

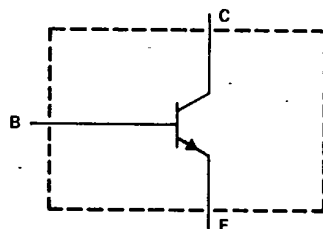
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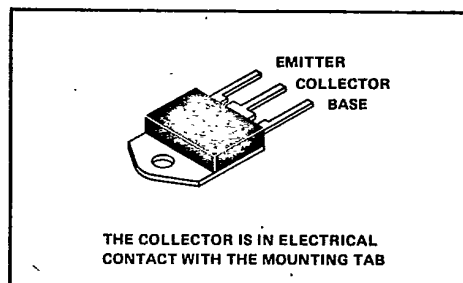
TIP55A, TIP56A, TIP57A, TIP58A
N-P-N SILICON POWER TRANSISTORS7-33-11
REVISED OCTOBER 1984

- Min $V_{(BR)CEO}$ of 250 V to 400 V
- 50 W at 100°C Case Temperature
- 10 A Peak Collector Current
- Designed for Automotive Ignition and Switching Regulator Applications
- Characterized For Operation In Ignition and Switching Regulator Applications
- High-Voltage, High Forward and Reverse Energy

device schematic



TO-218AA PACKAGE



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

	TIP55A	TIP56A	TIP57A	TIP58A
Collector-base voltage	350 V	400 V	450 V	500 V
Collector-emitter voltage ($I_B = 0$)	250 V	300 V	350 V	400 V
Emitter-base voltage	8 V	8 V	8 V	8 V
Continuous collector current	7.5 A			
Peak collector current (see Note 1)	10 A			
Continuous base current	4 A			
Safe operating area	See Figure 8			
Continuous device dissipation at (or below) 100°C case temperature (see Note 2)	50 W			
Continuous device dissipation at (or below) 25°C free-air temperature (see Note 3)	3 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	300°C			

- NOTES: 1. This value applies for $t_W \leq 10$ 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 24 mW/°C or refer to Dissipation Derating Curve, Figure 10.

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TIP Devices

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electrical characteristics at 25°C case temperature

PARAMETER	TEST CONDITIONS	TIP55A		TIP56A		TIP57A		TIP58A		UNIT	
		MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP		MAX
$V_{(BR)CEO}$	$I_C = 20 \text{ mA}$, See Note 4	250			300			350			V
I_{CER}	$V_{CE} = 350 \text{ V}$, $R_{BE} = 27 \Omega$		100								μA
	$V_{CE} = 400 \text{ V}$, $R_{BE} = 27 \Omega$				100						
	$V_{CE} = 450 \text{ V}$, $R_{BE} = 27 \Omega$						100				
	$V_{CE} = 500 \text{ V}$, $R_{BE} = 27 \Omega$								100		
I_{EBO}	$V_{EB} = 8 \text{ V}$, $I_C = 0$		100		100			100		100	μA
h_{FE}	$V_{CE} = 2 \text{ V}$, $I_C = 1 \text{ A}$, See Notes 4 and 5	10		100	10		100	10		100	
	$V_{CE} = 2 \text{ V}$, $I_C = 5 \text{ A}$, See Notes 4 and 5	6			6			6			
$V_{BE(sat)}$	$I_B = 1 \text{ A}$, $I_C = 5 \text{ A}$, See Notes 4 and 5			1.5		1.5			1.5		V
$V_{CE(sat)}$	$I_B = 1 \text{ A}$, $I_C = 5 \text{ A}$, See Notes 4 and 5			1.2		1.2		1.2		1.2	V
	$I_B = 4 \text{ A}$, $I_C = 10 \text{ A}$, See Notes 4 and 5			2.5		2.5		2.5		2.5	

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

thermal characteristics

PARAMETER	MIN	TYP	MAX	UNIT
$R_{\theta JC}$			1	$^{\circ}\text{C/W}$
$R_{\theta JA}$		41.7		
$R_{\theta CHS}$ (see Note 6)		0.6		$^{\circ}\text{C/W}$
$C_{\theta C}$		1.4		

NOTE 6: This parameter must be measured using a (0.003 inch) mica insulator with Dow-Corning 11 compound on both sides of the insulator, 6-32 mounting screws with bushing, and a mounting torque of 8 inch-pounds.

resistive-load switching characteristics at 25°C case temperature

PARAMETER	TEST CONDITIONS†	MIN	TYP	MAX	UNIT
t_d	$I_C = 5 \text{ A}$, $I_{B1} = 1 \text{ A}$, $I_{B2} = -1 \text{ A}$, $V_{BE(off)} = -4 \text{ V}$, $R_L = 40 \Omega$, See Figure 1		0.04		μs
t_r			0.13		
t_s			1.5		
t_f			0.2		

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

functional tests at 25°C free-air temperature

TEST	TEST CONDITIONS	LEVEL
Power ($V_{CE} \cdot I_C$)	$V_{CE} = 50 \text{ V}$, $I_C = 2 \text{ A}$, $t_{test} = 0.15 \text{ s}$	100 W
Reverse Pulse Energy $\left(\frac{I_C^2 L}{2} \right)$	$I_{CM} = 5 \text{ A}$, $L = 2 \text{ mH}$, $f = 10 \text{ Hz}$, $t_{test} = 0.5 \text{ s}$, See Figure 2	25 mJ
Forward Pulse Energy $\left(\frac{I_C^2 L}{2} \right)$	$I_{CM} = 10 \text{ A}$, $L = 5 \text{ mH}$, $V_{clamp} = V_{CEO \text{ max rating}}$, $f = 60 \text{ Hz}$, $t_{test} = 0.5 \text{ s}$, See Figure 3	250 mJ
Operation as Commutating Switch	$I_{load} = 5 \text{ A}$, $V_{CC} = 0.8 V_{CEO \text{ max rating}}$, $f = 20 \text{ kHz}$, $t_{test} = 0.5 \text{ s}$, See Figure 4	

TIP Devices

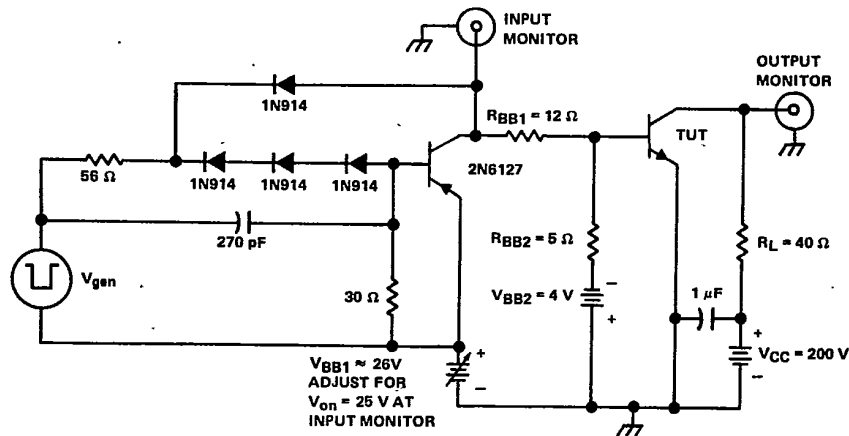
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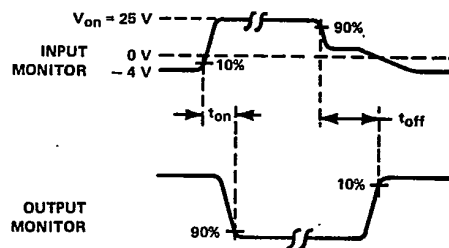
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N-P-N SILICON POWER TRANSISTORS

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PARAMETER MEASUREMENT INFORMATION



TEST CIRCUIT



VOLTAGE WAVEFORMS

- NOTES:
- A. V_{gen} is a $\sim 30\text{-V}$ 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

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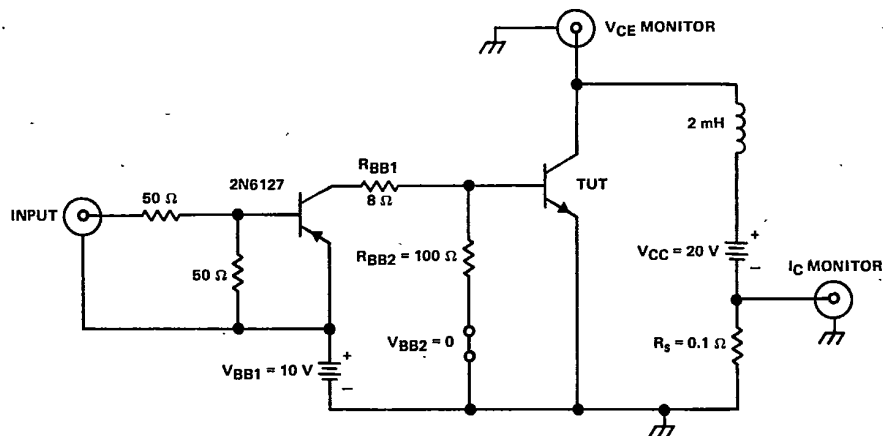
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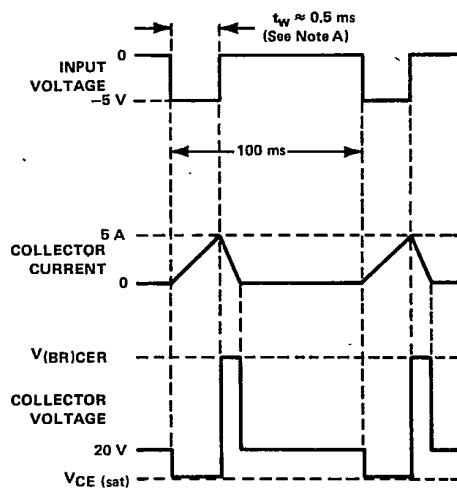
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FUNCTIONAL TEST INFORMATION



TEST CIRCUIT



VOLTAGE AND CURRENT WAVEFORMS

NOTE A: Input pulse duration is increased until $I_{CM} = 5$ A.

FIGURE 2. REVERSE PULSE ENERGY

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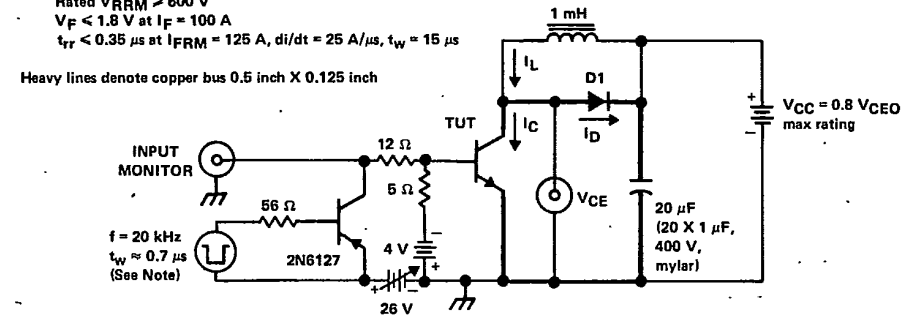
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FUNCTIONAL TEST INFORMATION

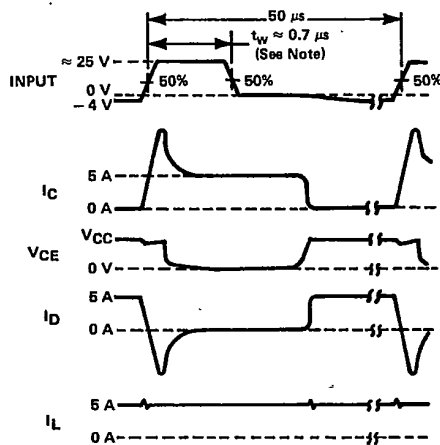
D1: RCA 40960 (or equivalent)

Rated $I_{FM} > 125$ ARated $V_{RRM} > 600$ V $V_F < 1.8$ V at $I_F = 100$ A $t_{rr} < 0.35$ μ s at $I_{FRM} = 125$ A, $di/dt = 25$ A/ μ s, $t_W = 15$ μ s

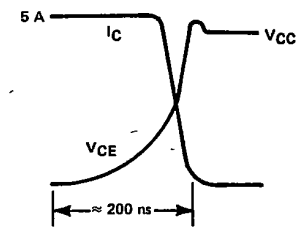
Heavy lines denote copper bus 0.5 inch X 0.125 inch



TEST CIRCUIT



WAVEFORMS

NOTE: Increase pulse duration until $I_C = 5$ A following its peak.

COLLECTOR VOLTAGE AND COLLECTOR CURRENT WAVEFORM DETAIL

FIGURE 4. OPERATION AS COMMUTATING SWITCH

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TYPICAL CHARACTERISTICS

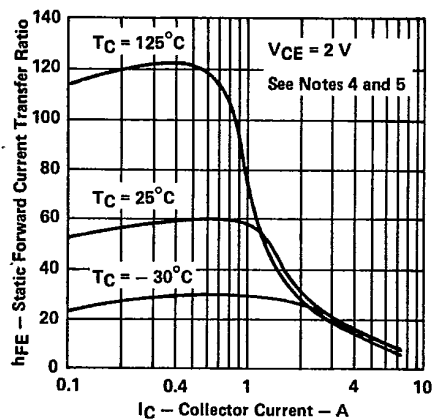
STATIC FORWARD CURRENT TRANSFER RATIO
vs
COLLECTOR CURRENT

FIGURE 5

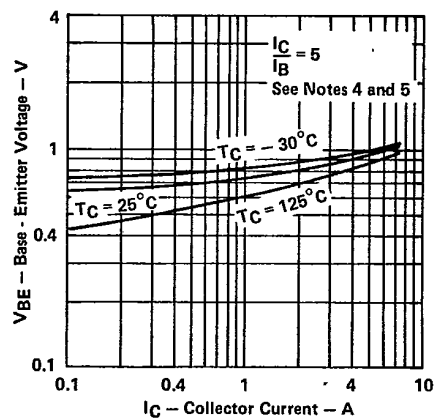
BASE-EMITTER VOLTAGE
vs
COLLECTOR CURRENT

FIGURE 6

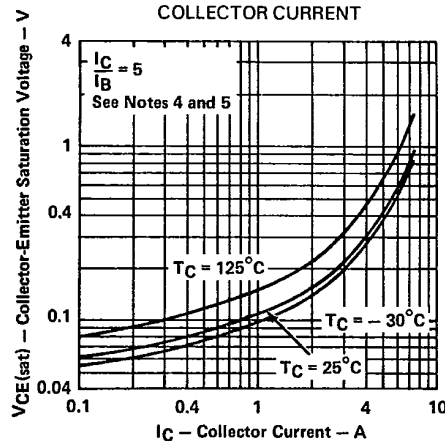
COLLECTOR-EMITTER SATURATION VOLTAGE
vs
COLLECTOR CURRENT

FIGURE 7

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

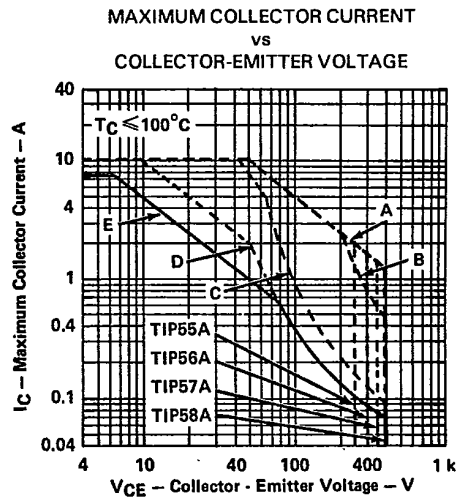
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MAXIMUM SAFE OPERATING AREA



CURVE	CONDITIONS
A	$t_W = 100 \mu\text{s}, d = 0.1 = 10\%$
B	$t_W = 1 \text{ ms}, d = 0.1 = 10\%$
C	$t_W = 10 \text{ ms}, d = 0.1 = 10\%$
D	$t_W = 150 \text{ ms}, d = 0.01 = 1\%$
E	D C OPERATION

FIGURE 8

THERMAL INFORMATION

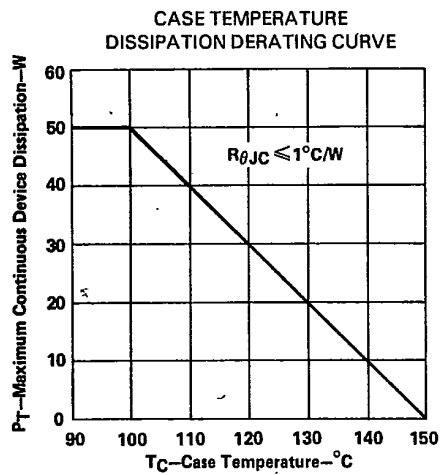


FIGURE 9

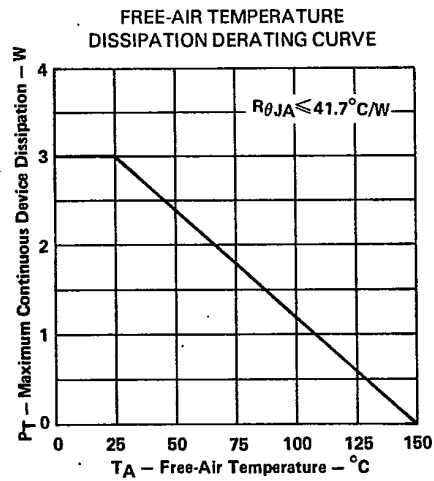


FIGURE 10

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