

# 2N3057A, 2N3700, 2N3700UB

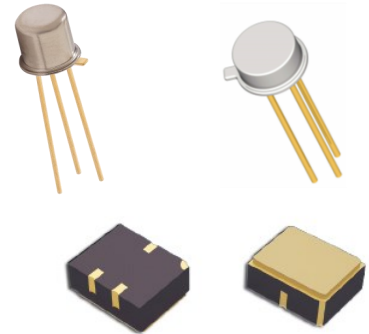


## NPN Low Power Silicon Transistor

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 ( $T_A = +25^\circ\text{C}$ unless otherwise specified)

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

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### Absolute Maximum Ratings ( $T_A = +25^\circ\text{C}$ 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 <sup>(1) (2)</sup> $T_A = +25^\circ\text{C}$ $T_C = +25^\circ\text{C}$ $T_C = +25^\circ\text{C}$ (2N3057A) $T_{SP(1S)} = +25^\circ\text{C}$ (2N3700UB)	$P_T$	0.5 W 1.0 W 1.8 W 1.5 W
Operating & Storage Temperature Range	$T_J, T_{STG}$	$-65^\circ\text{C}$ to $+200^\circ\text{C}$

### Thermal Characteristics

Characteristics	Symbol	Max. Value
Thermal Resistance, Junction to Case <sup>(2) (3)</sup> 2N3057A 2N3700	$R_{\theta JC}$	$80^\circ\text{C/W}$ $150^\circ\text{C/W}$
Thermal Resistance, Junction to Ambient <sup>(2) (3) (4)</sup>	$R_{\theta JA}$	$325^\circ\text{C/W}$
Thermal Resistance, Junction to Solder Pad <sup>(2) (3)</sup> 2N3700UB	$R_{\theta JSP(1S)}$	$90^\circ\text{C/W}$

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:  $T_C = +25^\circ\text{C}$ , 1 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

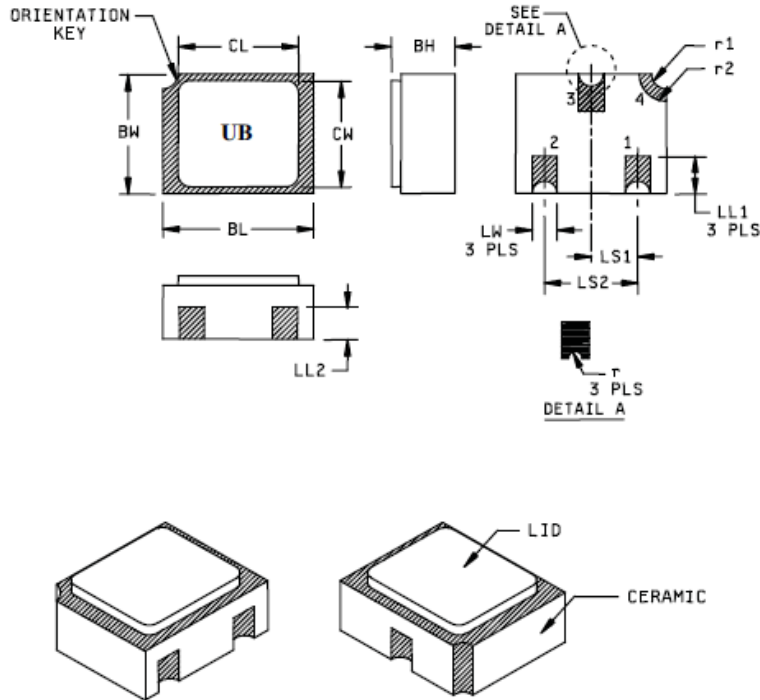
# 2N3057A, 2N3700, 2N3700UB



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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 <sub>1</sub>	.036	.040	0.91	1.02	
LS <sub>2</sub>	.071	.079	1.81	2.01	
LW	.016	.024	0.41	0.61	
r		.008		.203	
r <sub>1</sub>		.012		.305	
r <sub>2</sub>		.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  $\phi x$  symbology.

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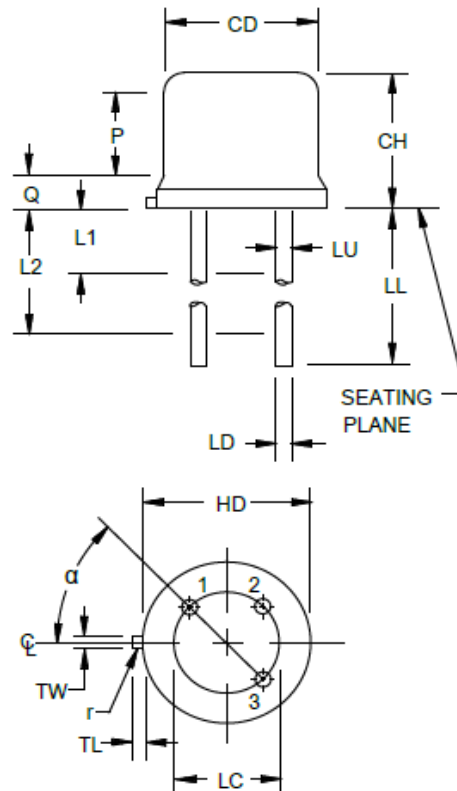


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## Outline Drawing (TO-18) for 2N3700 only

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
$\alpha$	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  $\phi x$  symbology.

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

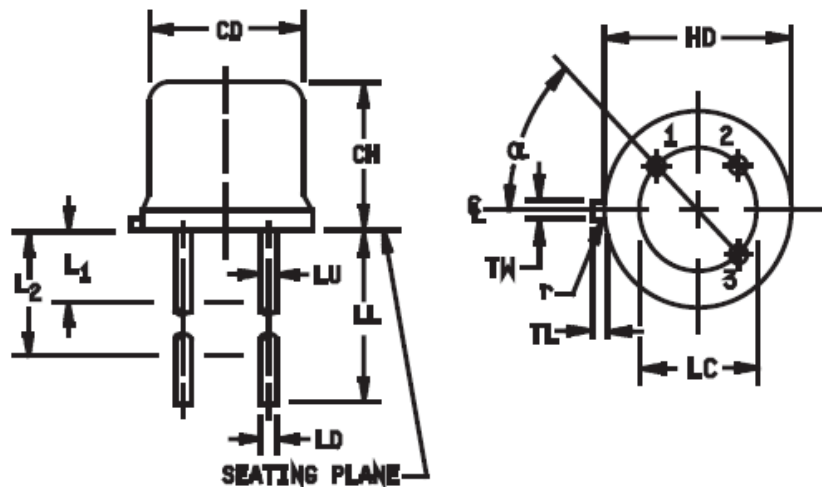
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## Outline Drawing (TO-46) for 2N3057 only

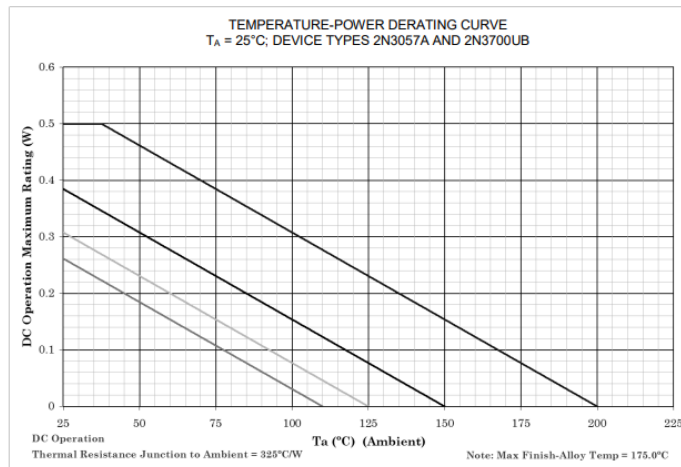


Symbol	Dimensions				Note
	Inches		Millimeters		
	Min	Max	Min	Max	
CD	.178	.195	4.52	4.95	
CH	.065	.085	1.65	2.16	
HD	.209	.230	5.31	5.84	
LC	.100 TP		2.54 TP		6
LD	.016	.021	0.41	0.53	7
LL	.500	1.750	12.70	44.45	7
LU	.016	.019	0.41	0.48	7
L1		.050		1.27	7
L2	.250		6.35		7
TL	.028	.048	0.71	1.22	3
TW	.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<sub>1</sub> and L<sub>2</sub>. Dimension LD applies between L<sub>2</sub> and LL minimum. Diameter is uncontrolled in L<sub>1</sub> 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 comers 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.

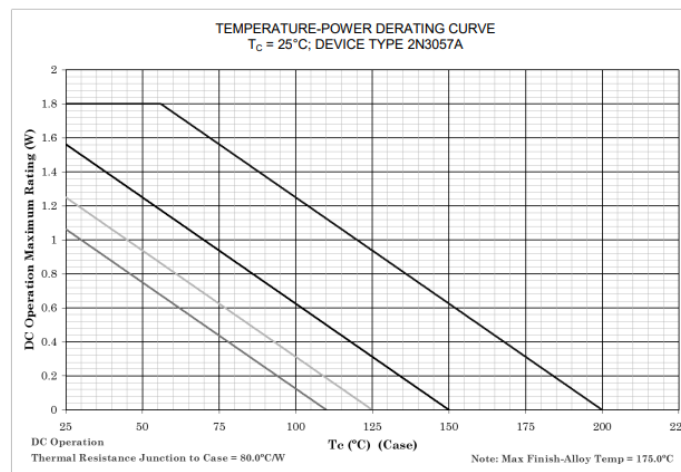
### Temperature-Power Derating Curves



**NOTES:**

1. This is the true inverse of the worst case thermal resistance value. All devices are capable of operating at  $\leq T_J$  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  $T_J \leq +150^\circ\text{C}$ , where the maximum temperature of electrical test is performed.
4. Derate design curve chosen at  $T_J \leq +125^\circ\text{C}$ , and  $+110^\circ\text{C}$  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).

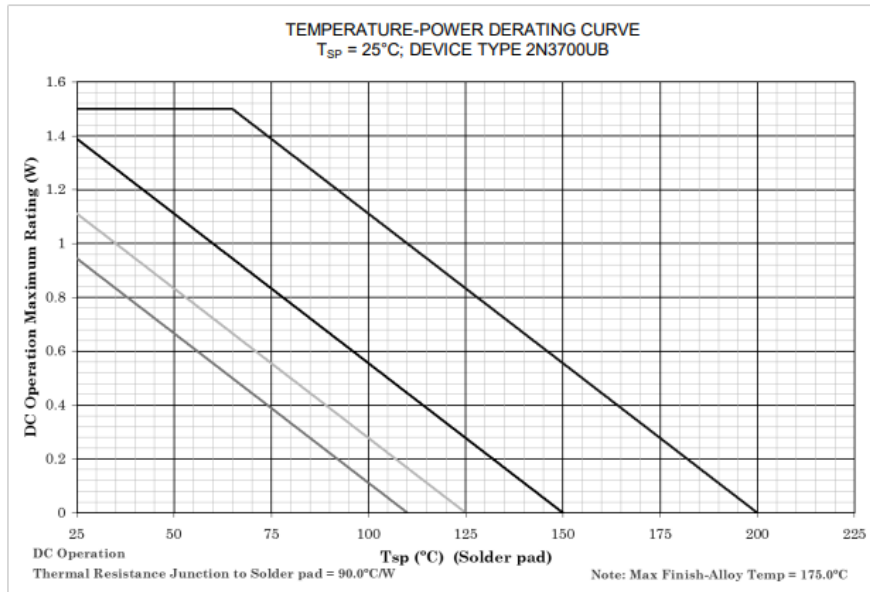


**NOTES:**

1. This is the true inverse of the worst case thermal resistance value. All devices are capable of operating at  $\leq T_J$  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  $T_J \leq +150^\circ\text{C}$ , where the maximum temperature of electrical test is performed.
4. Derate design curve chosen at  $T_J \leq +125^\circ\text{C}$ , and  $+110^\circ\text{C}$  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

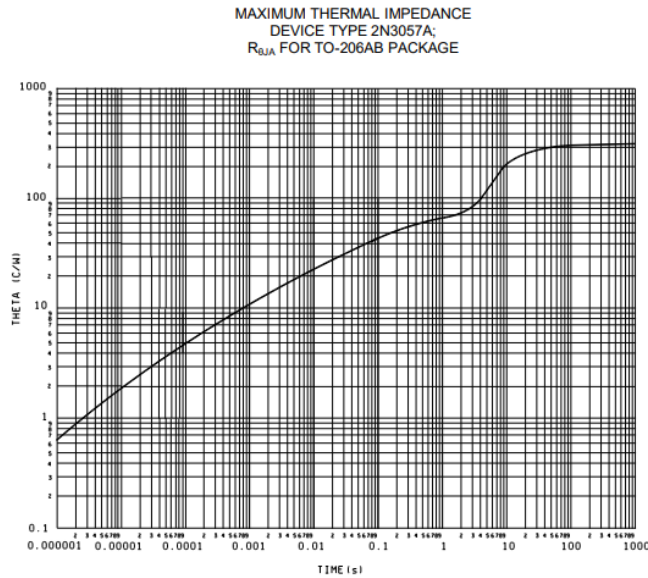


**NOTES:**

1. This is the true inverse of the worst case thermal resistance value. All devices are capable of operating at  $\leq T_J$  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  $T_J \leq +150^\circ\text{C}$ , where the maximum temperature of electrical test is performed.
4. Derate design curve chosen at  $T_J \leq +125^\circ\text{C}$ , and  $+110^\circ\text{C}$  to show power rating where most users want to limit  $T_J$  in their application.

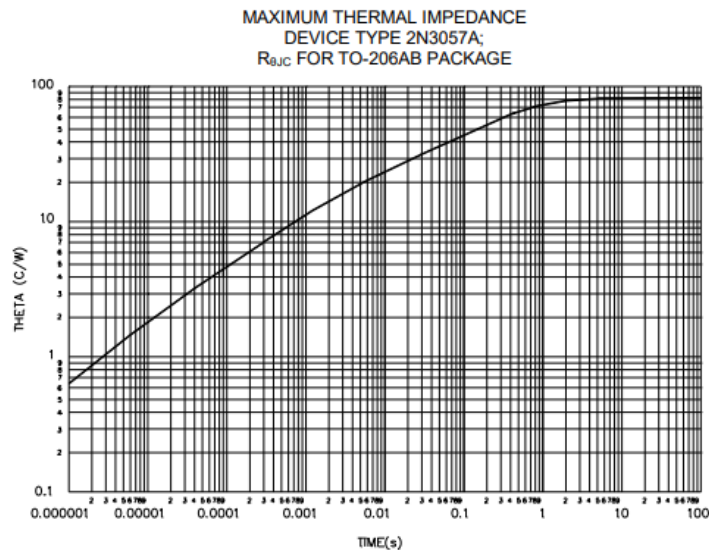
FIGURE 13. Derating for 2N3700UB ( $R_{\theta SP(1S)}$ ), infinite sink 3-points.

### Thermal Impedance Curves



$R_{\theta JA} = 325^{\circ}\text{C/W}$

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

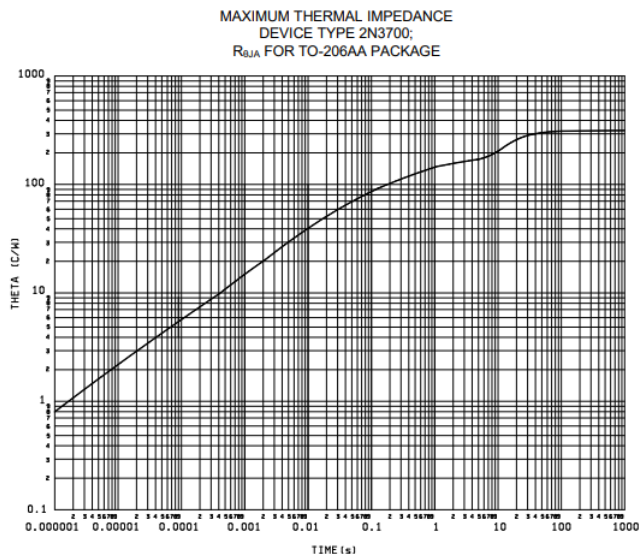


$R_{\theta JC} = 80^{\circ}\text{C/W}$

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

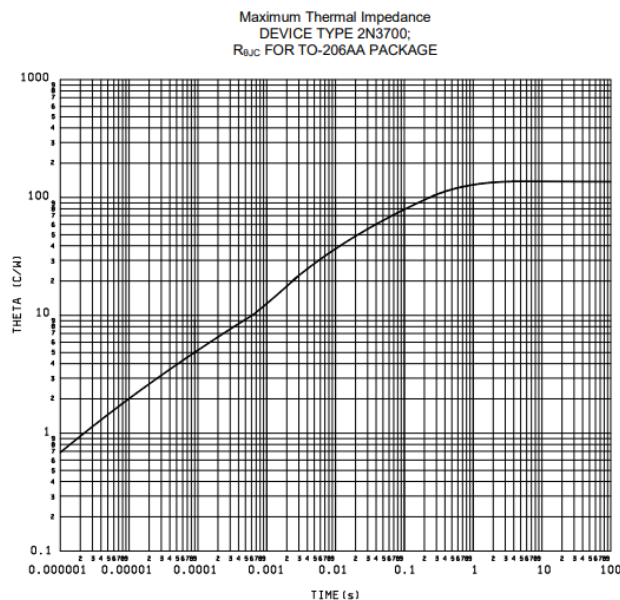


### Thermal Impedance Curves



$R_{\theta JA} = 325^{\circ}\text{C/W}$

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



$R_{\theta JC} = 150^{\circ}\text{C/W}$

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

## Thermal Impedance Curves

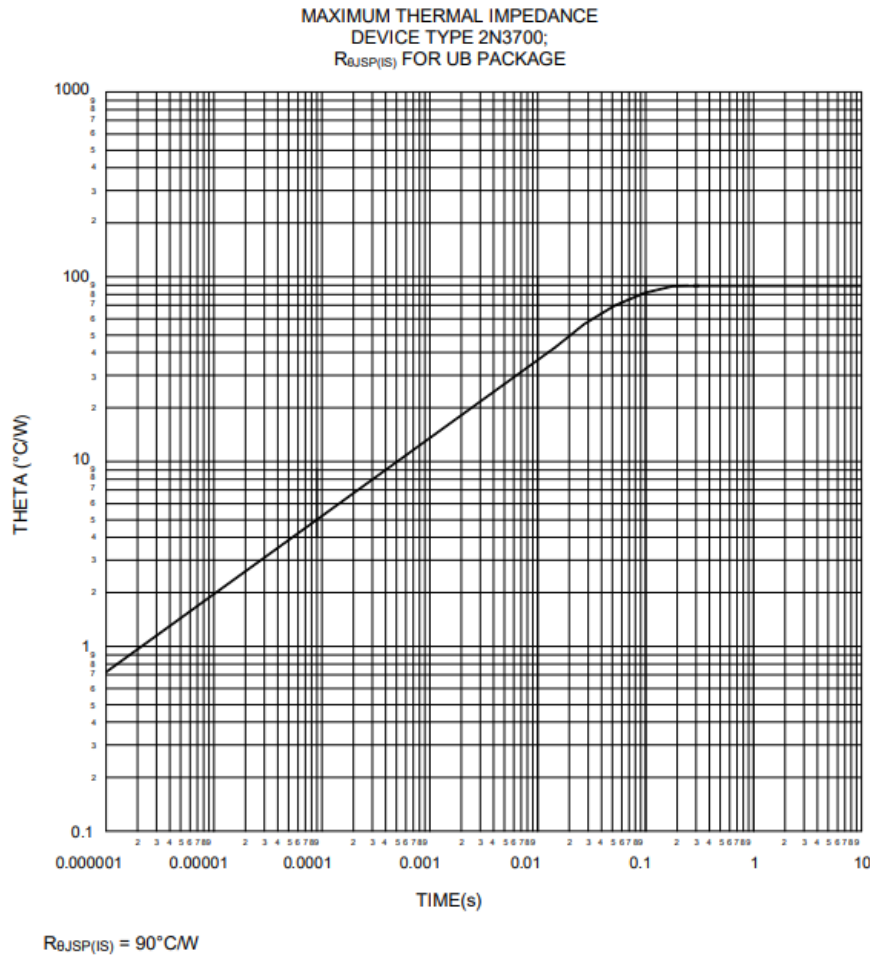


FIGURE 20. Thermal impedance graph ( $R_{\theta JSP(IS)}$ ) for a 2N3700 in a UB package.

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