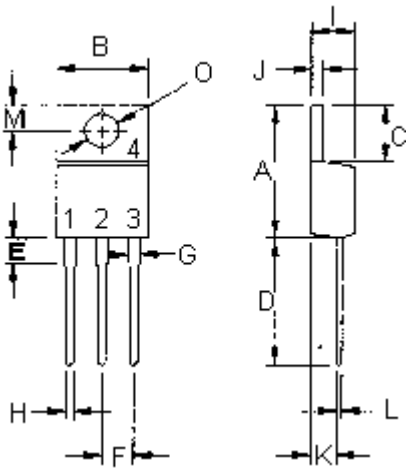
TIP31, TIP32

High Power Bipolar Transistors

TO-220

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



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

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

Dimensions : Millimetres

NPN **PNP**
TIP31A **TIP32A**
TIP32C **TIP32C**

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

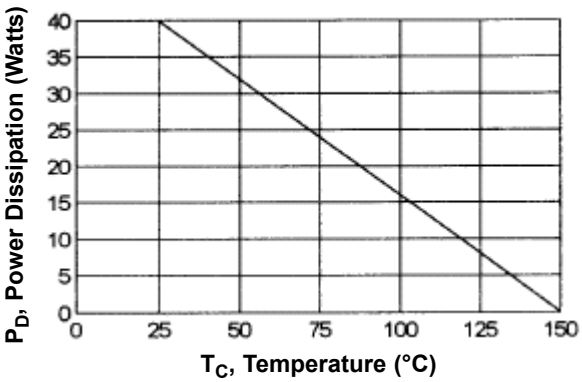
Maximum Ratings

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 - peak	I_C	3 5		
Base current	I_B	1		
Total power dissipation at tc = 25°C derate above 25°C	P_D	40 0.32		W W/°C
Operating and storage junction temperature range	T_J, T_{STG}	-65 to +150		°C

Thermal Characteristics

Characteristic	Symbol	Maximum	Unit
Thermal resistance junction to case	Rθjc	3.125	°C/W

Figure - 1 Power Derating



Electrical Characteristics (T_C = 25°C Unless Otherwise Noted)

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

(1) Pulse Test : Pulse width ≤ 300 µs, duty cycle ≤ 2%
(2) $f_T = |h_{FE}| \bullet f_{TEST}$

Figure - 2 Switching Time Equivalent Circuit

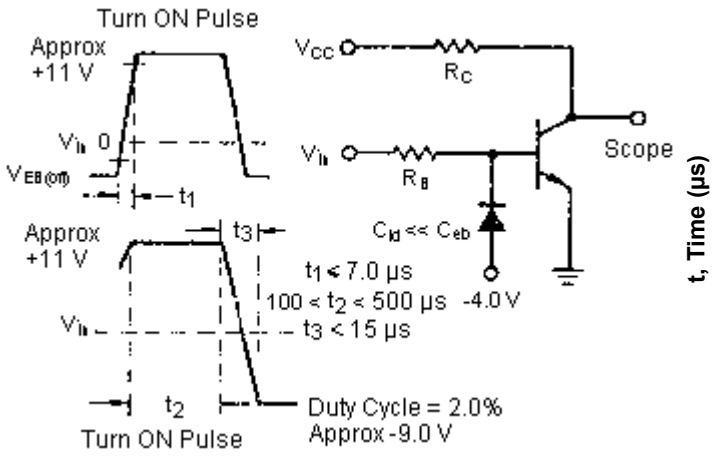


Figure - 3 Turn-On Time

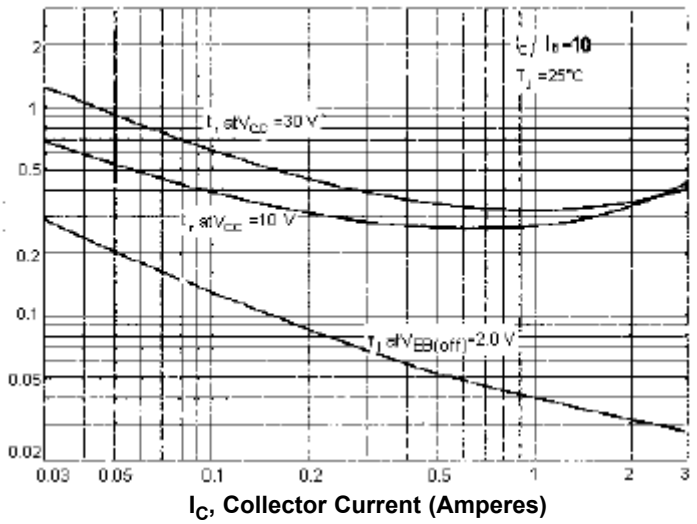


Figure - 4 DC Current Gain

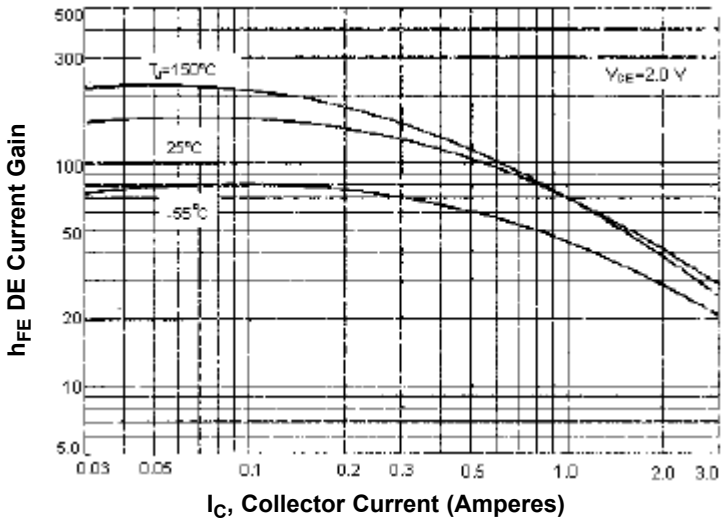


Figure - 5 Turn-Off Time

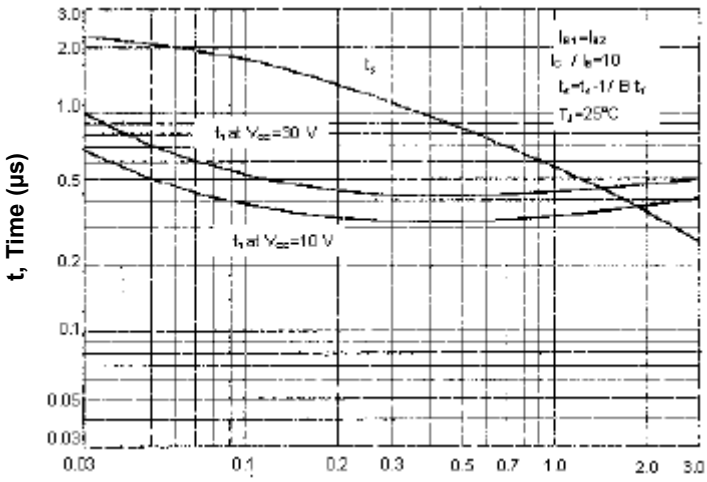
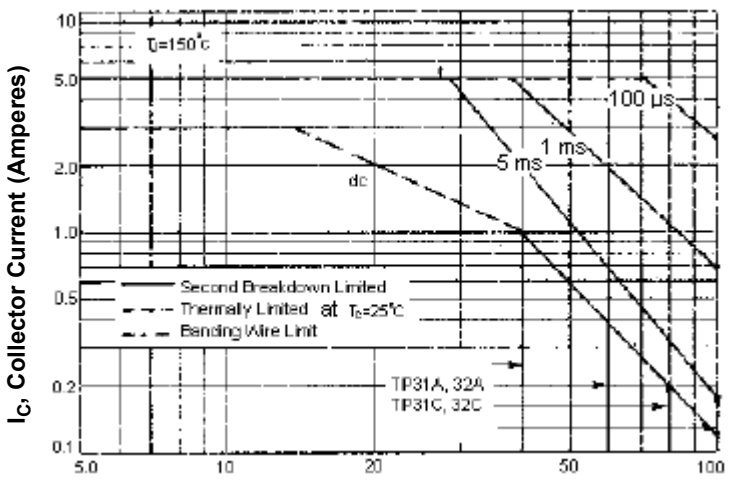


Figure - 6 Active Region Safe Operating Area



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 curve is based on $T_{J\,(PK)}$ = 150°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°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

Figure - 7 Collector Saturation Region

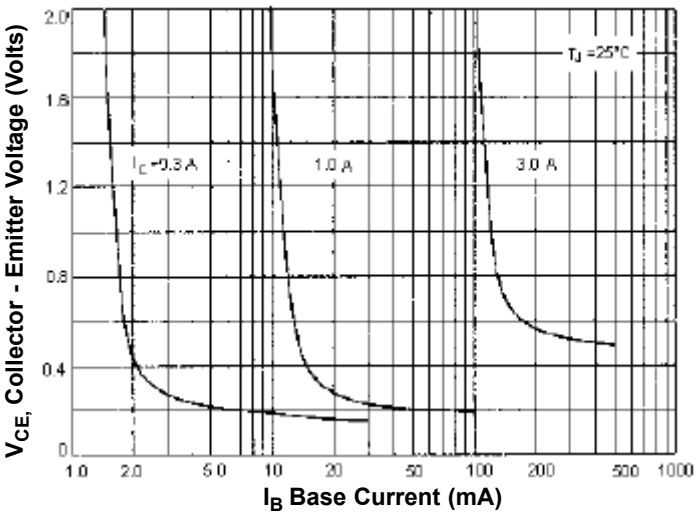


Figure - 8 Capacitances

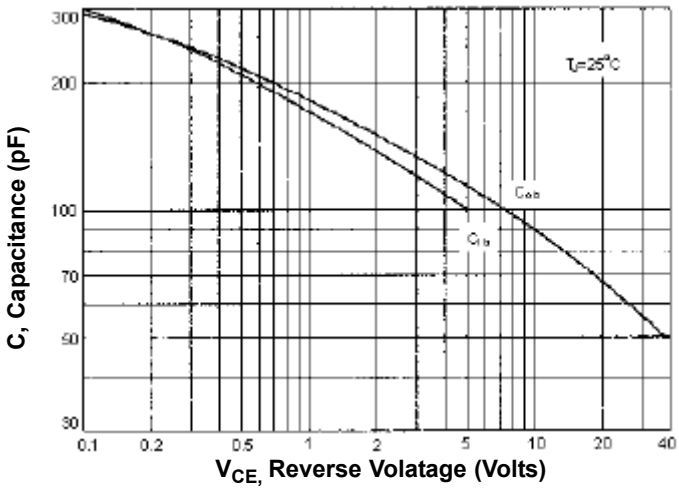


Figure - 9 "ON" Voltage

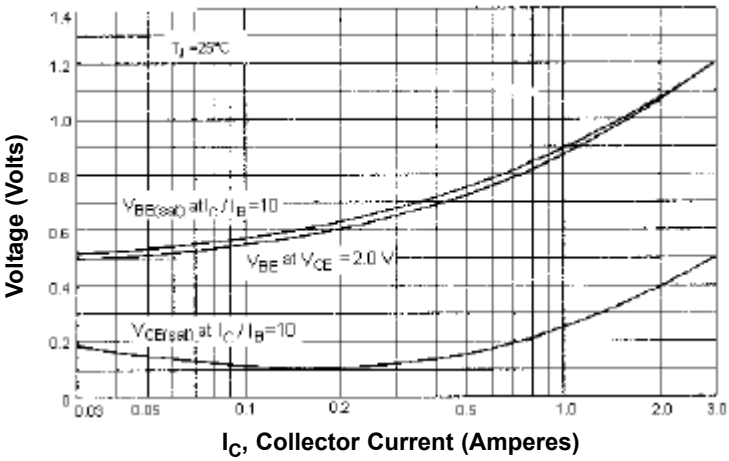
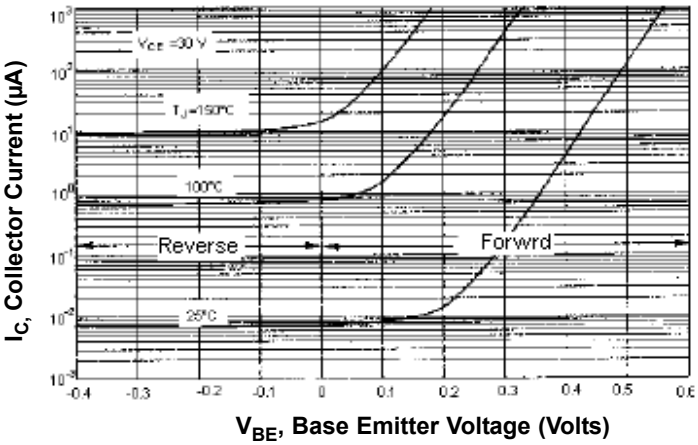


Figure - 10 Collector Cut-off Region



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