



# THE DATASHEET OF BDX53CTU



# ON Semiconductor

## Is Now

The logo for onsemi, featuring the word "onsemi" in a dark teal, lowercase, sans-serif font. The letter "i" is stylized with a white dot and a teal vertical bar. A small orange triangle is positioned above the top right of the "i". A trademark symbol (TM) is located to the right of the logo.

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[www.onsemi.com](http://www.onsemi.com)

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# BDX53B, BDX53C (NPN), BDX54B, BDX54C (PNP)

## Plastic Medium-Power Complementary Silicon Transistors

These devices are designed for general-purpose amplifier and low-speed switching applications.

### Features

- High DC Current Gain –  
 $h_{FE} = 2500$  (Typ) @  $I_C = 4.0$  Adc
- Collector Emitter Sustaining Voltage – @ 100 mAdc  
 $V_{CEO(sus)} = 80$  Vdc (Min) – BDX53B, 54B  
 $= 100$  Vdc (Min) – BDX53C, 54C
- Low Collector–Emitter Saturation Voltage –  
 $V_{CE(sat)} = 2.0$  Vdc (Max) @  $I_C = 3.0$  Adc  
 $= 4.0$  Vdc (Max) @  $I_C = 5.0$  Adc
- Monolithic Construction with Built–In Base–Emitter Shunt Resistors
- These Devices are Pb–Free and are RoHS Compliant\*

### MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Collector–Emitter Voltage BDX53B, BDX54B BDX53C, BDX54C	$V_{CEO}$	80 100	Vdc
Collector–Base Voltage BDX53B, BDX54B BDX53C, BDX54C	$V_{CB}$	80 100	Vdc
Emitter–Base Voltage	$V_{EB}$	5.0	Vdc
Collector Current – Continuous – Peak	$I_C$	8.0 12	Adc
Base Current	$I_B$	0.2	Adc
Total Device Dissipation @ $T_C = 25^\circ\text{C}$ Derate above $25^\circ\text{C}$	$P_D$	65 0.48	W W/ $^\circ\text{C}$
Operating and Storage Junction Temperature Range	$T_J, T_{stg}$	–65 to +150	$^\circ\text{C}$

Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

### THERMAL CHARACTERISTICS

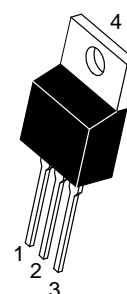
Characteristic	Symbol	Max	Unit
Thermal Resistance, Junction–to–Ambient	$R_{\theta JA}$	70	$^\circ\text{C}/\text{W}$
Thermal Resistance, Junction–to–Case	$R_{\theta JC}$	1.92	$^\circ\text{C}/\text{W}$



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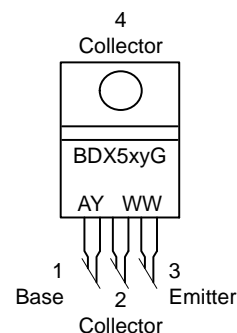
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## DARLINGTON 8 AMPERE COMPLEMENTARY SILICON POWER TRANSISTORS 80–100 VOLTS, 65 WATTS



TO-220  
CASE 221A  
STYLE 1

### MARKING DIAGRAM & PIN ASSIGNMENT



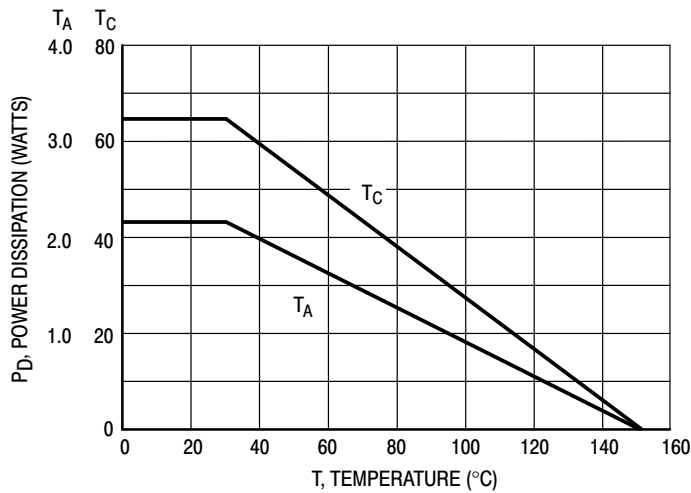
BDX5xy = Device Code  
x = 3 or 4  
y = B or C  
A = Assembly Location  
Y = Year  
WW = Work Week  
G = Pb–Free Package

### ORDERING INFORMATION

See detailed ordering and shipping information in the package dimensions section on page 6 of this data sheet.

\*For additional information on our Pb–Free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.

## BDX53B, BDX53C (NPN), BDX54B, BDX54C (PNP)



**Figure 1. Power Derating**

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

Characteristic	Symbol	Min	Max	Unit	
<b>OFF CHARACTERISTICS</b>					
Collector–Emitter Sustaining Voltage (Note 1) ( $I_C = 100\text{ mAdc}$ , $I_B = 0$ )	BDX53B, BDX54B BDX53C, BDX54C	$V_{CEO(sus)}$	80 100	– –	Vdc
Collector Cutoff Current ( $V_{CE} = 40\text{ Vdc}$ , $I_B = 0$ ) ( $V_{CE} = 50\text{ Vdc}$ , $I_B = 0$ )	BDX53B, BDX54B BDX53C, BDX54C	$I_{CEO}$	– –	0.5 0.5	mAdc
Collector Cutoff Current ( $V_{CB} = 80\text{ Vdc}$ , $I_E = 0$ ) ( $V_{CB} = 100\text{ Vdc}$ , $I_E = 0$ )	BDX53B, BDX54B BDX53C, BDX54C	$I_{CBO}$	– –	0.2 0.2	mAdc
<b>ON CHARACTERISTICS (Note 1)</b>					
DC Current Gain ( $I_C = 3.0\text{ Adc}$ , $V_{CE} = 3.0\text{ Vdc}$ )		$h_{FE}$	750	–	–
Collector–Emitter Saturation Voltage ( $I_C = 3.0\text{ Adc}$ , $I_B = 12\text{ mAdc}$ )		$V_{CE(sat)}$	– –	2.0 4.0	Vdc
Base–Emitter Saturation Voltage ( $I_C = 3.0\text{ Adc}$ , $I_C = 12\text{ mA}$ )		$V_{BE(sat)}$	–	2.5	Vdc
<b>DYNAMIC CHARACTERISTICS</b>					
Small–Signal Current Gain ( $I_C = 3.0\text{ Adc}$ , $V_{CE} = 4.0\text{ Vdc}$ , $f = 1.0\text{ MHz}$ )		$h_{fe}$	4.0	–	–
Output Capacitance ( $V_{CB} = 10\text{ Vdc}$ , $I_E = 0$ , $f = 0.1\text{ MHz}$ )	BDX53B, 53C BDX54B, 54C	$C_{ob}$	– –	300 200	pF

Product parametric performance is indicated in the Electrical Characteristics for the listed test conditions, unless otherwise noted. Product performance may not be indicated by the Electrical Characteristics if operated under different conditions.

1. Pulse Test: Pulse Width  $\leq 300\ \mu\text{s}$ , Duty Cycle  $\leq 2\%$ .

# BDX53B, BDX53C (NPN), BDX54B, BDX54C (PNP)

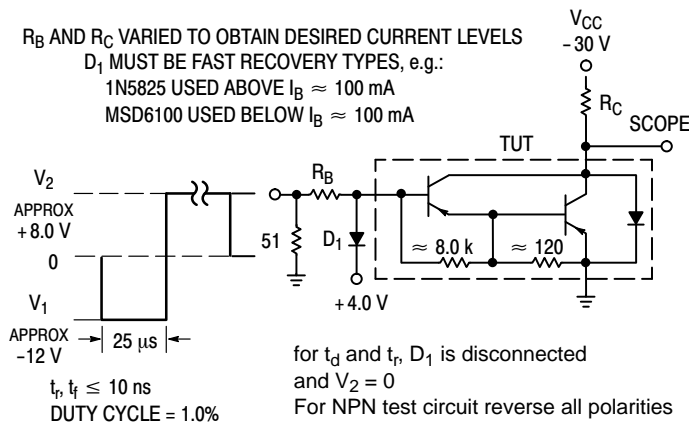


Figure 2. Switching Time Test Circuit

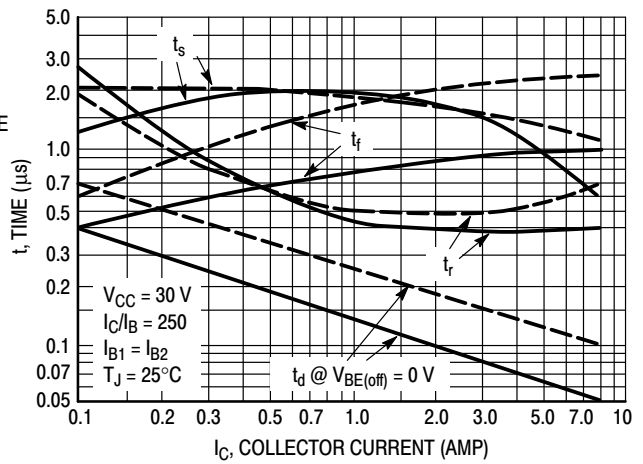


Figure 3. Switching Times

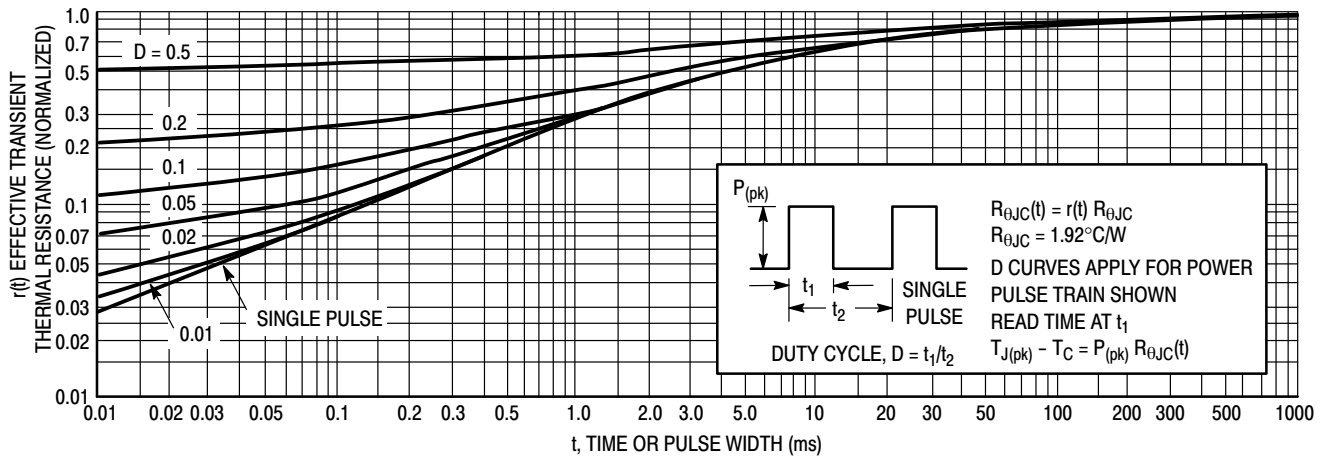


Figure 4. Thermal Response

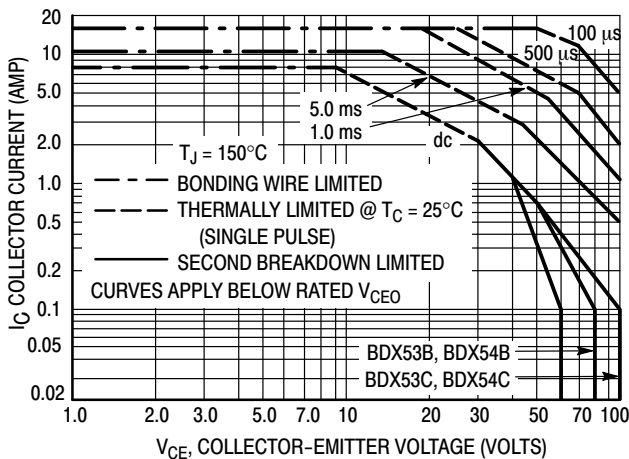


Figure 5. Active-Region Safe Operating Area

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 5 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.

# BDX53B, BDX53C (NPN), BDX54B, BDX54C (PNP)

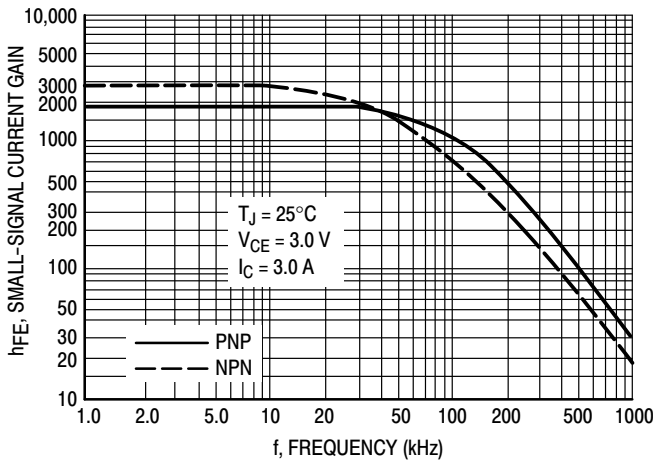


Figure 6. Small-Signal Current Gain

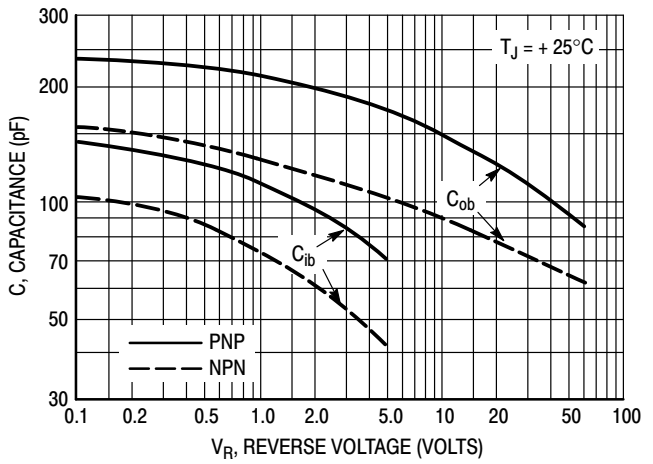
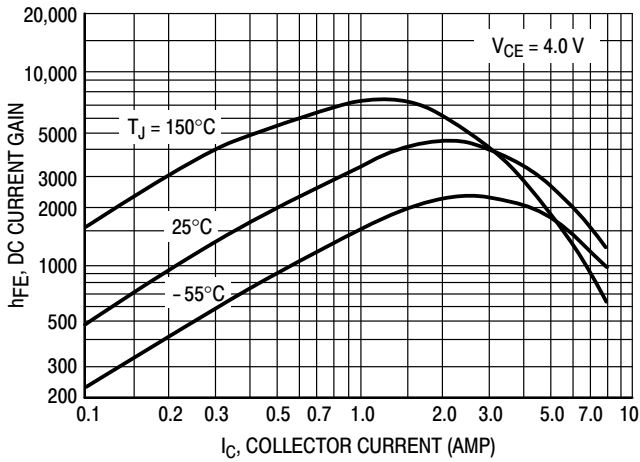


Figure 7. Capacitance

**NPN**  
**BDX53B, 53C**



**PNP**  
**BDX54B, 54C**

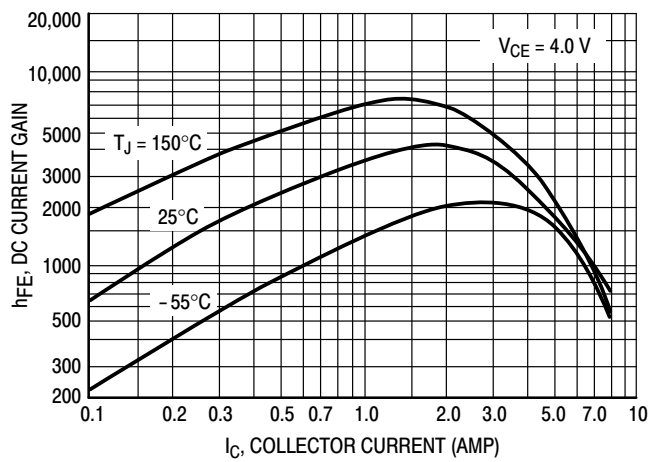


Figure 8. DC Current Gain

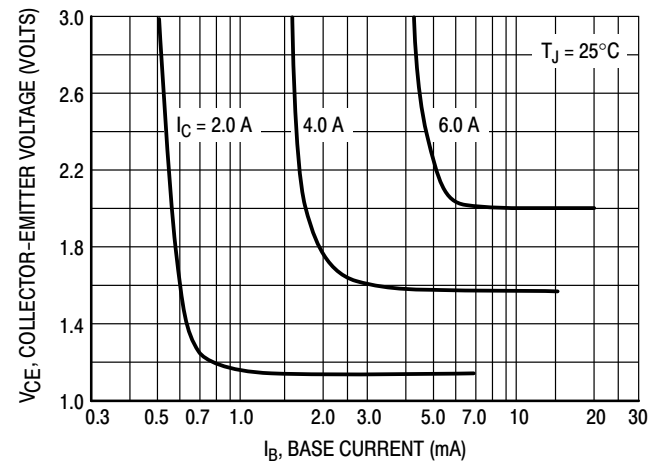
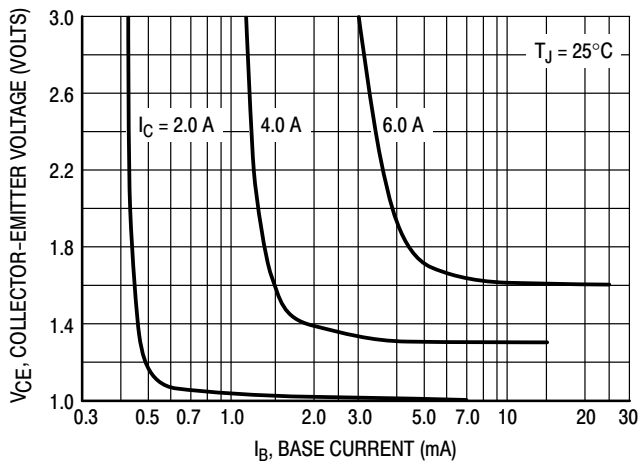


Figure 9. Collector Saturation Region

## BDX53B, BDX53C (NPN), BDX54B, BDX54C (PNP)

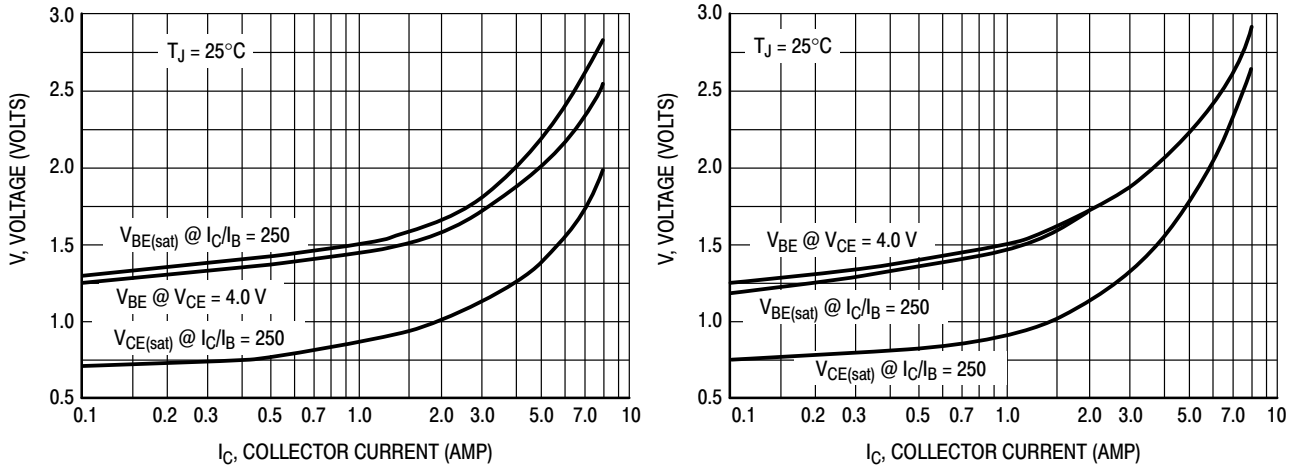


Figure 10. "On" Voltages

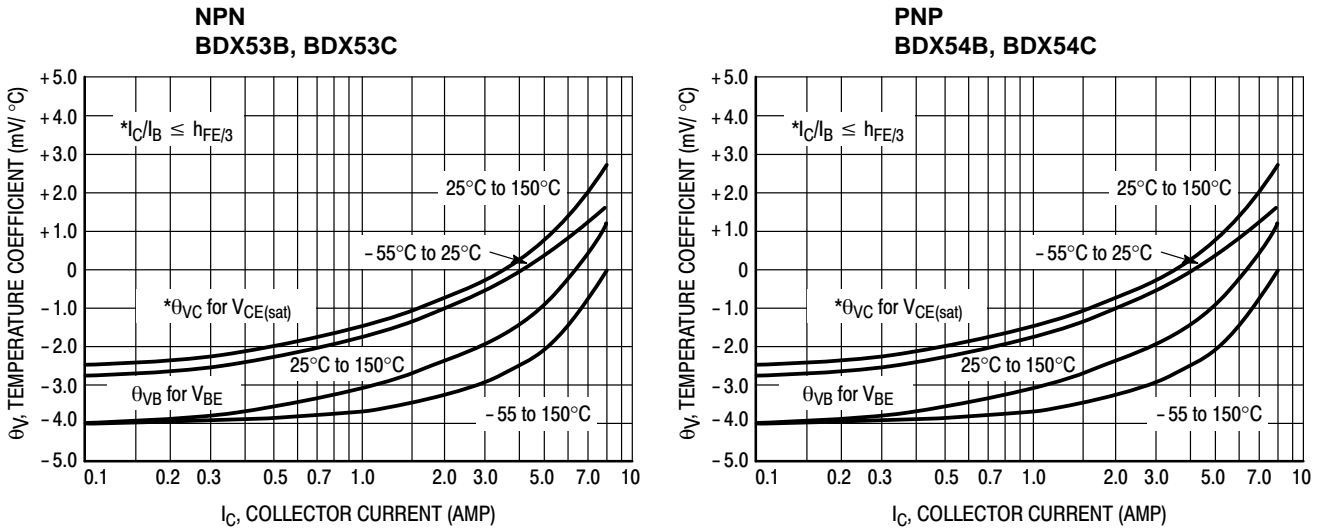


Figure 11. Temperature Coefficients

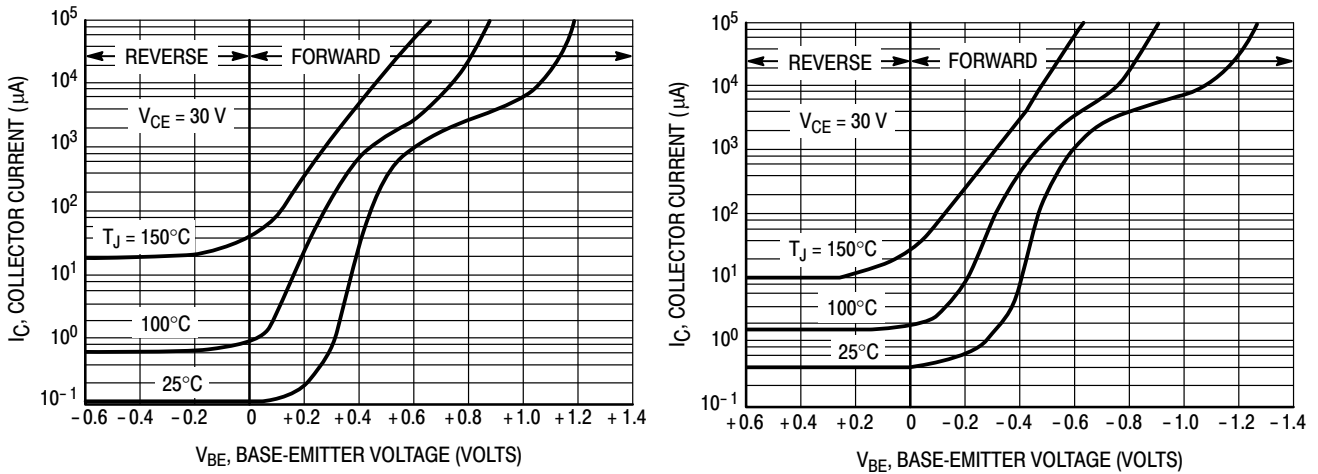


Figure 12. Collector Cut-Off Region

## BDX53B, BDX53C (NPN), BDX54B, BDX54C (PNP)



**Figure 13. Darlington Schematic**

### ORDERING INFORMATION

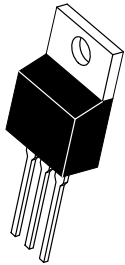
Device	Package	Shipping <sup>†</sup>
BDX53BG	TO-220 (Pb-Free)	50 Units / Rail
BDX53CG	TO-220 (Pb-Free)	50 Units / Rail
BDX54BG	TO-220 (Pb-Free)	50 Units / Rail
BDX54CG	TO-220 (Pb-Free)	50 Units / Rail

<sup>†</sup>For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, BRD8011/D.

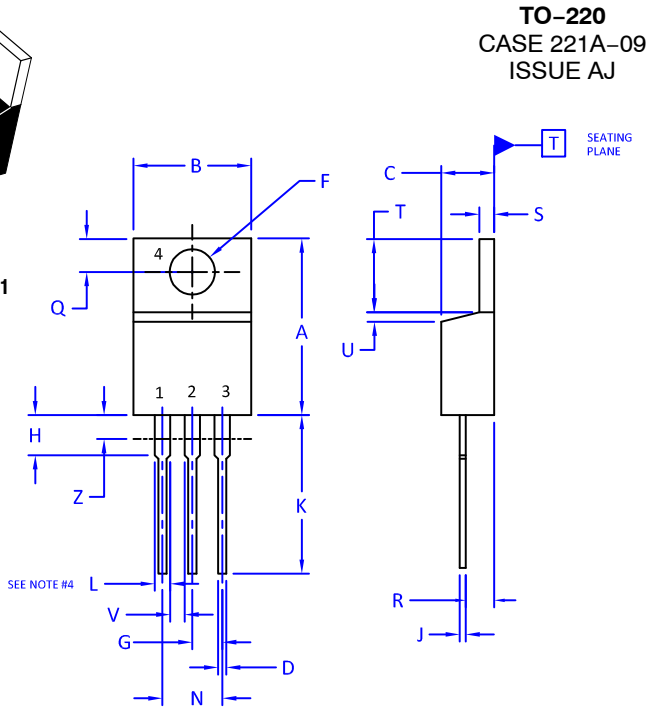
# MECHANICAL CASE OUTLINE

## PACKAGE DIMENSIONS

ON Semiconductor®



SCALE 1:1



**TO-220**  
CASE 221A-09  
ISSUE AJ

DATE 05 NOV 2019

**NOTES:**

1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 2009.
2. CONTROLLING DIMENSION: INCHES
3. DIMENSION Z DEFINES A ZONE WHERE ALL BODY AND LEAD IRREGULARITIES ARE ALLOWED.
4. MAX WIDTH FOR F102 DEVICE = 1.35MM

DIM	INCHES		MILLIMETERS	
	MIN.	MAX.	MIN.	MAX.
A	0.570	0.620	14.48	15.75
B	0.380	0.415	9.66	10.53
C	0.160	0.190	4.07	4.83
D	0.025	0.038	0.64	0.96
F	0.142	0.161	3.60	4.09
G	0.095	0.105	2.42	2.66
H	0.110	0.161	2.80	4.10
J	0.014	0.024	0.36	0.61
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	1.41
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

**STYLE 1:**

- PIN 1. BASE
- 2. COLLECTOR
- 3. EMITTER
- 4. COLLECTOR

**STYLE 2:**

- PIN 1. BASE
- 2. EMITTER
- 3. COLLECTOR
- 4. EMITTER

**STYLE 3:**

- PIN 1. CATHODE
- 2. ANODE
- 3. GATE
- 4. ANODE

**STYLE 4:**

- PIN 1. MAIN TERMINAL 1
- 2. MAIN TERMINAL 2
- 3. GATE
- 4. MAIN TERMINAL 2

**STYLE 5:**

- PIN 1. GATE
- 2. DRAIN
- 3. SOURCE
- 4. DRAIN

**STYLE 6:**

- PIN 1. ANODE
- 2. CATHODE
- 3. ANODE
- 4. CATHODE

**STYLE 7:**

- PIN 1. CATHODE
- 2. ANODE
- 3. CATHODE
- 4. ANODE

**STYLE 8:**

- PIN 1. CATHODE
- 2. ANODE
- 3. EXTERNAL TRIP/DELAY
- 4. ANODE

**STYLE 9:**

- PIN 1. GATE
- 2. COLLECTOR
- 3. EMITTER
- 4. COLLECTOR

**STYLE 10:**

- PIN 1. GATE
- 2. SOURCE
- 3. DRAIN
- 4. SOURCE

**STYLE 11:**

- PIN 1. DRAIN
- 2. SOURCE
- 3. GATE
- 4. SOURCE

**STYLE 12:**

- PIN 1. MAIN TERMINAL 1
- 2. MAIN TERMINAL 2
- 3. GATE
- 4. NOT CONNECTED

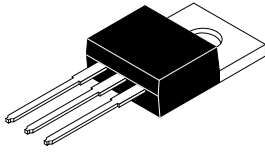
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# MECHANICAL CASE OUTLINE

## PACKAGE DIMENSIONS

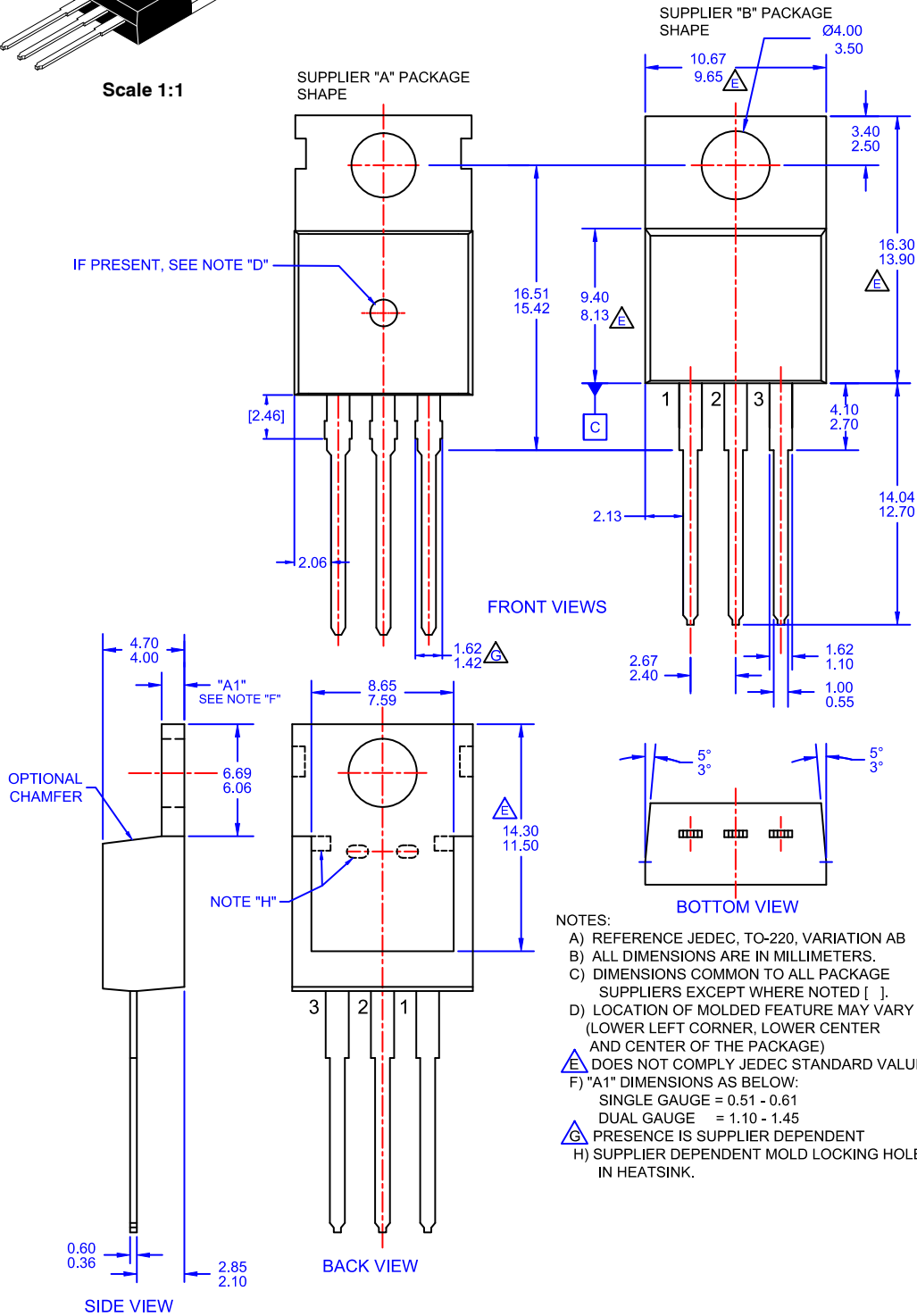
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Scale 1:1

### TO-220-3LD CASE 340AT ISSUE A


DATE 03 OCT 2017



- NOTES:
- A) REFERENCE JEDEC, TO-220, VARIATION AB
  - B) ALL DIMENSIONS ARE IN MILLIMETERS.
  - C) DIMENSIONS COMMON TO ALL PACKAGE SUPPLIERS EXCEPT WHERE NOTED [ ].
  - D) LOCATION OF MOLDED FEATURE MAY VARY (LOWER LEFT CORNER, LOWER CENTER AND CENTER OF THE PACKAGE)
  - E) DOES NOT COMPLY JEDEC STANDARD VALUE.
  - F) "A1" DIMENSIONS AS BELOW:  
 SINGLE GAUGE = 0.51 - 0.61  
 DUAL GAUGE = 1.10 - 1.45
  - G) PRESENCE IS SUPPLIER DEPENDENT
  - H) SUPPLIER DEPENDENT MOLD LOCKING HOLES IN HEATSINK.

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