

8961726 TEXAS INSTR (OPTO)

62C 36924 D

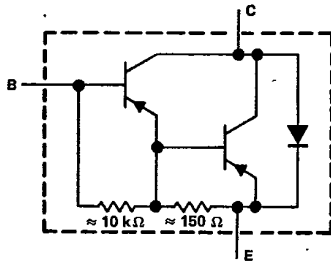
TIP145, TIP146, TIP147
P-N-P DARLINGTON-CONNECTED
SILICON POWER TRANSISTORS

REVISED OCTOBER 1984

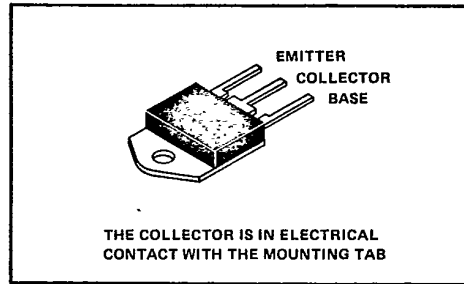
T-33-31

- Designed for Complementary Use With TIP140, TIP141, TIP142
- 125 W at 25°C Case Temperature
- 10 A Rated Collector Current
- Min h_{FE} of 1000 at 4 V, 5 A
- 100 mJ Reverse Energy Rating

device schematic



TO-218AA PACKAGE



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

	TIP145	TIP146	TIP147
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		-10 A	
Peak collector current (see Note 1)		-15 A	
Continuous base current		-0.5 A	
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)	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)	100 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 1 W/°C or refer to Dissipation Derating Curve, Figure 9.
 3. Derate linearly to 150°C free-air temperature at the rate of 28 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, $R_{BB2} = 100 \Omega$, $V_{BB2} = 0$ V, $R_S = 0.1 \Omega$, $V_{CC} = 20$ V, Energy $\approx I_C^2 L / 2$.



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**TIP145, TIP146, TIP147
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electrical characteristics at 25°C case temperature

PARAMETER	TEST CONDITIONS	TIP145		TIP146		TIP147		UNIT
		MIN	TYP MAX	MIN	TYP MAX	MIN	TYP MAX	
$V_{(BR)CEO}$	$I_C = -30\text{ mA}, I_B = 0$, See Note 5	-60		-80		-100		V
I_{CEO}	$V_{CE} = -30\text{ V}, I_B = 0$		-2					mA
	$V_{CE} = -40\text{ V}, I_B = 0$				-2			
	$V_{CE} = -50\text{ V}, I_B = 0$						-2	
I_{CBO}	$V_{CB} = -60\text{ V}, I_E = 0$		-1					mA
	$V_{CB} = -80\text{ V}, I_E = 0$				-1			
	$V_{CB} = -100\text{ V}, I_E = 0$						-1	
I_{EBO}	$V_{EB} = -5\text{ V}, I_C = 0$		-2		-2		-2	mA
h_{FE}	$V_{CE} = -4\text{ V}, I_C = -5\text{ A}$, See Notes 5 and 6	1000		1000		1000		
	$V_{CE} = -4\text{ V}, I_C = -10\text{ A}$, See Notes 5 and 6	500		500		500		
V_{BE}	$V_{CE} = -4\text{ V}, I_C = -10\text{ A}$, See Notes 5 and 6		-3		-3		-3	V
$V_{CE(sat)}$	$I_B = -10\text{ mA}, I_C = -5\text{ A}$, See Notes 5 and 6		-2		-2		-2	V
	$I_B = -40\text{ mA}, I_C = -10\text{ A}$, See Notes 5 and 6		-3		-3		-3	
V_F	$I_F = 10\text{ A}$, See Notes 5 and 6		3.5		3.5		3.5	V

- NOTES: 5. These parameters must be measured using pulse techniques, $t_w = 300\ \mu\text{s}$, 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.

resistive-load switching characteristics at 25°C case temperature

PARAMETER	TEST CONDITIONS †	MIN	TYP	MAX	UNIT
		t_{on}		0.9	
t_{off}	$I_C = -10\text{ A}, I_{B1} = -40\text{ mA}, I_{B2} = 40\text{ mA}$, $V_{BE(off)} = 4.2\text{ V}, R_L = 3\ \Omega$, See Figure 1		11		

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



TIP Devices

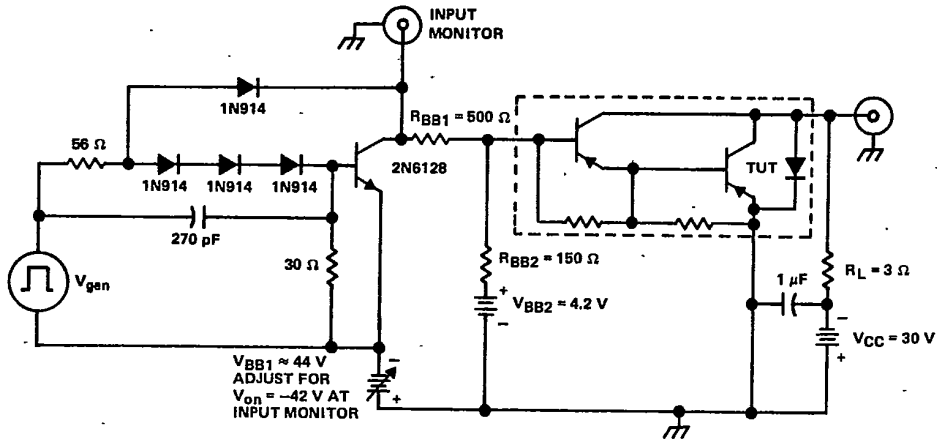
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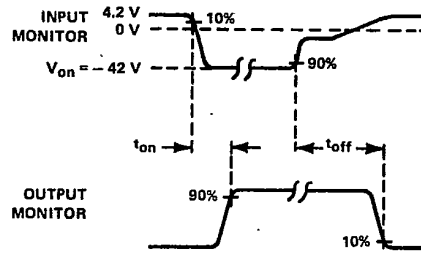
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PARAMETER MEASUREMENT INFORMATION

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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: $t_r \leq 15$ 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 Ω , $C_{in} \leq 11.5$ 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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TIP Devices

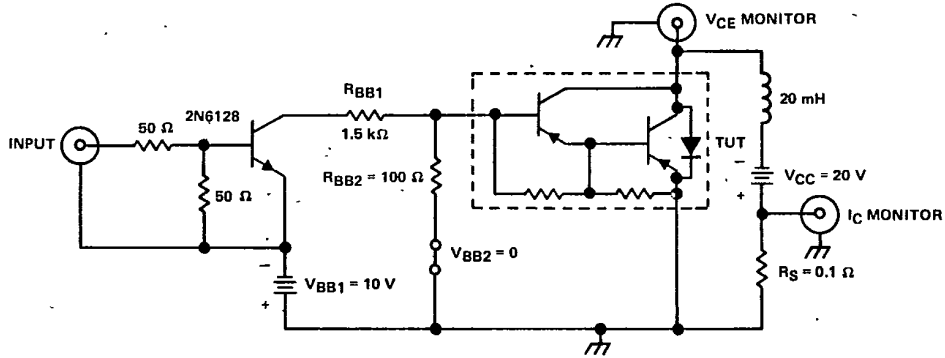
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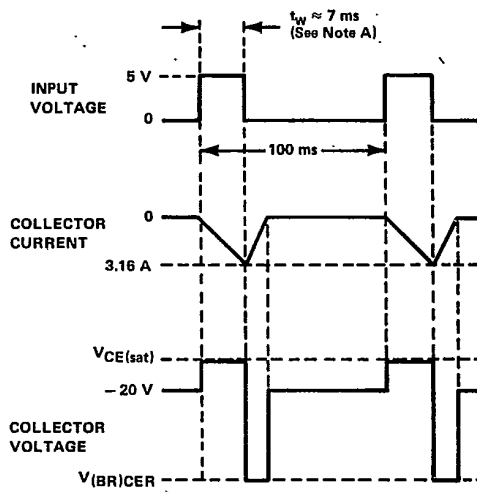
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PARAMETER MEASUREMENT INFORMATION



TEST CIRCUIT



VOLTAGE AND CURRENT WAVEFORMS

NOTE A: Input pulse duration is increased until $I_{CM} = -3.16$ A.

FIGURE 2. INDUCTIVE-LOAD SWITCHING



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TYPICAL CHARACTERISTICS

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STATIC FORWARD CURRENT TRANSFER RATIO
vs
COLLECTOR CURRENT

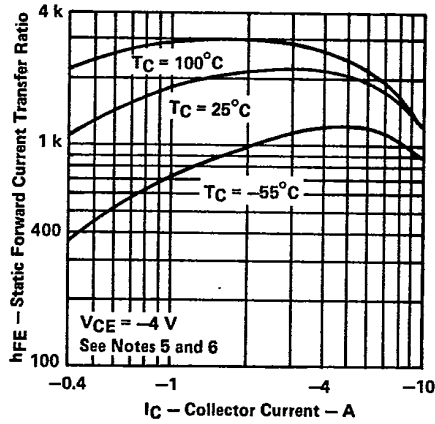


FIGURE 3

BASE-EMITTER VOLTAGE
vs
CASE TEMPERATURE

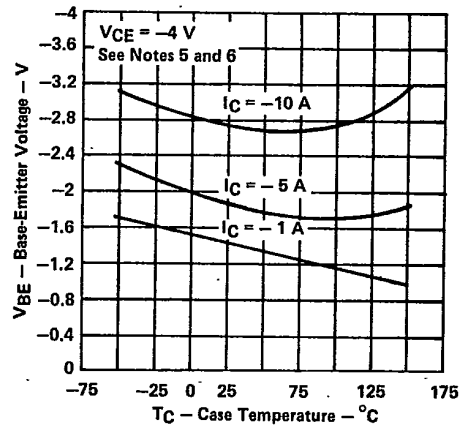


FIGURE 4

COLLECTOR-EMITTER SATURATION VOLTAGE
vs
CASE TEMPERATURE

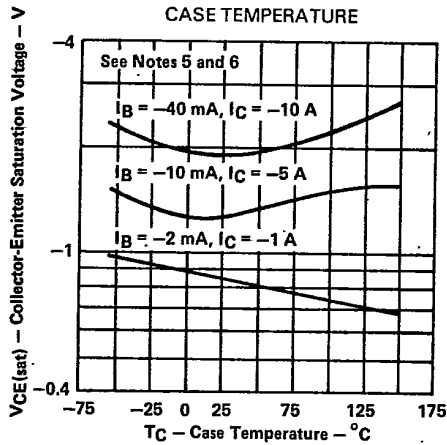


FIGURE 5

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

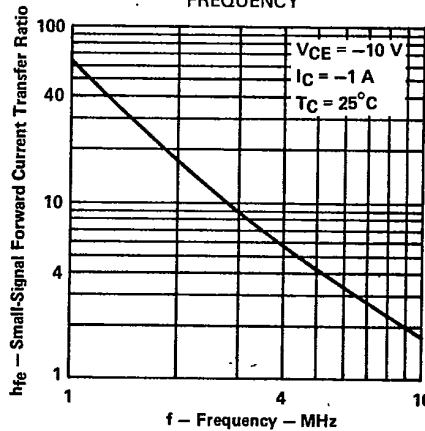


FIGURE 6

- 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.



TIP Devices

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MAXIMUM SAFE OPERATING AREA

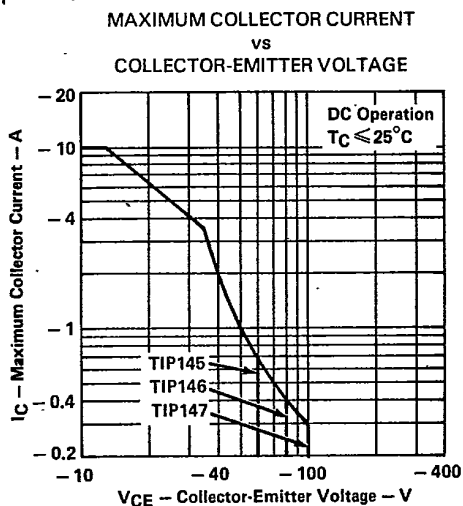


FIGURE 7

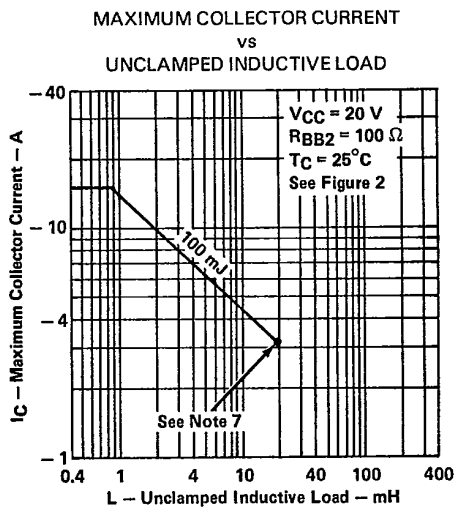


FIGURE 8

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

THERMAL INFORMATION

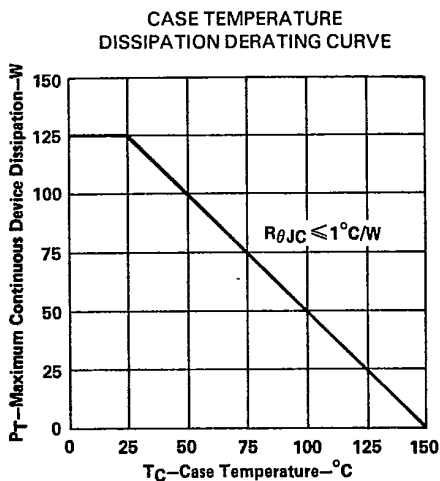


FIGURE 9

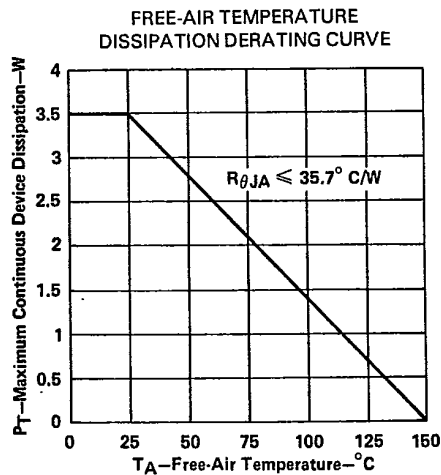


FIGURE 10

TIP Devices