

The documentation and process conversion measures necessary to comply with this revision shall be completed by 23 May 1994

INCH POUND

MIL-S-19500/241F  
23 February 1994  
SUPERSEDING  
MIL-S-19500/241E  
28 December 1987

MILITARY SPECIFICATION

SEMICONDUCTOR DEVICE, DIODE, SILICON, LOW LEAKAGE, GENERAL PURPOSE, SWITCHING  
TYPES 1N3595, 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 detail requirements for silicon, switching diodes. Four levels of product assurance are provided for each device type as specified in MIL-S-19500 (see 6.3.2). Two levels of product assurance are provided for die.

1.2 Physical dimensions. See 3.3 (similar to DD-35).

1.3 Maximum ratings.

$V_{RWM}$	$I_O$ 1/ $T_A = +25^\circ\text{C}$	$I_{FSM}$ $t_p = 1 \text{ s}$	$I_{FSM}$ $t_p = 1 \mu\text{s}$	$T_{op}$ and $T_{STG}$
V(pk)	mA dc	mA(pk)	A (pk)	$^\circ\text{C}$
125	150	500	4	-65 to +175

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

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

Limits	$V_{F1}$ $I_F = 200 \text{ mA dc}$	$V_{F2}$ $I_F = 100 \text{ mA dc}$	$V_{F3}$ $I_F = 50 \text{ mA dc}$	$V_{F4}$ $I_F = 10 \text{ mA dc}$	$V_{F5}$ $I_F = 5 \text{ mA dc}$	$V_{F6}$ $I_F = 1 \text{ mA dc}$
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	$I_{R1}$ $V_R = 125 \text{ V dc}$	$I_{R2}$ $V_R = 125 \text{ V dc}$ $T_A = +150^\circ\text{C}$	$C$ $V_R = 0 \text{ V dc}$ $f = 1 \text{ MHz}$	$t_{rr}$ $I_F = 10 \text{ mA dc}$ $V_R = 35 \text{ V dc}$
Min				
Max	1.0 nA dc	3 $\mu\text{A dc}$	8.0 pF	3 $\mu\text{s}$

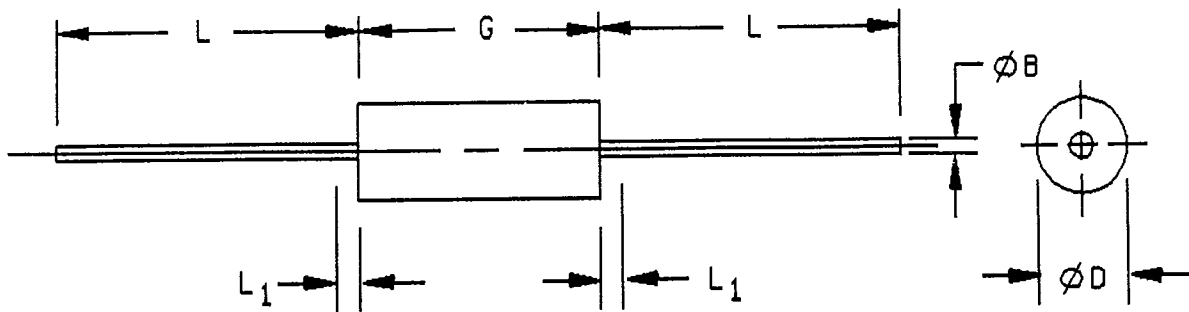
Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: Commander, Defense Electronics Supply Center, ATTN: DESC-ELDT, 1507 Wilmington Pike, Dayton, OH 45444-5765, by using the Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document or by letter.

AMSC N/A

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FSC 5961

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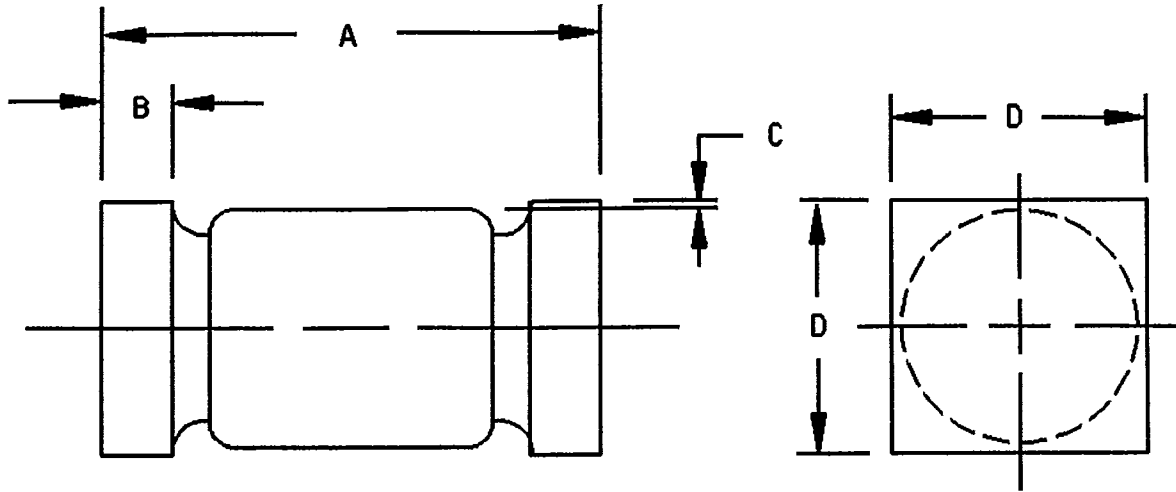
Ltr	Dimensions				Notes
	Inches		Millimeters		
	Min	Max	Min	Max	
$\phi B$	.018	.022	.046	.056	
$\phi D$	.055	.090	1.40	3.30	4
G	.120	.200	3.30	7.62	
L	1.00	1.500	25.40	38.10	
L <sub>1</sub>		.050		1.27	3

NOTES:

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

FIGURE 1. Physical dimensions 1N3595 and 1N3595-1.

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D-50				
Ltr	Inches		Millimeters	
	Min	Max	Min	Max
A	.165	.195	4.19	4.95
B	.019	.028	0.48	0.71
C	.003		0.08	
D	.070	.085	1.78	2.16

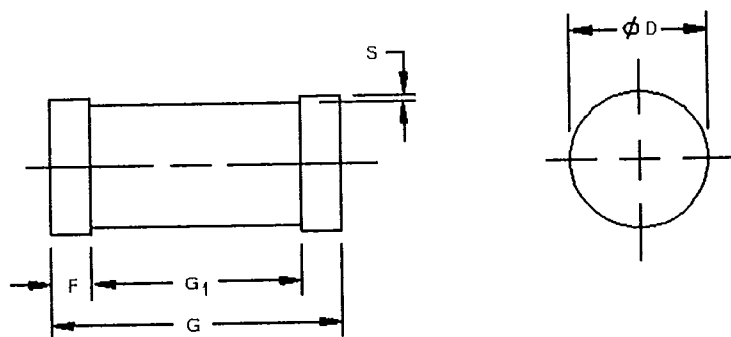
TYPES 1N3595US AND 1N3595US-1

NOTES:

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

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

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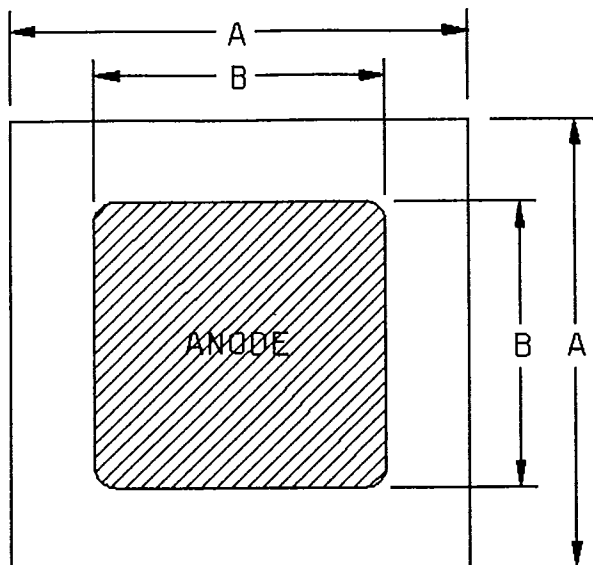
Symbol	Dimensions			
	Inches		Millimeters	
	Min	Max	Min	Max
$\phi D$	.063	.067	1.60	1.70
F	.016	.022	0.41	0.55
G	.130	.146	3.30	3.70
G1	.100 ref		2.54 ref	
S	.001 min		0.03 min	

NOTES:

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

FIGURE 3. Physical dimensions, surface mount (UR suffix) devices.

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Ltr	Dimensions			
	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  $\pm 0.001$  (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.

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## 2. APPLICABLE DOCUMENTS

### 2.1 Government documents.

2.1.1 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

##### MILITARY

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

#### STANDARD

##### MILITARY

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

(Unless otherwise indicated, copies of federal and military specifications, standards, and handbooks are available from the Standardization Document Order Desk, Building 4D, 700 Robbins Avenue, Philadelphia, PA 19120-5094.)

2.2 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 Associated detail specification. The individual item requirements shall be in accordance with MIL-S-19500, and as specified herein.

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

3.3 Design, construction, and physical dimensions. The design, construction, and physical dimensions shall be as specified in MIL-S-19500, and figures 1, 2, 3, and 4 herein.

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

3.3.2 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-S-19500, paragraph 30.14 and subparagraphs).

3.3.3 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-S-19500.

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

3.4.1 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.

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## 4. QUALITY ASSURANCE PROVISIONS

4.1 Sampling and inspection. Sampling and inspection shall be in accordance with MIL-S-19500, and as specified herein.

4.2 Qualification inspection. Qualification inspection shall be in accordance with MIL-S-19500, and as specified herein.

4.3 Screening (JANS, JANTX, and JANTXV levels only). Screening shall be in accordance with table II of MIL-S-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 II of MIL-S-19500)	Measurement	
	JANS level	JANTX and JANTXV levels
3a	Temperature cycling	Temperature cycling
3c <u>1/</u>	Thermal impedance (see 4.5.2)	Thermal impedance (see 4.5.2)
9	$I_{R1}$ and $V_{F1}$	N/A
11	$I_{R1}$ ; $V_{F1}$ ; $\Delta V_F \leq \pm 50$ mV change from initial value	$I_{R1}$ and $V_{F1}$
12	See 4.3.1 $t = 96$ hours	See 4.3.1 $t = 48$ hours
13 <u>2/</u>	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 maximum	Subgroup 2 of table I herein; $\Delta V_{F1} \leq \pm 50$ mV change from initial value

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

2/ PDA = 5 percent for screen 13, applies to  $\Delta I_{R1}$ ,  $\Delta V_{F1}$  and subgroup 2 of table I herein. 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 Quality conformance inspection. Quality conformance inspection shall be in accordance with MIL-S-19500, and as specified herein.

4.4.1 Group A inspection. Group A inspection shall be conducted in accordance with MIL-S-19500, and table I herein. (End-point electrical measurements shall be in accordance with the applicable steps of table II herein.)

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

4.4.2.1 Group B inspection, table IVa (JANS) of MIL-S-19500.

Subgroup	Method	Condition
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 IVb (JAN, JANTX, and JANTXV) of MIL-S-19500.

Subgroup	Method	Condition
B3	1027	$I_O = 150 \text{ mA dc}$ ; $V_R = 125 \text{ V (pk)}$ ; $T_A = \text{Room ambient}$ as defined in the general requirements of MIL-STD-750.

4.4.3 Group C inspection. Group C inspection shall be conducted in accordance with the conditions specified for subgroup testing in table V of MIL-S-19500, and as follows. Electrical measurements (end points) and delta requirements shall be in accordance with the applicable steps of table II herein.

Subgroup	Method	Condition
C2	2036	Tension: Test condition A; weight = 4 pounds; $t = 15 \text{ seconds}$ . 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	1026	$I_O = 150 \text{ mA dc}$ , $V_R = 125 \text{ V (pk)}$ ; $T_A = \text{Room ambient}$ as defined in the general requirements of MIL-STD-750.

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-S-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 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.



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TABLE I. Group A inspection.

Inspection 1/	MIL-STD-750		Symbol	Limits		Unit
	Method	Conditions		Min	Max	
<u>Subgroup 1</u>						
Visual and mechanical inspection	2071					
<u>Subgroup 2</u>						
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
<u>Subgroup 4</u>						
Capacitance	4001	$V_R = 0 \text{ V dc}; f = 1 \text{ MHz}$	C		8.0	pF
Reverse recovery time	4031	Condition A; $I_F = 10 \text{ mA dc};$ $V_R = 35 \text{ V dc};$ $R = 1,000 \Omega; C = 10 \text{ pF}$ (for test setup only, recover to 100 kilohms)	$t_{rr}$		3	$\mu\text{s}$
<u>Subgroup 5</u>						
Not applicable						

See footnote at end of table.

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TABLE I. Group A inspection - Continued.

Inspection	MIL-STD-750		Symbol	Limits		Unit
	Method	Conditions		Min	Max	
<u>Subgroup 6</u>						
Surge current	4066	$I_0 = 150 \text{ mA dc};$ $I_{FSM} = 0.50 \text{ A};$ ten 1 second surges, 1 surge/minute				
Electrical measurements		See table II, steps 1, 2, and 4				
<u>Subgroup 7</u>						
Not applicable						

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

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TABLE II. Groups A, B, and C electrical measurements. 1/, 2/, 3/

Step	Inspection	MIL-STD-750		Symbol	Limits		Unit
		Method	Conditions		Min	Max	
1.	Forward voltage	4011	$I_F = 200 \text{ mA dc}$	$V_{F1}$	.83	1.00	V dc
2.	Reverse current	4016	DC method; $V_R = 125 \text{ V dc}$	$I_{R1}$		1.0	nA dc
3.	Reverse current	4016	DC method; $V_R = 125 \text{ V dc}$	$I_{R2}$		2.0	nA dc
4.	Capacitance	4001	$V_R = 0 \text{ V dc}; f = 1 \text{ MHz}$	C		8.0	pF
5.	Forward current	4011	$I_F = 200 \text{ mA dc}$	$\Delta V_{F1}$	$\leq 50 \text{ mV dc change from initial value}$		
6.	Reverse current	4016	DC method, $V_R = 125 \text{ V dc}$	$\Delta I_{R1}$	$\leq 100 \text{ percent of initial value or } 0.1 \text{ nA dc, whichever is greater}$		

1/ The electrical measurements for table IVa (JANS) of MIL-S-19500 are as follows:

- a. Subgroup 3, see table II herein, steps 1, 2, and 4.
- b. Subgroup 4, see table II herein, steps 1, 2, 4, 5, and 6.
- c. Subgroup 5, see table II herein, steps 1, 2, 4, 5, and 6.

2/ The electrical measurements for table IVb (JAN, JANTX, and JANTXV) of MIL-S-19500 are as follows:

- a. Subgroup 2, see table II herein, steps 1, 2, and 4.
- b. Subgroup 3, see table II herein, steps 1, 3, and 4.
- c. Subgroup 6, see table II herein, steps 1, 3, and 4.

3/ The electrical measurements for table V of MIL-S-19500 are as follows:

- a. Subgroup 2, see table II herein, steps 1, 2, and 4.
- b. Subgroup 3, see table II herein, steps 1, 2, and 4 (JAN, JANTX, and JANTXV).
- c. Subgroup 6, see table II herein, steps 1, 2, 4, 5, and 6 (JANS); steps 1, 3, and 4 (JAN, JANTX, and JANTXV).

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## 5. PACKAGING

5.1 Packaging requirements. The requirements for packaging shall be in accordance with MIL-S-19500.

## 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-S-19500 are applicable to this specification.

6.2 Acquisition requirements. Acquisition documents should specify the following:

- a. Title, number, and date of the specification.
- b. Issue of DODISS to be cited in the solicitation, and if required, the specific issue of individual documents referenced (see 2.1).
- c. Lead finish (see 3.3.1).
- d. Product assurance level and type designator.
- e. For die acquisition, the JANHC or JANKC designation shall be specified (see 6.3 and figure 4).

6.3 Suppliers of JANC die. The qualified JANC suppliers with the applicable letter version (example JANHCA1N3595) will be identified on the QPL under the following Part or Identifying Number (PIN).

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

6.4 Changes from previous issue. Asterisks are not used in this revision to identify changes with respect to the previous issue due to the extensiveness of the changes.

## CONCLUDING MATERIAL

## Custodians:

Army - ER  
Navy - EC  
Air Force - 17

Preparing activity:  
DLA - ES

## Review activities:

Army - AR, MI, AV  
Navy - AS, CG, MC  
Air Force - 19, 85

(Project 5961-1434)