

## Complementary Silicon Plastic Power Transistors

... designed for use in general purpose amplifier and switching applications.

- Collector-Emitter Saturation Voltage —  
 $V_{CE(sat)} = 1.2 \text{ Vdc (Max) @ } I_C = 3.0 \text{ Adc}$
- Collector-Emitter Sustaining Voltage —  
 $V_{CEO(sus)} = 60 \text{ Vdc (Min) — TIP31A, TIP32A}$   
 $= 80 \text{ Vdc (Min) — TIP31B, TIP32B}$   
 $= 100 \text{ Vdc (Min) — TIP31C, TIP32C}$
- High Current Gain — Bandwidth Product  
 $f_T = 3.0 \text{ MHz (Min) @ } I_C = 500 \text{ mAdc}$
- Compact TO-220 AB Package

### \*MAXIMUM RATINGS

Rating	Symbol	TIP31A TIP32A	TIP31B TIP32B	TIP31C TIP32C	Unit
Collector-Emitter Voltage	$V_{CEO}$	60	80	100	Vdc
Collector-Base Voltage	$V_{CB}$	60	80	100	Vdc
Emitter-Base Voltage	$V_{EB}$	5.0			Vdc
Collector Current — Continuous Peak	$I_C$	3.0 5.0			Adc
Base Current	$I_B$	1.0			Adc
Total Power Dissipation @ $T_C = 25^\circ\text{C}$ Derate above $25^\circ\text{C}$	$P_D$	40 0.32			Watts W/ $^\circ\text{C}$
Total Power Dissipation @ $T_A = 25^\circ\text{C}$ Derate above $25^\circ\text{C}$	$P_D$	2.0 0.016			Watts W/ $^\circ\text{C}$
Unclamped Inductive Load Energy (1)	E	32			mJ
Operating and Storage Junction Temperature Range	$T_J, T_{stg}$	-65 to +150			$^\circ\text{C}$

### THERMAL CHARACTERISTICS

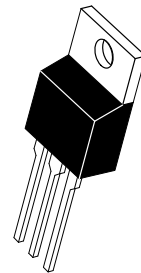
Characteristic	Symbol	Max	Unit
Thermal Resistance, Junction to Ambient	$R_{\theta JA}$	62.5	$^\circ\text{C/W}$
Thermal Resistance, Junction to Case	$R_{\theta JC}$	3.125	$^\circ\text{C/W}$

(1)  $I_C = 1.8 \text{ A}$ ,  $L = 20 \text{ mH}$ , P.R.F. = 10 Hz,  $V_{CC} = 10 \text{ V}$ ,  $R_{BE} = 100 \Omega$ .

**NPN**  
**TIP31A**  
**TIP31B\***  
**TIP31C\***  
**PNP**  
**TIP32A**  
**TIP32B\***  
**TIP32C\***

\*Motorola Preferred Device

**3 AMPERE**  
**POWER TRANSISTORS**  
**COMPLEMENTARY**  
**SILICON**  
**60-80-100 VOLTS**  
**40 WATTS**



**CASE 221A-06**  
**TO-220AB**

Preferred devices are Motorola recommended choices for future use and best overall value.

REV 1

# TIP31A TIP31B TIP31C TIP32A TIP32B TIP32C

## ELECTRICAL CHARACTERISTICS ( $T_C = 25^\circ\text{C}$ unless otherwise noted)

Characteristic	Symbol	Min	Max	Unit
<b>OFF CHARACTERISTICS</b>				
Collector–Emitter Sustaining Voltage (1) ( $I_C = 30\text{ mAdc}$ , $I_B = 0$ )	$V_{CE(sus)}$	60 80 100	— — —	Vdc
Collector Cutoff Current ( $V_{CE} = 30\text{ Vdc}$ , $I_B = 0$ ) ( $V_{CE} = 60\text{ Vdc}$ , $I_B = 0$ )	$I_{CEO}$	— — —	0.3 0.3 0.3	mAdc
Collector Cutoff Current ( $V_{CE} = 60\text{ Vdc}$ , $V_{EB} = 0$ ) ( $V_{CE} = 80\text{ Vdc}$ , $V_{EB} = 0$ ) ( $V_{CE} = 100\text{ Vdc}$ , $V_{EB} = 0$ )	$I_{CES}$	— — —	200 200 200	$\mu\text{Adc}$
Emitter Cutoff Current ( $V_{BE} = 5.0\text{ Vdc}$ , $I_C = 0$ )	$I_{EBO}$	—	1.0	mAdc

## ON CHARACTERISTICS (1)

DC Current Gain ( $I_C = 1.0\text{ Adc}$ , $V_{CE} = 4.0\text{ Vdc}$ ) ( $I_C = 3.0\text{ Adc}$ , $V_{CE} = 4.0\text{ Vdc}$ )	$h_{FE}$	25 10	— 50	—
Collector–Emitter Saturation Voltage ( $I_C = 3.0\text{ Adc}$ , $I_B = 375\text{ mAdc}$ )	$V_{CE(sat)}$	—	1.2	Vdc
Base–Emitter On Voltage ( $I_C = 3.0\text{ Adc}$ , $V_{CE} = 4.0\text{ Vdc}$ )	$V_{BE(on)}$	—	1.8	Vdc

## DYNAMIC CHARACTERISTICS

Current–Gain — Bandwidth Product ( $I_C = 500\text{ mAdc}$ , $V_{CE} = 10\text{ Vdc}$ , $f_{test} = 1.0\text{ MHz}$ )	$f_T$	3.0	—	MHz
Small–Signal Current Gain ( $I_C = 0.5\text{ Adc}$ , $V_{CE} = 10\text{ Vdc}$ , $f = 1.0\text{ kHz}$ )	$h_{fe}$	20	—	—

(1) Pulse Test: Pulse Width  $\leq 300\text{ }\mu\text{s}$ , Duty Cycle  $\leq 2.0\%$ .

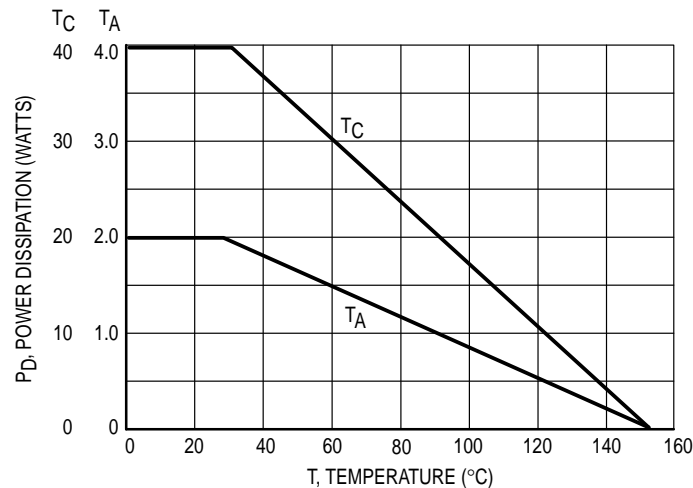


Figure 1. Power Derating

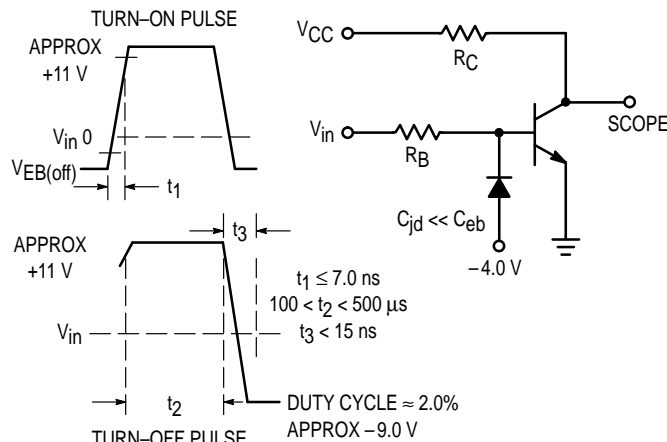


Figure 2. Switching Time Equivalent Circuit

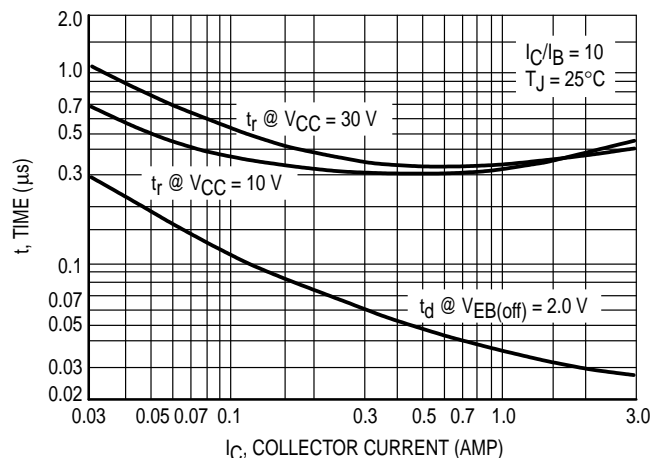


Figure 3. Turn–On Time

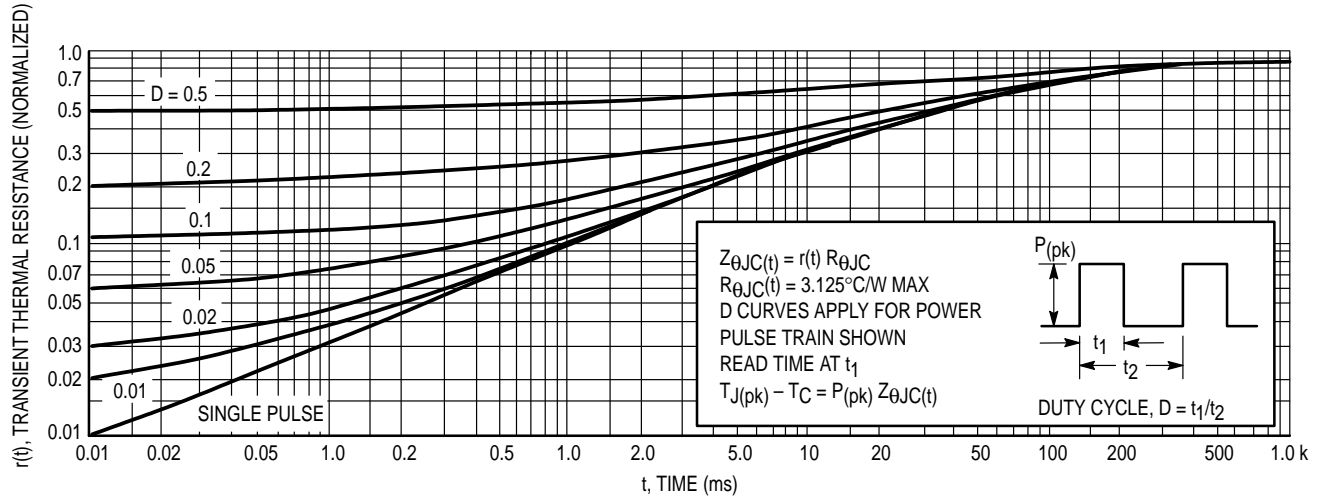


Figure 4. Thermal Response

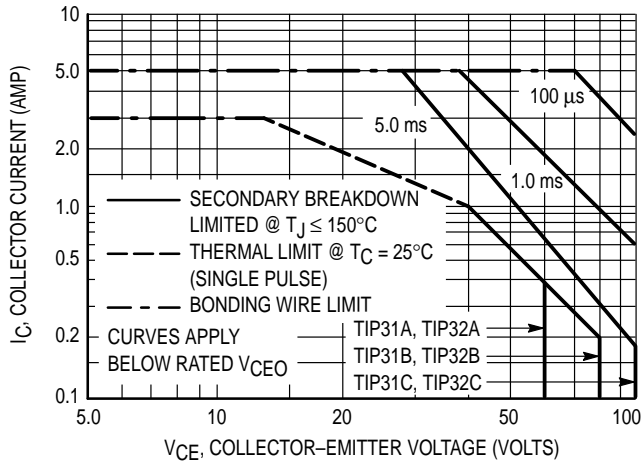


Figure 5. Active Region Safe Operating Area

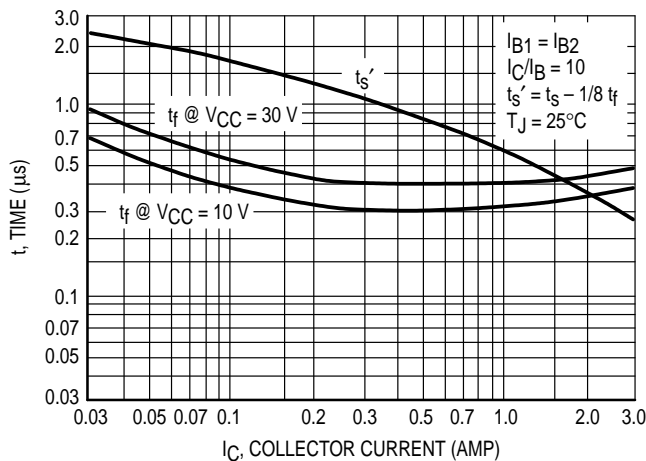


Figure 6. Turn-Off Time

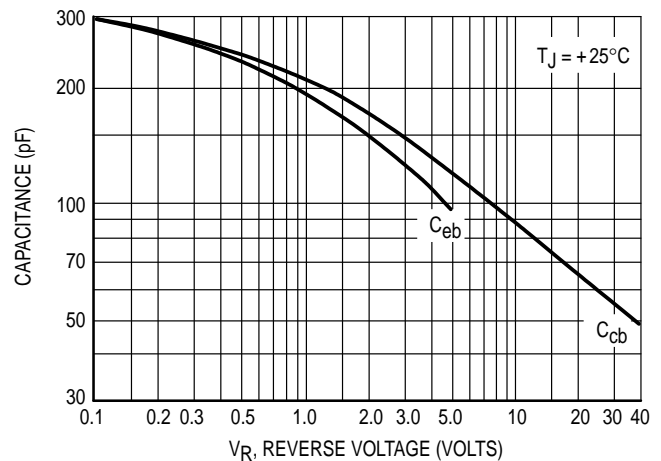
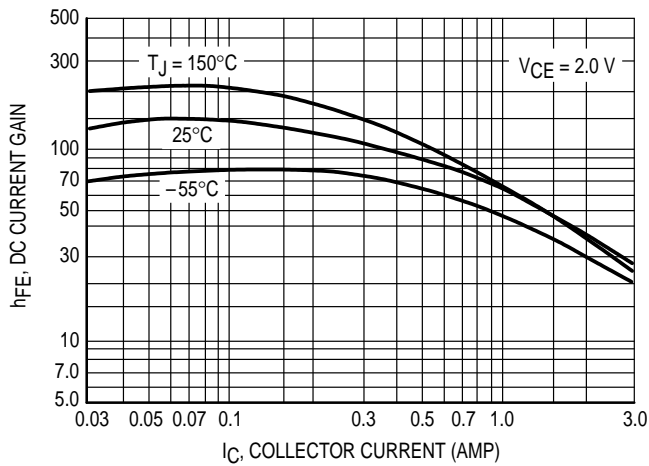
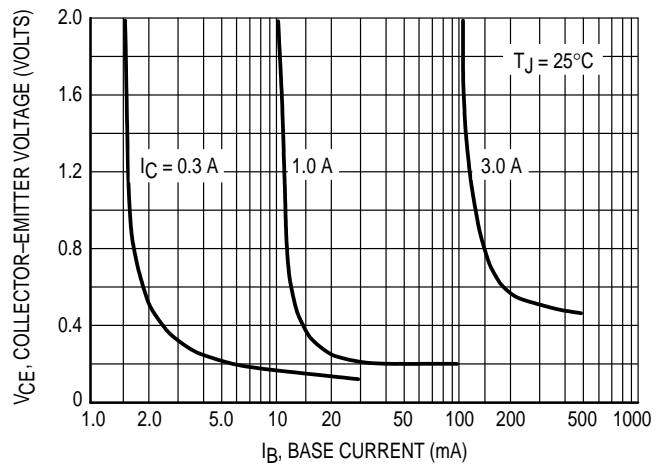


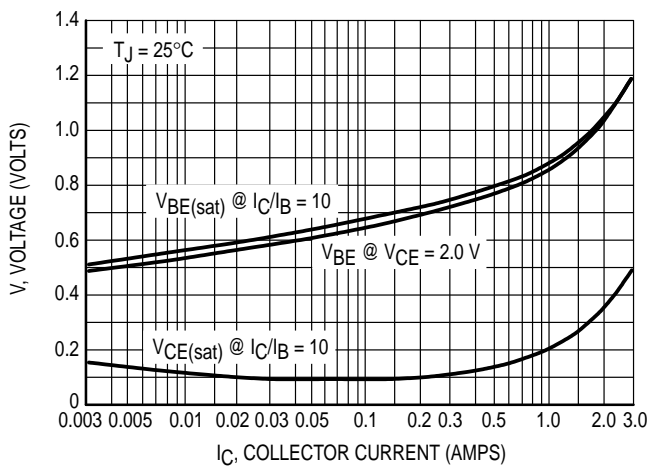
Figure 7. Capacitance



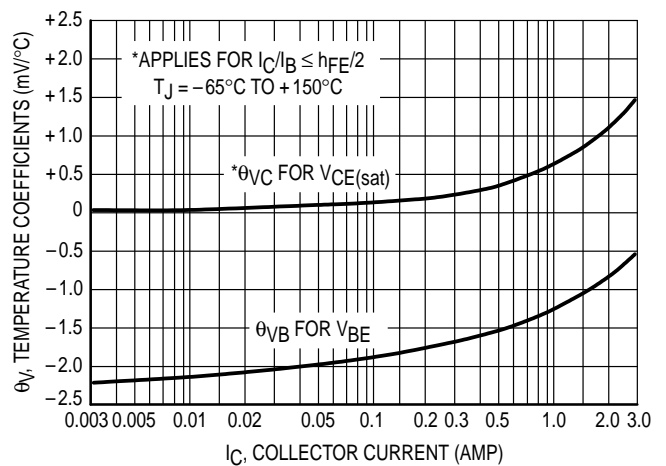
**Figure 8. DC Current Gain**



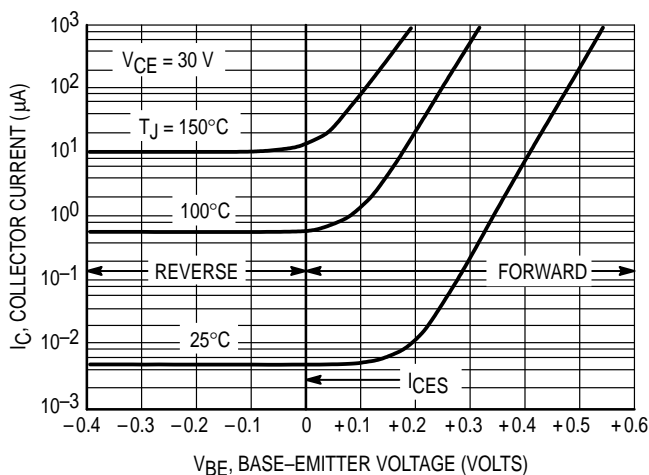
**Figure 9. Collector Saturation Region**



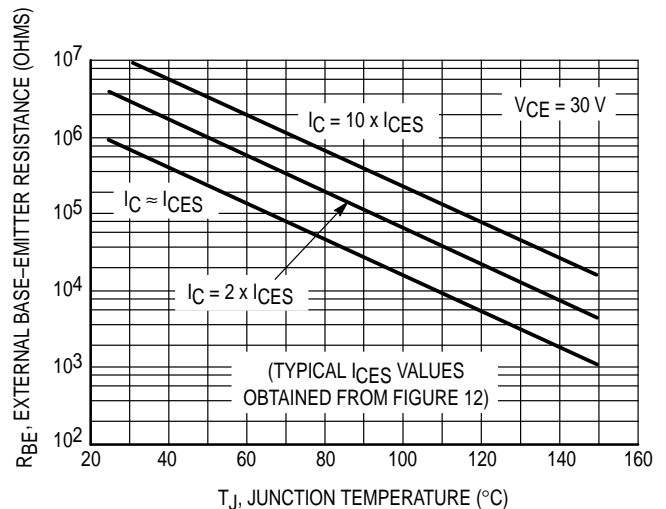
**Figure 10. "On" Voltages**



**Figure 11. Temperature Coefficients**

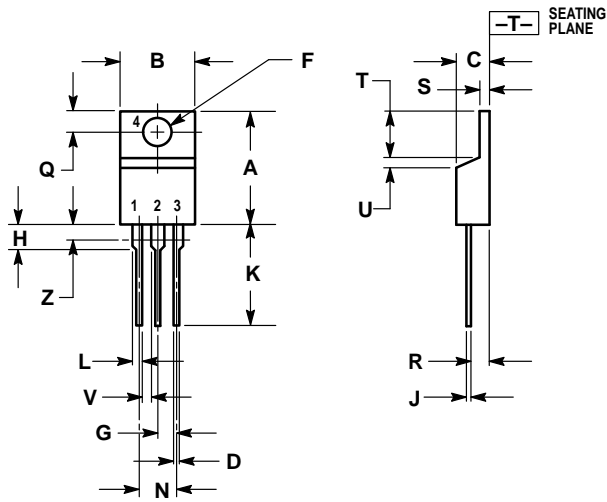


**Figure 12. Collector Cut-Off Region**



**Figure 13. Effects of Base-Emitter Resistance**

**TIP31A TIP31B TIP31C TIP32A TIP32B TIP32C**  
**PACKAGE DIMENSIONS**




- 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.

DIM	INCHES		MILLIMETERS	
	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	0.035	0.64	0.88
F	0.142	0.147	3.61	3.73
G	0.095	0.105	2.42	2.66
H	0.110	0.155	2.80	3.93
J	0.018	0.025	0.46	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

**CASE 221A-06**  
**TO-220AB**  
**ISSUE Y**

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**MOTOROLA**



**TIP31A/D**



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