The documentation and process conversion measures necessary to comply with this revision shall be completed by 4 July 2004.

INCH-POUND

MIL-PRF-19500/350H
24 March 2004
SUPERSEDING
MIL-PRF-19500/350G
2 April 2002

PERFORMANCE SPECIFICATION SHEET

* SEMICONDUCTOR DEVICE, TRANSISTOR, PNP, SILICON, LOW POWER
TYPES: 2N3867, 2N3867S, 2N3867U4, 2N3868, 2N3868S, AND 2N3868U4,
JAN, JANTX, JANTXV, JANS, JANHCA, JANHCB, JANKCA, AND JANKCB

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

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

1. SCOPE

1.1 Scope. This specification covers the performance requirements for 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), figure 2 (for encapsulated devices), figure 3, and figure 4 (for unencapsulated devices).

* 1.3 Maximum ratings. Unless otherwise specified, T_A = +25°C.

Types	P_T (1) T_A = +25°C	P_T (1) T_{PCB} = +25°C	P_T (2) T_C = +25°C	$R_{\theta JA}$	$R_{\theta JPCB}$	$R_{\theta JC}$	V_{CBO}	V_{CEO}	V_{EBO}	I_C	T_J and T_{STG}
	W	W	W	°C/W	°C/W	°C/W	V dc Min	V dc Min	V dc	A dc	°C
2N3867, S	1.0		10	175		17.5	40	40	4.0	3.0	-65 to +200
2N3868, S	1.0		10	175		17.5	60	60	4.0	3.0	-65 to +200
2N3867U4		1.0	35		175	5	40	40	4.0	3.0	-65 to +200
2N3868U4		1.0	35		175	5	60	60	4.0	3.0	-65 to +200

(1) For derating, see figure 5, 6, 7 and 8.
(2) For thermal curves, see figures 9, 10, 11 and 12.

* Comments, suggestions, or questions on this document should be addressed to Defense Supply Center, Columbus, ATTN: DSCC-VAC, P.O. Box 3990, Columbus, OH 43216-5000, or emailed to Semiconductor@dscc.dla.mil. Since contact information can change, you may want to verify the currency of this address information using the ASSIST Online database at http://www.dodssp.daps.mil/.

* 1.4 Primary electrical characteristics.

	h_{FE}				C_{obo} $I_E = 0$	|hfe| I_C = 100 mA dc	I_C = 1.5 A dc		$V_{CE(sat)}2$ I_C = 1.5 A dc
	I_C = 1.5 A dc V_{CE} = 2 V dc		I_C = 3.0 A dc V_{CE} = 5 V dc		V_{CB} = 10 V dc 100 kHz ≤ f ≤ 1 MHz	V_{CE} = 5 V dc f = 20 MHz	I_B = 150 mA dc		I_B = 150 mA dc
							t_{on}	t_{off}	
	2N3867 2N3867S 2N3867U4	2N3868 2N3868S 2N3868U4	2N3867 2N3867S 2N3867U4	2N3868 2N3968S 2N3968U4	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, 4, or 5 of this specification. This section does not include documents cited in other sections of this specification or recommended for additional information or as examples. While every effort has been made to ensure the completeness of this list, document users are cautioned that they must meet all specified requirements documents cited in sections 3, 4, or 5 of this specification, whether or not they are listed.

2.2 Government documents.

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

DEPARTMENT OF DEFENSE SPECIFICATION

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

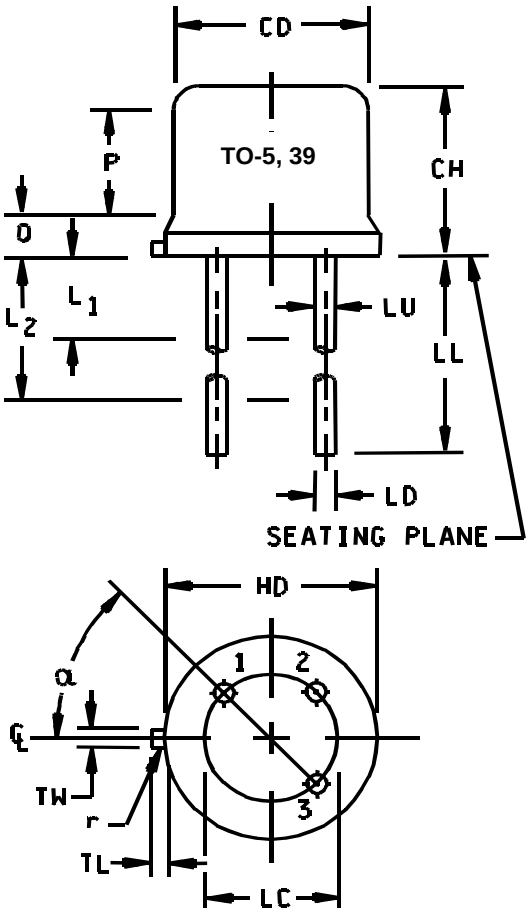
DEPARTMENT OF DEFENSE STANDARD

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

* (Copies of these documents are available online at http://assist.daps.dla.mil/quicksearch/ or http://www.dodssp.daps.mil or from the Standardization Document Order Desk, 700 Robbins Avenue, Building 4D, Philadelphia, PA 19111-5094.)

2.3 Order of precedence. In the event of a conflict between the text of this document and the references cited herein the text of this document takes precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

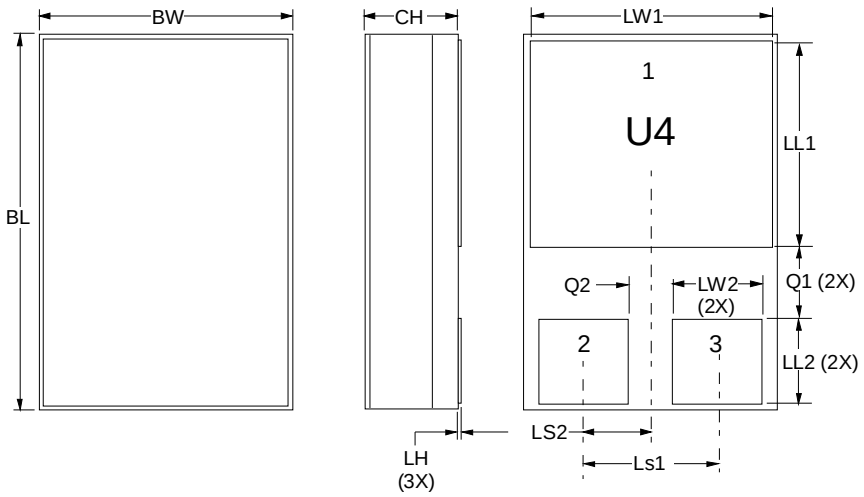
Symbol	Dimensions				Note
	Inches		Millimeters		
	Min	Max	Min	Max	
CD	.305	.335	7.75	8.51	5, 6
CH	.240	.260	6.12	6.60	
HD	.335	.370	8.51	9.40	4, 5
LC	.200 TP		5.08 TP		7
LD	.016	.019	0.41	0.48	8,9
LL	See note 8, 14				
LU	.016	.019	0.41	0.48	8,9
L1		.050		1.27	8,9
L2	.250		6.35		8,9
P	.100		2.54		7
Q		.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. Millimeters 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_1 and L_2. Dimension LD applies between L_2 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 ASME Y14.5M, diameters are equivalent to ϕx 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 inch (12.70 mm) min. and .750 inch (19.05 mm) max.

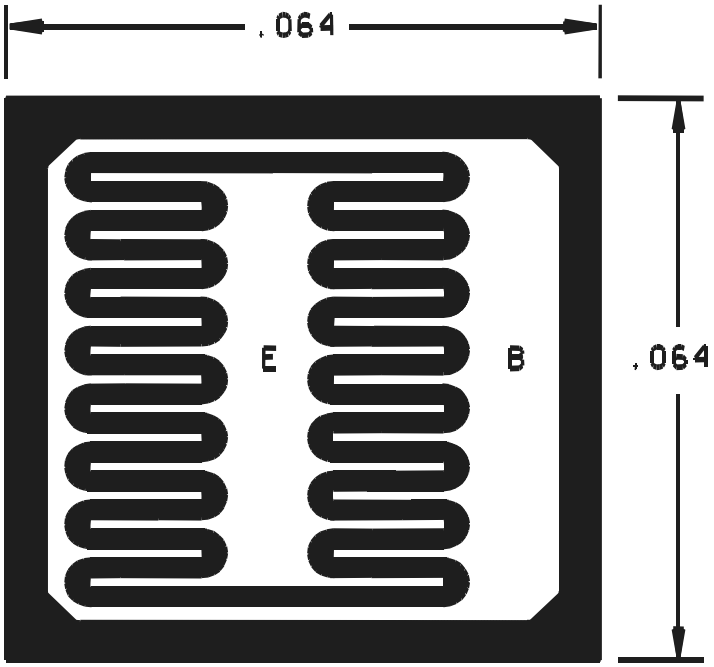
FIGURE 1. Physical dimensions (similar to TO-5, TO-39).



Symbol	Dimensions			
	Inches		Millimeters	
	Min	Max	Min	Max
BL	.215	.225	5.46	5.72
BW	.145	.155	3.68	3.94
CH	.050	.070	1.27	1.77
LH		.020		0.50
LW1	.135	.145	3.43	3.68
LW2	.047	.057	1.19	1.45
LL1	.085	.125	2.16	3.17
LL2	.045	.075	1.14	1.91
LS1	.065	.095	1.65	2.41
LS2	.033	.048	.825	1.21
Q1	.045	.070	1.14	1.78
Q2	.025	.048	.635	1.22
TERM 1	Collector			
TERM 2	Base			
TERM 3	Emitter			

NOTES:
1. Dimensions are in inches.
2. Millimeter equivalents are given for general information only.
3. In accordance with ASME Y14.5M.

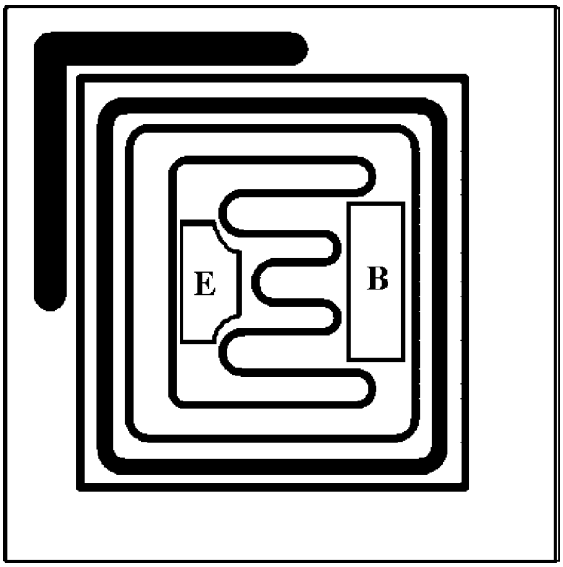
FIGURE 2. Physical dimensions and configuration (SMD.22, U4).



A version

NOTES:
1. Dimensions are in inches.
2. Millimeters are given for general information only.
3. Unless otherwise specified, tolerance is ± .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 3. JANHCA and JANKCA die dimensions.



B version

NOTES:

1. Chip size ..... .040 inch (1.02 mm) x .040 inch (1.02 mm) ± .001 inch (0.03 mm).
2. Chip thickness ..... .010 inch (0.26 mm) ± .0015 inch (0.04 mm).
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 inch (0.15 mm) x .008 inch (0.2 mm), E = .006 inch (0.15 mm) x .004 inch (0.1 mm).

* FIGURE 4. JANHCB and JANKCB die dimensions.

3. REQUIREMENTS

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

3.2 Qualification. Devices furnished under this specification shall be products that are manufactured by a manufacturer authorized by the qualifying activity for listing on the applicable qualified manufacturer's list 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, 3, and 4 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).

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 specification sheet 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 table IV of MIL-PRF-19500 and as specified herein. The following measurements shall be made in accordance with table I herein. Devices that exceed the limits of table I herein shall not be acceptable.

Screen (see table IV of MIL-PRF-19500)	Measurement	
	JANS level	JANTX and JANTXV levels
3c	Thermal impedance, method 3131 of MIL-STD-750 (see 4.3.3)	Thermal impedance, method 3131 of MIL-STD-750 (see 4.3.3)
7	Hermetic seal (optional)	Optional
9	I_{CEX1} and h_{FE2}	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; Δh_{FE2} = ± 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; Δh_{FE2} = ± 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; Δh_{FE2} = ± 15 percent of initial value.
14	Required	Required

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 the required junction temperature, T_J = +135° C minimum and a minimum power dissipation = 75 percent 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 method 3131 of Mil-Std-750 using the guidelines in that method for determining I_M, I_H, t_H, t_{MD} (and V_C where appropriate). The $Z_{\theta JX}$ limit used in Screen 3c shall comply with the Thermal Impedance graph in Figure n (less than or equal to the curve value at the same t_H time) and/or shall be less than the process determined statistical maximum limit as outlined in method 3131.

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 table I, 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 table I, 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; 2,000 cycles.
B5	1027	(NOTE: If a failure occurs, resubmission shall be at the test conditions of the original sample.) V_{CB} = 10 V dc, $P_D \geq$ 100 percent of maximum rated P_T (see 1.3). Option 1: For 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°C minimum. Option 2: For 216 hours minimum, sample size = 45, c = 0; adjust T_A or P_D to achieve T_J = +225°C minimum.
B6	3131	For TO-5 and TO-39 use $R_{\theta JA}$, for U4 use $R_{\theta JC}$, see 4.4.5.

* 4.4.2.2 Group B inspection, (JAN, JANTX, and JANTXV). Separate samples may be used for each step. In the event of a lot failure, the resubmission requirements of MIL-PRF-19500 shall apply. In addition, all catastrophic failures during CI shall be analyzed to the extent possible to identify root cause and corrective action.

Step	Method	Condition
1	1039	Steady-state life: Test condition B, 1,000 hours minimum, V_{CB} = 10 V dc, power shall be applied to achieve T_J = +150°C minimum using a minimum of P_D = 75 percent of maximum rated P_T as defined in 1.3. n = 45 devices, c = 0.
2	1039	HTRB: Test condition A, 48 hours minimum. n = 45 devices, c = 0.
3	1032	High-temperature life (non-operating), t = 340 hours, T_A = +200°C. n = 22, c = 0.

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

a. For JAN, JANTX, and JANTXV samples shall be selected randomly from a minimum of three wafers (or from each wafer in the lot) from each wafer lot. For JANS, samples shall be selected from each inspection lot. See MIL-PRF-19500.

b. Must be chosen from an inspection lot that has been submitted to and passed table I, subgroup 2, conformance inspection. When the final lead finish is solder or any plating prone to oxidation at high temperature, the samples for life test (subgroups B4 and B5 for JANS, and group B for JAN, JANTX, and JANTXV) may be pulled prior to the application of final lead finish.

4.4.3 Group C inspection, Group C inspection shall be conducted in accordance with the conditions specified for subgroup testing in table VII of MIL-PRF-19500, and in 4.4.3.1 (JANS) and 4.4.3.2 (JAN, JANTX, and JANTXV) herein for group C testing. Electrical measurements (end-points) and delta requirements shall be in accordance with table I, 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 V dc; T_J = +150°C min. Power shall be applied to the device to achieve $T_J \geq$ +150°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.

Subgroup	Method	Condition
C2	2036	Test condition E.
C5	3131	For TO-5 and TO-39 use $R_{\theta JA}$, for U4 use $R_{\theta JC}$, (see 4.4.5).
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 (end-points) and delta measurements shall be in accordance with the applicable steps of table I, subgroup 2; and table III herein.

4.4.5 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°C ≤ T_R ≤ +35°C. The chosen reference temperature shall be recorded before the test is started.

d. For max limit of thermal resistance see figures 9, 10, 11, and 12.

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.

* TABLE I. Group A inspection

Inspection 1/	MIL-STD-750		Symbol	Limit		Unit
	Method	Conditions		Min	Max	
Subgroup 1 2/						
Visual and mechanical Examination 3/	2071	n = 45 devices, c = 0				
Solderability 3/ 4/	2026	n = 15 leads, c = 0				
Resistance to solvent 3/ 4/ 5/	1022	n = 15 devices, c = 0				
Temperature cycling 3/ 4/	1051	Test condition C, 25 cycles. n = 22 devices, c = 0				
Hermetic seal 5/	1071	n = 22 devices, c = 0				
Fine leak Gross leak						
Electrical measurements 4/		Table I, subgroup 2				
Bond strength 3/ 4/	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) 4/	2075	n = 4 devices, c = 0.				
Subgroup 2						
Collector to base cutoff current	3036		I_{CBO1}		100	µA dc
2N3867, 2N3867S, 2N3867U4 2N3868, 2N3868S, 2N3868U4		V_{CB} = 40 V dc V_{CB} = 60 V dc				
Emitter to base cutoff current	3061	Bias condition D; V_{EB} = 4 V dc	I_{EBO1}		100	µA dc
Breakdown voltage, collector to emitter	3011	Bias condition D; I_C = 20 mA dc; pulsed (see 4.5.1)	$V_{(BR)CEO}$			
2N3867, 2N3867S, 2N3867U4 2N3868, 2N3868S, 2N3868U4				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, 2N3867U4 2N3868, 2N3868S, 2N3868U4		V_{CE} = 40 V dc, V_{CE} = 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	
Subgroup 2 - Continued						
Forward-current transfer ratio	3076	V_{CE} = 1.0 V dc, I_C = 500 mA dc, pulsed (see 4.5.1)	h_{FE1}			
2N3867, 2N3867S, 2N3867U4				50		
2N3868, 2N3868S, 2N3868U4				35		
Forward-current transfer ratio	3076	V_{CE} = 2.0 V dc, I_C = 1.5 A dc, pulsed (see 4.5.1)	h_{FE2}			
2N3867, 2N3867S, 2N3867U4				40	200	
2N3868, 2N3868S, 2N3868U4				30	150	
Forward-current transfer ratio	3076	V_{CE} = 3.0 V dc, I_C = 2.5 A dc, pulsed (see 4.5.1)	h_{FE3}			
2N3867, 2N3867S, 2N3867U4				25		
2N3868, 2N3868S, 2N3868U4				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 A 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	
Subgroup 3						
High temperature operation:		T_A = +150°C				
Collector to emitter cutoff current	3041	Bias condition A, V_{EB} = 2.0 V dc	I_{CEX2}		50	µA dc
2N3867, 2N3867S, 2N3867U4		V_{CE} = 40 V dc				
2N3868, 2N3868S, 2N3868U4		V_{CE} = 60 V dc				
Low temperature operation:		T_A = -55°C				
Forward-current transfer ratio	3076	V_{CE} = 1.0 V dc, I_C = 500 mA dc, pulsed (see 4.5.1)	h_{FE5}			
2N3867, 2N3867S, 2N3867U4				25		
2N3868, 2N3868S, 2N3868U4				17		
Subgroup 4						
Magnitude of common-emitter small-signal short-circuit forward-current transfer ratio	3306	V_{CE} = 5 V dc, I_C = 100 mA dc, f = 20 MHz	$\|h_{fe}\|$	3	12	
Open circuit output capacitance	3236	V_{CB} = 10 V dc, I_E = 0, 100 kHz ≤ f ≤ 1 MHz	C_{obo}		120	pF
Input capacitance (output open-circuited)	3240	V_{EB} = 3.0 V dc, I_C = 0, 100 kHz ≤ f ≤ 1 MHz	C_{ibo}		800	pF
Subgroup 5						
Pulse response	3251	Test condition A				
Delay time		V_{CC} = -30 V dc, V_{EB} = 0 , I_C = 1.5 A dc, I_{B1} = 150 mA dc, See figure 13	t_d		35	ns
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 13	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 14	t_s		500	ns

See footnotes at end of table.

* TABLE I. Group A inspection - Continued.

Inspection 1/	MIL-STD-750		Symbol	Limit		Unit
	Method	Conditions		Min	Max	
Subgroup 5 - Continued						
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 14	t_f		100	ns
SOA (continuous dc)	3051	T_C = +25°C, 1 cycle, t = 1.0 s, (see figure 15)				
Test 1		V_{CE} = 3.33 V dc, I_C = 3 A dc				
Test 2						
2N3867, 2N3867S, 2N3867U4		V_{CE} = 40 V dc, I_C = 160 mA dc				
2N3868, 2N3868S, 2N3868U4		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 1, double the sample size of the failed test or sequence of tests. A failure in table I, subgroup 1 shall not require retest of the entire subgroup. Only the failed test shall be rerun upon submission.
3/ Separate samples may be used.
4/ Not required for JANS devices.
5/ Not required for laser marked devices.

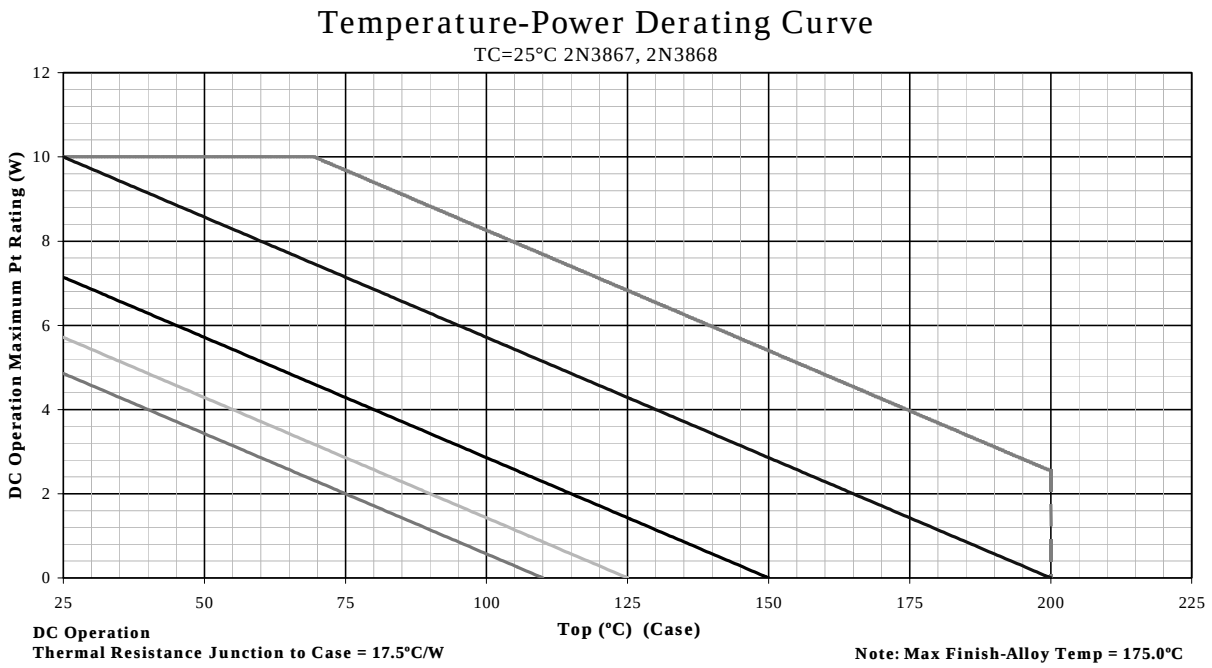
* TABLE II. Group E inspection (all quality levels) - for qualification and re-qualification only.

Inspection	MIL-STD-750		Qualification
	Method	Conditions	
Subgroup 1			45 devices c = 0
Temperature cycling (air to air)	1051	Test condition C, 500 cycles	
Hermetic seal	1071		
Fine leak Gross leak			
Electrical measurements		See table I, subgroup 2 herein.	
Subgroup 2			45 devices c = 0
Intermittent life	1037	V_{CB} = 10 V dc, 6,000 cycles, forced air cooling allowed on cooling cycle only.	
Electrical measurements		See table I, subgroup 2 herein.	
Subgroup 3			3 devices c = 0
Destructive physical analysis Decap analysis only	2102		
Subgroup 4			
Thermal impedance, thermal resistance curves		Each supplier shall submit their (typical) maximum design thermal impedance curves to the qualifying activity. In addition, the optimal test conditions and $Z_{\theta JX}$ limit shall be provided to the qualifying activity in the qualification report	sample size N/A
Subgroups 5			
Not applicable			
Subgroup 6			3 devices c = 0
ESD	1020		
Subgroup 8			45 devices c = 0
Reverse stability	1033	Condition A for devices ≥ 400 V dc. Condition B for devices < 400 V dc.	

TABLE III. Delta requirements.

Step	Inspection	MIL-STD-750		Symbol	Limit	Unit
		Method	Conditions			
1	Collector-base cutoff current	3041	Bias condition A, V_{EB} = 2.0 V dc	ΔI_{CEX1} 1/	100 percent of initial value or 200 nA dc, whichever is greater.	
	2N3867, 2N3867S		V_{CE} = 40 V dc			
	2N3868, 2N3868S		V_{CE} = 60 V dc			
2	Forward current transfer ratio	3076	V_{CE} = 2 V dc; I_C = 1.5 A dc; pulsed see 4.5.1	Δh_{FE2} 1/	15 percent change from initial reading.	

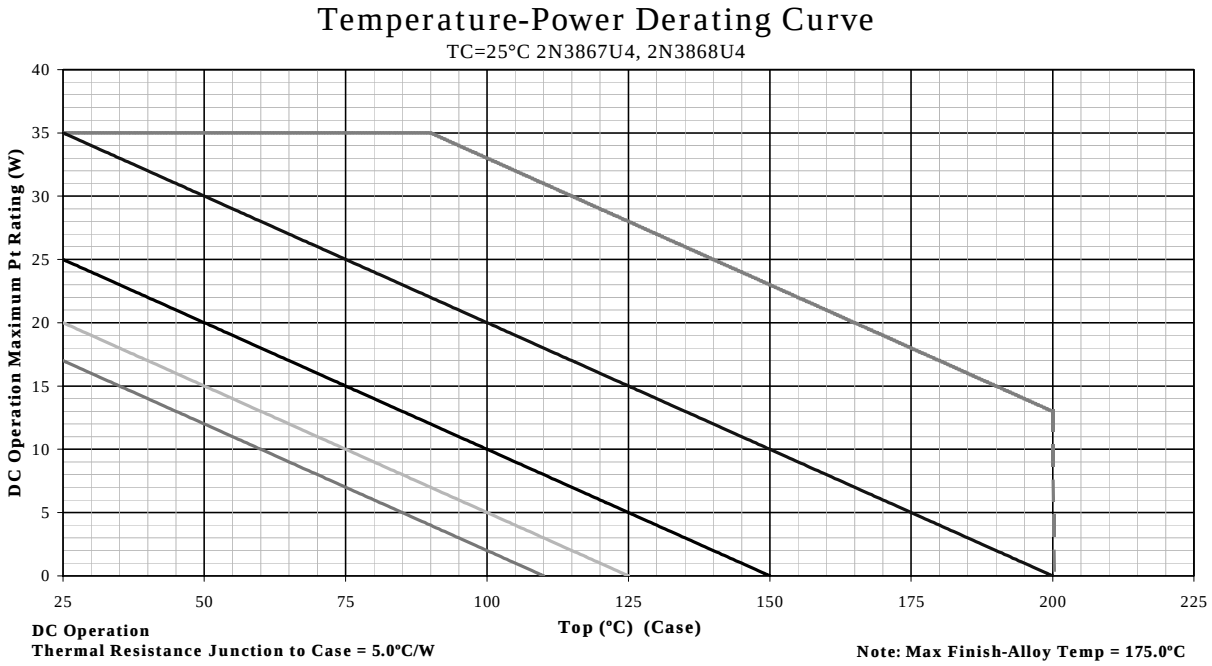
1/ Devices which exceed the table I limits for this test shall not be accepted.



NOTES:

1. Maximum theoretical derate design curve. This is the true inverse of the worst case thermal resistance value. All devices are capable of operating at ≤ T_J specified on this curve. Any parallel line to this curve will intersect the appropriate power for the desired maximum T_J allowed.
2. Derate design curve constrained by the maximum junction temperatures and power rating specified. (See 1.3 herein.)
3. Derate design curve chosen at T_J ≤ 150°C, where the maximum temperature of electrical test is performed.
4. Derate design curve chosen at T_J ≤ 125°C, and 110°C to show power rating where most users want to limit T_J in their application.

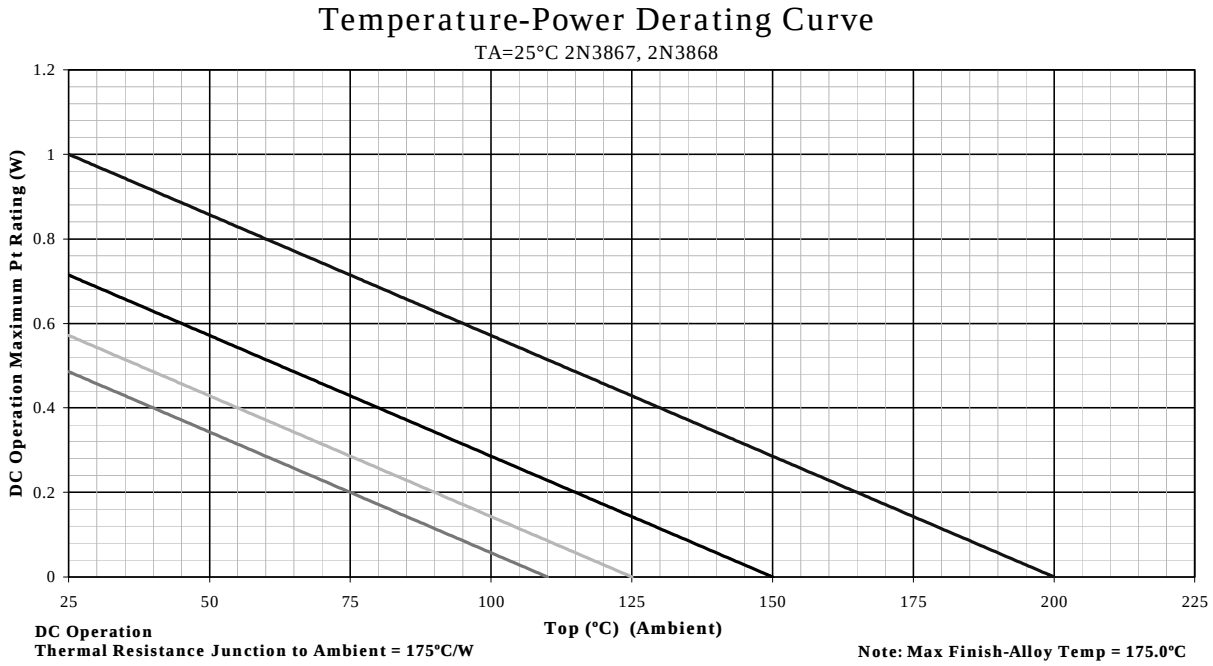
* FIGURE 5. Derating for 2N3867, 2N3868 (TO-5, TO-39).



NOTES:

1. Maximum theoretical derate design curve. This is the true inverse of the worst case thermal resistance value. All devices are capable of operating at $\leq T_J$ specified on this curve. Any parallel line to this curve will intersect the appropriate power for the desired maximum T_J allowed.
2. Derate design curve constrained by the maximum junction temperatures and power rating specified. (See 1.3 herein.)
3. Derate design curve chosen at $T_J \leq 150°C$, where the maximum temperature of electrical test is performed.
4. Derate design curve chosen at $T_J \leq 125°C$, and 110°C to show power rating where most users want to limit T_J in their application.

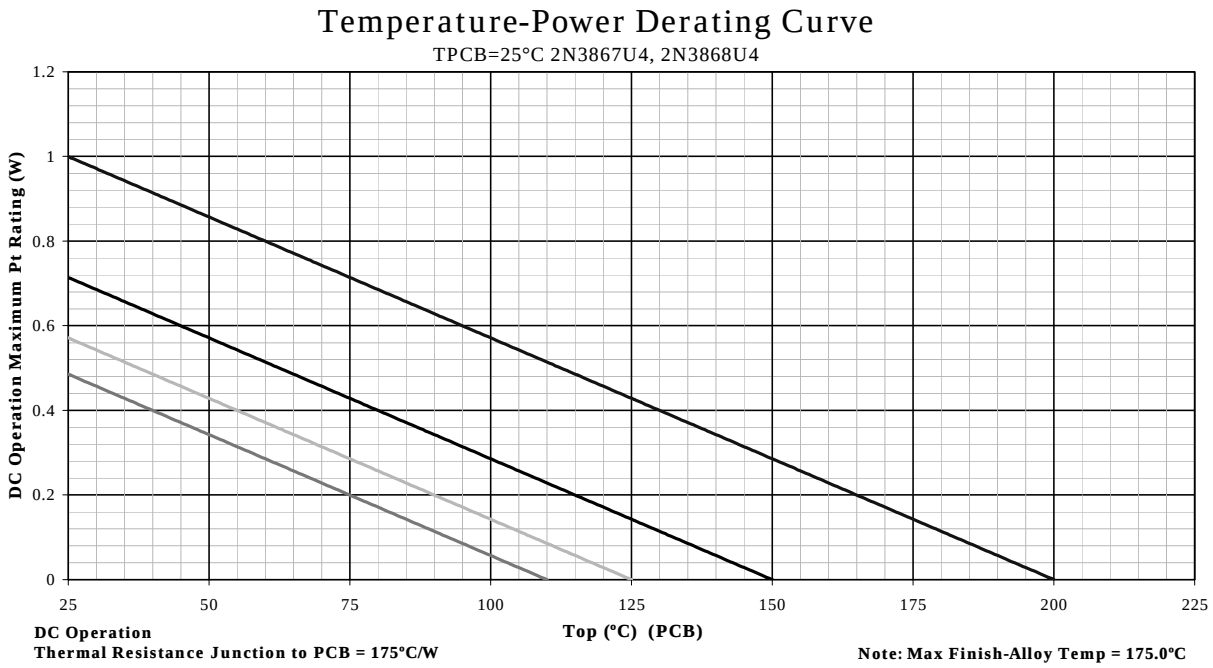
* FIGURE 6. Derating for 2N3867U4, 2N3868U4.



NOTES:

1. This is the true inverse of the worst case thermal resistance value. All devices are capable of operating at ≤ T_J specified on this curve. Any parallel line to this curve will intersect the appropriate power for the desired maximum T_J allowed. Derate design curve meets the maximum junction temperatures and power rating specified. (See 1.3 herein.)
2. Derate design curve chosen at $T_J \leq 150°C$, where the maximum temperature of electrical test is performed.
3. Derate design curve chosen at $T_J \leq 125°C$, and 110°C to show power rating where most users want to limit T_J in their application.

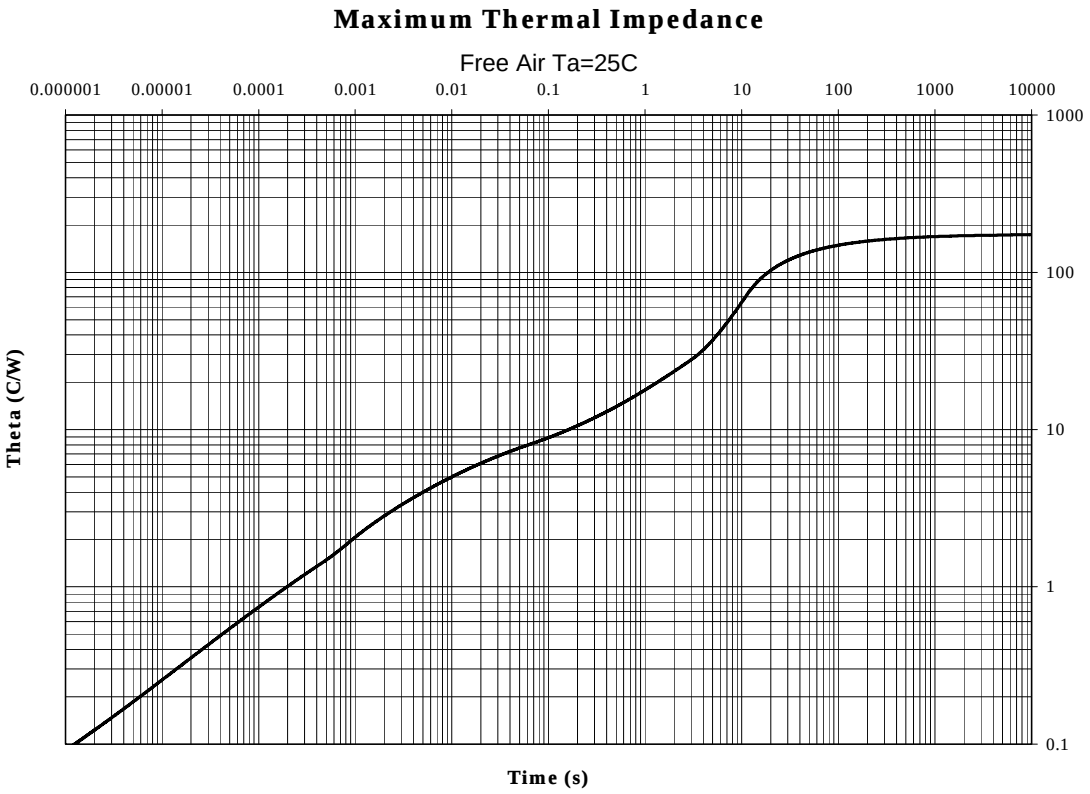
* FIGURE 7. Derating for 2N3867U4, 2N3868U4.



NOTES:

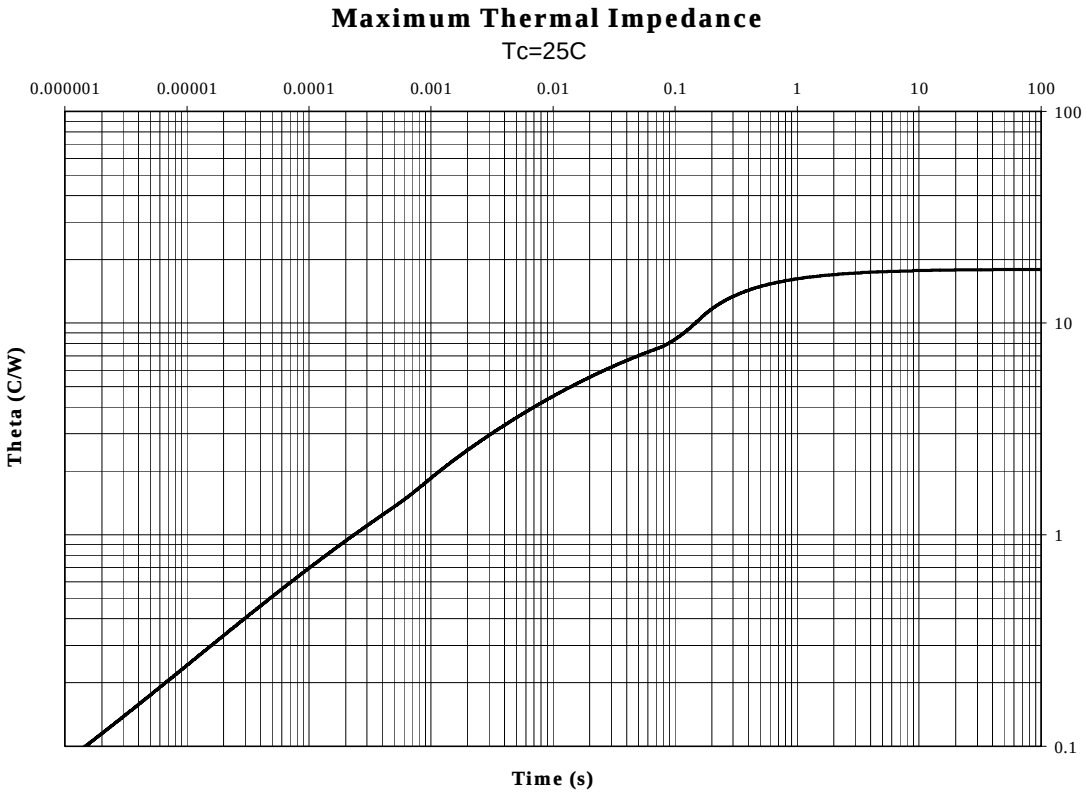
1. This is the true inverse of the worst case thermal resistance value. All devices are capable of operating at ≤ T_J specified on this curve. Any parallel line to this curve will intersect the appropriate power for the desired maximum T_J allowed. Derate design curve meets the maximum junction temperatures and power rating specified. (See 1.3 herein.)
2. Derate design curve chosen at $T_J \leq 150°C$, where the maximum temperature of electrical test is performed.
3. Derate design curve chosen at $T_J \leq 125°C$, and 110°C to show power rating where most users want to limit T_J in their application.

* FIGURE 8. Derating for 2N3867U4, 2N3868U4.



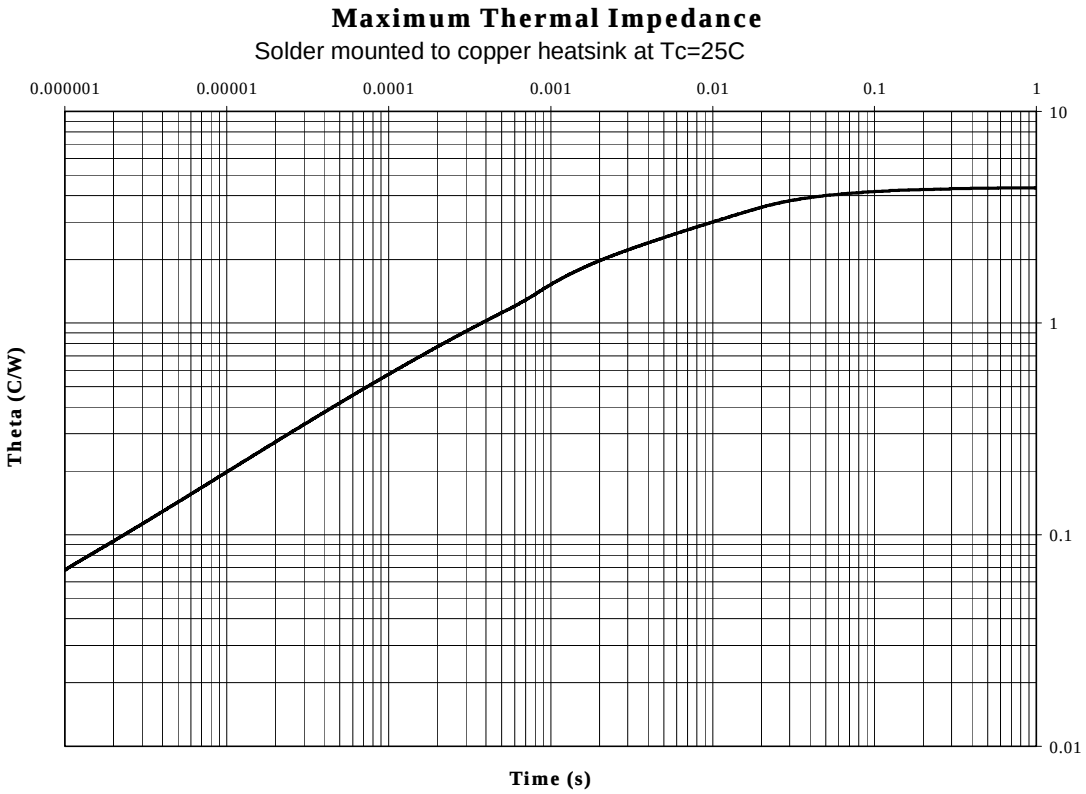
$R_{\theta JA}$ = 175 °C/W

FIGURE 9. Thermal impedance for 2N3867 (TO-5 and TO-39).



$R_{\theta JC}$ = 17.5 °C/W

FIGURE 10. Thermal impedance for 2N3867 (TO-5 and TO-39).



$R_{\theta JC}$ = 5 °C/W

FIGURE 11. Thermal impedance for 2N3867U4, 2N3868U4.

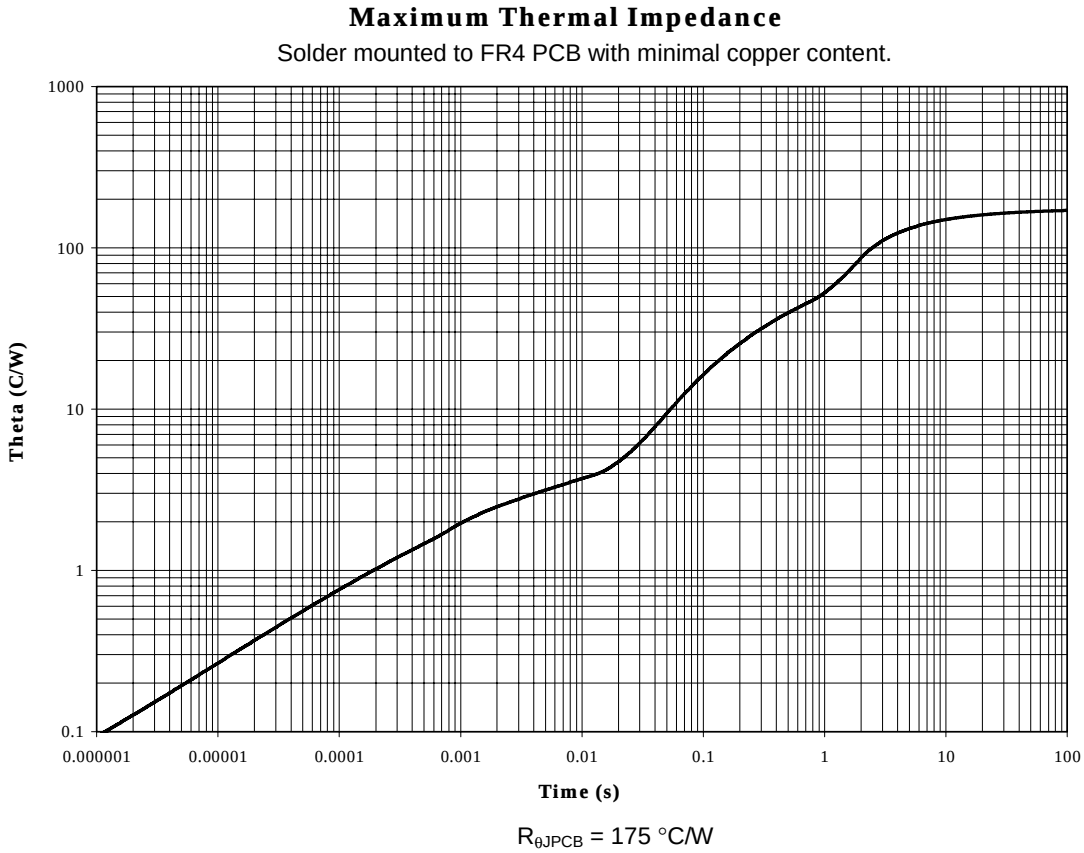


FIGURE 12. Thermal impedance for 2N3867U4, 2N3868U4.

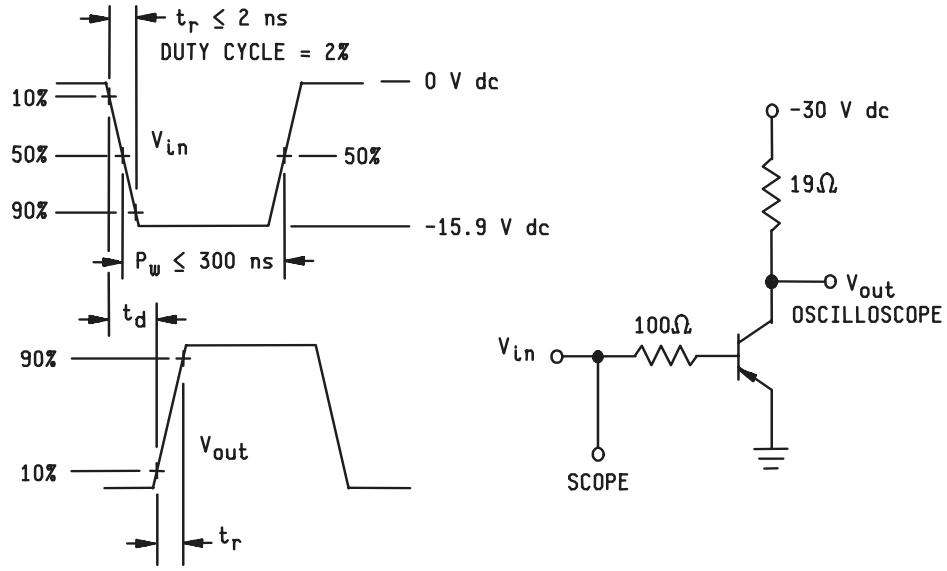


FIGURE 13. Equivalent circuit for measuring delay and rise times.

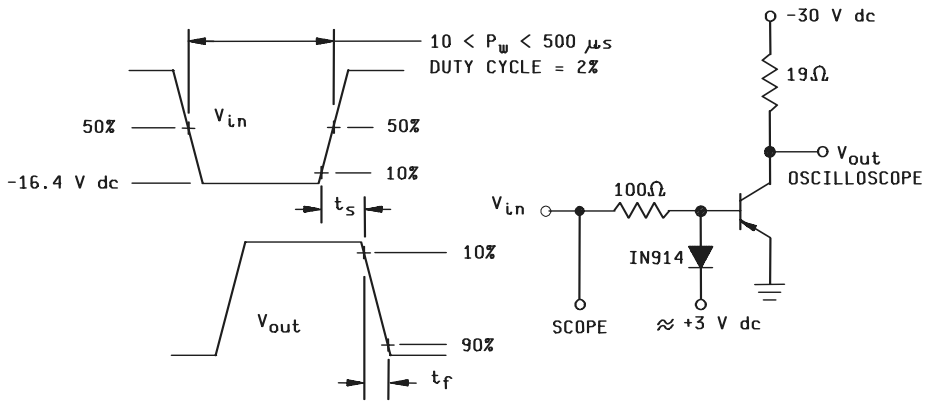


FIGURE 14. Equivalent circuit for measuring storage and fall times.

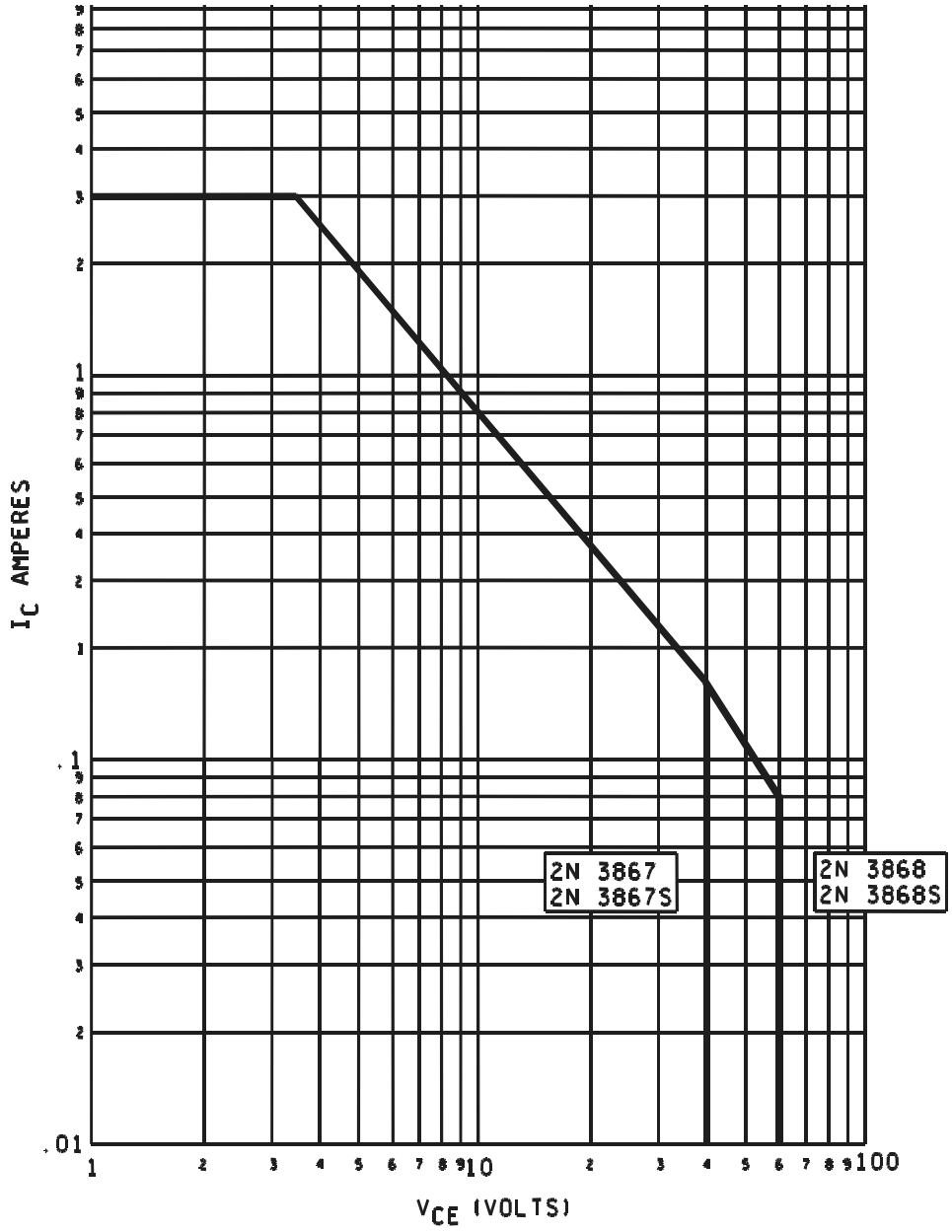


FIGURE 15. Maximum SOA graph (continuous dc).

5. PACKAGING

* 5.1 Packaging. For acquisition purposes, the packaging requirements shall be as specified in the contract or order (see 6.2). When actual packaging of materiel is to be performed by DoD or in-house contractor personnel, these personnel need to contact the responsible packaging activity to ascertain packaging requirements. Packaging requirements are maintained by the Inventory Control Point's packaging activities within the Military Service or Defense Agency, or within the Military Service's system commands. Packaging data retrieval is available from the managing Military Department's or Defense Agency's automated packaging files, CD-ROM products, or by contacting the responsible packaging activity.

6. NOTES

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

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

* 6.2 Acquisition requirements. Acquisition documents should specify the following:

a. Title, number, and date of this specification.

b. Packaging requirements (see 5.1).

c. Lead finish (see 3.4.1).

d. Product assurance level and type designator.

* 6.3 Qualification. With respect to products requiring qualification, awards will be made only for products which are, at the time of award of contract, qualified for inclusion in Qualified Manufacturers' List (QML 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 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 or e-mail vqe.chief@dla.mil.

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 QML.

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.

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

Preparing activity:
DLA - CC

(Project 5961-2712)

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

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