

# Darlington Complementary Silicon Power Transistors

... designed for general purpose and low speed switching applications.

- High DC Current Gain —  
 $h_{FE} = 2500$  (typ.) at  $I_C = 4.0$
- Collector–Emitter Sustaining Voltage at 100 mAdc  
 $V_{CE(sus)} = 80$  Vdc (min.) — BDX33B, 34B  
 $100$  Vdc (min.) — BDX33C, 34C
- Low Collector–Emitter Saturation Voltage  
 $V_{CE(sat)} = 2.5$  Vdc (max.) at  $I_C = 3.0$  Adc — BDX33B, 33C/34B, 34C
- Monolithic Construction with Build–In Base–Emitter Shunt resistors
- TO–220AB Compact Package

## MAXIMUM RATINGS

Rating	Symbol	BDX33B BDX34B	BDX33C BDX34C	Unit
Collector–Emitter Voltage	$V_{CEO}$	80	100	Vdc
Collector–Base Voltage	$V_{CB}$	80	100	Vdc
Emitter–Base Voltage	$V_{EB}$	5.0		Vdc
Collector Current — Continuous Peak	$I_C$	10 15		Adc
Base Current	$I_B$	0.25		Adc
Total Device Dissipation @ $T_C = 25^\circ\text{C}$ Derate above $25^\circ\text{C}$	$P_D$	70 0.56		Watts W/ $^\circ\text{C}$
Operating and Storage Junction Temperature Range	$T_J, T_{stg}$	–65 to +150		$^\circ\text{C}$

## THERMAL CHARACTERISTICS

Characteristic	Symbol	Max	Unit
Thermal Resistance, Junction to Case	$R_{\theta JC}$	1.78	$^\circ\text{C/W}$

**NPN**  
**BDX33B**  
**BDX33C\***  
**PNP**  
**BDX34B**  
**BDX34C\***

\*ON Semiconductor Preferred Device

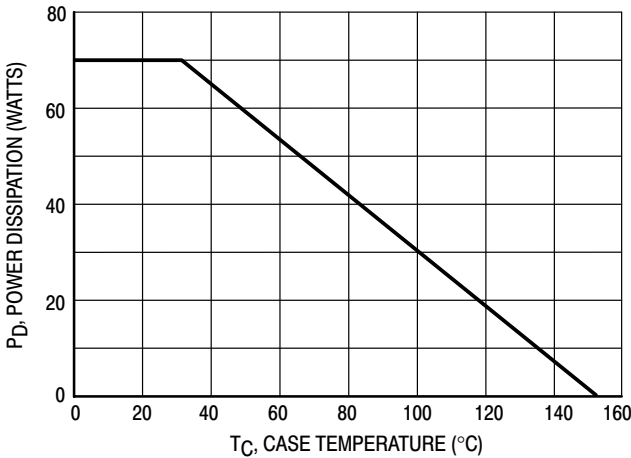
**DARLINGTON**  
**10 AMPERE**  
**COMPLEMENTARY**  
**SILICON**  
**POWER TRANSISTORS**  
**80–100 VOLTS**  
**70 WATTS**

STYLE 1:  
 PIN 1. BASE  
 2. COLLECTOR  
 3. EMITTER  
 4. COLLECTOR

**CASE 221A–09**  
**TO–220AB**

Preferred devices are ON Semiconductor recommended choices for future use and best overall value.

**BDX33B BDX33C BDX34B BDX34C**



**Figure 1. Power Derating**

# BDX33B BDX33C BDX34B BDX34C

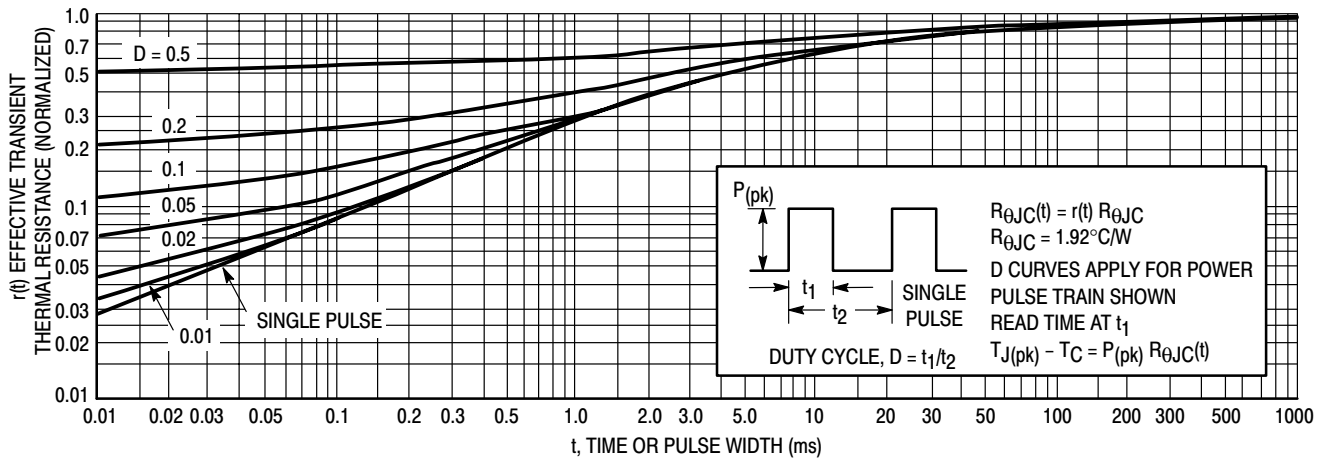
## ELECTRICAL CHARACTERISTICS ( $T_C = 25^\circ\text{C}$ unless otherwise noted)

Characteristic		Symbol	Min	Max	Unit
<b>OFF CHARACTERISTICS</b>					
Collector–Emitter Sustaining Voltage <sup>1</sup> ( $I_C = 100\text{ mAdc}$ , $I_B = 0$ )	BDX33B/BDX34B BDX33C/BDX34C	$V_{CEO(sus)}$	80 100	— —	Vdc
Collector–Emitter Sustaining Voltage <sup>1</sup> ( $I_C = 100\text{ mAdc}$ , $I_B = 0$ , $R_{BE} = 100$ )	BDX33B/BDX34B BDX33C/BDX33C	$V_{CER(sus)}$	80 100	— —	Vdc
Collector–Emitter Sustaining Voltage <sup>1</sup> ( $I_C = 100\text{ mAdc}$ , $I_B = 0$ , $V_{BE} = 1.5\text{ Vdc}$ )	BDX33B/BDX34B BDX33C/BDX34C	$V_{CEX(sus)}$	80 100	— —	Vdc
Collector Cutoff Current ( $V_{CE} = 1/2$ rated $V_{CEO}$ , $I_B = 0$ )	$T_C = 25^\circ\text{C}$ $T_C = 100^\circ\text{C}$	$I_{CEO}$	— —	0.5 10	mAdc
Collector Cutoff Current ( $V_{CB} =$ rated $V_{CBO}$ , $I_E = 0$ )	$T_C = 25^\circ\text{C}$ $T_C = 100^\circ\text{C}$	$I_{CBO}$	— —	1.0 5.0	mAdc
Emitter Cutoff Current ( $V_{BE} = 5.0\text{ Vdc}$ , $I_C = 0$ )		$I_{EBO}$	—	10	mAdc
<b>ON CHARACTERISTICS</b>					
DC Current Gain <sup>1</sup> ( $I_C = 3.0\text{ Adc}$ , $V_{CE} = 3.0\text{ Vdc}$ )	BDX33B, 33C/34B, 34C	$h_{FE}$	750	—	—
Collector–Emitter Saturation Voltage ( $I_C = 3.0\text{ Adc}$ , $I_B = 6.0\text{ mAdc}$ )	BDX33B, 33C/34B, 34C	$V_{CE(sat)}$	—	2.5	Vdc
Base–Emitter On Voltage ( $I_C = 3.0\text{ Adc}$ , $V_{CE} = 3.0\text{ Vdc}$ )	BDX33B, 33C/34B, 34C	$V_{BE(on)}$	—	2.5	Vdc
Diode Forward Voltage ( $I_C = 8.0\text{ Adc}$ )		$V_F$	—	4.0	Vdc

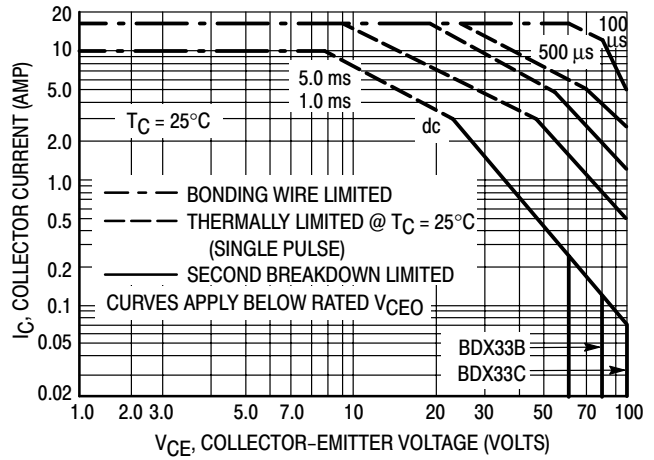
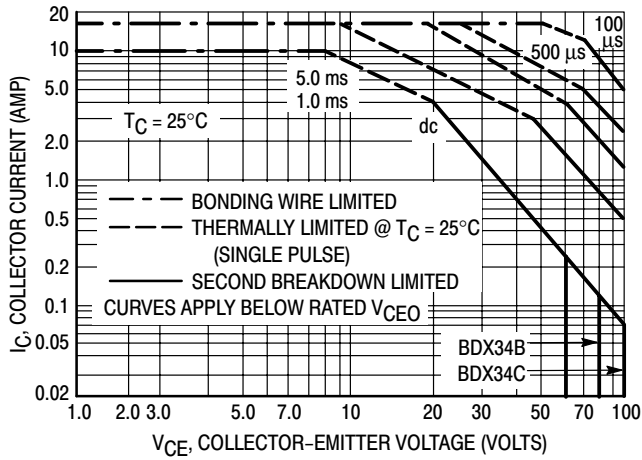
<sup>1</sup> Pulse Test: Pulse Width  $\leq 300\ \mu\text{s}$ , Duty Cycle  $\leq 2.0\%$ .

<sup>2</sup> Pulse Test non repetitive: Pulse Width = 0.25 s.

**BDX33B BDX33C BDX34B BDX34C**



**Figure 1. Thermal Response**

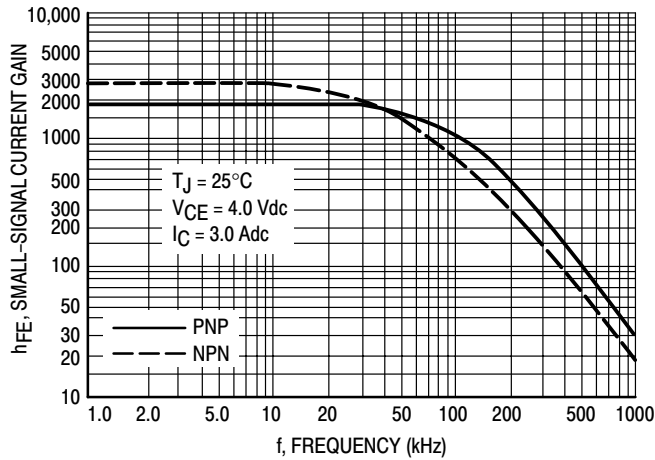


**Figure 2. Active-Region Safe Operating Area**

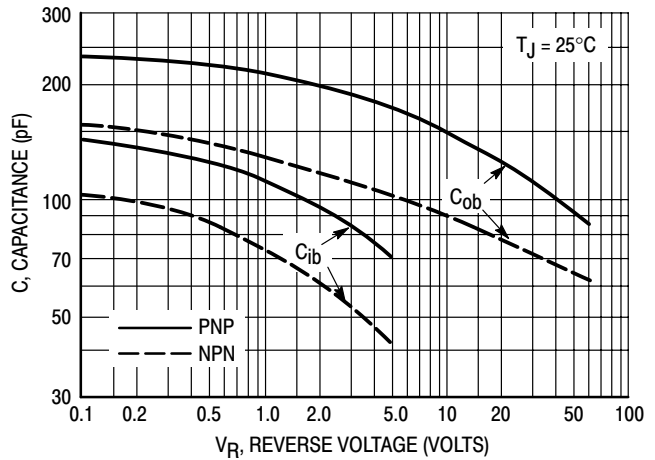
## BDX33B BDX33C BDX34B BDX34C

There are two limitations on the power handling ability of a transistor: average junction temperature and second breakdown. Safe operating area curves indicate  $I_C - V_{CE}$  limits of the transistor that must be observed for reliable operation, i.e., the transistor must not be subjected to greater dissipation than the curves indicate. The data of Figure 3 is based on  $T_{J(pk)} = 150^\circ\text{C}$ ;  $T_C$  is variable depending on

conditions. Second breakdown pulse limits are valid for duty cycles to 10% provided  $T_{J(pk)} = 150^\circ\text{C}$ .  $T_{J(pk)}$  may be calculated from the data in Figure 4. At high case temperatures, thermal limitations will reduce the power that can be handled to values less than the limitations imposed by second breakdown.



**Figure 3. Small-Signal Current Gain**

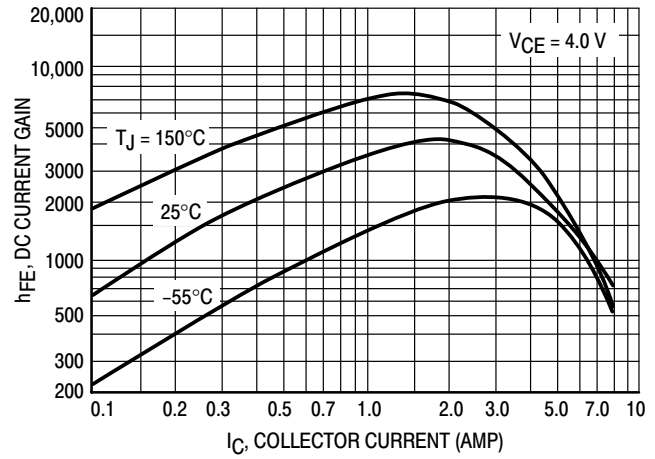
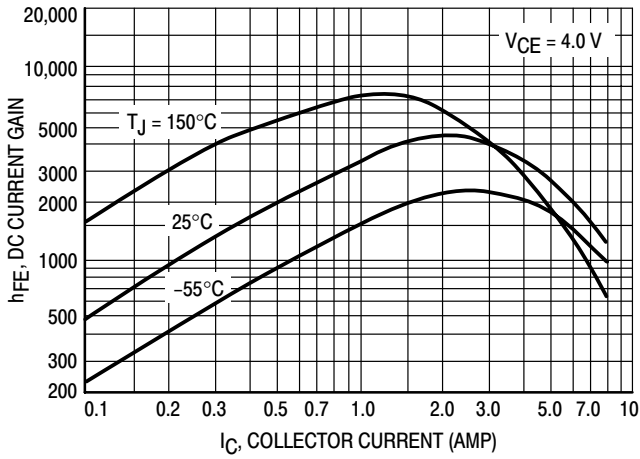


**Figure 4. Capacitance**

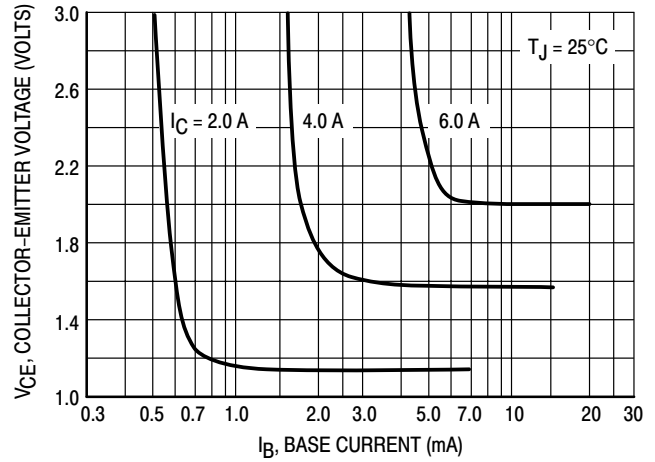
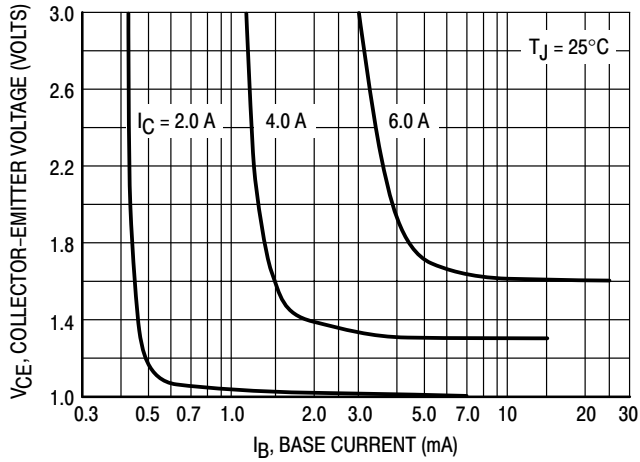
# BDX33B BDX33C BDX34B BDX34C

**NPN**  
**BDX33B, 33C**

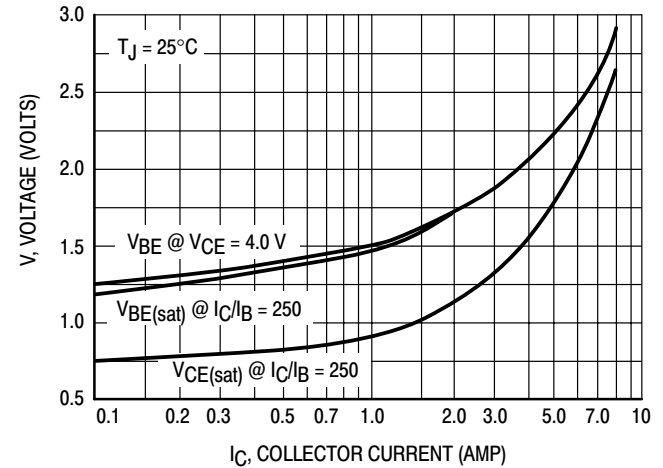
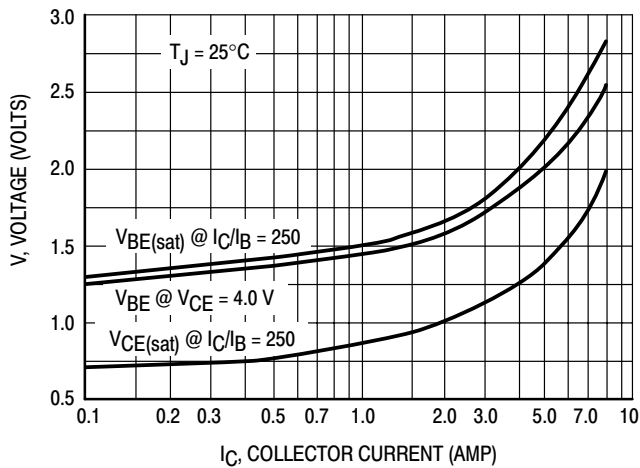
**PNP**  
**BDX34B, 34C**



**Figure 5. DC Current Gain**



**Figure 6. Collector Saturation Region**

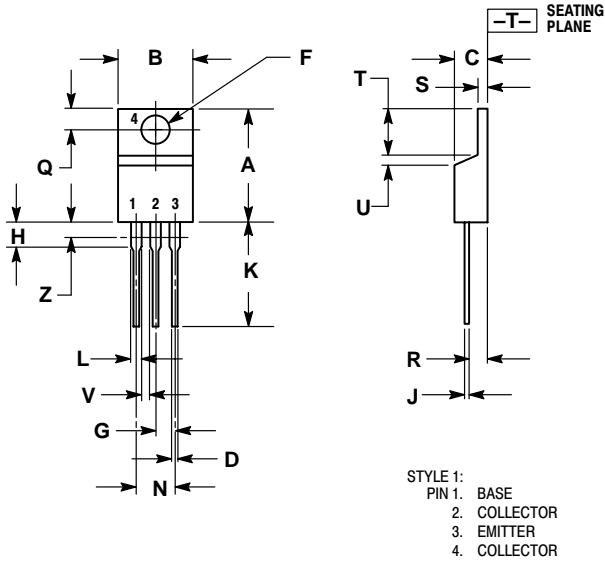


**Figure 7. "On" Voltages**

# BDX33B BDX33C BDX34B BDX34C

## PACKAGE DIMENSIONS

TO-220AB  
CASE 221A-09  
ISSUE AA



- NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
  2. CONTROLLING DIMENSION: INCH.
  3. DIMENSION Z DEFINES A ZONE WHERE ALL BODY AND LEAD IRREGULARITIES ARE ALLOWED.

DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	0.570	0.620	14.48	15.75
B	0.380	0.405	9.66	10.28
C	0.160	0.190	4.07	4.82
D	0.025	0.035	0.64	0.88
F	0.142	0.147	3.61	3.73
G	0.095	0.105	2.42	2.66
H	0.110	0.155	2.80	3.93
J	0.018	0.025	0.46	0.64
K	0.500	0.562	12.70	14.27
L	0.045	0.060	1.15	1.52
N	0.190	0.210	4.83	5.33
Q	0.100	0.120	2.54	3.04
R	0.080	0.110	2.04	2.79
S	0.045	0.055	1.15	1.39
T	0.235	0.255	5.97	6.47
U	0.000	0.050	0.00	1.27
V	0.045	---	1.15	---
Z	---	0.080	---	2.04

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