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October 2014

# FDMS0312AS

## N-Channel PowerTrench<sup>®</sup> SyncFET<sup>™</sup>

30 V, 22 A, 5.0 mΩ

### Features

- Max  $r_{DS(on)}$  = 5.0 mΩ at  $V_{GS} = 10$  V,  $I_D = 18$  A
- Max  $r_{DS(on)}$  = 6.2 mΩ at  $V_{GS} = 4.5$  V,  $I_D = 16$  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

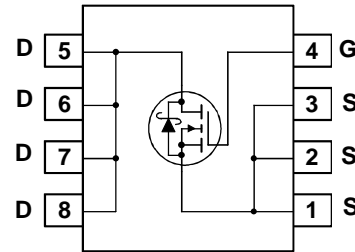
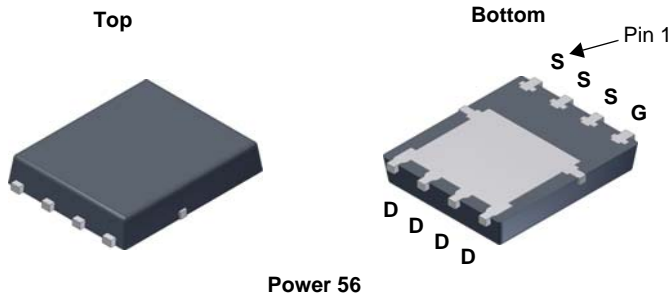


### General Description

The FDMS0312AS has been designed to minimize losses in power conversion application. Advancements in both silicon and package technologies have been combined to offer the lowest  $r_{DS(on)}$  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
- Telecom secondary side rectification



### MOSFET Maximum Ratings $T_C = 25^\circ\text{C}$ unless otherwise noted

Symbol	Parameter	Rated	Units
$V_{DS}$	Drain to Source Voltage	30	V
$V_{GS}$	Gate to Source Voltage (Note 4)	$\pm 20$	V
$I_D$	Drain Current -Continuous (Package limited) $T_C = 25^\circ\text{C}$	22	A
	-Continuous (Silicon limited) $T_C = 25^\circ\text{C}$	70	
	-Continuous $T_A = 25^\circ\text{C}$ (Note 1a)	18	
	-Pulsed	100	
$E_{AS}$	Single Pulse Avalanche Energy (Note 3)	33	mJ
$P_D$	Power Dissipation $T_C = 25^\circ\text{C}$	36	W
	Power Dissipation $T_A = 25^\circ\text{C}$ (Note 1a)	2.5	
$T_J, T_{STG}$	Operating and Storage Junction Temperature Range	-55 to +150	$^\circ\text{C}$

### Thermal Characteristics

$R_{\theta JC}$	Thermal Resistance, Junction to Case	3.4	$^\circ\text{C/W}$
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient (Note 1a)	50	

### Package Marking and Ordering Information

Device Marking	Device	Package	Reel Size	Tape Width	Quantity
FDMS0312AS	FDMS0312AS	Power 56	13 "	12 mm	3000 units

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

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
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**Off Characteristics**

$BV_{DSS}$	Drain to Source Breakdown Voltage	$I_D = 1 \text{ mA}, V_{GS} = 0 \text{ V}$	30			V
$\frac{\Delta BV_{DSS}}{\Delta T_J}$	Breakdown Voltage Temperature Coefficient	$I_D = 10 \text{ mA}$ , referenced to $25^\circ\text{C}$		18		mV/°C
$I_{DSS}$	Zero Gate Voltage Drain Current	$V_{DS} = 24 \text{ V}, V_{GS} = 0 \text{ V}$			500	μA
$I_{GSS}$	Gate to Source Leakage Current, Forward	$V_{GS} = 20 \text{ V}, V_{DS} = 0 \text{ V}$			100	nA

**On Characteristics**

$V_{GS(th)}$	Gate to Source Threshold Voltage	$V_{GS} = V_{DS}, I_D = 1 \text{ mA}$	1.2	1.5	3.0	V
$\frac{\Delta V_{GS(th)}}{\Delta T_J}$	Gate to Source Threshold Voltage Temperature Coefficient	$I_D = 10 \text{ mA}$ , referenced to $25^\circ\text{C}$		-4		mV/°C
$r_{DS(on)}$	Static Drain to Source On Resistance	$V_{GS} = 10 \text{ V}, I_D = 18 \text{ A}$		4.2	5.0	mΩ
		$V_{GS} = 4.5 \text{ V}, I_D = 16 \text{ A}$		5.4	6.2	
		$V_{GS} = 10 \text{ V}, I_D = 18 \text{ A}, T_J = 125^\circ\text{C}$		5.3	6.8	
$g_{FS}$	Forward Transconductance	$V_{DS} = 5 \text{ V}, I_D = 18 \text{ A}$		92		S

**Dynamic Characteristics**

$C_{iss}$	Input Capacitance	$V_{DS} = 15 \text{ V}, V_{GS} = 0 \text{ V},$ $f = 1 \text{ MHz}$		1365	1815	pF
$C_{oss}$	Output Capacitance			550	730	pF
$C_{riss}$	Reverse Transfer Capacitance			70	105	pF
$R_g$	Gate Resistance			0.5	2.5	Ω

**Switching Characteristics**

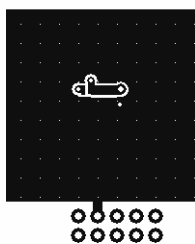
$t_{d(on)}$	Turn-On Delay Time	$V_{DD} = 15 \text{ V}, I_D = 18 \text{ A},$ $V_{GS} = 10 \text{ V}, R_{GEN} = 6 \Omega$		10	19	ns	
$t_r$	Rise Time			2.3	10	ns	
$t_{d(off)}$	Turn-Off Delay Time			25	40	ns	
$t_f$	Fall Time			6	12	ns	
$Q_g$	Total Gate Charge		$V_{GS} = 0 \text{ V to } 10 \text{ V}$		23	31	nC
$Q_g$	Total Gate Charge	$V_{GS} = 0 \text{ V to } 4.5 \text{ V}$	$V_{DD} = 15 \text{ V},$ $I_D = 18 \text{ A}$		11	16	nC
$Q_{gs}$	Gate to Source Charge				3.3		nC
$Q_{gd}$	Gate to Drain "Miller" Charge				3.7		nC

**Drain-Source Diode Characteristics**

$V_{SD}$	Source-Drain Diode Forward Voltage	$V_{GS} = 0 \text{ V}, I_S = 2 \text{ A}$ (Note 2)		0.63	0.8	V
		$V_{GS} = 0 \text{ V}, I_S = 18 \text{ A}$ (Note 2)		0.8	1.2	
$t_{rr}$	Reverse Recovery Time	$I_F = 18 \text{ A}, di/dt = 300 \text{ A}/\mu\text{s}$		23	36	ns
$Q_{rr}$	Reverse Recovery Charge			20	32	nC

**Notes:**

1.  $R_{\theta JA}$  is determined with the device mounted on a 1 in<sup>2</sup> 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.  $50^\circ\text{C/W}$  when mounted on a 1 in<sup>2</sup> pad of 2 oz copper.



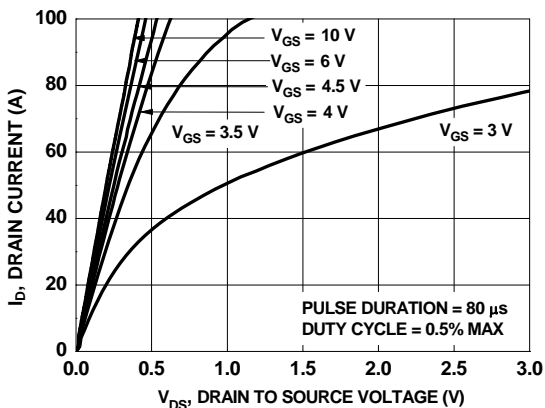
b.  $125^\circ\text{C/W}$  when mounted on a minimum pad of 2 oz copper.

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

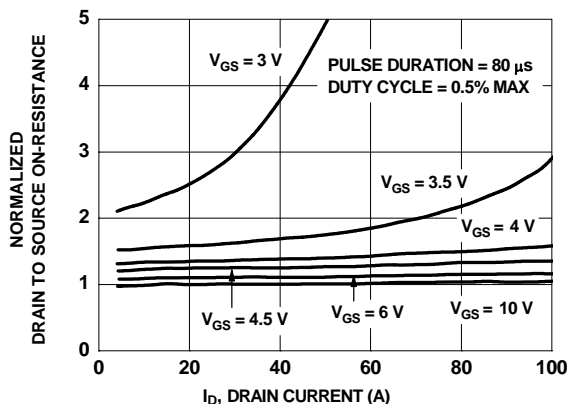
3.  $E_{AS}$  of 33 mJ is based on starting  $T_J = 25^\circ\text{C}$ ,  $L = 0.3 \text{ mH}$ ,  $I_{AS} = 15 \text{ A}$ ,  $V_{DD} = 27 \text{ V}$ ,  $V_{GS} = 10 \text{ V}$ .

4. As an N-ch device, the negative Vgs rating is for low duty cycle pulse occurrence only. No continuous rating is implied.

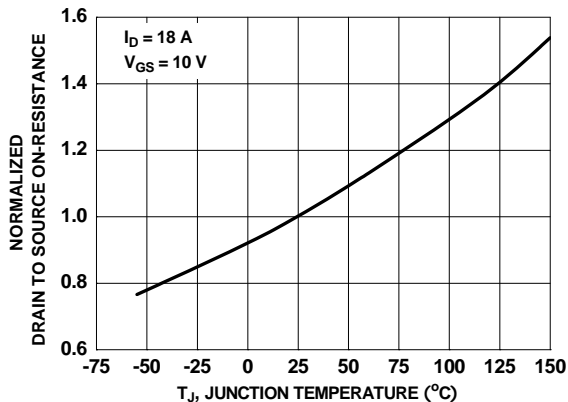
**Typical Characteristics**  $T_J = 25^\circ\text{C}$  unless otherwise noted



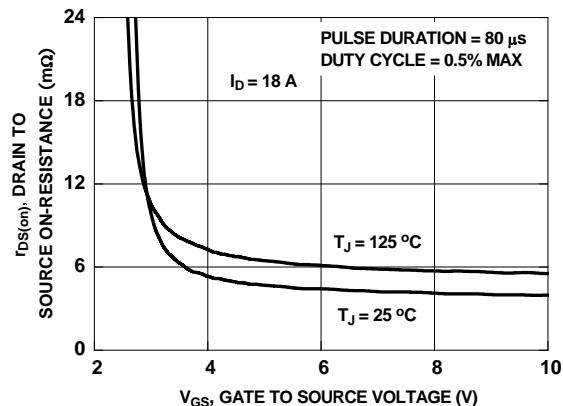
**Figure 1. On Region Characteristics**



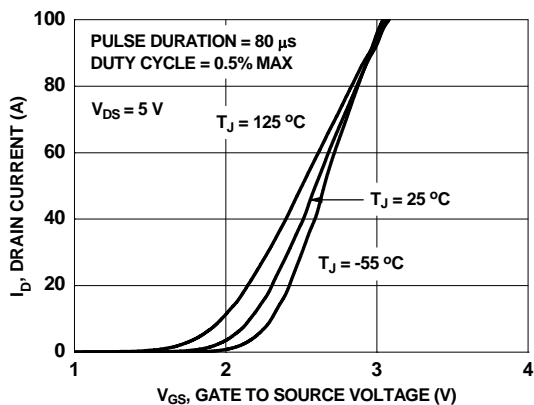
**Figure 2. Normalized On-Resistance vs Drain Current and Gate Voltage**



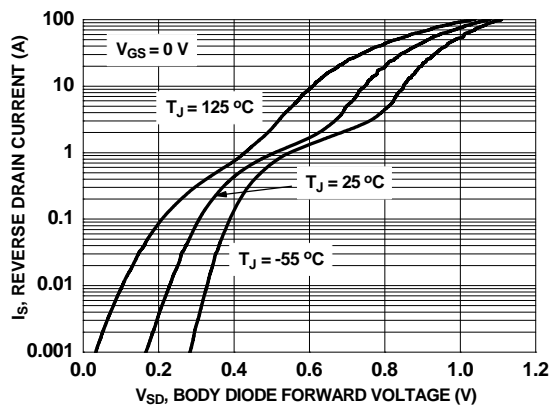
**Figure 3. Normalized On Resistance vs Junction Temperature**



**Figure 4. On-Resistance vs Gate to Source Voltage**

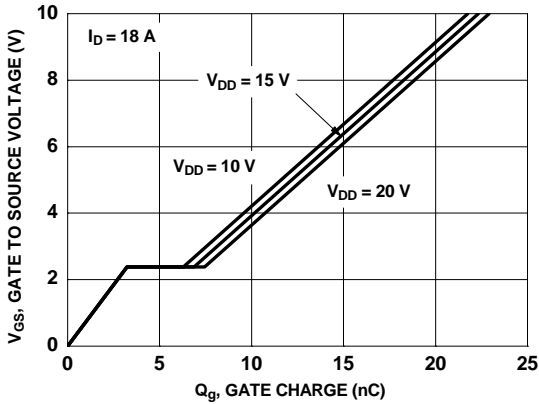


**Figure 5. Transfer Characteristics**

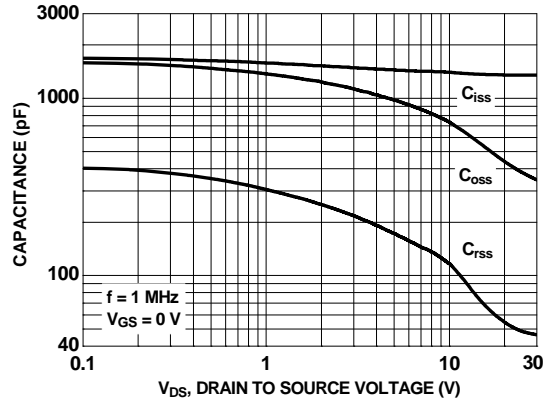


**Figure 6. Source to Drain Diode Forward Voltage vs Source Current**

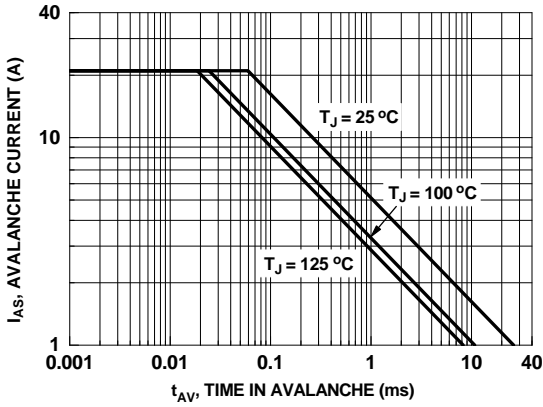
**Typical Characteristics**  $T_J = 25^\circ\text{C}$  unless otherwise noted



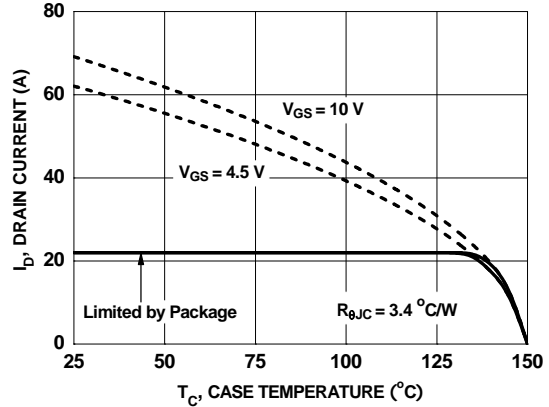
**Figure 7. Gate Charge Characteristics**



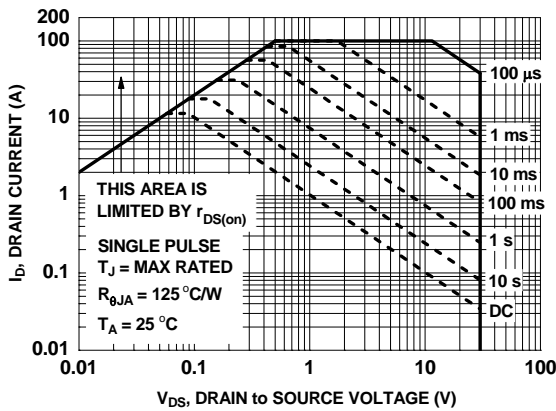
**Figure 8. Capacitance vs Drain to Source Voltage**



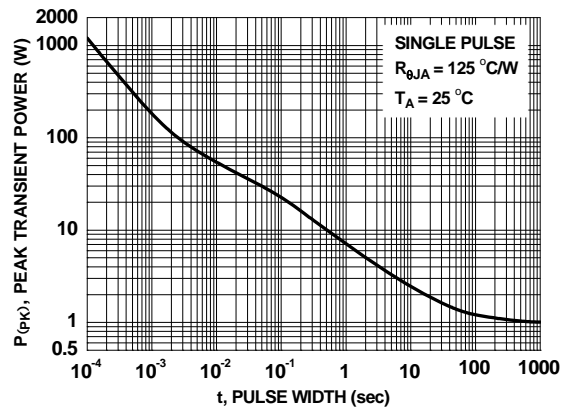
**Figure 9. Unclamped Inductive Switching Capability**



**Figure 10. Maximum Continuous Drain Current vs Case Temperature**

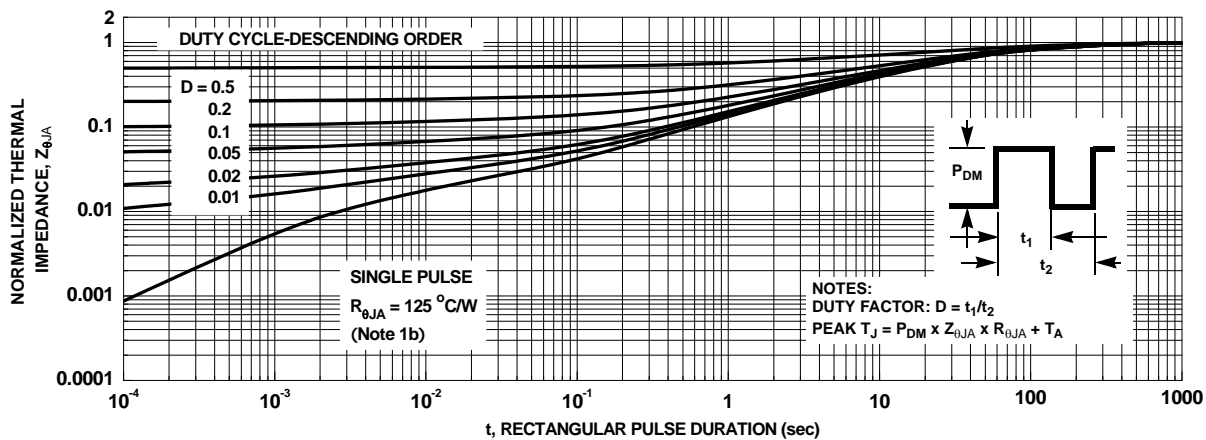


**Figure 11. Forward Bias Safe Operating Area**



**Figure 12. Single Pulse Maximum Power Dissipation**

**Typical Characteristics**  $T_J = 25^\circ\text{C}$  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 reverse recovery characteristic of the FDMS0312AS.

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

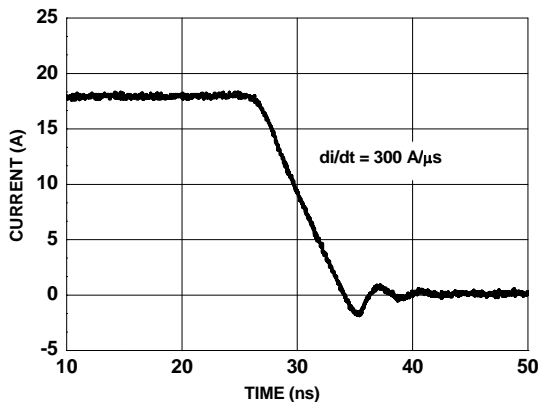


Figure 14. FDMS0312AS SyncFET body diode reverse recovery characteristic

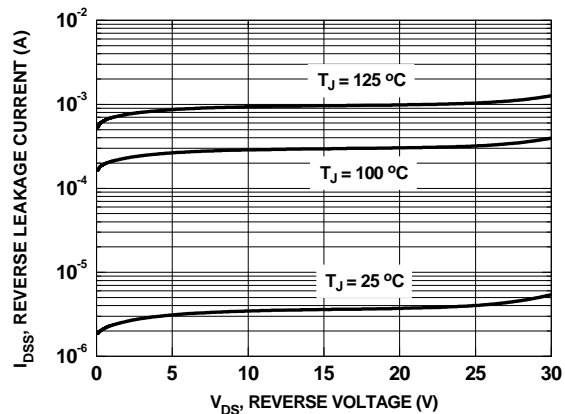


Figure 15. SyncFET body diode reverse leakage versus drain-source voltage





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