

The documentation process conversion measures necessary to comply with this revision shall be completed by 6 February 1998

METRIC

MIL-PRF-19500/625A
 6 November 1997
 SUPERSEDING
 MIL-S-19500/625
 15 July 1994

PERFORMANCE SPECIFICATION SHEET

SEMICONDUCTOR DEVICE, DIODE, SILICON, SWITCHING
 TYPES 1N6683, 1N6684, 1N6685, 1N6683US, 1N6684US, AND 1N6685US
 JAN, JANTX, JANTXV, JANS, JANHC, AND JANKC

1. SCOPE

1.1 Scope. This specification covers the performance requirements for switching diodes, suitable for high stress environments where silver button construction may be inadequate (see 6.3). Four levels of product assurance are provided for each encapsulated device type and two levels for each unencapsulated device type die as specified in MIL-PRF-19500.

1.2 Physical dimensions. See figure 1 (D0-204-AH), figure 2 (D-5D), and figure 3.

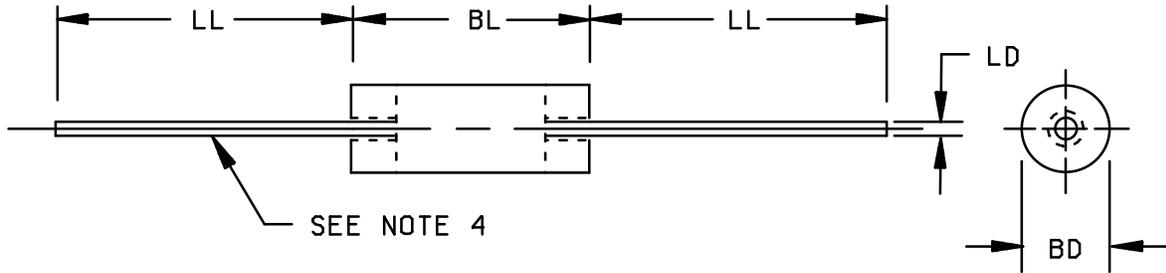
1.3 Maximum ratings. $T_A = +25^\circ\text{C}$.

Types	V_{BR}	V_{RWM}	I_{O1} 1/ 2/	I_{FSM} $t_p = 1 \mu s$	T_j and T_{STG}	$R_{\theta JX}$ L = .375	$R_{\theta JEC}$ L = 0	$Z_{\theta JX}$
	V(pk)	V(pk)	mA	A(pk)	$^\circ\text{C}$	$^\circ\text{C}/\text{W}$	$^\circ\text{C}/\text{W}$	$^\circ\text{C}/\text{W}$
1N6683, 1N6683US	200	175	200	3.0	-65 to +175	160	50	25
1N6684, 1N6684US	250	200	200	3.0	-65 to +175	160	50	25
1N6685, 1N6685US	350	275	200	3.0	-65 to +175	160	50	25

1/ Derate at 3.0 mA/ $^\circ\text{C}$ above $T_L = 75^\circ\text{C}$ at L = 9.53 mm (.375 inch).

2/ Derate at 4.0 mA/ $^\circ\text{C}$ above $T_{EC} = 125^\circ\text{C}$ for US suffix devices.

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 Street, Columbus, OH 43216-5000, by using the Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document or by letter.



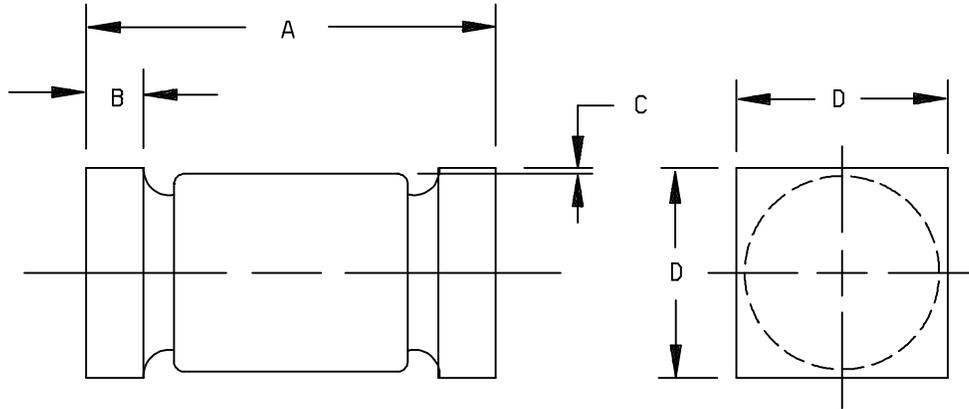
Symbol	Dimensions				Notes
	Millimeters		Inches		
	Min	Max	Min	Max	
BD	1.52	2.29	.060	.090	2, 3
LD	0.46	0.56	.018	.022	4
BL	3.05	5.08	.120	.200	
LL	25.40	38.10	1.000	1.500	

TYPES 1N6683, 1N6684, AND 1N6685

NOTES:

1. Inch equivalents are given for general information only.
2. The maximum dimension of BD shall apply for dimension BL.
3. The minimum dimension of BD shall apply over at least 1.65 mm (.065 inch) of dimension BL.
4. The specified lead diameter applies in the zone between 1.27 mm (.050 inch) from the diode body to the end of the lead. Outside of this zone lead shall not exceed BD.
5. Dimensions are in millimeters.

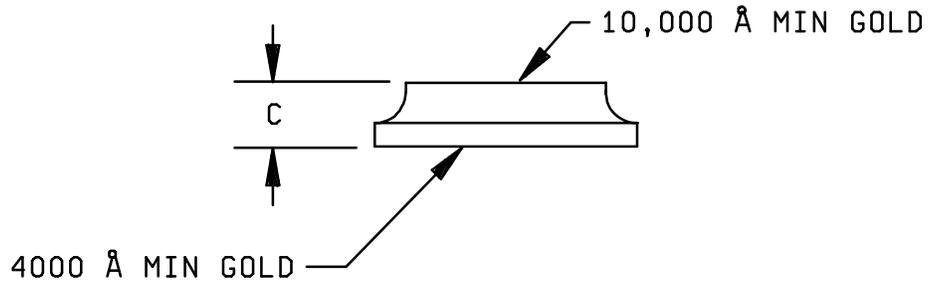
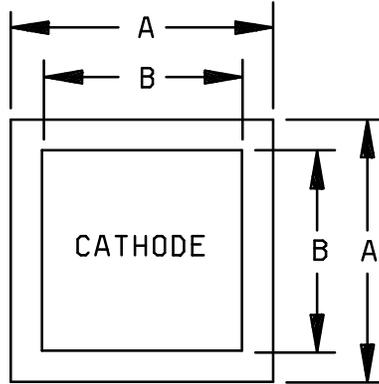
FIGURE 1. Physical dimension (D0-204-AH).



Symbol	Dimensions			
	Millimeters		Inches	
	Min	Max	Min	Max
A	4.19	4.95	.165	.195
B	0.48	0.71	.019	.028
C	0.08	----	.003	----
D	1.78	2.16	.070	.085

TYPES 1N6683US, 1N6684US, AND 1N6685US

FIGURE 2. Physical dimension for surface mount family (D-5D).



Symbol	Dimension			
	Millimeters		Inches	
	Min	Max	Min	Max
A	0.48	0.64	.019	.025
B	0.20	0.30	.008	.012
C	0.18	0.28	.007	.011

DESIGN DATA

Metallization:

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

Au thickness:

Top: 10,000Å minimum
 Back: 4,000Å minimum

FIGURE 3. JANHC and JANKC die (A Version).

MIL-PRF-19500/625A

Types	V_{fM} at I_{fM} pulsed	I_{R1} at $T_A = 25^\circ\text{C}$		I_{R2} at $T_A = 150^\circ\text{C}$		t_{rr} $I_F = I_R = 30\text{ mA}$ $I_{rr} = 3\text{ mA}$	C_T $V_R = 0$
		nA dc	V_R	$\mu\text{A dc}$	V_R		
1N6683, 1N6683US	1.0 V at 200 mA	100	175 V	100	175 V	50	5.0
1N6684, 1N6684US	1.0 V at 300 mA	100	200 V	100	200 V	50	8.0
1N6685, 1N6685US	1.1 V at 300 mA	200	275 V	200	275 V	50	8.0

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 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 6.3).

3.2 Associated specification. The individual item requirements shall be in accordance with MIL-PRF-19500 and as specified herein.

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

EC..... End cap.

3.3 Interface requirements and physical dimensions. The interface requirements and physical dimensions shall be as specified in MIL-PRF-19500 and on figures 1, 2, and 3 herein.

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 lead finish is desired, it shall be specified in the acquisition document (see 6.2).

3.3.2 Diode construction.

- a. Except for JANCH and JANCK, all devices shall be of metallurgically bonded, thermally matched, noncavity-double plug construction. Metallurgical bonds shall be in accordance with the requirements of category I (see MIL-PRF-19500).
- b. The US version shall be considered structurally identical to the non-US versions except for lead attach.

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

3.5 Polarity. The polarity of all types shall be indicated with a contrasting color band to denote the cathode end. Alternatively, for US suffix devices, a minimum of three contrasting color dots spaced around the cathode end of the device may be used.

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

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

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 (JANS, JANTX and JANTXV levels only). Screening shall be in accordance with MIL-PRF-19500 (Appendix E, 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.

Screen (see appendix E, table IV of MIL-PRF-19500)	Measurement	
	JANS level	JANTX and JANTXV levels
3c <u>1/</u>	Thermal impedance (see 4.5.5)	Thermal impedance (see 4.5.5)
9	I_{R1} , V_{F1} , or V_{F2}	Not applicable
11	I_{R1} , V_{F1} , or V_{F2} , $\Delta I_{R1} \leq \pm 100$ percent of initial value or ± 50 nA, whichever is greater. $\Delta V_{F1} \leq \pm 0.03$ V dc	I_{R1} , V_{F1} , or V_{F2}
12	See 4.3.1	See 4.3.1
13 <u>2/</u>	Subgroups 2 and 3 of table I herein; $\Delta I_{R1} \leq \pm 100$ percent of initial value or 50 nA, whichever is greater. $\Delta V_{F1} \leq 0.03$ V dc. Reverse scope display (see 4.5.2).	Subgroup 2 of table I herein; $\Delta I_{R1} \leq \pm 100$ percent of initial or 50 nA dc, whichever is greater. $\Delta V_{F1} \leq \pm 0.03$ V dc. Reverse scope display (see 4.5.2).

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

2/ When thermal impedance is performed prior to screen 13, it is not required to be repeated in screen 13.

4.3.1 Power burn-in conditions. Power burn-in conditions are as follows (see 4.5.3):

Method 1038, condition B, V_R = rated V_{RWM} ; f = 50-60 Hz; I_O = 200 mA. An alternative of I_F (dc) = 200 mA may be used.

T_A = room ambient as defined in the general requirements of MIL-STD-750, (see 4.5).

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 appendix E, table V of 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 appendix E, table VIa (JANS) and table VIb (JAN, JANTX, and JANTXV) of MIL-PRF-19500. Electrical measurements (end-points) requirements shall be in accordance with the applicable steps and footnotes of table I, group A, subgroup 2 herein.

4.2.2.1 Group B inspection, appendix E, table VIa (JANS) of MIL-PRF-19500.

Subgroup	Method	Conditions
4	1037	$V(pk)$ = rated V_{RWM} ; I_O shall be a maximum of 200 mA, 2,000 cycles. T_A = room ambient as defined in the general requirement of MIL-STD-750 (see 4.5); f = 50 -60 Hz (see 4.5.1); ON time, OFF time, and I_O shall be adjusted to achieve a delta lead temperature at $L = .953$ mm (.375 inch) from the body of 85°C, -5°C +15°C. Cycle time shall be a minimum of three minutes.
5	1027	I_O = 200 mA dc; V_R = rated V_{RWM} (see 1.3); f = 50-60 Hz (see 4.5.1); T_A = 150°C minimum. Increase T_A or I_O as required to achieve junction temperature as specified in MIL-PRF-19500.

4.2.2.2 Group B inspection, appendix E, table VIb (JAN, JANTX and JANTXV or MIL-PRF-19500).

<u>Subgroup</u>	<u>Method</u>	<u>Conditions</u>
3	1037	T_A = room ambient as defined in the general requirements of MIL-STD-750, (see 4.5); $V(pk)$ = rated V_{RWM} ; f = 50-60 Hz (see 4.5.1); I_O = 200 mA. Note: Leaded samples from the same lot may be used in lieu of US suffix sample for life test.
5	3101 or 4081	See 4.5.3.
6	1032	T_A = +175°C.

4.4.3 Group C inspection. Group C inspection shall be conducted in accordance with the conditions specified for subgroup testing in appendix E, table VII of MIL-PRF-19500. Electrical measurements (end-points) requirements shall be in accordance with the applicable steps and footnotes of table I, group A, subgroup 2 herein.

4.4.3.1 Group C Inspection, appendix E, table VII of MIL-PRF-19500

<u>Subgroup</u>	<u>Method</u>	<u>Conditions</u>
2	2036	Tension: Test condition A; weight 4 pounds, t = 15 seconds Lead fatigue: Test condition E. Note: Not applicable for US suffix types.
6	1026	Note: Leaded samples from the same lot may be used in lieu of U suffix samples for life tests.

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

4.5.1 Life test. These tests shall be conducted with a half-sine waveform of the specific peak voltage impressed across the diode in the reverse direction followed by a half-sine waveform of the specified average rectified current. The forward conduction angle of the rectified current shall be neither greater than 180 degrees, nor less than 150 degrees.

4.5.2 Scope display. The reverse breakdown characteristics shall be viewed on an oscilloscope with display calibration factors of 20 μA per division. Reverse current over the knee shall be at least 100 μA and less than 200 μA . Any discontinuity or dynamic instability of the trace shall be cause of rejection of that device.

4.5.3 Thermal resistance. Thermal resistance measurement shall be performed in accordance with MIL-STD-750, method 3101 or 4081. Forced moving air or draft shall not be permitted across the devices during test. The maximum limit for $R_{\theta JL}$ under these test conditions shall be $R_{\theta JL} (max) = 160^\circ C/W$ and $R_{\theta JEC} (max) = 100^\circ C/W$. The following conditions shall be applied if method 3101 is used.

I_H	75 mA to 300 mA.
t_H	25 seconds minimum.
I_M	1 mA to 10 mA.
t_{MD}	100 μs maximum.

LS = Lead spacing = 9.53 mm (.375 inch).

LS = 0 for US versions.

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

4.5.5 Thermal impedance ($Z_{\theta JX}$) measurements. The $Z_{\theta JX}$ measurements shall be performed in accordance with MIL-STD-750, method 3101. The maximum limit for $Z_{\theta JX}$ in screening (table II of MIL-PRF-19500) shall not exceed the group A, subgroup 2 limit. The conditions for $Z_{\theta JX}$ testing are as follows:

I_H	5-10 amps.
t_H	10 ms.
I_M	1 mA to 10 mA.
t_{MD}	100 μ s max.

4.5.5.1 For initial qualification or requalification. Read and record data ($Z_{\theta JX}$) shall be supplied to the qualifying activity on one lot (random sample of 500 devices minimum). Twenty-two serialized devices shall be sent to the qualifying activity for test correlation.

TABLE I. Group A inspection.

Inspection <u>1/</u>	MIL-STD-750		Limits			Unit
	Method	Conditions	Symbol	Min	Max	
<u>Subgroup 1</u>						
Visual and mechanical inspection	2071					
<u>Subgroup 2</u>						
Thermal impedance	3101	See 4.5.5	$Z_{\theta JX}$		25	°C/W
Forward voltage (1N6683 only)	4011	$t_p = 300 \mu s$ $I_F = 200 \text{ mA}$	V_{F1}		1.00	V dc
Forward voltage (1N6684 only)	4011	$t_p = 300 \mu s$ $I_F = 300 \text{ mA dc pulsed}$	V_{F2}		1.00	V dc
Forward voltage (1N6685 only)	4011	$t_p = 300 \mu s$ $I_F = 300 \text{ mA dc pulsed}$	V_{F3}		1.00	V dc
Breakdown voltage	4021		V_{BR}			V dc
1N6683, 1N6683US 1N6684US, 1N6640, 1N6640US 1N6685, 1N6685US		$I_R = 100 \mu A \text{ dc}$			200 250 350	
Reverse current	4016	DC method	I_{R1}			nA dc
1N6683, 1N6683US 1N6684, 1N6684US 1N6640, 1N6640US		$V_R = 175 \text{ V dc}$ $V_R = 200 \text{ V dc}$ $V_R = 275 \text{ V dc}$			100 100 200	
<u>Subgroup 3</u>						
High temperature operation:						
Reverse current	4016	$T_A = +150^\circ C,$ DC method	I_{R2}			$\mu A \text{ dc}$
1N6683, 1N6683US 1N6640, 1N6640US 1N6685, 1N6685US		$V_R = 175 \text{ V dc}$ $V_R = 200 \text{ V dc}$ $V_R = 275 \text{ V dc}$			100 100 200	

See footnotes at end of table.

TABLE I. Group A inspection - Continued.

Inspection <u>1/</u>	MIL-STD-750		Limits			Unit
	Method	Conditions	Symbol	Min	Max	
<u>Subgroup 4</u>						
Capacitance 1N6683, 1N6683US 1N6684, 1N6684US 1N6685, 1N6685US	4001	$V_R = 0$ V dc $V_{sig} = 50$ mV(p-p) $f = 1$ MHz			5.0 8.0 8.0	pF
Reverse recovery time 1N6683, 1N6683US 1N6684, 1N6684US 1N6685, 1N6685US	4031	Condition B $I_F = I_R = 30$ mA dc $I_{RR} = 3.0$ mA dc	t_{rr}		50 50 50	ns
<u>Subgroup 5</u>						
Not applicable						
<u>Subgroup 6</u>						
Surge current	4066	$I_{FSM} = 3.0$ A; 10 surges at 1 per minute (max). Surges duration = 1 μ s				
Electrical measurements		See table I, subgroup 2				

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

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

Inspection ^{1/}	MIL-STD-750	
	Method	Conditions
<u>Subgroup 1</u>		
Thermal shock (glass strain)	1056	See table I, group A, subgroup 2
Hermetic seal	1071	
Electrical measurements		
<u>Subgroup 2</u>		
Not applicable		
<u>Subgroup 3</u>		
Not applicable		
<u>Subgroup 4</u>		
Thermal resistance, junction to lead	3101 or 4081	L = .953 mm (.375 inch), R _{θJL} = 160°C/W maximum (see 4.5.4)
<u>Subgroup 5</u>		
Potted environment test	1054	

^{1/} For US suffix types thermal resistance, junction to end caps.
R_{θJEC} = 100°C/W max.

5. PACKAGING

5.1 Packaging. Packaging shall prevent mechanical damage of the devices during shipping and handling and shall not be detrimental to the device. 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.

5.2 Marking. Unless otherwise specified (see 6.2), marking shall be in accordance with MIL-STD-129.

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. See MIL-PRF-19500.

6.3 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 No.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, ATTN: DSCC-VQE, 3990 East Broad Street, Columbus, OH 43216-5000.

6.4 Suppliers of JANC die. The qualified JANCH and JANCK suppliers with the applicable letter version will be identified on the QPL (e.g. JANCKA1N6683).

JANC ordering information	
PIN	Manufacturer
1N6683 through 1N6685	HA and KA 1N6683 through HA and KA 1N6685

6.5 Substitution information. The 1N6683 (MIL-PRF-19500/625) is the preferred type in lieu of the 1N4938 and 1N4938-1 (MIL-PRF-19500/169) for high reliability, high stress application (see 1.1). The 1N6683 should be used whenever available.

6.5.1 Cross reference substitution list. JANS level will no longer be built to MIL-PRF-19500/169. Devices in stock are acceptable provided the date code does not exceed the date of implementation of MIL-PRF-19500/169. Devices required for spec flight applications are found herein. A PIN for PIN replacement table follows, and these devices are directly interchangeable.

Non-preferred PIN	Preferred PIN
1N4938-1	1N6683

6.6 Changes from previous issue. Marginal notations are not used in this revision to identify changes with respect to the previous issue due to the extent of the changes.

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

Preparing activity:
 DLA - CC
 (Project 5961-1899-01)

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

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-PRF-19500/625A	2. DOCUMENT DATE (YYMMDD) 971106
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3. DOCUMENT TITLE
SEMICONDUCTOR DEVICE, DIODE, SILICON, SWITCHING, TYPES 1N6683, 1N6684, 1N6685, 1N6683US, 1N6684US, AND 1N6685US, 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 (614)692-0510 (2) AUTOVON 850-0510	
c. ADDRESS (Include Zip Code) from Defense Supply Center Columbus, ATTN: DSCC-VAT, 3990 East Broad Street, 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 AUTOVON 289-2340	