

The documentation and process conversion measures necessary to comply with this revision shall be completed by 20 October 1999.

INCH-POUND

MIL-PRF-19500/144J  
 20 July 1999  
 SUPERSEDING  
 MIL-S-19500/144H  
 22 November 1993

PERFORMANCE SPECIFICATION SHEET

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 performance requirements for silicon switching diode. Three levels of product assurance are provided for each device type as specified in MIL-PRF-19500.

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

1.3 Maximum ratings.

Type	V(BR)	V <sub>RWM</sub>	I <sub>O</sub>	I <sub>FSM</sub> (1 sec)	I <sub>FSM</sub> (1 μs)	T <sub>J</sub> and T <sub>STG</sub>	Z <sub>θJX</sub>	R <sub>θJL</sub>
	<u>V<sub>dc</sub></u>	<u>V (pk)</u>	<u>mA</u>	<u>mA</u>	<u>A</u>	<u>°C</u>	<u>°C/W</u>	<u>°C/W</u>
1N3064	75	50	75 <u>1/</u>	500	2.0	-55 to +175	50	250
1N4454	75	50	200 <u>2/</u>	1,000	4.0	-55 to +175	50	250
1N4454-1	75	50	200 <u>2/</u>	1,000	4.0	-55 to +175	50	250
1N4532	75	50	125 <u>3/</u>	500	2.0	-55 to +175	50	250

1/ Derate linearly 0.5 mA/°C above T<sub>A</sub> = +25°C.

2/ Derate linearly 1.33 mA/°C above T<sub>A</sub> = +25°C.

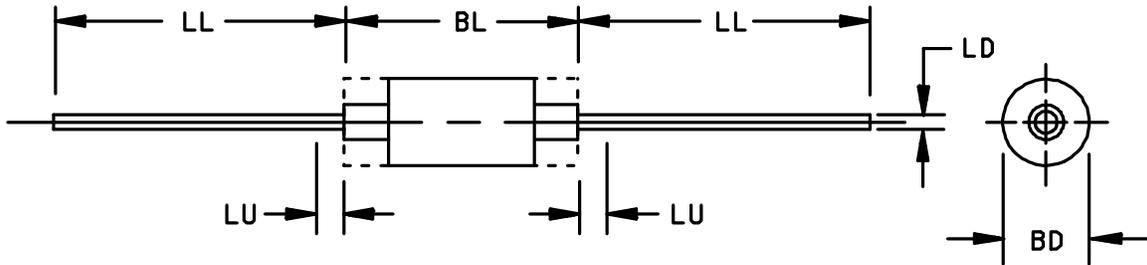
3/ Derate linearly 0.883 mA/°C between T<sub>A</sub> = +25°C to +175°C.

Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: Commander, Defense Supply Center Columbus, ATTN: DSCC-VAC, 3990 East Broad St., Columbus, OH 43216-5000, by using the 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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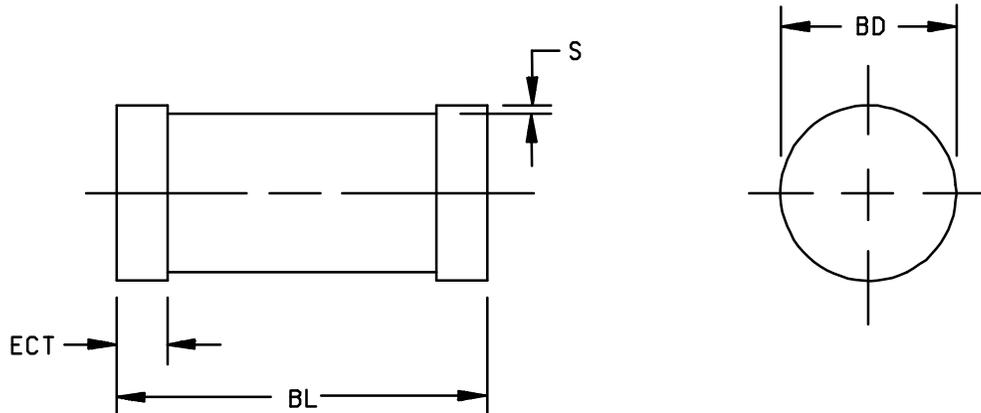


Types	Symbol	Dimensions				Notes
		Inches		Millimeters		
		Min	Max	Min	Max	
1N3064	BD	0.078	0.107	1.98	2.72	3,4
	BL	0.195	0.300	4.96	7.62	
	LD	0.018	0.022	0.46	0.56	7
	LL	1.000	1.500	25.40	38.10	
	LU		0.050		1.27	6
1N4454 1N4454-1	BD	0.056	0.075	1.42	1.91	3,4
	BL	0.140	0.180	3.56	4.57	
	LD	0.018	0.022	0.46	0.56	7
	LL	1.000	1.500	25.40	38.10	
	LU		0.050		1.27	6
1N4532	BD	0.050	0.065	1.27	1.65	3,4
	BL	0.080	0.120	2.03	3.05	
	LD	0.018	0.022	0.46	0.56	7
	LL	1.000	1.500	25.40	38.10	
	LU		0.050		1.27	6

## NOTES:

1. Dimensions are in inches.
2. Metric equivalents are given for general information only.
3. The maximum dimension of BD shall apply for dimension BL.
4. The minimum dimension of BD shall apply over at least .075 (1.91 mm) of dimension BL.
5. Ferrule is optional for dimension BL.
6. Within LU lead diameter may vary to allow for flash, lead finish build-up, and minor irregularities other than heat slugs.
7. 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 BD.
8. In accordance with ANSI Y14.5M, diameters are equivalent to  $\phi$ x symbology.

FIGURE 1. Physical dimensions for types.



Symbol	Dimensions			
	Inches		Millimeters	
	Min	Max	Min	Max
BL	.130	.146	3.30	3.70
BD	.063	.067	1.60	1.70
ECT	.016	.022	0.41	0.55
S	.001 min		0.03 min	

NOTES:

1. Dimensions are in inches.
2. Metric equivalent are given for general information only.
3. Dimensions are presolder dip.
4. Referencing to dimension S, minimum clearance of glass body to mounting surface on all orientations.
5. In accordance with ANSI Y14.5M, diameters are equivalent to  $\phi$ x symbology

FIGURE 1. Physical dimensions for type 1N4454UR-1 - Continued.

1.4 Primary electrical characteristics at  $T_A = +25^\circ\text{C}$ , unless otherwise specified.

Limits	$V_{F1}$ $I_F = 10 \text{ mA dc}$	$I_{R1}$ $V_R = 50 \text{ V dc}$	$C_O$ $V_R = 0$ $f = 1 \text{ MHz}$	$t_{rr}$ $I_F = I_R = 10 \text{ mA dc}$ $R_L = 100 \Omega$	$t_{fr}$ $V_{fr} = 5.0 \text{ V(pk)}$ $I_F = 100 \text{ mA dc}$
Min	---	---	---	---	---
Max	1.0 V dc	0.1 $\mu\text{A dc}$	2 pF	4.0 ns	30 ns

## 2. APPLICABLE DOCUMENTS

2.1 General. The documents listed in this section are specified in sections 3 and 4 of this specification. This section does not include documents cited in other sections of this specification or recommended for additional information or as examples. While every effort has been made to ensure the completeness of this list, document users are cautioned that they must meet all specified requirements documents cited in sections 3 and 4 of this specification, whether or not they are listed.

2.2 Government documents.

2.2.1 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

## DEPARTMENT OF DEFENSE

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

## STANDARD

## DEPARTMENT OF DEFENSE

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

(Unless otherwise indicated, copies of the above specifications, standards, and handbooks are available from the Defense Automated Printing Service, 700 Robbins Avenue, Building 4D (DPM-DODSSP), Philadelphia, PA 19111-5094.)

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

## 3. REQUIREMENTS

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

3.2 Abbreviations, symbols, and definitions. The abbreviations, symbols, and definitions used herein are defined in MIL-PRF-19500, and as follows.

EC - - - - End cap.

3.3 Interface requirements and physical dimensions. The Interface requirements and physical dimensions shall be as specified in MIL-PRF-19500, and figures 1 (similar to D0-35), and figure 2 (similar to D0-213AA) herein. The UR version devices shall be structurally identical to the leaded devices, except for lead termination.

3.3.1 Lead finish. Lead finish shall be solderable as defined in MIL-PRF-19500, MIL-STD-750, and herein. Where a choice of lead finish is desired, it shall be specified in the acquisition document.

3.3.2 Dash-one construction. Dash one (-1) devices shall be metallurgically bonded double plug construction in accordance with the requirements of category I, II, or III (see MIL-PRF-19500, paragraph A.3.19 and subparagraphs).

3.4 Marking. Devices shall be marked in accordance with MIL-PRF-19500. At the option of the manufacturer, the marking of the country of origin may be omitted from the body of the diode.

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

3.5 Polarity. The polarity shall be indicated with a contrasting color band to denote the cathode end. No color coding will be permitted. For UR suffix devices, a minimum of three contrasting color dots spaced around the cathode end may be used.

3.6 Electrical performance characteristics. Unless otherwise specified herein, the electrical performance characteristics are as specified in 1.3, 1.4, and table I.

3.7 Electrical test requirements. The electrical test requirements shall be the subgroups specified in table I herein.

3.8 Qualification. Devices furnished under this specification shall be products that are authorized by the qualifying activity for listing on the applicable qualified manufacturers list before contract award (see 4.2 and 6.4).

#### 4. VERIFICATION

4.1 Classification of Inspections. The inspection requirements specified herein are classified as follows:

- a. Qualification inspection (see 4.2).
- b. Screening (see 4.3)
- c. Conformance inspection (see 4.4).

4.2 Qualification inspection. Qualification inspection shall be in accordance with MIL-PRF-19500 and as specified herein.

4.3 Screening (JAN, JANTXV, JANTX levels only). Screening shall be in accordance with MIL-PRF-19500 (table IV) 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 IV of MIL-PRF-19500)	Measurement	
	JANTX and JANTXV levels	JAN level
3a	Temperature cycling	Temperature cycling (per MIL-PRF-19500 JANTX level)
3c <u>1/</u>	Thermal impedance (see 4.5.4)	Thermal impedance (see 4.5.4)
9	Not applicable	Not applicable
11	IR1, VF1	Not applicable
12	See 4.3.1, t = 48 hours	Not applicable
13 <u>2/</u> <u>3/</u>	Subgroup 2 of table I herein. $\Delta IR_1 \leq 100$ percent of initial reading or 25 nA dc, whichever is greater. $\Delta VF_1 \leq \pm 0.03$ V dc change from initial reading. Subgroup 2 of table I herein.	Not applicable

1/ Thermal impedance may be performed any time after sealing provided temperature cycling is performed in accordance with MIL-PRF-19500, screen 3 prior to this thermal test.

2/ PDA = 5 percent for screen 13, applies to  $\Delta IR_1$ ,  $\Delta VF_1$  and subgroup 2 of table I herein.

3/ Thermal resistance impedance ( $Z_{\theta JX}$ ) need not be repeated in screen 13.

4.3.1 Power burn-in conditions. All devices shall be operated under one of the following conditions:  $T_A$  = 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	$I_F = 75$ mA
1N4532	$I_O = 125$ mA	$I_F = 125$ mA
1N4454 and 1N4454-1	$I_O = 200$ mA	$I_F = 175$ mA

4.4 Conformance inspection. Conformance inspection shall be in accordance with MIL-PRF-19500 and as specified herein.

4.4.1 Group A inspection. Group A inspection shall be conducted in accordance with MIL-PRF-19500, and table I herein. Electrical measurements (end-points) shall be in accordance with the applicable inspections of table I, group A, subgroup 2 herein.

The following test condition shall be used for  $Z_{\theta JX}$ , group A inspection:

- a.  $I_M$  measure current ..... 1 mA - 10 mA.
- b.  $I_H$  forward heating current ..... 300 mA minimum.
- c.  $t_H$  heating time ..... 10 ms maximum
- d.  $t_{MD}$  measurement delay time ..... 70  $\mu$ s maximum

4.4.2 Group B inspection. Group B inspection shall be conducted in accordance with the conditions specified for subgroup testing in table VIb (JAN, JANTX, and JANTXV) of MIL-PRF-19500 and paragraph 4.4.2.1 herein. Electrical measurements (end-points) shall be in accordance with the applicable inspections of table I, group A, subgroup 2 herein. Delta measurements shall be in accordance with table II herein.

4.4.2.1 Group B inspection, table VIb (JAN, JANTX and JANTXV) of MIL-PRF-19500.

Subgroup	Method	Condition
B2	4066	(This test shall be performed on each subplot) $I_F = 50$ mA dc; 10 surges; $t_p = 1$ $\mu$ s; 1 surge per minute; $i_i(\text{surge}) \geq 2.0$ A(pk) for 1N3064 and 1N4532; $i_i(\text{surge}) \geq 4.0$ A(pk) for 1N4454, 1N4454-1, and 1N4454UR-1.
B3	1027	See 4.5.2; $V_R = 50$ V(pk); $f = 50$ -60 Hz; $I_O = I_O$ rated minimum (see 1.3), adjust $I_O$ or $T_A$ to achieve $T_J = 150^\circ\text{C}$ minimum.

4.4.3 Group C inspection. Group C inspection shall be conducted in accordance with the conditions specified for subgroup testing in table VII of MIL-PRF-19500, and as follows. Electrical measurements (end-points) shall be in accordance with table I, group A, subgroup 2 herein. Delta measurements shall be in accordance with table II herein.

Subgroup	Method	Condition
C2	2036	Test condition A; weight = 4 pounds, $t = 15 \pm 3$ seconds. Test condition E. (Note: Terminal strength not applicable to UR suffix devices.)
C5		Not applicable.
C6	1026	$V_r = 50$ V(pk); $f = 50$ -60 Hz; see 4.5.2; $I_O = I_O$ rated minimum (see 1.3), adjust $I_O$ or $T_A$ to achieve $T_J = 150^\circ\text{C}$ minimum.

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 not be greater than  $180^\circ$  nor less than  $150^\circ$ .

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. Thermal impedance  $Z_{\theta JX}$  measurements shall be performed in accordance with MIL-STD-750, method 3101 to remove atypical devices. The maximum limit shall not exceed the group A, subgroup 2 limit for  $Z_{\theta JX}$  in screening (table IV of MIL-PRF-19500).

## 5. PACKAGING

5.1 Packaging. For acquisition purposes, the packaging requirements shall be as specified in the contract or order (see 6.2). When actual packaging of material is to be performed by DoD personnel, these personnel need to contact the responsible packaging activity to ascertain requisite packaging requirements. Packaging requirements are maintained by the Inventory Control Points' packaging activity within the Military Department or Defense Agency, or within the Military Departments' System Command. Packaging data retrieval is available from the managing Military Department's or Defense Agency's automated packaging files, CD-ROM products, or by contacting the responsible packaging activity.

TABLE I. Group A inspection.

Inspection 1/	MIL-STD-750		Symbol	Limits		Unit
	Method	Conditions		Min	Max	
<u>Subgroup 1</u>						
Visual and mechanical examination	2071					
<u>Subgroup 2</u>						
Thermal impedance	3101	See 4.4.1	$Z_{\theta JX}$		70	$^{\circ}\text{C} / \text{W}$
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	$I_R = 5.0 \mu\text{A dc}$	$V_{(BR)1}$	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	$I_F = 10 \text{ mA dc}$	$V_{F2}$		0.7	V dc
Low temperature operation		$T_A = -55^{\circ}\text{C}$				
Breakdown voltage	4021	$I_R = 10 \mu\text{A dc}$	$V_{(BR)2}$	75		V dc
<u>Subgroup 4</u>						
Capacitance	4001	$V_R = 0 \text{ V dc}$ , $f = 1 \text{ MHz}$ , AC signal = 50 mV(pp) max	$C_O$		2.0	pF
Reverse recovery time	4031	Test condition A, $I_F = I_R = 10 \text{ mA dc}$ , $R_L = 100 \Omega$ , $C \leq 3 \text{ pF}$ , $I_{RR} = 1 \text{ mA}$	$t_{rr}$		4.0	ns
<u>Subgroups 5 and 6</u>						
Not applicable						

See footnote at end of table.

TABLE I. Group A inspection - Continued.

Inspection <u>1/</u>	MIL-STD-750		Symbol	Limits		Unit
	Method	Conditions		Min	Max	
<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 sampling plan, see MIL-PRF-19500.

TABLE II. Groups A, B, and C delta measurements. 1/ 2/

Step	Inspection <u>1/</u>	MIL-STD-750		Symbol	Limits		Unit
		Method	Conditions		Min	Max	
1.	Forward voltage	4011	$I_F = 10 \text{ mA dc}$	$\Delta V_{F1}$ <u>3/</u>	$\leq \pm 60 \text{ mV dc}$ change from initial reading		
2.	Reverse current	4016	DC method, $V_R = 50 \text{ V dc}$	$\Delta I_{R1}$ <u>3/</u>	$\leq 100 \%$ of initial value or $45 \text{ nA dc}$ , whichever is greater		

1/ The delta measurements for table VIb (JAN, JANTX, and JANTXV) of MIL-PRF-19500 are as follows:

- a. Subgroup 3, see table II herein, steps 1 and 2.
- b. Subgroup 6, see table II herein, steps 1 and 2.

2/ The delta measurements for table VII of MIL-PRF-19500 are as follows:

- a. Subgroup 6, see table II herein, steps 1 and 2.

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

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-PRF-19500 are applicable to this specification.

6.2 Acquisition requirements. Acquisition documents should specify the following:

- a. Issue of DODISS to be cited in the solicitation and, if required, the specific issue of individual documents referenced (see 2.2.1).
- b. Lead finish (see 3.3.1).
- c. Type designation and product assurance level.
- d. Packaging requirements (see 5.1).

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 extent of the changes.

6.4 Qualification. With respect to products requiring qualification, awards will be made only for products which are, at the time of award of contract, qualified for inclusion in Qualified Manufacturers List QML-19500 whether or not such products have actually been so listed by that date. The attention of the contractors is called to these requirements, and manufacturers are urged to arrange to have the products that they propose to offer to the Federal Government tested for qualification in order that they may be eligible to be awarded contracts or purchase orders for the products covered by this specification. Information pertaining to qualification of products may be obtained from Defense Supply Center Columbus, DSCC-VQE, Columbus, OH 43216.

Custodians:  
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(Project 5961-2144)

## STANDARDIZATION DOCUMENT IMPROVEMENT PROPOSAL

### INSTRUCTIONS

1. The preparing activity must complete blocks 1, 2, 3, and 8. In block 1, both the document number and revision letter should be given.
2. The submitter of this form must complete blocks 4, 5, 6, and 7, and send to preparing activity.
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#### I RECOMMEND A CHANGE:

1. DOCUMENT NUMBER  
MIL-PRF-19500/144J

2. DOCUMENT DATE (YYYYMMDD)

3. DOCUMENT TITLE SEMICONDUCTOR DEVICE, DIODE, SILICON, SWITCHING, TYPES 1N3064, 1N4454, 1N4454-1, 1N4532, 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

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d. TELEPHONE *(Include Area Code)*  
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(2) DSN  
*(If applicable)*

7. DATE SUBMITTED  
(YYYYMMDD)

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