

N-Ch and P-Ch Fast Switching MOSFETs

General Description

The QM2601S is the highest performance trench N-ch and P-ch MOSFETs with extreme high cell density, which provide excellent R_{DS(on)} and gate charge for most of the small power switching and load switch applications.

The QM2601S meet the RoHS and Green Product requirement with full function reliability approved.

Features

- Advanced high cell density Trench technology
- Super Low Gate Charge
- Excellent C_{dv/dt} effect decline
- Green Device Available

Absolute Maximum Ratings

Symbol	Parameter	Rating		Units
		N-Ch	P-Ch	
V _{DS}	Drain-Source Voltage	20	-20	V
V _{GS}	Gate-Source Voltage	±12	±12	V
I _D @T _A =25°C	Continuous Drain Current, V _{GS} @ 4.5V ¹	7.2	-4.5	A
I _D @T _A =70°C	Continuous Drain Current, V _{GS} @ 4.5V ¹	5.8	-3.6	A
I _{DM}	Pulsed Drain Current ²	35	-23	A
P _D @T _A =25°C	Total Power Dissipation ³	1.5	1.5	W
T _{STG}	Storage Temperature Range	-55 to 150	-55 to 150	°C
T _J	Operating Junction Temperature Range	-55 to 150	-55 to 150	°C

Thermal Data

Symbol	Parameter	Typ.	Max.	Unit
R _{θJA}	Thermal Resistance Junction-ambient ¹	---	85	°C/W
R _{θJC}	Thermal Resistance Junction-Case ¹	---	25	°C/W

Product Summary

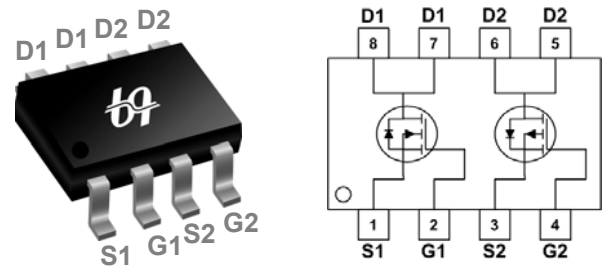


BVDSS	R _{DS(on)}	I _D
20V	18mΩ	7.2A
-20V	50mΩ	-4.5A

Applications

- High Frequency Point-of-Load Synchronous Small power switching for MB/NB/UMPC/VGA
- Networking DC-DC Power System
- Load Switch

Dual SOP8 Pin Configuration



N-Channel Electrical Characteristics ($T_J=25^\circ\text{C}$, unless otherwise noted)

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
BV_{DSS}	Drain-Source Breakdown Voltage	$V_{GS}=0V, I_D=250\mu A$	20	---	---	V
$\Delta BV_{DSS}/\Delta T_J$	BVDSS Temperature Coefficient	Reference to 25°C , $I_D=1mA$	---	0.024	---	V/ $^\circ\text{C}$
$R_{DS(ON)}$	Static Drain-Source On-Resistance ²	$V_{GS}=4.5V, I_D=7A$	---	15	18	m Ω
		$V_{GS}=2.5V, I_D=5A$	---	20	25	
$V_{GS(th)}$	Gate Threshold Voltage	$V_{GS}=V_{DS}, I_D=250\mu A$	0.5	0.8	1.2	V
$\Delta V_{GS(th)}$	$V_{GS(th)}$ Temperature Coefficient		---	-3.58	---	mV/ $^\circ\text{C}$
I_{DSS}	Drain-Source Leakage Current	$V_{DS}=16V, V_{GS}=0V, T_J=25^\circ\text{C}$	---	---	1	μA
		$V_{DS}=16V, V_{GS}=0V, T_J=55^\circ\text{C}$	---	---	5	
I_{GSS}	Gate-Source Leakage Current	$V_{GS}=\pm 12V, V_{DS}=0V$	---	---	± 100	nA
gfs	Forward Transconductance	$V_{DS}=5V, I_D=7A$	---	32.4	---	S
R_g	Gate Resistance	$V_{DS}=0V, V_{GS}=0V, f=1MHz$	---	1.5	3	Ω
Q_g	Total Gate Charge (4.5V)	$V_{DS}=15V, V_{GS}=4.5V, I_D=7A$	---	11.4	16.0	nC
Q_{gs}	Gate-Source Charge		---	1.63	2.3	
Q_{gd}	Gate-Drain Charge		---	2.95	4.1	
$T_{d(on)}$	Turn-On Delay Time	$V_{DD}=10V, V_{GS}=10V, R_G=3.3\Omega$ $I_D=7A$	---	4.8	9.6	ns
T_r	Rise Time		---	61	110	
$T_{d(off)}$	Turn-Off Delay Time		---	28	56	
T_f	Fall Time		---	8	16	
C_{iss}	Input Capacitance	$V_{DS}=15V, V_{GS}=0V, f=1MHz$	---	865	1211	pF
C_{oss}	Output Capacitance		---	86	120	
C_{rss}	Reverse Transfer Capacitance		---	72	101	

Diode Characteristics

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
I_S	Continuous Source Current ^{1,4}	$V_G=V_D=0V$, Force Current	---	---	7.2	A
I_{SM}	Pulsed Source Current ^{2,4}		---	---	35	A
V_{SD}	Diode Forward Voltage ²	$V_{GS}=0V, I_S=1A, T_J=25^\circ\text{C}$	---	---	1.2	V
t_{rr}	Reverse Recovery Time	$I_F=7A, di/dt=100A/\mu s, T_J=25^\circ\text{C}$	---	12.5	---	nS
Q_{rr}	Reverse Recovery Charge		---	4.4	---	nC

Note :

- 1.The data tested by surface mounted on a 1 inch² FR-4 board with 20Z copper.
- 2.The data tested by pulsed , pulse width $\leq 300\mu s$, duty cycle $\leq 2\%$
- 3.The power dissipation is limited by 150°C junction temperature
- 4.The data is theoretically the same as I_D and I_{DM} , in real applications , should be limited by total power dissipation.

P-Channel Electrical Characteristics ($T_J=25\text{ }^\circ\text{C}$, unless otherwise noted)

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
BV_{DSS}	Drain-Source Breakdown Voltage	$V_{GS}=0V, I_D=-250\mu A$	-20	---	---	V
$\Delta BV_{DSS}/\Delta T_J$	BV_{DSS} Temperature Coefficient	Reference to $25\text{ }^\circ\text{C}$, $I_D=-1mA$	---	-0.014	---	V/ $^\circ\text{C}$
$R_{DS(ON)}$	Static Drain-Source On-Resistance ²	$V_{GS}=-4.5V, I_D=-4A$	---	40	50	m Ω
		$V_{GS}=-2.5V, I_D=-1.5A$	---	58	72	
$V_{GS(th)}$	Gate Threshold Voltage	$V_{GS}=V_{DS}, I_D=-250\mu A$	-0.5	-0.8	-1.2	V
$\Delta V_{GS(th)}$	$V_{GS(th)}$ Temperature Coefficient		---	3.95	---	mV/ $^\circ\text{C}$
I_{DSS}	Drain-Source Leakage Current	$V_{DS}=-16V, V_{GS}=0V, T_J=25\text{ }^\circ\text{C}$	---	---	1	μA
		$V_{DS}=-16V, V_{GS}=0V, T_J=55\text{ }^\circ\text{C}$	---	---	5	
I_{GSS}	Gate-Source Leakage Current	$V_{GS}=\pm 12V, V_{DS}=0V$	---	---	± 100	nA
gfs	Forward Transconductance	$V_{DS}=-5V, I_D=-4A$	---	12	---	S
Q_g	Total Gate Charge (4.5V)	$V_{DS}=-15V, V_{GS}=-4.5V, I_D=-4A$	---	10	14.0	nC
Q_{gs}	Gate-Source Charge		---	1.93	2.7	
Q_{gd}	Gate-Drain Charge		---	3.18	4.5	
$T_{d(on)}$	Turn-On Delay Time	$V_{DD}=-10V, V_{GS}=-4.5V, R_G=3.3\Omega, I_D=-4A$	---	5.6	11.2	ns
T_r	Rise Time		---	47.4	85	
$T_{d(off)}$	Turn-Off Delay Time		---	31.6	63	
T_f	Fall Time		---	17.2	34.4	
C_{iss}	Input Capacitance	$V_{DS}=-15V, V_{GS}=0V, f=1MHz$	---	857	1200	pF
C_{oss}	Output Capacitance		---	114	160	
C_{rss}	Reverse Transfer Capacitance		---	108	151	

Diode Characteristics

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
I_S	Continuous Source Current ^{1,4}	$V_G=V_D=0V$, Force Current	---	---	-4.5	A
I_{SM}	Pulsed Source Current ^{2,4}		---	---	-23	A
V_{SD}	Diode Forward Voltage ²	$V_{GS}=0V, I_S=-1A, T_J=25\text{ }^\circ\text{C}$	---	---	-1	V
t_{rr}	Reverse Recovery Time	$I_F=-4A, dI/dt=100A/\mu s, T_J=25\text{ }^\circ\text{C}$	---	19.7	---	nS
Q_{rr}	Reverse Recovery Charge		---	5.2	---	nC

Note :

- 1.The data tested by surface mounted on a 1 inch² FR-4 board with 20Z copper.
- 2.The data tested by pulsed , pulse width $\leq 300\mu s$, duty cycle $\leq 2\%$
- 3.The power dissipation is limited by $150\text{ }^\circ\text{C}$ junction temperature
- 4.The data is theoretically the same as I_D and I_{DM} , in real applications , should be limited by total power dissipation.

N-Ch and P-Ch Fast Switching MOSFETs

N-Channel Typical Characteristics

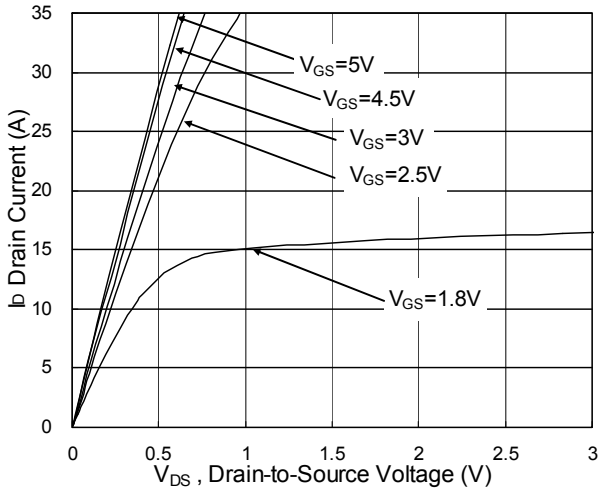


Fig.1 Typical Output Characteristics

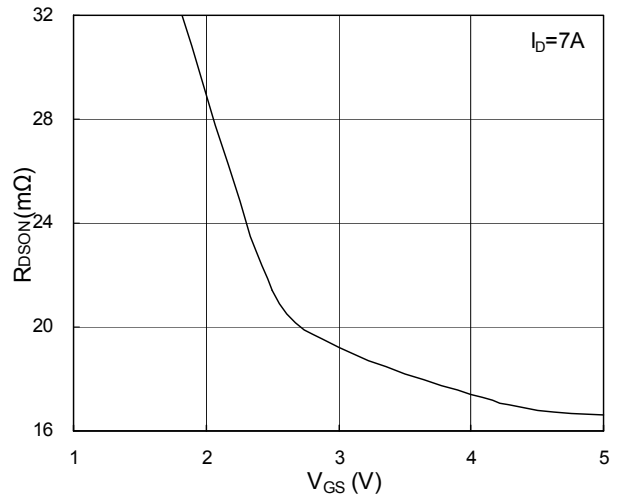


Fig.2 On-Resistance vs. Gate-Source

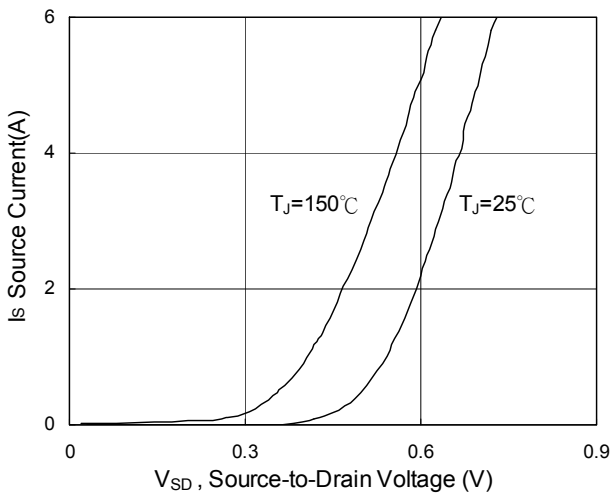


Fig.3 Forward Characteristics Of Reverse

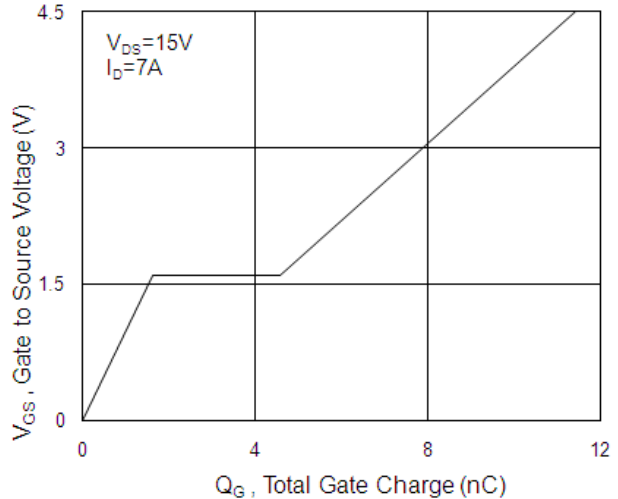


Fig.4 Gate-Charge Characteristics

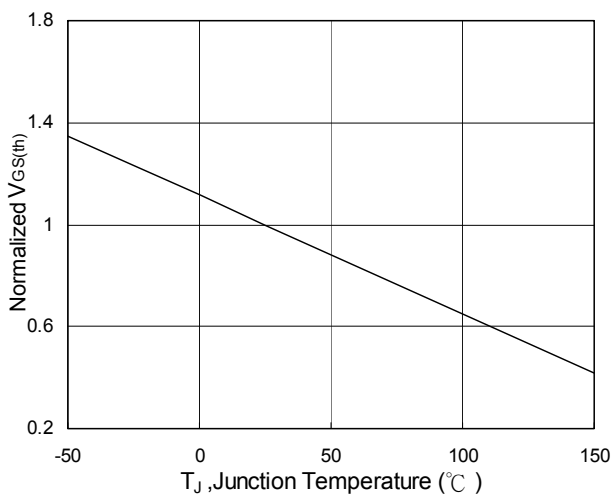


Fig.5 $V_{GS(th)}$ vs. T_J

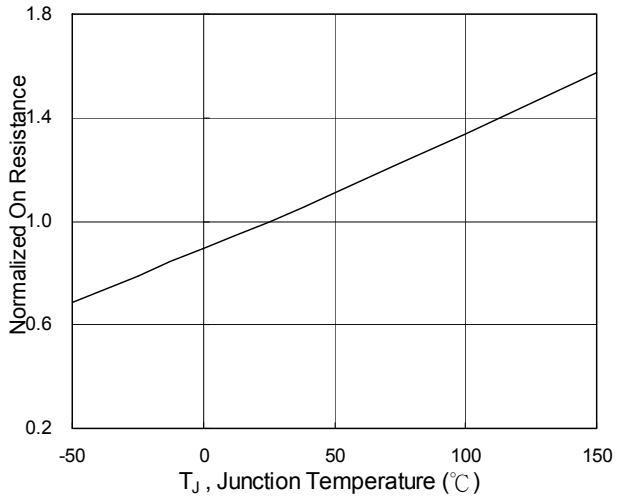


Fig.6 Normalized $R_{DS(on)}$ vs. T_J

N-Ch and P-Ch Fast Switching MOSFETs

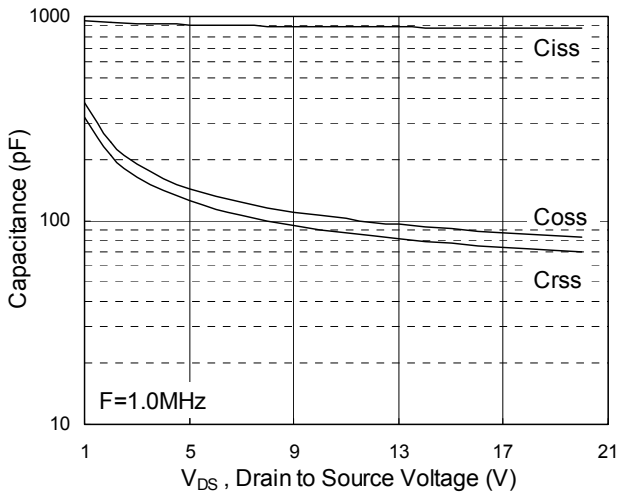


Fig.7 Capacitance

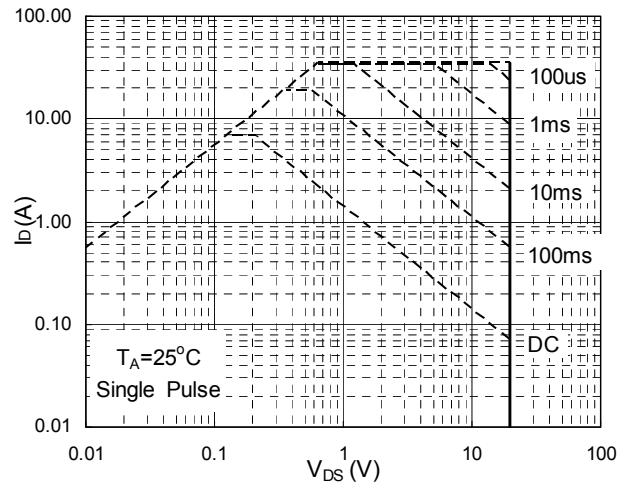


Fig.8 Safe Operating Area

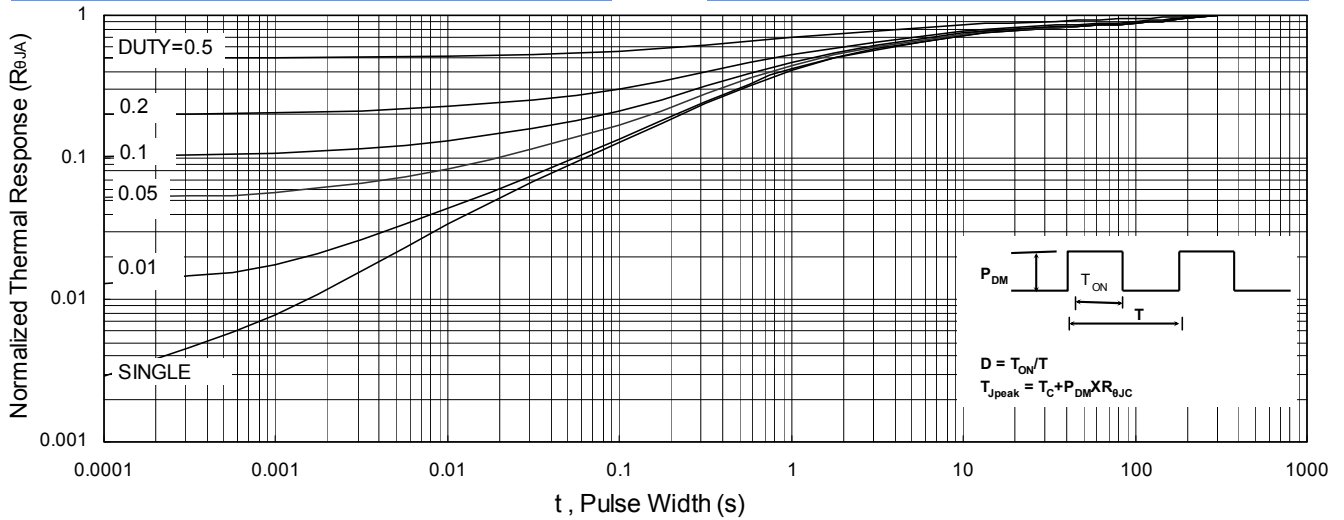


Fig.9 Normalized Maximum Transient Thermal Impedance

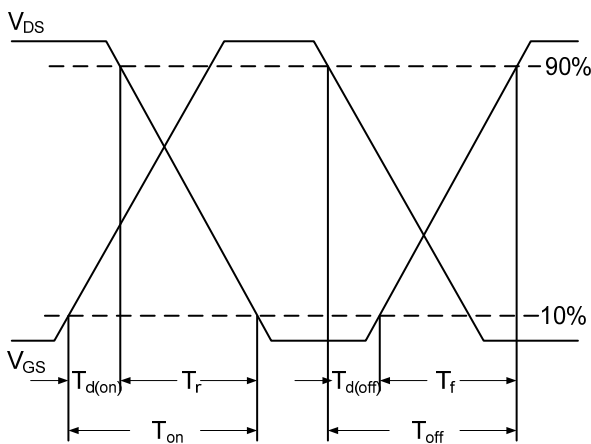


Fig.10 Switching Time Waveform

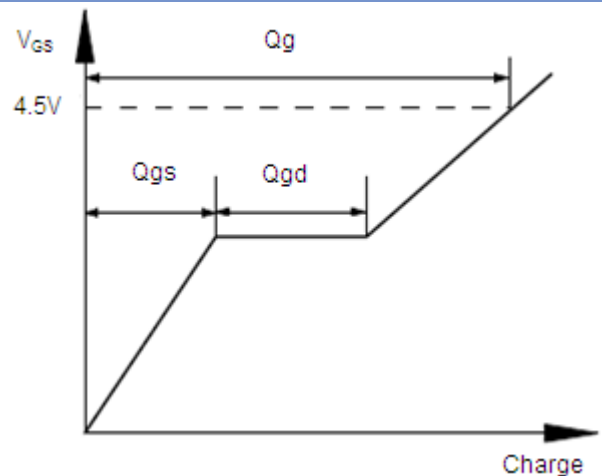


Fig.11 Gate Charge Waveform

N-Ch and P-Ch Fast Switching MOSFETs

P-Channel Typical Characteristics

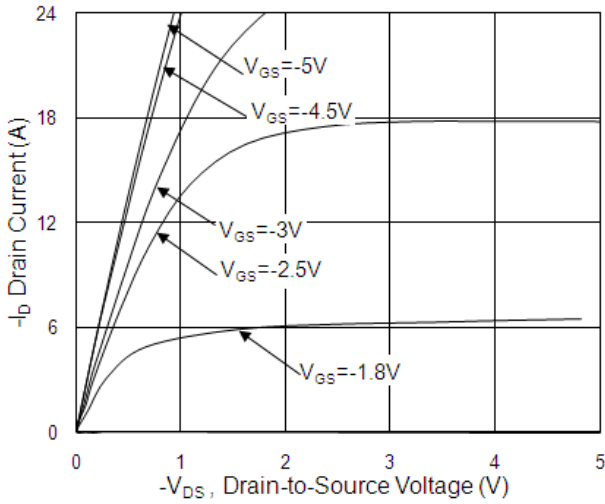


Fig.1 Typical Output Characteristics

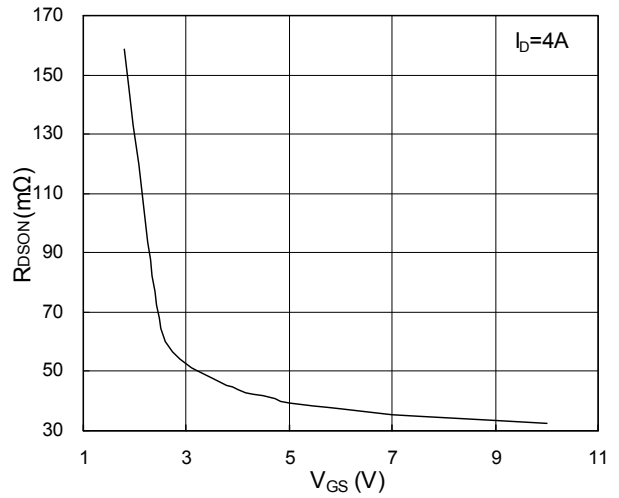


Fig.2 On-Resistance vs. Gate-Source

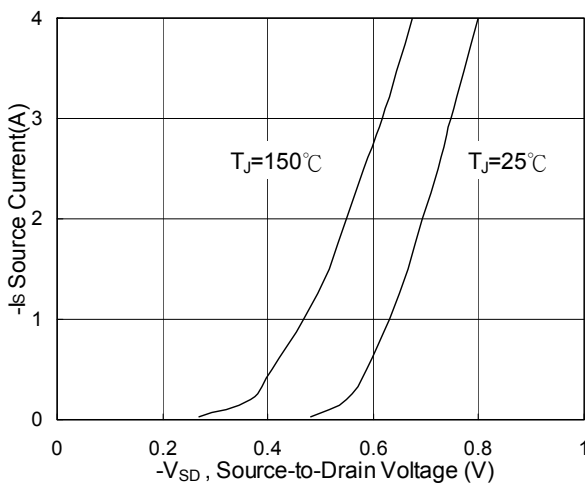


Fig.3 Forward Characteristics of reverse

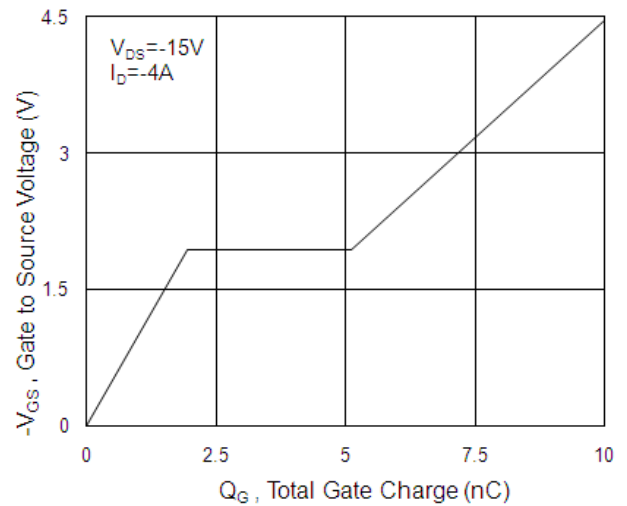


Fig.4 Gate-Charge Characteristics

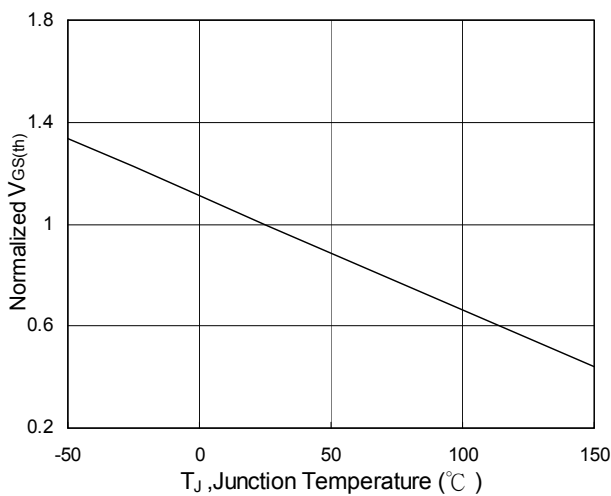


Fig.5 Normalized $V_{GS(th)}$ vs. T_J

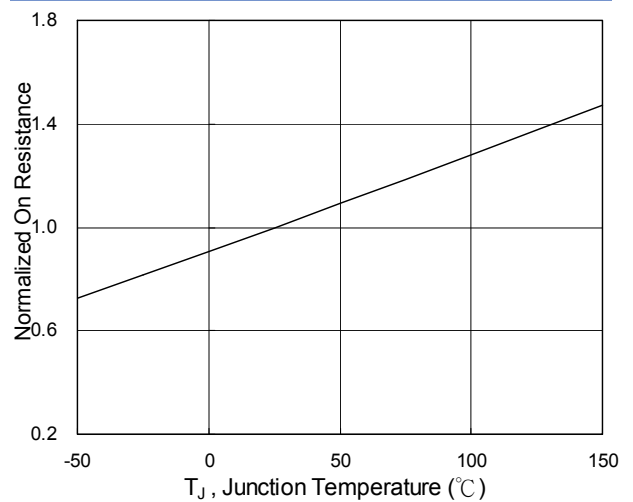


Fig.6 Normalized $R_{DS(on)}$ vs. T_J

N-Ch and P-Ch Fast Switching MOSFETs

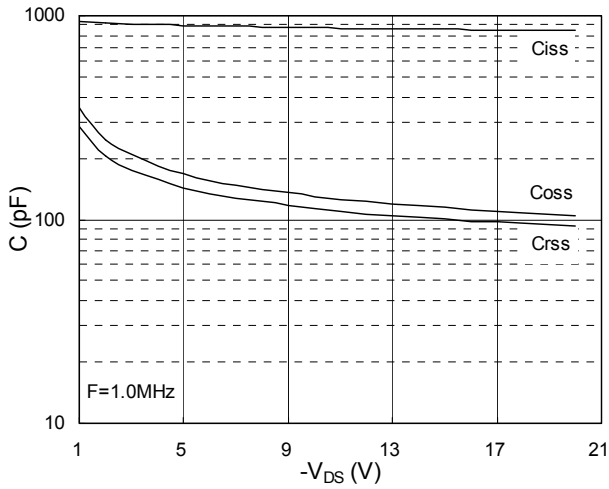


Fig.7 Capacitance

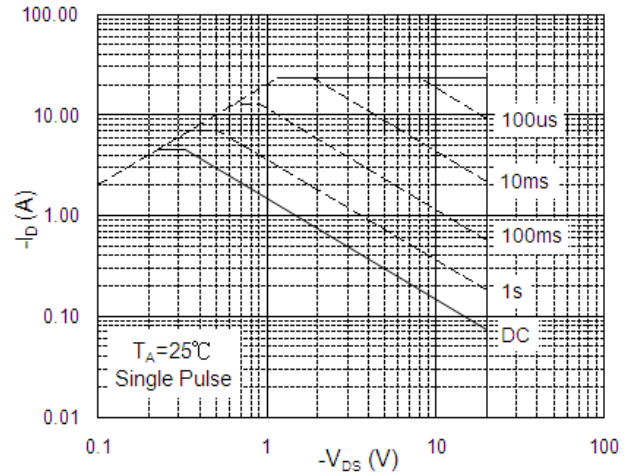


Fig.8 Safe Operating Area

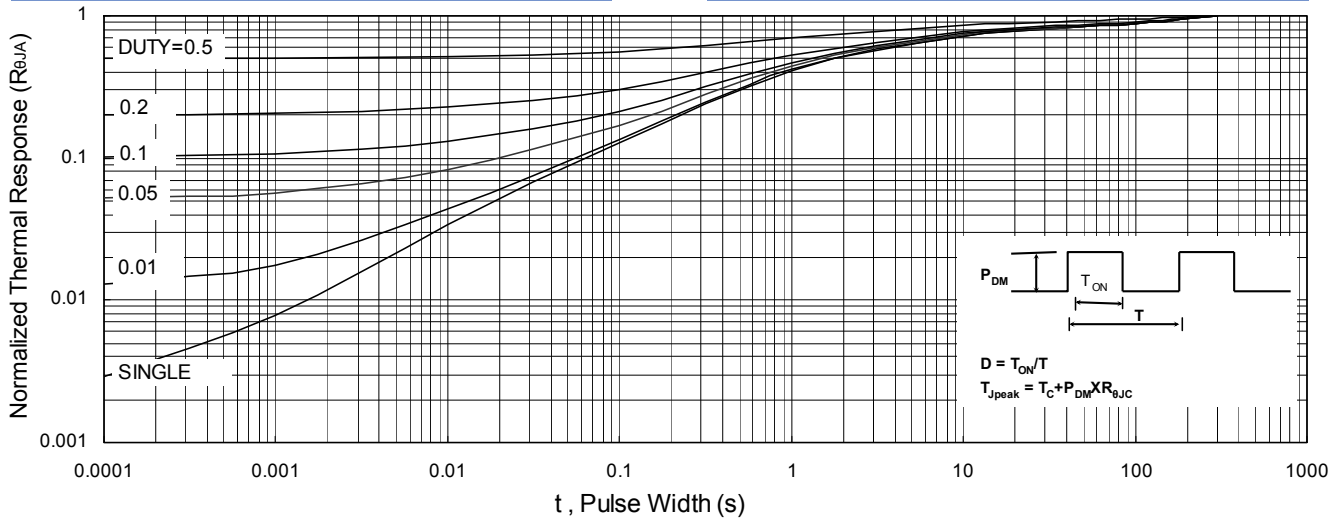


Fig.9 Normalized Maximum Transient Thermal Impedance

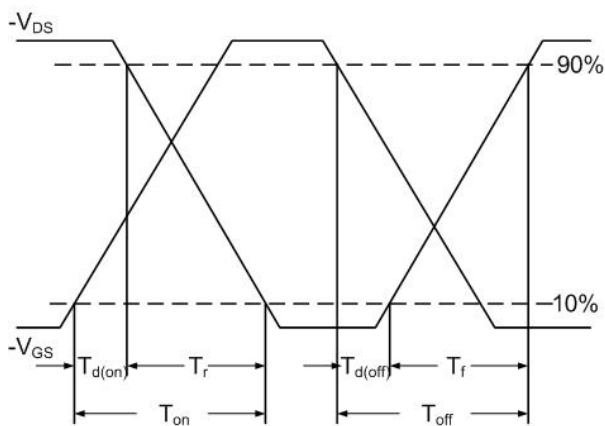


Fig.10 Switching Time Waveform

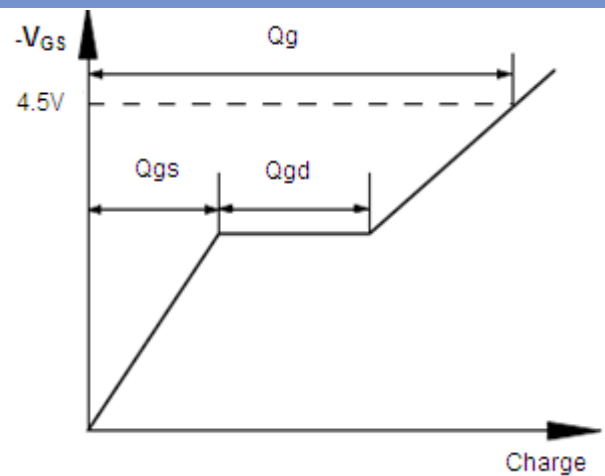


Fig.11 Gate Charge Waveform