FAIRCHILD SEMICONDUCTOR®

November 2013

# FDD850N10LD

## BoostPak (N-Channel PowerTrench® MOSFET + Diode)

**100 V, 15.3 A, 75 mΩ**

### Features

- $R_{DS(on)}$ = 61 mΩ (Typ.) @ $V_{GS}$ = 10 V, $I_D$ = 12 A
- $R_{DS(on)}$ = 64 mΩ (Typ.) @ $V_{GS}$ = 5.0 V, $I_D$ = 12 A
- Low Gate Charge (Typ. 22.2 nC)
- Low $C_{rss}$ (Typ. 42 pF)
- Fast Switching
- 100% Avalanche Tested
- Improved dv/dt Capability
- RoHS Compliant

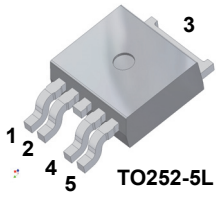
### Description

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

The NP diode is hyperfast rectifier with low forward voltage drop and excellent switching performance.

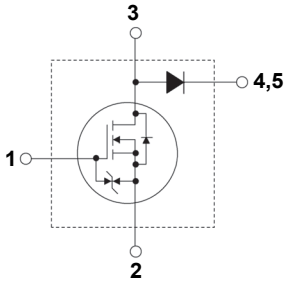
### Applications

- LED Monitor Backlight
- LED TV Backlight
- LED Lighting
- Consumer Appliances,
  DC-DC converter (Step up & Step down)




TO252-5L

1. Gate
2. Source
3. Drain / Anode
4. Cathode
5. Cathode




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

| Symbol | Parameter | | | FDD850N10LD | Unit |
|---|---|---|---|---|---|
| $V_{DSS}$ | Drain to Source Voltage | | | 100 | V |
| $V_{GSS}$ | Gate to Source Voltage | | | ±20 | V |
| $I_D$ | Drain Current | - Continuous ($T_C$ = 25°C) | | 15.3 | A |
| | | - Continuous ($T_C$ = 100°C) | | 9.7 | |
| $I_{DM}$ | Drain Current | - Pulsed | (Note 1) | 46 | A |
| $E_{AS}$ | Single Pulsed Avalanche Energy | | (Note 2) | 41 | mJ |
| dv/dt | Peak Diode Recovery dv/dt | | (Note 3) | 6.0 | V/ns |
| $P_D$ | Power Dissipation | ($T_C$ = 25°C) | | 42 | W |
| | | - Derate Above 25°C | | 0.33 | W/°C |
| $I_F$(AV) | Diode Average Rectified Forward Current ($T_C$ = 138°C) | | | 5 | A |
| $I_{FSM}$ | Diode Non-repetitive Peak Surge Current 60 Hz Single Half-Sine Wave | | | 50 | A |
| $T_J$, $T_{STG}$ | 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 | FDD850N10LD | Unit |
|---|---|---|---|
| $R_{\theta JC}$ | Thermal Resistance, Junction to Case for MOSFET, Max. | 3.0 | °C/W |
| $R_{\theta JC}$ | Thermal Resistance, Junction to Case for Diode, Max. | 2.5 | |
| $R_{\theta JA}$ | Thermal Resistance, Junction to Ambient, Max. | 87 | |

## Package Marking and Ordering Information

| Part Number | Top Mark | Package | Packing Method | Reel Size | Tape Width | Quantity |
|---|---|---|---|---|---|---|
| FDD850N10LD | 850N10LD | TO-252 5L | Tape and Reel | 13” | 16 mm | 2500 units |

## Electrical Characteristics of the MOSFET $T_C = 25^oC$ 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 | 100 | - | - | V |
| $\Delta BV_{DSS}$ / $\Delta T_J$ | Breakdown Voltage Temperature Coefficient | $I_D$ = 250 μA, Referenced to 25°C | - | 0.1 | - | V/°C |
| $I_{DSS}$ | Zero Gate Voltage Drain Current | $V_{DS}$ = 80 V, $V_{GS}$ = 0 V | - | - | 1 | μA |
| | | $V_{DS}$ = 80 V, $T_C$ = 125°C | - | - | 500 | |
| $I_{GSS}$ | Gate to Body Leakage Current | $V_{GS}$ = ±20 V, $V_{DS}$ = 0 V | - | - | ±100 | nA |
| **On Characteristics** | | | | | | |
| $V_{GS(th)}$ | Gate Threshold Voltage | $V_{GS}$ = $V_{DS}$, $I_D$ = 250 μA | 1.0 | - | 2.5 | V |
| $R_{DS(on)}$ | Static Drain to Source On Resistance | $V_{GS}$ = 10 V, $I_D$ = 12 A | - | 61 | 75 | mΩ |
| | | $V_{GS}$ = 5 V, $I_D$ =12 A | - | 64 | 96 | |
| $g_{FS}$ | Forward Transconductance | $V_{DS}$ = 10 V, $I_D$ = 15.3 A | - | 31 | - | S |
| **Dynamic Characteristics** | | | | | | |
| $C_{iss}$ | Input Capacitance | $V_{DS}$ = 25 V, $V_{GS}$ = 0 V, f = 1 MHz | - | 1100 | 1465 | pF |
| $C_{oss}$ | Output Capacitance | | - | 80 | 105 | pF |
| $C_{rss}$ | Reverse Transfer Capacitance | | - | 42 | - | pF |
| $Q_{g(tot)}$ | Total Gate Charge at 10V | $V_{DS}$ = 80 V, $I_D$ = 15.3 A (Note 4) | - | 22.2 | 28.9 | nC |
| $Q_{g(tot)}$ | Total Gate Charge at 5V | | - | 12.3 | 16.0 | nC |
| $Q_{gs}$ | Gate to Source Gate Charge | | - | 3.0 | - | nC |
| $Q_{gd}$ | Gate to Drain “Miller” Charge | | - | 5.7 | - | nC |
| ESR | Equivalent Series Resistance (G-S) | f = 1 MHz | - | 1.75 | - | Ω |
| **Switching Characteristics** | | | | | | |
| $t_{d(on)}$ | Turn-On Delay Time | $V_{DD}$ = 50 V, $I_D$ = 15.3 A, $V_{GS}$ = 5 V, $R_G$ = 4.7 Ω (Note 4) | - | 17 | 44 | ns |
| $t_r$ | Turn-On Rise Time | | - | 21 | 52 | ns |
| $t_{d(off)}$ | Turn-Off Delay Time | | - | 27 | 64 | ns |
| $t_f$ | Turn-Off Fall Time | | - | 8 | 26 | ns |
| **Drain-Source Diode Characteristics** | | | | | | |
| $I_S$ | Maximum Continuous Drain to Source Diode Forward Current | | - | - | 15.3 | A |
| $I_{SM}$ | Maximum Pulsed Drain to Source Diode Forward Current | | - | - | 46 | A |
| $V_{SD}$ | Drain to Source Diode Forward Voltage | $V_{GS}$ = 0 V, $I_{SD}$ = 12 A | - | - | 1.3 | V |
| $t_{rr}$ | Reverse Recovery Time | $V_{GS}$ = 0 V, $I_{SD}$ = 15.3 A, $V_{DS}$ = 80 V, $dI_F/dt$ = 100 A/μs | - | 38 | - | ns |
| $Q_{rr}$ | Reverse Recovery Charge | | - | 50 | - | nC |

**Notes:**

1. Repetitive rating: pulse-width limited by maximum junction temperature.
2. L = 1 mH, $I_{AS}$ = 9.1 A, $R_G$ = 25 Ω, starting $T_J$ = 25°C.
3. $I_{SD} \le$ 15.3 A, di/dt ≤ 200 A/μs, $V_{DD} \le BV_{DSS}$, starting $T_J$ = 25°C.
4. Essentially independent of operating temperature typical characteristics.

## Electrical Characteristics of the Diode $T_C = 25^oC$ unless otherwise noted.

| Symbol | Parameter | Test Conditions | | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|---|
| $V_R$ | DC Blocking Voltage | $I_R$ = 250 μA | | 150 | - | - | V |
| $V_{FM}$ | Maximum Instantaneous Forward Voltage | $I_F$ = 5 A | $T_C = 25^oC$ | - | - | 2.5 | V |
| | | | $T_C = 125^oC$ | - | 0.9 | - | |
| $I_{RM}$ | Maximum Instantaneous Reverse Current @ rated $V_R$ | | $T_C = 25^oC$ | - | - | 50 | uA |
| | | | $T_C = 125^oC$ | - | - | 1000 | |
| $t_{rr}$ | Diode Reverse Recovery Time | $I_F$ = 5 A, dI/dt = 200 A/μs | $T_C = 25^oC$ | - | 10.7 | 22 | ns |
| | | | $T_C = 125^oC$ | - | 14.5 | - | |
| $I_{rr}$ | Diode Peak Reverse Recovery Current | | $T_C = 25^oC$ | - | 2.2 | 5 | A |
| | | | $T_C = 125^oC$ | - | 3.4 | - | |
| $Q_{rr}$ | Diode Reverse Recovery Charge | | $T_C = 25^oC$ | - | 11.7 | - | nC |
| | | | $T_C = 125^oC$ | - | 24.7 | - | |
| $W_{AVL}$ | Avalanche Energy (L = 40 mH) | | | 10 | - | - | mJ |

## Typical Performance Characteristics - MOSFET

**Figure 1. On-Region Characteristics**

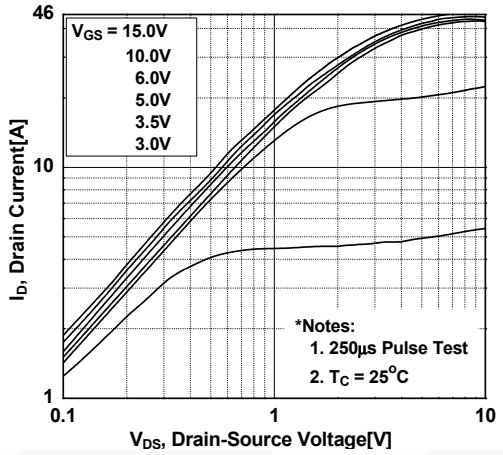



**Figure 2. Transfer Characteristics**

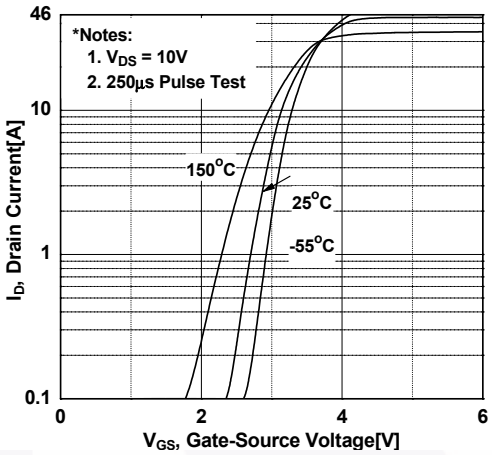



**Figure 3. On-Resistance Variation vs. Drain Current and Gate Voltage**

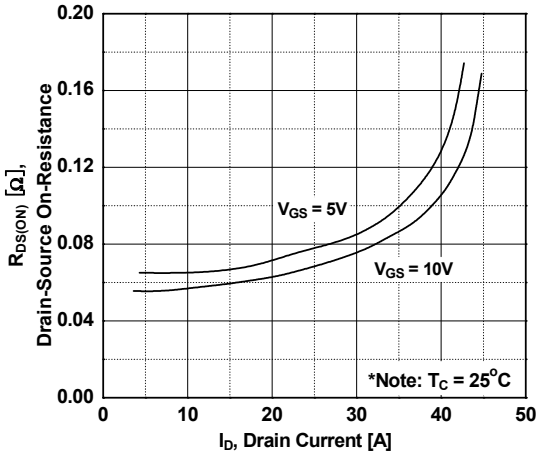



**Figure 4. Body Diode Forward Voltage Variation vs. Source Current and Temperature**

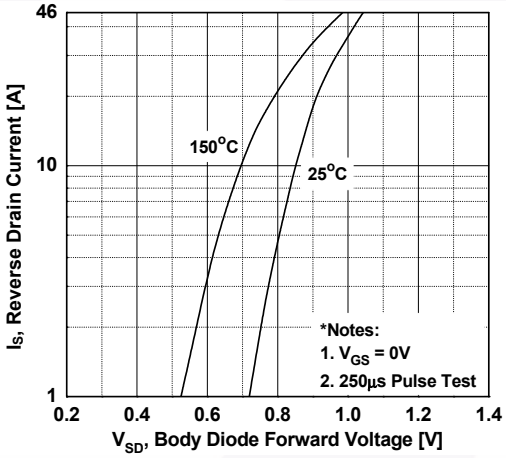



**Figure 5. Capacitance Characteristics**

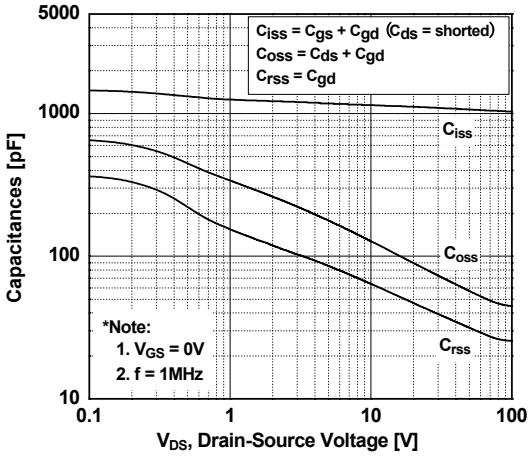
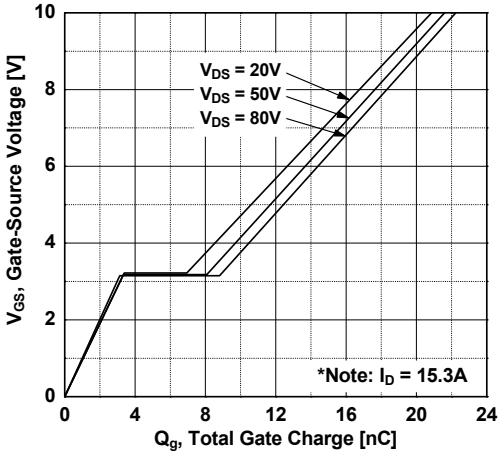



**Figure 6. Gate Charge Characteristics**



## Typical Performance Characteristics - MOSFET (Continued)

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

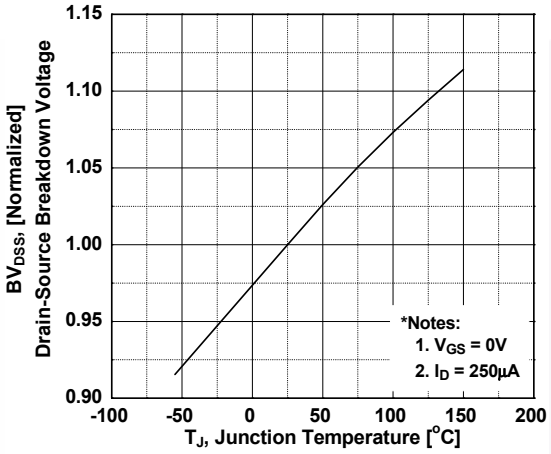



**Figure 8. On-Resistance Variation vs. Temperature**

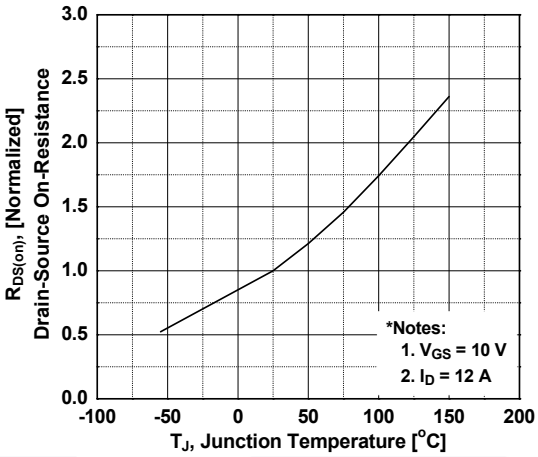



**Figure 9. Maximum Safe Operating Area**

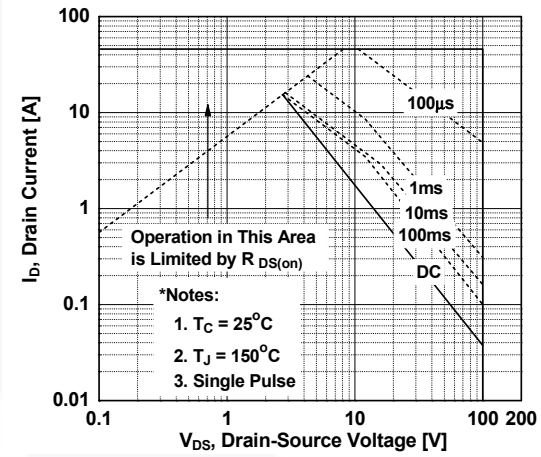
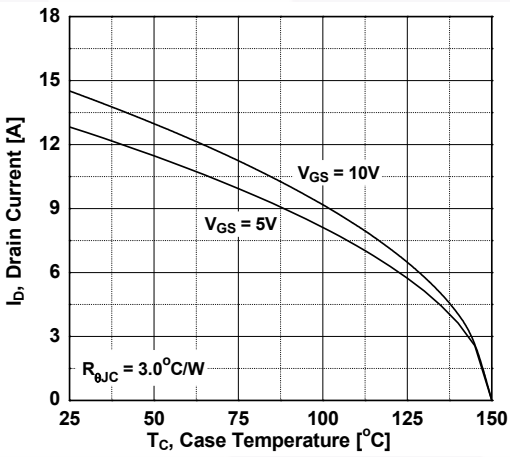



**Figure 10. Maximum Drain Current vs. Case Temperature**



## Typical Performance Characteristics - Diode (Continued)

**Figure 11. Diode Forward Voltage Drop vs. Forward Current**

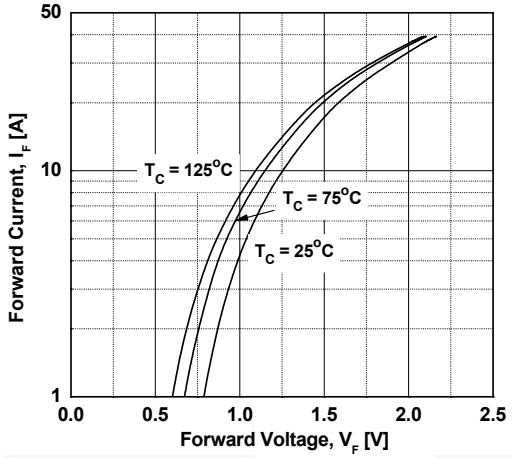



**Figure 12. Diode Reverse Current vs. Reverse Voltage**

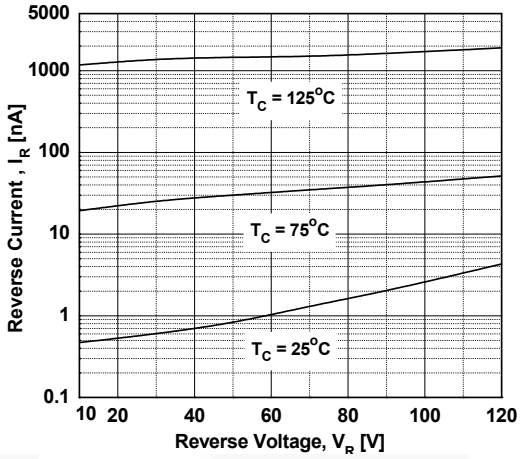



**Figure 13. Diode Junction Capacitance**

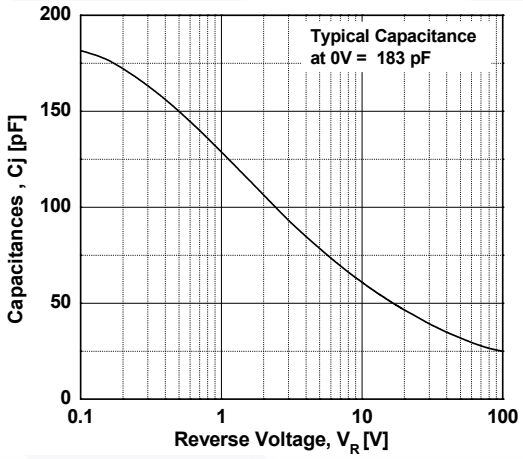



**Figure 14. Diode Reverse Recovery Time vs. di/dt**

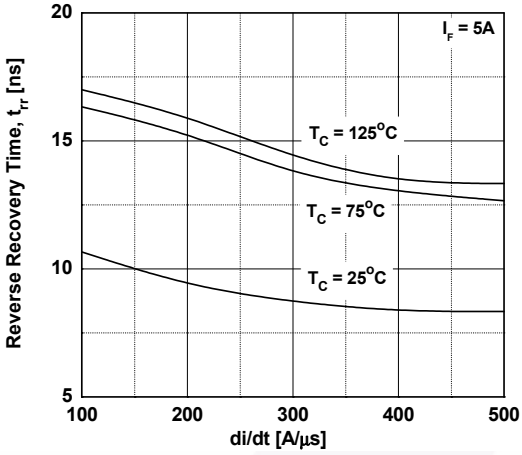



**Figure 15. Diode Reverse Recovery Current vs. di/dt**

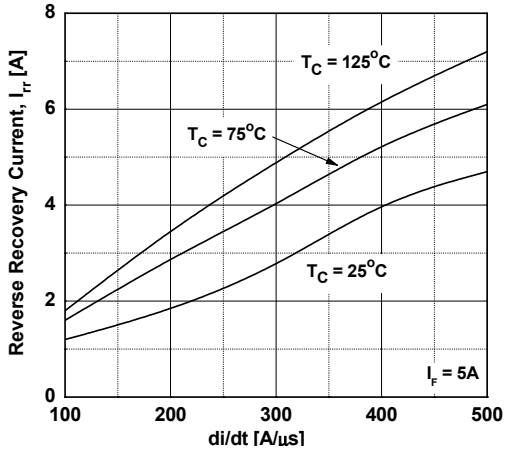
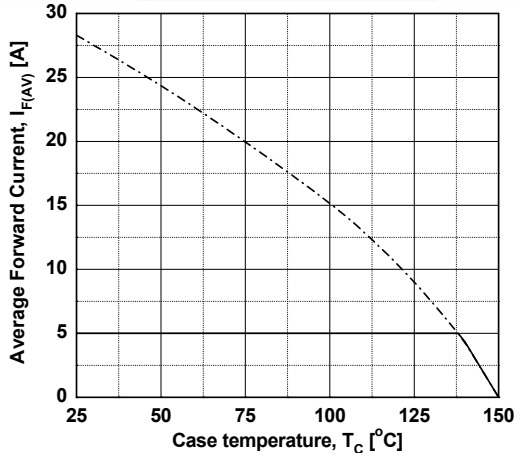



**Figure 16. Diode Forward Current Derating Curve**



## Typical Performance Characteristics (Continued)

**Figure 17. Transient Thermal Response Curve of MOSFET**

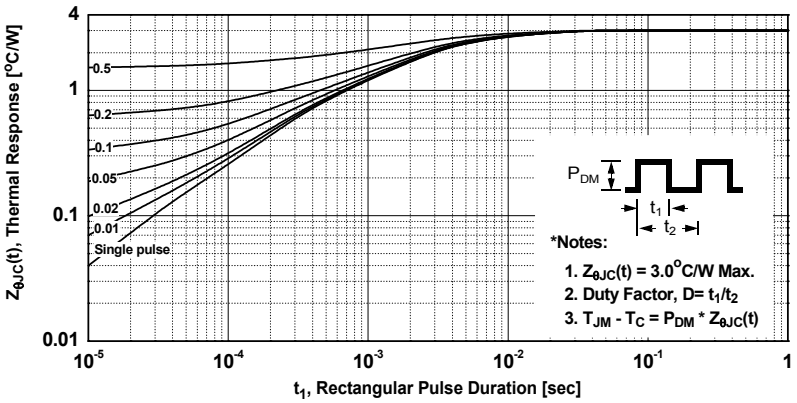
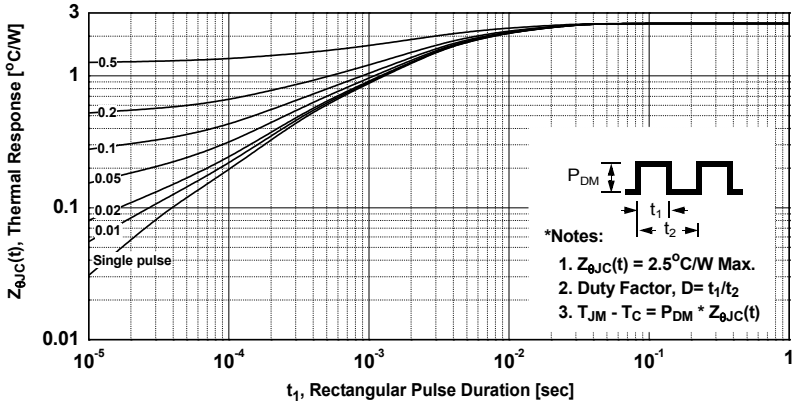



**Figure 18. Transient Thermal Response Curve of Diode**



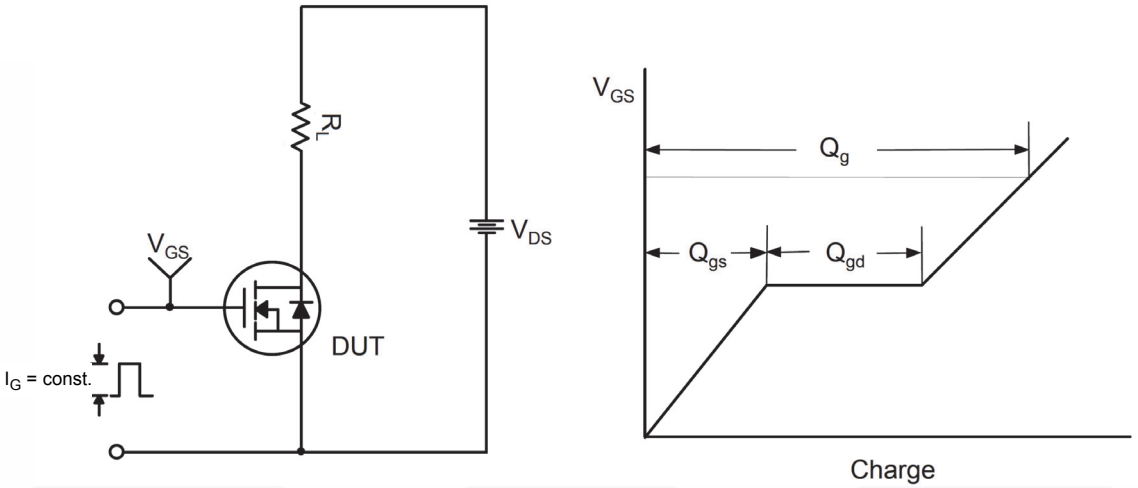



**Figure 19. Gate Charge Test Circuit & Waveform**

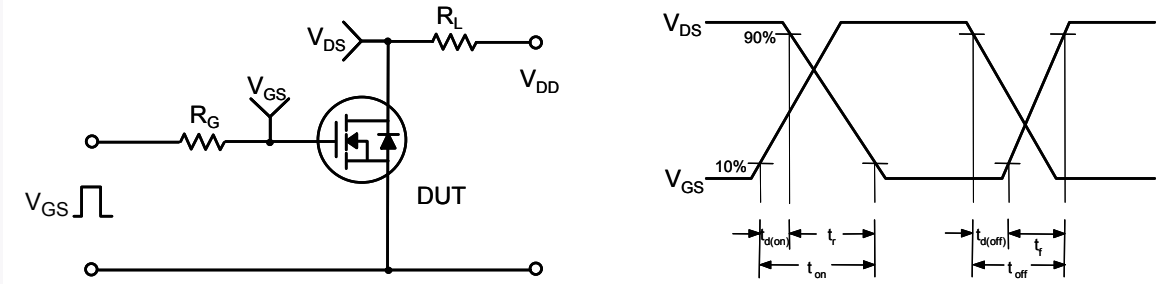



**Figure 20. Resistive Switching Test Circuit & Waveforms**

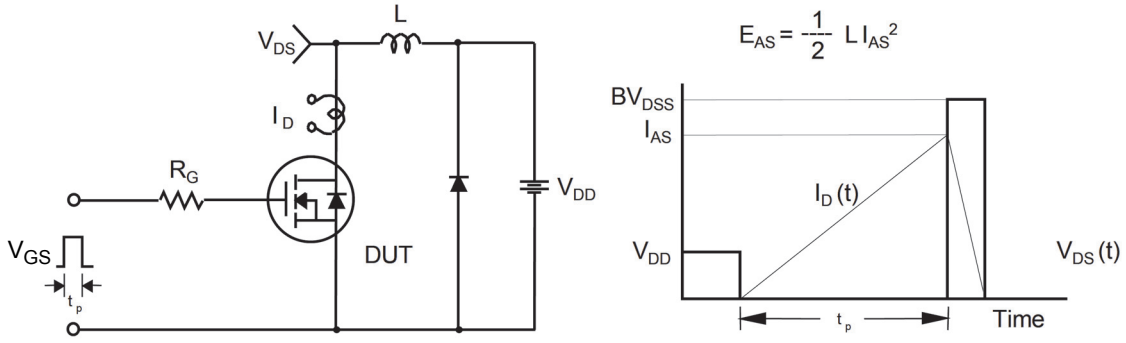



**Figure 21. Unclamped Inductive Switching Test Circuit & Waveforms**

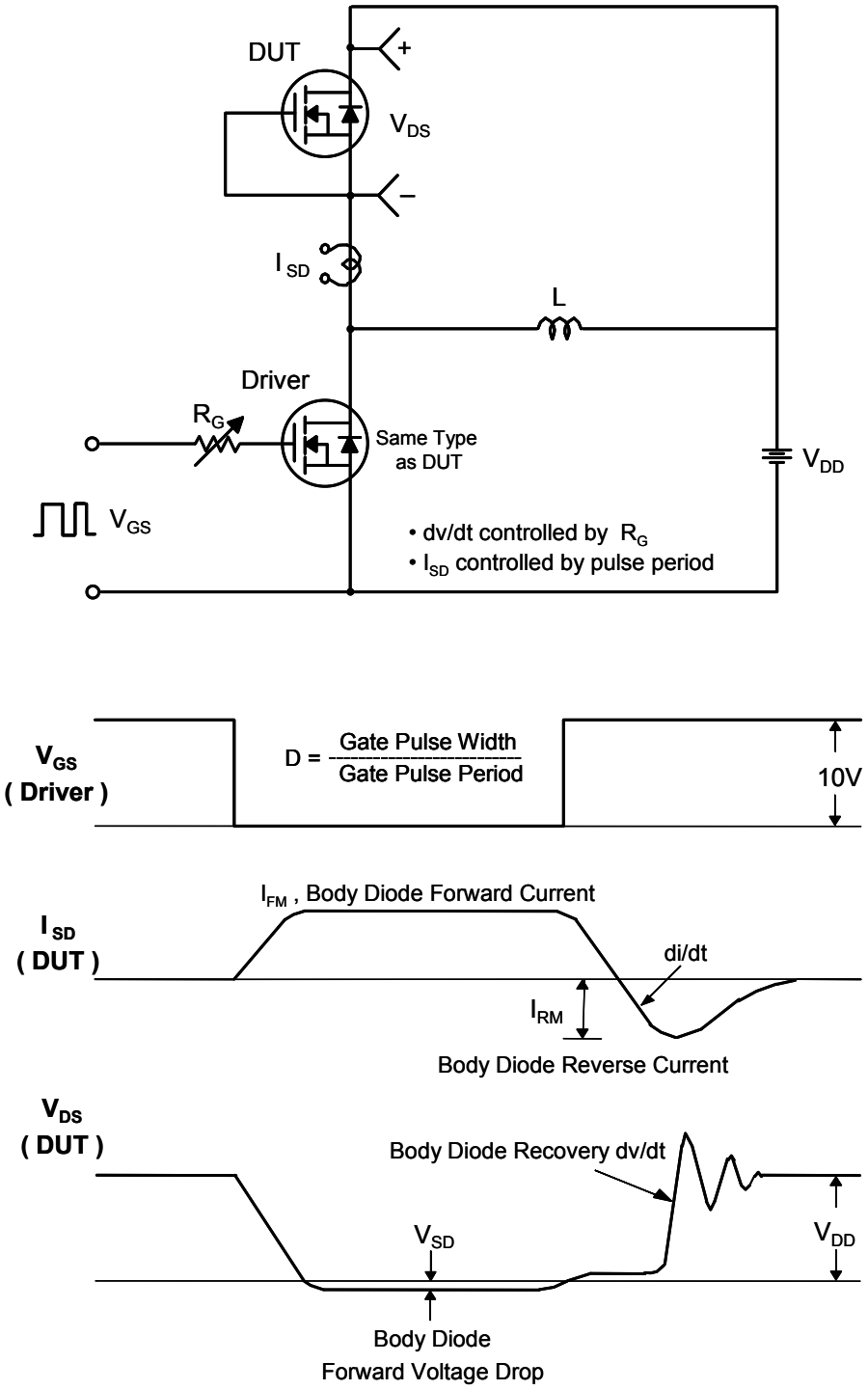



**Figure 22. Peak Diode Recovery dv/dt Test Circuit & Waveforms**

## Mechanical Dimensions

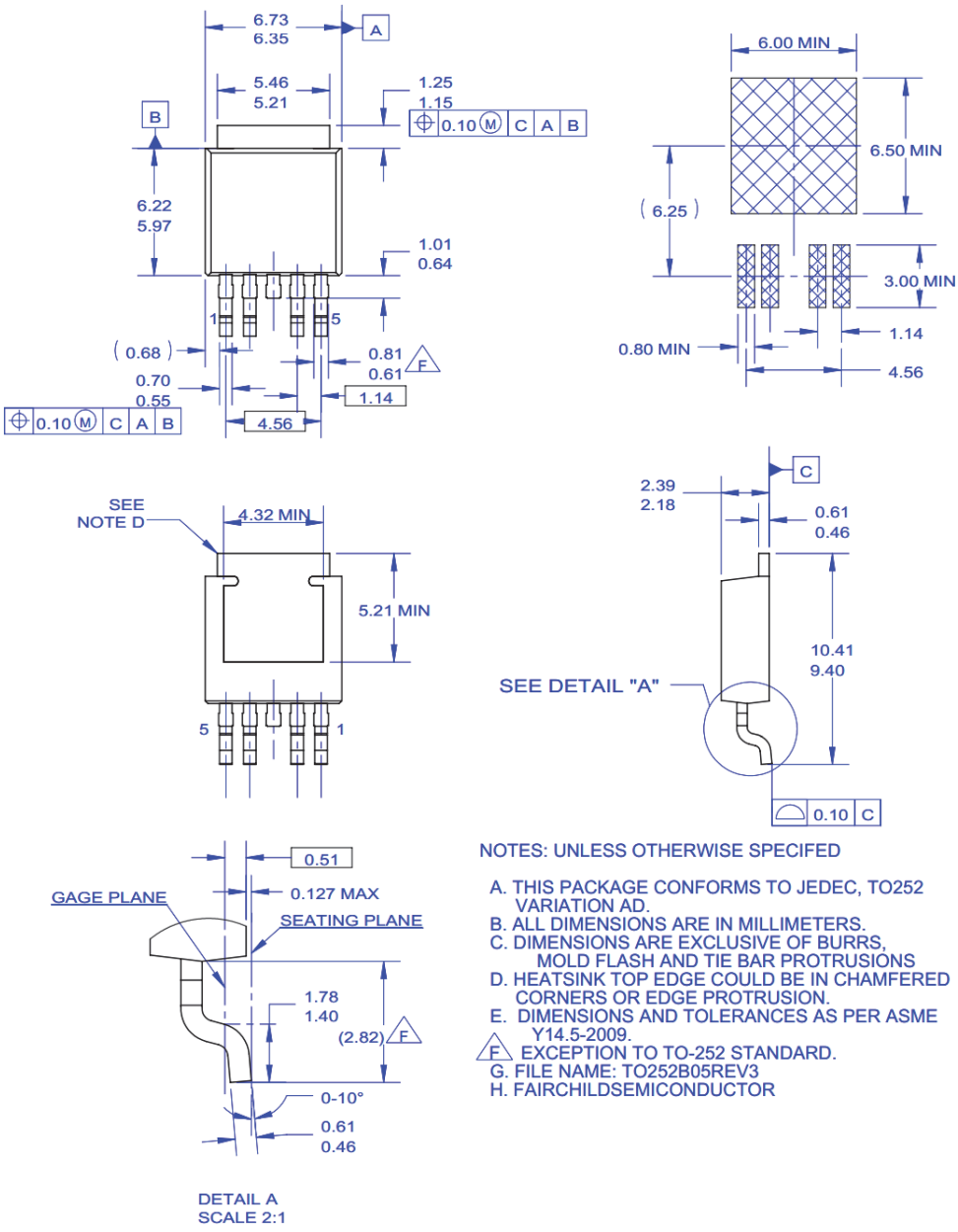



**Figure 23. TO252 (D-PAK), Molded, 5-Lead, Option AD**

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2. A critical component in any component of a life support, device, or system whose failure to perform can be reasonably expected to cause the failure of the life support device or system, or to affect its safety or effectiveness.

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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. |
| Obsolete | Not In Production | Datasheet contains specifications on a product that is discontinued by Fairchild Semiconductor. The datasheet is for reference information only. |

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