FAIRCHILD SEMICONDUCTOR®

June 2008

FDMS8660S
N-Channel PowerTrench® SyncFET™
30V, 40A, 2.4mΩ

Features

- Max $r_{DS(on)}$ = 2.4mΩ at V_{GS} = 10V, I_D = 25A
- Max $r_{DS(on)}$ = 3.5mΩ at V_{GS} = 4.5V, I_D = 21A
- Advanced Package and Silicon combination for low $r_{DS(on)}$ and high efficiency
- SyncFET Schottky Body Diode
- MSL1 robust package design
- RoHS Compliant

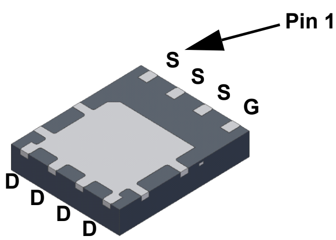
General Description

The FDMS8660S has been designed to minimize losses in power conversion applications. Advancements in both silicon and package technologies have been combined to offer the lowest $r_{DS(on)}$ while maintaining excellent switching performance. This device has the added benefit of an efficient monolithic Schottky body diode.

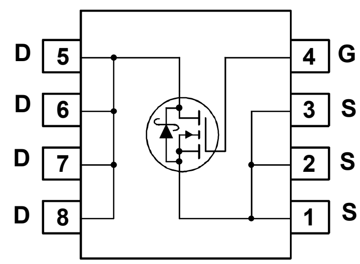
Application

Synchronous Rectifier for DC/DC Converters

- Notebook Vcore/ GPU low side switch
- Networking Point of Load low side switch
- Telecom secondary side rectification



Power 56 (Bottom view)



MOSFET Maximum Ratings T_A = 25°C unless otherwise noted

Symbol	Parameter	Ratings	Units
V_{DS}	Drain to Source Voltage	30	V
V_{GS}	Gate to Source Voltage	±20	V
I_D	Drain Current -Continuous (Package limited) T_C = 25°C	40	A
	-Continuous (Silicon limited) T_C = 25°C	147	
	-Continuous T_A = 25°C (Note 1a)	25	
	-Pulsed	200	
E_{AS}	Single Pulse Avalanche Energy (Note 3)	937	mJ
P_D	Power Dissipation T_C = 25°C	83	W
	Power Dissipation T_A = 25°C (Note 1a)	2.5	
T_J, T_{STG}	Operating and Storage Junction Temperature Range	-55 to +150	°C

Thermal Characteristics

$R_{\theta JC}$	Thermal Resistance, Junction to Case	1.5	°C/W
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient (Note 1a)	50	

Package Marking and Ordering Information

Device Marking	Device	Package	Reel Size	Tape Width	Quantity
FDMS8660S	FDMS8660S	Power 56	13''	12mm	3000 units

Electrical Characteristics T_J = 25°C unless otherwise noted

Off Characteristics

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
BV_{DSS}	Drain to Source Breakdown Voltage	I_D = 1mA, V_{GS} = 0V	30			V
$\frac{\Delta BV_{DSS}}{\Delta T_J}$	Breakdown Voltage Temperature Coefficient	I_D = 10mA, referenced to 25°C		21		mV/°C
I_{DSS}	Zero Gate Voltage Drain Current	V_{DS} = 24V, V_{GS} = 0V			500	μA
I_{GSS}	Gate to Source Leakage Current	V_{GS} = ±20V, V_{DS} = 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 = 1mA	1	1.5	2	V
$\frac{\Delta V_{GS(th)}}{\Delta T_J}$	Gate to Source Threshold Voltage Temperature Coefficient	I_D = 10mA, referenced to 25°C		-4		mV/°C
$r_{DS(on)}$	Drain to Source On Resistance	V_{GS} = 10V, I_D = 25A		1.9	2.4	mΩ
		V_{GS} = 4.5V, I_D = 21A		2.6	3.5	
		V_{GS} = 10V, I_D = 25A ,T_J = 125°C		2.9	3.9	
g_{FS}	Forward Transconductance	V_{DS} = 10V, I_D = 25A		123		S

Dynamic Characteristics

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
C_{iss}	Input Capacitance	V_{DS} = 15V, V_{GS} = 0V, f = 1MHz		4345		pF
C_{oss}	Output Capacitance			1215		pF
C_{rss}	Reverse Transfer Capacitance			425		pF
R_g	Gate Resistance	f = 1MHz		1.0	1.75	Ω

Switching Characteristics

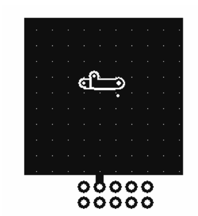
Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
$t_{d(on)}$	Turn-On Delay Time	V_{DD} = 15V, I_D = 1A V_{GS} = 10V, R_{GEN} = 6Ω		17	31	ns
t_r	Rise Time			12	22	ns
$t_{d(off)}$	Turn-Off Delay Time			76	122	ns
t_f	Fall Time			50	80	ns
$Q_{g(TOT)}$	Total Gate Charge at 10V	V_{GS} = 0V to 10V; V_{DS} = 15V, I_D = 25A		81	113	nC
$Q_{g(4.5V)}$	Total Gate Charge at 4.5V	V_{GS} = 0V to 4.5V		44	62	nC
Q_{gs}	Gate to Source Gate Charge			11		nC
Q_{gd}	Gate to Drain "Miller" Charge			16		nC

Drain-Source Diode Characteristics

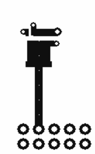
Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
V_{SD}	Source to Drain Diode Forward Voltage	V_{GS} = 0V, I_S = 2.2A (Note 2)		0.37	0.70	V
t_{rr}	Reverse Recovery Time	I_F = 25A, di/dt = 300A/μs		35		ns
Q_{rr}	Reverse Recovery Charge			98		nC

Notes:

1: $R_{\theta JA}$ is determined with the device mounted on a 1in² 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. 50°C/W when mounted on a 1 in² pad of 2 oz copper



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

Scale 1 : 1 on letter size paper

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

3: Starting T_J = 25°C, L = 3mH, I_{AS} = 25A, V_{DD} = 30V, V_{GS} = 10V.

Typical Characteristics T_J = 25°C unless otherwise noted

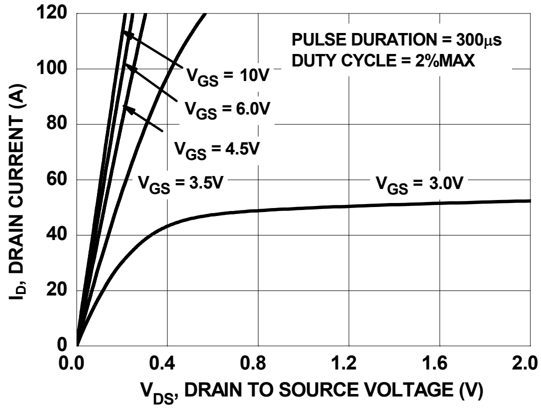


Figure 1. On-Region Characteristics

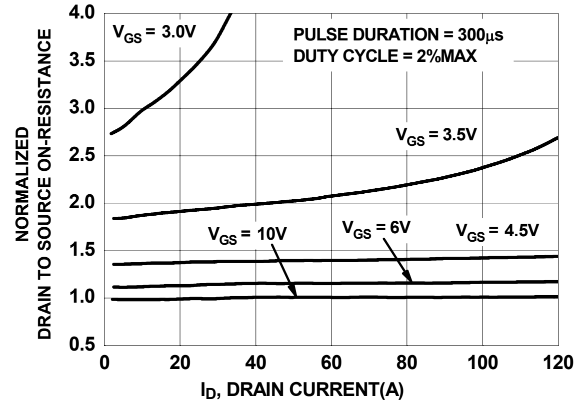


Figure 2. Normalized On-Resistance vs Drain Current and Gate Voltage

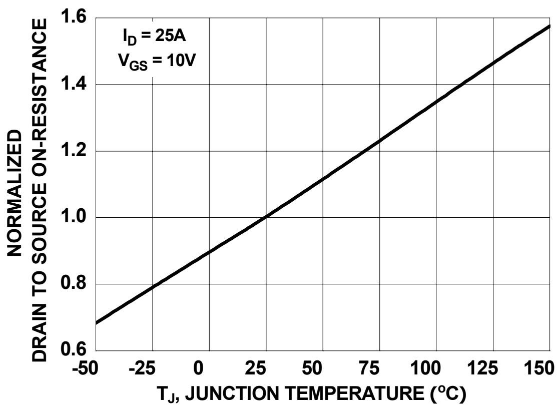


Figure 3. Normalized On-Resistance vs Junction Temperature

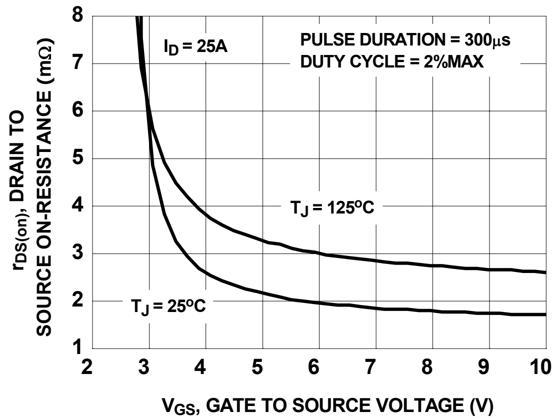


Figure 4. On-Resistance vs Gate to Source Voltage

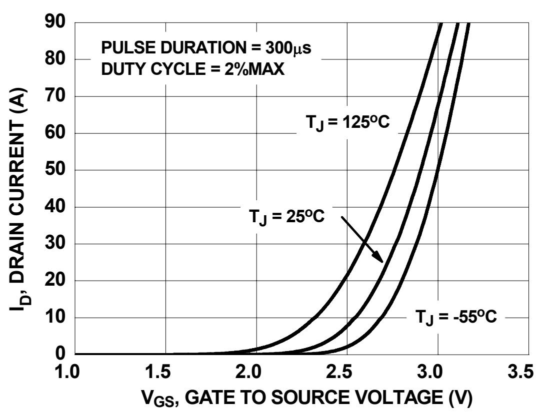


Figure 5. Transfer Characteristics

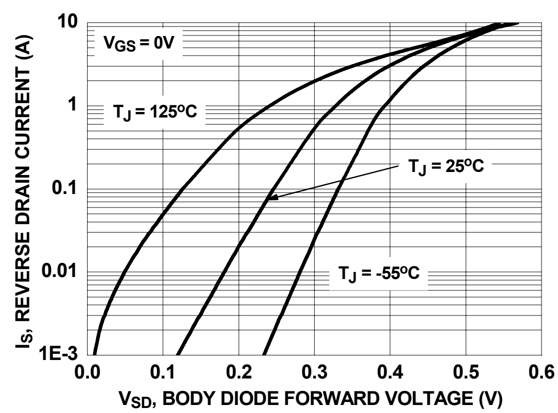


Figure 6. Source to Drain Diode Forward Voltage vs Source Current

Typical Characteristics T_J = 25°C unless otherwise noted

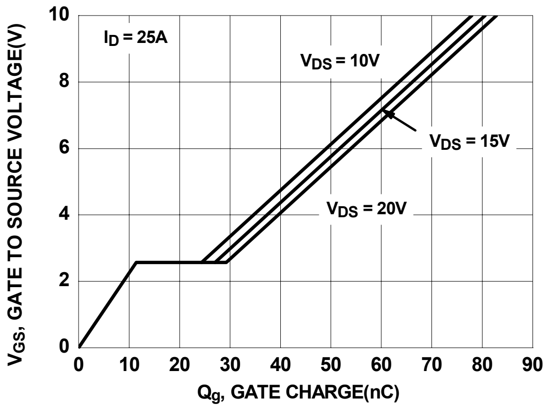


Figure 7. Gate Charge Characteristics

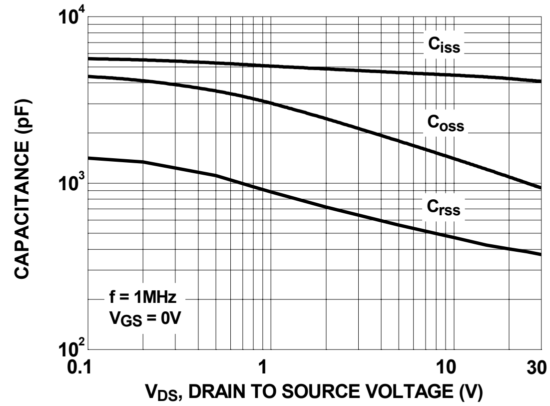


Figure 8. Capacitance vs Drain to Source Voltage

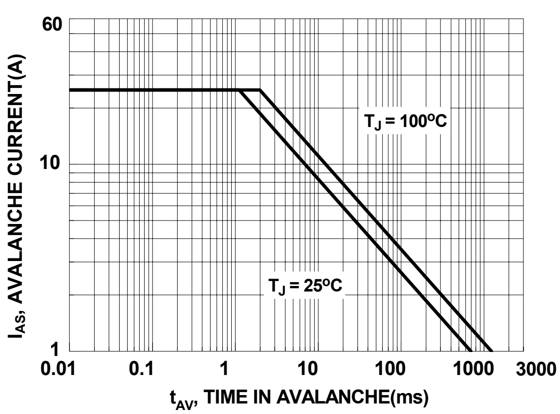


Figure 9. Unclamped Inductive Switching Capability

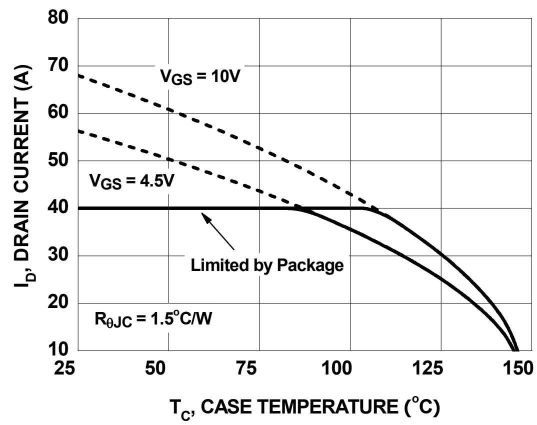


Figure 10. Maximum Continuous Drain Current vs Case Temperature

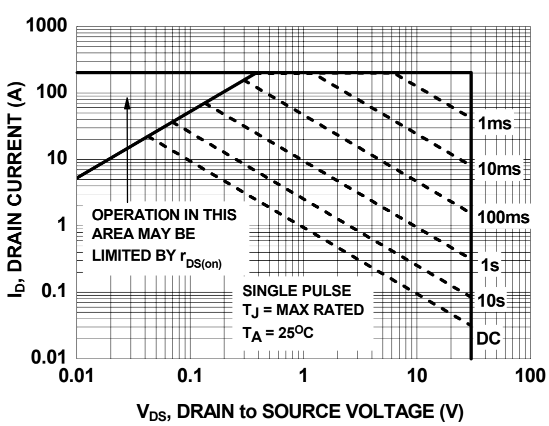


Figure 11. Forward Bias Safe Operating Area

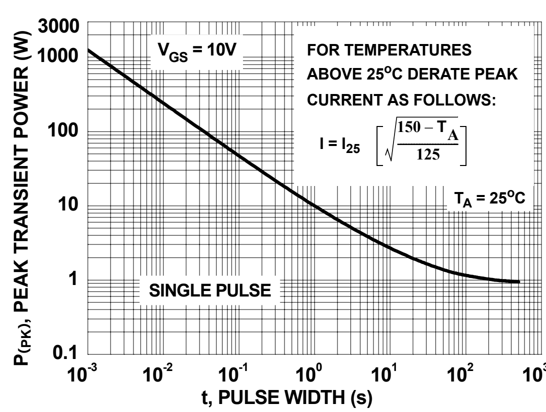


Figure 12. Single Pulse Maximum Power Dissipation

Typical Characteristics T_J = 25°C unless otherwise noted

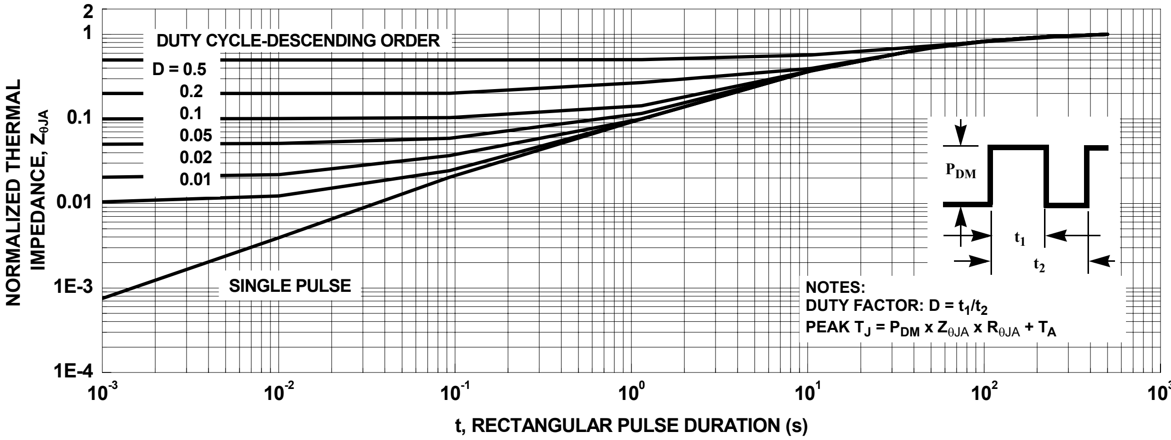


Figure 13. Transient Thermal Response Curve

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 14 shows the reverses recovery characteristic of the FDMS8660S.

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

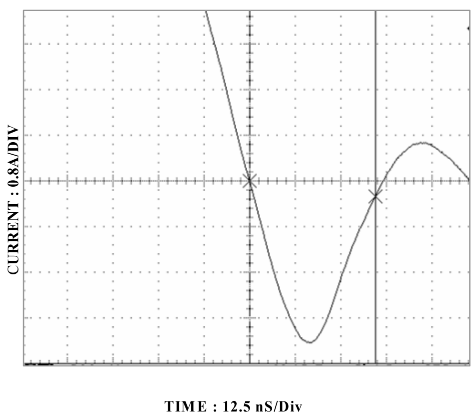


Figure 14. FDMS8660S SyncFET body diode reverse recovery characteristic

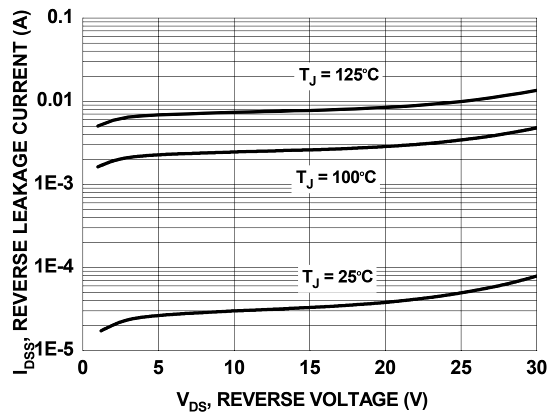
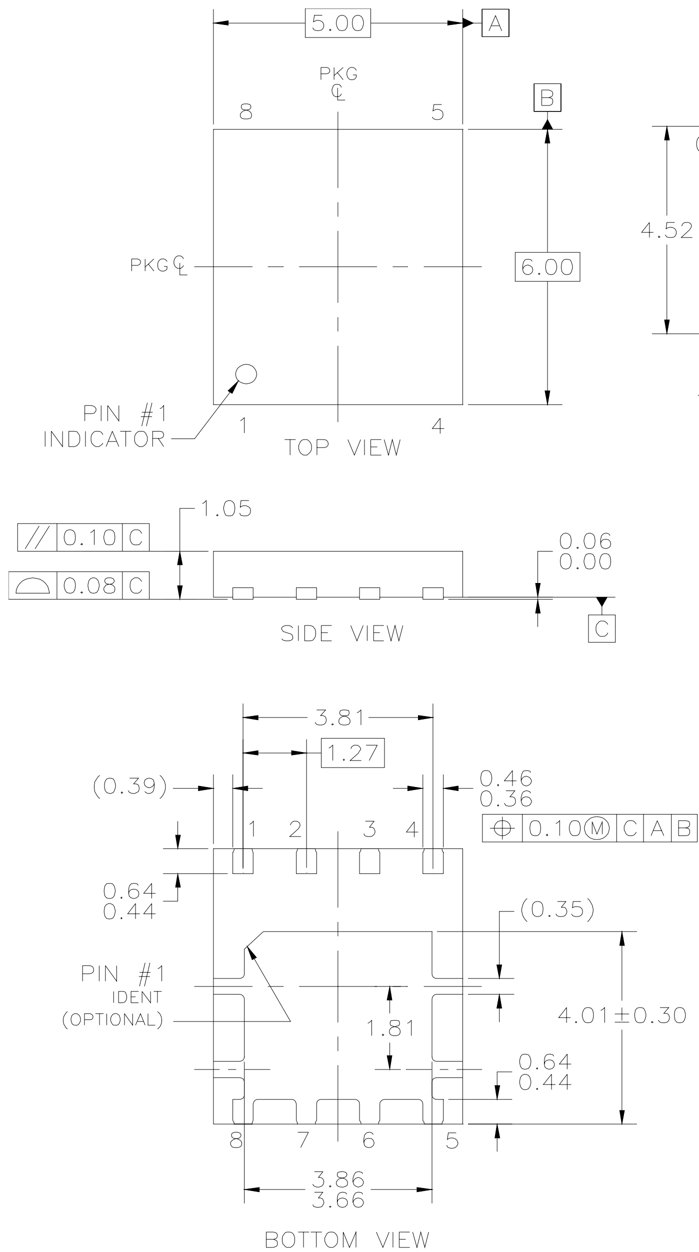


Figure 15. SyncFET body diode reverses leakage versus drain-source voltage



NOTES: UNLESS OTHERWISE SPECIFIED
A) ALL DIMENSIONS ARE IN MILLIMETERS.
B) NO JEDEC REFERENCE AS OF FEBRUARY 2006
C) DIMENSIONING AND TOLERANCING PER ASME Y14.5M 1994

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