# BDX33B, BDX33C (NPN)
# BDX34B, BDX34C (PNP)

# Darlington Complementary Silicon Power Transistors

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

**Features**

- High DC Current Gain – $h_{FE}$ = 2500 (typ.) at $I_C$ = 4.0
- Collector–Emitter Sustaining Voltage at 100 mAdc
  $V_{CEO(sus)}$ = 80 Vdc (min) – BDX33B, BDX334B
  = 100 Vdc (min) – BDX33C, BDX334C
- 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
- Pb–Free Packages are Available*

**MAXIMUM RATINGS**

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

**THERMAL CHARACTERISTICS**

| Characteristics | Symbol | Max | Unit |
|---|---|---|---|
| Thermal Resistance, Junction–to–Case | $R_{\theta JC}$ | 1.78 | °C/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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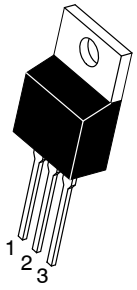
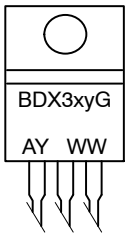
**10 AMPERE**
**COMPLEMENTARY SILICON**
**POWER TRANSISTORS**
**80–100 VOLTS, 65 WATTS**




**TO–220AB**
**CASE 221A–09**
**STYLE 1**

**MARKING DIAGRAM**




BDX3xy = 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 5 of this data sheet.

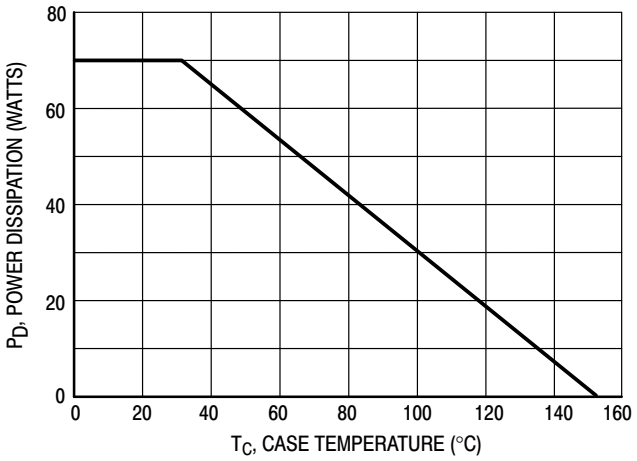



**Figure 1. Power Derating**

**ELECTRICAL CHARACTERISTICS** ($T_C$ = 25°C unless otherwise noted)

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

1. Pulse Test: Pulse Width ≤ 300 μs, Duty Cycle ≤ 2.0%.
2. Pulse Test non repetitive: Pulse Width = 0.25 seconds.

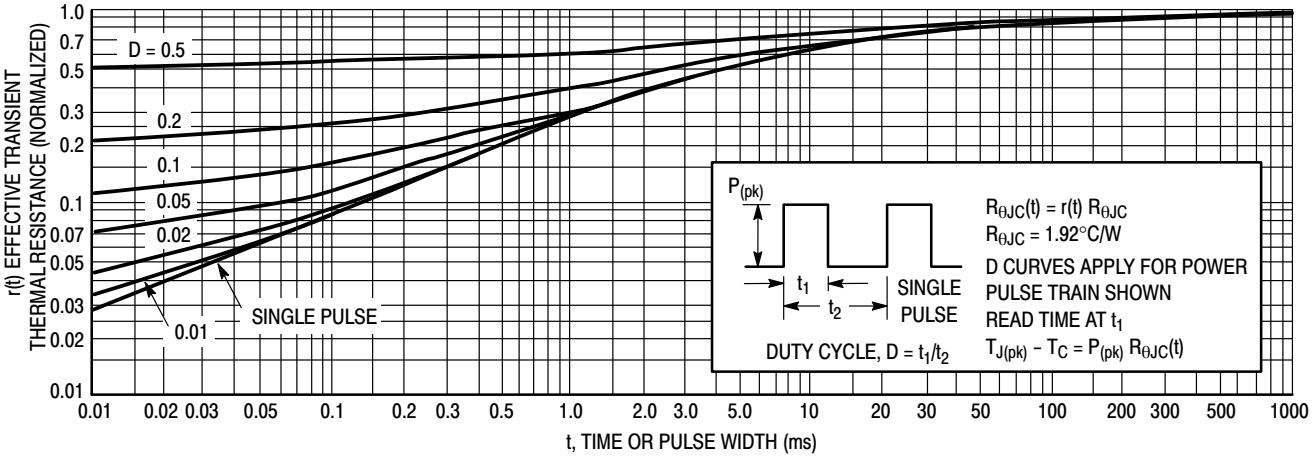



**Figure 1. Thermal Response**

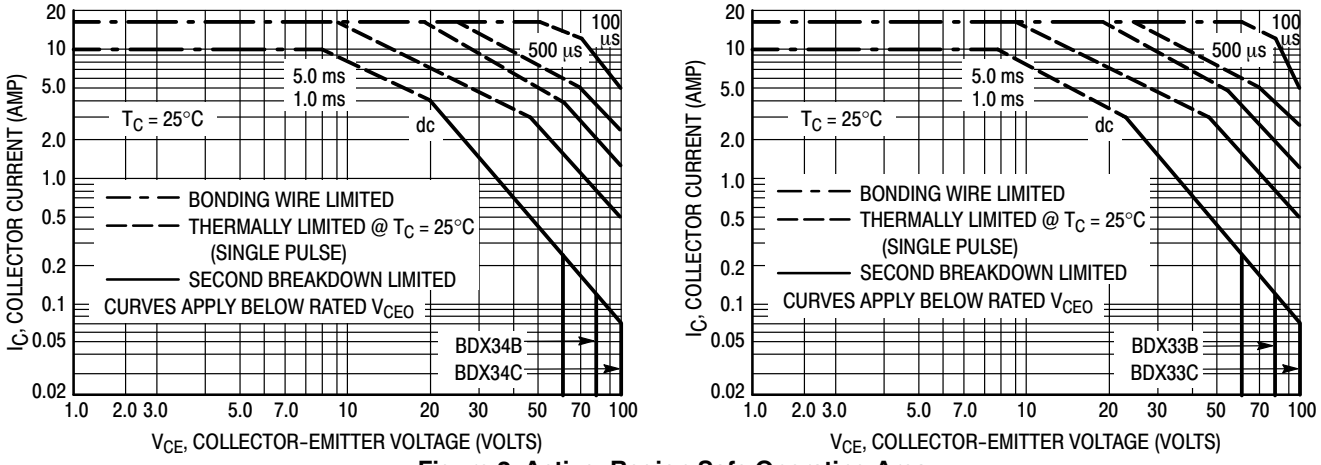



**Figure 2. Active−Region Safe Operating Area**

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 3 is based on $T_{J(pk)}$ = 150°C; $T_C$ is variable depending on conditions. Second breakdown pulse limits are valid for duty cycles to 10% provided $T_{J(pk)}$ = 150°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.

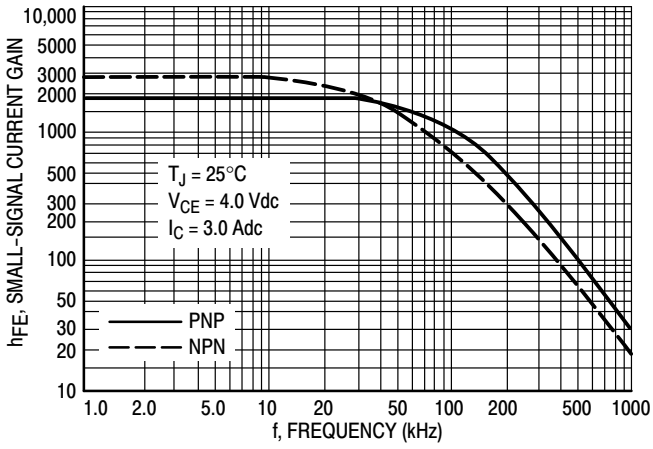



**Figure 3. Small−Signal Current Gain**

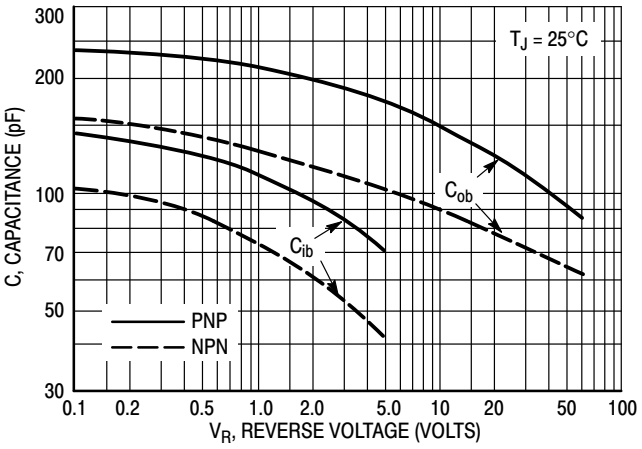



**Figure 4. Capacitance**

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

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

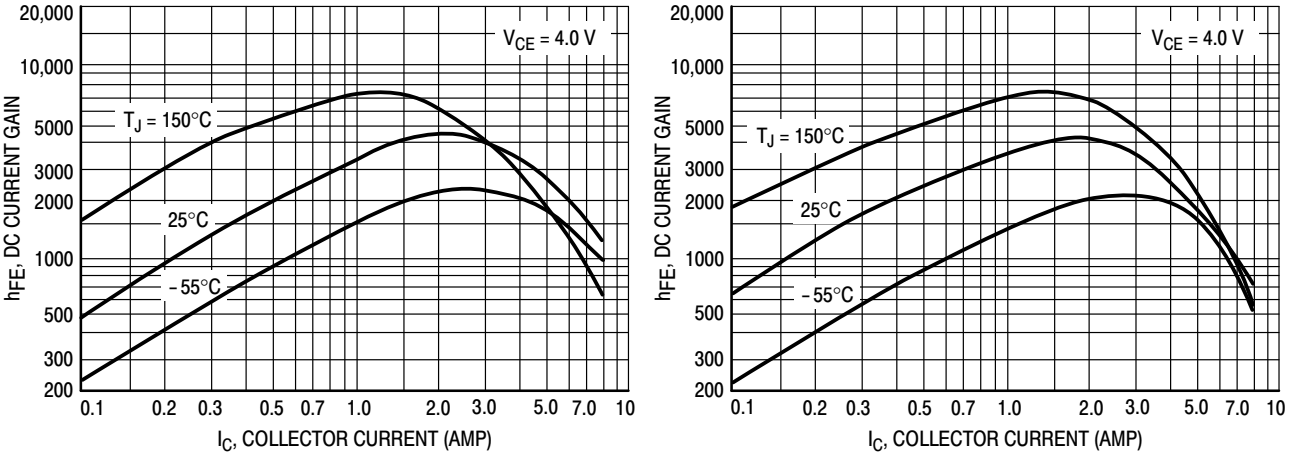



**Figure 5. DC Current Gain**

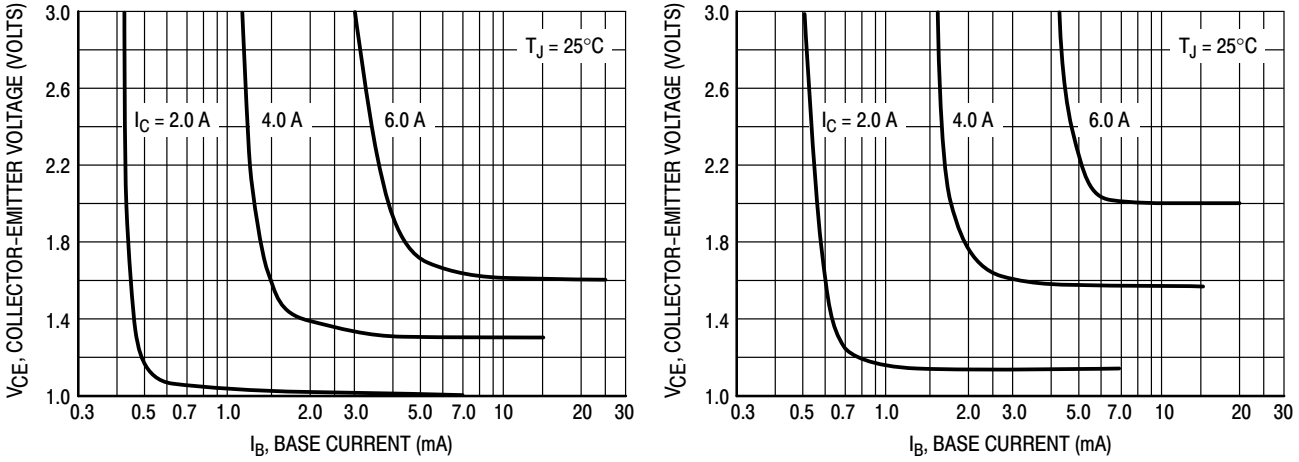



**Figure 6. Collector Saturation Region**

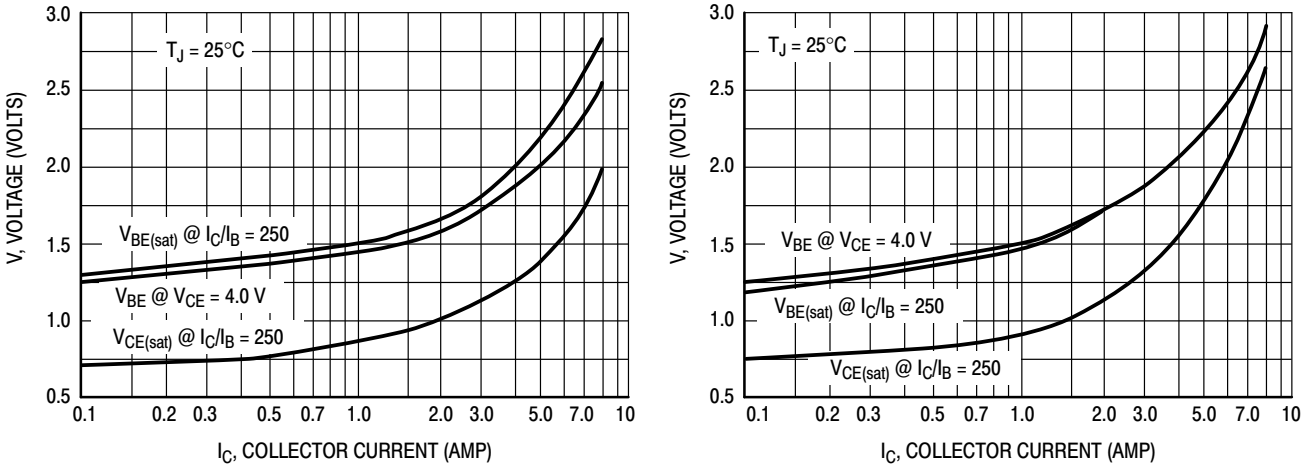



**Figure 7. “On” Voltages**

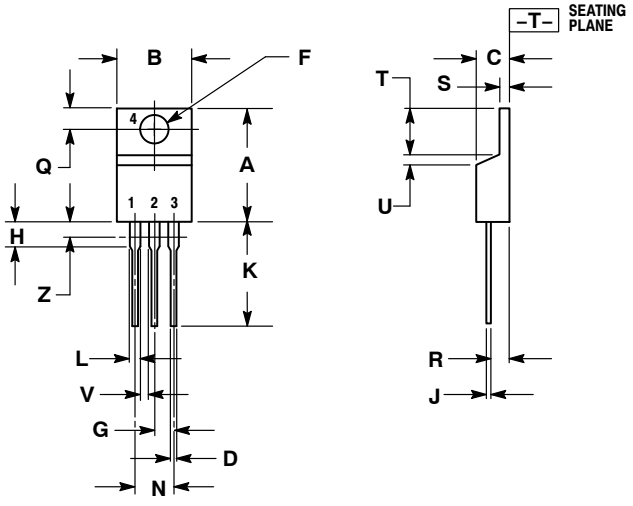
**ORDERING INFORMATION**

| Device | Package | Shipping† |
|---|---|---|
| BDX33B | TO−220 | 50 Units / Rail |
| BDX33BG | TO−220 (Pb−Free) | |
| BDX33C | TO−220 | 50 Units / Rail |
| BDX33CG | TO−220 (Pb−Free) | |
| BDX34B | TO−220 | 50 Units / Rail |
| BDX34BG | TO−220 (Pb−Free) | |
| BDX34C | TO−220 | 50 Units / Rail |
| BDX34CG | TO−220 (Pb−Free) | |

†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.

## 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.

| | INCHES | | MILLIMETERS | |
|---|---|---|---|---|
| DIM | 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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**BDX33B/D**

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