# MS6N90

## 900V N-Channel MOSFET

**Description**

The MS6N90 is a N-channel enhancement-mode MOSFET, providing the designer with the best combination of fast switching, ruggedized device design, low on-resistance and cost effectiveness. The TO-220 package is universally preferred for all commercial-industrial applications

**Features**

- RDS(on) (Max 2.4 Ω )@VGS=10V
- Gate Charge (Typical 33nC)
- Excellent Switching Characteristics
- Improved dv/dt Capability, High
- Ruggedness
- 100% Avalanche Tested
- Maximum Junction Temperature
- Range (150°˚C)
- RoHS compliant package

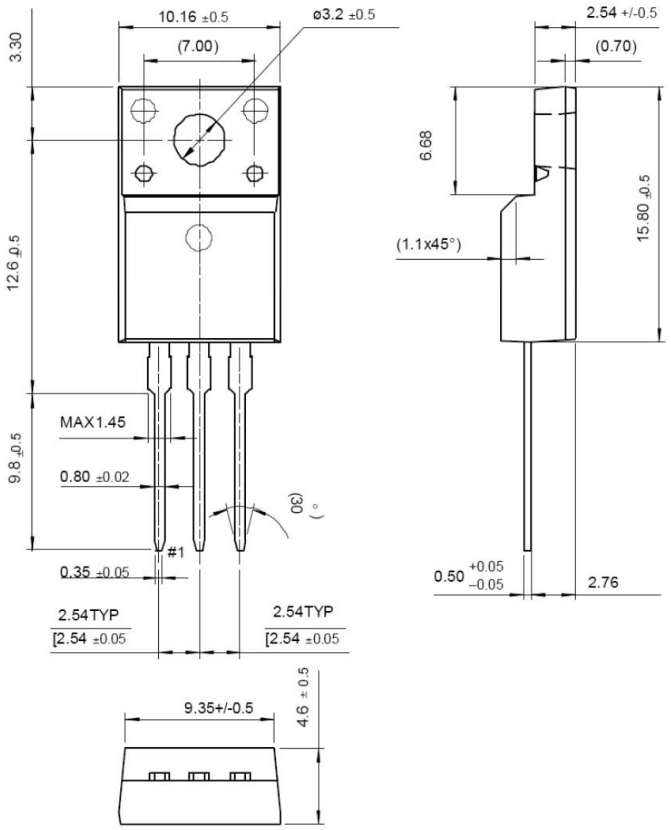
**Application**

- Open Framed Power Supply
- Adapter

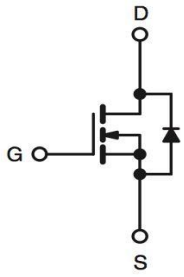
**Packing & Order Information**

50/Tube ; 1,000/Box


RoHS COMPLIANT




**Graphic symbol**




## MAXIMUM RATINGS AND ELECTRICAL CHARACTERISTICS

**Absolute Maximum Ratings (Tc=25°C unless otherwise specified)**

| Symbol | Parameter | Value | Unit |
|---|---|---|---|
| $V_{DSS}$ | Drain-Source Voltage | 800 | V |
| $I_D$ | Drain Current -Continuous (TC=25°C) | 36 | A |
| | Drain Current -Continuous (TC=100°C) | 4.2 | A |
| $I_{DM}$ | Drain Current –Pulsed | 28 | A |
| $V_{GS}$ | Gate-Source Voltage | ±30 | V |
| $E_{AS}$ | Single Pulsed Avalanche Energy | 580 | mJ |
| $E_{AR}$ | Repetitive Avalanche Energy | 16.7 | mJ |
| dv/dt | Peak Diode Recovery dv/dt | 4.5 | V/ns |

• Drain current limited by maximum junction temperature

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## Absolute Maximum Ratings (Tc=25°C unless otherwise specified)

| Symbol | Parameter | Value | Unit |
|---|---|---|---|
| $P_D$ | Power Dissipation (TC=25°C) | 165 | W |
| | - Derate above 25°C | 1.4 | W/°C |
| $T_J/T_{STG}$ | Operating and Storage Temperature Range | -55 to +150 | °C |
| $T_L$ | Maximum lead temperature for soldering purposes, 1/8" from case for 5 seconds | 300 | °C |

●Drain current limited by maximum junction temperature

## Thermal Resistance Characteristics

| Symbol | Parameter | Typ. | Max. | Units |
|---|---|---|---|---|
| $R_{\theta JC}$ | Junction-to-Case | -- | 0.75 | °C/W |
| $R_{\theta JA}$ | Junction-to-Ambient | -- | 62.5 | |

## On Characteristics

| Symbol | Parameter | Test Conditions | Min | Typ. | Max. | Units |
|---|---|---|---|---|---|---|
| $V_{GS}$ | Gate Threshold Voltage | $V_{DS}$ = $V_{GS}$,$I_D$ = 250μA | 3.0 | -- | 5.0 | V |
| $R_{DS(ON)}$ | Static Drain-Source On-Resistance | $V_{GS}$ =10 V,$I_D$ = 3 A | -- | 1.95 | 2.4 | Ω |

## Off Characteristics

| Symbol | Parameter | Test Conditions | Min | Typ. | Max. | Units |
|---|---|---|---|---|---|---|
| $BV_{DSS}$ | Drain-Source Breakdown Voltage | $V_{GS}$ = 0 V , $I_D$ = 250μA | 900 | -- | -- | V |
| $\Delta BV_{DSS}$ /$\Delta T_J$ | Breakdown Voltage Temperature Coefficient | $I_D$ = 250μA, Referenced to 25°C | -- | 0.6 | -- | V/°C |
| $I_{DSS}$ | Zero Gate Voltage Drain Current | $V_{DS}$ = 900 V , $V_{GS}$ = 0 V<br>$V_{DS}$ = 720 V , $V_C$ = 125°C | -- | -- | 10<br>100 | μA |
| $I_{GSSF}$ | Gate-Body Leakage Current,Forward | $V_{GS}$ = 30 V , $V_{DS}$ = 0 V | -- | -- | 100 | nA |
| $I_{GSSR}$ | Gate-Body Leakage Current,Reverse | $V_{GS}$ = -30 V , $V_{DS}$ = 0 V | -- | -- | -100 | nA |

## Dynamic Characteristics

| Symbol | Parameter | Test Conditions | Min | Typ. | Max. | Units |
|---|---|---|---|---|---|---|
| $C_{ISS}$ | Input Capacitance | $V_{DS}$ = 25 V, $V_{GS}$ = 0 V, f = 1.0MHz | -- | 1500 | -- | pF |
| $C_{OSS}$ | Coss Output Capacitance | | -- | 120 | -- | pF |
| $C_{RSS}$ | Crss Reverse Transfer Capacitance | | -- | 12 | -- | pF |

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## Switching Characteristics

| Symbol | Parameter | Test Conditions | Min | Typ. | Max. | Units |
|---|---|---|---|---|---|---|
| $t_{d(on)}$ | Turn-On Time | $V_{DS}$ = 450 V, $I_D$ = 6 A, $R_G$ = 25 Ω | -- | 50 | -- | ns |
| $t_r$ | Turn-On Rise Time | | -- | 100 | -- | ns |
| $t_{d(off)}$ | Turn-Off Delay Time | | -- | 50 | -- | ns |
| tf | Turn-Off Fall Time | | -- | 60 | -- | ns |
| $Q_g$ | Total Gate Charge | $V_{DS}$ = 720 V , $I_D$ = 6 A, $V_{GS}$ = 10 V | -- | 33 | -- | nC |
| $Q_{gs}$ | Gate-Source Charge | | -- | 10 | -- | nC |
| $Q_{gd}$ | Gate-Drain Charge | | -- | 13 | -- | nC |
| trr | Reverse Recovery Time | $I_S$ = 6 A , $V_{GS}$ = 0 V diF/dt =100A/μs | -- | 0.65 | -- | ns |
| Qrr | Reverse Recovery Charge | | -- | 7.0 | -- | μC |

## Source-Drain Diode Maximum Ratings and Characteristics

| Symbol | Parameter | Test Conditions | Min | Typ. | Max. | Units |
|---|---|---|---|---|---|---|
| $I_S$ | Continuous Source-Drain Diode Forward Current | | -- | -- | 6 | A |
| $I_{SM}$ | ISM Pulsed Source-Drain Diode Forward Current | | -- | -- | 24 | |
| $V_{SD}$ | Source-Drain Diode Forward Voltage | $I_S$ = 6 A , $V_{GS}$ = 0 V | -- | -- | 1.4 | V |

**Notes:**

1. Repeativity rating : pulse width limited by junction temperature
2. L = 34.0mH, $I_{AS}$ =6.0A, $V_{DD}$ = 50V, $R_G$ = 25Ω , Starting TJ = 25°C
3. $I_{SD}$ ≤ 6.0A, di/dt ≤ 200A/us, VDD ≤ BVDSS, Starting TJ = 25°C
4. Pulse Test : Pulse Width ≤ 300us, Duty Cycle ≤ 2%
5. Essentially independent of operating temperature.

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■Characteristics Curve

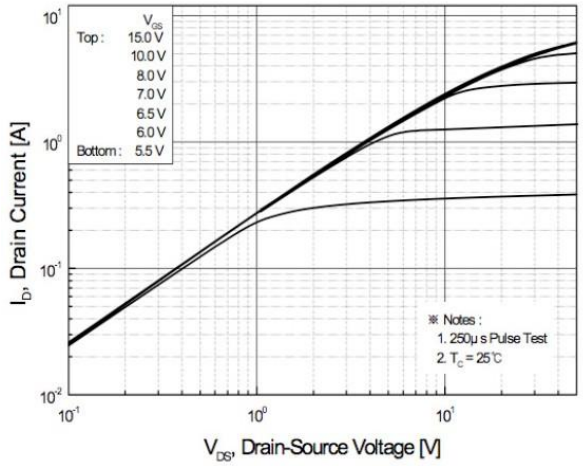


**FIG.1-ON REGION CHARACTERISTICS**

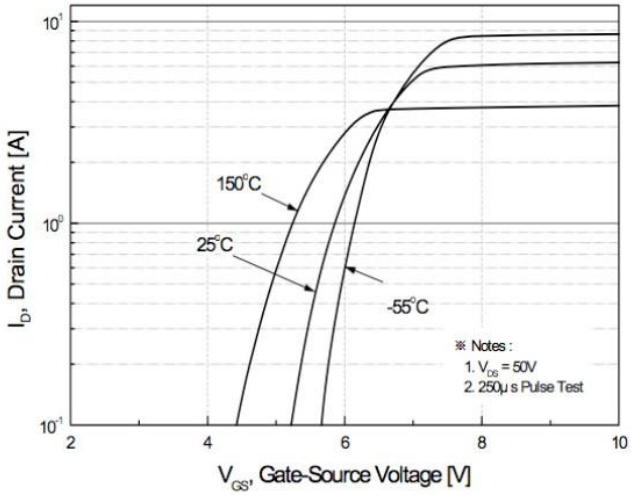


**FIG.2-TRANSFER CHARACTERISTICS**

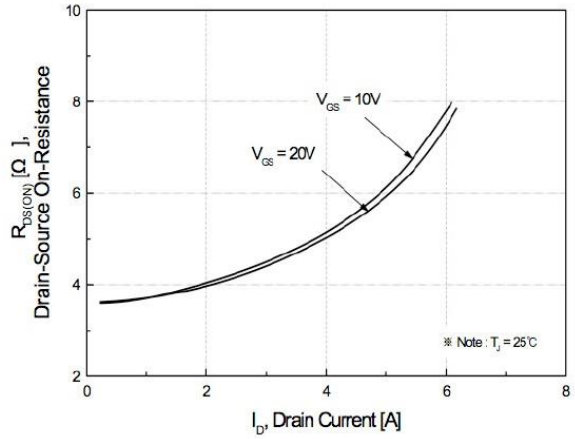


**FIG.3-ON RESISTANCE VARIATION VS DRAIN CURRENT AND GATE VOLTAGE**

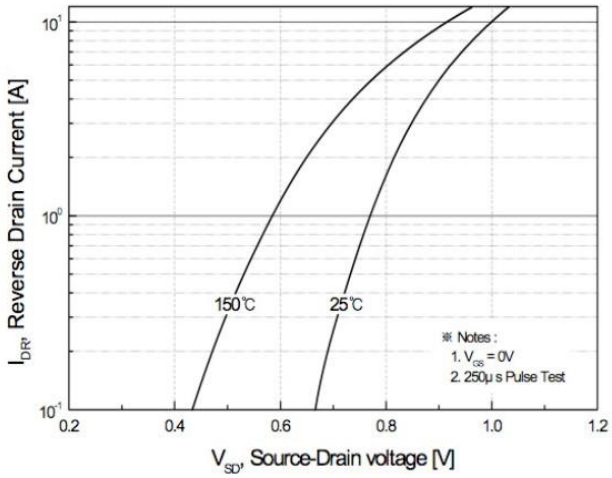


**FIG.4-BODY DIODE FORWARD VOLTAGE VARIATION WITH SOURCE CURRENT AND TEMPERATURE**

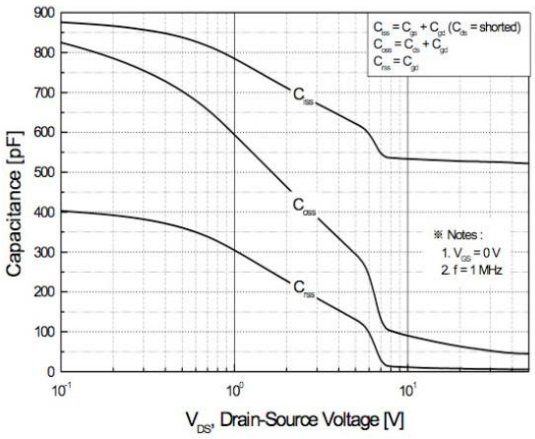


**FIG.5-CAPACITANCE CHARACTERISTICS**

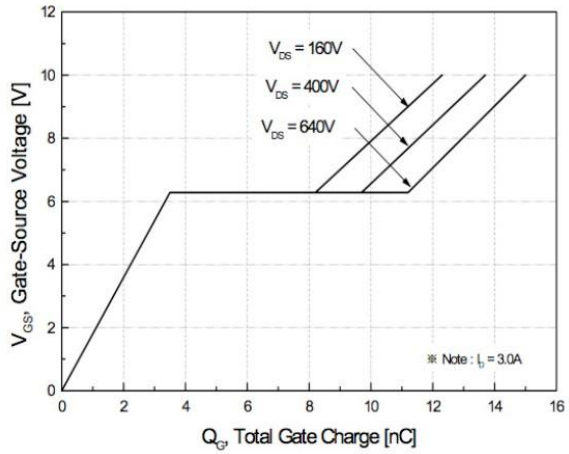


**FIG.6-GATE CHARGE CHARACTERISTICS**

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■Characteristics Curve

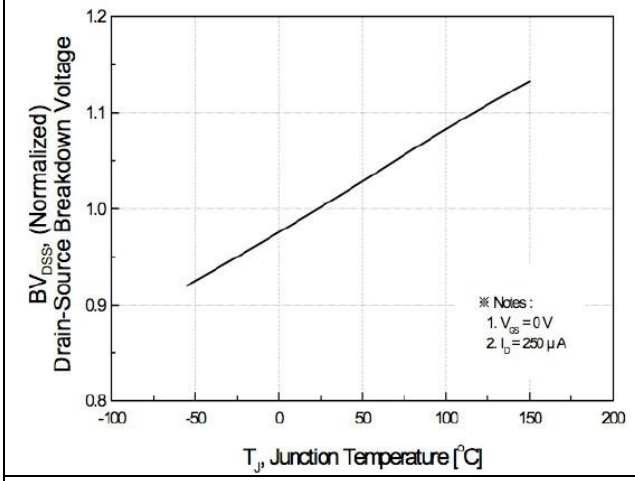


**FIG.7-BREAKDOWN VOLTAGE VARIATION VS TEMPERATURE**

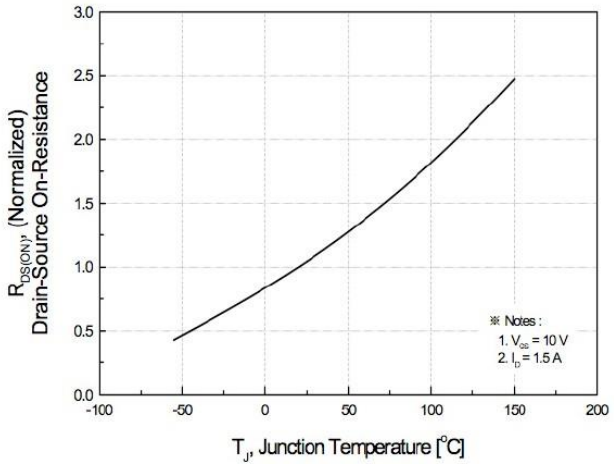


**FIG.8-ON-RESISTANCE VARIATION VS TEMPERATURE**

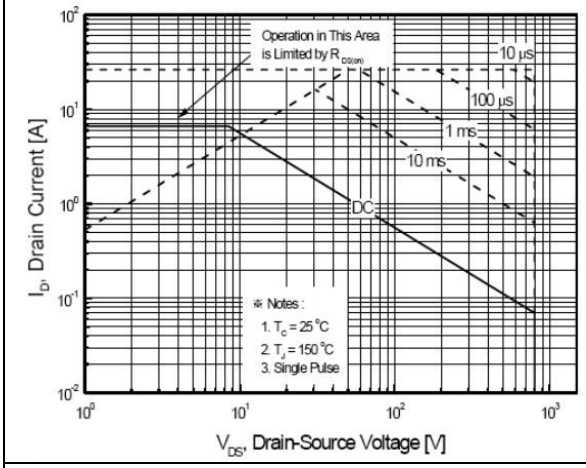


**FIG.9-MAXIMUM SAFE OPERATING AREA**

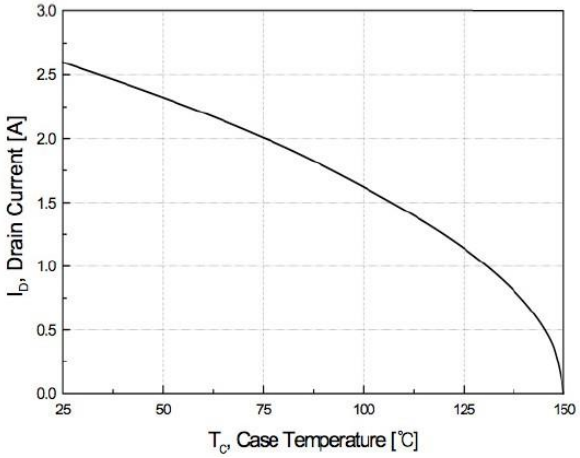


**FIG.10-MAXIMUM DRAIN CURRENT VS CASE TEMPERATURE**

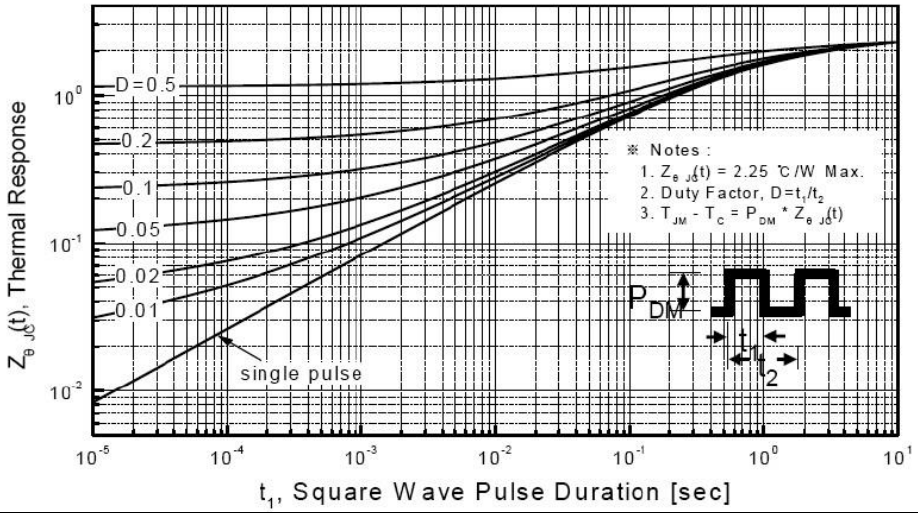


**FIG.11-TRANSIENT THERMAL RESPONSE CURVE**

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■Characteristics Test Circuit & Waveform

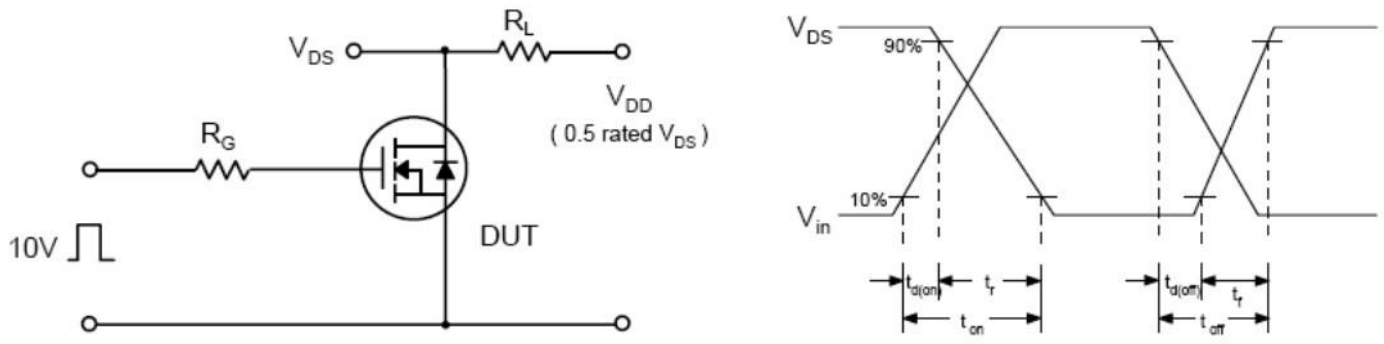


**FIG.12-RESISTIVE SWITCHING TEST CIRCUIT & WAVEFORMS**

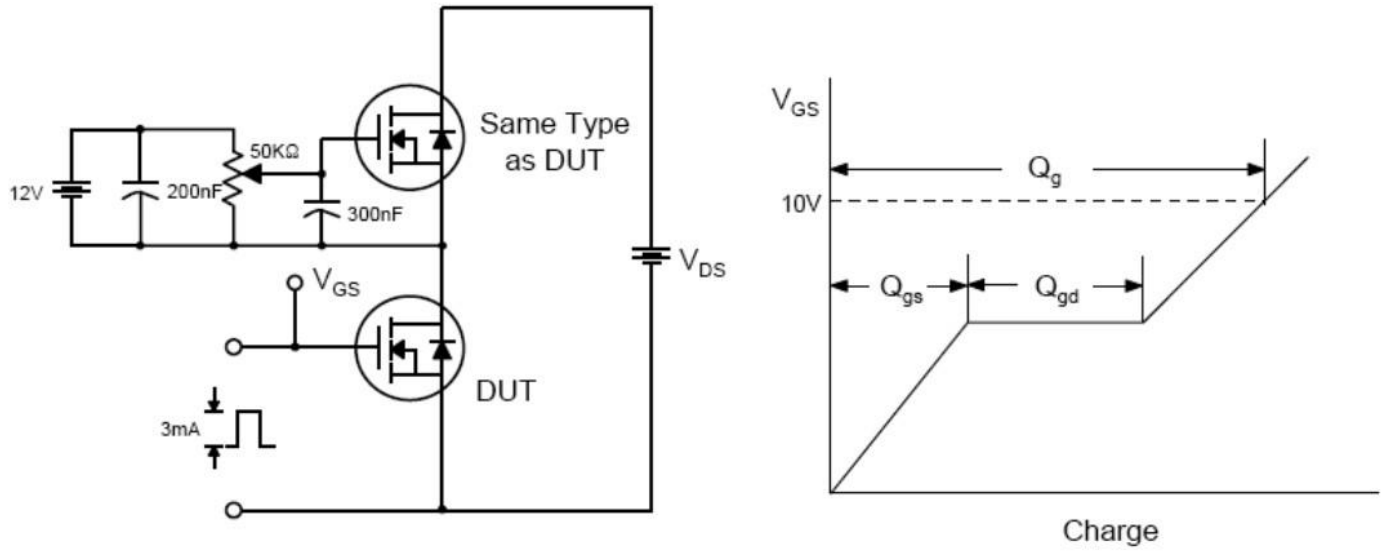


**FIG.13-GATE CHARGE TEST CIRCUIT & WAVEFORM**

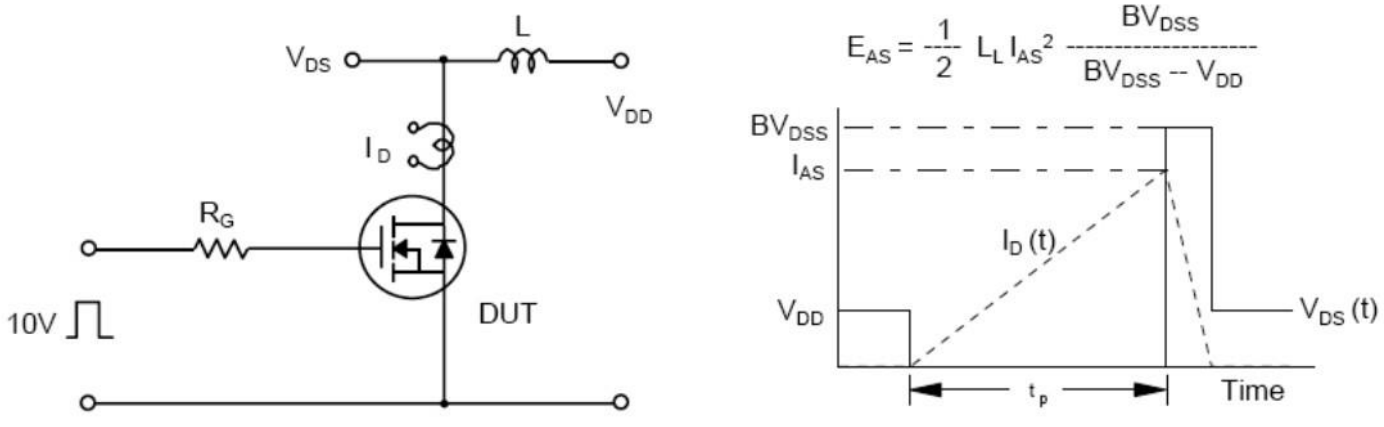


**FIG.14-UNCLAMPED LINDUCTIVE SWITCHING TEST CIRCUIT & WAVEFORMS**

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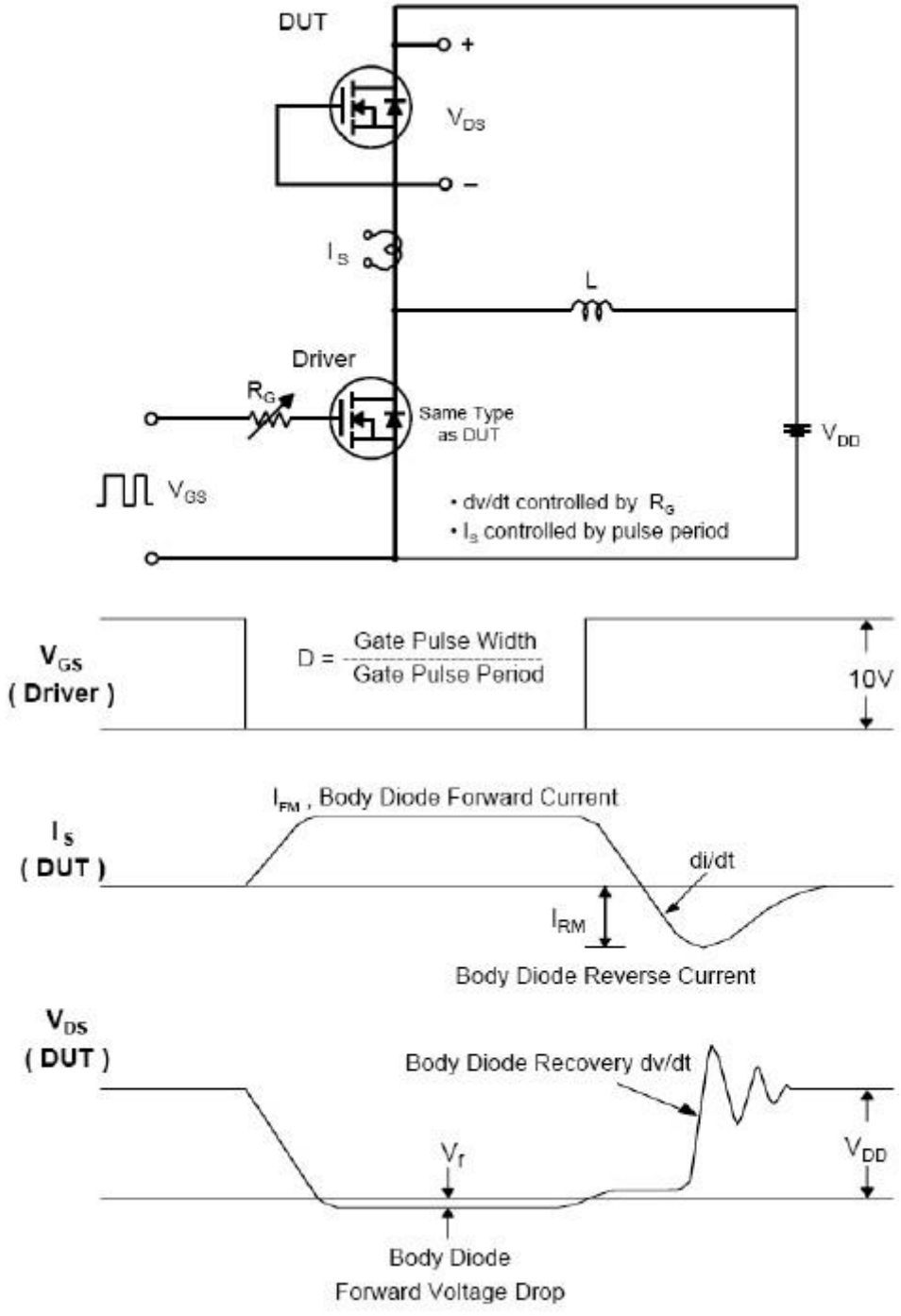


**Fig 15. Peak Diode Recovery dv/dt Test Circuit & Waveforms**

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