

# MSF5N50

## 500V N-Channel MOSFET

### Description

The MSF5N50 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

- Low On Resistance
- Simple Drive Requirement
- Low Gate Charge
- Fast Switching Characteristic
- RoHS compliant / Halogen free package available

### Application (500V-600V)

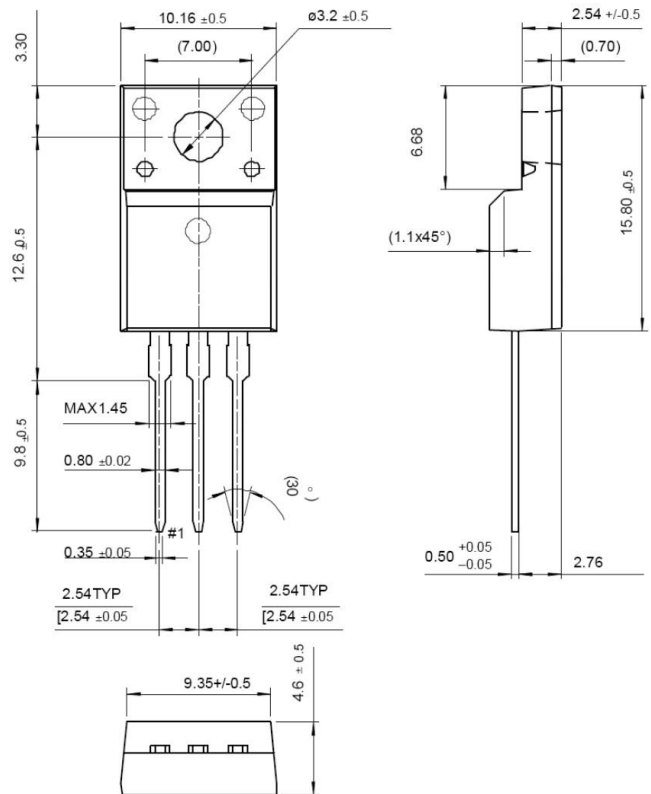
- Open Framed Power Supply
- Adapter
- STB

### Packing & Order Information

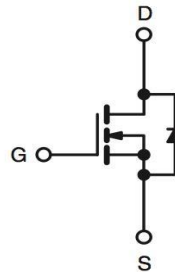
50/Tube ; 1,000/Box



**RoHS**  
COMPLIANT



### Graphic symbol



## MAXIMUM RATINGS AND ELECTRICAL CHARACTERISTICS

### Absolute Maximum Ratings

Symbol	Parameter	Value	Unit
V <sub>DSS</sub>	Drain-Source Voltage	500	V
V <sub>GS</sub>	Gate-Source Voltage	±30	V
I <sub>D</sub>	Continuous Drain Current (@ TC=25°C)	4.5	A
	Continuous Drain Current (@ TC=100°C)	2.9	A
I <sub>DM</sub>	Pulsed Drain Current	18	A
I <sub>AR</sub>	Avalanche Current	4.5	A
E <sub>AS</sub>	Single Pulsed Avalanche Energy	270	mJ
E <sub>AR</sub>	Repetitive Avalanche Energy	7.3	mJ
dv/dt	Peak Diode Recovery dv/dt	5.5	V/ns

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#### Absolute Maximum Ratings

Symbol	Parameter	Value	Unit
P <sub>D</sub>	Power Dissipation (TC=25°C)	38	W
	Power Dissipation (TC=100°C)	0.3	W/°C
T <sub>STG</sub>	Operating and Storage Temperature Range	-55 to +150	°C

#### NOTE:

1. Repetitive Rating : Pulse width limited by maximum junction temperature
2. I<sub>AS</sub>=4.5A, V<sub>DD</sub>=50V, R<sub>G</sub>=25Ω, Starting T<sub>J</sub> =25°C
3. I<sub>SD</sub>≤4.5A, di/dt≤300A/μs, V<sub>DD</sub>≤BV<sub>DSS</sub> , Starting T<sub>J</sub> =25 °C
4. Pulse Test : Pulse Width ≤ 300μs, Duty Cycle ≤ 2%
5. Essentially Independent of Operating Temperature

#### Static Characteristics

Symbol	Test Conditions	Min	Typ.	Max.	Units
V <sub>GS</sub>	V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = 250μA	2.0		4.0	V
*R <sub>DS(ON)</sub>	V <sub>GS</sub> = 10 V , I <sub>D</sub> = 2.25 A	--	1.2	1.5	mΩ
BV <sub>DSS</sub>	V <sub>GS</sub> = 0 V , I <sub>D</sub> = 250μA	500	--	--	V
ΔBV <sub>DSS</sub> /ΔT <sub>J</sub>	I <sub>D</sub> = 250μA, Referenced to 25°C		0.4		V/°C
I <sub>DSS</sub>	V <sub>DS</sub> = 500 V , V <sub>GS</sub> = 0 V	--	--	10	uA
	V <sub>DS</sub> = 400 V , V <sub>GS</sub> = 0 V , T <sub>J</sub> = 125°C			100	
I <sub>GSSF</sub>	V <sub>DS</sub> = 30 V , V <sub>GS</sub> = 0 V			100	nA
I <sub>GSSR</sub>	V <sub>DS</sub> = -30 V , V <sub>GS</sub> = 0 V	--	--	-100	nA

#### Dynamic Characteristics

Symbol	Test Conditions	Min	Typ.	Max.	Units
Q <sub>g</sub>	V <sub>DS</sub> = 400 V, I <sub>D</sub> = 4.5 A, V <sub>GS</sub> = 10 V	--	14	18	nC
Q <sub>gs</sub>		--	2.5	--	nC
Q <sub>gd</sub>		--	6	--	nC
t <sub>d(on)</sub>	V <sub>DS</sub> = 250 V, I <sub>D</sub> = 2.5 A, R <sub>G</sub> = 25 Ω	--	20	40	ns
t <sub>r</sub>		--	25	50	ns
t <sub>d(off)</sub>		--	45	90	ns
t <sub>f</sub>		--	25	50	ns
C <sub>ISS</sub>	V <sub>DS</sub> = 25 V, V <sub>GS</sub> = 0 V, f = 1.0MHz	--	550	720	pF
C <sub>OSS</sub>		--	80	105	pF
C <sub>RSS</sub>		--	10	13	pF

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### Source-Drain Diode Characteristics

Symbol	Test Conditions	Min	Typ.	Max.	Units
$I_S$		--	--	4.5	A
$I_{SM}$		--	--	18	
$V_{SD}$	$I_S = 4.5 \text{ A}, V_{GS} = 0 \text{ V}$	--	--	1.5	V
$t_{rr}$	$I_S = 4.5 \text{ A}, V_{GS} = 0 \text{ V}, dI/dt = 100 \text{ A}/\mu\text{s}$	--	250	--	ns
$Q_{rr}$		--	2.2	--	uC

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#### ■ Characteristics Curve

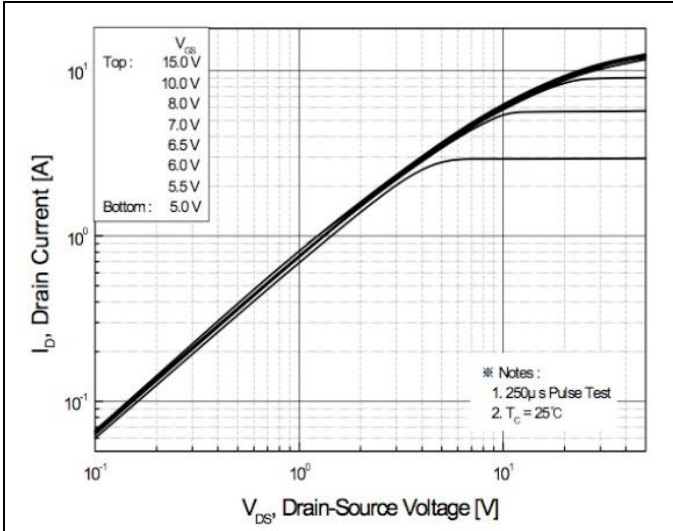


FIG.1-ON REGION CHARACTERISTICS

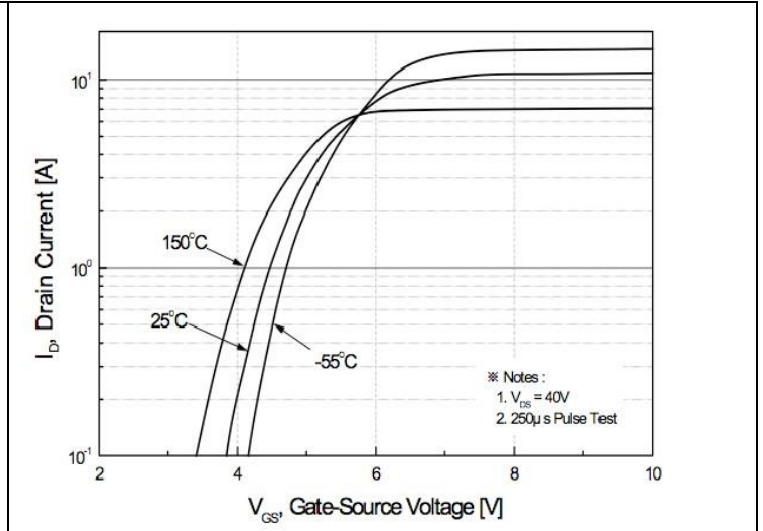


FIG.2-TRANSFER CHARACTERISTICS

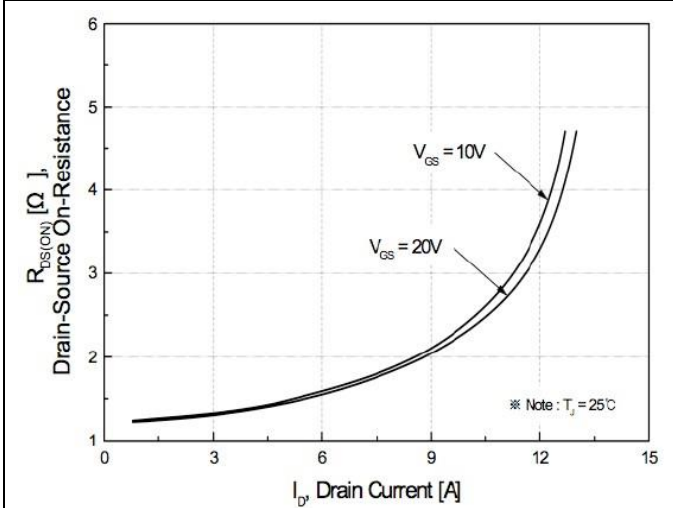


FIG.3-ON RESISTANCE VARIATION VS DRAIN CURRENT AND GATE VOLTAGE

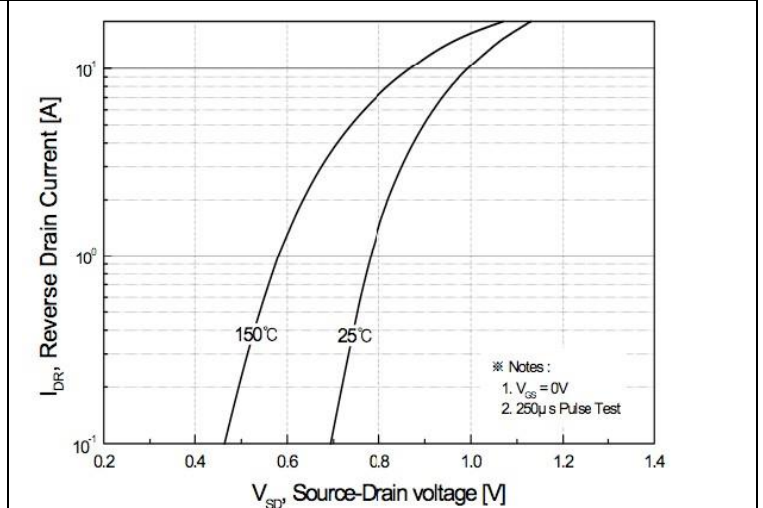


FIG.4-BODY DIODE FORWARD VOLTAGE VARIATION WITH SOURCE CURRENT AND TEMPERATURE

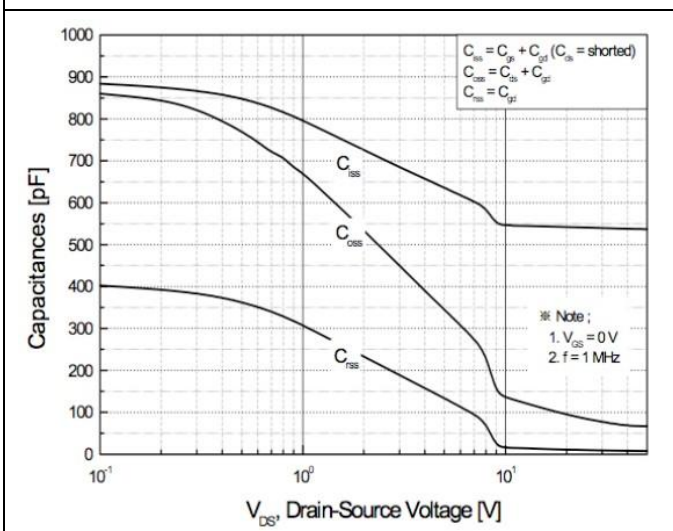


FIG.5-CAPACITANCE CHARACTERISTICS

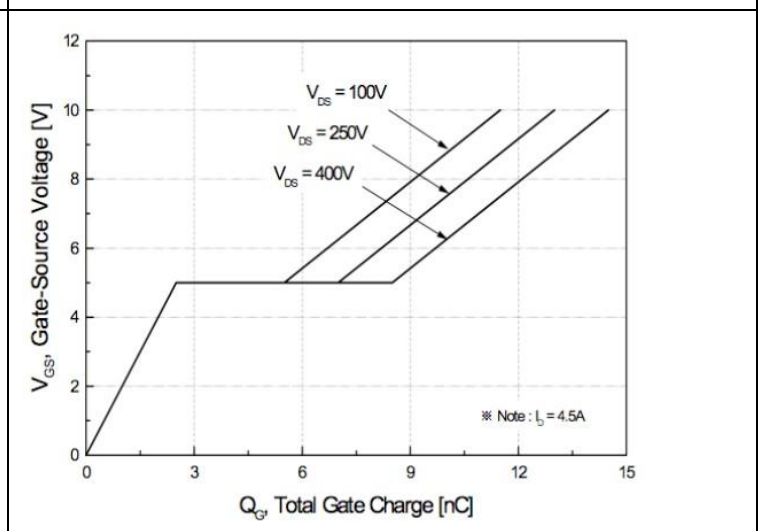
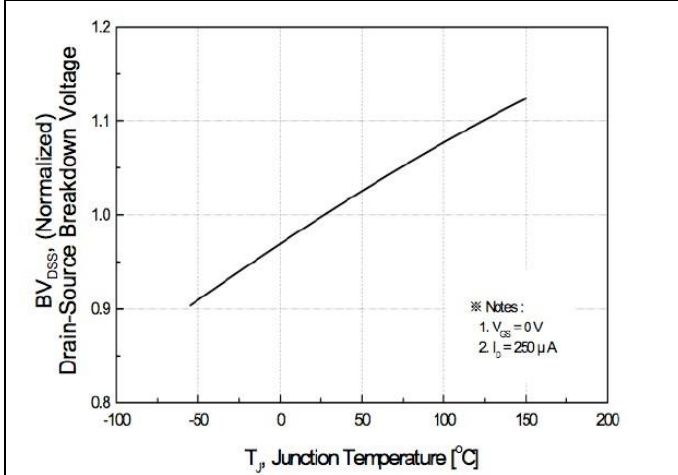


FIG.6-GATE CHARGE CHARACTERISTICS

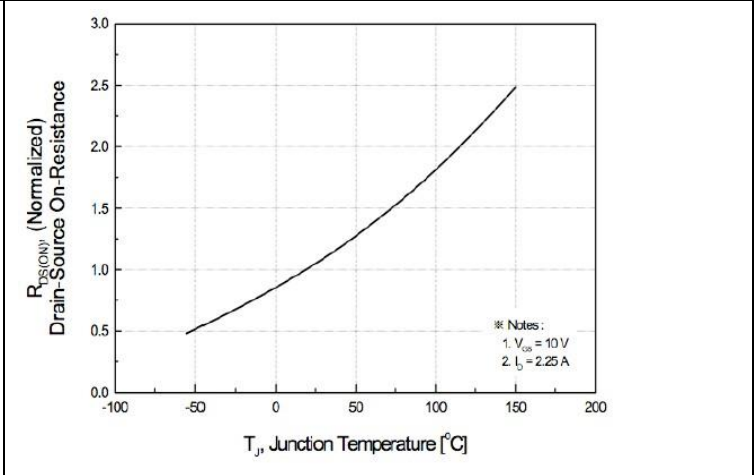
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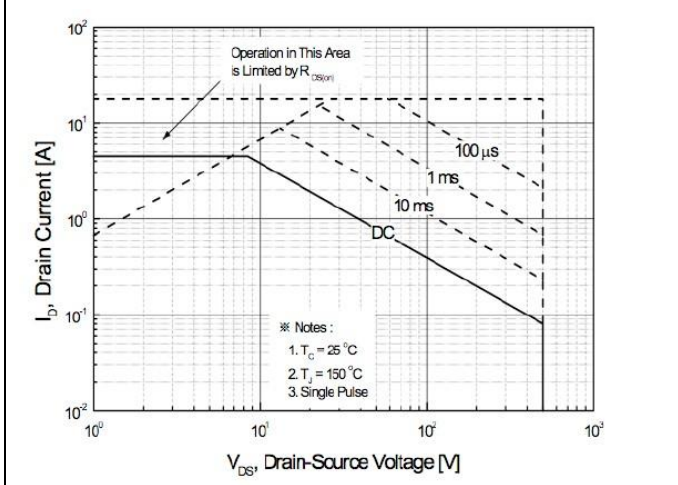
#### ■ Characteristics Curve



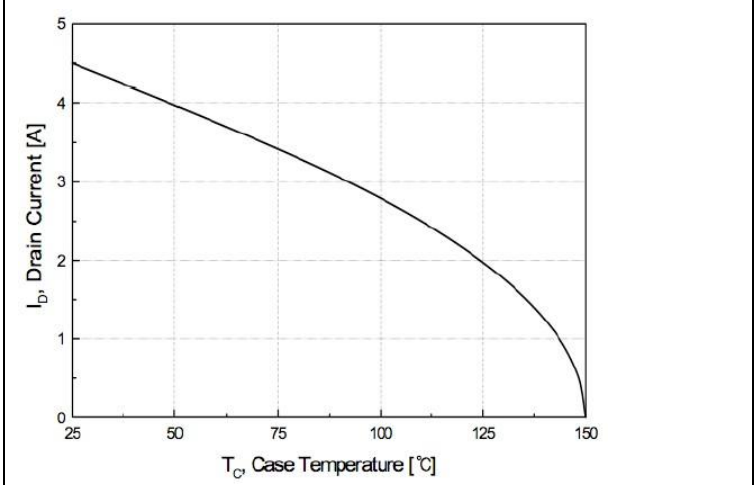
**FIG.7-BREAKDOWN VOLTAGE VARIATION VS TEMPERATURE**



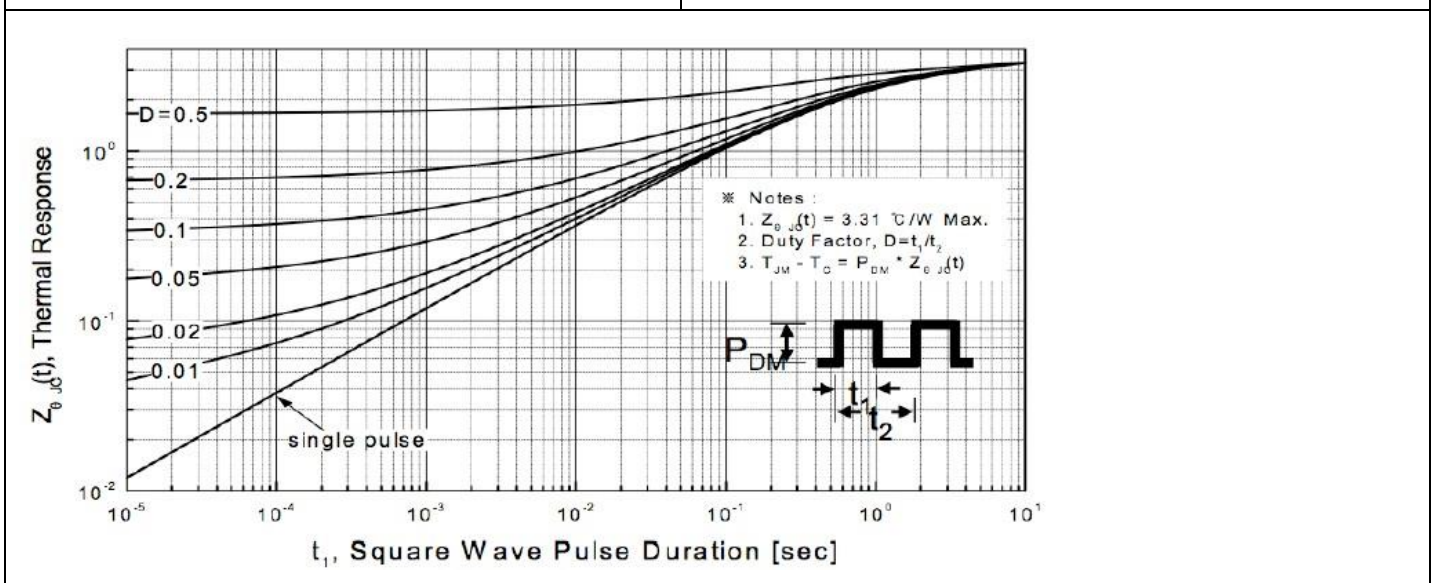
**FIG.8-ON-RESISTANCE VARIATION VS TEMPERATURE**



**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

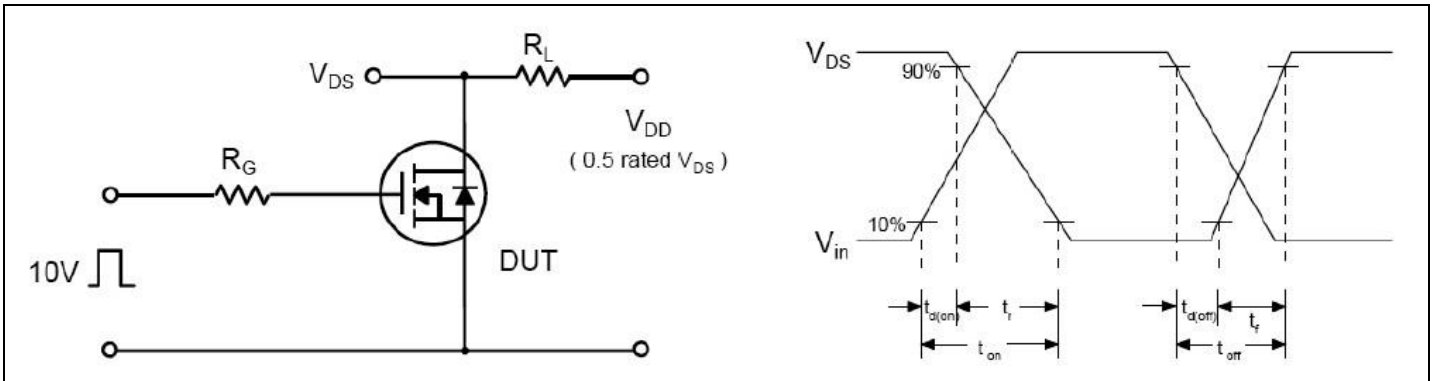


Fig 12. Resistive Switching Test Circuit & Waveforms

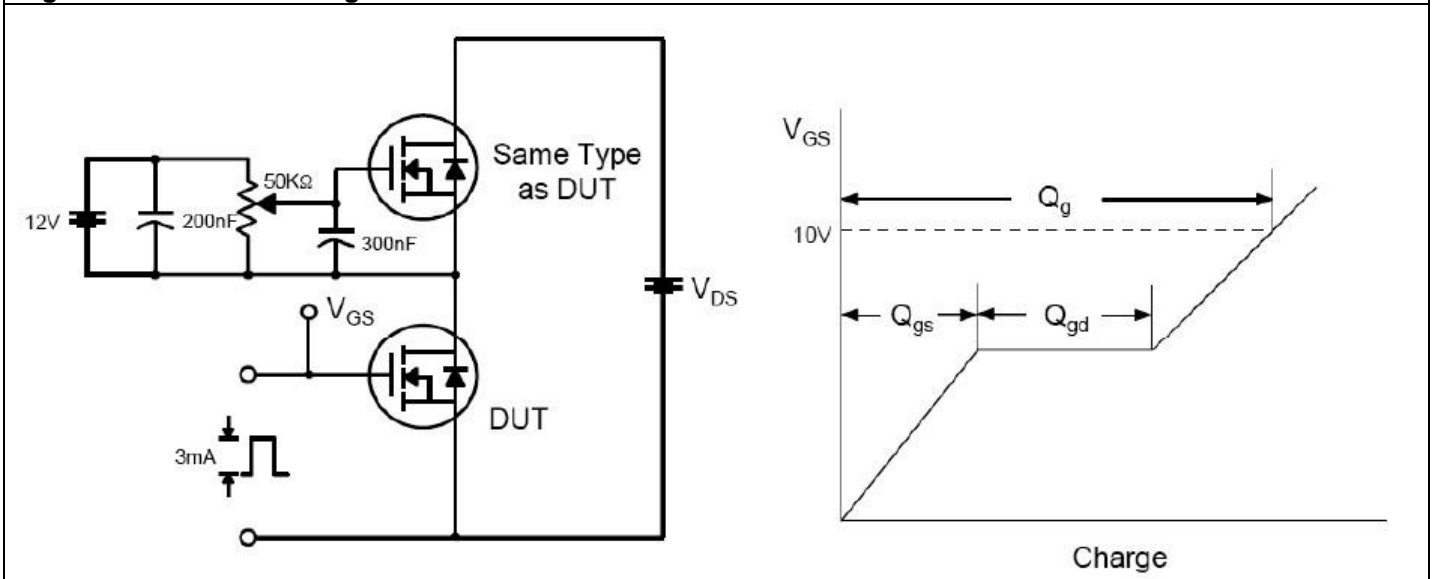


Fig 13. Gate Charge Test Circuit & Waveform

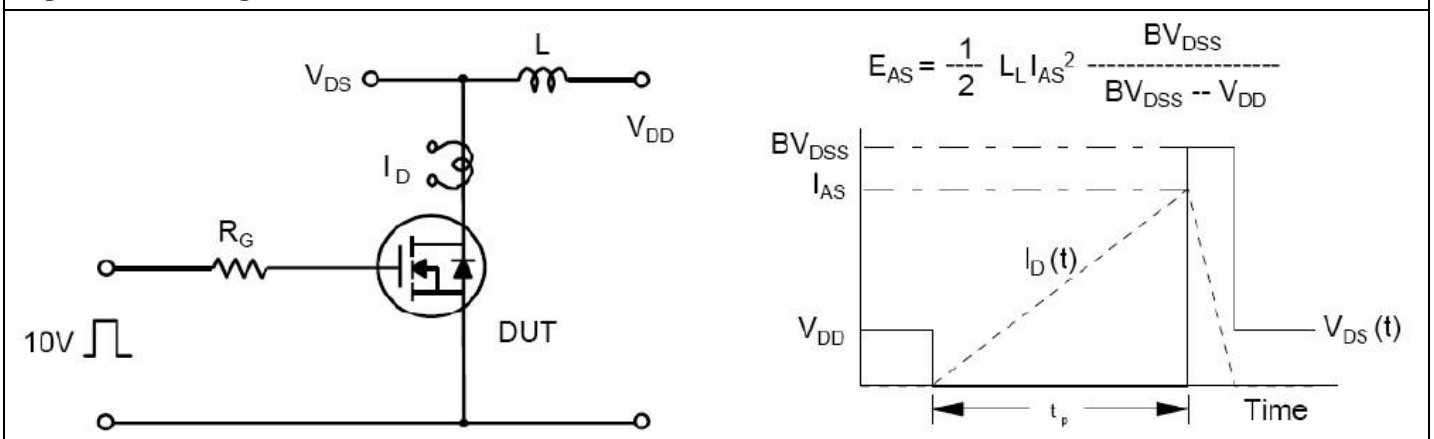


Fig 14. Unclamped Inductive Switching Test Circuit & Waveforms

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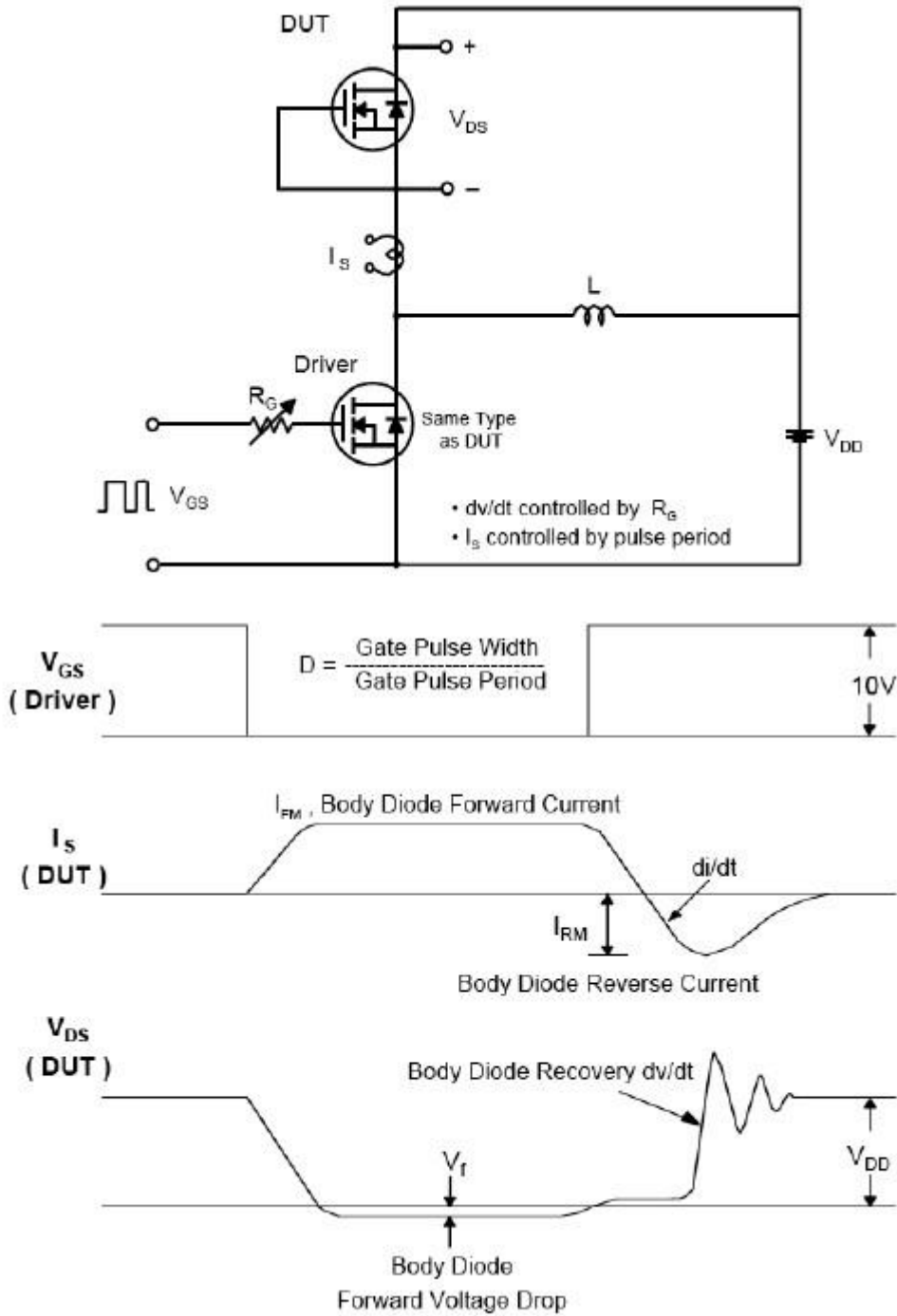


Fig 15. Peak Diode Recovery  $dv/dt$  Test Circuit & Waveforms

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