

# TIP31, TIP32

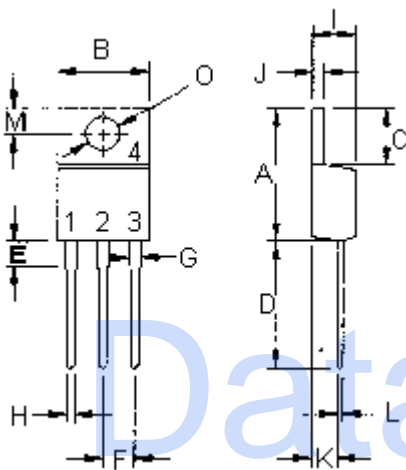
## High Power Bipolar Transistors



### Features:

- Collector - emitter sustaining voltage -  $V_{CEO(sus)}$   
= 60 V (Minimum) - TIP31A, TIP32A  
= 100 V (Minimum) - TIP31C, TIP32C
- Collector - emitter sustaining voltage -  $V_{CE(sat)}$  = 1.2 V (Maximum) at  $I_C = 3$  A
- Current gain - bandwidth product  $f_T = 3$  MHz (Minimum) at  $I_C = 500$  mA

TO-220



Dimensions	Minimum	Maximum
A	14.68	15.31
B	9.78	10.42
C	5.01	6.52
D	13.06	14.62
E	3.57	4.07
F	2.42	3.66
G	1.12	1.36
H	0.72	0.96
I	4.22	4.98
J	1.14	1.38
K	2.2	2.97
L	0.33	0.55
M	2.48	2.98
O	3.7	3.9

**NPN**  
**TIP31A**  
**TIP32C**

**PNP**  
**TIP32A**  
**TIP32C**

**3 Amperes**  
**Complementary Silicon**  
**Power Transistors**  
**60 - 100 Volts**  
**40 Watts**

- Pin**
1. Base
  2. Collector
  3. Emitter
  4. Collector (Case)

Dimensions : Millimetres

### Maximum Ratings

Characteristic	Symbol	TIP31A TIP32A	TIP31C TIP32C	Unit
Collector - emitter voltage	$V_{CEO}$	60	100	V
Collector - base voltage	$V_{CBO}$			
Emitter - base voltage	$V_{EBO}$	5		A
Collector current - continuous	$I_C$	3		
- peak		5		
Base current	$I_B$	1		
Total power dissipation at $t_c = 25^\circ\text{C}$ derate above $25^\circ\text{C}$	$P_D$	40	0.32	W W/ $^\circ\text{C}$
Operating and storage junction temperature range	$T_J, T_{STG}$	-65 to +150		$^\circ\text{C}$

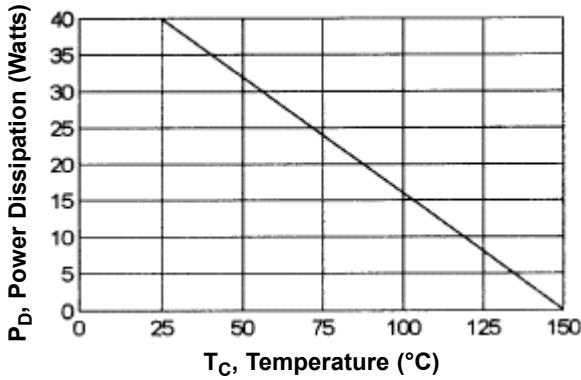
### Thermal Characteristics

Characteristic	Symbol	Maximum	Unit
Thermal resistance junction to case	$R_{\theta jc}$	3.125	$^\circ\text{C}/\text{W}$

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## High Power Bipolar Transistors

Figure - 1 Power Derating



### Electrical Characteristics ( $T_C = 25^\circ\text{C}$ Unless Otherwise Noted)

Characteristic	Symbol	Minimum	Maximum	Unit
<b>OFF Characteristics</b>				
Collector - emitter sustaining voltage (1) ( $I_C = 30\text{ mA}$ , $I_B = 0$ ) TIP31A, TIP32A TIP31C, TIP32C	$V_{CEO(SUS)}$	60 100	-	V
Collector cut off current ( $V_{CE} = 30\text{ V}$ , $I_B = 0$ ) ( $V_{CE} = 60\text{ V}$ , $I_B = 0$ ) TIP31A, TIP32A TIP31C, TIP32C	$I_{CEO}$	-	0.3	mA
Collector cut off current ( $V_{CE} = 60\text{ V}$ , $V_{EB} = 0$ ) ( $V_{CE} = 100\text{ V}$ , $V_{EB} = 0$ ) TIP31A, TIP32A TIP31C, TIP32C	$I_{CES}$	-	0.2	
Emitter cut off current ( $V_{EB} = 5\text{ V}$ , $I_C = 0$ )	$I_{EBO}$	-	1	
<b>ON Characteristics (1)</b>				
DC current gain ( $I_C = 1\text{ A}$ , $V_{CE} = 4\text{ V}$ ) ( $I_C = 3\text{ A}$ , $V_{CE} = 4\text{ V}$ )	$h_{FE}$	25 15	- 50	-
Collector - emitter saturation voltage ( $I_C = 3\text{ A}$ , $I_B = 375\text{ mA}$ )	$V_{CE(sat)}$	-	1.2	V
Base - emitter on voltage ( $I_C = 3\text{ A}$ , $V_{CE} = 4\text{ V}$ )	$V_{BE(on)}$	-	1.8	
<b>Dynamic Characteristics</b>				
Current gain - bandwidth product (2) ( $I_C = 500\text{ mA}$ , $V_{CE} = 10\text{ V}$ , $f_{TEST} = 1\text{ KHz}$ )	$f_T$	3	-	MHz
Small - signal current gain ( $I_C = 500\text{ A}$ , $V_{CE} = 10\text{ V}$ , $f = 1\text{ kHz}$ )	$h_{fe}$	20	-	-

(1) Pulse Test : Pulse width  $\leq 300\ \mu\text{s}$ , duty cycle  $\leq 2\%$

(2)  $f_T = |h_{FE}| \cdot f_{TEST}$

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Figure - 2 Switching Time Equivalent Circuit

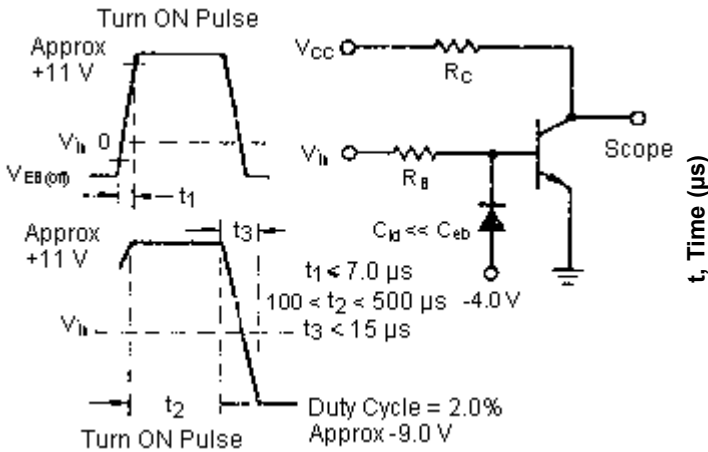


Figure - 4 DC Current Gain

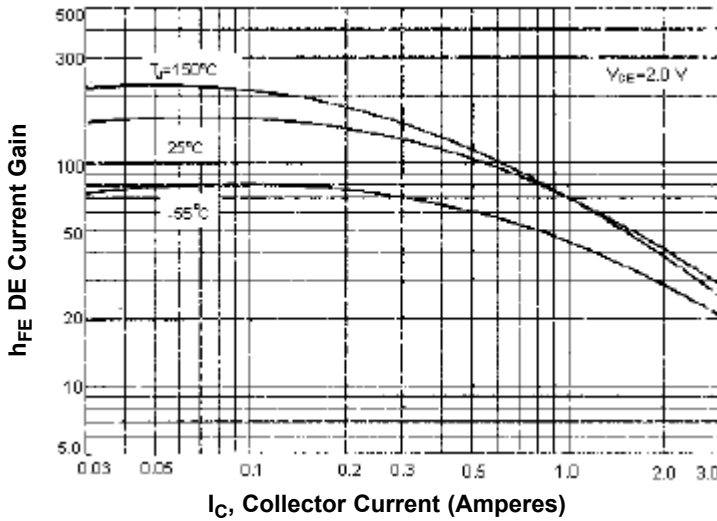


Figure - 6 Active Region Safe Operating Area

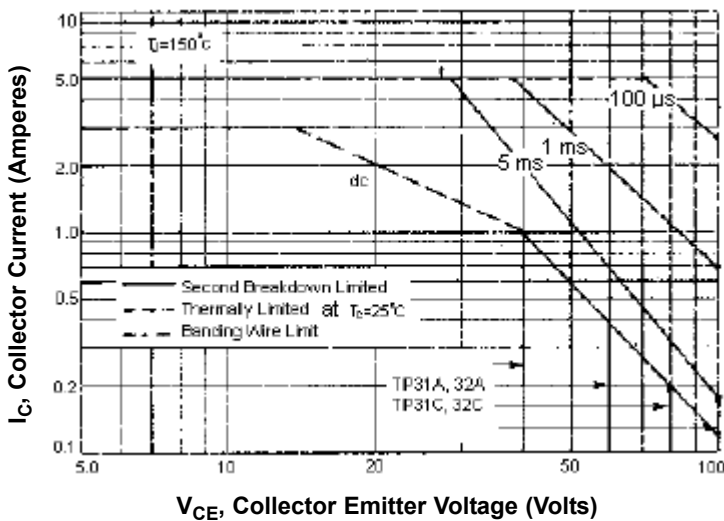


Figure - 3 Turn-On Time

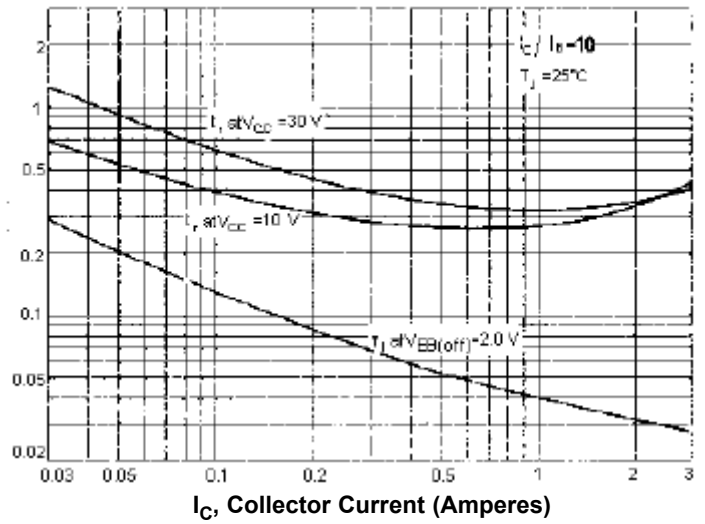
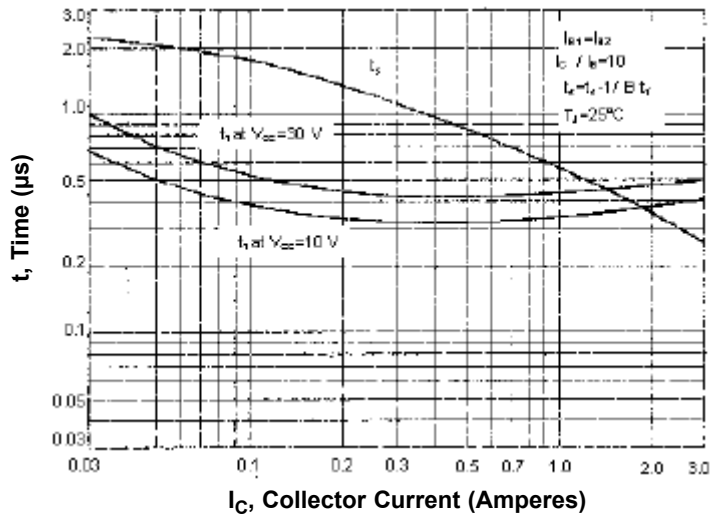


Figure - 5 Turn-Off Time



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 curve is based on  $T_{J(PK)} = 150^\circ\text{C}$ ;  $T_C$  is variable depending on power level. Second breakdown pulse limits are valid for duty cycles to 10% provided  $T_{J(PK)} = 150^\circ\text{C}$ . At high case temperatures, thermal limitation will reduce the power that can be handled to values less than the limitations imposed by second breakdown

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Figure - 7 Collector Saturation Region

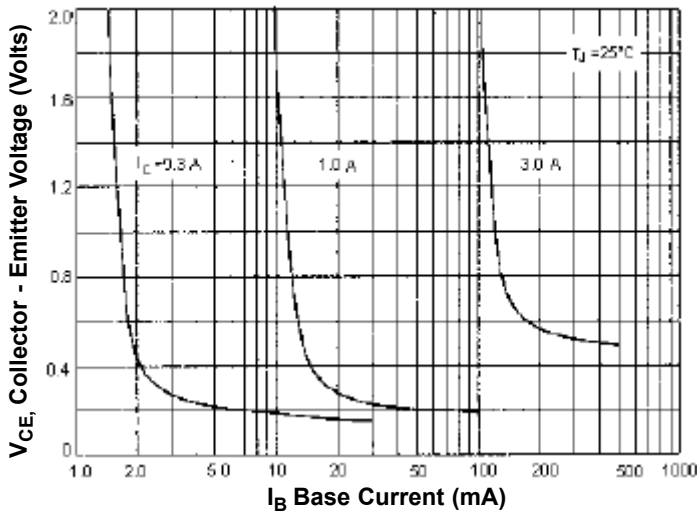


Figure - 8 Capacitances

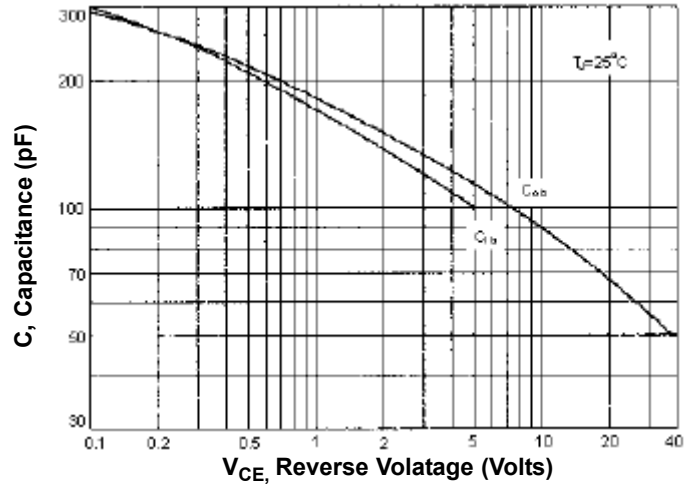


Figure - 9 "ON" Voltage

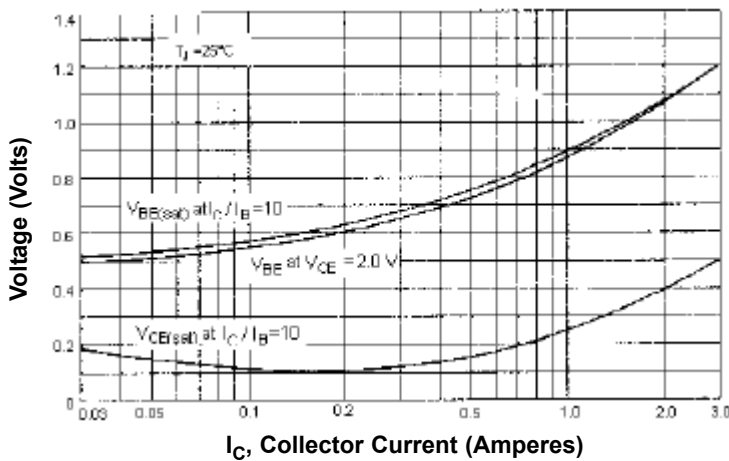
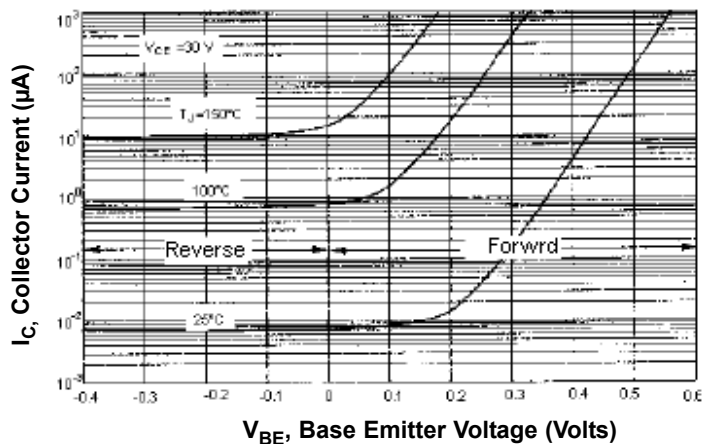


Figure - 10 Collector Cut-off Region



### Part Number Table

Description	Type	Part Number
High Power Bipolar Transistor	NPN	TIP31A
High Power Bipolar Transistor		TIP31C
High Power Bipolar Transistor	PNP	TIP32A
High Power Bipolar Transistor		TIP32C

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