

MT40022

N-Channel Power MOSFET
40V, 220A, 2.5mΩ



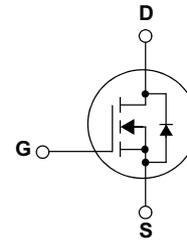
MT Semiconductor®

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Features

- Trench Power MV MOSFET technology
- Low RDS(ON)
- Low Gate Charge
- Optimized Ruggedness
- RoHS and Halogen-Free Compliant

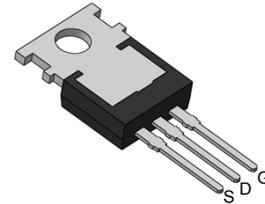
Simplified Schematic



Applications

- DC Motor Driver
- Synchronous Rectification in DC/DC and AC/DC Converters

MARKING DIAGRAM & PIN ASSIGNMENT



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

TO-220

Absolute Maximum Ratings $T_A=25^\circ\text{C}$ unless otherwise noted

| Parameter | Symbol | Maximum | Units |
|--|----------------|-------------------------|------------------|
| Drain-Source Voltage | V_{DS} | 40 | V |
| Gate-Source Voltage | V_{GS} | ± 20 | V |
| Continuous Drain Current ^E | I_D | $T_C=25^\circ\text{C}$ | 220 |
| | | $T_C=25^\circ\text{C}$ | 205 ^I |
| | | $T_C=100^\circ\text{C}$ | 120 |
| Pulsed Drain Current ^C | I_{DM} | 772 | A |
| Continuous Drain Current | I_{DSM} | $T_A=25^\circ\text{C}$ | 44 |
| | | $T_A=70^\circ\text{C}$ | 35 |
| Avalanche Current ^C | I_{AS} | 47 | A |
| Avalanche energy $L=0.3\text{mH}$ ^C | E_{AS} | 331 | mJ |
| Power Dissipation ^B | P_D | $T_C=25^\circ\text{C}$ | 187 |
| | | $T_C=100^\circ\text{C}$ | 93 |
| Power Dissipation ^A | P_{DSM} | $T_A=25^\circ\text{C}$ | 8.3 |
| | | $T_A=70^\circ\text{C}$ | 5.3 |
| Junction and Storage Temperature Range | T_J, T_{STG} | -55 to 175 | $^\circ\text{C}$ |

Electrical Characteristics ($T_J=25^\circ\text{C}$ unless otherwise noted)

| Symbol | Parameter | Conditions | Min | Typ | Max | Units |
|-----------------------------|--|--|--|------|-----------|---------------|
| STATIC PARAMETERS | | | | | | |
| BV_{DSS} | Drain-Source Breakdown Voltage | $I_D=250\mu\text{A}$, $V_{GS}=0\text{V}$ | 40 | | | V |
| I_{DSS} | Zero Gate Voltage Drain Current | $V_{DS}=32\text{V}$, $V_{GS}=0\text{V}$ $T_J=55^\circ\text{C}$ | | | 1 5 | μA |
| I_{GSS} | Gate-Body leakage current | $V_{DS}=0\text{V}$, $V_{GS}=\pm 20\text{V}$ | | | ± 100 | nA |
| $V_{GS(th)}$ | Gate Threshold Voltage | $V_{DS}=V_{GS}$, $I_D=250\mu\text{A}$ | 1.0 | 1.9 | 2.4 | V |
| $R_{DS(on)}$ | Static Drain-Source On-Resistance | $V_{GS}=10\text{V}$, $I_D=20\text{A}$ $T_J=125^\circ\text{C}$ | | 2.5 | 2.8 | m Ω |
| | | $V_{GS}=4.5\text{V}$, $I_D=20\text{A}$ | | 3.5 | 4.1 | |
| | | | | | 3.45 | 4 |
| g_{FS} | Forward Transconductance | $V_{DS}=5\text{V}$, $I_D=20\text{A}$ | | 100 | | S |
| V_{SD} | Diode Forward Voltage | $I_S=1\text{A}$, $V_{GS}=0\text{V}$ | | 0.7 | 1 | V |
| I_S | Maximum Body-Diode Continuous Current ^G | | | | 120 | A |
| DYNAMIC PARAMETERS | | | | | | |
| C_{iss} | Input Capacitance | $V_{GS}=0\text{V}$, $V_{DS}=20\text{V}$, $f=1\text{MHz}$ | | 5225 | | pF |
| C_{oss} | Output Capacitance | | | 895 | | pF |
| C_{rss} | Reverse Transfer Capacitance | | | 55 | | pF |
| R_g | Gate resistance | $f=1\text{MHz}$ | 1 | 2 | 3.1 | Ω |
| SWITCHING PARAMETERS | | | | | | |
| $Q_g(10\text{V})$ | Total Gate Charge | $V_{GS}=10\text{V}$, $V_{DS}=20\text{V}$, $I_D=20\text{A}$ | | 68 | 95 | nC |
| $Q_g(4.5\text{V})$ | Total Gate Charge | | | 28 | 40 | nC |
| Q_{gs} | Gate Source Charge | | | 16.5 | | nC |
| Q_{gd} | Gate Drain Charge | | | 4.5 | | nC |
| Q_{oss} | Output Charge | $V_{GS}=0\text{V}$, $V_{DS}=20\text{V}$ | | 37 | | nC |
| $t_{D(on)}$ | Turn-On DelayTime | $V_{GS}=10\text{V}$, $V_{DS}=20\text{V}$, $R_L=1\Omega$, $R_{GEN}=3\Omega$ | | 12.5 | | ns |
| t_r | Turn-On Rise Time | | | 9.5 | | ns |
| $t_{D(off)}$ | Turn-Off DelayTime | | | 57.5 | | ns |
| t_f | Turn-Off Fall Time | | | 10.5 | | ns |
| t_{rr} | Body Diode Reverse Recovery Time | | $I_F=20\text{A}$, $di/dt=500\text{A}/\mu\text{s}$ | | 20 | |
| Q_{rr} | Body Diode Reverse Recovery Charge | $I_F=20\text{A}$, $di/dt=500\text{A}/\mu\text{s}$ | | 60 | | nC |

TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

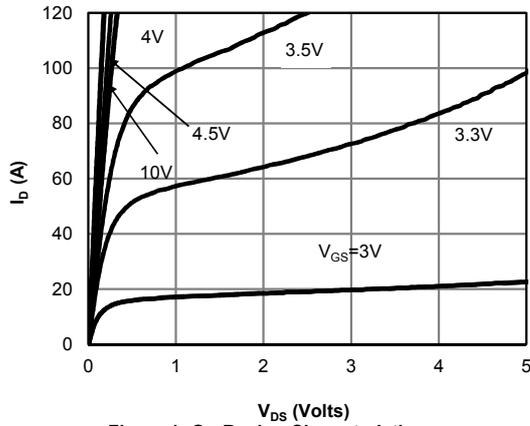


Figure 1: On-Region Characteristics

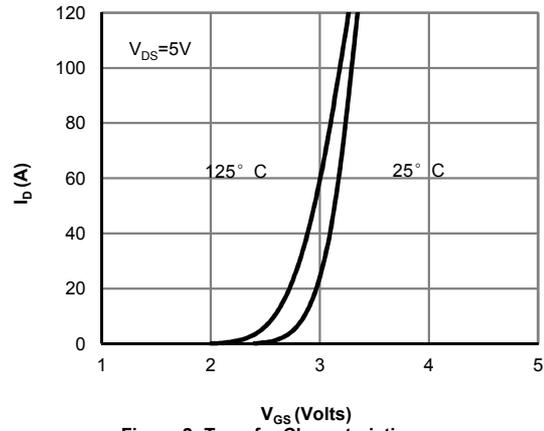


Figure 2: Transfer Characteristics

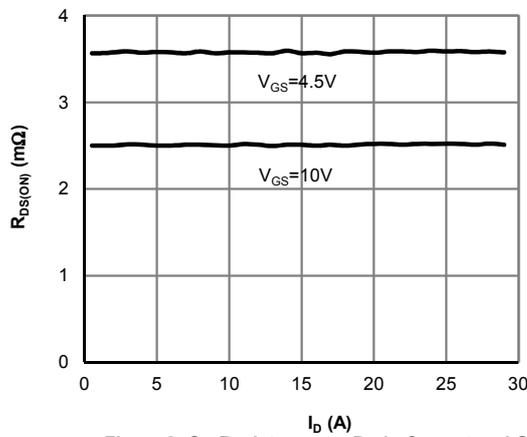


Figure 3: On-Resistance vs. Drain Current and Gate Voltage

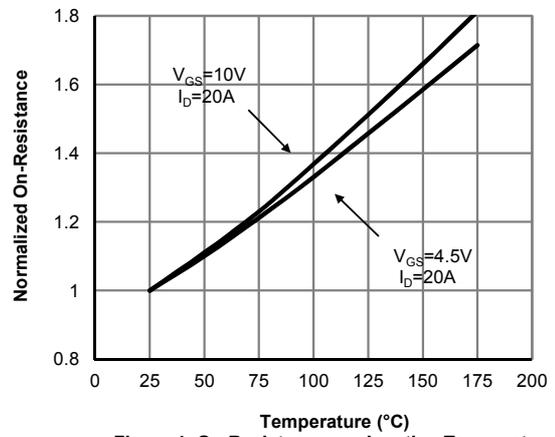


Figure 4: On-Resistance vs. Junction Temperature

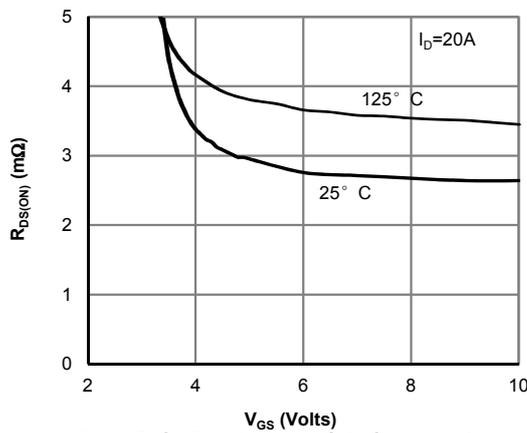


Figure 5: On-Resistance vs. Gate-Source Voltage

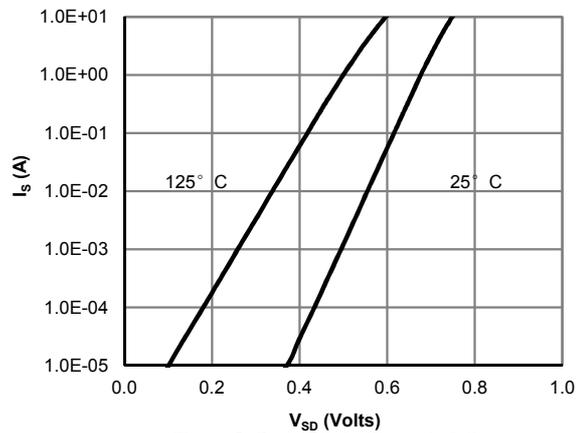


Figure 6: Body-Diode Characteristics

TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

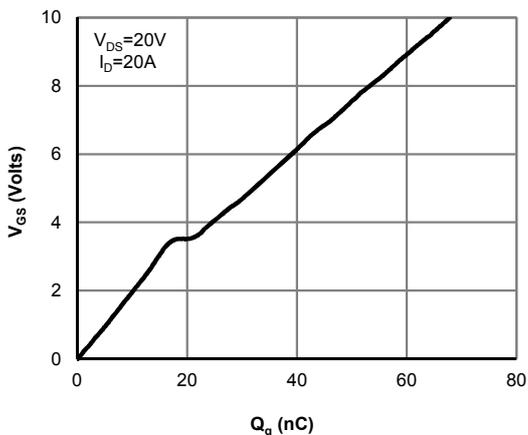


Figure 7: Gate-Charge Characteristics

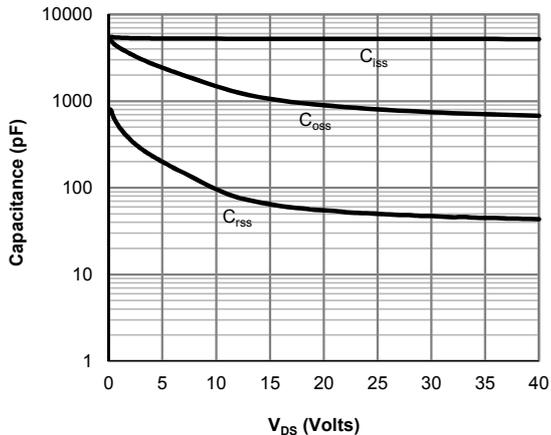


Figure 8: Capacitance Characteristics

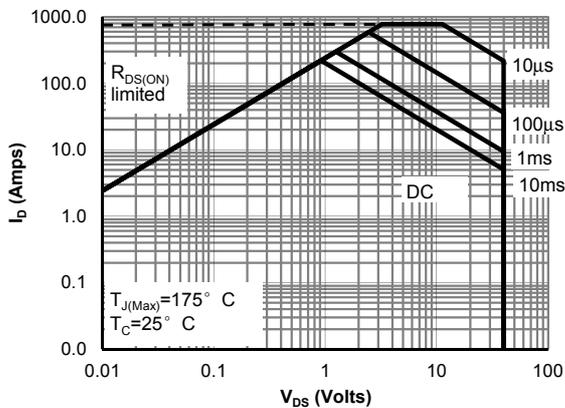


Figure 9: Maximum Forward Biased Safe Operating Area

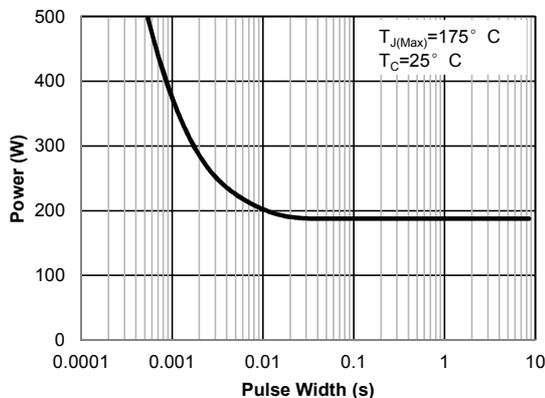


Figure 10: Single Pulse Power Rating Junction-to-Case

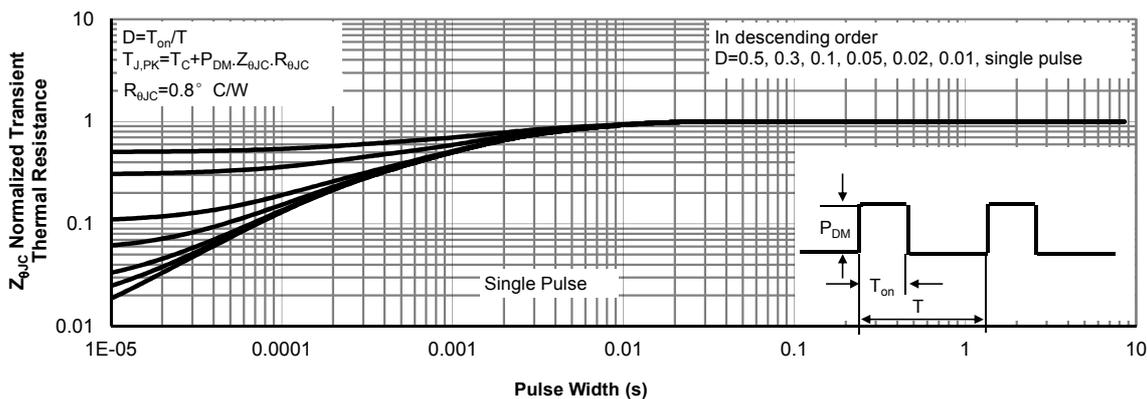


Figure 11: Normalized Maximum Transient Thermal Imp

TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

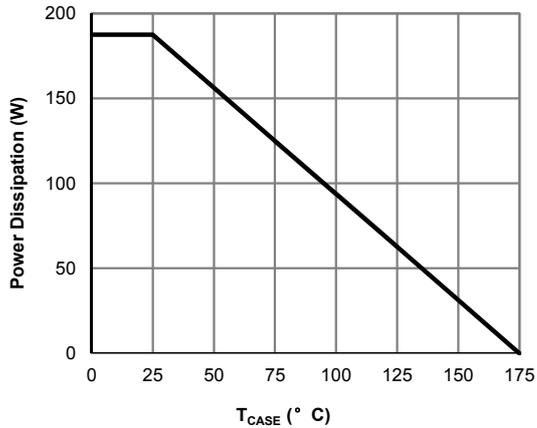


Figure 12: Power De-rating

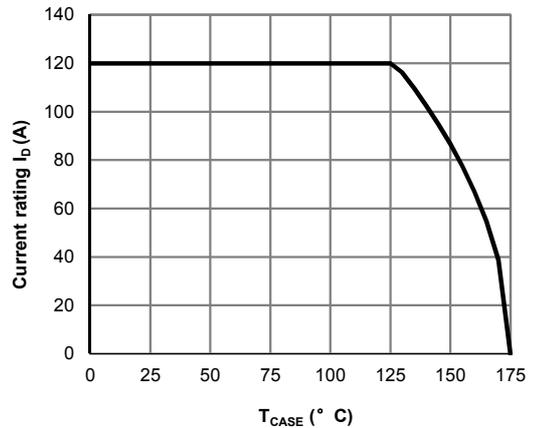


Figure 13: Current De-rating

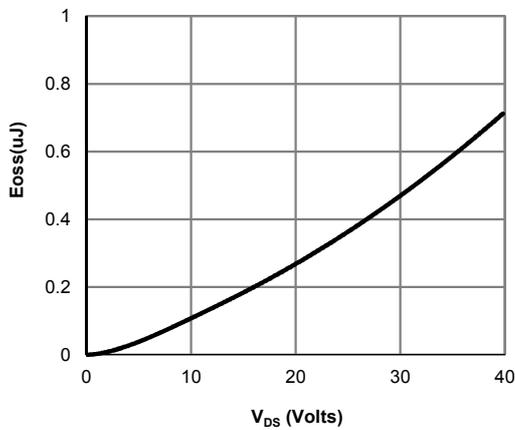


Figure 14: Coss stored Energy

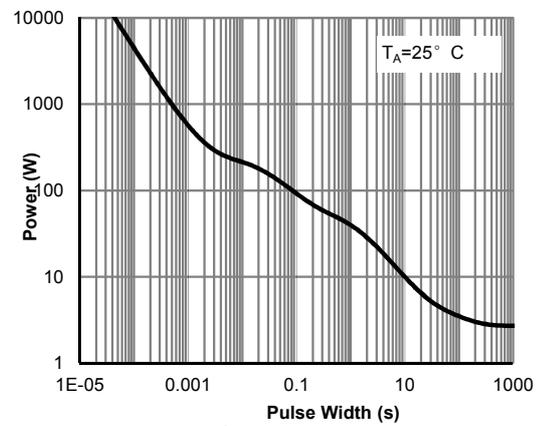


Figure 15: Single Pulse Power Rating Junction-to-Ambient

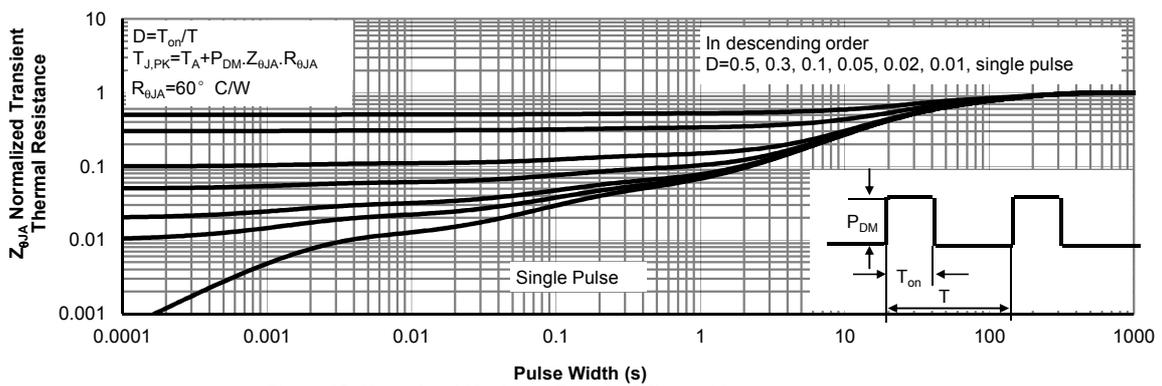


Figure 16: Normalized Maximum Transient Thermal Imp

Figure A: Gate Charge Test Circuit & Waveforms

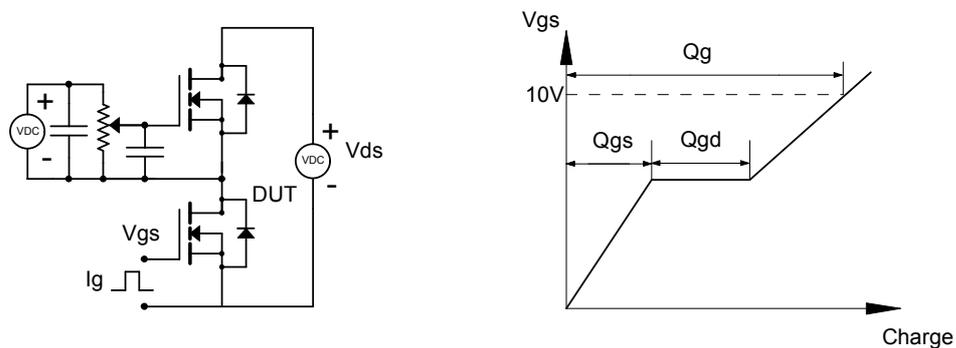


Figure B: Resistive Switching Test Circuit & Waveforms

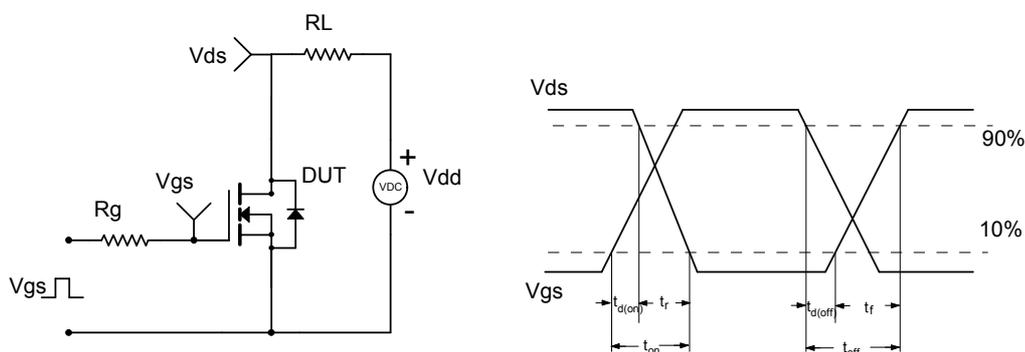


Figure C: Unclamped Inductive Switching (UIS) Test Circuit & Waveforms

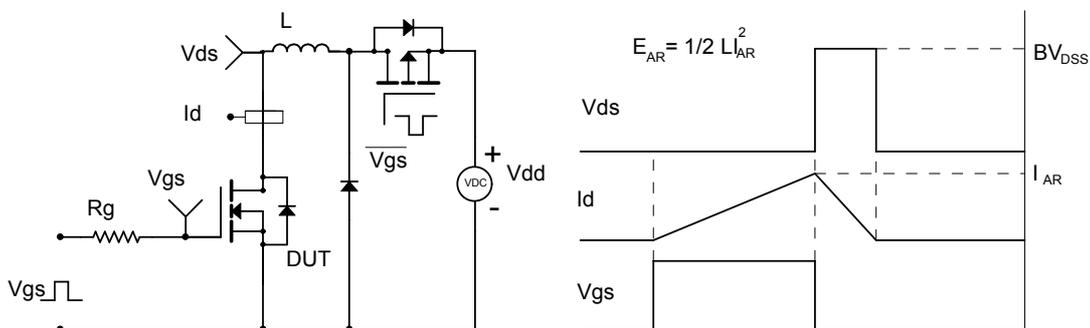
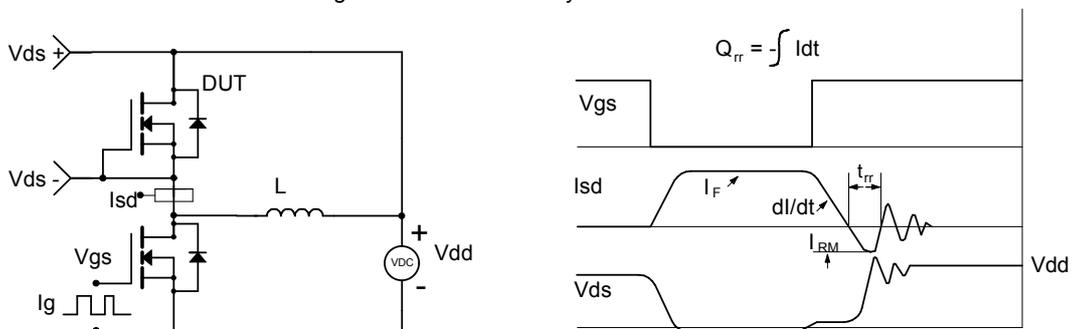


Figure D: Diode Recovery Test Circuit & Waveforms



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