

The documentation and process conversion measures necessary to comply with this revision shall be completed by 6 June 2002.

INCH-POUND

MIL-PRF-19500/395G  
6 March 2002  
SUPERSEDING  
MIL-PRF-19500/395F  
26 February 2001

## PERFORMANCE SPECIFICATION

SEMICONDUCTOR DEVICE, TRANSISTOR, NPN, SILICON, SWITCHING  
TYPES 2N3735, 2N3735L, 2N3737 AND 2N3737UB, JAN, JANTX, JANTXV, JANS AND JANHC, 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 NPN, silicon, switching transistors. Four levels of product assurance are provided for each device type as specified in MIL-PRF-19500 and two levels of product assurance are provided for unencapsulated devices.

1.2 Physical dimensions. See figure 1 (TO-39, TO-5 and TO-46), figure 2 (2N3737UB) and figure 3 (JANHC and JANKC).

### 1.3 Maximum ratings.

Type	$P_T$ $T_A = +25^\circ\text{C}$	$P_T$ $T_C = +25^\circ\text{C}$	$V_{CBO}$	$V_{CEO}$	$V_{EBO}$	$I_C$	$R_{\theta JC}$	$R_{\theta JA}$	$T_J$ and $T_{STG}$
	<u>W</u>	<u>W</u>	<u>V dc</u>	<u>V dc</u>	<u>V dc</u>	<u>A dc</u>	<u>°C/mW</u>	<u>°C/W</u>	<u>°C</u>
2N3735	1.0 (1)	2.9 (2)	75	40	5	1.5	.060	175	-65 to +200
2N3737	0.5 (3)	1.9 (4)	75	40	5	1.5	.088	350	-65 to +200
2N3737UB	0.5 (5)	-	75	40	5	1.5	-	325	-65 to +200

- (1) Derate linearly at 5.71 mW/°C above  $T_A = +25^\circ\text{C}$ .
- (2) Derate linearly at 16.6 mW/°C above  $T_C = +25^\circ\text{C}$ .
- (3) Derate linearly at 2.86 mW/°C above  $T_A = +25^\circ\text{C}$ .
- (4) Derate linearly at 11.3 mW/°C above  $T_C = +25^\circ\text{C}$ .
- (5) Derate linearly at 3.07 mW/°C above  $T_A = +37.5^\circ\text{C}$ .

### 1.4 Primary electrical characteristics.

Limits	$h_{FE3}$ (1)	$ h_{fe} $	$V_{CE(sat)}$	$C_{obo}$	Pulse response		
	$V_{CE} = 1.0 \text{ V dc}$ $I_C = 0.5 \text{ A dc}$	$V_{CE} = 10 \text{ V dc}$ $I_C = 50 \text{ mA dc}$ $f = 100 \text{ MHz}$	$I_C = 500 \text{ mA dc}$ $I_B = 50 \text{ mA dc}$	$V_{CB} = 10 \text{ V dc}$ $I_E = 0$ $100 \text{ kHz} \leq f \leq 1 \text{ MHz}$	$t_d$	$t_r$	$t_{off}$
Min	40	2.5	<u>V dc</u>	<u>pF</u>	<u>ns</u>	<u>ns</u>	<u>ns</u>
Max	140	6.0	0.5	9	8.0	40	60

(1) Pulsed (see 4.5.1)

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.

AMSC N/A

FSC 5961

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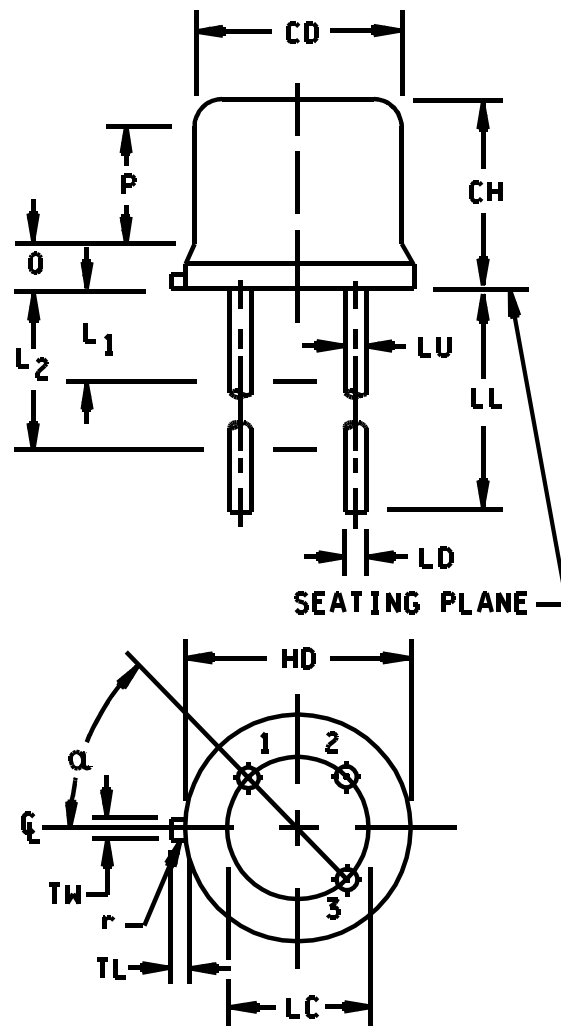


FIGURE 1. Physical dimensions TO-39, TO-5, TO-46.

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2N3735 DIMENSIONS, TO-39

Symbol	Dimensions				Notes
	Inches		Millimeters		
	Min	Max	Min	Max	
CD	.305	.355	7.75	9.02	
CH	.240	.260	6.10	6.60	
HD	.355	.370	9.02	9.40	
LC	.200 TP		5.08 TP		6
LD	.016	.021	0.41	0.53	7
LL	.500	.750	12.70	19.05	7
LU	.016	.019	0.41	0.48	7
L1		.050		1.27	7
L2	.250		6.35		7
P	.100		2.54		
TL	.029	.045	0.74	1.14	3
TW	.028	.034	0.71	0.86	9
Q		.040		1.02	4
r		.010		0.25	10
α	45°TP		45°TP		6

2N3735L DIMENSIONS, TO-5

Symbol	Dimensions				Notes
	Inches		Millimeters		
	Min	Max	Min	Max	
CD	.305	.355	7.75	9.02	
CH	.240	.260	6.10	6.60	
HD	.355	.370	9.02	9.40	
LC	.200 TP		5.08 TP		6
LD	.016	.021	0.41	0.53	7
LL	1.500	1.750	38.10	44.45	7
LU	.016	.019	0.41	0.48	7
L1		.050		1.27	7
L2	.250	6.35	7		
P	.100		2.54		
TL	.029	.045	0.74	1.14	3
TW	.028	.034	0.71	0.86	9
Q		.040		1.02	4
r		.010		0.25	10
$\alpha$	45°TP		45°TP		6

FIGURE 1. Physical dimensions (TO-39, TO-5, TO-46) – Continued.

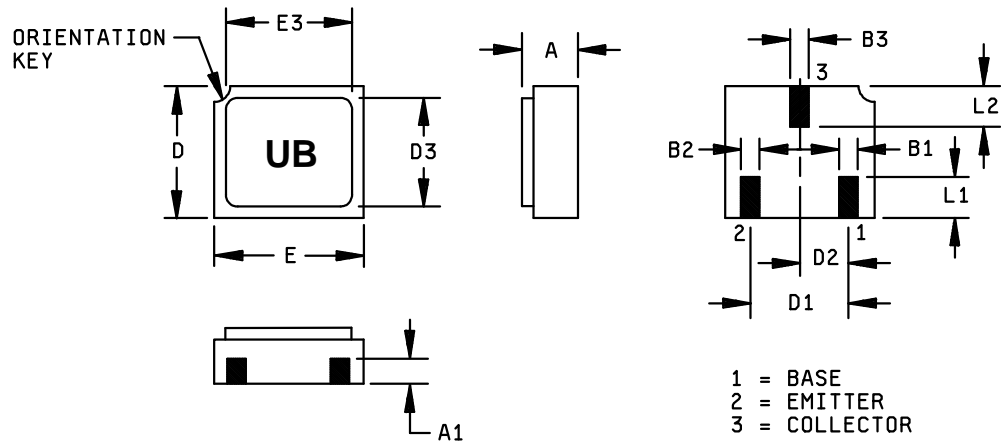
## 2N3737 DIMENSIONS, TO-46

Symbol	Dimensions				Notes
	Inches		Millimeters		
	Min	Max	Min	Max	
CD	.178	.195	4.52	4.95	
CH	.065	.085	1.65	2.16	
HD	.209	.230	5.31	5.84	
LC	.100 TP		2.54 TP		6
LD	.016	.021	0.41	0.53	7
LL	.500	1.750	12.70	19.05	7
LU	.016	.019	0.41	0.48	7
L1		.050		1.27	7
L2	.250		6.35		7
TL	.028	.048	0.71	1.22	3
TW	.036	.046	0.91	1.17	9
Q		.040		1.02	4
r		.007		.018	10
α	45°TP		45°TP		6

## NOTES:

1. Dimensions are in inches. Lead 1 is emitter, lead 2 is base, and lead 3 is collector.
2. Metric equivalents are given for general information only.
3. Symbol TL is measured from HD maximum.
4. Details of outline in this zone are optional.
5. Symbol CD shall not vary more than .010 inch (0.25 mm) in zone P. This zone is controlled for automatic handling.
6. Leads at gauge plane .054 inch (1.37 mm) +.001 inch (0.03 mm) -.000 inch (0.00 mm) below seating plane shall be within .007 inch (0.18 mm) radius of TP relative to tab. Device may be measured by direct methods or by gauge.
7. Symbol LU applies between L<sub>1</sub> and L<sub>2</sub>. Dimension LD applies between L<sub>2</sub> and LL minimum.
8. Lead number three is electrically connected to case.
9. Beyond r maximum, TW shall be held for a minimum length of .011 inch (0.28 mm).
10. Symbol r applied to both inside corners of tab.
11. In accordance with ANSI Y14.5 M, diameters are equivalent to  $\phi$ X symbology.
12. P dimension not applicable for the TO-46 case.

FIGURE 1. Physical dimensions (TO-39, TO-5, TO-46) – Continued.

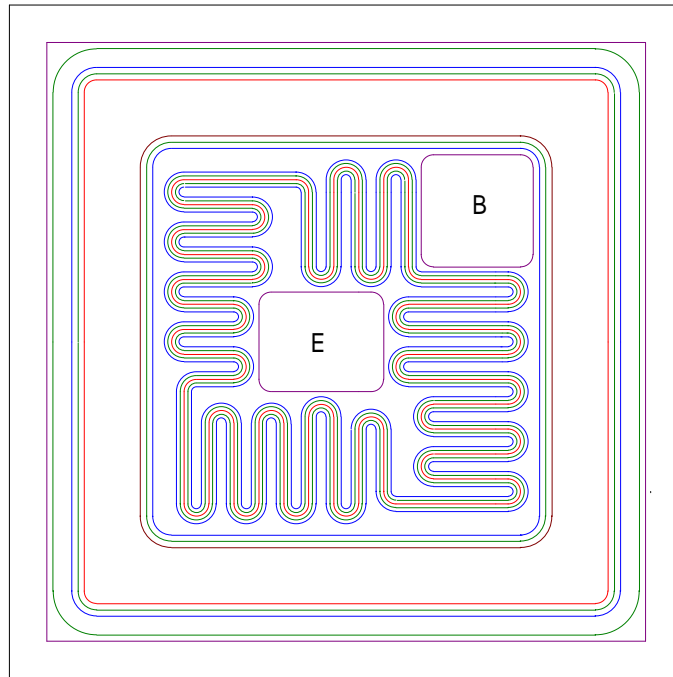


Symbol	Dimensions				Note
	Inches		Millimeters		
	Min	Max	Min	Max	
A	.046	.056	0.97	1.42	
A1	.017	.035	0.43	0.89	
B1	.016	.024	0.41	0.61	
B2	.016	.024	0.41	0.61	
B3	.016	.024	0.41	0.61	
D	.085	.108	2.41	2.74	
D1	.071	.079	1.81	2.01	
D2	.035	.039	0.89	0.99	
D3	.085	.108	2.41	2.74	
E	.115	.128	2.82	3.25	
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 2. Physical dimensions, surface mount (UB version).



Die size:	.027 x .027 inch (0.6858 x 0.6858 mm).
Die thickness:	.008 ±.0016 inch (0.2032 ±0.04064 mm).
Base pad:	.0045 x .0045 inch (0.1145 x 0.1145 mm).
Emitter pad:	.004 x .005 inch (0.1016 x 0.1270 mm).
Back metal:	Gold, 6500 ± 1950 Ang.
Top metal:	Aluminum, 24500 ± 2500 Ang.
Back side:	Collector.
Glassivation:	SiO <sub>2</sub> , 7500 ± 1500 Ang.

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

## 2. APPLICABLE DOCUMENTS

2.1 General. The documents listed in this section are specified in sections 3 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 and physical dimensions. Interface and physical dimensions shall be as specified in MIL-PRF-19500, and on figure 1 (TO-39, TO-5 and TO-46) 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).

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3.5 Electrical performance characteristics. Unless otherwise specified herein, the electrical performance characteristics are as specified in 1.3, 1.4 and table I.

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

3.7 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.

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 and tables I, II, and III).

4.2 Qualification inspection. Qualification inspection shall be in accordance with MIL-PRF-19500 and as specified herein.

\*4.2.1 JANHC and JANKC qualification. JANHC and JANKC qualification inspection shall be in accordance with MIL-PRF-19500.

\*4.3 Screening (JANTX, JANTXV 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	JANTX and JANTXV levels
3c	Thermal impedance, method 3131 of MIL-STD-750.	Thermal impedance, method 3131 of MIL-STD-750.
9	$I_{CBO2}$ and $h_{FE3}$	Not applicable
11	$I_{CBO2}$ ; $h_{FE3}$ ; $\Delta I_{CBO2} = 100$ percent or 25 nA dc, whichever is greater; $\Delta h_{FE3} = \pm 15$ percent of initial value.	$I_{CBO2}$ and $h_{FE3}$
12	See 4.3.1	See 4.3.1
13	Subgroups 2 and 3 of table I herein; $\Delta I_{CBO2} = 100$ percent or 25 nA dc, whichever is greater; $\Delta h_{FE3} = \pm 15$ percent of initial value.	Subgroup 2 of table I herein; $\Delta I_{CBO2} = 100$ percent or 25 nA dc, whichever is greater; $\Delta h_{FE3} = \pm 15$ percent of initial value.



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4.3.1 Power burn-in conditions. Power burn-in conditions are as follows: Adjust the power dissipated to achieve  $T_J = 135^\circ\text{C}$  minimum. The minimum power dissipated shall be 75 percent of the maximum rated as defined in 1.3.  $V_{CB} = 10 - 30 \text{ V dc}$ . NOTE: No heat sink or forced air cooling on the devices shall be permitted.

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.

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 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; delta requirements only apply to subgroups B4 and B5. 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.

<u>Subgroup</u>	<u>Method</u>	<u>Condition</u>
B3	2037	Test condition A.
B4	1037	$V_{CB} = 10 - 30 \text{ V dc}$ .
B5	1027	(Note: If a failure occurs, resubmission shall be at the test conditions of the original sample). $V_{CB} = 10 \text{ V dc}$ ; $P_D \geq 100$ percent of maximum rated $P_T$ (see 1.3).  Option 1: 96 hours minimum, sample size in accordance with table VIa of MIL-PRF-19500, adjust $T_A$ or $P_D$ to achieve $T_J = +275^\circ\text{C}$ minimum.  Option 2: 216 hours., sample size = 45, $c = 0$ ; adjust $T_A$ or $P_D$ to achieve $T_J = +225^\circ\text{C}$ minimum.
B6	3131	See 4.5.2.

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

<u>Step</u>	<u>Method</u>	<u>Condition</u>
1	1039	Steady-state life: Test condition B, 340 hours min., $V_{CB} = 10 - 30$ V dc, power shall be applied to achieve $T_J = +150^\circ\text{C}$ minimum using a minimum of $P_D = 75$ percent of maximum rated $P_T$ as defined in 1.3. $n = 45$ 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, $T_A = +200^\circ\text{C}$ . $n = 22$ , $c = 0$ .

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

- 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.
- 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, JANJ, 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 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; delta requirements only apply to subgroup C6.

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

<u>Subgroup</u>	<u>Method</u>	<u>Condition</u>
C2	2036	Test condition E (not applicable to 2N3737UB).
C6	1026	$V_{CB} = 10 - 30$ V dc; 1,000 hours; power shall be applied to achieve $T_J = +150^\circ\text{C}$ minimum, using a minimum of $P_D = 75$ percent of maximum rated $P_T$ as defined in 1.3.

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

<u>Subgroup</u>	<u>Method</u>	<u>Condition</u>
C2	2036	Test condition E (not applicable to 2N3737UB).
C5	3131	See 4.5.2.
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. 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 E inspection. Group E inspection shall be performed for qualification or requalification 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 to maintain qualification.

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

4.5.1 Pulse measurements. Conditions for pulse measurement shall be as specified in section 4 of MIL-STD-750.

4.5.2 Thermal resistance. Thermal resistance measurements shall be conducted in accordance with method 3131 of MIL-STD-750. The following details shall apply:

- a. Collector current magnitude during power application shall be 45 mA dc minimum for 2N3735 and 2N3735L and 31 mA dc minimum for 2N3737.
- b. Collector to emitter voltage magnitude shall be 20 V dc.
- c. Reference temperature measuring point shall be the case.
- d. Reference point temperature shall be 25°C.
- e. Mounting arrangement shall be with heat sink to case.
- f. Thermal resistance maximum limit of 60°C/W for 2N3735, 2N3735L, and 88°C/W for 2N3737 and 2N3737UB.

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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 examination <u>3/</u>	2071	n = 45 devices, c = 0				
Solderability <u>3/ 4/</u>	2026	n = 15 leads, c = 0				
Resistance to solvents <u>3/ 4/ 5/</u>	1022	n = 15 devices, c = 0				
Temp cycling <u>3/ 4/</u>	1051	Test condition C, 25 cycles. n = 22 devices, c = 0				
Hermetic seal <u>4/</u>	1071	n = 22 devices, c = 0				
Fine leak Gross leak						
Electrical measurements <u>4/</u>		Group A, subgroup 2				
Bond strength <u>3/ 4/</u>	2037	Precondition $T_A = +250^\circ\text{C}$ at t = 24 hrs or $T_A = +300^\circ\text{C}$ at t = 2 hrs n = 11 wires, c = 0				
<u>Subgroup 2</u>						
Breakdown voltage collector to emitter	3011	Bias condition D; $I_C = 10\text{ mA dc}$ , pulsed (see 4.5.1)	$V_{(BR)CEO}$	40		V dc
Collector to base cutoff current	3036	Bias condition D; $V_{(BR)CBO} = 75\text{ V dc}$ .	$I_{CBO1}$		10	$\mu\text{A dc}$
Emitter to base cutoff current	3061	Bias condition D; $V_{(BR)EBO} = 5\text{ V dc}$ .	$I_{EBO1}$		10	$\mu\text{A dc}$
Collector to base cutoff current	3036	Bias condition D; $V_{CB} = 30\text{ V dc}$	$I_{CBO2}$		250	nA dc
Collector to emitter cutoff current	3041	Bias condition A; $V_{CE} = 30\text{ V dc}$ $V_{EB} = 2.0\text{ V dc}$	$I_{CEX1}$		200	nA dc
Emitter to base cutoff current	3061	Bias condition D; $V_{EB} = 4.0\text{ V dc}$	$I_{EBO2}$		100	nA dc

See footnotes at end of table.

TABLE I. Group A inspection - Continued.

Inspection <u>1</u> /	MIL-STD-750		Symbol	Limit		Unit
	Method	Conditions		Min	Max	
<u>Subgroup 2</u> - continued						
Forward current transfer ratio	3076	$V_{CE} = 1.0 \text{ V dc}; I_C = 10 \text{ mA dc}$	$h_{FE1}$	35		
Forward current transfer ratio	3076	$V_{CE} = 1.0 \text{ V dc}; I_C = 150 \text{ mA dc}$ , pulsed (see 4.5.1)	$h_{FE2}$	40		
Forward current transfer ratio	3076	$V_{CE} = 1.0 \text{ V dc}; I_C = 500 \text{ mA dc}$ , pulsed (see 4.5.1)	$h_{FE3}$	40	140	
Forward current transfer ratio	3076	$V_{CE} = 1.5 \text{ V dc}; I_C = 1.0 \text{ A dc}$ , pulsed (see 4.5.1)	$h_{FE4}$	20	80	
Collector to emitter voltage (saturated)	3071	$I_C = 10 \text{ mA dc}, I_B = 1.0 \text{ mA dc}$	$V_{CE(sat)1}$		0.2	V dc
Collector to emitter voltage (saturated)	3071	$I_C = 150 \text{ mA dc}, I_B = 15 \text{ mA dc}$ , pulsed (see 4.5.1)	$V_{CE(sat)2}$		0.3	V dc
Forward current transfer ratio	3076	$V_{CE} = 5.0 \text{ V dc}; I_C = 1.5 \text{ A dc}$ , pulsed (see 4.5.1)	$h_{FE5}$	20		V dc
Collector to emitter voltage (saturated)	3071	$I_C = 500 \text{ mA dc}, I_B = 50 \text{ mA dc}$ , pulsed (see 4.5.1)	$V_{CE(sat)3}$		0.5	V dc
Collector to emitter voltage (saturated)	3071	$I_C = 1.0 \text{ A dc}, I_B = 100 \text{ mA dc}$ , pulsed (see 4.5.1)	$V_{CE(sat)4}$		0.9	V dc
Base to emitter saturated voltage	3066	Test condition A, $I_C = 10 \text{ mA dc}, I_B = 1.0 \text{ mA dc}$	$V_{BE(sat)1}$		0.8	V dc
Base to emitter saturated voltage	3066	Test condition A, $I_C = 150 \text{ mA dc}, I_B = 15 \text{ mA dc}$ , pulsed (see 4.5.1)	$V_{BE(sat)2}$		1.0	V dc
Base to emitter saturated voltage	3066	Test condition A, $I_C = 500 \text{ mA dc}, I_B = 50 \text{ mA dc}$ , pulsed (see 4.5.1)	$V_{BE(sat)3}$		1.2	V dc
Base to emitter saturated voltage	3066	Test condition A, $I_C = 1.0 \text{ A dc}, I_B = 100 \text{ mA dc}$ , pulsed (see 4.5.1)	$V_{BE(sat)4}$	0.9	1.4	V dc

See footnotes at end of table.

TABLE I. Group A inspection - Continued.

Inspection <u>1/</u>	MIL-STD-750		Symbol	Limit		Unit
	Method	Conditions		Min	Max	
<u>Subgroup 3</u>						
High-temperature operation:		$T_A = +150^\circ\text{C}$				
Collector to emitter cutoff current	3041	Bias condition A; $V_{CE} = 30\text{ V dc}$ , $V_{EB} = 2.0\text{ V dc}$	$I_{CEX2}$		250	$\mu\text{A dc}$
Low-temperature operation:		$T_A = -55^\circ\text{C}$				
Forward current transfer ratio	3076	$V_{CE} = 1.0\text{ V dc}$ ; $I_C = 500\text{ mA dc}$ , pulsed (see 4.5.1)	$h_{FE6}$	15		
<u>Subgroup 4</u>						
Magnitude of common - emitter small-signal short-circuit forward current transfer ratio	3306	$V_{CE} = 10\text{ V dc}$ ; $I_C = 50\text{ mA dc}$ ; $f = 100\text{ MHz}$	$ h_{fe} $	2.5	6.0	
Open circuit output capacitance	3236	$V_{CB} = 10\text{ V dc}$ , $I_E = 0$ , $100\text{ kHz} \leq f \leq 1\text{ MHz}$	$C_{obo}$		9.0	pF
Input capacitance (output open - circuited)	3240	$V_{EB} = 0.5\text{ V dc}$ , $I_C = 0$ , $100\text{ kHz} \leq f \leq 1\text{ MHz}$	$C_{ibo}$		80	pF
Pulse response:						
Delay response	3251	Test condition A; $V_{CC} = 30\text{ V dc}$ , $V_{BE} = 2\text{ V dc}$ , $I_C = 1.0\text{ A dc}$ , $I_{B1} = 100\text{ mA dc}$ , (see figure 4)	$t_d$		8.0	ns
Rise time	3251	Test condition A; $V_{CC} = 30\text{ V dc}$ , $V_{BE} = 2\text{ V dc}$ , $I_C = 1.0\text{ A dc}$ , $I_{B1} = 100\text{ mA dc}$ , (see figure 4)	$t_r$		40	ns
Turn-off time	3251	Test condition A; $V_{CC} = 30\text{ V dc}$ , $I_C = 1.0\text{ A dc}$ , $I_{B1} = -I_{B2} = 100\text{ mA dc}$ , (see figure 5)	$t_{off}$		60	ns
<u>Subgroups 5, 6 and 7</u>						
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 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	
<u>Subgroup 1</u>			45 devices c = 0
Temperature cycling (air to air)	1051	Test condition C, 500 cycles	
Hermetic seal			
Fine leak	1071		
Gross leak			
Electrical measurements		See group A, subgroup 2 herein.	
<u>Subgroup 2</u>			45 devices c = 0
Intermittent life	1037	V <sub>CB</sub> = 10 V dc, 6,000 cycles.	
Electrical measurements		See group A, subgroup 2 herein.	
<u>Subgroup 3</u>			
Not applicable			
<u>Subgroup 4, 5, 6 and 7</u>			
Not applicable			
<u>Subgroup 8</u>			45 devices c = 0
Reverse stability	1033	Condition A for devices $\geq 400$ V Condition B for devices $< 400$ V	

TABLE III. Groups B and C delta measurements. 1/ 2/ 3/

Step	Inspection	MIL-STD-750		Symbol	Limits		Unit
		Method	Conditions		Min	Max	
1.	Collector to base cutoff current	3036	Bias condition D, $V_{CB} = 30 \text{ V dc}$	$\Delta I_{CBO2}$	100 percent of initial value or 25 nA dc whichever is greater.		
2.	Forward-current transfer ratio	3076	$V_{CE} = 1 \text{ V dc}$ , $I_C = 500 \text{ mA dc}$ , pulsed (see 4.5.1)	$\Delta h_{FE3}$	$\pm 25$ percent change from initial value.		
3.	Collector to emitter voltage (saturated)	3071	$I_C = 500 \text{ mA dc}$ , $I_B = 50 \text{ mA dc}$ , pulsed (4.5.1 )	$\Delta V_{CE(SAT)3}$	$\pm 50 \text{ mV dc}$ change from previous measured value.		

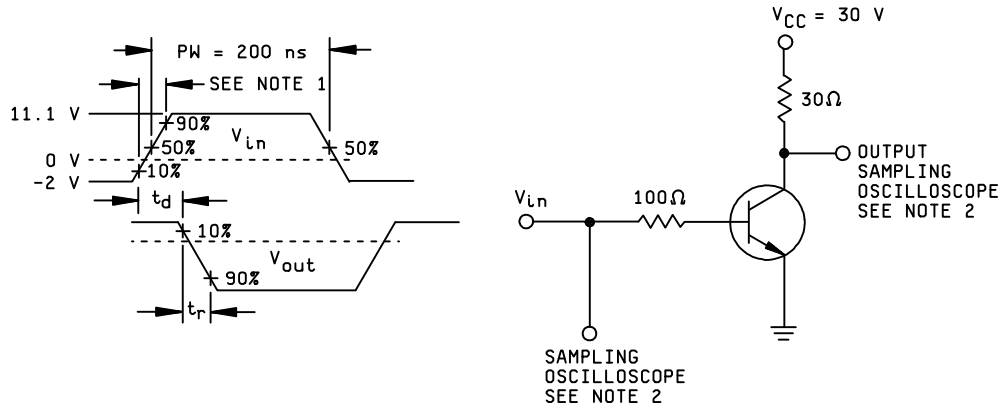
1/ The delta measurements for table VIa (JANS) of MIL-PRF-19500 are as follows:

- a. Subgroup 4, see table III herein, step 3.
- b. Subgroup 5, see table III herein, step 3.

2/ The delta measurements for 4.4.2.2 (JAN, JANTX, JANTXV) are as follows: See table III herein, steps 1 and 2, all subgroups.

3/ The delta measurements for table VII of MIL-PRF-19500 are as follows: Subgroup 6, see table III herein, steps 1 and 2 for (JANS).

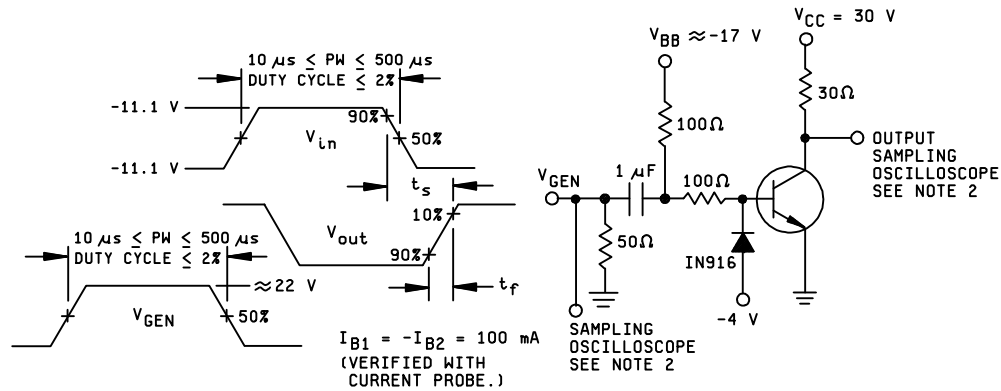




#### NOTES:

1. The rise time ( $t_r$ ) of the applied pulse shall be  $\leq 0.1\text{ ns}$ , duty cycle  $\leq 2$  percent, and the generator source impedance shall be  $50\Omega$ .
2. Sampling oscilloscope:  $Z_{in} \geq 100\text{ k}\Omega$ ,  $C_{in} \leq 12\text{ pF}$ , rise time  $\leq 5\text{ ns}$ .

FIGURE 4. Test circuit and waveforms for measuring turn-on.



#### NOTES:

1. The rise time ( $t_r$ ) of the applied pulse shall be  $\leq 0.1\text{ ns}$ , duty cycle  $\leq 2$  percent, and the generator source impedance shall be  $50\Omega$ .
2. Sampling oscilloscope:  $Z_{in} \geq 100\text{ k}\Omega$ ,  $C_{in} \leq 12\text{ pF}$ , rise time  $\leq 5\text{ ns}$ .

FIGURE 5. Test circuit and waveforms for measuring turn-off.

## 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 Points' packaging activity within the Military Department or Defense Agency, or within the Military Departments' System Command. Packaging data retrieval is available from the managing Military Departments' 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 2.2.1).
- c. The lead finish as specified (see 3.4.1).
- d. Packaging requirements (see 5.1).

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 Suppliers of JANHC and JANKC die. The qualified JANHC and JANKC suppliers with the applicable letter version (example JANHCA2N3737) will be identified on the QPL.

Die ordering information	
PIN	Manufacturer
	34156
2N3737	JANHCA2N3737
	JANKCA2N3737

6.5 Changes from previous issue. The margins of this specification are marked with an asterisk 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

Preparing activity:

DLA - CC

Review activities:

Army - AR, AV, MI, SM  
Navy - AS, MC  
Air Force – 19, 71, 99

(Project 5961-2558)

## STANDARDIZATION DOCUMENT IMPROVEMENT PROPOSAL

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#### I RECOMMEND A CHANGE:

1. DOCUMENT NUMBER  
MIL-PRF-19500/395G

2. DOCUMENT DATE  
6 March 2002

#### 2. DOCUMENT TITLE

SEMICONDUCTOR DEVICE, TRANSISTOR, NPN, SILICON, SWITCHING TYPES 2N3735, 2N3735L, 2N3737 AND 2N3737UB, JAN, JANTX, JANTXV, JANS AND JANHC, 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)

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7. DATE SUBMITTED

8. PREPARING ACTIVITY

a. Point of Contact  
Alan Barone

b. TELEPHONE

Commercial	DSN	FAX	EMAIL
614-692-0510	850-0510	614-692-6939	alan.barone@dscclia.mil

c. ADDRESS  
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