

# 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.

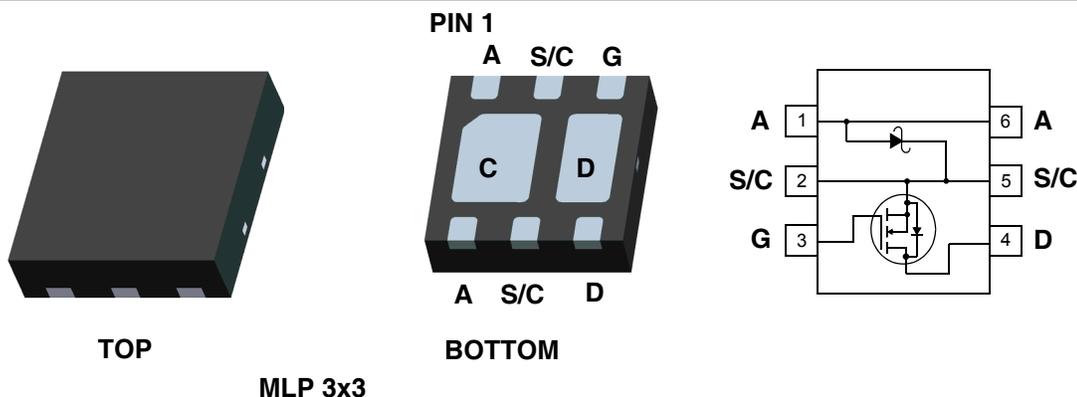
This device is designed specifically as a single package solution for Standard Buck Converter. It features a fast switching, low gate charge MOSFET with very low on-state resistance.

### Applications

- Standard Buck Converter

### Features

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



### Absolute Maximum Ratings $T_A = 25^\circ C$ unless otherwise noted

Symbol	Parameter	Ratings	Units
$V_{DSS}$	Drain-Source Voltage	20	V
$V_{GSS}$	Gate-Source Voltage	$\pm 12$	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	$^\circ C$

### Thermal Characteristics

$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient (Note 1a)	70	$^\circ C/W$
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient (Note 1b)	150	$^\circ C/W$

### Package Marking and Ordering Information

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

**Electrical Characteristics**  $T_A = 25^\circ\text{C}$  unless otherwise noted

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
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**Off Characteristics**

$B_{VDSS}$	Drain-Source Breakdown Voltage	$I_D = 250\mu\text{A}, V_{GS} = 0\text{V}$	20	-	-	V
$\frac{\Delta BV_{DSS}}{\Delta T_J}$	Breakdown Voltage Temperature Coefficient	$I_D = 250\mu\text{A}$ , Referenced to $25^\circ\text{C}$	-	12	-	mV/ $^\circ\text{C}$
$I_{DSS}$	Zero Gate Voltage Drain Current	$V_{GS} = 0\text{V}, V_{DS} = 16\text{V}$	-	-	1	$\mu\text{A}$
$I_{GSS}$	Gate-Body Leakage,	$V_{GS} = \pm 12\text{V}, V_{DS} = 0\text{V}$	-	-	$\pm 100$	nA

**On Characteristics** (Note 2)

$V_{GS(TH)}$	Gate Threshold Voltage	$V_{DS} = V_{GS}, I_D = 250\mu\text{A}$	0.6	1.0	1.5	V
$\frac{\Delta V_{GS(TH)}}{\Delta T_J}$	Gate Threshold Voltage Temperature Coefficient	$I_D = 250\mu\text{A}$ , Referenced to $25^\circ\text{C}$	-	-3	-	mV/ $^\circ\text{C}$
$R_{DS(ON)}$	Static Drain-Source On-Resistance	$I_D = 4.0\text{A}, V_{GS} = 4.5\text{V}$	-	54	100	m $\Omega$
		$I_D = 3.3\text{A}, V_{GS} = 2.5\text{V}$	-	83	150	
		$I_D = 4.0\text{A}, V_{GS} = 4.5\text{V}$ , $T_J = 125^\circ\text{C}$	-	74	147	
$I_{D(ON)}$	On-State Drain Current	$V_{GS} = 2.5\text{V}, V_{DS} = 5\text{V}$	10	-	-	A
$g_{FS}$	Forward Transconductance	$I_D = 4\text{A}, V_{DS} = 5\text{V}$	-	9.7	-	S

**Dynamic Characteristics**

$C_{ISS}$	Input Capacitance	$V_{DS} = 10\text{V}, V_{GS} = 0\text{V}$ , $f = 1\text{MHz}$	-	273	-	pF
$C_{OSS}$	Output Capacitance		-	63	-	pF
$C_{RSS}$	Reverse Transfer Capacitance		-	37	-	pF
$R_G$	Gate Resistance	$V_{GS} = 0\text{V}, f = 1\text{MHz}$	-	1.6	-	$\Omega$

**Switching Characteristics** (Note 2)

$t_{d(ON)}$	Turn-On Delay Time	$V_{DD} = 10\text{V}, I_D = 1\text{A}$ , $V_{GS} = 4.5\text{V}, R_{GEN} = 6\Omega$	-	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	$V_{DS} = 10\text{V}, I_D = 4.0\text{A}$ , $V_{GS} = 4.5\text{V}$	-	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**

$I_S$	Maximum Continuous Drain-Source Diode Forward Current	-	-	1.4	A	
$V_{SD}$	Drain-Source Diode Forward Voltage	$V_{GS} = 0\text{V}, I_S = 1.4\text{A}$ (Note 2)	-	0.8	-1.2	V
$t_{rr}$	Diode Reverse Recovery Time	$I_F = 4.0\text{A}, dI_F/dt = 100\text{A}/\mu\text{s}$	-	11	-	ns
$Q_{rr}$	Diode Reverse Recovery Charge		-	3	-	nC

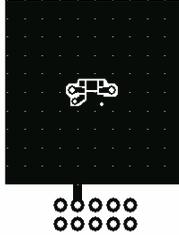
**Schottky Diode Characteristic**

$V_R$	Reverse Voltage	$I_R = 1\text{mA}$	20	-	-	V	
$I_R$	Reverse Leakage	$V_R = 5\text{V}$	$T_J = 25^\circ\text{C}$	-	-	100	$\mu\text{A}$
			$T_J = 100^\circ\text{C}$	-	-	10	mA
$V_F$	Forward Voltage	$I_F = 1\text{A}$	$T_J = 25^\circ\text{C}$	-	0.32	0.39	V

**Electrical Characteristics**  $T_A = 25^\circ\text{C}$  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)  $70^\circ\text{C/W}$  when mounted on a  $1\text{in}^2$  pad of 2 oz copper



b)  $150^\circ\text{C/W}$  when mounted on a minimum pad of 2 oz copper

Scale 1: 1 on letter size paper

2. Pulse Test: Pulse Width  $< 300\ \mu\text{s}$ , Duty Cycle  $< 2.0\%$

## Typical Characteristics

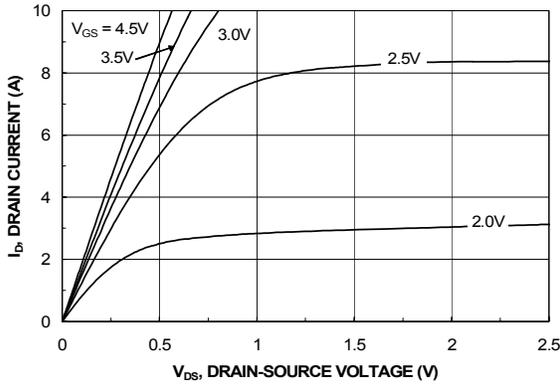


Figure 1. On-Region Characteristics

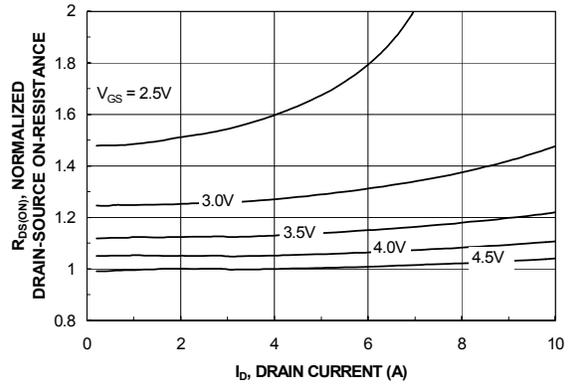


Figure 2. On-Resistance Variation with Drain Current and Gate Voltage

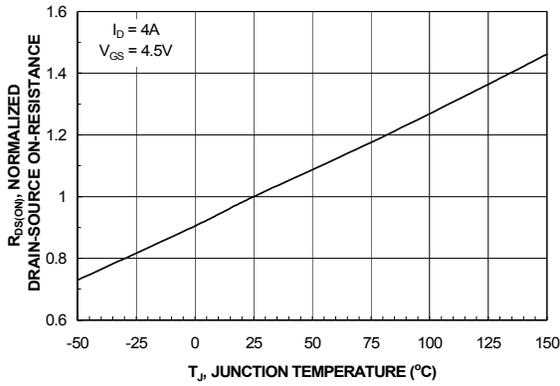


Figure 3. On-Resistance Variation with Temperature

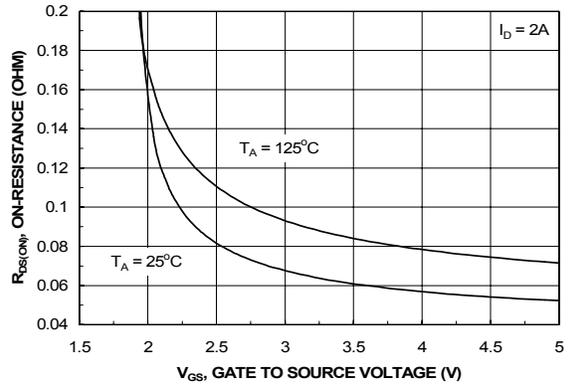


Figure 4. On-Resistance Variation with Gate-to-Source Voltage

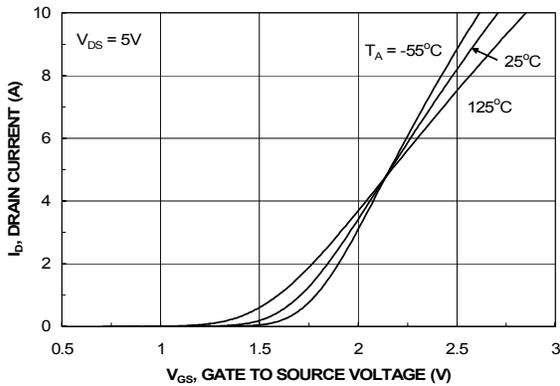


Figure 5. Transfer Characteristics

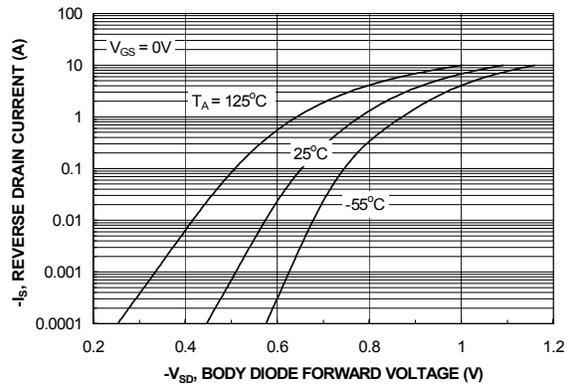
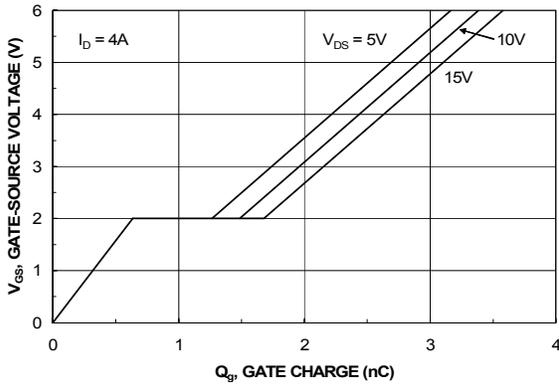
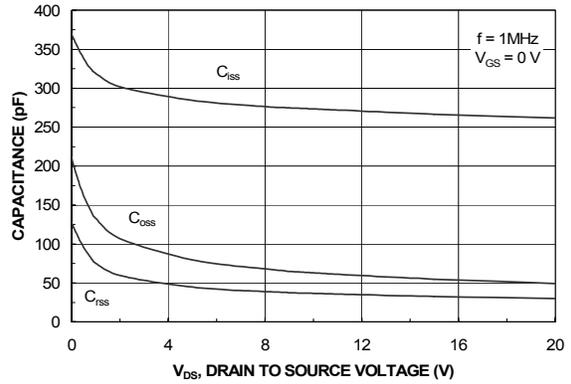


Figure 6. Body Diode Forward Voltage Variation with Source Current and Temperature

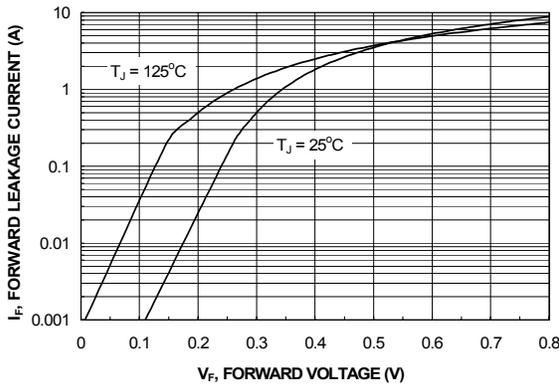
## Typical Characteristics



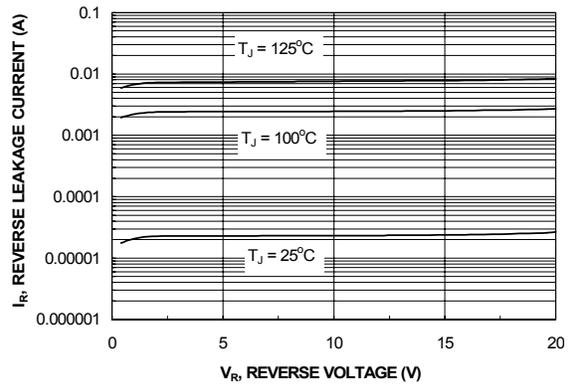
**Figure 7. Gate Charge Characteristics**



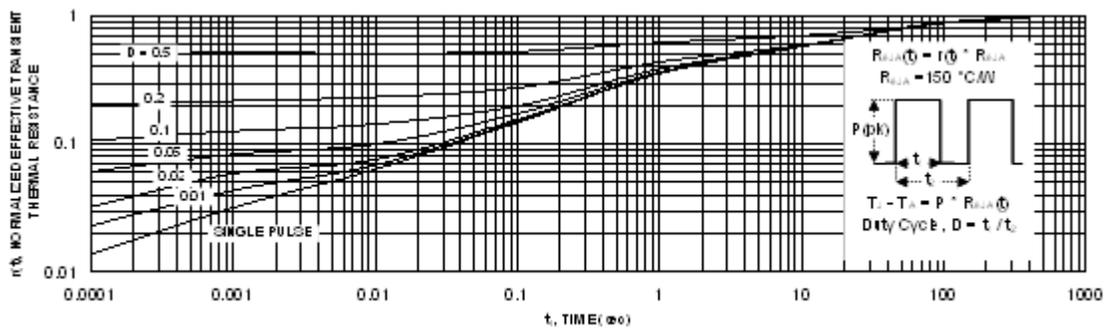
**Figure 8. Capacitance Characteristics**



**Figure 9. Schottky Diode Forward Voltage**

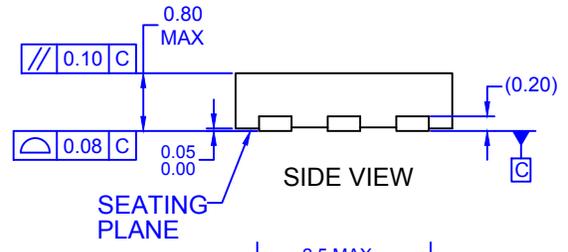
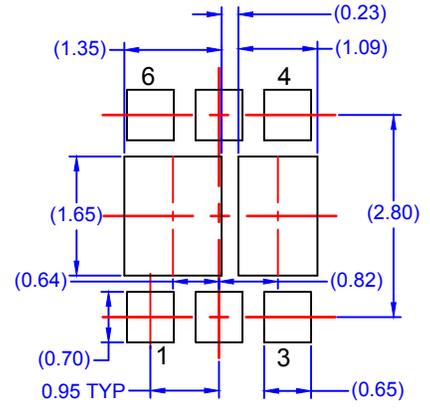
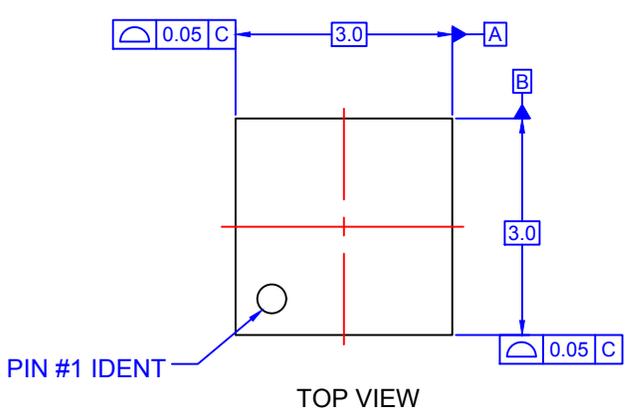


**Figure 10. Schottky Diode Reverse Current**



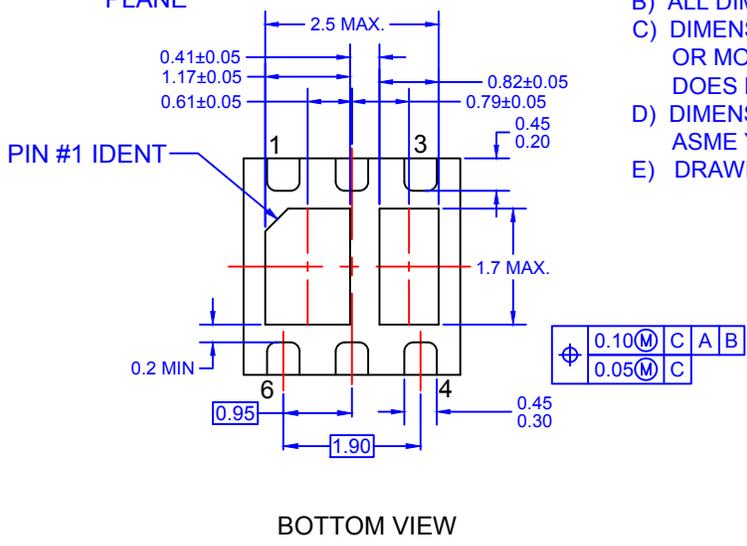
**Figure 11. Transient Thermal Response Curve**

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



RECOMMENDED LAND PATTERN

- 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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