The documentation and process conversion measures necessary to comply with this document shall be completed by 22 February 2017.

INCH-POUND

MIL-PRF-19500/426J
22 November 2016
SUPERSEDING
MIL-PRF-19500/426H
6 May 2014

PERFORMANCE SPECIFICATION SHEET

* TRANSISTOR, PNP, SILICON, AMPLIFIER
TYPE 2N4957, JAN, JANTX, JANTXV, JANS, JANHC, JANKC

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 PNP silicon, VHF-UHF amplifier transistors. Four levels of product assurance are provided for each encapsulated device (JAN, JANTX, JANTXV, and JANS). Two levels of product assurance are provided for each unencapsulated die (JANHC and JANKC). Provisions for radiation hardness assurance (RHA) to eight radiation levels ("M", "D", "P", "L", "R", "F", "G" and "H") are provided for JANTXV, JANS, JANHC, and JANKC product assurance levels.

* 1.2 Package outlines and die topography. The device package for the encapsulated device type are as follows: A a through-hole mount package similar to TO-72 in accordance with figure 1 or a surface mount (UB) version in accordance with figure 2. The dimensions and topography for JANHC and JANKC unencapsulated die are as follows: A version die in accordance with figure 3.

1.3 Maximum ratings.

P_T (1) T_A = +25°C	V_{CEO}	V_{CBO}	I_C	V_{EBO}	T_{STG} and T_J
mW	V dc	V dc	mA dc	V dc	°C
200	-30	-30	-30	-3.0	-65 to +200

(1) Derate at 1.14 mW/°C above T_A > +25°C.

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.dla.mil.

1.4 Primary electrical characteristics (common to all types).

Limits	h_{FE3} V_{CE} = -10 V dc I_C = -5.0 mA dc	$\|h_{fe}\|$ I_E = -2.0 mA dc, V_{CE} = -10 V dc f = 100 MHz	$r_b'C_c$ I_E = -2.0 mA dc f = 63.6 MHz V_{CB} = -10 V dc (2N4957 only)	$r_b'C_c$ I_E = -2.0 mA dc f = 63.6 MHz V_{CB} = -10 V dc (2N4957UB only)	C_{cb} V_{CB} = -10 V dc I_E = 0 100 kHz ≤ f ≤ 1 MHz	G_{pe} I_C = -2.0 mA dc f = 450 MHz V_{CE} = -10 V dc	NF I_C = -2.0 mA dc V_{CE} = -10 V dc f = 450 MHz
			ps	ps	pF	dB	dB
Min	30	12	1.0	1.0		17	
Max	165	36	8.0	16.0	0.8	25	3.5

* 1.5 Part or Identifying Number (PIN). The PIN is in accordance with MIL-PRF-19500 and as specified herein. See 6.5 for PIN construction example and 6.6 for a list of available PINs.

* 1.5.1 JAN certification mark and quality level.

* 1.5.1.1 Quality level designators for encapsulated devices. The quality level designators for encapsulated devices that are applicable for this specification sheet from the lowest to the highest level are as follows: "JAN", "JANTX", "JANTXV", and "JANS".

* 1.5.1.2 Quality level designators for unencapsulated devices (die). The quality level designators for unencapsulated devices (die) that are applicable for this specification sheet from the lowest to the highest level are as follows: "JANHC" and "JANKC".

* 1.5.2 Radiation hardness assurance (RHA) designator. The RHA levels that are applicable for this specification sheet from lowest to highest are as follows: "M", "D", "P", "L", "R", "F", "G", and "H".

* 1.5.3 Device type. The designation system for the device types of transistors covered by this specification sheet are as follows.

* 1.5.3.1 First number and first letter symbols. The transistors of this specification sheet use the first number and letter symbols "2N".

* 1.5.3.2 Second number symbols. The second number symbols for the transistors covered by this specification sheet are as follow: "4957".

* 1.5.4 Suffix symbols. The following suffix letters are incorporated in the PIN in the order listed in the table as applicable:

	A blank first suffix symbol indicates a through-hole mount package TO-72 metal can (see figure 1).
UB	Indicates a 4 pad surface mount package. The metal lid is connected to pad 4 (see figure 2)

* 1.5.5 Lead finish. The lead finishes applicable to this specification sheet are listed on QML-19500.

* 1.5.6 Die identifiers for unencapsulated devices (manufacturers and critical interface identifiers). The manufacturer die identifiers that are applicable for this specification sheet is "A".

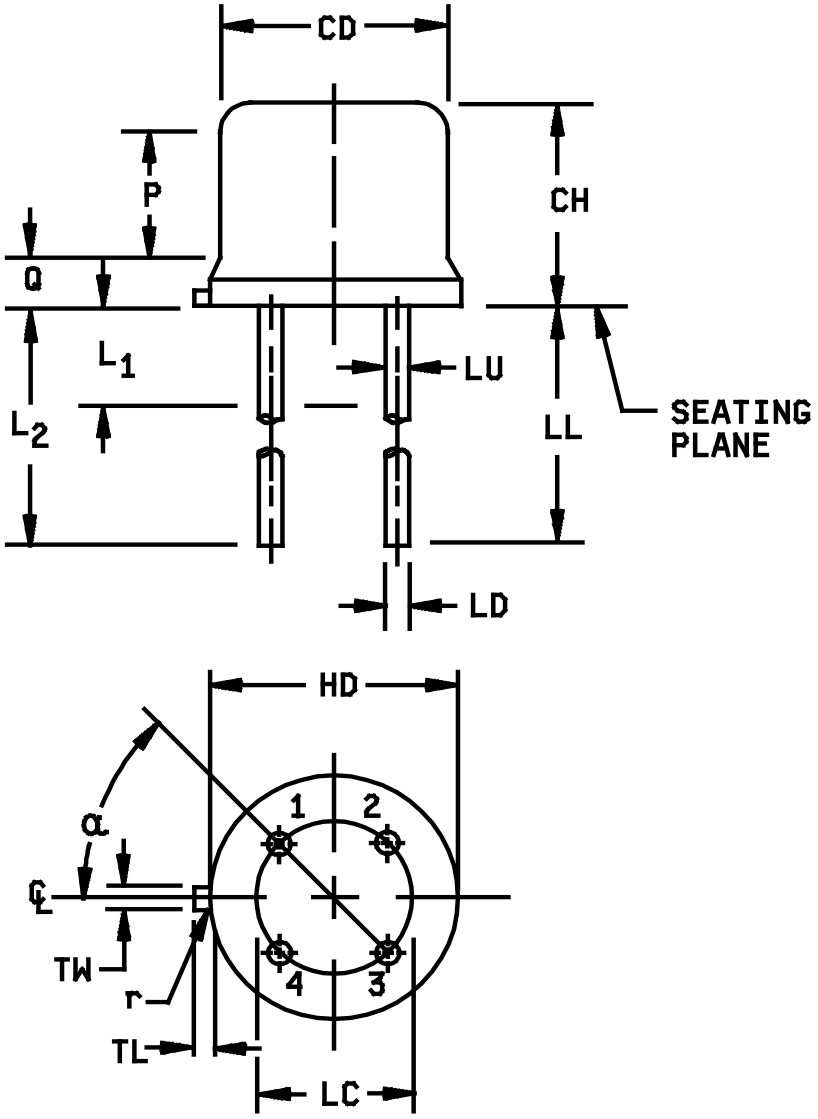


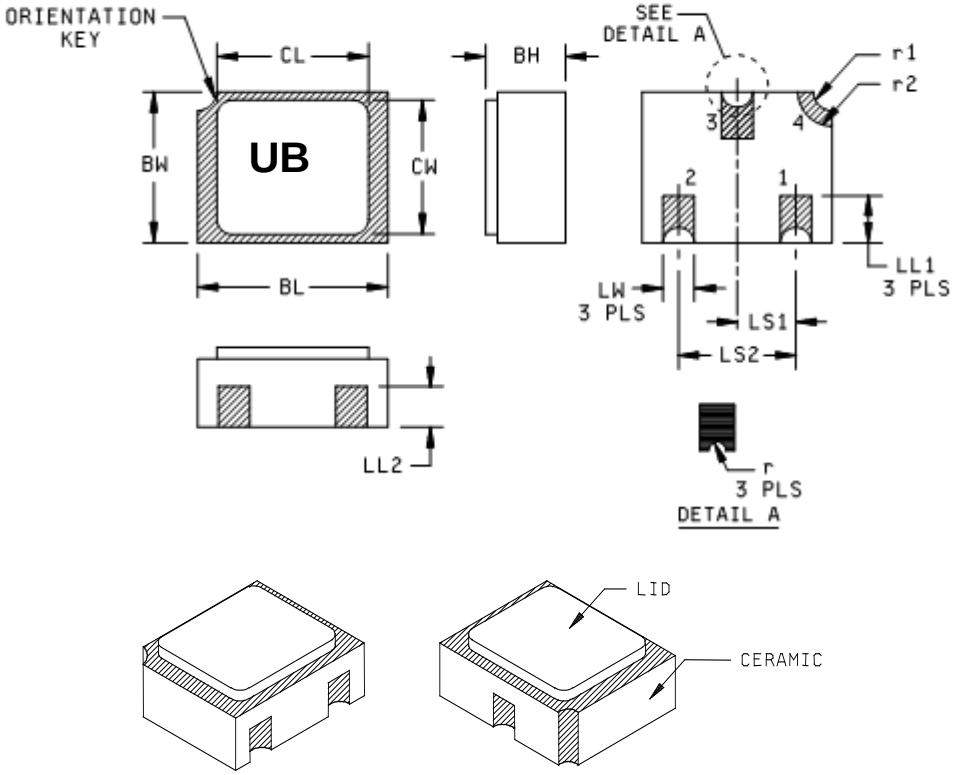
FIGURE 1. Physical dimensions of transistor type 2N4957 (TO-72).

Symbol	Dimensions				Notes
	Inches		Millimeters		
	Min	Max	Min	Max	
CD	.178	.195	4.52	4.95	5
CH	.170	.210	4.32	5.33	
HD	.209	.230	5.31	5.84	5
LC	.100 TP		2.54 TP		
LD	.016	.021	0.41	0.533	7,8
LL	.500	.750	12.70	19.05	7,8
LU	.016	.019	0.41	0.48	7,8
L_1		.050		1 .27	8
L_2	.250		6.35		8
P	.100		2.54		
Q		.050		1.27	5
r		.007		0.18	
TL	.028	.048	0.71	1.22	
TW	.036	.046	0.91	1.17	
α	45° TP		45° TP		

NOTES:

1. Dimension are in inches.
2. Millimeters are given for general information only.
3. Beyond r (radius) maximum, TL shall be held for a minimum length of .011 (0.28 mm).
* 4. Dimension TL measured from maximum HD.
5. Body contour optional within zone defined by HD, CD, and Q.
6. Leads at gauge plane .054 +.001 -.000 inch (1.37 +0.03 -0.00 mm) below seating plane shall be within .007 inch (0.18 mm) radius of true position (TP) at maximum material condition (MMC) relative to tab at MMC. The device may be measured by direct methods.
7. Dimension LU applies between L_1 and L_2. Dimension LD applies between L_2 and LL minimum. Diameter is uncontrolled in L_1 and beyond LL minimum.
8. All four leads.
9. Dimension r (radius) applies to both inside corners of tab.
10. In accordance with ASME Y14.5M, diameters are equivalent to ϕx symbology.
11. Lead 1 = emitter, lead 2 = base, lead 3 = collector, lead 4 = case (electrically connected).

FIGURE 1. Physical dimensions of transistor type 2N4957 (TO-72) Continued.

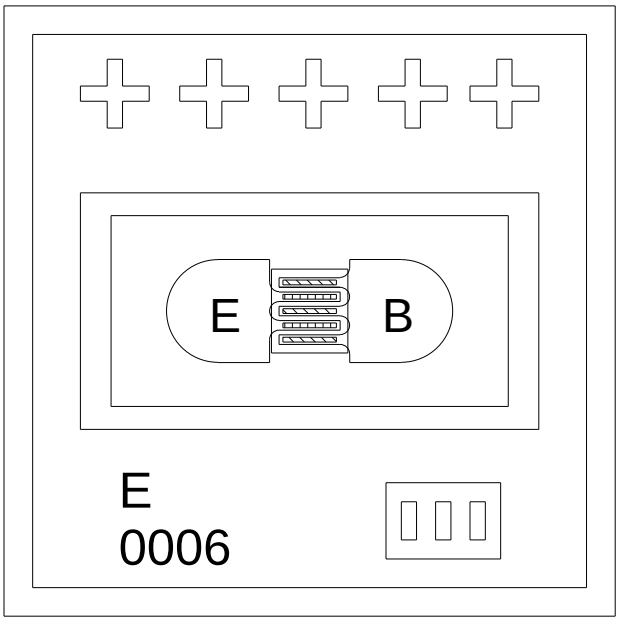


Symbol	Dimensions				Note
	Inches		Millimeters		
	Min	Max	Min	Max	
BH	.046	.056	1.17	1.42	
BL	.115	.128	2.92	3.25	
BW	.085	.108	2.16	2.74	
CL		.128		3.25	
CW		.108		2.74	
LL1	.022	.038	0.56	0.97	
LL2	.017	.035	0.43	0.89	
LS1	.036	.040	0.91	1.02	
LS2	.071	.079	1.80	2.01	
LW	.016	.024	0.41	0.61	
r		.008		.203	
r1		.012		.305	
r2		.022		.559	

NOTES:

1. Dimensions are in inches.
2. Millimeters are given for general information only.
3. Hatched areas on package denote metallized areas.
4. Lid material: Kovar.
5. Pad 1 = Base, Pad 2 = Emitter, Pad 3 = Collector, Pad 4 = Shielding connected to the lid.
6. In accordance with ASME Y14.5M, diameters are equivalent to ϕx symbology.

FIGURE 2. Physical dimensions, surface mount (2N4957UB version).



Die size:	.016 x .016 inch (0.406 mm x 0.406 mm).
Die thickness:	.008 ±.0016 inch (0.2032 mm ±0.04064 mm).
Base bonding pad:	.0023 x .0023 inch (0.058 mm x 0.058 mm).
Emitter bonding pad:	.0023 x .0023 inch (0.058 mm x 0.058 mm).
Back metal:	Gold, 6,500 ±1950 Å.
Top metal:	Aluminum, 14,500 ±3,000 Å.
Back side:	Collector.
Glassivation:	SiO_2, 7,500 ±1,500 Å.

FIGURE 3. JANHC and JANKC (A-version) die dimensions.

2. APPLICABLE DOCUMENTS

2.1 General. The documents listed in this section are specified in sections 3 or 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 of documents cited in sections 3 or 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 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://quicksearch.dla.mil/).

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 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 figures 1 (TO-72), 2 (UB, surface mount), and 3 (JANHC/JANKC die).

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

3.5 Radiation hardness assurance (RHA). Radiation hardness assurance requirements, PIN designators, and test levels shall be as defined in 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 specified in table I.

3.8 Marking. Devices shall be marked in accordance with MIL-PRF-19500, except for the UB suffix package. Marking on the UB package shall consist of an abbreviated part number, the date code, and the manufacturer's symbol or logo. The prefixes JAN, JANTX, JANTXV, and JANS can be abbreviated as J, JX, JV, and JS respectively. The "2N" prefix and the "UB" suffix can also be omitted. The radiation hardened designator M, D, P, L, R, F, G, or H shall immediately precede (or replace) the device "2N" identifier (depending upon degree of abbreviation required).

3.9 Workmanship. 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 JANHC and JANKC qualification. JANHC and JANKC qualification inspection shall be in accordance with MIL-PRF-19500.

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 IV tests, the tests specified in table IV herein that were not performed in the prior revision shall be performed on the first inspection lot of this revision to maintain qualification.

* 4.2.2.1 Group E thermal response. With extremely small junction devices such as this one, a true thermal impedance cannot be measured, only calculated. While “thermal response” has been substituted for “thermal impedance” herein, the terms, units and procedure as essentially unchanged. Each supplier shall submit a thermal response ($Z_{\theta JX}$) histogram of the entire qualification lot. The histogram data shall be taken prior to the removal of devices that are atypical for thermal response. Thermal response curves (from $Z_{\theta JX}$ test pulse time to $R_{\theta JX}$ minimum steady-state time) of the best device in the qual lot and the worst device in the qual lot (that meets the supplier proposed screening limit), or from the thermal grouping, shall be submitted. The optimal test conditions and proposed initial thermal response screening limit shall be provided in the qualification report. Data indicating how the optimal test conditions were derived for $Z_{\theta JX}$ shall also be submitted. The proposed maximum thermal response $Z_{\theta JX}$ screening limit shall be submitted. The qualifying activity may approve a different $Z_{\theta JX}$ limit for conformance inspection end-point measurements as applicable. Equivalent data, procedures, or statistical process control plans may be used for part, or all, of the above requirements. The approved thermal response conditions and limit for $Z_{\theta JX}$ shall be used by the supplier in screening and table I, subgroup 2. The approved thermal resistance conditions for $R_{\theta JX}$ shall be used by the supplier for conformance inspection. For product families with similar thermal characteristics based on the same physical and thermal die, package, and construction combination (thermal grouping), the supplier may use the same thermal response curves.

* 4.3 Screening.

4.3.1 Screeing of encapsulated device (JANTX, JANTXV and JANS 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	Measurement	
	JANS level	JANTX and JANTXV levels
3c	Thermal impedance, method 3131 of MIL-STD-750 (see 4.3.3)	Thermal impedance, method 3131 of MIL-STD-750 (see 4.3.3)
9	I_{CBO1}, h_{FE3}	Not applicable
10	24 hours minimum	24 hours minimum
11	I_{CBO1}; h_{FE3}; ΔI_{CBO1} = 100 percent of initial value or -10 nA dc, whichever is greater. Δh_{FE3} = ±20 percent	I_{CBO1} ,h_{FE3}
12	See 4.3.1, 240 hours minimum	See 4.3.1, 80 hours minimum
13	Subgroups 2 and 3 of table I herein; ΔI_{CBO1}= 100 percent of initial value or -10 nA dc, whichever is greater; Δh_{FE3} = ±20 percent	Subgroup 2 of table I herein; ΔI_{CBO1}= 100 percent of initial value or -10 nA dc, whichever is greater; Δh_{FE3} = ±20 percent

* 4.3.1.1 Power burn-in. Power burn-in conditions are as follows: T_A = room ambient as defined in the general requirements of 4.5 of MIL-STD-750, V_{CB} = -10 - -30 V dc. A power dissipation of P_D = 100 percent of P_T maximum as defined in 1.3 shall be used.

4.3.2 Screening (JANHC and JANKC). Screening of JANHC and JANKC die shall be in accordance with MIL-PRF-19500, “Discrete Semiconductor Die/Chip Lot Acceptance”. Burn-in duration for the JANKC level follows JANS requirements; the JANHC follows JANTX requirements.

4.3.3 Thermal impedance (ΔV_{BE} measurements). The ΔV_{BE} measurements shall be performed in accordance with method 3131 of MIL-STD-750 using the guidelines in that method for determining V_H, V_{CE}, I_M, I_H, t_H, and t_{MD}. The ΔV_{BE} limit used in screen 3c and table I, subgroup 2 shall be set statistically by the supplier over several die lots and submitted to the qualifying activity for approval.

4.4 Conformance inspection. Conformance inspection shall be in accordance with MIL-PRF-19500 and as specified herein. If alternate screening is being performed in accordance with MIL-PRF-19500, a sample of screened devices shall be submitted to and pass the requirements of group A1 and A2 inspection only (table E-VIB, group B, subgroup 1 is not required to be performed again if group B has already been satisfied in accordance with 4.4.2).

4.4.1 Group A inspection. Group A inspection shall be conducted in accordance with MIL-PRF-19500, and table I herein.

4.4.2 Group B inspection. Group B inspection shall be conducted in accordance with the tests and conditions specified for subgroup testing in table E-VIA (JANS) of MIL-PRF-19500 and 4.4.2.1 herein. (See 4.4.2.2 for JAN, JANTX, and JANTXV group B testing). Delta requirements shall be in accordance with table III herein as specified in the footnotes for table III.

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

	Subgroup	Method	Condition
*	B4	1037	V_{CB} = -10 - -30 V dc, T_A = room ambient as defined in the general requirements of 4.5 of MIL-STD-750, t(on) = t(off) = 3 minutes, P_D = maximum rated P_T (see 1.3) during the “on” cycle. P_D = 0 during the “off” cycle.
*	B5	1027	1,000 hours minimum, V_{CB} = -10 - -30 V dc, power shall be applied to achieve T_J = +150°C minimum using a minimum of P_D = 100 percent of maximum rated P_T as defined in 1.3; in addition, adjust T_A to achieve T_J. n = 45 devices, c = 0.

4.4.2.2 Group B inspection, (JAN, JANTX, and JANTXV). Separate samples may be used for each step. In the event of a lot failure, the resubmission requirements of MIL-PRF-19500 shall apply. In addition, all catastrophic failures during CI shall be analyzed to the extent possible to identify root cause and corrective action.

	Step	Method	Condition
*	1	1026	Steady-state life: 1,000 hours minimum, V_{CB} = -10 to -30 V dc, power shall be applied to achieve T_J = +150°C minimum using a minimum of P_D = 100 percent of maximum rated P_T as defined in 1.3; in addition, adjust T_A to achieve T_J. n = 45 devices, c = 0.
	2	1048	Blocking life, T_A = +150°C, V_{CB} = 80 percent of rated voltage, 48 hours minimum. n = 45 devices, c = 0.
	3	1032	High-temperature life (non-operating), t = 340 hours, T_A = +200°C. n = 22, c = 0.

4.4.2.3 Group B sample selection. Samples selected from group B inspection shall meet all of the following requirements:

a. For JAN, JANTX, and JANTXV samples shall be selected randomly from a minimum of three wafers (or from each wafer in the lot) from each wafer lot. For JANS, samples shall be selected from each inspection lot. See MIL-PRF-19500.

b Shall be chosen from an inspection lot that has been submitted to and passed group A, subgroup 2 conformance inspection. When the final lead finish is solder or any plating prone to oxidation at high temperature, the samples for life test (subgroups B4 and B5 for JANS, and group B for JAN, JANTX, and JANTXV) may be pulled prior to the application of final lead finish.

* 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. Delta requirements shall be in accordance with the steps of table III herein and as specified in the notes for table III.

	Subgroup	Method	Condition
	C2	2036	Test condition E; not applicable for UB devices.
*	C6	1026	For JANS only. 1,000 hours minimum, V_{CB} = -10 - -30 V dc, power shall be applied to achieve T_J = +150°C minimum using a minimum of P_D = 100 percent of maximum rated P_T as defined in 1.3; in addition, adjust T_A to achieve T_J. n = 45 devices, c = 0.

4.4.3.3 Group C sample selection. Samples for subgroups in group C shall be chosen at random from any inspection lot containing the intended package type and lead finish procured to the same specification which is submitted to and passes group A tests for conformance inspection. When the final lead finish is solder or any plating prone to oxidation at high temperature, the samples for C6 life test may be pulled prior to the application of final lead finish. Testing of a subgroup using a single device type enclosed in the intended package type shall be considered as complying with the requirements for that subgroup.

4.4.4 Group D inspection. Conformance inspection for hardness assured JANS and JANTXV types shall include the group D tests specified in table II herein. These tests shall be performed as required in accordance with MIL-PRF-19500 and method 1019 of MIL-STD-750 for total ionizing dose, or method 1017 of MIL-STD-750 for neutron fluence, as applicable (see 6.2 herein), except group D, subgroup 2 may be performed separate from other subgroups. Alternate package options may also be substituted for the testing provided there is no adverse effect to the fluence profile.

4.4.5 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 as specified in table IV herein. Electrical measurements (end-points) and delta requirements shall be in accordance with table III herein as specified in the footnotes for table III.

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 measurement shall be as specified in section 4 of MIL-STD-750.

4.5.2 Collector-base time constant. This parameter may be determined by applying an RF signal voltage of 1 volt (rms) across the collector-base terminals and measuring the ac voltage drop (V_{eb}) with a high impedance RF voltmeter across the emitter-base terminals. With f = 63.6 MHz used for the 1 volt signal, the following computation applies: C_c (ps) = 2 x V_{eb} (millivolts).

TABLE I. Group A inspection.

nspection 1/	MIL-STD-750		Symbol	Limit		Unit
	Method	Conditions		Min	Max	
Subgroup 1 2/						
Visual and mechanical inspection 3/	2071					
Solderability 3/ 4/	2026	15 leads, c = 0				
Resistance to solvents 3/ 4/ 5/	1022	15 devices, c = 0				
Temperature cycling 3/ 4/	1051	Test condition C, 25 cycles. n = 22 devices, c = 0				
Hermetic seal 4/ Fine leak Gross leak	1071	n = 22 devices, c = 0				
Electrical measurements 4/		Table I, subgroup 2				
Bond strength 3/ 4/	2037	Precondition T_A = +250°C at t = 24 hrs or T_A = +300°C at t = 2 hrs. n = 11 wires, c = 0				
Decap internal visual	2075	n = 4, c = 0				
Subgroup 2						
Thermal impedance 6/	3131	See 4.3.3	ΔV_{BE}			
Breakdown voltage, collector to emitter	3011	Bias condition D; I_C = -1.0 mA dc, I_B = 0	$V_{(BR)CEO}$	-30		V dc
Collector to base cutoff current	3036	Bias condition D; V_{CB} = -20 V dc, I_E = 0	I_{CB01}		-100	nA dc
Collector to base cutoff current	3036	Bias condition D; V_{CB} = -30 V dc	I_{CB02}		-100	µA dc
Emitter to base cutoff current	3061	Bias condition D; V_{EB} = -3 V dc	I_{EB0}		-100	µA dc
Forward-current transfer ratio	3076	V_{CE} = -10 V dc; I_C = -0.5 mA dc	h_{FE1}	15		
Forward-current transfer ratio	3076	V_{CE} = -10 V dc; I_C = -2.0 mA dc	h_{FE2}	20		
Forward-current transfer ratio	3076	V_{CE} = -10 V dc; I_C = -5.0 mA dc	h_{FE3}	30	165	

See footnotes at end of table.

TABLE I. Group A inspection - Continued.

Inspection 1/	MIL-STD-750		Symbol	Limit		Unit
	Method	Conditions		Min	Max	
Subgroup 3						
High temperature operation:		T_C = +150°C				
Collector to base cutoff current	3036	Bias condition D; V_{CE} = -20 V dc, I_E = 0	I_{CB03}		-100	µA dc
Low temperature operation:		T_A = -55°C				
Forward-current transfer ratio	3076	V_{CE} = -10 V dc; I_C = -5 mA dc;	h_{FE4}	10		
Subgroup 4						
Magnitude of common-emitter small-signal short-circuit forward-current transfer ratio	3306	V_{CE} = -10 V dc; I_E = -2.0 mA dc; f = 100 MHz; case lead grounded	$\|h_{fe}\|$	12	36	
Collector to base feedback capacitance	3236	V_{CB} = -10 V dc; I_E = 0; 100 kHz ≤ f ≤ 1 MHz; case and emitter leads shall be grounded	C_{cb}		0.8	pF
Collector to base time constant (2N4957 only)	3236	V_{CB} = -10 V dc; I_E = -2.0 mA dc; f = 63.6 MHz; case and emitter leads shall be grounded (see 4.5.2 and figure 4)	$r_b'C_c$	1.0	8.0	ps
Collector to base time constant (2N4957UB only)	3236	V_{CB} = -10 V dc; I_E = -2.0 mA dc; f = 63.6 MHz; case and emitter leads shall be grounded (see 4.5.2 and figure 4)	$r_b'C_c$	1.0	16.0	ps
Noise figure	3246	V_{CE} = -10 V dc; I_C = -2.0 mA dc; f = 450 MHz; R_L = 50 Ω; case lead shall be grounded (see figure 5)	NF		3.5	dB
Common-emitter small signal power gain	3256	V_{CE} = -10 V dc; I_C = -2.0 mA dc; f = 450 MHz; case lead shall be grounded (see figure 5)	G_{PE}	17	25	dB
Subgroups 5, 6, and 7						
Not applicable						

1/ For sampling plan (unless otherwise specified), see MIL-PRF-19500.
2/ For resubmission of failed group A, subgroup 1, double the sample size of the failed test or sequence of tests. A failure in group A, subgroup 1 shall not require retest of the entire subgroup. Only the failed test shall be rerun upon submission.
3/ Separate samples may be used.
4/ Not required for JANS devices.
5/ Not required for laser marked devices.
6/ This test required for the following end-point measurements only:
Group B, step 1 of 4.4.2.2 herein (JAN, JANTX, and JANTXV).
Group B, subgroups 3, 4, and 5 (JANS).
Group C, subgroup 2 and 6.
Group E, subgroup 1 and 2.

TABLE II. Group D inspection and end-point limits.

Inspection 1/ 2/ 3/	MIL-STD-750		Symbol	Limits		Unit
	Method	Conditions		Min	Max	
Subgroup 1 4/						
Neutron Irradiation	1017	Neutron exposure Vces = 0 V				
Breakdown voltage, collector to emitter	3011	Bias condition D; I_C = -1.0 mA dc, I_B = 0 A	$V_{(BR)CEO}$	-30		V dc
Collector to base cutoff current	3036	Bias condition D, V_{CB} = -20 V, I_E = 0 A	I_{CBO1}		-200	ηA dc
Collector to base cutoff current	3036	Bias condition D, V_{CB} = -30 V	I_{CBO2}		-200	µA dc
Emitter to base cutoff current	3061	Bias condition D, V_{EB} = -3 V	I_{EBO}		-200	µA dc
Forward-current transfer ratio	3076	V_{CE} = -10 V dc, I_C = -0.5 mA dc	[h_{FE1}] 5/	[7.5]		
Forward-current transfer ratio	3076	V_{CE} = -10 V dc, I_C = -2.0 mA dc	[h_{FE2}] 5/	[10]		
Forward-current transfer ratio	3076	V_{CE} = -10 V dc, I_C = -5.0 mA dc	[h_{FE3}] 5/	[15]	165	
Subgroup 2						
Steady-state total dose irradiation	1019	Gamma exposure V_{CES} = -24 V				
Breakdown voltage, collector to emitter	3011	Bias condition D; I_C = -1.0 mA dc, I_B = 0 A	$V_{(BR)CEO}$	-30		V dc
Collector to base cutoff current	3036	Bias condition D, V_{CB} = -20 V, I_E = 0 A	I_{CBO1}		-200	ηA dc
Collector to base cutoff current	3036	Bias condition D, V_{CB} = -30 V	I_{CBO2}		-200	µA dc
Emitter to base cutoff current	3061	Bias condition D, V_{EB} = -3 V	I_{EBO}		-200	µA dc
Forward-current transfer ratio	3076	V_{CE} = -10 V dc, I_C = -0.5 mA dc	[h_{FE1}] 5/	[7.5]		
Forward-current transfer ratio	3076	V_{CE} = -10 V dc, I_C = -2.0 mA dc	[h_{FE2}] 5/	[10]		
Forward-current transfer ratio	3076	V_{CE} = -10 V dc, I_C = -5.0 mA dc	[h_{FE3}] 5/	[15]	165	

1/ Tests to be performed on all devices receiving radiation exposure.
2/ For sampling plan, see MIL-PRF-19500.
3/ Electrical characteristics apply to all device types unless otherwise noted.
4/ See 6.2.e herein.
5/ See method 1019, of MIL-STD-750, for how to determine [h_{FE}] by first calculating the delta(1/h_{FE}) from the pre and post-radiation h_{FE}. Notice that [h_{FE}] is not the same as h_{FE} and cannot be measured directly. The [h_{FE}] value can never exceed the pre-radiation minimum h_{FE} that it is based upon.

* TABLE III. Groups B, C, and E delta end-point inspection measurements. 1/ 2/ 3/ 4/

Step	Inspection	MIL-STD-750		Symbol	Limits		Unit
		Method	Conditions		Min	Max	
* 1.	Collector to base cutoff current	3036	Bias condition D; V_{CB} = -20 V dc, I_E = 0	ΔI_{CB01}		±100 percent of initial value or -10 nA dc, whichever is greater.	
2.	Forward current transfer ratio	3076	I_C = -5 mA dc, V_{CE} = -10 V dc	Δh_{FE3}	30	±20 percent change from initial reading.	

1/ The delta measurements for table VIA (JANS) of MIL-PRF-19500 are subgroup 4 and 5, see table III herein, all steps.
2/ The delta measurements for group B of 4.4.2.2 herein (JAN, JANTX, and JANTXV) are: Step 1, 2, and 3 of 4.4.2.2, see table III herein, all steps.
3/ The delta measurements for table E-VII of MIL-PRF-19500, subgroup 6, all steps for JANS only:
4/ The delta measurements for table E-IX of MIL-PRF-19500 are: Subgroups 1 and 2, see table III herein, all steps.

* TABLE IV. Group E inspection (all quality levels) - for qualification or re-qualification only.

Inspection	MIL-STD-750		Qualification
	Method	Conditions	
Subgroup 1			45 devices c = 0
Temperature cycling (air to air)	1051	Test condition C, 500 cycles.	
Hermetic seal	1071		
Fine leak Gross leak			
Electrical measurements		See table I, subgroup 2 and table III herein.	
Subgroup 2			45 devices c = 0
Intermittent life	1037	V_{CB} = -10 V dc, 6,000 cycles, t(on) = t(off) = 3 min. P_D = maximum rated P_T (see 1.3) during the “on” cycle. P_D = 0 during the “off” cycle.	
Electrical measurements		See table I, subgroup 2 and table III herein.	
Subgroup 4			sample size N/A
Thermal impedance curves		See MIL-PRF-19500, table E-IX, subgroup 4.	
Subgroup 5			
Not applicable			
Subgroup 6			11 devices
ESD	1020		
Subgroup 8			45 devices c = 0
Reverse stability	1033	Condition B.	

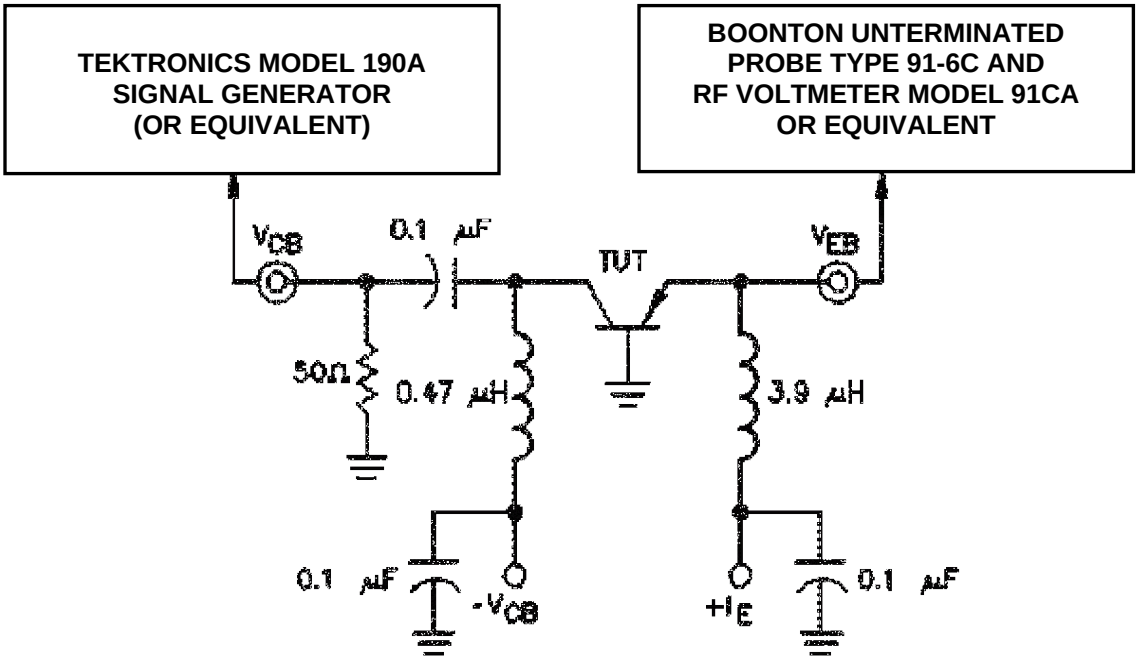
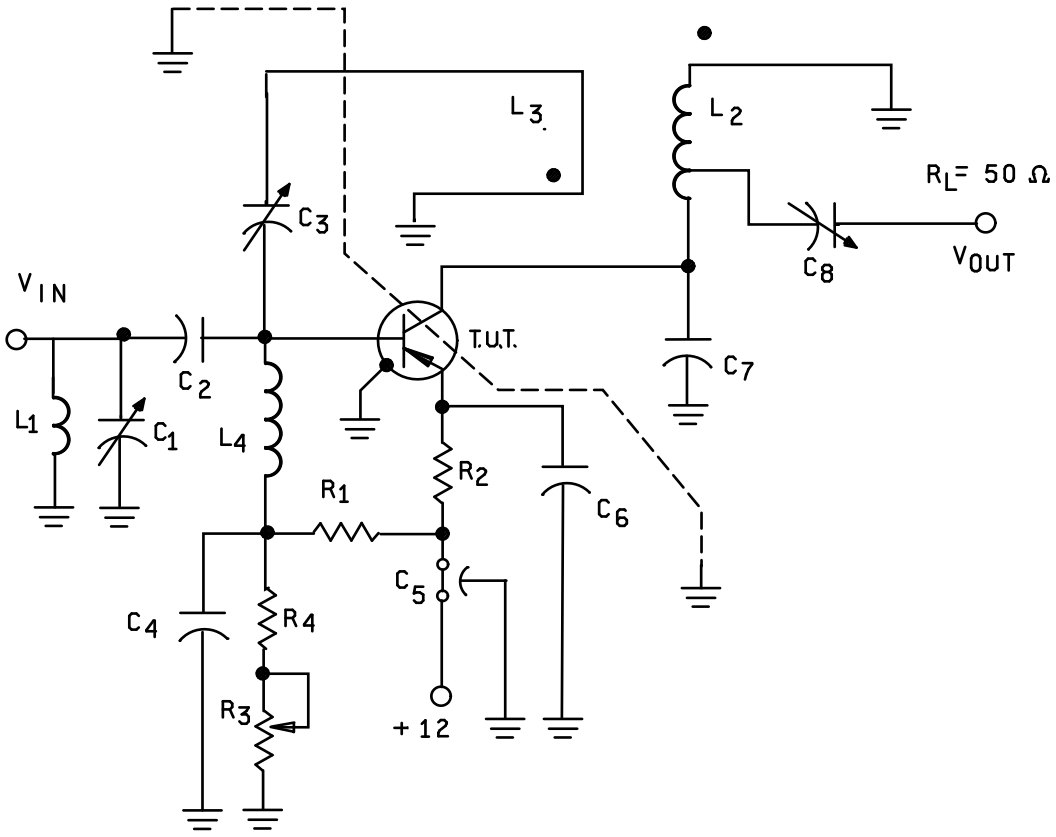


FIGURE 4. RF amplifier for collector to base time constant tests.



Values:

C_1, C_7	= 1-10 pF (variable air-piston type capacitors)
C_2, C_4, C_6	= 500 pF (button type capacitors)
C_3, C_8	= .4 - 6.0 pF (variable air-piston type capacitors)
C_5	= 1,000 pF
R_1	= 2.7 kΩ
R_2, R_4	= 1 kΩ
R_3	= 20 kΩ

L_1 = silver-plated brass bar, 1.0 inch (25.4 mm) long by .25 inch (6.35 mm) o.d. (straight bar).
L_2 = silver-plated brass bar, 1.5 inches (38.1 mm) long by .25 inch (6.35 mm) o.d. Tap is .25 inch (6.35 mm) from collector (straight bar).
L_3 = One-half turn of AWG number 16 wire, loop o.d. approximately .5 inch (12.7 mm), located .25 inch (6.35 mm) from, and parallel to L_2.
L_4 = 0.22 μH.

The noise source is a hot-cold body, (all type 70 or equivalent) with a test receiver (all type 70 or equivalent).

FIGURE 5. RF amplifier for power gain and noise figure tests.

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:

a. Title, number, and date of this specification.

b. Packaging requirements (see 5.1).

c. Lead finish (see 3.4.1).

* d. The complete PIN, see 1.5 and 6.5.

e. For acquisition of RHA designed devices, table II, subgroup 1 testing of group D is optional. If subgroup 1 testing is desired, it should be specified in the contract.

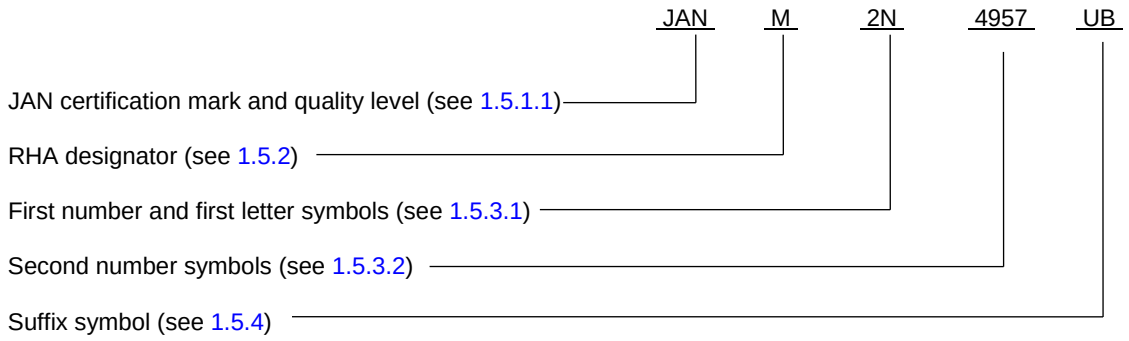
6.3 Qualification. With respect to products requiring qualification, awards will be made only for products which are, at the time of award of contract, qualified for inclusion in Qualified Manufacturers List (QML 19500) whether or not such products have actually been so listed by that date. The attention 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.dla.mil/ .

6.4 Suppliers of JANHC and JANKC die. The qualified JANHC and JANKC suppliers with the applicable letter version (example JANHCA2N4957) will be identified on the QML.

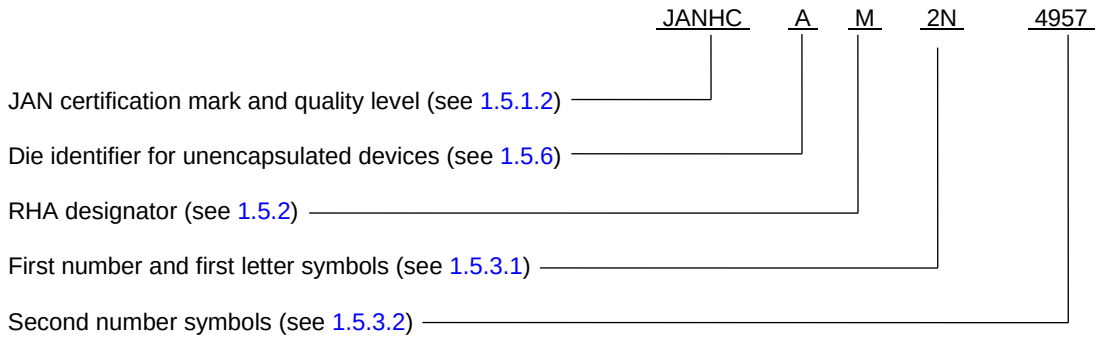
Die ordering information	
PIN	Manufacturer
	34156
2N4957	JANHCA2N4957 JANKCA2N4957

* 6.5 PIN construction examples.

* 6.5.1 Encapsulated devices The PINs for encapsulated devices are constructed using the following form.



* 6.5.2 Unencapsulated devices. The PINs for un-encapsulated devices are constructed using the following form.



* 6.6 List of PINs. The following is a list of possible PINs available on this specification sheet.

Encapsulated PINs for type 2N4957 and 2N4957UB			
JAN2N4957	JANTX2N4957	JANTXV#2N4957	JANS#2N4957
JAN2N4957UB	JANTX2N4957UB	JANTXV#2N4957UB	JANS#2N4957UB

Unencapsulated PINs for type 2N4957			
JANHCA#2N4957	JANKCA#2N4957		

* (1) The number sign (#) represent one of eight RHA designators available (M, D, P, L, R, F, G, or H). The PIN is also available without a RHA designator.

6.7 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 - 85
NASA - NA
DLA - CC

Review activities:
Army - AR, MI
Navy - SH
Air Force - 19

Preparing activity:
DLA - CC

(Project 5961-2016-101)

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 https://assist.dla.mil.