

**BD644 – 646 – 648 – 650 – 652**

## SILICON DARLINGTON POWER TRANSISTORS

PNP epitaxial-base transistors in a monolithic Darlington circuit and housed in a TO-220 envelope. They are intended for output stages in audio equipment, general amplifiers, and analogue switching application.

NPN complements are BD643, BD645, BD647, BD649 and BD651

Compliance to RoHS.

### ABSOLUTE MAXIMUM RATINGS

| Symbol     | Ratings                   |       | Value | Unit |
|------------|---------------------------|-------|-------|------|
| $-V_{CBO}$ | Collector-Base Voltage    | BD644 | 45    | V    |
|            |                           | BD646 | 60    |      |
|            |                           | BD648 | 80    |      |
|            |                           | BD650 | 100   |      |
|            |                           | BD652 | 120   |      |
| $-V_{CEO}$ | Collector-Emitter Voltage | BD644 | 45    | V    |
|            |                           | BD646 | 60    |      |
|            |                           | BD648 | 80    |      |
|            |                           | BD650 | 100   |      |
|            |                           | BD652 | 120   |      |
| $-V_{EBO}$ | Emitter-Base Voltage      | BD644 | 5     | V    |
|            |                           | BD646 |       |      |
|            |                           | BD648 |       |      |
|            |                           | BD650 |       |      |
|            |                           | BD652 |       |      |
| $-I_C$     | Collector Current         | BD644 | 8     | A    |
|            |                           | BD646 |       |      |
|            |                           | BD648 |       |      |
|            |                           | BD650 |       |      |
|            |                           | BD652 |       |      |
| $-I_{CM}$  | Collector Peak Current    | BD644 | 12    | A    |
|            |                           | BD646 |       |      |
|            |                           | BD648 |       |      |
|            |                           | BD650 |       |      |
|            |                           | BD652 |       |      |

## BD644 – 646 – 648 – 650 – 652

### ABSOLUTE MAXIMUM RATINGS

| Symbol | Ratings                          |                       |       | Value       | Unit             |
|--------|----------------------------------|-----------------------|-------|-------------|------------------|
| $-I_B$ | Base Current                     |                       | BD644 | 150         | mA               |
|        |                                  |                       | BD646 |             |                  |
|        |                                  |                       | BD648 |             |                  |
|        |                                  |                       | BD650 |             |                  |
|        |                                  |                       | BD652 |             |                  |
| $P_T$  | Power Dissipation                | @ $T_{mb} < 25^\circ$ | BD644 | 62.5        | Watts            |
|        |                                  |                       | BD646 |             |                  |
|        |                                  |                       | BD648 |             |                  |
|        |                                  |                       | BD650 |             |                  |
|        |                                  |                       | BD652 |             |                  |
| $T_J$  | Junction <i>Temperature</i>      |                       | BD644 | 150         | $^\circ\text{C}$ |
|        |                                  |                       | BD646 |             |                  |
|        |                                  |                       | BD648 |             |                  |
|        |                                  |                       | BD650 |             |                  |
|        |                                  |                       | BD652 |             |                  |
| $T_s$  | Storage <i>Temperature range</i> |                       | BD644 | -65 to +150 |                  |
|        |                                  |                       | BD646 |             |                  |
|        |                                  |                       | BD648 |             |                  |
|        |                                  |                       | BD650 |             |                  |
|        |                                  |                       | BD652 |             |                  |

Limiting values in accordance with the Absolute Maximum System (IEC 134)

### THERMAL CHARACTERISTICS

| Symbol       | Ratings                              | Value | Unit |
|--------------|--------------------------------------|-------|------|
| $R_{thJ-MB}$ | From junction to mounting base       | 2     | K/W  |
| $R_{thJ-A}$  | From junction to ambient in free air | 70    | K/W  |

## BD644 – 646 – 648 – 650 – 652

### ELECTRICAL CHARACTERISTICS

TC=25°C unless otherwise noted

| Symbol         | Ratings                                  | Test Condition(s)                                      |       | Min | Typ | Max | Unit |
|----------------|------------------------------------------|--------------------------------------------------------|-------|-----|-----|-----|------|
| $-I_{CBO}$     | Collector Cutoff Current                 | $-I_E=0, -V_{CB} = -V_{CEO}MAX$                        | BD644 | -   | -   | 0.1 | mA   |
|                |                                          |                                                        | BD646 |     |     |     |      |
|                |                                          |                                                        | BD648 |     |     |     |      |
|                |                                          |                                                        | BD650 |     |     |     |      |
|                |                                          |                                                        | BD652 |     |     |     |      |
|                |                                          | $-I_E=0, -V_{CB} = 1/2 - V_{CBO}MAX, T_J=150^{\circ}C$ | BD644 | -   | -   | 1   | mA   |
|                |                                          |                                                        | BD646 |     |     |     |      |
|                |                                          |                                                        | BD648 |     |     |     |      |
|                |                                          |                                                        | BD650 |     |     |     |      |
|                |                                          |                                                        | BD652 |     |     |     |      |
| $-I_{CEO}$     | Collector Cutoff Current                 | $-I_E=0, -V_{CE} = 1/2 - V_{CEO}MAX$                   | BD644 | -   | -   | 0.2 | mA   |
|                |                                          |                                                        | BD646 |     |     |     |      |
|                |                                          |                                                        | BD648 |     |     |     |      |
|                |                                          |                                                        | BD650 |     |     |     |      |
|                |                                          |                                                        | BD652 |     |     |     |      |
| $-I_{EBO}$     | Emitter Cutoff Current                   | $-V_{EB}=5\text{ V}, -I_C=0$                           | BD644 | -   | -   | 5.0 | mA   |
|                |                                          |                                                        | BD646 |     |     |     |      |
|                |                                          |                                                        | BD648 |     |     |     |      |
|                |                                          |                                                        | BD650 |     |     |     |      |
|                |                                          |                                                        | BD652 |     |     |     |      |
| $-V_{CE(SAT)}$ | Collector-Emitter saturation Voltage (*) | $-I_C=4\text{ A}, -I_B=16\text{ mA}$                   | BD644 | -   | -   | 2   | V    |
|                |                                          |                                                        | BD646 | -   | -   | 2   |      |
|                |                                          | $-I_C=3\text{ A}, -I_B=12\text{ mA}$                   | BD648 |     |     |     |      |
|                |                                          |                                                        | BD650 |     |     |     |      |
|                |                                          |                                                        | BD652 |     |     |     |      |
|                |                                          | $-I_C=5\text{ A}, -I_B=50\text{ mA}$                   | BD644 | -   | -   | 2.5 |      |
|                |                                          |                                                        | BD646 |     |     |     |      |
|                |                                          |                                                        | BD648 |     |     |     |      |
|                |                                          |                                                        | BD650 |     |     |     |      |
|                |                                          |                                                        | BD652 |     |     |     |      |
| $-V_{BE(SAT)}$ | Base-Emitter Saturation Voltage (*)      | $-I_C=5\text{ A}, -I_B=50\text{ mA}$                   | BD644 | -   | -   | 3   | V    |
|                |                                          |                                                        | BD646 |     |     |     |      |
|                |                                          |                                                        | BD648 |     |     |     |      |
|                |                                          |                                                        | BD650 |     |     |     |      |
|                |                                          |                                                        | BD652 |     |     |     |      |

## BD644 – 646 – 648 – 650 – 652

### ELECTRICAL CHARACTERISTICS

TC=25°C unless otherwise noted

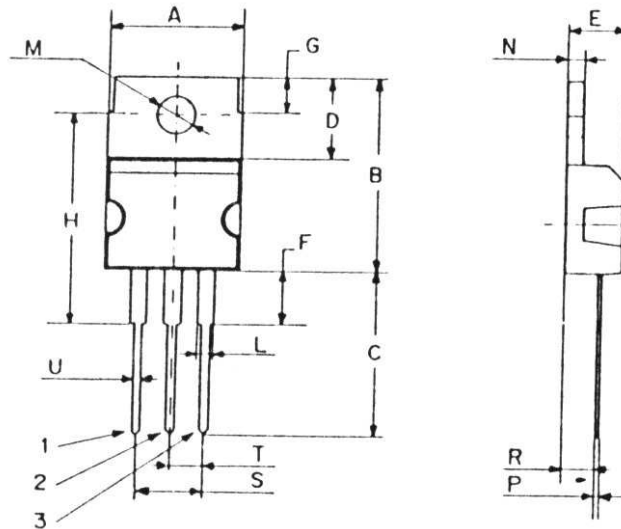
| Symbol    | Ratings                   |                                                             |           | Min | Typ  | Max | Unit          |
|-----------|---------------------------|-------------------------------------------------------------|-----------|-----|------|-----|---------------|
| $-V_{BE}$ | Base-Emitter Voltage (*)  | $-I_C=4\text{ A}, -V_{CE}=3\text{ V}$                       | BD644     | -   | -    | 2.5 | V             |
|           |                           | $-I_C=3\text{ A}, -V_{CE}=3\text{ V}$                       | BD646     | -   | -    | 2.5 |               |
|           |                           |                                                             | BD648     |     |      |     |               |
|           |                           |                                                             | BD650     |     |      |     |               |
|           |                           |                                                             | BD652     |     |      |     |               |
| $h_{FE}$  | DC Current Gain (*)       | $-V_{CE}=3.0\text{ V}$<br>$-I_C=0.5\text{ A}$               | BD644     | -   | 2700 | -   | -             |
|           |                           |                                                             | BD646     |     |      |     |               |
|           |                           |                                                             | BD648     |     |      |     |               |
|           |                           |                                                             | BD650     |     |      |     |               |
|           |                           |                                                             | BD652     |     |      |     |               |
|           |                           | $-V_{CE}=3.0\text{ V}, -I_C=4\text{ A}$                     | BD644     | 750 | -    | -   |               |
|           |                           | $-V_{CE}=3.0\text{ V}, -I_C=3\text{ A}$                     | BD646     | 750 | -    | -   |               |
|           |                           |                                                             | BD648     |     |      |     |               |
|           |                           |                                                             | BD650     |     |      |     |               |
|           |                           |                                                             | BD652     |     |      |     |               |
|           |                           | $-V_{CE}=3.0\text{ V}, -I_C=8\text{ A}$                     | BD644     | -   | 200  | -   |               |
|           |                           |                                                             | BD646     |     |      |     |               |
|           |                           |                                                             | BD648     |     |      |     |               |
|           |                           |                                                             | BD650     |     |      |     |               |
|           |                           |                                                             | BD652     |     |      |     |               |
| $h_{fe}$  | Small Signal Current Gain | $-V_{CE}=3.0\text{ V}, -I_C=4\text{ A}$<br>$f=1\text{ MHz}$ | BD644     | 10  | -    | -   |               |
|           |                           | $-V_{CE}=3.0\text{ V}$<br>$-I_C=3\text{ A}, f=1\text{ MHz}$ | BD646     | 10  | -    | -   |               |
|           |                           |                                                             | BD648     |     |      |     |               |
|           |                           |                                                             | BD650     |     |      |     |               |
|           |                           |                                                             | BD652     |     |      |     |               |
| $t_{on}$  | turn-on time              | $-I_C=3\text{ A}$                                           | All types | -   | 1    | -   | $\mu\text{s}$ |
| $t_{off}$ | turn-off time             | $-I_{Bon}=I_{Boff}=12\text{ mA}$                            |           | -   | 5    | -   |               |

(\*) Pulse Width  $\approx 300\text{ }\mu\text{s}$ , Duty Cycle  $\angle 2.0\%$

## BD644 – 646 – 648 – 650 – 652

### MECHANICAL DATA CASE TO-220

| DIMENSIONS (mm) |       |       |
|-----------------|-------|-------|
|                 | Min.  | Max.  |
| A               | 9,90  | 10,30 |
| B               | 15,65 | 15,90 |
| C               | 13,20 | 13,40 |
| D               | 6,45  | 6,65  |
| E               | 4,30  | 4,50  |
| F               | 2,70  | 3,15  |
| G               | 2,60  | 3,00  |
| H               | 15,75 | 17,15 |
| L               | 1,15  | 1,40  |
| M               | 3,50  | 3,70  |
| N               | -     | 1,37  |
| P               | 0,46  | 0,55  |
| R               | 2,50  | 2,70  |
| S               | 4,98  | 5,08  |
| T               | 2,49  | 2,54  |
| U               | 0,70  | 0,90  |



|         |           |
|---------|-----------|
| Pin 1 : | Base      |
| Pin 2 : | Collector |
| Pin 3 : | Emitter   |
| Package | Collector |

Revised September 2012

Information furnished is believed to be accurate and reliable. However, Comset Semiconductors assumes no responsibility for the consequences of use of such information nor for any infringement of patents or other rights of third parties which may results from its use. Data are subject to change without notice. Comset Semiconductors makes no warranty, representation or guarantee regarding the suitability of its products for any particular purpose, nor does Comset Semiconductors assume any liability arising out of the application or use of any product and specifically disclaims any and all liability, including without limitation consequential or incidental damages. Comset Semiconductors' products are not authorized for use as critical components in life support devices or systems.