

Small switching

US6M1

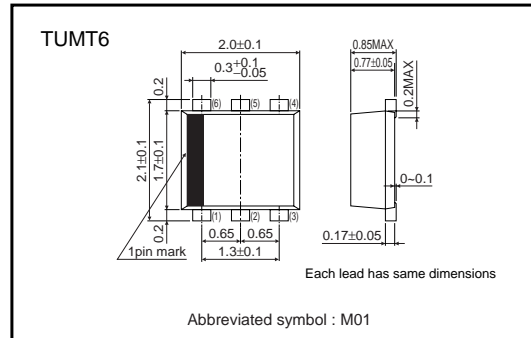
●Features

- 1) Low on-resistance.
- 2) Built-in G-S Protection Diode.
- 3) Small and Surface Mount Package (TUMT6).

●Application

Power switching, DC / DC converter.

●External dimensions (Unit : mm)



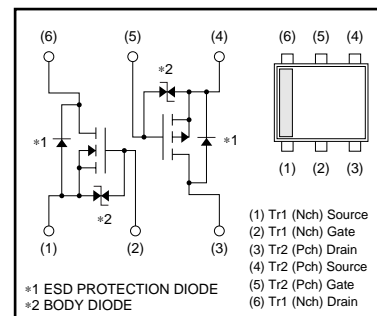
●Absolute maximum ratings (Ta=25°C)

Parameter	Symbol	Limits		Unit	
		Tr1 : Nchannel	Tr2 : Pchannel		
Drain-source voltage	V _{DSS}	30	-20	V	
Gate-source voltage	V _{GSS}	20	-12	V	
Drain current	Continuous	±1.4	±1	A	
	Pulsed	I _{DP}	±5.6	±4	A *1
Source current (Body diode)	Continuous	I _S	0.6	-0.4	A
	Pulsed	I _{SP}	5.6	-4	A *1
Total power dissipation (T _C =25°C)	P _D	1	1	W *2	
Channel temperature	T _{ch}	150	150	°C	
Storage temperature	T _{stg}	-55 to +150	-55 to +150	°C	

*1 P_w≤10μs, Duty cycle≤1%

*2 With each pin mounted on the recommended lands.

●Equivalent circuit



●Thermal resistance (Ta=25°C)

Parameter	Symbol	Limits	Unit
Channel to ambient	R _{th (ch-A)}	125	°C / W

Transistors

●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} =20V, 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)}	1.0	–	2.5	V	V _{DS} =10V, I _D =1mA
Static drain-source on-state resistance	R _{DS(on)} [*]	–	170	240	mΩ	I _D =1.4A, V _{GS} =10V
		–	250	350		I _D =1.4A, V _{GS} =4.5V
		–	270	380		I _D =1.4A, V _{GS} =4V
Forward transfer admittance	Y _{fs} [*]	1.0	–	–	S	I _D =1.4A, V _{DS} =10V
Input capacitance	C _{iss}	–	70	–	pF	V _{DS} =10V
Output capacitance	C _{oss}	–	15	–	pF	V _{GS} =0V
Reverse transfer capacitance	C _{rss}	–	12	–	pF	f=1MHz
Turn-on delay time	t _{d(on)} [*]	–	6	–	ns	I _D =0.7A, V _{DD} ≐15V
Rise time	t _r [*]	–	6	–	ns	V _{GS} =10V
Turn-off delay time	t _{d(off)} [*]	–	13	–	ns	R _L =21Ω
Fall time	t _f [*]	–	8	–	ns	R _{GS} =10Ω
Total gate charge	Q _g [*]	–	1.4	2.0	nC	V _{DD} ≐15V R _L ≐10.7Ω
Gate-source charge	Q _{gs} [*]	–	0.6	–	nC	V _{GS} =5V R _{GS} =10Ω
Gate-drain charge	Q _{gd} [*]	–	0.3	–	nC	I _D =1.4A

*Pulsed

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

<Tr1. N-ch MOSFET>

Parameter	Symbol	Min.	Typ.	Max.	Unit	Test Conditions
Forward voltage	V _{SD} [*]	–	–	1.2	V	I _S =1.4A, V _{GS} =0V

*Pulsed

Transistors

●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)} *	–	280	390	mΩ	I _D = –1A, V _{GS} = –4.5V
		–	310	430		I _D = –1A, V _{GS} = –4V
		–	570	800		I _D = –0.5A, V _{GS} = –2.5V
Forward transfer admittance	Y _{fs} *	0.7	–	–	S	I _D = –0.5A, V _{DS} = –10V
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, V _{DD} ≐ –15V
Rise time	t _r *	–	8	–	ns	V _{GS} = –4.5V
Turn-off delay time	t _{d(off)} *	–	25	–	ns	R _L =30Ω
Fall time	t _f *	–	10	–	ns	R _{GS} =10Ω
Total gate charge	Q _g *	–	2.1	–	nC	V _{DD} ≐ –15V R _L =15Ω
Gate-source charge	Q _{gs} *	–	0.5	–	nC	V _{GS} = –4.5V R _{GS} =10Ω
Gate-drain charge	Q _{gd} *	–	0.5	–	nC	I _D = –1A

*Pulsed

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

<Tr2. P-ch MOSFET>

Parameter	Symbol	Min.	Typ.	Max.	Unit	Test Conditions
Forward voltage	V _{SD} *	–	–	–1.2	V	I _S = –0.4A, V _{GS} =0V

*Pulsed

Transistors

N-ch

●Electrical characteristic curves

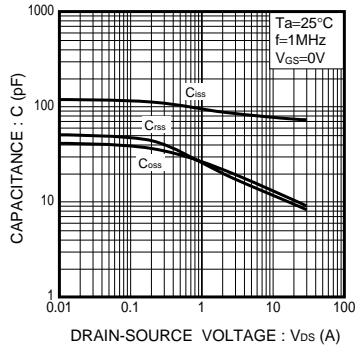


Fig.1 Typical Capacitance vs. Drain-Source Voltage

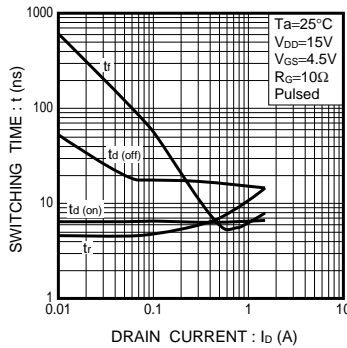


Fig.2 Switching Characteristics

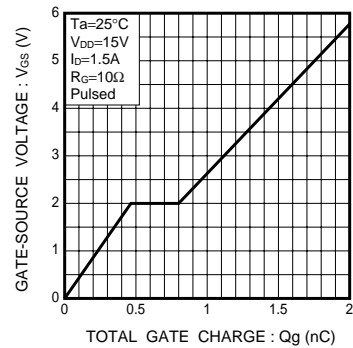


Fig.3 Dynamic Input Characteristics

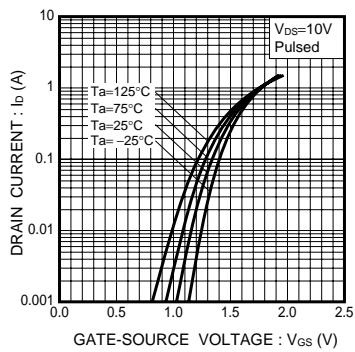


Fig.4 Typical Transfer Characteristics

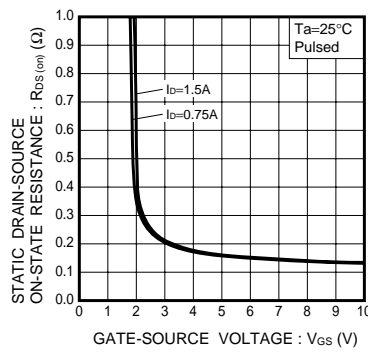


Fig.5 Static Drain-Source On-State Resistance vs. Gate-Source Voltage

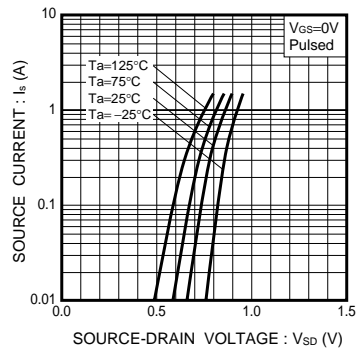


Fig.6 Source Current vs. Source-Drain Voltage

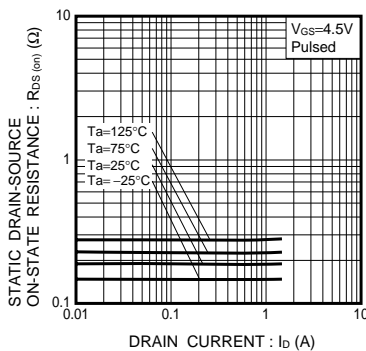


Fig.7 Static Drain-Source On-State Resistance vs. Drain Current (I)

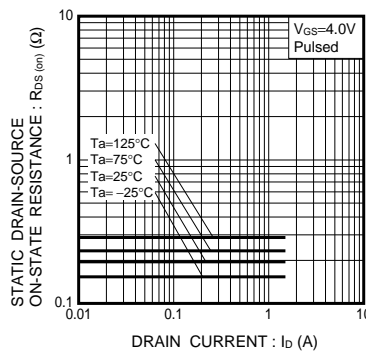


Fig.8 Static Drain-Source On-State Resistance vs. Drain Current (II)

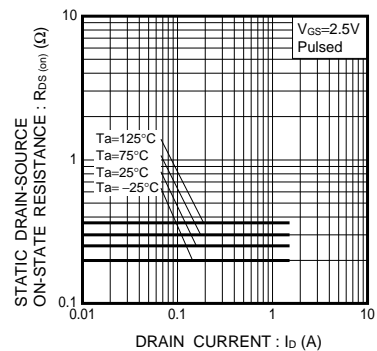


Fig.9 Static Drain-Source On-State Resistance vs. Drain Current (III)

Transistors

P-ch

●Electrical characteristic curves

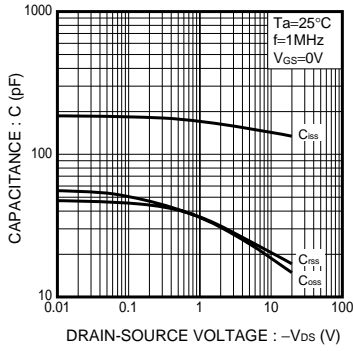


Fig.1 Typical Capacitance vs. Drain-Source Voltage

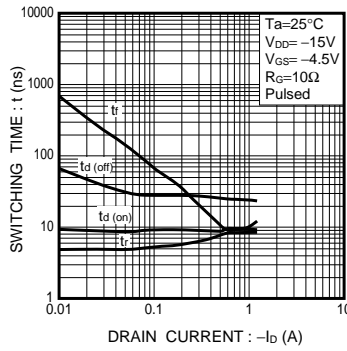


Fig.2 Switching Characteristics

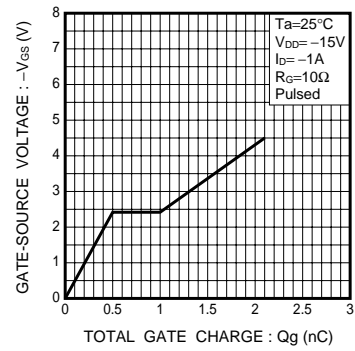


Fig.3 Dynamic Input Characteristics

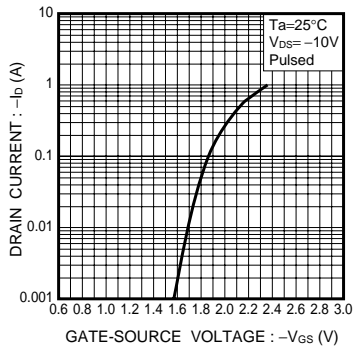


Fig.4 Typical Transfer Characteristics

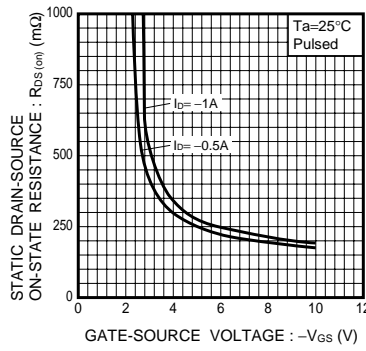


Fig.5 Static Drain-Source On-State Resistance vs. Gate-Source Voltage

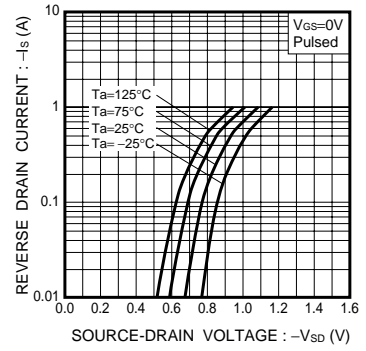


Fig.6 Source Current vs. Source-Drain Voltage

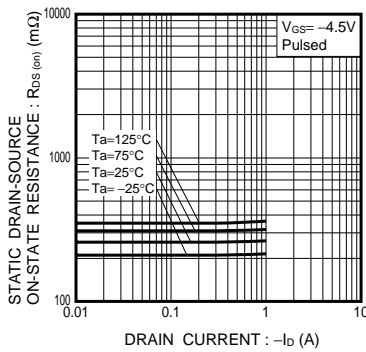


Fig.7 Static Drain-Source On-State Resistance vs. Drain Current (I)

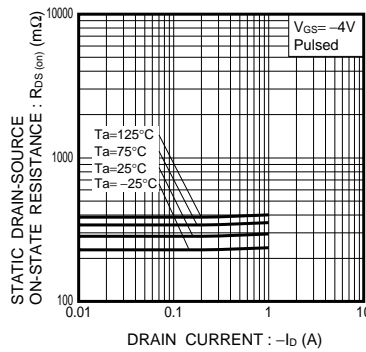


Fig.8 Static Drain-Source On-State Resistance vs. Drain Current (II)

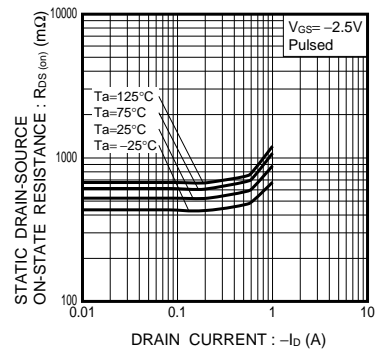


Fig.9 Static Drain-Source On-State Resistance vs. Drain Current (III)

Transistors

N-ch

●Measurement circuit

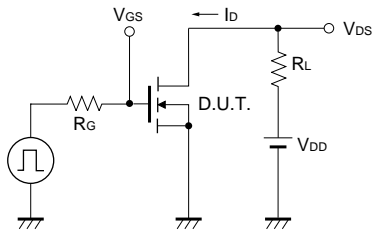


Fig.1-1 Switching Time Measurement Circuit

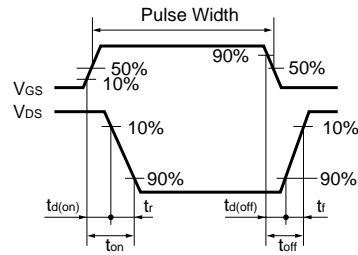


Fig.1-2 Switching Waveforms

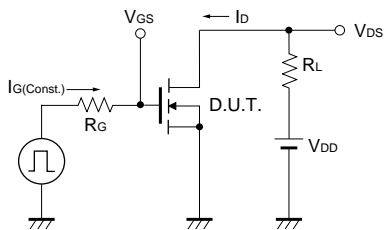


Fig.2-1 Gate Charge Measurement Circuit

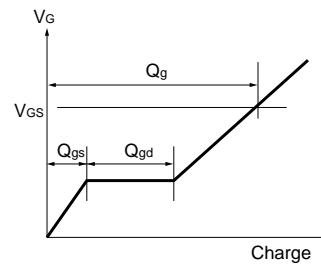


Fig.2-2 Gate Charge Waveform

Transistors

P-ch

●Measurement circuit

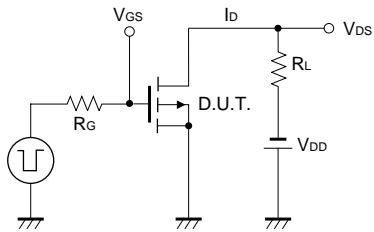


Fig.3-1 Switching Time Measurement Circuit

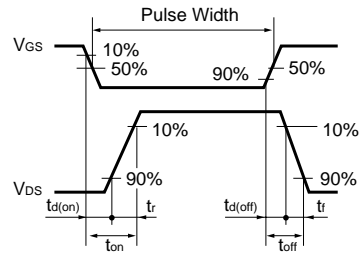


Fig.3-2 Switching Waveforms

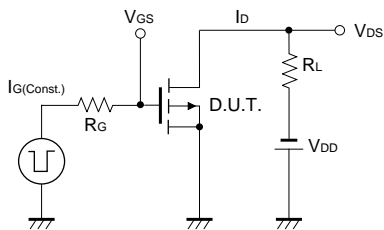


Fig.4-1 Gate Charge Measurement Circuit

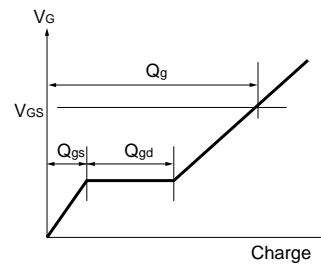


Fig.4-2 Gate Charge Waveform

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