2.5V Drive Nch+Pch MOSFET

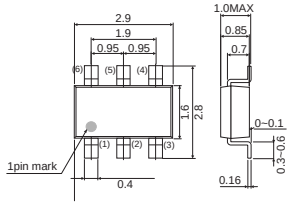
QS6M4

●Structure
Silicon P-channel MOSFET
Silicon N-channel MOSFET

●Features
1) The QS6M4 combines Pch MOSFET with a Nch MOSFET in a single TSMT6 package.
2) Low on-state resistance with a fast switching.
3) Low voltage drive (2.5V).

●Dimensions (Unit : mm)

TSMT6



Each lead has same dimensions

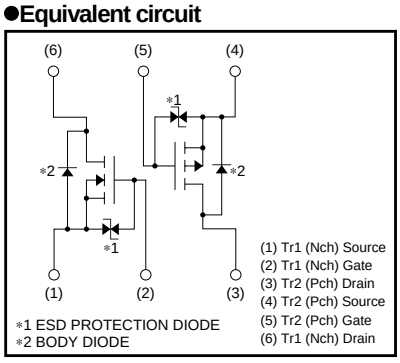
Abbreviated symbol : M04

●Applications
Load switch, inverter

●Packaging specifications

Type	Package	Taping
	Code	TR
	Basic ordering unit (pieces)	3000
QS6M4		○

●Equivalent circuit



(1) Tr1 (Nch) Source
(2) Tr1 (Nch) Gate
(3) Tr2 (Pch) Drain
(4) Tr2 (Pch) Source
(5) Tr2 (Pch) Gate
(6) Tr1 (Nch) Drain

*1 ESD PROTECTION DIODE
*2 BODY DIODE

●Absolute maximum ratings (Ta=25°C)

Parameter		Symbol	Limits		Unit
			Nchannel	Pchannel	
Drain-source voltage		V_{DSS}	30	−20	V
Gate-source voltage		V_{GSS}	±12	±12	V
Drain current	Continuous	I_D	±1.5	±1.5	A
	Pulsed	I_{DP} *1	±6.0	±6.0	A
Source current (Body diode)	Continuous	I_S	0.8	−0.75	A
	Pulsed	I_{SP} *1	6.0	−6.0	A
Total power dissipation		P_D *2	1.25		W / TOTAL
			0.9		W / ELEMENT
Channel temperature		Tch	150		°C
Storage temperature		Tstg	−55 to +150		°C

*1 Pw≤10μs, Duty cycle≤1%
*2 Mounted on a ceramic board

●Thermal resistance

Parameter	Symbol	Limits	Unit
Channel to ambient	Rth (ch-a)*	100	°C / W / TOTAL
		139	°C / W / ELEMENT

* Mounted on a ceramic board

●**Electrical characteristics** (Ta=25°C)

<Tr1. N-ch 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	$V_{(BR)\ DSS}$	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	V_{DS}=10V / I_D=1.0A
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}≒15V
Rise time	t_r *	–	18	–	ns	V_{GS}=4.5V
Turn-off delay time	$t_{d\ (off)}$ *	–	15	–	ns	R_L=15Ω / R_G=10Ω
Fall time	t_f *	–	15	–	ns	
Total gate charge	Q_g *	–	1.6	–	nC	V_{DD}≒15V R_L=10Ω
Gate-source charge	Q_{gs} *	–	0.5	–	nC	V_{GS}=4.5V R_G=10Ω
Gate-drain charge	Q_{gd} *	–	0.9	–	nC	I_D=1.5A

*Pulsed

●**Body diode characteristics** (Source-Drain)

<Tr1. N-ch MOSFET>

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

*Pulsed

●**Electrical characteristics** (Ta=25°C)

<Tr2. P-ch 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	$R_{DS\ (on)}$ *	–	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	V_{DS}= –10V / I_D= –0.75A
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=20Ω / R_G=10Ω
Fall time	t_f *	–	20	–	ns	
Total gate charge	Q_g *	–	3.0	–	nC	V_{DD}≒ –15V R_L=10Ω
Gate-source charge	Q_{gs} *	–	0.8	–	nC	V_{GS}= –4.5V R_G=10Ω
Gate-drain charge	Q_{gd} *	–	0.85	–	nC	I_D= –1.5A

*Pulsed

●**Body diode characteristics** (Source-Drain)

<Tr2. P-ch MOSFET>

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

N-ch

●Electrical characteristic curves

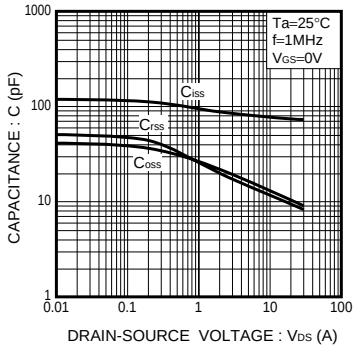


Fig.1 Typical Capacitance vs. Drain-Source Voltage

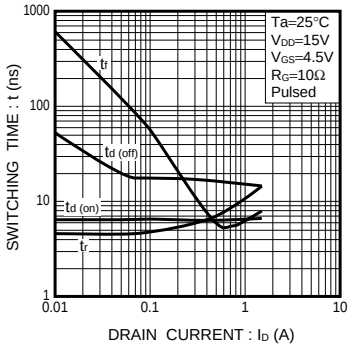


Fig.2 Switching Characteristics

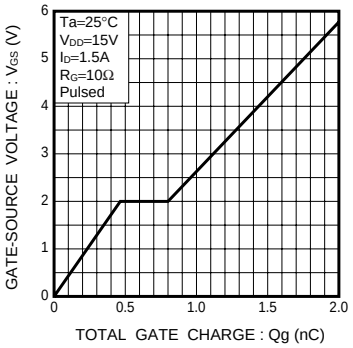


Fig.3 Dynamic Input Characteristics

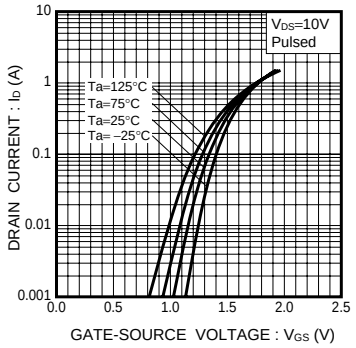


Fig.4 Typical Transfer Characteristics

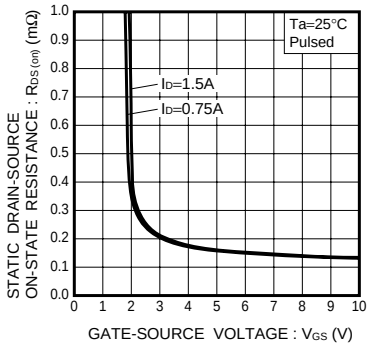


Fig.5 Static Drain-Source On-State Resistance vs. Gate-Source Voltage

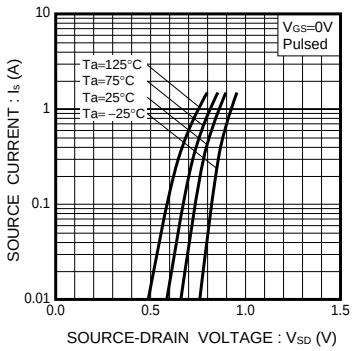


Fig.6 Source Current vs. Source-Drain Voltage

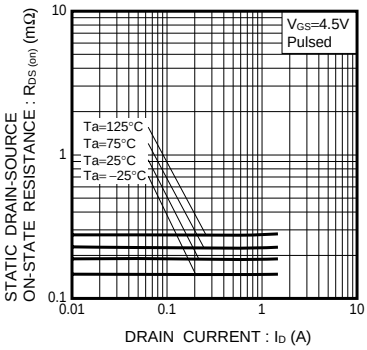


Fig.7 Static Drain-Source On-State Resistance vs. Drain Current (I)

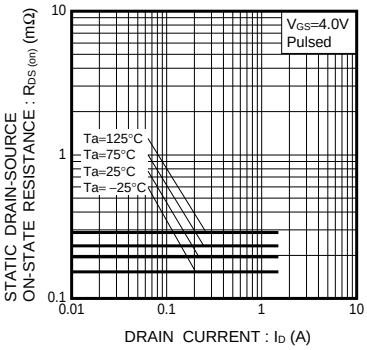


Fig.8 Static Drain-Source On-State Resistance vs. Drain Current (II)

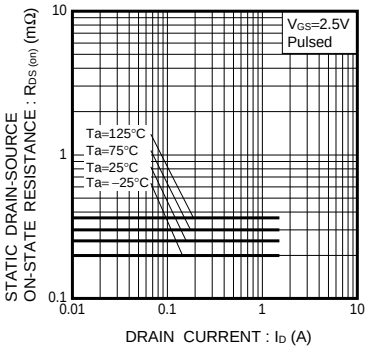


Fig.9 Static Drain-Source On-State Resistance vs. Drain Current (III)

P-ch

●Electrical characteristic curves

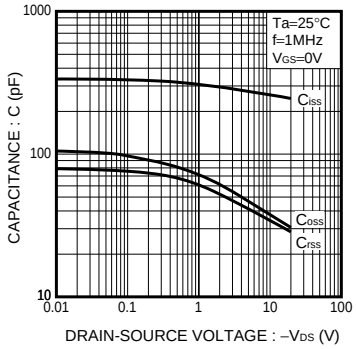


Fig.1 Typical Capacitance vs. Drain-Source Voltage

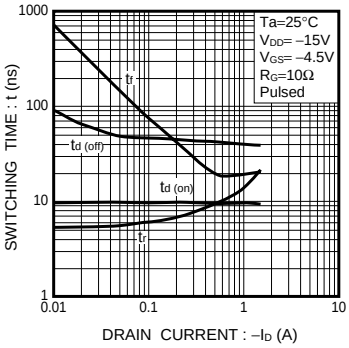


Fig.2 Switching Characteristics

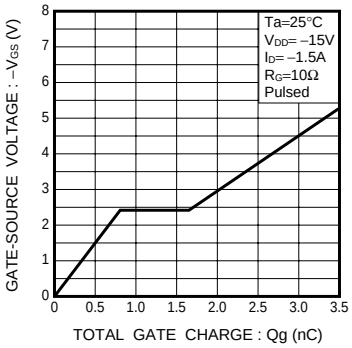


Fig.3 Dynamic Input Characteristics

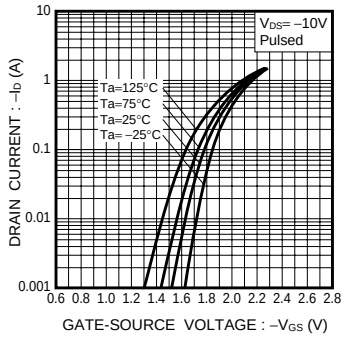


Fig.4 Typical Transfer Characteristics

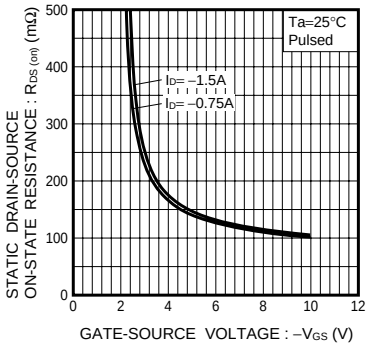


Fig.5 Static Drain-Source On-State Resistance vs. Gate-Source Voltage

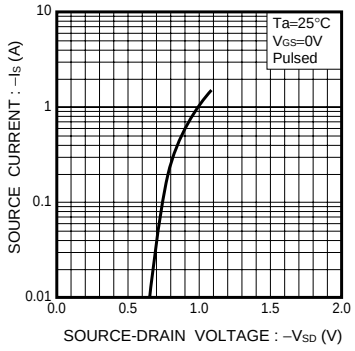


Fig.6 Source Current vs. Source-Drain Voltage

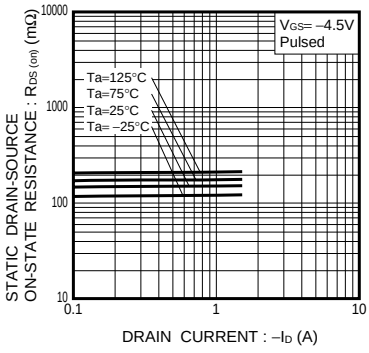


Fig.7 Static Drain-Source On-State Resistance vs. Drain Current (I)

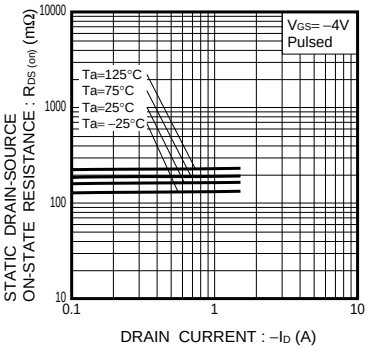


Fig.8 Static Drain-Source On-State Resistance vs. Drain Current (II)

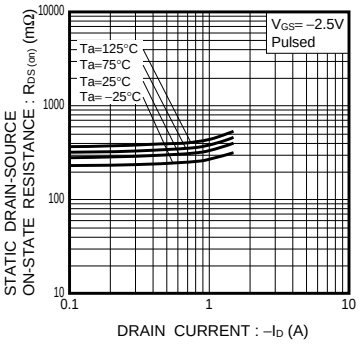


Fig.9 Static Drain-Source On-State Resistance vs. Drain Current (III)

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