

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

INCH-POUND

MIL-PRF-19500/483B
 20 July 1999
 SUPERSEDING
 MIL-S-19500/483A
 20 November 1994

PERFORMANCE SPECIFICATION SHEET

SEMICONDUCTOR DEVICE, SILICON, HIGH-POWER, THREE PHASE,
 FULL WAVE BRIDGE RECTIFIER
 PART NUMBERS M19500/483-01 THROUGH M19500/483-04 JANTX

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, three phase, full wave bridge rectifiers, intended for use in applications at frequencies of 1 kHz or less. One level of product assurance is provided for each device type as specified in MIL-PRF-19500.

1.2 Physical dimensions. See figure 1. See 3.3.

1.3 Maximum ratings.

M19500/483-	V_{RWM}	Bridge 1/ I_{O1} at $T_C = +55^\circ C$	Bridge 2/ I_{O2} at $T_C = +100^\circ C$	$i_f(\text{surge})$ $I_O = I_{O1}$ $T_C = +55^\circ C$ $t_p = 8.3 \text{ ms}$	Barometric pressure reduced
	<u>V (pk)</u>	<u>A dc</u>	<u>A dc</u>	<u>A (pk)</u>	<u>mmHg</u>
01	200	25	18.5	150	8
02	400	25	18.5	150	8
03	600	25	18.5	150	33
04	800	25	18.5	150	33

1/ Derate from 25 A dc at +55°C to 18.5 A dc at +100°C (144 mA dc/°C).

2/ Derate from 18.5 A dc at +100°C to 0 A dc at +150°C (370 mA dc/°C).

Operating temperature: -65°C to +150°C

Storage ambient temperature: -65°C to +150°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 Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document or by letter.

AMSC N/A

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

FSC 5961

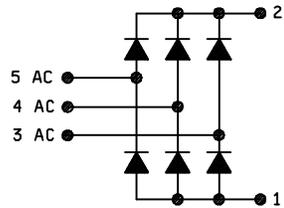
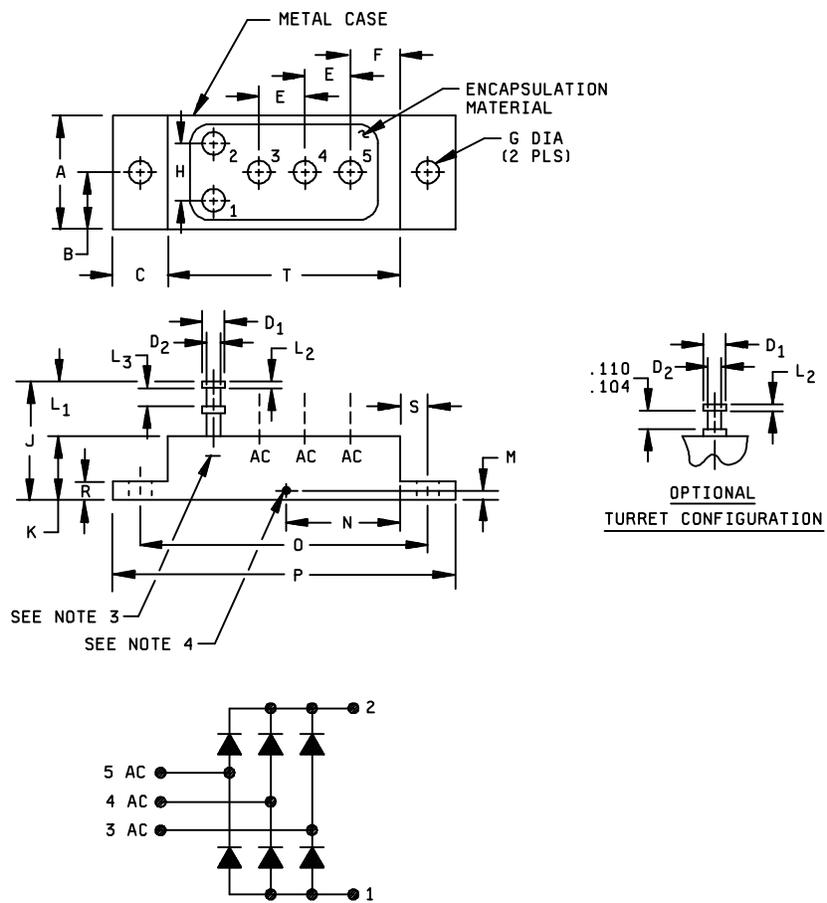


FIGURE 1. Physical dimensions.

MIL-PRF-19500/483B

Ltr	Dimensions			
	Inches		Millimeters	
	Min	Max	Min	Max
A	.730	.770	18.54	19.56
B	.355	.395	9.02	10.03
C	.355	.395	9.02	10.03
D ₁	.141	.151	3.58	3.84
D ₂	.108	.118	2.74	3.00
E	.355	.395	9.02	10.03
F	.230	.270	5.84	6.86
G	.149	.189	3.78	4.80
H	.355	.395	9.02	10.03
J		.820		20.83
K	.390	.590	9.91	14.99
L ₁	.240	.320	6.10	8.13
L ₂	.015	.030	0.38	0.76
L ₃	.100	.125	2.54	3.18
M	.040	.060	1.02	1.52
N	.720	.780	18.29	19.81
O	1.84	1.90	46.74	48.26
P	2.22	2.28	56.39	57.91
R	.090	.150	2.29	3.81
S	.168	.208	4.27	5.28
T	1.47	1.53	37.34	38.86

NOTES:

1. Dimensions are in inches.
2. Metric equivalents are given for general information only.
3. Polarity shall be marked as shown on drawing.
4. Point at which T_C is read shall be in metal part of case as shown on drawing.

FIGURE 1. Physical dimensions – Continued.

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. Abbreviations, symbols, and definitions used herein shall be as specified in MIL-PRF-19500.

n = number of diodes per leg

N = number of diodes per leg

3.3 Interface requirements and physical dimensions. The interface requirements and physical dimensions shall be as specified in MIL-PRF-19500 and figure 1, herein.

3.3.1 Internal construction. The rectifier bridge shall consist of a metal and plastic encased assembly of single or parallel discrete diodes. Each discrete diode shall be a glass-to-metal, ceramic-to-metal, or fused metal oxide-to-metal hermetically sealed package. The silicon die in each discrete diode shall be metallurgically bonded directly to the terminal pins. The completed assembly of diodes and other internal structures shall be encapsulated in a plastic material which polymerizes to a rigid condition by virtue of a chemical cross-linking mechanism. The rectifier bridge shall be free of voids either visible or as evidenced by failure to pass the environment test specified. Only those discrete diodes which have met these requirements and the screening of 4.3 shall be used in the rectifier bridge. Discrete diodes shall be manufactured and tested by the rectifier bridge manufacturer. Parallel diodes may be utilized in construction of this device.

3.3.2 Terminal finish. Terminal finish shall be as solderable in accordance with MIL-PRF-19500, MIL-STD-750 and herein. Where a choice of terminal finish is desired, it shall be specified in the acquisition document (see 6.2).

3.3.3 Parallel diode construction. For bridge design that employs more than one diode per leg and n equals the number of diodes per leg, the following design and matching conditions must be approved by the qualifying activity.

- a. Individual diode V_F matching at least the minimum rated room temperature (I_{O1} / n). The V_F must be to within 20 mV on each diode.
- b. The same diode design shall be used in each parallel leg.
- c. The design shall ensure similar lead lengths and uniform heat paths, so that all diodes in each leg are at similar junction temperatures.

3.4 Marking. Marking shall be in accordance with MIL-PRF-19500. The following markings may be used, JANTX devices - JXM, JTXM, JANTXM. Except that the M Part or Identifying Number (PIN) as shown in 1.3 shall be used in lieu of the type designation.

3.4.1 Polarity. Polarity shall be as marked on figure 1.

3.5 Electrical performance characteristics. Unless otherwise specified herein, the electrical performance characteristics are as specified in paragraph 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 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.

4.3 Screening (JANTX level 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.

4.3.1 Discrete diode screening. One hundred percent of the internal discrete diodes shall be subjected to the following.

Screen (see table IV of MIL-PRF-19500)	Measurement
	JANTX
3c	MIL-STD-750, method 3101 (see 4.5.4)
9	Not applicable
11	V_F at I_F/n and I_{R2}/n of subgroup 2 of table I herein.
12	See 4.3.1.1
13	V_F at I_F/n and I_{R2}/n of subgroup 2 of table I herein. $\Delta V_{F1}/n = \pm 0.05$ V dc; $\Delta I_{R2} = 100$ percent of initial value or ± 250 nA dc, whichever is greater. Scope display evaluation (see 4.5.3).

4.3.1.1 Power burn-in conditions. Power burn-in conditions shall be in accordance with MIL-STD-750, method 1038, test condition B, $T_A =$ room ambient as defined in the general requirements and mounting conditions of MIL-STD-750 (see 4.5), $V_{RWM} =$ rated V_{RWM} (see 1.3), $I_O = 3$ nA dc, $f = 50 - 60$ Hz.

4.3.2 Assembly screening. One hundred percent of the completed assemblies shall be subjected to the following:

Screen (see table IV of MIL-PRF-19500)	Measurement
	JANTX
3a	MIL-STD-750, method 1051, condition F, -55°C to +150°C, 10 cycles, no dwell required at +25°C.
End points	Subgroup 2 of table I herein; Dielectric withstanding voltage (see 4.5.1)

4.4 Conformance inspection. Conformance inspection shall be performed on the finished rectifier assemblies in accordance with MIL-PRF-19500.

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.

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 paragraphs 4.4.2.1. Electrical measurements (end-points) shall be in accordance with the applicable inspections of table I, group A, subgroup 2 herein.

4.4.2.1 Group B inspection, table VIb of MIL-PRF-19500.

Subgroup	Method	Conditions
B2	1051	Condition F, 25 cycles.
B2	1071	Not applicable
B3	1027	$I_0 = 0$ A dc; $T_A = +150^\circ\text{C}$; $V_{RWM} = 80$ percent of rated V_{RWM} (see 1.3); $f = 60$ Hz. Sampling plan $n = 10$ devices, $c = 0$.
B5		Operational thermal cycling, (see 4.5.5); Sampling plan $n = 10$, $c = 0$.
B6		Not applicable.
B7	3105	See 4.5.2, $n = 22$, $c = 0$

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.

4.4.3.1 Group C inspection, table VII of MIL-PRF-19500.

Subgroup	Method	Conditions
C2	1056	Not applicable.
C2	2036	Test condition A, 10 pounds, $t = 30$ seconds.
C2	2036	Test condition D1, $t = 10$ seconds, 2 inch-pounds.
C2 and C3	1071	Not applicable.
C5	1001	Pressure = rated (see 1.3), $I_R = 1.0$ μA dc maximum, $V_R =$ rated V_R (see 1.3), terminal to case, sampling plan = 12 devices, $c = 0$.
C6	1026	$I_0 = 0$ A dc; $T_A = +150^\circ\text{C}$; $V_{RWM} = 80$ percent rated V_{RWM} (see 1.3), $f = 60$ Hz. Sampling plan $n = 10$, $c = 0$.
C7		Not applicable
C8	4066	$V_{RWM} =$ rated V_{RWM} (see 1.3), bridge $I_0 = 25$ A dc (entire bridge biased); $T_C = +55^\circ\text{C}$ $+10^\circ\text{C}$, -0°C ; $i_{f(\text{surge})} = 150$ A (pk); $t_p = 8.3$ ms; 10 surges per leg at minimum 1 minute intervals; Sampling plan = 22 devices, $c = 0$.
		Alternate condition: Each leg may be biased separately to $I_0 = 12.5$ A dc, all other conditions the same as above.

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

4.5.1 Dielectric withstanding voltage. This test shall be performed with the metal case of the assembly connected to ground and all four terminals connected to the high potential side of a dc power supply or a scope display test set. The voltage applied between the terminals and the case, shall be 2,800 volts, and shall be held at that level for 10 seconds. Any discontinuity or dynamic instability of the trace, or a breakdown current in excess of 10 μ A dc, shall be cause for rejection.

4.5.2 Junction temperature test. The maximum T_J of any diode in the bridge at the below specified conditions shall be $\leq +175^\circ\text{C}$. The test shall be performed in accordance with MIL-STD-750, method 3105, except V_{F4} shall be $\geq V_{F2A}$. Test conditions shall be as follows:

- a. $T_C = +55^\circ\text{C}$, $I_O = 25$ A dc, $I_{ref} = 10$ mA dc, or
- b. $T_C = +100^\circ\text{C}$, $I_O = 18.5$ A dc, $I_{ref} = 10$ mA dc.

4.5.3 Scope display evaluation. This test shall be conducted in accordance with method 4023 of MIL-STD-750. The following conditions shall apply:

- a. Test condition B.
- b. Horizontal sensitivity: 50 to 200V/division.
- c. Vertical sensitivity: 5 to 20 μ A/division.
- d. Reverse current over the knee: 50 μ A minimum.

4.5.4 Thermal impedance. $Z_{\theta JX}$ measurement shall be performed in accordance with method 3101 of MIL-STD-750:

- a. Measurement current (I_M) +10 mA.
- b. Heating current (I_H) 10 A minimum.
- c. Heating time (t_H) 10 ms maximum.
- d. Measurement time delay (t_{MD}) 100 μ s maximum.

The maximum limit for $Z_{\theta JX}$ under these conditions is 1.5°C/W .

4.5.5 Operational thermal cycling. This test shall be performed by connecting a three phase 60 Hz sine wave input of 10 to 20 V rms to the ac terminals of the bridge. The resistive load or input voltage shall be made variable in order to maintain a rated bridge output current of 25 A dc. Bridge case temperature shall be maintained at $+55^\circ\text{C}$ except during the cooling cycle when case temperature shall be permitted to drop 20°C maximum. Life-test duration shall be 2,000 cycles with a heating time of 8 minutes, +2, -0 minutes and a cooling time ≥ 2 minutes.

TABLE I. Group A inspection.

Inspection <u>1/</u>	MIL-STD-750		Symbol	Limits		Unit
	Method	Conditions		Min	Max	
<u>Subgroup 1</u>						
Visual and mechanical inspection	2071					
<u>Subgroup 2</u>						
Forward voltage / leg	4011	$I_F = 39 \text{ A dc (pk)}$ $t_p = 8.3 \text{ ms maximum;}$ duty cycle ≤ 2 percent	V_{F1}			
M19500/483-01					1.3	V (pk)
M19500/483-02					1.3	V (pk)
M19500/483-03					1.3	V (pk)
M19500/483-04					1.5	V (pk)
Reverse current / leg	4016	DC method; $V_R = \text{rated } V_{RWM}$ (see 1.3)	I_{R1}		1.0	$\mu\text{A dc}$
Reverse current (discrete diode)	4016	DC method; $V_R = \text{rated } V_{RWM}$ (see 1.3)	I_{R2}		1.0	$\mu\text{A dc}$
Breakdown voltage / leg	4021	$I_R = 50 \mu\text{A dc}$	$V_{(BR)}$			
M19500/483-01				240		V dc
M19500/483-02				460		V dc
M19500/483-03				660		V dc
M19500/483-04				880		V dc
<u>Subgroup 3</u>						
High temperature operation:		$T_C = +100^\circ\text{C}$				
Reverse current / leg	4016	DC method; $V_R = \text{rated } V_{RWM}$ (see 1.3)	I_{R3}		200	$\mu\text{A dc}$
Low temperature operation:		$T_A = -65^\circ\text{C}$				
Reverse current / leg	4016	DC method; $V_R = \text{rated } V_{RWM}$ (see 1.3)	I_{R4}		2.0	$\mu\text{A dc}$
<u>Subgroup 4</u>						
Reverse recovery time / leg	4061	Condition B, $I_F = 0.5 \text{ A}$, $I_R = 1.0 \text{ A}$, $I_{Rec} = 0.25 \text{ A}$	t_{rr}		2.5	μs

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

TABLE II. Groups A, B, and C delta measurements. ^{1/}

Step	Inspection ^{1/}	MIL-STD-750		Symbol	Limits		Unit
		Method	Conditions		Min	Max	
1.	Junction temperature rise	3105	See 4.5.2	ΔT_J		+175	°C

^{1/} The delta measurements for table VIb (JANTX) of MIL-PRF-19500 are as follows:

- a. Subgroup B5, see table II herein, step 1.

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 Departments' 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.)

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 as specified.
- c. Type designation and product assurance level.

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 extensiveness 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 Manufacturer's 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:

Army - CR
Navy - EC
Air Force - 11
NASA - NA
DLA - CC

Preparing activity:

DLA - CC

(Project 5961-2183)

Review activities:

Army - AR, SM
Air Force - 19, 80, 99
Navy - AS, CG, MC

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.
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-19500/483B

2. DOCUMENT DATE (YYYYMMDD)

3. DOCUMENT TITLE

SEMICONDUCTOR DEVICE, SILICON, HIGH-POWER, THREE PHASE, FULL WAVE BRIDGE RECTIFIER, PART NUMBER M19500/483-01 THROUGH M19500/483-04 JANTX

4. NATURE OF CHANGE *(Identify paragraph number and include proposed rewrite, if possible. Attach extra sheets as needed.)*

5. REASON FOR RECOMMENDATION

6. SUBMITTER

a. NAME *(Last, First Middle Initial)*

b. ORGANIZATION

c. ADDRESS *(Include Zip Code)*

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

7. DATE SUBMITTED
(YYYYMMDD)

8. PREPARING ACTIVITY

a. NAME
Alan Barone

b. TELEPHONE *(Include Area Code)*
(1) Commercial
614-692-0510
(2) DSN
850-0510

c. ADDRESS *(Include Zip Code)*
DSCC-VAC
3990 East Broad Street
Columbus, Ohio 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

DD Form 1426, FEB 1999 (EG)

WHS/DIOR, Feb 99

PREVIOUS EDITIONS ARE OBSOLETE.