

The documentation and process conversion measures necessary to comply with this revision shall be completed by 6 May 1999

INCH-POUND

MIL-PRF-19500/350E  
 6 February 1999  
 SUPERSEDING  
 MIL-S-19500/350D  
 26 June 1995

PERFORMANCE SPECIFICATION SHEET

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 (similar to TO- 5) encapsulated devices, figure 2 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: Commander, Defense Supply Center Columbus, ATTN: DSCC-VAT, 3990 East Broad Street, 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 <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 I <sub>B</sub> = 150 mA 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				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

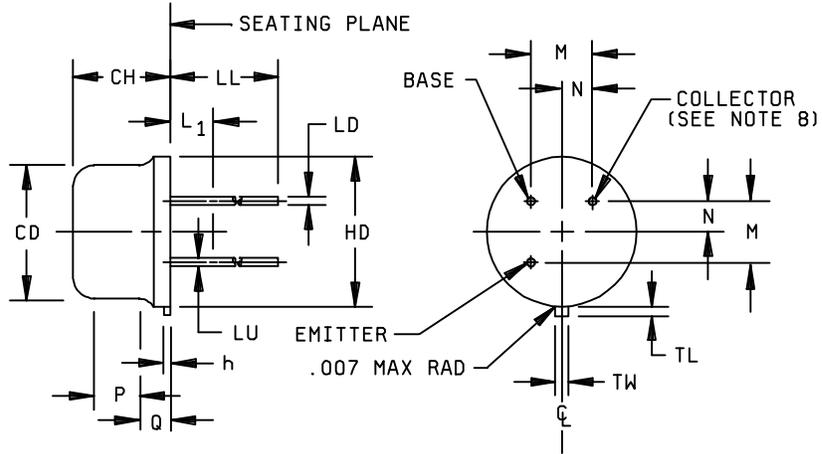
MIL-PRF-19500 - Semiconductor Devices, General Specification for.

STANDARD

MILITARY

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

(Unless otherwise indicated, copies of the above specifications, standards, and handbooks are available from the Standardization Document Order Desk, 700 Robbins Avenue, Building 4D, Philadelphia, PA 19111-5094.)



Ltr	Dimensions				Notes
	Inches		Millimeters		
	Min	Max	Min	Max	
HD	.335	.370	8.51	9.40	14
CD	.305	.335	7.75	8.51	14
CH	.240	.260	6.10	6.60	
LL					10,12,13
L1		.050		1.27	11
LD	.016	.021	0.41	0.53	3,10,14
LU	.016	.019	0.41	0.48	4,10,14

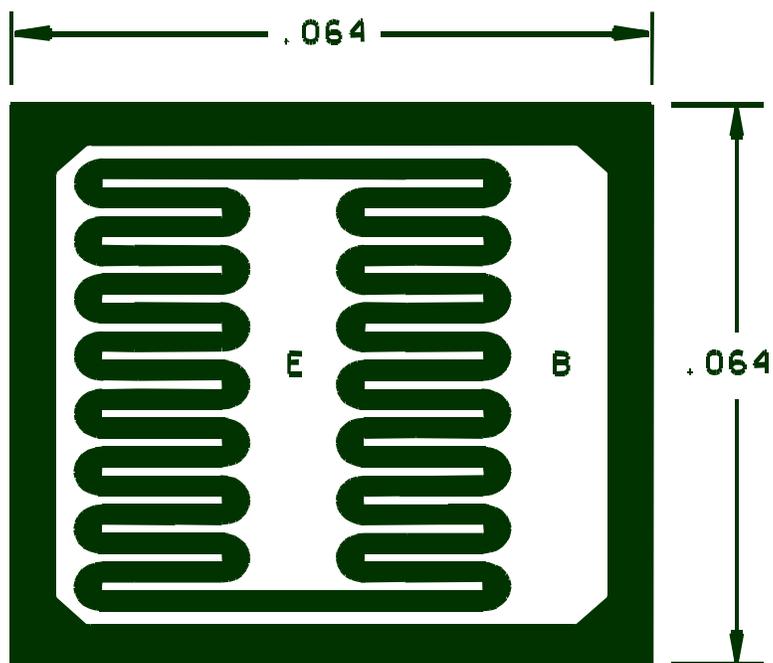
Ltr	Dimensions				Notes
	Inches		Millimeters		
	Min	Max	Min	Max	
P	.100		2.54		5
Q					6
TL	.029	.045	0.74	1.14	9
TW	.028	.034	0.71	0.86	
h	.009	.125	0.23	3.18	
M	.1414 Nom		3.59 Nom		7
N	.0707 Nom		1.80 Nom		7

FIGURE 1. Physical dimensions .

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 .050 inch (1.27 mm) and .250 inch (6.35 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 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. Figure 3 shows the preferred method of measurement.
8. The collector shall be electrically connected to the case.
9. Measured from the maximum diameter of the actual device.
10. All 3 leads (see 3.3.1).
11. Diameter of leads in this zone is not controlled.
12. For transistor types 2N3867 and 2N3868, dimension LL shall be 1.500 inches (38.10 mm) minimum and 1.75 inches (44.5 mm) maximum.
13. For transistor types 2N3867S and 2N3868S, dimension LL shall be 0.5 inch (13 mm) minimum and 0.75 inch (19.1 mm) maximum.
14. In accordance with ANSI Y14.5M, diameters are equivalent to  $\phi x$  symbology.

FIGURE 1. Physical dimensions - Continued.



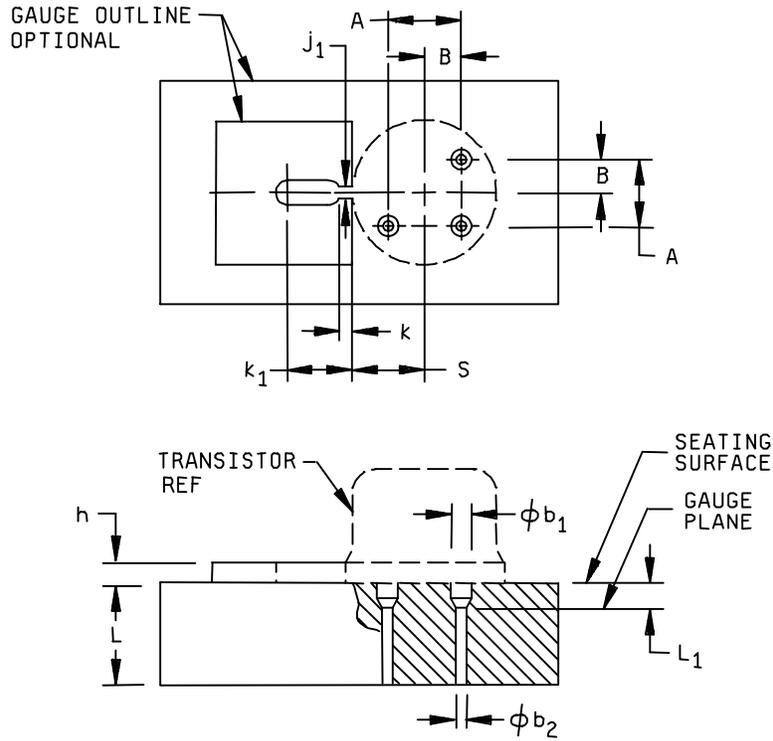
Inches	mm
.064	1.63

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.



Ltr	Dimensions			
	Inches		Millimeters	
	Min	Max	Min	Max
A	.1409	.1419	3.58	3.60
B	.0702	.0712	1.78	1.81
S	.182	.199	4.62	5.05
k	.009	.011	0.23	0.28
k1	.125 Nom		3.18 Nom	
L1	.054	.055	1.37	1.40
L	.372	.378	9.45	9.60
j1	.0350	.0355	0.89	0.90
h	.150 Nom		3.81 Nom	
phi b2	.0325	.0335	0.83	0.85
phi b1	.0595	.0605	1.51	1.54

NOTES:

1. Dimensions are in inches.
2. Metric equivalents are given for general information only.
3. The following gauging procedure shall be used: The use of a pin straightener prior to insertion in the gauge is permissible. The device being measured shall be inserted until its seating plane is  $.125 \pm .010$  inch ( $3.18 \pm 0.25$  mm) from the seating surface of the gauge. A spacer may be used to obtain the  $.125$  inch ( $3.18$  mm) distance from the gauge seat prior to force application. A force of  $8 \text{ oz} \pm .50 \text{ oz}$  shall then be applied parallel and symmetrical to the device's cylindrical axis. When examined visually after the force application (the force need not be removed), the seating plane of the device shall be seated against the gauge.
4. The location of the tab locator, within the limits of dimension 3, will be determined by the tab and flange dimension of the device being checked.

FIGURE 3. Gauge for lead and tab location.

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

3.2 Associated specification. The individual item requirements shall be in accordance with MIL-PRF-19500 and as specified herein.

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 figure 1 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 4.4.2 and 4.4.3 herein.

### 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.

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)	1/
9	I <sub>CBO2</sub> and h <sub>FE4</sub>	Not applicable
10	24 hours minimum	24 hours minimum
11	I <sub>CEX1</sub> ; h <sub>FE2</sub> ; ΔI <sub>CEX1</sub> 100 percent of initial value or 200 nA dc, whichever is greater; Δh <sub>FE2</sub> = ± 15 percent of initial value.	I <sub>CEX1</sub> ; h <sub>FE2</sub>
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 <sub>CEX1</sub> 100 percent of initial value or 200 nA dc, whichever is greater; Δh <sub>FE2</sub> = ± 15 percent of initial value.	Subgroup 2 of table I herein; ΔI <sub>CEX1</sub> 100 percent of initial value or 200 nA dc, whichever is greater; Δh <sub>FE2</sub> = ± 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: T<sub>A</sub> = Room ambient as defined in the general requirements (4.5) of MIL-STD-750:

JANTX, and JANTXV levels:

2N3867, 2N3867S.....	V <sub>CB</sub> = 10 to 30 V dc, P <sub>T</sub> = 1.0 W.
2N3868, 2N3868S.....	V <sub>CB</sub> = 10 to 30 V dc, P <sub>T</sub> = 1.0 W.
JANS (all device types).....	V <sub>CB</sub> = 10 to 30 V dc, P <sub>T</sub> = 1.0 W.

NOTE: No heat sink or forced air cooling on the devices shall be permitted.

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  $Z_{\theta JX} (max) = 17.5^\circ\text{C/W}$ .

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) of 4.4.2.1. Electrical measurements (end-points) and delta requirements shall be in accordance with group A, subgroup 2 and 4.5.3 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 4.5.3 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). 1/

Step	Method	Condition
1	1039	Steady-state life: Test condition B, 340 hours, $V_{CB} = 10$ -30 V dc, $T_J = 150^\circ\text{C}$ min. No heat sink or forced-air cooling on the devices shall be permitted. $n = 45$ 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. 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.

1/ 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.

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 4.5.3 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	$V_{CB} \geq 10$ V dc; $T_J = 150^\circ\text{C}$ min. No heat sink or forced-air cooling on the devices shall be permitted.

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  $R_{\theta JA} = 175^\circ\text{C}/\text{W}$ .
- e. Maximum limit shall be  $R_{\theta JC} = 17.5^\circ\text{C}/\text{W}$ .

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	3036	V <sub>CB</sub> = 40 V dc V <sub>CB</sub> = 60 V dc	I <sub>CBO1</sub>		100	μA dc
2N3867, S 2N3868, S						
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	3061	Bias condition D; I <sub>C</sub> = 20 mA dc; pulsed (see 4.5.1)	V <sub>(BR)CEO</sub>			V dc
2N3867, S 2N3868, S				40 60		
Collector to emitter cutoff current	3041	Bias condition A; V <sub>EB</sub> = 2.0 V dc	I <sub>CEX1</sub>		1.0	μA dc
2N3867, S 2N3868, S		V <sub>CE</sub> = 40 V dc, V <sub>CE</sub> = 60 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						
Forward-current transfer ratio 2N3867, S 2N3868, S	3076	$V_{CE} = 1.0$ V dc, $I_C = 500$ mA dc, pulsed (see 4.5.1)	$h_{FE1}$	50 35		
Forward-current transfer ratio 2N3867, S 2N3868, S	3076	$V_{CE} = 2.0$ V dc, $I_C = 1.5$ A dc, pulsed (see 4.5.1)	$h_{FE2}$	40 30	200 150	
Forward-current transfer ratio 2N3867, S 2N3868, S	3076	$V_{CE} = 3.0$ V dc, $I_C = 2.5$ A dc, pulsed (see 4.5.1)	$h_{FE3}$	25 20		
Forward-current transfer ratio	3076	$V_{CE} = 5.0$ V dc, $I_C = 3.0$ A dc, pulsed (see 4.5.1)	$h_{FE4}$	20		
Collector to emitter voltage (saturated)	3071	$I_C = 500$ mA dc; $I_B = 50$ mA dc, pulsed (see 4.5.1)	$V_{CE(sat)1}$		0.5	V dc
Collector to emitter voltage (saturated)	3071	$I_C = 1.5$ A dc; $I_B = 150$ mA dc; pulsed (see 4.5.1)	$V_{CE(sat)2}$		0.75	V dc
Collector to emitter voltage (saturated)	3071	$I_C = 2.5$ A dc; $I_B = 250$ mA dc; pulsed (see 4.5.1)	$V_{CE(sat)3}$		1.5	V dc
Base emitter voltage (saturated)	3066	Test condition A; $I_C = 500$ mA dc; $I_B = 50$ mA dc; pulsed (see 4.5.1)	$V_{BE(sat)1}$		1.0	V dc
Base emitter voltage (saturated)	3066	Test condition A; $I_C = 1.5$ mA dc; $I_B = 150$ 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; $I_C = 2.5$ A dc; $I_B = 250$ 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:		$T_A = +150^\circ\text{C}$				
Collector to emitter cutoff current	3041	Bias condition A, $V_{EB} = 2.0\text{ V dc}$	$I_{CEX2}$		200	$\mu\text{A dc}$
2N3867, S		$V_{CE} = 40\text{ V dc}$				
2N3868, S		$V_{CE} = 60\text{ V dc}$				
Low temperature operation:		$T_A = -55^\circ\text{C}$				
Forward-current transfer ratio	3076	$V_{CE} = 1.0\text{ V dc}$ , $I_C = 500\text{ mA dc}$ , pulsed (see 4.5.1)	$h_{FE5}$			
2N3867, S				25		
2N3868, S				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	$\text{pF}$
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	$\text{pF}$
<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	$\text{ns}$

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</u> - Continued						
Pulse response	3251	Test condition A				
Rise time		$V_{CC} = -30$ V dc, $V_{EB} = 0$ , $I_C = 1.5$ A dc, $I_{B1} = 150$ mA dc, See figure 4	$t_r$		65	ns
Storage time		$V_{CC} = -30$ V dc, $V_{EB} = 0$ , $I_C = 1.5$ A dc, $I_{B1} = I_{B2} = 150$ mA dc, See figure 5	$t_s$		500	ns
Fall time		$V_{CC} = -30$ V dc, $V_{EB} = 0$ , $I_C = 1.5$ 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 4.5.3 herein.				
<u>Subgroup 7</u> <u>4/</u>						
Decap internal visual (design verification)	2075	$n = 1$ 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			

4.5.3 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, S 2N3868, S	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 4.5.2	$\Delta h_{FE2}$ <u>1/</u>	15 percent change from initial reading.	

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

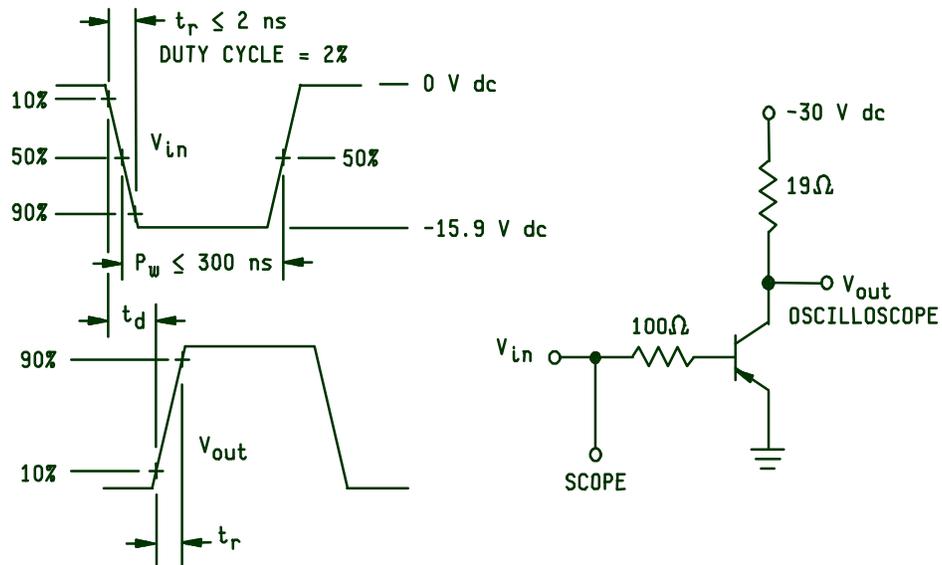


FIGURE 4. Equivalent circuit for measuring delay and rise times.

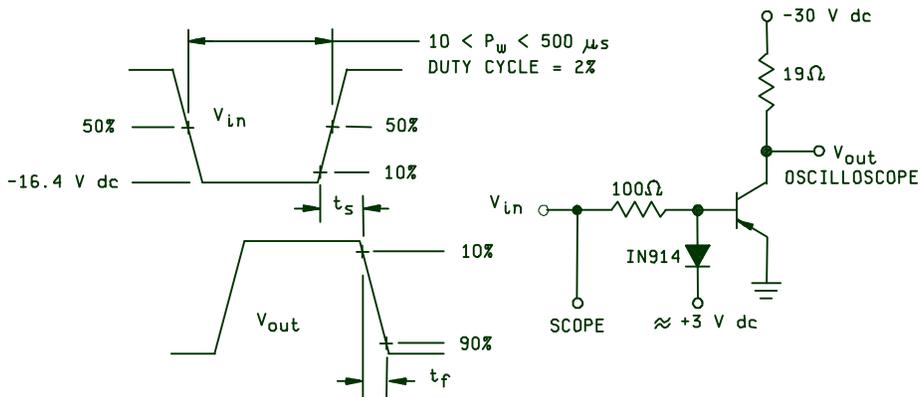


FIGURE 5. Equivalent circuit for measuring storage and fall times.

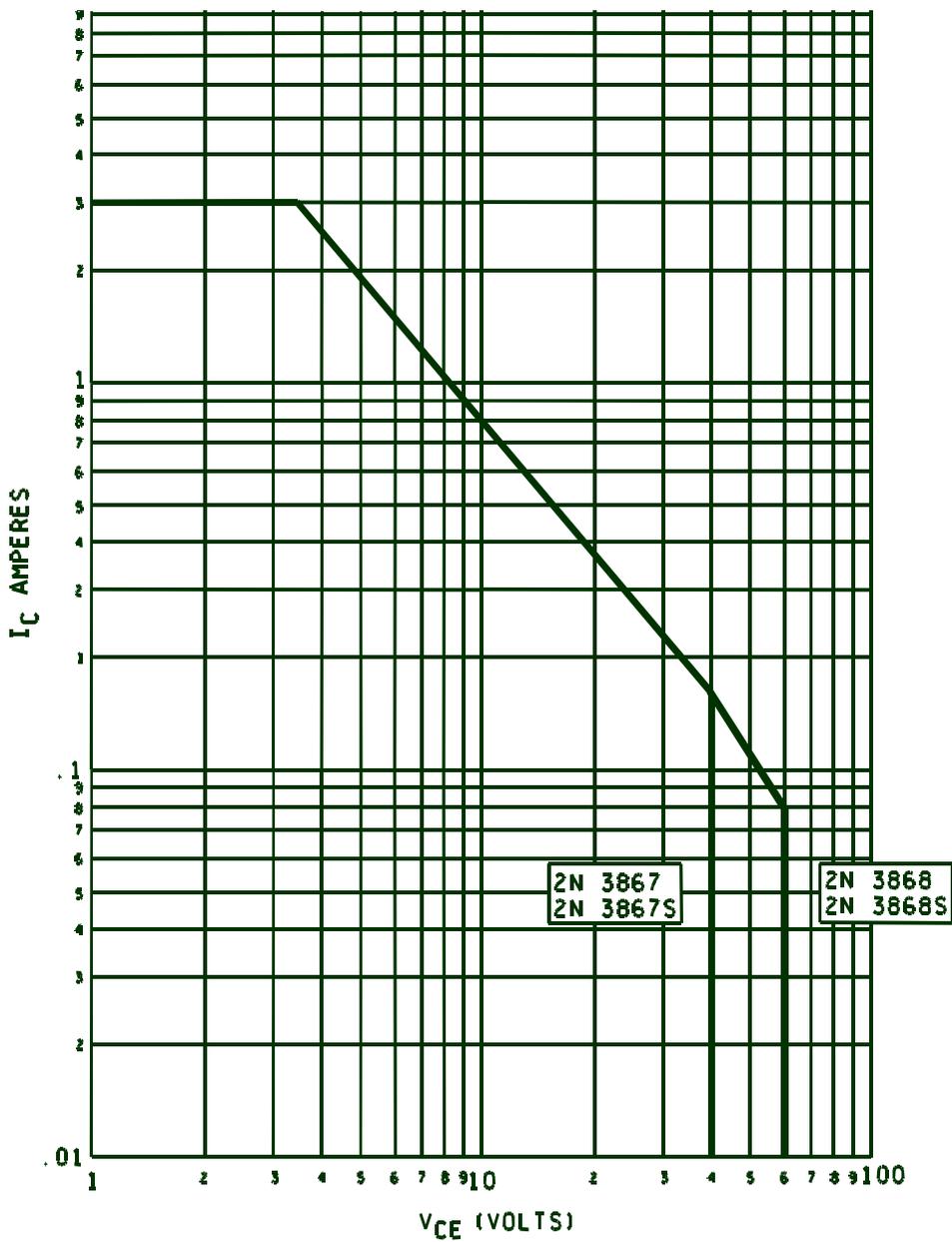


FIGURE 6. Maximum SOA graph (continuous dc).

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, JANHC2N3867) will be identified on the QML.

JANC ordering information	
PIN	Manufacturer
2N3867	JANHCA2N3867 JANKCA2N3867
2N3868	JANHCA2N3868 JANKCA2N3868

6.5 Changes from previous issue. Marginal notations are not used in this revision to identify changes with respect to the previous issue due to the extensiveness of the changes.

Custodians:  
 Army - ER  
 Navy - EC  
 Air Force - 17  
 NASA - NA

Preparing activity:  
 DLA - CC  
 (Project 5961-2060)

Review activities:  
 Army - AR, AV, MI, SM  
 Navy - AS, CG, MC  
 Air Force - 13, 15, 19, 85, 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.
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-19500/350E

**2. DOCUMENT DATE (YYMMDD)**  
990206

**3. DOCUMENT TITLE** SEMICONDUCTOR DEVICE, TRANSISTOR, PNP, SILICON, TYPES 2N3867S, 2N33868, 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  
(YYMMDD)

**8. PREPARING ACTIVITY**

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c. ADDRESS: Defense Supply Center  
Columbus, ATTN: DSCC-VAT, 3990 East Broad  
Street, Columbus, OH 43216-5000

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Defense Quality and Standardization Office  
5203 Leesburg Pike, Suite 1403, Falls Church, VA 22041-3466  
Telephone (703) 756-2340    DSN 289-2340