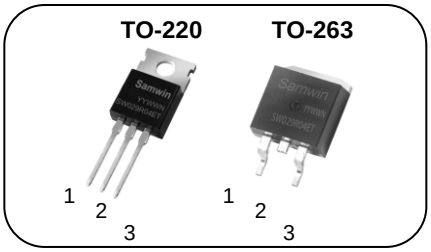
N-channel Enhanced mode TO-220/TO-263 MOSFET

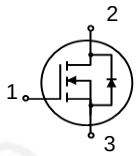
Features

- High ruggedness
- Low $R_{DS(ON)}$ (Typ 2.5mΩ)@V_{GS}=10V
- Low Gate Charge (Typ 151nC)
- Improved dv/dt Capability
- 100% Avalanche Tested
- Application:DC-DC Converter,Motor Control Synchronous Rectification



1. Gate 2. Drain 3. Source

BV_{DSS} : 40V
I_D : 120A
$R_{DS(ON)}$:2.5mΩ



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 P 029R04ET	SW029R04ET	TO-220	TUBE
2	SW B 029R04ET	SW029R04ET	TO-263	TUBE

Absolute maximum ratings

Symbol	Parameter		Value		Unit
			TO-220	TO-263	
V_{DSS}	Drain to source voltage		40		V
I_D	Continuous drain current (@T_C=25°C)		120*		A
	Continuous drain current (@T_C=100°C)		76*		A
I_{DM}	Drain current pulsed	(note 1)	480		A
V_{GS}	Gate to source voltage		±20		V
E_{AS}	Single pulsed avalanche energy	(note 2)	2309		mJ
E_{AR}	Repetitive avalanche energy	(note 1)	77		mJ
dv/dt	Peak diode recovery dv/dt	(note 3)	5		V/ns
P_D	Total power dissipation (@T_C=25°C)		298	250	W
	Derating factor above 25°C		2.4	2.0	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-220	TO-263	
R_{thjc}	Thermal resistance, Junction to case	0.42	0.50	°C/W
R_{thja}	Thermal resistance, Junction to ambient	53		°C/W

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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	40			V
ΔBV_{DSS} / ΔT_J	Breakdown voltage temperature coefficient	I_D=250uA, referenced to 25°C		0.03		V/°C
I_{DSS}	Drain to source leakage current	V_{DS}=40V, V_{GS}=0V			1	uA
		V_{DS}=32V, T_C=125°C			50	uA
I_{GSS}	Gate to source leakage current, forward	V_{GS}=20V, V_{DS}=0V			100	nA
	Gate to source leakage current, reverse	V_{GS}=-20V, V_{DS}=0V			-100	nA
On characteristics						
$V_{GS(TH)}$	Gate threshold voltage	V_{DS}=V_{GS}, I_D=250uA	2		4	V
$R_{DS(ON)}$	Drain to source on state resistance	V_{GS}=10V, I_D=60A		2.5	3.1	mΩ
		V_{GS}=10V, I_D=120A		2.6	3.2	mΩ
G_{fs}	Forward transconductance	V_{DS}=5V, I_D=60A		145		S
Dynamic characteristics						
C_{iss}	Input capacitance	V_{GS}=0V, V_{DS}=20V, f=1MHz		6390		pF
C_{oss}	Output capacitance			1630		
C_{rss}	Reverse transfer capacitance			1320		
$t_{d(on)}$	Turn on delay time	V_{DS}=20V, I_D=30A, R_G=25Ω, V_{GS}=10V (note 4,5)		74		ns
t_r	Rising time			257		
$t_{d(off)}$	Turn off delay time			263		
t_f	Fall time			286		
Q_g	Total gate charge	V_{DS}=32V,V_{GS}=10V,I_D=30A, Ig=4mA (note 4,5)		151		nC
Q_{gs}	Gate-source charge			26		
Q_{gd}	Gate-drain charge			71		
R_g	Gate resistance	V_{DS}=0V, Scan F mode		1.2		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			120	A
I_{SM}	Pulsed source current				480	A
V_{SD}	Diode forward voltage drop.	I_S=120A, V_{GS}=0V			1.4	V
t_{rr}	Reverse recovery time	I_S=30A, V_{GS}=0V, dI_F/dt=100A/us		45		ns
Q_{rr}	Reverse recovery charge			36		nC

※. Notes

1. Repeatitive rating : pulse width limited by junction temperature.
2. L =5.13mH, I_{AS} =30A, V_{DD}=40V, R_G=25Ω, Starting T_J = 25°C
3. I_{SD} ≤ 30A, 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.

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Fig. 1. On-state characteristics

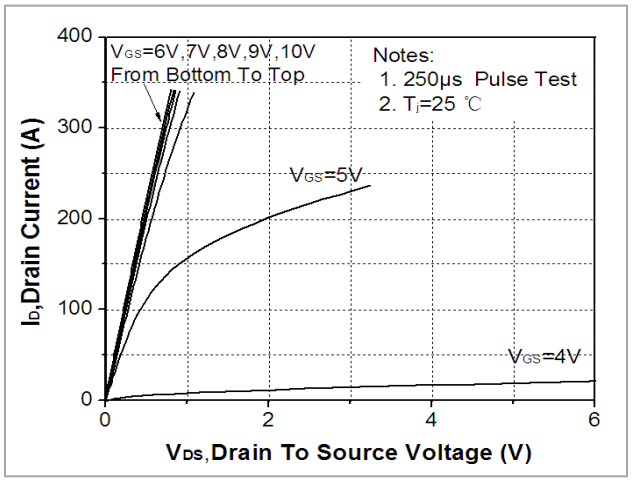


Fig. 2. Transfer characteristics

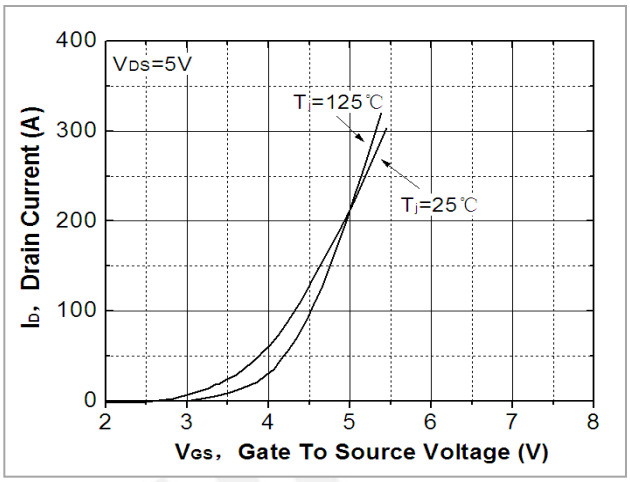


Fig. 3. On-resistance variation vs. drain current and gate voltage

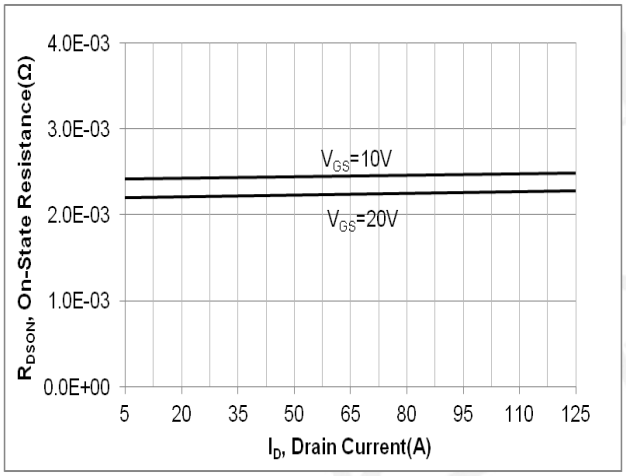


Fig. 4. On-state current vs. diode forward voltage

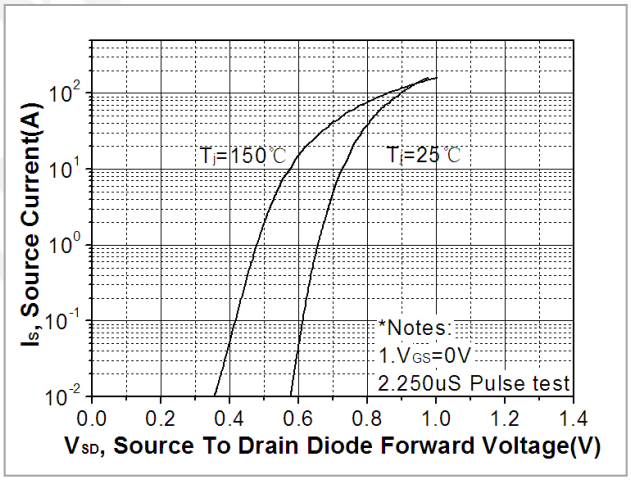


Fig 5. Breakdown voltage variation vs. junction temperature

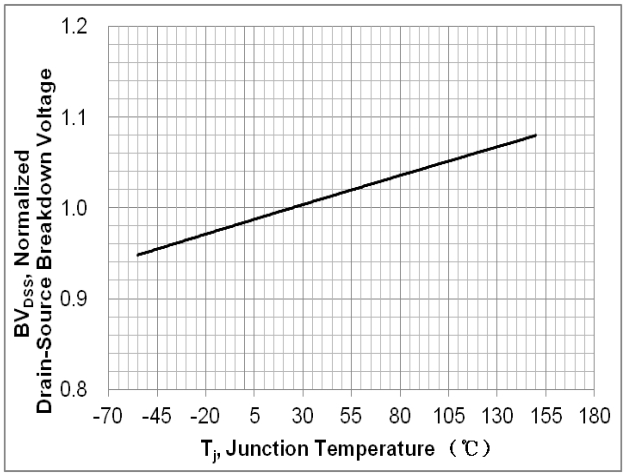
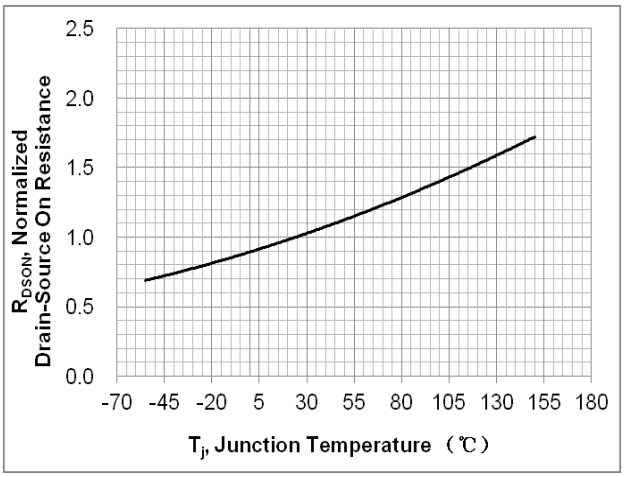


Fig. 6. On-resistance variation vs. junction temperature



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Fig. 7. Gate charge characteristics

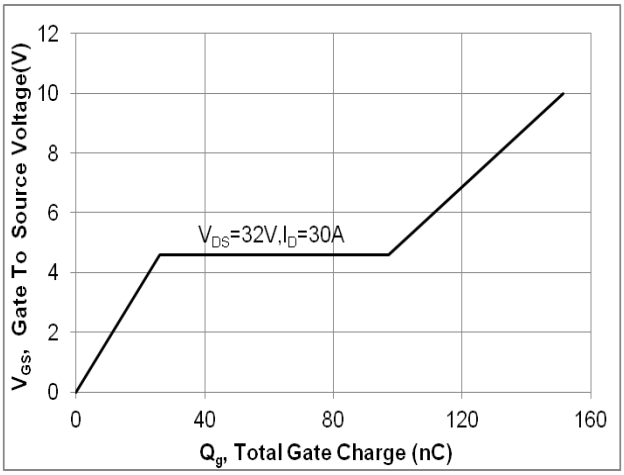


Fig. 8. Capacitance Characteristics

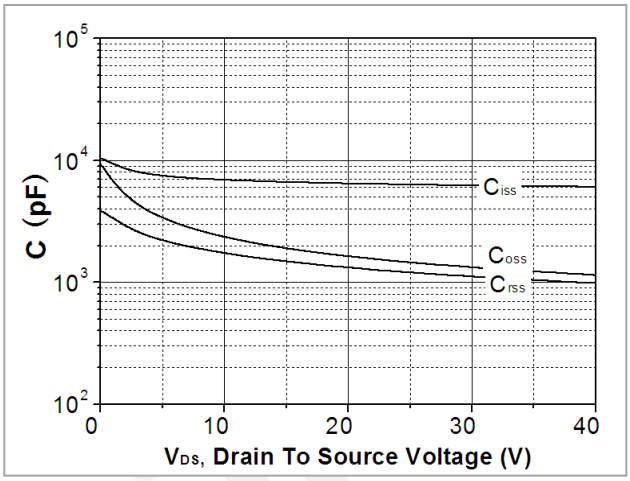


Fig. 9. Maximum safe operating area(TO-220)

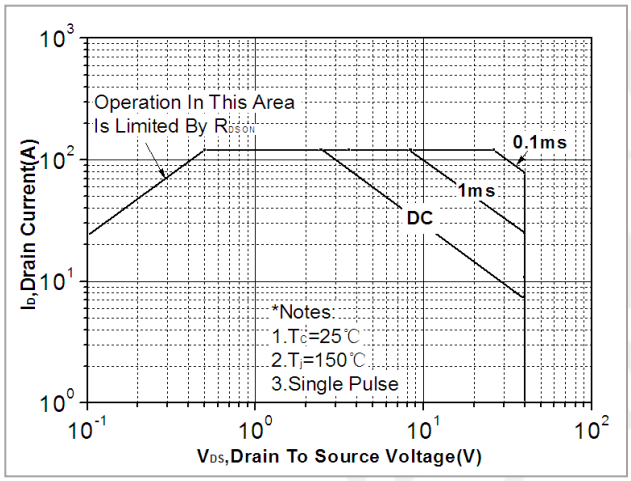


Fig. 10. Maximum safe operating area(TO-263)

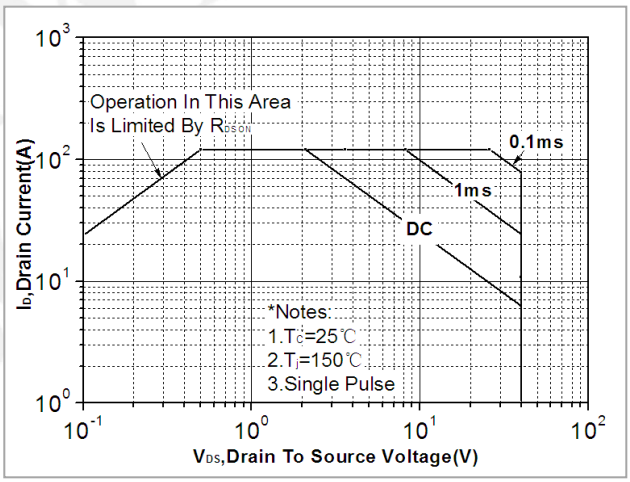
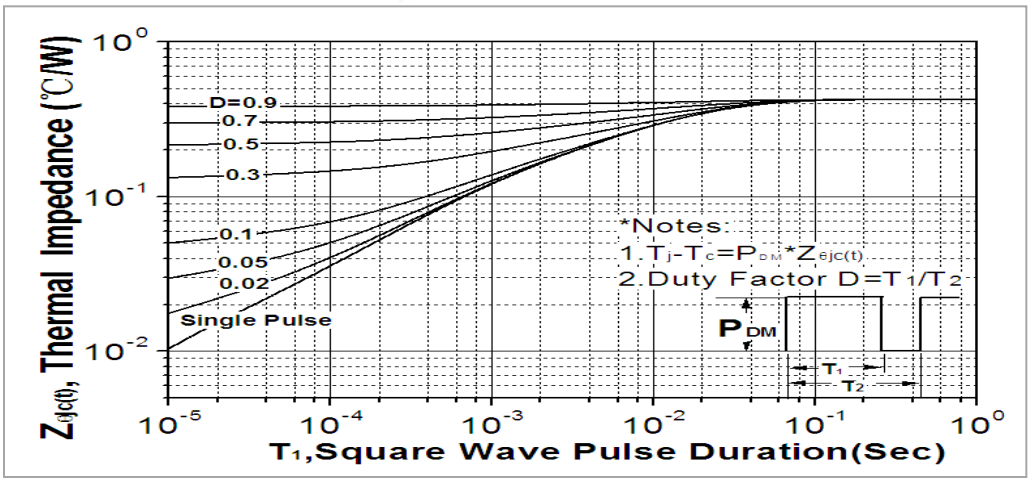


Fig. 11. Transient thermal response curve(TO-220)



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Fig. 12. Transient thermal response curve(TO-263)

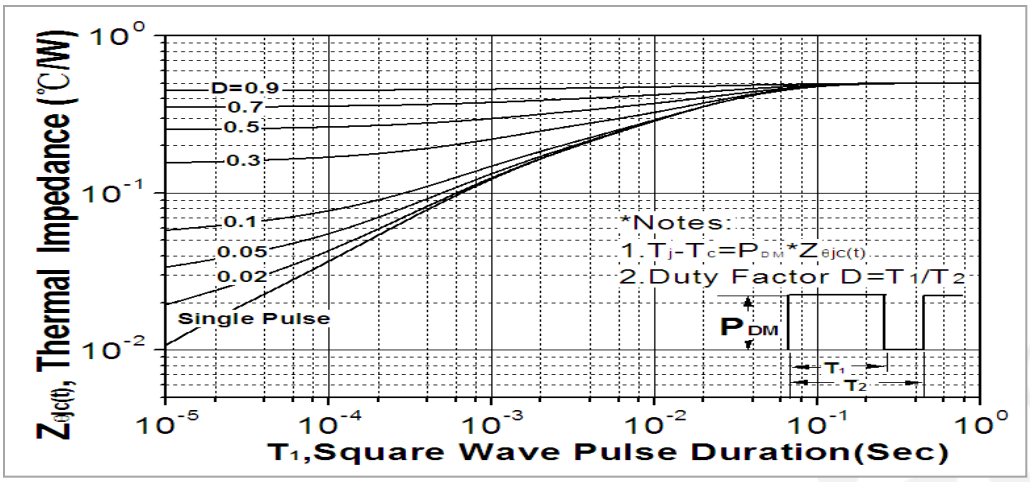


Fig. 13. Gate charge test circuit & waveform

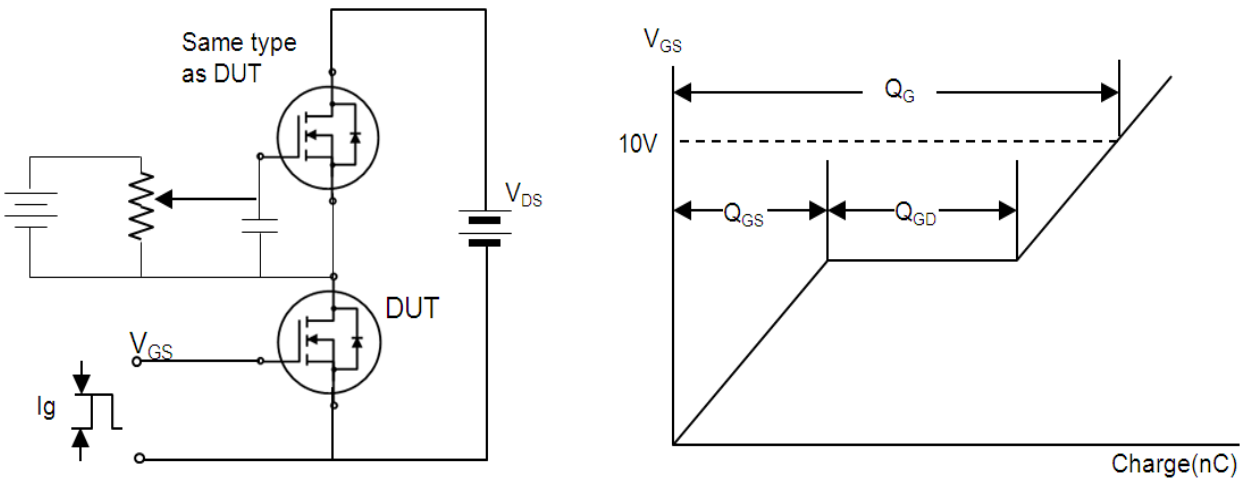
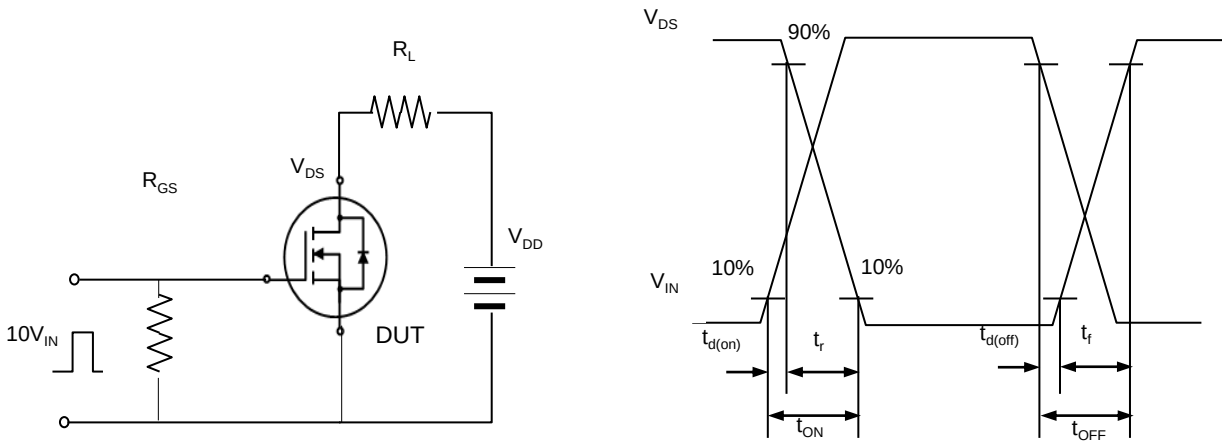


Fig. 14. Switching time test circuit & waveform



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Fig. 15. Unclamped Inductive switching test circuit & waveform

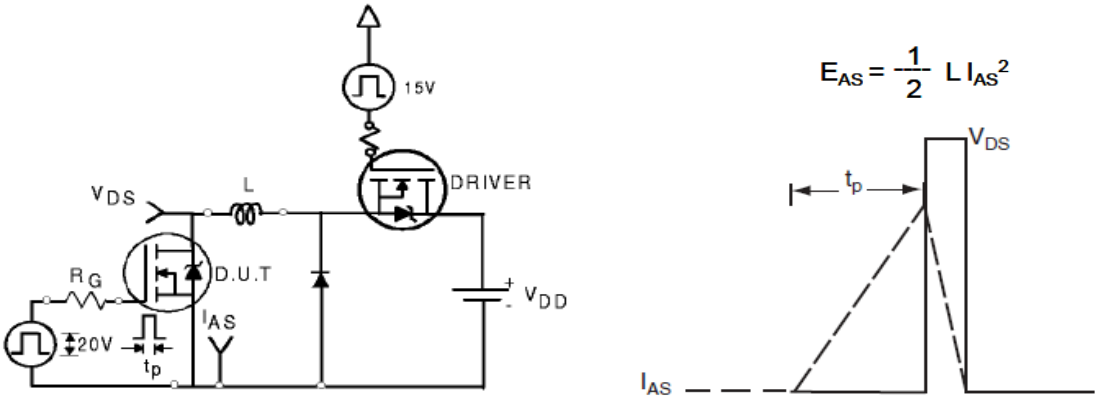
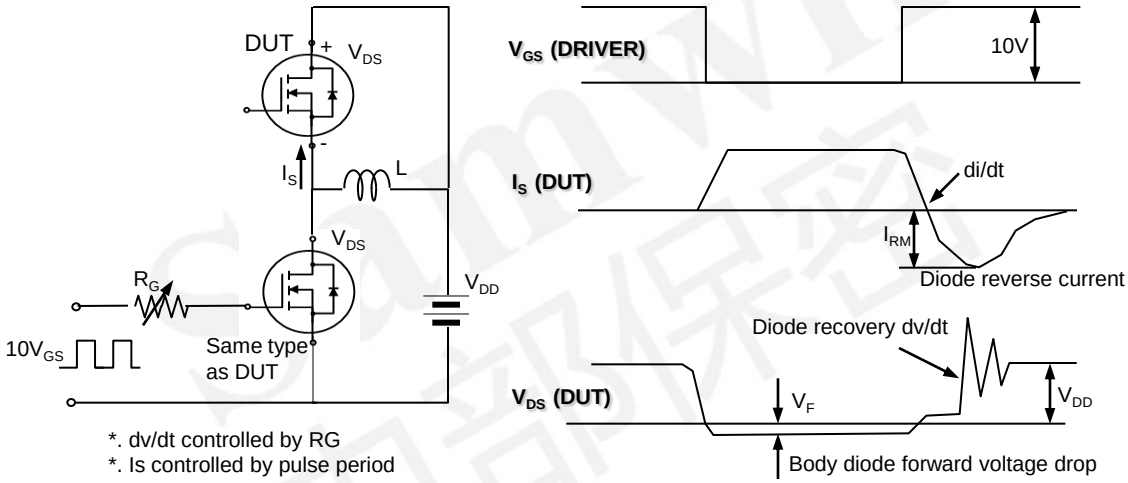


Fig. 16. Peak diode recovery dv/dt test circuit & waveform



DISCLAIMER

* All the data & curve in this document was tested in 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**)
* Suggestions for improvement are appreciated, Please send your suggestions to **samwin@samwinsemi.com**

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