

# TIP29, A, B, C (NPN), TIP30, A, B, C (PNP)

## Complementary Silicon Plastic Power Transistors

Designed for use in general purpose amplifier and switching applications. Compact TO-220 AB package.

### Features

- Pb-Free Packages are Available\*

### MAXIMUM RATINGS

| Rating                                                                                   | Symbol         | 29<br>30     | 29A<br>30A | 29B<br>30B | 29C<br>30C | Unit                     |
|------------------------------------------------------------------------------------------|----------------|--------------|------------|------------|------------|--------------------------|
| Collector – Emitter<br>Voltage                                                           | $V_{CEO}$      | 40           | 60         | 80         | 100        | Vdc                      |
| Collector – Base Voltage                                                                 | $V_{CB}$       | 40           | 60         | 80         | 100        | Vdc                      |
| Emitter – Base Voltage                                                                   | $V_{EB}$       | 5.0          |            |            |            | Vdc                      |
| Collector Current<br>– Continuous<br>– Peak                                              | $I_C$          | 1.0<br>3.0   |            |            |            | Adc                      |
| Base Current                                                                             | $I_B$          | 0.4          |            |            |            | Adc                      |
| Total Power Dissipation<br>@ $T_C = 25^\circ\text{C}$<br>Derate above $25^\circ\text{C}$ | $P_D$          | 30<br>0.24   |            |            |            | W<br>W/ $^\circ\text{C}$ |
| Total Power Dissipation<br>@ $T_A = 25^\circ\text{C}$<br>Derate above $25^\circ\text{C}$ | $P_D$          | 2.0<br>0.016 |            |            |            | W<br>W/ $^\circ\text{C}$ |
| Unclamped Inductive<br>Load Energy (Note 1)                                              | E              | 32           |            |            |            | mJ                       |
| Operating and Storage<br>Junction Temperature<br>Range                                   | $T_J, T_{stg}$ | –65 to +150  |            |            |            | $^\circ\text{C}$         |

### THERMAL CHARACTERISTICS

| Characteristic                          | Symbol          | Max   | Unit                      |
|-----------------------------------------|-----------------|-------|---------------------------|
| Thermal Resistance, Junction-to-Ambient | $R_{\theta JA}$ | 62.5  | $^\circ\text{C}/\text{W}$ |
| Thermal Resistance, Junction-to-Case    | $R_{\theta JC}$ | 4.167 | $^\circ\text{C}/\text{W}$ |

Stresses exceeding Maximum Ratings may damage the device. Maximum Ratings are stress ratings only. Functional operation above the Recommended Operating Conditions is not implied. Extended exposure to stresses above the Recommended Operating Conditions may affect device reliability.

1. This rating based on testing with  $L_C = 20\text{ mH}$ ,  $R_{BE} = 100\ \Omega$ ,  $V_{CC} = 10\text{ V}$ ,  $I_C = 1.8\text{ A}$ , P.R.F. = 10 Hz

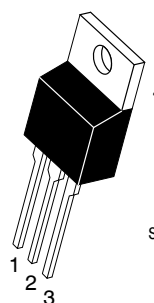
\*For additional information on our Pb-Free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.



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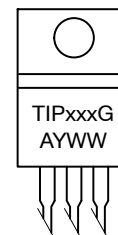
<http://onsemi.com>

## 1 AMPERE POWER TRANSISTORS COMPLEMENTARY SILICON 40, 60, 80, 100 VOLTS, 80 WATTS



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

### MARKING DIAGRAM

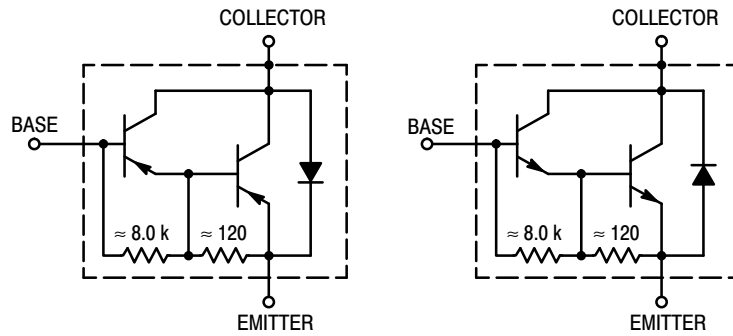


TIPxxx = Device Code:  
29, 29A, 29B, 29C  
30, 30A, 30B, 30C  
A = Assembly Location  
Y = Year  
WW = Work Week  
G = Pb-Free Package

### ORDERING INFORMATION

See detailed ordering and shipping information in the package dimensions section on page 2 of this data sheet.

## TIP29, A, B, C (NPN), TIP30, A, B, C (PNP)



**Figure 1. Darlington Circuit Schematic**

### ORDERING INFORMATION

| Device  | Package             | Shipping        |
|---------|---------------------|-----------------|
| TIP29   | TO-220              | 50 Units / Rail |
| TIP29G  | TO-220<br>(Pb-Free) | 50 Units / Rail |
| TIP29A  | TO-220              | 50 Units / Rail |
| TIP29AG | TO-220<br>(Pb-Free) | 50 Units / Rail |
| TIP29B  | TO-220              | 50 Units / Rail |
| TIP29BG | TO-220<br>(Pb-Free) | 50 Units / Rail |
| TIP29C  | TO-220              | 50 Units / Rail |
| TIP29CG | TO-220<br>(Pb-Free) | 50 Units / Rail |
| TIP30   | TO-220              | 50 Units / Rail |
| TIP30G  | TO-220<br>(Pb-Free) | 50 Units / Rail |
| TIP30A  | TO-220              | 50 Units / Rail |
| TIP30AG | TO-220<br>(Pb-Free) | 50 Units / Rail |
| TIP30B  | TO-220              | 50 Units / Rail |
| TIP30BG | TO-220<br>(Pb-Free) | 50 Units / Rail |
| TIP30C  | TO-220              | 50 Units / Rail |
| TIP30CG | TO-220<br>(Pb-Free) | 50 Units / Rail |

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

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

### OFF CHARACTERISTICS

|                                                                                                                                                                                                                       |                |     |     |                 |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------|-----|-----|-----------------|
| Collector-Emitter Sustaining Voltage ( $I_C = 30\text{ mAdc}$ , $I_B = 0$ ) (Note 2)                                                                                                                                  | $V_{CEO(sus)}$ |     |     | Vdc             |
| TIP29, TIP30                                                                                                                                                                                                          |                | 40  | –   |                 |
| TIP29A, TIP30A                                                                                                                                                                                                        |                | 60  | –   |                 |
| TIP29B, TIP30B                                                                                                                                                                                                        |                | 80  | –   |                 |
| TIP29C, TIP30C                                                                                                                                                                                                        |                | 100 | –   |                 |
| Collector Cutoff Current<br>( $V_{CE} = 30\text{ Vdc}$ , $I_B = 0$ )<br>( $V_{CE} = 60\text{ Vdc}$ , $I_B = 0$ )                                                                                                      | $I_{CEO}$      | –   | 0.3 | mAdc            |
| TIP29, TIP29A, TIP30, TIP30A                                                                                                                                                                                          |                | –   | 0.3 |                 |
| TIP29B, TIP29C, TIP30B, TIP30C                                                                                                                                                                                        |                | –   | 0.3 |                 |
| Collector Cutoff Current<br>( $V_{CE} = 40\text{ Vdc}$ , $V_{EB} = 0$ )<br>( $V_{CE} = 60\text{ Vdc}$ , $V_{EB} = 0$ )<br>( $V_{CE} = 80\text{ Vdc}$ , $V_{EB} = 0$ )<br>( $V_{CE} = 100\text{ Vdc}$ , $V_{EB} = 0$ ) | $I_{CES}$      | –   | 200 | $\mu\text{Adc}$ |
| TIP29, TIP30                                                                                                                                                                                                          |                | –   | 200 |                 |
| TIP29A, TIP30A                                                                                                                                                                                                        |                | –   | 200 |                 |
| TIP29B, TIP30B                                                                                                                                                                                                        |                | –   | 200 |                 |
| TIP29C, TIP30C                                                                                                                                                                                                        |                | –   | 200 |                 |
| Emitter Cutoff Current ( $V_{BE} = 5.0\text{ Vdc}$ , $I_C = 0$ )                                                                                                                                                      | $I_{EBO}$      | –   | 1.0 | mAdc            |

### ON CHARACTERISTICS (Note 2)

|                                                                                                                                  |               |          |         |     |
|----------------------------------------------------------------------------------------------------------------------------------|---------------|----------|---------|-----|
| DC Current Gain ( $I_C = 0.2\text{ Adc}$ , $V_{CE} = 4.0\text{ Vdc}$ )<br>( $I_C = 1.0\text{ Adc}$ , $V_{CE} = 4.0\text{ Vdc}$ ) | $h_{FE}$      | 40<br>15 | –<br>75 | –   |
| Collector-Emitter Saturation Voltage ( $I_C = 1.0\text{ Adc}$ , $I_B = 125\text{ mAdc}$ )                                        | $V_{CE(sat)}$ | –        | 0.7     | Vdc |
| Base-Emitter On Voltage ( $I_C = 1.0\text{ Adc}$ , $V_{CE} = 4.0\text{ Vdc}$ )                                                   | $V_{BE(on)}$  | –        | 1.3     | Vdc |

### DYNAMIC CHARACTERISTICS

|                                                                                                                                   |          |     |   |     |
|-----------------------------------------------------------------------------------------------------------------------------------|----------|-----|---|-----|
| Current-Gain – Bandwidth Product (Note 3)<br>( $I_C = 200\text{ mAdc}$ , $V_{CE} = 10\text{ Vdc}$ , $f_{test} = 1.0\text{ MHz}$ ) | $f_T$    | 3.0 | – | MHz |
| Small-Signal Current Gain ( $I_C = 0.2\text{ Adc}$ , $V_{CE} = 10\text{ Vdc}$ , $f = 1.0\text{ kHz}$ )                            | $h_{fe}$ | 20  | – | –   |

2. Pulse Test: Pulse Width  $\leq 300\text{ }\mu\text{s}$ , Duty Cycle  $\leq 2.0\%$

3.  $f_T = |h_{fe}| \cdot f_{test}$

## TIP29, A, B, C (NPN), TIP30, A, B, C (PNP)

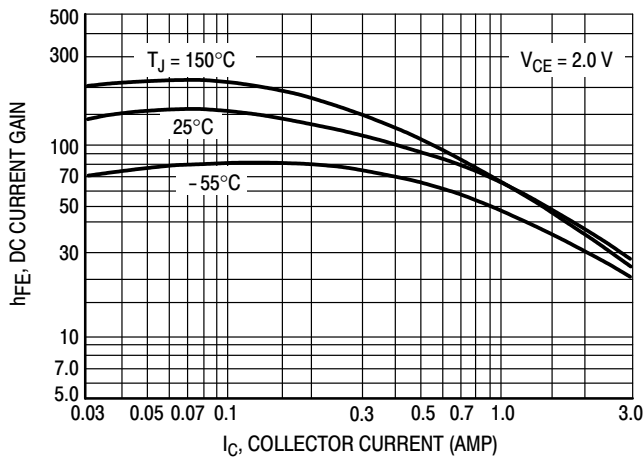


Figure 2. DC Current Gain

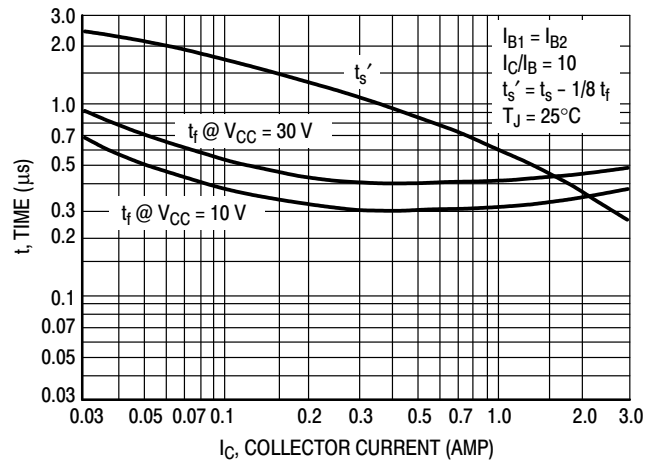


Figure 3. Turn-Off Time

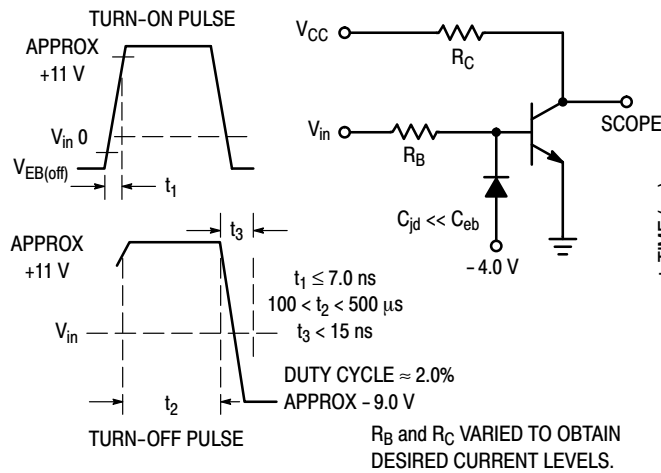


Figure 4. Switching Time Equivalent Circuit

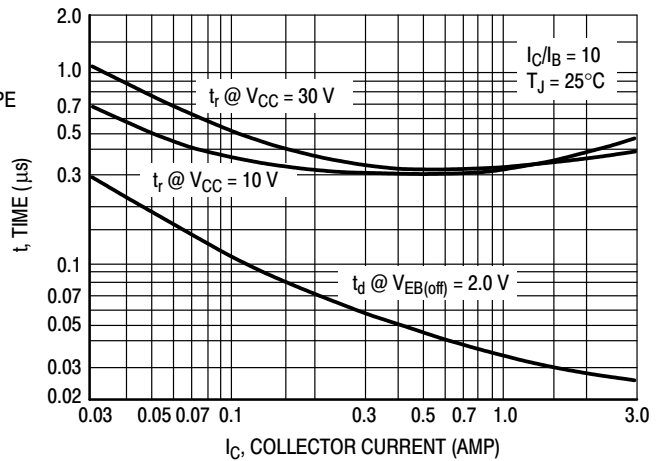


Figure 5. Turn-On Time

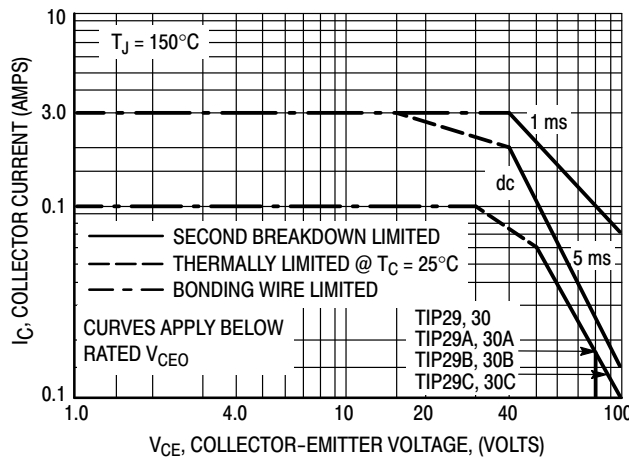


Figure 6. Active Region Safe Operating Area

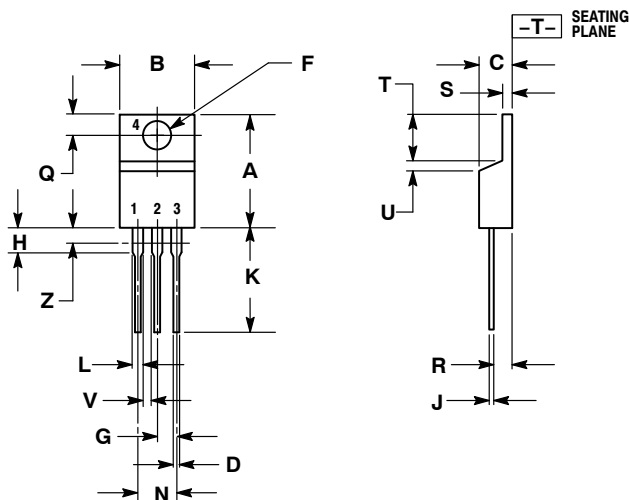
There are two limitations on the power handling ability of a transistor: average junction temperature and second breakdown. Safe operating area curves indicate  $I_C - V_{CE}$  operation; i.e., the transistor must not be subjected to greater dissipation than the curves indicate.

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  $T_{J(pk)} \leq 150^\circ\text{C}$ . At high case temperatures, thermal limitations will reduce the power that can be handled to values less than the limitations imposed by second breakdown.

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## PACKAGE DIMENSIONS

### TO-220 CASE 221A-09 ISSUE AG



#### NOTES:

1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.
3. DIMENSION Z DEFINES A ZONE WHERE ALL BODY AND LEAD IRREGULARITIES ARE ALLOWED.

| DIM | INCHES |       | MILLIMETERS |       |
|-----|--------|-------|-------------|-------|
|     | MIN    | MAX   | MIN         | MAX   |
| A   | 0.570  | 0.620 | 14.48       | 15.75 |
| B   | 0.380  | 0.405 | 9.66        | 10.28 |
| C   | 0.160  | 0.190 | 4.07        | 4.82  |
| D   | 0.025  | 0.036 | 0.64        | 0.91  |
| F   | 0.142  | 0.161 | 3.61        | 4.09  |
| G   | 0.095  | 0.105 | 2.42        | 2.66  |
| H   | 0.110  | 0.161 | 2.80        | 4.10  |
| J   | 0.014  | 0.025 | 0.36        | 0.64  |
| 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        | 1.39  |
| 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:

1. BASE
2. COLLECTOR
3. EMITTER
4. COLLECTOR

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