

# BD676G, BD676AG, BD678G, BD678AG, BD680G, BD680AG, BD682G, BD682TG

## Plastic Medium-Power Silicon PNP Darlington

This series of plastic, medium-power silicon PNP Darlington transistors can be used as output devices in complementary general-purpose amplifier applications.

### Features

- High DC Current Gain
- Monolithic Construction
- BD676, 676A, 678, 678A, 680, 680A, 682 are complementary with BD675, 675A, 677, 677A, 679, 679A, 681
- BD678, 678A, 680, 680A are equivalent to MJE 700, 701, 702, 703
- These Devices are Pb-Free and are RoHS Compliant\*

### MAXIMUM RATINGS

| Rating                                                                                                | Symbol         | Value                 | Unit                     |
|-------------------------------------------------------------------------------------------------------|----------------|-----------------------|--------------------------|
| Collector-Emitter Voltage<br>BD676G, BD676AG<br>BD678G, BD678AG<br>BD680G, BD680AG<br>BD682G, BD682TG | $V_{CEO}$      | 45<br>60<br>80<br>100 | Vdc                      |
| Collector-Base Voltage<br>BD676G, BD676AG<br>BD678G, BD678AG<br>BD680G, BD680AG<br>BD682G, BD682TG    | $V_{CB}$       | 45<br>60<br>80<br>100 | Vdc                      |
| Emitter-Base Voltage                                                                                  | $V_{EB}$       | 5.0                   | Vdc                      |
| Collector Current                                                                                     | $I_C$          | 4.0                   | Adc                      |
| Base Current                                                                                          | $I_B$          | 0.1                   | Adc                      |
| Total Device Dissipation<br>@ $T_C = 25^\circ\text{C}$<br>Derate above $25^\circ\text{C}$             | $P_D$          | 40<br>0.32            | W<br>W/ $^\circ\text{C}$ |
| Operating and Storage Junction<br>Temperature Range                                                   | $T_J, T_{stg}$ | -55 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

| Characteristic                          | Symbol          | Max  | Unit                      |
|-----------------------------------------|-----------------|------|---------------------------|
| Thermal Resistance,<br>Junction-to-Case | $R_{\theta JC}$ | 3.13 | $^\circ\text{C}/\text{W}$ |

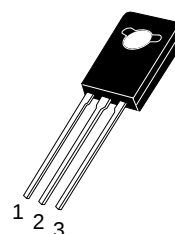
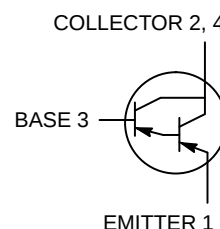
\*For additional information on our Pb-Free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.



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## 4.0 AMP DARLINGTON POWER TRANSISTORS PNP SILICON 45, 60, 80, 100 VOLT, 40 WATT



TO-225  
CASE 77-09  
STYLE 1

### MARKING DIAGRAMS



Y = Year  
WW = Work Week  
BD6xx = Device Code  
xx = 76, 78, 80, 82, or 82T  
G = Pb-Free Package

### ORDERING INFORMATION

See detailed ordering and shipping information in the package dimensions section on page 3 of this data sheet.

# BD676G, BD676AG, BD678G, BD678AG, BD680G, BD680AG, BD682G, BD682TG

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

| Characteristic                                                                                                                                                   | Symbol     | Min                   | Max              | Unit          |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|-----------------------|------------------|---------------|
| <b>OFF CHARACTERISTICS</b>                                                                                                                                       |            |                       |                  |               |
| Collector-Emitter Breakdown Voltage (Note 1)<br>( $I_C = 50\text{ mA}$ , $I_B = 0$ )<br>BD676G, BD676AG<br>BD678G, BD678AG<br>BD680G, BD680AG<br>BD682G, BD682TG | $BV_{CEO}$ | 45<br>60<br>80<br>100 | —<br>—<br>—<br>— | Vdc           |
| Collector Cutoff Current<br>( $V_{CE} = \text{Half Rated } BV_{CEO}$ , $I_B = 0$ )                                                                               | $I_{CEO}$  | —                     | 500              | $\mu\text{A}$ |
| Collector Cutoff Current<br>( $V_{CB} = \text{Rated } BV_{CEO}$ , $I_E = 0$ )<br>( $V_{CB} = \text{Rated } BV_{CEO}$ , $I_E = 0$ , $T_C = 100^\circ\text{C}$ )   | $I_{CBO}$  | —<br>—                | 0.2<br>2.0       | mAdc          |
| Emitter Cutoff Current<br>( $V_{BE} = 5.0\text{ Vdc}$ , $I_C = 0$ )                                                                                              | $I_{EBO}$  | —                     | 2.0              | mAdc          |

## ON CHARACTERISTICS

|                                                                                                                                                                                                                |               |            |            |     |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|------------|------------|-----|
| DC Current Gain (Note 1)<br>( $I_C = 1.5\text{ Adc}$ , $V_{CE} = 3.0\text{ Vdc}$ )<br>BD676G, BD678G, BD680G, BD682G<br>( $I_C = 2.0\text{ Adc}$ , $V_{CE} = 3.0\text{ Vdc}$ )<br>BD676AG, BD678AG, BD680AG    | $h_{FE}$      | 750<br>750 | —<br>—     | —   |
| Collector-Emitter Saturation Voltage (Note 1)<br>( $I_C = 1.5\text{ Adc}$ , $I_B = 30\text{ mA}$ )<br>BD678G, BD680G, BD682G<br>( $I_C = 2.0\text{ Adc}$ , $I_B = 40\text{ mA}$ )<br>BD676AG, BD678AG, BD680AG | $V_{CE(sat)}$ | —<br>—     | 2.5<br>2.8 | Vdc |
| Base-Emitter On Voltage (Note 1)<br>( $I_C = 1.5\text{ Adc}$ , $V_{CE} = 3.0\text{ Vdc}$ )<br>BD678G, BD680G, BD682G<br>( $I_C = 2.0\text{ Adc}$ , $V_{CE} = 3.0\text{ Vdc}$ )<br>BD676AG, BD678AG, BD680AG    | $V_{BE(on)}$  | —<br>—     | 2.5<br>2.5 | Vdc |

## DYNAMIC CHARACTERISTICS

|                                                                                                            |          |     |   |   |
|------------------------------------------------------------------------------------------------------------|----------|-----|---|---|
| Small-Signal Current Gain<br>( $I_C = 1.5\text{ Adc}$ , $V_{CE} = 3.0\text{ Vdc}$ , $f = 1.0\text{ MHz}$ ) | $h_{fe}$ | 1.0 | — | — |
|------------------------------------------------------------------------------------------------------------|----------|-----|---|---|

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.

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

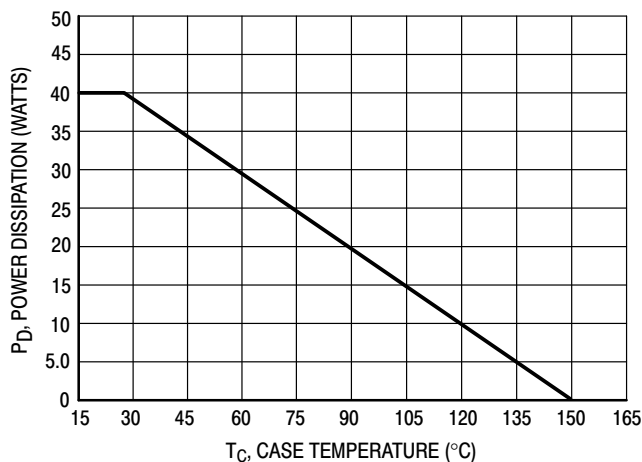


Figure 1. Power Temperature Derating

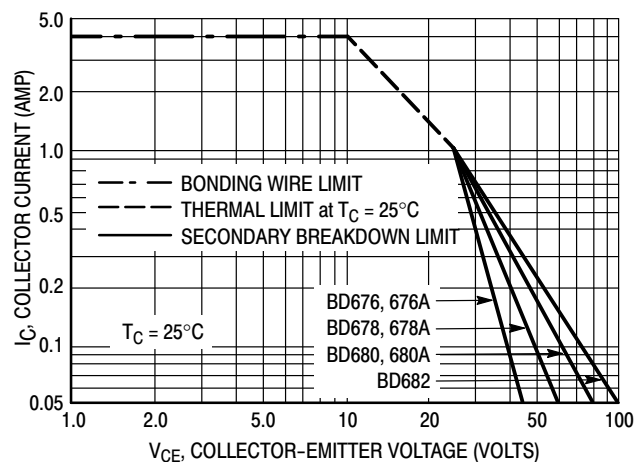


Figure 2. DC Safe Operating Area

## BD676G, BD676AG, BD678G, BD678AG, BD680G, BD680AG, BD682G, BD682TG

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

At high case temperatures, thermal limitations will reduce the power that can be handled to values less than the limitations imposed by secondary breakdown.

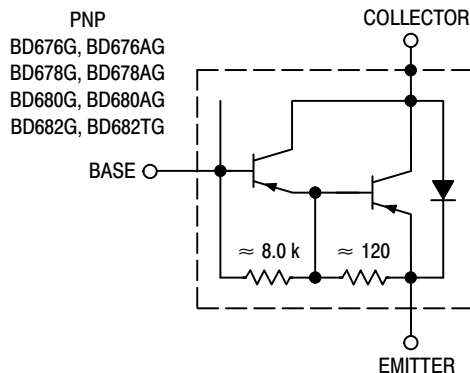


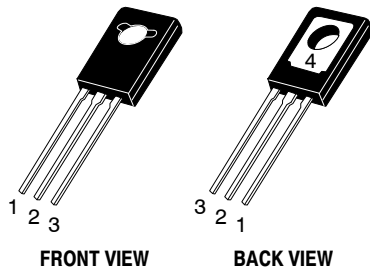
Figure 3. Darlington Circuit Schematic

### ORDERING INFORMATION

| Device  | Package             | Shipping        |
|---------|---------------------|-----------------|
| BD676G  | TO-225<br>(Pb-Free) | 500 Units / Box |
| BD676AG | TO-225<br>(Pb-Free) | 500 Units / Box |
| BD678G  | TO-225<br>(Pb-Free) | 500 Units / Box |
| BD678AG | TO-225<br>(Pb-Free) | 500 Units / Box |
| BD680G  | TO-225<br>(Pb-Free) | 500 Units / Box |
| BD680AG | TO-225<br>(Pb-Free) | 500 Units / Box |
| BD682G  | TO-225<br>(Pb-Free) | 500 Units / Box |
| BD682TG | TO-225<br>(Pb-Free) | 50 Units / Rail |

# MECHANICAL CASE OUTLINE PACKAGE DIMENSIONS

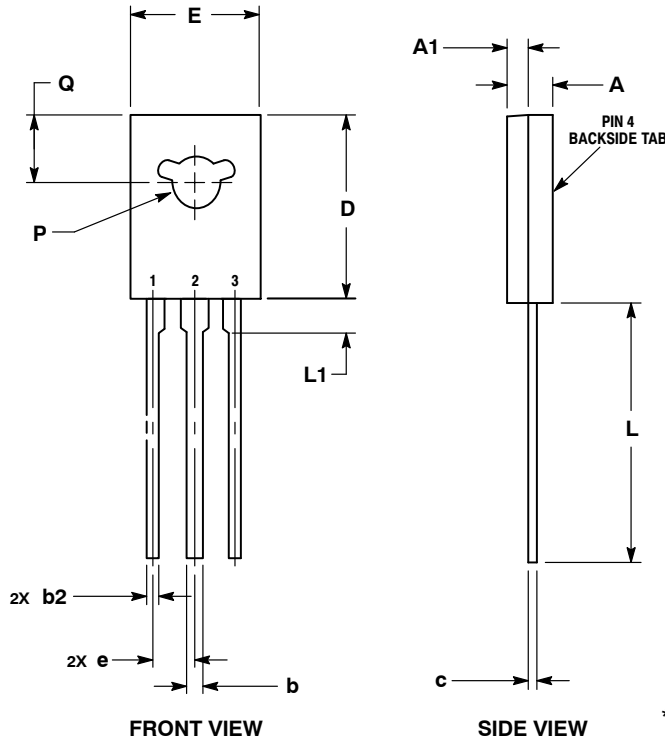
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SCALE 1:1

TO-225  
CASE 77-09  
ISSUE AD

DATE 25 MAR 2015

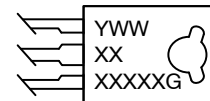


## NOTES:

1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
2. CONTROLLING DIMENSION: MILLIMETERS.
3. NUMBER AND SHAPE OF LUGS OPTIONAL.

| MILLIMETERS |       |       |
|-------------|-------|-------|
| DIM         | MIN   | MAX   |
| A           | 2.40  | 3.00  |
| A1          | 1.00  | 1.50  |
| b           | 0.60  | 0.90  |
| b2          | 0.51  | 0.88  |
| c           | 0.39  | 0.63  |
| D           | 10.60 | 11.10 |
| E           | 7.40  | 7.80  |
| e           | 2.04  | 2.54  |
| L           | 14.50 | 16.63 |
| L1          | 1.27  | 2.54  |
| P           | 2.90  | 3.30  |
| Q           | 3.80  | 4.20  |

## GENERIC MARKING DIAGRAM\*



Y = Year  
WW = Work Week  
XXXXX = Device Code  
G = Pb-Free Package

\*This information is generic. Please refer to device data sheet for actual part marking. Pb-Free indicator, "G" or microdot "▪", may or may not be present.

|                                                           |                                                       |                                                           |                                                         |                                                       |
|-----------------------------------------------------------|-------------------------------------------------------|-----------------------------------------------------------|---------------------------------------------------------|-------------------------------------------------------|
| STYLE 1:<br>PIN 1. EMITTER<br>2., 4. COLLECTOR<br>3. BASE | STYLE 2:<br>PIN 1. CATHODE<br>2., 4. ANODE<br>3. GATE | STYLE 3:<br>PIN 1. BASE<br>2., 4. COLLECTOR<br>3. EMITTER | STYLE 4:<br>PIN 1. ANODE 1<br>2., 4. ANODE 2<br>3. GATE | STYLE 5:<br>PIN 1. MT 1<br>2., 4. MT 2<br>3. GATE     |
| STYLE 6:<br>PIN 1. CATHODE<br>2., 4. GATE<br>3. ANODE     | STYLE 7:<br>PIN 1. MT 1<br>2., 4. GATE<br>3. MT 2     | STYLE 8:<br>PIN 1. SOURCE<br>2., 4. GATE<br>3. DRAIN      | STYLE 9:<br>PIN 1. GATE<br>2., 4. DRAIN<br>3. SOURCE    | STYLE 10:<br>PIN 1. SOURCE<br>2., 4. DRAIN<br>3. GATE |

|                  |             |                                                                                                                                                                                     |
|------------------|-------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
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| DESCRIPTION:     | TO-225      | PAGE 1 OF 1                                                                                                                                                                         |

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