

8961726 TEXAS INSTR (OPT0)

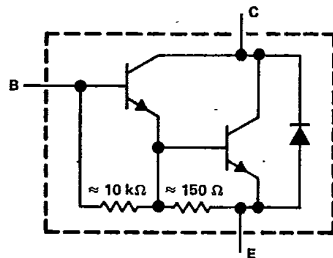
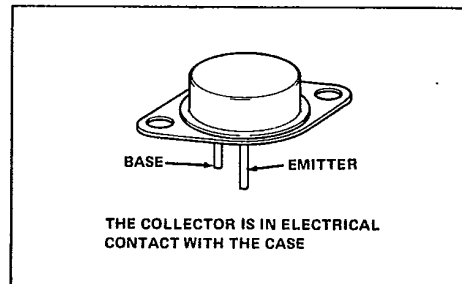
62C 36970 D

TIP640, TIP641, TIP642
N-P-N DARLINGTON-CONNECTED
SILICON POWER TRANSISTORS

REVISED OCTOBER 1984

- Designed For Complementary use with TIP645, TIP646, TIP647
- 175 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

T-33-29

device schematic**TO-3 PACKAGE****absolute maximum ratings at 25°C case temperature (unless otherwise noted)**

	TIP640	TIP641	TIP642
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 area 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)	175 W		
Continuous device dissipation at (or below) 25°C free-air temperature (see Note 3)	5 W		
Unclamped inductive load energy (see Note 4)	100 mJ		
Operating collector junction and storage temperature range	- 65°C to 200°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 200°C case temperature at the rate of 1 W/°C or refer to Dissipation Derating Curve, Figure 9.
 3. Derate linearly to 200°C free-air temperature at the rate of 28.6 mW/°C or refer to Dissipation Derating Curve, Figure 10.
 4. This rating is based on the capability of the transistor to operate safely in the circuit in 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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electrical characteristics at 25°C case temperature

PARAMETER	TEST CONDITIONS	TIP640			TIP641			TIP642			UNIT
		MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX	
$V_{(BR)CEO}$	$I_C = 30 \text{ mA}$, See Note 5 $I_B = 0$	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}	$V_{CE} = 4 \text{ V}$, See Notes 5 and 6 $I_C = 5 \text{ A}$	1000			1000			1000			
	$V_{CE} = 4 \text{ V}$, See Notes 5 and 6 $I_C = 10 \text{ A}$	500			500			500			
V_{BE}	$V_{CE} = 4 \text{ V}$, See Notes 5 and 6 $I_C = 10 \text{ A}$		3			3			3		V
$V_{CE(sat)}$	$I_B = 10 \text{ mA}$, See Notes 5 and 6 $I_C = 5 \text{ A}$		2			2			2		V
	$I_B = 40 \text{ mA}$, See Notes 5 and 6 $I_C = 10 \text{ A}$		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 located within 3.2 mm (0.125 inch) from the device body.

resistive-load switching characteristic at 25°C case temperature

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

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



TIP Devices

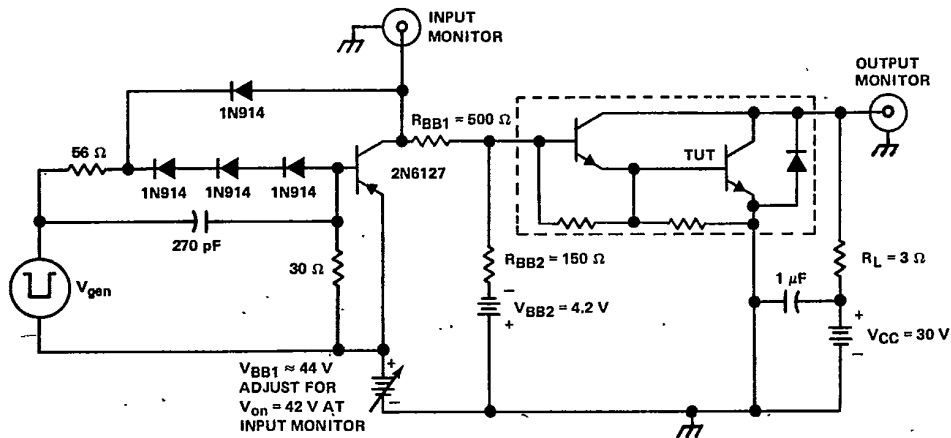
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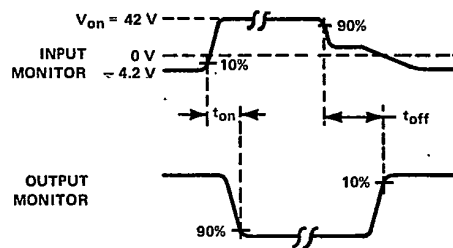
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PARAMETER MEASUREMENT INFORMATION

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TEST CIRCUIT



VOLTAGE WAVEFORMS

- NOTES: A. V_{gen} is a -30-V pulse into a $50\ \Omega$ 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



TIP Devices

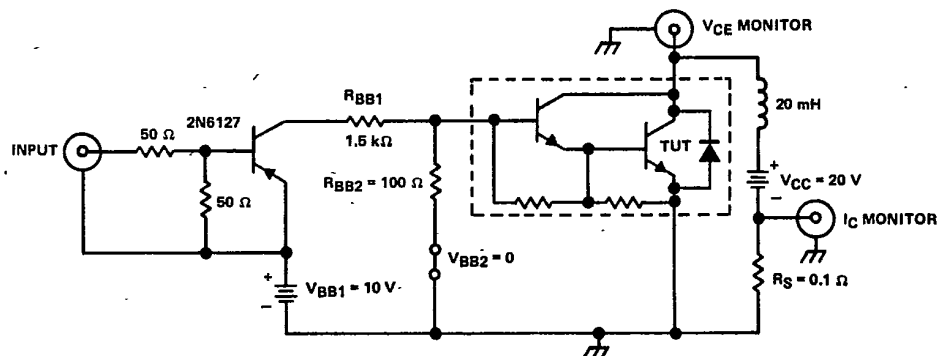
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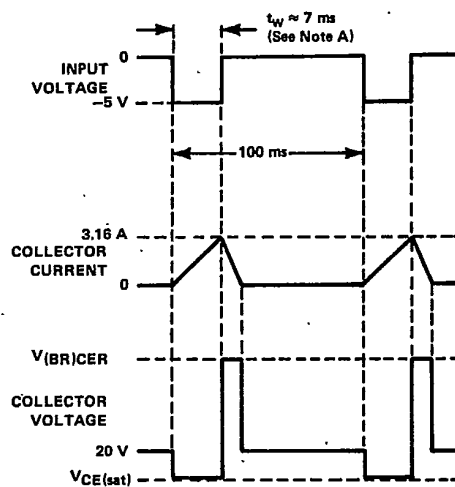
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PARAMETER MEASUREMENT INFORMATION



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

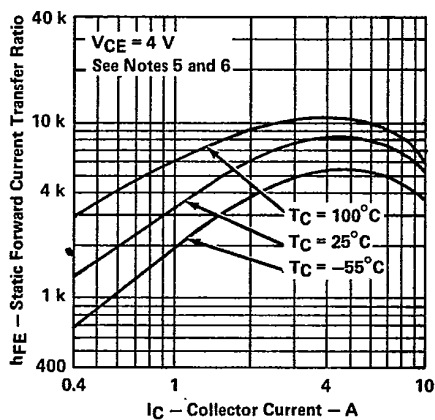


FIGURE 3

BASE EMITTER VOLTAGE
vs
CASE TEMPERATURE

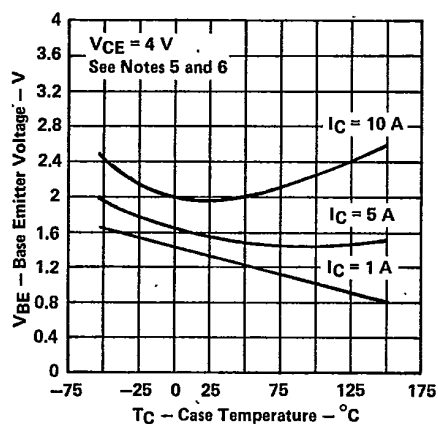


FIGURE 4

COLLECTOR-EMITTER SATURATION VOLTAGE
vs
CASE TEMPERATURE

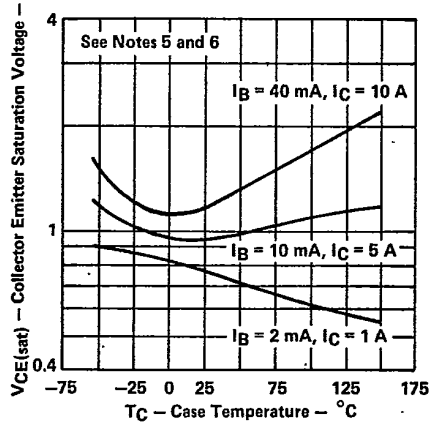


FIGURE 5

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

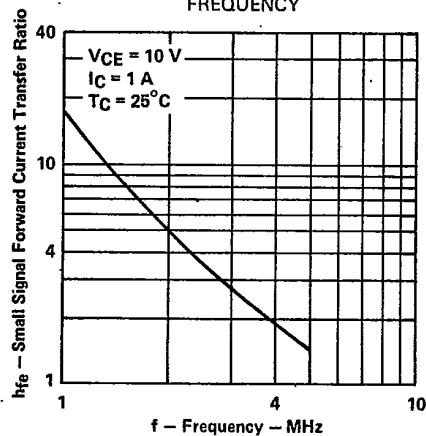


FIGURE 6

- 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 located within 3.2 mm (0.125 inch) from the device body.

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TIP Devices

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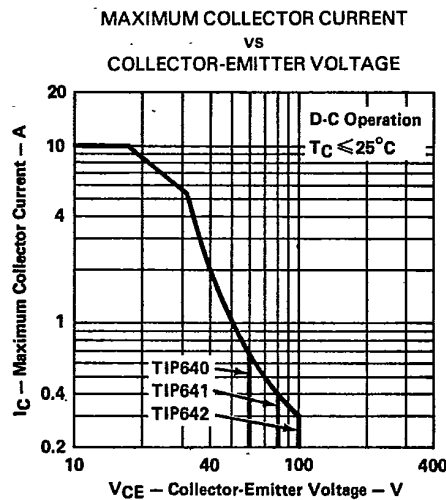
MAXIMUM SAFE OPERATING AREA

FIGURE 7

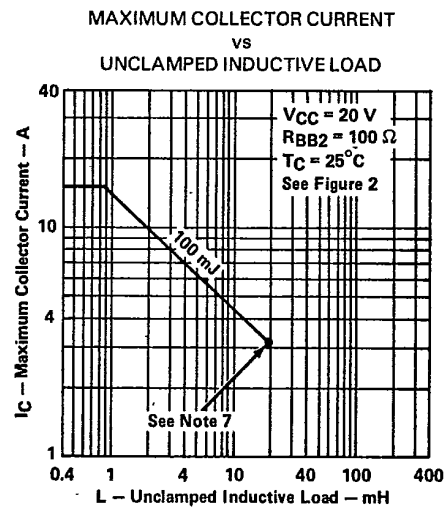


FIGURE 8

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

THERMAL INFORMATION

CASE TEMPERATURE
DISSIPATION DERATING CURVE

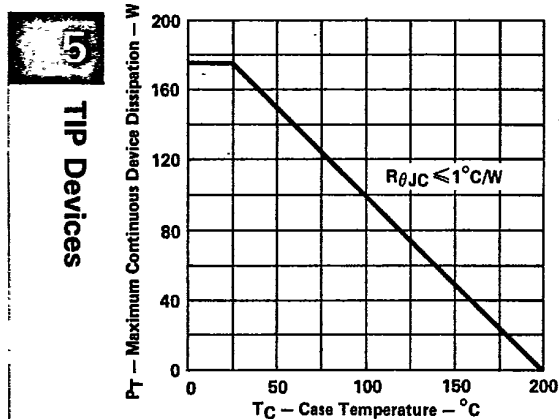


FIGURE 9

FREE-AIR TEMPERATURE
DISSIPATION DERATING CURVE

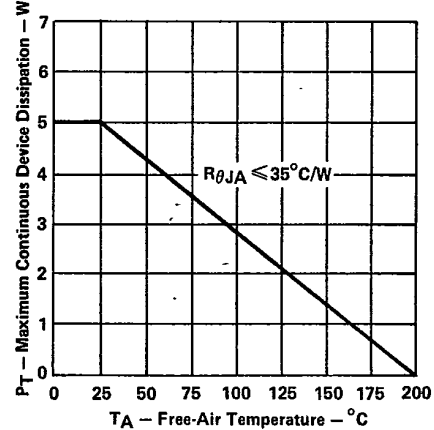


FIGURE 10