

## Plastic Medium-Power Complementary Silicon Transistors

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

- 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
- TO-220AB Compact Package

### MAXIMUM RATINGS

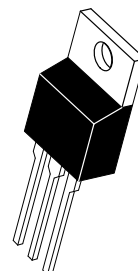
| Rating                                                                                 | Symbol         | BDX53B<br>BDX54B | BDX53C<br>BDX54C | Unit                         |
|----------------------------------------------------------------------------------------|----------------|------------------|------------------|------------------------------|
| 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<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 $25^\circ\text{C}$ | $P_D$          | 60<br>0.48       |                  | Watts<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  | $^\circ\text{C/W}$ |
| Thermal Resistance, Junction to Case    | $R_{\theta JC}$ | 70  | $^\circ\text{C/W}$ |

**NPN**  
**BDX53B**  
  
**BDX53C**  
**PNP**  
**BDX54B**  
  
**BDX54C**

**DARLINGTON**  
**8 AMPERE**  
**COMPLEMENTARY**  
**SILICON**  
**POWER TRANSISTORS**  
**80-100 VOLTS**  
**65 WATTS**



CASE 221A-06  
TO-220AB

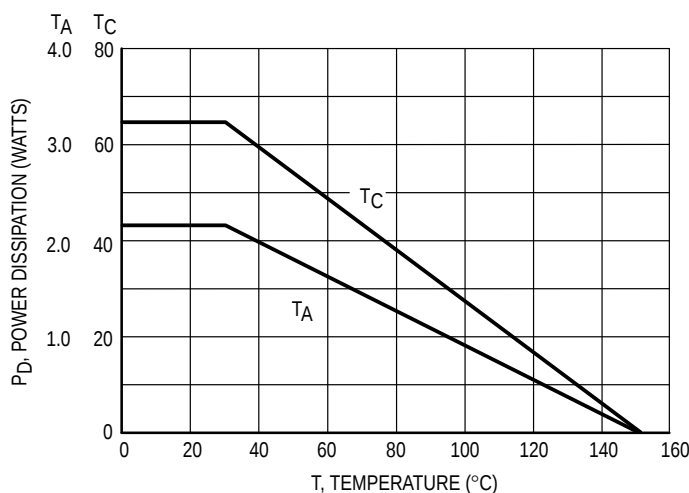


Figure 1. Power Derating



## BDX53B BDX53C BDX54B BDX54C

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

| Characteristic                                                                                                    | Symbol         | Min       | Max        | Unit |
|-------------------------------------------------------------------------------------------------------------------|----------------|-----------|------------|------|
| <b>OFF CHARACTERISTICS</b>                                                                                        |                |           |            |      |
| Collector–Emitter Sustaining Voltage (1)<br>( $I_C = 100\text{ mAdc}$ , $I_B = 0$ )                               | $V_{CEO(sus)}$ | 80<br>100 | —<br>—     | Vdc  |
| Collector Cutoff Current<br>( $V_{CE} = 40\text{ Vdc}$ , $I_B = 0$ )<br>( $V_{CE} = 50\text{ Vdc}$ , $I_B = 0$ )  | $I_{CEO}$      | —<br>—    | 0.5<br>0.5 | mAdc |
| Collector Cutoff Current<br>( $V_{CB} = 80\text{ Vdc}$ , $I_E = 0$ )<br>( $V_{CB} = 100\text{ Vdc}$ , $I_E = 0$ ) | $I_{CBO}$      | —<br>—    | 0.2<br>0.2 | mAdc |

### ON CHARACTERISTICS (1)

|                                                                                             |               |        |            |     |
|---------------------------------------------------------------------------------------------|---------------|--------|------------|-----|
| DC Current Gain<br>( $I_C = 3.0\text{ Adc}$ , $V_{CE} = 3.0\text{ Vdc}$ )                   | $h_{FE}$      | 750    | —          | —   |
| Collector–Emitter Saturation Voltage<br>( $I_C = 3.0\text{ Adc}$ , $I_B = 12\text{ mAdc}$ ) | $V_{CE(sat)}$ | —<br>— | 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 |

### DYNAMIC CHARACTERISTICS

|                                                                                                            |          |        |            |    |
|------------------------------------------------------------------------------------------------------------|----------|--------|------------|----|
| 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>( $V_{CB} = 10\text{ Vdc}$ , $I_E = 0$ , $f = 0.1\text{ MHz}$ )                      | $C_{ob}$ | —<br>— | 300<br>200 | pF |

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

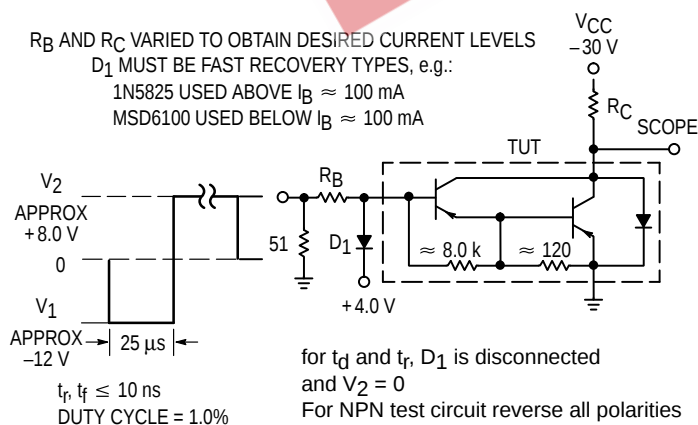


Figure 2. Switching Time Test Circuit

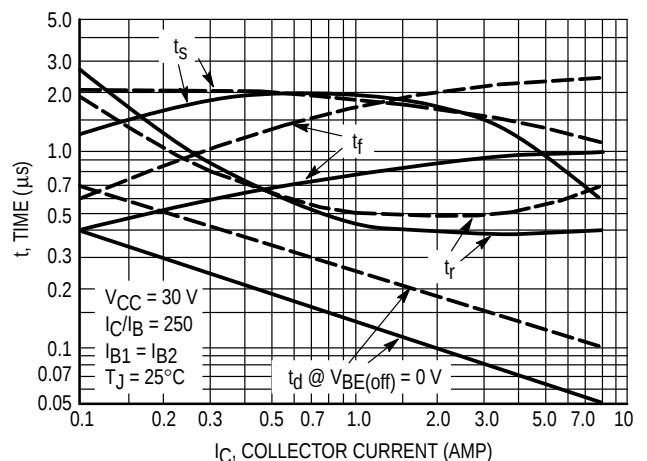


Figure 3. Switching Times

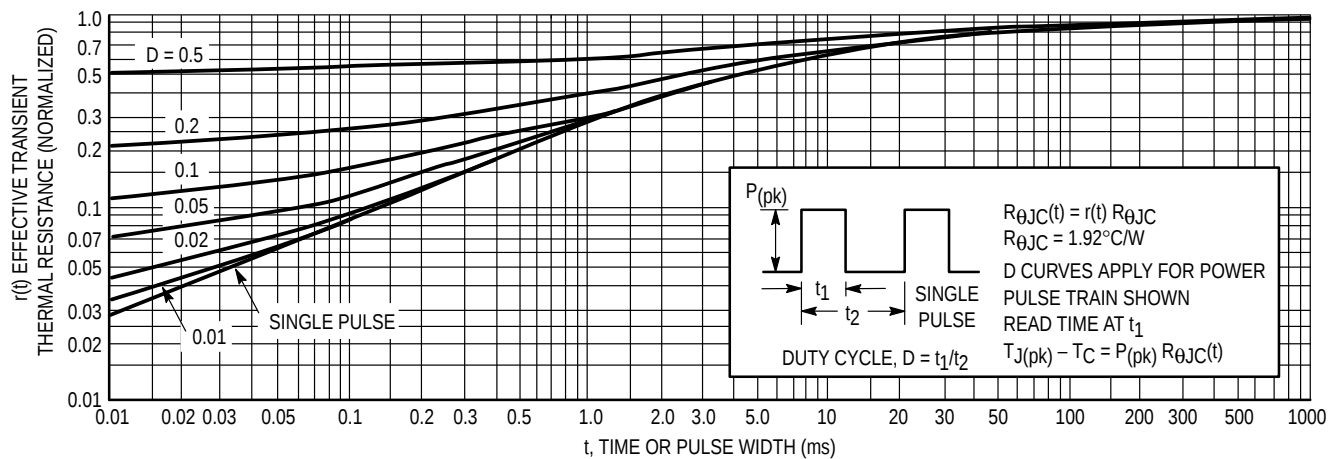


Figure 4. Thermal Response

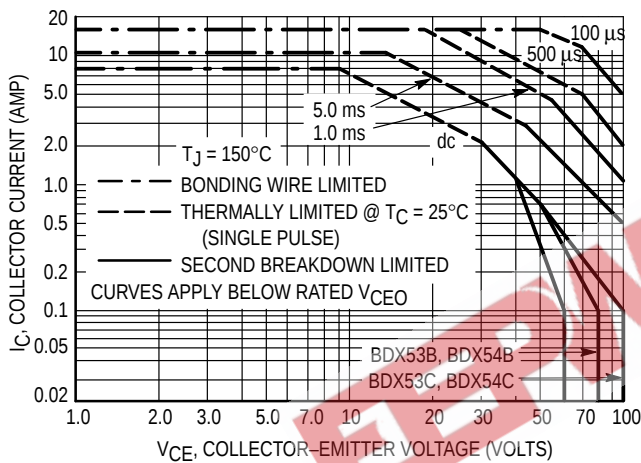


Figure 5. Active-Region Safe Operating Area

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.

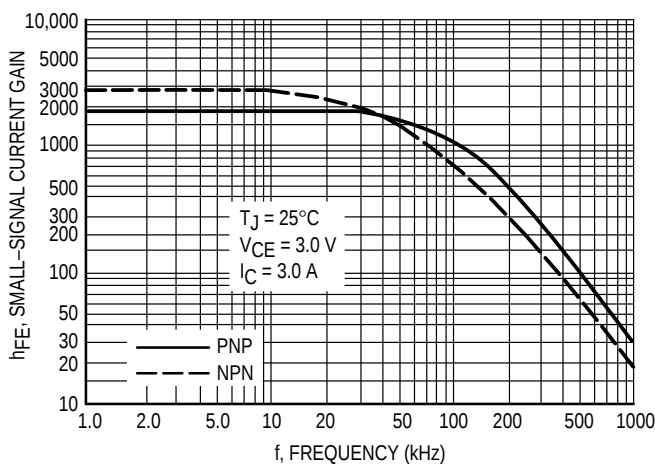


Figure 6. Small-Signal Current Gain

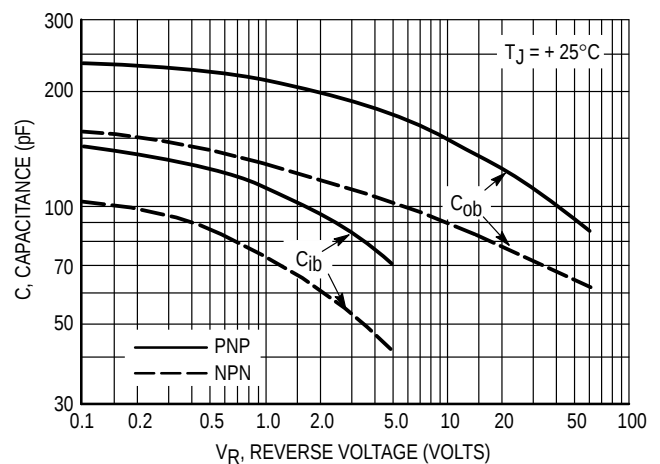
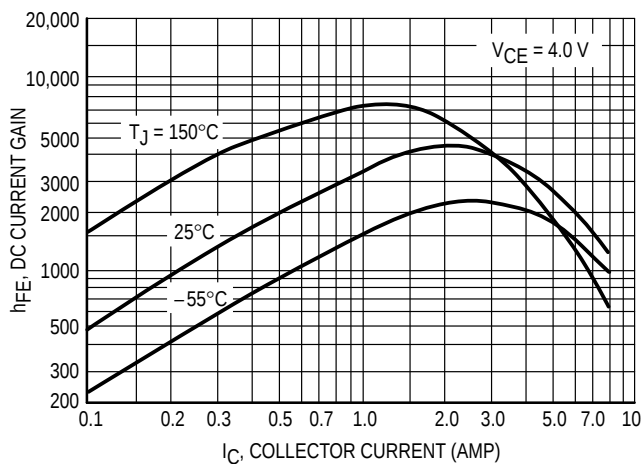


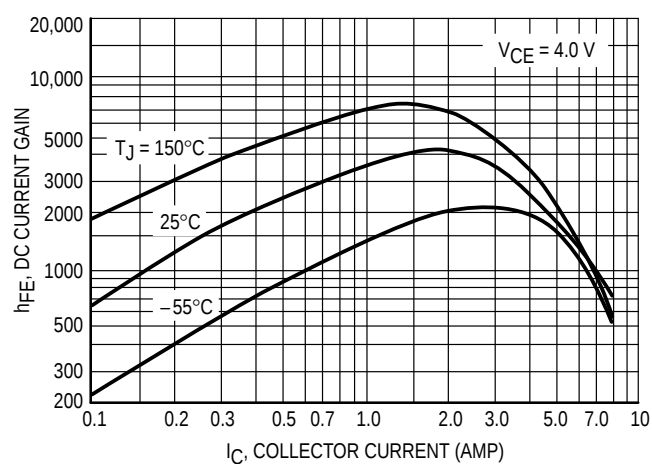
Figure 7. Capacitance

# BDX53B BDX53C BDX54B BDX54C

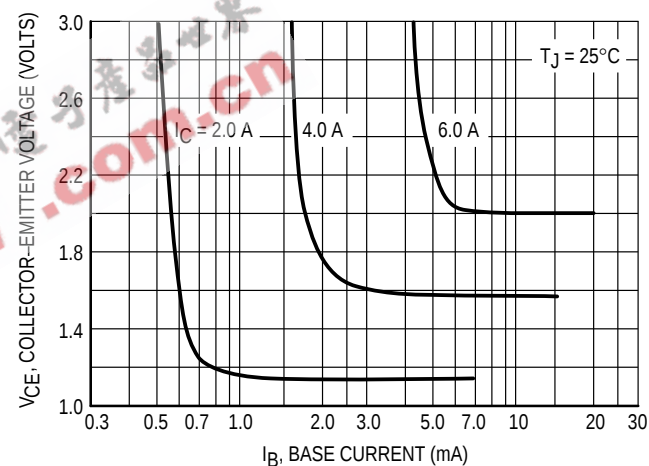
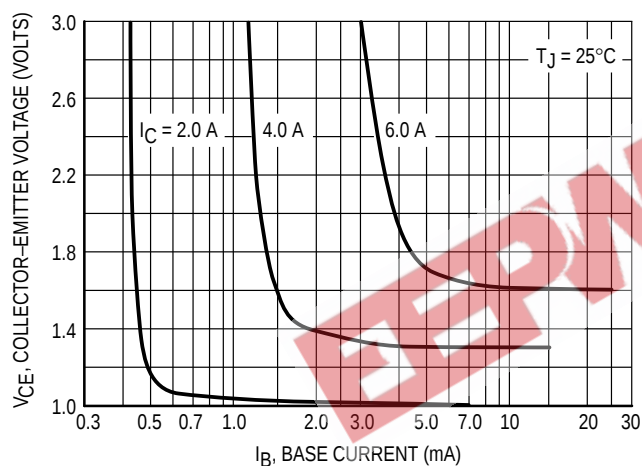
**NPN**  
**BDX53B, 53C**



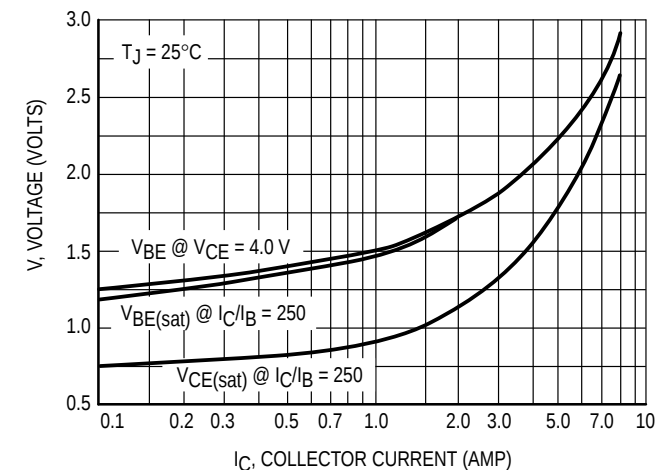
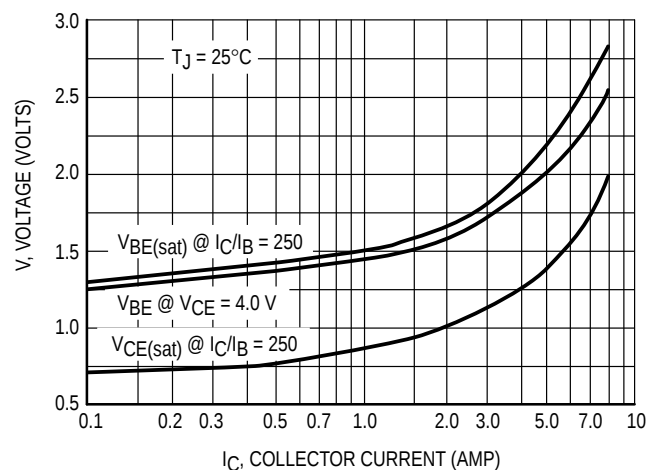
**PNP**  
**BDX54B, 54C**



**Figure 8. DC Current Gain**



**Figure 9. Collector Saturation Region**



**Figure 10. "On" Voltages**

# BDX53B BDX53C BDX54B BDX54C

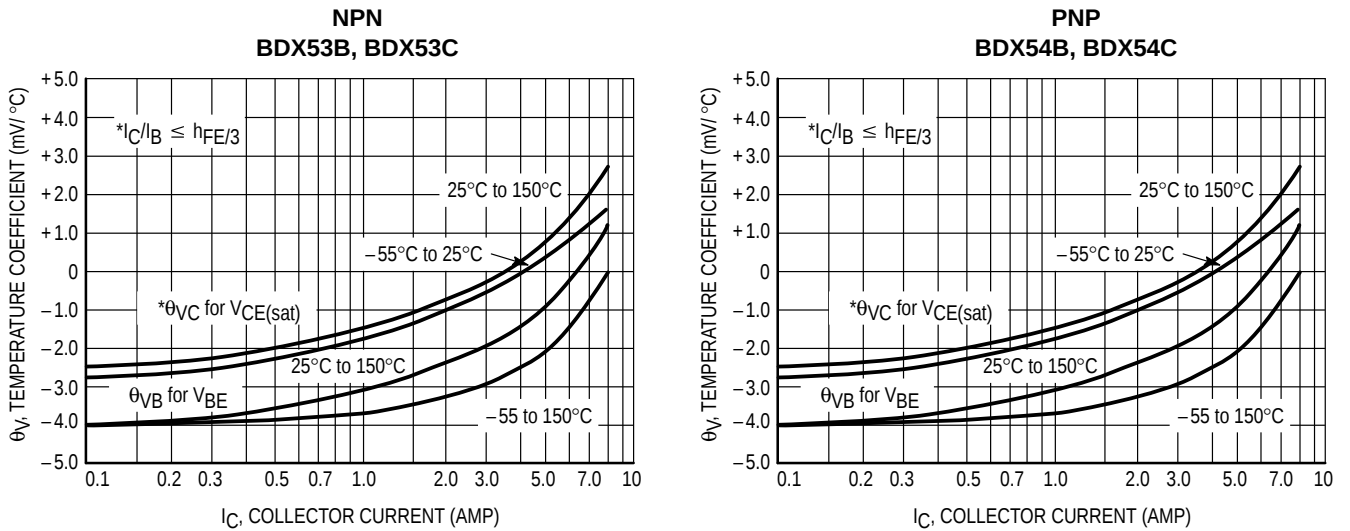


Figure 11. Temperature Coefficients

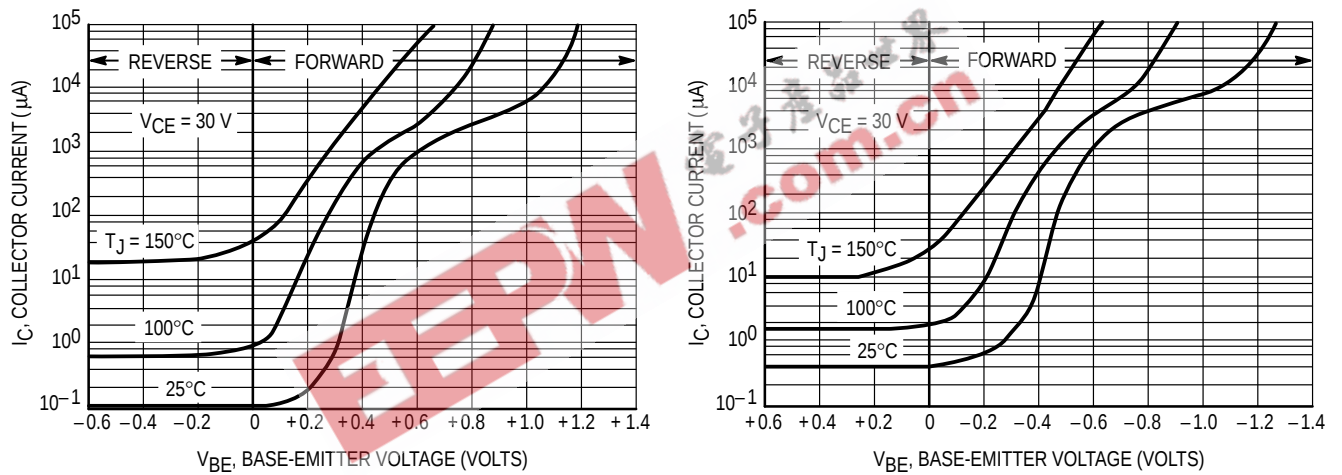


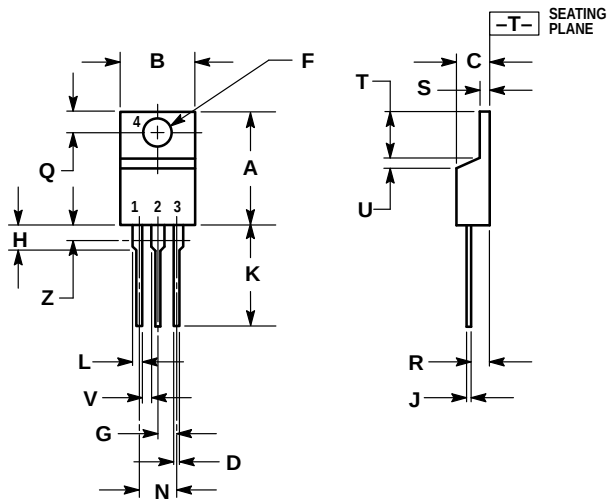
Figure 12. Collector Cut-Off Region



Figure 13. Darlington Schematic

**BDX53B BDX53C BDX54B BDX54C**

**PACKAGE DIMENSIONS**



- 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  |

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

**CASE 221A-06  
TO-220AB  
ISSUE Y**

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**BDX53B/D**

