The documentation and process conversion measures necessary to comply with this revision shall be completed by 22 February 1994

INCH POUND

MIL-S-19500/144H
22 November 1993
SUPERSEDING
MIL-S-19500/144G
24 April 1984

MILITARY SPECIFICATION

SEMICONDUCTOR DEVICE, DIODE, SILICON, SWITCHING
TYPES 1N3064, 1N4454, 1N4454-1, 1N4532, AND 1N4454UR-1
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 (see 6.3.2).

1.2 Physical dimensions. See figure 1 (DO-35) and figure 2 (DO-213AA) (see 3.3).

1.3 Maximum ratings.

Type	$V_{(BR)}$	V_{RWM}	I_O	I_{FSM} (1 sec)	I_{FSM} (1 µs)	T_J and T_{STG}	$Z_{\theta JX}$	$R_{\theta JL}$
	V dc	V(pk)	mA	mA	A	°C	°C/W	°C/W
1N3064	75	50	75 1/	500	2.0	-55 to +175	50	250
1N4454	75	50	200 2/	1,000	4.0	-55 to +175	50	250
1N4454-1	75	50	200 2/	1,000	4.0	-55 to +175	50	250
1N4532	75	50	125 3/	500	2.0	-55 to +175	50	250

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 T_A = +25°C, unless otherwise indicated.

Limits	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_{fr} = 5.0 V(pk) I_F = 100 mA dc
Min	---	---	---	---	---
Max	1.00 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, Defense Electronics Supply Center, ATTN: DESC-ECT, 1507 Wilmington Pike, Dayton, OH 45444, by using the self-addressed Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document or by letter.

AMSC N/A FSC 5961

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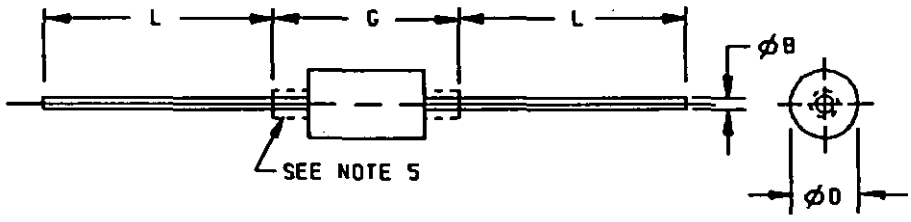

Types	Dimensions					Notes
	Ltr	Inches		Millimeters		
		Min	Max	Min	Max	
1N3064	G	.195	.300	4.96	7.62	
	ØD	.078	.107	1.98	2.72	3,4
	L	1.000	1.500	25.40	38.10	
	ØB	.018	.022	0.46	0.56	6
1N4454 1N4454-1	G	.140	.180	3.56	4.57	
	ØD	.056	.075	1.42	1.91	3,4
	L	1.000	1.500	25.40	38.10	
	ØB	.018	.022	0.46	0.56	6
1N4532	G	.080	.120	2.03	3.05	
	ØD	.050	.065	1.27	1.65	3,4
	L	1.000	1.500	25.40	38.10	
	ØB	.018	.022	0.46	0.56	6

NOTES:
1. Dimensions are in inches.
2. Metric equivalents are given for general information only.
3. The maximum dimension of ØD shall apply for dimension G.
4. The minimum dimension of ØD shall apply over at least .075 (1.91 mm) of dimension G.
5. Ferrule is optional 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 (.25 mm) for 1N4532 from the diode body to the end of the lead. Outside this zone, the lead diameter shall not exceed ØD.

FIGURE 1. Physical dimensions.

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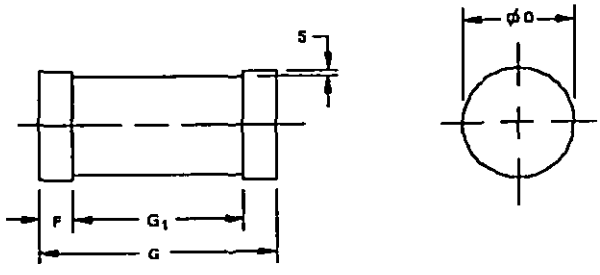

Ltr	Dimensions			
	Inches		Millimeters	
	Min	Max	Min	Max
ϕD	.063	.067	1.60	1.70
F	.016	.022	0.41	0.55
G	.130	.146	3.30	3.70
G1	.100 ref		2.54 ref	
S	.001 min		0.03 min	

NOTES:
1. Dimensions are in inches.
2. Metric equivalents are given for general information only.

FIGURE 2. Physical dimensions, 1N4454UR-1 (DO-213AA).

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2. APPLICABLE DOCUMENTS

2.1 Government documents.

2.1.1 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

MILITARY

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

STANDARD

MILITARY

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

(Unless otherwise indicated, copies of federal and military specifications, standards, and handbooks are available from the Standardization Document Order Desk, Building 4D, 700 Robbins Avenue, Philadelphia, PA 19120-5094.)

2.2 Order of precedence. In the event of a conflict between the text of this document and the references cited herein (except for related associated detail specifications, specification sheets, or MS standards), the text of this document shall take precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

3. REQUIREMENTS

3.1 Associated 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.

EC - - - - - - - - - - End cap.

3.3 Design, construction, and physical dimensions. The design, construction, and physical dimensions shall be as specified in MIL-S-19500, and figure 1 (DO-35) and figure 2 (DO-213AA) herein.

3.3.1 Lead finish. Lead finish shall be solderable in accordance with MIL-STD-750, MIL-S-19500. Where a choice of lead finish is desired, it shall be specified in the acquisition document.

3.3.2 Dash-one (-1) construction. See (see Mil-S-19500). The UR version devices shall be structurally identical to the leaded devices, except for lead termination.

3.4 Marking. Marking shall be in accordance with MIL-S-19500.

3.4.1 Marking for UR version devices. For UR version devices only, all marking may be omitted from the body (except 3.5), but shall be retained on the initial container.

3.5 Polarity. The polarity of all types shall be indicated with a contrasting color band to denote the cathode end. For UR suffix devices, a minimum of three contrasting color dots spaced around the cathode end may be used.

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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, and as specified herein.

4.3 Screening (JAN, JANTX, and JANTXV levels only). Screening shall be in accordance with table II of MIL-S-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 II of MIL-S-19500)	Measurement	
	JANTX and JANTXV levels	JAN Level
3a	Temperature cycling	Temperature cycling (per MIL-S-19500 JANTX level)
3c 1/	Thermal impedance (see 4.5.4)	Thermal impedance (see 4.5.4)
9	Not applicable	Not applicable
11	I_{R1} and V_{F1}	
12	See 4.3.1, t = 48 hours	
13 2/ 3/	Subgroup 2 of table I herein. ΔI_R ≤ 100% of initial reading or 25 nA dc, whichever is greater; ΔV_F ≤ ±.03 V dc change from initial reading. subgroup 2 of table I herein.	

1/ Thermal impedance may be performed any time after sealing provided temperature cycling is performed in accordance with MIL-S-19500, screen 3 prior to this thermal test.
2/ PDA = 5 percent for screen 13, applies to ΔI_{R1}, ΔV_Z and subgroup 2 of table I herein.
3/ Thermal impedance ($Z_{\theta JX}$)need not be repeated in screen 13.

4.3.1 Power burn-in conditions. Power burn-in conditions are as follows: T_A = Room ambient as defined in the general requirements of MIL-STD-750 (see 4.5).

Type	AC option V_R = 50 V(pk) f = 50-60 Hz (see 4.5.2)	DC option
1N3064	I_O = 75 mA dc	I_F = 75 mA dc
1N4532	I_O = 125 mA dc	I_F = 125 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.

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4.4.1 Group A inspection. Group A inspection shall be conducted in accordance with MIL-S-19500, and table I herein. The following test conditions shall be used for $Z_{\theta JX}$,group A inspection:

a. I_M measurement current - - - - - - - - - - - - - - - - 1 mA - 10 mA.
b. I_H forward heating current - - - - - - - - - - - - - - .5 A - 1.0 A.
c. t_H heating time - 10 ms.
d. t_{MD} measurement delay time - - - - - - - - - - - - 70 µs maximum.

4.4.2 Group B inspection. Group B inspection shall be conducted in accordance with the conditions specified for subgroup testing in table IVb (JAN, JANTX and JANTXV) of MIL-S-19500, and as follows. Electrical measurements (end points) and delta requirements shall be in accordance with footnote 2/ and the applicable steps of table II herein.

Subgroup	Method	Condition
B2	4066	(This test shall be performed on each sublot) I_F = 50 mA dc; 10 surges; tp = 1 µs; 1 surge per minute; i_f(surge) ≤ 2.0 A(pk) for 1N3064 and 1N4532; i_f(surge) ≤ 4.0 A(pk) for 1N4454, 1N4454-1, and 1N4454UR-1.
B3	1027	See 4.5.2; V_R = 50 V(pk); f = 50-60 Hz; I_O = 75 mA dc for 1N3064, 125 mA dc for 1N4532, and 200 mA dc for 1N4454, 1N4454-1, and 1N4454UR-1.

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 as follows. Electrical measurements (end points) and delta requirements shall be in accordance with footnote 3/ and the applicable steps of table II herein.

Subgroup	Method	Condition
C2	2036	Test condition A, weight = 4 lbs.; t = 15 ±3 seconds. Test condition E.(Note: Terminal strength not applicable to UR suffix devices.)
C6	1026	V_r = 50 V(pk); f = 50-60 Hz; See 4.5.2; I_O = 75 mA dc for 1N3064, 125 mA dc for 1N4532, and 200 mA dc for 1N4454, 1N4454-1, and 1N4454UR-1.

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 of pulse measurements shall be 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 not be greater than 180° nor less than 150°.

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 Thermal impedance $Z_{\theta JX}$ measurements for screening. The $Z_{\theta JX}$ measurements shall be performed in accordance with MIL-STD-750, method 3101. The maximum limit (not to exceed the group A, subgroup 2 limit) for $Z_{\theta JX}$ in screening (table II of MIL-S-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 $\bar{X}$, 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.

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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	3101	See 4.5.4	$Z_{\theta JX}$	---	50	°C/W
Forward voltage	4011	I_F = 10 mA dc	V_{F1}	---	1.00	V dc
Reverse current	4016	DC method; V_R = 50 V dc	I_{R1}	---	0.1	µA dc
Breakdown voltage	4021	I_R = 5.0 µA dc	$V_{(BR)1}$	75		V dc
Subgroup 3						
High temperature operation:		T_A = +150°C				
Reverse current	4016	DC method V_R = 50 V dc	I_{R2}	---	100	µA dc
Forward voltage	4011	I_F = 10 mA dc	V_{F2}	---	.7	V dc
Low temperature operation:		T_A = -55°C				
Breakdown voltage	4021	I_R = 10 µA dc	$V_{(BR)2}$	75	---	V dc
Subgroup 4						
Capacitance	4001	V_R = 0 V dc, f = 1 MHz AC signal = 50 mV(p-p) max	C_o	---	2.0	pF
Reverse recovery time	4031	Test condition A; $I_F = I_R$ = 10 mA dc; R_L = 100 Ω; C ≤ 3 pF	t_{rr}		4.0	ns
Subgroup 5 and 6						
Not applicable						
Subgroup 7						
Forward recovery voltage and time	4026	I_F = 100 mA dc; t_r ≤ 0.4 ns; see 4.5.3	V_{fr} t_{fr}	--- ---	5.0 30	V(pk) ns

1/ For sampling plan, see MIL-S-19500.

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TABLE II. Groups B and C electrical measurements.

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

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

2/ The electrical measurements for table IVb (JAN, JANTX, and JANTXV) of MIL-S-19500 are as follows:

a. Subgroup 2, see table II herein, steps 1 and 2.

b. Subgroup 3, see table II herein, steps 1, 2, 3, 4, and 5.

c. Subgroup 6, see table II herein, steps 1, 2, 3, 4, and 5.

3/ The electrical measurements for table V of MIL-S-19500 are as follows:

a. Subgroup 2, see table II herein, steps 1 and 2.

b. Subgroup 3, see table II herein, steps 1 and 2.

c. Subgroup 6, see table II herein, steps 1, 2, 3, 4, and 5.

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5. PACKAGING

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

6. NOTES

(This section contains information of a general or explanatory nature that may be helpful, but is not mandatory.)

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

6.2 Acquisition requirements. Acquisition documents should specify the following:

a. Title, number, and date of the specification.

b. Issue of DODISS to be cited in the solicitation, and if required, the specific issue of individual documents referenced (see 2.1).

c. Lead finish (see 3.3.1).

d. Product assurance level and type designation.

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

CONCLUDING MATERIAL

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

Review activities:
Army - AR, MI, SM
Navy - AS, CG, MC
Air Force - 19, 85, 99
DLA - ES

Preparing activity:
Navy - EC

Agent:
DLA - ES

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I RECOMMEND A CHANGE:	1. DOCUMENT NUMBER MIL-S-19500/144H	2. DOCUMENT DATE (YYMMDD) 93/11/22

3. DOCUMENT TITLE SEMICONDUCTOR DEVICE, DIODE, SILICON, SWITCHING TYPES 1N3064, 1N4454, 1N4454-1, 1N4532, AND 1N4454UR-1 JAN, JANTX, AND JANTXV

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) (1) Commercial (2) AUTOVON (If applicable)	7. DATE SUBMITTED (YYMMDD)

8. PREPARING ACTIVITY

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c. ADDRESS (Include Zip Code) Defense Electronics Supply Center DESC-ECT Dayton, OH 45444-5270	IF YOU DO NOT RECEIVE A REPLY WITHIN 45 DAYS, CONTACT: Defense Quality and Standardization Office 5203 Leesburg Pike, Suite 1403, Falls Church, VA 22041-3466 Telephone (703) 756-2340 AUTOVON 289-2340	

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