THERMAL CHARACTERISTICS

Characteristic	Symbol	Max	Unit
Thermal Resistance, Junction−to−Ambient	$R_{\theta JA}$	62.5	°C/W
Thermal Resistance, Junction−to−Case	$R_{\theta JC}$	3.125	°C/W

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

Characteristic		Symbol	Min	Max	Unit
OFF CHARACTERISTICS					
Collector−Emitter Sustaining Voltage (Note 2)		$V_{CEO(sus)}$			Vdc
(I_C = 30 mAdc, I_B = 0)	TIP31, TIP32		40	–	
	TIP31A, TIP32A		60	–	
	TIP31B, TIP32B		80	–	
	TIP31C, TIP32C		100	–	
Collector Cutoff Current (V_{CE} = 30 Vdc, I_B = 0)	TIP31, TIP32, TIP31A, TIP32A	I_{CEO}	–	0.3	mAdc
(V_{CE} = 60 Vdc, I_B = 0)	TIP31B, TIP31C, TIP32B, TIP32C		–	0.3	
Collector Cutoff Current		I_{CES}			μAdc
(V_{CE} = 40 Vdc, V_{EB} = 0)	TIP31, TIP32		–	200	
(V_{CE} = 60 Vdc, V_{EB} = 0)	TIP31A, TIP32A		–	200	
(V_{CE} = 80 Vdc, V_{EB} = 0)	TIP31B, TIP32B		–	200	
(V_{CE} = 100 Vdc, V_{EB} = 0)	TIP31C, TIP32C		–	200	
Emitter Cutoff Current (V_{BE} = 5.0 Vdc, I_C = 0)		I_{EBO}	–	1.0	mAdc
ON CHARACTERISTICS (Note 2)					
DC Current Gain (I_C = 1.0 Adc, V_{CE} = 4.0 Vdc)		h_{FE}	25	–	–
(I_C = 3.0 Adc, V_{CE} = 4.0 Vdc)			10	50	
Collector−Emitter Saturation Voltage (I_C = 3.0 Adc, I_B = 375 mAdc)		$V_{CE(sat)}$	–	1.2	Vdc
Base−Emitter On Voltage (I_C = 3.0 Adc, V_{CE} = 4.0 Vdc)		$V_{BE(on)}$	–	1.8	Vdc
DYNAMIC CHARACTERISTICS					
Current−Gain − Bandwidth Product (I_C = 500 mAdc, V_{CE} = 10 Vdc, f_{test} = 1.0 MHz)		f_T	3.0	–	MHz
Small−Signal Current Gain (I_C = 0.5 Adc, V_{CE} = 10 Vdc, f = 1.0 kHz)		h_{fe}	20	–	–

2. Pulse Test: Pulse Width ≤ 300 μs, Duty Cycle ≤ 2.0%.

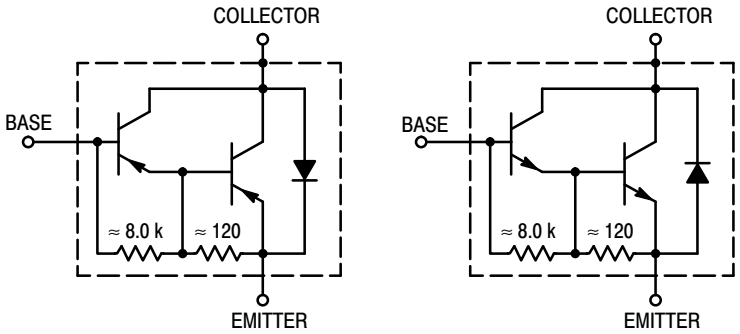


Figure 1. Darlington Circuit Schematic

ORDERING INFORMATION

Device	Package	Shipping
TIP31	TO−220	50 Units / Rail
TIP31G	TO−220 (Pb−Free)	50 Units / Rail
TIP31A	TO−220	50 Units / Rail
TIP31AG	TO−220 (Pb−Free)	50 Units / Rail
TIP31B	TO−220	50 Units / Rail
TIP31BG	TO−220 (Pb−Free)	50 Units / Rail
TIP31C	TO−220	50 Units / Rail
TIP31CG	TO−220 (Pb−Free)	50 Units / Rail
TIP32	TO−220	50 Units / Rail
TIP32G	TO−220 (Pb−Free)	50 Units / Rail
TIP32A	TO−220	50 Units / Rail
TIP32AG	TO−220 (Pb−Free)	50 Units / Rail
TIP32B	TO−220	50 Units / Rail
TIP32BG	TO−220 (Pb−Free)	50 Units / Rail
TIP32C	TO−220	50 Units / Rail
TIP32CG	TO−220 (Pb−Free)	50 Units / Rail

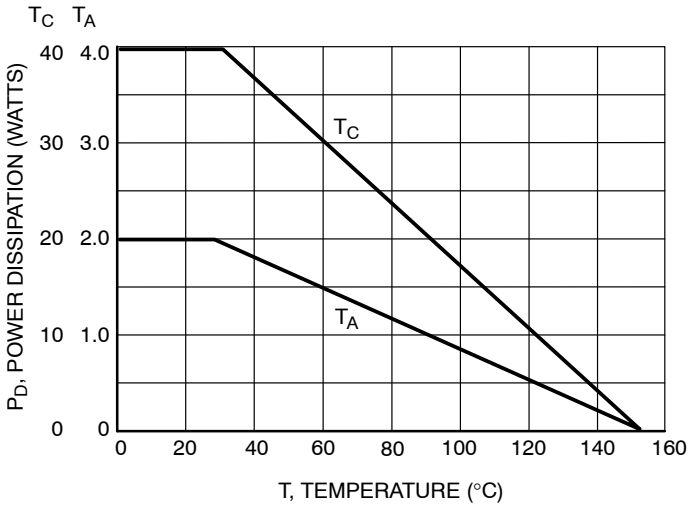
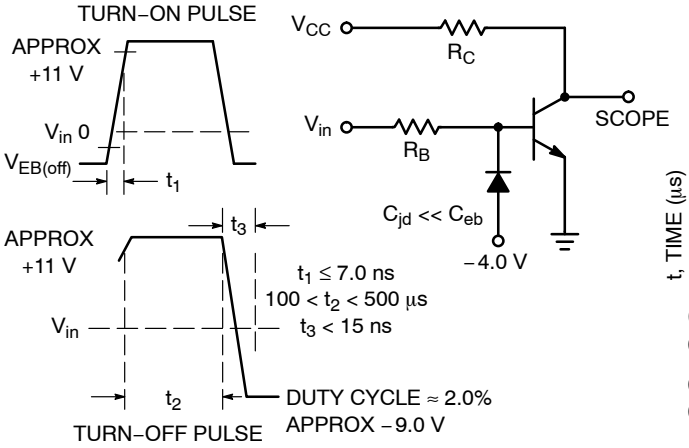
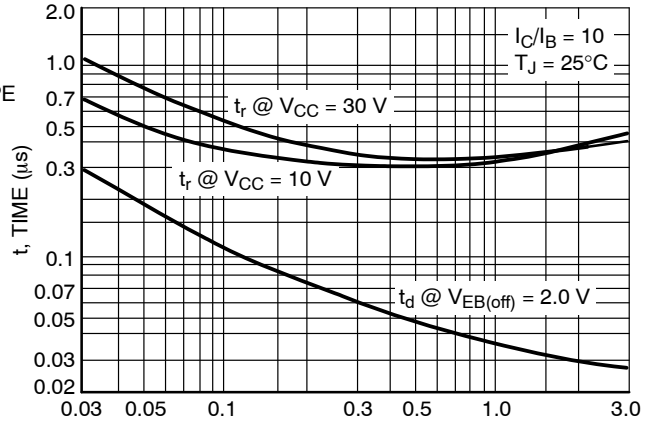


Figure 2. Power Derating



R_B and R_C VARIED TO OBTAIN DESIRED CURRENT LEVELS.

Figure 3. Switching Time Equivalent Circuit



I_C, COLLECTOR CURRENT (AMP)

Figure 4. Turn−On Time

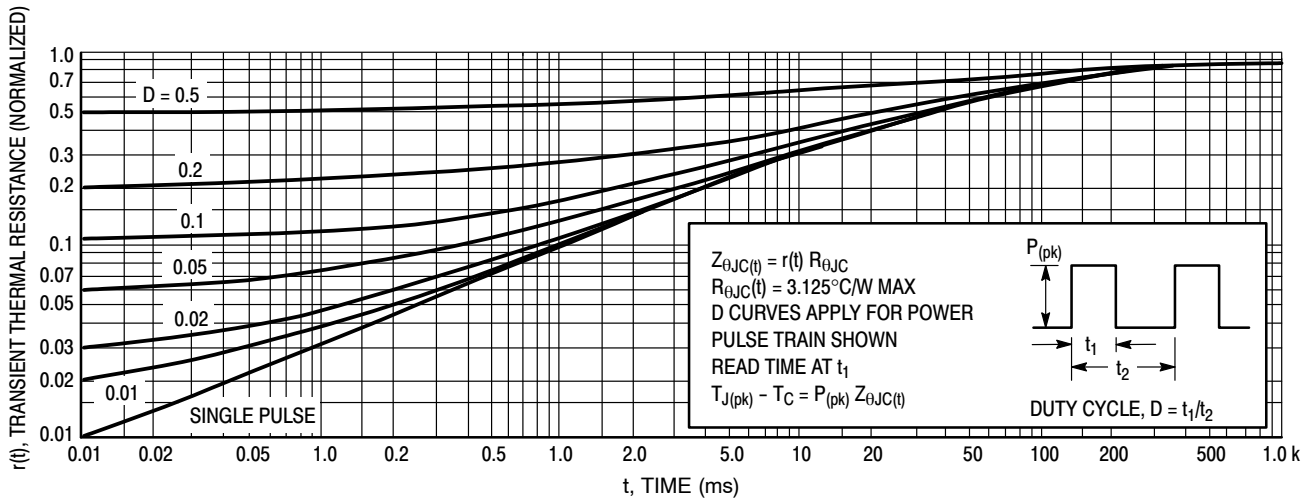


Figure 5. Thermal Response

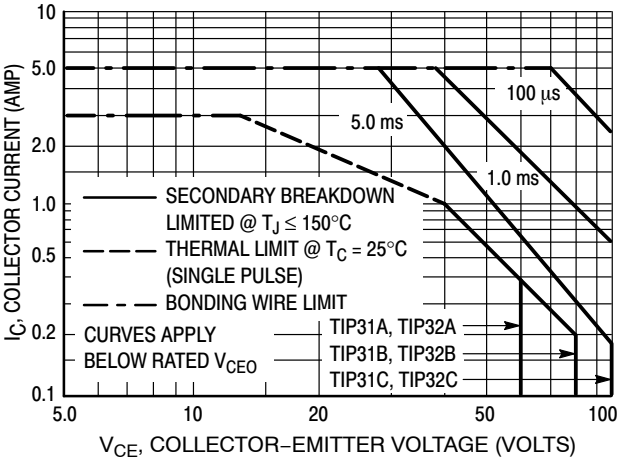


Figure 6. Active Region Safe Operating Area

There are two limitations on the power handling ability of a transistor: average junction temperature and second breakdown. Safe operating area curves indicate $I_C - V_{CE}$ limits of the transistor that must be observed for reliable operation; i.e., the transistor must not be subjected to greater dissipation than the curves indicate.

The data of Figure 6 is based on $T_{J(pk)} = 150°C$; T_C is variable depending on conditions. Second breakdown pulse limits are valid for duty cycles to 10% provided $T_{J(pk)} \le 150°C$. $T_{J(pk)}$ may be calculated from the data in Figure 5. At high case temperatures, thermal limitations will reduce the power that can be handled to values less than the limitations imposed by second breakdown.

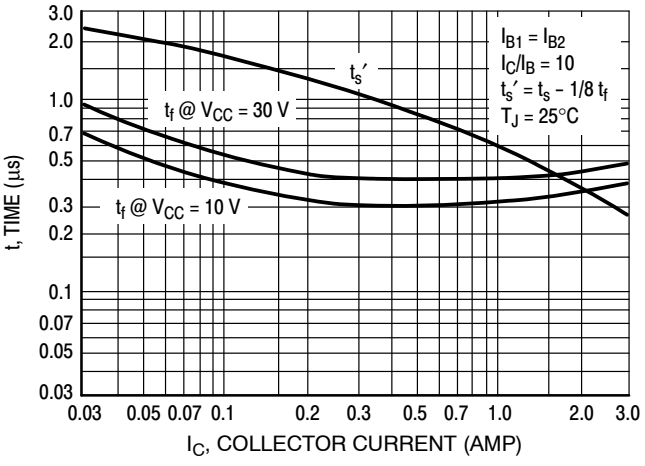


Figure 7. Turn–Off Time

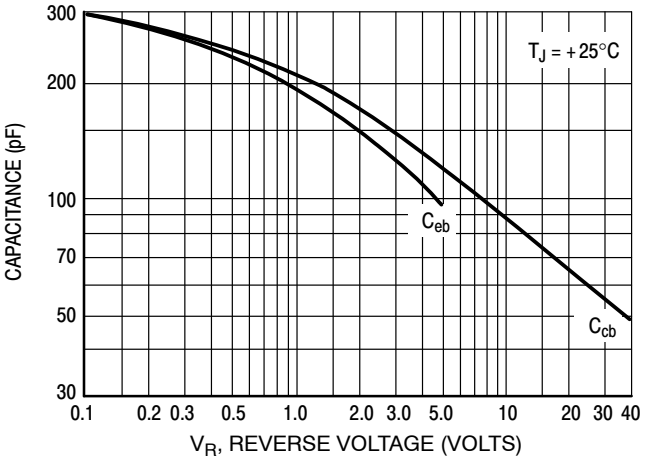


Figure 8. Capacitance

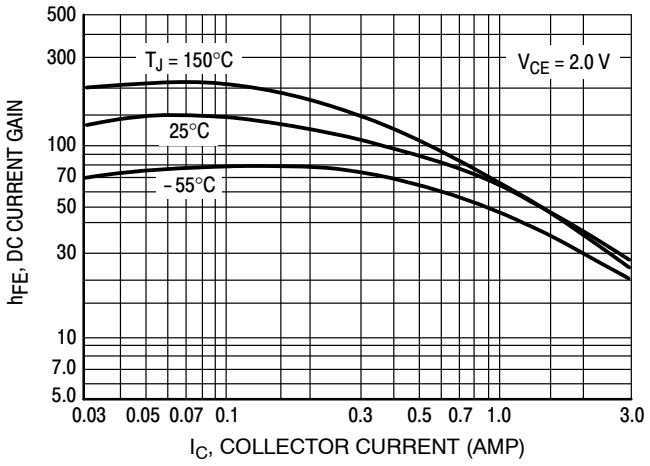


Figure 9. DC Current Gain

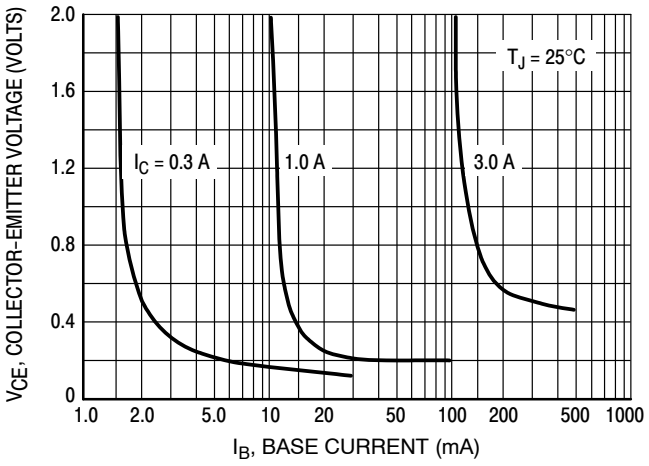


Figure 10. Collector Saturation Region

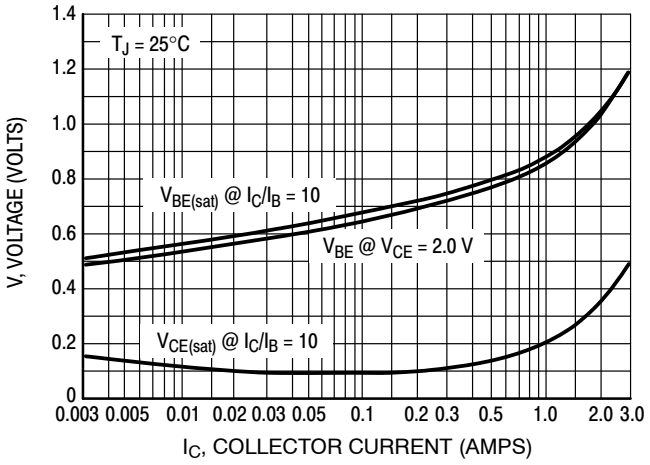


Figure 11. “On” Voltages

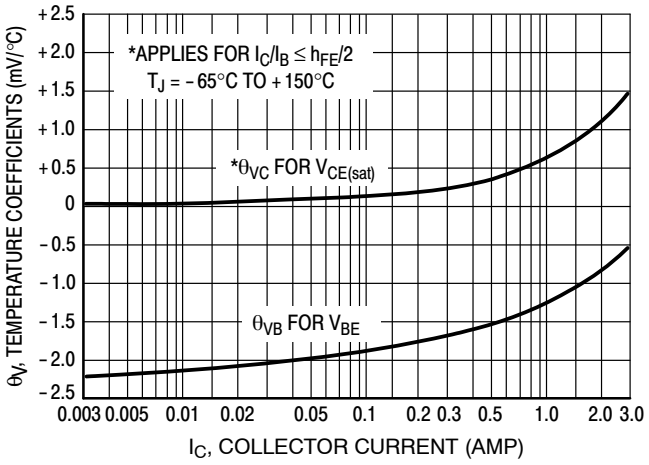


Figure 12. Temperature Coefficients

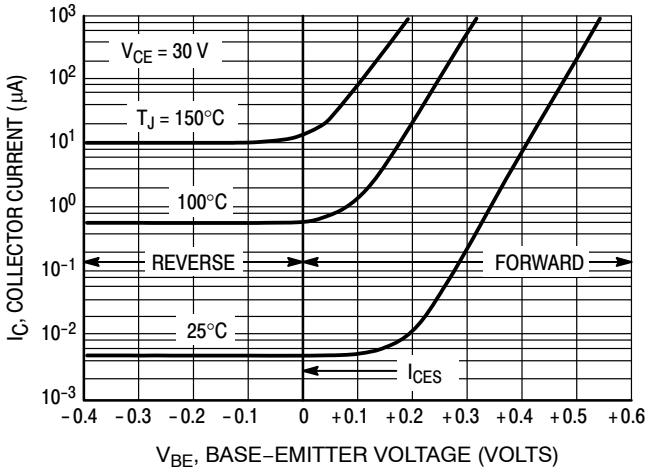


Figure 13. Collector Cut−Off Region

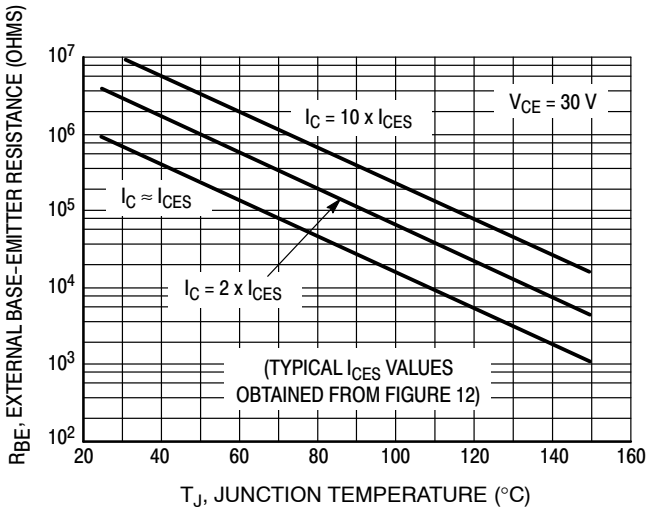
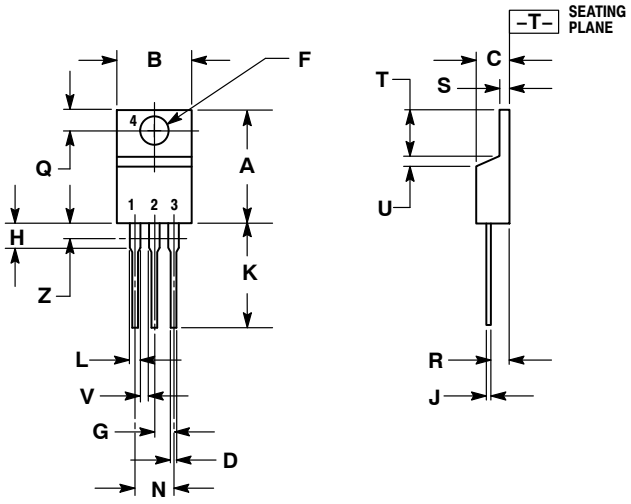


Figure 14. Effects of Base−Emitter Resistance

PACKAGE DIMENSIONS

TO−220
CASE 221A−09
ISSUE AG



NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.
3. DIMENSION Z DEFINES A ZONE WHERE ALL BODY AND LEAD IRREGULARITIES ARE ALLOWED.

	INCHES		MILLIMETERS	
DIM	MIN	MAX	MIN	MAX
A	0.570	0.620	14.48	15.75
B	0.380	0.405	9.66	10.28
C	0.160	0.190	4.07	4.82
D	0.025	0.036	0.64	0.91
F	0.142	0.161	3.61	4.09
G	0.095	0.105	2.42	2.66
H	0.110	0.161	2.80	4.10
J	0.014	0.025	0.36	0.64
K	0.500	0.562	12.70	14.27
L	0.045	0.060	1.15	1.52
N	0.190	0.210	4.83	5.33
Q	0.100	0.120	2.54	3.04
R	0.080	0.110	2.04	2.79
S	0.045	0.055	1.15	1.39
T	0.235	0.255	5.97	6.47
U	0.000	0.050	0.00	1.27
V	0.045	---	1.15	---
Z	---	0.080	---	2.04

STYLE 1:
PIN 1. BASE
2. COLLECTOR
3. EMITTER
4. COLLECTOR

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