FAIRCHILD SEMICONDUCTOR®

October 2006

FDD4685
40V P-Channel PowerTrench® MOSFET
–40V, –32A, 27mΩ

Features

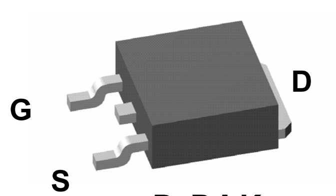
- Max $r_{DS(on)}$ = 27mΩ at V_{GS} = –10V, I_D = –8.4A
- Max $r_{DS(on)}$ = 35mΩ at V_{GS} = –4.5V, I_D = –7A
- High performance trench technology for extremely low $r_{DS(on)}$
- RoHS Compliant

General Description

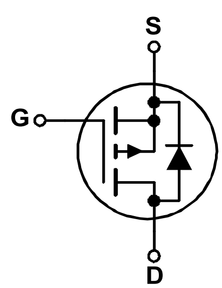
This P-Channel MOSFET has been produced using Fairchild Semiconductor's proprietary PowerTrench® technology to deliver low $r_{DS(on)}$ and good switching characteristic offering superior performance in application.

Application

- Inverter
- Power Supplies



D-PAK
(TO-252)



MOSFET Maximum Ratings T_C = 25°C unless otherwise noted

Symbol	Parameter	Ratings	Units
V_{DS}	Drain to Source Voltage	–40	V
V_{GS}	Gate to Source Voltage	±20	V
I_D	Drain Current -Continuous(Package Limited) T_C= 25°C	–32	A
	-Continuous(Silicon Limited) T_C= 25°C (Note 1)	–40	
	-Continuous T_A= 25°C (Note 1a)	–8.4	
	-Pulsed	–100	
E_{AS}	Drain-Source Avalanche Energy (Note 3)	121	mJ
P_D	Power Dissipation T_C= 25°C	69	W
	Power Dissipation (Note 1a)	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	1.8	°C/W
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient (Note 1a)	40	

Package Marking and Ordering Information

Device Marking	Device	Package	Reel Size	Tape Width	Quantity
FDD4685	FDD4685	D-PAK(TO-252)	13''	12mm	2500 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 = –250μA, V_{GS} = 0V	–40			V
$\frac{\Delta BV_{DSS}}{\Delta T_J}$	Breakdown Voltage Temperature Coefficient	I_D = –250μA, referenced to 25°C		–33		mV/°C
I_{DSS}	Zero Gate Voltage Drain Current	V_{DS} = –32V, V_{GS} = 0V			–1	μA
I_{GSS}	Gate to Source Leakage Current	V_{GS} = ±20V, V_{GS} = 0V			±100	nA

On Characteristics (Note 2)

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
$V_{GS(th)}$	Gate to Source Threshold Voltage	V_{GS} = V_{DS}, I_D = –250μA	–1	–1.6	–3	V
$\frac{\Delta V_{GS(th)}}{\Delta T_J}$	Gate to Source Threshold Voltage Temperature Coefficient	I_D = –250μA, referenced to 25°C		4.9		mV/°C
$r_{DS(on)}$	Static Drain to Source On Resistance	V_{GS} = –10V, I_D = –8.4A		23	27	mΩ
		V_{GS} = –4.5V, I_D = –7A		30	35	
		V_{GS} = –10V, I_D = –8.4A, T_J=125°C		33	42	
g_{FS}	Forward Transconductance	V_{DS} = –5V, I_D = –8.4A		23		S

Dynamic Characteristics

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
C_{iss}	Input Capacitance	V_{DS} = –20V, V_{GS} = 0V, f = 1MHz		1790	2380	pF
C_{oss}	Output Capacitance			260	345	pF
C_{rss}	Reverse Transfer Capacitance			140	205	pF
R_g	Gate Resistance	f = 1MHz		4		Ω

Switching Characteristics

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
$t_{d(on)}$	Turn-On Delay Time	V_{DD} = –20V, I_D = –8.4A V_{GS} = –10V, R_{GEN} = 6Ω		8	16	ns
t_r	Rise Time			15	27	ns
$t_{d(off)}$	Turn-Off Delay Time			34	55	ns
t_f	Fall Time			14	26	ns
$Q_{g(TOT)}$	Total Gate Charge	V_{DD} =–20V, I_D = –8.4A V_{GS} = –5V		19	27	nC
Q_{gs}	Gate to Source Gate Charge			5.6		nC
Q_{gd}	Gate to Drain “Miller” Charge			6.1		nC

Drain-Source Diode Characteristics

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
V_{SD}	Source to Drain Diode Forward Voltage	V_{GS} = 0V, I_S = –8.4A (Note 2)		–0.85	–1.2	V
t_{rr}	Reverse Recovery Time	I_F = –8.4A, di/dt = 100A/μs		30	45	ns
Q_{rr}	Reverse Recovery Charge			31	47	nC

Notes:

1: $R_{\theta JA}$ is the sum of the junction-to-case and case-to- ambient thermal resistance where the case thermal reference is defined as the solder mounting surface of the drain pins. $R_{\theta JC}$ is guaranteed by design while $R_{\theta JA}$ is determined by the user's board design.

a. 40°C/W when mounted on a 1 in^2 pad of 2 oz copper

b. 96°C/W when mounted on a minimum pad.

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

3: Starting T_J = 25°C, L = 3mH, I_{AS} = 9A, V_{DD} = 40V, V_{GS} = 10V.

Typical Characteristics T_J = 25°C unless otherwise noted

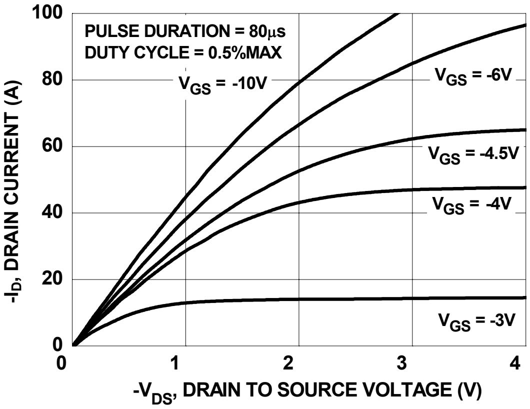


Figure 1. On Region Characteristics

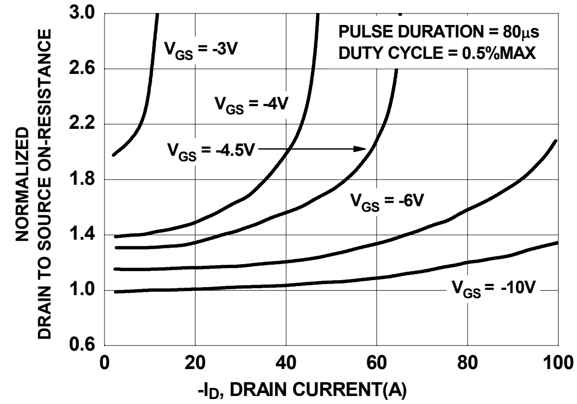


Figure 2. Normalized On-Resistance vs Drain Current and Gate Voltage

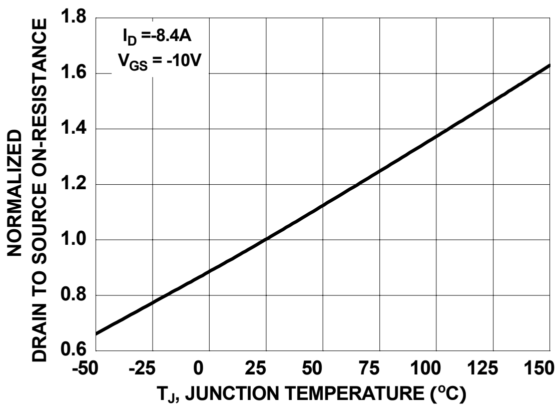


Figure 3. Normalized On Resistance vs Junction Temperature

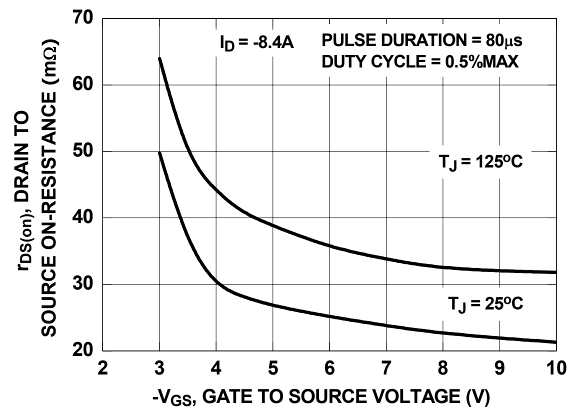


Figure 4. On-Resistance vs Gate to Source Voltage

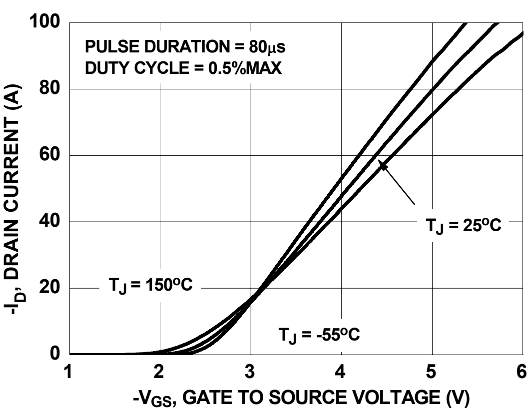


Figure 5. Transfer Characteristics

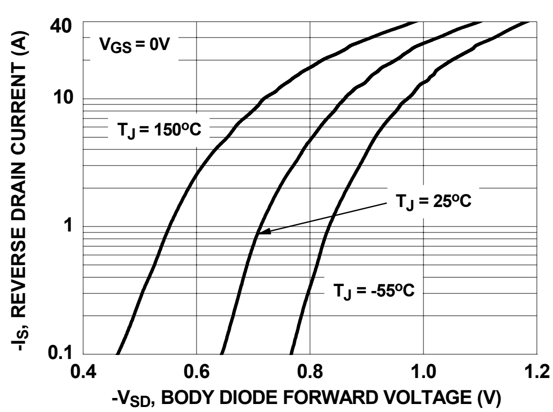


Figure 6. Source to Drain Diode Forward Voltage vs Source Current

Typical Characteristics T_J = 25°C unless otherwise noted

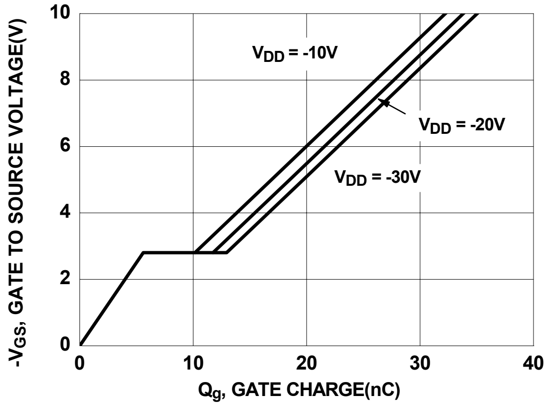


Figure 7. Gate Charge Characteristics

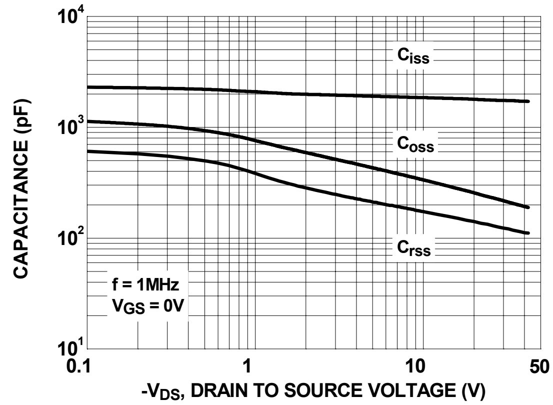


Figure 8. Capacitance vs Drain to Source Voltage

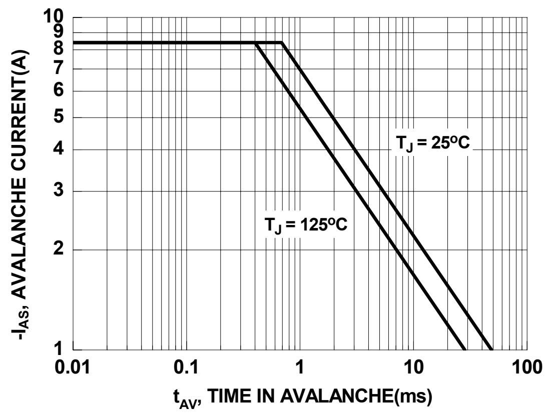


Figure 9. Unclamped Inductive Switching Capability

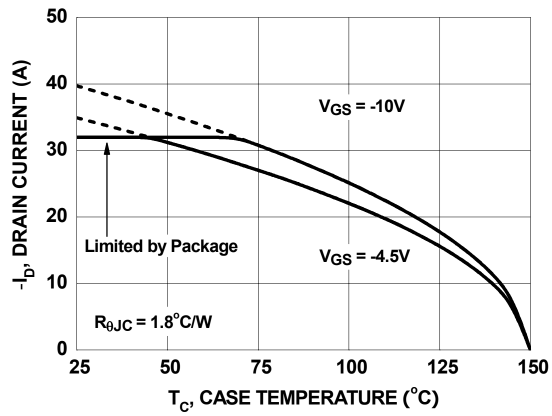


Figure 10. Maximum Continuous Drain Current vs Case Temperature

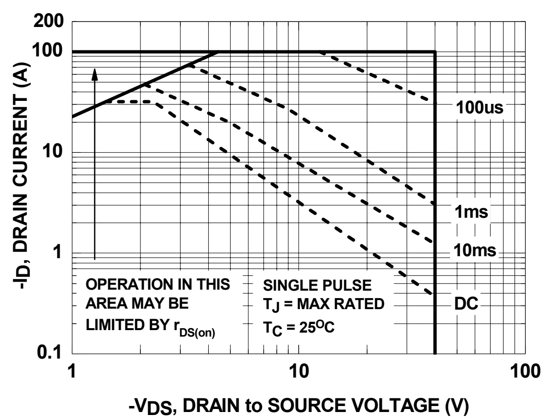


Figure 11. Forward Bias Safe Operating Area

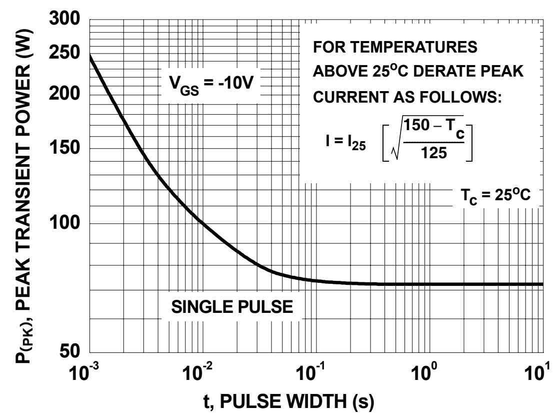


Figure 12. Single Pulse Maximum Power Dissipation

Typical Characteristics T_J = 25°C unless otherwise noted

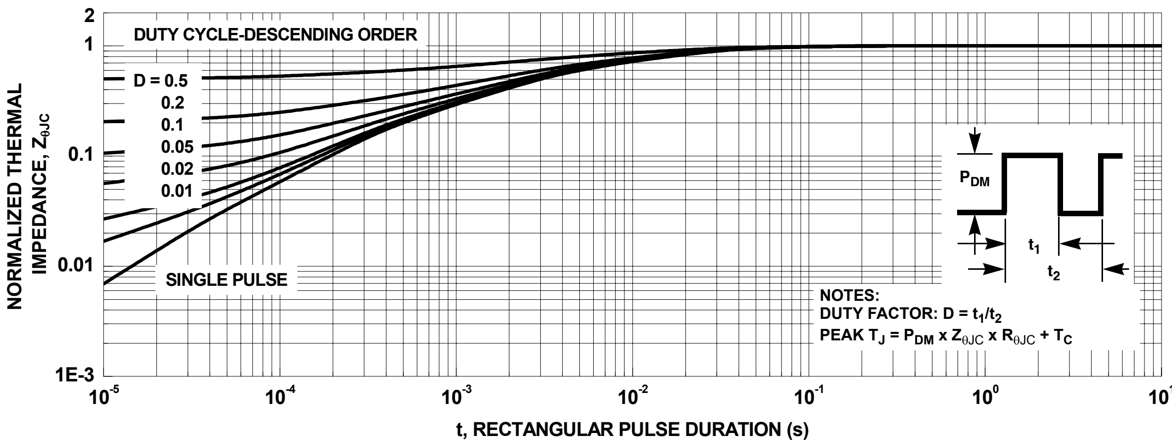


Figure 13. Transient Thermal Response Curve

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