

# MOSFET – Single, N-Channel, POWERTRENCH<sup>®</sup>, 1.5 V Specified

20 V, 9.5 A, 23 mΩ

## FDMA410NZ

### General Description

This Single N-Channel MOSFET has been designed using onsemi's advanced POWERTRENCH process to optimize the  $R_{DS(on)}$  @  $V_{GS} = 1.5$  V on special MicroFET™ leadframe.

### 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
- This Device is Pb-Free, Halide Free and is RoHS Compliant

### Applications

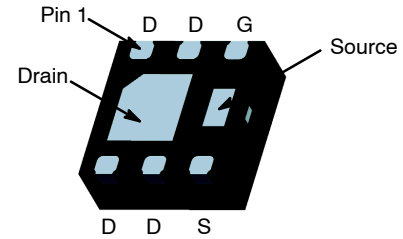
- Li-Ion Battery Pack
- Baseband Switch
- Load Switch
- DC-DC Conversion

### ABSOLUTE 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) – Pulsed	$T_A = 25^\circ\text{C}$ 9.5 24	A
$P_D$	Power Dissipation – (Note 1a) – (Note 1b)	$T_A = 25^\circ\text{C}$ 2.4 $T_A = 25^\circ\text{C}$ 0.9	W
$T_J, T_{STG}$	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.

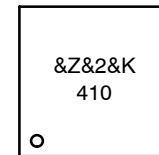
$V_{DS}$	$R_{DS(on)}$ MAX	$I_D$ MAX
20 V	23 mΩ @ 4.5 V	9.5 A
	29 mΩ @ 2.5 V	
	36 mΩ @ 1.8 V	
	50 mΩ @ 1.5 V	



Bottom

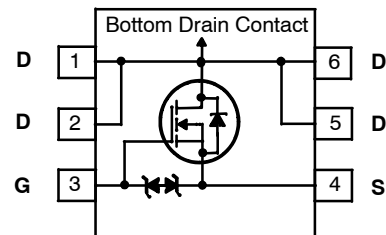
WDFN6 2x2, 0.65P  
(MicroFET 2x2)  
CASE 511CZ

### MARKING DIAGRAM



- &Z = Assembly Plant Code
- &2 = 2-Digit Date Code
- &K = 2-Digits Lot Run Traceability Code
- 410 = Specific Device Code

### PIN ASSIGNMENT



### ORDERING INFORMATION

Device	Package	Shipping†
FDMA410NZ	WDFN6 (Pb-Free, Halide Free)	3000 / Tape & Reel

†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](#).

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## THERMAL CHARACTERISTICS

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	

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

Symbol	Parameter	Test Condition	Min	Typ	Max	Unit
<b>OFF CHARACTERISTICS</b>						
$BV_{DSS}$	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 $25^\circ\text{C}$	–	17	–	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	$V_{GS} = 4.5 \text{ V}$ , $I_D = 9.5 \text{ A}$	–	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	
		$V_{GS} = 4.5 \text{ V}$ , $I_D = 9.5 \text{ A}$ , $T_J = 125^\circ\text{C}$	–	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	$V_{DD} = 10 \text{ V}$ , $I_D = 9.5 \text{ A}$ , $V_{GS} = 4.5 \text{ V}$ , $R_{GEN} = 6 \Omega$	–	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	$V_{DD} = 10 \text{ V}$ , $I_D = 9.5 \text{ A}$ , $V_{GS} = 4.5 \text{ V}$	–	10	14	nC
$Q_{gs}$	Gate to Source Charge		–	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

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.

# FDMA410NZ

## NOTES:

1.  $R_{\theta JA}$  is determined with the device mounted on a 1 in<sup>2</sup> pad 2 oz copper pad on a 1.5 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. 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

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

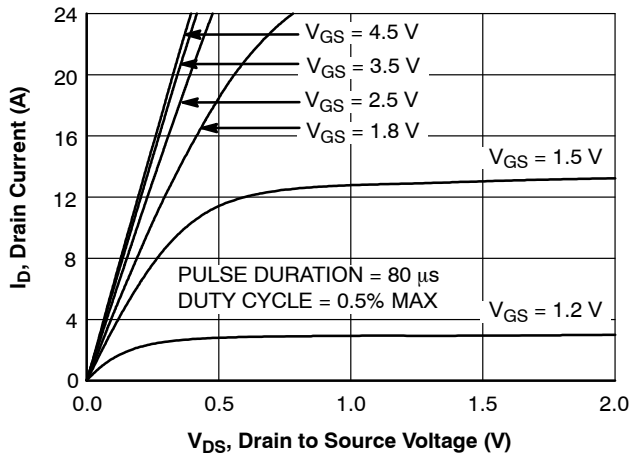


Figure 1. On-Region Characteristics

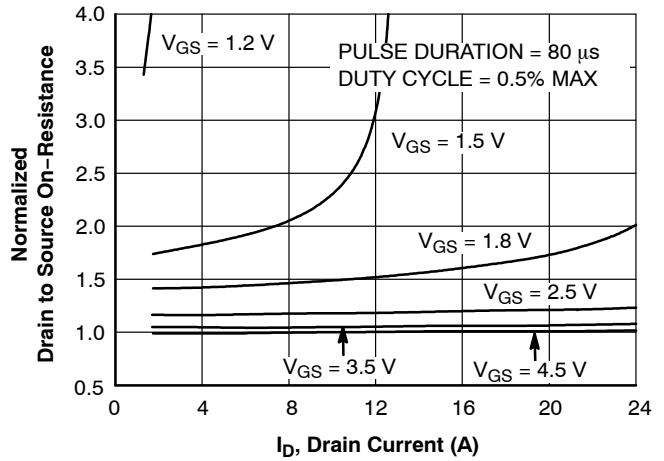


Figure 2. Normalized On-Resistance vs. Drain Current and Gate Voltage

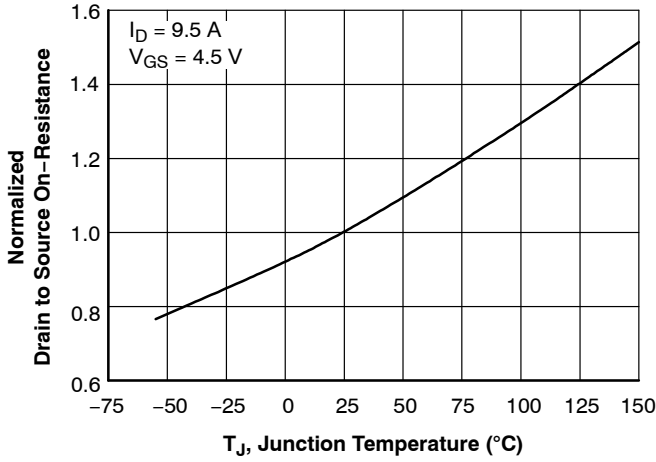


Figure 3. Normalized On-Resistance vs. Junction Temperature

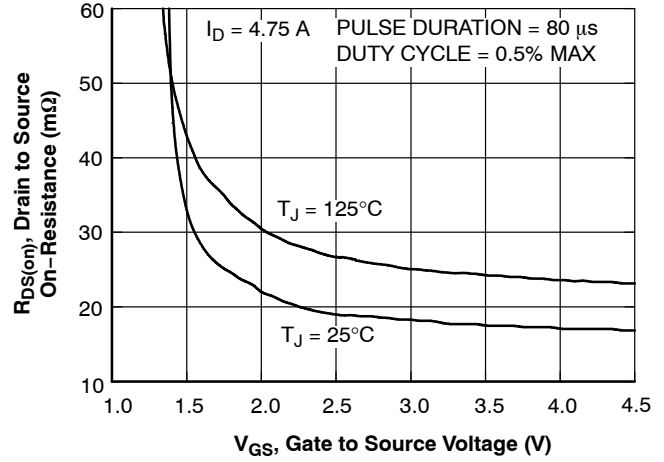


Figure 4. On-Resistance vs. Gate to Source Voltage

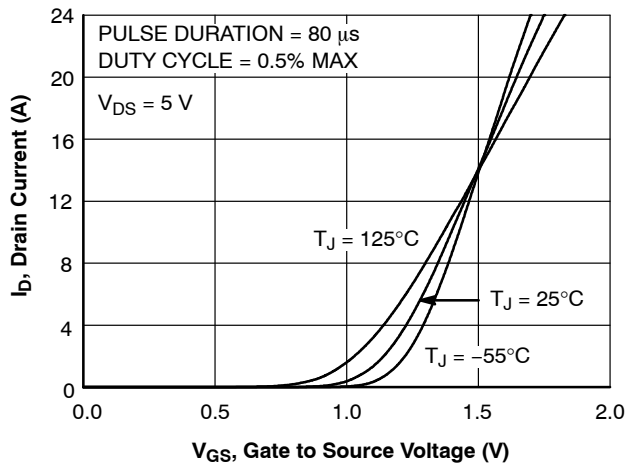


Figure 5. Transfer Characteristics

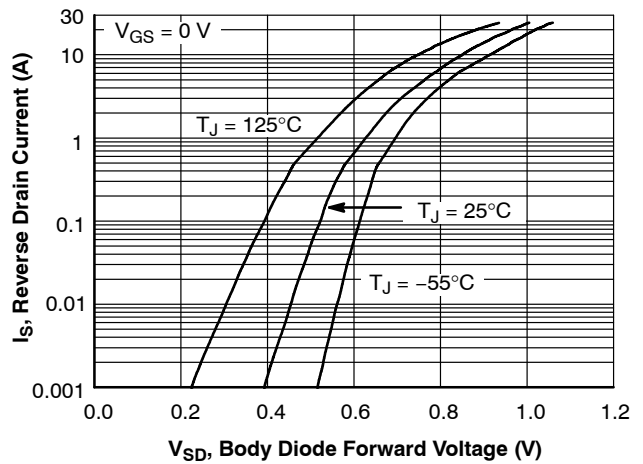


Figure 6. Source to Drain Diode Forward Voltage vs. Source Current

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## TYPICAL CHARACTERISTICS (continued)

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

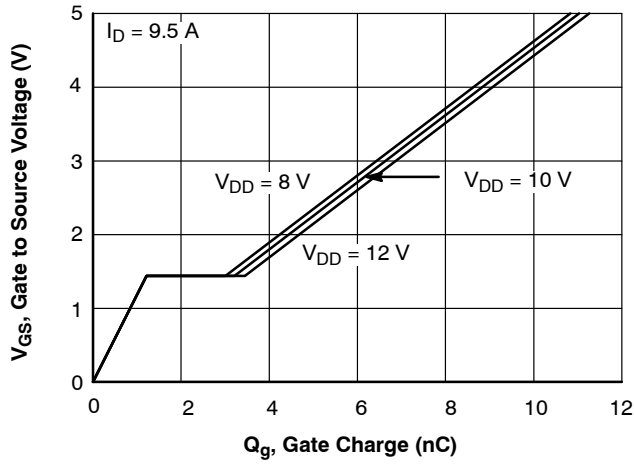


Figure 7. Gate Charge Characteristics

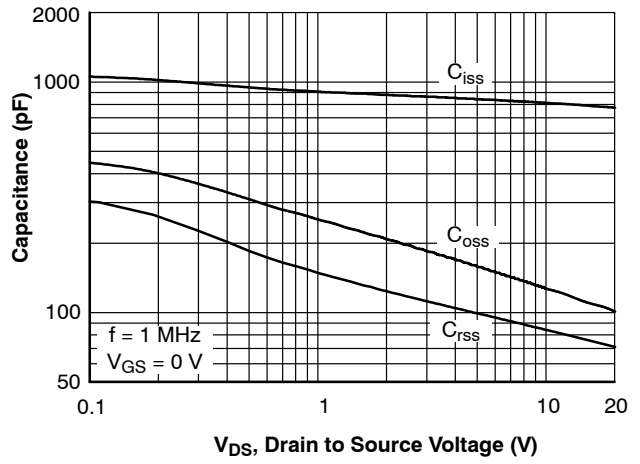


Figure 8. Capacitance vs. Drain to Source Voltage

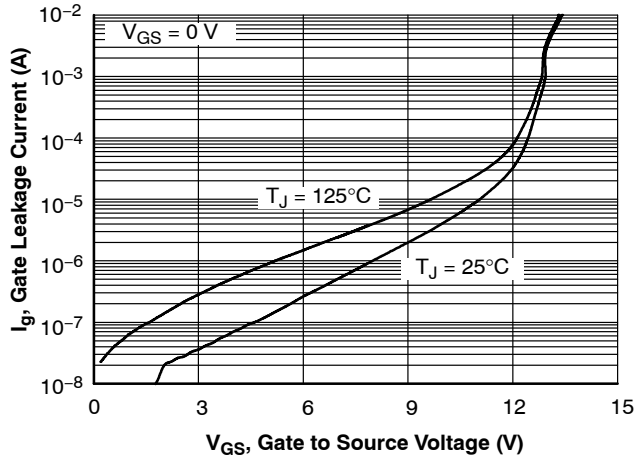


Figure 9. Gate Leakage Current vs. Gate to Source Voltage

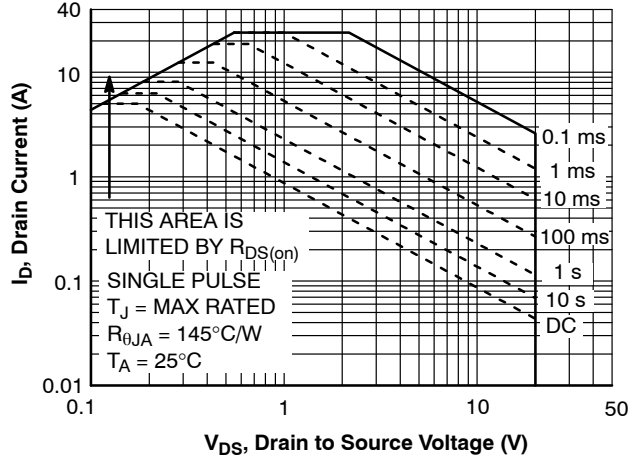


Figure 10. Forward Bias Safe Operating Area

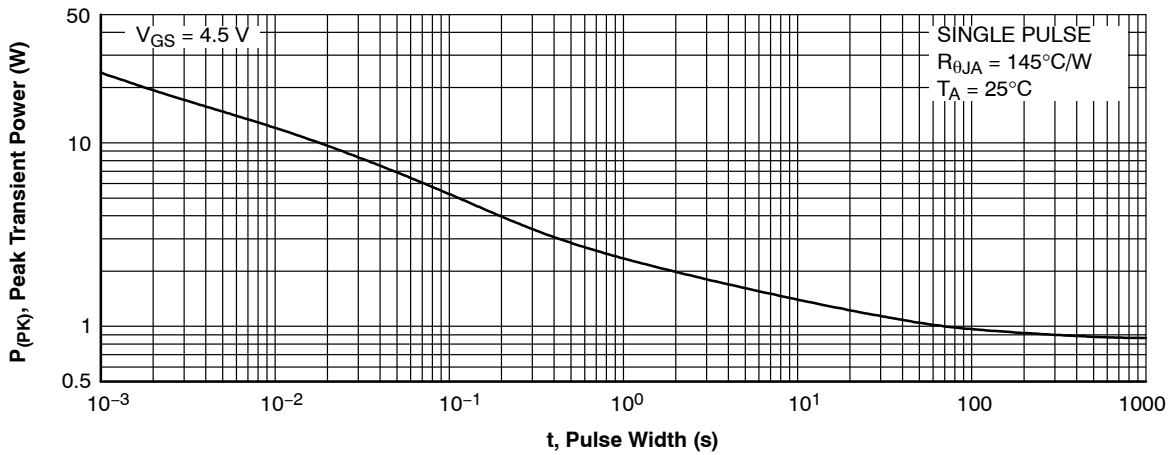


Figure 11. Single Pulse Maximum Power Dissipation

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## TYPICAL CHARACTERISTICS (continued)

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

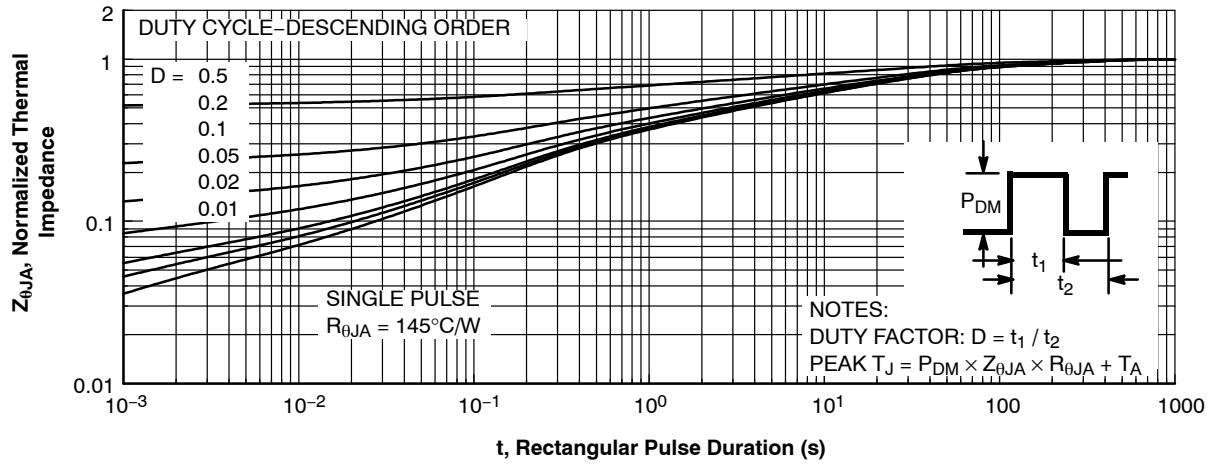


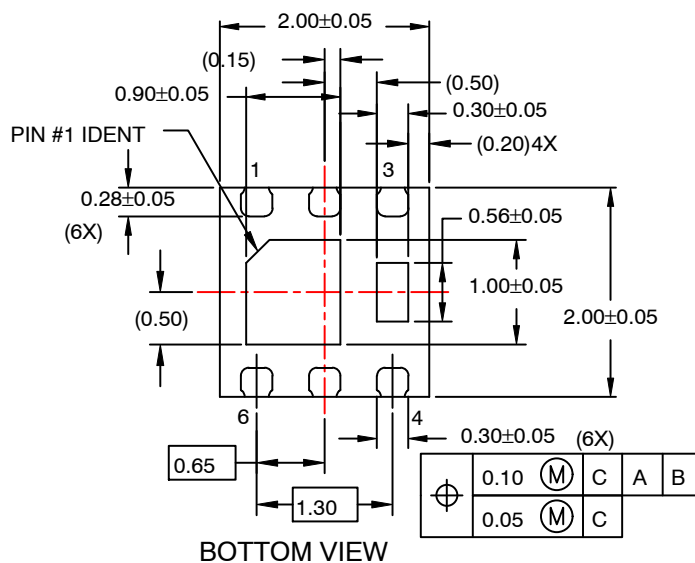
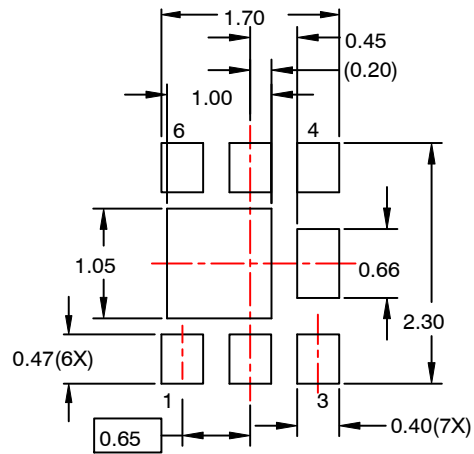
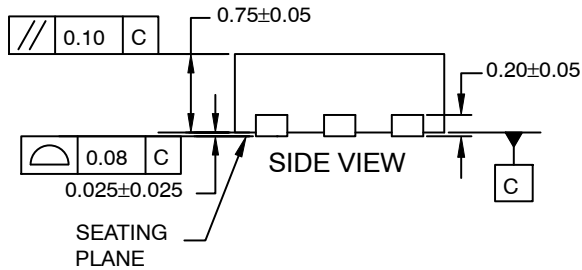
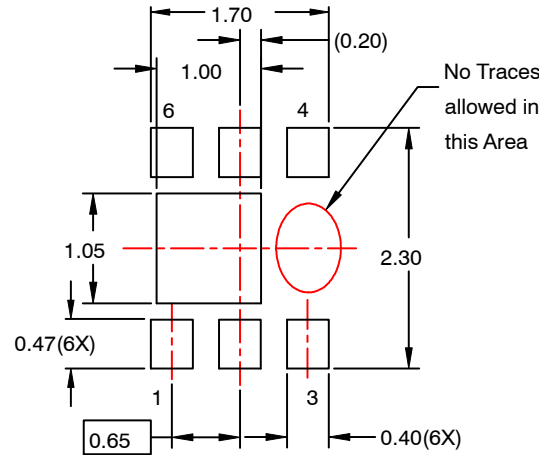
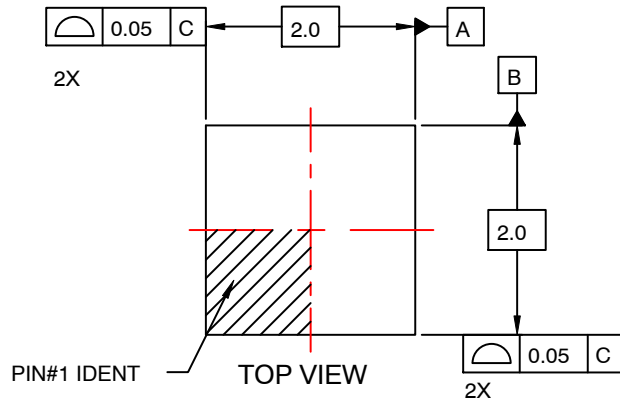
Figure 12. Junction-to-Ambient Transient Thermal Response Curve

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**WDFN6 2x2, 0.65P**  
**CASE 511CZ**  
**ISSUE O**

DATE 31 JUL 2016



**NOTES:**

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- C. DIMENSIONS AND TOLERANCES PER ASME Y14.5M, 2009.
- D. LAND PATTERN RECOMMENDATION IS EXISTING INDUSTRY LAND PATTERN.

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