FAIRCHILD SEMICONDUCTOR®

March 2006

FDMS8690

N-Channel PowerTrench® MOSFET

30V, 19.8A, 9mΩ

General Description

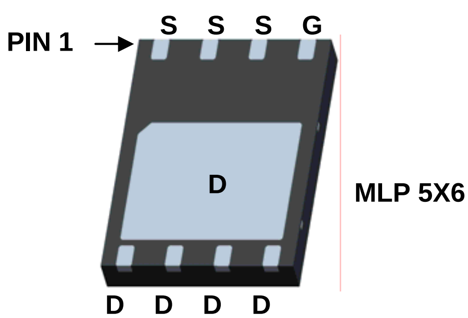
This device has been designed specifically to improve the efficiency of DC-DC converters. Using new techniques in MOSFET construction, the various components of gate charge and capacitance have been optimized to reduce switching losses. Low gate resistance and very low Miller charge enable excellent performance with both adaptive and fixed dead time gate drive circuits. Very low $r_{DS(on)}$ has been maintained to provide an extremely versatile device.

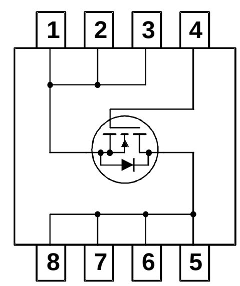
Applications

- High Efficiency DC-DC Converters
  - Notebook Vcore Power Supply
  - Multi purpose Point of Load

Features

- Max $r_{DS(on)}$ = 9.0mΩ at V_{GS} = 10V, I_D = 19.8A
- Max $r_{DS(on)}$ = 12.5mΩ at V_{GS} = 4.5V, I_D = 11.5A
- High performance trench technology for extremely low $r_{DS(on)}$ and gate charge
- Minimal Qgd (2.9 nC typical)
- RoHS Compliant





Absolute Maximum Ratings T_A=25°C unless otherwise noted

Symbol	Parameter		Ratings	Units
V_{DS}	Drain-Source Voltage		30	V
V_{GS}	Gate-Source Voltage		±20	V
I_D	Drain Current – Continuous	(Note 1a)	19.8	A
	– Pulsed		90	
P_D	Power Dissipation for Single Operation	(Note 1a)	2.8	W
		(Note 1b)	1.1	
T_J, T_{STG}	Operating and Storage Junction Temperature Range		–55 to +150	°C

Thermal Characteristics

Symbol	Parameter		Ratings	Units
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient	(Note 1a)	44	°C/W
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient	(Note 1b)	115	

Package Marking and Ordering Information

Device Marking	Device	Reel Size	Tape width	Quantity
FDMS8690	FDMS8690	7’’	12mm	3000 units

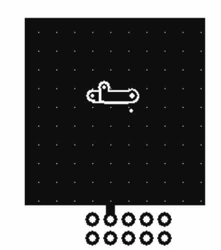
Electrical Characteristics

T_A = 25°C unless otherwise noted

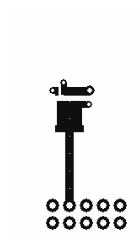
Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
Off Characteristics						
BV_{DSS}	Drain–Source Breakdown Voltage	V_{GS} = 0 V, I_D = 250 μA	30			V
$\frac{\Delta BV_{DSS}}{\Delta T_J}$	Breakdown Voltage Temperature Coefficient	I_D = 250 μA, Referenced to 25°C		34		mV/°C
I_{DSS}	Zero Gate Voltage Drain Current	V_{DS} = 24 V, V_{GS} = 0 V			1	μA
I_{GSS}	Gate–Body Leakage	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	1	1.6	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} = 10 V, I_D = 19.8 A V_{GS} = 4.5 V, I_D = 11.5 A V_{GS} = 10 V, I_D =19.8A, T_J = 125°C		7.4 9.9 10.6	9 12.5 13.3	mΩ
Dynamic Characteristics						
C_{iss}	Input Capacitance	V_{DS} = 15 V, V_{GS} = 0 V, f = 1.0 MHz		1260	1680	pF
C_{oss}	Output Capacitance			535	715	pF
C_{rss}	Reverse Transfer Capacitance			80	120	pF
R_G	Gate Resistance	f = 1.0 MHz		1.1		Ω
$t_{d(on)}$	Turn–On Delay Time	V_{DD} = 15 V, I_D = 1 A, V_{GS} = 10 V, R_{GEN} = 6 Ω		8	16	ns
t_r	Turn–On Rise Time			1.8	10	ns
$t_{d(off)}$	Turn–Off Delay Time			26	42	ns
t_f	Turn–Off Fall Time			19	35	ns
$Q_{g(TOT)}$	Total Gate Charge at V_{GS} = 10V	V_{DS} = 15 V, I_D = 14 A		18.8	27	nC
$Q_{g(5)}$	Total Gate Charge at V_{GS} = 5V			10	14	nC
Q_{gs}	Gate–Source Charge			3.5		nC
Q_{gd}	Gate–Drain Charge			2.9		nC
Drain–Source Diode Characteristics						
V_{SD}	Drain–Source Diode Forward Voltage	V_{GS} = 0 V, I_S = 2.1 A (Note 2)		0.7	1.2	V
t_{rr}	Diode Reverse Recovery Time	I_F = 14 A, di/dt = 100 A/µs			45	ns
Q_{rr}	Diode Reverse Recovery Charge				33	nC

Notes:

1. $R_{\theta JA}$ is determined with the device mounted on a 1in² 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) 44°C/W when mounted on a 1in² pad of 2 oz copper



b) 115 °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%

Typical Characteristics T_J = 25°C unless otherwise noted

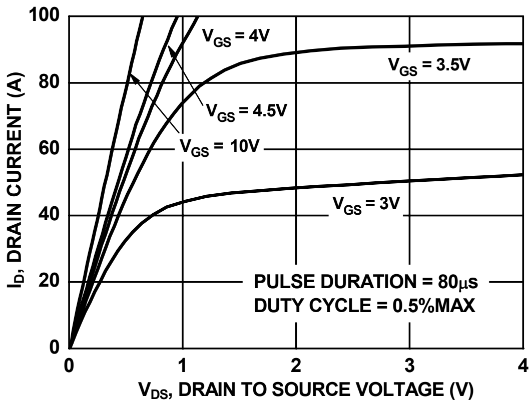


Figure 1. On Region Characteristics

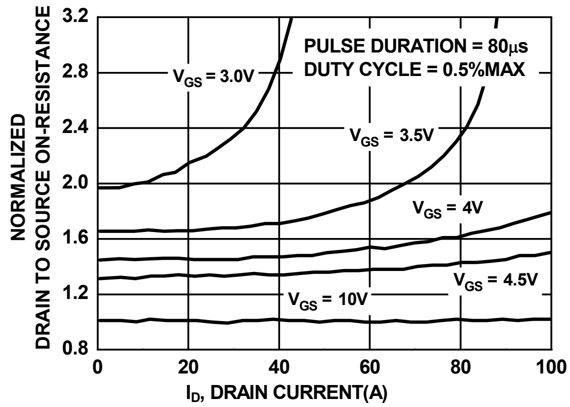


Figure 2. Normal On-Resistance vs Drain Current and Gate Voltage

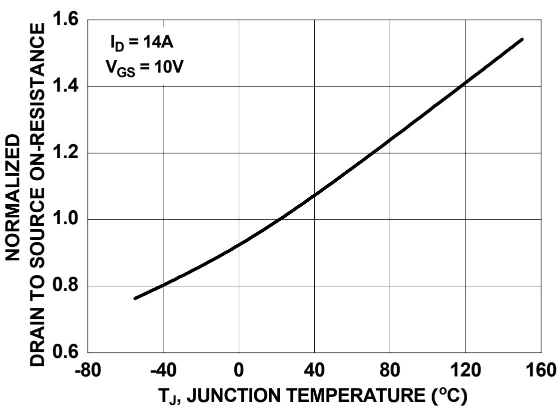


Figure 3. Normalized On Resistance vs Junction Temperature

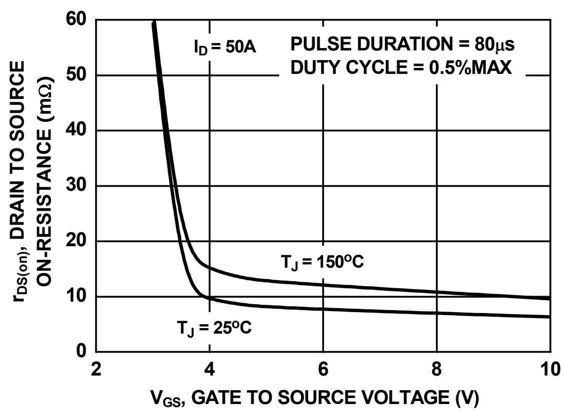


Figure 4. On-Resistance vs Gate to Source Voltage

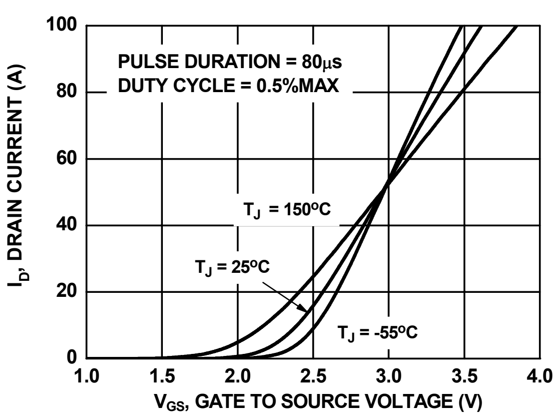


Figure 5. Transfer Characteristics

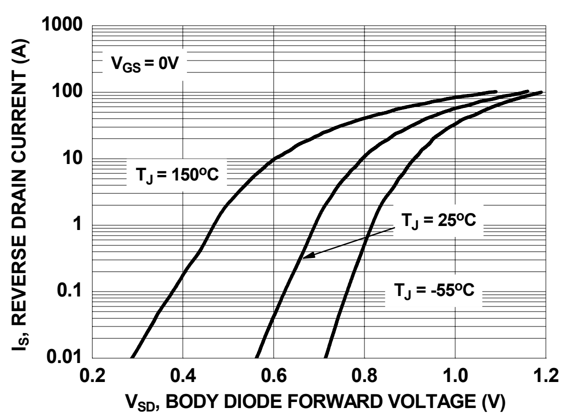


Figure 6. Source to Drain Diode Forward Voltage vs Source Current

Typical Characteristics T_J = 25°C unless otherwise noted

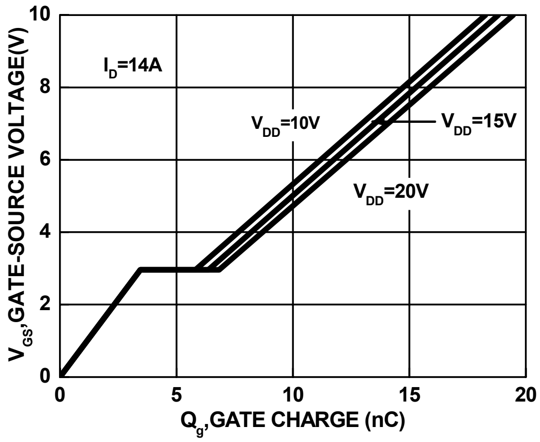


Figure 7. Gate Charge Characteristics

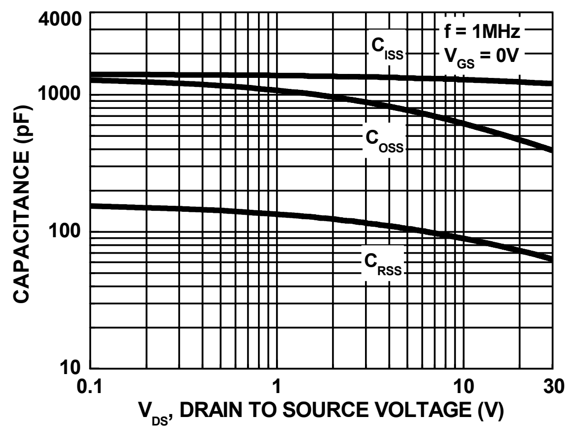


Figure 8. Capacitance Characteristics

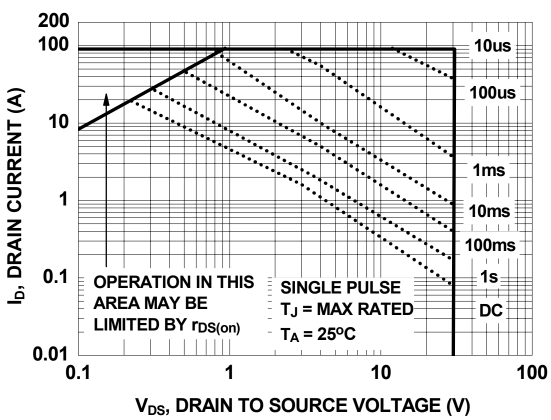


Figure 9. Forward Bias Safe Operating Area

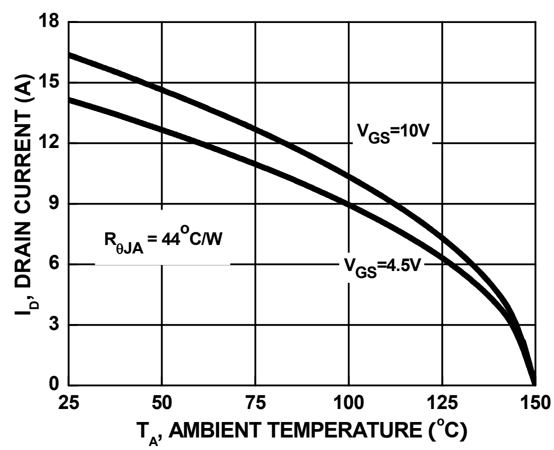


Figure 10. Maximum Continuous Drain Current vs Ambient Temperature

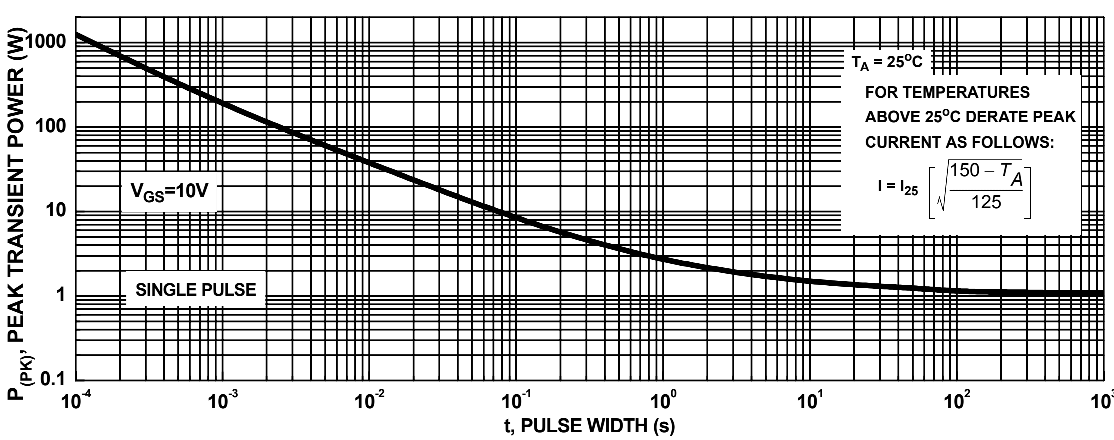


Figure 11. Single Pulse Maximum Power Dissipation

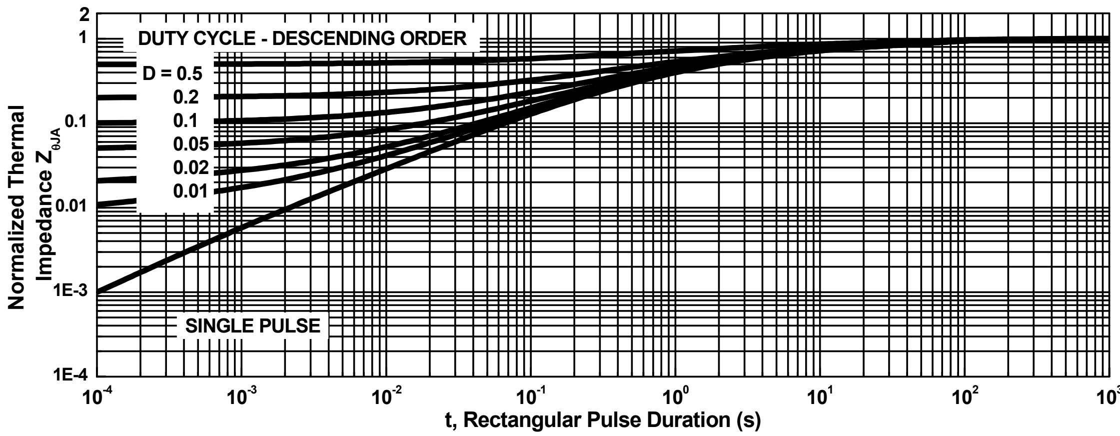
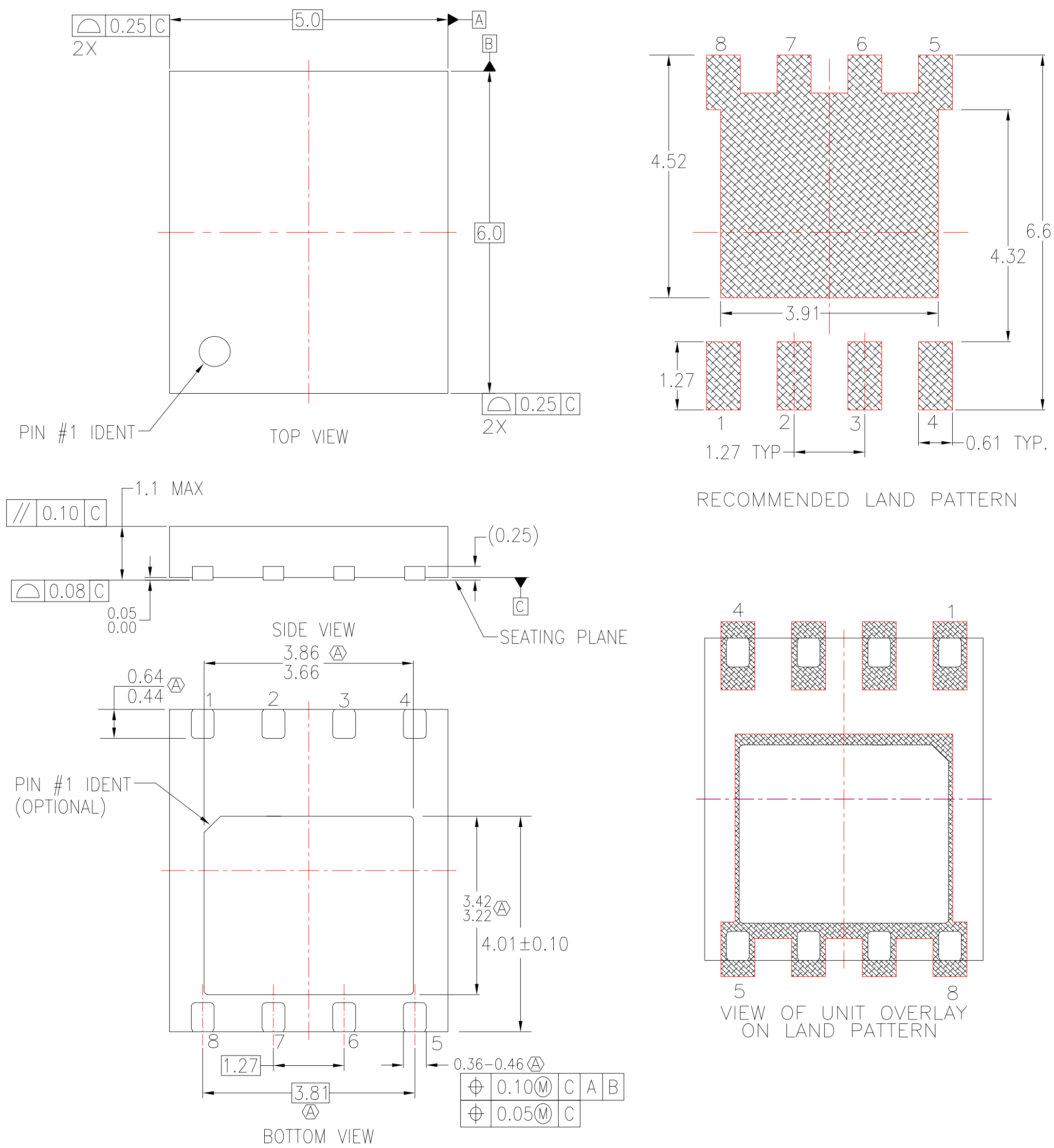


Figure 12. Transient Thermal Response Curve

Dimensional Outline and Pad Lay-out



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