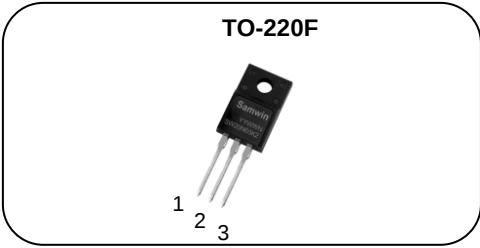


N-channel Enhanced mode TO-220F MOSFET

Features

- High ruggedness
- Low $R_{DS(ON)}$ (Typ 0.15Ω)@ $V_{GS}=10V$
- Low Gate Charge (Typ 37nC)
- Improved dv/dt Capability
- 100% Avalanche Tested
- Application: Charger, LED, PC Power



1. Gate 2. Drain 3. Source

BV_{DSS} : 650V
I_D : 20A
R_{DS(ON)} : 0.15Ω

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

General Description

This power MOSFET is produced with super junction 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 20N65K2	SW20N65K2	TO-220F	TUBE

Absolute maximum ratings

Symbol	Parameter	Value	Unit
V _{DSS}	Drain to source voltage	650	V
I _D	Continuous drain current (@T _C =25°C)	20*	A
	Continuous drain current (@T _C =100°C)	13*	A
I _{DM}	Drain current pulsed (note 1)	60	A
V _{GS}	Gate to source voltage	±30	V
E _{AS}	Single pulsed avalanche energy (note 2)	440	mJ
E _{AR}	Repetitive avalanche energy (note 1)	44	mJ
dv/dt	MOSFET dv/dt ruggedness (@V _{DS} =0~400V)	30	V/ns
dv/dt	Peak diode recovery dv/dt (note 3)	20	V/ns
P _D	Total power dissipation (@T _C =25°C)	40.3	W
	Derating factor above 25°C	0.3	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	3.1	°C/W
R _{thja}	Thermal resistance, Junction to ambient	46.7	°C/W

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

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
Off characteristics						
BV_{DSS}	Drain to source breakdown voltage	$V_{GS}=0V, I_D=250\mu A$	650			V
$\Delta BV_{DSS} / \Delta T_J$	Breakdown voltage temperature coefficient	$I_D=250\mu A$, referenced to 25°C		0.75		V/ $^\circ\text{C}$
I_{DSS}	Drain to source leakage current	$V_{DS}=650V, V_{GS}=0V$			1	μA
		$V_{DS}=520V, T_C=125^\circ\text{C}$			50	μA
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	$V_{DS}=V_{GS}, I_D=250\mu A$	2.5		4.5	V
$R_{DS(ON)}$	Drain to source on state resistance	$V_{GS}=10V, I_D=10A, T_J=25^\circ\text{C}$		0.15	0.19	Ω
		$V_{GS}=10V, I_D=10A, T_J=125^\circ\text{C}$		0.34		Ω
G_{fs}	Forward transconductance	$V_{DS}=30V, I_D=10A$		15		S
Dynamic characteristics						
C_{iss}	Input capacitance	$V_{GS}=0V, V_{DS}=200V, f=1\text{MHz}$		1440		pF
C_{oss}	Output capacitance			65		
C_{rss}	Reverse transfer capacitance			3.2		
$t_{d(on)}$	Turn on delay time	$V_{DS}=325V, I_D=20A, R_G=10\Omega, V_{GS}=10V$ (note 4,5)		23		ns
t_r	Rising time			38		
$t_{d(off)}$	Turn off delay time			107		
t_f	Fall time			39		
Q_g	Total gate charge	$V_{DS}=520V, V_{GS}=10V, I_D=20A, I_g=20mA$ (note 4,5)		37		nC
Q_{gs}	Gate-source charge			12		
Q_{gd}	Gate-drain charge			10		
R_g	Gate resistance	$V_{DS}=0V$, Scan F mode		16.5		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			20	A
I_{SM}	Pulsed source current				60	A
V_{SD}	Diode forward voltage drop.	$I_S=20A, V_{GS}=0V$			1.4	V
t_{rr}	Reverse recovery time	$I_S=20A, V_{GS}=0V, di/dt=100A/\mu s$		312		ns
Q_{rr}	Reverse recovery charge			4		μC

※. Notes

1. Repeattive rating : pulse width limited by junction temperature.
2. $L=55mH, I_{AS}=4A, V_{DD}=50V, R_G=25\Omega$, Starting $T_J=25^\circ\text{C}$
3. $I_{SD} \leq 20A, di/dt = 100A/\mu s, V_{DD} \leq BV_{DSS}$, 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

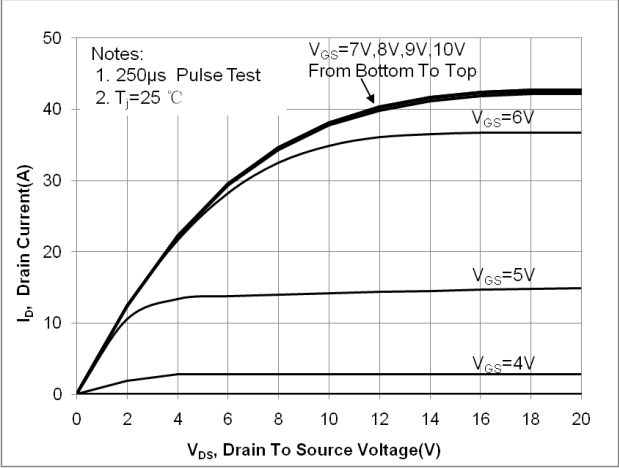


Fig. 2. Transfer Characteristics

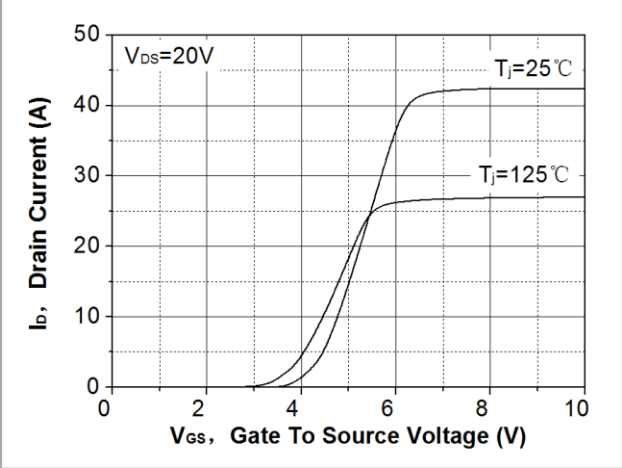


Fig. 3. On-resistance variation vs. drain current and gate voltage

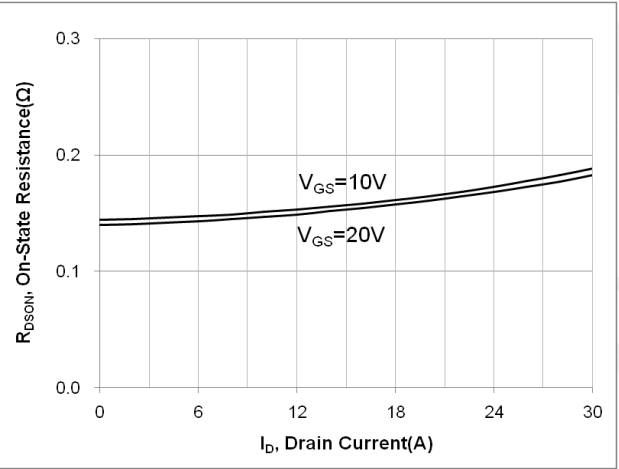


Fig. 4. On-state current vs. diode forward voltage

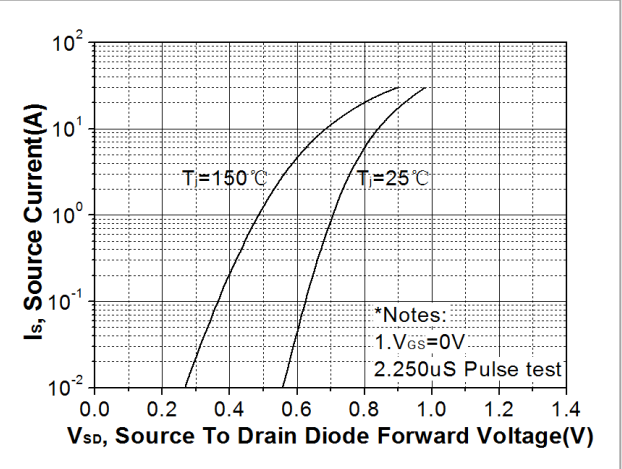


Fig 5. Breakdown voltage variation vs. junction temperature

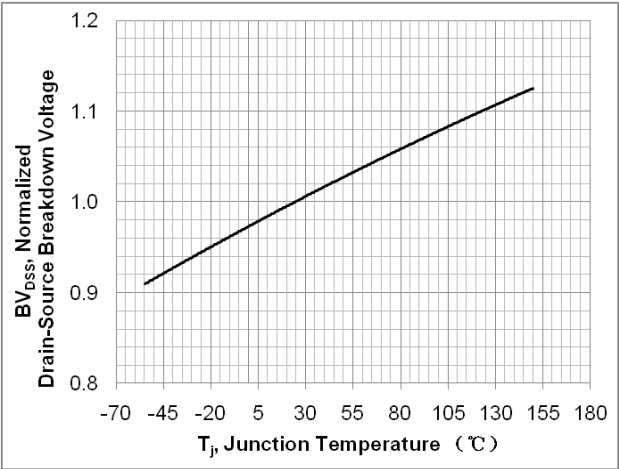


Fig. 6. On-resistance variation vs. junction temperature

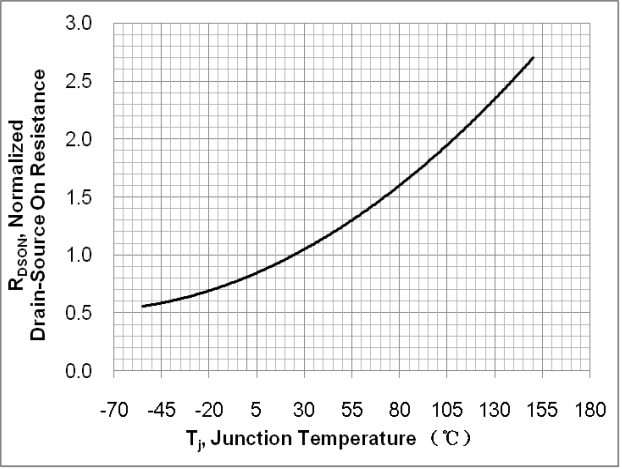


Fig. 7. Gate charge characteristics

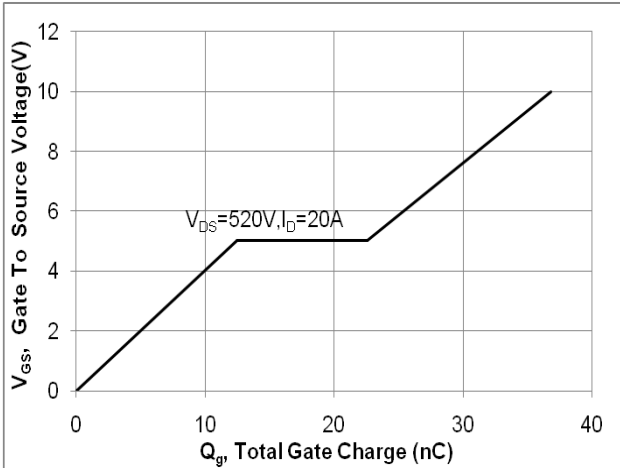


Fig. 8. Capacitance Characteristics

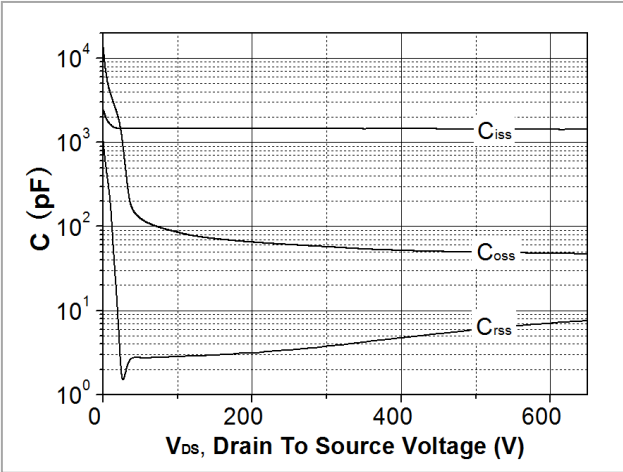


Fig. 9. Maximum safe operating area

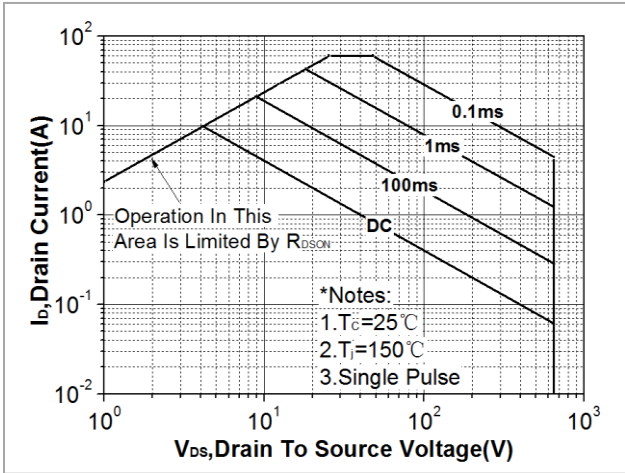


Fig. 10. Transient thermal response curve

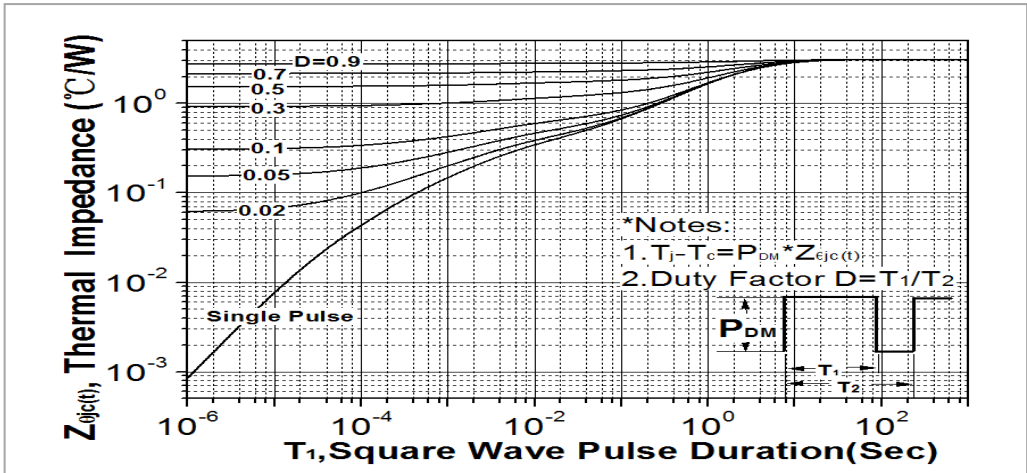


Fig. 11. Gate charge test circuit & waveform

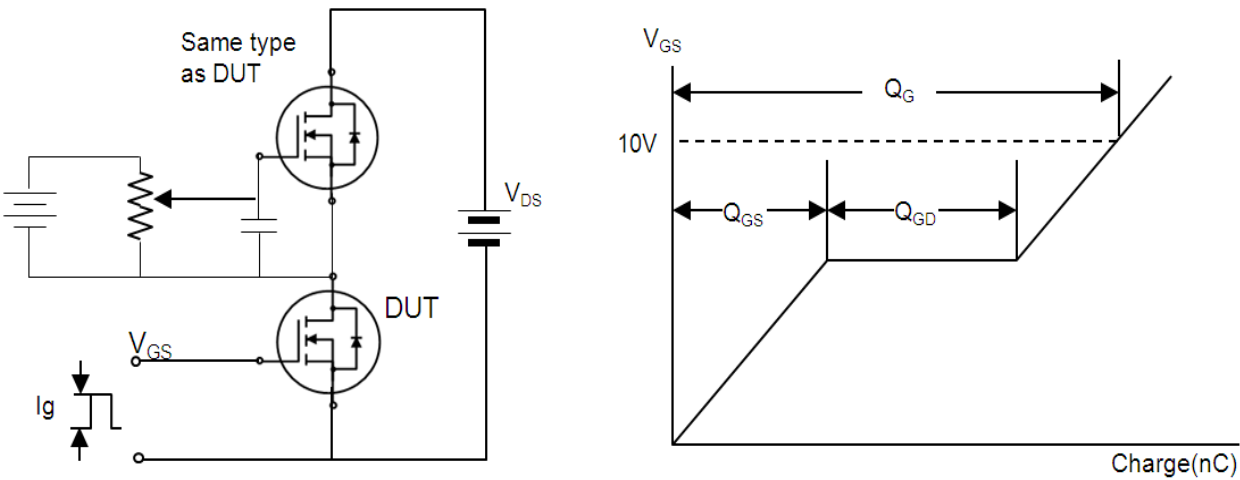


Fig. 12. Switching time test circuit & waveform

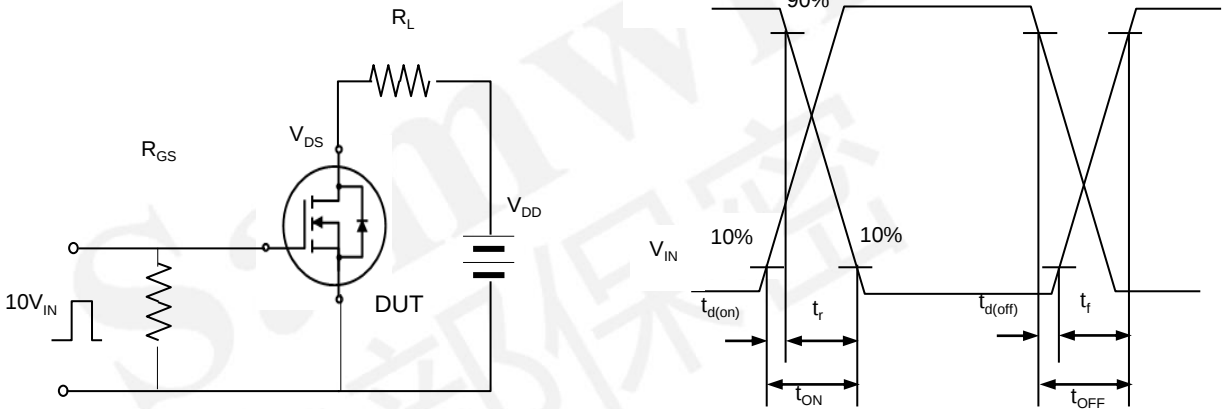


Fig. 13. Unclamped Inductive switching test circuit & waveform

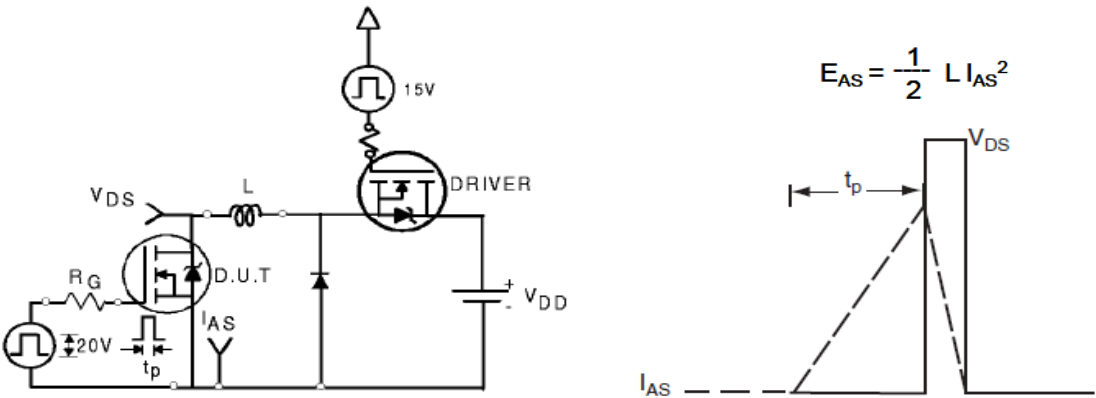
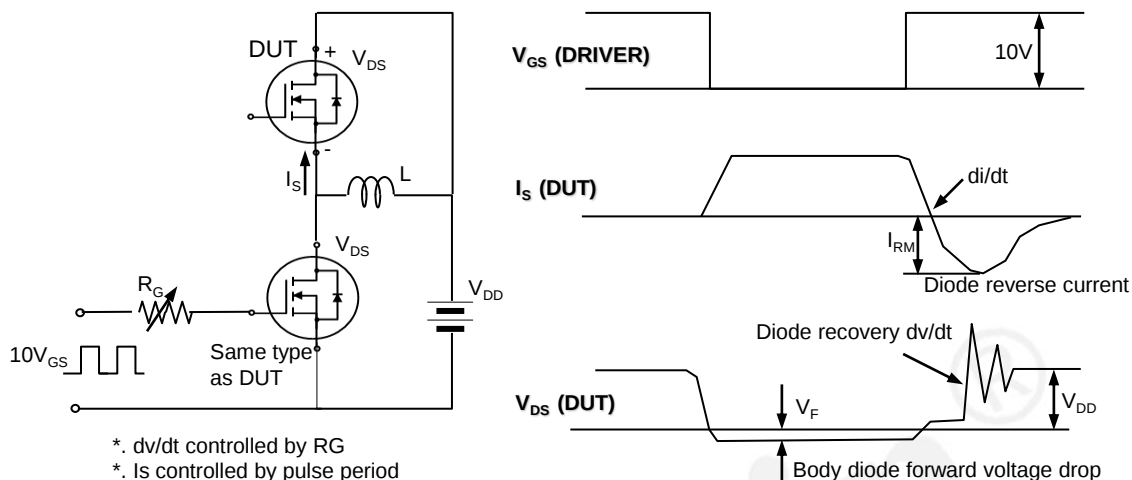


Fig. 14. Peak diode recovery dv/dt test circuit & waveform



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