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February 2004

FDS4072N7

40V N-Channel PowerTrench® MOSFET

General Description

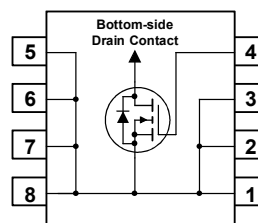
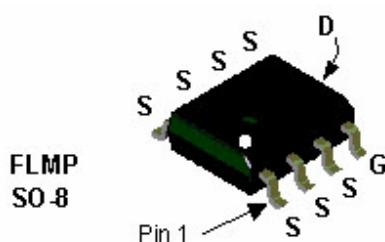
This N-Channel MOSFET has been designed specifically to improve the overall efficiency of DC/DC converters using either synchronous or conventional switching PWM controllers. It has been optimized for "low side" synchronous rectifier operation, providing an extremely low $R_{DS(ON)}$ in a small package.

Applications

- Synchronous rectifier
- DC/DC converter

Features

- 12.4 A, 40 V $R_{DS(ON)} = 11 \text{ m}\Omega @ V_{GS} = 4.5 \text{ V}$
 $R_{DS(ON)} = 9 \text{ m}\Omega @ V_{GS} = 10 \text{ V}$
- 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_{DS}	Drain-Source Voltage	40	V
V_{GS}	Gate-Source Voltage	± 12	V
I_D	Drain Current – Continuous (Note 1a)	12.4	A
	– Pulsed	60	
P_D	Power Dissipation (Note 1a) (Note 1b)	3.0	W
		1.5	
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	0.5	$^\circ\text{C/W}$

Package Marking and Ordering Information

Device Marking	Device	Reel Size	Tape width	Quantity
FDS4072N7	FDS4072N7	13"	12mm	2500 units

Electrical Characteristics

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

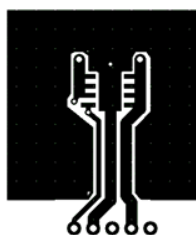
Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
Drain-Source Avalanche Ratings (Note 2)						
E _{AS}	Drain-Source Avalanche Energy	Single Pulse, V _{DD} = 20V, I _D =12.4 A			200	mJ
I _{AS}	Drain-Source Avalanche Current				12.4	A
Off Characteristics						
BV _{DSS}	Drain–Source Breakdown Voltage	V _{GS} = 0 V, I _D = 250 μA	40			V
$\frac{\Delta BV_{DSS}}{\Delta T_J}$	Breakdown Voltage Temperature Coefficient	I _D = 250 μA, Referenced to 25°C		38		mV/°C
I _{DSS}	Zero Gate Voltage Drain Current	V _{DS} = 32 V, V _{GS} = 0 V			1	μA
I _{GSSF}	Gate–Body Leakage, Forward	V _{GS} = 12 V, V _{DS} = 0 V			100	nA
I _{GSSR}	Gate–Body Leakage, Reverse	V _{GS} = –12 V, V _{DS} = 0 V			–100	nA
On Characteristics (Note 2)						
V _{GS(th)}	Gate Threshold Voltage	V _{DS} = V _{GS} , I _D = 250 μA	1	1.3	3	V
$\frac{\Delta V_{GS(th)}}{\Delta T_J}$	Gate Threshold Voltage Temperature Coefficient	I _D = 250 μA, Referenced to 25°C		–4.5		mV/°C
R _{DS(on)}	Static Drain–Source On–Resistance	V _{GS} = 4.5 V, I _D = 12.4 A V _{GS} = 10 V, I _D = 13.7 A V _{GS} = 4.5 V, I _D = 12.4 A, T _J = 125°C		9 8 14	11 9 18	mΩ
g _{FS}	Forward Transconductance	V _{DS} = 10 V, I _D = 12.4 A		84		S
Dynamic Characteristics						
C _{iss}	Input Capacitance	V _{DS} = 20 V, V _{GS} = 0 V, f = 1.0 MHz		4299		pF
C _{oss}	Output Capacitance			351		pF
C _{rss}	Reverse Transfer Capacitance			149		pF
Switching Characteristics (Note 2)						
t _{d(on)}	Turn–On Delay Time	V _{DD} = 20 V, I _D = 1 A, V _{GS} = 4.5 V, R _{GEN} = 6 Ω		20	36	ns
t _r	Turn–On Rise Time			12	22	ns
t _{d(off)}	Turn–Off Delay Time			52	83	ns
t _f	Turn–Off Fall Time			18	32	ns
Q _g	Total Gate Charge	V _{DS} = 20 V, I _D = 12.4 A, V _{GS} = 4.5 V		33	46	nC
Q _{gs}	Gate–Source Charge			7.8		nC
Q _{gd}	Gate–Drain Charge			8.1		nC
Drain–Source Diode Characteristics and Maximum Ratings						
I _S	Maximum Continuous Drain–Source Diode Forward Current				2.5	A
V _{SD}	Drain–Source Diode Forward Voltage	V _{GS} = 0 V, I _S = 2.5 A (Note 2)		0.7	1.2	V
t _{rr}	Diode Reverse Recovery Time	I _F = 12.4 A,		30		nS
Q _{rr}	Diode Reverse Recovery Charge	dI _F /dI _t = 100 A/μs		90		nC

Electrical Characteristics

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

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) 40°C/W when mounted on a 1 in^2 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

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

Typical Characteristics

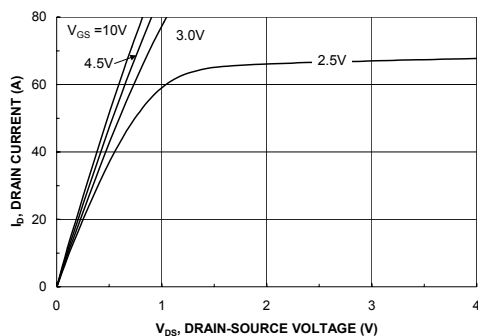


Figure 1. On-Region Characteristics.

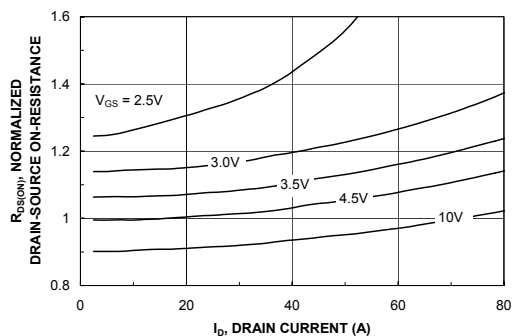


Figure 2. On-Resistance Variation with Drain Current and Gate Voltage.

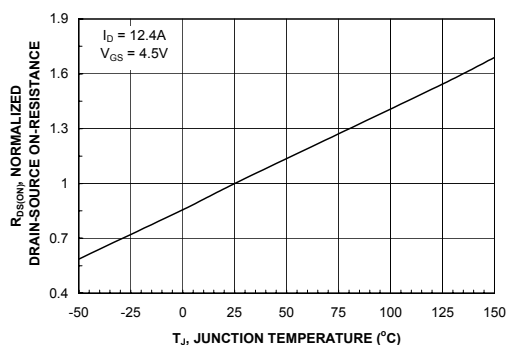


Figure 3. On-Resistance Variation with Temperature.

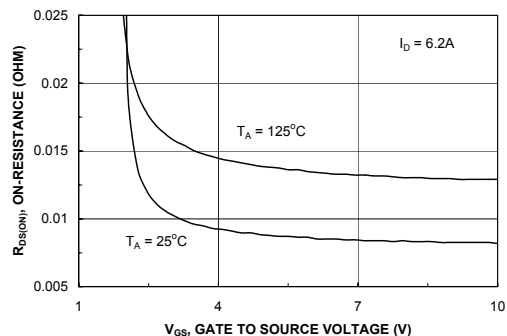


Figure 4. On-Resistance Variation with Gate-to-Source Voltage.

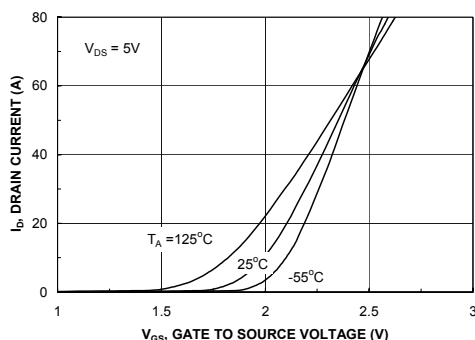


Figure 5. Transfer Characteristics.

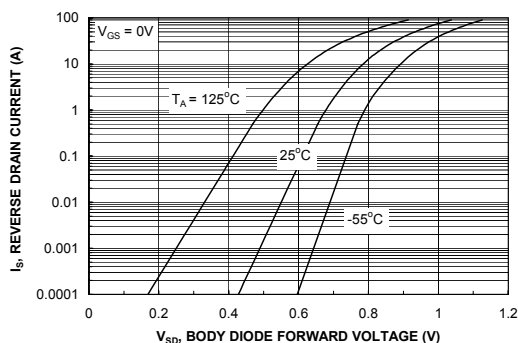


Figure 6. Body Diode Forward Voltage Variation with Source Current and Temperature.

Typical Characteristics

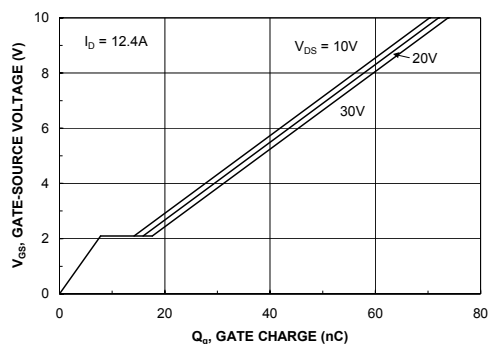


Figure 7. Gate Charge Characteristics.

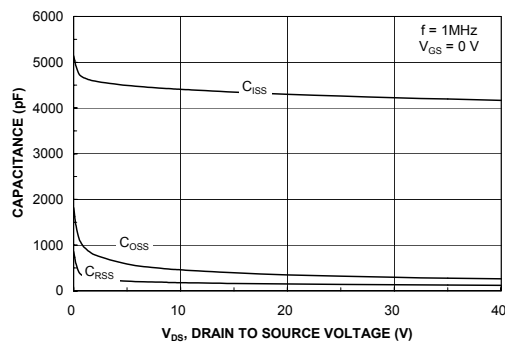


Figure 8. Capacitance Characteristics.

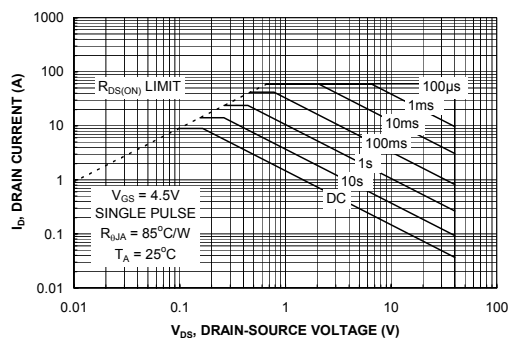


Figure 9. Maximum Safe Operating Area.

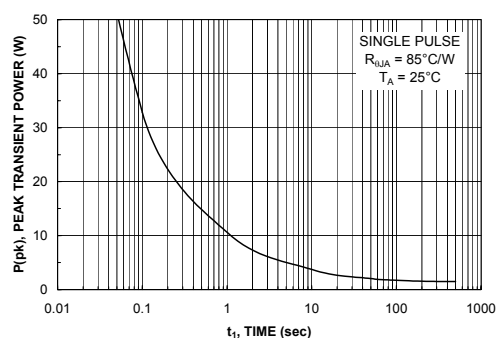


Figure 10. Single Pulse Maximum Power Dissipation.

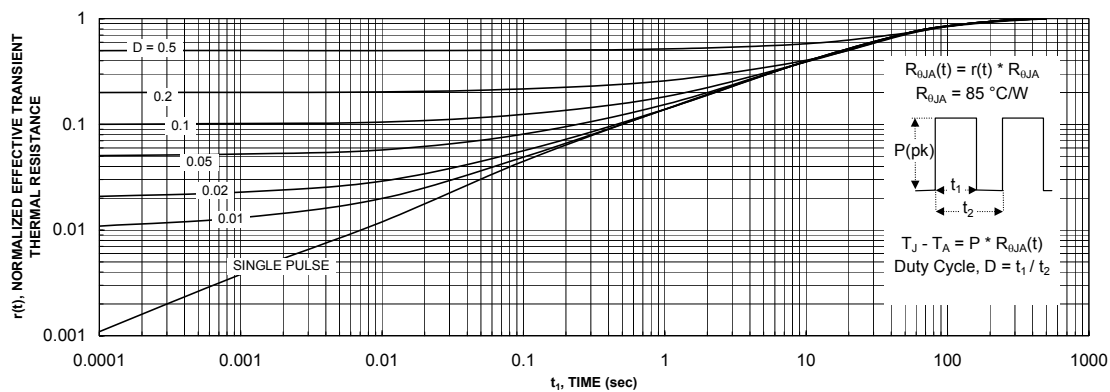
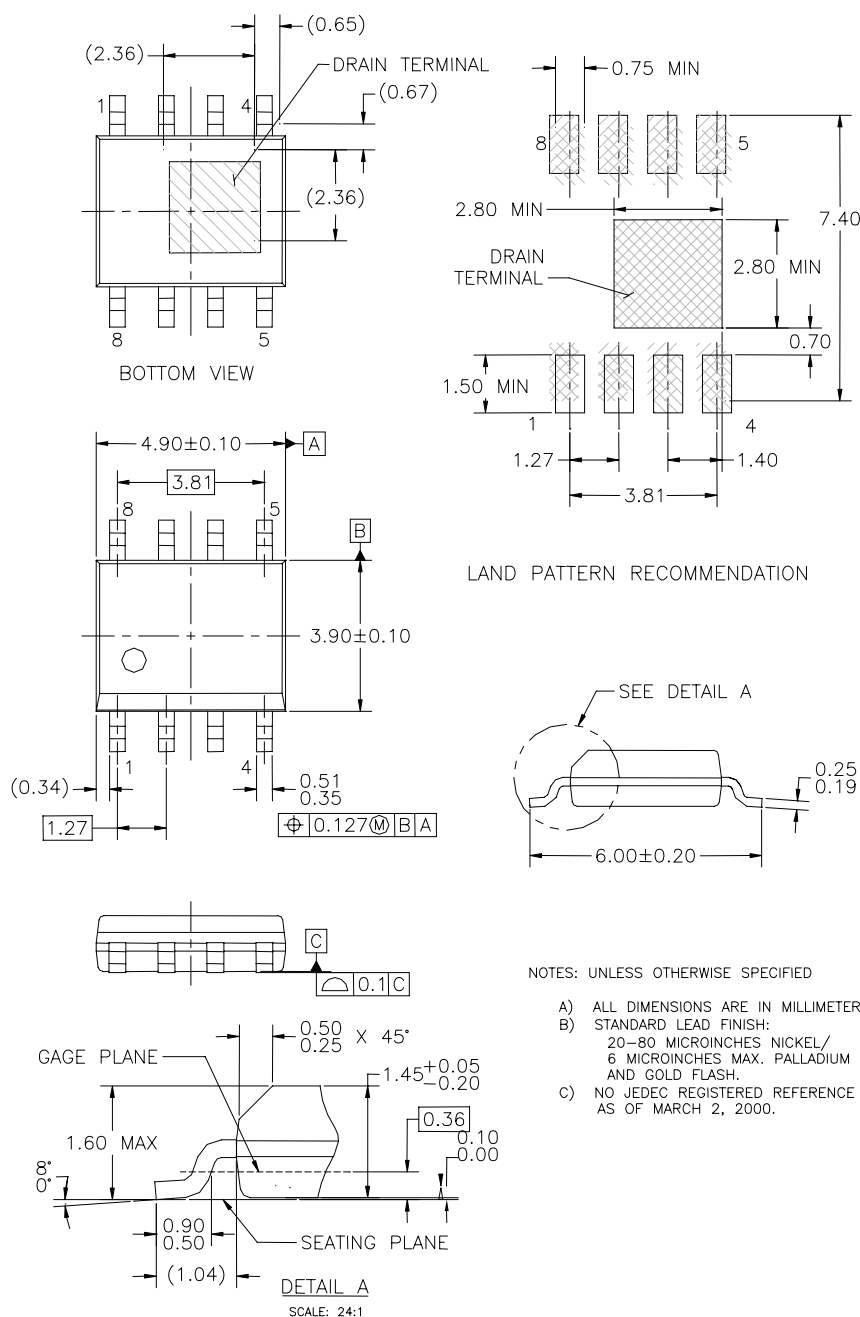


Figure 11. Transient Thermal Response Curve.

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

Dimensional Outline and Pad Layout



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