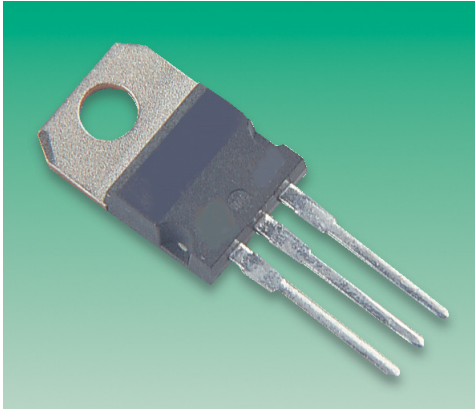


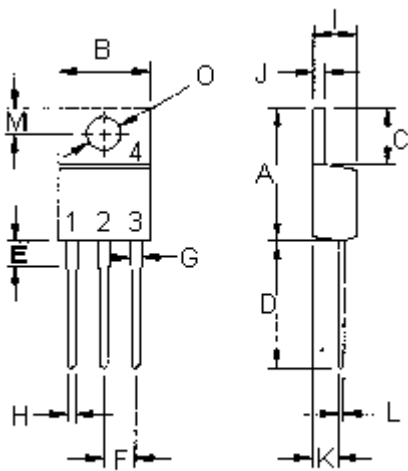
TIP31, TIP32

High Power Bipolar Transistor



Features:

- Collector-Emitter sustaining voltage -
 $V_{CE(sus)} = 60V$ (Minimum) - TIP31A, TIP32A
 $= 100V$ (Minimum) - TIP31C, TIP32C.
- Collector-Emitter saturation voltage -
 $V_{CE(sat)} = 1.2V$ (Maximum) at $I_C = 3.0A$.
- Current gain-bandwidth product $f_T = 3.0MHz$ (Minimum) at $I_C = 500mA$.



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

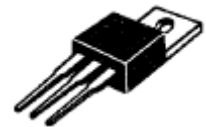
| Dimensions | Minimum | Maximum |
|------------|---------|---------|
| A | 14.68 | 15.31 |
| B | 9.78 | 10.42 |
| C | 5.01 | 6.52 |
| D | 13.06 | 14.62 |
| E | 3.57 | 4.07 |
| F | 2.42 | 3.66 |
| G | 1.12 | 1.36 |
| H | 0.72 | 0.96 |
| I | 4.22 | 4.98 |
| J | 1.14 | 1.38 |
| K | 2.20 | 2.97 |
| L | 0.33 | 0.55 |
| M | 2.48 | 2.98 |
| O | 3.70 | 3.90 |

Dimensions : Millimetres

NPN
TIP31A
TIP32C

PNP
TIP32A
TIP32C

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



TO-220

TIP31, TIP32

High Power Bipolar Transistor

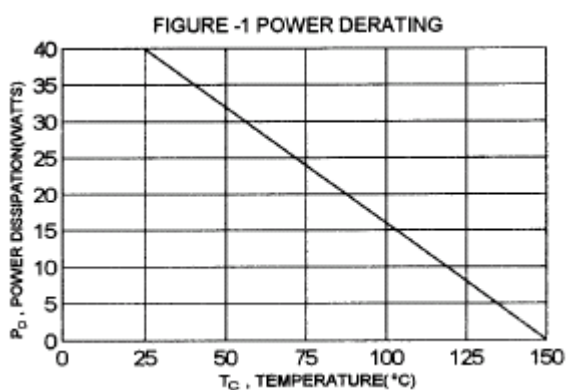


Maximum Ratings

| 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} | 5.0 | | |
| Collector Current-Continuous -Peak | I_C | 3.0 5.0 | | A |
| Base Current | I_B | 1.0 | | |
| Total Power Dissipation at $T_C = 25^\circ\text{C}$ Derate above 25°C | P_D | 40 0.32 | | W W/ $^\circ\text{C}$ |
| Operation 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 | $^\circ\text{C/W}$ |



TIP31, TIP32

High Power Bipolar Transistor



Electrical Characteristics ($T_C = 25^\circ\text{C}$ unless otherwise noted)

| Characteristic | Symbol | Minimum | Maximum | Unit |
|--------------------------------------------------------------------------------------------------------------------------------------------------------|----------------|-----------|---------|------|
| OFF Characteristics | | | | |
| 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 ($V_{EB} = 5.0\text{V}$, $I_C = 0$) | I_{EBO} | - | 1.0 | |
| ON Characteristics (1) | | | | |
| DC Current Gain ($I_C = 1.0\text{A}$, $V_{CE} = 4.0\text{V}$) ($I_C = 3.0\text{A}$, $V_{CE} = 4.0\text{V}$) | h_{FE} | 25 10 | - 50 | - |
| Collector-Emitter Saturation Voltage ($I_C = 3.0\text{A}$, $I_B = 375\text{mA}$) | $V_{CE(sat)}$ | - | 1.2 | V |
| Base-Emitter On Voltage ($I_C = 3.0\text{A}$, $V_{CE} = 4.0\text{V}$) | $V_{BE(on)}$ | - | 1.8 | |
| Dynamic Characteristics | | | | |
| Current Gain-Bandwidth Product (2) ($I_C = 500\text{mA}$, $V_{CE} = 10\text{V}$, $f_{TEST} = 1\text{MHz}$) | f_T | 3.0 | - | MHz |
| Small Signal Current Gain ($I_C = 500\text{mA}$, $V_{CE} = 10\text{V}$, $f = 1\text{kHz}$) | h_{FE} | 20 | - | - |

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

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

TIP31, TIP32

High Power Bipolar Transistor



Figure - 2 Switching Time Equivalent Circuit

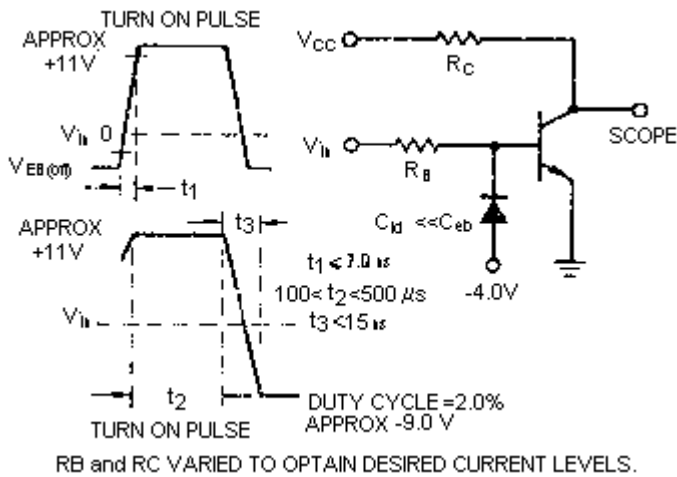


Figure - 3 Turn-On Time

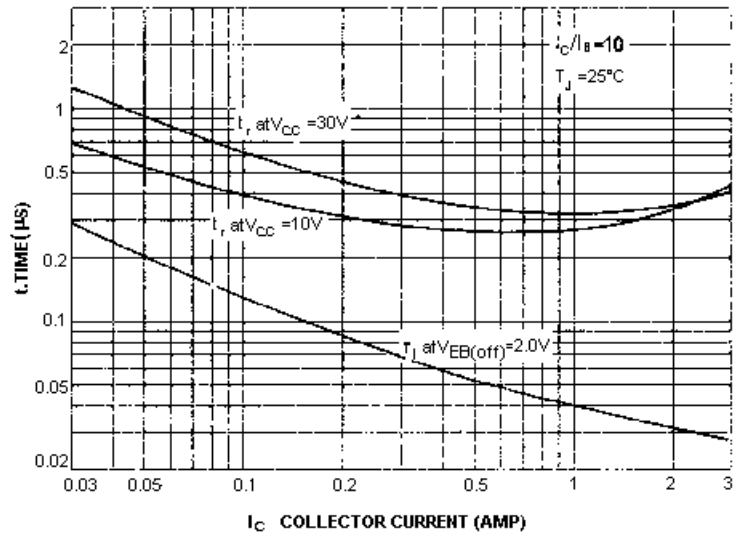


Figure - 4 DC Current Gain

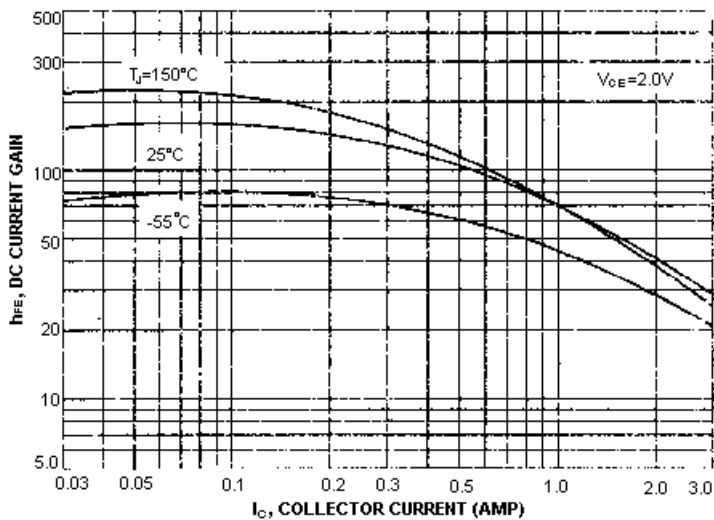
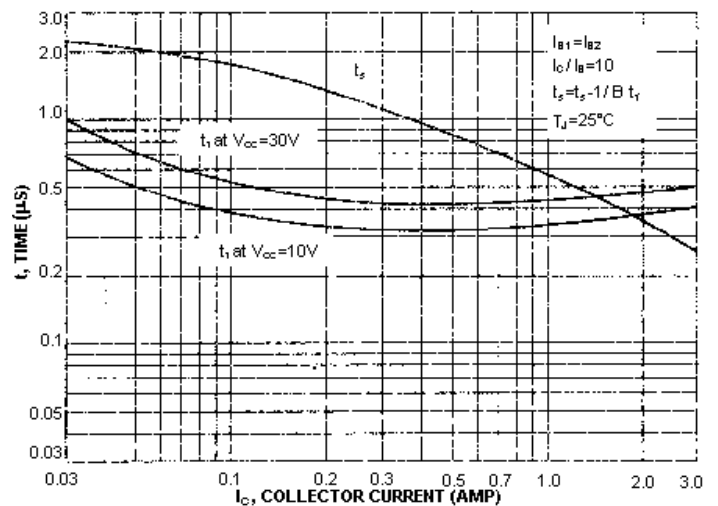


Figure - 5 Turn-Off Time

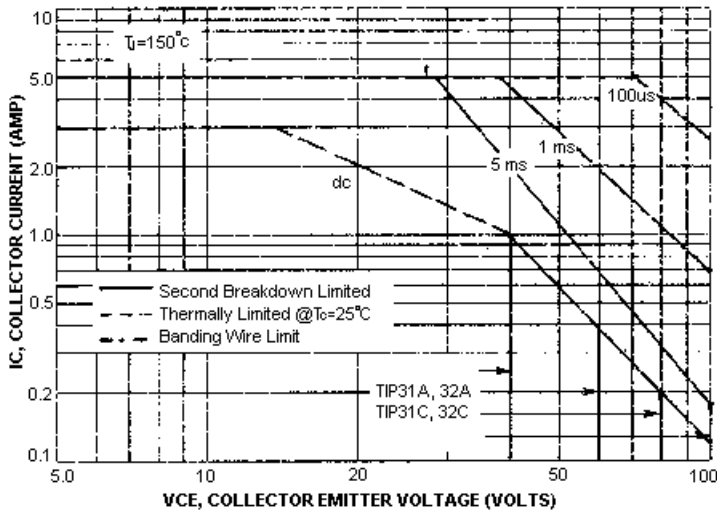


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High Power Bipolar Transistor



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

Figure - 7 Collector Saturation Region

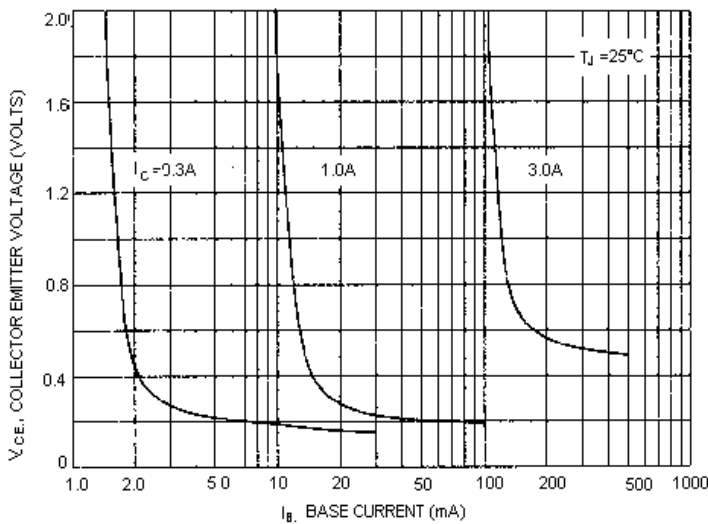
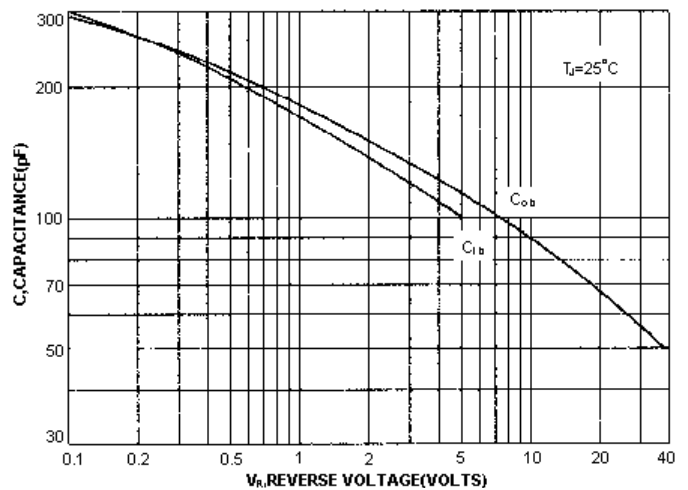


Figure - 8 Capacitances



TIP31, TIP32

High Power Bipolar Transistor



Figure - 9 "ON" Voltage

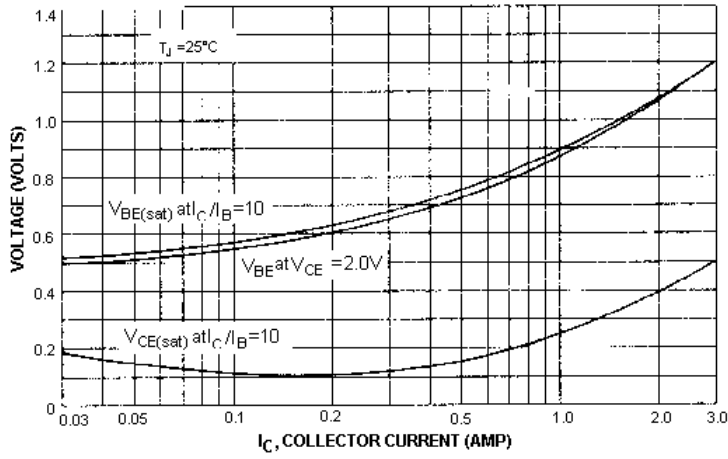
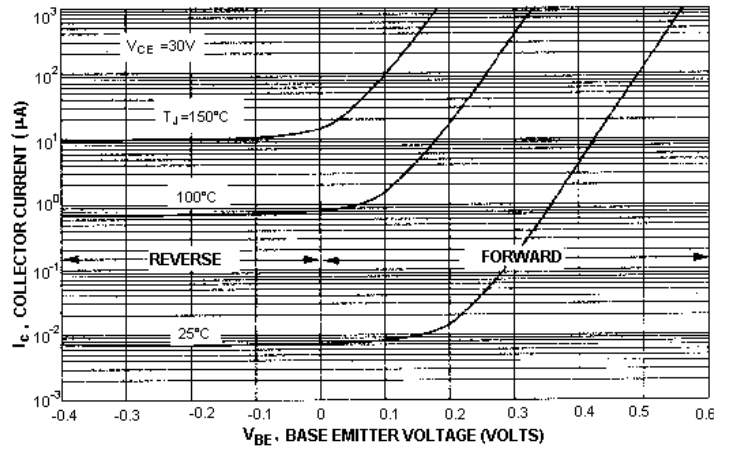


Figure - 10 Collector Cut-off Region



Specifications

| TYPE | Part Number |
|------|-------------|
| NPN | TIP31A |
| | TIP31C |
| PNP | TIP32A |
| | TIP32C |



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High Power Bipolar Transistor



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