



February 2007

# FDMS3572

## N-Channel UltraFET Trench<sup>®</sup> MOSFET

80V, 22A, 16.5mΩ

### Features

- Max  $r_{DS(on)}$  = 16.5mΩ at  $V_{GS}$  = 10V,  $I_D$  = 8.8A
- Max  $r_{DS(on)}$  = 24mΩ at  $V_{GS}$  = 6V,  $I_D$  = 8.4A
- Typ Qg = 28nC at  $V_{GS}$  = 10V
- Low Miller Charge
- Optimized efficiency at high frequencies
- RoHS Compliant

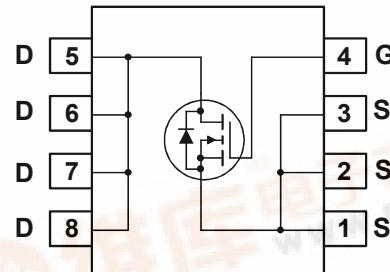
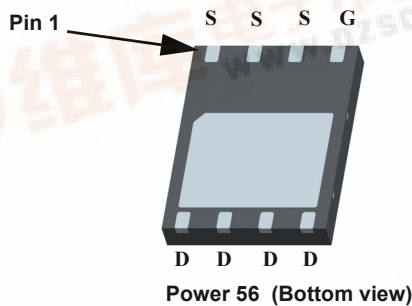


### General Description

UltraFET devices combine characteristics that enable benchmark efficiency in power conversion applications. Optimized for  $r_{DS(on)}$ , low ESR, low total and Miller gate charge, these devices are ideal for high frequency DC to DC converters.

### Application

- DC - DC Conversion



### MOSFET Maximum Ratings $T_A = 25^\circ\text{C}$ unless otherwise noted

| Symbol         | Parameter                                                            | Ratings     | Units            |
|----------------|----------------------------------------------------------------------|-------------|------------------|
| $V_{DS}$       | Drain to Source Voltage                                              | 80          | V                |
| $V_{GS}$       | Gate to Source Voltage                                               | ±20         | V                |
| $I_D$          | Drain Current -Continuous (Package limited) $T_C = 25^\circ\text{C}$ | 22          | A                |
|                | -Continuous (Silicon limited) $T_C = 25^\circ\text{C}$               | 48          |                  |
|                | -Continuous $T_A = 25^\circ\text{C}$ (Note 1a)                       | 8.8         |                  |
|                | -Pulsed                                                              | 50          |                  |
| $P_D$          | Power Dissipation $T_C = 25^\circ\text{C}$                           | 78          | W                |
|                | Power Dissipation $T_A = 25^\circ\text{C}$ (Note 1a)                 | 2.5         |                  |
| $T_J, T_{STG}$ | Operating and Storage Junction Temperature Range                     | -55 to +150 | $^\circ\text{C}$ |

### Thermal Characteristics

|                 |                                                   |     |                    |
|-----------------|---------------------------------------------------|-----|--------------------|
| $R_{\theta JC}$ | Thermal Resistance, Junction to Case              | 1.6 | $^\circ\text{C/W}$ |
| $R_{\theta JA}$ | Thermal Resistance, Junction to Ambient (Note 1a) | 50  |                    |

### Package Marking and Ordering Information

| Device Marking | Device   | Package  | Reel Size | Tape Width | Quantity   |
|----------------|----------|----------|-----------|------------|------------|
| FDMS3572       | FDMS3572 | Power 56 | 13"       | 12mm       | 3000 units |

FDMS3572 N-Channel UltraFET Trench<sup>®</sup> MOSFET

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

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

**Off Characteristics**

|                                      |                                           |                                                           |    |    |           |                            |
|--------------------------------------|-------------------------------------------|-----------------------------------------------------------|----|----|-----------|----------------------------|
| $BV_{DSS}$                           | Drain to Source Breakdown Voltage         | $I_D = 250\mu\text{A}$ , $V_{GS} = 0\text{V}$             | 80 |    |           | V                          |
| $\frac{\Delta BV_{DSS}}{\Delta T_J}$ | Breakdown Voltage Temperature Coefficient | $I_D = 250\mu\text{A}$ , referenced to $25^\circ\text{C}$ |    | 76 |           | $\text{mV}/^\circ\text{C}$ |
| $I_{DSS}$                            | Zero Gate Voltage Drain Current           | $V_{DS} = 64\text{V}$ , $V_{GS} = 0\text{V}$              |    |    | 1         | $\mu\text{A}$              |
| $I_{GSS}$                            | Gate to Source Leakage Current            | $V_{GS} = \pm 20\text{V}$ , $V_{DS} = 0\text{V}$          |    |    | $\pm 100$ | nA                         |

**On Characteristics**

|                                        |                                                          |                                                                         |   |      |      |                            |
|----------------------------------------|----------------------------------------------------------|-------------------------------------------------------------------------|---|------|------|----------------------------|
| $V_{GS(th)}$                           | Gate to Source Threshold Voltage                         | $V_{GS} = V_{DS}$ , $I_D = 250\mu\text{A}$                              | 2 | 3.2  | 4    | V                          |
| $\frac{\Delta V_{GS(th)}}{\Delta T_J}$ | Gate to Source Threshold Voltage Temperature Coefficient | $I_D = 250\mu\text{A}$ , referenced to $25^\circ\text{C}$               |   | -11  |      | $\text{mV}/^\circ\text{C}$ |
| $r_{DS(on)}$                           | Drain to Source On Resistance                            | $V_{GS} = 10\text{V}$ , $I_D = 8.8\text{A}$                             |   | 13.5 | 16.5 | $\text{m}\Omega$           |
|                                        |                                                          | $V_{GS} = 6\text{V}$ , $I_D = 8.4\text{A}$                              |   | 18.3 | 24   |                            |
|                                        |                                                          | $V_{GS} = 10\text{V}$ , $I_D = 8.8\text{A}$ , $T_J = 125^\circ\text{C}$ |   | 22.2 | 29   |                            |
| $g_{FS}$                               | Forward Transconductance                                 | $V_{DS} = 10\text{V}$ , $I_D = 8.8\text{A}$                             |   | 23   |      | S                          |

**Dynamic Characteristics**

|           |                              |                                                                     |  |      |      |          |
|-----------|------------------------------|---------------------------------------------------------------------|--|------|------|----------|
| $C_{iss}$ | Input Capacitance            | $V_{DS} = 40\text{V}$ , $V_{GS} = 0\text{V}$ ,<br>$f = 1\text{MHz}$ |  | 1870 | 2490 | pF       |
| $C_{oss}$ | Output Capacitance           |                                                                     |  | 275  | 365  | pF       |
| $C_{rss}$ | Reverse Transfer Capacitance |                                                                     |  | 78   | 120  | pF       |
| $R_g$     | Gate Resistance              |                                                                     |  | 1.3  |      | $\Omega$ |

**Switching Characteristics**

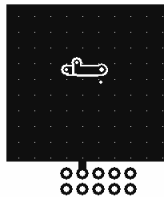
|              |                               |                                                                                            |  |    |    |    |
|--------------|-------------------------------|--------------------------------------------------------------------------------------------|--|----|----|----|
| $t_{d(on)}$  | Turn-On Delay Time            | $V_{DD} = 40\text{V}$ , $I_D = 8.8\text{A}$<br>$V_{GS} = 10\text{V}$ , $R_{GEN} = 6\Omega$ |  | 11 | 20 | ns |
| $t_r$        | Rise Time                     |                                                                                            |  | 13 | 24 | ns |
| $t_{d(off)}$ | Turn-Off Delay Time           |                                                                                            |  | 24 | 39 | ns |
| $t_f$        | Fall Time                     |                                                                                            |  | 12 | 22 | ns |
| $Q_{g(TOT)}$ | Total Gate Charge at 10V      | $V_{GS} = 0\text{V}$ to $10\text{V}$   $V_{DD} = 40\text{V}$<br>$I_D = 8.8\text{A}$        |  | 28 | 40 | nC |
| $Q_{gs}$     | Gate to Source Gate Charge    |                                                                                            |  | 9  |    | nC |
| $Q_{gd}$     | Gate to Drain "Miller" Charge |                                                                                            |  | 8  |    | nC |

**Drain-Source Diode Characteristics**

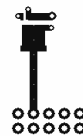
|          |                                       |                                                         |  |     |     |    |
|----------|---------------------------------------|---------------------------------------------------------|--|-----|-----|----|
| $V_{SD}$ | Source to Drain Diode Forward Voltage | $V_{GS} = 0\text{V}$ , $I_S = 8.8\text{A}$ (Note 2)     |  | 0.8 | 1.2 | V  |
| $t_{rr}$ | Reverse Recovery Time                 | $I_F = 8.8\text{A}$ , $di/dt = 100\text{A}/\mu\text{s}$ |  | 43  | 65  | ns |
| $Q_{rr}$ | Reverse Recovery Charge               |                                                         |  | 71  | 107 | nC |

**Notes:**

1:  $R_{\theta JA}$  is determined with the device mounted on a  $1\text{in}^2$  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  $R_{\theta CA}$  is determined by the user's board design.



a.  $50^\circ\text{C}/\text{W}$  when mounted on a  $1\text{in}^2$  pad of 2 oz copper



b.  $125^\circ\text{C}/\text{W}$  when mounted on a minimum pad of 2 oz copper

2: Pulse Test: Pulse Width <  $300\mu\text{s}$ , Duty cycle < 2.0%.

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

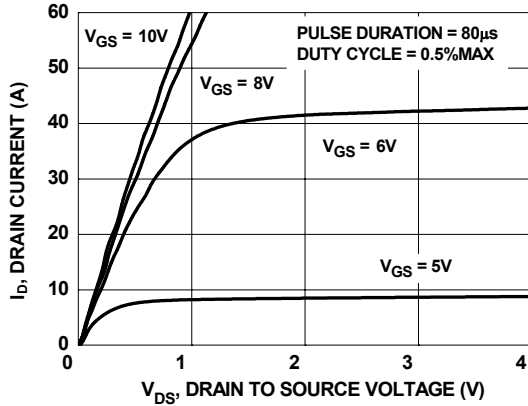


Figure 1. On Region Characteristics

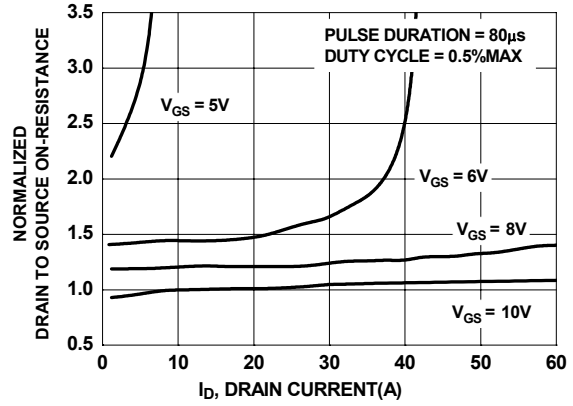


Figure 2. Normalized On-Resistance vs Drain Current and Gate Voltage

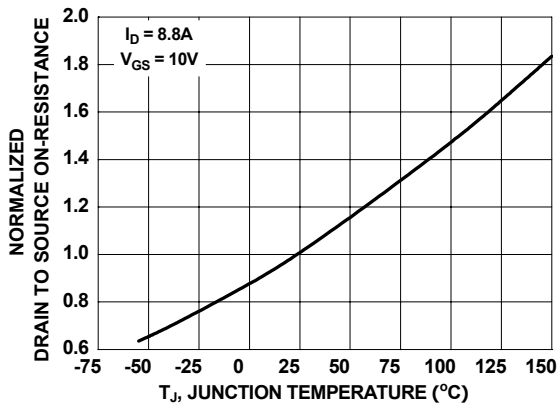


Figure 3. Normalized On Resistance vs Junction Temperature

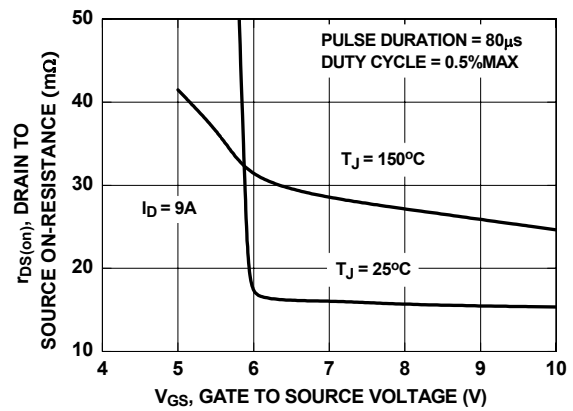


Figure 4. On-Resistance vs Gate to Source Voltage

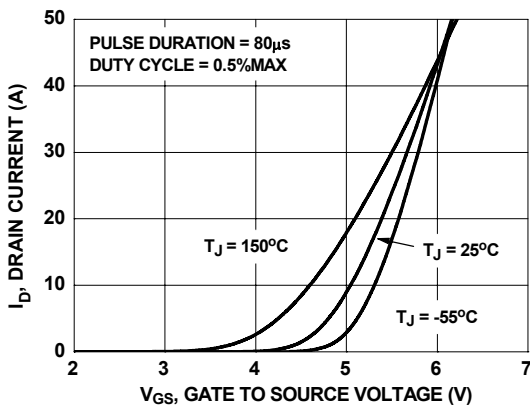


Figure 5. Transfer Characteristics

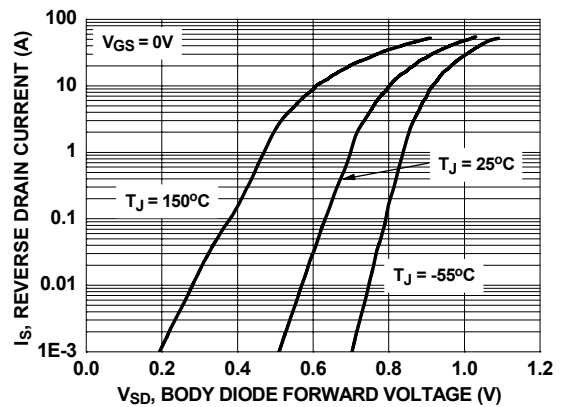


Figure 6. Source to Drain Diode Forward Voltage vs Source Current

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

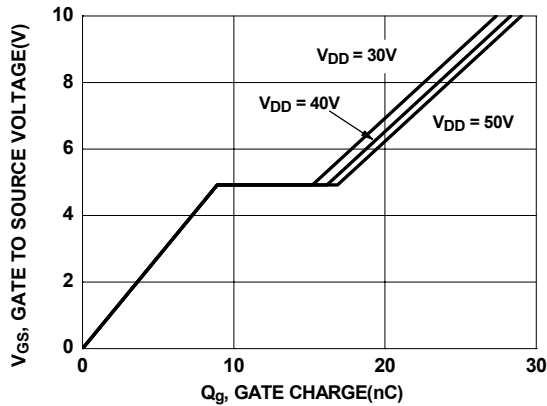


Figure 7. Gate Charge Characteristics

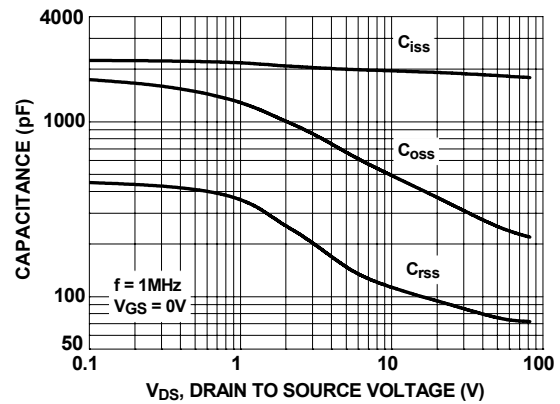


Figure 8. Capacitance vs Drain to Source Voltage

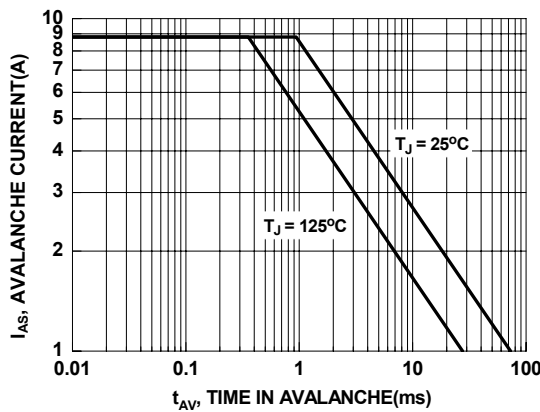


Figure 9. Unclamped Inductive Switching Capability

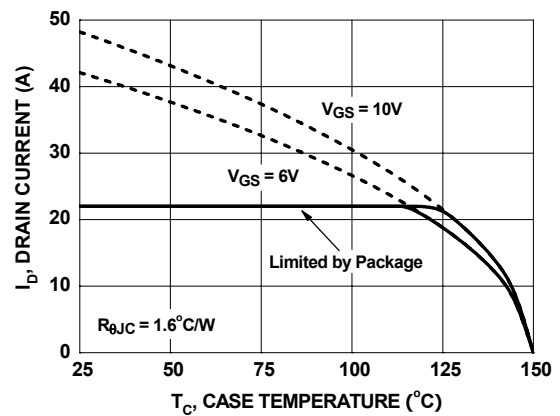


Figure 10. Maximum Continuous Drain Current vs Case Temperature

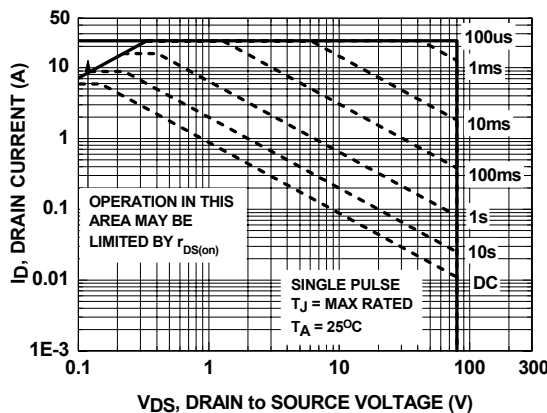


Figure 11. Forward Bias Safe Operating Area

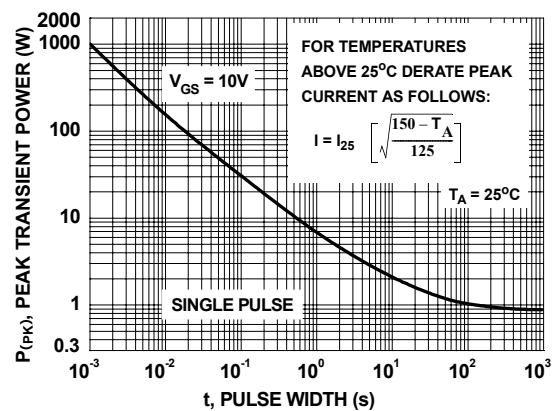
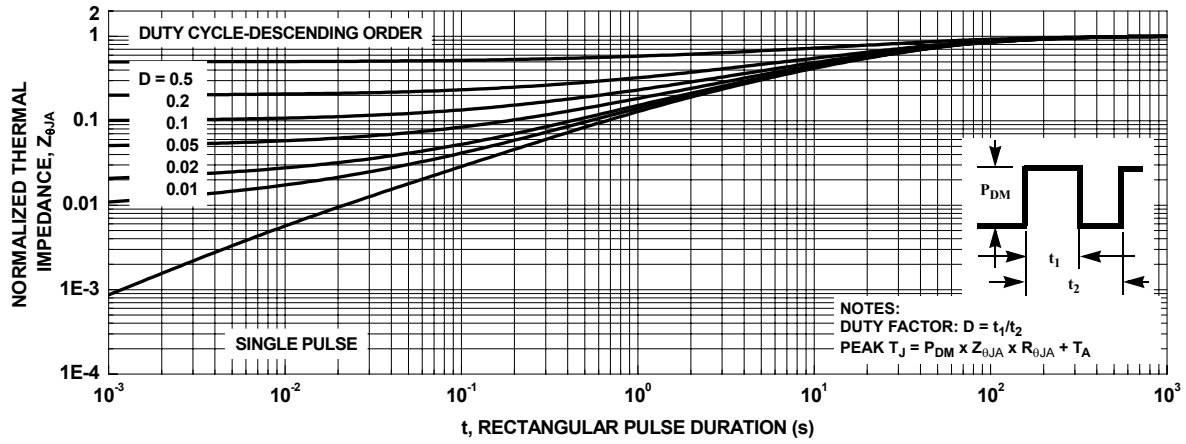
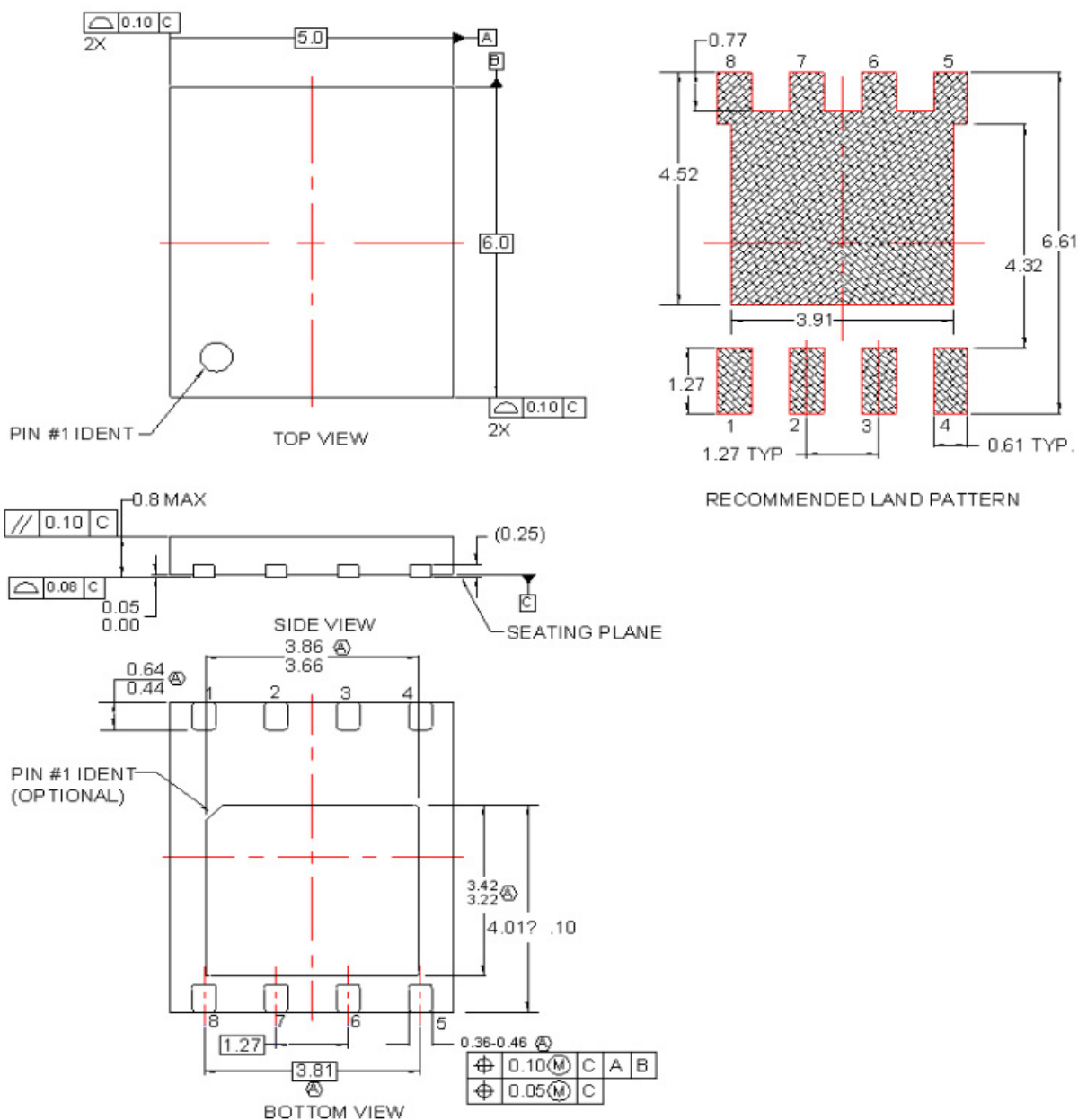


Figure 12. Single Pulse Maximum Power Dissipation

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





**NOTES:**

- (A) DOES NOT FULLY CONFORM TO JEDEC REGISTRATION, MO-229, DATED 11/2001.
- B. DIMENSIONS ARE IN MILLIMETERS.
- C. DIMENSIONS AND TOLERANCES PER ASME Y14.5M, 1994
- D. TERMINALS 5,6,7 AND 8 ARE TIED TO THE EXPOSED PADDLE

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| FRFET™                               | MSX™                | RapidConfigure™     | TinyLogic®       |         |
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