

MOSFET – P-Channel, POWERTRENCH® Integrated with Schottky Diode

-20 V, -3.1 A, 95 mΩ

FDFMA2P029Z, FDFMA2P029Z-F106

General Description

This device is designed specifically as a single package solution for the battery charge switch in cellular handset and other ultra-portable applications. It features a MOSFET with very low on-state resistance and an independently connected low forward voltage schottky diode allows 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

MOSFET

- Max $r_{DS(on)}$ = 95 mΩ at $V_{GS} = -4.5$ V, $I_D = -3.1$ A
- Max $r_{DS(on)}$ = 141 mΩ at $V_{GS} = -2.5$ V, $I_D = -2.5$ A
- HBM ESD Protection Level > 2.5 kV (Note 1)

Schottky

- $V_F < 0.37$ V @ 500 mA
- Low Profile – 0.8 mm Maximum – In the New Package MicroFET 2x2 mm
- These Devices are Pb-Free and are RoHS Compliant

NOTE:

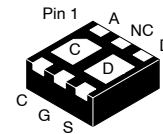
1. The diode connected between the gate and source serves only protection against ESD. No gate overvoltage rating is implied.

MOSFET

| V_{DS} MAX | $r_{DS(on)}$ MAX | I_D MAX |
|--------------|------------------|-----------|
| -20 V | 95 mΩ @ -4.5 V | -3.1 A |
| | 141 mΩ @ -2.5 V | |

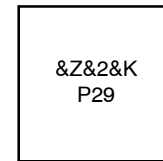
SCHOTTKY DIODE

| V_{RRM} MAX | V_F MAX | I_O MAX |
|---------------|-----------------|-----------|
| 20 V | 0.37 V @ 500 mA | 2 A |



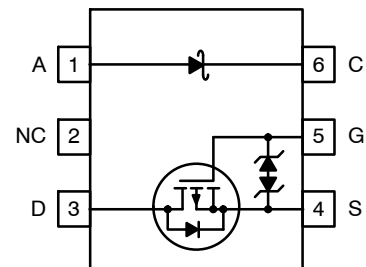
**WDFN6 2x2, 0.65P
 MicroFET
 CASE 511DA**

MARKING DIAGRAM



- &Z = Assembly Plant Code
- &2 = 2-Digit Date Code
- &K = 2-Digits Lot Run Traceability Code
- P29 = Device Code

PIN CONNECTIONS



ORDERING INFORMATION

See detailed ordering and shipping information on page 6 of this data sheet.

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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 | ± 12 | V |
| I_D | Drain Current | Continuous (Note 2a) | -3.1 |
| | | Pulsed | -6 |
| P_D | Power Dissipation | (Note 2a) | 1.4 |
| | | (Note 2b) | 0.7 |
| T_J, T_{STG} | Operating and Storage Junction Temperature Range | -55 to +150 | $^\circ\text{C}$ |
| V_{RRM} | Schottky Repetitive Peak Reverse Voltage | 20 | V |
| I_O | Schottky Average Forward Current | 2 | A |

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.

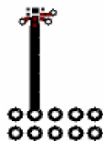
THERMAL CHARACTERISTICS

| Symbol | Parameter | Ratings | Unit |
|-----------------|---|---------|---------------------------|
| $R_{\theta JA}$ | Thermal Resistance, Junction to Ambient (Note 2a) | 86 | $^\circ\text{C}/\text{W}$ |
| $R_{\theta JA}$ | Thermal Resistance, Junction to Ambient (Note 2b) | 173 | |
| $R_{\theta JA}$ | Thermal Resistance, Junction to Ambient (Note 2c) | 86 | |
| $R_{\theta JA}$ | Thermal Resistance, Junction to Ambient (Note 2d) | 140 | |

2. $R_{\theta JA}$ is determined with the device mounted on a 1 in² 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.
- MOSFET $R_{\theta JA} = 86^\circ\text{C}/\text{W}$ when mounted on a 1 in² pad of 2 oz copper, 1.5" x 1.5" x 0.062" thick PCB.
 - MOSFET $R_{\theta JA} = 173^\circ\text{C}/\text{W}$ when mounted on a minimum pad of 2 oz copper.
 - Schottky $R_{\theta JA} = 86^\circ\text{C}/\text{W}$ when mounted on a 1 in² pad of 2 oz copper, 1.5" x 1.5" x 0.062" thick PCB.
 - Schottky $R_{\theta JA} = 140^\circ\text{C}/\text{W}$ when mounted on a minimum pad of 2 oz copper.



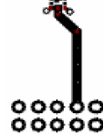
a. $86^\circ\text{C}/\text{W}$ when mounted on a 1 in² pad of 2 oz copper.



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



c. $86^\circ\text{C}/\text{W}$ when mounted on a 1 in² pad of 2 oz copper.



d. $140^\circ\text{C}/\text{W}$ when mounted on a minimum pad of 2 oz copper.

FDFMA2P029Z, FDFMA2P029Z-F106

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

| Symbol | Parameter | Test Conditions | 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 | - | -12 | - | 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} = ±12 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 | -0.6 | -1.0 | -1.5 | V |
| $\frac{\Delta V_{GS(th)}}{\Delta T_J}$ | Gate to Source Threshold Voltage Temperature Coefficient | I _D = -250 μA, referenced to 25°C | - | 4 | - | mV/°C |
| r _{DS(on)} | Static Drain to Source On-Resistance | V _{GS} = -4.5 V, I _D = -3.1 A | - | 60 | 95 | mΩ |
| | | V _{GS} = -2.5 V, I _D = -2.5 A | - | 88 | 141 | |
| | | V _{GS} = -4.5 V, I _D = -3.1 A, T _J = 125°C | - | 87 | 140 | |
| g _{FS} | Forward Transconductance | V _{DS} = -10 V, I _D = -3.1 A | - | -11 | - | S |

DYNAMIC CHARACTERISTICS

| | | | | | | |
|------------------|------------------------------|---|---|-----|-----|----|
| C _{iss} | Input Capacitance | V _{DS} = -10 V, V _{GS} = 0 V, f = 1 MHz | - | 540 | 720 | pF |
| C _{oss} | Output Capacitance | | - | 120 | 160 | pF |
| C _{rss} | Reverse Transfer Capacitance | | - | 100 | 150 | pF |

SWITCHING CHARACTERISTICS

| | | | | | | |
|---------------------|-------------------------------|--|---|-----|----|----|
| t _{d(on)} | Turn-On Delay Time | V _{DD} = -10 V, I _D = -1 A V _{GS} = -4.5 V, R _{GEN} = 6 Ω | - | 13 | 24 | ns |
| t _r | Rise Time | | - | 11 | 20 | ns |
| t _{d(off)} | Turn-Off Delay Time | | - | 37 | 59 | ns |
| t _f | Fall Time | | - | 36 | 58 | ns |
| Q _{g(TOT)} | Total Gate Charge | V _{DD} = -10 V, I _D = -3.1 A V _{GS} = -4.5 V | - | 7 | 10 | nC |
| Q _{gs} | Gate to Source Gate Charge | | - | 1.1 | - | nC |
| Q _{gd} | Gate to Drain "Miller" Charge | | - | 2.4 | - | nC |

DRAIN-SOURCE DIODE CHARACTERISTICS

| | | | | | | |
|-----------------|---|---|---|------|------|----|
| I _S | Maximum Continuous Drain-Source Diode Forward Current | - | - | -1.1 | A | |
| V _{SD} | Source to Drain Diode Forward Voltage | V _{GS} = 0 V, I _S = -1.1 A (Note 3) | - | -0.8 | -1.2 | V |
| t _{rr} | Reverse Recovery Time | I _F = -3.1 A, di/dt = 100 A/μs | - | 25 | - | ns |
| Q _{rr} | Reverse Recovery Charge | | - | 9 | - | nC |

SCHOTTKY DIODE CHARACTERISTICS

| | | | | | | | |
|----------------|-----------------|-------------------------|------------------------|----|------|-------|----|
| V _R | Reverse Voltage | I _R = 1 mA | T _J = 25°C | 20 | - | - | V |
| I _R | Reverse Leakage | V _R = 20 V | T _J = 25°C | - | 30 | 300 | μA |
| | | | T _J = 125°C | - | 10 | 45 | mA |
| V _F | Forward Voltage | I _F = 500 mA | T _J = 25°C | - | 0.32 | 0.37 | V |
| | | | T _J = 125°C | - | 0.21 | 0.26 | |
| | | I _F = 1 A | T _J = 25°C | - | 0.37 | 0.435 | |
| | | | T _J = 125°C | - | 0.28 | 0.33 | |

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.

3. Pulse Test: Pulse Width < 300 μs, Duty Cycle < 2.0%

TYPICAL CHARACTERISTICS

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

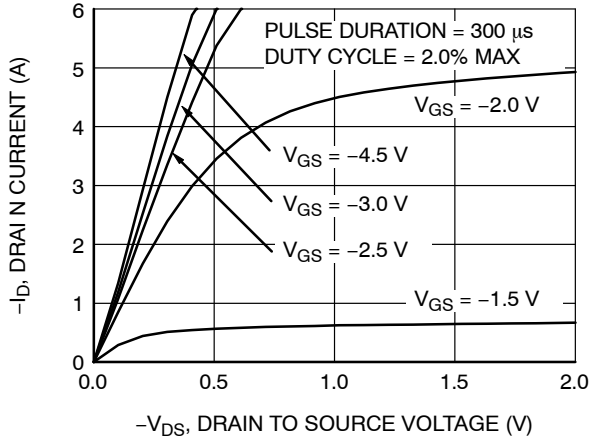


Figure 1. On Region Characteristics

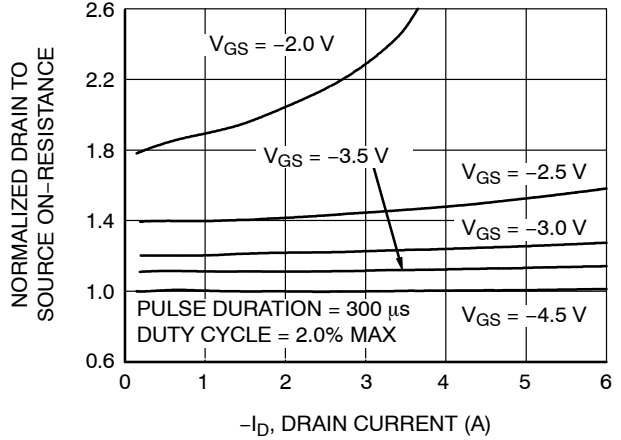


Figure 2. Normalized On-Resistance vs. Drain Current and Gate Voltage

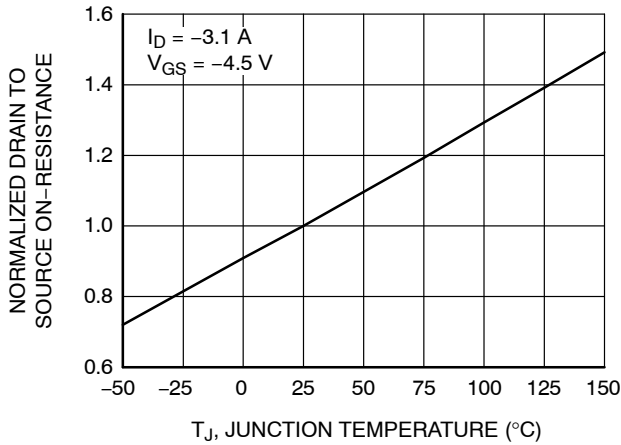


Figure 3. Normalized On-Resistance vs. Junction Temperature

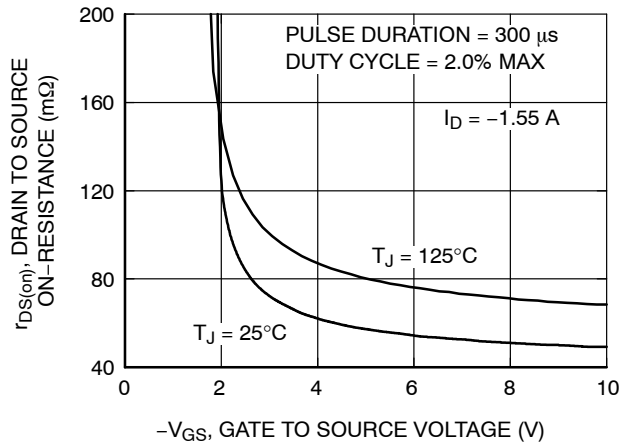


Figure 4. On-Resistance vs. Gate to Source Voltage

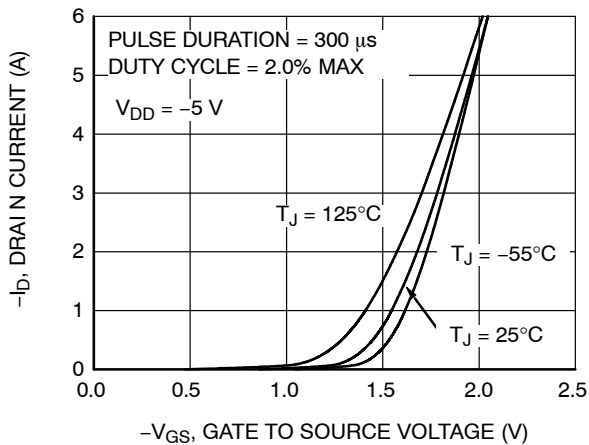


Figure 5. Transfer Characteristics

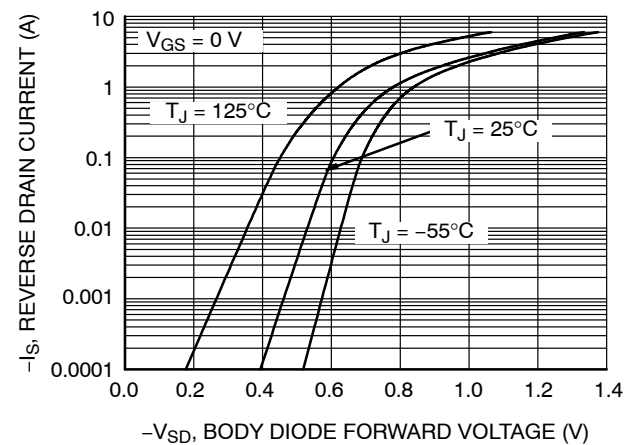


Figure 6. Source to Drain Diode Forward Voltage vs. Source Current

TYPICAL CHARACTERISTICS

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

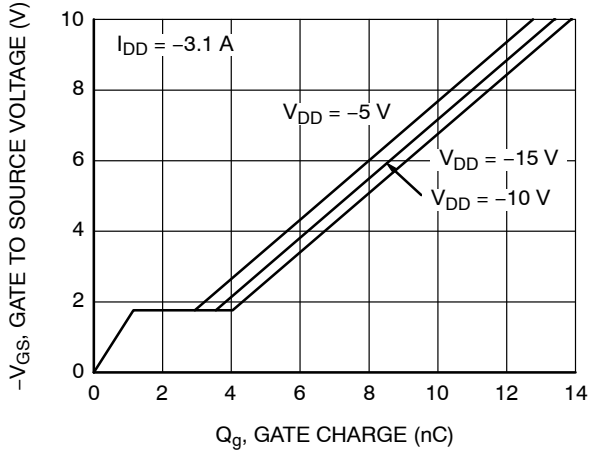


Figure 7. Gate Charge Characteristics

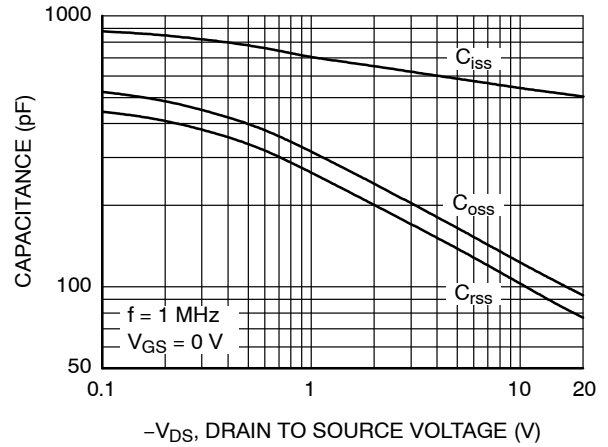


Figure 8. Capacitance Characteristics

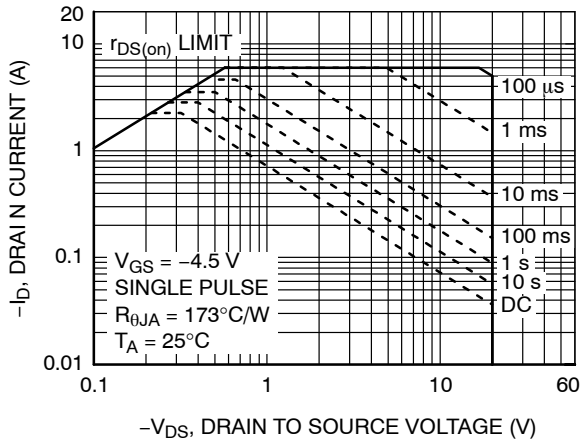


Figure 9. Forward Bias Safe Operating Area

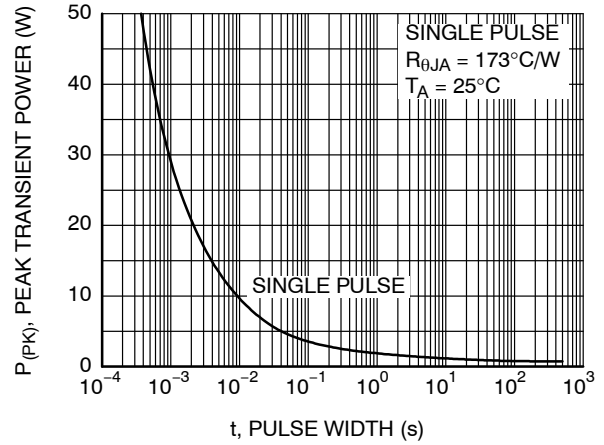


Figure 10. Single Pulse Maximum Power Dissipation

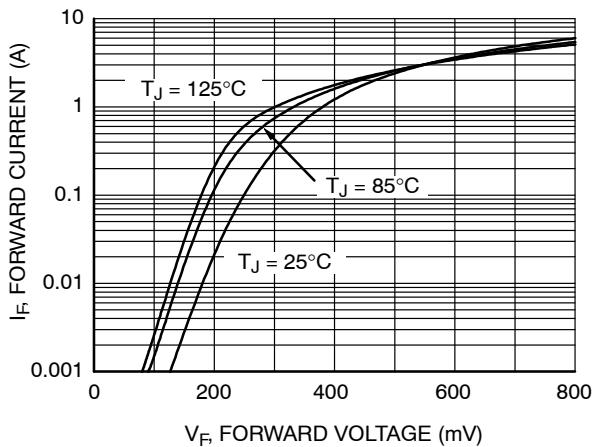


Figure 11. Schottky Diode Forward Voltage

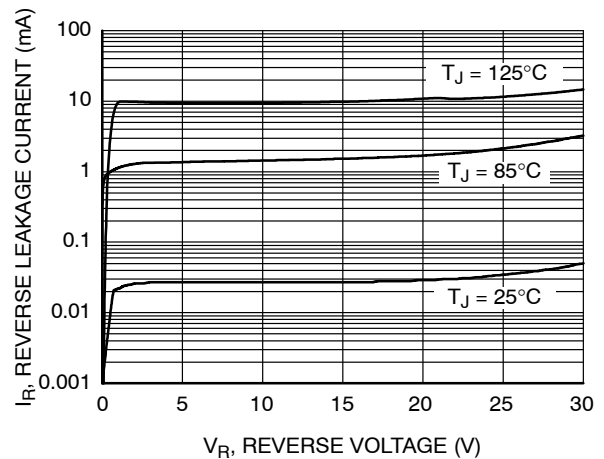


Figure 12. Schottky Diode Reverse Current

TYPICAL CHARACTERISTICS

(T_J = 25°C unless otherwise noted) (continued)

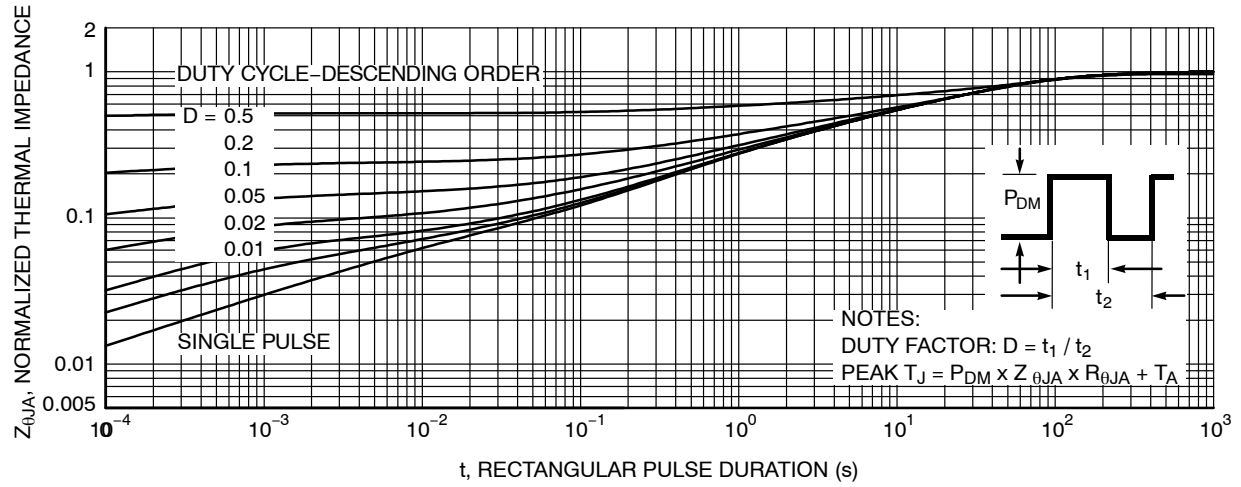


Figure 13. Transient Thermal Response Curve

PACKAGE MARKING AND ORDERING INFORMATION

| Device | Device Marking | Package Type | Reel Size | Tape Width | Shipping [†] |
|------------------|----------------|---|-----------|------------|-----------------------|
| FDMA2P029Z | P29 | WDFN6 2x2, 0.65P MicroFET (Pb-Free) | 7" | 8 mm | 3000 / Tape & Reel |
| FDFMA2P029Z-F106 | P29 | WDFN6 2x2, 0.65P MicroFET (Pb-Free) | 7" | 8 mm | 3000 / Tape & Reel |

[†]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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MECHANICAL CASE OUTLINE

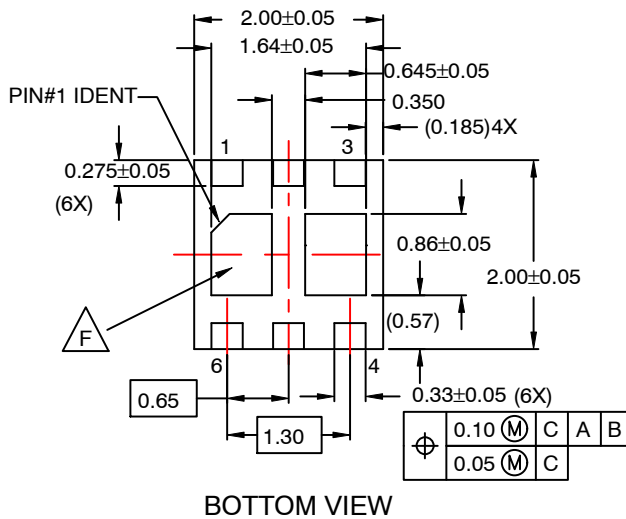
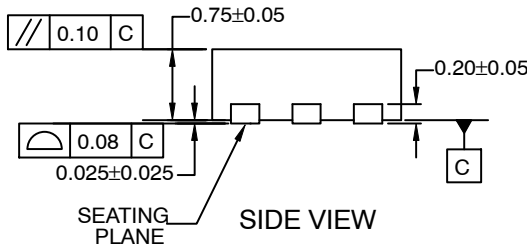
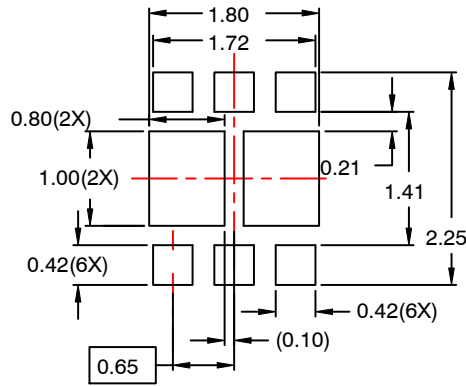
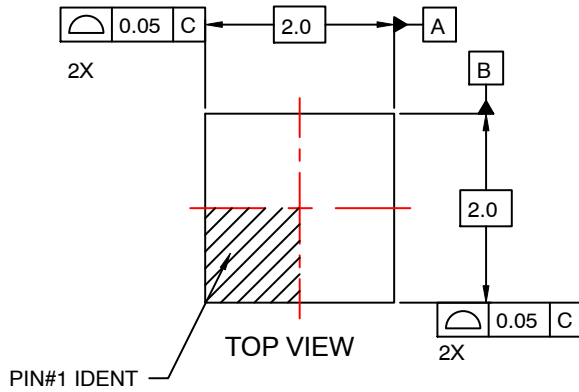
PACKAGE DIMENSIONS

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.

F. NON-JEDEC DUAL DAP

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