MIL-S-19500/329C
4 October 1983
SUPERSEDING
MIL-S-19500/329B
4 March 1966

MILITARY SPECIFICATION

SEMICONDUCTOR DEVICE, DIODE SILICON, VOLTAGE-VARIABLE CAPACITOR TYPES 1N4801A THROUGH 1N4815A AND 1N4801B THROUGH 1N4815B 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 capacitance-tolerance graded silicon voltage-variable capacitor, semiconductor diodes for use as precision devices for frequency-control tuning applications. 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 Ratings and characteristics. (See table V).

Limit	I_F at V_F = 1 V dc	$V_{(BR)}$ I_R = 100 µA	C V_R = 4 V dc f = 1 MHz 2/	$C_{(ratio)}$	P_T 1/	Q f = 1 MHz V_R = 4 V dc	Q f = 50 MHz V_R = 4 V dc	T_{STG} and T_{OP}
	mA dc	V dc	pf	(times)	mW			°C
Minimum	---	(See table V column 7)	(See table V column 1)	(See table V columns 2 through 5)	---	750	15	-65°C
Maximum	100	---			500	---	---	+150°C

1/ Derate linearly 4 mW/°C for ambient temperatures above 25°C
2/ Devices with an A suffix in the type designation have a capacitance tolerance of ±10% and devices with a B suffix have a capacitance tolerance of ±5%.

2. APPLICABLE DOCUMENTS

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

SPECIFICATION

MILITARY

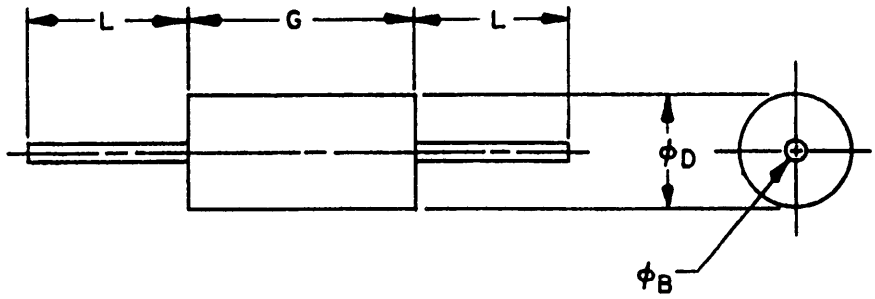
MIL-S-19500 - Semiconductor Devices, General Specification for.

STANDARD

MILITARY

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

Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: Commander, US Army Electronics Research and Development Command; ATTN: DRDEL-ED, Adelphi, MD 20783, using the self-addressed Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document or by letter.



DIMENSIONS					NOTES
LTR	INCHES		MILLIMETERS		
	MIN	MAX	MIN	MAX	
G	.230	.300	5.84	7.62	
ØD	.092	.130	2.34	3.30	4
L	1.000	1.500	25.40	38.10	
ØB	.018	.022	.48	.56	2,3

NOTES:
1. Metric equivalents are given for general information only and are based upon 1.00 inch = 25.4 mm.
2. Goldplated or tinned leads may be supplied provided units conform to subgroups 2 and 4 of Group B and subgroup 2 of Group C.
3. The specified lead diameter applies in the zone between .050 and 1.00 inch from the diode body. Outside this zone the lead diameter is not controlled.
4. The minimum body diameter shall be maintained over .15 inch of body length.

FIGURE 1. Physical dimensions.

(Copies of specifications, standards, handbooks, drawings, and publications required by manufacturers in connection with specific procurement 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. The abbreviations, symbols, and definitions used herein are defined in MIL-S-19500 and as follows:

Q - - - - - - - - - - Quality factor (ratio of reactance to effective resistance)

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

3.4 Marking. Device marking shall be in accordance with MIL-S-19500. At the manufacturer's option, the following marking may be omitted:

a. Manufacturer's identification.

b. Country of origin.

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

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.

4.3 Screening (JANTX and JANTXV). 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-S-19500)	Measurement JANTX and JANTXV levels
9	I_{R1}
10	Except T_A = 145°C ±5°C.
11	I_{R1}; ΔI_{R1} = 100 percent of initial value or 0.5 nA dc whichever is greater.
12	See 4.3.1
13	Subgroup 2 of table I herein; ΔI_{R1} = 100 percent of initial value or 0.5 nA dc, whichever is greater.

4.3.1 Power burn-in test conditions. Power burn-in conditions shall be as follows:

T_A = 145°C +5°C, -0°C; V_R = V_{RWM} (column 6 of table V herein)

4.4 Quality conformance inspection. Quality conformance inspection shall be in accordance with MIL-S-19500.

4.4.1 Preconditioned-unit constituency of inspection lots. All semiconductor devices covered herein, in each inspection lot presented for quality conformance inspection, shall have been subjected to the following preconditioning:

a. Maintained at T_A = +145°C +5°C, -0°C, minimum, for 172 hours, minimum.

b. Five exposure cycles in accordance with MIL-STD-750, Method 1051, Test Condition F, except that the exposure time at each temperature extreme shall be five minutes, minimum.

c. Seal evaluation in accordance with MIL-STD-750, Method 1071, Test Condition D.

4.4.2 Group A inspection. Group A inspection shall be conducted in accordance with MIL-S-19500, and table I herein.

4.4.3 Group B inspection. Group B inspection shall be conducted in accordance with the conditions specified for subgroup testing in table IVb (JAN, JANTX, JANTXV) 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.

4.4.4 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 Capacitance tests. All capacitance tests shall be made at f = 1 MHz, unless otherwise specified herein.

4.5.2 Temperature coefficient of capacitance test. Throughout the temperature range specified, the capacitance shall not change by more than the amount specified relative to the capacitance value measured at T = 25°C. (Refer to test method 4071 in MIL-STD-750 for guidance in the performance of this test.)

4.5.3 Time limit for end points. End-point tests for qualification and quality conformance inspection shall be completed within 96 hours after completion of the last test in the subgroup.

4.5.4 Terminal strength (lead fatique). Fracture of glass meniscus only, is not to be considered a failure.

4.5.5 High-temperature life, (operating). The markings shall be legible after the test.

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 should specify the following:

a. Lead finish

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

Review activities:
Army - AR
Navy - SH
Air Force - 85, 99
DLA - ES

User activities:
Army - MI
Navy - CG, MC
Air Force - 14, 19

Agent:
DLA - ES

Preparing activity:
Army - ER

(Project 5961-0895)

TABLE I. Group A inspection.

Inspection	MIL-STD-750 Method	MIL-STD-750 Conditions	LTPD JANS	LTPD JAN TX TXV	Symbol	Limits Min	Limits Max	Units
Subgroup 1								
Visual and mechanical examination	2071				---	---	---	---
Subgroup 2								
Forward voltage	4011	I_F = 100 mA dc			V_F	---	1	V dc
Reverse current	4016	V_R (see table V, col 6)			I_{R1}	---	5	nA dc
Breakdown voltage	4021	I_R = 100 µA dc;			$V_{(BR)}$	(see table V col 7)	---	V dc
Subgroup 3								
High temperature operation:		T_A = +150°C +5, -0°C						
Reverse current	4016	V_R (see table V col 6)			I_{R2}	---	5	µA dc
Subgroup 4								
Quality factor	4036	V_R = 4 V dc f = 50 MHz			Q_1	15	---	---
Quality factor	4036	V_R = 4 V dc f = 1 MHz			Q_2	750	---	---
Capacitance	4001	V_R = 4 V dc (see 4.5.1)			C	(see table V col 1)	---	pf
Capacitance ratio	4001	From $V_{R(1)}$ = 0.1 V dc to $V_{R(2)}$ = 4 V dc (see 4.5.1 and 4.5.2)			---	(see table V col 2)	(see table V col 3)	
Capacitance ratio	4001	From $V_{R(2)}$ = 4 V dc to V_{RWM} (see table V col. 6) (see 4.5.1 & 4.5.2)			---	(see table V col 4)	(see table V col 5)	
Subgroups 5, 6 and 7								
Not applicable								

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

Inspection	MIL-STD-750		LTPD
	Method	Conditions	
Subgroup 1			
Solderability	2026		
Resistance to solvents	1022		
Subgroup 2			
Thermal shock (temperature cycling)	1051	Test condition F	
Hermetic seal	1071		
a. Fine leak			
b. Gross leak			
Electrical measurements		See table IV, steps 1 and 2	
Subgroup 3			
Steady-state operation life (LTPD)	1027	$V_R = V_{RWM}$ (column 6 of table V) T_A = 145°C +5°C, -0°C	
Electrical measurements		See table IV, steps 1 and 2	
Subgroup 4			
Decap internal visual design verification	2075		
Subgroup 5			
Not applicable			
Subgroup 6			
High-temperature life (nonoperating)	1032	T_A = +150°C	
Electrical measurements		See table IV, steps 1 and 2	

TABLE III. Group C inspection for all quality levels.

Inspection	MIL-STD-750		LTPD
	Method	Conditions	
Subgroup 1			
Physical dimensions	2066	See figures 1.	
Subgroup 2			
Thermal shock (glass strain)	1056	Test condition A	
Terminal strength Tension	2036	Test condition A weight; 4 lb, t = 15 s ±3s	
Hermetic seal	1071		
a. Fine leak			
b. Gross leak			
Moisture resistance	1021		
External visual	2071		
Electrical measurements		See table IV, steps 1 and 2	
Subgroup 3			
Shock	2016		
Vibration, variable frequency	2056		
Constant acceleration	2006		
Electrical measurements		See table IV, steps 1 and 2	
Subgroup 4			
Salt atmosphere (corrosion)	1041		
Subgroup 5			
Not applicable			
Subgroup 6			
Steady-state operation life	1026	$V_R = V_{RWM}$ (column 6 of table V) T_A = +145°C +5, -0°C	
Electrical measurements		See table IV, steps 1 and 2 and 4.5.5	

TABLE IV. Groups B and C electrical measurements.

Step	Inspection	MIL-STD-750 Method	MIL-STD-750 Conditions	Symbol	Limits Min	Limits Max	Units
1.	Change in diode capacitance (See 4.5.2)	4001	V_R = 4 V dc	ΔC	---	±5% of initial value	
2.	Reverse current	4016	$V_R = V_{RWM}$ (see table V, column 6)	I_{R1}	---	5	nA dc

TABLE V. Ratings and characteristics

Type (See 1.1)	Col 1	Col 2	Col 3	Col 4	Col 5	Col 6	Col 7
	Nominal capacitance at V_R = 4 V dc	Capacitance ratio From $V_{R(1)}$ = 0.1 V dc to $V_{R(2)}$ = 4 V dc		Capacitance ratio From $V_{R(2)}$ = 4 V dc to V_{RWM}		V_{RWM}	Breakdown voltage at I_R = 100 μA dc
		Min	Max	Min	Max		
	pF	(times)		(times)		V	V dc
1N4801A, B	6.8	2.4	2.56	.260	.285	100	110
1N4802A, B	8.2	2.42	2.58	.257	.283	100	110
1N4803A, B	10	2.34	2.50	.255	.283	100	110
1N4804A, B	12	2.35	2.49	.244	.270	100	110
1N4805A, B	15	2.37	2.49	.233	.247	100	110
1N4806A, B	18	2.36	2.48	.242	.254	90	99
1N4807A, B	22	2.35	2.46	.241	.252	90	99
1N4808A, B	27	2.35	2.46	.276	.287	65	72
1N4809A, B	33	2.35	2.46	.285	.295	60	66
1N4810A, B	39	2.34	2.44	.295	.306	55	61
1N4811A, B	47	2.33	2.43	.311	.320	50	55
1N4812A, B	56	2.32	2.42	.345	.354	40	44
1N4813A, B	68	2.30	2.40	.396	.406	30	33
1N4814A, B	82	2.26	2.36	.481	.491	20	22
1N4815A, B	100	2.24	2.33	.480	.490	20	22

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