

# 2.5V Drive Nch+Pch MOSFET

## QS6M3

●Structure

Silicon N-channel / P-channel MOSFET

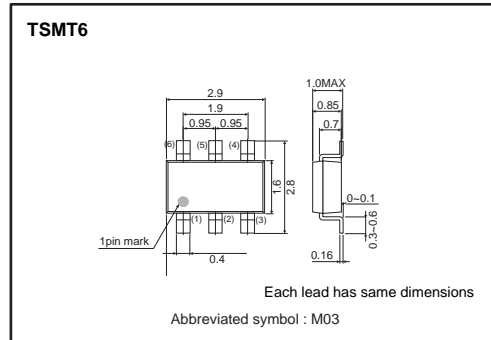
●Features

- 1) Low on-resistance.
- 2) Built-in G-S Protection Diode.
- 3) Small Surface Mount Package (TSMT6).

●Application

Power switching, DC / DC converter.

●Dimensions (Unit : mm)



●Packaging specifications

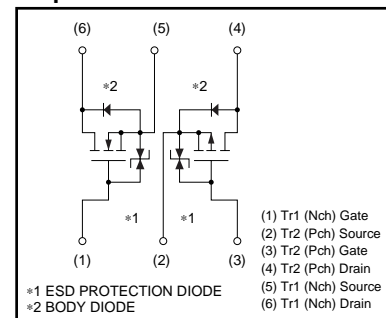
Type	Package	Taping
	Code	TR
	Basic ordering unit (pieces)	3000
QS6M3		○

●Absolute maximum ratings (Ta=25°C)

Parameter	Symbol	Limits		Unit
		Tr1 : Nch	Tr2 : Pch	
Drain-source voltage	V <sub>DSS</sub>	30	-20	V
Gate-source voltage	V <sub>GSS</sub>	±12	±12	V
Drain current	Continuous	I <sub>D</sub>	±1.5	A
	Pulsed	I <sub>DP</sub> *1	±6.0	A
Source current (Body diode)	Continuous	I <sub>S</sub>	0.8	A
	Pulsed	I <sub>SP</sub> *1	6.0	A
Total power dissipation	P <sub>D</sub> *2		1.25	W / TOTAL
			0.9	W / ELEMENT
Channel temperature	T <sub>ch</sub>	150		°C
Storage temperature	T <sub>stg</sub>	-55 to +150		°C

\*1 P<sub>w</sub>≤10μs, Duty cycle≤1%  
\*2 Mounted on a ceramic board

●Equivalent circuit



●Thermal resistance

Parameter	Symbol	Limits	Unit
Channel to ambient	R <sub>th</sub> (ch-a)*	100	°C / W / TOTAL
		139	°C / W / ELEMENT

\* Mounted on a ceramic board

Transistors

N-ch

●Electrical characteristics (Ta=25°C)

Parameter	Symbol	Min.	Typ.	Max.	Unit	Conditions
Gate-source leakage	$I_{GSS}$	–	–	±10	μA	$V_{GS}=\pm 12V, V_{DS}=0V$
Drain-source breakdown voltage	$V_{(BR)DSS}$	30	–	–	V	$I_D=1mA, V_{GS}=0V$
Zero gate voltage drain current	$I_{DSS}$	–	–	1	μA	$V_{DS}=30V, V_{GS}=0V$
Gate threshold voltage	$V_{GS(th)}$	0.5	–	1.5	V	$V_{DS}=10V, I_D=1mA$
Static drain-source on-state resistance	$R_{DS(on)}$ *	–	170	230	mΩ	$I_D=1.5A, V_{GS}=4.5V$
		–	180	245		$I_D=1.5A, V_{GS}=4.0V$
		–	260	360		$I_D=1.0A, V_{GS}=2.5V$
Forward transfer admittance	$ Y_{fs} $ *	1.0	–	–	S	$I_D=1.0A, V_{DS}=10V$
Input capacitance	$C_{iss}$	–	80	–	pF	$V_{DS}=10V$
Output capacitance	$C_{oss}$	–	25	–	pF	$V_{GS}=0V$
Reverse transfer capacitance	$C_{rss}$	–	15	–	pF	$f=1MHz$
Turn-on delay time	$t_{d(on)}$ *	–	7	–	ns	$I_D=1A, V_{DD}\approx 15V$
Rise time	$t_r$ *	–	18	–	ns	$V_{GS}=4.5V$
Turn-off delay time	$t_{d(off)}$ *	–	15	–	ns	$R_L=15\Omega$
Fall time	$t_f$ *	–	15	–	ns	$R_G=10\Omega$
Total gate charge	$Q_g$ *	–	1.6	–	nC	$V_{DD}\approx 15V, R_L=10\Omega$
Gate-source charge	$Q_{gs}$ *	–	0.5	–	nC	$V_{GS}=4.5V, R_G=10\Omega$
Gate-drain charge	$Q_{gd}$ *	–	0.9	–	nC	$I_D=1.5A$

\*Pulsed

●Body diode characteristics (Source-Drain) (Ta=25°C)

Parameter	Symbol	Min.	Typ.	Max.	Unit	Conditions
Forward voltage	$V_{SD}$ *	–	–	1.2	V	$I_S=3.2A, V_{GS}=0V$

\*Pulsed

Transistors

P-ch

●Electrical characteristics (Ta=25°C)

Parameter	Symbol	Min.	Typ.	Max.	Unit	Conditions
Gate-source leakage	$I_{GSS}$	–	–	±10	μA	$V_{GS} = \pm 12V, V_{DS} = 0V$
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	$R_{DS(on)}$ *	–	155	215	mΩ	$I_D = -1.5A, V_{GS} = -4.5V$
		–	170	235		$I_D = -1.5A, V_{GS} = -4.0V$
		–	310	430		$I_D = -0.75A, V_{GS} = -2.5V$
Forward transfer admittance	$ Y_{fs} $ *	1.0	–	–	S	$I_D = -0.75A, V_{DS} = -10V$
Input capacitance	$C_{iss}$	–	270	–	pF	$V_{DS} = -10V$
Output capacitance	$C_{oss}$	–	40	–	pF	$V_{GS} = 0V$
Reverse transfer capacitance	$C_{rss}$	–	35	–	pF	$f = 1MHz$
Turn-on delay time	$t_{d(on)}$ *	–	10	–	ns	$I_D = -0.75A, V_{DD} = -15V$
Rise time	$t_r$ *	–	12	–	ns	$V_{GS} = -4.5V$
Turn-off delay time	$t_{d(off)}$ *	–	45	–	ns	$R_L = 20\Omega$
Fall time	$t_f$ *	–	20	–	ns	$R_G = 10\Omega$
Total gate charge	$Q_g$ *	–	3.0	–	nC	$V_{DD} = -15V, R_L = 10\Omega$
Gate-source charge	$Q_{gs}$ *	–	0.8	–	nC	$V_{GS} = -4.5V, R_G = 10\Omega$
Gate-drain charge	$Q_{gd}$ *	–	0.85	–	nC	$I_D = -1.5A$

\*Pulsed

●Body diode characteristics (Source-Drain) (Ta=25°C)

Parameter	Symbol	Min.	Typ.	Max.	Unit	Conditions
Forward voltage	$V_{SD}$	–	–	–1.2	V	$I_S = -0.75A, V_{GS} = 0V$

Transistors

N-ch

●Electrical characteristic curves

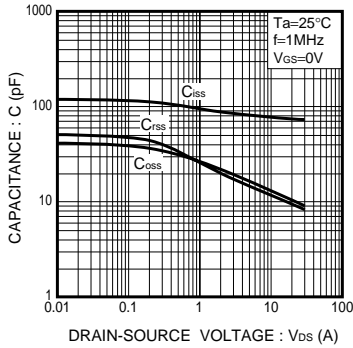


Fig.1 Typical Capacitance vs. Drain-Source Voltage

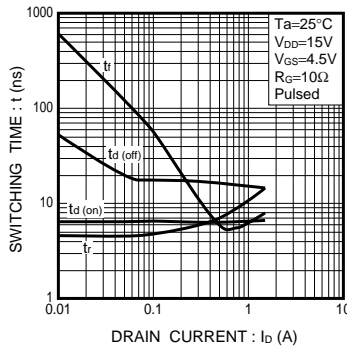


Fig.2 Switching Characteristics

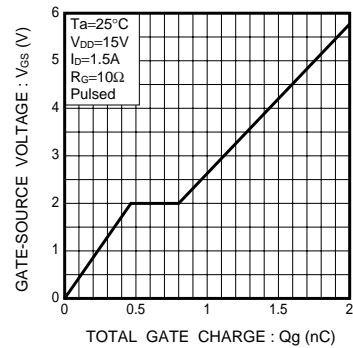


Fig.3 Dynamic Input Characteristics

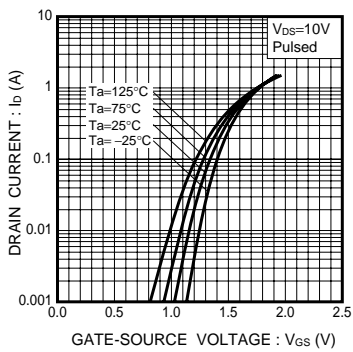


Fig.4 Typical Transfer Characteristics

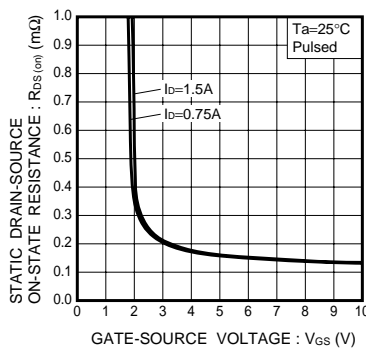


Fig.5 Static Drain-Source On-State Resistance vs. Gate-Source Voltage

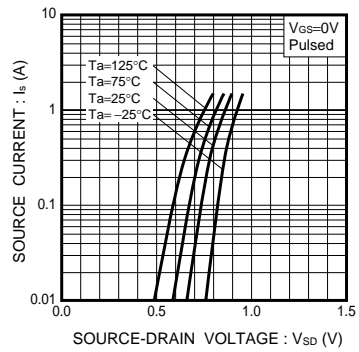


Fig.6 Source Current vs. Source-Drain Voltage

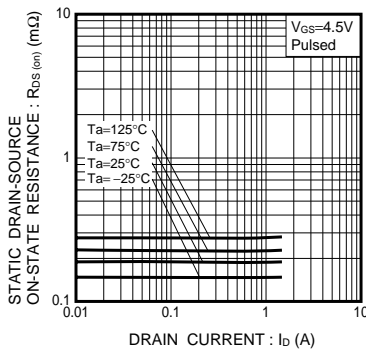


Fig.7 Static Drain-Source On-State Resistance vs. Drain Current (I)

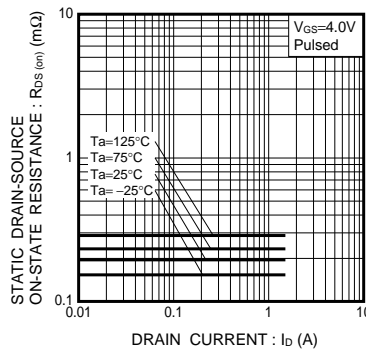


Fig.8 Static Drain-Source On-State Resistance vs. Drain Current (II)

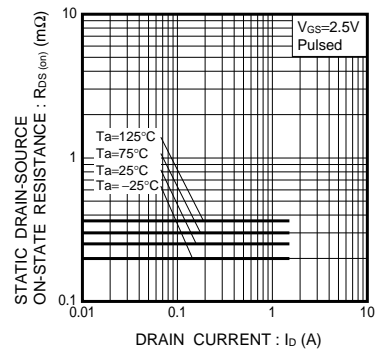


Fig.9 Static Drain-Source On-State Resistance vs. Drain Current (III)

Transistors

P-ch

●Electrical characteristic curves

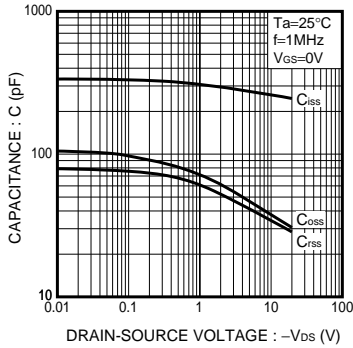


Fig.1 Typical Capacitance vs. Drain-Source Voltage

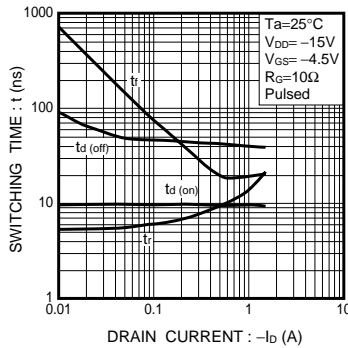


Fig.2 Switching Characteristics

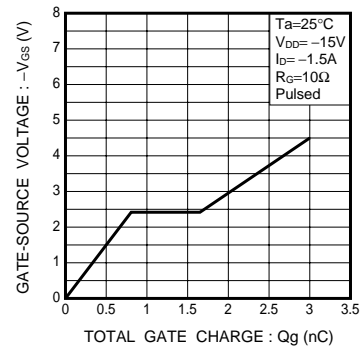


Fig.3 Dynamic Input Characteristics

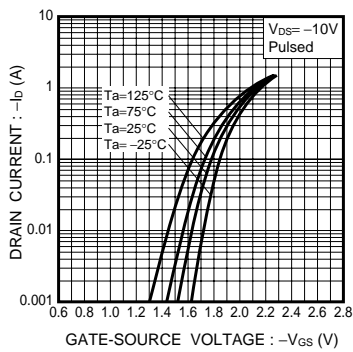


Fig.4 Typical Transfer Characteristics

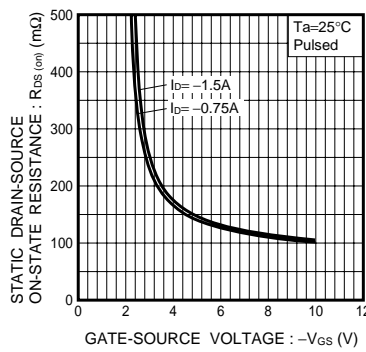


Fig.5 Static Drain-Source On-State Resistance vs. Gate-Source Voltage

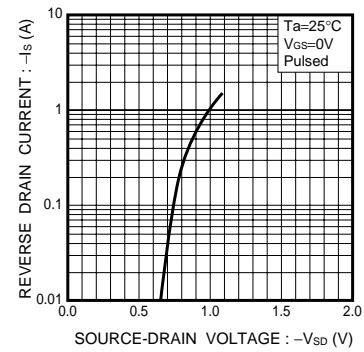


Fig.6 Source Current vs. Source-Drain Voltage

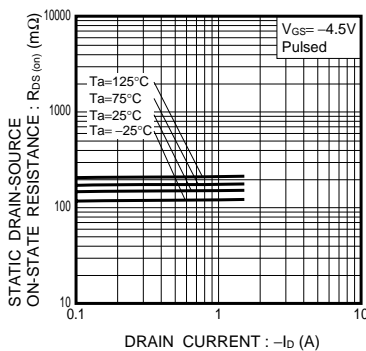


Fig.7 Static Drain-Source On-State Resistance vs. Drain Current (I)

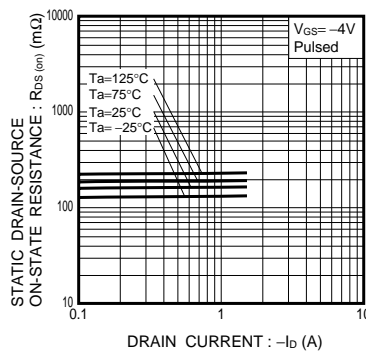


Fig.8 Static Drain-Source On-State Resistance vs. Drain Current (II)

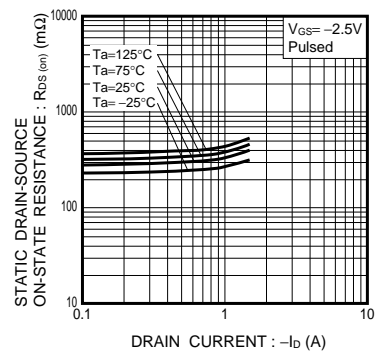


Fig.9 Static Drain-Source On-State Resistance vs. Drain Current (III)

Transistors

N-ch

●Measurement circuit

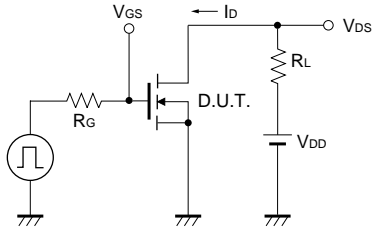


Fig.1-1 Switching Time Measurement Circuit

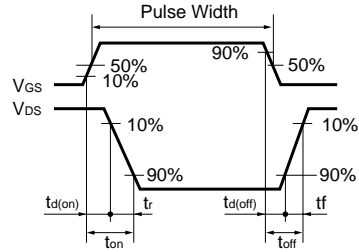


Fig.1-2 Switching Waveforms

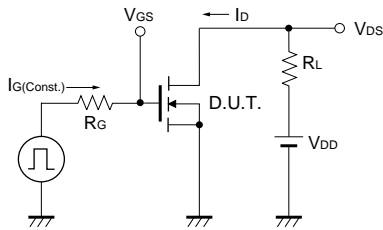


Fig.2-1 Gate Charge Measurement Circuit

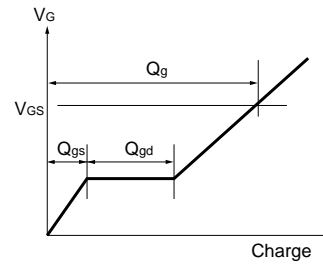


Fig.2-2 Gate Charge Waveform

Transistors

P-ch

●Measurement circuit

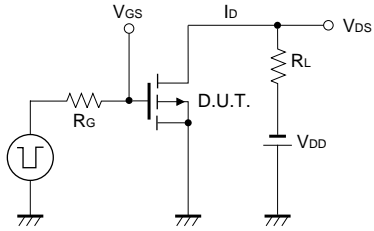


Fig.3-1 Switching Time Measurement Circuit

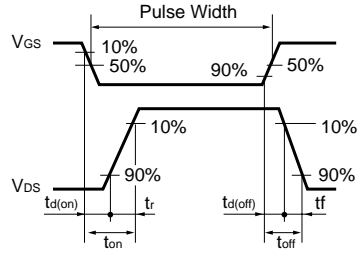


Fig.3-2 Switching Waveforms

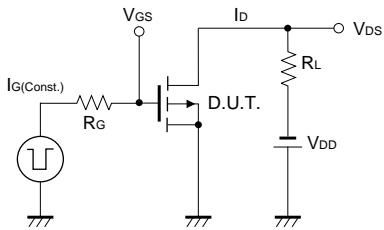


Fig.4-1 Gate Charge Measurement Circuit

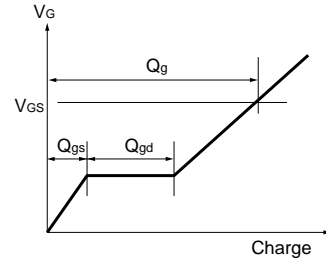


Fig.4-2 Gate Charge Waveform

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