

DARLINGTON COMPLEMENTARY SILICON POWER TRANSISTORS

...designed for general-purpose amplifier and low speed switching applications

FEATURES:

- * Collector-Emitter Sustaining Voltage-
 $V_{CE(SUS)} = 60 \text{ V (Min) - TIP140T, TIP145T}$
 $= 80 \text{ V (Min) - TIP141T, TIP146T}$
 $= 100 \text{ V (Min) - TIP142T, TIP147T}$
- * Collector-Emitter Saturation Voltage
 $V_{CE(sat)} = 2.0 \text{ V (Max.) @ } I_C = 5.0 \text{ A}$
- * Monolithic Construction with Built-in Base-Emitter Shunt Resistor

NPN	PNP
TIP140T	TIP145T
TIP141T	TIP146T
TIP142T	TIP147T

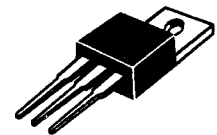
10 AMPERE
DARLINGTON
COMPLEMENTARY SILICON
POWER TRANSISTORS
60-100 VOLTS
80 WATTS

MAXIMUM RATINGS

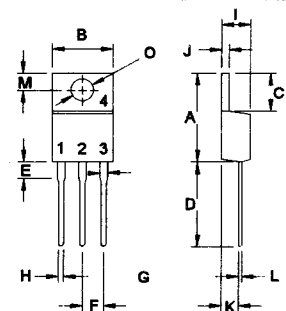
Characteristic	Symbol	TIP140T TIP145T	TIP141T TIP146T	TIP142T TIP147T	Unit
Collector-Emitter Voltage	V_{CEO}	60	80	100	V
Collector-Base Voltage	V_{CBO}	60	80	100	V
Emitter-Base Voltage	V_{EBO}	5.0			V
Collector Current-Continuous -Peak	I_C I_{CM}	10 15			A
Base Current	I_B	0.5			A
Total Power Dissipation @ $T_C = 25^\circ\text{C}$ Derate above 25°C	P_D	80 0.64			W W/ $^\circ\text{C}$
Operating and Storage Junction Temperature Range	T_J, T_{STG}	- 55 to +150			$^\circ\text{C}$

THERMAL CHARACTERISTICS

Characteristic	Symbol	Max	Unit
Thermal Resistance Junction to Case	$R_{\theta jc}$	1.56	$^\circ\text{C/W}$



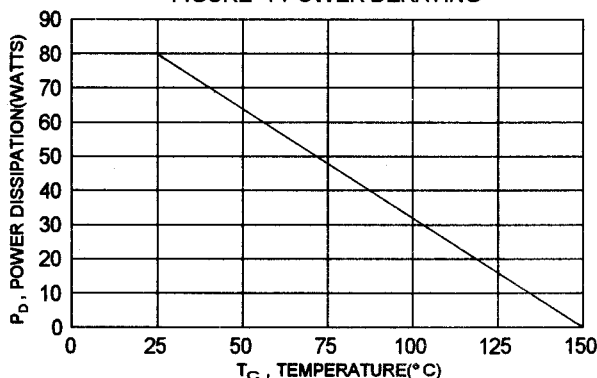
TO-220



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	4.98
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

FIGURE -1 POWER DERATING



TIP140T, TIP141T, TIP142T NPN / TIP145T, TIP146T, TIP147T PNP

ELECTRICAL CHARACTERISTICS ($T_c = 25^\circ\text{C}$ unless otherwise noted)

Characteristic	Symbol	Min	Max	Unit
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OFF CHARACTERISTICS

Collector - Emitter Sustaining Voltage (1) ($I_C = 30\text{ mA}$, $I_B = 0$)	TIP140T, TIP145T TIP141T, TIP146T TIP142T, TIP147T	$V_{CE(sus)}$	60 80 100	V
Collector Cutoff Current ($V_{CE} = 30\text{ V}$, $I_B = 0$) ($V_{CE} = 40\text{ V}$, $I_B = 0$) ($V_{CE} = 50\text{ V}$, $I_B = 0$)	TIP140T, TIP145T TIP141T, TIP146T TIP142T, TIP147T	I_{CEO}	2.0 2.0 2.0	mA
Collector Cutoff Current ($V_{CB} = 60\text{ V}$, $I_E = 0$) ($V_{CB} = 80\text{ V}$, $I_E = 0$) ($V_{CB} = 100\text{ V}$, $I_E = 0$)	TIP140T, TIP145T TIP141T, TIP146T TIP142T, TIP147T	I_{CBO}	1.0 1.0 1.0	mA
Emitter Cutoff Current ($V_{EB} = 5.0\text{ V}$, $I_C = 0$)		I_{EBO}	2.0	mA

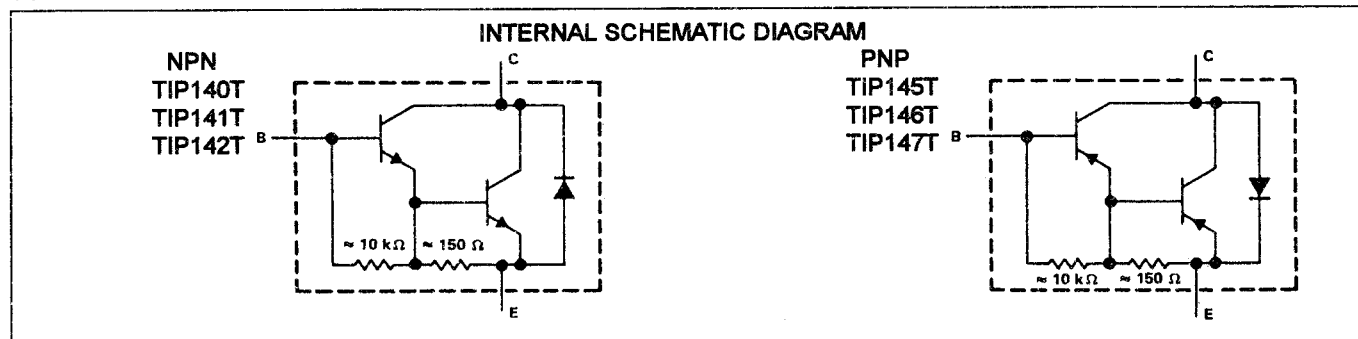
ON CHARACTERISTICS (1)

DC Current Gain ($I_C = 5.0\text{ A}$, $V_{CE} = 4.0\text{ V}$) ($I_C = 10\text{ A}$, $V_{CE} = 4.0\text{ V}$)	h_{FE}	1000 500		
Collector-Emitter Saturation Voltage ($I_C = 5.0\text{ A}$, $I_B = 10\text{ mA}$) ($I_C = 10\text{ A}$, $I_B = 40\text{ mA}$)	$V_{CE(sat)}$		2.0 3.0	V
Base-Emitter Saturation Voltage ($I_C = 10\text{ A}$, $I_B = 40\text{ mA}$)	$V_{BE(sat)}$		3.5	V
Base-Emitter On Voltage ($I_C = 10\text{ A}$, $V_{CE} = 4.0\text{ V}$)	$V_{BE(on)}$		3.0	V

SWITCHING CHARACTERISTICS

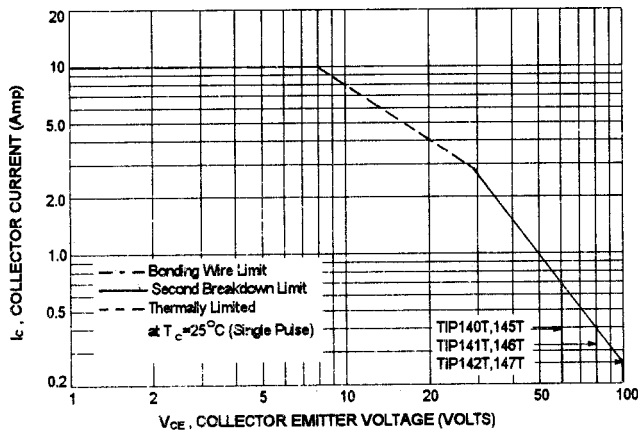
Delay Time	$V_{CC} = 30\text{ V}$, $I_C = 5.0\text{ A}$ $I_{B1} = -I_{B2} = 20\text{ mA}$, $t_p = 20\mu\text{s}$, Duty Cycle $\leq 2.0\%$	t_d	0.15(Typ)		μs
Rise Time		t_r	0.55(Typ)		μs
Storage Time		t_s	2.5(Typ)		μs
Fall Time		t_f	2.5(Typ)		μs

(1) Pulse Test: Pulse width = $300\mu\text{s}$, Duty Cycle $\leq 2.0\%$



TIP140T, TIP141T, TIP142T NPN / TIP145T, TIP146T, TIP147T PNP

FIG-2 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-2 is base on $T_{J(PK)} = 150^\circ\text{C}$; T_C is variable depending on conditions. 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-3 SMALL-SIGNAL COMMON-EMITTER FORWARD CURRENT TRANSFER RATIO

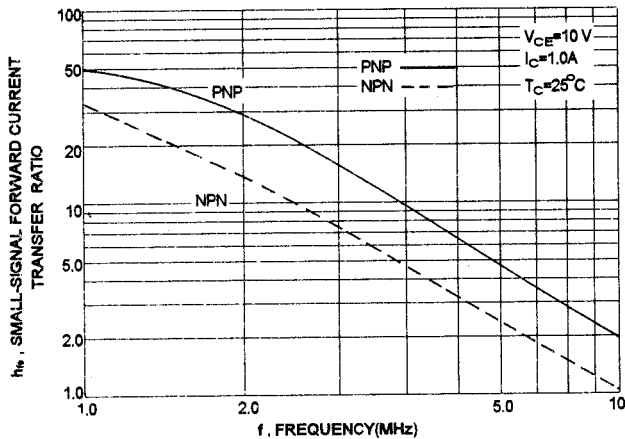


FIG-4 UNCLAMPED INDUCTIVE LOAD

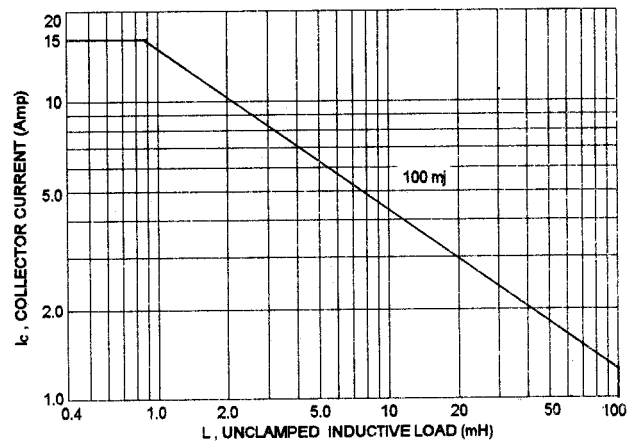


FIG-5 SWITCHING TIME

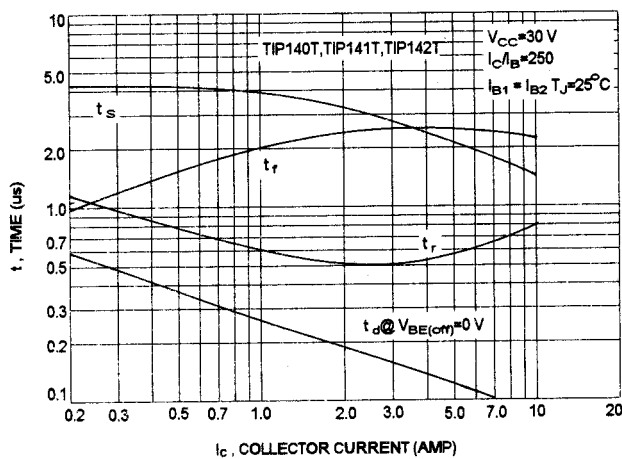
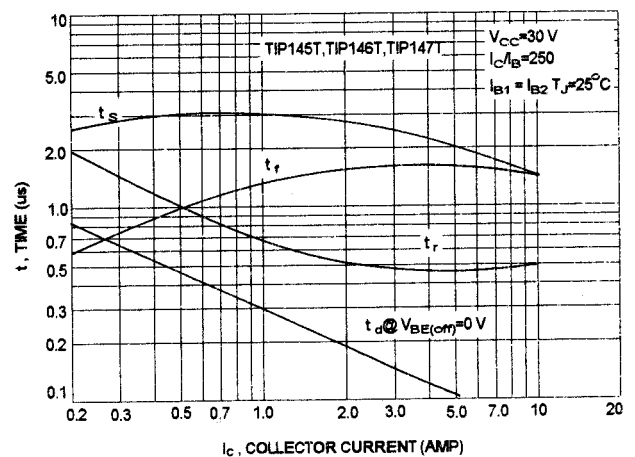


FIG-6 SWITCHING TIME



TIP140T, TIP141T, TIP142T NPN / TIP145T, TIP146T, TIP147T PNP

NPN TIP140T, TIP141T, TIP142T

PNP TIP145T, TIP146T, TIP147T

FIG-7 DC CURRENT GAIN

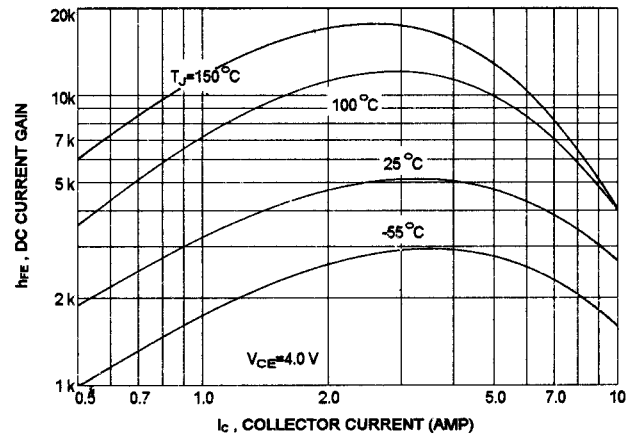
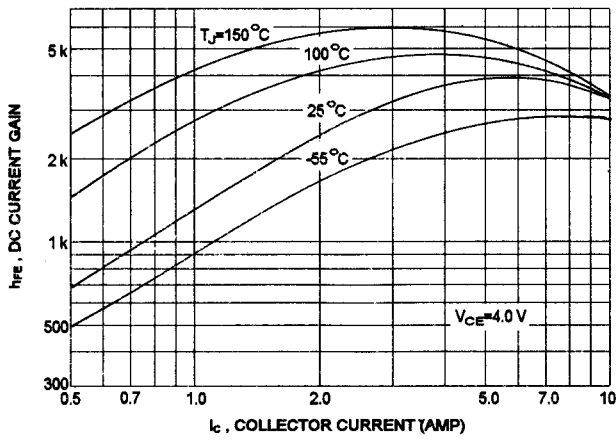


FIG-8 COLLECTOR-EMITTER SATURATION VOLTAGE

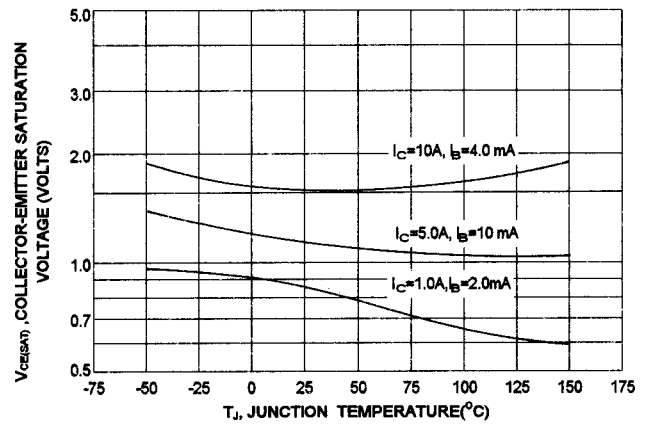
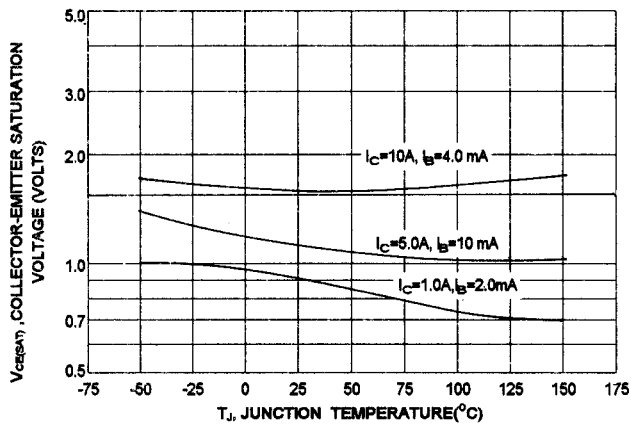


FIG-9 BASE-EMITTER VOLTAGE

