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September 2002

# FDN372S

## 30V N-Channel PowerTrench® SyncFET™

### General Description

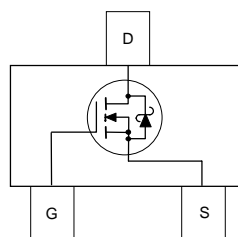
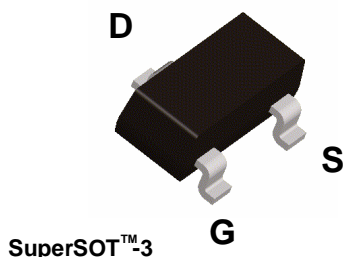
The FDN372S is designed to replace a single MOSFET and Schottky diode, used in synchronous DC-DC power supplies, with a single integrated component. This 30V MOSFET is designed to maximize power conversion efficiency with low Rds(on) and low gate charge. The FDN372S includes an integrated Schottky diode using Fairchild Semiconductor's monolithic SyncFET process, making it ideal as the low side switch in a synchronous converter.

### Applications

- DC-DC Converter
- Motor Drives

### Features

- 2.6 A, 30 V.  $R_{DS(ON)} = 40 \text{ m}\Omega @ V_{GS} = 10 \text{ V}$   
 $R_{DS(ON)} = 50 \text{ m}\Omega @ V_{GS} = 4.5 \text{ V}$
- Low gate charge
- Fast switching speed
- High performance trench technology for extremely low  $R_{DS(ON)}$



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

Symbol	Parameter	Rated	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)	2.6	A
	– Pulsed	10	
P <sub>D</sub>	Power Dissipation for Single Operation (Note 1a) (Note 1b)	0.5	W
		0.46	
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)	250	°C/W
R <sub>θJC</sub>	Thermal Resistance, Junction-to-Case (Note 1)	75	°C/W

### Package Marking and Ordering Information

Device Marking	Device	Reel Size	Tape width	Quantity
372	FDN372S	7"	8mm	3000 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	$I_D = 10\text{ mA}$ , Referenced to $25^\circ\text{C}$		24		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
<b>On Characteristics (Note 2)</b>						
$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS} = V_{GS}, I_D = 1\text{ mA}$	1	1.4	3	V
$\frac{\Delta V_{GS(th)}}{\Delta T_J}$	Gate Threshold Voltage Temperature Coefficient	$I_D = 10\text{ mA}$ , Referenced to $25^\circ\text{C}$		-3.2		mV/ $^\circ\text{C}$
$R_{DS(on)}$	Static Drain-Source On-Resistance	$V_{GS} = 10\text{ V}, I_D = 2.6\text{ A}$ $V_{GS} = 4.5\text{ V}, I_D = 2.3\text{ A}$ $V_{GS} = 10\text{ V}, I_D = 2.6\text{ A}, T_J = 125^\circ\text{C}$		32 36 45	40 50 60	m $\Omega$
$I_{D(on)}$	On-State Drain Current	$V_{GS} = 10\text{ V}, V_{DS} = 5\text{ V}$	10			A
$g_{FS}$	Forward Transconductance	$V_{DS} = 10\text{ V}, I_D = 2.6\text{ A}$		15		S
<b>Dynamic Characteristics</b>						
$C_{iss}$	Input Capacitance	$V_{DS} = 15\text{ V}, V_{GS} = 0\text{ V},$ $f = 1.0\text{ MHz}$		630		pF
$C_{oss}$	Output Capacitance			115		pF
$C_{rss}$	Reverse Transfer Capacitance			45		pF
$R_g$	Gate Resistance	$V_{GS} = 15\text{ mV}, f = 1.0\text{ MHz}$		2.4		$\Omega$
<b>Switching Characteristics (Note 2)</b>						
$t_{d(on)}$	Turn-On Delay Time	$V_{DD} = 15\text{ V}, I_D = 1\text{ A},$ $V_{GS} = 10\text{ V}, R_{GEN} = 6\text{ }\Omega$		7	14	ns
$t_r$	Turn-On Rise Time			5	10	ns
$t_{d(off)}$	Turn-Off Delay Time			21	34	ns
$t_f$	Turn-Off Fall Time			2.7	5.4	ns
$Q_g$	Total Gate Charge	$V_{DS} = 15\text{ V}, I_D = 2.6\text{ A},$ $V_{GS} = 5\text{ V}$		5.8	8.1	nC
$Q_{gs}$	Gate-Source Charge			1.3	1.9	nC
$Q_{gd}$	Gate-Drain Charge			1.2	1.7	nC
<b>Drain-Source Diode Characteristics and Maximum Ratings</b>						
$I_S$	Maximum Continuous Drain-Source Diode Forward Current				0.7	A
$V_{SD}$	Drain-Source Diode Forward Voltage	$V_{GS} = 0\text{ V}, I_S = 0.7\text{ A}$ (Note 2)		440	700	mV
$t_{rr}$	Diode Reverse Recovery Time	$I_F = 2.6\text{ A},$ $d_I/d_t = 300\text{ A}/\mu\text{s}$ (Note 2)		10		ns
$Q_{rr}$	Diode Reverse Recovery Charge			4		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)  $250^\circ\text{C/W}$  when mounted on a  $0.02\text{ in}^2$  pad of 2 oz. copper.

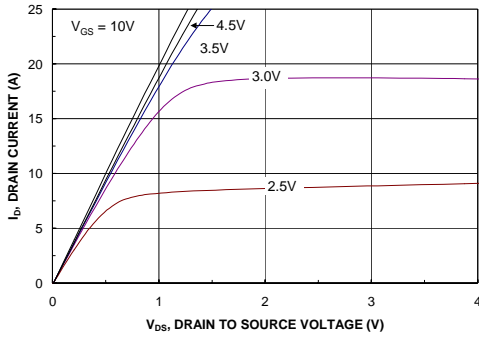


b)  $270^\circ\text{C/W}$  when mounted on a minimum pad.

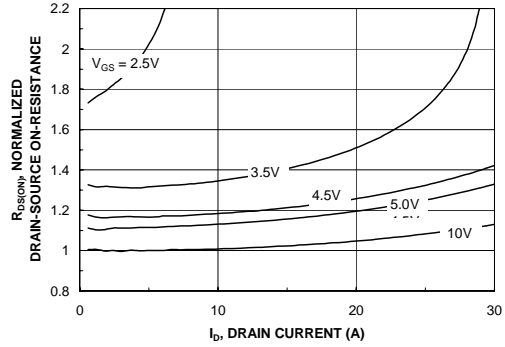
Scale 1 : 1 on letter size paper

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

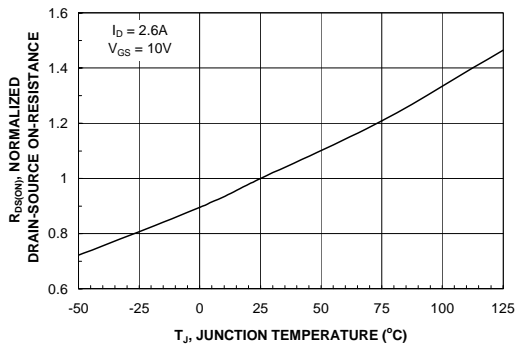
**Typical Characteristics**



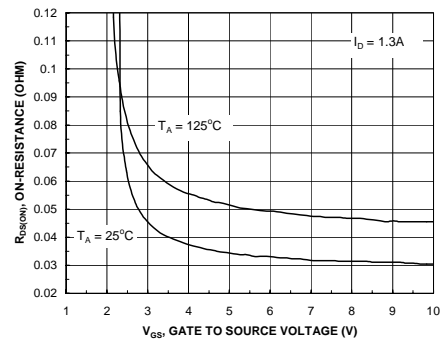
**Figure 1. On-Region Characteristics.**



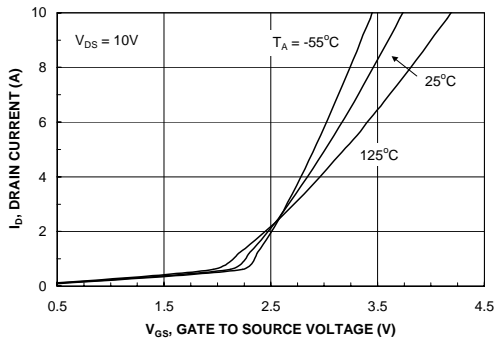
**Figure 2. On-Resistance Variation with Drain Current and Gate Voltage.**



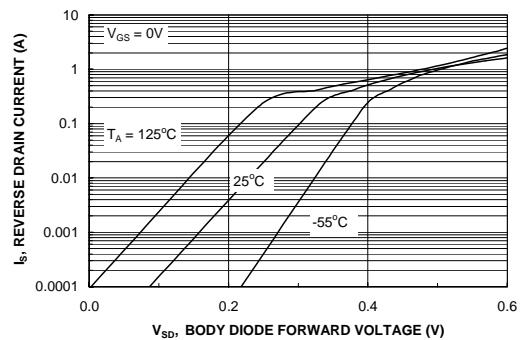
**Figure 3. On-Resistance Variation with Temperature.**



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

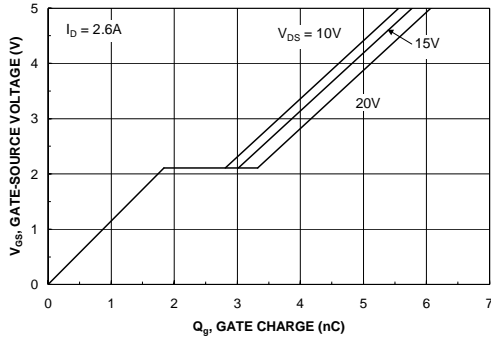


**Figure 5. Transfer Characteristics.**

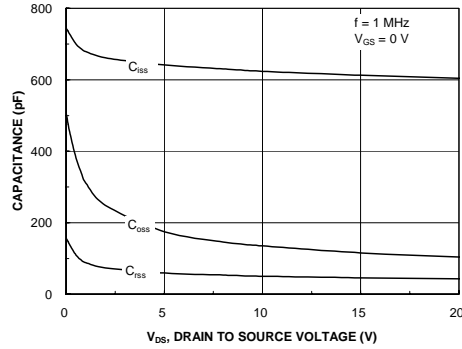


**Figure 6. Body Diode Forward Voltage Variation with Source Current and Temperature.**

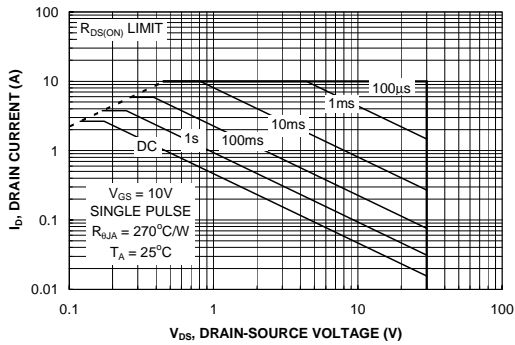
**Typical Characteristics**



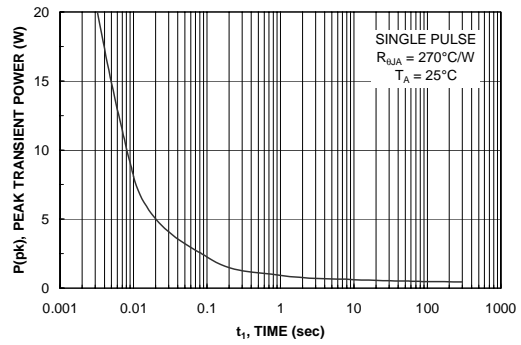
**Figure 7. Gate Charge Characteristics.**



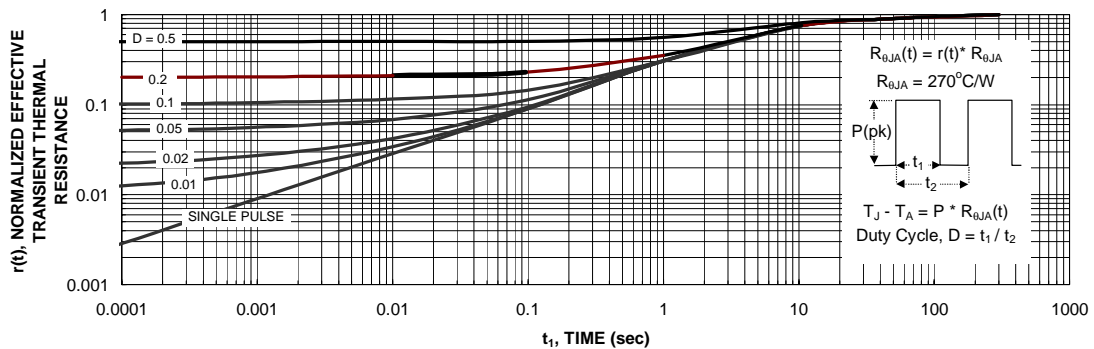
**Figure 8. Capacitance Characteristics.**



**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.

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