FAIRCHILD™

October 2014

FDMS7578

N-Channel Power Trench® MOSFET
25 V, 60 A, 5.8 mΩ

Features

- Max $r_{DS(on)}$ = 5.8 mΩ at V_{GS} = 10 V, I_D = 17 A

- Max $r_{DS(on)}$ = 8 mΩ at V_{GS} = 4.5 V, I_D = 14 A

- Advanced Package and Silicon combination for low $r_{DS(on)}$ and high efficiency

- Next generation enhanced body diode technology, engineered for soft recovery

- MSL1 robust package design

- 100% UIL tested

- RoHS Compliant

General Description

This N-Channel MOSFET has been designed specifically to improve the overall efficiency and to minimize switch node ringing of DC/DC converters using either synchronous or conventional switching PWM controllers. It has been optimized for low gate charge, low $r_{DS(on)}$, fast switching speed and body diode reverse recovery performance.

Applications

- Control MOSFET for Synchronous Buck Converters

- Notebook

- Server

- Telecomm

- High Efficiency DC-DC Switch Mode Power Supplies

Top

Bottom

Pin 1

S S S G

D D D D

Power 56

D	5	4	G
D	6	3	S
D	7	2	S
D	8	1	S
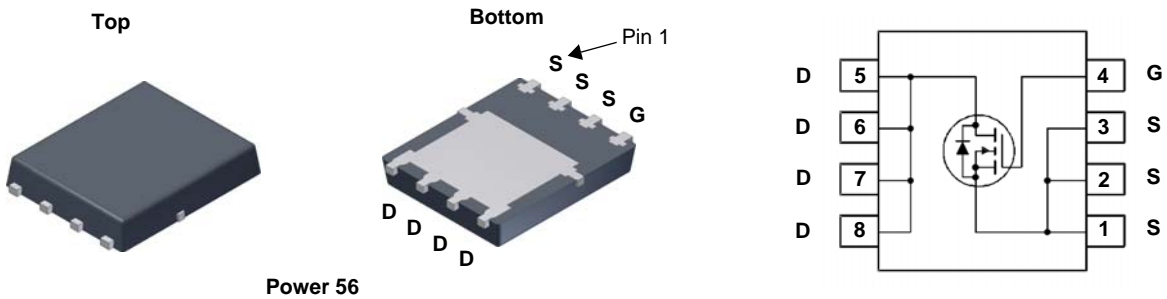
MOSFET Maximum Ratings T_A = 25 °C unless otherwise noted

Symbol	Parameter			Ratings	Units
V_{DS}	Drain to Source Voltage			25	V
V_{GS}	Gate to Source Voltage		(Note 4)	±20	V
I_D	Drain Current -Continuous	T_C = 25 °C		60	A
	-Continuous	T_A = 25 °C	(Note 1a)	17	
	-Pulsed		(Note5)	90	
E_{AS}	Single Pulse Avalanche Energy		(Note 3)	40	mJ
P_D	Power Dissipation	T_C = 25 °C		33	W
	Power Dissipation	T_A = 25 °C	(Note 1a)	2.5	
T_J, T_{STG}	Operating and Storage Junction Temperature Range			-55 to +150	°C

Thermal Characteristics

$R_{\theta JC}$	Thermal Resistance, Junction to Case		3.7	°C/W
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient	(Note 1a)	50	

Package Marking and Ordering Information

Device Marking	Device	Package	Reel Size	Tape Width	Quantity
FDMS7578	FDMS7578	Power 56	13 ''	12 mm	3000 units

Electrical Characteristics T_J = 25 °C unless otherwise noted

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
Off Characteristics						
BV_{DSS}	Drain to Source Breakdown Voltage	I_D = 250 μA, V_{GS} = 0 V	25			V
$\frac{\Delta BV_{DSS}}{\Delta T_J}$	Breakdown Voltage Temperature Coefficient	I_D = 250 μA, referenced to 25 °C		20		mV/°C
I_{DSS}	Zero Gate Voltage Drain Current	V_{DS} = 20 V, V_{GS} = 0 V			1	μA
I_{GSS}	Gate to Source Leakage Current,Forward	V_{GS} = 20 V, V_{DS} = 0 V			100	nA
On Characteristics						
$V_{GS(th)}$	Gate to Source Threshold Voltage	V_{GS} = V_{DS}, I_D = 250 μA	1.0	1.6	3.0	V
$\frac{\Delta V_{GS(th)}}{\Delta T_J}$	Gate to Source Threshold Voltage Temperature Coefficient	I_D = 250 μA, referenced to 25 °C		-6		mV/°C
$r_{DS(on)}$	Static Drain to Source On Resistance	V_{GS} = 10 V, I_D = 17 A		4.6	5.8	mΩ
		V_{GS} = 4.5 V, I_D = 14 A		6.3	8	
		V_{GS} = 10 V, I_D = 17 A, T_J = 125 °C		6.7	8.5	
g_{FS}	Forward Transconductance	V_{DD} = 5 V, I_D = 17 A		77		S
Dynamic Characteristics						
C_{iss}	Input Capacitance	V_{DS} = 13 V, V_{GS} = 0 V, f = 1 MHz		1221	1625	pF
C_{oss}	Output Capacitance			371	495	pF
C_{rss}	Reverse Transfer Capacitance			54	85	pF
R_g	Gate Resistance			1.2	2.4	Ω
Switching Characteristics						
$t_{d(on)}$	Turn-On Delay Time	V_{DD} = 13 V, I_D = 17 A, V_{GS} = 10 V, R_{GEN} = 6 Ω		8	17	ns
t_r	Rise Time			2.6	10	ns
$t_{d(off)}$	Turn-Off Delay Time			20	33	ns
t_f	Fall Time			2.2	10	ns
$Q_{g(TOT)}$	Total Gate Charge	V_{GS} = 0 V to 10 V V_{DD} = 13 V I_D = 17 A		18	25	nC
	Total Gate Charge	V_{GS} = 0 V to 4.5 V		8	11	nC
Q_{gs}	Total Gate Charge			3.7		nC
Q_{gd}	Gate to Drain "Miller" Charge			1.7		nC
Drain-Source Diode Characteristics						
V_{SD}	Source to Drain Diode Forward Voltage	V_{GS} = 0 V, I_S = 2 A (Note 2)		0.72	1.1	V
		V_{GS} = 0 V, I_S = 17 A (Note 2)		0.83	1.2	
t_{rr}	Reverse Recovery Time	I_F = 17 A, di/dt = 100 A/μs		20	32	ns
Q_{rr}	Reverse Recovery Charge			6	12	nC
t_{rr}	Reverse Recovery Time	I_F = 17 A, di/dt = 300 A/μs		19	34	ns
Q_{rr}	Reverse Recovery Charge			13	24	nC

NOTES:

1. $R_{\theta JA}$ is determined with the device mounted on a 1 in^2 pad 2 oz copper pad on a 1.5 x 1.5 in. board of FR-4 material. $R_{\theta JC}$ is guaranteed by design while $R_{\theta CA}$ is determined by the user's board design.
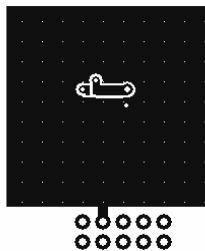
a. 50 °C/W when mounted on
a 1 in^2 pad of 2 oz copper

b.125 °C/W when mounted on
a minimum pad of 2 oz copper

2. Pulse Test: Pulse Width < 300 μs, Duty cycle < 2.0 %.
3. E_{AS} of 40 mJ is based on starting T_J = 25 °C, L = 1 mH, I_{AS} = 9 A, V_{DD} = 23 V, V_{GS} = 10 V. 100% test at L = 0.3 mH, I_{AS} = 14 A.
4. As an N-ch device, the negative Vgs rating is for low duty cycle pulse occurrence only. No continuous rating is implied.
5. Pulse Id refers to Figure.11 Forward Bias Safe Operation Area.

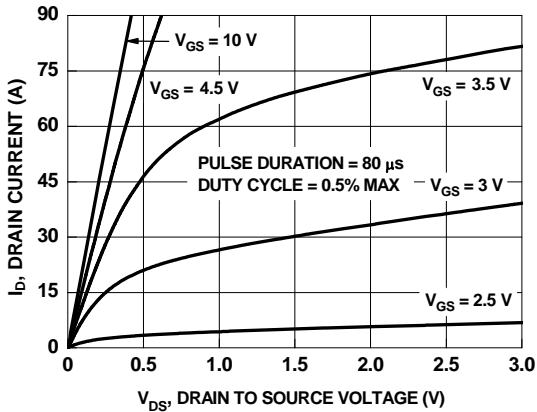## Typical Characteristics T_J = 25 °C unless otherwise noted

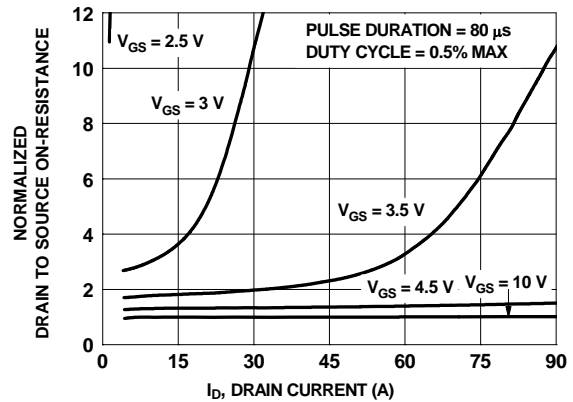**Figure 1. On-Region Characteristics**

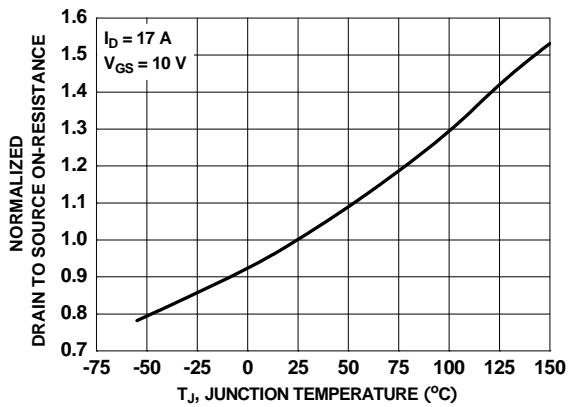**Figure 2. Normalized On-Resistance vs Drain Current and Gate Voltage**

Figure 3. Normalized On-Resistance vs Junction Temperature
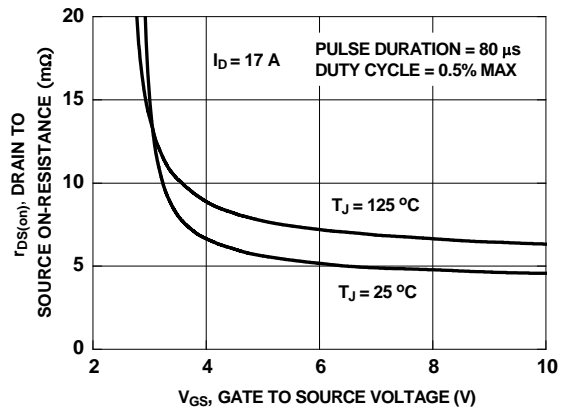

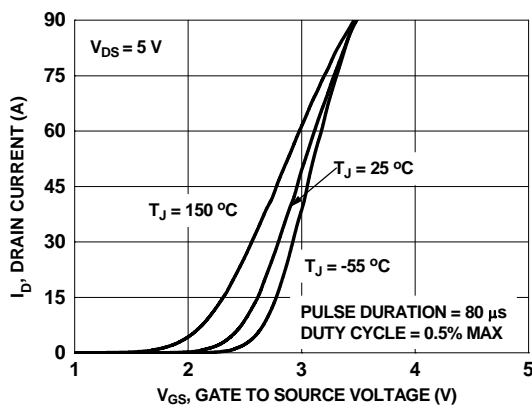**Figure 4. On-Resistance vs Gate to Source Voltage**
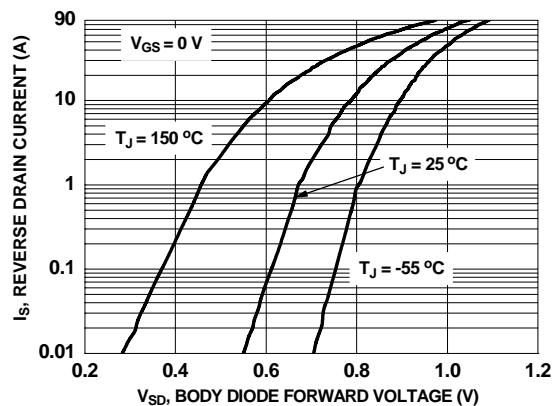

Figure 5. Transfer Characteristics

Figure 6. Source to Drain Diode Forward Voltage vs Source Current

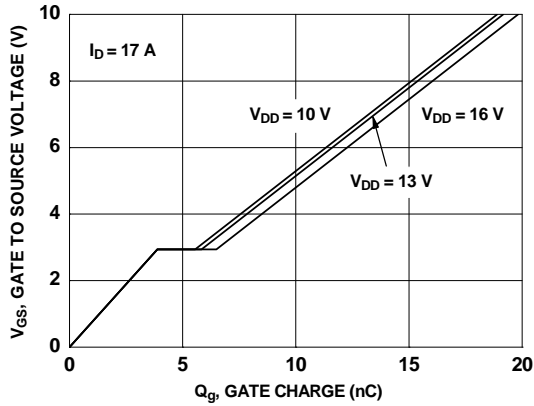**Typical Characteristics** T_J = 25 °C unless otherwise noted

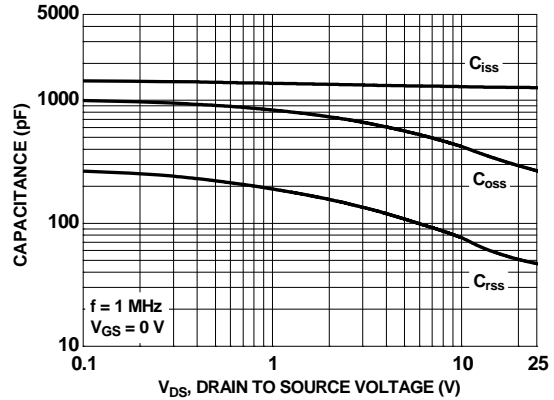Figure 7. Gate Charge Characteristics

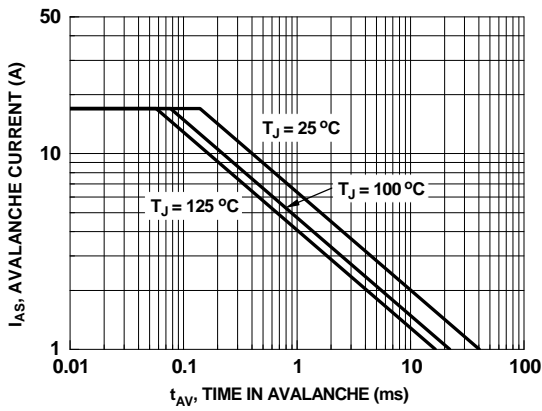Figure 8. Capacitance vs Drain to Source Voltage

Figure 9. Unclamped Inductive Switching Capability
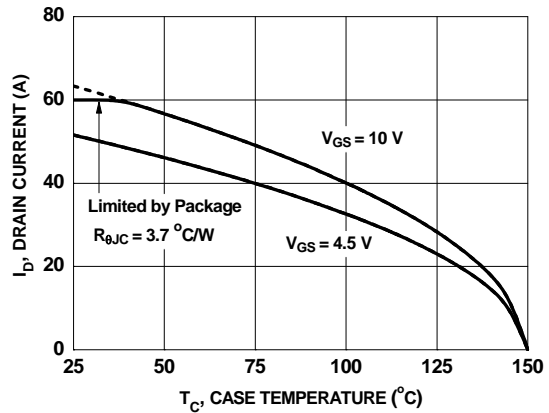

Figure 10. Maximum Continuous Drain Current vs Case Temperature
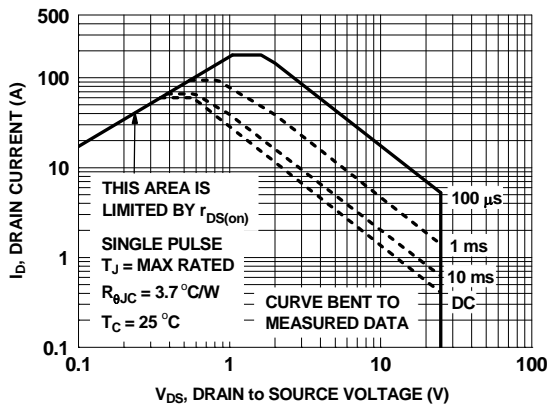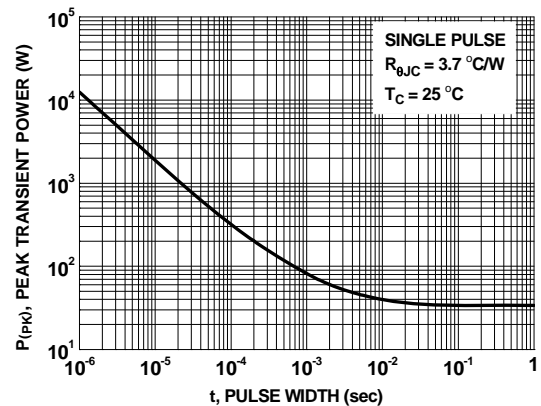

Figure 11. Forward Bias Safe Operating Area

Figure 12. Single Pulse Maximum Power Dissipation

Typical Characteristics T_J = 25 °C unless otherwise noted

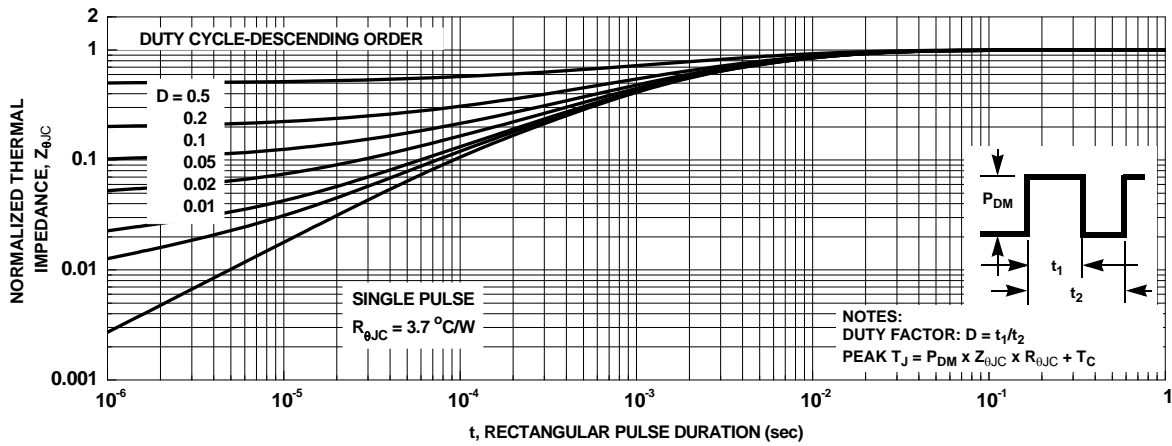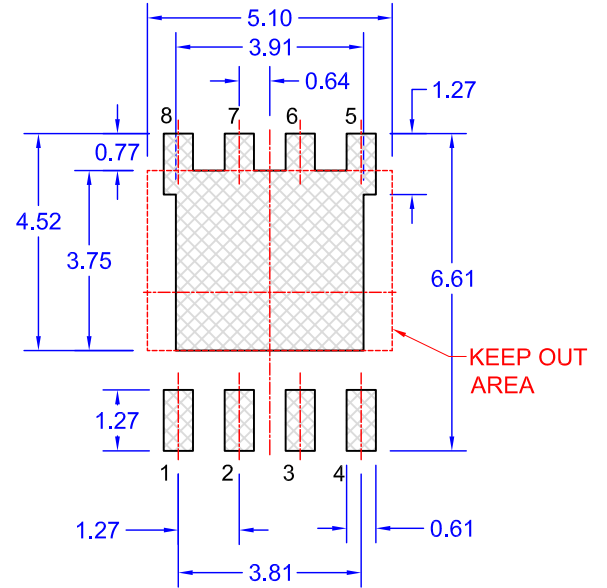**Figure 13. Transient Thermal Response Curve**

TOP VIEW

5.10 [A]

PKG CL

PKG CL

6.15

8 5

1 4

SEE DETAIL B

5.85
5.65

LAND PATTERN RECOMMENDATION

5.10
3.91
0.64
1.27

0.77

8 7 6 5

4.52

3.75

6.61

KEEP OUT AREA

1.27

1 2 3 4

1.27

0.61

3.81

SIDE VIEW

5.00
4.80

SEE DETAIL C

OPTIONAL DRAFT ANGLE MAY APPEAR ON FOUR SIDES OF THE PACKAGE

0°-12°

[// | 0.10 | C]

8X

[⌒ | 0.08 | C]

0.05
0.00

0.35
0.15

1.10
0.90

[C]

SEATING PLANE

DETAIL C
SCALE: 2:1

0.35
0.15

0.30
0.05

0°-12°

DETAIL B
SCALE: 2:1

BOTTOM VIEW

5.20
4.80

3.81

1.27

(0.34)

0.51
0.31 (8X)

[⊕ | 0.10 Ⓜ | C | A | B]

1 2 3 4

0.76
0.51

(0.52)

6.25
5.90

(0.50)

(0.30) (2X)

3.48 +0.30 −0.10

8 7 6 5

0.20 +0.10 −0.15 (8X)

3.96
3.61

0.44±0.10

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C. ALL DIMENSIONS ARE IN MILLIMETERS.
D. DIMENSIONING AND TOLERANCING PER ASME Y14.5M-2009.
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