

# 2.5V Drive Pch+SBD MOSFET

## ES6U42

### ●Structure

Silicon P-channel MOSFET /  
Schottky barrier diode

### ●Features

- 1) Pch MOSFET and schottky barrier diode are put in WEMT6 package.
- 2) High-speed switching, Low On-resistance.
- 3) Low voltage drive (2.5V drive).
- 4) Built-in Low  $V_f$  schottky barrier diode.

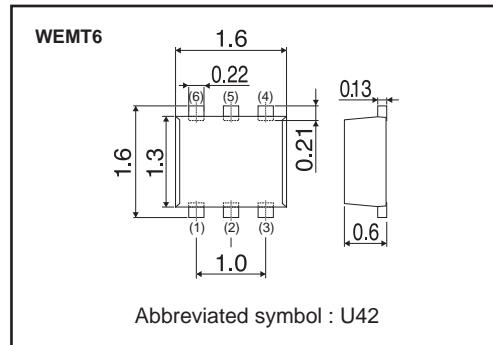
### ●Applications

Switching

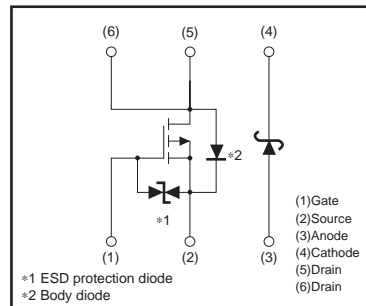
### ●Package specifications

Type	Package	Taping
	Code	T2R
	Basic ordering unit (pieces)	8000
ES6U42		○

### ●Dimensions (Unit : mm)



### ●Inner circuit



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

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Parameter	Symbol	Limits	Unit	
Drain-source voltage	$V_{DS}$	-20	V	
Gate-source voltage	$V_{GS}$	$\pm 12$	V	
Drain current	Continuous	$I_D$	$\pm 1.0$	A
	Pulsed	$I_{DP}$ *1	$\pm 4.0$	A
Source current (Body diode)	Continuous	$I_S$	-0.4	A
	Pulsed	$I_{SP}$ *1	-4.0	A
Channel temperature	$T_{ch}$	150	°C	
Power dissipation	$P_D$ *2	0.7	W / ELEMENT	

\*1  $P_W \leq 10\mu s$ , Duty cycles  $\leq 1\%$   
\*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 · 1cycle  
\*2 Mounted on a 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

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

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Parameter	Symbol	Min.	Typ.	Max.	Unit	Conditions
Gate-source leakage	I <sub>GSS</sub>	–	–	±10	μA	V <sub>GS</sub> = ±12V, V <sub>DS</sub> =0V
Drain-source breakdown voltage	V <sub>(BR) DSS</sub>	–20	–	–	V	I <sub>D</sub> = –1mA, V <sub>GS</sub> =0V
Zero gate voltage drain current	I <sub>DSS</sub>	–	–	–1	μA	V <sub>DS</sub> = –20V, V <sub>GS</sub> =0V
Gate threshold voltage	V <sub>GS(th)</sub>	–0.7	–	–2.0	V	V <sub>DS</sub> = –10V, I <sub>D</sub> = –1mA
Static drain-source on-state resistance	R <sub>DS(on)</sub> *	–	280	390	mΩ	I <sub>D</sub> = –1A, V <sub>GS</sub> = –4.5V
		–	310	430	mΩ	I <sub>D</sub> = –1A, V <sub>GS</sub> = –4V
		–	570	800	mΩ	I <sub>D</sub> = –0.5A, V <sub>GS</sub> = –2.5V
Forward transfer admittance	Y <sub>fs</sub>  *	0.7	–	–	S	V <sub>DS</sub> = –10V, I <sub>D</sub> = –0.5A
Input capacitance	C <sub>iss</sub>	–	150	–	pF	V <sub>DS</sub> = –10V
Output capacitance	C <sub>oss</sub>	–	20	–	pF	V <sub>GS</sub> = 0V
Reverse transfer capacitance	C <sub>rss</sub>	–	20	–	pF	f= 1MHz
Turn-on delay time	t <sub>d(on)</sub> *	–	9	–	ns	V <sub>DD</sub> ≐ –15V
Rise time	t <sub>r</sub> *	–	8	–	ns	V <sub>GS</sub> = –4.5V
Turn-off delay time	t <sub>d(off)</sub> *	–	25	–	ns	I <sub>D</sub> = –0.5A
Fall time	t <sub>f</sub> *	–	10	–	ns	R <sub>L</sub> ≐ 30Ω
Total gate charge	Q <sub>g</sub> *	–	2.1	–	nC	V <sub>DD</sub> ≐ –15V, V <sub>GS</sub> = –4.5V
Gate-source charge	Q <sub>gs</sub> *	–	0.5	–	nC	I <sub>D</sub> = –1A, R <sub>L</sub> ≐ 15Ω
Gate-drain charge	Q <sub>gd</sub> *	–	0.5	–	nC	R <sub>G</sub> = 10Ω

\*Pulsed

&lt;Body diode characteristics (Source-drain)&gt;

Parameter	Symbol	Min.	Typ.	Max.	Unit	Conditions
Forward voltage	V <sub>SD</sub> *	–	–	–1.2	V	I <sub>S</sub> = –1.0A, V <sub>GS</sub> =0V

\*Pulsed

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Parameter	Symbol	Min.	Typ.	Max.	Unit	Conditions
Forward voltage	V <sub>F</sub>	–	–	0.36	V	I <sub>F</sub> = 0.1A
		–	–	0.52	V	I <sub>F</sub> = 0.5A
Reverse current	I <sub>R</sub>	–	–	100	μA	V <sub>R</sub> = 20V

●Electrical characteristics curves

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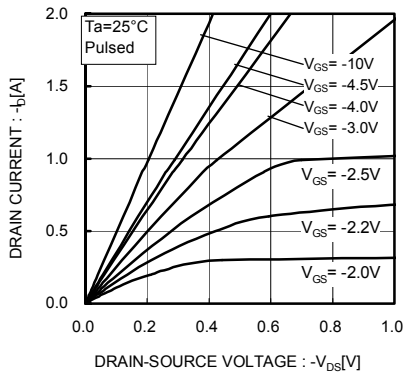


Fig.1 Typical Output Characteristics (I)

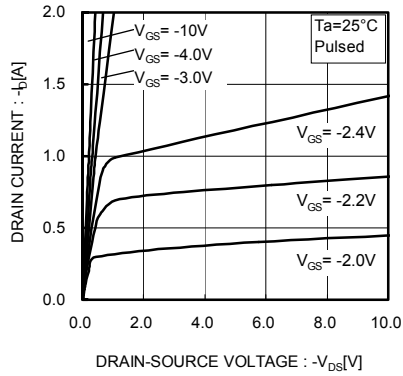


Fig.2 Typical Output Characteristics (II)

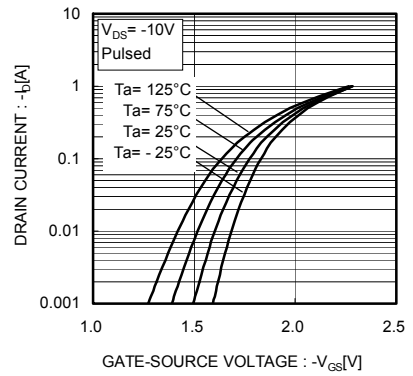


Fig.3 Typical Transfer Characteristics

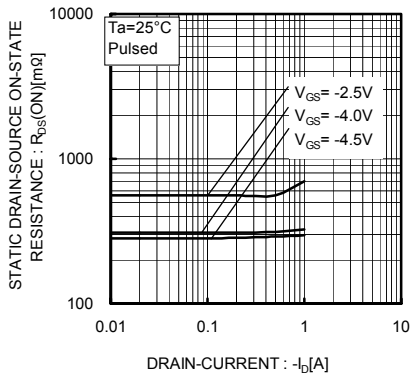


Fig.4 Static Drain-Source On-State Resistance vs. Drain Current (I)

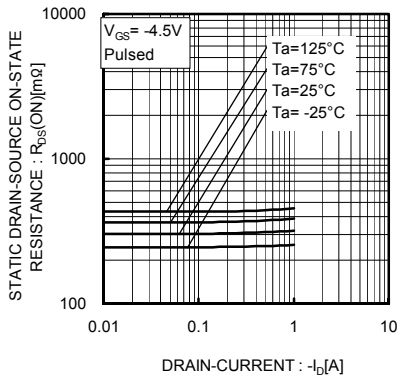


Fig.5 Static Drain-Source On-State Resistance vs. Drain Current (II)

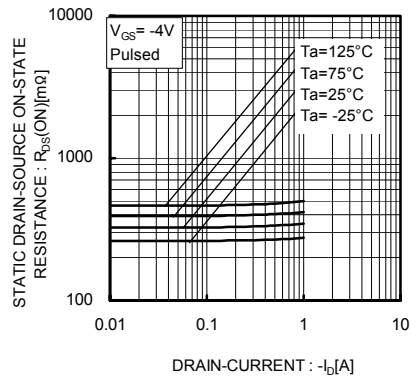


Fig.6 Static Drain-Source On-State Resistance vs. Drain Current (III)

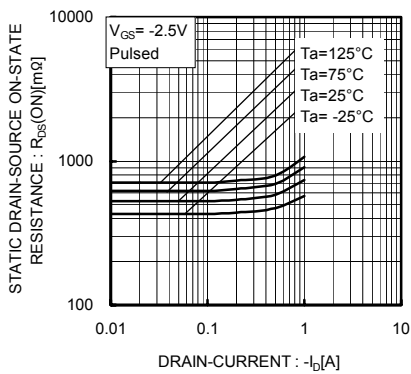


Fig.7 Static Drain-Source On-State Resistance vs. Drain Current (IV)

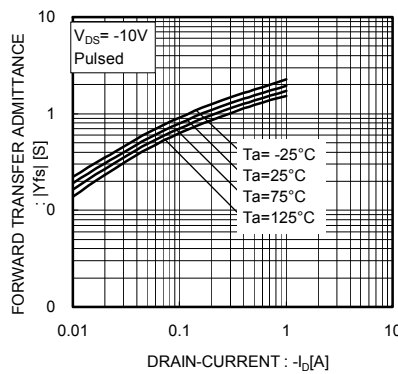


Fig.8 Forward Transfer Admittance vs. Drain Current

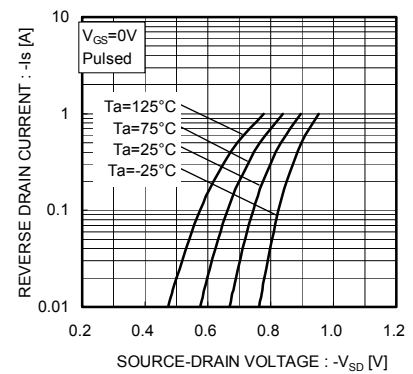


Fig.9 Reverse Drain Current vs. Source-Drain Voltage

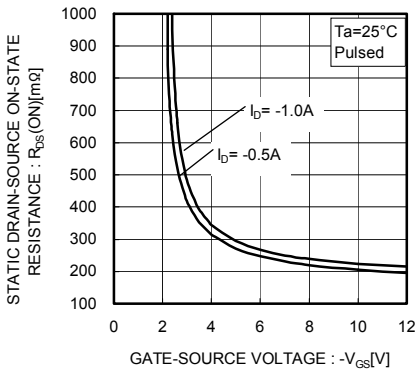


Fig.10 Static Drain-Source On-State Resistance vs. Gate Source Voltage

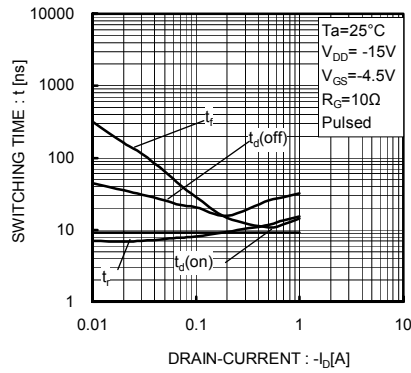


Fig.11 Switching Characteristics

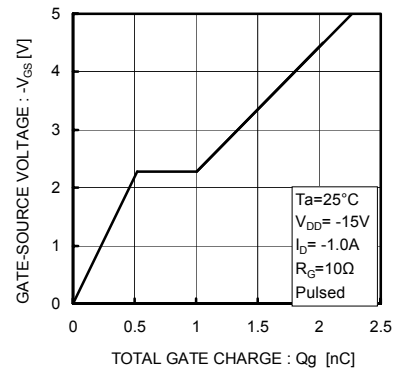


Fig.12 Dynamic Input Characteristics

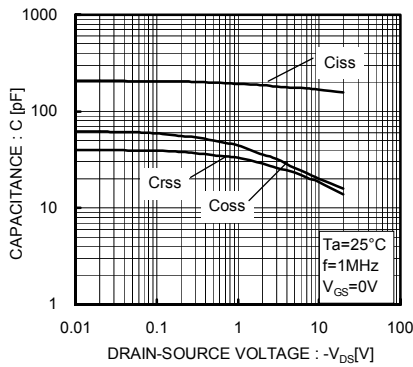


Fig.13 Typical Capacitance vs. Drain-Source Voltage

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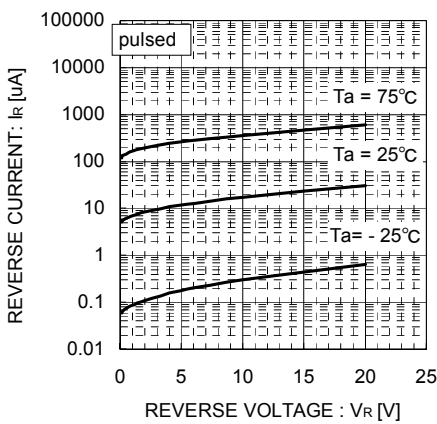


Fig.1 Reverse Current vs. Reverse Voltage

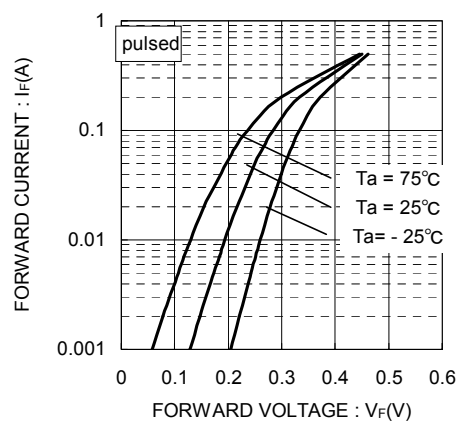


Fig.2 Forward Current vs. Forward Voltage

●Measurement circuit

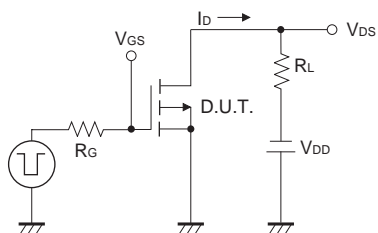


Fig.1-1 Switching Time Measurement Circuit

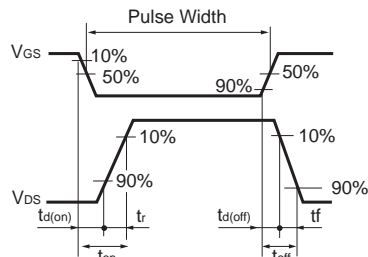


Fig.1-2 Switching Waveforms

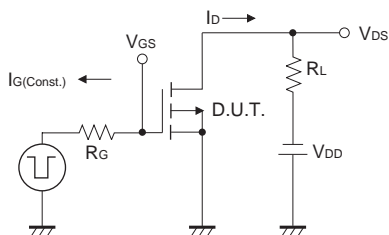


Fig.2-1 Gate Charge Measurement Circuit

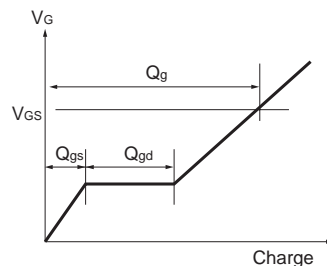


Fig.2-2 Gate Charge Waveform

●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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