

# 1.5V Drive Nch+SBD MOSFET

## ES6U2

### ●Structure

Silicon N-channel MOSFET / Schottky barrier diode

### ●Features

- 1) Nch MOSFET and schottky barrier diode are put in WEMT6 package.
- 2) High-speed switching, Low On-resistance.
- 3) Low voltage drive (1.5V drive).
- 4) Built-in Low  $V_F$  schottky barrier diode.

### ●Applications

Switching

### ●Package specifications

Type	Package	Taping
	Code	T2R
	Basic ordering unit (pieces)	8000
ES6U2		○

### ●Absolute maximum ratings (Ta=25°C)

<MOSFET>

Parameter	Symbol	Limits	Unit	
Drain-source voltage	$V_{DSS}$	20	V	
Gate-source voltage	$V_{GSS}$	±10	V	
Drain current	Continuous	$I_D$	±1.5	A
	Pulsed	$I_{DP}$ *1	±3.0	A
Source current (Body diode)	Continuous	$I_S$	0.5	A
	Pulsed	$I_{SP}$ *1	3.0	A
Channel temperature	$T_{ch}$	150	°C	
Power dissipation	$P_D$ *2	0.7	W / ELEMENT	

\*1  $P_w \leq 10\mu s$ , Duty cycle  $\leq 1\%$   
\*2 Mounted on a ceramic board

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Parameter	Symbol	Limits	Unit
Repetitive peak reverse voltage	$V_{RM}$	25	V
Reverse voltage	$V_R$	20	V
Forward current	$I_F$	0.5	A
Forward current surge peak	$I_{FSM}$ *1	2.0	A
Junction temperature	$T_j$	150	°C
Power dissipation	$P_D$ *2	0.5	W / ELEMENT

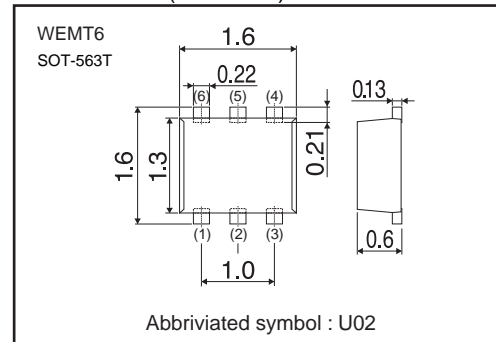
\*1 60Hz · 1cyc.  
\*2 Mounted on ceramic board

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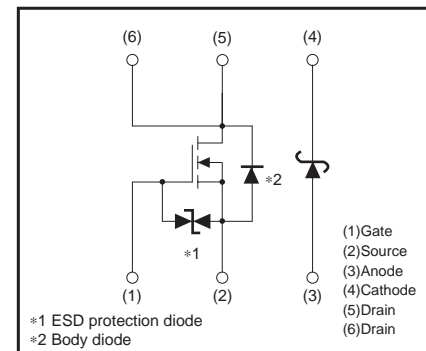
Parameter	Symbol	Limits	Unit
Power dissipation	$P_D$ *	0.8	W / TOTAL
Range of storage temperature	$T_{stg}$	-55 to +150	°C

\* Mounted on a ceramic board

### ●Dimensions (Unit : mm)



### ●Inner circuit



### ●Electrical characteristics (Ta=25°C)

<MOSFET>

Parameter	Symbol	Min.	Typ.	Max.	Unit	Conditions
Gate-source leakage	$I_{GSS}$	–	–	$\pm 10$	$\mu A$	$V_{GS}=\pm 10V, V_{DS}=0V$
Drain-source breakdown voltage	$V_{(BR)DSS}$	20	–	–	V	$I_D=1mA, V_{GS}=0V$
Zero gate voltage drain current	$I_{DSS}$	–	–	1	$\mu A$	$V_{DS}=20V, V_{GS}=0V$
Gate threshold voltage	$V_{GS(th)}$	0.3	–	1.0	V	$V_{DS}=10V, I_D=1mA$
Static drain-source on-state resistance	$R_{DS(on)}$ *	–	130	180	$m\Omega$	$I_D=1.5A, V_{GS}=4.5V$
		–	170	240	$m\Omega$	$I_D=1.5A, V_{GS}=2.5V$
		–	220	310	$m\Omega$	$I_D=0.8A, V_{GS}=1.8V$
		–	300	600	$m\Omega$	$I_D=0.3A, V_{GS}=1.5V$
Forward transfer admittance	$ Y_{fs} $ *	1.6	–	–	S	$V_{DS}=10V, I_D=1.5A$
Input capacitance	$C_{iss}$	–	110	–	pF	$V_{DS}=10V$
Output capacitance	$C_{oss}$	–	18	–	pF	$V_{GS}=0V$
Reverse transfer capacitance	$C_{rss}$	–	15	–	pF	$f=1MHz$
Turn-on delay time	$t_{d(on)}$ *	–	5	–	ns	$V_{DD}\doteq 10V$
Rise time	$t_r$ *	–	5	–	ns	$I_D=1A$
Turn-off delay time	$t_{d(off)}$ *	–	20	–	ns	$V_{GS}=4.5V$
Fall time	$t_f$ *	–	3	–	ns	$R_L\doteq 10\Omega$ $R_G=10\Omega$
Total gate charge	$Q_g$ *	–	1.8	–	nC	$V_{DD}\doteq 10V, V_{GS}=4.5V$
Gate-source charge	$Q_{gs}$ *	–	0.3	–	nC	$I_D=1.5A, R_L\doteq 6.7\Omega$
Gate-drain charge	$Q_{gd}$ *	–	0.3	–	nC	$R_G=10\Omega$

\*Pulsed

<Body diode characteristics (Source-drain)>

Parameter	Symbol	Min.	Typ.	Max.	Unit	Conditions
Forward voltage	$V_{SD}$ *	–	–	1.2	V	$I_S=1.5A, V_{GS}=0V$

\*Pulsed

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Parameter	Symbol	Min.	Typ.	Max.	Unit	Conditions
Forward voltage	$V_F$	–	–	0.36	V	$I_F=0.1A$
		–	–	0.52	V	$I_F=0.5A$
Reverse current	$I_R$	–	–	100	$\mu A$	$V_R=20V$

●Electrical characteristics curves

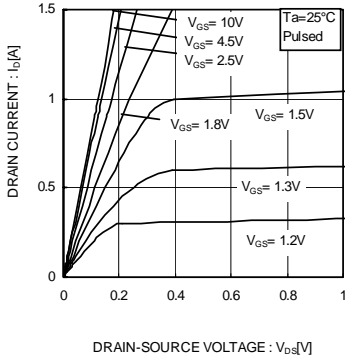


Fig.1 Typical Output Characteristics( I )

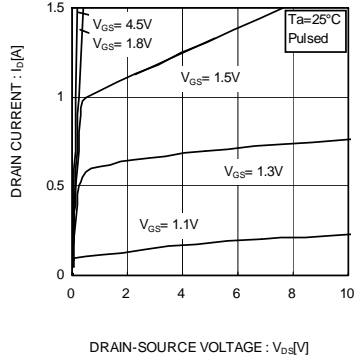


Fig.2 Typical Output Characteristics( II )

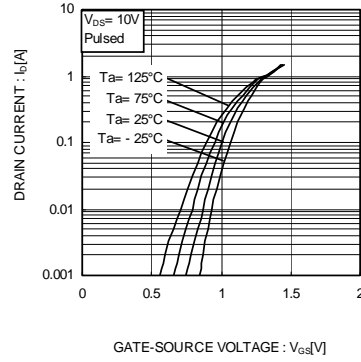


Fig.3 Typical Transfer Characteristics

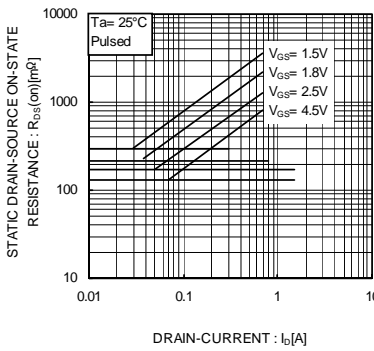


Fig.4 Static Drain-Source On-State Resistance vs. Drain Current( I )

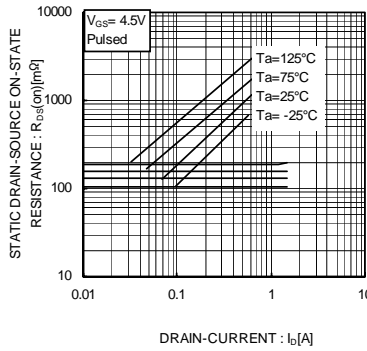


Fig.5 Static Drain-Source On-State Resistance vs. Drain Current( II )

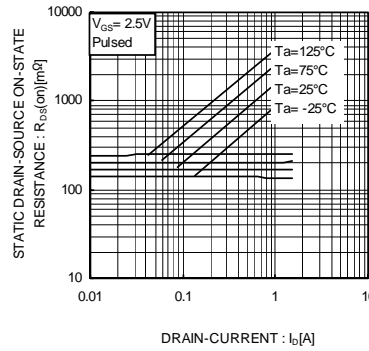


Fig.6 Static Drain-Source On-State Resistance vs. Drain Current( III )

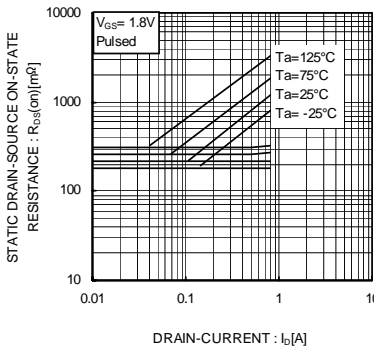


Fig.7 Static Drain-Source On-State Resistance vs. Drain Current( IV )

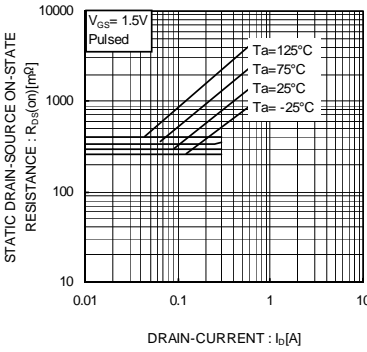


Fig.8 Static Drain-Source On-State Resistance vs. Drain Current( V )

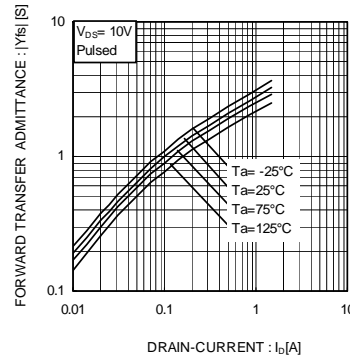


Fig.9 Forward Transfer Admittance vs. Drain Current

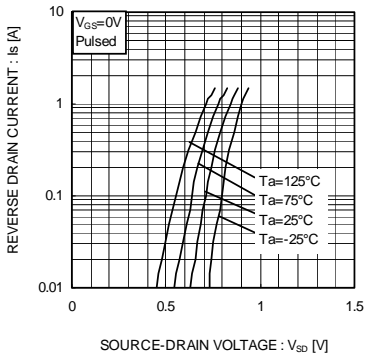


Fig.10 Reverse Drain Current vs. Source-Drain Voltage

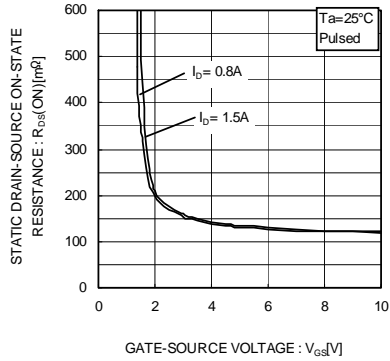


Fig.11 Static Drain-Source On-State Resistance vs. Gate Source Voltage

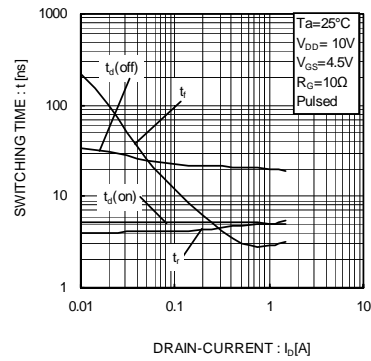


Fig.12 Switching Characteristics

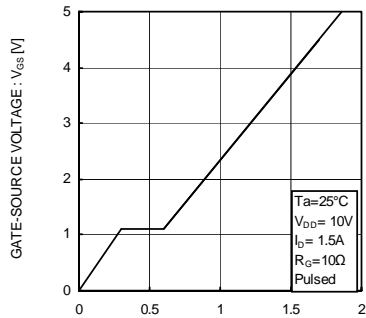


Fig.13 Dynamic Input Characteristics

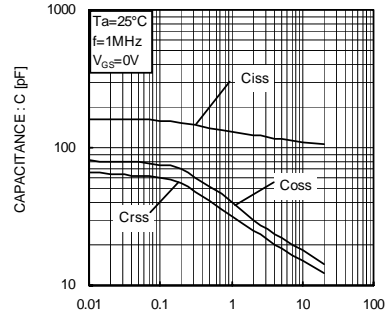


Fig.14 Typical Capacitance vs. Drain-Source Voltage

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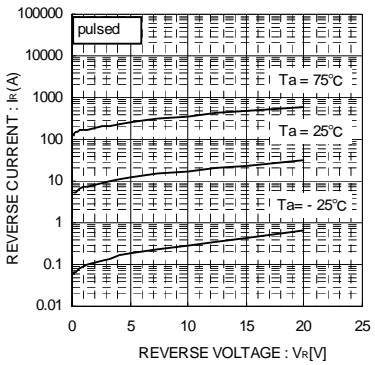


Fig.1 Reverse Current vs. Reverse Voltage

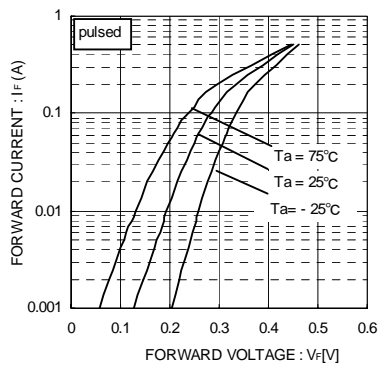


Fig.2 Forward Current vs. Forward Voltage

●Measurement circuit

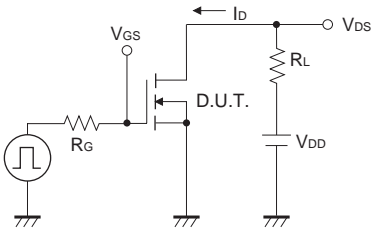


Fig.1-1 Switching Time Measurement Circuit

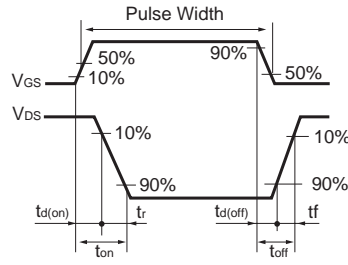


Fig.1-2 Switching Waveforms

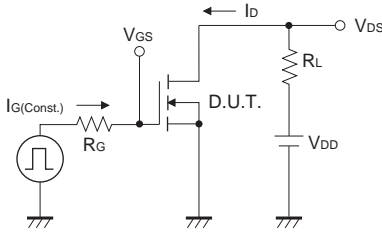


Fig.2-1 Gate Charge Measurement Circuit

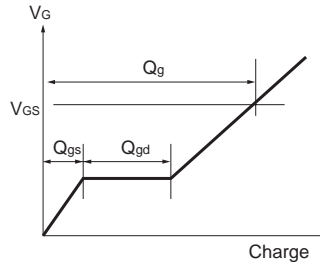


Fig.2-2 Gate Charge Waveform

●Notice

1. SBD has a large reverse leak current compared to other type of diode. Therefore; it would raise a junction temperature, and increase a reverse power loss. Further rise of inside temperature would cause a thermal runaway.  
This built-in SBD has low  $V_F$  characteristics and therefore, higher leak current. Please consider enough the surrounding temperature, generating heat of MOSFET and the reverse current.
2. This product might cause chip aging and breakdown under the large electrified environment. Please consider to design ESD protection circuit.

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