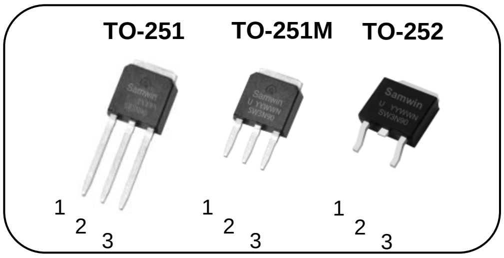
N-channel Enhanced mode TO-251/TO-251M/TO-252 MOSFET

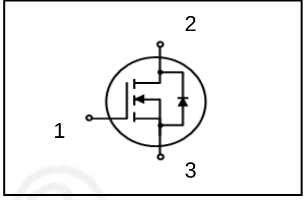
Features

- High ruggedness
- Low $R_{DS(ON)}$ (Typ 4.8Ω)@V_{GS}=10V
- Low Gate Charge (Typ 19nC)
- Improved dv/dt Capability
- 100% Avalanche Tested
- Application:Adaptor, LED, Industrial Power



1. Gate 2. Drain 3. Source

BV_{DSS} : 900V
I_D : 3A
$R_{DS(ON)}$: 4.8Ω



General Description

This power MOSFET is produced with advanced 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 I 3N90U	SW3N90U	TO-251	TUBE
2	SW MI 3N90U	SW3N90U	TO-251M	TUBE
3	SW D 3N90U	SW3N90U	TO-252	REEL

Absolute maximum ratings

Symbol	Parameter	Value			Unit
		TO-251	TO-251M	TO-252	
V_{DSS}	Drain to source voltage	900			V
I_D	Continuous drain current (@T_C=25ºC)	3*			A
	Continuous drain current (@T_C=100ºC)	1.9*			A
I_{DM}	Drain current pulsed (note 1)	12			A
V_{GS}	Gate to source voltage	±30			V
E_{AS}	Single pulsed avalanche energy (note 2)	100			mJ
E_{AR}	Repetitive avalanche energy (note 1)	15			mJ
dv/dt	Peak diode recovery dv/dt (note 3)	5			V/ns
P_D	Total power dissipation (@T_C=25ºC)	178.6	183.8	160.3	W
	Derating factor above 25ºC	1.43	1.47	1.28	W/ºC
T_{STG}, T_J	Operating junction temperature & storage temperature	-55 ~ + 150			ºC
T_L	Maximum lead temperature for soldering purpose, 1/8 from case for 5 seconds.	300			ºC

*. Drain current is limited by junction temperature.

Thermal characteristics

Symbol	Parameter	Value			Unit
		TO-251	TO-251M	TO-252	
R_{thjc}	Thermal resistance, Junction to case	0.7	0.68	0.78	ºC/W
R_{thja}	Thermal resistance, Junction to ambient	90	91		ºC/W

Electrical characteristic (T_C = 25ºC 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	900			V
ΔBV_{DSS} / ΔT_J	Breakdown voltage temperature coefficient	I_D=250uA, referenced to 25ºC		0.95		V/ºC
I_{DSS}	Drain to source leakage current	V_{DS}=900V, V_{GS}=0V			1	uA
		V_{DS}=720V, T_C=125ºC			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	3		5	V
$R_{DS(ON)}$	Drain to source on state resistance	V_{GS}=10V, I_D=1.5A		4.8	5.8	Ω
G_{fs}	Forward transconductance	V_{DS}=30V, I_D=1.5A		3.4		S
Dynamic characteristics						
C_{iss}	Input capacitance	V_{GS}=0V, V_{DS}=25V, f=1MHz		584		pF
C_{oss}	Output capacitance			49		
C_{rss}	Reverse transfer capacitance			6.4		
$t_{d(on)}$	Turn on delay time	V_{DS}=450V, I_D=3A, R_G=25Ω, V_{GS}=10V (note 4,5)		11		ns
t_r	Rising time			24		
$t_{d(off)}$	Turn off delay time			38		
t_f	Fall time			25		
Q_g	Total gate charge	V_{DS}=720V, V_{GS}=10V, I_D=3A (note 4,5)		19		nC
Q_{gs}	Gate-source charge			3.7		
Q_{gd}	Gate-drain charge			9		

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			3	A
I_{SM}	Pulsed source current				12	A
V_{SD}	Diode forward voltage drop.	I_S=3A, V_{GS}=0V			1.4	V
t_{rr}	Reverse recovery time	I_S=3A, V_{GS}=0V, dI_F/dt=100A/us		435		ns
Q_{rr}	Reverse recovery charge			2.9		uC

※. Notes

1. Repeatitive rating : pulse width limited by junction temperature.
2. L = 22mH, I_{AS} =3A, V_{DD} = 50V, R_G=25Ω, Starting T_J = 25ºC
3. I_{SD} ≤3A, di/dt = 100A/us, V_{DD} ≤ BV_{DSS}, Staring T_J =25ºC
4. Pulse Test : Pulse Width ≤ 300us, duty cycle ≤ 2%
5. Essentially independent of operating temperature.

Fig. 1. On-state characteristics

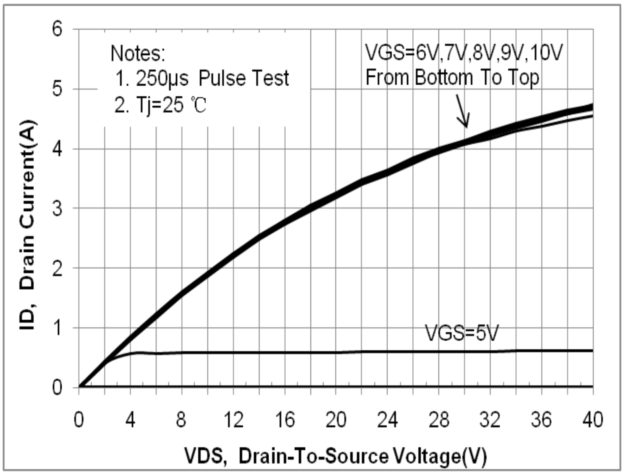


Fig. 2. Transfer Characteristics

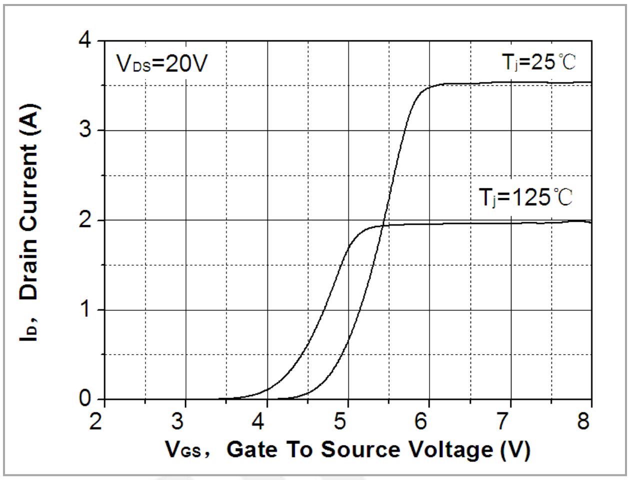


Fig. 3. On-resistance variation vs. drain current and gate voltage

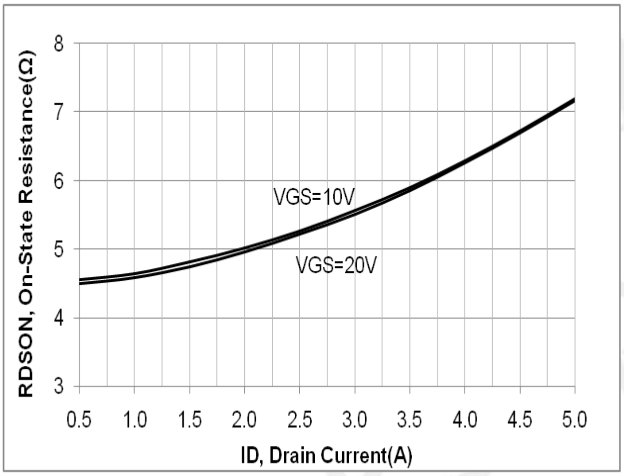


Fig. 4. On-state current vs. diode forward voltage

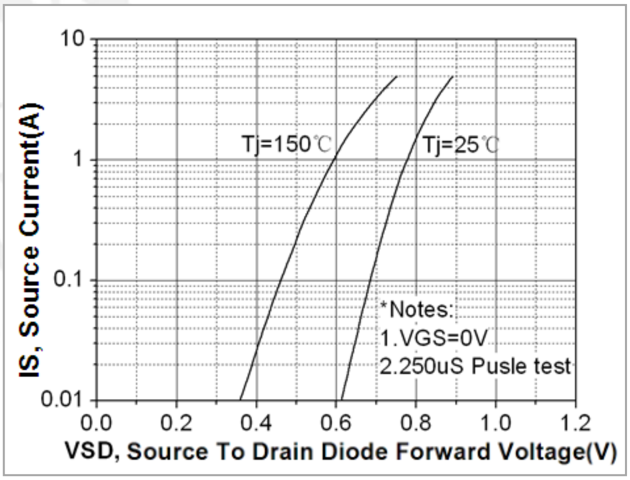


Fig 5. Breakdown voltage variation vs. junction temperature

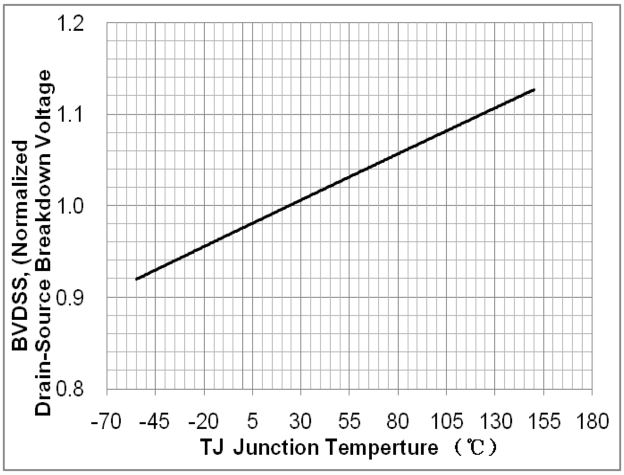


Fig. 6. On-resistance variation vs. junction temperature

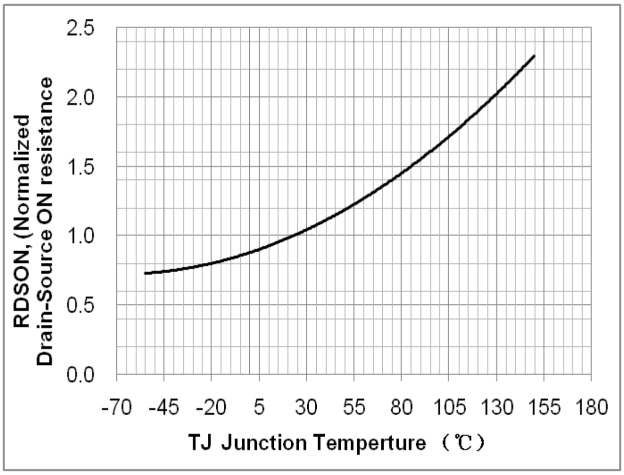


Fig. 7. Gate charge characteristics

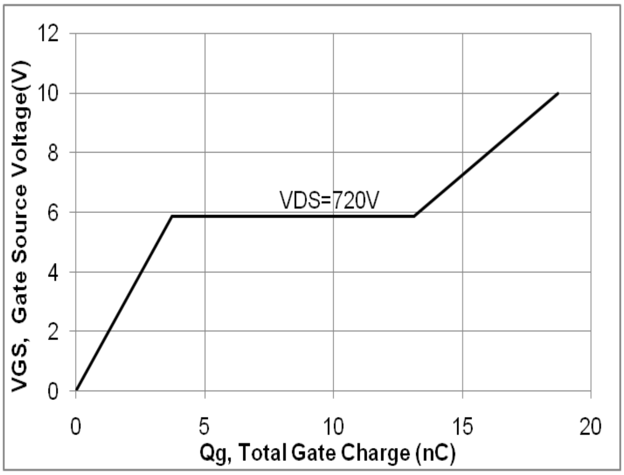


Fig. 8. Capacitance Characteristics

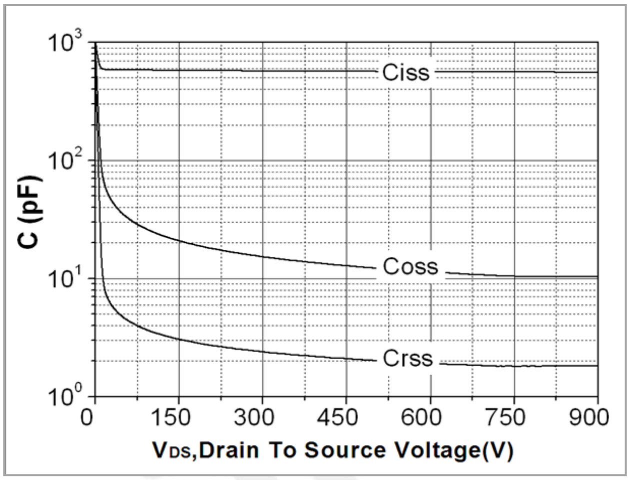


Fig. 9. Maximum safe operating area (TO-251)

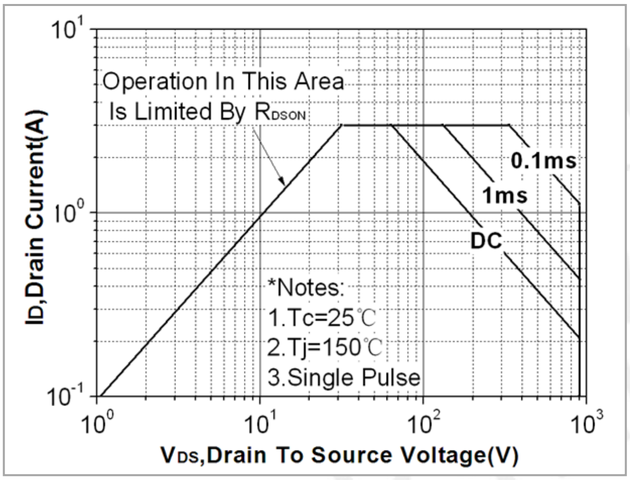


Fig. 10. Maximum safe operating area(TO-251M)

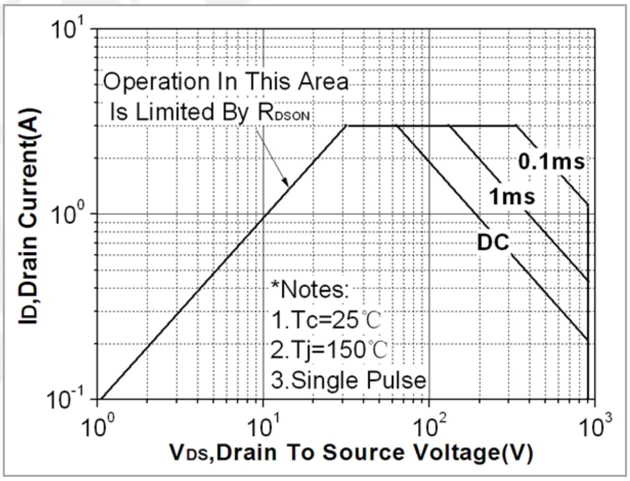


Fig. 11. Maximum safe operating area(TO-252)

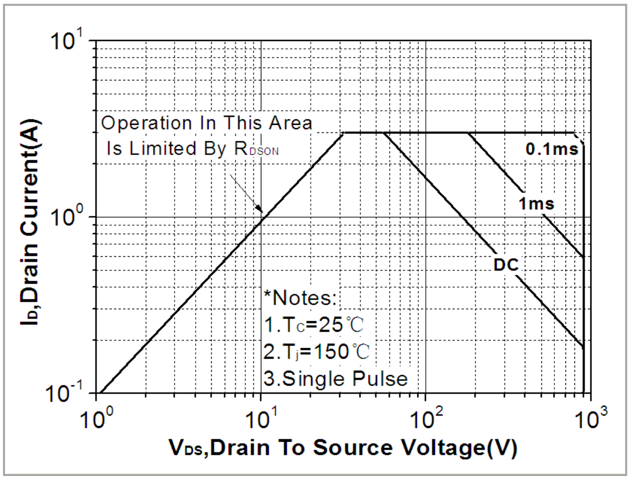


Fig. 12. Transient thermal response curve(TO-251)

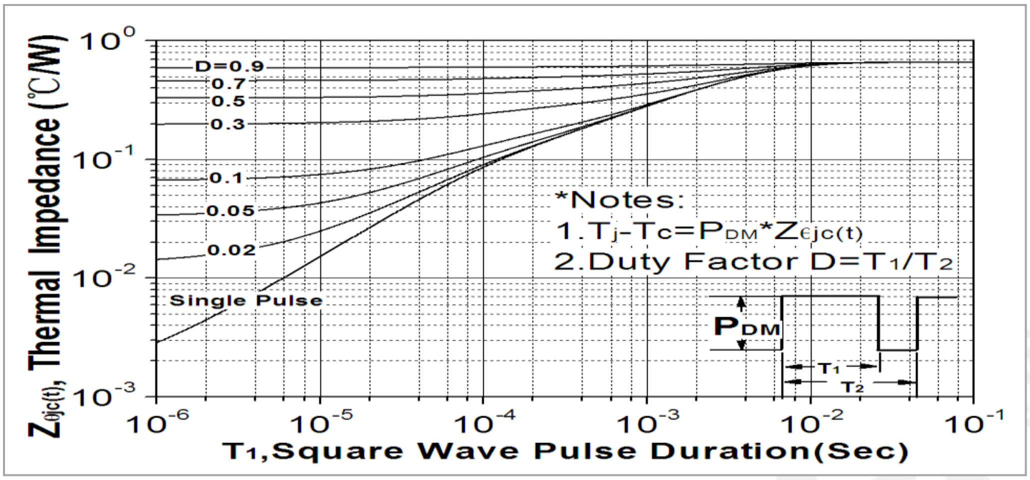


Fig. 13. Transient thermal response curve(TO-251M)

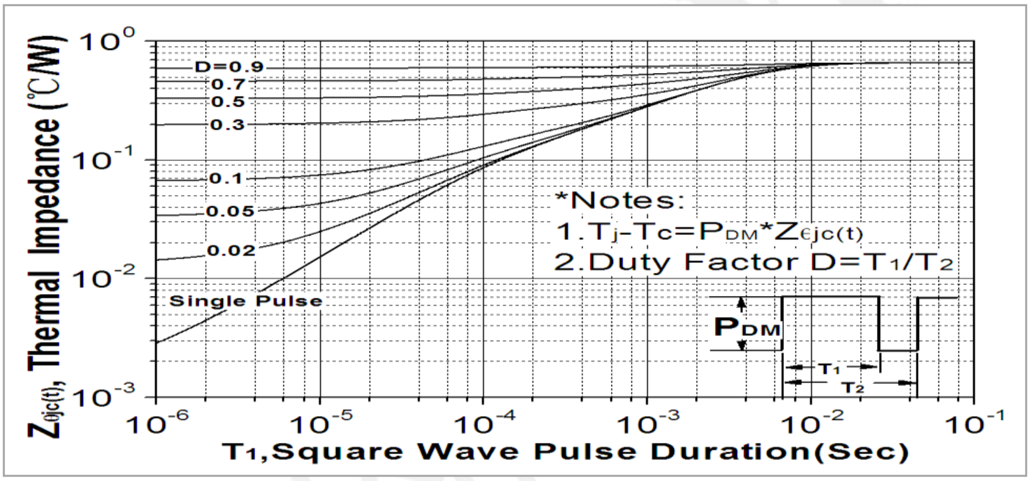


Fig. 14. Transient thermal response curve(TO-252)

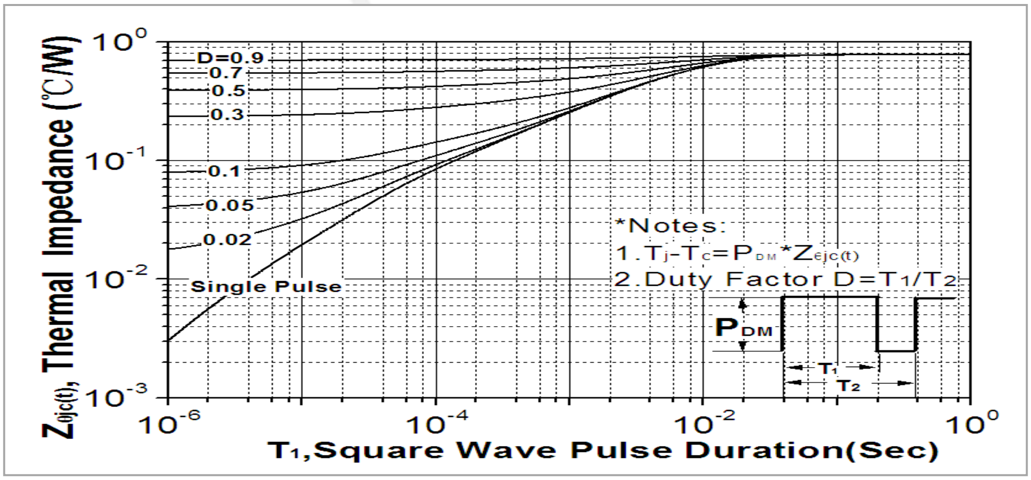


Fig. 15. Gate charge test circuit & waveform

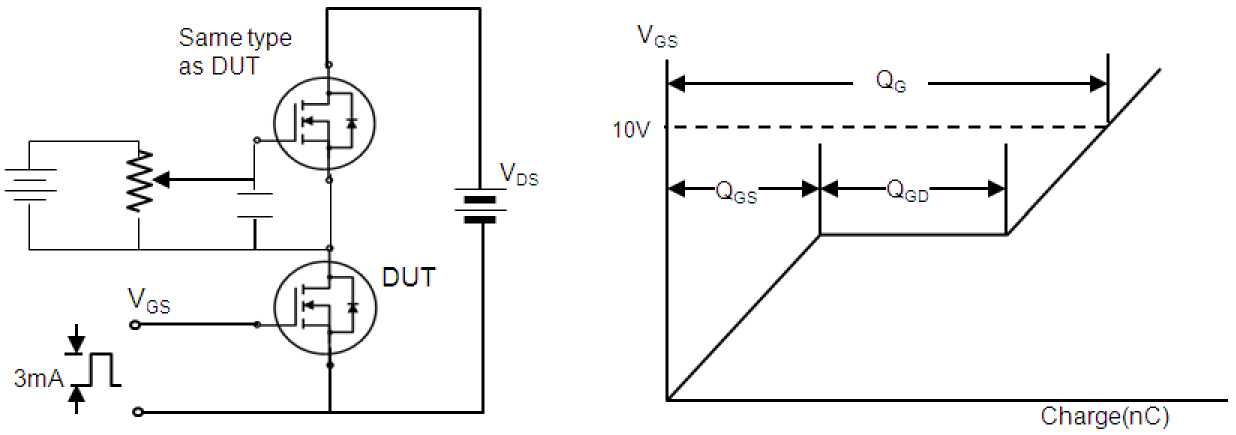


Fig. 16. Switching time test circuit & waveform

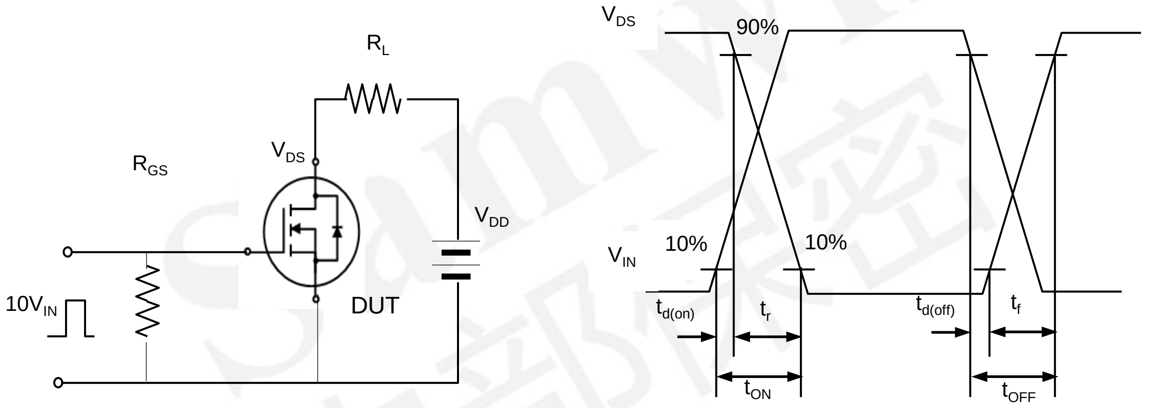


Fig. 17. Unclamped Inductive switching test circuit & waveform

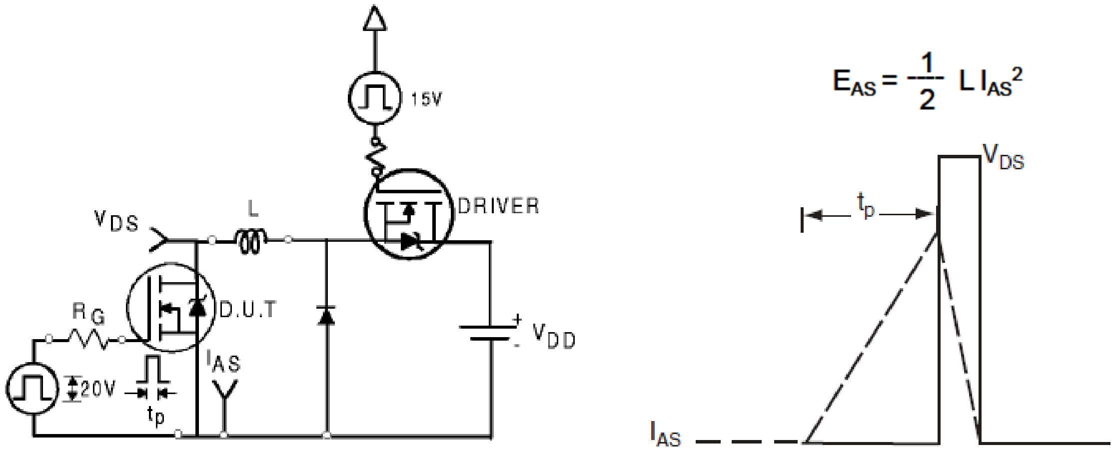
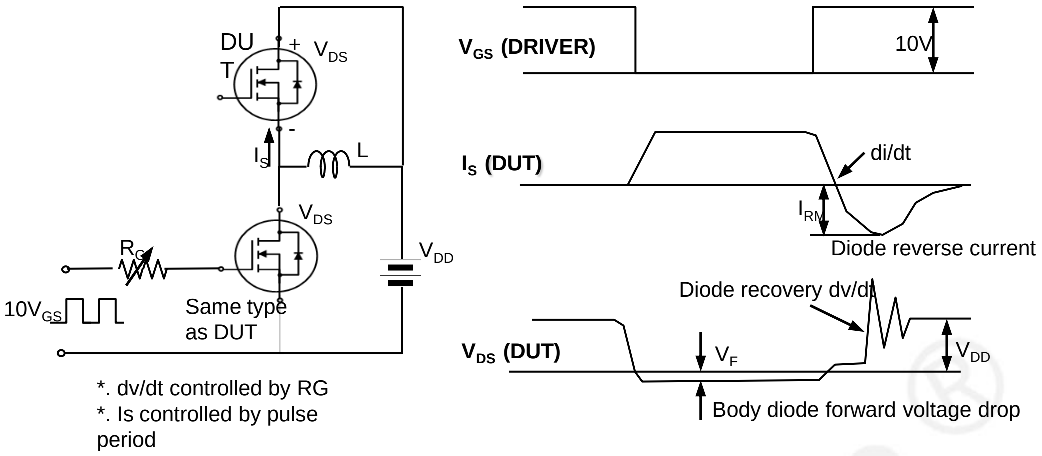


Fig. 18. Peak diode recovery dv/dt test circuit & waveform



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 test

* 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**