

The documentation and process conversion measures necessary to comply with this revision shall be completed by 12 January 2012.

INCH-POUND

MIL-PRF-19500/724C
12 October 2011
SUPERSEDING
MIL-PRF-19500/724B
28 February 2011

PERFORMANCE SPECIFICATION SHEET

SEMICONDUCTOR DEVICE, DIODE, SILICON, SCHOTTKY RECTIFIER,
TYPES 1N6920UTK4, 1N6921UTK4, 1N6922UTK4, 1N6920UTK4CS, 1N6921UTK4CS,
1N6922UTK4CS, 1N6920UTK4AS, 1N6921UTK4AS, AND 1N6922UTK4AS,
JANTX, JANTXV, AND JANS

This specification is approved for use by all Departments and Agencies of the Department of Defense.

The requirements for acquiring the product described herein shall consist of this specification sheet and [MIL-PRF-19500](#).

1. SCOPE

1.1 Scope. This specification covers the performance requirements for silicon, Schottky power surface mount rectifier diodes in a low profile package. Three levels of product assurance are provided for each device type as specified in [MIL-PRF-19500](#).

1.2 Physical dimensions. See [figure 1](#).

1.3 Maximum ratings. Unless otherwise specified $T_C = +25^\circ\text{C}$.

Column 1	Column 2	Column 3	Column 4	Column 5	Column 6	Column 7
Types	V _{RWM}	I_O $T_C = +100^\circ\text{C}$	I _{FSM} $t_p = 8.3 \text{ ms}$, $T_C = +25^\circ\text{C}$	$R_{\theta JC}$ (junction to cathode side)	$R_{\theta JC}$ (junction to anode side)	T_{STG} and T_J
	V dc	A dc	A (pk)	°C/W	°C/W	°C
1N6920UTK4, CS, AS	15	75	1,000	.50	.65	-65 to +150
1N6921UTK4, CS, AS	30	75	1,000	.50	.65	
1N6922UTK4, CS, AS	45	75	1,000	.50	.65	

Comments, suggestions, or questions on this document should be addressed to DLA Land and Maritime, ATTN: VAC, P.O. Box 3990, Columbus, OH 43218-3990, or emailed to Semiconductor@dla.mil. Since contact information can change, you may want to verify the currency of this address information using the ASSIST Online database at <https://assist.daps.dla.mil>.

1.4 Primary electrical characteristics. Unless otherwise specified, $T_C = +25^\circ\text{C}$.

Column 1	Column 2	Column 3	Column 4			Column 5
Types	V_F Maximum forward voltage at $T_C = +25^\circ\text{C}$ $V_{\text{dc}} \text{ at } I_F$	V_F Maximum forward voltage $T_C = +125^\circ\text{C}$ $V_{\text{dc}} \text{ at } I_F$	I_R Maximum reverse current (see column 2) mA at V_{RWM}			C_J Maximum junction capacitance $f = 1\text{MHz}$ $V_R = 5\text{ VDC}$
	40A	75A	75A	$T_J = +25^\circ\text{C}$	$T_J = +125^\circ\text{C}$	V_R
1N6920UTK4, CS, AS	.44	.50	.43	2.5	600	15
1N6921UTK4, CS, AS	.43	.50	.48	2.5	600	30
1N6922UTK4, CS, AS	.50	.60	.57	2.5	750	45
						3,200

2. APPLICABLE DOCUMENTS

2.1 General. The documents listed in this section are specified in sections 3, 4, or 5 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 of documents cited in sections 3, 4, or 5 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 cited in the solicitation or contract.

DEPARTMENT OF DEFENSE SPECIFICATIONS

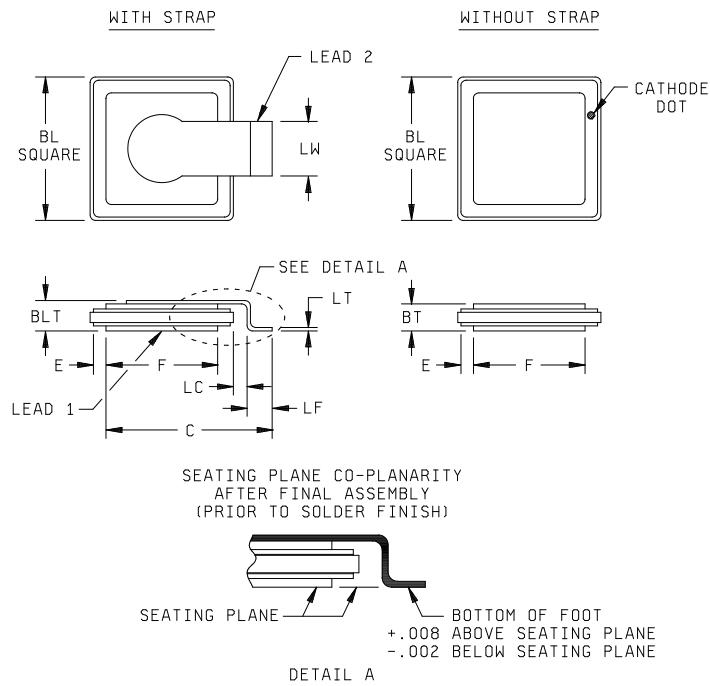
MIL-PRF-19500 - Semiconductor Devices, General Specification for.

DEPARTMENT OF DEFENSE STANDARDS

MIL-STD-750 - Test Methods for Semiconductor Devices.

(Copies of these documents are available online at <https://assist.daps.dla.mil/quicksearch/> or <https://assist.daps.dla.mil>, or from the Standardization Document Order Desk, 700 Robbins Avenue, Building 4D, Philadelphia, PA 19111-5094.)

2.3 Order of precedence. Unless otherwise noted herein or in the contract, 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.



Ltr	Dimensions			
	Inches		Millimeters	
	Min	Max	Min	Max
BL	.320	.340	8.13	8.64
BLT		.125		3.18
BT		.115		2.92
C	.378	.418	9.60	10.62
E	.032 NOM		.81 NOM	
F	.251	.261	6.38	6.63
LC	.040 NOM		1.02 NOM	
LF	.055	.075	1.40	1.91
LT	.005	.015	.127	.381
LW	.085	.115	2.16	2.92

NOTES:

1. Dimensions are in inches.
2. Millimeters are given for general information only.
3. In accordance with ASME Y14.5M, diameters are equivalent to ϕx symbology.
4. For anode, cathode, and strap connections, see 3.4.1 and 3.4.3.

FIGURE 1. Dimensions and configuration.

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](#).

3.4 Interface and physical dimensions. The interface and physical dimensions shall be as specified in [MIL-PRF-19500](#), and on [figure 1](#) herein.

3.4.1 Diode construction. These devices shall be constructed utilizing double plug construction with eutectic bonding between both sides of the silicon die and terminal pins (see [MIL-PRF-19500](#)). Metallurgical bond shall be in accordance with the requirements of category II in [MIL-PRF-19500](#). The diode body is ceramic. All seals are eutectic solder. Strap material is a copper alloy or copper sandwich. The 1N6920UTK4, 1N6921UTK4, and 1N6922UTK4 have no strap. The strap connects to the cathode on 1N6920UTK4CS, 1N6921UTK4CS, and 1N6922UTK4CS and to the anode on 1N6920UTK4AS, 1N6921UTK4AS, and 1N6922UTK4AS.

3.4.2 Lead formation and finish. Unless otherwise specified, lead finish (pads, bottom pad and strap foot) shall be solderable in accordance with [MIL-PRF-19500](#), [MIL-STD-750](#) and herein. Where a choice of lead finish or formation is desired, it shall be specified in the acquisition document (see [6.2](#)).

3.4.3 Polarity. Polarity shall be marked with the appropriate diode symbol on the strap or with a dot on the cathode side of the seal ring on "no strap" devices (see [figure 1](#)).

3.5 Marking. Marking shall be in accordance with [MIL-PRF-19500](#) and herein. All marking may be omitted from the device except for the polarity marking. When present, part number may be abbreviated (ex: JS6920 for JANS1N6920UTK4). All marking that is omitted from the body of the device shall appear on the label of the initial container.

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 [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](#) and [tables I, II, and III](#)).

4.2 Qualification inspection. Qualification inspection shall be in accordance with [MIL-PRF-19500](#) and as specified herein.

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

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

* 4.3 Screening. Screening shall be in accordance with table E-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 E-IV of MIL-PRF-19500)	Measurement	
	JANS level	JANTX and JANTXV levels
(1) 3b	Condition A, one pulse, $I_O = 0$, $V_{RWM} = 0$, $ I_{FSM} $ = see 1.3 , column 4 herein.	Condition A, one pulse, $I_O = 0$, $V_{RWM} = 0$, $ I_{FSM} $ = see 1.3 , column 4 herein.
3c	Thermal impedance (see 4.3.1).	Thermal impedance (see 4.3.1).
4	Not applicable	Not applicable
5	Not applicable	Not applicable
7b	Optional	Optional
8	Serialization required.	Not applicable
9	Not applicable	Not applicable
10	Not applicable	Not applicable
11	V_{F1} and $ I_{R1} $	V_{F1} and $ I_{R1} $
*	Method 1038 of MIL-STD-750 , test condition A; $T_C = +125^\circ\text{C}$, $t = 240$ hours, $V_{RM} = 80$ percent of rated V_{RWM} = see 1.3 , column 2 herein $V_{(pk)}$, $I_O = 0$, $f = 60$ Hz; alternate test: $V_{RM} = 80$ percent of rated V_{RWM} (see 1.3 , column 2 herein for V_{RWM}), $T_C = +125^\circ\text{C}$	Method 1038 of MIL-STD-750 , test condition A; $T_C = +125^\circ\text{C}$, $t = 48$ hours, $V_{RM} = 80$ percent of rated V_{RWM} = see 1.3 , column 2 herein $V_{(pk)}$, $I_O = 0$, $f = 60$ Hz; alternate test: $V_{RM} = 80$ percent of rated V_{RWM} (see 1.3 , column 2 herein for V_{RWM}), $T_C = +125^\circ\text{C}$
12	Subgroup 2, of table I herein, and subgroup 3 of table I herein, V_{F1} and $ I_{R1} $; $\Delta V_{F1} = \pm 50$ mV (pk); $\Delta I_{R1} = \pm .5$ mA dc or 100 percent from the initial value, whichever is greater. Scope display evaluation (see table I , subgroup 7)	Subgroup 2, of table I herein excluding thermal impedance; V_{F1} and $ I_{R1} $; $\Delta V_{F1} = \pm 50$ mV (pk); $\Delta I_{R1} = \pm .5$ mA dc or 100 percent from the initial value, whichever is greater. Scope display evaluation (see table I , subgroup 7)
13	Required	Required
14b	Not applicable	Not applicable

(1) Surge shall precede thermal impedance. These tests shall be performed anytime after screen 3 and before screen 10.

4.3.1 Thermal impedance. The thermal impedance measurements shall be performed in accordance with method 3101 of **MIL-STD-750**. See table E-IX, group E, subgroup 4 of **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 table E-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 tables E-VIA (JANS) and E-VIB (JANTX and JANTXV) of **MIL-PRF-19500** and [4.4.2.1](#) and [4.4.2.2](#) herein. Electrical measurements (end-points) shall be in accordance with **table I**, subgroup 2 herein. Delta measurements shall be in accordance with **table III** herein.

4.4.2.1 Group B inspection, table E-VIA (JANS) of [MIL-PRF-19500](#).

<u>Subgroup</u>	<u>Method</u>	<u>Condition</u>
B4	1037	$\Delta T_J = +85^\circ\text{C}$ minimum, $I_F = 2 \text{ A}$ minimum for 2,000 cycles.
B5	1038	Condition B, $I_F = 1 \text{ A}$ dc minimum, adjust T_A and I_F to achieve $T_J = +150^\circ\text{C}$, $+0^\circ\text{C}$, -35°C , $t = 240$ hours min; (heat sinking allowed).

4.4.2.2 Group B inspection, table E-VIB (JANTX and JANTXV) of [MIL-PRF-19500](#).

<u>Subgroup</u>	<u>Method</u>	<u>Condition</u>
B3	1037	$\Delta T_J = +85^\circ\text{C}$ minimum, $I_F = 2 \text{ A}$ minimum for 2,000 cycles.

4.4.3 Group C inspection. Group C inspection shall be conducted in accordance with the conditions specified for subgroup testing in table E-VII of [MIL-PRF-19500](#). Electrical measurements (end-points) shall be in accordance with [table I](#), subgroup 2 herein. Delta measurements shall be in accordance with [table III](#) herein.

<u>Subgroup</u>	<u>Method</u>	<u>Condition</u>
C5	3101	$I_H = 20 \text{ A}$ to 50 A , $I_M = 10 \text{ mA}$ to 250 mA , $t_H =$ thermal equilibrium; $t_{MD} = 200 \mu\text{sec}$ maximum.
C6	1037	$\Delta T_J = +85^\circ\text{C}$ minimum, $I_F = 2 \text{ A}$ minimum for 6,000 cycles.

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

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

4.5.1 Pulse measurements. Conditions for pulse measurement shall be as specified in section 4 of [MIL-STD-750](#).

4.5.2 Avalanche energy test. The Schottky rectifier shall be capable of absorbing the reverse energy of 350 rectangular pulses, $t_p = 1 \mu\text{sec}$, $I_R = 2 \text{ A}$ at 1 kHz. This will be performed during wafer or die level prior to device assembly.

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 2/ 1N6920UTK2, AS, CS 1N6921UTK2, AS, CS 1N6922UTK2, AS, CS	3101	$I_M = 10 \text{ mA to } 250 \text{ mA}$, $I_H = 150 \text{ A}$, $t_H = 2 \text{ ms}$, $t_{md} = 200 \mu\text{s}$ maximum	Z_{0JX}	.25 .25 .25	.25 .25 .25	°C/W °C/W °C/W
Forward voltage 1N6920UTK2, AS, CS 1N6921UTK2, AS, CS 1N6922UTK2, AS, CS	4011	Pulsed test (see 4.5.1) $t_p = 300 \mu\text{s}$ $I_F = 40 \text{ A (pk)}$ $I_F = 40 \text{ A (pk)}$ $I_F = 40 \text{ A (pk)}$	V_{F1}		.44 .43 .50	V
Forward voltage 1N6920UTK2, AS, CS 1N6921UTK2, AS, CS 1N6922UTK2, AS, CS	4011	Pulsed test (see 4.5.1) $t_p = 300 \mu\text{s}$ $I_F = 75 \text{ A (pk)}$ $I_F = 75 \text{ A (pk)}$ $I_F = 75 \text{ A (pk)}$	V_{F2}		.50 .50 .60	V
Reverse current leakage 1N6920UTK2, AS, CS 1N6921UTK2, AS, CS 1N6922UTK2, AS, CS	4016	DC method $V_R = 15 \text{ V}$ $V_R = 30 \text{ V}$ $V_R = 45 \text{ V}$	I_{R1}		2.5 2.5 2.5	mA mA mA
Breakdown voltage 1N6920UTK2, AS, CS 1N6921UTK2, AS, CS 1N6922UTK2, AS, CS	4021	Pulsed test (see 4.5.1) $t_p = 35 \text{ ms}$ $I_R = 15 \text{ mA (pk)}$ $I_R = 15 \text{ mA (pk)}$ $I_R = 15 \text{ mA (pk)}$	V_{BR1}	16.5 33 50		V

See footnotes at end of table.

TABLE I. Group A inspection – Continued.

Inspection 1/	MIL-STD-750		Symbol	Limits		Unit
	Method	Conditions		Min	Max	
<u>Subgroup 3</u>						
High temperature operation:		$T_C = +125^\circ\text{C}$				
Forward voltage	4011	Pulsed test (see 4.5.1) $t_p = 300 \mu\text{s}$ $I_F = 75 \text{ A (pk)}$ $I_F = 75 \text{ A (pk)}$ $I_F = 75 \text{ A (pk)}$	V_{F3}	.43	.48	V
1N6920UTK2, AS, CS 1N6921UTK2, AS, CS 1N6922UTK2, AS, CS				.48	.57	V
Reverse current leakage	4016	DC method $V_R = 15 \text{ V}$ $V_R = 30 \text{ V}$ $V_R = 45 \text{ V}$	I_{R2}	600	600	mA
1N6920UTK2, AS, CS 1N6921UTK2, AS, CS 1N6922UTK2, AS, CS				750	750	mA
Low temperature operation:		$T_C = -55^\circ\text{C}$				
Breakdown voltage	4021	Pulsed test (see 4.5.1) $t_p = 35 \text{ ms}$ $I_R = 15 \text{ mA (pk)}$ $I_R = 15 \text{ mA (pk)}$ $I_R = 15 \text{ mA (pk)}$	V_{BR2}	15	30	V
1N6920UTK2, AS, CS 1N6921UTK2, AS, CS 1N6922UTK2, AS, CS				45	45	V
<u>Subgroup 4</u>						
Junction capacitance	4001	$V_R = 5 \text{ V dc, } f = 1 \text{ MHz,}$ $V_{SIG} = 50 \text{ mV (p-p)}$	C_J	5,000	3,500	pF
1N6920UTK2, AS, CS 1N6921UTK2, AS, CS 1N6922UTK2, AS, CS				3,200	3,200	pF
<u>Subgroup 5</u>						
Not applicable						

See footnotes at end of table.

TABLE I. Group A inspection – Continued.

Inspection 1/	MIL-STD-750		Symbol	Limits		Unit
	Method	Conditions		Min	Max	
<u>Subgroup 6</u> Surge	4066	I _{FSM} = see 1.3, column 4, ten surges of 8.3 ms each at 1 minute intervals. Condition A: T _C = +25°C				
Electrical measurements		See table I, subgroup 2 herein				
<u>Subgroup 7</u> Scope display evaluation	4023	3/				
Electrical measurements		See table I, subgroup 2 herein				

1/ For sampling plan, see [MIL-PRF-19500](#).

2/ This test required for the following end-point measurements only:
 Group B, subgroups 3, 4, and 5 (JANS).
 Group B, subgroups 2 and 3 (JANTX and JANTXV).
 Group C, subgroups 2, and 6.
 Group E, subgroup 1.

3/ The reverse breakdown characteristics shall be viewed on an oscilloscope with display calibration factors of 2-mA/division and 10 to 20 V/division. Reverse current over the knee shall be at least 10 mA. Each device may exhibit a slightly rounded characteristic and any discontinuity or dynamic instability of the trace shall be cause for rejection.

* TABLE II. Group E inspection (all quality levels) – for qualification and requalification only.

Inspection	MIL-STD-750		Qualification
	Method	Conditions	
<u>Subgroup 1</u>			
Thermal shock (liquid to liquid)	1056	Test condition A, 0°C to +100°C.	n = 45, c = 0
Temperature cycling (air to air)	1051	Test condition C, 500 cycles.	
Hermetic seal	1071		
<u>Subgroup 2</u>			n = 45, c = 0
Life test	1038	Condition A, t = 1,000 hours, VR = 80 percent V _{rated} (see 1.3, column 2 herein).	
Electrical measurements		See table I , subgroup 2 and table III herein.	
<u>Subgroup 4</u>			
Thermal impedance curves		See MIL-PRF-19500 .	
<u>Subgroup 5</u>			
Not applicable			
<u>Subgroup 7</u>			n = 22, c = 0
Forward surge	4066	I _{FSM} = see 1.3, 110 percent of column 4; ten surges of 8.3 ms each at 1 minute intervals, condition A: T _C = +25°C.	
Electrical measurements		See table I , subgroup 2 except for thermal impedance.	

TABLE III. Groups B, C, and E delta requirements. 1/ 2/ 3/ 4/ 5/

Step	Inspection <u>1/</u>	MIL-STD-750		Symbol	Limit		Unit
		Method	Conditions		Min	Max	
1.	Forward voltage	4011		ΔV_{F1}	± 50 mV		
2.	Reverse current leakage	4016		ΔI_{R1}	$\pm .5$ mA or 100 percent of initial value whichever is greater.		

1/ The delta measurements for table E-VIA (JANS) of [MIL-PRF-19500](#) are as follows: Subgroups 4 and 5, see [table III](#) herein, steps 1 and 2.

2/ The delta measurements for table E-VIB (JANTX and JANTXV) of [MIL-PRF-19500](#) are as follows: Subgroup 3, see [table III](#) herein, steps 1 and 2.

3/ The delta measurements for table E-VII of [MIL-PRF-19500](#) are as follows: Subgroup 6, see [table III](#) herein, steps 1 and 2.

4/ The delta measurements for table E-IX of [MIL-PRF-19500](#) are as follows: Subgroups 1 and 2, see [table III](#) herein, steps 1 and 2.

5/ Devices which exceed the [table I](#) limits for this test shall not be accepted.

5. PACKAGING

5.1 Packaging. For acquisition purposes, the packaging requirements shall be as specified in the contract or order (see 6.2). When packaging of materiel is to be performed by DoD or in-house contractor personnel, these personnel need to contact the responsible packaging activity to ascertain packaging requirements. Packaging requirements are maintained by the Inventory Control Point's packaging activities within the Military Service or Defense Agency, or within the Military Service's system commands. 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. The notes specified in [MIL-PRF-19500](#) are applicable to this specification.)

6.1 Intended use. Semiconductors conforming to this specification are intended for original equipment design applications and logistic support of existing equipment.

6.2 Acquisition requirements. Acquisition documents should specify the following:

- Title, number, and date of this specification.
- Packaging requirements (see 5.1).
- Lead formation and finish (see [3.4.2](#)).
- Product assurance level and type designator.

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 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 orders for the products covered by this specification. Information pertaining to qualification of products may be obtained from DLA Land and Maritime, ATTN: VQE, P.O. Box 3990, Columbus, OH 43218-3990 or e-mail vqe.chief@dla.mil. An online listing of products qualified to this specification may be found in the Qualified Products Database (QPD) at <https://assist.daps.dla.mil>.

6.4 Changes from previous issue. The margins of this specification are marked with asterisks to indicate where changes from the previous issue were made. This was done as a convenience only and the Government assumes no liability whatsoever for any inaccuracies in these notations. Bidders and contractors are cautioned to evaluate the requirements of this document based on the entire content irrespective of the marginal notations and relationship to the last previous issue.

Custodians:

Army - CR
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Preparing activity:
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(Project 5961-2011-058)

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