

FDS6699S

30V N-Channel PowerTrench® SyncFET™

Features

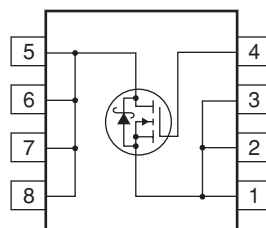
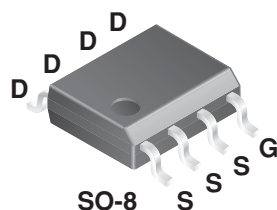
- 21 A, 30 V Max $R_{DS(ON)} = 3.6 \text{ m}\Omega$ @ $V_{GS} = 10 \text{ V}$
Max $R_{DS(ON)} = 4.5 \text{ m}\Omega$ @ $V_{GS} = 4.5 \text{ V}$
- Includes SyncFET Schottky body diode
- High performance trench technology for extremely low $R_{DS(ON)}$ and fast switching
- High power and current handling capability
- 100% R_G (Gate Resistance) tested

Applications

- Synchronous Rectifier for DC/DC Converters –
 - Notebook Vcore low side switch
 - Point of Load low side switch

General Description

The FDS6699S is designed to replace a single SO-8 MOSFET and Schottky diode in synchronous DC/DC power supplies. This 30V MOSFET is designed to maximize power conversion efficiency, providing a low $R_{DS(ON)}$ and low gate charge. The FDS6699S includes an integrated Schottky diode using Fairchild's monolithic SyncFET technology.



Absolute Maximum Ratings $T_A=25^\circ\text{C}$ unless otherwise noted

Symbol	Parameter	Ratings	Units
V_{DSS}	Drain-Source Voltage	30	V
V_{GSS}	Gate-Source Voltage	± 20	V
I_D	Drain Current – Continuous (Note 1a) – Pulsed	21	A
		105	
P_D	Power Dissipation for Single Operation (Note 1a) (Note 1b) (Note 1c)	2.5	W
		1.2	
		1	
T_J, T_{STG}	Operating and Storage Junction Temperature Range	-55 to $+125$	$^\circ\text{C}$
Thermal Characteristics			
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient (Note 1a)	50	$^\circ\text{C/W}$
$R_{\theta JC}$	Thermal Resistance, Junction-to-Case (Note 1)	25	

Package Marking and Ordering Information

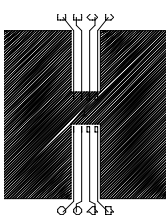
Device Marking	Device	Reel Size	Tape width	Quantity
FDS6699S	FDS6699S	13"	12mm	2500 units

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

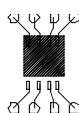
Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
Off Characteristics						
BV _{DSS}	Drain–Source Breakdown Voltage	V _{GS} = 0 V, I _D = 1 mA	30			V
$\frac{\Delta BV_{DSS}}{\Delta T_J}$	Breakdown Voltage Temperature Coefficient	I _D = 1 mA, Referenced to 25°C		28		mV/°C
I _{DSS}	Zero Gate Voltage Drain Current	V _{DS} = 24 V, V _{GS} = 0 V			500	μA
I _{GSS}	Gate–Body Leakage	V _{GS} = ±20 V, V _{DS} = 0 V			±100	nA
On Characteristics (Note 2)						
V _{GS(th)}	Gate Threshold Voltage	V _{DS} = V _{GS} , I _D = 1 mA	1	1.4	3	V
$\frac{\Delta V_{GS(th)}}{\Delta T_J}$	Gate Threshold Voltage Temperature Coefficient	I _D = 1 mA, Referenced to 25°C		–3.2		mV/°C
R _{DS(on)}	Static Drain–Source On–Resistance	V _{GS} = 10 V, I _D = 21 A V _{GS} = 4.5 V, I _D = 19 A V _{GS} =10 V, I _D =21 A, T _J =125°C		3.0 3.6 4.6	3.6 4.5 5.6	mΩ
g _{FS}	Forward Transconductance	V _{DS} = 10 V, I _D = 21 A		100		S
Dynamic Characteristics						
C _{iss}	Input Capacitance	V _{DS} = 15 V, V _{GS} = 0 V, f = 1.0 MHz		3610		pF
C _{oss}	Output Capacitance			1050		pF
C _{rss}	Reverse Transfer Capacitance			340		pF
R _G	Gate Resistance	V _{GS} = 15 mV, f = 1.0 MHz	0.4	1.8	3.1	Ω
Switching Characteristics (Note 2)						
t _{d(on)}	Turn–On Delay Time	V _{DD} = 15 V, I _D = 1 A, V _{GS} = 10 V, R _{GEN} = 6 Ω		11	20	ns
t _r	Turn–On Rise Time			12	22	ns
t _{d(off)}	Turn–Off Delay Time			73	117	ns
t _f	Turn–Off Fall Time			38	61	ns
Q _{g(TOT)}	Total Gate Charge at V _{gs} = 10V	V _{DD} = 15 V, I _D = 21 A,		65	91	nC
Q _g	Total Gate Charge at V _{gs} = 5V			35	49	nC
Q _{gs}	Gate–Source Charge			9		nC
Q _{gd}	Gate–Drain Charge			11		nC
Drain–Source Diode Characteristics and Maximum Ratings						
V _{SD}	Drain–Source Diode Forward Voltage	V _{GS} = 0 V, I _S = 3.5 A (Note 2)		0.36	0.7	V
t _{rr}	Diode Reverse Recovery Time	I _F = 21 A,		32		ns
I _{RM}	Diode Reverse Recovery Current	dI _F /d _t = 300 A/μs (Note 3)		2.2		A
Q _{rr}	Diode Reverse Recovery Charge			35		nC

Notes:

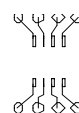
1. $R_{\theta JA}$ is the sum of the junction-to-case and case-to-ambient thermal resistance where the case thermal reference is defined as the solder mounting surface of the drain pins. $R_{\theta JC}$ is guaranteed by design while $R_{\theta CA}$ is determined by the user's board design.



a) 50°/W when mounted on a 1 in² pad of 2 oz copper



b) 105°/W when mounted on a .04 in² pad of 2 oz copper



c) 125°/W when mounted on a minimum pad.

Scale 1 : 1 on letter size paper

2. Pulse Test: Pulse Width < 300 μs , Duty Cycle < 2.0%
3. See "SyncFET Schottky body diode characteristics" below.

Typical Characteristics

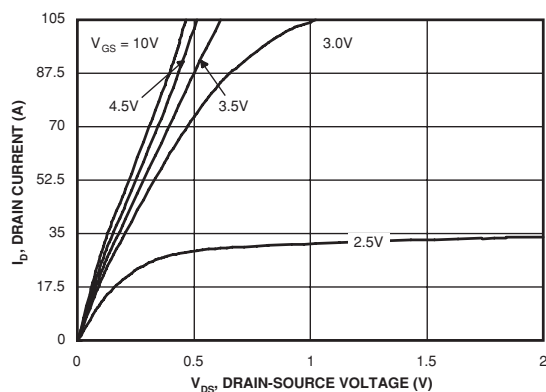


Figure 1. On-Region Characteristics.

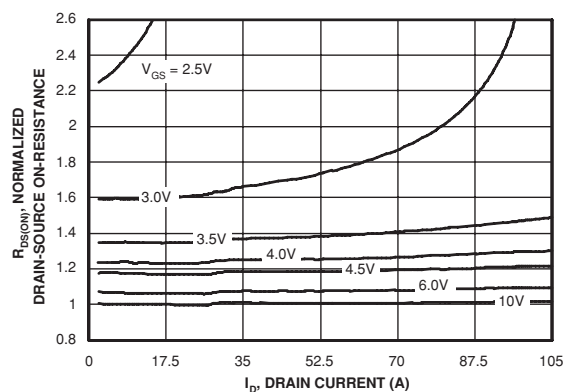


Figure 2. On-Resistance Variation with Drain Current and Gate Voltage.

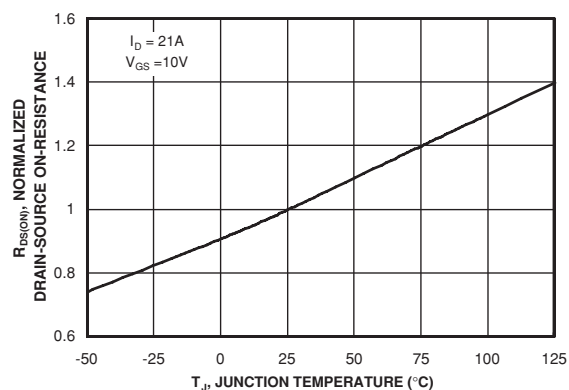


Figure 3. On-Resistance Variation with Temperature.

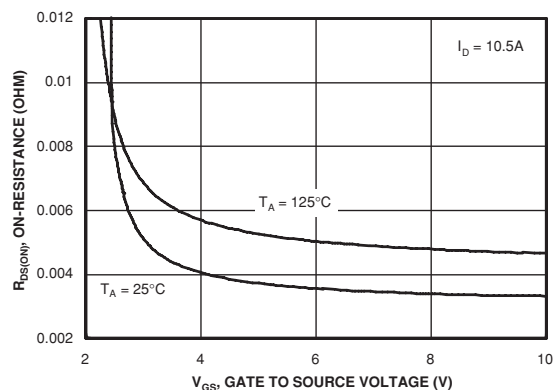


Figure 4. On-Resistance Variation with Gate-to-Source Voltage.

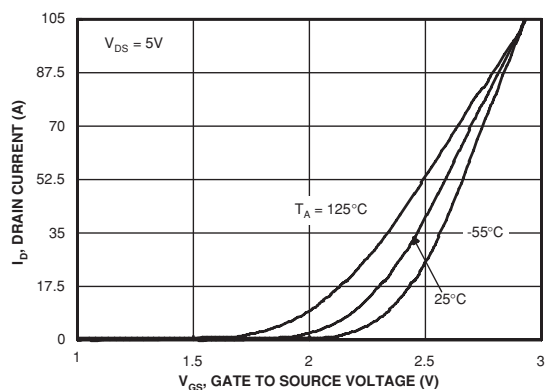


Figure 5. Transfer Characteristics.

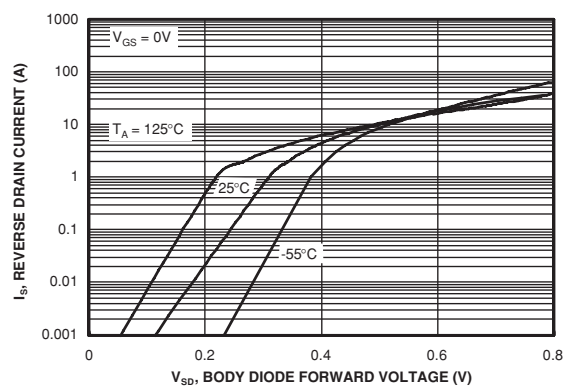


Figure 6. Body Diode Forward Voltage Variation with Source Current and Temperature.

Typical Characteristics (continued)

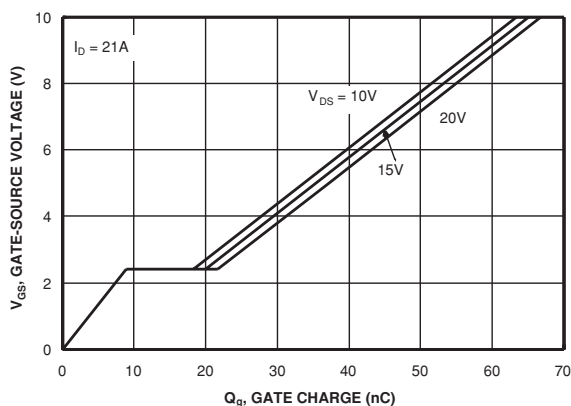


Figure 7. Gate Charge Characteristics.

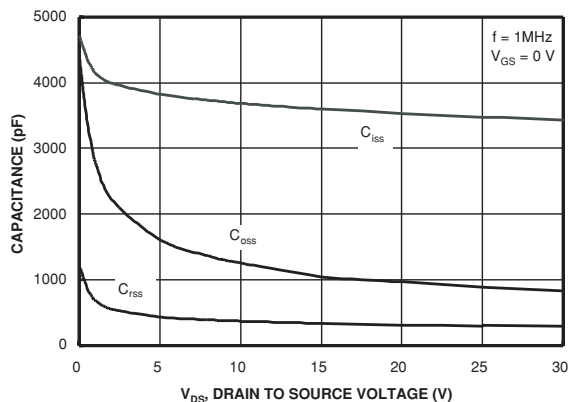


Figure 8. Capacitance Characteristics.

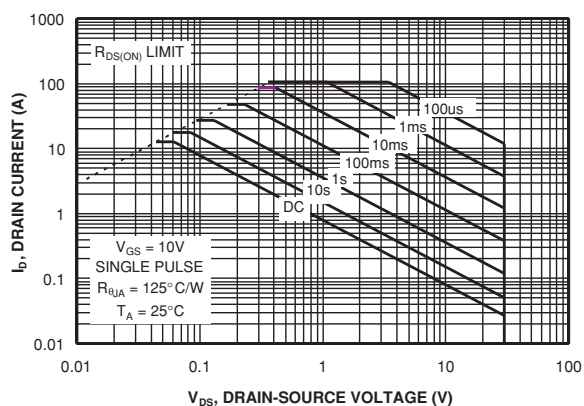


Figure 9. Maximum Safe Operating Area.

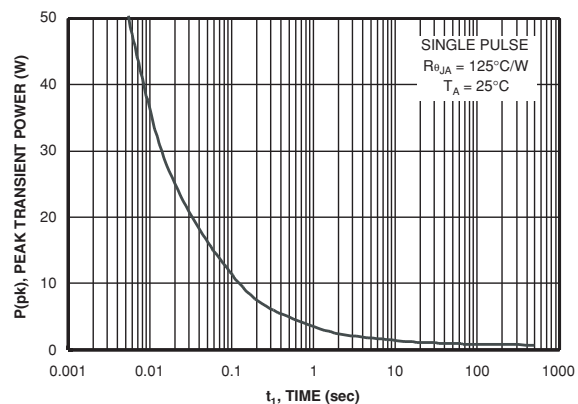


Figure 10. Single Pulse Maximum Power Dissipation.

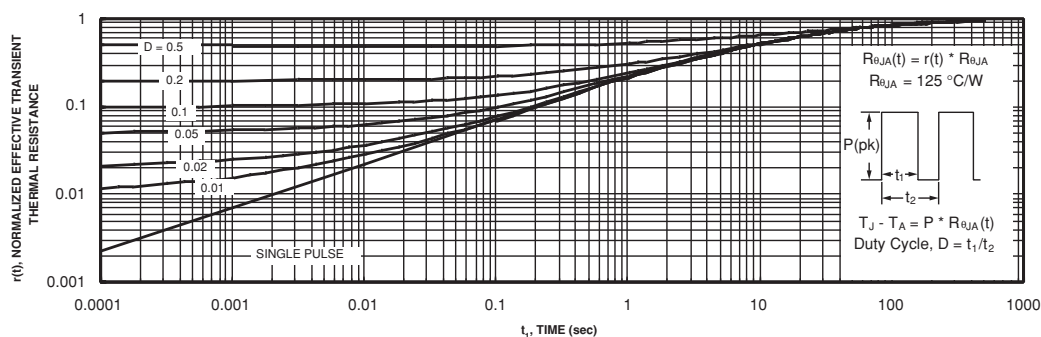


Figure 11. Transient Thermal Response Curve.

Thermal characterization performed using the conditions described in Note 1c. Transient thermal response will change depending on the circuit board design.

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 12 shows the reverse recovery characteristic of the FDS6699S.

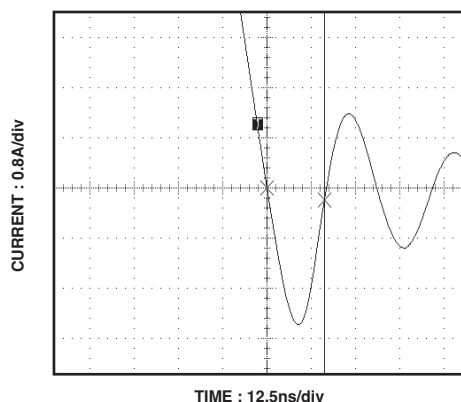


Figure 12. FDS6699S SyncFET body diode reverse recovery characteristic.

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

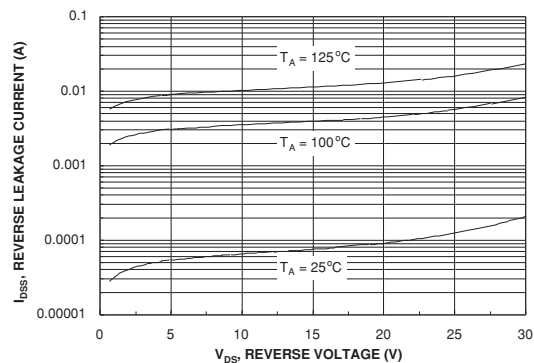


Figure 13. SyncFET body diode reverse leakage versus drain-source voltage and temperature.

TRADEMARKS

The following are registered and unregistered trademarks Fairchild Semiconductor owns or is authorized to use and is not intended to be an exhaustive list of all such trademarks.

ACE [™]	FAST [®]	IntelliMAX [™]	POP [™]	SPM [™]
ActiveArray [™]	FAST [™]	ISOPLANAR [™]	Power247 [™]	Stealth [™]
Bottomless [™]	FPS [™]	LittleFET [™]	PowerEdge [™]	SuperFET [™]
CoolFET [™]	FRFET [™]	MICROCOUPLER [™]	PowerSaver [™]	SuperSOT [™] -3
CROSSVOLT [™]	GlobalOptoisolator [™]	MicroFET [™]	PowerTrench [®]	SuperSOT [™] -6
DOMET [™]	GTO [™]	MicroPak [™]	QFET [®]	SuperSOT [™] -8
EcoSPARK [™]	HiSeC [™]	MICROWIRE [™]	QS [™]	SyncFET [™]
E ² CMOS [™]	I ² C [™]	MSX [™]	QT Optoelectronics [™]	TinyLogic [®]
EnSigna [™]	i-Lo [™]	MSXPro [™]	Quiet Series [™]	TINYOPTO [™]
FACT [™]	ImpliedDisconnect [™]	OCX [™]	RapidConfigure [™]	TruTranslation [™]
FACT Quiet Series [™]		OCXPro [™]	RapidConnect [™]	UHC [™]
Across the board. Around the world. [™]		OPTOLOGIC [®]	μSerDes [™]	UltraFET [®]
The Power Franchise [®]		OPTOPLANAR [™]	SILENT SWITCHER [®]	UniFET [™]
Programmable Active Droop [™]		PACMAN [™]	SMART START [™]	VCX [™]

DISCLAIMER

FAIRCHILD SEMICONDUCTOR RESERVES THE RIGHT TO MAKE CHANGES WITHOUT FURTHER NOTICE TO ANY PRODUCTS HEREIN TO IMPROVE RELIABILITY, FUNCTION OR DESIGN. FAIRCHILD DOES NOT ASSUME ANY LIABILITY ARISING OUT OF THE APPLICATION OR USE OF ANY PRODUCT OR CIRCUIT DESCRIBED HEREIN; NEITHER DOES IT CONVEY ANY LICENSE UNDER ITS PATENT RIGHTS, NOR THE RIGHTS OF OTHERS.

LIFE SUPPORT POLICY

FAIRCHILD'S PRODUCTS ARE NOT AUTHORIZED FOR USE AS CRITICAL COMPONENTS IN LIFE SUPPORT DEVICES OR SYSTEMS WITHOUT THE EXPRESS WRITTEN APPROVAL OF FAIRCHILD SEMICONDUCTOR CORPORATION. As used herein:

1. Life support devices or systems are devices or systems which, (a) are intended for surgical implant into the body, or (b) support or sustain life, or (c) whose failure to perform when properly used in accordance with instructions for use provided in the labeling, can be reasonably expected to result in significant injury to the user.

2. A critical component is any component of a life support device or system whose failure to perform can be reasonably expected to cause the failure of the life support device or system, or to affect its safety or effectiveness.

PRODUCT STATUS DEFINITIONS

Definition of Terms

Datasheet Identification	Product Status	Definition
Advance Information	Formative or In Design	This datasheet contains the design specifications for product development. Specifications may change in any manner without notice.
Preliminary	First Production	This datasheet contains preliminary data, and supplementary data will be published at a later date. Fairchild Semiconductor reserves the right to make changes at any time without notice in order to improve design.
No Identification Needed	Full Production	This datasheet contains final specifications. Fairchild Semiconductor reserves the right to make changes at any time without notice in order to improve design.
Obsolete	Not In Production	This datasheet contains specifications on a product that has been discontinued by Fairchild semiconductor. The datasheet is printed for reference information only.

Rev. 115