

## BD643 – 645 – 647 – 649 – 651

### SILICON DARLINGTON POWER TRANSISTORS

NPN 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.

PNP complements are BD644, BD646, BD648, BD650 and BD652

Compliance to RoHS.

#### ABSOLUTE MAXIMUM RATINGS

| Symbol    | Ratings                   |       | Value | Unit |
|-----------|---------------------------|-------|-------|------|
| $V_{CBO}$ | Collector-Base Voltage    | BD643 | 60    | V    |
|           |                           | BD645 | 80    |      |
|           |                           | BD647 | 100   |      |
|           |                           | BD649 | 120   |      |
|           |                           | BD651 | 140   |      |
| $V_{CEO}$ | Collector-Emitter Voltage | BD643 | 45    | V    |
|           |                           | BD645 | 60    |      |
|           |                           | BD647 | 80    |      |
|           |                           | BD649 | 100   |      |
|           |                           | BD651 | 120   |      |
| $V_{EBO}$ | Emitter-Base Voltage      | BD643 | 5     | V    |
|           |                           | BD645 |       |      |
|           |                           | BD647 |       |      |
|           |                           | BD649 |       |      |
|           |                           | BD651 |       |      |
| $I_C$     | Collector Current         | BD643 | 8     | A    |
|           |                           | BD645 |       |      |
|           |                           | BD647 |       |      |
|           |                           | BD649 |       |      |
|           |                           | BD651 |       |      |
| $I_{CM}$  | Collector Peak Current    | BD643 | 12    | A    |
|           |                           | BD645 |       |      |
|           |                           | BD647 |       |      |
|           |                           | BD649 |       |      |
|           |                           | BD651 |       |      |

## BD643 – 645 – 647 – 649 – 651

### ABSOLUTE MAXIMUM RATINGS

| Symbol | Ratings                   |                       |       | Value       | Unit             |
|--------|---------------------------|-----------------------|-------|-------------|------------------|
| $I_B$  | Base Current              |                       | BD643 | 300         | mA               |
|        |                           |                       | BD645 |             |                  |
|        |                           |                       | BD647 |             |                  |
|        |                           |                       | BD649 |             |                  |
|        |                           |                       | BD651 |             |                  |
| $P_T$  | Power Dissipation         | @ $T_{mb} < 25^\circ$ | BD643 | 62.5        | Watts            |
|        |                           |                       | BD645 |             |                  |
|        |                           |                       | BD647 |             |                  |
|        |                           |                       | BD649 |             |                  |
|        |                           |                       | BD651 |             |                  |
| $T_J$  | Junction Temperature      |                       | BD643 | 150         | $^\circ\text{C}$ |
|        |                           |                       | BD645 |             |                  |
|        |                           |                       | BD647 |             |                  |
|        |                           |                       | BD649 |             |                  |
|        |                           |                       | BD651 |             |                  |
| $T_s$  | Storage Temperature range |                       | BD643 | -65 to +150 |                  |
|        |                           |                       | BD645 |             |                  |
|        |                           |                       | BD647 |             |                  |
|        |                           |                       | BD649 |             |                  |
|        |                           |                       | BD651 |             |                  |

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 | 62.5  | K/W  |

## BD643 – 645 – 647 – 649 – 651

### ELECTRICAL CHARACTERISTICS

TC=25°C unless otherwise noted

| Symbol               | Ratings                                  | Test Condition(s)                                                                     |       | Min | Typ | Max | Unit |
|----------------------|------------------------------------------|---------------------------------------------------------------------------------------|-------|-----|-----|-----|------|
| I <sub>CBO</sub>     | Collector Cutoff Current                 | I <sub>E</sub> =0, V <sub>CB</sub> =V <sub>CEO</sub> Max                              | BD643 | -   | -   | 0.2 | mA   |
|                      |                                          |                                                                                       | BD645 |     |     |     |      |
|                      |                                          |                                                                                       | BD647 |     |     |     |      |
|                      |                                          |                                                                                       | BD649 |     |     |     |      |
|                      |                                          |                                                                                       | BD651 |     |     |     |      |
|                      |                                          | I <sub>E</sub> =0, V <sub>CB</sub> =1/2 V <sub>CBO</sub> Max<br>T <sub>J</sub> =150°C | BD643 | -   | -   | 2   | mA   |
|                      |                                          |                                                                                       | BD645 |     |     |     |      |
|                      |                                          |                                                                                       | BD647 |     |     |     |      |
|                      |                                          |                                                                                       | BD649 |     |     |     |      |
|                      |                                          |                                                                                       | BD651 |     |     |     |      |
| I <sub>CEO</sub>     | Collector Cutoff Current                 | I <sub>E</sub> =0, V <sub>CE</sub> =1/2 V <sub>CEO</sub> Max                          | BD643 | -   | -   | 0.5 | mA   |
|                      |                                          |                                                                                       | BD645 |     |     |     |      |
|                      |                                          |                                                                                       | BD647 |     |     |     |      |
|                      |                                          |                                                                                       | BD649 |     |     |     |      |
|                      |                                          |                                                                                       | BD651 |     |     |     |      |
| I <sub>EBO</sub>     | Emitter Cutoff Current                   | V <sub>EB</sub> =5 V, I <sub>C</sub> =0                                               | BD643 | -   | -   | 5.0 | mA   |
|                      |                                          |                                                                                       | BD645 |     |     |     |      |
|                      |                                          |                                                                                       | BD647 |     |     |     |      |
|                      |                                          |                                                                                       | BD649 |     |     |     |      |
|                      |                                          |                                                                                       | BD651 |     |     |     |      |
| V <sub>CEO</sub>     | Collector-Emitter Breakdown Voltage      | I <sub>C</sub> =30 mA, I <sub>B</sub> = 0                                             | BD643 | 45  | -   | -   | V    |
|                      |                                          |                                                                                       | BD645 | 60  | -   | -   |      |
|                      |                                          |                                                                                       | BD647 | 80  | -   | -   |      |
|                      |                                          |                                                                                       | BD649 | 100 | -   | -   |      |
|                      |                                          |                                                                                       | BD651 | 120 | -   | -   |      |
| V <sub>CE(SAT)</sub> | Collector-Emitter saturation Voltage (*) | I <sub>C</sub> =4 A, I <sub>B</sub> =16 mA                                            | BD643 | -   | -   | 2   | V    |
|                      |                                          | I <sub>C</sub> =3 A, I <sub>B</sub> =12 mA                                            | BD645 | -   | -   | 2   |      |
|                      |                                          |                                                                                       | BD647 |     |     |     |      |
|                      |                                          |                                                                                       | BD649 |     |     |     |      |
|                      |                                          |                                                                                       | BD651 |     |     |     |      |
|                      |                                          | I <sub>C</sub> =5 A, I <sub>B</sub> =50 mA                                            | BD643 | -   | -   | 2.5 |      |
|                      |                                          |                                                                                       | BD645 |     |     |     |      |
|                      |                                          |                                                                                       | BD647 |     |     |     |      |
|                      |                                          |                                                                                       | BD649 |     |     |     |      |
|                      |                                          |                                                                                       | BD651 |     |     |     |      |
| V <sub>BE(SAT)</sub> | Base-Emitter Saturation Voltage (*)      | I <sub>C</sub> =5 A, I <sub>B</sub> =50 mA                                            | BD643 | -   | -   | 3   | V    |
|                      |                                          |                                                                                       | BD645 |     |     |     |      |
|                      |                                          |                                                                                       | BD647 |     |     |     |      |
|                      |                                          |                                                                                       | BD649 |     |     |     |      |
|                      |                                          |                                                                                       | BD651 |     |     |     |      |

## BD643 – 645 – 647 – 649 – 651

### ELECTRICAL CHARACTERISTICS

TC=25°C unless otherwise noted

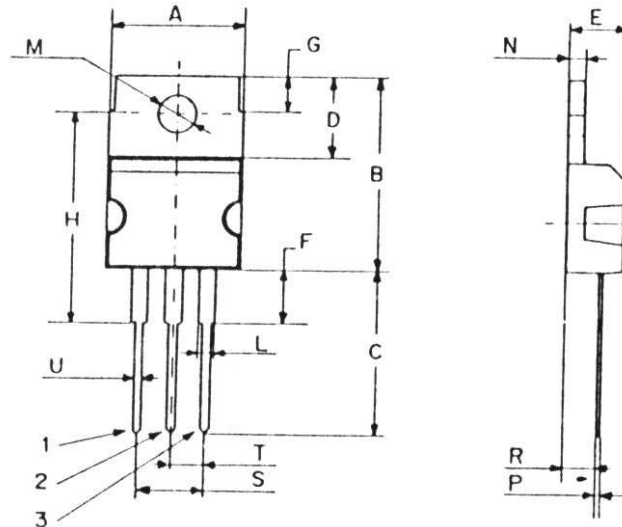
| Symbol   | Ratings                   | Test Condition(s)                                            |       | Min | Typ  | Max | Unit |  |
|----------|---------------------------|--------------------------------------------------------------|-------|-----|------|-----|------|--|
| $V_{BE}$ | Base-Emitter Voltage (*)  | $I_C=4\text{ A}$ , $V_{CE}=3\text{ V}$                       | BD643 | -   | -    | 2.5 | V    |  |
|          |                           | $I_C=3\text{ A}$ , $V_{CE}=3\text{ V}$                       | BD645 | -   | -    | 2.5 |      |  |
|          |                           |                                                              | BD647 |     |      |     |      |  |
|          |                           |                                                              | BD649 |     |      |     |      |  |
|          |                           |                                                              | BD651 |     |      |     |      |  |
| $h_{FE}$ | DC Current Gain (*)       | $V_{CE}=3.0\text{ V}$ , $I_C=0.5\text{ A}$                   | BD643 | -   | 1900 | -   | -    |  |
|          |                           |                                                              | BD645 |     |      |     |      |  |
|          |                           |                                                              | BD647 |     |      |     |      |  |
|          |                           |                                                              | BD649 |     |      |     |      |  |
|          |                           |                                                              | BD651 |     |      |     |      |  |
|          |                           | $V_{CE}=3.0\text{ V}$ , $I_C=4\text{ A}$                     | BD643 | 750 | -    | -   |      |  |
|          |                           | $V_{CE}=3.0\text{ V}$ , $I_C=3\text{ A}$                     | BD645 | 750 | -    | -   |      |  |
|          |                           |                                                              | BD647 |     |      |     |      |  |
|          |                           |                                                              | BD649 |     |      |     |      |  |
|          |                           |                                                              | BD651 |     |      |     |      |  |
|          |                           | $V_{CE}=3.0\text{ V}$ , $I_C=8\text{ A}$                     | BD643 | -   | 1800 | -   |      |  |
|          |                           |                                                              | BD645 |     |      |     |      |  |
|          |                           |                                                              | BD647 |     |      |     |      |  |
|          |                           |                                                              | BD649 |     |      |     |      |  |
|          |                           |                                                              | BD651 |     |      |     |      |  |
| $h_{fe}$ | Small Signal Current Gain | $V_{CE}=3.0\text{ V}$ , $I_C=4\text{ A}$<br>$f=1\text{ MHz}$ | BD643 | 10  | -    | -   | -    |  |
|          |                           | $V_{CE}=3.0\text{ V}$ , $I_C=3\text{ A}$<br>$f=1\text{ MHz}$ | BD645 | 10  | -    | -   |      |  |
|          |                           |                                                              | BD647 | 10  | -    | -   |      |  |
|          |                           |                                                              | BD649 | 10  | -    | -   |      |  |
|          |                           |                                                              | BD651 | 10  | -    | -   |      |  |

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

## BD643 – 645 – 647 – 649 – 651

### 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   |
| Case :  | Collector |

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