| NPN | PNP |
|---|---|
| BDX33 | BDX34 |
| BDX33A | BDX34A |
| BDX33B | BDX34B |
| BDX33C | BDX34C |

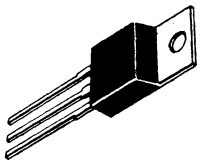
## DARLINGTON COMPLEMENTARY SILICON POWER TRANSISTORS

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

- High DC Current Gain – $h_{FE}$ = 2500 (typ.) at $I_C$ = 4.0 Adc
- Collector Emitter sustaining Voltage at 100 mAdc
  $V_{CEO(sus)}$ = 45 Vdc (min.) – BDX33, 34
  60 Vdc (min.) – BDX33A, 34A
  80 Vdc (min.) – BDX33B, 34B
  100 Vdc (min.) – BDX33C, 34C
- Low Collector Emitter Saturation Voltage
  $V_{CE(sat)}$ = 2.5 Vdc (max.) at $I_C$ = 4.0 Adc – BDX33, 33A/34, 34A
  2.5 Vdc (max.) at $I_C$ = 3.0 Adc – BDX33B, 33C/34B, 34C
- Monolithic Construction with Built-In Base Emitter Shunt resistors
- TO-220AB Compact Package
- TO-66 Lead form also available ordered with "-66" suffix.

## DARLINGTON 10 AMPERE

COMPLEMENTARY SILICON POWER TRANSISTORS
45-60-80-100 VOLTS
70 Watts



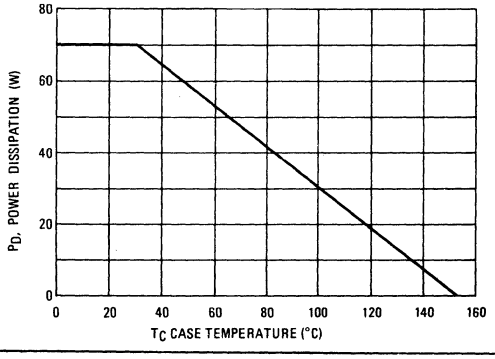
### MAXIMUM RATINGS

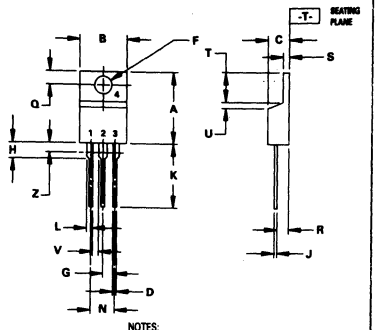
| Rating | Symbol | BDX33 BDX34 | BDX33A BDX34A | BDX33B BDX34B | BDX33C BDX34C | Unit |
|---|---|---|---|---|---|---|
| Collector-Emitter Voltage | $V_{CEO}$ | 45 | 60 | 80 | 100 | Vdc |
| Collector-Base Voltage | $V_{CB}$ | 45 | 60 | 80 | 100 | Vdc |
| Emitter-Base Voltage | $V_{EB}$ | 5.0 | | | | Vdc |
| Collector Current - Continuous<br>Peak | $I_C$ | 10<br>15 | | | | Adc |
| Base Current | $I_B$ | 0.25 | | | | Adc |
| Total Device Dissipation<br>@ $T_C$ = 25 °C<br>Derate above 25 °C | $P_D$ | 70<br>0.56 | | | | Watts<br>W/°C |
| Operating and Storage Junction Temperature Range | $T_J$, $T_{stg}$ | −65 to +150 | | | | °C |

### THERMAL CHARACTERISTICS

| Characteristic | Symbol | Max. | Unit |
|---|---|---|---|
| Thermal Resistance, Junction to Case | $R_{\theta JC}$ | 1.78 | °C/W |

FIGURE 1 – POWER DERATING




NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.
3. DIM Z DEFINES A ZONE WHERE ALL BODY AND LEAD IRREGULARITIES ARE ALLOWED.

| DIM | MILLIMETERS MIN | MILLIMETERS MAX | INCHES MIN | INCHES MAX |
|---|---|---|---|---|
| A | 14.48 | 15.75 | 0.570 | 0.620 |
| B | 9.66 | 10.28 | 0.380 | 0.405 |
| C | 4.07 | 4.82 | 0.160 | 0.190 |
| D | 0.64 | 0.88 | 0.025 | 0.035 |
| F | 3.61 | 3.73 | 0.142 | 0.147 |
| G | 2.42 | 2.66 | 0.095 | 0.105 |
| H | 2.80 | 3.93 | 0.110 | 0.155 |
| J | 0.46 | 0.71 | 0.018 | 0.028 |
| K | 12.70 | 14.27 | 0.500 | 0.562 |
| L | 1.15 | 1.39 | 0.045 | 0.055 |
| N | 4.83 | 5.33 | 0.190 | 0.210 |
| Q | 2.54 | 3.04 | 0.100 | 0.120 |
| R | 2.04 | 2.79 | 0.080 | 0.110 |
| S | 1.15 | 1.39 | 0.045 | 0.055 |
| T | 5.97 | 6.47 | 0.235 | 0.255 |
| U | 0.00 | 1.27 | 0.000 | 0.050 |
| V | 1.15 | — | 0.045 | — |
| Z | — | 2.04 | — | 0.080 |

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

**CASE 221A-04**
**TO-220AB**

3

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

| Characteristic | | Symbol | Min. | Max. | Unit |
|---|---|---|---|---|---|
| **OFF CHARACTERISTICS** | | | | | |
| Collector-Emitter Sustaining Voltage[1] ($I_C$ = 100 mAdc, $I_B$ = 0) | BDX33/BDX34 | $V_{CEO(sus)}$ | 45 | | Vdc |
| | BDX33A/BDX34A | | 60 | | |
| | BDX33B/BDX34B | | 80 | | |
| | BDX33C/BDX34C | | 100 | | |
| Collector-Emitter Sustaining Voltage[1] ($I_C$ = 100 mAdc, $I_B$ = 0, $R_{BE}$ = 100) | BDX33/BDX34 | $V_{CER(sus)}$ | 45 | | Vdc |
| | BDX33A/BDX34A | | 60 | | |
| | BDX33B/BDX34B | | 80 | | |
| | BDX33C/BDX34C | | 100 | | |
| Collector-Emitter Sustaining Voltage[1] ($I_C$ = 100 mAdc, $I_B$ = 0, $V_{BE}$ = 1.5 Vdc) | BDX33/BDX34 | $V_{CEX(sus)}$ | 45 | | Vdc |
| | BDX33A/BDX34A | | 60 | | |
| | BDX33B/BDX34B | | 80 | | |
| | BDX33C/BDX34C | | 100 | | |
| Collector Cutoff Current ($V_{CE}$ = ½ rated $V_{CEO}$, $I_B$ = 0) | $T_C$ = 25 °C | $I_{CEO}$ | | 0.5 | mAdc |
| | $T_C$ = 100 °C | | | 10 | |
| Collector Cutoff Current ($V_{CB}$ = rated $V_{CBO}$, $I_E$ = 0) | $T_C$ = 25 °C | $I_{CBO}$ | | 1 | mAdc |
| | $T_C$ = 100 °C | | | 5 | |
| Emitter Cutoff Current ($V_{BE}$ = 5.0 Vdc, $I_C$ = 0) | | $I_{EBO}$ | | 10 | mAdc |
| **ON CHARACTERISTICS** | | | | | |
| DC Current Gain[1] ($I_C$ = 4.0 Adc, $V_{CE}$ = 3.0 Vdc) | BDX33, 33A/34, 34A | $h_{FE}$ | 750 | | – |
| ($I_C$ = 3.0 Adc, $V_{CE}$ = 3.0 Vdc) | BDX33B, 33C/34B, 34C | | 750 | | |
| Collector-Emitter Saturation Voltage ($I_C$ = 4.0 Adc, $I_B$ = 8 mAdc) | BDX33, 33A/34, 34A | $V_{CE(sat)}$ | | 2.5 | Vdc |
| ($I_C$ = 3.0 Adc, $I_B$ = 6 mAdc) | BDX33B, 33C/34B, 34C | | | 2.5 | |
| Base-Emitter On Voltage ($I_C$ = 4.0 Adc, $V_{CE}$ = 3 V) | BDX33, 33A/34, 34A | $V_{BE(on)}$ | | 2.5 | Vdc |
| ($I_C$ = 3.0 Adc, $V_{CE}$ = 3 Vdc) | BDX33B, 33C/34B, 34C | | | 2.5 | |
| Diode Forward Voltage ($I_C$ = 8 Adc) | | $V_F$ | | 4 | Vdc |
| **SECOND BREAKDOWN**[2] | | | | | |
| Second Breakdown Collector Current With Base Forward Biased ($V_{CE}$ = 25 Vdc) | BDX33 Series | $I_{S/b}$ | 2.8 | | Adc |
| ($V_{CE}$ = 20 Vdc) | BDX34 Series | | 3.5 | | |
| ($V_{CE}$ = 36 Vdc) | BDX33 Series | | 1.0 | | |
| ($V_{CE}$ = 33 Vdc) | BDX34 Series | | 1.0 | | |
| **DYNAMIC CHARACTERISTICS** | | | | | |
| Small-Signal Current Gain ($T_C$ = 1.0 Adc, $V_{CE}$ = 5.0 Vdc, f = 1 MHz) | | $h_{FE}$ | 1000 | | – |
| Current Gain-Bandwidth product ($I_C$ = 1.0 Adc, $V_{CE}$ = 5.0 Vdc, f = 1.0 MHz) | | $f_T$ | 3 | | MHz |
| Output Capacitance ($V_{CB}$ = 10 Vdc, $I_E$ = 0, f = 0.1 MHz) | BDX33 Series | $C_{ob}$ | | 200 | pF |
| | BDX34 Series | | | 300 | |

[1] Pulse Test: Pulse Width ≤ 300 μs, Duty Cycle ≤ 2%
[2] Pulse Test non repetitive: Pulse Width = 0.25 s.

FIGURE 2 – THERMAL RESPONSE

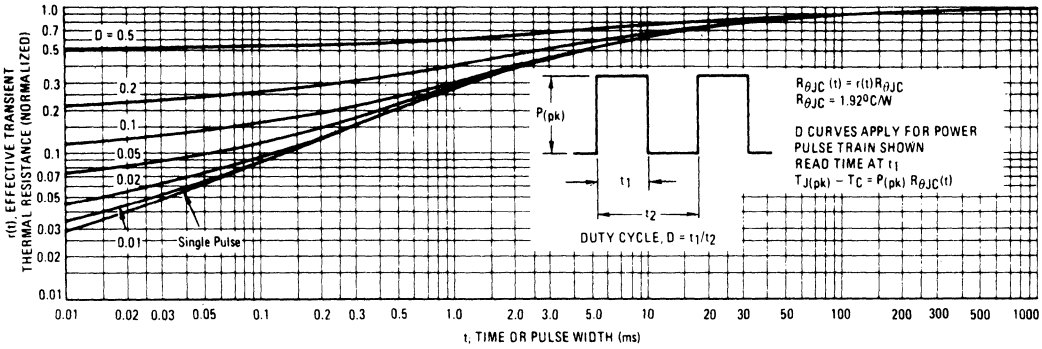
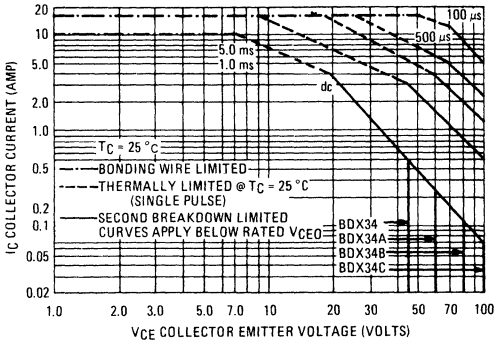
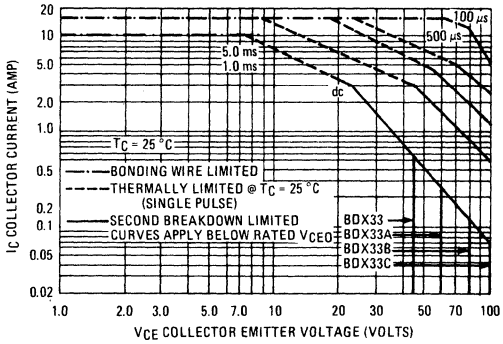



FIGURE 3 – ACTIVE-REGION SAFE OPERATING AREA




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 Fig. 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 Fig. . At high case temperatures, thermal limitations will reduce the power that can be handled to values less than the limitations imposed by second breakdown (see AN-415A).

3

FIGURE 4 – SMALL-SIGNAL CURRENT GAIN

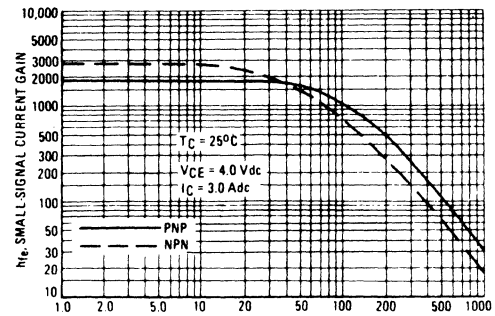
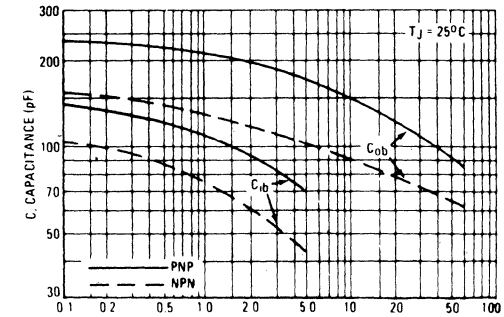


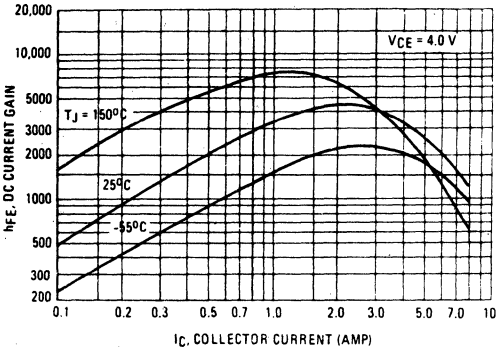

FIGURE 5 – CAPACITANCE



NPN
BDX33, 33A, 33B, 33C

PNP
BDX34, 34A, 34B, 34C

FIGURE 6 – DC CURRENT GAIN



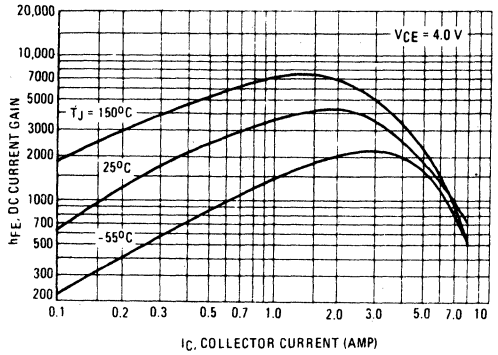
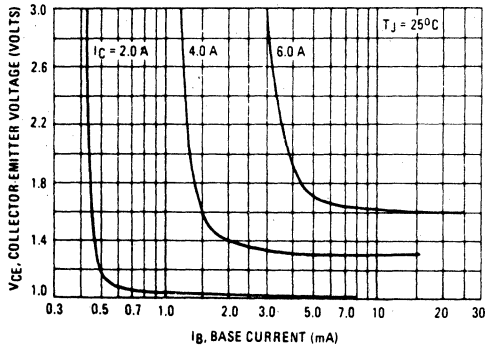




FIGURE 7 – COLLECTOR SATURATION REGION



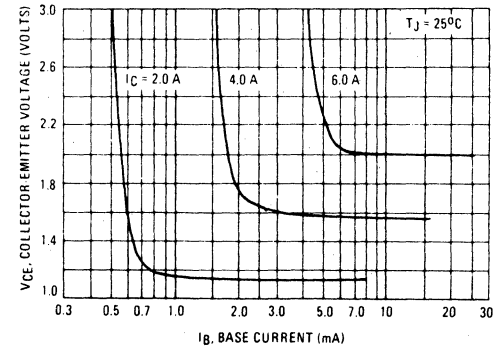




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FIGURE 8 – "ON" VOLTAGES