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FAIRCHILD

May 2015

FDPC5030SG

PowerTrench® Power Clip
30V Asymmetric Dual N-Channel MOSFET

Features

Q1: N-Channel

- Max $r_{DS(on)}$ = 5.0 mΩ at V_{GS} = 10 V, I_D = 17 A
- Max $r_{DS(on)}$ = 6.5 mΩ at V_{GS} = 4.5 V, I_D = 14 A

Q2: N-Channel

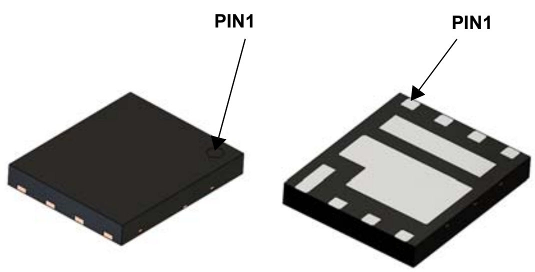
- Max $r_{DS(on)}$ = 2.4 mΩ at V_{GS} = 10 V, I_D = 25 A
- Max $r_{DS(on)}$ = 3.0 mΩ at V_{GS} = 4.5 V, I_D = 22 A
- Low Inductance Packaging Shortens Rise/Fall Times, Resulting in Lower Switching Losses
- MOSFET Integration Enables Optimum Layout for Lower Circuit Inductance and Reduced Switch Node Ringing
- RoHS Compliant

General Description

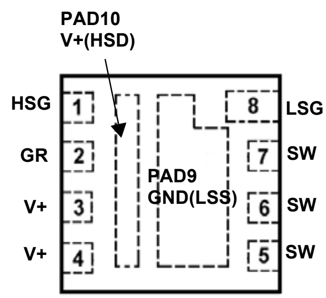
This device includes two specialized N-Channel MOSFETs in a dual package. The switch node has been internally connected to enable easy placement and routing of synchronous buck converters. The control MOSFET (Q1) and synchronous SyncFET™ (Q2) have been designed to provide optimal power efficiency.

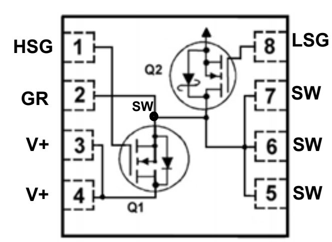
Applications

- Computing
- Communications
- General Purpose Point of Load



Top Power Clip 5X6 Bottom





Pin	Name	Description	Pin	Name	Description	Pin	Name	Description
1	HSG	High Side Gate	3,4,10	V+(HSD)	High Side Drain	8	LSG	Low Side Gate
2	GR	Gate Return	5,6,7	SW	Switching Node, Low Side Drain	9	GND(LSS)	Low Side Source

MOSFET Maximum Ratings T_A = 25 °C unless otherwise noted.

Symbol	Parameter		Q1	Q2	Units
V_{DS}	Drain to Source Voltage		30	30	V
V_{GS}	Gate to Source Voltage		±20	±12	V
I_D	Drain Current -Continuous	T_C = 25 °C (Note 5)	56	84	A
	-Continuous	T_C = 100 °C (Note 5)	35	53	
	-Continuous	T_A = 25 °C	17 Note 1a	25 Note 1b	
	-Pulsed	T_A = 25 °C (Note 4)	227	503	
E_{AS}	Single Pulse Avalanche Energy	(Note 3)	54	96	mJ
P_D	Power Dissipation for Single Operation	T_C = 25 °C	23	25	W
	Power Dissipation for Single Operation	T_A = 25 °C	2.1 Note 1a	2.3 Note 1b	
	Power Dissipation for Single Operation	T_A = 25 °C	1.0 Note 1c	1.1 Note 1d	
T_J, T_{STG}	Operating and Storage Junction Temperature Range		-55 to +150		°C

Thermal Characteristics

$R_{\theta JC}$	Thermal Resistance, Junction to Case	5.6	4.9	°C/W
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient	60 Note 1a	55 Note 1b	
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient	130 Note 1c	120 Note 1d	

Package Marking and Ordering Information

Device Marking	Device	Package	Reel Size	Tape Width	Quantity
FDPC5030SG	FDPC5030SG	Power Clip 56	13 ”	12 mm	3000 units

Electrical Characteristics T_J = 25 °C unless otherwise noted.

Symbol	Parameter	Test Conditions	Type	Min	Typ	Max	Units
Off Characteristics							
BV_{DSS}	Drain to Source Breakdown Voltage	I_D = 250 μA, V_{GS} = 0 V I_D = 1 mA, V_{GS} = 0 V	Q1 Q2	30 30			V
$\frac{\Delta BV_{DSS}}{\Delta T_J}$	Breakdown Voltage Temperature Coefficient	I_D = 250 μA, referenced to 25 °C I_D = 10 mA, referenced to 25 °C	Q1 Q2		15 16		mV/°C
I_{DSS}	Zero Gate Voltage Drain Current	V_{DS} = 24 V, V_{GS} = 0 V V_{DS} = 24 V, V_{GS} = 0 V	Q1 Q2			1 500	μA μA
I_{GSS}	Gate to Source Leakage Current, Forward	V_{GS} = 20 V, V_{DS}= 0 V V_{GS} = 12 V, V_{DS}= 0 V	Q1 Q2			100 100	nA nA
On Characteristics							
$V_{GS(th)}$	Gate to Source Threshold Voltage	V_{GS} = V_{DS}, I_D = 250 μA V_{GS} = V_{DS}, I_D = 1 mA	Q1 Q2	1.0 1.0	1.7 1.6	3.0 3.0	V
$\frac{\Delta V_{GS(th)}}{\Delta T_J}$	Gate to Source Threshold Voltage Temperature Coefficient	I_D = 250 μA, referenced to 25 °C I_D = 10 mA, referenced to 25 °C	Q1 Q2		-5 -3		mV/°C
$r_{DS(on)}$	Drain to Source On Resistance	V_{GS} = 10V, I_D = 17 A V_{GS} = 4.5 V, I_D = 14 A V_{GS} = 10 V, I_D = 17 A, T_J =125 °C	Q1		4.1 5.4 5.7	5.0 6.5 7.0	mΩ
		V_{GS} = 10V, I_D = 25 A V_{GS} = 4.5 V, I_D = 22 A V_{GS} = 10 V, I_D = 25 A, T_J =125 °C	Q2		1.9 2.4 2.7	2.4 3.0 3.4	
g_{FS}	Forward Transconductance	V_{DS} = 5 V, I_D = 17 A V_{DS} = 5 V, I_D = 25 A	Q1 Q2		93 139		S
Dynamic Characteristics							
C_{iss}	Input Capacitance	Q1: V_{DS} = 15 V, V_{GS} = 0 V, f = 1 MHZ Q2: V_{DS} = 15 V, V_{GS} = 0 V, f = 1 MHZ	Q1 Q2		1224 2730	1715 3825	pF
C_{oss}	Output Capacitance		Q1 Q2		397 801	560 1125	pF
C_{rss}	Reverse Transfer Capacitance		Q1 Q2		42 72	60 100	pF
R_g	Gate Resistance		Q1 Q2	0.1 0.1	0.5 1.1	1.5 2.2	Ω
Switching Characteristics							
$t_{d(on)}$	Turn-On Delay Time	Q1: V_{DD} = 15 V, I_D = 17 A, R_{GEN} = 6 Ω Q2: V_{DD} = 15 V, I_D = 25 A, R_{GEN} = 6 Ω	Q1 Q2		8 10	16 19	ns
t_r	Rise Time		Q1 Q2		2 4	10 10	ns
$t_{d(off)}$	Turn-Off Delay Time		Q1 Q2		18 30	33 48	ns
t_f	Fall Time		Q1 Q2		2 3	10 10	ns
Q_g	Total Gate Charge	V_{GS} = 0 V to 10 V; Q1 V_{DD} = 15 V, I_D = 17 A; Q2 V_{DD} = 15 V, I_D = 25 A	Q1 Q2		17 39	24 55	nC
Q_g	Total Gate Charge	V_{GS} = 0 V to 4.5 V	Q1 Q2		8 18	11 26	nC
Q_{gs}	Gate to Source Gate Charge		Q1 Q2		3.1 6.1		nC
Q_{gd}	Gate to Drain “Miller” Charge		Q1 Q2		2.0 4.3		nC

Electrical Characteristics T_J = 25 °C unless otherwise noted.

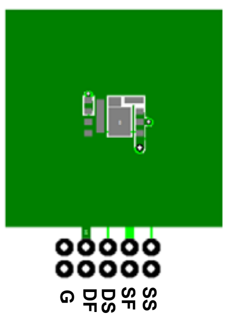
Symbol	Parameter	Test Conditions	Type	Min	Typ	Max	Units

Drain-Source Diode Characteristics

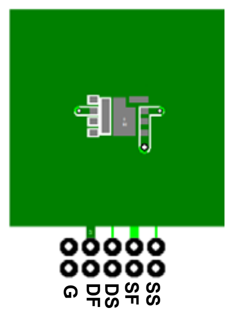
Symbol	Parameter	Test Conditions	Type	Min	Typ	Max	Units
V_{SD}	Source to Drain Diode Forward Voltage	V_{GS} = 0 V, I_S = 17 A (Note 2) V_{GS} = 0 V, I_S = 25 A (Note 2)	Q1 Q2		0.8 0.8	1.2 1.2	V
t_{rr}	Reverse Recovery Time	Q1 I_F = 17 A, di/dt = 100 A/µs Q2 I_F = 25 A, di/dt = 230 A/µs	Q1 Q2		23 27	37 44	ns
Q_{rr}	Reverse Recovery Charge		Q1 Q2		8 31	16 50	nC

Notes:

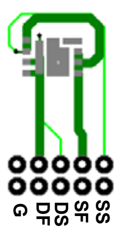
1.$R_{\theta JA}$ is determined with the device mounted on a 1 in^2 pad 2 oz copper pad on a 1.5 x 1.5 in. board of FR-4 material, $R_{\theta CA}$ is determined by the user's board design.



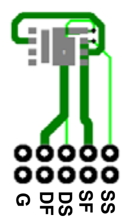
a. 60 °C/W when mounted on a 1 in^2 pad of 2 oz copper



b. 55 °C/W when mounted on a 1 in^2 pad of 2 oz copper



c. 130 °C/W when mounted on a minimum pad of 2 oz copper



d. 120 °C/W when mounted on a minimum pad of 2 oz copper

2 Pulse Test: Pulse Width < 300 µs, Duty cycle < 2.0%.

3. Q1 :E_{AS} of 54 mJ is based on starting T_J = 25 ^oC; L = 3 mH, I_{AS} = 6 A, V_{DD} = 30 V, V_{GS} = 10 V. 100% tested at L = 0.1 mH, I_{AS} =20 A.
   Q2: E_{AS} of 96 mJ is based on starting T_J = 25 ^oC; L = 3 mH, I_{AS} = 8 A, V_{DD} = 30 V, V_{GS} = 10 V. 100% tested at L = 0.1 mH, I_{AS} =27 A.

4. Pulsed Id refer to Fig.11 and Fig.24 SOA curve for more details.

5. Computed continuous current limited to Max Junction Temperature only, actual continuous current will be limited by thermal & electro-mechanical application board design.

Typical Characteristics (Q1 N-Channel) T_J = 25°C unless otherwise noted.

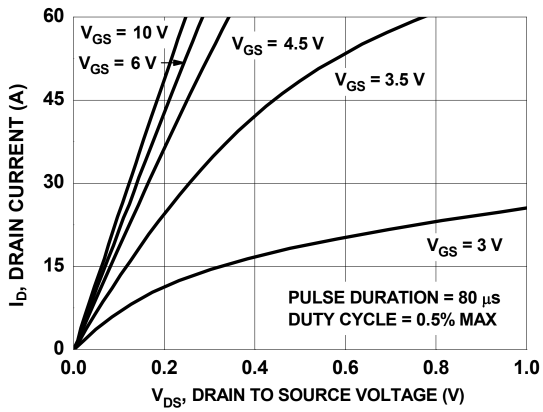


Figure 1. On Region Characteristics

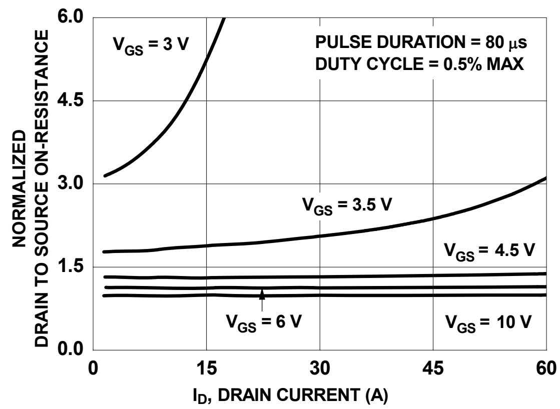


Figure 2. Normalized On-Resistance vs. Drain Current and Gate Voltage

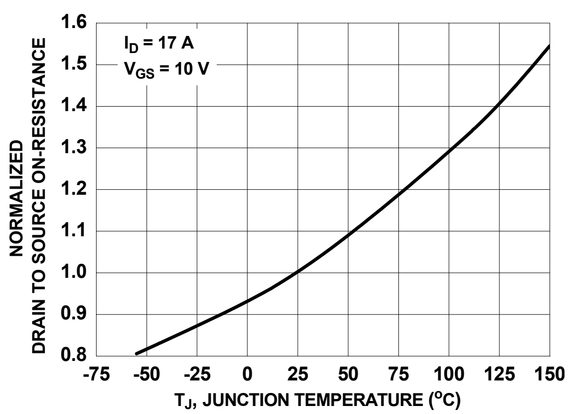


Figure 3. Normalized On Resistance vs. Junction Temperature

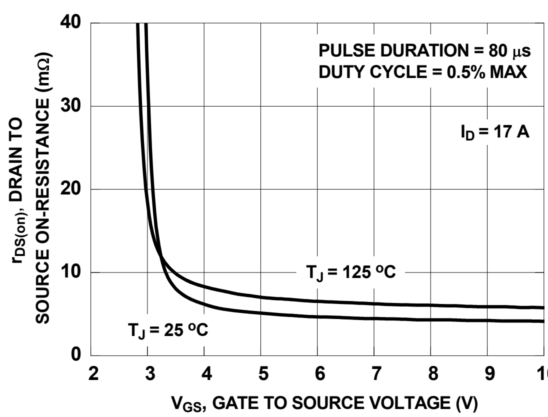


Figure 4. On-Resistance vs. Gate to Source Voltage

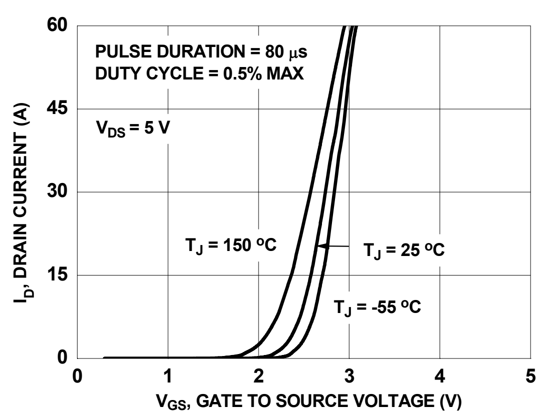


Figure 5. Transfer Characteristics

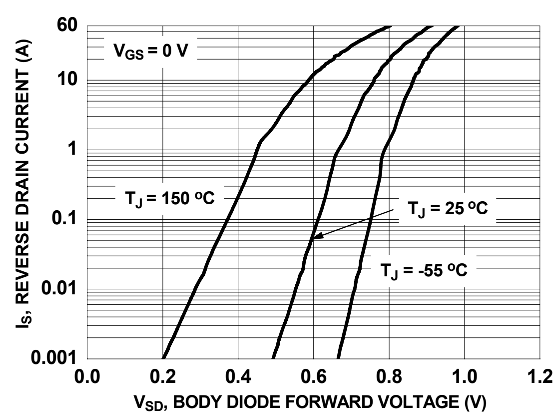


Figure 6. Source to Drain Diode Forward Voltage vs. Source Current

Typical Characteristics (Q1 N-Channel) T_J = 25°C unless otherwise noted.

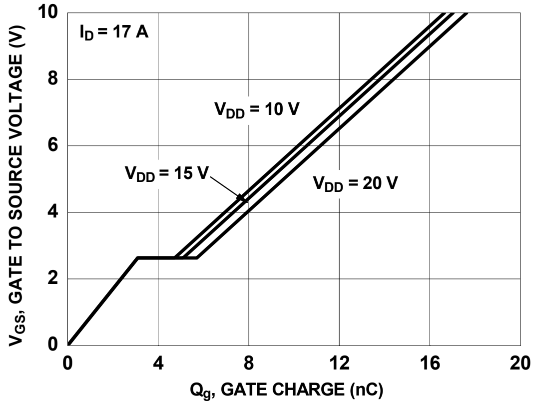


Figure 7. Gate Charge Characteristics

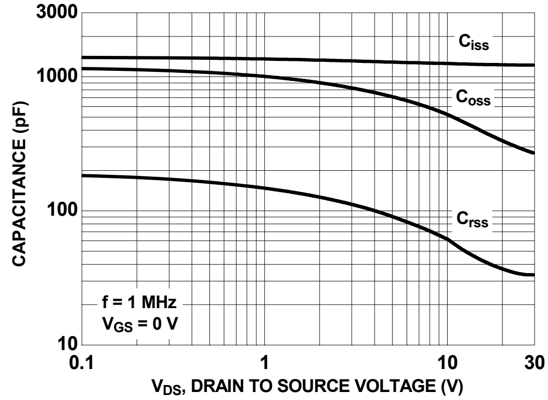


Figure 8. Capacitance vs. Drain to Source Voltage

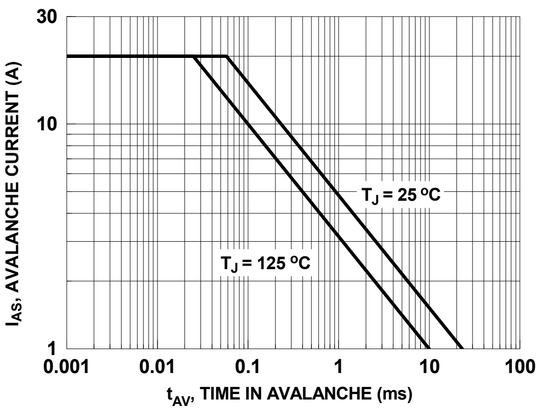


Figure 9. Unclamped Inductive Switching Capability

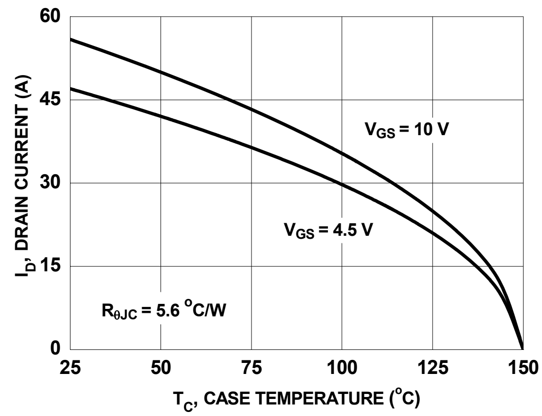


Figure 10. Maximum Continuous Drain Current vs. Case Temperature

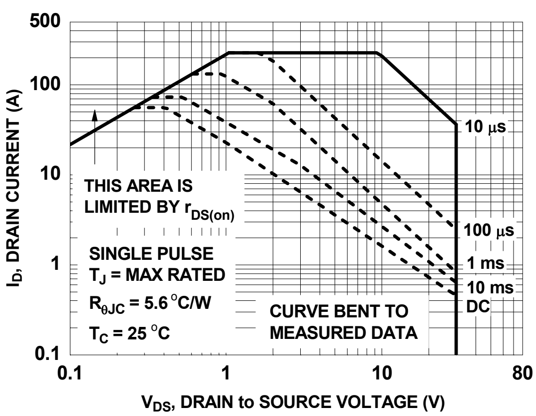


Figure 11. Forward Bias Safe Operating Area

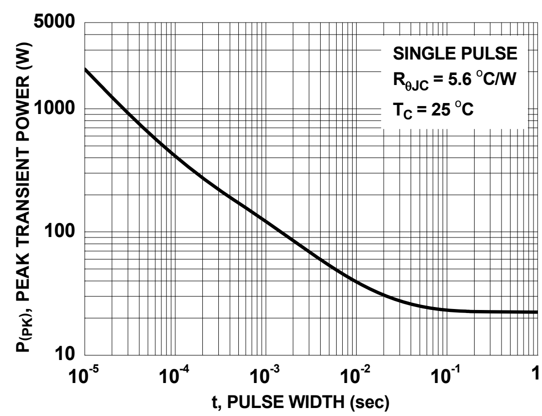


Figure 12. Single Pulse Maximum Power Dissipation

Typical Characteristics (Q1 N-Channel) T_J = 25°C unless otherwise noted.

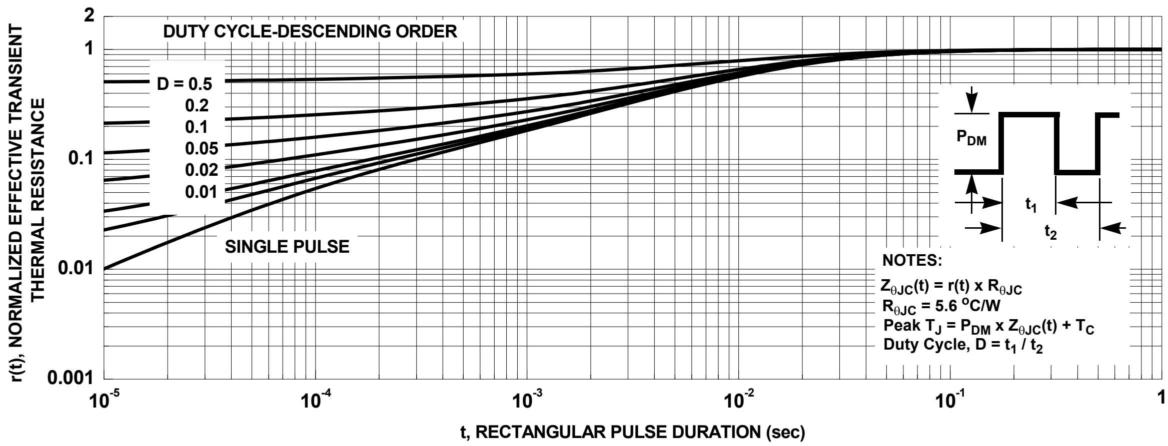


Figure 13. Junction-to-Case Transient Thermal Response Curve

Typical Characteristics (Q2 N-Channel) T_J = 25 °C unless otherwise noted.

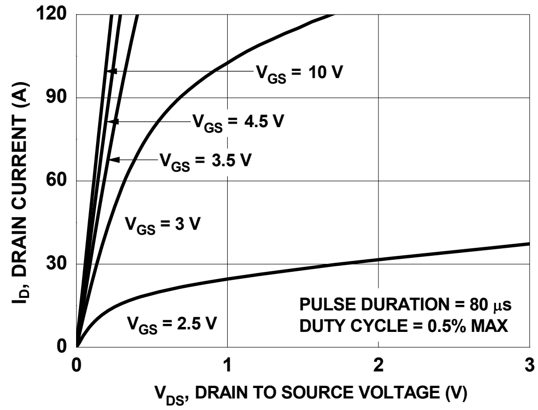


Figure 14. On- Region Characteristics

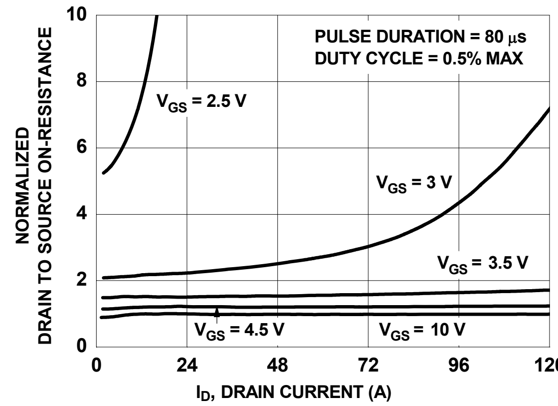


Figure 15. Normalized on-Resistance vs. Drain Current and Gate Voltage

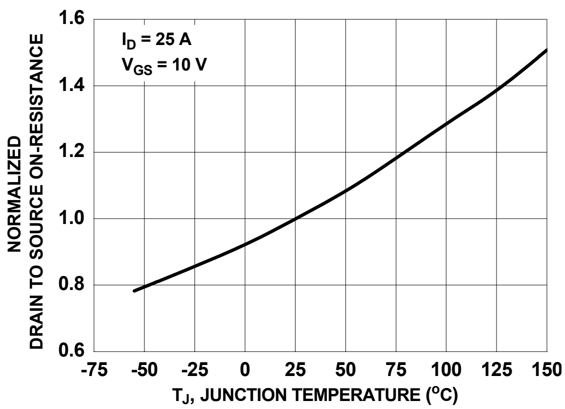


Figure 16. Normalized On-Resistance vs. Junction Temperature

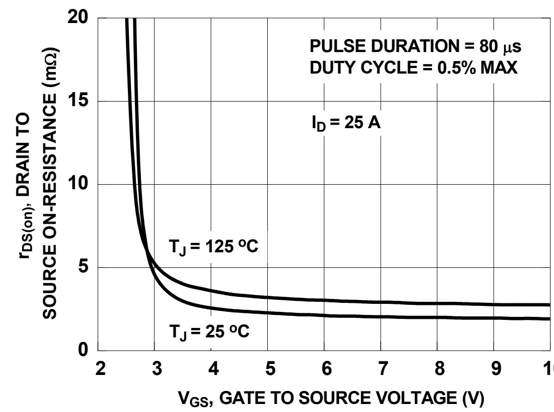


Figure 17. On-Resistance vs. Gate to Source Voltage

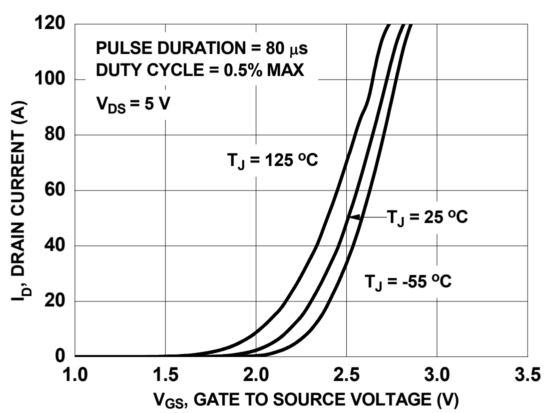


Figure 18. Transfer Characteristics

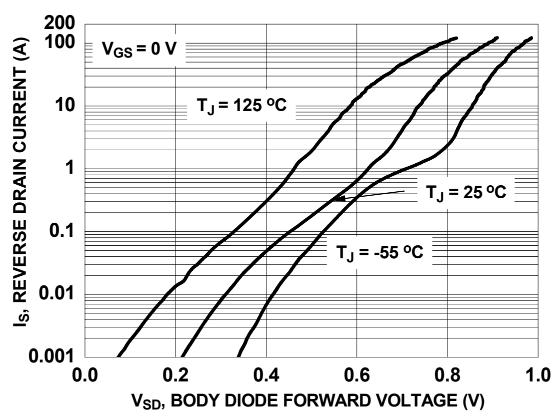


Figure 19. Source to Drain Diode Forward Voltage vs. Source Current

Typical Characteristics (Q2 N-Channel) T_J = 25°C unless otherwise noted.

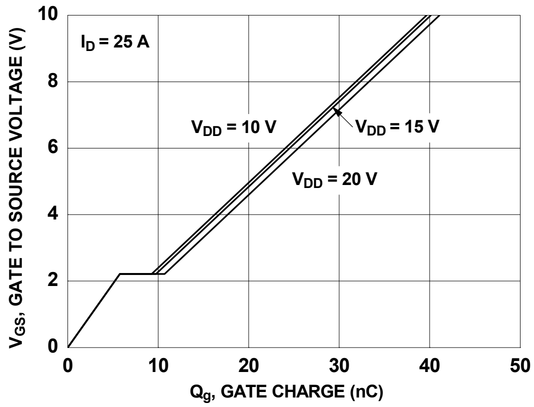


Figure 20. Gate Charge Characteristics

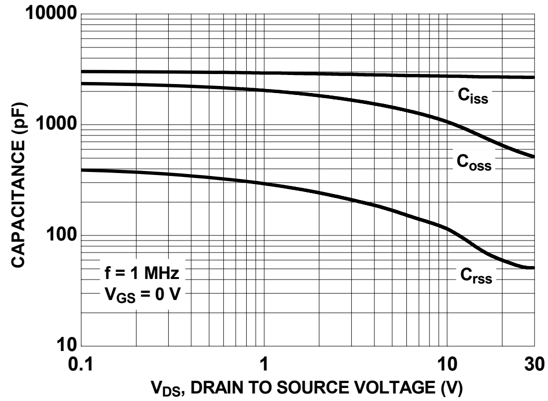


Figure 21. Capacitance vs. Drain to Source Voltage

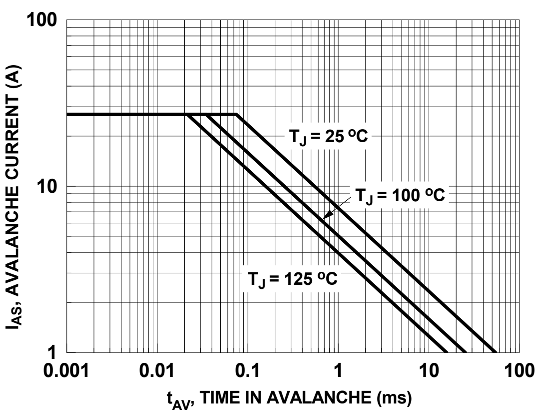


Figure 22. Unclamped Inductive Switching Capability

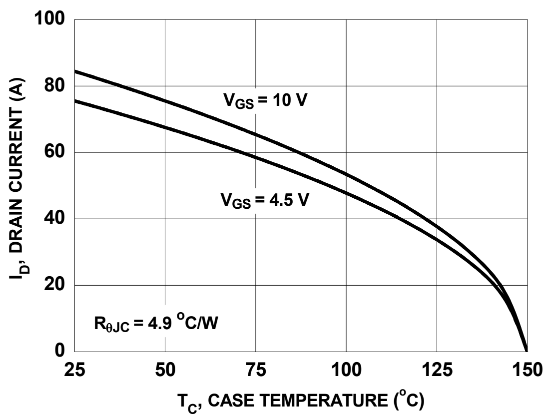


Figure 23. Maximum Continuous Drain Current vs. Case Temperature

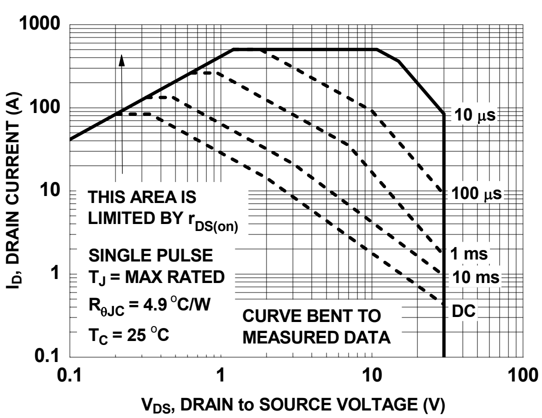


Figure 24. Forward Bias Safe Operating Area

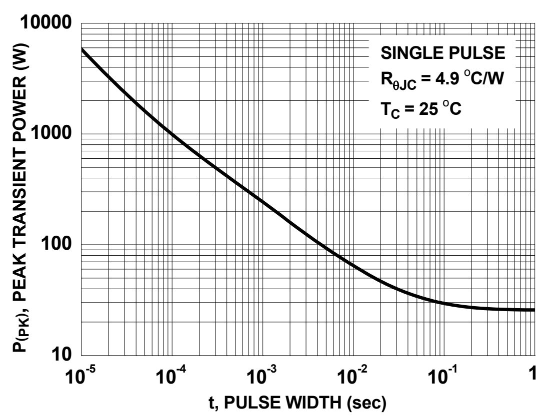


Figure 25. Single Pulse Maximum Power Dissipation

Typical Characteristics (Q2 N-Channel) T_J = 25 °C unless otherwise noted.

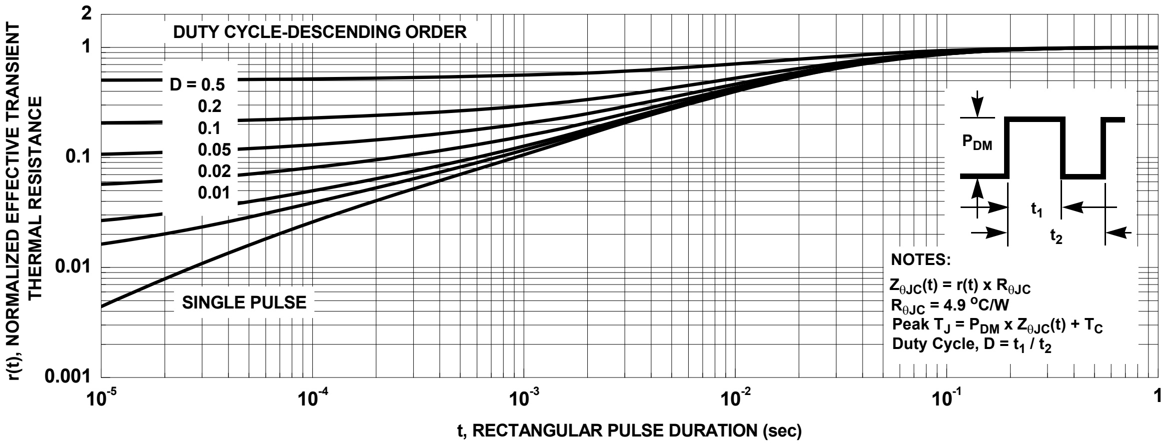


Figure 26. Junction-to-Case Transient Thermal Response Curve

Typical Characteristics (continued)

SyncFET^{TM} Schottky Body Diode Characteristics

Fairchild's SyncFET^{TM} process embeds a Schottky diode in parallel with PowerTrench® MOSFET. This diode exhibits similar characteristics to a discrete external Schottky diode in parallel with a MOSFET. Figure 27 shows the reverse recovery characteristic of the FDPC5030SG.

Schottky barrier diodes exhibit significant leakage at high temperature and high reverse voltage. This will increase the power in the device.

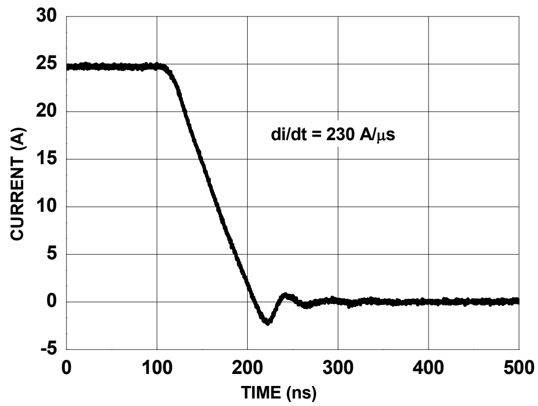


Figure 27. FDPC5030SG SyncFET^{TM} Body Diode Reverse Recovery Characteristic

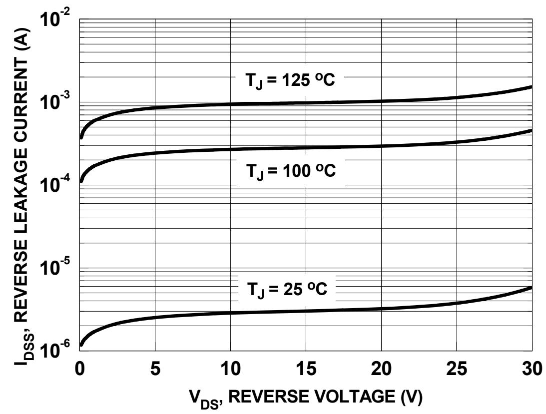
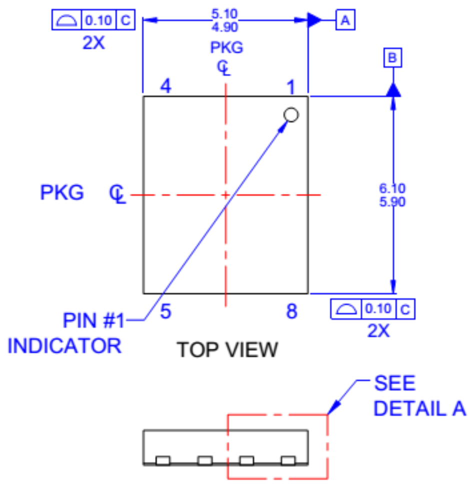


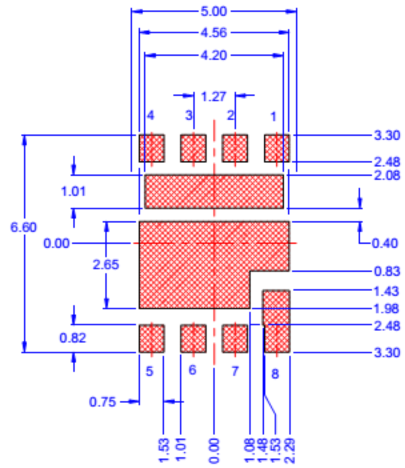
Figure 28. SyncFET^{TM} Body Diode Reverse Leakage vs. Drain-Source Voltage

Dimensional Outline and Pad Layout

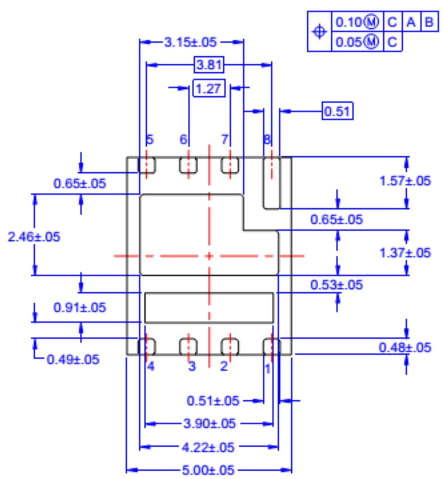


TOP VIEW

SIDE VIEW



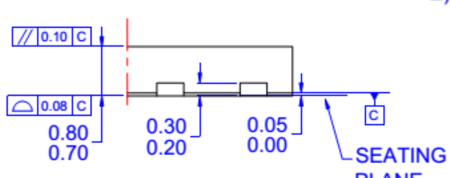
RECOMMENDED LAND PATTERN



BOTTOM VIEW

NOTES: UNLESS OTHERWISE SPECIFIED

A) DOES NOT FULLY CONFORM TO JEDEC REGISTRATION, MO-229, DATED 11/2001.
B) ALL DIMENSIONS ARE IN MILLIMETERS.
C) DIMENSIONS DO NOT INCLUDE BURRS OR MOLD FLASH. MOLD FLASH OR BURRS DOES NOT EXCEED 0.10MM.
D) DIMENSIONING AND TOLERANCING PER ASME Y14.5M-1994.
E) DRAWING FILE NAME: PQFN08KREV2



DETAIL A
(SCALE: 2X)

Package drawings are provided as a service to customers considering Fairchild components. Drawings may change in any manner without notice. Please note the revision and/or date on the drawing and contact a Fairchild Semiconductor representative to verify or obtain the most recent revision. Package specifications do not expand the terms of Fairchild's worldwide terms and conditions, specifically the warranty therein, which covers Fairchild products.

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CTL™
Current Transfer Logic™
DEUXPEED®
Dual Cool™
EcoSPARK®
EfficentMax™
ESBC™
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Fairchild®
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FACT Quiet Series™
FACT®
FAST®
FastvCore™
FETBench™
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F-PFS™
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Global Power Resource℠
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Marking Small Speakers Sound Louder and Better™
MegaBuck™
MICROCOUPLER™
MicroFET™
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Power Supply WebDesigner™
PowerTrench®
PowerXS™
Programmable Active Droop™
QFET®
QS™
Quiet Series™
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