

The documentation and process conversion measures necessary to comply with this revision shall be completed by 13 July 1998.

INCH-POUND

MIL-PRF-19500/554A
13 April 1998
SUPERSEDING
MIL-S-19500/554
28 May 1992

PERFORMANCE SPECIFICATION SHEET

SEMICONDUCTOR DEVICE, DIODE, SILICON,
SCHOTTKY BARRIER, FAST RECOVERY,
TYPE 1N6392
JAN, JANTX, JANTXV, AND JANHC

This specification is approved for use by the Department of the Air Force, and 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, fast recovery, Schottky barrier semiconductor diode. Three levels of product assurance are provided for each device type as specified in MIL-PRF-19500. One level of product assurance is provided for each unencapsulated device type.

1.2 Physical dimensions. See figure 1 (D0-5) and figures 2 and 3 (JANHC die).

1.3 Maximum ratings.

Type	V _{RRM} and V _{RWM} 1/	V _{RSM}	V _R 1/	I _{FM} 2/	I _O 3/	I _{FSM}	T _{op} T _{STG}
				T _C = +115° C	T _C = +115° C		
	V(pk)	V(pk)	V dc	A dc	A dc	A (pk)	° C
1N6392	45	54	45	60	54	1,000	-55 to +175

1/ Full rated V_{RRM} and V_{RWM} is applicable over the range of T_C = -55° C to +163° C for I_{FM} = 0. Full rated V_R is applicable over the temperature range of T_C = -55° C to +148° C. When V_R = 45 V dc and T_C = +148° C, then T_J = +175° C.

2/ Average current with a 50 percent duty cycle square wave including reverse amplitude equal to the magnitude of full rated V_{RWM}. Derate linearly at 1.25 A dc/° C for T_C > +115° C.

3/ Average current with an applied sine wave peak value equal to the magnitude of full rated V_{RWM}. Derate linearly at 1.125 A dc/° C for T_C > +115° C.

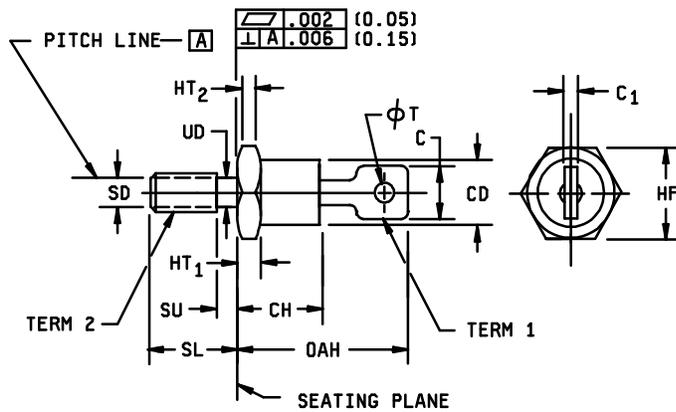
1.4 Unless otherwise noted, primary electrical characteristics at T = +25° C.

Type	Max V _{FM1} I _{FM} = 120 A (pk)	Max V _{FM3} I _{FM} = 10 A (pk)	Max I _{RM} V _{RM} = 45 V (pk)		Max C _T V _R = 5 V dc	Max R _{θJC}
			T _J = +175° C	T _J = +25° C		
	V (pk)	V (pk)	mA (pk)	mA (pk)	pF	° C/W
1N6392	0.82	0.51	600	20	3,000	1.0

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.

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

FSC 5961

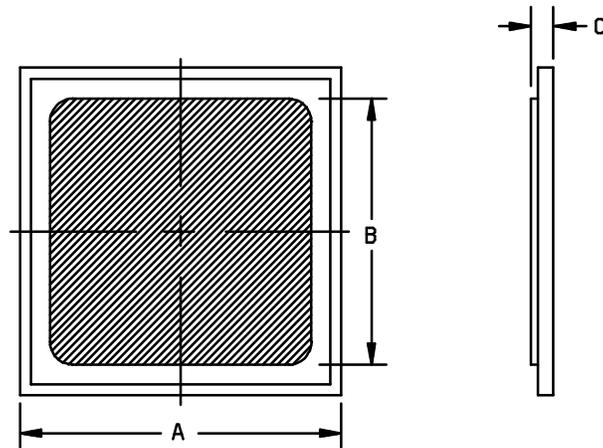


Ltr	Dimensions				Notes
	Inches		Millimeters		
	Min	Max	Min	Max	
C		.375	9.52		6
C1	.025	.080	0.64	2.03	
CD		.667		16.94	
CH		.450		11.43	
HF	.669	.688	17.00	17.47	
HT1	.115	.200	2.93	5.08	
HT2	.060		1.53		5
OAH	.750	1.00	19.05	25.40	
SD					4
SL	.422	.453	10.72	11.50	
SU		.090		2.28	
UD	.220	.249	5.59	6.32	3
ΦT	.140	.175	3.56	4.44	

NOTES:

1. Dimensions are in inches. Metric equivalents and given for general information only.
2. Units must not be damaged by torque of 30 inch-pound applied to .25-28 UNF-2B nut assembled on thread.
3. Length of incomplete or undercut threads of UD.
4. Maximum pitch diameter of plated threads shall be basic pitch diameter .2268 inch (5.76 mm) reference (FED-STD-H28, Screw-Thread Standards for Federal Services).
5. A chamfer or undercut on one or both ends of the hex portion is optional; minimum base diameter at seating plane .600 inch (15.24 mm).
6. The angular orientation and peripheral configuration of terminal 1 is undefined, however, the major surfaces over dimensions C and C₁ shall be flat and the minimum cross-sectional area from the hole to any point on the periphery shall be .0025 in² (1.59 mm²).
7. In accordance with ANSI Y14.5M, diameters are equivalent to ϕx symbology.

FIGURE 1. Physical dimensions (similar to D0-5).



A, B, and C versions

Ltr	Dimensions			
	Inches		Millimeters	
	Min	Max	Min	Max
A	.179	.187	4.55	4.75
B	.169	.173	4.29	4.39
C	.009	.013	.23	.33

NOTES:

1. Dimensions are in inches.
2. Metric equivalents are given for general information only.
3. The metallization characteristics of the die are:
 JANHC version: Anode (front) Cathode (back)
 A Ag Ag
 B Al Ag
 C Al Au

FIGURE 2. JANHCA die dimensions (A version).

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

3.3 Interface requirements and physical dimensions. The Interface requirements and physical dimensions shall be as specified in MIL-PRF-19500, and figures 1 (D0-5) and 2 (die) herein.

3.3.1 Lead finish. Lead finish shall be solderable as defined in MIL-PRF-19500, MIL-STD-750, and herein.

3.3.2 Polarity. Devices shall have the cathode electrically connected to the stud.

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

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

3.6 Electrical test requirements. The electrical test requirements shall be the subgroups specified in paragraphs 4.4.2 and 4.4.3.

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 6.2).

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 JANHC devices. JANHC devices shall be qualified in accordance with MIL-PRF-19500.

4.3 Screening (JANTX and JANTXV levels only). Screening shall be in accordance with table 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.

Screen (see table IV of MIL-PRF-19500)	Measurement
	JANTX and JANTXV levels
3a	Temperature cycling
9	Not applicable
11	Reverse energy test (see 4.5.2) and table I, subgroup 4 herein
12	MIL-STD-750, method 1038, test condition A, $T_C = +150^\circ\text{C}$ $V_{RM} = 36\text{ V (pk)}$, $I_O = 0$, $f = 60\text{ Hz}$; Alternate test: $V_R = 36\text{ V dc}$ and $T_C = +150^\circ\text{C}$.
13 <u>1/</u>	Subgroup 2 of table I herein; $\Delta V_{FM1} = \pm 0.05\text{ V (pk)}$ $\Delta I_{RM1} = \pm 100\text{ percent or } 5\text{ mA dc}$, whichever is greater. Scope display evaluation (see 4.5.3).

1/ All JAN level devices shall be subjected to the scope display evaluation test.

4.3.1 Screening (JANHC). Screening of JANHC die shall be in accordance with MIL-PRF-19500.

4.4 Conformance inspection. Conformance inspection shall be 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.

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 (end-points) shall be in accordance with table I, subgroup 2 herein.

Subgroup	Method	Condition
B2	4066	$I_{FSM} = 1,000\text{ A (pk)}$; $V_{RM} = 45\text{ V (pk)}$, $I_O = 54\text{ A dc}$, 10 surges of 8.3 ms each at 1 minute intervals. $+100^\circ\text{C} < T_C < +125^\circ\text{C}$.
B3	1027	$T_C = +150^\circ\text{C}$, $V_{RM} = 36\text{ V (pk)}$ or $V_R = 36\text{ V dc}$.
B5	4081	See 4.5.4.

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 (end-points) shall be in accordance with table I, subgroup 2 herein.

Subgroup	Method	Condition
C2	2036	Test condition A, 15 lbs, t = 15 s. Test condition F (method B), 15 pounds, t = 15 s. Test condition D1, 3 inch-pound, t = 15 s. Test condition D2, 30 inch-pound, t = 15 s.
C2	2071	
C6	1026	$I_O = 22.5$ A dc, $V_{RM} = 45$ V (pk), $T_C = +145^\circ\text{C} \pm 3^\circ\text{C}$.
C7		Operational power cycling, $I_O = 50$ A dc, T_C (low) = $+40^\circ\text{C}$ $+0^\circ\text{C}$, -15°C ; T_C (high) = 115°C $+5^\circ\text{C}$, -0°C ; 5,000 cycles; 22 devices, c = 0, (see 4.5.6)

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

4.5.1 Pulse measurements. Conditions for pulse measurements shall be as specified in section 4 of MIL-STD-750.

4.5.2 Peak reverse energy test. The peak reverse energy test is to be performed as on figure 3. The Schottky rectifier under test must be capable of absorbing the reverse energy, as defined, and meet the electrical requirements of table I, subgroup 4 herein.

4.5.3 Scope display evaluation. A curve trace visual display of the reverse characteristics (voltage versus current) shall be made using a calibration of 10 mA per division vertical sensitivity, and 10 V dc per division horizontal sensitivity. Increase the reverse voltage until the reverse current reaches 50 mA minimum to 70 mA maximum. Observe the curve characteristics. Any device with an erratic pattern, such as double trace, other than capacitance effects, intermittence, discontinuities other than zener noise at the knee of the curve, or shorts shall be removed from the lot. Time limit for this test shall be 5 seconds minimum.

This test shall be the last test performed on the device in the 100 percent screening tests. The percent defective result for evaluation against the percent defective allowed (PDA) shall be determined prior to the results of this test.

4.5.4 Thermal resistance. Thermal resistance measurements shall be performed in accordance with MIL-STD-750, method 4081. The case reference temperature shall be held to equilibrium within the range of $+20^\circ\text{C}$ to $+70^\circ\text{C}$ during the power application, and shall be measured at the hex flat. The maximum limit of $R_{\theta JC}$ shall be 1.0°C/W . The following parameter measurements shall be used:

$$I_{F1} = 20 \text{ A dc minimum to } 50 \text{ A dc maximum}$$

$$I_{F2} = 100 \text{ mA dc}$$

4.5.5 Reverse current at peak reverse voltage, alternate test. The reverse current at peak reverse voltage test requirement may be satisfied by performing the reverse energy test of 4.5.2 and measuring breakdown voltage to ensure $V_{BR} \geq 54$ V (pk) with $I_{RM} = 2.0$ A (pk).

4.5.6 Operating power cycling. One complete cycle for this test shall consist of the following two steps: Step 1, heat the case to the T_C (high) specified by passing the specified forward current through the diode under test. The reverse voltage shall be only enough to permit the reverse current to flow, and in any event should be a maximum of 5 V dc. Step 2, remove the applied current and allow the case temperature to cool to the T_C (low) specified. No time limit is applicable to the steps, but the cycling must be continuous until the required number of cycles has been completed. It is permissible to force cool the device during step 2.

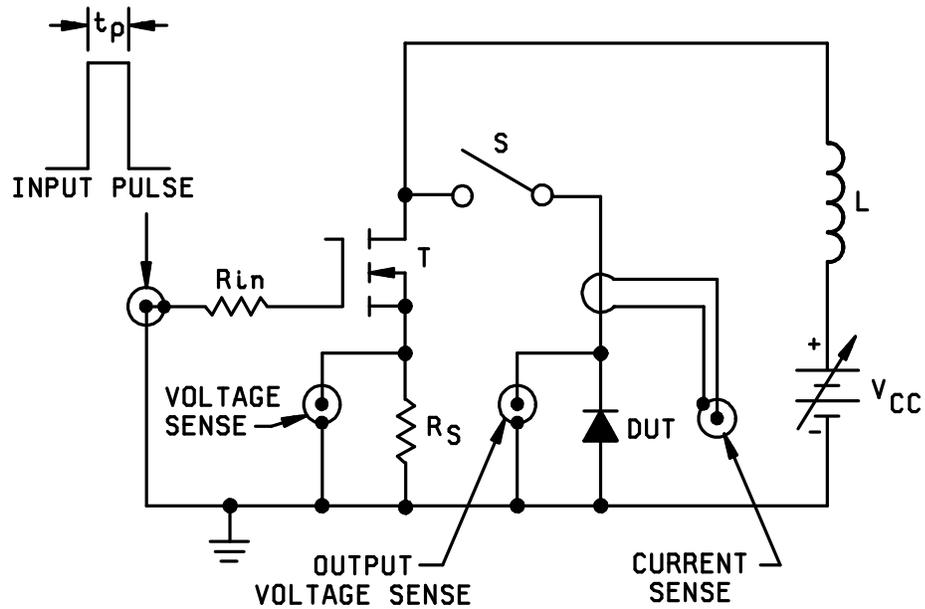
This test shall be considered a qualification test only, and needs to be performed during the initial qualification and as applicable to verify the adequacy of a design change.

4.5.7 Inspection conditions. Unless otherwise specified in MIL-PRF-19500 or herein, all inspections shall be conducted at a case temperature (T_C) of $+25^\circ\text{C} \pm 3^\circ\text{C}$.

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>						
Forward voltage	4011	$I_{FM} = 120 \text{ A (pk)}$ pulsed (see 4.5.1)	V_{FM1}	0.82	V (pk)	
		$I_{FM} = 60 \text{ A (pk)}$ pulsed (see 4.5.1)	V_{FM2}	0.68	V (pk)	
		$I_{FM} = 10 \text{ A (pk)}$ pulsed (see 4.5.1)	V_{FM3}	0.51	V (pk)	
Reverse current	4016	Pulsed method, (see 4.5.1) $V_{RM} = 45 \text{ V (pk)}$	I_{RM1}	20.0	mA (pk)	
<u>Subgroup 3</u>						
High temperature operation						
Reverse current leakage	4016	Pulse method, (see 4.5.1) $V_{RM} = 45 \text{ V (pk)}$ $T_J = +175^\circ \text{ C}$ $T_J = +125^\circ \text{ C}$ $T_C = -55^\circ \text{ C}$	I_{RM2} I_{RM3}	600 60	mA (pk) mA (pk)	
Low temperature operation						
Reverse current leakage	4016	Pulse method, (see 4.5.1) $V_{RM} = 45 \text{ V (pk)}$	I_{RM4}	400	mA (pk)	
Forward voltage	4011	Pulsed (see 4.5.1) $I_F = 10 \text{ A (pk)}$	V_{FM4}	0.69	V (pk)	
<u>Subgroup 4</u>						
Reverse current leakage at peak reverse voltage	4016	Pulse method, (see 4.5.1) $V_{RSM} = 54 \text{ V (pk)}$ (alternate test, see 4.5.5)	I_{RM5}	2.0	A (pk)	
Capacitance	4001	$V_R = 5 \text{ V dc}$; $f = 100 \text{ KHz} \leq f \leq 1 \text{ Mhz}$	C_T	3,000	pF	
<u>Subgroups 5, 6, and 7</u>						
Not applicable						

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



Input pulse
 $V_G = 10 \text{ V dc}$
 $R_G = 50 \Omega$
 $P.W. \approx 30 \mu\text{s}$
 Duty cycle ≤ 1 percent

$R_{in} = 50 \Omega, 1 \text{ W}$
 $R_S = 0.1 \Omega, 1 \text{ W}$
 $V_{CC} \approx 10 \text{ V dc}$
 $L = 260 \mu\text{H}$
 $T = \text{IRF130/2N6756 or equivalent}$

PROCEDURES:

1. With S open, adjust pulse width to test current of 2 A across R_S .
2. Close S, verify test current with current sense.
3. Read peak output voltage (see 4.5.5).

FIGURE 3. Peak reverse energy test circuit.

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 Agencies' 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-PRF-19500.

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.
- b. Lead finish may be specified (see 3.3.1).
- c. Case outlines (see figures 1 and 2).
- d. For die acquisition, the JANHC letter version should be specified (see figure 2).
- e. Product assurance level and type designator.

6.3 Suppliers of JANHC die. The qualified JANHC suppliers with the applicable letter version (example, JANHCA1N6392) will be identified on the QPL.

JANHC ordering information	
PIN	Manufacturer
1N6392	12969
	JANHCA1N6392
	JANHCB1N6392
	JANHCC1N6392

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 Products List QPL-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.

CONCLUDING MATERIAL

Custodians:
Air Force - 17

Preparing activity:
DLA - CC

Review activities:
Air Force - 11, 19, 85, 99

(Project 5961-F128)

STANDARDIZATION DOCUMENT IMPROVEMENT PROPOSAL		
<u>INSTRUCTIONS</u>		
<p>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.</p> <p>2. The submitter of this form must complete blocks 4, 5, 6, and 7.</p> <p>3. The preparing activity must provide a reply within 30 days from receipt of the form.</p> <p>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.</p>		
I RECOMMEND A CHANGE:	1. DOCUMENT NUMBER MIL-PRF-19500/554A	2. DOCUMENT DATE 13 April 1998
3. DOCUMENT TITLE SEMICONDUCTOR DEVICE, DIODE, SILICON, SCHOTTKY BARRIER, FAST RECOVERY, TYPE 1N6392 JAN, JANTX, JANTXV, AND JANHC		
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) 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@dsc.dla.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 Quality and Standardization Office 5203 Leesburg Pike, Suite 1403, Falls Church, VA 22041-3466 Telephone (703) 756-2340 DSN 289-2340	