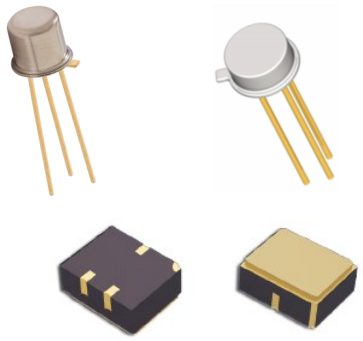
2N3057A, 2N3700, 2N3700UB

NPN Low Power Silicon Transistor

Rev. V3

Features

- JAN, JANTX, JANTXV and JANS Qualified to MIL-PRF-19500/391
- Lightweight & Low Power
- Ideal for Space, Military, & other High Reliability Applications
- TO-18 (TO-206AA), TO-46 (TO-206AB) Surface Mount UB Package Styles Package



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

Parameter	Test Conditions	Symbol	Units	Min.	Max.
Collector - Emitter Breakdown Voltage	I_C = 30 mA dc	$V_{(BR)CEO}$	V dc	80	—
Collector - Base Cutoff Current	V_{CB} = 140 V dc	I_{CBO1}	µA dc	—	10
Emitter - Base Cutoff Current	V_{EB} = 7 V dc V_{EB} = 5 V dc	I_{EBO1} I_{EBO2}	µA dc nA dc	—	10 10
Collector - Emitter Cutoff Current	V_{CE} = 90 V dc	I_{CES1}	nA dc	—	10
Forward Current Transfer Ratio	V_{CE} = 10 V dc; I_C = 150 mA dc V_{CE} = 10 V dc; I_C = 0.1 mA dc V_{CE} = 10 V dc; I_C = 10 mA dc V_{CE} = 10 V dc; I_C = 500 mA dc V_{CE} = 10 V dc; I_C = 1 A dc	h_{FE}	-	100 50 90 50 15	300 300 — 300 —
Collector - Emitter Saturation Voltage	I_C = 150 mA dc; I_B = 15 mA dc I_C = 500 mA dc; I_B = 50 mA dc	$V_{CE(sat)1}$ $V_{CE(sat)2}$	V dc	—	0.2 0.5
Base - Emitter Saturation Voltage	I_C = 150 mA dc; I_B = 15 mA dc	$V_{BE(SAT)}$	V dc	—	1.1
Collector - Emitter Cutoff Current	T_A = +150°C V_{CE} = 90 V dc	I_{CES2}	µA dc	—	5
Forward Current Transfer Ratio	T_A = -55°C V_{CE} = 10 V dc; I_C = 150 mA dc	h_{FE6}		40	
Small-Signal Short-Circuit Forward Current Transfer Ratio	V_{CE} = 5 V dc; I_C = 1 mA dc; f = 1 kHz	h_{fe}		80	400
Magnitude of Small-Signal Short-Circuit Forward Current Transfer Ratio	V_{CE} = 10 V dc; I_C = 50 mA dc; f = 20 MHz	$\lvert h_{fe} \rvert$		5	20
Open Circuit Output Capacitance	V_{CB} = 10 V dc; I_E = 0; 100 kHz ≤ f ≤ 1 MHz	C_{obo}	pF	—	12
Input Capacitance (Output Open Circuited)	V_{EB} = 0.5 V dc; I_C = 0; 100 kHz ≤ f ≤ 1 MHz	C_{ibo}	pF	—	60

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

Ratings	Symbol	Value
Collector - Emitter Voltage	V_{CEO}	80 V dc
Collector - Base Voltage	V_{CBO}	140 V dc
Emitter - Base Voltage	V_{EBO}	7 V dc
Collector Current	I_C	1 A dc
Total Power Dissipation (1) (2) T_A = +25°C T_C = +25°C T_C = +25°C (2N3057A) $T_{SP(IS)}$ = +25°C (2N3700UB)	P_T	 0.5 W 1.0 W 1.8 W 1.5 W
Operating & Storage Temperature Range	T_J, T_{STG}	-65°C to +200°C

Thermal Characteristics

Characteristics	Symbol	Max. Value
Thermal Resistance, Junction to Case (2) (3) 2N3057A 2N3700	$R_{\theta JC}$	 80°C/W 150°C/W
Thermal Resistance, Junction to Ambient (2) (3) (4)	$R_{\theta JA}$	325°C/W
Thermal Resistance, Junction to Solder Pad (2) (3) 2N3700UB	$R_{\theta JSP\ (IS)}$	90°C/W

1. For derating, see figures 8, 9, 10, 11, 12 and 13 of MIL-PRF-19500/391
2. See paragraph 3.3 of MIL-PRF-19500/391
3. For thermal curves, see figures 14, 15, 16, 17, 18, 19, and 20 of MIL-PRF-19500/391
4. For non-thermal conductive PCB or unknown PCB surface mount conditions in free air, substitute figures 8 and 12 for the UB package and use $R_{\theta JA}$

Safe Operating Area	
DC Tests:	T_C = +25 °C, I Cycle, t = 10 ms
Test 1:	V_{CE} = 10 V, I_C = 180 mA
Test 2:	V_{CE} = 40 V, I_C = 50 mA
Test 3:	V_{CE} = 80 V, I_C = 30 mA

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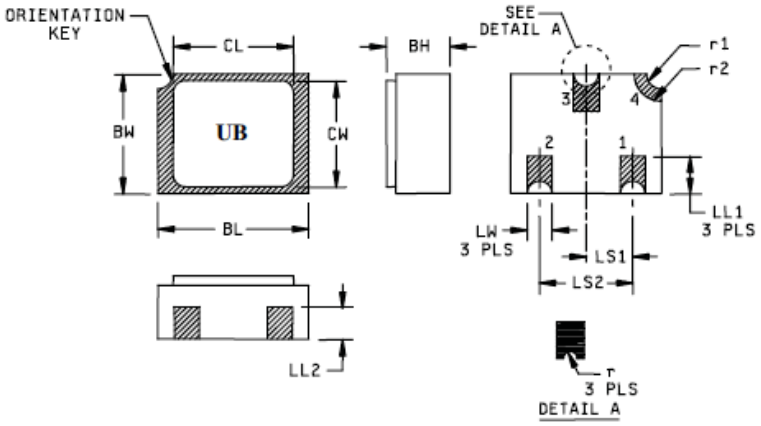
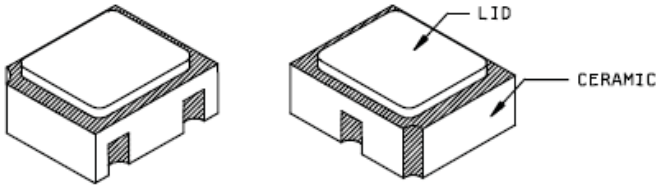
Outline Drawing (UB Surface Mount)





Symbol	Dimensions				Note
	Inches		Millimeters		
	Min	Max	Min	Max	
BH	.046	.056	1.17	1.42	
BL	.115	.128	2.92	3.25	
BW	.085	.108	2.16	2.74	
CL		.128		3.25	
CW		.108		2.74	
LL1	.022	.038	0.56	0.96	
LL2	.017	.035	0.43	0.89	

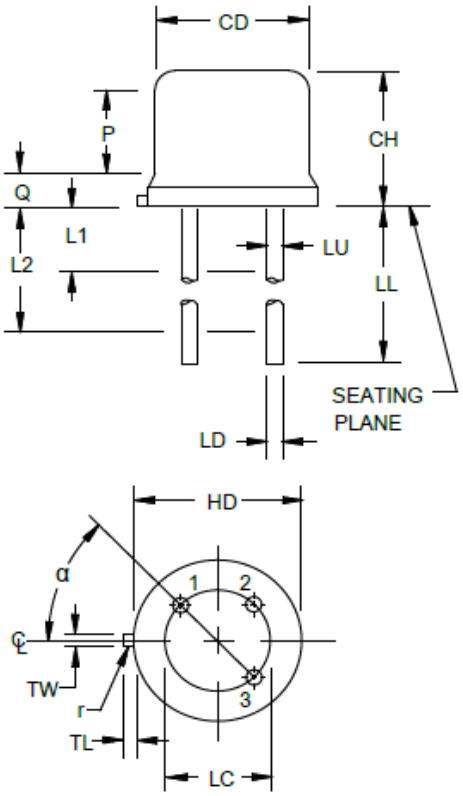
Symbol	Dimensions				Note
	Inches		Millimeters		
	Min	Max	Min	Max	
LS_1	.036	.040	0.91	1.02	
LS_2	.071	.079	1.81	2.01	
LW	.016	.024	0.41	0.61	
r		.008		.203	
r_1		.012		.305	
r_2		.022		.559	

NOTES:

1. Dimensions are in inches.
2. Millimeters are given for general information only.
3. Hatched areas on package denote metalized areas.
4. Pad 1 = Base, Pad 2 = Emitter, Pad 3 = Collector, Pad 4 = Shielding connected to the lid.
5. In accordance with ASME Y14.5M, diameters are equivalent to ϕx symbology.

Outline Drawing (TO-18) for 2N3700 only

Symbol	Dimensions				Note
	Inches		Millimeters		
	Min	Max	Min	Max	
CD	.178	.195	4.52	4.95	4
CH	.170	.210	4.32	5.33	
HD	.209	.230	5.31	5.84	4
LC	.100 TP		2.54 TP		5
LD	.016	.021	0.41	0.53	6, 7
LL	.500	.750	12.70	19.05	6, 7
LU	.016	.019	0.41	0.48	6, 7
L1		.050		1.27	6, 7
L2	.250		6.35		6, 7
P	.100		2.54		
Q		.030		0.76	4
TL	.028	.048	0.71	1.22	8
TW	.036	.046	0.91	1.17	9
r		.010		0.25	10
α	45° TP		45° TP		5

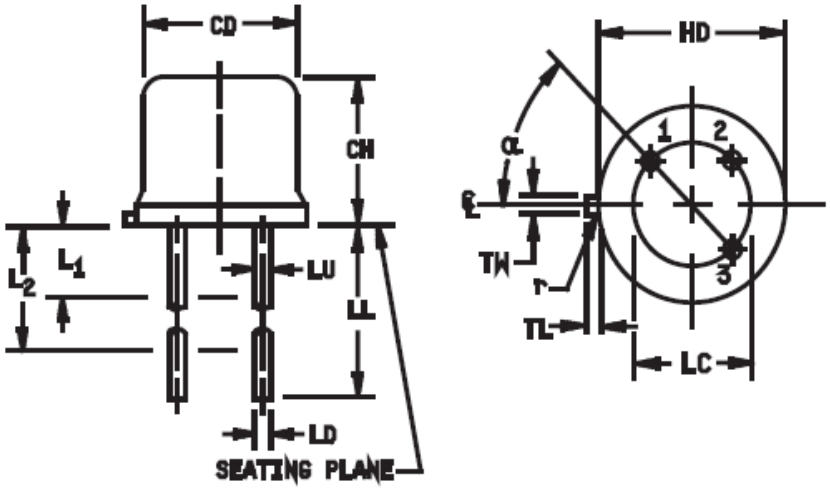


NOTES:

1. Dimension are in inches. Millimeters are given for general information only.
2. Terminal 1 = emitter, terminal 2 = base, terminal 3 = collector.
3. The collector shall be internally connected to the case.
4. Body contour optional within zone defined by dimensions CD, HD, and Q.
5. 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 gauge
6. Dimension LU applies between dimensions L1 and L2. Dimension LD applies between dimensions L2 and LL minimum. Diameter is uncontrolled in dimension L1 and beyond dimension LL minimum.
7. All three leads.
8. Dimension TL measured from maximum HD.
9. Beyond r (radius) maximum, dimension TW shall be held for a minimum length of .011 inch (0.28 mm).
10. Dimension r (radius) applies to both inside corners of tab.
11. In accordance with ASME Y14.5M, diameters are equivalent to ϕx symbology.

FIGURE 3. Physical dimensions for TO-206AA package (formerly TO-18) (device type 2N3700 only).

Outline Drawing (TO-46) for 2N3057 only

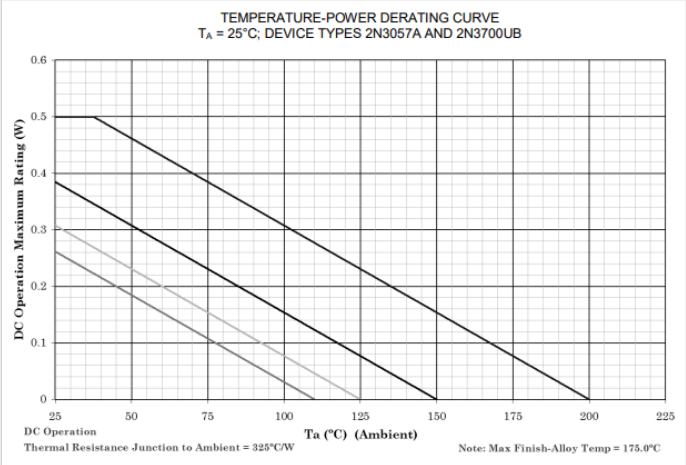


Symbol	Dimensions				Note
	Inches		Millimeters		
	Min	Max	Min	Max	
CD	.178	.195	4.52	4.95	
CH	.065	.085	1.65	2.16	
HD	.209	.230	5.31	5.84	
LC	.100 TP		2.54 TP		6
LD	.016	.021	0.41	0.53	7
LL	.500	1.750	12.70	44.45	7
LU	.016	.019	0.41	0.48	7
L1		.050		1.27	7
L2	.250		6.35		7
TL	.028	.048	0.71	1.22	3
TW	.036	.046	0.91	1.17	2
r		.007		0.18	10, 11
α	45° TP		45° TP		6

NOTES:

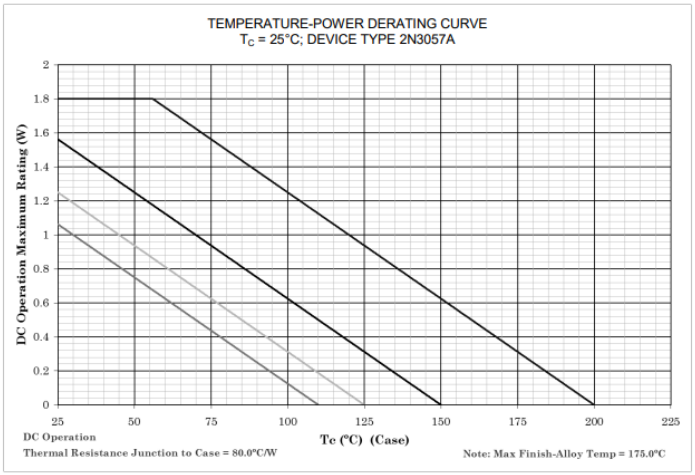
1. Dimension are in inches.
2. Millimeters are given for general information only.
3. Beyond r (radius) maximum, TW shall be held for a minimum length of .011 inch (0.28 mm).
4. Dimension TL measured from maximum HD.
5. Leads at gauge plane .054 +.001 -.000 inch (1.37 +0.03 -0.00 mm) below seating plane 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.
6. Dimension LU applies between L_1 and L_2. Dimension LD applies between L_2 and LL minimum. Diameter is uncontrolled in L_1 and beyond LL minimum.
7. All three leads.
8. The collector shall be internally connected to the case.
9. Dimension r (radius) applies to both inside corners of tab.
10. In accordance with ASME Y14.5M, diameters are equivalent to φx symbology.
11. Lead 1 = emitter, lead 2 = base, lead 3 = collector.

Temperature-Power Derating Curves



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.
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.

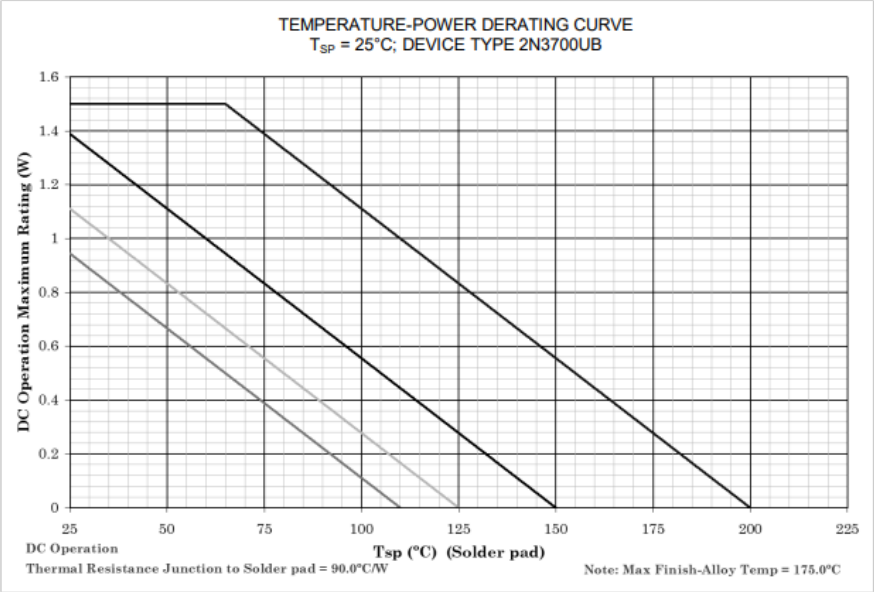
FIGURE 10. Derating for 2N3057A, 2N3700, and 2N3700UB ($R_{\theta JA}$) leads .125 inch (3.175 mm).



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.
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 11. Derating for 2N3057A ($R_{\theta JC}$) (TO-46), base case mounted.

Temperature-Power Derating Curves

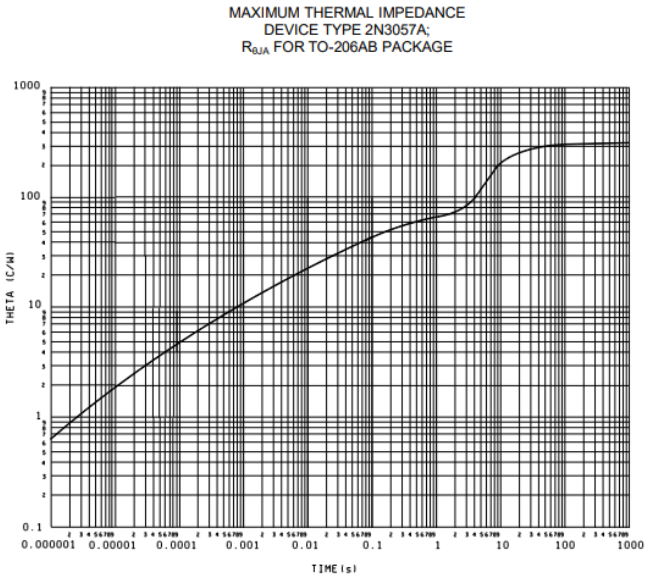


NOTES:

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.
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.

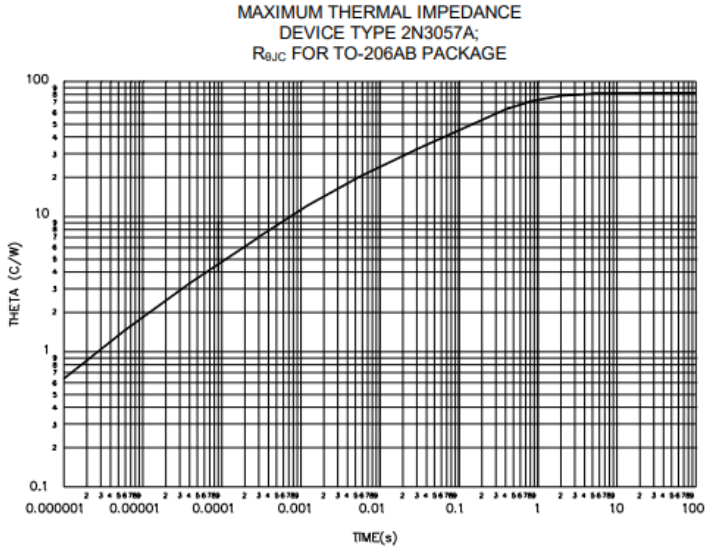
FIGURE 13. Derating for 2N3700UB ($R_{\theta JSP(IS)}$), infinite sink 3-points.

Thermal Impedance Curves



$R_{\theta JA}$ = 325°C/W

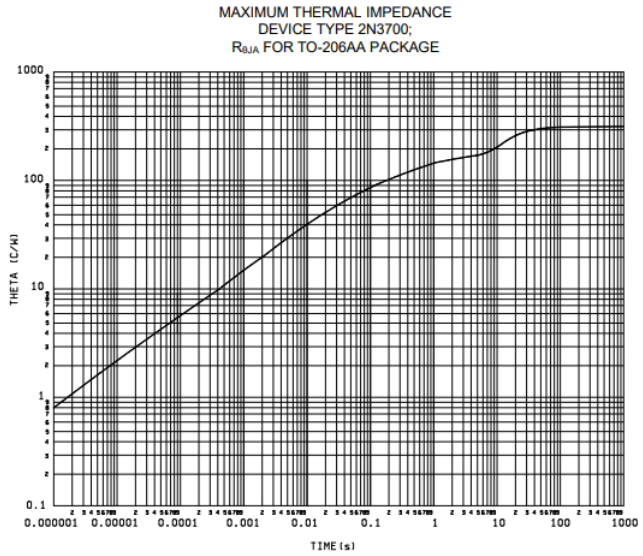
FIGURE 16. Thermal impedance graph ($R_{\theta JA}$) for devices (2N3057A) in TO-206AB package.



$R_{\theta JC}$ = 80°C/W

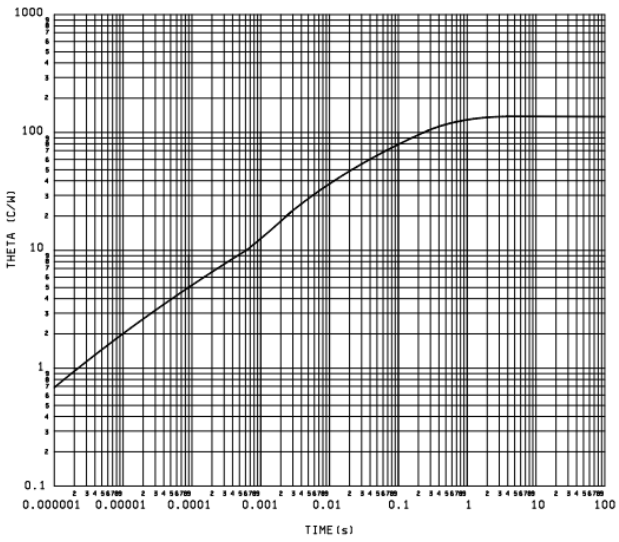
FIGURE 17. Thermal impedance graph ($R_{\theta JC}$) for devices (2N3057A) in TO-206AB package.

Thermal Impedance Curves



$R_{\theta JA}$ = 325°C/W

FIGURE 18. Thermal impedance graph ($R_{\theta JA}$) for devices (2N3700) in a TO-206AA package.



$R_{\theta JC}$ = 150°C/W

FIGURE 19. Thermal impedance graph ($R_{\theta JC}$) for devices (2N3700) in a TO-206AA package.

Thermal Impedance Curves

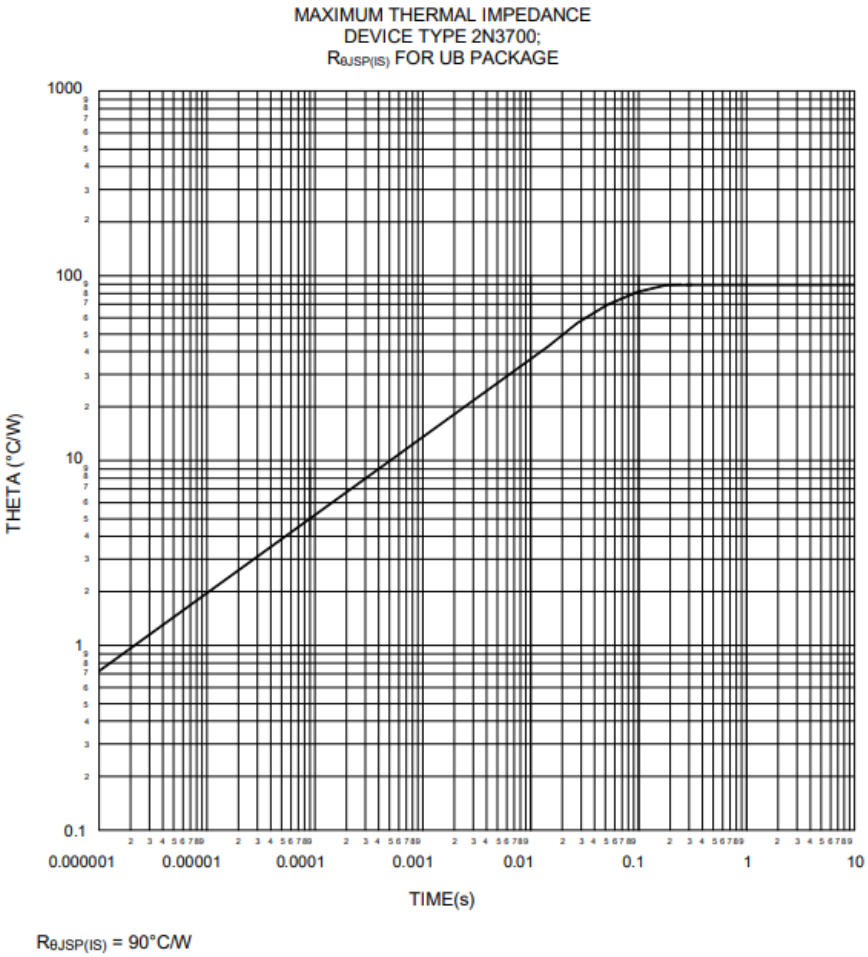


FIGURE 20. Thermal impedance graph ($R_{\theta JSP(IS)}$) for a 2N3700 in a UB package.