

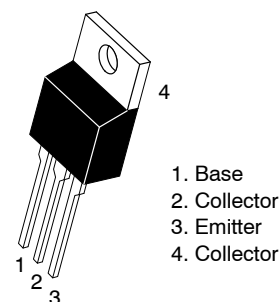
Complementary Silicon Transistors, Plastic, Medium-Power

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

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

Features

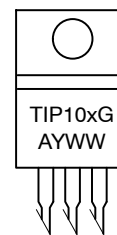
- High DC Current Gain –
 $h_{FE} = 2500 \text{ (Typ) @ } I_C$
 $= 4.0 \text{ Adc}$
- Collector–Emitter Sustaining Voltage – @ 30 mAdc
 $V_{CEO(sus)} = 60 \text{ Vdc (Min) – TIP100, TIP105}$
 $= 80 \text{ Vdc (Min) – TIP101, TIP106}$
 $= 100 \text{ Vdc (Min) – TIP102, TIP107}$
- Low Collector–Emitter Saturation Voltage –
 $V_{CE(sat)} = 2.0 \text{ Vdc (Max) @ } I_C$
 $= 3.0 \text{ Adc}$
 $= 2.5 \text{ Vdc (Max) @ } I_C = 8.0 \text{ Adc}$
- 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

MARKING DIAGRAM



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°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°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 | $^\circ\text{C/W}$ |
| $R_{\theta JA}$ | Thermal Resistance, Junction-to-Ambient | 62.5 | $^\circ\text{C/W}$ |

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 |
|--------|----------------|-----|-----|------|
|--------|----------------|-----|-----|------|

OFF CHARACTERISTICS

| | | | | | |
|----------------|---|--|-----------------|----------------|-----------------|
| $V_{CEO(sus)}$ | Collector–Emitter Sustaining Voltage (Note 1) ($I_C = 30\text{ mAdc}$, $I_B = 0$) | 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 | μAdc |
| 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 | μAdc |
| 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 ($I_C = 3.0\text{ Adc}$, $I_B = 6.0\text{ mAdc}$) ($I_C = 8.0\text{ Adc}$, $I_B = 80\text{ mAdc}$) | – – | 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 Adc, V _{CE} = 4.0 Vdc, f = 1.0 MHz) | 4.0 | – | – |
| 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 $\leq 300\ \mu\text{s}$, Duty Cycle $\leq 2\%$.

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

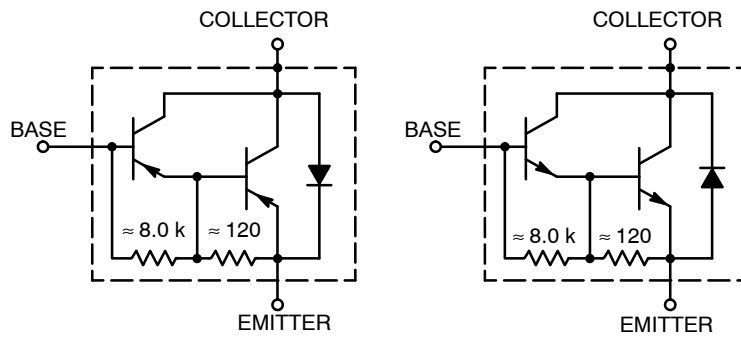


Figure 1. Darlington Circuit Schematic

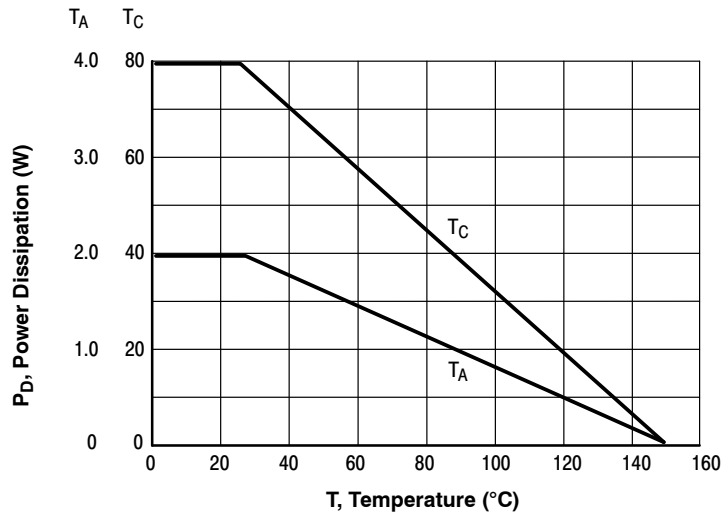


Figure 2. Power Derating

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

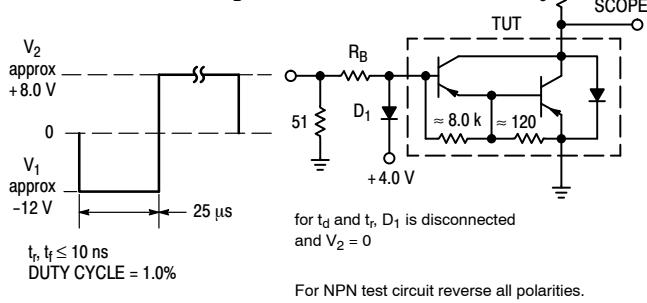


Figure 3. Switching Times Test Circuit

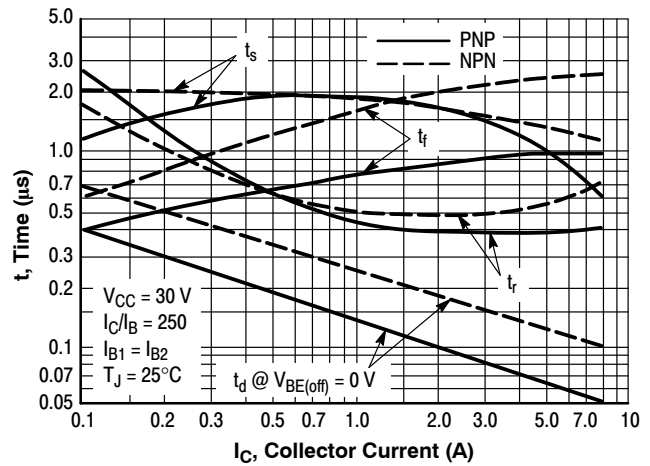


Figure 4. Switching Times

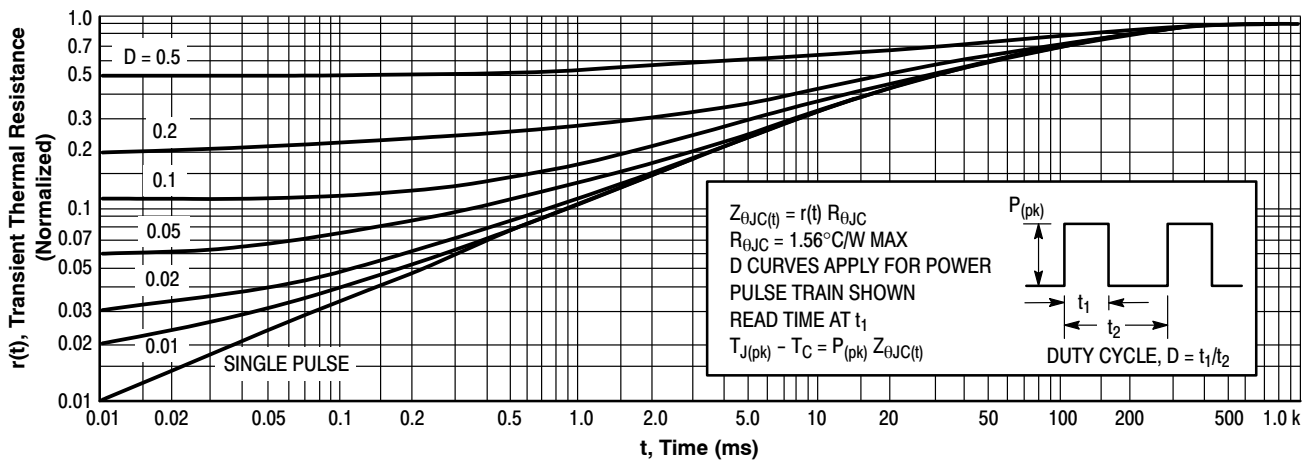


Figure 5. Thermal Response

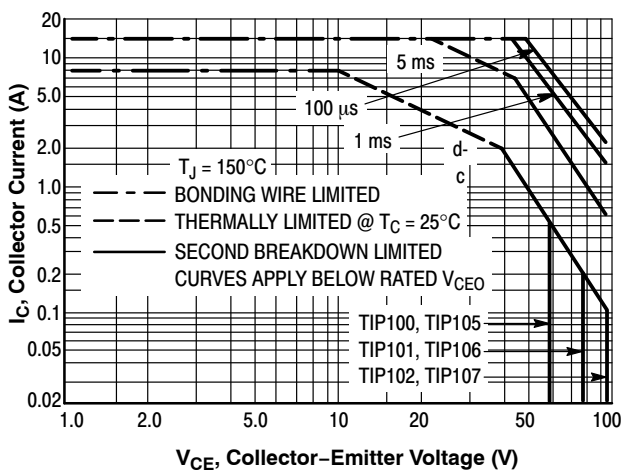


Figure 6. Active-Region Safe Operating Area

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)

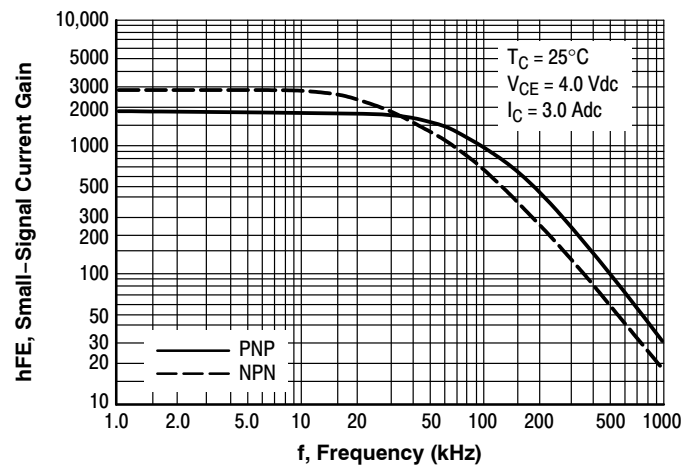


Figure 7. Small-Signal Current Gain

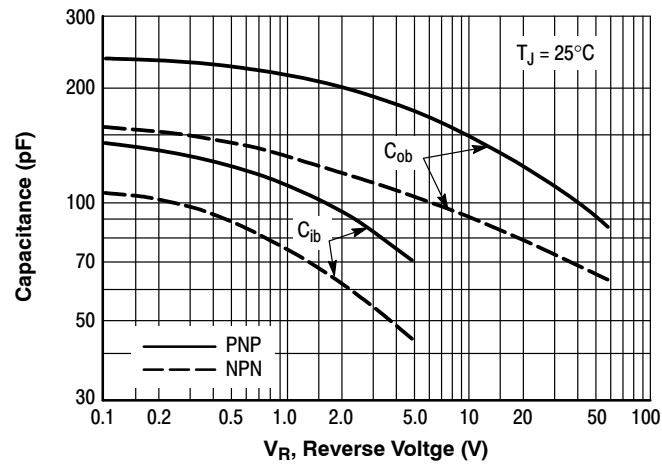


Figure 8. Capacitance

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

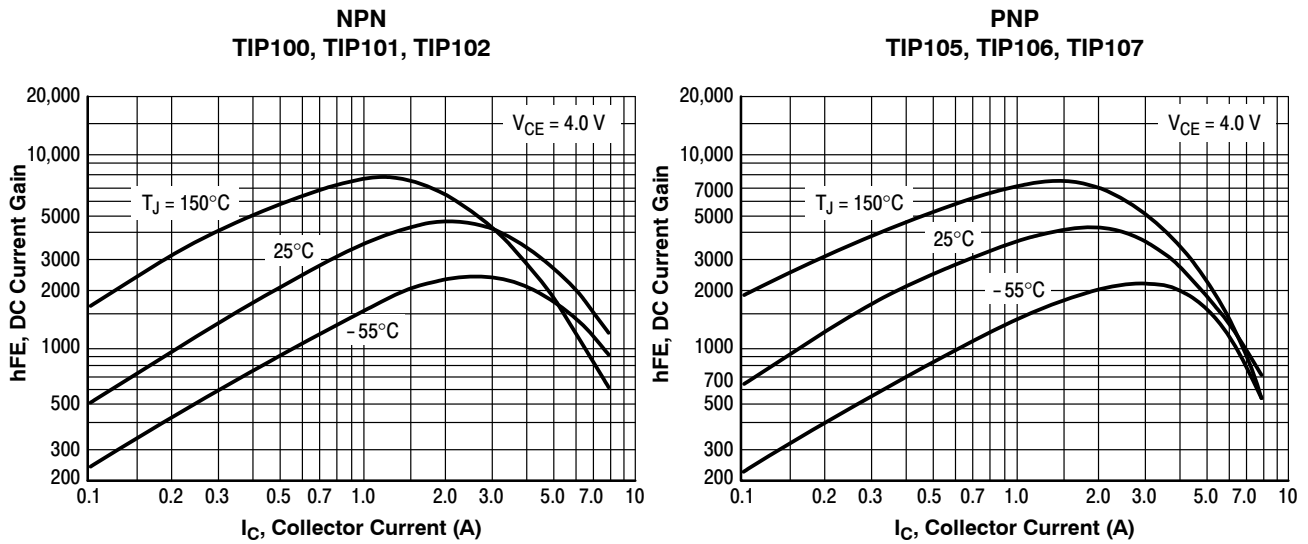


Figure 9. DC Current Gain

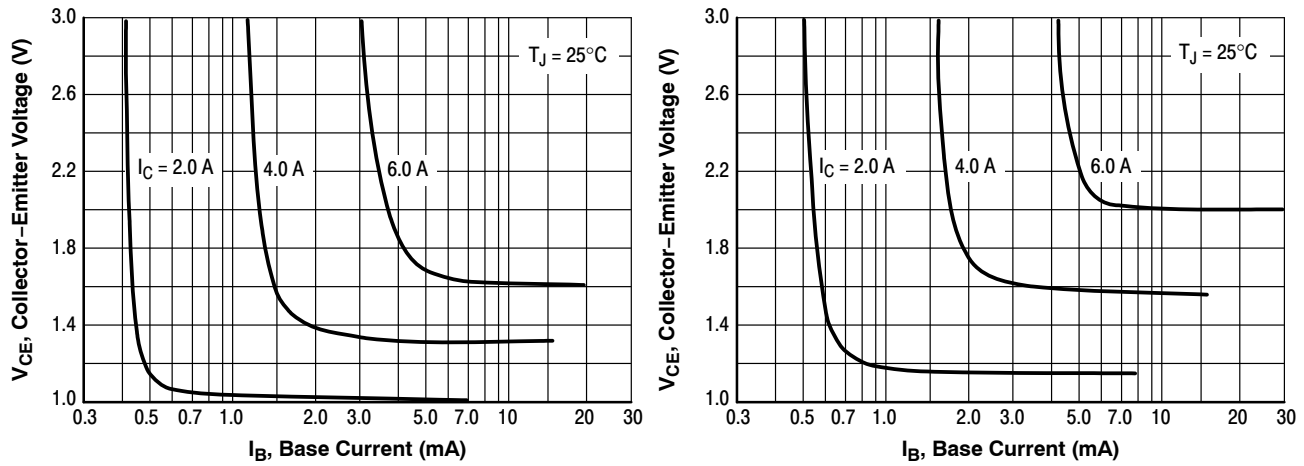


Figure 10. Collector Saturation Region

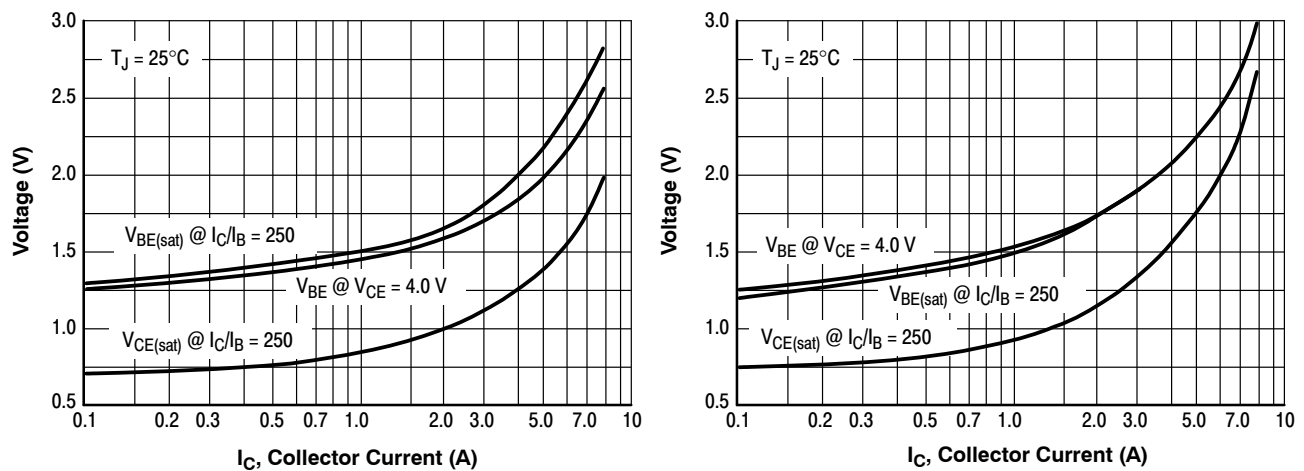
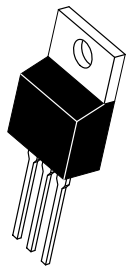


Figure 11. "On" Voltages

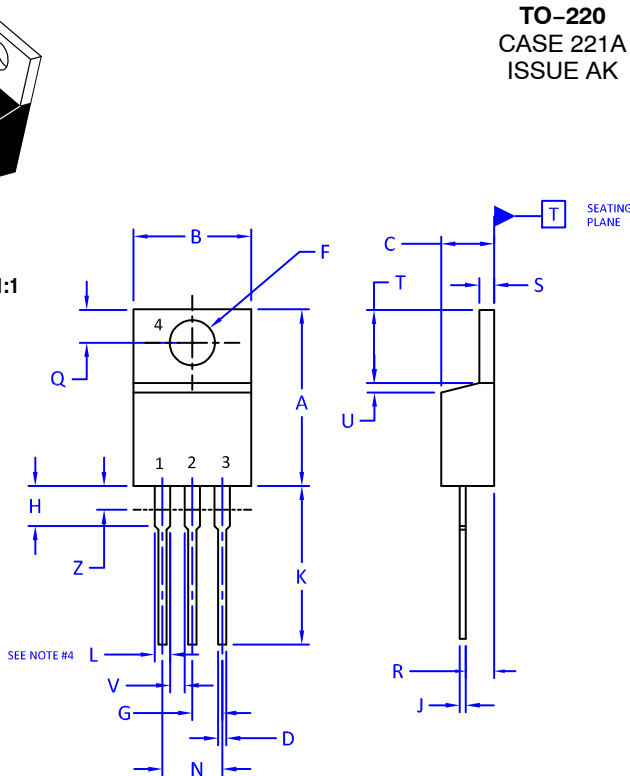
TIP100, TIP101, TIP102 (NPN); TIP105, TIP106, TIP107 (PNP)

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 |



SCALE 1:1



TO-220
CASE 221A
ISSUE AK

DATE 13 JAN 2022

NOTES:

1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 2009.
2. CONTROLLING DIMENSION: INCHES
3. DIMENSION Z DEFINES A ZONE WHERE ALL BODY AND LEAD IRREGULARITIES ARE ALLOWED.
4. MAX WIDTH FOR F102 DEVICE = 1.35MM

| DIM | INCHES | | MILLIMETERS | |
|-----|--------|-------|-------------|-------|
| | MIN. | MAX. | MIN. | MAX. |
| A | 0.570 | 0.620 | 14.48 | 15.75 |
| B | 0.380 | 0.415 | 9.66 | 10.53 |
| C | 0.160 | 0.190 | 4.07 | 4.83 |
| D | 0.025 | 0.038 | 0.64 | 0.96 |
| F | 0.142 | 0.161 | 3.60 | 4.09 |
| G | 0.095 | 0.105 | 2.42 | 2.66 |
| H | 0.110 | 0.161 | 2.80 | 4.10 |
| J | 0.014 | 0.024 | 0.36 | 0.61 |
| K | 0.500 | 0.562 | 12.70 | 14.27 |
| L | 0.045 | 0.060 | 1.15 | 1.52 |
| N | 0.190 | 0.210 | 4.83 | 5.33 |
| Q | 0.100 | 0.120 | 2.54 | 3.04 |
| R | 0.080 | 0.110 | 2.04 | 2.79 |
| S | 0.045 | 0.055 | 1.15 | 1.41 |
| T | 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 |

STYLE 1:
PIN 1. BASE
2. COLLECTOR
3. EMITTER
4. COLLECTOR

STYLE 2:
PIN 1. BASE
2. EMITTER
3. COLLECTOR
4. EMITTER

STYLE 3:
PIN 1. CATHODE
2. ANODE
3. GATE
4. ANODE

STYLE 4:
PIN 1. MAIN TERMINAL 1
2. MAIN TERMINAL 2
3. GATE
4. MAIN TERMINAL 2

STYLE 5:
PIN 1. GATE
2. DRAIN
3. SOURCE
4. DRAIN

STYLE 6:
PIN 1. ANODE
2. CATHODE
3. ANODE
4. CATHODE

STYLE 7:
PIN 1. CATHODE
2. ANODE
3. CATHODE
4. ANODE

STYLE 8:
PIN 1. CATHODE
2. ANODE
3. EXTERNAL TRIP/DELAY
4. ANODE

STYLE 9:
PIN 1. GATE
2. COLLECTOR
3. EMITTER
4. COLLECTOR

STYLE 10:
PIN 1. GATE
2. SOURCE
3. DRAIN
4. SOURCE

STYLE 11:
PIN 1. DRAIN
2. SOURCE
3. GATE
4. SOURCE

STYLE 12:
PIN 1. MAIN TERMINAL 1
2. MAIN TERMINAL 2
3. GATE
4. NOT CONNECTED

| | | |
|------------------|-------------|---|
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