



# NPN POWER TRANSISTORS

COMPLEMENTARY TO THE TIP32 SERIES

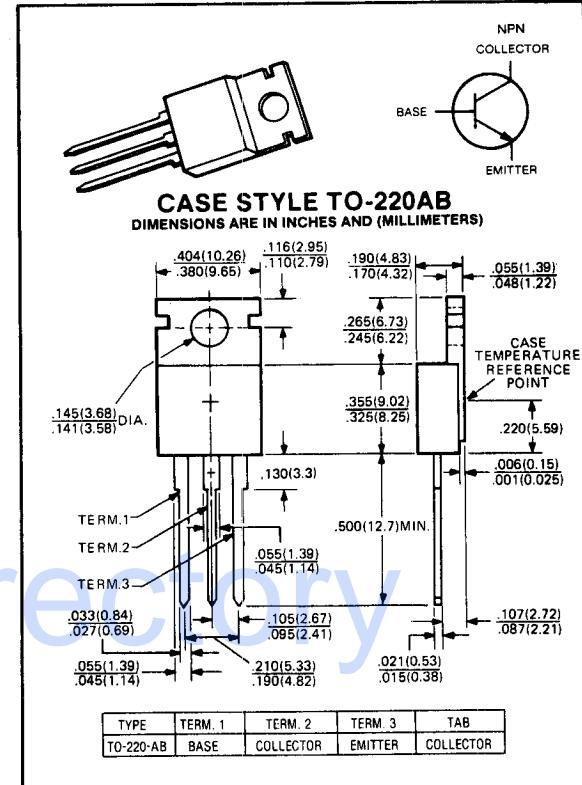
**TIP 31 Series**

40-100 VOLTS  
3 AMP, 40 WATTS

The TIP31 Series power transistors are designed for use in general purpose amplifier and switching applications.

**Features:**

- 40W at 25°C case temperature
- 3A continuous collector current
- 5A peak collector current
- Minimum  $f_T$  of 3 MHz at 10V, 0.5A
- Customer-specified selections available



maximum ratings ( $T_C = 25^\circ\text{C}$ ) (unless otherwise noted)

RATING	SYMBOL	TIP31	TIP31A	TIP31B	TIP31C	UNITS
Collector-Emitter Voltage	$V_{CEO}$	40	60	80	100	Volts
Collector-Base Voltage	$V_{CBO}$	80	100	120	140	Volts
Emitter Base Voltage	$V_{EBO}$	5	5	5	5	Volts
Collector Current — Continuous	$I_C$	3	3	3	3	A
Peak	$I_{CM}$	5	5	5	5	
Base Current — Continuous	$I_B$	1	1	1	1	A
Total Power Dissipation @ $T_A = 25^\circ\text{C}$	$P_D$	2	2	2	2	Watts
@ $T_C = 25^\circ\text{C}$		40	40	40	40	
Operating and Storage						
Junction Temperature Range	$T_J, T_{STG}$	-65 to +150	-65 to +150	-65 to +150	-65 to +150	°C

**thermal characteristics**

Thermal Resistance, Junction to Case	$R_{\theta JC}$	3.125	3.125	3.125	3.125	°C/W
Maximum Lead Temperature for Soldering Purposes: $\frac{1}{2}$ " from Case for 5 Seconds	$T_L$	250	250	250	250	°C

## electrical characteristics ( $T_C = 25^\circ C$ ) (unless otherwise specified)

CHARACTERISTIC		SYMBOL	MIN	TYP	MAX	UNIT
<b>off characteristics</b>						
Collector-Emitter Breakdown Voltage ( $I_C = 30mA$ )	TIP31 TIP31A TIP31B TIP31C	$V_{CEO}$	40 60 80 100	— — — —	— — — —	Volts
Collector Cutoff Current ( $V_{CE} = -30V$ ) ( $V_{CE} = 60V$ )	TIP31, TIP31A TIP31B, TIP31C	$I_{CEO}$	— —	— —	0.3 0.3	mA
Collector Cutoff Current ( $V_{CE} = 80V$ ) ( $V_{CE} = 100V$ ) ( $V_{CE} = 120V$ ) ( $V_{CE} = 140V$ )	TIP31 TIP31A TIP31B TIP31C	$I_{CES}$	— — — —	— — — —	0.2 0.2 0.2 0.2	mA
Emitter Cutoff Current ( $V_{EB} = 5V$ , $I_C = 0$ )		$I_{EBO}$	—	—	1	mA

## second breakdown

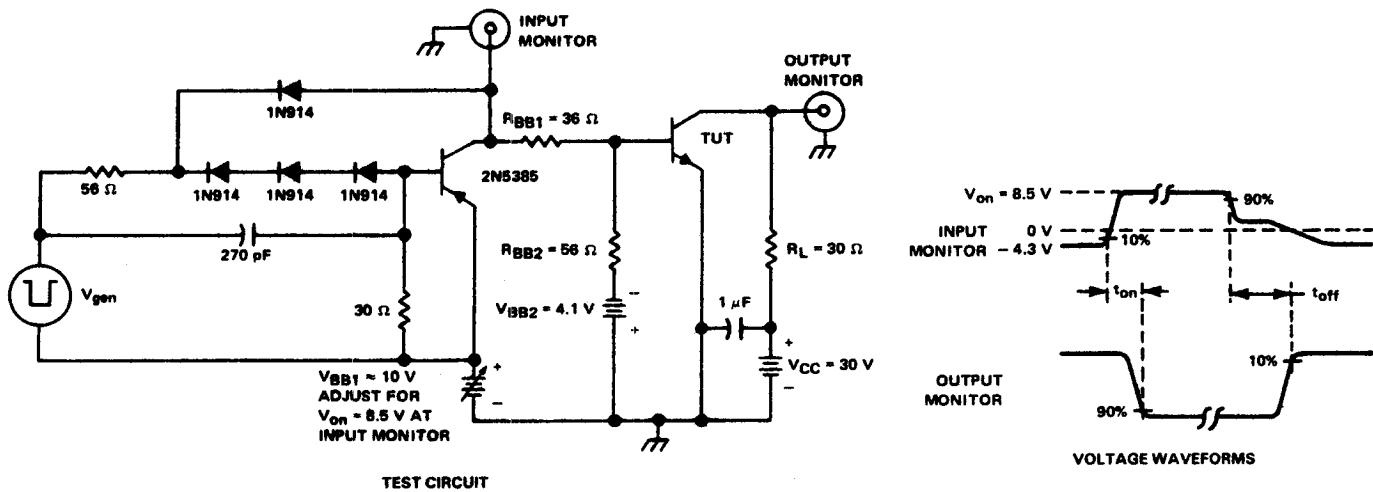
Second Breakdown with Base Forward Biased	FBSOA	SEE FIGURE 3
---	-------	--------------

## on characteristics

DC Current Gain ( $I_C = 1A$ , $V_{CE} = 4V$ ) ( $I_C = 3A$ , $V_{CE} = 4V$ )	$h_{FE}$	25 10	— —	— 50	— —
Collector-Emitter Saturation Voltage ( $I_C = 3A$ , $I_B = 375mA$ )	$V_{CE(sat)}$	—	—	1.2	V
Base-Emitter Voltage ( $I_C = 3A$ , $V_{CE} = 4V$ )	$V_{BE(on)}$	—	—	1.8	V

## switching characteristics

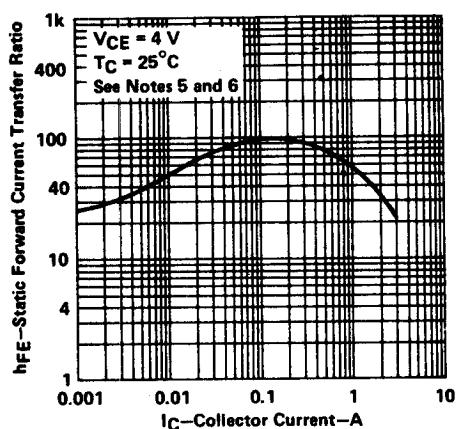
Turn-on Time	$R_L = 30\Omega$ , $I_C = 1A$ $I_{B1} = I_{B2} = 0.1A$	$t_{on}$	—	0.5	—	$\mu s$
Turn-off Time	$V_{BE(off)} = -4.3V$	$t_{off}$	—	2	—	



- NOTES:
- A.  $V_{gen}$  is a  $-30V$  pulse into a  $50\Omega$  termination.
  - B. The  $V_{gen}$  waveform is supplied by 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.

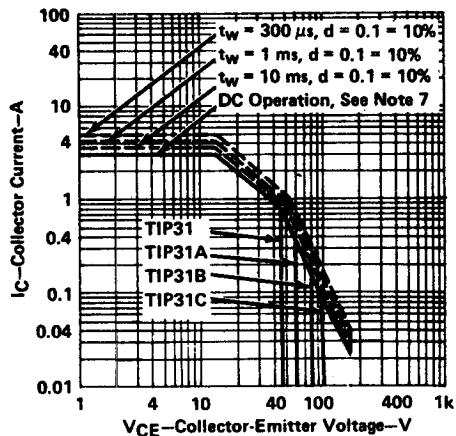
FIGURE 1. RESISTIVE-LOAD SWITCHING

**STATIC FORWARD CURRENT TRANSFER RATIO  
vs  
COLLECTOR CURRENT**



**FIGURE 2. TYPICAL CHARACTERISTICS**

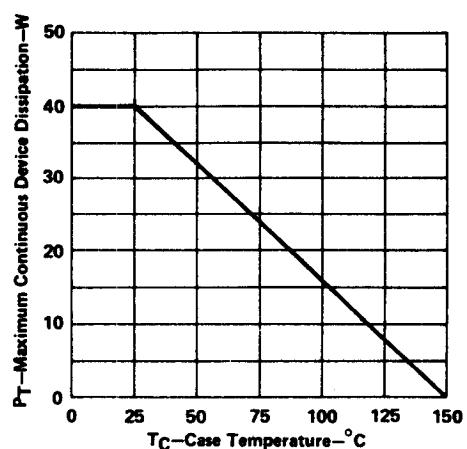
NOTES: 5. These parameters must be measured using pulse techniques,  $t_w = 300 \mu s$ , duty cycle  $< 2\%$ .  
6. These parameters are measured with voltage-sensing contacts separate from the current-carrying contacts.



**FIGURE 3 MAXIMUM SAFE OPERATING AREA**

NOTE 7: This combination of maximum voltage and current may be achieved only when switching from saturation to cutoff with a clamped inductive load.

**DISSIPATION DERATING CURVE**



**FIGURE 4 THERMAL INFORMATION**