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COMPLEMENTARY SILICON PLASTIC POWER TRANSISTORS

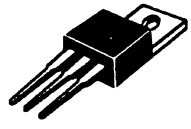
... designed for use in general purpose power amplifier and switching applications.

NPN	PNP
TIP31	TIP32
TIP31A	TIP32A
TIP31B	TIP32B
TIP31C	TIP32C

3 AMPERE
COMPLEMENTARY SILICON
POWER TRANSISTORS
40 -100 VOLTS
40 WATTS

FEATURES:

* Collector-Emitter Sustaining Voltage -
  $V_{CEO(sus)}$= 40V(Min)- TIP31,TIP32
  60V(Min)- TIP31A,TIP32A
  80V(Min)- TIP31B,TIP32B
  100V(Min)-TIP31C,TIP32C
* Collector-Emitter Saturation Voltage- $V_{CE(sat)}$=1.2V(Max)@I_C= 3.0 A
* Current Gain-Bandwidth Product f_T=3.0 MHz (Min)@ I_C=500 mA



TO-220

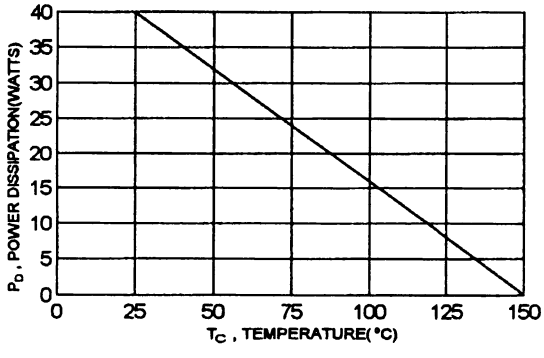
MAXIMUM RATINGS

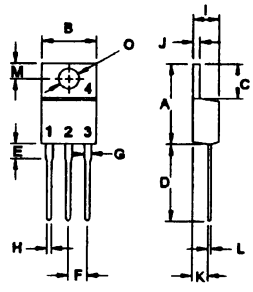
Characteristic	Symbol	TIP31 TIP32	TIP31A TIP32A	TIP31B TIP32B	TIP31C TIP32C	Unit
Collector-Emitter Voltage	V_{CEO}	40	60	80	100	V
Collector-Base Voltage	V_{CBO}	40	60	80	100	V
Emitter-Base Voltage	V_{EBO}	5.0				V
Collector Current - Continuous - Peak	I_C	3.0 5.0				A
Base Current	I_B	1.0				A
Total Power Dissipation@T_C = 25°C Derate above 25°C	P_D	40 0.32				W W/°C
Operating and Storage Junction Temperature Range	T_J, T_{STG}	-65 to +150				°C

THERMAL CHARACTERISTICS

Characteristic	Symbol	Max	Unit
Thermal Resistance Junction to Case	Rθjc	3.125	°C/W

FIGURE -1 POWER DERATING





PIN 1.BASE
2.COLLECTOR
3.EMITTER
4.COLLECTOR(CASE)

DIM	MILLIMETERS	
	MIN	MAX
A	14.68	15.31
B	9.78	10.42
C	5.01	6.52
D	13.06	14.62
E	3.57	4.07
F	2.42	3.66
G	1.12	1.36
H	0.72	0.96
I	4.22	4.96
J	1.14	1.38
K	2.20	2.97
L	0.33	0.55
M	2.48	2.98
O	3.70	3.90

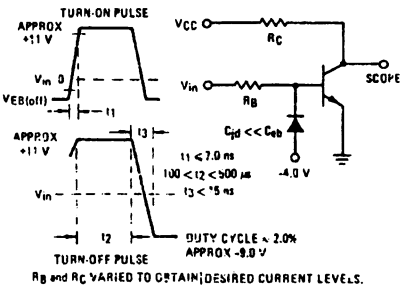
ELECTRICAL CHARACTERISTICS (T_C = 25°C unless otherwise noted)

Characteristic		Symbol	Min	Max	Unit
OFF CHARACTERISTICS					
Collector-Emitter Sustaining Voltage(1) (I_C= 30 mA, I_B= 0)	TIP31,TIP32 TIP31A,TIP32A TIP31B,TIP32B TIP31C,TIP32C	$V_{CEO(sus)}$	40 60 80 100		V
Collector Cutoff Current (V_{CE}= 30 V, I_B= 0) (V_{CE}= 60 V, I_B= 0)	 TIP31,TIP32,TIP31A,TIP32A TIP31B,TIP32B,TIP31C,TIP32C	I_{CEO}		 0.3 0.3	mA
Collector Cutoff Current (V_{CE}= 40 V, V_{EB}= 0) (V_{CE}= 60 V, V_{EB}= 0) (V_{CE}= 80 V, V_{EB}= 0) (V_{CE}= 100 V, V_{EB}= 0)	 TIP31,TIP32 TIP31A,TIP32A TIP31B,TIP32B TIP31C,TIP32C	I_{CES}		 0.2 0.2 0.2 0.2	mA
Emitter Cutoff Current (V_{EB}= 5.0 V, I_C= 0)		I_{EBO}		 1.0	mA
ON CHARACTERISTICS (1)					
DC Current Gain (I_C =1.0 A, V_{CE} = 4.0 V) (I_C= 3.0 A, V_{CE} = 4.0 V)		hFE	 25 10	 50	
Collector-Emitter Saturation Voltage (I_C = 3.0 A, I_B =375 mA)		$V_{CE(sat)}$		 1.2	V
Base-Emitter On Voltage (I_C =3.0 A, V_{CE}= 4.0 V)		$V_{BE(on)}$		 1.8	V
DYNAMIC CHARACTERISTICS					
Current Gain - Bandwidth Product (2) (I_C = 500 mA , V_{CE} = 10 V , f_{TEST} = 1 MHz)		f_T	3.0		MHz
Small Signal Current Gain (I_C = 500 mA , V_{CE} = 10 V , f = 1 kHz)		h_{fe}	20		

(1) Pulse Test: Pulse width ≤ 300 μs , Duty Cycle ≤ 2.0 %

(2) $f_T = |h_{fe}| \cdot f_{TEST}$

FIGURE 2 – SWITCHING TIME EQUIVALENT CIRCUIT



RB and RC VARIED TO OBTAIN DESIRED CURRENT LEVELS.

FIG-3 TURN-ON TIME

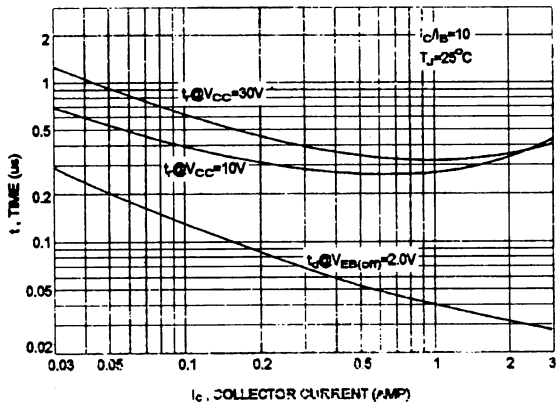


FIG-4 DC CURRENT GAIN

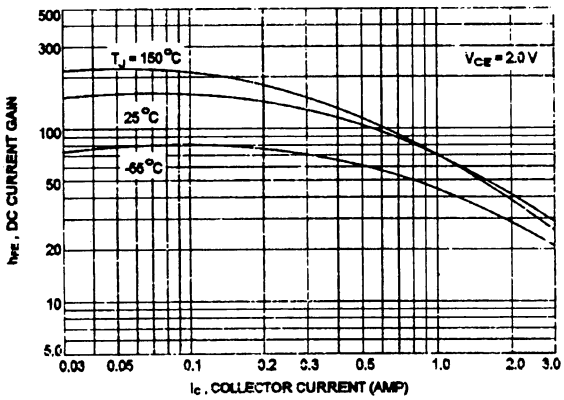


FIG-5 TURN-OFF TIME

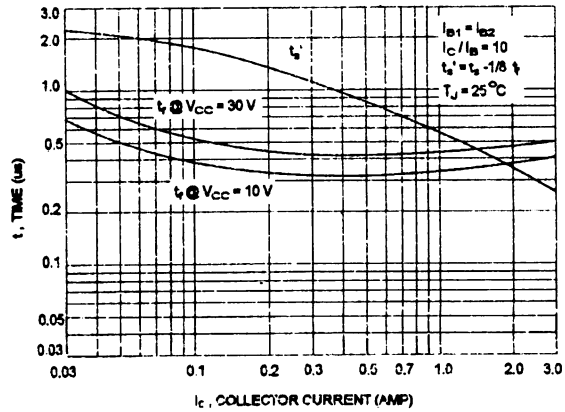
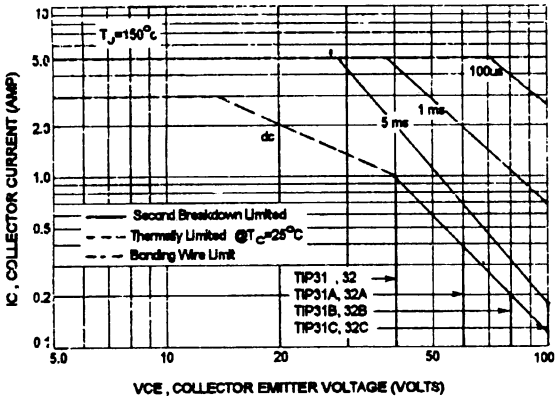


FIG-6 ACTIVE REGION SAFE OPERATING AREA



There are two limitation on the power handling ability of a transistor:average junction temperature and second breakdown safe operating area curves indicate I_C-V_{CE} limits of the transistor that must be observed for reliable operation i.e., the transistor must not be subjected to greater dissipation than curves indicate.

The data of FIG-6 curve is base on $T_{J(PK)}$=150 °C; T_C is variable depending on power level. second breakdown pulse limits are valid for duty cycles to 10% provided $T_{J(PK)} \leq$150°C,At high case temperatures,thermal limitation will reduce the power that can be handled to values less than the limitations imposed by second breakdown.

FIG-7 COLLECTOR SATURATION REGION

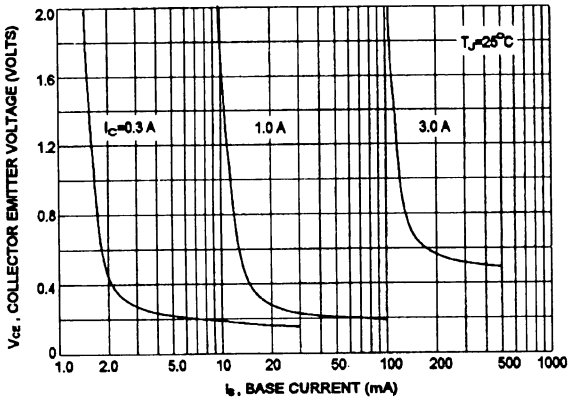


FIG-8 CAPACITANCES

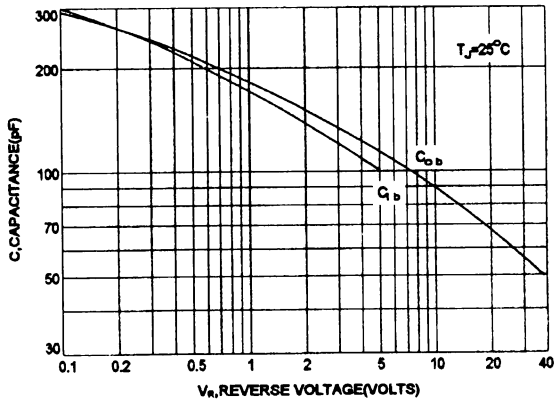


FIG-9 "ON" VOLTAGE

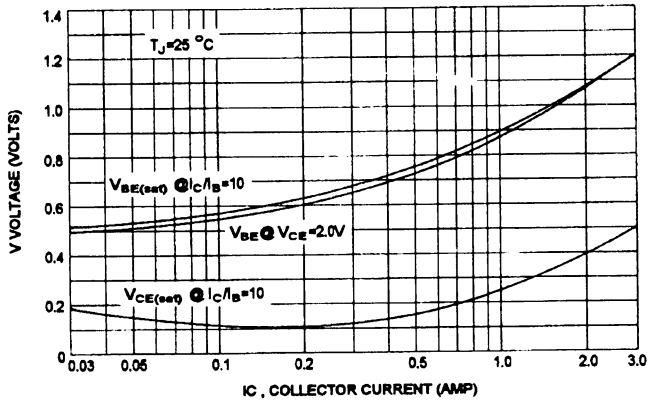


FIG-10 COLLECTOR CUT-OFF REGION