FAIRCHILD

February 2015

FDMC6686P

P-Channel PowerTrench® MOSFET

-20 V, -56 A, 4 mΩ

Features

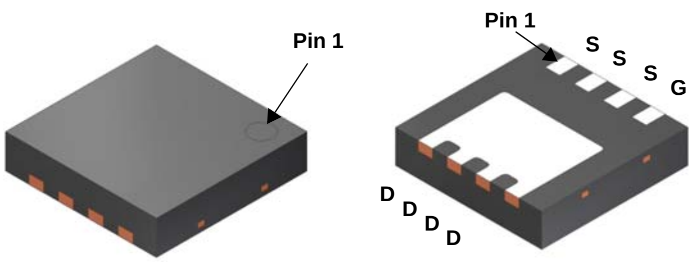
- Max $r_{DS(on)}$ = 4 mΩ at V_{GS} = -4.5 V, I_D = -18 A
- Max $r_{DS(on)}$ = 5.7 mΩ at V_{GS} = -2.5 V, I_D = -16 A
- Max $r_{DS(on)}$ =11.5 mΩ at V_{GS} = -1.8 V, I_D = -11 A
- High performance trench technology for extremely low $r_{DS(on)}$
- High power and current handling capability in a widely used surface mount package
- Lead-free and RoHS Compliant

General Description

This P-Channel MOSFET is produced using Fairchild Semiconductor's advanced PowerTrench® process that has been optimized for $r_{DS(ON)}$, switching performance and ruggedness.

Applications

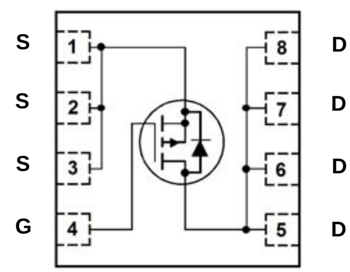
- Load Switch
- Battery Management
- Power Management
- Reverse Polarity Protection



Top

Bottom

Power 33



MOSFET Maximum Ratings T_A = 25 °C unless otherwise noted

Symbol	Parameter			Ratings	Units
V_{DS}	Drain to Source Voltage			-20	V
V_{GS}	Gate to Source Voltage			±8	V
I_D	Drain Current -Continuous	T_C = 25 °C		-56	A
	-Continuous	T_A = 25 °C	(Note 1a)	-18	
	-Pulsed		(Note 3)	-377	
P_D	Power Dissipation	T_C = 25 °C		40	W
	Power Dissipation	T_A = 25 °C	(Note 1a)	2.3	
T_J, T_{STG}	Operating and Storage Junction Temperature Range			-55 to +150	°C

Thermal Characteristics

$R_{\theta JC}$	Thermal Resistance, Junction to Case		3.1	°C/W
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient	(Note 1a)	53	

Package Marking and Ordering Information

Device Marking	Device	Package	Reel Size	Tape Width	Quantity
FDMC6686P	FDMC6686P	Power 33	13 ”	12 mm	3000 units

Electrical Characteristics T_J = 25 °C unless otherwise noted

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units

Off Characteristics

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
BV_{DSS}	Drain to Source Breakdown Voltage	I_D = -250 μA, V_{GS} = 0 V	-20			V
$\frac{\Delta BV_{DSS}}{\Delta T_J}$	Breakdown Voltage Temperature Coefficient	I_D = -250 μA, referenced to 25 °C		-15		mV/°C
I_{DSS}	Zero Gate Voltage Drain Current	V_{DS} = -16 V, V_{GS} = 0 V			-1	μA
I_{GSS}	Gate to Source Leakage Current	V_{GS} = ±8 V, V_{DS} = 0 V			±100	nA

On Characteristics

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
$V_{GS(th)}$	Gate to Source Threshold Voltage	$V_{GS} = V_{DS}$, I_D = -250 μA	-0.4	-0.75	-1	V
$\frac{\Delta V_{GS(th)}}{\Delta T_J}$	Gate to Source Threshold Voltage Temperature Coefficient	I_D = -250 μA, referenced to 25 °C		3		mV/°C
$r_{DS(on)}$	Static Drain to Source On Resistance	V_{GS} = -4.5 V, I_D = -18 A		3.3	4	mΩ
		V_{GS} = -2.5 V, I_D = -16 A		4.1	5.7	
		V_{GS} = -1.8 V, I_D = -11 A		6	11.5	
		V_{GS} = -4.5 V, I_D = -18 A, T_J = 125 °C		4.3	6.5	
g_{FS}	Forward Transconductance	V_{DS} = -5 V, I_D = -18 A		116		S

Dynamic Characteristics

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
C_{iss}	Input Capacitance	V_{DS} = -10 V, V_{GS} = 0 V, f = 1 MHz		8800	13200	pF
C_{oss}	Output Capacitance			1520	2280	pF
C_{rss}	Reverse Transfer Capacitance			1340	2010	pF
R_g	Gate Resistance			6.2		Ω

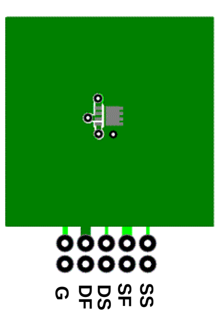
Switching Characteristics

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
$t_{d(on)}$	Turn-On Delay Time	V_{DD} = -10 V, I_D = -18 A, V_{GS} = -4.5 V, R_{GEN} = 6 Ω		25	40	ns
t_r	Rise Time			77	122	ns
$t_{d(off)}$	Turn-Off Delay Time			317	506	ns
t_f	Fall Time			178	285	ns
Q_g	Total Gate Charge	V_{DD} = -10 V, I_D = -18 A, V_{GS} = -4.5 V		87	122	nC
Q_{gs}	Gate to Source Charge			14		nC
Q_{gd}	Gate to Drain "Miller" Charge			24		nC

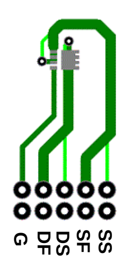
Drain-Source Diode Characteristics

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
V_{SD}	Source to Drain Diode Forward Voltage	V_{GS} = 0 V, I_S = -18 A (Note 2)		-0.7	-1.2	V
		V_{GS} = 0 V, I_S = -2 A (Note 2)		-0.6	-1.2	
t_{rr}	Reverse Recovery Time	I_F = -18 A, di/dt = 100 A/μs		38	61	ns
Q_{rr}	Reverse Recovery Charge			24	39	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. $R_{\theta JC}$ is guaranteed by design while $R_{\theta CA}$ is determined by the user's board design.



a. 53 °C/W when mounted on a 1 in^2 pad of 2 oz copper.



b. 125 °C/W when mounted on a minimum pad of 2 oz copper.

2. Pulse Test: Pulse Width < 300 μs, Duty cycle < 2.0%.
3. Pulse Id refers to Forward Bias Safe Operation Area.

Typical Characteristics T_J = 25 °C unless otherwise noted

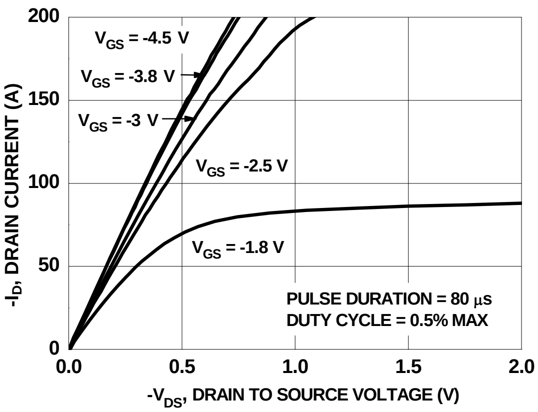


Figure 1. On-Region Characteristics

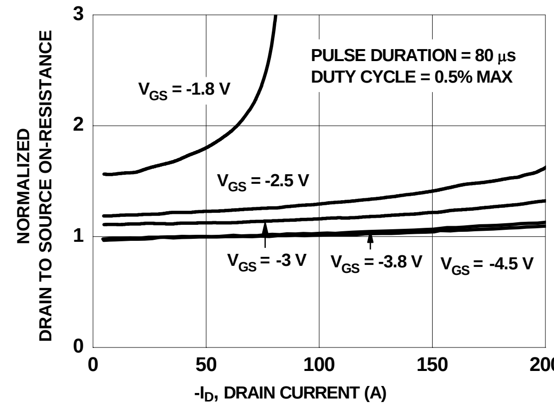


Figure 2. Normalized On-Resistance vs Drain Current and Gate Voltage

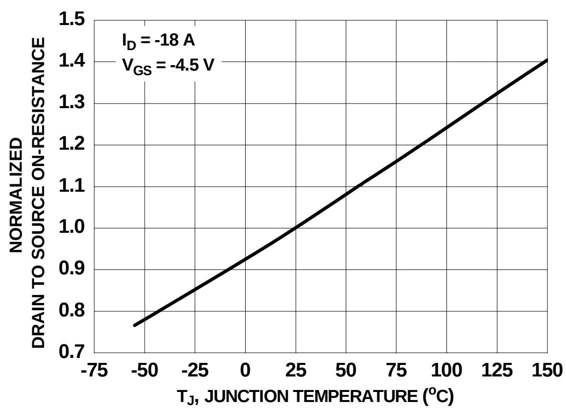


Figure 3. Normalized On-Resistance vs Junction Temperature

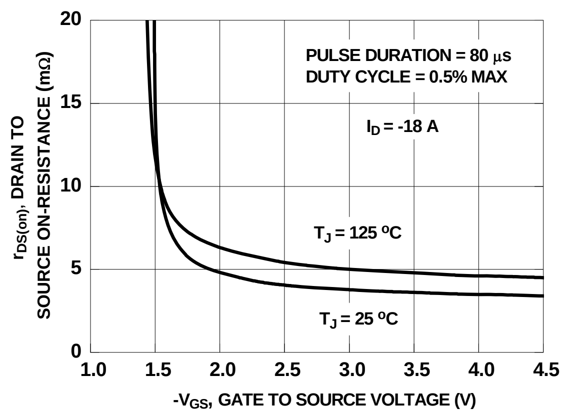


Figure 4. On-Resistance vs Gate to Source Voltage

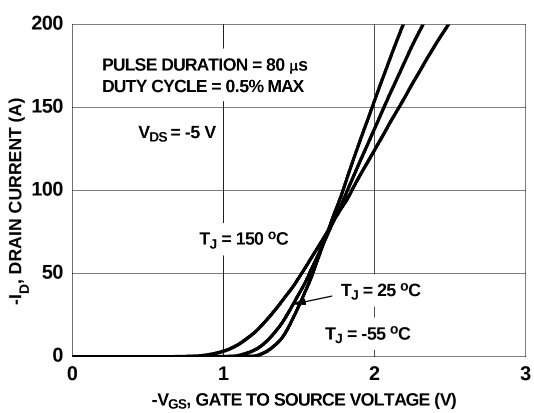


Figure 5. Transfer Characteristics

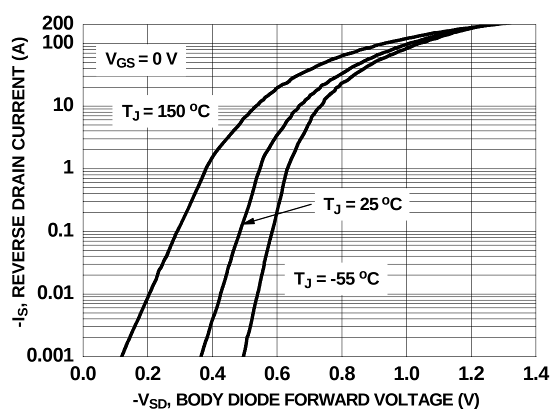


Figure 6. Source to Drain Diode Forward Voltage vs Source Current

Typical Characteristics T_J = 25 °C unless otherwise noted

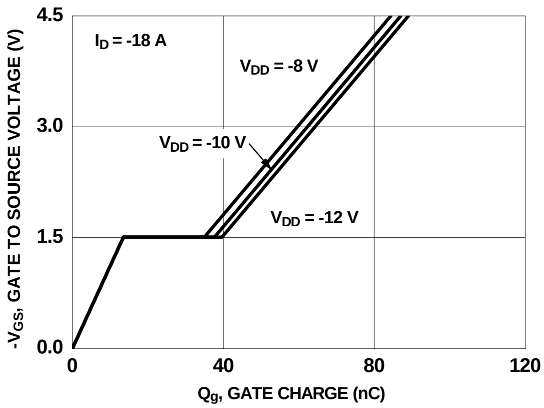


Figure 7. Gate Charge Characteristics

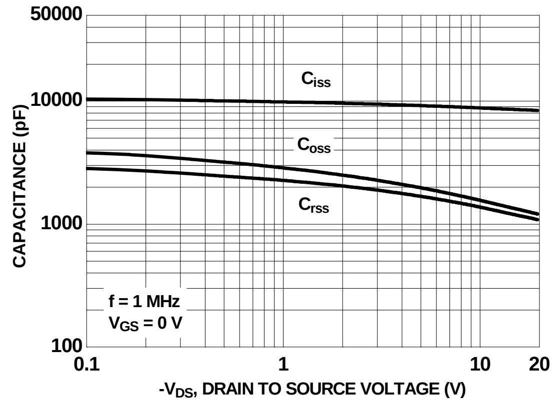


Figure 8. Capacitance vs Drain to Source Voltage

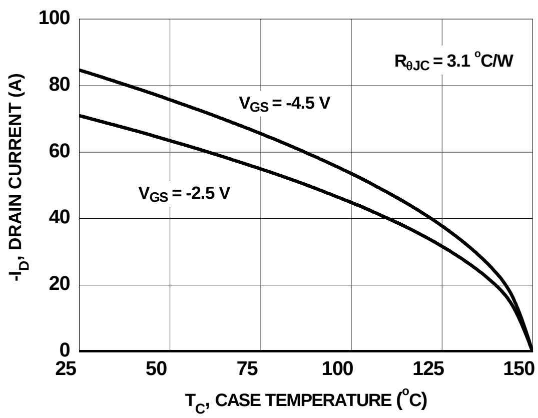


Figure 9. Maximum Continuous Drain Current vs Case Temperature

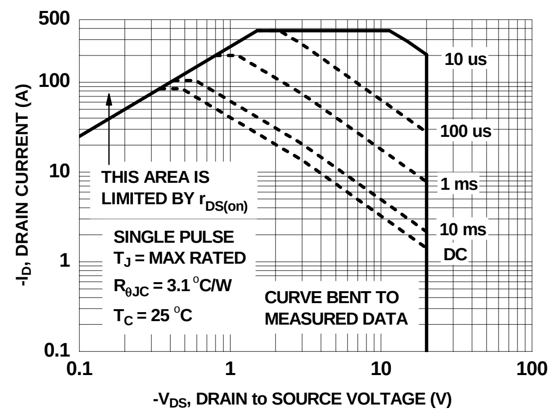


Figure 10. Forward Bias Safe Operating Area

Figure 11. Single Pulse Maximum Power Dissipation

Typical Characteristics T_J = 25 °C unless otherwise noted

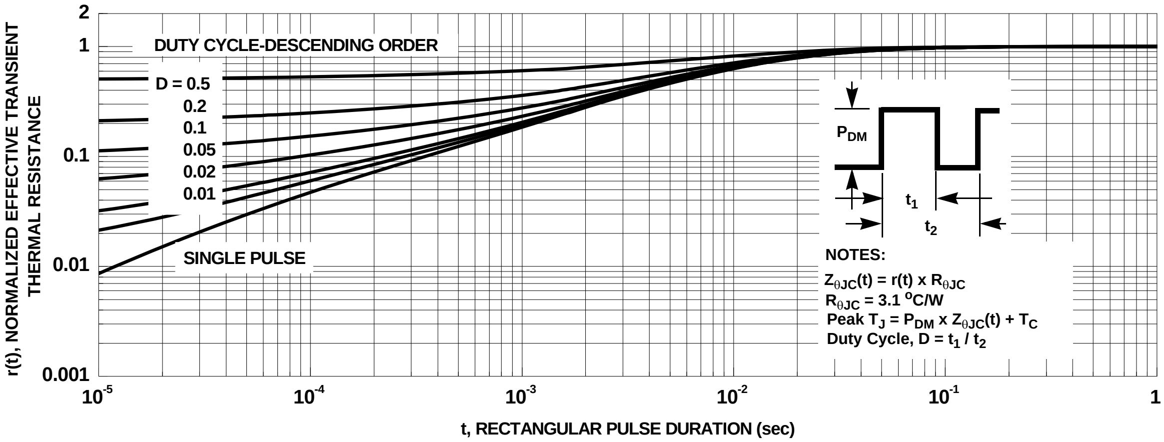
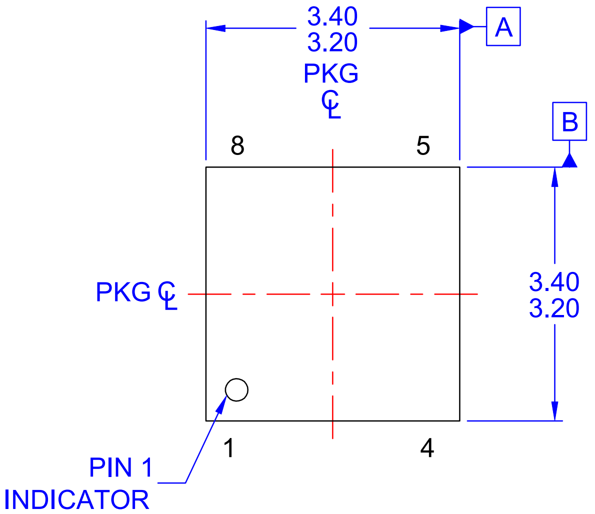
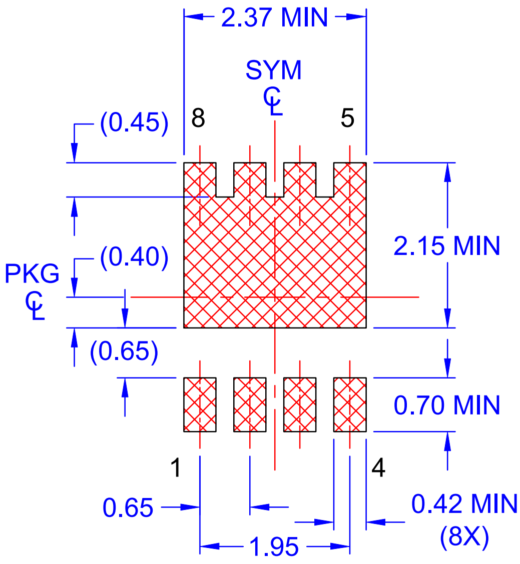
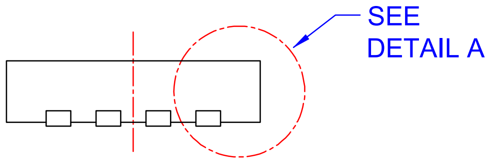


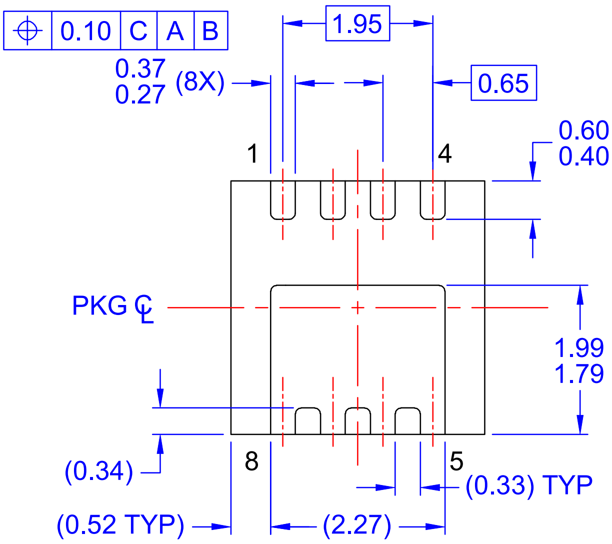
Figure 12. Junction-to-Case Transient Thermal Response Curve

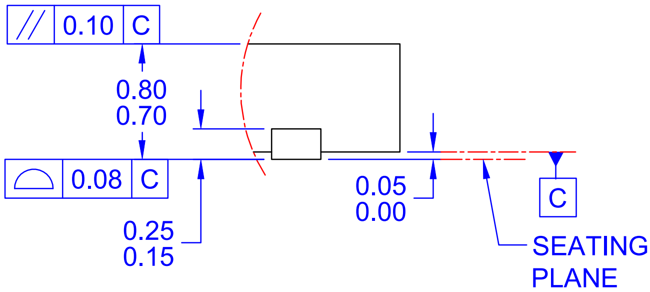




LAND PATTERN RECOMMENDATION







DETAIL A
SCALE: 2X

NOTES: UNLESS OTHERWISE SPECIFIED

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C) DIMENSIONS DO NOT INCLUDE BURRS OR MOLD FLASH. MOLD FLASH OR BURRS DOES NOT EXCEED 0.10MM.
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