

# TIP110, TIP115

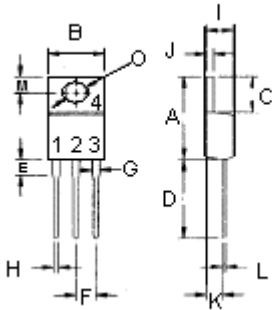
## Darlington Transistors



### Features:

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

- Collector-emitter sustaining voltage- $V_{CEO(sus)} = 60V$  (Minimum) - TIP110, TIP115.
- Collector-emitter saturation voltage- $V_{CE(sat)} = 2.5V$  (Maximum) at  $I_C = 2.0A$ .
- Monolithic construction with built-in-base-emitter shunt resistor.



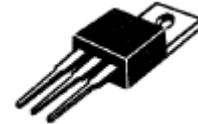
- Pin 1. Base  
 2. Collector  
 3. Emitter  
 4. Collector (Case)

Dimension	Minimum	Maximum
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

Dimensions : Millimetres

<b>NPN</b> <b>TIP110</b>	<b>PNP</b> <b>TIP115</b>
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2.0 Ampere  
 Darlington  
 Complementary Silicon  
 Power Transistors  
 60 Volts  
 50 Watts



**TO-220**

### Maximum Ratings

Characteristic	Symbol	TIP110 TIP115	Unit
Collector-Emitter Voltage	$V_{CEO}$	60	V
Collector-Base Voltage	$V_{CBO}$		
Emitter-Base Voltage	$V_{EBO}$	5.0	
Collector Current-Continuous Peak	$I_C$	2.0	A
	$I_{CM}$	4.0	
Base Current	$I_B$	50	mA
Total Power Dissipation at $T_C = 25^\circ C$ Derate above $25^\circ C$	$P_D$	50	W
		0.4	
Operating and Storage Junction Temperature Range	$T_J, T_{STG}$	-65 to +150	$^\circ C$

### Thermal Characteristics

Characteristic	Symbol	Maximum	Unit
Thermal Resistance Junction to Case	$R_{\theta jc}$	2.5	$^\circ C/W$

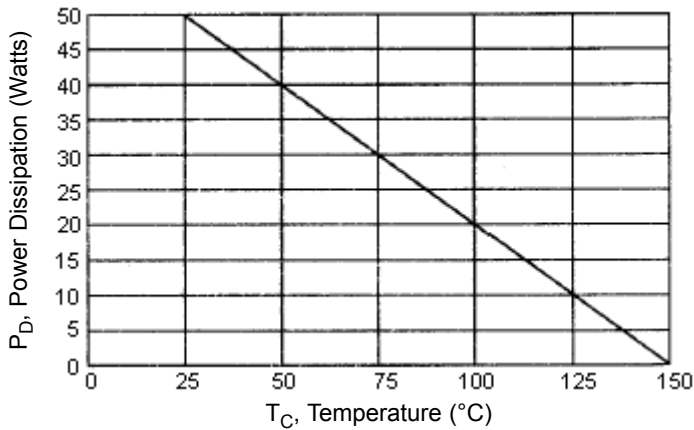


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Figure - 1 Power Derating



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

Characteristic	Symbol	Minimum	Maximum	Unit
<b>OFF Characteristics</b>				
Collector-Emitter Sustaining Voltage (1) ( $I_C = 30\text{mA}$ , $I_B = 0$ )	TIP110, TIP115 $V_{CEO(sus)}$	60	-	V
Collector Cut off Current ( $V_{CE} = 30\text{V}$ , $I_B = 0$ )	TIP110, TIP115 $I_{CEO}$	-	2.0	mA
Collector Cut off Current ( $V_{CB} = 60\text{V}$ , $I_E = 0$ )	TIP110, TIP115 $I_{CBO}$	-	1.0	
Emitter Cut off Current ( $V_{EB} = 5.0\text{V}$ , $I_C = 0$ )	$I_{EBO}$	-	2.0	
<b>ON Characteristics (1)</b>				
DC Current Gain ( $I_C = 1.0\text{A}$ , $V_{CE} = 4.0\text{V}$ ) ( $I_C = 2.0\text{A}$ , $V_{CE} = 4.0\text{V}$ )	$h_{FE}$	1000 500	-	-
Collector-Emitter Saturation Voltage ( $I_C = 2.0\text{A}$ , $I_B = 8.0\text{mA}$ )	$V_{CE(sat)}$	-	2.5	V
Base-Emitter On Voltage ( $I_C = 2.0\text{A}$ , $V_{CE} = 4.0\text{V}$ )	$V_{BE(on)}$	-	2.8	
<b>Dynamic Characteristics</b>				
Small-Signal Current Gain ( $I_C = 0.75\text{A}$ , $V_{CE} = 10\text{V}$ , $f = 1.0\text{MHz}$ )	$h_{fe}$	25	-	-
Output Capacitance ( $V_{CB} = 10\text{V}$ , $I_E = 0$ , $f = 0.1\text{MHz}$ )	TIP110 TIP115 $C_{ob}$	-	250 150	pF

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

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Internal Schematic Diagram

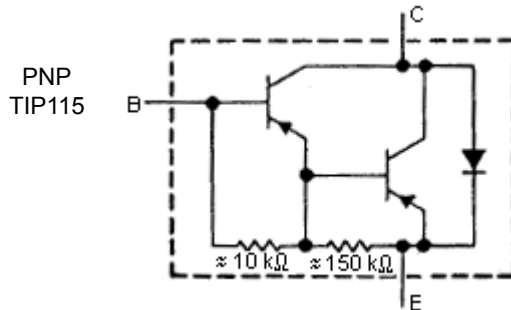
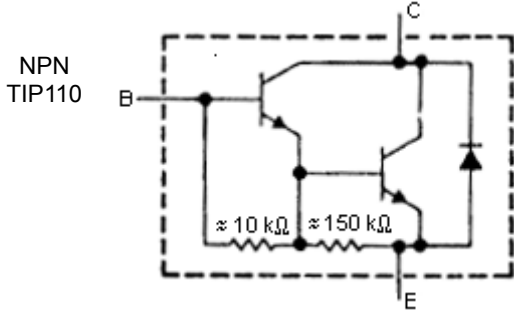


Figure - 2 Switching Time

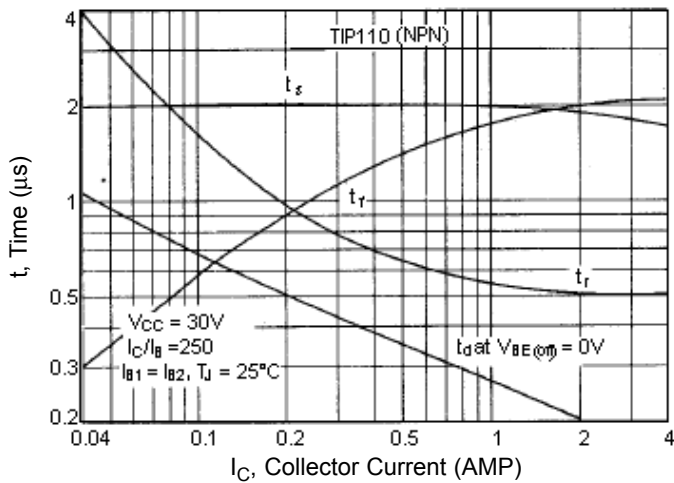


Figure - 3 Switching Time

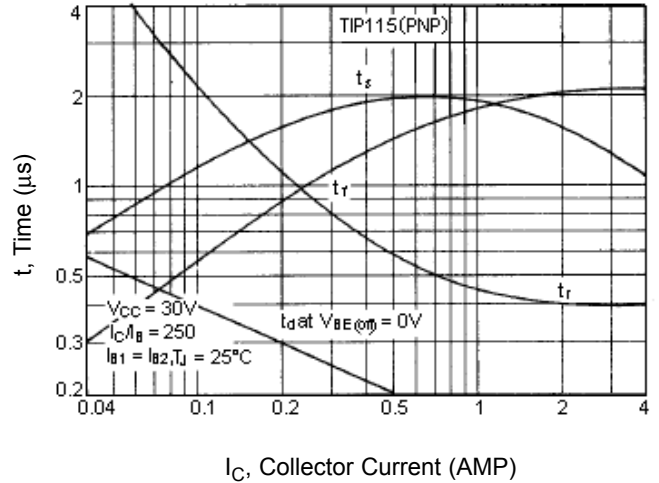


Figure - 4 Capacitances

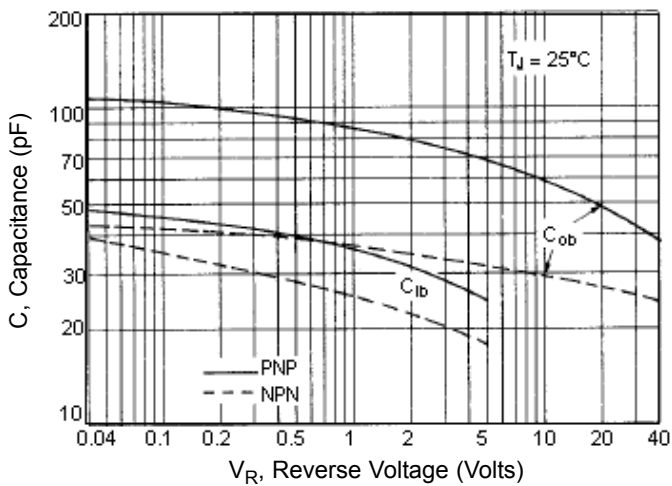
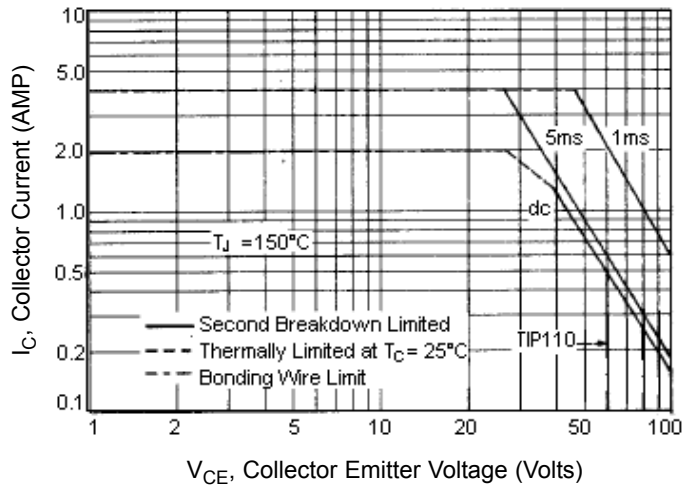


Figure - 5 Active Region Safe Operating Area

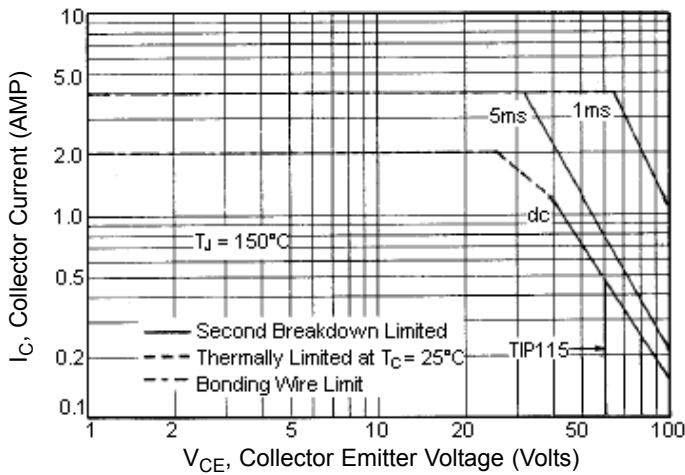


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Figure - 6 Active Region Safe Operating Area



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 the curves indicate.

The data of Figure - 5 and 6 is base on  $T_{J(PK)} = 150^\circ\text{C}$ ;  $T_C$  is variable depending on power level. Second breakdown pulse limits are valid for duty cycles to 10% provided  $T_{J(PK)} \leq 150^\circ\text{C}$ . At high case temperatures, thermal limitation will reduce the power that can be handled to values less than the limitations imposed by second breakdown.

### Specifications

$I_C$ (av) maximum (A)	$V_{CE0}$ maximum V	$h_{FE}$ minimum at $I_C = 1\text{A}$	$P_{tot}$ at $25^\circ\text{C}$ (W)	Package	Type	Part Number
2	60	1000	50	TO-220	NPN	TIP110
					PNP	TIP115

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