MIL-S-19500/304B
AMENDMENT 3
11 August 1987
SUPERSEDING
AMENDMENT 2
8 July 1985

MILITARY SPECIFICATION

SEMICONDUCTOR DEVICE, DIODE, SILICON, POWER RECTIFIER,
FAST-RECOVERY
TYPES 1N3885, 1N3886, 1N3888, 1N3890, 1N3891, 1N3893,
1N3890R, 1N3891R, AND 1N3893R
JAN, JANTX, JANTXV, AND JANS

This amendment forms a part of MIL-S-19500/304B, dated 14 September 1982, and is approved for use by all Departments and Agencies of the Department of Defense.

PAGE 1

1.4, Thermal resistance characteristic: Delete "2.0" and substitute "2.9".

PAGE 2

3.1, add the following after last sentence: "Lot accumulation period shall be six months in lieu of six weeks."

PAGE 3

* FIGURE 1, dimension from center of anode to cathode tip: Delete "1" and substitute "I".

PAGE 4

* FIGURE 2, dimension table, Ltr column: Delete "Øt" and substitute "ØT".

* FIGURE 2, dimension table, add the following under K:

Ltr	Minimum	Maximum	Notes
L	0.020	0.065	

FIGURE 2, NOTE 9: Delete "K" and substitute "R".

PAGE 5

* 4.3.1: Delete "(see 4.5.1)".

PAGE 6

* 4.5.4, delete in its entirety and substitute:

"4.5.4 Intermittent operation life. The rectifier shall be stud mounted in a heat sink and connected to a half-wave rectifier circuit with a resistive load, or connected to an equivalent circuit. The equivalent circuit shall impose a half-sine waveform of the specified peak voltage across the diode in the reverse direction, followed by a half-sine waveform of the specified average forward current. The forward conduction angle of the rectified current shall be not greater than 180° nor less than 150°. The power shall be equal to or greater than that of a half-sine wave."

PAGE 12

TABLE I, Subgroup 3, delete and substitute the following:

Inspection	MIL-STD-750		LTPD		Symbol	Limits		Units
	Method	Details	JANS	JAN JANTX JANTXV		Min	Max	
Subgroup 3				5				
High temperature operation:								
Reverse current	4016	T_C = 150°C DC method			I_{R2}	---	14	mA dc
1N3885, 1N3890, 1N3890R		V_R = 100 V dc						
1N3886, 1N3891, 1N3891R		V_R = 200 V dc						
1N3888, 1N3893, 1N3893R		V_R = 400 V dc						
Reverse current average	4046	T_C = 100°C I_O = 12 A dc; f = 60 Hz			I_{RO}	---	3	mA dc
1N3885, 1N3890, 1N3890R		V_R = 100 v(pk)						
1N3886, 1N3891, 1N3891R		V_R = 200 v(pk)						
1N3888, 1N3893, 1N3893R		V_R = 400 v(pk)						

PAGE 15

TABLE IIa, Subgroup 6, Thermal resistance test, Details column: Delete "2°C/W" and substitute "2.9°C/W".

PAGE 16

TABLE IIb, Subgroup 5, Thermal resistance test, Details column: Delete "2°C/W" and substitute "2.9°C/W".

The margins of this amendment are marked with an asterisk to indicate where changes (additions, modifications, corrections, deletions) from the previous amendment 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 amendment.

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

Review activities:
Army - AR, MI
Navy - SH
Air Force - 11, 19, 85, 99
DLA - ES

User activities:
Army - SM
Navy - AS, CG, MC, OS

Preparing activity:
Army - ER

Agent:
DLA - ES

(Project 5961-1056)

MILITARY SPECIFICATION

SEMICONDUCTOR DEVICE, DIODE, SILICON, POWER RECTIFIER,
FAST-RECOVERY
TYPES 1N3885, 1N3886, 1N3888, 1N3890, 1N3891,
1N3893, 1N3890R, 1N3891R, AND 1N3893R
JAN, JANTX, JANTXV, AND JANS

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

1. SCOPE

1.1 Scope. This specification covers the detail requirements for 12 ampere, silicon, fast recovery, power rectifier diodes. Four levels of product assurance are provided for each device type as specified in MIL-S-19500.

1.2 Physical dimensions. See figures 1 and 2.

1.3 Maximum ratings.

Type	V_R	V_{RWM}	I_O 1/ T_C = 100°C	I_{FSM} 1/120 s	t_{rr}	T_C
	v(pk)	v(pk)	Adc	a(pk)	ns	°C
1N3885, 1N3890, 1N3890R	100	100	12	150	200	-65
1N3886, 1N3891, 1N3891R	200	200	12	150	200	to
1N3888, 1N3893, 1N3893R	400	400	12	150	200	+150

1/ Derate linearly, 240 mAdc/°C for T_C > 100°C.
Storage temperature:
-65°C to +150°C - 1N3885, 1N3886, 1N3888
-65°C to +175°C - 1N3890, 1N3891, 1N3893
- 1N3890R, 1N3891R, 1N3893R
Barometric pressure reduced: 15 mmHg

1.4 Thermal resistance characteristic.

$R_{\theta JC}$ = 2.0 °C/W maximum.

2. APPLICABLE DOCUMENTS

2.1 Government specifications and standards. Unless otherwise specified, the following specifications and standards of the issue listed in that issue of the Department of Defense Index of Specifications and Standards specified in the solicitation, form a part of this specification to the extent specified herein.

Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: US Army Electronics Research and Development Command, DRDEL-ED, Adelphi, MD 20783 by using the self-addressed Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document or by letter.

SPECIFICATION

MILITARY

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

STANDARDS

FEDERAL

FED-STD-H28 - Screw Thread Standards for Federal Services.

MILITARY

MIL-STD-202 - Test Methods for Electronic and Electrical Component Parts.

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

(Copies of specifications, handbooks, standards, drawings, and publications required by manufacturers in connection with specific acquisition functions should be obtained from the contracting activity or as directed by the contracting officer.)

2.2 Order of precedence. In the event of conflict between the text of this specification and the references cited herein, the text of this specification shall take precedence.

3. REQUIREMENTS

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

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

R_{ISO} - - - - - - - Insulation resistance case-to-stud.

$i_r(rec)$ - - - - - - Peak reverse recovery current.

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

3.3.1 Diode types 1N3885, 1N3886, and 1N3888 (see figure 1). Diode types 1N3885, 1N3886, and 1N3888 have the stud and seating plane electrically insulated from the anode, cathode, and case.

3.3.2 Diode types 1N3890, 1N3891, and 1N3893 (see figure 2). Diode types 1N3890, 1N3891, and 1N3893 (forward polarity) have the cathode electrically connected to the stud and case.

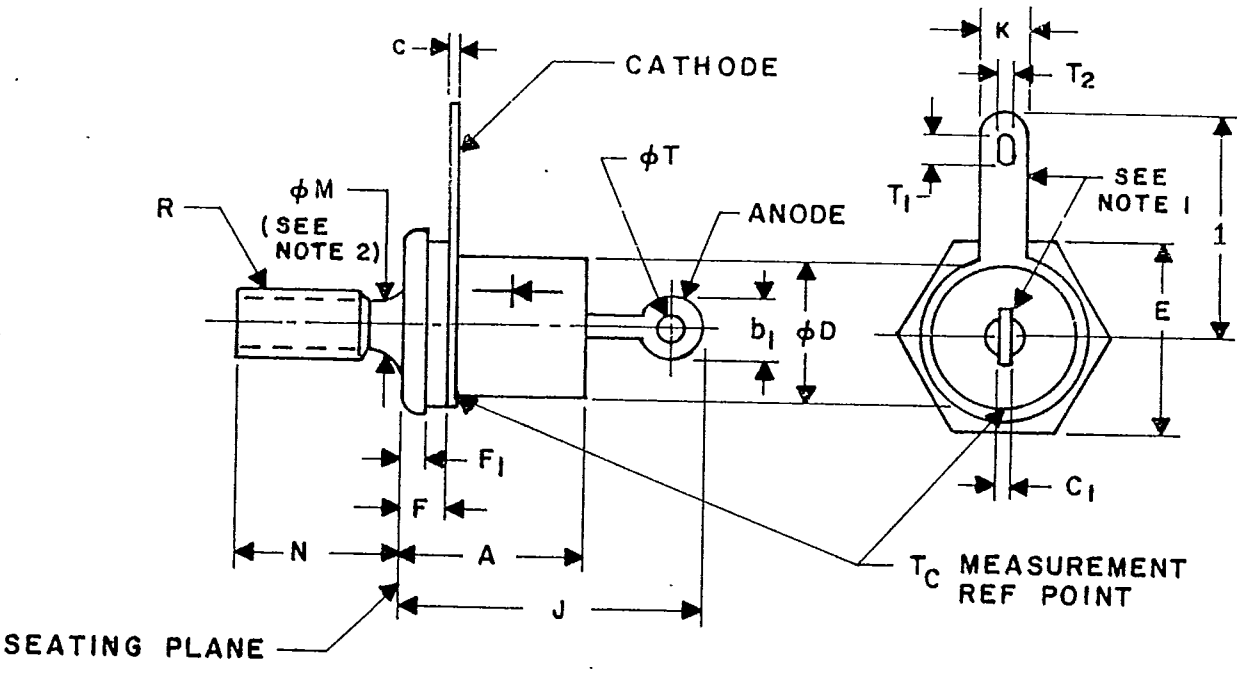
3.3.3 Diode types 1N3890R, 1N3891R, and 1N3893R (see figure 2). Diode types 1N3890R, 1N3891R, and 1N3893R (reverse polarity) have the anode electrically connected to the stud and case.

3.3.4 Dissimilar construction. Types utilizing construction as shown on figure 1 shall not be considered structurally identical to types utilizing construction as shown on figure 2.

3.4 Marking. Marking shall be in accordance with MIL-S-19500. At the option of the manufacturer, the following may be omitted from the body of the diode:

a. Country of origin.
b. Manufacturer's identification.

3.4.1 Polarity. The polarity shall be indicated by a graphic symbol with the arrow pointing toward the negative end for forward bias.

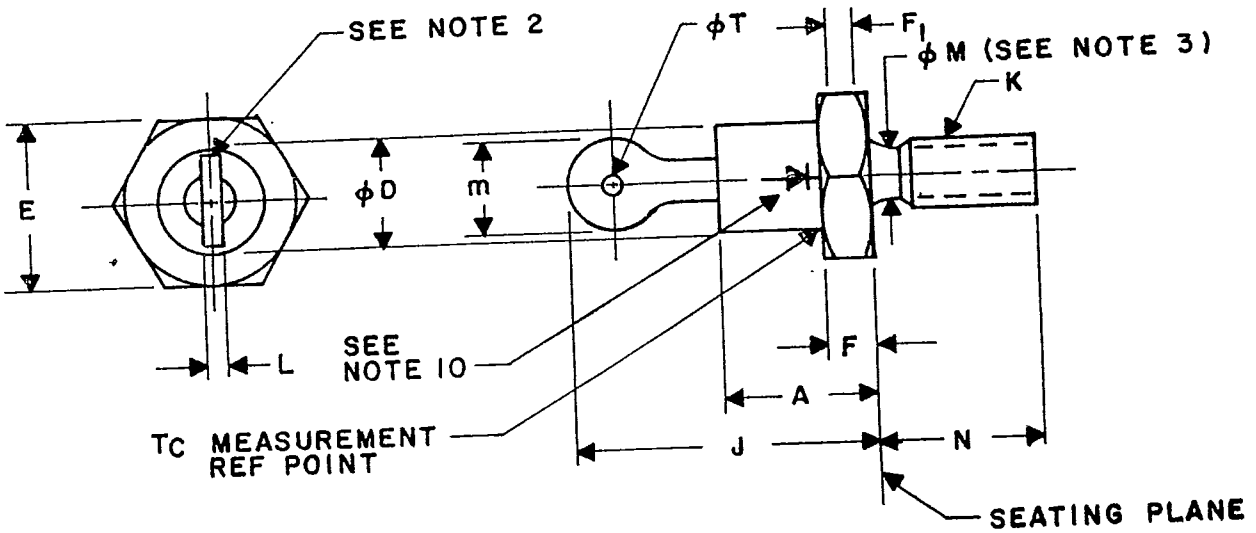


Ltr	Dimensions in inches with metric equivalents (mm) in parentheses (see note 9)		Notes
	Minimum	Maximum	
A		.550 (13.97)	
ØD		.487 (12.37)	
E	.487 (12.37)	.500 (12.70)	
F_1	.040 (1.02)		
F	.085 (2.16)	.160 (4.06)	
b_1		.250 (6.35)	1
c	.020 (.51)	.038 (.97)	
I	.750 (19.05)	.875 (22.23)	

Ltr	Dimensions in inches with metric equivalents (mm) in parentheses (see note 9)		Notes
	Minimum	Maximum	
J		.950 (24.13)	
K	.110 (2.79)	.140 (3.56)	1
T_2	.055 (1.40)	.075 (1.91)	
T_1	.110 (2.79)	.140 (3.56)	
N	.422 (10.72)	.453 (11.51)	
C_1		.050 (1.27)	
R			3,4,5,6
Øt	.060 (1.52)		
ØM	.163 (4.14)	.189 (4.80)	

NOTES:
1. Angular orientation of terminals is undefined. Square or radius on end of terminals is optional.
2. Diameter variations within these limits are permitted.
3. The ANSI thread reference is .190-32 UNF-2A.
4. Maximum pitch diameter of plated threads shall be basic pitch diameter .169 inch (4.29 mm) and in accordance with FED-STD-H28.
5. Unit shall not be damaged by torque of 15 in-lb applied to .190-32 UNF-2B nut assembled on thread.
6. Complete threads shall extend to within 0.078 (1.98) of the seating plane.
7. For marking, see 3.4.
8. Stud and seating plane shall be electrically insulated from the case, cathode, and anode.
9. Metric equivalents are given for general information only and are based upon 1 inch = 25.4 mm.

FIGURE 1. Physical dimensions for semiconductor device, diode, types 1N3885, 1N3886 and 1N3888.



Ltr	Dimensions in inches with metric equivalents (mm) in parentheses (see note 1)		Notes
	Minimum	Maximum	
A		.405 (10.29)	
ØD		.424 (10.77)	
E	.424 (10.77)	.437 (11.10)	
F	.075 (1.90)	.175 (4.44)	
J		.800 (20.32)	
m		.250 (6.35)	8
F_1	.060 (1.52)		
Øt	.060 (1.52)		
N	.422 (10.72)	.453 (11.51)	
K			4,5,6,7
ØM	.163 (4.14)	.189 (4.80)	

NOTES:
1. Metric equivalents are given for general information only and are based upon 1 inch = 25.4 mm.
2. Angular orientation of terminals is undefined.
3. Diameter variations within these limits are permitted.
4. The ANSI thread reference is .190-32 UNF-2A.
5. Maximum pitch diameter of plated threads shall be basic pitch diameter .169 inch (4.29 mm) and in accordance with FED-STD-H28.
6. Unit shall not be damaged by torque of 15 in-lb applied to .190-32 UNF-2B nut assembled on thread.
7. Complete threads shall extend to within .078 (1.98) of the seating plane.
8. Terminal-end shape is unrestricted.
9. Reversed (anode to stud) units shall be marked with an "K" following the last digit in the type number.
10. Forward polarity (cathode to stud) marking is shown.

FIGURE 2. Physical dimensions for semiconductor device, diode, types 1N3890, 1N3891, 1N3893, 1N3890R, 1N3891R and 1N3893R (DO-4).

4. QUALITY ASSURANCE PROVISIONS

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

4.2 Qualification inspection. Qualification inspection shall be in accordance with MIL-S-19500. Tests in either polarity shall be sufficient to obtain qualification approval of both polarities.

4.3 Screening (JANS, JANTX, and JANTXV levels only). Screening shall be in accordance with MIL-S-19500 (table II) and as specified herein. The following measurements shall be made in accordance with table I herein. Devices that exceed the limits of table I herein shall not be acceptable. For JANTX and JANTXV devices, screen 10 of MIL-S-19500 table II shall not be required.

Screen (see table II of MIL-S-19500)	Measurements	
	JANS level	JANTX and JANTXV levels
9	V_f and I_{R1}	- - -
11	V_f and I_{R1}; $\Delta V_f = \pm 0.1$ v(pk); ΔI_{R1} = 6 µAdc or 100% from the initial value whichever is greater.	V_f and I_{R1}
12	See 4.3.1	See 4.3.1
13	Subgroups 2 and 3 of table I herein; $\Delta V_f = \pm 0.1$ v(pk); ΔI_{R1} = 6 µAdc or 100% from the initial value whichever is greater.	Subgroup 2 of table I herein; $\Delta V_f = \pm 0.1$v(pk); ΔI_{R1} = 6 µAdc or 100% from the initial value whichever is greater.

NOTE: I_{R1} measurement shall not be indicative of an open condition.

4.3.1 Power burn-in conditions. Power burn-in conditions (all levels) are as follows:

T_C = 150°C; I_O = 0; f = 60 Hz (see 4.5.1)

1N3885, 1N3890, 1N3890R V_R = 100 v(pk)

1N3886, 1N3891, 1N3891R V_R = 200 v(pk)

1N3888, 1N3893, 1N3893R V_R = 400 v(pk)

4.4 Quality conformance inspection. Quality conformance inspection shall be in accordance with MIL-S-19500, and as specified herein.

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

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

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

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

4.5.1 Burn-in and steady-state operation life tests. These tests shall be conducted with a half-sine waveform of the specified peak voltage impressed across the diode in the reverse direction followed by a half-sine waveform of the specified average rectifier current. The forward conduction angle of the rectified current shall not be greater than 180° nor less than 150°.

4.5.2 Insulation resistance (case-to-stud). The case-to-stud insulation resistance shall be determined in terms of current flow between the case and stud. The specified test method shall be utilized except that the applied voltage shall be within ±2.0 percent of the specified value and the current shall be measured by a series microammeter with a voltage drop at 1.0 μAdc of less than 1.0 Vdc, and an accuracy of ±2.0 percent at the 1.0 μAdc point.

4.5.3 Reverse recovery time. The reverse recovery time shall be measured in the circuit of figure 5 or equivalent. Care should be exercised to minimize stray inductances in the test circuit and to insure that the total resistance of the reverse current loop can be adjusted sufficiently low so that more than 2 amperes will flow if not blocked by the diode being tested. Switch SW shall be activated and the regulated voltage source adjusted to achieve the specified forward current when SW is open. Inductance L and resistor R shall be adjusted to achieve the following characteristics of the waveform.

a. The di/dt shall be the specified value between the forward 0.5 ampere point and the reverse 0.2 ampere point.

b. The i_r(rec) shall be the maximum value obtainable, except that if it exceeds 2 amperes, it shall be reduced to equal 2 amperes.

The reverse recovery time shall then be determined from the current waveform as shown on figure 6.

4.5.4 Intermittent operation life. The rectifier shall be stud mounted in a heat sink and connected to a half-wave rectifier circuit with a resistive load, or connected to an equivalent circuit. The equivalent circuit shall impose a half-sine waveform of the specified peak voltage across the diode in the reverse direction, followed by a half-sine waveform of the specified average forward current. The forward conduction angle of the rectified current shall not be greater than 180° nor less than 150°. The power shall be equal to or greater than that of a half-sine wave. A 60 Hz sinusoidal voltage wave shall be applied with the conditions varied as follows:

a. The test shall start with the case temperature at 25°C +15°C, -5°C.

b. The power shall then be turned on and I_O shall equal 12 amperes minimum. Twenty minutes shall be allowed for the case temperature to become stabilized at 150°C minimum.

c. With I_O = 12 amperes minimum, the case temperature shall be maintained at 150°C minimum for 80 minutes.

d. The device will be turned off for a period of 20 minutes during which time the device shall be allowed to cool. (The reverse voltage may be left on during cooling.)

Conditions b, c, and d require a total of 120 minutes which comprise one thermal cycle. This thermal cycle shall be repeated continuously until the specified time has elapsed.

4.5.5 Thermal resistance. Thermal resistance shall be conducted in accordance with the following procedures and figures 3 and 4.

a. Apparatus.
(1) Thermocouple material. Copper-constantan (type T) shall be used for the temperature range -183°C to +373°C. The wire size shall be no larger than AWG size 30. The junction of the thermocouple shall be welded together to form a bead, rather than soldered or twisted. The accuracy of the thermocouple (under load conditions) shall be ±1.0°C where devices are exposed to still-air cooling and ±2.0°C for forced-air cooling.
(2) Controlled temperature chamber. The heat sink shall be capable of maintaining the specified reference point temperature to within ±0.5°C of the preset (measured) value.
(3) Instrumentation. Suitable electrical equipment shall provide controlled levels of conditioning power and be capable of making specified measurements. The instrument used to electrically measure the temperature sensitive parameter shall be capable of resolving a voltage change of 0.5 mV.

b. Procedure.
(1) Calibration test. For this test, the reference point temperature shall be maintained constant at a value such that the temperature sensitive parameter varies linearly with temperature. Increments of 25°C shall be used during calibration. The value of the TSP temperature coefficient ($\Delta V_{MC}/\Delta T_{MC}$) for the specified measuring current (100 mAdc maximum) shall be determined from the calibration curve.
(2) Power application test. The reference point temperature shall be held constant at the value determined from the calibration test. The device under test shall be operated with power applied at a duty factor greater than 99 percent. The junction to reference point temperature difference shall be greater than or equal to 30°C. The value of the temperature sensitive parameter shall be measured during the interval between heating pulses with specified measuring current applied (6 Adc minimum). This measurement shall be accomplished within 50 µs after the heating power has been discontinued. If nonthermal (magnetic) transients still exist at the end of the 50 µs time interval, the measurement may be delayed until the magnetic transients have subsided, but not to exceed a maximum delay time of 150 µs.
(3) Calculation of thermal resistance. The junction-to-reference point thermal resistance shall be calculated using the following equation:

$$R_{\theta JR} = \frac{T_J - T_R}{P_H} = \frac{V_{MH} - V_{MC}}{P_H} \times \left(\frac{\Delta V_{MC}}{\Delta T_{MC}}\right) - 1$$

$R_{\theta JR}$ = Thermal resistance, junction-to-reference point, in degrees celsius/watt.

T_J = Junction temperature in degrees celsius.

V_{MM} = Constant current supply for metering current I_M.

V_{FF} = Heating current supply.

T_R = Reference point temperature in degrees celsius.

P_H = Magnitude of heating power applied to device causing temperature difference ($T_J - T_R$) in watts.

I_M = Measuring or calibration current.

V_{MH} = Value of temperature-sensitive parameter corresponding to the temperature of the junction heated by P_H and measured at I_M, in millivolts.

T_{MC} = Calibration temperature measured at reference point, in degrees celsius.

V_{MC} = Value of temperature-sensitive parameter during calibration at T_M and specific value of T_{MC}, in millivolts.

Measurements of T_R and T_{MC} are made by means of a thermocouple attached to the reference point. The power dissipation in the device under test is calculated from the equation $P_H = I_F V_F$. If the power dissipation during measuring or calibration is not negligible, then P_C should be subtracted from P_H when calculating the thermal resistance.

c. Test circuit.

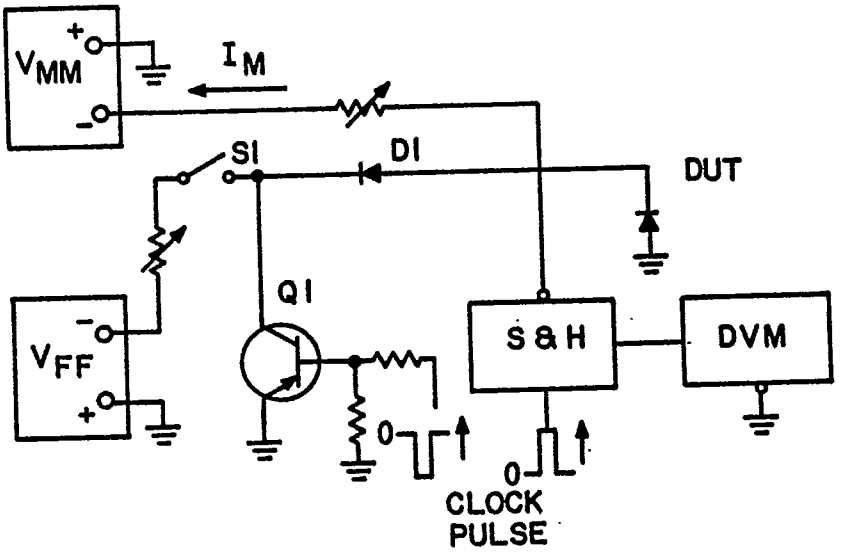


FIGURE 3. Thermal resistance test circuit.

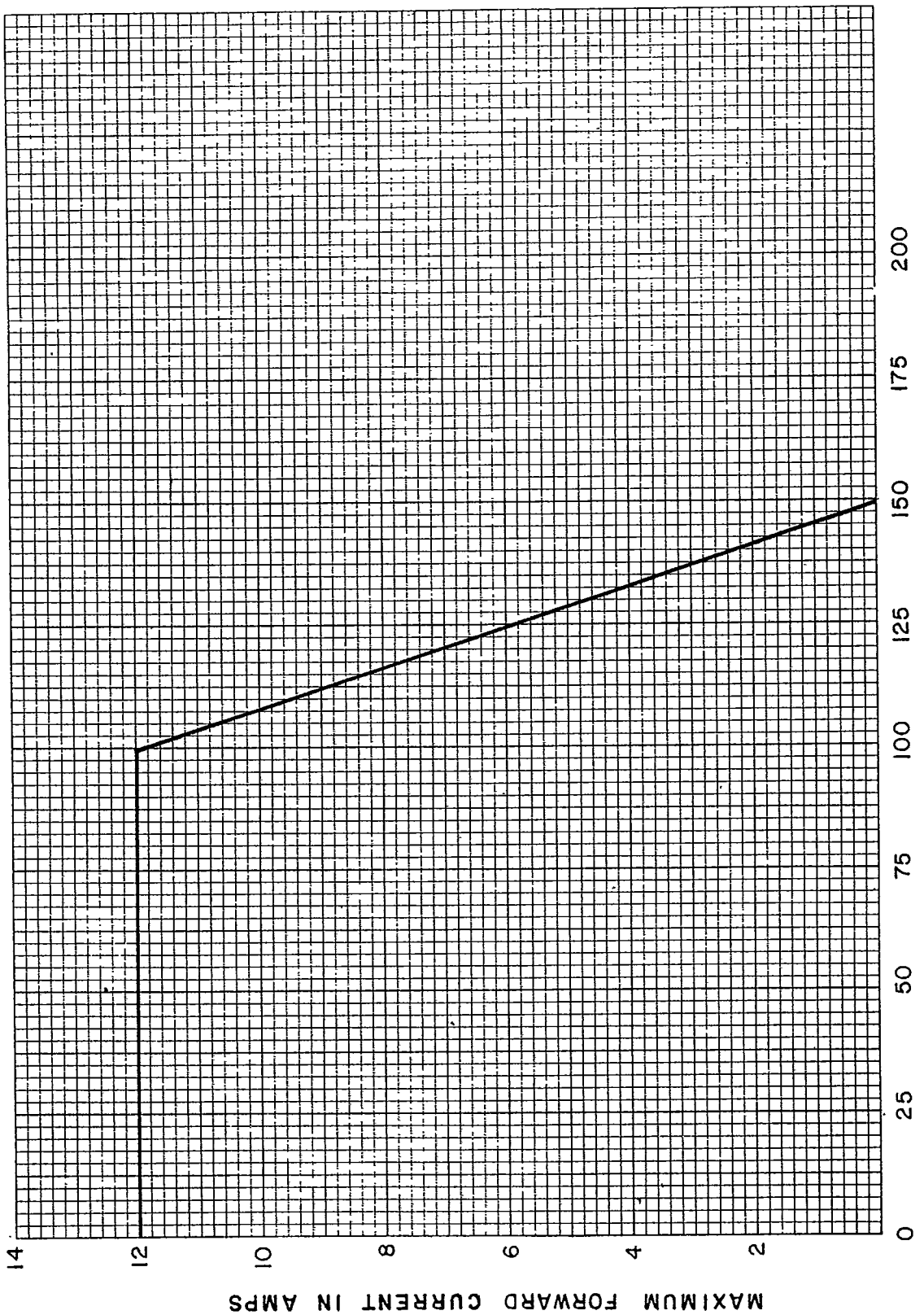
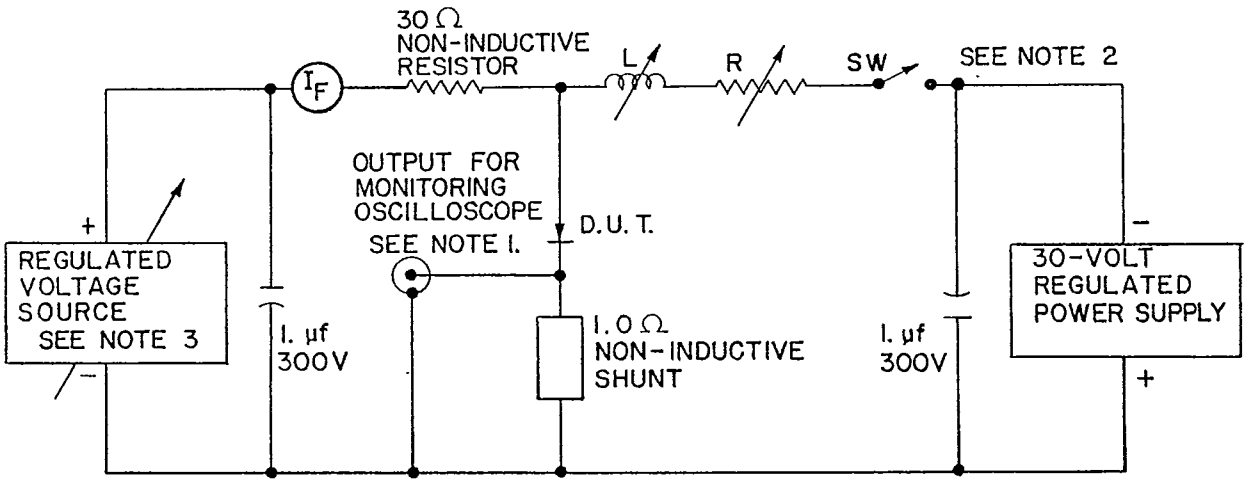
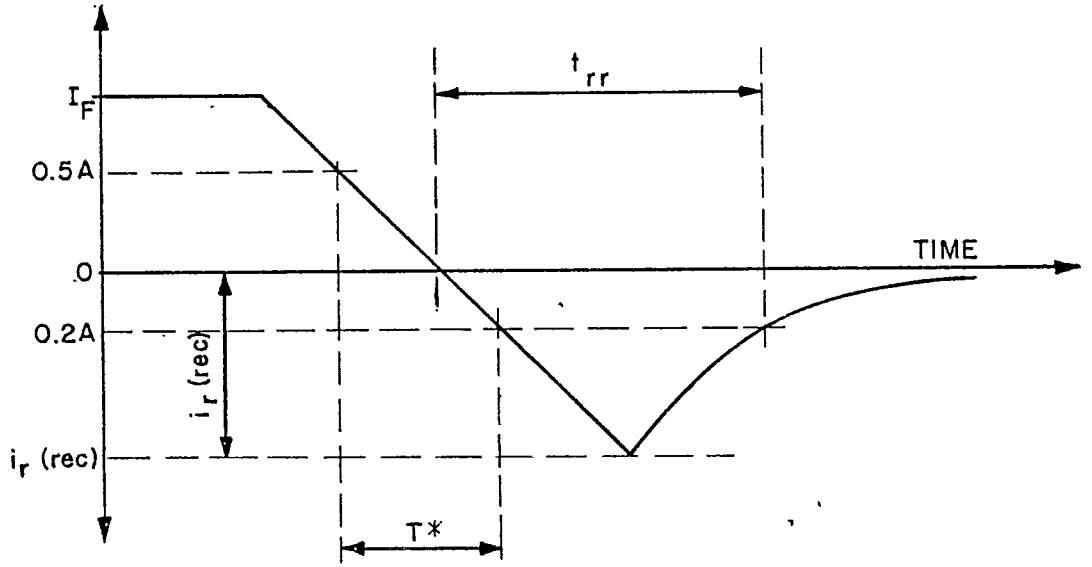


FIGURE 4. MAXIMUM CASE TEMPERATURE IN °C



NOTES:
1. Monitoring oscilloscope requirements: $t_r \leq 14$ ns, $R_{in} \geq 9M\Omega$, $C_{in} \leq 12$ pF, L_{in} (series) ≤ 0.5 μH.
2. SW characteristics: Mercury-wetted make-before-break relay switched at a 60 Hz rate. The relay should conduct for approximately 640 μs and be open for approximately 7.7 ms. (C.P. Clare HGP 1004 or equivalent).
3. Voltage source characteristics: Output impedance $\leq 0.5\Omega$ from 0 to 2 kHz.

FIGURE 5. Reverse recovery test circuit.



*Adjust L and R in accordance with paragraph 4.5.3 to achieve T = .028 μs ($L \simeq 1.2$ μH).

Then, $\frac{di}{dt} = \frac{-0.7}{.028} = -25A/\mu s$.

FIGURE 6. Reverse recovery current waveform through device under test.

5. PACKAGING

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

6. NOTES

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

6.2 Ordering data. Inspection data (see MIL-S-19500).

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

6.4 Supersession data. The following types were superseded through a previous revision of this specification and the cancellation of MIL-S-19500/266. Applicable substitutes are as follows:

Superseded types	Substitute types
1N3874, 1N3875, 1N3884	1N3885
1N3876	1N3886
1N3877, 1N3878, 1N3887	1N3888
1N3879, 1N3880, 1N3889	1N3890
1N3879R, 1N3880R, 1N3889R	1N3890R
1N3881	1N3891
1N3881R	1N3891R
1N3882, 1N3883, 1N3892	1N3893
1N3882R, 1N3883R, 1N3892R	1N3893R

NOTE: Superseded types shall not be used for new design.

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

Review activities:
Army - AR, MI
Navy - SH
Air Force - 11, 19, 85, 99
DLA - ES

User activities:
Army - SM
Navy - MC, CG, AS, OS

Agent:
DLA - ES

Preparing activity:
Army - ER

(Project 5961-0826)

TABLE I. Group A inspection.

Inspection	MIL-STD-750 Method	MIL-STD-750 Details	LTPD JANS	LTPD JAN JANTX JANTXV	Symbol	Limits Min	Limits Max	Units
Subgroup 1			15 (c=0)	5				
Visual and mechanical inspection	2071							
Subgroup 2			3 1/	5				
Forward voltage	4011	I_f = 38 a(pk) $t_p \leq$ 8.3 ms; duty cycle $\leq$ 2%			V_f	---	1.5	v(pk)
Reverse current	4016	DC method			I_R	---	15	µAdc
1N3885,1N3890, 1N3890R		V_R = 100 Vdc						
1N3886,1N3891, 1N3891R		V_R = 200 Vdc						
1N3888,1N3893, 1N3893R		V_R = 400 Vdc						
Insulation resistance (case to stud) applicable only to 1N3885, 1N3886, and 1N3888	1016	Test cond. C (see 4.5.2)			R_{ISO}	10^9		ohms
Subgroup 3				5				
High temperature operation:		T_C = 150°C						
Reverse current	4016	DC method			I_{R2}	---	14	mAdc
1N3885,1N3890, 1N3890R		V_R = 100 Vdc						
1N3886,1N3891, 1N3891R		V_R = 200 Vdc						
1N3888,1N3893, 1N3893R		V_R = 400 Vdc						
Reverse current average	4046	I_O = 12 Adc; f = 60 Hz			I_{RO}	---	3	mAdc
1N3885,1N3890, 1N3890R		v_R = 100 v(pk)						
1N3886,1N3891, 1N3891R		v_R = 200 v(pk)						
1N3888,1N3893, 1N3893R		v_R = 400 v(pk)						

See notes at end of table.

TABLE I. Group A inspection - Continued.

Inspection	MIL-STD-750		LTPD		Symbol	Limits		Units
	Method	Details	JANS	JAN JANTX JANTXV		Min	Max	
Subgroups 4 and 5								
Not applicable								
Subgroup 6			10 2/	10				
Surge current	4066	T_C = 100°C, I_O = 12 Adc; f = 60 Hz, I_{FSM}=150 a(pk); t_p = 1/120 s; 10 surges at 1/minute.						
1N3885,1N3890, 1N3890R		v_R = 100 v(pk)						
1N3886,1N3891, 1N3891R		v_R = 200 v(pk)						
1N3888,1N3893, 1N3893R		v_R = 400 v(pk)						
		After this test the following parameters from table I shall be measured: V_f and I_R						
Subgroup 7				10				
Reverse recovery time	---	T_C = 55°C, I_F = 1 Adc, V_R = 30 Vdc, $\frac{di}{dt}$ = -25A/µs, $i_{r(rec)} \leq 2$ a(pk) (See 4.5.3).			t_{rr}	---	200	ns

1. For JANS level all devices required by the specified LTPD shall be subjected to subgroups 2 and 3 combined.

2. For JANS level, all devices required by the specified LTPD shall be randomly selected from the devices subjected to subgroups 2 and 3, and shall be subjected to subgroups 6 and 7 combined.

TABLE IIa. Group B inspection for JANS devices.

Inspection	MIL-STD-750		Qualification and large lot quality conformance inspection LTPD	Small lot quality conformance inspection n/c
	Method	Details		
Subgroup 1			10	8/0
Physical dimensions	2066	(See figure 1)		
Subgroup 2			15	6/0
Solderability	2026	The immersion depth (solderability) shall be 0.200 inch from end of terminals. Both terminals of 1N3885, 1N3886, and 1N3888 shall be tested.		
Resistance to solvents	1022			
Subgroup 3			10	6/0
Thermal shock (temperature cycling)	1051			
Hermetic seal a. Fine b. Gross	1071	Condition D or F for gross leak.		
Electrical measurements		See table IV steps 1, 2, and 4		
Decap-internal visual (design verification)	2075			
Bond strength (wire or clip bonded) devices only)	2037			
Die shear	2017			
Subgroup 4			10	N/A
Intermittent operation life	1036	1N3885, 1N3890, 1N3890R 1N3886, 1N3891, 1N3891R 1N3888, 1N3893, 1N3893R V_R = 100 v(pk) V_R = 200 v(pk) V_R = 400 v(pk) (see 4.5.4) I_O = 12 Adc $t_{ON} = t_{OFF}$ = 5 minutes minimum for 2,000 cycles		
Electrical measurements		See table IV steps 1, 2, and 4		

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

Inspection	MIL-STD-750		Qualification and large lot quality conformance inspection LTPD	Small lot quality conformance inspection n/c
	Method	Details		
Subgroup 5				
Accelerated steady state operation life	1027	(See 4.5.1) I_O = 4.0 Adc, f = 60 Hz; T_A = 125°C or adjusted as required by the chosen T_A to give an average lot T_J = 275°C 1N3885, 1N3890, 1N3890R 1N3886, 1N3891, 1N3891R 1N3888, 1N3893, 1N3893R V_R = 100 v(pk) V_R = 200 v(pk) V_R = 400 v(pk)	10	12/2
Electrical measurements		See table IV steps 1, 3, and 5		
Bond strength (Al-Au die interconnect only)	2037		20 (c=o)	5/0
Subgroup 6				
Thermal resistance	---	See 4.5.5 and figure 3. $R_{\theta JC}$ = 2°C/W maximum	10	8/0

TABLE IIb. Group B inspection for JAN, JANTX, and JANTXV devices.

Inspection	MIL-STD-750 Method	MIL-STD-750 Details	LTPD
Subgroup 1			15
Solderability	2026	The immersion depth (solderability) shall be 0.200 inch from the end of terminals. Both terminals of types 1N3885, 1N3886, and 1N3888 shall be tested.	
Resistance to solvents	1022		
Subgroup 2			10
Thermal shock (temperature cycling)	1051	Time at temperature extremes = 15 minutes minimum.	
Insulated types Uninsulated types		-65°C to +150°C -65°C to +175°C	
Hermetic seal a. Fine leak b. Gross leak	1071	Test condition D or F for gross leak.	
Electrical measurements		See table IV steps 1 and 2.	
Subgroup 3			5
Steady-state-operation life	1027	(See 4.5.1) I_O = 12 Adc, f = 60 Hz, T_C = 100°C 1N3885, 1N3890, 1N3890R 1N3886, 1N3891, 1N3891R 1N3888, 1N3893, 1N3893R V_R = 100 v(pk) V_R = 200 v(pk) V_R = 400 v(pk)	
Electrical measurements		See table IV steps 1 and 3.	
Subgroup 4			
Decap internal visual (design verification)	2075		1 device/ 0 failure for each lot.
Subgroup 5			
Thermal resistance	---	See 4.5.5 and figure 3. $R_{\theta JC}$ = 2°C/W maximum	15
Subgroup 6			7
High temperature life (nonoperating)	1032	T_A = 200°C	
Electrical measurements		See table IV steps 1 and 3.	

TABLE III. Group C inspection (all quality levels).

Inspection	MIL-STD-750 Method	MIL-STD-750 Details	LTPD
Subgroup 1			
Physical dimensions	2066	(See figure 1)	15
Subgroup 2			10
Thermal shock (glass strain)	1056	Condition B	
Terminal strength	2036	Tension: Test cond. A, t = 15 ±3 s 1N3885, 1N3886, 1N3888 Weight = 5 lbs (both terminals) 1N3890, 1N3891, 1N3893 1N3890R, 1N3891R, 1N3893R Weight = 20 lbs. Torque (terminal) (axial lead only): Test cond. D_1 weight = 10 oz-in; t = 15 ±3 s Torque (stud): Test cond. D_2 weight = 15 lb-in; t = 15 ±3 s Bending stress: Test cond. F, method B; weight = 5 lbs; t = 15 ±3 s 1N3885, 1N3886, 1N3888 Weight = 1 lb (axial terminal only) 1N3890, 1N3891, 1N3893 1N3890R, 1N3891R, 1N3893R Weight = 5 lbs.	
Hermetic seal a. Fine leak b. Gross leak	1071		
Moisture resistance	1021		
External visual	2071		
Electrical measurements		See table IV steps 1 and 2 (JAN, JANTX, and JANTXV), 1, 2, and 4 (JANS)	

TABLE III. Group C inspection (all quality levels) - Continued.

Inspection	MIL-STD-750 Method	MIL-STD-750 Details	LTPD
Subgroup 3			10
Shock	2016		
Vibration, variable frequency	2056		
Constant acceleration	2006		
Electrical measurements		See table IV steps 1 and 2.	
Subgroup 4			15
Salt atmosphere (corrosion)	1041		
Subgroup 5			15
Barometric pressure (reduced)	1001	15 mm Hg = Pressure; t = 60 s While the test is being performed I_R shall be monitored and shall not exceed 25 µAdc.	
Subgroup 6			λ = 10
Steady-state operation life (see 4.5.1)	1026	I_O = 12 Adc, f = 60 Hz, T_C = 100°C 1N3885, 1N3890, 1N3890R 1N3886, 1N3891, 1N3891R 1N3888, 1N3893, 1N3893R V_R = 100 v(pk) V_R = 200 v(pk) V_R = 400 v(pk)	
Electrical measurements		See table IV steps 1, 2, and 5 (JANS), steps 1 and 3 (JAN, JANTX, and JANTXV)	

TABLE IV. Group B and C electrical measurements.

Step	Inspection	MIL-STD-750 Method	MIL-STD-750 Condition	Symbol	Limits Min	Limits Max	Units
1.	Forward voltage	4011	I_f = 38 a(pk); $t_p \leq 8.3$ ms duty cycle ≤2%	V_{f1}	---	1.5	v(pk)
2.	Reverse current	4016	DC method	I_{R1}	---	15	µAdc
	1N3885,1N3890,1N3890R		V_R = 100 Vdc				
	1N3886,1N3891,1N3891R		V_R = 200 Vdc				
	1N3888,1N3893,1N3893R		V_R = 400 Vdc				
3.	Reverse current	4016	DC method	I_{R3}	---	25	µAdc
	1N3885,1N3890,1N3890R		V_R = 100 Vdc				
	1N3886,1N3891,1N3891R		V_R = 200 Vdc				
	1N3888,1N3893,1N3893R		V_R = 400 Vdc				
4.	Forward voltage	4011	I_F = 50 mAdc	ΔV_F	±50 mVdc max. change from previous to post intermittent life and thermal shock measurement tests. (JANS only)		
5.	Reverse current	4016	DC method	ΔI_{R1} 1/	±10 µAdc or 100% of initial value whichever is greater.		
	1N3885,1N3890,1N3890R		V_R = 100 Vdc				
	1N3886,1N3891,1N3891R		V_R = 200 Vdc				
	1N3888,1N3893,1N3893R		V_R = 400 Vdc				

1/ Devices which exceed the group A limits for this test shall be rejected.

☆U.S. GOVERNMENT PRINTING OFFICE: 1982-605-034/5172