

# 4V Drive Nch + Pch MOSFET

## MP6M12

### ● Structure

Silicon N-channel MOSFET/  
Silicon P-channel MOSFET

### ● Features

- 1) Low on-resistance.
- 2) Built-in G-S Protection Diode.
- 3) Small Surface Mount Package (MPT6).

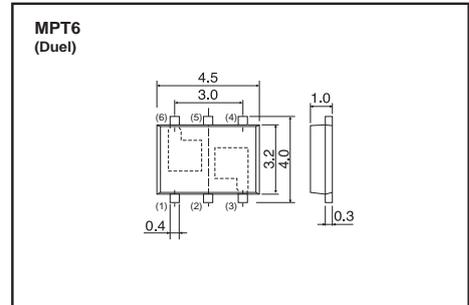
### ● Application

Switching

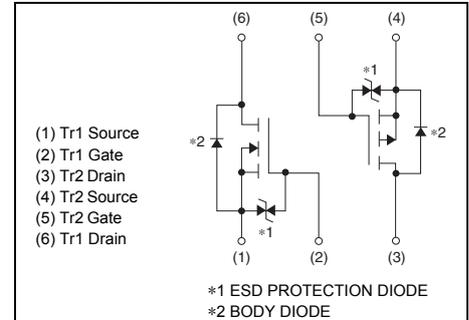
### ● Packaging specifications

Type	Package	Taping
	Code	TCR
	Basic ordering unit (pieces)	1000
MP6M12		○

### ● Dimensions (Unit : mm)



### ● Inner circuit



### ● Absolute maximum ratings (Ta = 25°C)

Parameter	Symbol	Limits		Unit
		Tr1 : N-ch	Tr2 : P-ch	
Drain-source voltage	$V_{DSS}$	30	-30	V
Gate-source voltage	$V_{GSS}$	$\pm 20$	$\pm 20$	V
Drain current	Continuous	$I_D$	$\pm 5.0$	A
	Pulsed	$I_{DP}^{*1}$	$\pm 12$	A
Source current (Body Diode)	Continuous	$I_s$	1.6	A
	Pulsed	$I_{sp}^{*1}$	12	A
Total power dissipation	$P_D^{*2}$	2.0		W / TOTAL
		1.4		W / ELEMENT
Channel temperature	Tch	150		°C
Range of storage temperature	Tstg	-55 to +150		°C

\*1  $P_w \leq 10 \mu s$ , Duty cycle  $\leq 1\%$

\*2 Mounted on a ceramic board.

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

<Tr1(Nch)>

Parameter	Symbol	Min.	Typ.	Max.	Unit	Conditions
Gate-source leakage	$I_{GSS}$	-	-	±10	μA	$V_{GS}=\pm 20V, V_{DS}=0V$
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	$R_{DS(on)}^*$	-	30	42	mΩ	$I_D=5.0A, V_{GS}=10V$
		-	40	56		$I_D=5.0A, V_{GS}=4.5V$
		-	45	63		$I_D=5.0A, V_{GS}=4.0V$
Forward transfer admittance	$ Y_{fs} ^f$	2.5	-	-	S	$V_{DS}=10V, I_D=5.0A$
Input capacitance	$C_{iss}$	-	250	-	pF	$V_{DS}=10V$
Output capacitance	$C_{oss}$	-	90	-	pF	$V_{GS}=0V$
Reverse transfer capacitance	$C_{rss}$	-	45	-	pF	$f=1MHz$
Turn-on delay time	$t_{d(on)}^*$	-	6	-	ns	$I_D=2.5A, V_{DD}=15V$
Rise time	$t_r^*$	-	27	-	ns	$V_{GS}=10V$
Turn-off delay time	$t_{d(off)}^*$	-	26	-	ns	$R_L=6\Omega$
Fall time	$t_f^*$	-	5	-	ns	$R_G=10\Omega$
Total gate charge	$Q_g^*$	-	4.0	-	nC	$I_D=5.0A$
Gate-source charge	$Q_{gs}^*$	-	1.2	-	nC	$V_{DD}=15V$
Gate-drain charge	$Q_{gd}^*$	-	1.2	-	nC	$V_{GS}=5V$

\*Pulsed

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

Parameter	Symbol	Min.	Typ.	Max.	Unit	Conditions
Forward Voltage	$V_{SD}^*$	-	-	1.2	V	$I_s=5.0A, V_{GS}=0V$

\*Pulsed

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

<Tr2(Pch)>

Parameter	Symbol	Min.	Typ.	Max.	Unit	Conditions
Gate-source leakage	$I_{GSS}$	-	-	±10	μA	$V_{GS}=\pm 20V, V_{DS}=0V$
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	$R_{DS(on)}^*$	-	40	56	mΩ	$I_D=-4.5A, V_{GS}=-10V$
		-	55	77		$I_D=-2.5A, V_{GS}=-4.5V$
		-	60	84		$I_D=-2.5A, V_{GS}=-4.0V$
Forward transfer admittance	$ Y_{fs}^f $	2.5	-	-	S	$I_D=-4.5A, V_{DS}=-10V$
Input capacitance	$C_{iss}$	-	800	-	pF	$V_{DS}=-10V$
Output capacitance	$C_{oss}$	-	120	-	pF	$V_{GS}=0V$
Reverse transfer capacitance	$C_{rss}$	-	110	-	pF	$f=1MHz$
Turn-on delay time	$t_{d(on)}^*$	-	10	-	ns	$I_D=-2.5A, V_{DD}=-15V$
Rise time	$t_r^*$	-	25	-	ns	$V_{GS}=-10V$
Turn-off delay time	$t_{d(off)}^*$	-	80	-	ns	$R_L=6.0\Omega$
Fall time	$t_f^*$	-	65	-	ns	$R_G=10\Omega$
Total gate charge	$Q_g^*$	-	8.4		nC	$I_D=-4.5A$
Gate-source charge	$Q_{gs}^*$	-	3.0	-	nC	$V_{DD}=-15V$
Gate-drain charge	$Q_{gd}^*$	-	3.5	-	nC	$V_{GS}=-5V$

\*Pulsed

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

Parameter	Symbol	Min.	Typ.	Max.	Unit	Conditions
Forward Voltage	$V_{SD}^*$	-	-	-1.2	V	$I_s=-4.5A, V_{GS}=0V$

\*Pulsed

●Electrical characteristic curves (Ta=25°C)

<Tr.1(Nch)>

Fig.1 Typical Output Characteristics ( I )

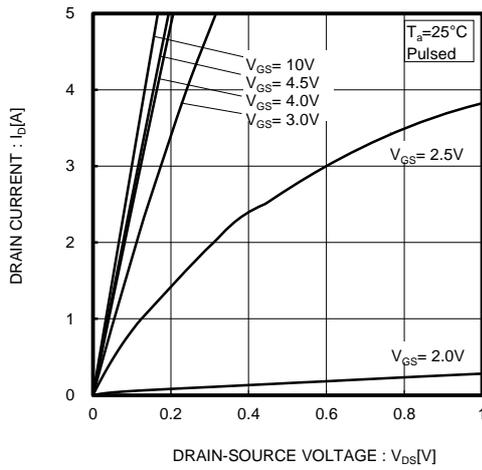


Fig.2 Typical Output Characteristics (II)

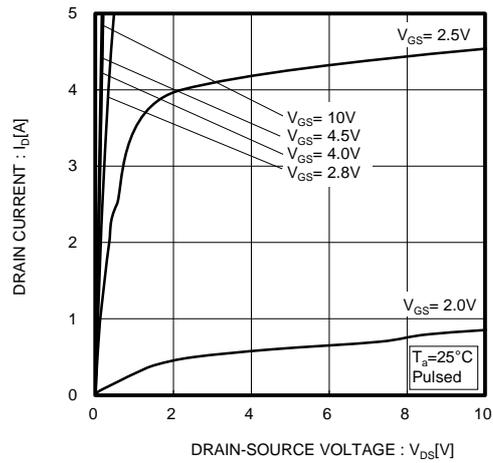


Fig.3 Typical Transfer Characteristics

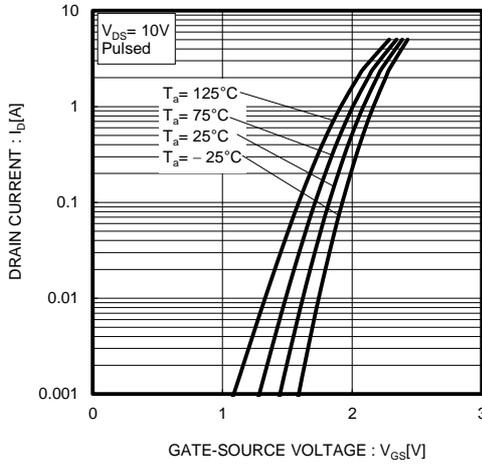


Fig.4 Static Drain-Source On-State Resistance vs. Drain Current ( I )

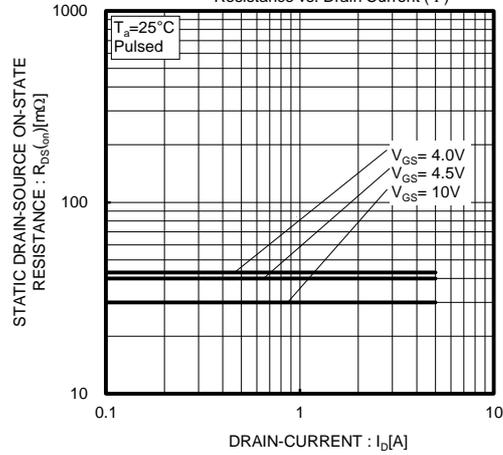


Fig.5 Static Drain-Source On-State Resistance vs. Drain Current (II)

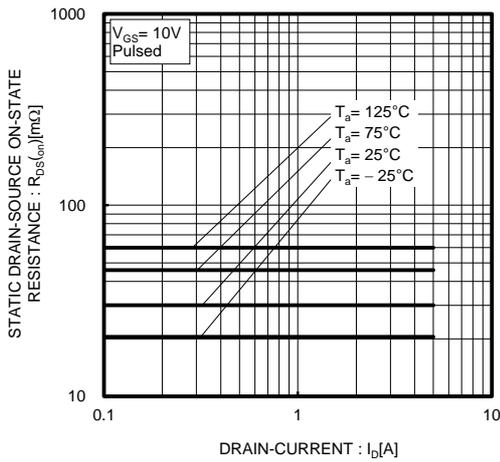


Fig.6 Static Drain-Source On-State Resistance vs. Drain Current (III)

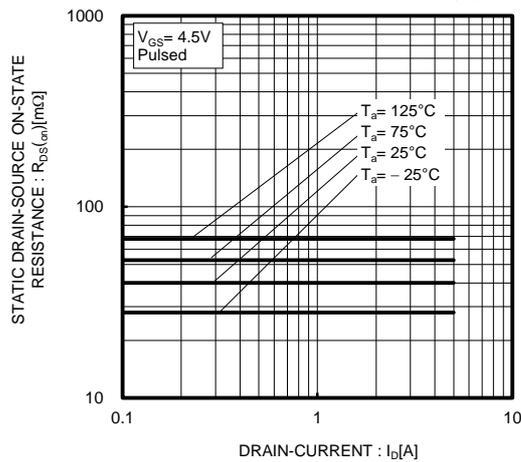


Fig.7 Static Drain-Source On-State Resistance vs. Drain Current (IV)

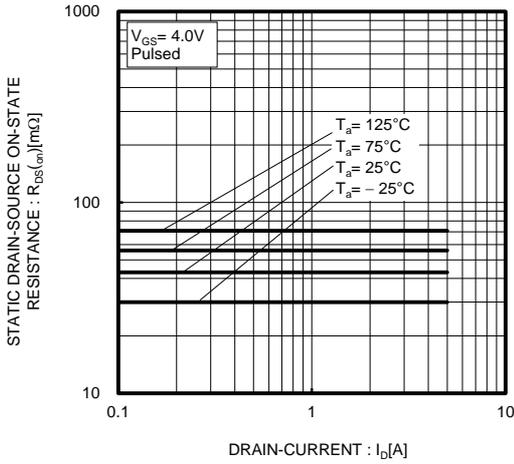


Fig.8 Forward Transfer Admittance vs. Drain Current

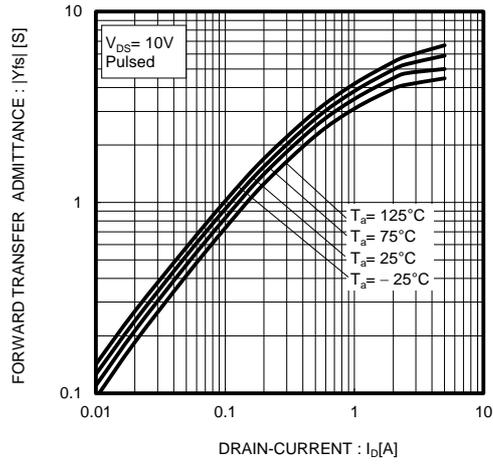


Fig.9 Reverse Drain Current vs. Source-Drain Voltage

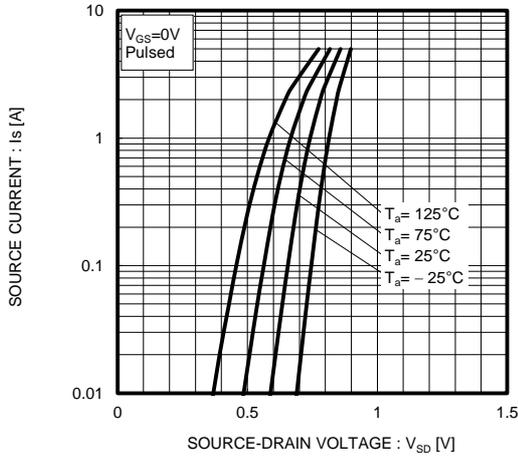


Fig.10 Static Drain-Source On-State Resistance vs. Gate Source Voltage

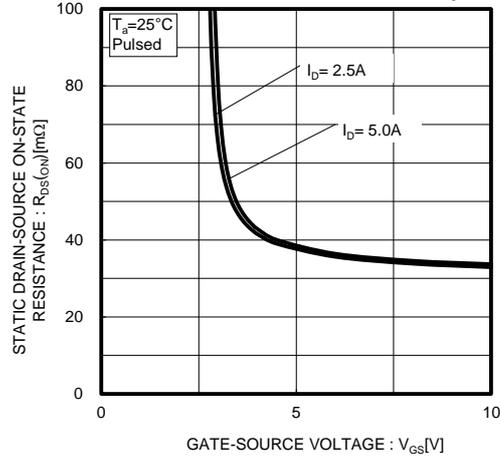


Fig.11 Switching Characteristics

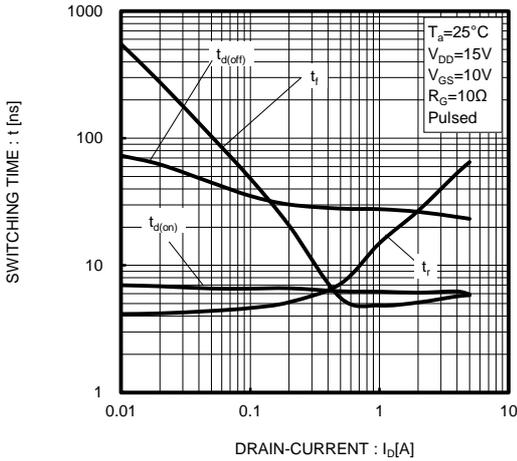


Fig.12 Dynamic Input Characteristics

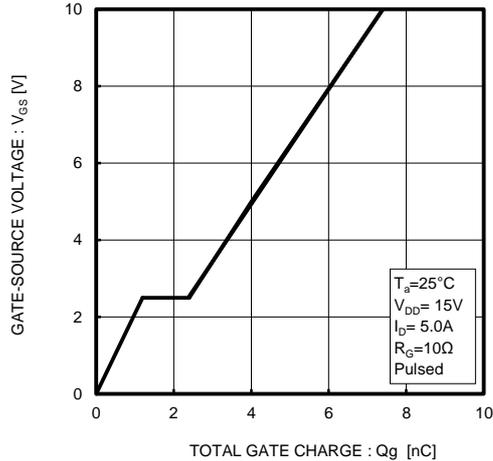


Fig.13 Typical Capacitance vs. Drain-Source Voltage

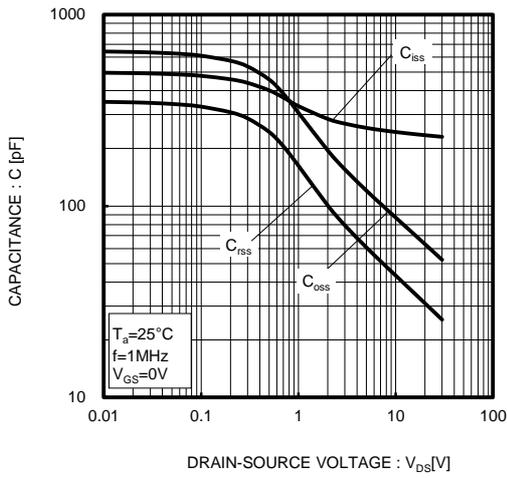


Fig.14 Maximum Safe Operating Area

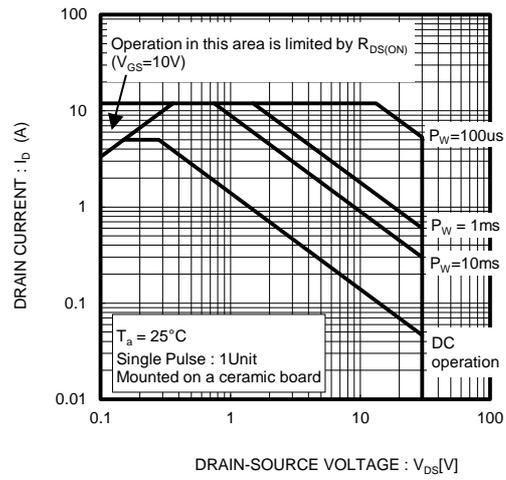
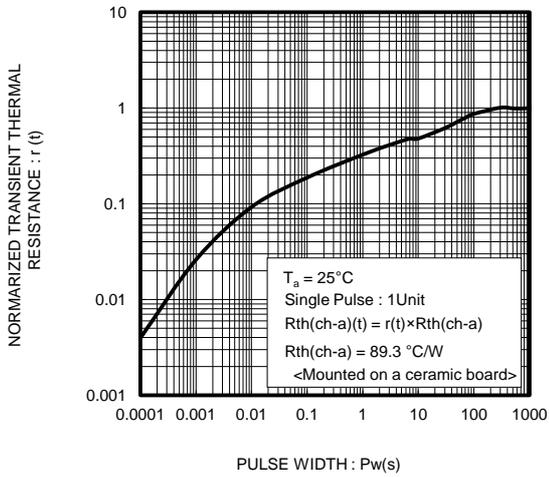


Fig.15 Normalized Transient Thermal Resistance vs. Pulse Width



<Tr.2(Pch)>

Fig.1 Typical Output Characteristics ( I )

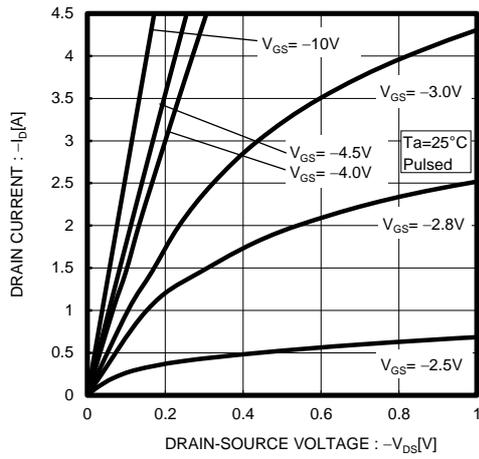


Fig.2 Typical Output Characteristics ( II )

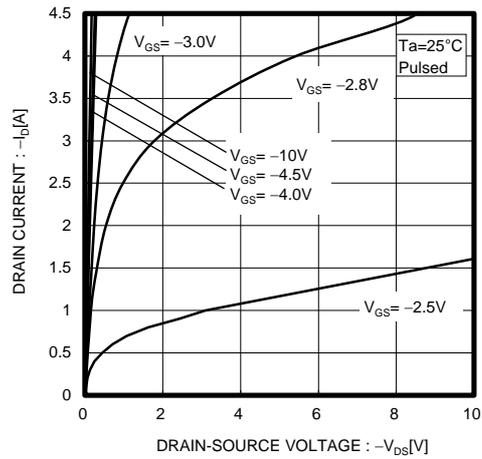


Fig.3 Typical Transfer Characteristics

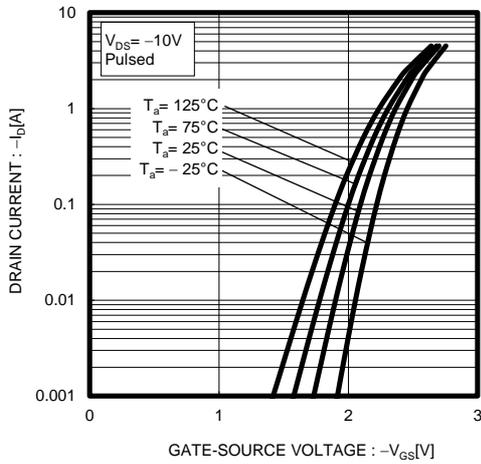


Fig.4 Static Drain-Source On-State Resistance vs. Drain Current ( I )

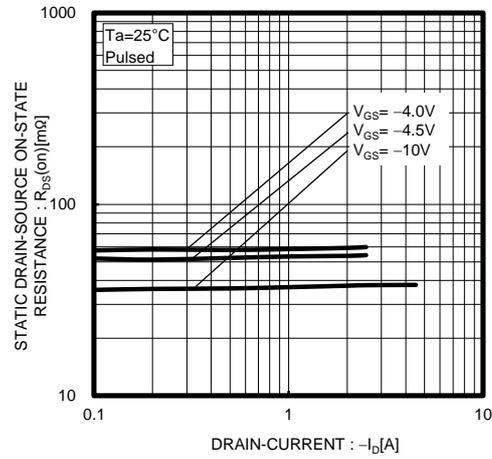


Fig.5 Static Drain-Source On-State Resistance vs. Drain Current ( II )

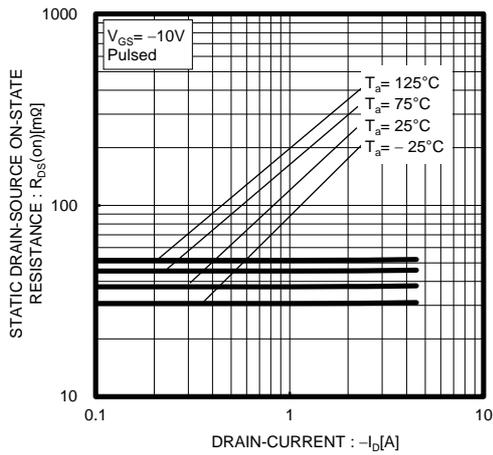


Fig.6 Static Drain-Source On-State Resistance vs. Drain Current ( III )

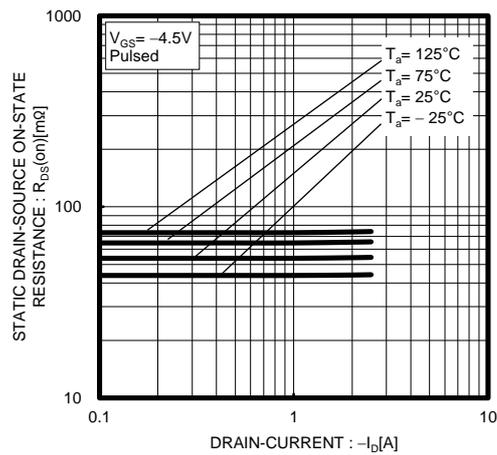


Fig.7 Static Drain-Source On-State Resistance vs. Drain Current(I<sub>D</sub>)

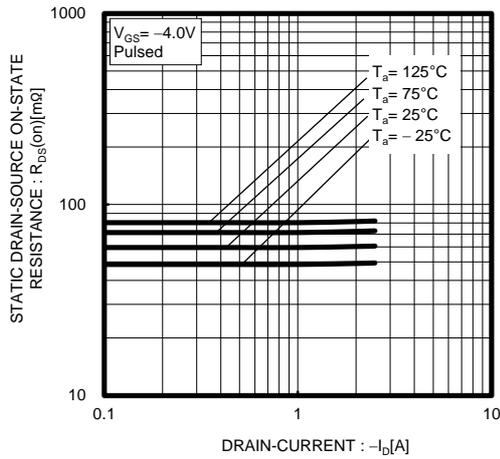


Fig.8 Forward Transfer Admittance vs. Drain Current

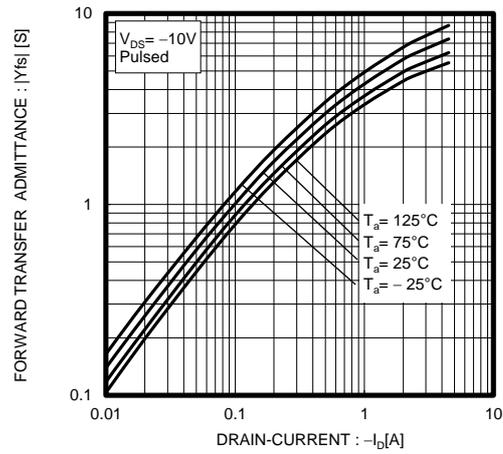


Fig.9 Reverse Drain Current vs. Source-Drain Voltage

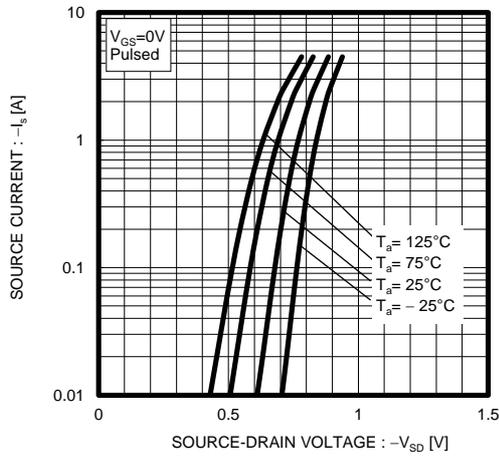


Fig.10 Static Drain-Source On-State Resistance vs. Gate Source Voltage

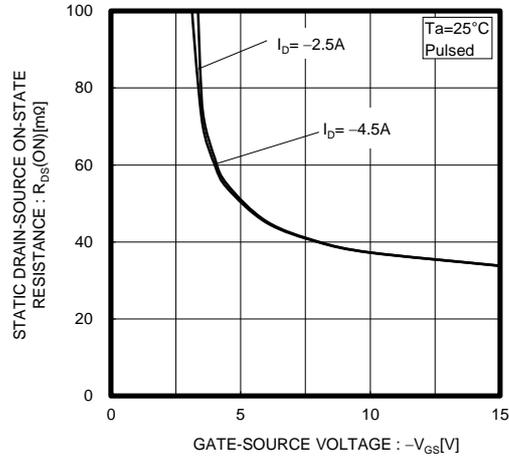


Fig.11 Switching Characteristics

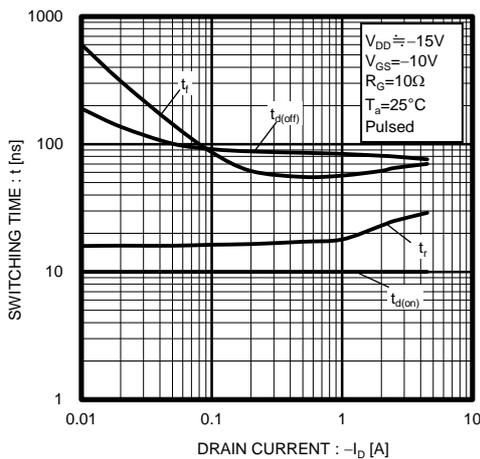


Fig.12 Dynamic Input Characteristics

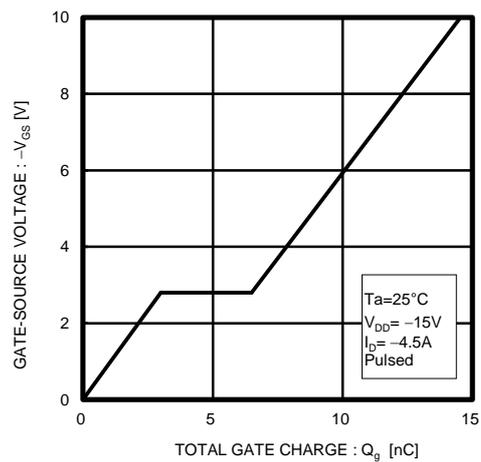




Fig.13 Typical Capacitance vs. Drain-Source Voltage

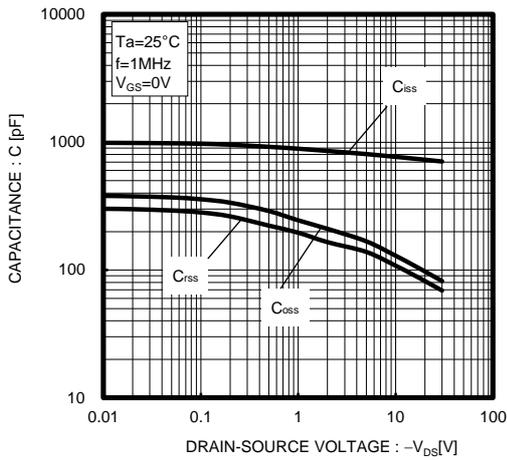


Fig.14 Maximum Safe Operating Area

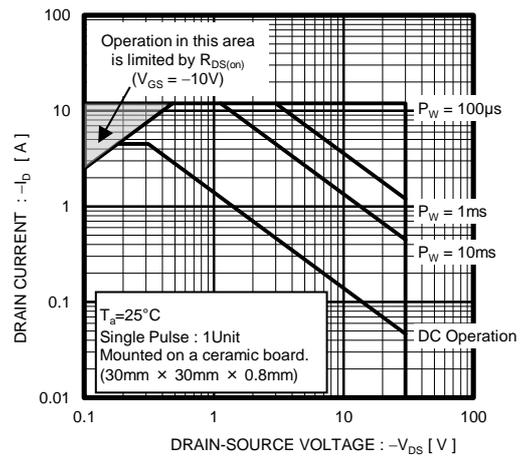
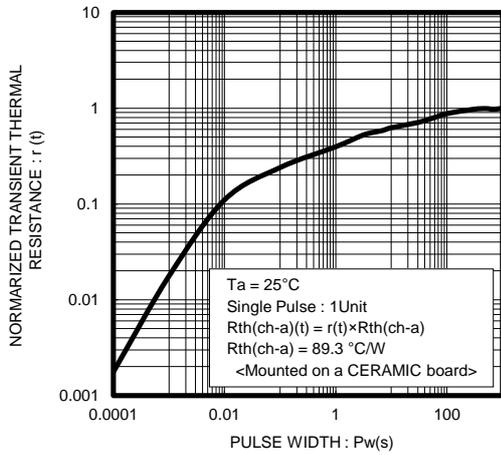


Fig.15 Normalized Transient Thermal Resistance vs. Pulse Width



● Measurement circuits

<Tr1(Nch)>

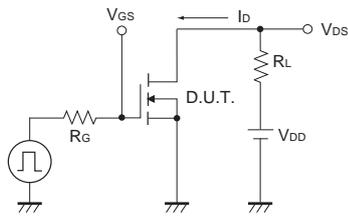


Fig.1-1 Switching Time Measurement Circuit

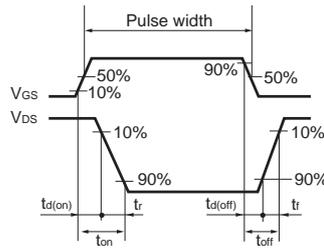


Fig.1-2 Switching Waveforms

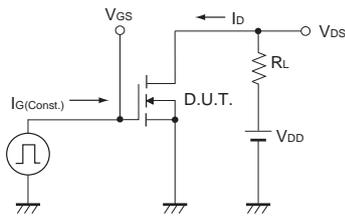


Fig.2-1 Gate Charge Measurement Circuit

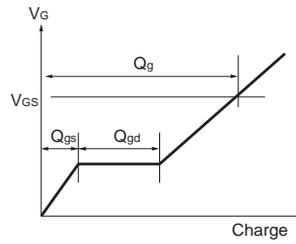


Fig.2-2 Gate Charge Waveform

<Tr2(Pch)>

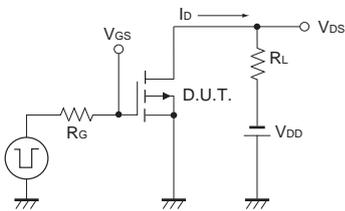


Fig.1-1 Switching Time Measurement Circuit

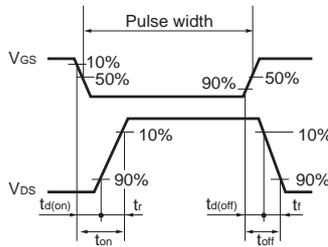


Fig.1-2 Switching Waveforms

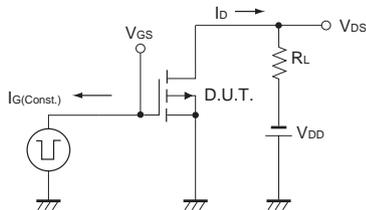


Fig.2-1 Gate Charge Measurement Circuit

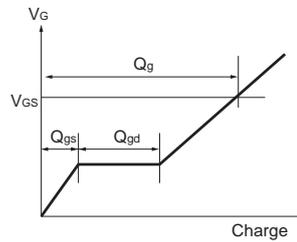


Fig.2-2 Gate Charge Waveform

● Notice

This product might cause chip aging and breakdown under the large electrified environment. Please consider to design ESD protection circuit.

## Notes

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