

COMPLEMENTARY SILICON PLASTIC POWER TRANSISTORS

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

FEATURES:

* Collector-Emitter Sustaining Voltage -

- $V_{CE(sus)}$ = 40V(Min)- TIP31, TIP32
- 60V(Min)- TIP31A, TIP32A
- 80V(Min)- TIP31B, TIP32B
- 100V(Min)- TIP31C, TIP32C

* Collector-Emitter Saturation Voltage- $V_{CE(sat)} = 1.2V(Max) @ I_C = 3.0 A$

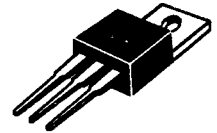
* Current Gain-Bandwidth Product $f_T = 3.0 MHz (Min) @ I_C = 500 mA$

| NPN | PNP |
|--------|--------|
| TIP31 | TIP32 |
| TIP31A | TIP32A |
| TIP31B | TIP32B |
| TIP31C | TIP32C |

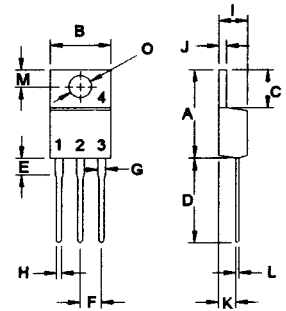
3 AMPERE
COMPLEMENTARY SILICON
POWER TRANSISTORS
40 -100 VOLTS
40 WATTS

MAXIMUM RATINGS

| Characteristic | Symbol | TIP31 TIP32 | TIP31A TIP32A | TIP31B TIP32B | TIP31C TIP32C | Unit |
|---|----------------|----------------|------------------|------------------|------------------|--------------------|
| Collector-Emitter Voltage | V_{CEO} | 40 | 60 | 80 | 100 | V |
| Collector-Base Voltage | V_{CBO} | 40 | 60 | 80 | 100 | V |
| Emitter-Base Voltage | V_{EBO} | 5.0 | | | | V |
| Collector Current - Continuous - Peak | I_C | 3.0 5.0 | | | | A |
| Base Current | I_B | 1.0 | | | | A |
| Total Power Dissipation @ $T_C = 25^\circ C$ Derate above $25^\circ C$ | P_D | 40 0.32 | | | | W W/ $^\circ C$ |
| Operating and Storage Junction Temperature Range | T_J, T_{STG} | -65 to +150 | | | | $^\circ C$ |



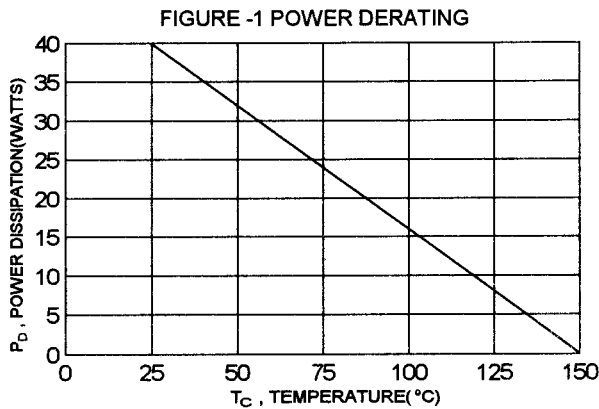
TO-220



PIN 1. BASE
2. COLLECTOR
3. EMITTER
4. COLLECTOR(CASE)

THERMAL CHARACTERISTICS

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



| DIM | MILLIMETERS | |
|-----|-------------|-------|
| | 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 | 2.20 | 2.97 |
| L | 0.33 | 0.55 |
| M | 2.48 | 2.98 |
| O | 3.70 | 3.90 |

TIP31, TIP31A, TIP31B, TIP31C NPN / TIP32, TIP32A, TIP32B, TIP32C PNP

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

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

OFF CHARACTERISTICS

| | | | | |
|---|--|---------------|--------------------------|----|
| Collector-Emitter Sustaining Voltage(1) ($I_C = 30\text{ mA}$, $I_B = 0$) | TIP31, TIP32 TIP31A, TIP32A TIP31B, TIP32B TIP31C, TIP32C | $V_{CE(sus)}$ | 40 60 80 100 | V |
| Collector Cutoff Current ($V_{CE} = 30\text{ V}$, $I_B = 0$) ($V_{CE} = 60\text{ V}$, $I_B = 0$) | TIP31, TIP32, TIP31A, TIP32A TIP31B, TIP32B, TIP31C, TIP32C | I_{CEO} | 0.3 0.3 | mA |
| Collector Cutoff Current ($V_{CE} = 40\text{ V}$, $V_{EB} = 0$) ($V_{CE} = 60\text{ V}$, $V_{EB} = 0$) ($V_{CE} = 80\text{ V}$, $V_{EB} = 0$) ($V_{CE} = 100\text{ V}$, $V_{EB} = 0$) | TIP31, TIP32 TIP31A, TIP32A TIP31B, TIP32B TIP31C, TIP32C | I_{CES} | 0.2 0.2 0.2 0.2 | mA |
| Emitter Cutoff Current ($V_{EB} = 5.0\text{ V}$, $I_C = 0$) | | I_{EBO} | 1.0 | mA |

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 | V |

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) $f_T = |h_{fe}| \cdot f_{TEST}$

FIGURE 2 - SWITCHING TIME EQUIVALENT CIRCUIT

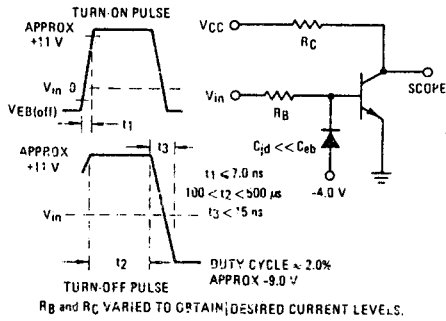


FIG-3 TURN-ON TIME

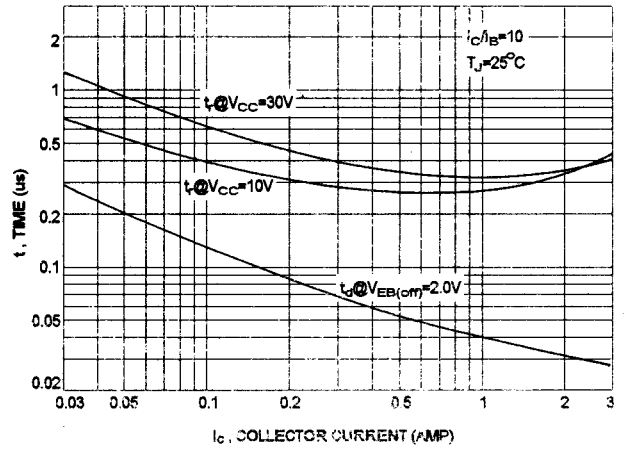


FIG-4 DC CURRENT GAIN

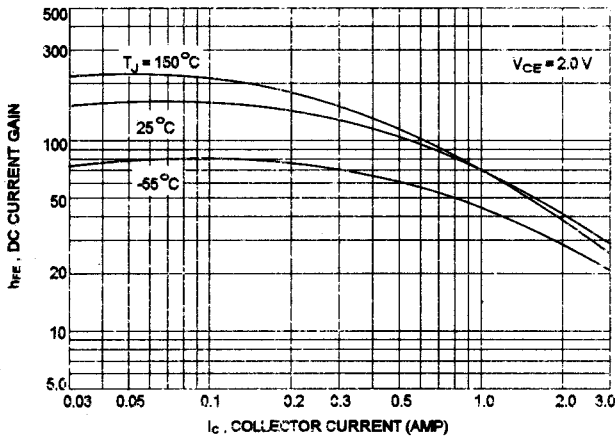


FIG-5 TURN-OFF TIME

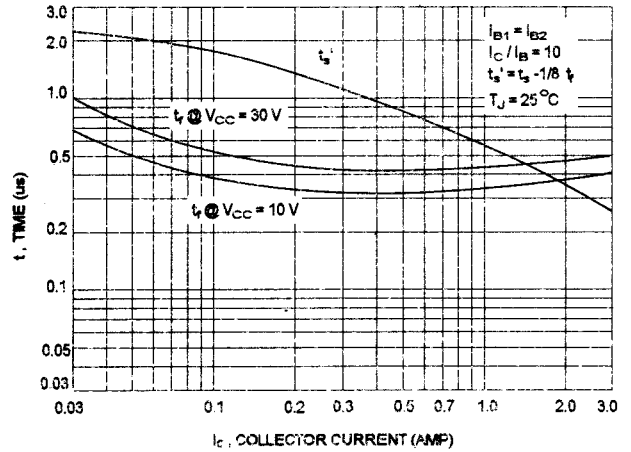
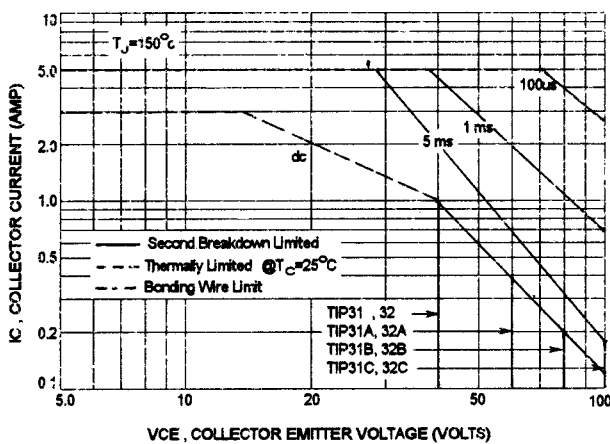


FIG-6 ACTIVE REGION SAFE OPERATING AREA



There are two limitation 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 curves indicate.

The data of FIG-6 curve is base on $T_{J(PK)} = 150^\circ C$; T_C is variable depending on power level. second breakdown pulse limits are valid for duty cycles to 10% provided $T_{J(PK)} \leq 150^\circ C$. At high case temperatures, thermal limitation will reduce the power that can be handled to values less than the limitations imposed by second breakdown.

TIP31, TIP31A, TIP31B, TIP31C NPN / TIP32, TIP32A, TIP32B, TIP32C PNP

FIG-7 COLLECTOR SATURATION REGION

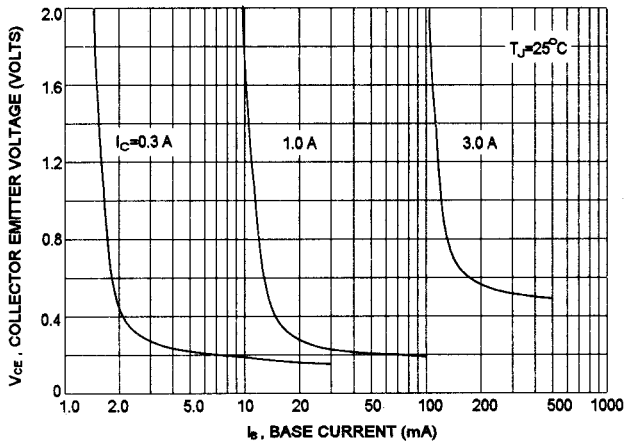


FIG-8 CAPACITANCES

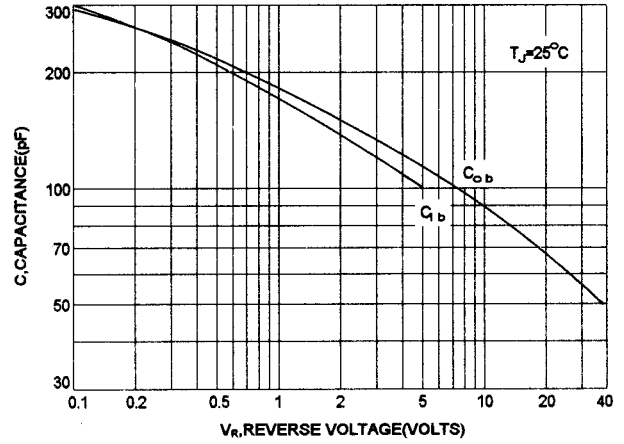


FIG-9 "ON" VOLTAGE

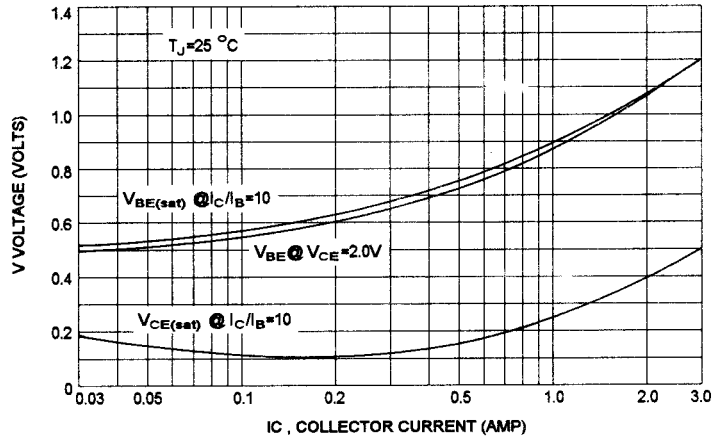


FIG-10 COLLECTOR CUT-OFF REGION

