

# 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
- Pb–Free Packages are Available\*

### MAXIMUM RATINGS

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

### 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 | $^\circ\text{C}/\text{W}$ |

Stresses exceeding Maximum Ratings may damage the device. Maximum Ratings are stress ratings only. Functional operation above the Recommended Operating Conditions is not implied. Extended exposure to stresses above the Recommended Operating Conditions may affect device reliability.

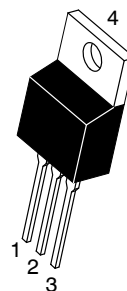
\*For additional information on our Pb–Free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.



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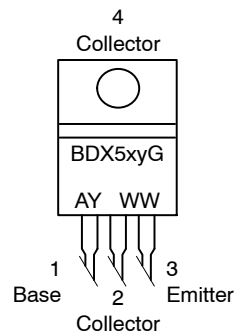
<http://onsemi.com>

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



TO–220AB  
CASE 221A  
STYLE 1

### MARKING DIAGRAM & PIN ASSIGNMENT

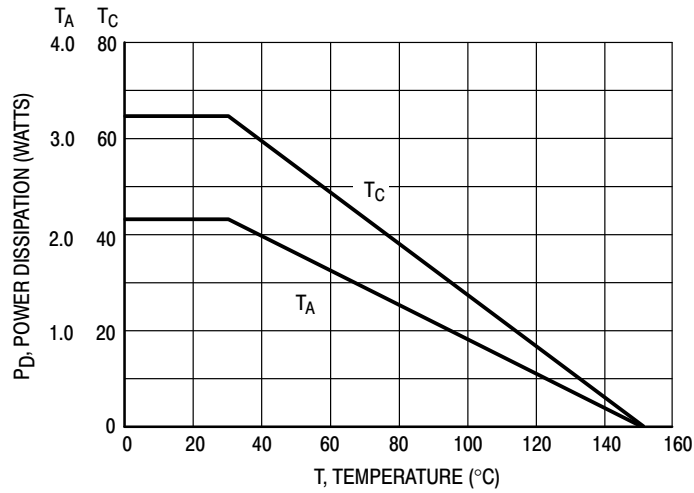


BDX5xy = Device Code  
x = 3 or 4  
y = B or C  
A = Assembly Location  
Y = Year  
WW = Work Week  
G = Pb–Free Package

### ORDERING INFORMATION

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

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



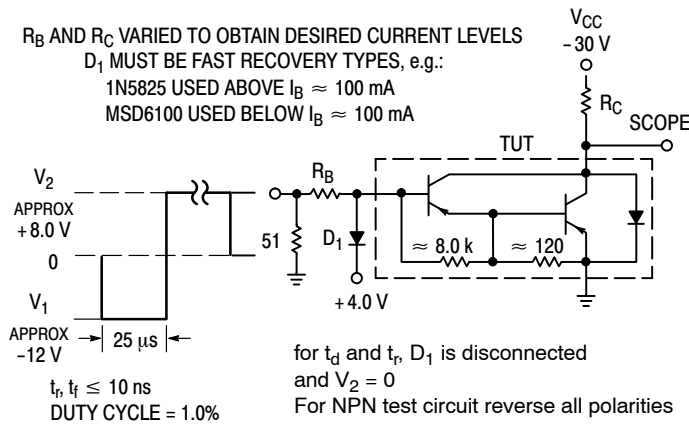
**Figure 1. Power Derating**

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

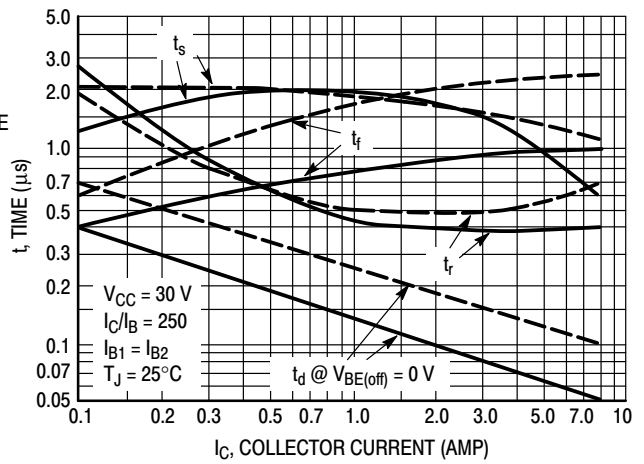
| Characteristic  | Symbol                           | Min            | Max        | Unit       |      |
|---|----------------------------------|----------------|------------|------------|------|
| <b>OFF CHARACTERISTICS</b>  |                                  |                |            |        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

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

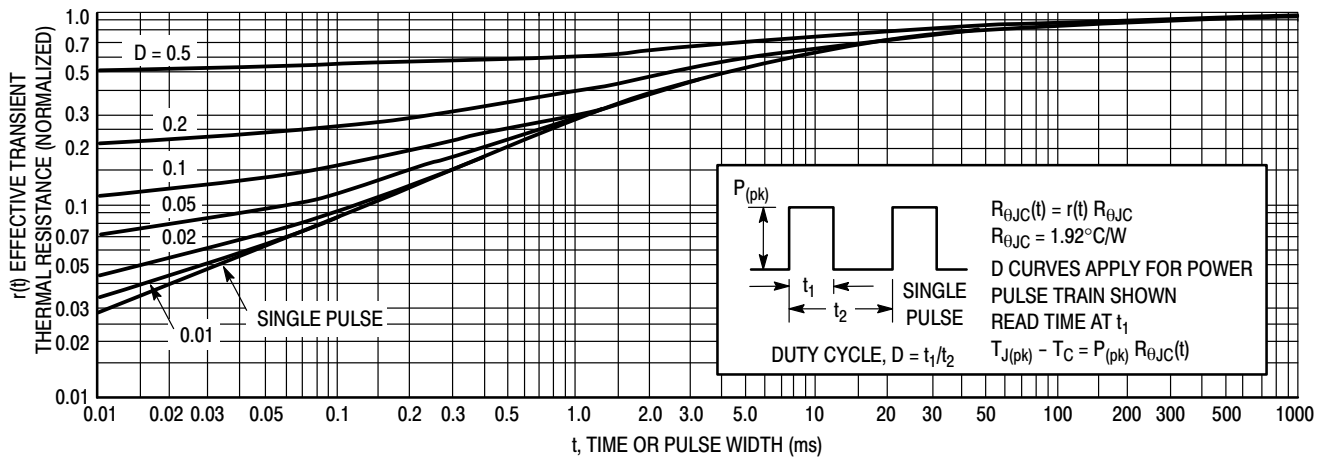
## BDX53B, BDX53C (NPN), BDX54B, BDX54C (PNP)



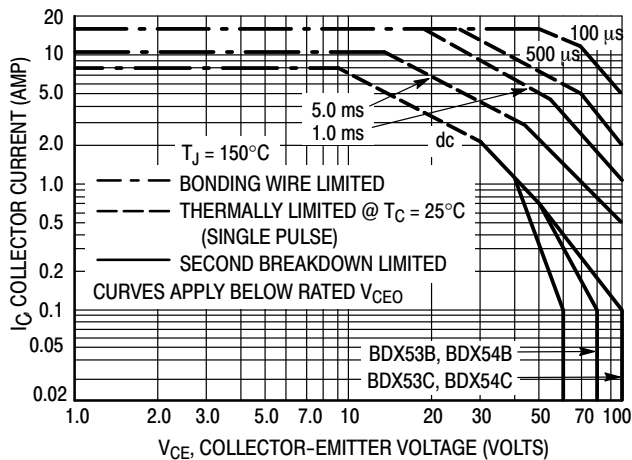
**Figure 2. Switching Time Test Circuit**



**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)

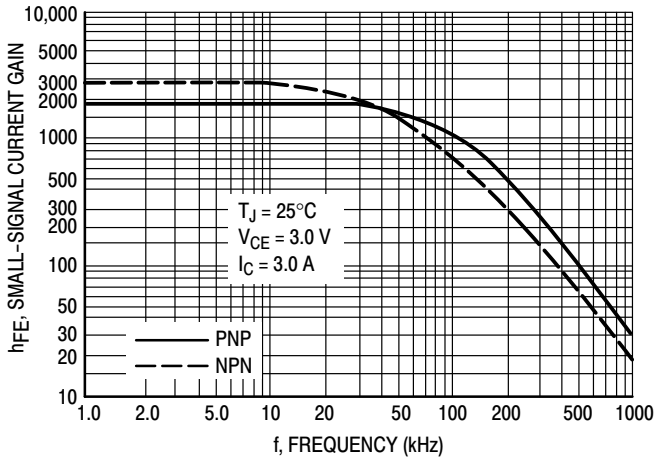


Figure 6. Small-Signal Current Gain

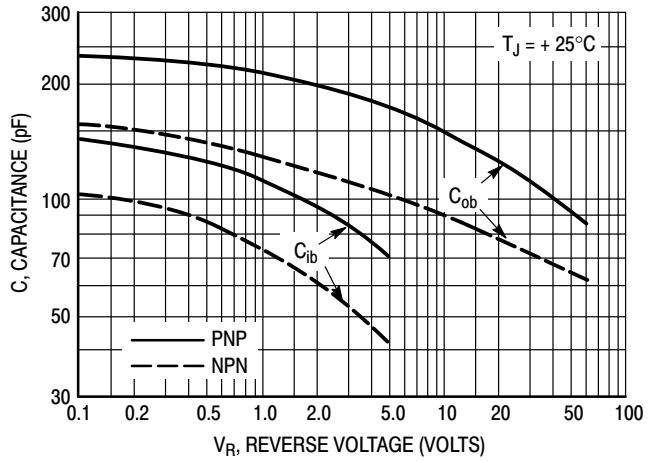
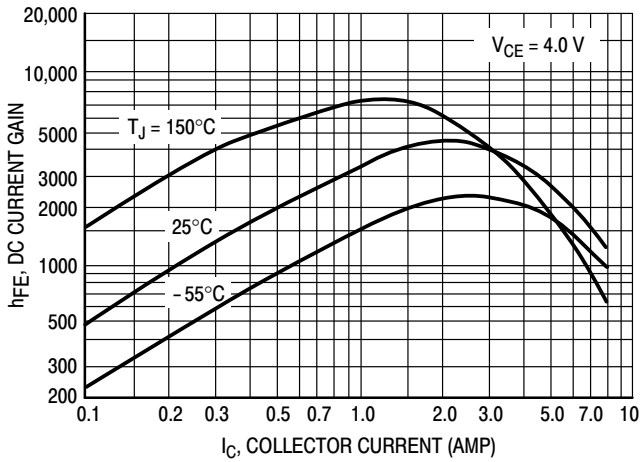


Figure 7. Capacitance

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



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

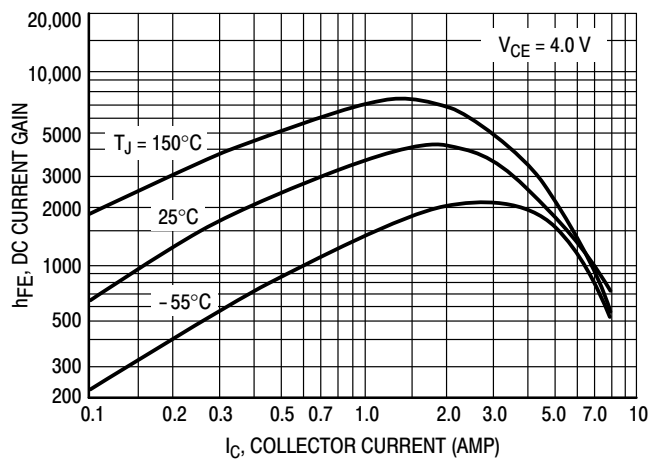


Figure 8. DC Current Gain

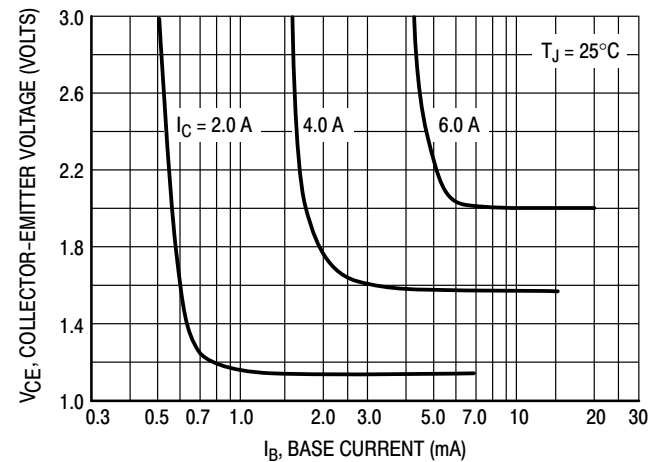
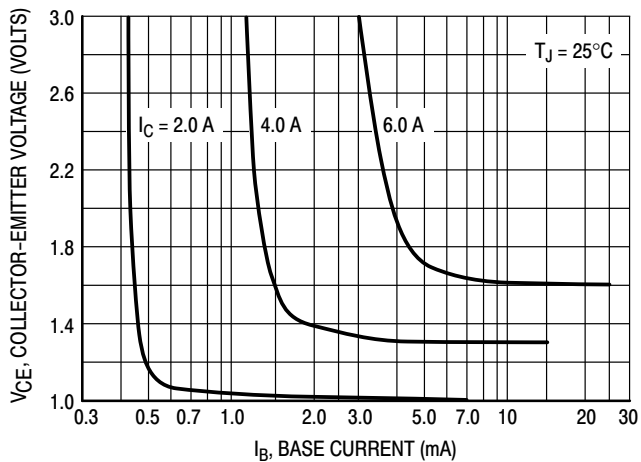


Figure 9. Collector Saturation Region

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

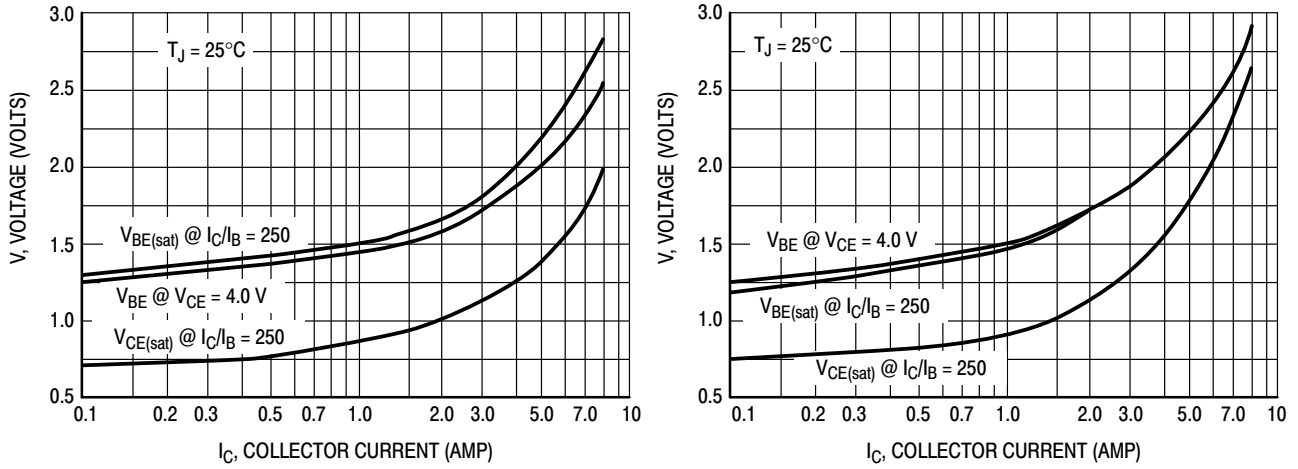


Figure 10. "On" Voltages

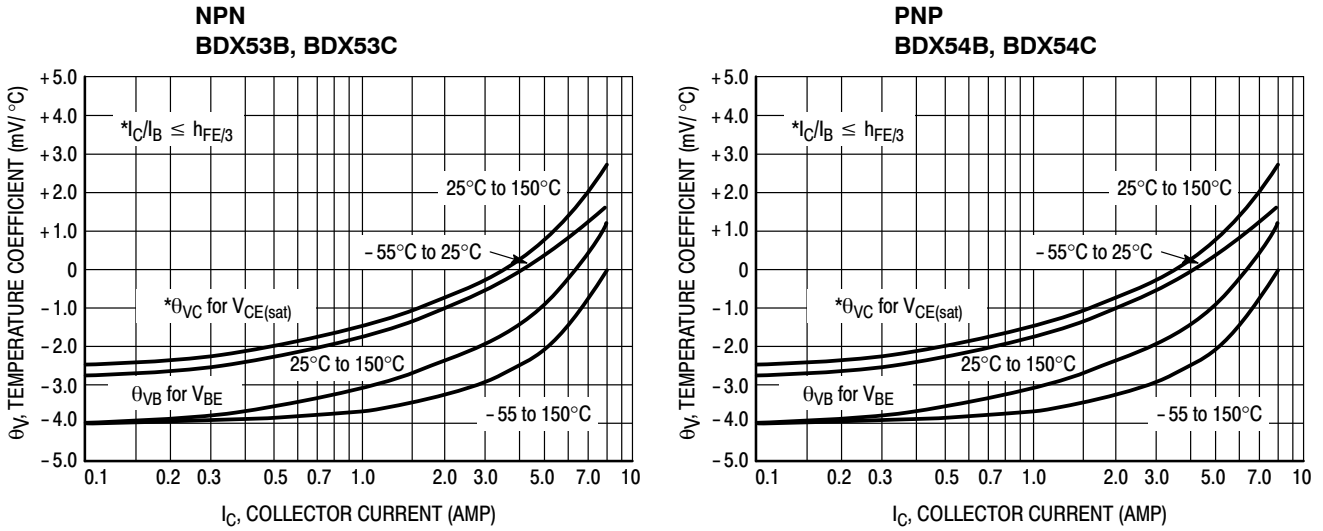


Figure 11. Temperature Coefficients

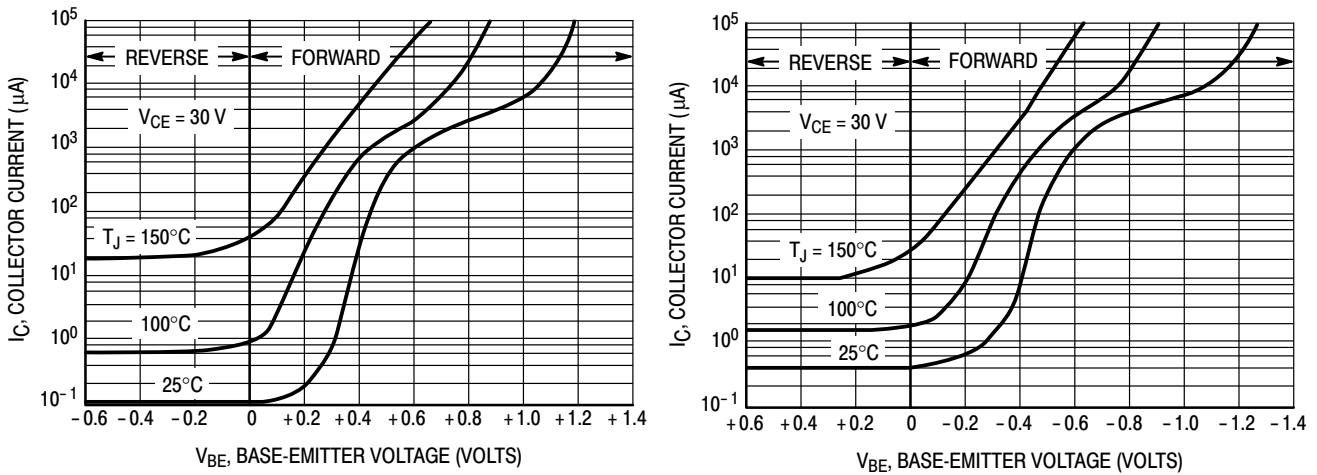


Figure 12. Collector Cut-Off Region

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



**Figure 13. Darlington Schematic**

### ORDERING INFORMATION

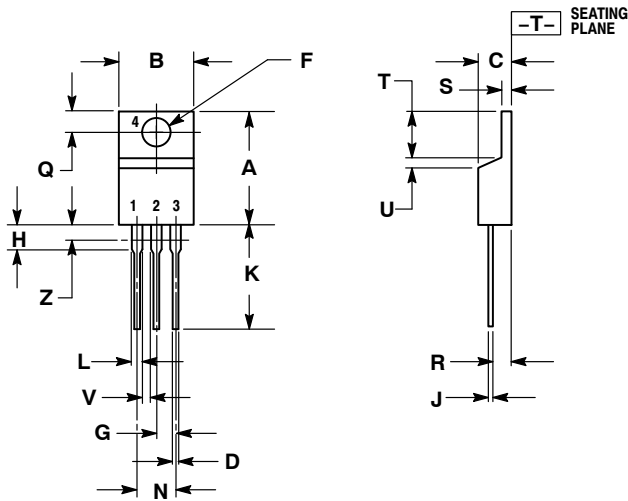
| Device  | Package             | Shipping <sup>†</sup> |
|---------|---------------------|-----------------------|
| BDX53B  | TO-220              | 50 Units / Rail       |
| BDX53BG | TO-220<br>(Pb-Free) |                       |
| BDX53C  | TO-220              | 50 Units / Rail       |
| BDX53CG | TO-220<br>(Pb-Free) |                       |
| BDX54B  | TO-220              | 50 Units / Rail       |
| BDX54BG | TO-220<br>(Pb-Free) |                       |
| BDX54C  | TO-220              | 50 Units / Rail       |
| BDX54CG | TO-220<br>(Pb-Free) |                       |

<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.

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

## PACKAGE DIMENSIONS

### TO-220 CASE 221A-09 ISSUE AG




#### 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  | 0.036 | 0.64        | 0.91  |
| F   | 0.142  | 0.161 | 3.61        | 4.09  |
| G   | 0.095  | 0.105 | 2.42        | 2.66  |
| H   | 0.110  | 0.161 | 2.80        | 4.10  |
| J   | 0.014  | 0.025 | 0.36        | 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  |

#### STYLE 1:

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

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