

The documentation and process conversion measures necessary to comply with this document shall be completed by 2 July, 2002.

INCH-POUND

MIL-PRF-19500/350G
 2 April 2002
 SUPERSEDING
 MIL-PRF-19500/350F
 18 August 2000

PERFORMANCE SPECIFICATION

SEMICONDUCTOR DEVICE, TRANSISTOR, PNP, SILICON, LOW-POWER
 TYPES: 2N3867, 2N3867S, 2N3868, AND 2N3868S
 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 PNP, silicon, switching transistor. Four levels of product assurance are provided for each encapsulated device type and two levels of product assurance are provided for each unencapsulated device type as specified in MIL-PRF-19500.

1.2 Physical dimensions. See figure 1 (TO- 5, TO-39) for encapsulated devices, figures 2 and 3 for unencapsulated devices.

* 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_{CEO}	V_{EBO}	I_C	T_{STG} and T_{OP}	$R_{\theta JC}$
	<u>W</u>	<u>W</u>	<u>V dc</u> min	<u>V dc</u> min	<u>V dc</u>	<u>A dc</u>	<u>°C</u>	<u>°C/W</u>
2N3867, S	1.0	10	40	40	4.0	3.0	-65 to +200	17.5
2N3868, S	1.0	10	60	60	4.0	3.0	-65 to +200	17.5

1/ Derate linearly 5.71 mW/°C for $T_A > +25^\circ\text{C}$.

2/ Derate linearly 5.71 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 _{FE}				C _{obo} I _E = 0 V _{CB} = 10 V dc 100 kHz ≤ f ≤ 1 MHz	h _{fe} I _C = 100 mA dc V _{CE} = 5 V dc f = 20 MHz	I _C = 1.5 A dc I _B = 150 mA dc		V _{CE(sat)} ² I _C = 1.5 A dc I _B = 150 mA dc
	I _C = 1.5 A dc V _{CE} = 2 V dc		I _C = 3.0 A dc V _{CE} = 5 V dc				t _{on}	t _{off}	
	2N3867 2N3867S	2N3868 2N3868S	2N3867 2N3867S	2N3868 2N3968S	pF		ns max	ns max	V dc
Min	40	30	20	20		3			
Max	200	150			120	12	100	600	0.75

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.

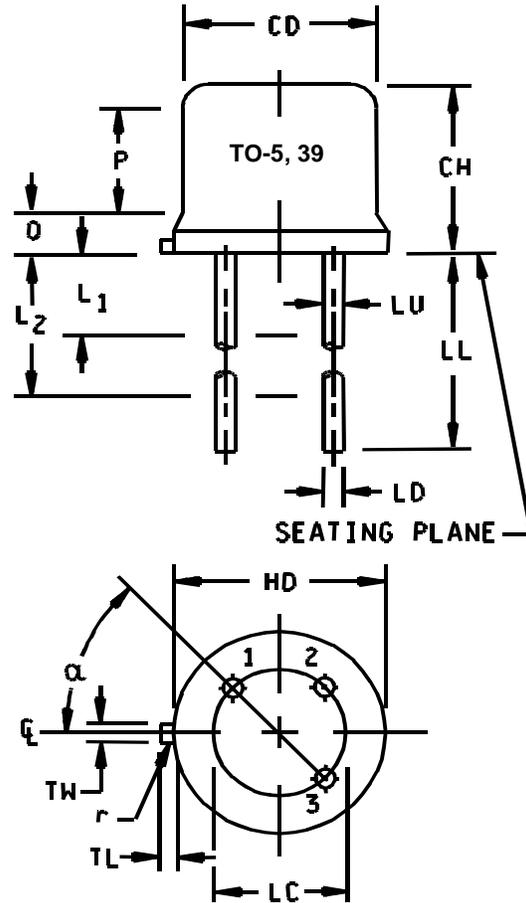
STANDARD

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, Building 4D (DPM-DODSSP), 700 Robbins Avenue, Philadelphia, PA 19111-5094.)

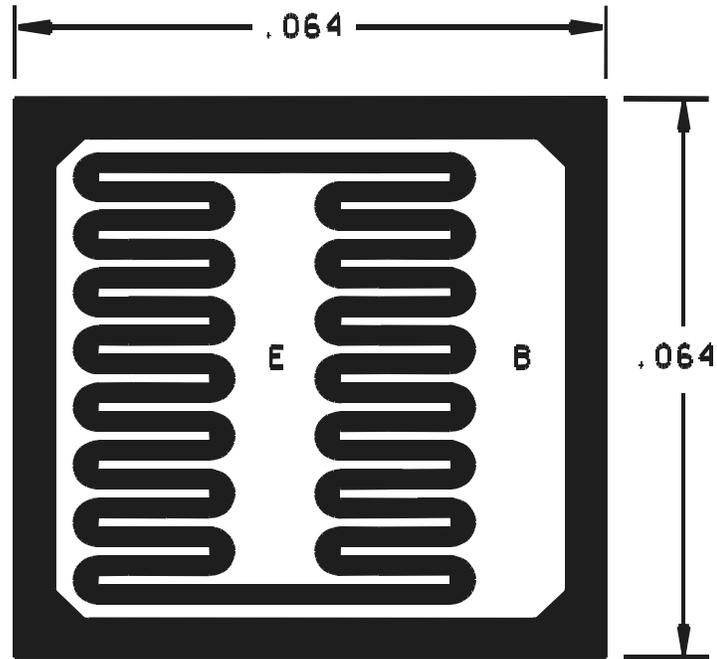
Symbol	Dimensions				Note
	Inches		Millimeters		
	Min	Max	Min	Max	
CD	.305	.335	7.75	8.51	6
CH	.240	.260	6.12	6.60	
HD	.335	.370	8.51	9.40	
LC	.200 TP		5.08 TP		7
LD	.016	.019	0.41	0.48	8,9
LL	See note 14				
LU	.016	.019	0.41	0.48	8,9
L1		.050		1.27	8,9
L2	.250		6.35		8,9
P	.100		2.54		7
Q		.030		0.76	5
TL	.029	.045	0.74	1.14	3,4
TW	.028	.034	0.71	0.86	3
r		.010		0.25	10
α	45° TP		45° TP		7
	1, 2, 10, 12, 13, 14				



NOTES:

1. Dimensions are in inches.
2. Metric equivalents are given for general information only.
3. Beyond r (radius) maximum, TW shall be held for a minimum length of .011 (0.28 mm).
4. Dimension TL measured from maximum HD.
5. Body contour optional within zone defined by HD, CD, and Q.
6. CD shall not vary more than .010 inch (0.25 mm) in zone P. This zone is controlled for automatic handling.
7. Leads at gauge plane .054 +.001 -.000 inch (1.37 +0.03 -0.00 mm) below seating plane shall be within .007 inch (0.18 mm) radius of true position (TP) at maximum material condition (MMC) relative to tab at MMC. The device may be measured by direct methods or by gauging procedure.
8. Dimension LU applies between L₁ and L₂. Dimension LD applies between L₂ and LL minimum. Diameter is uncontrolled in and beyond LL minimum.
9. All three leads.
10. The collector shall be internally connected to the case.
11. Dimension r (radius) applies to both inside corners of tab.
12. In accordance with ANSI Y14.5M, diameters are equivalent to ϕ x symbology.
13. Lead 1 = emitter, lead 2 = base, lead 3 = collector.
14. For non-S-suffix devices (TO-5), dimension LL = 1.5 inches (38.10 mm) min. and 1.75 inches (44.45 mm) max. For S-suffix types (TO-39), dimension LL = .5 inches (12.70 mm) min. and .750 inches (19.05 mm) max.

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

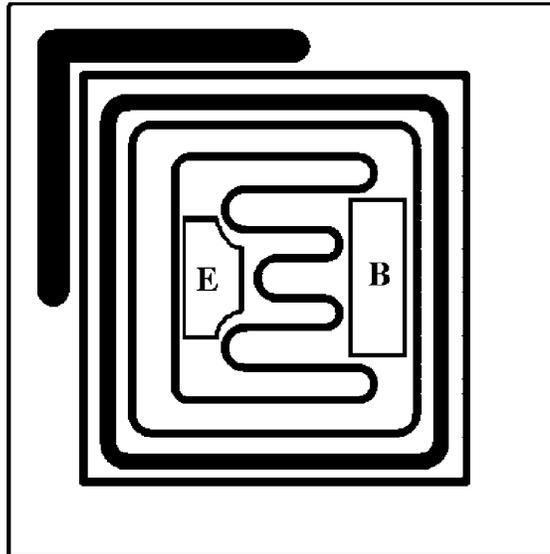


A version

NOTES:

1. Dimensions are in inches.
2. Metric equivalents are given for general information only.
3. Unless otherwise specified, tolerance is $\pm .005$ inch (0.13 mm).
4. The physical characteristics of the die are:
 - Thickness: .008 inch (0.20 mm) minimum, .012 inch (0.30 mm) maximum.
 - Top metal: Aluminum 25,000 Å nominal.
 - Back metal: Gold 2,500 Å minimum, 3,000 Å nominal.
 - Back side: Collector; Bonding pad: B = .045 inch (1.14 mm) x .008 inch (0.20 mm).
E = .039 inch (0.99 mm) x .008 inch (0.20 mm).

FIGURE 2. JANHCA and JANKCA die dimensions.



B Version

1. Chip size.....040 x .040 inch \pm .001 inch
2. Chip thickness.....010 \pm .0015 inch
3. Top metal.....Aluminum 15,000Å minimum, 18,000Å nominal
4. Back metal.....A. Al/Ti/Ni/Ag 12kÅ/3kÅ/7kÅ/7kÅ min., 15kÅ/5kÅ/10kÅ/10kÅ nom.
B. Gold 2,500Å minimum, 3,000Å nominal
C. Eutectic Mount - No Gold
5. Backside.....Collector
6. Bonding pad.....B = .006 x .008 inch, E = .006 x .004 inch

FIGURE 3. JANHCB and JANKCB die dimensions.

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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. The interface and physical dimensions shall be as specified in MIL-PRF-19500 and on figures 1, 2 and 3 herein.

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

3.5 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.

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.

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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.

* 4.2.2 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, the tests specified in table II herein it shall be performed by the first inspection lot processed to this revision to maintain qualification.

* 4.3 Screening (JANS, JANTXV, and JANTX levels only). Screening shall be in accordance with MIL-PRF-19500 (table IV) 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.
7	Hermetic seal (optional)	(1)
9	I_{CBO2} and h_{FE4}	Not applicable
10	24 hours minimum	24 hours minimum
11	I_{CEX1} ; h_{FE2} ; ΔI_{CEX1} 100 percent of initial value or 200 nA dc, whichever is greater; $\Delta h_{FE2} = \pm 15$ percent of initial value.	I_{CEX1} ; h_{FE2}
12	See 4.3.2 240 hours minimum	See 4.3.2 80 hours minimum
13	Subgroup 2 and 3 of table I herein; ΔI_{CEX1} 100 percent of initial value or 200 nA dc, whichever is greater; $\Delta h_{FE2} = \pm 15$ percent of initial value.	Subgroup 2 of table I herein; ΔI_{CEX1} 100 percent of initial value or 200 nA dc, whichever is greater; $\Delta h_{FE2} = \pm 15$ percent of initial value.

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

* 4.3.1. Screening (JANHC and JANKC). Screening of JANHC and JANKC die shall be in accordance with MIL-PRF-19500, "Discrete Semiconductor Die/Chip Lot Acceptance". Burn-in duration for the JANKC level follows JANS requirements; the JANHC follows JANTX requirements.

4.3.2. Power burn-in conditions. Power burn-in conditions are as follows: $V_{CB} = 10 - 30$ V dc, $T_A =$ room ambient as defined in 4.5 of MIL-STD-750. Power shall be applied to the device to achieve a junction temperature, $T_J = +135^\circ$ C minimum and a minimum power dissipation = 75 percent of max P_T as defined in 1.3.

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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) and 4.4.2.1 herein. Electrical measurements (end-points) and delta requirements shall be in accordance with group A, subgroup 2 and table III herein. See 4.4.2.2 for JAN, JANTX, and JANTXV group B testing. Electrical measurements (end-points) and delta requirements 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, appendix E, 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	(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 minimum, sample size = 45, $c = 0$; adjust T_A or P_D to achieve $T_J = +225^\circ\text{C}$ minimum.
	B6	3131	$R_{\theta JC} = 17.5^\circ\text{C/W}$, see 4.5.2.

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, $V_{CB} = 10 - 30 \text{ V dc}$. $n = 45$, $C = 0$. Power shall be applied to the device to achieve $T_J \geq +150^\circ\text{C}$ and power dissipation of $P_D \geq 75$ percent of the rated P_T (see 1.3).
	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. Group B, step 2 shall not be required more than once for any single wafer lot. $n = 45$, $c = 0$.
	3	1032	High-temperature life (non-operating), $T_A = +200^\circ\text{C}$. $n = 22$, $c = 0$, $t = 340$ hours.

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

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

4.4.3 Group C inspection. Group C inspection shall be conducted in accordance with the conditions specified for subgroup testing in table VII of MIL-PRF-19500, and in 4.4.3.1 (JANS) and 4.4.3.2 (JAN, JANTX, and JANTXV) herein for group C testing. Electrical measurements (end-points) and delta requirements shall be in accordance with group A, subgroup 2 and table III herein.

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

<u>Subgroup</u>	<u>Method</u>	<u>Condition</u>
C2	2036	Test condition E.
C6	1026	1,000 hours at $V_{CB} = 10 \text{ V dc}$; $T_J = +150^\circ\text{C min.}$ Power shall be applied to the device to achieve $T_J \geq +150^\circ\text{C}$ and a power dissipation of $P_D \geq 75$ percent of the rated P_T (see 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	$R_{\theta JC}$ (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 herein. Electrical measurements (endpoints) and delta measurements shall be in accordance with the applicable steps of table I, subgroup 2; except $Z_{\theta JX}$ need not be performed, and table III herein.

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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 shall be 500 mA dc.
- b. Collector emitter voltage magnitude shall be 10 V dc.
- c. 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.
- d. Maximum limit shall be $R_{\theta JA} = 175^{\circ}\text{C}/\text{W}$.
- e. Maximum limit shall be $R_{\theta JC} = 17.5^{\circ}\text{C}/\text{W}$.

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TABLE I. Group A inspection.

Inspection <u>1/</u>	MIL-STD-750		Symbol	Limit		Unit
	Method	Conditions		Min	Max	
<u>Subgroup 1 2/</u>						
Visual and mechanical <u>3/</u> examination	2071	n = 45 devices, c = 0				
Solderability <u>3/ 4/</u>	2026	n = 15 leads, c = 0				
Resistance to <u>3/ 4/ 5/</u> solvent	1022	n = 15 devices, c = 0				
Temperature cycling <u>3/ 4/</u>	1051	Test condition C, 25 cycles. n = 22 devices, c = 0				
Hermetic seal <u>5/</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)	2075	N = 4 devices, c = 0.				
<u>Subgroup 2</u>						
Collector to base cutoff current	3036	V _{CB} = 40 V dc V _{CB} = 60 V dc	I _{CBO1}		100	μA dc
2N3867, 2N3867S 2N3868, 2N3868S						
Emitter to base cutoff current	3061	Bias condition D; V _{EB} = 4 V dc	I _{EBO1}		100	μA dc
Breakdown voltage, collector to emitter	3061	Bias condition D; I _C = 20 mA dc; pulsed (see 4.5.1)	V _{(BR)CEO}			
2N3867, 2N3867S 2N3868, 2N3868S				40 60		V dc V dc
Collector to emitter cutoff current	3041	Bias condition A; V _{EB} = 2.0 V dc	I _{CEX1}		1.0	μA dc
2N3867, 2N3867S 2N3868, 2N3868S		V _{CE} = 40 V dc, V _{CE} = 60 V dc				

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 2</u> - Continued						
Forward-current transfer ratio 2N3867, 2N3867S 2N3868, 2N3868S	3076	$V_{CE} = 1.0 \text{ V dc}$, $I_C = 500 \text{ mA dc}$, pulsed (see 4.5.1)	h_{FE1}	50 35		
Forward-current transfer ratio 2N3867, 2N3867 S 2N3868, 2N3868S	3076	$V_{CE} = 2.0 \text{ V dc}$, $I_C = 1.5 \text{ A dc}$, pulsed (see 4.5.1)	h_{FE2}	40 30	200 150	
Forward-current transfer ratio 2N3867, 2N3867S 2N3868, 2N3868S	3076	$V_{CE} = 3.0 \text{ V dc}$, $I_C = 2.5 \text{ A dc}$, pulsed (see 4.5.1)	h_{FE3}	25 20		
Forward-current transfer ratio	3076	$V_{CE} = 5.0 \text{ V dc}$, $I_C = 3.0 \text{ A dc}$, pulsed (see 4.5.1)	h_{FE4}	20		
Collector to emitter voltage (saturated)	3071	$I_C = 500 \text{ mA dc}$; $I_B = 50 \text{ mA dc}$, pulsed (see 4.5.1)	$V_{CE(sat)1}$		0.5	V dc
Collector to emitter voltage (saturated)	3071	$I_C = 1.5 \text{ A dc}$; $I_B = 150 \text{ mA dc}$; pulsed (see 4.5.1)	$V_{CE(sat)2}$		0.75	V dc
Collector to emitter voltage (saturated)	3071	$I_C = 2.5 \text{ A dc}$; $I_B = 250 \text{ mA dc}$; pulsed (see 4.5.1)	$V_{CE(sat)3}$		1.5	V dc
Base emitter voltage (saturated)	3066	Test condition A; $I_C = 500 \text{ mA dc}$; $I_B = 50 \text{ mA dc}$; pulsed (see 4.5.1)	$V_{BE(sat)1}$		1.0	V dc
Base emitter voltage (saturated)	3066	Test condition A; $I_C = 1.5 \text{ A dc}$; $I_B = 150 \text{ mA dc}$; pulsed (see 4.5.1)	$V_{BE(sat)2}$	0.9	1.4	V dc
Base emitter voltage (saturated)	3066	Test condition A; $I_C = 2.5 \text{ A dc}$; $I_B = 250 \text{ mA dc}$; pulsed (see 4.5.1)	$V_{BE(sat)3}$		2.0	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 3</u>						
High temperature operation: Collector to emitter cutoff current 2N3867, 2N3867S 2N3868, 2N3868S	3041	$T_A = +150^\circ\text{C}$ Bias condition A, $V_{EB} = 2.0\text{ V dc}$ $V_{CE} = 40\text{ V dc}$ $V_{CE} = 60\text{ V dc}$	I_{CEX2}		200	$\mu\text{A dc}$
Low temperature operation: Forward-current transfer ratio 2N3867, 2N3867S 2N3868, 2N3868S	3076	$T_A = -55^\circ\text{C}$ $V_{CE} = 1.0\text{ V dc}$, $I_C = 500\text{ mA dc}$, pulsed (see 4.5.1)	h_{FE5}	25 17		
<u>Subgroup 4</u>						
Magnitude of common-emitter small-signal short-circuit forward-current transfer ratio	3306	$V_{CE} = 5\text{ V dc}$, $I_C = 100\text{ mA dc}$, $f = 20\text{ MHz}$	$ h_{fe} $	3	12	
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}		120	pF
Input capacitance (output open-circuited)	3240	$V_{EB} = 3.0\text{ V dc}$, $I_C = 0$, $100\text{ kHz} \leq f \leq 1\text{ MHz}$	C_{ibo}		800	pF
<u>Subgroup 5</u>						
Pulse response Delay time	3251	Test condition A $V_{CC} = -30\text{ V dc}$, $V_{EB} = 0$, $I_C = 1.5\text{ A dc}$, $I_{B1} = 150\text{ mA dc}$, See figure 4	t_d		35	ns

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 5</u> - Continued									
Pulse response	3251	Test condition A							
Rise time		$V_{CC} = -30$ V dc, $V_{EB} = 0$ V dc, $I_C = 1.5$ A dc, $I_{B1} = 150$ mA dc, See figure 4					t_r	65	ns
Storage time		$V_{CC} = -30$ V dc, $V_{EB} = 0$ V dc, $I_C = 1.5$ A dc, $I_{B1} = I_{B2} = 150$ mA dc, See figure 5					t_s	500	ns
Fall time		$V_{CC} = -30$ V dc, $V_{EB} = 0$ V dc, $I_C = 1.5$ A dc, $I_{B1} = I_{B2} = 150$ mA dc, See figure 5					t_f	100	ns
<u>Subgroup 6</u>									
SOA (continuous dc)	3051	$T_C = +25^\circ\text{C}$, 1 cycle, $t = 1.0$ s, (see figure 6)							
<u>Test 1</u>		$V_{CE} = 3.33$ V dc, $I_C = 3$ A dc							
<u>Test 2</u>									
2N3867, 2N3867S		$V_{CE} = 40$ V dc, $I_C = 160$ mA dc							
2N3868, 2N3868S		$V_{CE} = 60$ V dc, $I_C = 80$ mA dc							
Electrical measurements	See table III, steps 1, and 2.								

1/ For sampling plan see MIL-PRF-19500.

2/ For resubmission of failed subgroup A1, double the sample size of the failed test or sequence of tests. A failure in group A, subgroup 1 shall not require retest of the entire subgroup. Only the failed test shall be rerun upon submission.

3/ Separate samples may be used.

4/ Not required for JANS devices.

5/ Not required for laser marked devices.

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

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

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TABLE III. Delta requirements.

Step	Inspection	MIL-STD-750		Symbol	Limit	Unit
		Method	Conditions			
1	Collector-base cutoff current 2N3867, 2N3867S 2N3868, 2N3868S	3041	Bias condition D $V_{CE} = 40 \text{ V dc}$ $V_{CE} = 60 \text{ V dc}$	ΔI_{CEX1} <u>1/</u>	100 percent of initial value or 200 nA dc, whichever is greater.	
2	Forward current transfer ratio	3076	$V_{CE} = 2 \text{ V dc};$ $I_C = 1.5 \text{ A dc};$ pulsed see 4.5.1	Δh_{FE2} <u>1/</u>	15 percent change from initial reading.	

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

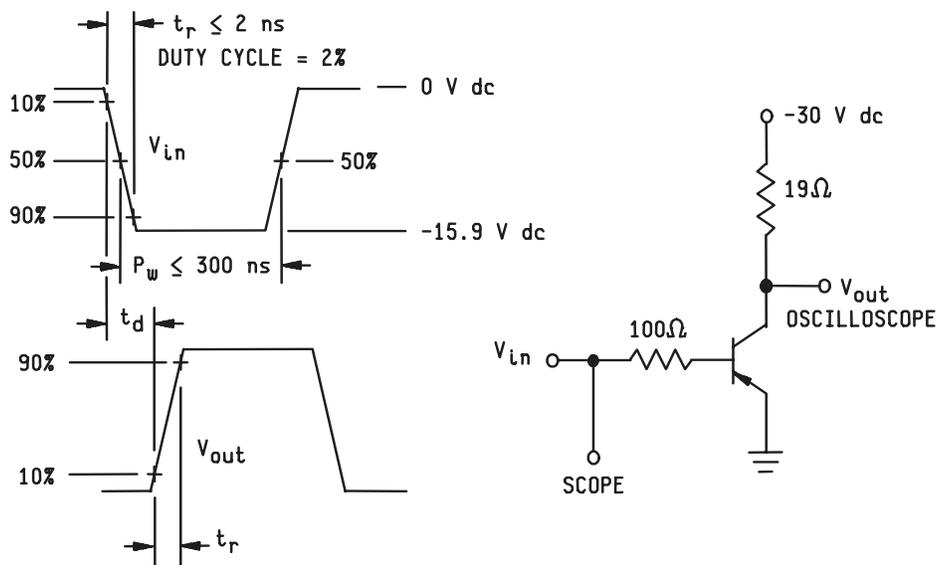


FIGURE 4. Equivalent circuit for measuring delay and rise times.

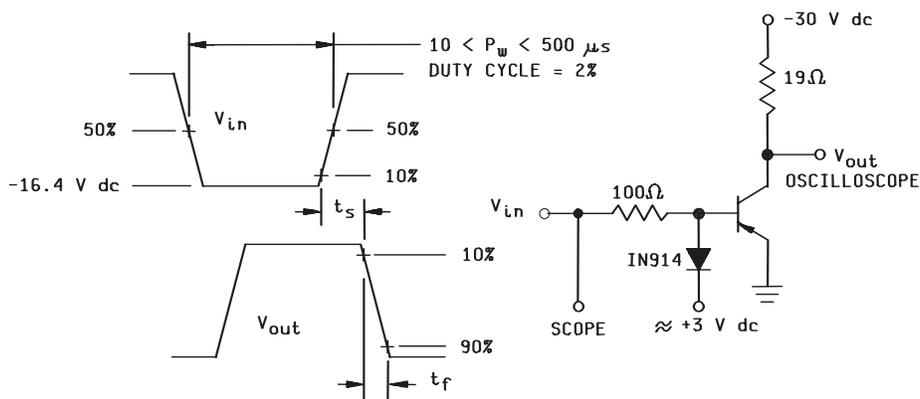


FIGURE 5. Equivalent circuit for measuring storage and fall times.

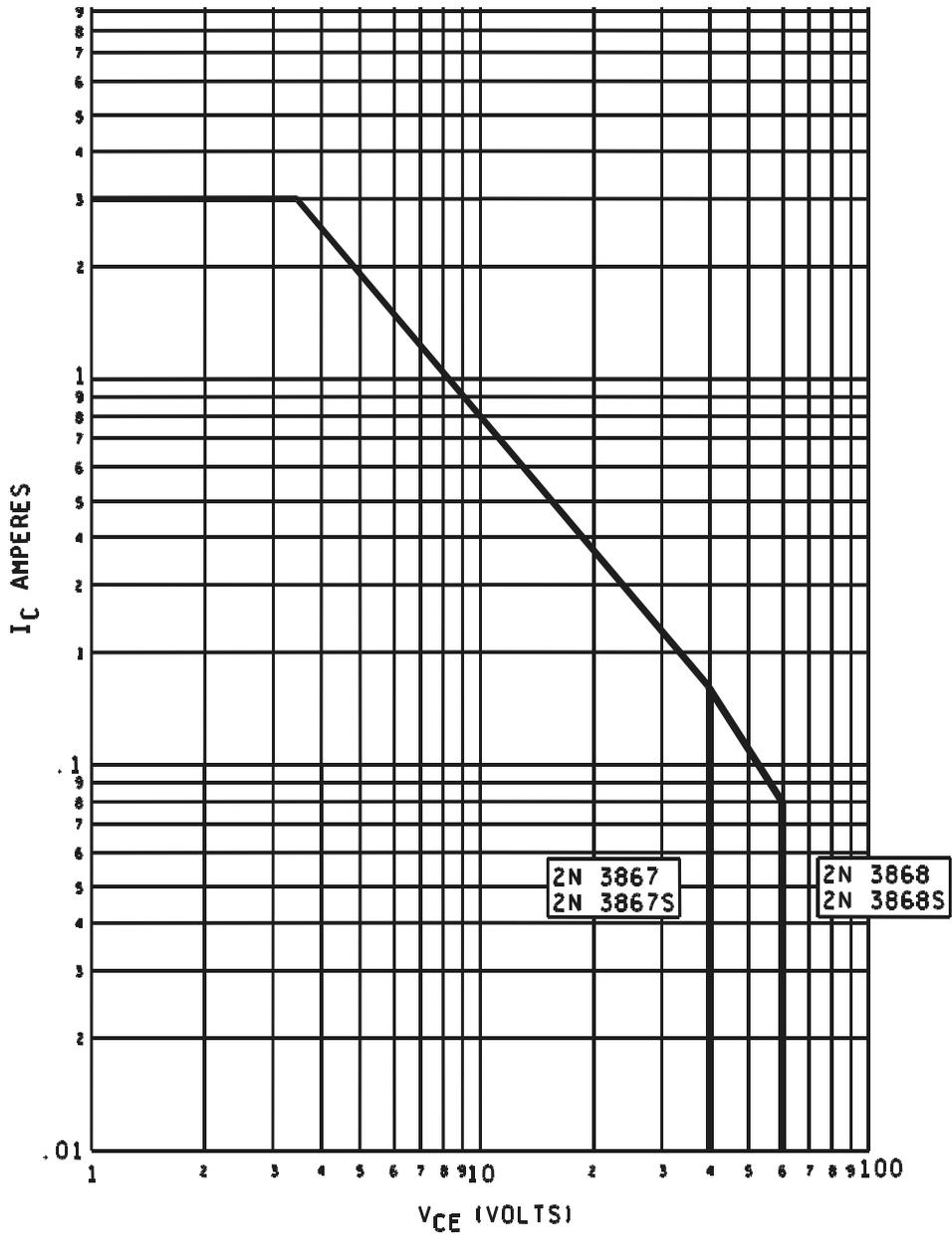


FIGURE 6. Maximum SOA graph (continuous dc).

5. PACKAGING

5.1 Packaging. For acquisition purposes, the packaging requirements should 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. Packaging requirements (see 5.1).
- d. Lead finish (see 3.4.1).

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, JANHCA2N3867) will be identified on the QPL.

JANC ordering information		
PIN	Manufacturers	
	33178	43611
2N3867	JANHCA2N3867, JANKCA2N3867	JANHCB2N3867, JANKCB2N3867
2N3868	JANHCA2N3868, JANKCA2N3868	JANHCB2N3868, JANKCB2N3868

* 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.

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Custodians:

Army - CR
Navy - EC
Air Force - 11
DLA - CC

Preparing activity:

DLA - CC

(Project 5961-2569)

Review activities:

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

STANDARDIZATION DOCUMENT IMPROVEMENT PROPOSAL

INSTRUCTIONS

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

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I RECOMMEND A CHANGE:

1. DOCUMENT NUMBER
MIL-PRF-19500/350G

2. DOCUMENT DATE
2 April 2002

3. **DOCUMENT TITLE** SEMICONDUCTOR DEVICE, TRANSISTOR, PNP, SILICON, LOW-POWER TYPES: 2N3867, 2N3867S, 2N3868, AND 2N3868S, 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
DSN
FAX
EMAIL

7. DATE SUBMITTED

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