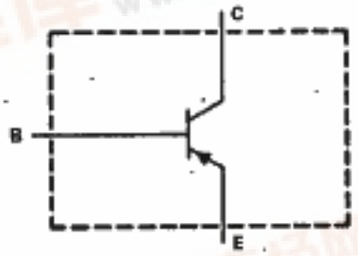
TIP74, TIP74A, TIP74B, TIP74C
P-N-P SILICON POWER TRANSISTORS

FEBRUARY 1977 – REVISED OCTOBER 1984

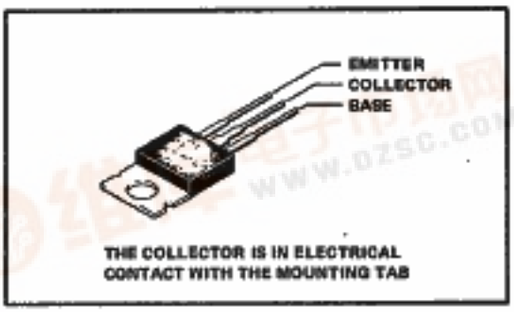
T-33-21

- Designed for Complementary Use with TIP73, TIP73A, TIP73B, TIP73C
- 80 W at 25°C Case Temperature
- 15 A Continuous Collector Current
- Min f_T of 5 MHz at 4 V, 1 A
- Meet or Surpass all JEDEC Registered Specifications for 2N6489, 2N6490, and 2N6491 at 25°C
- Designed for Power Amplifier and High-Speed Switching Applications

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)

	TIP74	TIP74A	TIP74B	TIP74C
Collector-base voltage	−50 V	−70 V	−90 V	−110 V
Collector-emitter voltage (I_B = 0)	−40 V	−60 V	−80 V	−100 V
Emitter-base voltage	−5 V			
Continuous collector current	−15 A			
Continuous base current	−5 A			
Safe operating areas at (or below) 25°C case temperature	See Figure 9			
Continuous device dissipation at (or below) 25°C case temperature (see Note 1)	80 W			
Continuous device dissipation at (or below) 25°C free-air temperature (see Note 2)	2 W			
Unclamped inductive load energy (see Note 3)	90 mJ			
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. Derate linearly to 150°C case temperature at the rate of 0.64 W/°C or refer to Dissipation Derating Curve, Figure 10.
2. Derate linearly to 150°C free-air temperature at the rate of 16 mW/°C or refer to Dissipation Derating Curve, Figure 11.
3. This rating is based on the capability of the transistor to operate safely in the circuit of Figure 2. L = 20 mH, R_{BB2} = 100 Ω, V_{BB2} = 0 V, R_S = 0.1 Ω, V_{CC} = −20 V. Energy = $I_C^2L/2$.

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

PARAMETER	TEST CONDITIONS			TIP74			TIP74A			UNIT
				MIN	TYP	MAX	MIN	TYP	MAX	
$V_{(BR)CEO}$	$I_C = -200$ mA,	$I_B = 0$,	See Note 4	−40			−60			V
$V_{(BR)CEV}$	$I_C = -200$ mA,	$V_{BE} = 1.5$ V,	See Note 4	−60			−70			V
I_{CEO}	$V_{CE} = -30$ V,	$I_B = 0$				−50			−50	μA
I_{CES}	$V_{CE} = -40$ V,	$V_{BE} = 0$				−50				μA
	$V_{CE} = -60$ V,	$V_{BE} = 0$							−50	
I_{EBO}	$V_{EB} = -5$ V,	$I_C = 0$				−50			−50	μA
h_{FE}	$V_{CE} = -4$ V,	$I_C = -5$ A,	See Notes 4 and 5	20		150	20		150	
	$V_{CE} = -4$ V,	$I_C = -15$ A,	See Notes 4 and 5	5			5			
V_{BE}	$V_{CE} = -4$ V,	$I_C = -5$ A,	See Notes 4 and 5			−1.3			−1.3	V
	$V_{CE} = -4$ V,	$I_C = -15$ A,	See Notes 4 and 5			−3.5			−3.5	
$V_{CE(sat)}$	$I_B = -500$ mA,	$I_C = -5$ A,	See Notes 4 and 5			−1.3			−1.3	V
	$I_B = -5$ A,	$I_C = -15$ A,	See Notes 4 and 5			−3.5			−3.5	
h_{fe}	$V_{CE} = -4$ V,	$I_C = -1$ A,	f = 1 kHz	25			25			
$\|h_{fe}\|$	$V_{CE} = -4$ V,	$I_C = -1$ A,	f = 1 MHz	5			5			

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

PARAMETER	TEST CONDITIONS			TIP74B			TIP74C			UNIT
				MIN	TYP	MAX	MIN	TYP	MAX	
$V_{(BR)CEO}$	$I_C = -200$ mA,	$I_B = 0$,	See Note 4	−80			−100			V
$V_{(BR)CEV}$	$I_C = -200$ mA,	$I_B = 0$,	See Note 4	−90			−110			V
I_{CEO}	$V_{CE} = -60$ V,	$I_B = 0$				−50			−50	μA
I_{CES}	$V_{CE} = -80$ V	$V_{BE} = 0$				−50				μA
	$V_{CE} = -100$ V,	$V_{BE} = 0$							−50	
I_{EBO}	$V_{EB} = -5$ V,	$I_C = 0$				−50			−50	μA
h_{FE}	$V_{CE} = -4$ V,	$I_C = -5$ A,	See Notes 4 and 5	20		150	20		150	
	$V_{CE} = -4$ V,	$I_C = -15$ A,	See Notes 4 and 5	5			5			
V_{BE}	$V_{CE} = -4$ V,	$I_C = -5$ A,	See Notes 4 and 5			−1.3			−1.3	V
	$V_{CE} = -4$ V,	$I_C = -15$ A,	See Notes 4 and 5			−3.5			−3.5	
$V_{CE(sat)}$	$I_B = -500$ mA,	$I_C = -5$ A,	See Notes 4 and 5			−1.3			−1.3	V
	$I_B = -5$ A,	$I_C = -15$ A,	See Notes 4 and 5			−3.5			−3.5	
h_{fe}	$V_{CE} = -4$ V,	$I_C = -1$ A,	f = 1 kHz	25			25			
$\|h_{fe}\|$	$V_{CE} = -4$ V,	$I_C = -1$ A,	f = 1 MHz	5			5			

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 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).

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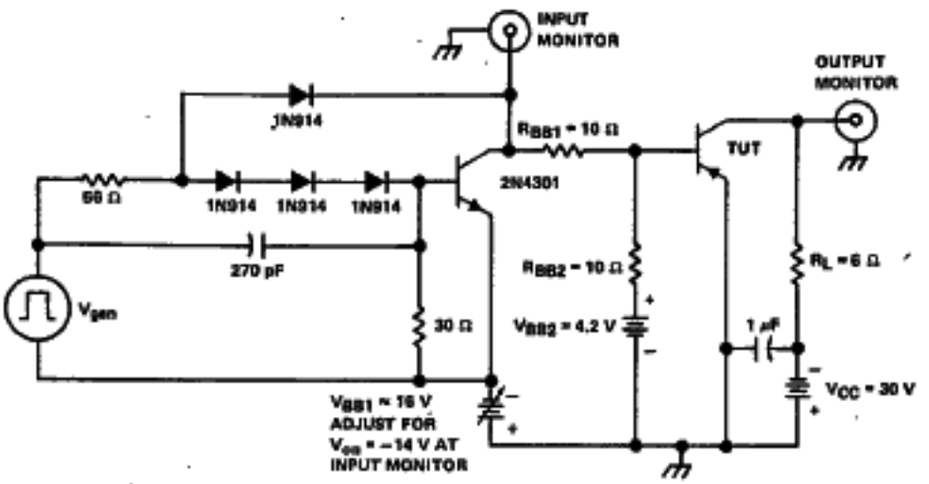
resistive-load switching characteristics at 25°C case temperature (unless otherwise noted)

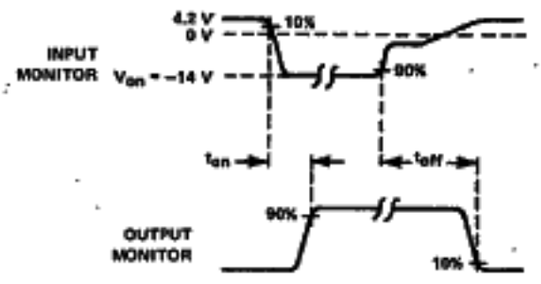
PARAMETER	TEST CONDITIONS†	MIN	TYP	MAX	UNIT
t_d	I_C = −5 A, I_{B1} = −0.5 A, I_{B2} = 0.5 A, $V_{BE(off)}$ = 4.2 V, R_L = 6 Ω, See Figure 1		20		ns
t_r			120		ns
t_s			600		ns
t_f			300		ns

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

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 μs, duty cycle ≤ 2%.
C. Waveforms are monitored on an oscilloscope with the following characteristics: t_r ≤ 15 ns, R_{in} ≥ 10 MΩ, 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 1. RESISTIVE-LOAD SWITCHING

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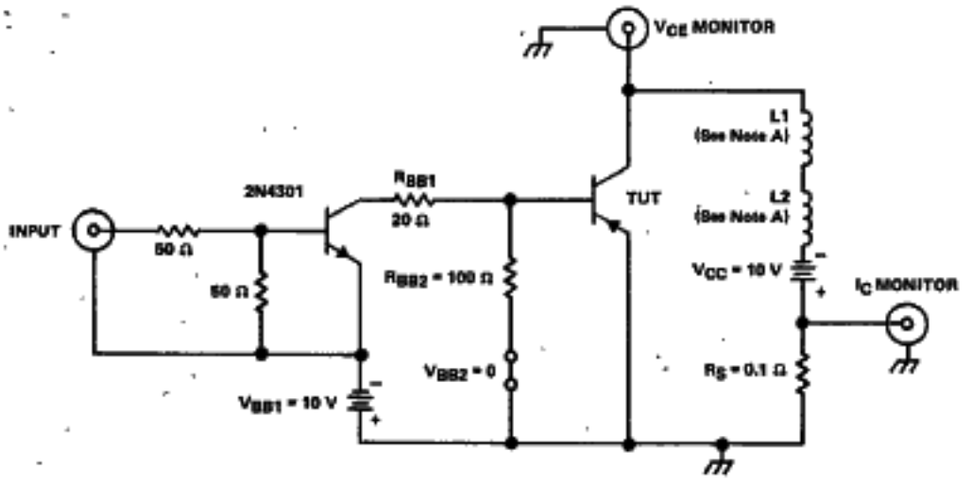
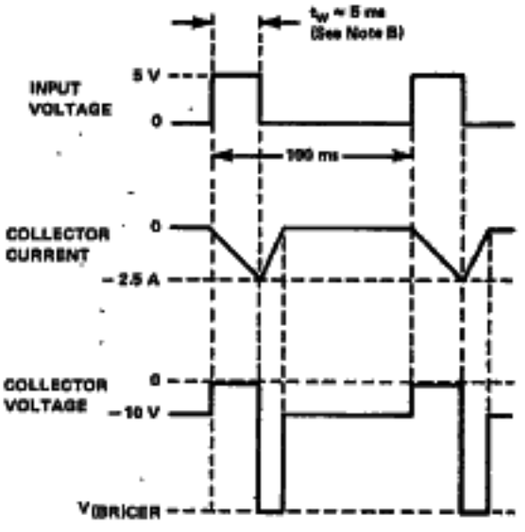
PARAMETER MEASUREMENT INFORMATION



TEST CIRCUIT



VOLTAGE AND CURRENT WAVEFORMS

NOTES: A. L1 and L2 are 10 mH, 0.11 Ω, Chicago Standard Transformer Corporation C-2688, or equivalent.
B. Input pulse duration is increased until I_{CM} = −3 A.

FIGURE 2. INDUCTIVE-LOAD SWITCHING

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TYPICAL CHARACTERISTICS

TIP74C
COLLECTOR CUTOFF CURRENT
vs
CASE TEMPERATURE

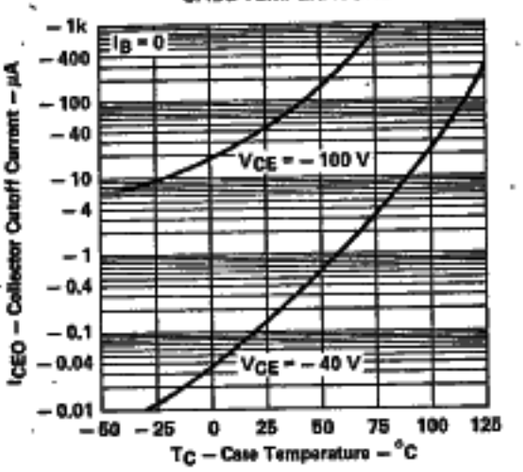

FIGURE 3

TIP74C
COLLECTOR CUTOFF CURRENT
vs
CASE TEMPERATURE

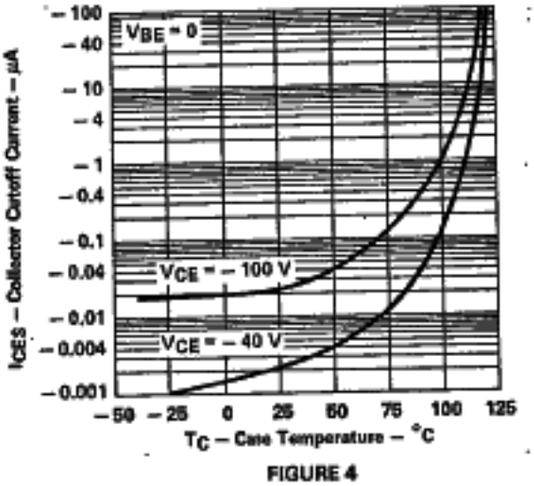

FIGURE 4

STATIC FORWARD CURRENT TRANSFER RATIO
vs
COLLECTOR CURRENT

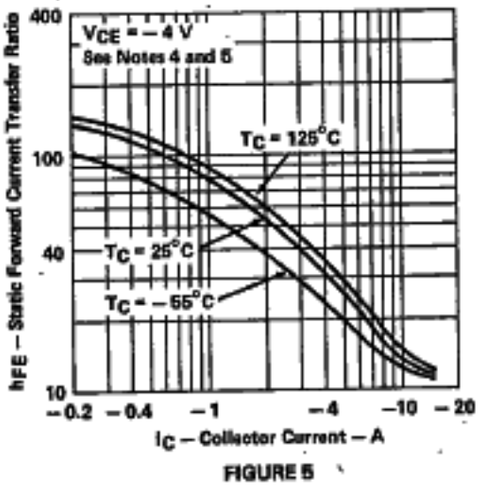

FIGURE 5

BASE-EMITTER VOLTAGE
vs
COLLECT CURRENT

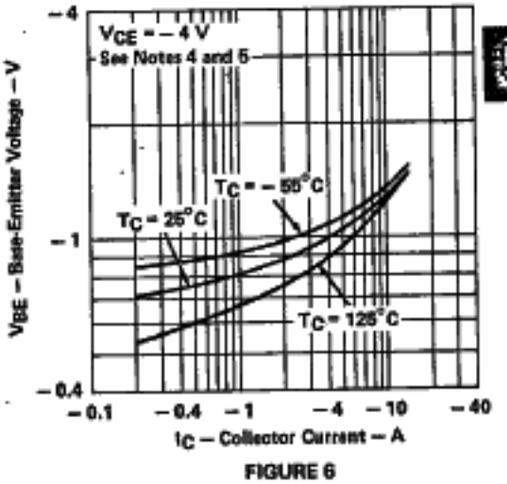

FIGURE 6

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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TYPICAL CHARACTERISTICS

COLLECTOR-EMITTER SATURATION VOLTAGE
vs
COLLECTOR CURRENT

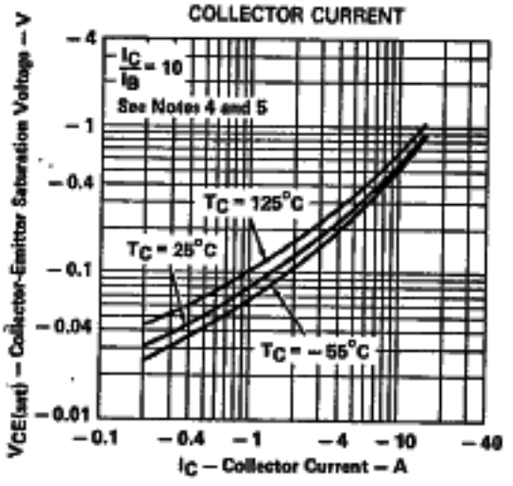

FIGURE 7

SWITCHING TIMES
vs
COLLECTOR CURRENT

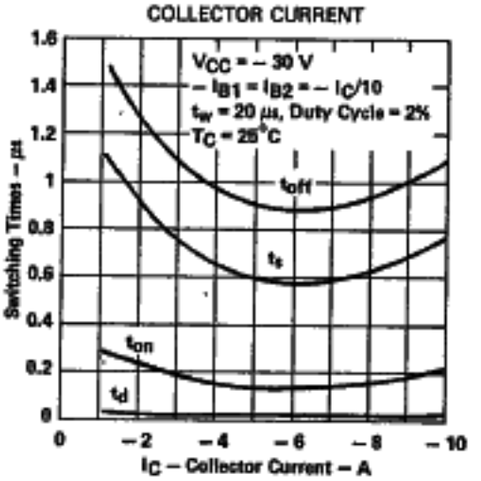

FIGURE 8

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 seperate from the current-carrying contacts and located within 3,2 mm (0.125 inch) from the device body.

MAXIMUM SAFE OPERATING AREA

MAXIMUM COLLECTOR CURRENT
vs
COLLECTOR-EMITTER VOLTAGE

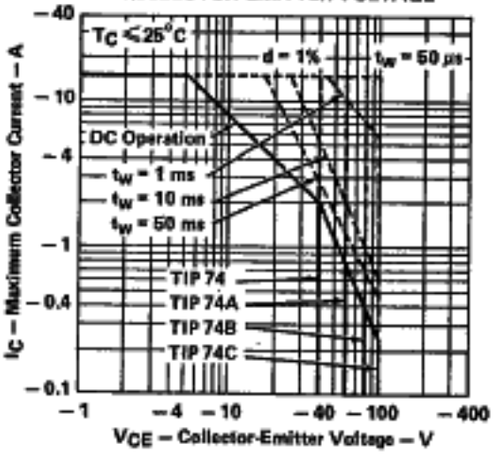

FIGURE 9

5 TIP Devices

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THERMAL INFORMATION

CASE TEMPERATURE
DISSIPATION DERATING CURVE

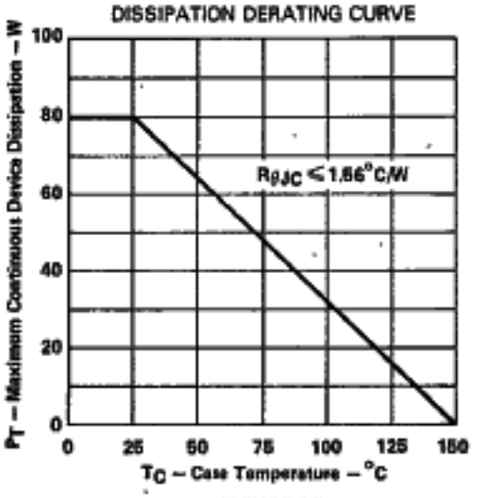

FIGURE 10

FREE-AIR TEMPERATURE
DISSIPATION DERATING CURVE

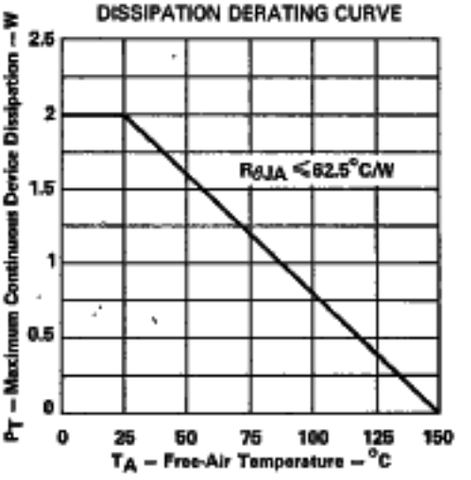

FIGURE 11

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