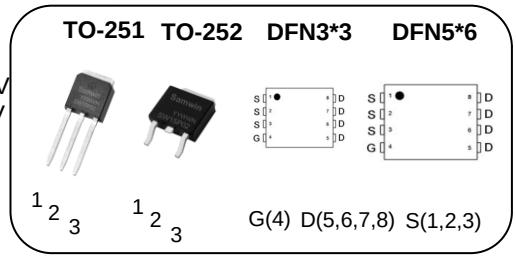
P-channel Enhanced mode TO-251/TO-252/DFN3*3/DFN5*6 MOSFET

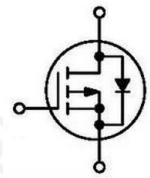
Features

- High ruggedness
- Low $R_{DS(ON)}$ (Typ 9.4mΩ)@V_{GS}=-4.5V
  Low $R_{DS(ON)}$ (Typ 8.1mΩ)@V_{GS}=-10V
- Low Gate Charge (Typ 91nC)
- Improved dv/dt Capability
- 100% Avalanche Tested
- Application: DC-DC Converter, Motor Control



TO251/252:1. Gate 2. Drain 3. Source
DFN3*3&DFN5*6:4.Gate 5,6,7,8.Drain 1,2,3.Source

BV_{DSS} : -20V
I_D : -15A
$R_{DS(ON)}$: 9.4mΩ @V_{GS}=-4.5V
8.1mΩ @V_{GS}=-10V



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 15P02	SW15P02	TO-251	TUBE
2	SW D 15P02	SW15P02	TO-252	REEL
3	SW H 15P02	SW15P02	DFN3*3	REEL
4	SW HA 15P02	SW15P02	DFN5*6	REEL

Absolute maximum ratings

Symbol	Parameter	Value				Unit
		TO-251	TO-252	DFN3*3	DFN5*6	
V_{DSS}	Drain to source voltage	-20				V
I_D	Continuous drain current (@T_C=25°C)	-15*				A
	Continuous drain current (@T_C=100°C)	-9.5*				A
I_{DM}	Drain current pulsed (note 1)	-60				A
V_{GS}	Gate to source voltage	±12				V
dv/dt	Peak diode recovery dv/dt (note 3)	5				V/ns
P_D	Total power dissipation (@T_C=25°C)	69.4	62.5			W
	Total power dissipation (@Ta=25°C)			1.5	3.3	W
	Derating factor above 25°C	0.6	0.5	0.01	0.03	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-251	TO-252	DFN3*3	DFN5*6	
R_{thjc}	Thermal resistance, Junction to case	1.8	2			°C/W
R_{thja}	Thermal resistance, Junction to ambient	62		81	38	°C/W

Note: R_{thja} is the sum of the junction-to-case and case-to-ambient thermal resistance where the case thermal reference is defined as the solder mounting surface of the drain pins. R_{thjc} is guaranteed by design while R_{thca} is determined by the user's board design. DFN3*3 R_{thja} 81°C/W & DFN5*6 R_{thja} 38°C/W on a 1 in^2 pad of 2oz copper.

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	-20			V
ΔBV_{DSS} / ΔT_J	Breakdown voltage temperature coefficient	I_D=-250uA, referenced to 25°C		0.01		V/°C
I_{DSS}	Drain to source leakage current	V_{DS}=-20V, V_{GS}=0V			-1	uA
		V_{DS}=-16V, T_C=125°C			-50	uA
I_{GSS}	Gate to source leakage current, forward	V_{GS}=-12V, V_{DS}=0V			-100	nA
	Gate to source leakage current, reverse	V_{GS}=12V, V_{DS}=0V			100	nA
On characteristics						
$V_{GS(TH)}$	Gate threshold voltage	V_{DS}=V_{GS}, I_D=-250uA	-0.5		-0.8	V
$R_{DS(ON)}$	Drain to source on state resistance	V_{GS}=-2.5V, I_D=-6A		12	15	mΩ
		V_{GS}=-4.5V, I_D=-7.5A		9.4	12	mΩ
		V_{GS}=-10V, I_D=-7.5A		8.1	11	mΩ
		V_{GS}=-10V, I_D=-15A		8.5	12	mΩ
G_{fs}	Forward transconductance	V_{DS}=-5V, I_D=-7.5A		48		S
Dynamic characteristics						
C_{iss}	Input capacitance	V_{GS}=0V, V_{DS}=-10V, f=1MHz		4410		pF
C_{oss}	Output capacitance			490		
C_{rss}	Reverse transfer capacitance			334		
$t_{d(on)}$	Turn on delay time	V_{DS}=-10V, I_D=-15A, R_G=25Ω, V_{GS}=-10V (note 4,5)		5		ns
t_r	Rising time			67		
$t_{d(off)}$	Turn off delay time			530		
t_f	Fall time			332		
Q_g	Total gate charge	V_{DS}=-16V, V_{GS}=-10V, I_D=-15A (note 4,5)		91		nC
Q_{gs}	Gate-source charge			6		
Q_{gd}	Gate-drain charge			13		

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			-15	A
I_{SM}	Pulsed source current				-60	A
V_{SD}	Diode forward voltage drop.	I_S=-15A, V_{GS}=0V			-1.4	V
t_{rr}	Reverse recovery time	I_S=-15A, V_{GS}=0V, dI_F/dt=100A/us		9		ns
Q_{rr}	Reverse recovery charge			0.8		nC

※. Notes

1. Repeatitive rating : pulse width limited by junction temperature.
2. I_{SD} ≤-15A, di/dt = 100A/us, V_{DD} ≤ BV_{DSS}, Staring T_J =25°C
3. Pulse Test : Pulse Width ≤ 300us, duty cycle ≤ 2%
4. Essentially independent of operating temperature.

Fig. 1. On-state characteristics

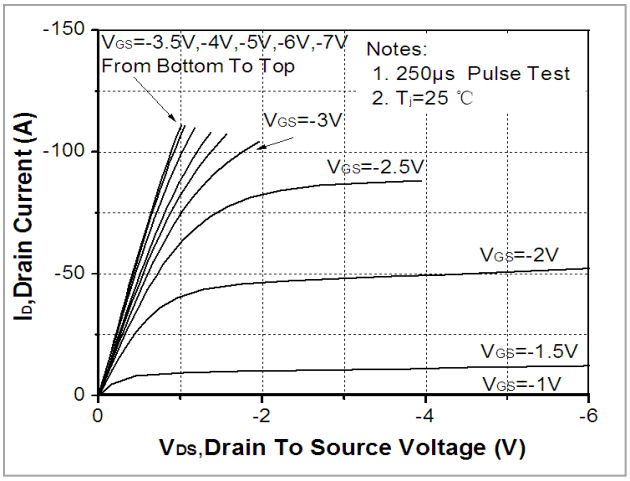


Fig. 2. Transfer characteristics

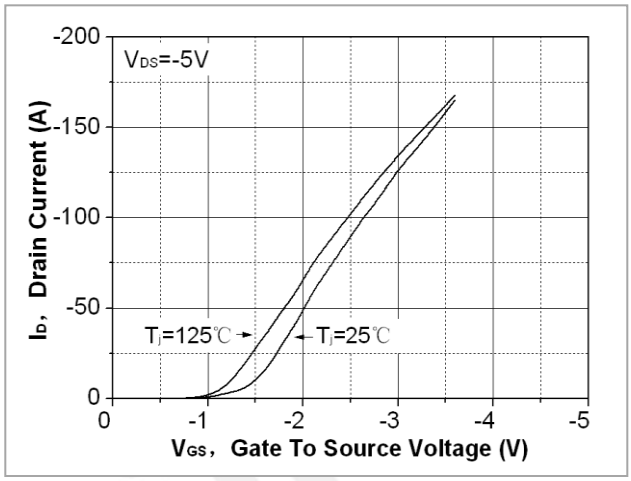


Fig. 3. On-resistance variation vs. drain current and gate voltage

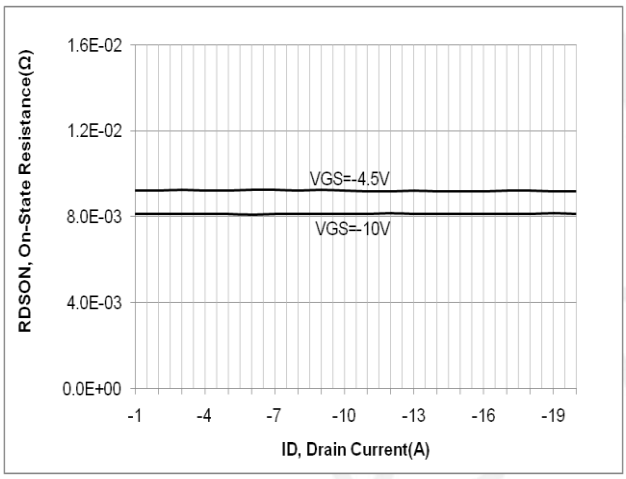


Fig. 4. On state current vs. diode forward voltage

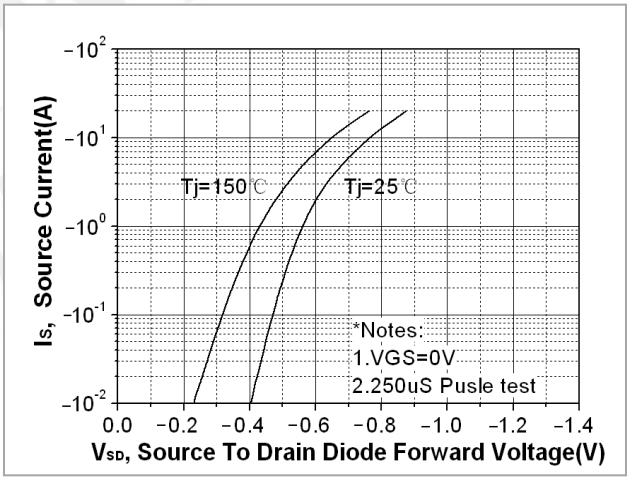


Fig 5. Breakdown Voltage Variation vs. Junction Temperature

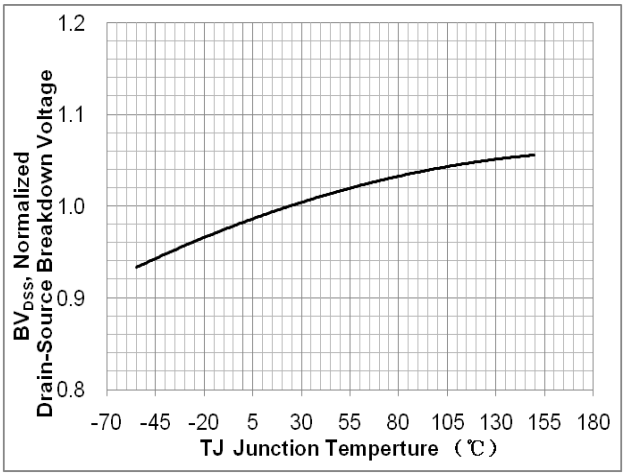


Fig. 6. On resistance variation vs. junction temperature

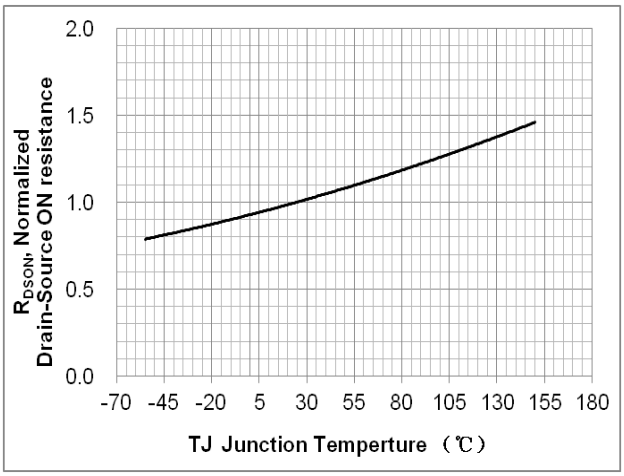


Fig. 7. Gate charge characteristics

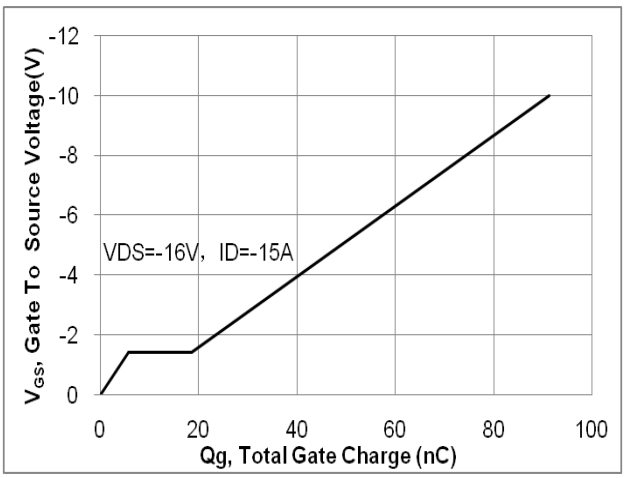


Fig. 8. Capacitance Characteristics

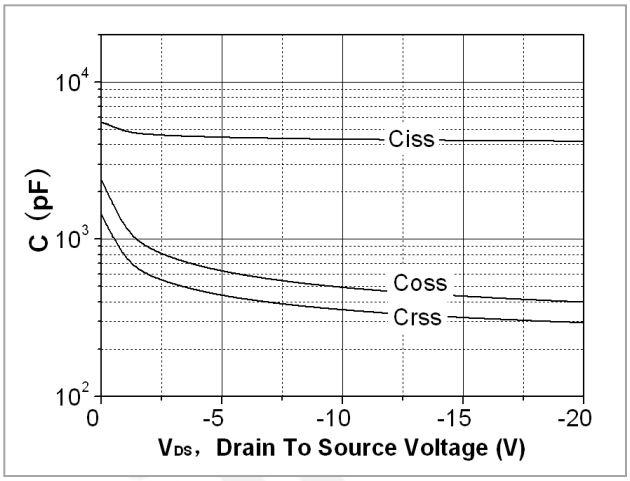


Fig. 9. Maximum safe operating area(TO-251)

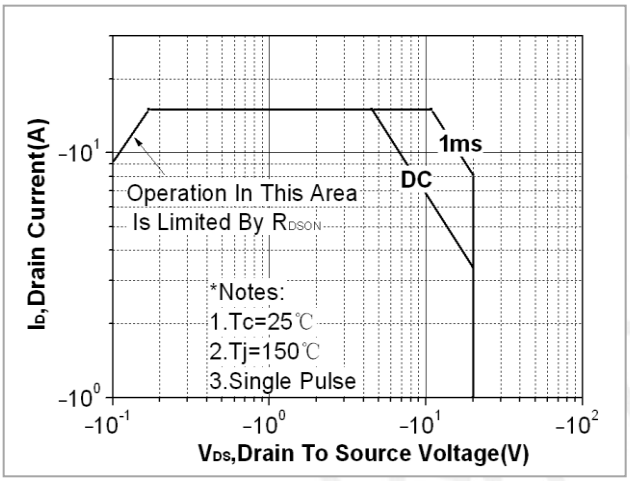


Fig. 10 . Maximum safe operating area(TO-252)

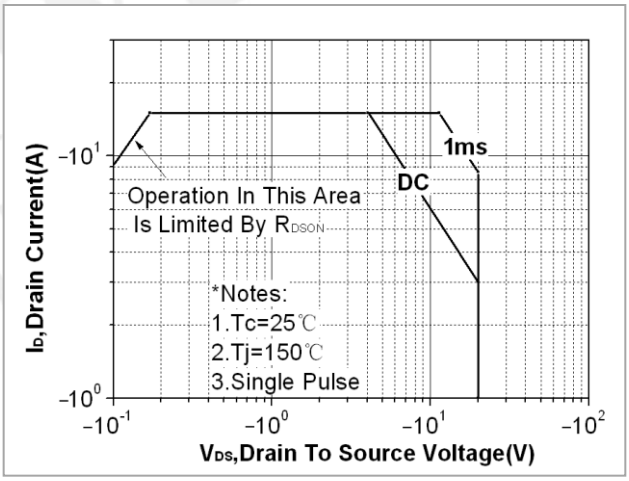


Fig. 11 . Maximum safe operating area(DFN3*3)

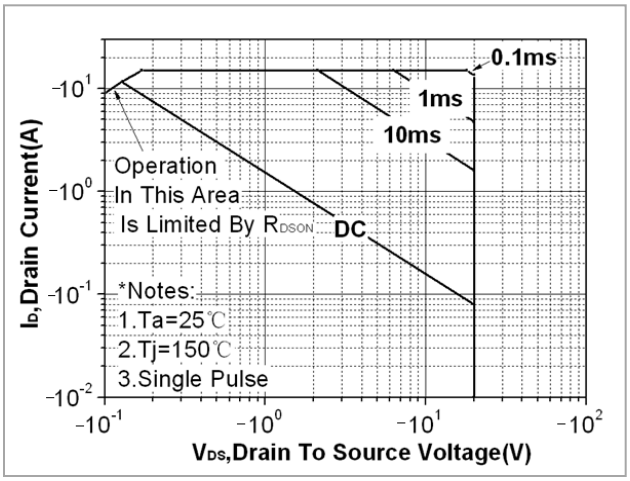


Fig. 12 . Maximum safe operating area(DFN5*6)

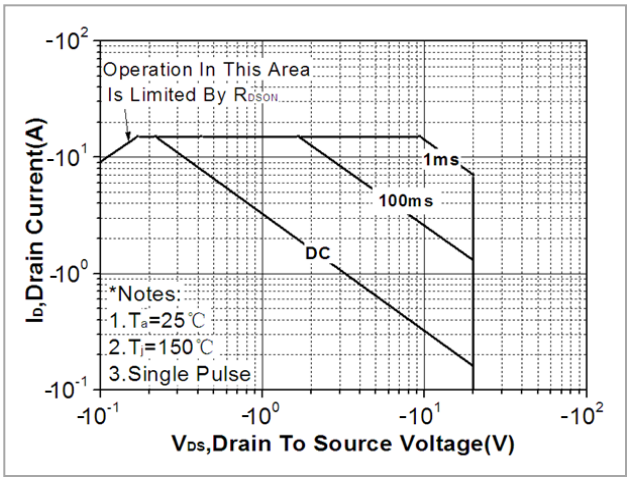


Fig. 13. Transient thermal response curve(TO-251)

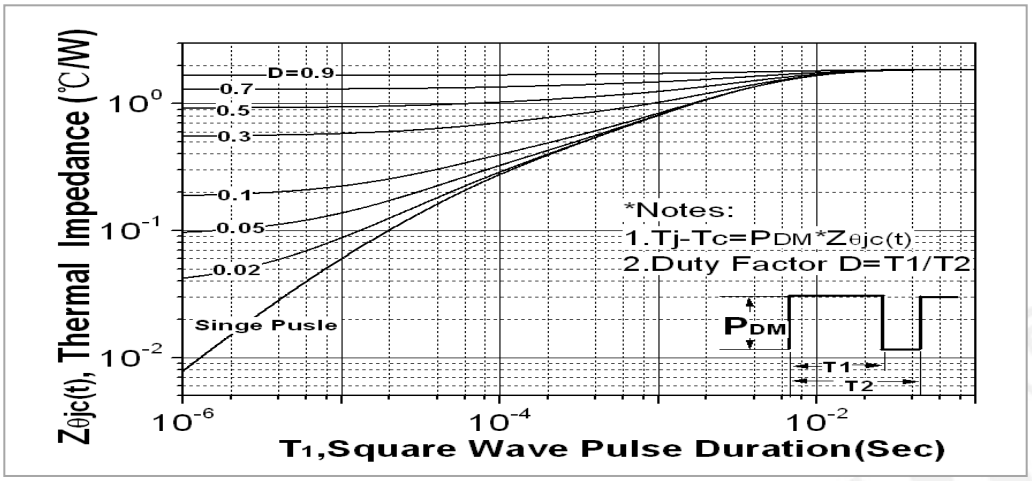


Fig. 14. Transient thermal response curve(TO-252)

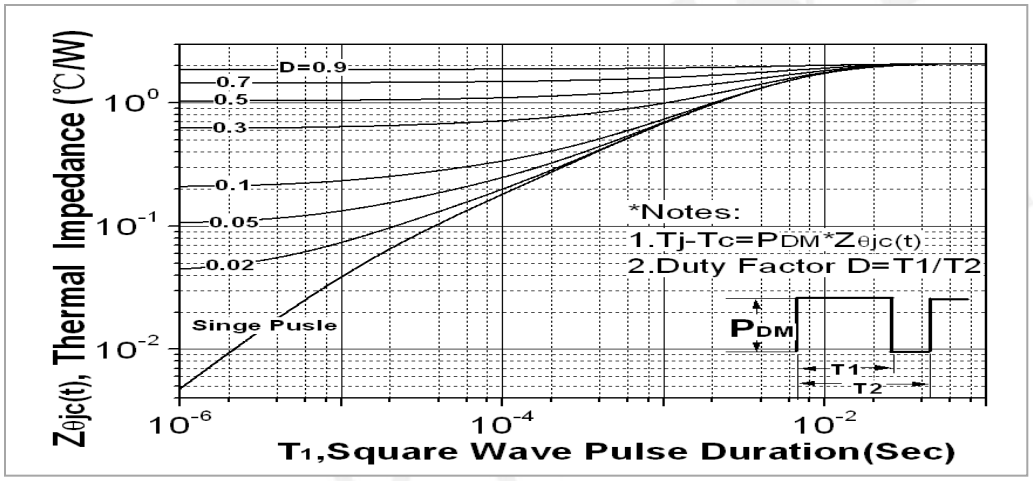


Fig. 15. Transient thermal response curve(DFN3*3)

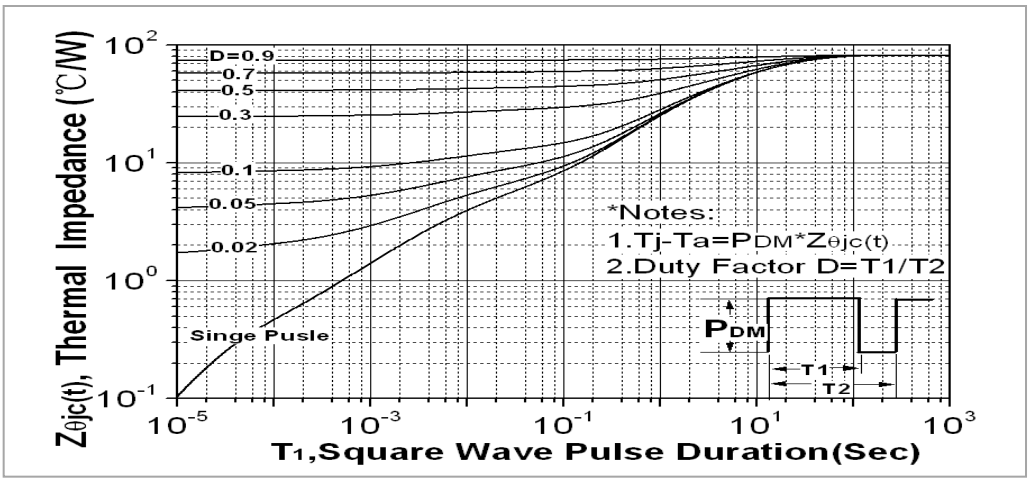


Fig. 16. Transient thermal response curve(DFN5*6)

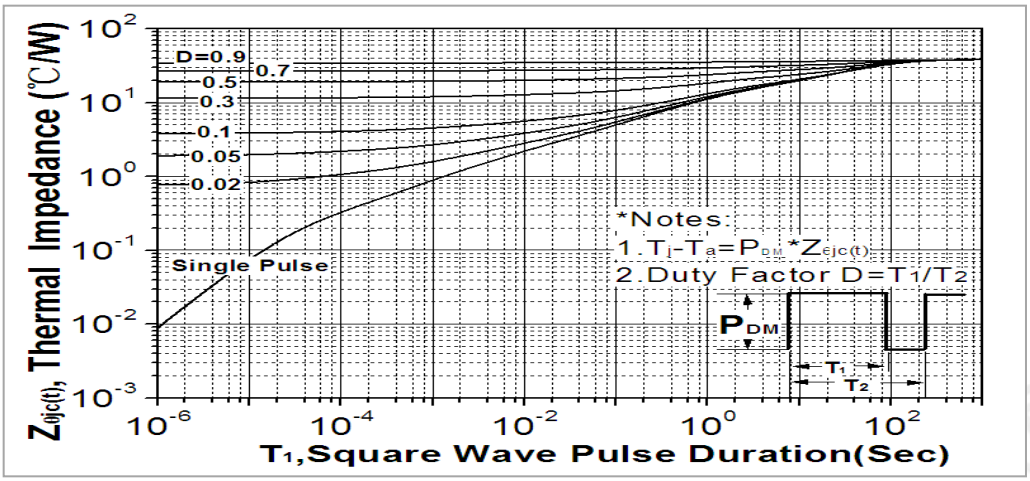


Fig. 17. Gate charge test circuit & waveform

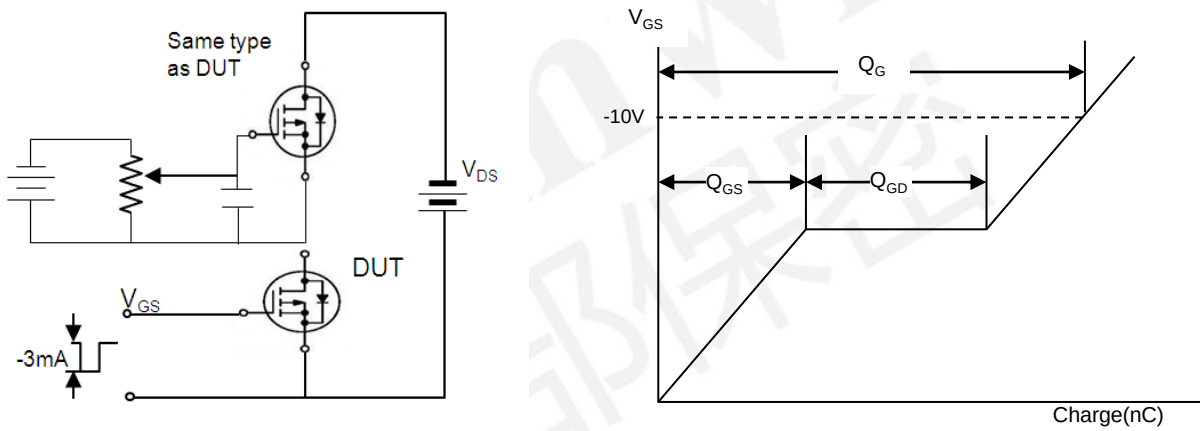


Fig. 18. Switching time test circuit & waveform

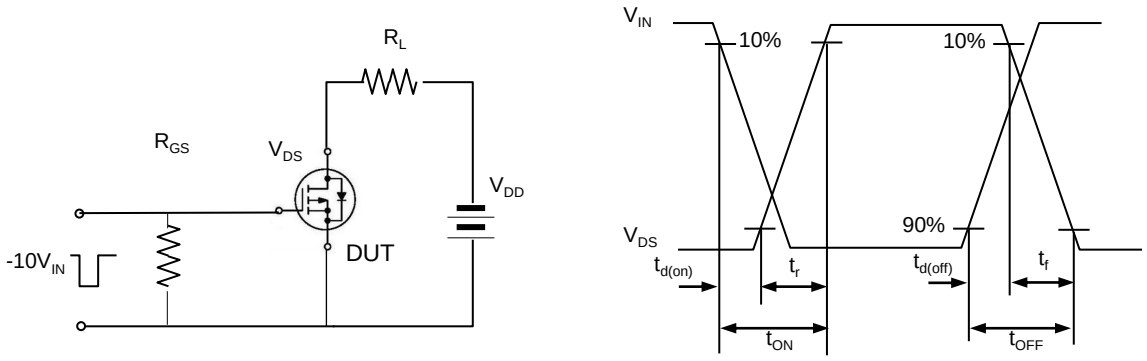


Fig. 19. Unclamped Inductive switching test circuit & waveform

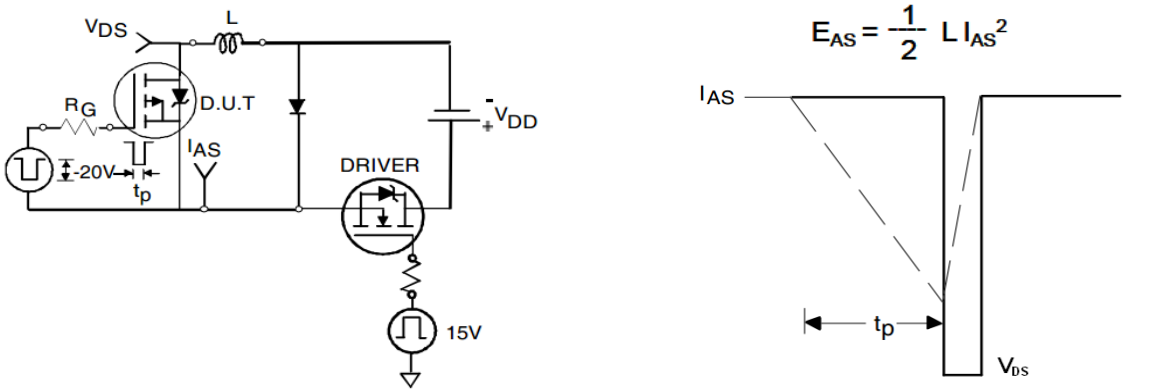
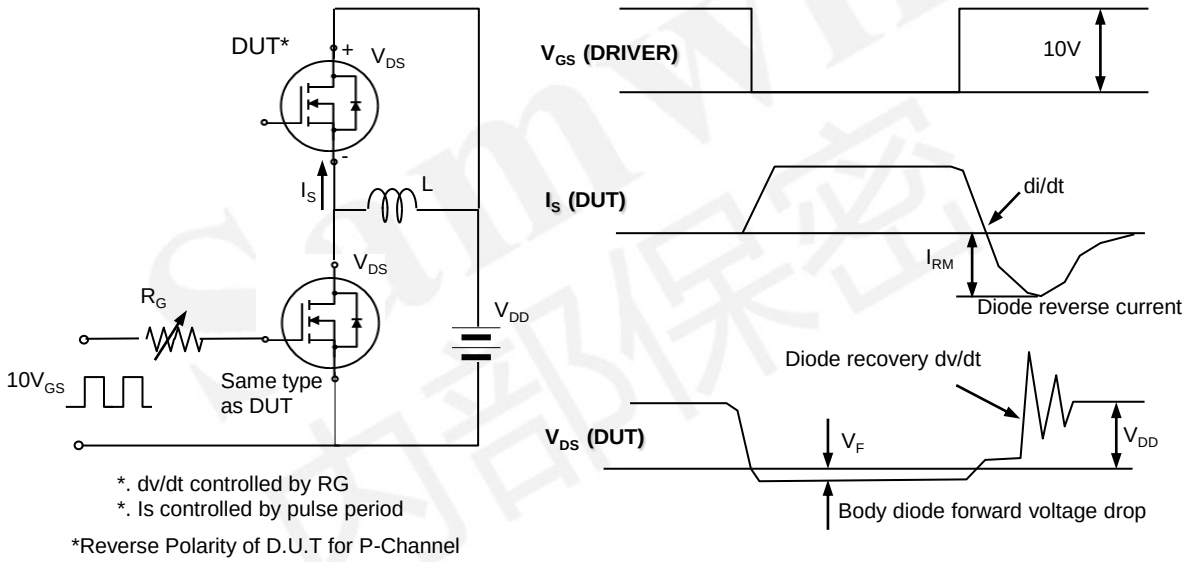


Fig. 20. Peak diode recovery dv/dt test circuit & waveform



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**