# onsemi

# **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

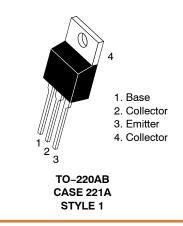
 Collector-Emitter Sustaining Voltage - @ 30 mAdc
 V<sub>CEO(sus)</sub> = 60 Vdc (Min) - TIP100, TIP105 = 80 Vdc (Min) - TIP101, TIP106

= 100 Vdc (Min) - TIP102, TIP107

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

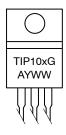
= 3.0 Adc

- $= 2.5 \text{ Vdc} (\text{Max}) @ I_{\text{C}} = 8.0 \text{ Adc}$
- 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 <sub>CEO</sub>	Collector – Emitter Voltage	60	80	100	Vdc
V <sub>CB</sub>	Collector – Base Voltage	60 80 100			Vdc
V <sub>EB</sub>	Emitter – Base Voltage	5.0			Vdc
Ι <sub>C</sub>	Collector Current – Continuous – Peak	8.0 15			Adc
Ι <sub>Β</sub>	Base Current	1.0			Adc
P <sub>D</sub>	Total Power Dissipation @ T <sub>C</sub> = 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 <sub>A</sub> = 25°C Derate above 25°C	2.0 0.016		W W/°C	
T <sub>J</sub> , T <sub>stg</sub>	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 <sub>0JC</sub> Thermal Resistance, Junction-to-Case 1.56	
	°C/W
R <sub>0JA</sub> 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  $\Omega$ 

#### ELECTRICAL CHARACTERISTICS (T<sub>C</sub> = 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 <sub>CE</sub> = 30 Vdc, I <sub>B</sub> = 0)	TIP100, TIP105	_	50					
$(V_{CE} = 40 \text{ Vdc}, I_{B} = 0)$	TIP101, TIP106	_	50					
(V <sub>CE</sub> = 50 Vdc, I <sub>B</sub> = 0)	TIP102, TIP107	-	50					
Collector Cutoff Current				μAdd				
(V <sub>CB</sub> = 60 Vdc, I <sub>E</sub> = 0)	TIP100, TIP105	_	50					
(V <sub>CB</sub> = 80 Vdc, I <sub>E</sub> = 0)	TIP101, TIP106	_	50					
(V <sub>CB</sub> = 100 Vdc, I <sub>E</sub> = 0)	TIP102, TIP107	-	50					
Emitter Cutoff Current (V <sub>BE</sub> = 5.0 Vdc, I <sub>C</sub> = 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<sub>FE</sub>  $(I_C = 3.0 \text{ Adc}, V_{CE} = 4.0 \text{ Vdc})$ 1000 20,000  $(I_{C} = 8.0 \text{ Adc}, V_{CE} = 4.0 \text{ Vdc})$ 200 \_ V<sub>CE(sat)</sub> 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<sub>BE(on)</sub> Base-Emitter On Voltage (I<sub>C</sub> = 8.0 Adc, V<sub>CE</sub> = 4.0 Vdc) \_ 2.8 Vdc

DYNAMIC CHARACTERISTICS

h <sub>fe</sub>	Small-Signal Current Gain (I <sub>C</sub> = 3.0 Adc, V <sub>CE</sub> = 4.0 Vdc, f = 1.0 MHz)			-	-
C <sub>ob</sub>	Output Capacitance (V <sub>CB</sub> = 10 Vdc, I <sub>E</sub> = 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%.

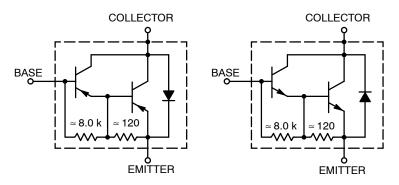


Figure 1. Darlington Circuit Schematic

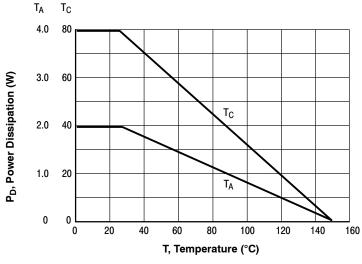


Figure 2. Power Derating

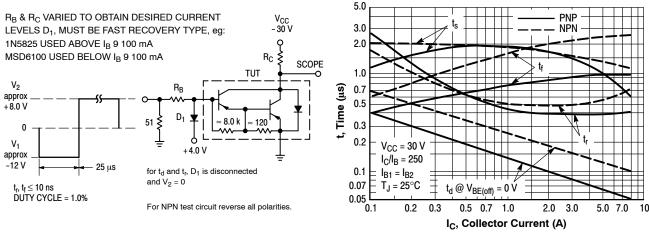


Figure 3. Switching Times Test Circuit

Figure 4. Switching Times

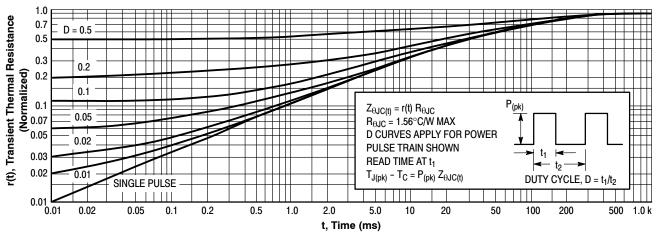


Figure 5. Thermal Response

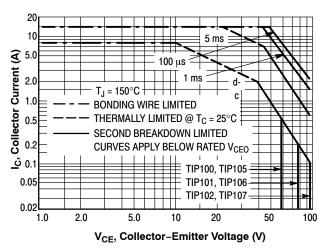


Figure 6. Active-Region Safe Operating Area

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

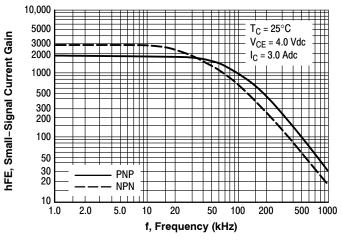


Figure 7. Small-Signal Current Gain

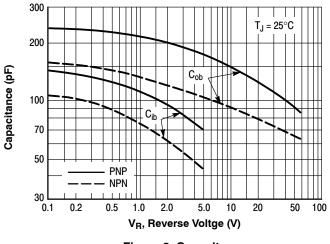
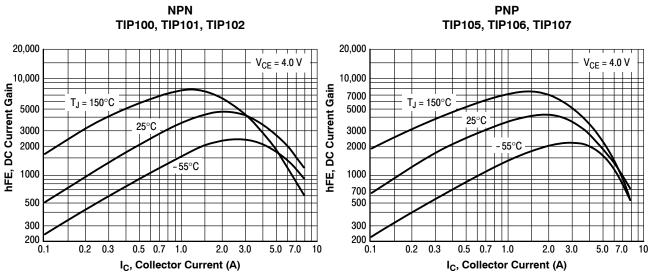
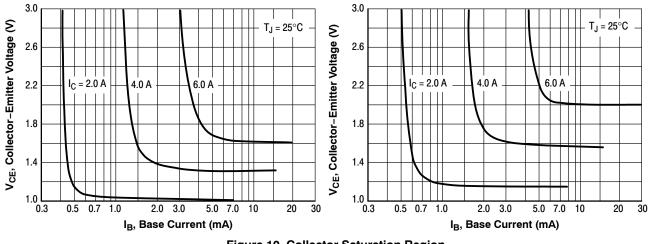
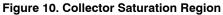


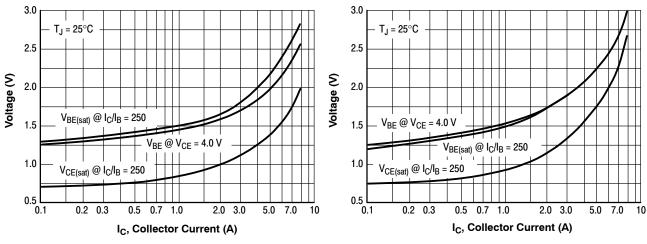
Figure 8. Capacitance

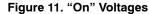












#### ORDERING INFORMATION

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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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	
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			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 <del>→    →</del>		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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