

# MOSFET – Single, N-Channel, 2.5 V, Specified, POWERTRENCH®

20 V, 5.7 A, 30 mΩ

## FDMA420NZ

### 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™ leadframe.

### Features

- $R_{DS(on)} = 30$  mΩ @  $V_{GS} = 4.5$  V,  $I_D = 5.7$  A
- $R_{DS(on)} = 40$  mΩ @  $V_{GS} = 2.5$  V,  $I_D = 5.0$  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-Ion Battery Pack

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

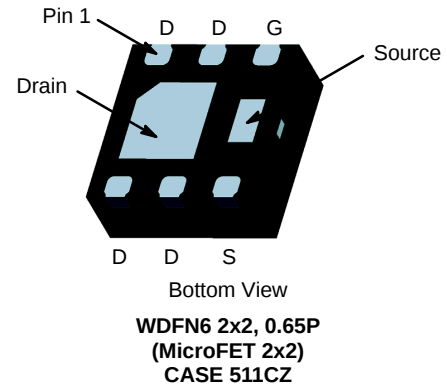
| Symbol         | Parameter                                                  | Ratings     | Unit |
|----------------|------------------------------------------------------------|-------------|------|
| $V_{DSS}$      | Drain-Source Voltage                                       | 20          | V    |
| $V_{GSS}$      | Gate-Source Voltage                                        | ±12         | V    |
| $I_D$          | Drain Current<br>– Continuous (Note 1a)<br>– Pulsed        | 5.7<br>24   | A    |
| $P_D$          | Power Dissipation (Steady State)<br>(Note 1a)<br>(Note 1b) | 2.4<br>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.

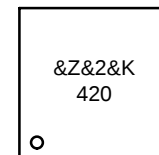
### THERMAL CHARACTERISTICS ( $T_A = 25^\circ\text{C}$ , unless otherwise noted)

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

| $V_{DSS}$ | $R_{DS(on)}$ MAX | $I_D$ MAX |
|-----------|------------------|-----------|
| 20 V      | 30 mΩ @ 4.5 V    | 5.7 A     |
|           | 40 mΩ @ 2.5 V    |           |

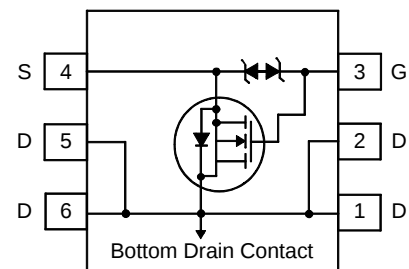


### MARKING DIAGRAM



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

### PIN ASSIGNMENT



### ORDERING INFORMATION

See detailed ordering and shipping information on page 5 of this data sheet.

# FDMA420NZ

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

| Symbol | Parameter | Test Condition | Min | Typ | Max | Unit |
|--------|-----------|----------------|-----|-----|-----|------|
|--------|-----------|----------------|-----|-----|-----|------|

### OFF CHARACTERISTICS

|                                      |                                           |                                                |    |    |     |       |
|--------------------------------------|-------------------------------------------|------------------------------------------------|----|----|-----|-------|
| B <sub>VDSS</sub>                    | Drain-Source Breakdown Voltage            | V <sub>GS</sub> = 0 V, I <sub>D</sub> = 250 μA | 20 | –  | –   | V     |
| $\frac{\Delta B_{VDSS}}{\Delta T_J}$ | Breakdown Voltage Temperature Coefficient | I <sub>D</sub> = 250 μA, Referenced to 25°C    | –  | 12 | –   | mV/°C |
| I <sub>DSS</sub>                     | Zero Gate Voltage Drain Current           | V <sub>DS</sub> = 16 V, V <sub>GS</sub> = 0 V  | –  | –  | 1   | μA    |
| I <sub>GSS</sub>                     | Gate-Body Leakage                         | V <sub>GS</sub> = ±12V, V <sub>DS</sub> = 0 V  | –  | –  | ±10 | μA    |

### ON CHARACTERISTICS

|                                        |                                                |                                                                         |     |      |     |       |
|----------------------------------------|------------------------------------------------|-------------------------------------------------------------------------|-----|------|-----|-------|
| V <sub>GS(th)</sub>                    | Gate Threshold Voltage                         | V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = 250 μA             | 0.6 | 0.83 | 1.5 | V     |
| $\frac{\Delta V_{GS(th)}}{\Delta T_J}$ | Gate Threshold Voltage Temperature Coefficient | I <sub>D</sub> = 250 μA, Referenced to 25°C                             | –   | –3.1 | –   | mV/°C |
| R <sub>DS(on)</sub>                    | Static Drain-Source On-Resistance              | V <sub>GS</sub> = 4.5 V, I <sub>D</sub> = 5.7 A                         | –   | 16.8 | 30  | mΩ    |
|                                        |                                                | V <sub>GS</sub> = 4.0 V, I <sub>D</sub> = 5.7 A                         | –   | 17.3 | 31  |       |
|                                        |                                                | V <sub>GS</sub> = 3.1 V, I <sub>D</sub> = 5.0 A                         | –   | 18.9 | 33  |       |
|                                        |                                                | V <sub>GS</sub> = 2.5 V, I <sub>D</sub> = 5.0 A                         | –   | 21.2 | 40  |       |
|                                        |                                                | V <sub>GS</sub> = 4.5 V, I <sub>D</sub> = 5.7 A, T <sub>J</sub> = 150°C | –   | 24.8 | 44  |       |
| g <sub>FS</sub>                        | Forward Transconductance                       | V <sub>DS</sub> = 5 V, I <sub>D</sub> = 5.7 A                           | –   | 28.3 | –   | S     |

### DYNAMIC CHARACTERISTICS

|                  |                              |                                                            |   |      |     |    |
|------------------|------------------------------|------------------------------------------------------------|---|------|-----|----|
| C <sub>iss</sub> | Input Capacitance            | V <sub>DS</sub> = 10 V, V <sub>GS</sub> = 0 V, f = 1.0 MHz | – | 701  | 935 | pF |
| C <sub>oss</sub> | Output Capacitance           |                                                            | – | 163  | 220 | pF |
| C <sub>rss</sub> | Reverse Transfer Capacitance |                                                            | – | 125  | 190 | pF |
| R <sub>G</sub>   | Gate Resistance              | f = 1.0 MHz                                                | – | 1.92 | –   | Ω  |

### SWITCHING CHARACTERISTICS

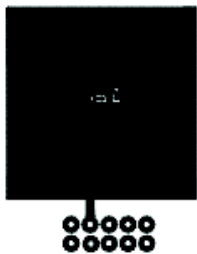
|                     |                     |                                                                                              |   |      |    |    |
|---------------------|---------------------|----------------------------------------------------------------------------------------------|---|------|----|----|
| t <sub>d(on)</sub>  | Turn-On Delay Time  | V <sub>DD</sub> = 10 V, I <sub>D</sub> = 1 A V <sub>GS</sub> = 4.5 V, R <sub>GEN</sub> = 6 Ω | – | 9.8  | 20 | ns |
| t <sub>r</sub>      | Turn-On Rise Time   |                                                                                              | – | 8.6  | 18 | ns |
| t <sub>d(off)</sub> | Turn-Off Delay Time |                                                                                              | – | 21.5 | 43 | ns |
| t <sub>f</sub>      | Turn-Off Fall Time  |                                                                                              | – | 8.6  | 18 | ns |
| Q <sub>g</sub>      | Total Gate Charge   | V <sub>DS</sub> = 10 V, I <sub>D</sub> = 5.7 A, V <sub>GS</sub> = 4.5 V                      | – | 8.8  | 12 | nC |
| Q <sub>gs</sub>     | Gate-Source Charge  |                                                                                              | – | 0.9  | 2  | nC |
| Q <sub>gd</sub>     | Gate-Drain Charge   |                                                                                              | – | 2.4  | 4  | nC |

### DRAIN-SOURCE CHARACTERISTICS

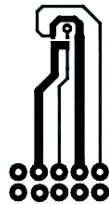
|                 |                                                       |                                               |   |      |     |    |
|-----------------|-------------------------------------------------------|-----------------------------------------------|---|------|-----|----|
| I <sub>S</sub>  | Maximum Continuous Drain-Source Diode Forward Current |                                               | – | –    | 2.0 | A  |
| 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> = 5.7 A, di/dt = 100 A/μs      | – | –    | 20  | ns |
| Q <sub>rr</sub> | Diode Reverse Recovery Charge                         |                                               | – | –    | 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.

1. R<sub>θJA</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 μs, 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)

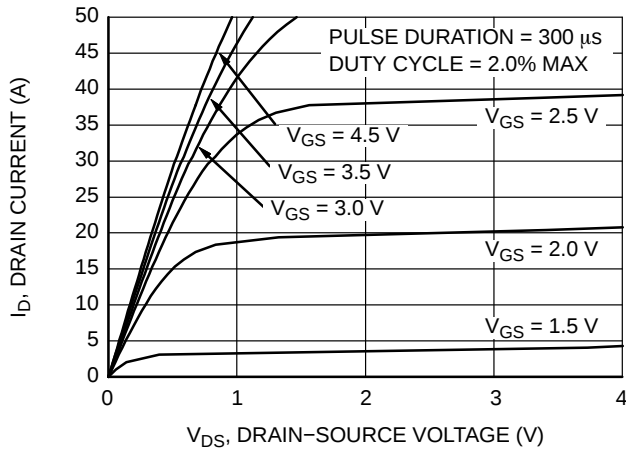


Figure 1. On Region Characteristics

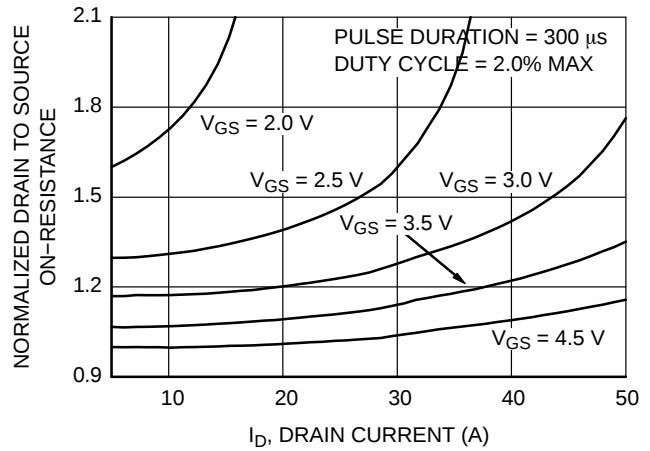


Figure 2. On-Resistance vs. Drain Current and Gate Voltage

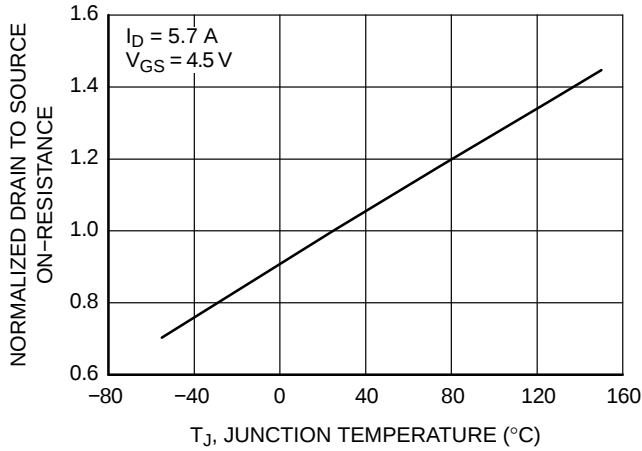


Figure 3. Normalized On Resistance vs. Junction Temperature

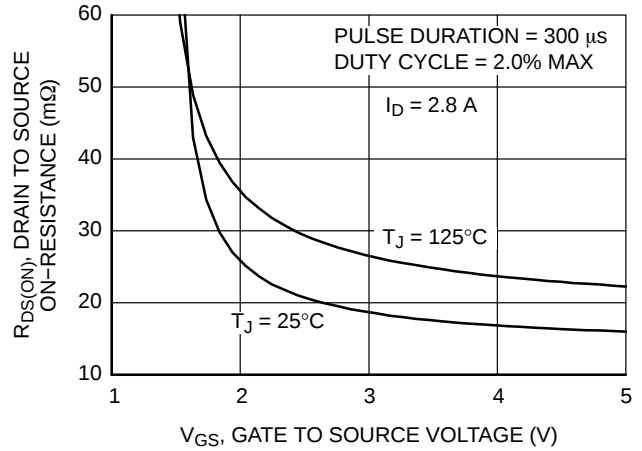


Figure 4. On-Resistance vs. Gate to Source Voltage

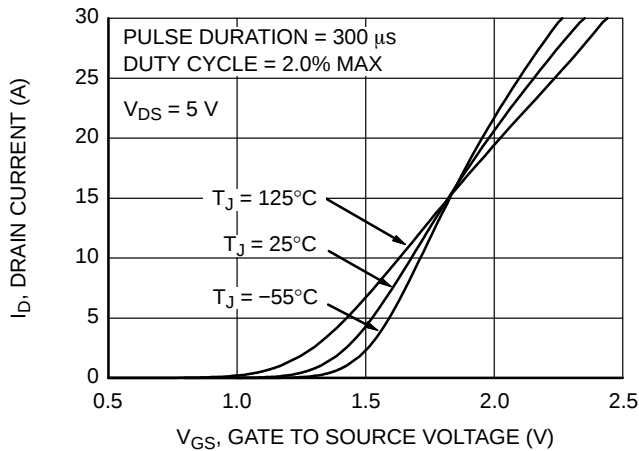


Figure 5. Transfer Characteristics

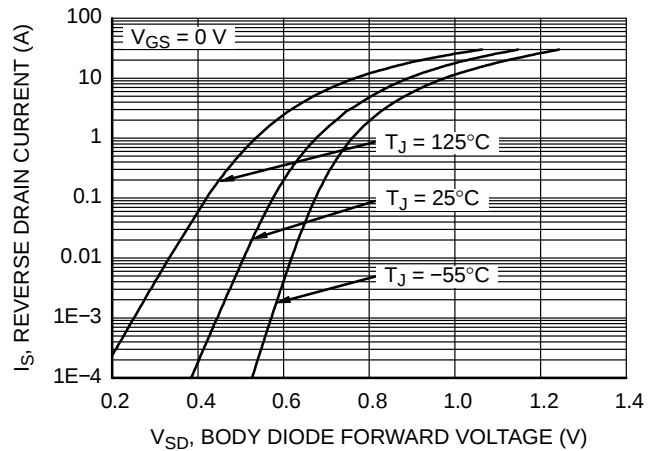


Figure 6. Source to Drain Diode Forward Voltage vs. Source Current

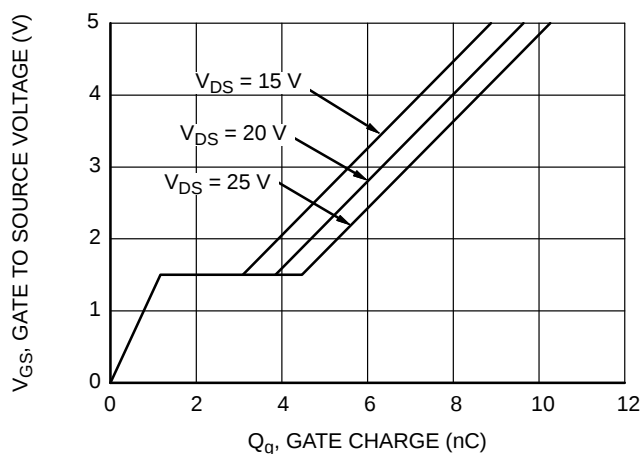
TYPICAL CHARACTERISTICS ( $T_J = 25^\circ\text{C}$ , unless otherwise noted) (continued)

Figure 7. Gate Charge Characteristics

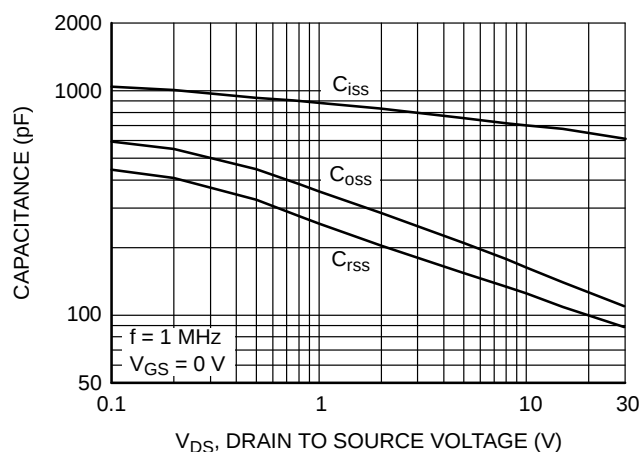


Figure 8. Capacitance vs. Drain to Source Voltage

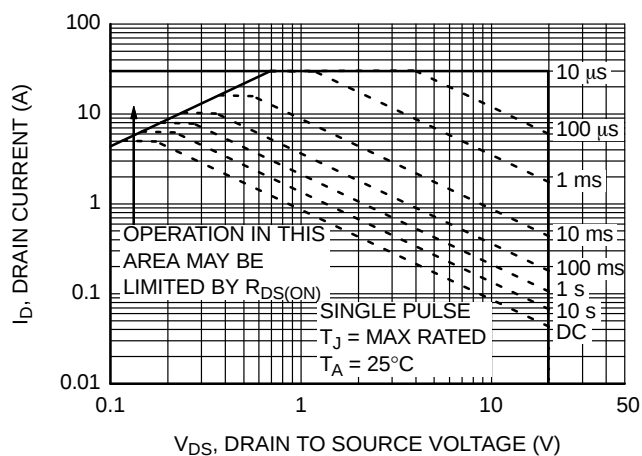


Figure 9. Forward Bias Safe Operating Area

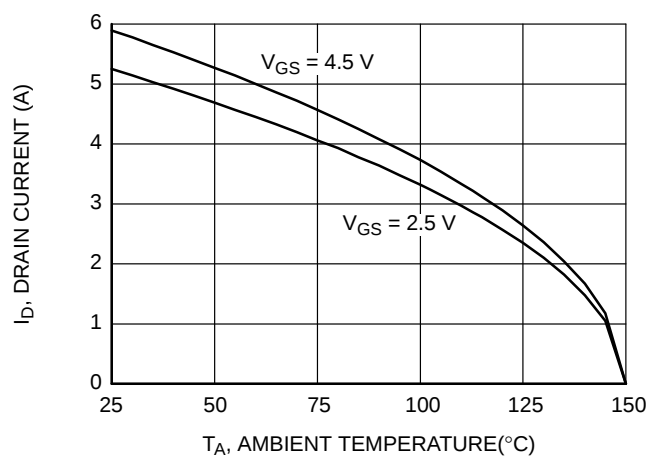


Figure 10. Maximum Continuous Drain Current vs. Ambient Temperature

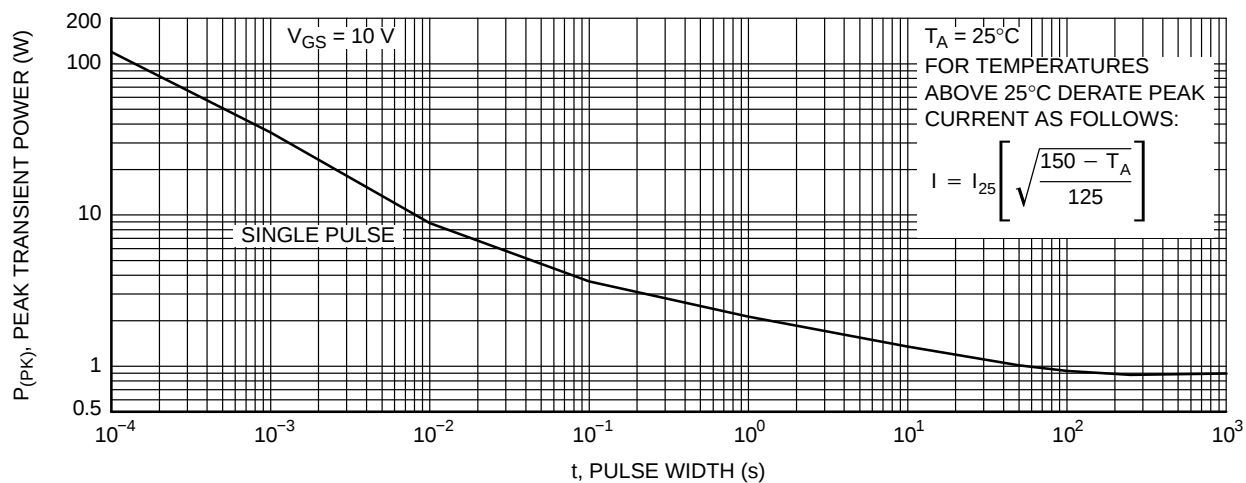


Figure 11. Single Pulse Maximum Power Dissipation

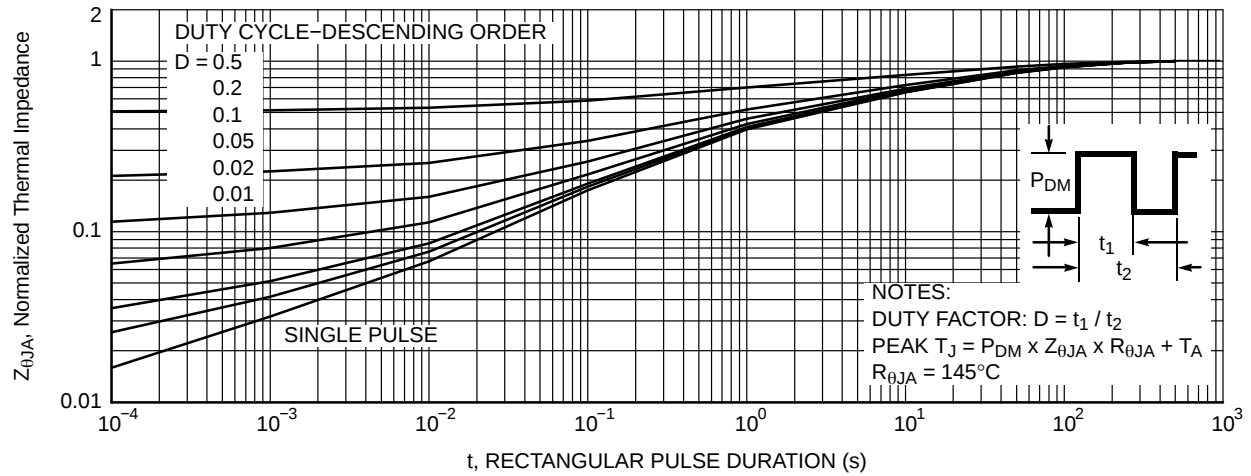
TYPICAL CHARACTERISTICS ( $T_J = 25^\circ\text{C}$ , unless otherwise noted) (continued)

Figure 12. Transient Thermal Response Curve

## PACKAGE MARKING AND ORDERING INFORMATION

| Device    | Device Marking | Package                                                      | Reel Size | Tape Width | Shipping <sup>†</sup> |
|-----------|----------------|--------------------------------------------------------------|-----------|------------|-----------------------|
| FDMA420NZ | 420            | WDFN6 2x2, 0.65P<br>(MicroFET 2x2)<br>(Pb-Free, Halide Free) | 7"        | 8 mm       | 3000 / Tape & Reel    |

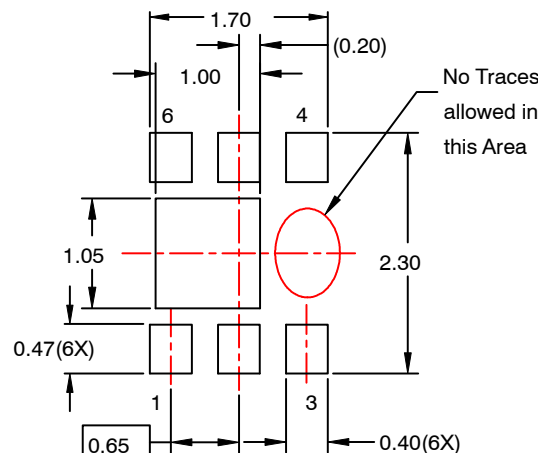
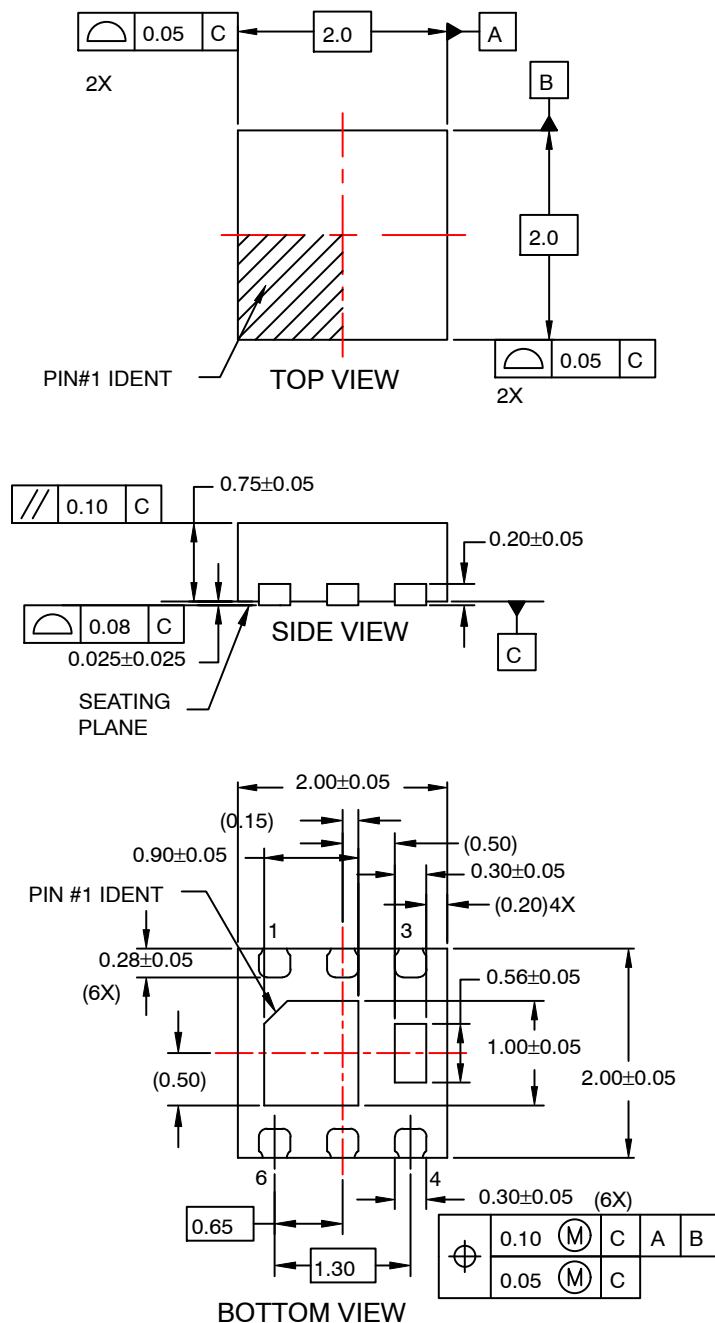
<sup>†</sup>For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, BRD8011/D.

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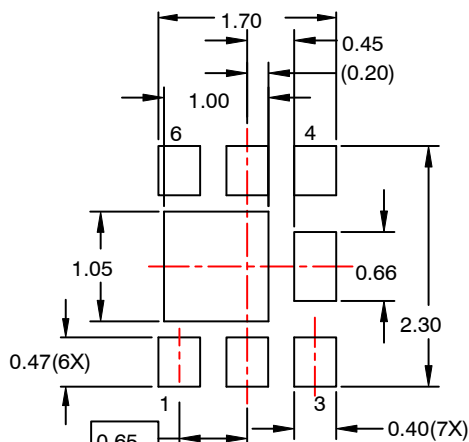
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**WDFN6 2x2, 0.65P**  
CASE 511CZ  
ISSUE O

DATE 31 JUL 2016



RECOMMENDED  
LAND PATTERN OPT 1



RECOMMENDED  
LAND PATTERN OPT 2

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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