

The documentation and process conversion measures necessary to comply with this revision shall be completed by 4 September 2008.

INCH-POUND  
MIL-PRF-19500/656A  
4 June 2008  
SUPERSEDING  
MIL-PRF-19500/656  
16 August 2001

\* PERFORMANCE SPECIFICATION

SEMICONDUCTOR DEVICE, DIODE, SILICON, SCHOTTKY,  
POWER RECTIFIER, COMMON CATHODE OR COMMON ANODE CENTER TAP,  
TYPES 1N6785 AND 1N6785R, JAN, 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 a silicon, Schottky, power rectifier diode. Four levels of product assurance are provided for each device type as specified in MIL-PRF-19500.

1.2 Physical dimensions. See figure 1 (TO-257AA).

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

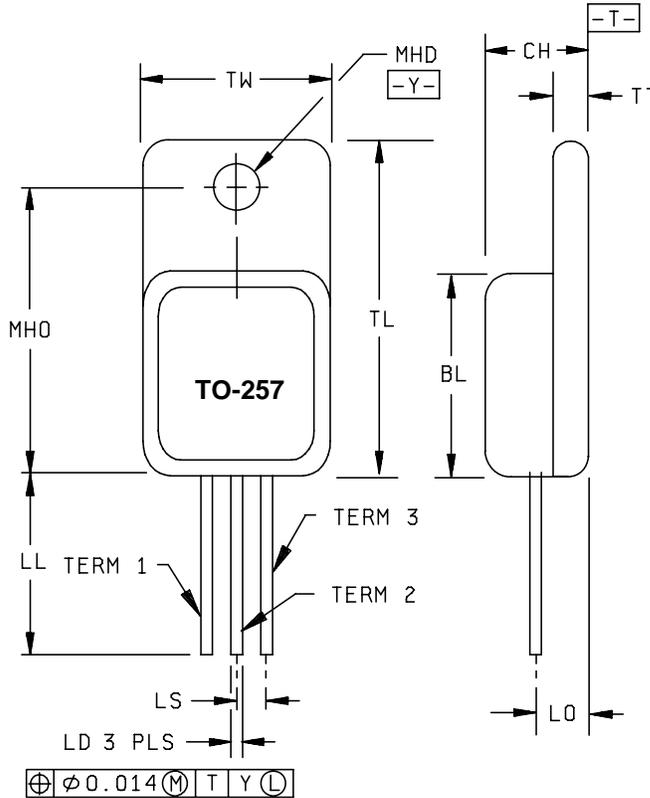
Type	$V_R$ (1)	$V_{RWM}$ (1)	$I_O$ (1) (2) (3)	$I_{FSM}$ (1) $T_C = +25^\circ\text{C}$ $t_p = 8.3 \text{ ms}$	$C_J$ at 5 V (1)	$R_{\theta JC}$ (1)	$R_{\theta JA}$ (1)	$T_{STG}$ and $T_J$
			$T_J = T_C = +100^\circ\text{C}$	$^\circ\text{C/W}$		$^\circ\text{C/W}$		
	<u>V</u>	<u>V</u>	<u>A dc</u>	<u>A(pk)</u>	<u>pF</u>			<u><math>^\circ\text{C}</math></u>
1N6785, 1N6785R	45	45	15	150	2,000	1.65	40	-65 to +150

(1) Each individual diode.

(2) Derate linearly at  $300 \text{ mA}/^\circ\text{C}$  from  $T_J = T_C = +100^\circ\text{C}$  to  $+150^\circ\text{C}$ ;  $300 \text{ mA}/^\circ\text{C}$  times  $50^\circ\text{C} = 15 \text{ A}$ , the device rating.

(3) Total package current is limited to 30 A dc.

\* Comments, suggestions, or questions on this document should be addressed to Defense Supply Center, Columbus, ATTN: DSCC-VAC, P.O. Box 3990, Columbus, OH 43218-3990, or emailed to [semiconductor@dsc.dla.mil](mailto:semiconductor@dsc.dla.mil). Since contact information can change, you may want to verify the currency of this address information using the ASSIST Online database at <http://assist.daps.dla.mil>.

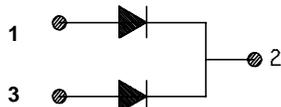


Ltr	Dimensions			
	Inches		Millimeters	
	Min	Max	Min	Max
BL	.410	.430	10.41	10.92
CH	.190	.200	4.83	5.08
LD	.025	.040	0.64	1.02
LL	.500	.750	12.7	19.05
LO	.120		3.05	
LS	.100 BSC		2.54 BSC	
MHD	.140	.150	3.56	3.81
MHO	.527	.537	13.38	13.64
TL	.645	.665	16.38	16.89
TT	.035	.045	0.889	1.14
TW	.410	.420	10.41	10.67

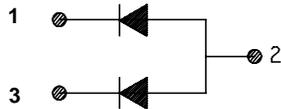
- NOTES:
1. Dimensions are in inches.
  2. Millimeters are given for general information only.
  3. All terminals are isolated from case.
  4. In accordance with ASME Y14.5M, diameters are equivalent to  $\Phi x$  symbology.

SCHMATIC

1N6785



1N6785R



\* FIGURE 1. Physical dimensions and configuration (TO-257AA).

## 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 <http://assist.daps.dla.mil/quicksearch/> or <http://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.

## 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 manufacturers 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 (TO-257AA) herein. Methods used for electrical isolation of the terminal feedthroughs shall employ materials that contain a minimum of 90 percent  $AL_2O_3$  (ceramic). Examples of such construction techniques are metallized ceramic eyelets or ceramic walled packages

3.4.1 Lead finish and formation. Lead finish shall be solderable as defined in 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 requirements (see 6.2).

3.4.2 Polarity. Polarity and terminal configuration shall be in accordance with figure 1 herein.

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

\* 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 group A as specified 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.

4.3 Screening (JANS, JANTX, and JANTXV levels only). 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) 3c	Method 3101 (see 4.3.2), peak reverse energy test (see 4.3.3)	Method 3101 (see 4.3.2), peak reverse energy test (see 4.3.3)
9 and 10	Not applicable	Not applicable
11	$V_{F2}$ and $I_{R1}$	$V_{F2}$ and $I_{R1}$
12	See 4.3.1, t = 240 hours	See 4.3.1, t = 48 hours
13	Subgroups 2 and 3 of table herein; $\Delta V_{F2} = \pm 50$ mV; $\Delta I_{R1} = 100$ percent of initial value or $\pm 250$ $\mu$ A dc, whichever is greater.	Subgroup 2 of table herein; $\Delta V_{F2} = \pm 50$ mV; $\Delta I_{R1} = 100$ percent of initial value or $\pm 250$ $\mu$ A dc, whichever is greater.

(1) Shall be performed anytime after screen 3.

4.3.1 Power burn-in conditions. Burn-in conditions are as follows: Method 1038 of MIL-STD-750, test condition A.  $T_C = +125^\circ\text{C}$ ;  $V_R = 36$  V dc.

4.3.2 Thermal impedance  $Z_{\Theta JX}$  measurements for screening. The  $Z_{\Theta JX}$  measurements shall be performed in accordance with method 3101 of MIL-STD-750. Test each die separately. The maximum limit and conditions for  $Z_{\Theta JX}$  in screening (table E-IV of MIL-PRF-19500) shall be derived by each vendor by means of process control of actual measurements which characterizes the die attach process. When three lot date codes have exhibited control, the data from these three lots will be used to establish a fixed screening limit (not to exceed the group A limit). Once a fixed limit has been established, monitor all future sealing lots using a sample from each lot to be plotted on the applicable statistical process chart.

4.3.2.1 Thermal impedance ( $Z_{\Theta JX}$  measurements) for initial qualification or requalification. The  $Z_{\Theta JX}$  measurements shall be performed in accordance with MIL-STD-750. Method 3101 (read and record date  $Z_{\Theta JX}$ ) derived conditions limits and thermal response curve shall be supplied to the qualifying activity on the qualification lot prior to qualification approval.

\* 4.3.3 Peak reverse energy test. The peak reverse energy test is to be performed using the circuit as shown on figure 2 or equivalent. The Schottky rectifier under test must be capable of absorbing the reverse energy, as follows:  $I_{RM} = 2$  A minimum,  $V_{RSM} = 45$  V dc minimum,  $L = 260$   $\mu$ H.

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 table E-V of MIL-PRF-19500, and table I herein. Electrical measurements (end-points) and delta requirements shall be in accordance with the applicable steps of table III herein. The following test conditions shall be used for  $Z_{\Theta JX}$ , group A inspection:

- a.  $I_M$  measure current - - - - - 10 mA.
- b.  $I_H$  forward heating current - - - - - 15 - 50 A.
- c.  $t_M$  heating time - - - - - 50 ms.
- d.  $t_{MS}$  measurement delay time - - - 100  $\mu$ s minimum.

The maximum limit for  $Z_{\Theta JX}$  under these test conditions are  $Z_{\Theta JX}(\max) = 1.55^\circ\text{C/W}$ .

4.4.2 Group B inspection. Group B inspection shall be conducted in accordance with the conditions specified for subgroup testing in table E-VIa (JANS) and E-VIb (JANTX and JANTXV) of MIL-PRF-19500, and as follows. Electrical measurements (end-points) and delta requirements shall be in accordance with the applicable steps of table III herein.

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

- a. Subgroup 4: Condition for intermittent operation life for each diode are as follows:  $I_F$  or  $I_O = 2$  A (minimum);  $\Delta T_J \geq 85^\circ\text{C}$ ,  $+15^\circ\text{C}$ ,  $-5^\circ\text{C}$  for 2,000 cycles minimum.
- b. Subgroups 5: Condition for steady-state operation life (accelerated) is as follows: Method 1038, condition A,  $T_J = T_C = +150^\circ\text{C}$ ,  $V_R = 36$  V dc.
- c. Subgroup 6: Limit for thermal resistance is  $R_{\Theta JC} = 1.65^\circ\text{C/W}$  maximum for each die.

4.4.2.2 Group B inspection, table E-VIb (JANTX and JANTXV) of MIL-PRF-19500. Subgroup 3: Condition for intermittent operation life for each diode are as follows:  $I_F$  or  $I_O = 2$  A (minimum);  $\Delta T_J \geq 85^\circ\text{C}$ ,  $+15^\circ\text{C}$ ,  $-5^\circ\text{C}$  for 2,000 cycles minimum.

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, and as follows. Electrical measurements (end points) and delta requirements shall be in accordance with the applicable steps of table III herein.

4.4.3.1 Group C inspection, table E-VII of MIL-PRF-19500.

- a. Subgroup 2: Condition for terminal strength are as follows: Tension: Test condition A, weight = 10 lbs,  $t = 15$  seconds.
- b. Subgroup 3: Condition for constant acceleration are as follows:  $X_1$ ,  $Y_1$ ,  $Z_1$ , and  $Z_2$  axis.
- c. Subgroup 6:  $I_F$  or  $I_O = 2$  A (minimum);  $\Delta T_J \geq 85^\circ\text{C}$ ,  $+15^\circ\text{C}$ ,  $-5^\circ\text{C}$  for 6,000 cycles minimum.

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

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

4.5.2 Thermal resistance. Thermal resistance shall be measured as follows in accordance with method 3101 or 5081 of MIL-STD-750. Each diode leg shall be measured.

- a.  $I_H$  - - - - - 15 - 50 A.
- b.  $I_M$  - - - - - 10 mA.
- c.  $R_{\theta JC}$  - - - 1.65°C/W.
- d.  $t_{Md}$  - - - - 100  $\mu\text{s}$  maximum.

MIL-PRF-19500/656A

TABLE I. Group A inspection.

Inspection <u>1/ 2/ 3/</u>	MIL-STD-750		Symbol	Limit		Unit
	Method	Conditions		Min	Max	
<u>Subgroup 1</u>						
Visual and mechanical inspection	2071					
<u>Subgroup 2</u>						
Thermal impedance	3101	See 4.3.2	Z <sub>θJX</sub>	1.55		°C/W
Forward voltage	4011	I <sub>F</sub> = 5 A (pk) pulsed (see 4.5.1)	V <sub>F1</sub>	0.55		V dc
		I <sub>F</sub> = 15 A (pk) pulsed (see 4.5.1)	V <sub>F2</sub>	0.75		V dc
		I <sub>F</sub> = 30 A (pk) pulsed (see 4.5.1)	V <sub>F3</sub>	1.0		V dc
Reverse current	4016	DC method, V <sub>R</sub> = 45 V dc, (see 4.5.1)	I <sub>R1</sub>	1.0		mA dc
<u>Subgroup 3</u>						
High temperature operation: Reverse current leakage	4016	T <sub>A</sub> = +125°C				
		DC method, pulsed (see 4.5.1)				
		V <sub>R</sub> = 45 V (pk)	I <sub>R2</sub>	40		mA dc
Low temperature operation: Forward voltage	4011	T <sub>A</sub> = -55°C				
		Pulsed (see 4.5.1), I <sub>F</sub> = 15 A (pk)	V <sub>F4</sub>	0.8		V dc
<u>Subgroup 4</u>						
Junction capacitance	4001	V <sub>R</sub> = 5 V dc; f = 1 MHz, V <sub>SIG</sub> = 50 mV (p-p) (max)	C <sub>J</sub>	2,000		pF
<u>Subgroup 5</u>						
Dielectric withstanding voltage	1016	V <sub>R</sub> = 500 V dc; all leads shorted; V measure from leads to case; sample is n = 116, c = 0	DWV	10		μA
<u>Subgroup 6 and 7</u>						
Not applicable						

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

2/ Each individual diode.

3/ If 4.3.2 test conditions are performed in 100 percent screening, this test need not be performed in group A.

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

Inspection	MIL-STD-750		Qualification inspection
	Method	Conditions	
<u>Subgroup 1</u>			
Thermal shock (temperature cycling)	1051	500 cycles	38 devices, c = 0
Hermetic seal	1071		
Electrical measurements		See table III, steps 1, 2, and 5	
<u>Subgroup 2</u>			38 devices, c = 0
Steady-state blocking life	1048	t = 1,000 hours, T <sub>C</sub> = +125°C; V <sub>R</sub> = 36	
Electrical measurements		See table III, steps 1 and 2	
<u>Subgroup 3</u>			
Not applicable			
<u>Subgroup 4</u>			10 devices, c = 0
Thermal resistance	3101	See 4.5.2, R <sub>θJC</sub> = 1.65°C/W	
<u>Subgroup 5 1/</u>			22 devices, c = 0
Surge	4066	Condition B; T <sub>A</sub> = +25°C; I <sub>FSM</sub> = 300 A, 100 surges	
Electrical measurements		See table III, steps 1 and 2.	

1/ For each diode.

TABLE III. Groups A, B, C, and E electrical end-point measurements. 1/ 2/ 3/ 4/

Step	Inspection	MIL-STD-750		Symbol	Limits		Unit
		Method	Conditions		Min	Max	
1.	Forward voltage	4011	$I_F = 15 \text{ A (pk)}$ , pulsed (see 4.5.1)	$V_{F2}$		0.75	V dc
2.	Reverse current leakage	4016	$V_R = 45 \text{ V dc}$ , pulsed (see 4.5.1) DC method	$I_{R1}$		1.0	mA dc
3.	Forward voltage	4011	$I_F = 15 \text{ A (pk)}$ , pulsed (see 4.5.1)	$\Delta V_{F2}$	$\pm 50 \text{ mV dc}$ from initial reading.		
4.	Reverse current	4016	$V_R = 45 \text{ V dc}$ , pulsed (see 4.5.1) DC method	$\Delta I_{R1}$	$\pm 250 \mu\text{A dc}$ or 100 percent from initial reading, whichever is greater.		
5.	Thermal impedance	3101	See 4.3.2	$Z_{\Theta JX}$		1.55	$^{\circ}\text{C/W}$

1/ Each individual diode.

2/ The electrical measurements for table E-VIa (JANS) of MIL-PRF-19500 are as follows:

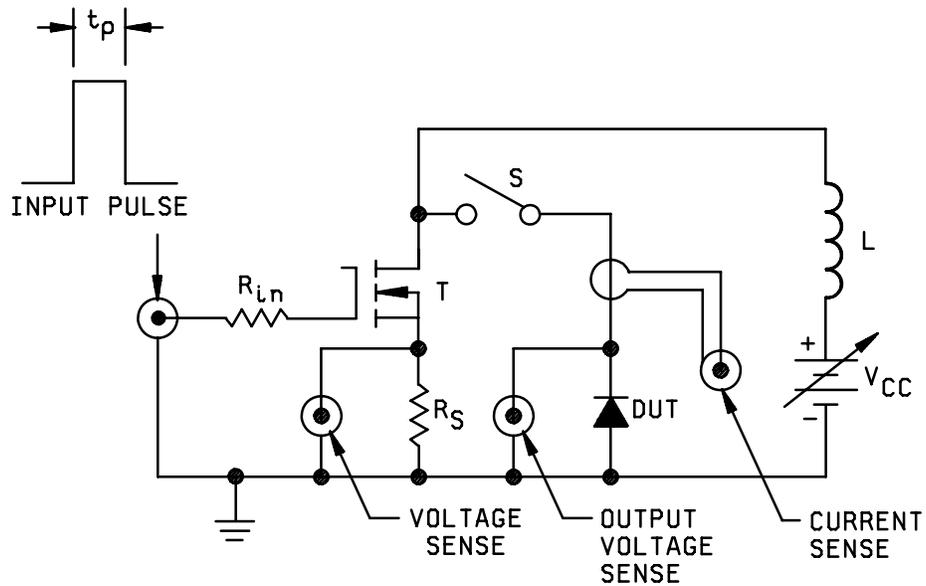
- a. Subgroup 3, see table III herein, steps 1 and 2.
- b. Subgroup 4, see table III herein, steps 1, 2, 3, 4, and 5.
- c. Subgroup 5, see table III herein, steps 1, 2, 3, and 4.

3/ The electrical measurements for table E-VIb (JANTX and JANTXV) of MIL-PRF-19500 are as follows:

- a. Subgroup 2, see table III herein, steps 1 and 2.
- b. Subgroup 3, see table III herein, steps 1, 2, and 5.
- c. Subgroup 6, see table III herein, steps 1 and 2.

4/ The electrical measurements for table E-VII of MIL-PRF-19500 are as follows:

- a. Subgroups 2 and 3, see table III herein, steps 1 and 2 for all levels.
- b. Subgroup 6, see table III herein, steps 1, 2, and 5 for all levels.



Input pulse	$R_{in} = 50$ ohms, 1 watt
$V_G = 10$ Volts	$R_s = 0.1$ ohms, 1 watt
$R_G = 50$ ohms	$V_{CC} \approx 10$ volts
P.W. $\approx 30$ $\mu$ s	$L = 260$ $\mu$ H
Duty cycle $\leq 1$ percent	$T =$ IRF130/2N6756 or equivalent

Procedures:

1. With  $S$  open, adjust pulse width to test current of 2 amps across  $R_s$ .
2. Close  $S$ , verify test current with current sense.
3. Read peak output voltage (see 4.3.3).

FIGURE 2. Peak reverse energy test circuit.

## 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. The acquisition requirements are as specified in 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 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 Defense Supply Center, Columbus, ATTN: DSCC/VQE, P.O. Box 3990, Columbus, OH 43218-3990 or e-mail [vqe.chief@dla.mil](mailto:vqe.chief@dla.mil). An online listing of products qualified to this specification may be found in the Qualified Products Database (QPD) at <http://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  
Navy - EC  
Air Force - 11  
NASA - NA  
DLA - CC

Preparing activity:  
DLA - CC  
  
(Project 5961-2008-058)

\* NOTE: The activities listed above were interested in this document as of the date of this document. Since organizations and responsibilities can change, you should verify the currency of the information above using the ASSIST Online database at <http://assist.daps.dla.mil>.