

MILITARY SPECIFICATION

SEMICONDUCTOR DEVICE, DIODE, SILICON, SWITCHING
 TYPES 1N3064, 1N4454, 1N4454-1, AND 1N4532
 JAN, JANTX, AND JANTXV

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 silicon, switching diodes. Three levels of product assurance are provided for each device type as specified in MIL-S-19500.

1.2 Physical dimensions. See figure 1.

1.3 Maximum ratings.

Type	V(BR)	V _{RWM}	I _o	I _{FSM} (1 sec)	I _{FSM} (1 μs)	T _{STG}	T _J
	V dc	V(pk)	mA	mA	A	°C	°C
1N3064	75	50	75 <u>1/</u>	500	2.0	-65 to +200	-65 to +175
1N4454	75	50	200 <u>2/</u>	1,000	4.0	-65 to +200	-65 to +175
1N4454-1	75	50	200 <u>2/</u>	1,000	4.0	-65 to +200	-65 to +175
1N4532	75	50	125 <u>3/</u>	500	2.0	-65 to +200	-65 to +175

1/ Derate linearly 0.5 mA/°C above T_A = +25°C.

2/ Derate linearly 1.33 mA/°C above T_A = +25°C.

3/ Derate linearly 0.833 mA/°C above T_A = +25°C.

1.4 Primary electrical characteristics at +25°C unless otherwise indicated.

Limit	V _{F1} I _F = 10 mA dc	I _{R1} V _R = 50 V dc	C _o V _R = 0 f = 1 MHz	t _{rr} I _F = I _R = 10 mA dc R _L = 100 ohms	t _{fr} V _{frr} = 5.0 V(pk) I _F = 100 mA dc
Min	---	---	---	---	---
Max	1.0 V dc	0.1 μA dc	2 pF	4.0 ns	30 ns

Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: Commander, Naval Electronic Systems Command, ATTN: ELEX 81112, Washington, DC 20363, by using the self-addressed Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document or by letter.

2. APPLICABLE DOCUMENTS

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

SPECIFICATION

MILITARY

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

STANDARD

MILITARY

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

(Copies of specifications, 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 a 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. Abbreviations, symbols, and definitions used herein shall be as specified in MIL-S-19500.

$V_{(BR)R}$ - - - - - Breakdown voltage

V_{RWM} - - - - - Working peak reverse voltage

3.3 Design, construction, and physical dimensions. The design, construction, and physical dimensions shall be as specified in MIL-S-19500, figure 1, and herein.

3.3.1 Lead material and finish. Lead material shall be Copper Clad Steel, Kovar or Alloy 52. Lead finish shall be gold, tin, or solder dipped. Where a choice of lead material or finish is desired, it shall be specified in the acquisition document (see 6.2).

3.3.2 1N4454-1 construction. This device shall be constructed utilizing double plug construction with high temperature metallurgical bonding between both sides of the silicon die and terminal pins.

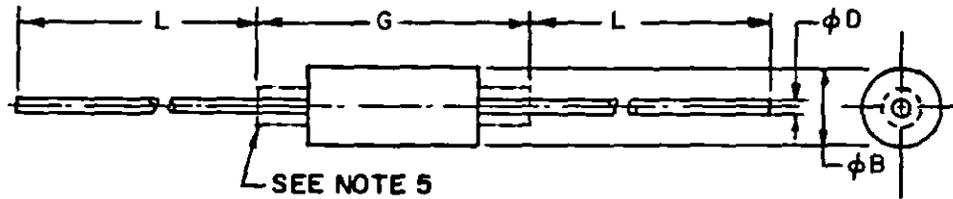
3.4 Marking. Marking shall be in accordance with MIL-S-19500. At the option of the manufacturer, the following marking may be omitted from the body of the diode:

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

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.



TYPES	DIMENSIONS					NOTES
	LTR	INCHES		MILLIMETERS		
		MIN	MAX	MIN	MAX	
1N3064	G	.195	.300	4.96	7.62	
	ØB	.078	.107	1.98	2.72	3,4
	L	1.000	1.500	25.40	38.10	
	ØD	.018	.022	0.46	0.56	2,6
1N4454 1N4454-1	G	.140	.180	3.56	4.57	
	ØB	.056	.075	1.42	1.91	3,4
	L	1.000	1.500	25.40	38.10	
	ØD	.018	.022	0.46	0.56	2,6
1N4532	G	.080	.120	2.03	3.05	
	ØB	.050	.065	1.27	1.65	3,4
	L	1.000	1.500	25.40	38.10	
	ØD	.018	.022	0.46	0.56	2,6

NOTES:

1. Metric equivalents are given for general information only and are based upon 1 inch = 25.4 mm.
2. Both leads shall be within the specified limits (See 3.3.1).
3. The maximum dimension of ØB shall apply for dimension G.
4. The minimum dimension of ØB shall apply over at least .075 (1.91 mm) of dimension G.
5. Ferrule is optional on types 1N4454, 1N4454-1, and 1N4532 for dimension G.
6. The specified lead diameter applies in the zone between .050 (1.27 mm) for 1N3064, 1N4454, and 1N4454-1 and .010 (0.25 mm) for 1N4532 from the diode body to the end of the lead. Outside of this zone the lead diameter shall not exceed ØB.

FIGURE 1. Semiconductor device, diode, types 1N3064, 1N4454, 1N4454-1 and 1N4532.

4.3 Screening (JANTXV and JANTX 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.

Screen (see table II of MIL-STD-19500)	Measurement
	JANTX and JANTXV levels
11	I_{R1} and V_{F1} 1/
12	See 4.3.1
13	Subgroup 2 of table I herein; 1/ $\Delta I_R = 100\%$ of initial reading or 25 nA dc, whichever is greater $\Delta V_F = \pm 0.03$ V dc change from initial value.

1/ Devices with I_{R1} measurements indicative of an open conditions or V_{F4} measurements (performed in lieu of measuring I_{R1} for an open condition) greater than 1.1 times V_{F4} (see 4.5.4) shall not be acceptable. The I_{R1} measurements to determine an open condition, or the optional V_{F4} measurements shall be performed on all devices.

4.3.1 Power burn-in conditions. Power burn-in conditions are as follows:

Type	$T_A = +25^\circ\text{C} \pm 3^\circ\text{C}$ $V_R = 50$ V(pk) $f = 60$ Hz	$T_A = +25^\circ\text{C} \pm 3^\circ\text{C}$
1N3064	$I_O = 75$ mA dc	$I_F = 75$ mA dc
1N4532	$I_O = 125$ mA dc	$I_F = 175$ mA dc
1N4454 and 1N4454-1	$I_O = 200$ mA dc	$I_F = 175$ mA dc

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 conducted in accordance with MIL-S-19500, and table I herein. Endpoint 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 conducted in accordance with the conditions specified for subgroup testing in table IVb of MIL-S-19500, and table II 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 conducted 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 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 Burn-in and life tests. These tests shall be conducted with a half-sine wave of the peak voltage specified herein impressed across the diode in the reverse direction, followed by a half-sine waveform of the average rectified current specified herein. The forward conduction angle of the rectified current shall be not greater than 180 degrees nor less than 150 degrees.

4.5.3 Forward recovery voltage and time. Forward recovery time shall be measured as the time interval between zero time and the point where the pulse has decreased to 110 percent of the steady-state value of V_F when $I_F = 100$ mA dc. The maximum rise time of the response detector shall be 1 ns.

4.5.4 Forward voltage (V_{F4}) at forward current surge peak (I_{FSM} at $T_A = 25^\circ\text{C}$). For a given design and construction, forward voltage at forward current surge peak (see 1.3, except for pulse width of 300 ± 200 μs) shall be measured on 30 devices. The average of the measured forward voltages shall be considered the process average forward voltage (V_{F4}) at the forward current surge peak (I_{FSM} at $T_A = 25^\circ\text{C}$).

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. Acquisition documents may specify the lead material and finish (see 3.3.1).

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.

Custodians:

Army - ER
Navy - EC
Air Force - 17

Preparing activity:

Navy - EC
(Project 5961-0907)

Review activities:

Army - MI, AR
Navy - SH, OS
Air Force - 11, 85, 99
DLA - ES

User activities:

Army - SM
Navy - AS, MC, CG
Air Force - 19

Agent:

DLA - ES

TABLE I. Group A inspection.

Inspection	MIL-STD-750		LTPD	Symbol	Limits		Unit
	Method	Conditions	1/		Min	Max	
<u>Subgroup 1</u>							
Visual and mechanical inspection	2071						
<u>Subgroup 2</u>							
Forward voltage	4011	$I_F = 10 \text{ mA dc}$		V_{F1}	---	1.0	V dc
Reverse current	4016	DC method $V_R = 50 \text{ V dc}$		I_{R1}	---	0.1	$\mu\text{A dc}$
Breakdown voltage	4021	$I_R = 5.0 \text{ }\mu\text{A dc}$		$V_{(BR)R1}$	75	---	V dc
<u>Subgroup 3</u>							
High temperature operation:		$T_A = +150^\circ\text{C}$					
Reverse current	4016	DC method; $V_R = 50 \text{ V dc}$		I_{R2}	---	100	$\mu\text{A dc}$
Forward voltage	4011	$I_F = 10 \text{ mA dc}$		V_{F2}	---	.7	V dc
Low temperature operation:		$T_A = -55^\circ\text{C}$					
Breakdown voltage	4021	$I_R = .10 \text{ }\mu\text{A dc}$		$V_{(BR)R2}$	75	---	V dc
<u>Subgroup 4</u>							
Capacitance	4001	$V_R = 0 \text{ V dc}; f = 1 \text{ MHz};$ AC signal = 50 mv(p-p) max		C_0	---	2.0	pF
Reverse recovery time	4031	Test condition B; $I_F = I_R = 10 \text{ mA dc};$ $R_L = 100\Omega; C \leq 3 \text{ pF}$		t_{rr}	---	4.0	ns
<u>Subgroups 5 and 6</u>							
Not applicable							
<u>Subgroup 7</u>							
Forward recovery voltage and time	4026	$I_F = 100 \text{ mA dc};$ $t_r \leq 0.4 \text{ ns};$ see 4.5.3		V_{fr} t_{fr}	---	5.0 30	V(pk) ns

1/ For LTPD numbers see MIL-S-19500.

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

Inspection	MIL-STD-750		LTPD ^{1/}
	Method	Conditions	
<u>Subgroup 1</u>			
Solderability	2026		
Resistance to solvents	1022		
<u>Subgroup 2</u>			
Thermal shock (temperature cycling)	1051	Test condition C;	
Hermetic seal	1071		
a. Fine leak			
b. Gross leak		Test condition E for glass encased double plug devices	
Electrical measurements		See table IV, steps 1 and 2	
<u>Subgroup 3</u>			
Steady-state operation life	1027	See 4.5.2; $V_R = 50$ V(pk); $f = 60$ Hz	
1N3064		$I_O = 75$ mA dc	
1N4532		$I_O = 125$ mA dc	
1N4454 and 1N4454-1		$I_O = 200$ mA dc	
Electrical measurements		See table IV, steps 1, 2, 3, 4, and 5	
<u>Subgroup 4</u>			
Decap internal visual design verification	2075		
<u>Subgroup 5</u>			
Not applicable			
<u>Subgroup 6</u>			
High-temperature life (nonoperating)	1032	$T_A = +200^\circ\text{C}$	
Electrical measurements		See table IV, steps 1, 2, 3, 4, and 5	
<u>Subgroup 7</u>			
Surge current	4066	$I_F = 50$ mA dc; 10 surges; $t_p = 1$ sec; 1 surge per minute	10
1N3064, 1N4532		$i_f(\text{surge}) \leq 500$ mA(pk)	
1N4454, 1N4454-1		$i_f(\text{surge}) \leq 1,000$ mA(pk)	
Surge current	4066	$I_F = 50$ mA dc; 10 surges; $t_p = 1$ μs ; 1 surge per minute	
1N3064, 1N4532		$i_f(\text{surge}) \leq 2.0$ A(pk)	
1N4454, 1N4454-1		$i_f(\text{surge}) \leq 4.0$ A(pk)	
Electrical measurements		See table IV, steps 1 and 2	

^{1/} For LTPD numbers see MIL-S-19500.

TABLE III. Group C inspection.

Inspection	Method	MIL-STD-750	LTPD ^{1/}
		Conditions	
<u>Subgroup 1</u>			
Physical dimensions	2066	See figure 1	
<u>Subgroup 2</u>			
Thermal shock (glass strain)	1056	Test condition A	
Terminal strength: Tension	2036	Test condition A; 4 lbs; t = 15 ±3 sec	
Lead fatigue		Test condition E	
Hermetic seal	1071		
a. Fine leak			
b. Gross leak		Test condition E for glass encased double plug devices	
Moisture resistance	1021	Omit initial conditioning	
External visual inspection	2071		
Electrical measurements		See table IV, steps 1 and 2	
<u>Subgroup 3</u>			
Shock	2016	Nonoperating; 1,500 G; t = 0.5 ms; 5 blows in each orientation: X ₁ , Y ₁ , and Y ₂	
Vibrations; variable frequency	2056	Nonoperating	
Constant acceleration	2006		
Electrical measurements		See table IV; steps 1 and 2	
<u>Subgroup 4</u>			
Salt atmosphere (corrosion)	1041		
<u>Subgroup 5</u>			
Not applicable			
<u>Subgroup 6</u>			
Steady-state operation life	1026	V _r = 50 V(pk); f = 60 Hz; See 4.5.2	
1N3064		I _o = 75 mA dc	
1N4532		I _o = 125 mA dc	
1N4454 and 1N4454-1		I _o = 200 mA dc	
Electrical measurements		See table IV, steps 1, 2, 3, 4, and 5	

^{1/} For LTPD numbers see MIL-S-19500.

TABLE IV. Group A, B, and C electrical measurements.

Step	Inspection	MIL-STD-750		Symbol	Limits		Unit
		Method	Conditions		Min	Max	
1.	Forward voltage	4011	$I_F = 10 \text{ mA dc}$	V_{F1}	---	1.0	V dc
2.	Reverse current	4016	DC method; $V_R = 50 \text{ V dc}$	I_{R1}	---	0.1	$\mu\text{A dc}$
3.	Capacitance	4001	$V_R = 0 \text{ V dc}$; $f = 1 \text{ MHz}$; ac - signal = 50 mV(p-p) max	C_0	---	2.0	pF
4.	Forward voltage	4011	$I_F = 10 \text{ mA dc}$	ΔV_{F1} <u>1/</u>			$\pm 60 \text{ mV dc}$ change from initial reading
5.	Reverse current	4016	DC method; $V_R = 20 \text{ V dc}$	ΔI_{R1} <u>1/</u>			100% or 45 nA dc change from initial reading, whichever is greater.

1/ Devices which exceed the group A limits for this test shall not be acceptable.

STANDARDIZATION DOCUMENT IMPROVEMENT PROPOSAL

(See Instructions - Reverse Side)

1. DOCUMENT NUMBER		2. DOCUMENT TITLE	
3a. NAME OF SUBMITTING ORGANIZATION		4. TYPE OF ORGANIZATION (Mark one)	
b. ADDRESS (Street, City, State, ZIP Code)		<input type="checkbox"/> VENDOR	
		<input type="checkbox"/> USER	
		<input type="checkbox"/> MANUFACTURER	
		<input type="checkbox"/> OTHER (Specify): _____	
5. PROBLEM AREAS			
a. Paragraph Number and Wording:			
b. Recommended Wording:			
c. Reason/Rationale for Recommendation:			
6. REMARKS			
7a. NAME OF SUBMITTER (Last, First, MI) - Optional		b. WORK TELEPHONE NUMBER (Include Area Code) - Optional	
c. MAILING ADDRESS (Street, City, State, ZIP Code) - Optional		8. DATE OF SUBMISSION (YYMMDD)	

DD FORM 1426
82 MAR

PREVIOUS EDITION IS OBSOLETE.