

# FDS7766S

## 30V N-Channel PowerTrench<sup>®</sup> MOSFET

### General Description

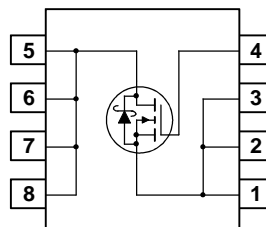
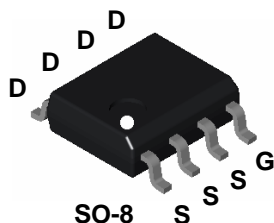
The FDS7766S is designed to replace a single SO-8 MOSFET and Schottky diode in synchronous DC:DC power supplies. This 30V MOSFET is designed to maximize power conversion efficiency, providing a low  $R_{DS(ON)}$  and low gate charge. The FDS7766S includes an integrated Schottky diode using Fairchild's monolithic SyncFET technology.

### Applications

- Synchronous rectifier
- DC/DC converter

### Features

- 17 A, 30 V  $R_{DS(ON)} = 5.5 \text{ m}\Omega @ V_{GS} = 10 \text{ V}$   
 $R_{DS(ON)} = 6.5 \text{ m}\Omega @ V_{GS} = 4.5 \text{ V}$
- High performance trench technology for extremely low  $R_{DS(ON)}$
- High power and current handling capability
- Fast switching



### Absolute Maximum Ratings T<sub>A</sub>=25°C unless otherwise noted

Symbol	Parameter	Ratings	Units
V <sub>DSS</sub>	Drain-Source Voltage	30	V
V <sub>GSS</sub>	Gate-Source Voltage	±16	V
I <sub>D</sub>	Drain Current – Continuous (Note 1a)	17	A
	– Pulsed	60	
P <sub>D</sub>	Power Dissipation for Single Operation (Note 1a)	2.5	W
	(Note 1b)	1.2	
	(Note 1c)	1.0	
T <sub>J</sub> , T <sub>STG</sub>	Operating and Storage Junction Temperature Range	-55 to +150	°C

### Thermal Characteristics

R <sub>θJA</sub>	Thermal Resistance, Junction-to-Ambient (Note 1a)	50	°C/W
R <sub>θJA</sub>	Thermal Resistance, Junction-to-Ambient (Note 1c)	125	°C/W
R <sub>θJC</sub>	Thermal Resistance, Junction-to-Case (Note 1)	25	°C/W

### Package Marking and Ordering Information

Device Marking	Device	Reel Size	Tape width	Quantity
FDS7766S	FDS7766S	13"	12mm	2500 units

## Electrical Characteristics

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

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
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### 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	$I_D = 15\text{ mA}$ , Referenced to $25^\circ\text{C}$		23		mV/ $^\circ\text{C}$
$I_{DSS}$	Zero Gate Voltage Drain Current	$V_{DS} = 24\text{ V}, V_{GS} = 0\text{ V}$			500	$\mu\text{A}$
$I_{GSS}$	Gate–Body Leakage	$V_{GS} = \pm 16\text{ V}, V_{DS} = 0\text{ V}$			$\pm 100$	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	$I_D = 15\text{ mA}$ , Referenced to $25^\circ\text{C}$		-2		mV/ $^\circ\text{C}$
$R_{DS(on)}$	Static Drain–Source On–Resistance	$V_{GS} = 10\text{ V}, I_D = 17\text{ A}$ $V_{GS} = 4.5\text{ V}, I_D = 15.5\text{ A}$ $V_{GS} = 10\text{ V}, I_D = 17\text{ A}, T_J = 125^\circ\text{C}$		4.0 4.6 5.7	5.5 6.5 7.2	m $\Omega$
$I_{D(on)}$	On–State Drain Current	$V_{GS} = 10\text{ V}, V_{DS} = 5\text{ V}$	30			A
$g_{FS}$	Forward Transconductance	$V_{DS} = 10\text{ V}, I_D = 17\text{ A}$		91		S

### Dynamic Characteristics

$C_{iss}$	Input Capacitance	$V_{DS} = 15\text{ V}, V_{GS} = 0\text{ V}$		4785		pF
$C_{oss}$	Output Capacitance	$f = 1.0\text{ MHz}$		825		pF
$C_{riss}$	Reverse Transfer Capacitance			290		pF
$R_G$	Gate Resistance	$V_{GS} = 15\text{ mV}, f = 1.0\text{ MHz}$		1.3		$\Omega$

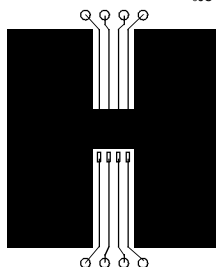
### Switching Characteristics (Note 2)

$t_{d(on)}$	Turn–On Delay Time	$V_{DD} = 15\text{ V}, I_D = 1\text{ A}$		12	22	ns
$t_r$	Turn–On Rise Time	$V_{GS} = 10\text{ V}, R_{GEN} = 6\ \Omega$		12	22	ns
$t_{d(off)}$	Turn–Off Delay Time			82	132	ns
$t_f$	Turn–Off Fall Time			30	49	ns
$Q_g$	Total Gate Charge	$V_{DS} = 15\text{ V}, I_D = 17\text{ A}$		41	58	nC
$Q_{gs}$	Gate–Source Charge	$V_{GS} = 5\text{ V}$		11		nC
$Q_{gd}$	Gate–Drain Charge			9		nC

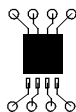
### Drain–Source Diode Characteristics and Maximum Ratings

$I_S$	Maximum Continuous Drain–Source Diode Forward Current				3.5	A
$V_{SD}$	Drain–Source Diode Forward Voltage	$V_{GS} = 0\text{ V}, I_S = 3.5\text{ A}$ (Note 2)		0.4	0.7	V
$t_{rr}$	Schottky Diode Reverse Recovery	$I_F = 17\text{ A}$ , $dI_F/dt = 300\text{ A}/\mu\text{s}$ (Note 2)		27		ns
$Q_{rr}$				28		nC

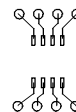
**Notes:** 1.  $R_{\theta JA}$  is the sum of the junction-to-case and case-to-ambient thermal resistance where the case thermal reference is defined as the solder mounting surface of the drain pins.  $R_{\theta JC}$  is guaranteed by design while  $R_{\theta CA}$  is determined by the user's board design.



a)  $50^\circ\text{C}/\text{W}$  when mounted on a  $1\text{ in}^2$  pad of 2 oz copper



b)  $105^\circ\text{C}/\text{W}$  when mounted on a  $.04\text{ in}^2$  pad of 2 oz copper



c)  $125^\circ\text{C}/\text{W}$  when mounted on a minimum pad.

Scale 1 : 1 on letter size page

2. Pulse Test: Pulse Width < 300 $\mu\text{s}$ , Duty Cycle < 2.0%

### Typical Characteristics

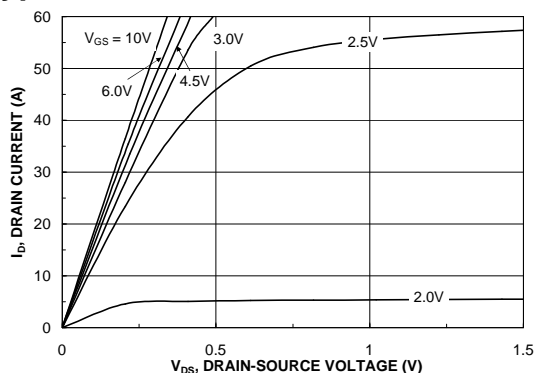


Figure 1. On-Region Characteristics.

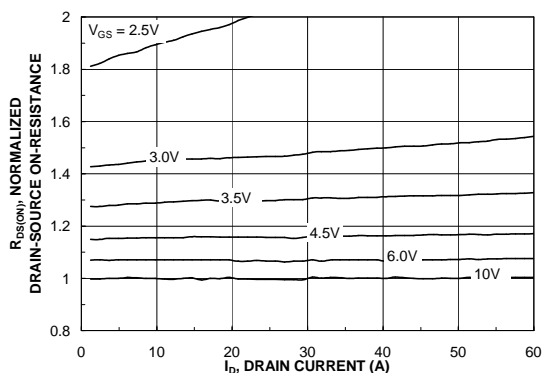


Figure 2. On-Resistance Variation with Drain Current and Gate Voltage.

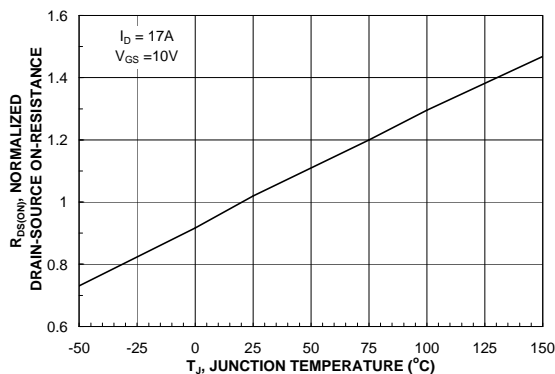


Figure 3. On-Resistance Variation with Temperature.

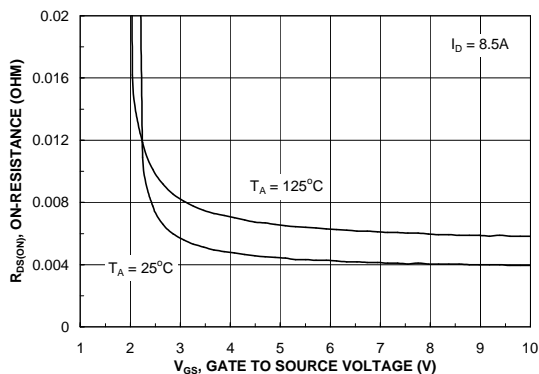


Figure 4. On-Resistance Variation with Gate-to-Source Voltage.

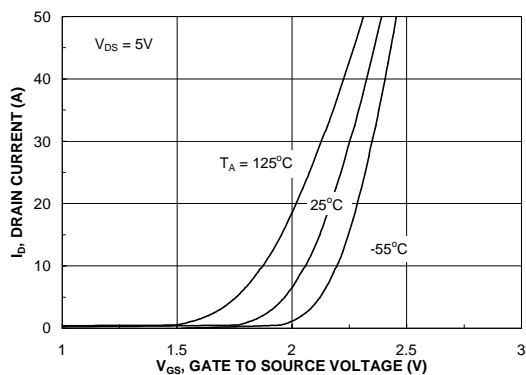


Figure 5. Transfer Characteristics.

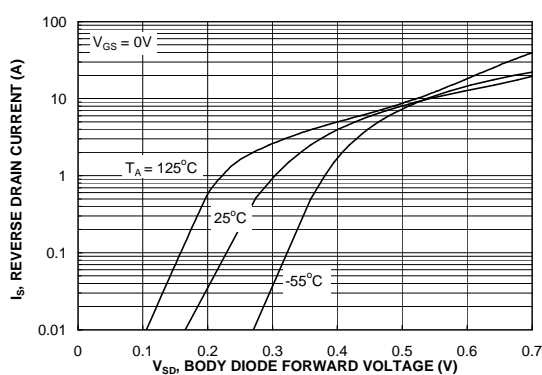
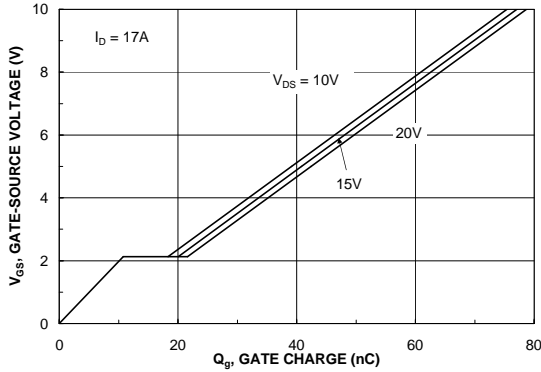
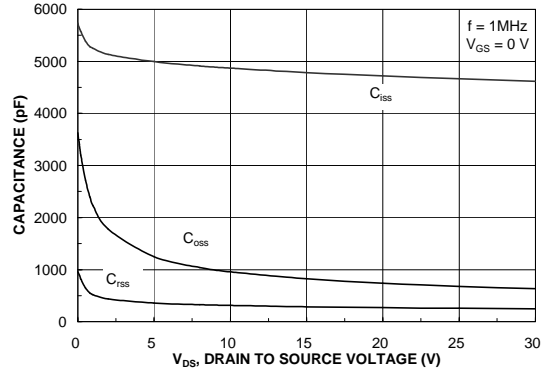


Figure 6. Body Diode Forward Voltage Variation with Source Current and Temperature.

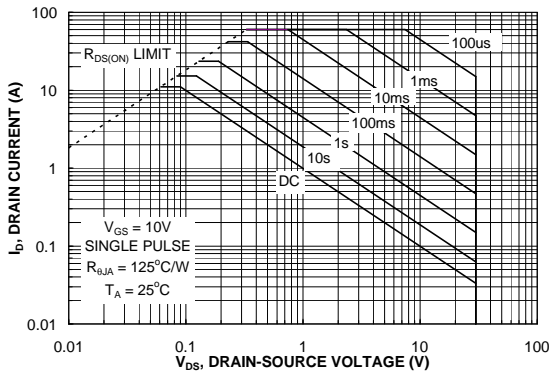
### Typical Characteristics



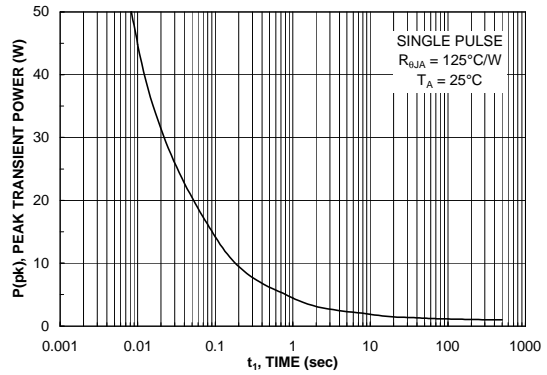
**Figure 7. Gate Charge Characteristics.**



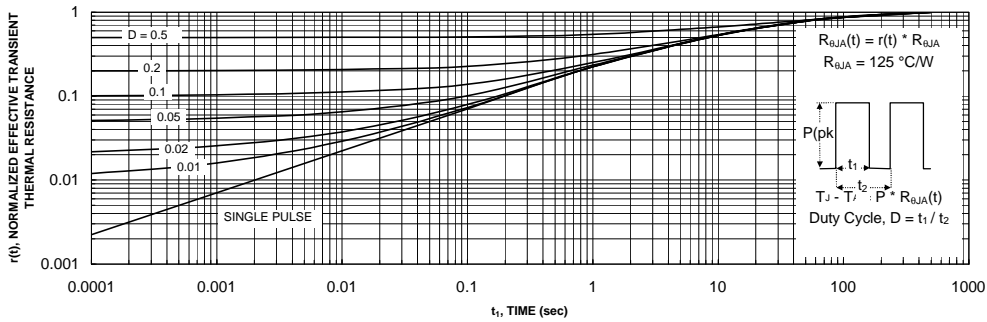
**Figure 8. Capacitance Characteristics.**



**Figure 9. Maximum Safe Operating Area.**



**Figure 10. Single Pulse Maximum Power Dissipation.**



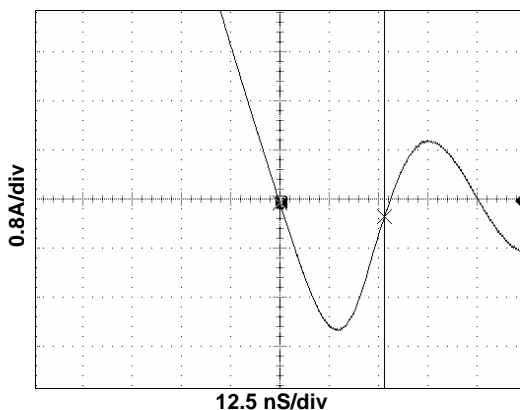
**Figure 11. Transient Thermal Response Curve.**

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

## Typical Characteristics (continued)

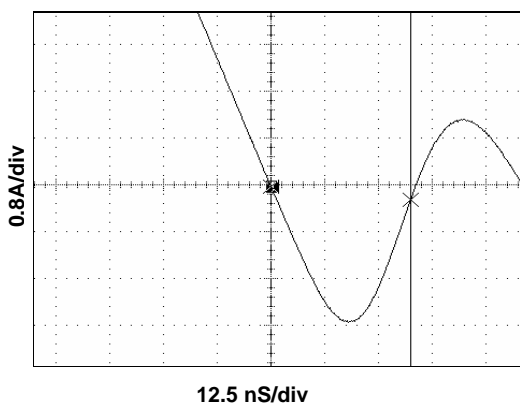
### SyncFET Schottky Body Diode Characteristics

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 FDS7766S.



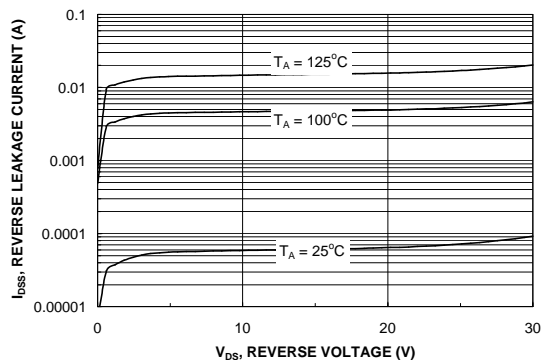
**Figure 12. FDS7766S SyncFET body diode reverse recovery characteristic.**

For comparison purposes, Figure 13 shows the reverse recovery characteristics of the body diode of an equivalent size MOSFET produced without SyncFET (FDS7766).



**Figure 13. Non-SyncFET (FDS7766) 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 body diode reverse leakage versus drain-source voltage and temperature**

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**Телефон:** 8 (812) 309 58 32 (многоканальный)

**Факс:** 8 (812) 320-02-42

**Электронная почта:** [org@eplast1.ru](mailto:org@eplast1.ru)

**Адрес:** 198099, г. Санкт-Петербург, ул. Калинина, дом 2, корпус 4, литера А.