

The documentation and process conversion measures necessary to comply with this document shall be completed by 6 March 2007.

INCH-POUND

MIL-PRF-19500/395J  
 6 December 2007  
 SUPERSEDING  
 MIL-PRF-19500/395H  
 27 October 2006

PERFORMANCE SPECIFICATION SHEET

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

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

The requirements for acquiring the product described herein shall consist of  
 this specification sheet and MIL-PRF-19500.

1. SCOPE

1.1 Scope. This specification covers the performance requirements for 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 and TO-5), figure 2 (TO-46), and figure 3 (2N3737UB).

\* 1.3 Maximum ratings. Unless otherwise specified,  $T_C = +25^\circ\text{C}$ .

Type	$P_T$ $T_A = +25^\circ\text{C}$	$P_T$ $T_C = +25^\circ\text{C}$	$P_T$ $T_{SP} = +25^\circ\text{C}$	$R_{\theta JA}$	$R_{\theta JC}$	$R_{\theta JSP}$	$T_J$ and $T_{STG}$
	W	W	W	$^\circ\text{C}/\text{W}$	$^\circ\text{C}/\text{W}$	$^\circ\text{C}/\text{mW}$	$^\circ\text{C}$
2N3735, 2N3735L	1.0 (1)	2.9 (2)	N/A	175	60	N/A	-65 to +200
2N3737	0.5 (3)	1.9 (4)	N/A	350	88	N/A	-65 to +200
2N3737UB	0.5 (5)	N/A	1.9 (4)	325 (6)	N/A	88 (6)	-65 to +200

Types	$V_{CBO}$	$V_{CEO}$	$V_{EBO}$	$I_C$
	$\underline{V_{dc}}$	$\underline{V_{dc}}$	$\underline{V_{dc}}$	$\underline{A_{dc}}$
2N3735, 2N3735L, 2N3737, 2N3737UB	75	40	5	1.5

- (1) Derate linearly at 5.71 mW/ $^\circ\text{C}$  above  $T_A = +25^\circ\text{C}$ .
- (2) Derate linearly at 16.6 mW/ $^\circ\text{C}$  above  $T_C = +25^\circ\text{C}$ .
- (3) Derate linearly at 2.86 mW/ $^\circ\text{C}$  above  $T_A = +25^\circ\text{C}$ .
- (4) Derate linearly at 11.3 mW/ $^\circ\text{C}$  above  $T_C = +32.8^\circ\text{C}$ .
- (5) Derate linearly at 3.07 mW/ $^\circ\text{C}$  above  $T_A = +37.5^\circ\text{C}$ .
- (6)  $T_A = +55^\circ\text{C}$  for UB on printed circuit board (PCB), PCB = FR4 .0625 inch (1.59 mm) 1 - layer 1 Oz Cu, horizontal, still air, pads (UB) = .034 inch (0.86 mm) x .048 inch (1.22 mm),  $R_{\theta JA}$  with a defined thermal resistance condition included is measured at  $P_T = 500$  mW.

Comments, suggestions, or questions on this document should be addressed to Defense Supply Center, Columbus, ATTN: DSCC-VAC, P.O. Box 3990, Columbus, OH 43218-3990, or emailed to [Semiconductor@dsc.dla.mil](mailto:Semiconductor@dsc.dla.mil). Since contact information can change, you may want to verify the currency of this address information using the ASSIST Online database at <http://assist.daps.dla.mil/>.

1.4 Primary electrical characteristics.

Limits	$h_{FE3}$ (1)	$ h_{re} $	$V_{CE(sat)}$	$C_{obo}$	Pulse response		
	$V_{CE} = 1.0$ V dc $I_C = 0.5$ A dc	$V_{CE} = 10$ V dc $I_C = 50$ mA dc $f = 100$ MHz	$I_C = 500$ mA dc $I_B = 50$ mA dc	$V_{CB} = 10$ 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).

## 2. APPLICABLE DOCUMENTS

2.1 General. The documents listed in this section are specified in sections 3, 4, or 5 of this specification. This section does not include documents cited in other sections of this specification or recommended for additional information or as examples. While every effort has been made to ensure the completeness of this list, document users are cautioned that they must meet all specified requirements of documents cited in sections 3, 4, or 5 of this specification, whether or not they are listed.

2.2 Government documents.

2.2.1 Specifications, standards, and handbooks. The following specifications, standards, and handbooks form a part of this document to the extent specified herein. Unless otherwise specified, the issues of these documents are those cited in the solicitation or contract.

## DEPARTMENT OF DEFENSE SPECIFICATIONS

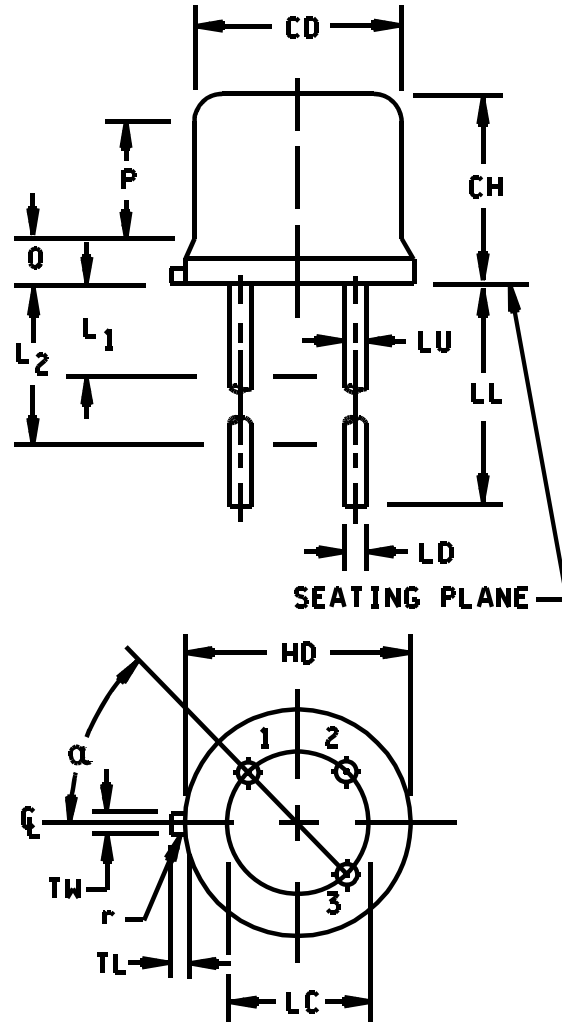
MIL-PRF-19500 - Semiconductor Devices, General Specification for.

## DEPARTMENT OF DEFENSE STANDARDS

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

(Copies of these documents are available online at <http://assist.daps.dla.mil/quicksearch/> or <http://assist.daps.dla.mil/> or from the Standardization Document Order Desk, 700 Robbins Avenue, Building 4D, 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.



\* FIGURE 1. Physical dimensions TO-39, TO-5.

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2N3735 Dimensions, TO-39

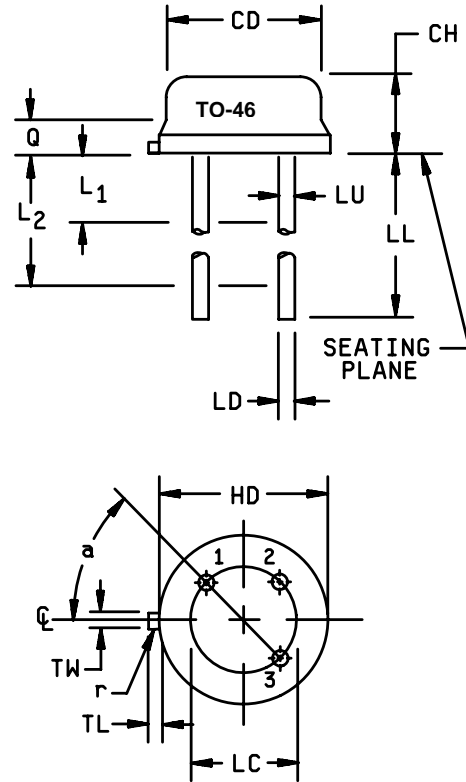
Symbol	Dimensions				Notes
	Inches		Millimeters		
	Min	Max	Min	Max	
CD	.305	.355	7.75	9.02	
CH	.240	.260	6.10	6.60	
HD	.355	.370	9.02	9.40	
LC	.200 TP		5.08 TP		6
LD	.016	.021	0.41	0.53	7
LL	.500	.750	12.70	19.05	7
LU	.016	.019	0.41	0.48	7
L <sub>1</sub>		.050		1.27	7
L <sub>2</sub>	.250		6.35		7
P	.100		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
L <sub>1</sub>		.050		1.27	7
L <sub>2</sub>	.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

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

Ltr.	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		5
LD	.016	.021	0.41	0.53	
LL	.500	1.750	12.70	44.45	6
LU	.016	.019	0.41	0.48	6
L <sub>1</sub>		.050		1.27	6
L <sub>2</sub>	.250		6.35		6
Q		.040		1.02	3
TL	.028	.048	0.71	1.22	8
TW	.036	.046	0.91	1.17	4
r		.010		0.25	9
$\alpha$	45° TP		45° TP		5

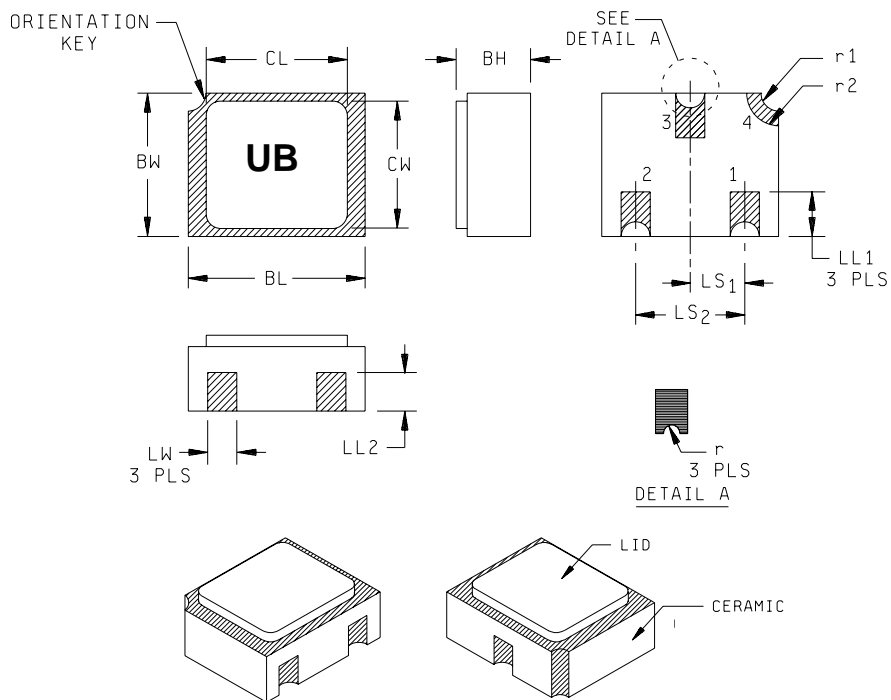


NOTES:

1. Dimensions are in inches.
2. Millimeters are given for general information only.
3. Symbol TL is measured from HD maximum.
4. Details of outline in this zone are optional.
5. 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.
6. Symbol LU applies between L<sub>1</sub> and L<sub>2</sub>. Dimension LD applies between L<sub>2</sub> and LL minimum.
7. Lead number three is electrically connected to case.
8. Beyond r maximum, TW shall be held for a minimum length of .011 inch (0.28 mm).
9. Symbol r applied to both inside corners of tab.
10. In accordance with ASME Y14.5M, diameters are equivalent to  $\phi$ x symbology.
11. Lead 1 is emitter, lead 2 is base, and lead 3 is collector.

\* FIGURE 2. Physical dimensions - TO-46 2N3737.

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Symbol	Dimensions				Note
	Inches		Millimeters		
	Min	Max	Min	Max	
BH	.046	.056	1.17	1.42	
BL	.115	.128	2.92	3.25	
BW	.085	.108	2.16	2.74	
CL		.128		3.25	
CW		.108		2.74	
LL1	.022	.038	0.56	0.96	
LL2	.017	.035	0.43	0.89	
LS <sub>1</sub>	.036	.040	0.91	1.02	
LS <sub>2</sub>	.071	.079	1.81	2.01	
LW	.016	.024	0.41	0.61	
r		.008		.203	
r1		.012		.305	
r2		.022		.559	

NOTES:

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

\* FIGURE 3. Physical dimensions for 2N3737UB, surface mount.

### 3. REQUIREMENTS

3.1 General. The individual item requirements shall be as specified in MIL-PRF-19500 and as modified herein.

3.2 Qualification. Devices furnished under this specification shall be products that are manufactured by a manufacturer authorized by the qualifying activity for listing on the applicable qualified manufacturer's list (QML) before contract award (see 4.2 and 6.3).

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

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), figure 2 (TO-46), and figure 3 (UB) herein.

3.4.1 Lead finish. Lead finish shall be solderable in accordance with MIL-PRF-19500, MIL-STD-750, and herein. Where a choice of lead finish is desired, it shall be specified in the acquisition document (see 6.2).

3.5 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 as specified in table I.

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 and II).

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

4.2.1 Group E qualification. Group E inspection shall be performed for qualification or re-qualification only. In case qualification was awarded to a prior revision of the specification sheet that did not request the performance of table III tests, the tests specified in table III herein that were not performed in the prior revision shall be performed on the first inspection lot of this revision to maintain qualification.

4.3 Screening (JANTX, JANTXV and JANS levels only). Screening shall be in accordance with table E-IV of MIL-PRF-19500, and as specified herein. The following measurements shall be made in accordance with table I herein. Devices that exceed the limits of table I herein shall not be acceptable.

Screen (see table E-IV of MIL-PRF-19500)	Measurement	
	JANS level	JANTX and JANTXV levels
(1) 3c	Thermal impedance, method 3131 of MIL-STD-750 (see 4.3.2).	Thermal impedance, method 3131 of MIL-STD-750 (see 4.3.2).
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; $I_{CBO2}$ = 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.

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

\* 4.3.1 Power burn-in conditions. Power burn-in conditions are as follows:  $V_{CB}$  = 10 - 30 V dc. Power shall be applied to achieve  $T_J$  = +135°C minimum using a minimum  $P_D$  = 75 percent of  $P_T$  maximum,  $T_A$  ambient rated as defined in 1.3. NOTE: No heat sink or forced air cooling on the devices shall be permitted. With approval of the qualifying activity and preparing activity, alternate burn-in criteria (hours, bias conditions,  $T_J$ , and mounting conditions) may be used for JANTX and JANTXV quality levels. A justification demonstrating equivalence is required. In addition, the manufacturing site's burn-in data and performance history will be essential criteria for burn-in modification approval.

\* 4.3.2 Thermal impedance. The thermal impedance measurements shall be performed in accordance with method 3131 of MIL-STD-750 using the guidelines in that method for determining  $I_M$ ,  $I_H$ ,  $t_H$ ,  $t_{SW}$  (and  $V_H$  where appropriate). The thermal impedance limit used in screen 3c and table I, subgroup 2 shall be set statistically by the supplier. See table III, group E, subgroup 4 herein.

\* 4.4 Conformance inspection. Conformance inspection shall be in accordance with MIL-PRF-19500, and as specified herein. If alternate screening is being performed in accordance with MIL-PRF-19500, a sample of screened devices shall be submitted to and pass the requirements of subgroups 1 and 2 of table I herein, inspection only (table E-VIB of MIL-PRF-19500, group B, subgroup 1 is not required to be performed since solderability and resistance to solvents testing is performed in table I 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 E-VIA (JANS) of MIL-PRF-19500 and table E-VIB (small die flow, JAN, JANTX, and JANTXV). Electrical measurements (end-points) and delta requirements shall be in accordance with table I, subgroup 2 and table II herein; delta requirements only apply to subgroups B4 and B5. See table E-VIC of MIL-PRF-19500 and 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 table I, subgroup 2 and table II herein.



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

<u>Subgroup</u>	<u>Method</u>	<u>Condition</u>
B3	2037	Test condition A.
B4	1037	$V_{CB} = 10 - 30$ V dc.
B5	1027	(NOTE: If a failure occurs, resubmission shall be at the test conditions of the original sample). $V_{CB} = 10$ 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 E-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		Not applicable.

4.4.2.2 Group B inspection, table E-VIC (small die flow, 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	1026	Steady-state life: 1,000 hours minimum, $V_{CB} = 10$ V dc, power shall be applied to achieve $T_J = +150^\circ\text{C}$ minimum using a minimum of $P_D = 75$ percent of maximum rated $P_T$ as defined in 1.3. $n = 45$ devices, $c = 0$ . The sample size may be increased and the test time decreased as long as the devices are stressed for a total of 45,000 device hours minimum, and the actual time of test is at least 340 hours.
2	1048	Blocking life, $T_A = +150^\circ\text{C}$ , $V_{CB} = 80$ percent of rated voltage, 48 hours minimum. $n = 45$ devices, $c = 0$ .
3	1032	High temperature life (non-operating), $t = 340$ hours, $T_A = +200^\circ\text{C}$ . $n = 22$ , $c = 0$ .

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

- a. For JAN, JANTX, and JANTXV samples shall be selected randomly from a minimum of three wafers (or from each wafer in the lot) from each wafer lot. For JANS, samples shall be selected from each inspection lot. See MIL-PRF-19500.
- b. Shall be chosen from an inspection lot that has been submitted to and passed table I, subgroup 2, conformance inspection. When the final lead finish is solder or any plating prone to oxidation at high temperature, the samples for life test (subgroups B4 and B5 for JANS, and group B for JAN, JANTX, and JANTXV) may be pulled prior to the application of final lead finish.

4.4.3 Group C inspection. Group C inspection shall be conducted in accordance with the tests and conditions specified for subgroup testing in table E-VII of MIL-PRF-19500, and in 4.4.3.1 (JANS) and 4.4.3.2 (JAN, JANTX, and JANTXV) herein for group C testing. Electrical measurements (end-points) and delta requirements shall be in accordance with table I, subgroup 2 and table II herein; delta requirements only apply to subgroup C6.

4.4.3.1 Group C inspection, table E-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. The sample size may be increased and the test time decreased as long as the devices are stressed for a total of 45,000 device hours minimum, and the actual time of test is at least 340 hours.

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

<u>Subgroup</u>	<u>Method</u>	<u>Condition</u>
C2	2036	Test condition E (not applicable to 2N3737UB).
C5	3131	$R_{\theta JA}$ and $R_{\theta JC}$ only, as applicable (see 1.3 and 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 table I tests herein 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 conducted in accordance with the conditions specified for subgroup testing in table E-IX of MIL-PRF-19500 and as specified in table III herein. Electrical measurements (end-points) shall be in accordance with table I, subgroup 2 herein; delta measurements shall be in accordance with the applicable steps table II.

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 measurement shall be performed in accordance with method 3131 of MIL-STD-750 using the guidelines in that method for determining  $I_M$ ,  $I_H$ , and  $t_H$ . Measurement delay time  $t_{MD} = 70$  ms max.

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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/ 6/</u>	1071	n = 22 devices, c = 0				
Fine leak Gross leak						
Electrical measurements <u>4/</u>		Table I, subgroup 2				
Bond strength <u>3/ 4/</u>	2037	Precondition T <sub>A</sub> = +250°C at t = 24 hrs or T <sub>A</sub> = +300°C at t = 2 hrs n = 11 wires, c = 0				
<u>Subgroup 2</u>						
Thermal impedance <u>7/</u>	3131	See 4.3.2	Z <sub>θJX</sub>			°C/W
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>	40		V dc
Collector to base cutoff current	3036	Bias condition D; V <sub>(BR)CBO</sub> = 75 V dc	I <sub>CBO1</sub>		10	μA dc
Emitter to base cutoff current	3061	Bias condition D; V <sub>(BR)EBO</sub> = 5 V dc	I <sub>EBO1</sub>		10	μA dc
Collector to base cutoff current	3036	Bias condition D; V <sub>CB</sub> = 30 V dc	I <sub>CBO2</sub>		250	nA dc
Collector to emitter cutoff current	3041	Bias condition A; V <sub>CE</sub> = 30 V dc V <sub>EB</sub> = 2.0 V dc	I <sub>CEX1</sub>		200	nA dc
Emitter to base cutoff current	3061	Bias condition D; V <sub>EB</sub> = 4.0 V dc	I <sub>EBO2</sub>		100	nA dc
Forward current transfer ratio	3076	V <sub>CE</sub> = 1.0 V dc; I <sub>C</sub> = 10 mA dc	h <sub>FE1</sub>	35		
Forward current transfer ratio	3076	V <sub>CE</sub> = 1.0 V dc; I <sub>C</sub> = 150 mA dc, pulsed (see 4.5.1)	h <sub>FE2</sub>	40		
Forward current transfer ratio	3076	V <sub>CE</sub> = 1.0 V dc; I <sub>C</sub> = 500 mA dc, pulsed (see 4.5.1)	h <sub>FE3</sub>	40	140	

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	$V_{CE} = 1.5 \text{ V dc}; I_C = 1.0 \text{ A dc}$ , 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
<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		

See footnotes at end of table.

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\* TABLE I. Group A inspection - Continued.

Inspection <u>1/</u>	MIL-STD-750		Symbol	Limit		Unit
	Method	Conditions		Min	Max	
<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 table I, double the sample size of the failed test or sequence of tests.

A failure in table I, subgroup 1 shall not require retest of the entire subgroup. Only the failed test shall be rerun upon submission.

3/ Separate samples may be used.

4/ Not required for JANS devices.

5/ Not required for laser marked devices.

6/ This hermetic seal test is an end-point to temp-cycling in addition to electrical measurements.

7/ This test required for the following end-point measurements only: Group B, subgroups 3, 4, and 5 (JANS); group B, see 4.4.2.2 herein, after each step (JAN, JANTX, and JANTXV); group C, subgroup 2 and 6, group E, subgroup 1.

TABLE II. 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 E-VIA (JANS) of MIL-PRF-19500 are as follows:

a. Subgroup 4, see table II herein, step 3.

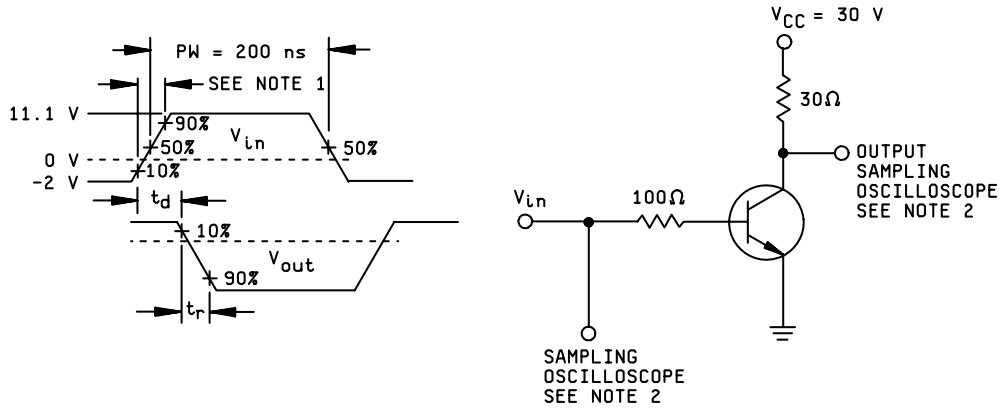
b. Subgroup 5, see table II herein, step 3.

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

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

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

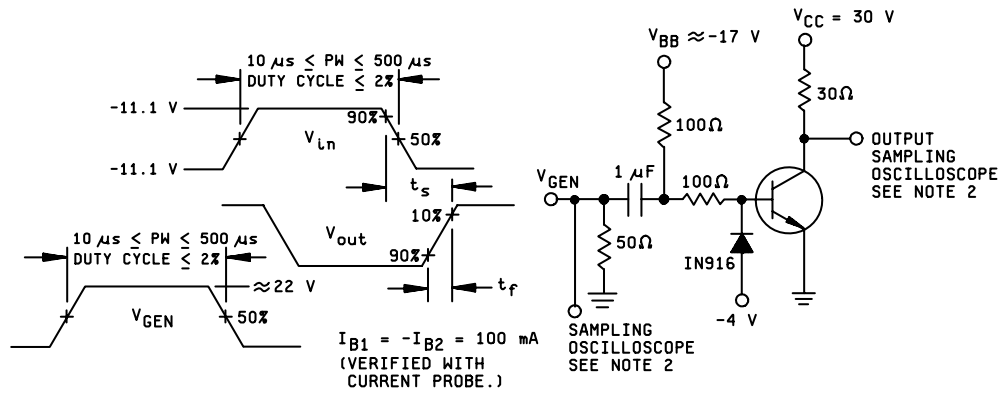
Inspection	MIL-STD-750		Sample plan
	Method	Conditions	
<u>Subgroup 1</u>			45 devices c = 0
Temperature cycling (air to air)	1051	Test condition C, 500 cycles	
Hermetic seal Fine leak Gross leak	1071		
Electrical measurements		See table I, subgroup 2 herein	
<u>Subgroup 2</u>			45 devices c = 0
Intermittent life	1037	$V_{CB} = 10 \text{ V dc}$ , 6,000 cycles. Adjust device current, or power, to achieve a minimum $\Delta T_J$ of $+100^\circ\text{C}$	
Electrical measurements		See table I, subgroup 2 herein	
<u>Subgroup 4</u>			Sample size N/A
Thermal impedance curves		See MIL-PRF-19500, table E-IX, group E, subgroup 4.	
<u>Subgroup 6</u>			3 devices
Electrostatic discharge (ESD)	1020		
<u>Subgroup 8</u>			45 devices c = 0
Reverse stability	1033	Condition B	



NOTES:

1. The rise time ( $t_r$ ) of the applied pulse shall be  $\leq 0.1$  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  $\leq 5$  ns.

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



NOTES:

1. The rise time ( $t_r$ ) of the applied pulse shall be  $\leq 0.1$  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  $\leq 5$  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 packaging of materiel is to be performed by DoD or in-house contractor personnel, these personnel need to contact the responsible packaging activity to ascertain packaging requirements. Packaging requirements are maintained by the Inventory Control Point's packaging activities within the Military Service or Defense Agency, or within the Military Service's system commands. Packaging data retrieval is available from the managing Military Department's or Defense Agency's automated packaging files, CD-ROM products, or by contacting the responsible packaging activity.

## 6. NOTES

\* (This section contains information of a general or explanatory nature that may be helpful, but is not mandatory. The notes specified in MIL-PRF-19500 are applicable to this specification.)

\* 6.1 Intended use. Semiconductors conforming to this specification are intended for original equipment design applications and logistic support of existing equipment.

6.2 Acquisition requirements. Acquisition documents should specify the following:

- a. Title, number, and date of this specification.
- b. Packaging requirements (see 5.1).
- c. Lead finish (see 3.4.1).
- d. Product assurance level and type designator.

6.3 Qualification. With respect to products requiring qualification, awards will be made only for products which are, at the time of award of contract, qualified for inclusion in Qualified Manufacturers List (QML 19500) whether or not such products have actually been so listed by that date. The attention of the contractors is called to these requirements, and manufacturers are urged to arrange to have the products that they propose to offer to the Federal Government tested for qualification in order that they may be eligible to be awarded contracts or orders for the products covered by this specification. Information pertaining to qualification of products may be obtained from Defense Supply Center, Columbus, ATTN: DSCC/VQE, P.O. Box 3990, Columbus, OH 43218-3990 or e-mail [vqe.chief@dla.mil](mailto:vqe.chief@dla.mil).

\* 6.4 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

(Project 5961-2007-071)

Review activities:

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

NOTE: The activities listed above were interested in this document as of the date of this document. Since organizations and responsibilities can change, you should verify the currency of the information above using the ASSIST Online database at <http://assist.daps.dla.mil/> .