FAIRCHILD SEMICONDUCTOR®

August 2005

FDFM2N111

Integrated N-Channel PowerTrench® MOSFET and Schottky Diode

General Description

FDFM2N111 combines the exceptional performance of Fairchild's PowerTrench MOSFET technology with a very low forward voltage drop Schottky barrier rectifier in a MicroFET package.

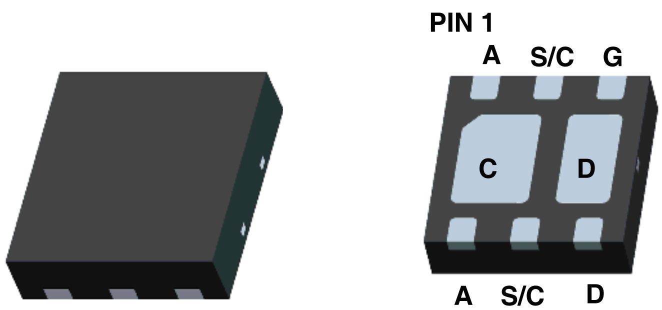
This device is designed specifically as a single package solution for Standard Buck Converter. It features a fast switching, low gate charge MOSFET with very low on-state resistance.

Applications

- Standard Buck Converter

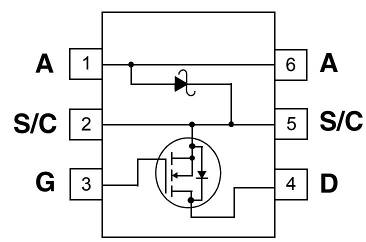
Features

- 4 A, 20 V $R_{DS(ON)}$ = 100mΩ @ V_{GS} = 4.5 V
  $R_{DS(ON)}$ = 150mΩ @ V_{GS} = 2.5 V
- Low Profile - 0.8 mm maximun - in the new package MicroFET 3x3 mm



TOP BOTTOM

MLP 3x3



Absolute Maximum Ratings T_A = 25°C unless otherwise noted

Symbol	Parameter		Ratings	Units
V_{DSS}	Drain-Source Voltage		20	V
V_{GSS}	Gate-Source Voltage		±12	V
I_D	Drain Current -Continuous	(Note 1a)	4	A
	-Pulsed		10	
V_{RRM}	Schottky Repetitive Peak Reverse voltage		20	V
I_O	Schottky Average Forward Current	(Note 1a)	2	A
P_D	Power dissipation (Steady State)	(Note 1a)	1.7	W
	Power dissipation (Steady State)	(Note 1b)	0.8	
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)	70	°C/W
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient	(Note 1b)	150	°C/W

Package Marking and Ordering Information

Device Marking	Device	Reel Size	Tape Width	Quantity
2N111	FDFM2N111	7inch	12mm	3000 units

Electrical Characteristics T_A = 25°C unless otherwise noted

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units

Off Characteristics

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
B_{VDSS}	Drain-Source Breakdown Voltage	I_D = 250µA, V_{GS} = 0V	20	-	-	V
$\frac{\Delta BV_{DSS}}{\Delta T_J}$	Breakdown Voltage Temperature Coefficient	I_D = 250µA, Referenced to 25°C	-	12	-	mV/°C
I_{DSS}	Zero Gate Voltage Drain Current	V_{GS} = 0V, V_{DS} = 16V	-	-	1	µA
I_{GSS}	Gate-Body Leakage,	V_{GS} = ±12V, V_{DS} = 0V	-	-	±100	nA

On Characteristics (Note 2)

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
$V_{GS(TH)}$	Gate Threshold Voltage	V_{DS} = V_{GS}, I_D = 250µA	0.6	1.0	1.5	V
$\frac{\Delta V_{GS(TH)}}{\Delta T_J}$	Gate Threshold Voltage Temperature Coefficient	I_D = 250µA, Referenced to 25°C	-	-3	-	mV/°C
$R_{DS(ON)}$	Static Drain-Source On-Resistance	I_D = 4.0A, V_{GS} = 4.5V	-	54	100	mΩ
		I_D = 3.3A, V_{GS} = 2.5V	-	83	150	
		I_D = 4.0A, V_{GS} = 4.5V, T_J = 125°C	-	74	147	
$I_{D(ON)}$	On-State Drain Current	V_{GS} = 2.5V, V_{DS} = 5V	10	-	-	A
g_{FS}	Forward Transconductance	I_D = 4A, V_{DS} = 5V	-	9.7	-	S

Dynamic Characteristics

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
C_{ISS}	Input Capacitance	V_{DS} = 10V, V_{GS} = 0V, f = 1MHz	-	273	-	pF
C_{OSS}	Output Capacitance		-	63	-	pF
C_{RSS}	Reverse Transfer Capacitance		-	37	-	pF
R_G	Gate Resistance	V_{GS} = 0V, f = 1MHz,	-	1.6	-	Ω

Switching Characteristics (Note 2)

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
$t_{d(ON)}$	Turn-On Delay Time	V_{DD} = 10V, I_D = 1A V_{GS} = 4.5V, R_{GEN} = 6Ω	-	6	12	ns
t_r	Turn-On Rise Time		-	7	14	ns
$t_{d(OFF)}$	Turn-Off Delay Time		-	11	20	ns
t_f	Turn-Off Fall Time		-	1.7	3.4	ns
Q_g	Total Gate Charge	V_{DS} = 10V, I_D = 4.0A, V_{GS} = 4.5V	-	2.7	3.8	nC
Q_{gs}	Gate-Source Charge		-	0.6	-	nC
Q_{gd}	Gate-Drain Charge		-	0.9	-	nC

Drain-Source Diode Characteristics and Maximum Ratings

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
I_S	Maximum Continuous Drain-Source Diode Forward Current		-	-	1.4	A
V_{SD}	Drain-Source Diode Forward Voltage	V_{GS} = 0V, I_S = 1.4 A (Note 2)	-	0.8	-1.2	V
t_{rr}	Diode Reverse Recovery Time	I_F= 4.0A, dI_F/dt=100A/µs	-	11	-	ns
Q_{rr}	Diode Reverse Recovery Charge		-	3	-	nC

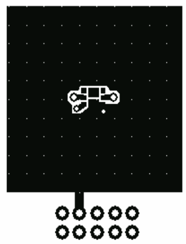
Schottky Diode Characteristic

Symbol	Parameter	Test Conditions		Min	Typ	Max	Units
V_R	Reverse Voltage	I_R = 1mA		20	-	-	V
I_R	Reverse Leakage	V_R = 5V	T_J = 25°C	-	-	100	µA
			T_J = 100°C			10	mA
V_F	Forward Voltage	I_F = 1A	T_J = 25°C	-	0.32	0.39	V

Electrical Characteristics T_A = 25°C unless otherwise noted

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. $R_{\theta CA}$ is guaranteed by design while $R_{\theta CA}$ is determined by the user's board design.



a) 70°C/W when mounted on a 1in² pad of 2 oz copper

b) 150°C/W whe mounted on a minimum pad of 2 oz copper

Scale 1: 1 on letter size paper

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

Typical Characteristics

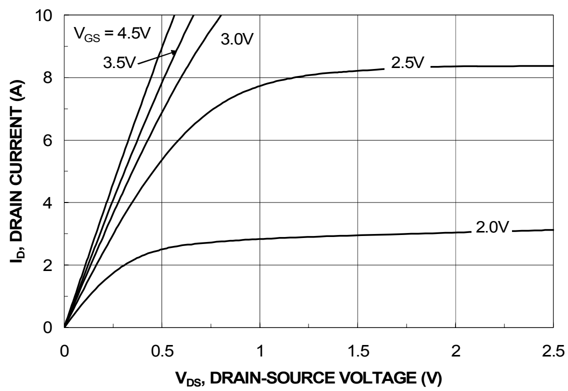


Figure 1. On-Region Characteristics

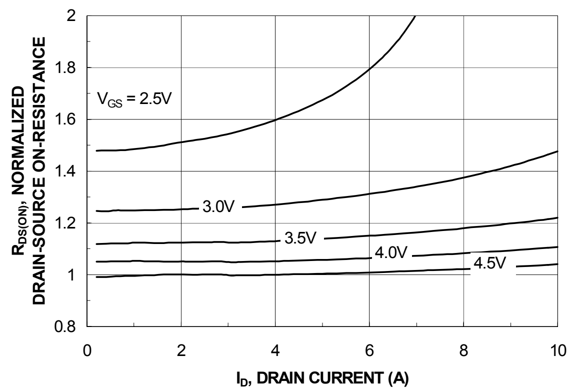


Figure 2. On-Resistance Variation with Drain Current and Gate Voltage

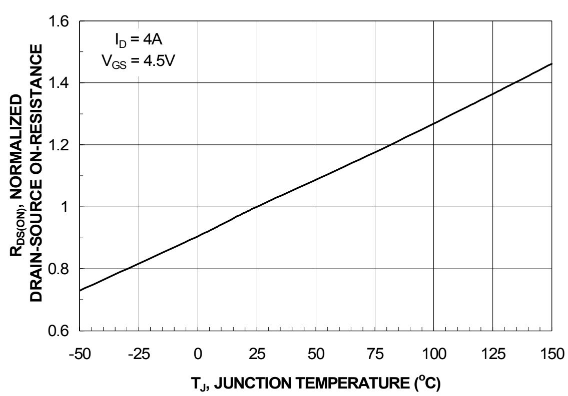


Figure 3. On-Resistance Variation with Temperature

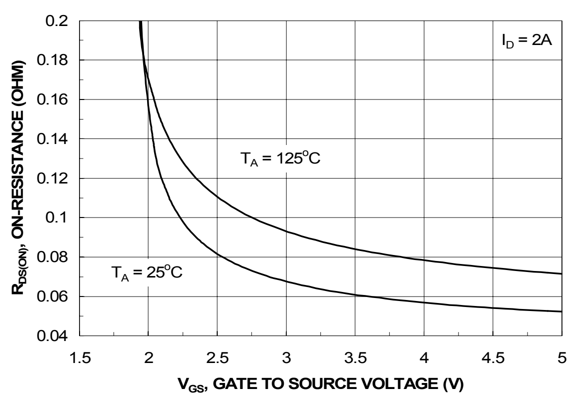


Figure 4. On-Resistance Variation with Gate-to-Source Voltage

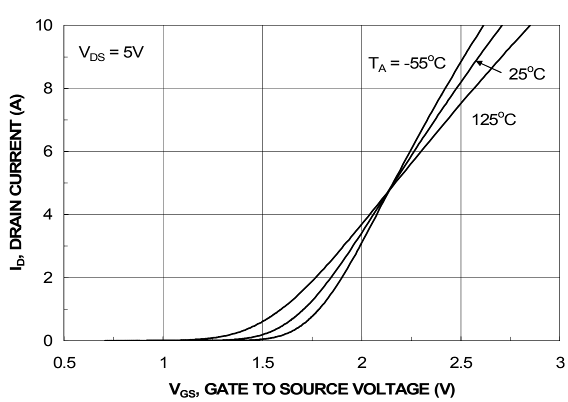


Figure 5. Transfer Characteristics

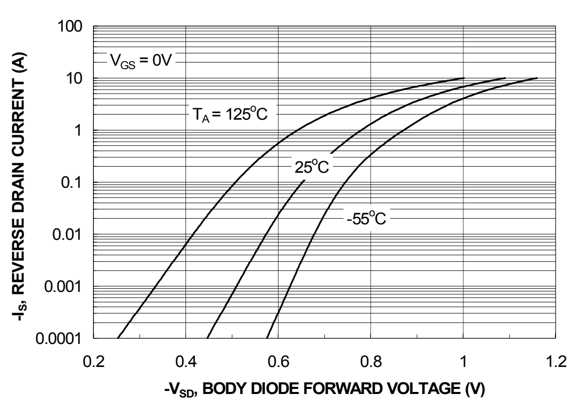


Figure 6. Body Diode Forward Voltage Variation with Source Current and Temperature

Typical Characteristics

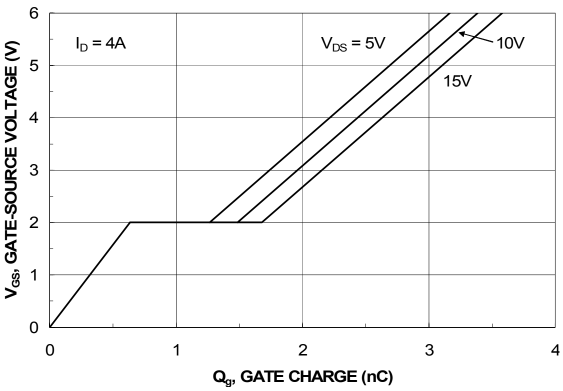


Figure 7. Gate Charge Characteristics

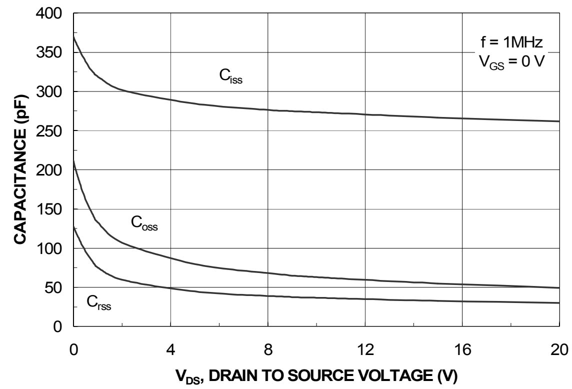


Figure 8. Capacitance Characteristics

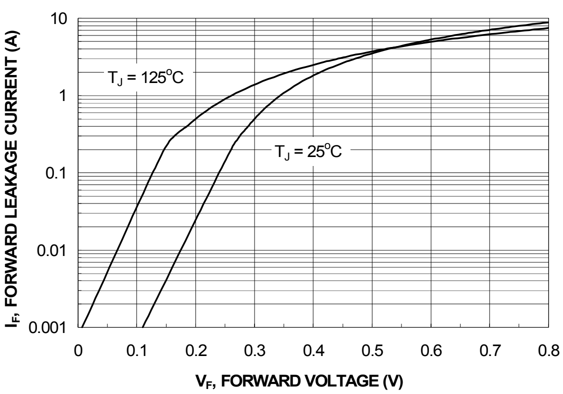


Figure 9. Schottky Diode Forward Voltage

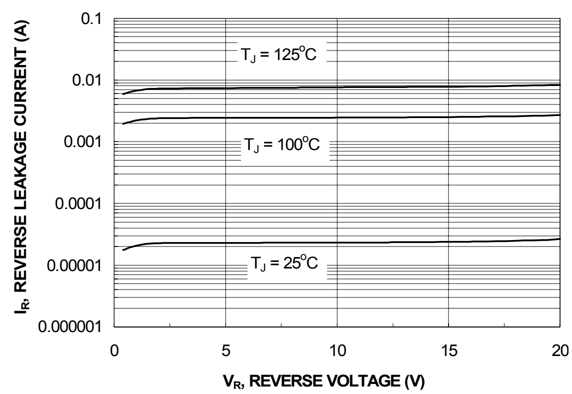


Figure 10. Schottky Diode Reverse Current

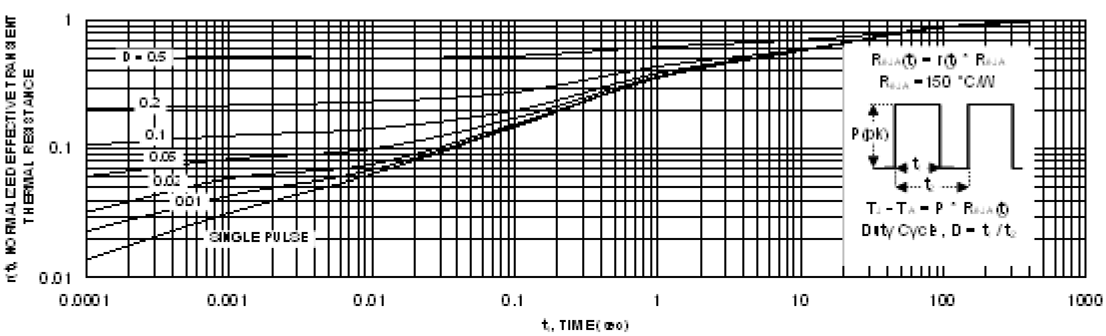
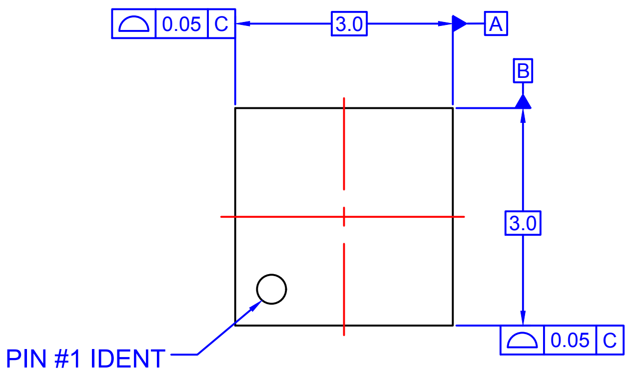
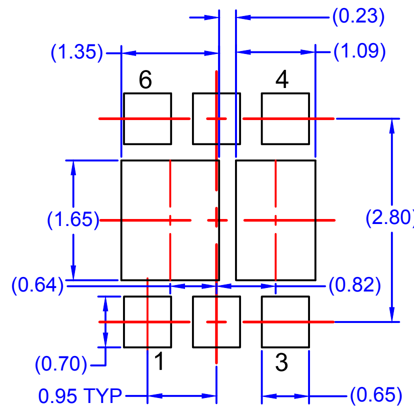


Figure 11. Transient Thermal Response Curve

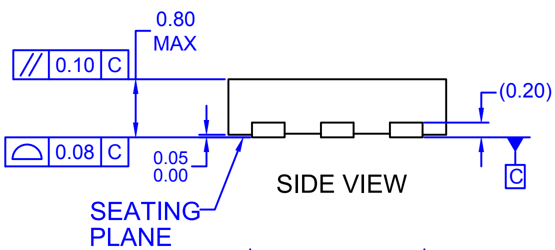
Thermal characterization performed using the conditions described in Note 1b.
Transient thermal response will change depending on the circuit board design.



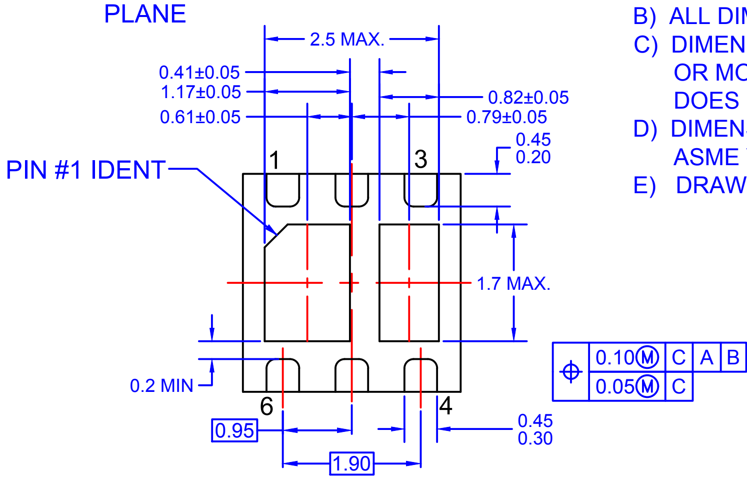
TOP VIEW



RECOMMENDED LAND PATTERN



SIDE VIEW



BOTTOM VIEW

NOTES: UNLESS OTHERWISE SPECIFIED

A) CONFORMS TO JEDEC REGISTRATION, MO-229, VARIATION WEEA

B) ALL DIMENSIONS ARE IN MILLIMETERS.

C) DIMENSIONS DO NOT INCLUDE BURRS OR MOLD FLASH. MOLD FLASH OR BURRS DOES NOT EXCEED 0.10MM.

D) DIMENSIONING AND TOLERANCING PER ASME Y14.5M-2009.

E) DRAWING FILE NAME: MKT-MLP06HREV2

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