

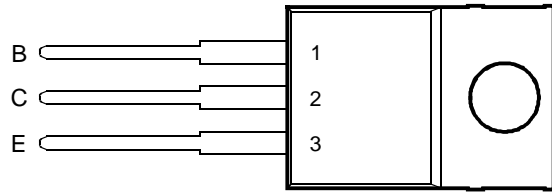
# BDX33, BDX33A, BDX33B, BDX33C, BDX33D NPN SILICON POWER DARLINGTONS

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AUGUST 1993 - REVISED MARCH 1997

- **Designed for Complementary Use with BDX34, BDX34A, BDX34B, BDX34C and BDX34D**
- **70 W at 25°C Case Temperature**
- **10 A Continuous Collector Current**
- **Minimum  $h_{FE}$  of 750 at 3 V, 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 ( $I_E = 0$ )	BDX33	$V_{CBO}$	45	V
	BDX33A		60	
	BDX33B		80	
	BDX33C		100	
	BDX33D		120	
Collector-emitter voltage ( $I_B = 0$ )	BDX33	$V_{CEO}$	45	V
	BDX33A		60	
	BDX33B		80	
	BDX33C		100	
	BDX33D		120	
Emitter-base voltage		$V_{EBO}$	5	V
Continuous collector current		$I_C$	10	A
Continuous base current		$I_B$	0.3	A
Continuous device dissipation at (or below) 25°C case temperature (see Note 1)		$P_{tot}$	70	W
Continuous device dissipation at (or below) 25°C free air temperature (see Note 2)		$P_{tot}$	2	W
Operating free air temperature range		$T_J$	-65 to +150	°C
Storage temperature range		$T_{stg}$	-65 to +150	°C
Operating free-air temperature range		$T_A$	-65 to +150	°C

NOTES: 1. Derate linearly to 150°C case temperature at the rate of 0.56 W/°C.  
2. Derate linearly to 150°C free air temperature at the rate of 16 mW/°C.

## PRODUCT INFORMATION

Information is current as of publication date. Products conform to specifications in accordance with the terms of Power Innovations standard warranty. Production processing does not necessarily include testing of all parameters.

# BDX33, BDX33A, BDX33B, BDX33C, BDX33D

## NPN SILICON POWER DARLINGTONS

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

PARAMETER	TEST CONDITIONS			MIN	TYP	MAX	UNIT
$V_{(BR)CEO}$ Collector-emitter breakdown voltage	$I_C = 100 \text{ mA}$	$I_B = 0$	(see Note 3)	BDX33 BDX33A BDX33B BDX33C BDX33D	45 60 80 100 120		V
$I_{CEO}$ Collector-emitter cut-off current	$V_{CE} = 30 \text{ V}$ $V_{CE} = 30 \text{ V}$ $V_{CE} = 40 \text{ V}$ $V_{CE} = 50 \text{ V}$ $V_{CE} = 60 \text{ V}$ $V_{CE} = 30 \text{ V}$ $V_{CE} = 30 \text{ V}$ $V_{CE} = 40 \text{ V}$ $V_{CE} = 50 \text{ V}$ $V_{CE} = 60 \text{ V}$	$I_B = 0$ $I_B = 0$ $I_B = 0$ $I_B = 0$ $I_B = 0$ $I_B = 0$ $I_B = 0$ $I_B = 0$ $I_B = 0$ $I_B = 0$	$T_C = 100^\circ\text{C}$ $T_C = 100^\circ\text{C}$ $T_C = 100^\circ\text{C}$ $T_C = 100^\circ\text{C}$ $T_C = 100^\circ\text{C}$	BDX33 BDX33A BDX33B BDX33C BDX33D BDX33 BDX33A BDX33B BDX33C BDX33D		0.5 0.5 0.5 0.5 0.5 10 10 10 10 10	mA
$I_{CBO}$ Collector cut-off current	$V_{CB} = 45 \text{ V}$ $V_{CB} = 60 \text{ V}$ $V_{CB} = 80 \text{ V}$ $V_{CB} = 100 \text{ V}$ $V_{CB} = 120 \text{ V}$ $V_{CB} = 45 \text{ V}$ $V_{CB} = 60 \text{ V}$ $V_{CB} = 80 \text{ V}$ $V_{CB} = 100 \text{ V}$ $V_{CB} = 120 \text{ V}$	$I_E = 0$ $I_E = 0$ $I_E = 0$ $I_E = 0$ $I_E = 0$ $I_E = 0$ $I_E = 0$ $I_E = 0$ $I_E = 0$ $I_E = 0$	$T_C = 100^\circ\text{C}$ $T_C = 100^\circ\text{C}$ $T_C = 100^\circ\text{C}$ $T_C = 100^\circ\text{C}$ $T_C = 100^\circ\text{C}$	BDX33 BDX33A BDX33B BDX33C BDX33D BDX33 BDX33A BDX33B BDX33C BDX33D		1 1 1 1 1 5 5 5 5 5	mA
$I_{EBO}$ Emitter cut-off current	$V_{EB} = 5 \text{ V}$	$I_C = 0$				10	mA
$h_{FE}$ Forward current transfer ratio	$V_{CE} = 3 \text{ V}$ $V_{CE} = 3 \text{ V}$ $V_{CE} = 3 \text{ V}$ $V_{CE} = 3 \text{ V}$ $V_{CE} = 3 \text{ V}$	$I_C = 4 \text{ A}$ $I_C = 4 \text{ A}$ $I_C = 3 \text{ A}$ $I_C = 3 \text{ A}$ $I_C = 3 \text{ A}$	(see Notes 3 and 4)	BDX33 BDX33A BDX33B BDX33C BDX33D	750 750 750 750 750		
$V_{BE(on)}$ Base-emitter voltage	$V_{CE} = 3 \text{ V}$ $V_{CE} = 3 \text{ V}$ $V_{CE} = 3 \text{ V}$ $V_{CE} = 3 \text{ V}$ $V_{CE} = 3 \text{ V}$	$I_C = 4 \text{ A}$ $I_C = 4 \text{ A}$ $I_C = 3 \text{ A}$ $I_C = 3 \text{ A}$ $I_C = 3 \text{ A}$	(see Notes 3 and 4)	BDX33 BDX33A BDX33B BDX33C BDX33D		2.5 2.5 2.5 2.5 2.5	V
$V_{CE(sat)}$ Collector-emitter saturation voltage	$I_B = 8 \text{ mA}$ $I_B = 8 \text{ mA}$ $I_B = 6 \text{ mA}$ $I_B = 6 \text{ mA}$ $I_B = 6 \text{ mA}$	$I_C = 4 \text{ A}$ $I_C = 4 \text{ A}$ $I_C = 3 \text{ A}$ $I_C = 3 \text{ A}$ $I_C = 3 \text{ A}$	(see Notes 3 and 4)	BDX33 BDX33A BDX33B BDX33C BDX33D		2.5 2.5 2.5 2.5 2.5	V
$V_{EC}$ Parallel diode forward voltage	$I_E = 8 \text{ A}$	$I_B = 0$				4	V

NOTES: 3. These parameters must be measured using pulse techniques,  $t_p = 300 \mu\text{s}$ , duty cycle  $\leq 2\%$ .

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

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## thermal characteristics

PARAMETER		MIN	TYP	MAX	UNIT
$R_{\theta JC}$	Junction to case thermal resistance			1.78	°C/W
$R_{\theta JA}$	Junction to free air thermal resistance			62.5	°C/W

## resistive-load-switching characteristics at 25°C case temperature

PARAMETER	TEST CONDITIONS †			MIN	TYP	MAX	UNIT
$t_{on}$ Turn-on time	$I_C = 3\text{ A}$	$I_{B(on)} = 12\text{ mA}$	$I_{B(off)} = -12\text{ mA}$		1		$\mu\text{s}$
$t_{off}$ Turn-off time	$V_{BE(off)} = -3.5\text{ V}$	$R_L = 10\ \Omega$	$t_p = 20\ \mu\text{s}, dc \leq 2\%$		5		$\mu\text{s}$

† Voltage and current values shown are nominal; exact values vary slightly with transistor parameters.

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## TYPICAL CHARACTERISTICS

TYPICAL DC CURRENT GAIN  
VS  
COLLECTOR CURRENT

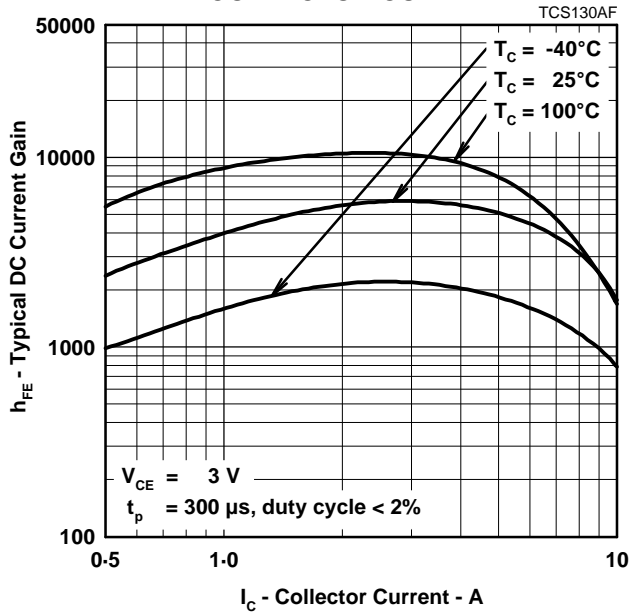


Figure 1.

COLLECTOR-EMITTER SATURATION VOLTAGE  
VS  
COLLECTOR CURRENT

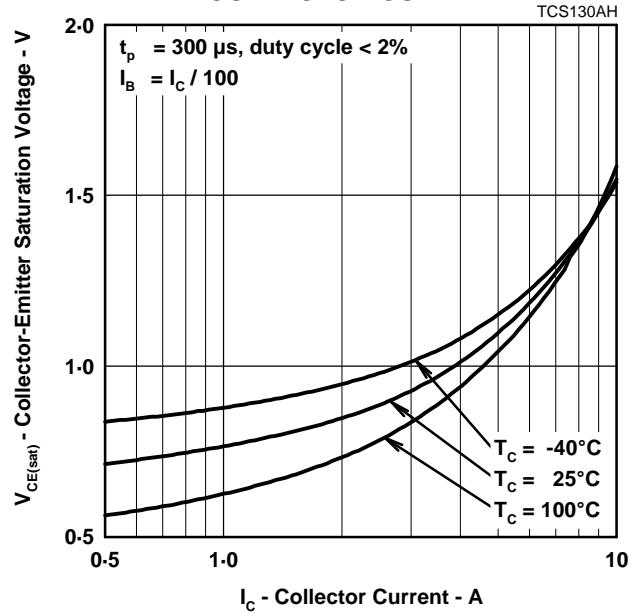


Figure 2.

BASE-EMITTER SATURATION VOLTAGE  
VS  
COLLECTOR CURRENT

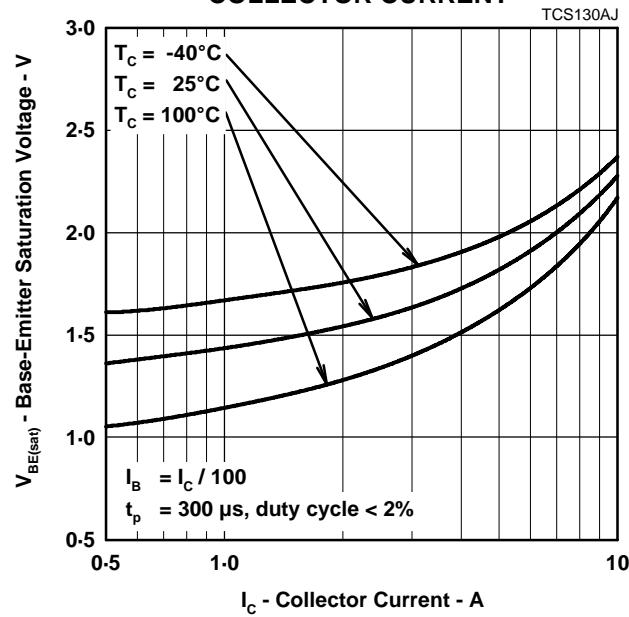


Figure 3.

THERMAL INFORMATION

MAXIMUM POWER DISSIPATION  
VS  
CASE TEMPERATURE

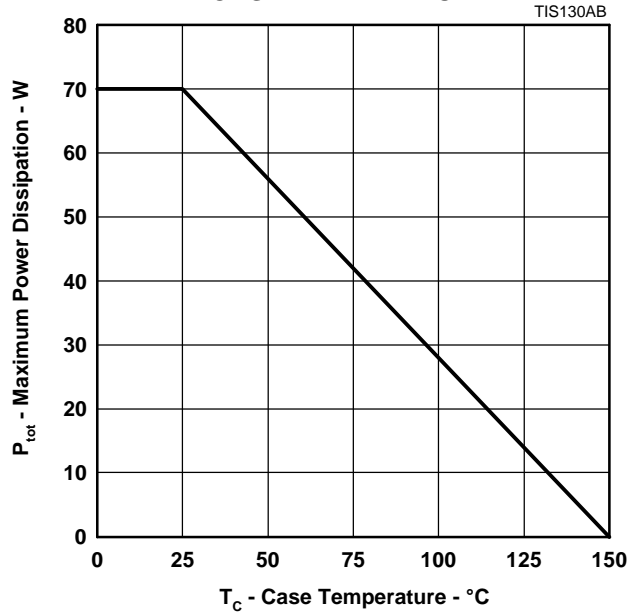


Figure 4.

# BDX33, BDX33A, BDX33B, BDX33C, BDX33D NPN SILICON POWER DARLINGTONS

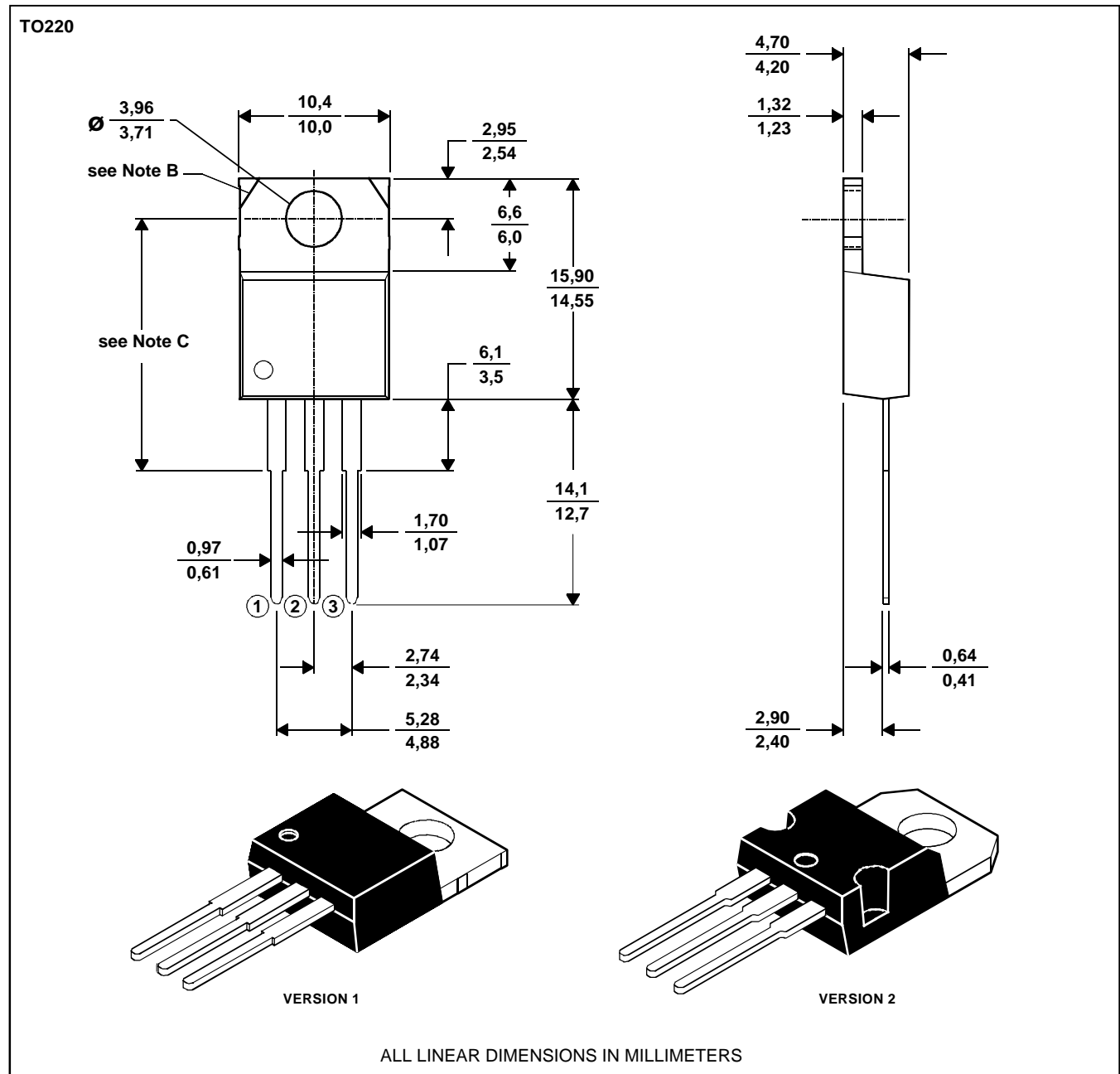
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## MECHANICAL DATA

### TO-220

#### 3-pin plastic flange-mount package

This single-in-line package consists of a circuit mounted on a lead frame and encapsulated within a plastic compound. The compound will withstand soldering temperature with no deformation, and circuit performance characteristics will remain stable when operated in high humidity conditions. Leads require no additional cleaning or processing when used in soldered assembly.



- NOTES: A. The centre pin is in electrical contact with the mounting tab.  
 B. Mounting tab corner profile according to package version.  
 C. Typical fixing hole centre stand off height according to package version.  
 Version 1, 18.0 mm. Version 2, 17.6 mm.

MDXXBE

## PRODUCT INFORMATION

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