The documentation and process conversion measures necessary to comply with this revision shall be completed by 1 October 2002.

INCH-POUND

MIL-PRF-19500/291K
1 July 2002
SUPERSEDING
MIL-PRF-19500/291J
5 August 2000

PERFORMANCE SPECIFICATION

SEMICONDUCTOR DEVICE, TRANSISTOR, PNP, SILICON, SWITCHING,
TYPES 2N2906A, 2N2906AL, 2N2907A, 2N2907AL, 2N2906AUA
2N2907AUA, 2N2906AUB, AND 2N2907AUB
JAN, JANTX, JANTXV, JANJ, 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 PNP, silicon, switching transistors. Five levels of product assurance are provided for each encapsulated device type as specified in MIL-PRF-19500 and two levels of product assurance are provided for each unencapsulated device type.

* 1.2 Physical dimensions. See figure 1 (similar to a T0-18), figures 2 and 3 (surface mount case outlines UA and UB), and figures 4 and 5 (JANHC and JANKC).

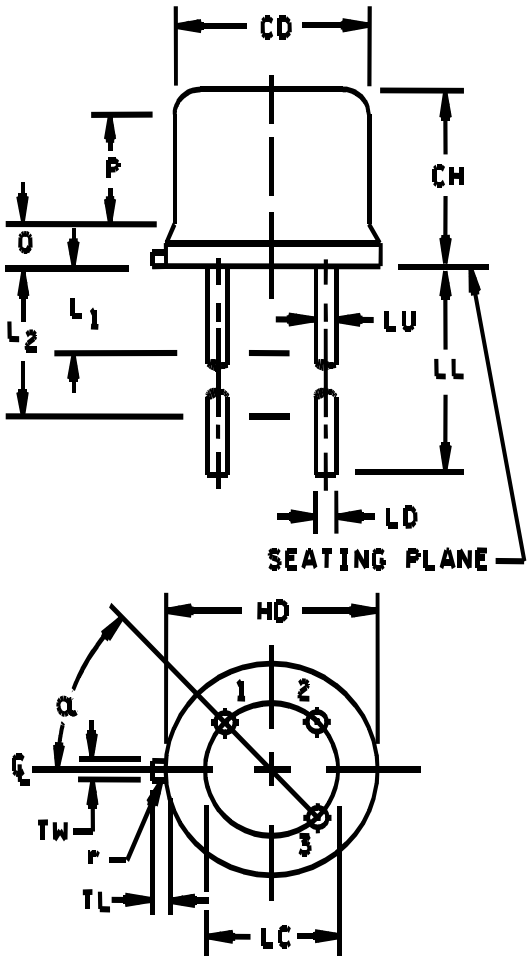
1.3 Maximum ratings.

Types	P_T T_A = +25°C	I_C	V_{CBO}	V_{CEO}	V_{EBO}	$R_{\theta JA}$	T_J and T_{STG}
	W	mA dc	V dc	V dc	V dc	°C/W	°C
2N2906A, L, 2N2907A, L	0.5 (1)	600	60	60	5	325	-65 to +200
2N2906AUA, 2N2907AUA	0.65 (2)	600	60	60	5	210	-65 to +200
2N2906AUB, 2N2907AUB	0.5 (1)	600	60	60	5	325	-65 to +200

(1) Derate linearly 3.08 mW/°C above T_A = +37.5°C.
(2) Derate linearly 4.76 mW/°C above T_A = +63.5°C.

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, P. O. 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.

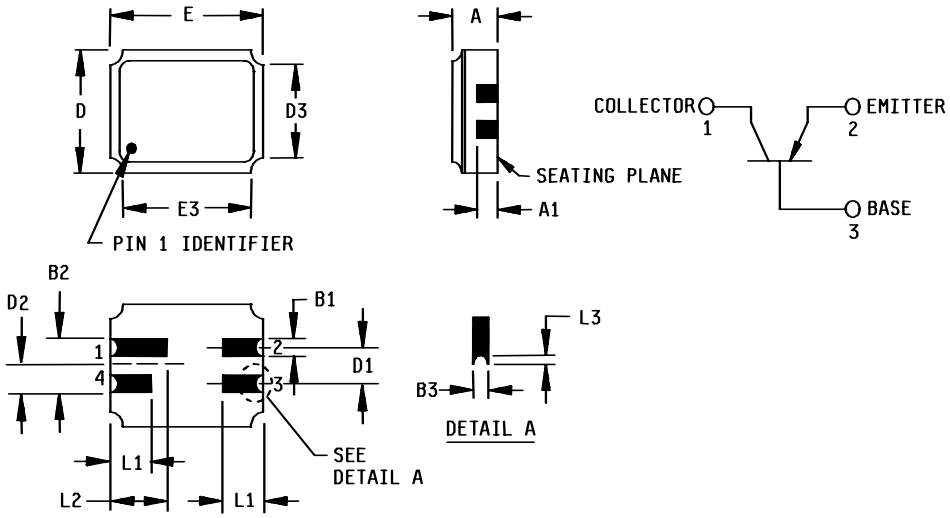
Symbol	Dimensions				Notes
	Inches		Millimeters		
	Min	Max	Min	Max	
CD	.178	.195	4.52	4.95	
CH	.170	.210	4.32	5.33	
HD	.209	.230	5.31	5.84	
LC	.100 TP		2.54 TP		6
LD	.016	.021	0.41	0.53	7,8
LL	.500	.750	12.70	19.05	7,8,13
LU	.016	.019	0.41	0.48	7,8
L_1		.050		1.27	7,8
L_2	.250		6.35		7,8
P	.100		2.54		
Q		.030		0.76	5
TL	.028	.048	0.71	1.22	3,4
TW	.036	.046	0.91	1.17	3
r		.010		0.25	10
α	45° TP		45° TP		6



NOTES:

1. Dimension are in inches.
2. Metric equivalents are given for general information only.
3. Beyond r (radius) maximum, TW 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 +0.03 -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.
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 three leads.
9. The collector shall be internally connected to the case.
10. Dimension r (radius) applies to both inside corners of tab.
11. In accordance with ANSI Y14.5M, diameters are equivalent to ϕx symbology.
12. Lead 1 = emitter, lead 2 = base, lead 3 = collector.
13. For L suffix devices, dimension LL = 1.5 inches (38.10 mm) min. and 1.75 inches (44.45 mm) max.

* FIGURE 1. Physical dimensions (similar to TO-18).

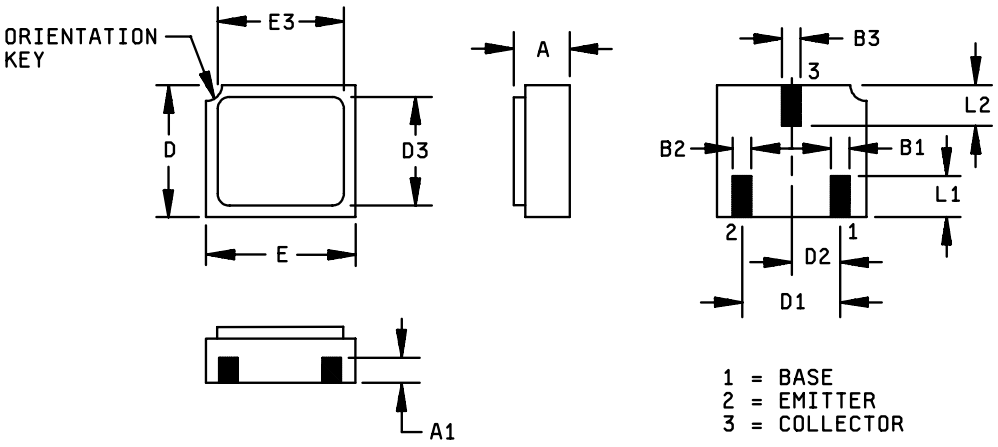


Ltr	Dimensions				Notes	Ltr	Dimensions				Notes
	Inches		Millimeters				Inches		Millimeter		
	Min	Max	Min	Max			Min	Max	Min	Max	
A	.061	.075	1.55	1.90	3	D_2	.0375 BSC		0.952 BSC		
A_1	.029	.041	0.74	1.04		D_3		.155		3.93	
B_1	.022	.028	0.56	0.71		E	.215	.225	5.46	5.71	
B_2	.075 REF		1.91 REF			E_3		.225		5.71	
B_3	.006	.022	0.15	0.56	5	L_1	.032	.048	0.81	1.22	
D	.145	.155	3.68	3.93		L_2	.072	.088	1.83	2.23	
D_1	.045	.055	1.14	1.39		L_3	.003	.007	0.08	0.18	5

NOTES:

1. Dimensions are in inches.
2. Metric equivalents are given for general information only.
3. Dimension "A" controls the overall package thickness. When a window lid is used, dimension "A" must increase by a minimum of .010 inch (0.254 mm) and a maximum of .040 inch (1.020 mm).
4. The corner shape (square, notch, radius, etc.) may vary at the manufacturer's option, from that shown on the drawing.
5. Dimensions "B3" minimum and "L3" minimum and the appropriately castellation length define an unobstructed three-dimensional space traversing all of the ceramic layers in which a castellation was designed. (Castellations are required on bottom two layers, optional on top ceramic layer.) Dimension "B3" maximum and "L3" maximum define the maximum width and depth of the castellation at any point on its surface. Measurement of these dimensions may be made prior to solder dipping.

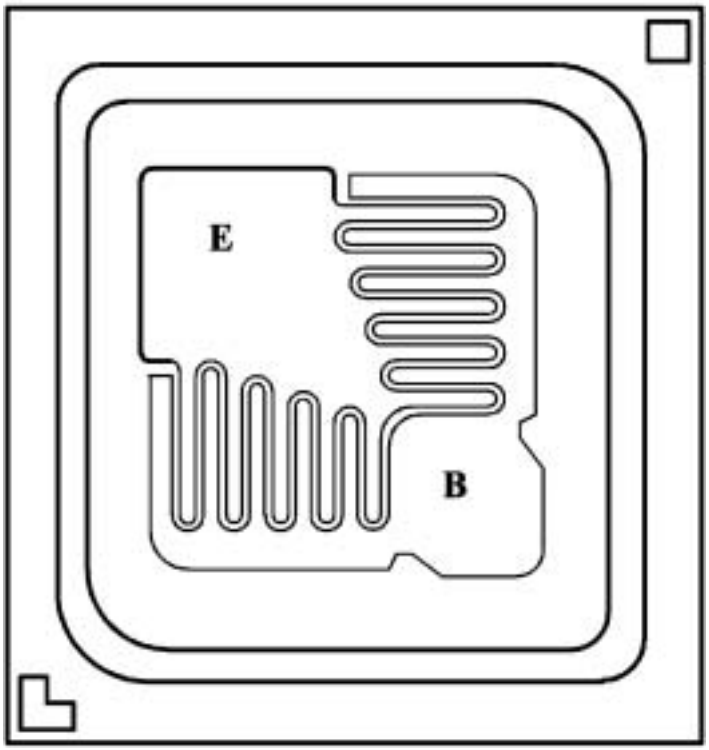
* FIGURE 2. Physical dimensions, surface mount (UA version).



Symbol	Dimensions			
	Inches		Millimeters	
	Min	Max	Min	Max
A	.046	.056	1.17	1.42
A1	.017	.035	0.43	0.89
B1	.016	.024	0.41	0.61
B2	.016	.024	0.41	0.61
B3	.016	.024	0.41	0.61
D	.085	.108	2.16	2.74
D1	.071	.079	1.81	2.01
D2	.035	.039	0.89	0.99
D3	.085	.108	2.16	2.74
E	.115	.128	2.92	3.25
E3		.128		3.25
L1	.022	.038	0.56	0.96
L2	.022	.038	0.56	0.96

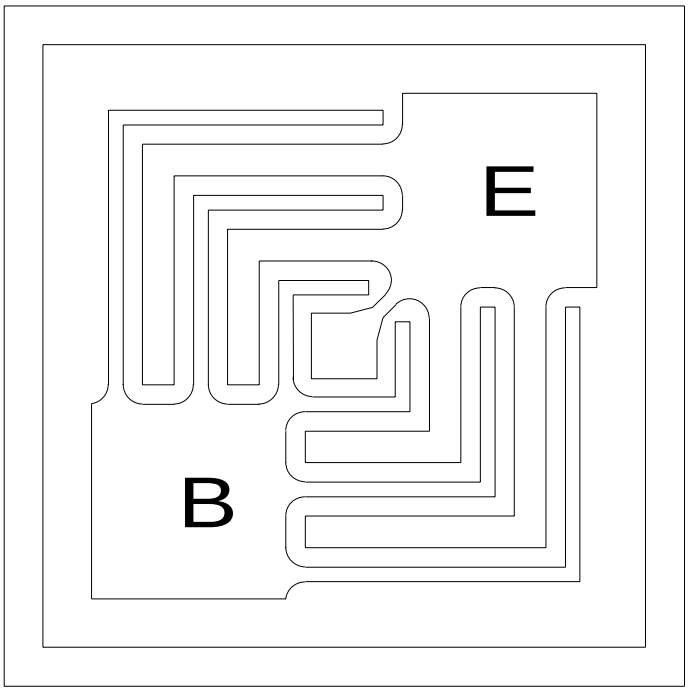
NOTES:
1. Dimensions are in inches.
2. Metric equivalents are given for general information only.

* FIGURE 3. Physical dimensions, surface mount (UB version).



1.	Chip size:	23 x 23 mils ± 2 mils.
2.	Chip thickness:	10 ± 1.5 mils.
3.	Top metal:	Aluminum 15,000 Å minimum, 18,000 Å nominal.
4.	Back metal:	A. Al/Ti/Ni/Ag 15kÅ/5kÅ/10kÅ/10kÅ B. Gold 2.5 kÅ minimum, 3.0 kÅ nominal. C. Eutectic Die Mount - No Metal
5.	Glassivation:	SI_3N_4 2kÅ minimum, 2.2k nominal
6.	Backside:	Collector
7.	Bonding pad:	B = 4.2 x 4.2 mils, E = 4.2 x 4.2 mils

* FIGURE 4. JANHC and JANKC (B-version) die dimensions.



Die size:	20 x 20 Mils square
Die thickness:	8 ± 1.6 Mils
Base pad:	4 x 4 Mils
Emitter pad:	4 x 4 Mils
Back metal	Gold, 6,500 ± 1950 Ang.
Top metal:	Aluminum, 20,000 ± 2,000 Ang.
Back side:	Collector.
Glassivation:	SiO_2, 7,500 ± 1,500 Ang.

* FIGURE 5. JANHC and JANKC (D-version) die dimensions.

* 1.4 Primary electrical characteristics at T_A = +25°C.

	h_{FE} at V_{CE} = 10 V dc									
	h_{FE1} I_C = 0.1 mA dc		h_{FE2} I_C = 1.0 mA dc		h_{FE3} I_C = 10 mA dc		h_{FE4} (1) I_C = 150 mA dc		h_{FE5} (1) I_C = 500 mA dc	
	2N2906A, L, UA,UB	2N2907A, L, UA,UB	2N2906A L, UA,UB	2N2907A L, UA,UB	2N2906A L, UA,UB	2N2907A L, UA,UB	2N2906A L, UA,UB	2N2907A L, UA,UB	2N2906A L, UA,UB	2N2907A L, UA,UB
Min	40	75	40	100	40	100	40	100	40	50
Max			175	450			120	300		

Types	Limit	| h_{fe} | f = 100 MHz V_{CE} = 20 V dc I_C = 20 mA dc	C_{obo} 100 kHz ≤ f ≤ 1 MHz V_{CB} = 10 V dc I_E = 0	Switching (saturated) t_{on} See figure 6	Switching (saturated) t_{off} See figure 7
			pF	ns	Ns
2N2906A, 2N2907A, L, UA, UB	Min	2.0			
	Max		8	45	300

Types	Limits	$V_{CE(sat)1}$ (1) I_C = 150 mA dc I_B = 15 mA dc	$V_{CE(sat)2}$ (1) I_C = 500 mA dc I_B = 50 mA dc	$V_{BE(sat)1}$ (1) I_C = 150 mA dc I_B = 15 mA dc	$V_{BE(sat)2}$ (1) I_C = 500 mA dc I_B = 50 mA dc
		V dc	V dc	V dc	V dc
2N2906A, 2N2907A, L, UA, UB	Min				
	Max	0.4	1.6	1.3	2.6

(1) Pulsed see 4.5.1.

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, 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 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 manufactured by a manufacturer authorized by the qualifying activity for listing on the applicable qualified manufacturer's list (QML) before contract award (see 4.2 and 6.3).

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

* 3.4 Interface requirements and physical dimensions. The Interface requirements and physical dimensions shall be as specified in MIL-PRF-19500, and figures 1, 2, 3, 4, and 5 herein. Epoxy die attach may be used when a moisture monitor plan has been submitted and approved by the qualifying activity.

3.4.1 Lead finish. Lead finish shall be solderable as defined in MIL-PRF-19500. 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, 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, JANJ and JANS can be abbreviated as J, JX, JV, JJ and JS respectively. The "2N" prefix and the "AUB" suffix can also be omitted.

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 the subgroups specified in table I, group A 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, and as specified herein.

* 4.2.1 JANJ devices. For JANJ level, 3.3.1 through 3.3.1.3 of MIL-PRF-19500 shall apply, except as modified herein. Supplier imposed requirements, as well as alternate screens, procedures, and/or controls shall be documented in the QM plan and must be submitted to the qualifying activity for approval. When alternate screens, procedures, and/or controls are used in lieu of the JANJ screens herein, equivalency shall be proven and documented in the QM plan. Radiation characterization may be submitted in the QM plan at the option of the manufacturer, however, 3.3.1.1 of MIL-PRF-19500 is not required. Die lot controls and rework requirements shall be in accordance with 3.13 of MIL-PRF-19500 and D.3.13.2.1 for JANS level. Lot formation and conformance inspection requirements for JANJ shall be those used for JANTXV devices as a minimum.

* 4.2.2 JANJ qualification. For JANJ qualification, 4.4.2.1 herein shall be performed as required by the qualifying activity. A JANS certified supplier may supply JANJ product utilizing the JANJ screening flow in 4.3 herein.

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

* 4.2.4 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 associated specification that did not request the performance of table II tests, the tests specified in table II herein shall be performed by the first inspection lot of this revision to maintain qualification.

* 4.3 Screening (JANTX, JANTXV, JANJ, and JANS 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	JANJ level
1b	Required	Required
2	Optional	Optional
3a 3b (1) 3c	Required Not applicable Required (see 4.3.3)	Required Not applicable Required (see 4.3.3)
4	Required	Optional
5	Required	Required (one pass minimum)
6	Not applicable	Not applicable
(2) 7a and 7b	Required	Required
8	Required	Not required
9	I_{CBO2}, h_{FE4} read and record	I_{CBO2}, h_{FE4} (Bin and cell)
10	24 hours minimum	24 hours minimum
11	I_{CBO2}; h_{FE4}; ΔI_{CBO2} = 100 percent of initial value or 5 nA dc, whichever is greater. Δh_{FE4} = ±15 percent	I_{CBO2}; h_{FE4}; ΔI_{CBO2} = 100 percent of initial value or 5 nA dc, whichever is greater. Δh_{FE4} = ±15 percent
12	See 4.3.2, 240 hours minimum	See 4.3.2, 160 hours minimum
(3) 13	Subgroups 2 and 3 of table I herein; ΔI_{CBO2} = 100 percent of initial value or 5 nA dc, whichever is greater; Δh_{FE4} = ±15 percent	Subgroups 2 and 3 of table I herein; ΔI_{CBO2} = 100 percent of initial value or 5 nA dc, whichever is greater; Δh_{FE4} = ±15 percent
(2) 14a, and 14b	Optional	Optional
15	Required	Required - attributes data only, film or non-film techniques may be utilized
16	Required	Required

See notes at end of screen table.

* 4.3 Screening (JANTX, JANTXV, JANJ, and JANS levels only) - Continued.

Screen (see table IV of MIL-PRF-19500)	Measurement
	JANTXV and JANTX level
1b	Required (JANTXV only)
2	Optional
3a	Required
3b	Not applicable
(1) 3c	Required (see 4.3.3)
4	Optional
5	Not required
6	Not applicable
(2) 7a and 7b	Required
8	Not required
9	Not applicable
10	24 hours minimum
11	I_{CBO2} , h_{FE4}
12	See 4.3.2, 80 hours minimum
13	Subgroup 2 of table I herein; ΔI_{CBO2} = 100 percent of initial value or 5 nA dc, whichever is greater; Δh_{FE4} = ±15 percent
14a and 14b	Optional
15 and 16	Not required

(1) Thermal impedance may be performed any time after sealing provided temperature cycling is performed in accordance with MIL-PRF-19500, screen 3 prior to this thermal test.
(2) Hermeticity evaluation may be performed in either step 7 or step 14.
(3) PDA = 5 percent for screen 13, applies to ΔI_{CBO2}, Δh_{FE4}, I_{CBO2}, and h_{FE4} thermal impedance ($Z_{\theta JX}$) is not required in screen 13.

* 4.3.1 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.

4.3.2 Power burn-in conditions. Power burn-in conditions are as follows: T_A = room ambient as defined in the general requirements of 4.5 of MIL-STD-750. Power shall be applied to the device to achieve T_J = minimum +135°C and minimum power dissipation of P_D = 75 percent P_T max as defined in 1.3.

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

a. I_M measurement current .....5 mA.

b. I_H forward heating current.....200 mA (min).

c. t_H heating time .....25 - 30 ms.

d. t_{md} measurement delay time.....60 µs max.

e. V_{CE} collector-emitter voltage .....10 V dc minimum

The maximum limit for $Z_{\theta JX}$ under these test conditions are $Z_{\theta JX}$ (max) = 60°C/W. (UA, UB); 67°C/W (TO-18).

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 E.5.3.1d of 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 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. Group A inspection for JANJ shall be in accordance with JANTXV of 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 table I, group A, subgroup 2 and 4.5.3 herein. See 4.4.2.2 for JAN, JANTX, JANJ and JANTXV group B testing. Electrical measurements (end-points) and delta requirements for JAN, JANTX, JANJ and JANTXV shall be after each step in 4.4.2.2 and shall be in accordance with table I, group A, subgroup 2 and 4.5.3 herein.

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

Subgroup	Method	Condition
B4	1037	V_{CB} = 10 - 30 V dc.
B5	1027	V_{CB} = 10 V dc; $P_D \geq$ 100 percent of maximum rated P_T (see 1.3). (NOTE: If a failure occurs, resubmission shall be at the test conditions of the original sample.) Option 1: 96 hours minimum sample size in accordance with MIL-PRF-19500, table VIa, adjust T_A or P_D to achieve T_J = +275°C minimum. Option 2: 216 hours minimum, sample size = 45, c = 0; adjusted T_A or P_D to achieve a T_J = +225°C minimum.

4.4.2.2 Group B inspection, (JAN, JANTX, JANTXV and JANJ). 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	Condition
1	1027	Steady-state life: Test condition B, 340 hours, V_{CB} = 10 - 30 V dc, power shall be applied to the device to achieve T_J = +150°C minimum, and minimum power dissipation of 75 percent of max rated P_T (see 1.3 herein); n = 45, c = 0.
2	1027	The steady-state life test of step 1 shall be extended to 1,000 hours 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_A = +200°C, t = 340 hours, 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, JANTXV and JANJ, 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 table I, 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, JANTXV and JANJ) 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, JANTXV and JANJ) herein for group C testing. Electrical measurements (end-points) and delta requirements shall be in accordance with table I, group A, subgroup 2 and 4.5.3 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 for UA and UB devices).
C6	1027	Test condition B, 1,000 hours, V_{CB} = 10 - 30 V dc, power shall be applied to the device to achieve T_J = +150°C minimum, and minimum power dissipation of 75 percent of max rated P_T (see 1.3 herein); n = 45, c = 0.

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

Subgroup	Method	Condition
C2	2036	Test condition E; not applicable for UA and UB devices.
C5	3131	$R_{\theta JA}$ (see 1.3).
C6		Not applicable.

4.4.3.3 Group C sample selection. Samples for steps 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, 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 conducted in accordance with the conditions specified for subgroup testing in appendix E, table IX of MIL-PRF-19500 and as specified in table II herein. Electrical measurements (end-points) shall be in accordance with table I, group A, subgroup 2 herein. Delta measurements shall be in accordance with the applicable steps of 4.5.3.

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

4.5.3 Delta requirements. Delta requirements shall be as specified below:

Step	Inspection	MIL-STD-750		Symbol	Limit
		Method	Conditions		
1	Collector-base cutoff current	3036	Bias condition D, V_{CB} = 50 V dc	ΔI_{CB02} (1)	100 percent of initial value or 10 nA dc, whichever is greater.
2	Forward current transfer ratio	3076	V_{CE} = 10 V dc; I_C = 150 mA dc; pulsed see 4.5.1	Δh_{FE4} (1)	$\pm$ 25 percent change from initial reading.

(1) Devices which exceed the group A limits for this test shall not be accepted.

* TABLE I. Group A inspection.

Inspection 1/	MIL-STD-750		Symbol	Limit		Unit
	Method	Conditions		Min	Max	
Subgroup 1 2/						
Visual and mechanical inspection 3/	2071	n = 45 devices, c = 0				
Solderability 3/ 4/	2026	n = 15 leads, c = 0				
Resistance to solvents 3/ 4/ 5/	1022	n = 15 devices, c = 0				
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				
Electrical measurements 4/		Group A, subgroup 2				
Bond strength 3/ 4/	2037	Precondition T_A = + 250°C at t = 24 hours or T_A = + 300°C at t = 2 hours n = 11 wires, c = 0				
Decap internal visual (design verification) 4/	2075	n = 4 devices, c = 0				
Subgroup 2						
Collector to base cutoff current	3036	Bias condition D; V_{CB} = 60 V dc	I_{CBO1}		10	µA dc
Cutoff current, emitter to base	3061	Bias condition D; V_{EB} = 5 V dc	I_{EBO1}		10	µA dc
Breakdown voltage, collector to emitter	3011	Bias condition D; I_C = 10 mA dc; pulsed (see 4.5.1)	$V_{(BR)CEO}$	60		V dc
Collector to emitter cutoff current	3041	Bias condition D; V_{CE} = 50 V dc	I_{CES}		50	nA dc
Collector to base cutoff current	3036	Bias condition D; V_{CB} = 50 V dc	I_{CBO2}		10	nA dc
Emitter to base cutoff current	3061	Bias condition D; V_{EB} = 4 V dc	I_{EBO2}		50	nA dc

See footnotes at end of table.

TABLE I. Group A inspection - Continued.

Inspection 1/	MIL-STD-750		Symbol	Limit		Unit
	Method	Conditions		Min	Max	
Subgroup 2 - Continued	3076	V_{CE} = 10 V dc; I_C = 0.1 mA dc	h_{FE1}			
Forward-current transfer ratio				40		
2N2906A, L, UA, UB				75		
2N2907A, L, UA, UB						
Forward-current transfer ratio	3076	V_{CE} = 10 V dc; I_C = 1.0 mA dc	h_{FE2}			
2N2906A, L, UA, UB				40	175	
2N2907A, L, UA, UB				100	450	
Forward-current transfer ratio	3076	V_{CE} = 10 V dc; I_C = 10 mA dc	h_{FE3}			
2N2906A, L, UA, UB				40		
2N2907A, L, UA, UB				100		
Forward-current transfer ratio	3076	V_{CE} = 10 V dc; I_C = 150 mA dc; pulsed (see 4.5.1)	h_{FE4}			
2N2906A, L, UA, UB				40	120	
2N2907A, L, UA, UB				100	300	
Forward-current transfer ratio	3076	V_{CE} = 10 V dc; I_C = 500 mA dc; pulsed (see 4.5.1)	h_{FE5}			
2N2906A, L, UA, UB				40		
2N2907A, L, UA, UB				50		
Collector-emitter saturation voltage	3071	I_C = 150 mA dc; I_B = 15 mA dc, pulsed (see 4.5.1)	$V_{CE(sat)1}$		0.4	V dc
Collector-emitter saturation voltage	3071	I_C = 500 mA dc; I_B = 50 mA dc; pulsed (see 4.5.1)	$V_{CE(sat)2}$		1.6	V dc
Base-emitter saturation voltage	3066	Test condition A; I_C = 150 mA dc; I_B = 15 mA dc; pulsed (see 4.5.1)	$V_{BE(sat)1}$	0.6	1.3	V dc
Base-emitter saturation voltage	3066	Test condition A; I_C = 500 mA dc; I_B = 50 mA dc; pulsed (see 4.5.1)	$V_{BE(sat)2}$		2.6	

See footnotes at end of table.

TABLE I. Group A inspection - Continued.

Inspection 1/	MIL-STD-750		Symbol	Limit		Unit
	Method	Conditions		Min	Max	
Subgroup 3						
High temperature operation		T_A = +150°C				
Collector to base cutoff current	3036	Bias condition D; V_{CB} = 50 V dc	I_{CBO3}		10	µA dc
Low temperature operation		T_A = -55°C				
Forward-current transfer ratio	3076	V_{CE} = 10 V dc; I_C = 10 mA dc	h_{FE6}			
2N2906A, L, UA, UB 2N2907A, L, UA, UB				20 50		
Subgroup 4						
Small-signal short-circuit forward current transfer ratio	3206	V_{CE} = 10 V dc; I_C = 1 mA dc; f = 1 kHz	h_{fe}			
2N2906A, L, UA, UB 2N2907A, L, UA, UB				40 100		
Magnitude of small-signal short- circuit forward current transfer ratio	3306	V_{CE} = 20 V dc; I_C = 20 mA dc; f = 100 MHz	$\|h_{fe}\|$	2.0		
Open circuit output capacitance	3236	V_{CB} = 10 V dc; I_E = 0; 100 kHz ≤ f ≤ 1 MHz	C_{obo}		8	pF
Input capacitance (output open- circuited)	3240	V_{EB} = 2.0 V dc; I_C = 0; 100 kHz ≤ f ≤ 1 MHz	C_{ibo}		30	pF
Saturated turn-on time		(See figure 6)	t_{on}		45	ns
Saturated turn-off time		(See figure 7)	t_{off}		300	ns

See footnotes at end of table.

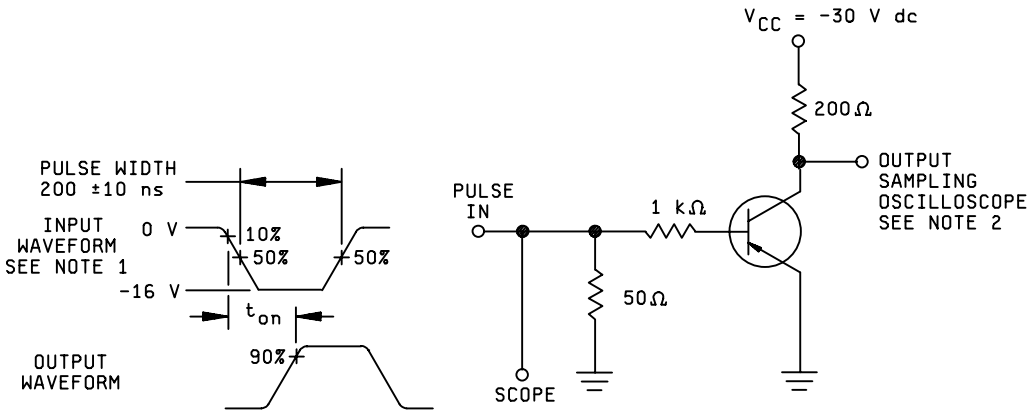
TABLE I. Group A inspection - Continued.

Inspection 1/	MIL-STD-750		Symbol	Limit		Unit
	Method	Conditions		Min	Max	
Subgroups 5, 6, and 7 Not applicable						

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 JANS devices.
5/ Not required for laser marked devices.

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

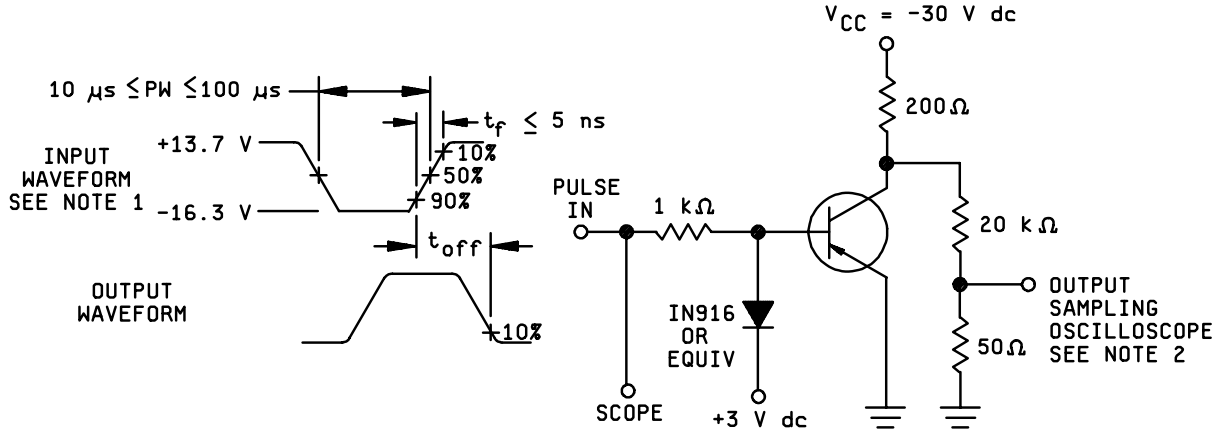
Inspection	MIL-STD-750		Qualification
	Method	Conditions	
Subgroup 1			45 devices c = 0
Temperature cycling (air to air)	1051	Test condition C, 500 cycles.	
Hermetic seal	1071		
Fine leak Gross leak			
Electrical measurements		See table I, group A, subgroup 2 and 4.5.3 herein.	
Subgroup 2			45 devices c = 0
Intermittent life	1037	V_{CB} = 10 V dc, 6,000 cycles.	
Electrical measurements		See table I, group A, subgroup 2 and 4.5.3 herein.	
Subgroups 3, 4, 5, 6 and 7			
Not applicable			
Subgroup 8			45 devices c = 0
Reverse stability	1033	Condition A for devices ≥ 400 V, condition B for devices < 400 V.	



NOTES:

1. The rise time (t_r) of the applied pulse shall be ≤ 2.0 ns, duty cycle ≤ 2 percent and the generator source impedance shall be 50 ohms.
2. Sampling oscilloscope: Z_{in} ≥ 100 K ohms, C_{in} ≤ 12 pF, rise time ≤ 5 ns.

* FIGURE 6. Saturated turn-on switching time test circuit.



NOTES:

1. The rise time (t_r) of the applied pulse shall be ≤ 2.0 ns, duty cycle ≤ 2 percent and the generator source impedance shall be 50 ohms.
2. Sampling oscilloscope: Z_{in} ≥ 100 K ohms, C_{in} ≤ 12 pF, rise time ≤ 5 ns.

* FIGURE 7. Saturated turn-off switching time test circuit.

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 Intended use. The notes specified in MIL-PRF-19500 are applicable to this specification.

* 6.2 Acquisition requirements. Acquisition documents must specify the following:

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

b. Issue of DoDISS to be cited in the solicitation, and if required, the specific issue of individual documents referenced (see 2.2).

c. Packaging requirements (see 5.1).

d. Lead finish (see 3.4.1).

e. Type designation and quality assurance level.

f. For die acquisition, the letter version must be specified (see figures 4 and 5).

* 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, ATTN: DSCC/VQE, P.O. Box 3990, Columbus, OH 43216-5000.

6.4 Supersession information. Devices covered by this specification supersede the manufacturers' and users' Part or Identifying Number (PIN). The term Part or Identifying Number (PIN) is equivalent to the term part number which was previously used in this specification. This information in no way implies that manufacturers' PIN's are suitable as a substitute for the military PIN.

* 6.5 Suppliers of JANHC and JANKC die. The qualified JANHC and JANKC suppliers with the applicable letter version (example JANHCB2N2907A) will be identified on the QML.

Die ordering information (1) (2)		
PIN	Manufacturer	
	43611	34156
2N2906A 2N2907A	JANHCB2N2906A JANHCB2N2907A	JANHCD2N2906A JANHCD2N2907A

(1) For JANKC level, replace JANHC with JANKC.
(2) JANHCA, JANKCA, JANHCC, and JANKCC versions are obsolete.

* 6.6 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 - 11
NASA - NA
DLA - CC

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

Preparing activity:
DLA - CC

(Project 5961-2566)

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.

I RECOMMEND A CHANGE:	1. DOCUMENT NUMBER MIL-PRF-19500/291K	2. DOCUMENT DATE 1 July 2002

3. **DOCUMENT TITLE**
SEMICONDUCTOR DEVICE, TRANSISTOR, PNP, SILICON, SWITCHING, TYPES 2N2906A, 2N2906AL, 2N2907A, 2N2907AL, 2N2906AUA 2N2907AUA, 2N2906AUB, AND 2N2907AUB JAN, JANTX, JANTXV, JANJ, 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) COMMERCIAL DSN FAX EMAIL	7. DATE SUBMITTED

8. PREPARING ACTIVITY

a. Point of Contact Alan Barone	b. TELEPHONE Commercial: 614-692-0510 DSN: 850-0510 FAX: 614-692-6939 EMAIL: alan_barone@dscc.dla.mil
c. ADDRESS Defense Supply Center Columbus ATTN: DSCC-VAC P.O. Box 3990 Columbus, OH 43216-5000	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