The documentation and process conversion measures necessary to comply with this revision shall be completed by 22 Oct 94.

METRIC

MIL-S-19500/620B
22 July 1994
SUPERSEDING
MIL-S-19500/620A
21 March 1994

MILITARY SPECIFICATION

SEMICONDUCTOR DEVICE, HERMETIC, DIODE, SILICON, RECTIFIER,
SCHOTTKY BARRIER, TYPES 1N5822 AND 1N5822US
JAN, JANTX, JANTXV, JANS, JANHC, AND JANKC

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, Schottky barrier rectifier diodes. Four levels of product assurance are provided for each device type as specified in MIL-S-19500. Two levels of product assurance for die (element evaluation).

1.2 Physical dimensions. See figures 1, 2, and 3 (JANC die) dimensions.

1.3 Maximum ratings.

Types	V_{RWM} 1/	I_{O1} 2/	I_{FSM}	T_{STG}	T_J
	V (pk)	A dc	A (pk)	°C	°C
1N5822, 1N5822US	40	3.0	80	-65 to +150	-65 to +125

1/ Derate linearly at 1.2 V/°C above T_L or T_{EC} = +90°C where T_L is at L = 9.52 mm (.375 inch).
2/ Derate linearly at 43 mA/°C above T_L or T_{EC} = +55°C where T_L is at L = 9.52 mm (.375 inch).

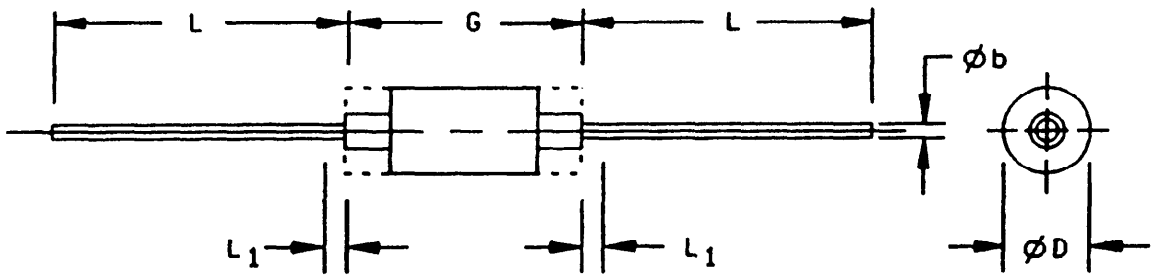
1.4 Primary electrical characteristics. Unless otherwise specified, primary electrical characteristics at T_A = +25°C.

Types	Max V_{FM1} I_{FM} = 1.0 A	Max V_{FM2} I_{FM} = 3.0 A	Max V_{FM3} I_{FM} = 9.4 A	Max I_{RM} V_{RM} = 40 V dc pulsed method (see 4.5.1)		Max $R_{\theta JL}$ or $R_{\theta JEC}$	Max $Z_{\theta JX}$
				T_J = +25°C I_{RM1}	T_J = +100°C I_{RM2}	9.52 mm (.375 inch) lead length or end cap	
	V (pk)	V (pk)	V (pk)	mA	mA	°C/W	°C/W
1N5822	0.40	0.50	0.70	0.10	10.0	30	3.0
1N5822US	0.40	0.50	0.70	0.10	10.0	10	3.0

Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: Defense Electronics Supply Center, ATTN: DESC-ELD, 1507 Wilmington Pike, Dayton, OH 45444-5765, by using the Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document or by letter.

FSC 5961

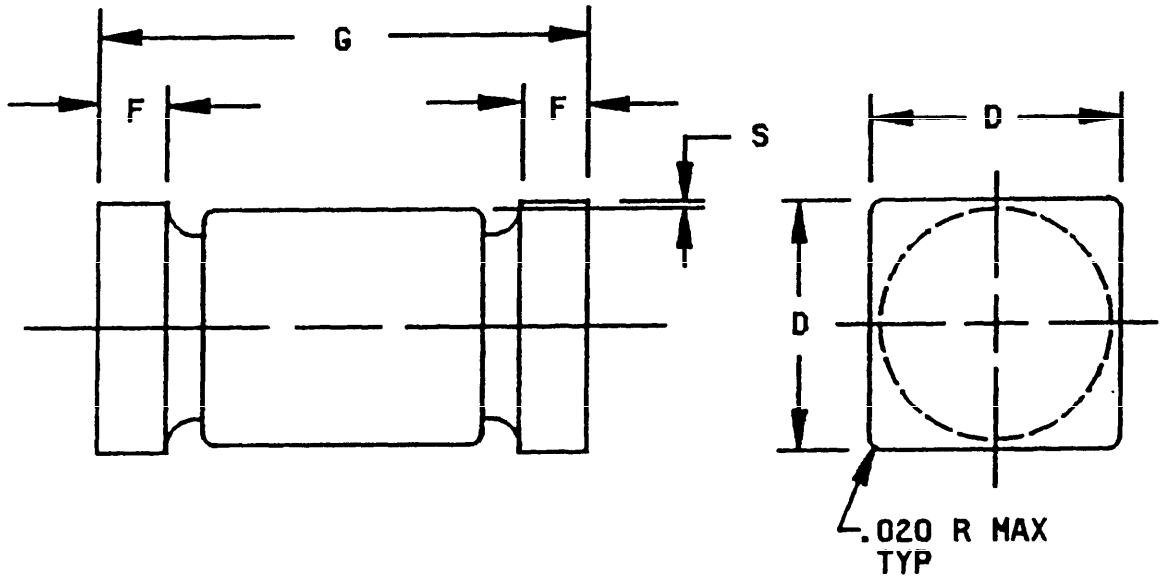
AMSC N/A
DISTRIBUTION STATEMENT A. Approved for public release; distribution is unlimited.



Symbol	Dimensions				Notes
	Millimeters		Inches		
	Min	Max	Min	Max	
ØB	0.91	1.07	.036	.042	
ØD	2.92	3.68	.115	.145	3
G	3.30	4.95	.130	.195	
L	22.86	33.02	.900	1.300	
L_1		0.76		.030	4

NOTES:
1. Dimensions are in millimeters.
2. Inch-pound equivalents are given for general information only.
3. Symbol ØD shall be measured at the largest diameter.
4. Lead diameter is not controlled in this zone to allow for flash, lead finish build-up, and mirror irregularities other than heat slugs.

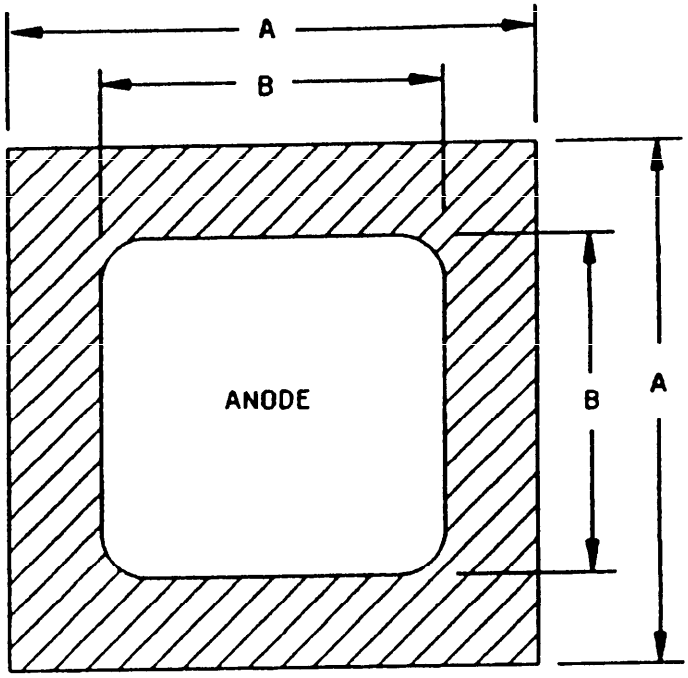
FIGURE 1. Physical dimensions of 1N5822.



Symbol	Dimensions			
	Millimeters		Inches	
	Min	Max	Min	Max
G	5.08	5.72	.200	.225
D	3.48	3.76	.137	.148
F	0.48	0.71	.019	.028
S	0.08	---	.003	---

NOTES:
1. Dimensions are in millimeters.
2. Inch-pound equivalents are given for general information only.

FIGURE 2. Physical dimensions of surface mount family, 1N5822US (D-5B).



BACKSIDE IS CATHODE

Symbol	Dimensions			
	Millimeters		Inches	
	Min	Max	Min	Max
A	1.57	1.63	.062	.064
B	1.32	1.37	.052	.054

Design data

Metallization:
Top: (Anode) . . . . . AL
Back: (Cathode). . . . . Au

AL thickness . . . . . 25,000 A minimum.
Gold thickness . . . . . 4,000 A minimum.
Chip thickness . . . . . 0.254 mm (10 mils) ±.051 (2 mils).

FIGURE 3. JANC (A-version) die dimensions.

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 Defense Printing Service Detachment Office, Building 4D (Customer Service), 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 takes precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

3. REQUIREMENTS

3.1 Associated detail specification. The individual item requirements shall be in accordance with MIL-S-19500 and as specified herein.

3.2 Abbreviations, symbols, and definitions. Abbreviations, symbols, and definitions used herein shall be as specified in MIL-S-19500, and as follows:

JANH	High reliability product assurance level for unencapsulated devices.
JANK	Space reliability product assurance level for unencapsulated devices.

3.3 Design, construction, and physical dimensions. The design, construction, and physical dimensions shall be as specified in MIL-S-19500 and on figures 1, 2, and 3 herein. Plastic packages are prohibited. The US Government's preferred system of measurement is the metric SI system. However, since this item was originally designed using inch-pound units of measurement, in the event of conflict between the metric and inch-pound units, the inch-pound units shall take precedence.

3.3.1 Lead material and finish. Lead material shall be copper clad steel with a minimum of 70 percent copper by weight. Lead finish shall be in accordance with MIL-S-19500 and MIL-STD-750. Where a choice of lead finish is desired, it shall be specified in the acquisition document (see 6.2).

3.3.2 Diode construction. All devices shall be metallurgically bonded, noncavity double plug construction in accordance with the requirements of category II or III (see MIL-S-19500).

3.3.2.1 Surface mount. The U version shall be considered structurally identical to the non-U version except for lead attach.

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

3.4.1 Marking for US devices. US-suffix parts are to be marked with the polarity identification. Initial container package marking will be in accordance with MIL-S-19500.

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.

4.2.1 Construction verification. Cross sectional photos from three devices shall be submitted in the qualification report.

4.2.2 JANHC and JANKC devices. Qualification for devices shall be in accordance with appendix H of MIL-S-19500. This testing may be performed on a TO-5 package in lieu of the axial leaded package.

4.3 Screening (JANTX, JANTXV, and JANS levels only). Screening shall be in accordance with table II of MIL-S-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 II of MIL-S-19500)	Measurement		
	JANS level	JANTX and JANTXV levels	JAN level
3a	Temperature cycling	Temperature cycling	Temperature cycling in accordance with MIL-S-19500, JANTX level.
3c 1/	Thermal impedance (see 4.5.3)	Thermal impedance (see 4.5.3)	Thermal impedance (see 4.5.3)
9	I_{R1} and V_{FM2}	Not applicable	Not applicable
10 2/	T_A = +90°C; V_{RWM} = 40 V (pk); I_O = 0, half sine wave, f = 60 Hz	T_A = +90°C; V_{RWM} = 40 V (pk); I_O = 0, half sine wave, f = 60 Hz	Not applicable
11	ΔI_{R1} ≤ 100 percent of initial reading or .05 mA, whichever is greater. ΔV_{FM2} ≤ ±50 mV dc.	I_{R1} and V_{FM2}	Not applicable
12	See 4.3.2	See 4.3.2, t = 48 hours	Not applicable
13	Subgroup 2 of table I herein; ΔI_{R1} ≤ 100 percent of initial reading or .05 mA, whichever is greater; V_{FM2} ≤ ±50 mV dc.	Subgroup 2 of table I herein; ΔI_{R1} ≤ 100 percent of initial reading or .05 mA whichever, is greater; V_{FM2} ≤ ±50 mV dc.	Not applicable

1/ Thermal impedance shall be performed any time after sealing provided. Temperature cycling is performed in accordance with MIL-S-19500, screen 3 prior to this thermal impedance.

2/ Junction temperature (T_J) is not to exceed +100°C with V_{RWM} = 40 V (pk). T_J is affected by the device mounting thermal resistance when parasitic power is generated by the temperature dependent leakage current. Until this leakage becomes significant near thermal runaway, T_J remains approximately equal to T_A or T_L for I_O = 0.

4.3.1 Screening (JANHC or JANKC). Screening of die shall be in accordance with MIL-S-19500, appendix H. As a minimum, die shall be 100 percent probed in accordance with group A, subgroup 2.

4.3.2 Burn-in conditions. Burn-in conditions are as follows: I_F = 3 A dc. Mounting and test conditions in accordance with MIL-STD-750, method 1038, test condition B.

4.3.2.1 Mounting. Devices may be mounted using any convenient method including the temporary attachment of leads on US suffix devices, provided that the parts are burned-in at $T_J \geq +110°C$.

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

4.4.1 Group A inspection. Group A inspection shall be conducted in accordance with MIL-S-19500, and table I herein. The following test conditions shall be used for $Z_{\theta JX}$, group A inspection:

a. I_M measurement current . . . . . 1 mA to 10 mA.

b. I_H forward heating current . . . . . 10 A to 20 A.

c. t_H heating time . . . . . 10 ms.

d. t_{MD} measurement delay time . . . . . 100 μs maximum.

4.4.2 Group B inspection. Group B inspection shall be conducted in accordance with the conditions specified for subgroup testing in table IVb (JAN, JANTX, and JANTXV) of MIL-S-19500. Electrical measurements (end-points) and delta requirements shall be in accordance with the applicable steps of table I, group A, subgroup 2 herein.

4.4.2.1 Group B inspection, table IVa (JANS) of MIL-S-19500.

Subgroup	Method	Condition
3	4066	I_{FSM} = 80 A (pk), condition A 2, I_O = 3 A dc; T_A = room ambient as defined in the general requirements of MIL-STD-750 (see 4.5); 5 surges of 8.3 ms each at 1 minute intervals.
4	1036	I_O = 3 A dc; T_A = room ambient as defined in the general requirements of MIL-STD-750 (see 4.5); f = 50-60 Hz; V_{RWM} = 40 V (pk); $t_{on} = t_{off}$ 3 minutes minimum for 2,000 cycles.
5	1027	T_A = +75°C ±25°C; I_O = 3 A dc (minimum) with I_O adjusted as required to achieve an average lot. T_J = +125°C +0°C, -5°C.
6	3101	$R_{\theta JL}$ = 30°C/W; L = 9.52 mm (.375 inch) lead length (non-surface mount). $R_{\theta JEC}$ = 10°C/W (surface mount).

4.4.2.2 Group B inspection, table IVb (JAN, JANTX, and JANTXV of MIL-S-19500).

Subgroup	Method	Condition
2	4066	I_{FSM} = 80 A (pk), condition A 2, I_O = 3 A dc; T_A = room ambient as defined in the general requirements of MIL-STD-750 (see 4.5); 5 surges of 8.3 ms each at 1 minute intervals.
3	1027	I_O = 3 A dc; f = 50-60 Hz; V_{RWM} = 40 V (pk). $T_L \leq +55°C$, lead length = 9.52 mm (.375 inch).
4	2075	In accordance with 4.5.2.

TABLE I. Group A inspection.

Inspection 1/	MIL-STD-750		Symbol	Limits		Unit
	Method	Conditions		Min	Max	
Subgroup 1						
Visual and mechanical examination	2071					
Subgroup 2						
Thermal impedance	3101	See 4.5.3	$Z_{\theta JX}$		3.0	°C/W
Forward voltage	4011	I_{FM} = 1.0 A (pk) pulse method (see 4.5.1)	V_{FM1}		0.40	V
	4011	I_{FM} = 3.0 A (pk) pulse method (see 4.5.1)	V_{FM2}		0.50	V
	4011	I_{FM} = 9.4 A (pk) pulse method (see 4.5.1)	V_{FM3}		0.70	V
Reverse current leakage	4016	V_{RM} = 40 V (pk) pulse method (see 4.5.1)	I_{RM1}		0.10	mA
Subgroup 3						
High temperature operation:		T_A = +100°C				
Reverse current leakage	4016	V_{RM} = 40 V (pk) pulse method (see 4.5.1)	I_{RM2}		10.0	mA
Forward voltage	4011	I_F = 3.0 A (pk) pulse method (see 4.5.1)	V_{FM4}		0.47	V
Low temperature operation:		T_A = -55°C				
Reverse current leakage	4016	V_{RM} = 40 V (pk) pulse method (see 4.5.1)	I_{RM3}		0.40	mA
Forward voltage	4011	I_F = 3.0 A (pk) pulse method (see 4.5.1)	V_{FM5}		0.62	V

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

TABLE II. Group E inspection (all quality levels) for qualification only. 1/

Inspection 2/	MIL-STD-750		Sampling plan
	Method	Conditions	
Subgroup 1			22 devices c = 0
Thermal shock (temperature cycling)	1051	500 cycles	
Hermetic seal	1071	Test condition E	
Electrical measurement		See table I, group A, subgroup 2	
Subgroup 2			22 devices c = 0
Steady-state reverse bias	1038	Test condition A; 1,000 hours, see 4.3, screen 10	
Electrical measurement		See table I, group A, subgroup 2	
Subgroup 3			
Not applicable			
Subgroup 4			22 devices c = 0
Thermal resistance, (forward voltage drop diode method)	4081 or 3101	$R_{\theta JL}$ = 30°C/W maximum at 9.52 mm (.375 inch) lead length; $R_{\theta JEC}$ = 10°C/W maximum; method 3101 in accordance with 4.5.3 except, I_H = 5 A and T_H = 20 s (minimum)	
Subgroup 5			
Not applicable			
Subgroup 6			
Not applicable			

1/ For initial design and process change verification only (one time testing).
2/ For sampling plan, see MIL-S-19500.

TABLE I. Group A inspection.

Inspection 1/	MIL-STD-750		Symbol	Limits		Unit
	Method	Conditions		Min	Max	
Subgroup 1						
Visual and mechanical examination	2071					
Subgroup 2						
Thermal impedance	3101	See 4.5.3	$Z_{\theta JX}$		3.0	°C/W
Forward voltage	4011	I_{FM} = 1.0 A (pk) pulse method (see 4.5.1)	V_{FM1}		0.40	V
	4011	I_{FM} = 3.0 A (pk) pulse method (see 4.5.1)	V_{FM2}		0.50	V
	4011	I_{FM} = 9.4 A (pk) pulse method (see 4.5.1)	V_{FM3}		0.70	V
Reverse current leakage	4016	V_{RM} = 40 V (pk) pulse method (see 4.5.1)	I_{RM1}		0.10	mA
Subgroup 3						
High temperature operation:		T_A = +100°C				
Reverse current leakage	4016	V_{RM} = 40 V (pk) pulse method (see 4.5.1)	I_{RM2}		10.0	mA
Forward voltage	4011	I_F = 3.0 A (pk) pulse method (see 4.5.1)	V_{FM4}		0.47	V
Low temperature operation:		T_A = -55°C				
Reverse current leakage	4016	V_{RM} = 40 V (pk) pulse method (see 4.5.1)	I_{RM3}		0.40	mA
Forward voltage	4011	I_F = 3.0 A (pk) pulse method (see 4.5.1)	V_{FM5}		0.62	V

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

5. PACKAGING

5.1 Packaging requirements. The requirements for packaging shall be in accordance with MIL-S-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-S-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 as specified (see 3.3.1).

c. Product assurance level and type designation; and for die acquisition, the JANHC and JANKC identification (see 6.3 and figures 3 and 4).

6.3 Suppliers of die. The qualified die suppliers with the applicable letter version (e.g., JANHCA1N5822) will be identified on the QPL.

JANC ordering information		
	Manufacturer	
PIN	55801	---
1N5822	JANHCA1N5822	---
	JANKCA1N5822	---

6.4 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.

CONCLUDING MATERIAL

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

Review activities:
Army - AR, MI, SM
Navy - AS, CG, MC
Air Force - 19, 85, 99

Preparing activity:
DLA - ES

(Project 5961-1680)

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-S-19500/620B	2. DOCUMENT DATE (YYMMDD) 94/07/22

3. DOCUMENT TITLE
SEMICONDUCTOR DEVICE, HERMETIC, DIODE, SILICON, RECTIFIER, SCHOTTKY BARRIER, TYPES 1N5822 AND 1N5822US JAN, JANTX, JANTXV, JANS, JANHC, AND JANKC

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) AUTOVON (If applicable)	7. DATE SUBMITTED (YYMMDD)

8. PREPARING ACTIVITY

a. NAME Alan Barone	b. TELEPHONE (Include Area Code) (1) Commercial: 513-296-6048 (2) AUTOVON: 986-6048
c. ADDRESS (Include Zip Code) Defense Electronics Supply Center Attn: DESC-ELDT Dayton, Ohio 45444-5765	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 AUTOVON 289-2340