

2.5V Drive Pch+SBD MOSFET

US5U38

●Structure

Silicon P-channel MOSFET
Schottky Barrier DIODE

●Features

- 1) The US5U38 combines Pch MOSFET with a Schottky barrier diode in a TUMT5 package.
- 2) Low on-resistance with fast switching.
- 3) Low voltage drive (2.5V).
- 4) Built-in schottky barrier diode has low forward voltage.

●Applications

Switching

●Packaging specifications

Type	Package	Taping
	Code	TR
	Basic ordering unit (pieces)	3000
US5U38		○

●Absolute maximum ratings (Ta=25°C)

<MOSFET>

Parameter		Symbol	Limits	Unit
Drain-source voltage		V_{DS}	-20	V
Gate-source voltage		V_{GS}	±12	V
Drain current	Continuous	I_D	±1.0	A
	Pulsed	I_{DP} *1	±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 *3	0.7	W / ELEMENT

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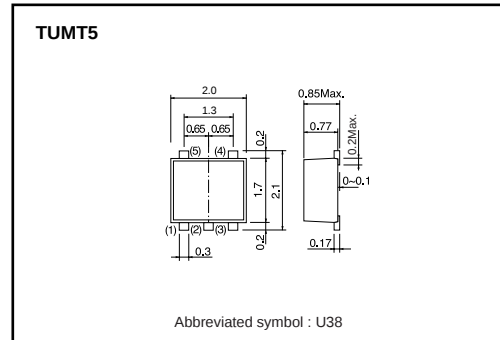
Repetitive peak reverse voltage	V_{RM}	25	V
Reverse voltage	V_R	20	V
Forward current	I_F	0.7	A
Forward current surge peak	I_{FSM} *2	3.0	A
Junction temperature	T_j	150	°C
Power dissipation	P_D *3	0.5	W / ELEMENT

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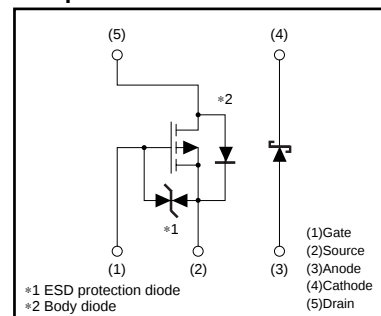
Power dissipation	P_D *3	1.0	W / TOTAL
Range of storage temperature	T_{stg}	-55 to +150	°C

*1 $P_w \leq 10 \mu s$, Duty cycle $\leq 1\%$ *2 60Hz-1cyc. *3 Mounted on a ceramic board

●Dimensions (Unit : mm)



●Equivalent circuit



Transistor

●Electrical characteristics (Ta=25°C)

<MOSFET>

Parameter	Symbol	Min.	Typ.	Max.	Unit	Conditions
Gate-source leakage	I_{GSS}	—	—	±10	μA	$V_{GS}=±12V$, $V_{DS}=0V$
Drain-source breakdown voltage	$V_{(BR)DSS}$	−20	—	—	V	$I_D=−1mA$, $V_{GS}=0V$
Zero gate voltage drain current	I_{DSS}	—	—	−1	μA	$V_{DS}=−20V$, $V_{GS}=0V$
Gate threshold voltage	$V_{GS(th)}$	−0.7	—	−2.0	V	$V_{DS}=−10V$, $I_D=−1mA$
Static drain-source on-state resistance	$R_{DS(on)}$ *	—	280	390	mΩ	$I_D=−1A$, $V_{GS}=−4.5V$
		—	310	430	mΩ	$I_D=−1A$, $V_{GS}=−4.0V$
		—	570	800	mΩ	$I_D=−0.5A$, $V_{GS}=−2.5V$
Forward transfer admittance	$ Y_{fs} $ *	0.7	—	—	S	$V_{DS}=−10V$, $I_D=−0.5A$
Input capacitance	C_{iss}	—	150	—	pF	$V_{DS}=−10V$
Output capacitance	C_{oss}	—	20	—	pF	$V_{GS}=0V$
Reverse transfer capacitance	C_{rss}	—	20	—	pF	$f=1MHz$
Turn-on delay time	$t_{d(on)}$ *	—	9	—	ns	$I_D=−0.5A$
Rise time	t_r *	—	8	—	ns	$V_{DD} \hat{=} −15V$
Turn-off delay time	$t_{d(off)}$ *	—	25	—	ns	$V_{GS}=−4.5V$
Fall time	t_f *	—	10	—	ns	$R_L \hat{=} 30\Omega$
Total gate charge	Q_g *	—	2.1	—	nC	$I_D=−1A$, $V_{DD} \hat{=} −15V$
Gate-source charge	Q_{gs} *	—	0.5	—	nC	$V_{GS}=−4.5V$
Gate-drain charge	Q_{gd} *	—	0.5	—	nC	$R_L \hat{=} 15\Omega$, $R_G=10\Omega$

* Pulsed

<Body diode (source–drain)>

Parameter	Symbol	Min.	Typ.	Max.	Unit	Conditions
Forward voltage	V_{SD}	—	—	−1.2	V	$I_S=−0.4A$, $V_{GS}=0V$

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Parameter	Symbol	Min.	Typ.	Max.	Unit	Conditions
Forward voltage	V_F	—	—	0.49	V	$I_F=0.7A$
Reverse current	I_R	—	—	200	μA	$V_R=20V$

Transistor

●Electrical characteristic curves

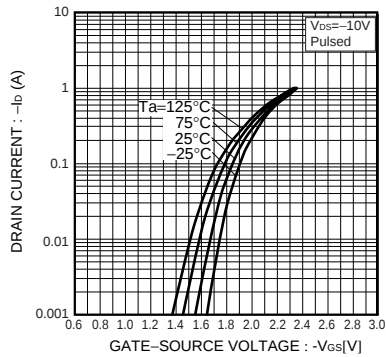


Fig.1 Typical Transfer Characteristics

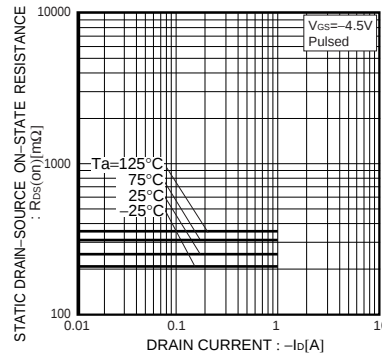


Fig.2 Static Drain-Source On-State Resistance vs. Drain Current (I)

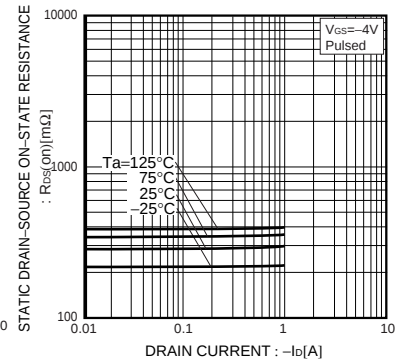


Fig.3 Static Drain-Source On-State Resistance vs. Drain Current (II)

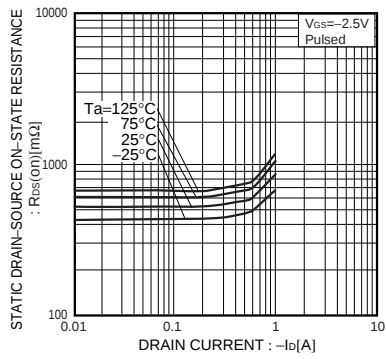


Fig.4 Static Drain-Source On-State Resistance vs. Drain Current (III)

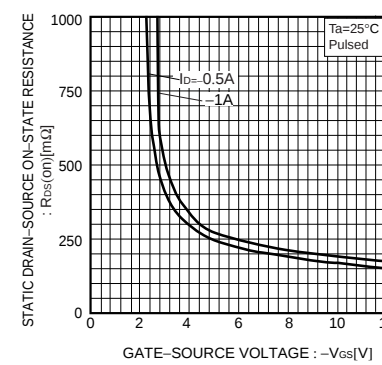


Fig.5 Static Drain-Source On-State Resistance vs. Gate-Source Voltage

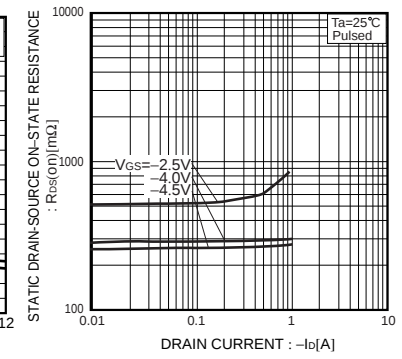


Fig.6 Static Drain-Source On-State Resistance vs. Drain Current

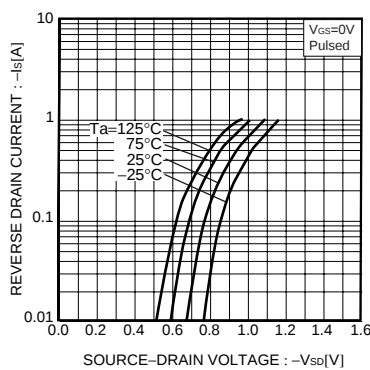


Fig.7 Reverse Drain Current vs. Source-Drain Current

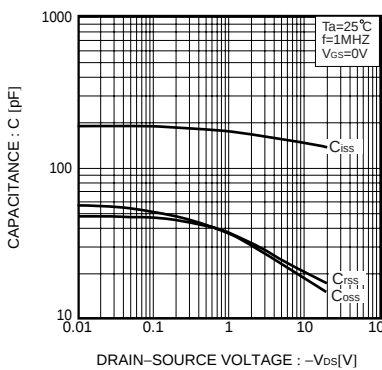


Fig.8 Typical Capacitance vs. Drain-Source Voltage

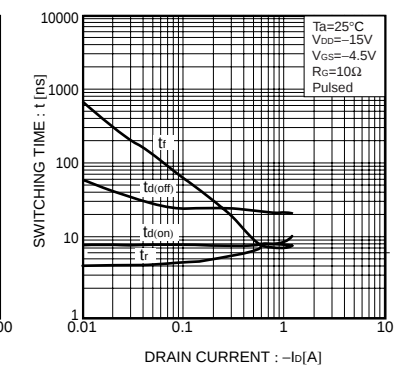


Fig.9 Switching Characteristics

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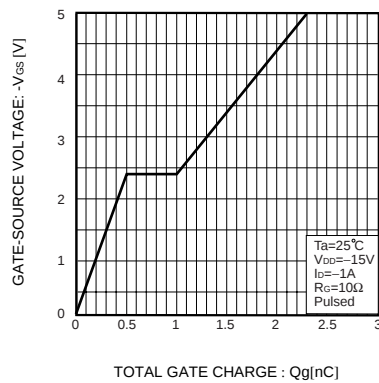


Fig.10 Dynamic Input Characteristics

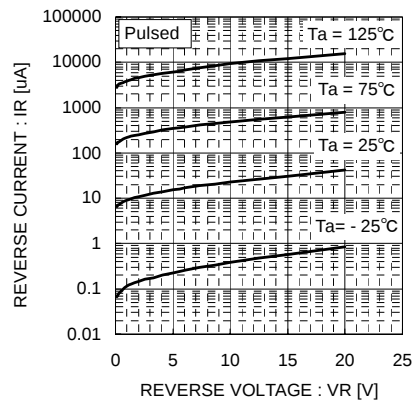


Fig.11 Reverse Current vs. Reverse Voltage

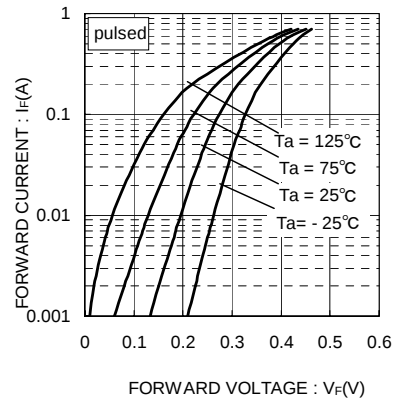


Fig.12 Forward Current vs. Forward Voltage

●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.

Transistor

●Measurement circuits

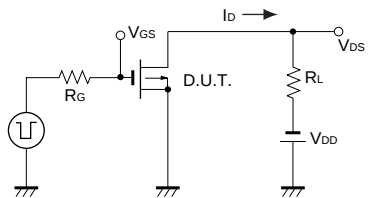


Fig.13 Switching Time Measurement Circuit

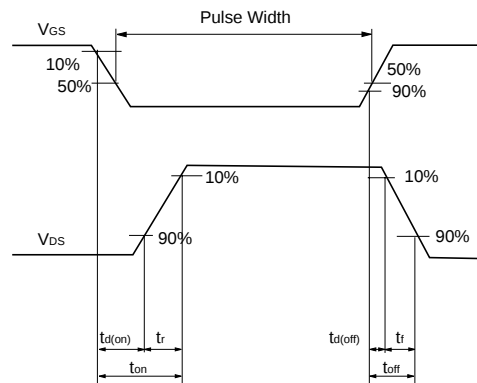


Fig.14 Switching Waveforms

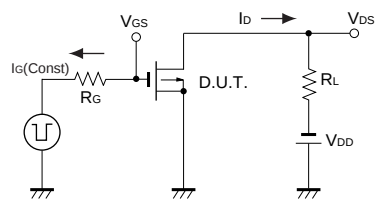


Fig.15 Gate Charge Measurement Circuit

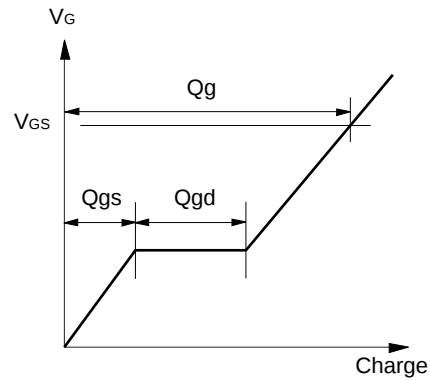


Fig.16 Gate Charge Waveforms

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