

# Small switching (30V, 2.0A)

## QS5U13

**●Features**

- 1) The QS5U13 combines Nch MOSFET with a Schottky barrier diode in a single TSMT5 package.
- 2) Nch MOSFET have a low on-state resistance with a fast switching.
- 3) Nch MOSFET is reacted a low voltage drive (2.5V).
- 4) The Independently connected Schottky barrier diode have a low forward voltage.

**●Applications**

Load switch, DC / DC conversion

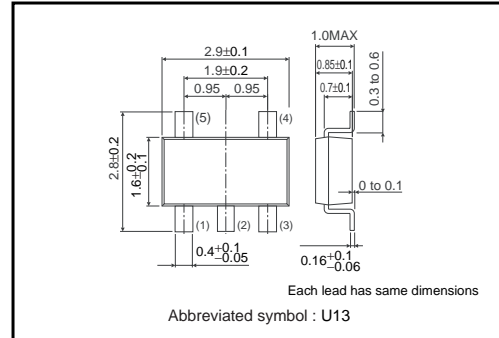
**●Structure**

Silicon N-channel MOSFET  
Schottky Barrier DIODE

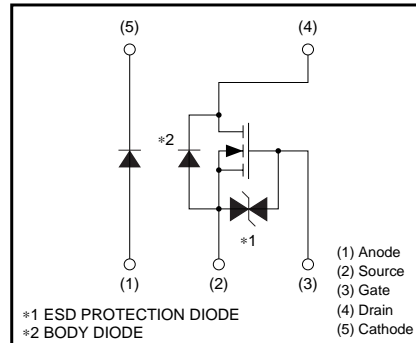
**●Packaging specifications**

Type	Package	Taping
	Code	TR
	Basic ordering unit (pieces)	3000
QS5U13		○

**●External dimensions (Unit : mm)**



**●Equivalent circuit**



Transistors

●Absolute maximum ratings (Ta=25°C)

<MOSFET>

Parameter	Symbol	Limits	Unit
Drain-source voltage	V <sub>DSS</sub>	30	V
Gate-source voltage	V <sub>GSS</sub>	12	V
Drain current	Continuous	I <sub>D</sub>	±2.0 A
	Pulsed	I <sub>DP</sub>	±8.0 A Pw≤10μs, Duty cycle≤1%
Source current (Body diode)	Continuous	I <sub>S</sub>	0.8 A
	Pulsed	I <sub>SP</sub>	3.2 A Pw≤10μs, Duty cycle≤1%
Channel temperature	T <sub>ch</sub>	150	°C

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Repetitive peak reverse voltage	V <sub>RM</sub>	30	V
Reverse voltage	V <sub>R</sub>	20	V
Forward current	I <sub>F</sub>	0.5	A
Forward current surge peak	I <sub>FSM</sub>	2.0	A 60Hz · 1cyc.
Junction temperature	T <sub>j</sub>	125	°C

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Total power dissipation	P <sub>D</sub>	1.0	W / Total / Mounted on a ceramic board
Range of Storage temperature	T <sub>stg</sub>	-50 to 150	°C

●Electrical characteristics (Ta=25°C)

<MOSFET>

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>	30	-	-	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> =30V / V <sub>GS</sub> =0V
Gate threshold voltage	V <sub>GS(th)</sub>	0.5	-	1.5	V	V <sub>DS</sub> =10V / I <sub>D</sub> =1mA
Static drain-source on-state resistance	R <sub>DS(on)</sub> *	-	71	100	mΩ	I <sub>D</sub> =2.0A, V <sub>GS</sub> =4.5V
		-	76	107	mΩ	I <sub>D</sub> =2.0A, V <sub>GS</sub> =4V
		-	110	154	mΩ	I <sub>D</sub> =2.0A, V <sub>GS</sub> =2.5V
Forward transfer admittance	Y <sub>fs</sub>	1.5	-	-	S	V <sub>DS</sub> =10V, I <sub>D</sub> =2.0A
Input capacitance	C <sub>iss</sub>	-	175	-	pF	V <sub>DS</sub> =10V
Output capacitance	C <sub>oss</sub>	-	50	-	pF	V <sub>GS</sub> =0V
Reverse transfer capacitance	C <sub>riss</sub>	-	25	-	pF	f=1MHz
Turn-on delay time	t <sub>d(on)</sub> *	-	8	-	ns	I <sub>D</sub> =1.0A
Rise time	t <sub>r</sub> *	-	10	-	ns	V <sub>DD</sub> ≐15V
Turn-off delay time	t <sub>d(off)</sub> *	-	21	-	ns	V <sub>GS</sub> =4.5V
Fall time	t <sub>f</sub> *	-	8	-	ns	R <sub>L</sub> =15Ω
Total gate charge	Q <sub>g</sub>	-	2.8	3.9	nC	R <sub>GS</sub> =10Ω
Gate-source charge	Q <sub>gs</sub>	-	0.6	-	nC	V <sub>DD</sub> ≐15V
Gate-drain charge	Q <sub>gd</sub>	-	0.8	-	nC	V <sub>GS</sub> =4.5V
						I <sub>D</sub> =2.0A

\*Pulsed

<MOSFET>Body diode (source-drain)

Forward voltage	V <sub>SD</sub>	-	-	1.2	V	I <sub>S</sub> =3.2A / V <sub>GS</sub> =0V
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Forward voltage	V <sub>F</sub>	-	-	0.47	V	I <sub>F</sub> =0.5A
Reverse leakage	I <sub>R</sub>	-	-	100	μA	V <sub>R</sub> =20V

Transistors

●Electrical characteristic curves

<MOSFET>

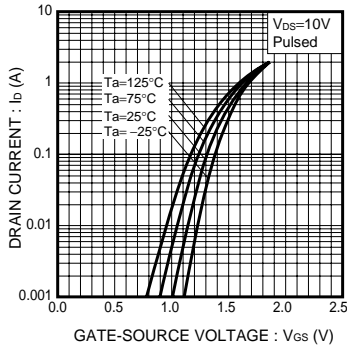


Fig.1 Typical Transfer Characteristics

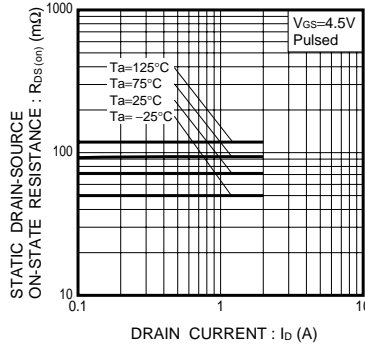


Fig.2 Static Drain-Source On-State Resistance vs. Drain Current

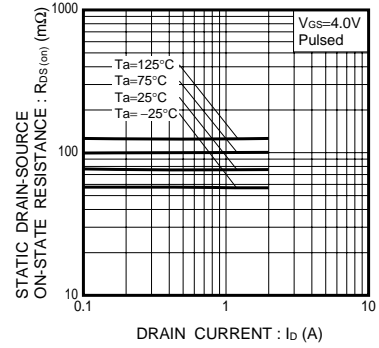


Fig.3 Static Drain-Source On-State Resistance vs. Drain Current

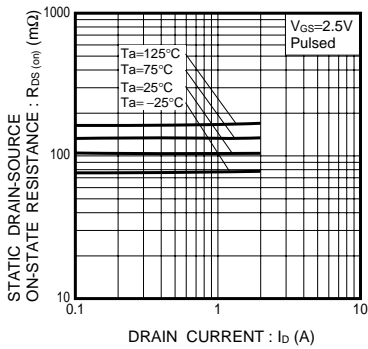


Fig.4 Static Drain-Source On-State Resistance vs. Drain Current

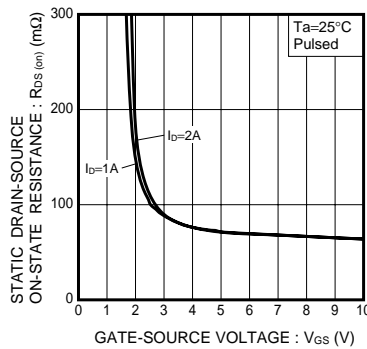


Fig.5 Static Drain-Source On-State Resistance vs. Gate-Source Voltage

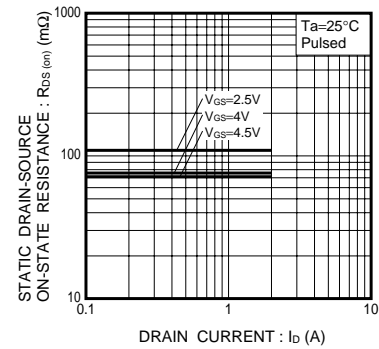


Fig.6 Static Drain-Source On-State Resistance vs. Drain Current

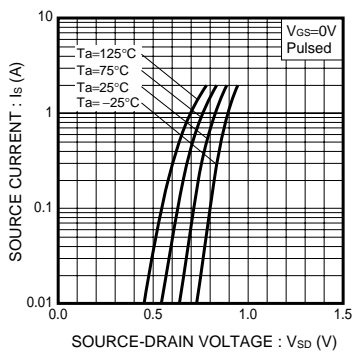


Fig.7 Reverse Drain Current vs. Source-Drain Current

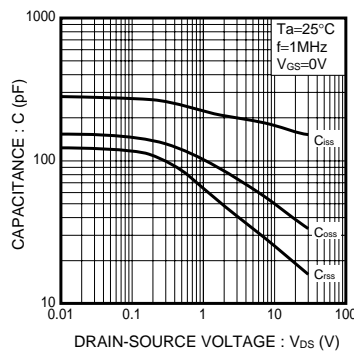


Fig.8 Typical Capacitance vs. Drain-Source Voltage

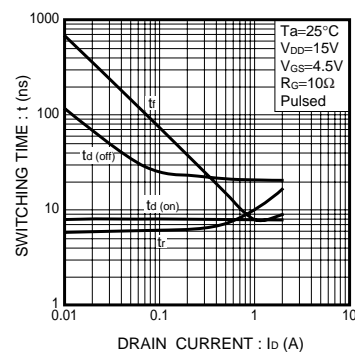


Fig.9 Switching Characteristics

Transistors

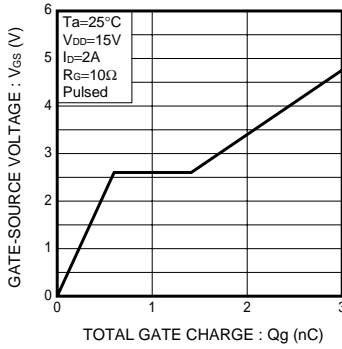


Fig.10 Dynamic Input Characteristics

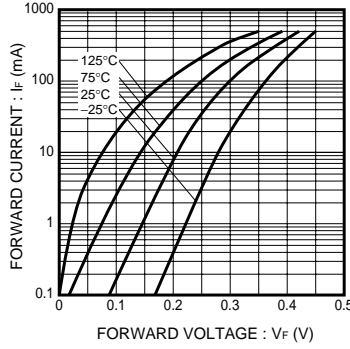


Fig.11 Forward Current vs. Forward Voltage

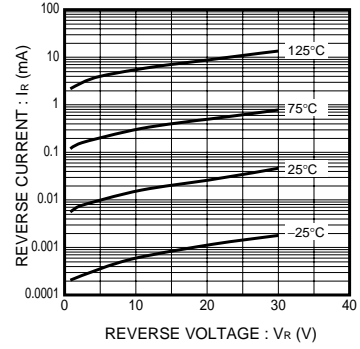


Fig.12 Reverse Current vs. Reverse Voltage

● Measurement circuits

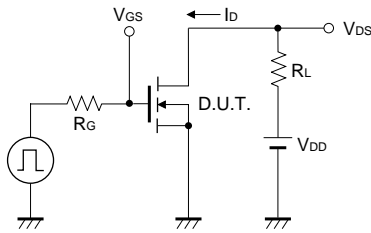


Fig.13 Switching Time Measurement Circuit

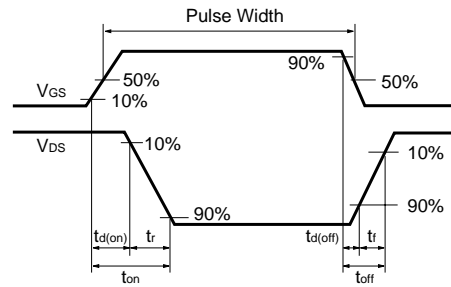


Fig.14 Switching Waveforms

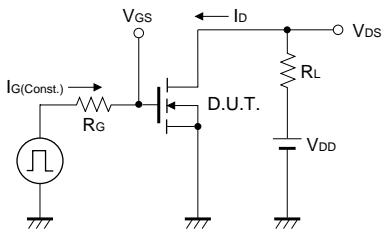


Fig.15 Gate Charge Measurement Circuit

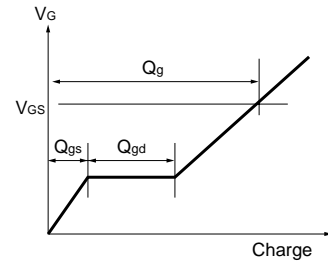


Fig.16 Gate Charge Waveform

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