

# **MOSFET** – Single, N-Channel, POWERTRENCH<sup>®</sup>, 2.5 V Specified

30 V, 5.0 A, 40 m $\Omega$ 

# FDMA430NZ

# **General Description**

This Single N-Channel MOSFET has been designed using **onsemi**'s advanced POWERTRENCH process to optimize the  $R_{DS(on)}$  @  $V_{GS} = 2.5$  V on special MicroFET<sup>TM</sup> leadframe.

#### **Features**

- $R_{DS(on)} = 40 \text{ m}\Omega$  at  $V_{GS} = 4.5 \text{ V}$ ,  $I_D = 5.0 \text{ A}$
- $R_{DS(on)} = 50 \text{ m}\Omega$  at  $V_{GS} = 2.5 \text{ V}$ ,  $I_D = 4.5 \text{ A}$
- Low Profile 0.8 mm Maximum in the New Package MicroFET 2x2 mm
- HBM ESD Protection Level > 2.5 kV Typical (Note 3)
- Free from Halogenated Compounds and Antimony Oxides
- This Device is Pb-Free, Halide Free and is RoHS Compliant

#### **Applications**

• Li-lon Battery Pack

# ABSOLUTE MAXIMUM RATINGS (T<sub>A</sub> = 25°C, unless otherwise noted)

Symbol	Parameter	Ratings	Unit
$V_{DSS}$	Drain-Source Voltage	30	V
V <sub>GSS</sub>	Gate-Source Voltage	±12	V
I <sub>D</sub>	Drain Current - Continuous (Note 1a) - Pulsed	5.0 20	Α
P <sub>D</sub>	Power Dissipation (Steady State)  – (Note 1a)  – (Note 1b)	2.4 0.9	W
T <sub>J</sub> , T <sub>STG</sub>	Operating and Storage Junction Temperature Range	-55 to +150	°C

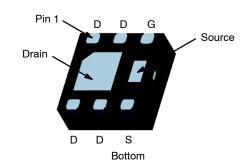
Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

## THERMAL CHARACTERISTICS (T<sub>A</sub> = 25°C, unless otherwise noted)

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

1

V <sub>DS</sub>	R <sub>DS(on)</sub> MAX	I <sub>D</sub> MAX
30 V	40 mΩ @ 4.5 V	5.0 A
	50 mΩ @ 2.5 V	



WDFN6 2x2, 0.65P (MicroFET 2x2) CASE 511CZ

#### **MARKING DIAGRAM**



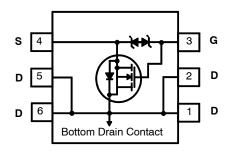
&Z = Assembly Plant Code

&2 = 2-Digit Date Code

&K = 2-Digits Lot Run Traceability Code

430 = Specific Device Code

## **PIN ASSIGNMENT**



## **ORDERING INFORMATION**

Device	Package	Shipping <sup>†</sup>
FDMA430NZ	WDFN6 (Pb-Free, Halide Free)	3000 / Tape & Reel

<sup>†</sup>For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specification Brochure, BRD8011/D.

# **ELECTRICAL CHARACTERISTICS** (T<sub>J</sub> = 25°C unless otherwise noted)

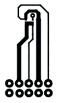
Symbol	Parameter	Test Condition	Min	Тур	Max	Unit
OFF CHAR	OFF CHARACTERISTICS					
BV <sub>DSS</sub>	Drain-Source Breakdown Voltage	I <sub>D</sub> = 250 μA, V <sub>GS</sub> = 0 V	30	-	_	V
$\frac{\Delta BV_{DSS}}{\Delta T_{J}}$	Breakdown Voltage Temperature Coefficient	$I_D$ = 250 $\mu A$ , referenced to 25°C	-	25.2	-	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 <sub>GSS</sub>	Gate-Body Leakage	$V_{GS} = \pm 12 \text{ V}, V_{DS} = 0 \text{ V}$	_	-	±10	μΑ
ON CHARAC	ON CHARACTERISTICS (Note 2)					
V <sub>GS(th)</sub>	Gate Threshold Voltage	$V_{GS} = V_{DS}, I_D = 250 \mu A$	0.6	0.81	1.5	V
$\frac{\Delta V_{GS(th)}}{\Delta T_{J}}$	Gate Threshold Voltage Temperature Coefficient	$I_D$ = 250 $\mu A$ , referenced to 25°C	-	-3.2	-	mV/°C
R <sub>DS(on)</sub>	Static Drain-Source On Resistance	V <sub>GS</sub> = 4.5 V, I <sub>D</sub> = 5.0 A	-	23.6	40	mΩ
		V <sub>GS</sub> = 4.0 V, I <sub>D</sub> = 5.0 A	_	23.9	41	
		V <sub>GS</sub> = 3.1 V, I <sub>D</sub> = 4.5 A	_	25.4	43	
		V <sub>GS</sub> = 2.5 V, I <sub>D</sub> = 4.5 A	_	27.6	50	
		V <sub>GS</sub> = 4.5 V, I <sub>D</sub> = 5.0 A, T <sub>J</sub> = 150°C	_	37.0	61	
9FS	Forward Transconductance	V <sub>DS</sub> = 5 V, I <sub>D</sub> = 5.0 A	_	25.6	_	S
DYNAMIC C	HARACTERISTICS					
C <sub>iss</sub>	Input Capacitance	V <sub>DS</sub> = 10 V, V <sub>GS</sub> = 0 V, f = 1.0 MHz	-	600	800	pF
C <sub>oss</sub>	Output Capacitance		_	110	150	pF
C <sub>rss</sub>	Reverse Transfer Capacitance		-	75	115	pF
$R_{G}$	Gate Resistance	f = 1.0 MHz	-	3.5	-	Ω
SWITCHING	CHARACTERISTICS (Note 2)					
t <sub>d(on)</sub>	Turn-On Delay Time	V <sub>DD</sub> = 10 V, I <sub>D</sub> = 1 A,	-	8.3	17	ns
t <sub>r</sub>	Turn-On Rise Time	$V_{GS}$ = 4.5 V, $R_{GEN}$ = 6 $\Omega$	_	7.1	15	ns
t <sub>d(off)</sub>	Turn-Off Delay Time	1	_	18.1	37	ns
t <sub>f</sub>	Turn-Off Fall Time		_	6.0	12	ns
$Q_g$	Total Gate Charge	V <sub>DS</sub> = 10 V, I <sub>D</sub> = 5.0 A, V <sub>GS</sub> = 4.5 V	_	7.3	11	nC
Q <sub>gs</sub>	Gate-Source Charge	1	-	0.8	2	nC
$Q_{gd}$	Gate-Drain Charge		-	1.9	3	nC
DRAIN-SOURCE DIODE CHARACTERISTICS AND MAXIMUM RATINGS						
I <sub>S</sub>	Maximum Continuous Drain-Source Diode Forward Current		_	_	2.0	Α
V <sub>SD</sub>	Drain-Source Diode Forward Voltage	V <sub>GS</sub> = 0 V, I <sub>S</sub> = 2.0 A	_	0.69	1.2	V
t <sub>rr</sub>	Diode Reverse Recovery Time	I <sub>F</sub> = 5.0 A, di/dt = 100 A/μs	-	-	17	ns
Q <sub>rr</sub>	Diode Reverse Recovery Charge	1	_	_	5	nC

Product parametric performance is indicated in the Electrical Characteristics for the listed test conditions, unless otherwise noted. Product performance may not be indicated by the Electrical Characteristics if operated under different conditions.

R<sub>0,JA</sub> 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.



a. 52°C/W when mounted on a 1 in<sup>2</sup> pad of 2 oz copper



b. 145°C/W when mounted on a minimum pad of 2 oz copper

- 2. Pulse Test: Pulse Width < 300  $\mu$ s, Duty cycle < 2.0%.
  3. The diode connected between the gate and source serves only as protection against ESD. No gate overvoltage rating is implied.

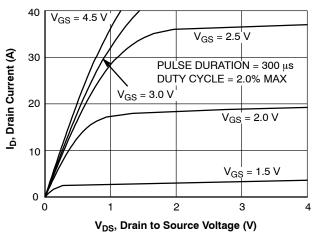
#### **TYPICAL CHARACTERISTICS**

(T<sub>J</sub> = 25°C unless otherwise noted)

1.8

1.7

1.6



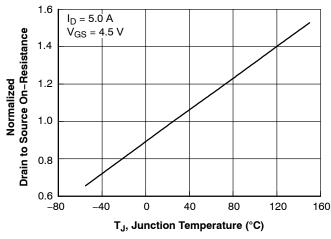
Drain to Source On-Resistance 1.5 2.5 V **Normalized** 1.4 3.0 V 1.3 3.5 1.2 1.1 1.0 0.9 8.0 5 10 15 20 25 30 35 40

V<sub>GS</sub> = 2.0 V

Figure 1. On-Region Characteristics

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

I<sub>D</sub>, Drain Current (A)



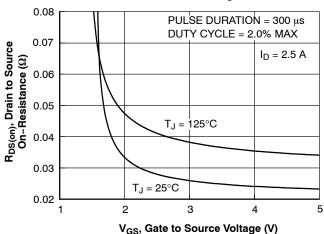
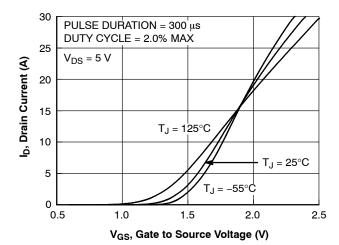


Figure 3. Normalized On-Resistance vs. Junction Temperature

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



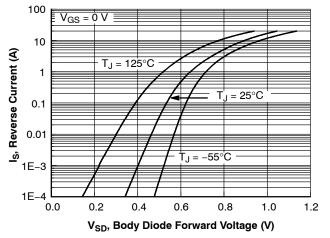


Figure 5. Transfer Characteristics

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

# TYPICAL CHARACTERISTICS (continued)

 $(T_J = 25^{\circ}C \text{ unless otherwise noted})$ 

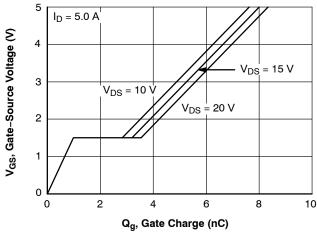


Figure 7. Gate Charge Characteristics

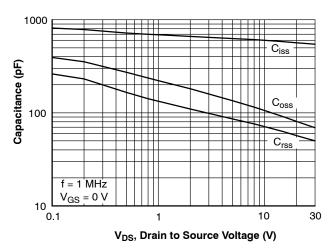


Figure 8. Capacitance vs. Drain to Source

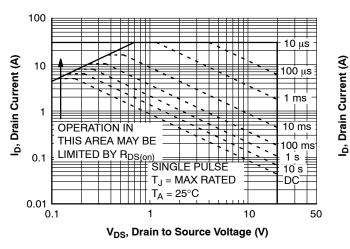


Figure 9. Safe Operating Area

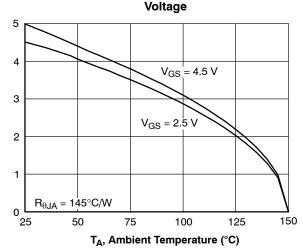


Figure 10. Maximum Continuous Drain Current vs. Ambient Temperature

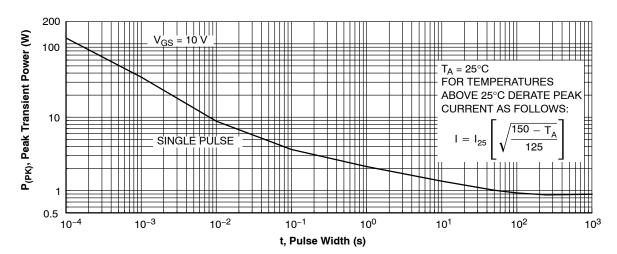


Figure 11. Single Pulse Maximum Power Dissipation

# TYPICAL CHARACTERISTICS (continued)

 $(T_J = 25^{\circ}C \text{ unless otherwise noted})$ 

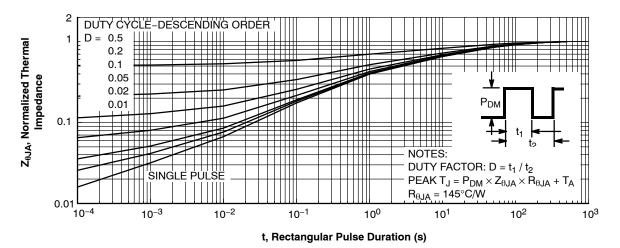


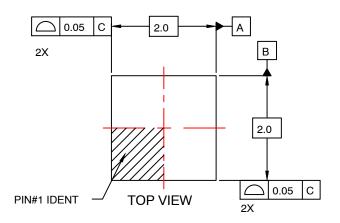
Figure 12. Transient Thermal Response Curve

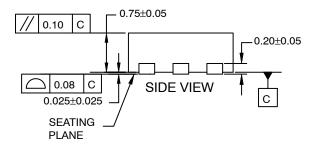
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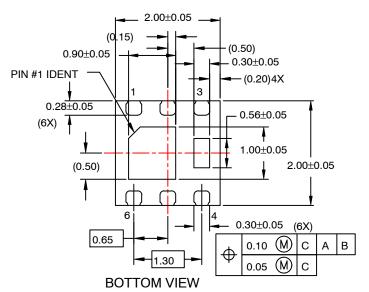
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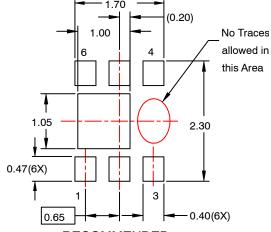
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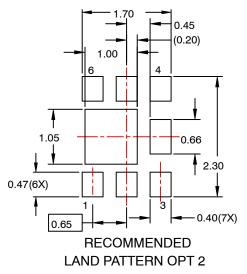








RECOMMENDED LAND PATTERN OPT 1



#### NOTES:

- A. PACKAGE DOES NOT FULLY CONFORM TO JEDEC MO-229 REGISTRATION
- B. DIMENSIONS ARE IN MILLIMETERS.
- C. DIMENSIONS AND TOLERANCES PER ASME Y14.5M, 2009.
- D. LAND PATTERN RECOMMENDATION IS EXISTING INDUSTRY LAND PATTERN.

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