THE DATASHEET OF

FDS2170N3

January 2004

FAIRCHILD SEMICONDUCTOR®

FDS2170N3

200V N-Channel PowerTrench® MOSFET

General Description

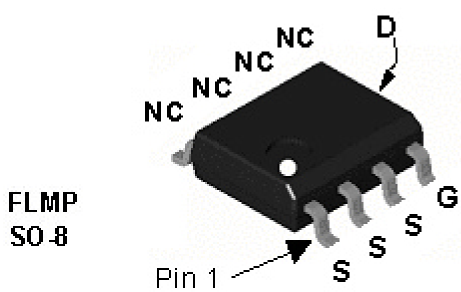
This N-Channel MOSFET has been designed specifically to improve the overall efficiency of DC/DC converters using either synchronous or conventional switching PWM controllers. It has been optimized for "low side" synchronous rectifier operation, providing an extremely low $R_{DS(ON)}$ in a small package.

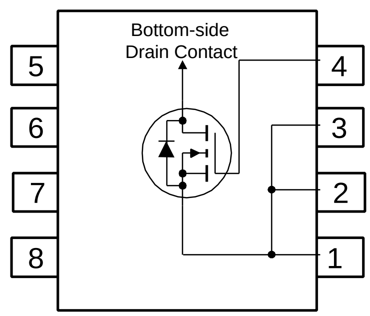
Applications

- Synchronous rectifier
- DC/DC converter

Features

- 3.0 A, 200 V. $R_{DS(ON)}$ = 128 mΩ @ V_{GS} = 10 V
- High performance trench technology for extremely low $R_{DS(ON)}$
- High power and current handling capability
- Fast switching, low gate charge (26nC typical)
- FLMP SO-8 package: Enhanced thermal performance in industry-standard package size





Absolute Maximum Ratings T_A=25°C unless otherwise noted

Symbol	Parameter		Ratings	Units
V_{DSS}	Drain-Source Voltage		200	V
V_{GSS}	Gate-Source Voltage		± 20	V
I_D	Drain Current – Continuous	(Note 1a)	3.0	A
	– Pulsed		20	
P_D	Power Dissipation for Single Operation	(Note 1a)	3.0	W
		(Note 1b)	1.8	
T_J, T_{STG}	Operating and Storage Junction Temperature Range		–55 to +150	°C

Thermal Characteristics

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

Package Marking and Ordering Information

Device Marking	Device	Reel Size	Tape width	Quantity
FDS2170N3	FDS2170N3	13''	12mm	2500 units

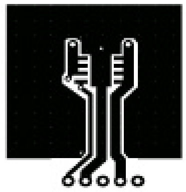
Electrical Characteristics

T_A = 25°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} = 200 V, I_D=10 A			400	mJ
I_{AR}	Drain-Source Avalanche Current				10	A
Off Characteristics						
BV_{DSS}	Drain–Source Breakdown Voltage	V_{GS} = 0 V, I_D = 250 μA	200			V
$\frac{\Delta BV_{DSS}}{\Delta T_J}$	Breakdown Voltage Temperature Coefficient	I_D = 250 μA, Referenced to 25°C		231		mV/°C
I_{DSS}	Zero Gate Voltage Drain Current	V_{DS} = 160 V, V_{GS} = 0 V			1	μA
I_{GSSF}	Gate–Body Leakage, Forward	V_{GS} = 20 V, V_{DS} = 0 V			100	nA
I_{GSSR}	Gate–Body Leakage, Reverse	V_{GS} = –20 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	2	4	4.5	V
$\frac{\Delta V_{GS(th)}}{\Delta T_J}$	Gate Threshold Voltage Temperature Coefficient	I_D = 250 μA, Referenced to 25°C		–10		mV/°C
$R_{DS(on)}$	Static Drain–Source On–Resistance	V_{GS} = 10 V, I_D = 3.0 A V_{GS} = 10 V, I_D = 3.0 A, T_J = 125°C		108 214	128 268	mΩ
g_{FS}	Forward Transconductance	V_{DS} = 10 V, I_D = 3.0 A		15		S
Dynamic Characteristics						
C_{iss}	Input Capacitance	V_{DS} = 100 V, V_{GS} = 0 V, f = 1.0 MHz		1292		pF
C_{oss}	Output Capacitance			72		pF
C_{rss}	Reverse Transfer Capacitance			24		pF
R_G	Gate Resistance	V_{GS} = 15 mV, f = 1.0 MHz		1.5		Ω
Switching Characteristics (Note 2)						
$t_{d(on)}$	Turn–On Delay Time	V_{DD} = 100 V, I_D = 1 A, V_{GS} = 10 V, R_{GEN} = 6 Ω		12	22	ns
t_r	Turn–On Rise Time			5	10	ns
$t_{d(off)}$	Turn–Off Delay Time			30	48	ns
t_f	Turn–Off Fall Time			23	36	ns
Q_g	Total Gate Charge	V_{DS} = 100 V, I_D = 3.0 A, V_{GS} = 10 V		26	36	nC
Q_{gs}	Gate–Source Charge			7		nC
Q_{gd}	Gate–Drain Charge			10		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)		0.76	1.2	V
t_{rr}	Diode Reverse Recovery Time	I_F = 3.0A, d_{iF}/d_t = 100 A/µs (Note 2)		95		nS
Q_{rr}	Diode Reverse Recovery Charge			552		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.



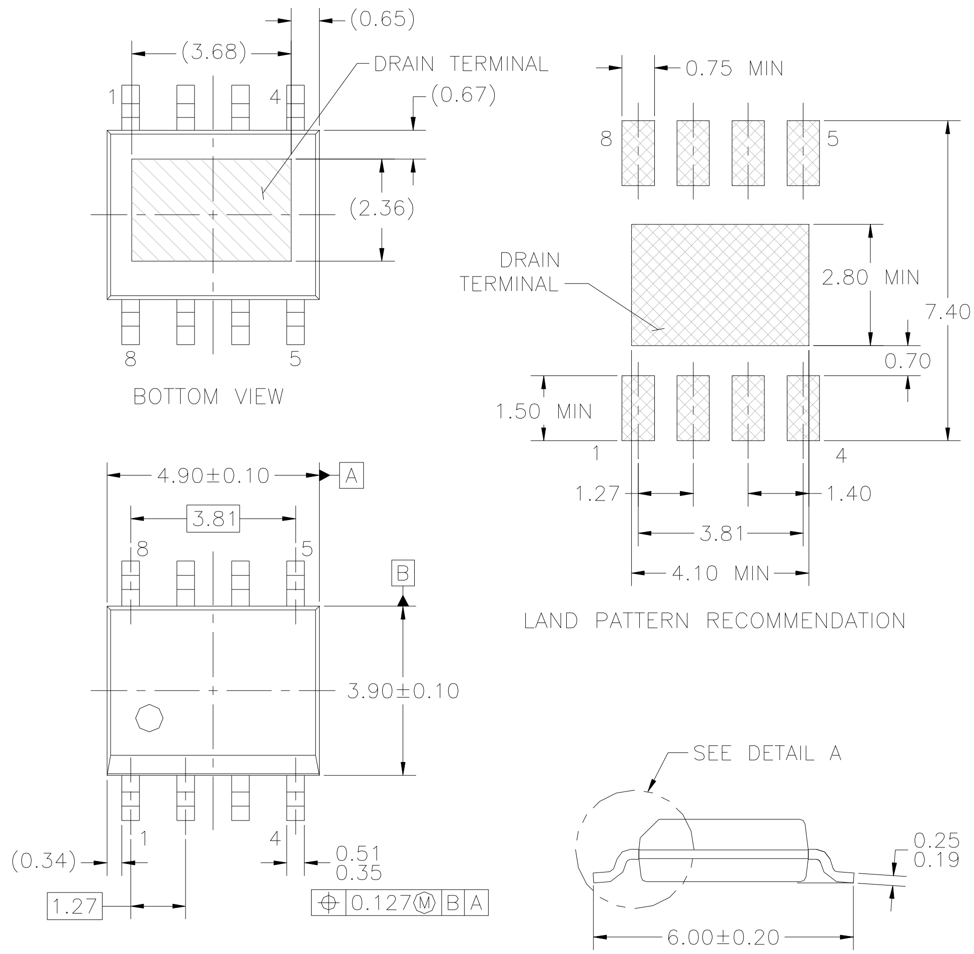
a) 40°C/W when mounted on a 1in^2 pad of 2 oz copper

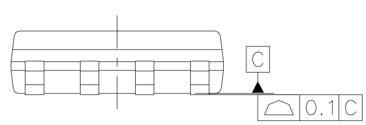
b) 85°C/W when mounted on a minimum pad of 2 oz copper

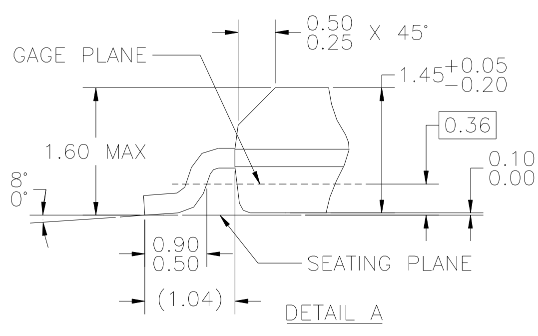
Scale 1 : 1 on letter size paper

2. Pulse Test: Pulse Width < 300µs, Duty Cycle < 2.0%

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.

Typical Characteristics

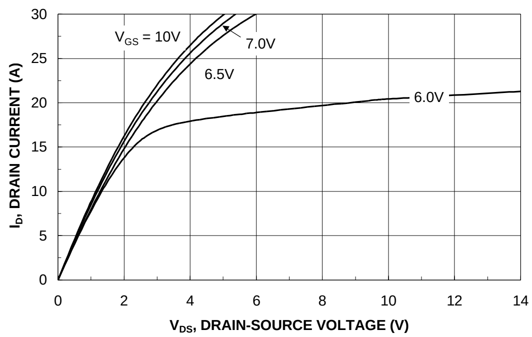


Figure 1. On-Region Characteristics.

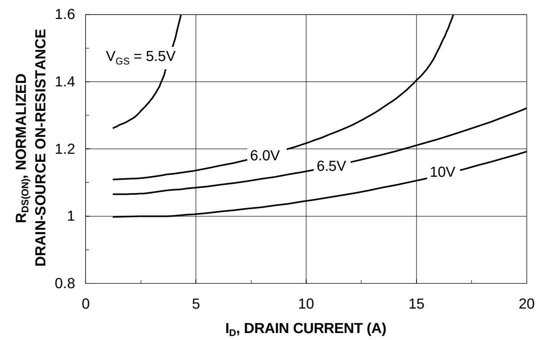


Figure 2. On-Resistance Variation with Drain Current and Gate Voltage.

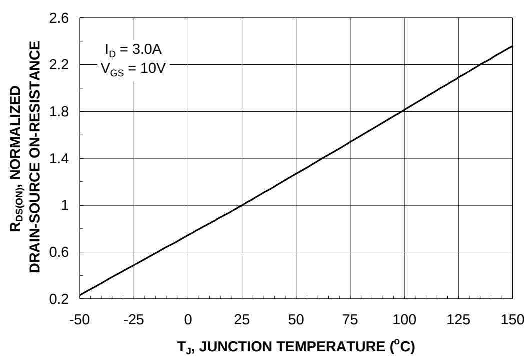


Figure 3. On-Resistance Variation with Temperature.

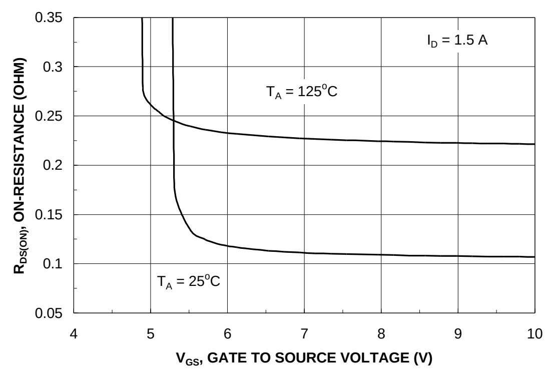


Figure 4. On-Resistance Variation with Gate-to-Source Voltage.

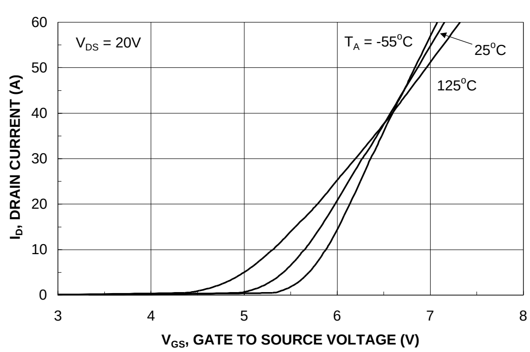


Figure 5. Transfer Characteristics.

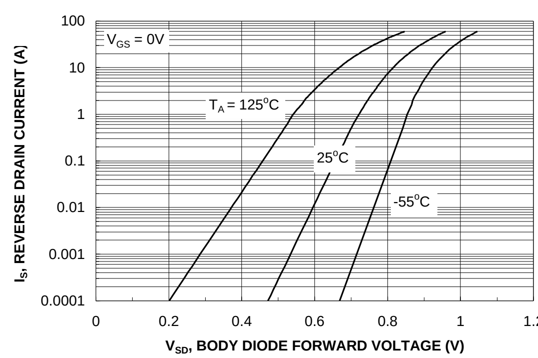


Figure 6. Body Diode Forward Voltage Variation with Source Current and Temperature.

Typical Characteristics

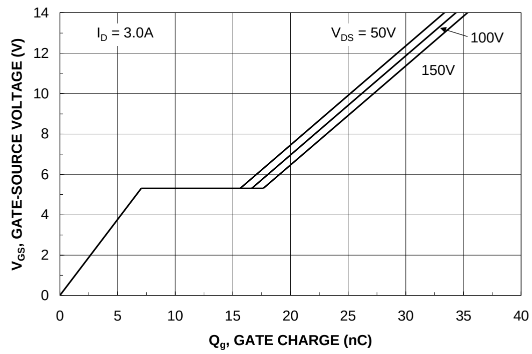


Figure 7. Gate Charge Characteristics.

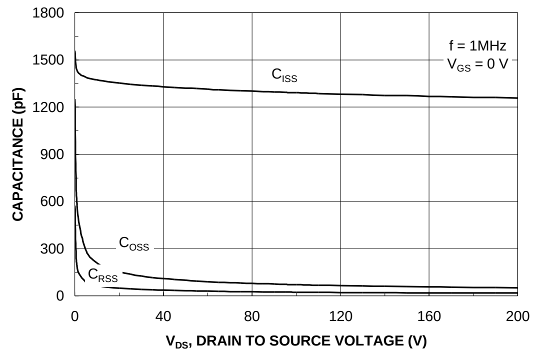


Figure 8. Capacitance Characteristics.

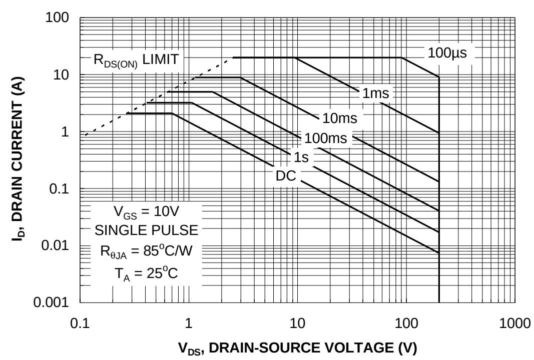


Figure 9. Maximum Safe Operating Area.

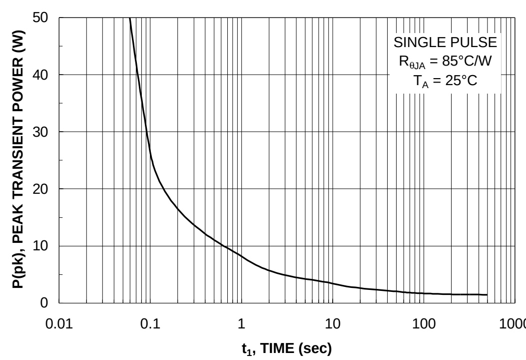


Figure 10. Single Pulse Maximum Power Dissipation.

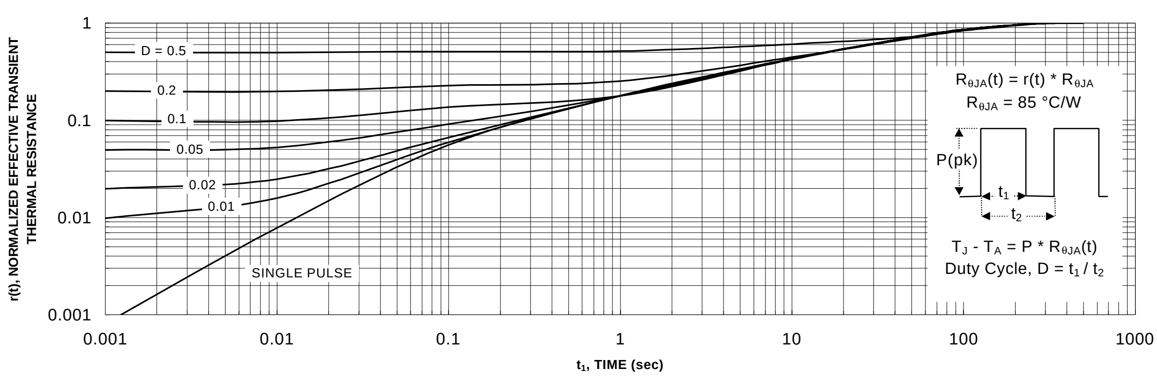


Figure 11. Transient Thermal Response Curve.

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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