

## PLASTIC MEDIUM-POWER COMPLEMENTARY SILICON TRANSISTORS

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

### FEATURES:

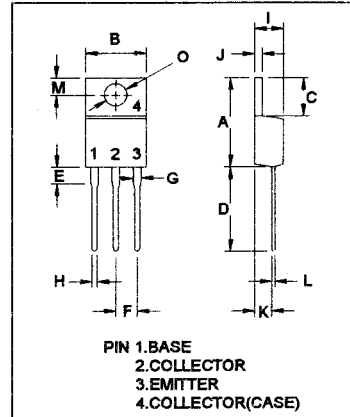
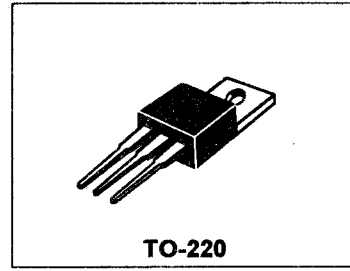
- \* Collector-Emitter Sustaining Voltage-  
 $V_{CEO(SUS)} = 60 \text{ V (Min) - TIP110, TIP115}$   
 $= 80 \text{ V (Min) - TIP111, TIP116}$   
 $= 100 \text{ V (Min) - TIP112, TIP117}$
- \* Collector-Emitter Saturation Voltage  
 $V_{CE(sat)} = 2.5 \text{ V (Max.) @ } I_C = 2.0 \text{ A}$
- \* Monolithic Construction with Built-in Base-Emitter Shunt Resistor

<b>NPN</b>	<b>PNP</b>
<b>TIP110</b>	<b>TIP115</b>
<b>TIP111</b>	<b>TIP116</b>
<b>TIP112</b>	<b>TIP117</b>

**2.0 AMPERE  
DARLINGTON  
COMPLEMENTARY SILICON  
POWER TRANSISTORS  
60-100 VOLTS  
50 WATTS**

### MAXIMUM RATINGS

Characteristic	Symbol	TIP110 TIP115	TIP111 TIP116	TIP112 TIP117	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	$I_C$ $I_{CM}$	2.0 4.0			A
Base Current	$I_B$	50			mA
Total Power Dissipation @ $T_C = 25^\circ\text{C}$ Derate above $25^\circ\text{C}$	$P_D$	50 0.4			W W/ $^\circ\text{C}$
Operating and Storage Junction Temperature Range	$T_J, T_{STG}$	- 65 to +150			$^\circ\text{C}$

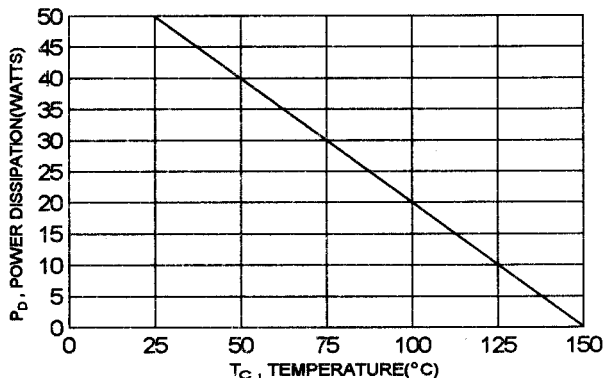


### THERMAL CHARACTERISTICS

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

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



**TIP110, TIP111, TIP112 NPN / TIP115, TIP116, TIP117 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) ( $I_C = 30\text{ mA}$ , $I_B = 0$ )	TIP110,TIP115 TIP111,TIP116 TIP112,TIP117	$V_{CEO(sus)}$	60 80 100	V
Collector Cutoff Current ( $V_{CE} = 30\text{ V}$ , $I_B = 0$ ) ( $V_{CE} = 40\text{ V}$ , $I_B = 0$ ) ( $V_{CE} = 50\text{ V}$ , $I_B = 0$ )	TIP110,TIP115 TIP111,TIP116 TIP112,TIP117	$I_{CEO}$	2.0 2.0 2.0	mA
Collector Cutoff Current ( $V_{CB} = 60\text{ V}$ , $I_E = 0$ ) ( $V_{CB} = 80\text{ V}$ , $I_E = 0$ ) ( $V_{CB} = 100\text{ V}$ , $I_E = 0$ )	TIP110,TIP115 TIP111,TIP116 TIP112,TIP117	$I_{CBO}$	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 ( $I_C = 1.0\text{ A}$ , $V_{CE} = 4.0\text{ V}$ ) ( $I_C = 2.0\text{ A}$ , $V_{CE} = 4.0\text{ V}$ )		$h_{FE}$	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	V

**DYNAMIC CHARACTERISTICS**

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,TIP111,TIP112 TIP115,TIP116,TIP117	$C_{ob}$	250 150	pF

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

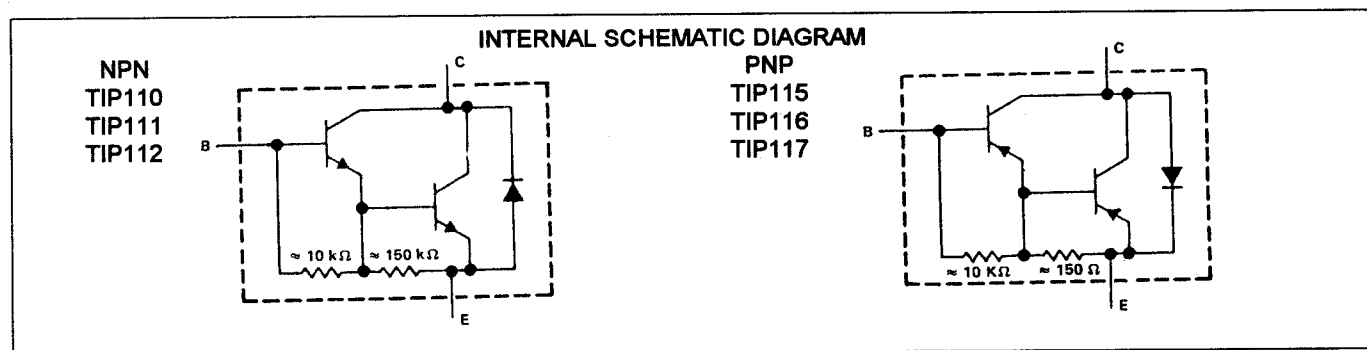


FIG-2 SWITCHING TIME

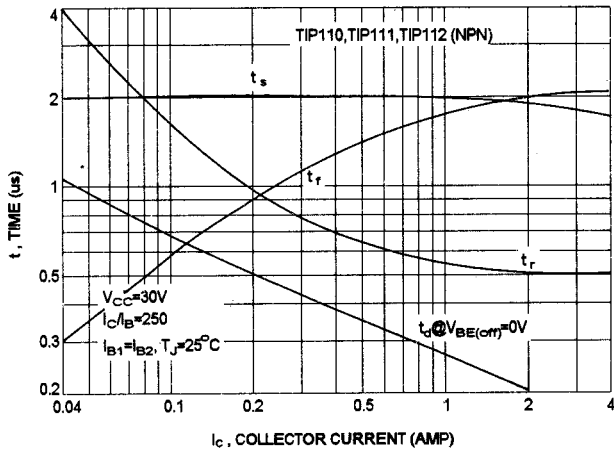


FIG-3 SWITCHING TIME

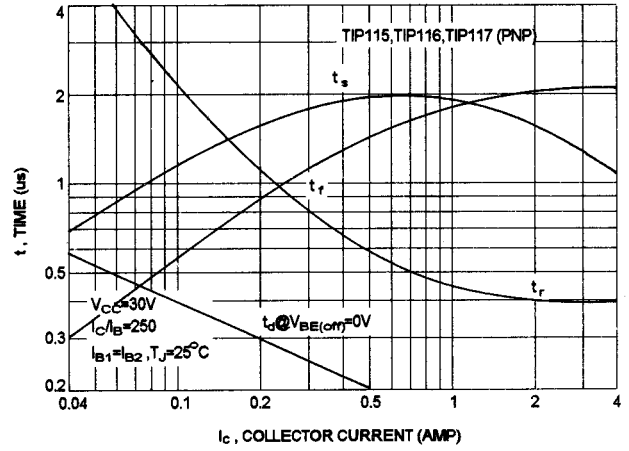


FIG-4 CAPACITANCES

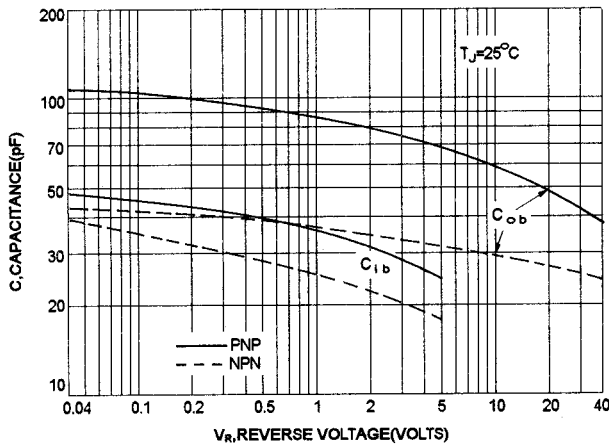


FIG-5 ACTIVE REGION SAFE OPERATING AREA

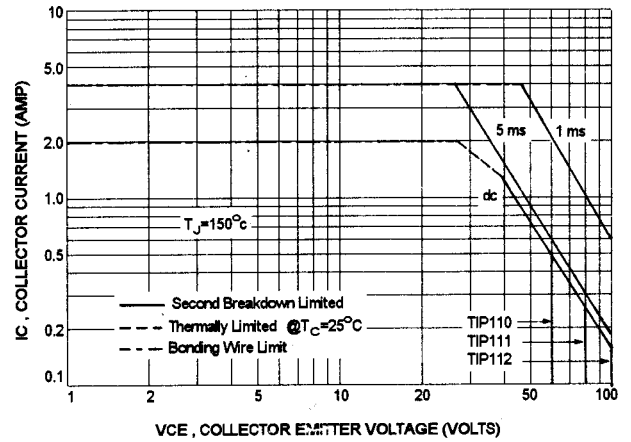
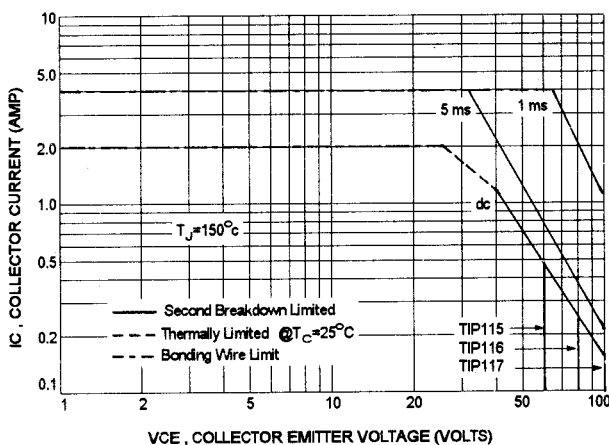


FIG-6 ACTIVE REGION SAFE OPERATING AREA



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