

The documentation and process conversion measures necessary to comply with this revision shall be completed by 26 August 2016.

INCH-POUND

MIL-PRF-19500/403A(USAF)
 27 May 2016
 SUPERSEDING
 MIL-S-19500/403(USAF)
 8 July 1968

PERFORMANCE SPECIFICATION SHEET

SEMICONDUCTOR DEVICE, DIODE, SILICON, SWITCHING,
 AXIAL LEADED PACKAGE, TYPE 1N4500,
 QUALITY LEVELS JAN AND JANTX

Inactive for new design after 7 June 1999.

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

The requirements for acquiring the product described herein shall consist of this specification sheet and [MIL-PRF-19500](#).

1. SCOPE

1.1 Scope. This specification covers the performance requirements for silicon, switching diodes for use in circuits with high forward conductance. Two levels of product assurance (JAN and JANTX) are provided for the device type as specified in [MIL-PRF-19500](#).

1.2 Package outline. The device package outline is an axial leaded body similar to a modified DO-204AA (formerly DO-7) in accordance with [figure 1](#) for all device types.

1.3 Maximum ratings. Unless otherwise specified, $T_A = +25^\circ\text{C}$.

Type	V_{BR}	V_{RWM}	I_O	$I_{f(\text{surge})}$ (1 sec)	$I_{f(\text{surge})}$ (1 μsec)	T_{op}	T_{stg}
	<u>V dc</u>	<u>V(pk)</u>	<u>mA dc</u>	<u>a</u>	<u>a</u>	<u>°C</u>	<u>°C</u>
1N4500	80	75	300 (1)	0.5	4.0	-65 to +175	-65 to +200

(1) Derate 2.0 mA dc/°C for T_A above 25°C.

1.4 Primary electrical characteristics. Unless otherwise specified, $T_C = +25^\circ\text{C}$.

Limits	V_{F1} $I_F = 250 \mu\text{A dc}$	V_{F2} $I_F = 1.0 \text{ mA dc}$	V_{F3} $I_F = 10 \text{ mA dc}$	V_{F4} $I_F = 20 \text{ mA dc}$	V_{F5} (1) $I_F = 300 \text{ mA dc}$
	<u>mV dc</u>	<u>mV dc</u>	<u>mV dc</u>	<u>mV dc</u>	<u>V dc</u>
Minimum	470	520	640	670	---
Maximum	560	600	720	770	1.10

Comments, suggestions, or questions on this document should be addressed to DLA Land and Maritime, ATTN: VAC, P.O. Box 3990, Columbus, OH 43218-3990, or emailed to Semiconductor@dla.mil. Since contact information can change, you may want to verify the currency of this address information using the ASSIST Online database at <https://assist.dla.mil>.



1.4 Primary electrical characteristics – continued.

Limits	C $V_R = 0$; $100 \text{ kHz} \leq f \leq 1 \text{ MHz}$; $V_{\text{sig}} = 50 \text{ mV (p-p)}$	t_{rr} $I_F = I_R = 10 \text{ mA dc}$; $R_L = 100 \text{ ohms}$
	<u>pF</u>	<u>nsec</u>
Minimum		
Maximum	4.0	6.0

(1) Pulsed, see 4.5.1.

1.5 Part or Identifying Number (PIN). The PIN is in accordance with MIL-PRF-19500, and as specified herein. See 6.4 for PIN construction example and 6.5 for a list of available PINs.

1.5.1 JAN certification mark and quality level. The quality level designators for encapsulated devices that are applicable for this specification sheet are "JAN" and "JANTX".

1.5.2 Device type. The designation system for the device types of diodes covered by this specification sheet are as follows.

1.5.2.1 First number and first letter symbols. The diodes of this specification sheet use the first number and letter symbols "1N".

1.5.2.2 Second number symbols. The second number symbols for the diodes covered by this specification sheet are "4500".

1.5.3 Suffix symbols. Suffix symbols are not applicable to this specification sheet.

1.5.4 Lead finish. The lead finishes applicable to this specification sheet are listed on QPDSIS-19500.

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 cited in the solicitation or contract.

DEPARTMENT OF DEFENSE SPECIFICATIONS

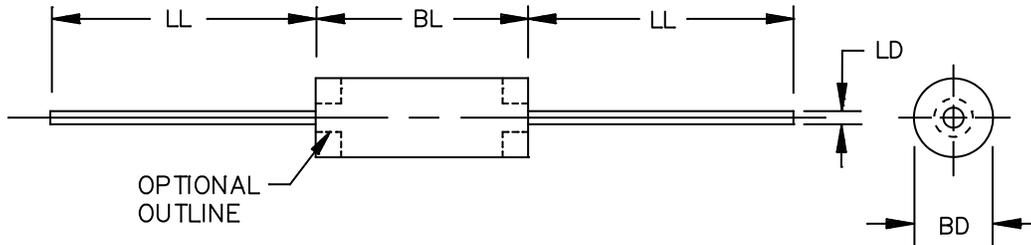
MIL-PRF-19500 – Semiconductor Devices, General Specification for.

DEPARTMENT OF DEFENSE STANDARDS

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

(Copies of these documents are available online at <http://quicksearch.dla.mil>.)

2.3 Order of precedence. Unless otherwise noted herein or in the contract, in the event of a conflict between the text of this document and the references cited herein, the text of this document takes precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.



Symbol	Dimensions				Notes
	Inches		Millimeters		
	Min	Max	Min	Max	
BD	.060	.107	1.52	2.72	2
BL	.140	.300	3.56	7.62	3
LD	.018	.022	0.46	0.56	4
LL	1.000	1.500	25.40	38.10	

NOTES:

1. Dimensions are in inches. Millimeters are given for general information only.
2. Dimension BD shall be measured at the largest diameter.
3. The dimension BL shall include all uncontrolled areas of the device leads.
4. In accordance with ASME Y14.5M, diameters are equivalent to Φ x symbology.

FIGURE 1. Physical dimensions of modified DO-204AA (formerly DO-7) package.

3. REQUIREMENTS

3.1 General. The individual item requirements shall be as specified in [MIL-PRF-19500](#) and as specified herein.

3.2 Qualification. Devices furnished under this specification shall be products that are manufactured by a manufacturer authorized by the qualifying activity for listing on the applicable qualified manufacturer's list (QML) before contract award (see [4.2](#) and [6.3](#)).

3.3 Abbreviations, symbols, and definitions. The abbreviations, symbols, and definitions used herein shall be as specified in [MIL-PRF-19500](#).

3.4 Interface and physical dimensions. The interface and physical dimensions shall be as specified in [MIL-PRF-19500](#) and herein. The device package style is an axial leaded body similar to a modified DO-204AA in accordance with [figure 1](#).

3.4.1 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 requirements (see [6.2](#)).

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

3.6 Electrical test requirements. The electrical test requirements shall be as specified in table I.

3.7 Marking. Marking shall be in accordance with MIL-PRF-19500.

3.7.1 Polarity. The polarity shall be indicated with a contrasting color band to denote the cathode end.

3.8 Workmanship. Devices shall be processed in such a manner as to be uniform in quality and shall be free from other defects that will affect life, serviceability, or appearance.

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 and tables I and II).

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

4.2.1 Group E qualification. Group E inspection shall be performed for qualification or re-qualification only. In case qualification was awarded to a prior revision of the specification sheet that did not request the performance of table II tests, the tests specified in table II herein that were not performed in the prior revision shall be performed on the first inspection lot of this revision to maintain qualification.

4.3 Screening (quality level JANTX only). Screening shall be in accordance with table E-IV of MIL-PRF-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.

Screening	Quality level JANTX only
9	Not required
10	Method 1038 of MIL-STD-750, condition A
(2) 11	I_{R1} and V_{F1}
12	See 4.3.1
13	Subgroup 2 of table I herein; $\Delta I_{R1} \leq 100$ percent of initial value or 15 nA dc, whichever is greater; $\Delta V_{F1} \leq 25$ mV dc

4.3.1 Power burn-in conditions. Power burn-in conditions shall be as follows: Method 1038 of MIL-STD-750, condition B. V_R = rated V_{RWM} ; $f = 50$ to 60 Hz; $I_O = 300$ mA dc or $I_F = 300$ mA dc minimum, $T_A = 75^\circ\text{C}$ maximum.

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 shall be in accordance with table I, subgroup 2 herein.

4.4.2 Group B inspection. Group B inspection shall be conducted in accordance with the tests and conditions specified for subgroup testing in table E-VIB of MIL-PRF-19500 and herein.

<u>Subgroup</u>	<u>Method</u>	<u>Conditions</u>
B3	1027	$V(\text{pk}) = \text{rated } V_{\text{RWM}}$; $f = 50$ to 60 Hz; $I_{\text{O}} = 300$ mA dc minimum; adjust T_{A} or I_{O} to obtain a minimum T_{J} of $+150^{\circ}\text{C}$.

4.4.3 Group C inspection. Group C inspection shall be conducted in accordance with the conditions specified for subgroup testing in table E-VII of MIL-PRF-19500, and as follows.

<u>Subgroup</u>	<u>Method</u>	<u>Conditions</u>
C2	2036	Axial devices: Tension: Condition A, 10 lb (4.54 Kg), 6 lb for hard glass (2.72 Kg), $t = 15$ s. Fatigue: Condition E for all types.
C6	1026	1,000 hours minimum, $V(\text{pk}) = \text{rated } V_{\text{RWM}}$; $f = 50$ to 60 Hz; $I_{\text{O}} = 300$ mA dc minimum; adjust T_{A} or I_{O} to obtain a minimum T_{J} of $+150^{\circ}\text{C}$.

4.4.4 Group E inspection. Group E inspection shall be conducted in accordance with the conditions specified for subgroup testing in table E-IX of MIL-PRF-19500 and as specified in table II herein.

4.5 Method of inspection. Methods of inspection shall be as specified in the appropriate tables and as follows.

4.5.1 Pulse response measurements. The conditions for pulse response measurement shall be as specified in section 4 of MIL-STD-750.

4.5.2 Stored charge. The stored charge shall be measured using a B-line Electronics Corporation Model QS-3 Stored Charge Meter or equivalent. Conditions shall be as specified in table I.

4.5.3 Steady-state operational life. This test 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.

TABLE I. Group A inspection.

Inspection <u>1/</u>	MIL-STD-750		Symbol	Limit		Unit
	Method	Conditions		Min	Max	
<u>Subgroup 1</u>						
Visual and mechanical examination	2071					
<u>Subgroup 2</u>						
Forward voltage	4011	Condition A; $I_F = 250 \mu\text{A}$ dc	V_{F1}	470	560	mV dc
Forward voltage	4011	Condition A; $I_F = 1.0$ mA dc	V_{F2}	520	600	mV dc
Forward voltage	4011	Condition A; $I_F = 10$ mA dc	V_{F3}	660	720	mV dc
Forward voltage	4011	Condition A; $I_F = 20$ mA dc	V_{F4}	670	770	mV dc
Forward voltage	4011	Condition A; $I_F = 300$ mA dc	V_{F5}	---	1.10	V dc
Reverse current leakage	4016	DC method, $V_R = 75$ V dc	I_{R1}		100	nA dc
Breakdown voltage	4021	$I_R = 5.0 \mu\text{A}$ dc	V_{BR}	80	---	V dc
<u>Subgroup 3</u>						
High temperature operation:		$T_A = +150^\circ\text{C}$				
Reverse current leakage	4016	DC method, $V_R = 75$ V dc	I_{R2}		10	μA dc
Capacitance	4001	$V_R = 0$ V dc; $v_{\text{sig}} = 50$ mv (p – p) max; $100 \text{ kHz} \leq f \leq 1 \text{ MHz}$				
Reverse recovery time	4031	Condition B; $I_F = I_R = 10$ mA dc; $R_L = 100 \Omega$, $C \leq 3$ pF	t_{rr}		6	nsec
Stored charge		See 4.5.2	Q_S			
Test 1		$I_F = 0.1$ mA dc		---	4.5	pcb
Test 2		$I_F = 1.0$ mA dc		---	20	pcb
Test 3		$I_F = 10$ mA dc		---	70	pcb

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

TABLE II. Group E inspection (all quality levels) for qualification and requalification only.

Inspection	MIL-STD-750		Sample plan
	Method	Conditions	
<u>Subgroup 1</u>			n = 45, c = 0
Thermal shock (glass strain)	1056	100 cycles 0°C to +100°C	
Temperature cycling	1051	-65°C to +175°C.	
Hermetic seal	1071	Gross leak only.	
Electrical measurements		See table I , subgroup 2.	
<u>Subgroup 2</u>			n = 45, c = 0
Intermittent operation life	1037	10,000 cycles; I _F = I _O = 300 mA dc, T _{on} = T _{off} = 1 minute.	
Electrical measurements		See table I , subgroup 2.	
<u>Subgroup 4</u>			
Thermal impedance curves		See MIL-PRF-19500 .	Sample size N/A
<u>Subgroup 5</u>			
Not applicable			
<u>Subgroup 8</u>			
Resistance to glass cracking	1057	Test condition B. Test until failure occurs or to a maximum of 25 cycles, whichever comes first.	n = 45

5. PACKAGING

5.1 Packaging. For acquisition purposes, the packaging requirements shall be as specified in the contract or order (see 6.2). When packaging of materiel is to be performed by DoD or in-house contractor personnel, these personnel need to contact the responsible packaging activity to ascertain packaging requirements. Packaging requirements are maintained by the Inventory Control Point's packaging activities within the Military Service or Defense Agency, or within the Military Service's system commands. 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.

6. NOTES

(This section contains information of a general or explanatory nature that may be helpful, but is not mandatory. The notes specified in [MIL-PRF-19500](#) are applicable to this specification.)

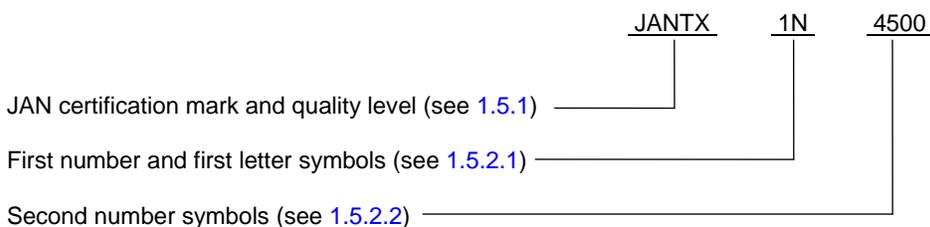
6.1 Intended use. Semiconductors conforming to this specification are intended for original equipment design applications and logistic support of existing equipment.

6.2 Acquisition requirements. Acquisition documents should specify the following:

- a. Title, number, and date of this specification.
- b. Packaging requirements (see 5.1).
- c. Lead finish (see [3.4.1](#)).
- d. The complete PIN, see [1.5](#) and 6.4.

6.3 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 orders for the products covered by this specification. Information pertaining to qualification of products may be obtained from DLA Land and Maritime, ATTN: VQE, P.O. Box 3990, Columbus, OH 43218-3990 or e-mail vqe.chief@dla.mil.

6.4 PIN construction example. The PINs for encapsulated devices are constructed using the following form.



6.5 List of PINs. There are only two PINs for this specification sheet: JAN1N4500 and JANTX1N4500.

6.6 Symbols used in this specification sheet. The following symbols are used in this specification sheet. The definition associated with the symbol shall be as defined in [MIL-PRF-19500](#) or herein.

C	Capacitance.
f	Frequency.
$I_{f(\text{surge})}$	Surge forward current, RMS value of alternating component.
I_F	Forward current, DC value, no alternating component.
I_o	Average forward current, over a full cycle 180 degrees conduction angle, 60 (or 50) Hz, half sine wave equal to $I_{FM}/3.14$ (Pi).
I_R	Reverse current.
Q_S	Stored charge.
t_{rr}	Reverse recovery time.
T_A	Ambient or free air temperature.
T_C	Case temperature.
T_J	Junction temperature.
T_{off}	Turn off time.
T_{on}	Turn on time
T_{op}	Operating temperature.
T_{stg}	Storage temperature.
V_{BR}	Breakdown voltage.
V_F	Forward voltage.
$V(pk)$	Peak voltage.
V_R	Reverse voltage.
V_{RWM}	Working peak reverse voltage.
V_{sig}	Signal voltage.

6.7 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.

Custodians:
Air Force – 85
DLA – CC

Preparing activity:
DLA – CC

(Project 5961–2016–043)

Review activities:
Air Force – 19, 70, 99

NOTE: The activities listed above were interested in this document as of the date of this document. Since organizations and responsibilities can change, you should verify the currency of the information above using the ASSIST Online database at <https://assist.dla.mil>.