

Features

- JAN, JANTX, JANTXV, JANS, and JANSR 100K rads (si) per MIL-PRF-19500/561
- TO-39 (TO-205AD) Package



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

Parameter	Test Conditions	Symbol	Units	Min.	Max.
Collector - Emitter Breakdown Voltage	$I_C = -50 \text{ mA dc}$	$V_{(BR)CEO}$	V dc	-100	—
Collector - Emitter Cutoff Current	$V_{CE} = -100 \text{ V dc}$	I_{CEO}	$\mu\text{A dc}$	—	-100
Collector - Emitter Cutoff Current	$V_{BE} = +1.5 \text{ V dc}; V_{CE} = -90 \text{ V dc}$	I_{CEX1}	$\mu\text{A dc}$		-10
Collector - Base Cutoff Current	$V_{CB} = -100 \text{ V dc}$	I_{CBO}	$\mu\text{A dc}$	—	-10
Emitter - Base Cutoff Current	$V_{EB} = -6.0 \text{ V dc}$	I_{EBO}	$\mu\text{A dc}$	—	-100
Forward Current Transfer Ratio	$V_{CE} = -2.0 \text{ V dc}; I_C = -0.5 \text{ A dc}$ $V_{CE} = -2.0 \text{ V dc}; I_C = -2.0 \text{ A dc}$ $V_{CE} = -2.0 \text{ V dc}; I_C = -5.0 \text{ A dc}$	h_{FE}	-	60 60 40	240
Collector - Emitter Saturation Voltage	$I_C = -2.0 \text{ A dc}, I_B = -0.2 \text{ A dc}$ $I_C = -5.0 \text{ A dc}, I_B = -0.5 \text{ A dc}$	$V_{CE(SAT)1}$ $V_{CE(SAT)2}$	V dc	—	-0.7 -1.2
Emitter - Base Saturation Voltage	$I_C = -2.0 \text{ A dc}, I_B = -0.2 \text{ A dc}$ $I_C = -5.0 \text{ A dc}, I_B = -0.5 \text{ A dc}$	$V_{BE(SAT)1}$ $V_{BE(SAT)1}$	V dc	—	-1.2 -1.8
Collector - Emitter Cutoff Current	$T_A = +150^\circ\text{C}$ $V_{CE} = -90 \text{ V dc}; V_{BE} = +1.5 \text{ V dc}$	I_{CEX2}	$\mu\text{A dc}$		-15
Forward - Current Transfer Ratio	$T_A = -55^\circ\text{C}$ $V_{CE} = -2.0 \text{ V dc}; I_C = -2.0 \text{ A dc}$	h_{FE4}		12	
Dynamic Characteristics					
Small-Signal Short-Circuit Forward - Current Transfer Ratio	$V_{CE} = -10 \text{ V dc}; I_C = -0.5 \text{ A dc}; f = 10 \text{ MHz}$	$ h_{fe} $	-	3	15
Output Capacitance	$V_{CB} = -10 \text{ V dc}; I_E = 0;$ $100 \text{ kHz} \leq f \leq 1 \text{ MHz}$	C_{obo}	pF	—	300
Input Capacitance	$V_{BE} = -2.0 \text{ Vdc}; I_C = 0;$ $100 \text{ kHz} \leq f \leq 1 \text{ MHz}$	C_{ibo}	pF	—	1250
Switching Characteristics					
Delay Time	See figure 11 of MIL-PRF-19500/561	t_d	ns	—	100
Rise Time	See figure 11 of MIL-PRF-19500/561	t_r	ns	—	100
Storage Time	See figure 12 of MIL-PRF-19500/561	t_s	μs	—	2.0
Fall Time	See figure 12 of MIL-PRF-19500/561	t_f	ns	—	200

Absolute Maximum Ratings ($T_A = +25^\circ\text{C}$ unless otherwise noted)

Ratings	Symbol	Value
Collector - Emitter Voltage	V_{CEO}	-100 V dc
Collector - Base Voltage	V_{CBO}	-100 V dc
Emitter - Base Voltage	V_{EBO}	-6.0 V dc
Base Current	I_B	-1.0 A dc
Collector Current	I_C	-5.0 A dc
Total Power Dissipation @ $T_A = +25^\circ\text{C}$ ⁽¹⁾ @ $T_C = +25^\circ\text{C}$ ⁽²⁾	P_T	1.0 W 17.5 W
Operating & Storage Temperature Range	T_J, T_{STG}	-65°C to $+200^\circ\text{C}$

(1) See figure 6 of MIL-PRF-19500/561

(2) See figure 7 and 8 of MIL-PRF-19500/561

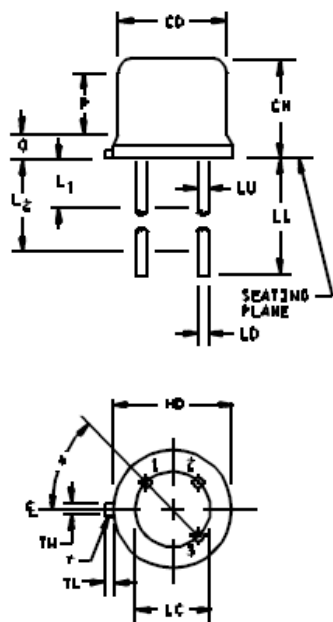
Thermal Characteristics

Characteristics	Symbol	Max. Value
Thermal Resistance, Junction to Case	$R_{\theta JC}$	10°C/W
Thermal Resistance, Junction to Ambient	$R_{\theta JA}$	175°C/W

Safe Operating Area

DC Tests:	$T_C = +25^\circ\text{C}; I$ Cycle; $t \geq 0.5$ s
Test 1:	$V_{CE} = -2.0$ V dc; $I_C = -5.0$ A dc
Test 2:	$V_{CE} = -90$ V dc; $I_C = -55$ mA dc

Outline Drawing (TO-39)

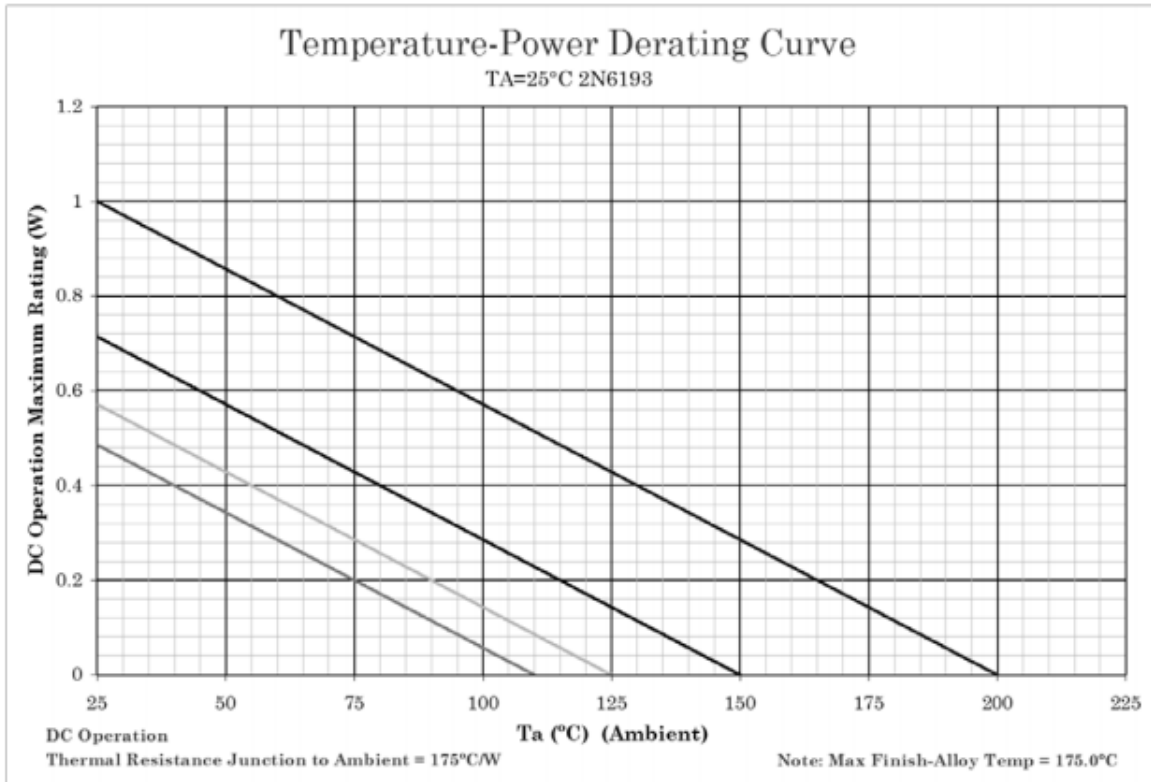


Ltr	Dimensions				Notes
	Inches		Millimeters		
	Min	Max	Min	Max	
CD	.305	.355	7.75	9.02	
CH	.240	.260	6.10	6.60	
HD	.355	.370	9.02	9.40	
LC	.200 TP		5.08 TP		6
LD	.016	.021	0.41	0.53	7
LL	.500	.750	12.70	19.05	7
LU	.016	.019	0.41	0.48	7
L1		.050		1.27	7
L2	.250		6.35		7
TL	.029	.045	0.74	1.14	3
TW	.028	.034	0.71	0.86	10
P	.100		2.54		5
Q		.040		1.02	4
R		.010		0.25	11
α	45° TP		45° TP		6
Notes	1, 2, 8, 9				

NOTES:

1. Dimensions are in inches.
2. Millimeters are given for general information only.
3. Symbol TL is measured from HD maximum.
4. Details of outline in this zone are optional.
5. Symbol CD shall not vary more than .010 inch (0.25 mm) in zone P. This zone is controlled for automatic handling.
6. Leads at gauge plane .054 inch (1.37 mm) +.001 inch (0.03 mm) -.000 inch (0.00 mm) below seating plane shall be within .007 inch (0.18 mm) radius of true position (TP) relative to tab. Device may be measured by direct methods or by gauge.
7. Symbol LD applies between L₁ and L₂. Dimension LD applies between L₂ and LL minimum.
8. Lead designation, depending on device type, shall be as follows: 1 Emitter, 2 Base, and 3 Collector
9. Lead number three is electrically connected to case.
10. Beyond r maximum, TW shall be held for a minimum length of .011 inch (0.28 mm).
11. Symbol r applied to both inside corners of tab.
12. In accordance with ASME Y14.5M, diameters are equivalent to ϕ x symbology.

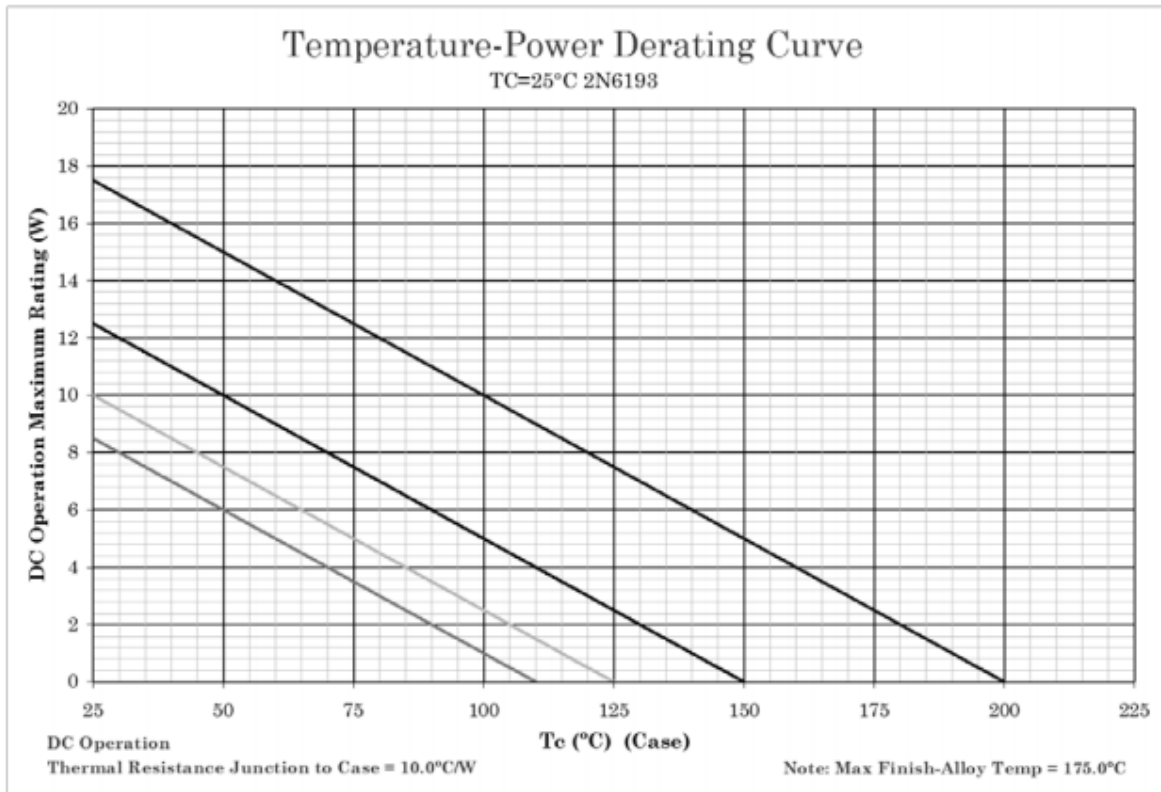
FIGURE 1. Physical dimensions (TO-39).



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 temperature ($T_J \leq 200^\circ\text{C}$) 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°C to show power rating where most users want to limit T_J in their application.

FIGURE 6. Temperature-power derating for 2N6193 $R_{\theta JA}$ (TO-39 Kovar).

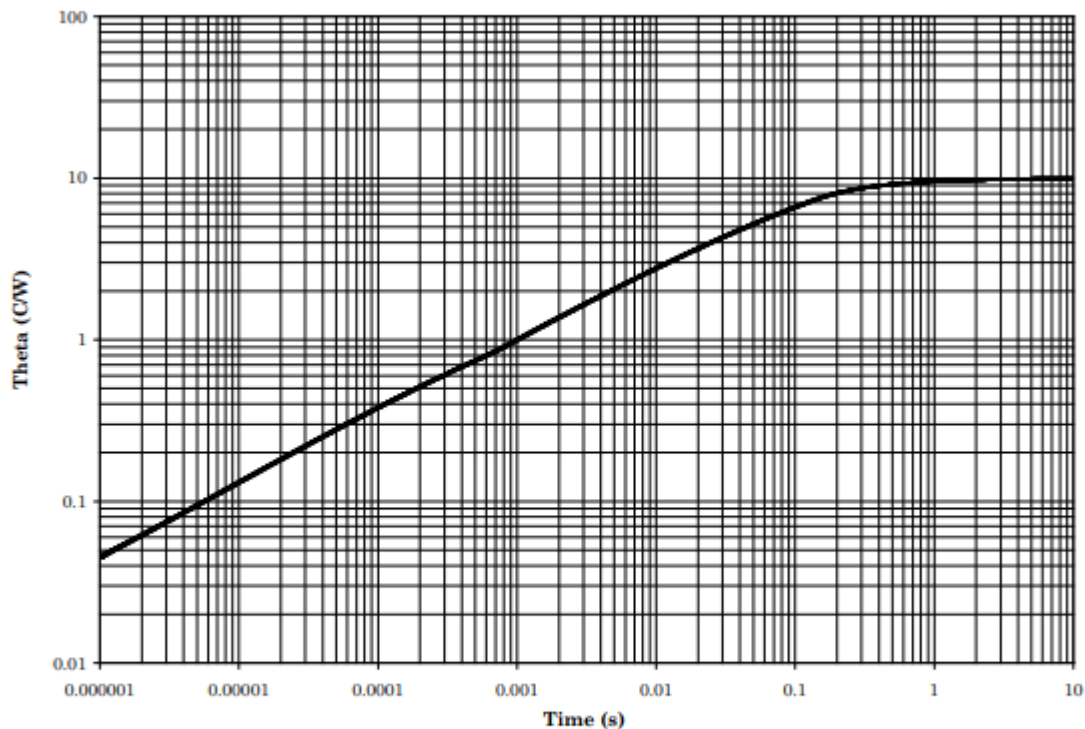


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FIGURE 7. Temperature-power derating for 2N6193 $R_{\theta JC}$ (TO-39 Kovar).

Maximum Thermal Impedance



$T_C = 25^\circ\text{C}$, thermal resistance $R_{\theta JC} = 10^\circ\text{C/W}$.

FIGURE 9. Thermal impedance graph ($R_{\theta JC}$) for 2N6193 (TO-39 Kovar).

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