

The documentation and process conversion measures necessary to comply with this revision shall be completed by 1 August 2000.

INCH-POUND

MIL-PRF-19500/241H
 1 May 2000
 SUPERSEDING
 MIL-PRF-19500/241G
 7 April 1997

PERFORMANCE SPECIFICATION

SEMICONDUCTOR DEVICE, DIODE, SILICON, LOW LEAKAGE, CONTROLLED FORWARD VOLTAGE
 TYPES 1N3595US, 1N3595UR, 1N3595-1, 1N3595UR-1, AND 1N3595US-1
 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 performance requirements for silicon, controlled voltage diodes. Four levels of product assurance are provided for each device type as specified in MIL-PRF-19500 (see 6.3.2). Two levels of product assurance are provided for die.

1.2 Physical dimensions. See figure 1 (similar to D0-35), figures 2 and 3 (surface mount) and figure 4 (die).

1.3 Maximum ratings.

V_{RWM}	I_O (1)	I_{FSM} $t_p = 1$ s	I_{FSM} $t_p = 1$ μ s	T_{OP} and T_{STG}
<u>V(pk)</u>	<u>mA dc</u>	<u>mA (pk)</u>	<u>A (pk)</u>	<u>°C</u>
125	150	500	4	-65 to +175

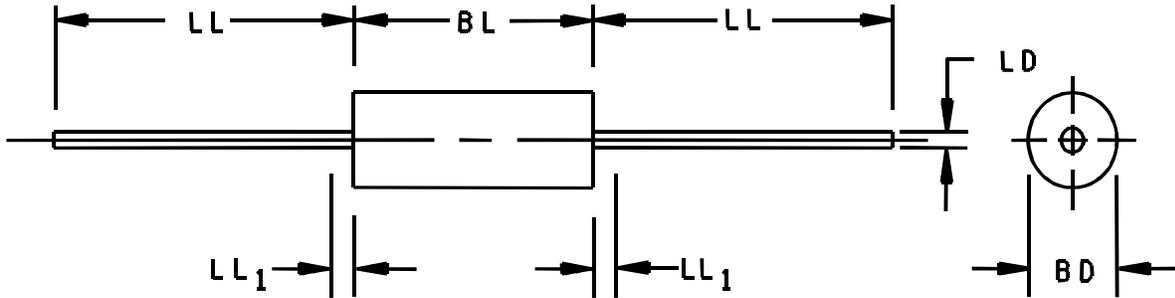
(1) Derate at 1.0 mA dc/°C above $T_A = +25^\circ\text{C}$.

1.4 Primary electrical characteristics at $T_A = +25^\circ\text{C}$, unless otherwise indicated.

Limits	V_{F1} $I_F = 200$ mA dc	V_{F2} $I_F = 100$ mA dc	V_{F3} $I_F = 50$ mA dc	V_{F4} $I_F = 10$ mA dc	V_{F5} $I_F = 5$ mA dc	V_{F6} $I_F = 1$ mA dc
Min	0.83 V dc	0.79 V dc	0.74 V dc	0.65 V dc	0.60 V dc	0.52 V dc
Max	1.00 V dc	0.92 V dc	0.88 V dc	0.80 V dc	0.75 V dc	0.68 V dc

Limits	I_{R1} $V_R = 125$ V dc	I_{R2} $V_R = 125$ V dc $T_A = +150^\circ\text{C}$	C $V_R = 0$ V dc $f = 1$ MHz	t_{rr} $I_F = 10$ mA dc $V_R = 35$ V dc
Min				
Max	10 nA dc	3 μ A dc	8.0 pF	3 μ s

Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: Defense Supply Center Columbus, ATTN: DSCC-VAC, P.O. Box 3990, Columbus, OH 43216-5000, by using the Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document or by letter.

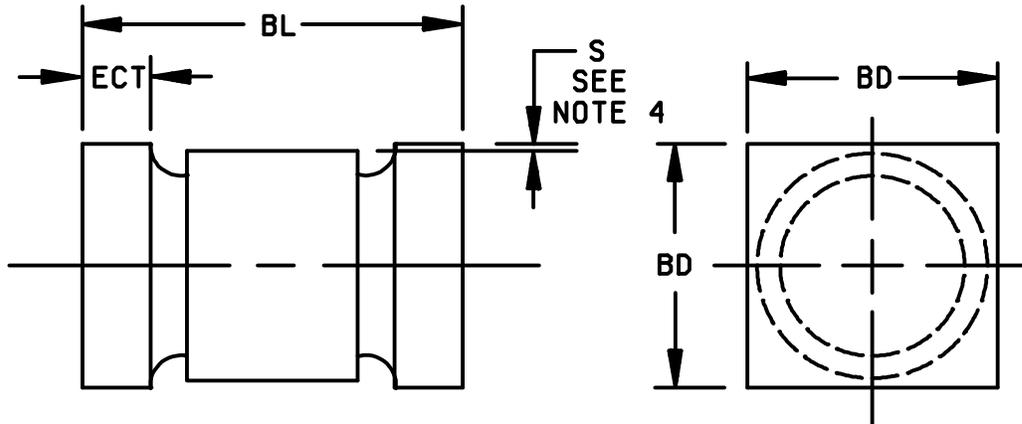


Dimensions					
Ltr	Inches		Millimeters		Notes
	Min	Max	Min	Max	
BD	.055	.090	1.40	3.30	4
BL	.120	.200	3.30	7.62	
LD	.018	.022	0.046	0.056	
LL	1.00	1.50	25.40	38.10	
LL1		.050		1.27	3

NOTES:

1. Dimensions are in inches.
2. Metric equivalents are given for general information only.
3. Lead diameter not controlled in zones LL₁ to allow for flash, lead finish build-up, and minor irregularities other than heat slugs.
4. Dimension BD shall be measured at the largest diameter.

FIGURE 1. Physical dimensions 1N3595-1 (similar to DO-35).



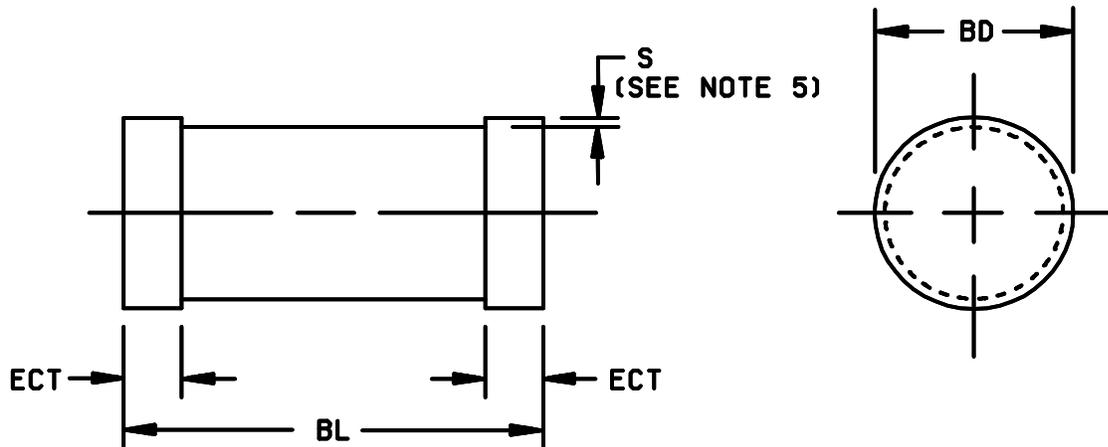
Dimensions (D-5D)				
Ltr	Inches		Millimeters	
	Min	Max	Min	Max
BL	.165	.195	4.19	4.95
ECT	.019	.028	0.48	0.71
S	.003		0.08	
BD	.070	.085	1.78	2.16

TYPES 1N3595US AND 1N3595US-1

NOTES:

1. Dimensions are in inches.
2. Metric equivalents are given for general information only.
3. Dimensions are presolder dip.
4. Referencing dimension S, minimum clearance of glass body to mounting surface on all orientations.
5. In accordance with ANSI Y14.5M, diameters are equivalent to ϕx symbology.

FIGURE 2. Physical dimensions, surface mount (US suffix) devices.

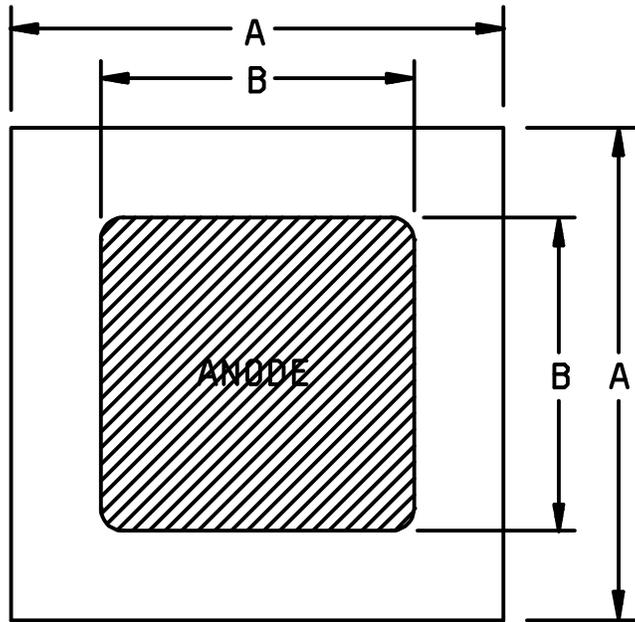


Dimensions				
Ltr	Inches		Millimeters	
	Min	Max	Min	Max
BD	.063	.067	1.60	1.70
BL	.130	.146	3.30	3.70
ECT	.016	.022	0.41	0.55
S	.001 min		0.03 min	

NOTES:

1. Dimensions are in inches.
2. Metric equivalents are given for general information only.
3. Dimensions are presolder dip.
4. In accordance with ANSI Y14.5M, diameters are equivalent to ϕx symbology.
5. Referencing dimension S, minimum clearance of glass body to mounting surface on all orientations.

FIGURE 3. Physical dimensions, surface mount (UR suffix) devices (similar to DO-213AA).



Dimensions				
Ltr	Inches		Millimeters	
	Min	Max	Min	Max
A	.020	.022	.508	.559
B	.012	.014	.305	.355

NOTES:

1. Dimensions are in inches.
2. Metric equivalents are given for general information only.
3. Unless otherwise specified, tolerance is $\pm .001$ (0.025 mm).
4. The physical characteristics of the die are:
 Thickness: .008 (0.20 mm) to .010 (0.30 mm).
 Top metal: Aluminum 25,000 Å minimum, 35,000 Å maximum.
 Back metal: Gold 4,000 Å minimum.
 Back side: Cathode.

FIGURE 4. Physical dimensions JANHCA and JANKCA die.

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, Building 4D (DPM-DODSSP), 700 Robbins Avenue, 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, 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 General. The requirements for acquiring the product described herein shall consist of this document and MIL-PRF-19500.

3.2 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 6.4).

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

3.4 Interface requirements and physical dimensions. The Interface requirements and physical dimensions shall be as specified in MIL-PRF-19500, and figures 1 (similar to DO-35), 2, 3 (surface mount), and 4 (die) herein.

3.4.1 Lead finish. Lead finish shall be solderable in accordance with MIL-STD-750 and MIL-PRF-19500. Where a choice of lead finish is desired, it shall be specified in the acquisition document.

3.4.2 Dash one construction. Dash one (-1) devices shall be metallurgically bonded double plug construction in accordance with the requirements of category I, II, or III (see MIL-PRF-19500).

3.4.3 JANS construction. All JANS devices shall be metallurgically bonded-thermally matched non-cavity double plug constructions utilizing only category I metallurgical bond in accordance with MIL-PRF-19500.

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

3.5.1 Marking of surface mount (UR or US) devices. For surface mount devices only, all marking except the polarity indication may be omitted from the body of the device, but shall remain on the initial container. The polarity shall be indicated with a contrasting color band to denote the cathode end or alternately with a minimum of three contrasting color dots spaced evenly around the periphery at the cathode end.

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

3.7 Electrical test requirements. The electrical test requirements shall be the subgroups specified in table I herein.

3.8 Workmanship. Semiconductor devices shall be processed in such a manner as to be uniform in quality and shall be free from other defects that will affect life, serviceability, or appearance.

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, and as specified herein.

MIL-PRF-19500/241H

4.3 Screening (JANS, 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	
	JANS level	JANTX and JANTXV levels
3a	Temperature cycling	Temperature cycling
3c (1)	Thermal impedance (see 4.4.1 and 4.5.2)	Thermal impedance (see 4.4.1 and 4.5.2)
9	I_{R1} and V_{F1}	Not applicable
11	I_{R1} , V_{F1} , $\Delta V_{F1} \leq \pm 50$ mV change from initial value. $\Delta I_{R1} \leq \pm 0.5$ nA dc.	I_{R1} and V_{F1}
12	See 4.3.1 $t = 240$ hours minimum	See 4.3.1 $t = 48$ hours minimum
13 (2)	Subgroups 2 and 3 of table I herein; $\Delta V_{F1} \leq \pm 50$ mV change from initial value. $\Delta I_{R1} \leq \pm 0.5$ nA dc.	Subgroup 2 of table I herein; $\Delta V_{F1} \leq \pm 50$ mV change from initial value. $\Delta I_{R1} \leq \pm 0.5$ nA dc.

- (1) Thermal impedance may be performed any time after sealing provided temperature cycling is performed in accordance with MIL-PRF-19500, screen 3 prior to this thermal test.
- (2) PDA = 5 percent for screen 13, applies to ΔI_{R1} , ΔV_{F1} . Thermal impedance ($Z_{\theta JX}$) is not required in screen 13.

4.3.1 Power burn-in conditions. Power burn-in conditions are as follows:

T_A = Room ambient as defined in the general requirements of MIL-STD-750;
 I_F = 150 mA dc.

4.4 Conformance inspection. Conformance inspection shall be in accordance with MIL-PRF-19500, and as specified herein.

4.4.1 Group A inspection. Group A inspection shall be conducted in accordance with MIL-PRF-19500, and table I herein. End-point electrical measurements shall be in accordance with group A, subgroup 2 herein. The following test conditions shall be used for $Z_{\theta JX}$: $Z_{\theta JX} = 70^\circ\text{C/W}$ maximum $I_H = 1$ A, $t_H = 10$ ms, $I_M = 1$ mA, $t_{md} = 70$ μs maximum.

MIL-PRF-19500/241H

4.4.2 Group B inspection. Group B inspection shall be conducted in accordance with the conditions specified for subgroup testing in tables VIa (JANS) and VIb (JAN, JANTX, and JANTXV) of MIL-PRF-19500 and paragraphs 4.4.2.1 and 4.4.2.2 herein. Electrical measurements (end-points) shall be in accordance with table I, group A, subgroup 2 herein. Delta measurements shall be in accordance with table II herein.

4.4.2.1 Group B inspection, table VIa (JANS) of MIL-PRF-19500.

<u>Subgroup</u>	<u>Method</u>	<u>Condition</u>
B4	1037	$V_R = 125 \text{ V(pk)}$; $T_A = \text{Room ambient as defined in the general requirements of MIL-STD-750}$; $I_O = 150 \text{ mA dc}$; $t_{on} = t_{off} = 3 \text{ minutes minimum for 2,000 cycles}$.
B5	1027	$T_A = +125^\circ\text{C}$; $I_O = 150 \text{ mA dc}$; $V_R = 125 \text{ V(pk)}$.
B6		Not applicable.

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

<u>Subgroup</u>	<u>Method</u>	<u>Condition</u>
B3	1027	$I_O = 150 \text{ mA min}$, $f = 50 - 60 \text{ Hz}$, $T_J = +150^\circ\text{C min.}$, supplier may adjust T_A to obtain a minimum T_J of $+150^\circ\text{C}$, $V_R = 125 \text{ V(pk)}$.
B5	3101 or 4081	$L = .375"$, $R_{\theta JL} = 250^\circ\text{C/W}$; $L = 0"$, $R_{\theta JC} = 100^\circ\text{C/W}$ (surface mount); No moving air permitted.
B6	1032	$T_A = +175^\circ\text{C}$

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. Delta measurements shall be in accordance with table II herein.

<u>Subgroup</u>	<u>Method</u>	<u>Condition</u>
C2	2036	Tension: Test condition A; weight = 4 pounds; t = 15 seconds. Lead fatigue: Test condition E, weight = 16 oz. Terminal strength is not applicable to surface mount devices ("UR" or "US" suffix).
C3	2056	Nonoperating (Not applicable to 1N3595-1).
C5		Not applicable.
C6	1027	$I_O = 150 \text{ mA min}$, $f = 50 - 60 \text{ Hz}$, $T_J = +150^\circ\text{C min.}$, supplier may adjust T_A to obtain a minimum T_J of $+150^\circ\text{C}$, $V_R = 125 \text{ V(pk)}$.

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

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

4.5.2 Thermal impedance $Z_{\theta JX}$ measurements for screening. The $Z_{\theta JX}$ measurements shall be performed in accordance with MIL-STD-750, method 3101. The maximum limit (not to exceed the group A, subgroup 2 limit) for $Z_{\theta JX}$ in screening (table II of MIL-PRF-19500) shall be derived by each vendor by means of statistical process control. When the process has exhibited control and capability, the capability data shall be used to establish the fixed screening limit. In addition to screening, once a fixed limit has been established, monitor all future sealing lots using a random five piece sample from each lot to be plotted on the applicable \bar{X} , R chart. If a lot exhibits an out of control condition, the entire lot shall be removed from the line and held for Engineering evaluation and disposition.

MIL-PRF-19500/241H

TABLE I. Group A inspection.

Inspection 1/	MIL-STD-750		Symbol	Limits		Unit
	Method	Conditions		Min	Max	
<u>Subgroup 1</u>						
Visual and mechanical examination	2071					
<u>Subgroup 2</u>						
Thermal impedance	3101	See 4.4.1	$Z_{\theta JX}$		70	°C /W
Forward voltage	4011	$I_F = 200 \text{ mA dc}$,	V_{F1}	0.83	1.00	V dc
Forward voltage	4011	$I_F = 100 \text{ mA dc}$,	V_{F2}	0.79	0.92	V dc
Forward voltage	4011	$I_F = 50 \text{ mA dc}$,	V_{F3}	0.74	0.88	V dc
Forward voltage	4011	$I_F = 10 \text{ mA dc}$,	V_{F4}	0.65	0.80	V dc
Forward voltage	4011	$I_F = 5 \text{ mA dc}$,	V_{F5}	0.60	0.75	V dc
Forward voltage	4011	$I_F = 1 \text{ mA dc}$,	V_{F6}	0.52	0.68	V dc
Reverse current	4016	DC method, $V_R = 125 \text{ V dc}$	I_{R1}		1.0	nA dc
<u>Subgroup 3</u>						
High temperature operation		$T_A = +150^\circ\text{C}$				
Reverse current	4016	DC method; $V_R = 125 \text{ V dc}$	I_{R2}		3.0	$\mu\text{A dc}$
Low temperature operation		$T_A = -55^\circ\text{C}$				
Breakdown voltage	4021	$I_R = 100 \mu\text{A dc}$,	$V_{(BR)}$	150		V dc

See footnote at end of table.

MIL-PRF-19500/241H

TABLE I. Group A inspection - continued.

Inspection 1/ <u>Subgroup 4</u>	MIL-STD-750		Symbol	Limits		Unit
	Method	Conditions		Min	Max	
Capacitance	4001	VR = 0 V dc; f = 1 MHz	C		8.0	pF
Reverse recovery time	4031	Condition A; IF = 10 mA dc; VR = 35 V dc; R = 1,000 Ω; C = 10 pF (for test setup only, recover to 100 kΩ)	t _{rr}		3	μs
<u>Subgroup 5</u>						
Not applicable						
<u>Subgroup 6</u>						
Surge current	4066	IO = 150 mA dc; IFSM = 0.50 A; ten 1 second surges, 1 surge/minute				
Electrical measurements		See table I, group A, subgroup 2 herein.				
<u>Subgroup 7</u>						
Not applicable						

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

TABLE II. Groups B and C delta measurements. 1/ 2/

Step	Inspection <u>1/</u>	MIL-STD-750		Symbol	Limits		Unit
		Method	Conditions		Min	Max	
1.	Forward voltage	4011	IF = 200 mA dc	ΔV_{F1}	≤ 50 mV change from initial value.		
2	Reverse current	4016	DC method; $V_R = 125$ V dc	ΔI_{R1}	≤ 100 percent of initial value or 0.1 nA dc, whichever is greater.		

1/ The delta measurements for table VIa (JANS) of MIL-PRF-19500 are as follows:

- a. Subgroup 4, see table II herein, steps 1, and 2.
- b. Subgroup 5, see table II herein, steps 1, and 2.

2/ The delta measurements for table VII of MIL-PRF-19500 are as follows:

- a. Subgroup 6, see table II herein, steps 1 and 2 (JANS only).

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 Intended use. 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 (see 3.3.1).
- c. Type designation and product assurance level.
- d. Packaging requirements (see 5.1).

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 extent 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 Manufacturers List QML-19500 whether or not such products have actually been so listed by that date. The attention of the contractor 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.

6.5 Suppliers of JANHC die. The qualified JANHC suppliers with the applicable letter version (example JANHCA1N645-1) will be identified on the QML.

JANC ordering information	
PIN	Manufacturer
	14552
1N3595	JANHCA1N3595
1N3595	JANKCA1N3595

MIL-PRF-19500/241H

CONCLUDING MATERIAL

Custodians:

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

Preparing activity:
DLA - CC

(Project 5961-2227)

Review activities:

Army - AR, MI, AV
Navy - AS, CG, MC
Air Force - 19

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-19500/241H	2. DOCUMENT DATE 1 May 2000
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3. **DOCUMENT TITLE** SEMICONDUCTOR DEVICE, DIODE, SILICON, LOW LEAKAGE, CONTROLLED FORWARD VOLTAGE TYPES 1N3595US, 1N3595UR, 1N3595-1, 1N3595UR-1, AND 1N3595US-1 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)	7. DATE SUBMITTED	
	COMMERCIAL DSN FAX EMAIL		

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-VAC, 3990 East Broad Street, Columbus, OH 43213-1199	IF YOU DO NOT RECEIVE A REPLY WITHIN 45 DAYS, CONTACT: Defense Standardization Program Office (DLSC-LM) 8725 John J. Kingman, Suite 2533, Fort Belvoir, VA 22060-6221 Telephone (703) 767-6888 DSN 427-6888