

# FDMA410NZ

## Single N-Channel 1.5 V Specified PowerTrench® MOSFET

20 V, 9.5 A, 23 mΩ

### Features

- Max  $r_{DS(on)}$  = 23 mΩ at  $V_{GS} = 4.5$  V,  $I_D = 9.5$  A
- Max  $r_{DS(on)}$  = 29 mΩ at  $V_{GS} = 2.5$  V,  $I_D = 8.0$  A
- Max  $r_{DS(on)}$  = 36 mΩ at  $V_{GS} = 1.8$  V,  $I_D = 4.0$  A
- Max  $r_{DS(on)}$  = 50 mΩ at  $V_{GS} = 1.5$  V,  $I_D = 2.0$  A
- HBM ESD protection level > 2.5 kV (Note 3)
- Low Profile-0.8 mm maximum in the new package MicroFET 2x2 mm
- Free from halogenated compounds and antimony oxides
- RoHS Compliant

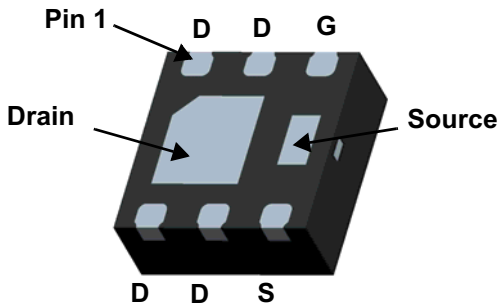


### General Description

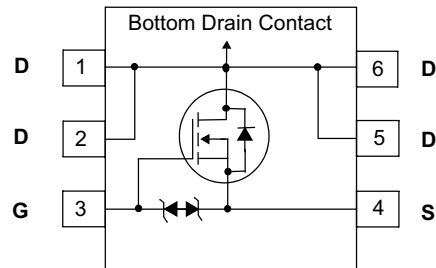
This Single N-Channel MOSFET has been designed using Fairchild Semiconductor's advanced Power Trench process to optimize the  $r_{DS(on)}$  @  $V_{GS} = 1.5$  V on special MicroFET leadframe.

### Applications

- Li-Ion Battery Pack
- Baseband Switch
- Load Switch
- DC-DC Conversion



MicroFET 2X2 (Bottom View)



### MOSFET Maximum Ratings $T_A = 25$ °C unless otherwise noted

Symbol	Parameter	Ratings	Units
$V_{DS}$	Drain to Source Voltage	20	V
$V_{GS}$	Gate to Source Voltage	±8	V
$I_D$	-Continuous $T_A = 25$ °C (Note 1a)	9.5	A
	-Pulsed	24	
$P_D$	Power Dissipation $T_A = 25$ °C (Note 1a)	2.4	W
	Power Dissipation $T_A = 25$ °C (Note 1b)	0.9	
$T_J, T_{STG}$	Operating and Storage Junction Temperature Range	-55 to +150	°C

### Thermal Characteristics

$R_{\theta JA}$	Thermal Resistance, Junction to Ambient (Note 1a)	52	°C/W
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient (Note 1b)	145	

### Package Marking and Ordering Information

Device Marking	Device	Package	Reel Size	Tape Width	Quantity
410	FDMA410NZ	MicroFET 2X2	7"	12 mm	3000 units

## Electrical Characteristics $T_J = 25\text{ }^\circ\text{C}$ unless otherwise noted

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

$BV_{DSS}$	Drain to Source Breakdown Voltage	$I_D = 250\text{ }\mu\text{A}$ , $V_{GS} = 0\text{ V}$	20			V
$\frac{\Delta BV_{DSS}}{\Delta T_J}$	Breakdown Voltage Temperature Coefficient	$I_D = 250\text{ }\mu\text{A}$ , referenced to $25\text{ }^\circ\text{C}$		17		mV/ $^\circ\text{C}$
$I_{DSS}$	Zero Gate Voltage Drain Current	$V_{DS} = 16\text{ V}$ , $V_{GS} = 0\text{ V}$			1	$\mu\text{A}$
$I_{GSS}$	Gate to Source Leakage Current	$V_{GS} = \pm 8\text{ V}$ , $V_{DS} = 0\text{ V}$			$\pm 10$	$\mu\text{A}$

### On Characteristics

$V_{GS(th)}$	Gate to Source Threshold Voltage	$V_{GS} = V_{DS}$ , $I_D = 250\text{ }\mu\text{A}$	0.4	0.7	1.0	V
$\frac{\Delta V_{GS(th)}}{\Delta T_J}$	Gate to Source Threshold Voltage Temperature Coefficient	$I_D = 250\text{ }\mu\text{A}$ , referenced to $25\text{ }^\circ\text{C}$		-3		mV/ $^\circ\text{C}$
$r_{DS(on)}$	Static Drain to Source On Resistance	$V_{GS} = 4.5\text{ V}$ , $I_D = 9.5\text{ A}$		17	23	m $\Omega$
		$V_{GS} = 2.5\text{ V}$ , $I_D = 8.0\text{ A}$		20	29	
		$V_{GS} = 1.8\text{ V}$ , $I_D = 4.0\text{ A}$		24	36	
		$V_{GS} = 1.5\text{ V}$ , $I_D = 2.0\text{ A}$		29	50	
		$V_{GS} = 4.5\text{ V}$ , $I_D = 9.5\text{ A}$ , $T_J = 125\text{ }^\circ\text{C}$		23	32	
$g_{FS}$	Forward Transconductance	$V_{DD} = 5\text{ V}$ , $I_D = 9.5\text{ A}$		35		S

### Dynamic Characteristics

$C_{iss}$	Input Capacitance	$V_{DS} = 10\text{ V}$ , $V_{GS} = 0\text{ V}$ , $f = 1\text{ MHz}$		815	1080	pF
$C_{oss}$	Output Capacitance			130	175	pF
$C_{rss}$	Reverse Transfer Capacitance			85	130	pF
$R_g$	Gate Resistance	$f = 1\text{ MHz}$		2.1		$\Omega$

### Switching Characteristics

$t_{d(on)}$	Turn-On Delay Time	$V_{DD} = 10\text{ V}$ , $I_D = 9.5\text{ A}$ , $V_{GS} = 4.5\text{ V}$ , $R_{GEN} = 6\text{ }\Omega$		7.5	15	ns
$t_r$	Rise Time			3.9	10	ns
$t_{d(off)}$	Turn-Off Delay Time			27	44	ns
$t_f$	Fall Time			3.7	10	ns
$Q_g$	Total Gate Charge			10	14	nC
$Q_{gs}$	Gate to Source Charge	$V_{GS} = 4.5\text{ V}$ , $V_{DD} = 10\text{ V}$ , $I_D = 9.5\text{ A}$		1.2		nC
$Q_{gd}$	Gate to Drain "Miller" Charge			2.0		nC

### Drain-Source Diode Characteristics

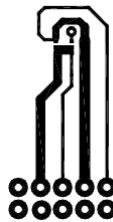
$I_S$	Maximum Continuous Drain-Source Diode Forward Current			2.0	A	
$V_{SD}$	Source to Drain Diode Forward Voltage	$V_{GS} = 0\text{ V}$ , $I_S = 2.0\text{ A}$ (Note 2)		0.7	1.2	V
$t_{rr}$	Reverse Recovery Time	$I_F = 9.5\text{ A}$ , $di/dt = 100\text{ A}/\mu\text{s}$		12	22	ns
$Q_{rr}$	Reverse Recovery Charge			2.6	10	nC

#### NOTES:

- $R_{\theta JA}$  is determined with the device mounted on a  $1\text{ in}^2$  pad 2 oz copper pad on a  $1.5 \times 1.5\text{ in.}$  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.  $52\text{ }^\circ\text{C/W}$  when mounted on a  $1\text{ in}^2$  pad of 2 oz copper.

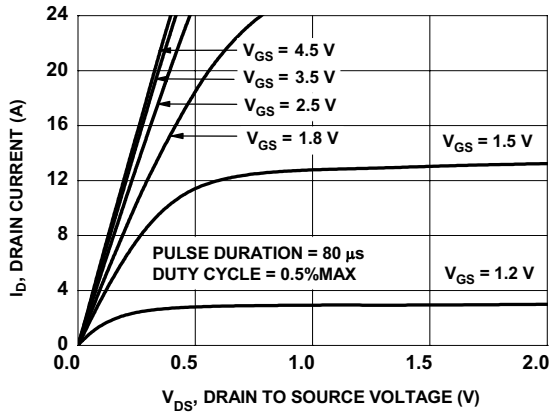


b.  $145\text{ }^\circ\text{C/W}$  when mounted on a minimum pad of 2 oz copper.

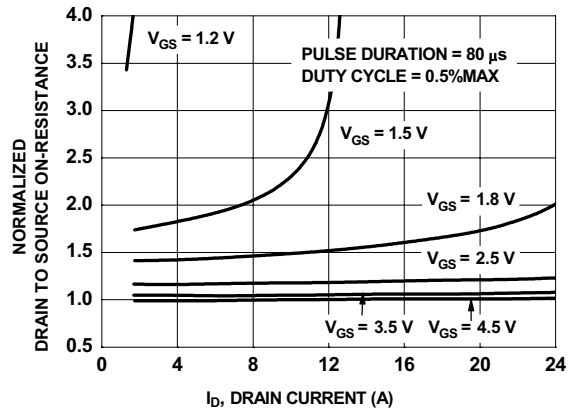
- Pulse Test: Pulse Width  $< 300\text{ }\mu\text{s}$ , Duty cycle  $< 2.0\%$ .

- The diode connected between the gate and source serves only as protection against ESD. No gate overvoltage rating is implied.

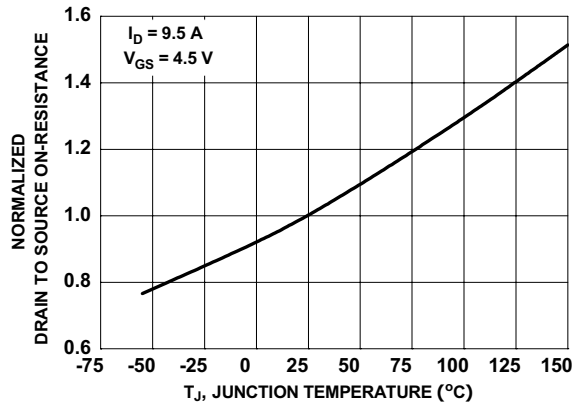
**Typical Characteristics**  $T_J = 25\text{ }^\circ\text{C}$  unless otherwise noted



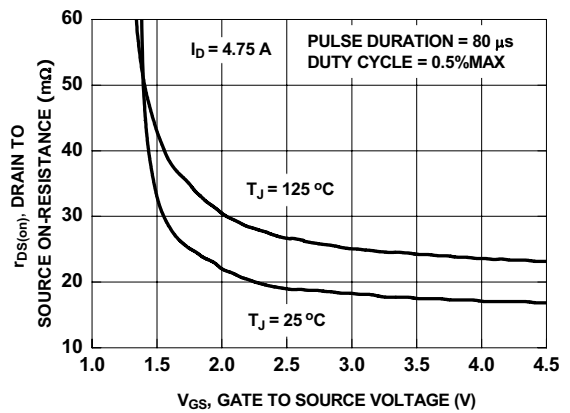
**Figure 1. On-Region Characteristics**



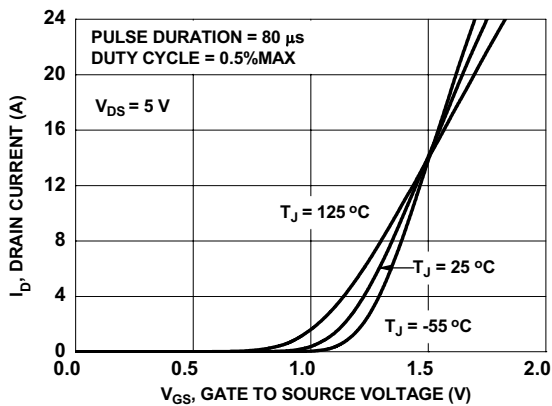
**Figure 2. Normalized On-Resistance vs Drain Current and Gate Voltage**



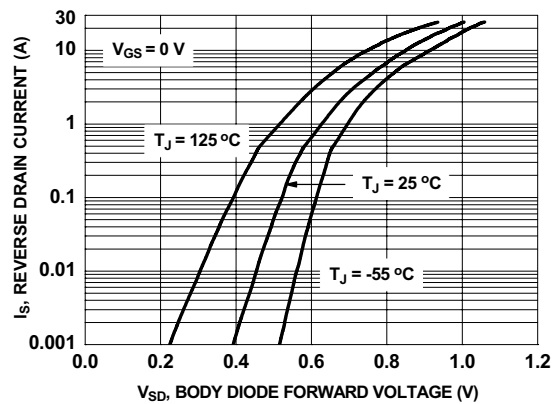
**Figure 3. Normalized On-Resistance vs Junction Temperature**



**Figure 4. On-Resistance vs Gate to Source Voltage**

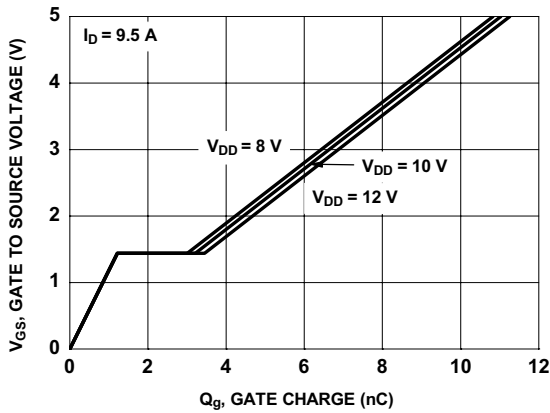


**Figure 5. Transfer Characteristics**

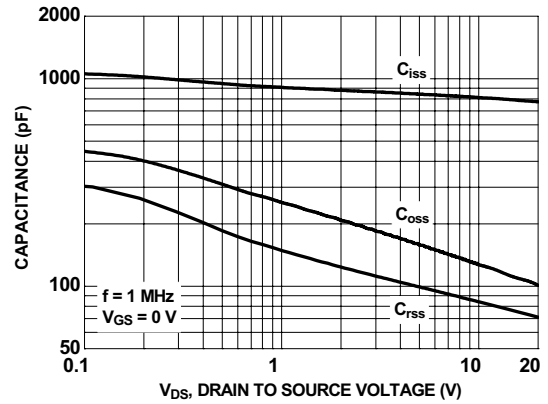


**Figure 6. Source to Drain Diode Forward Voltage vs Source Current**

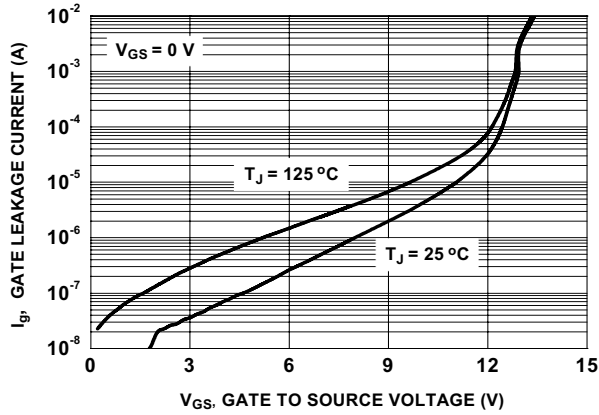
**Typical Characteristics**  $T_J = 25^\circ\text{C}$  unless otherwise noted



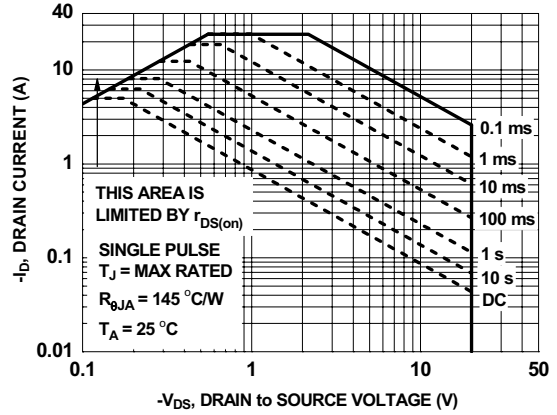
**Figure 7. Gate Charge Characteristics**



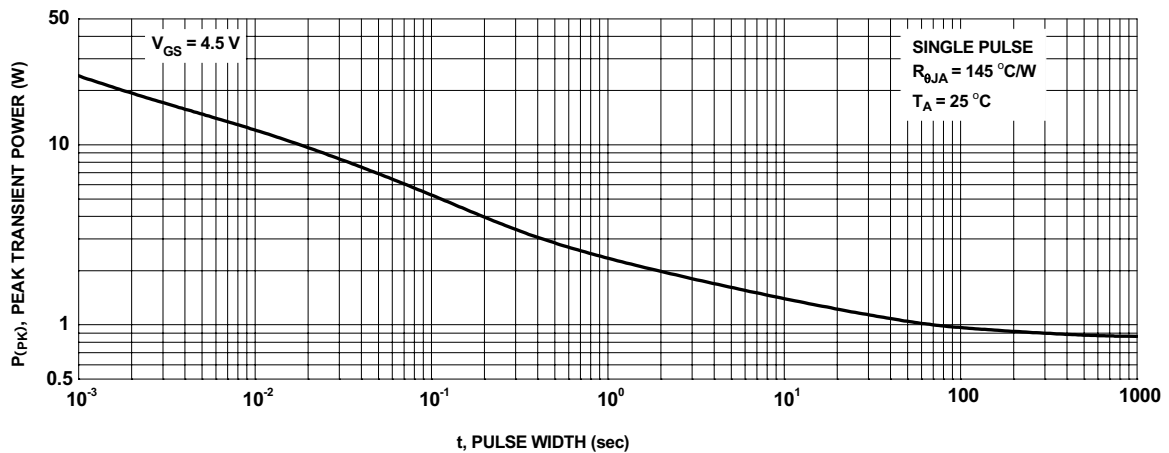
**Figure 8. Capacitance vs Drain to Source Voltage**



**Figure 9. Gate Leakage Current vs Gate to Source Voltage**

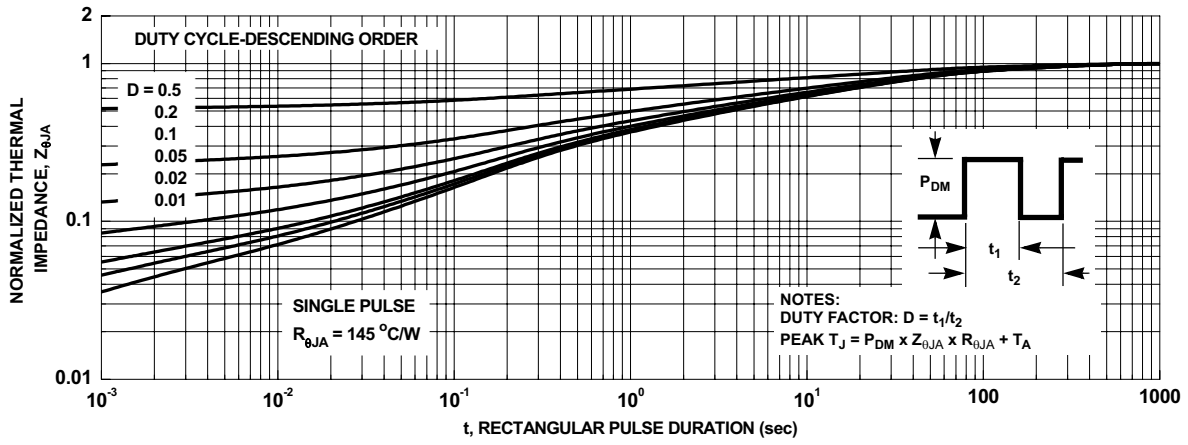


**Figure 10. Forward Bias Safe Operation Area**



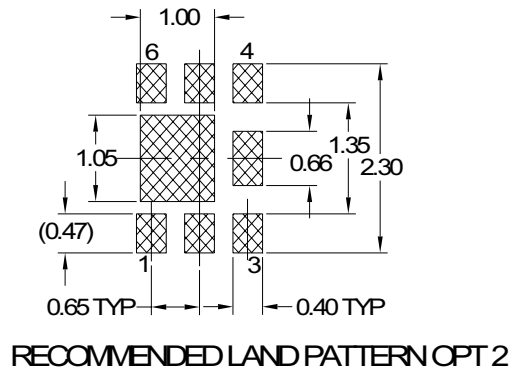
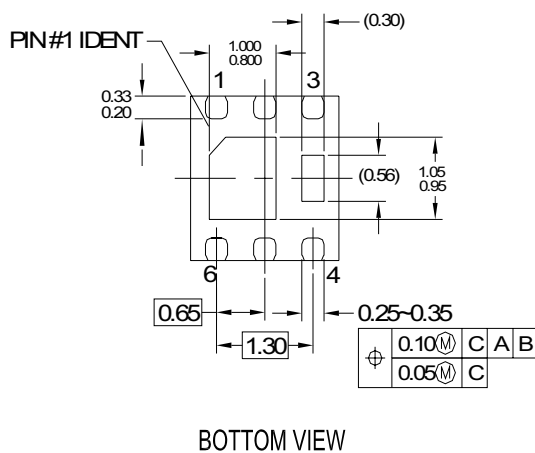
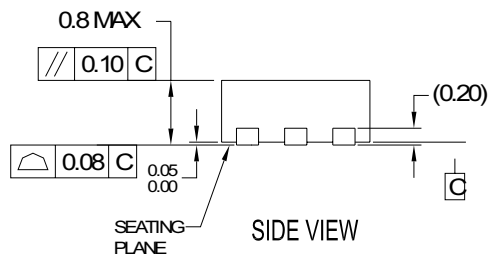
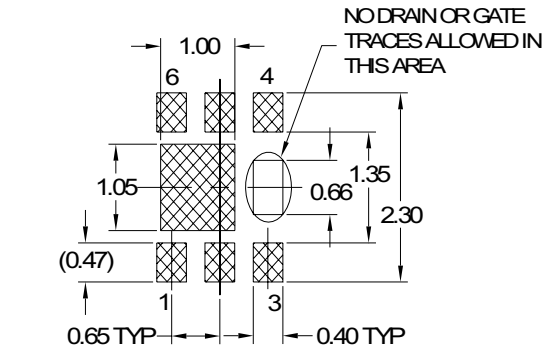
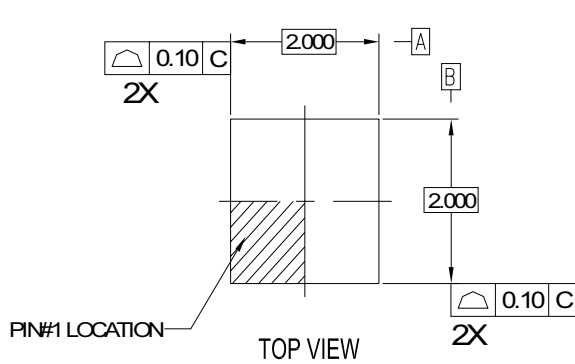
**Figure 11. Single Pulse Maximum Power Dissipation**

**Typical Characteristics**  $T_J = 25\text{ }^\circ\text{C}$  unless otherwise noted



**Figure 12. Junction-to-Ambient Transient Thermal Response Curve**

## Dimensional Outline and Pad Layout







### NOTES:

- A. DOES NOT FULLY CONFORM TO JEDEC REGISTRATION MO-229 DATED AUG/2003
- B. DIMENSIONS ARE IN MILLIMETERS.
- C. DIMENSIONS AND TOLERANCES PER ASME Y14.5M, 1994
- D. DRAWING FILENAME: MKT-MLP06Lrev2.



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