FAIRCHILD SEMICONDUCTOR®

December 2006

FDFMA2N028Z

Integrated N-Channel PowerTrench® MOSFET and Schottky Diode

20V, 3.7A, 68mΩ

Features

MOSFET

- Max $r_{DS(on)}$ = 68mΩ at V_{GS} = 4.5V, I_D = 3.7A
- Max $r_{DS(on)}$ = 86mΩ at V_{GS} = 2.5V, I_D = 3.3A

Schottky

- V_F < 0.37V @ 500mA
- Low profile - 0.8 mm maximum - in the new package MicroFET 2x2 mm
- RoHS Compliant

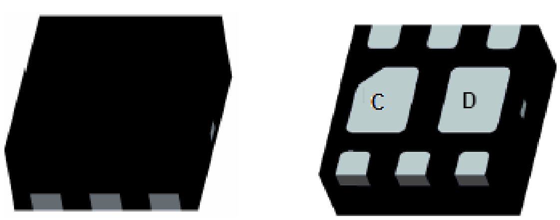
General Description

This device is designed specifically as a single package solution for a boost topology in cellular handset and other ultra-portable applications. It features a MOSFET with low on-state resistance, and an independently connected schottky diode with low forward voltage.

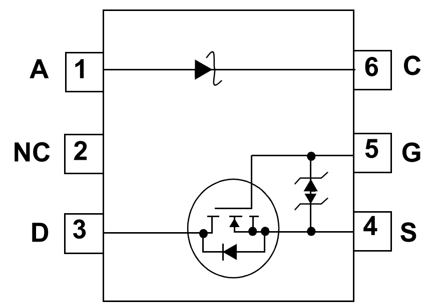
The MicroFET 2x2 package offers exceptional thermal performance for its physical size and is well suited to switching and linear mode applications.

Application

- DC - DC Conversion



MicroFET 2X2



MOSFET Maximum Ratings T_J = 25°C unless otherwise noted

Symbol	Parameter		Ratings	Units
V_{DS}	Drain to Source Voltage		20	V
V_{GS}	Gate to Source Voltage		±12	V
I_D	Drain Current -Continuous	(Note 1a)	3.7	A
	-Pulsed		6	
P_D	Power Dissipation	(Note 1a)	1.4	W
	Power Dissipation	(Note 1b)	0.7	
T_J, T_{STG}	Operating and Storage Junction Temperature Range		-55 to +150	°C
V_{RR}	Schottky Repetitive Peak Reverse Voltage		20	V
I_O	Schottky Average Forward Current		2	A

Thermal Characteristics

$R_{\theta JA}$	Thermal Resistance, Junction to Ambient	(Note 1a)	86	°C/W
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient	(Note 1b)	173	
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient	(Note 1c)	86	
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient	(Note 1d)	140	

Package Marking and Ordering Information

Device Marking	Device	Package	Reel Size	Tape Width	Quantity
.N28	FDFMA2N028Z	MicroFET 2X2	7"	8mm	3000 units

Electrical Characteristics T_J = 25°C unless otherwise noted

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units

Off Characteristics

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
BV_{DSS}	Drain to 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		15		mV/°C
I_{DSS}	Zero Gate Voltage Drain Current	V_{DS} = 16V, V_{GS} = 0V			1	µA
I_{GSS}	Gate to Source Leakage Current	V_{GS} = ±12V, V_{DS} = 0V			±10	µA

On Characteristics

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
$V_{GS(th)}$	Gate to Source Threshold Voltage	V_{GS} = V_{DS}, I_D = 250µA	0.6	1.0	1.5	V
$\frac{\Delta V_{GS(th)}}{\Delta T_J}$	Gate to Source Threshold Voltage Temperature Coefficient	I_D = 250µA, referenced to 25°C		–4		mV/°C
$r_{DS(on)}$	Static Drain to Source On Resistance	V_{GS} = 4.5V, I_D = 3.7A		37	68	mΩ
		V_{GS} = 2.5V, I_D = 3.3A		50	86	
		V_{GS} = 4.5V, I_D = 3.7A, T_J = 125°C		53	90	
g_{FS}	Forward Trans conductance	V_{DS} = 10V, I_D = 3.7A		16		S

Dynamic Characteristics

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
C_{iss}	Input Capacitance	V_{DS} = 10V, V_{GS} = 0V, f = 1.0MHz		340	455	pF
C_{oss}	Output Capacitance			80	110	pF
C_{rss}	Reverse Transfer Capacitance			60	90	pF

Switching Characteristics

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		8	16	ns
t_r	Rise Time			8	16	ns
$t_{d(off)}$	Turn-Off Delay Time			14	26	ns
t_f	Fall Time			3	6	ns
$Q_{g(TOT)}$	Total Gate Charge	V_{DS} = 10V I_D = 3.7A V_{GS} = 4.5V		4	6	nC
Q_{gs}	Gate to Source Gate Charge			0.7		nC
Q_{gd}	Gate to Drain "Miller" Charge			1.1		nC

Drain-Source Diode Characteristics

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
I_S	Maximum Continuous Drain-Source Diode Forward Current				1.1	A
V_{SD}	Source to Drain Diode Forward Voltage	V_{GS} = 0V, I_S = 1.1A (Note 2)		0.7	1.2	V
t_{rr}	Reverse Recovery Time	I_F = 3.7A, di/dt = 100A/µs		11		ns
Q_{rr}	Reverse Recovery Charge			2		nC

Schottky Diode Characteristics

Symbol	Parameter	Test Conditions		Min	Typ	Max	Units
V_R	Reverse Voltage	I_R = 1mA	T_J = 25°C	20			V
I_R	Reverse Leakage	V_R = 20V	T_J = 25°C		30	300	µA
			T_J = 125°C		10	45	mA
V_F	Forward Voltage	I_F = 500mA	T_J = 25°C		0.32	0.37	V
			T_J = 125°C		0.21	0.26	
		I_F = 1A	T_J = 25°C		0.37	0.435	
			T_J = 125°C		0.28	0.33	

Electrical Characteristics T_J = 25°C unless otherwise noted

Notes:

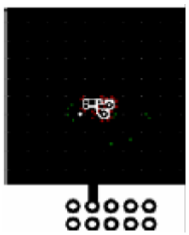
1: $R_{\theta JA}$ is determined with the device mounted on a $1in^2$ pad 2 oz. copper pad on a 1.5 x 1.5 in. board of FR-4 material. $R_{\theta JC}$ is guaranteed by design while $R_{\theta JA}$ is determined by the user's board design.

(a) MOSFET $R_{\theta JA}$ = 86°C/W when mounted on a $1in^2$ pad of 2 oz copper, 1.5" x 1.5" x 0.062" thick PCB.

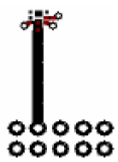
(b) MOSFET $R_{\theta JA}$ = 173°C/W when mounted on a minimum pad of 2 oz copper.

(c) Schottky $R_{\theta JA}$ = 86°C/W when mounted on a $1in^2$ pad of 2 oz copper, 1.5" x 1.5" x 0.062" thick PCB.

(d) Schottky $R_{\theta JA}$ = 140°C/W when mounted on a minimum pad of 2 oz copper.

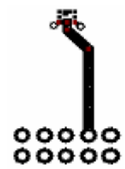


a)86°C/W when mounted on a $1in^2$ pad of 2 oz copper.



b)173°C/W when mounted on a minimum pad of 2 oz copper.

c)86°C/W when mounted on a $1in^2$ pad of 2 oz copper.



d)140°C/W when mounted on a minimum pad of 2 oz copper.

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

Typical Characteristics T_J = 25°C unless otherwise noted

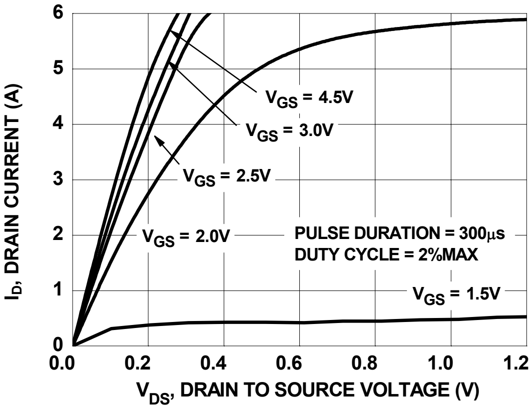


Figure 1. On-Region Characteristics

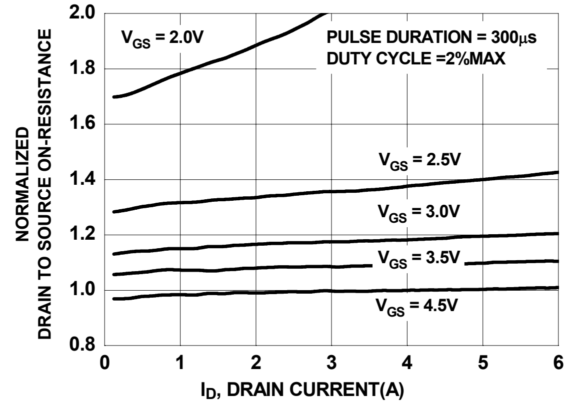


Figure 2. Normalized On-Resistance vs Drain Current and Gate Voltage

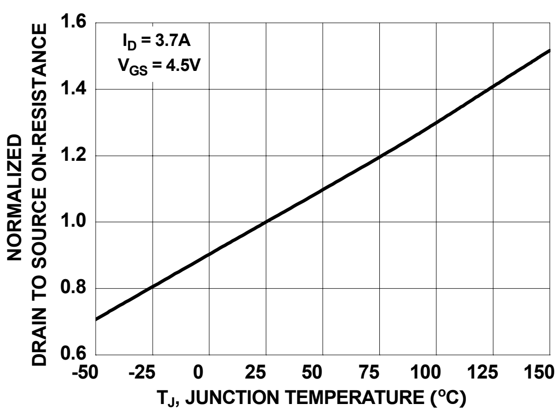


Figure 3. Normalized On-Resistance vs Junction Temperature

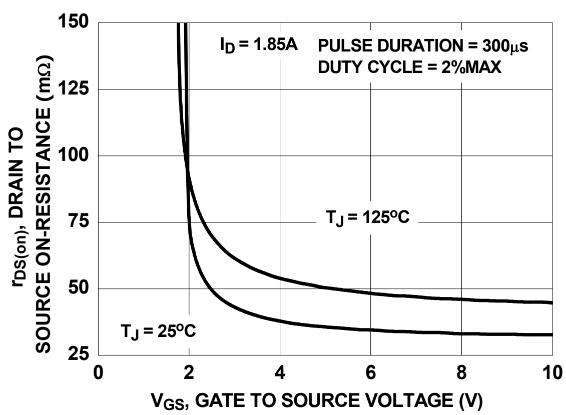


Figure 4. On-Resistance vs Gate to Source Voltage

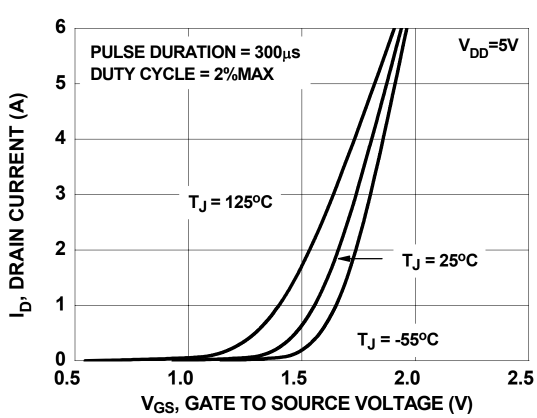


Figure 5. Transfer Characteristics

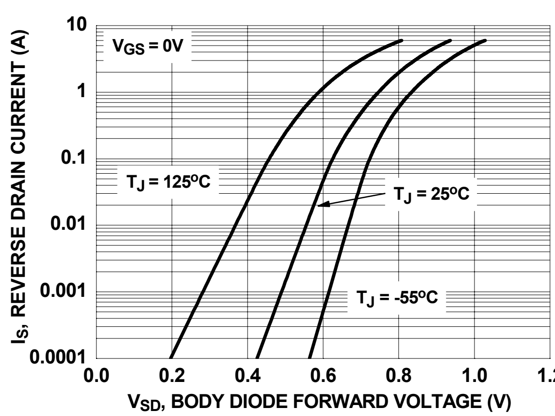


Figure 6. Source to Drain Diode Forward Voltage vs Source Current

Typical Characteristics T_J = 25°C unless otherwise noted

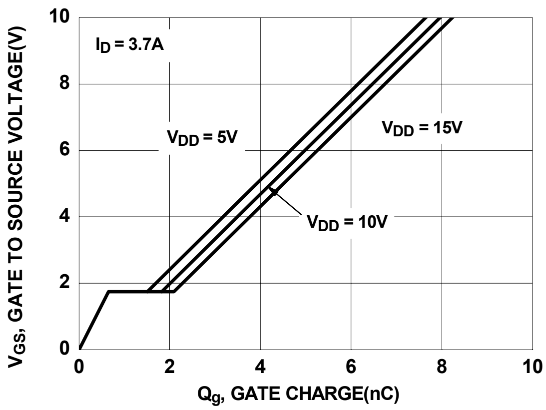


Figure 7. Gate Charge Characteristics

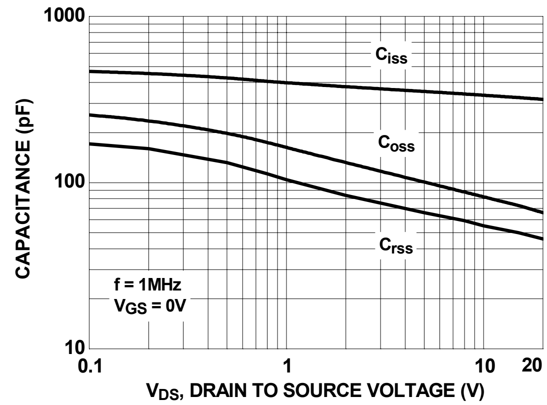


Figure 8. Capacitance Characteristics

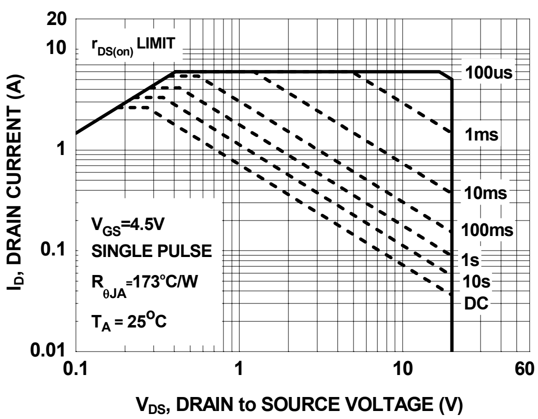


Figure 9. Forward Bias Safe Operating Area

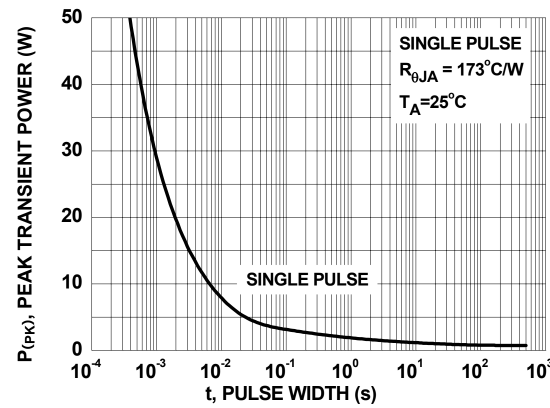


Figure 10. Single Pulse Maximum Power Dissipation

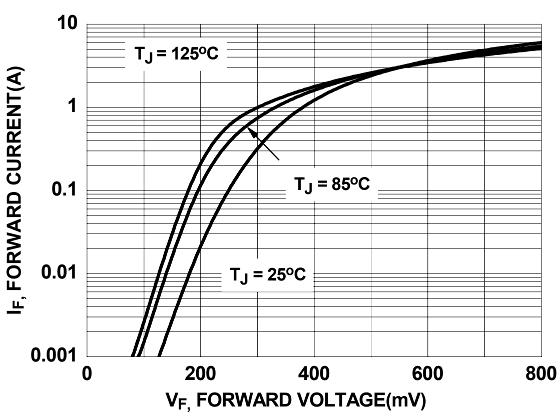


Figure 11. Schottky Diode Forward Current

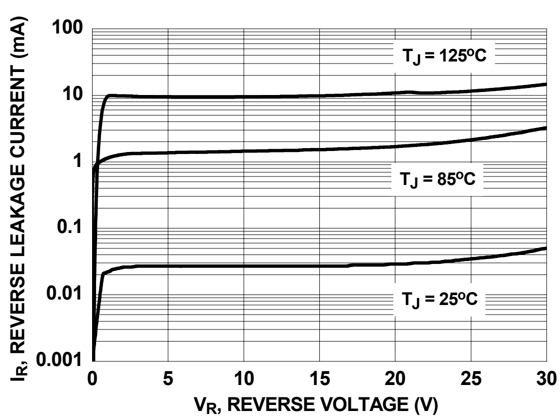


Figure 12. Schottky Diode Reverse Current

Typical Characteristics T_J = 25°C unless otherwise noted

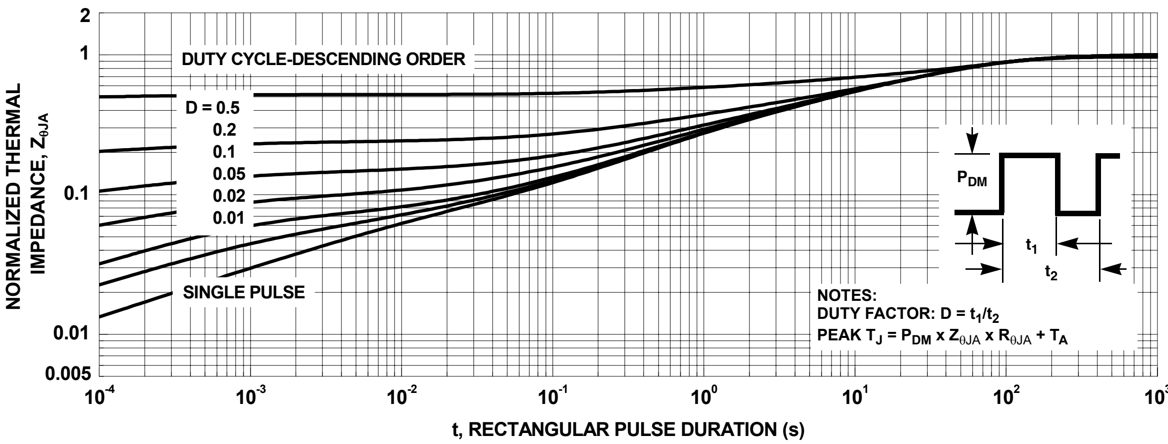
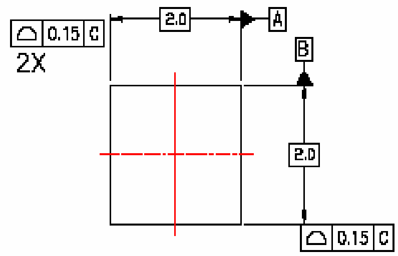
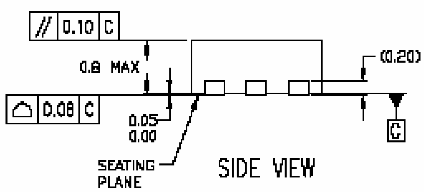


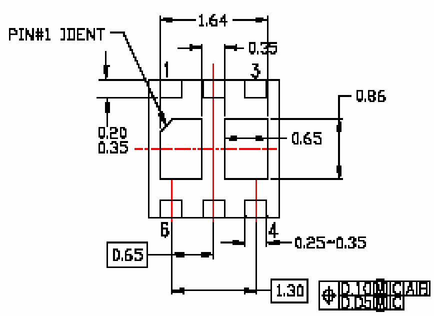
Figure 13. Transient Thermal Response Curve



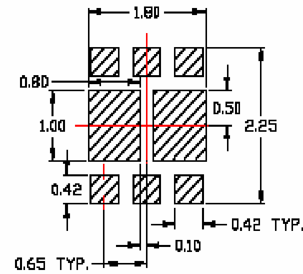
TOP VIEW



SIDE VIEW



BOTTOM VIEW



RECOMMENDED LAND PATTERN

NOTES:

A. CONFORMS TO JEDEC REGISTRATION MO–229, VARIATION VCCC, DATED 11/2001

B. DIMENSIONS ARE IN MILLIMETERS.

C. DIMENSIONS AND TOLERANCES PER ASME Y14.5M, 1994

MLP06JrevB

TRADEMARKS

The following are registered and unregistered trademarks Fairchild Semiconductor owns or is authorized to use and is not intended to be an exhaustive list of all such trademarks.

ACEx™
ActiveArray™
Bottomless™
Build it Now™
CoolFET™
CROSSVOLT™
DOME™
EcoSPARK™
E^2CMOS™
EnSigna™
FACT®
FAST®
FASTr™
FPS™
FRFET™
FACT Quiet Series™
GlobalOptoisolator™
GTO™
HiSeC™
I^2C™
i-Lo™
ImpliedDisconnect™
IntelliMAX™
ISOPLANAR™
LittleFET™
MICROCOUPLER™
MicroFET™
MicroPak™
MICROWIRE™
MSX™
MSXPro™
Across the board. Around the world.™
The Power Franchise®
Programmable Active Droop™
OCX™
OCXPro™
OPTOLOGIC®
OPTOPLANAR™
PACMAN™
POP™
Power247™
PowerEdge™
PowerSaver™
PowerTrench®
QFET®
QS™
QT Optoelectronics™
Quiet Series™
RapidConfigure™
RapidConnect™
µSerDes™
ScalarPump™
SILENT SWITCHER®
SMART START™
SPM™
Stealth™
SuperFET™
SuperSOT™-3
SuperSOT™-6
SuperSOT™-8
SyncFET™
TCM™
TinyBoost™
TinyBuck™
TinyPWM™
TinyPower™
TinyLogic®
TINYOPTO™
TruTranslation™
UHC®
UniFET™
VCX™
Wire™

LIFE SUPPORT POLICY
FAIRCHILD'S PRODUCTS ARE NOT AUTHORIZED FOR USE AS CRITICAL COMPONENTS IN LIFE SUPPORT DEVICES OR SYSTEMS WITHOUT THE EXPRESS WRITTEN APPROVAL OF FAIRCHILD SEMICONDUCTOR CORPORATION.

As used herein:
1. Life support devices or systems are devices or systems which, (a) are intended for surgical implant into the body, or (b) support or sustain life, or (c) whose failure to perform when properly used in accordance with instructions for use provided in the labeling, can be reasonably expected to result in significant injury to the user.

2. A critical component is any component of a life support device or system whose failure to perform can be reasonably expected to cause the failure of the life support device or system, or to affect its safety or effectiveness.

PRODUCT STATUS DEFINITIONS
Definition of Terms

Datasheet Identification	Product Status	Definition
Advance Information	Formative or In Design	This datasheet contains the design specifications for product development. Specifications may change in any manner without notice.
Preliminary	First Production	This datasheet contains preliminary data, and supplementary data will be published at a later date. Fairchild Semiconductor reserves the right to make changes at any time without notice in order to improve design.
No Identification Needed	Full Production	This datasheet contains final specifications. Fairchild Semiconductor reserves the right to make changes at any time without notice in order to improve design.
Obsolete	Not In Production	This datasheet contains specifications on a product that has been discontinued by Fairchild semiconductor. The datasheet is printed for reference information only.

Rev. I22