优尚

YOUSHANG SEMICONDUCTOR

# 设计研发新型功率器件

## 各类小信号开关

## 中低压及高压大电流等场效应管

0755-83047638
ysbdt@szyoushang.cn
www.szyoushang.cn

企业微信二维码

企业QQ二维码

## Features

- NPN Transistor:
  - $BV_{CEO}$ > 100V
  - $I_C$ = 3A Continuous Collector Current
  - $I_{CM}$ = 8A Peak Pulse Current
  - $R_{CE(SAT)}$ = 90mΩ (Typ)
- PNP Transistor
  - $BV_{CEO}$ > -100V
  - $I_C$ = -3A Continuous Collector Current
  - $I_{CM}$ = -8A Peak Pulse Current
  - $R_{CE(SAT)}$ = 110mΩ (Typ)

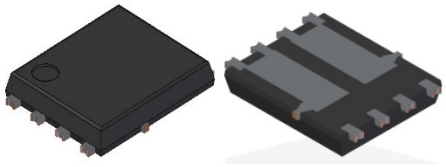
## Mechanical Data

- Case: POWERDI5060-8/SWP (Type UXD)
- Case Material: Molded Plastic, “Green” Molding Compound. UL Flammability Classification Rating 94V-0
- Moisture Sensitivity: Level 1 per J-STD-020
- Terminal Finish - Matte Tin Annealed over Copper Lead-Frame; Solderable per MIL-STD-202, Method 208 e3
- Weight: 0.097 grams (Approximate)

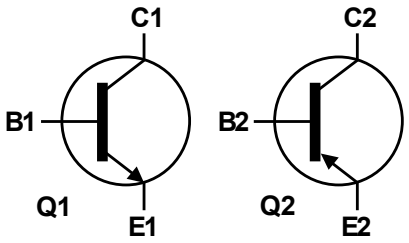
## Applications

- Power Management
- Load Switches
- MOSFET and IGBT Gate Drivers

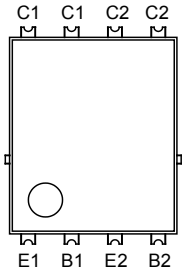
PowerDI5060-8/SWP (Type UXD)



Top View Bottom View




Internal Schematic




Top View
Pin Configuration

## NPN Absolute Maximum Ratings (@ $T_A$ = +25°C, unless otherwise specified.)

| Characteristic | Symbol | Value | Unit |
|---|---|---|---|
| Collector-Base Voltage | $V_{CBO}$ | 100 | V |
| Collector-Emitter Voltage | $V_{CEO}$ | 100 | V |
| Emitter-Base Voltage | $V_{EBO}$ | 7 | V |
| Base Current | $I_B$ | 500 | mA |
| Continuous Collector Current | $I_C$ | 3 | A |
| Peak Pulse Collector Current | $I_{CM}$ | 8 | A |

## PNP Absolute Maximum Ratings (@ $T_A$ = +25°C, unless otherwise specified.)

| Characteristic | Symbol | Value | Unit |
|---|---|---|---|
| Collector-Base Voltage | $V_{CBO}$ | -100 | V |
| Collector-Emitter Voltage | $V_{CEO}$ | -100 | V |
| Emitter-Base Voltage | $V_{EBO}$ | -7 | V |
| Base Current | $I_B$ | -500 | mA |
| Continuous Collector Current | $I_C$ | -3 | A |
| Peak Pulse Collector Current | $I_{CM}$ | -8 | A |

## Thermal Characteristics (@ $T_A$ = +25°C, unless otherwise specified.)

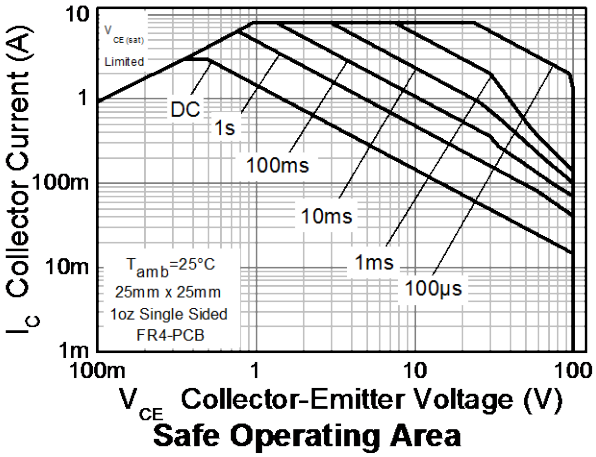
| Characteristic | | Symbol | Value | Unit |
|---|---|---|---|---|
| Power Dissipation | (Notes 5, 7) | $P_D$ | 1.47 | W |
| Linear Derating Factor | (Notes 6, 7) | | 11.76 | mW/°C |
| Thermal Resistance, Junction to Ambient | (Notes 5, 7) | $R_{\theta JA}$ | 85 | °C/W |
| | (Notes 6, 7) | | 37 | |
| Thermal Resistance, Junction to Lead | (Note 8) | $R_{\theta JL}$ | 5.7 | |
| Operating and Storage Temperature Range | | $T_J$, $T_{STG}$ | -55 to +150 | °C |

## ESD Ratings (Note 9)

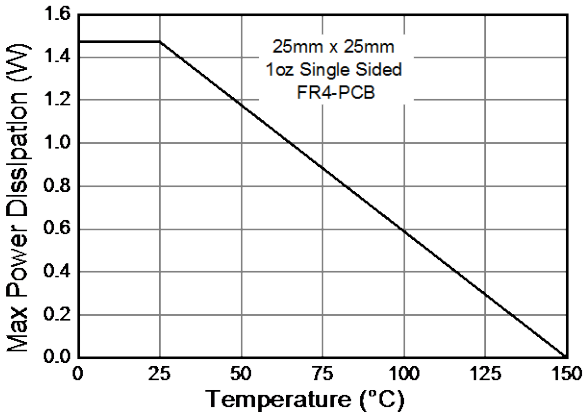
| Characteristic | Symbol | Value | Unit | JEDEC Class |
|---|---|---|---|---|
| Electrostatic Discharge - Human Body Model | ESD HBM | 4000 | V | 3A |
| Electrostatic Discharge - Machine Model | ESD MM | 400 | V | C |

Notes:
5. For a device mounted with the collector lead on 25mm x 25mm 1oz copper that is on single-sided 1.6mm FR4 PCB; device with one active die is measured under still air conditions whilst operating in a steady-state.
6. Same as Note 5, except the device is measured at t ≤ 5 sec.
7. For a dual device with one active die.
8. Thermal resistance from junction to solder-point (at the end of the collector lead).
9. Refer to JEDEC specification JESD22-A114 and JESD22-A115.

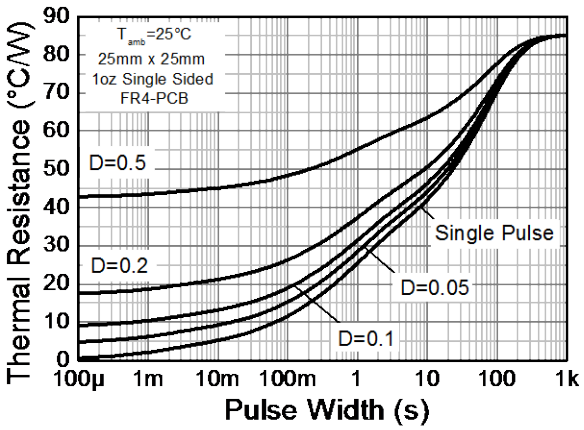
## Thermal Characteristics and Derating Information



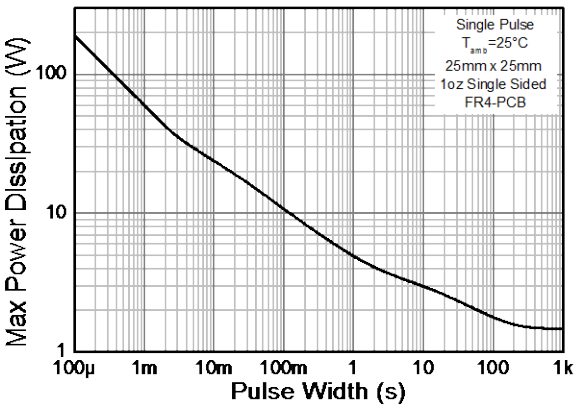

**Safe Operating Area**




**Derating Curve**




**Transient Thermal Impedance**



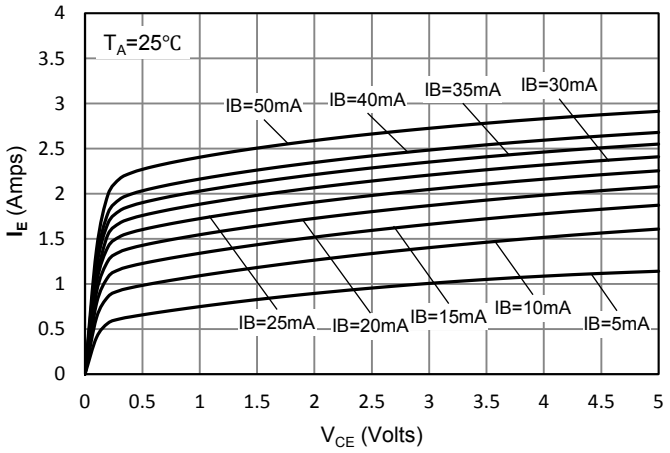

**Pulse Power Dissipation**

## NPN Electrical Characteristics (@ $T_A$ = +25°C, unless otherwise specified.)

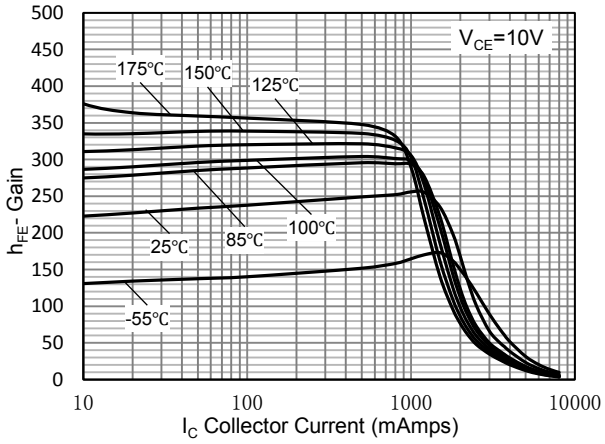
| Characteristic | Symbol | Min | Typ | Max | Unit | Test Condition |
|---|---|---|---|---|---|---|
| **OFF CHARACTERISTICS** | | | | | | |
| Collector-Base Breakdown Voltage | $BV_{CBO}$ | 100 | — | — | V | $I_C$ = 100μA |
| Collector-Emitter Breakdown Voltage (Note 10) | $BV_{CEO}$ | 100 | — | — | V | $I_C$ = 10mA |
| Emitter-Base Breakdown Voltage | $BV_{EBO}$ | 7 | — | — | V | $I_E$ = 100μA |
| Collector-Base Cutoff Current | $I_{CBO}$ | — | — | 100 | nA | $V_{CB}$ = 80V |
| | | — | — | 50 | μA | $V_{CB}$ = 80V @Tj = 150°C |
| Emitter Cutoff Current | $I_{EBO}$ | — | — | 100 | nA | $V_{EB}$ = 7V |
| Collector-Emitter Cutoff Current | $I_{CES}$ | — | — | 100 | nA | $V_{CES}$ = 80V |
| **ON CHARACTERISTICS** (Note 10) | | | | | | |
| DC Current Gain | $h_{FE}$ | 150 | 250 | — | — | $I_C$ = 500mA, $V_{CE}$ = 10V |
| | | 80 | 250 | — | | $I_C$ = 1A, $V_{CE}$ = 10V |
| | | 20 | 100 | — | | $I_C$ = 2A, $V_{CE}$ = 10V |
| | | 10 | 40 | — | | $I_C$ = 3A, $V_{CE}$ = 10V |
| Collector-Emitter Saturation Voltage | $V_{CE(sat)}$ | — | 90 | 150 | mV | $I_C$ = 1A, $I_B$ = 50mA |
| | | — | 225 | 330 | mV | $I_C$ = 3A, $I_B$ = 300mA |
| Collector-Emitter Saturation Resistance | $R_{CE(sat)}$ | — | 90 | 150 | mΩ | $I_C$ = 1A, $I_B$ = 50mA |
| Base-Emitter Saturation Voltage | $V_{BE(sat)}$ | — | 0.86 | 1.0 | V | $I_C$ = 1A, $I_B$ = 50mA |
| | | — | 1.0 | 1.2 | | $I_C$ = 2A, $I_B$ = 200mA |
| Base-Emitter Turn-On Voltage | $V_{BE(on)}$ | — | 0.67 | 0.85 | V | $I_C$ = 0.1A, $V_{CE}$ = 2V |
| **SMALL SIGNAL CHARACTERISTICS** | | | | | | |
| Current Gain-Bandwidth Product | $f_T$ | — | 130 | — | MHz | $V_{CE}$ = 10V, $I_C$ = 100mA, f = 100MHz |
| Output Capacitance | $C_{obo}$ | — | 11 | — | pF | $V_{CB}$ = 10V, f = 1MHz |
| Delay Time | $t_d$ | — | 40 | — | ns | $V_{CC}$ = 12.5V, $I_C$ = 1A<br>$I_{B1}$ = -$I_{B2}$ = 0.05A |
| Rise Time | $t_r$ | — | 20 | — | ns | |
| Turn-On Time | $t_{on}$ | — | 60 | — | ns | |
| Storage Time | $t_s$ | — | 620 | — | ns | |
| Fall Time | $t_f$ | — | 40 | — | ns | |
| Turn-Off Time | $t_{off}$ | — | 660 | — | ns | |

Note: 10. Measured under pulsed conditions. Pulse width ≤ 300μs. Duty cycle ≤ 2%.

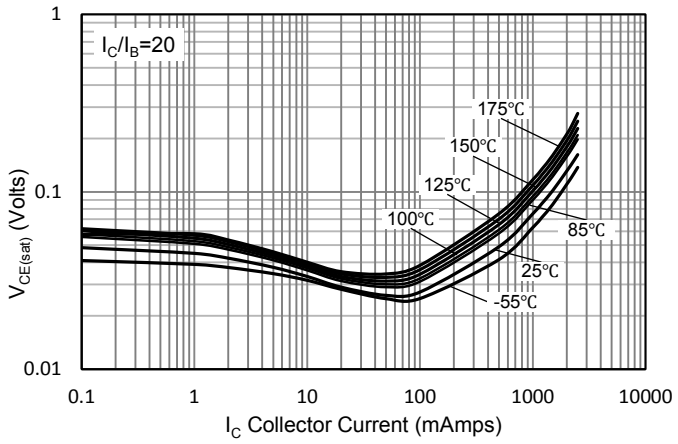
## NPN Typical Electrical Characteristics (@ $T_A$ = +25°C, unless otherwise specified.)



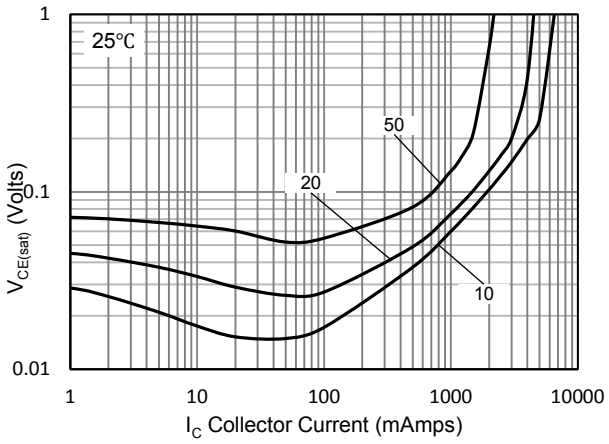

**$V_{CE}$ vs $I_E$**



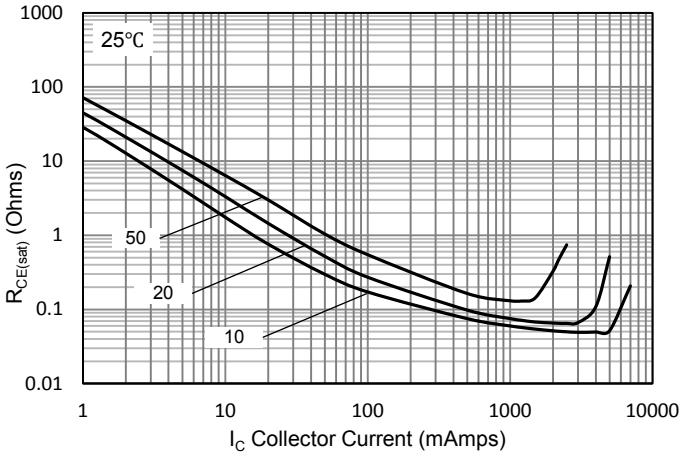

**$h_{FE}$ vs $I_C$**



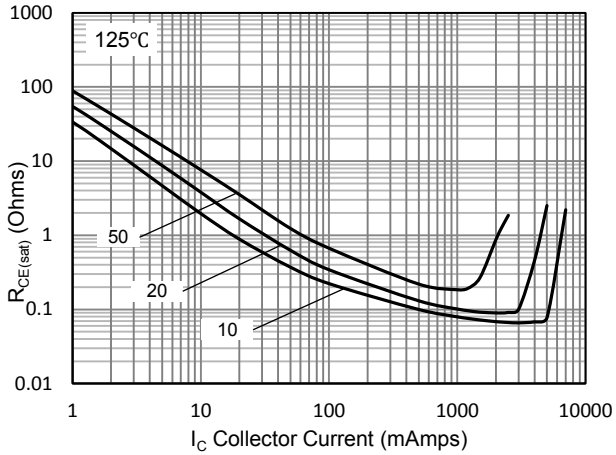

**$V_{CE(sat)}$ vs $I_C$**




**$V_{CE(sat)}$ vs $I_C$**

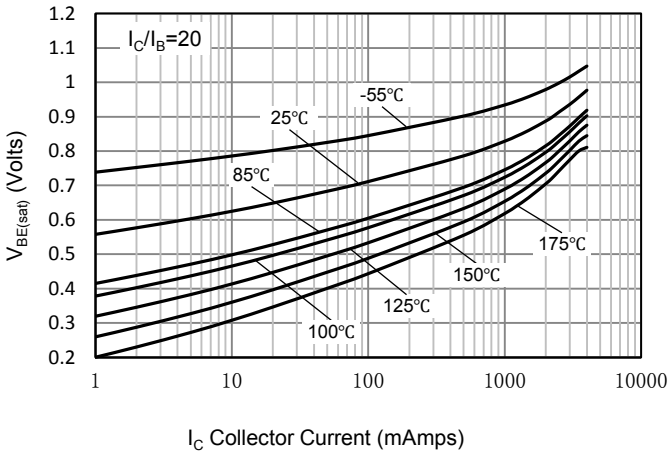



**$R_{CE(sat)}$ vs $I_C$**

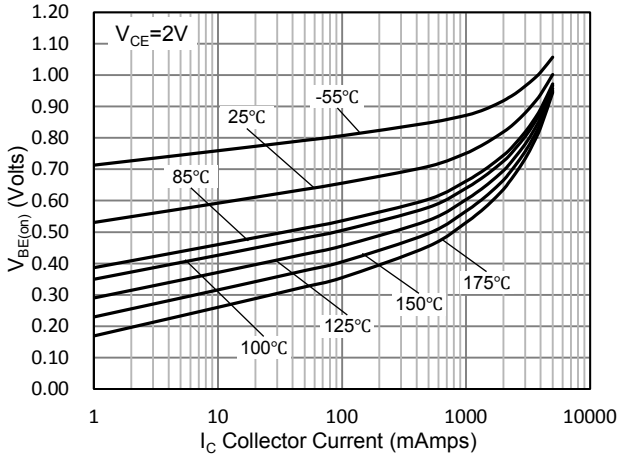



**$R_{CE(sat)}$ vs $I_C$**

## NPN Typical Electrical Characteristics (@ $T_A$ = +25°C, unless otherwise specified.) (continued)




**$V_{BE(sat)}$ vs $I_C$**



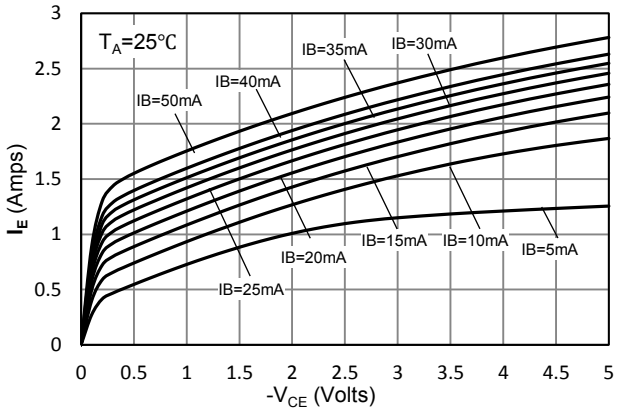

**$V_{BE(on)}$ vs $I_C$**

## PNP Electrical Characteristics (@ $T_A$ = +25°C, unless otherwise specified.)

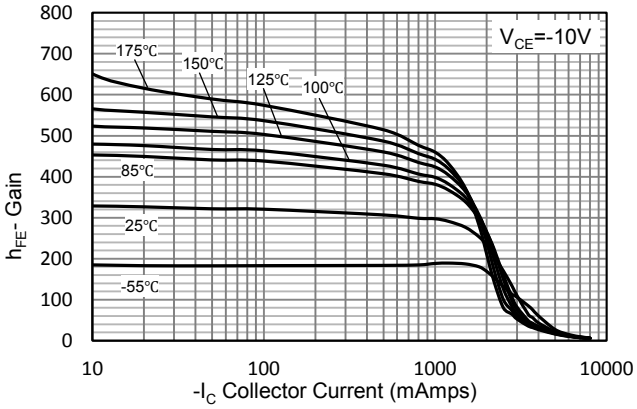
| Characteristic | Symbol | Min | Typ | Max | Unit | Test Condition |
|---|---|---|---|---|---|---|
| **OFF CHARACTERISTICS** | | | | | | |
| Collector-Base Breakdown Voltage | $BV_{CBO}$ | -100 | — | — | V | $I_C$ = -100μA |
| Collector-Emitter Breakdown Voltage (Note 10) | $BV_{CEO}$ | -100 | — | — | V | $I_C$ = -10mA |
| Emitter-Base Breakdown Voltage | $BV_{EBO}$ | -7 | — | — | V | $I_E$ = -100μA |
| Collector-Base Cutoff Current | $I_{CBO}$ | — | — | -100 | nA | $V_{CB}$ = -80V |
| | | — | — | -50 | μA | $V_{CB}$ = -80V @Tj = 150°C |
| Emitter Cutoff Current | $I_{EBO}$ | — | — | -100 | nA | $V_{EB}$ = -7V |
| Collector-Emitter Cutoff Current | $I_{CES}$ | — | — | -100 | nA | $V_{CES}$ = -80V |
| **ON CHARACTERISTICS** (Note 10) | | | | | | |
| DC Current Gain | $h_{FE}$ | 170 | 305 | — | — | $I_C$ = -500mA, $V_{CE}$ = -10V |
| | | 160 | 275 | — | | $I_C$ = -1A, $V_{CE}$ = -10V |
| | | 45 | 90 | — | | $I_C$ = -2A, $V_{CE}$ = -10V |
| | | 10 | 20 | — | | $I_C$ = -3A, $V_{CE}$ = -10V |
| Collector-Emitter Saturation Voltage | $V_{CE(sat)}$ | — | -70 | -110 | mV | $I_C$ = -0.5A, $I_B$ = -50mA |
| | | — | -220 | -325 | | $I_C$ = -2A, $I_B$ = -200mA |
| Collector-Emitter Saturation Resistance | $R_{CE(sat)}$ | — | 110 | 180 | mΩ | $I_C$ = -2A, $I_B$ = -200mA |
| Base-Emitter Saturation Voltage | $V_{BE(sat)}$ | — | -0.91 | -1 | V | $I_C$ = -1A, $I_B$ = -50mA |
| | | — | -1.02 | -1.2 | | $I_C$ = -2A, $I_B$ = -200mA |
| Base-Emitter Turn-On Voltage | $V_{BE(on)}$ | — | -0.68 | -0.9 | V | $I_C$ = -0.1A, $V_{CE}$ = -2V |
| **SMALL SIGNAL CHARACTERISTICS** | | | | | | |
| Current Gain-Bandwidth Product | $f_T$ | — | 100 | — | MHz | $V_{CE}$ = -10V, $I_C$ = -100mA, f = 100MHz |
| Output Capacitance | $C_{obo}$ | — | 30 | — | pF | $V_{CB}$ = -10V, f = -1MHz |
| Delay Time | $t_d$ | — | 30 | — | ns | $V_{CC}$ = -12.5V, $I_C$ = -1A<br>$I_{B1}$ = -$I_{B2}$ = -50mA |
| Rise Time | $t_r$ | — | 30 | — | ns | |
| Turn-On Time | $t_{on}$ | — | 60 | — | ns | |
| Storage Time | $t_s$ | — | 660 | — | ns | |
| Fall Time | $t_f$ | — | 50 | — | ns | |
| Turn-Off Time | $t_{off}$ | — | 710 | — | ns | |

Note: 10. Measured under pulsed conditions. Pulse width ≤ 300μs. Duty cycle ≤ 2%.

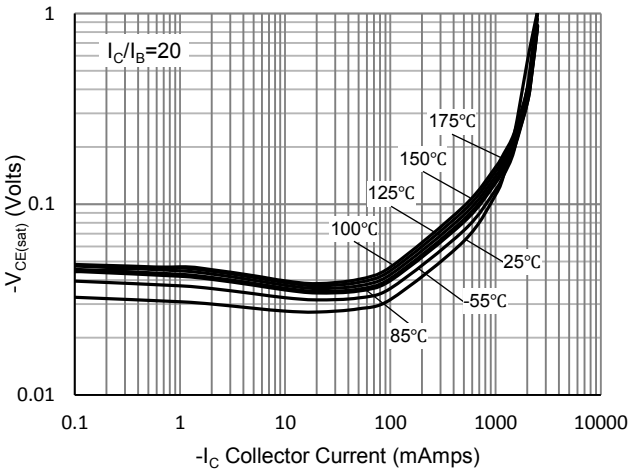
## PNP Typical Electrical Characteristics (@ $T_A$ = +25°C, unless otherwise specified.)



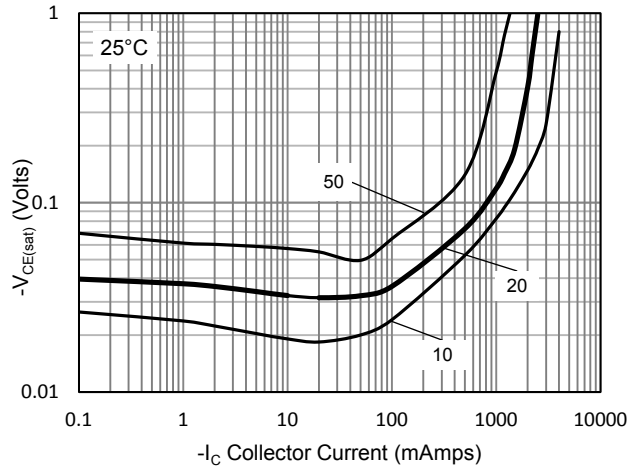

**$V_{CE}$ vs $I_E$**



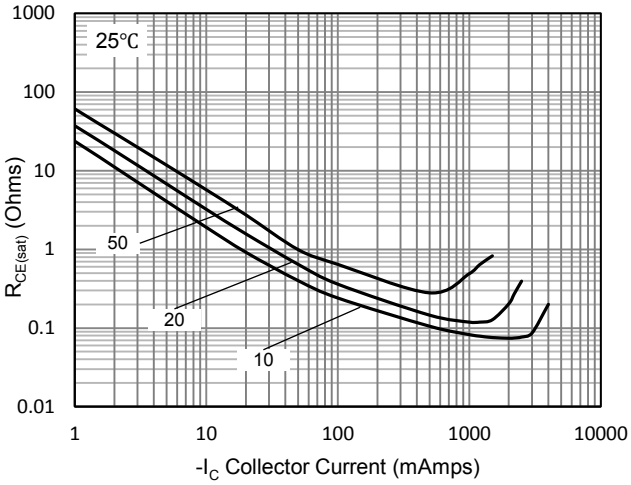

**$h_{FE}$ vs $I_C$**



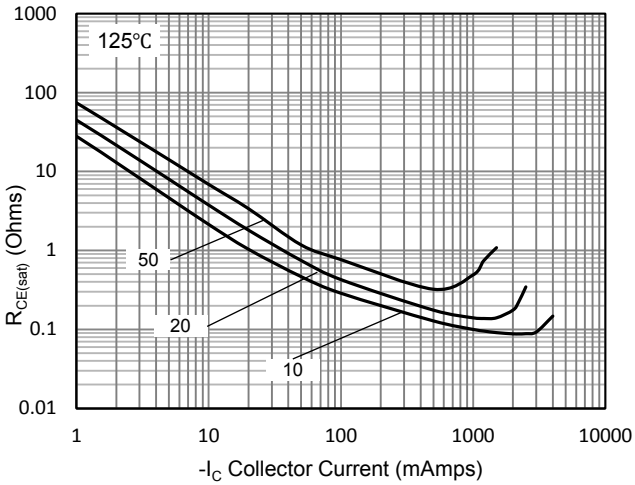

**$V_{CE(sat)}$ vs $I_C$**




**$V_{CE(sat)}$ vs $I_C$**

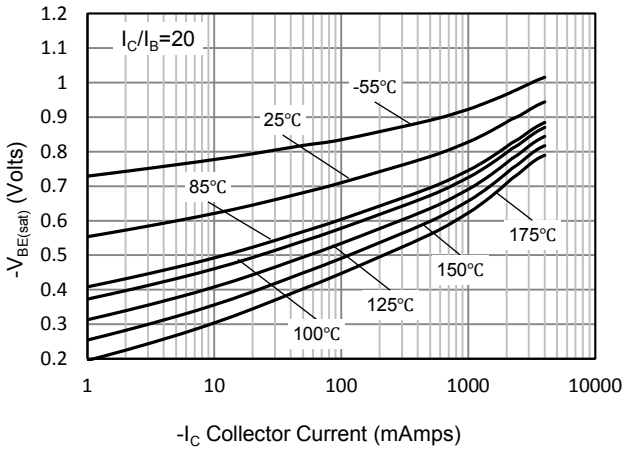



**$R_{CE(sat)}$ vs $I_C$**

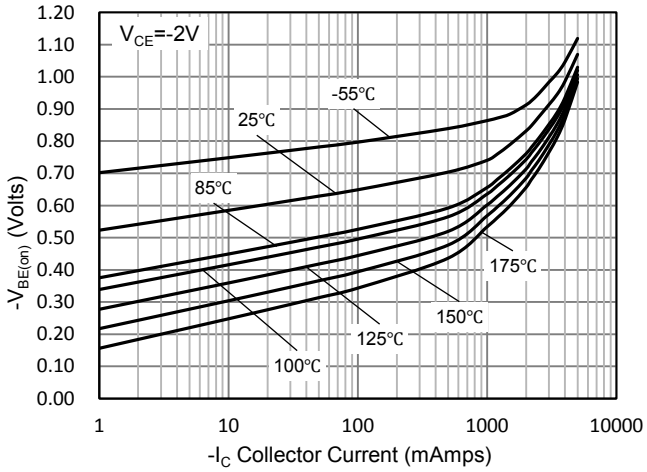



**$R_{CE(sat)}$ vs $I_C$**

## PNP Typical Electrical Characteristics (@ $T_A$ = +25°C, unless otherwise specified.) (continued)



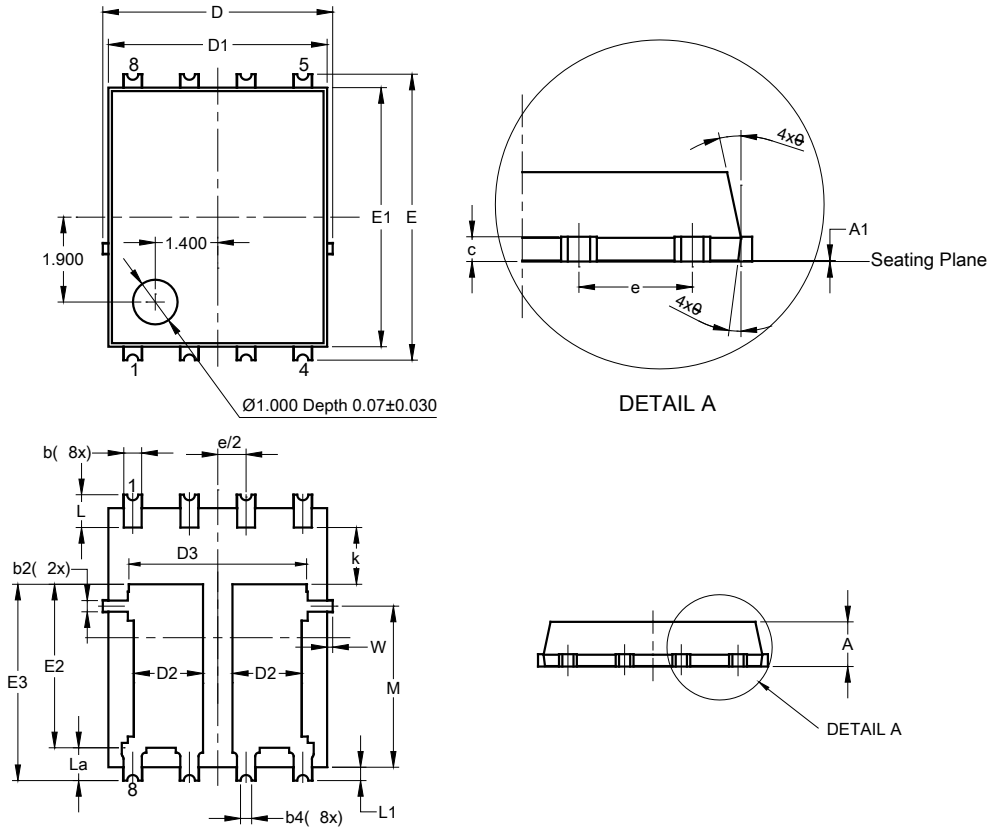

**$V_{BE(sat)}$ vs $I_C$**




**$V_{BE(on)}$ vs $I_C$**

## Package Outline Dimensions

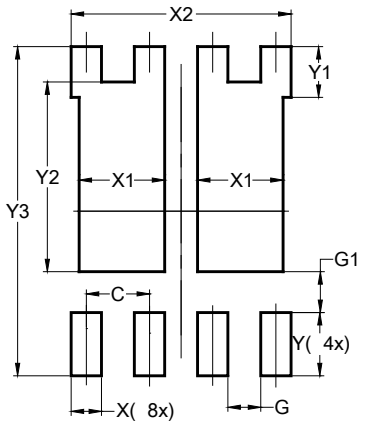
**PowerDI5060-8/SWP (Type UXD)**




| PowerDI5060-8/SWP (Type UXD) | | | |
|---|---|---|---|
| **Dim** | **Min** | **Max** | **Typ** |
| **A** | 0.90 | 1.10 | 1.00 |
| **A1** | 0.00 | 0.05 | -- |
| **b** | 0.30 | 0.50 | 0.41 |
| **b2** | 0.20 | 0.35 | 0.25 |
| **b4** | 0.25REF | | |
| **c** | 0.230 | 0.330 | 0.277 |
| **D** | 5.15 BSC | | |
| **D1** | 4.70 | 5.10 | 4.90 |
| **D2** | 1.46 | 1.66 | 1.55 |
| **D3** | 3.78 | 4.18 | 3.98 |
| **E** | 6.40 BSC | | |
| **E1** | 5.60 | 6.00 | 5.80 |
| **E2** | 3.46 | 3.86 | 3.66 |
| **E2a** | 4.195 | 4.595 | 4.395 |
| **e** | 1.27BSC | | |
| **k** | 1.05 | -- | -- |
| **L** | 0.635 | 0.835 | 0.735 |
| **La** | 0.635 | 0.835 | 0.735 |
| **L1** | 0.200 | 0.400 | 0.300 |
| **M** | 3.205 | 4.005 | 3.605 |
| **W** | 0.025 | 0.225 | 0.125 |
| **θ** | 10° | 12° | 11° |
| **θ1** | 6° | 8° | 7° |
| **All Dimensions in mm** | | | |

## Suggested Pad Layout

**PowerDI5060-8/SWP (Type UXD)**




| Dimensions | Value (in mm) |
|---|---|
| **C** | 1.270 |
| **G** | 0.660 |
| **G1** | 0.820 |
| **X** | 0.610 |
| **X1** | 1.720 |
| **X2** | 4.420 |
| **Y** | 1.270 |
| **Y1** | 1.020 |
| **Y2** | 3.810 |
| **Y3** | 6.610 |