

The documentation and process conversion measures necessary to comply with this document shall be completed by 30 June 2013.

INCH-POUND

MIL-PRF-19500/426G  
30 March 2013  
SUPERSEDING  
MIL-PRF-19500/426F  
29 June 2011

## PERFORMANCE SPECIFICATION SHEET

SEMICONDUCTOR DEVICE, TRANSISTOR, PNP, SILICON, AMPLIFIER  
TYPE 2N4957 AND 2N4957UB, JAN, JANTX, JANTXV, JANTXVM, JANTXVD, JANTXVP, JANTXVL, JANTXVR,  
JANTXVF, JANTXVG, JANTXVH, JANS, JANSM, JANSJ, JANSK, JANSN, JANSO, JANSR, JANSF, JANSI, JANSJ,  
JANHC, JANHCM, JANHCD, JANHCP, JANHCL, JANHCR, JANHCF, JANHCG, JANHCH, JANKC, JANKCM,  
JANKCD, JANKCP, JANKCL, JANKCR, JANKCF, JANKCG, AND JANKCH

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 device type as specified in MIL-PRF-19500. Two levels of product assurance are provided for each unencapsulated device type. Radiation hardness assurance (RHA) level designators "M", "D", "P", "L", "R", "F", "G", and "H" are appended to the device prefix to identify devices which have passed RHA requirements.

1.2 Physical dimensions. See [figure 1](#) (TO-72) and [figure 2](#) (surface mount) and [figure 3](#) (JANHC and JANKC die).

1.3 Maximum ratings.

$P_T$ (1) $T_A = +25^\circ\text{C}$	$V_{CE0}$	$V_{CBO}$	$I_C$	$V_{EBO}$	$T_{STG}$ and $T_J$
<u>mW</u>	<u>V dc</u>	<u>V dc</u>	<u>mA dc</u>	<u>V dc</u>	<u>°C</u>
200	30	30	30	3.0	-65 to +200

(1) Derate at 1.14 mW/°C above  $T_A > +25^\circ\text{C}$ .

\* 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](mailto: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>.

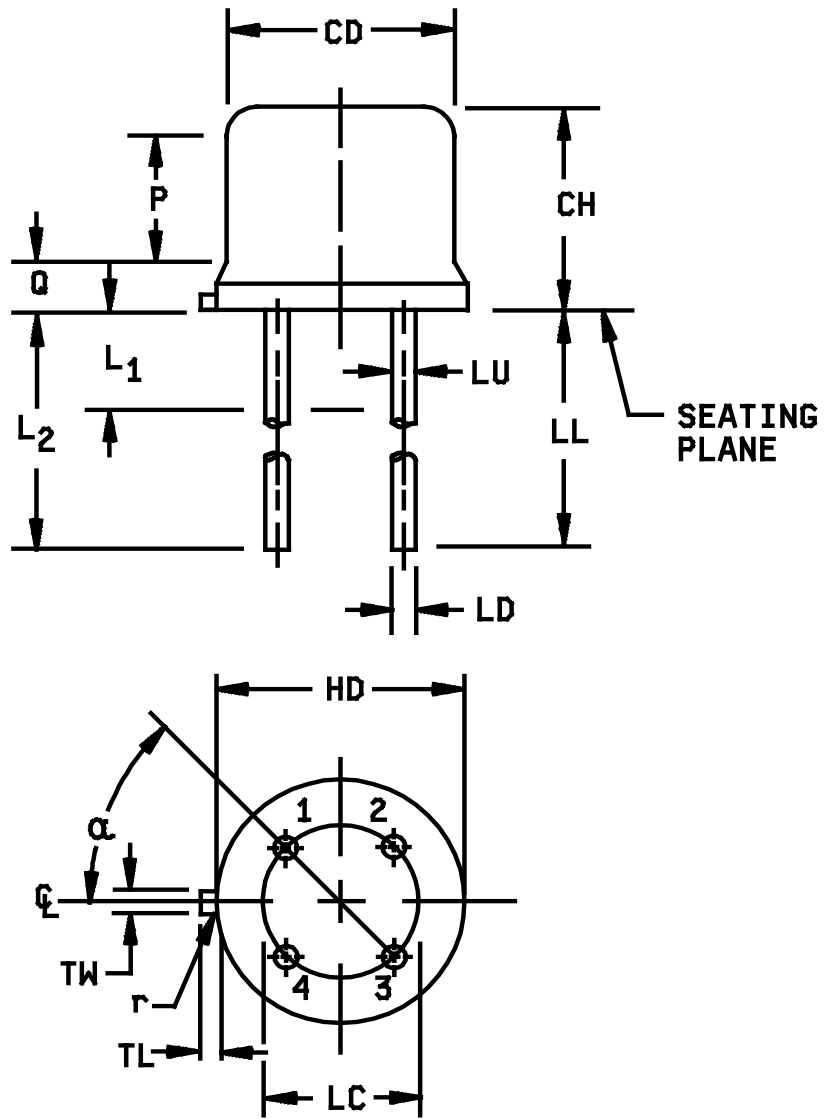


FIGURE 1. Physical dimensions of transistor type 2N4957 (TO-72).

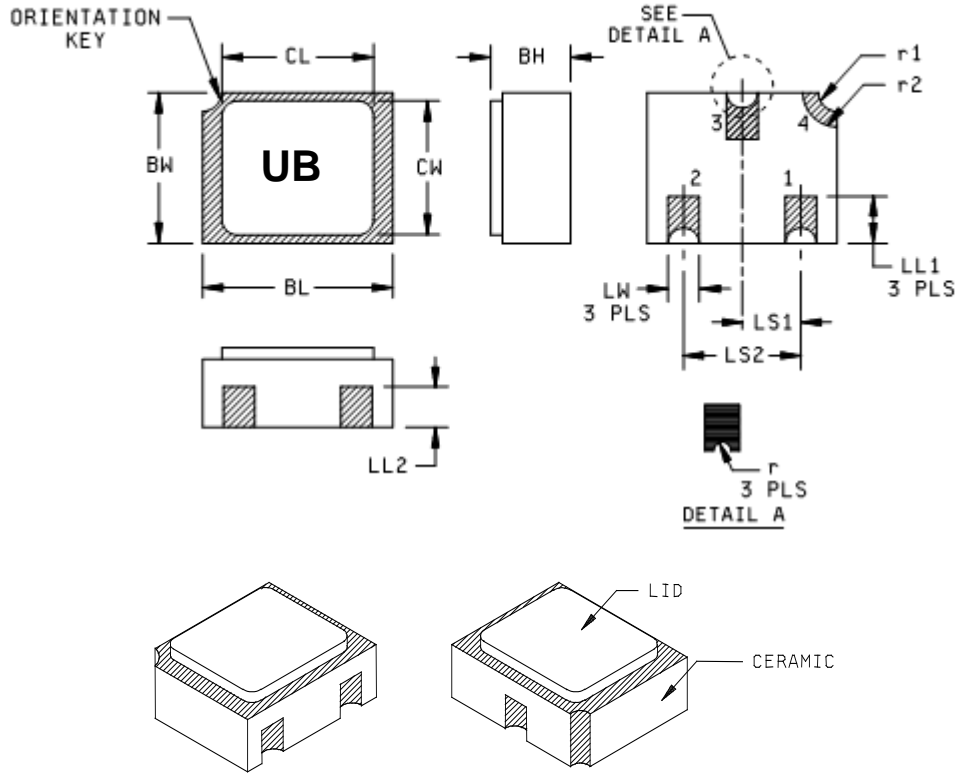
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Symbol	Dimensions				Notes
	Inches		Millimeters		
	Min	Max	Min	Max	
CD	.178	.195	4.52	4.95	5
CH	.170	.210	4.32	5.33	
HD	.209	.230	5.31	5.84	5
LC	.100 TP		2.54 TP		
LD	.016	.021	0.41	0.533	7,8
LL	.500	.750	12.70	19.05	7,8
LU	.016	.019	0.41	0.48	7,8
L <sub>1</sub>		.050		1.27	8
L <sub>2</sub>	.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	
$\alpha$	45° TP		45° TP		

## NOTES:

1. Dimension are in inches.
2. Millimeters are given for general information only.
3. Beyond r (radius) maximum, TH 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<sub>1</sub> and L<sub>2</sub>. Dimension LD applies between L<sub>2</sub> and LL minimum. Diameter is uncontrolled in L<sub>1</sub> 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  $\phi$ x 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.

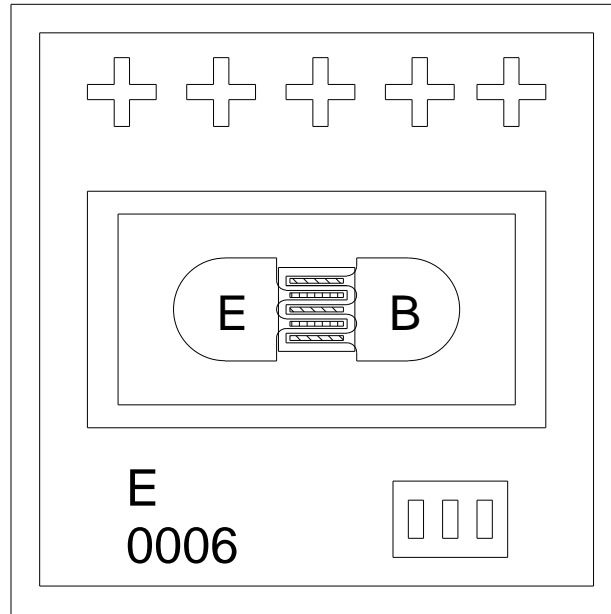


Symbol	Dimensions				Note
	Inches		Millimeters		
	Min	Max	Min	Max	
BH	.046	.056	1.17	1.42	
BL	.115	.128	2.92	3.25	
BW	.085	.108	2.16	2.74	
CL		.128		3.25	
CW		.108		2.74	
LL1	.022	.038	0.56	0.97	
LL2	.017	.035	0.43	0.89	
LS1	.036	.040	0.91	1.02	
LS2	.071	.079	1.80	2.01	
LW	.016	.024	0.41	0.61	
r		.008		.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  $\phi$ x 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 <sub>2</sub> , 7,500 ±1,500 Å.

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

1.4 Primary electrical characteristics (common to all types).

Limits	hFE3	hfe	r <sub>b</sub> 'C <sub>C</sub>	r <sub>b</sub> 'C <sub>C</sub>	C <sub>cb</sub>	G <sub>pe</sub>	NF
	V <sub>CE</sub> = 10 V dc I <sub>C</sub> = 5.0 mA dc	I <sub>E</sub> = 2.0 mA dc, V <sub>CE</sub> = 10 V dc f = 100 MHz	I <sub>E</sub> = 2.0 mA dc f = 63.6 MHz V <sub>CB</sub> = 10 V dc (2N4957 only)	I <sub>E</sub> = 2.0 mA dc f = 63.6 MHz V <sub>CB</sub> = 10 V dc (2N4957UB only)	V <sub>CB</sub> = 10 V dc I <sub>E</sub> = 0 100 kHz ≤ f ≤ 1 MHz	I <sub>C</sub> = 2.0 mA dc f = 450 MHz V <sub>CE</sub> = 10 V dc	I <sub>C</sub> = 2.0 mA dc V <sub>CE</sub> = 10 V dc f = 450 MHz
			<u>ps</u>	<u>ps</u>	<u>pF</u>	<u>dB</u>	<u>dB</u>
Min	30	12	1.0	1.0		17	
Max	165	36	8.0	16.0	0.8	25	3.5

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.dla.mil/quicksearch> or <https://assist.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 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.

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

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4.3 Screening (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 (see table IV of MIL-PRF-19500)	Measurement	
	JANS level	JANTX and JANTXV levels
3c	Thermal impedance, method 3131 of MIL-STD-750 (see <a href="#">4.3.3</a> )	Thermal impedance, method 3131 of MIL-STD-750 (see <a href="#">4.3.3</a> )
7	Optional	Optional
9	$I_{CBO1}$ , $h_{FE3}$	Not applicable
10	24 hours minimum	24 hours minimum
11	$I_{CBO1}$ ; $h_{FE3}$ ; $\Delta I_{CBO1}$ = 100 percent of initial value or 10 nA dc, whichever is greater. $\Delta h_{FE3}$ = $\pm 20$ percent	$I_{CBO1}$ , $h_{FE3}$
12	See <a href="#">4.3.1</a> , 240 hours minimum	See <a href="#">4.3.1</a> , 80 hours minimum
13	Subgroups 2 and 3 of <a href="#">table I</a> herein; $\Delta I_{CBO1}$ = 100 percent of initial value or 10 nA dc, whichever is greater; $\Delta h_{FE3}$ = $\pm 20$ percent	Subgroup 2 of <a href="#">table I</a> herein; $\Delta I_{CBO1}$ = 100 percent of initial value or 10 nA dc, whichever is greater; $\Delta h_{FE3}$ = $\pm 20$ percent
14	Required	Required

4.3.1 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,  $V_{CB} = 10 - 20$  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 ( $\Delta V_{BE}$  measurements). The  $\Delta V_{BE}$  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  $\Delta V_{BE}$  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). Electrical measurements (end-points) shall be in accordance with table I, subgroup 2 and 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.

<u>Subgroup</u>	<u>Method</u>	<u>Condition</u>
B4	1037	$V_{CB} = 10$ 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, $V_{CB} = 10$ V dc, power shall be applied to achieve $T_J = +150^\circ\text{C}$ 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.

<u>Step</u>	<u>Method</u>	<u>Condition</u>
1	1026	Steady-state life: 1,000 hours minimum, $V_{CB} = 10$ V dc, power shall be applied to achieve $T_J = +150^\circ\text{C}$ 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, $T_A = +150^\circ\text{C}$ , $V_{CB} = 80$ percent of rated voltage, 48 hours minimum. $n = 45$ devices, $c = 0$ .
3	1032	High-temperature life (non-operating), $t = 340$ hours, $T_A = +200^\circ\text{C}$ . $n = 22$ , $c = 0$ .

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. Electrical measurements (end-points) and delta requirements shall be in accordance with the steps of [table III](#) herein and as specified in the notes for [table III](#).

<u>Subgroup</u>	<u>Method</u>	<u>Condition</u>
C2	2036	Test condition E; not applicable for UB devices.
* C6	1026	For JANS only. 1,000 hours minimum, VCB = 10 V dc, power shall be applied to achieve $T_J = +150^\circ\text{C}$ 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) =  $2 \times V_{eb}$  (millivolts).

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\* TABLE I. Group A inspection.

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

See footnotes at end of table.

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\* TABLE I. Group A inspection - Continued.

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

<sup>1/</sup> For sampling plan (unless otherwise specified), see MIL-PRF-19500.

<sup>2/</sup> 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.

<sup>3/</sup> Separate samples may be used.

<sup>4/</sup> Not required for JANS devices.

<sup>5/</sup> Not required for laser marked devices.

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

Inspection <u>1/</u> <u>2/</u> <u>3/</u>	MIL-STD-750		Symbol	Limits		Unit
	Method	Conditions		Min	Max	
<u>Subgroup 1</u> <u>4/</u>						
Neutron Irradiation	1017	Neutron exposure $V_{ces} = 0$ 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	$\eta$ A dc
Collector to base cutoff current	3036	Bias condition D, $V_{CB} = 30$ V	$I_{CBO2}$		200	$\mu$ A dc
Emitter to base cutoff current	3061	Bias condition D, $V_{EB} = 3$ V	$I_{EBO}$		200	$\mu$ A dc
Forward-current transfer ratio	3076	$V_{CE} = 10$ V dc, $I_C = 0.5$ mA dc	$[h_{FE1}]$ <u>5/</u>	[7.5]		
Forward-current transfer ratio	3076	$V_{CE} = 10$ V dc, $I_C = 2.0$ mA dc	$[h_{FE2}]$ <u>5/</u>	[10]		
Forward-current transfer ratio	3076	$V_{CE} = 10$ V dc, $I_C = 5.0$ mA dc	$[h_{FE3}]$ <u>5/</u>	[15]	165	
<u>Subgroup 2</u>						
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	$\eta$ A dc
Collector to base cutoff current	3036	Bias condition D, $V_{CB} = 30$ V	$I_{CBO2}$		200	$\mu$ A dc
Emitter to base cutoff current	3061	Bias condition D, $V_{EB} = 3$ V	$I_{EBO}$		200	$\mu$ A dc
Forward-current transfer ratio	3076	$V_{CE} = 10$ V dc, $I_C = 0.5$ mA dc	$[h_{FE1}]$ <u>5/</u>	[7.5]		
Forward-current transfer ratio	3076	$V_{CE} = 10$ V dc, $I_C = 2.0$ mA dc	$[h_{FE2}]$ <u>5/</u>	[10]		
Forward-current transfer ratio	3076	$V_{CE} = 10$ V dc, $I_C = 5.0$ mA dc	$[h_{FE3}]$ <u>5/</u>	[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.

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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; $V_{CB} = 20 \text{ V dc}$ , $I_E = 0$	$\Delta I_{CB01}$		$\pm 100$ percent of initial value or 10 nA dc, whichever is greater.	
2.	Forward current transfer ratio	3076	$I_C = 5 \text{ mA dc}$ , $V_{CE} = 10 \text{ V dc}$	$\Delta h_{FE3}$	30	$\pm 20$ 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.

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

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

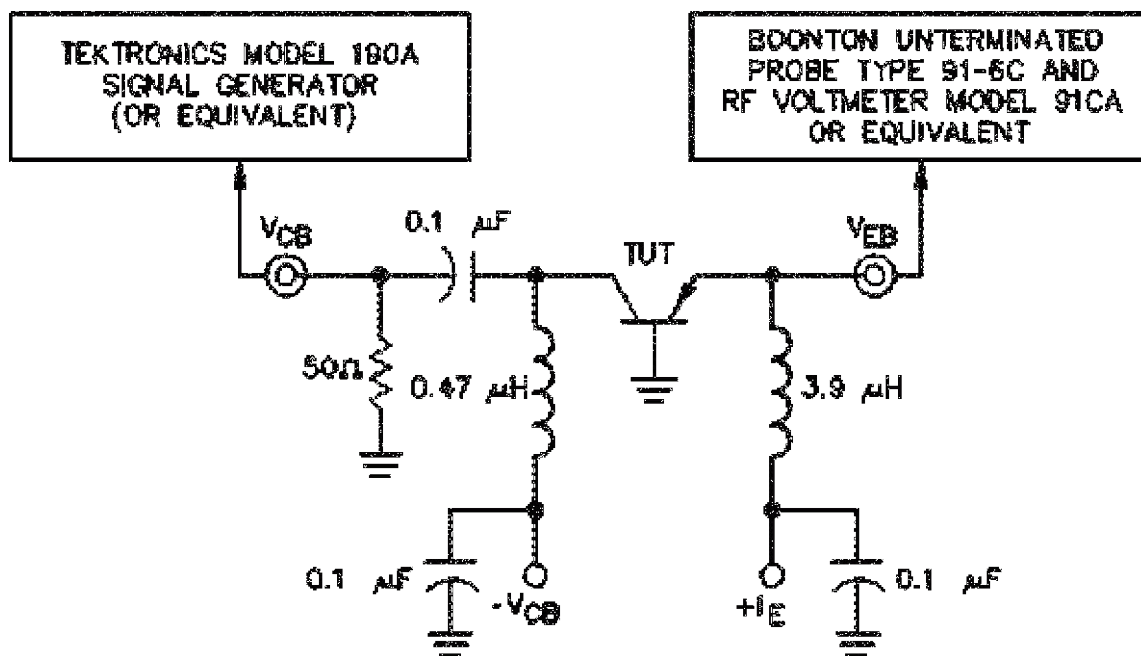
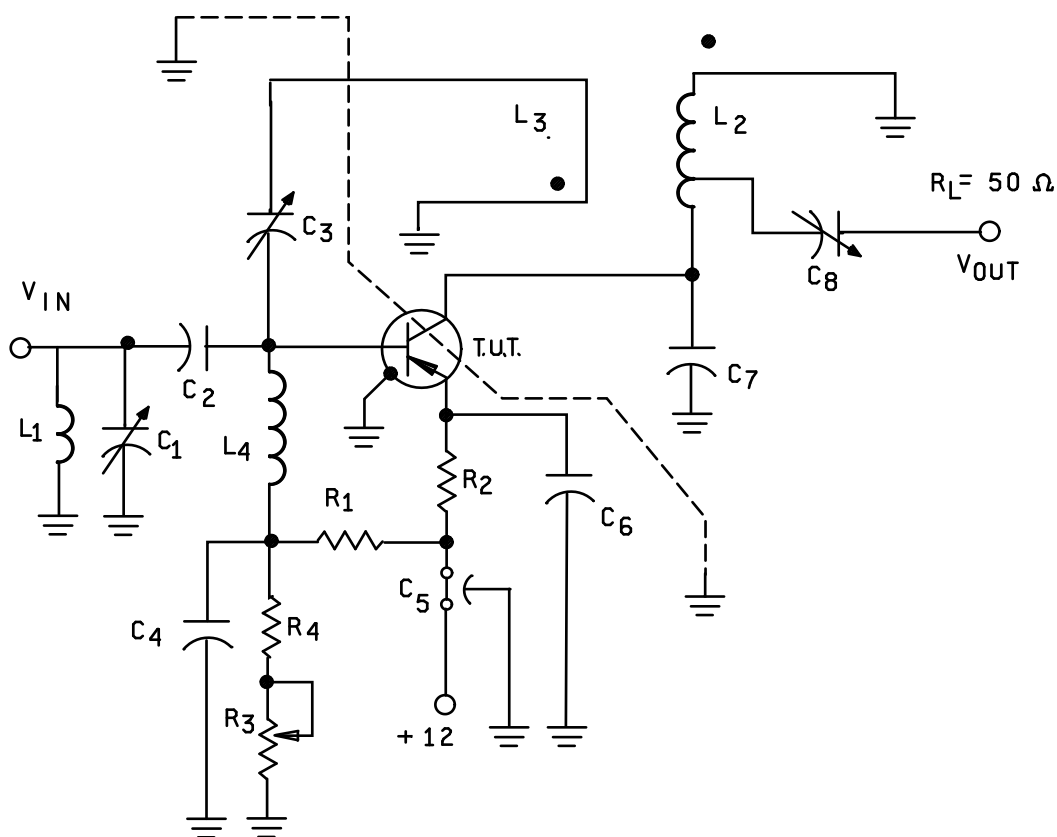


FIGURE 4. RF amplifier for collector to base time constant tests.





Values:

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

$L_1$  = 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  $L_2$ .

$L_4 = 0.22\text{ }\mu\text{H}$ .

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. Product assurance level and type designator.
- 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](mailto: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 (1)	
PIN	Manufacturer
	34156
2N4957	JANHCA2N4957

(1) For JANKC level, replace JANHC with JANKC.

6.5 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

Preparing activity:

DLA - CC  
(Project 5961-2012-085)

Review activities:

Army - AR, MI  
Navy - SH  
Air Force - 19

\* 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>.