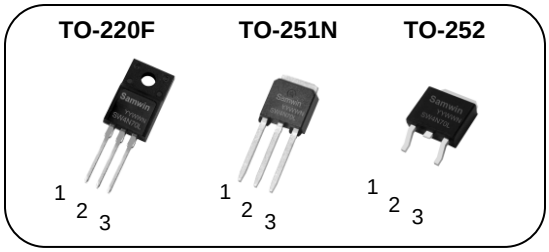
N-channel Enhanced mode TO-220F/TO-251N/TO-252 MOSFET

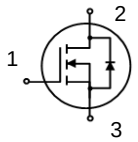
Features

- High ruggedness
- Low $R_{DS(ON)}$ (Typ 0.8Ω)@V_{GS}=10V
- Low Gate Charge (Typ 18nC)
- Improved dv/dt Capability
- 100% Avalanche Tested
- Application: LED,Charge, Adaptor



1. Gate 2. Drain 3. Source

BV_{DSS} : 700V
I_D : 4A
$R_{DS(ON)}$: 0.8Ω



General Description

This power MOSFET is produced with advanced super junction technology of SAMWIN. This technology enable the power MOSFET to have better characteristics, including fast switching time, low on resistance, low gate charge and especially excellent avalanche characteristics.

Order Codes

Item	Sales Type	Marking	Package	Packaging
1	SW F 4N70L	SW4N70L	TO-220F	TUBE
2	SW N 4N70L	SW4N70L	TO-251N	TUBE
3	SW D 4N70L	SW4N70L	TO-252	REEL

Absolute maximum ratings

Symbol	Parameter	Value			Unit
		TO-220F	TO-251N	TO-252	
V_{DSS}	Drain to source voltage	700			V
I_D	Continuous drain current (@T_C=25°C)	4*			A
	Continuous drain current (@T_C=100°C)	2.5*			A
I_{DM}	Drain current pulsed (note 1)	16			A
V_{GS}	Gate to source voltage	±30			V
E_{AS}	Single pulsed avalanche energy (note 2)	202			mJ
E_{AR}	Repetitive avalanche energy (note 1)	20			mJ
dv/dt	MOSFET dv/dt ruggedness (@VDS=0~400V)	30			V/ns
dv/dt	Peak diode recovery dv/dt (note 3)	20			V/ns
P_D	Total power dissipation (@T_C=25°C)	20	125	114	W
	Derating factor above 25°C	0.16	1.0	0.9	W/°C
T_{STG}, T_J	Operating junction temperature & storage temperature	-55 ~ + 150			°C
T_L	Maximum lead temperature for soldering purpose, 1/8 from case for 5 seconds.	300			°C

*. Drain current is limited by junction temperature.

Thermal characteristics

Symbol	Parameter	Value			Unit
		TO-220F	TO-251N	TO-252	
R_{thjc}	Thermal resistance, Junction to case	6.2	1.0	1.1	°C/W
R_{thja}	Thermal resistance, Junction to ambient	54	86		°C/W

Electrical characteristic (T_C = 25°C unless otherwise specified)

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
Off characteristics						
BV_{DSS}	Drain to source breakdown voltage	V_{GS}=0V, I_D=250uA	700			V
ΔBV_{DSS} / ΔT_J	Breakdown voltage temperature coefficient	I_D=250uA, referenced to 25°C		0.89		V/°C
I_{DSS}	Drain to source leakage current	V_{DS}=700V, V_{GS}=0V			1	uA
		V_{DS}=560V, T_C=125°C			50	uA
I_{GSS}	Gate to source leakage current, forward	V_{GS}=30V, V_{DS}=0V			100	nA
	Gate to source leakage current, reverse	V_{GS}=-30V, V_{DS}=0V			-100	nA
On characteristics						
$V_{GS(TH)}$	Gate threshold voltage	V_{DS}=V_{GS}, I_D=250uA	2.5		4.5	V
$R_{DS(ON)}$	Drain to source on state resistance	V_{GS}=10V, I_D=2A		0.8	1.0	Ω
G_{fs}	Forward transconductance	V_{DS}=30V, I_D=2A		3		S
Dynamic characteristics						
C_{iss}	Input capacitance	V_{GS}=0V, V_{DS}=200V, f=1MHz		433		pF
C_{oss}	Output capacitance			28		
C_{rss}	Reverse transfer capacitance			3		
$t_{d(on)}$	Turn on delay time	V_{DS}=350V, I_D=4A, R_G=25Ω, V_{GS}=10V (note 4,5)		10		ns
t_r	Rising time			25		
$t_{d(off)}$	Turn off delay time			34		
t_f	Fall time			24		
Q_g	Total gate charge	V_{DS}=560V, V_{GS}=10V, I_D=4A , I_g=3mA (note 4,5)		18		nC
Q_{gs}	Gate-source charge			3		
Q_{gd}	Gate-drain charge			10		
R_g	Gate resistance	V_{DS}=0V, Scan F mode		2.6		Ω

Source to drain diode ratings characteristics

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
I_S	Continuous source current	Integral reverse p-n Junction diode in the MOSFET			4	A
I_{SM}	Pulsed source current				16	A
V_{SD}	Diode forward voltage drop.	I_S=4A, V_{GS}=0V			1.4	V
t_{rr}	Reverse recovery time	I_S=4A, V_{GS}=0V, dI_F/dt=100A/us		280		ns
Q_{rr}	Reverse recovery charge			2.3		uC

※. Notes

1. Repeatitive rating : pulse width limited by junction temperature.
2. L =70mH, IAS =2.4A, VDD=50V, RG=25Ω, Starting TJ = 25°C
3. I_{SD} ≤ 4A, di/dt = 100A/us, V_{DD} ≤ BV_{DSS}, Staring T_J =25°C
4. Pulse Test : Pulse Width ≤ 300us, duty cycle ≤ 2%.
5. Essentially independent of operating temperature.

Fig. 1. On-state characteristics

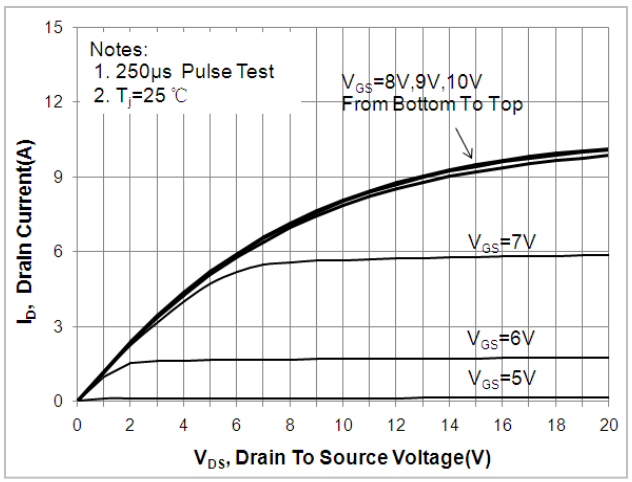


Fig. 2. Transfer Characteristics

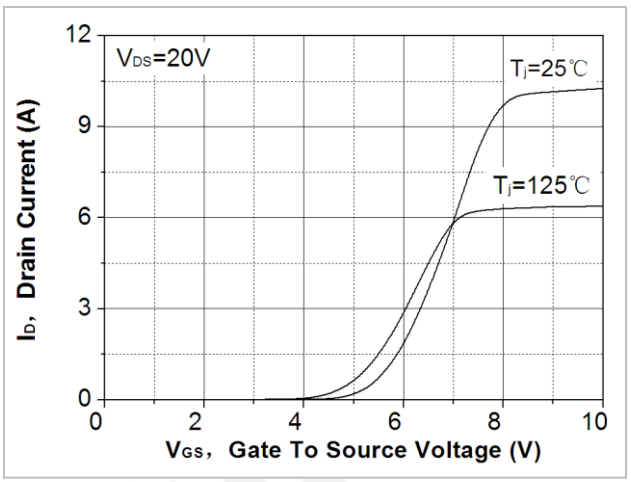


Fig. 3. On-resistance variation vs. drain current and gate voltage

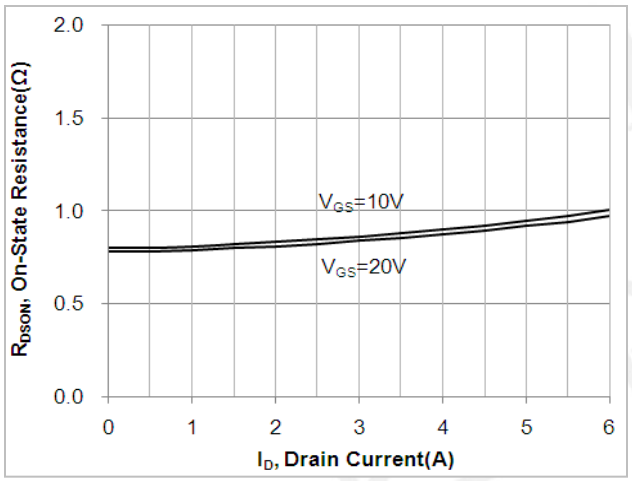


Fig. 4. On-state current vs. diode forward voltage

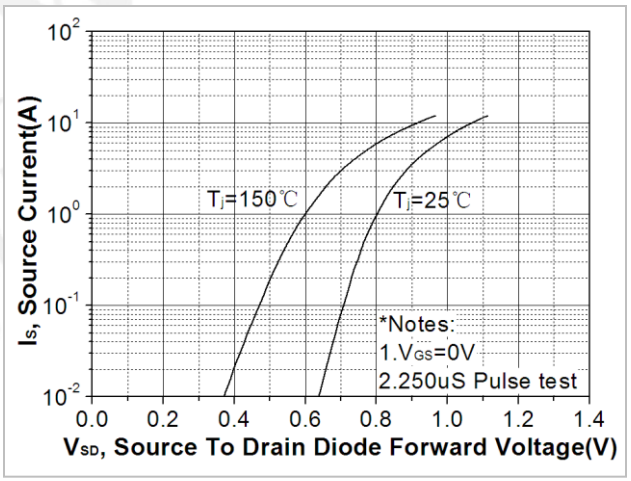


Fig 5. Breakdown voltage variation vs. junction temperature

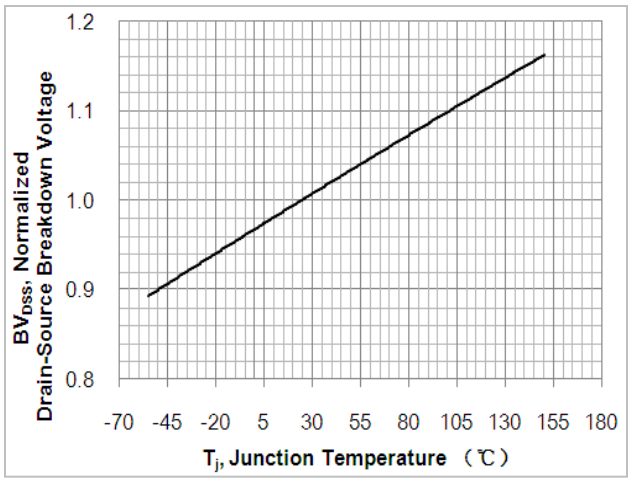


Fig. 6. On-resistance variation vs. junction temperature

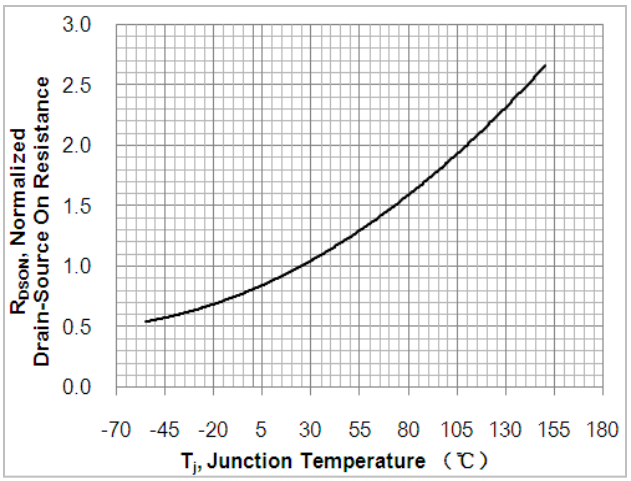


Fig. 7. Gate charge characteristics

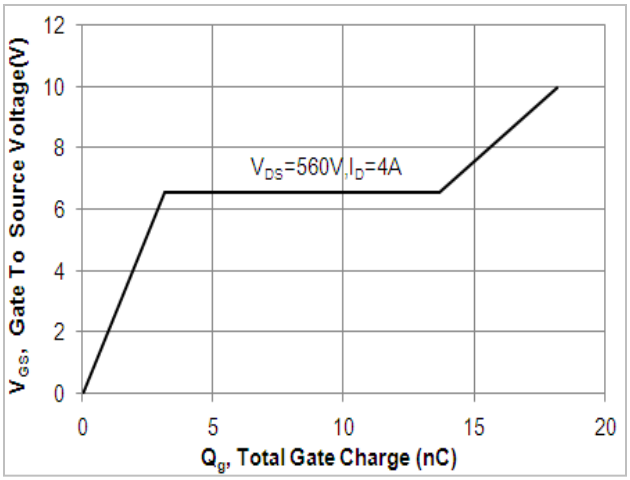


Fig. 8. Capacitance Characteristics

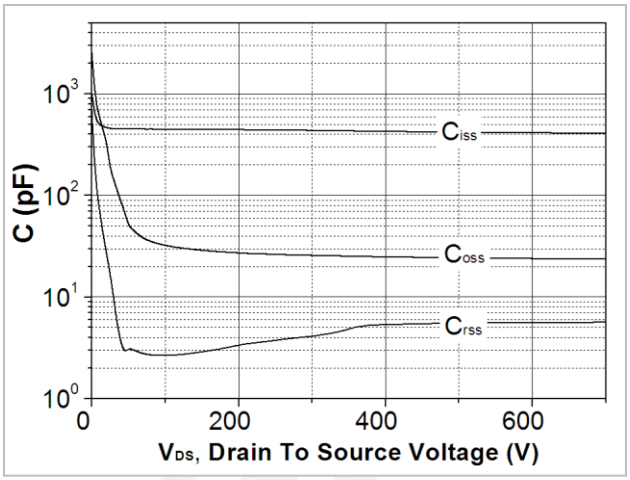


Fig. 9. Maximum safe operating area (TO-220F)

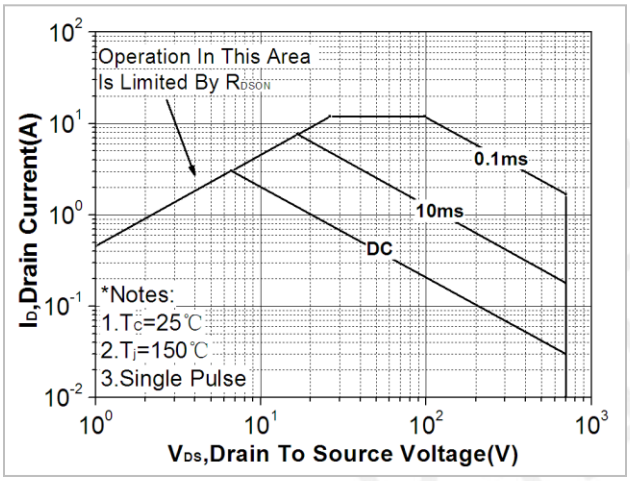


Fig. 10. Maximum safe operating area (TO-251N)

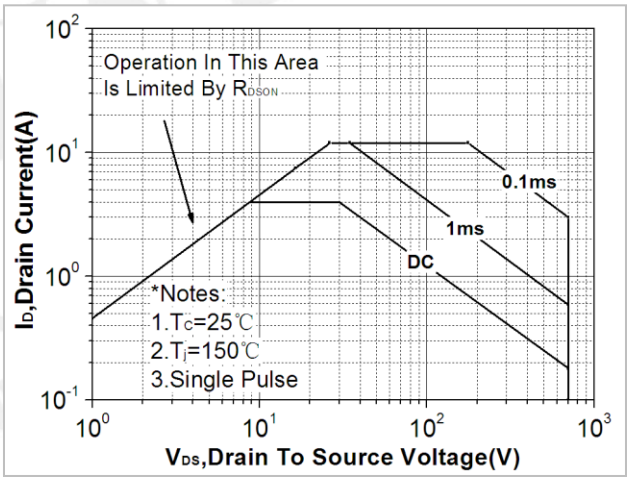


Fig.11. Maximum safe operating area (TO-252)

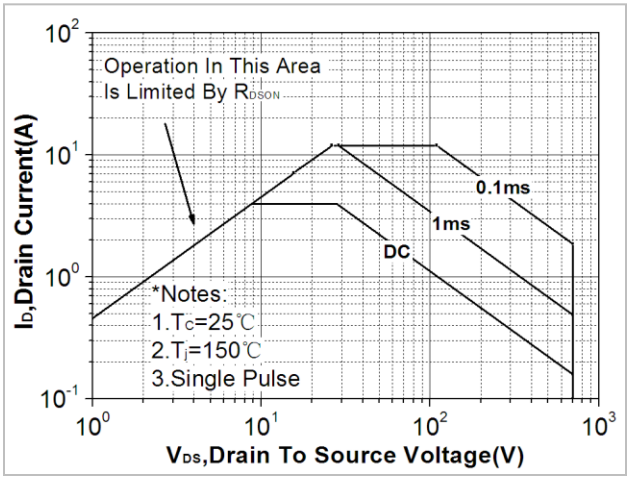


Fig. 12. Transient thermal response curve (TO-220F)

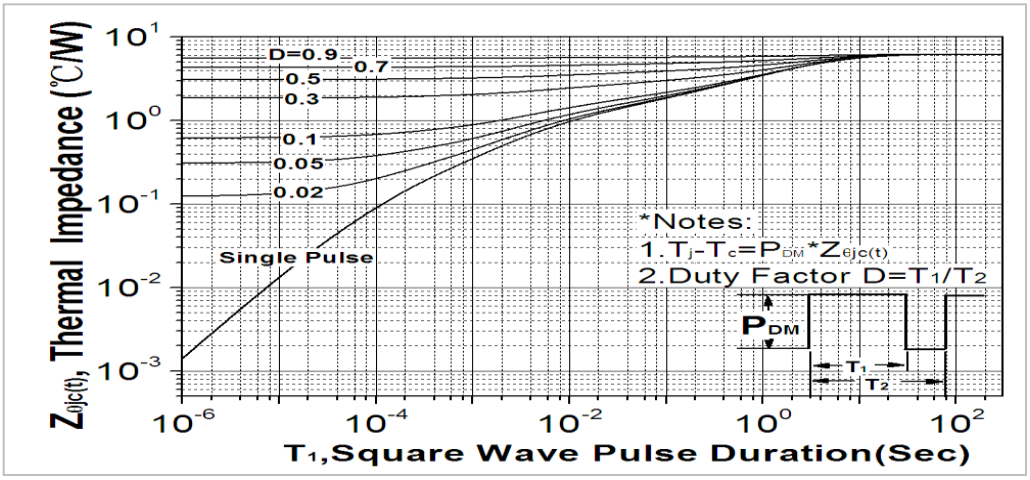


Fig. 13. Transient thermal response curve (TO-251N)

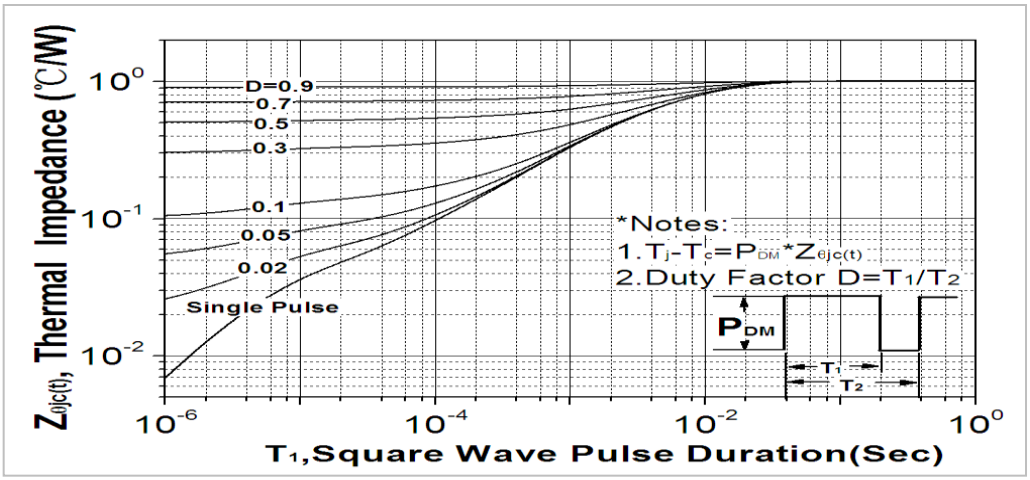


Fig. 14. Transient thermal response curve (TO-252)

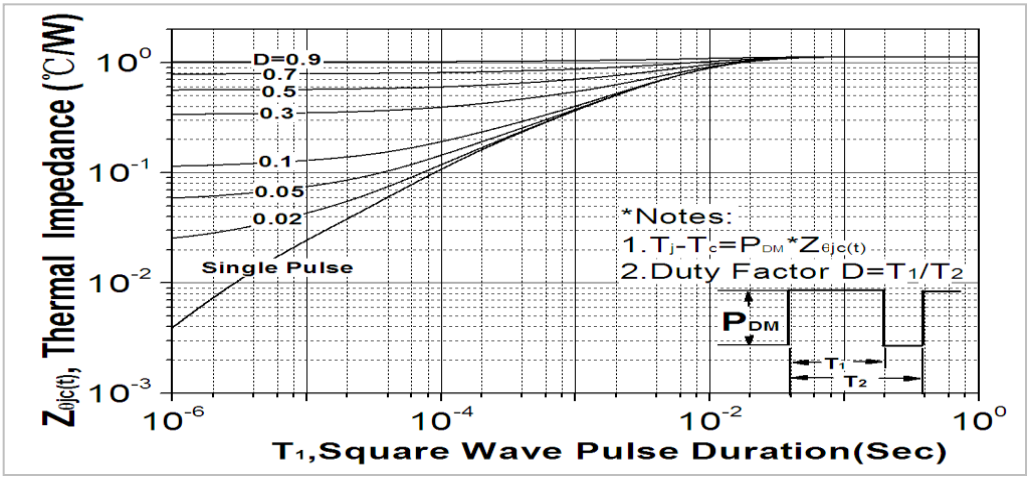


Fig. 15. Gate charge test circuit & waveform

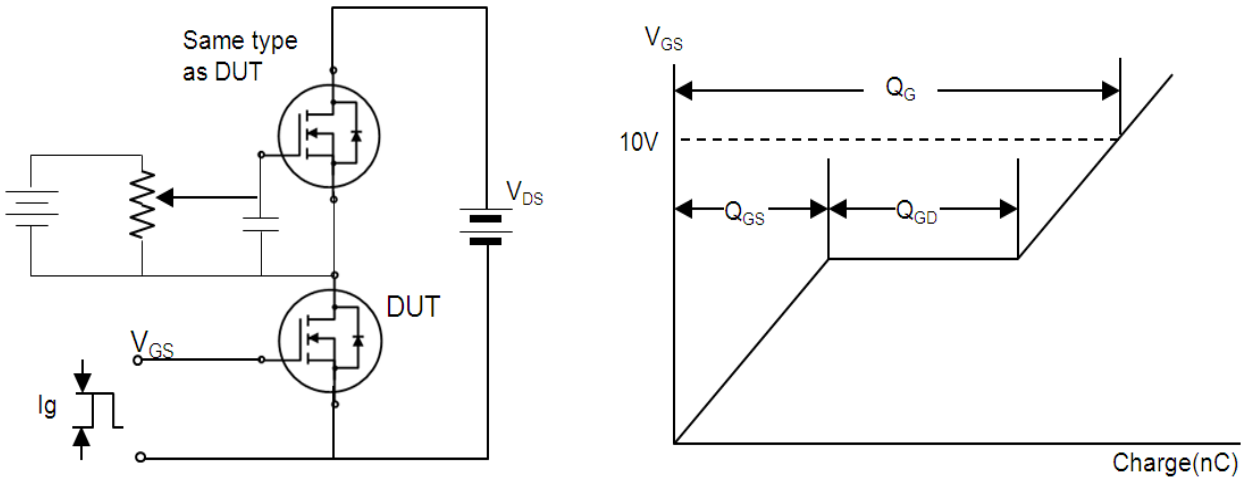


Fig. 16. Switching time test circuit & waveform

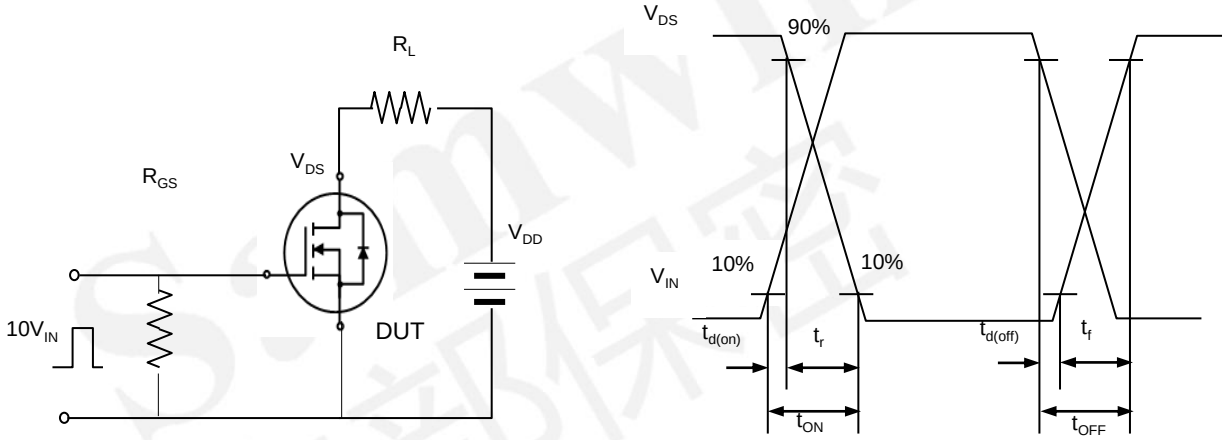


Fig. 17. Unclamped Inductive switching test circuit & waveform

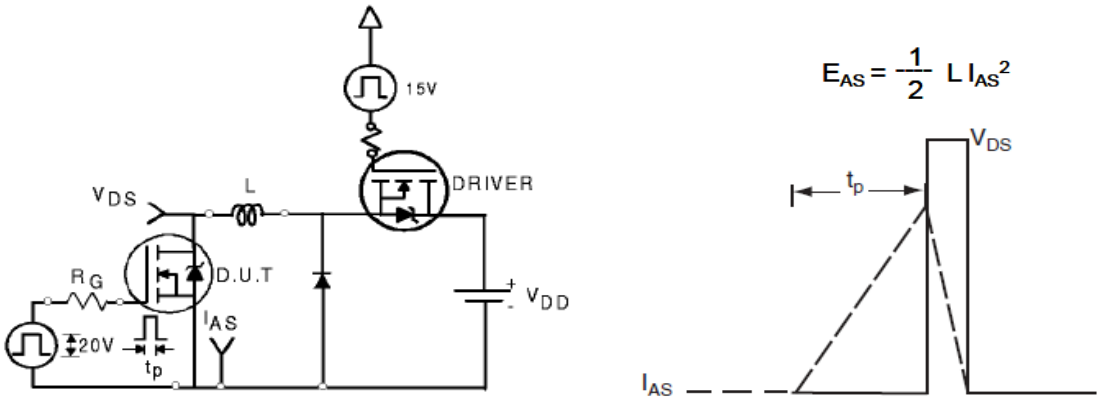
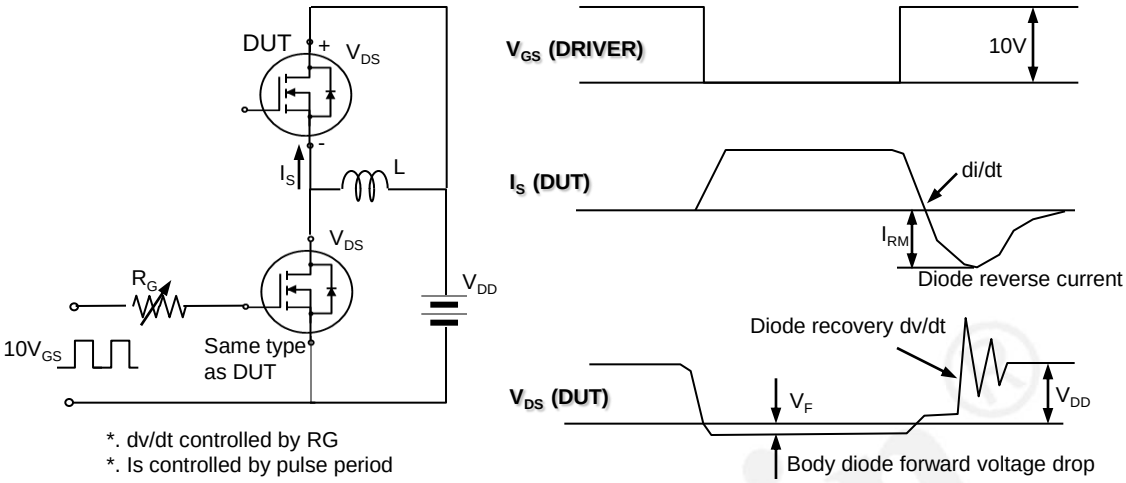


Fig. 18. Peak diode recovery dv/dt test circuit & waveform



DISCLAIMER

* All the data & curve in this document was tested in XI' AN SEMIPOWER TESTING & APPLICATION CENTER.

* This product has passed the PCT,TC,HTRB,HTGB,HAST,PC and Solderdunk reliability testing.

* Qualification standards can also be found on the Web site (**http://www.semipower.com.cn**)

* Suggestions for improvement are appreciated, Please send your suggestions to **samwin@samwinsemi.com**