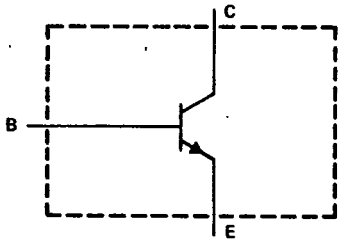
T-33-09

TIP29, TIP29A, TIP29B, TIP29C, TIP29D, TIP29E, TIP29F
N-P-N SILICON POWER TRANSISTORS

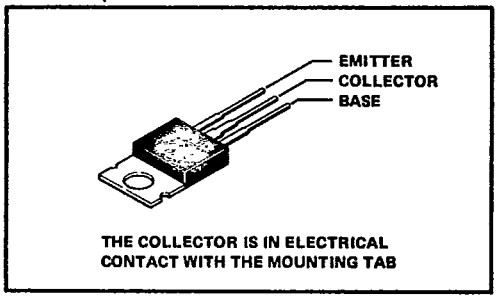
JULY 1968 – REVISED OCTOBER 1984

- Designed for Complementary Use With TIP30 series
- 30 W at 25°C Case Temperature
- 1 A Continuous Collector Current
- 3 A Peak Collector Current
- Minimum f_T of 3 MHz at 10 V, 0.2 A
- Customer-Specified Selections Available

device schematic



TO-220AB PACKAGE



THE COLLECTOR IS IN ELECTRICAL CONTACT WITH THE MOUNTING TAB

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

	TIP29	TIP29A	TIP29B	TIP29C
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	1 A			
Peak collector current (see Note 1)	3 A			
Continuous base current	0.4 A			
Safe operating areas at 25°C case temperature	See Figure 4			
Continuous device dissipation at 25°C case temperature (see Note 2)	30 W			
Continuous device dissipation at (or below) 25°C free-air temperature (see Note 3)	2 W			
Unclamped inductive load energy (see Note 4)	32 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 0.24 W/°C.
3. Derate linearly to 150°C free-air temperature at the rate of 16 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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TIP29, TIP29A, TIP29B, TIP29C, TIP29D, TIP29E, TIP29F
N-P-N SILICON POWER TRANSISTORS

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

	TIP29D	TIP29E	TIP29F
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	1 A		
Peak collector current (see Note 1)	3 A		
Continuous base current	0.4 A		
Safe operating areas at 25°C case temperature	See Figure 4		
Continuous device dissipation at 25°C case temperature (see Note 2)	30 W		
Continuous device dissipation at (or below) 25°C free-air temperature (see Note 3)	2 W		
Unclamped inductive load energy (see Note 4)	32 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 0.24 W/°C.
3. Derate linearly to 150°C free-air temperature at the rate of 16 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	TIP29			TIP29A			TIP29B			TIP29C			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			0.3			0.3							mA
	V_{CE} = 60 V, I_B = 0									0.3			0.3	
I_{CES}	V_{CE} = 80 V, V_{BE} = 0			0.2										mA
	V_{CE} = 100 V, V_{BE} = 0						0.2							
	V_{CE} = 120 V, V_{BE} = 0									0.2				
	V_{CE} = 140 V, V_{BE} = 0												0.2	
I_{EBO}	V_{EB} = 5 V, I_C = 0			1			1			1			1	mA
h_{FE}	V_{CE} = 4 V, I_C = 0.2 A, See Notes 5 and 6	40			40			40			40			
	V_{CE} = 4 V, I_C = 1 A, See Notes 5 and 6	15		75	15		75	15		75	15		75	
V_{BE}	V_{CE} = 4 V, I_C = 1 A, See Notes 5 and 6			1.3			1.3			1.3			1.3	V
$V_{CE(sat)}$	I_B = 125 mA, I_C = 1 A, See Notes 5 and 6			0.7			0.7			0.7			0.7	V
h_{fe}	V_{CE} = 10 V, I_C = 0.2 A, f = 1 MHz	20			20			20			20			
$\|h_{fe}\|$	V_{CE} = 10 V, I_C = 0.2 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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electrical characteristics at 25°C case temperature (unless otherwise noted)

PARAMETER	TEST CONDITIONS		TIP29D			TIP29E			TIP29F			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		0.3			0.3			0.3		mA
I_{CES}	V_{CE} = 160 V,	V_{BE} = 0		0.2								mA
	V_{CE} = 180 V,	V_{BE} = 0					0.2					
	V_{CE} = 200 V,	V_{BE} = 0								0.2		
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 = 0.2 A,	40			40			40			
	V_{CE} = 4 V, See Notes 5 and 6	I_C = 1 A,	15			15			15			
V_{BE}	V_{CE} = 4 V, See Notes 5 and 6	I_C = 1 A,		1.3			1.3			1.3		V
$V_{CE(sat)}$	I_B = 125 mA, See Notes 5 and 6	I_C = 1 A,		0.7			0.7			0.7		V
h_{fe}	V_{CE} = 10 V, f = 1 MHz	I_C = 0.2 A,	20			20			20			
$\|h_{fe}\|$	V_{CE} = 10 V, f = 1 MHz	I_C = 0.2 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
$R_{\theta JC}$			4.17	°C/W
$R_{\theta JA}$			62.5	

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

PARAMETER	TEST CONDITIONS†			MIN	TYP	MAX	UNIT
t_{on}	I_C = 1 A,	I_{B1} = 0.1 A,	I_{B2} = −0.1 A,		0.5		μs
t_{off}	$V_{BE(off)}$ = −4.3 V,	R_L = 30 Ω,	See Figure 1		2		

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

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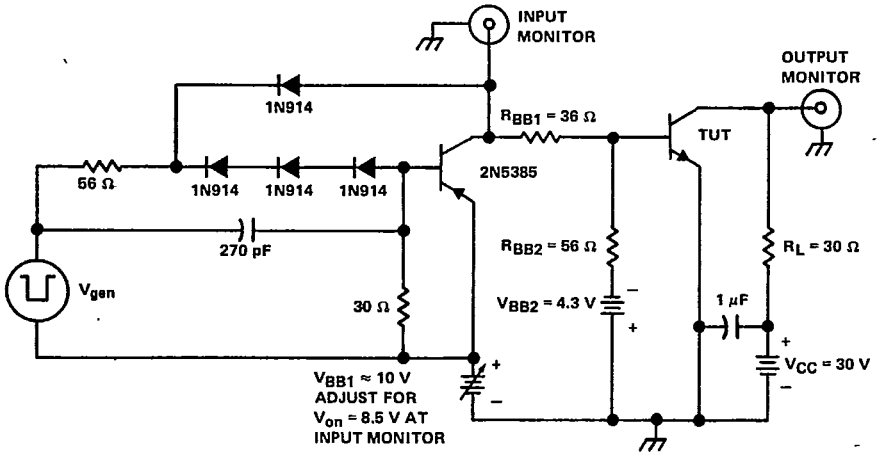
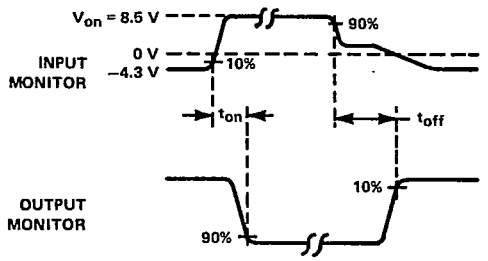
N-P-N SILICON POWER TRANSISTORS

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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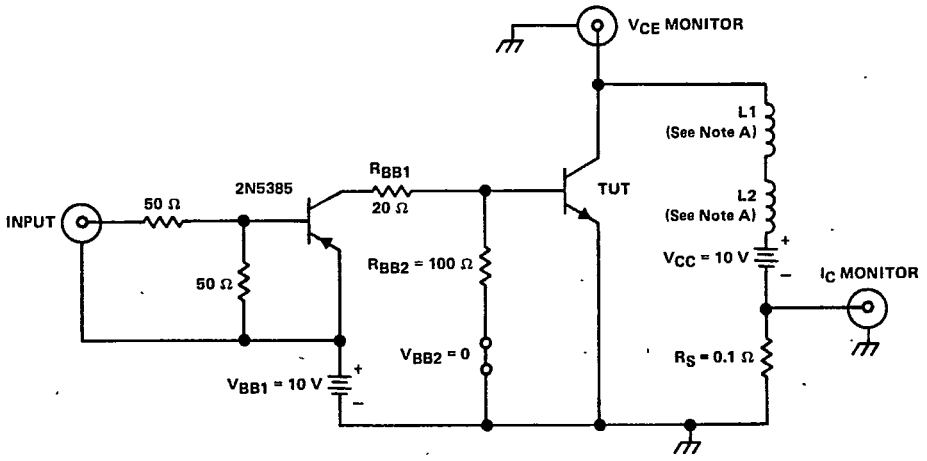
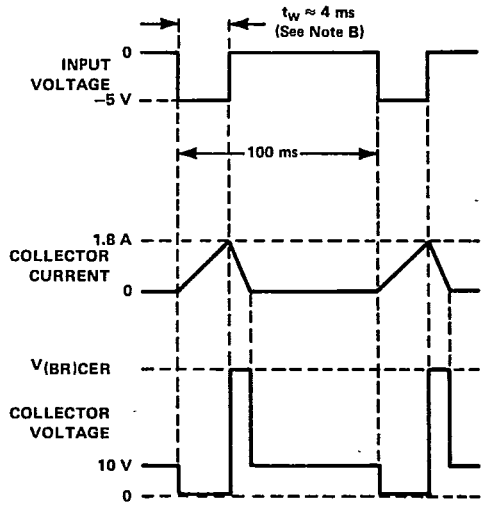


TEST CIRCUIT



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} = 1.8 A.

FIGURE 2. INDUCTIVE-LOAD SWITCHING

**TIP29, TIP29A, TIP29B, TIP29C,
TIP29D, TIP29E, TIP29F
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TYPICAL CHARACTERISTICS

STATIC FORWARD CURRENT TRANSFER RATIO
vs
COLLECTOR CURRENT

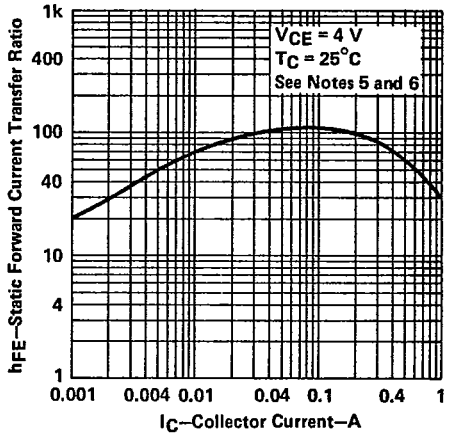

FIGURE 3

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

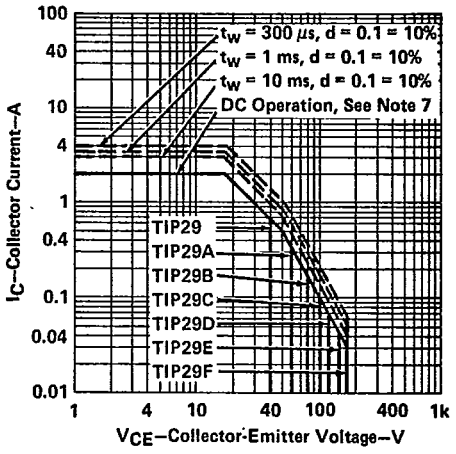

FIGURE 4

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

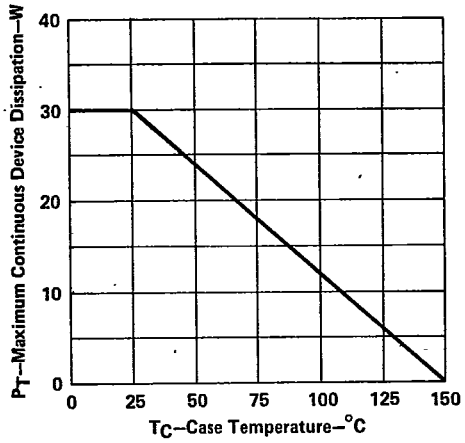

FIGURE 5