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June 2014

FDB016N04AL7

N-Channel PowerTrench[®] MOSFET

40 V, 306 A, 1.6 mΩ

Features

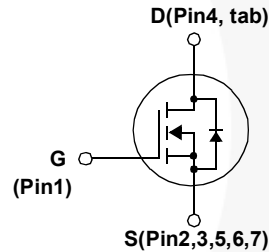
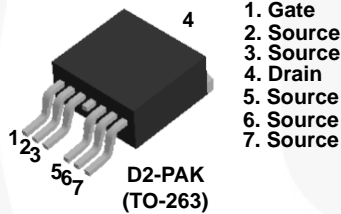
- $R_{DS(on)} = 1.16 \text{ m}\Omega$ (Typ.) @ $V_{GS} = 10 \text{ V}$, $I_D = 80 \text{ A}$
- Fast Switching Speed
- Low Gate Charge
- High Performance Trench Technology for Extremely Low $R_{DS(on)}$
- High Power and Current Handling Capability
- RoHS Compliant

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

- Synchronous Rectification for ATX / Server / Telecom PSU
- Battery Protection Circuit
- Motor drives and Uninterruptible Power Supplies



MOSFET Maximum Ratings $T_C = 25^\circ\text{C}$ unless otherwise noted.

| Symbol | Parameter | FDB016N04AL7 | Unit |
|----------------|--|---|------------------|
| V_{DSS} | Drain to Source Voltage | 40 | V |
| V_{GSS} | Gate to Source Voltage | ± 20 | V |
| I_D | Drain Current | - Continuous ($T_C = 25^\circ\text{C}$, Silicon Limited) | 306* |
| | | - Continuous ($T_C = 100^\circ\text{C}$, Silicon Limited) | 216* |
| | | - Continuous ($T_C = 25^\circ\text{C}$, Package Limited) | 160 |
| I_{DM} | Drain Current | - Pulsed (Note 1) | 1224 |
| E_{AS} | Single Pulsed Avalanche Energy | (Note 2) | 1350 |
| dv/dt | Peak Diode Recovery dv/dt | (Note 3) | 6.0 |
| P_D | Power Dissipation | ($T_C = 25^\circ\text{C}$) | 283 |
| | | - Derate Above 25°C | 1.89 |
| T_J, T_{STG} | Operating and Storage Temperature Range | -55 to +175 | $^\circ\text{C}$ |
| T_L | Maximum Lead Temperature for Soldering, 1/8" from Case for 5 Seconds | 300 | $^\circ\text{C}$ |

*Calculated continuous current based on maximum allowable junction temperature. Package limitation current is 160 A.

Thermal Characteristics

| Symbol | Parameter | FDB016N04AL7 | Unit |
|-----------------|---|--------------|---------------------------|
| $R_{\theta JC}$ | Thermal Resistance, Junction to Case, Max. | 0.53 | $^\circ\text{C}/\text{W}$ |
| $R_{\theta JA}$ | Thermal Resistance, Junction to Ambient, Max. | 62.5 | |

Package Marking and Ordering Information

| Part Number | Top Mark | Package | Packing Method | Reel Size | Tape Width | Quantity |
|--------------|------------|----------|----------------|-----------|------------|-----------|
| FDB016N04AL7 | FDB016N04A | D2PAK-7L | Tape and Reel | 330 mm | 24 mm | 800 units |

Electrical Characteristics $T_C = 25^\circ\text{C}$ unless otherwise noted.

| Symbol | Parameter | Test Conditions | Min. | Typ. | Max. | Unit |
|--------|-----------|-----------------|------|------|------|------|
|--------|-----------|-----------------|------|------|------|------|

Off Characteristics

| | | | | | | |
|--------------------------------------|---|---|----|------|-----------|---------------------------|
| BV_{DSS} | Drain to Source Breakdown Voltage | $I_D = 250 \mu\text{A}, V_{GS} = 0 \text{ V}, T_C = 25^\circ\text{C}$ | 40 | - | - | V |
| $\frac{\Delta BV_{DSS}}{\Delta T_J}$ | Breakdown Voltage Temperature Coefficient | $I_D = 250 \mu\text{A}$, Referenced to 25°C | - | 0.03 | - | $\text{V}/^\circ\text{C}$ |
| I_{DSS} | Zero Gate Voltage Drain Current | $V_{DS} = 32 \text{ V}, V_{GS} = 0 \text{ V}$ | - | - | 10 | μA |
| | | $V_{DS} = 32 \text{ V}, T_C = 150^\circ\text{C}$ | - | - | 500 | |
| I_{GSS} | Gate to Body Leakage Current | $V_{GS} = \pm 20 \text{ V}, V_{DS} = 0 \text{ V}$ | - | - | ± 100 | nA |

On Characteristics

| | | | | | | |
|--------------|--------------------------------------|---|-----|------|-----|------------------|
| $V_{GS(th)}$ | Gate Threshold Voltage | $V_{GS} = V_{DS}, I_D = 250 \mu\text{A}$ | 1.0 | - | 3.0 | V |
| $R_{DS(on)}$ | Static Drain to Source On Resistance | $V_{GS} = 10 \text{ V}, I_D = 80 \text{ A}$ | - | 1.16 | 1.6 | $\text{m}\Omega$ |
| g_{FS} | Forward Transconductance | $V_{DS} = 10 \text{ V}, I_D = 80 \text{ A}$ | - | 381 | - | S |

Dynamic Characteristics

| | | | | | | |
|--------------|----------------------------------|---|----------|------|-------|----|
| C_{iss} | Input Capacitance | $V_{DS} = 25 \text{ V}, V_{GS} = 0 \text{ V},$ $f = 1 \text{ MHz}$ | - | 8715 | 11600 | pF |
| C_{oss} | Output Capacitance | | - | 2035 | 2710 | pF |
| C_{rss} | Reverse Transfer Capacitance | | - | 230 | - | pF |
| $Q_{g(tot)}$ | Total Gate Charge at 10V | $V_{DS} = 32 \text{ V}, I_D = 80 \text{ A},$ $V_{GS} = 10 \text{ V}$ | - | 129 | 167 | nC |
| Q_{gs} | Gate to Source Gate Charge | | - | 28 | - | nC |
| Q_{gs2} | Gate Charge Threshold to Plateau | | - | 12 | - | nC |
| Q_{gd} | Gate to Drain "Miller" Charge | | (Note 4) | - | 17 | - |

Switching Characteristics

| | | | | | | |
|--------------|------------------------------------|---|----------|------|-----|----------|
| $t_{d(on)}$ | Turn-On Delay Time | $V_{DD} = 20 \text{ V}, I_D = 80 \text{ A},$ $R_G = 4.7 \Omega, V_{GS} = 10 \text{ V}$ | - | 21 | 52 | ns |
| t_r | Turn-On Rise Time | | - | 14 | 38 | ns |
| $t_{d(off)}$ | Turn-Off Delay Time | | - | 118 | 246 | ns |
| t_f | Turn-Off Fall Time | | (Note 4) | - | 33 | 76 |
| ESR | Equivalent Series Resistance (G-S) | $f = 1 \text{ MHz}$ | - | 1.25 | - | Ω |

Drain-Source Diode Characteristics

| | | | | | | |
|----------|--|--|---|------|-----|----|
| I_S | Maximum Continuous Drain to Source Diode Forward Current | - | - | 306 | A | |
| I_{SM} | Maximum Pulsed Drain to Source Diode Forward Current | - | - | 1224 | A | |
| V_{SD} | Drain to Source Diode Forward Voltage | $V_{GS} = 0 \text{ V}, I_{SD} = 80 \text{ A}$ | - | - | 1.3 | V |
| t_{rr} | Reverse Recovery Time | $V_{GS} = 0 \text{ V}, I_{SD} = 80 \text{ A},$ | - | 68 | - | ns |
| Q_{rr} | Reverse Recovery Charge | $di_F/dt = 100 \text{ A}/\mu\text{s}$ | - | 84 | - | nC |

Notes:

1. Repetitive rating; pulse-width limited by maximum junction temperature.
2. $L = 3 \text{ mH}, I_{AS} = 30 \text{ A}, V_{DD} = 25 \text{ V}, R_G = 25 \Omega$, starting $T_J = 25^\circ\text{C}$.
3. $I_{SD} \leq 80 \text{ A}, di/dt \leq 200 \text{ A}/\mu\text{s}, V_{DD} \leq BV_{DSS}$, starting $T_J = 25^\circ\text{C}$.
4. Essentially independent of operating temperature typical characteristics.

Typical Performance Characteristics

Figure 1. On-Region Characteristics

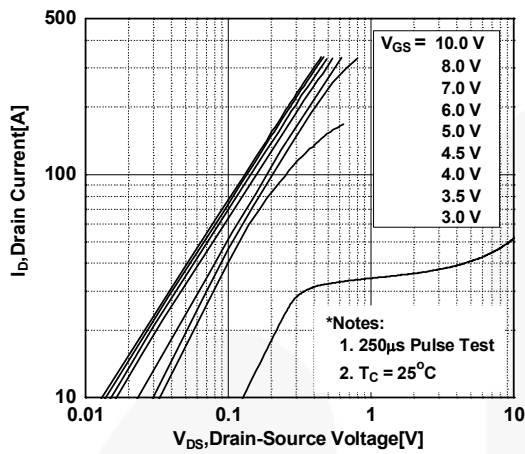


Figure 2. Transfer Characteristics

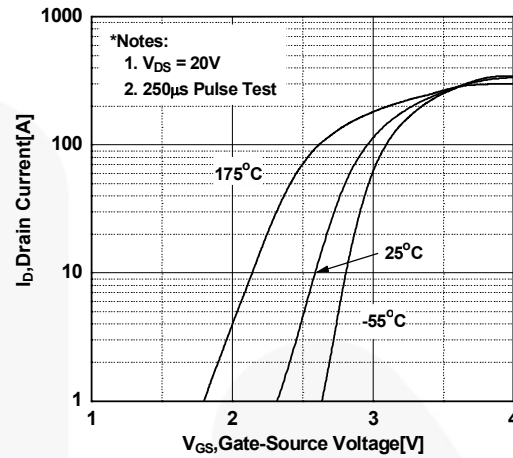


Figure 3. On-Resistance Variation vs. Drain Current and Gate Voltage

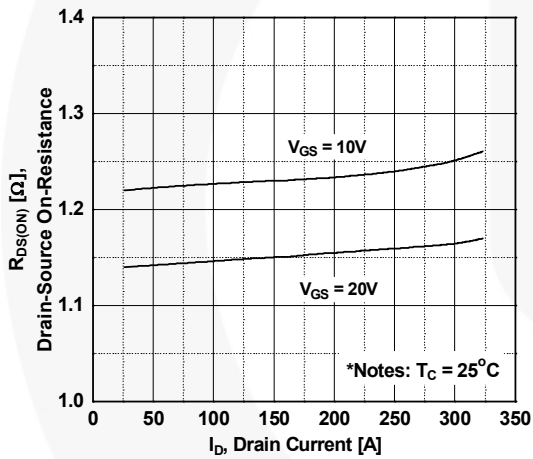


Figure 4. Body Diode Forward Voltage Variation vs. Source Current and Temperature

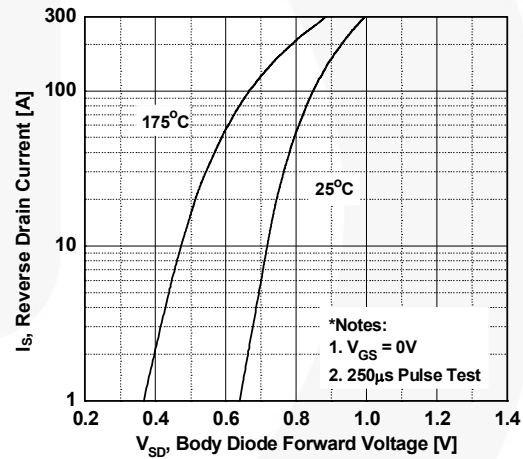


Figure 5. Capacitance Characteristics

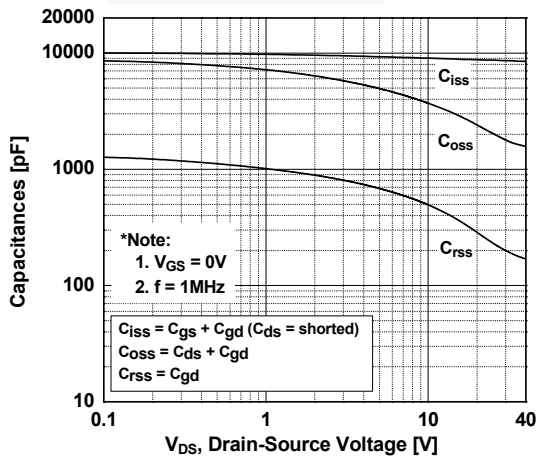
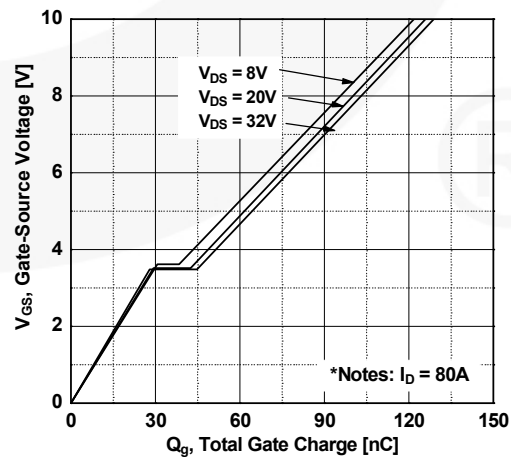


Figure 6. Gate Charge Characteristics



Typical Performance Characteristics (Continued)

Figure 7. Breakdown Voltage Variation vs. Temperature

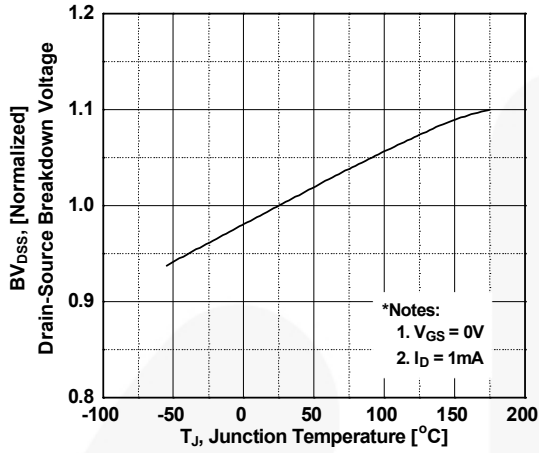


Figure 8. On-Resistance Variation vs. Temperature

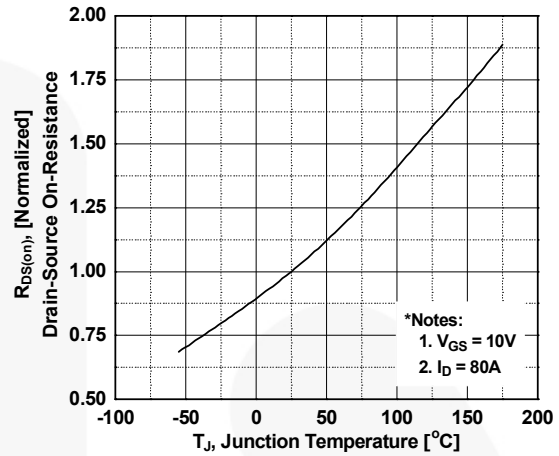


Figure 9. Maximum Safe Operating Area

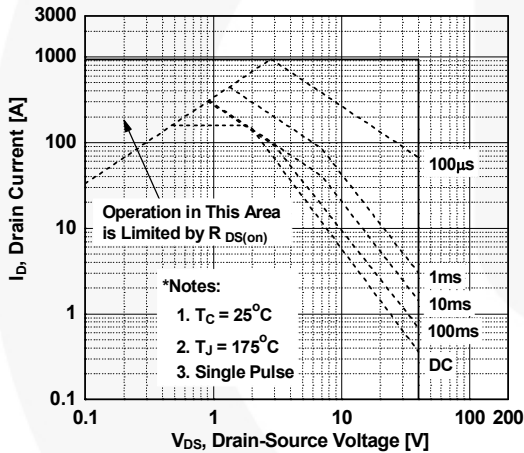


Figure 10. Maximum Drain Current vs. Case Temperature

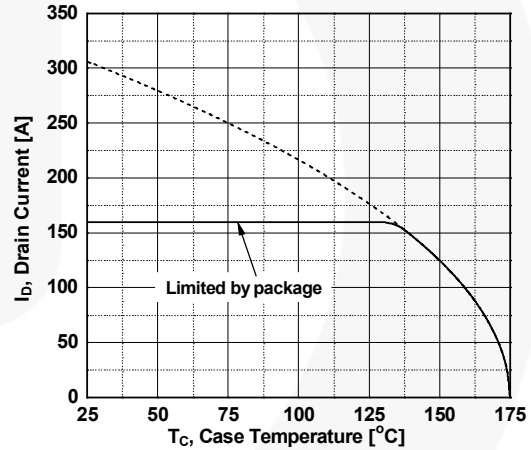
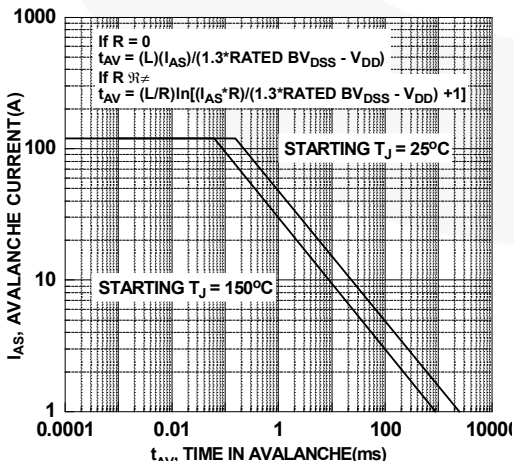


Figure 11. Unclamped Inductive Switching Capability



Typical Performance Characteristics (Continued)

Figure 12. Transient Thermal Response Curve

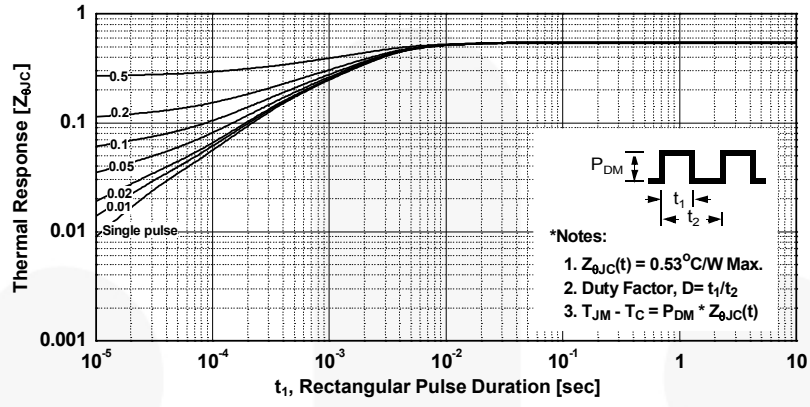


Figure 13. Gate Charge Test Circuit & Waveform

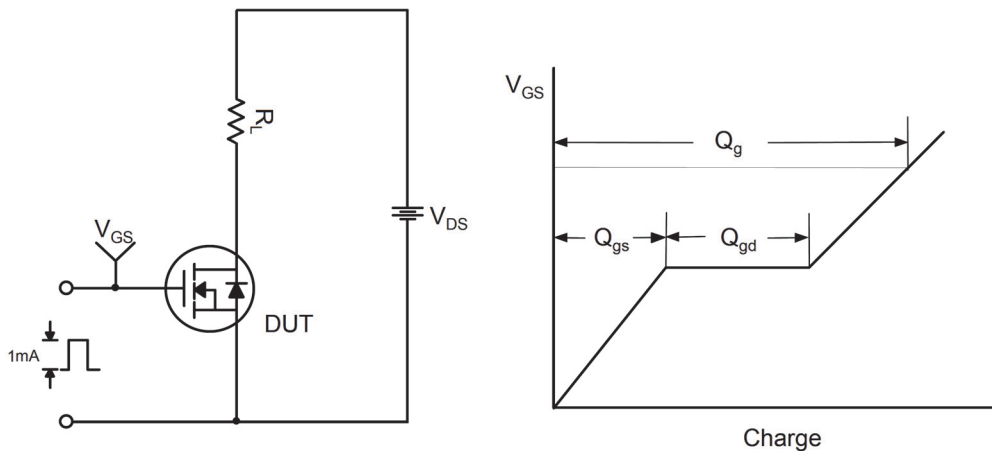


Figure 14. Resistive Switching Test Circuit & Waveforms

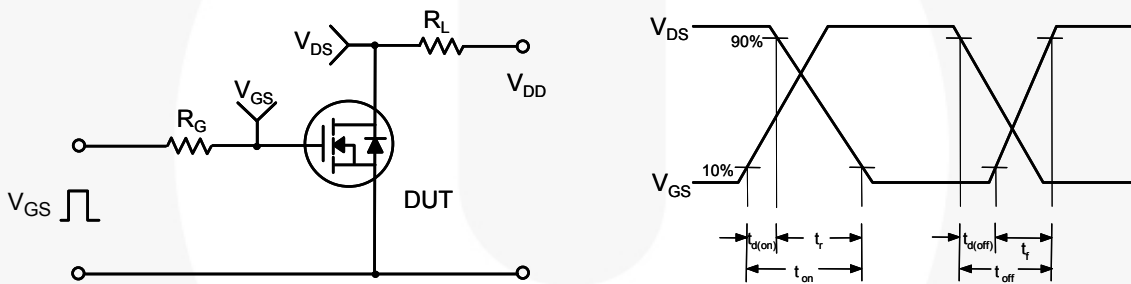


Figure 15. Unclamped Inductive Switching Test Circuit & Waveforms

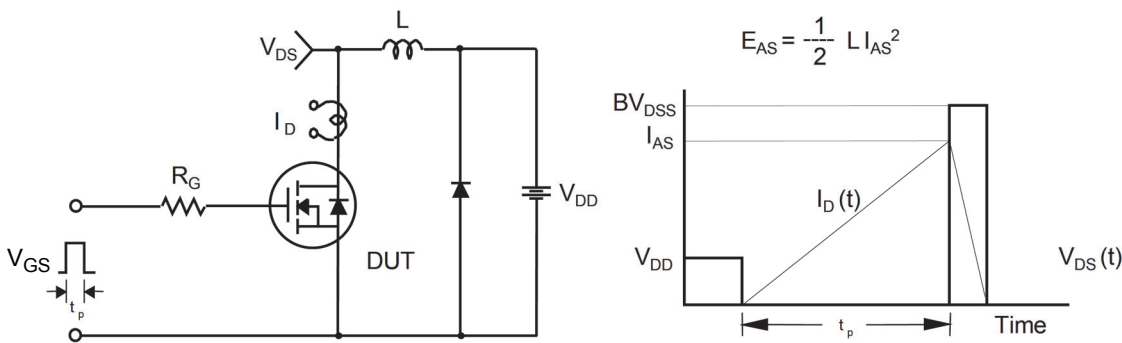
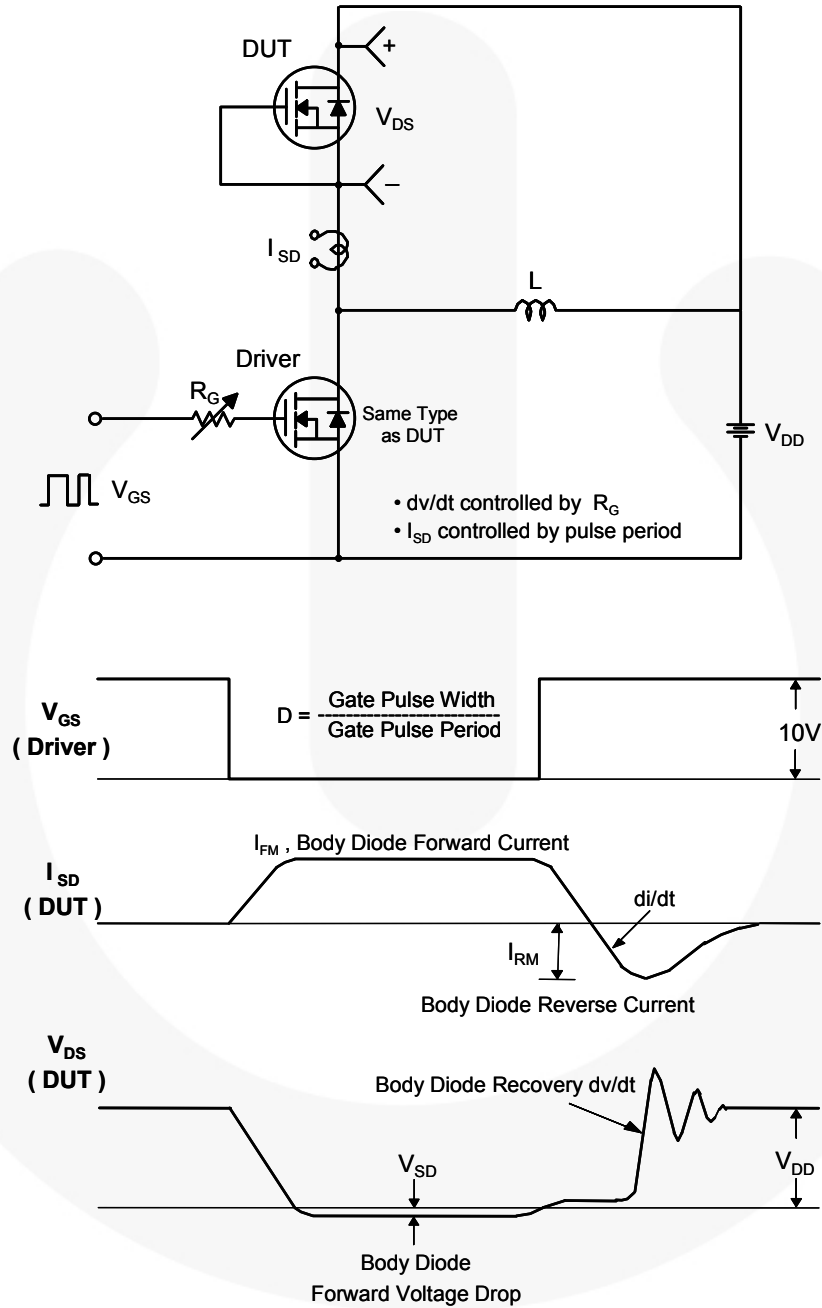



Figure 16. Peak Diode Recovery dv/dt Test Circuit & Waveforms





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