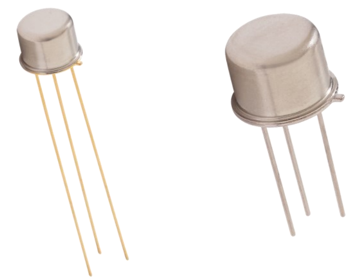
2N3867, 2N3867S & 2N3868, 2N3868S

PNP Silicon Low Power Transistor

Rev. V3

Features



- Available in JAN, JANTX, JANTXV per MIL-PRF-19500/350
- TO-5 Package: 2N3867, 2N3868
- TO-39 Package: 2N3867S, 2N3868S
- Designed for High Speed Switching and Amplifier Applications

Electrical Characteristics (T_A = 25°C unless otherwise noted)

Parameter	Test Conditions	Symbol	Units	Min.	Max.
Collector - Base Breakdown Voltage	V_{CB} = -40V 2N3867, 2N3867S V_{CB} = -60V 2N3868, 2N3868S	I_{CBO1}	µA dc		-100
Collector - Emitter Breakdown Voltage	I_C = -20 mA dc, 2N3867, 2N3867S I_C = -20 mA dc, 2N3868, 2N3868S	$V_{(BR)CEO}$	V dc	-40 -60	—
Collector - Emitter Cutoff Current	V_{EB} = +2.0 V dc, V_{CE} = -40 Vdc, 2N3867, 2N3867S V_{EB} = +2.0 V dc, V_{CE} = -60 Vdc, 2N3868, 2N3868S	I_{CEX1}	µA dc	—	 -1.0 -1.0
Emitter - Base Cutoff Current	V_{EB} = -4.0 Vdc	I_{EBO1}	µA dc	—	-100
Forward Current Transfer Ratio	V_{CE} = -1.0 V dc, I_C = -500 mA dc 2N3867, 2N3867S 2N3868, 2N3868S V_{CE} = -2.0 Vdc, I_C = -1.5 A dc 2N3867, 2N3867S 2N3868, 2N3868S V_{CE} = -3.0 V dc, I_C = -2.5 A dc 2N3867, 2N3867S 2N3868, 2N3868S V_{CE} = -5.0 V dc, I_C = -3.0 mA dc All Types	h_{FE}	-	 50 35 40 30 25 20 20	 — — 200 150 — — —
Collector - Emitter Saturation Voltage	I_C = -500 mA dc, I_B = -50 mA dc I_C = -1.5 A dc, I_B = -150 mA dc I_C = -2.5 A dc, I_B = -250 mA dc	$V_{CE(sat)1}$ $V_{CE(sat)2}$ $V_{CE(sat)3}$	V dc	—	-0.5 -0.75 -1.5
Base - Emitter Saturation Voltage	I_C = -500 mA dc, I_B = -50 mA dc I_C = -1.5 A dc, I_B = -150 mA dc I_C = -2.5 A, I_B = -250 mA dc	$V_{BE(sat)1}$ $V_{BE(sat)2}$ $V_{BE(sat)3}$	V dc	-0.9	-1.0 -1.4 -2.0

(Continued next page)

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Electrical Characteristics (T_A = +25°C unless otherwise noted)

Parameter	Test Conditions	Symbol	Units	Min.	Max.
Collector - Emitter Cutoff Current	T_A = +150°C V_{EB} = +2.0 V dc, V_{CE} = -40 Vdc, 2N3867, 2N3867S V_{EB} = +2.0 V dc, V_{CE} = -60 Vdc, 2N3868, 2N3868S	I_{CEX2}	µA dc	—	-50 -50
Forward-Current Transfer Ratio	T_A = -55°C V_{CE} = -1.0 V dc, I_C = -500 mA dc 2N3867, 2N3867S 2N3868, 2N3868S	h_{FE5}	V dc	25 17	
Dynamic Characteristics					
Magnitude of Common Emitter Small-Signal Short-Circuit Forward Current Transfer Ratio	V_{CE} = -5.0 V dc, I_C = -100 mA dc, f = 20 MHz	$\vert h_{fe} \vert$	-	3	12
Open Circuit Output Capacitance	V_{CB} = 10 Vdc, I_E = 0, 100 kHz ≤ f ≤ 1 MHz	C_{obo}	pF	—	120
Input Capacitance	V_{CB} = -3 Vdc, I_C = 0, 100 kHz ≤ f ≤ 1 MHz	C_{ibo}	pF	—	800
Switching Characteristics					
Delay Time	V_{CC} = -30 V dc, V_{EB} = 0, I_C = -1.5 A dc, I_{B1} = -150 mA dc	t_d	ns	—	35
Rise Time	V_{CC} = -30 V dc, V_{EB} = 0 V dc, I_C = -1.5 A dc, I_{B1} = -150 mA dc	t_r	ns	—	65
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	t_s	ns	—	500
Fall Time	V_{CC} = -30 V dc, V_{EB} = 0V dc, I_C = -1.5 A dc, I_{B1} = I_{B2} = -150 mA dc	t_f	ns	—	100

Absolute Maximum Ratings (T_A = +25°C unless otherwise noted)

Ratings	Symbol	Value
Collector - Emitter Voltage 2N3867, 2N3867S 2N3868, 2N3868S	V_{CEO}	-40 V dc -60 V dc
Collector - Base Voltage 2N3867, 2N3867S 2N3868, 2N3868S	V_{CBO}	-40 V dc -60 V dc
Emitter - Base Voltage	V_{EBO}	-4.0 V dc
Collector Current	I_C	-3.0 A dc
Total Power Dissipation @ T_A = +25°C (1) @ T_C = +25°C (2)	P_T	1.0 W 10 W
Operating & Storage Temperature Range	T_J, T_{STG}	-65°C to +200°C

(1) For derating, see figures 5, 6, 7 and 8 of MIL-PRF-19500/350.
(2) For thermal curves, see figures 9, 10, 11 and 12 of MIL-PRF-19500/350.

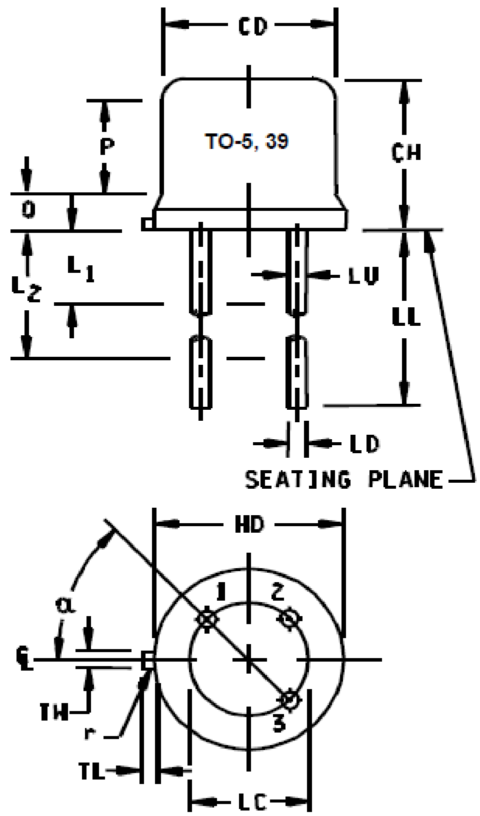
Thermal Characteristics

Characteristics	Symbol	Max. Value
Thermal Resistance, Junction to Case	$R_{\theta JC}$	17.5°C/W

Safe Operating Area	
DC Tests:	T_C = +25°C, I Cycle, t = 1.0 s (see figure 15 of MIL-PRF-19500/350
Test 1:	V_{CE} = -3.33 V dc, I_C = -3 A dc
Test 2:	V_{CE} = -40 V dc, I_C = -160 mA dc, 2N3867, 2N3867S
Test 3:	V_{CE} = -60 V dc, I_C = -80 mA dc, 2N3868, 2N3868S

Outline Drawings (TO-5, TO-39)

Symbol	Dimensions				Note
	Inches		Millimeters		
	Min	Max	Min	Max	
CD	.305	.335	7.75	8.51	5, 6
CH	.240	.260	6.10	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
L_1		.050		1.27	8,9
L_2	.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					

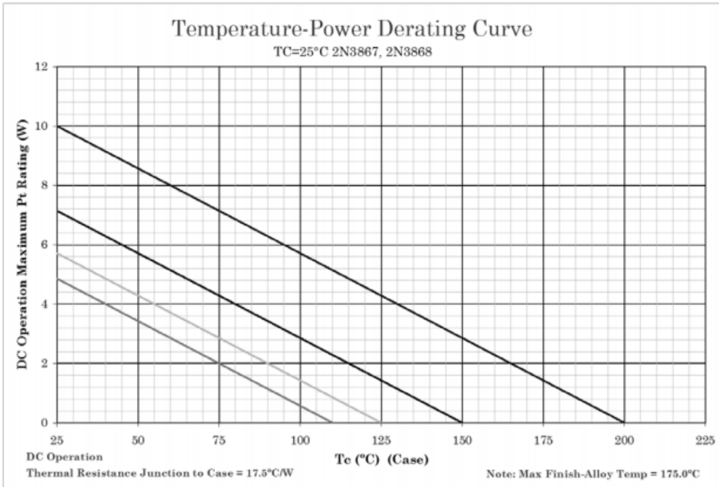


NOTES:

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 (TO-5), dimension LL = 1.5 inches (38.10 mm) min. and 1.75 inches (44.45 mm) max. For S-suffix types (TO-39), dimension LL = .5 inch (12.70 mm) min. and .750 inch (19.05 mm) max.

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

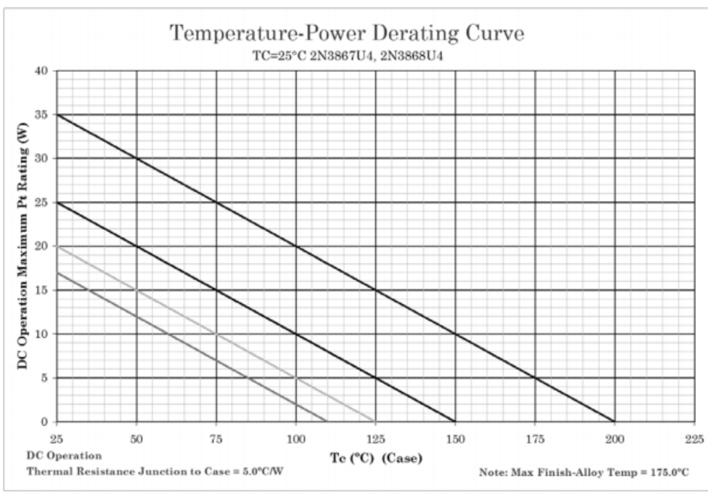
Temperature-Power Derating Curves



NOTES:

1. 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).

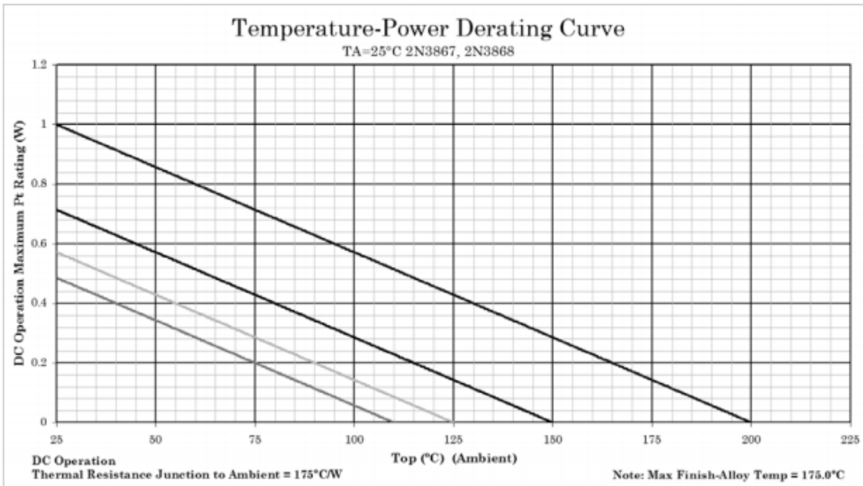


NOTES:

1. 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 6. Derating for 2N3867U4, 2N3868U4.

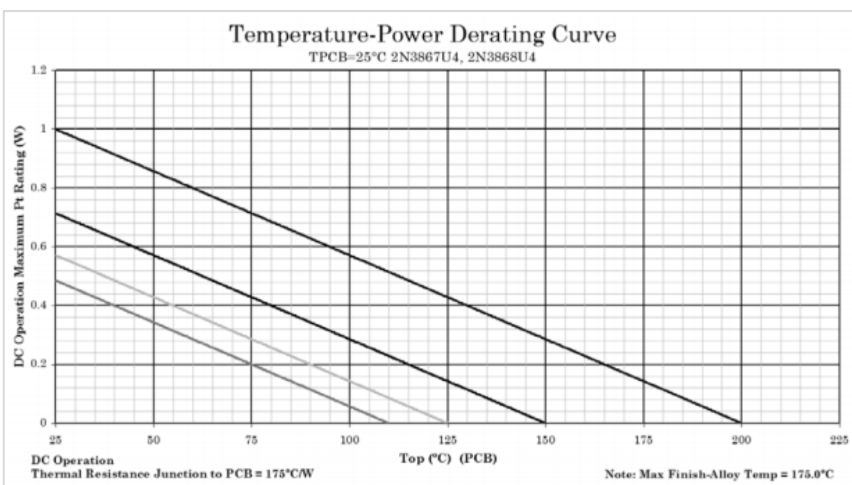
Temperature-Power Derating Curves



NOTES:

1. 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 $T_J \leq 150°C$, 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 7. Derating for 2N3867, 2N3868.

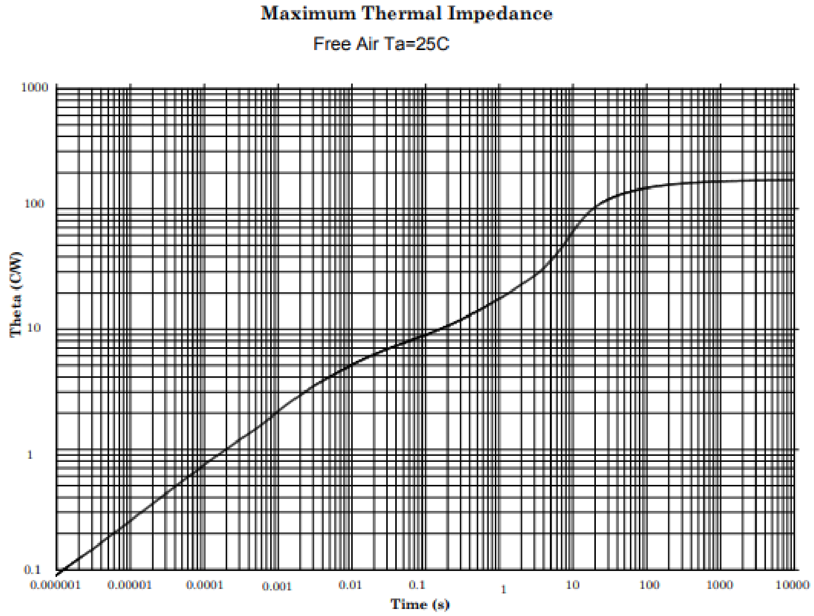


NOTES:

1. 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 $T_J \leq 150°C$, 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.

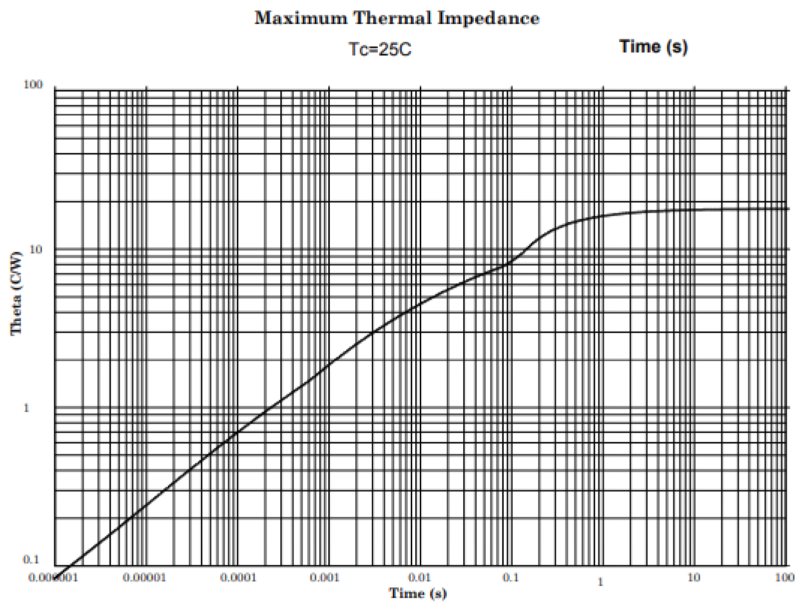
FIGURE 8. Derating for 2N3867U4, 2N3868U4.

Thermal Impedance Curves



$R_{\theta JA}$ = 175 °C/W

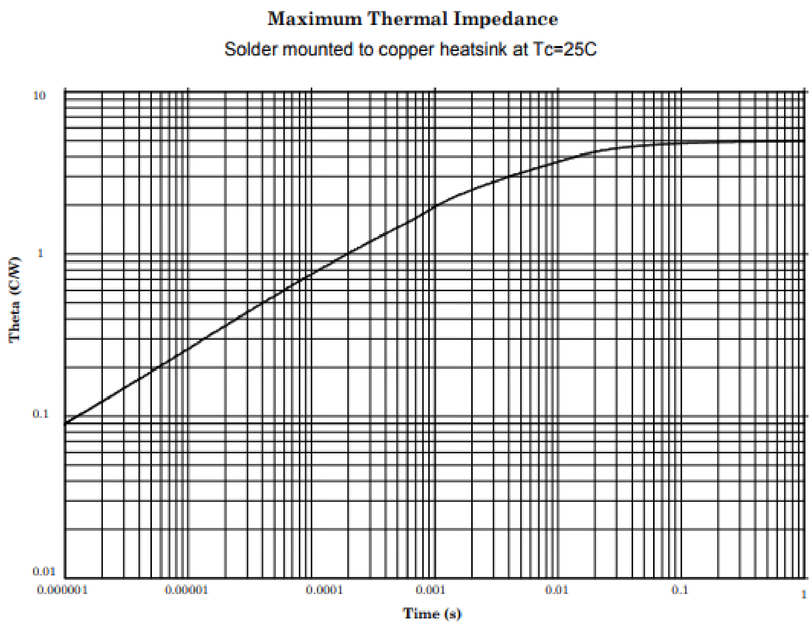
FIGURE 9. Thermal impedance for 2N3867 and 2N3868 (TO-5 and TO-39).



$R_{\theta JC}$ = 17.5 °C/W

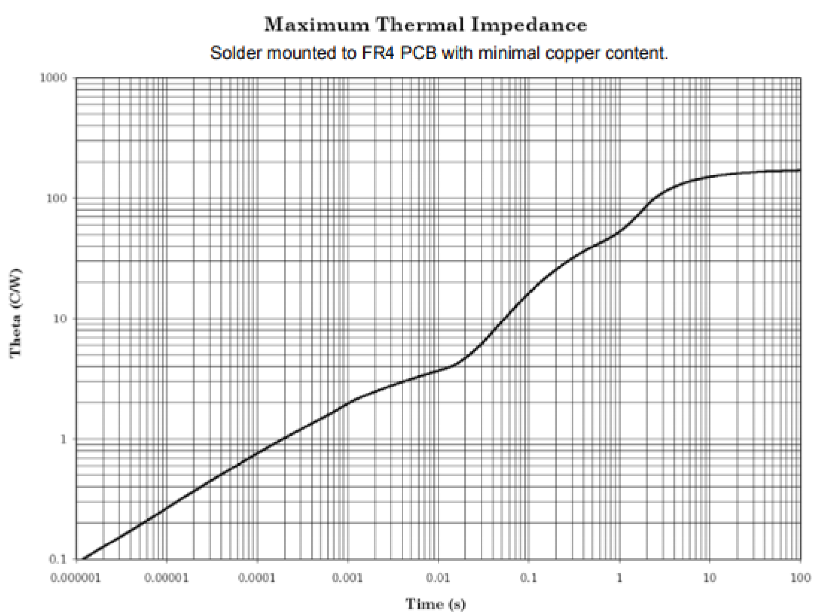
FIGURE 10. Thermal impedance for 2N3867 and 2N3868 (TO-5 and TO-39).

Thermal Impedance Curves



$R_{\theta JC}$ = 5 °C/W

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



$R_{\theta JPCB}$ = 175 °C/W

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

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