

The documentation and process conversion measures necessary to comply with this revision shall be completed by 20 September 2000.

INCH-POUND

MIL-PRF-19500/355G  
 30 June 2000  
 SUPERSEDING  
 MIL-PRF-19500/355F  
 11 January 1999

PERFORMANCE SPECIFICATION

SEMICONDUCTOR DEVICE, UNITIZED DUAL TRANSISTOR, NPN, SILICON  
 TYPES 2N2919, 2N2920, 2N2919L, 2N2920L, 2N2919U, AND 2N2920U, JAN, JANTX, JANTXV, JANS,  
 JANHC, AND JANKC

This specification is approved for use by all Departments and Agencies of the Department of Defense.

1. SCOPE

1.1 Scope. This specification covers the performance requirements for two electrically isolated, matched NPN silicon transistors as one dual unit. 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 die.

1.2 Physical dimensions. See figure 1 (similar to T0-78), figure 2 (surface mount), and figure 3 (die).

1.3 Maximum ratings.

P <sub>T</sub> (1) T <sub>A</sub> = +25°C		P <sub>T</sub> (2) T <sub>C</sub> = +25°C		I <sub>C</sub>	V <sub>CB0</sub>	V <sub>CEO</sub>	V <sub>EBO</sub>	T <sub>J</sub> and T <sub>STG</sub>
One section	Both sections	One section	Both sections					
<u>mW</u>	<u>mW</u>	<u>mW</u>	<u>W</u>	<u>mA dc</u>	<u>V dc</u>	<u>V dc</u>	<u>V dc</u>	<u>°C</u>
300	500	750	1.25	30	70	60	6	-65 to +200

- (1) For T<sub>A</sub> > +25°C, derate linearly 2.0 mW/°C, one section; 3.33 mW/°C, both sections.  
 (2) For T<sub>C</sub> > +25°C, derate linearly 5.0 mW/°C, one section; 8.33 mW/°C, both sections.

1.4 Primary electrical characteristics of each individual section.

	h <sub>FE1</sub>		h <sub>FE</sub>	V <sub>CE(SAT)</sub>
	V <sub>CE</sub> = 5 V dc I <sub>C</sub> = 10 μA dc		V <sub>CE</sub> = 5 V dc I <sub>C</sub> = 0.5 mA dc f = 20 MHz	I <sub>C</sub> = 1 mA dc I <sub>B</sub> = 100 μA dc
	2N2919 2N2919L 2N2919U	2N2920 2N2920L 2N2920U		
Min Max	60 240	175 600		

Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: (Defense Supply Center, Columbus, ATTN: DSCC/VAC, Post Office Box 3990, Columbus, OH 43216-5000), by using the Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document or by letter.

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1.5 Primary electrical matching characteristics of each individual section.

	$\frac{h_{FE2-1}}{h_{FE2-2}}$ <p><math>V_{CE} = 5 \text{ V dc}</math> <math>I_C = 100 \mu\text{A dc}</math></p> <p>(1)</p>	$ V_{BE1} - V_{BE2} _1$ <p><math>V_{CE} = 5 \text{ V dc}</math> <math>I_C = 10 \mu\text{A dc}</math></p>	$ \Delta(V_{BE1} - V_{BE2})_{\Delta T_A} _1$ <p><math>V_{CE} = 5 \text{ V dc}</math> <math>I_C = 100 \mu\text{A dc}</math> <math>T_A = +25^\circ\text{C and } -55^\circ\text{C}</math></p>	$ \Delta(V_{BE1} - V_{BE2})_{\Delta T_A} _2$ <p><math>V_{CE} = 5 \text{ V dc}</math> <math>I_C = 100 \mu\text{A dc}</math> <math>T_A = +125^\circ\text{C and } +25^\circ\text{C}</math></p>
		<u>mV dc</u>	<u>mV dc</u>	<u>mV dc</u>
Min	0.9			
Max	1.0	5	0.8	1.0

(1) The larger number shall be placed in the denominator.

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 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 listed in the issue of the Department of Defense Index of Specifications and Standards (DODISS) and supplement thereto, cited in the solicitation (see 6.2).

SPECIFICATION

DEPARTMENT OF DEFENSE

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

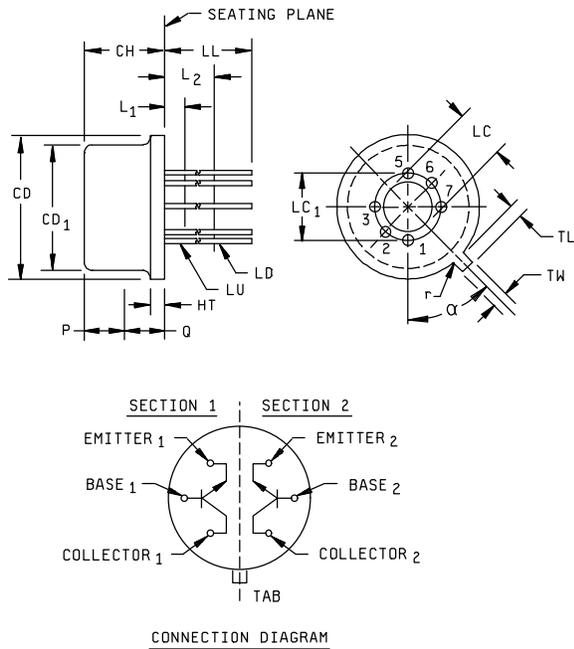
STANDARD

DEPARTMENT OF DEFENSE

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

(Unless otherwise indicated, copies of the above specifications, standards, and handbooks are available from the Document Automation and Production Services (DAPS), Building 4D (DPM-DODSSP), 700 Robbins Avenue, Philadelphia, PA 19111-5094.)

2.3 Order of precedence. In the event of a conflict between the text of this document and the references cited herein (except for related associated specifications or specification sheets), the text of this document takes precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

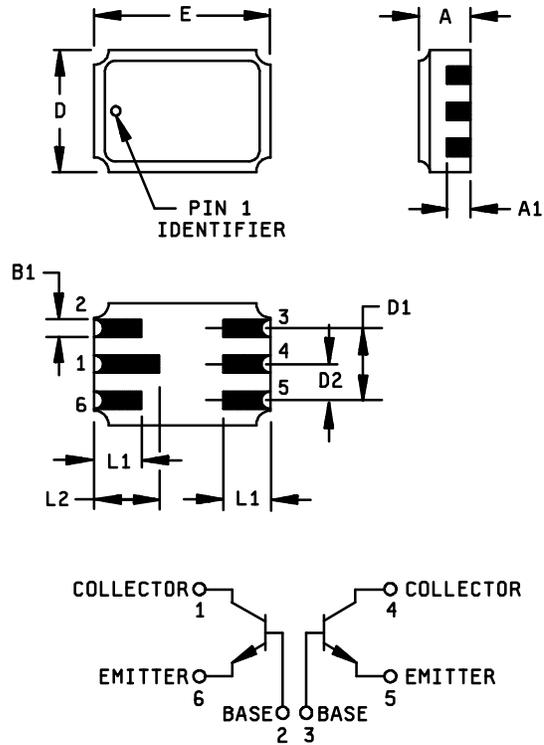


Symbol	Dimensions				Notes
	Inches		Millimeters		
	Min	Max	Min	Max	
CD	.335	.370	8.51	9.40	
CD <sub>1</sub>	.305	.335	7.75	8.51	
CH	.140	.260	3.56	6.60	
HT	.009	.041	0.23	1.04	
LC	.140	.160	3.56	4.06	
LC <sub>1</sub>	.200 TP		5.08 TP		9
LD	.016	.021	.041	0.53	10
LL	See notes 10, 11, and 12				
LU	.016	.019	0.41	0.48	10
L <sub>1</sub>	---	.050	---	1.27	10
L <sub>2</sub>	.250	---	6.35	---	10
P	.100	---	2.54	---	8
Q	---	.050	---	1.27	7
TL	.029	.045	0.74	1.14	5, 6
TW	.028	.034	0.71	0.86	4, 5
r	---	.010	---	1.27	
α	45°TP		45°TP		9

NOTES:

1. Dimensions are in inches.
2. Metric equivalents are given for general information only.
3. Tab shown omitted.
4. Lead numbers 4 and 8 are omitted on this variation.
5. Beyond r maximum, TW shall be held to a minimum length of 0.21 inches (0.53 mm).
6. TL shall be measured from maximum CD.
7. Details of outline in this zone are optional.
8. CD<sub>1</sub> shall not vary more than .010 inch (0.25 mm) in zone P. This zone is controlled for automatic handling.
9. Leads at gauge plane .054 - .055 inches (1.37 - 1.40 mm) below seating plane shall be within .007 inches (0.18 mm) radius of true position (TP) at a maximum material condition (MMC) relative to the tab at MMC. The device may be measured by direct methods or by the gauge and gauging procedures described on gauge drawing GS-1.
10. LU applies between L<sub>1</sub> and L<sub>2</sub>. LD applies between L<sub>2</sub> and LL minimum. Diameter is uncontrolled in L<sub>1</sub> and beyond LL minimum.
11. For transistor types 2N2919 and 2N2920, LL is .500 inch (12.70 mm) minimum and .750 inch (19.05 mm) maximum.
12. For transistor type 2N2919L and 2N2920L, LL is 1.500 inches (38.10 mm) minimum and 1.750 inches (44.45 mm) maximum.

FIGURE 1. Physical dimensions.

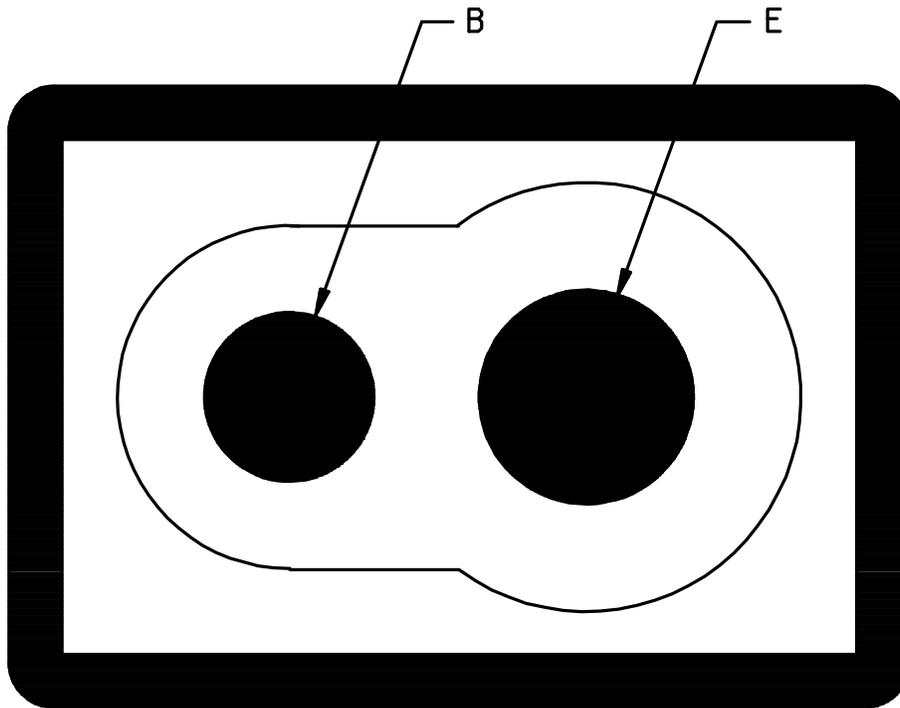


Symbol	Dimensions				Note
	Inches		Millimeters		
	Min	Max	Min	Max	
A	.058	.100	1.47	2.54	
A1	.026	.039	0.66	0.99	
B1	.022	.028	0.56	0.71	
D	.165	.175	4.19	4.44	
D1	.095	.105	2.41	2.67	
D2	.045	.055	1.14	1.40	
E	.240	.250	6.10	6.35	
L1	.060	.070	1.52	1.78	
L2	.082	.098	2.08	2.49	

NOTES:

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

FIGURE 2. Physical Dimensions (2N2919U and 2N2920U).



NOTES:

1. Chip size ..... 15 x 19 mils  $\pm$  1 mil
2. Chip thickness ..... 10  $\pm$  1.5 mil
3. Top metal ..... Aluminum 15,000Å minimum, 18,000Å nominal
4. Back metal ..... A. Gold 2,500Å minimum, 3,000Å nominal  
B. Eutectic Mount – No Gold
5. Backside ..... Collector
6. Bonding pad ..... B = 3 mils, E = 4 mils diameter
7. Passivation ..... Si<sub>3</sub>N<sub>4</sub> (Silicon Nitride) 2 kÅ min, 2.2 kÅ nom.

FIGURE 3. Physical dimensions, JANHCA and JANKCA die.

3. REQUIREMENTS

3.1 General. The requirements for acquiring the product described herein shall consist of this document and MIL-PRF-19500.

3.2 Qualification. Devices furnished under this specification shall be products that are authorized by the qualifying activity for listing on the applicable qualified products list 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.

$\frac{h_{FE-1}}{h_{FE-2}}$	..... Static forward-current-gain-ratio. The matching ratio of the static forward-current transfer ratios of each section
$ V_{BE1} - V_{BE2} $	..... Absolute value of base-emitter-voltage differential between the individual sections.
$ \Delta(V_{BE1} - V_{BE2})_{\Delta TA} $	..... Absolute value of the algebraic difference between the base-emitter-voltage differentials between the individual sections at two different temperatures.

3.4 Interface requirements and physical dimensions. The Interface requirements and physical dimensions shall be as specified in MIL-PRF-19500 and herein.

3.4.1 Lead material and finish. Lead finish shall be solderable as defined in 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 Marking. Marking shall be in accordance with MIL-PRF-19500.

3.6 Electrical performance characteristics. Unless otherwise specified herein, the electrical performance characteristics are as specified in 1.3.

3.7 Electrical test requirements. The electrical test requirements shall be group A as specified herein.

3.8 Workmanship. Semiconductor devices shall be processed in such a manner as to be uniform in quality and shall be free from other defects that will affect life, serviceability, or appearance.

4. VERIFICATION

4.1 Classification of inspections. The inspection requirements specified herein are classified as follows:

- a. Qualification inspection (see 4.2).
- b. Screening (see 4.3)
- c. Conformance inspection (see 4.4).

4.2 Qualification inspection. Qualification inspection shall be in accordance with MIL-PRF-19500.

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4.3 Screening (JANS, JANTXV, and JANTX levels only). Screening shall be in accordance with table 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 (see 4.3.2)	Thermal impedance (see 4.3.2)
9	$I_{CBO2}$ , $h_{FE3}$ , $\frac{h_{FE2-1}}{h_{FE2-2}}$	Not applicable
10	48 hours minimum	48 hours minimum
11	$I_{CBO2}$ , $h_{FE3}$ , $\frac{h_{FE2-1}}{h_{FE2-2}}$ $\Delta I_{CBO2}$ = 100 percent of initial value or 1 nA dc, whichever is greater. $\Delta h_{FE3} = \pm 20$ percent	$I_{CBO2}$ , $h_{FE3}$ , $\frac{h_{FE2-1}}{h_{FE2-2}}$
12	See 4.3.1 240 hours minimum	See 4.3.1 80 hours minimum
13	Subgroups 2 and 3 of table I herein; $\Delta I_{CBO2}$ = 100 percent of initial value or 1 nA dc, whichever is greater; $\Delta h_{FE3} = \pm 25$ percent	Subgroup 2 of table I herein; $\Delta I_{CBO2}$ = 100 percent of initial value or 1 nA dc, whichever is greater; $\Delta h_{FE3} = \pm 25$ percent

4.3.1 Power burn-in conditions. Power burn-in conditions are as follows:  $V_{CB} = 10$  to 30 V dc:

Power shall be applied to achieve  $T_J = 135^\circ\text{C}$  minimum and a minimum power dissipation = 75 % of maximum rated  $P_T$  (see 1.3).

NOTE: No heat sink or forced air cooling on the devices shall be permitted.

4.3.2 Thermal impedance ( $Z_{\theta JX}$  measurements). The  $Z_{\theta JX}$  measurements shall be performed in accordance with MIL-STD-750, Method 3131.

- $I_M$  measurement current .....5 mA.
- $I_H$  forward heating current .....200 mA (min).
- $t_H$  heating time .....25 - 30 ms.
- $t_{md}$  measurement delay time .....60  $\mu\text{s}$  max.
- $V_{CE}$  collector-emitter voltage .....10 V dc minimum

The maximum limit for  $Z_{\theta JX}$  under these test conditions are  $Z_{\theta JX} (\text{max}) = 72^\circ\text{C/W}$ .

4.4 Conformance inspection. Conformance inspection shall be in accordance with MIL-PRF-19500, and as specified herein. If alternate screening is being performed per MIL-PRF-19500, a sample of screened devices shall be submitted to and pass the requirements of group A1 and A2 inspection only (table VIb, group B, subgroup 1 is not required to be performed again if group B has already been satisfied per 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 conditions specified for subgroup testing in table VIa (JANS) of MIL-PRF-19500 and 4.4.2.1. Electrical measurements (end-points) and delta requirements shall be in accordance with group A, subgroup 2 and table III herein. See 4.4.2.2 for JAN, JANTX, and JANTXV group B testing. Electrical measurements (end-points) and delta requirements for JAN, JANTX, and JANTXV shall be after each step in 4.4.2.2 and shall be in accordance with group A, subgroup 2 and table III herein.

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

Subgroup	Method	Condition
B4	1037	$V_{CB} = 10 \text{ V dc}$
B5	1027	$V_{CB} = 10 \text{ V dc}$ ; $T_A = +125^\circ\text{C} \pm 25^\circ\text{C}$ for 96 hours with $P_T$ adjusted according to the chosen $T_A$ to give an average $T_J = +275^\circ\text{C}$ minimum. Optionally, the test may be conducted for minimum 216 hours with $P_T$ adjusted to achieve $T_J = 225^\circ\text{C}$ minimum, sample size (for option) = 45, $c = 0$ . In this case, the ambient temperature shall be adjusted such that a minimum 100% of maximum rated $P_T$ (see 1.3) is applied to the device under test. (Note: If a failure occurs, resubmission shall be at the test conditions of the original sample.)

4.4.2.2 Group B inspection, (JAN, JANTX, and JANTXV). (1)

Step	Method	Condition
1	1039	Steady-state life: Test condition B, 340 hours, $V_{CB} = 10 - 30 \text{ V dc}$ , $T_J = 150^\circ\text{C min.}$ , external heating of the device under test to achieve $T_J = +150^\circ\text{C}$ minimum is allowed provided that a minimum of 75% of rated power is dissipated. No heat sink or forced-air cooling on the devices shall be permitted. $n = 45$ devices, $c = 0$
2	1039	The steady state life test of step 1 shall be extended to 1,000 hrs for each die design. Samples shall be selected from a wafer lot every twelve months of wafer production. Group B step 2 shall not be required more than once for any single wafer lot. $n = 45$ , $c = 0$ .
3	1032	High-Temperature life (non-operating), $t = 340$ hours, $T_A = +200^\circ\text{C}$ . $n = 22$ , $c = 0$

(1) 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.

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. Must 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 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. Electrical measurements (end points) and delta requirements shall be in accordance with group A, subgroup 2 and table III herein.

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

Subgroup	Method	Condition
C2	2036	Test condition E, not applicable to surface mount.
C6	1026	1,000 hours at $V_{CB} = 20 \text{ V dc}$ ; $T_J = 150^\circ\text{C min.}$ , external heating of the device under test to achieve $T_J = +150^\circ\text{C}$ minimum is allowed provided that a minimum of 75% of rated power is dissipated. No heat sink or forced-air cooling on device shall be permitted.

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

Subgroup	Method	Condition
C2	2036	Test condition E, not applicable to surface mount.
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 group A tests for conformance inspection. 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 E Inspection. Group E inspection shall be performed for qualification or re-qualification only. The tests specified in table II herein must be performed to maintain qualification.

4.5 Method 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 Testing of units. All specified electrical tests, including end-point tests, shall be performed equally on both sections of the transistor types covered herein, except where the electrical characteristic being evaluated applies to the transistor as a device entity.

4.5.3 Disposition of leads when testing characteristics of each section. During the measurement of the characteristics of each section, the leads of the section not under test shall be open-circuited.

4.5.4 Forward-current-gain ratio. The value for the forward-current-gain ratio for each individual section of a dual unit shall be measured using method 3076 of MIL-STD-750. The forward-current-gain ratio shall be calculated by dividing one of the values by the other. If possible, this ratio shall be measured directly to improve accuracy.

4.5.5 Base-emitter-voltage differential. The base-emitter-voltage differential shall be determined by connecting the emitters of the individual sections together, applying specified electrical test conditions to each individual section in accordance with test condition B, method 3066 of MIL-STD-750, and measuring the absolute value of the voltage between the bases of the individual sections of a dual unit.

4.5.6 Base-emitter-voltage differential change with temperature. The value of the base-emitter-voltage differential shall be measured at the two specified temperatures in accordance with 4.5.5 except that the polarities of the differentials and identities of the individual sections shall be maintained. The absolute value of the algebraic difference between the values at the two temperature extremes shall be calculated. A mathematical formula for this parameter is:

$$|(V_{BE1}(T_1) - V_{BE2}(T_1)) - (V_{BE1}(T_2) - V_{BE2}(T_2))|$$

4.5.7 Noise figure test. Noise figure shall be measured using a model no. 2173C/2181 Quan Tech Laboratories test set, or equivalent. Conditions shall be as specified in table I.

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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 <u>3/</u> examination	2071	n = 45 devices, c = 0				
Solderability <u>3/</u> , <u>5/</u>	2026	n = 15 leads, c = 0				
Resistance to solvents <u>3/</u> , <u>4/</u> , <u>5/</u>	1022	n = 15 devices, c = 0				
Temp Cycling <u>3/</u> , <u>5/</u>	1051	Test condition C, 25 cycles. n = 22 devices, c = 0				
Hermetic Seal <u>5/</u> Fine leak Gross leak	1071	n = 22 devices, c = 0				
Electrical measurements, <u>5/</u>		Group A, subgroup 2				
Bond strength <u>3/</u> , <u>5/</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				
<u>Subgroup 2</u>						
Collector to base cutoff current	3036	Bias condition D; V <sub>CB</sub> = 70 V dc	I <sub>CB01</sub>		10	μA dc
Emitter to base cutoff current	3061	Bias condition D; V <sub>EB</sub> = 6 V dc	I <sub>EB01</sub>		10	μA dc
Breakdown voltage, collector to emitter	3011	Bias condition D; I <sub>C</sub> = 10 mA dc; pulsed (see 4.5.1)	V <sub>(BR)CEO</sub>	60		V dc
Collector to base cutoff Current	3036	Bias condition D; V <sub>CB</sub> = 45 V dc	I <sub>CB02</sub>		2	nA dc
Collector to emitter cutoff Current	3041	Bias condition D; V <sub>CE</sub> = 5 V dc	I <sub>CE01</sub>		2	nA dc
Collector to emitter cutoff Current	3041	Bias condition D; V <sub>CE</sub> = 40 V dc	I <sub>CE02</sub>		20	nA dc
Emitter to base cutoff current	3061	Bias condition D; V <sub>EB</sub> = 5 V dc	I <sub>EB02</sub>		2	nA dc
Forward-current transfer ratio	3076	V <sub>CE</sub> = 5 V dc; I <sub>C</sub> = 10 μA dc	h <sub>FE1</sub>			
2N2919, 2N2919L, 2N2919U 2N2920, 2N2920L, 2N2920U				60 175	240 600	
Forward-current transfer ratio	3076	V <sub>CE</sub> = 5 V dc; I <sub>C</sub> = 100 μA dc	h <sub>FE2</sub>			
2N2919, 2N2919L, 2N2919U 2N2920, 2N2920L, 2N2920U				100 235	325 800	

See footnotes at end of table.

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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 2</u> - Continued						
Forward-current transfer ratio 2N2919, 2N2919L, 2N2919U 2N2920, 2N2920L, 2N2020U	3076	$V_{CE} = 5 \text{ V dc}; I_C = 1 \text{ mA dc};$	$h_{FE3}$	150 300	600 1,000	
Base-emitter saturation voltage	3066	Test condition A; $I_C = 1.0 \text{ mA dc}; I_B = 100 \mu\text{A dc};$	$V_{BE(sat)1}$	0.5	1.0	V dc
Collector-emitter saturation voltage	3071	$I_C = 1.0 \text{ mA dc}; I_B = 100 \mu\text{A dc};$	$V_{CE(sat)1}$		0.3	V dc
Forward-current <u>6/</u> transfer ratio (gain ratio)	3076	$V_{CE} = 5 \text{ V dc}, I_C = 100 \mu\text{A dc}$ (see 4.5.4)	$\frac{h_{FE2-1}}{h_{FE2-2}}$	0.9	1.0	
Absolute value of base-emitter-voltage differential	3066	Test condition B; $V_{CE} = 5 \text{ V dc},$ $I_C = 10 \mu\text{A dc}$ (see 4.5.5)	$ V_{BE1} - V_{BE2} _1$		5	mV dc
Absolute value of base-emitter-voltage differential	3066	Test condition B; $V_{CE} = 5 \text{ V dc},$ $I_C = 100 \mu\text{A dc}$ (see 4.5.5)	$ V_{BE1} - V_{BE2} _2$		3	mV dc
Absolute value of base-emitter-voltage differential	3066	Test condition B; $V_{CE} = 5 \text{ V dc},$ $I_C = 1 \text{ mA dc}$ (see 4.5.5)	$ V_{BE1} - V_{BE2} _3$		5	mV dc
Base-emitter-voltage (nonsaturated) (absolute value of differential change with temperature) <u>7/</u>	3066	Test condition B; $V_{CE} = 5 \text{ V dc},$ $I_C = 100 \mu\text{A dc}$ $T_A = +25^\circ\text{C}$ and $-55^\circ\text{C}$ (see 4.5.6)	$ \Delta V_{BE1} - V_{BE2} \Delta T_A _1$		0.8	mV dc
Base-emitter-voltage (nonsaturated) (absolute value of differential change with temperature) <u>7/</u>	3066	Test condition B; $V_{CE} = 5 \text{ V dc},$ $I_C = 100 \mu\text{A dc}$ $T_A = +125^\circ\text{C}$ and $+25^\circ\text{C}$ (see 4.5.6)	$ \Delta V_{BE1} - V_{BE2} \Delta T_A _2$		1	mV dc
<u>Subgroup 3</u>						
High temperature operation		$T_A = +150^\circ\text{C}$				
Collector to base cutoff current	3036	Bias condition D; $V_{CB} = 45 \text{ V dc}$	$I_{CB03}$		2.5	$\mu\text{A dc}$
Low temperature operation		$T_A = -55^\circ\text{C}$				
Forward-current transfer ratio 2N2919, 2N2919L, 2N2919U 2N2920, 2N2920L, 2N2920U	3076	$V_{CE} = 5 \text{ V dc}; I_C = 10 \mu\text{A dc}$	$h_{FE4}$	20 50		

See footnotes at end of table.

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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 4</u>						
Small-signal short-circuit input impedance	3201	$V_{CE} = 5 \text{ V dc}; I_C = 0.5 \text{ mA dc}; f = 1 \text{ kHz}$	$h_{ie}$	3	30	$k\Omega$
Small-signal open-circuit reverse voltage transfer ratio	3211	$V_{CE} = 5 \text{ V dc}; I_C = 1 \text{ mA dc}; f = 1 \text{ kHz}$	$h_{re}$		$1 \times 10^{-3}$	
Small-signal open-circuit output admittance	3216	$V_{CE} = 5 \text{ V dc}; I_C = 1 \text{ mA dc}; f = 1 \text{ kHz}$	$h_{oe}$		60	$\mu\text{mhos}$
Small-signal short-circuit forward current transfer ratio (magnitude $h_{fe}$ )	3306	$V_{CE} = 5 \text{ V dc}; I_C = 0.5 \text{ mA dc}; f = 20 \text{ MHz}$	$ h_{fe} $	3	20	
Open circuit output capacitance	3236	$V_{CB} = 5 \text{ V dc}; I_E = 0$ $100 \text{ kHz} \leq f \leq 1 \text{ MHz}$	$C_{obo}$		5	$\text{pF}$
Noise figure	3246	$V_{CE} = 5 \text{ V dc}; I_C = 10 \mu\text{A dc}$ $R_g = 10 \text{ k}\Omega$ , (see 4.5.7)				
Test 1		$f = 100 \text{ Hz}$	F1		5	$\text{dB}$
Test 2		$f = 1 \text{ kHz}$	F2		3	$\text{dB}$
Test 3		$f = 10 \text{ kHz}$	F3		3	$\text{dB}$
<u>Subgroups 5 and 6</u>						
Not required						
<u>Subgroup 7 5/</u>						
Decap internal visual (design verification)	2075	$n = 1 \text{ device}, c = 0$				

1/ For sampling plan 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 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 laser marked devices.

5/ Not required for JANS devices.

6/ The larger number shall be placed in the denominator.

7/ When using group A, subgroup 2 as electrical endpoints, this test is only required for JANS endpoints.

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TABLE II. Group E inspection (all quality levels) - For qualification only

Inspection	MIL-STD-750		Qualification
	Method	Conditions	
<u>Subgroup 1</u>			12 devices c = 0
Temperature cycling (air to air)	1051	Test condition C, 500 cycles	
Hermetic seal	1071		
Fine leak			
Gross leak			
Electrical measurements		See group A, subgroup 2 and table III herein.	
<u>Subgroup 2</u>			45 devices c = 0
Intermittent life	1037	Intermittent operation life: $V_{CB} = 10 \text{ V dc}$ , 6,000 cycles, $\Delta T_J \geq +100^\circ\text{C}$ ; forced air cooling allowed on cooling cycle only.	
Electrical measurements		See group A, subgroup 2 and table III herein.	
<u>Subgroup 3</u>			
Not applicable			
<u>Subgroup 4</u>			
Not applicable			
<u>Subgroup 5</u>			
Not applicable			

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Table III. Groups B, C, and E delta measurements.

Step	Inspection	MIL-STD-750		Symbol	Limit		Unit
		Method	Conditions		Min	Max	
1.	Base-emitter voltage (nonsaturated) (absolute value of differential-change with temperature)	3066	Test condition B; V <sub>CE</sub> = 5 V dc; I <sub>C</sub> = 100 μA dc; T <sub>A</sub> = +25° and -55°C (see 4.5.6)	$ \Delta(V_{BE1} - V_{BE2})  \frac{2\Delta T_A}{1}$		0.80	mV dc
2.	Base emitter voltage (nonsaturated) (absolute value of differential-change with temperature)	3066	Test condition B; V <sub>CE</sub> = 5 V dc; I <sub>C</sub> = 100 μA dc; T <sub>A</sub> = +125° and +25°C (see 4.5.6)	$ \Delta(V_{BE1} - V_{BE2})  \frac{2\Delta T_A}{2}$		1.0	mV dc
3	Collector-base cutoff current	3036	Bias condition D, V <sub>CB</sub> = 45 V dc	$\Delta I_{CB02} \frac{2}{1}$	100% of initial value or 1 nA dc, whichever is greater.		
4	Forward current transfer ratio	3076	V <sub>CE</sub> = 5 V dc; I <sub>C</sub> = 1 mA dc; pulsed see 4.5.2	$\Delta h_{FE3} \frac{2}{1}$	±25% change from initial reading.		

1/ JANS only

2/ Devices which exceed the group A limits for this test shall not be accepted.

3/ The delta measurements for group B, table VIa (JANS) of MIL-PRF-19500 are as follows: Subgroups 3, 4, and 5, see table III herein, steps 1 and 2.

4/ The delta measurements for 4.4.2.2 herein (group B, JAN, JANTX, and JANTXV) are as follows: Steps 1, 2, 3, and 4 of table III shall be performed after each step in 4.4.2.2 herein.

5/ The delta measurements for group C, table VII of MIL-PRF-19500 are as follows: Subgroup 6, see table III herein, steps 1 and 2 for JANS, steps 3 and 4 for JAN, JANTX, and JANTXV.

5. PACKAGING

5.1 Packaging. For acquisition purposes, the packaging requirements shall be as specified in the contract or order (see 6.2). When actual packaging of materiel is to be performed by DoD personnel, these personnel need to contact the responsible packaging activity to ascertain requisite packaging requirements. Packaging requirements are maintained by the Inventory Control Point's packaging activity within the Military Department or Defense Agency, or within the Military Department's System Command. 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.)

6.1 Notes. The notes specified in MIL-PRF-19500 are applicable to this specification.

6.2 Acquisition requirements. See MIL-PRF-19500.

6.3 Qualification. With respect to products requiring qualification, awards will be made only for products which are, at the time of award of contract, qualified for inclusion in Qualified Manufacturers' List (QML) whether or not such products have actually been so listed by that date. The attention of the contractors is called to these requirements, and manufacturers are urged to arrange to have the products that they propose to offer to the Federal Government tested for qualification in order that they may be eligible to be awarded contracts or orders for the products covered by this specification. Information pertaining to qualification of products may be obtained from Defense Supply Center Columbus, DSCC-VQE, Columbus, OH 43216.

6.4 Suppliers of JANHC die. The qualified JANHC suppliers with the applicable letter version (example JANHCA2N2919) will be identified on the QML.

JANC ordering information	
PIN	Manufacturer
	43611
2N2919	JANHCA2N2919 JANKCA2N2919

6.5 Changes from previous issue. Marginal notations are not used in this revision to identify changes with respect to the previous issue due to the extent of the changes.

Custodians:  
 Army - CR  
 Navy - EC  
 Air Force - 11  
 NASA - NA

Preparing activity:  
 DLA - CC

(Project 5961-2193)

Review activities:  
 Army - AR, MI, SM  
 Navy - AS, CG, MC  
 Air Force - 13, 19, 99

**STANDARDIZATION DOCUMENT IMPROVEMENT PROPOSAL**

INSTRUCTIONS

1. The preparing activity must complete blocks 1, 2, 3, and 8. In block 1, both the document number and revision letter should be given.
2. The submitter of this form must complete blocks 4, 5, 6, and 7.
3. The preparing activity must provide a reply within 30 days from receipt of the form.

NOTE: This form may not be used to request copies of documents, nor to request waivers, or clarification of requirements on current contracts. Comments submitted on this form do not constitute or imply authorization to waive any portion of the referenced document(s) or to amend contractual requirements.

<b>I RECOMMEND A CHANGE:</b>	1. DOCUMENT NUMBER	2. DOCUMENT DATE
	MIL-PRF-19500/355G	30 June 2000

**3. DOCUMENT TITLE**  
SEMICONDUCTOR DEVICE, UNITIZED DUAL TRANSISTOR, NPN, SILICON TYPES 2N2919, 2N2920, 2N2919L, 2N2920L, 2N2919U, AND 2N2920U, JAN, JANTX, JANTXV, JANS, JANHC, AND JANKC

4. NATURE OF CHANGE (Identify paragraph number and include proposed rewrite, if possible. Attach extra sheets as needed.)

5. REASON FOR RECOMMENDATION

6. SUBMITTER

a. NAME (Last, First, Middle initial)	b. ORGANIZATION	
c. ADDRESS (Include Zip Code)	d. TELEPHONE (Include Area Code)	7. DATE SUBMITTED
	COMMERCIAL DSN FAX EMAIL	

8. PREPARING ACTIVITY

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c. ADDRESS Defense Supply Center Columbus, ATTN: DSCC-VAC, 3990 East Broad Street, Columbus, OH 43213-1199	IF YOU DO NOT RECEIVE A REPLY WITHIN 45 DAYS, CONTACT: Defense Standardization Program Office (DLSC-LM) 8725 John J. Kingman, Suite 2533, Fort Belvoir, VA 22060-6221 Telephone (703) 767-6888    DSN 427-6888