The documentation and process conversion measures necessary to comply with this revision shall be completed by 19 September 1991

INCH-POUND

MIL-S-19500/278E
19 January 1991
SUPERSEDING
MIL-S-19500/278D
20 June 1977

MILITARY SPECIFICATION

SEMICONDUCTOR DEVICE, DIODE, SILICON, MATCHED PAIR
TYPES 1N4306, 1N4306M, 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, matched pair, diodes used in switching circuits. The 'M' suffix device shall be two individually matched diodes. These two diodes shall be shipped in a separate container (see 5.1.1). Two levels of product assurance are provided for each device type as specified in MIL-S-19500.

1.2 Physical dimensions. See figures 1 and 2.

1.3 Maximum ratings. T_A = +25°C unless otherwise specified.

Type	V_R	I_O	I_{FRM}	I_{FSM}		P_{FM} 1/
				1 s	1 µs	
	V dc	mA dc	mA	mA (pk)	A (pk)	mW
1N4306	50	75	115	500	2	250

1/ Derate linearly, 2.0 mA/°C from +25°C to +150°C.
Operating temperature: T_A = -65°C to +150°C.
Storage temperature: T_A = -65°C to +175°C.
Barometric pressure reduced (altitude operation): 8 mm Hg.

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 45444-5280 or by 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

DISTRIBUTION STATEMENT A. Approved for public release; distribution is unlimited.

1.4 Electrical characteristics, each diode.

Limit	V_{F1} I_F = 100 µA dc	V_{F2} I_F = 1 mA dc	V_{F3} I_F = 10 mA dc	V_{F4} I_F = 50 mA dc	I_{R1} V_R = 50 V dc
	V dc	V dc	V dc	V dc	nA dc
Min	.440	.560	.670	.750	---
Max	.550	.670	.810	1.00	50

Limit	I_{R2} V_R = 75 V dc	I_{R3} V_R = 50 V dc T_A = +150°C	C_T V_R = 0 f = 1 MHz	t_{rr} 1/ I_F = 10 mA dc I_R = 10 mA dc Recovery to I_R = 1 mA dc
	µA dc	µA dc	pF	ns
Min	---	---	---	---
Max	5	50	2.0	4

1/ The reverse recovery time (method 4031, condition A, of MIL-STD-750) at T_J = +125°C shall not exceed three times the +25°C limits.

1.5 Electrical characteristics, matched pair. Each pair has the following characteristics in addition to those specified in 1.4.

Limit	ΔV_{F1} I_F = 0.1 to 10 mA dc T_A = -55°C to +125°C	ΔV_{F2} I_F = 10 to 50 mA dc T_A = -55°C to +125°C
	mV dc	mV dc
Min	---	---
Max	10	20

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.

STANDARDS

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 Documents Order Desk, Building 4D, 700 Robbins Avenue, Philadelphia, PA 19111-5094.

2.2 Order of precedence. In the event of a conflict between the text of this document and the references cited herein, 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 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 shall be as specified in MIL-S-19500.

3.3 Design, construction, and physical dimensions. The design, construction, and physical dimensions shall be as specified in MIL-S-19500, and figures 1 and 2 herein. The 1N4306M is a modified version of the 1N4306 consisting of two matched discrete diodes without the final encapsulation (see 5.1.1).

3.3.1 Lead finish. Lead finish shall be solderable as defined in MIL-S-19500, MIL-STD-750, and herein. Where a choice of finish is desired, it shall be specified in the contractor purchase order (see 6.2).

3.4 Marking. Marking shall be in accordance with MIL-S-19500, except at the option of the manufacturer, the following marking may be omitted from the body of the device but retained on the initial container.

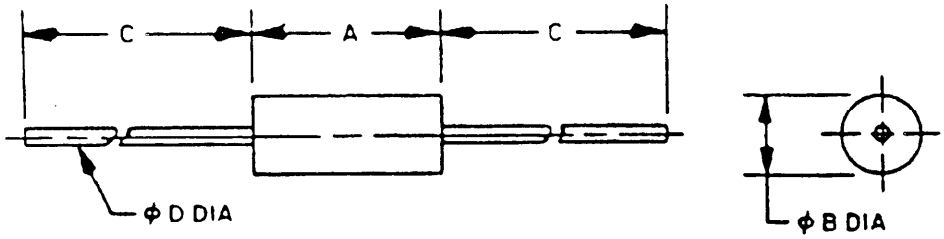
a. Country of origin.

b. Manufacturer's identification.

c. Lot identification code.

d. The "1N" portion of the type designation.

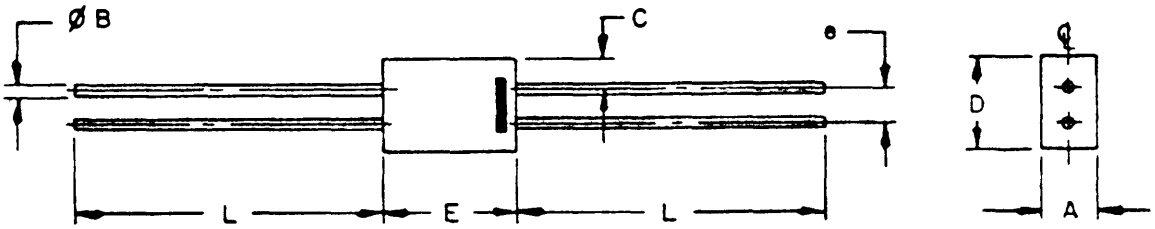
3.5 Polarity. The polarity shall be indicated by a contrasting color band to denote the cathode end.

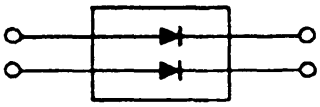


Ltr	Dimensions				Notes
	Inches		Millimeters		
	Min	Max	Min	Max	
A	.230	.300	5.84	7.62	
ØB	.085	.107	2.16	2.72	
C	1.000	1.500	25.40	38.10	
ØD	.018	.022	0.46	0.56	3, 4

NOTES:
1. Dimensions are in inches.
2. Metric equivalents are given for general information only.
3. The specified lead diameter applies in the zone between .050 (1.27 mm) and 1.000 (25.40 mm) from the diode body. Outside of this zone, the lead diameter is not controlled.
4. Both leads shall be within the specified dimension.
5. The minimum body diameter shall be maintained over .15 inch (3.8 mm) of body length.

FIGURE 1. Physical dimensions, type 1N4306.





CONNECTION DIAGRAM

Ltr	Dimensions			
	Inches		Millimeters	
	Min	Max	Min	Max
A	.162	.182	4.11	4.62
ØB	.019	.021	.48	.53
C	.083	.097	2.11	2.46
D	.280	.300	7.11	7.62
E	.435	.455	11.05	11.56
e	.104	.112	2.64	2.84
L	.900	1.500	22.86	38.10

NOTES:
1. Dimensions are in inches.
2. Metric equivalents are given for general information only.
3. ØB is applicable to all leads.

FIGURE 2. Physical dimensions, type 1N4306M.

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 (JANTX and JANTXV levels only). 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)	Measurements
	JANTX and JANTXV levels
11	V_{F4}, and I_{R1} 1/
12	MIL-STD-750, method 1038, test condition A, t = 48 hours (see 4.3.1)
13	Subgroup 2 of table I herein, V_{F4} and I_{R1}: ΔV_{F4} = ± 25 mV (pk); ΔI_{R1} = ± 10 nA dc or 100 percent from the initial value, whichever is greater.

1/ I_{R1} measurement shall not be indicative of an open condition.

4.3.1 Power burn-in conditions. Power burn-in conditions are as follows: T_A = +150°C; V_R = 40 V dc; I_F = 0 mA dc; t = 48 hours minimum.

4.4 Quality conformance inspection. Quality conformance inspection shall be in accordance with MIL-S-19500, and as specified herein.

4.4.1 Group A inspection. Group A inspection shall be conducted in accordance with MIL-S-19500, and table I herein. (End-point electrical measurements shall be in accordance with the applicable steps of table V herein.)

4.4.2 Group B inspection. Group B inspection shall be conducted in accordance with the conditions specified for subgroup testing in table IVb (JANTX and 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 V herein.

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 table III herein. Electrical measurements (end points) and delta requirements shall be in accordance with the applicable steps of table V herein.

4.4.4 Group E inspection. Group E inspection shall be conducted in accordance with the conditions specified for subgroup testing in table V of MIL-S-19500, and table IV herein. Electrical measurements (end points) and delta requirements shall be in accordance with the applicable steps of table V herein.

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

4.5.1 Reverse recovery time. MIL-STD-750, method 4031, condition B; $I_F = I_R = 10$ mA dc; recovery to $I_R = 1$ mA dc.

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						
Forward voltage (each diode)	4011	$I_F = 100$ µA dc	V_{F1}	.440	.550	V dc
Forward voltage (each diode)	4011	$I_F = 1$ mA dc	V_{F2}	.560	.670	V dc
Forward voltage (each diode)	4011	$I_F = 10$ mA dc	V_{F3}	.670	.810	V dc
Forward voltage (each diode)	4011	$I_F = 50$ mA dc	V_{F4}	.750	1.00	V dc
Reverse current (each diode)	4016	$V_R = 50$ V dc; dc method	I_{R1}	---	50	nA dc
Reverse current (each diode)	4016	$V_R = 75$ V dc; dc method	I_{R2}	---	5	µA dc
Voltage match	4011	$I_F = 0.1$ to 10 mA dc $T_A = -55°C$ to $+125°C$	ΔV_{F1}	---	10	mV dc
Voltage match	4011	$I_F = 10$ to 50 mA dc $T_A = -55°C$ to $+125°C$	ΔV_{F2}	---	20	mV dc

See footnote at end of table.

TABLE I. Group A inspection - Continued.

Inspection 1/	MIL-STD-750		Symbol	Limits		Unit
	Method	Conditions		Min	Max	
Subgroup 3						
High temperature operation Reverse current (each diode)	4016	T_A = +150°C; V_R = 50 V dc	I_{R3}	---	50	µA dc
Low temperature operation	4011	T_A = -65°C I_F = 10 mA dc	V_{F3}	.822	.900	V dc
Subgroup 4						
Capacitance (each diode)	4001	V_R = 0; F = 1 MHz	C_T	---	2.0	pF
Reverse recovery time (each diode)	4031	Condition A or B; I_F = I_R = 10 mA dc Recovery to I_R = 1 mA dc	t_{rr}	---	4	ns
Subgroup 5						
Not applicable						
Subgroup 6						
Surge current	4066	I_O = 75 mA dc, I_{FSM} = 500 mA (pk) 10 1-second surges, 1 surge/minute				
Electrical measurements		See table V, steps 1, 2, and 3				
Subgroup 7						
Not applicable						

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

TABLE II. Group B inspection for JANTX and JANTXV.

Inspection 1/	MIL-STD-750	
	Method	Conditions
Subgroup 1		
Solderability	2026	
Resistance to solvents	1022	
Subgroup 2		
Thermal shock (temperature cycling)	1051	
Hermetic seal a. Fine leak b. Gross leak	1071	
Electrical measurements		See table V, steps 1, 2, and 3
Subgroup 3 2/		
Steady-state operation life (each diode)	1026	I_O = 50 mA dc; V_R = 50 V(pk), f = 60 Hz
Electrical measurements		See table V, steps 1, 2, 3, 4, and 5
Subgroup 4		
Decap internal visual (design verification)	2075	
Subgroup 5		
Not applicable		
Subgroup 6		
High-temperature life (nonoperating)	1031	T_A = +150°C
Electrical measurements		See table V, steps 1, 2, 3, 4, and 5

1/ For sampling plan, see MIL-S-19500.
2/ Devices from this group are not shippable.

TABLE III. Group C inspection.

Inspection 1/	MIL-STD-750	
	Method	Conditions
Subgroup 1		
Physical dimensions	2026	See figures 1 and 2
Subgroup 2 2/		
Thermal shock (glass strain)	1056	
Terminal strength	2036	Test condition A; weight = 4 pounds; t = 30 s
Hermetic seal a. Fine leak b. Gross leak	1071	
Moisture resistance	1021	Omit initial conditioning
Electrical measurements		See table V, steps 1, 2, and 3
Subgroup 3		
Shock	2016	
Vibration, variable frequency	2056	
Constant acceleration	2006	
Electrical measurements		See table V, steps 1, 2, and 3
Subgroup 4		
Salt atmosphere (corrosion)	1041	
Subgroup 5		
Not applicable		

See footnote at end of table.

TABLE III. Group C inspection - Continued.

Inspection 1/	MIL-STD-750	
	Method	Conditions
Subgroup 6 2/		
Steady state operation life (each diode)	1026	I_O = 50 mA dc; V_R = 50 V(pk) f = 60 Hz
Electrical measurements		See table V, steps 1, 2, 3, 4, and 5
Subgroup 7		
Not applicable		

1/ For sampling plan, see MIL-S-19500.
2/ Devices from this subgroup are not shippable.

TABLE IV. Group E inspection (all quality levels) for qualification only.

Inspection	MIL-STD-750		Qualification conformance sampling
	Method	Conditions	
Subgroup 1			22 devices, c = 0
Thermal shock (glass strain)	1056	+0°C to +100°C, 100 cycles	
Electrical measurements		See table V, steps 1, 2, and 3	
Subgroup 2			45 devices, c = 0
Steady-state dc blocking life	1038	Condition A; 1,000 hours	
Electrical measurements		See table V, steps 1, 2, 3, 4, and 5	
Subgroup 3			3 devices, c = 0
Destructive physical analysis	2101		
Subgroup 4			
Not applicable			

TABLE V. Groups A, B, C, and E electrical end-point measurements.

Step	Inspection	MIL-STD-750		Symbol	Limits		Unit
		Method	Conditions		Min	Max	
1.	Forward voltage	4011	I_F = 50 mA dc	V_{F4}	.75	1.0	V dc
2.	Reverse current	4016	DC method, V_R = 50 V dc	I_{R1}	---	50	nA dc
3.	Capacitance	4001	V_R = 0, f = 1.0 MHz	C_T	---	2.0	pF
4.	Forward voltage	4011	I_F = 50 mA dc	ΔV_{F4}	---	±25	nV dc
5.	Reverse current	4016	DC method, V_R = 50 V dc	ΔI_{R1}	25 percent of initial value or 10 nA dc (whichever is greater) Change from initial group A readings.		

5. PACKAGING

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

5.1.1 Preparation for delivery of the 1N4306M. The 1N4306M shall be packaged in a manner that will maintain their matched integrity during shipping and handling.

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 must 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 may be specified (see 3.3.1).

6.3 Substitution information. Devices covered by this specification are substitutable for the manufacturer's and user's Part or Identifying Number (PIN). This information in no way implies that manufacturer's PIN's are suitable as a substitute for the military PIN.

Military PIN	Manufacturer's CAGE code	Manufacturer's and user's PIN

6.4 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.

CONCLUDING MATERIAL

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

Review activities:
Army - AR, MI, MU
Air Force - 19, 85, 99
DLA - ES
Navy - OS, SH

User activities:
Army - SM
Navy - AS, CG, MC

Preparing activity:
Navy - EC

Agent:
DLA - ES

(Project 5961-1192)