D = 1 mA dc	$V_{GS(TH)1}$	2.5	4.5	V dc
Gate reverse current	3411	V_{GS} = +20 V dc and -20 V dc, bias condition C, V_{DS} = 0	I_{GSS1}		±100	nA dc
Drain current	3413	V_{GS} = 0 V dc, bias condition C, V_{DS} = 80 percent of rated V_{DS}	I_{DSS1}		50	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}	$r_{DS(on)}1$			
2N7465T3, U3					1.39	Ω
2N7466T3, U3					1.77	Ω
Static drain to source on-state resistance	3421	VGS = 12 V dc, condition A, pulsed (see 4.5.1), I_D = I_{D1}	$r_{DS(on)}2$			
2N7465T3, U3					1.52	Ω
2N7466T3, U3					1.90	Ω
Forward voltage	4011	Pulsed (see 4.5.1), I_D = I_{D1}, V_{GS} = 0 V dc	V_{SD}		1.2	V

See footnotes 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 reverse 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
Drain current	3413	V_{GS} = 0 V dc, bias condition C, 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), $I_D = I_{D2}$	$r_{DS(on)3}$			
2N7465T3, U3					2.64	Ω
2N7466T3, U3					3.76	Ω
Gate to source voltage (threshold)	3403	$V_{DS} \geq V_{GS}$, I_D = 1 mA dc	$V_{GS(TH)2}$	1.5		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	$V_{GS(TH)3}$		5.5	V dc
Subgroup 4						
Forward transconductance	3475	I_D = rated I_{D2}, V_{DD} = 15 V (see 4.5.1)	g_{FS}			
2N7465T3, U3				0.5		mhos
2N7466T3, U3				0.4		mhos
Switching time test	3472	$I_D = I_{D1}$, V_{GS}= 12 V dc, R_G = 7.5Ω, V_{DD} = 50 percent of rated V_{DS}				
Turn-on delay time			$t_{d(on)}$			
2N7465T3, U3					25	ns
2N7466T3, U3					25	ns
Rise time			t_r			
2N7465T3, U3					75	ns
2N7466T3, U3					65	ns

See footnotes 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						
Turn-off delay time			$t_{d(off)}$			
2N7465T3, U3					58	ns
2N7466T3, U3					60	ns
Fall time			t_f			
2N7465T3, U3					58	ns
2N7466T3, U3					63	ns
Subgroup 5						
Safe operating area test (high voltage)	3474	See figures 5 and 6; t_p = 10 ms, V_{DS} = 200 V				
Electrical measurements		See table I, subgroup 2 herein.				
Subgroup 6						
Not applicable						
Subgroup 7						
Gate charge	3471	Condition B	$Q_{G(on)}$			
2N7465T3, U3					31	nC
2N7466T3, U3					30	nC
Gate to source charge			Q_{GS}			nC
2N7465T3, U3					8.5	nC
2N7466T3, U3					8	nC
Gate to drain charge			Q_{GD}			
2N7465T3, U3					20	nC
2N7466T3, U3					18	nC
Reverse recovery time		di/dt ≤ 100A/µs, V_{DD} ≤ 50 V, I_D = I_{D1}	t_{rr}			
2N7465T3, U3					350	ns
2N7466T3, U3					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 9, 11, or 13): Group B, subgroups 3 and 4 (JANS) or group B, subgroups 2 and 3 (JANTXV); group C, subgroup 6; group E, subgroup 1.

* TABLE II. Group D inspection.

Inspection 1/ 2/ 3/	MIL-STD-750		Symbol	Preirradiation limits		Postirradiation limits		Unit
	Method	Conditions		R		R		
				Min	Max	Min	Max	
Subgroup 1								
Not applicable								
Subgroup 2		T_C = +25°C						
Steady-state total dose irradiation (V_{GS} bias) 4/	1019	V_{GS} = 12V V_{DS} = 0						
Steady-state total dose irradiation (V_{DS} bias) 4/	1019	V_{GS} = 0 V_{DS} = 80 percent of rated V_{DS} (pre-irradiation)						
End-point electricals		Table I, subgroup 2 herein.						
Breakdown voltage, drain to source	3407	V_{GS} = 0 I_D = 1 mA bias condition C	$V_{(BR)DSS}$					
2N7465T3, U3 2N7466T3, U3				400 500		400 500		V dc V dc
Gate to source voltage (threshold)	3403	$V_{DS} \geq V_{GS}$	V_{GSth1}					
2N7465T3, U3 2N7466T3, U3				2.5 2.5	4.5 4.5	2.0 2.0	4.5 4.5	V dc V dc
Gate reverse current	3411	V_{GS} = 20 V V_{DS} = 0 bias condition C	I_{GSSF1}		100		100	nA dc
Gate reverse current	3411	V_{GS} = -20 V V_{DS} = 0 bias condition C	I_{GSSR1}		-100		-100	nA dc
Drain current	3413	V_{GS} = 0 bias condition C V_{DS} = 80 percent of rated V_{DS} (pre-irradiation)	I_{DSS1}		50		50	µA dc

See footnotes at end of table.

TABLE II. Group D inspection - Continued.

Inspection 1/ 2/ 3/	MIL-STD-750		Symbol	Preirradiation limits		Postirradiation limits		Unit
	Method	Conditions		R		R		
				Min	Max	Min	Max	
Static drain to source on-state voltage	3405	V_{GS} = 12 V condition A pulsed (see 4.5.1) $I_D = I_{D2}$	V_{DSon1}					
2N7465T3, U3					4.726		4.726	V dc
2N7466T3, U3					4.956		4.956	V dc
Forward voltage source to drain diode	4011	V_{GS} = 0 $I_D = I_{D1}$	V_{SD}		1.2		1.2	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 specification utilizing the same die design.
3/ At the manufacturer's 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/ Separate samples shall be pulled for each bias.

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

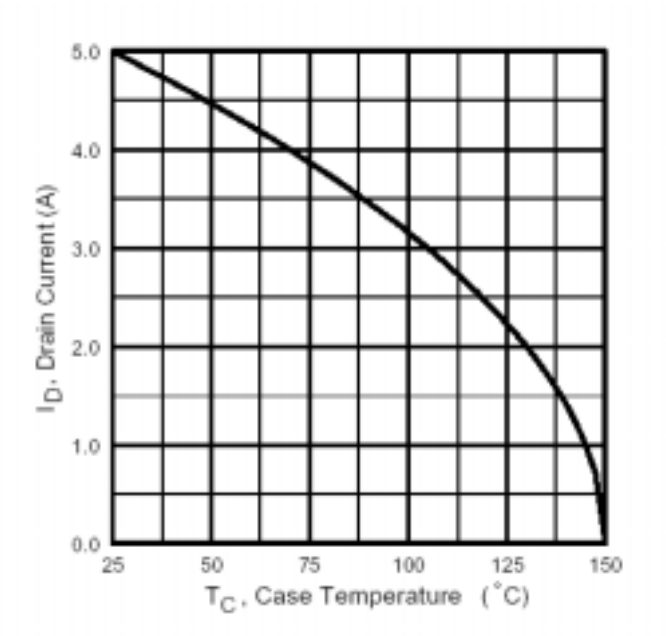
Inspection	MIL-STD-750		Qualification and large lot quality conformance inspection
	Method	Conditions	
Subgroup 1			12 devices c = 0
Thermal shock (temperature cycling)	1051	Test condition G, 500 cycles	
Hermetic seal	1071		
Fine leak Gross leak			
Electrical measurements		See table I, subgroup 2	
Subgroup 2 1/			12 devices c = 0
Steady-state reverse bias	1042	Condition B, 1,000 hours	
Electrical measurements		See table I, subgroup 2	
Steady-state gate bias	1042	Condition A, 1,000 hours	
Electrical measurements		See table I, subgroup 2	
Subgroup 3			3 devices c = 0
DPA	2102		
Subgroup 4			sample size N/A
Thermal resistance, thermal impedance curves		Each supplier shall submit their (typical) design thermal impedance curves. In addition, test conditions and $Z_{\theta JX}$ limit shall be provided to the qualifying activity in the qualification report.	
Subgroup 5			15 devices c = 0
Barometric pressure (reduced)	1001	V_{DS} = rated $V_{(BR)DSS}$, $I_{(ISO)}$ < 0.25 mA	
Subgroup 6			3 devices
ESD	1020		
Electrical measurements		See table I, subgroup 2	

See footnotes at end of table.

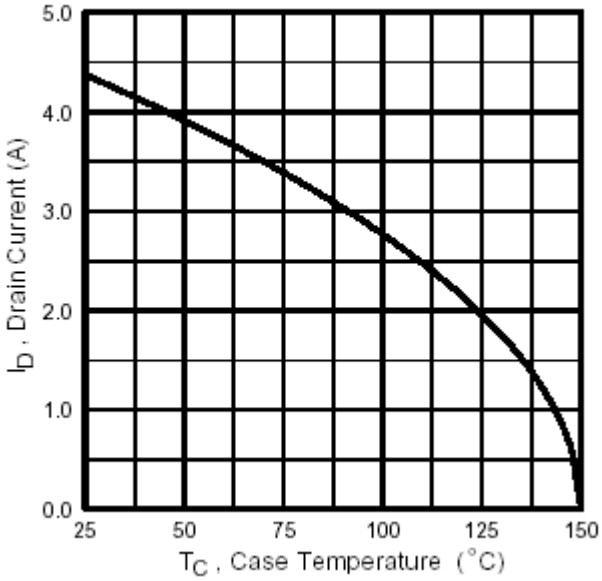
* TABLE III. Group E inspection (all quality levels) for qualification only - Continued.

Inspection	MIL-STD-750		Qualification and large lot quality conformance inspection
	Method	Conditions	
Subgroup 7			3 devices c = 0
SEE 2/ 3/ 4/	1080	See figure 7	
Electrical measurements 5/		I_{GSS1} and I_{DSS1} in accordance with table I, subgroup 2	
SEE irradiation		Fluence = 3E5 ±20 percent ions/cm^2 Flux = 2E3 to 2E4 ions/cm^2/sec Temperature = 25 ±5 °C	
2N7465T3, U3		LET = 28 MeV-cm^2/mg Range = 43 microns, energy = 285 MeV Insitu bias conditions: V_{DS} = 325V & V_{GS} = -15V LET = 37 MeV-cm^2/mg Range = 39 microns, energy = 305 MeV Insitu bias conditions: V_{DS} = 325V & VGS = -10V V_{DS} = 275V & VGS = -15V	
2N7466T3, U3		LET = 28 MeV-cm^2/mg Range = 43 microns, energy = 285 MeV Insitu bias conditions: V_{DS} = 375V & VGS = -20V LET = 37 MeV-cm^2/mg Range = 39 microns, energy = 305 MeV Insitu bias conditions: V_{DS} = 350V & VGS = -10V V_{DS} = 325V & VGS = -15V V_{DS} = 300V & VGS = -20V	
Electrical measurements 5/		I_{GSS1} and I_{DSS1} per table I, subgroup 2	
Subgroup 8			
Commutating diode for safe operating area test procedure for measuring dv/dt during reverse recovery of power MOSFET transistors or insulated gate bipolar transistors	3476		22 devices, c = 0
Soldering heat	2031	1 cycle	45 devices, c = 0

1/ A separate sample for each test shall be pulled.
2/ Group E qualification of single event effect testing may be performed prior to lot formation. Qualification may be extended to other performance specifications utilizing the same structurally identical die design.
3/ Device qualification to a higher level LET is sufficient to qualify all lower level LET's.
4/ The sampling plan applies to each bias condition.
5/ Examine I_{GSS1} and I_{DSS1} before and following SEE irradiation to determine acceptability for each bias condition. Other test conditions in accordance with table I, subgroup 2, may be performed at the manufacturer's option.

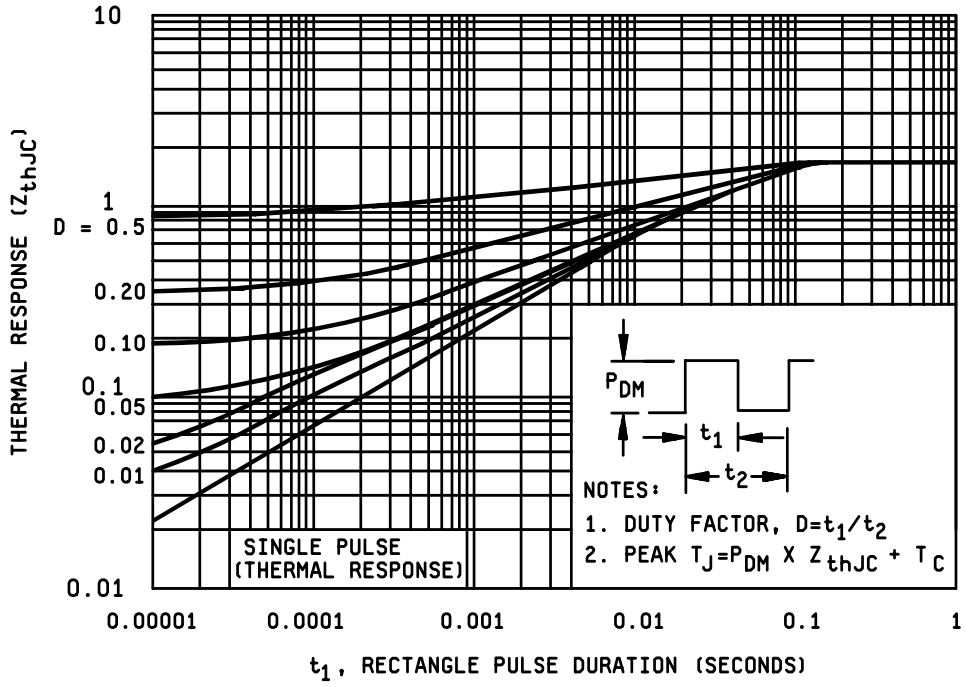


2N7465T3 and 2N7465U3

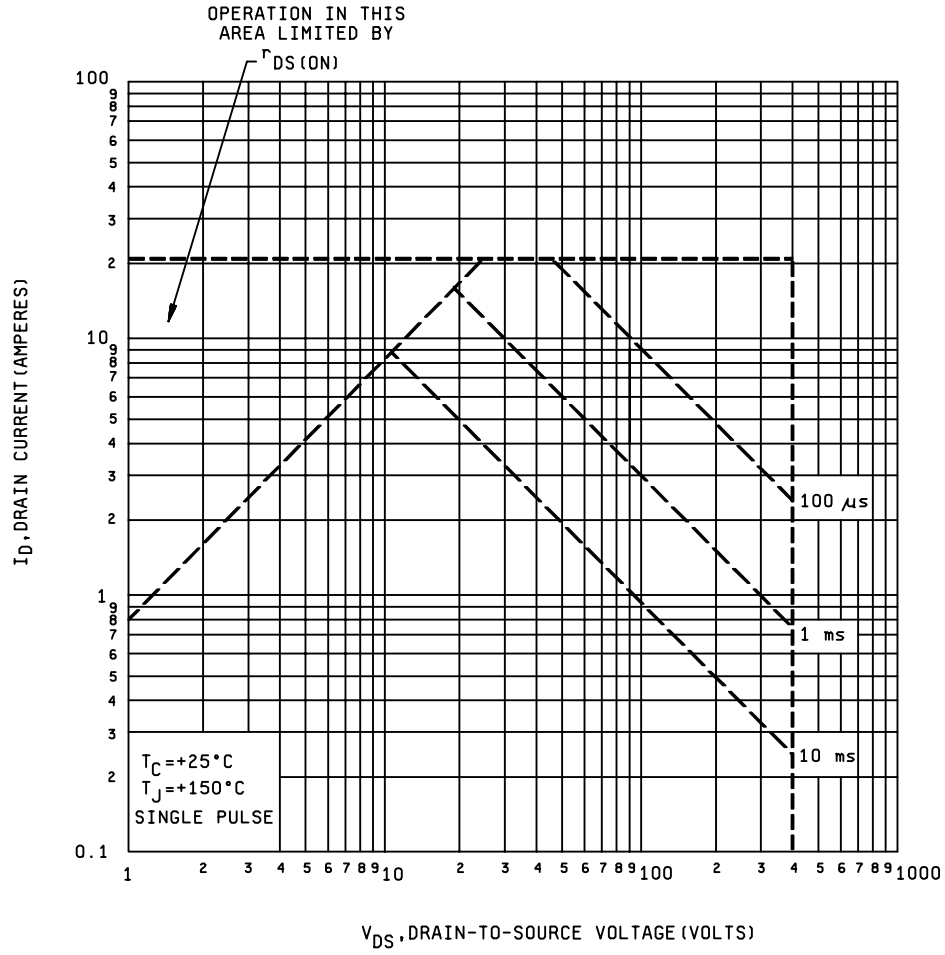


2N7466T3 and 2N7466U3

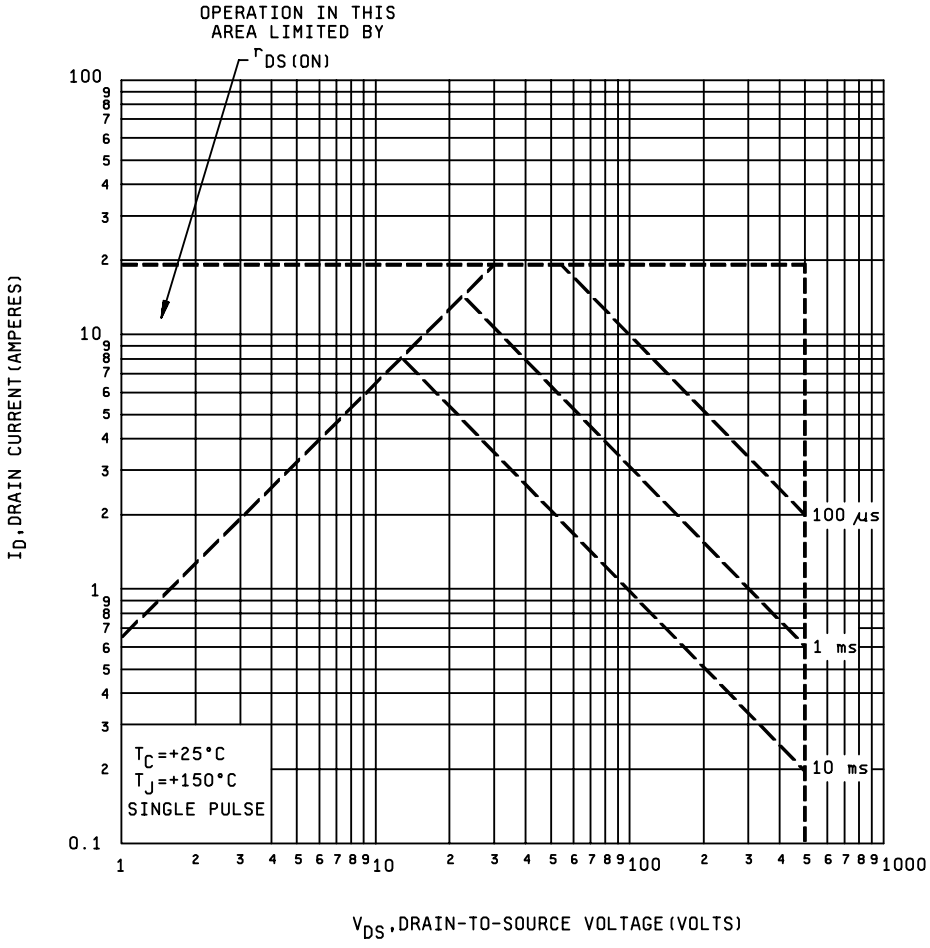
* FIGURE 3. Maximum drain current and case temperature graphs.



* FIGURE 4. Thermal impedance curves.

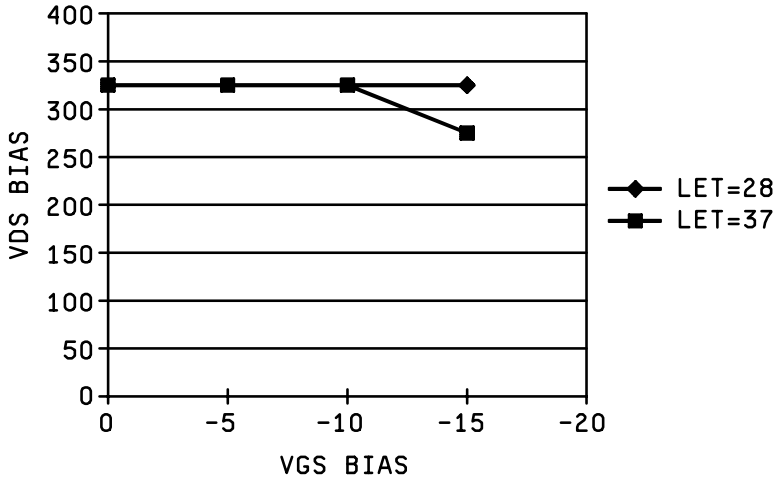


* FIGURE 5. Safe operating area graph (2N7465T3 and 2N7465U3).

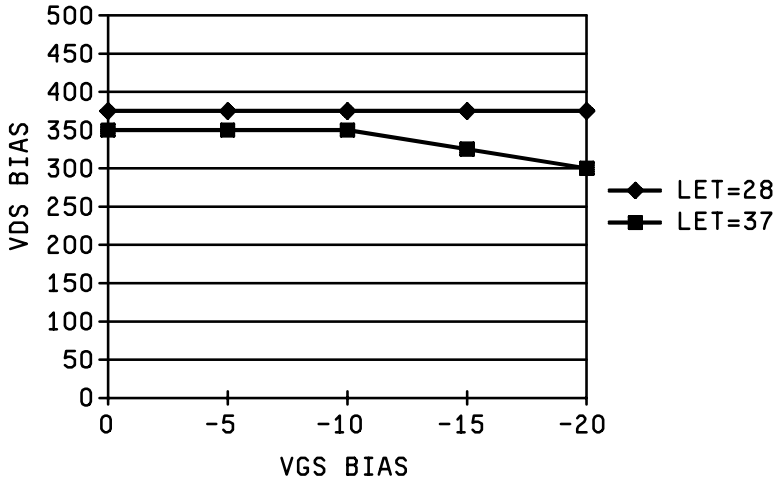


* FIGURE 6. Safe operating area graph (2N7466T3 and 2N7466U3).

2N7465T3, 2N7465U3



2N7466T3, 2N7466U3



* FIGURE 7. SEE safe operation 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. Packaging requirements (see 5.1).

d. Lead finish (see 3.4.1).

e. Type designation and product 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) 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 (military PIN)	Commercial PIN	
	TO-257AA	SMD.5
2N7465T3, U3 2N7466T3, U3	IRHY7330SE IRHY7430SE	IRHNJ7330SE IRHNJ7430SE

* 6.5 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:
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Navy - EC
Air Force - 11
NASA - NA
DLA - CC

Preparing activity:
DLA - CC

(Project 5961-2692)

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I RECOMMEND A CHANGE:	1. DOCUMENT NUMBER MIL-PRF-19500/676B	2. DOCUMENT DATE 4 September 2003

3. **DOCUMENT TITLE** SEMICONDUCTOR DEVICE, FIELD EFFECT RADIATION HARDENED (TOTAL DOSE AND SINGLE EVENT EFFECTS) TRANSISTORS, N-CHANNEL, SILICON TYPES 2N7465T3 AND 2N7466T3 AND U3 SUFFIXES JANTXVR AND JANSR

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@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