

8961726 TEXAS INSTR (OPTO)

62C 36800 D

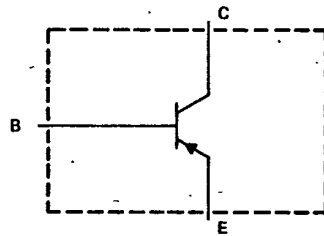
TIP36, TIP36A, TIP36B, TIP36C,  
TIP36D, TIP36E, TIP36F  
P-N-P SILICON POWER TRANSISTORS

JULY 1968 - REVISED OCTOBER 1984

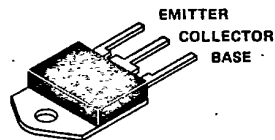
- Designed for Complementary Use With TIP35 Series
- 125 W at 25°C Case Temperature
- 25 A Continuous Collector Current
- 40 A Peak Collector Current
- Minimum  $f_T$  of 3 MHz at 10 V, 1 A
- Customer-Specified Selections Available

T-33-13

## device schematic



TO-218AA PACKAGE



THE COLLECTOR IS IN ELECTRICAL  
CONTACT WITH THE MOUNTING TAB

## absolute maximum ratings at 25°C case temperature (unless otherwise noted)

|                                                                                    | TIP36          | TIP36A | TIP36B | TIP36C |
|------------------------------------------------------------------------------------|----------------|--------|--------|--------|
| Collector-base voltage                                                             | -80 V          | -100 V | -120 V | -140 V |
| Collector-emitter voltage ( $I_B = 0$ )                                            | -40 V          | -60 V  | -80 V  | -100 V |
| Emitter-base voltage                                                               | -5 V           |        |        |        |
| Continuous collector current                                                       | -25 A          |        |        |        |
| Peak collector current (see Note 1)                                                | -40 A          |        |        |        |
| Continuous base current                                                            | -5 A           |        |        |        |
| Safe operating areas at 25°C case temperature                                      | See Figure 4   |        |        |        |
| Continuous device dissipation at 25°C case temperature (see Note 2)                | 125 W          |        |        |        |
| Continuous device dissipation at (or below) 25°C free-air temperature (see Note 3) | 3.5 W          |        |        |        |
| Unclamped inductive load energy (see Note 4)                                       | 90 mJ          |        |        |        |
| Operating collector junction and storage temperature range                         | -65°C to 150°C |        |        |        |
| Lead temperature 3,2 mm (0.125 inch) from case for 10 seconds                      | 250°C          |        |        |        |

NOTES: 1. This value applies for  $t_W \leq 0.3$  ms, duty cycle  $\leq 10\%$ .  
2. Derate linearly to 150°C case temperature at the rate of 1 W/°C.  
3. Derate linearly to 150°C free-air temperature at the rate of 28 mW/°C.  
4. This rating is based on the capability of the transistor to operate safely in the circuit in Figure 2.

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TIP Devices

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TIP36, TIP36A, TIP36B, TIP36C,  
TIP36D, TIP36E, TIP36F  
P-N-P SILICON POWER TRANSISTORS

absolute maximum ratings at 25°C case temperature (unless otherwise noted)

|                                                                                    | TIP36D         | TIP36E | TIP36F |
|------------------------------------------------------------------------------------|----------------|--------|--------|
| Collector-base voltage                                                             | -160 V         | -180 V | -200 V |
| Collector-emitter voltage ( $I_B = 0$ )                                            | -120 V         | -140 V | -160 V |
| Emitter-base voltage                                                               | -5 V           |        |        |
| Continuous collector current                                                       | -25 A          |        |        |
| Peak collector current (see Note 1)                                                | 40 A           |        |        |
| Continuous base current                                                            | -5 A           |        |        |
| Safe operating areas at 25°C case temperature                                      | See Figure 4   |        |        |
| Continuous device dissipation at 25°C case temperature (see Note 2)                | 125 W          |        |        |
| Continuous device dissipation at (or below) 25°C free-air temperature (see Note 3) | 3.5 W          |        |        |
| Unclamped inductive load energy (see Note 4)                                       | 90 mJ          |        |        |
| Operating collector junction and storage temperature range                         | -65°C to 150°C |        |        |
| Lead temperature 3,2 mm (0.125 inch) from case for 10 seconds                      | 250°C          |        |        |

- NOTES: 1. This value applies for  $t_W \leq 0.3$  ms, duty cycle  $\leq 10\%$ .  
 2. Derate linearly to 150°C case temperature at the rate of 1 W/°C.  
 3. Derate linearly to 150°C free-air temperature at the rate of 28 mW/°C.  
 4. This rating is based on the capability of the transistor to operate safely in the circuit in Figure 2.

electrical characteristics at 25°C case temperature (unless otherwise noted)

| PARAMETER     | TEST CONDITIONS                                            | TIP36 |     |     | TIP36A |     |     | TIP36B |     |     | TIP36C |     |     | UNIT |
|---------------|------------------------------------------------------------|-------|-----|-----|--------|-----|-----|--------|-----|-----|--------|-----|-----|------|
|               |                                                            | MIN   | TYP | MAX | MIN    | TYP | MAX | MIN    | TYP | MAX | MIN    | TYP | MAX |      |
| $V_{(BR)CEO}$ | $I_C = -30$ mA, $I_B = 0$ ,<br>See Note 5                  | -40   |     |     | -60    |     |     | -80    |     |     | -100   |     |     | V    |
| $I_{CEO}$     | $V_{CE} = -30$ V, $I_B = 0$<br>$V_{CE} = -60$ V, $I_B = 0$ | -1    |     |     | -1     |     |     | -1     |     |     | -1     |     |     | mA   |
| $I_{CES}$     | $V_{CE} = -80$ V, $V_{BE} = 0$                             | -0.7  |     |     |        |     |     |        |     |     |        |     |     | mA   |
|               | $V_{CE} = -100$ V, $V_{BE} = 0$                            |       |     |     | -0.7   |     |     |        |     |     |        |     |     |      |
|               | $V_{CE} = -120$ V, $V_{BE} = 0$                            |       |     |     |        |     |     | -0.7   |     |     |        |     |     |      |
|               | $V_{CE} = -140$ V, $V_{BE} = 0$                            |       |     |     |        |     |     |        |     |     | -0.7   |     |     |      |
| $I_{EBO}$     | $V_{EB} = -5$ V, $I_C = 0$                                 | -1    |     |     | -1     |     |     | -1     |     |     | -1     |     |     | mA   |
| $h_{FE}$      | $V_{CE} = -4$ V, $I_C = -1.5$ A,<br>See Notes 5 and 6      | 25    |     |     | 25     |     |     | 25     |     |     | 25     |     |     |      |
|               | $V_{CE} = -4$ V, $I_C = -15$ A,<br>See Notes 5 and 6       | 10    | 50  |     | 10     | 50  |     | 10     | 50  |     | 10     | 50  |     |      |
| $V_{BE}$      | $V_{CE} = -4$ V, $I_C = -15$ A,<br>See Notes 5 and 6       | -2    |     |     | -2     |     |     | -2     |     |     | -2     |     |     | V    |
|               | $V_{CE} = -4$ V, $I_C = -25$ A,<br>See Notes 5 and 6       | -4    |     |     | -4     |     |     | -4     |     |     | -4     |     |     |      |
| $V_{CE(sat)}$ | $I_B = -1.5$ A, $I_C = -15$ A,<br>See Notes 5 and 6        | -1.8  |     |     | -1.8   |     |     | -1.8   |     |     | -1.8   |     |     | V    |
|               | $I_B = -5$ A, $I_C = -25$ A,<br>See Notes 5 and 6          | -4    |     |     | -4     |     |     | -4     |     |     | -4     |     |     |      |
| $h_{fe}$      | $V_{CE} = -10$ V, $I_C = -1$ A,<br>$f = 1$ kHz             | 25    |     |     | 25     |     |     | 25     |     |     | 25     |     |     |      |
| $ h_{fe} $    | $V_{CE} = -10$ V, $I_C = -1$ A,<br>$f = 1$ MHz             | 3     |     |     | 3      |     |     | 3      |     |     | 3      |     |     |      |

- NOTES: 5. These parameters must be measured using pulse techniques,  $t_W = 300$   $\mu$ s, duty cycle  $\leq 2\%$ .  
 6. These parameters are measured with voltage-sensing contacts separate from the current-carrying contacts.

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62C 36802 D

TIP36, TIP36A, TIP36B, TIP36C,  
TIP36D, TIP36E, TIP36F  
P-N-P SILICON POWER TRANSISTORS

electrical characteristics at 25°C case temperature (unless otherwise noted)

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| PARAMETER     | TEST CONDITIONS                                                           | TIP36D      | TIP36E      | TIP36F      | UNIT |
|---------------|---------------------------------------------------------------------------|-------------|-------------|-------------|------|
|               |                                                                           | MIN TYP MAX | MIN TYP MAX | MIN TYP MAX |      |
| $V_{(BR)CEO}$ | $I_C = -30 \text{ mA}$ ,<br>See Note 5<br>$I_B = 0$                       | -120        | -140        | -160        | V    |
| $I_{CEO}$     | $V_{CE} = -90 \text{ V}$ ,<br>$I_B = 0$                                   | -1          | -1          | -1          | mA   |
| $I_{CES}$     | $V_{CE} = -180 \text{ V}$ ,<br>$V_{BE} = 0$                               | -0.7        |             |             | mA   |
|               | $V_{CE} = -180 \text{ V}$ ,<br>$V_{BE} = 0$                               |             | -0.7        |             |      |
|               | $V_{CE} = -200 \text{ V}$ ,<br>$V_{BE} = 0$                               |             |             | -0.7        |      |
| $I_{EBO}$     | $V_{EB} = -5 \text{ V}$ ,<br>$I_C = 0$                                    | -1          | -1          | -1          | mA   |
| $h_{FE}$      | $V_{CE} = -4 \text{ V}$ ,<br>See Notes 5 and 6<br>$I_C = -1.5 \text{ A}$  | 25          | 25          | 25          |      |
|               | $V_{CE} = -4 \text{ V}$ ,<br>See Notes 5 and 6<br>$I_C = -15 \text{ A}$   | 8           | 8           | 8           |      |
| $V_{BE}$      | $V_{CE} = -4 \text{ V}$ ,<br>See Notes 5 and 6<br>$I_C = -15 \text{ A}$   | -2          | -2          | -2          | V    |
|               | $V_{CE} = -4 \text{ V}$ ,<br>See Notes 5 and 6<br>$I_C = -25 \text{ A}$   | -4          | -4          | -4          |      |
| $V_{CE(sat)}$ | $I_B = -3 \text{ A}$ ,<br>See Notes 5 and 6<br>$I_C = -15 \text{ A}$      | -2.5        | -2.5        | -2.5        | V    |
|               | $I_B = -6.25 \text{ A}$ ,<br>See Notes 5 and 6<br>$I_C = -25 \text{ A}$   | -5          | -5          | -5          |      |
| $h_{fe}$      | $V_{CE} = -10 \text{ V}$ ,<br>$f = 1 \text{ kHz}$<br>$I_C = -1 \text{ A}$ | 25          | 25          | 25          |      |
| $ h_{fe} $    | $V_{CE} = -10 \text{ V}$ ,<br>$f = 1 \text{ MHz}$<br>$I_C = -1 \text{ A}$ | 3           | 3           | 3           |      |

NOTES: 5. These parameters must be measured using pulse techniques,  $t_W = 300 \mu\text{s}$ , duty cycle  $\leq 2\%$ .

6. These parameters are measured with voltage-sensing contacts separate from the current-carrying contacts.

## thermal characteristics

| PARAMETER       | MIN TYP MAX | UNIT |
|-----------------|-------------|------|
| $R_{\theta JC}$ | 1           | °C/W |
| $R_{\theta JA}$ | 35.7        |      |

## resistive-load switching characteristic at 25°C case temperature (unless otherwise noted)

| PARAMETER | TEST CONDITIONS†                                                                   | MIN TYP MAX | UNIT          |
|-----------|------------------------------------------------------------------------------------|-------------|---------------|
| $t_{on}$  | $I_C = -15 \text{ A}$ ,<br>$I_{B1} = -1.5 \text{ A}$ ,<br>$I_{B2} = 1.5 \text{ A}$ | 1.1         | $\mu\text{s}$ |
| $t_{off}$ | $V_{BE(off)} = 4.15 \text{ V}$ ,<br>$R_L = 2 \Omega$ ,<br>See Figure 1             | 0.8         |               |

† Voltage and current values shown are nominal; exact values vary slightly with transistor parameters.

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TIP Devices

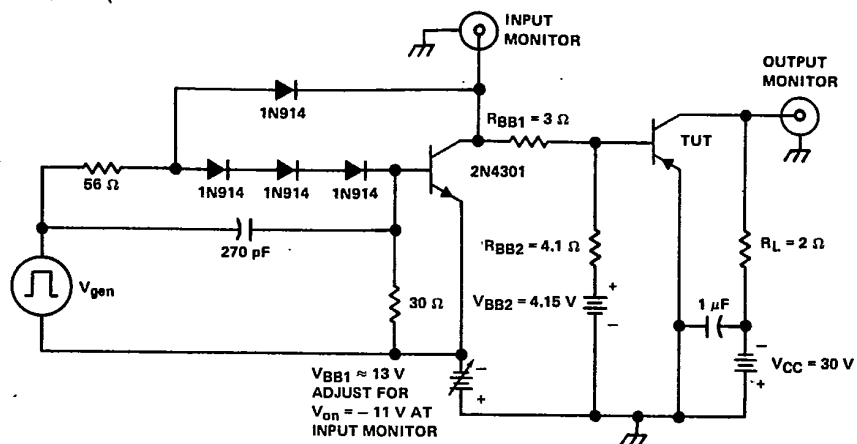
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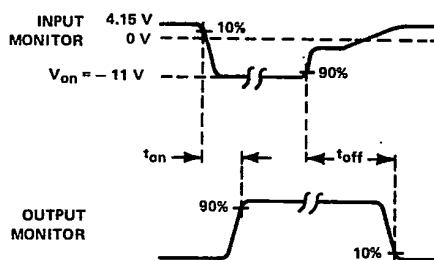
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TIP36, TIP36A, TIP36B, TIP36C,  
TIP36D, TIP36E, TIP36F  
P-N-P SILICON POWER TRANSISTORS

## PARAMETER MEASUREMENT INFORMATION



TEST CIRCUIT



VOLTAGE WAVEFORMS

- NOTES: A.  $V_{gen}$  is a 30-V pulse into a 50  $\Omega$  termination.  
B. The  $V_{gen}$  waveform is supplied by a generator with the following characteristics:  $t_r \leq 15$  ns,  $t_f \leq 15$  ns,  $Z_{out} = 50 \Omega$ ,  $t_w = 20 \mu$ s, duty cycle  $\leq 2\%$ .  
C. Waveforms are monitored on an oscilloscope with the following characteristics:  $t_r \leq 15$  ns,  $R_{in} \geq 10$  M $\Omega$ ,  $C_{in} \leq 11.5$  pF.  
D. Resistors must be noninductive types.  
E. The d-c power supplies may require additional bypassing in order to minimize ringing.

FIGURE 1. RESISTIVE-LOAD SWITCHING

TIP Devices

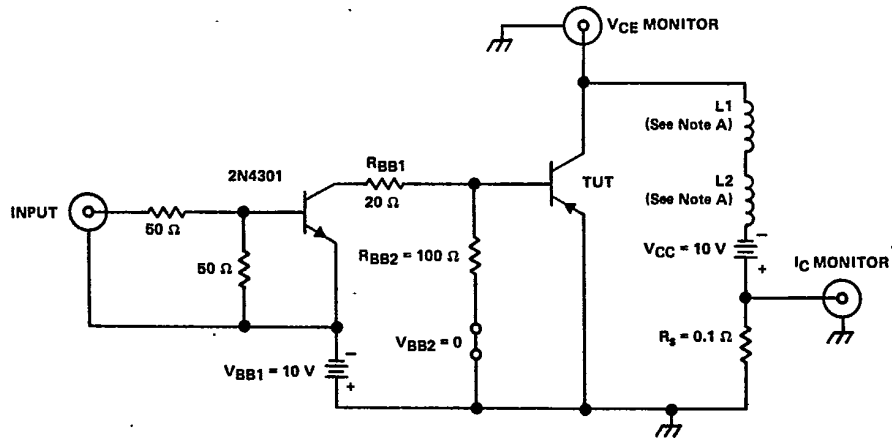
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62C 36804 D

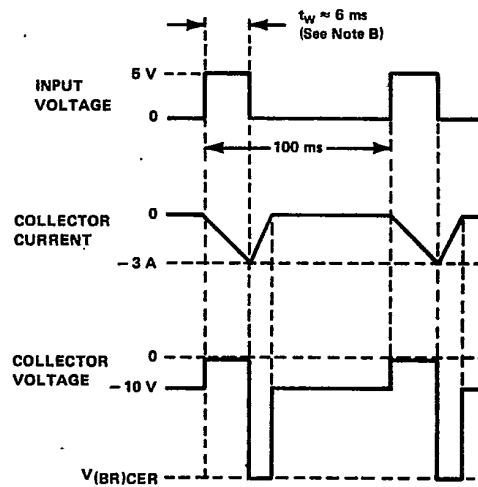
TIP36, TIP36A, TIP36B, TIP36C,  
TIP36D, TIP36E, TIP36F  
P-N-P SILICON POWER TRANSISTORS

## PARAMETER MEASUREMENT INFORMATION

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TEST CIRCUIT



VOLTAGE AND CURRENT WAVEFORMS

NOTES: A. L1 and L2 are 10 mH, 0.11  $\Omega$ , Chicago Standard Transformer Corporation C-2688, or equivalent.  
B. Input pulse duration is increased until  $I_{CM} = -3$  A.

FIGURE 2. INDUCTIVE-LOAD SWITCHING

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62C 36805 D

TIP36, TIP36A, TIP36B, TIP36C,  
TIP36D, TIP36E, TIP36F  
P-N-P SILICON POWER TRANSISTORS

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**TYPICAL CHARACTERISTICS**  
STATIC FORWARD CURRENT TRANSFER RATIO  
vs  
COLLECTOR CURRENT

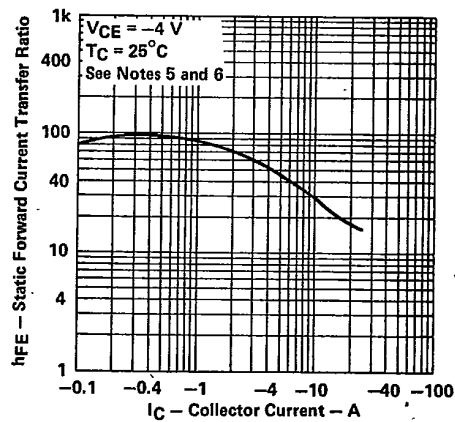


FIGURE 3

NOTES: 5. These parameters must be measured using pulse techniques,  $t_w = 300 \mu s$ , duty cycle  $\leq 2\%$ .

6. These parameters are measured with voltage-sensing contacts separate from the current-carrying contacts.

**MAXIMUM SAFE OPERATING AREA**  
FORWARD-BIAS SAFE OPERATING AREA

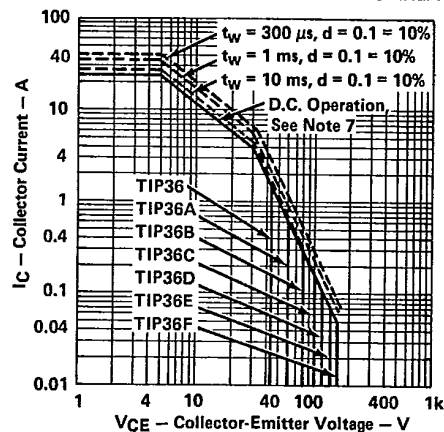


FIGURE 4

NOTE 7: This combination of maximum voltage and current may be achieved only when switching from saturation to cutoff with a clamped inductive load.

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## THERMAL INFORMATION

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## DISSIPATION DERATING CURVE

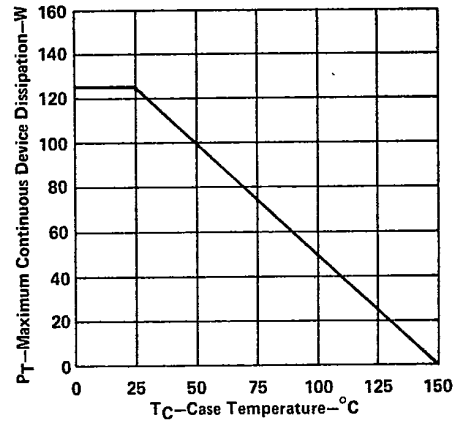


FIGURE 5

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