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February 2016

FDMS7658AS

N-Channel PowerTrench[®] SyncFETTM 30 V, 176 A, 1.9 m Ω

Features

- Max $r_{DS(on)}$ = 1.9 m Ω at V_{GS} = 10 V, I_D = 28 A
- Max $r_{DS(on)}$ = 2.2 m Ω at V_{GS} = 7 V, I_D = 26 A
- Advanced Package and Silicon Combination for Low r_{DS(on)} and High Efficiency
- SyncFETTM Schottky Body Diode
- MSL1 Robust Package Design
- 100% UIL Tested
- RoHS Compliant

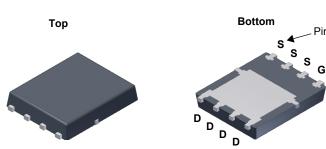


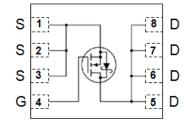
General Description

The FDMS7658AS 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
- Telecom Secondary Side Rectification





Power 56

MOSFET Maximum Ratings TA = 25 °C unless otherwise noted.

Symbol	Parameter			Ratings	Units
V_{DS}	Drain to Source Voltage			30	V
V_{GS}	Gate to Source Voltage		(Note 4)	±20	V
	Drain Current -Continuous	T _C = 25 °C	(Note 5)	176	
	-Continuous	T _C = 100 °C	(Note 5)	112	_
'D	-Continuous	T _A = 25 °C	(Note 1a)	29	A
	-Pulsed		(Note 6)	670	
dv/dt	MOSFET dv/dt			1.5	V/ns
E _{AS}	Single Pulse Avalanche Energy		(Note 3)	162	mJ
P _D	Power Dissipation	T _C = 25 °C		89	W
	Power Dissipation	T _A = 25 °C	(Note 1a)	2.5	VV
T _J , T _{STG}	Operating and Storage Junction Temperatu	re Range		-55 to +150	°C

Thermal Characteristics

$R_{\theta JC}$	Thermal Resistance, Junction to Case	1.4	°C/W
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient (Note 1a)	50	C/VV

Package Marking and Ordering Information

Device Marking	Device	Package	Reel Size	Tape Width	Quantity
FDMS7658AS	FDMS7658AS	Power 56	13 "	12 mm	3000 units

Electrical Characteristics $T_J = 25$ °C unless otherwise noted.

Symbol	Parameter	Test Conditions	Min.	Тур.	Max.	Units
Off Chara	acteristics					
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		23		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	1.7	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
r _{DS(on)}	Static Drain to Source On Resistance	V _{GS} = 10 V, I _D = 28 A		1.5	1.9	mΩ
		$V_{GS} = 7 \text{ V}, I_D = 26 \text{ A}$		1.7	2.2	
		$V_{GS} = 4.5 \text{ V}, I_D = 23 \text{ A}$		1.9	2.4	
		V _{GS} = 10 V, I _D = 28 A, T _J = 125 °C		2.0	2.6	
9 _{FS}	Forward Transconductance	V _{DS} = 5 V, I _D = 28 A		181		S

Dynamic Characteristics

C _{iss}	Input Capacitance	\\ -15\\\\\ -0\\\		5525	7350	pF
Coss	Output Capacitance	V _{DS} = 15 V, V _{GS} = 0 V, f = 1 MHz		2020	2685	pF
C _{rss}	Reverse Transfer Capacitance	1 - 1 1011 12		150	230	pF
R_g	Gate Resistance		0.1	0.4	0.9	Ω

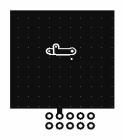
Switching Characteristics

t _{d(on)}	Turn-On Delay Time		20	36	ns
t _r	Rise Time	V _{DD} = 15 V, I _D = 28 A,	8	17	ns
t _{d(off)}	Turn-Off Delay Time	V_{GS} = 10 V, R_{GEN} = 6 Ω	43	70	ns
t _f	Fall Time		5	10	ns
Q_g	Total Gate Charge	V _{GS} = 0 V to 10 V	78	109	nC
Qg	Total Gate Charge	$V_{GS} = 0 \text{ V to } 4.5 \text{ V} V_{DD} = 15 \text{ V},$	35	49	nC
Q _{gs}	Gate to Source Gate Charge	I _D = 28 A	16.4		nC
Q_{gd}	Gate to Drain "Miller" Charge		6.6		nC

Drain-Source Diode Characteristics

V_{SD}	Source to Drain Diode Forward Voltage	$V_{GS} = 0 V, I_S = 2 A$ (Note 2)	2)	0.38	0.9	\/
		$V_{GS} = 0 \text{ V}, I_S = 28 \text{ A}$ (Note 2)	2)	0.74	1.3	v
t _{rr}	Reverse Recovery Time	I _F = 28 A, di/dt = 300 A/μs		46	75	ns
Q _{rr}	Reverse Recovery Charge	1F - 26 A, αι/αι - 300 A/μs		73	117	nC

^{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.

- 2. Pulse Test: Pulse Width < 300 μ s, Duty cycle < 2.0%. 3. E_{AS} of 162 mJ is based on starting T_J = 25 °C, L = 1 mH, I_{AS} = 18 A, V_{DD} = 27 V, V_{GS} = 10 V. 100% test at L = 0.3 mH, I_{AS} = 28 A. 4. As an N-ch device, the negative Vgs rating is for low duty cycle pulse occurrence only. No continuous rating is implied. 5. Computed continuous current limited to Max Junction Temperature only, actual continuous current will be limited by thermal & electro-mechanical application board design. 6. Pulsed Id please refer to Fig 11 SOA graph for more details.

Typical Characteristics T_J = 25 °C unless otherwise noted.

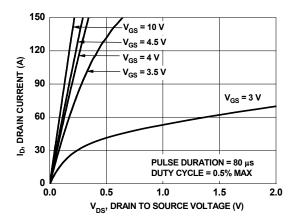


Figure 1. On-Region Characteristics

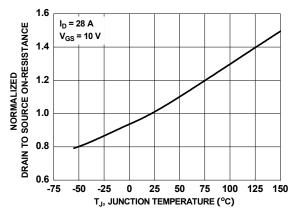


Figure 3. Normalized On-Resistance vs. Junction Temperature

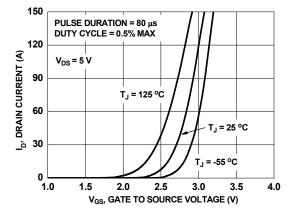


Figure 5. Transfer Characteristics

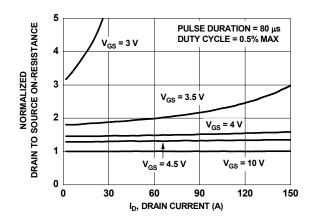


Figure 2. Normalized On-Resistance vs. Drain Current and Gate Voltage

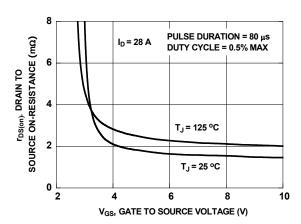


Figure 4. On-Resistance vs. Gate to Source Voltage

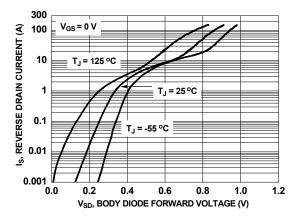


Figure 6. Source to Drain Diode Forward Voltage vs. Source Current

Typical Characteristics T_J = 25 °C unless otherwise noted.

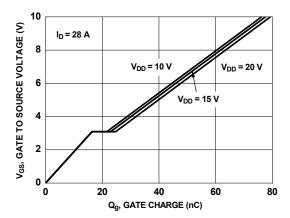


Figure 7. Gate Charge Characteristics

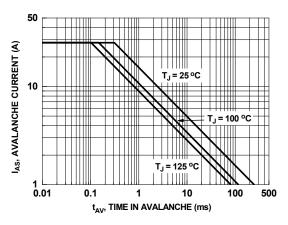


Figure 9. Unclamped Inductive Switching Capability

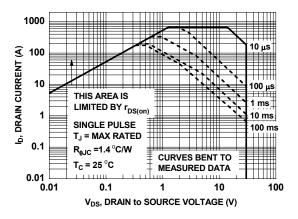


Figure 11. Forward Bias Safe Operating Area

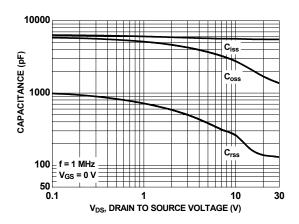


Figure 8. Capacitance vs. Drain to Source Voltage

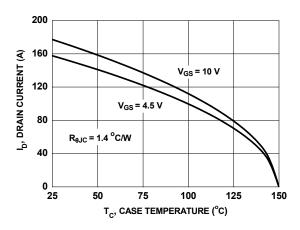


Figure 10. Maximum Continuous Drain Current vs. Case Temperature

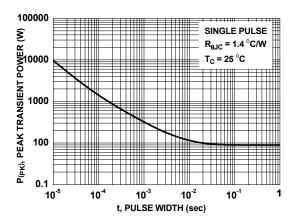


Figure 12. Single Pulse Maximum Power Dissipation

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

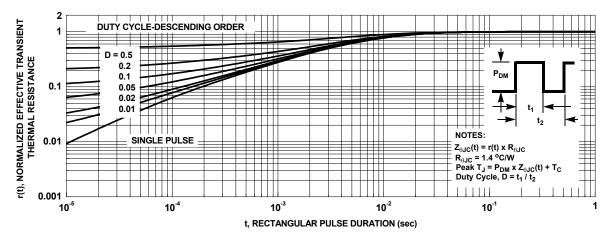


Figure 13. Junction-to-Case Transient Thermal Response Curve

Typical Characteristics (continued)

SyncFETTM Schottky body diode Characteristics

Fairchild's SyncFETTM 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 FDMS7658AS.

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

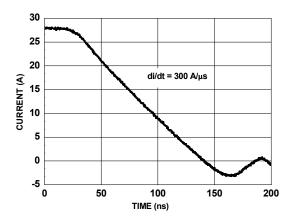


Figure 14. FDMS7658AS SyncFETTM Body Diode Reverse Recovery Characteristic

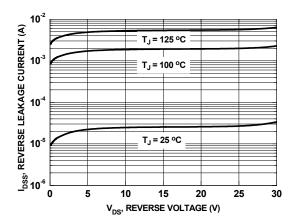


Figure 15. SyncFETTM Body Diode Reverses Leakage vs. Drain-Source Voltage



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Офис по работе с юридическими лицами:

105318, г. Москва, ул. Щербаковская д. 3, офис 1107, 1118, ДЦ «Щербаковский»

Телефон: +7 495 668-12-70 (многоканальный)

Факс: +7 495 668-12-70 (доб.304)

E-mail: info@moschip.ru

Skype отдела продаж:

moschip.ru moschip.ru_6 moschip.ru_4 moschip.ru_9