



July 2014

FDFMA3P029Z

Integrated P-Channel PowerTrench[®] MOSFET and Schottky Diode

-30 V, -3.3 A, 87 mΩ

Features

MOSFET

- Max $r_{DS(on)}$ = 87 mΩ at $V_{GS} = -10$ V, $I_D = -3.3$ A
- Max $r_{DS(on)}$ = 152 mΩ at $V_{GS} = -4.5$ V, $I_D = -2.3$ A
- HBM ESD protection level > 2 KV typical (Note 3)

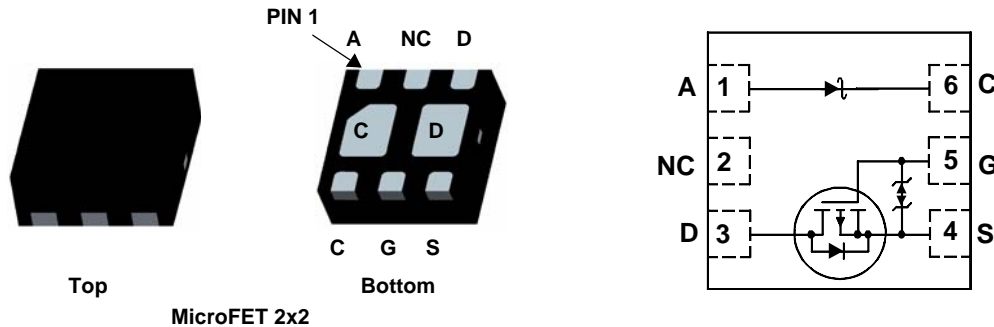
Schottky

- $V_F < 0.37$ V @ 500 mA
- Low profile - 0.8 mm maximum - in the new package MicroFET 2x2 mm
- RoHS Compliant

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.



MOSFET Maximum Ratings $T_A = 25$ °C unless otherwise noted

| Symbol | Parameter | Ratings | Units |
|----------------|--|-------------|-------|
| V_{DS} | Drain to Source Voltage | -30 | V |
| V_{GS} | Gate to Source Voltage | ±25 | V |
| I_D | Drain Current -Continuous (Note 1a) | -3.3 | A |
| | -Pulsed | -15 | |
| P_D | Power Dissipation (Note 1a) | 1.4 | W |
| | | (Note 1b) | |
| T_J, T_{STG} | Operating and Storage Junction Temperature Range | -55 to +150 | °C |
| V_{RRM} | Schottky Repetitive Peak Reverse Voltage | 20 | V |
| I_O | Schottky Average Forward Current | 2 | A |

Thermal Characteristics

| | | | |
|-----------------|---|-----|------|
| $R_{\theta JA}$ | Thermal Resistance, Junction to Ambient (Note 1a) | 86 | °C/W |
| $R_{\theta JA}$ | Thermal Resistance, Junction to Ambient (Note 1b) | 173 | |
| $R_{\theta JA}$ | Thermal Resistance, Junction to Ambient (Note 1c) | 86 | |
| $R_{\theta JA}$ | Thermal Resistance, Junction to Ambient (Note 1d) | 173 | |

Package Marking and Ordering Information

| Device Marking | Device | Package | Reel Size | Tape Width | Quantity |
|----------------|-------------|--------------|-----------|------------|------------|
| 3P2 | FDFMA3P029Z | MicroFET 2X2 | 7" | 8 mm | 3000 units |

FDFMA3P029Z Integrated P-Channel PowerTrench[®] MOSFET and Schottky Diode

Electrical Characteristics $T_J = 25\text{ }^\circ\text{C}$ unless otherwise noted

| Symbol | Parameter | Test Conditions | Min | Typ | Max | Units |
|--------|-----------|-----------------|-----|-----|-----|-------|
|--------|-----------|-----------------|-----|-----|-----|-------|

Off Characteristics

| | | | | | | |
|--------------------------------------|---|--|-----|-----|----------|----------------------|
| BV_{DSS} | Drain to Source Breakdown Voltage | $I_D = -250\ \mu\text{A}, V_{GS} = 0\ \text{V}$ | -30 | | | V |
| $\frac{\Delta BV_{DSS}}{\Delta T_J}$ | Breakdown Voltage Temperature Coefficient | $I_D = -250\ \mu\text{A}$, referenced to $25\text{ }^\circ\text{C}$ | | -22 | | mV/ $^\circ\text{C}$ |
| I_{DSS} | Zero Gate Voltage Drain Current | $V_{DS} = -24\ \text{V}, V_{GS} = 0\ \text{V}$ | | | -1 | μA |
| I_{GSS} | Gate to Source Leakage Current | $V_{GS} = \pm 25\ \text{V}, V_{DS} = 0\ \text{V}$ | | | ± 10 | μA |

On Characteristics

| | | | | | | |
|--|--|---|------|------|------|----------------------|
| $V_{GS(th)}$ | Gate to Source Threshold Voltage | $V_{GS} = V_{DS}, I_D = -250\ \mu\text{A}$ | -1.3 | -1.9 | -2.3 | V |
| $\frac{\Delta V_{GS(th)}}{\Delta T_J}$ | Gate to Source Threshold Voltage Temperature Coefficient | $I_D = -250\ \mu\text{A}$, referenced to $25\text{ }^\circ\text{C}$ | | 5 | | mV/ $^\circ\text{C}$ |
| $r_{DS(on)}$ | Static Drain to Source On-Resistance | $V_{GS} = -10\ \text{V}, I_D = -3.3\ \text{A}$ | | 69 | 87 | m Ω |
| | | $V_{GS} = -4.5\ \text{V}, I_D = -2.3\ \text{A}$ | | 108 | 152 | |
| | | $V_{GS} = -10\ \text{V}, I_D = -3.3\ \text{A}, T_J = 125\text{ }^\circ\text{C}$ | | 97 | 122 | |
| g_{FS} | Forward Transconductance | $V_{DS} = -5\ \text{V}, I_D = -3.3\ \text{A}$ | | 6 | | S |
| R_g | Gate Resistance | | | 12 | | Ω |

Dynamic Characteristics

| | | | | | | |
|-----------|------------------------------|---|--|-----|-----|----|
| C_{iss} | Input Capacitance | $V_{DS} = -15\ \text{V}, V_{GS} = 0\ \text{V}, f = 1\ \text{MHz}$ | | 324 | 435 | pF |
| C_{oss} | Output Capacitance | | | 59 | 80 | pF |
| C_{rss} | Reverse Transfer Capacitance | | | 53 | 80 | pF |

Switching Characteristics

| | | | | | | |
|--------------|-------------------------------|---|--|-----|----|----|
| $t_{d(on)}$ | Turn-On Delay Time | $V_{DD} = -15\ \text{V}, I_D = -3.3\ \text{A}, V_{GS} = -10\ \text{V}, R_{GEN} = 6\ \Omega$ | | 5.2 | 11 | ns |
| t_r | Rise Time | | | 3 | 10 | ns |
| $t_{d(off)}$ | Turn-Off Delay Time | | | 17 | 31 | ns |
| t_f | Fall Time | | | 11 | 25 | ns |
| $Q_{g(TOT)}$ | Total Gate Charge | $V_{GS} = 0\ \text{V to } -10\ \text{V}$ | $V_{DD} = -15\ \text{V}, I_D = -3.3\ \text{A}$ | 7.2 | 10 | nC |
| | Total Gate Charge | $V_{GS} = 0\ \text{V to } -5\ \text{V}$ | | 4.1 | 6 | nC |
| Q_{gs} | Gate to Source Gate Charge | | | 1.0 | | nC |
| Q_{gd} | Gate to Drain "Miller" Charge | | | 1.9 | | nC |

Drain-Source Diode Characteristics

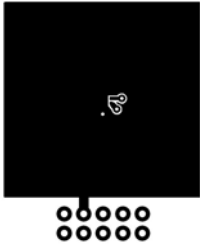
| | | | | | | |
|----------|---------------------------------------|---|--|-------|------|----|
| V_{SD} | Source to Drain Diode Forward Voltage | $V_{GS} = 0\ \text{V}, I_S = -3.3\ \text{A}$ (Note 2) | | -0.94 | -1.3 | V |
| t_{rr} | Reverse Recovery Time | $I_F = -3.3\ \text{A}, di/dt = 100\ \text{A}/\mu\text{s}$ | | 20 | 32 | ns |
| Q_{rr} | Reverse Recovery Charge | | | 10 | 18 | nC |

Schottky Diode Characteristics

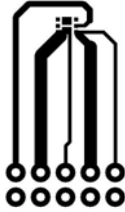
| | | | | | | | |
|-------|-----------------|------------------------|-----------------------------------|----|------|-------|---------------|
| V_R | Reverse Voltage | $I_R = 1\ \text{mA}$ | $T_J = 25\text{ }^\circ\text{C}$ | 20 | | | V |
| I_R | Reverse Leakage | $V_R = 20\ \text{V}$ | $T_J = 25\text{ }^\circ\text{C}$ | | 30 | 300 | μA |
| | | | $T_J = 125\text{ }^\circ\text{C}$ | | 10 | 45 | mA |
| V_F | Forward Voltage | $I_F = 500\ \text{mA}$ | $T_J = 25\text{ }^\circ\text{C}$ | | 0.32 | 0.37 | V |
| | | | $T_J = 125\text{ }^\circ\text{C}$ | | 0.21 | 0.26 | |
| | | $I_F = 1\ \text{A}$ | $T_J = 25\text{ }^\circ\text{C}$ | | 0.37 | 0.435 | |
| | | | $T_J = 125\text{ }^\circ\text{C}$ | | 0.28 | 0.33 | |

Notes:

- 1: $R_{\theta JA}$ 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.
- (a) MOSFET $R_{\theta JA} = 86$ °C/W when mounted on a 1in² pad of 2 oz copper, 1.5" x 1.5" x 0.062" thick PCB
 - (b) MOSFET $R_{\theta JA} = 173$ °C/W when mounted on a minimum pad of 2 oz copper
 - (c) Schottky $R_{\theta JA} = 86$ °C/W when mounted on a 1in² pad of 2 oz copper, 1.5" x 1.5" x 0.062" thick PCB.
 - (d) Schottky $R_{\theta JA} = 173$ °C/W when mounted on a minimum pad of 2 oz copper.



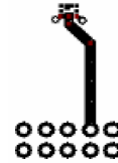
a) 86 °C/W when mounted on a 1in² pad of 2 oz copper.



b) 173 °C/W when mounted on a minimum pad of 2 oz copper.



c) 86 °C/W when mounted on a 1in² pad of 2 oz copper.



d) 173 °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 protection against ESD. No gate overvoltage rating is implied.

Typical Characteristics $T_J = 25\text{ }^\circ\text{C}$ unless otherwise noted

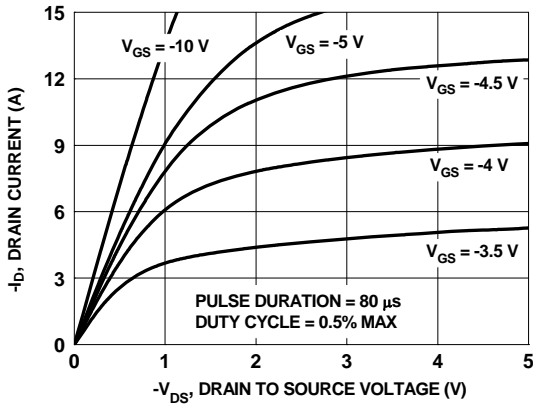


Figure 1. On-Region Characteristics

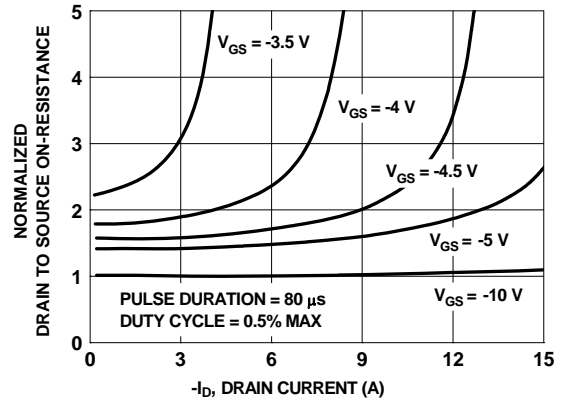


Figure 2. Normalized On-Resistance vs Drain Current and Gate Voltage

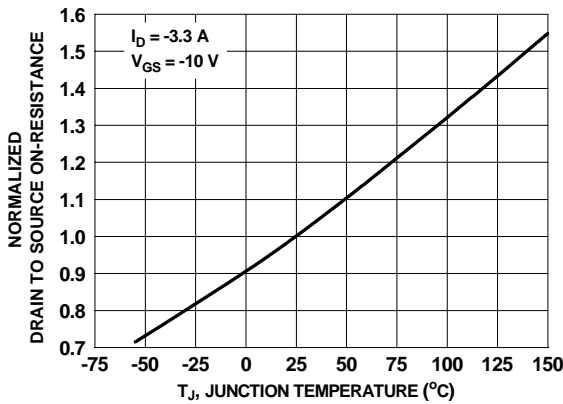


Figure 3. Normalized On-Resistance vs Junction Temperature

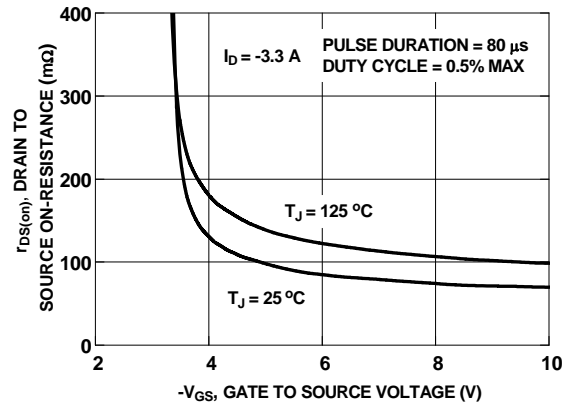


Figure 4. On-Resistance vs Gate to Source Voltage

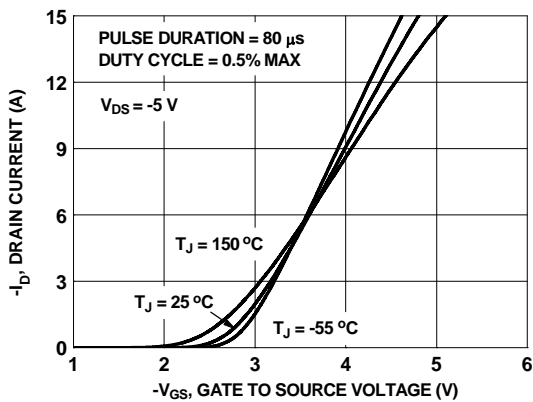


Figure 5. Transfer Characteristics

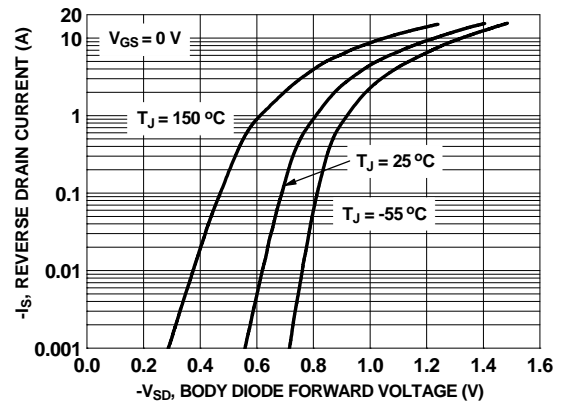


Figure 6. Source to Drain Diode Forward Voltage vs Source Current

Typical Characteristics $T_J = 25\text{ }^\circ\text{C}$ unless otherwise noted

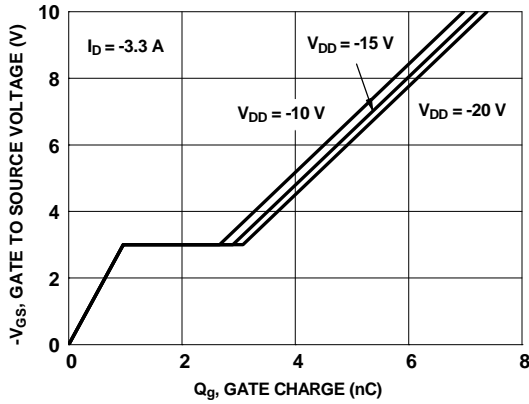


Figure 7. Gate Charge Characteristics

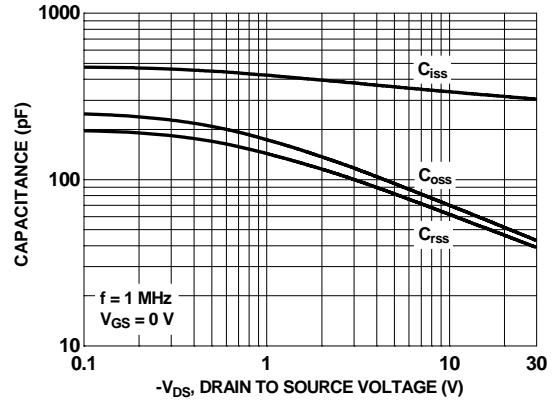


Figure 8. Capacitance vs Drain to Source Voltage

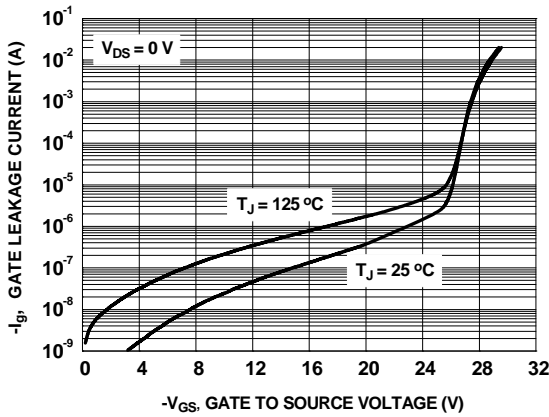


Figure 9. Gate Leakage Current vs Gate to Source Voltage

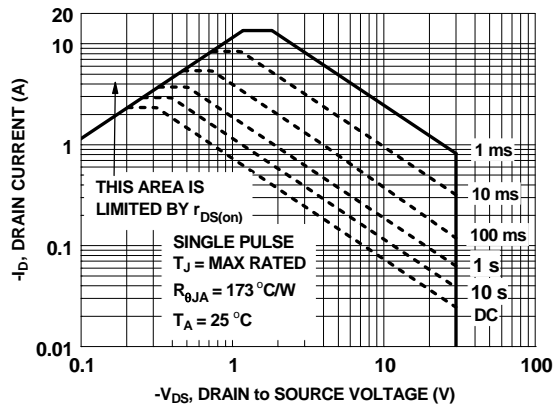


Figure 10. Forward Bias Safe Operating Area

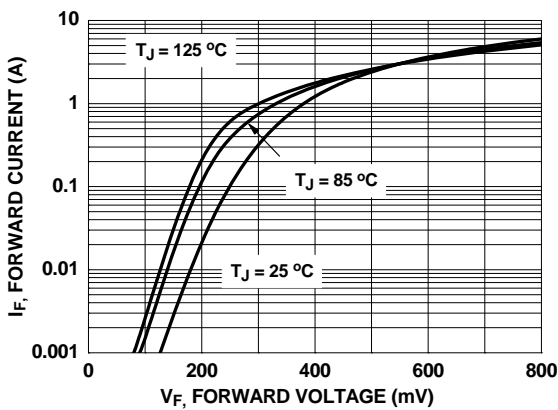


Figure 11. Schottky Diode Forward Voltage

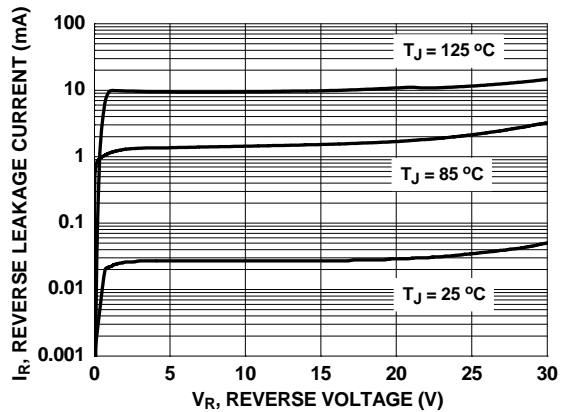


Figure 12. Schottky Diode Reverse Current

Typical Characteristics $T_J = 25\text{ }^\circ\text{C}$ unless otherwise noted

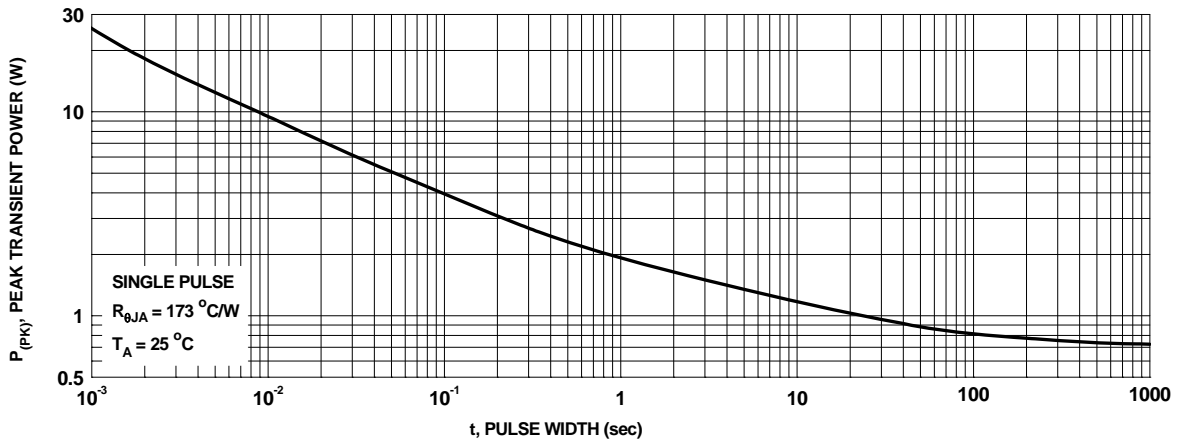


Figure 13. Single Pulse Maximum Power Dissipation

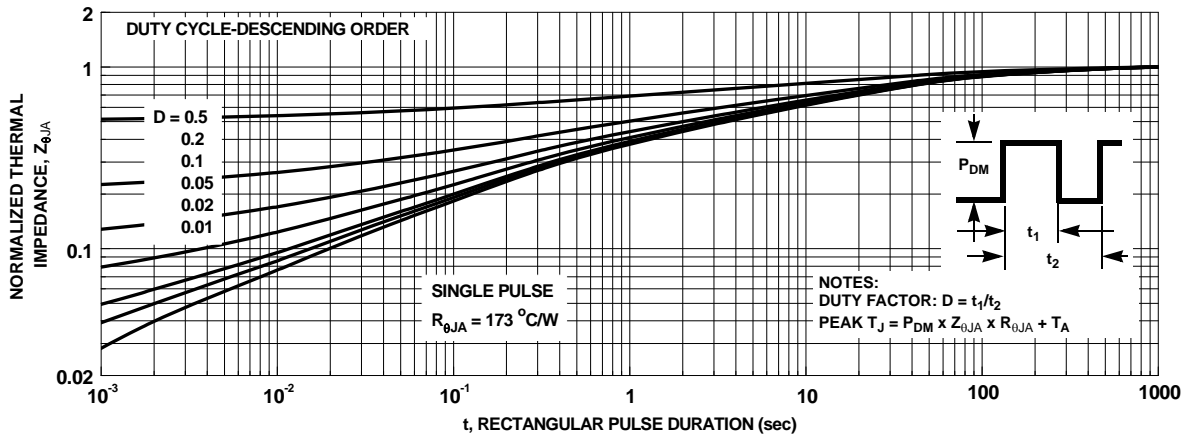
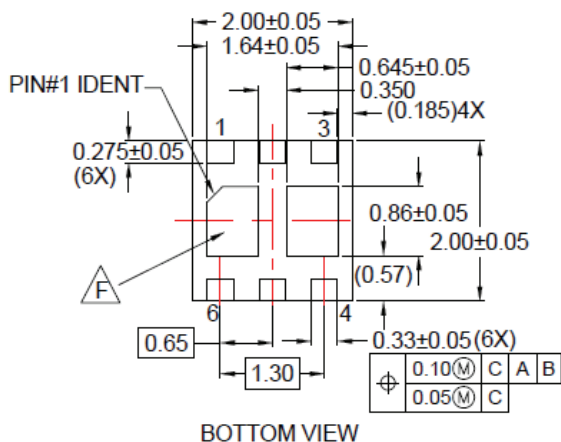
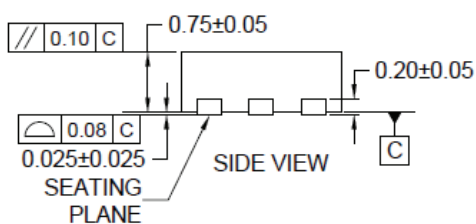
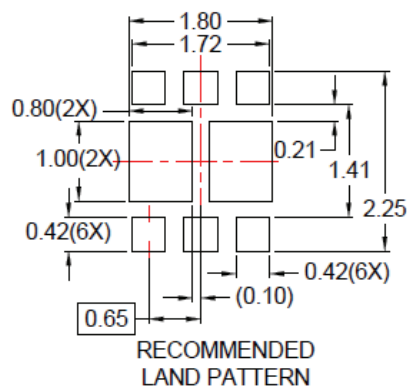
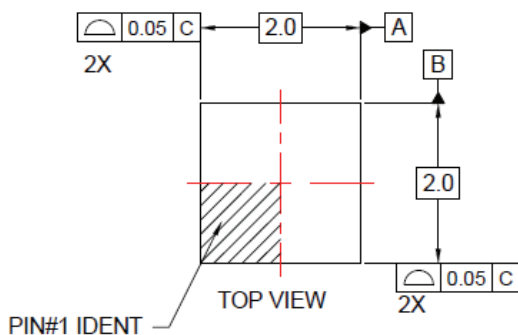


Figure 14. Junction-to-Ambient Transient Thermal Response Curve

Dimensional Outline and Pad Layout



NOTES:

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 - B. DIMENSIONS ARE IN MILLIMETERS.
 - C. DIMENSIONS AND TOLERANCES PER ASME Y14.5M, 2009.
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