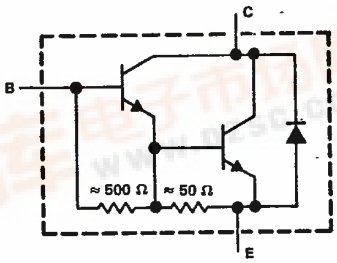
TIPL774
N-P-N DARLINGTON-CONNECTED SILICON POWER TRANSISTOR

OCTOBER 1982 – REVISED OCTOBER 1984

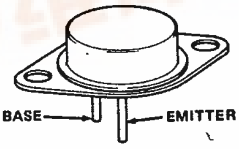
T-33-29

- 20 A Continuous Collector Current
- 150 W at 50°C Case Temperature
- Forward-Bias SOA . . . 30 V, 5 A
- Reverse-Bias SOA . . . 450 V, 15 A
- Forward Pulse Energy . . . 300 mJ
- V_{CEO} . . . 450 V Min
- High-Voltage, High-Forward and Clamped Reverse Energy
- Designed for Ignition Systems, Motor Controls, and Solenoid Driver Applications

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)

	TIPL774
Collector-base voltage	550 V
Collector-emitter voltage (I_B = 0)	450 V
Emitter-base voltage	8 V
Continuous collector current	20 A
Peak collector current (see Note 1)	30 A
Continuous base current	3 A
Continuous device dissipation at (or below) 50°C case temperature (see Note 2)	150 W
Continuous device dissipation at (or below) 25°C free-air temperature (see Note 3)	5.5 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 $t_w \leq 5$ ms, duty cycle ≤ 10 %.
2. Derate linearly to 200°C case temperature at the rate of 1 W/°C or refer to Dissipation Derating Curve, Figure 8.
3. Derate linearly to 200°C free-air temperature at the rate of 31.4 mW/°C or refer to Dissipation Derating Curve, Figure 9.

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electrical characteristics at 25°C case temperature (unless otherwise noted)

PARAMETER	TEST CONDITIONS				TIPL774 MIN	TIPL774 TYP	TIPL774 MAX	UNIT
$V_{(BR)CBO}$	I_C = 1 mA,	I_E = 0,	See Note 4		550			V
$V_{(BR)CEO}$	I_C = 10 mA,	I_B = 0,	See Note 4		450			V
$V_{CER(sus)}$	I_C = 7 A,		See Figure 1		450			V
I_{CEO}	V_{CE} = 400 V,	I_B = 0					250	μA
	V_{CE} = 400 V,	I_B = 0,	T_C = 150°C				1	mA
I_{CES}	V_{CE} = 450 V,	V_{BE} = 0					250	μA
	V_{CE} = 450 V,	V_{BE} = 0,	T_C = 150°C				1	mA
I_{EBO}	V_{EB} = 1 V,	I_C = 0					5	mA
h_{FE}	I_C = 5 A,	V_{CE} = 10 V,	See Notes 4 and 5,	T_C = −30°C	200			
	I_C = 5 A,	V_{CE} = 10 V,	See Notes 4 and 5		300			
	I_C = 5 A,	V_{CE} = 10 V,	See Notes 4 and 5,	T_C = 125°C	500			
$V_{CE(sat)}$	I_C = 5 A,	I_B = 35 mA,	See Notes 4 and 5				2	V
	I_C = 15 A,	I_B = 1.5 A,	See Notes 4 and 5				3	
$V_{BE(sat)}$	I_C = 5 A,	I_B = 35 mA,	See Notes 4 and 5				2	V
V_F	I_F = 10 A,		See Notes 4 and 5				3	V
C_{obo}	V_{CE} = 20 V,	I_E = 0,	f = 0.1 MHz			120		pF

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.

thermal characteristics

PARAMETER		MIN	TYP	MAX	UNIT
$R_{\theta JC}$				1	°C/W
$R_{\theta JA}$				32	
$R_{\theta CHS}$	See Note 6		0.4		
$C_{\theta C}$			5.3		J/°C

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 with 0.138-32 mounting screws with bushings, and a mounting torque of 8 inch-pounds (0.9 newton-meters).

resistive-load switching characteristics at 25°C case temperature

PARAMETER	TEST CONDITIONS	MIN	TYP	MAX	UNIT
t_{on}	I_C = 5 A, I_{B1} = 70 mA,			5	μs
t_s	$V_{BE(off)}$ = 0 V, R_L = 100 Ω, See Figure 2			20	
t_f				10	

functional tests at 25°C free-air temperature

TEST	CONDITIONS	MIN	TYP	MAX	LEVEL
Forward Pulse Energy $\left(\frac{I_C^2 L}{2}\right)$	I_{CM} = 7 A, L = 12 mH, V_{CLAMP} = 400 V, f = 75 Hz, T_{test} = 1 s, See Figure 3			300	mJ

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PARAMETER MEASUREMENT INFORMATION

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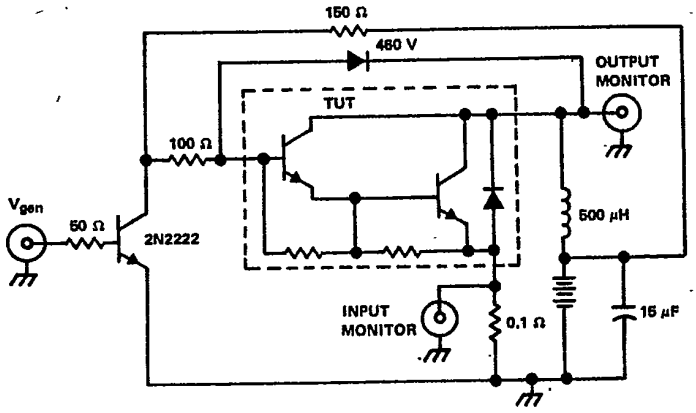
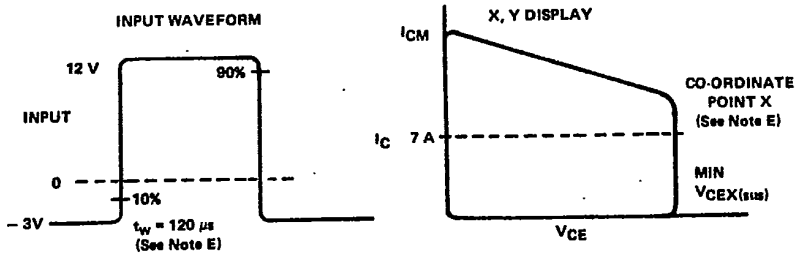


TEST CIRCUIT



WAVEFORMS

NOTES: A. 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 = 120 μs, duty cycle = 2%.
B. Waveforms are monitored on an X-Y oscilloscope with the following characteristics: t_r = 15 ns, R_{in} = 10 MΩ, C_{in} = 11.5 pF.
C. Resistors must be noninductive types.
D. The d-c power supplies may require additional bypassing in order to minimize ringing.
E. Adjust input pulse duration until collector current is 12 A at point 'X', I_{CM} must not exceed 30 A.

FIGURE 1. COLLECTOR-EMITTER SUSTAINING VOLTAGE

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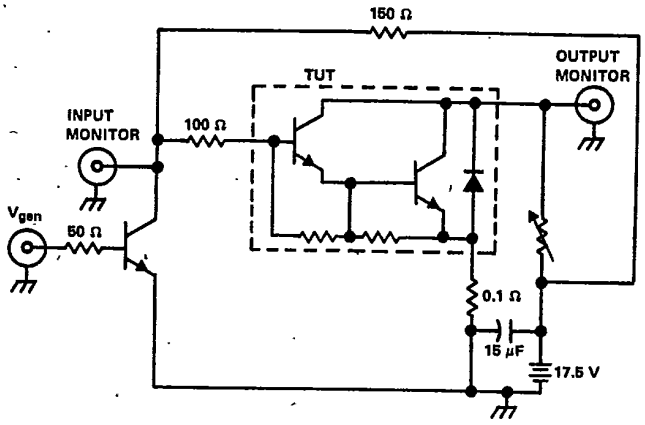
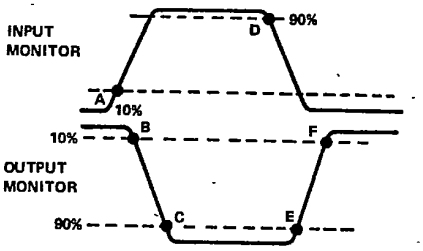
PARAMETER MEASUREMENT INFORMATION



TEST CIRCUIT



VOLTAGE WAVEFORMS

NOTES: A. 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 = 120 μs, duty cycle = 2%.
B. Waveforms are monitored on an X-Y oscilloscope with the following characteristics: t_r = 15 ns, R_{in} = 10 MΩ, C_{in} = 11.5 pF.
C. Resistors must be noninductive types.
D. The d-c power supplies may require additional bypassing in order to minimize ringing.

FIGURE 2. RESISTIVE-LOAD SWITCHING

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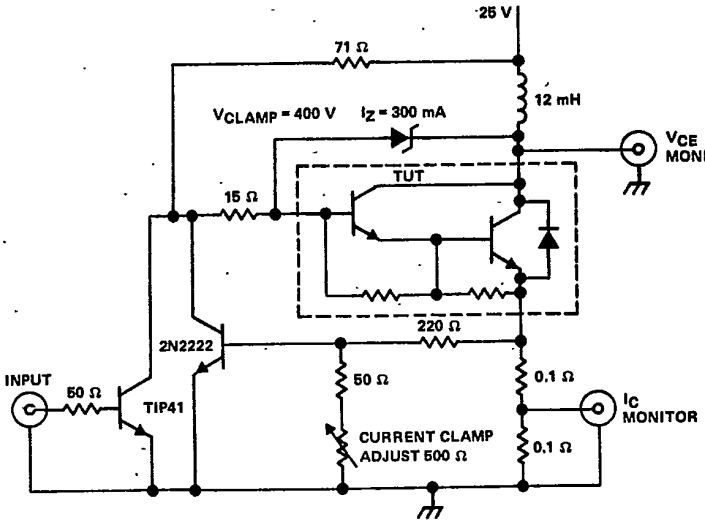
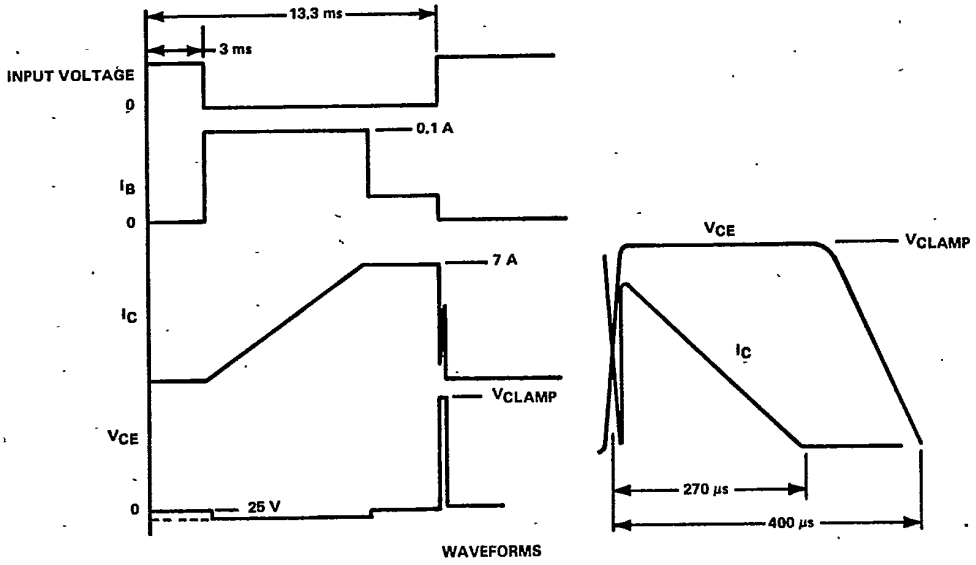
PARAMETER MEASUREMENT INFORMATION



TEST CIRCUIT



WAVEFORMS

NOTES: A. Base and collector currents are measured using probes such as Tektronix types P6019, P6020, P6042, or the equivalent.
B. Waveforms are monitored on an oscilloscope with the following characteristics: $t_r \leq 20$ ns, $R_{in} \geq 10$ MΩ, $C_{in} \leq 11.5$ pF.

FIGURE 3. FORWARD PULSE ENERGY

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TYPICAL CHARACTERISTICS

STATIC FORWARD CURRENT TRANSFER RATIO vs COLLECTOR CURRENT

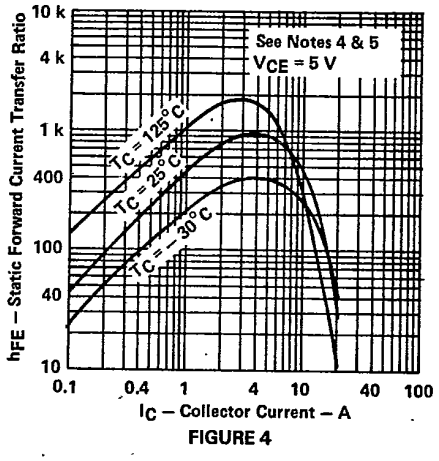

FIGURE 4

COLLECTOR-EMITTER SATURATION VOLTAGE vs COLLECTOR CURRENT

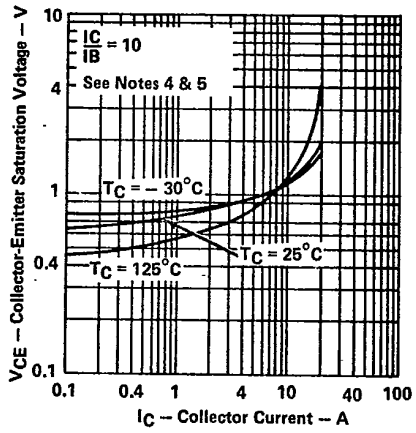

FIGURE 5

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.

MAXIMUM SAFE OPERATING AREA

FORWARD-BIAS SAFE OPERATING AREA

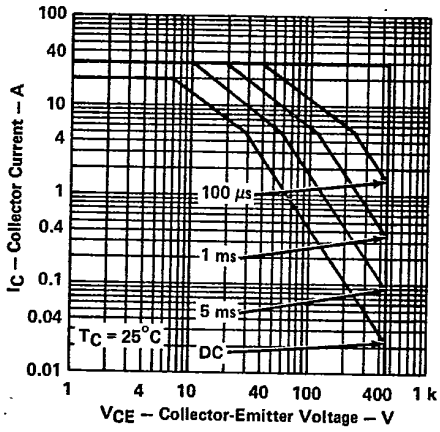

FIGURE 6

MAXIMUM COLLECTOR CURRENT vs CLAMPED COLLECTOR-EMITTER VOLTAGE

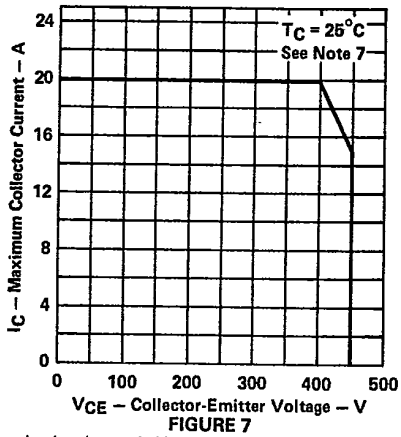

FIGURE 7

NOTE 7: This combination of maximum voltage and current may be achieved only when switching from saturation to cut-off with a clamped inductive load as in Figure 1, V_{BB} = 0, R_{BB} = 100 Ω.

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THERMAL INFORMATION

CASE TEMPERATURE
DISSIPATION DERATING CURVE

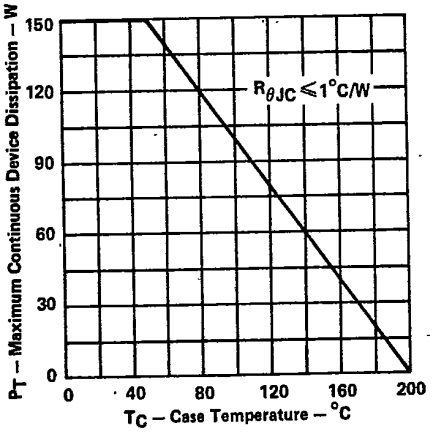

FIGURE 8

FREE-AIR TEMPERATURE
DISSIPATION DERATING CURVE

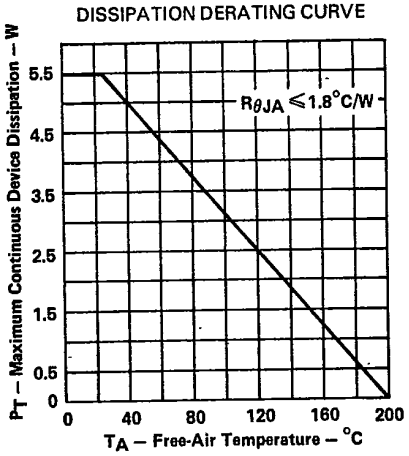

FIGURE 9