# MSF3N80

## 800V N-Channel MOSFET

**Description**

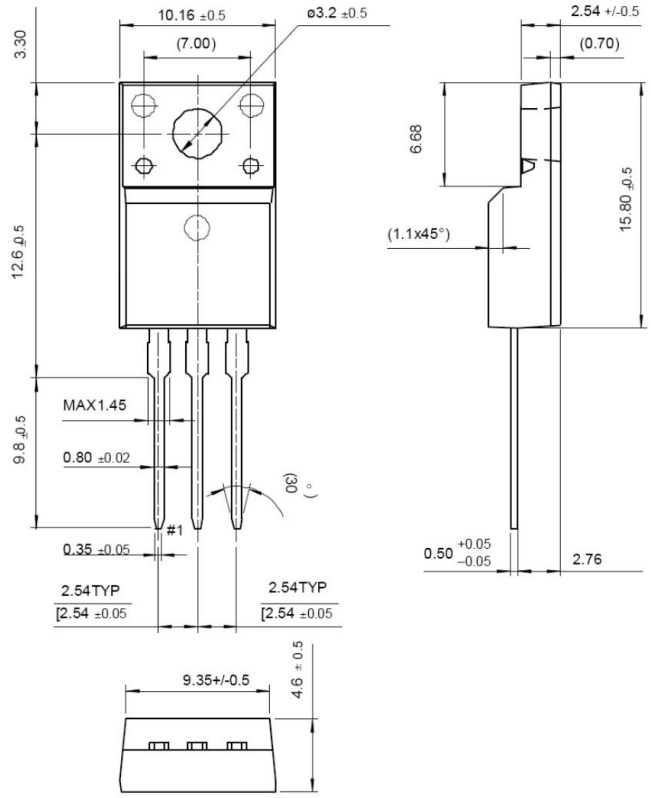
The MSF3N80 is a N-channel enhancement-mode MOSFET , providing the designer with the best combination of fast switching, ruggedized device design, low on-resistance and cost effectiveness. The TO-220F package is universally preferred for all commercial-industrial applications

**Features**

- RDS(on) (Max 4.8 Ω )@VGS=10V
- Gate Charge (Typical 15.0nC)
- Improved dv/dt Capability, High Ruggedness
- 100% Avalanche Tested
- Maximum Junction Temperature Range (150˚C)
- RoHS compliant package

**Application**

- Adapter
- Switching Mode Power Supply

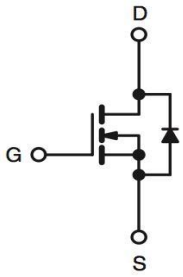



**Packing & Order Information**

50/Tube ; 1,000/Box

RoHS COMPLIANT

**Graphic symbol**




## MAXIMUM RATINGS AND ELECTRICAL CHARACTERISTICS

**Absolute Maximum Ratings**

| Symbol | Parameter | Value | Unit |
|---|---|---|---|
| $V_{DSS}$ | Drain-Source Voltage | 800 | V |
| $V_{GS}$ | Gate-Source Voltage | ±30 | V |
| $I_D$ | Drain Current -Continuous (TC=25°C) | 3.0 | A |
| | Drain Current -Continuous (TC=100°C) | 1.8 | A |
| $I_{DM}$ | Drain Current Pulsed | 12 | A |
| $E_{AS}$ | Single Pulsed Avalanche Energy | 336 | mJ |
| $E_{AR}$ | Repetitive Avalanche Energy | 10.7 | mJ |
| dv/dt | Peak Diode Recovery dv/dt | 4.0 | V/ns |
| $T_J$,$T_{STG}$ | Operating and Storage Temperature Range | -55 to +150 | °C |

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## Absolute Maximum Ratings

| Symbol | Parameter | Value | Unit |
|---|---|---|---|
| $P_D$ | Total Power Dissipation (TC=25°C) | 1.7 | W |
| | Derating Factor above 25 °C | 0.85 | W/°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 characteristics (Tc=25°C unless otherwise noted)

| Symbol | Parameter | Max. | Units |
|---|---|---|---|
| $R_{\theta JC}$ | Junction-to-Case | 3.0 | °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 | $V_{DS}$ = $V_{GS}$,$I_D$ = 250 μA | 3.0 | 3.8 | 5.0 | V |
| $R_{DS(ON)}$ | Static Drain-Source On-Resistance | $V_{GS}$ = 10 V,$I_D$ = 1.5 A | -- | 3.8 | 4.8 | Ω |

## Off Characteristics

| Symbol | Parameter | Test Conditions | Min | Typ. | Max. | Units |
|---|---|---|---|---|---|---|
| $BV_{DSS}$ | Drain-Source Breakdown Voltage | $V_{GS}$ = 0 V , $I_D$ = 250μA | 800 | -- | -- | V |
| $\Delta BV_{DSS}$ /$\Delta T_J$ | Breakdown Voltage Temperature Coefficient | $I_D$ = 250μA, Referenced to 25°C | -- | 1.0 | -- | V/°C |
| $I_{DSS}$ | Zero Gate Voltage Drain Current | $V_{DS}$ = 800 V , $V_{GS}$ = 0 V<br>$V_{DS}$ = 640 V , $T_C$ = 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 |
|---|---|---|---|---|---|---|
| $t_{d(on)}$ | Turn-On Time | $V_{DS}$ = 400 V, $I_D$ = 3 A, $R_G$ = 25 Ω | -- | 20 | -- | ns |
| $t_r$ | Turn-On Time | | -- | 50 | -- | ns |
| $t_{d(off)}$ | Turn-Off Delay Time | | -- | 40 | -- | ns |
| tf | Turn-Off Fall Time | | -- | 40 | -- | ns |
| $Q_g$ | Total Gate Charge | $V_{DS}$ = 640 V,$I_D$ = 3 A, $V_{GS}$ = 10 V | -- | 15 | -- | nC |
| $Q_{gs}$ | Gate-Source Charge | | -- | 3.5 | -- | nC |
| $Q_{gd}$ | Gate-Drain Charge | | -- | 7.5 | -- | nC |

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| 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 | -- | 550 | -- | pF |
| $C_{OSS}$ | Output Capacitance | | -- | 60 | -- | pF |
| $C_{RSS}$ | Reverse Transfer Capacitance | | -- | 8.0 | -- | pF |

| Source-Drain Diode Maximum Ratings and Characteristics | | | | | | |
|---|---|---|---|---|---|---|
| **Symbol** | **Parameter** | **Test Conditions** | **Min** | **Typ.** | **Max.** | **Units** |
| $I_S$ | Continuous Source-Drain Diode Forward Current | | -- | -- | 3.0 | A |
| $I_{SM}$ | ISM Pulsed Source-Drain Diode Forward Current | | -- | -- | 12.0 | |
| $V_{SD}$ | Source-Drain Diode Forward Voltage | $I_S$ = 3 A , $V_{GS}$ = 0 V | -- | -- | 1.5 | V |
| $t_{rr}$ | Reverse Recovery Time | $I_S$ = 3 A , $V_{GS}$ = 0 V diF/dt=100A/μs | -- | 650 | -- | ns |
| $Q_{rr}$ | Reverse Recovery Charge | | -- | 5.0 | -- | μC |

**Notes;**

1. Repetitive Rating: Pulse width limited by maximum junction temperature
2. $I_{AS}$=3A, $V_{DD}$=50V, $R_G$=25Ω, Starting $T_J$=25℃
3. $I_{SD}$≦3A, di/dt≦300A/μs,$V_{DD}$≦$BV_{DSS}$, Starting $T_J$=25℃
4. Pulse Test: Pulse Width ≦ 300μs, Duty Cycle≦ 2%
5. Essentially Independent of Operating Temperature

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## 800V N-Channel MOSFET

■Characteristics Curve

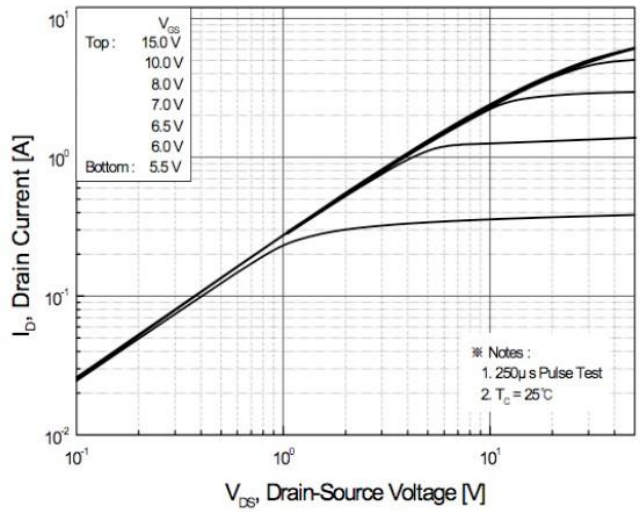


**FIG.1-ON REGION CHARACTERISTICS**

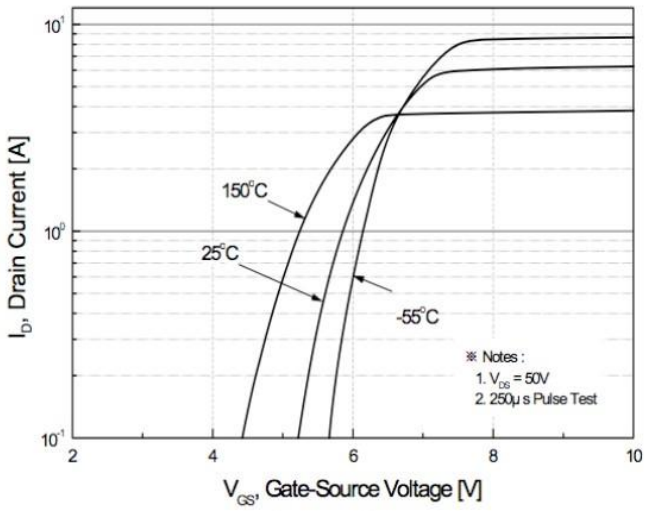


**FIG.2-TRANSFER CHARACTERISTICS**

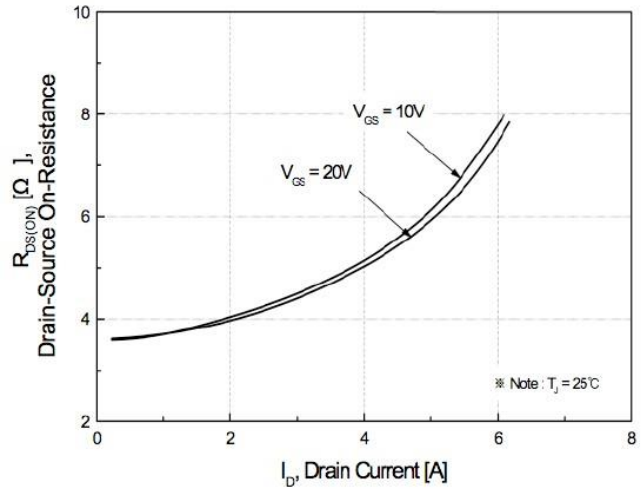


**FIG.3-ON RESISTANCE VARIATION VS DRAIN CURRENT AND GATE VOLTAGE**

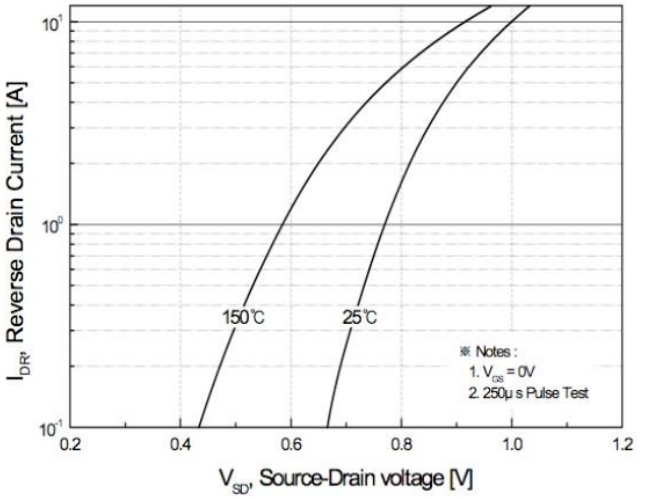


**FIG.4-BODY DIODE FORWARD VOLTAGE VARIATION WITH SOURCE CURRENT AND TEMPERATURE**

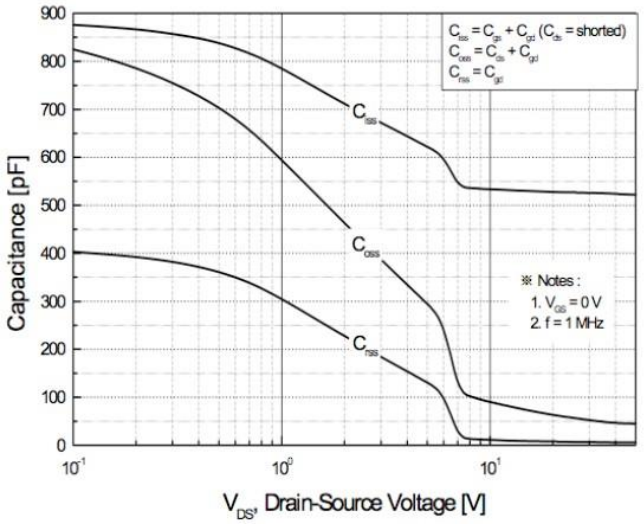


**FIG.5-CAPACITANCE CHARACTERISTICS**

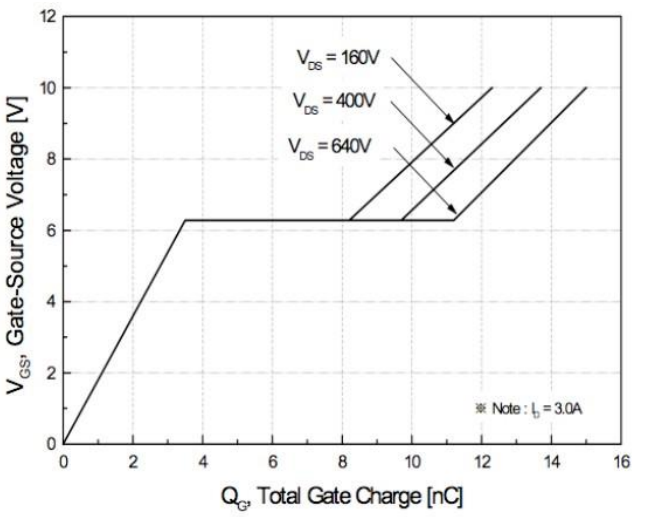


**FIG.6-GATE CHARGE CHARACTERISTICS**

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■Characteristics Curve

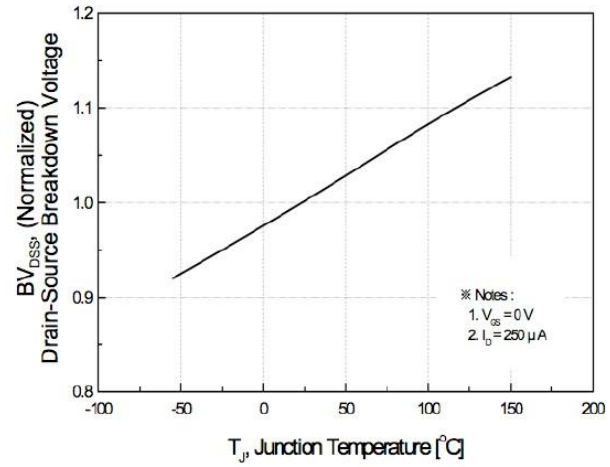


**FIG.7-BREAKDOWN VOLTAGE VARIATION VS TEMPERATURE**

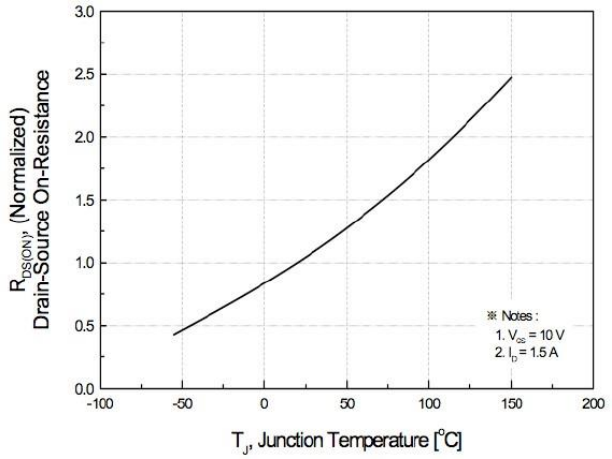


**FIG.8-ON-RESISTANCE VARIATION VS TEMPERATURE**

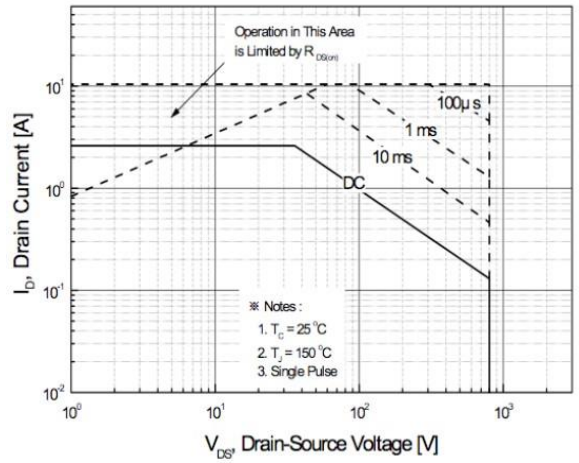


**FIG.9-MAXIMUM SAFE OPERATING AREA**

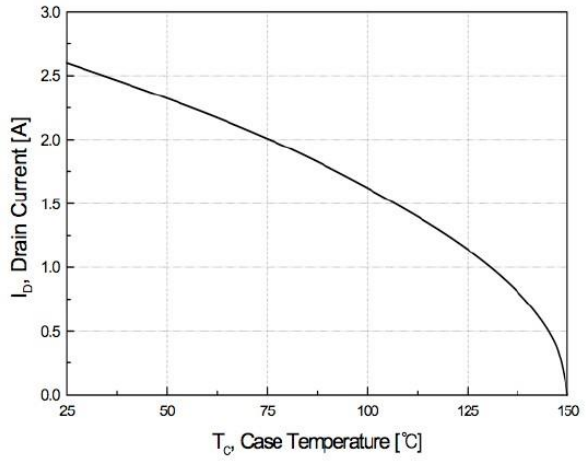


**FIG.10-MAXIMUM DRAIN CURRENT VS CASE TEMPERATURE**

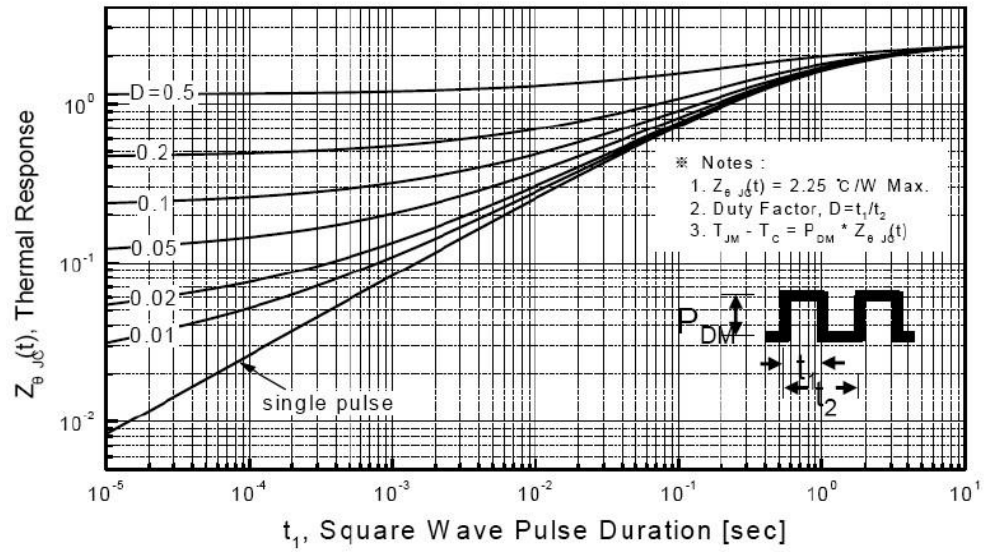


**FIG.11-TRANSIENT THERMAL RESPONSE CURVE**

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■Characteristics Test Circuit & Waveform

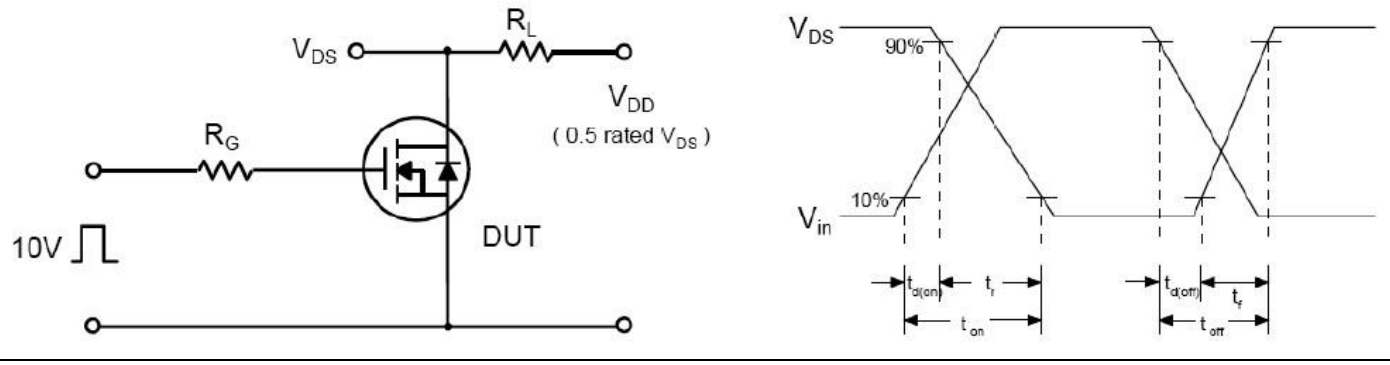


**Fig 12. Resistive Switching Test Circuit & Waveforms**

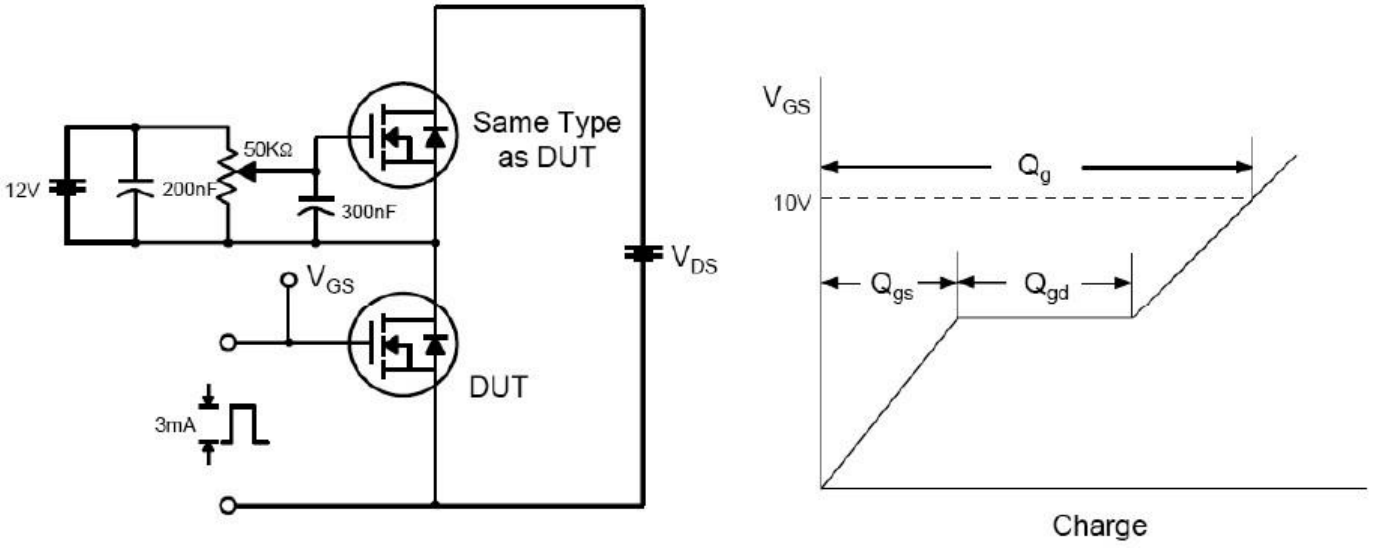


**Fig 13. Gate Charge Test Circuit & Waveform**

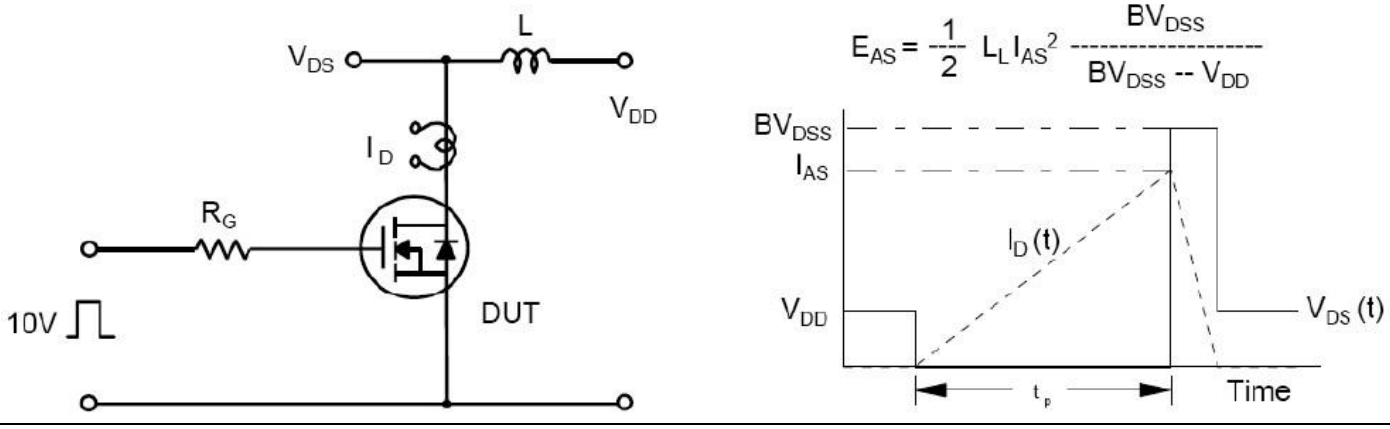


**Fig 14. Unclamped Inductive Switching Test Circuit & Waveforms**

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