

July 2011

FDMS0312S

N-Channel PowerTrench[®] SyncFETTM 30 V, 42 A, 4.9 m Ω

Features

- Max $r_{DS(on)}$ = 4.9 m Ω at V_{GS} = 10 V, I_D = 18 A
- Max $r_{DS(on)}$ = 5.8 m Ω at V_{GS} = 4.5 V, I_D = 14 A
- Advanced Package and Silicon combination for low r_{DS(on)} and high efficiency
- SyncFET Schottky Body Diode
- MSL1 robust package design
- 100% UIL tested
- RoHS Compliant

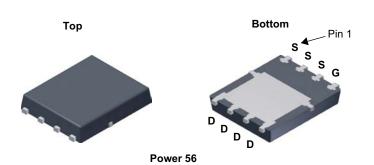


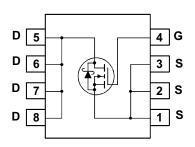
General Description

The FDMS0312S has been designed to minimize losses in power conversion application. Advancements in both silicon and package technologies have been combined to offer the lowest $r_{\text{DS}(\text{on})}$ while maintaining excellent switching performance. This device has the added benefit of an efficient monolithic Schottky body diode.

Applications

- Synchronous Rectifier for DC/DC Converters
- Notebook Vcore/ GPU low side switch
- Networking Point of Load low side switch
- Desktop





MOSFET Maximum Ratings T_A = 25 °C unless otherwise noted

Symbol	Parameter	Parameter			Units
V _{DS}	Drain to Source Voltage			30	V
V _{GS}	Gate to Source Voltage		(Note 4)	±20	V
	Drain Current -Continuous (Package limited)	T _C = 25 °C		42	
I _D	-Continuous (Silicon limited)	T _C = 25 °C		83	┐ ,
	-Continuous	T _A = 25 °C	(Note 1a)	19	_ A
	-Pulsed			90	
E _{AS}	Single Pulse Avalanche Energy		(Note 3)	60	mJ
D	Power Dissipation	T _C = 25 °C		46	w
P_{D}	Power Dissipation	T _A = 25 °C	(Note 1a)	2.5	
T _J , T _{STG}	Operating and Storage Junction Temperature R	Operating and Storage Junction Temperature Range			°C

Thermal Characteristics

$R_{\theta JC}$	Thermal Resistance, Junction to Case	2.7	°C/M
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient (Note 1a)	50	°C/W

Package Marking and Ordering Information

Device Marking	Device	Package	Reel Size	Tape Width	Quantity
FDMS0312S	FDMS0312S	Power 56	3 "	12 mm	3000 units

1

Electrical Characteristics T_J = 25 °C unless otherwise noted

Symbol	Parameter	Test Conditions	Min	Тур	Max	Units
Off Chara	cteristics					
BV _{DSS}	Drain to Source Breakdown Voltage	I _D = 1 mA, V _{GS} = 0 V	30			V
$\frac{\Delta BV_{DSS}}{\Delta T_{J}}$	Breakdown Voltage Temperature Coefficient	I _D = 10 mA, referenced to 25 °C		18		mV/°C
I _{DSS}	Zero Gate Voltage Drain Current	V _{DS} = 24 V, V _{GS} = 0 V			500	μΑ
I _{GSS}	Gate to Source Leakage Current, Forward	V _{GS} = 20 V, V _{DS} = 0 V			100	nA

On Characteristics (Note 2)

	` '					
V _{GS(th)}	Gate to Source Threshold Voltage	$V_{GS} = V_{DS}$, $I_D = 1 \text{ mA}$	1.2	1.9	3.0	V
$\frac{\Delta V_{GS(th)}}{\Delta T_J}$	Gate to Source Threshold Voltage Temperature Coefficient	I _D = 10 mA, referenced to 25 °C		-5		mV/°C
		V _{GS} = 10 V, I _D = 18 A		3.6	4.9	
r _{DS(on)}	Static Drain to Source On Resistance	$V_{GS} = 4.5 \text{ V}, I_D = 14 \text{ A}$		4.7	5.8	mΩ
	V _{GS} = 10 V, I _D = 18 A, T _J = 125 °C		5	6.2		
g _{ES}	Forward Transconductance	V _{DS} = 5 V, I _D = 18 A		97		s

Dynamic Characteristics

C _{iss}	Input Capacitance		2120	2820	pF
Coss	Output Capacitance	V _{DS} = 15 V, V _{GS} = 0 V, f = 1 MHz	735	975	pF
C _{rss}	Reverse Transfer Capacitance	I – I MHZ	90	135	pF
Ra	Gate Resistance		1.1	2.2	Ω

Switching Characteristics

4	Turn-On Delay Time		12	21	no
t _{d(on)}	Turri-Ori Delay Tirrie		12	21	ns
t _r	Rise Time	V _{DD} = 15 V, I _D = 18 A,	5	10	ns
t _{d(off)}	Turn-Off Delay Time	$V_{GS} = 10 \text{ V}, R_{GEN} = 6 \Omega$	28	44	ns
t_f	Fall Time		4	10	ns
Q _a	Total Gate Charge	V _{GS} = 0 V to 10 V	33	46	nC
Q_{α}	Total Gate Charge	$V_{GS} = 0 \text{ V to } 4.5 \text{ V}$ $V_{DD} = 15 \text{ V}$	15	22	nC
Qgs	Gate to Source Gate Charge	I _D = 18 A	6.5		nC
Q _{ad}	Gate to Drain "Miller" Charge		4.0		nC

Drain-Source Diode Characteristics

V Committee Bright Franch Ville		$V_{GS} = 0 \text{ V}, I_S = 2 \text{ A}$ (Note 2)	0.48	0.7	
V _{SD}	Source to Drain Diode Forward Voltage	V _{GS} = 0 V, I _S = 18 A (Note 2)	0.80	1.2	V
t _{rr}	Reverse Recovery Time	1 40 4 3'(4) 000 4/	26	42	ns
Q _{rr}	Reverse Recovery Charge	I _F = 18 A, di/dt = 300 A/μs 26 4		42	nC

Notes:

^{1.} R_{0,1A} 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_{0,1C} is guaranteed by design while R_{0,CA} is determined by the user's board design.



a. 50 °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 $\mu\text{s},$ Duty cycle < 2.0%.
- 3. E_{AS} of 60 mJ is based on starting T_J = 25 $^{\circ}$ C, L = 1 mH, I_{AS} = 11 A, V_{DD} = 27 V, V_{GS} = 10 V. 100% test at L = 0.3 mH, I_{AS} = 16 A.
- 4. As an N-ch device, the negative Vgs rating is for low duty cycle pulse occurrence only. No continuous rating is implied.

Typical Characteristics T_J = 25 °C unless otherwise noted

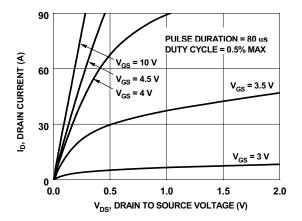


Figure 1. On-Region Characteristics

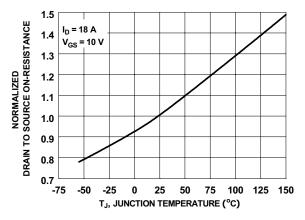


Figure 3. Normalized On-Resistance vs Junction Temperature

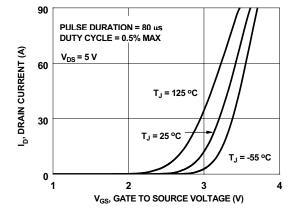


Figure 5. Transfer Characteristics

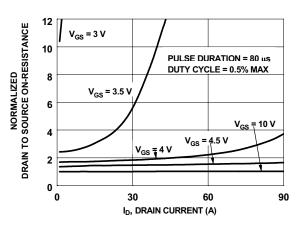


Figure 2. Normalized On-Resistance vs Drain Current and Gate Voltage

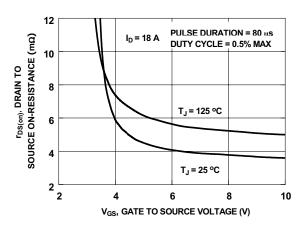


Figure 4. On-Resistance vs Gate to Source Voltage

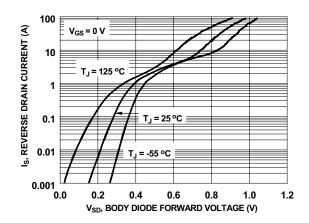


Figure 6. Source to Drain Diode Forward Voltage vs Source Current

Typical Characteristics $T_J = 25$ °C unless otherwise noted

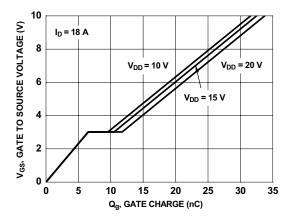


Figure 7. Gate Charge Characteristics

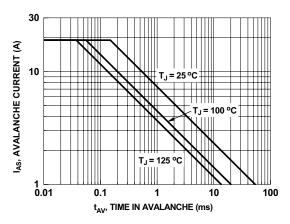


Figure 9. Unclamped Inductive Switching Capability

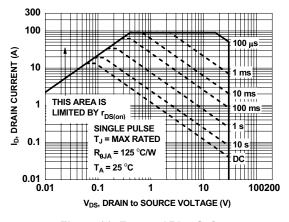


Figure 11. Forward Bias Safe Operating Area

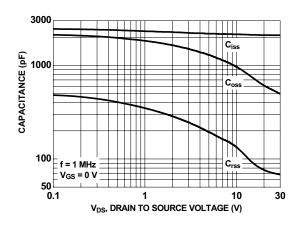


Figure 8. Capacitance vs Drain to Source Voltage

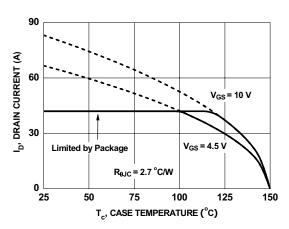


Figure 10. Maximum Continuous Drain Current vs Case Temperature

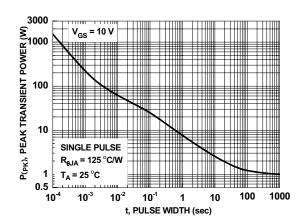


Figure 12. Single Pulse Maximum Power Dissipation

Typical Characteristics T_J = 25 °C unless otherwise noted

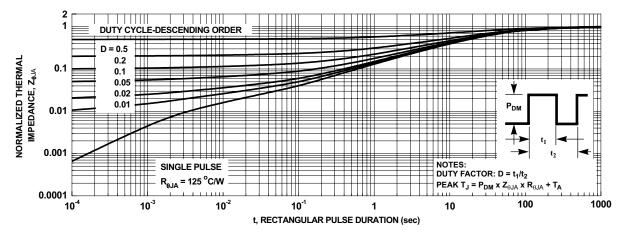


Figure 13. Junction-to-Ambient Transient Thermal Response Curve

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 FDMS0312S.

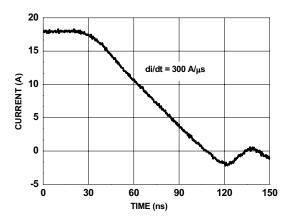


Figure 14. FDMS0312S SyncFET body diode reverse recovery characteristic

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

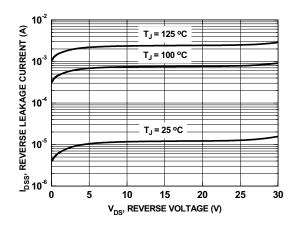
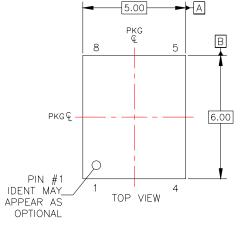
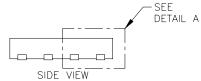
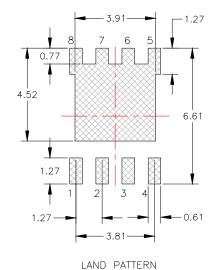


Figure 15. SyncFET body diode reverses leakage versus drain-source voltage

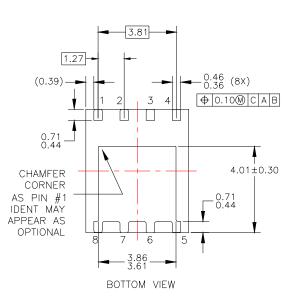
Dimensional Outline and Pad Layout

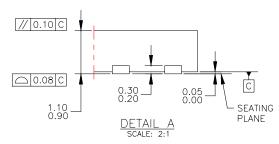


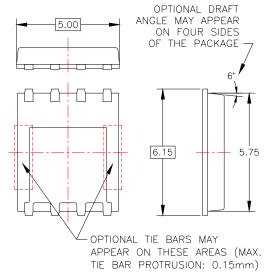




RECOMMENDATION







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Rev 155