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FAIRCHILD SEMICONDUCTOR®

January 2014

# FDD390N15ALZ

## N-Channel PowerTrench® MOSFET

**150 V, 26 A, 42 mΩ**

### Features

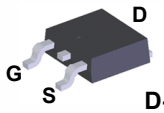
- $R_{DS(on)}$ = 33.4 mΩ (Typ.) @ $V_{GS}$ = 10 V, $I_D$ = 26 A
- $R_{DS(on)}$ = 42.2 mΩ (Typ.) @ $V_{GS}$ = 4.5 V, $I_D$ = 20 A
- Fast Switching Speed
- Low Gate Charge, $Q_G$ = 17.6 nC (Typ.)
- High Performance Trench Technology for Extremely Low $R_{DS(on)}$
- High Power and Current Handling Capability
- RoHS Compliant

### Description

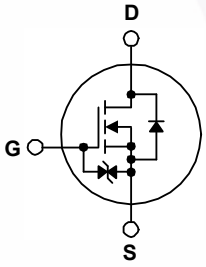
This N-Channel MOSFET is produced using Fairchild Semiconductor's advanced PowerTrench® process that has been tailored to minimize the on-state resistance while maintaining superior switching performance.

### Applications

- Consumer Applicances
- LED TV
- Synchronous Rectification
- Uninterruptible Power Supplies
- Micro Solar Inverter




D-PAK




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

| Symbol | Parameter | | | FDD390N15ALZ | 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) | | 26 | A |
| | | - Continuous ($T_C$ = 100°C) | | 17 | |
| $I_{DM}$ | Drain Current | - Pulsed | (Note 1) | 104 | A |
| $E_{AS}$ | Single Pulsed Avalanche Energy | | (Note 2) | 96 | mJ |
| dv/dt | Peak Diode Recovery dv/dt | | (Note 3) | 13 | V/ns |
| $P_D$ | Power Dissipation | ($T_C$ = 25°C) | | 63 | W |
| | | - Derate Above 25°C | | 0.5 | W/°C |
| $T_J$, $T_{STG}$ | Operating and Storage Temperature Range | | | -55 to +150 | °C |
| $T_L$ | Maximum Lead Temperature for Soldering, 1/8" from Case for 5 Seconds | | | 300 | °C |

### Thermal Characteristics

| Symbol | Parameter | FDD390N15ALZ | Unit |
|---|---|---|---|
| $R_{\theta JC}$ | Thermal Resistance, Junction to Case, Max. | 2.0 | °C/W |
| $R_{\theta JA}$ | Thermal Resistance, Junction to Ambient, Max. | 87 | |

## Package Marking and Ordering Information

| Part Number | Top Mark | Package | Packing Method | Reel Size | Tape Width | Quantity |
|---|---|---|---|---|---|---|
| FDD390N15ALZ | FDD390N15ALZ | DPAK | Tape and Reel | 330 mm | 16 mm | 2500 units |

## 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 | $I_D$ = 250 μA, $V_{GS}$ = 0 V | 150 | - | - | V |
| $\Delta BV_{DSS}$ / $\Delta T_J$ | Breakdown Voltage Temperature Coefficient | $I_D$ = 250 μA, Referenced to 25°C | - | 0.15 | - | V/°C |
| $I_{DSS}$ | Zero Gate Voltage Drain Current | $V_{DS}$ = 120 V, $V_{GS}$ = 0 V | - | - | 1 | μA |
| | | $V_{DS}$ = 120 V, $T_C$ = 125°C | - | - | 500 | |
| $I_{GSS}$ | Gate to Body Leakage Current | $V_{GS}$ = ±20 V, $V_{DS}$ = 0 V | - | - | ±10 | μA |
| **On Characteristics** | | | | | | |
| $V_{GS(th)}$ | Gate Threshold Voltage | $V_{GS}$ = $V_{DS}$, $I_D$ = 250 μA | 1.4 | - | 2.8 | V |
| $R_{DS(on)}$ | Static Drain to Source On Resistance | $V_{GS}$ = 10 V, $I_D$ = 26 A | - | 33.4 | 42 | mΩ |
| | | $V_{GS}$ = 4.5 V, $I_D$ = 20 A | - | 42.2 | 64 | mΩ |
| $g_{FS}$ | Forward Transconductance | $V_{DS}$ = 10 V, $I_D$ = 26 A | - | 50 | - | S |
| **Dynamic Characteristics** | | | | | | |
| $C_{iss}$ | Input Capacitance | $V_{DS}$ = 75 V, $V_{GS}$ = 0 V, f = 1 MHz | - | 1323 | 1760 | pF |
| $C_{oss}$ | Output Capacitance | | - | 93 | 120 | pF |
| $C_{rss}$ | Reverse Transfer Capacitance | | - | 4 | 6 | pF |
| $C_{oss(er)}$ | Energy Related Output Capacitance | $V_{DS}$ = 75 V, $V_{GS}$ = 0 V | - | 165 | - | pF |
| $Q_{g(tot)}$ | Total Gate Charge at 10V | $V_{GS}$ = 10 V; $V_{DS}$ = 75 V, $I_D$ = 26 A | - | 17.6 | 39 | nC |
| $Q_{g(tot)}$ | Total Gate Charge at 5V | $V_{GS}$ = 4.5 V; $V_{DS}$ = 75 V, $I_D$ = 26 A | - | 8.1 | 10.5 | nC |
| $Q_{gs}$ | Gate to Source Gate Charge | (Note 4) | - | 4.7 | - | nC |
| $Q_{gd}$ | Gate to Drain “Miller” Charge | (Note 4) | - | 2.3 | - | nC |
| ESR | Equivalent Series Resistance (G-S) | f = 1 MHz | - | 1.48 | - | Ω |
| **Switching Characteristics** | | | | | | |
| $t_{d(on)}$ | Turn-On Delay Time | $V_{DD}$ = 75 V, $I_D$ = 26 A, $V_{GS}$ = 10 V, $R_G$ = 4. 7Ω | - | 12.8 | 35.6 | ns |
| $t_r$ | Turn-On Rise Time | | - | 9.3 | 28.6 | ns |
| $t_{d(off)}$ | Turn-Off Delay Time | | - | 26.9 | 63.8 | ns |
| $t_f$ | Turn-Off Fall Time | (Note 4) | - | 3.2 | 16.4 | ns |
| **Drain-Source Diode Characteristics** | | | | | | |
| $I_S$ | Maximum Continuous Drain to Source Diode Forward Current | | - | - | 26 | A |
| $I_{SM}$ | Maximum Pulsed Drain to Source Diode Forward Current | | - | - | 104 | A |
| $V_{SD}$ | Drain to Source Diode Forward Voltage | $V_{GS}$ = 0 V, $I_{SD}$ = 26 A | - | - | 1.25 | V |
| $t_{rr}$ | Reverse Recovery Time | $V_{GS}$ = 0 V, $I_{SD}$ = 26 A, $dI_F/dt$ = 100 A/μs | - | 70 | - | ns |
| $Q_{rr}$ | Reverse Recovery Charge | | - | 169 | - | nC |

**Notes:**

1. Repetitive rating: pulse-width limited by maximum junction temperature.
2. L = 3 mH, $I_{AS}$ = 6.75 A, starting $T_J$ = 25°C.
3. $I_{SD} \le$ 26 A, di/dt ≤ 200 A/μs, $V_{DD} \le BV_{DSS}$, starting $T_J$ = 25°C.
4. Essentially independent of operating temperature typical characteristics.

## Typical Performance Characteristics

**Figure 1. On-Region Characteristics**

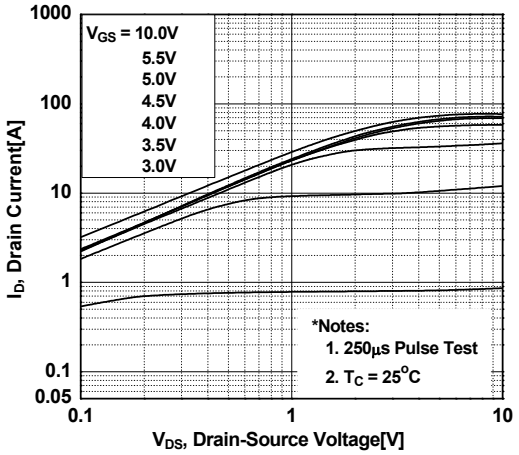



**Figure 2. Transfer Characteristics**

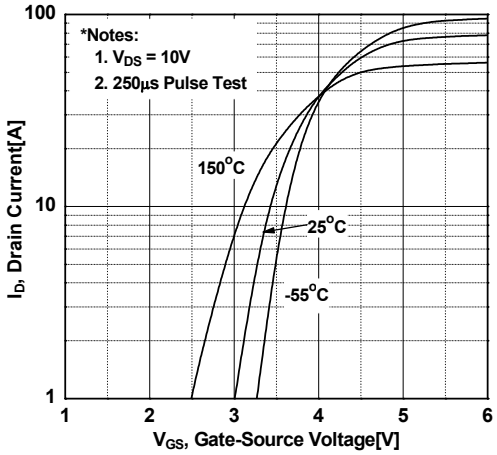



**Figure 3. On-Resistance Variation vs. Drain Current and Gate Voltage**

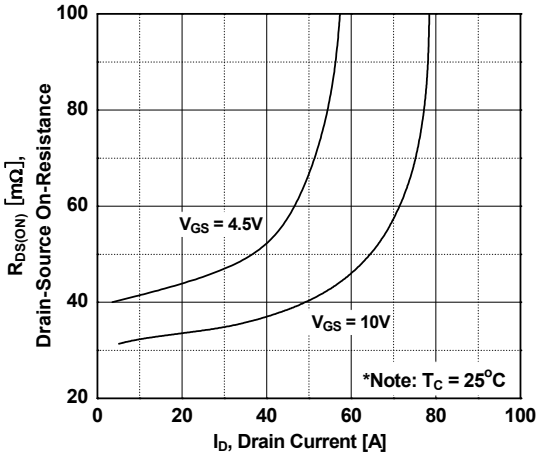



**Figure 4. Body Diode Forward Voltage Variation vs. Source Current and Temperature**

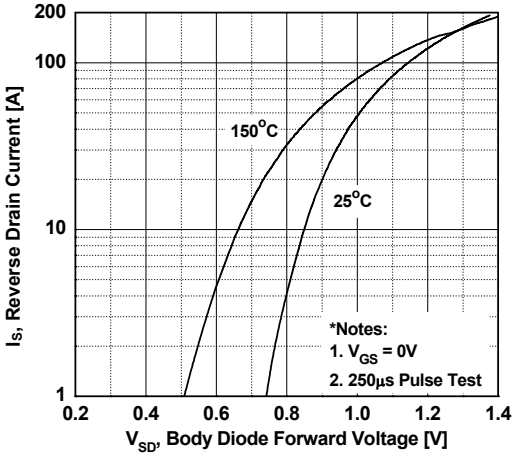



**Figure 5. Capacitance Characteristics**

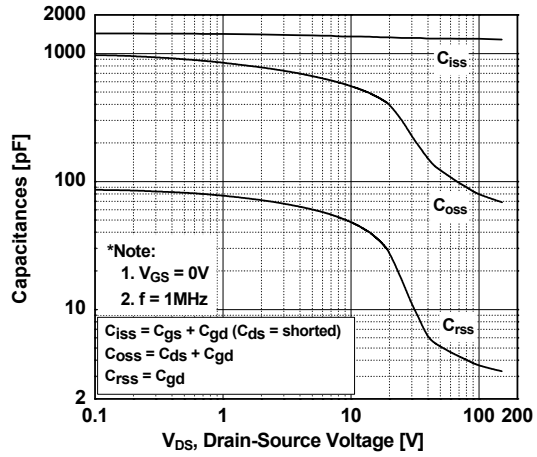
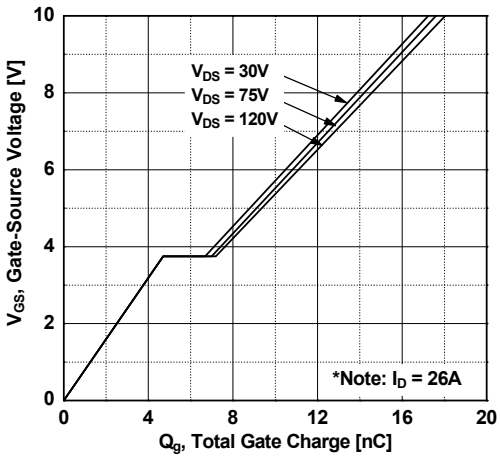



**Figure 6. Gate Charge Characteristics**



## Typical Performance Characteristics (Continued)

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

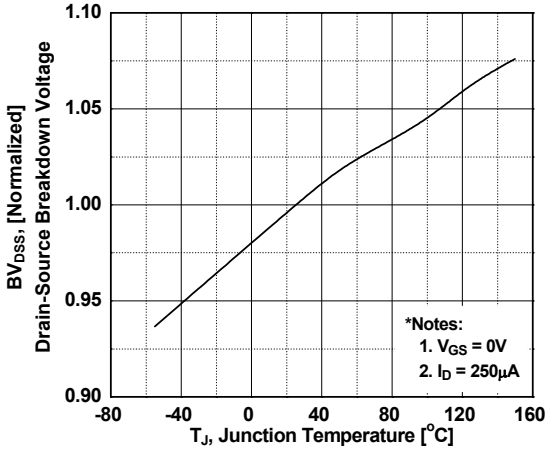



**Figure 8. On-Resistance Variation vs. Temperature**

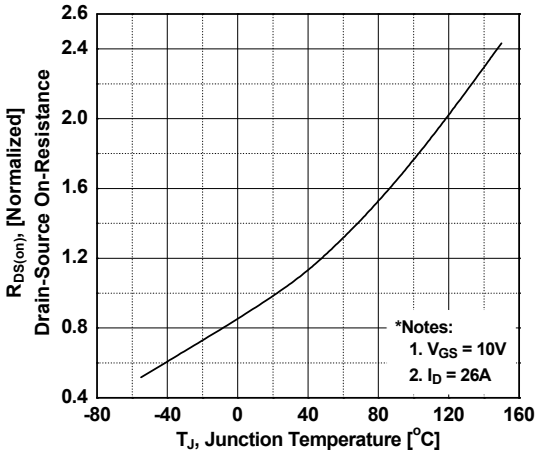



**Figure 9. Maximum Safe Operating Area**

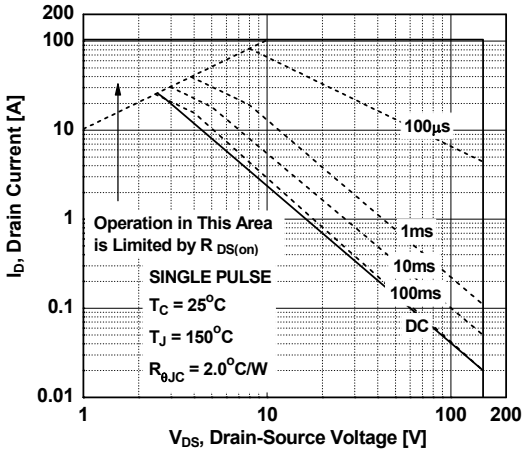



**Figure 10. Maximum Drain Current vs. Case Temperature**

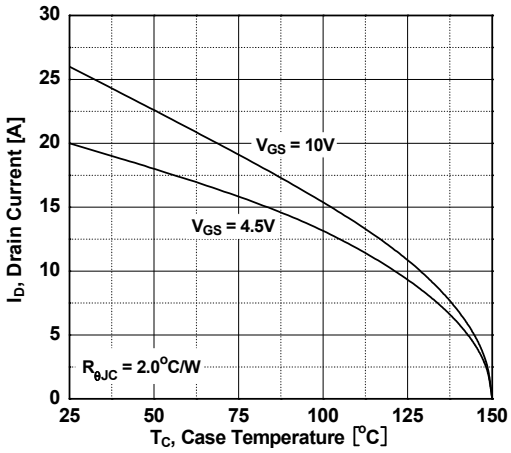



**Figure 11. Eoss vs. Drain to Source Voltage**

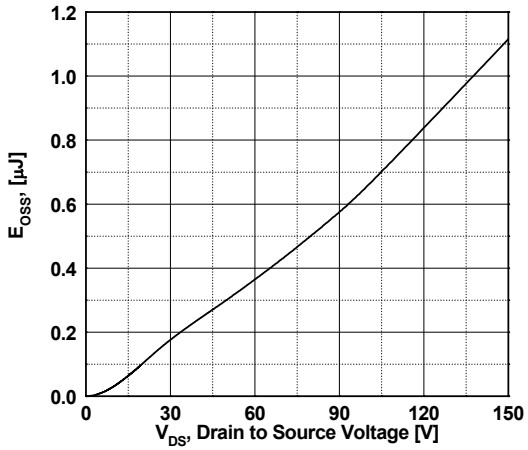
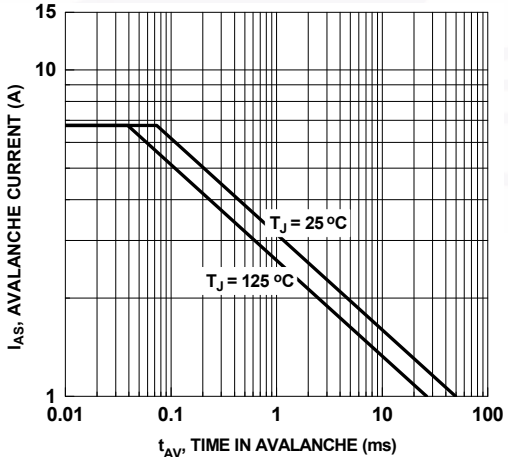
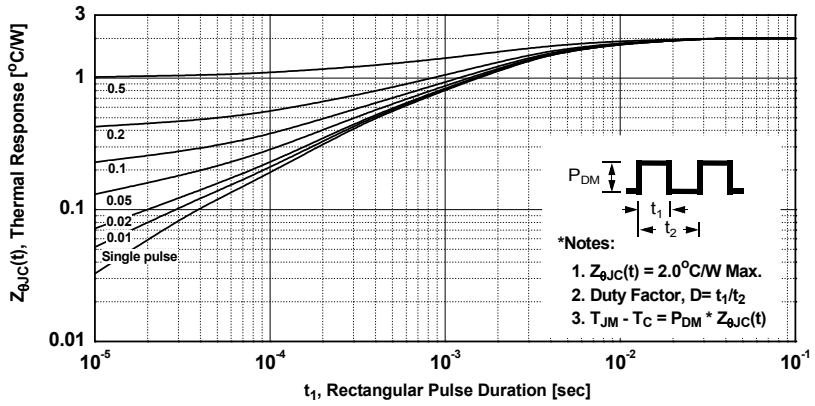



**Figure 12. Unclamped Inductive Switching Capability**



## Typical Performance Characteristics (Continued)

**Figure 13. Transient Thermal Response Curve**



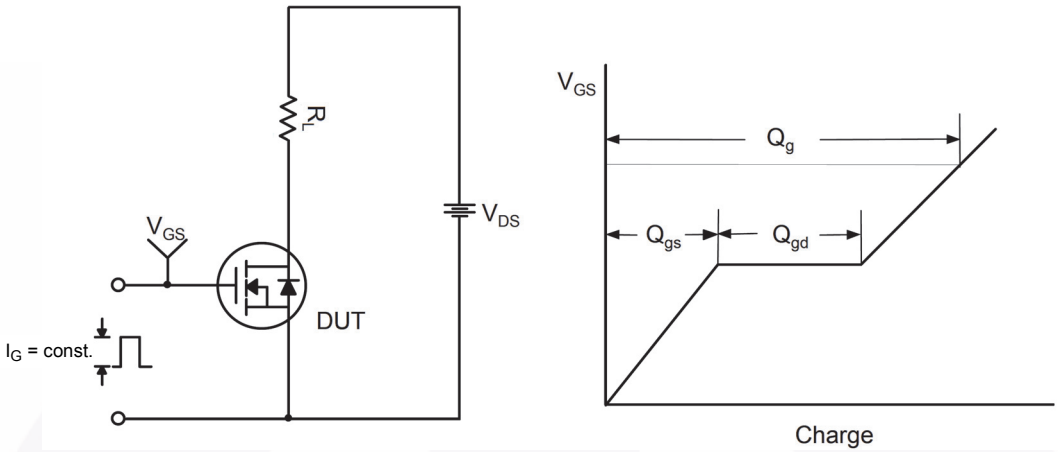



**Figure 14. Gate Charge Test Circuit & Waveform**

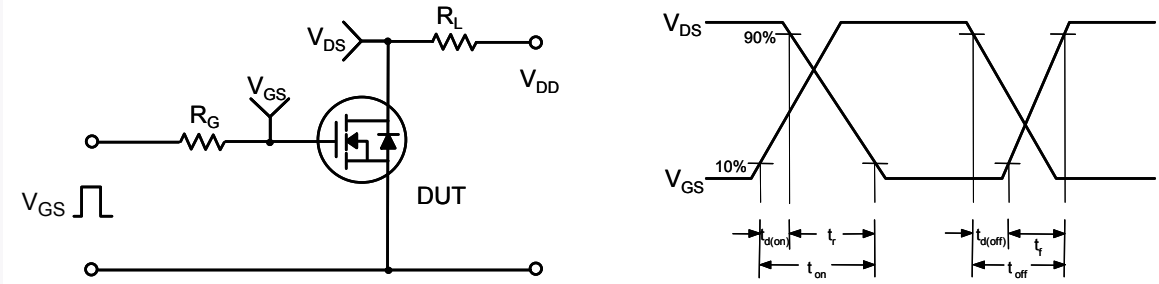



**Figure 15. Resistive Switching Test Circuit & Waveforms**

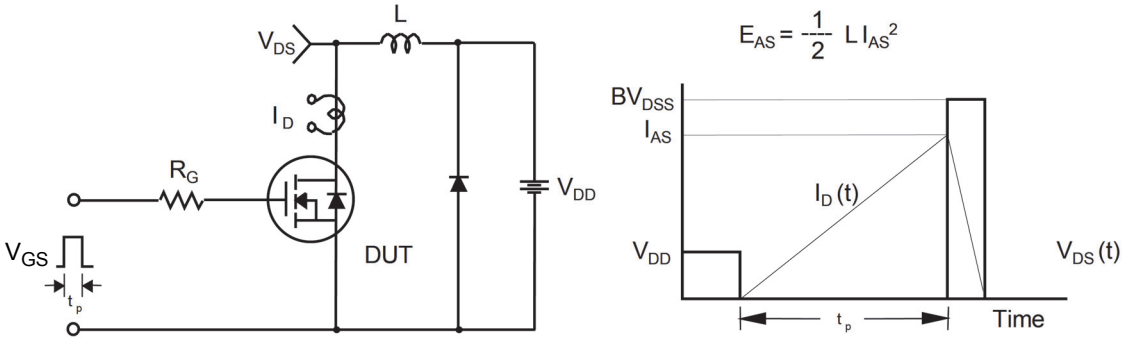



**Figure 16. Unclamped Inductive Switching Test Circuit & Waveforms**

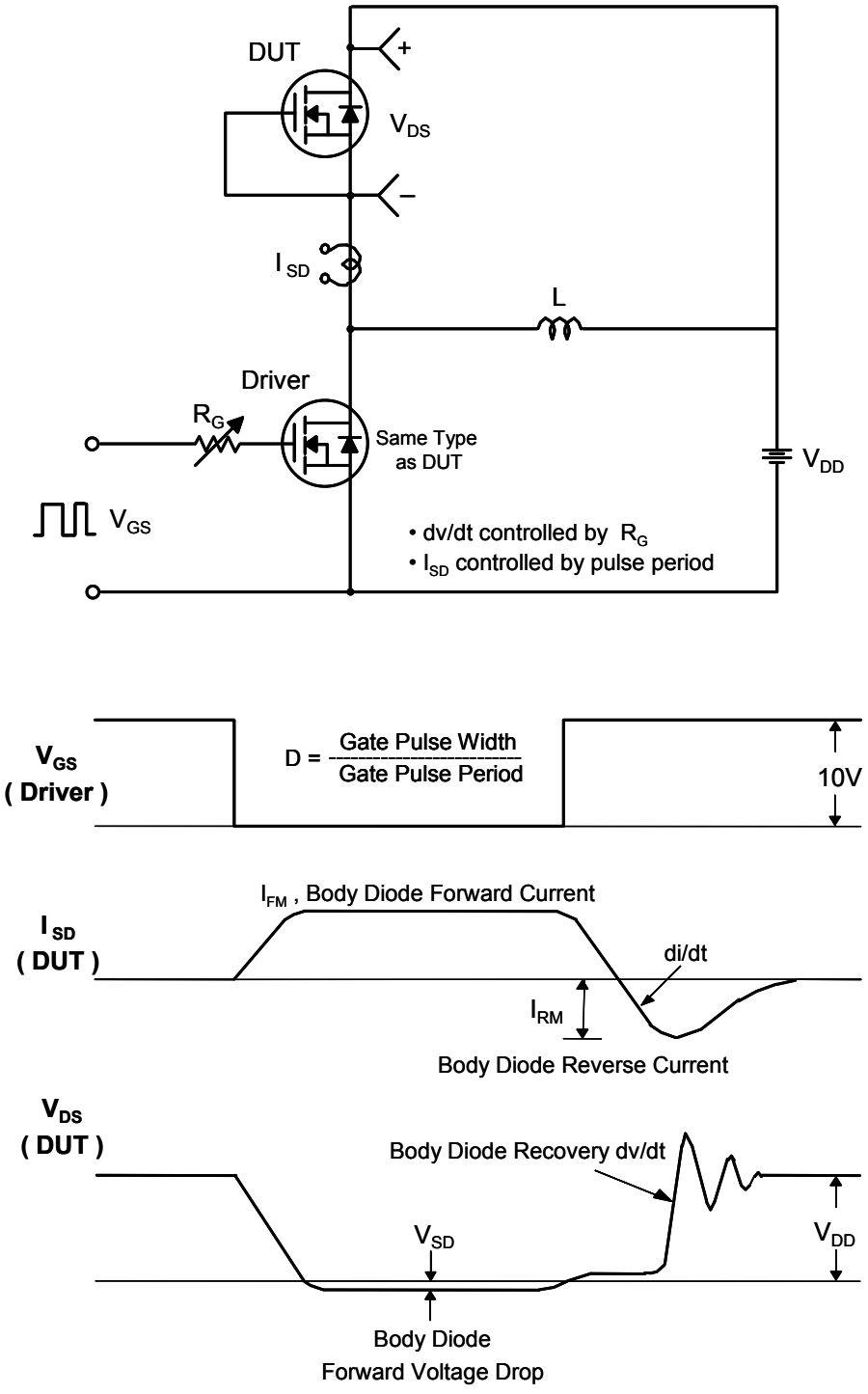



**Figure 17. Peak Diode Recovery dv/dt Test Circuit & Waveforms**

## Mechanical Dimensions

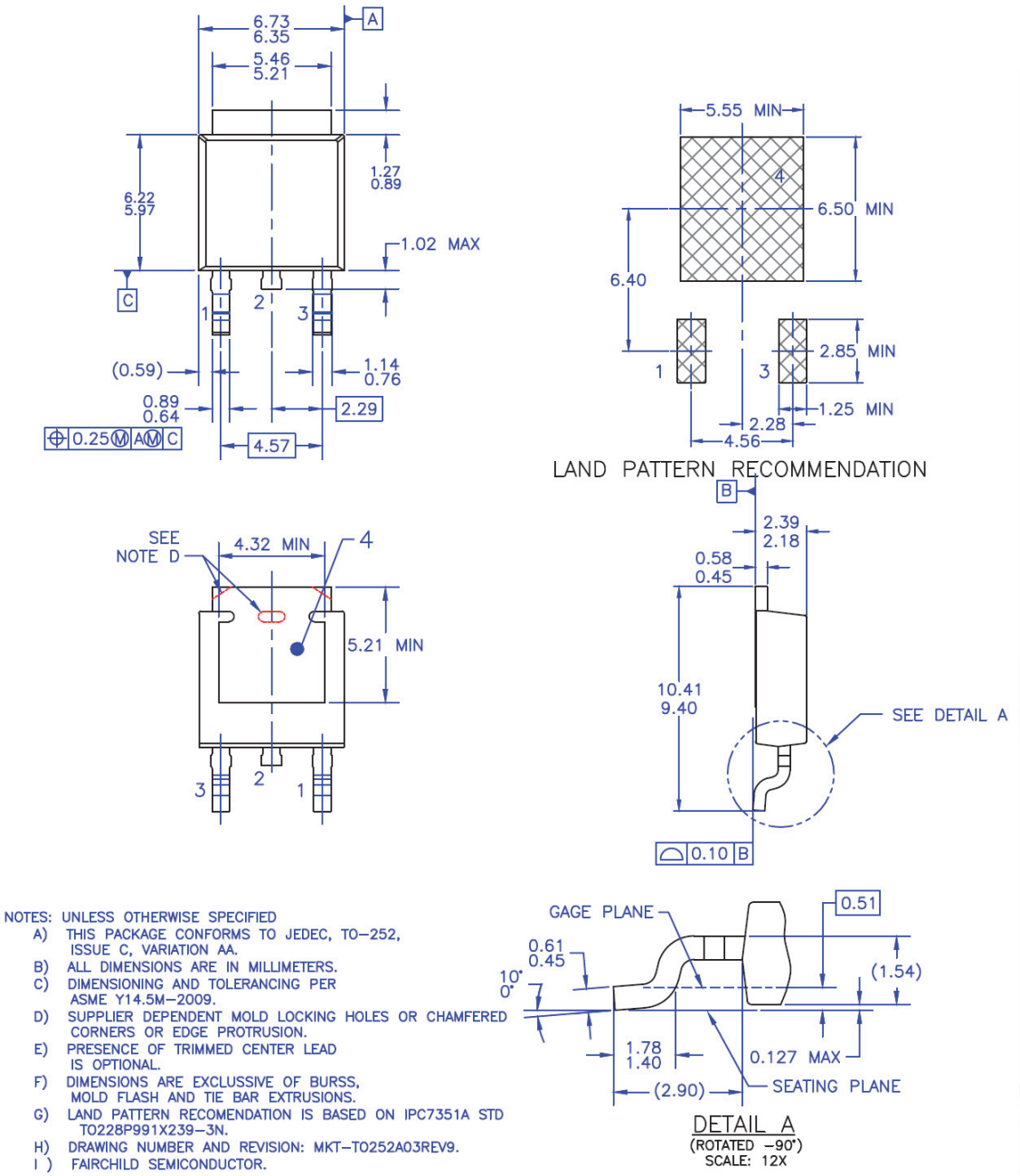



**Figure 18. TO252 (D-PAK), Molded, 3-Lead, Option AA&AB**

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