## *N-channel Enhanced mode TO-252 MOSFET*

Features

- High ruggedness
- Low $R_{DS(ON)}$ (Typ 5.8mΩ)@V_{GS}=10V
- Low Gate Charge (Typ 102nC)
- Improved dv/dt Capability
- 100% Avalanche Tested
- Application:Synchronous Rectification, Li Battery Protect Board, Inverter

TO-252

1. Gate 2.Drain 3.Source
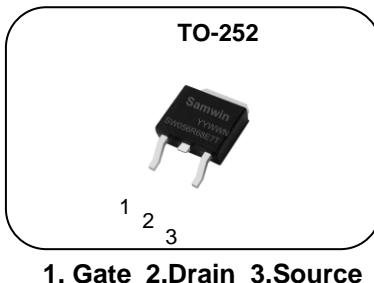
BV_{DSS} : 68V
I_D : 100A
$R_{DS(ON)}$:5.8mΩ
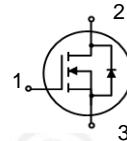
General Description

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 D 056R68E7T	SW056R68E7T	TO-252	REEL

Absolute maximum ratings

Symbol	Parameter		Value	Unit
V_{DSS}	Drain to source voltage		68	V
I_D	Continuous drain current (@T_C=25°C)		100*	A
	Continuous drain current (@T_C=100°C)		79*	A
I_{DM}	Drain current pulsed	(note 1)	400	A
V_{GS}	Gate to source voltage		±20	V
E_{AS}	Single pulsed avalanche energy	(note 2)	289	mJ
E_{AR}	Repetitive avalanche energy	(note 1)	28	mJ
dv/dt	Peak diode recovery dv/dt	(note 3)	5	V/ns
P_D	Total power dissipation (@T_C=25°C)		178.6	W
	Derating factor above 25°C		1.4	W/°C
T_{STG}, T_J	Operating junction temperature & storage temperature		-55 ~ + 150	°C

*. Drain current is limited by junction temperature.

Thermal characteristics

Symbol	Parameter	Value	Unit
R_{thjc}	Thermal resistance, Junction to case	0.7	°C/W

Electrical characteristic (T_J = 25ºC 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	68			V
ΔBV_{DSS} / ΔT_J	Breakdown voltage temperature coefficient	I_D=250uA, referenced to 25ºC		0.05		V/ºC
I_{DSS}	Drain to source leakage current	V_{DS}=68V, V_{GS}=0V			1	uA
		V_{DS}=54V, T_J=125ºC			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=30A,T_J=25ºC		5.8	7.1	mΩ
		V_{GS}=10V, I_D=30A,T_J=125ºC		9.6		mΩ
G_{fs}	Forward transconductance	V_{DS}=10V, I_D=30A		45		S
Dynamic characteristics						
C_{iss}	Input capacitance	V_{GS}=0V, V_{DS}=34V, f=1MHz		5178		pF
C_{oss}	Output capacitance			357		
C_{rss}	Reverse transfer capacitance			320		
$t_{d(on)}$	Turn on delay time	V_{DS}=34V, I_D=30A, R_G=4.7Ω, V_{GS}=10V (note 4,5)		39		ns
t_r	Rising time			80		
$t_{d(off)}$	Turn off delay time			95		
t_f	Fall time			35		
Q_g	Total gate charge	V_{DS}=54V, V_{GS}=10V, I_D=30A , I_G=3mA (note 4,5)		102		nC
Q_{gs}	Gate-source charge			28		
Q_{gd}	Gate-drain charge			37		
R_g	Gate resistance	V_{DS}=0V, Scan F mode		3.3		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			100	A
I_{SM}	Pulsed source current				400	A
V_{SD}	Diode forward voltage drop.	I_S=50A, V_{GS}=0V			1.4	V
t_{rr}	Reverse recovery time	I_S=30A, V_{GS}=0V, dI_F/dt=100A/us		31		ns
Q_{rr}	Reverse recovery charge			28		nC

※. Notes
1. Repeatitive rating : pulse width limited by junction temperature.
2. L =0.5mH, I_{AS} =34A, V_{DD}=40V, R_G=25Ω, Starting T_J = 25ºC
3. I_{SD} ≤30A, di/dt = 100A/us, V_{DD} ≤ BV_{DSS}, Staring T_J =25ºC
4. Pulse Test : Pulse Width ≤ 300us, duty cycle ≤ 2%.
5. Essentially independent of operating temperature.

Fig. 1. On-state characteristics

Notes:
1. 250μs Pulse Test
2. T_j=25 ℃

V_{GS}=10V

V_{GS}=9V

V_{GS}=8V

V_{GS}=7V

V_{GS}=6V

V_{GS}=5V

I_D, Drain Current (A)

V_{DS}, Drain To Source Voltage (V)
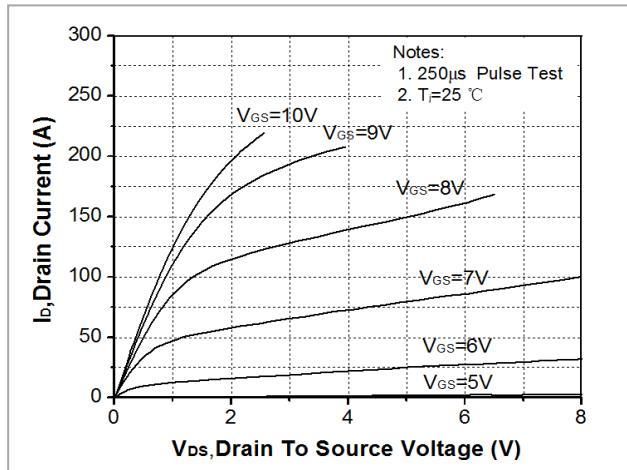
Fig. 2. Transfer Characteristics

V_{DS}=5V

T_j=125 ℃

T_j=25 ℃

I_D, Drain Current (A)

V_{GS}, Gate To Source Voltage (V)
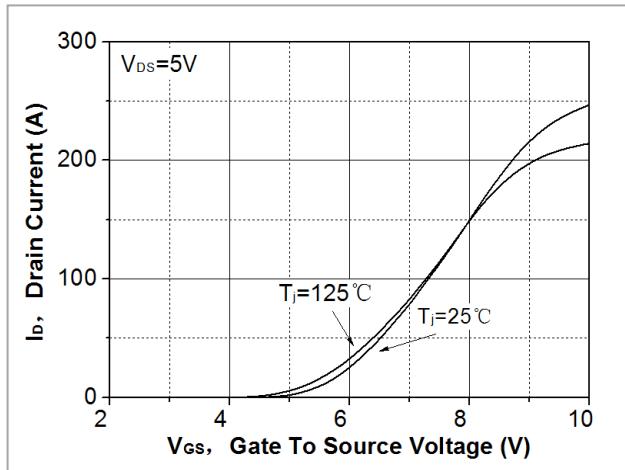
Fig. 3. On-resistance variation vs. drain current and gate voltage

V_{GS}=10V

V_{GS}=20V

R_{DSON}, On-State Resistance(Ω)

I_D, Drain Current(A)
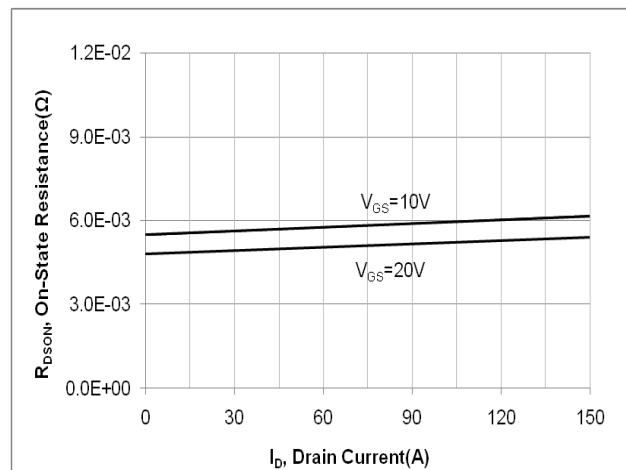
Fig. 4. On-state current vs. diode forward voltage

T_j=150 ℃

T_j=25 ℃

*Notes:
1. V_{GS}=0V
2. 250uS Pulse test

I_S, Source Current(A)

V_{SD}, Source To Drain Diode Forward Voltage(V)
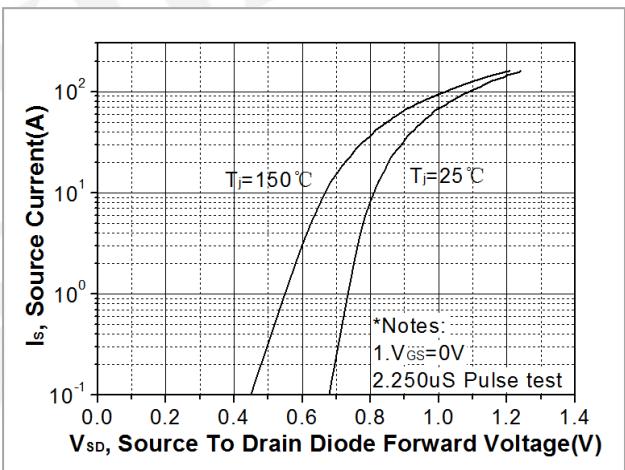
Fig 5. Breakdown voltage variation vs. junction temperature

BV_{DSS}, Normalized Drain-Source Breakdown Voltage

T_j, Junction Temperature (℃)
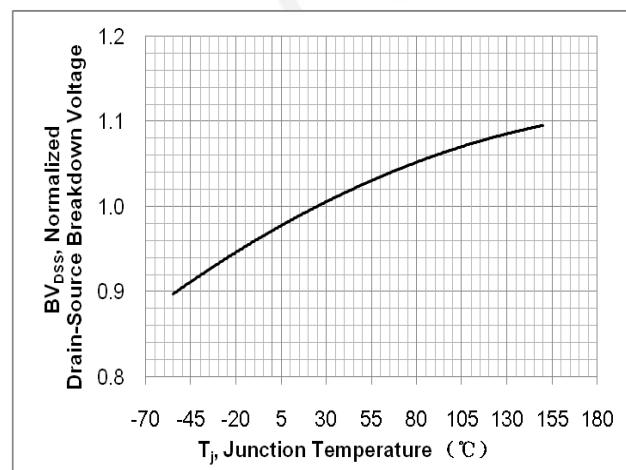
Fig. 6. On-resistance variation vs. junction temperature

R_{DSON}, Normalized Drain-Source On Resistance

T_j, Junction Temperature (℃)
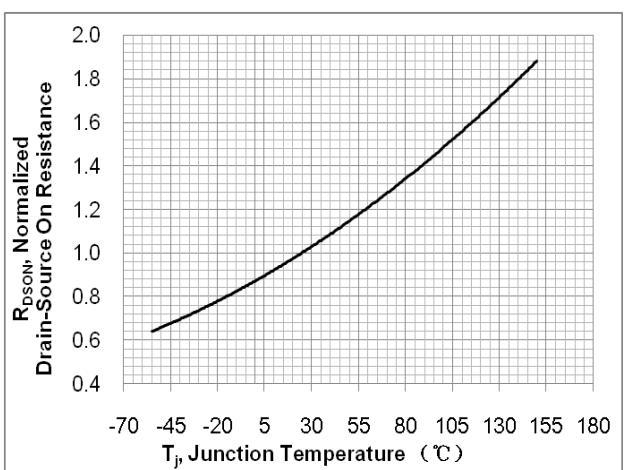
**Fig. 7. Gate charge characteristics**
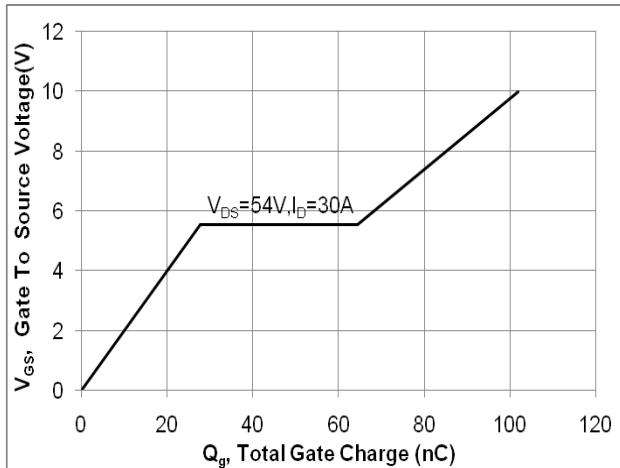

Fig. 8. Capacitance Characteristics
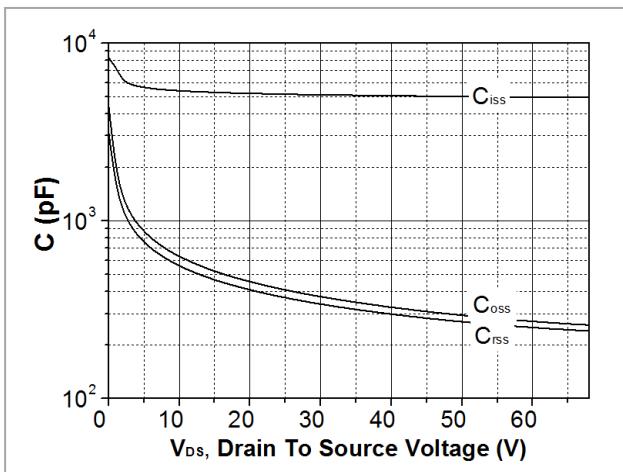
**Fig. 9. Maximum safe operating area**
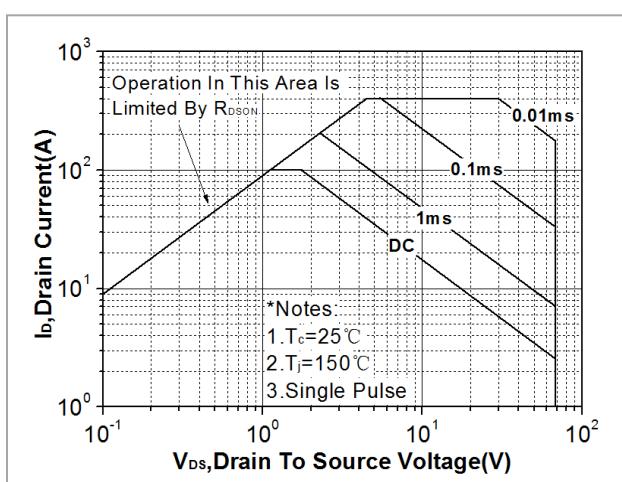
Fig. 10. Maximum drain current vs. case temperature
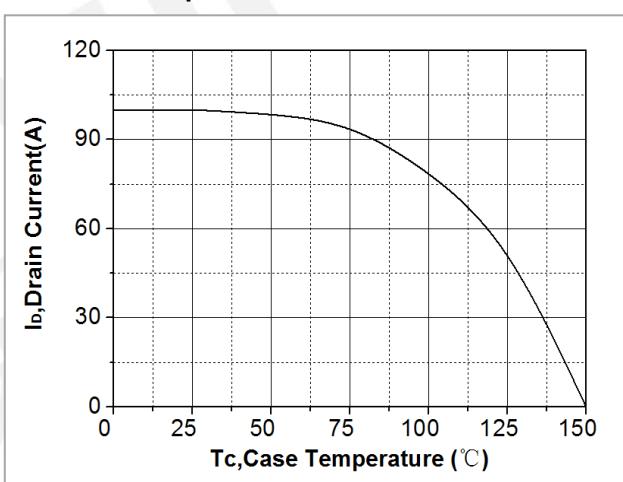

**Fig. 11. Transient thermal response curve**
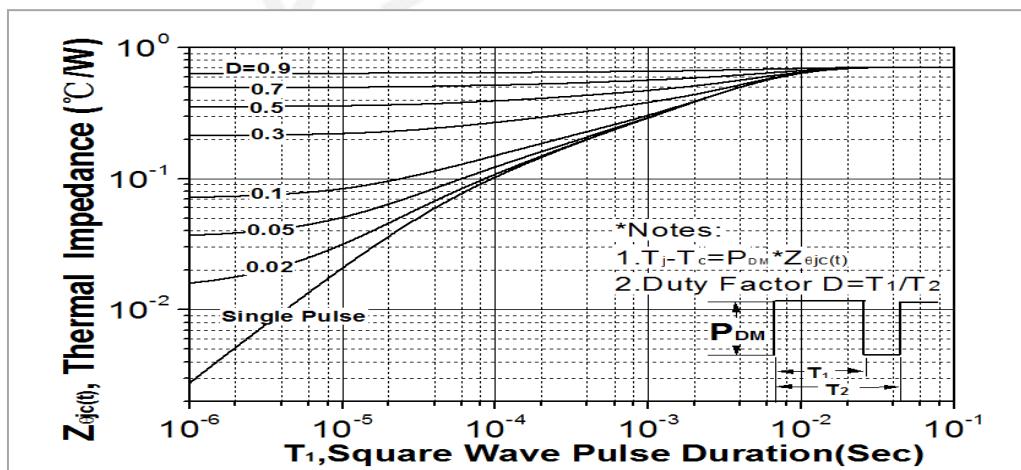
Fig. 12. Gate charge test circuit & waveform
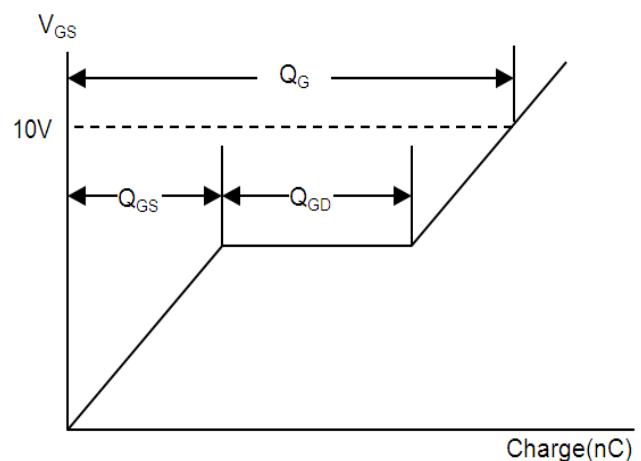
Fig. 13. Switching time test circuit & waveform
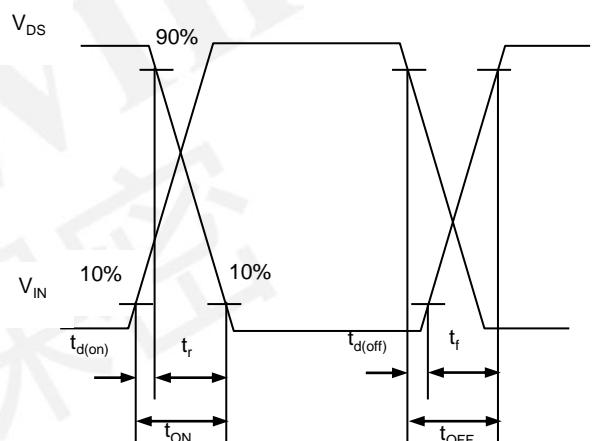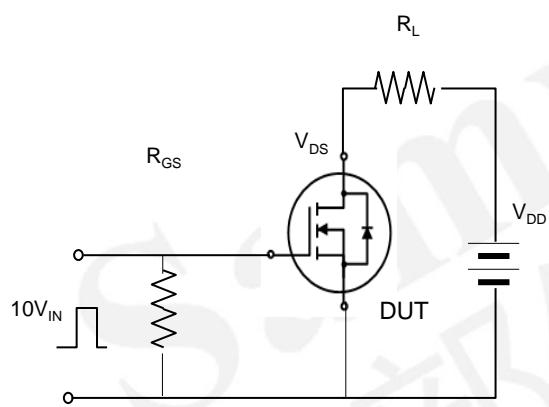
Fig. 14. Unclamped Inductive switching test circuit & waveform

$$E_{AS} = \frac{1}{2} L I_{AS}^2$$
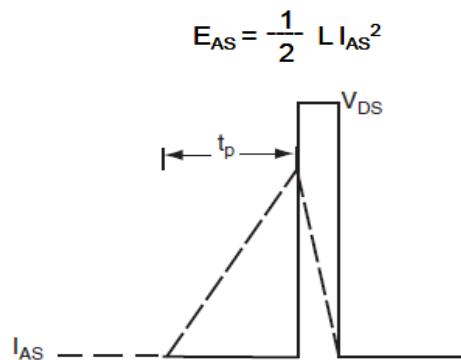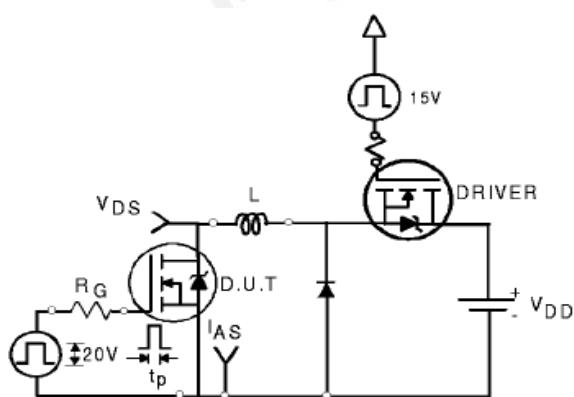
Fig. 15. Peak diode recovery dv/dt test circuit & waveform

DUT

+ V_{DS}

I_S L

V_{DS}

R_G V_{DD}

$10V_{GS}$ Same type as DUT

*. dv/dt controlled by RG
*. Is controlled by pulse period

V_{GS} **(DRIVER)**   10V

I_S **(DUT)**   di/dt I_{RM} Diode reverse current

Diode recovery dv/dt

V_{DS} **(DUT)** V_F V_{DD} Body diode forward voltage drop
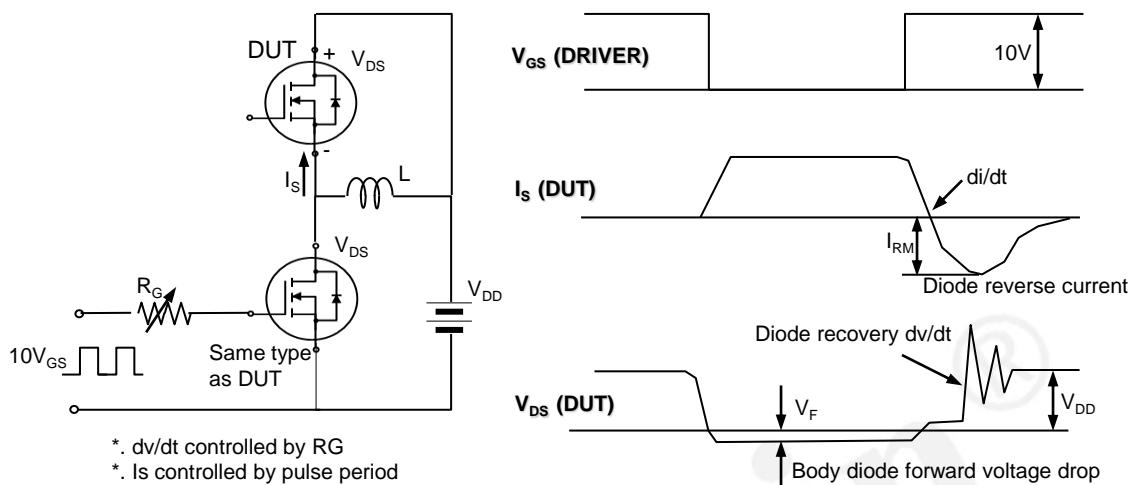
DISCLAIMER

* 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**