

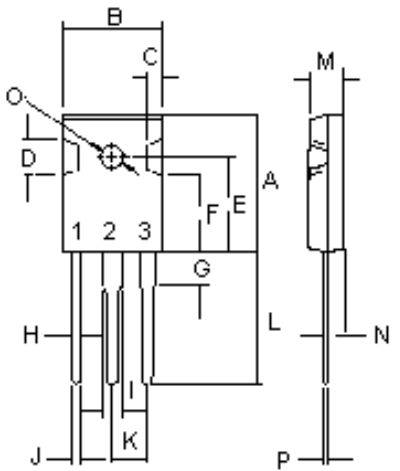
# Darlington Transistors



## Features:

Designed for general-purpose amplifier and low speed switching applications

- Collector-Emitter sustaining voltage
  - $V_{CEO(sus)} = 60\text{ V (Minimum)}$  - TIP145
  - $= 80\text{ V (Minimum)}$  - TIP141, TIP146
  - $= 100\text{ V (Minimum)}$  - TIP142, TIP147
- Collector-Emitter saturation voltage
  - $V_{CE(sat)} = 2\text{ V (Maximum)}$  at  $I_C = 5\text{ A}$
- Monolithic construction with Built-in Base-Emitter shunt resistor



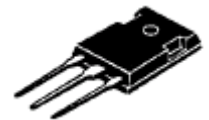
Pin 1. Base  
2. Collector  
3. Emitter

Dimensions	Minimum	Maximum
A	20.63	22.38
B	15.38	16.2
C	1.9	2.7
D	5.1	6.1
E	14.81	15.22
F	11.72	12.84
G	4.2	4.5
H	1.82	2.46
I	2.92	3.23
J	0.89	1.53
K	5.26	5.66
L	18.5	21.5
M	4.68	5.36
N	2.4	2.8
O	3.25	3.65
P	0.55	0.7

Dimensions : Millimetres

NPN      PNP  
 TIP141   TIP145  
 TIP142   TIP146  
 TIP147

10 Amperes  
 Darlington  
 Complementary  
 Silicon  
 Power Transistors  
 60 - 100 V  
 125 W



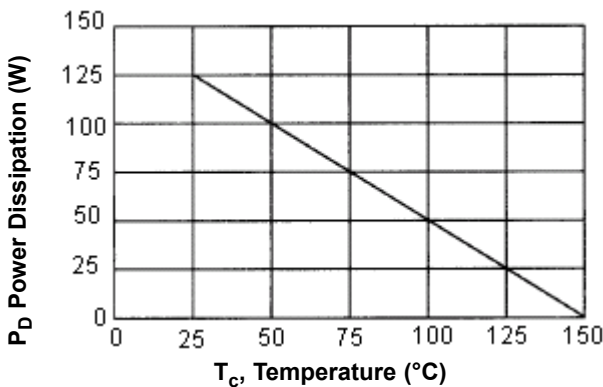
TO-247 (3P)

## Maximum Ratings

Characteristic	Symbol	TIP145	TIP141 TIP146	TIP142 TIP147	Unit
Collector - Emitter Voltage	$V_{CEO}$	60	80	100	V
Collector - Base Voltage	$V_{CBO}$				
Emitter - Base Voltage	$V_{EBO}$	5			
Collector Current - Continuous - Peak	$I_C$ $I_{CM}$	10 15			A
Base Current	$I_B$	0.5			
Total Power Dissipation at $T_C = 25^\circ\text{C}$ Derate above $25^\circ\text{C}$	$P_D$	125 1			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	Maximum	Unit
Thermal Resistance Junction to case	$R_{\theta jc}$	1	$^\circ\text{C} / \text{W}$



## Electrical Characteristics ( $T_C = 25^\circ\text{C}$ unless otherwise specified)

Characteristic	Symbol	Minimum	Maximum	Unit
<b>OFF Characteristics</b>				
Collector - Emitter Sustaining Voltage (1) ( $I_C = 30 \text{ mA}$ , $I_B = 0$ ) TIP145 TIP141, TIP146 TIP142, TIP147	$V_{CEO (sus)}$	60 80 100	-	V
Collector Cut off Current ( $V_{CE} = 30 \text{ V}$ , $I_B = 0$ ) ( $V_{CE} = 40 \text{ V}$ , $I_B = 0$ ) ( $V_{CE} = 50 \text{ V}$ , $I_B = 0$ ) TIP145 TIP141, TIP146 TIP142, TIP147	$I_{CEO}$	-	2 2 2	mA
Collector Cut off Current ( $V_{CB} = 60 \text{ V}$ , $I_E = 0$ ) ( $V_{CB} = 80 \text{ V}$ , $I_E = 0$ ) ( $V_{CB} = 100 \text{ V}$ , $I_E = 0$ ) TIP145 TIP141, TIP146 TIP142, TIP147	$I_{CBO}$	-	1 1 1	
Emitter Cut off Current ( $V_{EB} = 5 \text{ V}$ , $I_C = 0$ )	$I_{EBO}$	-	2	

# Darlington Transistors

## Electrical Characteristics ( $T_C = 25^\circ\text{C}$ unless otherwise specified)

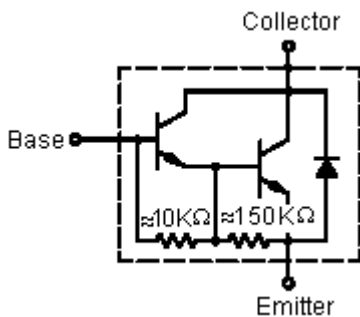
ON Characteristics (1)				
DC Current Gain ( $I_C = 5\text{ A}$ , $V_{CE} = 4\text{ V}$ ) ( $I_C = 10\text{ A}$ , $V_{CE} = 4\text{ V}$ )	$h_{FE}$	1,000 500	-	-
Collector - Emitter Saturation Voltage ( $I_C = 5\text{ A}$ , $I_B = 10\text{ mA}$ ) ( $I_C = 10\text{ A}$ , $I_B = 40\text{ mA}$ )	$V_{CE(sat)}$	-	2 3	V
Base - Emitter Saturation Voltage ( $I_C = 10\text{ A}$ , $I_B = 40\text{ mA}$ )	$V_{BE(sat)}$	-	3.5	
Base - Emitter On Voltage ( $I_C = 10\text{ A}$ , $V_{CE} = 4\text{ V}$ )	$V_{BE(on)}$	-	3	

Switching Characteristics					
Delay Time	$V_{CC} = 30\text{ V}$ , $I_C = 5\text{ A}$ $I_{B1} = -I_{B2} = 20\text{ mA}$ $t_p = 20\text{ }\mu\text{s}$ , Duty cycle $\leq 2\%$	$t_d$	0.15 (Typical)	-	$\mu\text{s}$
Rise Time		$t_r$	0.55 (Typical)	-	
Storage Time		$t_s$	2.5 (Typical)	-	
Fall Time		$t_f$		-	

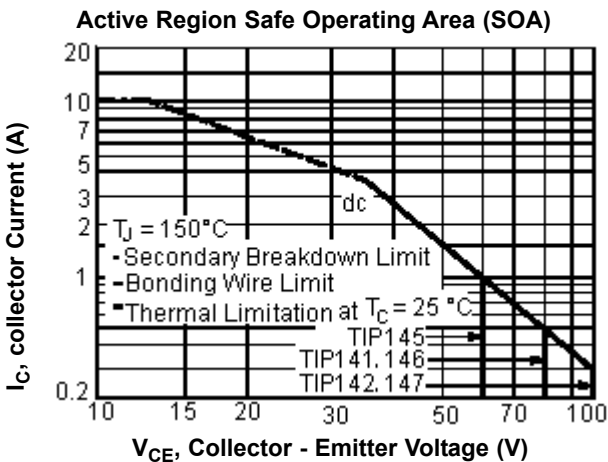
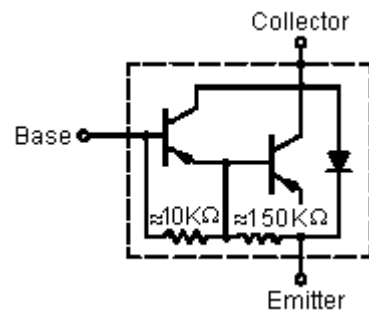
1. Pulse Test : Pulse width = 30  $\mu\text{s}$ , Duty cycle = 2%

## Internal Schematic Diagram

NPN : TIP141, TIP142



PNP : TIP145, TIP146, TIP147

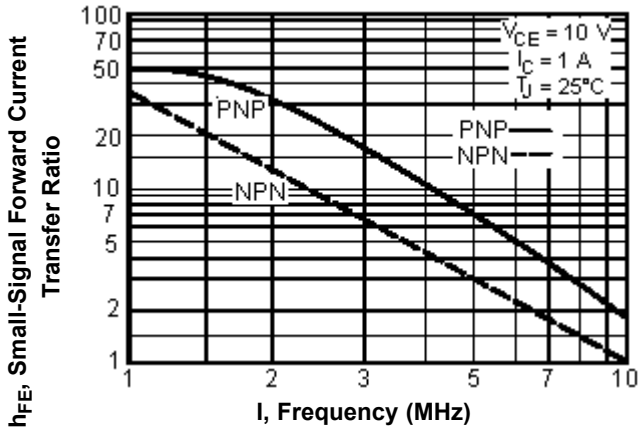


There are two limitations on the power handling ability of a transistor: average junction temperature and second breakdown safe operating area curves indicate  $I_C - V_{CE}$  limits of the transistor that must be observed for reliable operation i.e., the transistor must not be subjected to greater dissipation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

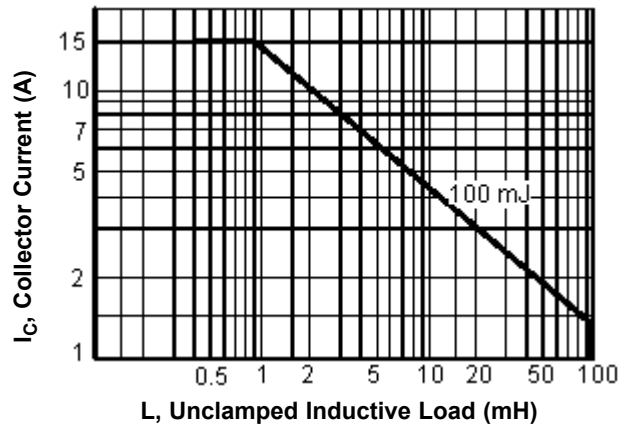
# Darlington Transistors



Small-Signal Common-Emitter Forward Current Transfer Ratio

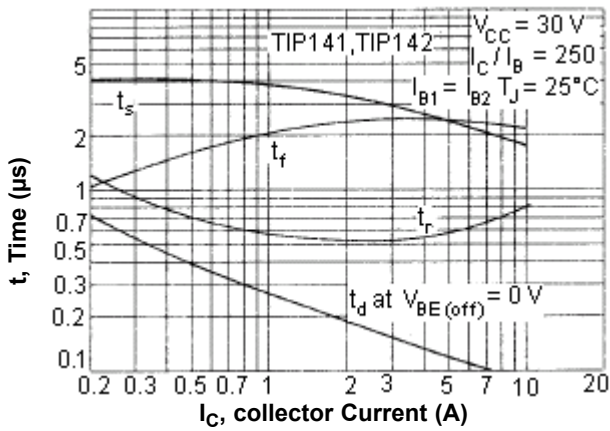


Unclamped Inductive Load



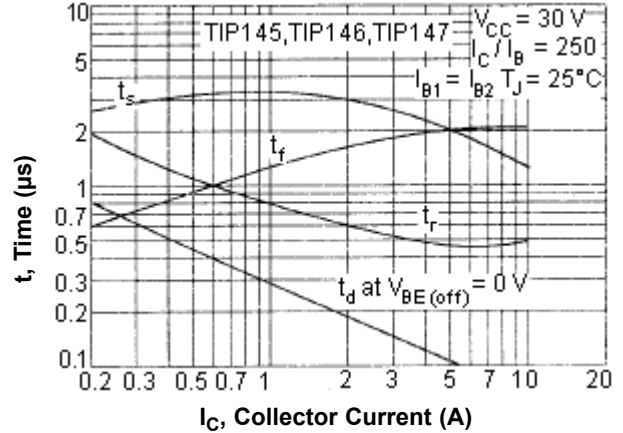
NPN : TIP141, TIP142

Switching Time

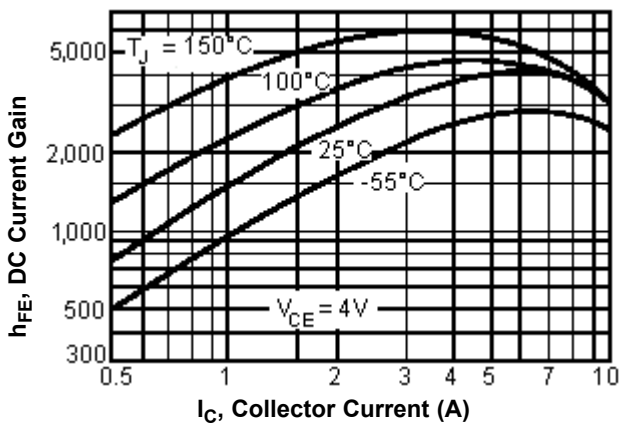


PNP : TIP145, TIP146, TIP147

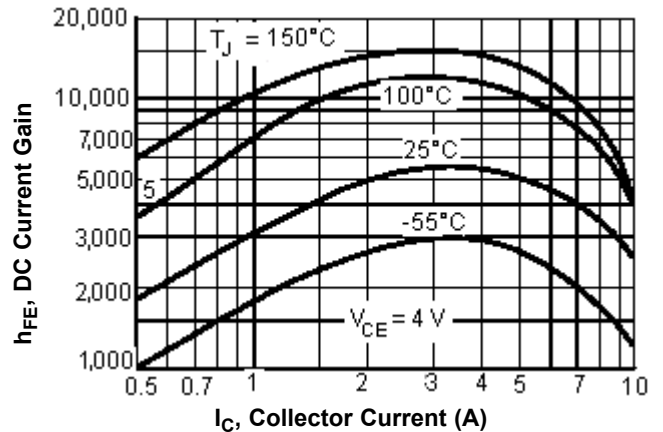
Switching Time



DC Current Gain



DC Current Gain

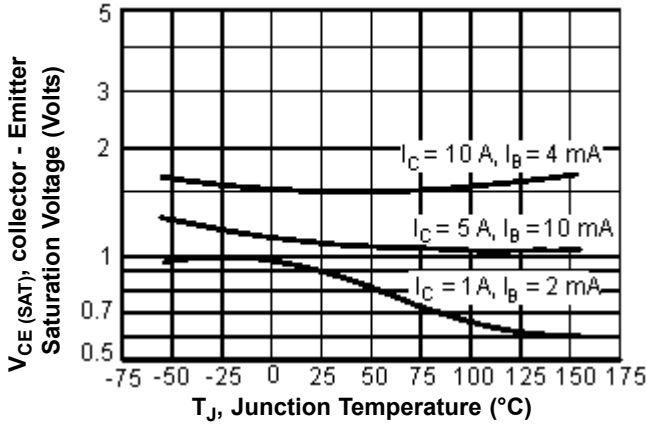


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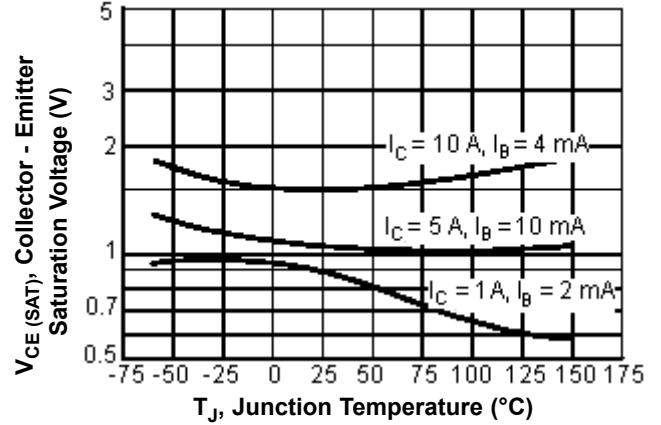
NPN : TIP141, TIP142

Collector - Emitter Saturation Voltage

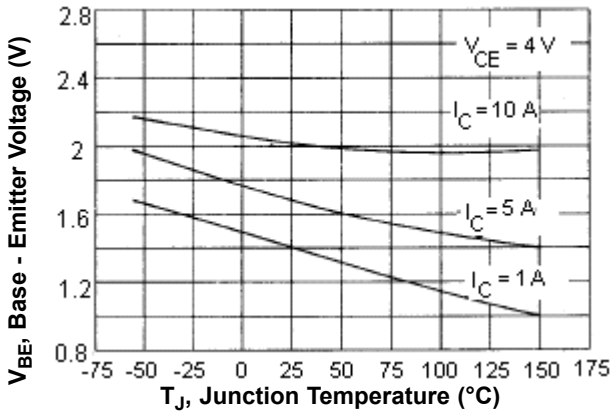


PNP : TIP145, TIP146, TIP147

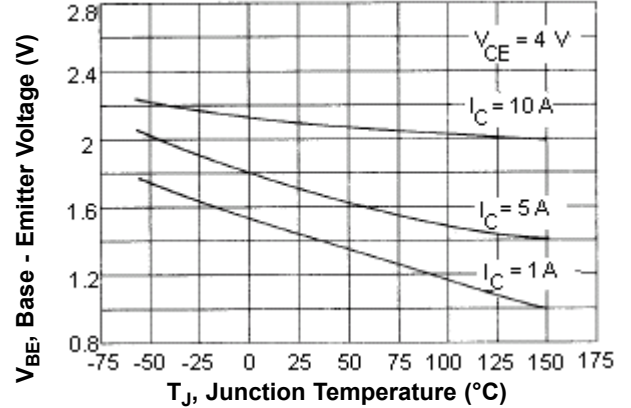
Collector - Emitter Saturation Voltage



Base - Emitter Voltage



Base - Emitter Voltage



## Specification Table

$I_C$ (A)	$V_{CE0}$ Maximum (V)	$h_{FE}$ Minimum at $I_C = 5$ A	$P_{tot}$ at 25°C (W)	Package	Type	Part Number
10	80	1,000	125	TO-247 (3P)	NPN	TIP141
	100					TIP142
	60				PNP	TIP145
	80					TIP146
	100					TIP147

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