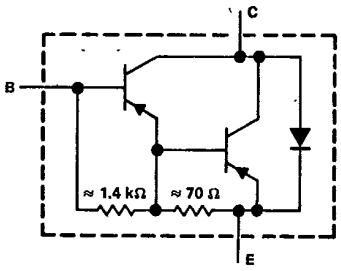
TIP105, TIP106, TIP107
P-N-P DARLINGTON CONNECTED SILICON POWER TRANSISTORS

REVISED OCTOBER 1984

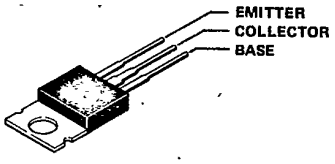
T-33-31

- Designed for Complementary Use with TIP100, TIP101, TIP102
- 80 W at 25°C Case Temperature
- 8 A Continuous Collector Current
- Min h_{FE} of 200 at 4 V, 8 A
- Max I_{CEO} of 50 μA
- Max $V_{CE(sat)}$ of 2.5 V at I_C = 8 A
- Designed to Replace:
  - 2N6042 Series
  - MJE6042 Series
  - SE9402 Series
  - RCA8203B Series

device schematic



TO-220AB PACKAGE



THE COLLECTOR IS IN ELECTRICAL CONTACT WITH THE MOUNTING TAB

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

	TIP105	TIP106	TIP107
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	−8 A		
Peak collector current (see Note 1)	−15 A		
Continuous base current	−1 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)	80 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 $t_w \leq 0.3$ ms, duty cycle ≤ 10%.
2. Derate linearly to 150°C case temperature at the rate of 0.64 W/C or refer to Dissipation Derating Curve, Figure 9.
3. Derate linearly to 150°C free-air temperature at the rate of 16 mW/C or refer to Dissipation Derating Curve, Figure 10.

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electrical characteristics at 25°C case temperature

PARAMETER	TEST CONDITIONS		TIP105			TIP106			TIP107			UNIT
			MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX	
$V_{(BR)CEO}$	$I_C = -30$ mA, See Note 5	$I_B = 0$,	−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		20 000	1000		20 000	1000		20 000	
	$V_{CE} = -4$ V, See Notes 4 and 5	$I_C = -8$ A,	200			200			200			
V_{BE}	$V_{CE} = -4$ V, See Notes 4 and 5	$I_C = -8$ 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
	$I_B = -80$ mA, See Notes 4 and 5	$I_C = -8$ A,			−2.5			−2.5			−2.5	
V_F	$I_F = 8$ A, See Notes 4 and 5	$I_B = 0$,			3.5			3.5			3.5	V

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.

thermal characteristics

PARAMETER	MIN	TYP	MAX	UNIT
$R_{\theta JC}$			1.56	°C/W
$R_{\theta JA}$			62.5	°C/W
$R_{\theta CHS}$ (see Note 6)		0.7		°C/W
$C_{\theta C}$		0.9		J/C

NOTE: 6 This parameter is measured using a 0,08 mm (0.003 inch) mica insulator with Dow-Corning 11 compound or 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	$I_C = -8$ A,	$I_{B1} = -80$ mA,	$I_{B2} = 80$ mA,		0.035		μs
t_r	$V_{BE(off)} = 5$ V,	$R_L = 5\ \Omega$,	See Figure 1		0.3		μs
t_s					0.9		μs
t_f					1.3		μs

† 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 ($V_{CE} \cdot I_C$)	$V_{CE} = -40$ 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, $t_{test} = 0.5$ s,	L = 20 mH, See Figure 2	f = 10 Hz,	10 mJ

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PARAMETER MEASUREMENT INFORMATION

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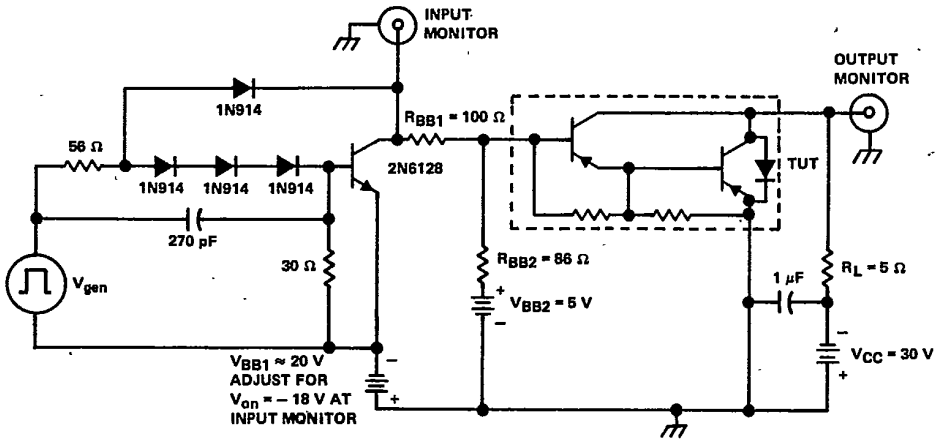
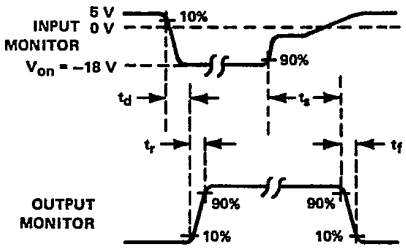


TEST CIRCUIT



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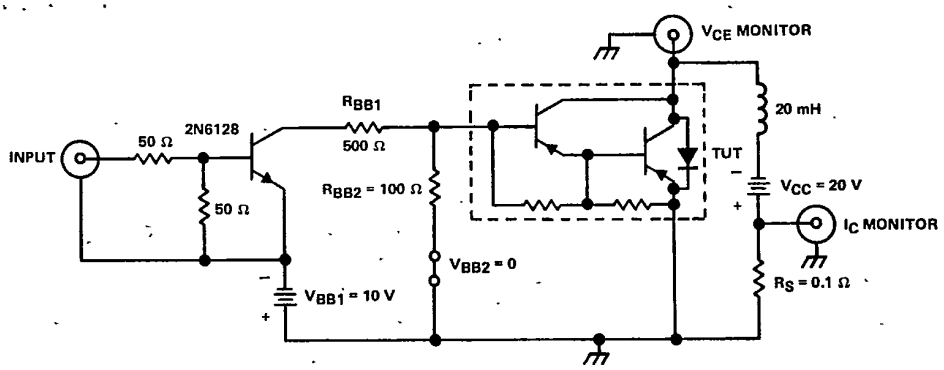
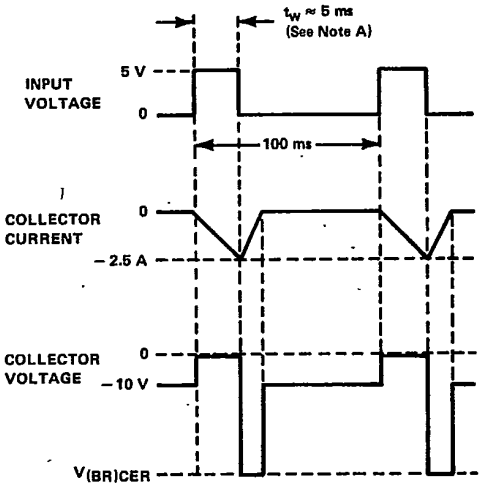
PARAMETER MEASUREMENT INFORMATION



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

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STATIC FORWARD CURRENT TRANSFER RATIO
vs
COLLECTOR CURRENT

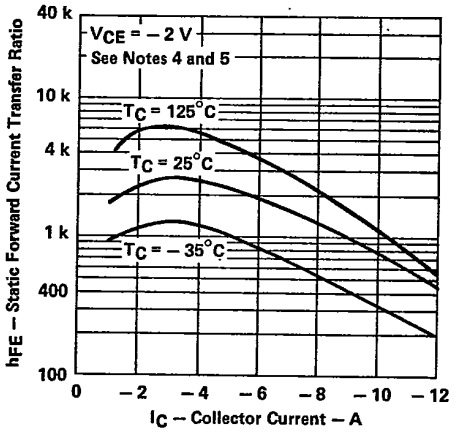

FIGURE 3

STATIC FORWARD CURRENT TRANSFER RATIO
vs
COLLECTOR CURRENT

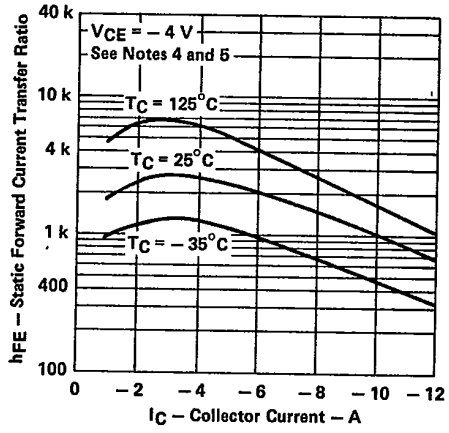

FIGURE 4

COLLECTOR-EMITTER SATURATION VOLTAGE
vs
COLLECTOR CURRENT

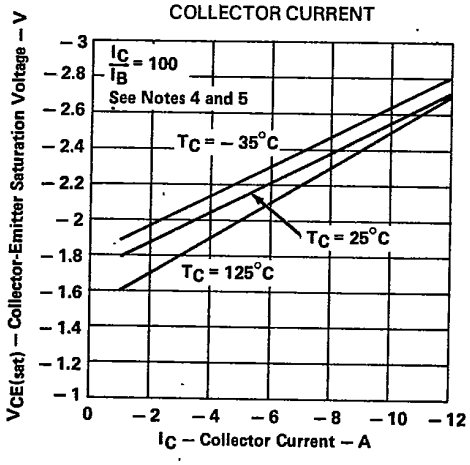

FIGURE 5

BASE-EMITTER VOLTAGE
vs
COLLECTOR CURRENT

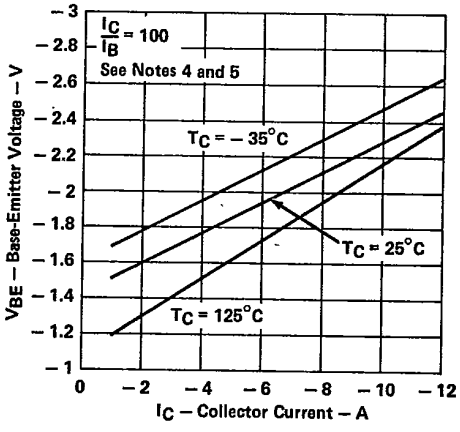

FIGURE 6

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 and 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

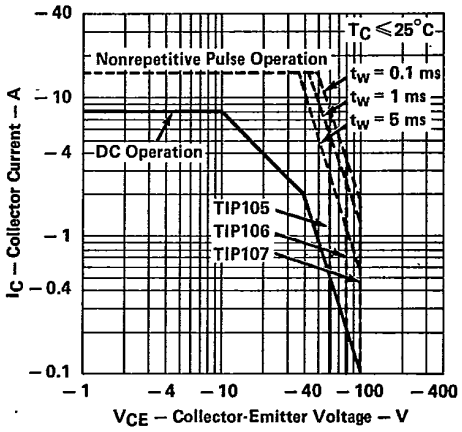

FIGURE 7

MAXIMUM COLLECTOR CURRENT
vs
UNCLAMPED INDUCTIVE LOAD

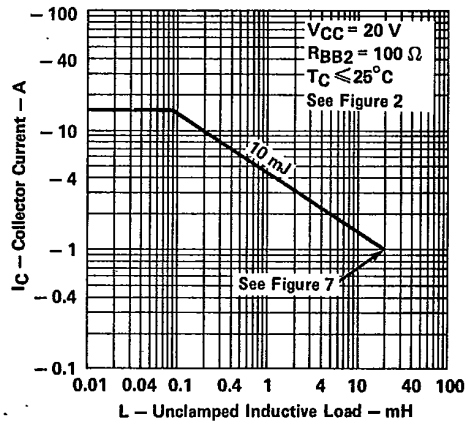

FIGURE 8

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

THERMAL INFORMATION

CASE TEMPERATURE
DISSIPATION DERATING CURVE

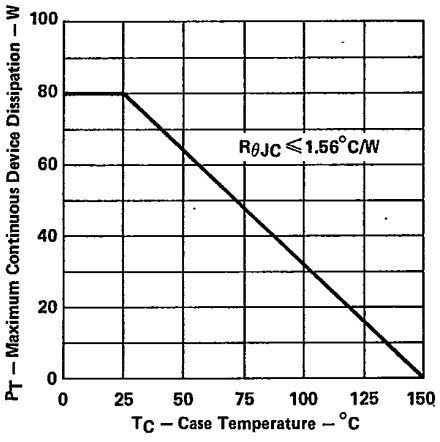

FIGURE 9

FREE-AIR TEMPERATURE
DISSIPATION DERATING CURVE

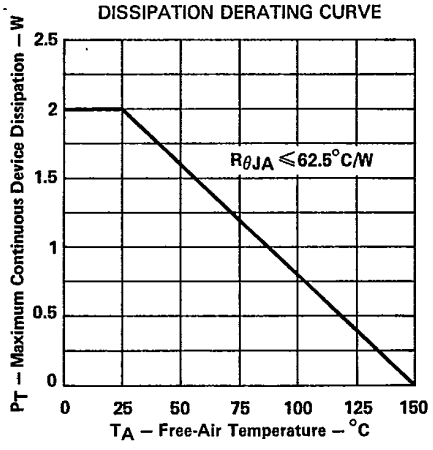

FIGURE 10

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1283

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This file is the datasheet for the following electronic components:

TIP107 - http://www.ti.com/product/tip107?HQS=TI-null-null-dscatalog-df-pf-null-wwe

TIP106 - http://www.ti.com/product/tip106?HQS=TI-null-null-dscatalog-df-pf-null-wwe

TIP105 - http://www.ti.com/product/tip105?HQS=TI-null-null-dscatalog-df-pf-null-wwe