## Features

- Excellent $R_{DS(ON)}$ and Low Gate Charge
- 100% UIS Tested
- 100% ΔVds Tested
- Halogen-free; RoHS-compliant

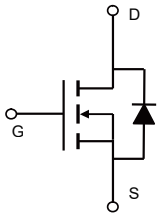
## Applications

- SMPS with PFC and Flyback
- Silver ATX,adapter,TV,lighting,Telecom

## Product Summary

| Parameters | Value | Unit |
|---|---|---|
| $V_{DSS}$ | 600 | V |
| $V_{GS(th)_Typ}$ | 3.2 | V |
| $I_D$(@$V_{GS}$=10V) | 7.1 | A |
| $R_{DS(ON)_Typ}$(@$V_{GS}$=10V | 920 | mΩ |

TO-251



Schematic

## Ordering Information

| Device | Marking | MSL | Form | Package | Tube(pcs) | Per Carton (pcs) |
|---|---|---|---|---|---|---|
| VSM7N60-T1 | VSM7N60 | 3 | Tube | TO-251 | 75 | 29700 |

## Absolute Maximum Ratings (@ $T_C$ = 25°C unless otherwise specified)

| Symbol | Parameter | | Value | Unit |
|---|---|---|---|---|
| $V_{DS}$ | Drain-to-Source Voltage | | 600 | V |
| $V_{GS}$ | Gate-to-Source Voltage | | ±30 | V |
| $I_D$ | Continuous Drain Current | $T_C$ = 25°C | 7.1 | A |
| | | $T_C$ = 100°C | 4.5 | |
| $I_{DM}$ | Pulsed Drain Current (1) | | Refer to Fig.4 | A |
| $E_{AS}$ | Single Pulsed Avalanche Energy (2) | | 245 | mJ |
| $P_D$ | Power Dissipation | $T_C$ = 25°C | 153 | W |
| | | $T_C$ = 100°C | 61 | |
| $T_J$, $T_{STG}$ | Junction & Storage Temperature Range | | -55 to 150 | °C |

## Thermal Characteristics

| Symbol | Parameter | Max | Unit |
|---|---|---|---|
| $R_{\theta JA}$ | Thermal Resistance, Junction to Ambient(3) | 39 | °C/W |
| $R_{\theta JC}$ | Thermal Resistance, Junction to Case | 0.8 | |

## Electrical Characteristics ($T_J$ = 25°C unless otherwise specified)

| Symbol | Parameter | Conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| **Off Characteristics** | | | | | | |
| $V_{(BR)DSS}$ | Drain-Source Breakdown Voltage | $I_D$ = 250 μA, $V_{GS}$ = 0V | 600 | - | - | V |
| $I_{DSS}$ | Zero Gate Voltage Drain Current | $V_{DS}$ = 600V, $V_{GS}$ = 0V | - | - | 1.0 | μA |
| $I_{GSS}$ | Gate-Body Leakage Current | $V_{DS}$ = 0V, $V_{GS}$ = ±30V | - | - | ±100 | nA |
| **On Characteristics** | | | | | | |
| $V_{GS(th)}$ | Gate Threshold Voltage | $V_{DS}$ = $V_{GS}$, $I_D$ = 250 μA | 2.0 | 3.2 | 4.0 | V |
| $R_{DS(ON)}$ | Static Drain-Source ON-Resistance(4) | $V_{GS}$ = 10V, $I_D$ = 1A | - | 920 | 1196 | mΩ |
| **Dynamic Characteristics** | | | | | | |
| $R_g$ | Gate Resistance | f = 1MHz | - | 2.3 | - | Ω |
| $C_{iss}$ | Input Capacitance | $V_{GS}$ = 0V, $V_{DS}$ = 300V, f = 1MHz | 796 | 1115 | 1449 | pF |
| $C_{oss}$ | Output Capacitance | | 24 | 34 | 44 | pF |
| $C_{rss}$ | Reverse Transfer Capacitance | | 5 | 7.6 | 10 | pF |
| $Q_g$ | Total Gate Charge | $V_{GS}$ = 0 to 10V $V_{DS}$ = 300V, $I_D$ = 1A | 17 | 24 | 32 | nC |
| $Q_{gs}$ | Gate Source Charge | | - | 5.5 | - | nC |
| $Q_{gd}$ | Gate Drain("Miller") Charge | | - | 7.4 | - | nC |
| | | | | | | |
| **Switching Characteristics** | | | | | | |
| $t_{d(on)}$ | Turn-On DelayTime | $V_{GS}$ = 10V, $V_{DD}$ = 300V $I_D$= 1A, $R_{GEN}$ = 6.2Ω | - | 12 | - | ns |
| $t_r$ | Turn-On Rise Time | | - | 15 | - | ns |
| $t_{d(off)}$ | Turn-Off DelayTime | | - | 39 | - | ns |
| $t_f$ | Turn-Off Fall Time | | - | 47 | - | ns |
| **Body Diode Characteristics** | | | | | | |
| $I_S$ | Maximum Continuous Body Diode Forward Current | | - | - | 7 | A |
| $I_{SM}$ | Maximum Pulsed Body Diode Forward Current | | - | - | 28 | A |
| $V_{SD}$ | Body Diode Forward Voltage | $V_{GS}$ = 0V, $I_S$ = 1A | - | | 1.2 | V |
| trr | Body Diode Reverse Recovery Time | $I_F$ = 1A, di/dt = 100A/us | 133 | 186 | 251 | ns |
| Qrr | Body Diode Reverse Recovery Charge | | - | 915 | - | nC |

Notes:

1. Repetitive Rating: Pulse Width Limited by Maximum Junction Temperature.
2. $E_{AS}$ condition: Starting $T_J$=25C, $V_{DD}$=50V, $V_{GS}$=10V, $R_G$=25ohm, L=10mH, $I_{AS}$=7A, $V_{DD}$=0V during time in avalanche.
3. $R_{\theta JA}$ is measured with the device mounted on FR-4 substrate PC board, 2oz copper, with minimum recommended pad layout.
4. Pulse Test: Pulse Width≤300μs, Duty Cycle≤0.5%.

# Typical Performance Characteristics

Figure 1: Power De-rating

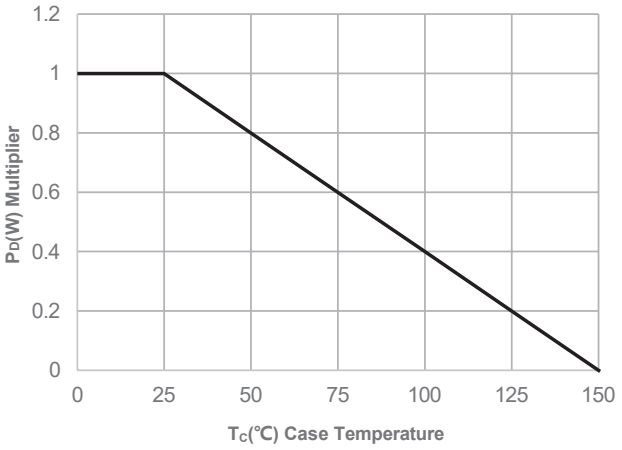



Figure 2: Current De-rating

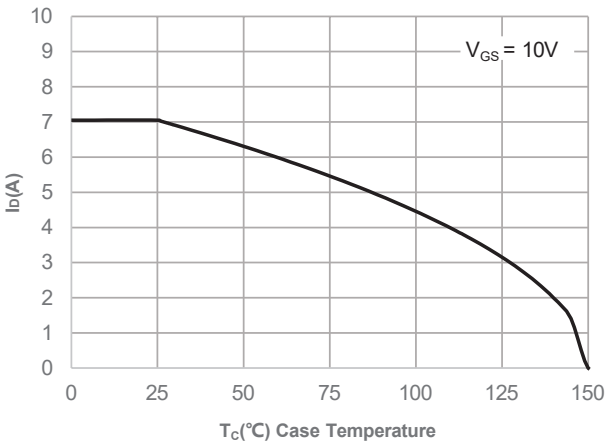



Figure 3: Normalized Maximum Transient Thermal Impedance

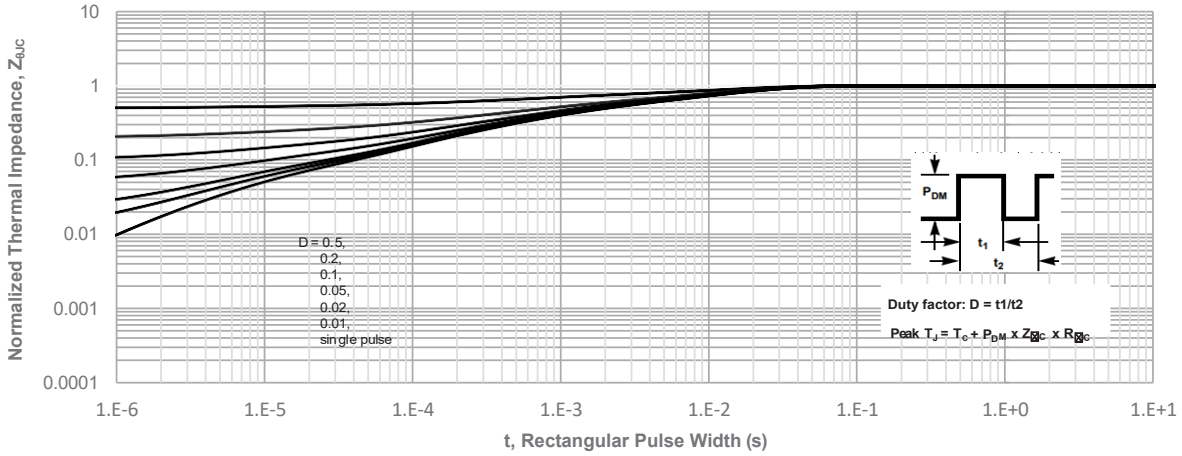
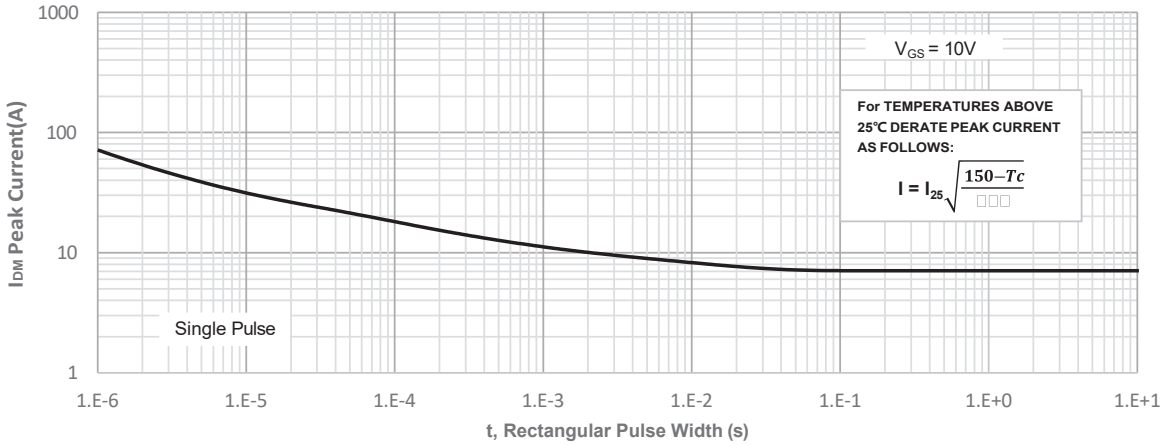



Figure 4: Peak Current Capacity



# Typical Performance Characteristics

Figure 5: Output Characteristics

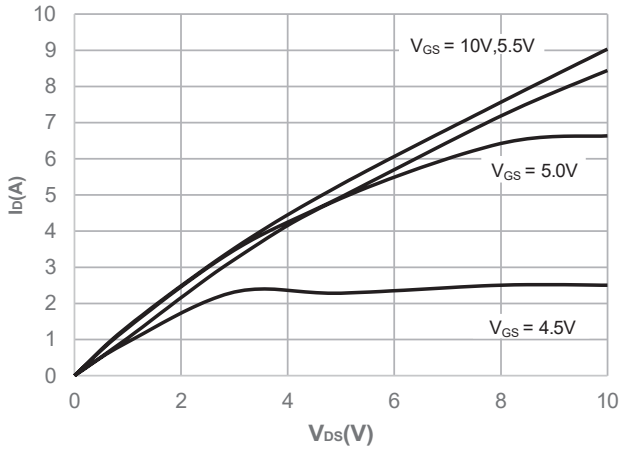



Figure 6: Typical Transfer Characteristics

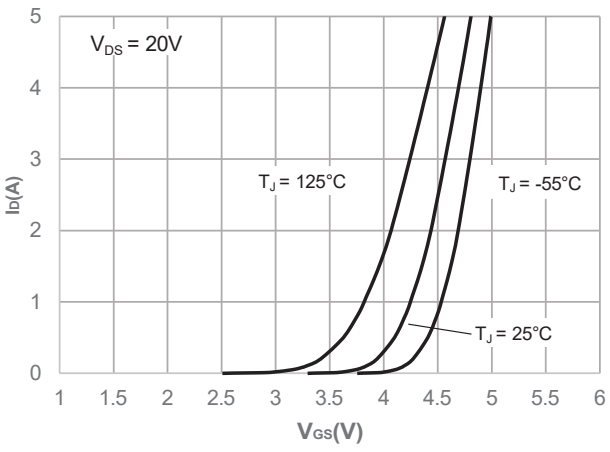



Figure 7: On-resistance vs. Drain Current

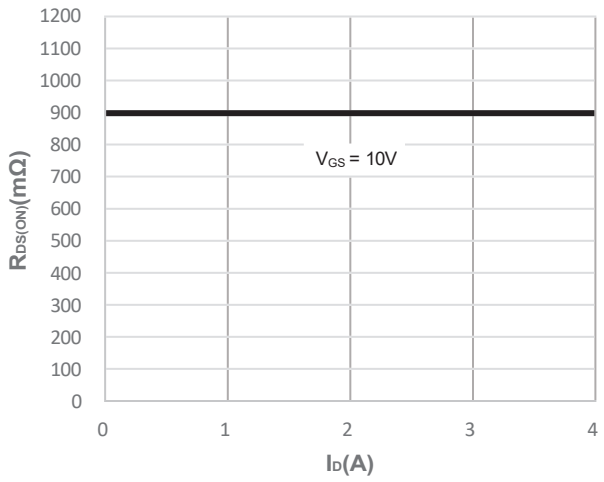



Figure 8: Body Diode Characteristics

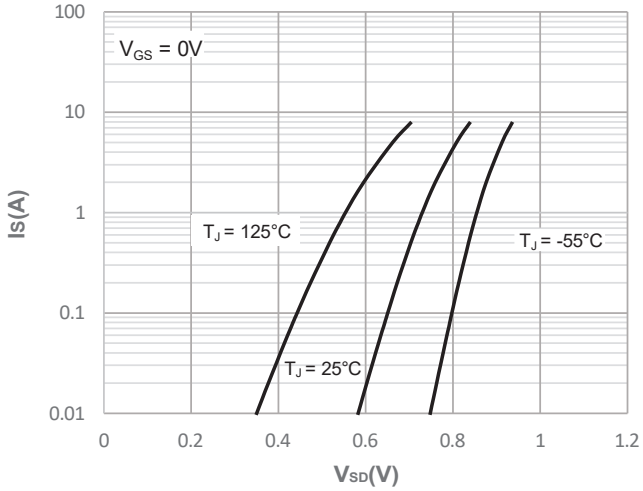



Figure 9: Gate Charge Characteristics

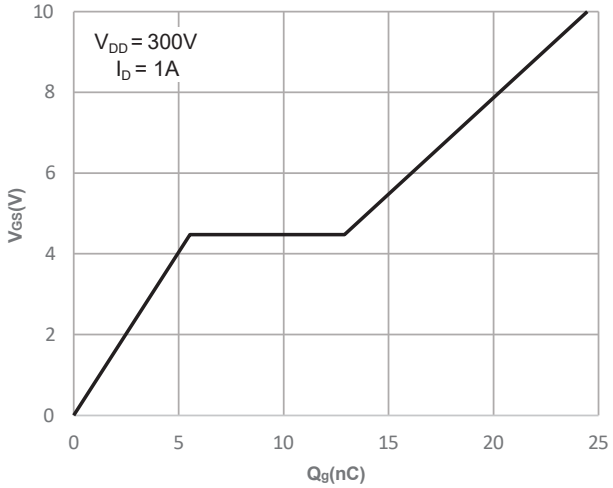
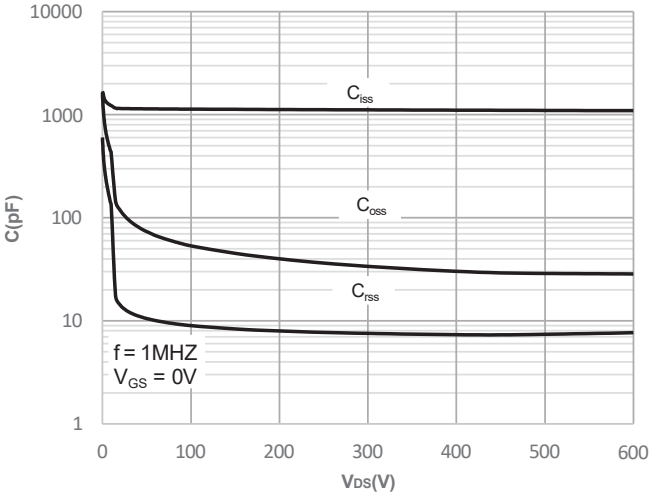



Figure 10: Capacitance Characteristics



# Typical Performance Characteristics

Figure 11: Normalized Breakdown voltage vs. Junction Temperature

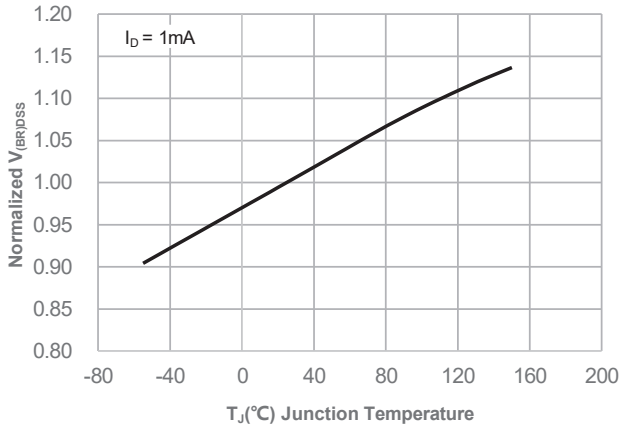



Figure 12: Normalized on Resistance vs. Junction Temperature

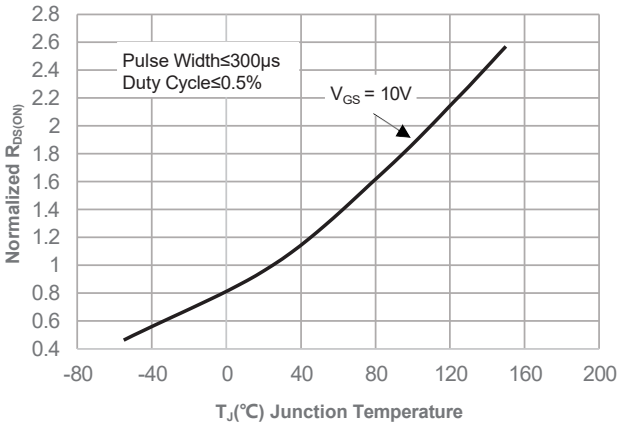



Figure 13: Normalized Threshold Voltage vs. Junction Temperature

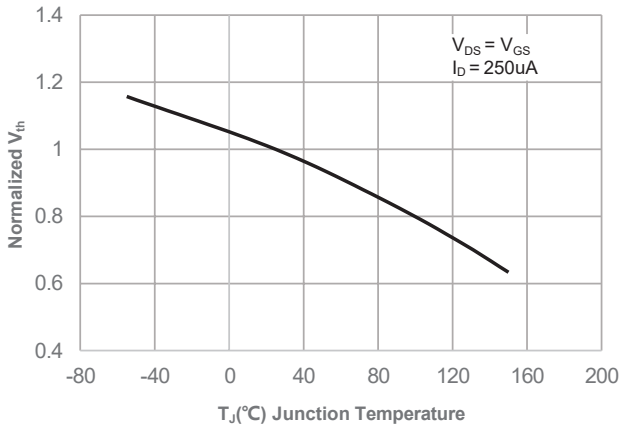



Figure 14: $R_{DS(ON)}$ vs. $V_{GS}$

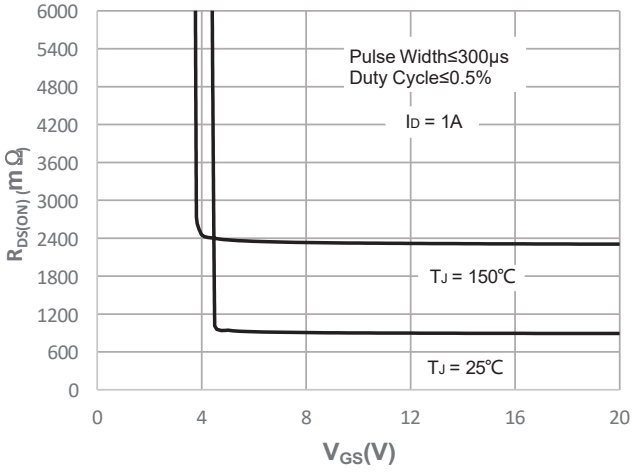
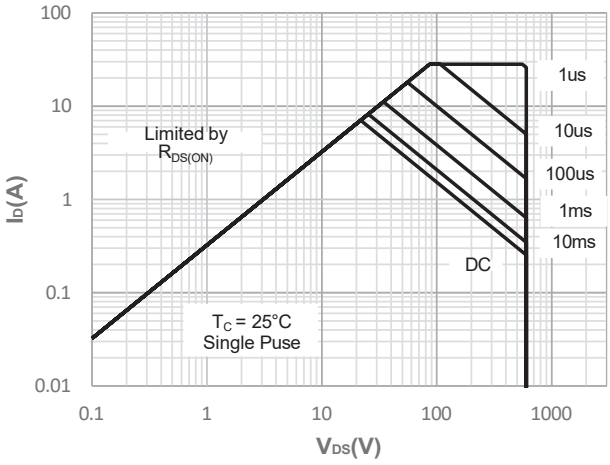



Figure 15: Maximum Safe Operating Area



## Test Circuit

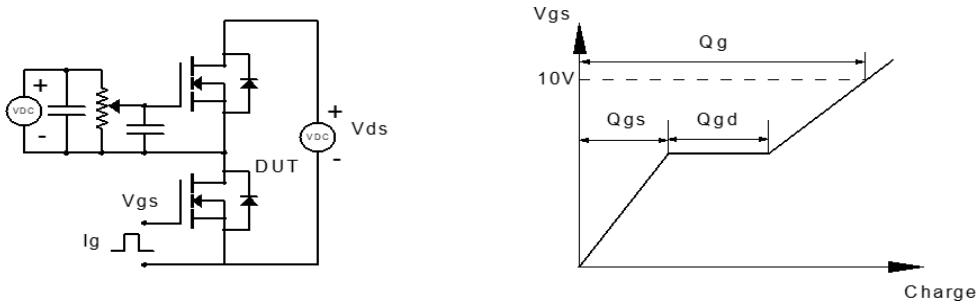



**Figure 1: Gate Charge Test Circuit & Waveform**

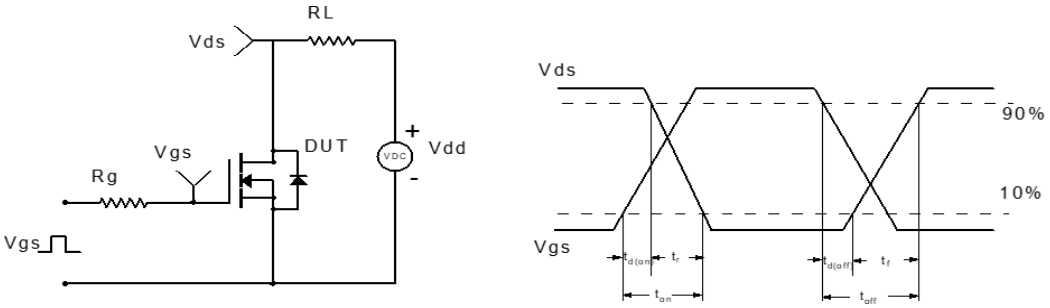



**Figure 2: Resistive Switching Test Circuit & Waveform**

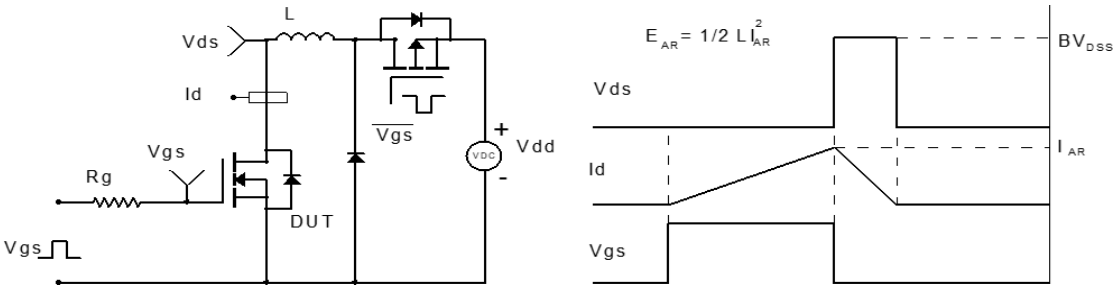



**Figure 3: Unclamped Inductive Switching Test Circuit& Waveform**

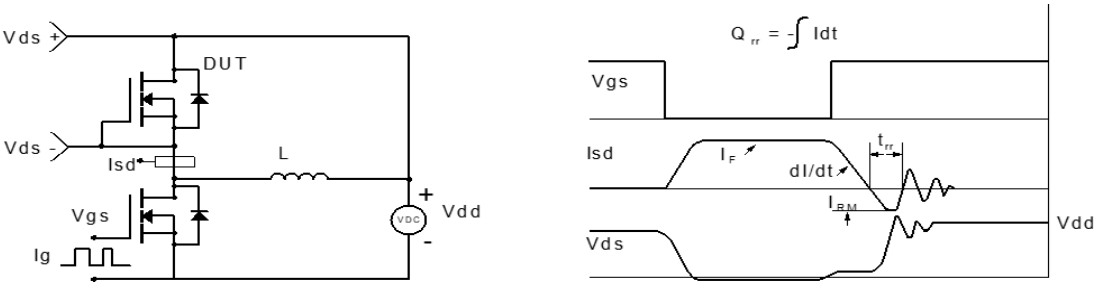



**Figure 4: Diode Recovery Test Circuit & Waveform**