

# MOSFET – Dual N-Channel, POWERTRENCH®

20 V, 5.0 A, 54 mΩ

**FDMA1024NZ**

## General Description

This is designed specifically as a single package solution for dual switching requirements in cellular handset and other ultra-portable applications. It features two independent N-Channel MOSFETs with low on-state resistance for minimum conduction losses.

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

## Features

- Max  $r_{DS(on)}$  = 54 mΩ at  $V_{GS} = 4.5$  V,  $I_D = 5.0$  A
- Max  $r_{DS(on)}$  = 66 mΩ at  $V_{GS} = 2.5$  V,  $I_D = 4.2$  A
- Max  $r_{DS(on)}$  = 82 mΩ at  $V_{GS} = 1.8$  V,  $I_D = 2.3$  A
- Max  $r_{DS(on)}$  = 114 mΩ at  $V_{GS} = 1.5$  V,  $I_D = 2.0$  A
- HBM ESD Protection Level = 1.6 kV (Note 3)
- Low Profile – 0.8 mm Maximum in the New Package MicroFET™ 2 x 2 mm
- Free from Halogenated Compounds and Antimony Oxides
- This Device is Pb-Free and is RoHS Compliant

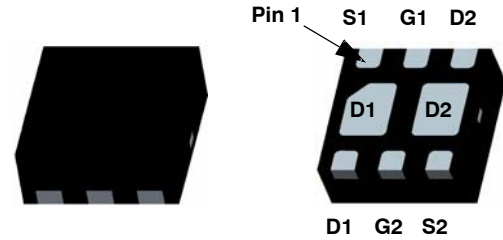
## Applications

- Baseband Switch
- Loadswitch
- DC-DC Buck Converters

## MOSFET MAXIMUM RATINGS ( $T_A = 25^\circ\text{C}$ unless otherwise noted)

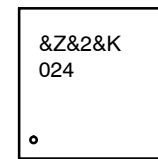
Symbol	Parameter	Ratings	Unit
$V_{DS}$	Drain to Source Voltage	20	V
$V_{GS}$	Gate to Source Voltage	±8	V
$I_D$	Drain Current – Continuous (Note 1a)	5.0	A
	– Pulsed	6.0	
$P_D$	Power Dissipation (Note 1a)	1.4	W
	Power Dissipation (Note 1b)	0.7	
$T_J$ , $T_{STG}$	Operating and Storage Junction Temperature Range	-55 to +150	°C

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.



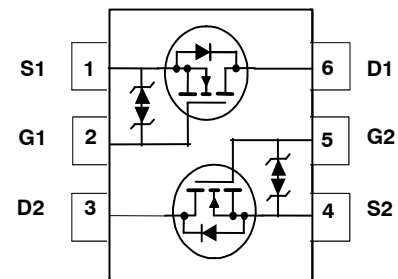
WDFN6 2x2, 0.65P  
(MicroFET™ 2x2)  
CASE 511DA

## MARKING DIAGRAM



- &Z = Assembly Plant Code
- &2 = Numeric Date Code
- &K = Lot Code
- 024 = Specific Device Code

## PIN ASSIGNMENT



## ORDERING INFORMATION

See detailed ordering and shipping information on page 2 of this data sheet.

# FDMA1024NZ

## THERMAL CHARACTERISTICS

Symbol	Parameter	Ratings	Unit
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient (Note 1a)	86 (Single Operation)	°C/W
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient (Note 1b)	173 (Single Operation)	
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient (Note 1c)	69 (Dual Operation)	
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient (Note 1d)	151 (Dual Operation)	

## PACKAGE MARKING AND ORDERING INFORMATION

Device Marking	Device	Package	Shipping <sup>†</sup>
024	FDMA1024NZ	WDFN6 2x2, 0.65P (MicroFET 2x2) (Pb-Free)	3000 Units / 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 Specifications Brochure, BRD8011/D.

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

Symbol	Parameter	Test Condition	Min	Typ	Max	Unit
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### OFF CHARACTERISTICS

$BV_{DSS}$	Drain to 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 $25^\circ\text{C}$		19		mV/°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	$V_{GS} = V_{DS}$ , $I_D = 250 \mu\text{A}$	0.4	0.7	1.0	V
$\frac{\Delta V_{GS(th)}}{\Delta T_J}$	Gate to Source Threshold Voltage Temperature Coefficient	$I_D = 250 \mu\text{A}$ , referenced to $25^\circ\text{C}$		-3		mV/°C
$r_{DS(on)}$	Static Drain to Source On-Resistance	$V_{GS} = 4.5 \text{ V}$ , $I_D = 5.0 \text{ A}$		37	54	m $\Omega$
		$V_{GS} = 2.5 \text{ V}$ , $I_D = 4.2 \text{ A}$		43	66	
		$V_{GS} = 1.8 \text{ V}$ , $I_D = 2.3 \text{ A}$		52	82	
		$V_{GS} = 1.5 \text{ V}$ , $I_D = 2.0 \text{ A}$		67	114	
		$V_{GS} = 4.5 \text{ V}$ , $I_D = 5.0 \text{ A}$ , $T_J = 125^\circ\text{C}$		51	75	
$g_{FS}$	Forward Transconductance	$V_{DD} = 5 \text{ V}$ , $I_D = 5.0 \text{ A}$		16		S

### DYNAMIC CHARACTERISTICS

$C_{iss}$	Input Capacitance	$V_{DS} = 10 \text{ V}$ , $V_{GS} = 0 \text{ V}$ , $f = 1 \text{ MHz}$		375	500	pF
$C_{oss}$	Output Capacitance			70	95	
$C_{rss}$	Reverse Transfer Capacitance			40	65	
$R_G$	Gate Resistance	$f = 1 \text{ MHz}$		4.3		$\Omega$

### SWITCHING CHARACTERISTICS

$t_{d(on)}$	Turn – On Delay Time	$V_{DD} = 10 \text{ V}$ , $I_D = 5.0 \text{ A}$ , $V_{GS} = 4.5 \text{ V}$ , $R_{GEN} = 6 \Omega$		5.3	11	ns
$t_r$	Rise Time			2.2	10	
$t_{D(off)}$	Turn – Off Delay Time			18	33	
$t_f$	Fall Time			2.3	10	
$Q_g$	Total Gate Charge	$V_{GS} = 4.5 \text{ V}$ , $V_{DD} = 10 \text{ V}$ , $I_D = 5.0 \text{ A}$		5.2	7.3	nC
$Q_{gs}$	Gate to Source Gate Charge			0.6		
$Q_{gd}$	Gate to Drain “Miller” Charge			0.9		

# FDMA1024NZ

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

Symbol	Parameter	Test Condition	Min	Typ	Max	Unit
<b>DRAIN-SOURCE DIODE CHARACTERISTICS</b>						
$I_S$	Maximum Continuous Source-Drain Diode Forward Current				1.1	A
$V_{SD}$	Source to Drain Diode Forward Voltage	$V_{GS} = 0\text{ V}, I_S = 1.1\text{ A}$ (Note 2)		0.7	1.2	V
$t_{rr}$	Reverse Recovery Time	$I_F = 5.0\text{ A}, di/dt = 100\text{ A}/\mu\text{s}$		19	35	ns
$Q_{rr}$	Reverse Recovery Charge			5	10	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.

### NOTES:

- $R_{\theta JA}$  is determined with the device mounted on a 1 in<sup>2</sup> pad 2 oz copper pad on a 1.5 × 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.
  - $R_{\theta JA} = 86^\circ\text{C}/\text{W}$  when mounted on a 1 in<sup>2</sup> pad of 2 oz copper, 1.5" × 1.5" × 0.062" thick PCB. For single operation.
  - $R_{\theta JA} = 173^\circ\text{C}/\text{W}$  when mounted on a a minimum pad of 2 oz copper. For single operation.
  - $R_{\theta JA} = 69^\circ\text{C}/\text{W}$  when mounted on a 1 in<sup>2</sup> pad of 2 oz copper, 1.5" × 1.5" × 0.062" thick PCB. For dual operation.
  - $R_{\theta JA} = 151^\circ\text{C}/\text{W}$  when mounted on a a minimum pad of 2 oz copper. For dual operation.



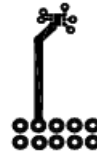
a)  $86^\circ\text{C}/\text{W}$  when mounted on a 1 in<sup>2</sup> pad of 2 oz copper.



b)  $173^\circ\text{C}/\text{W}$  when mounted on a minimum pad of 2 oz copper.



c)  $69^\circ\text{C}/\text{W}$  when mounted on a 1 in<sup>2</sup> pad of 2 oz copper.



d)  $151^\circ\text{C}/\text{W}$  when mounted on a minimum pad of 2 oz copper.

- Pulse Test: Pulse Width < 300  $\mu\text{s}$ , 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

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

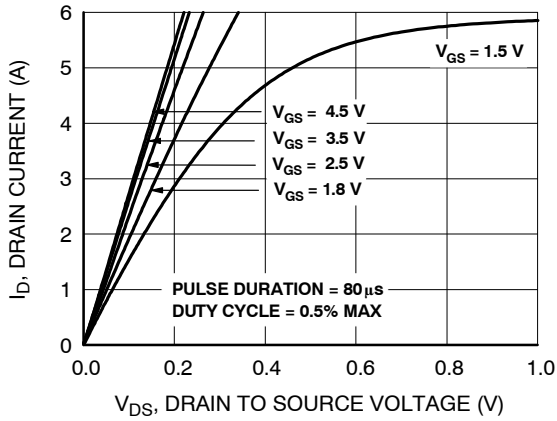


Figure 1. On-Region Characteristics

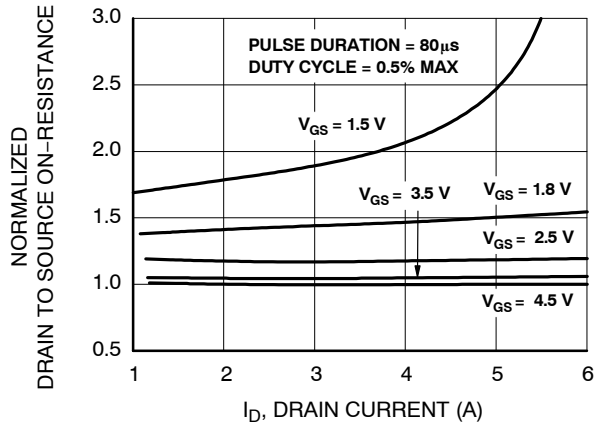


Figure 2. Normalized On-Resistance vs Drain Current and Gate Voltage

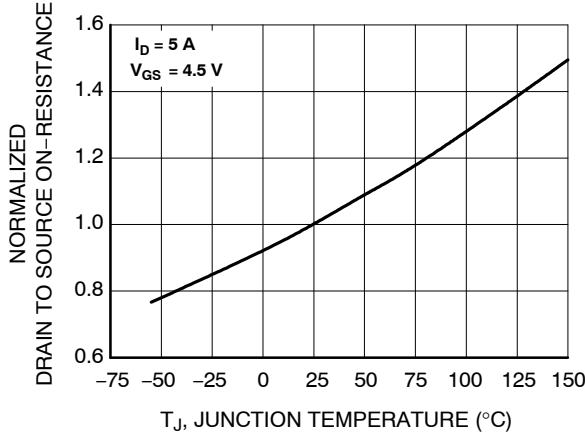


Figure 3. Normalized On-Resistance vs Junction Temperature

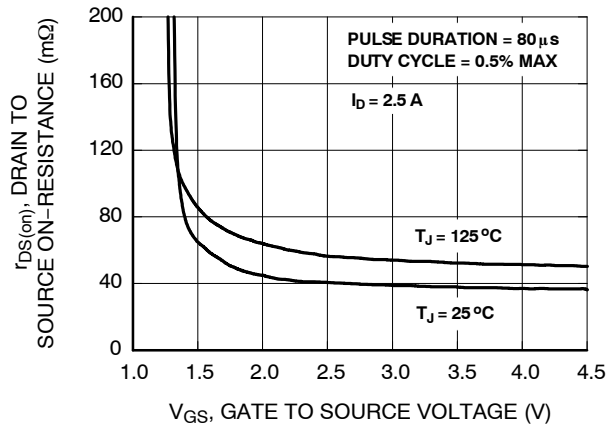


Figure 4. On-Resistance vs Gate to Source Voltage

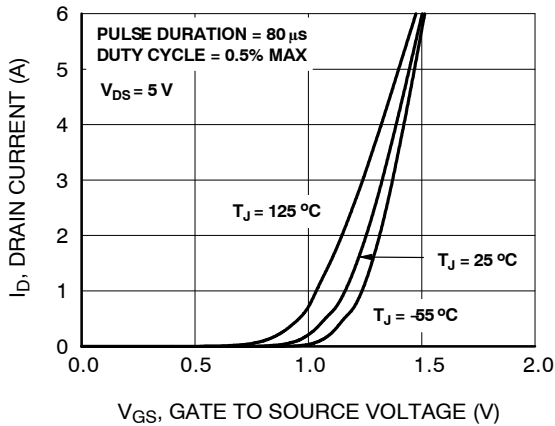


Figure 5. Transfer Characteristics

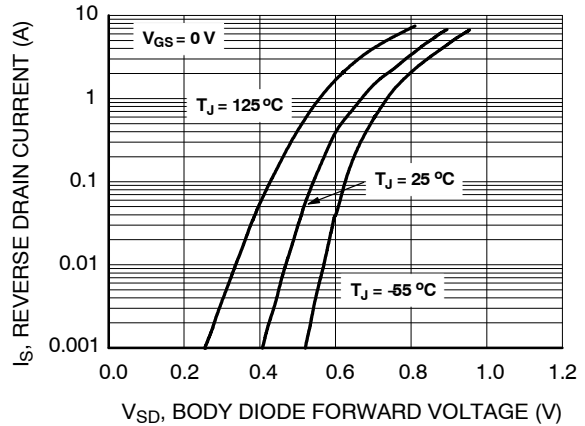


Figure 6. Source to Drain Diode Forward Voltage vs Source Current

# FDMA1024NZ

## TYPICAL CHARACTERISTICS (continued)

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

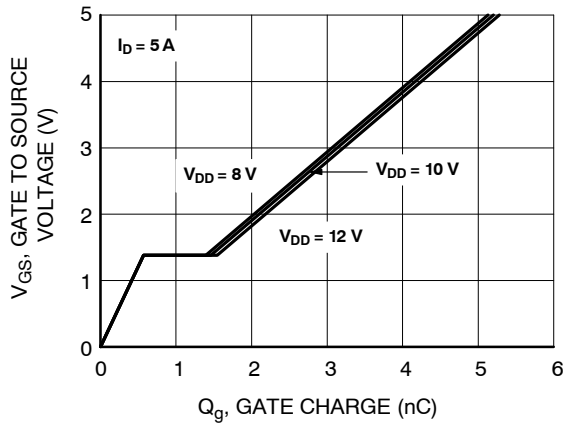


Figure 7. Gate Charge Characteristics

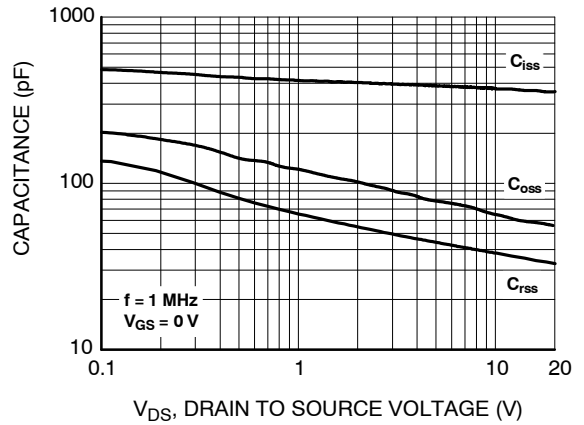


Figure 8. Capacitance vs Drain to Source Voltage

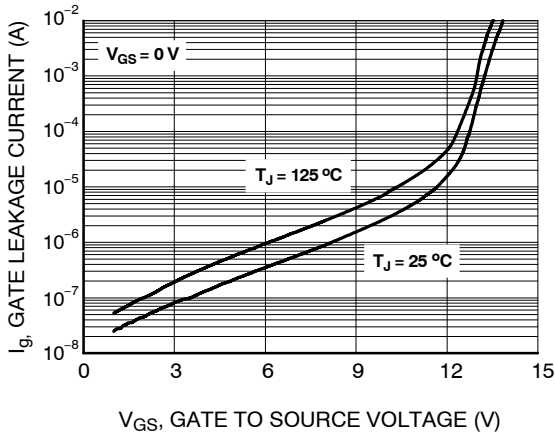


Figure 9. Gate Leakage Current vs. Gate to Source Voltage

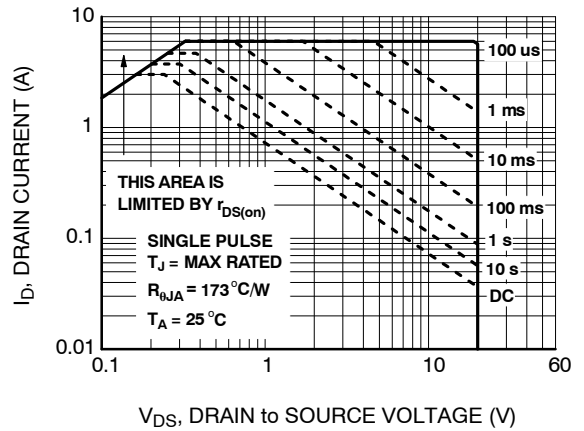


Figure 10. Forward Bias Safe Operating Area

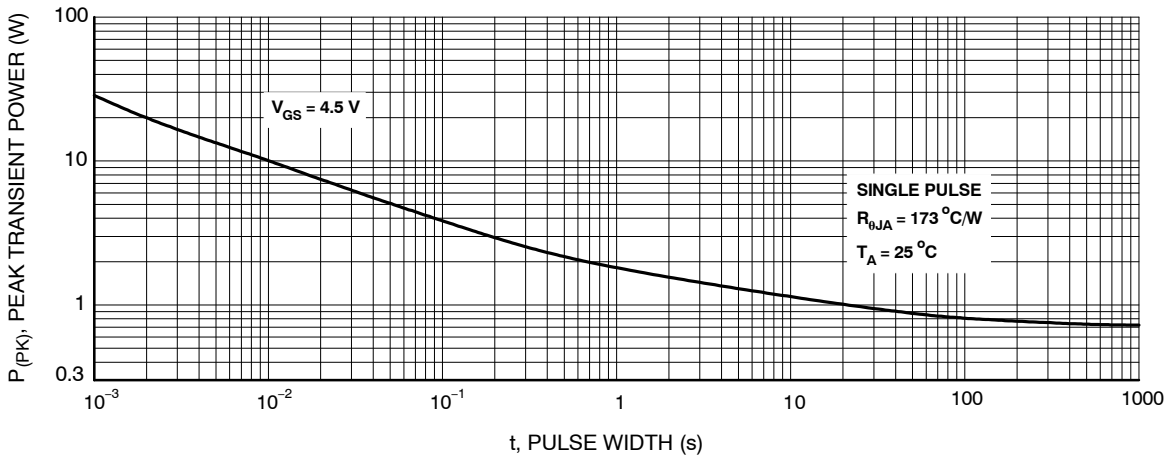


Figure 11. Single Pulse Maximum Power Dissipation

TYPICAL CHARACTERISTICS (continued)

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

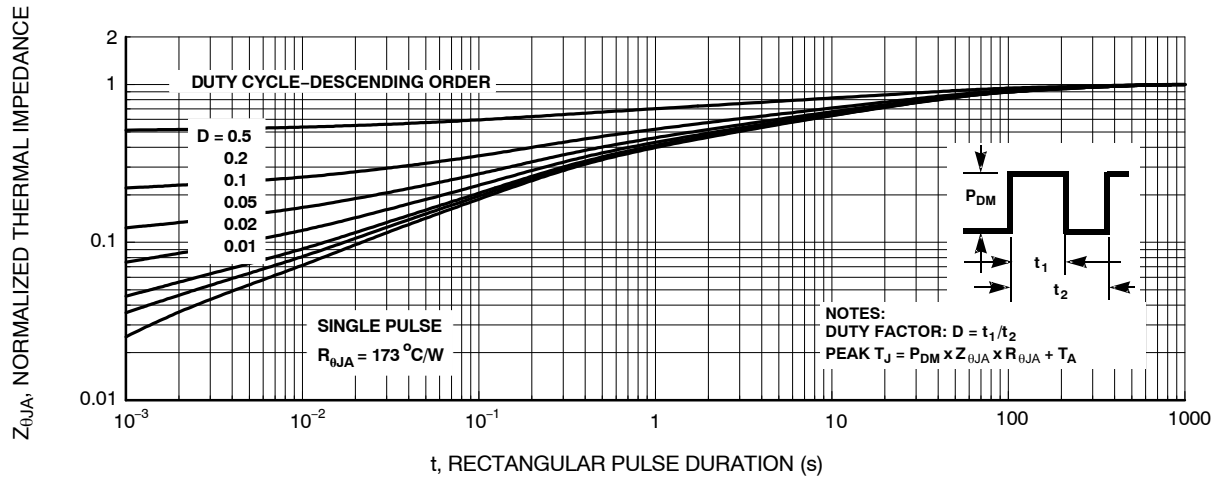


Figure 12. Junction to Ambient Transient Thermal Response Curve

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# MECHANICAL CASE OUTLINE

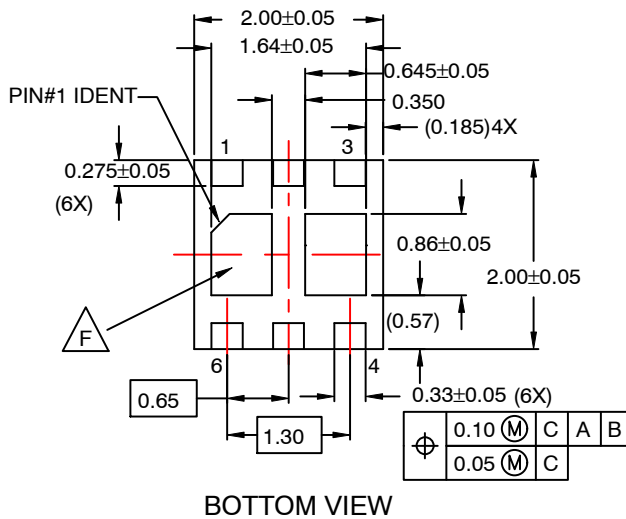
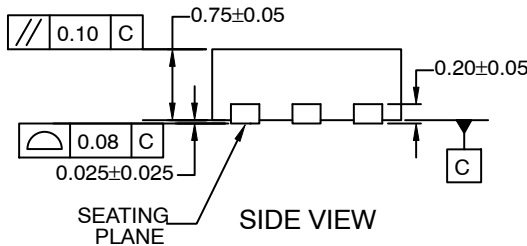
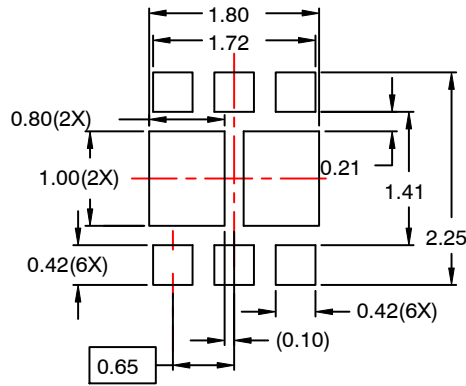
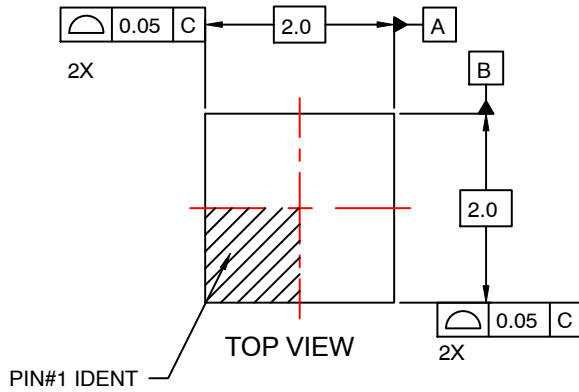
## PACKAGE DIMENSIONS

ON Semiconductor®



WDFN6 2x2, 0.65P  
CASE 511DA  
ISSUE O

DATE 31 JUL 2016



NOTES:

- A. CONFORM TO JEDEC REGISTRATIONS MO-229, VARIATION VCCC, EXCEPT WHERE NOTED.
- B. DIMENSIONS ARE IN MILLIMETERS.
- C. DIMENSIONS AND TOLERANCES PER ASME Y14.5M, 2009.
- D. LAND PATTERN RECOMMENDATION IS EXISTING INDUSTRY LAND PATTERN.
- E. NON-JEDEC DUAL DAP

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