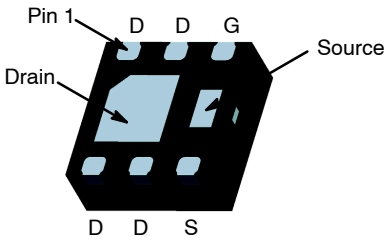
# MOSFET – Single, N-Channel, POWERTRENCH®, 1.5 V Specified

## 20 V, 9.5 A, 23 mΩ

# FDMA410NZ

| $V_{DS}$ | $R_{DS(on)}$ 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**

### 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.

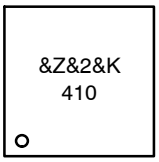
### Features

- 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

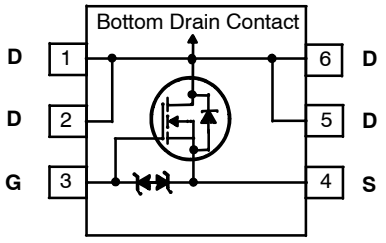
- Li−Ion Battery Pack
- Baseband Switch
- Load Switch
- DC−DC Conversion

### MARKING DIAGRAM




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

### PIN ASSIGNMENT




### ABSOLUTE MAXIMUM RATINGS ($T_A$ = 25°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<br>− Continuous (Note 1a)<br>− Pulsed | $T_A$ = 25°C | 9.5<br>24 | A |
| $P_D$ | Power Dissipation<br>− (Note 1a)<br>− (Note 1b) | $T_A$ = 25°C<br>$T_A$ = 25°C | 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.

### ORDERING INFORMATION

| Device | Package | Shipping† |
|---|---|---|
| FDMA410NZ | WDFN6<br>(Pb−Free,<br>Halide Free) | 3000 /<br>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.

## 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 | |

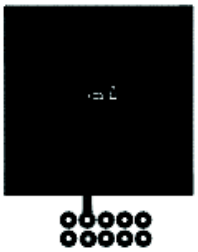
## ELECTRICAL CHARACTERISTICS ($T_J$ = 25°C unless otherwise noted)

| Symbol | Parameter | Test Condition | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| **OFF CHARACTERISTICS** | | | | | | |
| $BV_{DSS}$ | Drain to Source Breakdown Voltage | $I_D$ = 250 μA, $V_{GS}$ = 0 V | 20 | – | – | V |
| $\frac{\Delta BV_{DSS}}{\Delta T_J}$ | Breakdown Voltage Temperature Coefficient | $I_D$ = 250 μA, referenced to 25°C | – | 17 | – | mV/°C |
| $I_{DSS}$ | Zero Gate Voltage Drain Current | $V_{DS}$ = 16 V, $V_{GS}$ = 0 V | – | – | 1 | μA |
| $I_{GSS}$ | Gate to Source Leakage Current | $V_{GS}$ = ±8 V, $V_{DS}$ = 0 V | – | – | ±10 | μA |
| **ON CHARACTERISTICS** | | | | | | |
| $V_{GS(th)}$ | Gate to Source Threshold Voltage | $V_{GS}$ = $V_{DS}$, $I_D$ = 250 μA | 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 μA, referenced to 25°C | – | –3 | – | mV/°C |
| $R_{DS(on)}$ | Static Drain to Source On Resistance | $V_{GS}$ = 4.5 V, $I_D$ = 9.5 A | – | 17 | 23 | mΩ |
| | | $V_{GS}$ = 2.5 V, $I_D$ = 8.0 A | – | 20 | 29 | |
| | | $V_{GS}$ = 1.8 V, $I_D$ = 4.0 A | – | 24 | 36 | |
| | | $V_{GS}$ = 1.5 V, $I_D$ = 2.0 A | – | 29 | 50 | |
| | | $V_{GS}$ = 4.5 V, $I_D$ = 9.5 A, $T_J$ = 125°C | – | 23 | 32 | |
| $g_{FS}$ | Forward Transconductance | $V_{DD}$ = 5 V, $I_D$ = 9.5 A | – | 35 | – | S |
| **DYNAMIC CHARACTERISTICS** | | | | | | |
| $C_{iss}$ | Input Capacitance | $V_{DS}$ = 10 V, $V_{GS}$ = 0 V, f = 1 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 MHz | – | 2.1 | – | Ω |
| **SWITCHING CHARACTERISTICS** | | | | | | |
| $t_{d(on)}$ | Turn–On Delay Time | $V_{DD}$ = 10 V, $I_D$ = 9.5 A, $V_{GS}$ = 4.5 V, $R_{GEN}$ = 6 Ω | – | 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 V, $I_D$ = 9.5 A, $V_{GS}$ = 4.5 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 V, $I_S$ = 2.0 A (Note 2) | – | 0.7 | 1.2 | V |
| $t_{rr}$ | Reverse Recovery Time | $I_F$ = 9.5 A, di/dt = 100 A/μs | – | 12 | 22 | ns |
| $Q_{rr}$ | Reverse Recovery Charge | | – | 2.6 | 10 | nC |

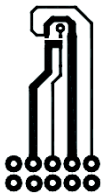
Product parametric performance is indicated in the Electrical Characteristics for the listed test conditions, unless otherwise noted. Product performance may not be indicated by the Electrical Characteristics if operated under different conditions.

NOTES:

1. $R_{\theta JA}$ is determined with the device mounted on a 1 $in^2$ 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 $in^2$ 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°C unless otherwise noted)

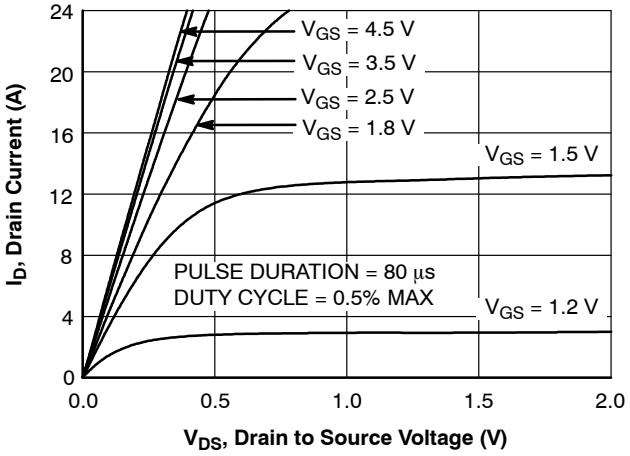



**Figure 1. On−Region Characteristics**

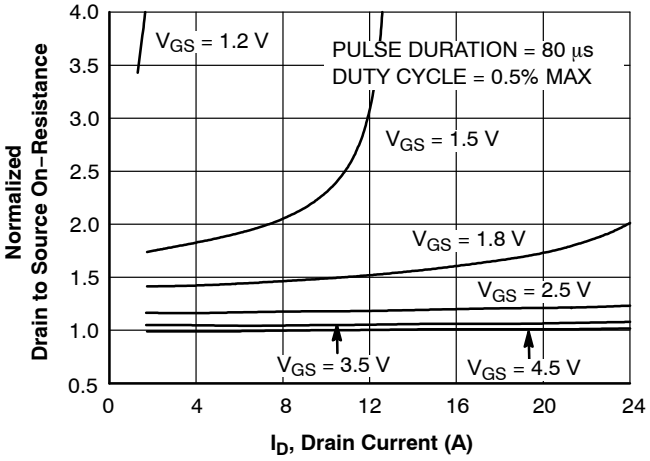



**Figure 2. Normalized On−Resistance vs. Drain Current and Gate Voltage**

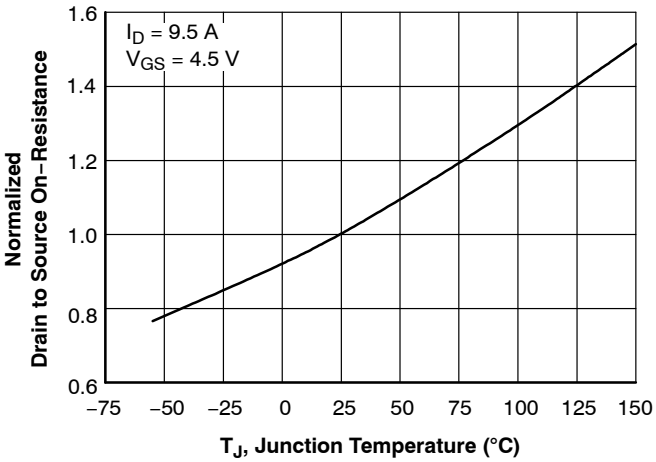



**Figure 3. Normalized On−Resistance vs. Junction Temperature**

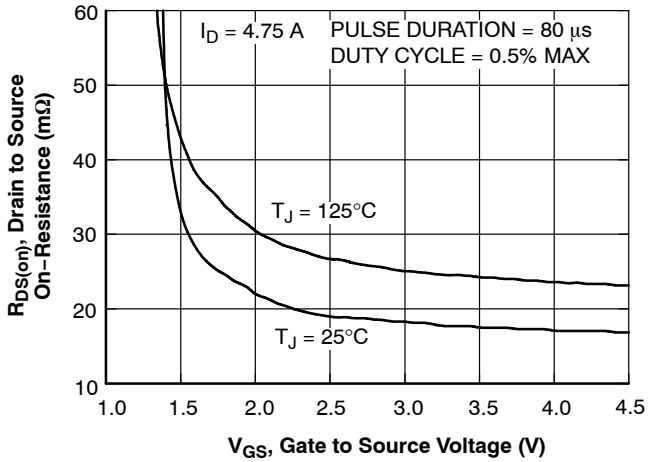



**Figure 4. On−Resistance vs. Gate to Source Voltage**

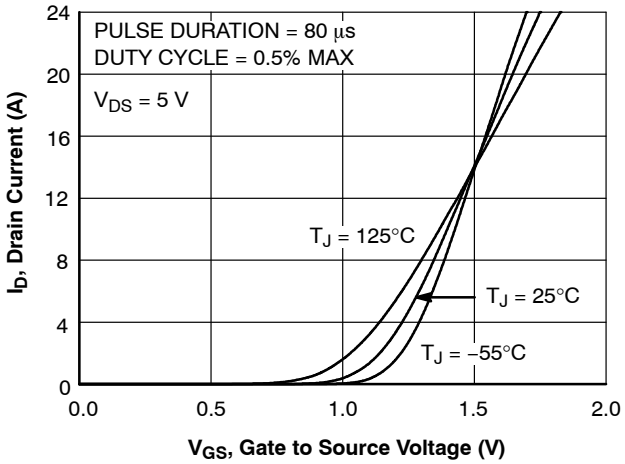



**Figure 5. Transfer Characteristics**

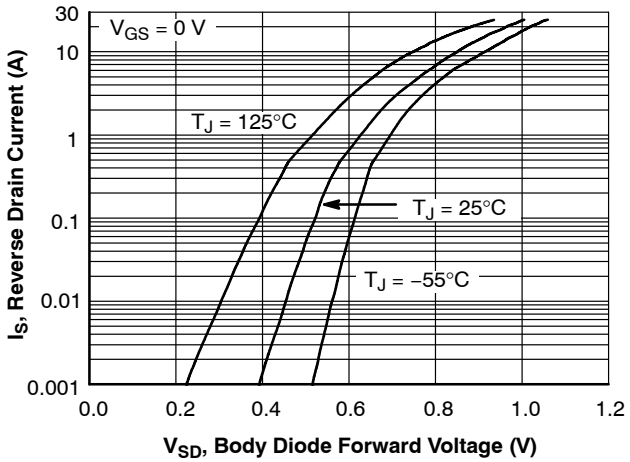



**Figure 6. Source to Drain Diode Forward Voltage vs. Source Current**

## TYPICAL CHARACTERISTICS (continued)

($T_J$ = 25°C unless otherwise noted)

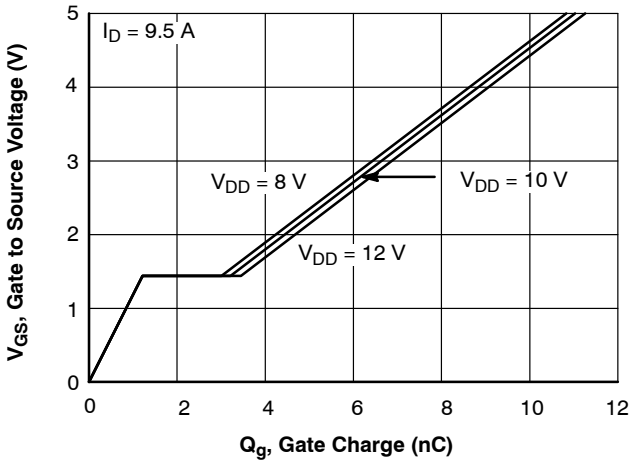



**Figure 7. Gate Charge Characteristics**

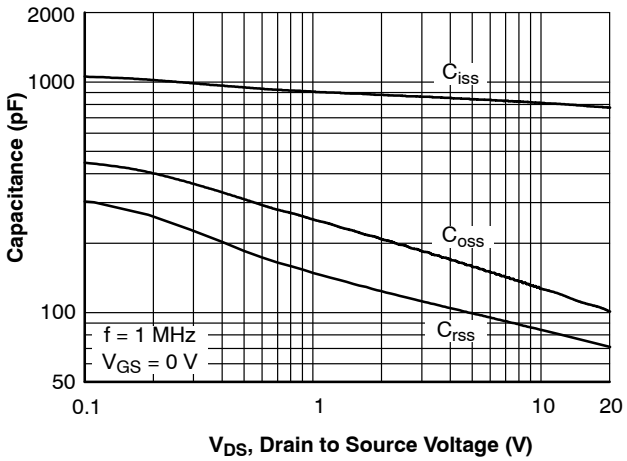



**Figure 8. Capacitance vs. Drain to Source Voltage**

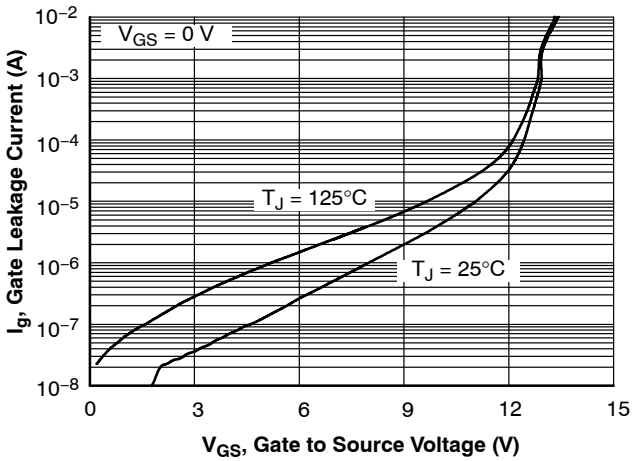



**Figure 9. Gate Leakage Current vs. Gate to Source Voltage**

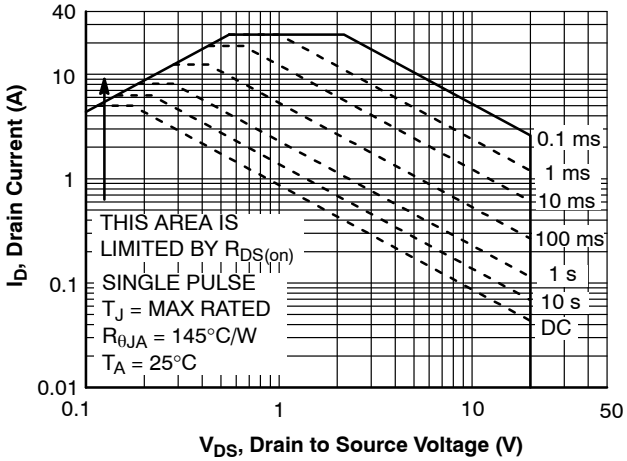



**Figure 10. Forward Bias Safe Operating Area**

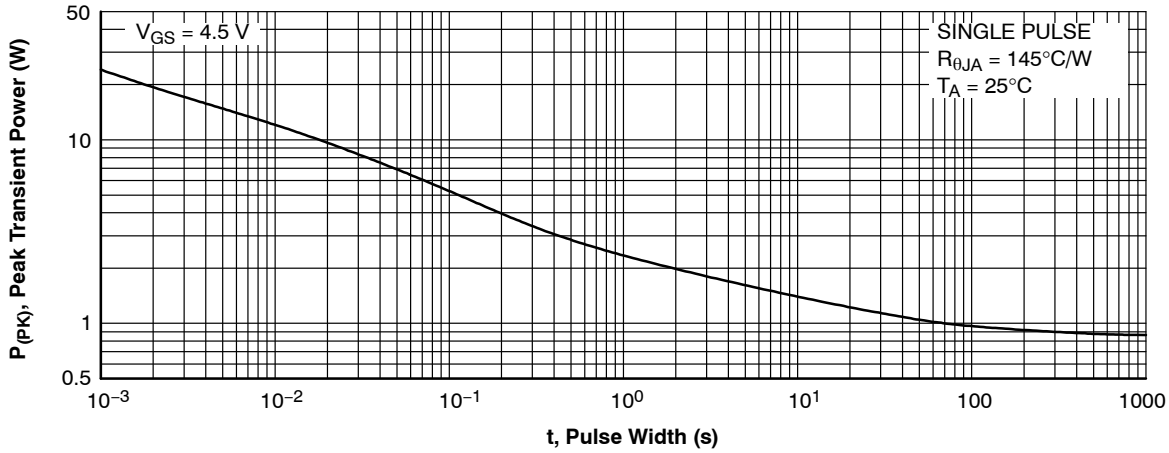



**Figure 11. Single Pulse Maximum Power Dissipation**

## TYPICAL CHARACTERISTICS (continued)

($T_J$ = 25°C unless otherwise noted)

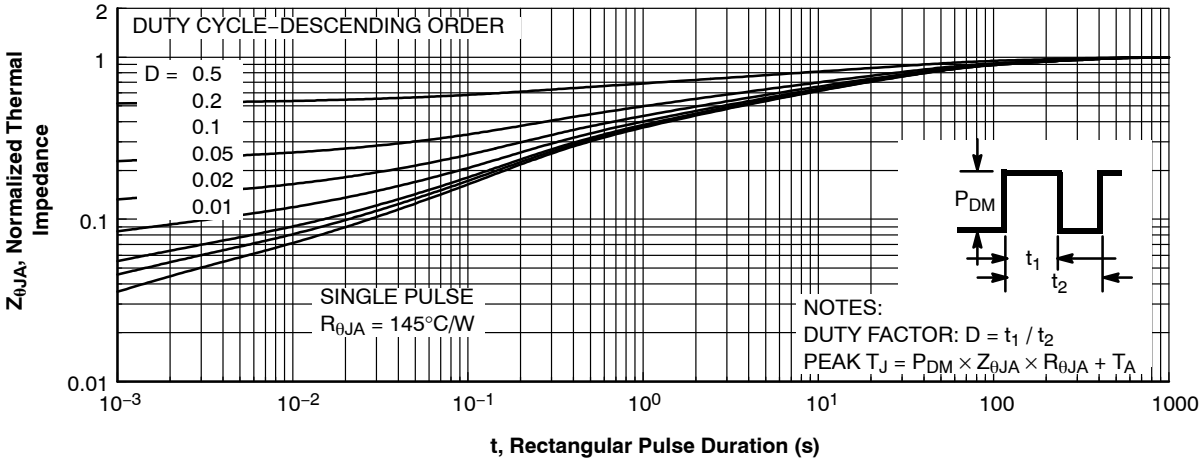
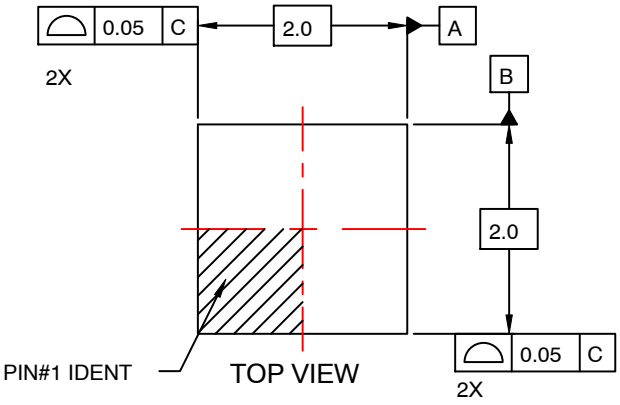
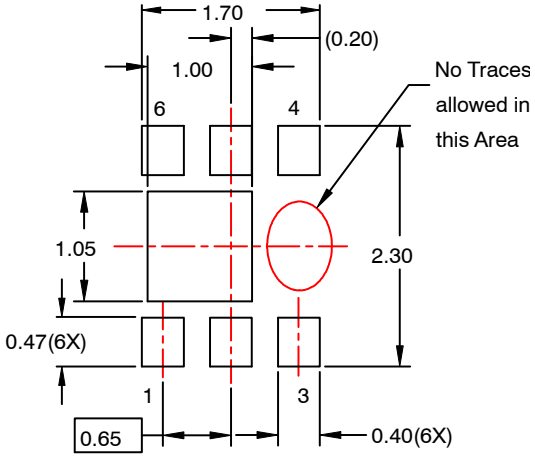



**Figure 12. Junction−to−Ambient Transient Thermal Response Curve**

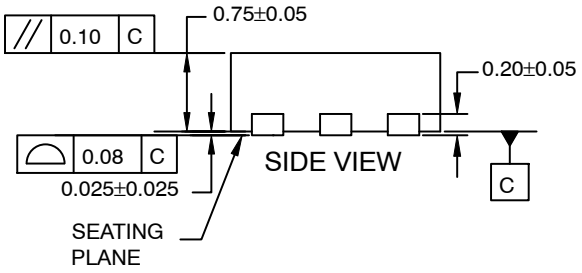
**WDFN6 2x2, 0.65P**
CASE 511CZ
ISSUE O

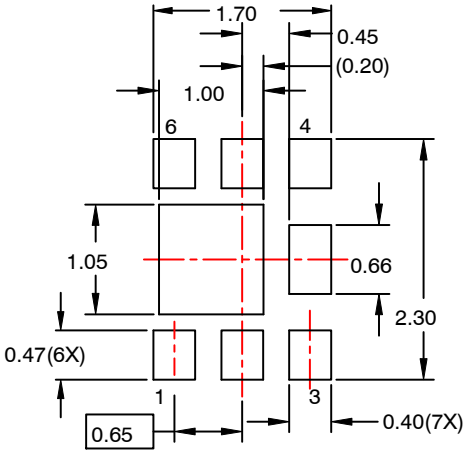
DATE 31 JUL 2016



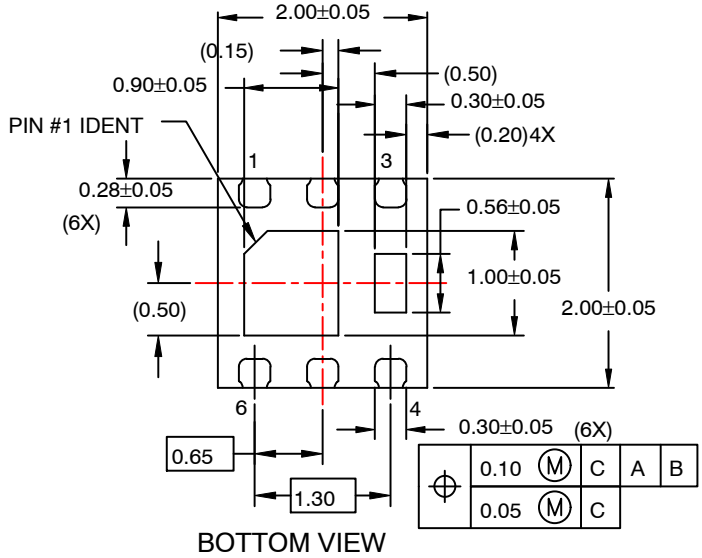




RECOMMENDED
LAND PATTERN OPT 1




RECOMMENDED
LAND PATTERN OPT 2




BOTTOM VIEW

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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