

The documentation and process conversion measures necessary to comply with this revision shall be completed by 18 November 2000

INCH-POUND

MIL-PRF-19500/350F  
 18 August 2000  
 SUPERSEDING  
 MIL-S-19500/350E  
 6 February 1999

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	-55 to +200	17.5
2N3868, S	1.0	10	60	60	4.0	3.0	-55 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.

AMSC N/A  
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FSC 5961

1.4 Primary electrical characteristics.

	h <sub>FE</sub>				C <sub>obo</sub> I <sub>E</sub> = 0  V <sub>CB</sub> = 10 V dc 100 kHz ≤ f ≤ 1 MHz	h <sub>fe</sub>   I <sub>C</sub> = 100 mA dc  V <sub>CE</sub> = 5 V dc f = 20 MHz	I <sub>C</sub> = 1.5 A dc		V <sub>CE(sat)</sub> <sup>2</sup> I <sub>C</sub> = 1.5 A dc  I <sub>B</sub> = 150 mA dc	
	I <sub>C</sub> = 1.5 A dc V <sub>CE</sub> = 2 V dc		I <sub>C</sub> = 3.0 A dc V <sub>CE</sub> = 5 V dc				I <sub>B</sub> = 150 mA dc	t <sub>on</sub>		t <sub>off</sub>
	2N3867 2N3867S	2N3868 2N3868S	2N3867 2N3867S	2N3868 2N3968S				pF		ns max
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.

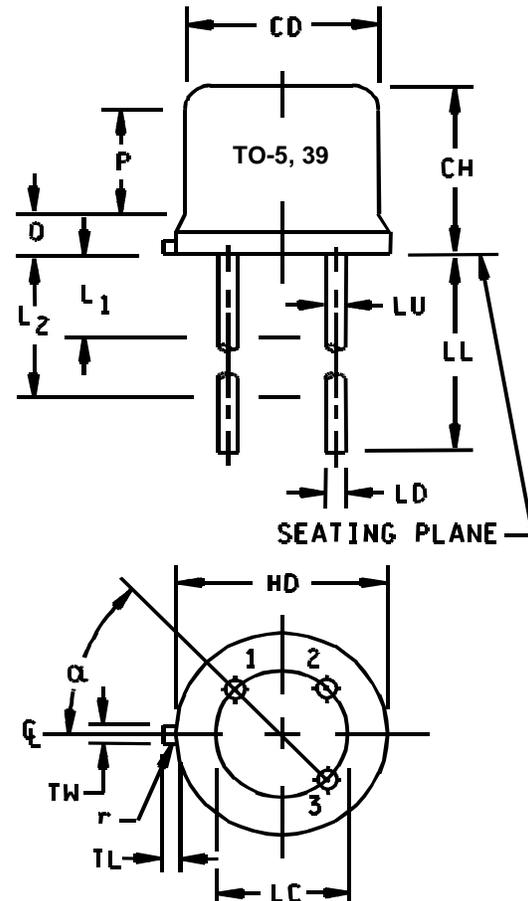
## STANDARD

## 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 Defense Automated Printing Service, Building 4D (DPM-DODSSP), 700 Robbins Avenue, Philadelphia, PA 19111-5094.)

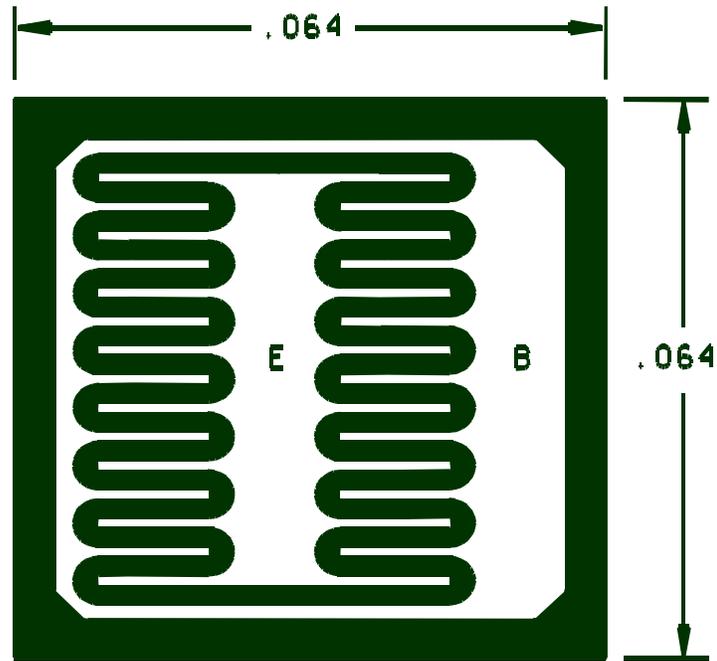
Symbol	Dimensions				Note
	Inches		Millimeters		
	Min	Max	Min	Max	
CD	.305	.335	7.75	8.51	6
CH	.240	.260	6.12	6.60	
HD	.335	.370	8.51	9.40	
LC	.200 TP		5.08 TP		7
LD	.016	.019	0.41	0.48	8,9
LL	See note 14				
LU	.016	.019	0.41	0.48	8,9
L1	---	.050	---	1.27	8,9
L2	.250	---	6.35	---	8,9
P	.100	---	2.54	---	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
$\alpha$	45° TP		45° TP		7
	1, 2, 10, 12, 13, 14				



## NOTES:

1. Dimension are in inches.
2. Metric equivalents are given for general information only.
3. Beyond r (radius) maximum, TW shall be held for a minimum length of .011 (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 L<sub>1</sub> and L<sub>2</sub>. Dimension LD applies between L<sub>2</sub> 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  $\phi$ x symbology.
13. Lead 1 = emitter, lead 2 = base, lead 3 = collector.
14. For non-S-suffix devices (T0-5), dimension LL = 1.5 inches (38.10 mm) min. and 1.75 inches (44.45 mm) max. For S-suffix types (T0-39), dimension LL = .5 inches (12.70 mm) min. and .750 inches (19.05 mm) max

FIGURE 1. Physical dimensions (similar to TO-5, T0-39).

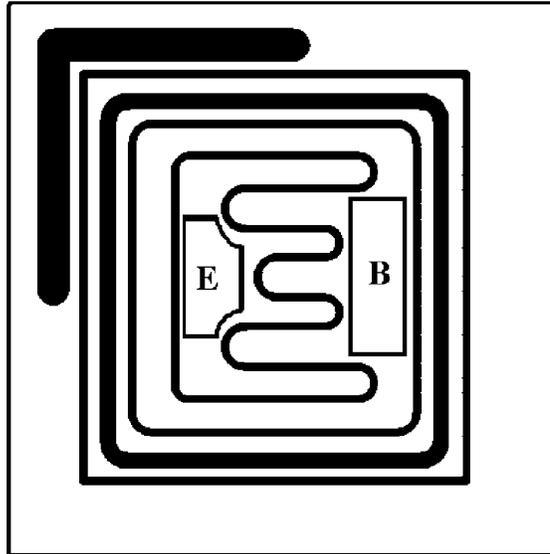


A version

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 is .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.....40 x 40 mils  $\pm$  1 mil
2. Chip thickness.....10  $\pm$  1.5 mil
3. Top metal.....Aluminum 15,000 $\text{\AA}$  minimum, 18,000 $\text{\AA}$  nominal
4. Back metal.....A. Al/Ti/Ni/Ag 12k $\text{\AA}$ /3k $\text{\AA}$ /7k $\text{\AA}$ /7k $\text{\AA}$  min., 15k $\text{\AA}$ /5k $\text{\AA}$ /10k $\text{\AA}$ /10k $\text{\AA}$  nom.  
B. Gold 2,500 $\text{\AA}$  minimum, 3,000 $\text{\AA}$  nominal  
C. Eutectic Mount – No Gold
5. Backside.....Collector
6. Bonding pad.....B = 6 x 8 mils, E = 6 x 4 mils

FIGURE 3. JANHCB and JANKCB die dimensions.

2.3 Non-Government publications. The following document forms a part of this document to the extent specified herein. Unless otherwise specified, the issues of the documents which are DoD adopted are those listed in the issue of the DODISS cited in the solicitation. Unless otherwise specified, the issues of documents not listed in the DODISS are the issues of the documents cited in the solicitation (see 6.2).

AMERICAN NATIONAL STANDARDS INSTITUTE

ANSI Y14.5M - Dimensioning and Tolerancing.

(Application for copies should be addressed to the American National Standards Institute, 11 West 42nd Street, New York, NY 10036.)

2.4 Order of precedence. In the event of a conflict between the text of this document and the references cited herein (except for related associated specifications or specification sheets), the text of this document takes precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

3. REQUIREMENTS

3.1 General. The requirements for acquiring the product described herein shall consist of this document and MIL-PRF-19500.

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

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

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

3.4.1 Lead material and 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 Marking. Marking shall be in accordance with MIL-PRF-19500.

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

3.7 Electrical test requirements. The electrical test requirements shall be the subgroups specified in Table I herein.

3.8 Workmanship. Semiconductor devices shall be processed in such a manner as to be uniform in quality and shall be free from other defects that will affect life, serviceability, or appearance.

4. VERIFICATION

4.1 Classification of inspections. The inspection requirements specified herein are classified as follows:

- a. Qualification inspection (see 4.2).
- b. Screening (see 4.3).
- c. Conformance inspection (see 4.4).

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

4.3 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 (see 4.3.3)	Thermal impedance (see 4.3.3)
7	Hermetic seal (optional)	<u>1/</u>
9	ICBO2 and hFE4	Not applicable
10	24 hours minimum	24 hours minimum
11	I <sub>CEX1</sub> ; hFE2; $\Delta$ I <sub>CEX1</sub> 100 percent of initial value or 200 nA dc, whichever is greater; $\Delta$ hFE2 = $\pm$ 15 percent of initial value.	I <sub>CEX1</sub> ; hFE2
12	See 4.3.2 240 hours minimum	See 4.3.2 80 hours minimum
13	Subgroup 2 and 3 of table I herein; $\Delta$ I <sub>CEX1</sub> 100 percent of initial value or 200 nA dc, whichever is greater; $\Delta$ hFE2 = $\pm$ 15 percent of initial value.	Subgroup 2 of table I herein; $\Delta$ I <sub>CEX1</sub> 100 percent of initial value or 200 nA dc, whichever is greater; $\Delta$ hFE2 = $\pm$ 15 percent of initial value.

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

4.3.1 Screening (JANHC 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 group A, subgroup 2.

4.3.2 Power burn-in conditions. Power burn-in conditions are as follows:  
 $V_{CB} = 10 - 30$  Vdc,  $T_A =$  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 min and a minimum Power dissipation = 75% of max  $P_T$  as defined in 1.3.

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

- a.  $I_M$  measurement current -----10 mA.
- b.  $I_H$  forward heating current -----2A to 3 A.
- c.  $t_H$  heating time -----10 ms.
- d.  $t_{MD}$  measurement delay time -----50  $\mu$ s max.
- e.  $V_{CE}$  collector-emitter voltage ----- 10 V dc minimum

The maximum limit for  $Z_{\theta JX}$  under these test conditions are  $Z_{\theta JX} \text{ (max)} = 17.5^\circ\text{C/W}$ .

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

Subgroup	Method	Condition
B4	1037	$V_{CB} = 10$ V dc; $P_T = 1.0$ W at : $T_A =$ Room ambient as defined in the general requirements of MIL-STD-750 see 4.5; $t_{ON} = t_{OFF} = 3$ minutes minimum for 2,000 cycles.
B5	1027	$V_{CB} = 10$ to 30 V dc; $T_A = 125^\circ\text{C} \pm 25^\circ\text{C}$ for 96 hours, $P_T = 1$ W at $T_A = 100^\circ\text{C}$ or adjusted as required by the chosen $T_A$ to give an average lot $T_J = 275^\circ\text{C}$ .
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.

Step	Method	Condition
1	1039	Steady-state life: Test condition B, 340 hours, $V_{CB} = 10 - 30$ 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 $P_D \geq 75\%$ 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.

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.

Subgroup	Method	Condition
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 $P_D \geq 75\%$ 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.

Subgroup	Method	Condition
C2	2036	Test condition E.
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 performed for qualification or re-qualification only. The tests specified in table II herein must be performed to maintain qualification.

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  $+25^\circ\text{C} \leq TR \leq +35^\circ\text{C}$ . The chosen reference temperature shall be recorded before the test is started.
- d. Maximum limit shall be  $R_{\theta JA} = 175^\circ\text{C/W}$ .
- e. Maximum limit shall be  $R_{\theta JC} = 17.5^\circ\text{C/W}$ .

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/ 5/</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/ 5/</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>5/</u>		Group A, subgroup 2				
Bond strength <u>3/ 5/</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>						
Collector to base cutoff current  2N3867, 2N3867S 2N3868, 2N3868S	3036	V <sub>CB</sub> = 40 V dc V <sub>CB</sub> = 60 V dc	I <sub>CBO1</sub>		100	μA dc
Emitter to base cutoff current	3061	Bias condition D; V <sub>EB</sub> = 4 V dc	I <sub>EBO1</sub>		100	μA dc
Breakdown voltage, collector to emitter  2N3867, 2N3867S 2N3868, 2N3868S	3061	Bias condition D; I <sub>C</sub> = 20 mA dc; pulsed (see 4.5.1)	V <sub>(BR)CEO</sub>		40 60	V dc
Collector to emitter cutoff current  2N3867, 2N3867S 2N3868, 2N3868S	3041	Bias condition A; V <sub>EB</sub> = 2.0 V dc  V <sub>CE</sub> = 40 V dc, V <sub>CE</sub> = 60 V dc	I <sub>CEX1</sub>		1.0	μA 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						
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 <u>1/</u>	MIL-STD-750		Symbol	Limit		Unit
	Method	Conditions		Min	Max	
<u>Subgroup 3</u>		$T_A = +150^\circ\text{C}$				
High temperature operation:						
Collector to emitter cutoff current	3041	Bias condition A, $V_{EB} = 2.0 \text{ V dc}$	$I_{CEX2}$		200	$\mu\text{A dc}$
2N3867, 2N3867S 2N3868, 2N3868S		$V_{CE} = 40 \text{ V dc}$ $V_{CE} = 60 \text{ V dc}$ $T_A = -55^\circ\text{C}$				
Low temperature operation:						
Forward-current transfer ratio	3076	$V_{CE} = 1.0 \text{ V dc}$ , $I_C = 500 \text{ mA dc}$ , pulsed (see 4.5.1)	$h_{FE5}$			
2N3867, 2N3867S 2N3868, 2N3868S				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	3251	Test condition A				
Delay time		$V_{CC} = -30 \text{ V dc}$ , $V_{EB} = 0$ , $I_C = 1.5 \text{ A dc}$ , $I_{B1} = 150 \text{ mA dc}$ , See figure 4	$t_d$		35	ns

See footnotes at end of table.

TABLE I. Group A inspection - Continued.

Inspection <u>1/</u>	MIL-STD-750		Symbol	Limit		Unit
	Method	Conditions		Min	Max	
<u>Subgroup 5 - Continued</u>						
Pulse response	3251	Test condition A				
Rise time		$V_{CC} = -30 \text{ V dc}$ , $V_{EB} = 0$ , $I_C = 1.5 \text{ A dc}$ , $I_{B1} = 150 \text{ mA dc}$ , See figure 4	$t_r$		65	ns
Storage time		$V_{CC} = -30 \text{ V dc}$ , $V_{EB} = 0$ , $I_C = 1.5 \text{ A dc}$ , $I_{B1} = I_{B2} = 150 \text{ mA dc}$ , See figure 5	$t_s$		500	ns
Fall time		$V_{CC} = -30 \text{ V dc}$ , $V_{EB} = 0$ , $I_C = 1.5 \text{ A dc}$ , $I_{B1} = I_{B2} = 150 \text{ mA dc}$ , See figure 5	$t_f$		100	ns
<u>Subgroup 6</u>						
SOA (continuous dc)	3051	$T_C = +25^\circ\text{C}$ , 1 cycle, $t = 1.0 \text{ s}$ , (see figure 6)				
<u>Test 1</u>		$V_{CE} = 3.33 \text{ V dc}$ , $I_C = 3 \text{ A dc}$				
<u>Test 2</u>						
2N3867, 2N3867S		$V_{CE} = 40 \text{ V dc}$ , $I_C = 160 \text{ mA dc}$				
2N3868, 2N3868S		$V_{CE} = 60 \text{ V dc}$ , $I_C = 80 \text{ mA dc}$				
Electrical measurements		See 4.5.3 herein.				
<u>Subgroup 7 <u>4/</u></u>						
Decap internal visual (design verification)	2075	$n = 1 \text{ device}$ , $c = 0$				

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 laser marked devices.

5/ Not required for JANS devices.

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	12 devices c = 0
Hermetic seal	1071		
Fine leak Gross leak			
Electrical measurements		See group A, subgroup 2 and 4.5.3 herein.	
<u>Subgroup 2</u>			
Intermittent life	1037	Intermittent operation life: $V_{CB} = 10$ V dc , 6,000 cycles, $\Delta T_J \geq +100^\circ\text{C}$ ; forced air cooling allowed on cooling cycle only.	45 devices c = 0
Electrical measurements		See group A, subgroup 2 and 4.5.3 herein.	
<u>Subgroups 3, 4, and 5</u>			
Not applicable			

Table III Delta requirements. Delta requirements shall be as specified below:

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

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

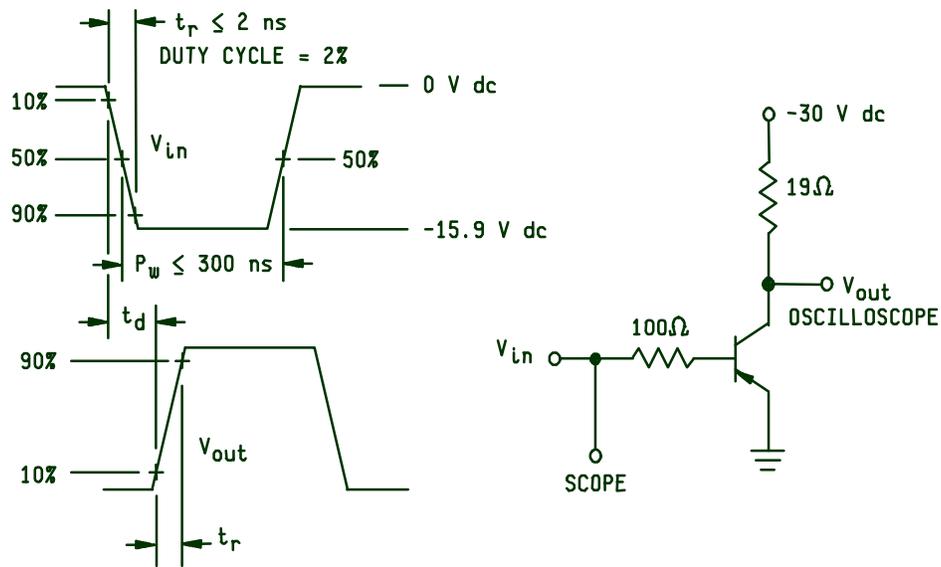


FIGURE 4. Equivalent circuit for measuring delay and rise times.

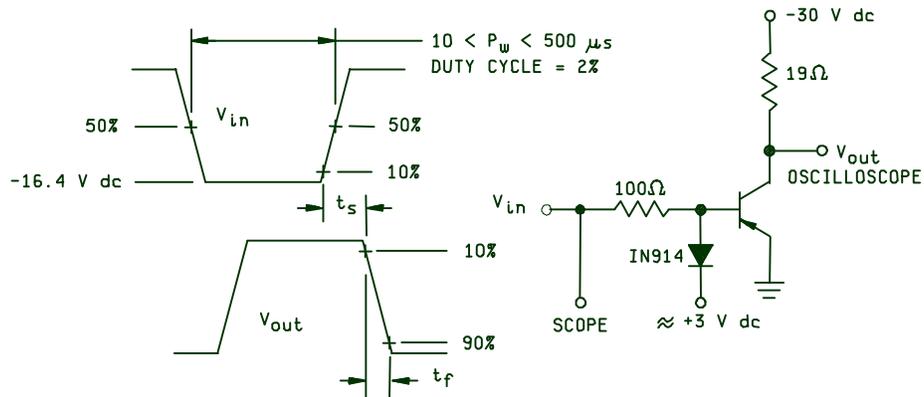


FIGURE 5. Equivalent circuit for measuring storage and fall times.

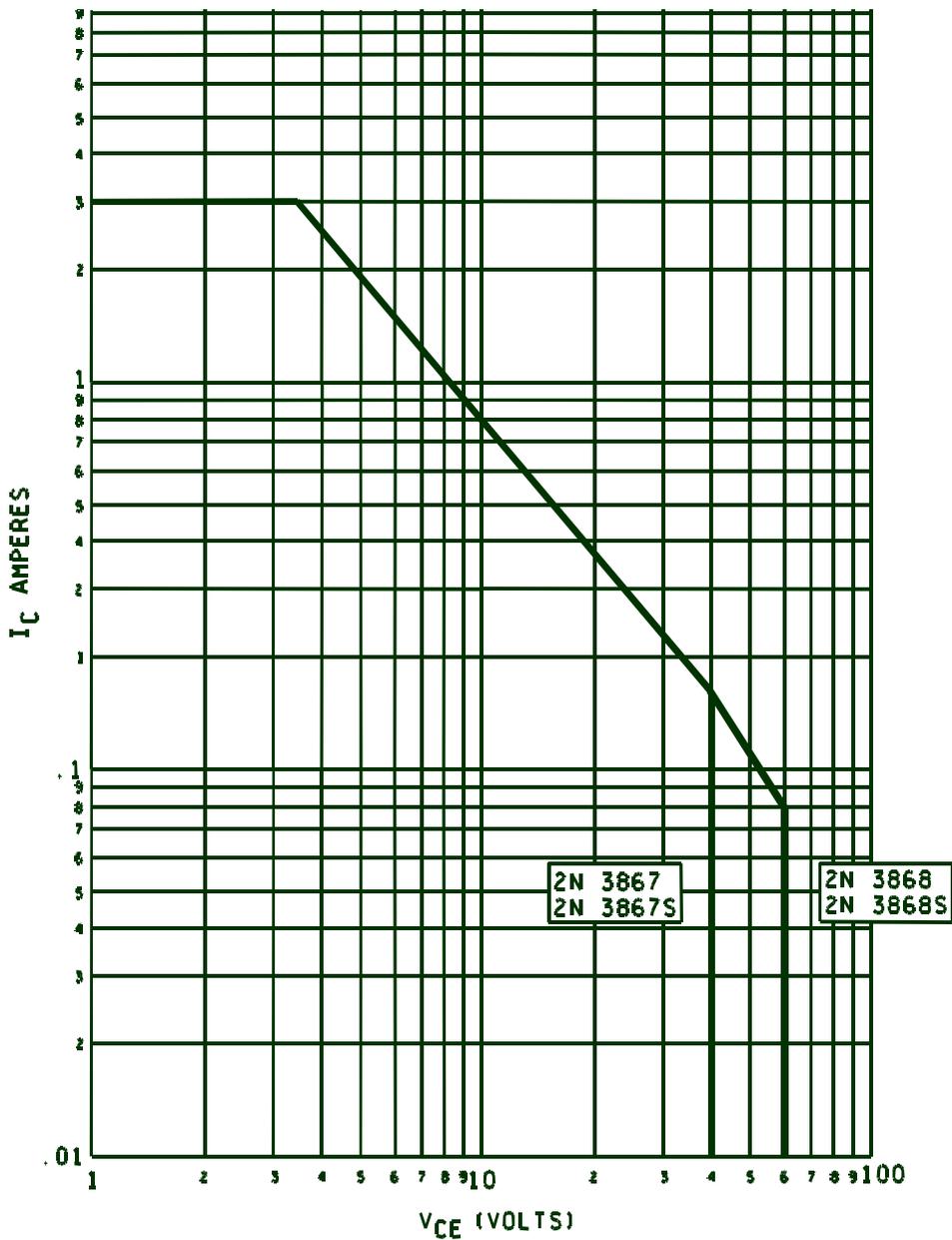


FIGURE 6. Maximum SOA graph (continuous dc).

5. PACKAGING

5.1 Packaging. Packaging shall prevent mechanical damage of the devices during shipping and handling and shall not be detrimental to the device. When actual packaging of material 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.

5.2 Marking. Unless otherwise specified (see 6.2), marking shall be in accordance with MIL-PRF-19500.

6. NOTES

(This section contains information of a general or explanatory nature that may be helpful, but is not mandatory.)

6.1 Notes. The notes specified in MIL-PRF-19500 are applicable to this specification.

6.2 Acquisition requirements. See MIL-PRF-19500.

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 No.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 purchase 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, 3990 East Broad Street, 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. Changes to this issue entail the addition of chips only.

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

Preparing activity:  
 DLA - CC  
 (Project 5961-2291)

Review activities:  
 Army - AR, AV, MI, SM  
 Navy - AS, CG, MC  
 Air Force - 13, 19, 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.
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3. The preparing activity must provide a reply within 30 days from receipt of the form.

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<b>I RECOMMEND A CHANGE:</b>	1. DOCUMENT NUMBER MIL-PRF-19500/350F	2. DOCUMENT DATE 18 August 2000
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 <i>(Identify paragraph number and include proposed rewrite, if possible. Attach extra sheets as needed.)</i>		
5. REASON FOR RECOMMENDATION		
6. SUBMITTER		
a. NAME <i>(Last, First Middle Initial)</i>	b. ORGANIZATION	
c. ADDRESS <i>(Include Zip Code)</i>	d. TELEPHONE <i>(Include Area Code)</i> COMMERCIAL DSN FAX EMAIL	7. DATE SUBMITTED
8. PREPARING ACTIVITY		
a. NAME Alan Barone	b. TELEPHONE Commercial                      DSN                      FAX                      EMAIL 614-692-0510      850-0510      614-692-6939      alan_barone@dsccl.dla.mil	
c. ADDRESS <i>(Include Zip Code)</i> DSCC-VAC 3900 E. Broad Street Columbus, Ohio 43216-5000	IF YOU DO NOT RECEIVE A REPLY WITHIN 45 DAYS, CONTACT: Defense Standardization Program Office (DLSC-LM) 8725 John J. Kingman Road, Suite 2533 Fort Belvoir, Virginia 22060-6221 Telephone (703)767-6888 DSN 427-6888	