



October 2001

FDP6676S/FDB6676S

FDP6676S / FDB6676S

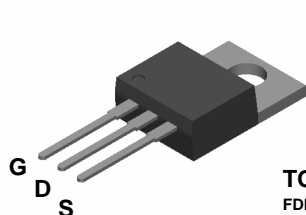
30V N-Channel PowerTrench® SyncFET™

General Description

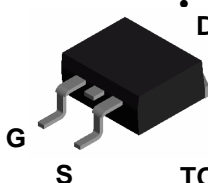
This MOSFET is designed to replace a single MOSFET and parallel Schottky diode in synchronous DC:DC power supplies. This 30V MOSFET is designed to maximize power conversion efficiency, providing a low $R_{DS(ON)}$ and low gate charge. The FDP/B6676S includes an integrated Schottky diode using Fairchild's monolithic SyncFET technology. The performance of the FDP/B6676S as the low-side switch in a synchronous rectifier is indistinguishable from the performance of the FDP/B6676 in parallel with a Schottky diode.

Features

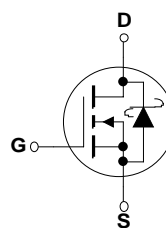
- 38 A, 30 V. $R_{DS(ON)} = 6.5 \text{ m}\Omega$ @ $V_{GS} = 10 \text{ V}$
 $R_{DS(ON)} = 8.0 \text{ m}\Omega$ @ $V_{GS} = 4.5 \text{ V}$
- Includes SyncFET Schottky body diode
- Low gate charge (40nC typical)
- High performance trench technology for extremely low $R_{DS(ON)}$ and fast switching
- High power and current handling capability



TO-220
FDP Series



TO-263AB
FDB Series



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	± 16	V
I_D	Drain Current – Continuous (Note 1)	76	A
	– Pulsed (Note 1)	150	
P_D	Total Power Dissipation @ $T_C = 25^\circ\text{C}$	70	W
	Derate above 25°C	0.56	W/ $^\circ\text{C}$
T_J, T_{STG}	Operating and Storage Junction Temperature Range	-55 to $+150$	$^\circ\text{C}$
T_L	Maximum lead temperature for soldering purposes, 1/8" from case for 5 seconds	275	$^\circ\text{C}$

Thermal Characteristics

$R_{\theta JC}$	Thermal Resistance, Junction-to-Case	1.8	$^\circ\text{C/W}$
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient	55	$^\circ\text{C/W}$

Package Marking and Ordering Information

Device Marking	Device	Reel Size	Tape width	Quantity
FDB6676S	FDB6676S	13"	24mm	800
FDP6676S	FDP6676S	Tube	n/a	45

Electrical Characteristics $T_A = 25^\circ\text{C}$ 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, $V_{DD} = 25\text{ V}$, $I_D = 12\text{ A}$			310	mJ
I_{AR}	Drain-Source Avalanche Current				12	A

Off Characteristics

BV_{DSS}	Drain-Source Breakdown Voltage	$V_{GS} = 0\text{ V}$, $I_D = 1\text{ mA}$	30			V
$\frac{\Delta BV_{DSS}}{\Delta T_J}$	Breakdown Voltage Temperature Coefficient	$I_D = 1\text{ mA}$, Referenced to 25°C		25		mV/ $^\circ\text{C}$
I_{DSS}	Zero Gate Voltage Drain Current	$V_{DS} = 24\text{ V}$, $V_{GS} = 0\text{ V}$			500	μA
I_{GSSF}	Gate-Body Leakage, Forward	$V_{GS} = 16\text{ V}$, $V_{DS} = 0\text{ V}$			100	nA
I_{GSSR}	Gate-Body Leakage, Reverse	$V_{GS} = -16\text{ V}$, $V_{DS} = 0\text{ V}$			-100	nA

On Characteristics (Note 2)

$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS} = V_{GS}$, $I_D = 1\text{ mA}$	1	1.3	3	V
$\frac{\Delta V_{GS(th)}}{\Delta T_J}$	Gate Threshold Voltage Temperature Coefficient	$I_D = 1\text{ mA}$, Referenced to 25°C		-8.4		mV/ $^\circ\text{C}$
$R_{DS(on)}$	Static Drain-Source On-Resistance	$V_{GS} = 10\text{ V}$, $I_D = 38\text{ A}$ $V_{GS} = 4.5\text{ V}$, $I_D = 35\text{ A}$ $V_{GS} = 10\text{ V}$, $I_D = 38\text{ A}$, $T_J = 125^\circ\text{C}$		4.7 5.2 7.3	6.5 8.0 11	m Ω
$I_{D(on)}$	On-State Drain Current	$V_{GS} = 10\text{ V}$, $V_{DS} = 10\text{ V}$	60			A
g_{FS}	Forward Transconductance	$V_{DS} = 10\text{ V}$, $I_D = 38\text{ A}$		145		S

Dynamic Characteristics

C_{iss}	Input Capacitance	$V_{DS} = 15\text{ V}$, $V_{GS} = 0\text{ V}$, $f = 1.0\text{ MHz}$		4853		pF
C_{oss}	Output Capacitance			850		pF
C_{rss}	Reverse Transfer Capacitance			316		pF

Switching Characteristics (Note 2)

$t_{d(on)}$	Turn-On Delay Time	$V_{DS} = 15\text{ V}$, $I_D = 1\text{ A}$, $V_{GS} = 10\text{ V}$, $R_{GEN} = 6\text{ }\Omega$		14	25	ns
t_r	Turn-On Rise Time			11	20	ns
$t_{d(off)}$	Turn-Off Delay Time			89	142	ns
t_f	Turn-Off Fall Time			31	50	ns
Q_g	Total Gate Charge	$V_{DS} = 15\text{ V}$, $I_D = 38\text{ A}$, $V_{GS} = 5\text{ V}$		40	56	nC
Q_{gs}	Gate-Source Charge			10		nC
Q_{gd}	Gate-Drain Charge			11		nC

Drain-Source Diode Characteristics and Maximum Ratings

V_{SD}	Drain-Source Diode Forward Voltage	$V_{GS} = 0\text{ V}$, $I_S = 3.5\text{ A}$ (Note 1) $V_{GS} = 0\text{ V}$, $I_S = 7\text{ A}$ (Note 1)		0.4 0.5	0.7	V
t_{rr}	Diode Reverse Recovery Time	$I_F = 3.5\text{ A}$		28.5		nS
Q_{rr}	Diode Reverse Recovery Charge	$dI_F/dt = 300\text{ A}/\mu\text{s}$ (Note 2)		57		nC

Notes:

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

Typical Characteristics

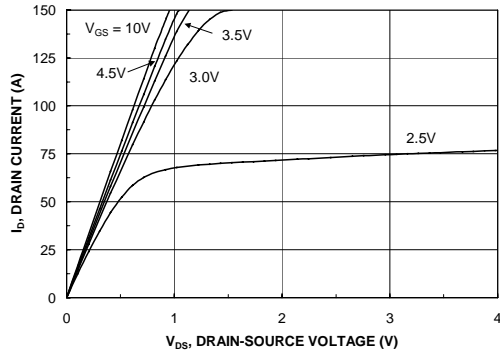


Figure 1. On-Region Characteristics.

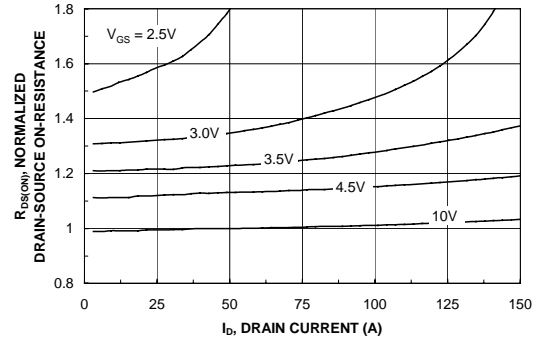


Figure 2. On-Resistance Variation with Drain Current and Gate Voltage.

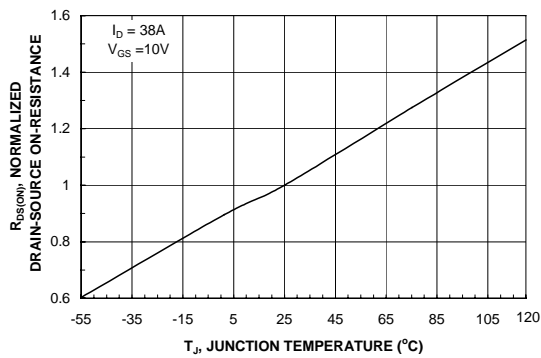


Figure 3. On-Resistance Variation with Temperature.

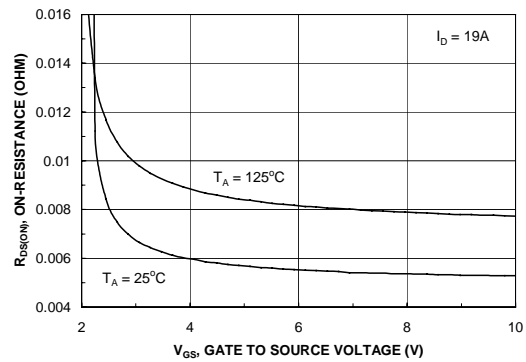


Figure 4. On-Resistance Variation with Gate-to-Source Voltage.

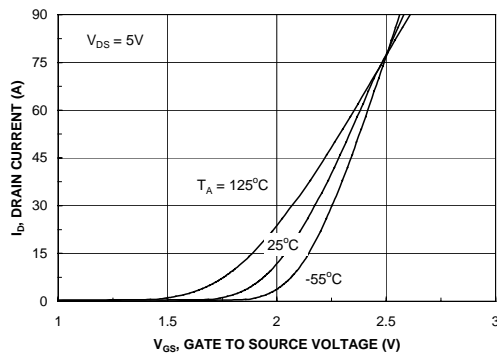


Figure 5. Transfer Characteristics.

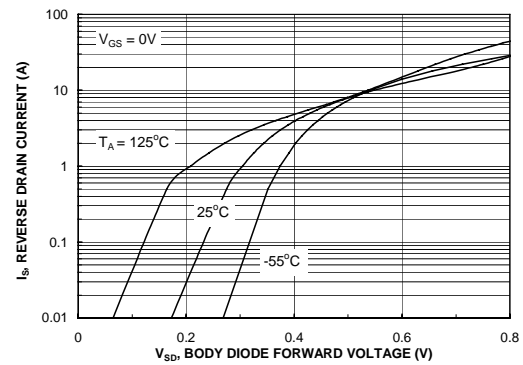


Figure 6. Body Diode Forward Voltage Variation with Source Current and Temperature.

Typical Characteristics (continued)

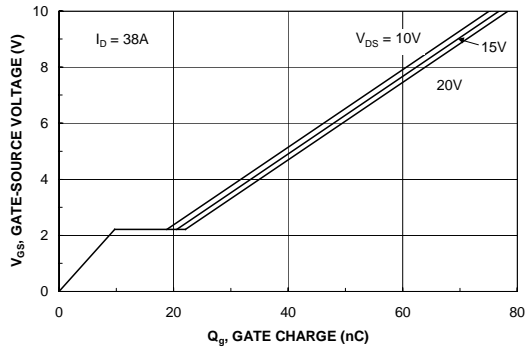


Figure 7. Gate Charge Characteristics.

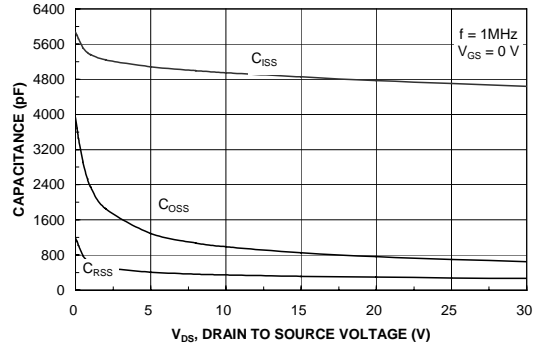


Figure 8. Capacitance Characteristics.

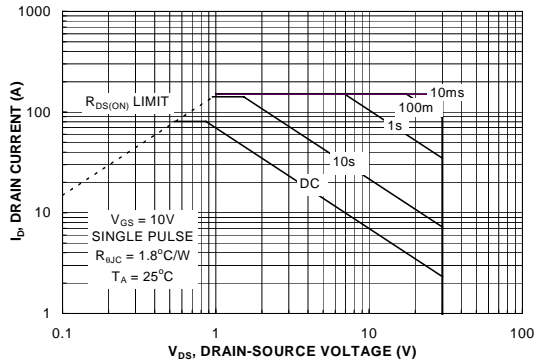


Figure 9. Maximum Safe Operating Area.

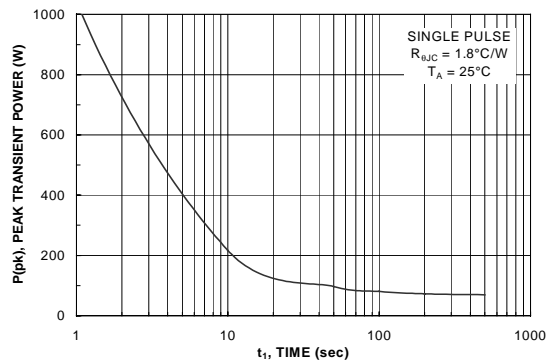


Figure 10. Single Pulse Maximum Power Dissipation.

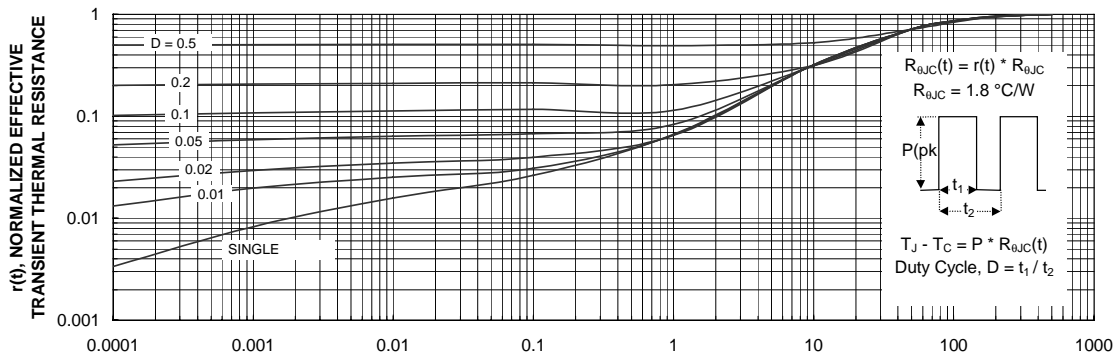


Figure 11. Transient Thermal Response Curve.

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 FDP6676S.

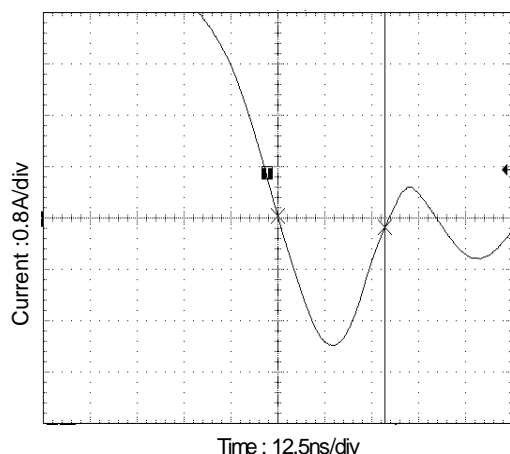


Figure 12. FDP6676S SyncFET body diode reverse recovery characteristic.

For comparison purposes, Figure 13 shows the reverse recovery characteristics of the body diode of an equivalent size MOSFET produced without SyncFET (FDP6676).

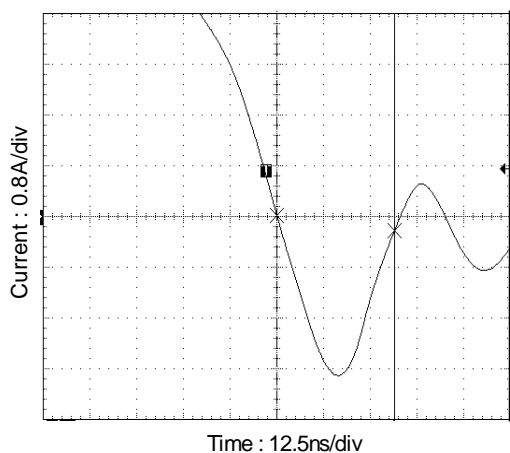


Figure 13. Non-SyncFET (FDP6676) body diode reverse recovery characteristic.

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

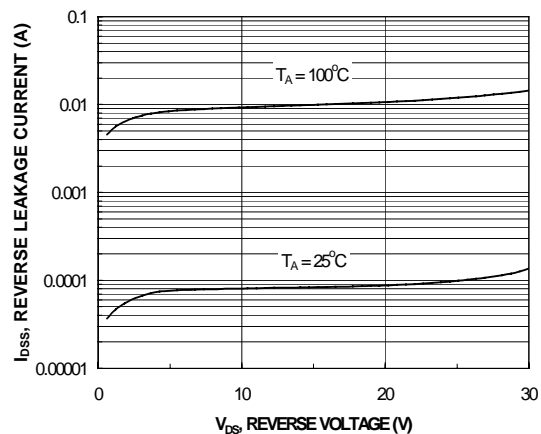


Figure 14. SyncFET diode reverse leakage versus drain-source voltage and temperature.

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.

ACEx™	FAST®	OPTOLOGIC™	SMART START™	VCX™
Bottomless™	FASTr™	OPTOPLANAR™	STAR*POWER™	
CoolFET™	FRFET™	PACMAN™	Stealth™	
CROSSVOLT™	GlobalOptoisolator™	POP™	SuperSOT™-3	
DenseTrench™	GTO™	Power247™	SuperSOT™-6	
DOMETM	HiSeC™	PowerTrench®	SuperSOT™-8	
EcoSPARK™	ISOPLANAR™	QFET™	SyncFET™	
E ² CMOS™	LittleFET™	QST™	TinyLogic™	
EnSigna™	MicroFET™	QT Optoelectronics™	TruTranslation™	
FACT™	MicroPak™	Quiet Series™	UHC™	
FACT Quiet Series™	MICROWIRE™	SILENT SWITCHER®	UltraFET®	

STAR*POWER is used under license

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.