

8961726 TEXAS INSTR (OPTO)

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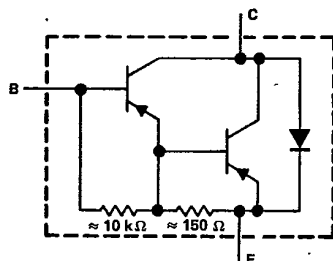
TIP145, TIP146, TIP147
P-N-P DARLINGTON-CONNECTED
SILICON POWER TRANSISTORS

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



THE COLLECTOR IS IN ELECTRICAL
 CONTACT WITH THE MOUNTING TAB

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 $\approx I_C^2 L/2$.

TIP Devices

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SILICON POWER TRANSISTORS

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, $t_w = 300\text{ }\mu\text{s}$, 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}	$I_C = -10\text{ A}$, $I_{B1} = -40\text{ mA}$, $I_{B2} = 40\text{ mA}$, $V_{BE(off)} = 4.2\text{ V}$, $R_L = 3\text{ }\Omega$, See Figure 1		0.9		μs
t_{off}			11		

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

TIP Devices

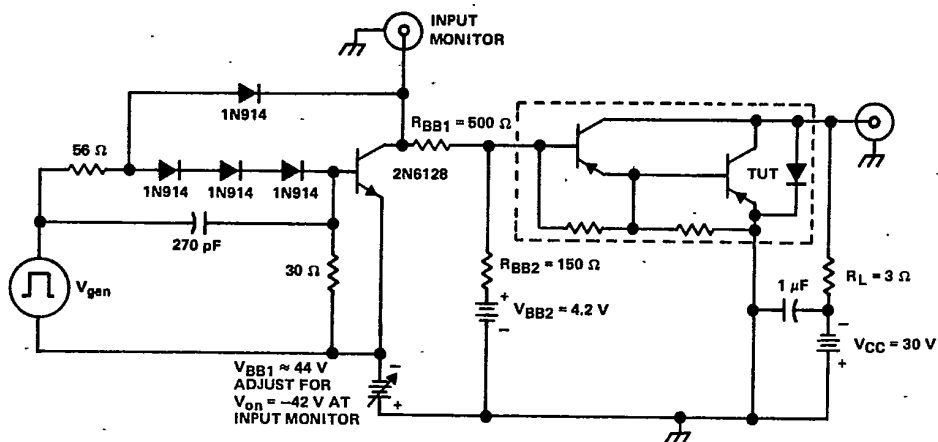
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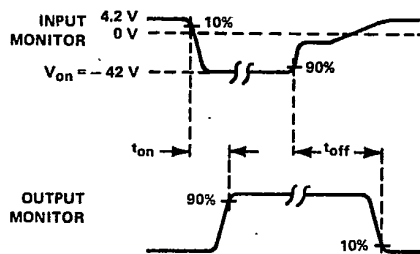
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PARAMETER MEASUREMENT INFORMATION

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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: $t_r \leq 15 \text{ ns}$, $t_f \leq 15 \text{ ns}$, $Z_{out} = 50 \Omega$, $t_w = 20 \mu\text{s}$, duty cycle $\leq 2\%$.
C. Waveforms are monitored on an oscilloscope with the following characteristics: $t_r \leq 15 \text{ ns}$, $R_{in} \geq 10 \text{ M}\Omega$, $C_{in} \leq 11.5 \text{ pF}$.
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

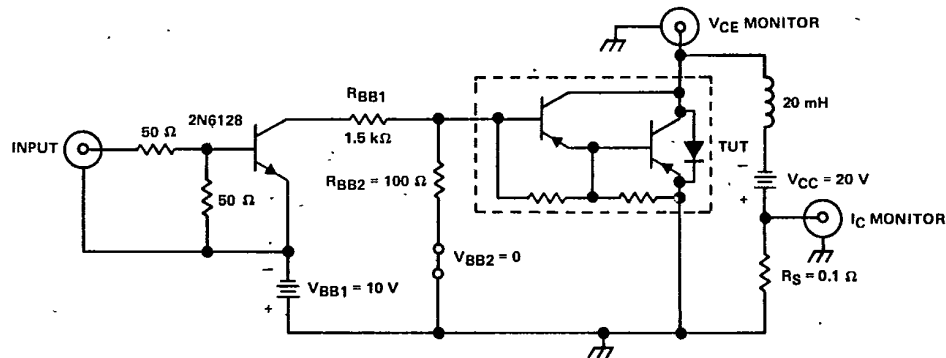
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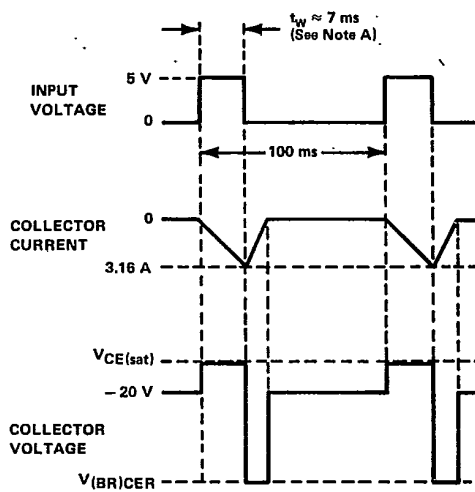
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PARAMETER MEASUREMENT INFORMATION



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

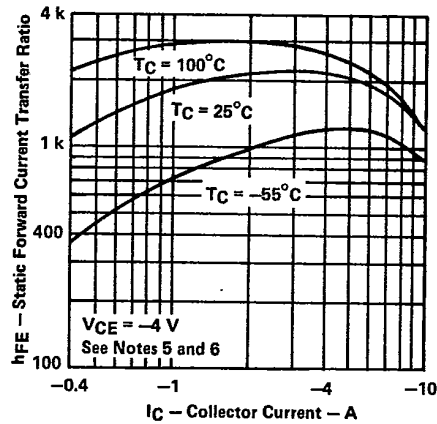


FIGURE 3

BASE-EMITTER VOLTAGE
vs
CASE TEMPERATURE

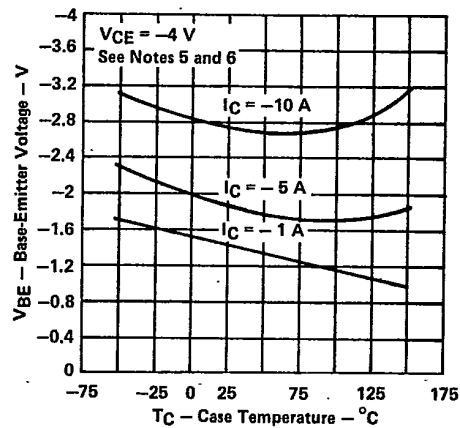


FIGURE 4

COLLECTOR-EMITTER SATURATION VOLTAGE
vs
CASE TEMPERATURE

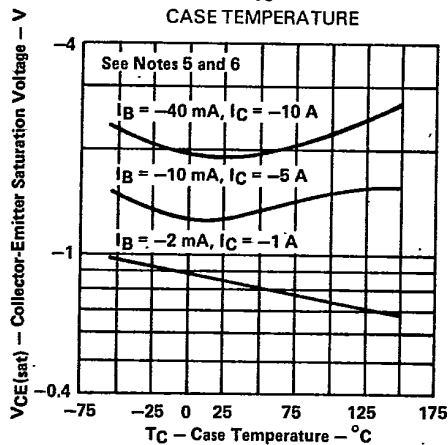


FIGURE 5

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

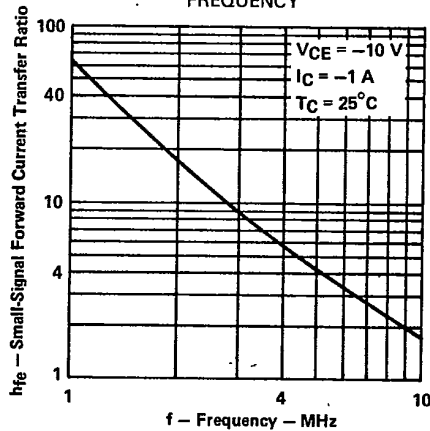


FIGURE 6

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

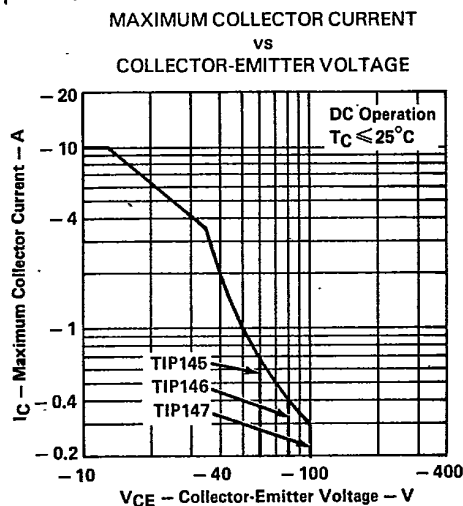


FIGURE 7

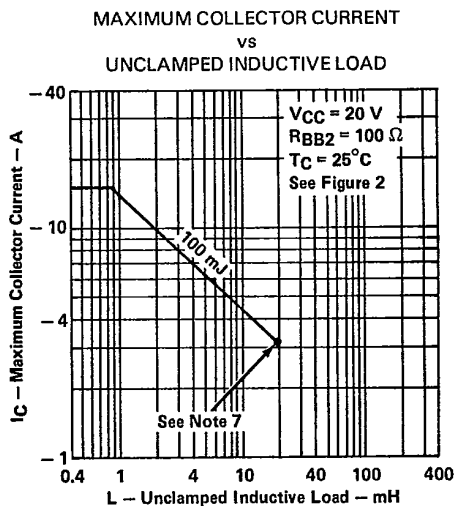


FIGURE 8

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

THERMAL INFORMATION

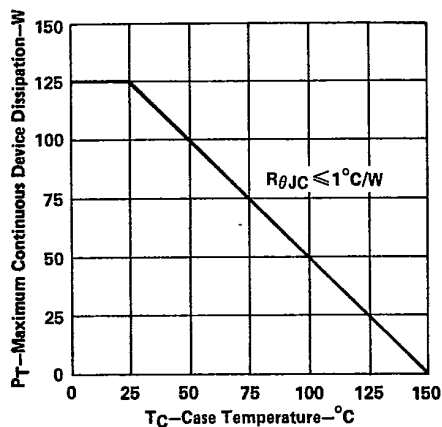
CASE TEMPERATURE
DISSIPATION DERATING CURVE

FIGURE 9

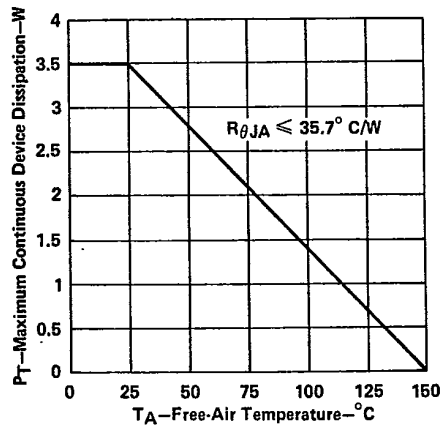
FREE-AIR TEMPERATURE
DISSIPATION DERATING CURVE

FIGURE 10

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