FAIRCHILD SEMICONDUCTOR

December 2002

FDD6676S

30V N-Channel PowerTrench$^{\text{Ò}}$ MOSFET

General Description

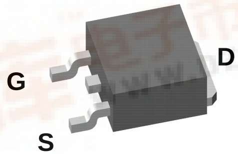
The FDS6676S is designed to replace a DPAK MOSFET and Schottky diode in synchronous DC:DC power supplies. This 30V MOSFET is designed to maximize power conversion efficiency, providing a low $R_{DS(ON)}$ and low gate charge. The FDD6676S includes an integrated Schottky diode using Fairchild's monolithic SyncFET technology.

Applications

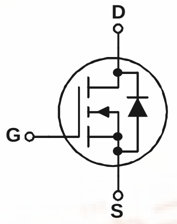
- DC/DC converter

Features

- 78 A, 30 V $R_{DS(ON)} = 6.0\ m\Omega$ @ $V_{GS} = 10\ V$
  $R_{DS(ON)} = 7.1\ m\Omega$ @ $V_{GS} = 4.5\ V$
- Low gate charge
- Fast Switching
- High performance trench technology for extremely low $R_{DS(ON)}$



D-PAK
(TO-252)



Absolute Maximum Ratings

$T_A=25^oC$ unless otherwise noted

Symbol	Parameter		Ratings	Units
V_{DSS}	Drain-Source Voltage		30	V
V_{GSS}	Gate-Source Voltage		±16	V
I_D	Drain Current – Continuous	(Note 3)	78	A
	– Pulsed	(Note 1a)	100	
P_D	Power Dissipation for Single Operation	(Note 1)	70	W
		(Note 1a)	3.1	
		(Note 1b)	1.3	
T_J, T_{STG}	Operating and Storage Junction Temperature Range		–55 to +150	°C

Thermal Characteristics

$R_{\theta JC}$	Thermal Resistance, Junction-to-Case	(Note 1)	1.8	°C/W
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient	(Note 1a)	40	°C/W
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient	(Note 1b)	96	°C/W

Package Marking and Ordering Information

Device Marking	Device	Reel Size	Tape width	Quantity
FDD6676S	FDD6676S	13''	12mm	2500 units

Electrical Characteristics

T_A = 25°C unless otherwise noted

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
Drain-Source Avalanche Ratings (Note 2)						
W_{DSS}	Drain-Source Avalanche Energy	Single Pulse, V_{DD} = 15 V, I_D = 16A			250	mJ
I_{AR}	Drain-Source Avalanche Current				16	A
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 = 10 mA, Referenced to 25°C		24		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} = ±16 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	1.3	3	V
$\frac{\Delta V_{GS(th)}}{\Delta T_J}$	Gate Threshold Voltage Temperature Coefficient	I_D = 10 mA, Referenced to 25°C		–0.9		mV/°C
$R_{DS(on)}$	Static Drain–Source On–Resistance	V_{GS} = 10 V, I_D = 16 A V_{GS} = 4.5 V, I_D = 15 A V_{GS} = 10 V, I_D = 16 A,T_J=125°C		4.6 5.2 7.2	6.0 7.1 9.0	mΩ
g_{FS}	Forward Transconductance	V_{DS} = 5 V, I_D = 16 A		79		S
$I_{D(on)}$	On-State Drain Current	V_{GS} = 10 V, V_{DS} = 5 V	60			A
Dynamic Characteristics						
C_{iss}	Input Capacitance	V_{DS} = 15 V, V_{GS} = 0 V, f = 1.0 MHz		4770		pF
C_{oss}	Output Capacitance			840		pF
C_{rss}	Reverse Transfer Capacitance			305		pF
R_G	Gate Resistance	V_{GS} = 0 V, f = 1.0 MHz		1.5		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		13	23	ns
t_r	Turn–On Rise Time			13	23	ns
$t_{d(off)}$	Turn–Off Delay Time			86	138	ns
t_f	Turn–Off Fall Time			34	54	ns
Q_g	Total Gate Charge	V_{DS} = 15V, I_D = 16 A, V_{GS} = 5 V		41	58	nC
Q_{gs}	Gate–Source Charge			10		nC
Q_{gd}	Gate–Drain Charge			10		nC

Electrical Characteristics (continued)

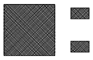
T_A = 25°C unless otherwise noted

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
Drain–Source Diode Characteristics and Maximum Ratings						
I_S	Maximum Continuous Drain–Source Diode Forward Current				3.5	A
V_{SD}	Drain–Source Diode Forward Voltage	V_{GS} = 0 V, I_S = 3.5 A (Note 2)		385	700	mV
t_{RR}	Diode Reverse Recovery Time	dI_F/dt = 300A/us, I_F = 16A		29		ns
I_{RM}	Maximum Recovery Current			2.1		A
Q_{RR}	Diode Reverse Recovery Charge			30		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) $R_{\theta JA}$ = 40°C/W when mounted on a 1in^2 pad of 2 oz copper



b) $R_{\theta JA}$ = 96°C/W when mounted on a minimum pad.

Scale 1 : 1 on letter size paper

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

3. Maximum current is calculated as: $\sqrt{\frac{P_D}{R_{DS(ON)}}}$

where P_D is maximum power dissipation at T_C = 25°C and $R_{DS(on)}$ is at $T_{J(max)}$ and V_{GS} = 10V. Package current limitation is 21A

Typical Characteristics

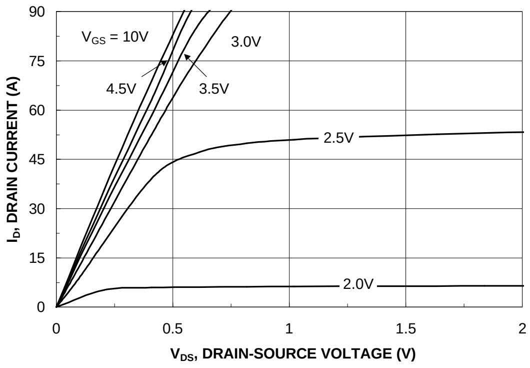


Figure 1. On-Region Characteristics

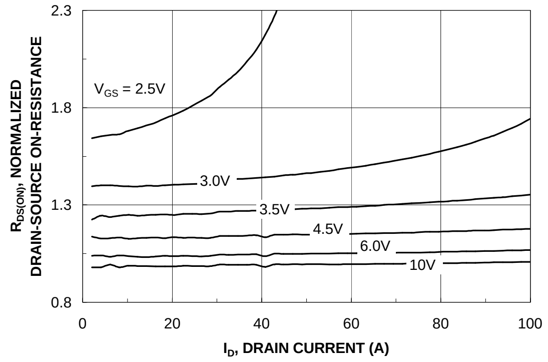


Figure 2. On-Resistance Variation with Drain Current and Gate Voltage

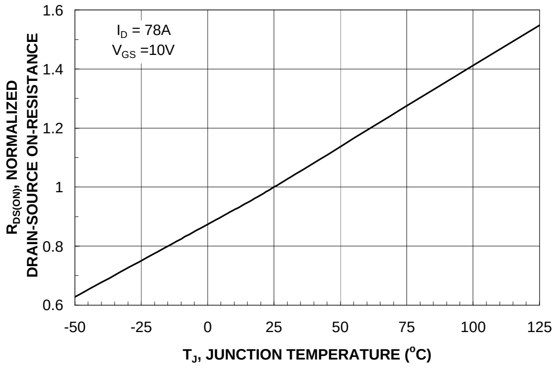


Figure 3. On-Resistance Variation with Temperature

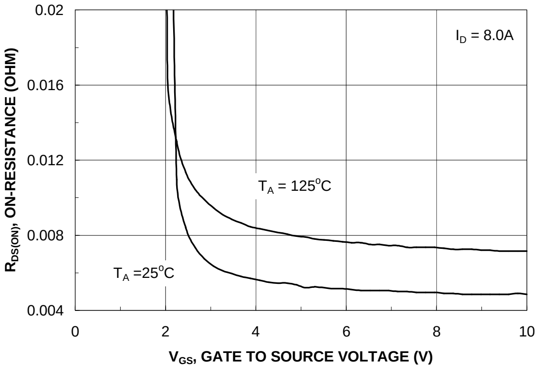


Figure 4. On-Resistance Variation with Gate-to-Source Voltage

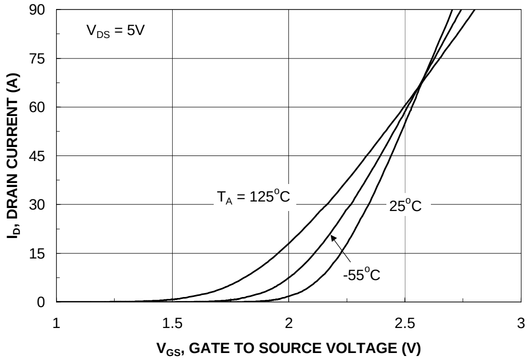


Figure 5. Transfer Characteristics

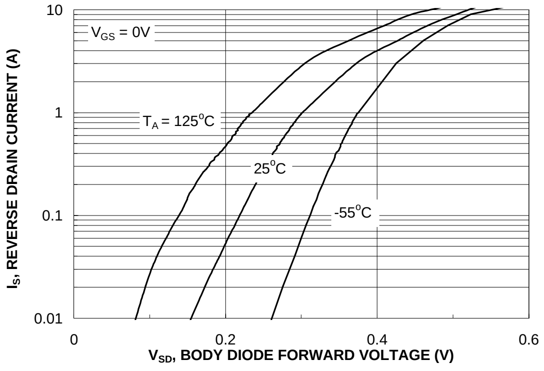


Figure 6. Body Diode Forward Voltage Variation with Source Current and Temperature

Typical Characteristics

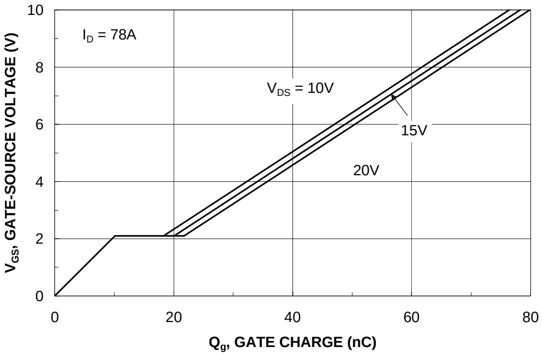


Figure 7. Gate Charge Characteristics

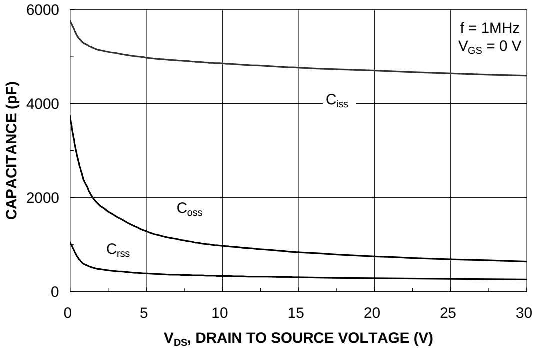


Figure 8. Capacitance Characteristics

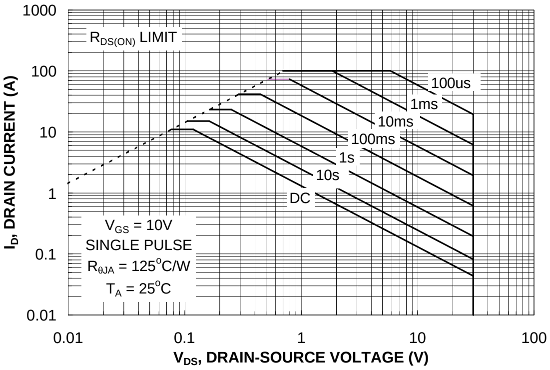


Figure 9. Maximum Safe Operating Area

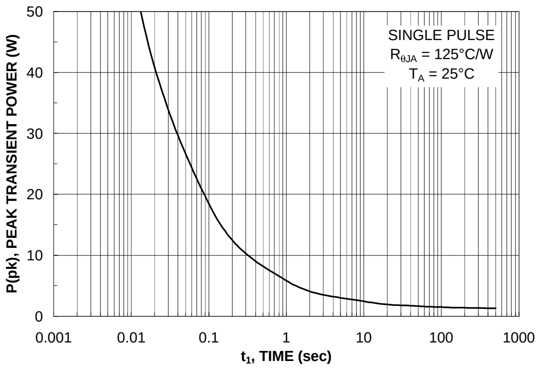


Figure 10. Single Pulse Maximum Power Dissipation

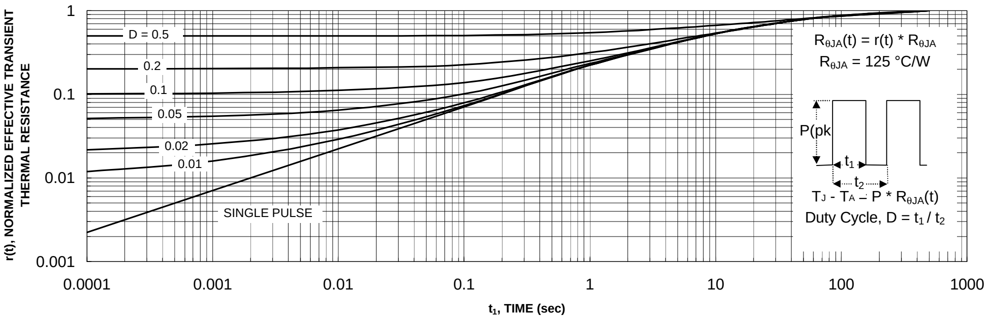


Figure 11. Transient Thermal Response Curve

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

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