March 2013

# FDB390N15A

## N-Channel PowerTrench® MOSFET

**150 V, 27 A, 39 mΩ**

## Features

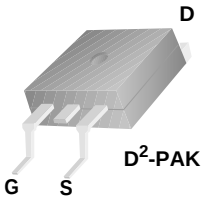
- $R_{DS(on)}$ = 33.5 mΩ ( Typ.)@ $V_{GS}$ = 10 V, $I_D$ = 27 A
- Fast Switching Speed
- Low Gate Charge, $Q_G$ = 14.3 nC(Typ.)
- High Performance Trench Technology for Extremely Low $R_{DS(on)}$
- High Power and Current Handling Capability
- RoHS Compliant

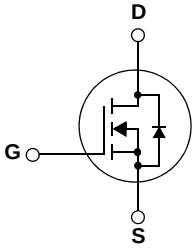
## Description

This N-Channel MOSFET is produced using Fairchild Semiconductor®'s advance PowerTrench® process that has been tailored to minimize the on-state resistance while maintaining superior switching performance.

## Applications

- Consumer Appliances
- LED TV
- Synchronous Rectification
- Uninterruptible Power Supply
- Micro Solar Inverter




## MOSFET Maximum Ratings $T_C$ = 25°C unless otherwise noted

| Symbol | Parameter | | FDB390N15A | Unit |
|---|---|---|---|---|
| $V_{DSS}$ | Drain to Source Voltage | | 150 | V |
| $V_{GSS}$ | Gate to Source Voltage | | ±20 | V |
| $I_D$ | Drain Current | -Continuous ($T_C$ = 25°C,Silicon Limited) | 27 | A |
| | | -Continuous ($T_C$ = 100°C,Silicon Limited) | 19 | |
| $I_{DM}$ | Drain Current | - Pulsed (Note 1) | 108 | A |
| $E_{AS}$ | Single Pulsed Avalanche Energy | (Note 2) | 78 | mJ |
| dv/dt | Peak Diode Recovery dv/dt | (Note 3) | 6.0 | V/ns |
| $P_D$ | Power Dissipation | ($T_C$ = 25°C) | 75 | W |
| | | - Derate above 25°C | 0.5 | W/°C |
| $T_J$, $T_{STG}$ | Operating and Storage Temperature Range | | -55 to +175 | °C |
| $T_L$ | Maximum Lead Temperature for Soldering Purpose, 1/8" from Case for 5 Seconds | | 300 | °C |

## Thermal Characteristics

| Symbol | Parameter | FDB390N15A | Unit |
|---|---|---|---|
| $R_{\theta JC}$ | Thermal Resistance, Junction to Case, Max. | 2.0 | °C/W |
| $R_{\theta JA}$ | Thermal Resistance, Junction to Ambient (minimum pad of 2 oz copper), Max. | 62.5 | |
| | Thermal Resistance, Junction to Ambient (1 $in^2$ pad of 2 oz copper), Max. | 40 | |

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## Package Marking and Ordering Information

| Device Marking | Device | Package | Reel Size | Tape Width | Quantity |
|---|---|---|---|---|---|
| FDB390N15A | FDB390N15A | $D^2$-PAK | 330mm | 24mm | 800 |

## Electrical Characteristics $T_C = 25^oC$ unless otherwise noted

| Symbol | Parameter | Test Conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| **Off Characteristics** | | | | | | |
| $BV_{DSS}$ | Drain to Source Breakdown Voltage | $I_D$ = 250μA, $V_{GS}$ = 0V | 150 | - | - | V |
| $\frac{\Delta BV_{DSS}}{\Delta T_J}$ | Breakdown Voltage Temperature Coefficient | $I_D$ = 250μA, Referenced to 25°C | - | 0.1 | - | V/°C |
| $I_{DSS}$ | Zero Gate Voltage Drain Current | $V_{DS}$ = 120V, $V_{GS}$ = 0V | - | - | 1 | μA |
| | | $V_{DS}$ = 120V, $T_C$ = 150°C | - | - | 500 | |
| $I_{GSS}$ | Gate to Body Leakage Current | $V_{GS}$ = ±20V, $V_{DS}$ = 0V | - | - | ±100 | nA |
| **On Characteristics** | | | | | | |
| $V_{GS(th)}$ | Gate Threshold Voltage | $V_{GS}$ = $V_{DS}$, $I_D$ = 250μA | 2.0 | - | 4.0 | V |
| $R_{DS(on)}$ | Static Drain to Source On Resistance | $V_{GS}$ = 10V, $I_D$ = 27A | - | 33.5 | 39.0 | mΩ |
| $g_{FS}$ | Forward Transconductance | $V_{DS}$ = 10V, $I_D$ = 27A | - | 33 | - | S |
| **Dynamic Characteristics** | | | | | | |
| $C_{iss}$ | Input Capacitance | $V_{DS}$ = 75V, $V_{GS}$ = 0V, f = 1MHz | - | 965 | 1285 | pF |
| $C_{oss}$ | Output Capacitance | | - | 96 | 130 | pF |
| $C_{rss}$ | Reverse Transfer Capacitance | | - | 5.8 | - | pF |
| $C_{oss(er)}$ | Energy Related Output Capacitance | $V_{DS}$ = 75V, $I_D$ = 27A | | 169 | - | pF |
| $Q_{g(tot)}$ | Total Gate Charge at 10V | $V_{DS}$ = 75V, $I_D$ = 27A, $V_{GS}$ = 10V (Note 4) | - | 14.3 | 18.6 | nC |
| $Q_{gs}$ | Gate to Source Gate Charge | | | 5.0 | - | nC |
| $Q_{gs2}$ | Gate Charge Threshold to Plateau | | - | 2.0 | - | nC |
| $Q_{gd}$ | Gate to Drain “Miller” Charge | | - | 3.5 | - | nC |
| ESR | Equivalent Series Resistance (G-S) | f = 1MHz | - | 1.4 | - | Ω |
| **Switching Characteristics** | | | | | | |
| $t_{d(on)}$ | Turn-On Delay Time | $V_{DD}$ = 75V, $I_D$ = 27A, $V_{GS}$ = 10V, $R_{GEN}$ = 4.7Ω (Note 4) | - | 14 | 38 | ns |
| $t_r$ | Turn-On Rise Time | | - | 10 | 30 | ns |
| $t_{d(off)}$ | Turn-Off Delay Time | | - | 20 | 50 | ns |
| $t_f$ | Turn-Off Fall Time | | - | 5 | 20 | ns |
| **Drain-Source Diode Characteristics** | | | | | | |
| $I_S$ | Maximum Continuous Drain to Source Diode Forward Current | | - | - | 27 | A |
| $I_{SM}$ | Maximum Pulsed Drain to Source Diode Forward Current | | - | - | 108 | A |
| $V_{SD}$ | Drain to Source Diode Forward Voltage | $V_{GS}$ = 0V, $I_{SD}$ = 27A | - | - | 1.25 | V |
| $t_{rr}$ | Reverse Recovery Time | $V_{GS}$ = 0V, $I_{SD}$ = 27A, $V_{DD}$ = 75V, $dI_F/dt$ = 100A/μs | - | 63 | - | ns |
| $Q_{rr}$ | Reverse Recovery Charge | | - | 131 | - | nC |

**Notes:**

1. Repetitive Rating: Pulse width limited by maximum junction temperature
2. Starting $T_J$ = 25°C, L = 3 mH, $I_{SD}$ = 7.2 A
3. $I_{SD}$ ≤ 27A, di/dt ≤ 200A/μs, $V_{DD}$ ≤ $BV_{DSS}$, Starting $T_J$ = 25°C
4. Essentially Independent of Operating Temperature Typical Characteristics

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## Typical Performance Characteristics

**Figure 1. On-Region Characteristics**

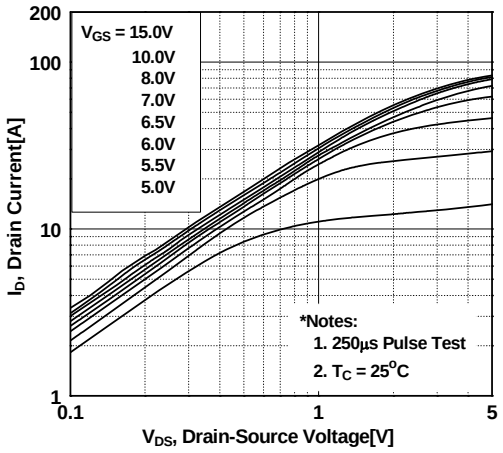



**Figure 2. Transfer Characteristics**

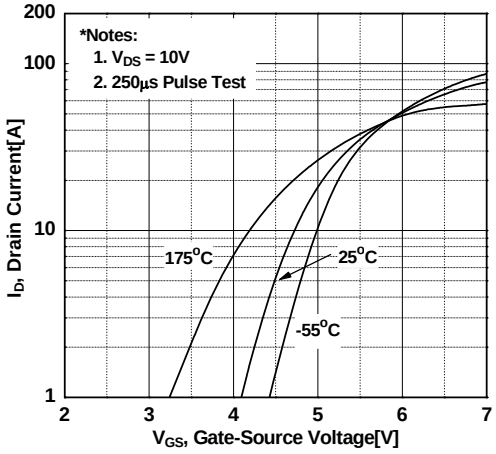



**Figure 3. On-Resistance Variation vs. Drain Current and Gate Voltage**

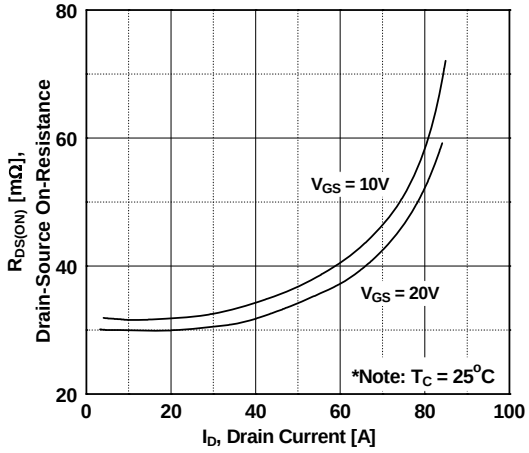



**Figure 4. Body Diode Forward Voltage Variation vs. Source Current and Temperature**

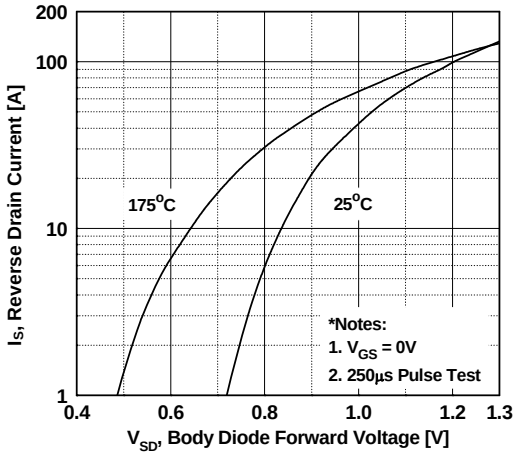



**Figure 5. Capacitance Characteristics**

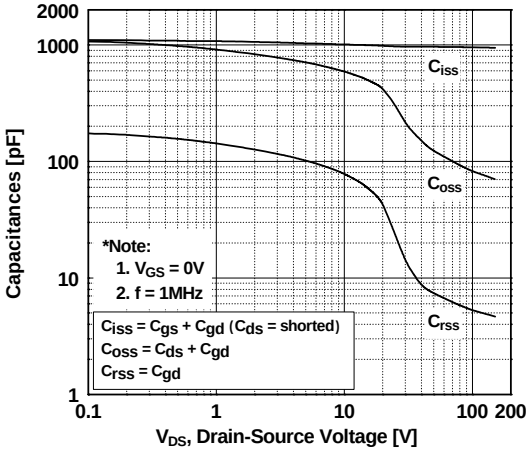
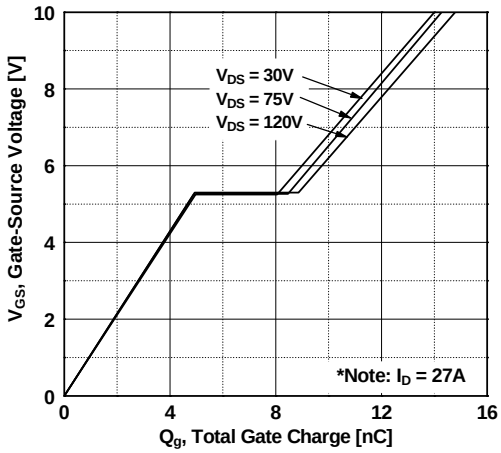



**Figure 6. Gate Charge Characteristics**

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## Typical Performance Characteristics (Continued)

**Figure 7. Breakdown Voltage Variation vs. Temperature**

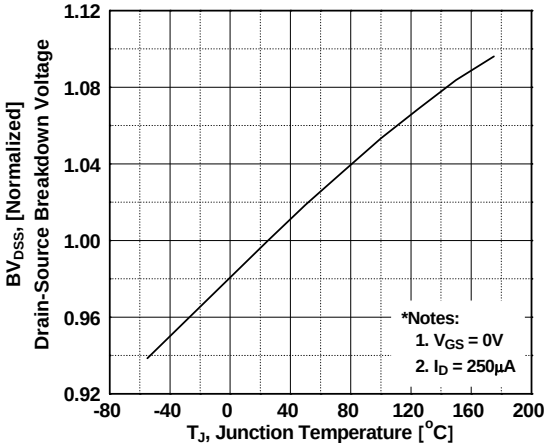



**Figure 8. On-Resistance Variation vs. Temperature**

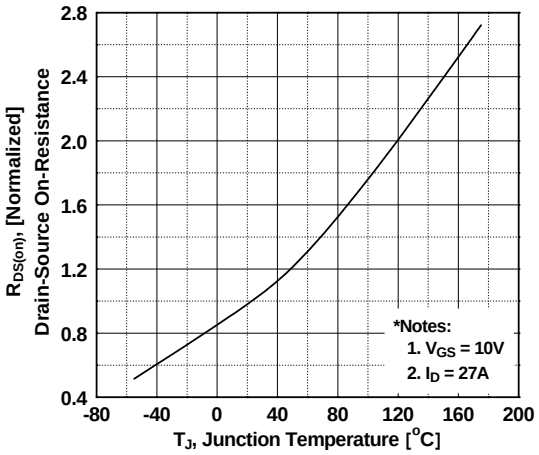



**Figure 9. Maximum Safe Operating Area**

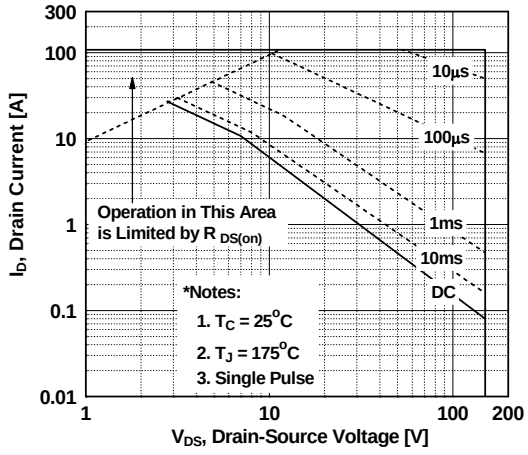



**Figure 10. Maximum Drain Current vs. Case Temperature**

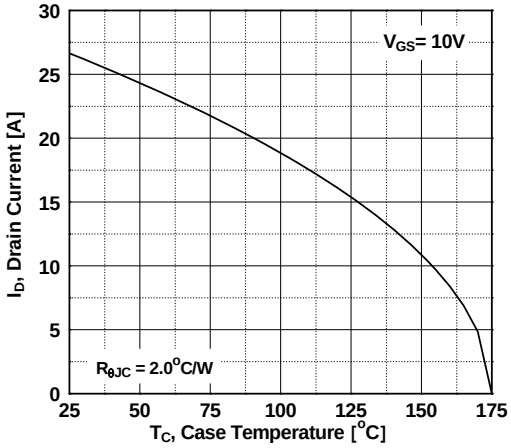



**Figure 11. Eoss vs. Drain to Source Voltage**

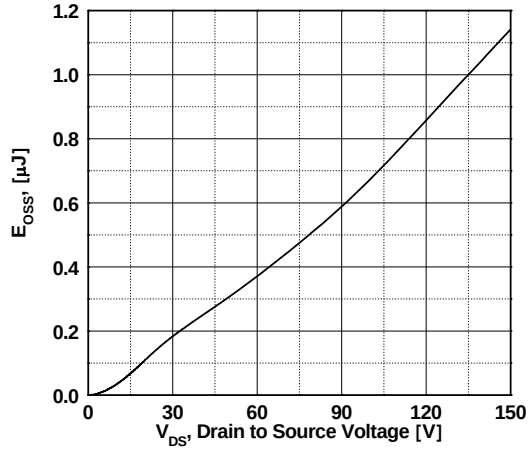
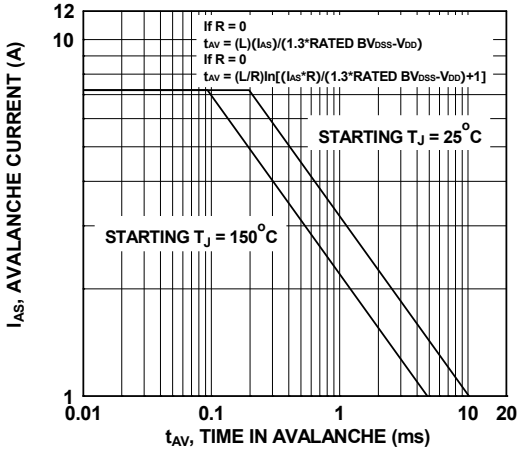



**Figure 12. Unclamped Inductive Switching Capability**

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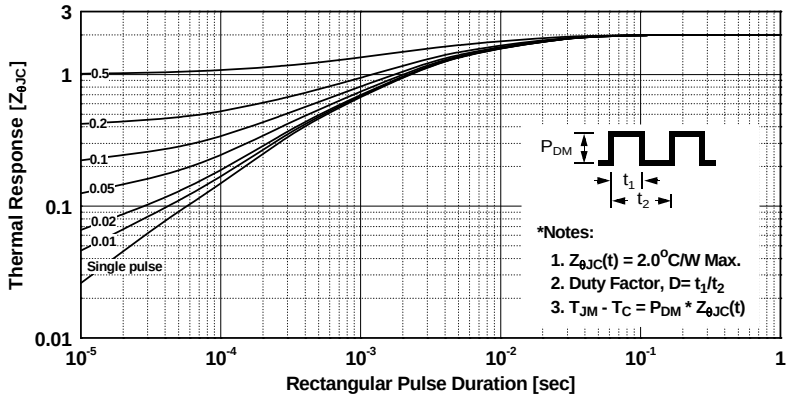
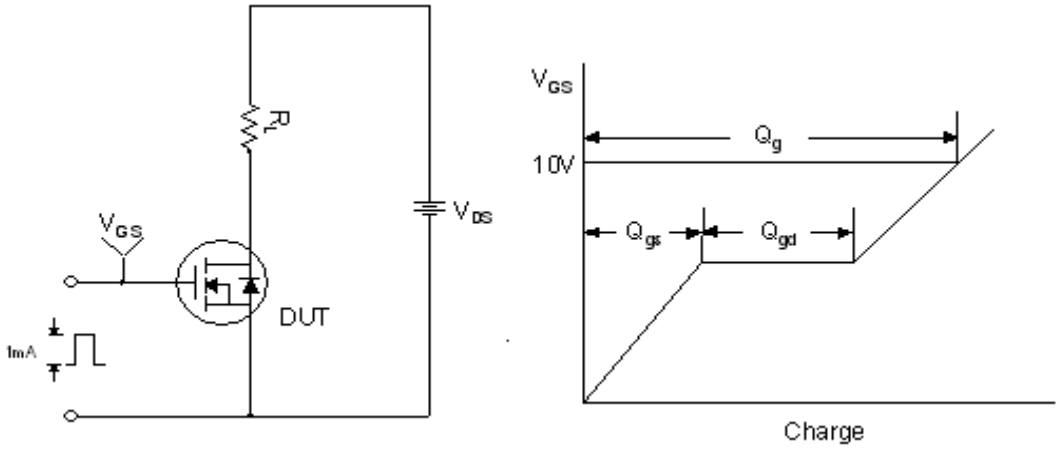
## Typical Performance Characteristics (Continued)

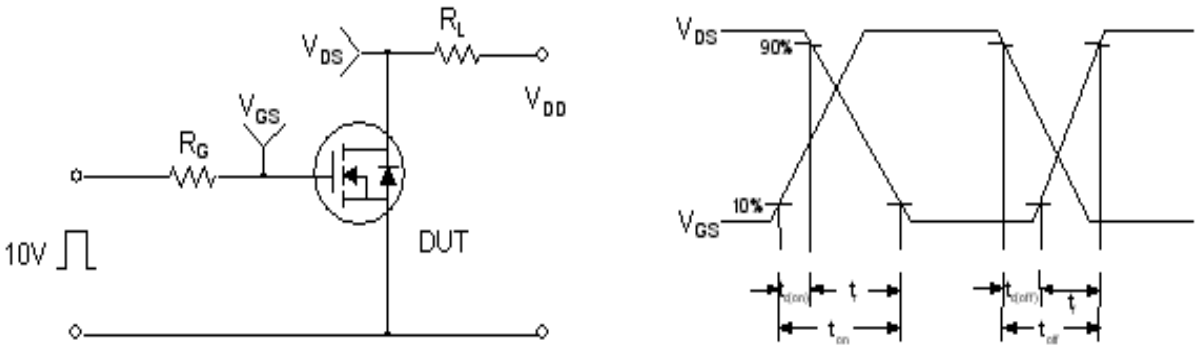
**Figure 13. Transient Thermal Response Curve**



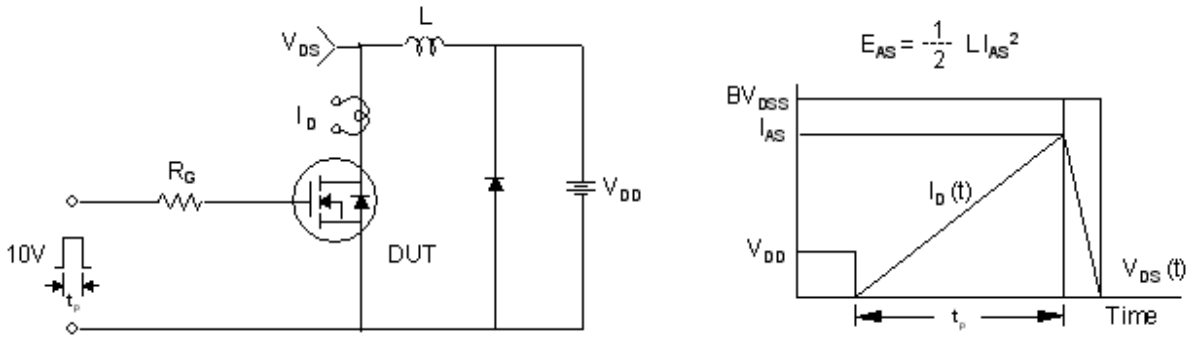
**Gate Charge Test Circuit & Waveform**



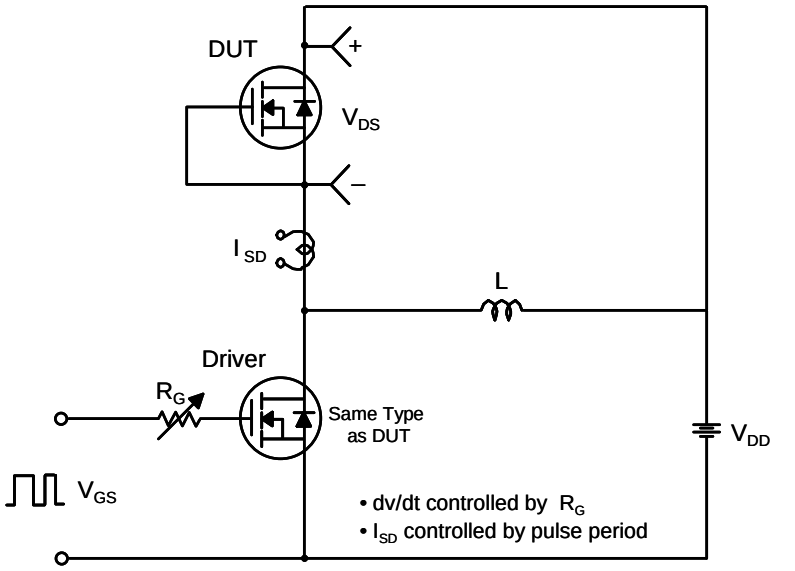

**Resistive Switching Test Circuit & Waveforms**

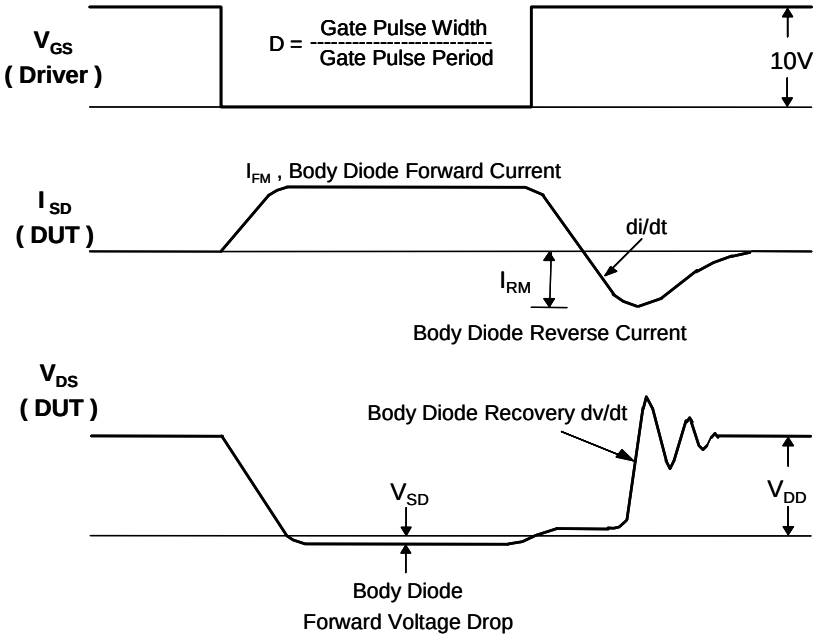



**Unclamped Inductive Switching Test Circuit & Waveforms**



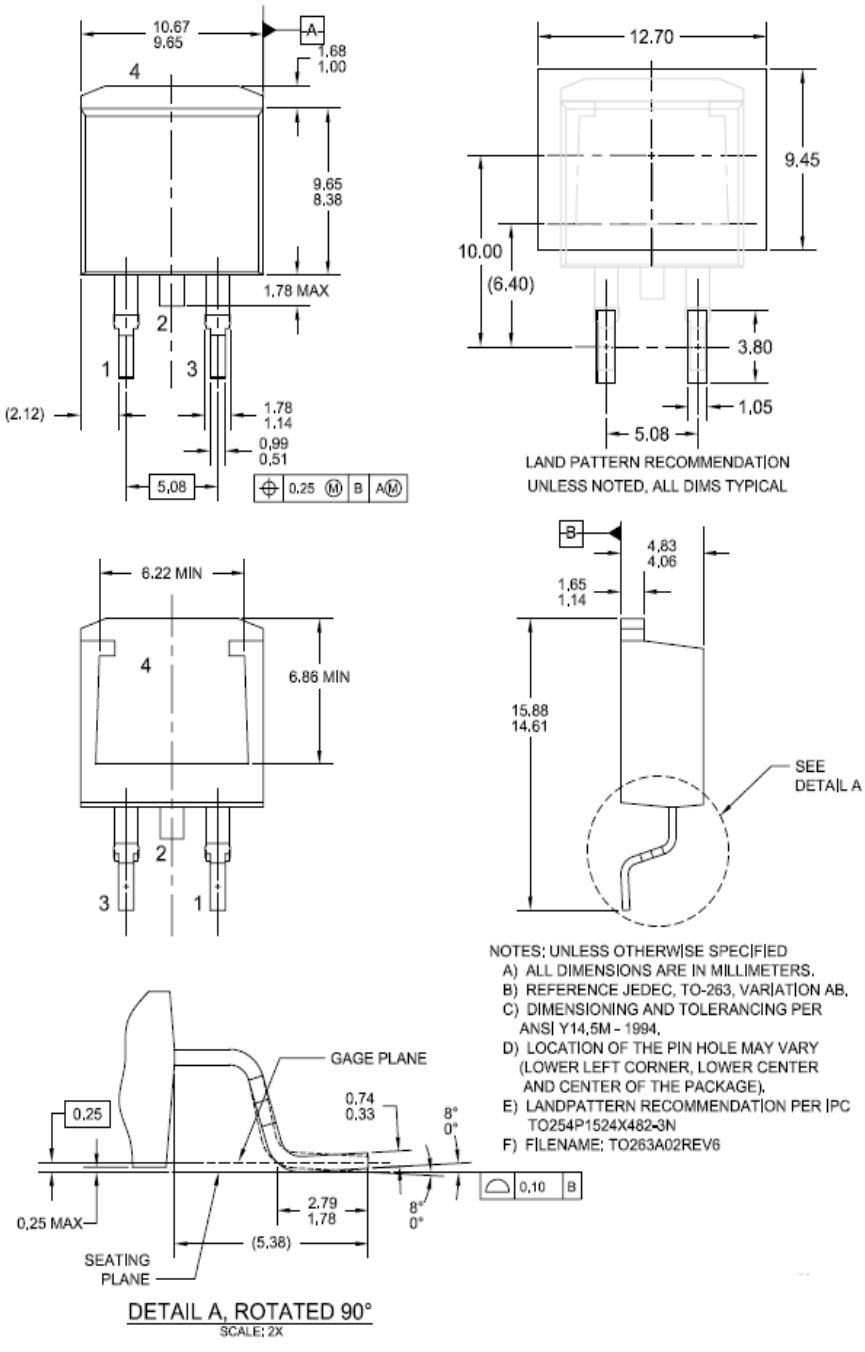
**Peak Diode Recovery dv/dt Test Circuit & Waveforms**



## Mechanical Dimensions

# $D^2PAK$




Dimensions in Millimeters

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