

PERFORMANCE SPECIFICATION

SEMICONDUCTOR DEVICE, DIODE, SILICON, SWITCHING
TYPES 1N4148SOI(NBN), JAN, JANTX, JANTXV, AND JANS

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, diffused, switching diodes, mounted as Silicon-On-Insulator (SOI), available as single down-mounted device, or available in multiple arrays as designated by the (NBN) suffix. Four levels of product assurance are provided for the device type as specified in MIL-PRF-19500.

1.2 Physical dimensions. See figure 1.

1.3 Maximum ratings.

Type	$V_{(BR)}$	V_{RWM}	I_o $T_A = 25^\circ\text{C}$	I_{FSM} $t_p = 1/120 \text{ s}$	T_{STG}	T_J	$Z_{\theta JX}$	$R_{\theta JMP}$
	<u>V dc</u>	<u>V (pk)</u>	<u>mA</u>	<u>A (pk)</u>	<u>°C</u>	<u>°C</u>	<u>°C/W</u>	<u>°C/W</u>
1N4148SOI	100	75	200 (1)	2	-55 to +150	-55 to +150	20	40

(1) Derate at 1.6 mA/°C above $T_A = 25^\circ\text{C}$.

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, Post Office 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.

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

Type (1)	V_{F1}		V_{F2}		I_{R1} at $V_R = 20 \text{ V dc}$	I_{R2} at $V_R = 75 \text{ V dc}$
	I_F mA dc	V dc	I_F mA dc	V dc	nA dc	$\mu\text{A dc}$
1N4148SOI	10	0.8	100	1.2	25	0.5

Type	I_{R3} at $V_R = 20 \text{ V dc}$ $T_A = 150^\circ\text{C}$	I_{R4} at $V_R = 75 \text{ V dc}$ $T_A = 150^\circ\text{C}$	t_{fr} at $V_{fr} = 5.0 \text{ V dc (pk)}$ and $I_F = 50 \text{ mA dc}$	t_{rr}
	$\mu\text{A dc}$	$\mu\text{A dc}$	ns	ns
1N4148SOI	35	75	20	5

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.

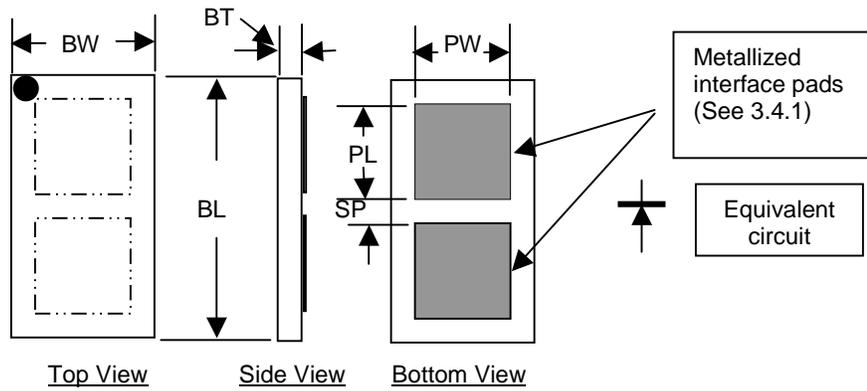
STANDARD

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 Document Automation and Production Services (DAPS), 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.



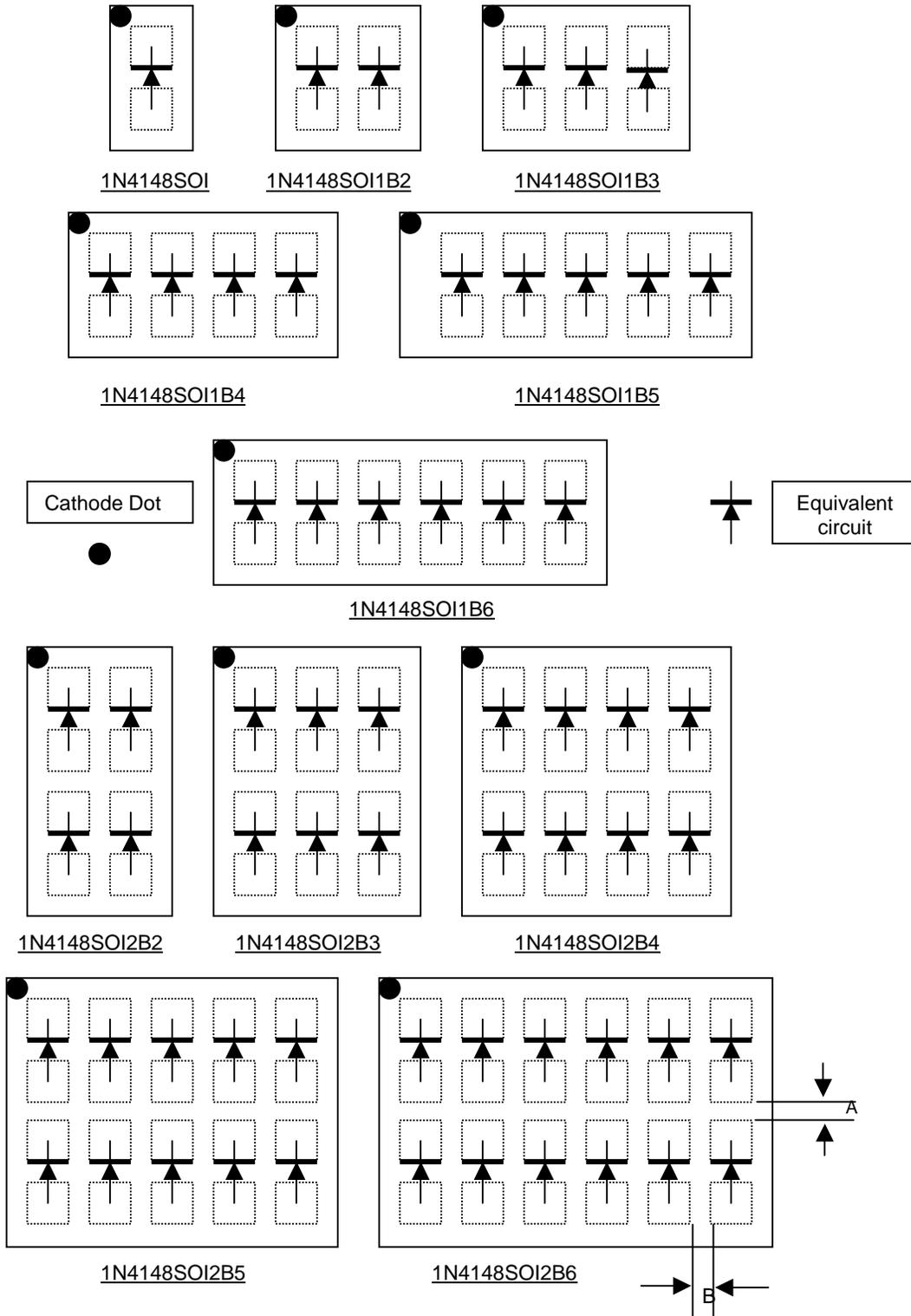
Dimensions					Notes 1, 2
Ltr	Inches		Millimeters		
	Min	Max	Min	Max	
BL	0.037	0.039	0.94	0.99	
BW	0.017	0.019	0.43	0.48	
PW	0.007	0.009	0.18	0.23	
PL	0.007	0.009	0.18	0.23	
BT	0.015	0.019	0.38	0.48	
SP	0.010	0.014	0.25	0.36	

NOTES:

1. Dimensions are in inches.
2. Millimeters are given for general information only.

FIGURE 1. Semiconductor device, diode, type 1N4148SOI.

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Note: Reference Fig. 1 for individual dimensions. A and B dimensions are 0.009 – 0.015 inches (0.229 – 0.381 mm)

FIGURE 2. Description of (NBN) array designation.

3. REQUIREMENTS

3.1 General. The individual item requirements shall be as specified in MIL-PRF-19500 and as modified herein.

3.2 Qualification. Devices furnished under this specification shall be products that are manufactured by a manufacturer authorized by the qualifying activity for listing on the applicable qualified manufacturer's list (QML) before contract award (see 4.2 and 6.3).

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

V_{fr} Forward recovery voltage. Specified maximum forward voltage used to determine forward recovery time.

$R_{\theta JMP}$ Thermal resistance, junction to mounting pad

3.4 Interface and physical dimensions. Interface and physical dimensions shall be as specified in MIL-PRF-19500, and on figure 1 herein.

3.4.1 Interface metallization. Interface metallization shall be solderable in accordance with MIL-PRF-19500, MIL-STD-750, and herein. Where a choice of interface metallization is desired, it shall be specified in the acquisition document (see 6.2).

3.4.2 Diode construction. Devices shall constructed using a silicon on insulator technique with both the cathode and anode attachments on one side of the device. The opposite side of the device shall be non-conductive and isolated from the electrical elements of the device.

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

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

3.7 Marking. Devices shall not be marked. Initial container package marking shall be in accordance with MIL-PRF-19500.

3.8 Polarity. The polarity shall be indicated with a contrasting color dot to denote the cathode end.

3.9 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. Qualification inspection shall be performed on PIN 1N4148SOI to qualify all variations. The qualification inspection samples may be mounted to appropriate substrates or carriers in order to facilitate testing.

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4.2.1 Group E qualification. Group E qualification shall be performed herein for qualification or requalification only. In case qualification was awarded to a prior revision of the associated specification that did not request the performance of table II tests, the tests specified in table II herein shall be performed on the first inspection lot to this revision to maintain qualification.

4.3 Screening (JAN, JANTX, JANTXV and JANS levels). 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.

Screening (see table IV of MIL-PRF-19500)	JAN level	JANTXV and JANTX level	JANS level
1a	Not required	Not required	Not required
1b		Required (JANTXV only)	Required
2	Not required	Not required	Not required
3a	Temperature cycling in accordance with MIL-PRF-19500.	Temperature cycling in accordance with MIL-PRF-19500.	Temperature cycling in accordance with MIL-PRF-19500.
(1) 3c	Thermal impedance (Method 3101 of MIL-STD-750) see 4.3.1	Thermal impedance (Method 3101 of MIL-STD-750) see 4.3.1	Thermal impedance (Method 3101 of MIL-STD-750) see 4.3.1
4	Not required	Not applicable	Not applicable
5	Not required	Not applicable	Not applicable
6	Not required	Not applicable	Not applicable
7	Not required	Not applicable	Not applicable
8	Not required	Not required	100%
9	Table I, subgroup 2 herein	Table I, subgroup 2 herein	Table I, subgroup 2 herein
10	Not required	Method 1038 of MIL-STD-750, condition A	Method 1038 of MIL-STD-750, condition A
(2) (3) 11	Not required	Subgroup 2 of table I herein; $\Delta I_{R1} = 100$ percent of initial value or 15 nA dc, whichever is greater; $\Delta V_{F1} = 25$ mV dc	Subgroups 2 and 3 of table I herein; $\Delta I_{R1} \leq 100$ percent of initial value or 15 nA dc, whichever is greater; $\Delta V_{F1} \leq \pm 25$ mV dc
12	Not required	Not required	Not required
13	Not required	Not required	Not required.
14	Not required	Not required	Not required
15	Not required	Not required	100%
16	Not required	Not required	Required

NOTES:

- (1) Thermal impedance shall be performed any time after sealing provided temperature cycling is performed in accordance with MIL-PRF-19500, screen 3 before this thermal test.
- (2) Test within 24 hours after removal from test.
- (3) When thermal impedance is performed before screen 13, it is not required to be repeated in screen 13.

4.3.1 Thermal impedance ($Z_{\theta JMP}$ measurements). Thermal impedance measurements shall be in accordance with method 3101 of MIL-STD-750, and as follows.

- a. $I_H = 300$ mA to 500 mA.
- b. $t_H = 10$ ms.
- c. $I_M = 1$ mA to 10 mA.
- d. $t_{MD} = 70$ μ s maximum.

The maximum limit for $Z_{\theta JX}$ under these test conditions is $Z_{\theta JX} = 20^\circ\text{C/W}$.

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4.4 Conformance inspection. Conformance inspection shall be in accordance with MIL-PRF-19500 and as specified herein. Conformance inspection shall be performed on PIN 1N4148SOI to qualify all variations. The conformance inspection samples may be mounted to appropriate substrates or carriers in order to facilitate testing.

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 table I, 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 VIa (JANS) or table VIb (JAN, JANTX, and JANTXV) of MIL-PRF-19500 and as specified herein. Electrical measurements (end-points) shall be in accordance with table I, subgroup 2 herein except for the thermal impedance test.

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

<u>Subgroup</u>	<u>Method</u>	<u>Condition</u>
B3	1051	-55°C to +150°C.
B3	4066	Not applicable.
B3	1071	Hermetic Seal not applicable
B4		Not applicable
B5	1038	$T_A = +150^\circ\text{C}$; $V_{BR} = 95 \text{ V dc}$, 240 hours
B6	3101	$R_{\theta\text{JMP}} \leq 40^\circ\text{C/W}$

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>
B2	1051	-55°C to +150°C
B2	4066	Not applicable.
B2	1071	Not applicable.
B3	1038	$V_{RWM} = 75 \text{ Vdc}$, $T_A = 150^\circ\text{C}$., 340 hours
B5		Not required

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 except for the thermal impedance test.

<u>Subgroup</u>	<u>Method</u>	<u>Conditions</u>
C2	1051	-55°C to +150°C.
C2	2037	Terminal Strength, not applicable
C2	1071	Not applicable
C3, C4		Not applicable
C5	3101	$R_{\theta JMP} \leq 40^{\circ}\text{C}/\text{W}$
C6	1026	$T_A = +150^{\circ}\text{C} \pm 5^{\circ}\text{C}$, $V_{RWM} = 75 \text{ V(pk)}$,

4.4.4 Group E inspection. Group E inspection shall be conducted in accordance with the conditions specified for subgroup testing in appendix E, table IX of MIL-PRF-19500 and as specified herein. Electrical measurements (end-points) shall be in accordance with table I, subgroup 2 herein.

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 for pulse measurements shall be specified in section 4 of MIL-STD-750.

4.5.2 Forward recovery voltage and time. Forward recovery time shall be measured as the time interval between zero time and the point where the pulse has decreased to 110 percent of the steady-state value of V_F when $I_F = 50 \text{ mA dc}$. The maximum rise time of the response detector shall be 1 ns.

4.5.3 Thermal resistance. Thermal resistance measurement shall be in accordance with method 3101 of MIL-STD-750. Forced moving air or draft shall not be permitted across the device during test. The maximum limit for $R_{\theta JMP}$ under these test conditions shall be as shown in group C of 4.4.3). The following conditions shall apply when using method 3101.

- a. I_H 75 mA to 300 mA.
- b. t_H 25 seconds minimum
- c. I_M 1 mA to 10 mA.
- d. t_{MD} 70 μs maximum.

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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>						
Thermal impedance	3101	See 4.3.1	Z _{0JMP}		20	°C/W
Forward voltage	4011	I _F = 10 mA dc	V _{F1}		0.8	V dc
Breakdown voltage	4021	I _R = 100 μA dc	V _{BR1}	100		V dc
Reverse current	4016	DC method V _R = 20 V dc	I _{R1}		25	nA dc
Reverse current	4016	DC method V _R = 75 V dc	I _{R2}		500	nA dc
Forward voltage	4011	I _F = 100 mA dc	V _{F2}		1.2	V dc
<u>Subgroup 3</u>						
High temperature operation:		T _A = +150°C				
Reverse current	4016	DC method V _R = 20 V dc	I _{R3}		35	μA dc
Reverse current	4016	DC method V _R = 75 V dc	I _{R4}		75	μA dc
Forward voltage	4011	I _F = 10 mA dc	V _{F3}		0.8	V dc
Low temperature operation:		T _A = -55°C				
Forward voltage	4011	I _F = 100 mA dc	V _{F4}		1.3	V dc
<u>Subgroup 4</u>						
Junction capacitance	4001	V _R = 0 V dc, f = 1 MHz, V _{sig} = 50 mV _{p-p} maximum	C ₁			
Junction capacitance	4001	V _R = 1.5 V dc, f = 1 MHz, V _{sig} = 50 mV _{p-p} maximum	C ₂		4.0 2.8	pF pF
<u>Subgroup 4 Continued</u>						
Reverse recovery time	4031	Condition A, C ≥ 1 nF, I _F = I _R = 10 mA dc, R _L = 100Ω ±5% I _{R(REC)} = 1.0 mA dc, R ≥ 1000Ω.	t _{rr}		5	ns

See footnote at end of table.

TABLE I. Group A inspection - Continued.

Inspection <u>1/</u>	MIL-STD-750		Symbol	Limits		Unit
	Method	Conditions		Min	Max	
<u>Subgroup 5</u> Not applicable						
<u>Subgroup 6</u> Surge current	4066	Condition A (sine wave) $i_{f(surge)} = 2 \text{ A (pk)}$, $I_O = \text{maximum rated dc current} = 0$ $V_{RM} = 0$ 10 surges, 8.3 ms width each, one surge per minute, $T_A = +25^\circ\text{C}$ or Condition B (square wave) $I_{F(surge)} = 1.41 \text{ A (pk)}$ $t_p = 8.3 \text{ ms}$ $n = 10$ $d.f. = 0.0055\%$ $T_A = 25^\circ\text{C}$ See table I, subgroup 2				
Electrical measurements						
<u>Subgroup 7</u> Forward recovery voltage and time	4026	$I_F = 50 \text{ mA dc}$ (see 4.5.2)	V_{fr} t_{fr}	5.0 20	V (pk) ns	

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

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

Inspection	MIL-STD-750		Sampling plan
	Method	Conditions	
<u>Subgroup 1</u>			45 devices c = 0
Temperature cycling	1051	-55 to 150°C, 500 cycles	
Electrical measurements		See table I, subgroup 2	
<u>Subgroup 2</u>			45 devices c = 0
Intermittent operating life	1037	10,000 cycles	
Electrical measurements		See table I, subgroup 2	
<u>Subgroup 3</u>			3 devices c = 0
DPA		In accordance with suppliers procedure.	
<u>Subgroup 4</u>			Sample size N/A
Thermal impedance curves		Each supplier shall submit their (typical) design thermal impedance curves. In addition, test conditions and $Z_{\theta JMP}$ limit shall be provided to the qualifying activity in the qualification report.	
<u>Subgroup 5</u>			3 devices c = 0
ESD	1020		

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 materiel 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 Point's packaging activity within the Military Department or Defense Agency, or within the Military Department's System Command. Packaging data retrieval is available from the managing Military Department's 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 must specify the following:

- a. Title, number, and date of this specification.
- b. Issue of DoDISS to be cited in the solicitation and, if required, the specific issue of individual documents referenced (see 2.2.1).
- c. Packaging requirements (see 5.1).
- d. Lead finish (see 3.4.1).
- e. Type designation including array suffix (See Figure 2) and product assurance level.
- f. Special array configurations, with approval of the manufacturer, will be identified in the contract.

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 Manufacturers' List (QML) 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 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, P.O. Box 3990, Columbus, OH 43216-5000.

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

Preparing activity
DLA - CC

(Project 5961-2838)

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-19500/690	2. DOCUMENT DATE 7 November 2003
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3. **DOCUMENT** SEMICONDUCTOR DEVICE, DIODE, SILICON, SWITCHING TYPES 1N4148SOI(NBN), JAN, JANTX, JANTXV, AND JANS

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@dla.mil
c. ADDRESS Defense Supply Center, Columbus ATTN: DSCC-VAC P.O. Box 3990 Columbus, OH 43216-5000	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			