



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

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Features

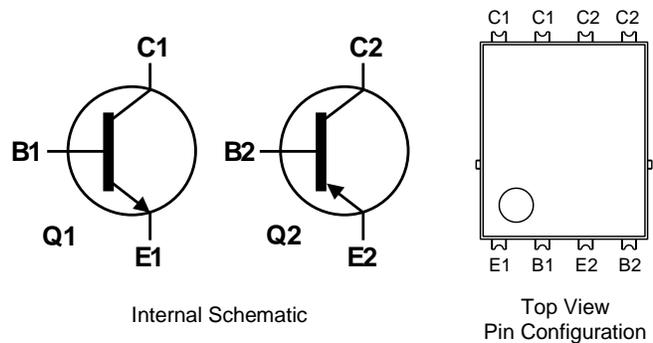
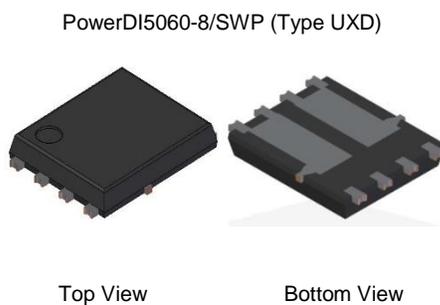
- NPN Transistor:
 - $BV_{CEO} > 100V$
 - $I_C = 3A$ Continuous Collector Current
 - $I_{CM} = 8A$ Peak Pulse Current
 - $R_{CE(sat)} = 90m\Omega$ (Typ)
- PNP Transistor
 - $BV_{CEO} > -100V$
 - $I_C = -3A$ Continuous Collector Current
 - $I_{CM} = -8A$ Peak Pulse Current
 - $R_{CE(sat)} = 110m\Omega$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

Mechanical Data

- Package: PowerDI5060-8/SWP (Type UXD)
- Package 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



NPN Absolute Maximum Ratings (@ $T_A = +25^\circ\text{C}$, 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 (@ $T_A = +25^\circ\text{C}$, 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 (@ $T_A = +25^\circ\text{C}$, unless otherwise specified.)

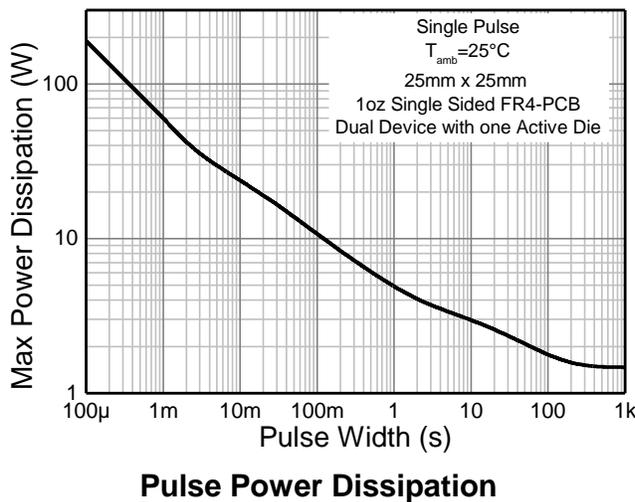
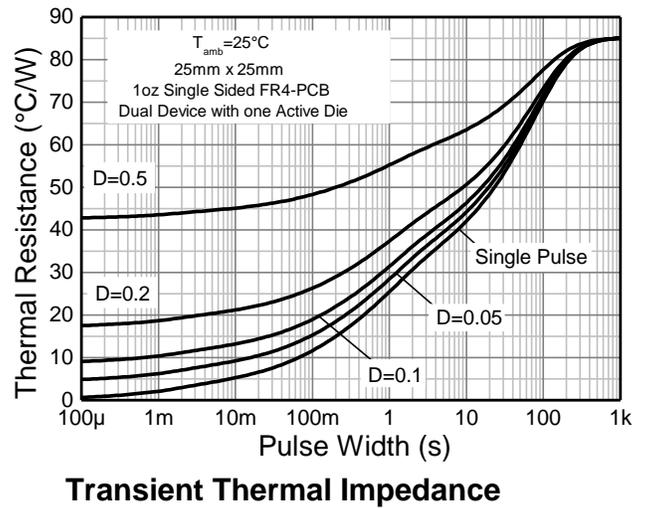
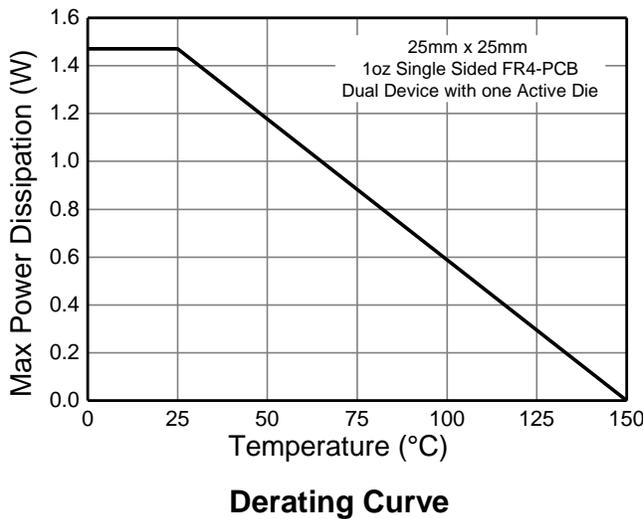
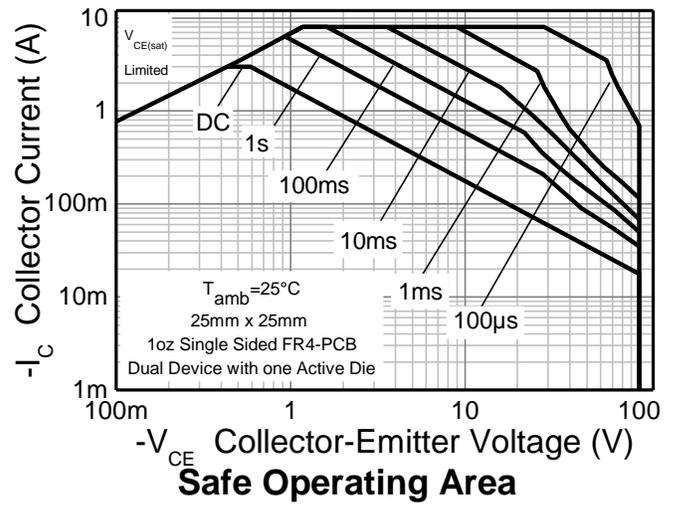
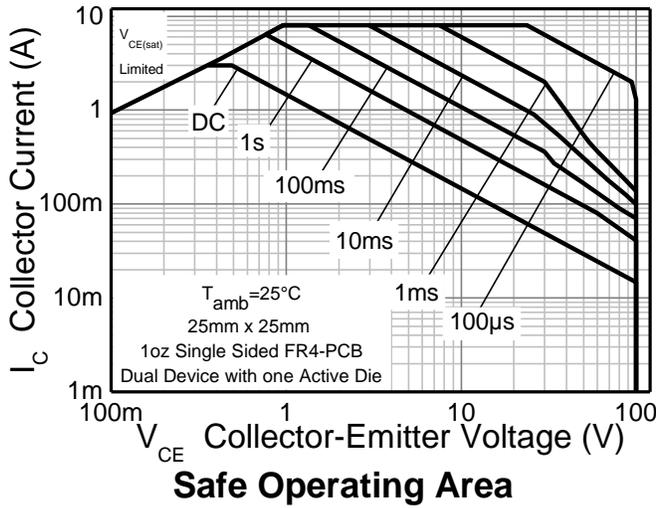
Characteristic	Symbol	Value	Unit
Power Dissipation	P_D	1.47	W
Linear Derating Factor		11.76	
Thermal Resistance, Junction to Ambient	$R_{\theta JA}$	85	$^\circ\text{C/W}$
		37	
Thermal Resistance, Junction to Lead	$R_{\theta JL}$	5.7	
Operating and Storage Temperature Range	T_J, T_{STG}	-55 to +150	

ESD Ratings (Note 9)

Characteristic	Symbol	Value	Unit	JEDEC Class
Electrostatic Discharge – Human Body Model	ESD HBM	4000	V	3A
Electrostatic Discharge – Charged Device Model	ESD CDM	1000	V	C3

- Notes:
- 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.
 - Same as Note 5, except the device is measured at $t \leq 5$ sec.
 - For a dual device with one active die.
 - Thermal resistance from junction to solder-point (at the end of the collector lead).
 - Refer to JEDEC specification JESD22-A114 and JESD22-A115.

Thermal Characteristics and Derating Information

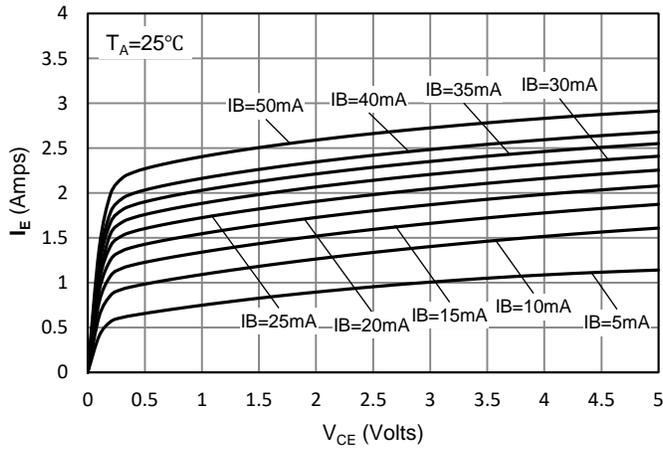


NPN Electrical Characteristics (@ $T_A = +25^\circ\text{C}$, unless otherwise specified.)

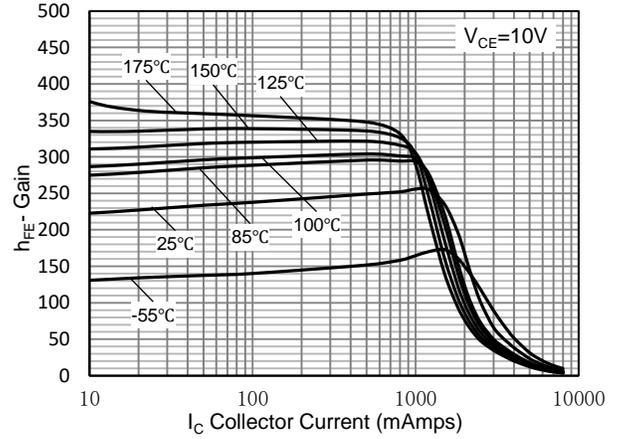
Characteristic	Symbol	Min	Typ	Max	Unit	Test Condition
OFF CHARACTERISTICS						
Collector-Base Breakdown Voltage	BV_{CBO}	100	—	—	V	$I_C = 100\mu\text{A}$
Collector-Emitter Breakdown Voltage (Note 10)	BV_{CEO}	100	—	—	V	$I_C = 10\text{mA}$
Emitter-Base Breakdown Voltage	BV_{EBO}	7	—	—	V	$I_E = 100\mu\text{A}$
Collector-Base Cutoff Current	I_{CBO}	—	—	100	nA	$V_{CB} = 80\text{V}$
		—	—	50	μA	$V_{CB} = 80\text{V}$ @ $T_j = 150^\circ\text{C}$
Emitter Cutoff Current	I_{EBO}	—	—	100	nA	$V_{EB} = 7\text{V}$
Collector-Emitter Cutoff Current	I_{CES}	—	—	100	nA	$V_{CES} = 80\text{V}$
ON CHARACTERISTICS (Note 10)						
DC Current Gain	h_{FE}	150	250	—	—	$I_C = 500\text{mA}$, $V_{CE} = 10\text{V}$
		80	250	—		$I_C = 1\text{A}$, $V_{CE} = 10\text{V}$
		20	100	—		$I_C = 2\text{A}$, $V_{CE} = 10\text{V}$
		10	40	—		$I_C = 3\text{A}$, $V_{CE} = 10\text{V}$
Collector-Emitter Saturation Voltage	$V_{CE(sat)}$	—	90	150	mV	$I_C = 1\text{A}$, $I_B = 50\text{mA}$
		—	225	330	mV	$I_C = 3\text{A}$, $I_B = 300\text{mA}$
Collector-Emitter Saturation Resistance	$R_{CE(sat)}$	—	90	150	m Ω	$I_C = 1\text{A}$, $I_B = 50\text{mA}$
Base-Emitter Saturation Voltage	$V_{BE(sat)}$	—	0.86	1.0	V	$I_C = 1\text{A}$, $I_B = 50\text{mA}$
		—	1.0	1.2		$I_C = 2\text{A}$, $I_B = 200\text{mA}$
Base-Emitter Turn-On Voltage	$V_{BE(on)}$	—	0.67	0.85	V	$I_C = 0.1\text{A}$, $V_{CE} = 2\text{V}$
SMALL SIGNAL CHARACTERISTICS						
Current Gain-Bandwidth Product	f_T	—	130	—	MHz	$V_{CE} = 10\text{V}$, $I_C = 100\text{mA}$, $f = 100\text{MHz}$
Output Capacitance	C_{obo}	—	11	—	pF	$V_{CB} = 10\text{V}$, $f = 1\text{MHz}$
Delay Time	t_d	—	40	—	ns	$V_{CC} = 12.5\text{V}$, $I_C = 1\text{A}$ $I_{B1} = -I_{B2} = 0.05\text{A}$
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 $\leq 300\mu\text{s}$. Duty cycle $\leq 2\%$.

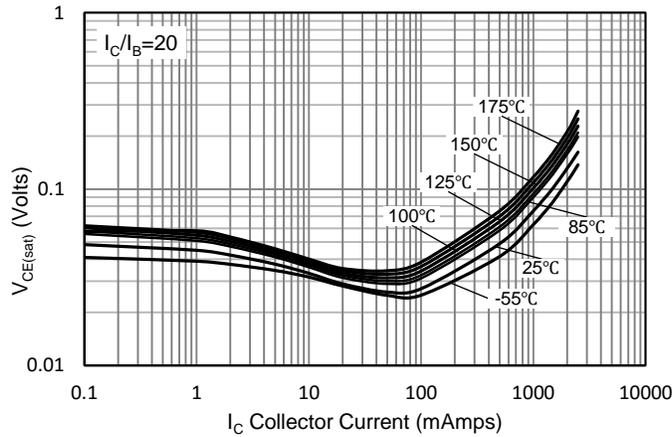
NPN Typical Electrical Characteristics (@ $T_A = +25^\circ\text{C}$, unless otherwise specified.)



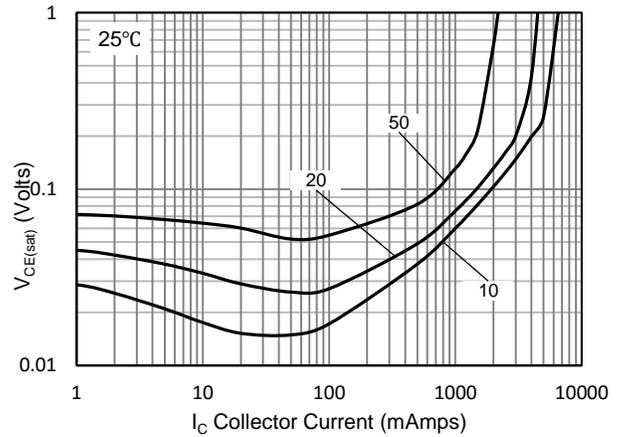
V_{CE} vs I_E



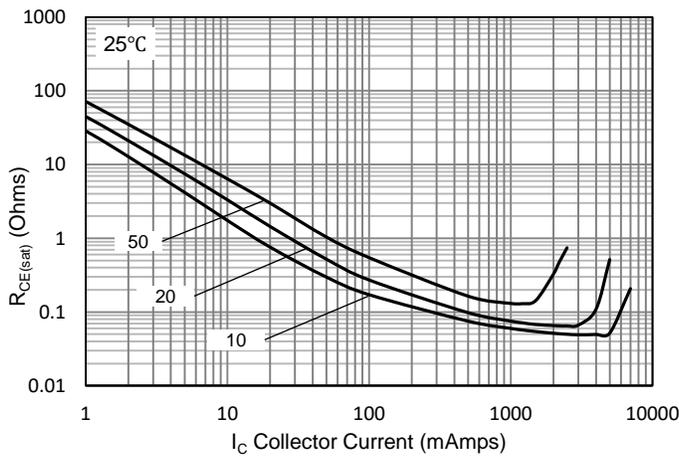
h_{FE} vs I_C



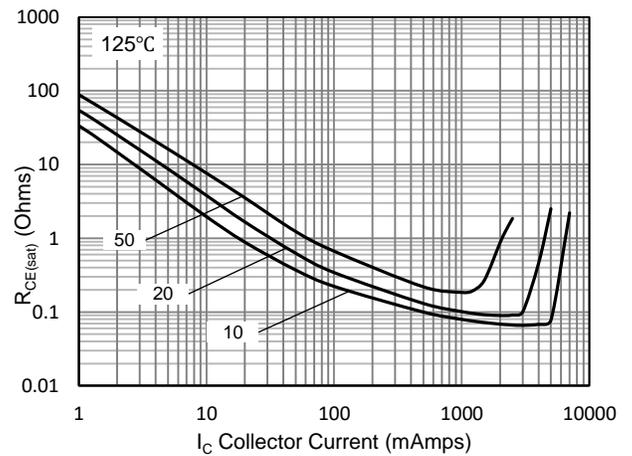
$V_{CE(sat)}$ vs I_C



$V_{CE(sat)}$ vs I_C

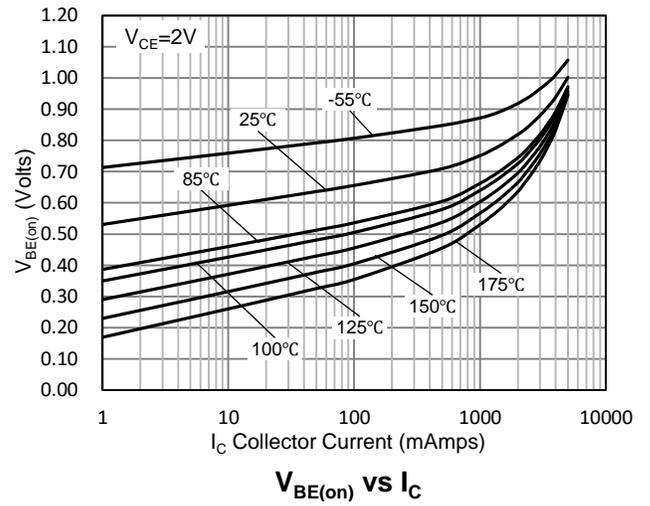
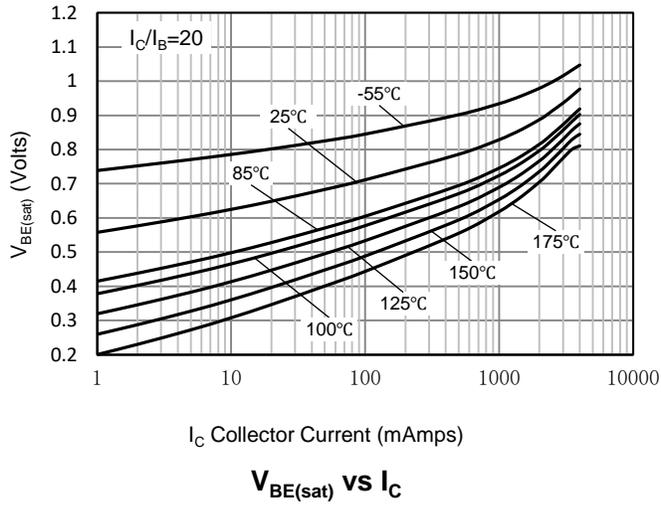


$R_{CE(sat)}$ vs I_C



$R_{CE(sat)}$ vs I_C

NPN Typical Electrical Characteristics (@ $T_A = +25^\circ\text{C}$, unless otherwise specified.) (continued)

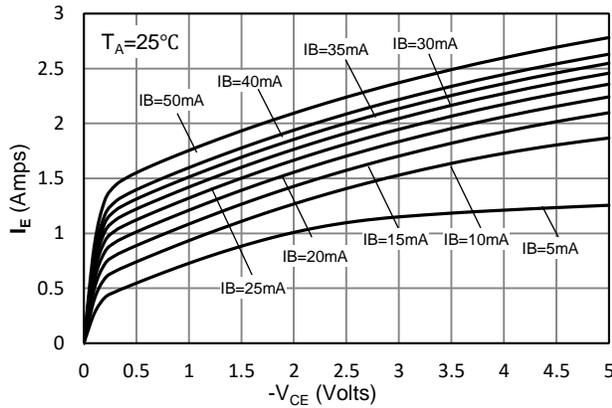


PNP Electrical Characteristics (@ $T_A = +25^\circ\text{C}$, unless otherwise specified.)

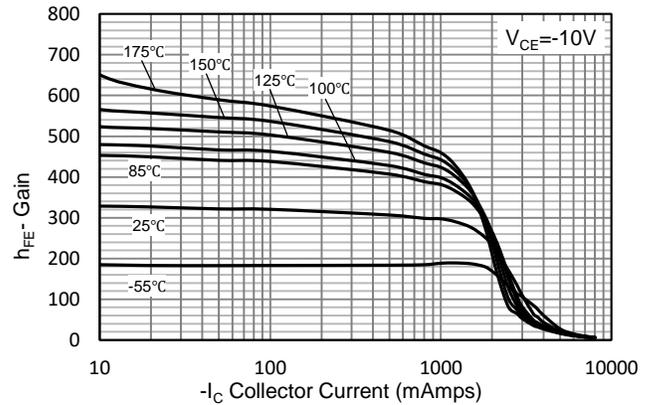
Characteristic	Symbol	Min	Typ	Max	Unit	Test Condition
OFF CHARACTERISTICS						
Collector-Base Breakdown Voltage	BV_{CBO}	-100	—	—	V	$I_C = -100\mu\text{A}$
Collector-Emitter Breakdown Voltage (Note 10)	BV_{CEO}	-100	—	—	V	$I_C = -10\text{mA}$
Emitter-Base Breakdown Voltage	BV_{EBO}	-7	—	—	V	$I_E = -100\mu\text{A}$
Collector-Base Cutoff Current	I_{CBO}	—	—	-100	nA	$V_{CB} = -80\text{V}$
		—	—	-50	μA	$V_{CB} = -80\text{V}$ @ $T_J = 150^\circ\text{C}$
Emitter Cutoff Current	I_{EBO}	—	—	-100	nA	$V_{EB} = -7\text{V}$
Collector-Emitter Cutoff Current	I_{CES}	—	—	-100	nA	$V_{CES} = -80\text{V}$
ON CHARACTERISTICS (Note 10)						
DC Current Gain	h_{FE}	170	305	—	—	$I_C = -500\text{mA}$, $V_{CE} = -10\text{V}$
		160	275	—		$I_C = -1\text{A}$, $V_{CE} = -10\text{V}$
		45	90	—		$I_C = -2\text{A}$, $V_{CE} = -10\text{V}$
		10	20	—		$I_C = -3\text{A}$, $V_{CE} = -10\text{V}$
Collector-Emitter Saturation Voltage	$V_{CE(sat)}$	—	-70	-110	mV	$I_C = -0.5\text{A}$, $I_B = -50\text{mA}$
		—	-220	-325		$I_C = -2\text{A}$, $I_B = -200\text{mA}$
Collector-Emitter Saturation Resistance	$R_{CE(sat)}$	—	110	180	m Ω	$I_C = -2\text{A}$, $I_B = -200\text{mA}$
Base-Emitter Saturation Voltage	$V_{BE(sat)}$	—	-0.91	-1	V	$I_C = -1\text{A}$, $I_B = -50\text{mA}$
		—	-1.02	-1.2		$I_C = -2\text{A}$, $I_B = -200\text{mA}$
Base-Emitter Turn-On Voltage	$V_{BE(on)}$	—	-0.68	-0.9	V	$I_C = -0.1\text{A}$, $V_{CE} = -2\text{V}$
SMALL SIGNAL CHARACTERISTICS						
Current Gain-Bandwidth Product	f_T	—	100	—	MHz	$V_{CE} = -10\text{V}$, $I_C = -100\text{mA}$, $f = 100\text{MHz}$
Output Capacitance	C_{obo}	—	30	—	pF	$V_{CB} = -10\text{V}$, $f = -1\text{MHz}$
Delay Time	t_d	—	30	—	ns	$V_{CC} = -12.5\text{V}$, $I_C = -1\text{A}$ $I_{B1} = -I_{B2} = -50\text{mA}$
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 $\leq 300\mu\text{s}$. Duty cycle $\leq 2\%$.

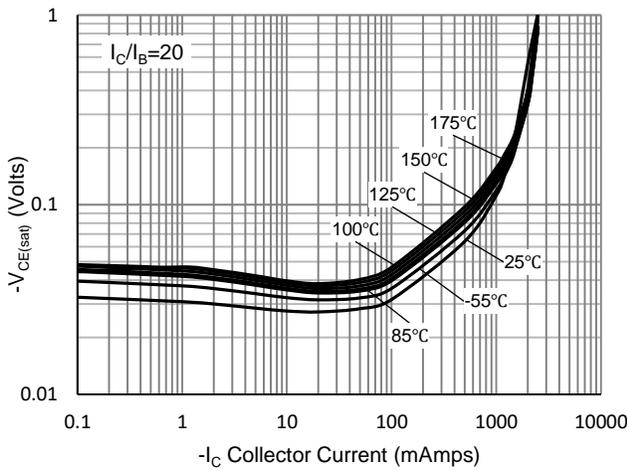
PNP Typical Electrical Characteristics (@ $T_A = +25^\circ\text{C}$, unless otherwise specified.)



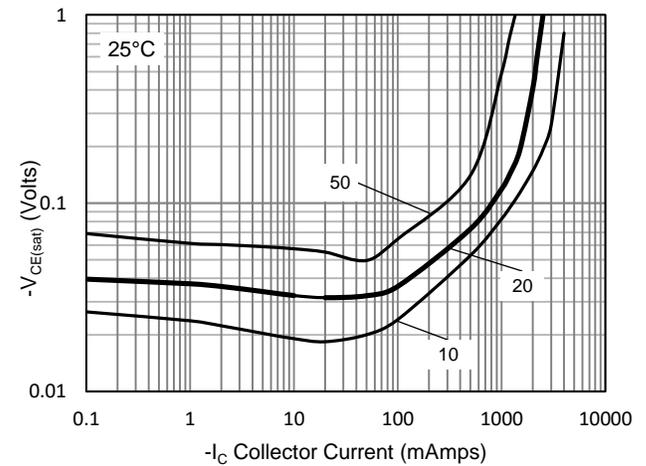
V_{CE} vs I_E



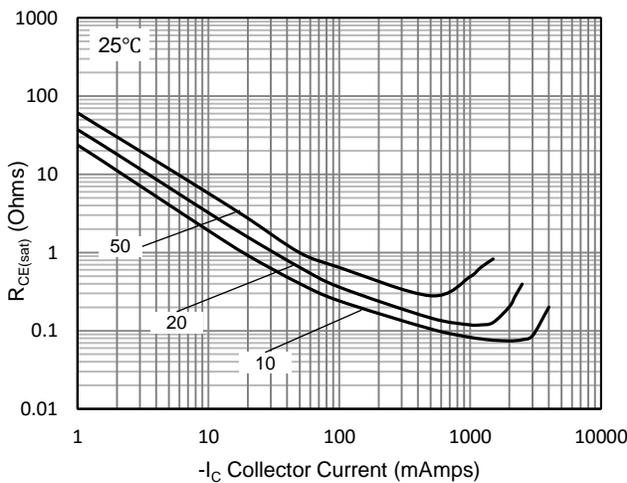
h_{FE} vs I_C



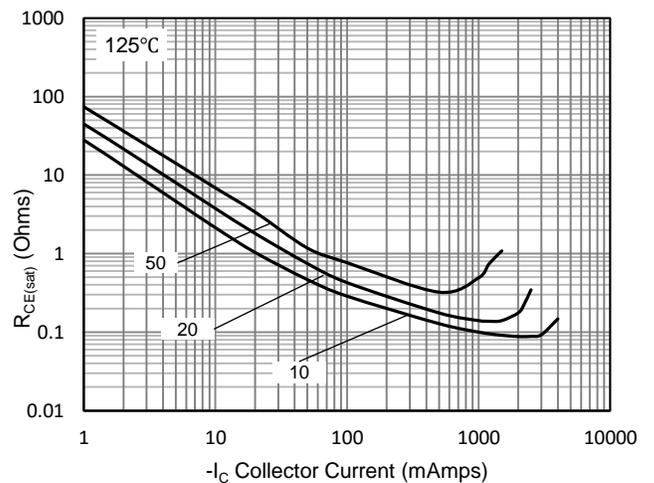
$V_{CE(sat)}$ vs I_C



$V_{CE(sat)}$ vs I_C

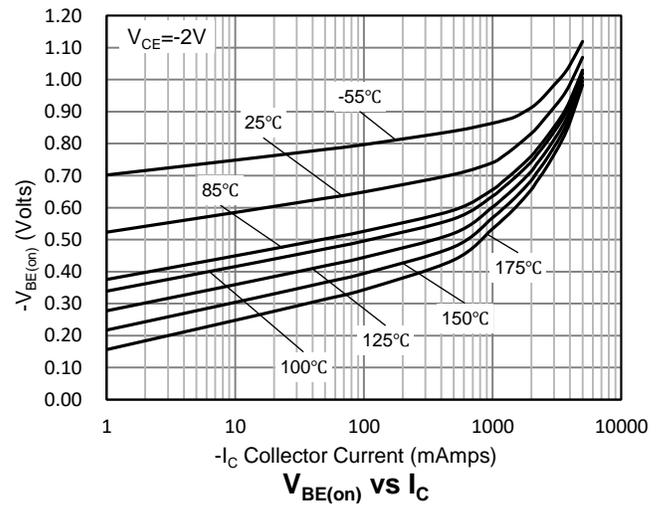
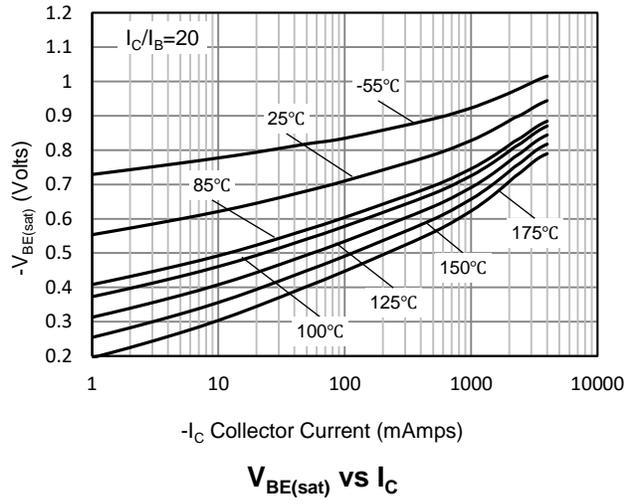


$R_{CE(sat)}$ vs I_C

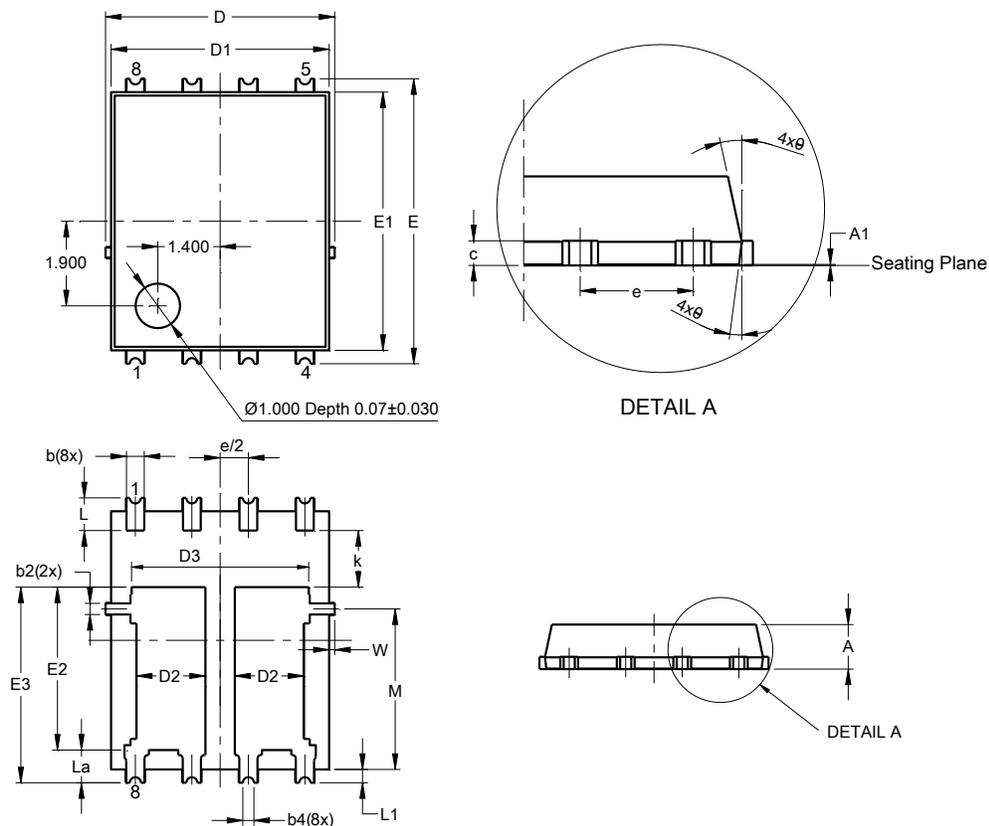


$R_{CE(sat)}$ vs I_C

PNP Typical Electrical Characteristics (@ $T_A = +25^\circ\text{C}$, unless otherwise specified.) (continued)

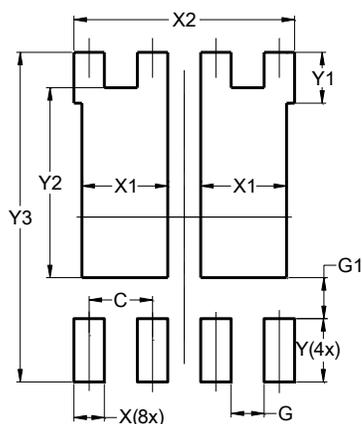


Package Outline Dimensions

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°
$\theta 1$	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