

# MOSFET – Dual N-Channel, POWER TRENCH®

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

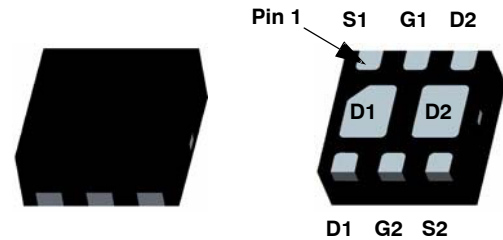
## Applications

- Baseband Switch
- Loadswitch
- DC-DC Buck Converters

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

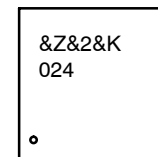
Symbol	Parameter	Ratings	Unit
$V_{DS}$	Drain to Source Voltage	20	V
$V_{GS}$	Gate to Source Voltage	±8	V
$I_D$	Drain Current – Continuous (Note 1a)	5.0	A
	– Pulsed	6.0	
$P_D$	Power Dissipation (Note 1a)	1.4	W
	Power Dissipation (Note 1b)	0.7	
$T_J$ , $T_{STG}$	Operating and Storage Junction Temperature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



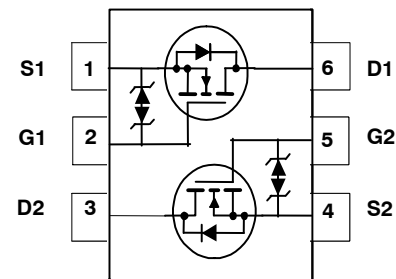
WDFN6 2x2, 0.65P  
(MicroFET™ 2x2)  
CASE 511DA

## 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
--------	-----------	----------------	-----	-----	-----	------

### 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		

**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

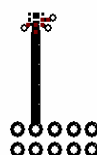
Product parametric performance is indicated in the Electrical Characteristics for the listed test conditions, unless otherwise noted. Product performance may not be indicated by the Electrical Characteristics if operated under different conditions.

**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.
  - $R_{\theta JA} = 86^\circ\text{C/W}$  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.
  - $R_{\theta JA} = 173^\circ\text{C/W}$  when mounted on a a minimum pad of 2 oz copper. For single operation.
  - $R_{\theta JA} = 69^\circ\text{C/W}$  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.
  - $R_{\theta JA} = 151^\circ\text{C/W}$  when mounted on a a minimum pad of 2 oz copper. For dual operation.



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



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



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



d)  $151^\circ\text{C/W}$  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

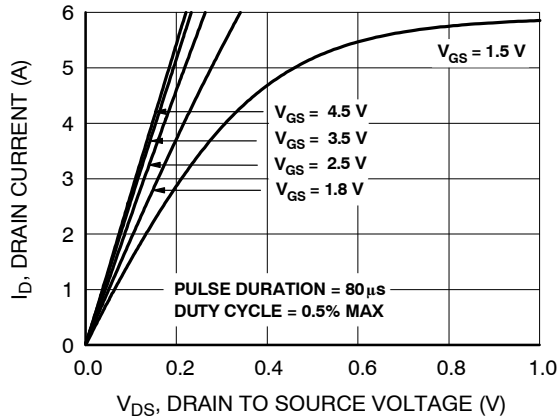
(T<sub>J</sub> = 25°C unless otherwise noted)

Figure 1. On-Region Characteristics

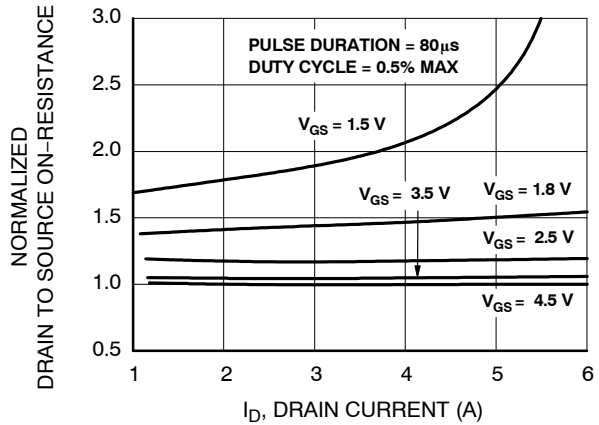


Figure 2. Normalized On-Resistance vs Drain Current and Gate Voltage

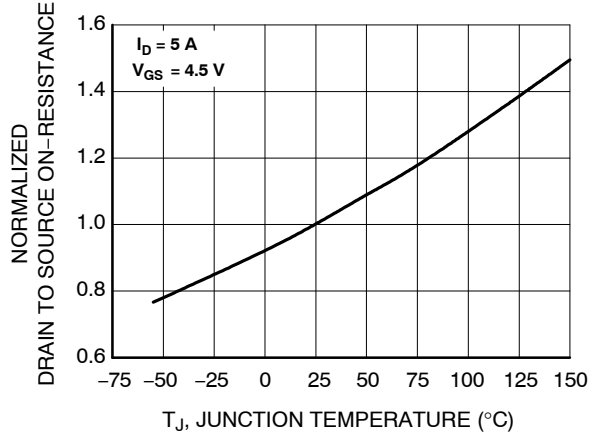


Figure 3. Normalized On-Resistance vs Junction Temperature

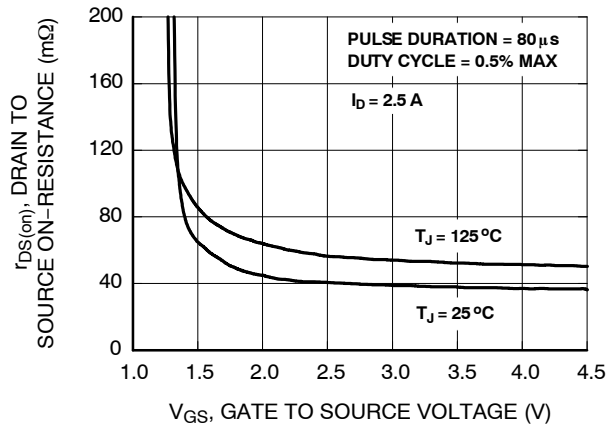


Figure 4. On-Resistance vs Gate to Source Voltage

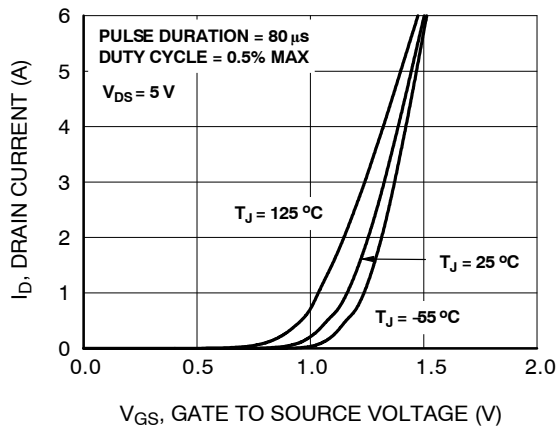


Figure 5. Transfer Characteristics

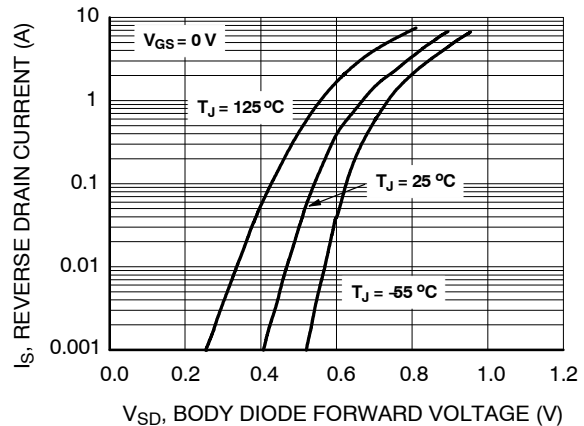


Figure 6. Source to Drain Diode Forward Voltage vs Source Current

## TYPICAL CHARACTERISTICS (continued)

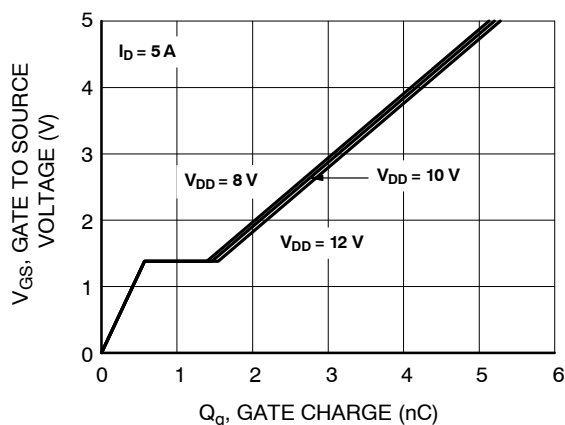
(T<sub>J</sub> = 25°C unless otherwise noted)

Figure 7. Gate Charge Characteristics

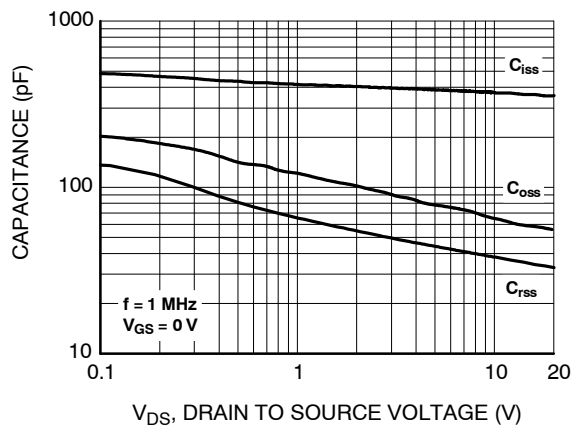


Figure 8. Capacitance vs Drain to Source Voltage

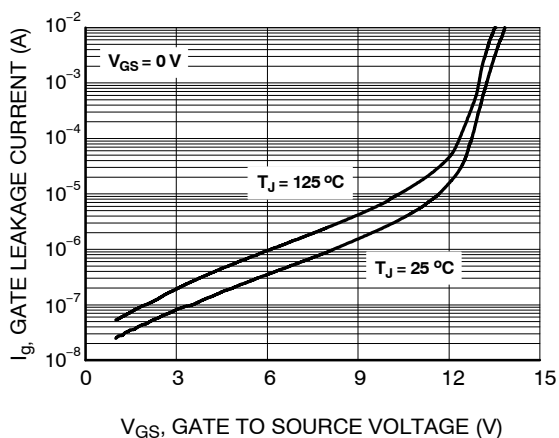


Figure 9. Gate Leakage Current vs. Gate to Source Voltage

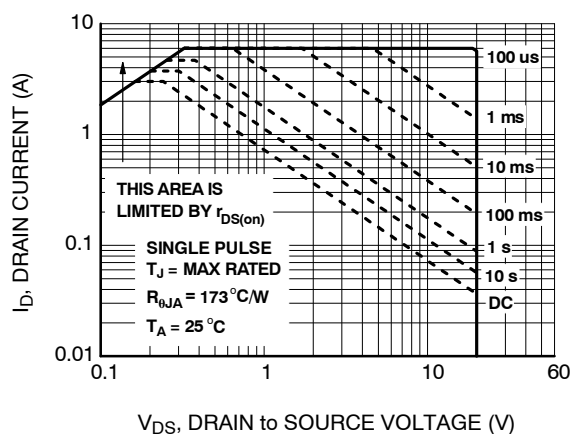


Figure 10. Forward Bias Safe Operating Area

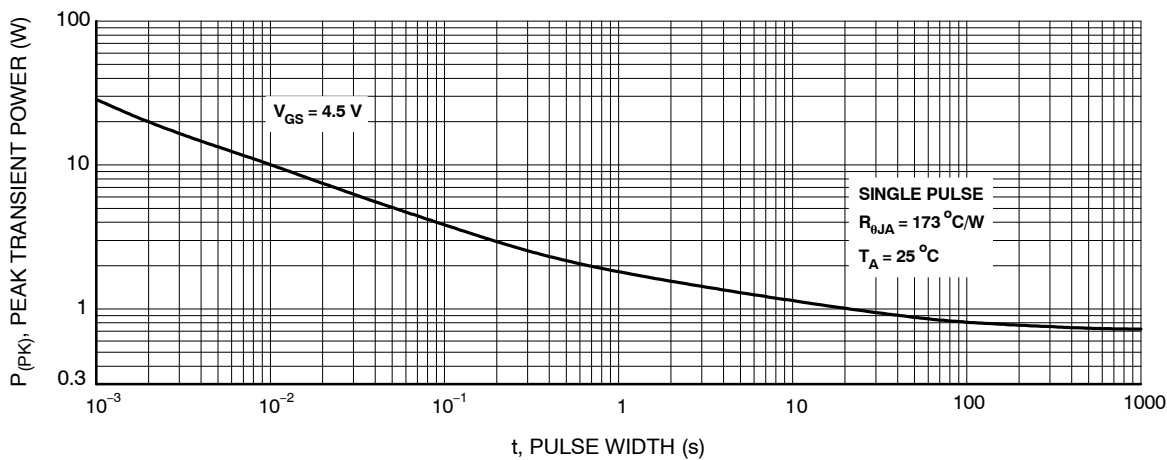


Figure 11. Single Pulse Maximum Power Dissipation

## TYPICAL CHARACTERISTICS (continued)

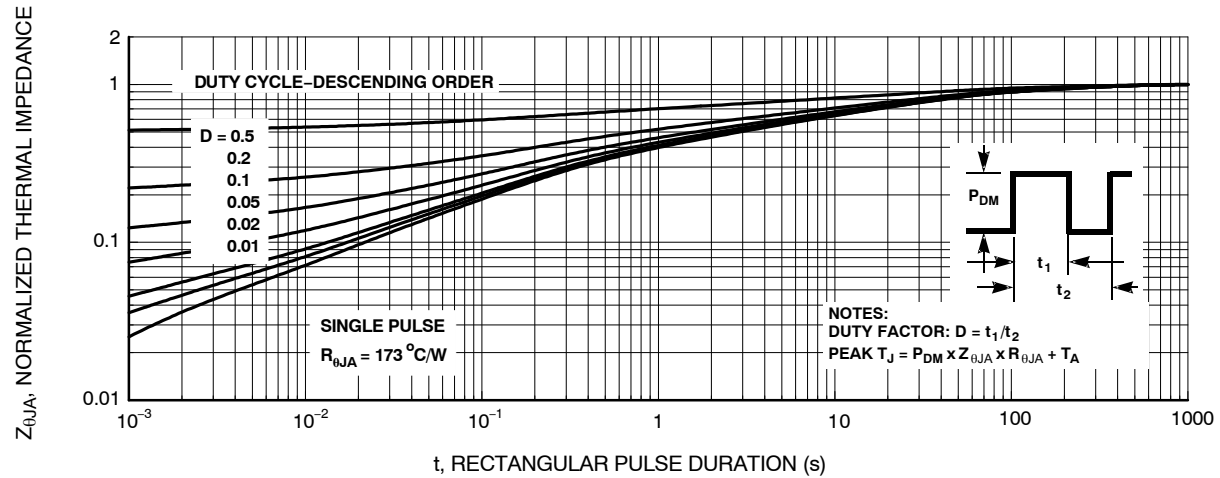
(T<sub>J</sub> = 25°C unless otherwise noted)

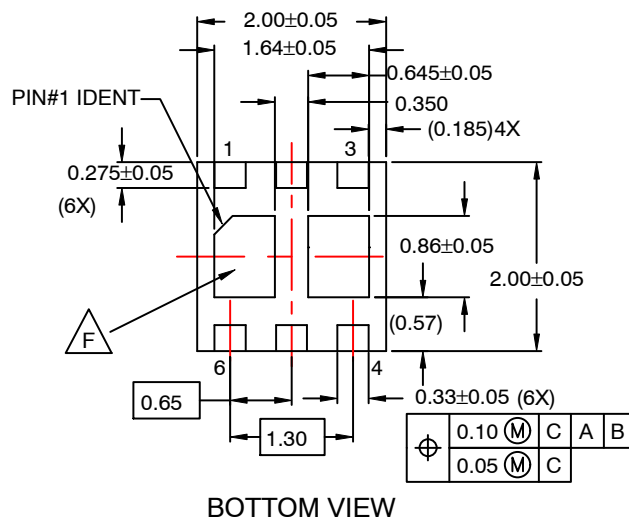
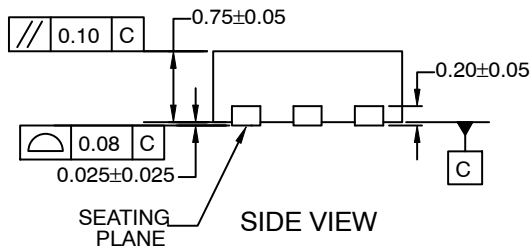
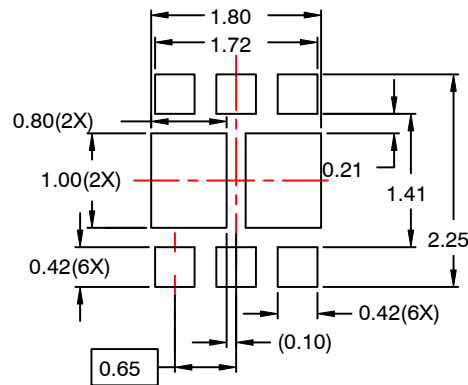
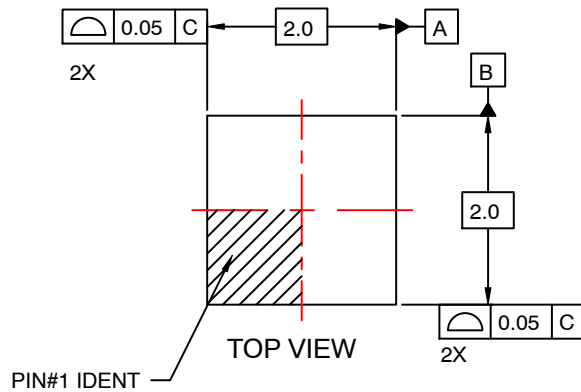
Figure 12. Junction to Ambient Transient Thermal Response Curve

POWERTRENCH is a registered trademark of Semiconductor Components Industries, LLC dba "onsemi" or its affiliates and/or subsidiaries in the United States and/or other countries.

MicroFET is trademark of Semiconductor Components Industries, LLC dba "onsemi" or its affiliates and/or subsidiaries in the United States and/or other countries.

### 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.

F. NON-JEDEC DUAL DAP

DOCUMENT NUMBER:	98AON13615G	Electronic versions are uncontrolled except when accessed directly from the Document Repository. Printed versions are uncontrolled except when stamped "CONTROLLED COPY" in red.
DESCRIPTION:	WDFN6 2X2, 0.65P	PAGE 1 OF 1

ON Semiconductor and  are trademarks of Semiconductor Components Industries, LLC dba ON Semiconductor or its subsidiaries in the United States and/or other countries. ON Semiconductor reserves the right to make changes without further notice to any products herein. ON Semiconductor makes no warranty, representation or guarantee regarding the suitability of its products for any particular purpose, nor does ON Semiconductor assume any liability arising out of the application or use of any product or circuit, and specifically disclaims any and all liability, including without limitation special, consequential or incidental damages. ON Semiconductor does not convey any license under its patent rights nor the rights of others.

**onsemi**, **Onsemi**, and other names, marks, and brands are registered and/or common law trademarks of Semiconductor Components Industries, LLC dba "**onsemi**" or its affiliates and/or subsidiaries in the United States and/or other countries. **onsemi** owns the rights to a number of patents, trademarks, copyrights, trade secrets, and other intellectual property. A listing of **onsemi**'s product/patent coverage may be accessed at [www.onsemi.com/site/pdf/Patent-Marking.pdf](http://www.onsemi.com/site/pdf/Patent-Marking.pdf). **onsemi** reserves the right to make changes at any time to any products or information herein, without notice. The information herein is provided "as-is" and **onsemi** makes no warranty, representation or guarantee regarding the accuracy of the information, product features, availability, functionality, or suitability of its products for any particular purpose, nor does **onsemi** assume any liability arising out of the application or use of any product or circuit, and specifically disclaims any and all liability, including without limitation special, consequential or incidental damages. Buyer is responsible for its products and applications using **onsemi** products, including compliance with all laws, regulations and safety requirements or standards, regardless of any support or applications information provided by **onsemi**. "Typical" parameters which may be provided in **onsemi** data sheets and/or specifications can and do vary in different applications and actual performance may vary over time. All operating parameters, including "Typicals" must be validated for each customer application by customer's technical experts. **onsemi** does not convey any license under any of its intellectual property rights nor the rights of others. **onsemi** products are not designed, intended, or authorized for use as a critical component in life support systems or any FDA Class 3 medical devices or medical devices with a same or similar classification in a foreign jurisdiction or any devices intended for implantation in the human body. Should Buyer purchase or use **onsemi** products for any such unintended or unauthorized application, Buyer shall indemnify and hold **onsemi** and its officers, employees, subsidiaries, affiliates, and distributors harmless against all claims, costs, damages, and expenses, and reasonable attorney fees arising out of, directly or indirectly, any claim of personal injury or death associated with such unintended or unauthorized use, even if such claim alleges that **onsemi** was negligent regarding the design or manufacture of the part. **onsemi** is an Equal Opportunity/Affirmative Action Employer. This literature is subject to all applicable copyright laws and is not for resale in any manner.

## ADDITIONAL INFORMATION

### TECHNICAL PUBLICATIONS:

Technical Library: [www.onsemi.com/design/resources/technical-documentation](http://www.onsemi.com/design/resources/technical-documentation)  
onsemi Website: [www.onsemi.com](http://www.onsemi.com)

### ONLINE SUPPORT: [www.onsemi.com/support](http://www.onsemi.com/support)

For additional information, please contact your local Sales Representative at  
[www.onsemi.com/support/sales](http://www.onsemi.com/support/sales)