

# FDMS039N08B

## N-Channel PowerTrench® MOSFET

80V, 100A, 3.9mΩ

### Features

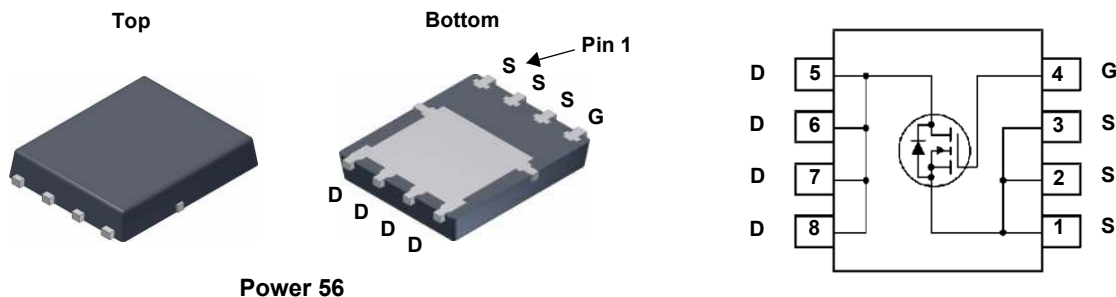
- $R_{DS(on)} = 3.2m\Omega$  (Typ.) @  $V_{GS} = 10V$ ,  $I_D = 50A$
- Low FOM  $R_{DS(on)} \cdot Q_G$
- Low reverse recovery charge,  $Q_{rr}$
- Soft reverse recovery body diode
- Enables highly efficiency in synchronous rectification
- Fast Switching Speed
- 100% UIL Tested
- RoHS Compliant

### Description

This N-Channel MOSFET is produced using Fairchild Semiconductor's advanced PowerTrench process that has been especially tailored to minimize the on-state resistance and yet maintain superior switching performance.

### Application

- Synchronous Rectification for Server / Telecom PSU
- Battery Charger and Battery Protection circuit
- DC motor drives and Uninterruptible Power Supplies
- Micro Solar Inverter



### MOSFET Maximum Ratings $T_C = 25^\circ C$ unless otherwise noted\*

| Symbol         | Parameter                               | Ratings                                      | Units      |
|----------------|-----------------------------------------|----------------------------------------------|------------|
| $V_{DSS}$      | Drain to Source Voltage                 | 80                                           | V          |
| $V_{GSS}$      | Gate to Source Voltage                  | $\pm 20$                                     | V          |
| $I_D$          | Drain Current                           | - Continuous ( $T_C = 25^\circ C$ )          | A          |
|                |                                         | - Continuous ( $T_A = 25^\circ C$ ) (Note 1) |            |
| $I_{DM}$       | Drain Current                           | - Pulsed (Note 2)                            | A          |
| $E_{AS}$       | Single Pulsed Avalanche Energy          | (Note 3)                                     | mJ         |
| $P_D$          | Power Dissipation                       | ( $T_C = 25^\circ C$ )                       | W          |
|                |                                         | ( $T_A = 25^\circ C$ ) (Note 1)              | W          |
| $T_J, T_{STG}$ | Operating and Storage Temperature Range | -55 to +150                                  | $^\circ C$ |

### Thermal Characteristics

| Symbol          | Parameter                                        | Ratings | Units        |
|-----------------|--------------------------------------------------|---------|--------------|
| $R_{\theta JC}$ | Thermal Resistance, Junction to Case             | 1.2     | $^\circ C/W$ |
| $R_{\theta JA}$ | Thermal Resistance, Junction to Ambient (Note 1) | 50      |              |

## Package Marking and Ordering Information

| Device Marking | Device      | Package  | Reel Size | Tape Width | Quantity   |
|----------------|-------------|----------|-----------|------------|------------|
| FDMS039N08B    | FDMS039N08B | Power 56 | 13 "      | 12 mm      | 3000 units |

## Electrical Characteristics $T_C = 25^\circ\text{C}$ 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 $25^\circ\text{C}$ | -  | 0.04 | -         | $^\circ\text{C}$ |
| $I_{DSS}$                            | Zero Gate Voltage Drain Current           | $V_{DS} = 64\text{V}$ , $V_{GS} = 0\text{V}$              | -  | -    | 1         | $\mu\text{A}$    |
| $I_{GSS}$                            | Gate to Body Leakage Current              | $V_{GS} = \pm 20\text{V}$ , $V_{DS} = 0\text{V}$          | -  | -    | $\pm 100$ | nA               |

### On Characteristics

|              |                                      |                                                     |     |     |     |                  |
|--------------|--------------------------------------|-----------------------------------------------------|-----|-----|-----|------------------|
| $V_{GS(th)}$ | Gate Threshold Voltage               | $V_{GS} = V_{DS}$ , $I_D = 250\mu\text{A}$          | 2.5 | -   | 4.5 | V                |
| $R_{DS(on)}$ | Static Drain to Source On Resistance | $V_{GS} = 10\text{V}$ , $I_D = 50\text{A}$          | -   | 3.2 | 3.9 | $\text{m}\Omega$ |
| $g_{FS}$     | Forward Transconductance             | $V_{DS} = 10\text{V}$ , $I_D = 50\text{A}$ (Note 4) | -   | 100 | -   | S                |

### Dynamic Characteristics

|               |                                   |                                                                                    |   |      |      |    |
|---------------|-----------------------------------|------------------------------------------------------------------------------------|---|------|------|----|
| $C_{iss}$     | Input Capacitance                 | $V_{DS} = 40\text{V}$ , $V_{GS} = 0\text{V}$<br>$f = 1\text{MHz}$                  | - | 5715 | 7600 | pF |
| $C_{oss}$     | Output Capacitance                |                                                                                    | - | 881  | 1170 | pF |
| $C_{rss}$     | Reverse Transfer Capacitance      |                                                                                    | - | 15   | -    | pF |
| $C_{oss(er)}$ | Energy Related Output Capacitance | $V_{DS} = 40\text{V}$ , $V_{GS} = 0\text{V}$                                       | - | 1646 | -    | pF |
| $Q_{g(tot)}$  | Total Gate Charge at 10V          | $V_{DS} = 40\text{V}$ , $I_D = 50\text{A}$<br>$V_{GS} = 0\text{V}$ to $10\text{V}$ | - | 77   | 100  | nC |
| $Q_{gs}$      | Gate to Source Gate Charge        |                                                                                    | - | 34   | -    | nC |
| $Q_{gs2}$     | Gate Charge Threshold to Plateau  |                                                                                    | - | 13   | -    | nC |
| $Q_{gd}$      | Gate to Drain "Miller" Charge     |                                                                                    | - | 16   | -    | nC |

### Switching Characteristics

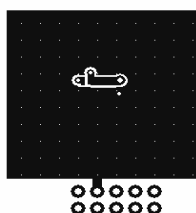
|              |                              |                                                                                             |   |     |     |          |
|--------------|------------------------------|---------------------------------------------------------------------------------------------|---|-----|-----|----------|
| $t_{d(on)}$  | Turn-On Delay Time           | $V_{DD} = 40\text{V}$ , $I_D = 50\text{A}$<br>$V_{GS} = 10\text{V}$ , $R_{GEN} = 4.7\Omega$ | - | 42  | 94  | ns       |
| $t_r$        | Turn-On Rise Time            |                                                                                             | - | 25  | 60  | ns       |
| $t_{d(off)}$ | Turn-Off Delay Time          |                                                                                             | - | 48  | 106 | ns       |
| $t_f$        | Turn-Off Fall Time           |                                                                                             | - | 17  | 44  | ns       |
| ESR          | Equivalent Series Resistance | Drain Open, $f = 1\text{MHz}$                                                               | - | 1.2 | -   | $\Omega$ |

### Drain-Source Diode Characteristics

|                 |                                                          |                                                                                                              |   |    |     |    |
|-----------------|----------------------------------------------------------|--------------------------------------------------------------------------------------------------------------|---|----|-----|----|
| I <sub>S</sub>  | Maximum Continuous Drain to Source Diode Forward Current |                                                                                                              | - | -  | 100 | A  |
| I <sub>SM</sub> | Maximum Pulsed Drain to Source Diode Forward Current     |                                                                                                              | - | -  | 400 | A  |
| V <sub>SD</sub> | Drain to Source Diode Forward Voltage                    | V <sub>GS</sub> = 0V, I <sub>SD</sub> = 50A                                                                  | - | -  | 1.3 | V  |
| t <sub>rr</sub> | Reverse Recovery Time                                    | V <sub>GS</sub> = 0V, I <sub>SD</sub> = 50A, V <sub>DD</sub> = 40V<br>dI <sub>F</sub> /dt = 100A/μs (Note 4) | - | 68 | -   | ns |
| Q <sub>rr</sub> | Reverse Recovery Charge                                  |                                                                                                              | - | 80 | -   | 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.  $R_{\theta JC}$  is guaranteed by design while  $R_{\theta CA}$  is determined by the user's board design.



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



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

2. Repetitive Rating: Pulse width limited by maximum junction temperature
3.  $L = 0.3\text{mH}$ ,  $I_{AS} = 40\text{A}$ , Starting  $T_J = 25^\circ\text{C}$
4. Pulse Test: Pulse Width  $\leq 300\mu\text{s}$ , Duty cycle  $\leq 2.0\%$
5. Essentially Independent of Operating Temperature Typical Characteristics

## Typical Performance Characteristics

Figure 1. On-Region Characteristics

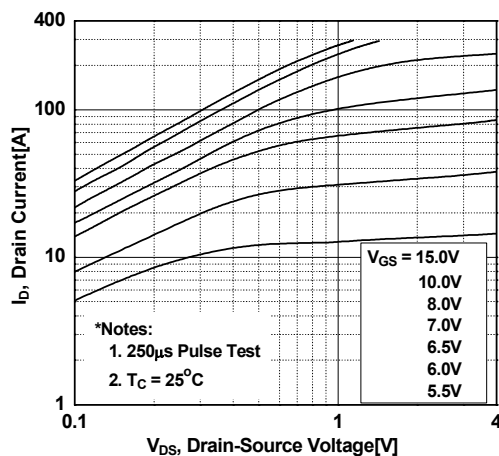


Figure 2. Transfer Characteristics

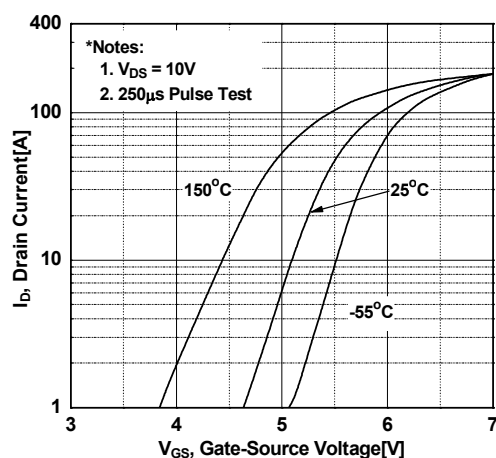


Figure 3. On-Resistance Variation vs. Drain Current and Gate Voltage

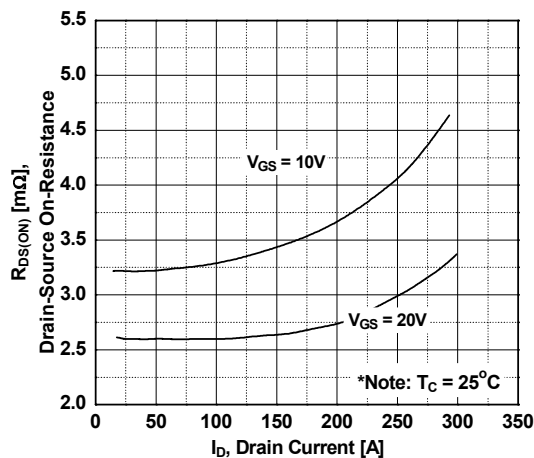


Figure 4. Body Diode Forward Voltage Variation vs. Source Current and Temperature

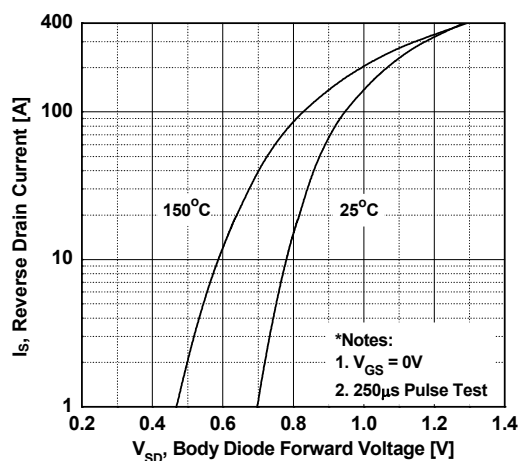


Figure 5. Capacitance Characteristics

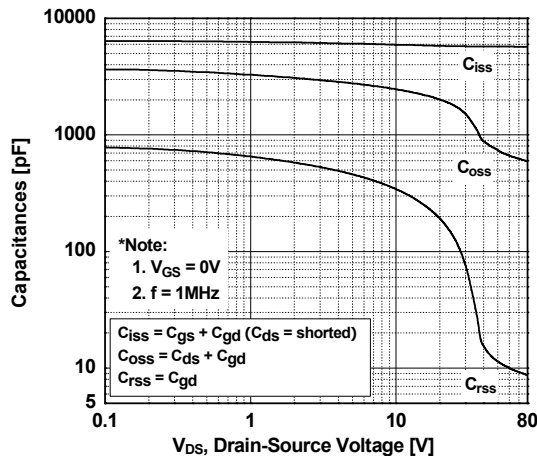
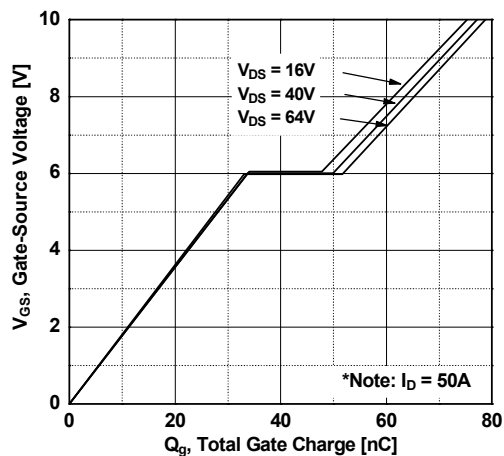


Figure 6. Gate Charge Characteristics



## Typical Performance Characteristics (Continued)

Figure 7. Breakdown Voltage Variation vs. Temperature

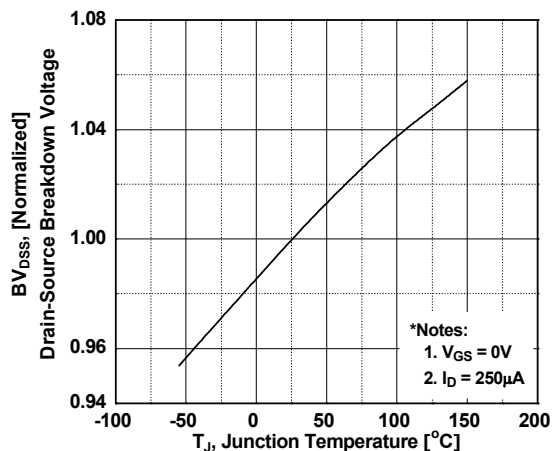


Figure 8. On-Resistance Variation vs. Temperature

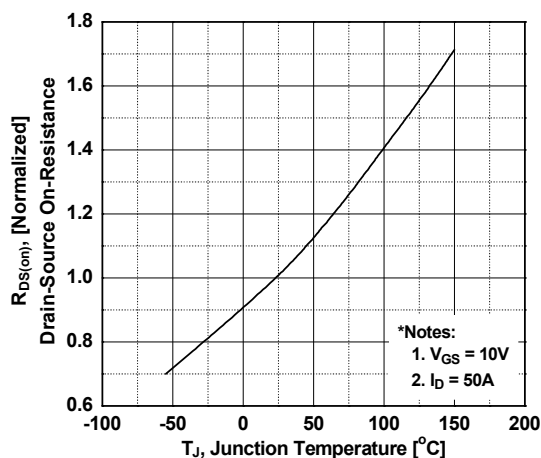


Figure 9. Maximum Safe Operating Area vs. Ambient Temperature

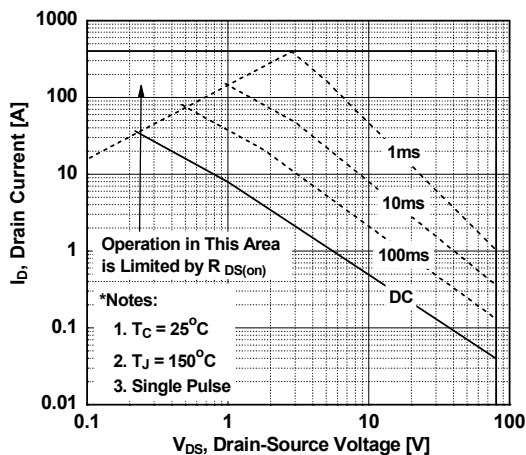


Figure 10. Maximum Drain Current

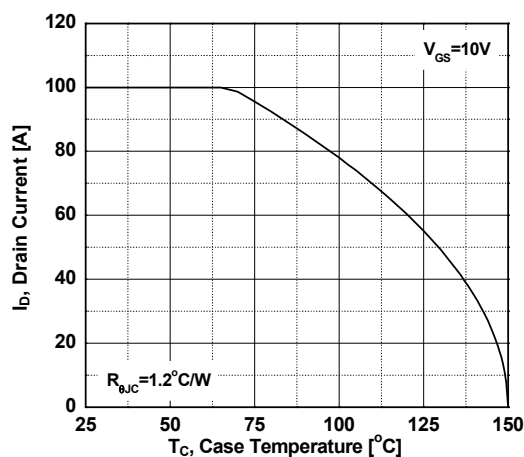


Figure 11. Unclamped Inductive Switching Capability

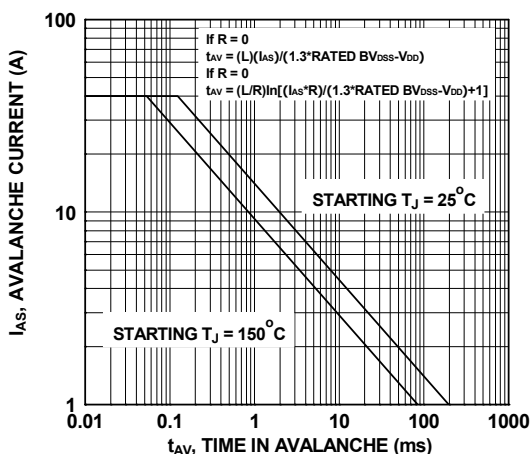
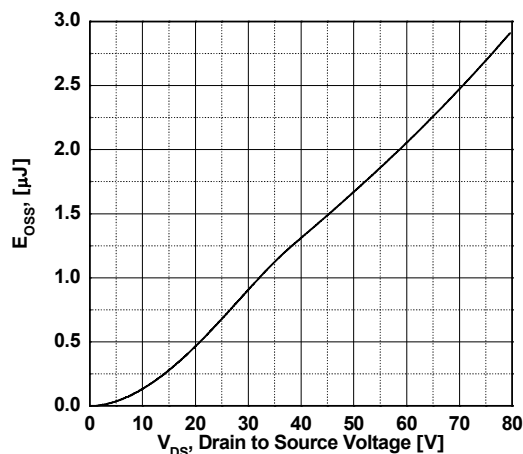
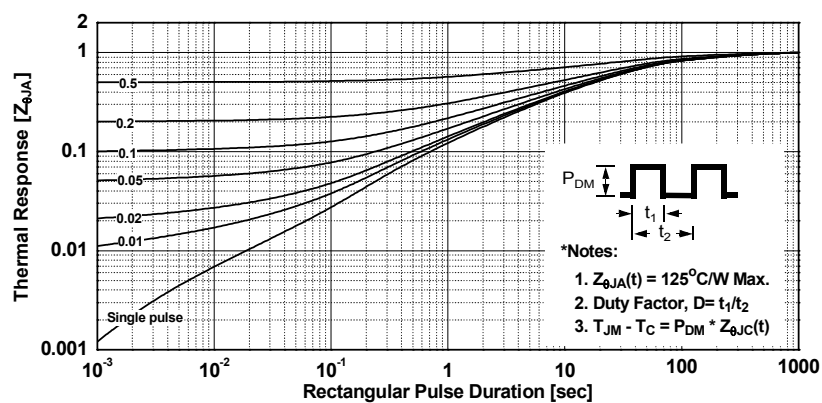


Figure 12. Eoss vs. Drain to Source Voltage

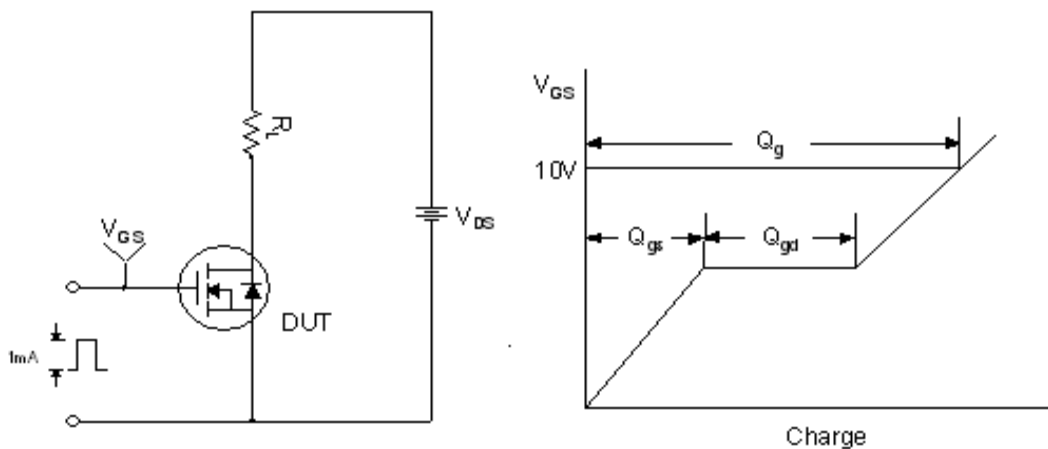


# Typical Performance Characteristics (Continued)

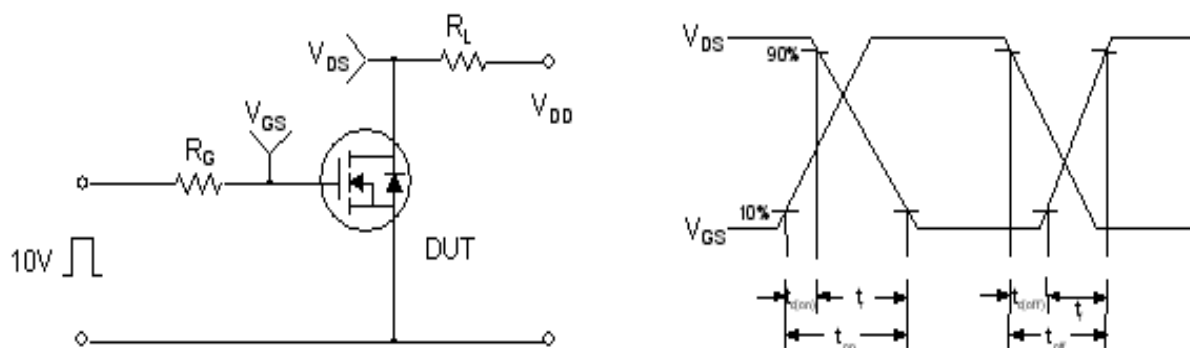
## Figure 13. Transient Thermal Response Curve



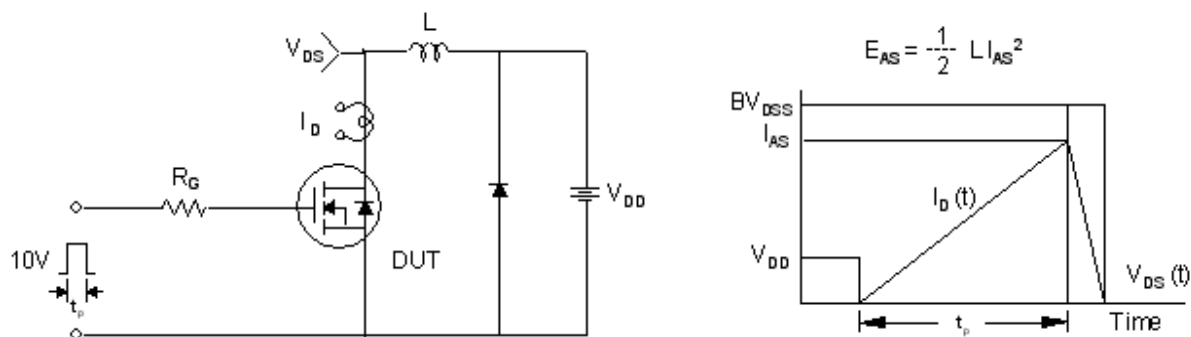
Gate Charge Test Circuit & Waveform



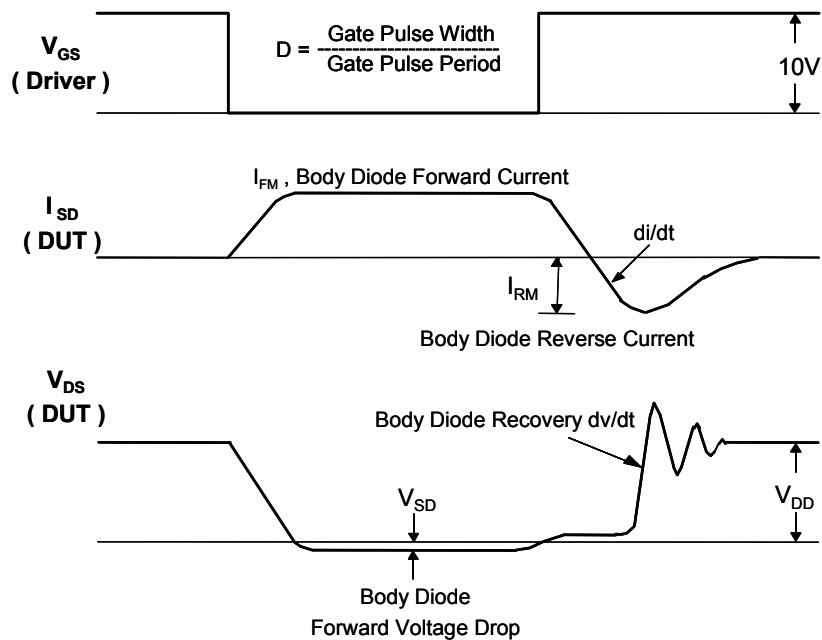
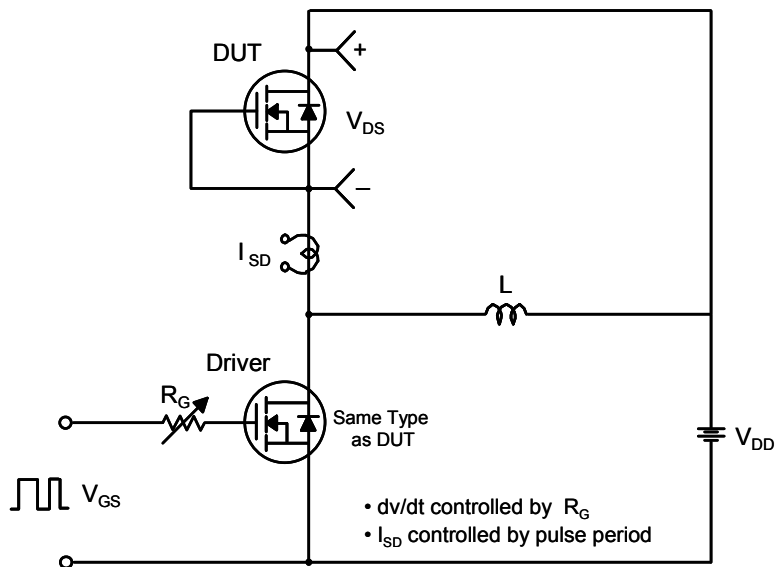
Resistive Switching Test Circuit & Waveforms



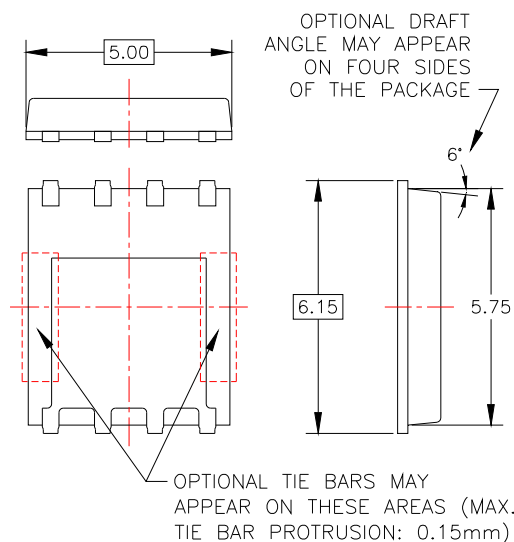
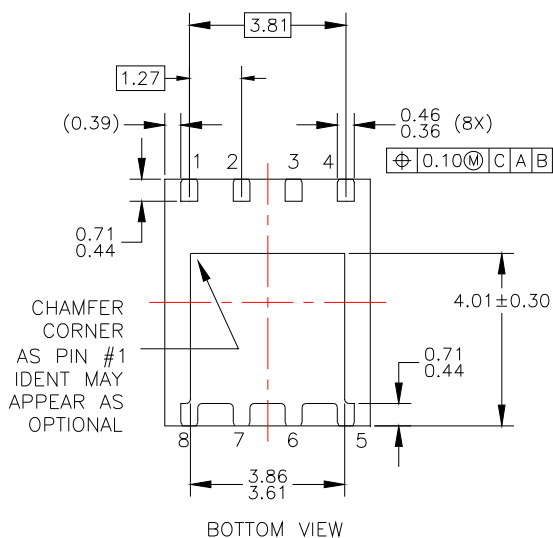
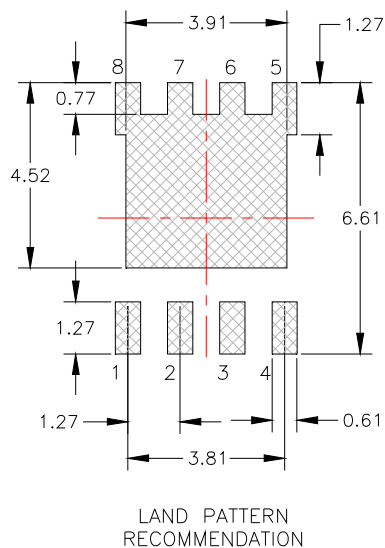
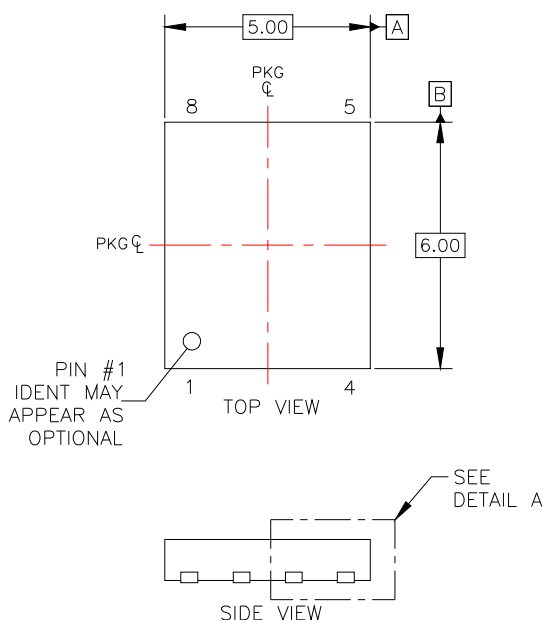
Unclamped Inductive Switching Test Circuit & Waveforms



# Peak Diode Recovery dv/dt Test Circuit & Waveforms

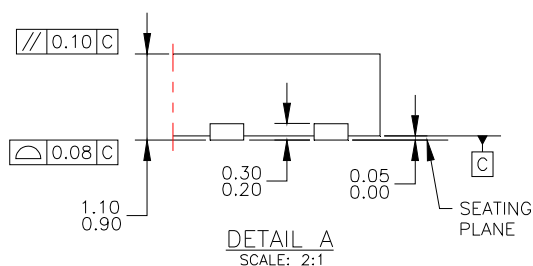


# Dimensional Outline and Pad Layout



NOTES: UNLESS OTHERWISE SPECIFIED

- A) PACKAGE STANDARD REFERENCE: JEDEC MO-240, ISSUE A, VAR. AA, 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: PQFN08REV4







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|                                                                                   |                                     |                                       |                                                                                     |
|-----------------------------------------------------------------------------------|-------------------------------------|---------------------------------------|-------------------------------------------------------------------------------------|
| 2Cool™                                                                            | FlashWriter® *                      | PDP SPM™                              | The Power Franchise®                                                                |
| AccuPower™                                                                        | FPS™                                | Power-SPM™                            | The Right Technology for Your Success™                                              |
| Auto-SPM™                                                                         | F-PFS™                              | PowerTrench®                          |                                                                                     |
| AX-CAP™ *                                                                         | FRFET®                              | PowerXS™                              | the power®                                                                          |
| BitSiC®                                                                           | Global Power Resource <sup>SM</sup> | Programmable Active Droop™            | TinyBoost™                                                                          |
| Build it Now™                                                                     | Green FPS™                          | QFET®                                 | TinyBuck™                                                                           |
| CorePLUS™                                                                         | Green FPS™ e-Series™                | QS™                                   | TinyCalc™                                                                           |
| CorePOWER™                                                                        | Gmax™                               | Quiet Series™                         | TinyLogic®                                                                          |
| CROSSVOLT™                                                                        | GTO™                                | RapidConfigure™                       | TINYOPTO™                                                                           |
| CTL™                                                                              | IntelliMAX™                         |                                       | TinyPower™                                                                          |
| Current Transfer Logic™                                                           | ISOPLANAR™                          |                                       | TinyPWM™                                                                            |
| DEUXPEED®                                                                         | MegaBuck™                           | Saving our world, 1mW/W/kW at a time™ | TinyWire™                                                                           |
| Dual Cool™                                                                        | MICROCOUPLER™                       | SignalWise™                           | TranSiC®                                                                            |
| EcoSPARK®                                                                         | MicroFET™                           | SmartMax™                             | TriFault Detect™                                                                    |
| EfficientMax™                                                                     | MicroPak™                           | SMART START™                          | TRUECURRENT®*                                                                       |
| ESBC™                                                                             | MicroPak2™                          | SPM®                                  | µSerDes™                                                                            |
|  | MillerDrive™                        | STEALTH™                              |  |
| Fairchild®                                                                        | MotionMax™                          | SuperFET®                             | UHC®                                                                                |
| Fairchild Semiconductor®                                                          | Motion-SPM™                         | SuperSOT™-3                           | Ultra FRFET™                                                                        |
| FACT Quiet Series™                                                                | mWSaver™                            | SuperSOT™-6                           | UniFET™                                                                             |
| FACT®                                                                             | OptiHiT™                            | SuperSOT™-8                           | VCX™                                                                                |
| FAST®                                                                             | OPTOLOGIC®                          | SupreMOS®                             | VisualMax™                                                                          |
| FastvCore™                                                                        | OPTOPLANAR®                         | SyncFET™                              | XS™                                                                                 |
| FETBench™                                                                         |                                     | Sync-Lock™                            |                                                                                     |
|                                                                                   |                                     | ®*                                    |                                                                                     |

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| Datasheet Identification | Product Status        | Definition                                                                                                                                                                                          |
|--------------------------|-----------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Advance Information      | Formative / In Design | Datasheet contains the design specifications for product development. Specifications may change in any manner without notice.                                                                       |
| Preliminary              | First Production      | Datasheet contains preliminary data; supplementary data will be published at a later date. Fairchild Semiconductor reserves the right to make changes at any time without notice to improve design. |
| No Identification Needed | Full Production       | Datasheet contains final specifications. Fairchild Semiconductor reserves the right to make changes at any time without notice to improve the design.                                               |
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