



# THE DATASHEET OF BD646

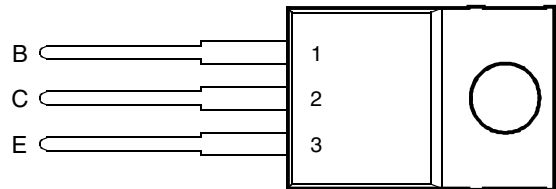


# BD646, BD648, BD650, BD652 PNP SILICON POWER DARLINGTONS

**BOURNS®**

- Designed for Complementary Use with BD645, BD647, BD649 and BD651
- 62.5 W at 25°C Case Temperature
- 8 A Continuous Collector Current
- Minimum  $h_{FE}$  of 750 at 3V, 3 A

TO-220 PACKAGE  
(TOP VIEW)



Pin 2 is in electrical contact with the mounting base.

MDTRACA



This series is obsolete and not recommended for new designs.

### absolute maximum ratings at 25°C case temperature (unless otherwise noted)

RATING		SYMBOL	VALUE	UNIT
Collector-base voltage ( $I_E = 0$ )	BD646	$V_{CB0}$	-80	V
	BD648		-100	
	BD650		-120	
	BD652		-140	
Collector-emitter voltage ( $I_B = 0$ )	BD646	$V_{CE0}$	-60	V
	BD648		-80	
	BD650		-100	
	BD652		-120	
Emitter-base voltage		$V_{EB0}$	-5	V
Continuous collector current		$I_C$	-8	A
Peak collector current (see Note 1)		$I_{CM}$	-12	A
Continuous base current		$I_B$	-0.3	A
Continuous device dissipation at (or below) 25°C case temperature (see Note 2)		$P_{tot}$	62.5	W
Continuous device dissipation at (or below) 25°C free air temperature (see Note 3)		$P_{tot}$	2	W
Unclamped inductive load energy (see Note 4)		$\frac{1}{2}LI_C^2$	50	mJ
Operating junction temperature range		$T_j$	-65 to +150	°C
Storage temperature range		$T_{stg}$	-65 to +150	°C
Lead temperature 3.2 mm from case for 10 seconds		$T_L$	260	°C

NOTES: 1. This value applies for  $t_p \leq 0.3$  ms, duty cycle  $\leq 10\%$ .

2. Derate linearly to 150°C case temperature at the rate of 0.4 W/°C.

3. Derate linearly to 150°C free air temperature at the rate of 16 mW/°C.

4. This rating is based on the capability of the transistor to operate safely in a circuit of:  $L = 20$  mH,  $I_{B(on)} = -5$  mA,  $R_{BE} = 100 \Omega$ ,  $V_{BE(off)} = 0$ ,  $R_S = 0.1 \Omega$ ,  $V_{CC} = -20$  V.

## PRODUCT INFORMATION

MAY 1993 - REVISED SEPTEMBER 2002  
Specifications are subject to change without notice.

**BD646, BD648, BD650, BD652**  
**PNP SILICON POWER DARLINGTONS**



**electrical characteristics at 25°C case temperature (unless otherwise noted)**

PARAMETER	TEST CONDITIONS	MIN	TYP	MAX	UNIT
$V_{(BR)CEO}$ Collector-emitter breakdown voltage	$I_C = -30 \text{ mA}$ $I_B = 0$ (see Note 5)	BD646 BD648 BD650 BD652	-60 -80 -100 -120		V
$I_{CEO}$ Collector-emitter cut-off current	$V_{CE} = -30 \text{ V}$ $I_B = 0$ $V_{CE} = -40 \text{ V}$ $I_B = 0$ $V_{CE} = -50 \text{ V}$ $I_B = 0$ $V_{CE} = -60 \text{ V}$ $I_B = 0$	BD646 BD648 BD650 BD652		-0.5 -0.5 -0.5 -0.5	mA
$I_{CBO}$ Collector cut-off current	$V_{CB} = -60 \text{ V}$ $I_E = 0$ $V_{CB} = -80 \text{ V}$ $I_E = 0$ $V_{CB} = -100 \text{ V}$ $I_E = 0$ $V_{CB} = -120 \text{ V}$ $I_E = 0$ $V_{CB} = -40 \text{ V}$ $I_E = 0$ $T_C = 150^\circ\text{C}$ $V_{CB} = -50 \text{ V}$ $I_E = 0$ $T_C = 150^\circ\text{C}$ $V_{CB} = -60 \text{ V}$ $I_E = 0$ $T_C = 150^\circ\text{C}$ $V_{CB} = -70 \text{ V}$ $I_E = 0$ $T_C = 150^\circ\text{C}$	BD646 BD648 BD650 BD652 BD646 BD648 BD650 BD652		-0.2 -0.2 -0.2 -0.2 -2.0 -2.0 -2.0 -2.0	mA
$I_{EBO}$ Emitter cut-off current	$V_{EB} = -5 \text{ V}$ $I_C = 0$ (see Notes 5 and 6)			-5	mA
$h_{FE}$ Forward current transfer ratio	$V_{CE} = -3 \text{ V}$ $I_C = -3 \text{ A}$ (see Notes 5 and 6)		750		
$V_{CE(sat)}$ Collector-emitter saturation voltage	$I_B = -12 \text{ mA}$ $I_C = -3 \text{ A}$ $I_B = -50 \text{ mA}$ $I_C = -5 \text{ A}$ (see Notes 5 and 6)			-2 -2.5	V
$V_{BE(sat)}$ Base-emitter saturation voltage	$I_B = -50 \text{ mA}$ $I_C = -5 \text{ A}$ (see Notes 5 and 6)			-3	V
$V_{BE(on)}$ Base-emitter voltage	$V_{CE} = -3 \text{ V}$ $I_C = -3 \text{ A}$ (see Notes 5 and 6)			-2.5	V

NOTES: 5. These parameters must be measured using pulse techniques,  $t_p = 300 \mu\text{s}$ , duty cycle  $\leq 2\%$ .

6. These parameters must be measured using voltage sensing contacts, separate from the current carrying contacts.

**thermal characteristics**

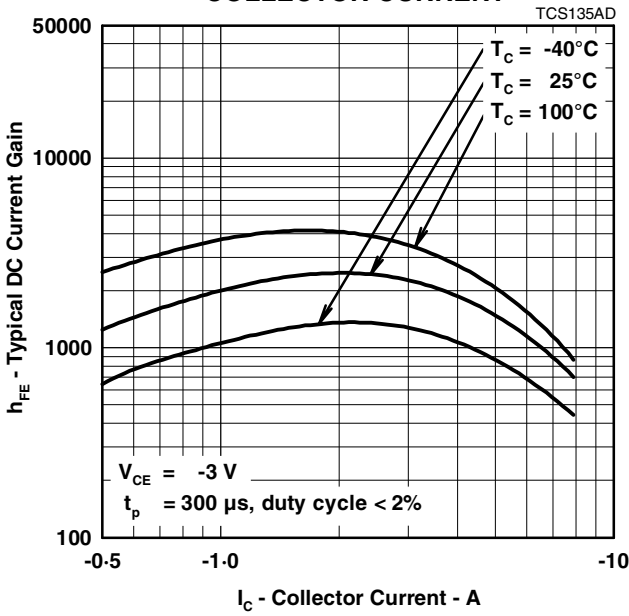
PARAMETER	MIN	TYP	MAX	UNIT
$R_{\theta JC}$ Junction to case thermal resistance			2.0	°C/W
$R_{\theta JA}$ Junction to free air thermal resistance			62.5	°C/W

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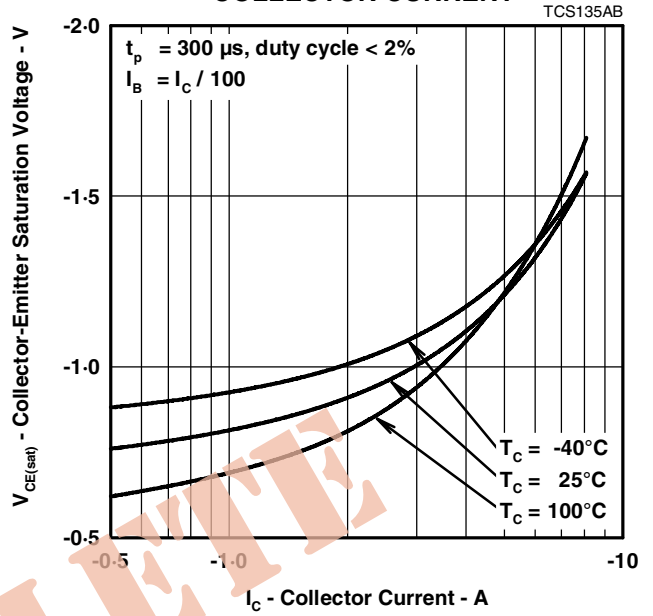
**TYPICAL CHARACTERISTICS**

**TYPICAL DC CURRENT GAIN  
vs  
COLLECTOR CURRENT**



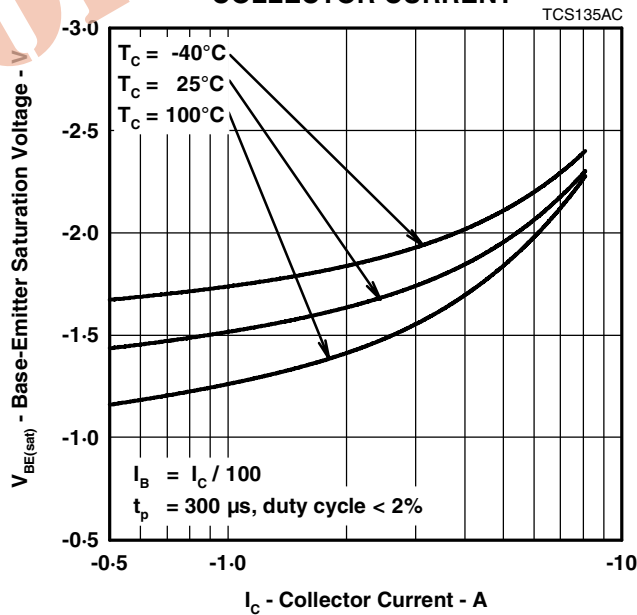
**Figure 1.**

**COLLECTOR-EMITTER SATURATION VOLTAGE  
vs  
COLLECTOR CURRENT**



**Figure 2.**

**BASE-EMITTER SATURATION VOLTAGE  
vs  
COLLECTOR CURRENT**



**Figure 3.**

**PRODUCT INFORMATION**

**MAXIMUM SAFE OPERATING REGIONS**

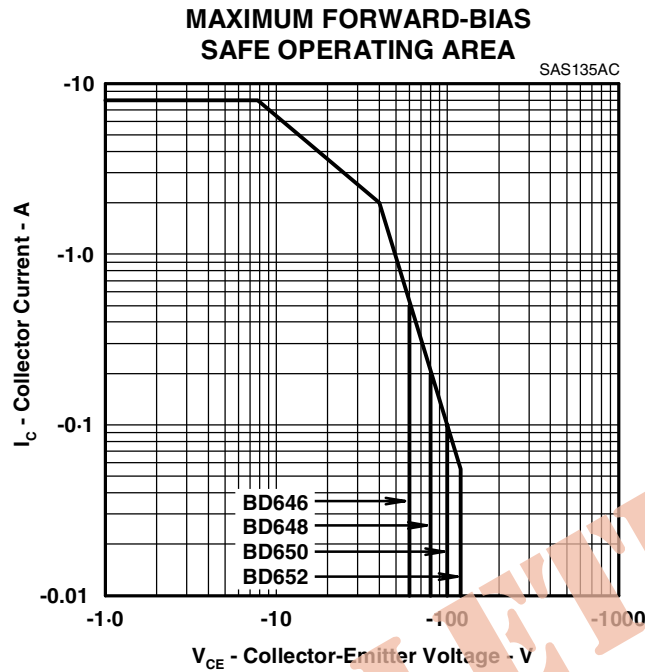


Figure 4.

**THERMAL INFORMATION**

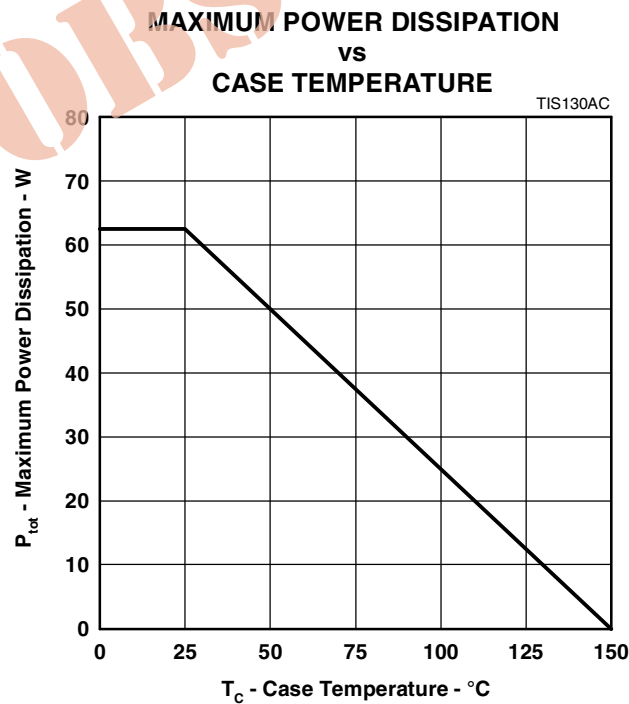




Figure 5.

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