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Please note: As part of the Fairchild Semiconductor integration, some of the Fairchild orderable part numbers will need to change in order to meet ON Semiconductor's system requirements. Since the ON Semiconductor product management systems do not have the ability to manage part nomenclature that utilizes an underscore (_), the underscore (_) in the Fairchild part numbers will be changed to a dash (-). This document may contain device numbers with an underscore (_). Please check the ON Semiconductor website to verify the updated device numbers. The most current and up-to-date ordering information can be found at www.onsemi.com. Please email any questions regarding the system integration to Fairchild_questions@onsemi.com.

FAIRCHILD™

FDPC5018SG

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 $r_{DS(on)}$ = 1.6 mΩ at V_{GS} = 10 V, I_D = 32 A
- Max $r_{DS(on)}$ = 2.0 mΩ at V_{GS} = 4.5 V, I_D = 28 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

Power Clip 5X6

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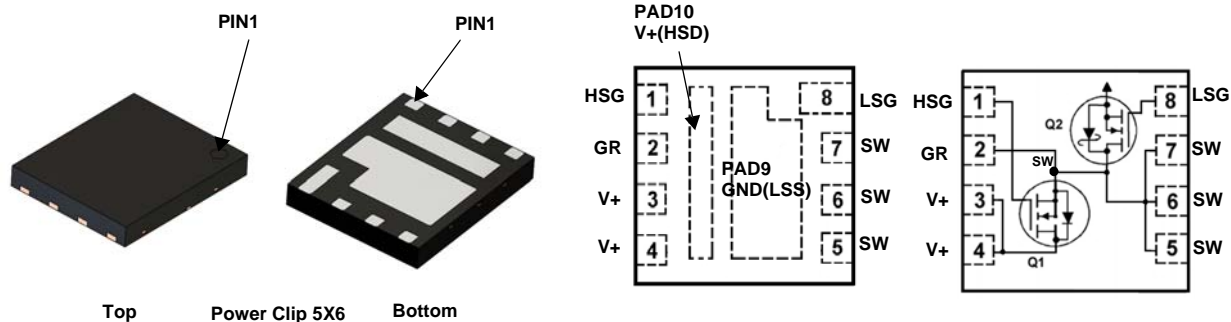
Pin	Name	Description	Pin	Name	Description	Pin	Name	Description
1	HSG	High Side Gate	3,4,10	V+(HSD)	High Side Drain	8	LSG	Low Side Gate
2	GR	Gate Return	5,6,7	SW	Switching Node, Low Side Drain	9	GND(LSS)	Low Side Source

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

Symbol	Parameter			Q1	Q2	Units
V_{DS}	Drain to Source Voltage			30	30	V
Bvdsst	Bvdsst (transient) < 100nS			32.5	32.5	V
V_{GS}	Gate to Source Voltage			±20	±12	V
I_D	Drain Current -Continuous	T_C = 25 °C (Note 5)		56	109	A
	-Continuous	T_C = 100 °C (Note 5)		35	69	
	-Continuous	T_A = 25 °C		17[Note1a]	32[Note1b]	
	-Pulsed	T_A = 25 °C (Note 4)		227	704	
E_{AS}	Single Pulse Avalanche Energy	(Note 3)		54	181	mJ
P_D	Power Dissipation for Single Operation	T_C = 25 °C		23	29	W
	Power Dissipation for Single Operation	T_A = 25 °C		2.1[Note1a]	2.3[Note1b]	
	Power Dissipation for Single Operation	T_A = 25 °C		1.0[Note1c]	1.1[Note1d]	
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	4.3	°C/W
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient			60[Note1a]	55[Note1b]	
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient			130[Note1c]	120[Note1d]	

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FDPC5018SG Rev.1.1

Package Marking and Ordering Information

Device Marking	Device	Package	Reel Size	Tape Width	Quantity
FDPC5018SG	FDPC5018SG	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 19		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 = 32 A V_{GS} = 4.5 V, I_D = 28 A V_{GS} = 10 V, I_D = 32 A ,T_J =125 °C	Q2		1.4 1.7 2.1	1.6 2.0 2.4	
g_{FS}	Forward Transconductance	V_{DS} = 5 V, I_D = 17 A V_{DS} = 5 V, I_D = 32 A	Q1 Q2		93 188		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 4593	1715 6430	pF
C_{oss}	Output Capacitance		Q1 Q2		397 1210	560 1695	pF
C_{rss}	Reverse Transfer Capacitance		Q1 Q2		42 80	60 115	pF
R_g	Gate Resistance		Q1 Q2	0.1 0.1	0.5 0.8	1.5 2.4	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 = 32 A, R_{GEN} = 6 Ω	Q1 Q2		8 14	16 25	ns
t_r	Rise Time		Q1 Q2		2 5	10 10	ns
$t_{d(off)}$	Turn-Off Delay Time		Q1 Q2		18 38	33 61	ns
t_f	Fall Time		Q1 Q2		2 4	10 10	ns
Q_g	Total Gate Charge	V_{GS} = 0 V to 10 V	Q1 Q2		17 62	24 87	nC
Q_g	Total Gate Charge	V_{GS} = 0 V to 4.5 V	Q1 Q2		8 28	11 40	nC
Q_{gs}	Gate to Source Gate Charge	Q1 V_{DD} = 15 V, I_D = 17 A Q2 V_{DD} = 15 V, I_D = 32 A	Q1 Q2		3.1 11		nC
Q_{gd}	Gate to Drain "Miller" Charge		Q1 Q2		2.0 5.3		nC

Electrical Characteristics T_J = 25 °C unless otherwise noted.

Symbol	Parameter	Test Conditions	Type	Min	Typ	Max	Units
Drain-Source Diode Characteristics							
V_{SD}	Source to Drain Diode Forward Voltage	V_{GS} = 0 V, I_S = 17 A (Note 2) V_{GS} = 0 V, I_S = 32 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	Q1 Q2		23 32	37 51	ns
Q_{rr}	Reverse Recovery Charge	Q2 I_F = 32 A, di/dt = 240 A/µs	Q1 Q2		8 40	16 64	nC

Notes:

1. $R_{\theta JA}$ is determined with the device mounted on a 1 in² 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.
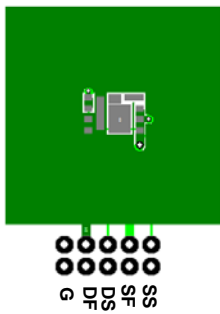
a. 60 °C/W when mounted on a 1 in² pad of 2 oz copper
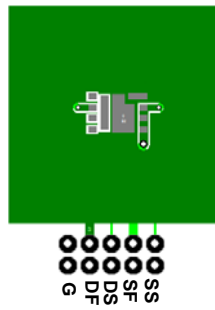
b. 55 °C/W when mounted on a 1 in² pad of 2 oz copper
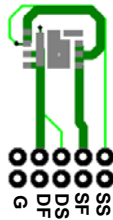
c. 130 °C/W when mounted on a minimum pad of 2 oz copper

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 °C; 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 181 mJ is based on starting T_J = 25 °C; L = 3 mH, I_{AS} = 11 A, V_{DD} = 30 V, V_{GS} = 10 V.100% tested at L = 0.1 mH, I_{AS} =36 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.
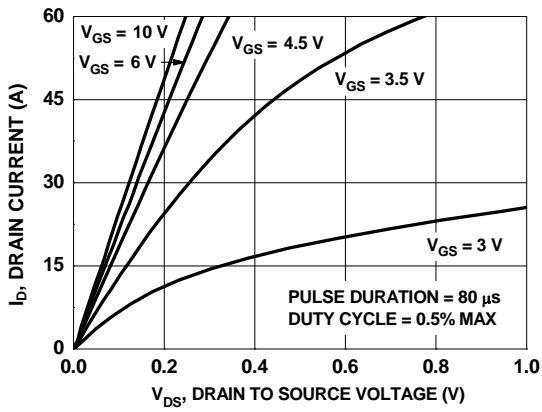
Figure 1. On Region Characteristics
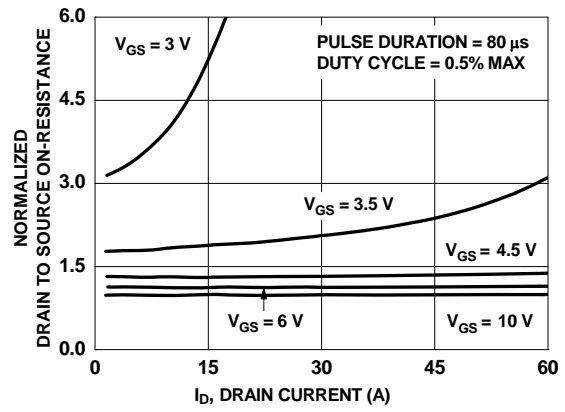
Figure 2. Normalized On-Resistance
vs. Drain Current and Gate Voltage
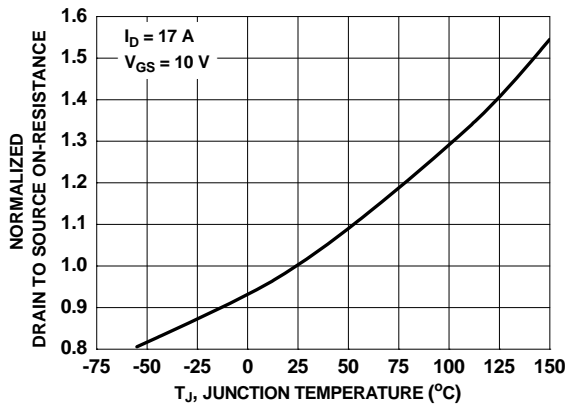
Figure 3. Normalized On Resistance
vs. Junction Temperature
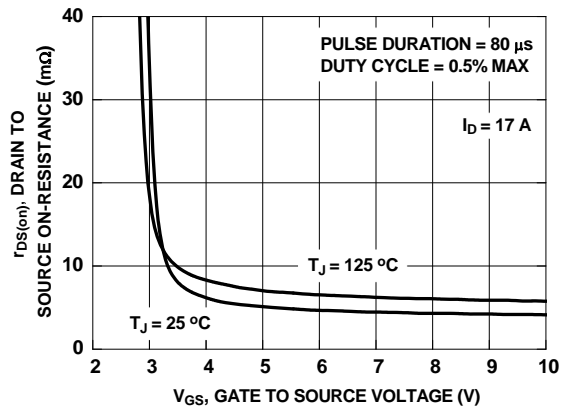
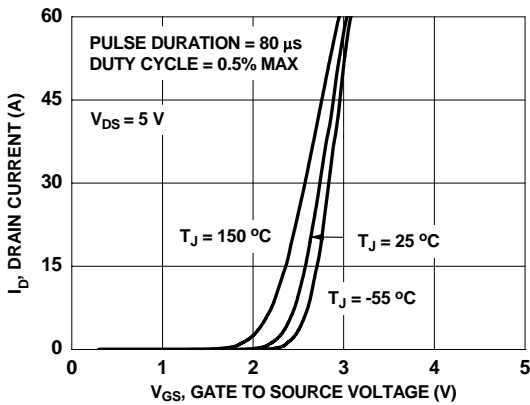Figure 4. On-Resistance vs. Gate to
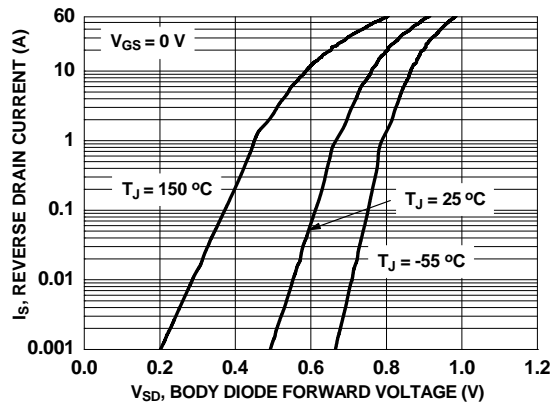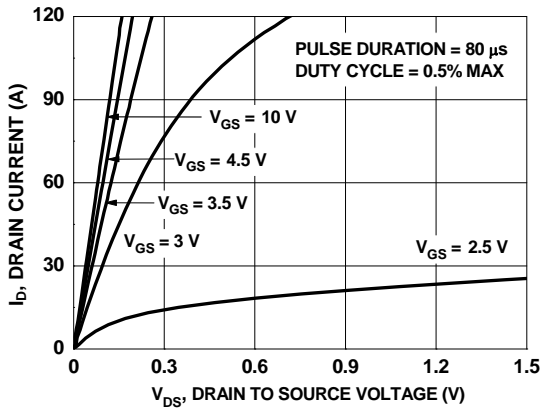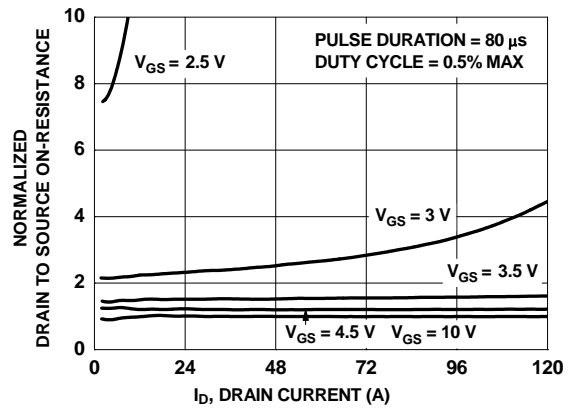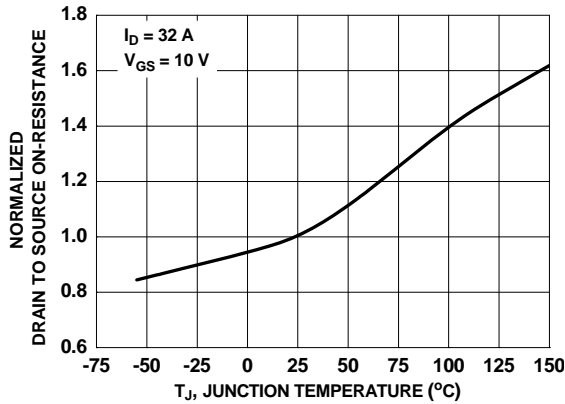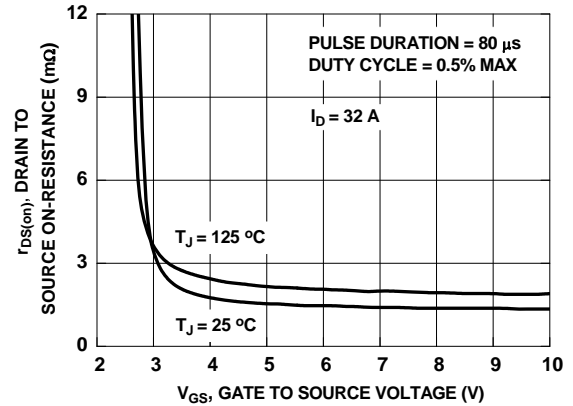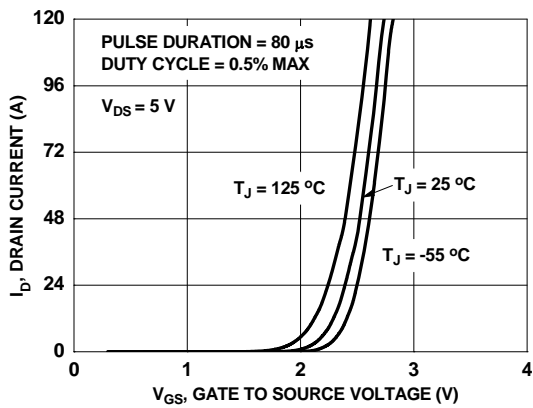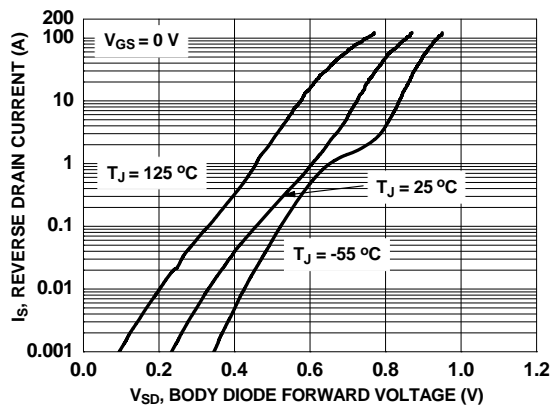Source Voltage

Figure 5. Transfer Characteristics

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

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Typical Characteristics (Q1 N-Channel) T_J = 25°C unless otherwise noted.
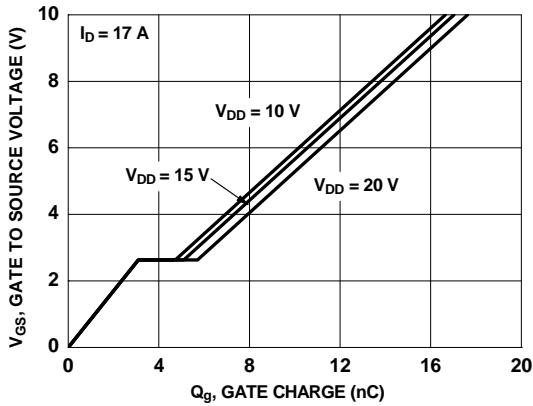
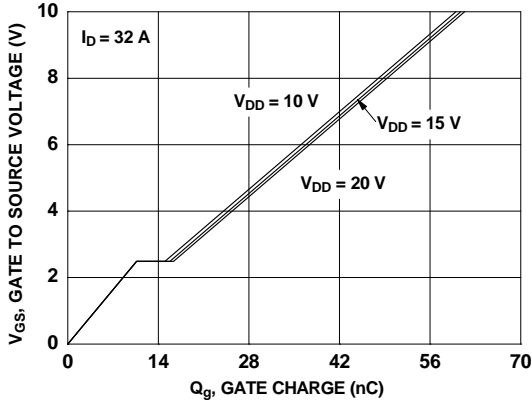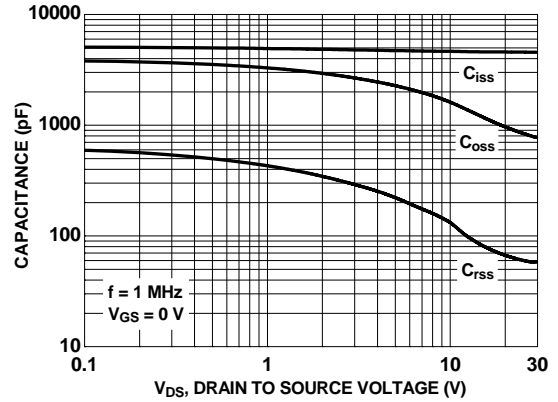
Figure 7. Gate Charge Characteristics
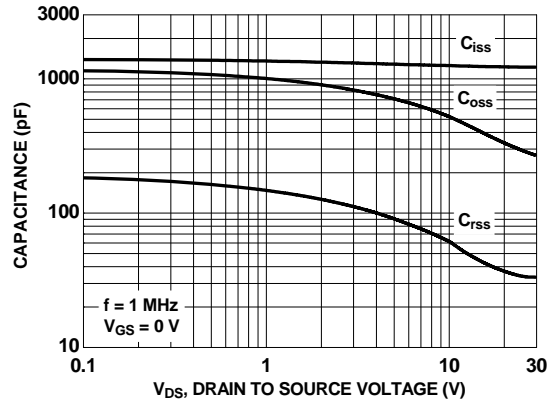
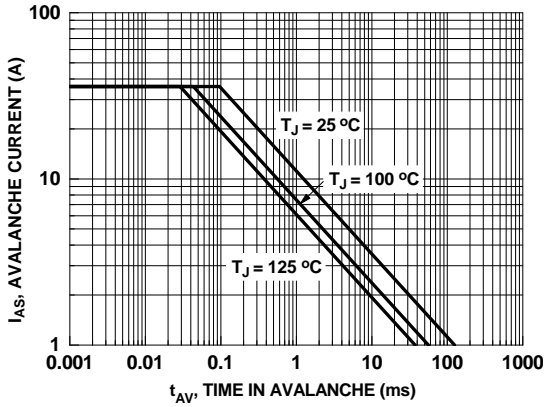
Figure 8. Capacitance vs. Drain to Source Voltage
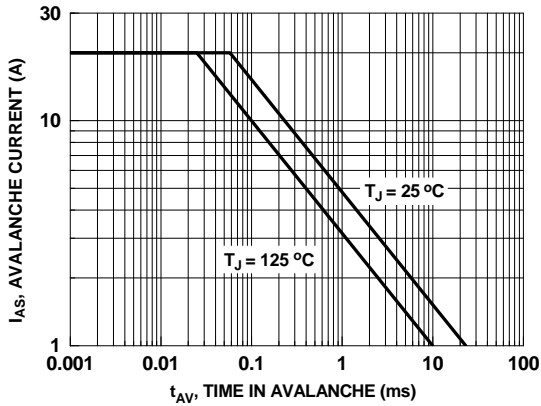
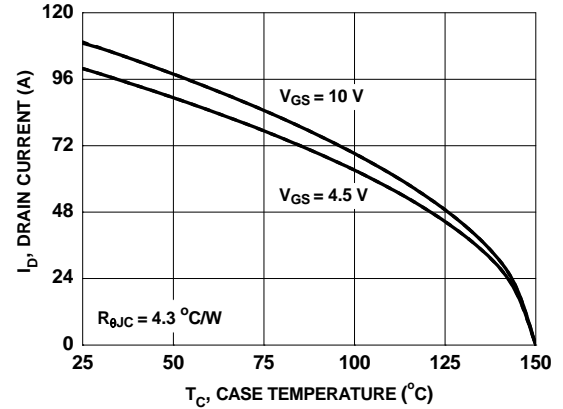Figure 9. Unclamped Inductive Switching Capability
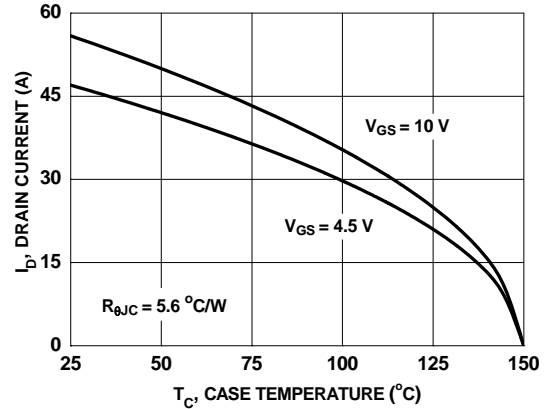
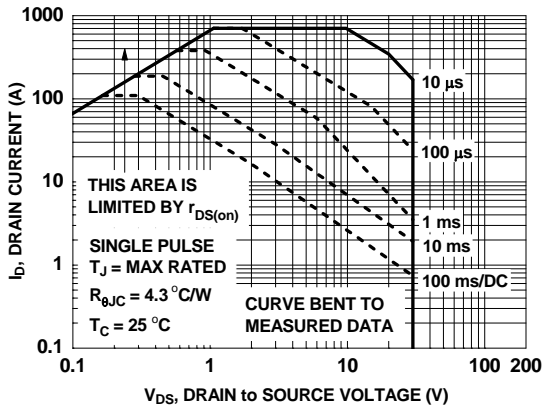Figure 10. Maximum Continuous Drain Current vs. Case Temperature
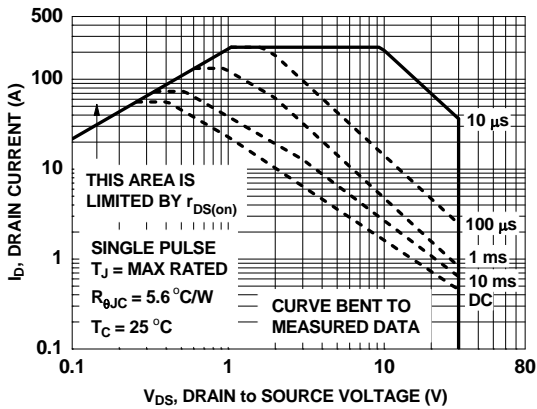
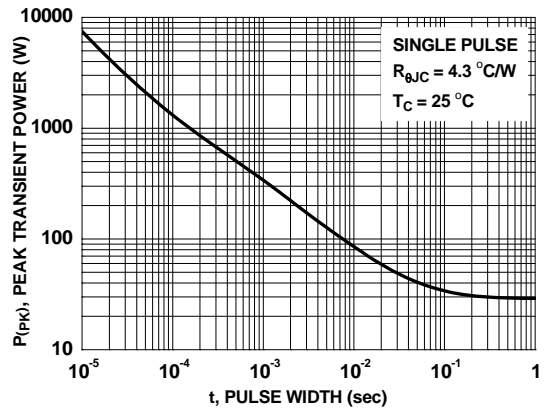
Figure 11. Forward Bias Safe Operating Area
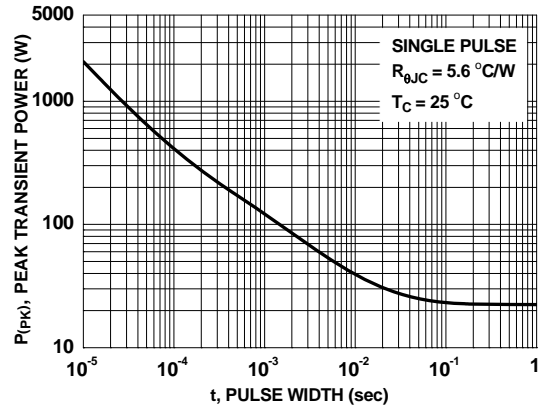
Figure 12. Single Pulse Maximum Power Dissipation

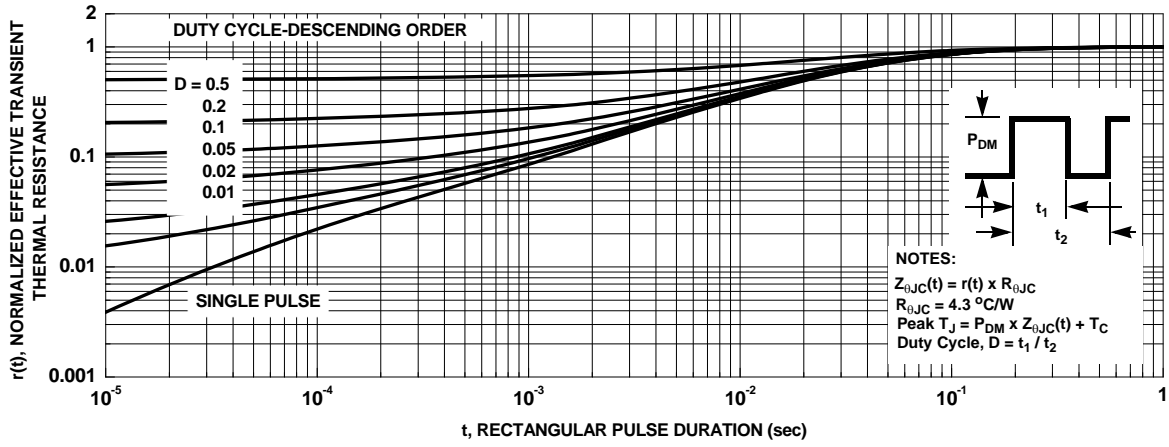## Typical Characteristics (Q1 N-Channel) T_J = 25°C unless otherwise noted.
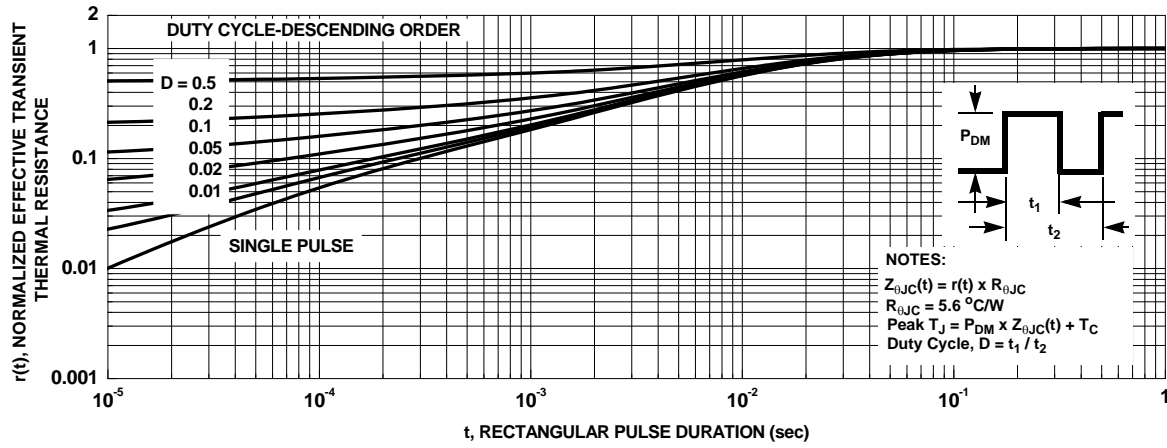
Figure 13. Junction-to-Case Transient Thermal Response Curve

Plot labels and notes from the figure:

- r(t), NORMALIZED EFFECTIVE TRANSIENT THERMAL RESISTANCE
- DUTY CYCLE-DESCENDING ORDER
- D = 0.5, 0.2, 0.1, 0.05, 0.02, 0.01
- SINGLE PULSE
- t, RECTANGULAR PULSE DURATION (sec)
- P_{DM}, t_1, t_2

NOTES:
$Z_{\theta JC}(t) = r(t) \times R_{\theta JC}$
$R_{\theta JC} = 5.6\ ^{o}C/W$
Peak $T_J = P_{DM} \times Z_{\theta JC}(t) + T_C$
Duty Cycle, $D = t_1 / t_2$

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

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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

On the figure:

DUTY CYCLE-DESCENDING ORDER

D = 0.5
0.2
0.1
0.05
0.02
0.01

SINGLE PULSE

r(t), NORMALIZED EFFECTIVE TRANSIENT THERMAL RESISTANCE

t, RECTANGULAR PULSE DURATION (sec)

NOTES:
$Z_{\theta JC}(t) = r(t) \times R_{\theta JC}$
$R_{\theta JC} = 4.3 \; ^{o}C/W$
Peak $T_J = P_{DM} \times Z_{\theta JC}(t) + T_C$
Duty Cycle, $D = t_1 / t_2$

P_{DM}
t_1
t_2

Typical Characteristics (continued)

SyncFET™ Schottky Body Diode Characteristics

Fairchild's SyncFET™ 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 FDPC5018SG.

Schottky barrier diodes exhibit significant leakage at high temperature and high reverse voltage. This will increase the power in the device.
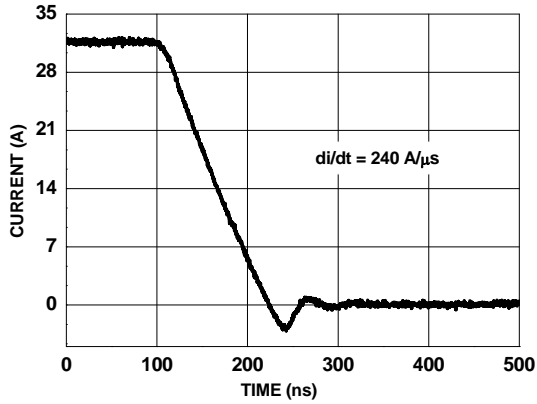
Figure 27. FDPC5018SG SyncFET™ Body Diode Reverse Recovery Characteristic
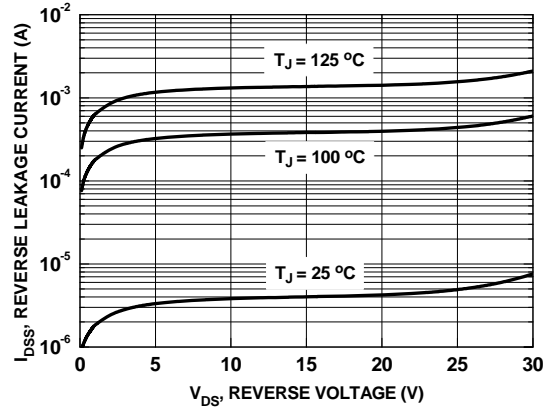
Figure 28. SyncFET™ Body Diode Reverse Leakage vs. Drain-Source Voltage

TOP VIEW

0.10 C
2X

5.10
4.90
PKG C_L

0.10 C
2X

B

A

4   1

PKG C_L

6.10
5.90

5   8

PIN #1
INDICATOR

SIDE VIEW

SEE
DETAIL A

RECOMMENDED LAND PATTERN

5.00
4.56
4.20
1.27

4 3 2 1

3.30
2.48
2.08

1.01

6.60

0.00

0.40

2.65

0.83
1.43
1.98
2.48
3.30

0.82

5 6 7 8

0.75

1.53
1.01
0.00
1.08
1.48
1.53
2.29

BOTTOM VIEW

0.10 Ⓜ C A B
0.05 Ⓜ C

3.15±.05
3.81
1.27

0.51

5 6 7 8

0.65±.05

1.57±.05

2.46±.05

0.65±.05

1.37±.05

0.53±.05

0.91±.05

0.49±.05

0.48±.05

4 3 2 1

0.51±.05
3.90±.05
4.22±.05
5.00±.05
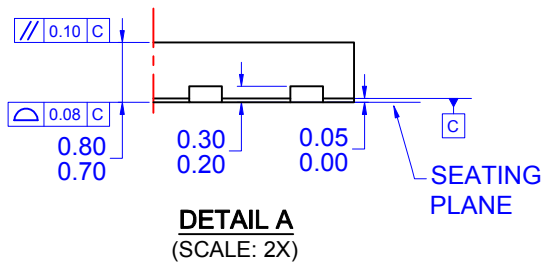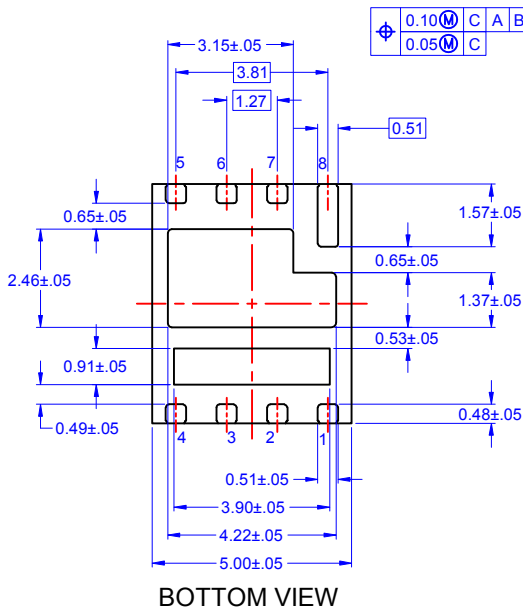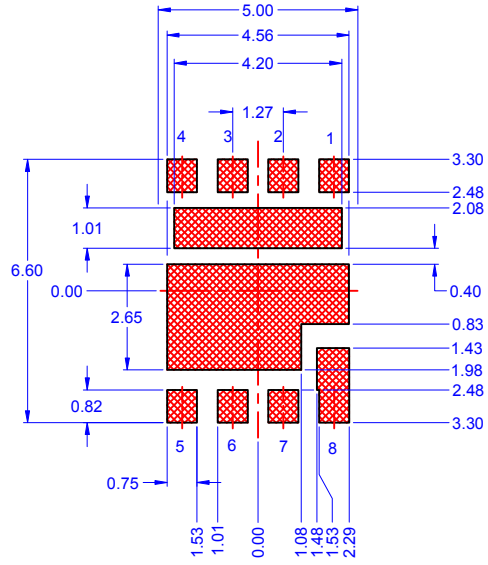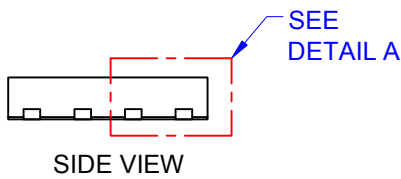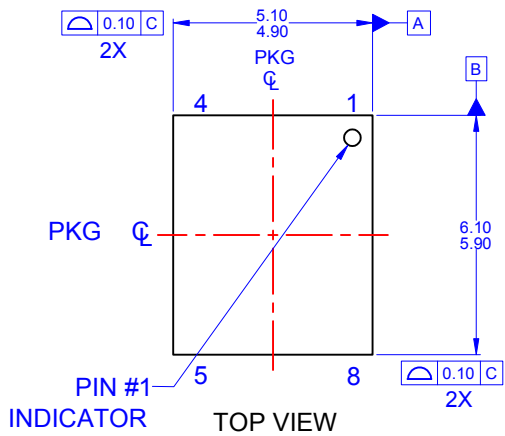
NOTES: UNLESS OTHERWISE SPECIFIED

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)

∥ 0.10 C

0.08 C

0.80
0.70

0.30
0.20

0.05
0.00

C

SEATING
PLANE

PUBLICATION ORDERING INFORMATION

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