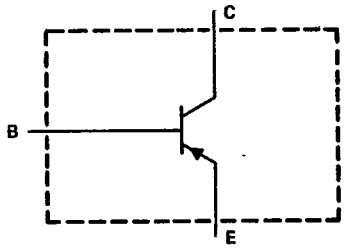
TIP32, TIP32A, TIP32B, TIP32C, TIP32D, TIP32E, TIP32F
P-N-P SILICON POWER TRANSISTORS

JULY 1968 – REVISED OCTOBER 1984

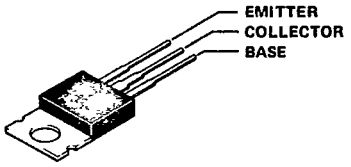
T-33-19

- Designed for Complementary Use With TIP31 Series
- 40 W at 25°C Case Temperature
- 3 A Continuous Collector Current
- 5 A Peak Collector Current
- Minimum f_T of 3 MHz at 10 V, 0.5 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)

	TIP32	TIP32A	TIP32B	TIP32C
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	−3 A			
Peak collector current (see Note 1)	−5 A			
Continuous base current	−1 A			
Safe operating areas at 25°C case temperature	See Figure 4			
Continuous device dissipation at 25°C case temperature (see Note 2)	40 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 0.32 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 of Figure 2.

TIP32, TIP32A, TIP32B, TIP32C, TIP32D, TIP32E, TIP32F P-N-P SILICON POWER TRANSISTORS

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

	TIP32D	TIP32E	TIP32F
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	−3 A		
Peak collector current (see Note 1)	−5 A		
Continuous base current	−1 A		
Safe operating area at 25°C case temperature	See Figure 4		
Continuous device dissipation at 25°C case temperature (see Note 2)	40 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 0.32 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	TIP32		TIP32A		TIP32B		TIP32C		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 = −1 A, See Notes 5 and 6	25		25		25		25		
	V_{CE} = −4 V, I_C = −3 A, See Notes 5 and 6	10	50	10	50	10	50	10	50	
V_{BE}	V_{CE} = −4 V, I_C = −3 A, See Notes 5 and 6		−1.8		−1.8		−1.8		−1.8	V
$V_{CE(sat)}$	I_B = −0.375 A, I_C = −3 A, See Notes 5 and 6		−1.2		−1.2		−1.2		−1.2	V
h_{fe}	V_{CE} = −10 V, I_C = −0.5 A, f = 1 MHz	20		20		20		20		
$\|h_{fe}\|$	V_{CE} = −10 V, I_C = −0.5 A, f = 1MHz	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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TIP32, TIP32A, TIP32B, TIP32C, TIP32D, TIP32E, TIP32F
P-N-P SILICON POWER TRANSISTORS

T-33-19

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

PARAMETER	TEST CONDITIONS	TIP32D	TIP32E	TIP32F	UNIT
		MIN TYP MAX	MIN TYP MAX	MIN TYP MAX	
$V_{(BR)CEO}$	$I_C = -30$ mA, $I_B = 0$, See Note 5	−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, $I_C = -1$ A, See Notes 5 and 6	25	25	25	
	$V_{CE} = -4$ V, $I_C = -3$ A, See Notes 5 and 6	5	5	5	
V_{BE}	$V_{CE} = -4$ V, $I_C = -3$ A, See Notes 5 and 6	−1.8	−1.8	−1.8	V
$V_{CE(sat)}$	$I_B = -750$ mA, $I_C = -3$ A, See Notes 5 and 6	−2.5	−2.5	−2.5	V
h_{fe}	$V_{CE} = -10$ V, $I_C = -0.5$ A, f = 1 MHz	20	20	20	
$\lvert h_{fe} \rvert$	$V_{CE} = -10$ V, $I_C = -0.5$ A, f = 1 MHz	3	3	3	

NOTES: 5. These parameters must be measured using pulse techniques, $t_w = 300\ \mu s$, 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
$R_{\theta JC}$	3.125	°C/W
$R_{\theta JA}$	62.5	

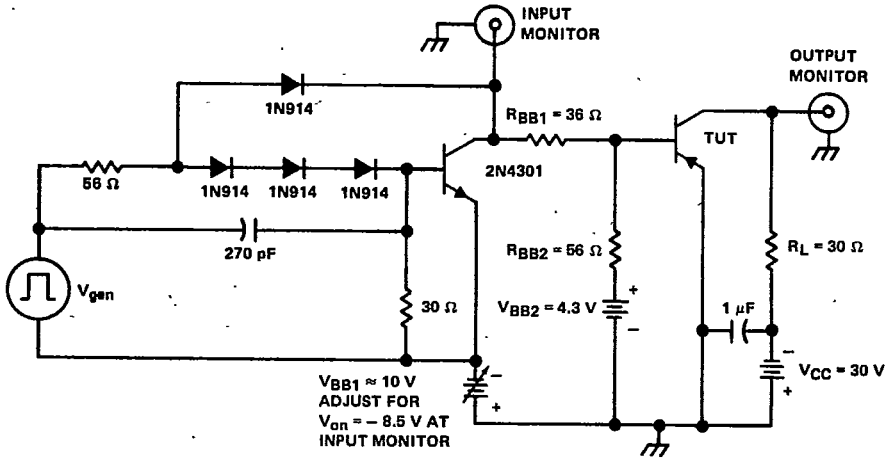
resistive-load switching characteristic at 25°C case temperature (unless otherwise noted)

PARAMETER	TEST CONDITIONS†	MIN TYP MAX	UNIT
t_{on}	$I_C = -1$ A, $I_{B1} = -0.1$ A, $I_{B2} = 0.1$ A,	0.3	μs
t_{off}	$V_{BE(off)} = 4.3$ V, $R_L = 30\ \Omega$, See Figure 1	1	

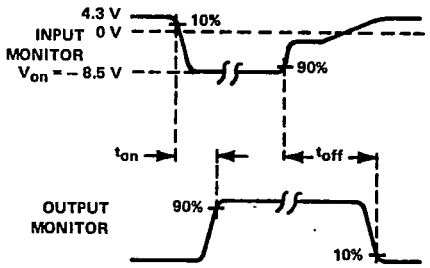
† Voltage and current values shown are nominal; exact values vary slightly with transistor parameters.

TIP32, TIP32A, TIP32B, TIP32C, TIP32D, TIP32E, TIP32F
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 Ω termination.
B. The V_{gen} waveform is supplied by 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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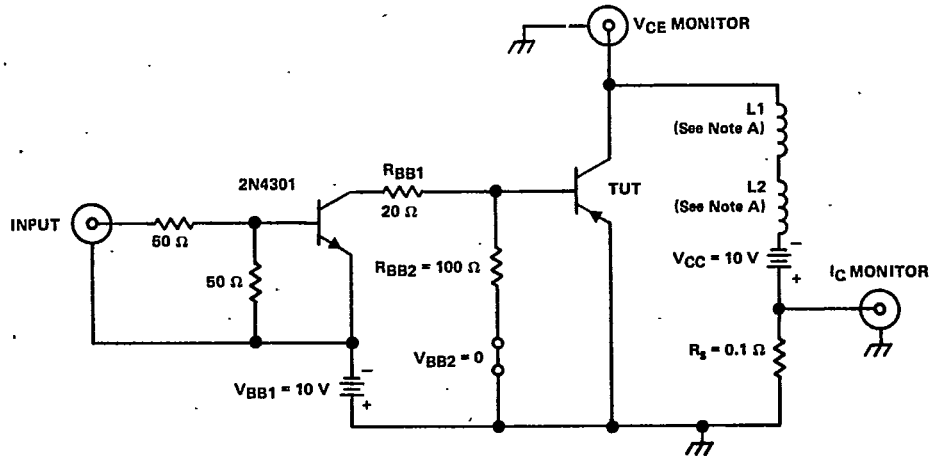
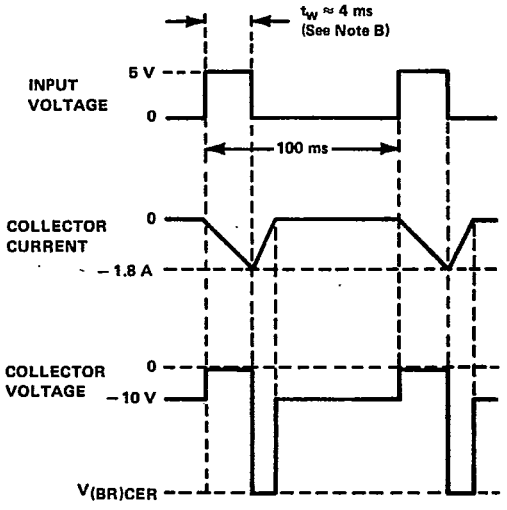
T-33-19

PARAMETER MEASUREMENT INFORMATION



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

TIP32, TIP32A, TIP32B, TIP32C,
TIP32D, TIP32E, TIP32F
P-N-P SILICON POWER TRANSISTORS

TYPICAL CHARACTERISTICS

STATIC FORWARD CURRENT TRANSFER RATIO
vs
COLLECTOR CURRENT

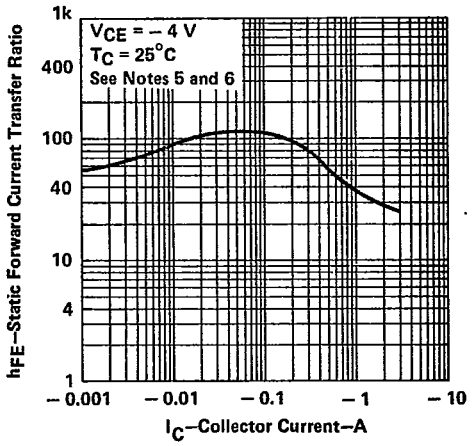


FIGURE 3

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

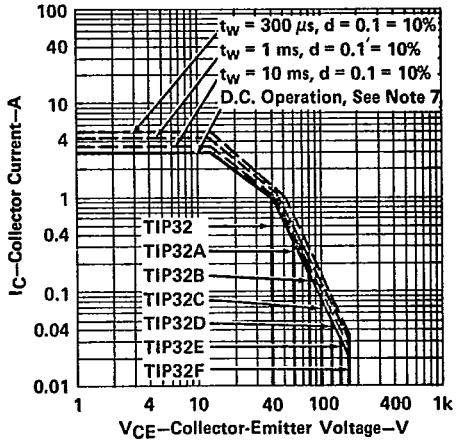


FIGURE 4

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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1283

THERMAL INFORMATION

T-33-19

DISSIPATION DERATING CURVE

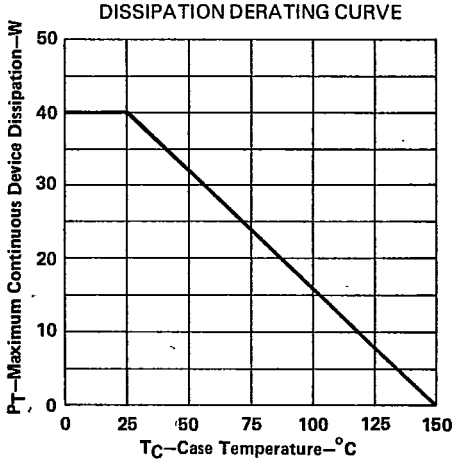

FIGURE 5