The documentation and process conversion measures necessary to comply with this document shall be completed by 16 May 2005.

INCH-POUND

MIL-PRF-19500/348F
15 February 2005
SUPERSEDING
MIL-PRF-19500/348E
25 July 1999

PERFORMANCE SPECIFICATION SHEET

SEMICONDUCTOR DEVICE, TRANSISTOR, PNP, SILICON, SWITCHING,
TYPES 2N3467, 2N3467L, 2N3468, 2N3468L, JAN, JANTX, JANTXV, AND JANS

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 transistors. Four levels of product assurance is provided for the device type as specified in MIL-PRF-19500.

1.2 Physical dimensions. See figure 1 (TO-39 and TO-5).

* 1.3 Maximum ratings. (T_A = +25°C unless otherwise specified).

P_T (1)	P_T (2)	V_{CBO}		V_{CEO}		V_{EBO}	I_C	RΘJA	RΘJC	T_J and T_{STG}
T_A = +25°C	T_C = +25°C	2N3467 2N3467L	2N3468 2N3468L	2N3467 2N3467L	2N3468 2N3468L					
W	W	V dc	V dc	V dc	V dc	V dc	A dc	°C/W	°C/W	°C
1.0	5.0	40	50	40	50	5.0	1.0	175	30	-55 to +200

(1) See figure 2.
(2) See figure 3.

* Comments, suggestions, or questions on this document should be addressed to Defense Supply Center, Columbus, ATTN: DSCC-VAC, P.O. Box 3990, Columbus, OH 43218-3990, 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://assist.daps.dla.mil.

1.4 Primary electrical characteristics.

Limits	h_{FE2} (1)		h_{FE3} (1)		$V_{CE(sat)2}$
	V_{CE} = 1.0 V dc I_C = 500 mA dc	V_{CE} = 1.0 V dc I_C = 500 mA dc	V_{CE} = 5.0 V dc I_C = 1.0 A dc	V_{CE} = 5.0 V dc I_C = 1.0 A dc	I_C = 500 mA dc I_B = 50 mA dc
	2N3467 2N3467L	2N3468 2N3468L	2N3467 2N3467L	2N3468 2N3468L	
Min Max	40 120	25 75	40	25	V dc 0.6

Limits	C_{obo}	f_T		t_{on}	t_{off}
	V_{CB} = 10 V dc I_E = 0; 100 kHz ≤ f ≤ 1 MHz	V_{CE} = 10 V dc I_C = 50 mA dc f = 100 MHz		I_C = 500 mA dc I_B = 50 mA dc	I_C = 500 mA dc I_B = 50 mA dc
		2N3467 2N3467L	2N3468 2N3468L		
Min Max	pF 25	Mhz 175 500	Mhz 150 500	ns 40	ns 90

(1) Pulsed (see 4.5.1).

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 of 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 SPECIFICATIONS

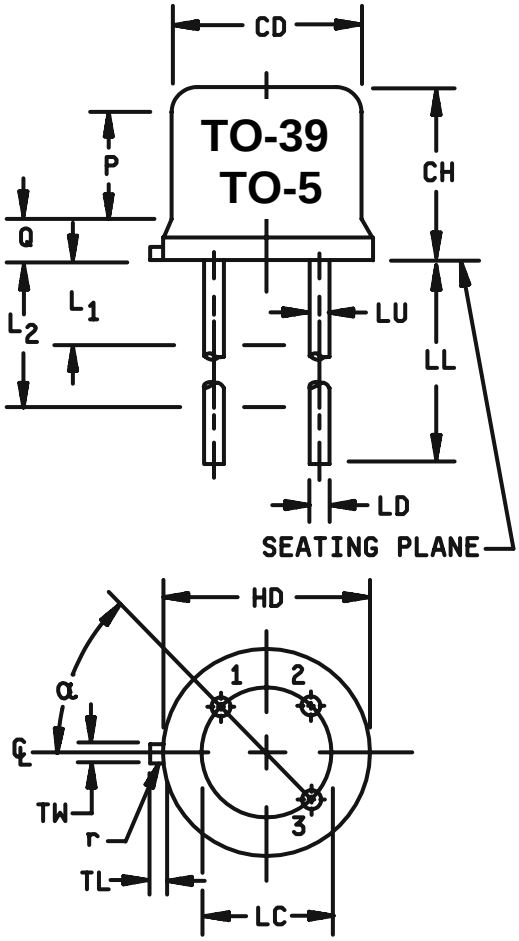
MIL-PRF-19500 - Semiconductor Devices, General Specification for.

DEPARTMENT OF DEFENSE STANDARDS

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

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

Symbol	Dimensions				Notes
	Inches		Millimeters		
	Min	Max	Min	Max	
CD	.305	.335	7.75	8.51	
CH	.240	.260	6.10	6.60	
HD	.335	.370	8.51	9.40	
LC	.200 TP		5.08 TP		6
LD	.016	.021	0.41	0.53	7, 8
LL					7, 8, 11, 12
LU	.016	.019	.041	0.48	7, 8
L_1		.050		1.27	7, 8
L_2	.250		6.35		7, 8
Q		.050		1.27	5
TL	.029	.045	0.74	1.14	4
TW	.028	.034	0.71	0.86	3
r		.010		0.25	10
α	45° TP		45° TP		6
P	.100		2.54		



NOTES:

1. Dimension 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. 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.
7. Dimension LU applies between L_1 and L_2. Dimension LD applies between L_2 and minimum. Diameter is uncontrolled in L_1 and beyond LL minimum.
8. All three leads.
9. The collector shall be internally connected to the case.
10. Dimension r (radius) applies to both inside corners of tab.
11. For “non-L”-suffix devices (TO-39), dimension LL is .500 (12.70 mm) minimum, .750 (19.05 mm) maximum.
12. For "L" suffix devices (TO-5), dimension LL is 1.500 (38.10 mm) minimum, 1.750 (44.45 mm) maximum.
13. Lead 1 = emitter, lead 2 = base, lead 3 = collector.
14. In accordance with ASME Y14.5M, diameters are equivalent to Φx symbology.

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

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

3. REQUIREMENTS

* 3.1 General. The 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 manufacturers 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 figure 1.

* 3.4.1 Lead finish. Lead finish shall be solderable as defined in MIL-PRF-19500. 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.

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 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 tests, the tests specified in table II herein that were not performed in the prior revision shall be performed on the first inspection lot of this revision to maintain qualification.

* 4.3 Screening (JANTX, JANTXV, and JANS 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	JANTXV and JANTX level
1b	Required	Required (JANTXV only)
2	Optional	Optional
3a 3b (1) 3c	Required Not applicable Required, method 3131 of MIL-STD-750	Required Not applicable Required, method 3131 of MIL-STD-750
4	Required	Optional
5	Required	Not required
6	Not applicable	Not applicable
7a and 7b	Optional	Optional
8	Required	Not required
9	I_{CBO1}, h_{FE2} read and record	Not applicable
10	24 hours minimum	24 hours minimum
11	I_{CBO1}; h_{FE2}; ΔI_{CBO1} = 100 percent of initial value or 50 nA dc, whichever is greater. $\Delta h_{FE2} = \pm 25$ percent	I_{CBO1}, h_{FE2}
12	See 4.3.1, 240 hours minimum	See 4.3.1
(2) 13	Subgroups 2 and 3 of table I herein; ΔI_{CBO1}= 100 percent of initial value or 50 nA dc, whichever is greater; $\Delta h_{FE2} = \pm 25$ percent	Subgroup 2 of table I herein; ΔI_{CBO1}= 100 percent of initial value or 50 nA dc, whichever is greater; $\Delta h_{FE2} = \pm 25$ percent
14a and 14b	Required	Required
15	Required	Not required
16	Required	Not required

(1) Thermal impedance limits shall not exceed figures 4 and 5.
(2) PDA = 5 percent for screen 13, applies to ΔI_{CBO1}, Δh_{FE2}, I_{CBO1}, and h_{FE2}. Thermal impedance ($Z_{\Theta JX}$) is not required in screen 13.

* 4.3.1 Power burn-in conditions. Power burn-in conditions are as follows: V_{CB} = 10 - 30 V dc. Power shall be applied to achieve T_J = +135°C minimum using a minimum P_D = 75 percent of P_T maximum rated as defined in 1.3. With approval of the qualifying activity and preparing activity alternate burn-in criteria (hours, bias conditions, T_J and mounting conditions) may be used. A justification demonstrating equivalence is required. In addition, the manufacturing site's burn-in data and performance history will be essential criteria for burn-in modification approval.

* 4.3.2 Thermal impedance. See figures 4 and 5. The thermal impedance 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_{CE}. The thermal impedance limit shall comply with the thermal impedance graphs in figures 4 and 5 (less than or equal to the curve value at the same t_H time) and shall be less than the process determined statistical maximum limit as outlined in method 3131 of MIL-STD-750. See Group E subgroup 4 herein.

* 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 subgroups 1 and 2, of table I herein, 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 tests and conditions specified for subgroup testing in table VIa (JANS) of MIL-PRF-19500 and 4.4.2.1. Electrical measurements (end-points) and delta requirements shall be in accordance with table I, 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 for 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 4.5.3 herein.

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

Subgroup	Method	Condition
B4	1037	V_{CB} = 10 - 30 V dc.
B5	1027	V_{CB} = 10 V dc; $P_D \geq$ 100 percent of maximum rated P_T (see 1.3). (NOTE: If a failure occurs, resubmission shall be at the test conditions of the original sample.) Option 1: 96 hours minimum sample size in accordance with MIL-PRF-19500, table VIa, adjust T_A or P_D to achieve T_J = +275°C minimum. Option 2: 216 hours minimum, sample size = 45, c = 0; adjusted T_A or P_D to achieve a T_J = +225°C minimum.
B6	3131	$R_{\Theta JA}$, $R_{\Theta JC}$ only (see 1.3).

* 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 conformance inspection shall be analyzed to the extent possible to identify root cause and corrective action. Whenever a failure is identified as wafer lot and wafer processing related, the entire wafer lot and related devices assembled from the wafer lot shall be rejected unless an appropriate determined corrective action to eliminate the failure mode has been implemented and the devices from the wafer lot are screened to eliminate the failure mode.

Step	Method	Condition
1	1026	Steady-state life: 1,000 hours minimum, V_{CB} = 10 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, c = 0.
2	1048	Blocking life: 48 hours minimum, T_A = +150°C, V_{CB} = 80 percent of rated voltage. n = 45, 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 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	t = 1,000 hours, V_{CB} = 10 V dc, power temperature shall be applied to the device to achieve T_J = +150°C minimum, and minimum power dissipation of 75 percent of maximum rated P_T (see 1.3 herein); n = 45, c = 0.
	1037	For solder die attach, $V_{CB} \geq$ 10 V dc, 6,000 cycles.

* 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	$R_{\Theta JA}$, $R_{\Theta JC}$ only (see 1.3).
C6		Not applicable.

* 4.4.3.3 Group C sample selection. Samples for steps in group C shall be chosen at random from any inspection lot containing the intended package type and lead finish procured to the same specification which is submitted to and passes table I tests for conformance inspection. When the final lead finish is solder or any plating prone to oxidation at high temperature, the samples for C6 life test may be pulled prior to the application of final lead finish. Testing of a subgroup using a single device type enclosed in the intended package type shall be considered as complying with the requirements for that subgroup.

* 4.4.4 Group E inspection. Group E inspection shall be conducted in accordance with the conditions specified for subgroup testing in appendix E, table IX of MIL-PRF-19500 and as specified in table II herein. Electrical measurements (end-points) shall be in accordance with table I, subgroup 2 herein. Delta measurements shall be in accordance with the applicable steps of 4.5.3.

4.5 Method of inspection. Methods of inspection shall be as specified in the appropriate tables and as follows.

4.5.1 Pulse measurements. Conditions for pulse measurement shall be as specified in section 4 of MIL-STD-750.

4.5.2 Input capacitance. This test shall be conducted in accordance with method 3240 of MIL-STD-750, except the output capacitor shall be omitted.

* 4.5.3 Delta requirements. Delta requirements shall be as specified below: (1) (2) (3) (4) (5)

Step	Inspection	MIL-STD-750		Symbol	Limit
		Method	Conditions		
1.	Collector to base cutoff current	3036	Bias condition D; V_{CB} = 30 V dc	ΔI_{CBO1} (1)	100 percent of initial value or 50 nA dc, whichever is greater.
2.	Collector to emitter voltage saturated	3071	I_C = 500 mA dc; I_B = 50 mA dc; pulsed (see 4.5.1)	$\Delta V_{CE(SAT)2}$	50 mV dc change from initial value.
3.	Forward-current transfer ratio	3076	V_{CE} = 1.0 V dc; I_C = 500 mA dc; pulsed (see 4.5.1)	Δh_{FE2} (1)	25 percent change from initial value.

(1) Devices which exceed the table I limits for this test shall not be accepted.
(2) The delta electrical measurements for subgroup 5, table VIa (JANS) of MIL-PRF-19500 are as follows: see 4.5.3, steps 1, 2, and 3.
(3) The delta measurements for Group B (see 4.4.2.2. herein, JAN, JANTX and JANTXV) are as follows: see 4.5.3, steps 1, 2 and 3.
(4) The delta electrical measurements for subgroup 6, table VII of MIL-PRF-19500 are as follows: see 4.5.3, step 3.
* (5) The delta measurements for table IX of MIL-PRF-19500 and table II herein are as follows: Subgroups 1 and 2, see 4.5.3, all steps.

4.5.4 Thermal resistance. Thermal resistance measurements shall be conducted in accordance with method 3131 of MIL-STD-750. The following details shall apply:

a. Minimum collector current magnitude during power application shall be 160 mA dc for $R_{\Theta JC}$ and 32 mA dc for $R_{\Theta JA}$.

b. Collector to base voltage magnitude shall be 10 V dc.

c. Reference temperature measuring point shall be the case for $R_{\Theta JC}$ and ambient air for $R_{\Theta JA}$.

d. Reference point temperature shall be selected with 25°C $\leq T_R \leq$ 35°C and recorded before test is started.

e. Mounting arrangement shall be with heat sink to case for $R_{\Theta JC}$ and without heat sink for $R_{\Theta JA}$.

f. Maximum limits shall be $R_{\Theta JC}$ = 30°C/W and $R_{\Theta JA}$ = 175°C/W.

* TABLE I. Group A inspection.

Inspection 1/	MIL-STD-750		Symbol	Limit		Unit
	Method	Conditions		Min	Max	
Subgroup 1 2/						
Visual and mechanical inspection 3/	2071	n = 45 , c = 0				
Solderability 3/ 4/	2026	n = 15 leads, c = 0				
Resistance to solvents 3/ 4/ 5/	1022	n = 15 , c = 0				
Temp cycling 3/ 4/	1051	Test condition C, 25 cycles. n = 22 , c = 0				
Hermetic seal 4/ Fine leak Gross leak	1071	n = 22 , c = 0				
Electrical measurements 4/		Table I, subgroup 2				
Bond strength 3/ 4/	2037	Precondition T_A = +250°C at t = 24 hours or T_A = +300°C at t = 2 hours n = 11 wires, c = 0				
Decap internal visual (design verification) 4/	2075	n = 4 , c = 0				
Subgroup 2						
Thermal impedance	3131	See 4.3.2.	$Z_{\Theta JX}$			°C/W
Breakdown voltage collector to base	3001	Bias condition D; I_C = 10 μA dc	$V_{(BR)CBO}$			
2N3467, L				40		V dc
2N3468, L				50		V dc
Breakdown voltage emitter to base	3026	Bias condition D; I_E = 10 μA dc	$V_{(BR)EBO}$	5.0		V dc
Breakdown voltage, collector to emitter	3011	Bias condition D; I_C = 10 mA dc; pulsed (see 4.5.1)	$V_{(BR)CEO}$			
2N3647, L				40		V dc
2N3648, L				50		V dc
Collector to base cutoff current	3036	Bias condition D; V_{CB} = 30 V dc	I_{CBO1}		100	nA dc
Collector to emitter cutoff current	3041	Bias condition A; V_{EB} = 3.0 V dc; V_{CE} = 30 V dc	I_{CEX}		100	nA dc
Forward to current transfer ratio	3076	V_{CE} = 1.0 V dc; I_C = 150 mA dc; pulsed (see 4.5.1)	h_{FE1}			
2N3467, L				40		
2N3468, L				25		

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_{FE2}			
2N3467, L				40	120	
2N3468, L				25	75	
Forward-current transfer ratio	3076	V_{CE} = 5.0 V dc; I_C = 1.0 A dc; pulsed (see 4.5.1)	h_{FE3}			
2N3467, L				40		
2N3468, L				25		
Collector to emitter saturation voltage	3071	I_C = 150 mA dc; I_B = 15 mA dc; pulsed (see 4.5.1)	$V_{CE(SAT)1}$		0.35	V dc
Collector to emitter saturation voltage	3071	I_C = 500 mA dc; I_B = 50 mA dc; pulsed (see 4.5.1)	$V_{CE(SAT)2}$		0.6	V dc
Collector to emitter saturation voltage	3071	I_C = 1.0 A dc; I_B = 100 mA dc; pulsed (see 4.5.1)	$V_{CE(SAT)3}$		1.2	V dc
Base to emitter voltage saturated	3066	Test condition A; I_C = 150 mA dc I_B = 15 mA dc; pulsed (see 4.5.1)	$V_{BE(SAT)1}$		1.0	V dc
Base to emitter voltage saturated	3066	Test condition A; I_C = 500 mA dc; I_B = 50 mA dc; pulsed (see 4.5.1)	$V_{BE(SAT)2}$	0.8	1.2	V dc
Base to emitter voltage saturated	3066	Test condition A; I_C = 1.0 A dc; I_B = 100 mA dc; pulsed (see 4.5.1)	$V_{BE(SAT)3}$		1.6	V dc
Subgroup 3						
High-temperature operation:		T_A = +150°C				
Collector to base cutoff current	3036	Bias condition D; V_{CB} = 30 V dc	I_{CBO2}		50	µA dc
Low-temperature operation:		T_A = -55°C				
Forward-current transfer ratio	3076	V_{CE} = 1.0 V dc; I_C = 150 mA dc; pulsed (see 4.5.1)	h_{FE4}			
2N3467, L				16		
2N3468, L				10		

See footnotes at end of table.

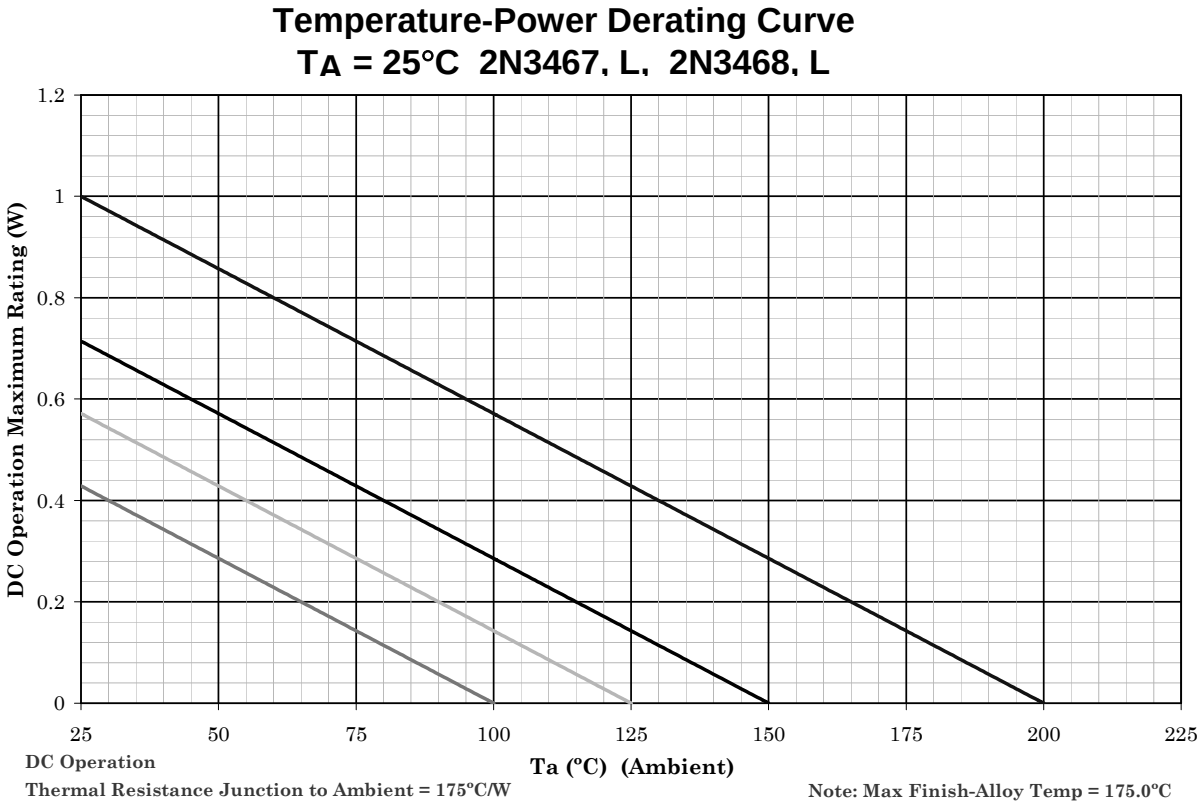
* TABLE I. Group A inspection - Continued.

Inspection 1/	MIL-STD-750		Symbol	Limit		Unit
	Method	Conditions		Min	Max	
Subgroup 4						
Extrapolated unity gain frequency	3261	V_{CE} = 10 V dc; I_C = 50 mA dc; f = 100 MHz	f_t			
2N3467, L				175	500	MHz
2N3468, L				150	500	MHz
Open circuit output capacitance	3236	V_{CB} = 10 V dc; I_E = 0; 100 kHz ≤ f ≤ 1 MHz	C_{obo}		25	pF
Input capacitance (output open-circuited)	3240	V_{EB} = 0.5 V dc; I_C = 0; 100 kHz ≤ f ≤ 1 MHz (see 4.5.2)	C_{ibo}		100	pF
Pulse response						
Delay time	3251	Test condition A; I_C = 500 mA dc; I_{B1} = 50 mA dc; V_{EB} = 2 V dc (see figure 6)	t_d		10	ns
Rise time	3251	Test condition A; I_C = 500 mA dc; I_{B1} = 50 mA dc; V_{EB} = 2 V dc (see figure 6)	t_r		30	ns
Storage time	3251	Test condition A; I_C = 500 mA dc; I_{B1} = I_{B2} = 50 mA dc; (see figure 7)	t_s		60	ns
Fall time	3251	Test condition A; I_C = 500 mA dc; I_{B1} = I_{B2} = 50 mA dc; (see figure 7)	t_f		30	ns
Subgroups 5, 6, and 7						
Not applicable						

1/ For sampling plan see MIL-PRF-19500.
2/ For resubmission of failed subgroup of table I, 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 or requalification 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 and 4.5.3 herein.	
Subgroup 2			45 devices c = 0
Intermittent life	1037	V_{CB} = 10 V dc, 6,000 cycles.	
Electrical measurements		See table I, subgroup 2 and 4.5.3 herein.	
Subgroup 4			
Thermal impedance curves		Each supplier shall submit their qualification lot average and design thermal impedance curves to the qualification activity. In addition, optimal test conditions and thermal impedance limit shall be provided to the qualifying activity in the qualification report.	Sample size N/A
Subgroup 5			
Not applicable			
Subgroup 6			3 devices c = 0
ESD	1020		
Subgroup 8			45 devices c = 0
Reverse stability	1033	Condition B	

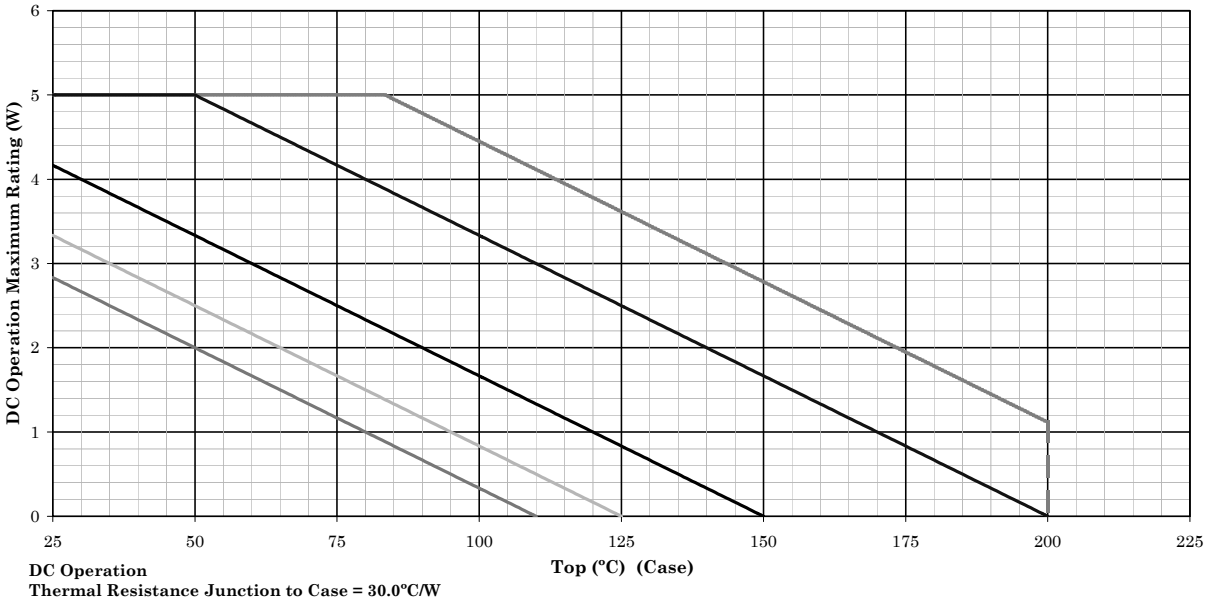


NOTES:

1. 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 temperature ($T_J \leq 200°C$) 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 curves 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 2. Temperature-power derating $R_{\Theta JA}$.

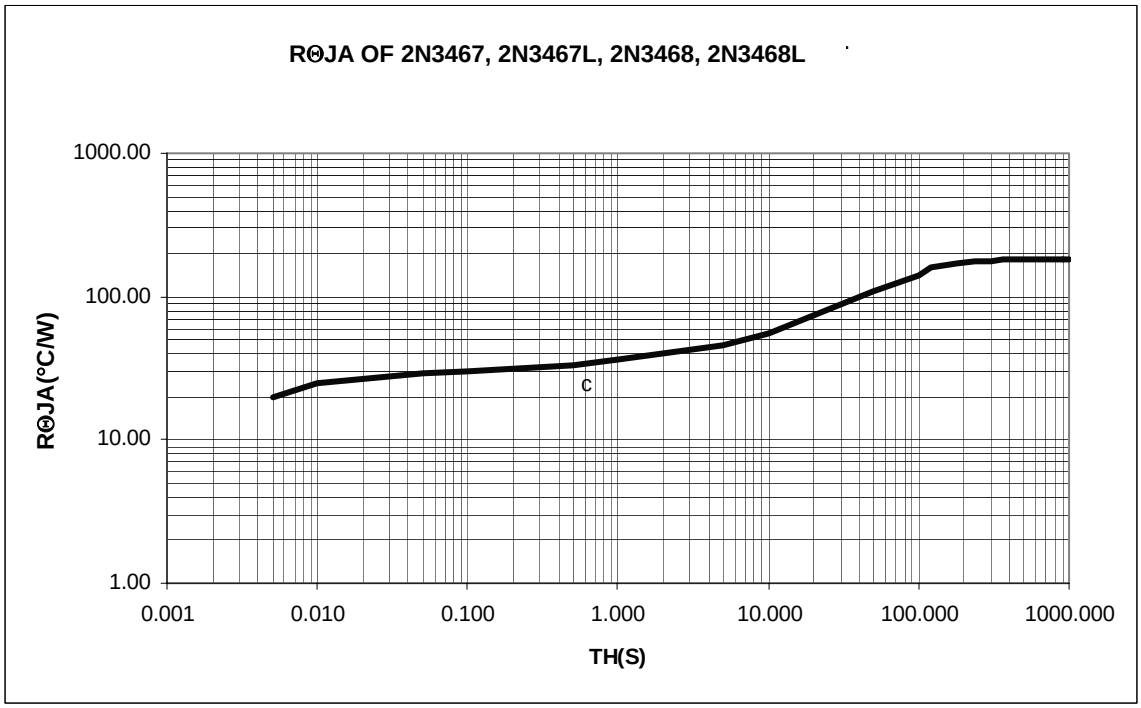
Temperature-Power Derating Curve
T_C = 25°C 2N3467, L, 2N3468, L



NOTES:

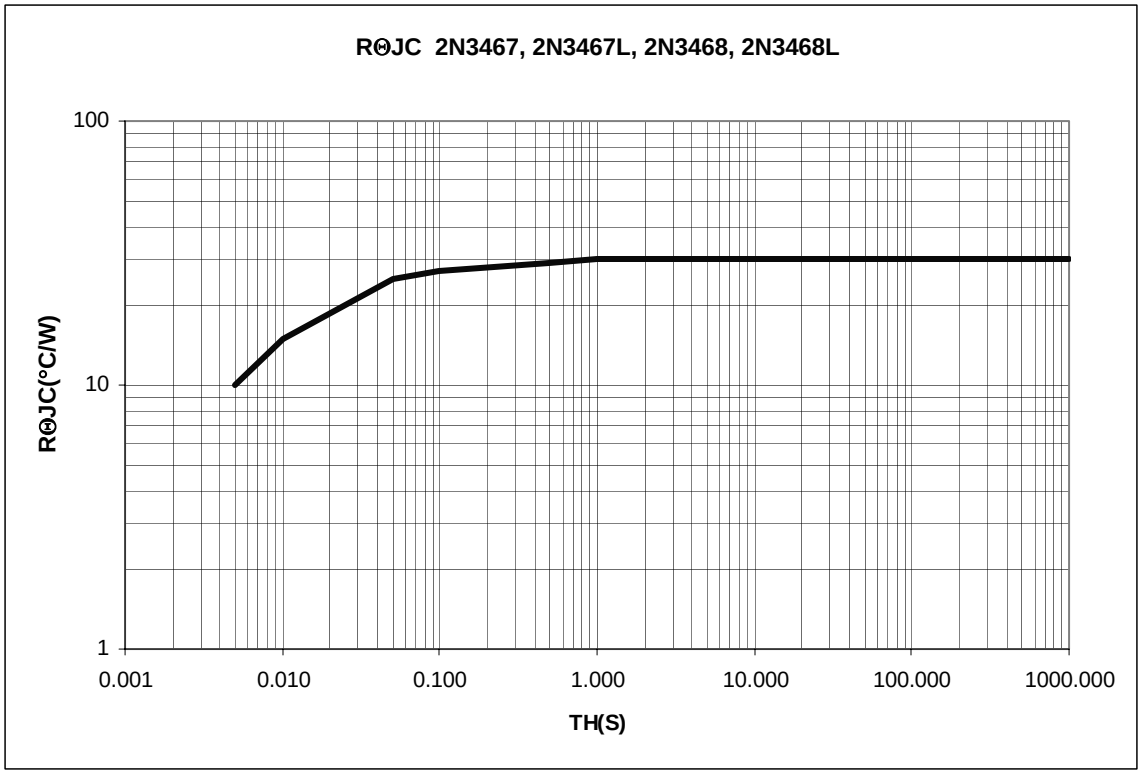
1. Top curve is thermal runaway loci and cannot be used as a derate design curve since it exceeds the maximum ratings for this part. Operating under this curve using these mounting conditions assures the device will not have a thermal runaway. This is the true inverse of the worst case thermal resistance value extrapolated out to the thermal runaway point.
2. Derate design curve constrained by the maximum junction temperature ($T_J \leq 200°C$) 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 curves 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 3. Temperature-power derating $R_{\Theta JC}$.



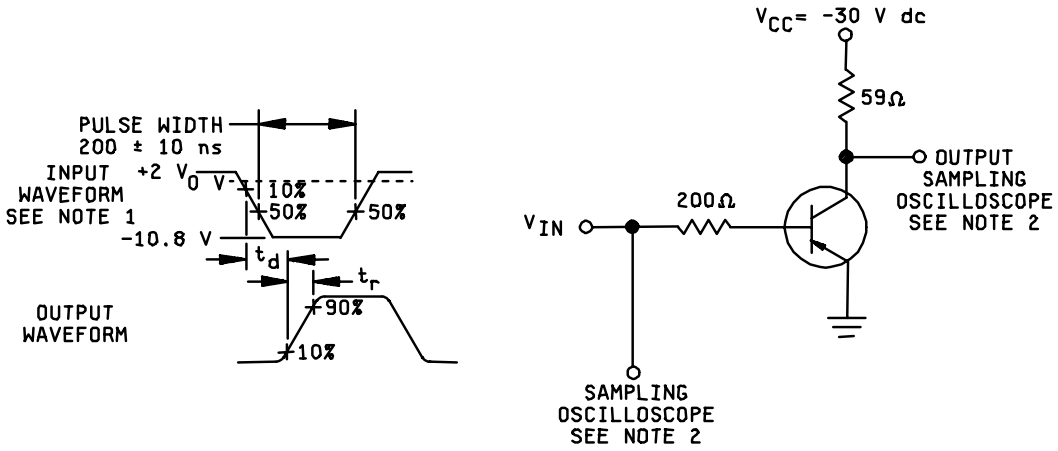
Thermal Resistance = 175°C/W. T_A = 25°C

* FIGURE 4. Thermal impedance graph ($R_{\Theta JA}$).



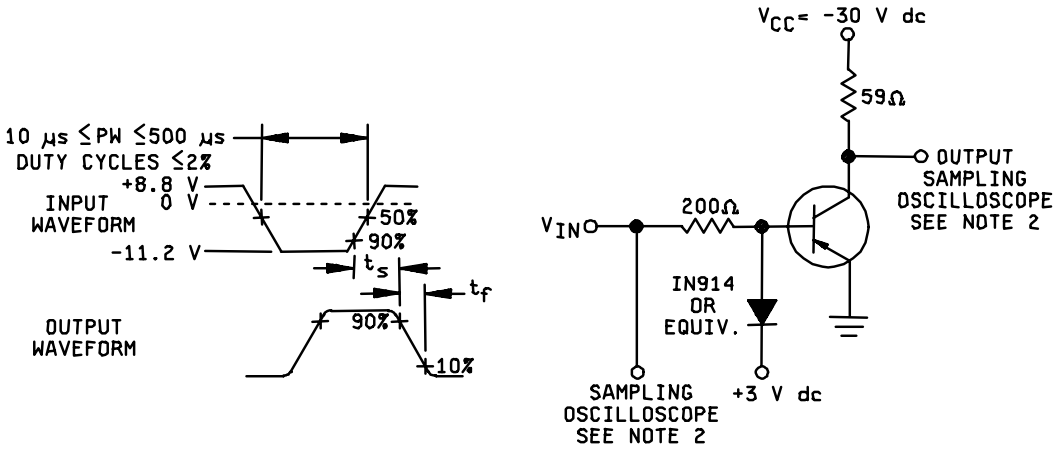
Thermal Resistance = 30°C/W, T_C = 25°C

* FIGURE 5. Thermal impedance graph ($R_{\Theta JC}$).



NOTES:
1. The rise time (t_r) of the applied pulse shall be ≤ 2 ns, duty cycle ≤ 2 percent and the generator source impedance shall be 50 ohms.
2. Sampling oscilloscope: Z_{in} ≥ 100 kΩ, C_{in} ≤ pF, rise time ≤ .2 ns.

FIGURE 6. Equivalent circuit for measuring delay and rise times.



NOTES:
1. The rise time (t_r) of the applied pulse shall be ≤ 2 ns, duty cycle ≤ 2 percent and the generator source impedance shall be 50 ohms.
2. Sampling oscilloscope: Z_{in} ≥ 100 kΩ, C_{in} ≤ pF, rise time ≤ .2 ns.

FIGURE 7. Equivalent circuit for measuring storage and fall times.

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-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 43218-3990 or e-mail vqe.chief@dla.mil.

6.4 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 5961-2920)

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

* NOTE: The activities listed above were interested in this document as of the date of this document. Since organizations and responsibilities can change, you should verify the currency of the information above using the ASSIST Online database at: http://assist.daps.dla.mil.