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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

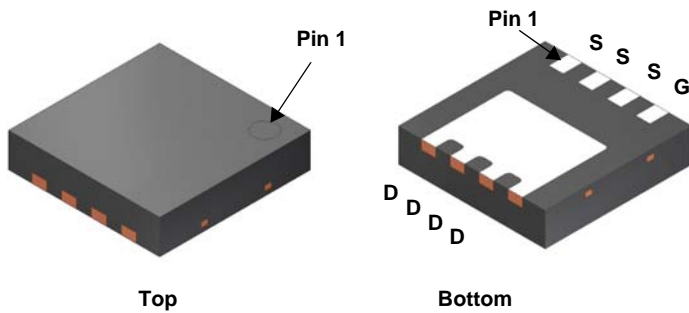


General Description

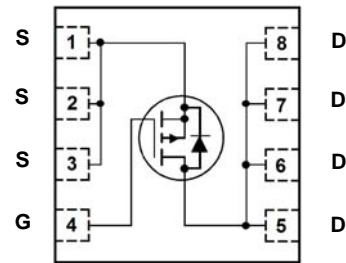
This P-Channel MOSFET is produced using Fairchild Semiconductor's advanced PowerTrench[®] process that has been optimized for $r_{DS(ON)}$, switching performance and ruggedness.

Applications

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



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	A
	-Continuous	$T_A = 25$ °C (Note 1a)	
	-Pulsed	(Note 3)	
P_D	Power Dissipation	$T_C = 25$ °C	W
	Power Dissipation	$T_A = 25$ °C (Note 1a)	
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

FDMC6686P P-Channel PowerTrench[®] MOSFET

Electrical Characteristics $T_J = 25\text{ }^\circ\text{C}$ unless otherwise noted

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
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Off Characteristics

BV_{DSS}	Drain to Source Breakdown Voltage	$I_D = -250\text{ }\mu\text{A}, V_{GS} = 0\text{ V}$	-20			V
$\frac{\Delta BV_{DSS}}{\Delta T_J}$	Breakdown Voltage Temperature Coefficient	$I_D = -250\text{ }\mu\text{A}$, referenced to $25\text{ }^\circ\text{C}$		-15		mV/ $^\circ\text{C}$
I_{DSS}	Zero Gate Voltage Drain Current	$V_{DS} = -16\text{ V}, V_{GS} = 0\text{ V}$			-1	μA
I_{GSS}	Gate to Source Leakage Current	$V_{GS} = \pm 8\text{ V}, V_{DS} = 0\text{ V}$			± 100	nA

On Characteristics

$V_{GS(th)}$	Gate to Source Threshold Voltage	$V_{GS} = V_{DS}, I_D = -250\text{ }\mu\text{A}$	-0.4	-0.75	-1	V
$\frac{\Delta V_{GS(th)}}{\Delta T_J}$	Gate to Source Threshold Voltage Temperature Coefficient	$I_D = -250\text{ }\mu\text{A}$, referenced to $25\text{ }^\circ\text{C}$		3		mV/ $^\circ\text{C}$
$r_{DS(on)}$	Static Drain to Source On Resistance	$V_{GS} = -4.5\text{ V}, I_D = -18\text{ A}$		3.3	4	m Ω
		$V_{GS} = -2.5\text{ V}, I_D = -16\text{ A}$		4.1	5.7	
		$V_{GS} = -1.8\text{ V}, I_D = -11\text{ A}$		6	11.5	
		$V_{GS} = -4.5\text{ V}, I_D = -18\text{ A}, T_J = 125\text{ }^\circ\text{C}$		4.3	6.5	
g_{FS}	Forward Transconductance	$V_{DS} = -5\text{ V}, I_D = -18\text{ A}$		116		S

Dynamic Characteristics

C_{iss}	Input Capacitance	$V_{DS} = -10\text{ V}, V_{GS} = 0\text{ V},$ $f = 1\text{ MHz}$		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

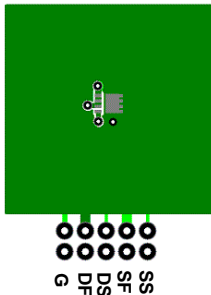
$t_{d(on)}$	Turn-On Delay Time	$V_{DD} = -10\text{ V}, I_D = -18\text{ A},$ $V_{GS} = -4.5\text{ V}, R_{GEN} = 6\text{ }\Omega$		25	40	ns
t_r	Rise Time			77	122	ns
$t_{d(off)}$	Turn-Off Delay Time			317	506	ns
t_f	Fall Time			178	285	ns
Q_g	Total Gate Charge			87	122	nC
Q_{gs}	Gate to Source Charge	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

Drain-Source Diode Characteristics

V_{SD}	Source to Drain Diode Forward Voltage	$V_{GS} = 0\text{ V}, I_S = -18\text{ A}$ (Note 2)		-0.7	-1.2	V
		$V_{GS} = 0\text{ V}, I_S = -2\text{ A}$ (Note 2)		-0.6	-1.2	
t_{rr}	Reverse Recovery Time	$I_F = -18\text{ A}, di/dt = 100\text{ A}/\mu\text{s}$		38	61	ns
Q_{rr}	Reverse Recovery Charge			24	39	nC

NOTES:

- $R_{\theta JA}$ is determined with the device mounted on a 1 in^2 pad 2 oz copper pad on a $1.5 \times 1.5\text{ in.}$ 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. $53\text{ }^\circ\text{C/W}$ when mounted on a 1 in^2 pad of 2 oz copper.



b. $125\text{ }^\circ\text{C/W}$ when mounted on a minimum pad of 2 oz copper.

- Pulse Test: Pulse Width $< 300\text{ }\mu\text{s}$, Duty cycle $< 2.0\%$.
- Pulse I_d refers to Forward Bias Safe Operation Area.

Typical Characteristics $T_J = 25\text{ }^\circ\text{C}$ unless otherwise noted

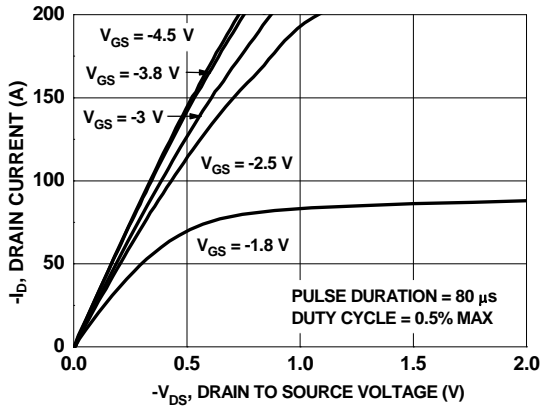


Figure 1. On-Region Characteristics

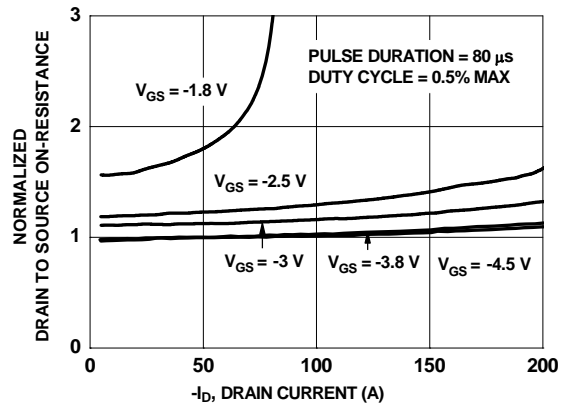


Figure 2. Normalized On-Resistance vs Drain Current and Gate Voltage

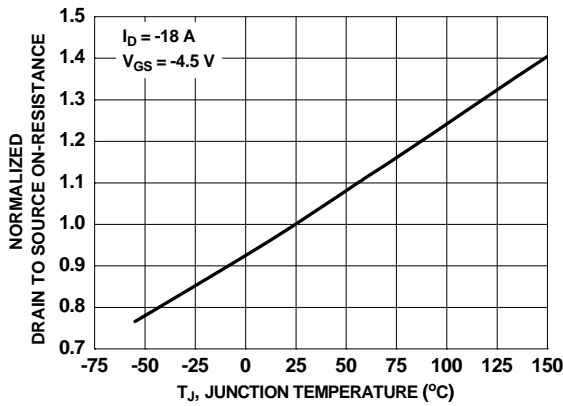


Figure 3. Normalized On-Resistance vs Junction Temperature

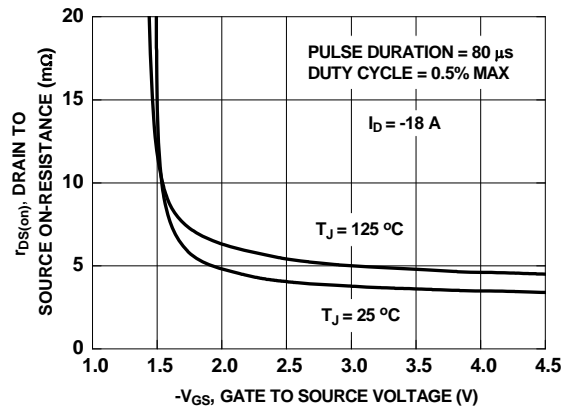


Figure 4. On-Resistance vs Gate to Source Voltage

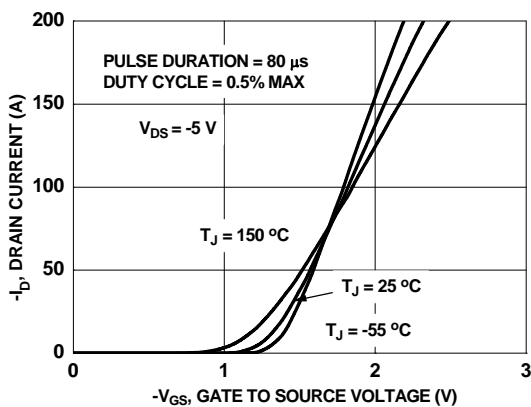


Figure 5. Transfer Characteristics

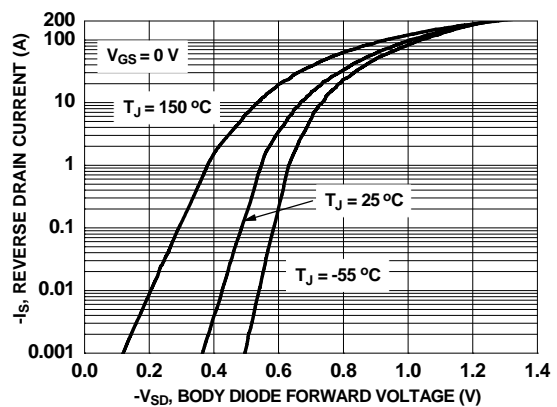


Figure 6. Source to Drain Diode Forward Voltage vs Source Current

Typical Characteristics $T_J = 25\text{ }^\circ\text{C}$ unless otherwise noted

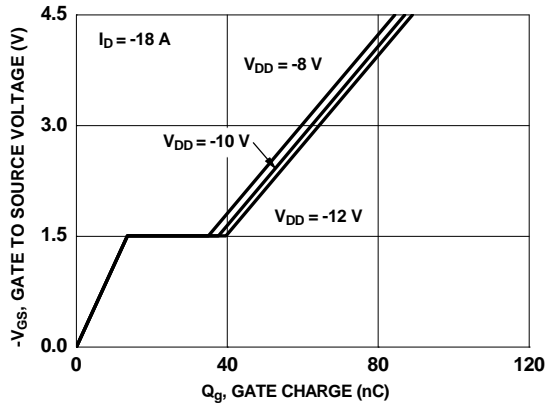


Figure 7. Gate Charge Characteristics

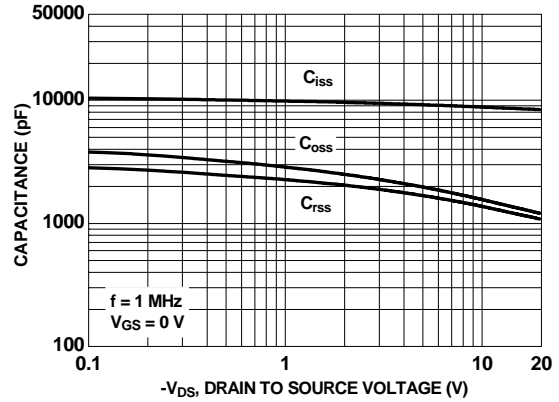


Figure 8. Capacitance vs Drain to Source Voltage

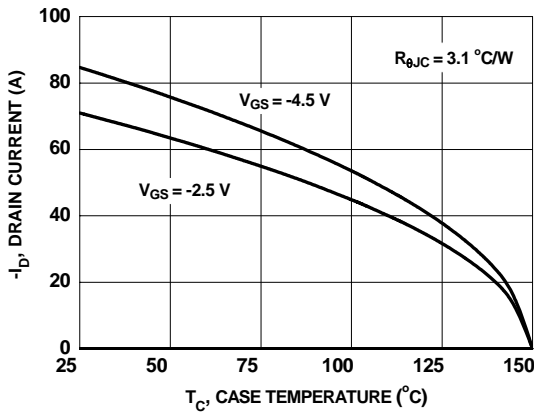


Figure 9. Maximum Continuous Drain Current vs Case Temperature

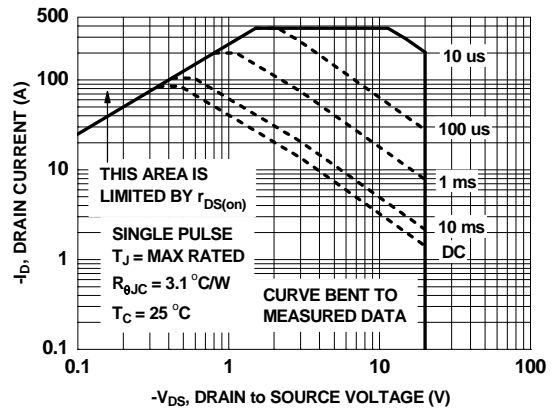


Figure 10. Forward Bias Safe Operating Area

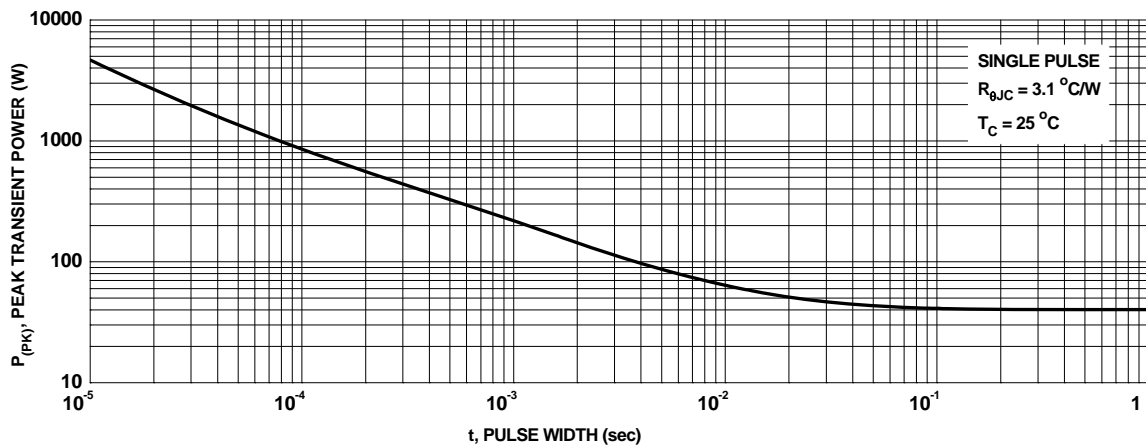


Figure 11. Single Pulse Maximum Power Dissipation

Typical Characteristics $T_J = 25\text{ }^\circ\text{C}$ unless otherwise noted

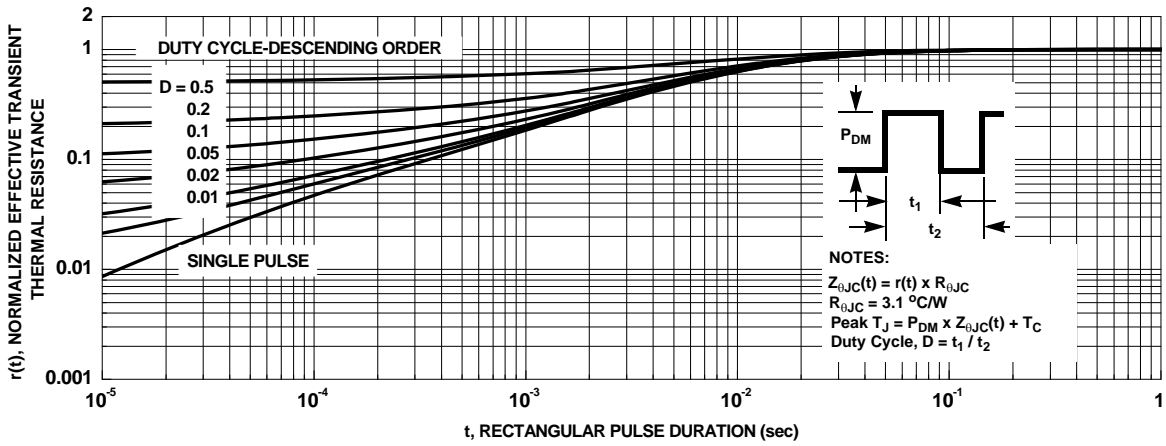


Figure 12. Junction-to-Case Transient Thermal Response Curve

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