MIL-S-19500/104C
29 November 1965
SUPERSEDING
MIL-S-19500/104B(NAVY)
17 August 1962

MILITARY SPECIFICATION

SEMICONDUCTOR DEVICE, DIODE, SILICON, POWER RECTIFIER

TYPES 1N1124A, 1N1126A, 1N1128A, 1N3649, 1N3650
1N1124RA, 1N1126RA, 1N1128RA, 1N3649R, AND 1N3650R

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

1. SCOPE

1.1 Scope. This specification covers the detail requirements for 1 amp, silicon, power rectifiers with the following ratings:

1.2 Reverse types (suffix R). Reverse and forward types are identical except: The forward types have the cathode connected to the stud; the reverse types have the anode connected to the stud. Designated values are applicable to both types.

1.3 Maximum ratings.

Type	v_r	V_{RM}(wkg)	I_o [1/] $T_C \leq 50°$ C	I_o T_C = 150° C	i_f	i_f(surge) 1/120 sec
	v(pk)	v(pk)	Adc	Adc	a	a
1N1124A	250	200	3.3	1	10	25
1N1126A	500	400	3.3	1	10	25
1N1128A	750	600	3.3	1	10	25
1N3649	1000	800	3.3	1	10	25
1N3650	1250	1000	3.3	1	10	25

[1/] Derate at 23 mAdc/°C between T_C = 50° C and T_C = 150° C.

OPERATING CASE TEMPERATURE: -65° C to + 150° C
STORAGE TEMPERATURE: -65° C to + 175° C
BAROMETRIC PRESSURE, REDUCED: 8 mm Hg - 1N1124A and 1N1126A; 16 mm Hg - 1N1128A; 30 mm Hg - 1N3649; 54 mm Hg - 1N3650

2. APPLICABLE DOCUMENTS

2.1 The following documents, of the issue in effect on date of invitation for bids or request for proposal, form a part of the specification to the extent specified herein.

SPECIFICATIONS

MILITARY

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

STANDARDS

MILITARY

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

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

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

2.2 Other publications. The following document forms a part of this specification to the extent specified herein. Unless otherwise indicated, the issue in effect on date of invitation for bids or request for proposal shall apply.

NATIONAL BUREAU OF STANDARDS

Handbook H28 - Screw-Thread Standards for Federal Services.

(Application for copies should be addressed to the Superintendent of Documents, Government Printing Office, Washington, D. C. 20402.)

3. REQUIREMENTS

3.1 General. Requirements shall be in accordance with MIL-S-19500, and as specified herein.

3.2 Abbreviations and symbols. The abbreviations and symbols used herein are defined in MIL-S-19500.

3.3 Design and construction. The semiconductor diodes shall be of the design, construction, and physical dimensions specified on figure 1.

3.4 Performance characteristics. Performance characteristics shall be as specified in tables I, II, and III.

3.5 Marking. The following marking specified in MIL-S-19500 may be omitted at the option of the manufacturer:

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

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

4. QUALITY ASSURANCE PROVISIONS

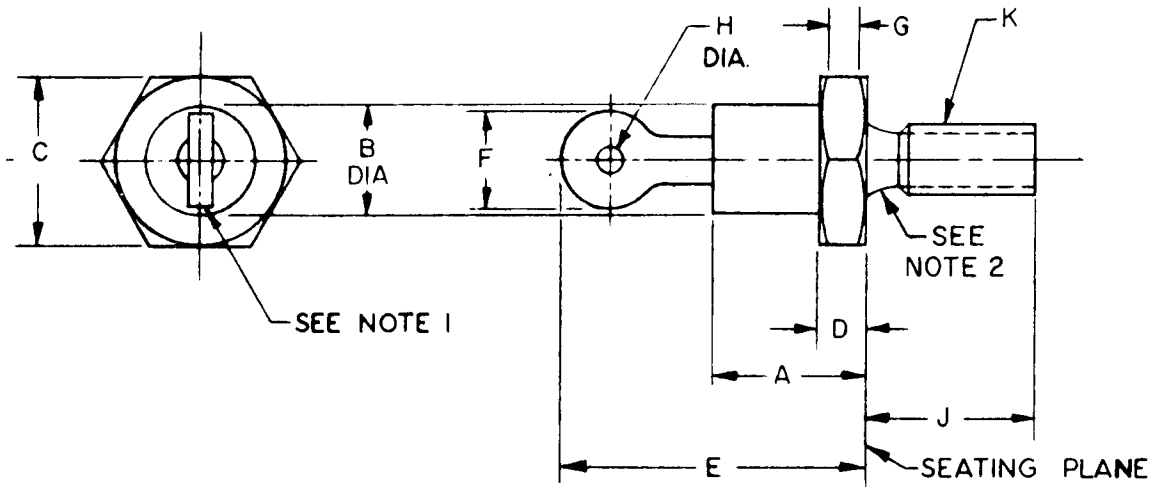
4.1 Sampling and inspection. Sampling and inspection shall be in accordance with MIL-S-19500.

4.2 Qualification inspection. Qualification inspection shall consist of the examinations and tests specified in tables I, II, and III. Subgroups 1, 2, and 3 of group B inspection and subgroup 2 of group C inspection may be performed on an inspection lot in accordance with MIL-S-19500 or may be performed on an inspection sublot on any type to qualify all types. Testing of either polarity for subgroups 1, 2, and 3 of group B inspection and subgroup 2 of group C inspection is sufficient to obtain qualification approval of both polarities. Subgroups 4, 5, and 6 of group B inspection shall be performed on an inspection sublot for each polarity type of the lowest and highest voltage units being qualified. Subgroup 7 of group B inspection and subgroup 1 of group C inspection shall be performed on an inspection sublot for each type being qualified. Either polarity may be tested to qualify both polarities for subgroup 7 of group B inspection. Each polarity must be tested separately to qualify its polarity for subgroup 1 of group C.

4.3 Quality conformance inspection. Qualify conformance inspection shall consist of the examinations and tests specified in groups A, B, and C. Types of opposite polarity shall be considered as separate lots.

4.4 Group A inspection. Group A inspection shall consist of the examinations and tests specified in table I and shall be conducted on an inspection sublot of each type.

4.5 Group B inspection. Group B inspection shall consist of the examinations and tests specified in table II. Subgroups 5 and 6 shall be performed on an inspection lot with 50% of the sample being the highest voltage type present in the lot and 50% of the sample being the highest volume type present in the lot.



DIMENSIONS					NOTES
LTR	INCHES		MILLIMETERS		
	MIN	MAX	MIN	MAX	
A		.405		10.29	
B		.424		10.77	
C	.424	.437	10.77	11.10	
D	.075	.175	1.90	4.44	
E		.800		20.32	
F		.250		6.35	7
G	.060		1.52		
H	.060		1.52		
J	.422	.453	10.72	11.51	
K					4,5, 6

NOTES:

1. Angular orientation of this terminal is undefined.
2. Dia of unthreaded portion .189 inch (4.80 mm) max; .163 inch (4.14 mm) min.
3. The A.S.A. thread reference is 10-32 UNF2A.
4. Max pitch dia of plated threads shall be basic pitch dia .169 inch (4.31 mm) and in accordance with Handbook H28.
5. Unit shall not be damaged by torque of 15 in-lb applied to 10-32NF2B nut assembled on thread.
6. Complete threads shall extend to within 2-1/2 threads of the seating plane.
7. Terminal end shape is unrestricted.
8. Reversed (anode to stud) units shall be marked with an R following the last digit in the type no.
9. For marking see 3.5.
10. Metric equivalents (to the nearest .01 mm) are given for general information only and are based upon 1 inch = 25.4 mm.
11. Dimensions are in inches.

FIGURE 1. Semiconductor devices, diode, types 1N1124A, 1N1126A, 1N1128A, 1N3649 and 1N3650.

4.6 Group C inspection. Group C inspection shall consist of examinations and tests specified in table III. This inspection shall be conducted on the initial lot, and thereafter every six months during production. Subgroup 1 shall be performed on an inspection sublot of each type. In the event subsequent lots contain voltage types other than those previously accepted under group C subgroup 1 provisions in the current six month period, the additional types shall be subjected to group C, subgroup 1 inspection.

4.7 Methods of examination and test. Methods of examination and test shall be as specified in tables I, II, and III, and as follows:

4.7.1 Steady state operation life. This test shall be conducted with a half-sine wave form of the specified peak voltage impressed across the diode in the reverse direction followed by a half-sine wave form of the specified average rectifier current. The forward conduction angle of the rectified current shall not be greater than 180° nor less than 130° ; and the power shall be equal to or greater than that of a half-sine wave.

4.7.2 Inspection conditions. Unless otherwise specified herein, all inspections shall be conducted at a case temperature (T_C) of 25° C.

4.7.3 Shock. The shock testing apparatus shall be capable of providing shock pulses of the specified peak acceleration, waveform, and pulse duration to the body of the device. The acceleration pulse, as determined from the unfiltered output of a transducer with a natural frequency greater than 10,000 cycles per second, shall be a half sine waveform with an allowable distortion not greater than ±20 percent of the specified peak acceleration. The pulse duration shall be measured between the points at 10 percent of the peak acceleration during rise and at 10 percent of the peak acceleration during decay. Absolute tolerance of the pulse duration shall be ±40 percent of the specified duration.

4.7.4 Solderability. The immersion depth shall cover the flat portion of the terminal.

4.7.5 Time limit for end points. End point tests for qualification and quality conformance inspection shall be completed within 96 hours after completion of the last test in the subgroup.

TABLE I. Group A inspection.

Examination or test	MIL-STD-750		LTPD	Symbol	Limits		
	Method	Detail			Min	Max	Unit
Subgroup 1			7				
Visual and mechanical examination	2071			---	---	---	---
Subgroup 2			5				
Forward voltage	4011	I_F = 10 Adc (pulse); $t_p \leq 8.5$ msec; duty cycle $\leq 2\%$		V_F	---	2.2	Vdc
Reverse current	4016			I_R			
1N1124A		V_R = 200 Vdc			---	5	μAdc
1N1126A		V_R = 400 Vdc			---	5	μAdc
1N1128A		V_R = 600 Vdc			---	5	μAdc
1N3649		V_R = 800 Vdc			---	5	μAdc
1N3650		V_R = 1000 Vdc			---	5	μAdc
Reverse current at peak reverse voltage	4016			i_r			
1N1124A		v_r = 250 v(pk)			---	100	μa(pk)
1N1126A		v_r = 500 v(pk)			---	100	μa(pk)
1N1128A		v_r = 750 v(pk)			---	100	μa(pk)
1N3649		v_r = 1000 v(pk)			---	100	μa(pk)
1N3650		v_r = 1250 v(pk)			---	100	μa(pk)

TABLE I. Group A inspection. - Continued

Examination or test	MIL-STD-750		LTPD	Symbol	Limits		
	Method	Details			Min	Max	Unit
Subgroup 2 - Continued							
Reverse current	4016	$T_C = 150^{+5}_{-0}$ °C		I_R			
1N1124A		V_R = 200 Vdc			---	200	µAdc
1N1126A		V_R = 400 Vdc			---	200	µAdc
1N1128A		V_R = 600 Vdc			---	200	µAdc
1N3649		V_R = 800 Vdc			---	200	µAdc
1N3650		V_R = 1000 Vdc			---	200	µAdc

TABLE II. Group B inspection.

Examination or test	MIL-STD-750		LTPD	Symbol	Limits		
	Method	Details			Min	Max	Unit
Subgroup 1			10				
Physical dimensions	2066	(See figure 1)		---	---	---	---
Subgroup 2			10				
Solderability (see 4.7.4)	2026	Dwell time = 10 ± 1 sec		---	---	---	---
Thermal shock (temperature cycling)	1051	Test cond. F		---	---	---	---
Thermal shock (glass strain)	1056	Test cond. A		---	---	---	---
Terminal strength: Tension	2036	Test cond. A; 20 lbs; t = 15 ± 3 sec		---	---	---	---
Torque (terminal)		Test cond. D1, 10 oz-in.; t = 15 ± 3 sec		---	---	---	---
Torque (stud)		Test cond. D2; 15 lb-in.; t = 30 ± 3 sec		---	---	---	---
Bending stress (axial strain)		Test cond. F, method B; 3 lbs; t = 15 ± 3 sec		---	---	---	---
Seal	---	MIL-STD-202, method 112, test cond. C, procedure III; test cond. A for gross leaks		---	---	$5X10^{-7}$	Atm cc/sec
Moisture resistance	1021	Omit initial conditioning		---	---	---	---
End points: (See 4.7.5)							
Forward voltage	4011	I_F = 10 Adc (pulse); $t_p \leq 8.5$ msec; duty cycle ≤ 2%		V_F	---	2.2	Vdc

TABLE II. Group B inspection. - Continued

Examination or test	MIL-STD-750		LTPD	Symbol	Limits		
	Method	Details			Min	Max	Unit
Subgroup 2 - Continued							
Reverse current	4016			I_R			
1N1124A		V_R = 200 Vdc			---	5	µAdc
1N1126A		V_R = 400 Vdc			---	5	µAdc
1N1128A		V_R = 600 Vdc			---	5	µAdc
1N3649		V_R = 800 Vdc			---	5	µAdc
1N3650		V_R = 1000 Vdc			---	5	µAdc
Subgroup 3			10				
Shock (see 4.7.3)	2016	Nonoperating; 500 G; t = 0.5 msec; 5 blows in each orientation: X_1, Y_1, and Y_2		---	---	---	---
Vibration fatigue	2046	10 G, nonoperating		---	---	---	---
Vibration, variable frequency	2056	10 G, nonoperating		---	---	---	---
Constant acceleration	2006	10,000 G; nonoperating; X_1, Y_1, and Y_2 orientations		---	---	---	---
End points: (Same as subgroup 2)							
Subgroup 4			10				
Surge current	4066	i_f(surge) = 25 a; f = 60 cps; I_O = 1 Adc; $T_C = 150\ ^{+5}_{-0}$ °C; Ten 1/120 sec surges, 1 surge/minute					
1N1124A		v_r = 200 v(pk)		---	---	---	---
1N1126A		v_r = 400 v(pk)		---	---	---	---
1N1128A		v_r = 600 v(pk)		---	---	---	---
1N3649		v_r = 800 v(pk)		---	---	---	---
1N3650		v_r = 1000 v(pk)		---	---	---	---
End points: (Same as subgroup 2)							
Subgroup 5			λ = 10				
High-temperature life (nonoperating)	1031	$T_A = 175\ ^{+5}_{-0}$ °C		---	---	---	---
End points: (See 4.7.5) Forward voltage	4011	I_F = 10 Adc (pulse); $t_p \leq$ 8.5 msec; duty cycle ≤ 2%		V_F	---	2.3	Vdc
Reverse current:	4016			I_R			
1N1124A		V_R = 200 Vdc			---	10	µAdc
1N1126A		V_R = 400 Vdc			---	10	µAdc
1N1128A		V_R = 600 Vdc			---	10	µAdc
1N3649		V_R = 800 Vdc			---	10	µAdc
1N3650		V_R = 1000 Vdc			---	10	µAdc

TABLE II. Group B inspection. - Continued

Examination or test	MIL-STD-750		LTPD	Symbol	Limits		
	Method	Details			Min	Max	Unit
Subgroup 6			λ = 10				
Steady state operation life (see 4.7.1)	1026	I_o = 1 Adc; T_C = 150 $^{+5}_{-0}$ °C; f = 60 cps		---	---	---	---
1N1124A		v_r = 200 v(pk)		---	---	---	---
1N1126A		v_r = 400 v(pk)		---	---	---	---
1N1128A		v_r = 600 v(pk)		---	---	---	---
1N3649		v_r = 800 v(pk)		---	---	---	---
1N3650		v_r = 1000 v(pk)		---	---	---	---
End points: (Same as subgroup 5)							
Subgroup 7			5				
Low-temperature operation:		T_C = -65 $^{+0}_{-5}$ °C					
Forward voltage	4011	I_F = 10 Adc (pulse) $t_p \leq$ 8.5 msec duty cycle $\leq$ 2%		V_F	---	2.2	Vdc
Reverse current	4016			I_R			
1N1124A		V_R = 200 Vdc			---	100	μAdc
1N1126A		V_R = 400 Vdc			---	100	μAdc
1N1128A		V_R = 600 Vdc			---	100	μAdc
1N3649		V_R = 800 Vdc			---	100	μAdc
1N3650		V_R = 1000 Vdc			---	100	μAdc

TABLE III. Group C inspection.

Examination or test	MIL-STD-750		LTPD	Symbol	Limits		
	Method	Details			Min	Max	Unit
Subgroup 1			10				
Barometric pressure, reduced (altitude operation)	1001	8 mm Hg - 1N1124A, 1N1126A 16 mm Hg - 1N1128A 30 mm Hg - 1N3649 54 mm Hg - 1N3650 t = 60 sec		---	---	---	---
Measurement during test:							
Reverse current	4016			I_R			
1N1124A		V_R = 200 Vdc			---	5	μAdc
1N1126A		V_R = 400 Vdc			---	5	μAdc
1N1128A		V_R = 600 Vdc			---	5	μAdc
1N3649		V_R = 800 Vdc			---	5	μAdc
1N3650		V_R = 1000 Vdc			---	5	μAdc
Subgroup 2			10				
Salt atmosphere	1041			---	---	---	---

5. PREPARATION FOR DELIVERY

5.1 Preparation for delivery. Preparation for delivery shall be in accordance with MIL-S-19500.

6. NOTES

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

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

Custodians:
Army - EL
Navy - SH
Air Force - 11

Review activities:
Army - EL, MU
Navy - SH
Air Force - 11, 17, 85

User activities:
Army - EL, MI
Navy - WP, MC, CG
Air Force - 14, 19

Preparing activity:
Navy - SH

(Project 5960-2143)