

N-Ch and P-Ch 20V Fast Switching MOSFETs

General Description

The QM2604V is the highest performance trench N-ch and P-ch MOSFETs with extreme high cell density, which provide excellent RDSON and gate charge for most of the small power switching and load switch applications.

The QM2604V meet the RoHS and Green Product requirement with full function reliability approved.

Features

- Advanced high cell density Trench technology
- Super Low Gate Charge
- Excellent Cdv/dt effect decline
- Green Device Available

Absolute Maximum Ratings

Symbol	Parameter	Rating		Units
		N-Channel	P-Channel	
V_{DS}	Drain-Source Voltage	20	20	V
V_{GS}	Gate-Source Voltage	± 12	± 12	V
$I_D@T_A=25^\circ C$	Continuous Drain Current, $V_{GS} @ 4.5V^1$	3.8	-2.3	A
$I_D@T_A=70^\circ C$	Continuous Drain Current, $V_{GS} @ 4.5V^1$	3	-1.8	A
I_{DM}	Pulsed Drain Current ²	15.2	-9.2	A
$P_D@T_C=25^\circ C$	Total Power Dissipation ³	1.1	1.1	W
T_{STG}	Storage Temperature Range	-55 to 150	-55 to 150	$^\circ C$
T_J	Operating Junction Temperature Range	-55 to 150	-55 to 150	$^\circ C$

Thermal Data

Symbol	Parameter	Typ.	Max.	Unit
$R_{\theta JA}$	Thermal Resistance Junction-ambient ¹	---	110	$^\circ C/W$
$R_{\theta JC}$	Thermal Resistance Junction-Case ¹	---	70	$^\circ C/W$

Product Summary

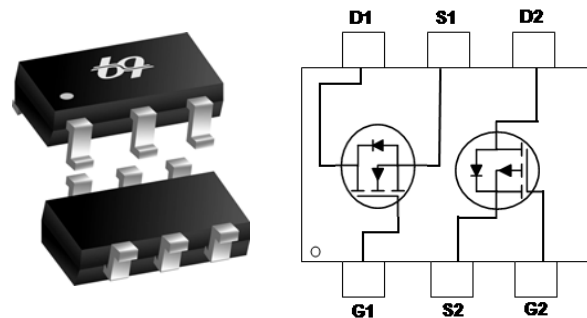


BVDSS	RDSON	ID
20V	50m Ω	3.8A
-20V	155 m Ω	-2.3A

Applications

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

TSOP6 Pin Configuration



N-Ch and P-Ch 20V Fast Switching MOSFETs
N-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
$\Delta BV_{DSS}/\Delta T_J$	BVDSS Temperature Coefficient	Reference to 25°C , $I_D=1\text{mA}$	---	0.015	---	V/ $^\circ\text{C}$
$R_{DS(ON)}$	Static Drain-Source On-Resistance ²	$V_{GS}=4.5V, I_D=4A$	---	42	50	m Ω
		$V_{GS}=2.5V, I_D=2A$	---	55	65	
$V_{GS(th)}$	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		---	-2.86	---	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
g_{fs}	Forward Transconductance	$V_{DS}=5V, I_D=3A$	---	10.5	---	S
R_g	Gate Resistance	$V_{DS}=0V, V_{GS}=0V, f=1\text{MHz}$	---	1.9	3.8	Ω
Q_g	Total Gate Charge (4.5V)	$V_{DS}=15V, V_{GS}=4.5V, I_D=3A$	---	4.7	6.6	nC
Q_{gs}	Gate-Source Charge		---	0.68	0.96	
Q_{gd}	Gate-Drain Charge		---	1.3	1.8	
$T_{d(on)}$	Turn-On Delay Time	$V_{DD}=10V, V_{GS}=4.5V, R_G=3.3\Omega, I_D=3A$	0.7	1.4	2.8	ns
T_r	Rise Time		20	40	72	
$T_{d(off)}$	Turn-Off Delay Time		6.2	12.4	25	
T_f	Fall Time		2.8	5.6	11	
C_{iss}	Input Capacitance	$V_{DS}=15V, V_{GS}=0V, f=1\text{MHz}$	---	296	414	μF
C_{oss}	Output Capacitance		---	44	62	
C_{riss}	Reverse Transfer Capacitance		---	35	49	

Diode Characteristics

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
I_S	Continuous Source Current ^{1,4}	$V_G=V_D=0V$, Force Current	---	---	3.8	A
I_{SM}	Pulsed Source Current ^{2,4}		---	---	15.2	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	$I_F=3A, dI/dt=100A/\mu s, T_J=25^\circ\text{C}$	---	8.9	---	nS
Q_{rr}	Reverse Recovery Charge		---	1.7	---	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.

N-Channel Typical Characteristics

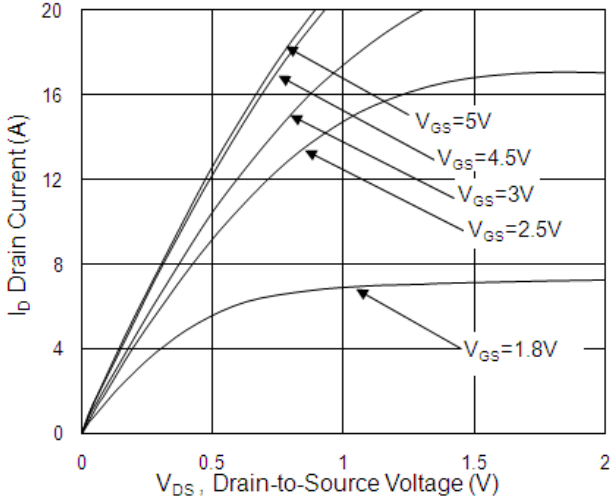


Fig.1 Typical Output Characteristics

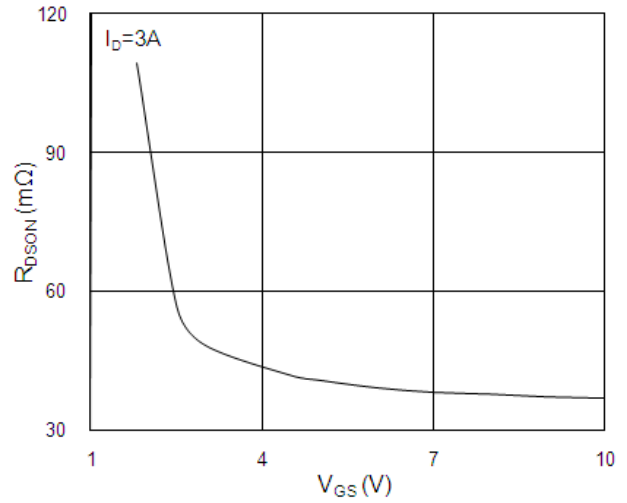


Fig.2 On-Resistance vs. Gate-Source

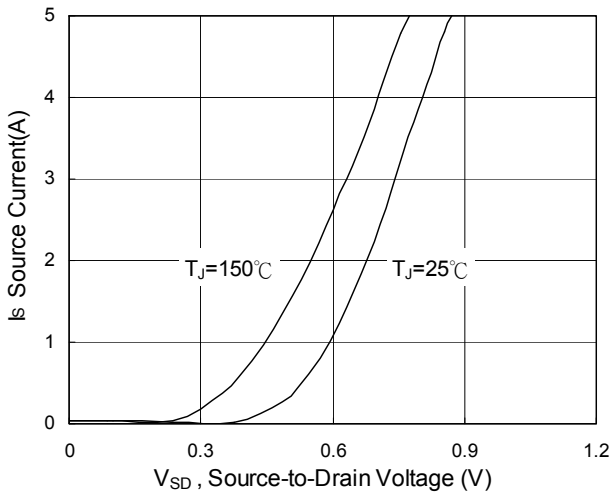


Fig.3 Forward Characteristics Of Reverse

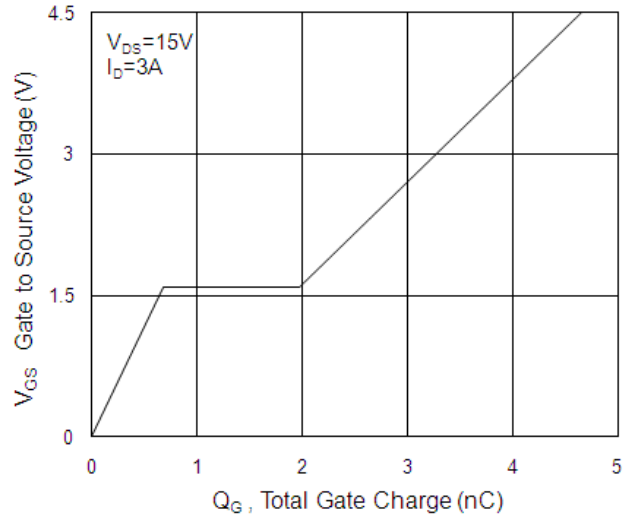


Fig.4 Gate-Charge Characteristics

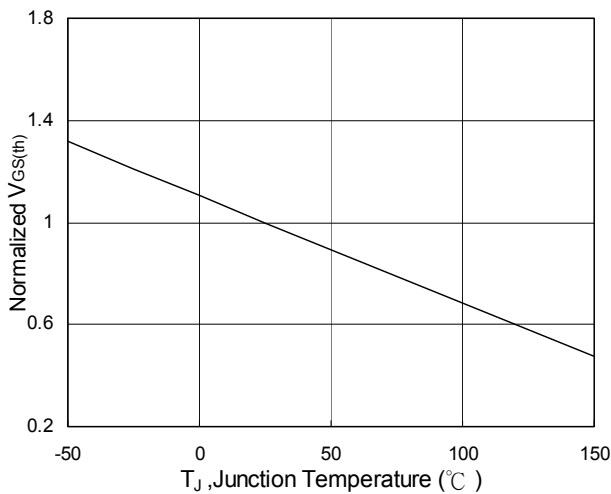


Fig.5 Normalized $V_{GS(th)}$ vs. T_J

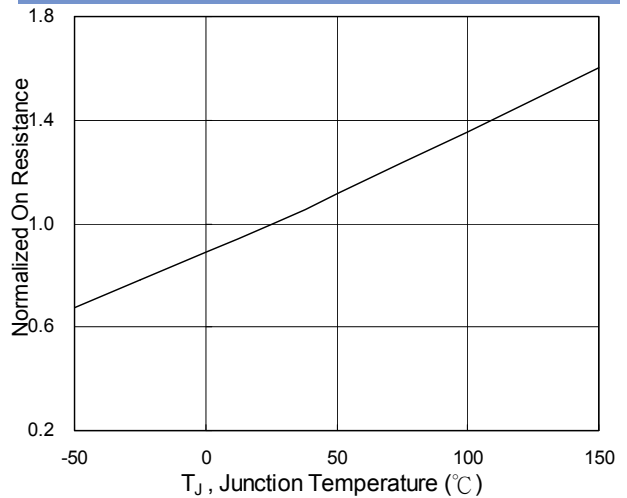


Fig.6 Normalized $R_{DS(on)}$ vs. T_J

N-Ch and P-Ch 20V Fast Switching MOSFETs

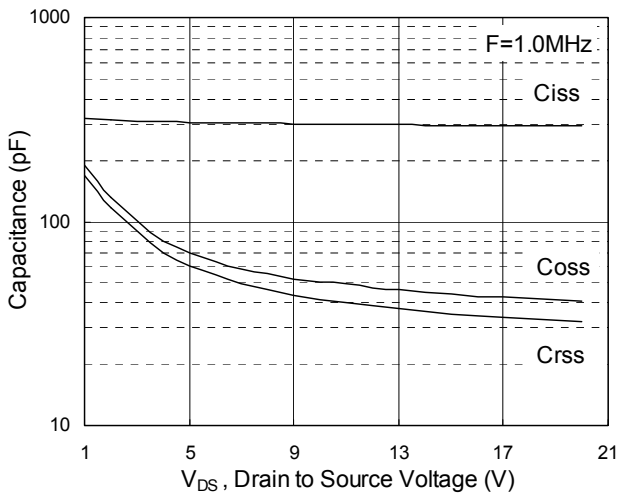


Fig.7 Capacitance

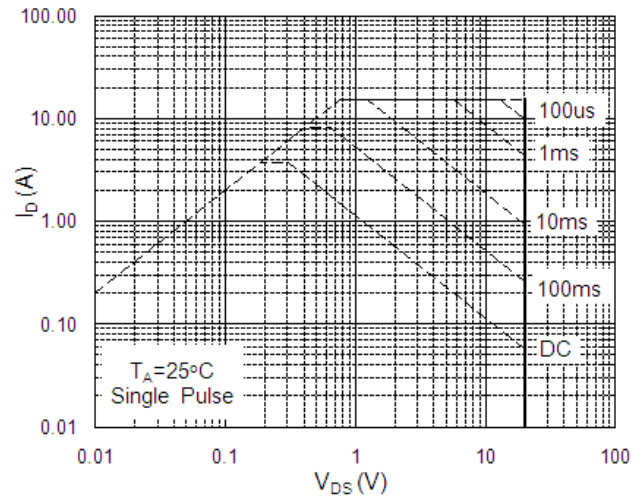


Fig.8 Safe Operating Area

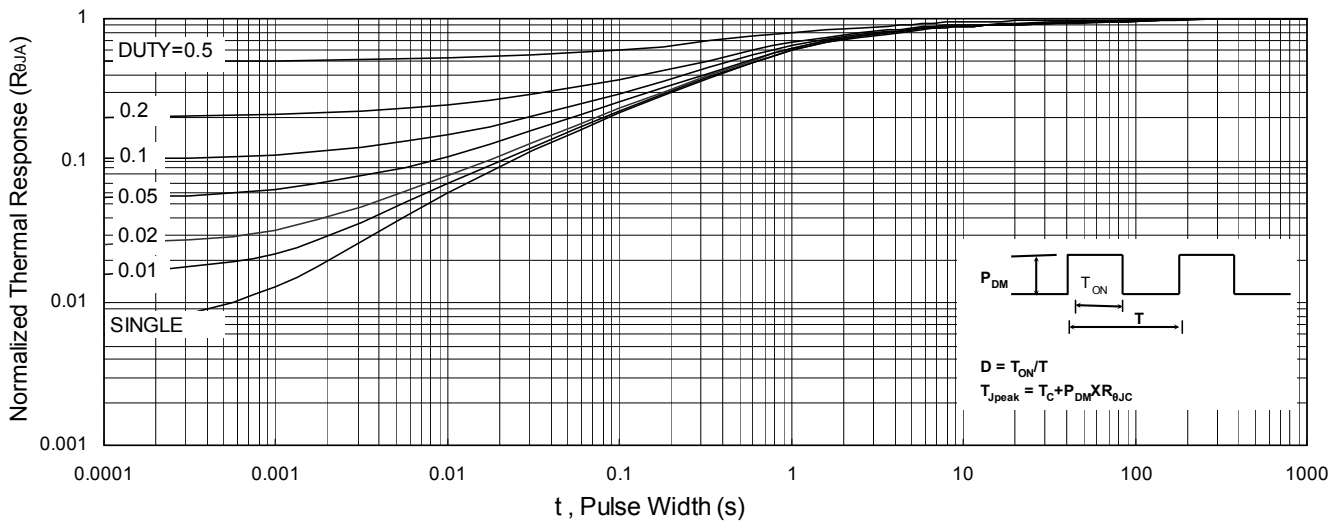


Fig.9 Normalized Maximum Transient Thermal Impedance

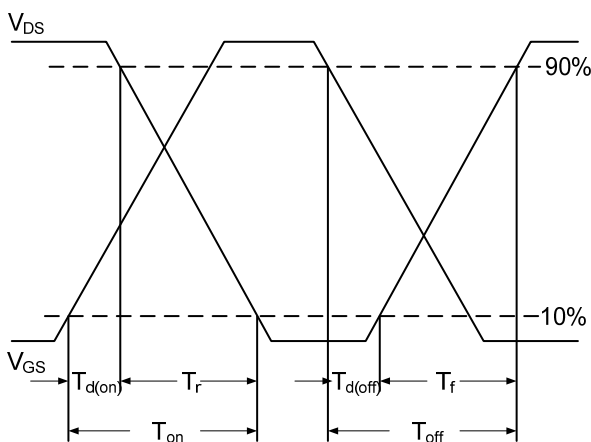


Fig.10 Switching Time Waveform

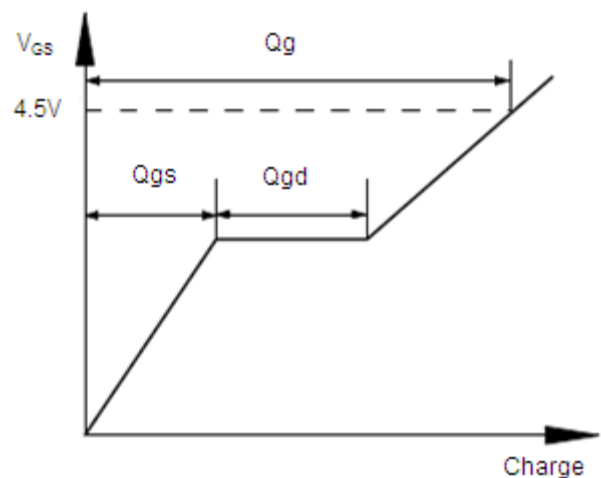


Fig.11 Gate Charge Waveform

N-Ch and P-Ch 20V Fast Switching MOSFETs

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
$\Delta BV_{DSS}/\Delta T_J$	BVDSS Temperature Coefficient	Reference to 25°C , $I_D=-1\text{mA}$	---	-0.016	---	V/ $^\circ\text{C}$
$R_{DS(ON)}$	Static Drain-Source On-Resistance ²	$V_{GS}=-4.5V, I_D=-3A$	---	125	155	m Ω
		$V_{GS}=-2.5V, I_D=-2A$	---	180	220	
$V_{GS(th)}$	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		---	3.97	---	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
g_{fs}	Forward Transconductance	$V_{DS}=-5V, I_D=-2A$	---	5.6	---	S
R_g	Gate Resistance	$V_{DS}=0V, V_{GS}=0V, f=1\text{MHz}$	---	25	50	Ω
Q_g	Total Gate Charge (-4.5V)	$V_{DS}=-15V, V_{GS}=-4.5V, I_D=-2A$	---	4.7	6.6	nC
Q_{gs}	Gate-Source Charge		---	0.8	1.1	
Q_{gd}	Gate-Drain Charge		---	1.3	1.8	
$T_{d(on)}$	Turn-On Delay Time	$V_{DD}=-10V, V_{GS}=-4.5V, R_G=3.3\Omega, I_D=-2A$	1.6	3.2	6.4	ns
T_r	Rise Time		17.1	34	61	
$T_{d(off)}$	Turn-Off Delay Time		9	18	36	
T_f	Fall Time		4.6	9.2	18.4	
C_{iss}	Input Capacitance	$V_{DS}=-15V, V_{GS}=0V, f=1\text{MHz}$	---	320	448	μF
C_{oss}	Output Capacitance		---	51	71	
C_{riss}	Reverse Transfer Capacitance		---	41	57	

Diode Characteristics

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
I_S	Continuous Source Current ^{1,4}	$V_G=V_D=0V$, Force Current	---	---	-2.3	A
I_{SM}	Pulsed Source Current ^{2,4}		---	---	-9.2	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	$I_F=-2A, dI/dt=100A/\mu s, T_J=25^\circ\text{C}$	---	10.2	---	nS
Q_{rr}	Reverse Recovery Charge		---	2.5	---	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.

N-Ch and P-Ch 20V Fast Switching MOSFETs

P-Channel Typical Characteristics

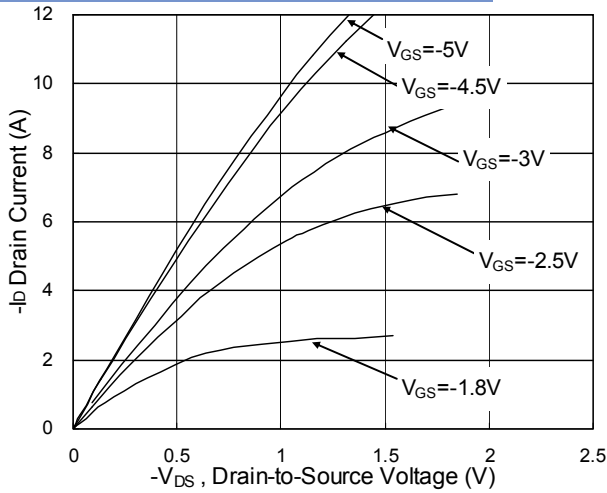


Fig.1 Typical Output Characteristics

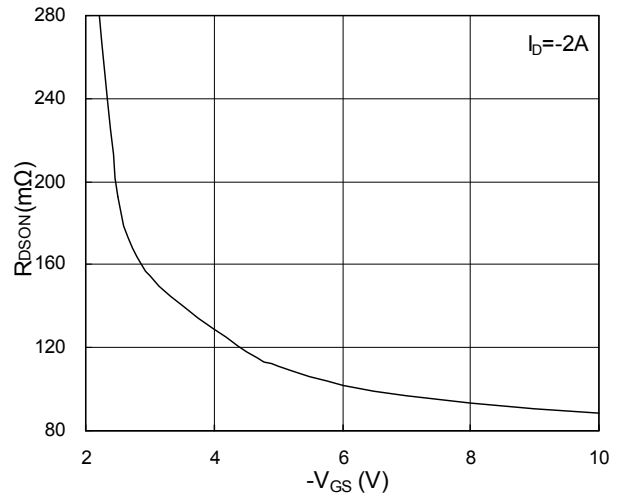


Fig.2 On-Resistance vs. Gate-Source

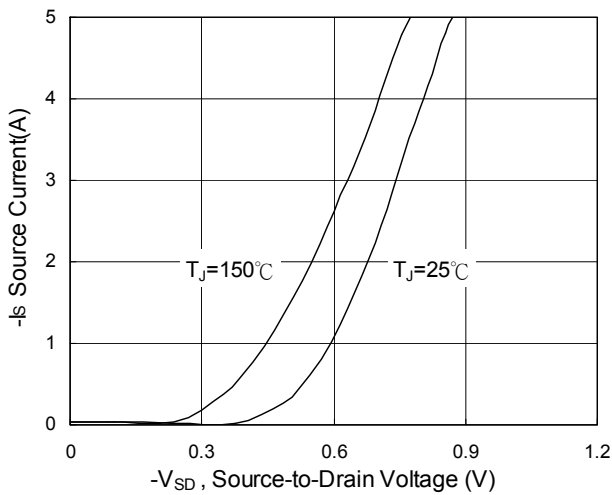


Fig.3 Forward Characteristics Of Reverse

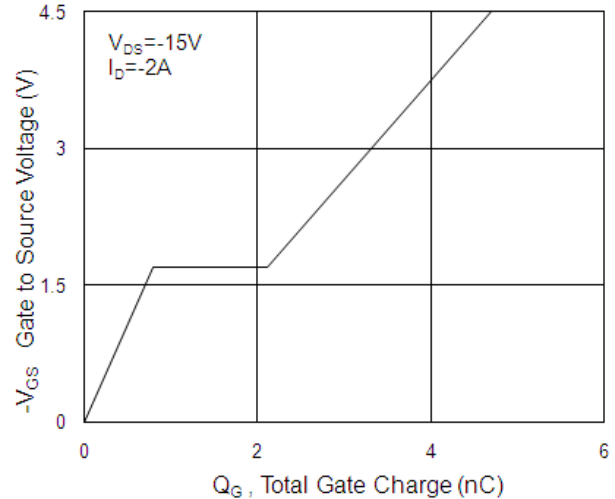


Fig.4 Gate-Charge Characteristics

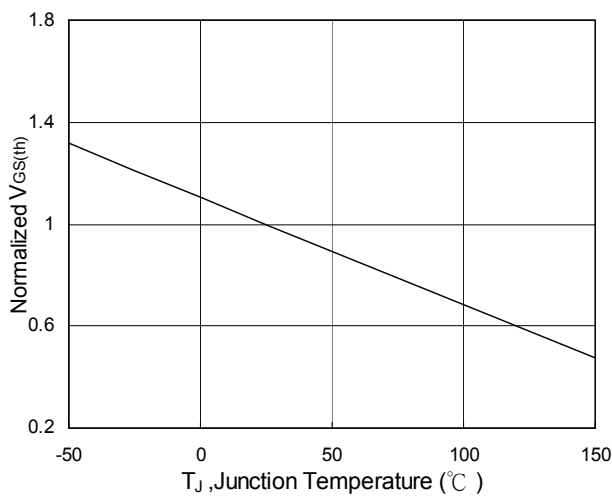


Fig.5 Normalized $V_{GS(th)}$ vs. T_J

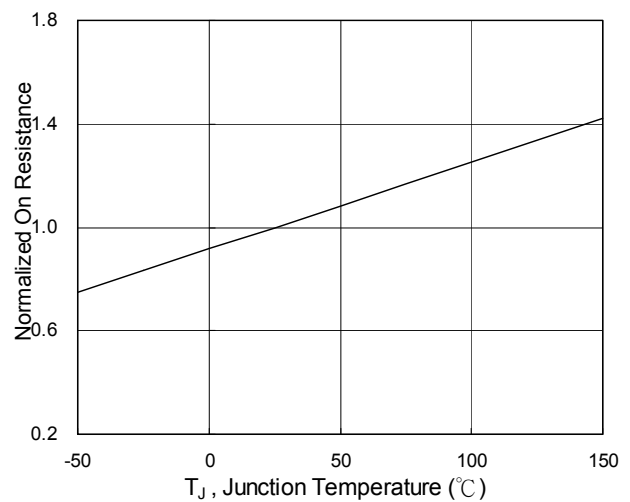


Fig.6 Normalized $R_{DS(on)}$ vs. T_J

N-Ch and P-Ch 20V Fast Switching MOSFETs

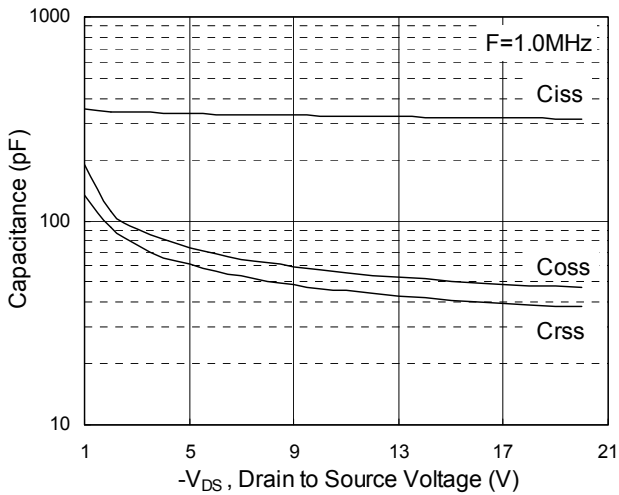


Fig.7 Capacitance

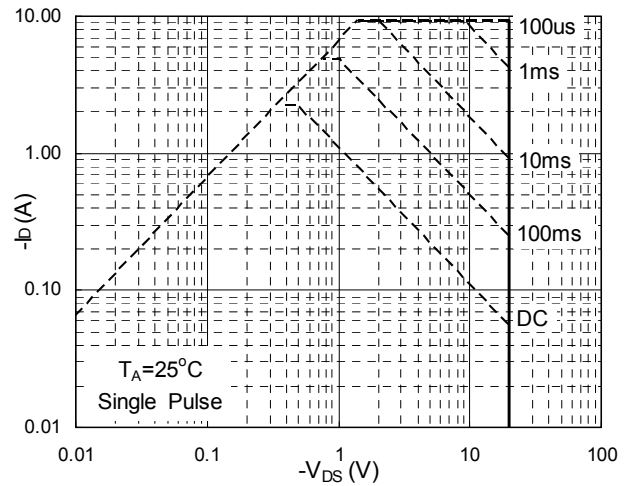


Fig.8 Safe Operating Area

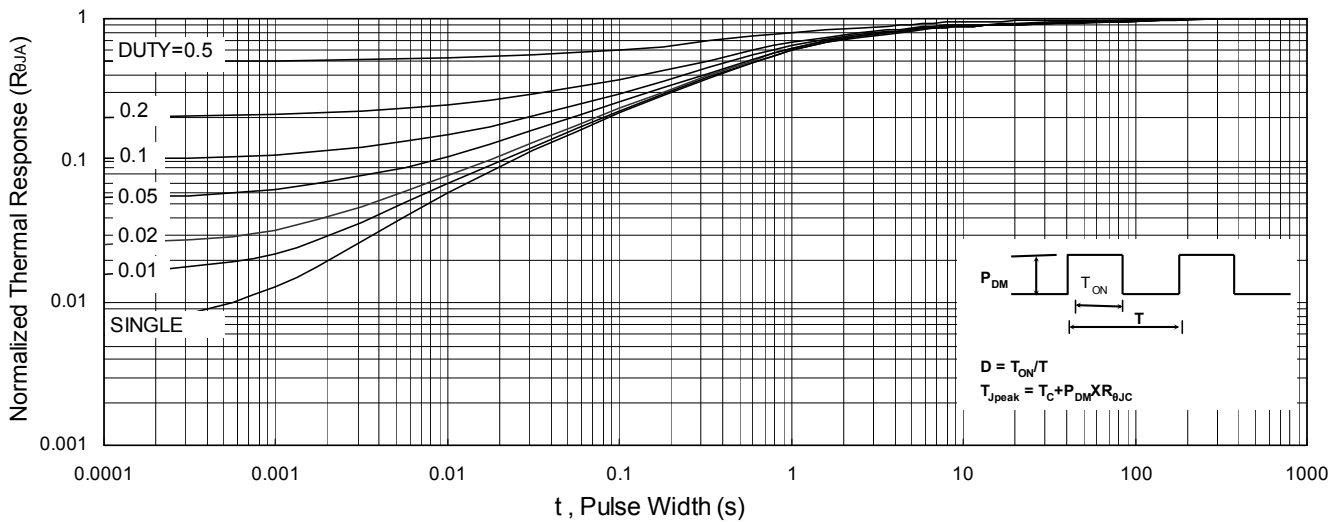


Fig.9 Normalized Maximum Transient Thermal Impedance

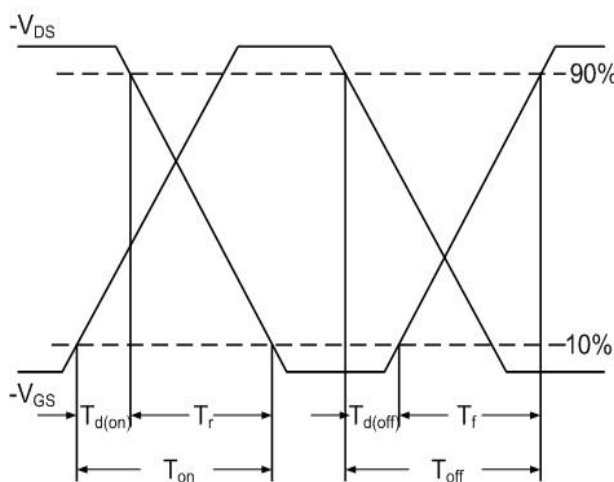


Fig.10 Switching Time Waveform

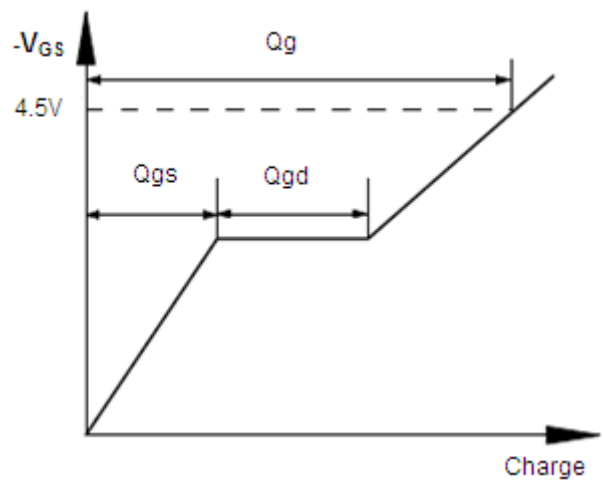


Fig.11 Gate Charge Waveform