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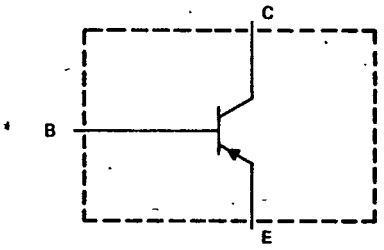
TIP36, TIP36A, TIP36B, TIP36C, TIP36D, TIP36E, TIP36F
P-N-P SILICON POWER TRANSISTORS

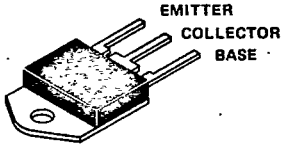
JULY 1968 – REVISED OCTOBER 1984

- 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

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 ≤ 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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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 ≤ 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, See Note 5	−40		−60		−80		−100		V
I_{CEO}	V_{CE} = −30 V, I_B = 0		−1		−1					mA
	V_{CE} = −60 V, I_B = 0						−1		−1	
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, See Notes 5 and 6	25		25		25		25		
	V_{CE} = −4 V, I_C = −15 A, See Notes 5 and 6	10	50	10	50	10	50	10	50	
V_{BE}	V_{CE} = −4 V, I_C = −15 A, See Notes 5 and 6		−2		−2		−2		−2	V
	V_{CE} = −4 V, I_C = −25 A, See Notes 5 and 6		−4		−4		−4		−4	
$V_{CE(sat)}$	I_B = −1.5 A, I_C = −15 A, See Notes 5 and 6		−1.8		−1.8		−1.8		−1.8	V
	I_B = −5 A, I_C = −25 A, See Notes 5 and 6		−4		−4		−4		−4	
h_{fe}	V_{CE} = −10 A, I_C = −1 A, f = 1 kHz	25		25		25		25		
$\lvert h_{fe} \rvert$	V_{CE} = −10 V, I_C = −1 A, f = 1 MHz	3		3		3		3		

NOTES: 5. These parameters must be measured using pulse techniques, t_w = 300 μs, duty cycle ≤ 2%.
6. These parameters are measured with voltage-sensing contacts separate from the current-carrying contacts.

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

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

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

NOTES: 5. These parameters must be measured using pulse techniques, t_w = 300 μs, duty cycle ≤ 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 A,	I_{B1} = −1.5 A,	I_{B2} = 1.5 A,			1.1	μs
t_{off}	$V_{BE(off)}$ = 4.15 V,	R_L = 2 Ω,	See Figure 1			0.8	

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

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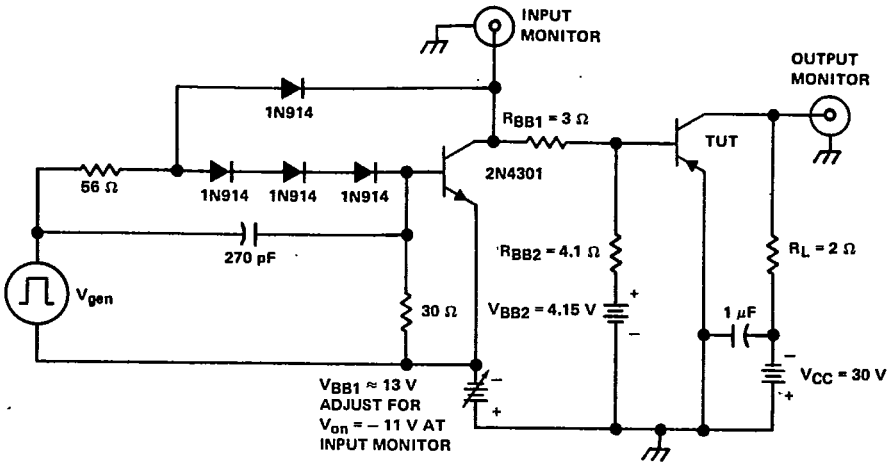
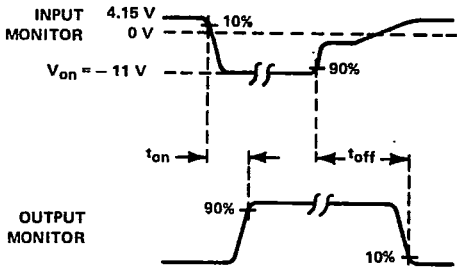
PARAMETER MEASUREMENT INFORMATION



TEST CIRCUIT



VOLTAGE WAVEFORMS

NOTES: A. V_{gen} is a 30-V pulse into a 50 Ω 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 ≤ 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

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PARAMETER MEASUREMENT INFORMATION

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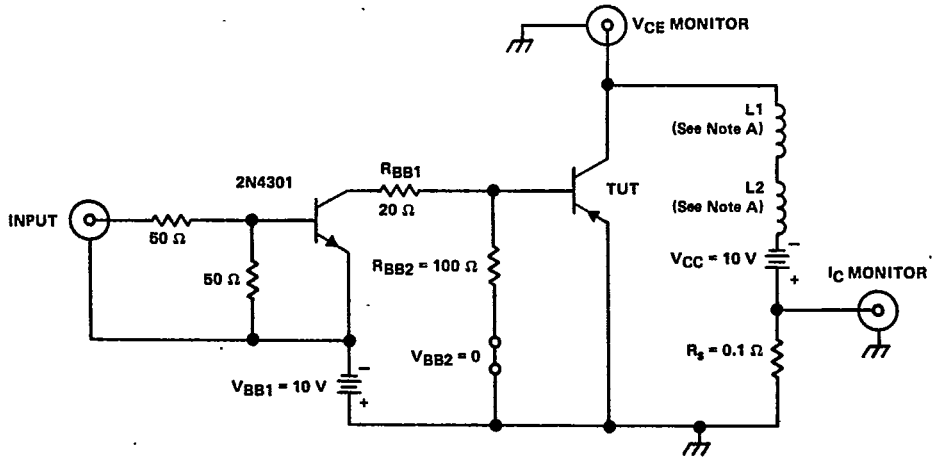
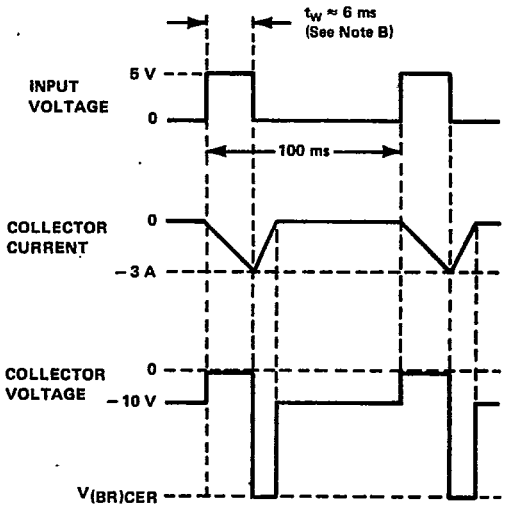


TEST CIRCUIT



VOLTAGE AND CURRENT WAVEFORMS

NOTES: A. L1 and L2 are 10 mH, 0.11 Ω, 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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P-N-P SILICON POWER TRANSISTORS

TYPICAL CHARACTERISTICS

STATIC FORWARD CURRENT TRANSFER RATIO
vs
COLLECTOR CURRENT

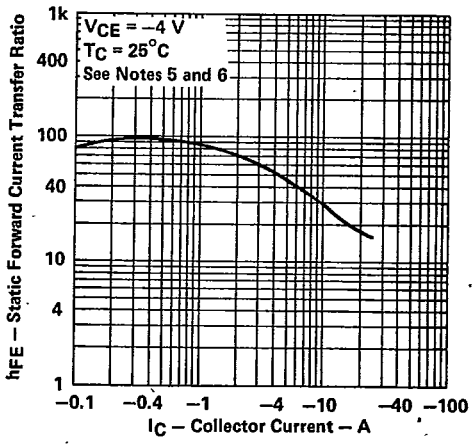

FIGURE 3

NOTES: 5. These parameters must be measured using pulse techniques, t_w = 300 μs, duty cycle ≤ 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

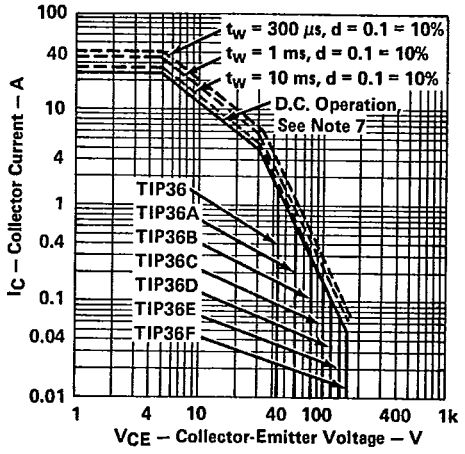

FIGURE 4

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

DISSIPATION DERATING CURVE

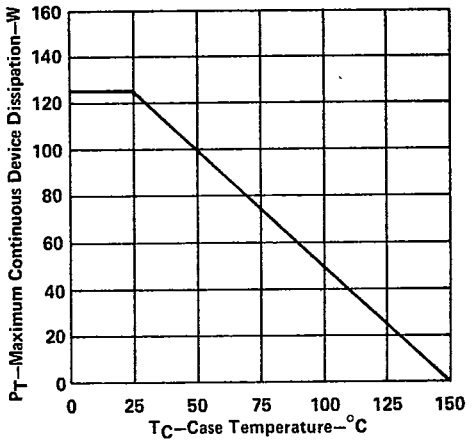

FIGURE 5