

N-Ch and P-Ch Fast Switching MOSFETs
General Description

The UD4305 is the highest performance trench N-ch MOSFETs with extreme high cell density, which provide excellent R_{DS(on)} and gate charge for most of the synchronous buck converter applications.

The UD4305 meet the RoHS and Green Product requirement 100% EAS guaranteed with full function reliability approved.

Features

- Advanced high cell density Trench technology
- Super Low Gate Charge
- Excellent CdV/dt effect decline
- 100% EAS Guaranteed
- Green Device Available

Absolute Maximum Ratings

Symbol	Parameter	Rating		Units
		N-Ch	P-Ch	
V _{DS}	Drain-Source Voltage	40	-40	V
V _{GS}	Gate-Source Voltage	±20	±20	V
I _D @T _C =25°C	Continuous Drain Current, V _{GS} @ 10V ¹	32	-23	A
I _D @T _C =100°C	Continuous Drain Current, V _{GS} @ 10V ¹	25	-18	A
I _{DM}	Pulsed Drain Current ²	64	-46	A
EAS	Single Pulse Avalanche Energy ³	55	66	mJ
I _{AS}	Avalanche Current	25	-27.2	A
P _D @T _C =25°C	Total Power Dissipation ⁴	31.3	31.3	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

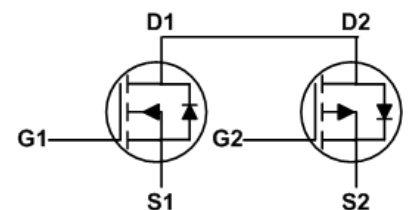
Symbol	Parameter	Typ.	Max.	Unit
R _{θJA}	Thermal Resistance Junction-Ambient ¹	---	62	°C/W
R _{θJC}	Thermal Resistance Junction-Case ¹	---	4	°C/W

Product Summary

BVDSS	R _{DS(on)}	I _D
40V	17mΩ	32A
-40V	40mΩ	-23A

Applications

- High Frequency Point-of-Load Synchronous Buck Converter for MB/NB/UMPC/VGA
- Networking DC-DC Power System
- CCFL Back-light Inverter

TO252 Pin Configuration


N-Ch and P-Ch Fast Switching MOSFETs
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	$V_{GS}=0V, I_D=250\mu A$	40	---	---	V
$\Delta BV_{DSS}/\Delta T_J$	BVDSS Temperature Coefficient	Reference to 25°C , $I_D=1\text{mA}$	---	0.032	---	V/ $^\circ\text{C}$
$R_{DS(ON)}$	Static Drain-Source On-Resistance ²	$V_{GS}=10V, I_D=10A$	---	14	17	m Ω
		$V_{GS}=4.5V, I_D=6A$	---	18	22	
$V_{GS(th)}$	Gate Threshold Voltage	$V_{GS}=V_{DS}, I_D=250\mu A$	1.0	1.5	2.5	V
$\Delta V_{GS(th)}$	$V_{GS(th)}$ Temperature Coefficient		---	-4.8	---	mV/ $^\circ\text{C}$
I_{DSS}	Drain-Source Leakage Current	$V_{DS}=32V, V_{GS}=0V, T_J=25^\circ\text{C}$	---	---	1	μA
		$V_{DS}=32V, V_{GS}=0V, T_J=55^\circ\text{C}$	---	---	5	
I_{GSS}	Gate-Source Leakage Current	$V_{GS}=\pm 20V, V_{DS}=0V$	---	---	± 100	nA
g_{fs}	Forward Transconductance	$V_{DS}=5V, I_D=10A$	---	16.2	---	S
R_g	Gate Resistance	$V_{DS}=0V, V_{GS}=0V, f=1\text{MHz}$	---	2.1	4.2	Ω
Q_g	Total Gate Charge (4.5V)	$V_{DS}=20V, V_{GS}=4.5V, I_D=12A$	---	9.1	---	nC
Q_{gs}	Gate-Source Charge		---	2.1	---	
Q_{gd}	Gate-Drain Charge		---	4.1	---	
$T_{d(on)}$	Turn-On Delay Time	$V_{DD}=15V, V_{GS}=10V, R_G=3.3\Omega, I_D=1A$	---	15.2	---	ns
T_r	Rise Time		---	3.6	---	
$T_{d(off)}$	Turn-Off Delay Time		---	46.4	---	
T_f	Fall Time		---	3.2	---	
C_{iss}	Input Capacitance	$V_{DS}=15V, V_{GS}=0V, f=1\text{MHz}$	---	1013	---	μF
C_{oss}	Output Capacitance		---	107	---	
C_{riss}	Reverse Transfer Capacitance		---	76	---	

Guaranteed Avalanche Characteristics

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
EAS	Single Pulse Avalanche Energy ⁵	$V_{DD}=25V, L=0.1\text{mH}, I_{AS}=15A$	20	---	---	mJ

Diode Characteristics

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
I_S	Continuous Source Current ^{1,6}	$V_G=V_D=0V$, Force Current	---	---	32	A
I_{SM}	Pulsed Source Current ^{2,6}		---	---	64	A
V_{SD}	Diode Forward Voltage ²	$V_{GS}=0V, I_S=1A, T_J=25^\circ\text{C}$	---	---	1	V

Note :

- The data tested by surface mounted on a 1 inch² FR-4 board with 20Z copper.
- The data tested by pulsed, pulse width $\leq 300\mu\text{s}$, duty cycle $\leq 2\%$
- The EAS data shows Max. rating. The test condition is $V_{DD}=25V, V_{GS}=10V, L=0.1\text{mH}, I_{AS}=25A$
- The power dissipation is limited by 150°C junction temperature
- The Min. value is 100% EAS tested guarantee.
- 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	$V_{GS}=0V, I_D=-250\mu A$	-40	---	---	V
$\Delta BV_{DSS}/\Delta T_J$	BV_{DSS} Temperature Coefficient	Reference to $25\text{ }^\circ\text{C}$, $I_D=-1mA$	---	-0.012	---	V/ $^\circ\text{C}$
$R_{DS(ON)}$	Static Drain-Source On-Resistance ²	$V_{GS}=-10V, I_D=-6A$	---	32	40	m Ω
		$V_{GS}=-4.5V, I_D=-3A$	---	52	65	
$V_{GS(th)}$	Gate Threshold Voltage	$V_{GS}=V_{DS}, I_D=-250\mu A$	-1.0	-1.6	-2.5	V
$\Delta V_{GS(th)}$	$V_{GS(th)}$ Temperature Coefficient		---	4.32	---	mV/ $^\circ\text{C}$
I_{DSS}	Drain-Source Leakage Current	$V_{DS}=-32V, V_{GS}=0V, T_J=25\text{ }^\circ\text{C}$	---	---	1	μA
		$V_{DS}=-32V, V_{GS}=0V, T_J=55\text{ }^\circ\text{C}$	---	---	5	
I_{GSS}	Gate-Source Leakage Current	$V_{GS}=\pm 20V, V_{DS}=0V$	---	---	± 100	nA
gfs	Forward Transconductance	$V_{DS}=-10V, I_D=-6A$	---	12.6	---	S
R_g	Gate Resistance	$V_{DS}=0V, V_{GS}=0V, f=1MHz$	---	13	16	Ω
Q_g	Total Gate Charge (-4.5V)	$V_{DS}=-20V, V_{GS}=-4.5V, I_D=-12A$	---	9	---	nC
Q_{gs}	Gate-Source Charge		---	2.54	---	
Q_{gd}	Gate-Drain Charge		---	3.1	---	
$T_{d(on)}$	Turn-On Delay Time	$V_{DD}=-15V, V_{GS}=-10V, R_G=3.3\Omega, I_D=-1A$	---	19.2	---	ns
T_r	Rise Time		---	12.8	---	
$T_{d(off)}$	Turn-Off Delay Time		---	48.6	---	
T_f	Fall Time		---	4.6	---	
C_{iss}	Input Capacitance	$V_{DS}=-15V, V_{GS}=0V, f=1MHz$	---	1004	---	pF
C_{oss}	Output Capacitance		---	108	---	
C_{rss}	Reverse Transfer Capacitance		---	80	---	

Guaranteed Avalanche Characteristics

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
EAS	Single Pulse Avalanche Energy ⁵	$V_{DD}=-25V, L=0.1mH, I_{AS}=-15A$	20	---	---	mJ

Diode Characteristics

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
I_S	Continuous Source Current ^{1,6}	$V_G=V_D=0V$, Force Current	---	---	-23	A
I_{SM}	Pulsed Source Current ^{2,6}		---	---	-46	A
V_{SD}	Diode Forward Voltage ²	$V_{GS}=0V, I_S=-1A, T_J=25\text{ }^\circ\text{C}$	---	---	-1	V

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 EAS data shows Max. rating . The test condition is $V_{DD}=-25V, V_{GS}=-10V, L=0.1mH, I_{AS}=-27.2A$
- 4.The power dissipation is limited by $150\text{ }^\circ\text{C}$ junction temperature
- 5.The Min. value is 100% EAS tested guarantee.
- 6.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

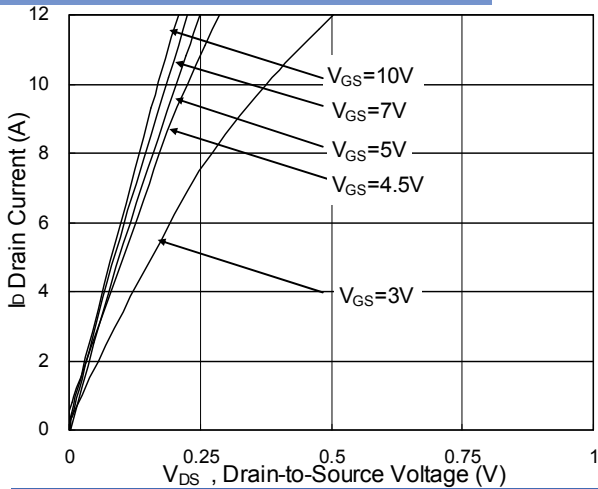


Fig.1 Typical Output Characteristics

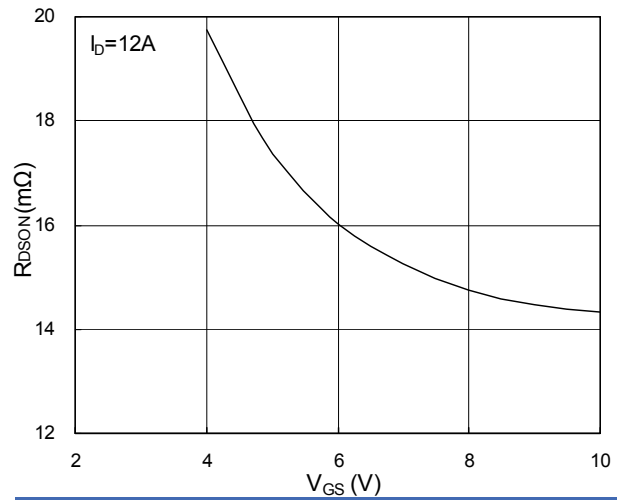


Fig.2 On-Resistance vs. G-S Voltage

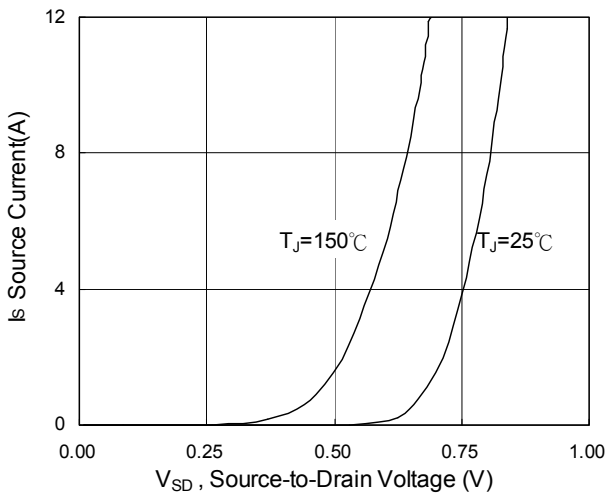


Fig.3 Forward Characteristics of Reverse

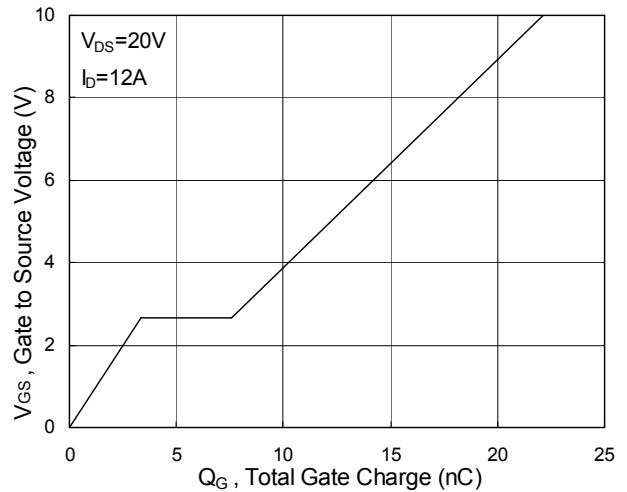


Fig.4 Gate-Charge Characteristics

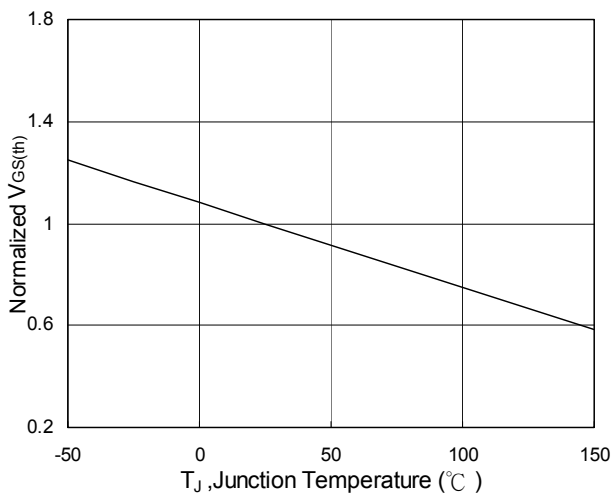


Fig.5 Normalized $V_{GS(th)}$ vs. T_J

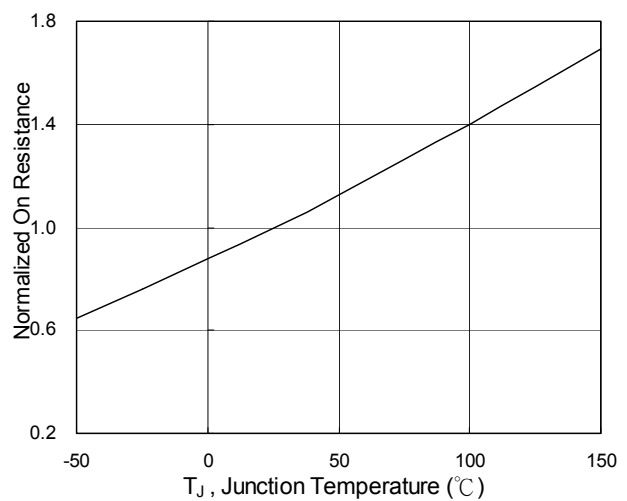


Fig.6 Normalized $R_{DS(on)}$ vs. T_J

N-Ch and P-Ch Fast Switching MOSFETs

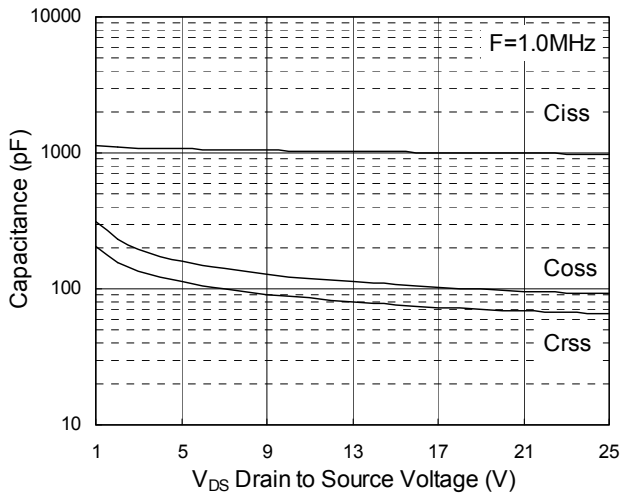


Fig.7 Capacitance

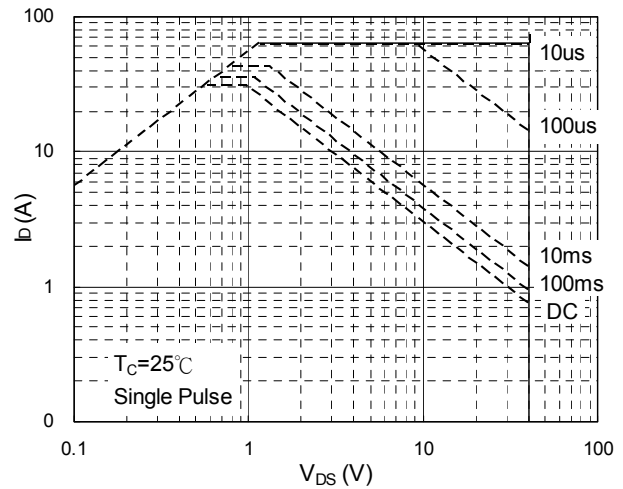


Fig.8 Safe Operating Area

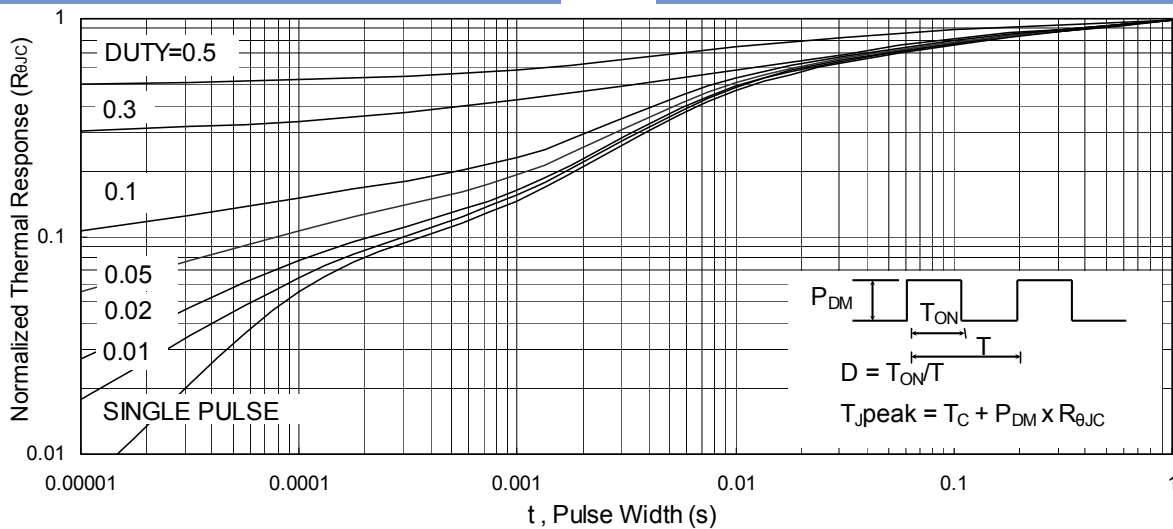


Fig.9 Normalized Maximum Transient Thermal Impedance

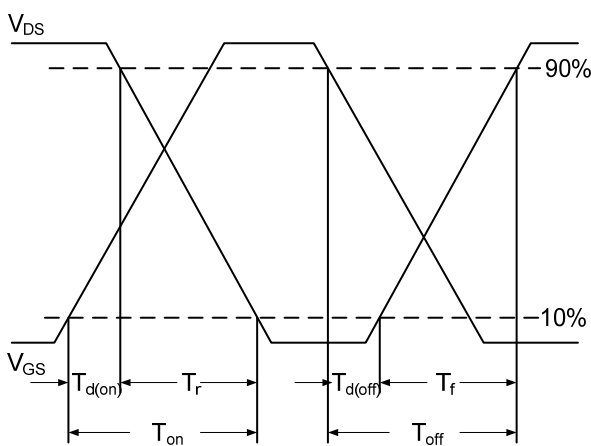


Fig.10 Switching Time Waveform

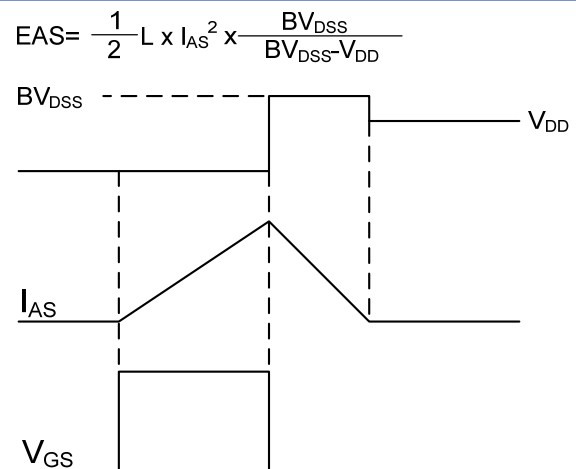


Fig.11 Unclamped Inductive Switching Wave

N-Ch and P-Ch Fast Switching MOSFETs

P-Channel Typical Characteristics

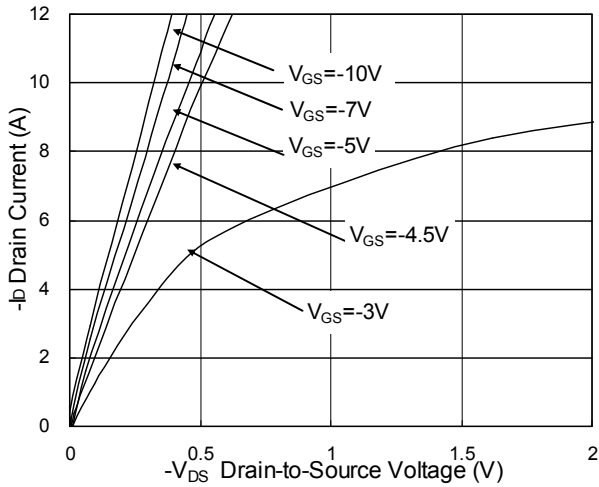


Fig.1 Typical Output Characteristics

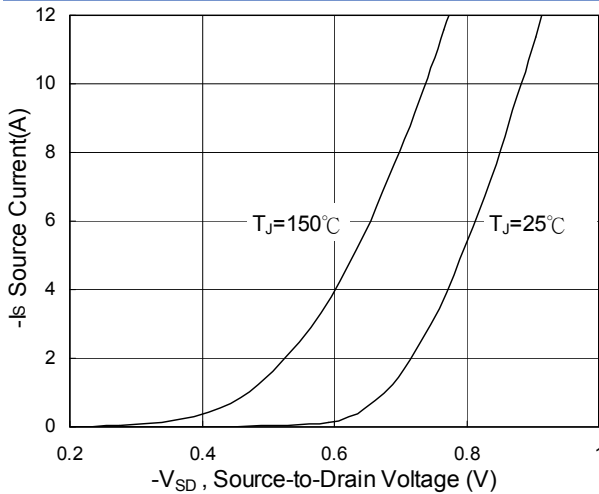


Fig.3 Forward Characteristics of Reverse

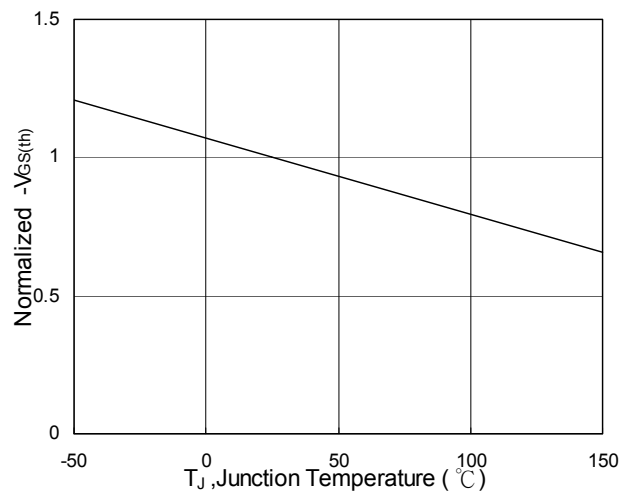


Fig.5 Normalized $V_{GS(th)}$ v.s T_J

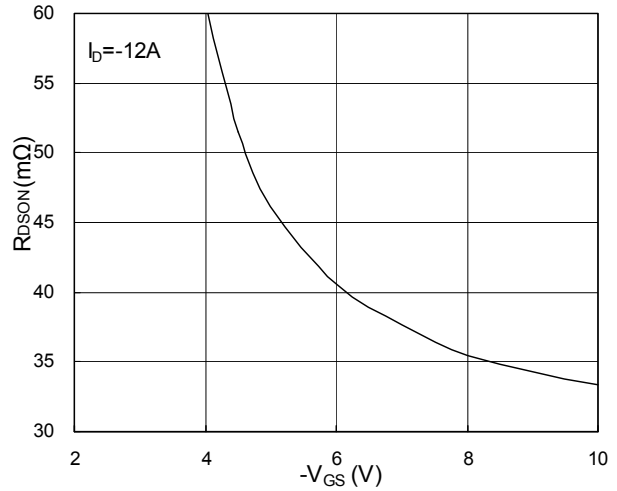


Fig.2 On-Resistance v.s Gate-Source

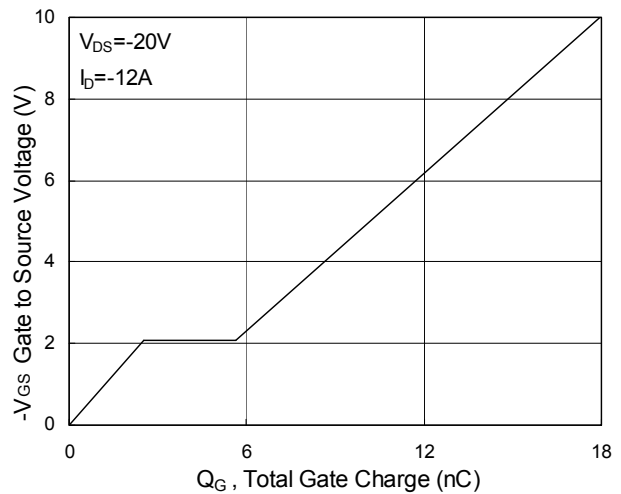


Fig.4 Gate-Charge Characteristics

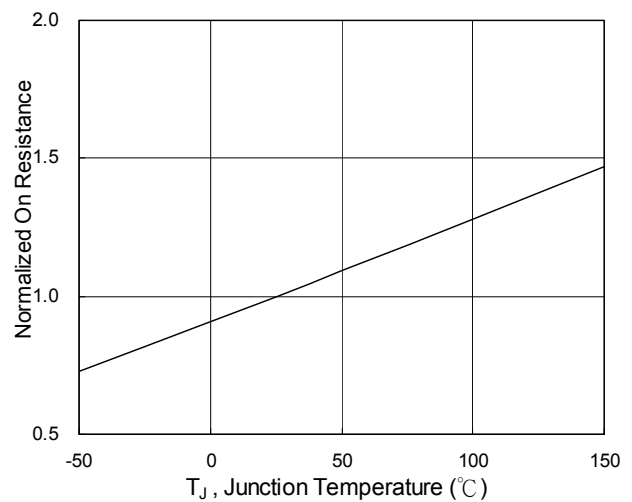


Fig.6 Normalized $R_{DS(on)}$ v.s T_J

N-Ch and P-Ch Fast Switching MOSFETs

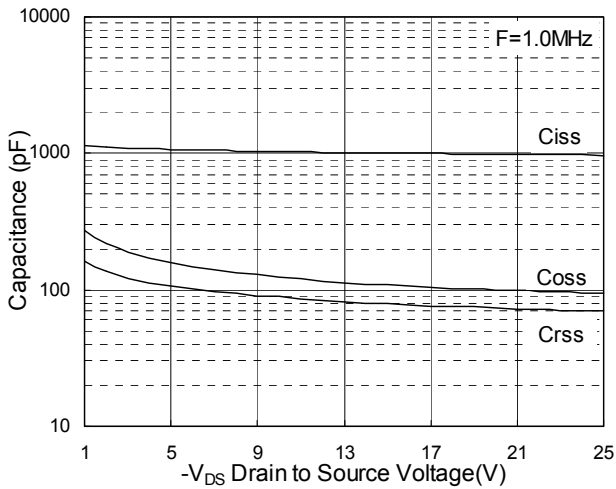


Fig.7 Capacitance

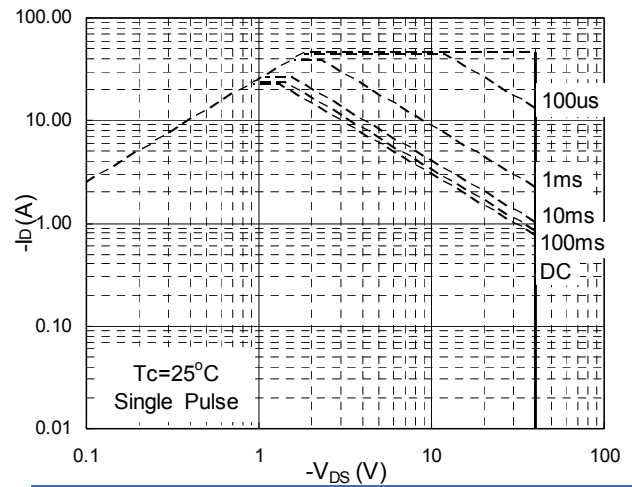


Fig.8 Safe Operating Area

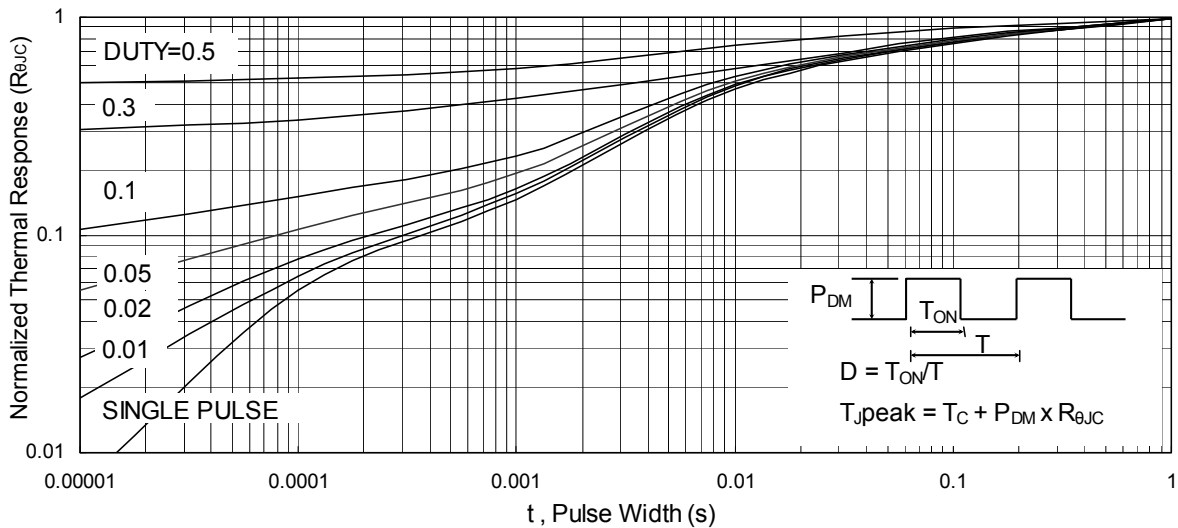


Fig.9 Normalized Maximum Transient Thermal Impedance

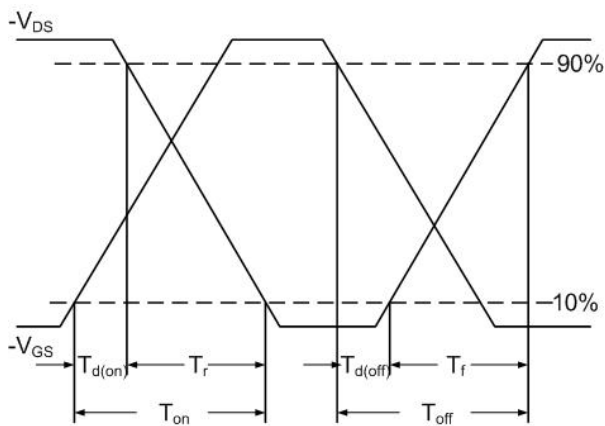


Fig.10 Switching Time Waveform

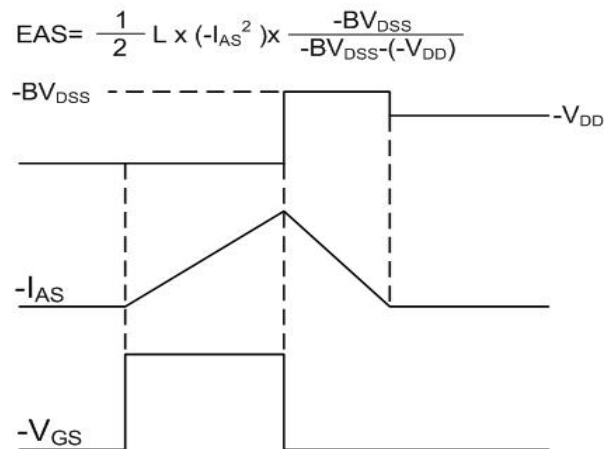


Fig.11 Unclamped Inductive Waveform