FAIRCHILD SEMICONDUCTOR™

December 2000

FDS3570

80V N-Channel PowerTrench® MOSFET

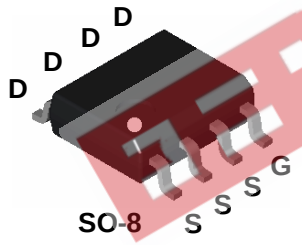
General Description

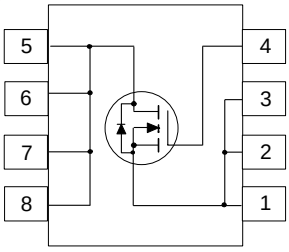
This N-Channel Logic Level MOSFET has been designed specifically to improve the overall efficiency of DC/DC converters using either synchronous or conventional switching PWM controllers.

These MOSFETs feature faster switching and lower gate charge than other MOSFETs with comparable $R_{DS(on)}$ specifications resulting in DC/DC power supply designs with higher overall efficiency.

Features

- 9 A, 80 V. $R_{DS(ON)}$ = 0.020 Ω @ V_{GS} = 10 V
  $R_{DS(ON)}$ = 0.023 Ω @ V_{GS} = 6 V.
- Fast switching speed.
- High performance trench technology for extremely low $R_{DS(ON)}$.
- High power and current handling capability.





Absolute Maximum Ratings

T_A = 25°C unless otherwise noted

Symbol	Parameter		Ratings	Units
V_{DSS}	Drain-Source Voltage		80	V
V_{GSS}	Gate-Source Voltage		±20	V
I_D	Drain Current - Continuous	(Note 1a)	9	A
	- Pulsed		50	
P_D	Power Dissipation for Single Operation	(Note 1a)	2.5	W
		(Note 1b)	1.2	
		(Note 1c)	1	
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)	50	°C/W
$R_{\theta JC}$	Thermal Resistance, Junction-to-Case	(Note 1)	25	°C/W

Package Marking and Ordering Information

Device Marking	Device	Reel Size	Tape Width	Quantity
FDS3570	FDS3570	13''	12mm	2500 units

Electrical Characteristics

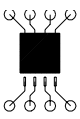
T_A = 25°C unless otherwise noted

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
Drain-Source Avalanche Ratings (Note 2)						
W_{DSS}	Single Pulse Drain-Source Avalanche Energy	V_{DD} = 40 V, I_D = 9 A			360	mJ
I_{AR}	Maximum Drain-Source Avalanche Current				9	A
Off Characteristics						
BV_{DSS}	Drain-Source Breakdown Voltage	V_{GS} = 0 V, I_D = 250 µA	80			V
$\frac{\Delta BV_{DSS}}{\Delta T_J}$	Breakdown Voltage Temperature Coefficient	I_D = 250 µA, Referenced to 25°C		77		mV/°C
I_{DSS}	Zero Gate Voltage Drain Current	V_{DS} = 64 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	2.4	4	V
$\frac{\Delta V_{GS(th)}}{\Delta T_J}$	Gate Threshold Voltage Temperature Coefficient	I_D = 250 µA, Referenced to 25°C		-7		mV/°C
$R_{DS(on)}$	Static Drain-Source On-Resistance	V_{GS} = 10 V, I_D = 9 A V_{GS} = 10 V, I_D = 9 A, T_J = 125°C V_{GS} = 6 V, I_D = 8.4 A		0.015 0.027 0.016	0.020 0.038 0.023	Ω
$I_{D(on)}$	On-State Drain Current	V_{GS} = 10 V, V_{DS} = 5 V	25			A
g_{FS}	Forward Transconductance	V_{DS} = 5 V, I_D = 7.6 A		40		S
Dynamic Characteristics						
C_{iss}	Input Capacitance	V_{DS} = 25 V, V_{GS} = 0 V, f = 1.0 MHz		2750		pF
C_{oss}	Output Capacitance			280		pF
C_{rss}	Reverse Transfer Capacitance			140		pF
Switching Characteristics (Note 2)						
$t_{d(on)}$	Turn-On Delay Time	V_{DD} = 40 V, I_D = 1 A, V_{GS} = 10 V, R_{GEN} = 6 Ω		20	32	ns
t_r	Turn-On Rise Time			12	24	ns
$t_{d(off)}$	Turn-Off Delay Time			60	95	ns
t_f	Turn-Off Fall Time			24	38	ns
Q_g	Total Gate Charge	V_{DS} = 40 V, I_D = 9 A, V_{GS} = 10 V		54	76	nC
Q_{gs}	Gate-Source Charge			9.6		nC
Q_{gd}	Gate-Drain Charge			14		nC
Drain-Source Diode Characteristics and Maximum Ratings						
I_S	Maximum Continuous Drain-Source Diode Forward Current				2.1	A
V_{SD}	Drain-Source Diode Forward Voltage	V_{GS} = 0 V, I_S = 2.1 A (Note 2)		0.72	1.2	V

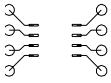
Notes:

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° C/W when mounted on a 1 in² pad of 2 oz. copper.



b) 105° C/W when mounted on a 0.04 in² pad of 2 oz. copper.



c) 125° C/W when mounted on a minimum pad.

Scale 1 : 1 on letter size paper

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

Typical Characteristics

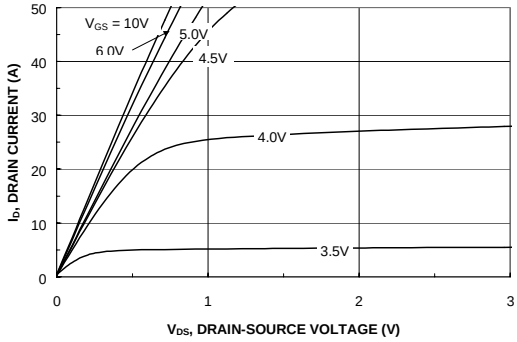


Figure 1. On-Region Characteristics.

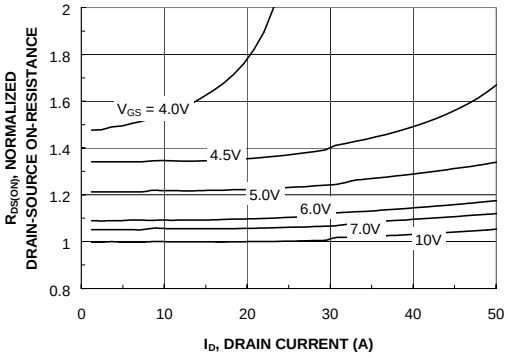


Figure 2. On-Resistance Variation with Drain Current and Gate Voltage.

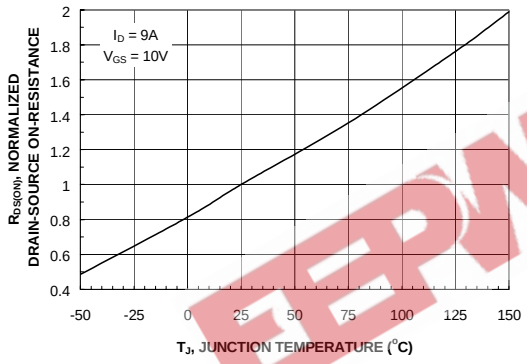


Figure 3. On-Resistance Variation with Temperature.

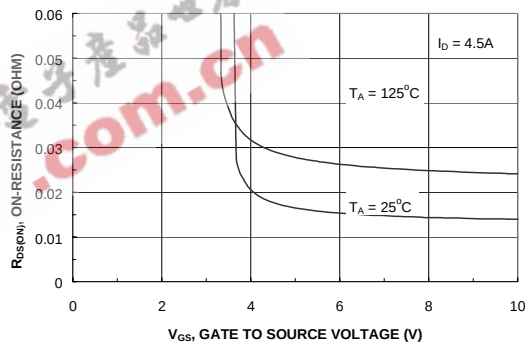


Figure 4. On-Resistance Variation with Gate-to-Source Voltage.

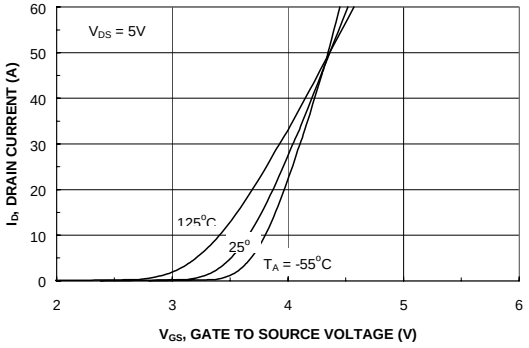


Figure 5. Transfer Characteristics.

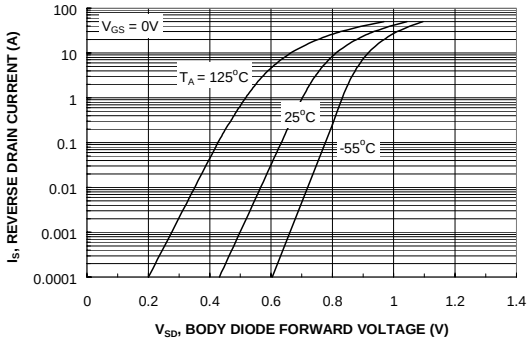
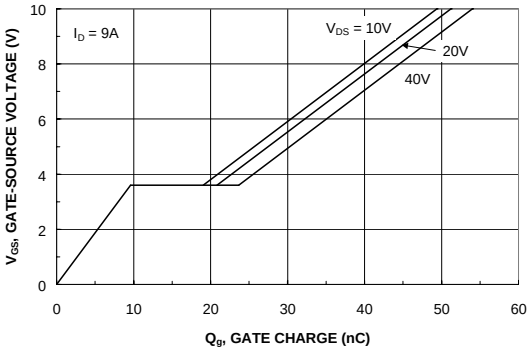
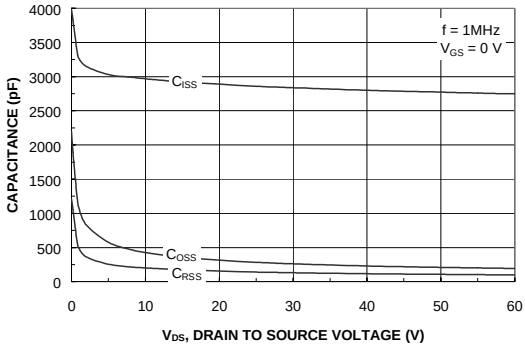
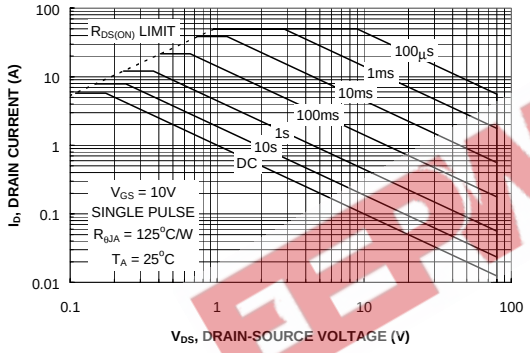
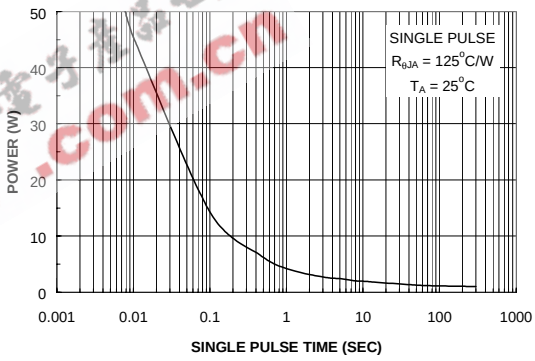


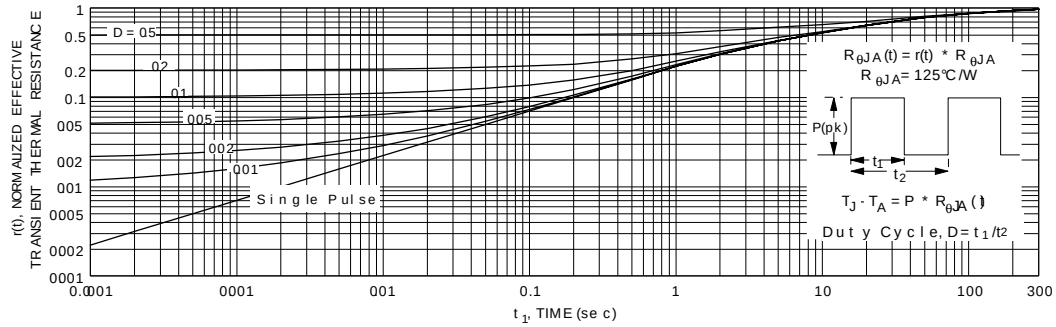
Figure 6. Body Diode Forward Voltage Variation with Source Current and Temperature.


I_D = 9A
V_{DS} = 10V
20V
40V
V_{GS}, GATE-SOURCE VOLTAGE (V)
Q_g, GATE CHARGE (nC)


f = 1MHz
V_{GS} = 0 V
C_{ISS}
C_{OSS}
C_{RSS}
CAPACITANCE (pF)
V_{DS}, DRAIN TO SOURCE VOLTAGE (V)


$R_{DS(ON)}$ LIMIT
100µs
1ms
10ms
100ms
1s
10s
DC
V_{GS} = 10V
SINGLE PULSE
$R_{\theta JA}$ = 125°C/W
T_A = 25°C
I_D, DRAIN CURRENT (A)
V_{DS}, DRAIN-SOURCE VOLTAGE (V)


SINGLE PULSE
$R_{\theta JA}$ = 125°C/W
T_A = 25°C
POWER (W)
SINGLE PULSE TIME (SEC)


D = 05
02
01
005
002
001
Single Pulse
$R_{\theta JA}(t) = r(t) * R_{\theta JA}$
$R_{\theta JA}$ = 125°C/W
P(pk)
t_1
t_2
$T_J - T_A = P * R_{\theta JA}(t)$
Duty Cycle, D = t_1/t_2
r(t), NORMALIZED EFFECTIVE TRANSIENT THERMAL RESISTANCE
t_1, TIME (sec)

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FACT Quiet Series™
FAST®
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MICROWIRE™
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