

# ON Semiconductor

## Is Now

# onsemi™

To learn more about onsemi™, please visit our website at  
[www.onsemi.com](http://www.onsemi.com)

---

**onsemi** and **onsemi** and other names, marks, and brands are registered and/or common law trademarks of Semiconductor Components Industries, LLC dba "**onsemi**" or its affiliates and/or subsidiaries in the United States and/or other countries. **onsemi** owns the rights to a number of patents, trademarks, copyrights, trade secrets, and other intellectual property. A listing of **onsemi** product/patent coverage may be accessed at [www.onsemi.com/site/pdf/Patent-Marking.pdf](http://www.onsemi.com/site/pdf/Patent-Marking.pdf). **onsemi** reserves the right to make changes at any time to any products or information herein, without notice. The information herein is provided "as-is" and **onsemi** makes no warranty, representation or guarantee regarding the accuracy of the information, product features, availability, functionality, or suitability of its products for any particular purpose, nor does **onsemi** assume any liability arising out of the application or use of any product or circuit, and specifically disclaims any and all liability, including without limitation special, consequential or incidental damages. Buyer is responsible for its products and applications using **onsemi** products, including compliance with all laws, regulations and safety requirements or standards, regardless of any support or applications information provided by **onsemi**. "Typical" parameters which may be provided in **onsemi** data sheets and/or specifications can and do vary in different applications and actual performance may vary over time. All operating parameters, including "Typicals" must be validated for each customer application by customer's technical experts. **onsemi** does not convey any license under any of its intellectual property rights nor the rights of others. **onsemi** products are not designed, intended, or authorized for use as a critical component in life support systems or any FDA Class 3 medical devices or medical devices with a same or similar classification in a foreign jurisdiction or any devices intended for implantation in the human body. Should Buyer purchase or use **onsemi** products for any such unintended or unauthorized application, Buyer shall indemnify and hold **onsemi** and its officers, employees, subsidiaries, affiliates, and distributors harmless against all claims, costs, damages, and expenses, and reasonable attorney fees arising out of, directly or indirectly, any claim of personal injury or death associated with such unintended or unauthorized use, even if such claim alleges that **onsemi** was negligent regarding the design or manufacture of the part. **onsemi** is an Equal Opportunity/Affirmative Action Employer. This literature is subject to all applicable copyright laws and is not for resale in any manner. Other names and brands may be claimed as the property of others.



# FDMC010N08C

## N-Channel Shielded Gate PowerTrench® MOSFET 80 V, 51 A, 10 mΩ

### Features

- Shielded Gate MOSFET Technology
- Max  $r_{DS(on)}$  = 10 mΩ at  $V_{GS} = 10$  V,  $I_D = 16$  A
- Max  $r_{DS(on)}$  = 25 mΩ at  $V_{GS} = 6$  V,  $I_D = 8$  A
- 50% lower  $Q_{rr}$  than other MOSFET suppliers
- Lowers switching noise/EMI
- MSL1 robust package design
- 100% UIL tested
- RoHS Compliant

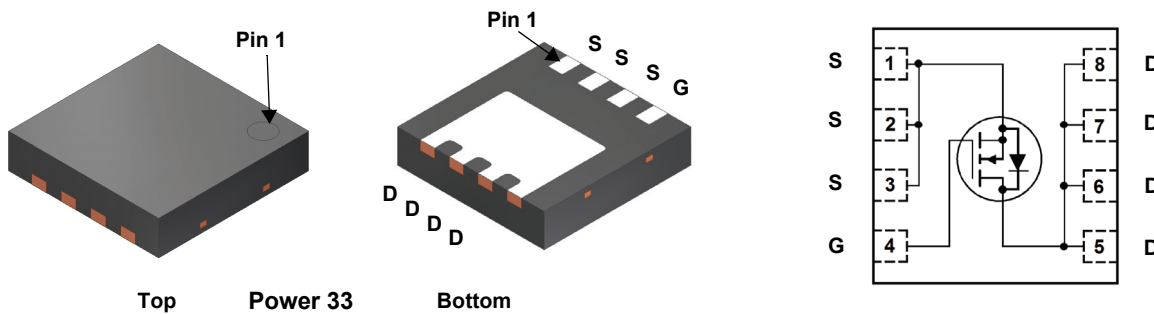


### General Description

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



### 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                           | $\pm 20$                           | V                |
| $I_D$          | Drain Current -Continuous                        | $T_C = 25^\circ\text{C}$ (Note 5)  | 51               |
|                | -Continuous                                      | $T_C = 100^\circ\text{C}$ (Note 5) | 32               |
|                | -Continuous                                      | $T_A = 25^\circ\text{C}$ (Note 1a) | 11               |
|                | -Pulsed  | (Note 4)                           | 206              |
| $E_{AS}$       | Single Pulse Avalanche Energy                    | (Note 3)                           | 96               |
| $P_D$          | Power Dissipation                                | $T_C = 25^\circ\text{C}$           | 52               |
|                | Power Dissipation                                | $T_A = 25^\circ\text{C}$ (Note 1a) | 2.4              |
| $T_J, T_{STG}$ | Operating and Storage Junction Temperature Range | -55 to +150                        | $^\circ\text{C}$ |

### Thermal Characteristics

|                 |   |     |                    |
|-----------------|---|-----|--------------------|
| $R_{\theta JC}$ | Thermal Resistance, Junction to Case              | 2.4 | $^\circ\text{C/W}$ |
| $R_{\theta JA}$ | Thermal Resistance, Junction to Ambient (Note 1a) | 53  |                    |

### Package Marking and Ordering Information

| Device Marking | Device      | Package  | Reel Size | Tape Width | Quantity   |
|----------------|-------------|----------|-----------|------------|------------|
| FDMC010N08C    | FDMC010N08C | Power 33 | 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 $25^\circ\text{C}$ |    | 75 |           | 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                         | $V_{GS} = V_{DS}, I_D = 90\ \mu\text{A}$                             | 2.0 | 2.9  | 4.0 | V                    |
| $\frac{\Delta V_{GS(th)}}{\Delta T_J}$ | Gate to Source Threshold Voltage Temperature Coefficient | $I_D = 90\ \mu\text{A}$ , referenced to $25^\circ\text{C}$           |     | -8   |     | mV/ $^\circ\text{C}$ |
| $r_{DS(on)}$                           | Static Drain to Source On Resistance                     | $V_{GS} = 10\ \text{V}, I_D = 16\ \text{A}$                          |     | 8.0  | 10  | m $\Omega$           |
|  |  | $V_{GS} = 6\ \text{V}, I_D = 8\ \text{A}$                            |     | 12.3 | 25  |                      |
|  |  | $V_{GS} = 10\ \text{V}, I_D = 16\ \text{A}, T_J = 125^\circ\text{C}$ |     | 14   | 18  |                      |
| $g_{FS}$                               | Forward Transconductance                                 | $V_{DS} = 5\ \text{V}, I_D = 16\ \text{A}$                           |     | 35   |     | S                    |

### Dynamic Characteristics

|           |                              |   |     |      |      |          |
|-----------|------------------------------|---|-----|------|------|----------|
| $C_{iss}$ | Input Capacitance            | $V_{DS} = 40\ \text{V}, V_{GS} = 0\ \text{V},$<br>$f = 1\ \text{MHz}$ |     | 1070 | 1500 | pF       |
| $C_{oss}$ | Output Capacitance           |   |     | 381  | 530  | pF       |
| $C_{rss}$ | Reverse Transfer Capacitance |   |     | 20   | 30   | pF       |
| $R_g$     | Gate Resistance              |   | 0.1 | 0.4  | 0.7  | $\Omega$ |

### Switching Characteristics

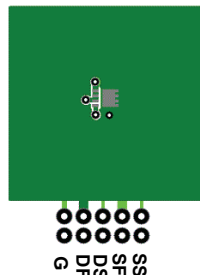
|              |                               |  |   |      |      |    |    |
|--------------|-------------------------------|--|---|------|------|----|----|
| $t_{d(on)}$  | Turn-On Delay Time            | $V_{DD} = 40\ \text{V}, I_D = 16\ \text{A},$<br>$V_{GS} = 10\ \text{V}, R_{GEN} = 6\ \Omega$ |   | 9    | 19   | ns |    |
| $t_r$        | Rise Time                     |  |   | 3    | 10   | ns |    |
| $t_{d(off)}$ | Turn-Off Delay Time           |  |   | 17   | 31   | ns |    |
| $t_f$        | Fall Time                     |  |   | 5    | 10   | ns |    |
| $Q_g$        | Total Gate Charge             |  | $V_{GS} = 0\ \text{V to } 10\ \text{V}$       |      | 15   | 22 | nC |
| $Q_g$        | Total Gate Charge             |  | $V_{GS} = 0\ \text{V to } 6\ \text{V}$        |      | 10   | 14 | nC |
| $Q_{gs}$     | Gate to Source Charge         | $V_{DD} = 40\ \text{V},$<br>$I_D = 16\ \text{A}$   |   | 5    |      | nC |    |
| $Q_{gd}$     | Gate to Drain "Miller" Charge |  |   | 3    |      | nC |    |
| $Q_{oss}$    | Output Charge                 |  | $V_{DD} = 40\ \text{V}, V_{GS} = 0\ \text{V}$ |      | 22.1 |    | nC |
| $Q_{sync}$   | Total Gate Charge Sync        | $V_{DS} = 0\ \text{V}, I_D = 16\ \text{A}$   |   | 13.3 |      | nC |    |

### Drain-Source Diode Characteristics

|          |                                       |   |  |     |     |    |
|----------|---------------------------------------|---|--|-----|-----|----|
| $V_{SD}$ | Source to Drain Diode Forward Voltage | $V_{GS} = 0\ \text{V}, I_S = 2\ \text{A}$ (Note 2)      |  | 0.7 | 1.2 | V  |
|          |                                       | $V_{GS} = 0\ \text{V}, I_S = 16\ \text{A}$ (Note 2)     |  | 0.8 | 1.3 |    |
| $t_{rr}$ | Reverse Recovery Time                 | $I_F = 8\ \text{A}, di/dt = 300\ \text{A}/\mu\text{s}$  |  | 17  | 30  | ns |
| $Q_{rr}$ | Reverse Recovery Charge               |   |  | 20  | 33  | nC |
| $t_{rr}$ | Reverse Recovery Time                 | $I_F = 8\ \text{A}, di/dt = 1000\ \text{A}/\mu\text{s}$ |  | 13  | 23  | ns |
| $Q_{rr}$ | Reverse Recovery Charge               |   |  | 45  | 73  | 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.  $53^\circ\text{C}/\text{W}$  when mounted on a 1 in<sup>2</sup> pad of 2 oz copper



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

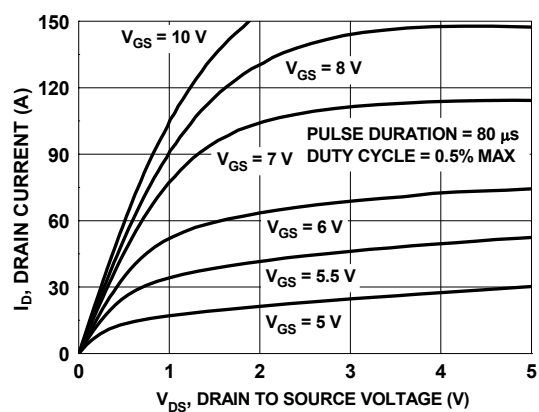
2. Pulse Test: Pulse Width < 300  $\mu\text{s}$ , Duty cycle < 2.0%.

3.  $E_{AS}$  of 96 mJ is based on starting  $T_J = 25^\circ\text{C}$ ,  $L = 3\ \text{mH}$ ,  $I_{AS} = 8\ \text{A}$ ,  $V_{DD} = 72\ \text{V}$ ,  $V_{GS} = 10\ \text{V}$ , 100% test at  $L = 0.1\ \text{mH}$ ,  $I_{AS} = 25\ \text{A}$ .

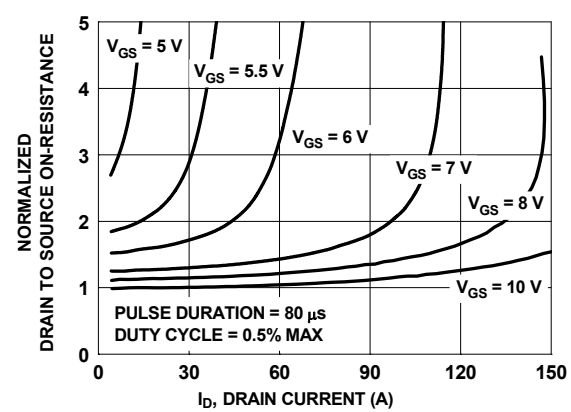
4. Pulsed  $I_d$  please refer to Fig 11 SOA graph for more details.

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

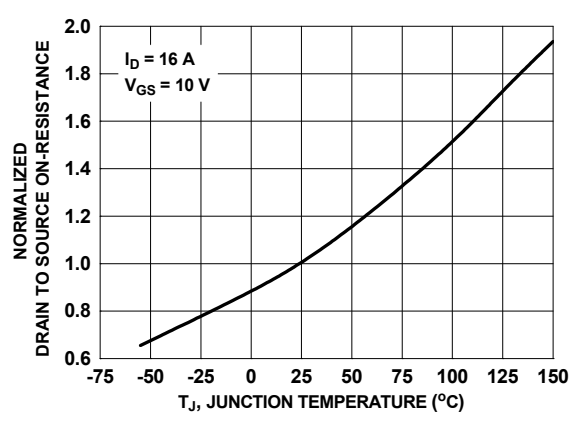
**Typical Characteristics**  $T_J = 25\text{ }^\circ\text{C}$  unless otherwise noted.



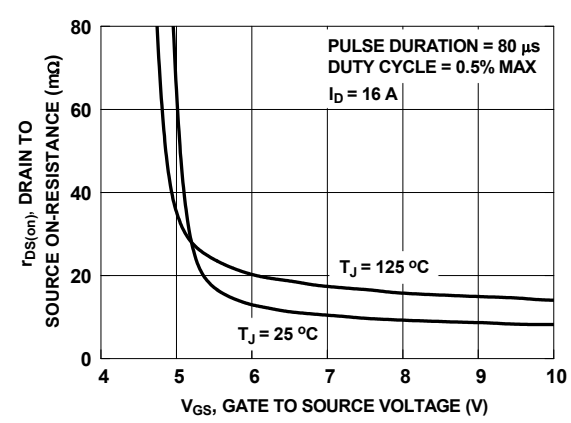
**Figure 1. On Region Characteristics**



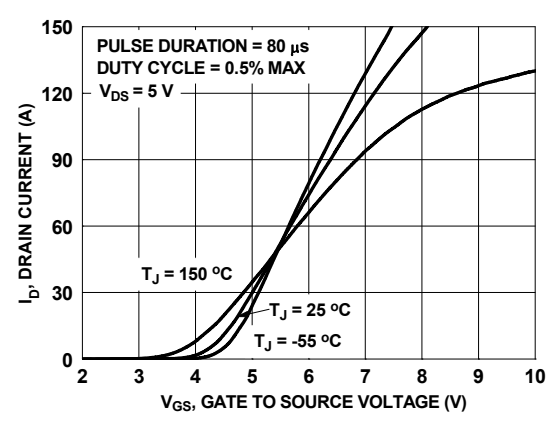
**Figure 2. Normalized On-Resistance vs. Drain Current and Gate Voltage**



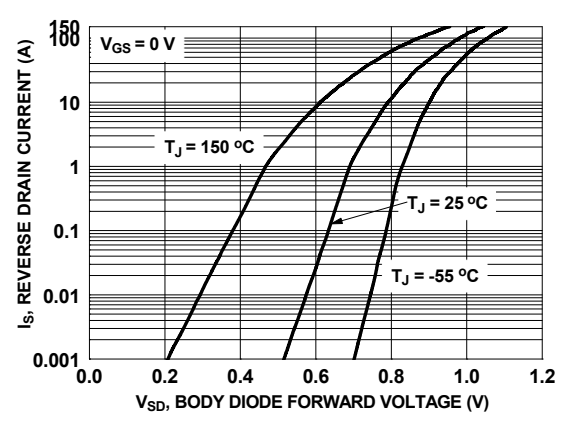
**Figure 3. Normalized On Resistance vs. Junction Temperature**



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

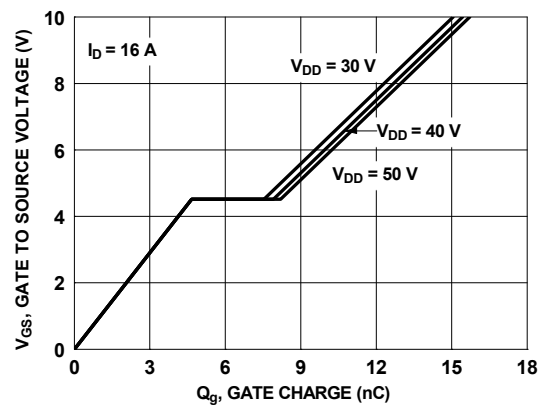


**Figure 5. Transfer Characteristics**

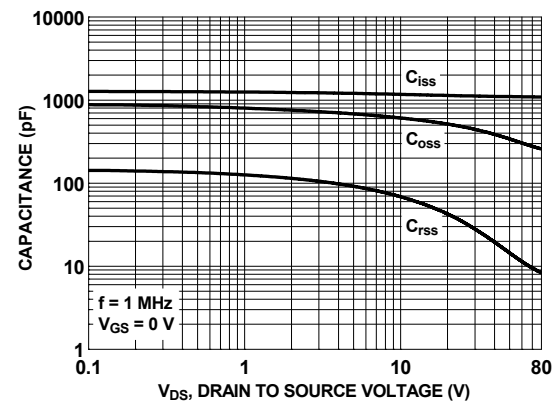


**Figure 6. Source to Drain Diode Forward Voltage vs. Source Current**

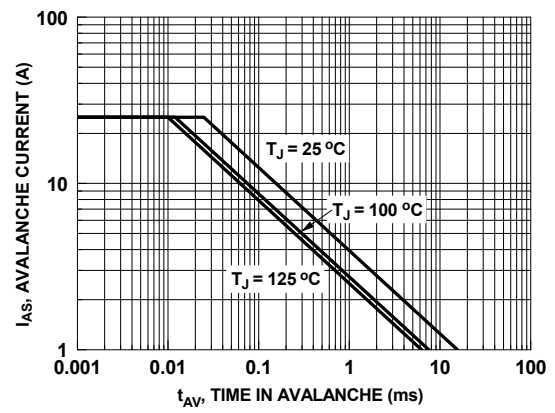
**Typical Characteristics**  $T_J = 25\text{ }^\circ\text{C}$  unless otherwise noted.



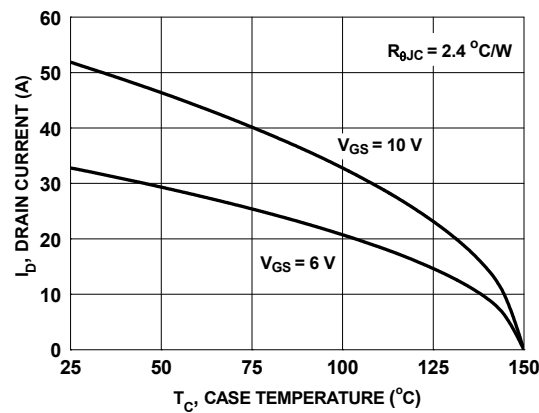
**Figure 7. Gate Charge Characteristics**



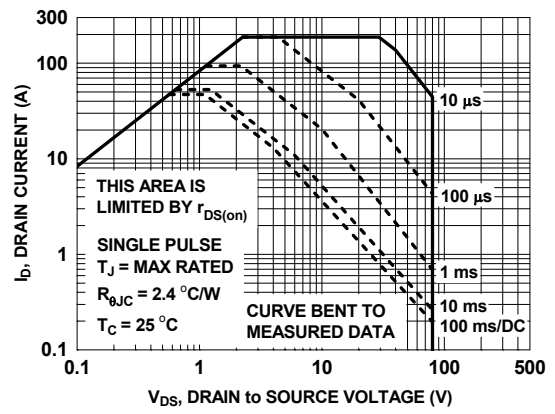
**Figure 8. Capacitance vs. Drain to Source Voltage**



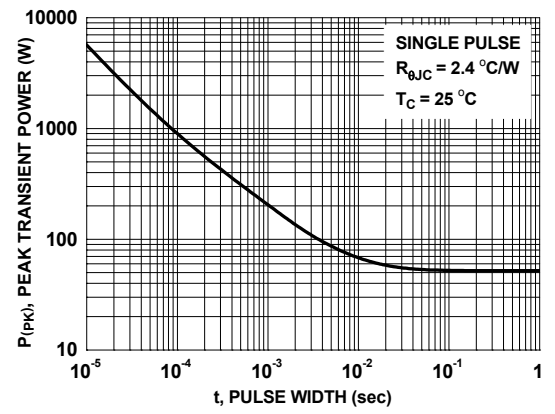
**Figure 9. Unclamped Inductive Switching Capability**



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

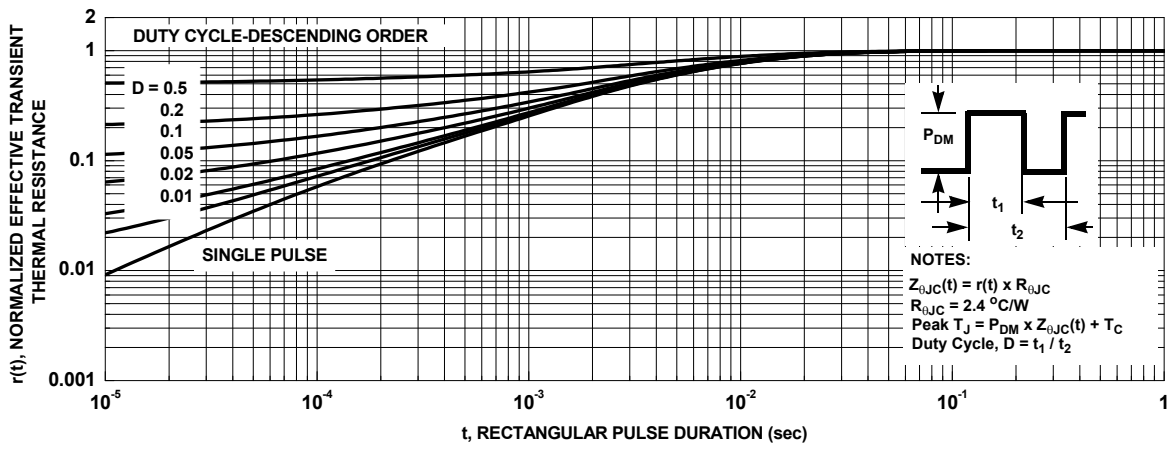


**Figure 11. Forward Bias Safe Operating Area**



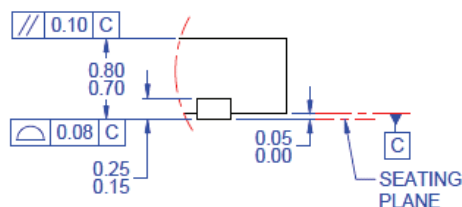
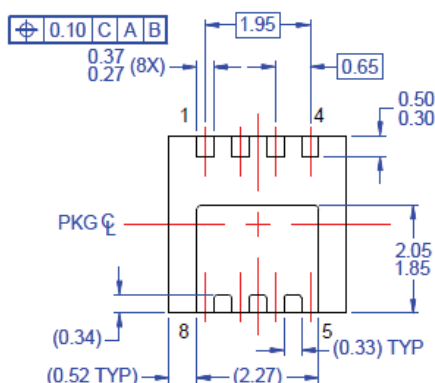
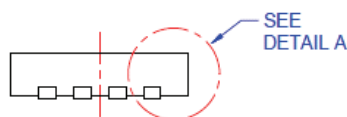
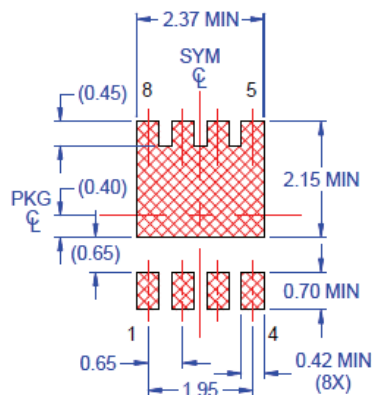
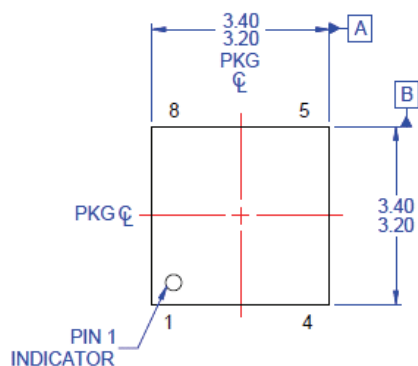
**Figure 12. Single Pulse Maximum Power Dissipation**

**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



**DETAIL A**  
SCALE: 2X

**NOTES: UNLESS OTHERWISE SPECIFIED**

- A) PACKAGE STANDARD REFERENCE: JEDEC MO-240, ISSUE A, VAR. BA, DATED OCTOBER 2002.
- 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-1994.
- E) DRAWING FILE NAME: PQFN08HREV1

ON Semiconductor and the ON Logo are trademarks of Semiconductor Components Industries, LLC dba ON Semiconductor or its subsidiaries in the United States and/or other countries.

ON Semiconductor owns the rights to a number of patents, trademarks, copyrights, trade secrets, and other intellectual property. A listing of ON Semiconductor's product/patent coverage may be accessed at [www.onsemi.com/site/pdf/Patent-Marking.pdf](http://www.onsemi.com/site/pdf/Patent-Marking.pdf). ON Semiconductor reserves the right to make changes without further notice to any products herein. ON Semiconductor makes no warranty, representation or guarantee regarding the suitability of its products for any particular purpose, nor does ON Semiconductor assume any liability arising out of the application or use of any product or circuit, and specifically disclaims any and all liability, including without limitation special, consequential or incidental damages. Buyer is responsible for its products and applications using ON Semiconductor products, including compliance with all laws, regulations and safety requirements or standards, regardless of any support or applications information provided by

ON Semiconductor. "Typical" parameters which may be provided in ON Semiconductor data sheets and/or specifications can and do vary in different applications and actual performance may vary over time. All operating parameters, including "Typicals" must be validated for each customer application by customer's technical experts. ON Semiconductor does not convey any license under its patent rights nor the rights of others. ON Semiconductor products are not designed, intended, or authorized for use as a critical component in life support systems or any FDA Class 3 medical devices or medical devices with a same or similar classification in a foreign jurisdiction or any devices intended for implantation in the human body. Should Buyer purchase or use ON Semiconductor products for any such unintended or unauthorized application, Buyer shall indemnify and hold ON Semiconductor and its officers, employees, subsidiaries, affiliates, and distributors harmless against all claims, costs, damages, and expenses, and reasonable attorney fees arising out of, directly or indirectly, any claim of personal injury or death associated with such unintended or unauthorized use, even if such claim alleges that ON Semiconductor was negligent regarding the design or manufacture of the part. ON Semiconductor is an Equal Opportunity/Affirmative Action Employer. This literature is subject to all applicable copyright laws and is not for resale in any manner.