

8961726 TEXAS INSTR (OPTO)

62C 36888 D

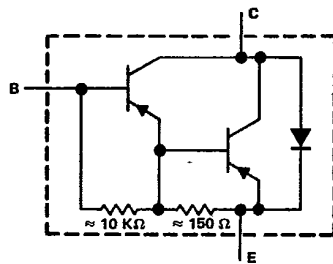
TIP115, TIP116, TIP117
P-N-P DARLINGTON-CONNECTED
SILICON POWER TRANSISTORS

REVISED - OCTOBER 1984

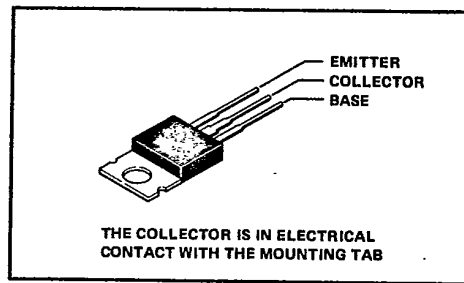
T-33-31

- Designed for Complementary Use With TIP110, TIP111, TIP112
- High SOA Capability, 40 V and 1.25 A
- 50 W at 25°C Case Temperature
- 4 A Rated Collector Current
- Min h_{FE} of 500 at 4 V, 2 A
- 25 mJ Reverse Energy Rating

device schematic



TO-220AB PACKAGE



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

	TIP115	TIP116	TIP117
Collector-base voltage	- 60 V	- 80 V	- 100 V
Collector-emitter voltage ($I_B = 0$)	- 60 V	- 80 V	- 100 V
Emitter-base voltage		- 5 V	
Continuous collector current		- 4 A	
Peak collector current (see Note 1)		- 6 A	
Continuous base current		- 50 mA	
Safe operating areas at (or below) 25°C case temperature	See Figures 7 and 8		
Continuous device dissipation at (or below) 25°C case temperature (see Note 2)	50 W		
Continuous device dissipation at (or below) 25°C free-air temperature (see Note 3)	2 W		
Unclamped inductive load energy (see Note 4)	25 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	260°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 0.4 W/°C or refer to Dissipation Derating Curve, Figure 9.
 3. Derate linearly to 150°C free-air temperature at the rate of 16 mW/°C or refer to Dissipation Derating Curve, Figure 10.
 4. This rating is based on the capability of the transistors to operate safely in the circuit of Figure 2. $L = 20$ mH, $R_{\theta B2} = 100 \Omega$, $V_{BB2} = 0$ V, $R_S = 0.1 \Omega$, $V_{CC} = 20$ V. Energy $\approx I_C^2 L / 2$.



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electrical characteristics at 25°C case temperature

PARAMETER	TEST CONDITIONS	TIP115			TIP116			TIP117			UNIT
		MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX	
V(BR)CEO	I _C = -30 mA, I _B = 0, See Note 5	-60			-80			-100			V
I _{CEO}	V _{CE} = -30 V, I _B = 0			-2			-2				mA
	V _{CE} = -40 V, I _B = 0										
	V _{CE} = -50 V, I _B = 0									-2	
I _{CBO}	V _{CB} = -60 V, I _E = 0			-1							mA
	V _{CB} = -80 V, I _E = 0						-1				
	V _{CB} = -100 V, I _E = 0									-1	
I _{EBO}	V _{EB} = -5 V, I _C = 0			-2			-2			-2	mA
h _{FE}	V _{CE} = -4 V, I _C = -1 A, See Notes 5 and 6	1000			1000			1000			
	V _{CE} = -4 V, I _C = -2 A, See Notes 5 and 6	500			500			500			
V _{BE}	V _{CE} = -4 V, I _C = -2 A, See Notes 5 and 6			-2.8			-2.8			-2.8	V
V _{CE(sat)}	I _B = -8 mA, I _C = -2 A, See Notes 5 and 6			-2.5			-2.5			-2.5	V
V _F	I _F = 5 A, See Notes 5 and 6			3.5			3.5			3.5	V

- 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 located within 3,2 mm (0.125 inch) from the device body.

resistive-load switching characteristics at 25°C case temperature

PARAMETER	TEST CONDITIONS†	MIN	TYP	MAX	UNIT
t _{on}	I _C = -2 A, I _{B1} = -8 mA, I _{B2} = 8 mA,			2.6	μs
t _{off}	V _{BE(off)} = 5 V, R _L = 15 Ω, See Figure 1			4.5	

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



TIP Devices

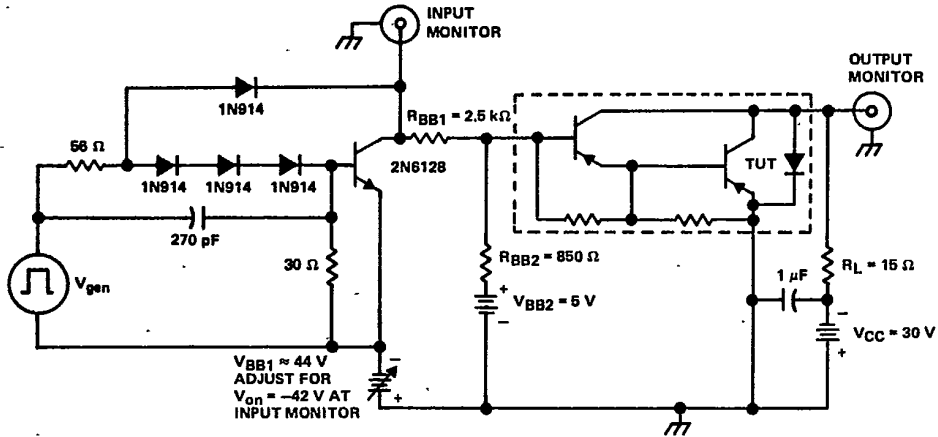
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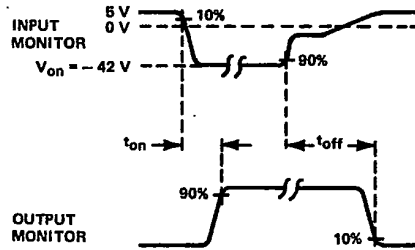
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PARAMETER MEASUREMENT INFORMATION

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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 < 15 ns, t_f < 15 ns, Z_{out} = 50 Ω, t_w = 20 μs, duty cycle < 2%.
 - C. Waveforms are monitored on an oscilloscope with the following characteristics: t_r < 15 ns, R_{in} > 10 MΩ, C_{in} < 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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TIP Devices

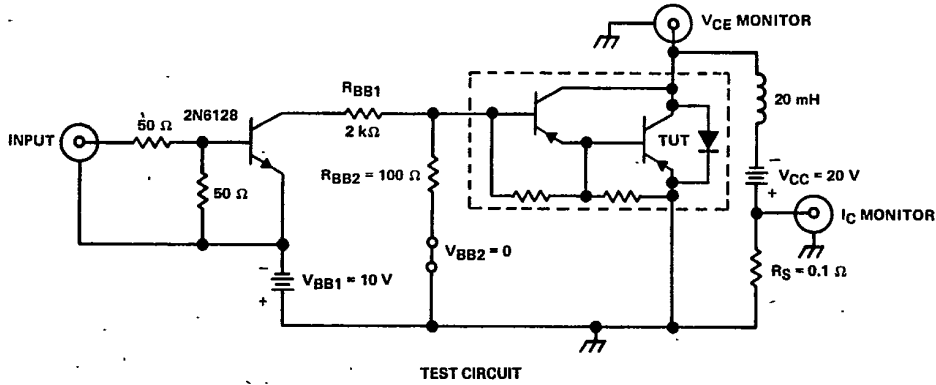
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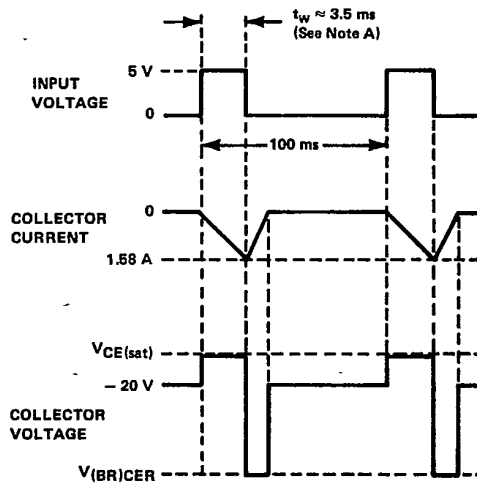
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PARAMETER MEASUREMENT INFORMATION



TEST CIRCUIT



VOLTAGE AND CURRENT WAVEFORMS

NOTE A: Input pulse duration is increased until $I_{CM} = -1.58$ A.

FIGURE 2. INDUCTIVE-LOAD SWITCHING



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TYPICAL CHARACTERISTICS

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STATIC FORWARD CURRENT TRANSFER RATIO
vs
COLLECTOR CURRENT

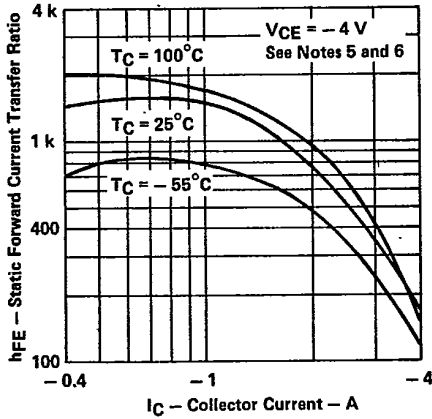


FIGURE 3

BASE-EMITTER VOLTAGE
vs
CASE TEMPERATURE

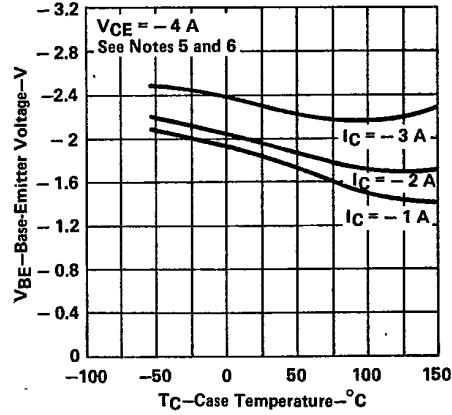


FIGURE 4

COLLECTOR-EMITTER
SATURATION VOLTAGE
vs
CASE TEMPERATURE

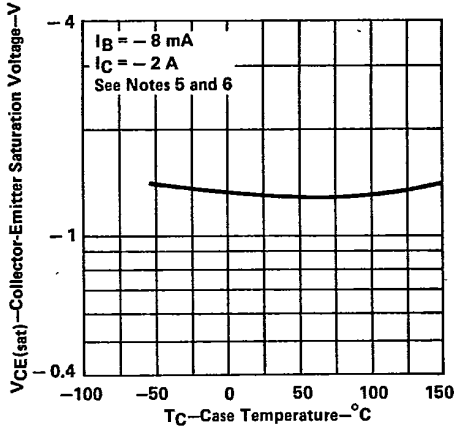


FIGURE 5

SMALL-SIGNAL COMMON-EMITTER
FORWARD CURRENT TRANSFER RATIO
vs
FREQUENCY

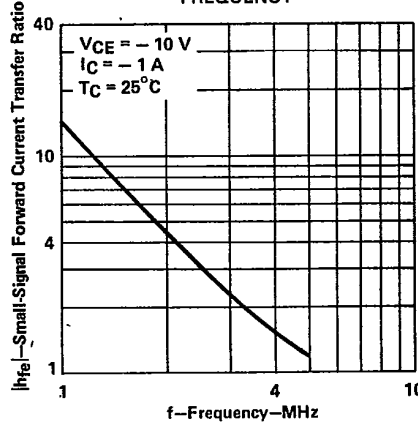


FIGURE 6

- 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 and located within 3,2 mm (0.125 inch) from the device body.

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MAXIMUM SAFE OPERATING AREA

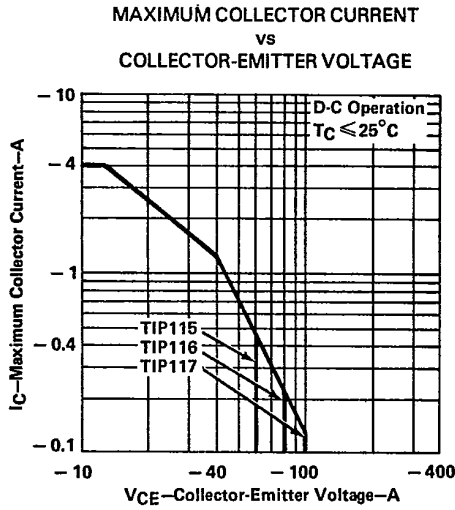


FIGURE 7

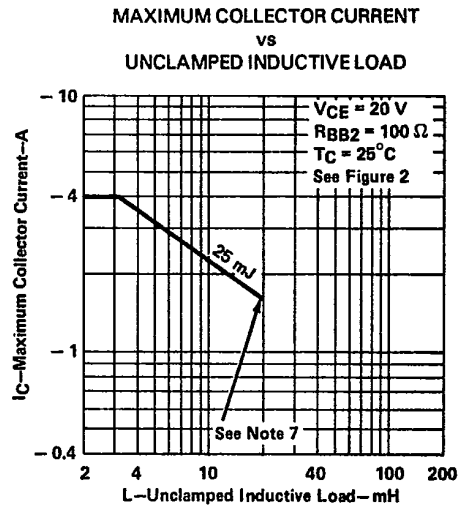


FIGURE 8

NOTE 7. Above this point the safe operating area has not been defined.

THERMAL INFORMATION

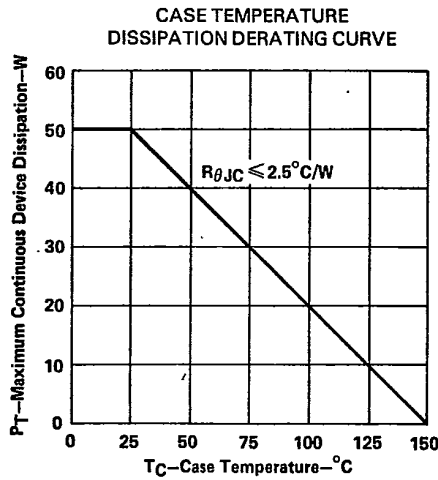


FIGURE 9

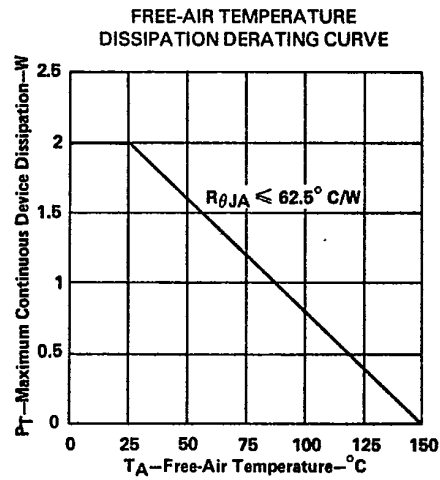


FIGURE 10



TIP Devices