

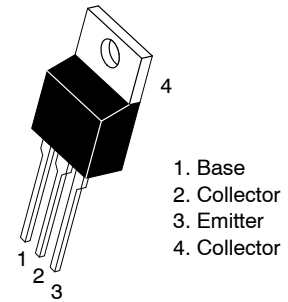
# Complementary Silicon Transistors, Plastic, Medium-Power

## 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 –
  - $V_{CE(sat)} = 2.0$  Vdc (Max) @  $I_C$
  - $= 3.0$  Adc
  - $= 2.5$  Vdc (Max) @  $I_C = 8.0$  Adc
- Monolithic Construction with Built-in Base–Emitter Shunt Resistors
- These Devices are Pb-Free and are RoHS Compliant



TO-220AB  
 CASE 221A  
 STYLE 1

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

### MARKINGDIAGRAM



- TIP10x = Device Code
- x = 0, 1, 2, 5, 6, or 7
- A = Assembly Location
- Y = Year
- WW = Work Week
- G = Pb-Free Package

### ORDERING INFORMATION

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

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

## 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
$I_C$	Collector Current – Continuous – Peak	8.0 15			Adc
$I_B$	Base Current	1.0			Adc
$P_D$	Total Power Dissipation @ $T_C = 25^\circ\text{C}$ Derate above $25^\circ\text{C}$	80 0.64			W W/ $^\circ\text{C}$
E	Unclamped Inductive Load Energy (Note 1)	30			mJ
$P_D$	Total Power Dissipation @ $T_A = 25^\circ\text{C}$ Derate above $25^\circ\text{C}$	2.0 0.016			W W/ $^\circ\text{C}$
$T_J, T_{stg}$	Operating and Storage Junction Temperature Range	–65 to +150			$^\circ\text{C}$

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

Symbol	Characteristic	Max	Unit
$R_{\theta JC}$	Thermal Resistance, Junction–to–Case	1.56	$^\circ\text{C}/\text{W}$
$R_{\theta JA}$	Thermal Resistance, Junction–to–Ambient	62.5	$^\circ\text{C}/\text{W}$

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

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

Symbol	Characteristic	Min	Max	Unit
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### OFF CHARACTERISTICS

$V_{CEO(sus)}$	Collector–Emitter Sustaining Voltage (Note 1) ( $I_C = 30\text{ mA}$ , $I_B = 0$ )	TIP100, TIP105 TIP101, TIP106 TIP102, TIP107	60 80 100	– – –	Vdc
$I_{CEO}$	Collector Cutoff Current ( $V_{CE} = 30\text{ Vdc}$ , $I_B = 0$ ) ( $V_{CE} = 40\text{ Vdc}$ , $I_B = 0$ ) ( $V_{CE} = 50\text{ Vdc}$ , $I_B = 0$ )	TIP100, TIP105 TIP101, TIP106 TIP102, TIP107	– – –	50 50 50	$\mu\text{Adc}$
$I_{CBO}$	Collector Cutoff Current ( $V_{CB} = 60\text{ Vdc}$ , $I_E = 0$ ) ( $V_{CB} = 80\text{ Vdc}$ , $I_E = 0$ ) ( $V_{CB} = 100\text{ Vdc}$ , $I_E = 0$ )	TIP100, TIP105 TIP101, TIP106 TIP102, TIP107	– – –	50 50 50	$\mu\text{Adc}$
$I_{EBO}$	Emitter Cutoff Current ( $V_{BE} = 5.0\text{ Vdc}$ , $I_C = 0$ )		–	8.0	mAdc

### ON CHARACTERISTICS (Note 1)

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

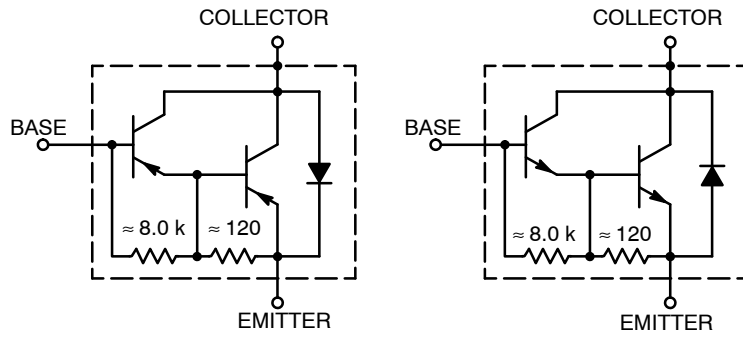
### DYNAMIC CHARACTERISTICS

$h_{fe}$	Small–Signal Current Gain ( $I_C = 3.0\text{ Adc}$ , $V_{CE} = 4.0\text{ Vdc}$ , $f = 1.0\text{ MHz}$ )	4.0	–	–	
$C_{ob}$	Output Capacitance ( $V_{CB} = 10\text{ Vdc}$ , $I_E = 0$ , $f = 0.1\text{ MHz}$ )	TIP105, TIP106, TIP107 TIP100, TIP101, TIP102	– –	300 200	pF

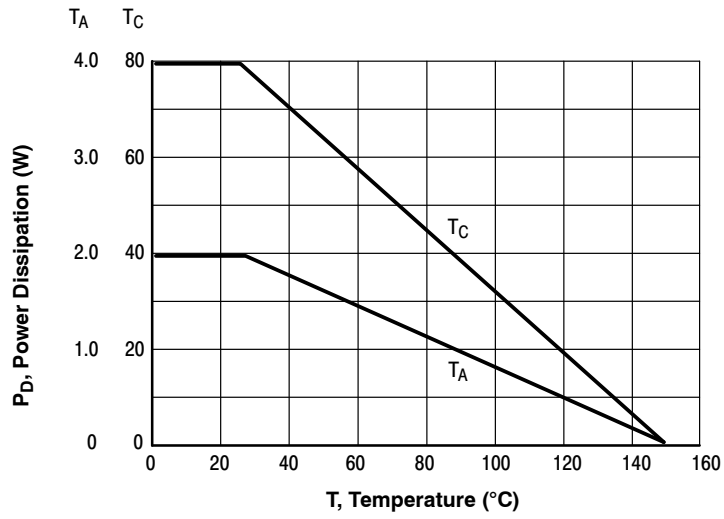
Product parametric performance is indicated in the Electrical Characteristics for the listed test conditions, unless otherwise noted. Product performance may not be indicated by the Electrical Characteristics if operated under different conditions.

2. Pulse Test: Pulse Width  $\leq 300\ \mu\text{s}$ , Duty Cycle  $\leq 2\%$ .

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



**Figure 1. Darlington Circuit Schematic**



**Figure 2. Power Derating**

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

$R_B$  &  $R_C$  VARIED TO OBTAIN DESIRED CURRENT LEVELS  $D_1$ , MUST BE FAST RECOVERY TYPE, eg: 1N5825 USED ABOVE  $I_B$  9 100 mA MSD6100 USED BELOW  $I_B$  9 100 mA

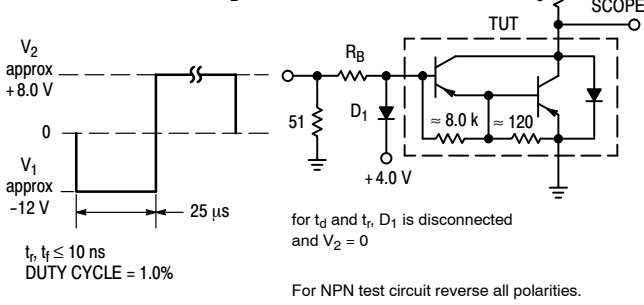


Figure 3. Switching Times Test Circuit

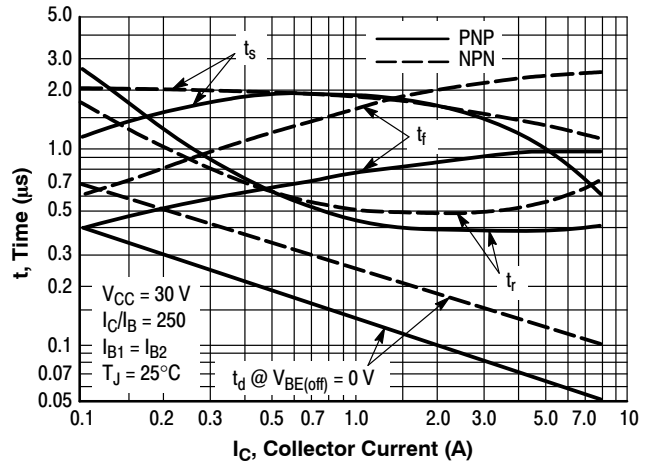


Figure 4. Switching Times

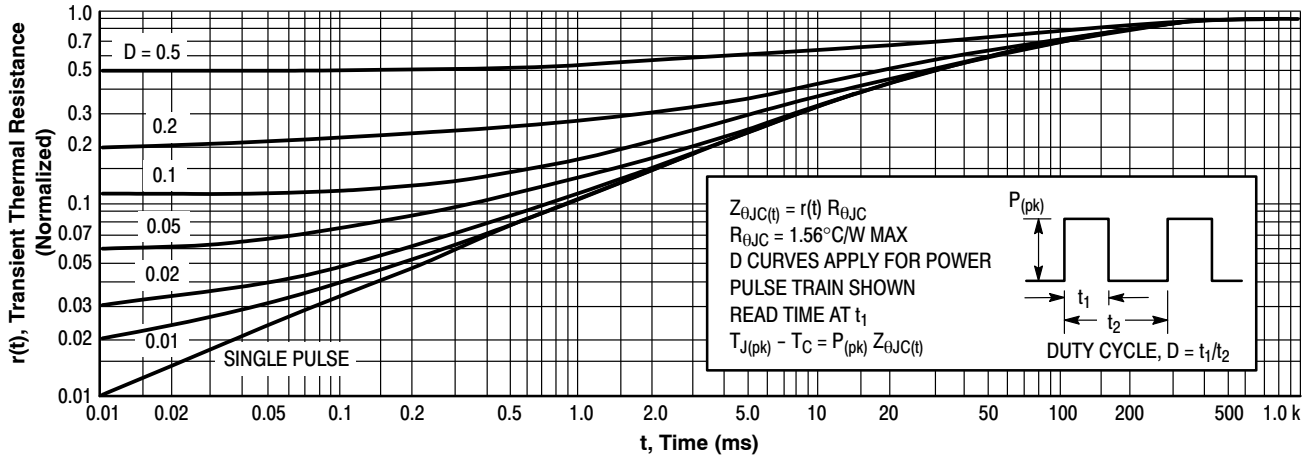


Figure 5. Thermal Response

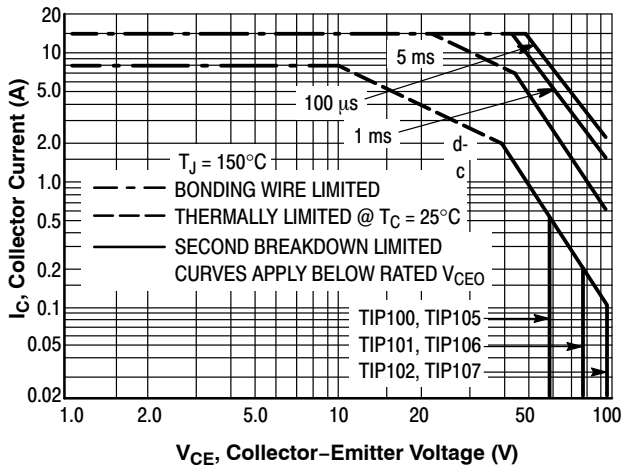


Figure 6. Active-Region Safe Operating Area

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  $T_{J(pk)} = 150^\circ\text{C}$ ;  $T_C$  is variable depending on conditions. Second breakdown pulse limits are valid for duty cycles to 10% provided  $T_{J(pk)} < 150^\circ\text{C}$ .  $T_{J(pk)}$  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

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

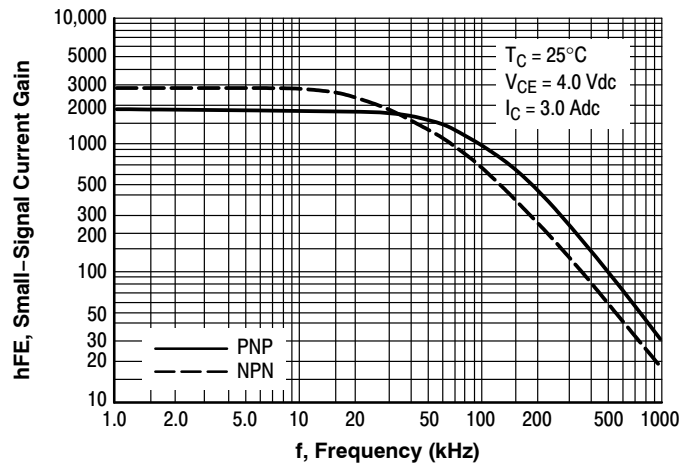


Figure 7. Small-Signal Current Gain

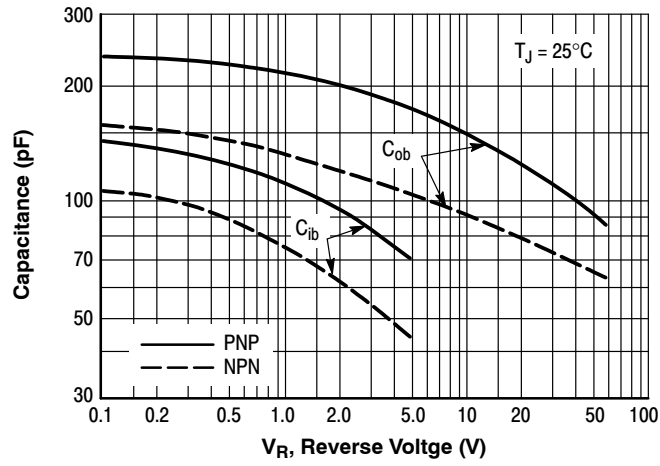


Figure 8. Capacitance

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

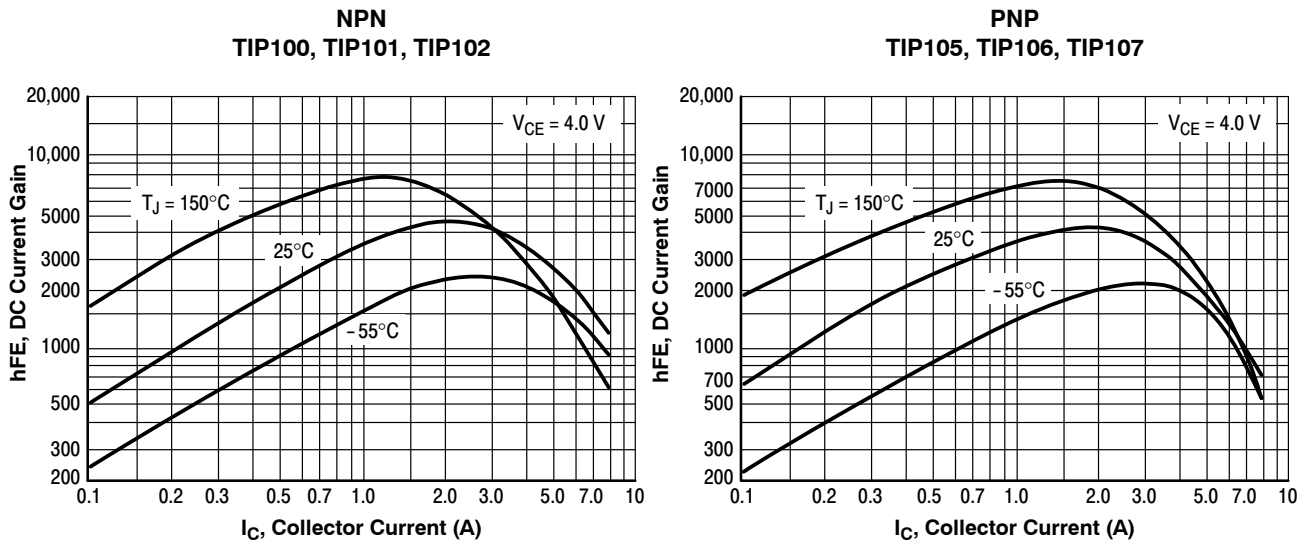


Figure 9. DC Current Gain

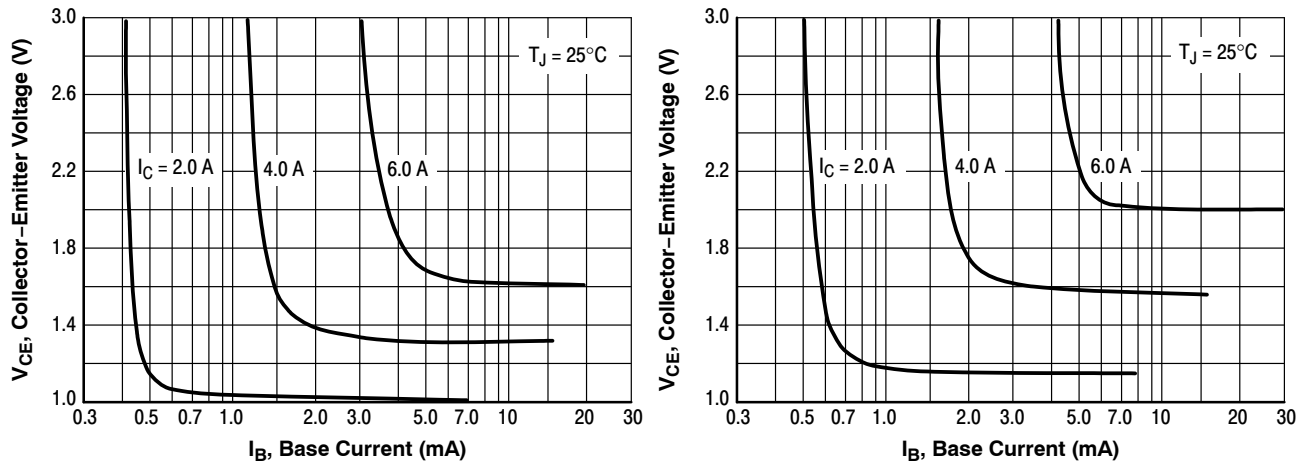


Figure 10. Collector Saturation Region

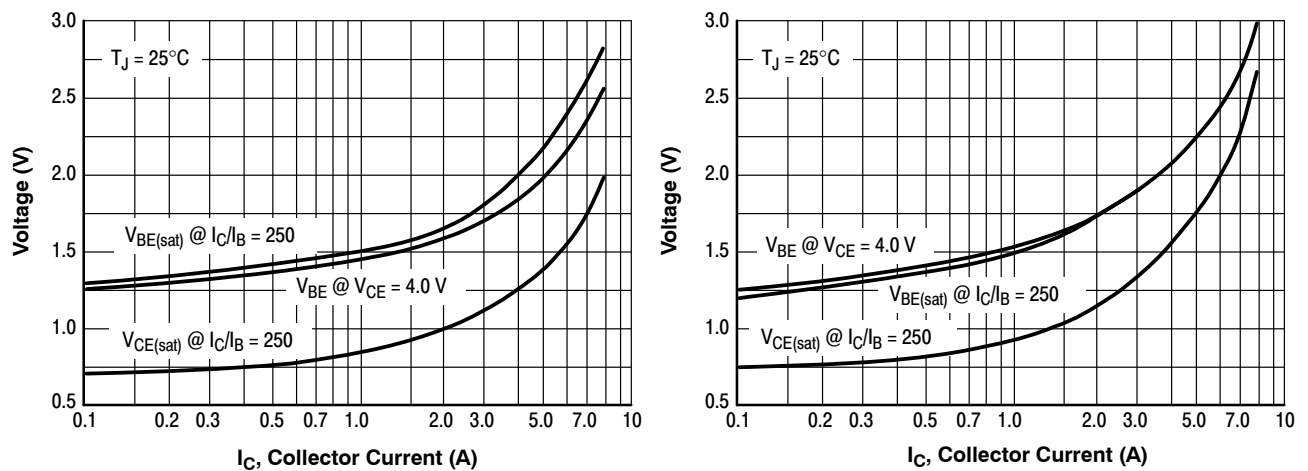
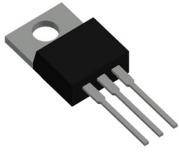


Figure 11. "On" Voltages

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

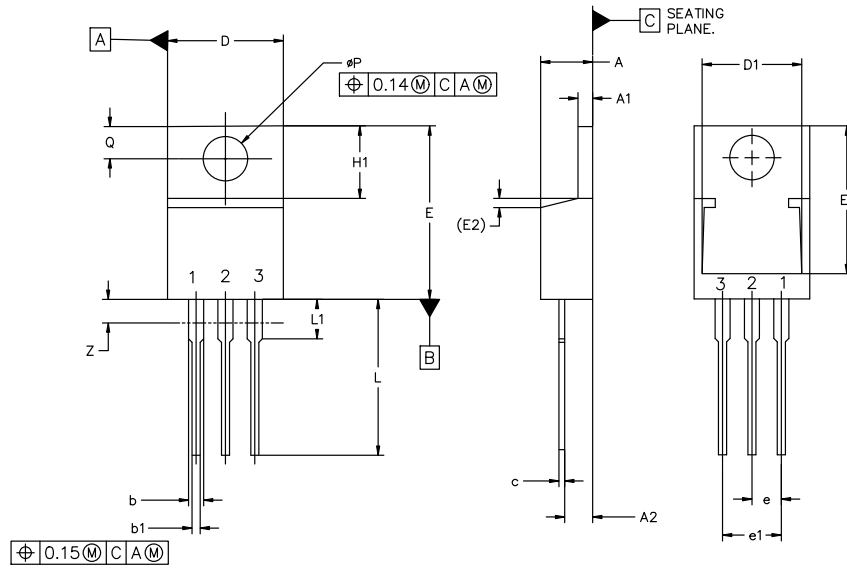
### ORDERING INFORMATION

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



TO-220-3 10.10x15.12x4.45, 2.54P  
CASE 221A  
ISSUE AL

DATE 05 FEB 2025



MILLIMETERS			
DIM	MIN	NOM	MAX
A	4.07	4.45	4.83
A1	1.15	1.28	1.41
A2	2.04	2.42	2.79
b	1.15	1.34	1.52
b1	0.64	0.80	0.96
c	0.36	0.49	0.61
D	9.66	10.10	10.53
D1	8.43	8.63	8.83
E	14.48	15.12	15.75
E1	12.58	12.78	12.98
E2	1.27 REF		

MILLIMETERS			
DIM	MIN	NOM	MAX
e	2.42	2.54	2.66
e1	4.83	5.08	5.33
H1	5.97	6.22	6.47
L	12.70	13.49	14.27
L1	2.80	3.45	4.10
Q	2.54	2.79	3.04
φP	3.60	3.85	4.09
Z	---	---	3.48

- NOTES:
1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 2018.
  2. CONTROLLING DIMENSION: MILLIMETERS.
  3. DIMENSION Z DEFINES A ZONE WHERE ALL BODY AND LEAD IRREGULARITIES ARE ALLOWED.

- |  |  |   |  |
|--|--|---|--|
| <p>STYLE 1:<br/>PIN 1. BASE<br/>2. COLLECTOR<br/>3. EMITTER<br/>4. COLLECTOR</p> | <p>STYLE 2:<br/>PIN 1. BASE<br/>2. EMITTER<br/>3. COLLECTOR<br/>4. EMITTER</p> | <p>STYLE 3:<br/>PIN 1. CATHODE<br/>2. ANODE<br/>3. GATE<br/>4. ANODE</p>    | <p>STYLE 4:<br/>PIN 1. MAIN TERMINAL 1<br/>2. MAIN TERMINAL 2<br/>3. GATE<br/>4. MAIN TERMINAL 2</p> |
| <p>STYLE 5:<br/>PIN 1. GATE<br/>2. DRAIN<br/>3. SOURCE<br/>4. DRAIN</p>          | <p>STYLE 6:<br/>PIN 1. ANODE<br/>2. CATHODE<br/>3. ANODE<br/>4. CATHODE</p>    | <p>STYLE 7:<br/>PIN 1. CATHODE<br/>2. ANODE<br/>3. CATHODE<br/>4. ANODE</p> | <p>STYLE 8:<br/>PIN 1. CATHODE<br/>2. ANODE<br/>3. EXTERNAL TRIP/DELAY<br/>4. ANODE</p>              |
| <p>STYLE 9:<br/>PIN 1. GATE<br/>2. COLLECTOR<br/>3. EMITTER<br/>4. COLLECTOR</p> | <p>STYLE 10:<br/>PIN 1. GATE<br/>2. SOURCE<br/>3. DRAIN<br/>4. SOURCE</p>      | <p>STYLE 11:<br/>PIN 1. DRAIN<br/>2. SOURCE<br/>3. GATE<br/>4. SOURCE</p>   | <p>STYLE 12:<br/>PIN 1. MAIN TERMINAL 1<br/>2. MAIN TERMINAL 2<br/>3. GATE<br/>4. NOT CONNECTED</p>  |

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