

# BD676, BD676A, BD678, BD678A, BD680, BD680A, BD682, BD682T



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## 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 –  
 $h_{FE} = 750$  (Min) @  $I_C = 1.5$  and  $2.0$  Adc
- 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
- Pb-Free Package are Available\*

### MAXIMUM RATINGS

| Rating  | Symbol         | Value                 | Unit                     |
|---|----------------|-----------------------|--------------------------|
| Collector-Emitter Voltage<br>BD676, BD676A<br>BD678, BD678A<br>BD680, BD680A<br>BD682     | $V_{CEO}$      | 45<br>60<br>80<br>100 | Vdc                      |
| Collector-Base Voltage<br>BD676, BD676A<br>BD678, BD678A<br>BD680, BD680A<br>BD682        | $V_{CB}$       | 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           | $^\circ\text{C}$         |

### THERMAL CHARACTERISTICS

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

Maximum ratings are those values beyond which device damage can occur. Maximum ratings applied to the device are individual stress limit values (not normal operating conditions) and are not valid simultaneously. If these limits are exceeded, device functional operation is not implied, damage may occur and reliability may be affected.

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

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



TO-225AA  
CASE 77  
STYLE 1

### MARKING DIAGRAMS



BD6xx = Device Code  
xx = 76, 76A, 78, 78A,  
80, 80A, 82, or 82T

Y = Year  
WW = Work Week  
G = Pb-Free Package

### ORDERING INFORMATION

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

# BD676, BD676A, BD678, BD678A, BD680, BD680A, BD682, BD682T

## 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>( $I_C = 50\text{ mA}$ , $I_B = 0$ )   | BD676, 676A<br>BD678, 678A<br>BD680, 680A<br>BD682 | $BV_{CEO}$ | 45<br>60<br>80<br>100 | –<br>–<br>–<br>– | Vdc           |
| Collector Cutoff Current ( $V_{CE} = \text{Half Rated } BV_{CEO}$ , $I_B = 0$ )  |  | $I_{CEO}$  | –                     | 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 ( $V_{BE} = 5.0\text{ Vdc}$ , $I_C = 0$ )   |  | $I_{EBO}$  | –                     | 2.0              | mAdc          |

## ON CHARACTERISTICS

|   |  |               |            |            |        |
|---|--|---------------|------------|------------|--------|
| DC Current Gain (Note 1)<br>( $I_C = 1.5\text{ Adc}$ , $V_{CE} = 3.0\text{ Vdc}$ )<br>( $I_C = 2.0\text{ Adc}$ , $V_{CE} = 3.0\text{ Vdc}$ )            | BD676, 678, 680, 682<br>BD676A, 678A, 680A | $h_{FE}$      | 750<br>750 | –<br>–     | –<br>– |
| Collector–Emitter Saturation Voltage (Note 1)<br>( $I_C = 1.5\text{ Adc}$ , $I_B = 30\text{ mA}$ )<br>( $I_C = 2.0\text{ Adc}$ , $I_B = 40\text{ mA}$ ) | BD678, 680, 682<br>BD676A, 678A, 680A      | $V_{CE(sat)}$ | –<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>( $I_C = 2.0\text{ Adc}$ , $V_{CE} = 3.0\text{ Vdc}$ )    | BD678, 680, 682<br>BD676A, 678A, 680A      | $V_{BE(on)}$  | –<br>–     | 2.5<br>2.5 | Vdc    |

## DYNAMIC CHARACTERISTICS

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

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

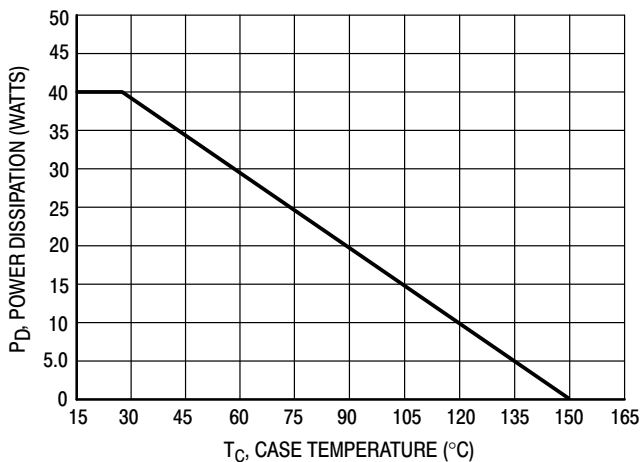


Figure 1. Power Temperature Derating

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.

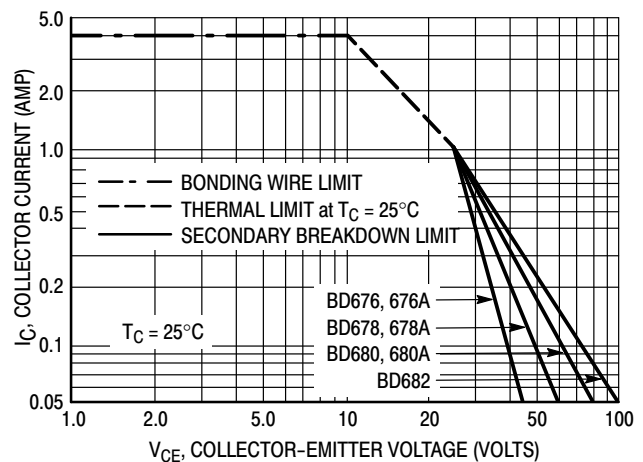
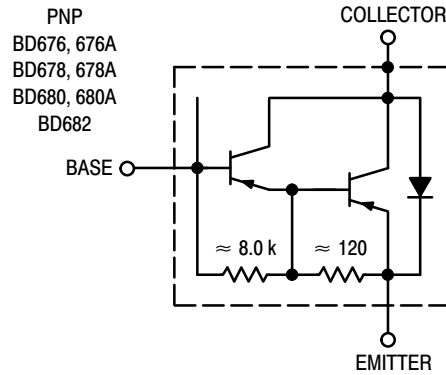


Figure 2. DC Safe Operating Area

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

**BD676, BD676A, BD678, BD678A, BD680, BD680A, BD682, BD682T**



**Figure 3. Darlington Circuit Schematic**

**ORDERING INFORMATION**

| Device  | Package               | Shipping        |
|---------|-----------------------|-----------------|
| BD676   | TO-225AA              | 500 Units / Box |
| BD676G  | TO-225AA<br>(Pb-Free) | 500 Units / Box |
| BD676A  | TO-225AA              | 500 Units / Box |
| BD676AG | TO-225AA<br>(Pb-Free) | 500 Units / Box |
| BD678   | TO-225AA              | 500 Units / Box |
| BD678G  | TO-225AA<br>(Pb-Free) | 500 Units / Box |
| BD678A  | TO-225AA              | 500 Units / Box |
| BD678AG | TO-225AA<br>(Pb-Free) | 500 Units / Box |
| BD680   | TO-225AA              | 500 Units / Box |
| BD680G  | TO-225AA<br>(Pb-Free) | 500 Units / Box |
| BD680A  | TO-225AA              | 500 Units / Box |
| BD680AG | TO-225AA<br>(Pb-Free) | 500 Units / Box |
| BD682   | TO-225AA              | 500 Units / Box |
| BD682G  | TO-225AA<br>(Pb-Free) | 500 Units / Box |
| BD682T  | TO-225AA              | 50 Units / Rail |
| BD682TG | TO-225AA<br>(Pb-Free) | 50 Units / Rail |

# BD676, BD676A, BD678, BD678A, BD680, BD680A, BD682, BD682T

## PACKAGE DIMENSIONS

TO-225AA  
CASE 77-09  
ISSUE Z



### NOTES:

1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.
3. 077-01 THRU -08 OBSOLETE, NEW STANDARD 077-09.

| DIM | INCHES    |       | MILLIMETERS |       |
|-----|-----------|-------|-------------|-------|
|     | MIN       | MAX   | MIN         | MAX   |
| A   | 0.425     | 0.435 | 10.80       | 11.04 |
| B   | 0.295     | 0.305 | 7.50        | 7.74  |
| C   | 0.095     | 0.105 | 2.42        | 2.66  |
| D   | 0.020     | 0.026 | 0.51        | 0.66  |
| F   | 0.115     | 0.130 | 2.93        | 3.30  |
| G   | 0.094 BSC |       | 2.39 BSC    |       |
| H   | 0.050     | 0.095 | 1.27        | 2.41  |
| J   | 0.015     | 0.025 | 0.39        | 0.63  |
| K   | 0.575     | 0.655 | 14.61       | 16.63 |
| M   | 5° TYP    |       | 5° TYP      |       |
| Q   | 0.148     | 0.158 | 3.76        | 4.01  |
| R   | 0.045     | 0.065 | 1.15        | 1.65  |
| S   | 0.025     | 0.035 | 0.64        | 0.88  |
| U   | 0.145     | 0.155 | 3.69        | 3.93  |
| V   | 0.040     | ---   | 1.02        | ---   |

### STYLE 1:

1. EMITTER
2. COLLECTOR
3. BASE

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