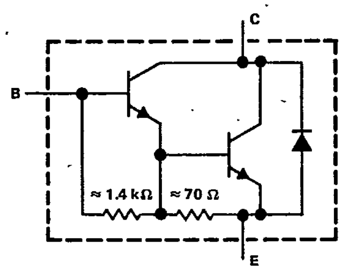
TIP600, TIP601, TIP602 N-P-N DARLINGTON-CONNECTED SILICON POWER TRANSISTORS

REVISED OCTOBER 1984

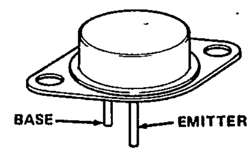
T-33-29

- Designed For Complementary Use With TIP605, TIP606, TIP607
- 100 W at 25°C Case Temperature
- 10 A Rated Collector Current
- Min h_{FE} of 200 at 4 V, 10 A
- Max I_{CEO} of 50 μA
- Max $V_{CE(sat)}$ of 2.5 V at I_C = 10 A
- Similar to 2N6055, 2N6056, 2N6383, 2N6384, 2N6385

device schematic



TO-3 PACKAGE



THE COLLECTOR IS IN ELECTRICAL CONTACT WITH THE CASE

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

	TIP600	TIP601	TIP602
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	1 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)	100 W		
Continuous device dissipation at (or below) 25°C free-air temperature (see Note 3)	5 W		
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	300°C		

NOTES: 1. This value applies for $t_w \leq 0.3$ ms, duty cycle ≤ 10%.
2. Derate linearly to 200°C case temperature at the rate of 0.57 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.

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electrical characteristics at 25°C case temperature

PARAMETER	TEST CONDITIONS		TIP600 MIN	TIP600 TYP	TIP600 MAX	TIP601 MIN	TIP601 TYP	TIP601 MAX	TIP602 MIN	TIP602 TYP	TIP602 MAX	UNIT
$V_{(BR)CEO}$	$I_C = 30\,mA$, See Note 4	$I_B = 0$,	60			80			100			V
I_{CEO}	$V_{CE} = 30\,V$,	$I_B = 0$			50							µA
	$V_{CE} = 40\,V$,	$I_B = 0$						50				
	$V_{CE} = 50\,V$,	$I_B = 0$									50	
I_{CBO}	$V_{CB} = 60\,V$,	$I_E = 0$			50							µA
	$V_{CB} = 80\,V$,	$I_E = 0$						50				
	$V_{CB} = 100\,V$,	$I_E = 0$									50	
I_{EBO}	$V_{EB} = 5\,V$,	$I_C = 0$			8			8			8	mA
h_{FE}	$V_{CE} = 4\,V$, See Notes 4 and 5	$I_C = 3\,A$,	1000		20000	1000		20000	1000		20000	
	$V_{CE} = 4\,V$, See Notes 4 and 5	$I_C = 10\,A$,	200			200			200			
V_{BE}	$V_{CE} = 4\,V$, See Notes 4 and 5	$I_C = 10\,A$,			2.8			2.8			2.8	V
$V_{CE(sat)}$	$I_B = 6\,mA$, See Notes 4 and 5	$I_C = 3\,A$,			2			2			2	V
	$I_B = 100\,mA$, See Notes 4 and 5	$I_C = 10\,A$,			2.5			2.5			2.5	
V_F	$I_F = 10\,A$,	See Notes 4 and 5			3.5			3.5			3.5	V

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.

thermal characteristics

PARAMETER		MIN	TYP	MAX	UNIT
$R_{\theta JC}$				1.75	°C/W
$R_{\theta JA}$				35	
$R_{\theta CHS}$	See Note 6		0.4		

NOTE 6: This parameter is measured using a 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 characteristic at 25°C case temperature

PARAMETER	TEST CONDITIONS†	MIN	TYP	MAX	UNIT
t_d	$I_C = 8\,A$, $I_{B1} = 80\,mA$, $I_{B2} = -80\,mA$, $V_{BE(off)} = -5\,V$, $R_L = 5\,\Omega$, See Figure 1		0.035		µs
t_r			0.35		
t_s			1.8		
t_f			2.45		

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

functional tests at 25°C free-air temperature

TEST	CONDITIONS	LEVEL
Power ($V_{CE} \cdot I_C$)	$V_{CE} = 40\,V$, $I_C = 2\,A$, $t_{test} = 0.15\,s$	80 W
Reverse Pulse Energy $\left(\frac{I_C^2 L}{2}\right)$	$I_{CM} = 1\,A$, $L = 20\,mH$, $f = 10\,Hz$, $t_{test} = 0.5\,s$, See Figure 2	10 mJ

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PARAMETER MEASUREMENT INFORMATION

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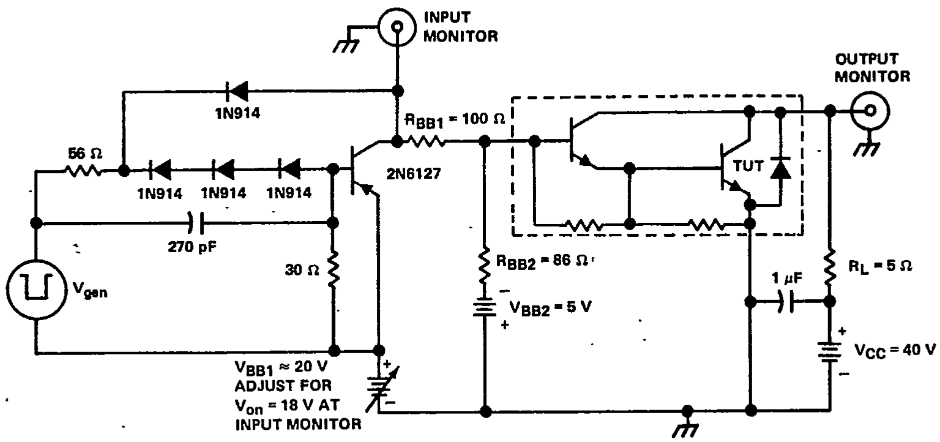
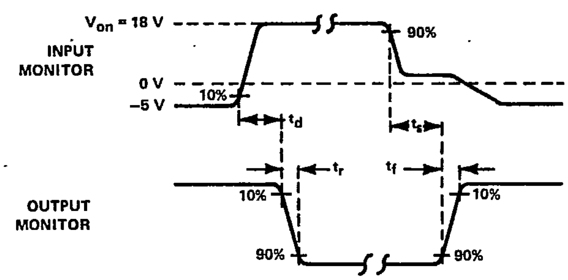


TEST CIRCUIT



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 Ω, t_w = 20 µs, duty cycle ≤ 2 %.
C. Waveforms are monitored on an oscilloscope with the following characteristics: $t_r \leq 15$ ns, $R_{in} \geq 10$ MΩ, $C_{in} \leq 11.5$ 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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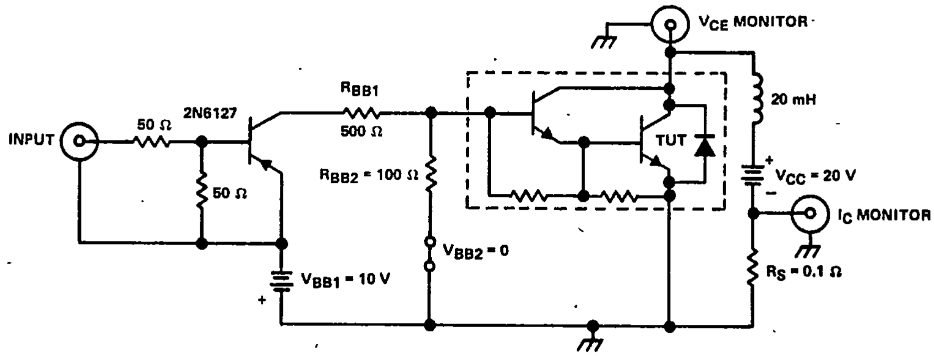
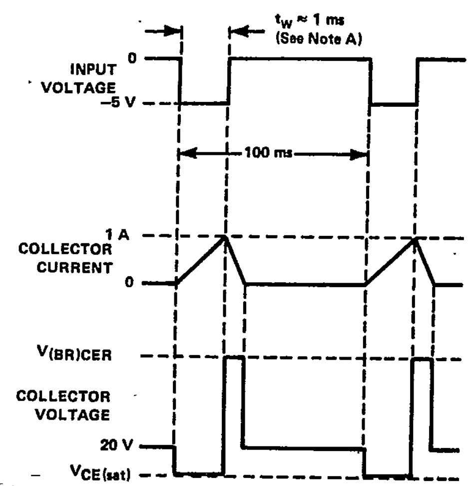
PARAMETER MEASUREMENT INFORMATION



TEST CIRCUIT



VOLTAGE AND CURRENT WAVEFORMS

NOTE A: Input pulse duration is increased until I_{CM} = 1 A.

FIGURE 2. INDUCTIVE-LOAD SWITCHING

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TYPICAL CHARACTERISTICS

STATIC FORWARD CURRENT TRANSFER RATIO
vs
COLLECTOR CURRENT

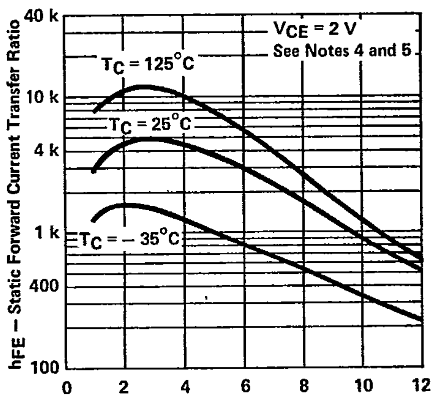

FIGURE 3

STATIC FORWARD CURRENT TRANSFER RATIO
vs
COLLECTOR CURRENT

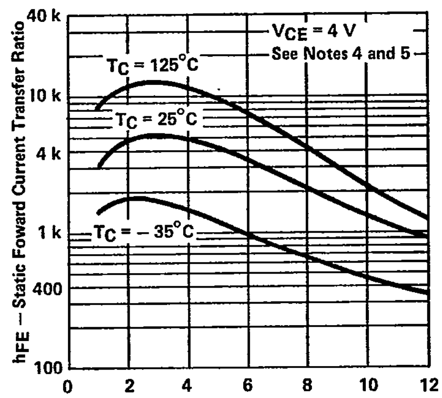

FIGURE 4

COLLECTOR-EMITTER
SATURATION VOLTAGE
vs
COLLECTOR CURRENT

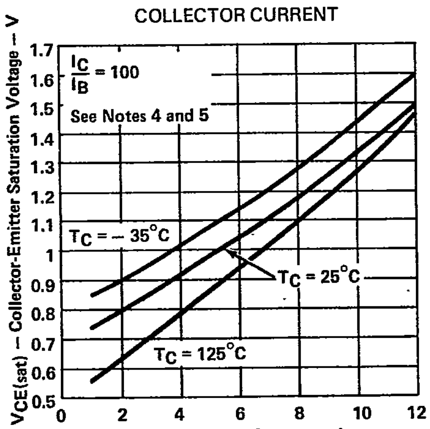

FIGURE 5

BASE-EMITTER VOLTAGE
vs
COLLECTOR CURRENT

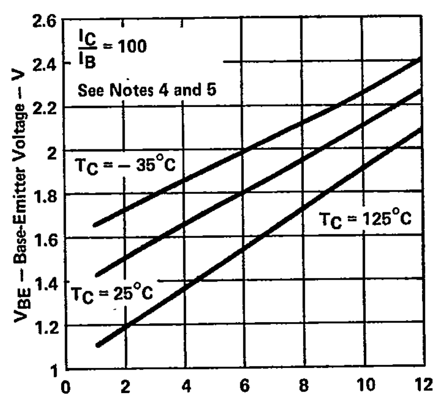

FIGURE 6

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TIP Devices

NOTES: 4. These parameters must be measured using pulse techniques, t_w = 300 μs, duty cycle ≤ 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

MAXIMUM COLLECTOR CURRENT
vs
COLLECTOR-EMITTER VOLTAGE

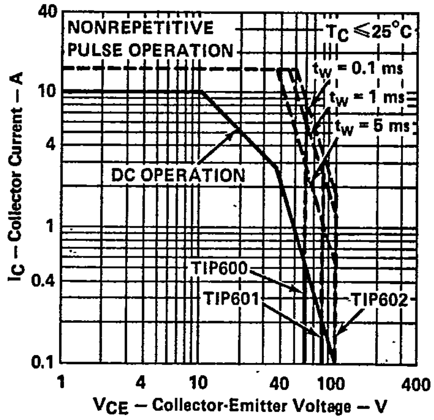

FIGURE 7

MAXIMUM COLLECTOR CURRENT
vs
UNCLAMPED INDUCTIVE LOAD

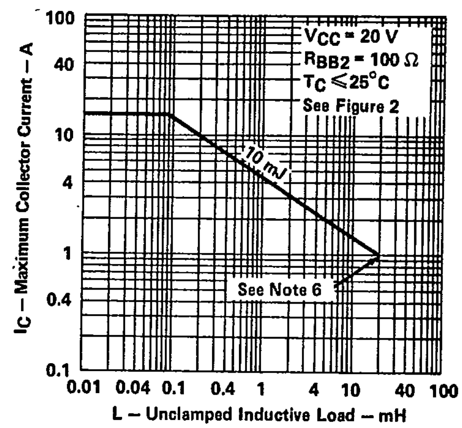

FIGURE 8

NOTE 6: Above this point the safe operating area has not been defined.

THERMAL INFORMATION

CASE TEMPERATURE
DISSIPATION DERATING CURVE

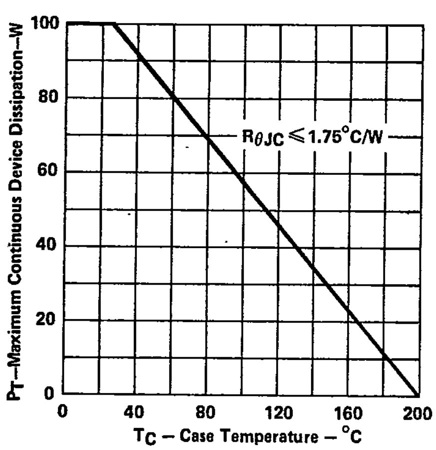

FIGURE 9

FREE-AIR TEMPERATURE
DISSIPATION DERATING CURVE

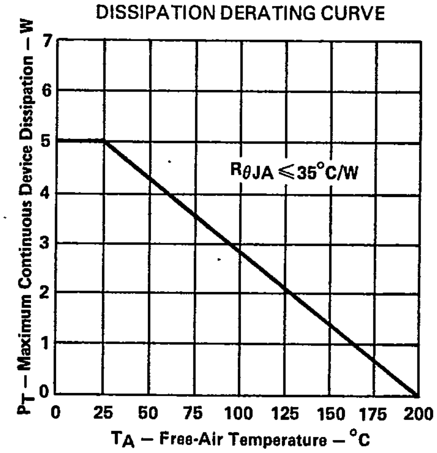

FIGURE 10

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