MILITARY SPECIFICATION

SEMICONDUCTOR DEVICE, DIODE, SILICON, SWITCHING, TYPES 1N643, 1N662 AND 1N663

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 silicon, semiconductor diodes for use, particularly, in computer-equipment circuits, and having the following particular characteristics.

1.2 Physical dimensions. See figure 1.

1.3 Maximum ratings.

Type	V_r	V_{RM}(wkg)	I_o 1/	i_f(surge) (at: 1/120 sec)
	V(pk)	V(pk)	mAdc	mA
1N643	200	175	40	500
1N662	100	80	40	500
1N663	100	80	100	500

1/ Derate 1N643 and 1N662 at 0.32 mAdc/°C above T_A = 25°C.
Derate 1N663 at 0.48 mAdc/°C above T_A = 25°C.

OPERATING AMBIENT TEMPERATURE: -65° to +150°C
STORAGE TEMPERATURE: -65° to +175°C
BAROMETRIC PRESSURE, REDUCED: 15 torr

1.4 Electrical characteristics.

V_F	I_R V_R = 10 Vdc	C	t_{rr}
Vdc(max)	nAdc(max)	pF(max)	ns(max)
1.0	25	3	1N643 300
1.0	25	3	1N662 500
1.0	25	3	1N663 500

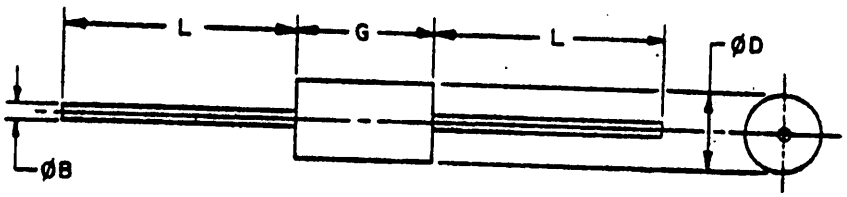
2. APPLICABLE DOCUMENTS

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

SPECIFICATIONS

MILITARY

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



LTR	DIMENSIONS				NOTES
	INCHES		MILLIMETERS		
	MIN	MAX	MIN	MAX	
ØB	.019	.021	.48	.53	3
ØD	.077	.130	1.96	3.30	
G	.195	.300	4.95	7.62	
L	1.000	1.500	25.40	38.10	

NOTES:
1. Metric equivalents (to the nearest .01 mm) are given for general information only and are based upon 1 inch = 25.4 mm.
2. See 3.5.
3. Both leads shall be within the specified limit.

FIGURE 1. Semiconductor device diode, types 1N643, 1N662, and 1N663.

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

4.4.1 Steady state operation life. This test shall be conducted with a half-sine wave of the specified peak voltage impressed across the diode in the reverse direction followed by a half-sine wave form of the specified average rectified current. The forward conduction angle of the rectified current shall not be greater than 180° nor less than 150°, and the power shall be equal to or greater than that of a half-sine wave.

4.4.2 Thermal shock (temperature cycling). Temperature cycling shall be in accordance with MIL-STD-750, method 1051, test condition C, except that the high temperature shall be 175°C. Ten cycles shall be continuously performed and the time at the temperature extremes shall be 15 minutes (minimum).

TABLE I. Group A inspection.

Examination or test	MIL-STD-750		LTPD	Symbol	Limits		Unit
	Method	Details			Min	Max	
Subgroup 1			10				
Visual and mechanical examination	2071			---	---	---	---
Subgroup 2			5				
Forward voltage	4011			V_F			
1N643		I_F = 10 mAdc			---	1.0	Vdc
1N662		I_F = 10 mAdc			---	1.0	Vdc
1N663		I_F = 100 mAdc			---	1.0	Vdc
Reverse current	4016	V_R = 10 Vdc		I_R			
1N643					---	25	nAdc
1N662					---	25	nAdc
1N663					---	25	nAdc
Reverse current	4016			I_R			
1N643		V_R = 100 Vdc			---	1.0	μAdc
1N662		V_R = 50 Vdc			---	5.0	μAdc
1N663		V_R = 75 Vdc			---	5.0	μAdc
Reverse current at peak reverse voltage	4016			i_r			
1N643		v_r = 200 V(pk)			---	100	μA(pk)
1N662		v_r = 100 V(pk)			---	100	μA(pk)
1N663		v_r = 100 V(pk)			---	100	μA(pk)
Reverse recovery time	4031	Test condition B; I_F = 5 mAdc; I_R = 17.5 mAdc; R_L = 2300 ohms ±10%; C = 40 pF, max		t_{rr}			
		Recover to:					
1N643		I_R = 200 μAdc			---	300	ns
1N662		I_R = 400 μAdc			---	500	ns
1N663		I_R = 200 μAdc			---	500	ns

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.)

3. REQUIREMENTS

3.1 General. 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 are defined in MIL-S-19500.

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

3.3.1 Lead finish. Lead finish shall be tinned or gold plated. Lead finish may be specified in the contract or order (see 6.2), without affecting the qualified product status of the device or applicable JAN marking.

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 from the body of the diode at the option of the manufacturer:

(a) First letter "C" from qualification designation code.
(b) Manufacturer's identification.
(c) Country of origin.

It is permissible to have the type number on two adjacent lines; however, if this is done, the break in the type number shall be as follows: 1N-XXX.

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 consist of the examinations and tests specified in tables I, II, and III.

4.3 Quality conformance inspection. Quality conformance inspection shall consist of group A, B, and C inspections.

4.3.1 Group A inspection. Group A inspection shall consist of the examinations and tests specified in table I.

4.3.2 Group B inspection. Group B inspection shall consist of the examinations and tests specified in table II.

4.3.3 Group C inspection. Group C inspection shall consist of the examinations and tests specified in table III. This inspection shall be conducted on the initial lot and thereafter every 6 months during production.

TABLE I. Group A inspection. - Continued

Examination or test	MIL-STD-750 Method	MIL-STD-750 Details	LTPD	Symbol	Limits Min	Limits Max	Unit
Subgroup 2 - Continued							
Forward recovery time	4026	I_F = 50 mAdc		v_{fr} t_{fr}	--- ---	3.5 100	Vdc ns
Reverse current	4016	V_R = 10 Vdc; T_A = 100°C		I_R			
1N643 1N662 1N663					--- --- ---	5 5 5	µAdc µAdc µAdc
Reverse current	4016	T_A = 100°C		I_R			
1N643 1N662 1N663		V_R = 100 Vdc V_R = 50 Vdc V_R = 75 Vdc			--- --- ---	15 100 50	µAdc µAdc µAdc
Capacitance	4001			C			
1N643 1N662 1N663		V = 175 V V = 80 V V - 80 V			--- --- ---	3 3 3	pF pF pF

TABLE II. Group B inspection.

Examination or test	MIL-STD-750 Method	MIL-STD-750 Details	LTPD	Symbol	Limits Min	Limits Max	Unit
Subgroup 1			10				
Physical dimensions	2066	(See figure 1)		---	---	---	---
Subgroup 2			15				
Solderability	2026						
Thermal shock (temperature cycling)	1051	Test condition C		---	---	---	---
Thermal shock (glass strain)	1056	Test condition A		---	---	---	---
Vibration, variable frequency	2056	Nonoperating		---	---	---	---
Terminal strength: Tension	2036	Test condition A; 2 lbs; t = 3 sec		---	---	---	---
Hermetic seal	1071	Test condition G or H for fine leaks; C or E for gross leaks		---	---	---	---
Moisture resistance	1021	(Omit initial conditioning)		---	---	---	---
End points: Forward voltage	4011			V_F			
1N643 1N662 1N663		I_F = 10 mAdc I_F = 10 mAdc I_F = 100 mAdc			--- --- ---	1.0 1.0 1.0	Vdc Vdc Vdc

TABLE II. Group B inspection. - Continued

Examination or test	MIL-STD-750 Method	MIL-STD-750 Details	LTPD	Symbol	Limits Min	Limits Max	Unit
Subgroup 2 - Continued							
End points: -Continued							
Reverse current	4016	T_A = 100°C		I_R			
1N643		V_R = 100 Vdc			---	15	µAdc
1N662		V_R = 50 Vdc			---	100	µAdc
1N663		V_R = 75 Vdc			---	50	µAdc
Subgroup 3			15				
Shock	2016	500 G; t≃ 1 ms; 5 blows each orientation: X_1, Y_1, and Y_2		---	---	---	---
Vibration, variable frequency (nonoperating)	2056	10 G		---	---	---	---
Constant acceleration	2006	20,000 G; X_1, Y_1, and Y_2 orientations		---	---	---	---
End points: (Same as subgroup 2)							
Subgroup 4			15				
Terminal strength: Lead fatigue	2036	Test condition E; 1 lb		---	---	---	---
End points: (Same as for subgroup 2)							
Subgroup 5			15				
Surge current	4066	T_A = 100°C; I_o = 10 mAdc; i_r(surge) = 500 mA; t_p = 1/120 s 10 surges at 1/minute					
1N643		v_r = 175 V(pk)		---	---	---	---
1N662		v_r = 80 V(pk)		---	---	---	---
1N663		v_r = 80 V(pk)		---	---	---	---
End points: (Same as subgroup 2)							
Subgroup 6			15				
Salt atmosphere (corrosion)	1041			---	---	---	---
Subgroup 7			λ = 10				
High-temperature life (nonoperating)	1031	T_A = 175°C		---	---	---	---
End points: (Same as subgroup 2)							

TABLE II. Group B inspection. - Continued

Examination or test	MIL-STD-750 Method	MIL-STD-750 Details	LTPD	Symbol	Limits Min	Limits Max	Unit
Subgroup 8			λ = 10				
Steady state operation life	1026	f = 60 Hz (see 4.4.1)					
1N643		I_o = 40 mAdc; V_{RM}(wkg) = 175 V(pk)		---	---	---	---
1N662		I_o = 40 mAdc; V_{RM}(wkg) = 80 V(pk)		---	---	---	---
1N663		I_o = 60 mAdc; V_{RM}(wkg) = 80 V(pk)		---	---	---	---
End points: (Same as subgroup 2)							
Subgroup 9			15				
Low temperature operation:		T_A = -65°C					
Forward voltage	4011			V_F			
1N643		I_F = 10 mAdc			---	1.2	Vdc
1N662		I_F = 10 mAdc			---	1.2	Vdc
1N663		I_F = 100 mAdc			---	1.2	Vdc
Reverse current	4016			I_R			
1N643		V_R = 100 Vdc			---	1	µAdc
1N662		V_R = 50 Vdc			---	5	µAdc
1N663		V_R = 75 Vdc			---	5	µAdc

TABLE III. Group C inspection.

Examination or test	MIL-STD-750 Method	MIL-STD-750 Details	LTPD	Symbol	Limits Min	Limits Max	Unit
Subgroup 1			15				
Barometric pressure, reduced (altitude operation)	1001	15 torr; t = 60 sec		---	---	---	---
Measurement during test:							
Reverse current at peak reverse voltage	4016			i_r			
1N643		v_r = 200 V(pk)			---	100	µA(pk)
1N662		v_r = 100 V(pk)			---	100	µA(pk)
1N663		v_r = 100 V(pk)			---	100	µA(pk)

5. PREPARATION FOR DELIVERY

5.1 See MIL-S-19500, section 5.

6. NOTES

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

Custodians:
Army - EL
Navy - EC
Air Force - 17

Review activities:
Army - MU, MI
Navy -
Air Force - 11, 80
DSA - ES

User activities:
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Navy - AS, CG, MC, OS, SH
Air Force - 13, 15, 19

Preparing activity:
Army - EL

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(Project 5961-0244)

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