

8961726 TEXAS INSTR (OPTO)

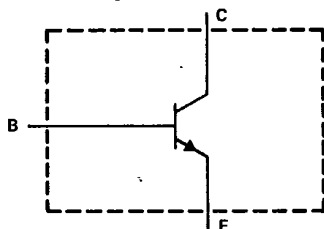
62C 36860 D

TIP75, TIP75A, TIP75B, TIP75C
N-P-N SILICON POWER TRANSISTORS

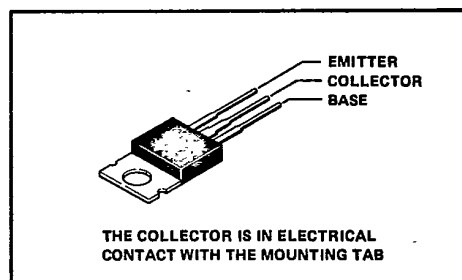
APRIL 1978 - REVISED OCTOBER 1984

- 65 W at 25°C Case Temperature
- 5 A Peak Collector Current
- High-Voltage, High-Forward and Clamped Reverse Energy Circuit Characteristics
- Reverse-Bias SOA . . . 200 V to 400 V, 3 A
- Designed for Automotive Ignition, Linear Amplifier, and Switching Regulator Applications

device schematic



TO-220AB PACKAGE



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

	TIP75	TIP75A	TIP75B	TIP75C
Collector-base voltage	350 V	400 V	450 V	500 V
Collector-emitter voltage ($I_B = 0$)	200 V	250 V	300 V	400 V
Emitter-base voltage	8 V			
Continuous collector current	3 A			
Peak collector current (see Note 1)	5 A			
Continuous base current	1.5 A			
Safe operating areas at (or below) 25°C case temperature	See Figures 10 and 11			
Continuous device dissipation at (or below) 25°C case temperature (see Note 2)	65 W			
Continuous device dissipation at (or below) 25°C free-air temperature (see Note 3)	2 W			
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 $t_W \leq 5$ ms, duty cycle ≤ 10 %.
2. Derate linearly to 150°C case temperature at the rate of 0.52 °C/W or refer to Dissipation Derating Curve, Figure 12.
3. Derate linearly to 150°C free-air temperature at the rate of 16 °C/mW or refer to Dissipation Derating Curve, Figure 13.



TIP Devices

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TIP75, TIP75A, TIP75B, TIP75C
N-P-N SILICON POWER TRANSISTORS

electrical characteristics at 25°C case temperature

PARAMETER	TEST CONDITIONS	TIP75			TIP75A			TIP75B			TIP75C			UNIT
		MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX	
$V_{(BR)CBO}$	$I_C = 10 \text{ mA}$, See Note 4 $I_E = 0$	350			400			450			500			V
$V_{(BR)CEO}$	$I_C = 10 \text{ mA}$, See Note 4 $I_B = 0$	200			250			300			400			V
$V_{CEX(sus)}$	$I_C = 3 \text{ A}$, See Figure 1	200			250			300			400			V
I_{CEO}	$V_{CE} = 150 \text{ V}$, $I_B = 0$		150			150						150		μA
	$V_{CE} = 250 \text{ V}$, $I_B = 0$							150					150	μA
I_{CES}	$V_{CE} = 300 \text{ V}$, $V_{BE} = 0$		50											μA
	$V_{CE} = 350 \text{ V}$, $V_{BE} = 0$				50									
	$V_{CE} = 400 \text{ V}$, $V_{BE} = 0$							50						
	$V_{CE} = 450 \text{ V}$, $V_{BE} = 0$										50			
I_{EBO}	$V_{EB} = 8 \text{ V}$, $I_C = 0$		1			1			1			1		mA
h_{FE}	$V_{CE} = 5 \text{ V}$, $I_C = 0.5 \text{ A}$, See Notes 4 and 5	30	250		30	250		30	250		30	250		
	$V_{CE} = 2 \text{ V}$, $I_C = 2 \text{ A}$, See Notes 4 and 5	12			12			12			12			
	$V_{CE} = 4 \text{ V}$, $I_C = 3 \text{ A}$, See Notes 4 and 5	10			10			10			10			
V_{BE}	$I_B = 50 \text{ mA}$, $I_C = 0.5 \text{ A}$, See Notes 4 and 5		1			1			1			1		V
	$I_B = 0.6 \text{ A}$, $I_C = 3 \text{ A}$, See Notes 4 and 5		1.2			1.2			1.2			1.2		
$V_{CE(sat)}$	$I_B = 50 \text{ mA}$, $I_C = 0.5 \text{ A}$, See Notes 4 and 5		0.5			0.5			0.5			0.5		V
	$I_B = 0.6 \text{ A}$, $I_C = 3 \text{ A}$, See Notes 4 and 5		1.9			1.9			1.9			1.9		
h_{fe}	$V_{CE} = 5 \text{ V}$, $f = 1 \text{ kHz}$, $I_C = 0.5 \text{ A}$	30			30			30			30			
$ h_{fe} $	$V_{CE} = 5 \text{ V}$, $f = 1 \text{ MHz}$, $I_C = 0.5 \text{ A}$	10			10			10			10			
C_{obo}	$V_{CB} = 10 \text{ V}$, $f = 1 \text{ MHz}$, $I_E = 0$		275			275			275			275		pF

NOTES: 4. These parameters must be measured using pulse techniques, $t_W = 300 \mu\text{s}$, duty cycle $\leq 2\%$.

5. 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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thermal characteristics

PARAMETER	MIN	TYP	MAX	UNIT
$R_{\theta JC}$		1.92		°C/W
$R_{\theta JA}$		62.5		
$R_{\theta CHS}$ See Note 6		0.7		
$C_{\theta C}$		0.9		J/°C

NOTE 6: This parameter is measured using 0.08 mm (0.003-inch) mica insulator with Dow-Corning 11 compound on both sides of the insulator, a 0.138-32 (formerly 6-32) mounting screw with bushing, and a mounting torque of 0.9 newton-meter (8 Inch-pounds).

resistive-load switching characteristics at 25°C case temperature

PARAMETER	TEST CONDITIONS†	MIN	TYP	MAX	UNIT
t_d	$I_C = 2\text{ A}, \quad I_{B1} = 0.2\text{ A}, \quad I_{B2} = -0.2\text{ A},$ $V_{BE(off)} = -4\text{ V}, \quad R_L = 100\ \Omega, \quad \text{See Figure 2}$		20		ns
t_r			340		
t_s			1400		
t_f			800		

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

inductive-load switching characteristics at 25°C case temperature

PARAMETER	TEST CONDITIONS†	MIN	TYP	MAX	UNIT
t_{sv}	$V_{(clamp)} = \text{Min } V_{CEX(sus)}, \quad I_{CM} = 3\text{ A},$ $I_{B1} = 0.5\text{ A}, \quad I_{B2} = -0.5\text{ A}, \quad \text{See Figure 3}$		1700		ns
t_{sj}			2300		
t_{tv}			700		
t_{ti}			700		
t_{xp}			1300		

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

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TIP Devices

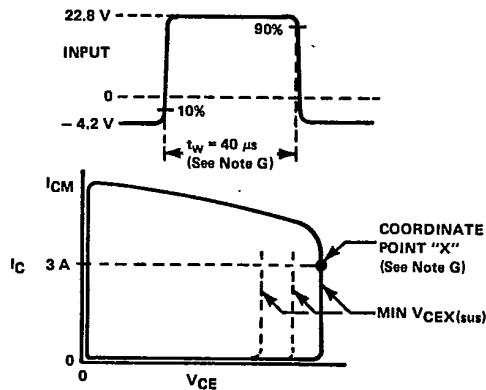
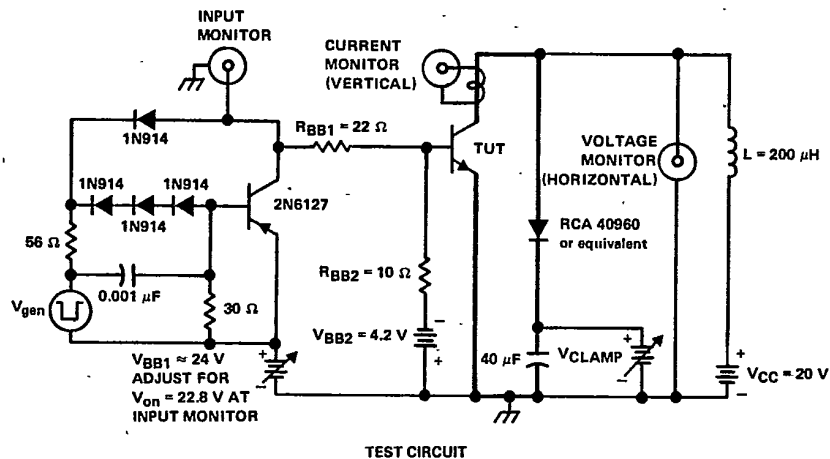
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TIP75, TIP75A, TIP75B, TIP75C
N-P-N SILICON POWER TRANSISTORS

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PARAMETER MEASUREMENT INFORMATION



- 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: $t_r \leq 15\text{ ns}$, $t_f \leq 15\text{ ns}$, $Z_{out} = 50\ \Omega$, $t_w = 40\ \mu\text{s}$, duty cycle $\leq 2\%$.
 C. Waveforms are monitored on an X-Y 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.
 F. Heavy lines denote copper bus 0.5 inch by 0.125 inch (12.7 mm by 3.2 mm) fabricated to have minimum inductance.
 G. Adjust input pulse duration until collector current is 3 A at point "X". I_{CM} must not exceed 5 A.

FIGURE 1. COLLECTOR-EMITTER SUSTAINING VOLTAGE TEST

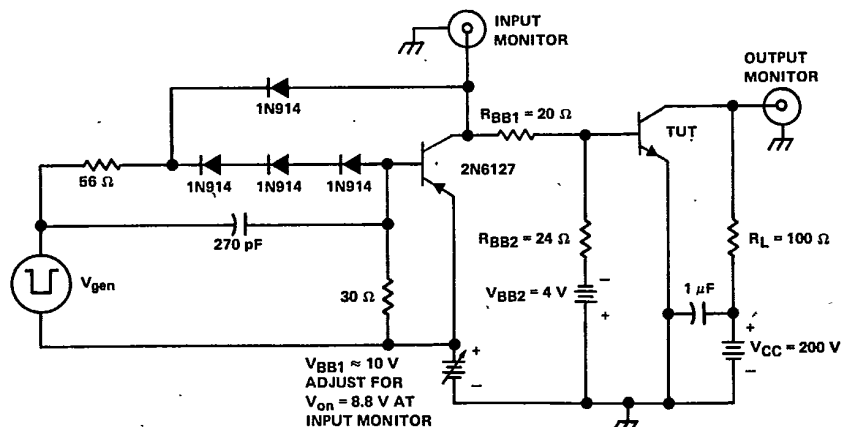
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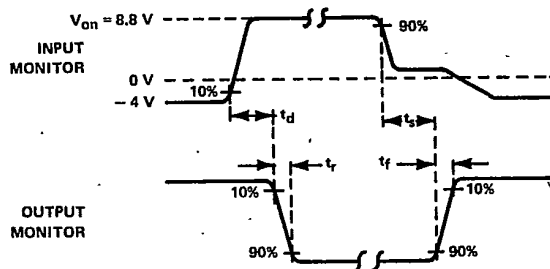
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N-P-N SILICON POWER TRANSISTORS

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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 a generator with the following characteristics: t_r ≤ 15 ns, t_f ≤ 15 ns, Z_{out} = 50 Ω , t_w = 20 μ s, duty cycle ≤ 2%.
 C. Waveforms are monitored on an oscilloscope with the following characteristics: t_r ≤ 15 ns, R_{in} ≥ 10 M Ω , 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 2. RESISTIVE-LOAD SWITCHING

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TIP Devices

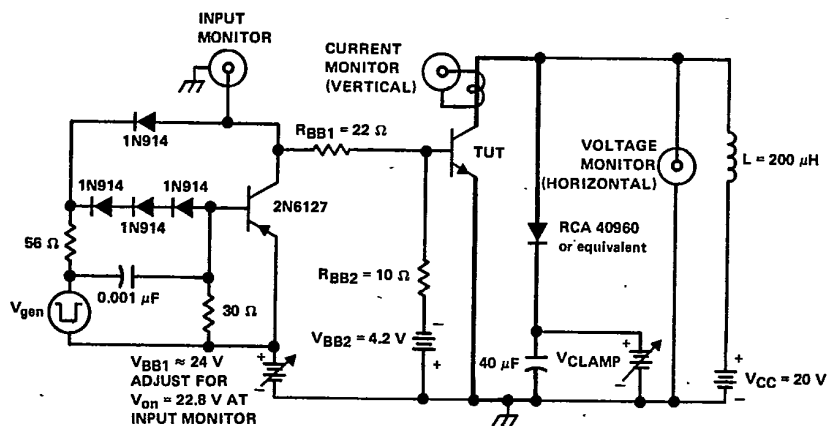
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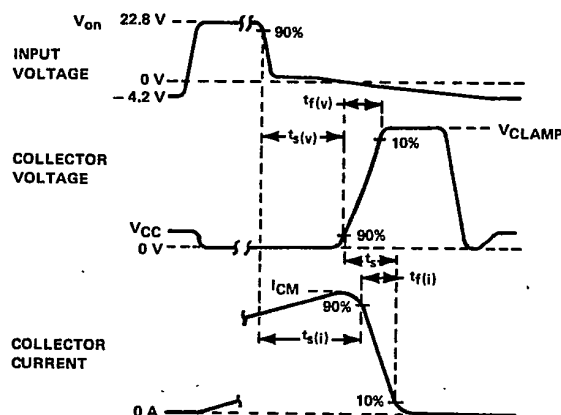
TIP75, TIP75A, TIP75B, TIP75C
N-P-N SILICON POWER TRANSISTORS

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PARAMETER MEASUREMENT INFORMATION



TEST CIRCUIT



WAVEFORMS

- NOTES:
- V_{gen} is a $\sim 30\text{-V}$ pulse into a 50Ω termination.
 - The V_{gen} waveform is supplied by a generator with the following characteristics: $t_r \leq 15 \text{ ns}$, $t_f \leq 15 \text{ ns}$, $Z_{out} = 50 \Omega$, $t_w \approx 25 \mu\text{s}$, duty cycle $\leq 2\%$. Pulse duration is adjusted for $I_{CM} = 3 \text{ A}$.
 - Waveforms are monitored on an oscilloscope with the following characteristics: $t_r \leq 15 \text{ ns}$, $R_{in} \geq 10 \text{ M}\Omega$, $C_{in} \leq 11.5 \text{ pF}$.
 - Resistors must be noninductive types.
 - The d-c power supplies may require additional bypassing in order to minimize ringing.
 - Heavy lines denote copper bus 0.5 inch by 0.125 (12.7 mm by 3.2 mm) fabricated to have minimum inductance.

FIGURE 3. INDUCTIVE-LOAD SWITCHING TIMES.

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TYPICAL CHARACTERISTICS

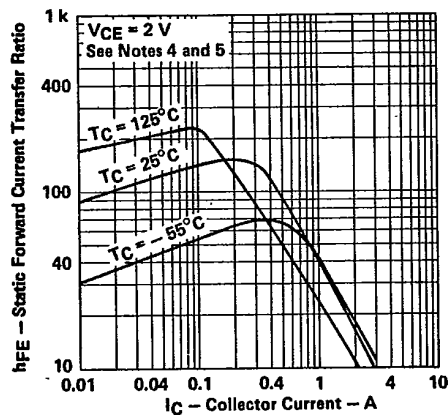
STATIC FORWARD CURRENT TRANSFER RATIO
vs
COLLECTOR CURRENT

FIGURE 4

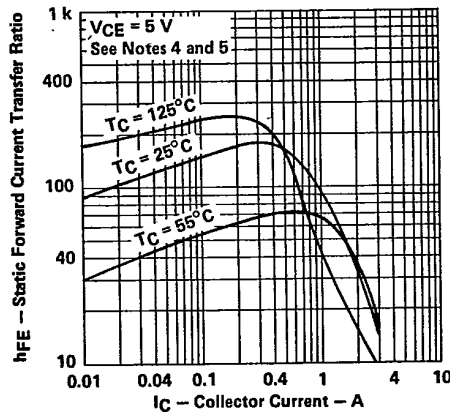
STATIC FORWARD CURRENT TRANSFER RATIO
vs
COLLECTOR CURRENT

FIGURE 5

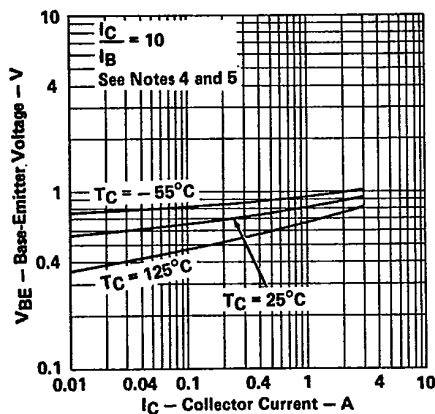
BASE-EMITTER VOLTAGE
vs
COLLECTOR CURRENT

FIGURE 6

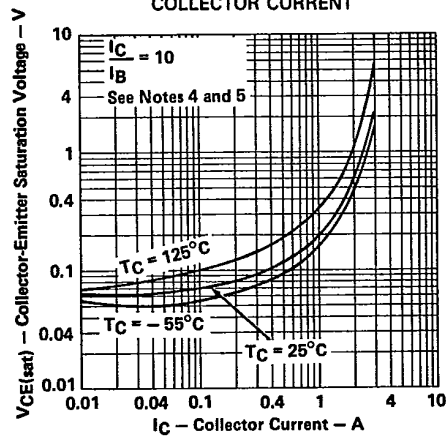
COLLECTOR-EMITTER SATURATION VOLTAGE
vs
COLLECTOR CURRENT

FIGURE 7

- NOTES: 4. These parameters must be measured using pulse techniques, $t_W = 300 \mu s$, duty cycle $< 2\%$.
5. 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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TIP75, TIP75A, TIP75B, TIP75C
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TYPICAL CHARACTERISTICS

COLLECTOR CUTOFF CURRENT
vs
TEMPERATURE

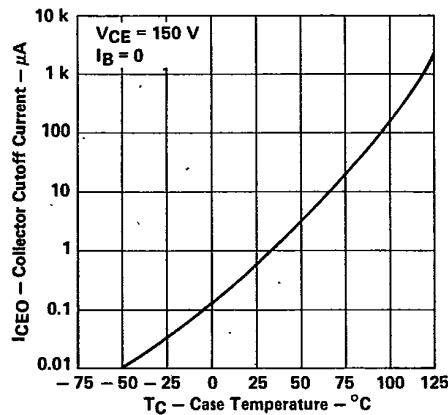


FIGURE 8

COLLECTOR CUTOFF CURRENT
vs
TEMPERATURE

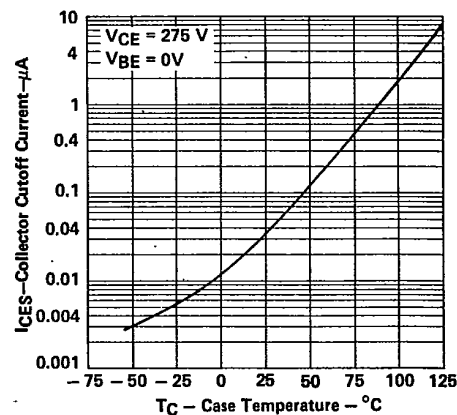


FIGURE 9

MAXIMUM SAFE OPERATING AREA

FORWARD-BIAS SAFE OPERATING AREA

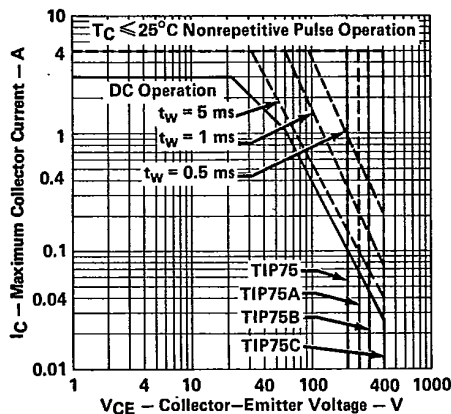


FIGURE 10

REVERSE-BIAS SAFE OPERATING AREA

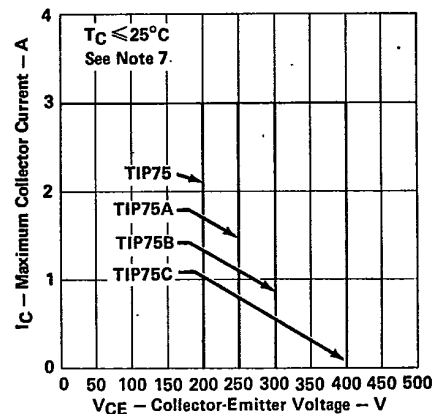


FIGURE 11

NOTE 6: This combination of maximum voltage and current may be achieved only when switching from saturation to cutoff with a clamped inductive load as in Figure 3.

TIP Devices

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THERMAL INFORMATION

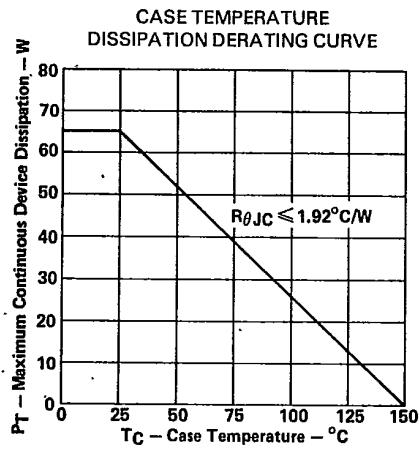


FIGURE 12

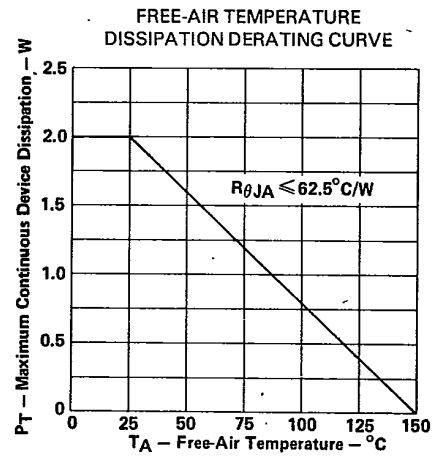


FIGURE 13

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TIP Devices