

# FDS7088SN3

## 30V N-Channel PowerTrench® SyncFET™

### General Description

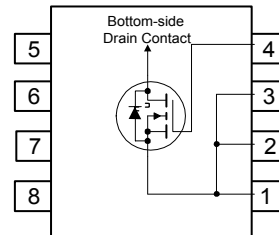
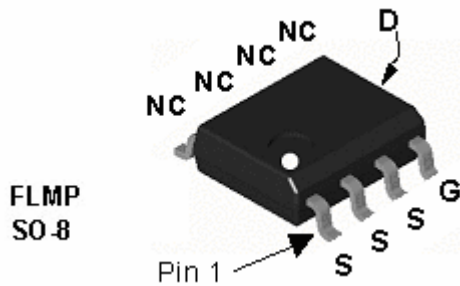
The FDS7088SN3 is designed to replace a single SO-8 FLMP MOSFET and Schottky diode in synchronous DC:DC power supplies. This 30V MOSFET is designed to maximize power conversion efficiency, providing a low  $R_{DS(ON)}$  and low gate charge. The FDS7088SN3 includes an integrated Schottky diode using Fairchild's monolithic SyncFET technology. The performance of the FDS7088SN3 as the low-side switch in a synchronous rectifier is close to the performance of the FDS7088N3 in parallel with a Schottky diode.

### Applications

- DC/DC converter
- Motor drives

### Features

- 21 A, 30 V  $R_{DS(ON)} = 4.0 \text{ m}\Omega @ V_{GS} = 10 \text{ V}$   
 $R_{DS(ON)} = 4.9 \text{ m}\Omega @ V_{GS} = 4.5 \text{ V}$
- High performance trench technology for extremely low  $R_{DS(ON)}$
- High power and current handling capability
- Fast switching
- FLMP SO-8 package: Enhanced thermal performance in industry-standard package size



### 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	$\pm 20$	V
$I_D$	Drain Current – Continuous (Note 1a)	21	A
	– Pulsed	60	
$P_D$	Power Dissipation for Single Operation (Note 1a) (Note 1b)	3.0	W
		1.7	
$T_J, T_{STG}$	Operating and Storage Junction Temperature Range	$-55$ to $+150$	$^\circ\text{C}$

### Thermal Characteristics

$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient (Note 1a)	40	$^\circ\text{C/W}$
$R_{\theta JC}$	Thermal Resistance, Junction-to-Case (Note 1)	0.5	$^\circ\text{C/W}$

### Package Marking and Ordering Information

Device Marking	Device	Reel Size	Tape width	Quantity
FDS7088SN3	FDS7088SN3	13"	12mm	2500 units

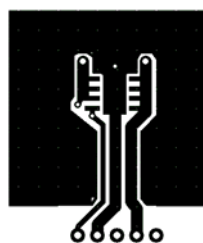
## Electrical Characteristics

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

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
<b>Off Characteristics</b>						
$BV_{DSS}$	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 $25^\circ\text{C}$		28		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	$V_{GS} = \pm 20\text{ V}, V_{DS} = 0\text{ V}$			$\pm 100$	nA
<b>On Characteristics (Note 2)</b>						
$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS} = V_{GS}, I_D = 1\text{ mA}$	1	1.5	3	V
$\frac{\Delta V_{GS(th)}}{\Delta T_J}$	Gate Threshold Voltage Temperature Coefficient	$I_D = 15\text{ mA}$ , Referenced to $25^\circ\text{C}$		-3		mV/ $^\circ\text{C}$
$R_{DS(on)}$	Static Drain–Source On–Resistance	$V_{GS} = 10\text{ V}, I_D = 21\text{ A}$ $V_{GS} = 4.5\text{ V}, I_D = 19\text{ A}$ $V_{GS} = 10\text{ V}, I_D = 21\text{ A}, T_J = 125^\circ\text{C}$		3.4 4.0 5	4.0 4.9	m $\Omega$
$g_{FS}$	Forward Transconductance	$V_{DS} = 10\text{ V}, I_D = 21\text{ A}$		85		S
<b>Dynamic Characteristics</b>						
$C_{iss}$	Input Capacitance	$V_{DS} = 15\text{ V}, V_{GS} = 0\text{ V},$ $f = 1.0\text{ MHz}$		3230		pF
$C_{oss}$	Output Capacitance			890		pF
$C_{riss}$	Reverse Transfer Capacitance			300		pF
$R_G$	Gate Resistance	$V_{GS} = 15\text{ mV}, f = 1.0\text{ MHz}$		1.6		$\Omega$
<b>Switching Characteristics (Note 2)</b>						
$t_{d(on)}$	Turn–On Delay Time	$V_{DD} = 15\text{ V}, I_D = 1\text{ A},$ $V_{GS} = 10\text{ V}, R_{GEN} = 6\ \Omega$		20	32	ns
$t_r$	Turn–On Rise Time			21	34	ns
$t_{d(off)}$	Turn–Off Delay Time			45	72	ns
$t_f$	Turn–Off Fall Time			33	53	ns
$Q_{g(TOT)}$	Total Gate Charge at $V_{GS}=10\text{V}$	$V_{DD} = 15\text{ V}, I_D = 10\text{ A}$		57	80	nC
$Q_g$	Total Gate Charge	$V_{DD} = 15\text{ V}, I_D = 10\text{ A}$ $V_{GS} = 5\text{ V}$		31	44	nC
$Q_{gs}$	Gate–Source Charge			8		nC
$Q_{gd}$	Gate–Drain Charge			10		nC
<b>Drain–Source Diode Characteristics and Maximum Ratings</b>						
$I_S$	Maximum Continuous Drain–Source Schottky Diode Forward Current				4.3	A
$V_{SD}$	Drain–Source Schottky Diode Forward Voltage	$V_{GS} = 0\text{ V}, I_S = 4.3\text{ A}$ (Note 2)		0.4	0.7	V
$t_{RR}$	Reverse Recovery Time	$I_F = 21\text{ A}$ $diF/dt = 300\text{ A/us}$		28		ns
$Q_{RR}$	Reverse Recovery Charge			29		nC

**Notes:**

- $R_{\theta JA}$  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) 40°C/W when mounted on a 1 in<sup>2</sup> pad of 2 oz copper



b) 85°C/W when mounted on a minimum pad of 2 oz copper

Scale 1 : 1 on letter size paper

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

### Typical Characteristics

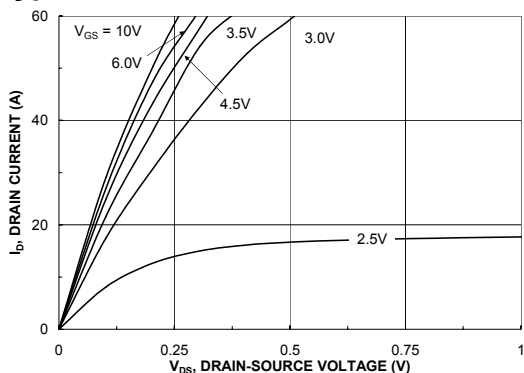


Figure 1. On-Region Characteristics.

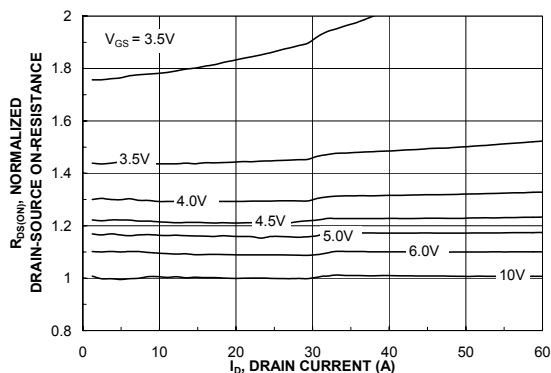


Figure 2. On-Resistance Variation with Drain Current and Gate Voltage.

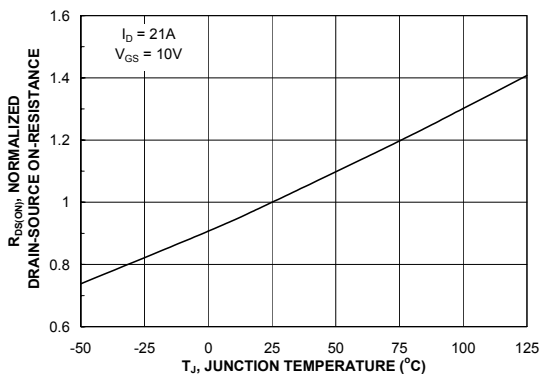


Figure 3. On-Resistance Variation with Temperature.

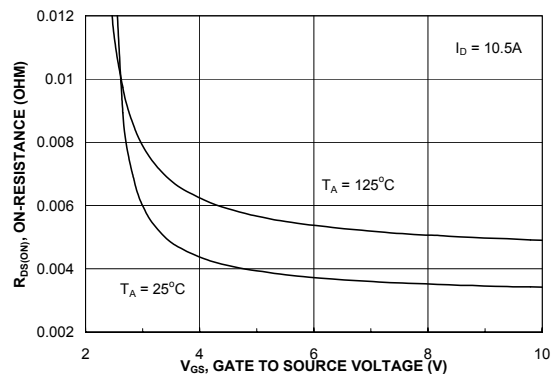


Figure 4. On-Resistance Variation with Gate-to-Source Voltage.

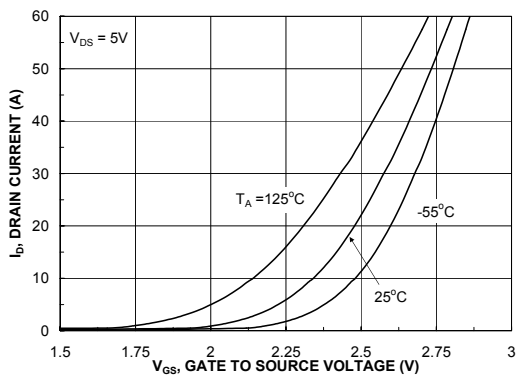


Figure 5. Transfer Characteristics.

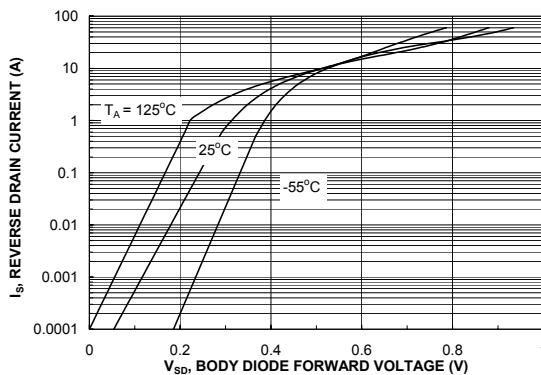
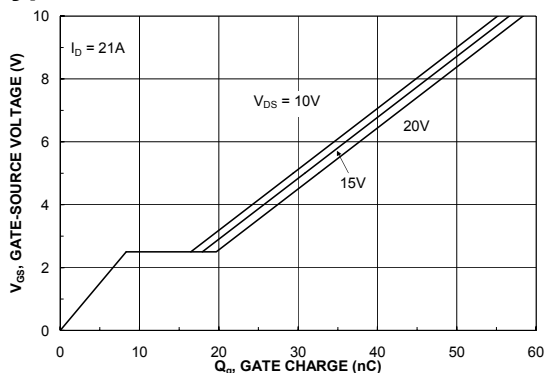
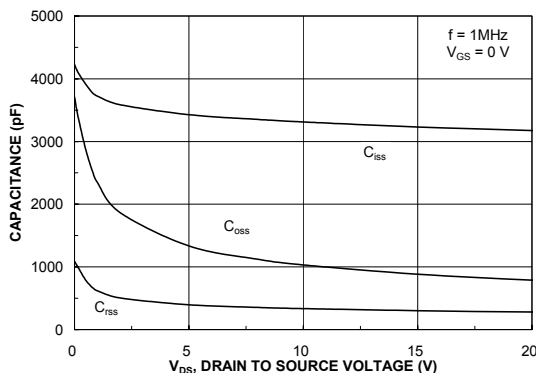


Figure 6. Body Diode Forward Voltage Variation with Source Current and Temperature.

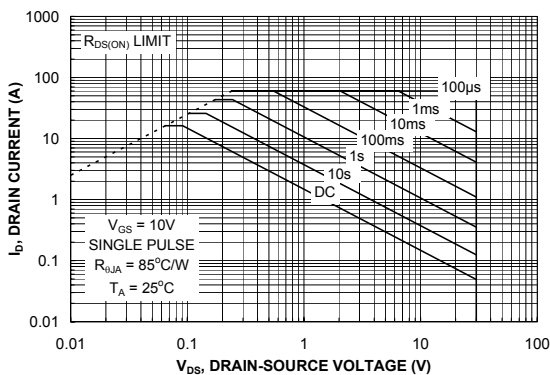
### Typical Characteristics



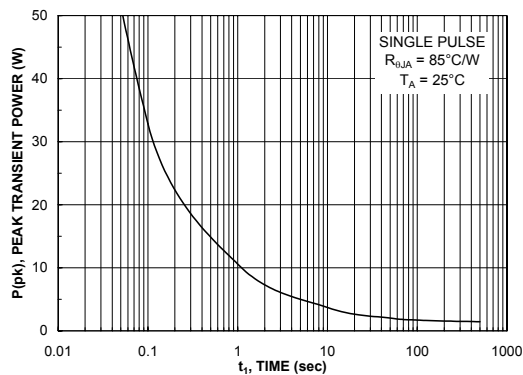
**Figure 7. Gate Charge Characteristics.**



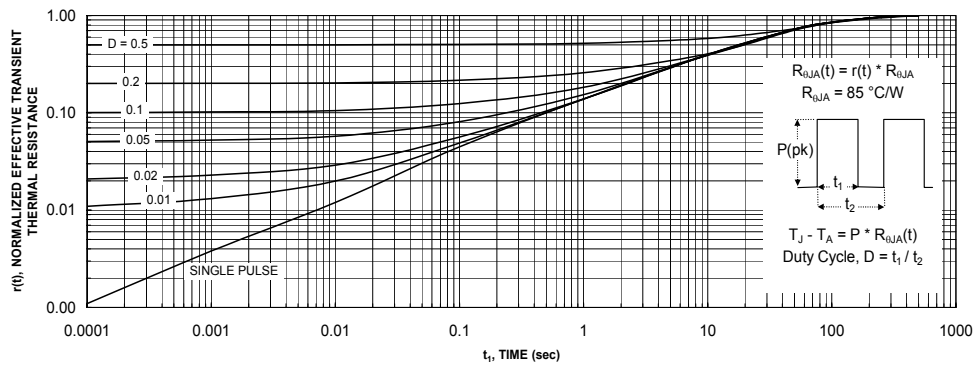
**Figure 8. Capacitance Characteristics.**



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



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



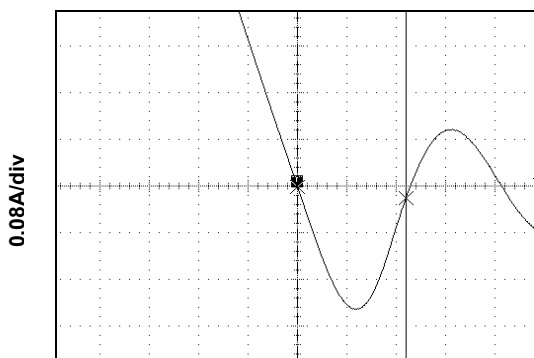
**Figure 11. Transient Thermal Response Curve.**

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

## Typical Characteristics (continued)

### SyncFET Schottky Body Diode Characteristics

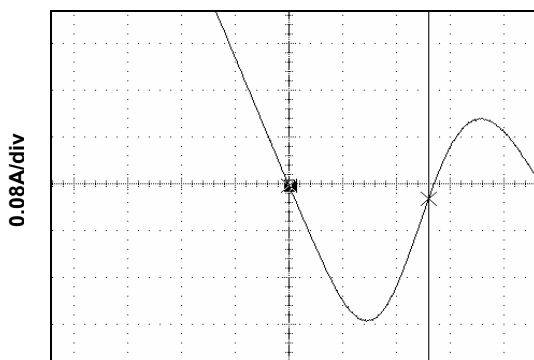
Fairchild's SyncFET process embeds a Schottky diode in parallel with PowerTrench MOSFET. This diode exhibits similar characteristics to a discrete external Schottky diode in parallel with a MOSFET. Figure 12 shows the reverse recovery characteristic of the FDS7088SN3.



12.5 nS/div

**Figure 12. FDS7088SN3 SyncFET body diode reverse recovery characteristic.**

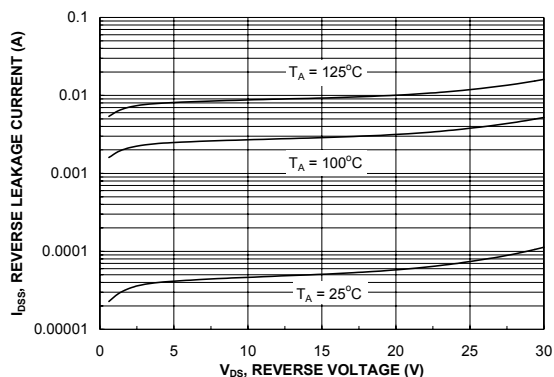
For comparison purposes, Figure 13 shows the reverse recovery characteristics of the body diode of an equivalent size MOSFET produced without SyncFET (FDS7088N3).



12.5 nS/div

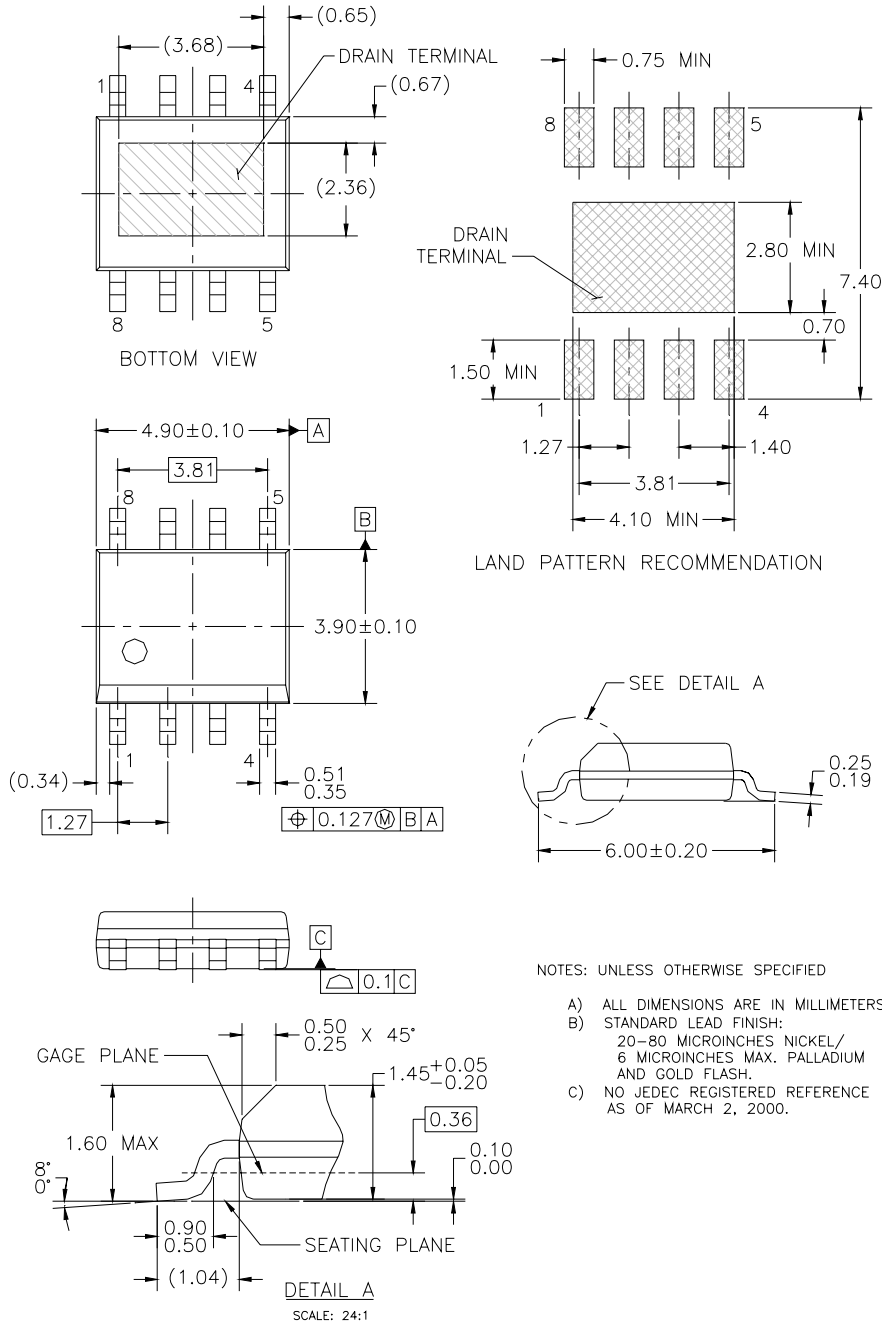
**Figure 13. Non-SyncFET (FDS7088N3) body diode reverse recovery characteristic.**

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**

### Dimensional Outline and Pad Layout



NOTES: UNLESS OTHERWISE SPECIFIED

- A) ALL DIMENSIONS ARE IN MILLIMETERS.
- B) STANDARD LEAD FINISH:  
20-80 MICROINCHES NICKEL/  
6 MICROINCHES MAX. PALLADIUM  
AND GOLD FLASH.
- C) NO JEDEC REGISTERED REFERENCE  
AS OF MARCH 2, 2000.

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CoolFET™	FRFET™	MicroFET™	QFET®	SuperSOT™-8
CROSSVOLT™	GlobalOptoisolator™	MicroPak™	QS™	SyncFET™
DOMET™	GTO™	MICROWIRE™	QT Optoelectronics™	TinyLogic®
EcoSPARK™	HiSeC™	MSX™	Quiet Series™	TINYOPTO™
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EnSigna™	i-Lo™	OCX™	RapidConnect™	UHC™
FACT™	ImpliedDisconnect™	OCXPro™	µSerDes™	UltraFET®
FACT Quiet Series™		OPTOLOGIC®	SILENT SWITCHER®	VCX™
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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.