# Complementary Silicon Plastic Power Transistors

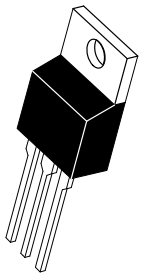
. . . designed for use in general purpose amplifier and switching applications.

- Collector–Emitter Saturation Voltage —
  $V_{CE(sat)}$ = 1.5 Vdc (Max) @ $I_C$ = 6.0 Adc
- Collector–Emitter Sustaining Voltage —
  $V_{CEO(sus)}$ = 60 Vdc (Min) — TIP41A, TIP42A
  = 80 Vdc (Min) — TIP41B, TIP42B
  = 100 Vdc (Min) — TIP41C, TIP42C
- High Current Gain — Bandwidth Product
  $f_T$ = 3.0 MHz (Min) @ $I_C$ = 500 mAdc
- Compact TO–220 AB Package

**NPN**
**TIP41A**
**TIP41B***
**TIP41C***
**PNP**
**TIP42A**
**TIP42B***
**TIP42C***

***Motorola Preferred Device**

**6 AMPERE**
**POWER TRANSISTORS**
**COMPLEMENTARY**
**SILICON**
**60 – 80 – 100 VOLTS**
**65 WATTS**



**CASE 221A–06**
**TO–220AB**

***MAXIMUM RATINGS**

| Rating | Symbol | TIP41A TIP42A | TIP41B TIP42B | TIP41C TIP42C | Unit |
|---|---|---|---|---|---|
| Collector–Emitter Voltage | $V_{CEO}$ | 60 | 80 | 100 | Vdc |
| Collector–Base Voltage | $V_{CB}$ | 60 | 80 | 100 | Vdc |
| Emitter–Base Voltage | $V_{EB}$ | 5.0 | | | Vdc |
| Collector Current — Continuous<br>Peak | $I_C$ | 6<br>10 | | | Adc |
| Base Current | $I_B$ | 2.0 | | | Adc |
| Total Power Dissipation<br>@ $T_C$ = 25°C<br>Derate above 25°C | $P_D$ | 65<br>0.52 | | | Watts<br>W/°C |
| Total Power Dissipation<br>@ $T_A$ = 25°C<br>Derate above 25°C | $P_D$ | 2.0<br>0.016 | | | Watts<br>W/°C |
| Unclamped Inductive Load Energy (1) | E | 62.5 | | | mJ |
| Operating and Storage Junction Temperature Range | $T_J$, $T_{stg}$ | –65 to +150 | | | °C |

**THERMAL CHARACTERISTICS**

| Characteristic | Symbol | Max | Unit |
|---|---|---|---|
| Thermal Resistance, Junction to Ambient | $R_{\theta JA}$ | 62.5 | °C/W |
| Thermal Resistance, Junction to Case | $R_{\theta JC}$ | 1.92 | °C/W |

(1) $I_C$ = 2.5 A, L = 20 mH, P.R.F. = 10 Hz, $V_{CC}$ = 10 V, $R_{BE}$ = 100 Ω.

**Preferred** devices are Motorola recommended choices for future use and best overall value.

**REV 1**

**ELECTRICAL CHARACTERISTICS** ($T_C$ = 25°C unless otherwise noted)

| Characteristic | | Symbol | Min | Max | Unit |
|---|---|---|---|---|---|
| **OFF CHARACTERISTICS** | | | | | |
| Collector–Emitter Sustaining Voltage (1) ($I_C$ = 30 mAdc, $I_B$ = 0) | TIP41A, TIP42A<br>TIP41B, TIP42B<br>TIP41C, TIP42C | $V_{CEO(sus)}$ | 60<br>80<br>100 | —<br>—<br>— | Vdc |
| Collector Cutoff Current<br>($V_{CE}$ = 30 Vdc, $I_B$ = 0)<br>($V_{CE}$ = 60 Vdc, $I_B$ = 0) | TIP41A, TIP42A<br>TIP41B, TIP41C<br>TIP42B, TIP42C | $I_{CEO}$ | —<br>—<br>— | 0.7<br>0.7<br>0.7 | mAdc |
| Collector Cutoff Current<br>($V_{CE}$ = 60 Vdc, $V_{EB}$ = 0)<br>($V_{CE}$ = 80 Vdc, $V_{EB}$ = 0)<br>($V_{CE}$ = 100 Vdc, $V_{EB}$ = 0) | <br>TIP41A, TIP42A<br>TIP41B, TIP42B<br>TIP41C, TIP42C | $I_{CES}$ | <br>—<br>—<br>— | <br>400<br>400<br>400 | μAdc |
| Emitter Cutoff Current ($V_{BE}$ = 5.0 Vdc, $I_C$ = 0) | | $I_{EBO}$ | — | 1.0 | mAdc |
| **ON CHARACTERISTICS (1)** | | | | | |
| DC Current Gain ($I_C$ = 0.3 Adc, $V_{CE}$ = 4.0 Vdc)<br>($I_C$ = 3.0 Adc, $V_{CE}$ = 4.0 Vdc) | | $h_{FE}$ | 30<br>15 | —<br>75 | — |
| Collector–Emitter Saturation Voltage ($I_C$ = 6.0 Adc, $I_B$ = 600 mAdc) | | $V_{CE(sat)}$ | — | 1.5 | Vdc |
| Base–Emitter On Voltage ($I_C$ = 6.0 Adc, $V_{CE}$ = 4.0 Vdc) | | $V_{BE(on)}$ | — | 2.0 | Vdc |
| **DYNAMIC CHARACTERISTICS** | | | | | |
| Current–Gain — Bandwidth Product ($I_C$ = 500 mAdc, $V_{CE}$ = 10 Vdc, $f_{test}$ = 1.0 MHz) | | $f_T$ | 3.0 | — | MHz |
| Small–Signal Current Gain ($I_C$ = 0.5 Adc, $V_{CE}$ = 10 Vdc, f = 1.0 kHz) | | $h_{fe}$ | 20 | — | — |

(1) Pulse Test: Pulse Width ≤ 300 μs, Duty Cycle ≤ 2.0%.

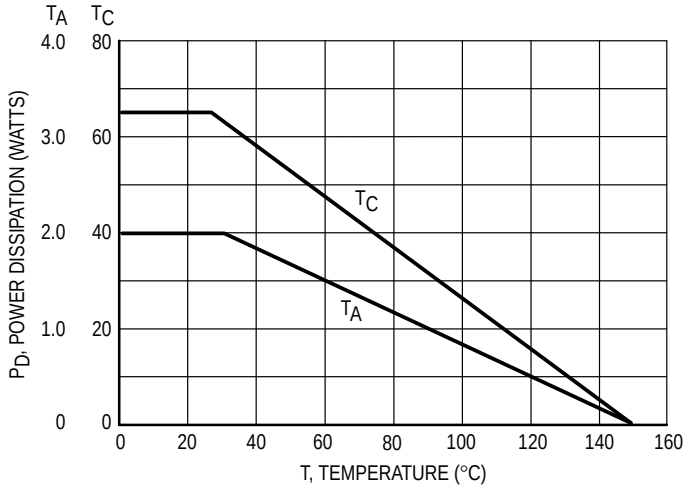
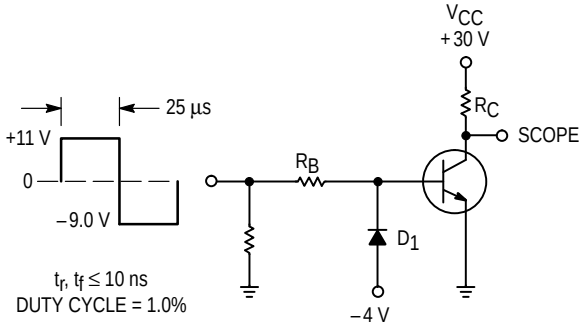



**Figure 1. Power Derating**




$R_B$ and $R_C$ VARIED TO OBTAIN DESIRED CURRENT LEVELS

$D_1$ MUST BE FAST RECOVERY TYPE, e.g.:
1N5825 USED ABOVE $I_B \approx 100$ mA
MSD6100 USED BELOW $I_B \approx 100$ mA

**Figure 2. Switching Time Test Circuit**

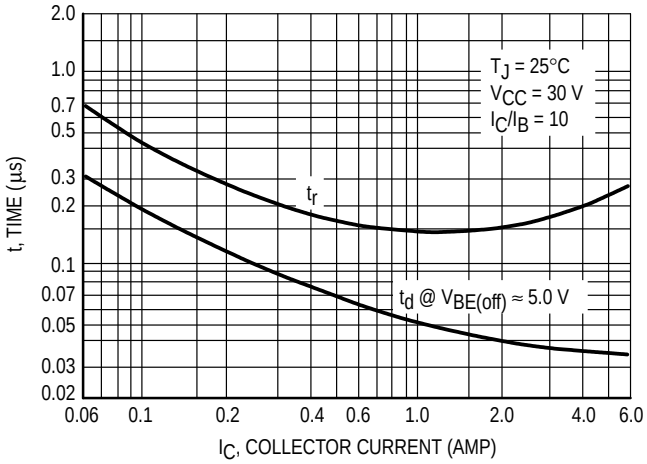



**Figure 3. Turn–On Time**

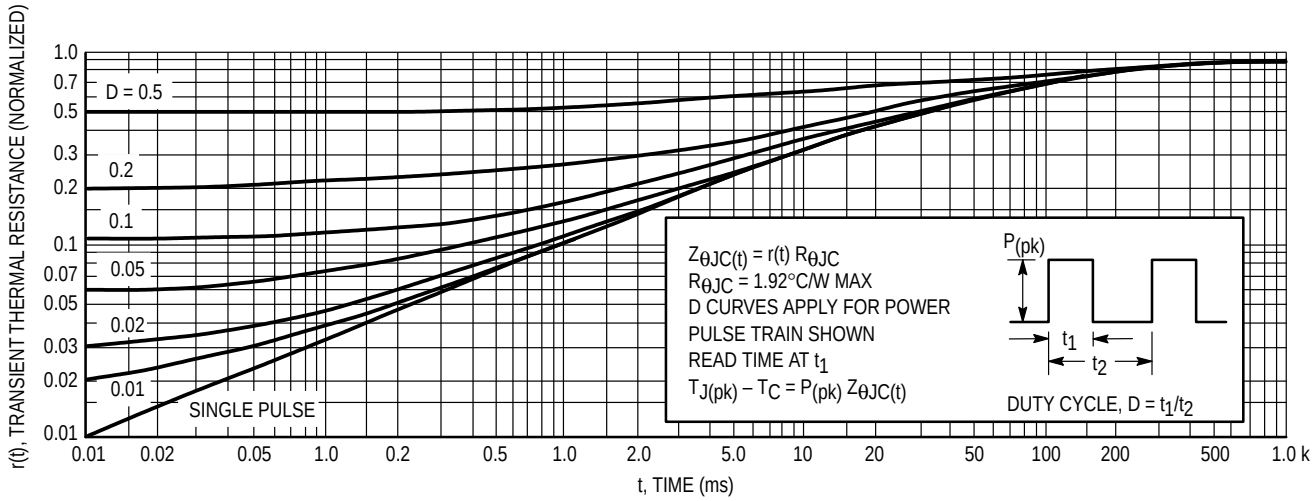



**Figure 4. Thermal Response**

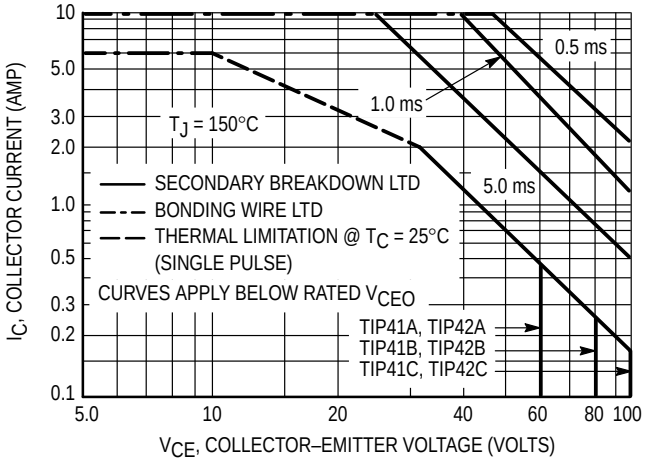



**Figure 5. Active–Region Safe Operating Area**

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 5 is based on $T_{J(pk)}$ = 150°C; $T_C$ is variable depending on conditions. Second breakdown pulse limits are valid for duty cycles to 10% provided $T_{J(pk)} \leq$ 150°C. $T_{J(pk)}$ may be calculated from the data in Figure 4. At high case temperatures, thermal limitations will reduce the power that can be handled to values less than the limitations imposed by second breakdown.

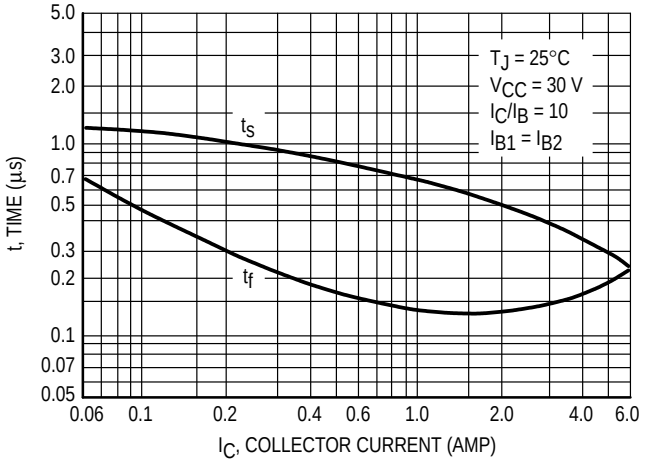



**Figure 6. Turn–Off Time**

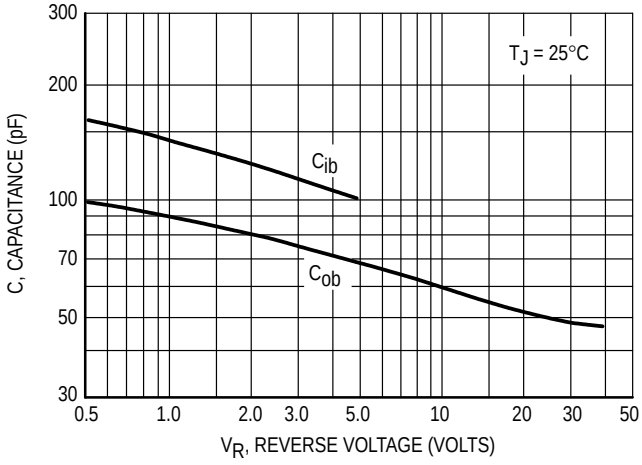



**Figure 7. Capacitance**

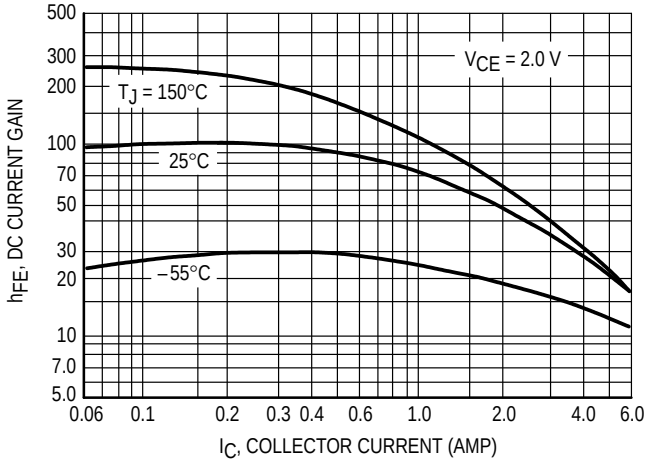



**Figure 8. DC Current Gain**

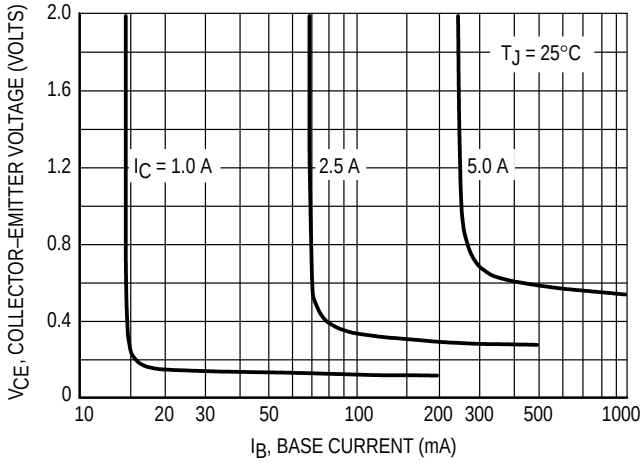



**Figure 9. Collector Saturation Region**

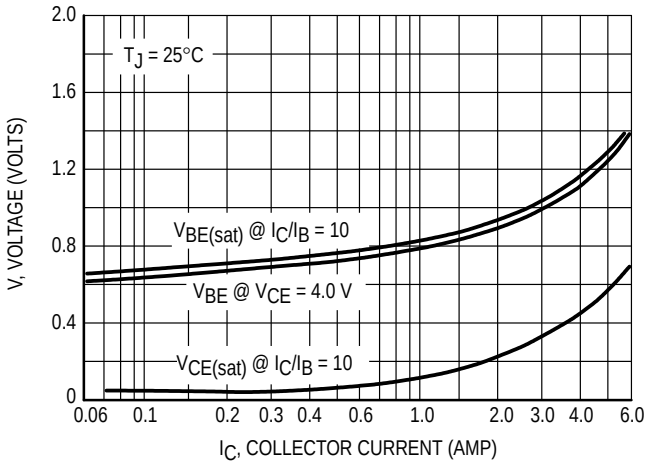



**Figure 10. “On” Voltages**

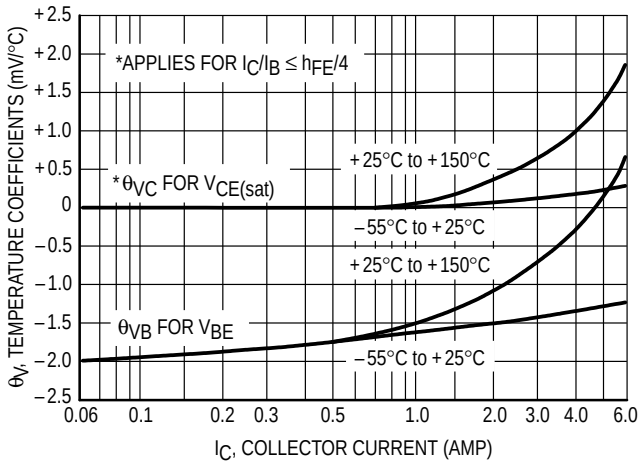



**Figure 11. Temperature Coefficients**

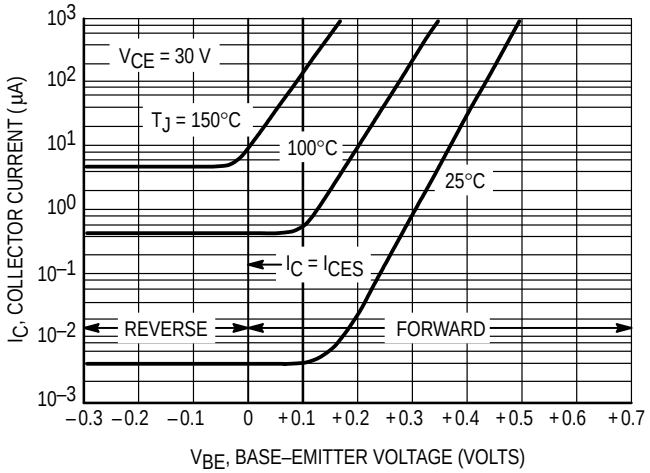



**Figure 12. Collector Cut–Off Region**

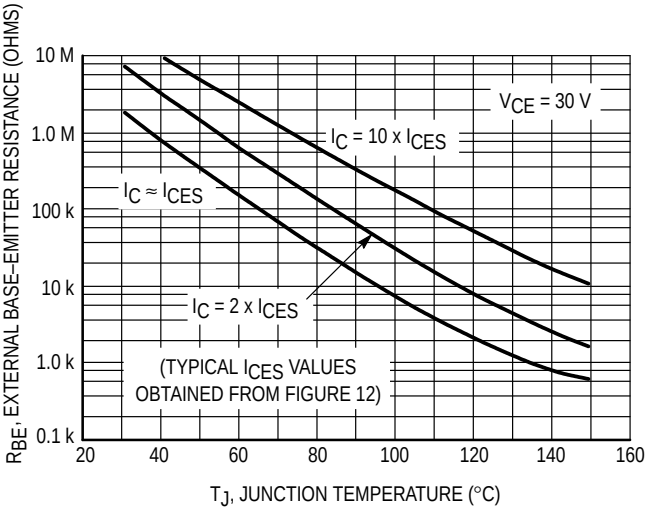
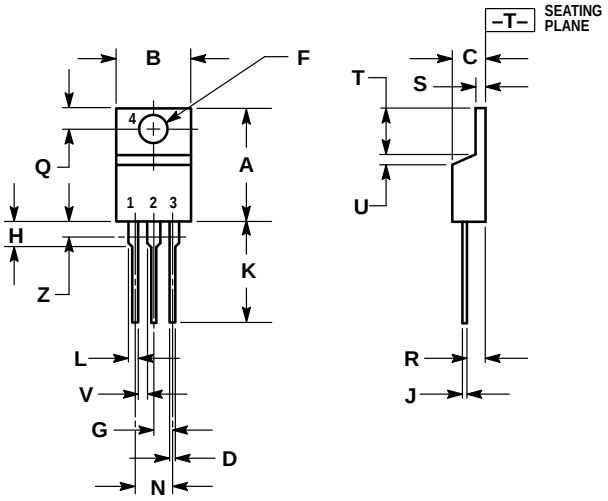



**Figure 13. Effects of Base–Emitter Resistance**

## PACKAGE DIMENSIONS




NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.
3. DIMENSION Z DEFINES A ZONE WHERE ALL BODY AND LEAD IRREGULARITIES ARE ALLOWED.

| | INCHES | | MILLIMETERS | |
|---|---|---|---|---|
| DIM | MIN | MAX | MIN | MAX |
| A | 0.570 | 0.620 | 14.48 | 15.75 |
| B | 0.380 | 0.405 | 9.66 | 10.28 |
| C | 0.160 | 0.190 | 4.07 | 4.82 |
| D | 0.025 | 0.035 | 0.64 | 0.88 |
| F | 0.142 | 0.147 | 3.61 | 3.73 |
| G | 0.095 | 0.105 | 2.42 | 2.66 |
| H | 0.110 | 0.155 | 2.80 | 3.93 |
| J | 0.018 | 0.025 | 0.46 | 0.64 |
| K | 0.500 | 0.562 | 12.70 | 14.27 |
| L | 0.045 | 0.060 | 1.15 | 1.52 |
| N | 0.190 | 0.210 | 4.83 | 5.33 |
| Q | 0.100 | 0.120 | 2.54 | 3.04 |
| R | 0.080 | 0.110 | 2.04 | 2.79 |
| S | 0.045 | 0.055 | 1.15 | 1.39 |
| T | 0.235 | 0.255 | 5.97 | 6.47 |
| U | 0.000 | 0.050 | 0.00 | 1.27 |
| V | 0.045 | — | 1.15 | — |
| Z | — | 0.080 | — | 2.04 |

STYLE 1:
PIN 1. BASE
2. COLLECTOR
3. EMITTER
4. COLLECTOR

**CASE 221A–06**
**TO–220AB**
**ISSUE Y**

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