

The documentation and process conversion measures necessary to comply with this revision shall be completed by 8 October 2002.

INCH-POUND

MIL-PRF-19500/368F
8 July 2002
SUPERSEDING
MIL-PRF-19500/368E
24 August 2001

PERFORMANCE SPECIFICATION

SEMICONDUCTOR DEVICE, TRANSISTOR, NPN, SILICON, LOW-POWER
TYPES: 2N3439, 2N3439L, 2N3439UA, 2N3440, 2N3440L AND 2N3440UA,
JAN, JANTX, JANTXV, JANS, JANHC, AND JANKC

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

1. SCOPE

1.1 Scope. This specification covers the performance requirements for NPN, silicon, low-power, high voltage transistors. Four levels of product assurance are provided for each encapsulated device types as specified in MIL-PRF-19500, and two levels of product assurance for each unencapsulated device type die.

* 1.2 Physical dimensions. See figure 1 (similar to TO-5 and TO-39), figure 2 (JANHCA and JANKCA (A versions)), figure 3 (JANHCB and JANKCB (B versions)), and figure 4 (2N3439UA and 2N3440UA surface mount versions).

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

Types	P_T (1) $T_A = +25^\circ\text{C}$	P_T (2) $T_C = +25^\circ\text{C}$	V_{CBO}	V_{EBO}	V_{CEO}	I_C	T_{STG} and T_{OP}	$R_{\theta JA}$
	<u>W</u>	<u>W</u>	<u>V dc</u>	<u>V dc</u>	<u>V dc</u>	<u>A dc</u>	<u>°C</u>	<u>°C/W</u>
2N3439, 2N3439L, 2N3439UA	0.8	5.0	450	7	350	1.0	-65 to +200	325
2N3440, 2N3440L 2N3440UA	0.8	5.0	300	7	250	1.0	-65 to +200	325

(1) Derate linearly 5.7 mW/°C for $T_A > +60^\circ\text{C}$.

(2) Derate linearly 28.6 mW/°C for $T_C > +25^\circ\text{C}$.

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.

1.4 Primary electrical characteristics.

	h_{FE2} (1) $V_{CE} = 10 \text{ V dc}$ $I_C = 2 \text{ mA dc}$	h_{FE1} (1) $V_{CE} = 10 \text{ V dc}$ $I_C = 20 \text{ mA dc}$	$ h_{fe} $ $V_{CE} = 10 \text{ V dc}$ $I_C = 10 \text{ mA dc}$ $f = 5 \text{ MHz}$	C_{obo} $V_{CB} = 10 \text{ V dc}$ $I_E = 0$ $100 \text{ kHz} \leq f \leq 1 \text{ MHz}$	$V_{BE(sat)}$ (1) $I_C = 50 \text{ mA dc}$ $I_B = 4 \text{ mA dc}$	$V_{CE(sat)}$ $I_C = 50 \text{ mA dc}$ $I_B = 4 \text{ mA dc}$
Min Max	30	40 160	3 15	<u>pF</u> 10	<u>V dc</u> 1.3	<u>V dc</u> 0.5

(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.

HANDBOOK

DEPARTMENT OF DEFENSE

MIL-HDBK-6100 - List of Case Outlines and Dimensions for Discrete 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.

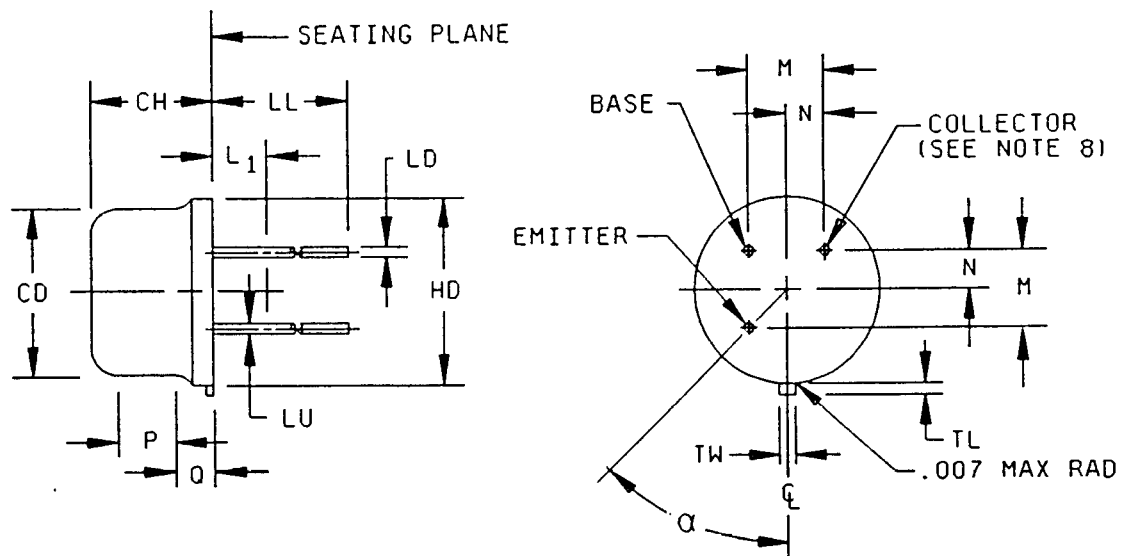


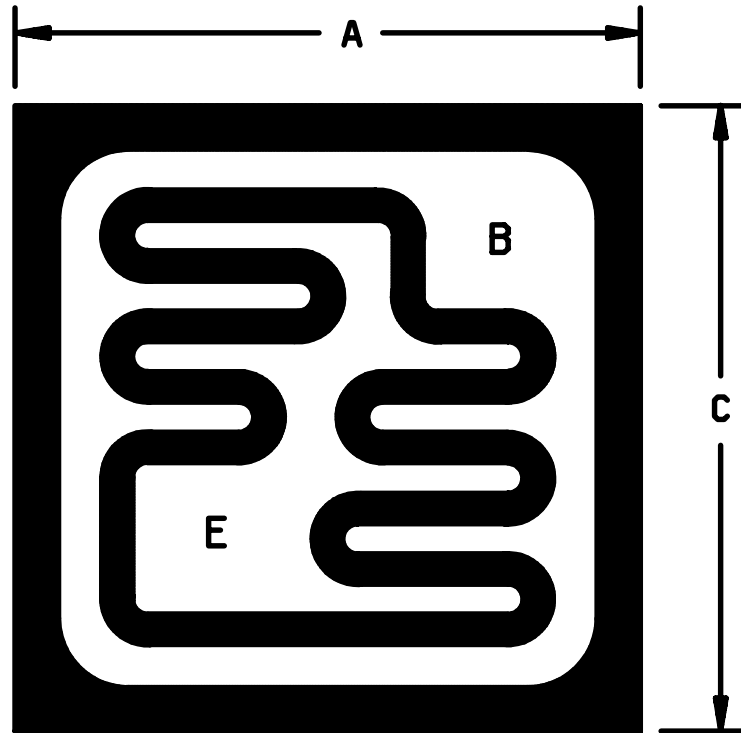
FIGURE 1. Physical dimensions (similar to TO-5 and TO-39).

Symbol	Dimensions				Notes
	Inches		Millimeters		
	Min	Max	Min	Max	
CD	.305	.335	7.75	8.51	
CH	.240	.260	6.10	6.60	
HD	.335	.370	8.51	9.40	
LD	.016	.021	0.41	0.53	3, 10
LL	See notes 10, 12, and 13				
L1		.050		1.27	11
LU	.016	.019	0.41	0.48	4, 10
M	.1414 Nom		3.591 Nom		7
N	.0707 Nom		1.796 Nom		7
P	.100		2.54		5
Q					6
TL	.029	.045	0.74	1.14	9
TW	.028	.034	0.71	0.86	

NOTES:

1. Dimensions are in inches.
2. Metric equivalents are given for general information only.
3. Measured in the zone beyond .250 inch (6.35 mm) from the seating plane.
4. Measured in the zone .50 inch (1.27 mm) from the seating plane.
5. Variations on dimension CD in this zone shall not exceed .010 inch (0.25 mm).
6. Outline in this zone is not controlled.
7. When measured in a gauging plane .054 +.001, -.000 inch (1.37 +0.03, - 0.00 mm) below the seating plane of the transistor, maximum diameter leads shall be within .007 inch (0.18 mm) of their true location relative to a maximum width tab. Smaller diameter leads shall fall within the outline of the maximum diameter lead tolerance.
8. The collector shall be electrically connected to the case.
9. Measured from the maximum diameter of the actual device.
10. All three leads (see 3.4.1).
11. Diameter of leads in this zone is not controlled.
12. For transistor types 2N3439 and 2N3440, L = .500 inch (12.70 mm) minimum, and .750 inch (19.05 mm) maximum.
13. For transistor types 2N3439L and 2N3440L, L = 1.500 inches (38.10 mm) minimum, and 1.750 inches (44.45 mm) maximum.

FIGURE 1. Physical dimensions - Continued.

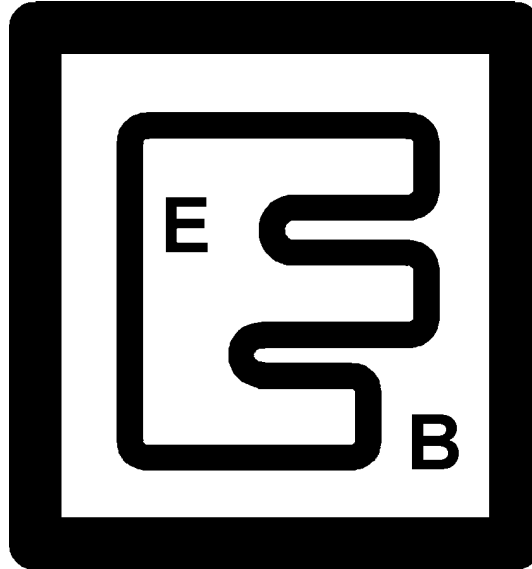


Ltr	Inches		Millimeters	
	Min	Max	Min	Max
A	.038	.044	0.97	1.12
C	.038	.044	0.97	1.12

NOTES:

1. Dimensions are in inches.
2. Metric equivalents are given for general information only.
3. The physical characteristics of the die thickness are, .006 inch (0.15 mm) to .012 inch (0.30 mm).
Metallization, top: Al = 17,500 Å minimum, 20,000 Å nominal.
Back: Au = 2,500 Å minimum, 3,000 Å nominal.
Bonding pad: B = .004 inch (0.10 mm) by .005 inch (0.13 mm).
E = .004 inch (0.10 mm) by .005 inch (0.13 mm).
4. Backside is collector.
5. Requirements in accordance with MIL-PRF-19500 are performed in a TO-5 package.

* FIGURE 2. Physical dimensions JANHCA and JANKCA (die) A versions.

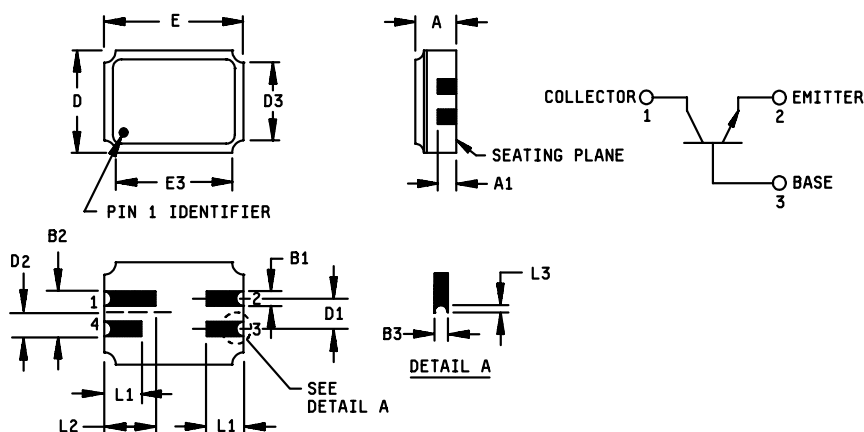


1. Chip size..... .040 x .040 inch \pm .002 inch (1.02 mm x 1.02 mm \pm 0.05 mm).
2. Chip thickness..... .010 \pm .0015 inch nominal (0.254 mm \pm 0.038 mm).
3. Top metal..... Aluminum 30,000Å minimum, 33,000Å nominal.
4. Back metal..... A. Al/Ti/Ni/Ag 12kÅ/3kÅ/7kÅ/7kÅ minimum, 15kÅ/ 5kÅ/10kÅ/10kÅ nominal.
B. Gold 2.500Å minimum, 3000Å nominal.
5. Backside..... Collector.
6. Bonding pad..... B = .005 x .008 inch (0.127 mm x 0.203 mm).
E = .010 x .007 inch (0.254 mm x 0.178 mm).

NOTES:

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

FIGURE 3. Physical dimensions JANHCB and JANKCB (die) B versions.



Symbol	Dimensions				Note
	Inches		Millimeters		
	Min	Max	Min	Max	
A	.061	.075	1.55	1.90	3
A1	.029	.041	0.74	1.04	
B1	.022	.028	0.56	0.71	
B2	.075 REF		1.91 REF		
B3	.006	.022	0.15	0.56	5
D	.145	.155	3.68	3.93	
D1	.045	.055	1.14	1.39	
D2	.0375 BSC		.952 BSC		
D3		.155		3.93	
E	.215	.225	5.46	5.71	
E3		.225		5.71	
L1	.032	.048	0.81	1.22	
L2	.072	.088	1.83	2.23	
L3	.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 4. Physical dimensions, surface mount (2N3439UA, 2N3440UA) version.

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. The interface and physical dimensions shall be as specified in MIL-PRF-19500, MIL-HDBK-6100 and on figure 1 (similar to TO- 5 and TO-39), figure 2 (JANHCA and JANKCA, (A versions)), figure 3 (JANHCB and JANKCB (B versions)), and figure 4 (2N3439UA and 2N3440UA surface mount versions).

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 herein.

3.6 Electrical test requirements. The electrical test requirements shall be the subgroups specified in table I herein.

3.7 Marking. Marking shall be in accordance with MIL-PRF-19500. At the option of the manufacturer, marking may be omitted from the body, but shall be retained on the initial container.

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

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

Screen (see table IV of MIL-PRF-19500)	Measurement	
	JANS level	JANTX and JANTXV levels
3c	Thermal impedance (see 4.3.3)	Thermal impedance (see 4.3.3)
7	Hermetic seal (optional)	(1)
9	I_{CBO1} and h_{FE1}	Not applicable
10	48 hours minimum	48 hours minimum
11	I_{CBO1} ; h_{FE1} ; ΔI_{CBO1} = 100 percent of initial value or 0.5 μ A dc, whichever is greater; Δh_{FE1} = \pm 15 percent of initial value.	I_{CBO1} and h_{FE1}
12	See 4.3.2, 240 hours minimum	See 4.3.2, 80 hours minimum
13	Subgroups 2 and 3 of table I herein; ΔI_{CBO1} = 100 percent of initial value or 200 nA dc, whichever is greater; Δh_{FE1} = \pm 15 percent of initial value.	Subgroup 2 of table I herein; ΔI_{CBO1} = 100 percent of initial value or 200 nA dc, whichever is greater; Δh_{FE1} = \pm 15 percent of initial value.
14	Optional	Optional (1)

(1) Hermetic seal test shall be performed in either screen 7 or screen 14.

4.3.1 Screening (JANH C and JANKC). Screening of JANHC and JANKC die shall be in accordance with MIL-PRF-19500. As a minimum, die shall be 100 percent probed to ensure the assembled chips will meet the requirements of table I, group A, subgroup 2.

4.3.2 Power burn-in conditions. Power burn-in conditions are as follows: $V_{CB} = 10 - 30$ V dc. Power shall be applied to achieve $T_J = +135^\circ\text{C}$ minimum using a minimum $P_D = 75$ percent of P_T maximum rated 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 method 3131 MIL-STD-750. Read and record data ($Z_{\theta JX}$) shall be supplied to the qualifying activity on one lot (random sample of 500 devices minimum) prior to shipment. The following conditions shall apply.

- I_H forward heating current ----- 250 mA.
- t_H heating time ----- 10 ms.
- I_M measurement current ----- 10 mA.
- t_{MD} measurement delay time ----- 30 - 60 μ s.
- V_{CE} collector-emitter voltage ----- 10 V dc minimum.

The maximum limit for $Z_{\theta JX}$ under these test conditions are $Z_{\theta JX} (\text{max}) = 20^\circ\text{C/W}$.

4.4 Conformance inspection. Conformance inspection shall be in accordance with MIL-PRF-19500 and as specified herein. If alternate screening is being performed in accordance with 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.

4.4.2 Group B inspection. Group B inspection shall be conducted in accordance with the conditions specified for subgroup testing in VIa (JANS) of 4.4.2.1 herein. Electrical measurements (end-points) requirements shall be in accordance with table I, group A, subgroup 2 herein. Delta requirements shall be in accordance with 4.5.3 herein. See 4.4.2.2 herein for JAN, JANTX, and JANTXV group B testing. Electrical measurements (end-points) requirements shall be in accordance with table I, group A, subgroup 2 herein. Delta requirements shall be in accordance with 4.5.3 herein.

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

<u>Subgroup</u>	<u>Method</u>	<u>Condition</u>
B4	1037	$V_{CB} = 10 \text{ V dc}$, 2,000 cycles.
B5	1027	$V_{CB} = 10\text{-}30 \text{ V dc}$; $P_D \geq 100$ 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 hrs min, 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 hrs min., sample size = 45, $c = 0$; adjust T_A or P_D to achieve $T_J = +225^\circ\text{C}$ minimum.

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, $V_{CB} = 10 - 30$ 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 hours for each die design. Samples shall be selected from a wafer lot every twelve months of wafer production, however, 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 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, 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 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.

<u>Subgroup</u>	<u>Method</u>	<u>Condition</u>
C2	2036	Test condition E, except the UA package.
C6	1026	1,000 hours at $V_{CB} = 10$ V dc; power shall be applied to achieve $T_J = +150^\circ\text{C}$ minimum and 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.
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 lot containing the intended package type and lead finish procured to the same specification which is submitted to and passes group A tests for conformance inspection. Testing of a subgroup using a single device type enclosed in the intended package type shall be considered as complying with the requirements for that subgroup.

* 4.4.4 Group E inspection. Group E inspection shall be conducted in accordance with the conditions specified for subgroup testing in appendix E, table IX of MIL-PRF-19500 and as specified in table III 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 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 Thermal resistance. Thermal resistance measurements shall be conducted in accordance with method 3131 of MIL-STD-750. The following conditions shall apply:

- a. Collector current magnitude during power application shall be 150 mA dc for $R_{\theta JC}$.
- b. Collector emitter voltage magnitude shall be 10 V dc.
- c. Reference temperature measuring point shall be the case.
- d. Reference temperature measuring point shall be $+25^{\circ}\text{C} \leq T_R \leq +35^{\circ}\text{C}$. The chosen reference temperature shall be recorded before the test is started.
- e. Mounting arrangement shall be with heat sink to case for $R_{\theta JC}$.

Maximum limit shall be $R_{\theta JC} = 35^{\circ}\text{C/W}$.

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

Step	Inspection	MIL-STD-750		Symbol	Unit
		Method	Conditions		
1	Collector-base cutoff current	3036	Bias condition D, $V_{CB} = 360$ V dc for 2N3439, 2N3439L, 2N3439UA $V_{CB} = 250$ V dc for 2N3440, 2N3440L, 2N3440UA	ΔI_{CB01} (1)	100 percent of initial value or 200 nA dc, whichever is greater.
2	Forward current transfer ratio	3076	$V_{CE} = 10$ V dc; $I_C = 20$ mA dc; pulsed see 4.5.1	Δh_{FE1} (1)	± 15 percent change from initial reading.

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

MIL-PRF-19500/368F

* TABLE I. Group A inspection.

Inspection <u>1/</u>	MIL-STD-750		Symbol	Limit		Unit
		Conditions		Min	Max	
<u>Subgroup 1 2/</u>						
Visual and mechanical <u>3/</u> examination	2071	n = 45 devices, c = 0				
Solderability <u>3/ 4/</u>	2026	n = 15 leads, c = 0				
Resistance to <u>3/ 4/ 5/</u> solvent	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°C at t = 24 hrs or T _A = +300°C at t = 2 hrs, n = 11 wires, c = 0				
Decap internal visual (design verification) <u>4/</u>	2075	n = 4 devices, c = 0				
<u>Subgroup 2</u>						
Emitter to base cutoff current	3061	Bias condition D, V _{EB} = 7 V dc	I _{EBO1}		10	μA dc
Collector to emitter cutoff	3041	Bias condition D	I _{CEO}		2	μA dc
2N3439, 2N3439L, 2N3439UA 2N3440, 2N3440L, 2N3440UA		V _{CE} = 300 V dc V _{CE} = 200 V dc				
Collector to emitter cutoff current	3041	Bias condition A, V _{BE} = -1.5 V dc	I _{CEX}		5	μA dc
2N3439, 2N3439L, 2N3439UA 2N3440, 2N3440L, 2N3440UA		V _{CE} = 450 V dc V _{CE} = 300 V dc				
Collector to base cutoff current	3036	Bias condition D	I _{CBO1}		2	μA dc
2N3439, 2N3439L, 2N3439UA 2N3440, 2N3440L, 2N3440UA		V _{CB} = 360 V dc V _{CB} = 250 V 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	
<u>Subgroup 2</u> - Continued						
Collector to base cutoff current 2N3439, 2N3439L, 2N3439UA 2N3440, 2N3440L, 2N3440UA	3036	Bias condition D $V_{CB} = 450 \text{ V dc}$ $V_{CB} = 300 \text{ V dc}$	I_{CB02}		5	$\mu\text{A dc}$
Base emitter voltage (nonsaturated)	3066	Test condition A, pulsed (see 4.5.1), $I_C = 50 \text{ mA dc}$, $I_B = 4 \text{ mA dc}$	$V_{BE(sat)}$		1.3	V dc
Collector to emitter voltage (saturated)	3071	Pulsed (see 4.5.1), $I_C = 50 \text{ mA dc}$, $I_B = 4 \text{ mA dc}$	$V_{CE(sat)}$		0.5	V dc
Forward-current transfer ratio	3076	Pulsed (see 4.5.1), $V_{CE} = 10 \text{ V dc}$, $I_C = 20 \text{ mA}$	h_{FE1}	40	160	
Forward-current transfer ratio	3076	Pulsed (see 4.5.1), $V_{CE} = 10 \text{ V dc}$, $I_C = 2 \text{ mA}$	h_{FE2}	30		
Forward-current transfer ratio	3076	Pulsed (see 4.5.1), $V_{CE} = 10 \text{ V dc}$, $I_C = 0.2 \text{ mA}$	h_{FE3}	10		
<u>Subgroup 3</u>						
High temperature operation:		$T_A = +150^{\circ}\text{C}$				
Collector to emitter cutoff current 2N3439, 2N3439L, 2N3439UA 2N3440, 2N3440L, 2N3440UA	3036	Bias condition D $V_{CB} = 360 \text{ V dc}$ $V_{CB} = 250 \text{ V dc}$	I_{CB03}		100	$\mu\text{A dc}$
Low temperature operation:		$T_A = -55^{\circ}\text{C}$				
Forward-current transfer ratio	3076	$V_{CE} = 10 \text{ V dc}$, $I_C = 20 \text{ mA dc}$, pulsed (see 4.5.1)	h_{FE4}	15		
<u>Subgroup 4</u>						
Pulse response:	3251	Test condition A				
Turn-on time		$V_{CC} = 200 \text{ V dc}$, $I_C = 20 \text{ mA dc}$, $I_{B1} = 2 \text{ mA dc}$, see figure 5	t_{on}		1	μs
Turn-off time		$V_{CC} = 200 \text{ V dc}$, $I_C = 20 \text{ mA dc}$, $I_{B1} = -I_{B2} = 2 \text{ mA dc}$, see figure 5	t_{off}		10	μs

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 4</u> - Continued						
Magnitude of common- emitter small-signal short-circuit forward-current transfer ratio	3306	V _{CE} = 10 V dc, I _C = 10 mA dc, f = 5 MHz	h _{fe}	3	15	pF
Open capacitance input open circuited	3236	V _{CB} = 10 V dc, I _E = 0, 100 kHz ≤ f ≤ 1 MH	C _{obo}		10	
Small-signal short- circuit forward-current transfer ratio	3206	V _{CE} = 10 V dc, I _C = 5 mA, f = 1 kHz	h _{fe}	25		
Input capacitance (output open circuited)	3240	V _{CB} = 5 V dc, I _E = 0, 100 kHz ≤ f ≤ 1 MHz	C _{ibo}		75	
<u>Subgroup 5</u>						
Safe operating area (continuous dc)	3051	(See figure 6) T _C = +25°C, 1 cycle, t = 1.0 s.				V dc
<u>Test 1</u>		V _{CE} = 5 V dc, I _C = 1 A dc				
<u>Test 2</u>						
Only 2N3439, 2N3439L, 2N3439UA		V _{CE} = 350 V dc, I _C = 14 mA dc				
<u>Test 3</u>						
Only 2N3440, 2N3440L, 2N3440UA		V _{CE} = 250 V dc, I _C = 20 mA dc				
Electrical measurements		See table I, subgroup 2 and 4.5.3 herein.				
Breakdown voltage, collector to emitter	3011	I _C = 10 mA, R _{BB1} = 470 ohms V _{BB1} = 6 V, L = 25 mH minimum f = 30 to 60 Hz	V _{BR(CEO)}			
2N3439, 2N3439L, 2N3439UA 2N3440, 2N3440L, 2N3440UA				350 250		

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.

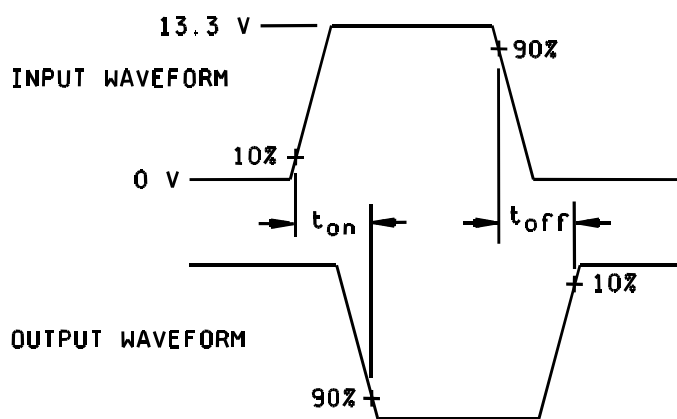
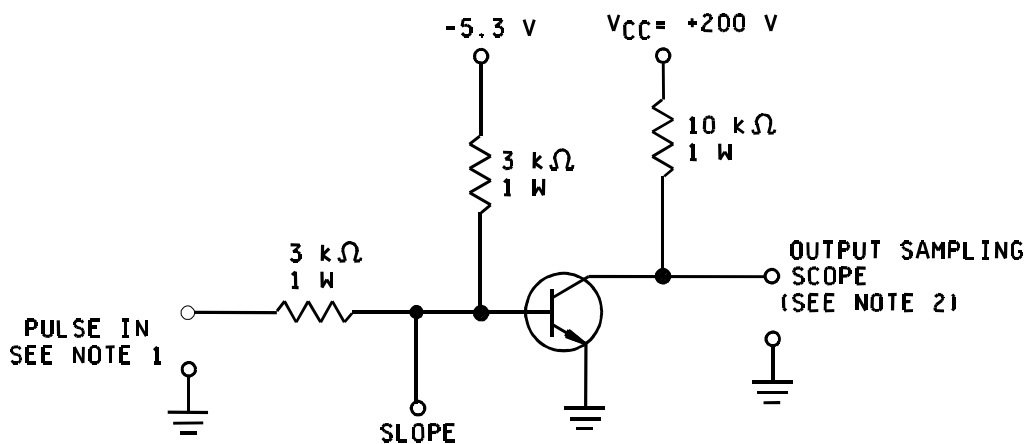
3/ Separate samples may be used.

4/ Not required for JANS.

5/ Not required for laser marked devices.

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

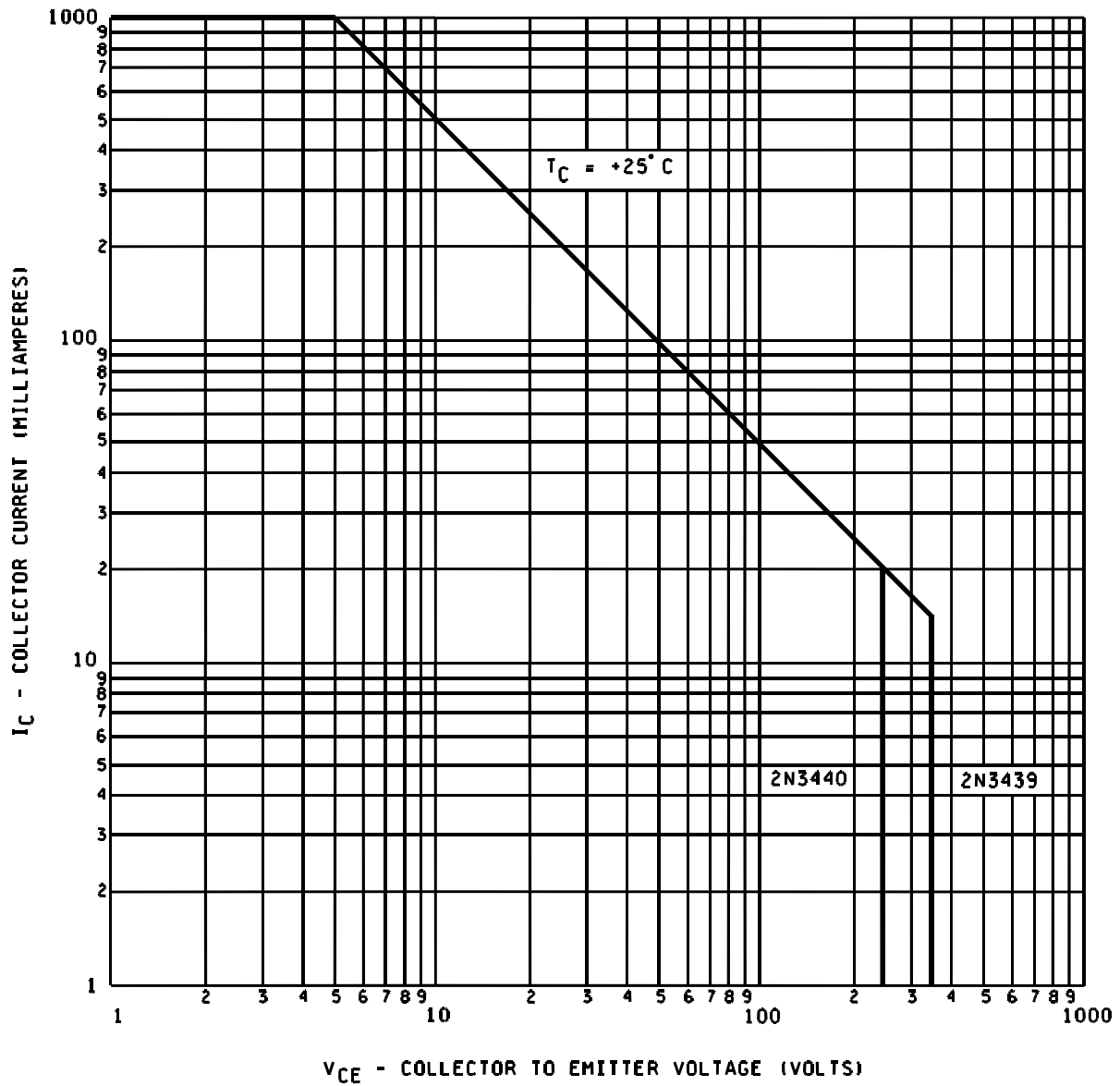
Inspection	MIL-STD-750		Qualification
	Method	Conditions	
<u>Subgroup 1</u>			45 devices c = 0
Temperature cycling (air to air)	1051	Test condition C, 500 cycles	
Hermetic seal	1071		
Fine leak			
Gross leak			
Electrical measurements		See table I, group A, subgroup 2.	
<u>Subgroup 2</u>			45 devices c = 0
Intermittent life	1037	Intermittent operation life: $V_{CB} \geq 10$ V dc, 6000 cycles	
Electrical measurements		See table I, group A, subgroup 2.	
<u>Subgroups 3, 4, 5, 6, and 7</u>			
Not applicable			
<u>Subgroup 8</u>			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) and fall time (t_f) of applied pulse shall be ≤ 20 ns, duty cycle ≤ 2 percent, generator source impedance shall be 50 ohms, pulse width = 20 μ s.
2. Output sampling oscilloscope: $Z_{IN} \geq 100$ k Ω , $C_{IN} \leq 50$ pF, and rise time ≤ 1.0 μ s.

FIGURE 5. Pulse response test circuit.



NOTE: Also applies to the corresponding "L" and "UA" suffix devices.

* FIGURE 6. Maximum safe operating graph (continuous dc).

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 2.2.1).
- c. Packaging requirements (see 5.1).
- d. Lead finish (see 3.4.1).
- e. Type designation and quality assurance level.

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 Manufacturer's 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 JANHCA2N3439) will be identified on the QML.

Die ordering information		
PIN	Manufacturer	
	33178	43611
2N3439	JANHCA2N3439 JANKCA2N3439	JANHCB2N3439 JANKCB2N3439
2N3440	JANHCA2N3440 JANKCA2N3440	JANHCB2N3440 JANKCB2N3440

* 6.5 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:
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 Navy - EC
 Air Force - 11
 DLA - CC

Preparing activity:
 DLA - CC
 (Project 5961-2607)

Review activities:
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I RECOMMEND A CHANGE:

1. DOCUMENT NUMBER
MIL-PRF-19500/368F

2. DOCUMENT DATE
8 July 2002

3. **DOCUMENT TITLE** SEMICONDUCTOR DEVICE, TRANSISTOR, NPN, SILICON, LOW-POWER TYPES: 2N3439, 2N3439L, 2N3439UA, 2N3440, 2N3440L, AND 2N3440UA, JAN, JANTX, JANTXV, JANS, JANHC, AND JANKC

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

5. **REASON FOR RECOMMENDATION**

6. **SUBMITTER**

a. NAME (Last, First, Middle initial)

b. ORGANIZATION

c. ADDRESS (Include Zip Code)

d. TELEPHONE (Include Area Code)
COMMERCIAL
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7. DATE SUBMITTED

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