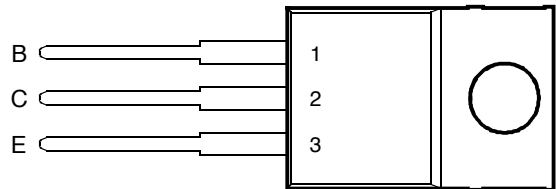


- RoHS compliant\*
- Designed for Complementary Use with BD646, BD648, BD650 and BD652
- 62.5 W at 25°C Case Temperature
- 8 A Continuous Collector Current
- Minimum  $h_{FE}$  of 750 at 3V, 3 A

TO-220 PACKAGE  
(TOP VIEW)



Pin 2 is in electrical contact with the mounting base.

MDTRACA



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

RATING		SYMBOL	VALUE	UNIT
Collector-base voltage ( $I_E = 0$ )	BD645	$V_{CBO}$	80	V
	BD647		100	
	BD649		120	
	BD651		140	
Collector-emitter voltage ( $I_B = 0$ )	BD645	$V_{CEO}$	60	V
	BD647		80	
	BD649		100	
	BD651		120	
Emitter-base voltage		$V_{EBO}$	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.

**How to Order**

Device	Package	Carrier	Order As
BDxxx	TO-220	Tube	BDxxx-S

Insert xxx transistor type number 645, 647, 649, etc.

**PRODUCT INFORMATION**

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\*RoHS Directive 2002/95/EC Jan. 27, 2003 including annex and RoHS Recast 2011/65/EU June 8, 2011. Specifications are subject to change without notice.

The device characteristics and parameters in this data sheet can and do vary in different applications and actual device performance may vary over time. Users should verify actual device performance in their specific applications.

**BD645, BD647, BD649, BD651**  
**NPN 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)	BD645 60 BD647 80 BD649 100 BD651 120			V
$I_{CEO}$ Collector-emitter cut-off current	$V_{CE} = 30 \text{ V}$ $V_{CE} = 40 \text{ V}$ $V_{CE} = 50 \text{ V}$ $V_{CE} = 60 \text{ V}$	$I_B = 0$	BD645 BD647 BD649 BD651		0.5 0.5 0.5 0.5	mA
$I_{CBO}$ Collector cut-off current	$V_{CB} = 60 \text{ V}$ $V_{CB} = 80 \text{ V}$ $V_{CB} = 100 \text{ V}$ $V_{CB} = 120 \text{ V}$ $V_{CB} = 40 \text{ V}$ $V_{CB} = 50 \text{ V}$ $V_{CB} = 60 \text{ V}$ $V_{CB} = 70 \text{ V}$	$I_E = 0$	BD645 BD647 BD649 BD651 BD645 BD647 BD649 BD651		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	$I_B = 12 \text{ mA}$ $I_B = 50 \text{ mA}$	$I_C = 3 \text{ A}$ $I_C = 5 \text{ A}$ (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.

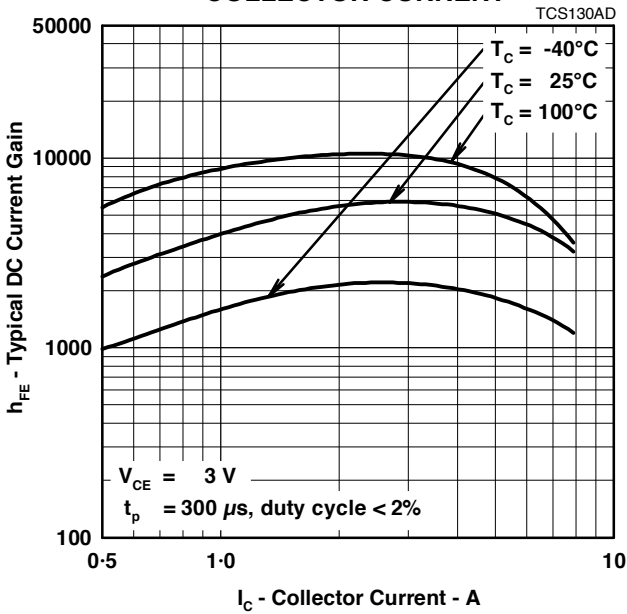
**thermal characteristics**

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

**PRODUCT INFORMATION**

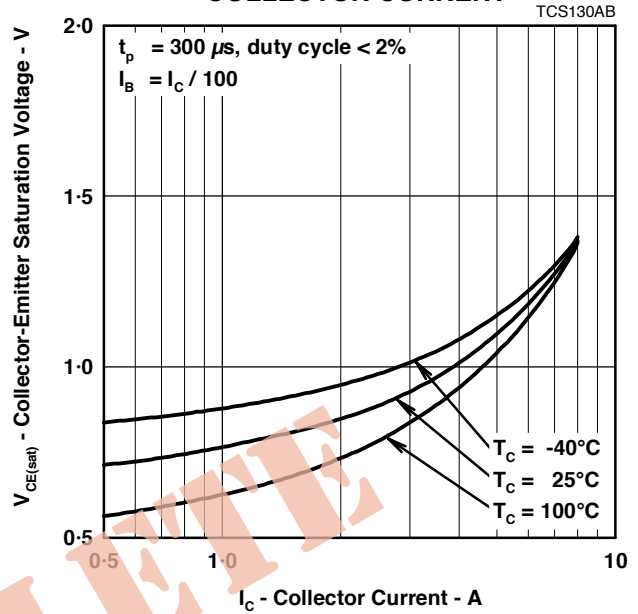
**TYPICAL CHARACTERISTICS**

**TYPICAL DC CURRENT GAIN  
vs  
COLLECTOR CURRENT**



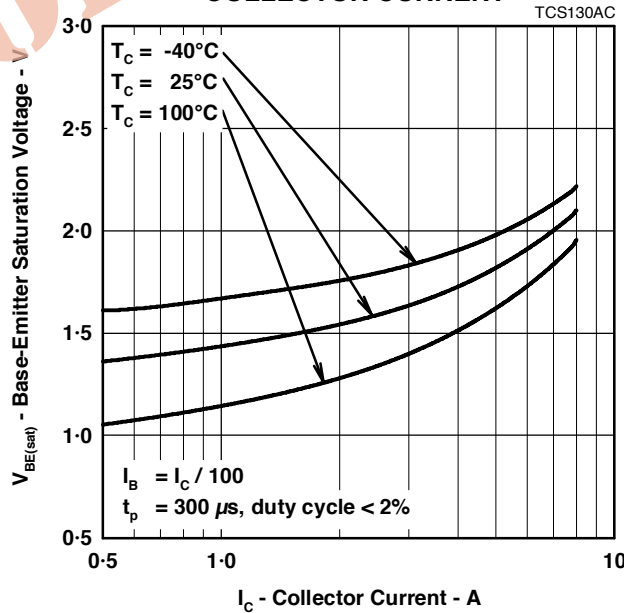
**Figure 1.**

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



**Figure 2.**

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



**Figure 3.**

**PRODUCT INFORMATION**

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**MAXIMUM SAFE OPERATING REGIONS**

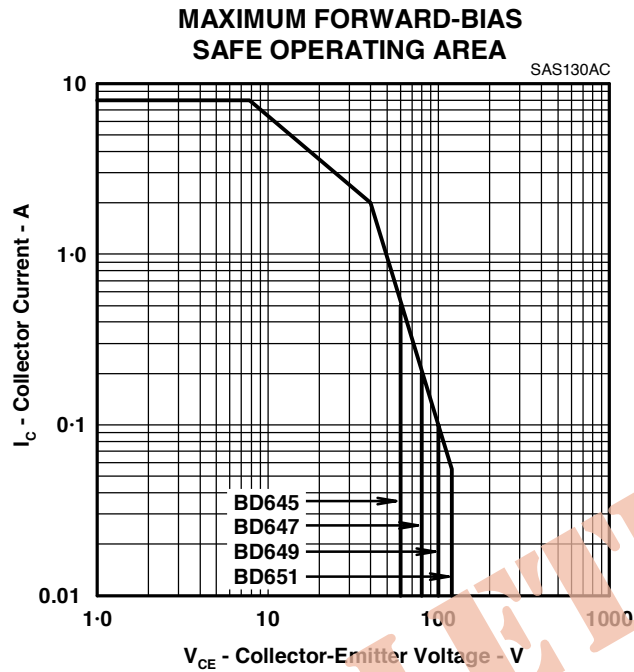


Figure 4.

**THERMAL INFORMATION**

**MAXIMUM POWER DISSIPATION  
vs  
CASE TEMPERATURE**

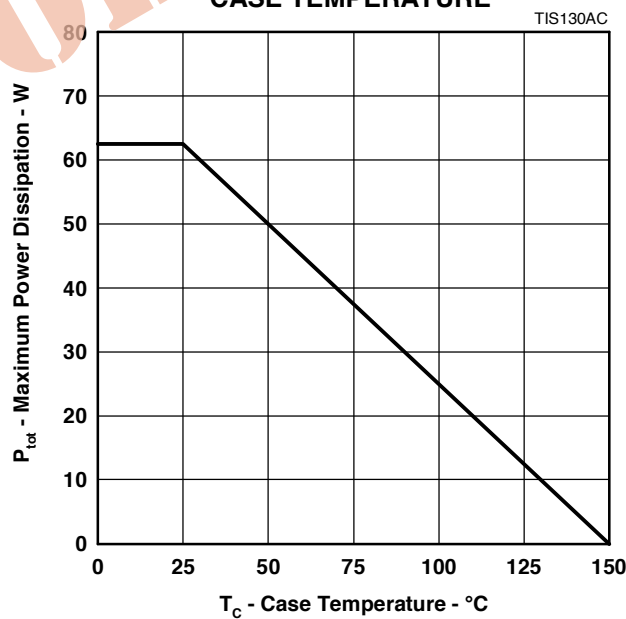


Figure 5.

**PRODUCT INFORMATION**

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