

# MSF12N65

## 650V N-Channel MOSFET

### Description

The MSF12N65 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 gate charge ( typical 52nC)
- High ruggedness
- Fast switching
- 100% avalanche tested
- Improved dv/dt capability
- RoHS compliant package

### Application

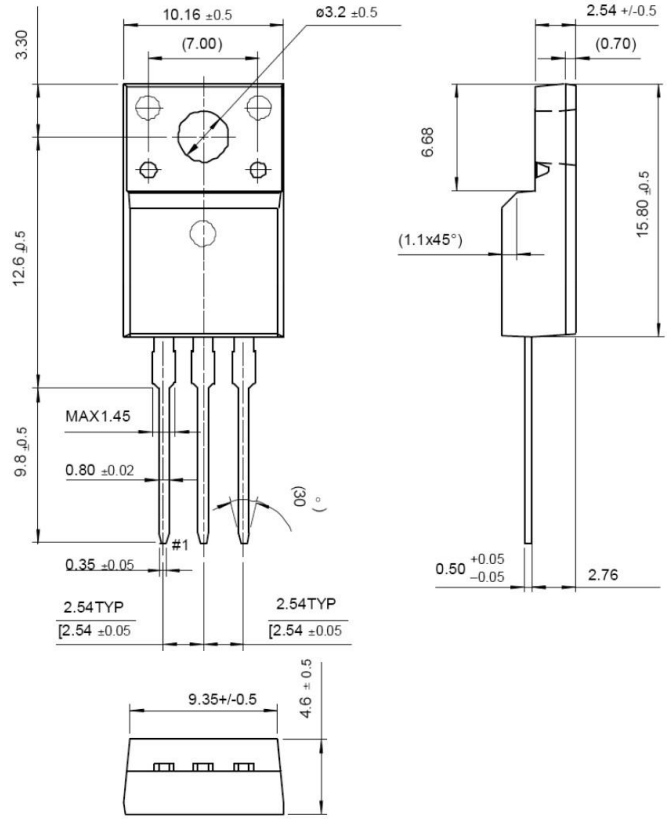
- Power Factor Correction
- LCD TV Power
- Full and Half Bridge Power

### Packing & Order Information

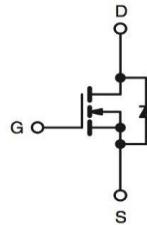
50/Tube ; 1,000/Bo



**RoHS  
COMPLIANT**



### Graphic symbol



## MAXIMUM RATINGS AND ELECTRICAL CHARACTERISTICS

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

Symbol	Parameter	Value	Unit
V <sub>DS</sub>	Drain-Source Voltage	650	V
V <sub>GS</sub>	Gate-Source Voltage	±30	V
I <sub>D</sub>	Drain Current -Continuous (TC=25°C)	12	A
	Drain Current -Continuous (TC=100°C)	7.4	A
I <sub>DM</sub>	Drain Current Pulsed	48	A
E <sub>AS</sub>	Single Pulsed Avalanche Energy	865	mJ
E <sub>AR</sub>	Repetitive Avalanche Energy	23.1	mJ
dV/dt	Peak Diode Recovery dV/dt	4.5	V/ns
P <sub>D</sub>	Power Dissipation (TC = 25 °C)	54	W
	Power Dissipation (TC=100°C)	0.43	W/°C

- Drain current limited by maximum junction temperature

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

Symbol	Parameter	Value	Unit
T <sub>J</sub> , T <sub>STG</sub>	Operating and Storage Temperature Range	-55 to +150	°C

NOTE:

1. Repetitive rating; pulse width limited by maximum junction temperature.

### On Characteristics

Symbol	Parameter	Test Conditions	Min	Typ.	Max.	Units
V <sub>GS</sub>	Gate Threshold Voltage	V <sub>DS</sub> =V <sub>GS</sub> , I <sub>D</sub> =250μA	3.0	--	5.0	V
R <sub>DS(ON)</sub>	Static Drain-Source On-Resistance	V <sub>GS</sub> =10V, I <sub>D</sub> =3A	--	1.95	2.4	Ω

### Off Characteristics

Symbol	Parameter	Test Conditions	Min	Typ.	Max.	Units
V <sub>GS</sub>	Gate Threshold Voltage	V <sub>DS</sub> =V <sub>GS</sub> , I <sub>D</sub> =250μA	2.0	--	4.0	V
R <sub>DS(ON)</sub>	Static Drain-Source On-Resistance	V <sub>GS</sub> =10V, I <sub>D</sub> =3A	--	0.58	0.65	Ω
BV <sub>DSS</sub>	Drain-Source Breakdown Voltage	V <sub>GS</sub> =0 V , I <sub>D</sub> =250μA	600	--	--	V
ΔBV <sub>DSS</sub> /ΔT <sub>J</sub>	Breakdown Voltage Temperature Coefficient	I <sub>D</sub> =250μA, Referenced to 25°C	--	0.5	--	V/°C
I <sub>DSS</sub>	Zero Gate Voltage Drain Current	V <sub>DS</sub> =600V , V <sub>GS</sub> = 0 V V <sub>DS</sub> =480V , T <sub>C</sub> = 125°C	--	--	1 10	μA
I <sub>GSSF</sub>	Gate-Body Leakage Current, Forward	V <sub>GS</sub> =30V , V <sub>DS</sub> =0 V	--	--	100	nA
I <sub>GSSR</sub>	Gate-Body Leakage Current, Reverse	V <sub>GS</sub> =-30V , V <sub>DS</sub> =0 V	--	--	-100	nA

### Dynamic Characteristics

Symbol	Parameter	Test Conditions	Min	Typ.	Max.	Units
C <sub>ISS</sub>	Input Capacitance	V <sub>DS</sub> =25V, V <sub>GS</sub> =0V, f=1.0MHz	--	1760	2290	pF
C <sub>OSS</sub>	Output Capacitance		--	182	235	pF
C <sub>RSS</sub>	Reverse Transfer Capacitance		--	21	28	pF

### Dynamic Characteristics

Symbol	Parameter	Test Conditions	Min	Typ.	Max.	Units
t <sub>d(on)</sub>	Turn-On Time	V <sub>DS</sub> =250 V, I <sub>D</sub> =12A, R <sub>G</sub> =10Ω	--	30	70	ns
t <sub>r</sub>	Turn-On Time		--	85	180	ns
t <sub>d(off)</sub>	Turn-Off Delay Time		--	140	280	ns
t <sub>f</sub>	Turn-Off Fall Time		--	90	190	ns
Q <sub>g</sub>	Total Gate Charge	V <sub>DS</sub> =480V, I <sub>D</sub> =12A, V <sub>GS</sub> =10 V	--	48	63	nC
Q <sub>gs</sub>	Gate-Source Charge		--	8.5	--	nC
Q <sub>gd</sub>	Gate-Drain Charge		--	21	--	nC

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### Source-Drain Diode Maximum Ratings and Characteristics

Symbol	Parameter	Test Conditions	Min	Typ.	Max.	Units
$I_S$	Continuous Source-Drain Diode Forward Current		--	--	12	A
$I_{SM}$	ISM Pulsed Source-Drain Diode Forward Current		--	--	48	
$V_{SD}$	Source-Drain Diode Forward Voltage	$I_S=12A, V_{GS}=0V$	--	--	1.5	V
$t_{rr}$	Reverse Recovery Time	$I_S=12A, V_{GS}=0V$ $diF/dt=100A/\mu s$	--	460	--	ns
$Q_{rr}$	Reverse Recovery Charge		--	4.9	--	$\mu C$

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#### ■ Characteristics Curve

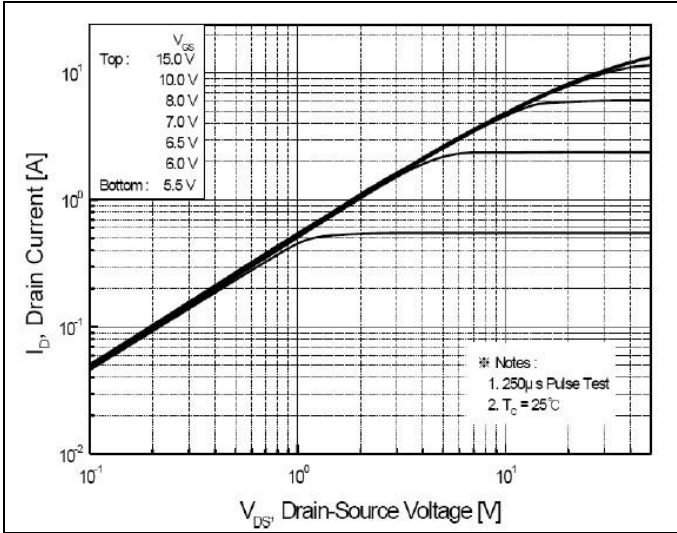


FIG.1-ON REGION CHARACTERISTICS

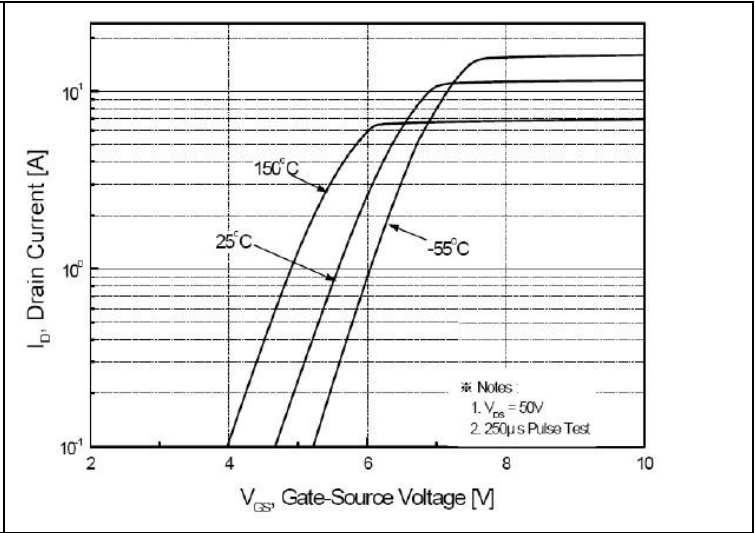


FIG.2-TRANSFER CHARACTERISTICS

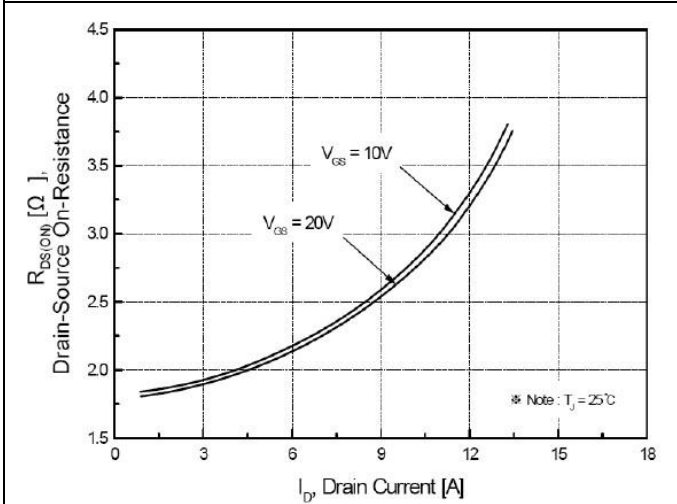


FIG.3-ON RESISTANCE VARIATION VS DRAIN CURRENT AND GATE VOLTAGE

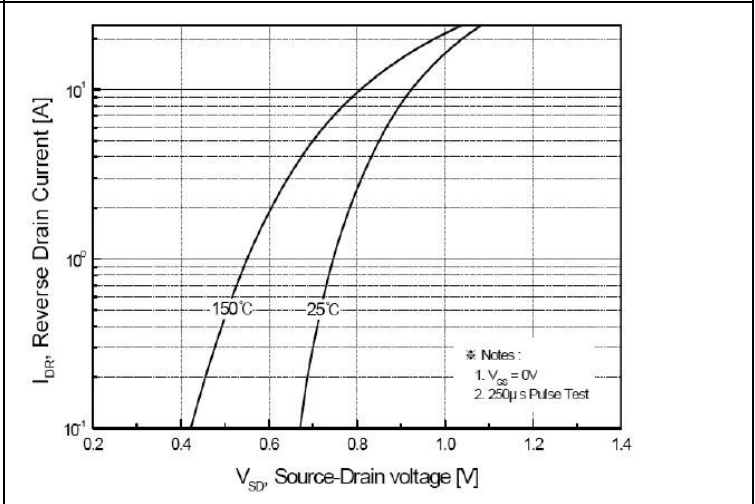


FIG.4-BODY DIODE FORWARD VOLTAGE VARIATION WITH SOURCE CURRENT AND TEMPERATURE

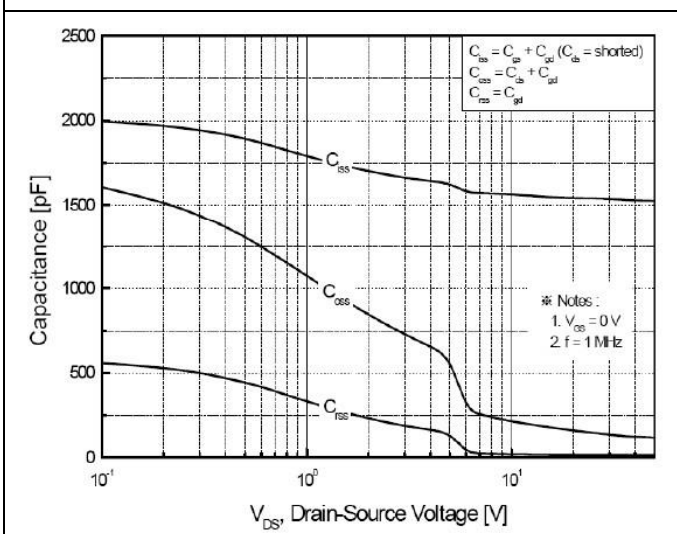


FIG.5-CAPACITANCE CHARACTERISTICS

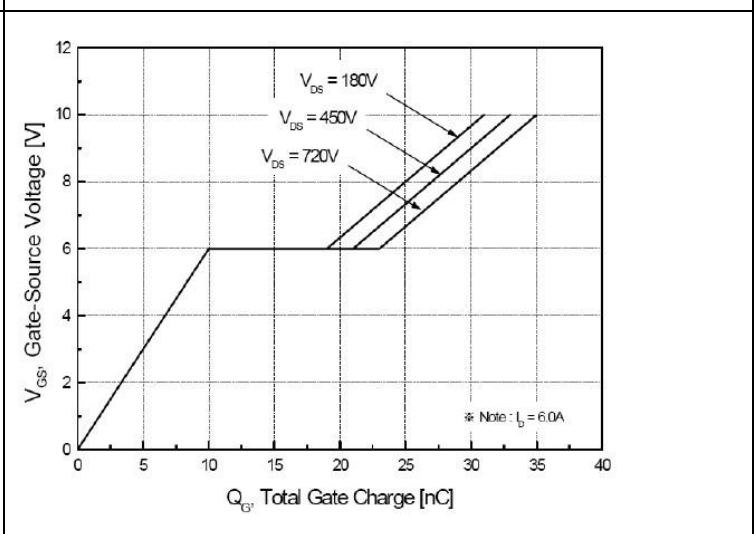
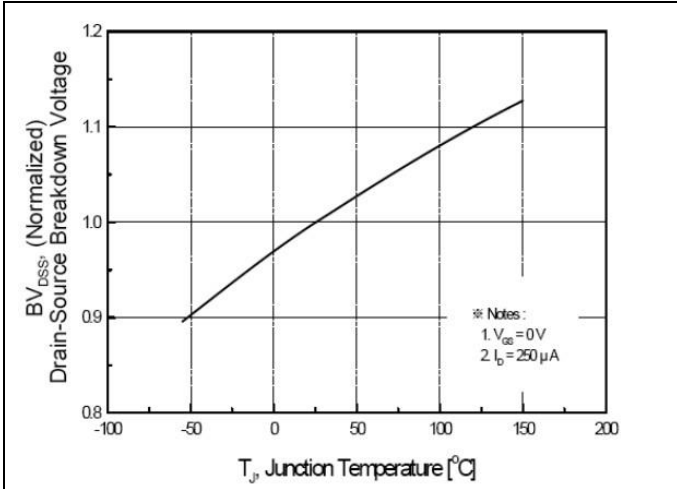


FIG.6-GATE CHARGE CHARACTERISTICS

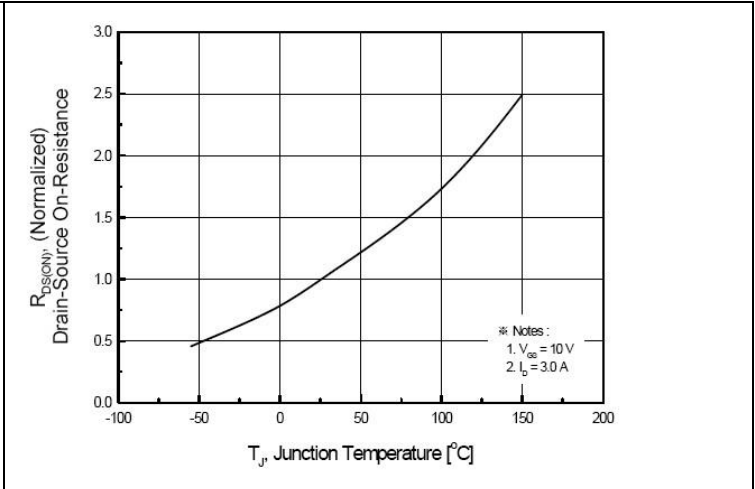
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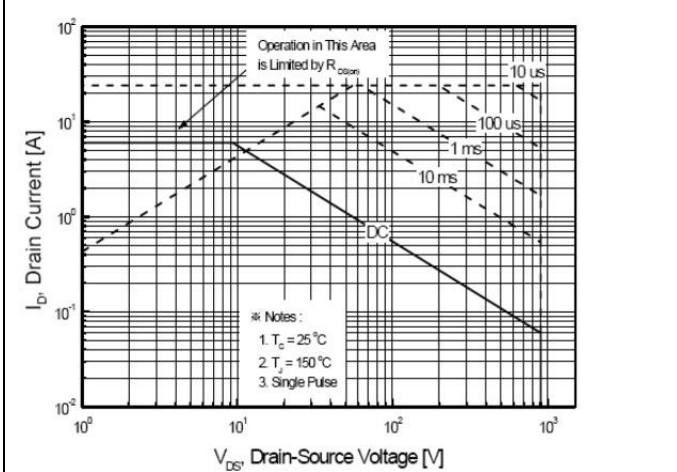
#### ■ Characteristics Curve



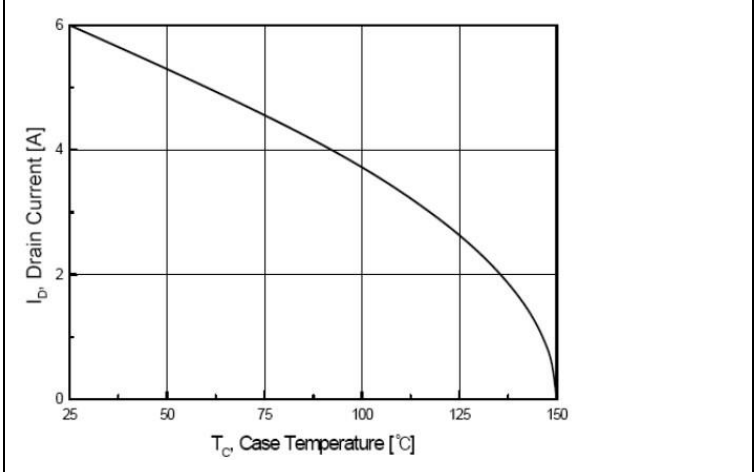
**FIG.7-BREAKDOWN VOLTAGE VARIATION VS TEMPERATURE**



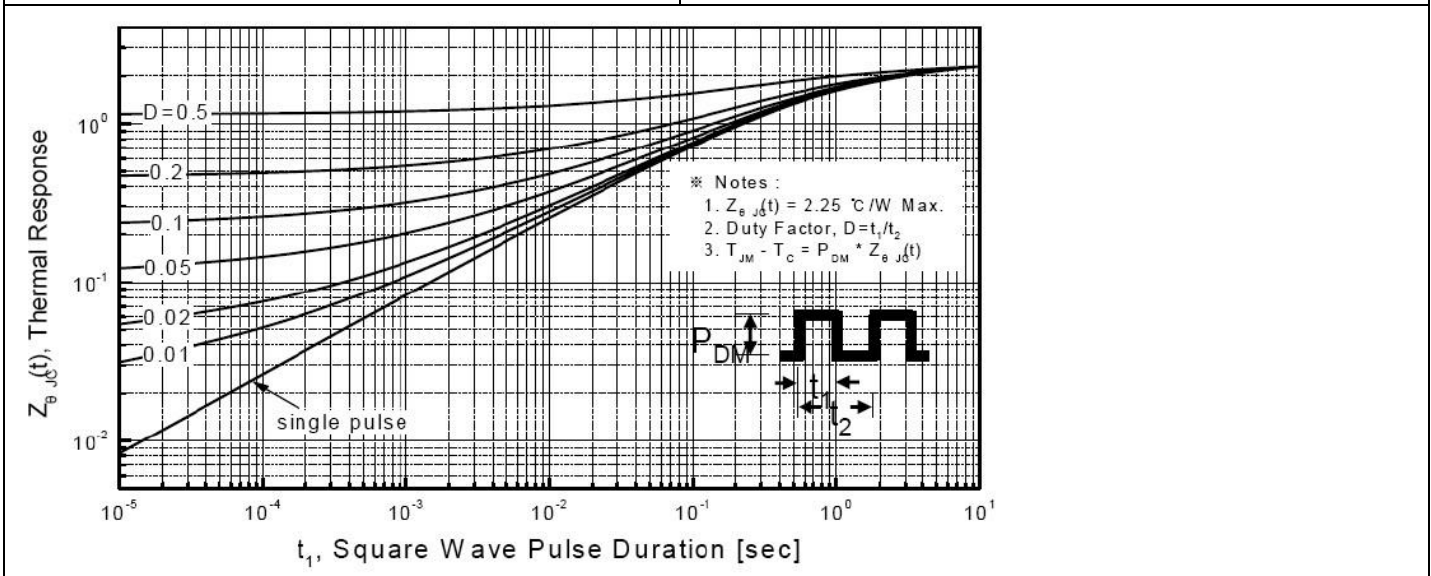
**FIG.8-ON-RESISTANCE VARIATION VS TEMPERATURE**



**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

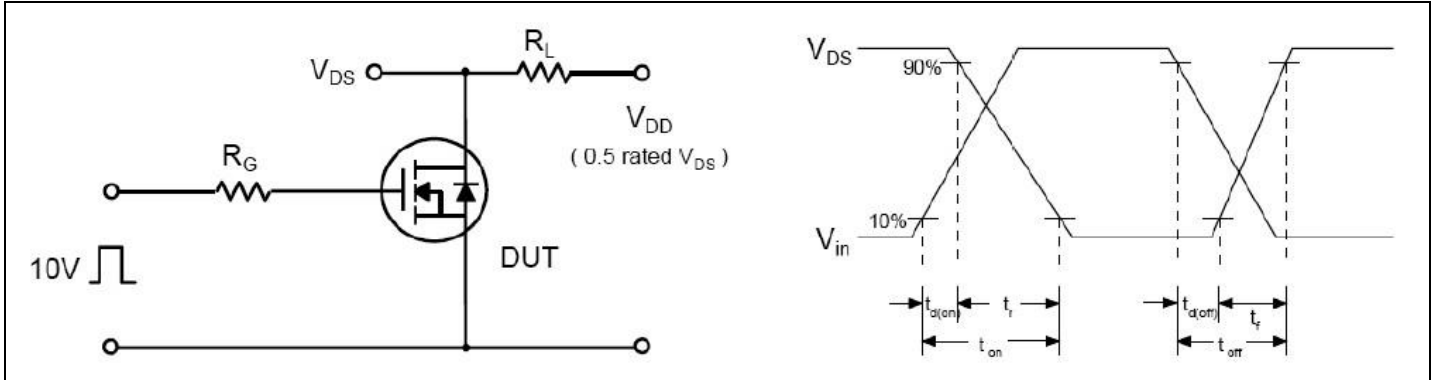


Fig 12. Resistive Switching Test Circuit & Waveforms

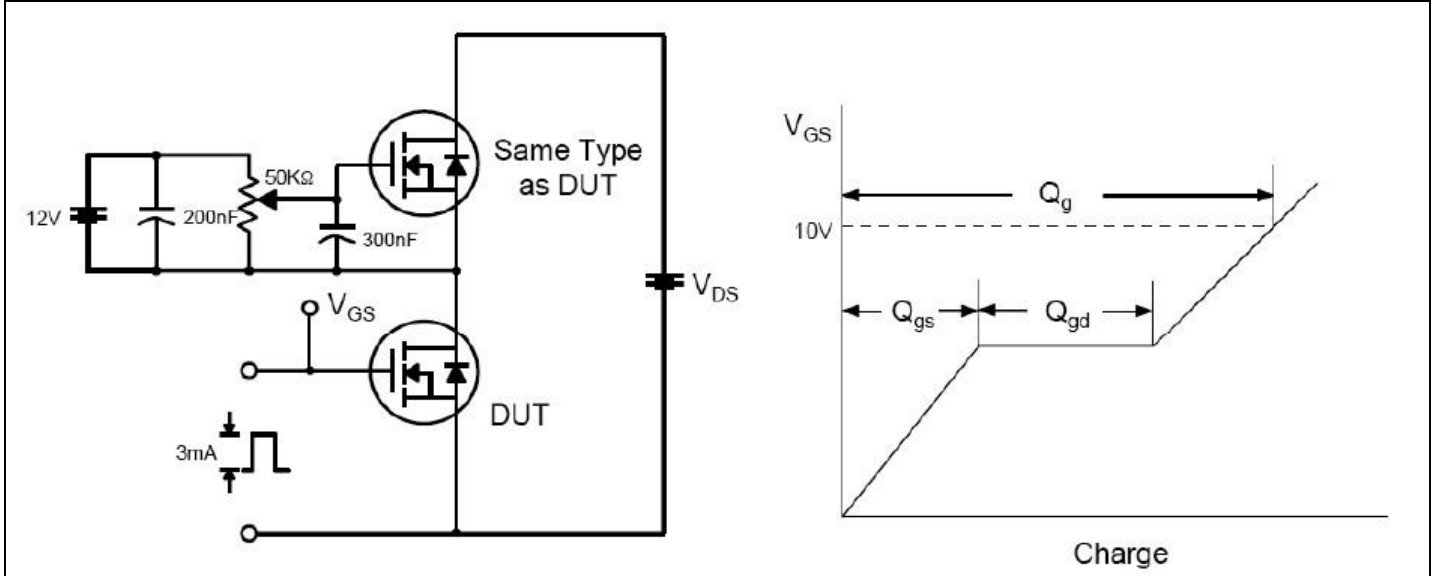


Fig 13. Gate Charge Test Circuit & Waveform

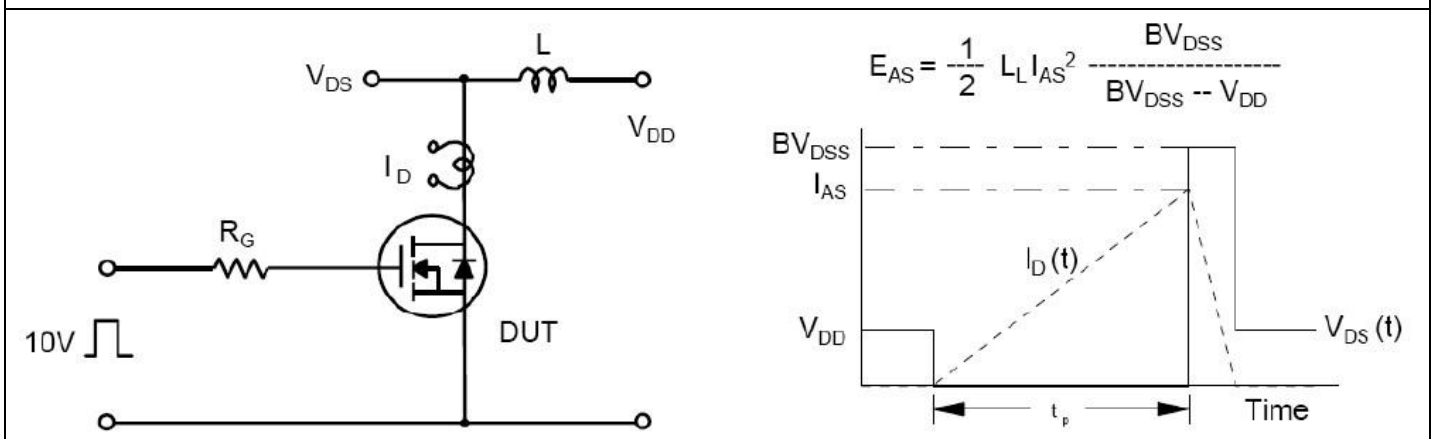


Fig 14. Unclamped Inductive Switching Test Circuit & Waveforms

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#### Disclaimer

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