

## Features:

- Collector-Emitter sustaining voltage -  
 $V_{CE(sus)} = 60V$  (Min.) - TIP31A, TIP32A  
 $= 100V$  (Min.) - TIP31C, TIP32C
- Collector-Emitter saturation voltage -  
 $V_{CE(sat)} = 1.2V$  (Max.) at  $I_C = 3A$
- Current gain-bandwidth product  $f_T = 3MHz$  (Min.) at  $I_C = 500mA$

## Maximum Ratings

| Characteristic                                                        | Symbol                            | TIP31A<br>TIP32A | TIP31C<br>TIP32C | Unit      |
|-----------------------------------------------------------------------|-----------------------------------|------------------|------------------|-----------|
| Collector-Emitter Voltage                                             | V <sub>CEO</sub>                  | 60               | 100              | V         |
| Collector-Base Voltage                                                | V <sub>CBO</sub>                  |                  |                  |           |
| Emitter-Base Voltage                                                  | V <sub>EBO</sub>                  | 5                |                  |           |
| Collector Current-Continuous<br>-Peak                                 | I <sub>C</sub>                    | 3<br>5           |                  | A         |
| Base Current                                                          | I <sub>B</sub>                    | 1                |                  |           |
| Total Power Dissipation at T <sub>C</sub> = 25°C<br>Derate above 25°C | P <sub>D</sub>                    | 40<br>0.32       |                  | W<br>W/°C |
| Operation and Storage Junction Temperature Range                      | T <sub>J</sub> , T <sub>STG</sub> | -65 to +150      |                  | °C        |

## Thermal Characteristics

| Characteristic                      | Symbol          | Max.  | Unit         |
|-------------------------------------|-----------------|-------|--------------|
| Thermal Resistance Junction to Case | $R_{\theta jc}$ | 3.125 | $^\circ C/W$ |

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

| Characteristic | Symbol | Min. | Max. | Unit |
|----------------|--------|------|------|------|
|----------------|--------|------|------|------|

### OFF Characteristics

|                                                                                                                                                |                |           |     |    |
|------------------------------------------------------------------------------------------------------------------------------------------------|----------------|-----------|-----|----|
| Collector-Emitter Sustaining Voltage (1)<br>$I_C = 30\text{mA}$ , $I_B = 0$<br>TIP31A, TIP32A<br>TIP31C, TIP32C                                | $V_{CEO(sus)}$ | 60<br>100 | -   | V  |
| Collector Cut off Current<br>$V_{CE} = 30\text{V}$ , $I_B = 0$<br>$V_{CE} = 60\text{V}$ , $I_B = 0$<br>TIP31A, TIP32A<br>TIP31C, TIP32C        | $I_{CEO}$      | -         | 0.3 | mA |
| Collector Cut off Current<br>$V_{CE} = 60\text{V}$ , $V_{EB} = 0$<br>$V_{CE} = 100\text{V}$ , $V_{EB} = 0$<br>TIP31A, TIP32A<br>TIP31C, TIP32C | $I_{CES}$      | -         | 0.2 |    |
| Emitter Cut off Current<br>$V_{EB} = 5\text{V}$ , $I_C = 0$                                                                                    | $I_{EBO}$      | -         | 1   |    |

### ON Characteristics (1)

|                                                                                                         |               |          |         |   |
|---------------------------------------------------------------------------------------------------------|---------------|----------|---------|---|
| DC Current Gain<br>$I_C = 1\text{A}$ , $V_{CE} = 4\text{V}$<br>$I_C = 3\text{A}$ , $V_{CE} = 4\text{V}$ | $h_{FE}$      | 25<br>10 | -<br>50 | - |
| Collector-Emitter Saturation Voltage<br>$I_C = 3\text{A}$ , $I_B = 375\text{mA}$                        | $V_{CE(sat)}$ | -        | 1.2     | V |
| Base-Emitter On Voltage<br>$I_C = 3\text{A}$ , $V_{CE} = 4\text{V}$                                     | $V_{BE(on)}$  | -        | 1.8     |   |

### Dynamic Characteristics

|                                                                                                               |          |    |   |     |
|---------------------------------------------------------------------------------------------------------------|----------|----|---|-----|
| Current Gain-Bandwidth Product (2)<br>$I_C = 500\text{mA}$ , $V_{CE} = 10\text{V}$ , $f_{TEST} = 1\text{MHz}$ | $f_T$    | 3  | - | MHz |
| Small Signal Current Gain<br>$I_C = 500\text{mA}$ , $V_{CE} = 10\text{V}$ , $f = 1\text{kHz}$                 | $h_{FE}$ | 20 | - | -   |

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

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

Figure - 1 Power Derating

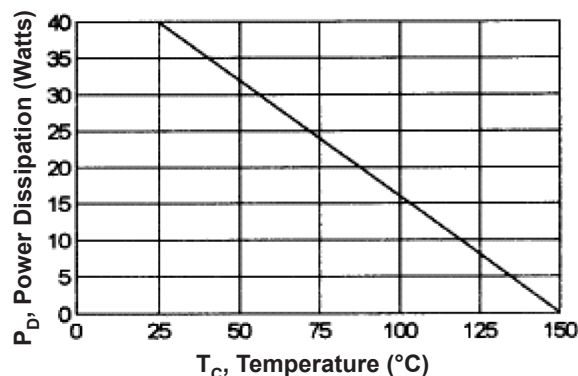
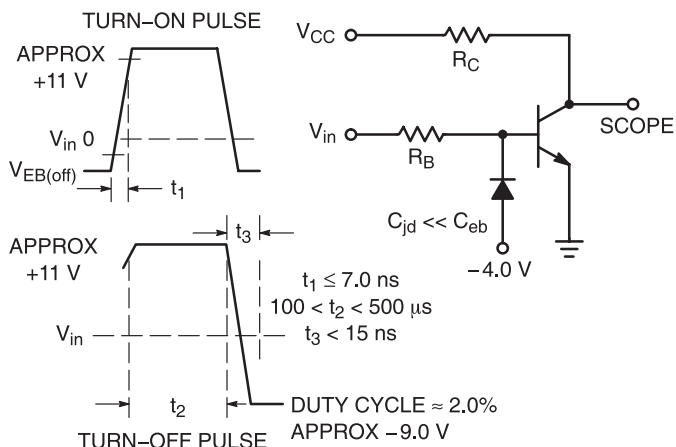


Figure - 2 Switching Time Equivalent Circuit



$R_B$  and  $R_C$  Varied to Obtain Desired Current Levels

Figure - 3 Turn-On Time

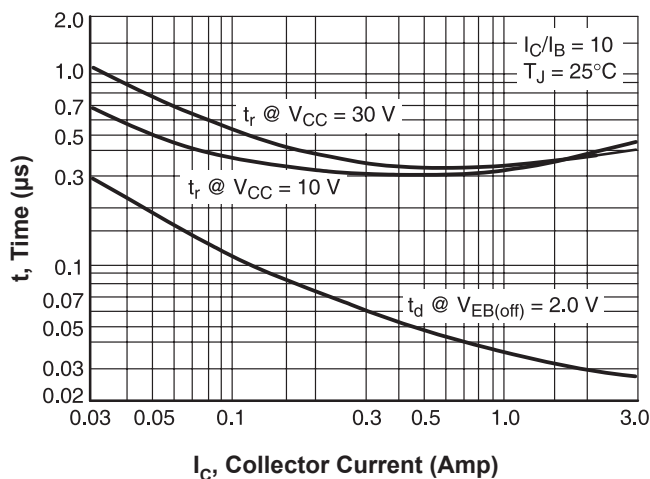


Figure - 4 DC Current Gain

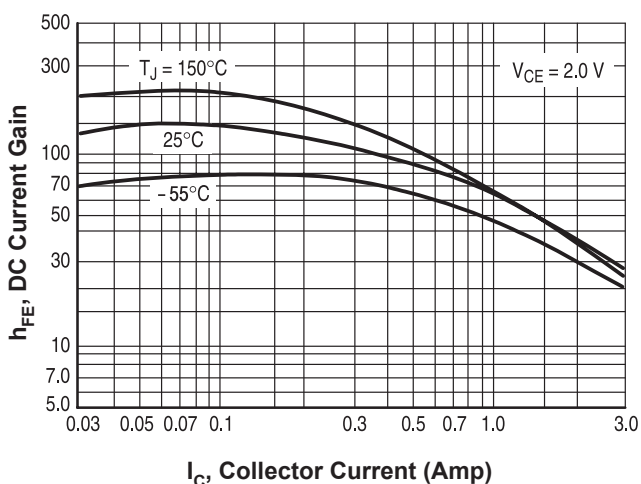


Figure - 5 Turn-Off Time

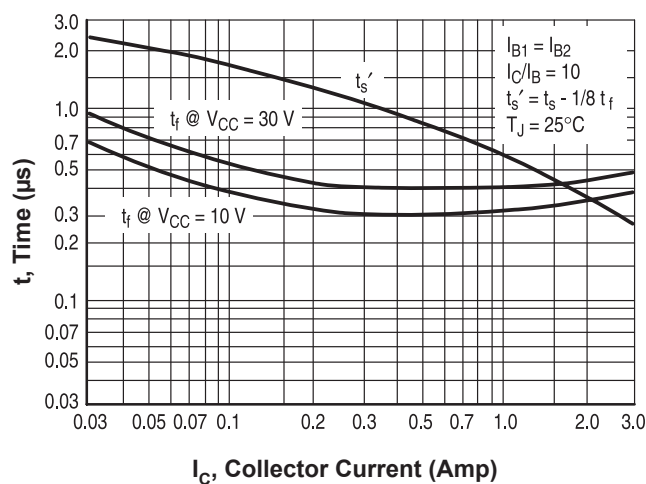
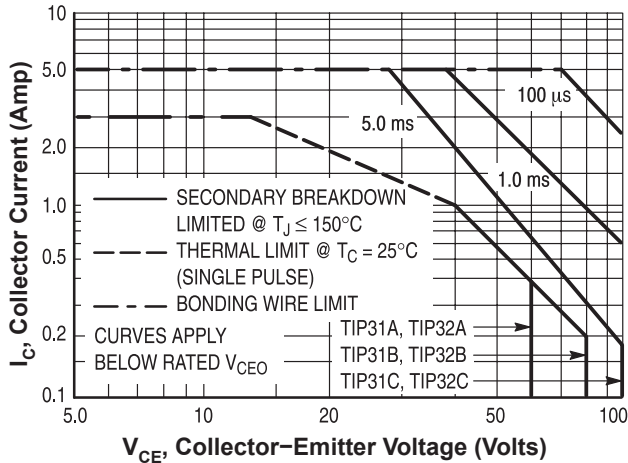


Figure - 6 Active Region Safe Operating Area



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  $T_{J(PK)} = 150^\circ\text{C}$ ;  $T_C$  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

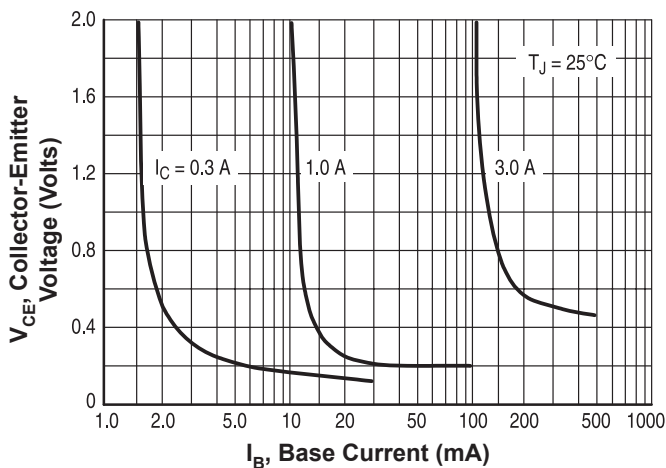


Figure - 8 Capacitances

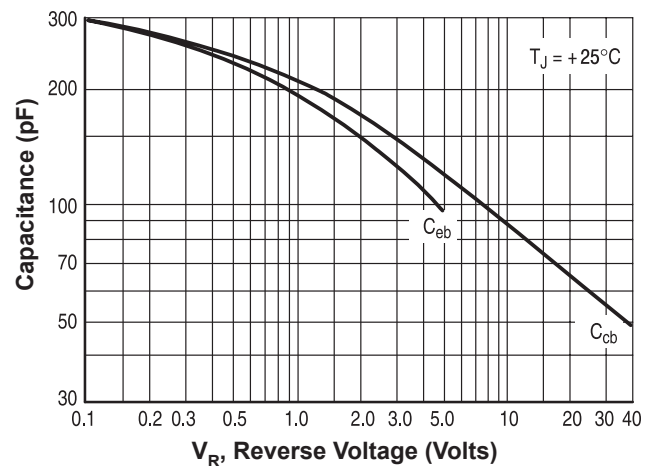


Figure - 9 "ON" Voltage

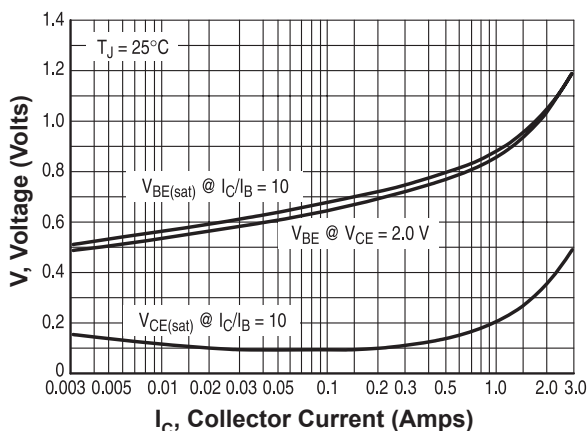
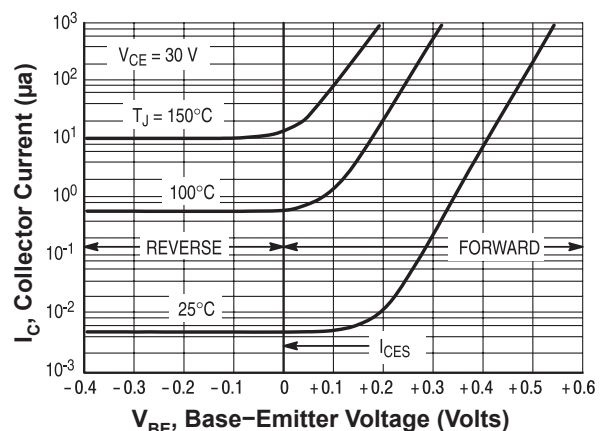
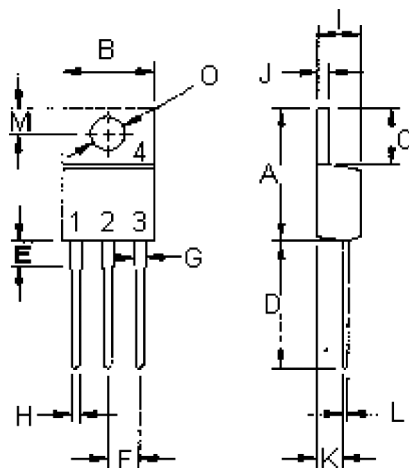


Figure - 10 Collector Cut-off Region





## Pin Configuration:

1. Base
2. Collector
3. Emitter
4. Collector(case)

| Dimensions | Min.  | Max.  |
|------------|-------|-------|
| 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

## Part Number Table

| Description             | Part Number |
|-------------------------|-------------|
| Transistor, NPN, TO-220 | TIP31A      |
|                         | TIP31C      |
| Transistor, PNP, TO-220 | TIP32A      |
|                         | TIP32C      |

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