

July 2008

# **FDMC8651**

# N-Channel Power Trench<sup>®</sup> MOSFET 30 V, 20 A, 6.1 m $\Omega$

#### **Features**

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

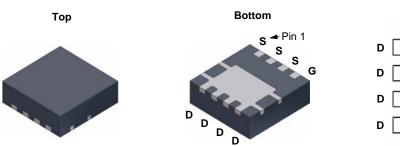


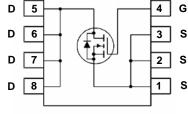
#### **General Description**

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 Miller charge enable excellent performance with both adaptive and fixed dead time gate drive circuits. Very low  $r_{\rm DS(on)}$  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<sub>A</sub> = 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
	Drain Current -Continuous (Package limited)	T <sub>C</sub> = 25 °C		20	
	-Continuous (Silicon limited)	T <sub>C</sub> = 25 °C		64	^
ID	-Continuous	T <sub>A</sub> = 25 °C	(Note 1a)	15	A
	-Pulsed			60	
E <sub>AS</sub>	Single Pulse Avalanche Energy		(Note 3)	128	mJ
D	Power Dissipation	T <sub>C</sub> = 25 °C		41	W
$P_{D}$	Power Dissipation	T <sub>A</sub> = 25 °C	(Note 1a)	2.3	VV
T <sub>J</sub> , T <sub>STG</sub>	Operating and Storage Junction Temperature R	ange		-55 to +150	°C

#### **Thermal Characteristics**

$R_{\theta JC}$	Thermal Resistance, Junction to Case		3	°C // //
R <sub>AJA</sub>	Thermal Resistance, Junction to Ambient	(Note 1a)	53	°C/W

#### **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	Тур	Max	Units
Off Chara	cteristics					
$BV_{DSS}$	Drain to Source Breakdown Voltage	$I_D = 250 \mu A, V_{GS} = 0 V$	30			V
$\frac{\Delta BV_{DSS}}{\Delta T_{J}}$	Breakdown Voltage Temperature Coefficient	$I_D$ = 250 $\mu$ A, referenced to 25 °C		27.5		mV/°C
I <sub>DSS</sub>	Zero Gate Voltage Drain Current	V <sub>DS</sub> = 24 V, V <sub>GS</sub> = 0 V			1	μΑ
$I_{GSS}$	Gate to Source Leakage Current	$V_{GS} = \pm 12 \text{ V}, V_{DS} = 0 \text{ V}$			±100	nA

#### On Characteristics

$V_{GS(th)}$	Gate to Source Threshold Voltage	$V_{GS} = V_{DS}, I_{D} = 250 \mu A$	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 $\mu$ A, referenced to 25 °C		-4.4		mV/°C
		$V_{GS} = 4.5 \text{ V}, I_D = 15 \text{ A}$		4.3	6.1	
r <sub>DS(on)</sub>	Static Drain to Source On Resistance	$V_{GS} = 2.5 \text{ V}, I_D = 12 \text{ A}$		6.2	9.3	mΩ
, ,		$V_{GS} = 4.5 \text{ V}, I_D = 15 \text{ A}, T_J = 125 \text{ °C}$		6.3	9.0	
9 <sub>FS</sub>	Forward Transconductance	V <sub>DD</sub> = 5 V, I <sub>D</sub> = 15 A		91		S

#### **Dynamic Characteristics**

C <sub>iss</sub>	Input Capacitance	V 45.V.V 0.V	2530	3365	pF
C <sub>oss</sub>	Output Capacitance	$V_{DS} = 15 \text{ V}, V_{GS} = 0 \text{ V},$ f = 1  MHz	865	1150	pF
C <sub>rss</sub>	Reverse Transfer Capacitance	1 - 1 1/11/12	140	205	pF
R <sub>g</sub>	Gate Resistance		0.8		Ω

## **Switching Characteristics**

t <sub>d(on)</sub>	Turn-On Delay Time		18	31	ns
t <sub>r</sub>	Rise Time	V <sub>DD</sub> = 15 V, I <sub>D</sub> = 15 A,	9	18	ns
t <sub>d(off)</sub>	Turn-Off Delay Time	$V_{GS} = 4.5 \text{ V}, R_{GEN} = 6 \Omega$	35	56	ns
t <sub>f</sub>	Fall Time		6	12	ns
$Q_{g(TOT)}$	Total Gate Charge at 4.5 V		19.4	27.2	nC
$Q_{gs}$	Total Gate Charge	V <sub>DD</sub> = 15 V, I <sub>D</sub> = 15 A	4.8		nC
$Q_{gd}$	Gate to Drain "Miller" Charge		4.2		nC

#### **Drain-Source Diode Characteristics**

V <sub>SD</sub> Source to Drain Diode Forward Voltage $V_{GS} = 0 \text{ V}, I_{S} = 1.7 \text{ A}$ (Note 2) 0.7	1.2	V
l <sub>rr</sub> Reverse Recovery Time I <sub>E</sub> = 15 A, di/dt = 100 A/μs	55	ns
Q <sub>rr</sub> Reverse Recovery Charge	30	nC

<sup>1.</sup> R<sub>0JA</sub> is determined with the device mounted on a 1in<sup>2</sup> pad 2 oz copper pad on a 1.5 x 1.5 in. board of FR-4 material. R<sub>0JC</sub> is guaranteed by design while R<sub>0CA</sub> is determined by the user's board design.



a. 53 °C/W when mounted on a 1 in<sup>2</sup> 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  $\mu\text{s},$  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<sub>J</sub> = 25 °C unless otherwise noted

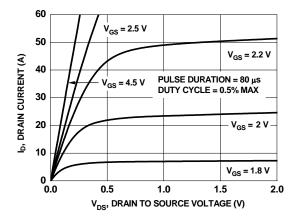


Figure 1. On-Region Characteristics

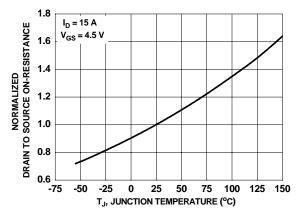


Figure 3. Normalized On-Resistance vs Junction Temperature

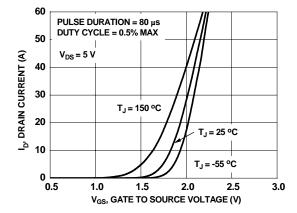


Figure 5. Transfer Characteristics

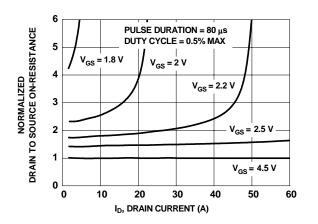


Figure 2. Normalized On-Resistance vs Drain Current and Gate Voltage

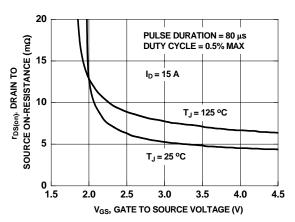


Figure 4. On-Resistance vs Gate to Source Voltage

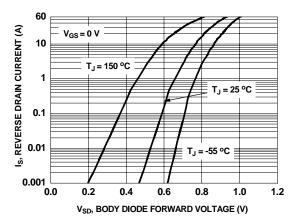


Figure 6. Source to Drain Diode Forward Voltage vs Source Current

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

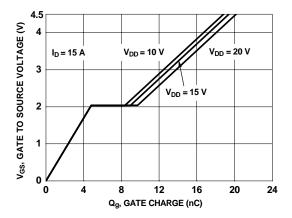


Figure 7. Gate Charge Characteristics

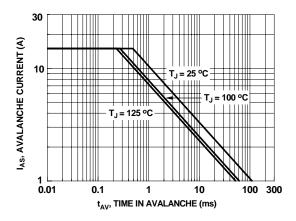


Figure 9. Unclamped Inductive Switching Capability

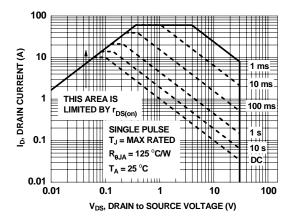


Figure 11. Forward Bias Safe Operating Area

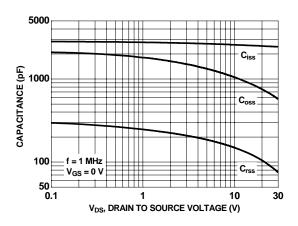


Figure 8. Capacitance vs Drain to Source Voltage

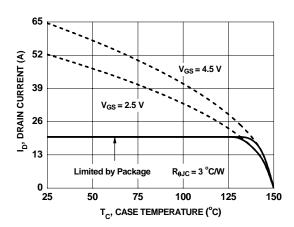


Figure 10. Maximum Continuous Drain Current vs Case Temperature

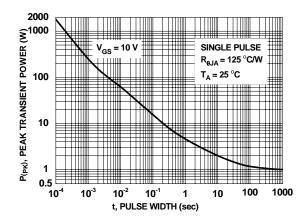


Figure 12. Single Pulse Maximum Power Dissipation

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

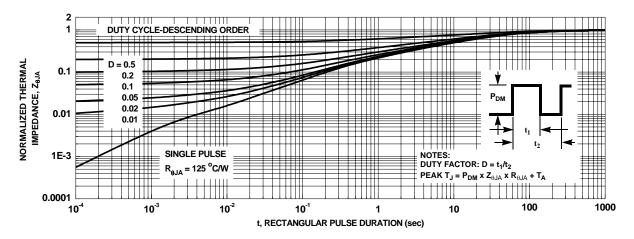
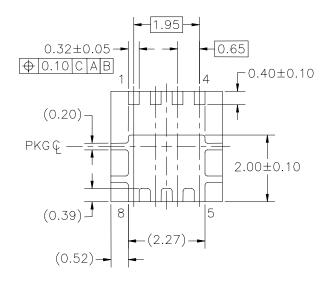
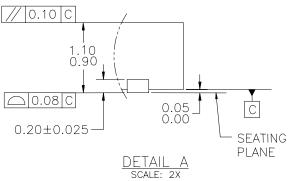


Figure 13. Junction-to-Ambient Transient Thermal Response Curve

#### **Dimensional Outline and Pad Layout** -3.30±0.10-2.37 MIN SYM PKG Œ -(0.45)8 5 2.15 MIN (0.40)PKG Q-PKGÇ $3.30\pm0.10$ (0.65) $\bigcirc$ 0.70 MIN 4 1 0.65 -0.42 MIN SEE DETAIL A







NOTES: UNLESS OTHERWISE SPECIFIED

PACKAGE STANDARD REFERENCE: JEDEC MO-240, ISSUE A, VAR. BA, DATED OCTOBER 2002.

1.95

- ALL DIMENSIONS ARE IN MILLIMETERS.
- DIMENSIONS DO NOT INCLUDE BURRS OR MOLD FLASH. MOLD FLASH OR BURRS DOES NOT EXCEED 0.10MM.
- DIMENSIONING AND TOLERANCING PER ASME Y14.5M-1994.
- DRAWING FILE NAME: PQFN08BREV1





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