

The documentation and process conversion measures necessary to comply with this revision shall be completed by 28 September 1999

INCH-POUND

MIL-PRF-19500/436A
28 June 1999
SUPERSEDING
MIL-S-19500/436(USAF)
28 August 1970

PERFORMANCE SPECIFICATION SHEET

SEMICONDUCTOR DEVICE, DIODE, SILICON, VOLTAGE-VARIABLE CAPACITOR
TYPES 1N5461B THROUGH 1N5476B, AND 1N5461C THROUGH 1N5476C
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 a silicon, voltage-variable-capacitor diode. Three levels of product assurance are provided for each device type as specified in MIL-PRF-19500.

1.2 Physical dimensions. See figure 1 (similar to D0-7)

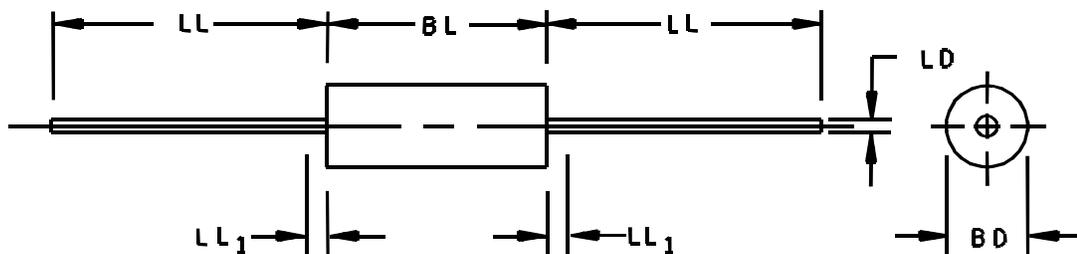
1.3 Ratings and characteristics.

P_T ^{1/}		$V_{RM(wkg)}$	BV $I_R = 10 \mu A$ dc	C $V_R = 4$ V dc $f = 1$ MHz	Capacitance ratio	Q $V_R = 4$ V dc $f = 50$ MHz
Min	<u>mW</u>	<u>V(pk)</u>	<u>V dc</u>	<u>pF</u>	(See table II)	(See table II)
Max	400	30	---	(See table II)	---	---

^{1/} Derate linearly 2.67 mW/°C above 25°C.

OPERATING AMBIENT TEMPERATURE: -65°C TO +175°C
STORAGE TEMPERATURE: -65°C TO +200°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-VAT, 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.



Ltr	Dimensions				Notes
	Inches		Millimeters		
	Min	Max	Min	Max	
LD	.018	.022	0.46	0.56	
BD	.078	.107	1.98	2.72	3
BL	.195	.300	4.95	7.62	3
LL	1.00	1.50	25.40	38.10	
LL1	---	.050	---	1.27	4

NOTES:

1. Dimensions are in inches.
2. Metric equivalents are given for general information only.
3. Package contour optional within BD and length BL. Heat slugs, if any, shall be included within this cylinder but shall not be subject to minimum limit of BD.
4. Within this zone lead, diameter may vary to allow for lead finishes and irregularities other than heat slugs.

FIGURE 1. Physical dimensions

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

MILITARY

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

(Unless otherwise indicated, copies of the above specifications, standards, and handbooks are available from the Standardization Document Order Desk, 700 Robbins Avenue, Building 4D, 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:

- Q..... Quality factor (ratio of reactance to effective resistance)
- TC_C Temperature coefficient of capacitance.

3.3 Interface requirements and physical dimensions. The Interface requirements and physical dimensions shall be as specified in MIL-PRF-19500, MIL-HDBK-6100, and herein.

3.3.1 Lead finish. Lead finish shall be solderable in accordance with MIL-STD-750 and MIL-PRF-19500, and herein. Lead finish may be specified in the contract (see 6.2), without affecting the qualified product status of the device or applicable JAN marking.

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

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

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

3.7 Qualification. Devices furnished under this specification shall be products that are authorized by the qualifying activity for listing on the applicable qualified products 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.

4.2.1 Inspection lot. Inspection lot shall be defined in MIL-PRF-19500, except that the lot accumulation period requirements shall be 6 months in lieu of 6 weeks.

4.3 Screening (JANTX and JANTXV 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
2	48 hrs, $T_A = 200^\circ\text{C}$
3a	Temperature cycling
9	I_R
10	See 4.3.1
11	I_R $\Delta I_R = 100\%$ of initial value or 10 nA dc, whichever is greater.

4.3.1 High temperature reverse bias (HTRB). HTRB conditions are as follows: $T_A = 150^\circ\text{C}$, $V_R = 25\text{ V dc}$, $t = 96\text{ hours}$.

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

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 as follows. Electrical measurements (endpoints) shall be in accordance with the applicable footnotes and steps of table III herein.

Subgroup	Method	Condition
B2	1051	$t_{\text{high}} = 175^\circ\text{C}$; 10 cycles
B3	1027	$V_R = 25\text{ V dc}$, $T_A = 150^\circ\text{C}$, $t = 500\text{ hrs}$.
B6	1032	$t = 1000\text{ hrs}$.
B7	----	$T_A = -65^\circ\text{C}$ to $+85^\circ\text{C}$, $V_R = 4\text{ V dc}$, $n = 22$, $c = 0$; (see 4.4.4).

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 (endpoints) shall be in accordance with the applicable footnotes and steps of table III herein.

Subgroup	Method	Condition
C2	2036	Terminal strength: test condition A; 4 lbs, t = 15 sec. Lead fatigue, test cond. E.
C6	1027	V _R = 25 V dc, T _A = 150°C, t = 1000 hrs.

4.4.4 Temperature coefficient of capacitance. Throughout the temperature range specified the capacitance shall not change by more than .04 %/°C relative to the capacitance value measured at T_A = 25°C. The temperature coefficient of capacitance may be computed by the following formula:

$$TC_C = \frac{C_T (+85^\circ\text{C}) - C_T (-65^\circ\text{C})}{85 + 65} \times \frac{10^2}{C_T (25^\circ\text{C})}$$

(Accuracy is limited by the C_T measurement to ± 0.1 pF.)

TABLE I. Group A inspection.

Inspection 1/	MIL-STD-750		Symbol	Limits		Unit
	Method	Conditions		Min	Max	
<u>Subgroup 1</u>						
Visual and mechanical inspection	2071					
<u>Subgroup 2</u>						
Breakdown voltage	4021	$I_R = 10 \mu\text{A dc}$	BV_R	30	---	V dc
Reverse current	4016	DC method; $V_R = 25 \text{ V dc}$	I_{R1}	---	20	nA dc
Reverse current	4016	DC method; $V_R = 25 \text{ V dc}$ $T_A = 150^\circ\text{C}$	I_{R2}	---	20	$\mu\text{A dc}$
<u>Subgroup 3</u>						
Capacitance	4001	$V_R = 4 \text{ V dc}; f = 1 \text{ MHz}$	C	Col. 3 table II	Col 4 table II	pF
Capacitance ratio	4001	$V_R = 2 \text{ V dc to } V_R = 30 \text{ V dc};$ $f = 1 \text{ MHz}$	---	Col 5 table II	Col 6 table II	---
Quality factor	4036	$V_R = 4 \text{ V dc};$ $f = 50 \text{ MHz}$	Q	Col 7 table II	---	---

For sampling plan, see MIL-PRF-19500.

TABLE II.

Col. 1	Col. 2	Col. 3	Col. 4	Col. 5	Col. 6	Col. 7
Type	Capacitance $V_R = 4 \text{ V dc}$			Capacitance ratio from $V_R = 2 \text{ V dc}$ to $V_R = 30 \text{ V dc}$		Q $V_R = 4 \text{ V dc}$ $f = 50 \text{ MHz}$
	Nom.	Min	Max	Min	Max	Min
	μF	μF	μF			
1N5461B	6.8	6.46	7.14	2.7	3.1	600
1N5462B	8.2	7.79	8.61	2.8	3.1	600
1N5463B	10.0	9.5	10.5	2.8	3.1	550
1N5464B	12.0	11.4	12.6	2.8	3.1	550
1N5465B	15.0	14.25	15.75	2.8	3.1	550
1N5466B	18.0	17.1	18.9	2.9	3.1	500
1N5467B	20.0	19.0	21.0	2.9	3.1	500
1N5468B	22.0	20.9	23.1	2.9	3.2	500
1N5469B	27.0	25.65	28.35	2.9	3.2	500
1N5470B	33.0	31.35	34.65	2.9	3.2	500
1N5471B	39.0	37.05	40.95	2.9	3.2	450
1N5472B	47.0	44.65	49.35	2.9	3.2	400
1N5473B	56.0	53.2	58.8	2.9	3.3	300
1N5474B	68.0	64.6	71.4	2.9	3.3	250
1N5475B	82.0	77.9	86.1	2.9	3.3	225
1N5476B	100.0	95.0	105.0	2.9	3.3	200
1N5461C	6.8	6.66	6.94	2.7	3.1	600
1N5462C	8.2	8.04	8.36	2.8	3.1	600
1N5463C	10.0	9.8	10.2	2.8	3.1	550
1N5464C	12.0	11.76	12.24	2.8	3.1	550
1N5465C	15.0	14.7	15.3	2.8	3.1	550
1N5466C	18.0	17.64	18.36	2.9	3.1	500
1N5467C	20.0	19.60	20.4	2.9	3.1	500
1N5468C	22.0	21.56	22.44	2.9	3.2	500
1N5469C	27.0	26.46	27.54	2.9	3.2	500
1N5470C	33.0	32.34	33.66	2.9	3.2	500
1N5471C	39.0	38.22	39.78	2.9	3.2	450
1N5472C	47.0	46.06	47.94	2.9	3.2	400
1N5473C	56.0	54.88	57.12	2.9	3.3	300
1N5474C	68.0	66.64	69.36	2.9	3.3	250
1N5475C	82.0	80.36	83.64	2.9	3.3	225
1N5476C	100.0	98.0	102.00	2.9	3.3	200

TABLE III. Electrical end-point measurements.

Step	Inspection	MIL-STD-750		Symbol	Limits		Unit
		Method	Details		Min	Max	
1.	Reverse current	4016	$V_R = 25$ V dc; dc method	I_{R1}		20	nA dc
2.	Capacitance	4001	$V_R = 4$ V dc; $f = 1$ MHz	C	Col. 3 of table II	Col. 4 of table II	pF

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

- a. Subgroups 2, 3, and 6, see table III herein, steps 1 and 2.

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

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

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.

5.2 Marking. Unless otherwise specified (see 6.2), marking shall be in accordance with MIL-STD-129.

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.

MIL-PRF-19500/436A

CONCLUDING MATERIAL

Custodians:
Air Force - 11
DLA - CC

Review activities:
Air Force - 19

Preparing activity:
DLA - CC

(Project 5961-F159)RP

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.
3. The preparing activity must provide a reply within 30 days from receipt of the form.

NOTE: This form may not be used to request copies of documents, nor to request waivers, or clarification of requirements on current contracts. Comments submitted on this form do not constitute or imply authorization to waive any portion of the referenced document(s) or to amend contractual requirements.

I RECOMMEND A CHANGE:		1. DOCUMENT NUMBER MIL-PRF-19500/436A	2. DOCUMENT DATE 99/06/28
3. DOCUMENT TITLE SEMICONDUCTOR DEVICE, DIODE, SILICON, VOLTAGE-VARIABLE CAPACITOR TYPES 1N5461B THROUGH 1N5476B, AND 1N5461C THROUGH 1N5476C JAN, JANTX, AND JANTXV			
4. NATURE OF CHANGE <i>(Identify paragraph number and include proposed rewrite, if possible. Attach extra sheets as needed.)</i>			
5. REASON FOR RECOMMENDATION			
6. SUBMITTER			
a. NAME (Last, First, Middle initial)		b. ORGANIZATION	
c. ADDRESS (Include Zip Code)		d. TELEPHONE (Include Area Code) Commercial DSN FAX EMAIL	7. DATE SUBMITTED
8. PREPARING ACTIVITY			
a. Point of Contact Alan Barone		b. TELEPHONE Commercial DSN FAX EMAIL 614-692-0510 850-0510 614-692-6939 alan_barone@dscclia.mil	
c. ADDRESS Defense Supply Center Columbus ATTN: DSCC-VAT Columbus, OH 43216-5000		IF YOU DO NOT RECEIVE A REPLY WITHIN 45 DAYS, CONTACT: Defense Standardization Program Office (DLSC -LM) 8725 John J. Kingman Road, Suite 2533 Fort Belvoir, Virginia 22060-6221 Telephone (703) 767-6888 DSN 427-6888	