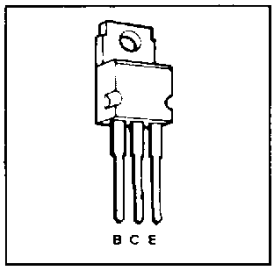
TIP31,TIP31A,TIP31B,TIP31C
NPN SILICON POWER TRANSISTORS

SLPS067 Revised March 1990

- **Designed for Complementary Use with the TIP32 Series**
- **40 W at 25°C Case Temperature**
- **3 A Continuous Collector Current**
- **5 A Peak Collector Current**
- **Customer Specified Selections Available**



PACKAGE: TO220

Absolute Maximum Ratings at 25°C Case Temperature (unless otherwise noted)

		TIP31	TIP31A	TIP31B	TIP31C
V_{CBO}	Collector - base voltage (I_E = 0)	80 V	100 V	120 V	140 V
V_{CEO}	Collector - emitter voltage (I_B =0)	40 V	60 V	80 V	100 V
V_{EBO}	Base - emitter voltage	5 V			
I_C	Continuous collector current	3 A			
I_{CM}	Peak collector current (Note 1)	5 A			
I_B	Continuous base current	1 A			
P_{tot}	Continuous device dissipation at (or below) 25°C case temperature (Note 2)	40 W			
P_{tot}	Continuous device dissipation at (or below) 25°C free - air temperature (Note 3)	2 W			
$I_C^2L/2$	Unclamped inductive load energy (Note 4)	32 mJ			
T_j & T_{stg}	Operating junction and storage temperature range	-65°C to + 150°C			
T_L	Lead temperature 3.2 mm from case for 10 seconds	250°C			

NOTES 1. This value applies for t_w = 0.3 ms, duty cycle = 10%.
2. Derate linearly to 150°C case temperature at the rate of 0.32 W/°C.
3. Derate linearly to 150°C free - air temperature at the rate of 16 mW/°C.
4. This rating is based on the capability of the transistor to operate safely in a circuit of L = 20 mH, R_{BE2} = 100 Ω, V_{BE2} = 0 V, R_S = 0.1 Ω, V_{CC} = 20 V.

Electrical Characteristics at 25°C Case Temperature (unless otherwise noted)

PARAMETER		TEST CONDITIONS			MIN	TYP	MAX	UNIT
$V_{(BR)CEO}$	Collector - emitter sustaining voltage	I_C = 30 mA (Note 5)	I_B = 0	TIP31 TIP31A TIP31B TIP31C	40 60 80 100			V
I_{CES}	Collector - emitter cut - off current	V_{CE} = 80 V V_{CE} = 100 V V_{CE} = 120 V V_{CE} = 140 V	V_{BE} = 0 V_{BE} = 0 V_{BE} = 0 V_{BE} = 0	TIP31 TIP31A TIP31B TIP31C			0.2 0.2 0.2 0.2	mA
I_{CEO}	Collector cut - off current	V_{CE} = 30 V V_{CE} = 60 V	I_B = 0 I_B = 0	TIP31/31A TIP31B/31C			0.3 0.3	mA
I_{EBO}	Emitter cut - off current	V_{EB} = 5 V	I_C = 0				1.0	mA
h_{FE}	Forward current transfer ratio	V_{CE} = 4 V V_{CE} = 4 V	I_C = 1 A I_C = 3 A	(Notes 5 & 6)	25 10		50	
$V_{CE(sat)}$	Collector - emitter saturation voltage	I_B = 375 mA	I_C = 3 A	(Notes 5 & 6)			1.2	V
V_{BE}	Base - emitter voltage	V_{CE} = 4 V	I_C = 3 A	(Notes 5 & 6)			1.8	V
h_{fe}	Small signal forward current transfer ratio	V_{CE} = 10 V	I_C = 0.5 A	f = 1 kHz	20			
$\|h_{fe}\|$	Small signal forward current transfer ratio	V_{CE} = 10 V	I_C = 0.5 A	f = 1 MHz	3			

Thermal Characteristics

	PARAMETER	MIN	TYP	MAX	UNIT
$R_{\theta JC}$	Junction - to - case thermal resistance			3.125	°C/W
$R_{\theta JA}$	Junction - to - free - air thermal resistance			62.5	°C/W

Resistive Load Switching Characteristics at 25°C Case Temperature (unless otherwise noted)

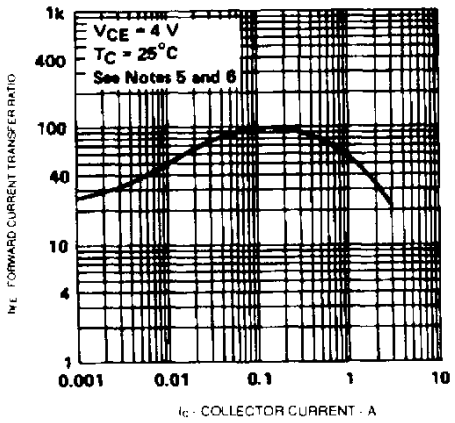
	PARAMETER	TEST CONDITIONS†			MIN	TYP	MAX	UNIT
t_{on}	Turn on time	I_C = 1 A	$I_{B(on)}$ = 0.1 A	$I_{B(off)}$ = -0.1 A		0.5		µs
t_{off}	Turn off time	$V_{BE(off)}$ = -4.3 V	R_L = 30 Ω			2		µs

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

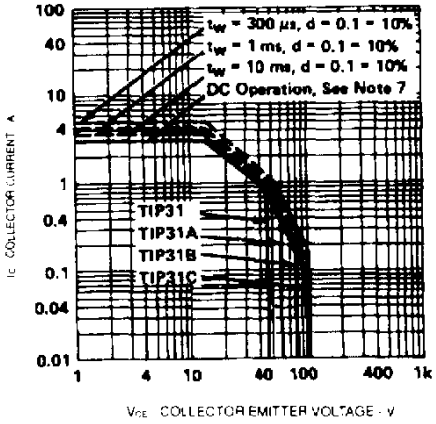
NOTES 5. These parameters must be measured using pulse techniques, t_w = 300µs, duty cycle ≤ 2%.
6. These parameters must be measured using voltage sensing contacts separate from the current carrying contacts.
7. This combination of maximum voltage and current may be achieved only when switching from saturation to cutoff with a clamped inductive load.

TYPICAL CHARACTERISTICS

FORWARD CURRENT TRANSFER RATIO
VS
COLLECTOR CURRENT



MAXIMUM FORWARD - BIAS
MAXIMUM SAFE OPERATING AREA



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