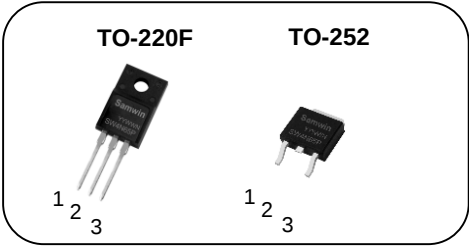


N-channel Enhanced mode TO-220F/TO-252 MOSFET

Features

- High ruggedness
- Low $R_{DS(ON)}$ (Typ 2.0Ω)@ $V_{GS}=10V$
- Low Gate Charge (Typ 15nC)
- Improved dv/dt Capability
- 100% Avalanche Tested
- Application: LED, Charger, PC Power



1. Gate 2. Drain 3. Source

BV_{DSS} : 650V
 I_D : 4A
 $R_{DS(ON)}$: 2.0Ω



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 F 4N65P	SW4N65P	TO-220F	TUBE
2	SW D 4N65P	SW4N65P	TO-252	REEL

Absolute maximum ratings

Symbol	Parameter	Value		Unit
		TO-220F	TO-252	
V_{DSS}	Drain to source voltage	650		V
I_D	Continuous drain current (@ $T_C=25^{\circ}C$)	4*		A
	Continuous drain current (@ $T_C=100^{\circ}C$)	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)	224		mJ
E_{AR}	Repetitive avalanche energy (note 1)	20		mJ
dv/dt	Peak diode recovery dv/dt (note 3)	5		V/ns
P_D	Total power dissipation (@ $T_C=25^{\circ}C$)	23	104	W
	Derating factor above 25°C	0.19	0.8	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-252	
R_{thjc}	Thermal resistance, Junction to case	5.4	1.2	°C/W
R_{thja}	Thermal resistance, Junction to ambient	51		°C/W

Electrical characteristic (T_J = 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	650			V
ΔBV _{DSS} / ΔT _J	Breakdown voltage temperature coefficient	I _D =250uA, referenced to 25°C		0.45		V/°C
I _{DSS}	Drain to source leakage current	V _{DS} =650V, V _{GS} =0V			1	uA
		V _{DS} =520V, T _J =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, T _J =25°C		2.0	2.4	Ω
		V _{GS} =10V, I _D =2A, T _J =125°C		4.0		Ω
G _{fs}	Forward transconductance	V _{DS} =30V, I _D =2A		5.2		S
Dynamic characteristics						
C _{iss}	Input capacitance	V _{GS} =0V, V _{DS} =25V, f=1MHz		637		pF
C _{oss}	Output capacitance			53		
C _{rss}	Reverse transfer capacitance			3		
t _{d(on)}	Turn on delay time	V _{DS} =325V, I _D =4A, R _G =10Ω, V _{GS} =10V (note 4,5)		10		ns
t _r	Rising time			22		
t _{d(off)}	Turn off delay time			23		
t _f	Fall time			22		
Q _g	Total gate charge	V _{DS} =520V, V _{GS} =10V, I _D =4A I _G =1mA (note 4,5)		15		nC
Q _{gs}	Gate-source charge			5		
Q _{gd}	Gate-drain charge			4		
R _g	Gate resistance	f=1MHz		0.7		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		366		ns
Q _{rr}	Reverse recovery charge			1.4		uC

- ※. Notes
1.

Repeitative rating : pulse width limited by junction temperature.
2.

L =28mH, I_{AS} =4A, V_{DD}=100V, R_G=25Ω, Starting T_J = 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

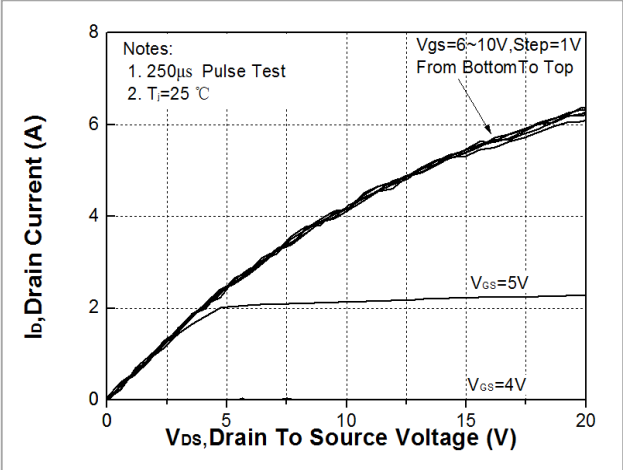


Fig. 2. Transfer Characteristics

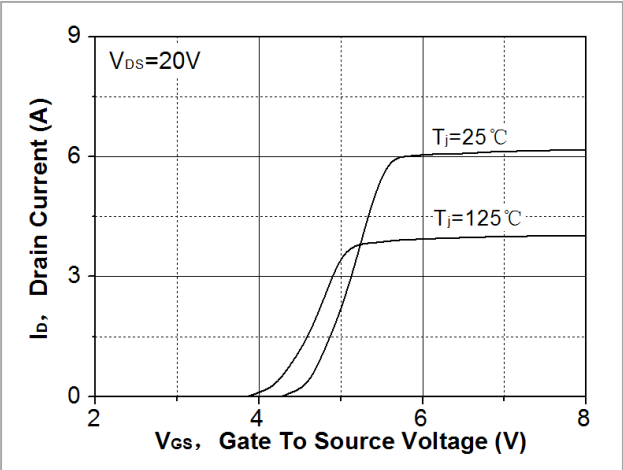


Fig. 3. On-resistance variation vs. drain current and gate voltage

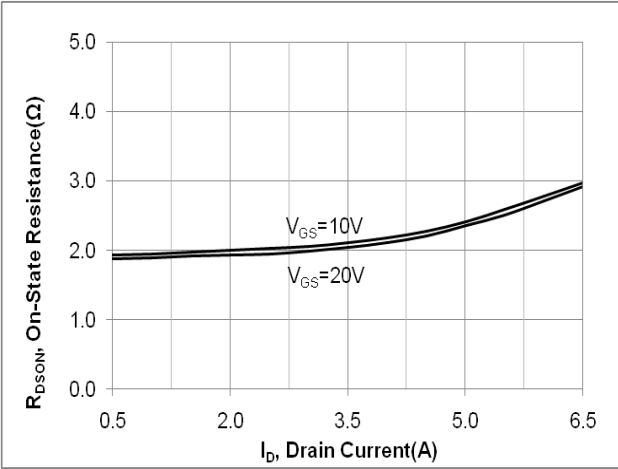


Fig. 4. On-state current vs. diode forward voltage

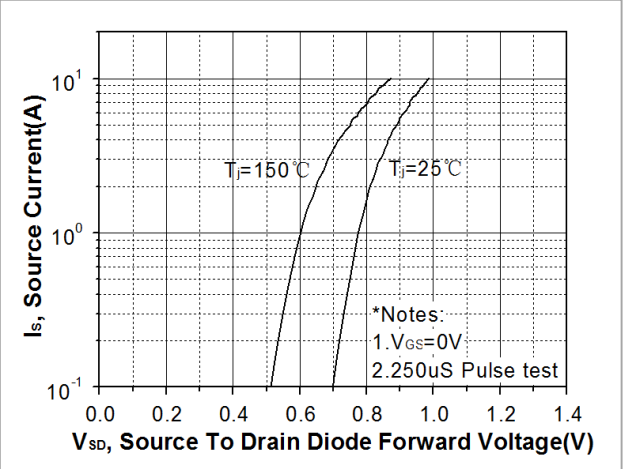


Fig 5. Breakdown voltage variation vs. junction temperature

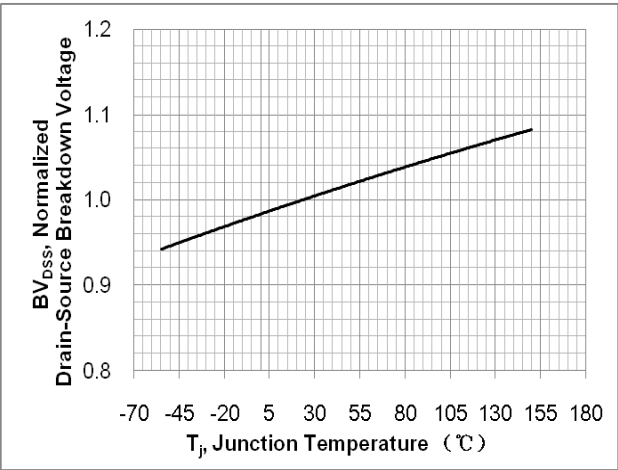


Fig. 6. On-resistance variation vs. junction temperature

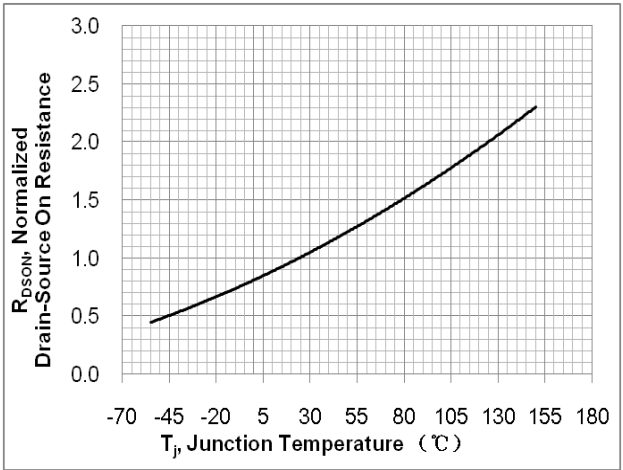


Fig. 7. Gate charge characteristics

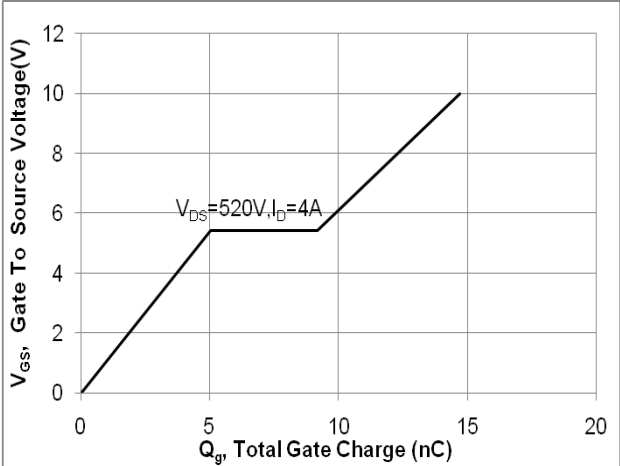


Fig. 8. Capacitance Characteristics

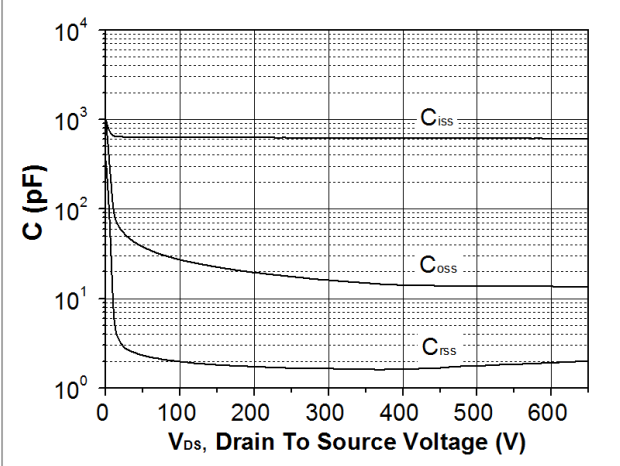


Fig. 9. Maximum safe operating area(TO-220F)

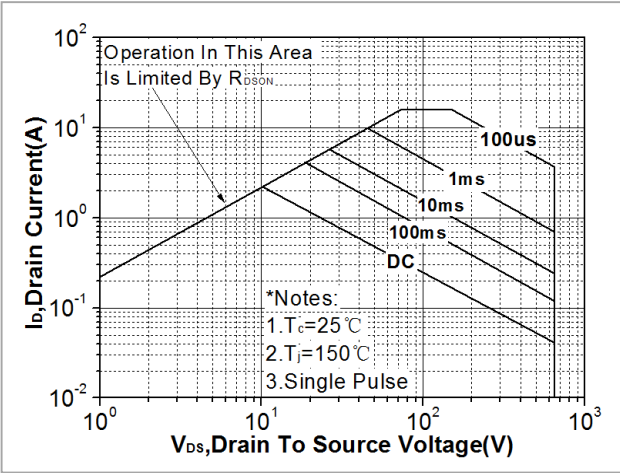


Fig. 10. Maximum safe operating area(TO-252)

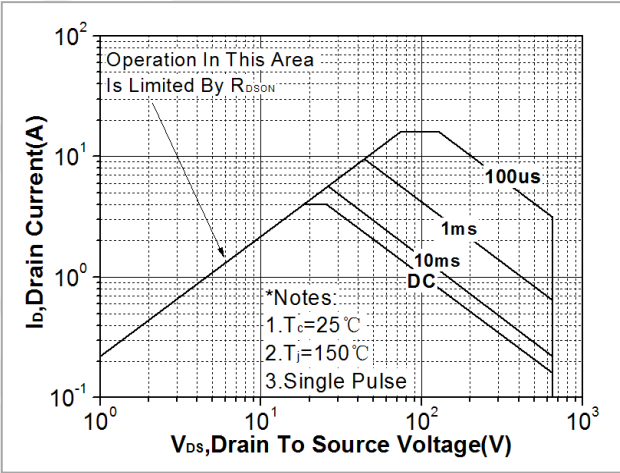


Fig. 11. Transient thermal response curve(TO-220F)

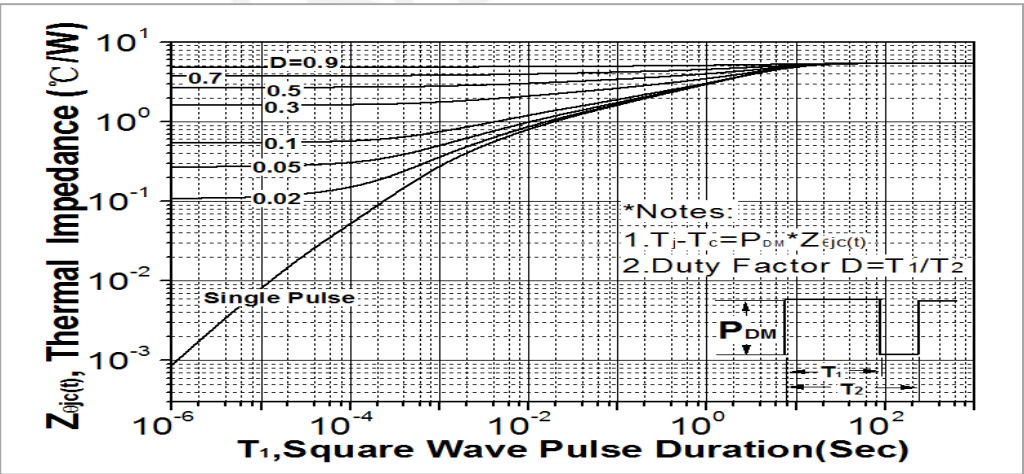


Fig. 12. Transient thermal response curve(TO-252)

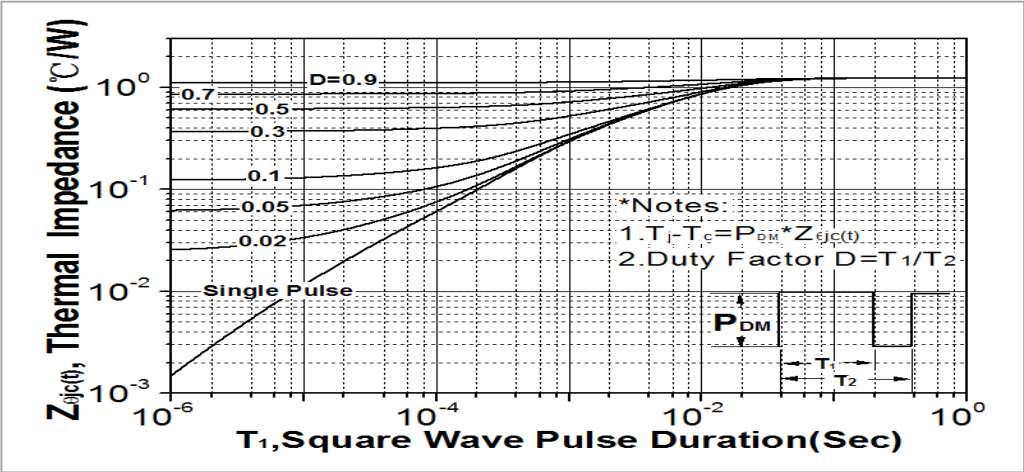


Fig. 13. Gate charge test circuit & waveform

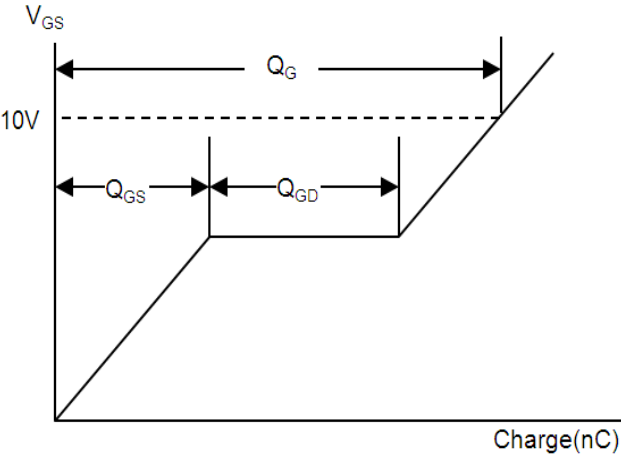
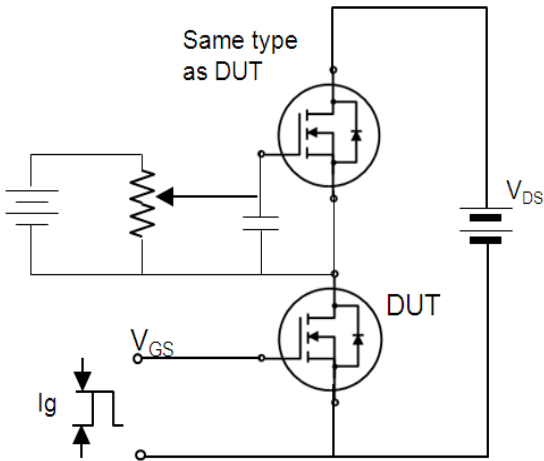


Fig. 14. Switching time test circuit & waveform

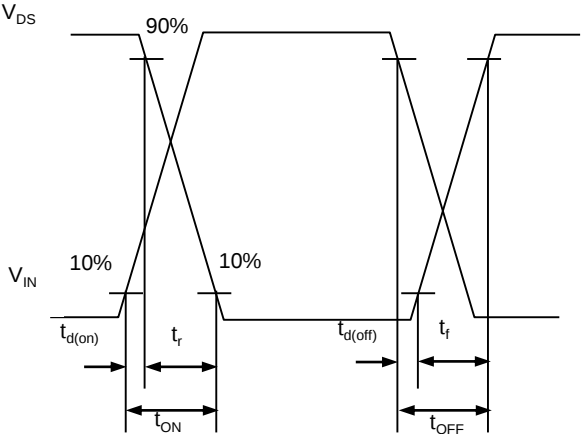
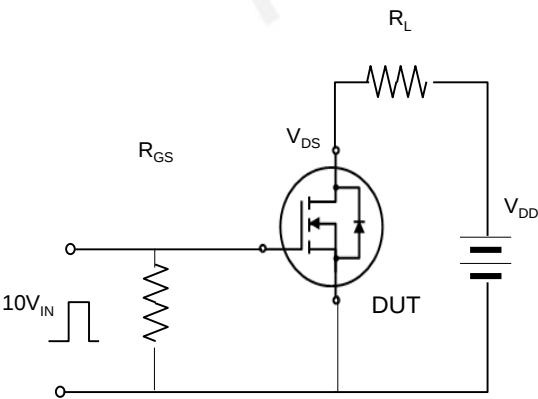


Fig. 15. Unclamped Inductive switching test circuit & waveform

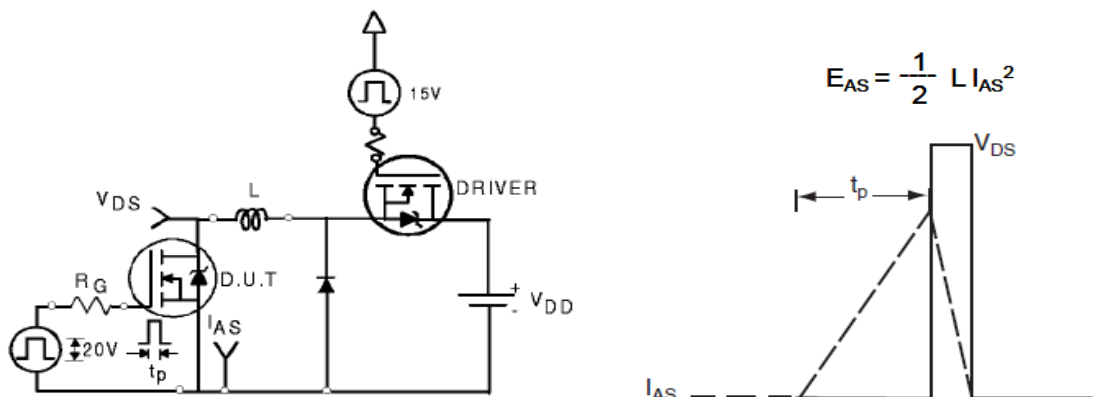
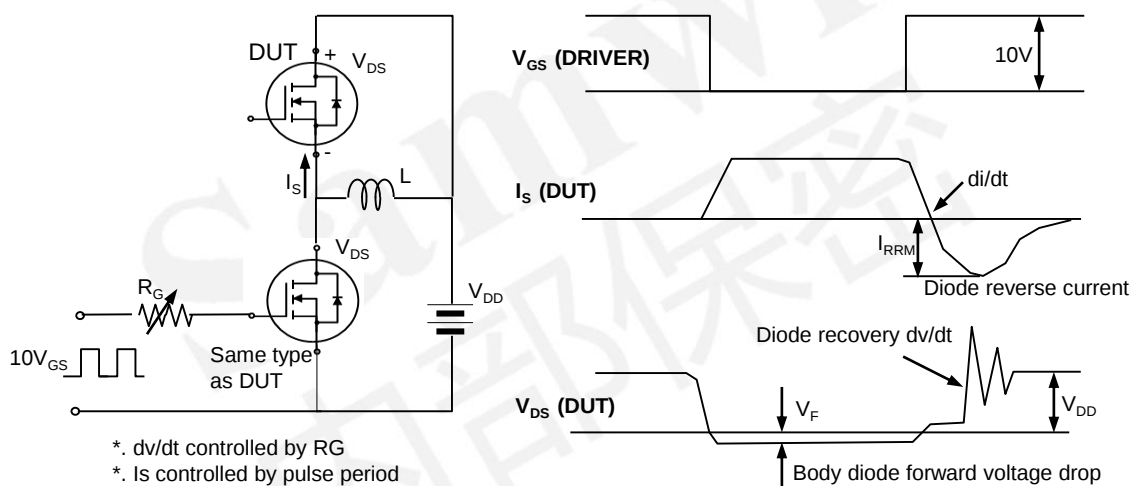


Fig. 16. Peak diode recovery dv/dt test circuit & waveform



DISCLAIMER

- * All the data & curve in this document was tested in 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