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# FDMS003N08C

## N-Channel Shielded Gate PowerTrench® MOSFET

80 V, 147 A, 3.1 mΩ

### Features

- Shielded Gate MOSFET Technology
- Max  $r_{DS(on)}$  = 3.1 mΩ at  $V_{GS} = 10$  V,  $I_D = 56$  A
- Max  $r_{DS(on)}$  = 8.1 mΩ at  $V_{GS} = 6$  V,  $I_D = 28$  A
- 50% lower Qrr than other MOSFET suppliers
- Lowers switching noise/EMI
- MSL1 robust package design
- 100% UIL tested
- RoHS Compliant

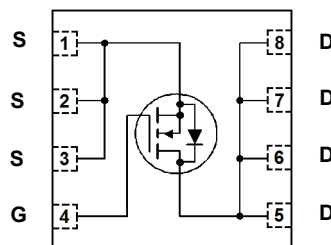
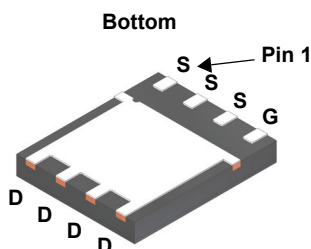
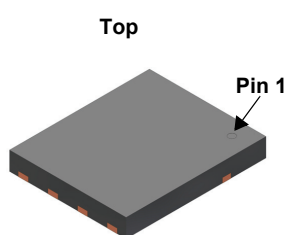


### General Description

This N-Channel MV MOSFET is produced using ON Semiconductor's advanced PowerTrench® process that incorporates Shielded Gate technology. This process has been optimized to minimise on-state resistance and yet maintain superior switching performance with best in class soft body diode.

### Applications

- Primary DC-DC MOSFET
- Synchronous Rectifier in DC-DC and AC-DC
- Motor Drive
- Solar



Power 56

### 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 $T_C = 25^\circ\text{C}$ (Note 5) | 147         | A                |
|                | -Continuous $T_C = 100^\circ\text{C}$ (Note 5)              | 92          |                  |
|                | -Continuous $T_A = 25^\circ\text{C}$ (Note 1a)              | 22          |                  |
|                | -Pulsed (Note 4)                                            | 658         |                  |
| $E_{AS}$       | Single Pulse Avalanche Energy (Note 3)                      | 486         | mJ               |
| $P_D$          | Power Dissipation $T_C = 25^\circ\text{C}$                  | 125         | W                |
|                | Power Dissipation $T_A = 25^\circ\text{C}$ (Note 1a)        | 2.7         |                  |
| $T_J, T_{STG}$ | Operating and Storage Junction Temperature Range            | -55 to +150 | $^\circ\text{C}$ |

### Thermal Characteristics

|                 |                                                   |    |                    |
|-----------------|---------------------------------------------------|----|--------------------|
| $R_{\theta JC}$ | Thermal Resistance, Junction to Case              | 1  | $^\circ\text{C/W}$ |
| $R_{\theta JA}$ | Thermal Resistance, Junction to Ambient (Note 1a) | 45 |                    |

### Package Marking and Ordering Information

| Device Marking | Device      | Package  | Reel Size | Tape Width | Quantity   |
|----------------|-------------|----------|-----------|------------|------------|
| FDMS003N08C    | FDMS003N08C | Power 56 | 13 "      | 12 mm      | 3000 units |

## 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 $25^\circ\text{C}$ |    | 60 |     | 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            | $V_{GS} = \pm 20\ \text{V}$ , $V_{DS} = 0\ \text{V}$        |    |    | 100 | nA                   |

### On Characteristics

|                                        |                                                          |                                                                            |     |      |     |                      |
|----------------------------------------|----------------------------------------------------------|----------------------------------------------------------------------------|-----|------|-----|----------------------|
| $V_{GS(th)}$                           | Gate to Source Threshold Voltage                         | $V_{GS} = V_{DS}$ , $I_D = 310\ \mu\text{A}$                               | 2.0 | 2.9  | 4.0 | V                    |
| $\frac{\Delta V_{GS(th)}}{\Delta T_J}$ | Gate to Source Threshold Voltage Temperature Coefficient | $I_D = 310\ \mu\text{A}$ , referenced to $25^\circ\text{C}$                |     | -8.2 |     | mV/ $^\circ\text{C}$ |
| $r_{DS(on)}$                           | Static Drain to Source On Resistance                     | $V_{GS} = 10\ \text{V}$ , $I_D = 56\ \text{A}$                             |     | 2.6  | 3.1 | m $\Omega$           |
|                                        |                                                          | $V_{GS} = 6\ \text{V}$ , $I_D = 28\ \text{A}$                              |     | 3.8  | 8.1 |                      |
|                                        |                                                          | $V_{GS} = 10\ \text{V}$ , $I_D = 56\ \text{A}$ , $T_J = 125^\circ\text{C}$ |     | 4.3  | 5.2 |                      |
| $g_{FS}$                               | Forward Transconductance                                 | $V_{DS} = 5\ \text{V}$ , $I_D = 56\ \text{A}$                              |     | 123  |     | S                    |

### Dynamic Characteristics

|           |                              |                                                                           |     |      |      |          |
|-----------|------------------------------|---------------------------------------------------------------------------|-----|------|------|----------|
| $C_{iss}$ | Input Capacitance            | $V_{DS} = 40\ \text{V}$ , $V_{GS} = 0\ \text{V}$ ,<br>$f = 1\ \text{MHz}$ |     | 3820 | 5350 | pF       |
| $C_{oss}$ | Output Capacitance           |                                                                           |     | 1335 | 1870 | pF       |
| $C_{rss}$ | Reverse Transfer Capacitance |                                                                           |     | 44   | 80   | pF       |
| $R_g$     | Gate Resistance              |                                                                           | 0.1 | 0.6  | 1.3  | $\Omega$ |

### Switching Characteristics

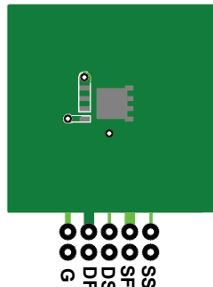
|              |                               |                                                                                                     |                                                   |    |    |    |
|--------------|-------------------------------|-----------------------------------------------------------------------------------------------------|---------------------------------------------------|----|----|----|
| $t_{d(on)}$  | Turn-On Delay Time            | $V_{DD} = 40\ \text{V}$ , $I_D = 56\ \text{A}$ ,<br>$V_{GS} = 10\ \text{V}$ , $R_{GEN} = 6\ \Omega$ |                                                   | 20 | 36 | ns |
| $t_r$        | Rise Time                     |                                                                                                     |                                                   | 8  | 16 | ns |
| $t_{d(off)}$ | Turn-Off Delay Time           |                                                                                                     |                                                   | 40 | 64 | ns |
| $t_f$        | Fall Time                     |                                                                                                     |                                                   | 12 | 23 | ns |
| $Q_g$        | Total Gate Charge             | $V_{GS} = 0\ \text{V}$ to $10\ \text{V}$                                                            | $V_{DD} = 40\ \text{V}$ ,<br>$I_D = 56\ \text{A}$ | 52 | 73 | nC |
| $Q_g$        | Total Gate Charge             | $V_{GS} = 0\ \text{V}$ to $6\ \text{V}$                                                             |                                                   | 33 | 46 | nC |
| $Q_{gs}$     | Gate to Source Charge         |                                                                                                     |                                                   | 17 |    | nC |
| $Q_{gd}$     | Gate to Drain "Miller" Charge |                                                                                                     |                                                   | 10 |    | nC |
| $Q_{oss}$    | Output Charge                 | $V_{DD} = 40\ \text{V}$ , $V_{GS} = 0\ \text{V}$                                                    |                                                   | 77 |    | nC |
| $Q_{sync}$   | Total Gate Charge Sync        | $V_{DS} = 0\ \text{V}$ , $I_D = 56\ \text{A}$                                                       |                                                   | 44 |    | nC |

### Drain-Source Diode Characteristics

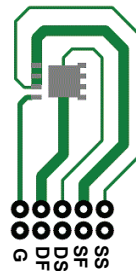
|          |                                       |                                                             |  |     |     |    |
|----------|---------------------------------------|-------------------------------------------------------------|--|-----|-----|----|
| $V_{SD}$ | Source to Drain Diode Forward Voltage | $V_{GS} = 0\ \text{V}$ , $I_S = 2.2\ \text{A}$ (Note 2)     |  | 0.7 | 1.2 | V  |
|          |                                       | $V_{GS} = 0\ \text{V}$ , $I_S = 56\ \text{A}$ (Note 2)      |  | 0.8 | 1.3 |    |
| $t_{rr}$ | Reverse Recovery Time                 | $I_F = 28\ \text{A}$ , $di/dt = 300\ \text{A}/\mu\text{s}$  |  | 28  | 45  | ns |
| $Q_{rr}$ | Reverse Recovery Charge               |                                                             |  | 53  | 84  | nC |
| $t_{rr}$ | Reverse Recovery Time                 | $I_F = 28\ \text{A}$ , $di/dt = 1000\ \text{A}/\mu\text{s}$ |  | 23  | 36  | ns |
| $Q_{rr}$ | Reverse Recovery Charge               |                                                             |  | 121 | 194 | nC |

Notes:

1.  $R_{\theta JA}$  is determined with the device mounted on a 1 in<sup>2</sup> pad 2 oz copper pad on a 1.5 x 1.5 in. board of FR-4 material.  $R_{\theta CA}$  is determined by the user's board design.



a.  $45^\circ\text{C/W}$  when mounted on a 1 in<sup>2</sup> pad of 2 oz copper.



b.  $115^\circ\text{C/W}$  when mounted on a minimum pad of 2 oz copper.

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

3.  $E_{AS}$  of 486 mJ is based on starting  $T_J = 25^\circ\text{C}$ ; N-ch:  $L = 3\ \text{mH}$ ,  $I_{AS} = 18\ \text{A}$ ,  $V_{DD} = 80\ \text{V}$ ,  $V_{GS} = 10\ \text{V}$ . 100% test at  $L = 0.1\ \text{mH}$ ,  $I_{AS} = 57\ \text{A}$ .

4. Pulsed  $I_d$  please refer to Fig 11 SOA graph for more details.

5. Computed continuous current limited to Max Junction Temperature only, actual continuous current will be limited by thermal & electro-mechanical application board design.

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

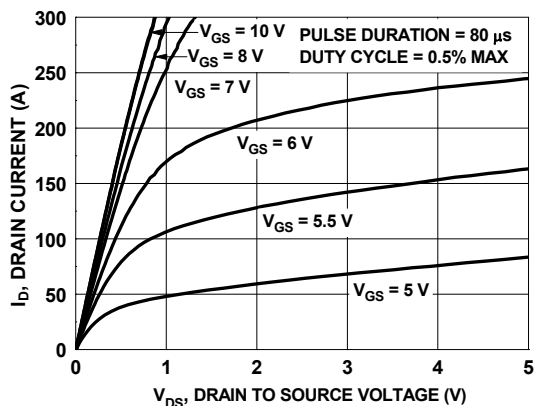


Figure 1. On Region Characteristics

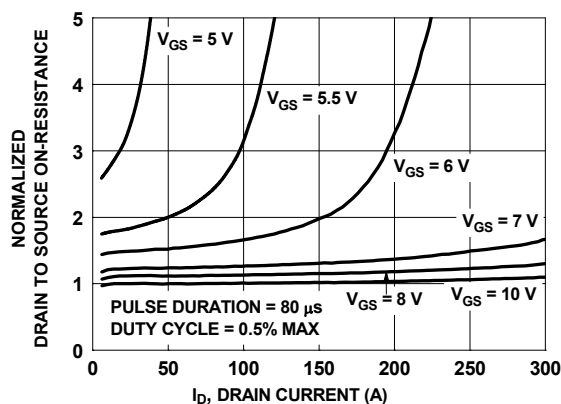


Figure 2. Normalized On-Resistance vs. Drain Current and Gate Voltage

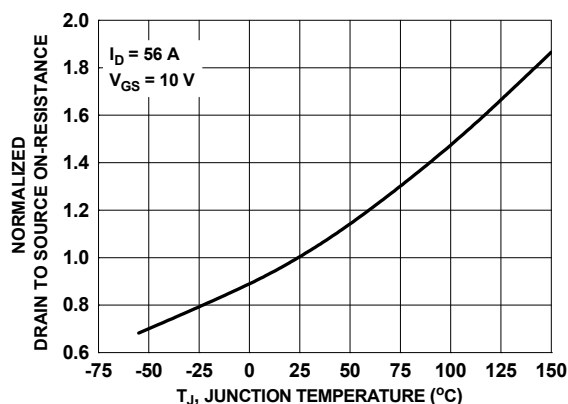


Figure 3. Normalized On Resistance vs. Junction Temperature

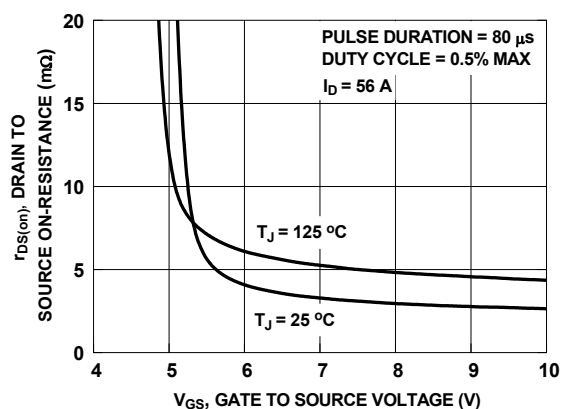


Figure 4. On-Resistance vs. Gate to Source Voltage

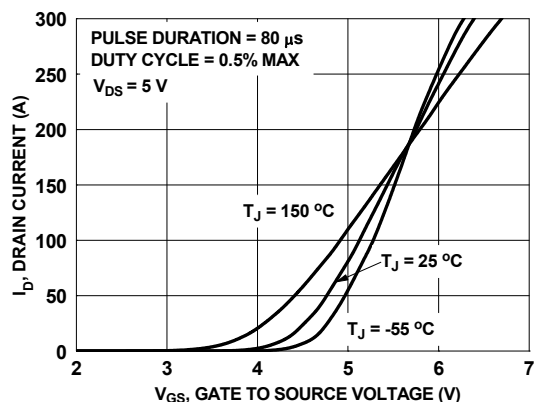


Figure 5. Transfer Characteristics

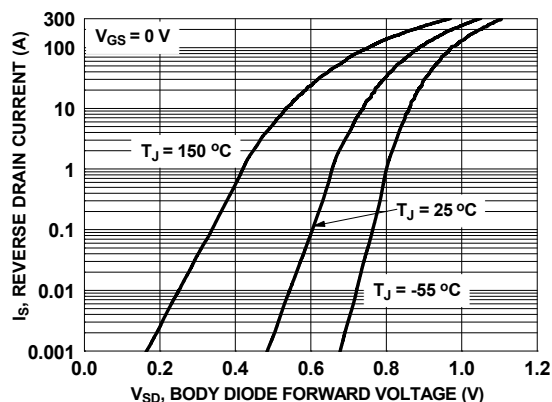
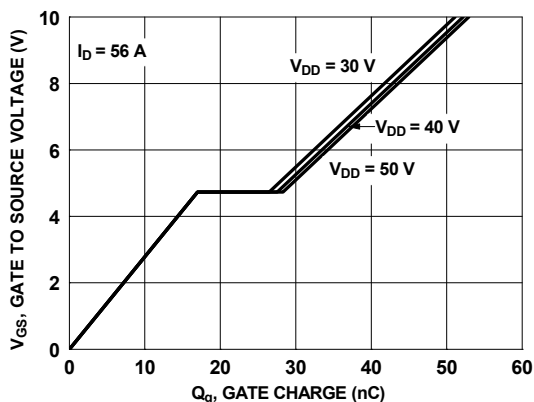
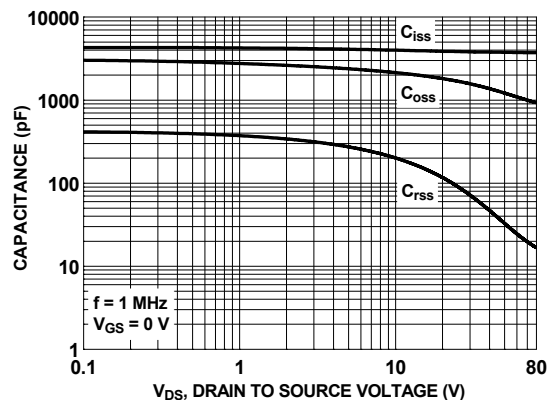


Figure 6. Source to Drain Diode Forward Voltage vs. Source Current

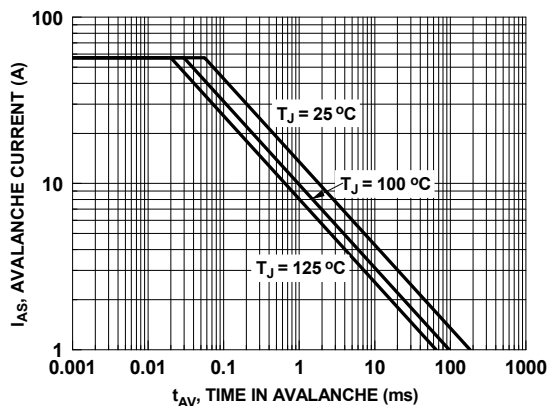
# **Typical Characteristics** $T_J = 25^\circ\text{C}$ unless otherwise noted.



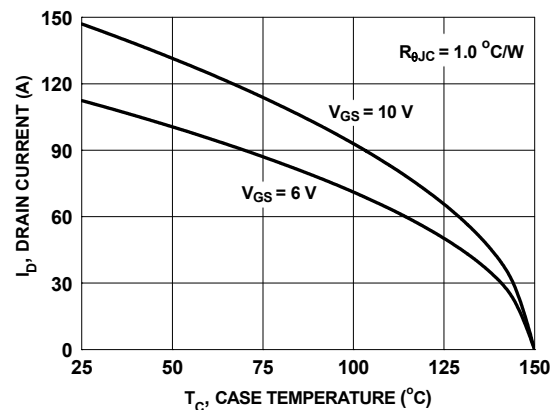
**Figure 7. Gate Charge Characteristics**



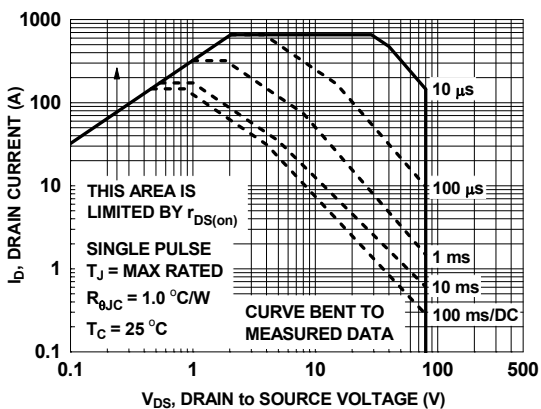
**Figure 8. Capacitance vs. Drain to Source Voltage**



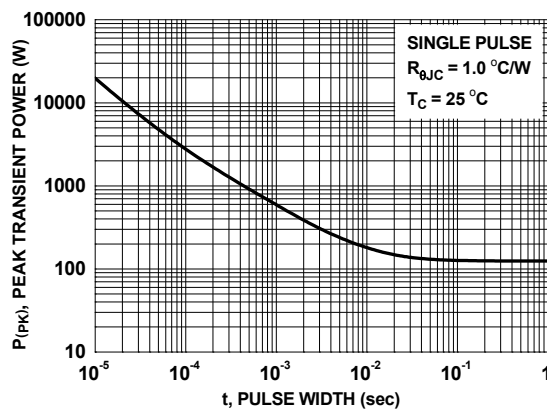
**Figure 9. Unclamped Inductive Switching Capability**



**Figure 10. Maximum Continuous Drain Current vs. Case Temperature**

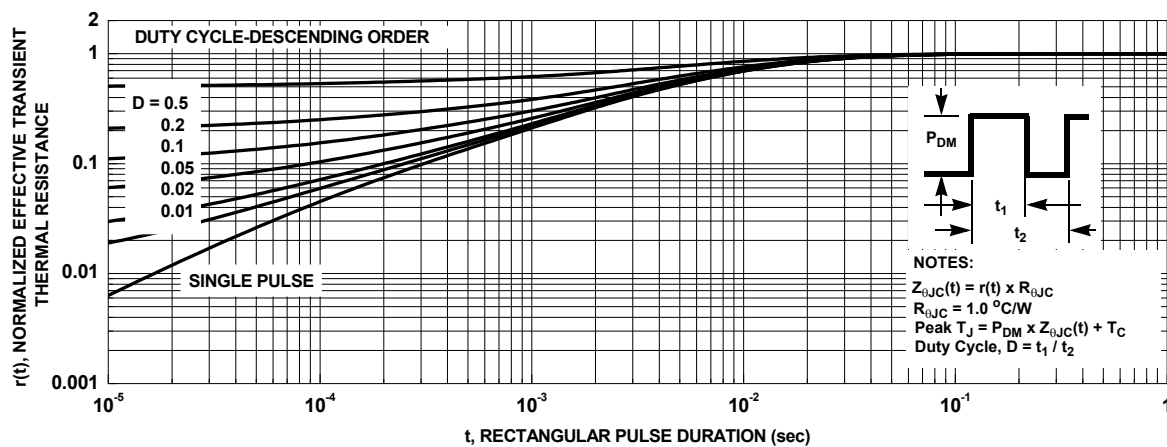


**Figure 11. Forward Bias Safe Operating Area**



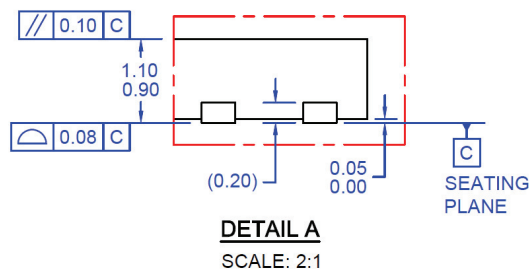
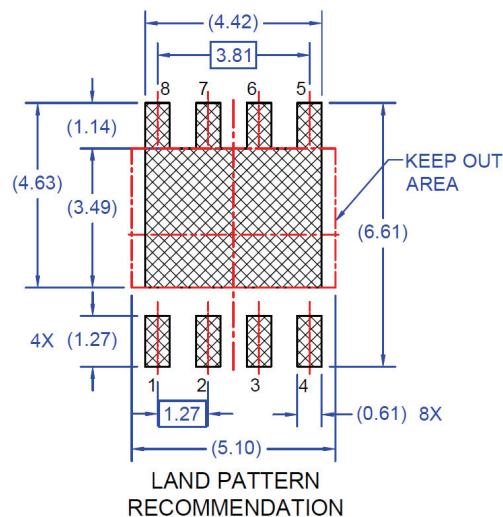
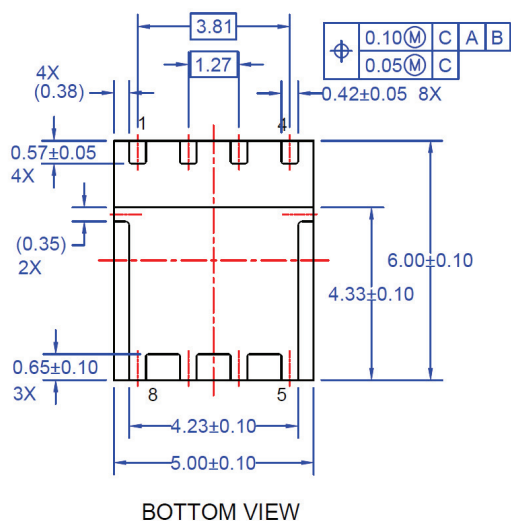
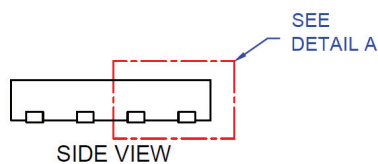
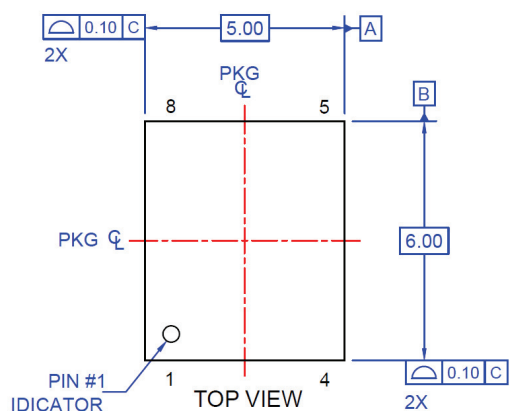
**Figure 12. Single Pulse Maximum Power Dissipation**

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



**Figure 13. Junction-to-Case Transient Thermal Response Curve**

## Dimensional Outline and Pad Layout



- NOTES: UNLESS OTHERWISE SPECIFIED
- A) PACKAGE STANDARD REFERENCE: JEDEC MO-240, ISSUE A, VAR. AA,
  - B) ALL DIMENSIONS ARE IN MILLIMETERS.
  - C) DIMENSIONS DO NOT INCLUDE BURRS OR MOLD FLASH. MOLD FLASH OR BURRS DOES NOT EXCEED 0.10MM.
  - D) DIMENSIONING AND TOLERANCING PER ASME Y14.5M-2009.
  - E) IT IS RECOMMENDED TO HAVE NO TRACES OR VIAS WITHIN THE KEEP OUT AREA.
  - F) DRAWING FILE NAME: PQFN08TREV1.

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