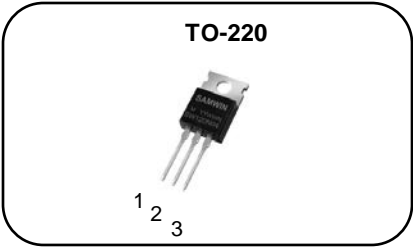


N-channel Enhanced mode TO-220 MOSFET

Features

- High ruggedness
- Low  $R_{DS(ON)}$  (Typ 4mΩ) @  $V_{GS}=10V$
- Low Gate Charge (Typ 57nC)
- Improved dv/dt Capability
- 100% Avalanche Tested
- Application:DC-DC Converter, Motor Control , Synchronous Rectification



1. Gate 2. Drain 3. Source

**BV<sub>DSS</sub> : 40V**  
**I<sub>D</sub> : 120A**  
**R<sub>DS(ON)</sub> :4mΩ**

A schematic symbol for an N-channel MOSFET. It shows a circle with a horizontal line on the left (gate), a vertical line on the right (drain), and a diagonal line on the bottom (source). The pins are labeled 1, 2, and 3.

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 120N04M	SW120N04M	TO-220	TUBE

Absolute maximum ratings

Symbol	Parameter	Value	Unit
$V_{DSS}$	Drain to source voltage	40	V
$I_D$	Continuous drain current (@ $T_C=25^{\circ}C$ )	120*	A
	Continuous drain current (@ $T_C=100^{\circ}C$ )	75.6*	A
$I_{DM}$	Drain current pulsed (note 1)	480	A
$V_{GS}$	Gate to source voltage	$\pm 20$	V
$E_{AS}$	Single pulsed avalanche energy (note 2)	300	mJ
$E_{AR}$	Repetitive avalanche energy (note 1)	66	mJ
dv/dt	Peak diode recovery dv/dt (note 3)	5	V/ns
$P_D$	Total power dissipation (@ $T_C=25^{\circ}C$ )	138.7	W
	Derating factor above 25°C	1.1	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
$R_{thjc}$	Thermal resistance, Junction to case	0.9	°C/W
$R_{thja}$	Thermal resistance, Junction to ambient	49	°C/W

Electrical characteristic (  $T_C = 25^\circ\text{C}$  unless otherwise specified )

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
<b>Off characteristics</b>						
$BV_{DSS}$	Drain to source breakdown voltage	$V_{GS}=0V, I_D=250\mu A$	40			V
$\Delta BV_{DSS} / \Delta T_J$	Breakdown voltage temperature coefficient	$I_D=250\mu A$ , referenced to $25^\circ\text{C}$		0.04		$V/^\circ\text{C}$
$I_{DSS}$	Drain to source leakage current	$V_{DS}=40V, V_{GS}=0V$			1	$\mu A$
		$V_{DS}=32V, T_C=125^\circ\text{C}$			50	$\mu A$
$I_{GSS}$	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
<b>On characteristics</b>						
$V_{GS(TH)}$	Gate threshold voltage	$V_{DS}=V_{GS}, I_D=250\mu A$	1		3	V
$R_{DS(ON)}$	Drain to source on state resistance	$V_{GS}=10V, I_D=70A$		4	5	$m\Omega$
$G_{fs}$	Forward transconductance	$V_{DS}=8V, I_D=30A$		100		S
<b>Dynamic characteristics</b>						
$C_{iss}$	Input capacitance	$V_{GS}=0V, V_{DS}=25V, f=1\text{MHz}$		2945		pF
$C_{oss}$	Output capacitance			462		
$C_{rss}$	Reverse transfer capacitance			201		
$t_{d(on)}$	Turn on delay time	$V_{DS}=20V, I_D=25A,$ $V_{GS}=10V, R_G=25\Omega$ (note 4,5)		15		ns
$t_r$	Rising time			76		
$t_{d(off)}$	Turn off delay time			156		
$t_f$	Fall time			83		
$Q_g$	Total gate charge	$V_{DS}=35V, V_{GS}=10V, I_D=25A$ (note 4,5)		57		nC
$Q_{gs}$	Gate-source charge			12		
$Q_{gd}$	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			120	A
$I_{SM}$	Pulsed source current				480	A
$V_{SD}$	Diode forward voltage drop.	$I_S=70A, V_{GS}=0V$			1.4	V
$t_{rr}$	Reverse recovery time	$I_S=25A, V_{GS}=0V,$ $di_f/dt=100A/\mu s$		10		ns
$Q_{rr}$	Reverse recovery charge			3		nC

※. Notes

1. Repeattive rating : pulse width limited by junction temperature.
2.  $L = 0.7mH, I_{AS} = 30A, V_{DD} = 30V, R_G = 25\Omega$ , Starting  $T_J = 25^\circ\text{C}$
3.  $I_{SD} \leq 25A, di/dt = 100A/\mu s, V_{DD} \leq BV_{DSS}$ , Starting  $T_J = 25^\circ\text{C}$
4. Pulse Test : Pulse Width  $\leq 300\mu s$ , duty cycle  $\leq 2\%$ .
5. Essentially independent of operating temperature.

Fig. 1. On-state characteristics

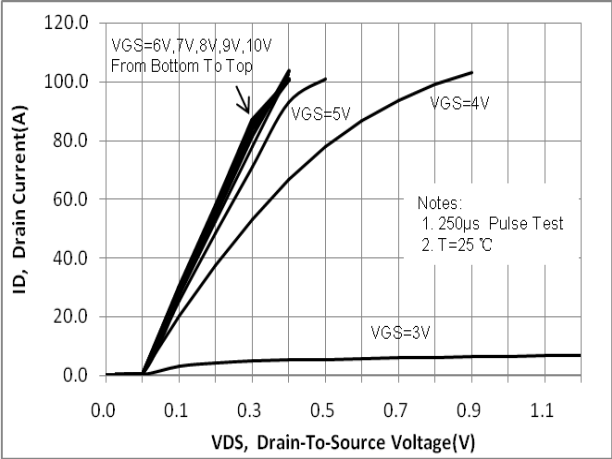


Fig. 2. On-resistance variation vs. drain current and gate voltage

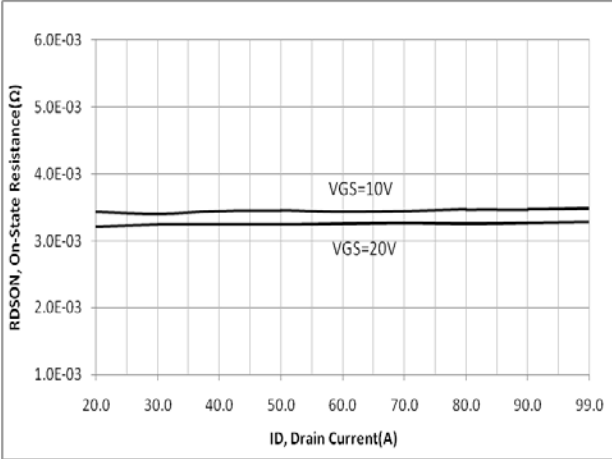


Fig. 3. Gate charge characteristics

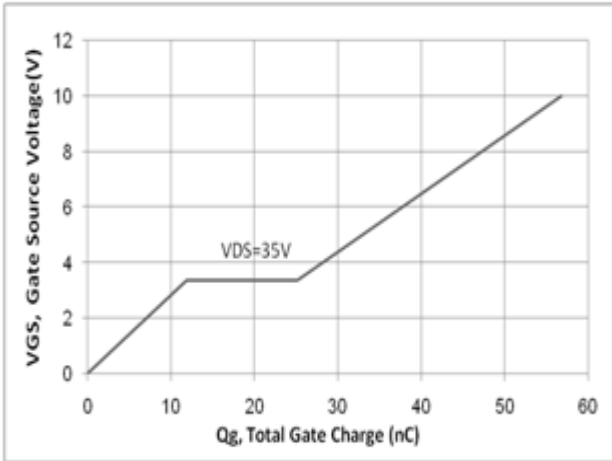


Fig. 4. On state current vs. diode forward voltage

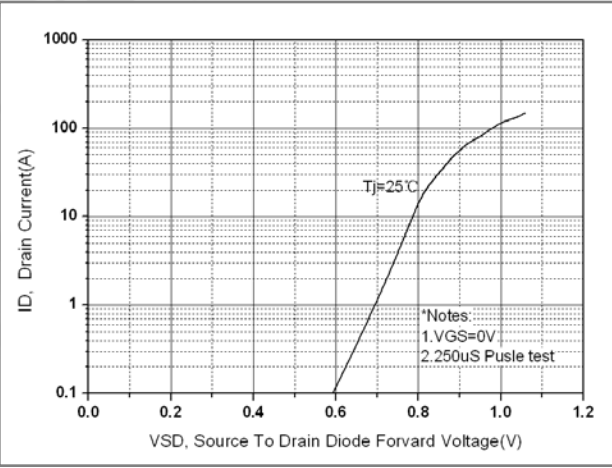


Fig 5. Breakdown Voltage Variation vs. Junction Temperature

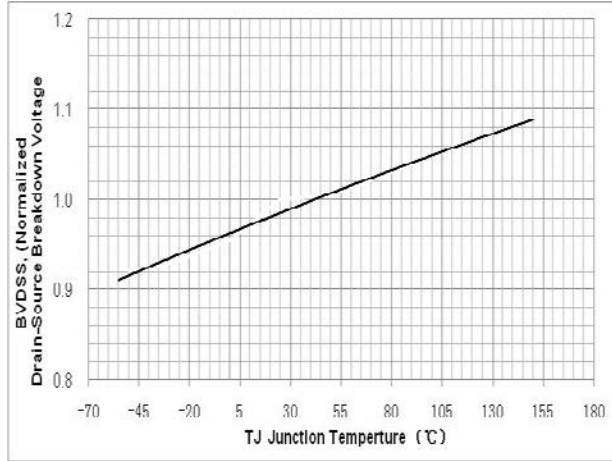


Fig. 6. On resistance variation vs. junction temperature

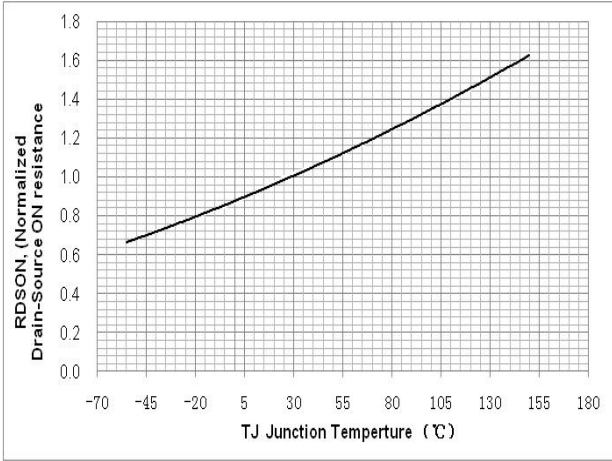


Fig. 7. Maximum safe operating area

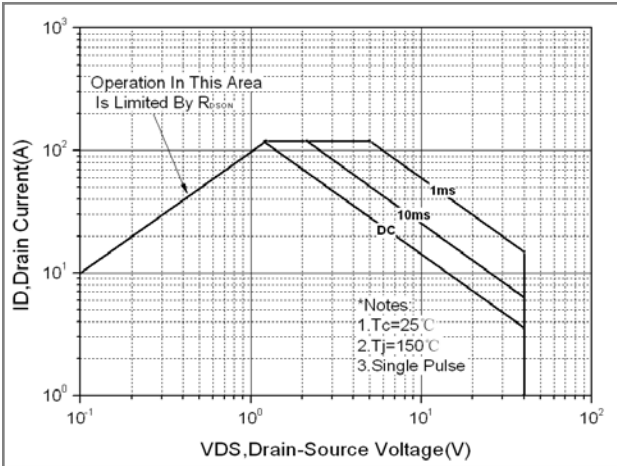


Fig. 8. Capacitance Characteristics

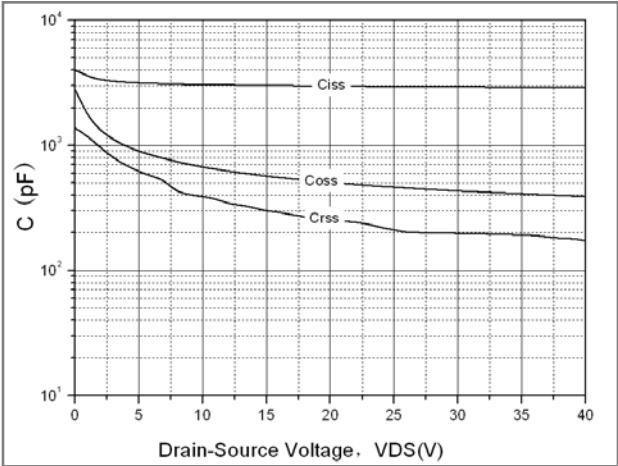


Fig. 9. Transient thermal response curve

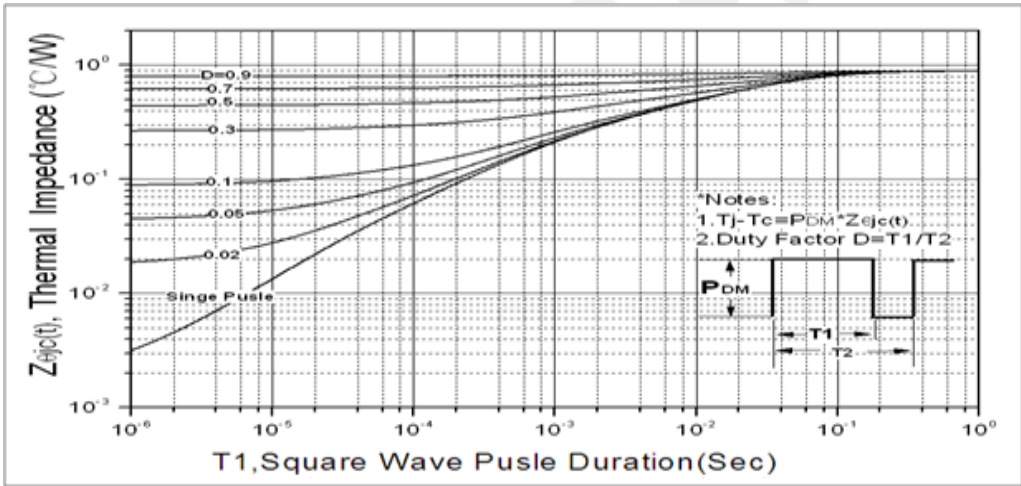


Fig. 10. Gate charge test circuit & waveform

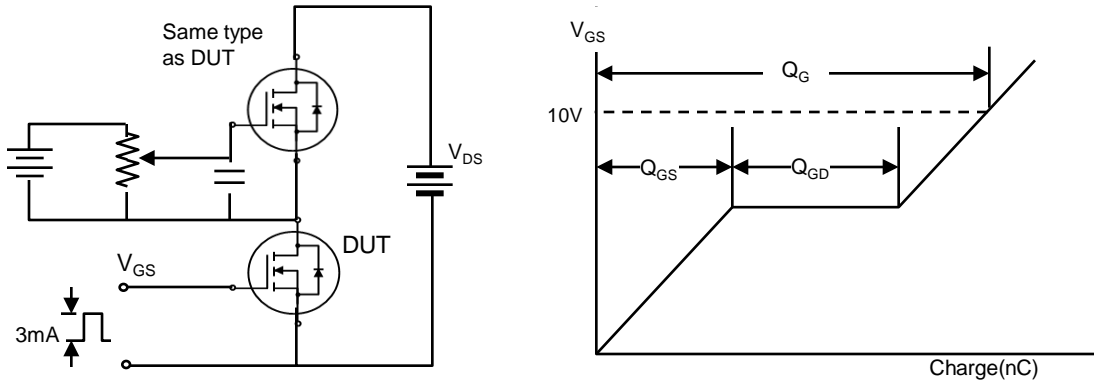


Fig. 11. Switching time test circuit & waveform

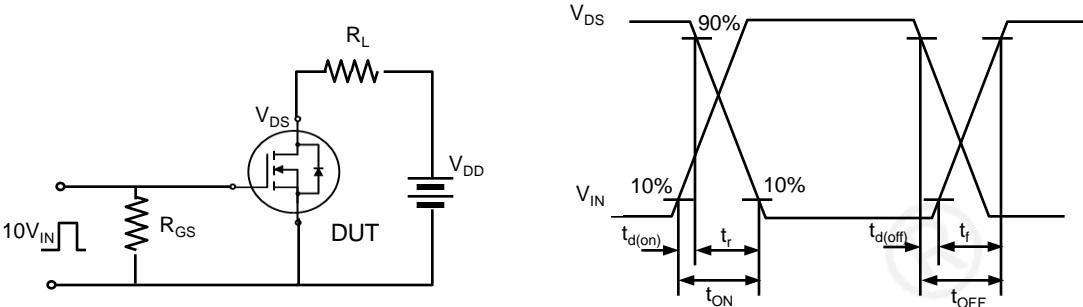


Fig. 12. Unclamped Inductive switching test circuit & waveform

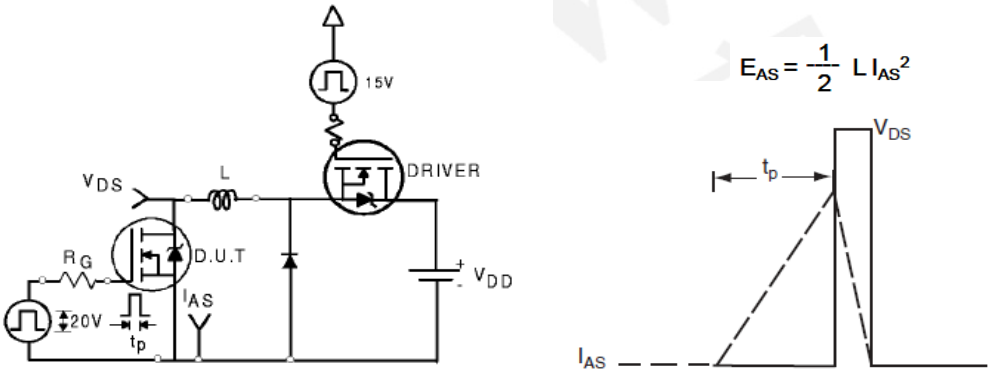
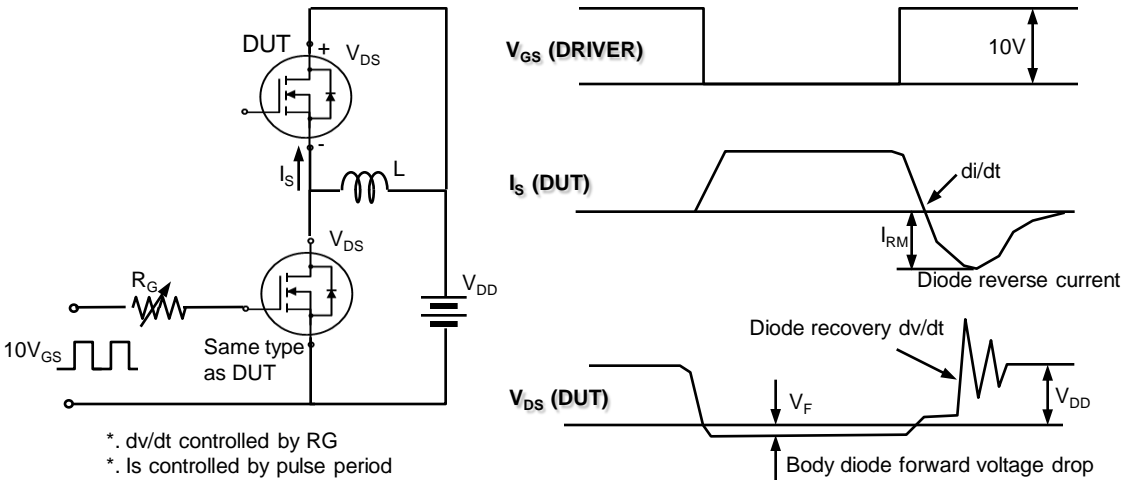



Fig. 13. Peak diode recovery dv/dt test circuit & waveform



Samwin®  
内部保密

### 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](mailto:samwin@samwinsemi.com)