

## DARLINGTON COMPLEMENTARY SILICON POWER TRANSISTORS

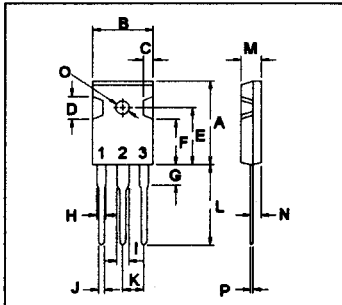
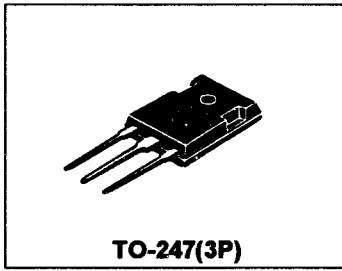
...designed for general-purpose amplifier and low speed switching applications

### FEATURES:

- \* Collector-Emitter Sustaining Voltage-  
 $V_{CEO(SUS)} = 60 \text{ V (Min) - TIP140, TIP145}$   
 $= 80 \text{ V (Min) - TIP141, TIP146}$   
 $= 100 \text{ V (Min) - TIP142, TIP147}$
- \* 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

<b>NPN</b>	<b>PNP</b>
<b>TIP140</b>	<b>TIP145</b>
<b>TIP141</b>	<b>TIP146</b>
<b>TIP142</b>	<b>TIP147</b>

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



**PIN 1.BASE**  
**2.COLLECTOR**  
**3.EMITTER**

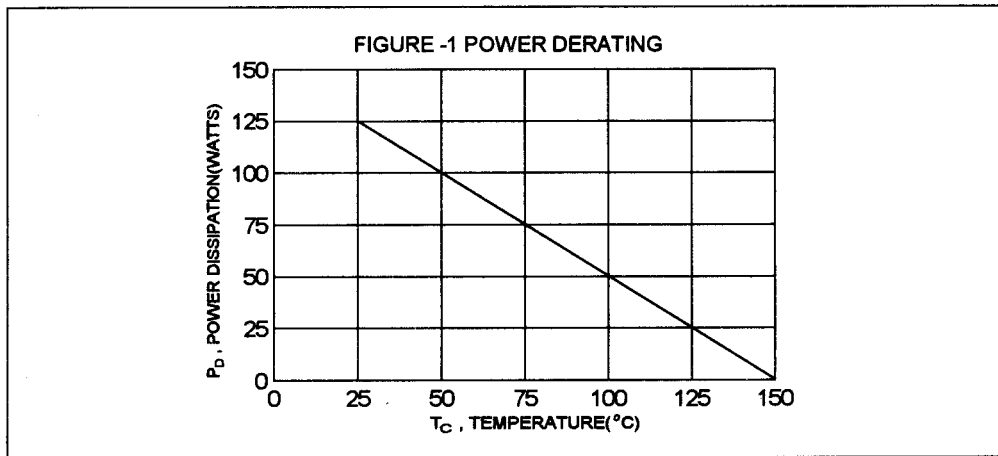
DIM	MILLIMETERS	
	MIN	MAX
A	20.63	22.38
B	15.38	16.20
C	1.90	2.70
D	5.10	6.10
E	14.81	15.22
F	11.72	12.84
G	4.20	4.50
H	1.82	2.46
I	2.92	3.23
J	0.89	1.53
K	5.26	5.66
L	18.50	21.50
M	4.68	5.36
N	2.40	2.80
O	3.25	3.65
P	0.55	0.70

### MAXIMUM RATINGS

Characteristic	Symbol	TIP140 TIP145	TIP141 TIP146	TIP142 TIP147	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 $25^\circ\text{C}$	$P_D$	125 1.0			W W/ $^\circ\text{C}$
Operating and Storage Junction Temperature Range	$T_J, T_{STG}$	- 65 to +150			$^\circ\text{C}$

### THERMAL CHARACTERISTICS

Characteristic	Symbol	Max	Unit
Thermal Resistance Junction to Case	$R_{\theta jc}$	1.0	$^\circ\text{C/W}$



TIP140, TIP141, TIP142 NPN / TIP145, TIP146, TIP147 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) ( $I_C = 30\text{ mA}, I_B = 0$ )	TIP140, TIP145 TIP141, TIP146 TIP142, TIP147	$V_{CE(sus)}$	60 80 100	V
Collector Cutoff Current ( $V_{CE} = 30\text{ V}, I_B = 0$ ) ( $V_{CE} = 40\text{ V}, I_B = 0$ ) ( $V_{CE} = 50\text{ V}, I_B = 0$ )	TIP140, TIP145 TIP141, TIP146 TIP142, TIP147	$I_{CEO}$	2.0 2.0 2.0	mA
Collector Cutoff Current ( $V_{CB} = 60\text{ V}, I_E = 0$ ) ( $V_{CB} = 80\text{ V}, I_E = 0$ ) ( $V_{CB} = 100\text{ V}, I_E = 0$ )	TIP140, TIP145 TIP141, TIP146 TIP142, TIP147	$I_{CBO}$	1.0 1.0 1.0	mA
Emitter Cutoff Current ( $V_{EB} = 5.0\text{ V}, I_C = 0$ )		$I_{EBO}$	2.0	mA

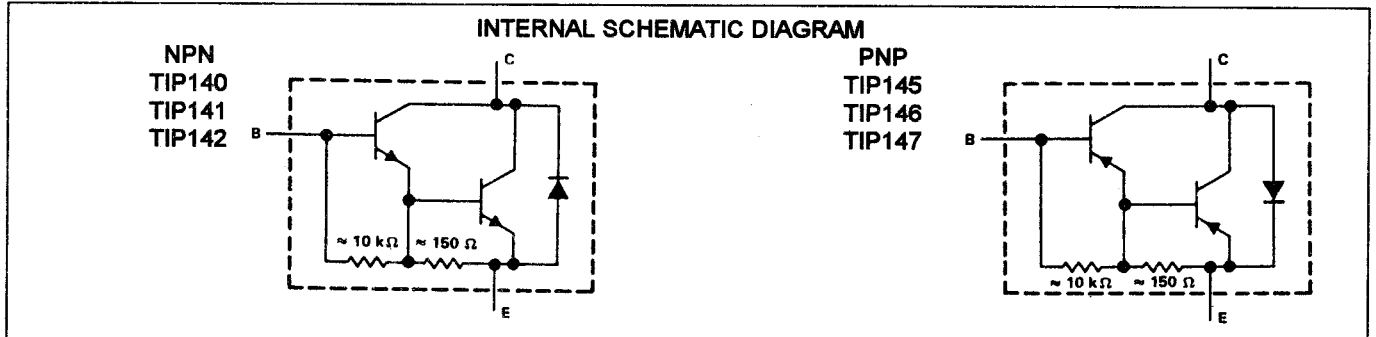
**ON CHARACTERISTICS (1)**

DC Current Gain ( $I_C = 5.0\text{ A}, V_{CE} = 4.0\text{ V}$ ) ( $I_C = 10\text{ A}, V_{CE} = 4.0\text{ V}$ )		hFE	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

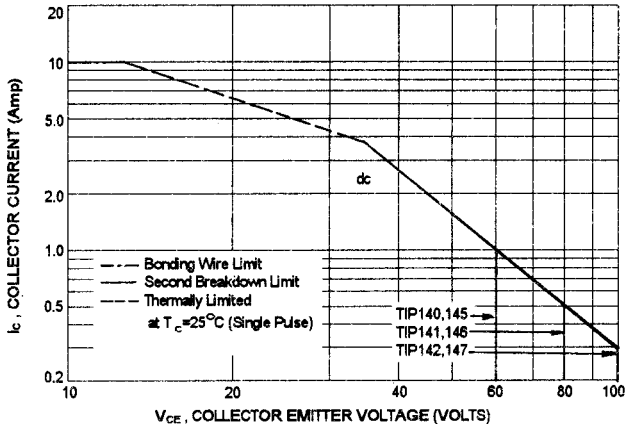
**SWITCHING CHARACTERISTICS**

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

(1) Pulse Test: Pulse width = 300 us , Duty Cycle  $\leq 2.0\%$



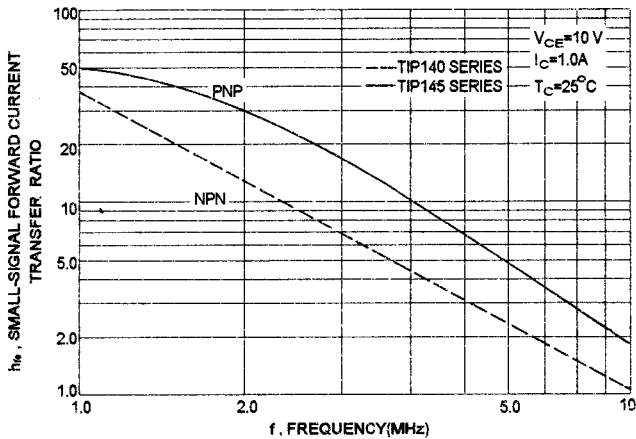
ACTIVE REGION SAFE OPERATING AREA (SOA)



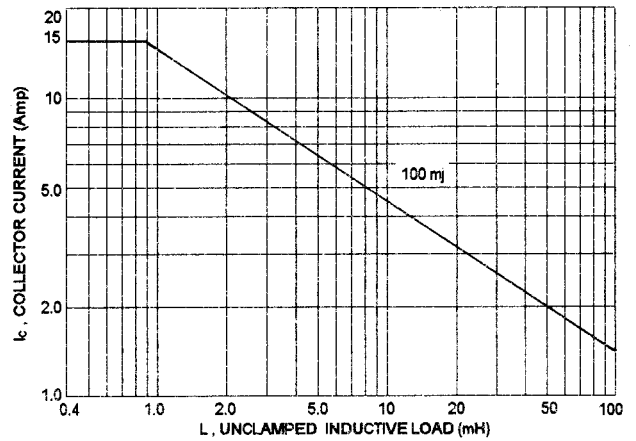
There are two limitation on the power handling ability of a transistor: average junction temperature and second breakdown safe operating area curves indicate  $I_C$ - $V_{CE}$  limits of the transistor that must be observed for reliable operation i.e., the transistor must not be subjected to greater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

The data of SOA curve 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.

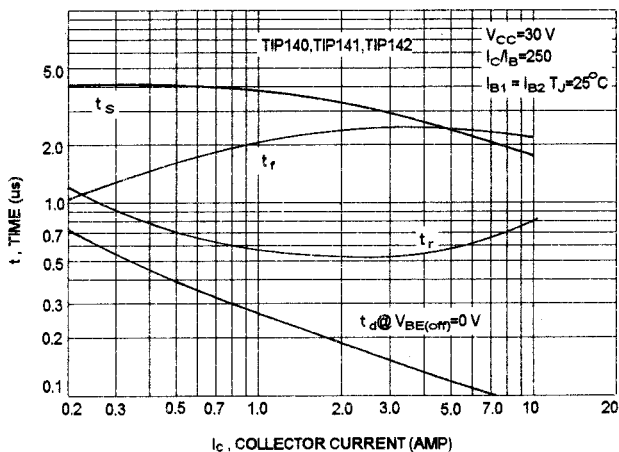
SMALL-SIGNAL COMMON-EMITTER FORWARD CURRENT TRANSFER RATIO



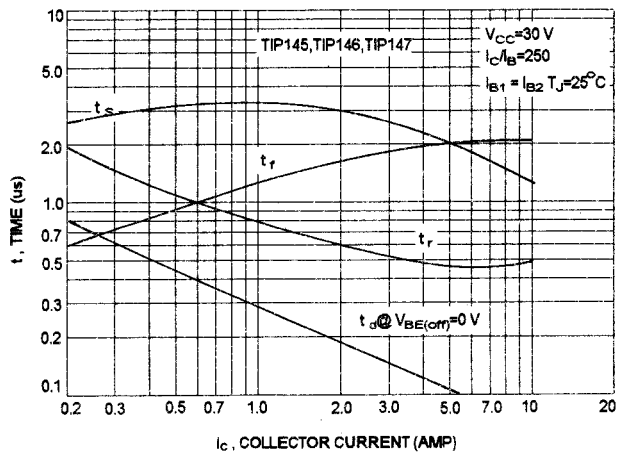
UNCLAMPED INDUCTIVE LOAD



SWITCHING TIME

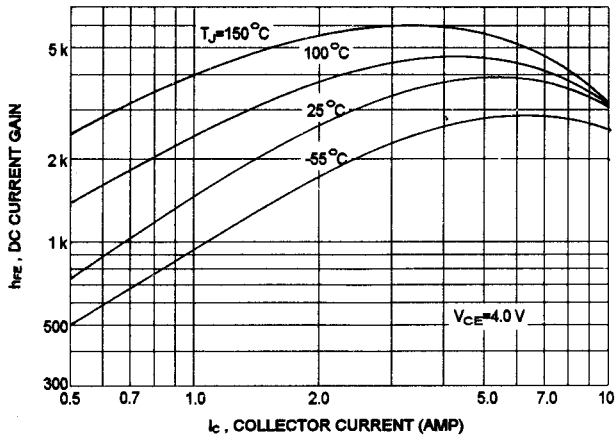


SWITCHING TIME

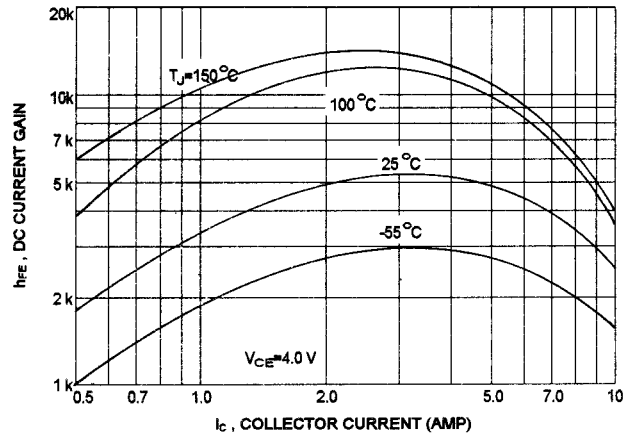


TIP140, TIP141, TIP142 NPN / TIP145, TIP146, TIP147 PNP

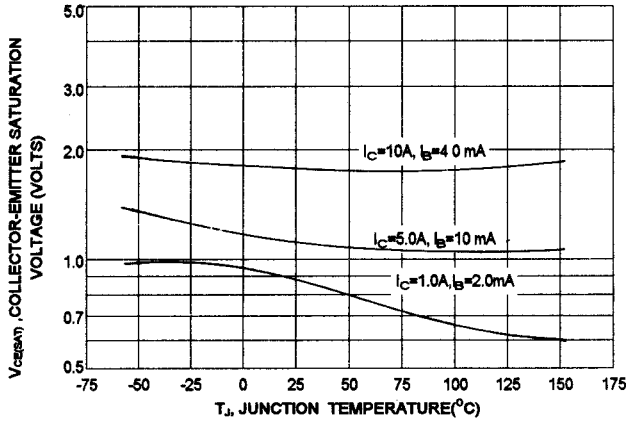
NPN TIP140, TIP141, TIP142  
DC CURRENT GAIN



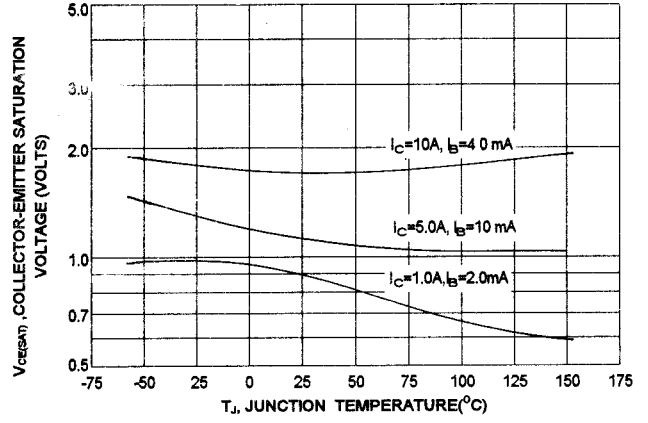
PNP TIP145, TIP146, TIP147  
DC CURRENT GAIN



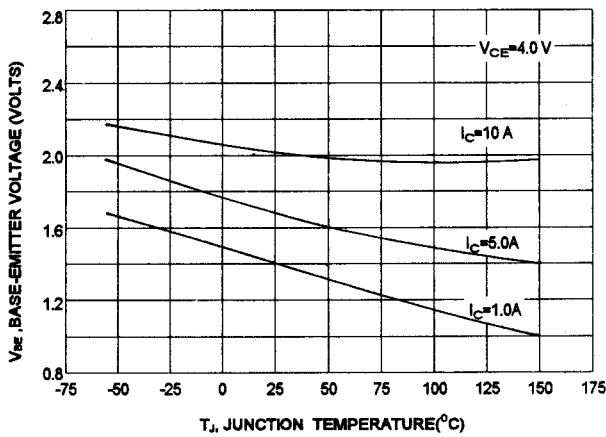
COLLECTOR-EMITTER SATURATION VOLTAGE



COLLECTOR-EMITTER SATURATION VOLTAGE



BASE-EMITTER VOLTAGE



BASE-EMITTER VOLTAGE

