

## DARLINGTON COMPLEMENTARY SILICON POWER TRANSISTORS

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

### FEATURES:

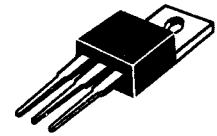
- \* Collector-Emitter Sustaining Voltage-  
 $V_{CE(SUS)} = 60 \text{ V (Min) - TIP140T, TIP145T}$   
 $= 80 \text{ V (Min) - TIP141T, TIP146T}$   
 $= 100 \text{ V (Min) - TIP142T, TIP147T}$
- \* Collector-Emitter Saturation Voltage  
 $V_{CE(sat)} = 2.0 \text{ V (Max.) @ } I_C = 5.0 \text{ A}$
- \*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

| NPN     | PNP     |
|---------|---------|
| TIP140T | TIP145T |
| TIP141T | TIP146T |
| TIP142T | TIP147T |

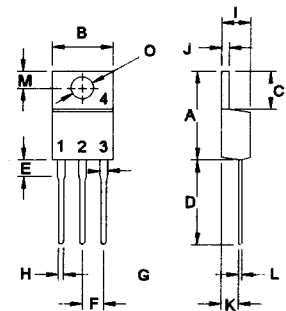
10 AMPERE  
DARLINGTON  
COMPLEMENTARY SILICON  
POWER TRANSISTORS  
60-100 VOLTS  
80 WATTS

### MAXIMUM RATINGS

| Characteristic  | Symbol            | TIP140T<br>TIP145T | TIP141T<br>TIP146T | TIP142T<br>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<br>-Peak   | $I_C$<br>$I_{CM}$ | 10<br>15           |                    |                    | A                        |
| Base Current  | $I_B$             | 0.5                |                    |                    | A                        |
| Total Power Dissipation @ $T_C = 25^\circ\text{C}$<br>Derate above $25^\circ\text{C}$ | $P_D$             | 80<br>0.64         |                    |                    | W<br>W/ $^\circ\text{C}$ |
| Operating and Storage Junction<br>Temperature Range                                   | $T_J, T_{STG}$    | - 55 to +150       |                    |                    | $^\circ\text{C}$         |



TO-220

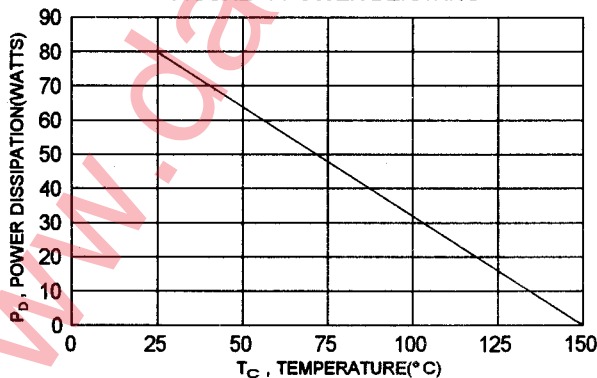


PIN 1. BASE  
2. COLLECTOR  
3. EMITTER  
4. COLLECTOR(CASE)

### THERMAL CHARACTERISTICS

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

FIGURE -1 POWER DERATING



| 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  |

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

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

| Characteristic | Symbol | Min | Max | Unit |
|----------------|--------|-----|-----|------|
|----------------|--------|-----|-----|------|

**OFF CHARACTERISTICS**

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

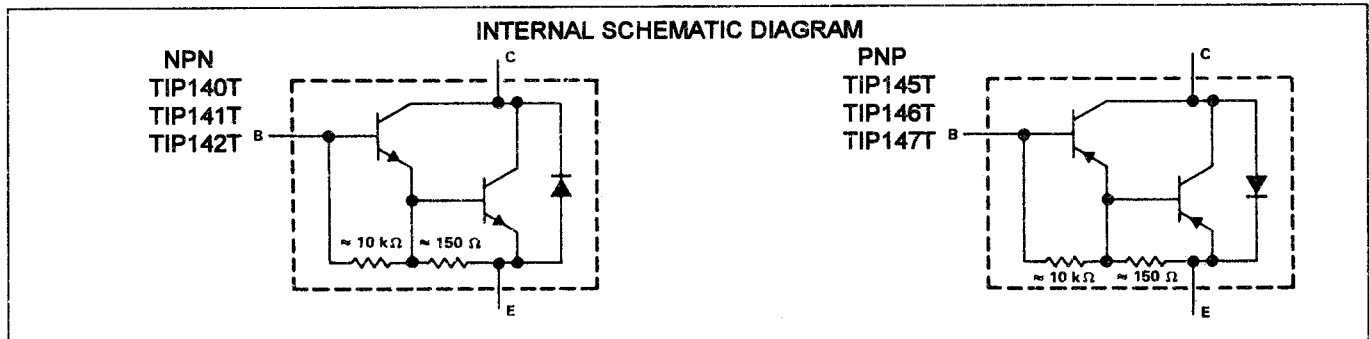
**ON CHARACTERISTICS (1)**

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

**SWITCHING CHARACTERISTICS**

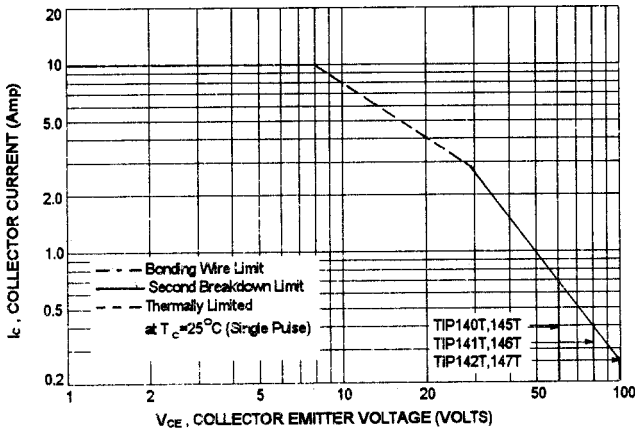
|              |   |       |           |  |    |
|--------------|---|-------|-----------|--|----|
| Delay Time   | $V_{CC} = 30\text{ V}$ , $I_C = 5.0\text{ A}$<br>$I_{B1} = -I_{B2} = 20\text{ mA}$ ,<br>$t_p = 20\mu\text{s}$ , Duty Cycle $\leq 2.0\%$ | $t_d$ | 0.15(Typ) |  | us |
| Rise Time    |   | $t_r$ | 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  $\leq 2.0\%$



# 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

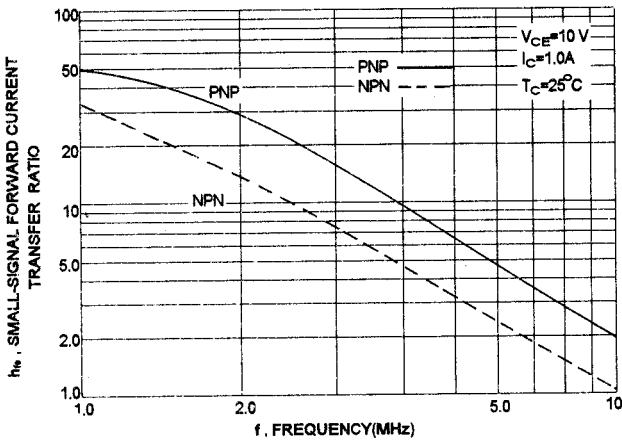


FIG-4 UNCLAMPED INDUCTIVE LOAD

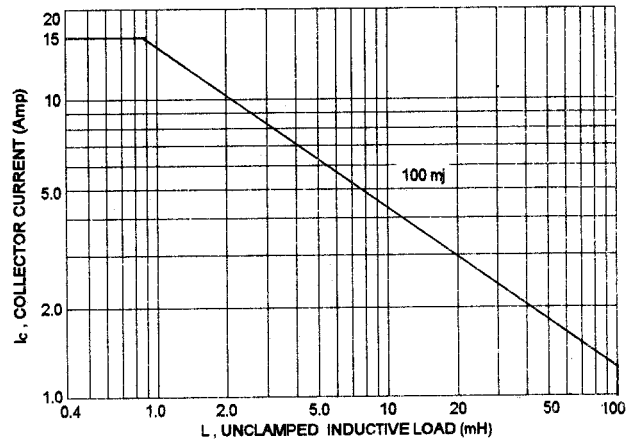


FIG-5 SWITCHING TIME

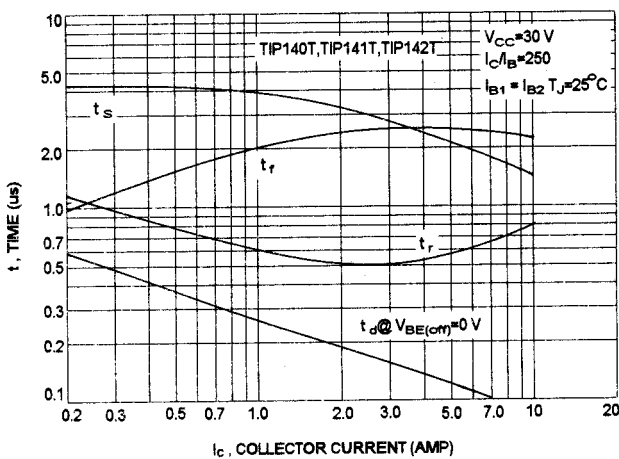
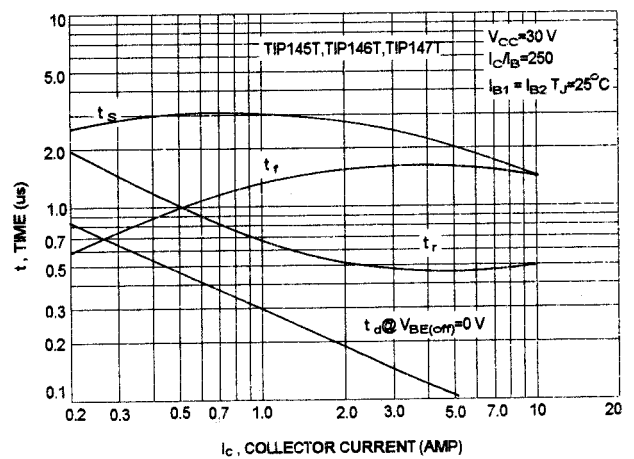


FIG-6 SWITCHING TIME



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

NPN TIP140T, TIP141T, TIP142T

PNP TIP145T, TIP146T, TIP147T

FIG-7 DC CURRENT GAIN

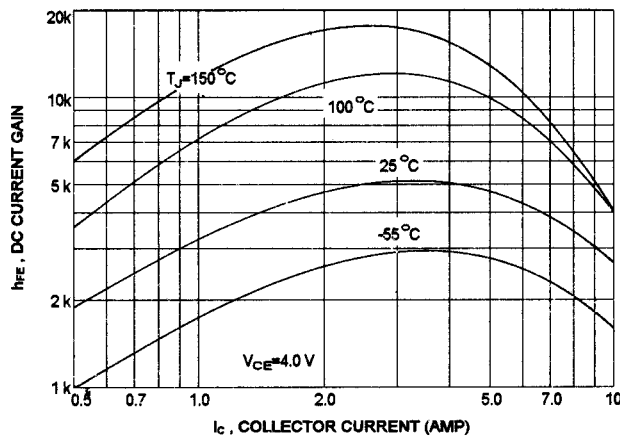
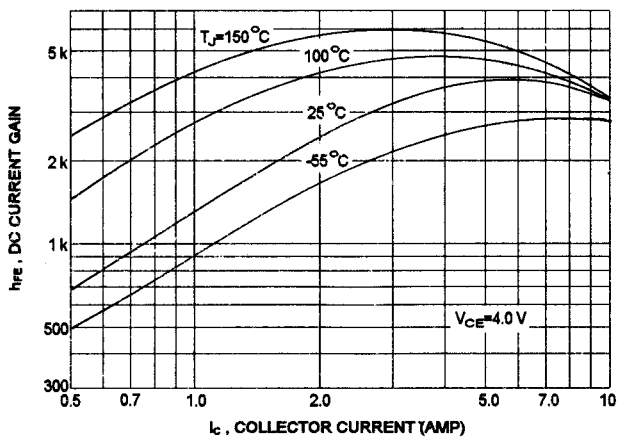


FIG-8 COLLECTOR-EMITTER SATURATION VOLTAGE

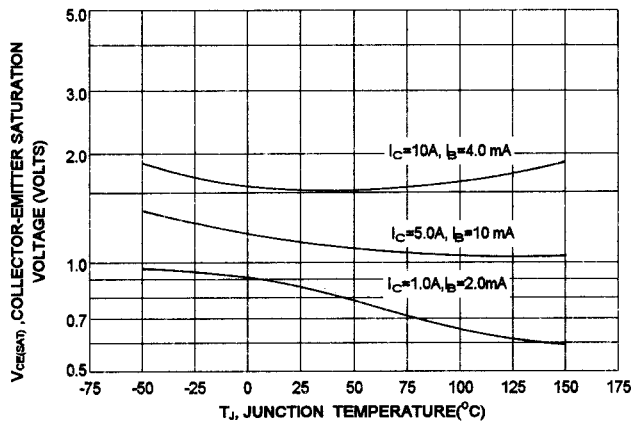
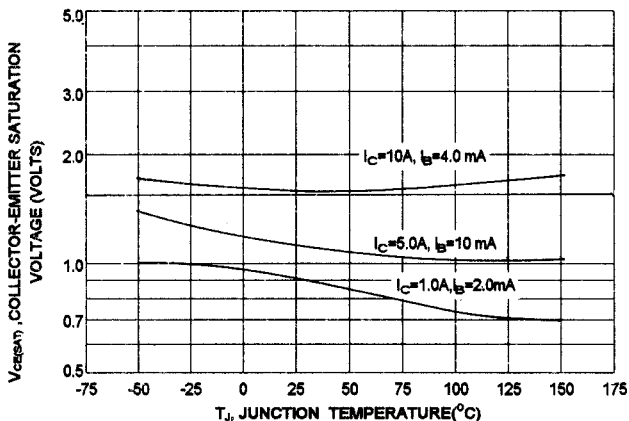


FIG-9 BASE-EMITTER VOLTAGE

