FAIRCHILD SEMICONDUCTOR®

July 2008

FDMC8651

N-Channel Power Trench® MOSFET

30 V, 20 A, 6.1 mΩ

Features

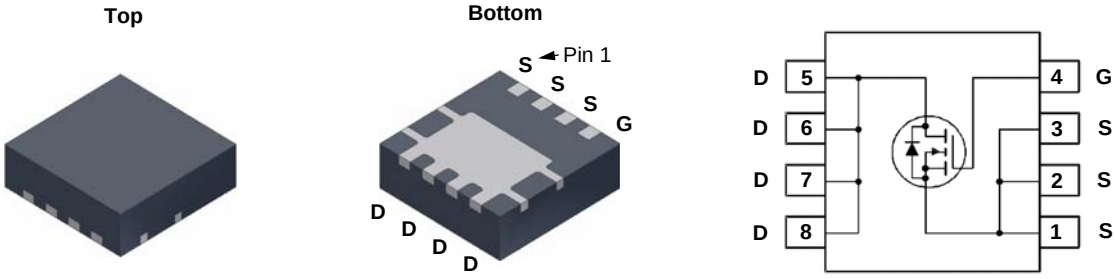
- Max $r_{DS(on)}$ = 6.1 mΩ at V_{GS} = 4.5 V, I_D = 15 A
- Max $r_{DS(on)}$ = 9.3 mΩ at V_{GS} = 2.5 V, I_D = 12 A
- Low Profile - 1 mm max in Power 33
- 100% UIL Tested
- RoHS Compliant

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 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 a sub logic-level device.

Applications

- Synchronous rectifier
- 3.3 V input synchronous buck switch



Power 33

MOSFET Maximum Ratings T_A = 25 °C unless otherwise noted

Symbol	Parameter			Ratings	Units
V_{DS}	Drain to Source Voltage			30	V
V_{GS}	Gate to Source Voltage			±12	V
I_D	Drain Current -Continuous (Package limited)	T_C = 25 °C		20	A
	-Continuous (Silicon limited)	T_C = 25 °C		64	
	-Continuous	T_A = 25 °C	(Note 1a)	15	
	-Pulsed			60	
E_{AS}	Single Pulse Avalanche Energy		(Note 3)	128	mJ
P_D	Power Dissipation	T_C = 25 °C		41	W
	Power Dissipation	T_A = 25 °C	(Note 1a)	2.3	
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	°C/W
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient (Note 1a)	53	

Package Marking and Ordering Information

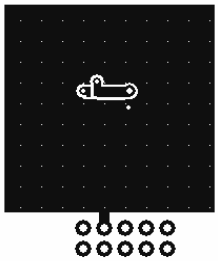
Device Marking	Device	Package	Reel Size	Tape Width	Quantity
FDMC8651	FDMC8651	Power 33	13 ”	12 mm	3000 units

Electrical Characteristics T_J = 25 °C unless otherwise noted

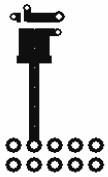
Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
Off Characteristics						
BV_{DSS}	Drain to Source Breakdown Voltage	I_D = 250 μA, V_{GS} = 0 V	30			V
$\frac{\Delta BV_{DSS}}{\Delta T_J}$	Breakdown Voltage Temperature Coefficient	I_D = 250 μA, referenced to 25 °C		27.5		mV/°C
I_{DSS}	Zero Gate Voltage Drain Current	V_{DS} = 24 V, V_{GS} = 0 V			1	μA
I_{GSS}	Gate to Source Leakage Current	V_{GS} = ±12 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	0.8	1.1	1.5	V
$\frac{\Delta V_{GS(th)}}{\Delta T_J}$	Gate to Source Threshold Voltage Temperature Coefficient	I_D = 250 μA, referenced to 25 °C		-4.4		mV/°C
$r_{DS(on)}$	Static Drain to Source On Resistance	V_{GS} = 4.5 V, I_D = 15 A		4.3	6.1	mΩ
		V_{GS} = 2.5 V, I_D = 12 A		6.2	9.3	
		V_{GS} = 4.5 V, I_D = 15 A, T_J = 125 °C		6.3	9.0	
g_{FS}	Forward Transconductance	V_{DD} = 5 V, I_D = 15 A		91		S
Dynamic Characteristics						
C_{iss}	Input Capacitance	V_{DS} = 15 V, V_{GS} = 0 V, f = 1 MHz		2530	3365	pF
C_{oss}	Output Capacitance			865	1150	pF
C_{rss}	Reverse Transfer Capacitance			140	205	pF
R_g	Gate Resistance			0.8		Ω
Switching Characteristics						
$t_{d(on)}$	Turn-On Delay Time	V_{DD} = 15 V, I_D = 15 A, V_{GS} = 4.5 V, R_{GEN} = 6 Ω		18	31	ns
t_r	Rise Time			9	18	ns
$t_{d(off)}$	Turn-Off Delay Time			35	56	ns
t_f	Fall Time			6	12	ns
$Q_{g(TOT)}$	Total Gate Charge at 4.5 V	V_{DD} = 15 V, I_D = 15 A		19.4	27.2	nC
Q_{gs}	Total Gate Charge			4.8		nC
Q_{gd}	Gate to Drain “Miller” Charge			4.2		nC
Drain-Source Diode Characteristics						
V_{SD}	Source to Drain Diode Forward Voltage	V_{GS} = 0 V, I_S = 15 A (Note 2)		0.8	1.3	V
		V_{GS} = 0 V, I_S = 1.7 A (Note 2)		0.7	1.2	
t_{rr}	Reverse Recovery Time	I_F = 15 A, di/dt = 100 A/μs		35	55	ns
Q_{rr}	Reverse Recovery Charge			17	30	nC

NOTES:

1. $R_{\theta JA}$ is determined with the device mounted on a 1in^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. 53 °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. Starting T_J = 25 °C; N-ch: L = 1 mH, I_{AS} = 16 A, V_{DD} = 27 V, V_{GS} = 10 V.

Typical Characteristics T_J = 25 °C unless otherwise noted

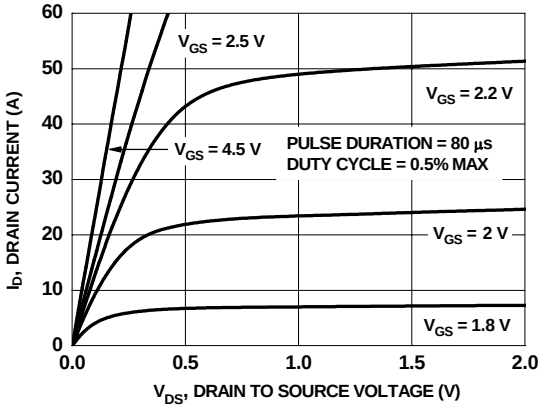


Figure 1. On-Region Characteristics

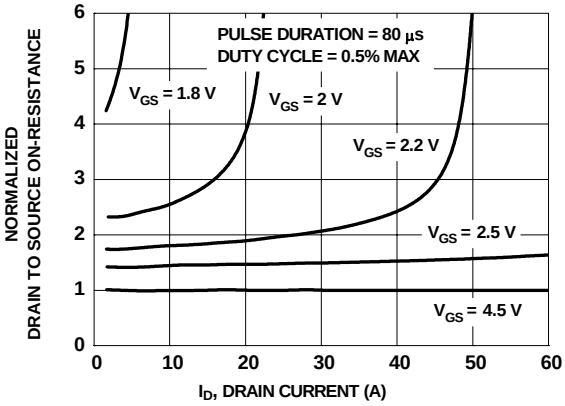


Figure 2. Normalized On-Resistance vs Drain Current and Gate Voltage

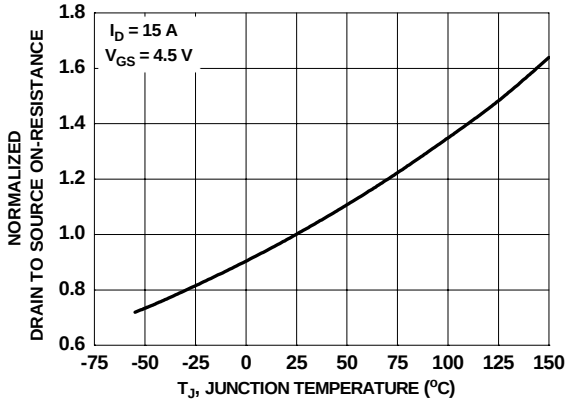


Figure 3. Normalized On-Resistance vs Junction Temperature

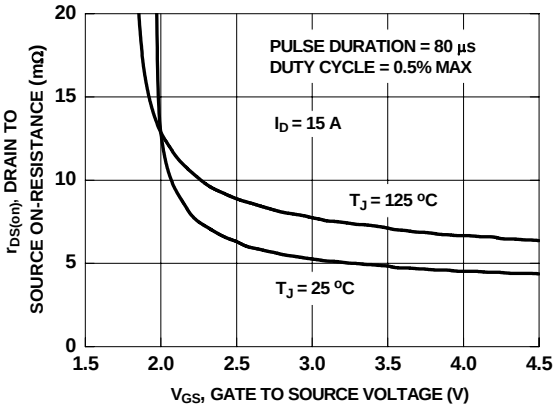


Figure 4. On-Resistance vs Gate to Source Voltage

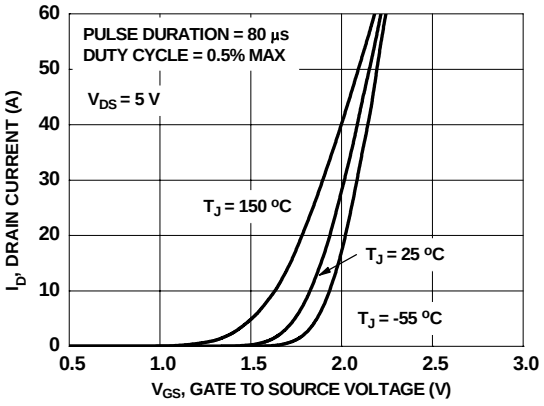


Figure 5. Transfer Characteristics

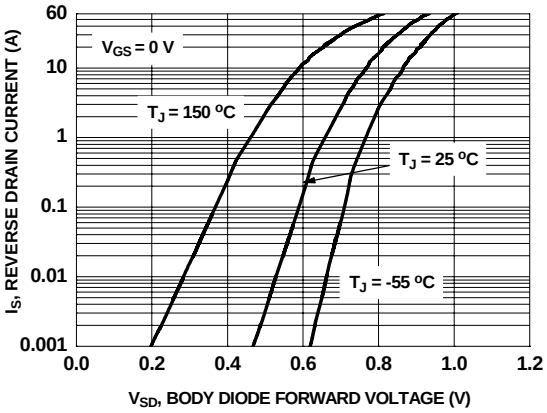


Figure 6. Source to Drain Diode Forward Voltage vs Source Current

Typical Characteristics T_J = 25 °C unless otherwise noted

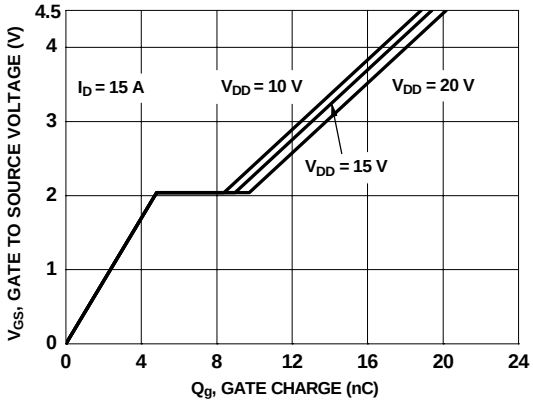


Figure 7. Gate Charge Characteristics

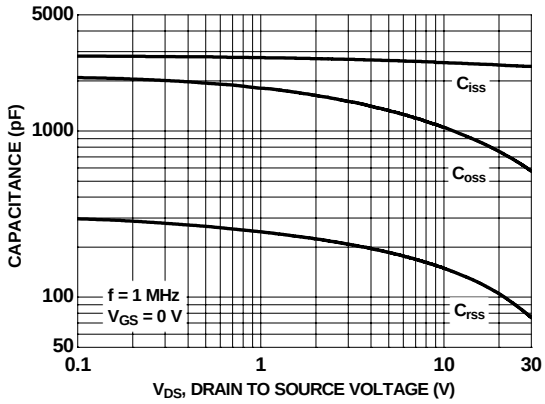


Figure 8. Capacitance vs Drain to Source Voltage

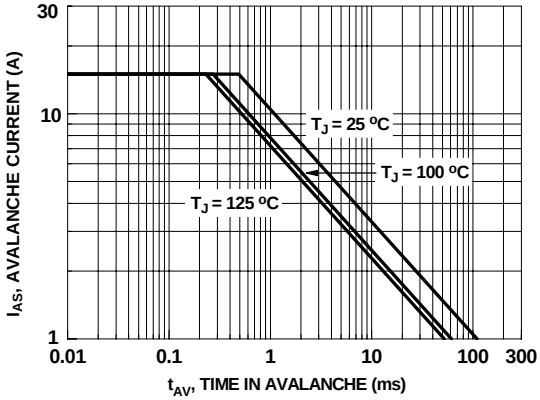


Figure 9. Unclamped Inductive Switching Capability

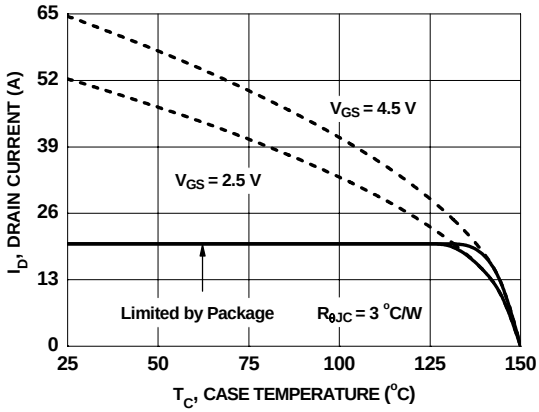


Figure 10. Maximum Continuous Drain Current vs Case Temperature

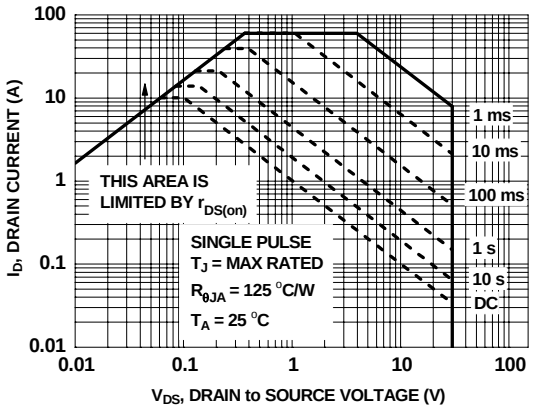


Figure 11. Forward Bias Safe Operating Area

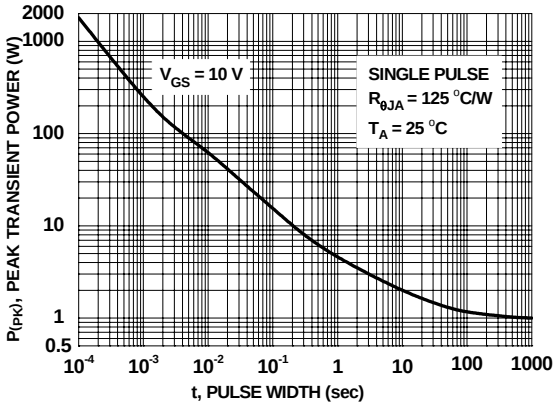


Figure 12. Single Pulse Maximum Power Dissipation

Typical Characteristics T_J = 25 °C unless otherwise noted

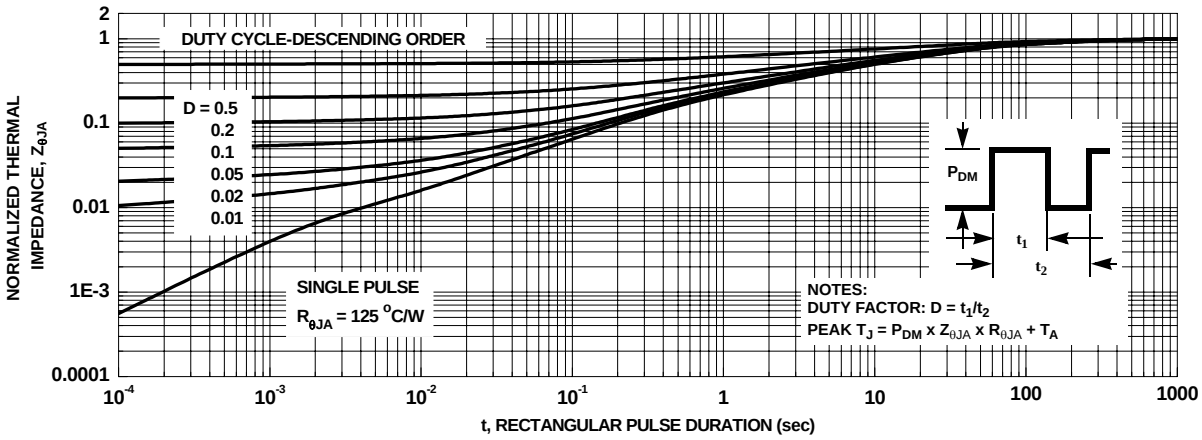
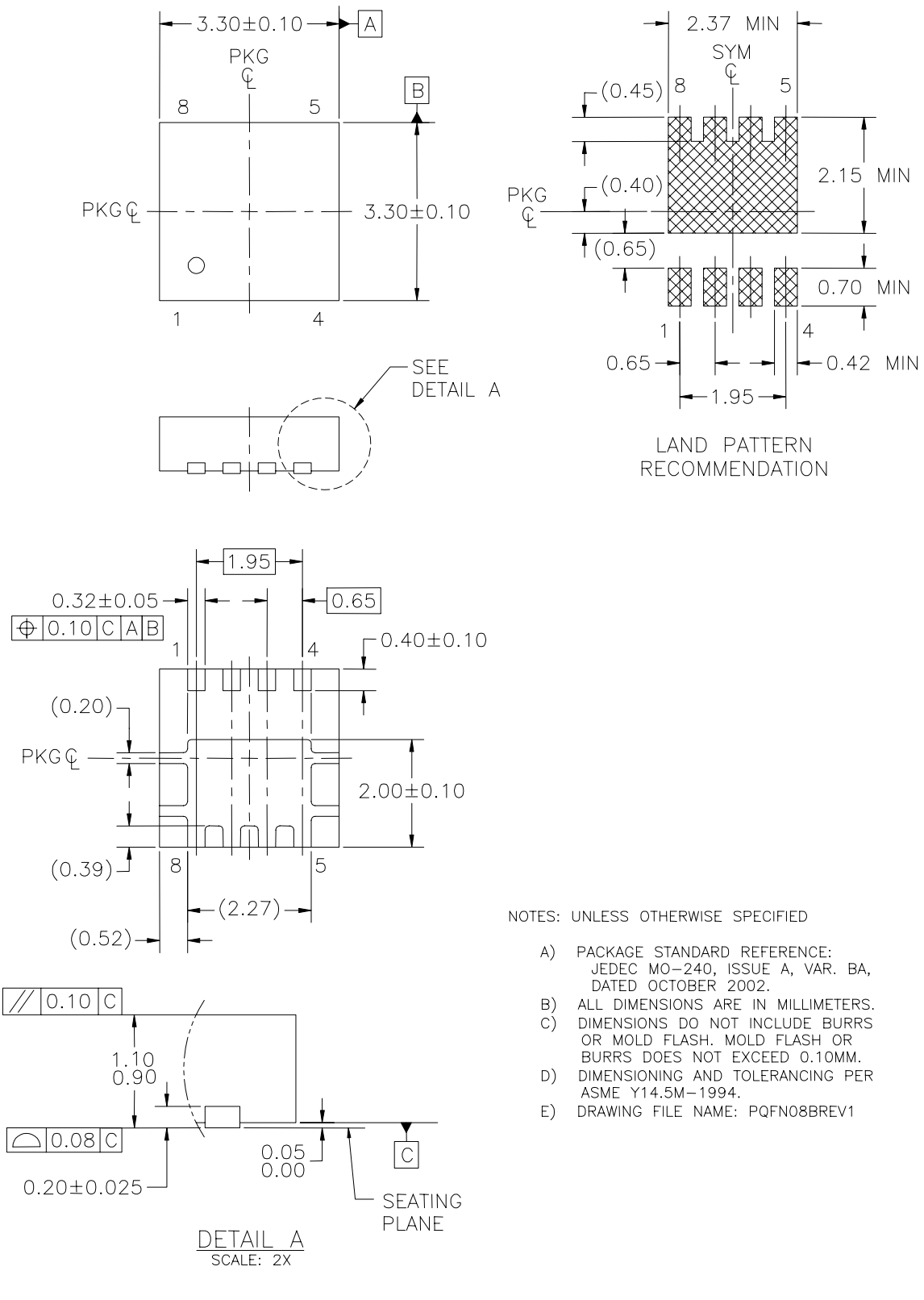


Figure 13. Junction-to-Ambient Transient Thermal Response Curve

Dimensional Outline and Pad Layout



NOTES: UNLESS OTHERWISE SPECIFIED

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D) DIMENSIONING AND TOLERANCING PER ASME Y14.5M-1994.
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