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Complementary Silicon Transistors, Plastic, Medium-Power

TIP100, TIP101, TIP102 (NPN); TIP105, TIP106, TIP107 (PNP)

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

Features

• High DC Current Gain -

 $h_{FE} = 2500 (Typ) @ I_C$ = 4.0 Adc

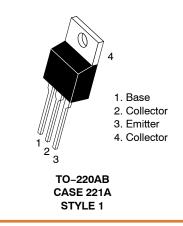
 Collector-Emitter Sustaining Voltage - @ 30 mAdc
 V_{CEO(sus)} = 60 Vdc (Min) - TIP100, TIP105 = 80 Vdc (Min) - TIP101, TIP106

= 100 Vdc (Min) - TIP102, TIP107

- Low Collector-Emitter Saturation Voltage -
 - $V_{CE(sat)} = 2.0 \text{ Vdc} (Max) @ I_C$

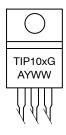
= 3.0 Adc

- $= 2.5 \text{ Vdc} (\text{Max}) @ I_{\text{C}} = 8.0 \text{ Adc}$
- Monolithic Construction with Built-in Base-Emitter Shunt Resistors
- These Devices are Pb-Free and are RoHS Compliant



DARLINGTON 8 AMPERE COMPLEMENTARY SILICON POWER TRANSISTORS 60–80–100 VOLTS, 80 WATTS

MARKINGDIAGRAM



 $\begin{array}{ll} TIP10x &= Device \ Code \\ x &= 0, 1, 2, 5, 6, or \ 7 \\ A &= Assembly \ Location \\ Y &= Year \\ WW &= Work \ Week \\ G &= Pb-Free \ Package \end{array}$

ORDERING INFORMATION

See detailed ordering and shipping information on page 7 of this data sheet.

MAXIMUM RATINGS

| Symbol | Rating | TIP100, TIP105 | TIP101, TIP106 | TIP102, TIP107 | Unit |
|-----------------------------------|--|-------------------|-------------------|-------------------|-----------|
| V _{CEO} | Collector – Emitter Voltage | 60 | 80 | 100 | Vdc |
| V _{CB} | Collector – Base Voltage | 60 80 100 | | | Vdc |
| V _{EB} | Emitter – Base Voltage | 5.0 | | | Vdc |
| Ι _C | Collector Current – Continuous – Peak | 8.0 15 | | | Adc |
| Ι _Β | Base Current | 1.0 | | | Adc |
| P _D | Total Power Dissipation @ T _C = 25°C Derate above 25°C | 80 0.64 | | | W W/°C |
| E | Unclamped Inductive Load Energy (Note 1) | 30 | | | mJ |
| PD | Total Power Dissipation @ T _A = 25°C Derate above 25°C | 2.0 0.016 | | W W/°C | |
| T _J , T _{stg} | Operating and Storage Junction Temperature Range | -65 to +150 | | | °C |

Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

THERMAL CHARACTERISTICS

| R _{0JC} Thermal Resistance, Junction-to-Case 1.56 | |
|--|------|
| | °C/W |
| R _{0JA} Thermal Resistance, Junction-to-Ambient62.5 | °C/W |

1. I_C = 1.1 A, L = 50 mH, P.R.F. = 10 Hz, V_{CC} = 20 V, R_{BE} = 100 Ω

ELECTRICAL CHARACTERISTICS (T_C = 25°C unless otherwise noted)

| Characteristic | | Min | Max | Unit | | | | |
|--|---|-----|-----|---|--|--|--|--|
| OFF CHARACTERISTICS | | | | | | | | |
| Collector-Emitter Sustaining Voltage (Note 1) | | | | Vdc | | | | |
| $(I_{\rm C} = 30 \text{ mAdc}, I_{\rm B} = 0)$ | TIP100, TIP105 | 60 | - | | | | | |
| | TIP101, TIP106 | 80 | - | | | | | |
| | TIP102, TIP107 | 100 | - | | | | | |
| Collector Cutoff Current | | | | μAdd | | | | |
| (V _{CE} = 30 Vdc, I _B = 0) | TIP100, TIP105 | _ | 50 | | | | | |
| $(V_{CE} = 40 \text{ Vdc}, I_{B} = 0)$ | TIP101, TIP106 | _ | 50 | | | | | |
| (V _{CE} = 50 Vdc, I _B = 0) | TIP102, TIP107 | - | 50 | | | | | |
| Collector Cutoff Current | | | | μAdd | | | | |
| (V _{CB} = 60 Vdc, I _E = 0) | TIP100, TIP105 | _ | 50 | | | | | |
| (V _{CB} = 80 Vdc, I _E = 0) | TIP101, TIP106 | _ | 50 | | | | | |
| (V _{CB} = 100 Vdc, I _E = 0) | TIP102, TIP107 | - | 50 | | | | | |
| Emitter Cutoff Current (V _{BE} = 5.0 Vdc, I _C = 0) | | _ | 8.0 | mAdo | | | | |
| - | ERISTICS Collector-Emitter Sustaining Voltage (Note 1) $(I_C = 30 \text{ mAdc}, I_B = 0)$ Collector Cutoff Current $(V_{CE} = 30 \text{ Vdc}, I_B = 0)$ $(V_{CE} = 40 \text{ Vdc}, I_B = 0)$ $(V_{CE} = 50 \text{ Vdc}, I_B = 0)$ $(V_{CB} = 60 \text{ Vdc}, I_E = 0)$ $(V_{CB} = 80 \text{ Vdc}, I_E = 0)$ $(V_{CB} = 100 \text{ Vdc}, I_E = 0)$ | | | $ \begin{array}{c c c c c c c c c c c c c c c c c c c $ | | | | |

DC Current Gain h_{FE} $(I_C = 3.0 \text{ Adc}, V_{CE} = 4.0 \text{ Vdc})$ 1000 20,000 $(I_{C} = 8.0 \text{ Adc}, V_{CE} = 4.0 \text{ Vdc})$ 200 _ V_{CE(sat)} Collector-Emitter Saturation Voltage Vdc $(I_C = 3.0 \text{ Adc}, I_B = 6.0 \text{ mAdc})$ _ 2.0 $(I_{C} = 8.0 \text{ Adc}, I_{B} = 80 \text{ mAdc})$ 2.5 _ V_{BE(on)} Base-Emitter On Voltage (I_C = 8.0 Adc, V_{CE} = 4.0 Vdc) _ 2.8 Vdc

DYNAMIC CHARACTERISTICS

| h _{fe} | Small-Signal Current Gain (I _C = 3.0 Adc, V _{CE} = 4.0 Vdc, f = 1.0 MHz) | | | - | - |
|-----------------|--|--|--------|------------|----|
| C _{ob} | Output Capacitance (V _{CB} = 10 Vdc, I _E = 0, f = 0.1 MHz) | TIP105, TIP106, TIP107 TIP100, TIP101, TIP102 | - - | 300 200 | pF |

Product parametric performance is indicated in the Electrical Characteristics for the listed test conditions, unless otherwise noted. Product performance may not be indicated by the Electrical Characteristics if operated under different conditions.

2. Pulse Test: Pulse Width \leq 300 µs, Duty Cycle \leq 2%.

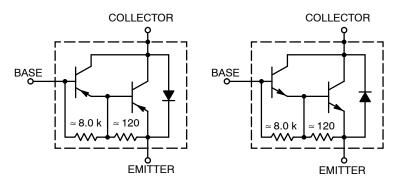


Figure 1. Darlington Circuit Schematic

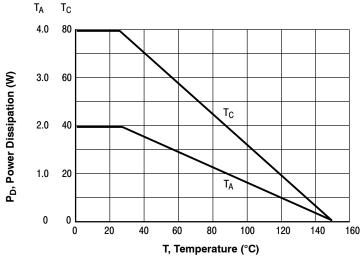


Figure 2. Power Derating

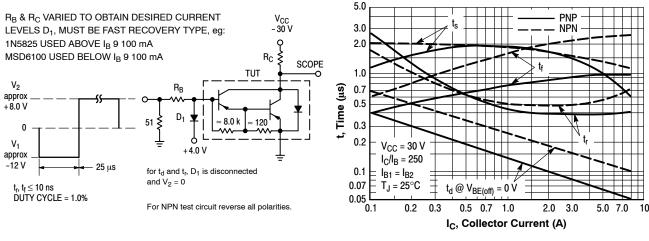


Figure 3. Switching Times Test Circuit

Figure 4. Switching Times

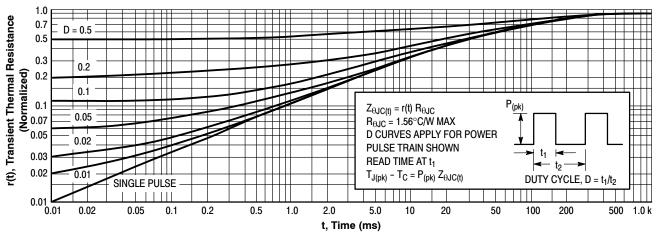


Figure 5. Thermal Response

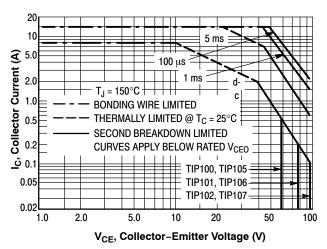


Figure 6. Active-Region Safe Operating Area

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 the curves indicate.

The data of Figure 6 is based on $T_{J(pk)} = 150^{\circ}$ C; T_{C} is variable depending on conditions. Second breakdown pulse limits are valid for duty cycles to 10% provided $T_{J(pk)} < 150^{\circ}$ C. $T_{J(pk)}$ may be calculated from the data in Figure 5. At high case temperatures, thermal limitations will reduce the power that can be handled to values less than the limitations imposed by second breakdown

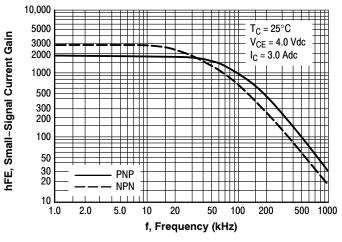


Figure 7. Small-Signal Current Gain

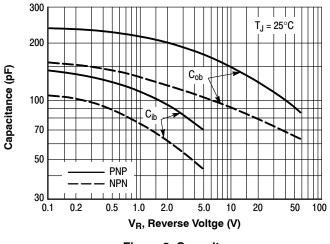
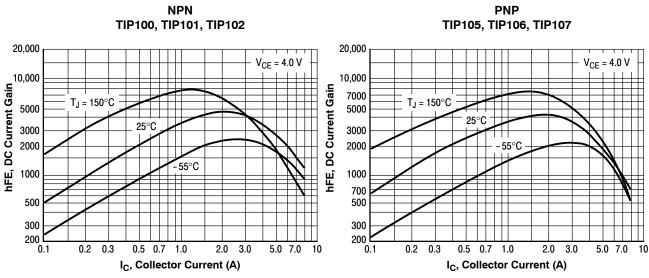
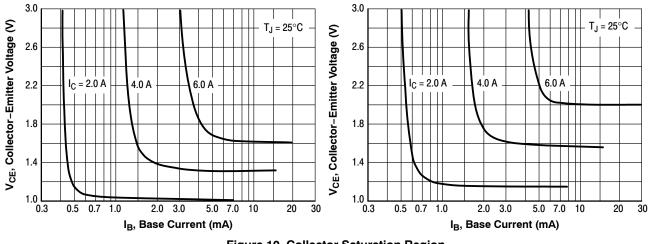
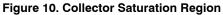


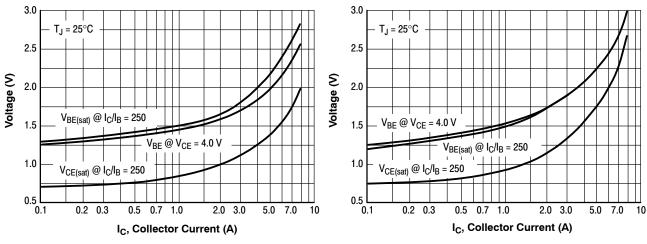
Figure 8. Capacitance

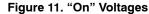












ORDERING INFORMATION

| Device | Package | Shipping |
|---------|---------------------|-----------------|
| TIP100 | TO-220 | 50 Units / Rail |
| TIP100G | TO-220 (Pb-Free) | 50 Units / Rail |
| TIP101 | TO-220 | 50 Units / Rail |
| TIP101G | TO-220 (Pb-Free) | 50 Units / Rail |
| TIP102 | TO-220 | 50 Units / Rail |
| TIP102G | TO-220 (Pb-Free) | 50 Units / Rail |
| TIP105 | TO-220 | 50 Units / Rail |
| TIP105G | TO-220 (Pb-Free) | 50 Units / Rail |
| TIP106 | TO-220 | 50 Units / Rail |
| TIP106G | TO-220 (Pb-Free) | 50 Units / Rail |
| TIP107 | TO-220 | 50 Units / Rail |
| TIP107G | TO-220 (Pb-Free) | 50 Units / Rail |

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|---|---|--------------------|------------------------------------|--|---|---|--------------|-------------|
| SCALE 1:1 | | PLANE 1 2 3. | . CONT . DIMEI LEA | ROLLING D NSION Z DE D IRREGUL/ WIDTH FOR | AND TOLERAI IMENSION: IN FINES A ZONI ARITIES ARE A F102 DEVICE | NCHES E WHERE AL ALLOWED. E = 1.35MM | L BODY AND | |
| A A | | | | INC | 1 | MILLIM | | |
| | Ŭ | | DIM | MIN. | MAX. | MIN. | MAX. | |
| 1 2 3 | | | A | 0.570 | 0.620 | 14.48 | 15.75 | |
| | | | B | 0.380 | 0.415 | 9.66 | 10.53 | |
| <u>╄</u> <u></u> | | | C D | 0.160 | 0.190 | 4.07 | 4.83 | |
| | | | F | 0.025 | 0.038 | 0.64 3.60 | 0.96 4.09 | |
| Z-J K | | | G | 0.095 | 0.101 | 2.42 | 2.66 | |
| | | | н | 0.110 | 0.161 | 2.42 | 4.10 | |
| | | | | 0.014 | 0.024 | 0.36 | 0.61 | |
| | | | ĸ | 0.500 | 0.562 | 12.70 | 14.27 | |
| ∨4 | R — | | L | 0.045 | 0.060 | 1.15 | 1.52 | |
| G | J → → | | N | 0.190 | 0.210 | 4.83 | 5.33 | |
| D | | | Q | 0.100 | 0.120 | 2.54 | 3.04 | |
| N | | | R | 0.080 | 0.110 | 2.04 | 2.79 | |
| | | | s | 0.045 | 0.055 | 1.15 | 1.41 | |
| | | | т | 0.235 | 0.255 | 5.97 | 6.47 | |
| | | | U | 0.000 | 0.050 | 0.00 | 1.27 | |
| | | | V | 0.045 | | 1.15 | | |
| | | | Z | | 0.080 | | 2.04 | |
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