1.5V Drive Nch+SBD MOSFET

QS5U36

●Structure
Silicon N-channel MOSFET
Schottky Barrier DIODE

●Features
1) The QS5U36 combines Nch MOSFET with a Schottky barrier diode in a single TSMT5 package.
2) Low on-state resistance with fast switching.
3) Low voltage drive (1.5V).
4) The Independently connected Schottky barrier diode has low forward voltage.

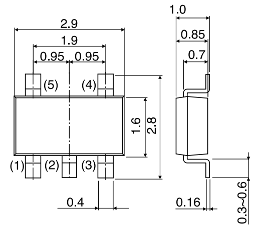
●Applications
Switching

●Packaging specifications

Type	Package	Taping
	Code	TR
	Basic ordering unit (pieces)	3000
QS5U36		○

●Dimensions (Unit : mm)

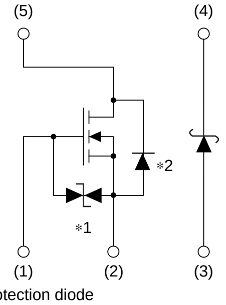
TSMT5



Each lead has same dimensions

Abbreviated symbol : U36

●Equivalent circuit



(1)Gate
(2)Source
(3)Anode
(4)Cathode
(5)Drain

∗1 ESD protection diode
∗2 Body diode

●Absolute maximum ratings (Ta=25°C)

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Parameter		Symbol	Limits	Unit
Drain-source voltage		V_{DSS}	20	V
Gate-source voltage		V_{GSS}	±10	V
Drain current	Continuous	I_D	±2.5	A
	Pulsed	I_{DP} *1	±5.0	A
Source current (Body diode)	Continuous	I_S	0.7	A
	Pulsed	I_{SP} *1	5.0	A
Channel temperature		Tch	150	°C
Power dissipation		P_D *3	0.9	W/ELEMENT

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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	0.7	A
Forward current surge peak	I_{FSM} *2	3.0	A
Junction temperature	Tj	150	°C
Power dissipation	P_D *3	0.7	W/ELEMENT

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Parameter	Symbol	Limits	Unit
Total power dissipation	P_D *3	1.25	W / TOTAL
Range of storage temperature	Tstg	−55 to +150	°C

*1 Pw≤10µs, Duty cycle≤1% *2 60Hz•1cyc. *3 Mounted on a ceramic board

●Electrical characteristics (Ta=25°C)

<MOSFET>

Parameter	Symbol	Min.	Typ.	Max.	Unit	Conditions
Gate-source leakage	I_{GSS}	–	–	±10	µA	V_{GS}=±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	µA	V_{DS}=20V / V_{GS}=0V
Gate threshold voltage	$V_{GS(th)}$	0.3	–	1.3	V	V_{DS}=10V / I_D=1mA
Static drain-source on-state resistance	$R_{DS(on)}$*	–	58	81	mΩ	I_D=2.5A, V_{GS}=4.5V
		–	74	104	mΩ	I_D=2.5A, V_{GS}=2.5V
		–	95	133	mΩ	I_D=1.3A, V_{GS}=1.8V
		–	120	240	mΩ	I_D=0.5A, V_{GS}=1.5V
Forward transfer admittance	$\lvert Y_{fs} \rvert$ *	2.7	–	–	S	V_{DS}=10V, I_D=2.5A
Input capacitance	C_{iss}	–	280	–	pF	V_{DS}=10V
Output capacitance	C_{oss}	–	65	–	pF	V_{GS}=0V
Reverse transfer capacitance	C_{rss}	–	35	–	pF	f=1MHz
Turn-on delay time	$t_{d(on)}$ *	–	6	–	ns	I_D=1.3A
Rise time	t_r *	–	15	–	ns	V_{DD}≒10V, V_{GS}=4.5V
Turn-off delay time	$t_{d(off)}$ *	–	30	–	ns	R_L≒7.7Ω
Fall time	t_f *	–	15	–	ns	R_G=10Ω
Total gate charge	Q_g *	–	3.5	–	nC	I_D=2.5A, V_{DD}≒10V
Gate-source charge	Q_{gs} *	–	0.8	–	nC	V_{GS}=4.5V
Gate-drain charge	Q_{gd} *	–	0.7	–	nC	R_L≒4Ω, R_G=10Ω

*Pulsed

<MOSFET>Body diode (source-drain)

Parameter	Symbol	Min.	Typ.	Max.	Unit	Conditions
Forward voltage	V_{SD} *	–	–	1.2	V	I_S=0.7A / V_{GS}=0V

*Pulsed

<Di>

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

●Electrical characteristic curves

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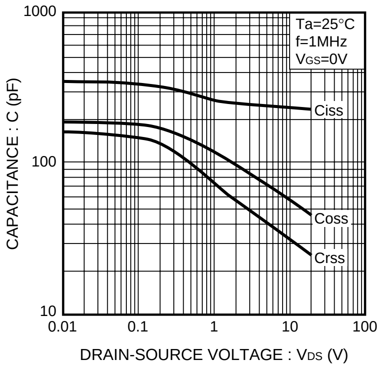

Fig.1 Typical Capacitance vs. Drain-Source Voltage

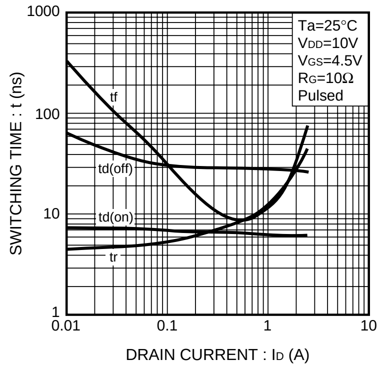

Fig.2 Switching Characteristics

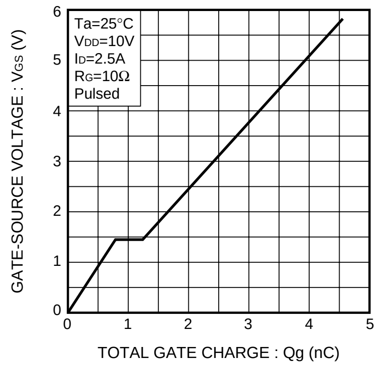

Fig.3 Dynamic Input Characteristics

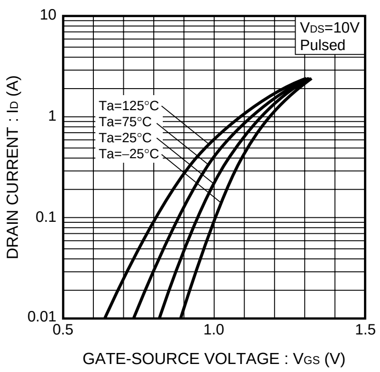

Fig.4 Typical Transfer Characteristics

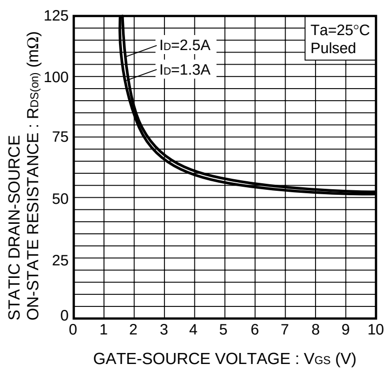

Fig.5 Static Drain-Source On-State Resistance vs. Gate-source Voltage

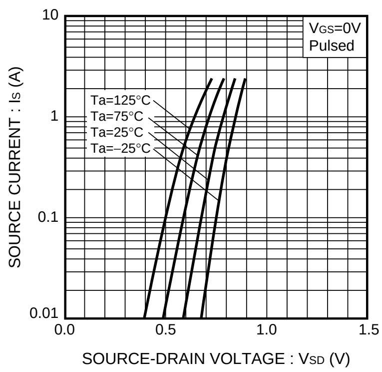

Fig.6 Source Current vs. Source-Drain Voltage

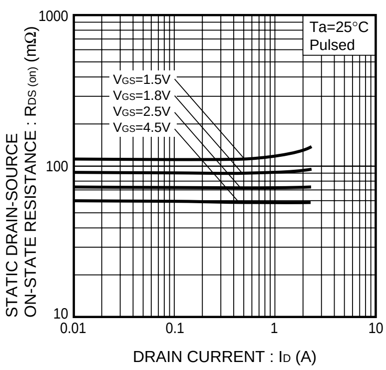

Fig.7 Static Drain-Source On-State Resistance vs. Drain Current (I)

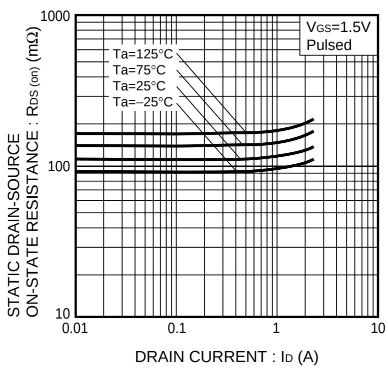

Fig.8 Static Drain-Source On-State Resistance vs. Drain Current (II)

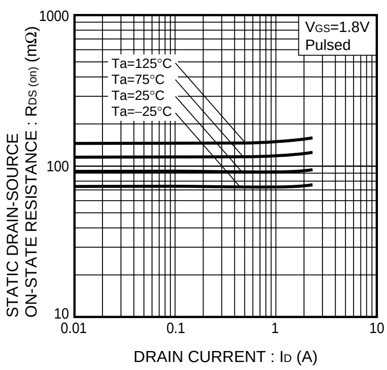

Fig.9 Static Drain-Source On-State Resistance vs. Drain Current (III)

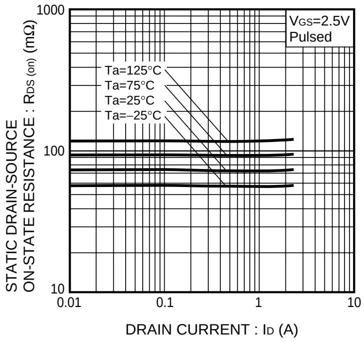

Fig.10 Static Drain-Source On-State Resistance vs. Drain Current (Ⅳ)

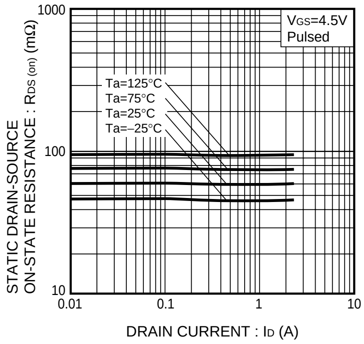

Fig.11 Static Drain-Source On-State Resistance vs. Drain Current (Ⅴ)

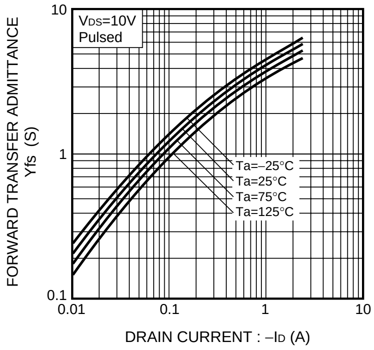

Fig.12 Forward Transfer Admittance vs. Drain Current

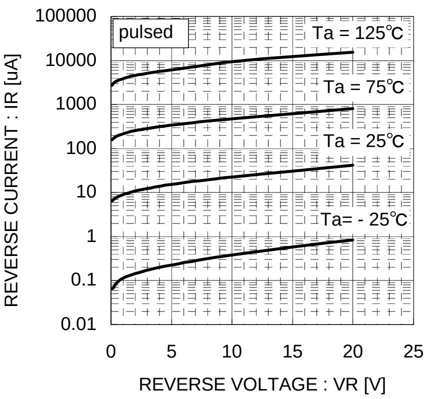

Fig.13 Reverse Current vs. Reverse Voltage

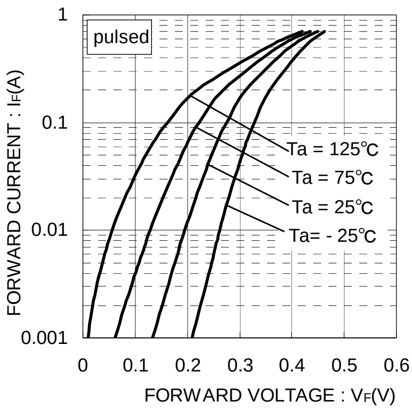

Fig.14 Forward Current vs. Forward Voltage

●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.

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●Measurement circuit

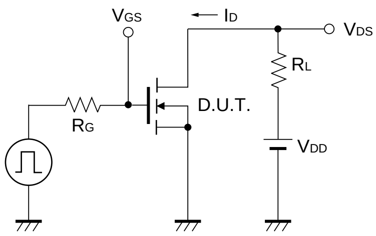

Fig.15 Switching Time Measurement Circuit

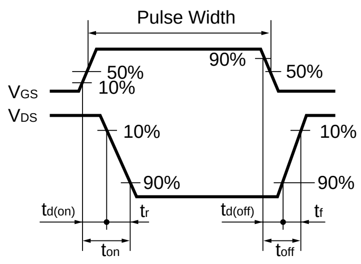

Fig.16 Switching Waveforms

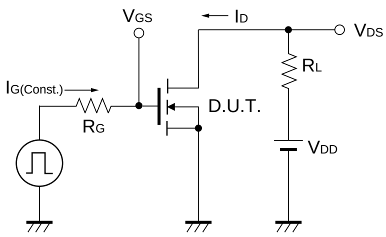

Fig.17 Gate Charge Measurement Circuit

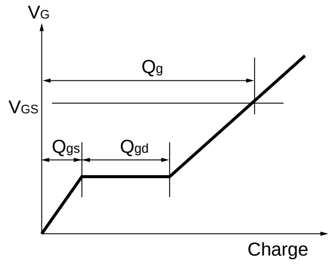

Fig.18 Gate Charge Waveform

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