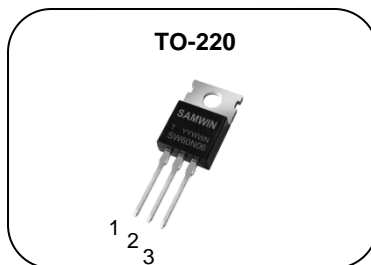


## N-channel TO-220 MOSFET

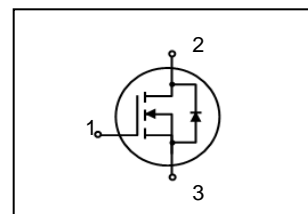
### Features

- High ruggedness
- $R_{DS(ON)}$  (Max8m $\Omega$ ) @  $V_{GS}=10V$
- Gate Charge (Typical 77nC)
- Improved dv/dt Capability
- 100% Avalanche Tested



1. Gate 2. Drain 3. Source

$BV_{DSS}$  : 60V  
 $I_D$  : 60A  
 $R_{DS(ON)}$  : 8m $\Omega$



### General Description

This power MOSFET is produced with advanced VDMOS 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. This power MOSFET is usually used at high efficient DC to DC converter block and switch mode power supply.

### Order Codes

Item	Sales Type	Marking	Package	Packaging
1	SW P 60N06	SW60N06T	TO-220	TUBE

### Absolute maximum ratings

Symbol	Parameter	Value	Unit
$V_{DSS}$	Drain to Source Voltage	60	V
$I_D$	Continuous Drain Current (@ $T_C=25^\circ C$ )	60*	A
	Continuous Drain Current (@ $T_C=100^\circ C$ )	37.8*	A
$I_{DM}$	Drain current pulsed (note 1)	240	A
$V_{GS}$	Gate to Source Voltage	$\pm 20$	V
$E_{AS}$	Single pulsed Avalanche Energy (note 2)	350	mJ
$E_{AR}$	Repetitive Avalanche Energy (note 1)	67	mJ
dv/dt	Peak diode Recovery dv/dt (note 3)	5	V/ns
$P_D$	Total power dissipation (@ $T_C=25^\circ C$ )	141	W
	Derating Factor above 25 $^\circ C$	1.1	W/ $^\circ C$
$T_{STG}, T_J$	Operating Junction Temperature & Storage Temperature	-55 ~ + 150	$^\circ C$
$T_L$	Maximum Lead Temperature for soldering purpose, 1/8 from Case for 5 seconds.	300	$^\circ C$

\*. Drain current is limited by junction temperature.

### Thermal characteristics

Symbol	Parameter	Value	Unit
$R_{thjc}$	Thermal resistance, Junction to case	0.88	$^\circ C/W$
$R_{thcs}$	Thermal resistance, Case to Sink		$^\circ C/W$
$R_{thja}$	Thermal resistance, Junction to ambient	53.1	$^\circ C/W$

## 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	$V_{GS}=0V, I_D=250\mu A$	60			V
$\Delta BV_{DSS} / \Delta T_J$	Breakdown voltage temperature coefficient	$I_D=250\mu A$ , referenced to $25^\circ\text{C}$		0.05		$V/^\circ\text{C}$
$I_{DSS}$	Drain to source leakage current	$V_{DS}=60V, V_{GS}=0V$			1	$\mu A$
		$V_{DS}=48V, T_C=125^\circ\text{C}$			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	$V_{DS}=V_{GS}, I_D=250\mu A$	2		4	V
$R_{DS(ON)}$	Drain to source on state resistance	$V_{GS}=10V, I_D=30A$		6.8	8	$m\Omega$
$G_{fs}$	Forward Transconductance	$V_{DS}=10V, I_D=15A$		55		S
<b>Dynamic characteristics</b>						
$C_{iss}$	Input capacitance	$V_{GS}=0V, V_{DS}=25V, f=1\text{MHz}$		3960		pF
$C_{oss}$	Output capacitance			335		
$C_{riss}$	Reverse transfer capacitance			270		
$t_{d(on)}$	Turn on delay time	$V_{DS}=30V, I_D=60A, R_G=25\Omega$ (note 4, 5)		37		ns
$t_r$	Rising time			98		
$t_{d(off)}$	Turn off delay time			127		
$t_f$	Fall time			92		
$Q_g$	Total gate charge	$V_{DS}=50V, V_{GS}=10V, I_D=60A$ (note 4, 5)		77		nC
$Q_{gs}$	Gate-source charge			14		
$Q_{gd}$	Gate-drain charge			35		

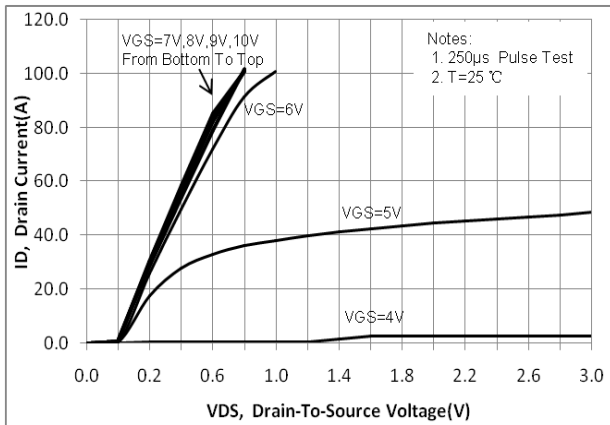
## Source to drain diode ratings characteristics

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$I_S$	Continuous source current	Integral reverse p-n Junction diode in the MOSFET			60	A
$I_{SM}$	Pulsed source current				240	A
$V_{SD}$	Diode forward voltage drop.	$I_S=60A, V_{GS}=0V$			1.15	V
$T_{rr}$	Reverse recovery time	$I_S=60A, V_{GS}=0V,$		13		ns
$Q_{rr}$	Reverse recovery Charge	$di_f/dt=100A/\mu s$		6		nC

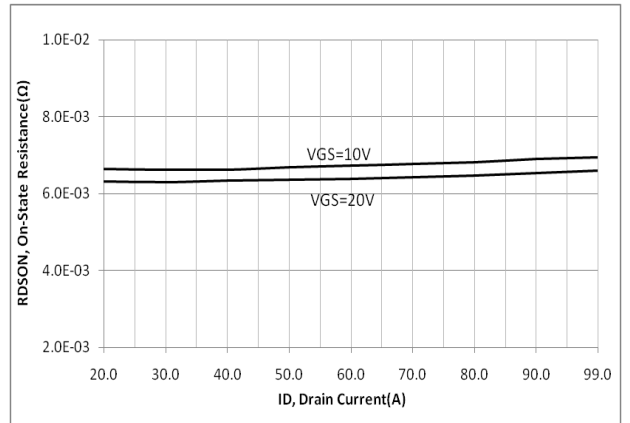
### ※. Notes

1. Repetitive rating : pulse width limited by junction temperature.
2.  $L = 0.8\text{mH}, I_{AS} = 30A, V_{DD} = 30V, R_G=25\Omega$ , Starting  $T_J = 25^\circ\text{C}$
3.  $I_{SD} \leq 60A, di/dt = 100A/\mu s, V_{DD} \leq BV_{DSS}$ , 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.

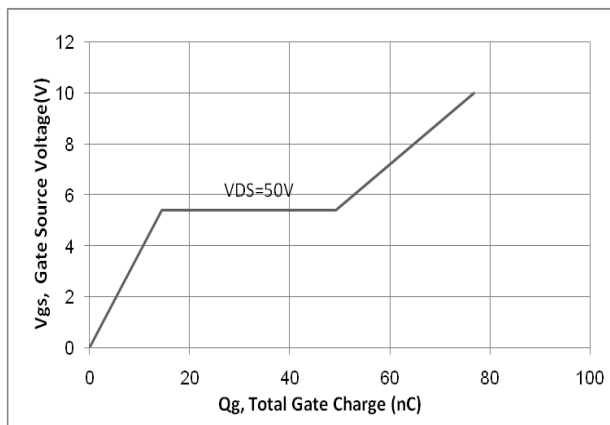
**Fig. 1. On-state characteristics**



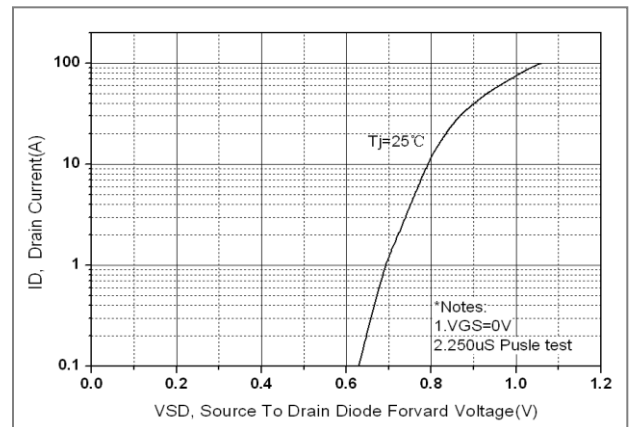
**Fig. 2. On-resistance variation vs. drain current and gate voltage**



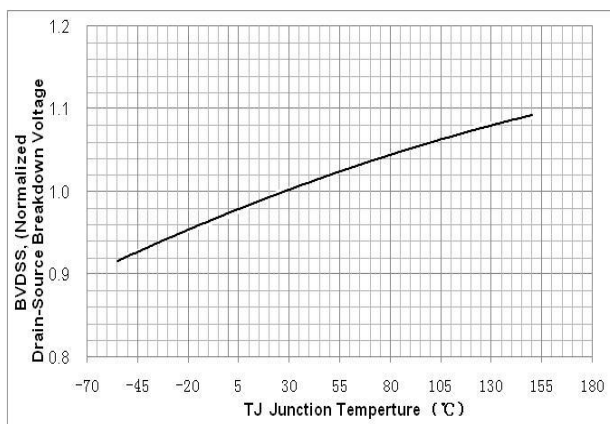
**Fig. 3. Gate charge characteristics**



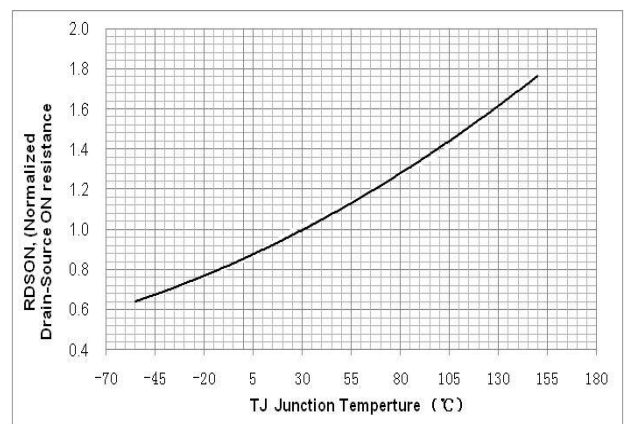
**Fig. 4. On state current vs. diode forward voltage**



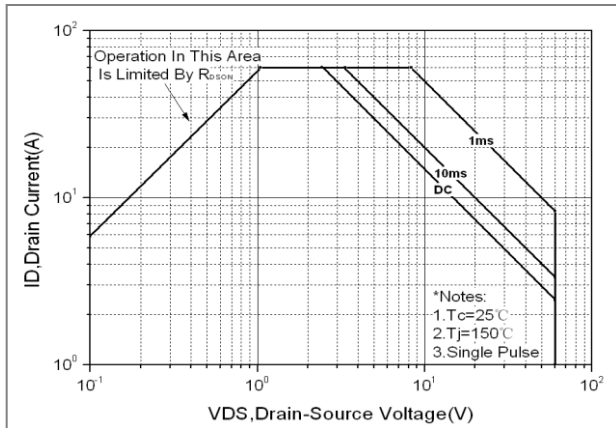
**Fig 5. Breakdown Voltage Variation vs. Junction Temperature**



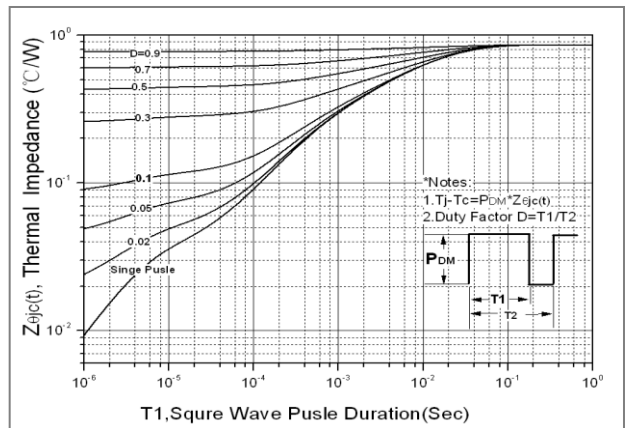
**Fig. 6. On resistance variation vs. junction temperature**



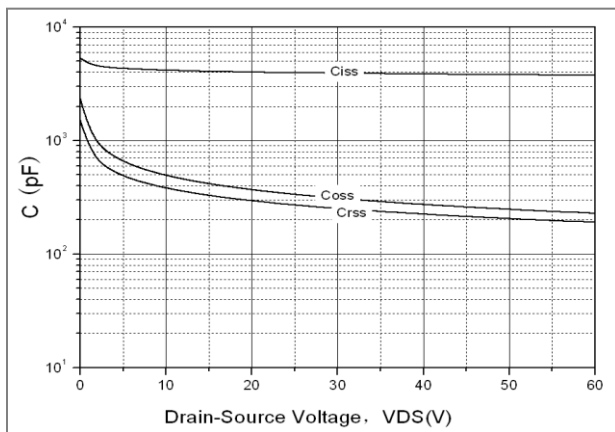
**Fig. 7. Maximum safe operating area**



**Fig. 8. Transient thermal response curve**



**Fig. 9. Capacitance Characteristics**



**Fig. 10. Gate charge test circuit & waveform**

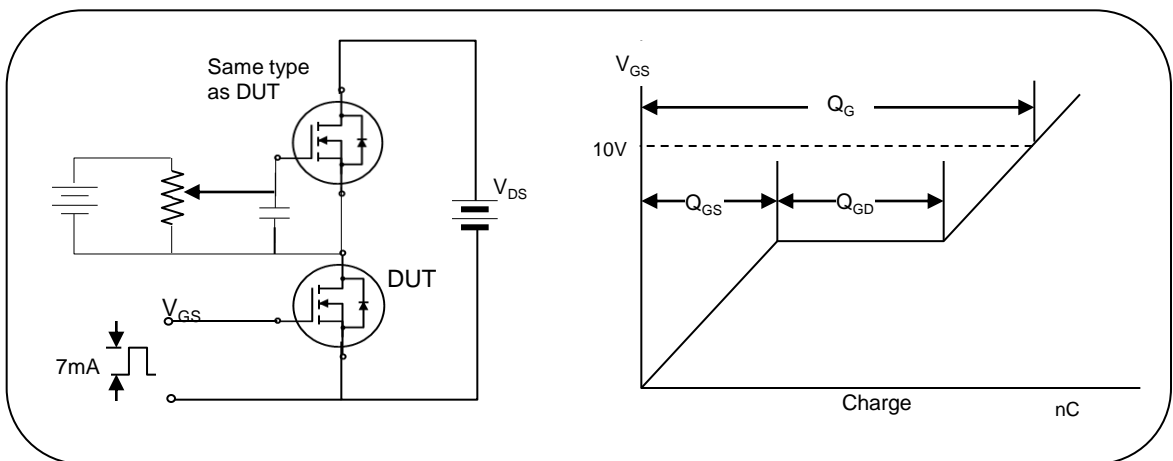


Fig. 11. Switching time test circuit & waveform

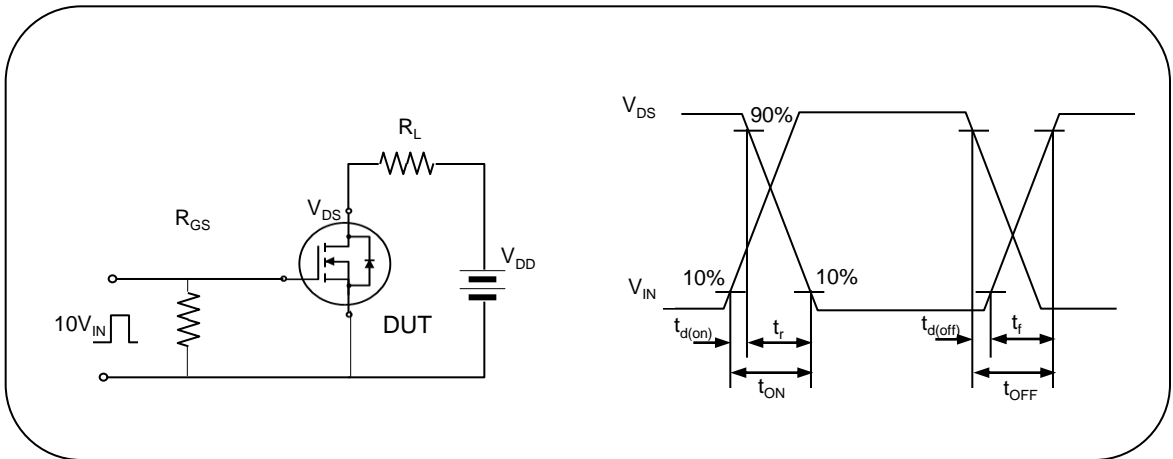


Fig. 12. Unclamped Inductive switching test circuit & waveform

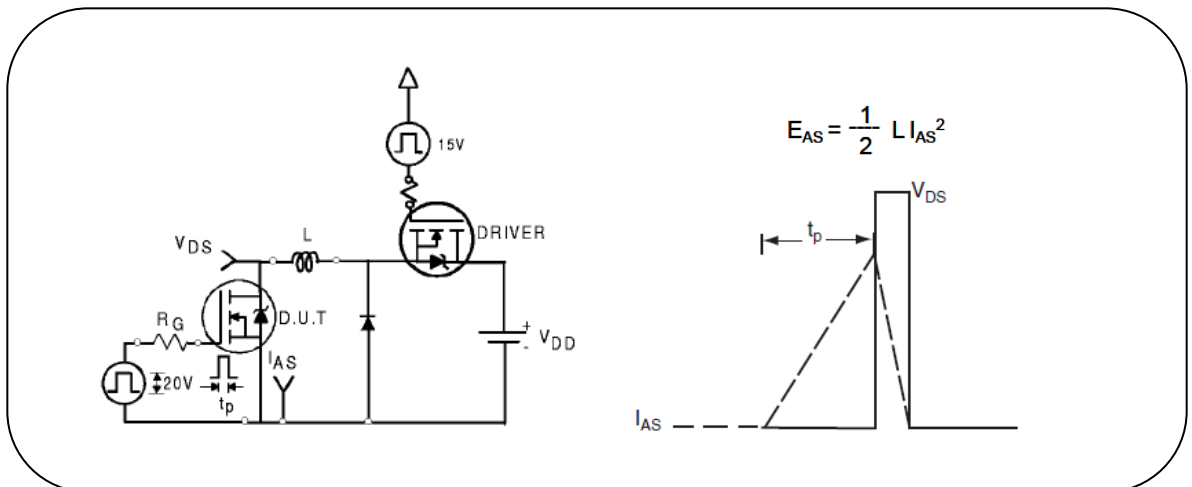


Fig. 13. Peak diode recovery dv/dt test circuit & waveform

