

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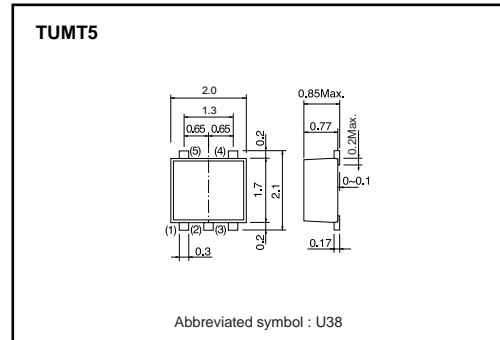
Repetitive peak reverse voltage	V_{RM}	25	V
Reverse voltage	V_R	20	V
Forward current	I_F	0.7	A
Forward current surge peak	I_{FSM} *2	3.0	A
Junction temperature	T_j	150	°C
Power dissipation	P_D *3	0.5	W / ELEMENT

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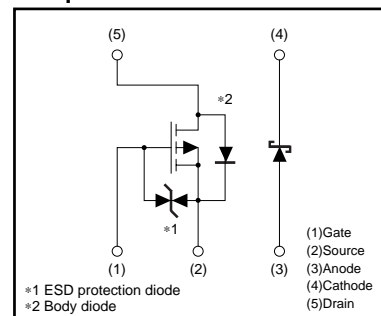
Power dissipation	P_D *3	1.0	W / TOTAL
Range of storage temperature	T_{stg}	-55 to +150	°C

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

●Dimensions (Unit : mm)



●Equivalent circuit



Transistor

●Electrical characteristics (Ta=25°C)

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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} ≐–15V V _{GS} =–4.5V
Turn-off delay time	t _{d(off)} *	–	25	–	ns	R _L ≐30Ω
Fall time	t _f *	–	10	–	ns	R _G =10Ω
Total gate charge	Q _g *	–	2.1	–	nC	I _D =–1A, V _{DD} ≐–15V
Gate-source charge	Q _{gs} *	–	0.5	–	nC	V _{GS} =–4.5V
Gate-drain charge	Q _{gd} *	–	0.5	–	nC	R _L ≐15Ω, R _G =10Ω

* 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

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●Electrical characteristic curves

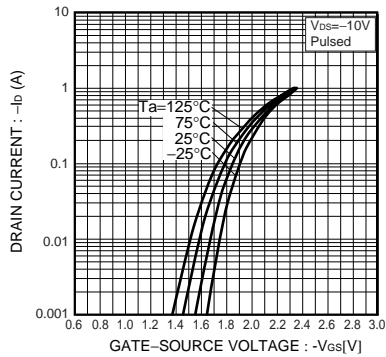


Fig.1 Typical Transfer Characteristics

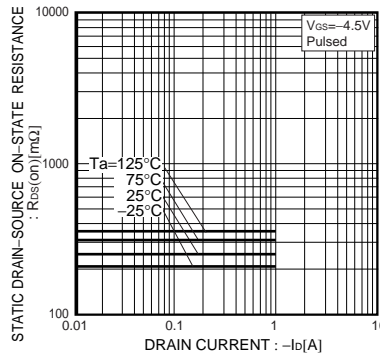


Fig.2 Static Drain-Source On-State Resistance vs. Drain Current (I)

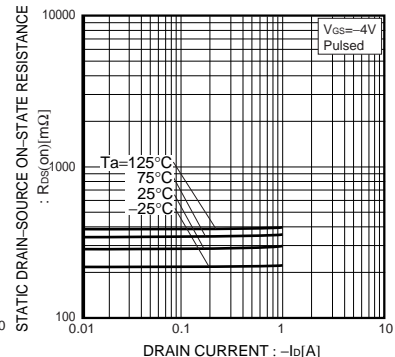


Fig.3 Static Drain-Source On-State Resistance vs. Drain Current (II)

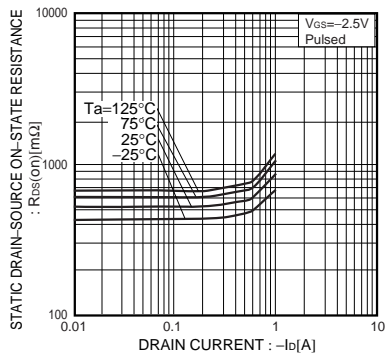


Fig.4 Static Drain-Source On-State Resistance vs. Drain Current (III)

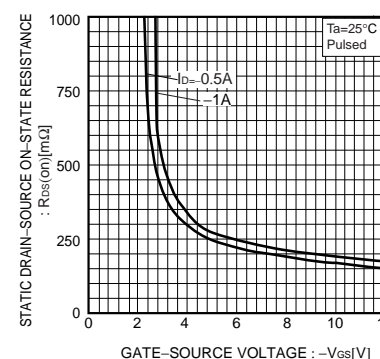


Fig.5 Static Drain-Source On-State Resistance vs. Gate-Source Voltage

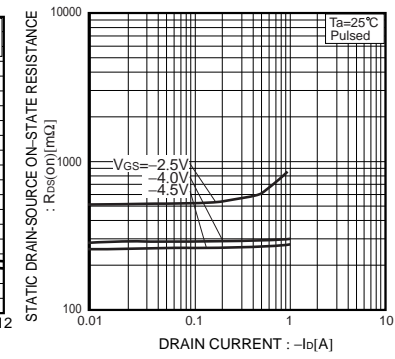


Fig.6 Static Drain-Source On-State Resistance vs. Drain Current

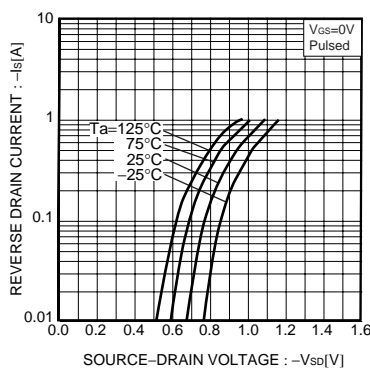


Fig.7 Reverse Drain Current vs. Source-Drain Current

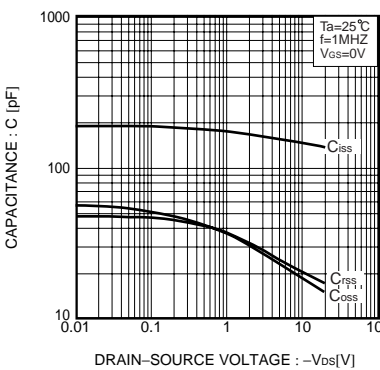


Fig.8 Typical Capacitance vs. Drain-Source Voltage

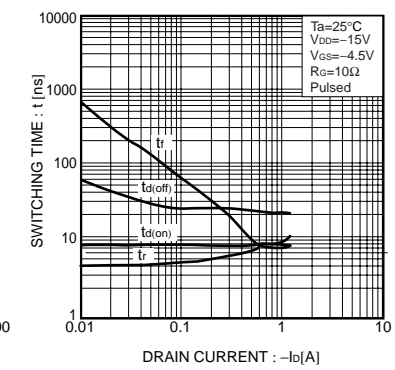


Fig.9 Switching Characteristics

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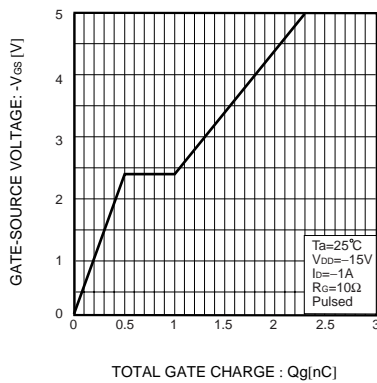


Fig.10 Dynamic Input Characteristics

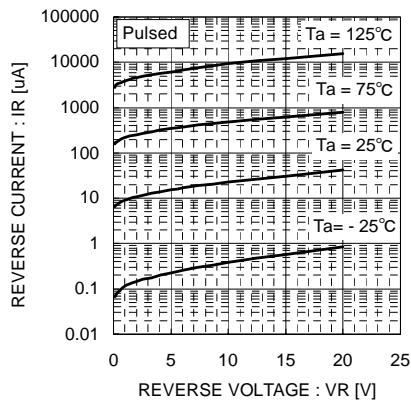


Fig.11 Reverse Current vs. Reverse Voltage

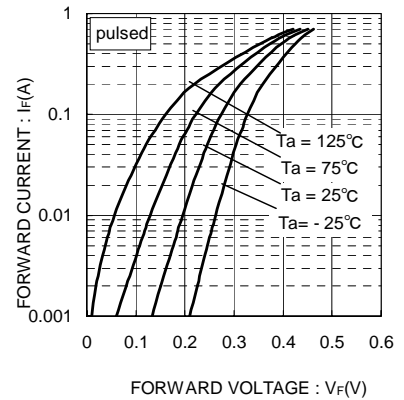


Fig.12 Forward Current vs. Forward Voltage

●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

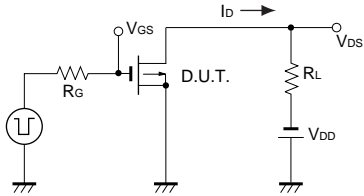


Fig.13 Switching Time Measurement Circuit

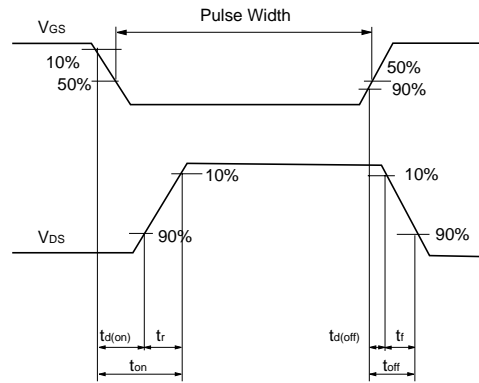


Fig.14 Switching Waveforms

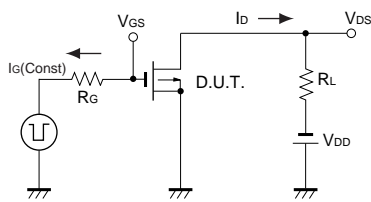


Fig.15 Gate Charge Measurement Circuit

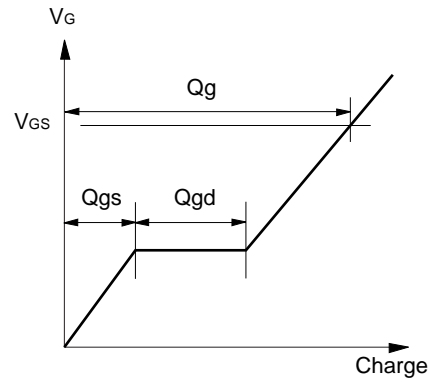


Fig.16 Gate Charge Waveforms

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