

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°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 | $^\circ\text{C}/\text{W}$ |

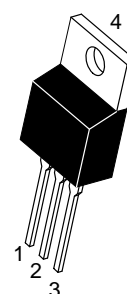
*For additional information on our Pb–Free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.



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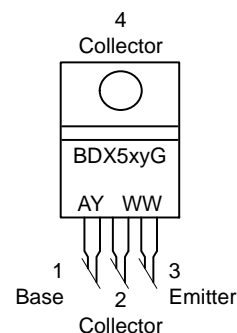
www.onsemi.com

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.

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

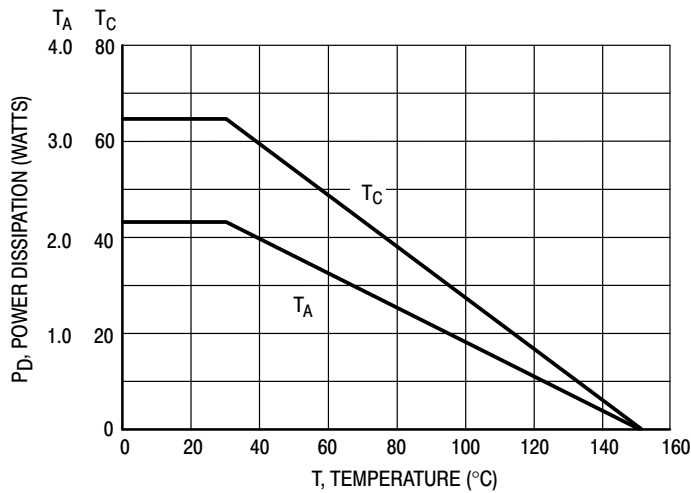


Figure 1. Power Derating

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

| Characteristic | Symbol | Min | Max | Unit | |
|---|----------------------------------|----------------|------------|------------|------|
| OFF CHARACTERISTICS | | | | | |
| 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 |
| ON CHARACTERISTICS (Note 1) | | | | | |
| 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 | |
| DYNAMIC CHARACTERISTICS | | | | | |
| 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 ($V_{CB} = 10\text{ Vdc}$, $I_E = 0$, $f = 0.1\text{ MHz}$) | 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)

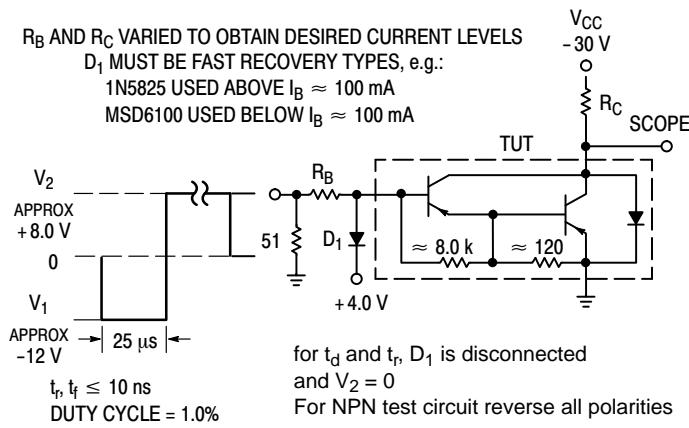


Figure 2. Switching Time Test Circuit

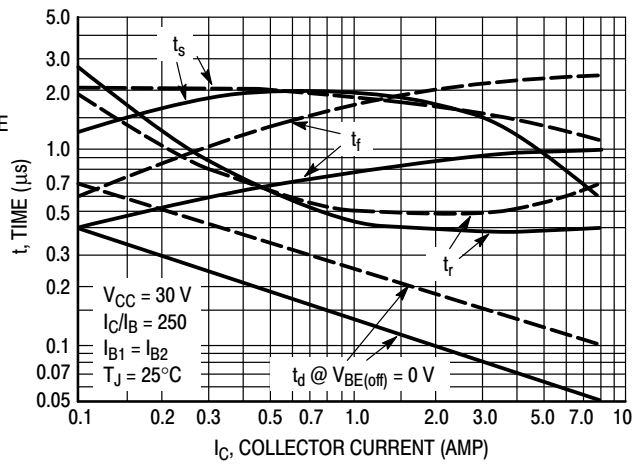


Figure 3. Switching Times

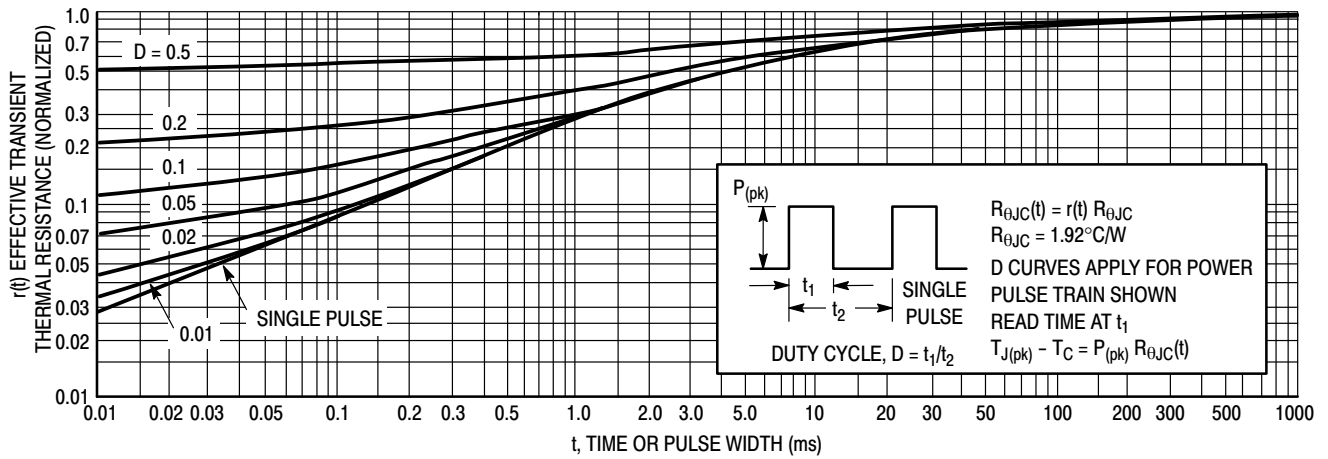


Figure 4. Thermal Response

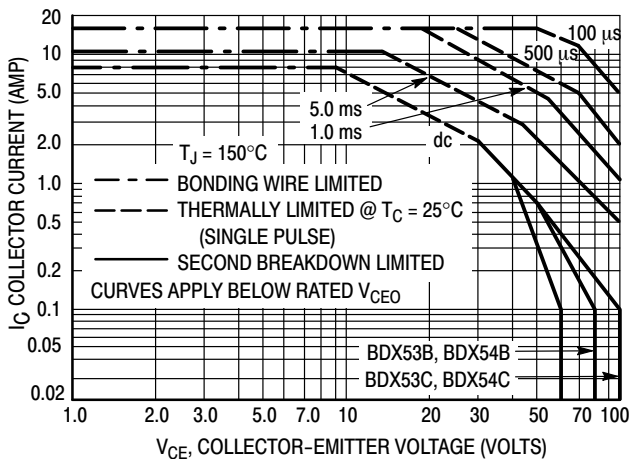


Figure 5. Active-Region Safe Operating Area

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)

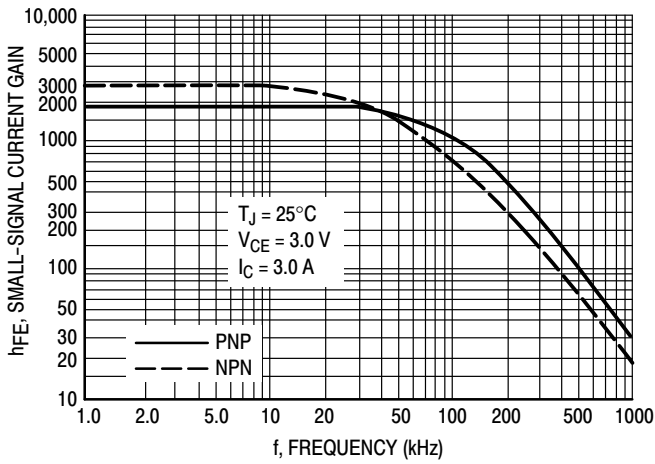


Figure 6. Small-Signal Current Gain

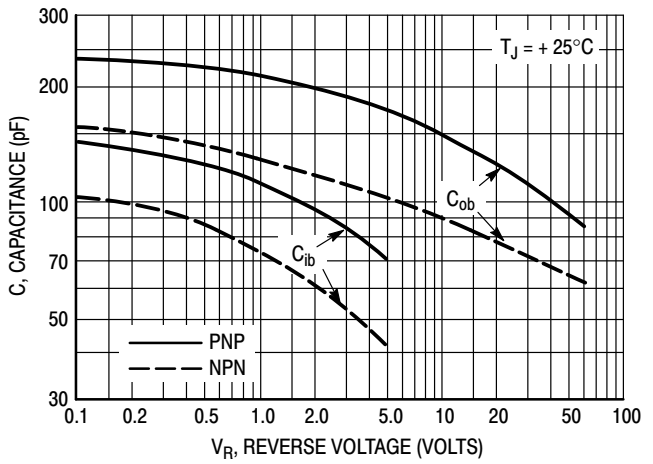
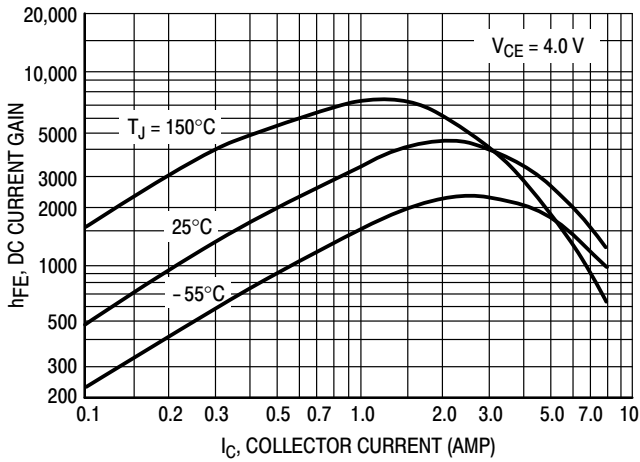


Figure 7. Capacitance

NPN
BDX53B, 53C



PNP
BDX54B, 54C

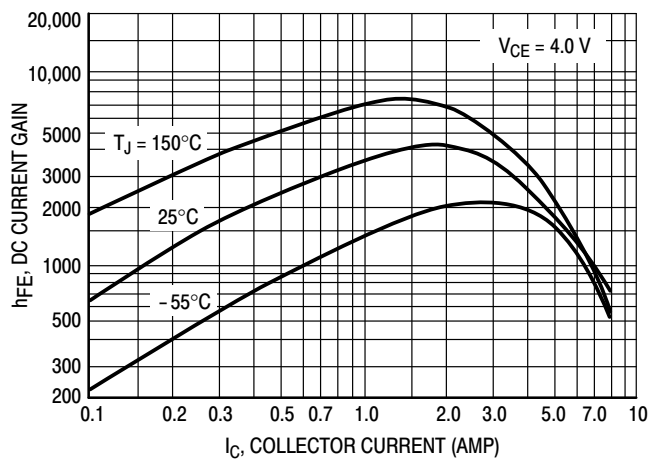


Figure 8. DC Current Gain

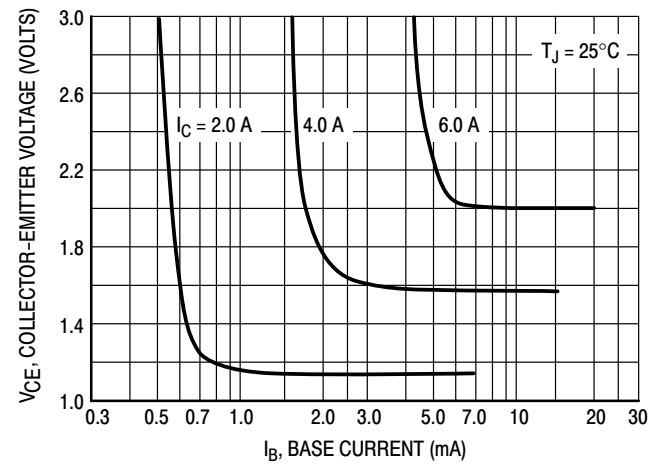
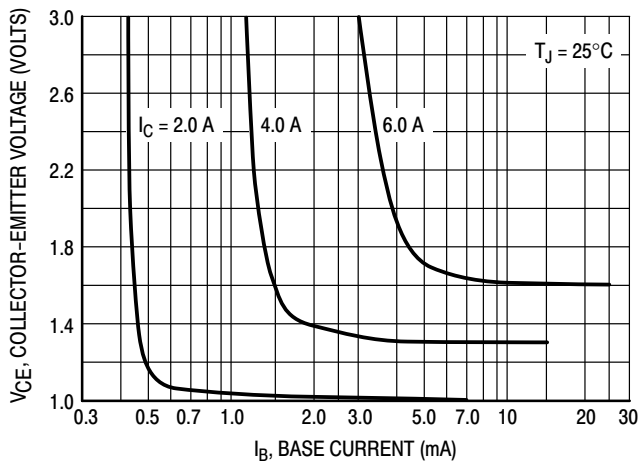


Figure 9. Collector Saturation Region

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

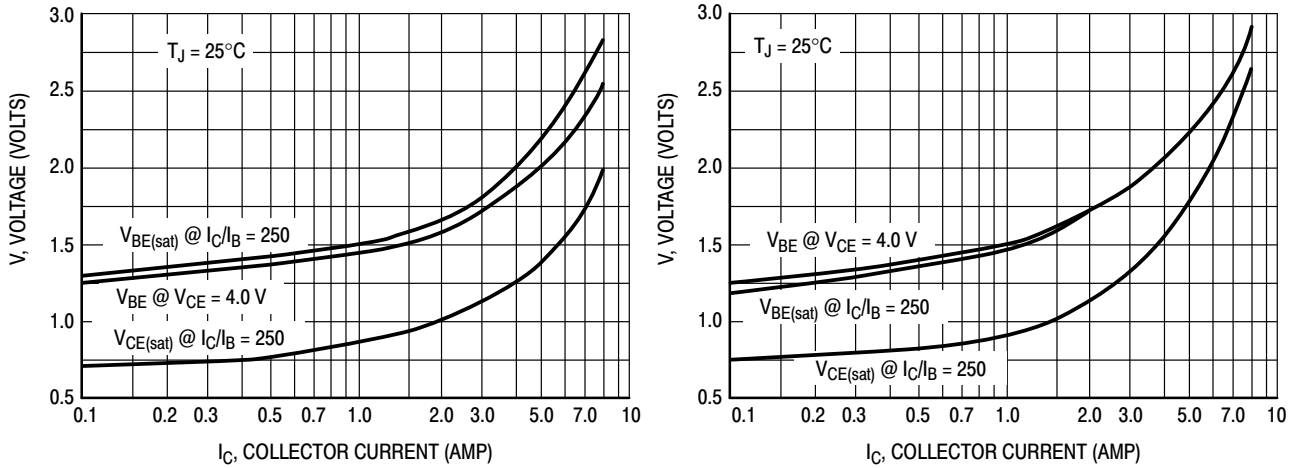


Figure 10. "On" Voltages

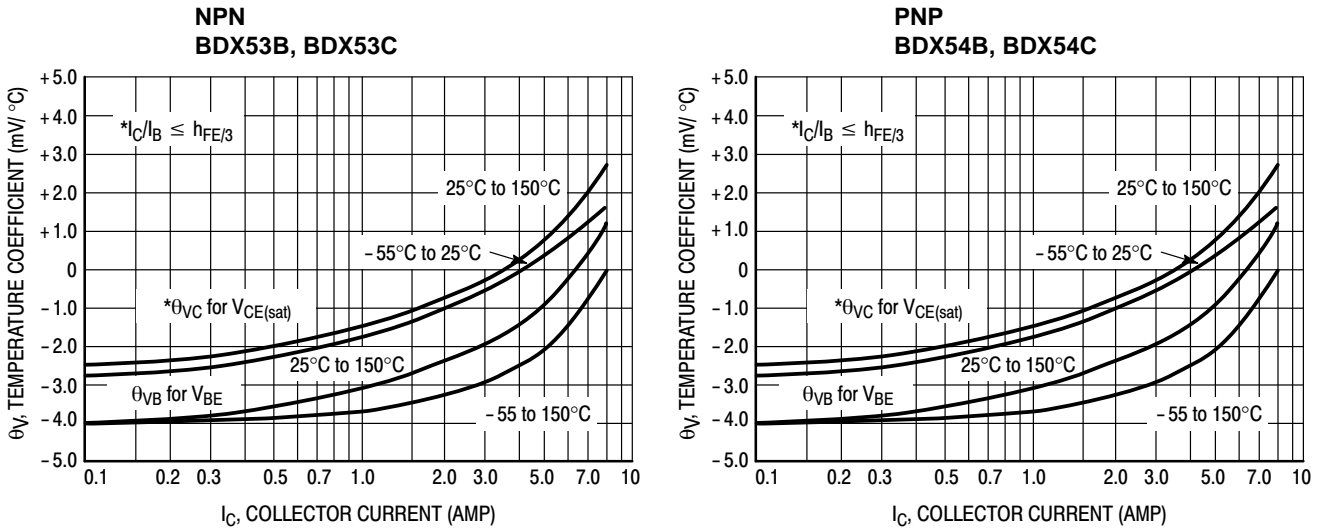


Figure 11. Temperature Coefficients

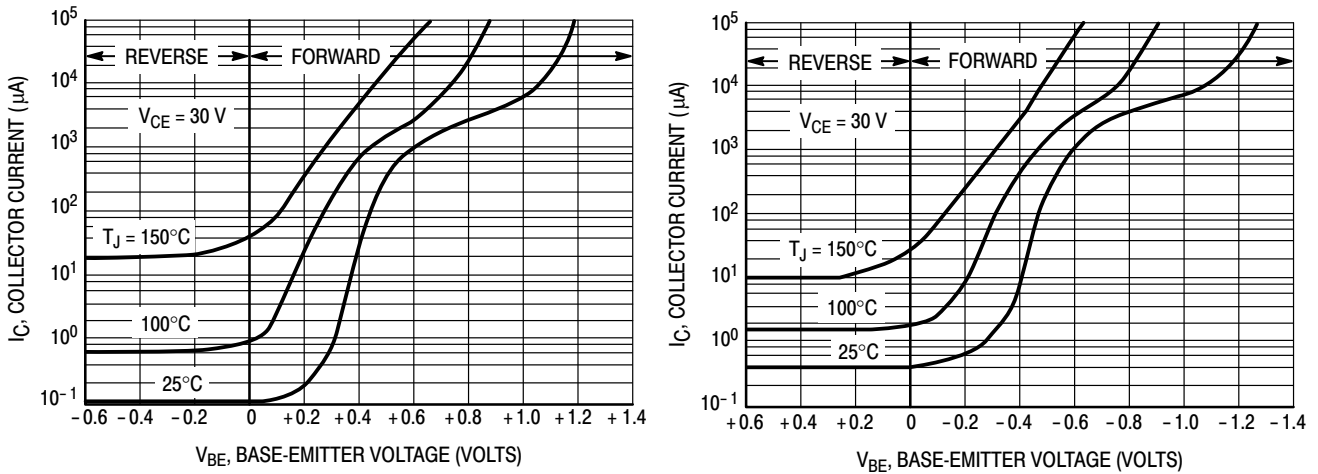


Figure 12. Collector Cut-Off Region

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



Figure 13. Darlington Schematic

ORDERING INFORMATION

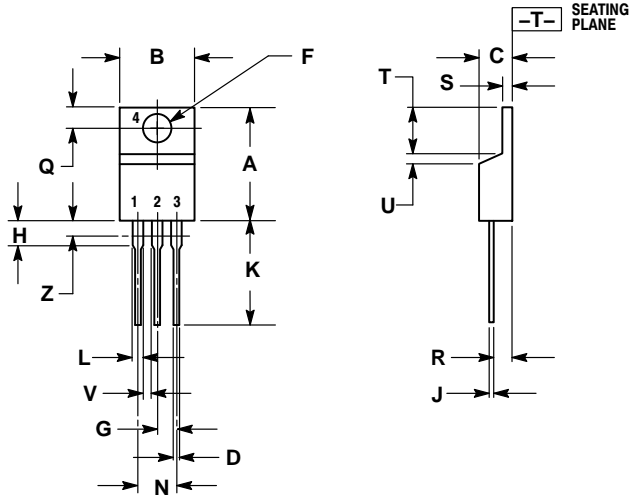
| Device | Package | Shipping [†] |
|---------|---------------------|-----------------------|
| BDX53BG | TO-220 (Pb-Free) | 50 Units / Rail |
| BDX53CG | TO-220 (Pb-Free) | 50 Units / Rail |
| BDX54BG | TO-220 (Pb-Free) | 50 Units / Rail |
| BDX54CG | TO-220 (Pb-Free) | 50 Units / Rail |

[†]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 AH




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 | 0.415 | 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 | 3.61 | 4.09 |
| G | 0.095 | 0.105 | 2.42 | 2.66 |
| H | 0.110 | 0.161 | 2.80 | 4.10 |
| J | 0.014 | 0.024 | 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 | 1.39 |
| 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:

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

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