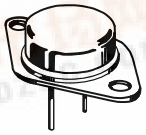
2N5301
2N5302
2N5303

High-Power NPN Silicon Transistors

20 AND 30 AMPERE POWER TRANSISTORS NPN SILICON 40–60–80 VOLTS 200 WATTS

. . . for use in power amplifier and switching circuits applications.

- High Collector–Emitter Sustaining Voltage —
  $V_{CEO(sus)}$ = 80 Vdc (Min) @ I_C = 200 mAdc (2N5303)
- Low Collector–Emitter Saturation Voltage —
  $V_{CE(sat)}$ = 0.75 Vdc (Max) @ I_C = 10 Adc (2N5301, 2N5302)
  1.0 Vdc (Max) @ I_C = 10 Adc (2N5303)
- Excellent Safe Operating Area —
  200 Watt dc Power Rating to 30 Vdc (2N5303)
- Complements to PNP 2N4398, 2N4399 and 2N5745



CASE 1–07
TO–204AA
(TO–3)

***MAXIMUM RATINGS**

Rating	Symbol	2N5301	2N5302	2N5303	Unit
Collector–Emitter Voltage	V_{CEO}	40	60	80	Vdc
Collector–Base Voltage	V_{CB}	40	60	80	Vdc
Collector Current — Continuous	I_C	30	30	20	Adc
Base Current	I_B	7.5			Adc
Total Device Dissipation @ T_C = 25°C Derate above 25°C	P_D	200 1.14			Watts W/°C
Operating and Storage Junction Temperature Range	T_J, T_{stg}	–65 to +200			°C

THERMAL CHARACTERISTICS

Characteristic	Symbol	Max	Unit
Thermal Resistance, Junction to Case	θ_{JC}	0.875	°C/W
Thermal Resistance, Case to Ambient	θ_{CA}	34	°C/W

* Indicates JEDEC Registered Data.

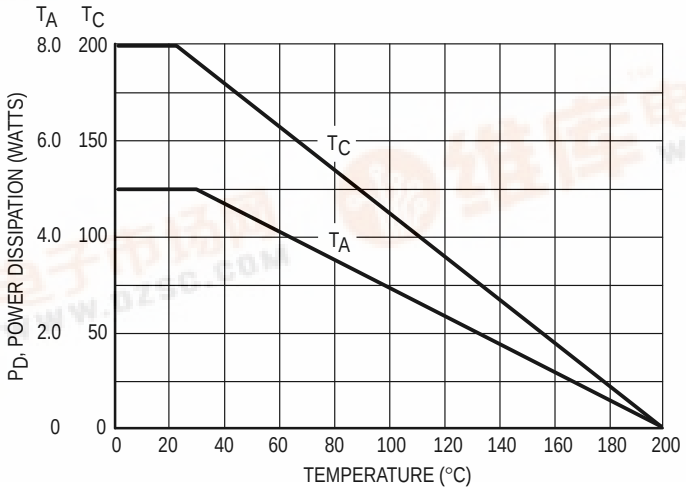


Figure 1. Power Temperature Derating Curve

ELECTRICAL CHARACTERISTICS (T_C = 25°C unless otherwise noted)

Characteristic		Symbol	Min	Max	Unit
***OFF CHARACTERISTICS**					
Collector–Emitter Sustaining Voltage (Note 1)		$V_{CEO(sus)}$			Vdc
(I_C = 200 mAdc, I_B = 0)	2N5301		40	—	
	2N5302		60	—	
	2N5303		80	—	
Collector Cutoff Current		I_{CEO}			mAdc
(V_{CE} = 40 Vdc, I_B = 0)	2N5301		—	5.0	
(V_{CE} = 60 Vdc, I_B = 0)	2N5302		—	5.0	
(V_{CE} = 80 Vdc, I_B = 0)	2N5303		—	5.0	
Collector Cutoff Current		I_{CEX}			mAdc
(V_{CE} = 40 Vdc, $V_{EB(off)}$ = 1.5 Vdc)	2N5301		—	1.0	
(V_{CE} = 60 Vdc, $V_{EB(off)}$ = 1.5 Vdc)	2N5302		—	1.0	
(V_{CE} = 80 Vdc, $V_{EB(off)}$ = 1.5 Vdc)	2N5303		—	1.0	
Collector Cutoff Current		I_{CEX}			mAdc
(V_{CE} = 40 Vdc, $V_{EB(off)}$ = 1.5 Vdc, T_C = 150°C)	2N5301		—	10	
(V_{CE} = 60 Vdc, $V_{EB(off)}$ = 1.5 Vdc, T_C = 150°C)	2N5302		—	10	
(V_{CE} = 80 Vdc, $V_{EB(off)}$ = 1.5 Vdc, T_C = 150°C)	2N5303		—	10	
Collector Cutoff Current		I_{CBO}			mAdc
(V_{CB} = 40 Vdc, I_E = 0)	2N5301		—	1.0	
(V_{CB} = 80 Vdc, I_E = 0)	2N5302		—	1.0	
(V_{CB} = 80 Vdc, I_E = 0)	2N5303		—	1.0	
Emitter Cutoff Current (V_{BE} = 5.0 Vdc, I_C = 0)		I_{EBO}	—	5.0	mAdc
ON CHARACTERISTICS					
DC Current Gain (Note 1)		h_{FE}			—
*(I_C = 1.0 Adc, V_{CE} = 2.0 Vdc)	ALL TYPES		40	—	
*(I_C = 10 Adc, V_{CE} = 2.0 Vdc)	2N5303		15	60	
*(I_C = 15 Adc, V_{CE} = 2.0 Vdc)	2N5301, 2N5302		15	60	
(I_C = 20 Adc, V_{CE} = 4.0 Vdc)	2N5303		5.0	—	
(I_C = 30 Adc, V_{CE} = 4.0 Vdc)	2N5301, 2N5302		5.0	—	
*Collector–Emitter Saturation Voltage (Note 1)		$V_{CE(sat)}$			Vdc
(I_C = 10 Adc, I_B = 1.0 Adc)	2N5301, 2N5302		—	0.75	
(I_C = 10 Adc, I_B = 1.0 Adc)	2N5303		—	1.0	
(I_C = 15 Adc, I_B = 1.5 Adc)	2N5303		—	1.5	
(I_C = 20 Adc, I_B = 2.0 Adc)	2N5301, 2N5302		—	2.0	
(I_C = 20 Adc, I_B = 4.0 Adc)	2N5303		—	2.0	
(I_C = 30 Adc, I_B = 6.0 Adc)	2N5301, 2N5302		—	3.0	
*Base Emitter Saturation Voltage (Note 1)		$V_{BE(sat)}$			Vdc
(I_C = 10 Adc, I_B = 1.0 Adc)	ALL TYPES		—	1.7	
(I_C = 15 Adc, I_B = 1.5 Adc)	2N5301, 2N5302		—	1.8	
(I_C = 15 Adc, I_B = 1.5 Adc)	2N5303		—	2.0	
(I_C = 20 Adc, I_B = 2.0 Adc)	2N5301, 2N5302		—	2.5	
(I_C = 20 Adc, I_B = 4.0 Adc)	2N5303		—	2.5	
*Base–Emitter On Voltage (Note 1)		$V_{BE(on)}$			Vdc
(I_C = 10 Adc, V_{CE} = 2.0 Vdc)	2N5303		—	1.5	
(I_C = 15 Adc, V_{CE} = 2.0 Vdc)	2N5301, 2N5302		—	1.7	
(I_C = 20 Adc, V_{CE} = 4.0 Vdc)	2N5303		—	25	
(I_C = 30 Adc, V_{CE} = 4.0 Vdc)	2N5301, 2N5302		—	3.0	
***DYNAMIC CHARACTERISTICS**					
Current–Gain — Bandwidth Product (I_C = 1.0 Adc, V_{CE} = 10 Vdc, f = 1.0 MHz)		f_T	2.0	—	MHz
Small–Signal Current Gain (I_C = 1.0 Adc, V_{CE} = 10 Vdc, f = 1.0 kHz)		h_{fe}	40	—	—
***SWITCHING CHARACTERISTICS**					
Rise Time	(V_{CC} = 30 Vdc, I_C = 10 Adc, I_{B1} = I_{B2} = 1.0 Adc)	t_r	—	1.0	μs
Storage Time		t_s	—	2.0	μs
Fall Time		t_f	—	1.0	μs

* Indicates JEDEC Registered Data.

Note 1: Pulse Width ≤ 300 μs, Duty Cycle ≤ 2.0%.

SWITCHING TIME EQUIVALENT TEST CIRCUITS

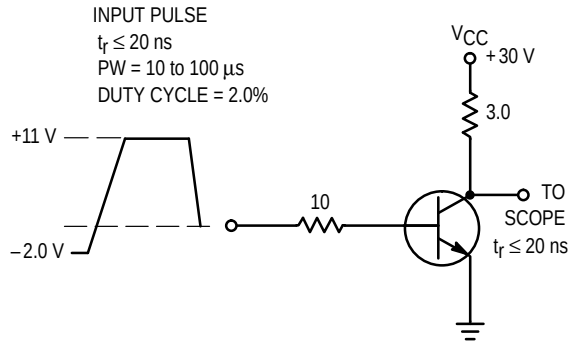


Figure 2. Turn–On time

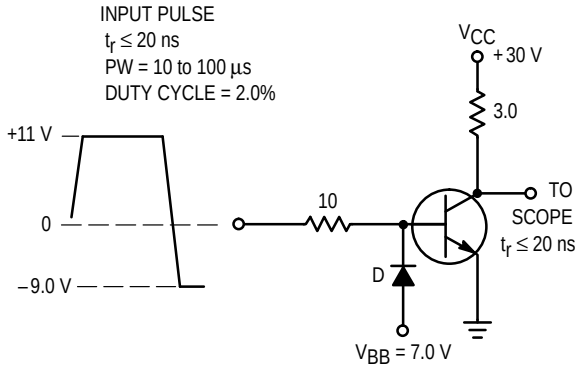


Figure 3. Turn–Off time

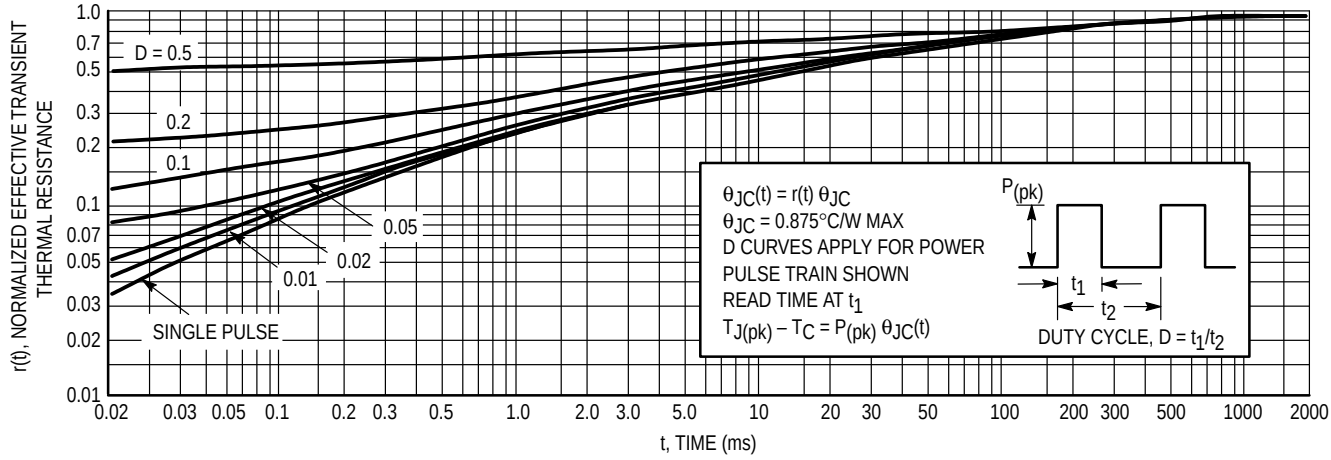


Figure 4. Thermal Response

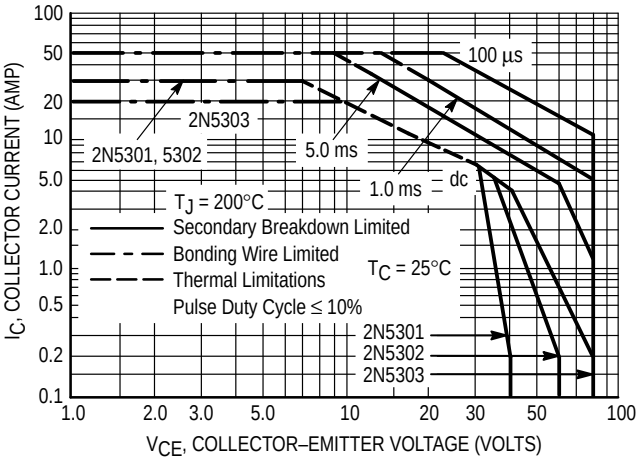


Figure 5. Active–Region Safe Operating Area

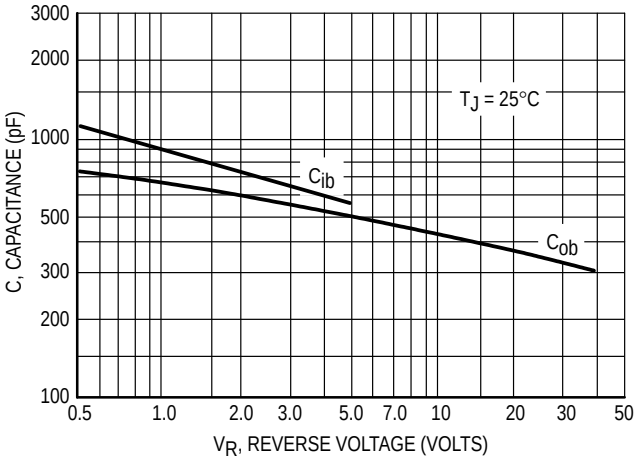


Figure 6. Capacitance versus Voltage

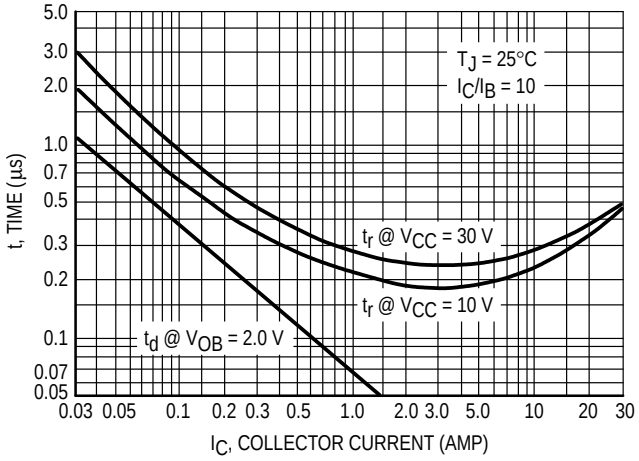


Figure 7. Turn–On Time

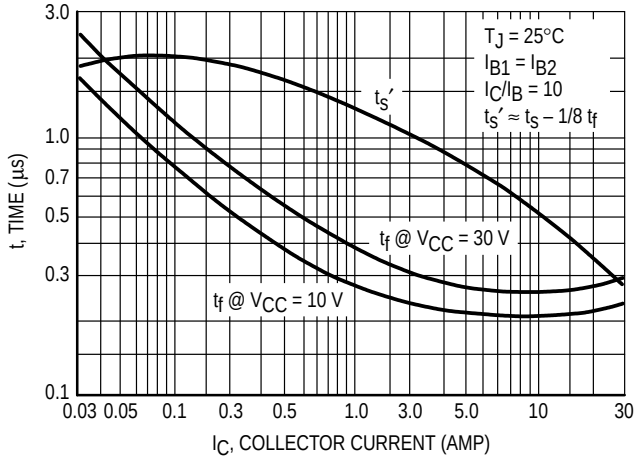


Figure 8. Turn–Off Time

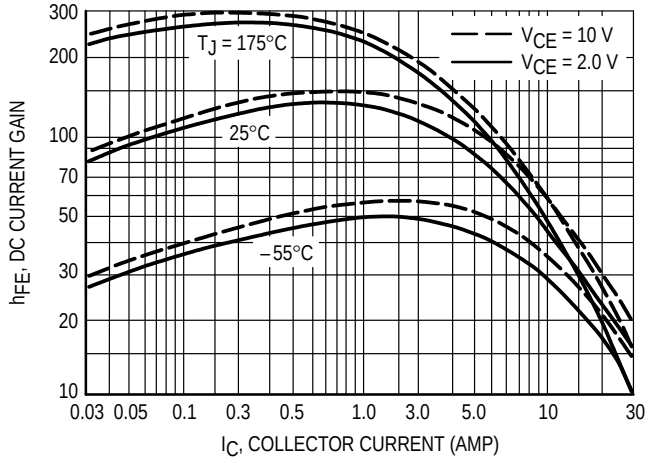


Figure 9. DC Current Gain

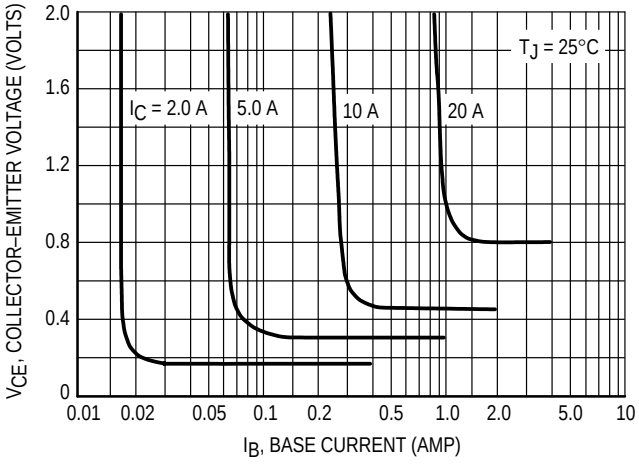


Figure 10. Collector Saturation Region

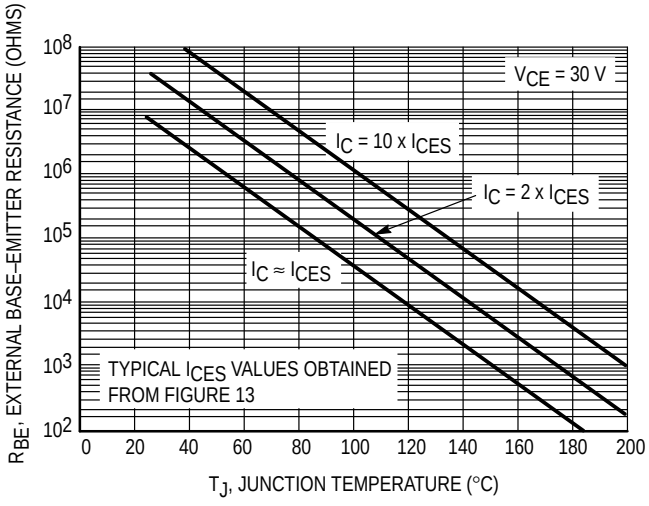


Figure 11. Effects of Base–Emitter Resistance

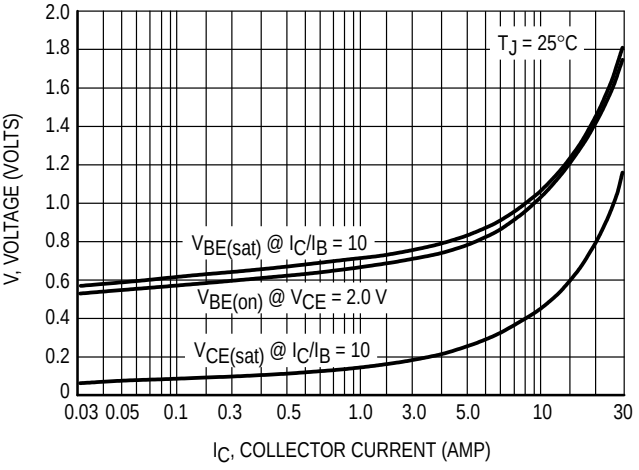


Figure 12. “On” Voltages

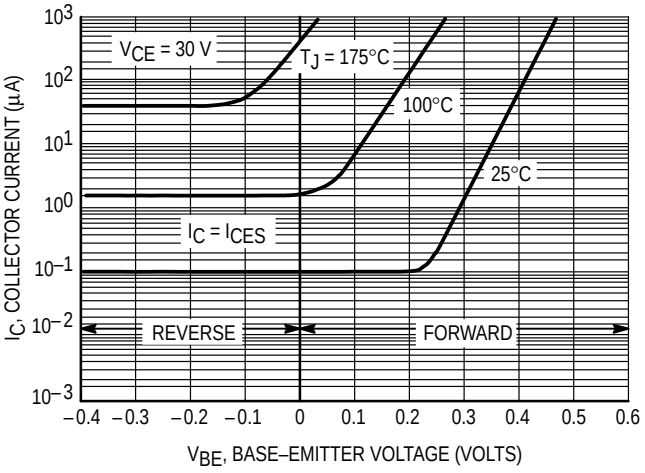


Figure 13. Collector Cut–Off Region

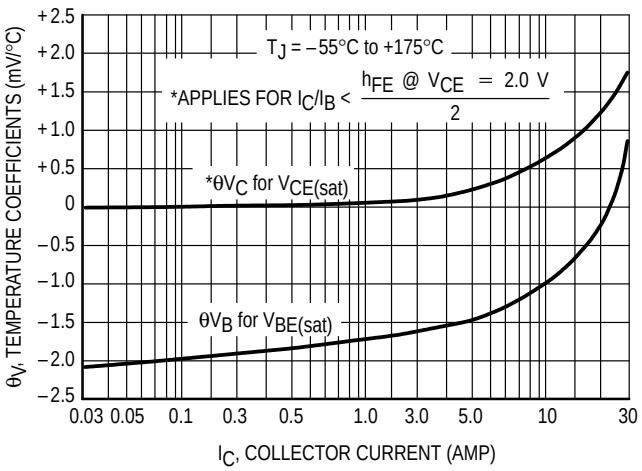
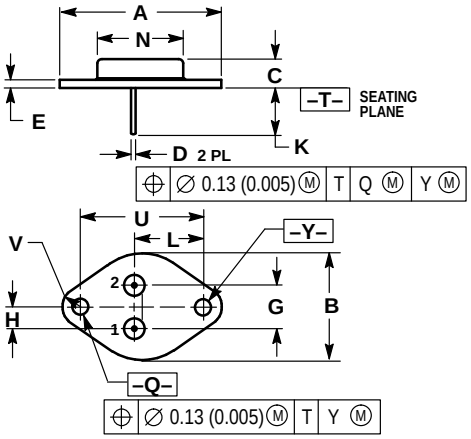


Figure 14. Temperature Coefficients

PACKAGE DIMENSIONS



NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.
3. ALL RULES AND NOTES ASSOCIATED WITH REFERENCED TO–204AA OUTLINE SHALL APPLY.

	INCHES		MILLIMETERS	
DIM	MIN	MAX	MIN	MAX
A	1.550 REF		39.37 REF	
B	—	1.050	—	26.67
C	0.250	0.335	6.35	8.51
D	0.038	0.043	0.97	1.09
E	0.055	0.070	1.40	1.77
G	0.430 BSC		10.92 BSC	
H	0.215 BSC		5.46 BSC	
K	0.440	0.480	11.18	12.19
L	0.665 BSC		16.89 BSC	
N	—	0.830	—	21.08
Q	0.151	0.165	3.84	4.19
U	1.187 BSC		30.15 BSC	
V	0.131	0.188	3.33	4.77

STYLE 1:
PIN 1. BASE
2. EMITTER
CASE: COLLECTOR

CASE 1–07
TO–204AA (TO–3)
ISSUE Z

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