The documentation and process conversion measures necessary to comply with this document shall be completed by 29 July 2016.

INCH-POUND

MIL-PRF-19500/301M
w/AMENDMENT 1
29 April 2016
SUPERSEDING
MIL-PRF-19500/301M
25 September 2015

PERFORMANCE SPECIFICATION SHEET

* TRANSISTOR, NPN SILICON, LOW-POWER,
THROUGH-HOLE MOUNT, SUFACE MOUNT, AND UNENCAPSULATED DIE,
TYPE 2N918, QUALITY LEVELS JAN, JANTX, JANTXV, JANS, JANHC, AND 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 detail requirements for NPN, silicon, ultra-high frequency transistors. Four levels of product assurance (JAN, JANTX, JANTXV and JANS) are provided for each device type as specified in MIL-PRF-19500 and two levels of product assurance are provided for unencapsulated devices. 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. The device packages for the encapsulated device types are as follows: (2N918) (TO-72) in accordance with figure 1, 2N918UB (UB) in accordance with figure 2. The dimensions and topography for JANHC and JANKC unencapsulated die is as follows: A version die in accordance with figure 3 and B version die in accordance with figure 4.

1.3 Maximum ratings. Unless otherwise specified, T_A = +25°C.

Types	P_T (1) T_A = +25°C	$R_{\theta JA}$	$R_{\theta JSP}$	V_{CBO}	V_{CEO}	V_{EBO}	I_C	T_{STG} and T_J
	mW	°C/W	°C/W	V dc	V dc	V dc	mA dc	°C
2N918	200	(2)		30	15	3.0	50	-65 to +200
2N918UB	200		(2)	30	15	3.0	50	

(1) Derate linearly, 1.14 mW/°C above T_A = +25°C.
(2) See figure 5 and figure 6 for the manufacturer estimated $R_{\theta J}$ curves.

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. Unless otherwise specified, at T_A = +25°C.

Limit	h_{FE1} V_{CE} = 10 V dc I_C = 500 μA dc	h_{FE2} V_{CE} = 1.0 V dc I_C = 3.0 mA dc	h_{FE3} V_{CB} = 10 V dc I_C = 10 mA dc
Minimum Maximum	10	20 200	20

Limit	$\|h_{FE}\|$ V_{CE} = 10 V dc I_C = 4 mA dc f = 100 MHz	$r_b' C_c$ V_{CB} = 10 V dc I_E = -4.0 mA dc f = 79.8 MHz	C_{obo2} V_{CB} = 10 V dc I_E = 0 mA dc 100 kHz ≤ f ≤1 MHz	NF V_{CE} = 6 V dc I_C = 1 mA dc f = 60 MHz g_s = 2.5 mmho	G_{pe} V_{CB} = 12 V dc I_C = 6.0 mA dc f = 200 MHz
		ps	pF	DB	dB
Minimum	6.0				15
Maximum	18.0	25	1.7	6.0	

* 1.5 Part or Identifying Number (PIN). The PIN is in accordance with MIL-PRF-19500, and as specified herein. See 6.4 for PIN construction example and 6.5 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: The base quality level "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 for JANS quality levels are as follows: "M", "D", "P", "L", “R”, "F", "G", and "H". For the RHA levels for TXV quality levels are as follows: "R" and "F".

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 follows: "918".

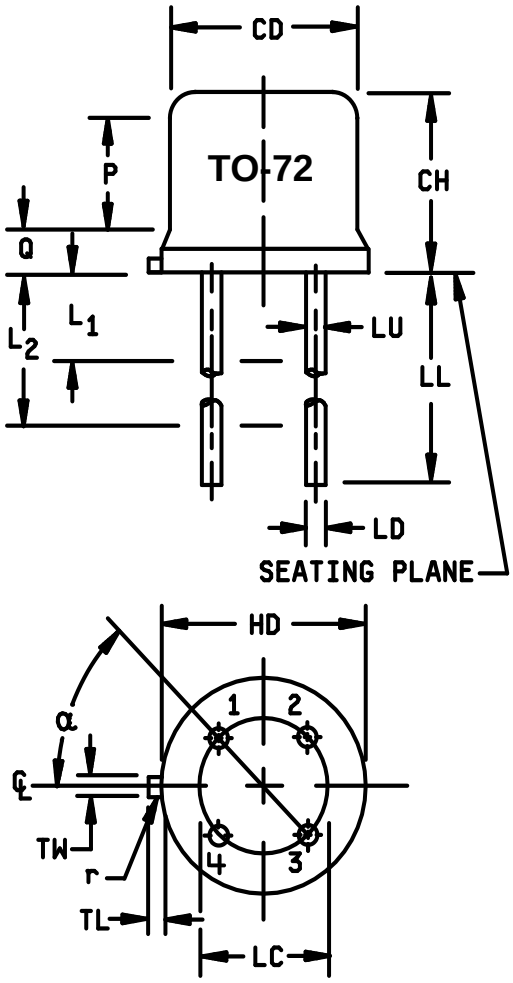
1.5.4 Suffix symbols. The following suffix letters are incorporated in the PIN in the order listed in the table as applicable:

	A blank first suffix symbol indicates a encapsulated devices (see figure 1).
UB	Indicates a surface mount (2N918UB) (see figure 2)

1.5.5 Lead finish. The lead finishes applicable to this specification sheet are listed on QML–19500. The lead finish designator shall be separated from the main PIN by a dash.

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

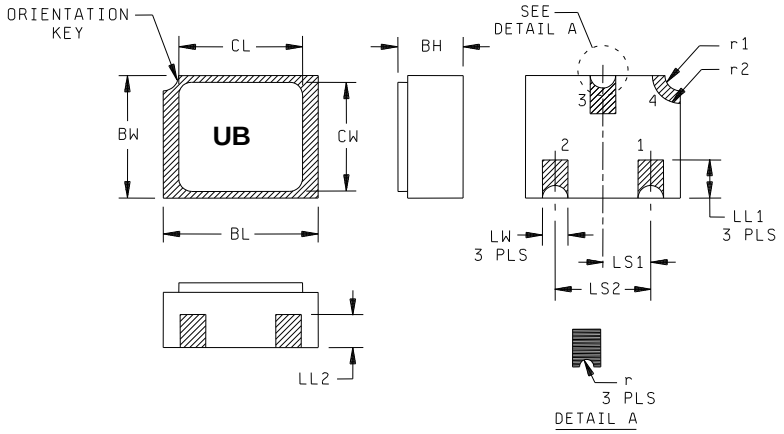
Symbol	Dimensions				Notes
	Inches		Millimeters		
	Min	Max	Min	Max	
CD	.178	.195	4.52	4.95	5
CH	.170	.210	4.32	5.33	
HD	.209	.230	5.31	5.84	5
LC	.100 TP		2.54 TP		7,8
LD	.016	.021	.406	.533	7,8
LL	.500	.750	12.70	19.05	7,8
LU	.016	.019	.406	.483	
L_1		.050		1 .27	
L_2	.250		6.35		
P	.100		2.54		
Q		.040		1.02	5
TL	.028	.048	.71	1.22	
TW	.036	.046	.91	1.17	
r		.007		.18	
α	45° TP				

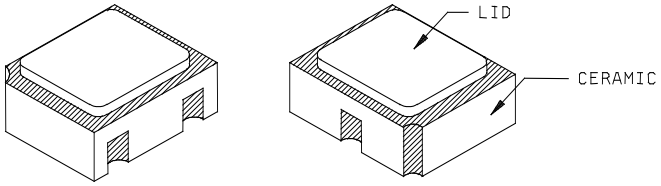


NOTES:

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 inch (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 +0.025 -0.00 mm) below seating plane shall be within .007 inch (0.18mm) radius of true position (TP) at maximum material condition (MMC) relative to tab at MMC.
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 for 2N918 (TO-72).



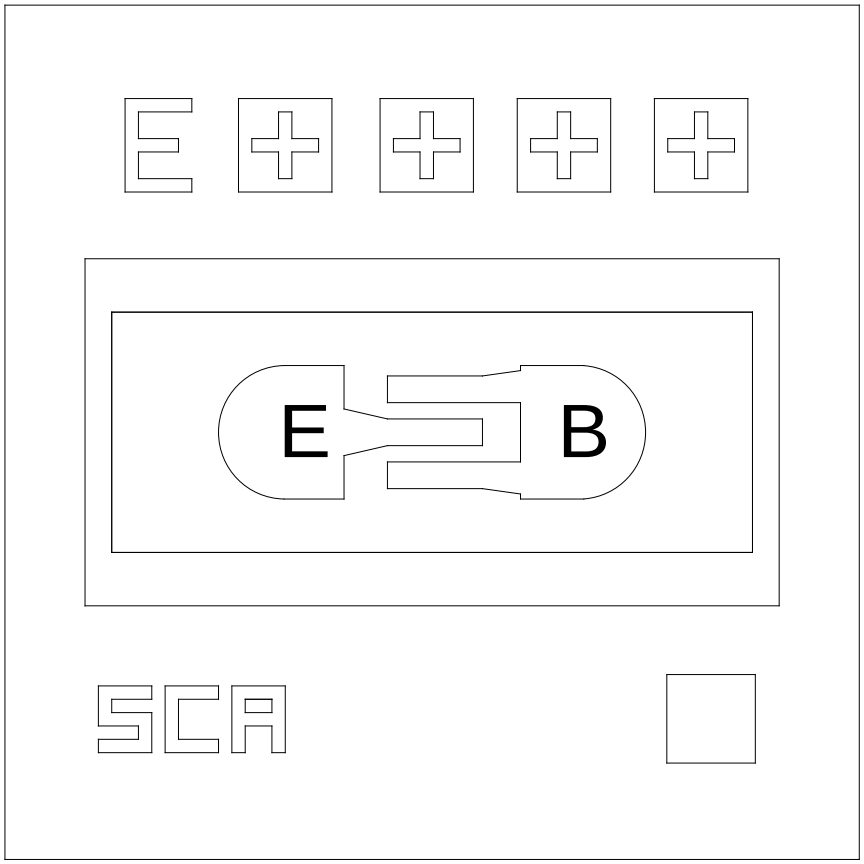


Symbol	Dimensions				Note
	Inches		Millimeters		
	Min	Max	Min	Max	
BH	.046	.056	1.17	1.42	
BL	.115	.128	2.92	3.25	
BW	.085	.108	2.16	2.74	
CL		.128		3.25	
CW		.108		2.74	
LL1	.022	.038	0.56	0.97	
LL2	.017	.035	0.43	0.89	

Symbol	Dimensions				Note
	Inches		Millimeters		
	Min	Max	Min	Max	
LS_1	.036	.040	0.91	1.02	
LS_2	.071	.079	1.80	2.01	
LW	.016	.024	0.41	0.61	
r		.008		.203	
r1		.012		.305	
r2		.022		.559	

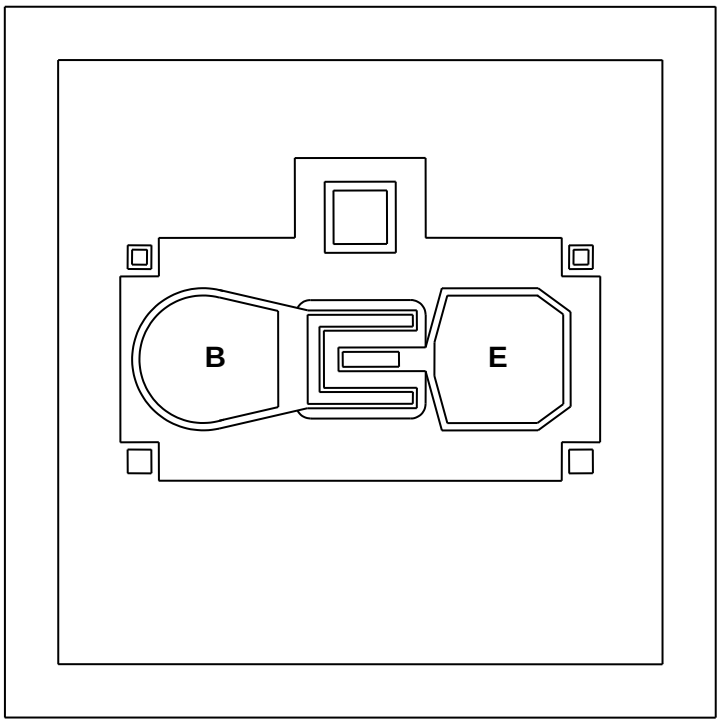
NOTES:
1. Dimensions are in inches.
2. Millimeters are given for general information only.
3. Hatched areas on package denote metallized areas.
4. Lid material: Kovar.
5. Pad 1 = Base, Pad 2 = Emitter, Pad 3 = Collector, Pad 4 = Shielding connected to the lid.
6. In accordance with ASME Y14.5M, diameters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

FIGURE 2. Physical dimensions for 2N918UB, surface mount.



Die size---------	.016 x .016 inch, (0.406 mm X 0.406 mm).
Die thickness---	.008 ±.0016 inch, (0.203 mm ± 0.0406 mm).
Base pad--------	.0027 x .0027 inch, (0.069 mm X 0.069 mm).
Emitter pad-----	.0027 x .0027 inch, (0.069 mm X 0.069 mm).
Back metal-----	Gold, 6,500 ±1,950 Å.
Top metal------	Aluminum, 17,500 ±2,500 Å.
Back side------	Collector.
Glassivation---	SiO_2, 7,500 ±1,500 Å.

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



Die size--------- .017 x .017 inch, (0.432 mm X 0.432 mm).
Die thickness--- .010 ±.0016 inch, (0.254 mm ± 0.041 mm).
Base pad-------- .0030 x .0027 inch, (0.076 mm X 0.069 mm).
Emitter pad----- .00275 x .0027 inch, (0.070 mm X 0.069 mm).
Back metal----- Gold, 3,500 Å minimum, 5,000 Å nominal.
Top metal------ Aluminum, 10,000 Å minimum, 12,000 Å nominal.
Back side------ Collector.

FIGURE 4. JANHCB (B-version) die dimensions.

2. APPLICABLE DOCUMENTS

2.1 General. The documents listed in this section are specified in sections 3 and 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 and 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 and as follows.

g_s..... Noise source conductance.
P_o ..... Oscillator, power output.
R_{BE} External resistance, base to emitter.

3.4 Interface requirements and physical dimensions. Interface requirements and physical dimensions shall be as specified in MIL-PRF-19500, and figure 1 (TO-72), figure 2 (surface mount UB), figure 3 (die), and figure 4 (die) herein.

3.4.1 Lead finish. Lead finish shall be solderable in accordance with MIL-PRF-19500, MIL-STD-750, 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 herein.

3.7 Electrical test requirements. The electrical test requirements shall be as specified in table I.

3.8 Marking. Marking shall be 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 manufacturers 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 hardness 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. Low power transistor 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 table I, table II, and table 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 III 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 procedures are 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 Screening of encapsulated devices (JAN, JANTXV, JANTX, and JANS levels). 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
(1) 3c	Thermal impedance, method 3131 of MIL-STD-750 (see 4.3.1.2).	Thermal impedance, method 3131 of MIL-STD-750 (see 4.3.1.2).
9	I_{CBO1} and h_{FE2}	
11	I_{CBO1} and h_{FE2} ΔI_{CBO1} = 100 percent of initial value or 5 nA dc, whichever is greater; Δh_{FE2} = ±15 percent.	I_{CBO1} and h_{FE2}
12	See 4.3.1.1	See 4.3.1.1
13	Subgroups 2 and 3 of table I herein; ΔI_{CBO1} = 100 percent of initial value or 5 nA dc, whichever is greater; Δh_{FE2} = ±15 percent.	Subgroup 2 of table I herein; ΔI_{CBO1} = 100 percent of initial value or 5 nA dc, whichever is greater; Δh_{FE2} = ±20 percent.

(1) Shall be performed anytime after temperature cycling, screen 3a; JANTX and JANTXV levels do not need to be repeated in screening requirements.

4.3.1.1 Power burn-in conditions. Power burn-in conditions are as follows: 2N918, UB, V_{CB} = 5 - 15 V dc, P_T = 200 mW at T_A = room ambient as defined in the general requirements of 4.5 in MIL-STD-750. NOTE: No heat sink or forced air cooling on the devices shall be permitted.

4.3.1.2 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.

4.3.2 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.

4.4 Conformance inspection. Conformance inspection shall be in accordance with MIL-PRF-19500 and as specified herein. Group A inspection shall be performed on each sublot.

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) and table E-VIC (JAN, JANTX, and JANTXV) of MIL-PRF-19500 and 4.4.2.1 and 4.4.2.2 herein. Delta measurements shall be in accordance with table III herein.

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

	Subgroup	Method	Conditions
*	B3	2037	Test condition D. All internal leads for each device shall be pulled separately.
	B4	1037	V_{CB} = 10 V dc, 2,000 cycles, $t_{ON} = t_{OFF}$ = 3 minutes, $P_{D(ON)} = P_D$ max rated in accordance with 1.3; $P_{D(OFF)} = 0$.
	B5	1027	V_{CB} = 10 V dc; 1,000 hours maximum rated power shall be applied and ambient temperature adjusted to achieve T_J = +150°C minimum. n = 45, c = 0.

* 4.4.2.2 Group B inspection, table E-VIC (JAN, JANTX, and JANTXV) of MIL-PRF-19500. Separate samples may be used for each step. In the event of a group B failure, the manufacturer may pull a new sample at double size from either the failed assembly lot or from another assembly lot from the same wafer lot. If the new "assembly lot" option is exercised, the failed assembly lot shall be scrapped.

Step	Method	Conditions
1	1026	Steady-state life: 1,000 hours, V_{CB} = 10 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 without going over the maximum rated V_{CEO}, 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 table I, 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 tests and conditions specified for subgroup testing in table E-VII of MIL-PRF-19500, and in 4.4.3.1 (JANS) and 4.4.3.2 (JAN, JANTX, and JANTXV) herein for group C testing. Delta measurements shall be in accordance with table III herein.

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

Subgroup	Method	Conditions
C2	2036	Test condition E, not applicable for UB devices.
C5	3131	See 1.3 herein.
C6	1026	V_{CB} = 10 V dc, 1,000 hours; maximum rated power shall be applied and ambient temperature adjusted to achieve T_J = +150°C minimum. n = 45 devices, c = 0. For small lots, n = 12 devices, c = 0. The sample size may be increased and the test time decreased as long as the devices are stressed for a total of 45,000 device hours minimum, and the actual time of test is at least 340 hours.

4.4.3.2. Group C inspection, table E-VII (JAN, JANTX, and JANTXV) of MIL-PRF-19500.

Subgroup	Method	Condition
C2	2036	Test condition E; not applicable for UB devices.
C5	3131	See 1.3 herein.
C6		Not applicable.

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 table I 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, JANTX, 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.e 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 appendix E, table E-IX of MIL-PRF-19500 and as specified in table IV herein. Delta measurements shall be in accordance with table III herein.

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

4.5.1 Input capacitance. This test shall be conducted in accordance with method 3240 of MIL-STD-750 except that the output capacitor shall be omitted.

4.5.2 Disposition of case lead during electrical measurements. Unless otherwise specified all electrical measurements and operating life test shall be performed with the case lead connected to the emitter.

4.5.3 Noise figure. The noise figure shall be measured using commercially available test equipment and its associated standard test procedures (see figure 7).

4.5.4 Collector-base time constant. This parameter may be determined by applying an rf signal voltage of 1.0 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 = 79.8 MHz used for the 1.0 volt signal, the following computation applies:

$r_b' C_c$: (psec) = 2 x V_{eb} (millivolts)

TABLE I. Group A inspection.

Inspection 1/	MIL-STD-750		Symbol	Limits		Unit
	Method	Conditions		Min	Max	
Subgroup 1 2/						
Visual and mechanical Examination 3/	2071					
Solderability 3/ 4/	2026	n = 15 leads, c = 0				
Resistance to solvents 3/ 4/ 5/	1022	n = 15 devices, c = 0				
* Salt atmosphere (corrosion) 4/	1041	n = 6 devices, c = 0, (For laser marked devices only)				
Temp 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 Test conditions G or H				
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 (design verification) 4/	2075	n = 4 devices, c = 0				
Subgroup 2						
Thermal impedance 6/	3131	See 4.3.1.2	ΔV_{BE}			
Collector to base cutoff current	3036	Bias condition D, V_{CBO} = 30 V	I_{CBO2}		1	µA dc
Breakdown voltage, collector to emitter	3011	Bias condition D, I_C = 3.0 mA dc	$V_{(BR)CEO}$	15		V dc
Emitter to base cutoff current	3061	Bias condition D, V_{EB}= 3 V	I_{EBO2}		10	µA dc
Collector to base cutoff current	3036	Bias condition D, V_{CB} = 25 V dc	I_{CBO1}		10	nA dc
Emitter to base cutoff current	3061	Bias condition D, V_{EB} = 2.5 V dc	I_{EBO1}		10	nA dc
Forward-current transfer ratio	3076	V_{CE} = 10 V dc; I_C = 500 µA dc	h_{FE1}	10		
Forward-current transfer ratio	3076	V_{CE} = 1.0 V dc; I_C = 3.0 mA dc	h_{FE2}	20	200	
Forward-current transfer ratio	3076	V_{CE} = 10 V dc; I_C = 10 mA dc	h_{FE3}	20		

See footnotes at end of table.

TABLE I. Group A inspection - Continued.

Inspection 1/	MIL-STD-750		Symbol	Limits		Unit
	Method	Conditions		Min	Max	
Subgroup 2 - Continued.						
Collector to emitter voltage (saturated)	3071	I_C = 10 mA dc; I_B = 1.0 mA dc	$V_{CE(sat)}$		0.4	V dc
Base to emitter voltage (saturated)	3066	Test condition A; I_C = 10 mA dc; I_B = 1.0 mA dc	$V_{BE(sat)}$		1.0	V dc
Subgroup 3						
High temperature operation		T_A = +150°C				
Collector to base cutoff current	3036	Bias condition D, V_{CB} = 25 V dc	I_{CBO2}		1.0	µA dc
Low-temperature operation		T_A = -55°C				
Forward-current transfer ratio	3076	V_{CE} = 1.0 V dc; I_C = 3.0 mA dc	h_{FE4}	10		
Subgroup 4						
Open circuit output capacitance	3236	V_{CB} = 0 V dc; I_E = 0, 100 kHz ≤ f ≤ 1 MHz	C_{obo1}		3.0	pF
Open circuit output capacitance	3236	V_{CB} = 10 V dc; I_E = 0, 100 kHz ≤ f ≤ 1 MHz	C_{obo2}		1.7	pF
Input capacitance (output open circuited)	3240	V_{EB} = 0.5 V dc; I_C = 0, 100 kHz ≤ f ≤ 1 MHz	C_{ibo}		2.0	pF
Magnitude of common emitter, small-signal short-circuit forward current transfer ratio	3306	V_{CE} = 10 V dc; I_C = 4.0 mA, f = 100 MHz	$\|h_{FE}\|$	6.0	18	
Noise figure		V_{CE} = 6 V dc; I_C = 1.0 mA dc; f = 60 MHz; g_s = 2.5 mmho (see 4.5.2, 4.5.3, and figure 7)	NF		6.0	dB
Small-signal power gain	3256	V_{CB} = 12 V dc; I_C = 6.0 mA dc; f = 200 MHz; (see figure 8)	G_{pe}	15		dB
Collector-base time constant		V_{CB} = 10 V dc; I_E = -4.0 mA dc; f = 79.8 MHz (see 4.5.2 and 4.5.4)	$r_b' C_c$		25	ps

See footnotes at end of table.

TABLE I. Group A inspection - Continued.

Inspection 1/	MIL–STD–750		Symbol	Limits		Unit
	Method	Conditions		Min	Max	
Subgroup 4 - Continued.						
Oscillator power output		V_{CB} = 15 V dc; I_C = 8.0 mA dc; f ≥ 500 MHz (see figure 9)	P_o	30		mW
Collector efficiency		V_{CB} = 15 V dc; I_C = 8.0 mA dc; f ≥ 500 MHz (see figure 9)	η	25		%
Subgroup 5						
Not applicable						

1/ For sampling plan (unless otherwise specified see MIL-PRF-19500.
2/ For resubmission of failed subgroup A1, double the sample size of the failed test or sequence of tests. A failure in table I, 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 measurement only:
Group B, steps 2 and 3 (JAN, JANTX, and JANTXV).
Group B, subgroups 3, 4, and 5 (JANS).
Group C, subgroups 2 and 6.
Group E, subgroups 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 V_{CES} = 0 V				
Collector to base cutoff current	3036	Bias condition D, V_{CBO} = 30 V	I_{CBO2}		2	µA dc
Breakdown voltage, collector to emitter	3011	Bias condition D; I_C = 3.0 mA dc	$V_{(BR)CEO}$	15		V dc
Emitter to base cutoff current	3061	Bias condition D, V_{EB} = 3 V	I_{EBO2}		20	µA dc
Collector to base cutoff current	3036	Bias condition D; V_{CB} = 25 V dc	I_{CBO1}		20	ηA dc
Emitter to base cutoff current	3061	Bias condition D, V_{EB} = 2.5 V dc	I_{EBO1}		20	ηA dc
Forward-current transfer ratio	3076	V_{CE} = 10 V dc, I_C = 500 µA dc	$[h_{FE1}]$	[5]		
Forward-current transfer ratio	3076	V_{CE} = 1.0 V dc, I_C = 3.0 mA dc	$[h_{FE2}]$	[10]	200	
Forward-current transfer ratio	3076	V_{CE} = 10 V dc, I_C = 10 mA dc	$[h_{FE3}]$	[10]		
Collector to emitter voltage (saturated)	3071	I_C = 10 mA dc, I_B = 1.0 mA dc	$V_{CE(sat)}$		0.46	V dc
Base to emitter voltage (saturated)	3066	Test condition A; I_C = 10 mA; I_B = 1.0 mA	$V_{BE(sat)}$		1.15	V dc

See footnotes at end of table.

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

Inspection 1/ 2/ 3/	MIL-STD-750		Symbol	Limits		Unit
	Method	Conditions		Min	Max	
Subgroup 2						
Steady-state total dose irradiation	1019	Gamma exposure V_{ECS} = 12 V				
Collector to base cutoff current	3036	Bias condition D, V_{CBO} = 30 V	I_{CBO2}		2	µA dc
Breakdown voltage, collector to emitter	3011	Bias condition D; I_C = 3.0 mA dc	$V_{(BR)CEO}$	15		V dc
Emitter to base cutoff current	3061	Bias condition D, V_{EB} = 3 V	I_{EBO2}		20	µA dc
Collector to base cutoff current	3036	Bias condition D; V_{CB} = 25 V dc	I_{CBO1}		20	ηA dc
Emitter to base cutoff current	3061	Bias condition D, V_{EB} = 2.5 V dc	I_{EBO1}		20	ηA dc
Forward-current transfer ratio	3076	V_{CE} = 10 V dc, I_C = 500 µA dc	$[h_{FE1}]$	[5]		
Forward-current transfer ratio	3076	V_{CE} = 1.0 V dc, I_C = 3.0 mA dc	$[h_{FE2}]$	[10]	200	
Forward-current transfer ratio	3076	V_{CE} = 10 V dc, I_C = 10 mA dc	$[h_{FE3}]$	[10]		
Collector to emitter voltage (saturated)	3071	I_C = 10 mA dc, I_B = 1.0 mA dc	$V_{CE(sat)}$		0.46	V dc
Base to emitter voltage (saturated)	3066	Test condition A; I_C = 10 mA; I_B = 1.0 mA	$V_{BE(sat)}$		1.15	V dc

1/ Tests to be performed on all devices receiving radiation exposure.
2/ For sampling plan, see MIL-PRF-19500.
3/ Electrical characteristics apply to the corresponding AL, UA, UB, and UBC suffix versions 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 the $[h_{FE}]$ 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.

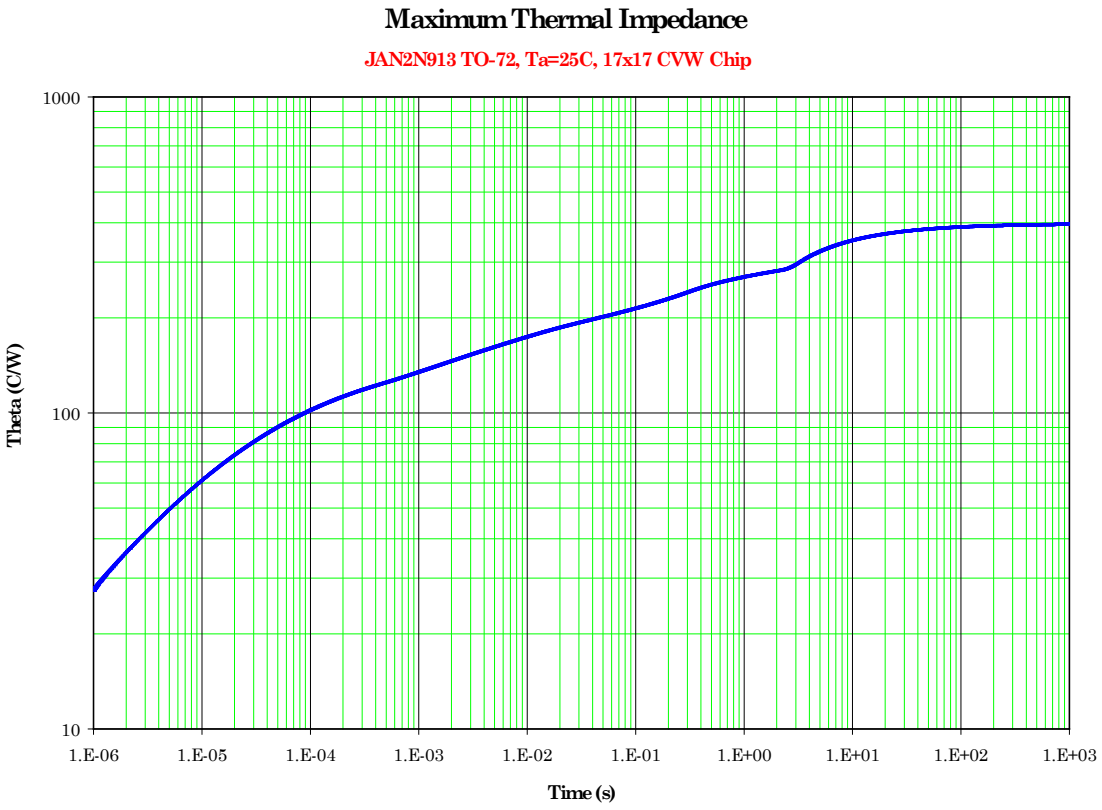
TABLE III. Groups B, C, and E delta electrical measurements. 1/ 2/ 3/ 4/

Step	Inspection	MIL-STD-750		Symbol	Limits		Unit
		Method	Conditions		Min	Max	
1.	Collector-base cutoff current	3036	Bias condition D; V_{CB} = 25 V dc	ΔI_{CBO1} 3/	100 percent of initial value or 5 nA dc, whichever is greater.		
2.	Forward-current transfer ratio	3076	V_{CE} = 1.0 V dc; I_C = 3.0 mA dc	Δh_{FE2} 3/	±25 percent change from initial reading.		
3.	Collector-emitter voltage (saturated)	3071	I_C = 10 mA dc; I_B = 1.0 mA dc	$\Delta V_{CE(sat)}$ 3/	±50 mV dc change from previously measured value.		

1/ The delta electrical measurements for table E-VIa (JANS) of MIL-PRF-19500 are as follows:
   a. Subgroup 4, see table III herein, step 3.
   b. Subgroup 5, see table III herein, steps 1, 2, and 3.
2/ The delta measurements for table E-VII of MIL-PRF-19500 are as follows: Subgroup 6, see table III herein, steps 1, 2, and 3 for JANS level.
3/ The delta measurements for table E-IX of MIL-PRF-19500 and table IV herein are as follows: Subgroups 1 and 2, see table III herein, steps 1, 2, and 3, all levels.
4/ Devices which exceed the table I limits for this test shall not be acceptable.

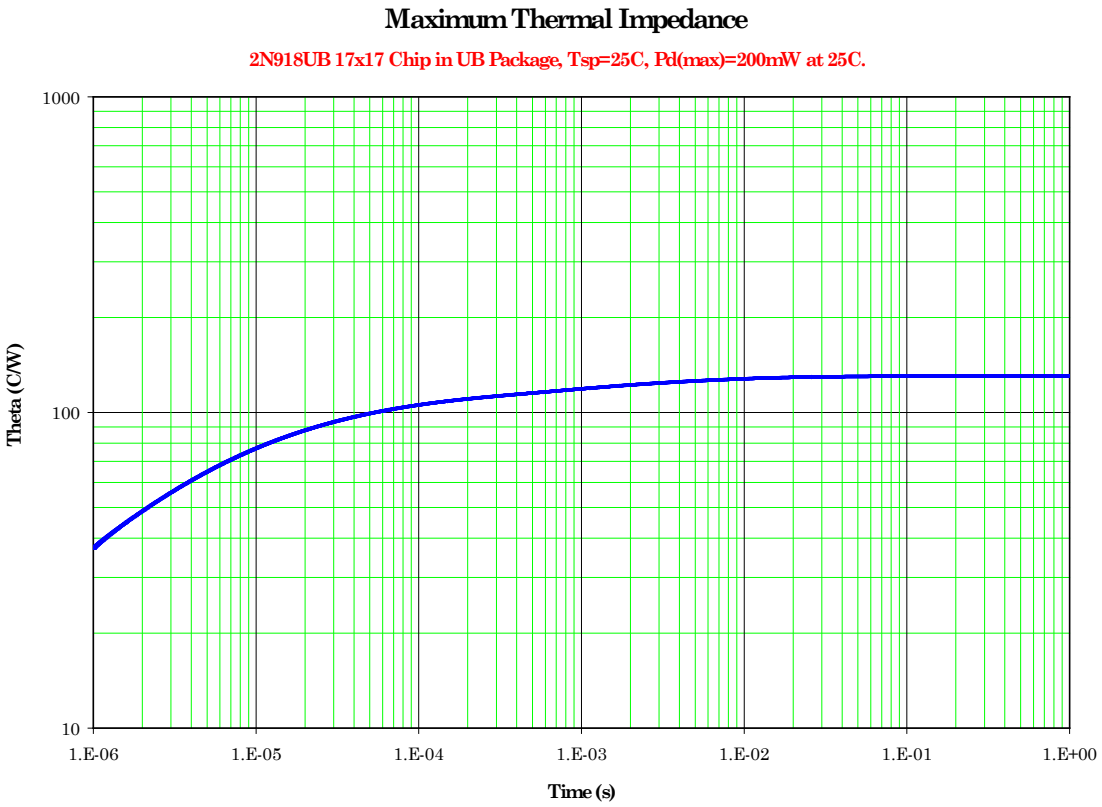
TABLE IV. Group E inspection (all quality levels) - for qualification or re-qualification only.

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 Fine leak Gross leak	1071		
Electrical measurements		See table I, subgroup 2 and table III herein.	
Subgroup 2			45 devices c = 0
Intermittent life	1037	Intermittent operation life: V_{CB} = 10 V dc; 6,000 cycles, $t_{ON} = t_{OFF}$ = 3 minutes, $P_{D(ON)} = P_D$ max rated in accordance with 1.3; $P_{D(OFF)}$ = 0.	
Electrical measurements		See table I, subgroup 2 and table III herein.	
Subgroup 4			
Thermal impedance curves		See 4.2.2.1.	
Subgroup 5			
Not applicable			
Subgroup 6			11 devices
ESD	1020		
Subgroup 8			45 devices c = 0
Reverse stability	1033	Condition B.	



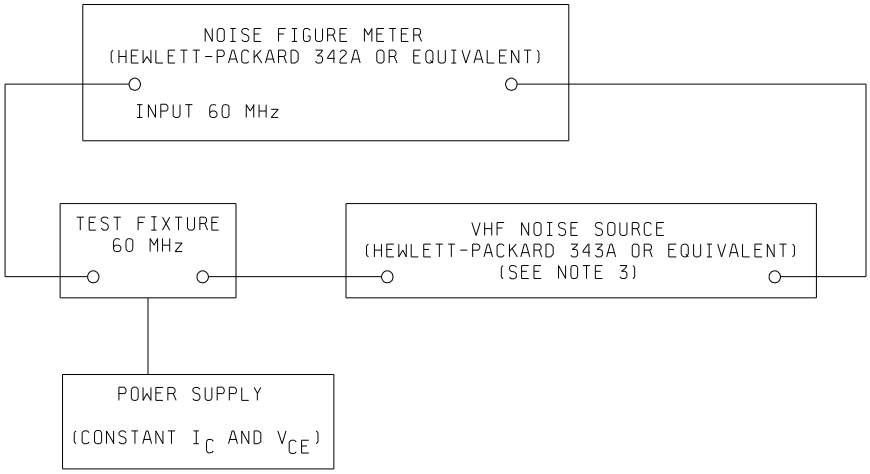
Thermal Impedance Curve, Ta=25C° Free Air, Calculated. Thermal resistance = 400C°/W.

FIGURE 5. Thermal impedance graph ($R_{\theta JA}$) for 2N918 (TO-72).



Thermal Impedance Curve, Tsp=25C°, Calculated. Thermal resistance = 130C°/W.

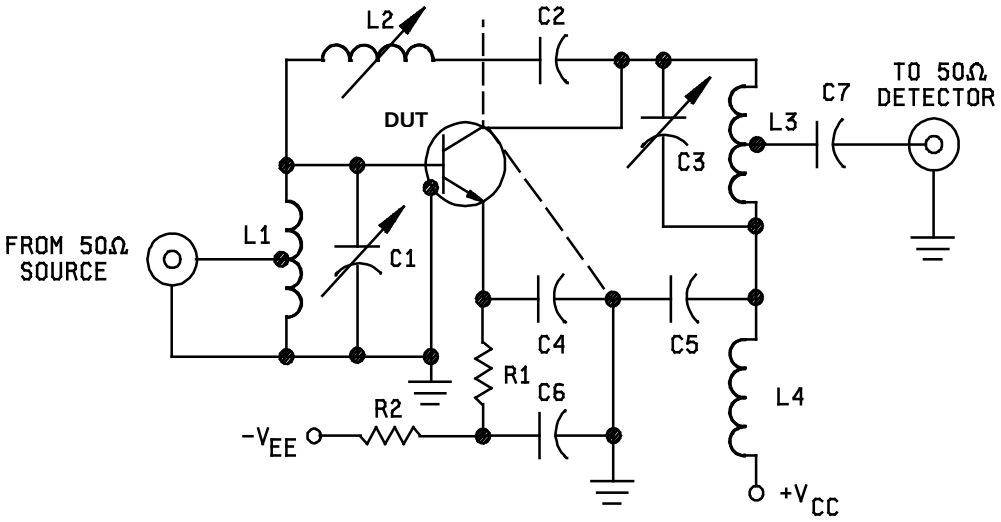
FIGURE 6. Thermal impedance graph ($R_{\theta JSP}$) for 2N918UB (UB).



NOTES:

1. The test fixture shall consist of a 60 MHz tuned amplifier and suitable biasing circuits. It should be constructed utilizing very high-frequency design techniques.
2. The effective source susceptance should be tuned for each device being tested to obtain minimum noise figure.
3. The HP-343A has a 50-ohm output resistance, therefore a suitable impedance transformer must be used to obtain an effective source conductance of 2.5 mmho at the transistor with minimum losses.

FIGURE 7. Block diagram for noise-figure test.



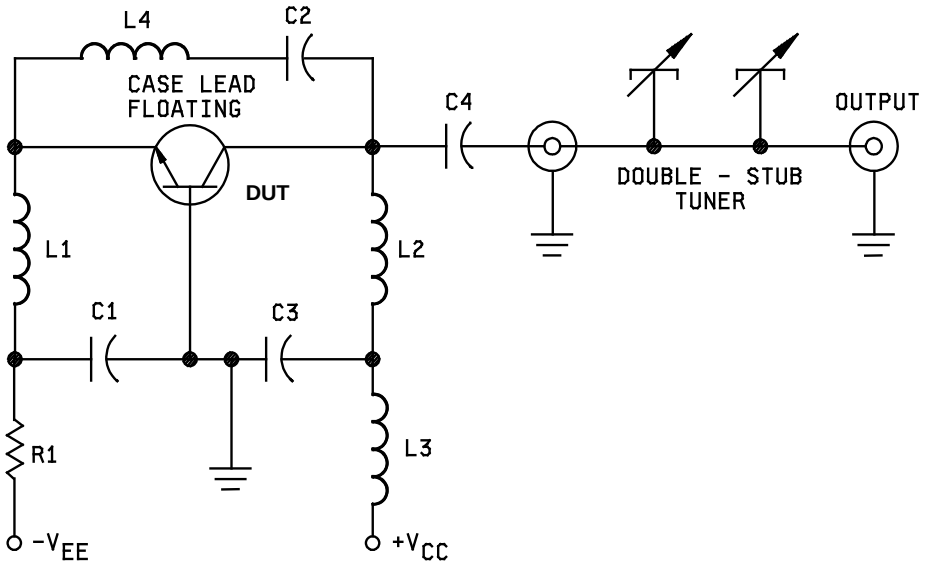
NEUTRALIZATION PROCEDURE:

a. Connect a 200 MHz signal generator (with a 50 ohm output impedance) to the input terminals of the amplifier and connect a 50 ohm rf voltmeter to the output terminals of the amplifier.
b. Apply V_{EE} and V_{CC} to obtain the specified test conditions.
c. Adjust the output of the signal generator to approximately 10 millivolts and tune C1 and C3 for maximum output.
d. Interchange the connections to the signal generator and rf voltmeter and with sufficient signal applied at the output terminals, tune L2 for a minimum indication on the rf voltmeter.
e. Repeat this sequence until optimum settings are obtained for all variables.

CIRCUIT-COMPONENT INFORMATION:

C1: 3-12 pF
C2 and C7: 1,000 pF
C3: 1.5 - 7.5 pF
C4 and C5: 0.01 μF
C6: 0.05 μF
L1: 3½ T No. 16 AWG .313 inch (7.95 mm) ID, .438 inch (11.13 mm) length, turns ratio ≅ 2 to 1
L2: 0.4 - 0.65 μh, Miller No. 4303 (or equal)
L3: 8 T No. 16 AWG, .125 inch (3.18 mm) ID, .875 inch (22.23 mm) length, turns ratio ≅ 8 to 1
L4: 200 MHz RFC
R1: 100 Ω
R2: 1 kΩ

FIGURE 8. Small-signal power gain.



OSCILLATOR ADJUSTMENT PROCEDURE:
Measurement of P_o shall be made in this circuit or a suitable equivalent. The circuit adjustment procedure is as follows:

a. Set V_{CC} and V_{EE} to obtain the specified test conditions.
b. Adjust the stub tuner to obtain the maximum output at the specified frequency of oscillation.
c. Check I_C and reset if necessary.
d. Read P_o.

NOTE: Collector efficiency (η), may be determined as follows:

$$\eta \text{ in } \% \frac{P_o}{120} \times 100$$ where P_o is in milliwatts.

CIRCUIT-COMPONENT INFORMATION:

C1 and C3: 1,000 pF
C2: 50 pF
C4: 75 pF
R1: 2.2 kΩ
L1 and L3: 500 mC RFC
L2: 2 turns No. 16 AWG, .375 inch (9.523 mm) OD, 1.250 inches (31.75 mm) length
L4: 9 turns No. 22 AWG, .188 inch (4.78 mm) OD, .500 inch (12.70 mm) length

Double-stub tuner consists of the following commercially available components:
2 GR Type 874 TEE (or equivalent).
1 GR Type 874-D20 adjustable stub (or equivalent).
1 GR Type 874-LA adjustable line (or equivalent).
1 GR Type 874-WN3 short-circuit termination (or equivalent).

FIGURE 9. Oscillator power output.

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).

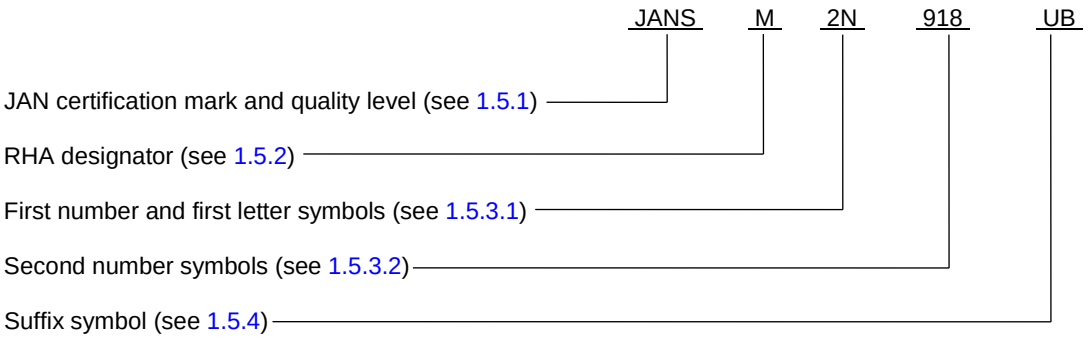
* d. The complete PIN, see 1.5 and 6.4.

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

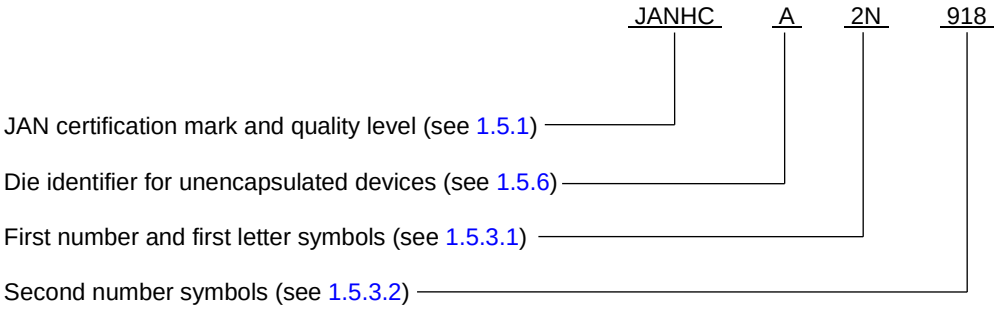
6.3 Qualification. With respect to products requiring qualification, awards will be made only for products which are, at the time of award of contract, qualified for inclusion in Qualified Manufacturers List (QML 19500) whether or not such products have actually been so listed by that date. The attention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

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



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



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

JAN2N918	JANTXV2N918	JANTXV#2N918 (1)	
JAN2N918UB	JANTXV2N918UB	JANTXV#2N918UB (1)	
JANTX2N918	JANS2N918	JANS#2N918 (2)	
JANTX2N918UB	JANS2N918UB	JANS#2N918UB (2)	

(1) The number sign (#) represents one of two RHA designators available (R and F).
(2) The number sign (#) represent one of eight RHA designators available (M, D, P, L, R, F, G, or H).

6.6 Suppliers of JANHC and JANKC die. The qualified JANHC and JANKC suppliers with the applicable letter version (example JANHCA2N918) will be identified on the QML.

Die ordering information		
PIN	Manufacturer	
	34156	43611
2N918 2N918	JANHCA2N918 JANKCA2N918	JANHCB2N918

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 previous issue.

Custodians:
Army - CR
Navy - EC
Air Force - 85
NASA - NA
DLA - CC

Review activities:
Army - AR, MI
Navy - AS, MC, SH
Air Force - 19, 99

Preparing activity:
DLA - CC

(Project 5961-2016-037)

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.