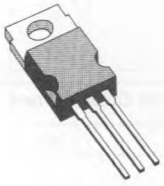
SGS-THOMSON MICROELECTRONICS

# BDX33/33A/33B/33C
# BDX34/34A/34B/34C

## HIGH GAIN GENERAL PURPOSE

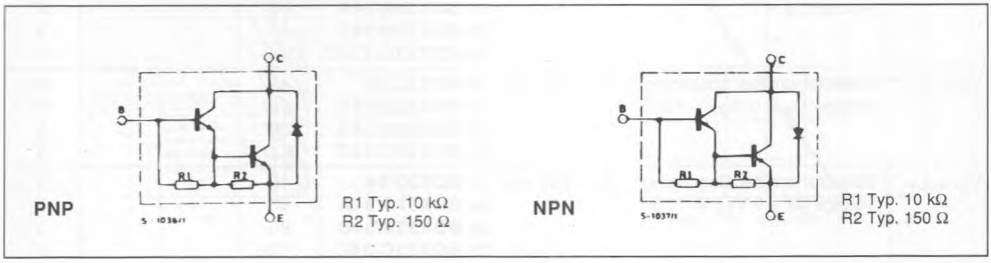
### DESCRIPTION

The BDX33, BDX33A, BDX33B and BDX33C are silicon epitaxial-base NPN transistors in monolithic Darlington configuration and are mounted in Jedec TO-220 plastic package. They are intended for use in power linear and switching applications. This complementary PNP types are the BDX34, BDX34A, BDX34B and BDX34C respectively.



TO-220

### INTERNAL SCHEMATIC DIAGRAMS




### ABSOLUTE MAXIMUM RATINGS

| Symbol | Parameter | NPN *PNP | Value | | | | Unit |
|---|---|---|---|---|---|---|---|
| | | | BDX33 BDX34 | BDX33A BDX34A | BDX33B BDX34B | BDX33C BDX34C | |
| $V_{CBO}$ | Collector-base Voltage ($I_E$ = 0) | | 45 | 60 | 80 | 100 | V |
| $V_{CEO}$ | Collector-emitter Voltage ($I_B$ = 0) | | 45 | 60 | 80 | 100 | V |
| $I_C$ | Collector Current | | 10 | | | | A |
| $I_{CM}$ | Collector Peak Current | | 15 | | | | A |
| $I_B$ | Base Current | | 0.25 | | | | A |
| $P_{tot}$ | Total Power Dissipation at $T_{case} \leq 25$ °C | | 70 | | | | W |
| $T_{stg}$ | Storage Temperature | | – 65 to 150 | | | | °C |
| $T_j$ | Junction Temperature | | 150 | | | | °C |

* For PNP types voltage and current values are negative.

## THERMAL DATA

| | | | | |
|---|---|---|---|---|
| $R_{th\ j\text{-}case}$ | Thermal Resistance Junction-case | Max | 1.78 | °C/W |

## ELECTRICAL CHARACTERISTICS ($T_{case}$ = 25 °C unless otherwise specified)

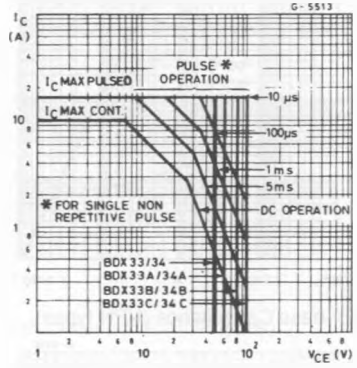
| Symbol | Parameter | Test Conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| $I_{CBO}$ | Collector Cutoff Current ($I_E$ = 0) | for **BDX33/34** $V_{CB}$ = 45 V | | | 0.2 | mA |
| | | for **BDX33A/34A** $V_{CB}$ = 60 V | | | 0.2 | mA |
| | | for **BDX33B/34B** $V_{CB}$ = 80 V | | | 0.2 | mA |
| | | for **BDX33C/X34C** $V_{CB}$ = 100 V | | | 0.2 | mA |
| | | $T_{case}$ = 100 °C | | | | |
| | | for **BDX33/34** $V_{CB}$ = 45 V | | | 5 | mA |
| | | for **BDX33A/34A** $V_{CB}$ = 60 V | | | 5 | mA |
| | | for **BDX33B/34B** $V_{CB}$ = 80 V | | | 5 | mA |
| | | for **BDX33C/X34C** $V_{CB}$ = 100 V | | | 5 | mA |
| $I_{CEO}$ | Collector Cutoff Current ($I_B$ = 0) | for **BDX33/34** $V_{CB}$ = 22 V | | | 0.5 | mA |
| | | for **BDX33A/34A** $V_{CB}$ = 30 V | | | 0.5 | mA |
| | | for **BDX33B/34B** $V_{CB}$ = 40 V | | | 0.5 | mA |
| | | for **BDX33C/X34C** $V_{CB}$ = 50 V | | | 0.5 | mA |
| | | $T_{case}$ = 100 °C | | | | |
| | | for **BDX33/34** $V_{CB}$ = 22 V | | | 10 | mA |
| | | for **BDX33A/34A** $V_{CB}$ = 30 V | | | 10 | mA |
| | | for **BDX33B/34B** $V_{CB}$ = 40 V | | | 10 | mA |
| | | for **BDX33C/X34C** $V_{CB}$ = 50 V | | | 10 | mA |
| $I_{EBO}$ | Emitter Cutoff Current ($I_C$ = 0) | $V_{EB}$ = 5 V | | | 5 | mA |
| $V_{CEO(sus)}$* | Collector-emitter Sustaining Voltage ($I_B$ = 0) | $I_C$ = 100 mA for **BDX33/34** | 45 | | | V |
| | | for **BDX33A/34A** | 60 | | | V |
| | | for **BDX33B/34B** | 80 | | | V |
| | | for **BDX33C/X34C** | 100 | | | V |
| $V_{CER(sus)}$* | Collector-emitter Sustaining Voltage ($I_B$ = 0 $R_{BE}$ = 100 Ω) | $I_C$ = 100 mA for **BDX33/34** | 45 | | | V |
| | | for **BDX33A/34A** | 60 | | | V |
| | | for **BDX33B/34B** | 80 | | | V |
| | | for **BDX33C/34C** | 100 | | | V |
| $V_{CEV(sus)}$* | Collector-emitter Sustaining Voltage ($I_B$ = 0 $V_{BE}$ = − 1.5 V) | $I_C$ = 100 mA for **BDX33/34** | 45 | | | V |
| | | for **BDX33A/34A** | 60 | | | V |
| | | for **BDX33B/34B** | 80 | | | V |
| | | for **BDX33C/34C** | 100 | | | V |

## ELECTRICAL CHARACTERISTICS (continued)

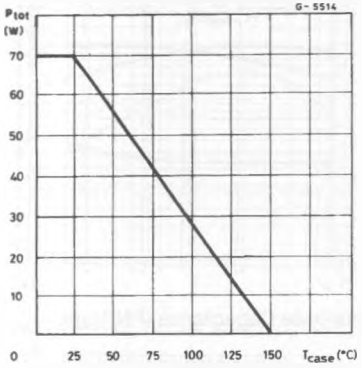
| Symbol | Parameter | Test Conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| $V_{CE(sat)}$* | Collector-emitter Saturation Voltage | for **BDX33/33A/34/34A**<br>$I_C$ = 4 A $I_B$ = 8 mA<br>for **BDX33B/33C/34B/34C**<br>$I_C$ = 3 A $I_B$ = 6 mA | | | 2.5<br><br>2.5 | V<br><br>V |
| $V_{BE}$* | Base-emitter Voltage | for **BDX33/33A/34/34A**<br>$I_C$ = 4 A $V_{CE}$ = 3 V<br>for **BDX33B/33C/34B/34C**<br>$I_C$ = 3 A $V_{CE}$ = 3 V | | | 2.5<br><br>2.5 | V<br><br>V |
| $h_{FE}$* | DC Current Gain | for **BDX33/33A/34/34A**<br>$I_C$ = 4 A $V_{CE}$ = 3 V<br>for **BDX33B/33C/34B/34C**<br>$I_C$ = 3 A $V_{CE}$ = 3 V | 750<br><br>750 | | | |
| $V_F$* | Parallel-diode Forward Voltage | $I_F$ = 8 A | | | 4 | V |
| $h_{fe}$ | Small Signal Current Gain | $I_C$ = 1 A $V_{CE}$ = 5 V f = 1 KHz | 100 | | | |

* Pulsed : pulse duration = 300 ms, duty cycle = 1.5 %.
For PNP types voltage and current values are negative.

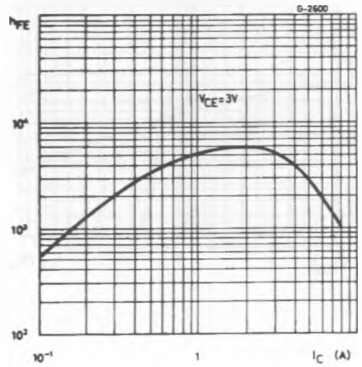
Safe Operating Areas.



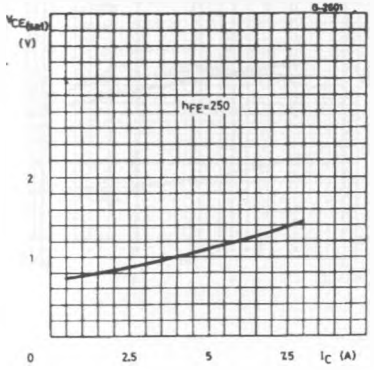

Case Temperature Dissipation Derating Curve.



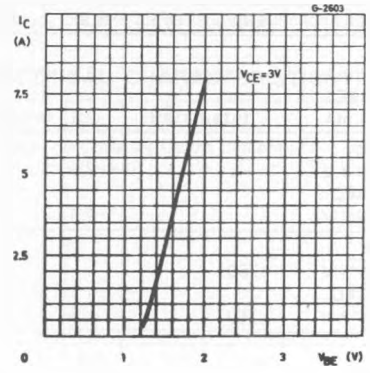

DC Current Gain (NPN types).



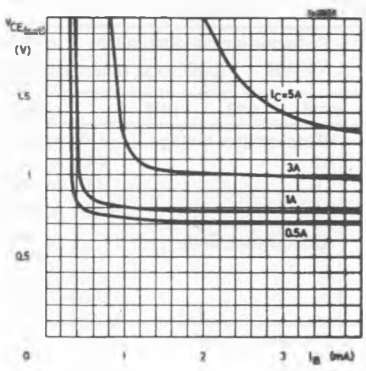

Collector-emitter Saturation Voltage (NPN types).



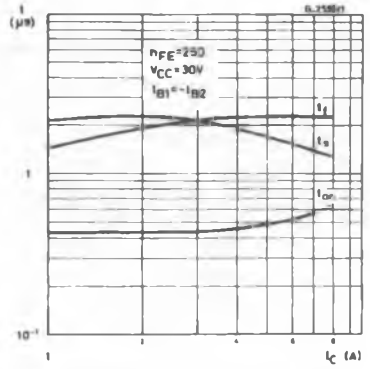
DC Transconductance (NPN types).



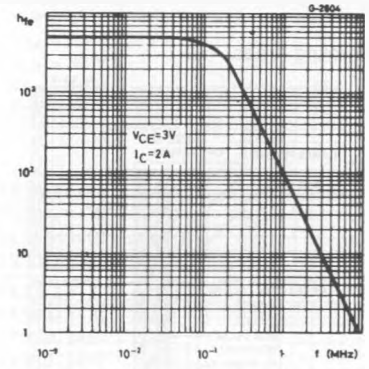

Collector-emitter Saturation Voltage (NPN types).



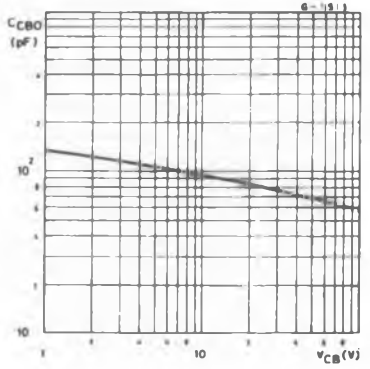

Saturated Switching Characteristics (NPN types).




Small Signal Current Gain (NPN types).




Collector-base Capacitance (PNP types).

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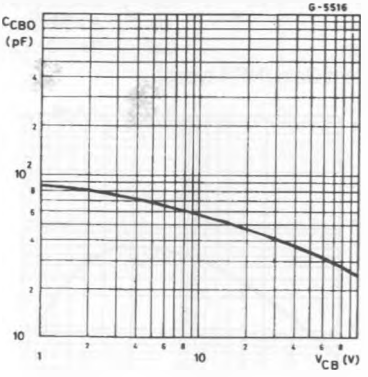

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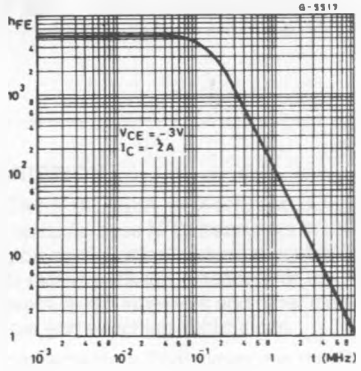
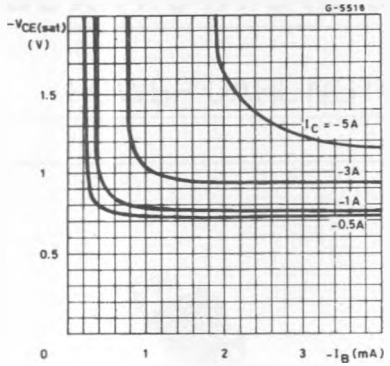
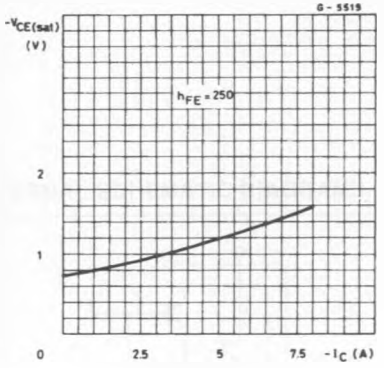



Collector-emitter Saturation Voltage (PNP types).




Collector-emitter Saturation Voltage (PNP types).

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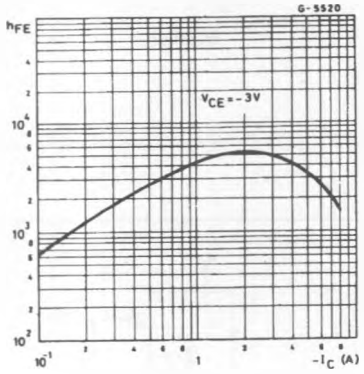
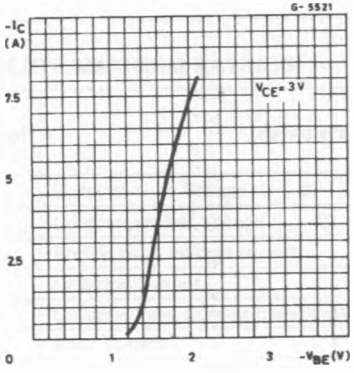



DC Transconductance (PNP types).




Saturated Switching Characteristics (PNP types).