

# MSF10N60

## 600V N-Channel MOSFET

### Description

The MSF10N60 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 package

### Application

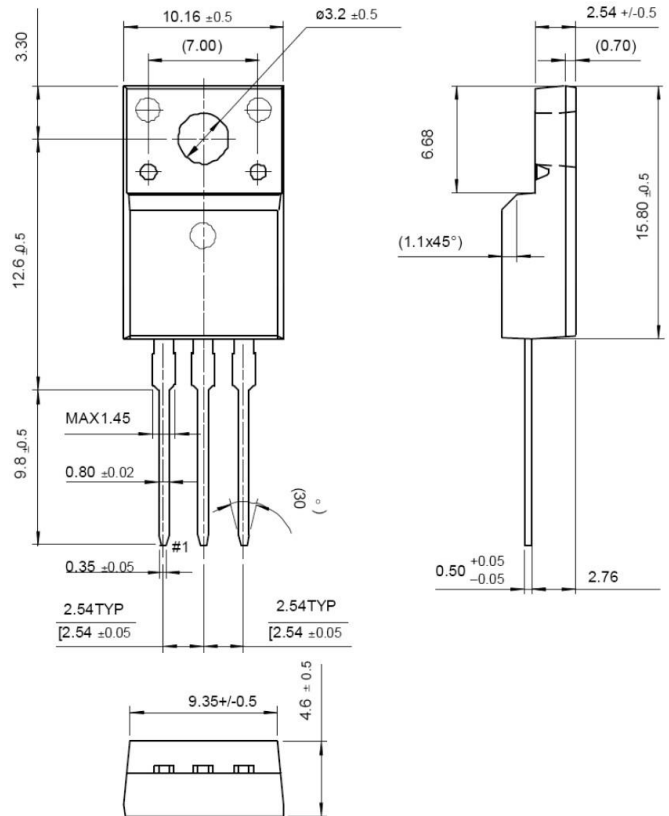
- Power Factor Correction
- LCD TV Power
- Full and Half Bridge Power

### Packing & Order Information

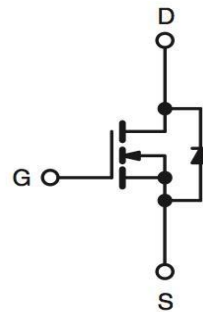
50/Tube ; 1,000/Box



**RoHS  
COMPLIANT**



### Graphic symbol



## MAXIMUM RATINGS AND ELECTRICAL CHARACTERISTICS

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

Symbol	Parameter	Value	Unit
V <sub>DS</sub>	Drain-Source Voltage	600	V
V <sub>GS</sub>	Gate-Source Voltage	±30	V
I <sub>D</sub>	Drain Current -Continuous (TC=25°C)	9.5	A
	Drain Current -Continuous (TC=100°C)	5.7	A
I <sub>DM</sub>	Drain Current Pulsed	38	A
E <sub>AS</sub>	Single Pulsed Avalanche Energy	700	mJ
I <sub>AR</sub>	Avalanche Current	9.5	A
E <sub>AR</sub>	Repetitive Avalanche Energy	15.6	mJ
dV/dt	Peak Diode Recovery dV/dt	4.5	V/ns

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

Symbol	Parameter	Value	Unit
P <sub>D</sub>	Power Dissipation (TC = 25 °C)	50	W
	Power Dissipation (TC=100°C)	0.38	W/°C
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
2. I<sub>AS</sub>=9.5A, V<sub>DD</sub>=50V, R<sub>G</sub>=25Ω, Starting T<sub>J</sub> =25°C
3. I<sub>SD</sub>≤9.5A, di/dt≤300A/μs, V<sub>DD</sub>≤B<sub>V</sub>D<sub>SS</sub>, Starting T<sub>J</sub> =25 °C
4. Pulse test : Pulse Width ≤ 300μs, Duty Cycle ≤ 2%
5. Essentially Independent of Operating temperature

### Thermal characteristics (Tc=25°C unless otherwise noted)

Symbol	Parameter	Max.	Units
R <sub>θJC</sub>	Junction-to-Case	2.25	°C/W
R <sub>θJA</sub>	Junction-to-Ambient	62.5	

### 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
B <sub>V</sub> D <sub>SS</sub>	Drain-Source Breakdown Voltage	V <sub>GS</sub> =0 V , I <sub>D</sub> =250μA	900	--	--	V
ΔB <sub>V</sub> D <sub>SS</sub> /ΔT <sub>J</sub>	Breakdown Voltage Temperature Coefficient	I <sub>D</sub> =250μA, Referenced to 25°C	--	1.03	--	V/°C
I <sub>DSS</sub>	Zero Gate Voltage Drain Current	V <sub>DS</sub> =900V , V <sub>GS</sub> = 0 V V <sub>DS</sub> =720V , T <sub>C</sub> = 125°C	--	--	10 100	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	--	1500	2010	pF
C <sub>OSS</sub>	Output Capacitance		--	145	190	pF
C <sub>RSS</sub>	Reverse Transfer Capacitance		--	15	20	pF

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Dynamic Characteristics						
Symbol	Parameter	Test Conditions	Min	Typ.	Max.	Units
$t_{d(on)}$	Turn-On Time	$V_{DS}=450\text{ V}, I_D=6\text{ A},$ $R_G=25\Omega$	--	40	80	ns
$t_r$	Turn-On Time		--	120	240	ns
$t_{d(off)}$	Turn-Off Delay Time		--	60	120	ns
$t_f$	Turn-Off Fall Time		--	70	140	ns
$Q_g$	Total Gate Charge	$V_{DS}=720\text{ V}, I_D=6\text{ A},$ $V_{GS}=10\text{ V}$	--	33	45	nC
$Q_{gs}$	Gate-Source Charge		--	10	--	nC
$Q_{gd}$	Gate-Drain Charge		--	13	--	nC

Source-Drain Diode Maximum Ratings and Characteristics						
Symbol	Parameter	Test Conditions	Min	Typ.	Max.	Units
$I_S$	Continuous Source-Drain Diode Forward Current		--	--	6.0	A
$I_{SM}$	ISM Pulsed Source-Drain Diode Forward Current		--	--	24.0	
$V_{SD}$	Source-Drain Diode Forward Voltage	$I_S=6\text{ A}, V_{GS}=0\text{ V}$	--	--	1.4	V
$t_{rr}$	Reverse Recovery Time	$I_S=6\text{ A}, V_{GS}=0\text{ V}$ $diF/dt=100\text{ A}/\mu\text{s}$	--	780	--	ns
$Q_{rr}$	Reverse Recovery Charge		--	9.0	--	$\mu\text{C}$

#### Notes;

1. Repetitive Rating: Pulse width limited by maximum junction temperature
2.  $L=34\text{ mH}, I_{AS}=6\text{ A}, V_{DD}=50\text{ V}, R_G=25\Omega$ , Starting  $T_J=25^\circ\text{C}$
3.  $I_{SD}\leq 6\text{ A}, di/dt\leq 200\text{ A}/\mu\text{s}, V_{DD}\leq BV_{DSS}$ , Starting  $T_J=25^\circ\text{C}$
4. Pulse Test: Pulse Width  $\leq 300\mu\text{s}$ , Duty Cycle  $\leq 2\%$
5. Essentially Independent of Operating Temperature

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### 600V N-Channel MOSFET

#### Characteristics Curve

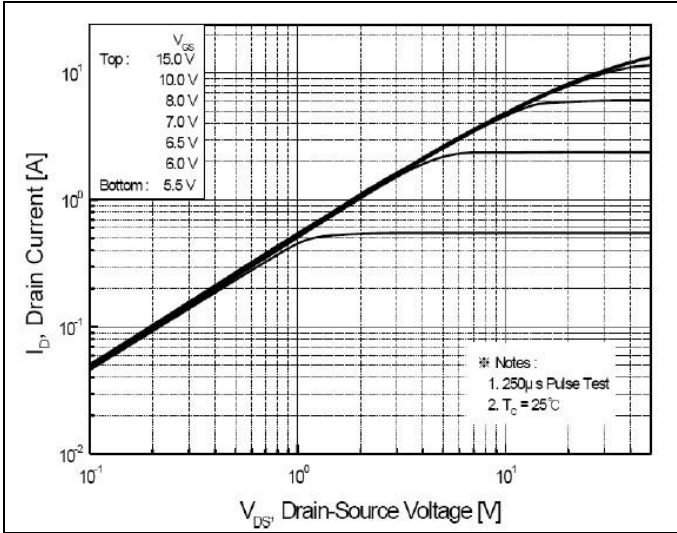


FIG.1-ON REGION CHARACTERISTICS

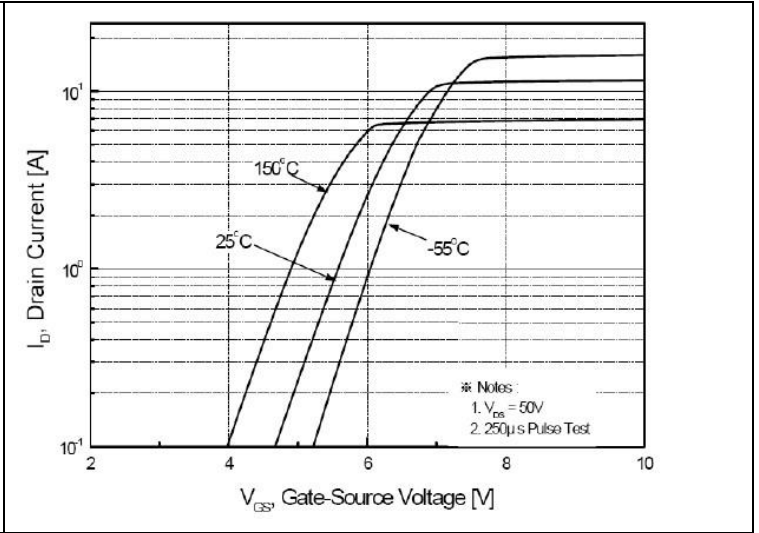


FIG.2-TRANSFER CHARACTERISTICS

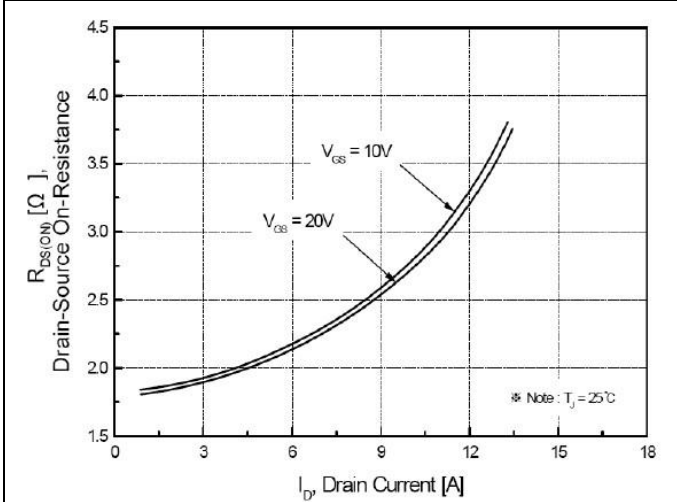


FIG.3-ON RESISTANCE VARIATION VS DRAIN CURRENT AND GATE VOLTAGE

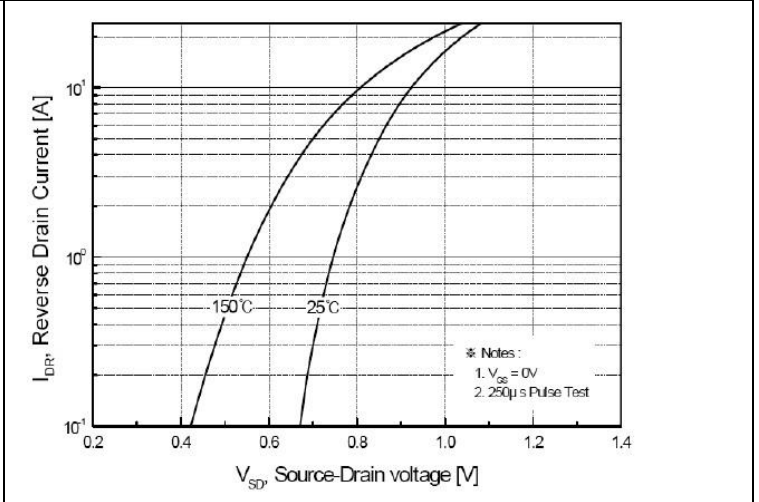


FIG.4-BODY DIODE FORWARD VOLTAGE VARIATION WITH SOURCE CURRENT AND TEMPERATURE

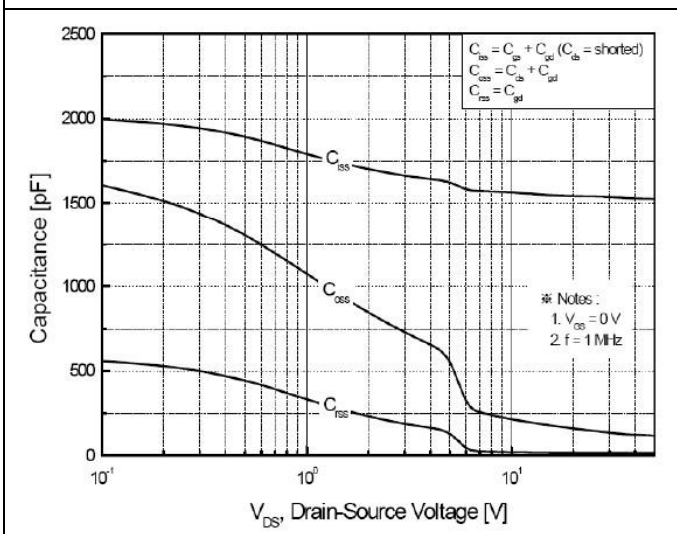


FIG.5-CAPACITANCE CHARACTERISTICS

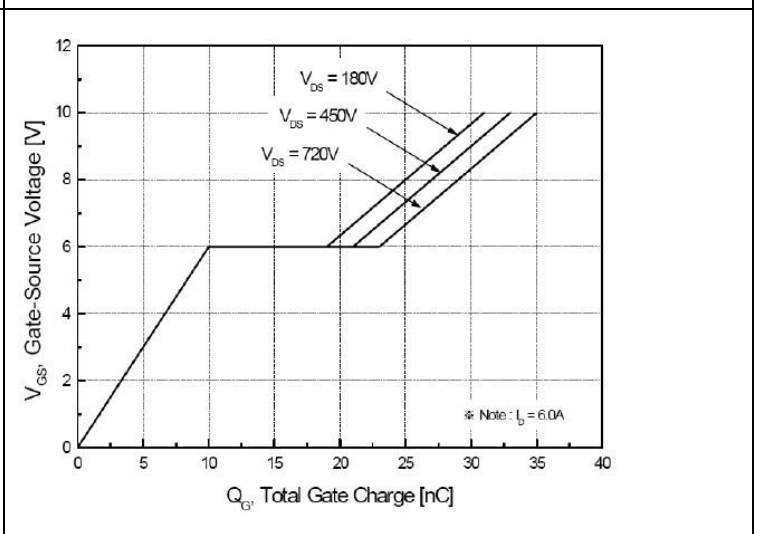
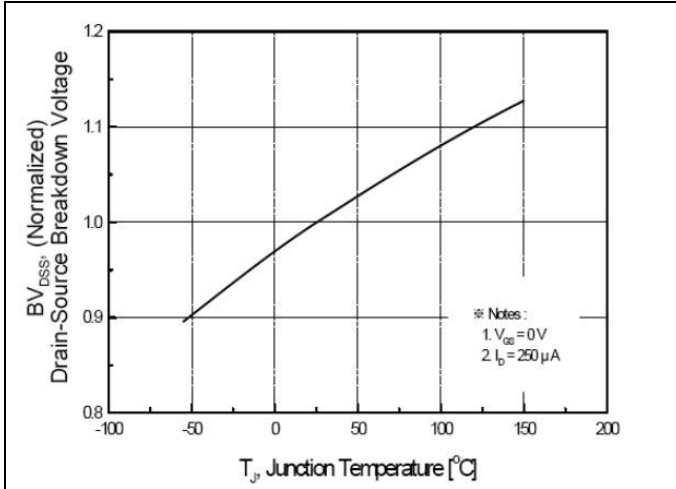


FIG.6-GATE CHARGE CHARACTERISTICS

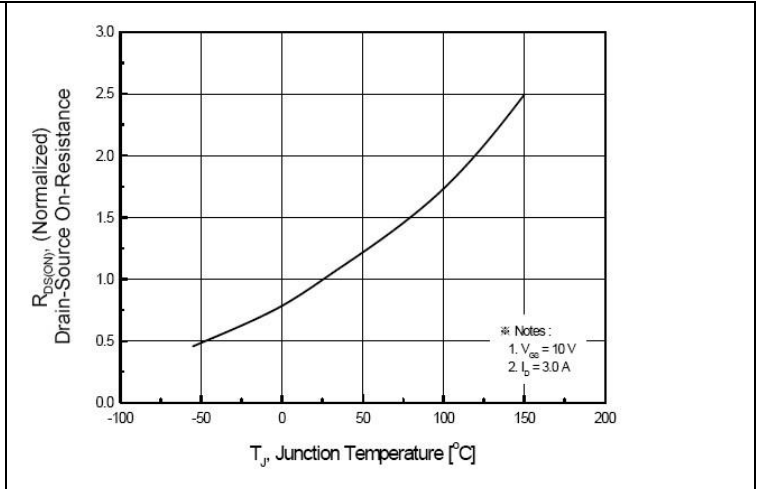
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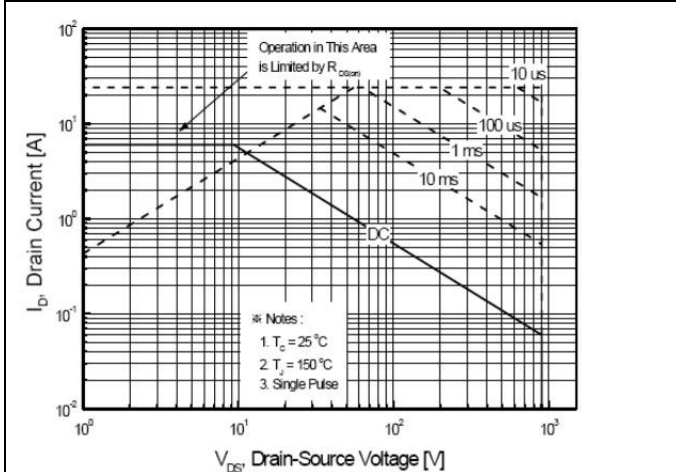
#### ■ Characteristics Curve



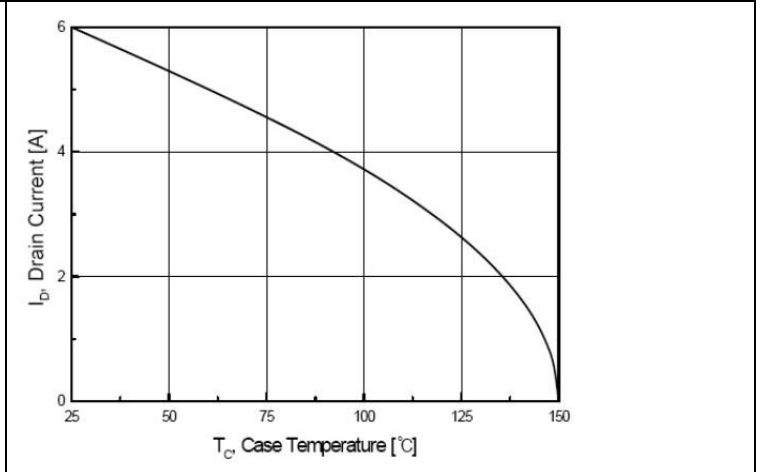
**FIG.7-BREAKDOWN VOLTAGE VARIATION VS TEMPERATURE**



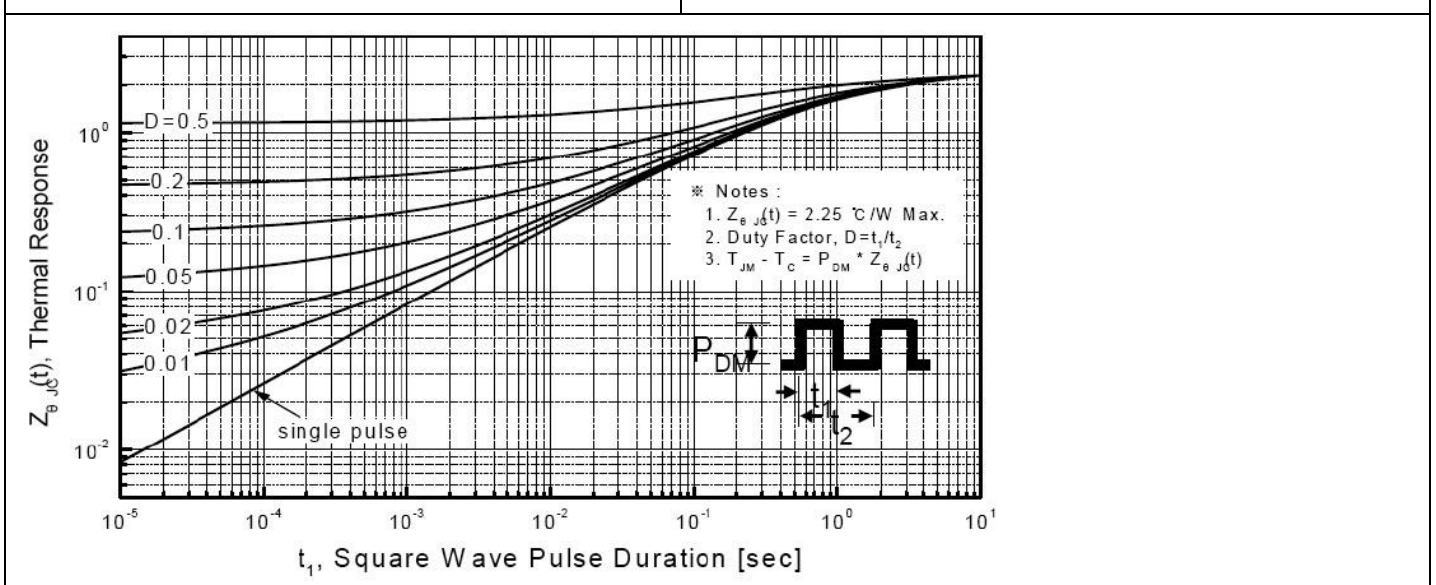
**FIG.8-ON-RESISTANCE VARIATION VS TEMPERATURE**



**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

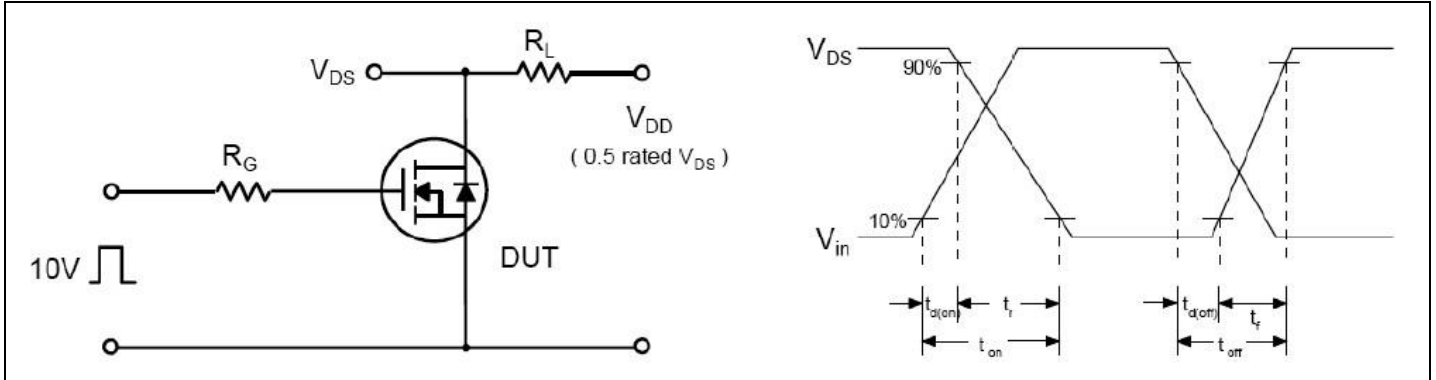


Fig 12. Resistive Switching Test Circuit & Waveforms

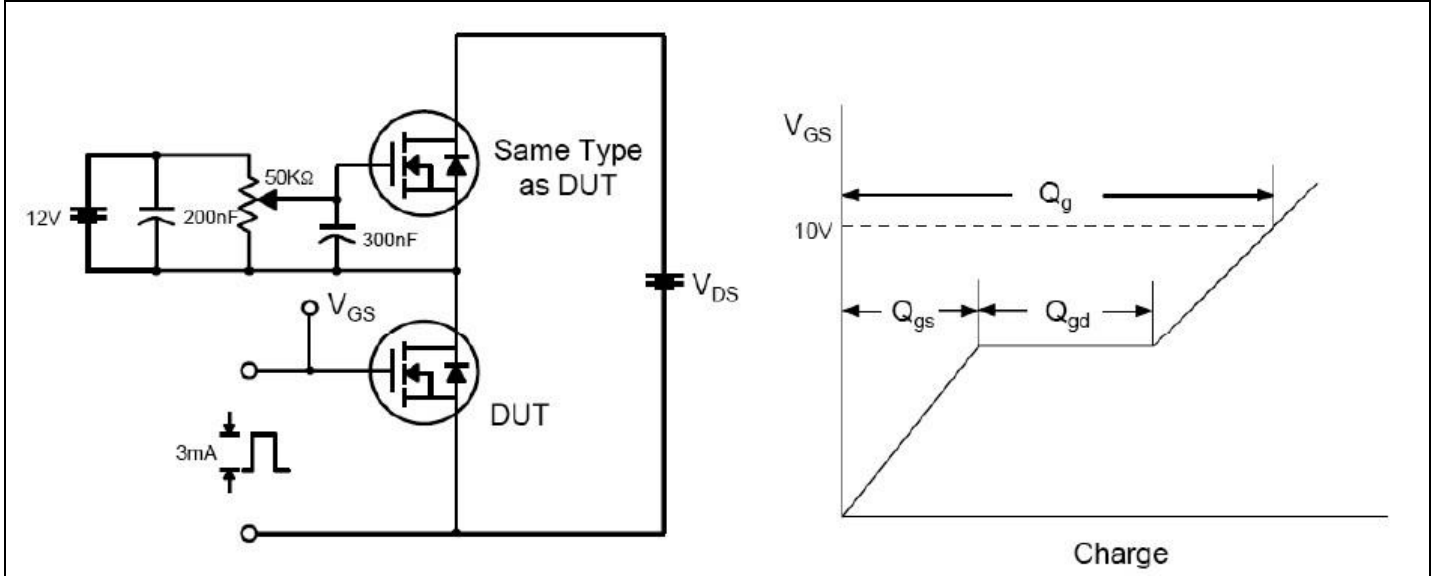


Fig 13. Gate Charge Test Circuit & Waveform

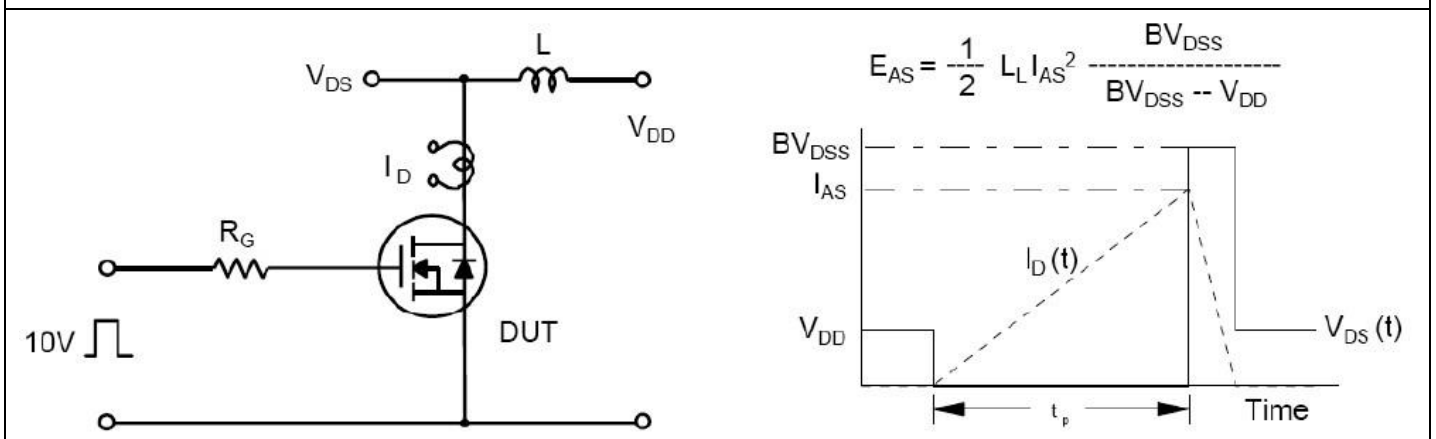


Fig 14. Unclamped Inductive Switching Test Circuit & Waveforms

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