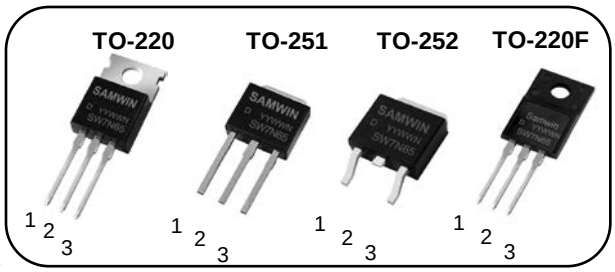
N-channel Enhancement mode TO-220/TO-251/TO-252/TO-220F MOSFET

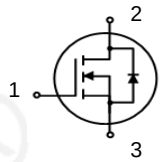
Features

- High ruggedness
- $R_{DS(ON)}$ (Typ 1.1Ω)@V_{GS}=10V
- Gate Charge (Typ 30nC)
- Improved dv/dt Capability
- 100% Avalanche Tested
- Application: Charger,TV-POWER



1. Gate 2. Drain 3. Source

BV_{DSS} : 650V
I_D : 7A
$R_{DS(ON)}$: 1.1Ω



General Description

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

Order Codes

Item	Sales Type	Marking	Package	Packaging
1	SW P 7N65D	SW7N65D	TO-220	TUBE
2	SW I 7N65D	SW7N65D	TO-251	TUBE
3	SW D 7N65D	SW7N65D	TO-252	REEL
4	SW F 7N65D	SW7N65D	TO-220F	TUBE

Absolute maximum ratings

Symbol	Parameter	Value				Unit
		TO-220	TO-251	TO-252	TO-220F	
V_{DSS}	Drain to Source Voltage	650				V
I_D	Continuous Drain Current (@T_C=25ºC)	7*				A
	Continuous Drain Current (@T_C=100ºC)	4.4*				A
I_{DM}	Drain current pulsed (note 1)	28				A
V_{GS}	Gate to Source Voltage	±30				V
E_{AS}	Single pulsed Avalanche Energy (note 2)	430				mJ
E_{AR}	Repetitive Avalanche Energy (note 1)	40				mJ
dv/dt	Peak diode Recovery dv/dt (note 3)	5				V/ns
P_D	Total power dissipation (@T_C=25ºC)	208.3	173.6		27.9	W
	Derating Factor above 25ºC	1.67	1.39		0.22	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-220	TO-251	TO-252	TO-220F	
R_{thjc}	Thermal resistance, Junction to case	0.6	0.72		4.5	ºC/W
R_{thcs}	Thermal resistance, Case to Sink	0.5	0.5	/	0.5	ºC/W
R_{thja}	Thermal resistance, Junction to ambient	60	82		50	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	650			V
ΔBV_{DSS} / ΔT_J	Breakdown voltage temperature coefficient	I_D=250uA, referenced to 25ºC		0.51		V/ºC
I_{DSS}	Drain to source leakage current	V_{DS}=650V, V_{GS}=0V			1	uA
		V_{DS}=520V, 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	2.5		4.5	V
$R_{DS(ON)}$	Drain to source on state resistance	V_{GS}=10V, I_D = 3.5A		1.1	1.4	Ω
Gfs	Forward Transconductance	V_{DS} = 30 V, I_D = 3.5A		6.3		S
Dynamic characteristics						
C_{iss}	Input capacitance	V_{GS}=0V, V_{DS}=25V, f=1MHz		950		pF
C_{oss}	Output capacitance			108		
C_{rss}	Reverse transfer capacitance			16		
$t_{d(on)}$	Turn on delay time	V_{DS}=350V, I_D=7A, R_G=25Ω (note 4,5)		16		ns
tr	Rising time			36		
$t_{d(off)}$	Turn off delay time			83		
t_f	Fall time			40		
Q_g	Total gate charge	V_{DS}=520V, V_{GS}=10V, I_D=7A (note 4,5)		30		nC
Q_{gs}	Gate-source charge			5		
Q_{gd}	Gate-drain charge			15		

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			7	A
I_{SM}	Pulsed source current				28	A
V_{SD}	Diode forward voltage drop.	I_S=7A, V_{GS}=0V			1.4	V
T_{rr}	Reverse recovery time	I_S=7A, V_{GS}=0V, dI_F/dt=100A/us		436		ns
Q_{rr}	Reverse recovery Charge			8.7		uC

※. Notes

1. Repeatitive rating : pulse width limited by junction temperature.
2. L = 17.5mH, I_{AS} = 7A, V_{DD} = 50V, R_G=25Ω, Starting T_J = 25ºC
3. I_{SD} ≤ 7A, 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

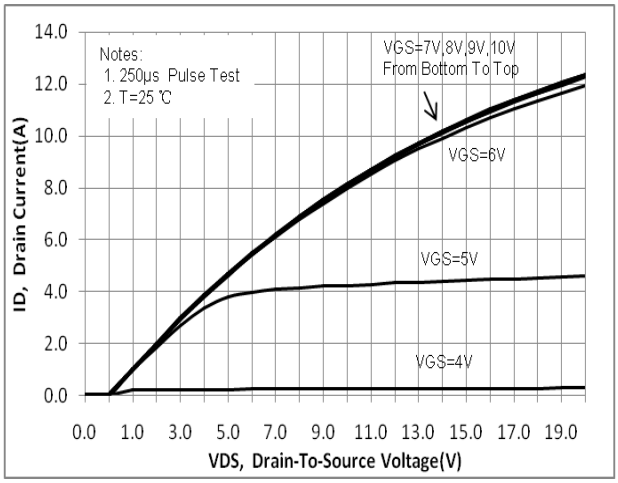


Fig. 2. On-resistance variation vs. drain current and gate voltage

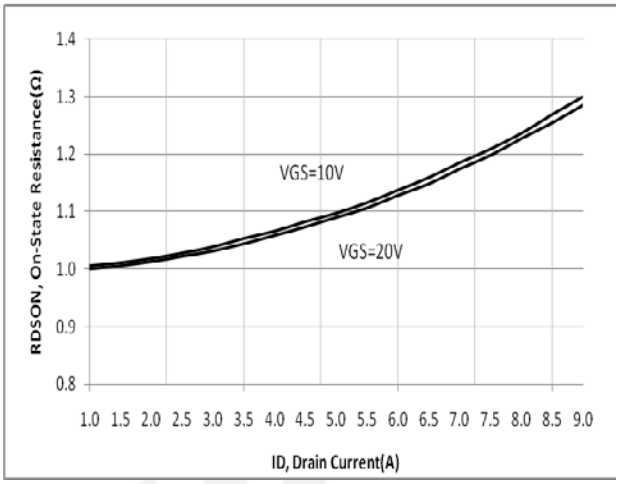


Fig. 3. Gate charge characteristics

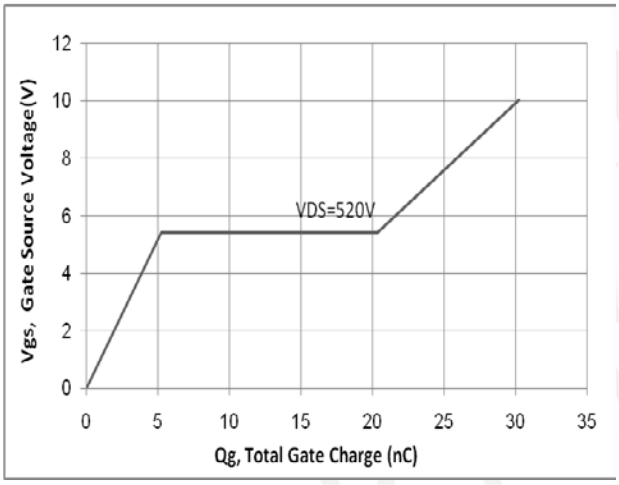


Fig. 4. On state current vs. diode forward voltage

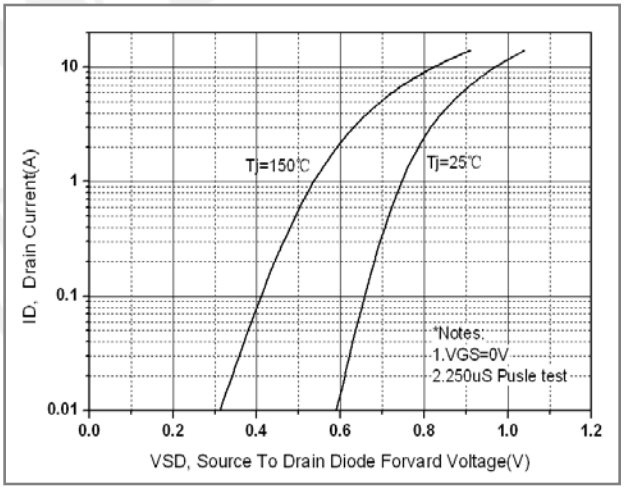


Fig 5. Breakdown Voltage Variation vs. Junction Temperature

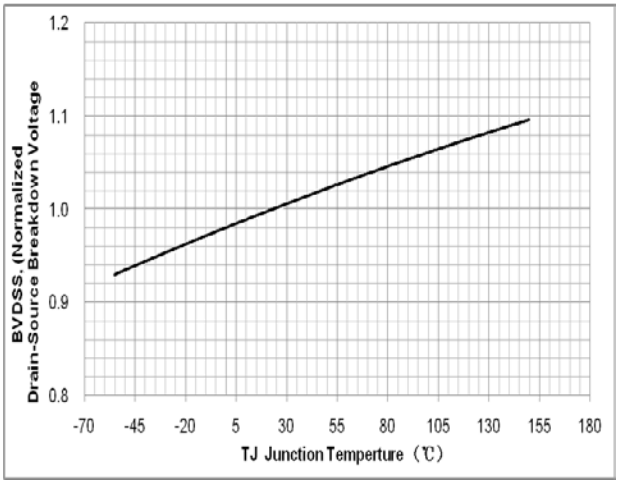


Fig. 6. On resistance variation vs. junction temperature

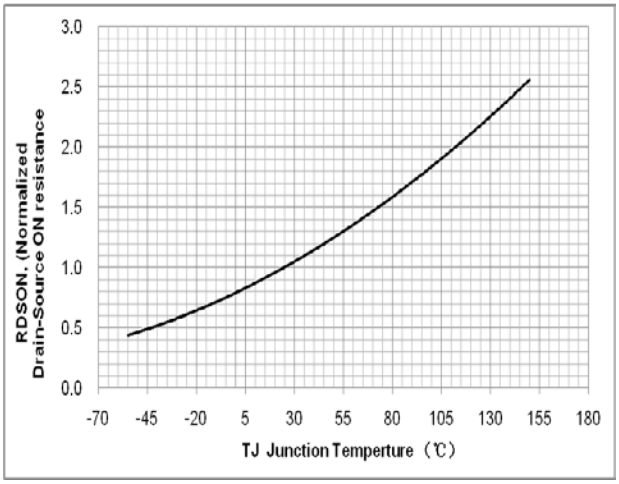


Fig. 7. Maximum safe operating area(TO-220)

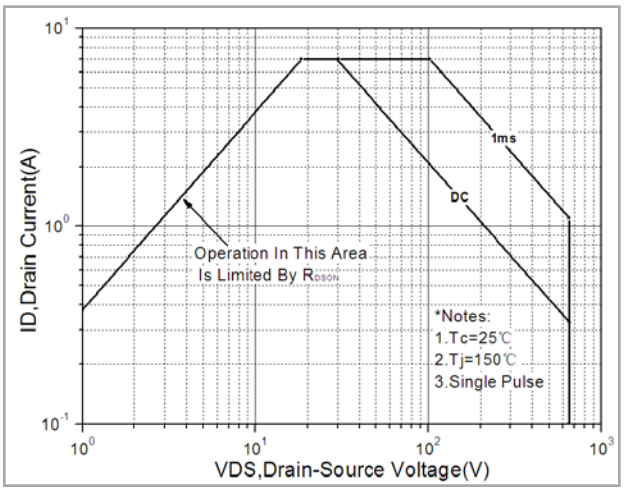


Fig. 8. Transient thermal response curve(TO-220)

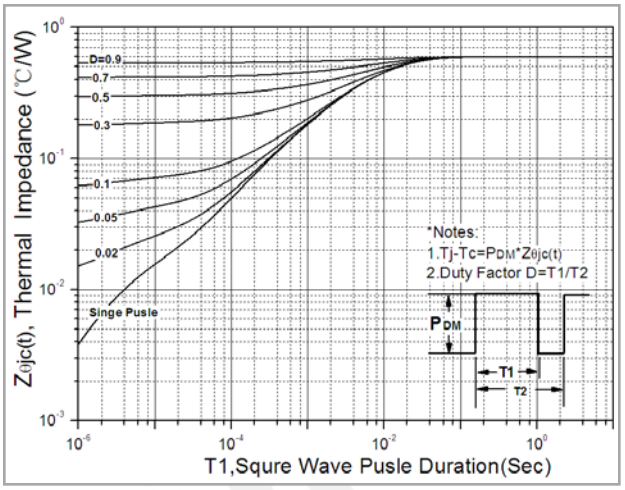


Fig. 9. Maximum safe operating area(TO-251/252)

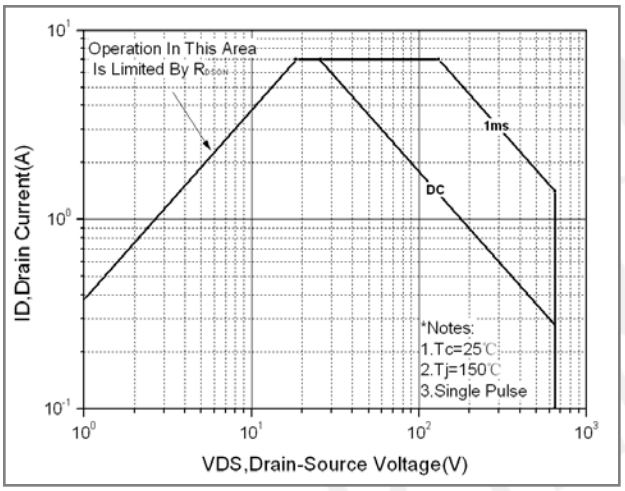


Fig. 10. Transient thermal response curve(TO-251/252)

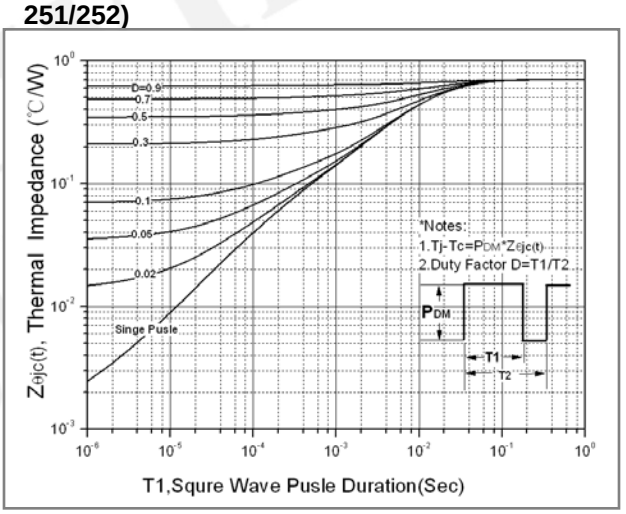


Fig. 11. Maximum safe operating area(TO-220F)

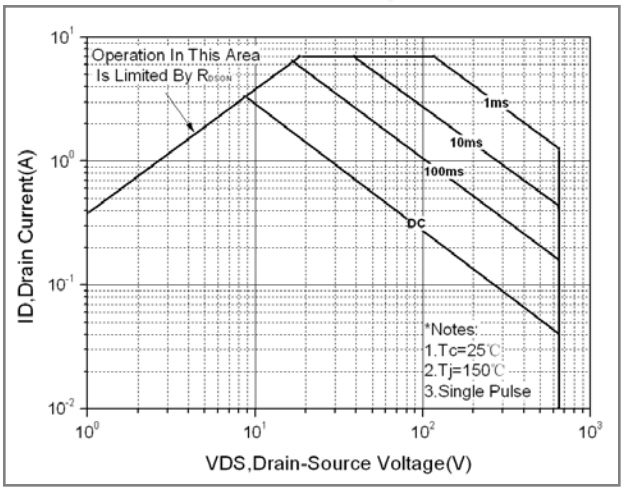


Fig. 12. Transient thermal response curve(TO-220F)

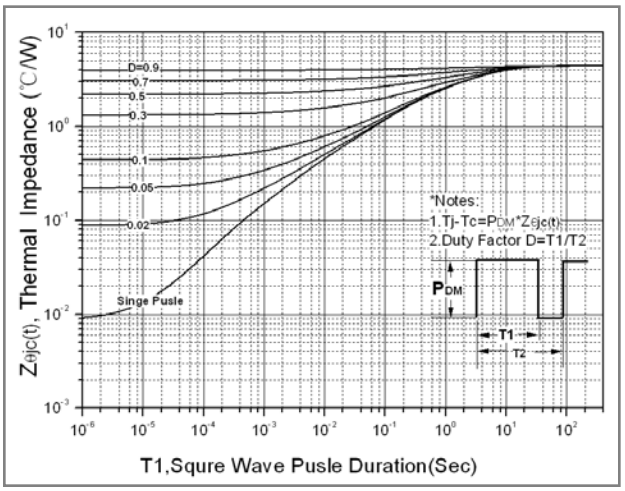


Fig. 13. Capacitance Characteristics

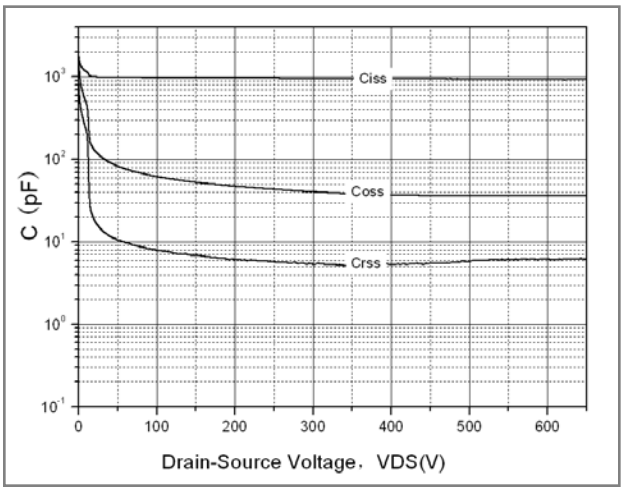


Fig. 14. Gate charge test circuit & waveform

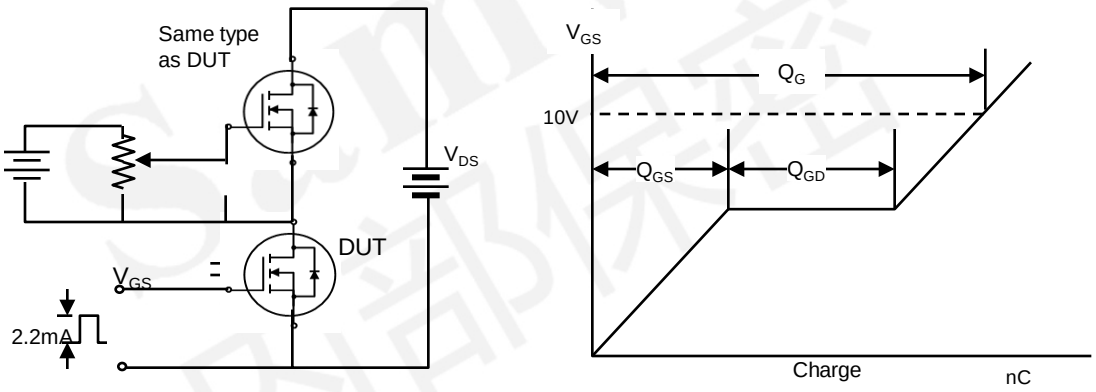


Fig. 15. Switching time test circuit & waveform

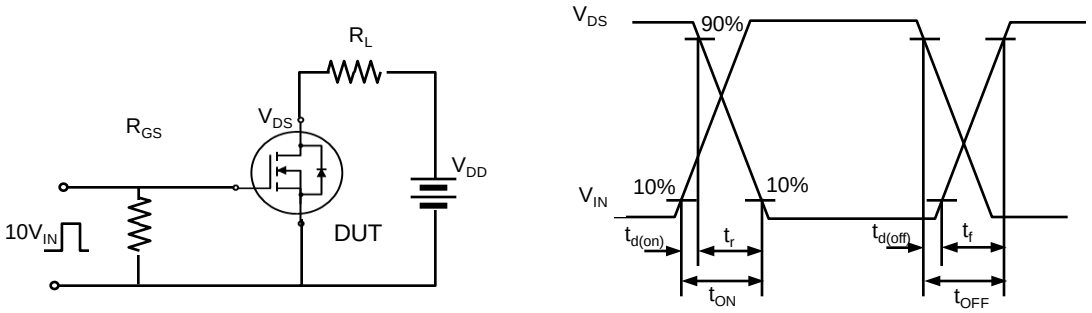


Fig. 16. Unclamped Inductive switching test circuit & waveform

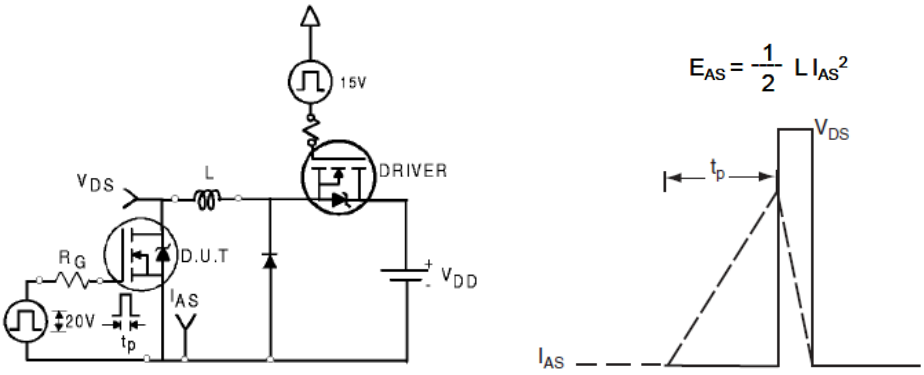
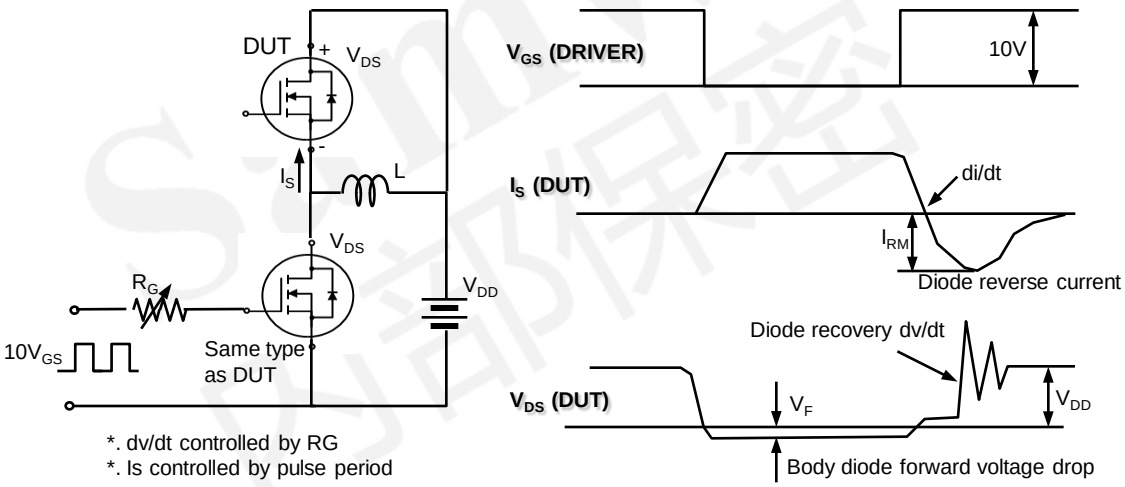


Fig. 17. Peak diode recovery dv/dt test circuit & waveform



DISCLAIRATION:

* All the data&curve within 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**)
* Any advice, please send your proposal to **samwin@samwinsemi.com**