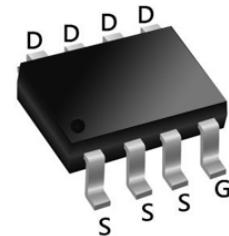


N-Ch and P-Ch Fast Switching MOSFETs

Features:

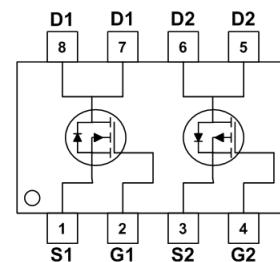
- ★ Super Low Gate Charge
- ★ 100% EAS Guaranteed
- ★ Green Device Available
- ★ Excellent CdV/dt effect decline
- ★ Advanced high cell density Trench technology



SOP8 Pin Configuration

The KWS6903 is the high performance complementary N-ch and P-ch MOSFETs with high cell density, which provide excellent RDSON and gate charge for most of the synchronous buck converter applications.

The KWS6903 meet the RoHS and Green Product requirement 100% EAS guaranteed with full function reliability approved.



BVDSS	RDSON(Typ.)	ID
60V	38mΩ	5A
-60V	80mΩ	-3.8A

Absolute Maximum Ratings

Symbol	Parameter	Rating		Units
		N-Channel	P-Channel	
V _{DS}	Drain-Source Voltage	60	-60	V
V _{GS}	Gate-Source Voltage	±20	±20	V
I _D @T _A =25°C	Continuous Drain Current, V _{GS} @ 10V ¹	5	-3.8	A
I _D @T _A =70°C	Continuous Drain Current, V _{GS} @ 10V ¹	4	-3.2	A
I _{DM}	Pulsed Drain Current ²	20	-14	A
EAS	Single Pulse Avalanche Energy ³	22	28.8	mJ
I _{AS}	Avalanche Current	21	-24	A
P _D @T _A =25°C	Total Power Dissipation ⁴	2	2	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
	Thermal Resistance Junction-Ambient ¹ (t≤10sec)	---	62.5	°C/W

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	$V_{\text{GS}}=0\text{V}$, $I_D=250\mu\text{A}$	60	---	---	V
$R_{\text{DS}(\text{ON})}$	Static Drain-Source On-Resistance ²	$V_{\text{GS}}=10\text{V}$, $I_D=5\text{A}$	---	38	52	$\text{m}\Omega$
		$V_{\text{GS}}=4.5\text{V}$, $I_D=4\text{A}$	---	55	75	
$V_{\text{GS}(\text{th})}$	Gate Threshold Voltage	$V_{\text{GS}}=V_{\text{DS}}$, $I_D=250\mu\text{A}$	1.0	---	2.5	V
I_{DSS}	Drain-Source Leakage Current	$V_{\text{DS}}=48\text{V}$, $V_{\text{GS}}=0\text{V}$, $T_J=25^{\circ}\text{C}$	---	---	1	uA
		$V_{\text{DS}}=48\text{V}$, $V_{\text{GS}}=0\text{V}$, $T_J=55^{\circ}\text{C}$	---	---	5	
I_{GSS}	Gate-Source Leakage Current	$V_{\text{GS}}=\pm 20\text{V}$, $V_{\text{DS}}=0\text{V}$	---	---	± 100	nA
g_{fs}	Forward Transconductance	$V_{\text{DS}}=5\text{V}$, $I_D=4\text{A}$	---	28	---	S
Q_g	Total Gate Charge (4.5V)	$V_{\text{DS}}=48\text{V}$, $V_{\text{GS}}=4.5\text{V}$, $I_D=4\text{A}$	---	19	---	nC
Q_{gs}	Gate-Source Charge		---	2.6	---	
Q_{gd}	Gate-Drain Charge		---	4.1	---	
$T_{\text{d}(\text{on})}$	Turn-On Delay Time	$V_{\text{DD}}=30\text{V}$, $V_{\text{GS}}=10\text{V}$, $R_G=3.3\Omega$, $I_D=4\text{A}$	---	3	---	ns
T_r	Rise Time		---	34	---	
$T_{\text{d}(\text{off})}$	Turn-Off Delay Time		---	23	---	
T_f	Fall Time		---	6	---	
C_{iss}	Input Capacitance	$V_{\text{DS}}=15\text{V}$, $V_{\text{GS}}=0\text{V}$, $f=1\text{MHz}$	---	1027	---	pF
C_{oss}	Output Capacitance		---	65	---	
C_{rss}	Reverse Transfer Capacitance		---	46	---	

Diode Characteristics

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
I_s	Continuous Source Current ^{1,5}	$V_G=V_D=0\text{V}$, Force Current	---	---	2.5	A
V_{SD}	Diode Forward Voltage ²	$V_{\text{GS}}=0\text{V}$, $I_s=1\text{A}$, $T_J=25^{\circ}\text{C}$	---	---	1.2	V

Note :

- 1.The data tested by surface mounted on a 1 inch² FR-4 board with 2OZ copper.
- 2.The data tested by pulsed , pulse width $\leq 300\mu\text{s}$, duty cycle $\leq 2\%$
- 3.The EAS data shows Max. rating . The test condition is $V_{\text{DD}}=25\text{V}$, $V_{\text{GS}}=10\text{V}$, $L=0.1\text{mH}$, $I_{\text{AS}}=21\text{A}$
- 4.The power dissipation is limited by 150°C junction temperature
- 5.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 ($T_J=25^{\circ}\text{C}$, unless otherwise noted)

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
BV_{DSS}	Drain-Source Breakdown Voltage	$V_{\text{GS}}=0\text{V}$, $I_D=-250\mu\text{A}$	-60	---	---	V
$R_{\text{DS}(\text{ON})}$	Static Drain-Source On-Resistance ²	$V_{\text{GS}}=-10\text{V}$, $I_D=-3.5\text{A}$	---	80	100	$\text{m}\Omega$
		$V_{\text{GS}}=-4.5\text{V}$, $I_D=-3.1\text{A}$	---	100	105	
$V_{\text{GS}(\text{th})}$	Gate Threshold Voltage	$V_{\text{GS}}=V_{\text{DS}}$, $I_D=-250\mu\text{A}$	-	---	-	V
I_{DSS}	Drain-Source Leakage Current	$V_{\text{DS}}=-48\text{V}$, $V_{\text{GS}}=0\text{V}$, $T_J=25^{\circ}\text{C}$	---	---	1	uA
		$V_{\text{DS}}=-48\text{V}$, $V_{\text{GS}}=0\text{V}$, $T_J=55^{\circ}\text{C}$	---	---	5	
I_{GSS}	Gate-Source Leakage Current	$V_{\text{GS}}=\pm 20\text{V}$, $V_{\text{DS}}=0\text{V}$	---	---	\pm	nA
g_{fs}	Forward Transconductance	$V_{\text{DS}}=-5\text{V}$, $I_D=-3\text{A}$	---	8.5	---	S
Q_g	Total Gate Charge (-4.5V)	$V_{\text{DS}}=-48\text{V}$, $V_{\text{GS}}=-4.5\text{V}$, $I_D=-3\text{A}$	---	12.	---	nC
Q_{gs}	Gate-Source Charge		---	2.2	---	
Q_{gd}	Gate-Drain Charge		---	6.3	---	
$T_{\text{d}(\text{on})}$	Turn-On Delay Time	$V_{\text{DD}}=-15\text{V}$, $V_{\text{GS}}=-10\text{V}$, $R_G=3.3\Omega$, $I_D=-1\text{A}$	---	9.2	---	ns
T_r	Rise Time		---	20.	---	
$T_{\text{d}(\text{off})}$	Turn-Off Delay Time		---	46.	---	
T_f	Fall Time		---	9.4	---	
C_{iss}	Input Capacitance	$V_{\text{DS}}=-15\text{V}$, $V_{\text{GS}}=0\text{V}$, $f=1\text{MHz}$	---	113	---	pF
C_{oss}	Output Capacitance		---	76	---	
C_{rss}	Reverse Transfer Capacitance		---	50	---	

Diode Characteristics

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
I_s	Continuous Source Current ^{1,5}	$V_G=V_D=0\text{V}$, Force Current	---	---	-	A
V_{SD}	Diode Forward Voltage ²	$V_{\text{GS}}=0\text{V}$, $I_s=-1\text{A}$, $T_J=25^{\circ}\text{C}$	---	---	-	V

Note :

- 1.The data tested by surface mounted on a 1 inch² FR-4 board with 2OZ copper.
- 2.The data tested by pulsed , pulse width $\leq 300\mu\text{s}$, duty cycle $\leq 2\%$
- 3.The EAS data shows Max. rating . The test condition is $V_{\text{DD}}=-25\text{V}$, $V_{\text{GS}}=-10\text{V}$, $L=0.1\text{mH}$, $I_{\text{AS}}=-24\text{A}$
- 4.The power dissipation is limited by 150°C junction temperature
- 5.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

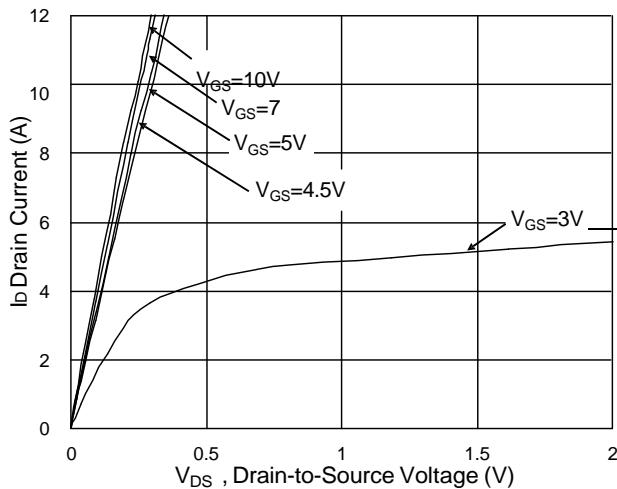


Fig.1 Typical Output Characteristics

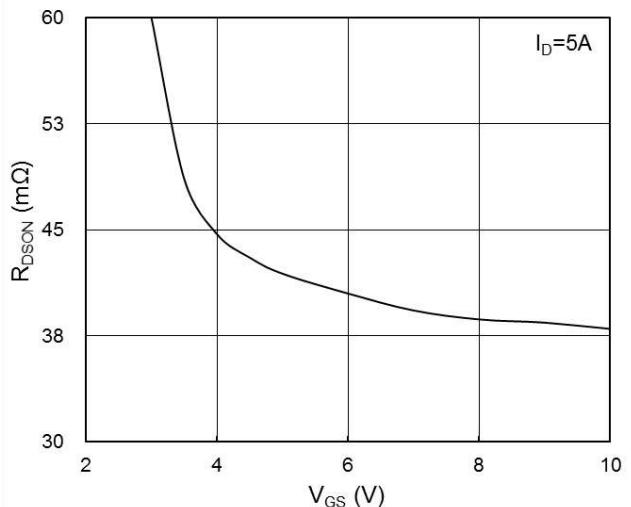


Fig.2 On-Resistance vs. G-S Voltage

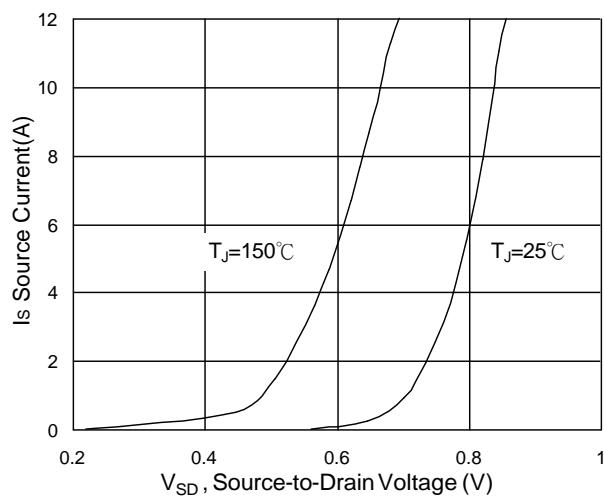


Fig.3 Source Drain Forward Characteristics

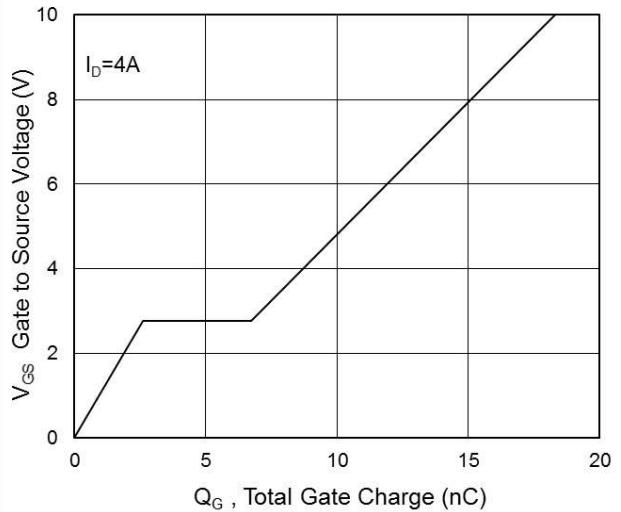


Fig.4 Gate-Charge Characteristics

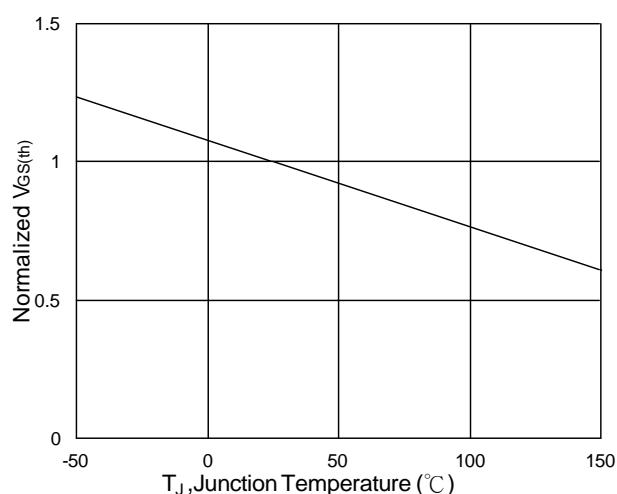


Fig.5 Normalized $V_{GS(th)}$ vs. T_J

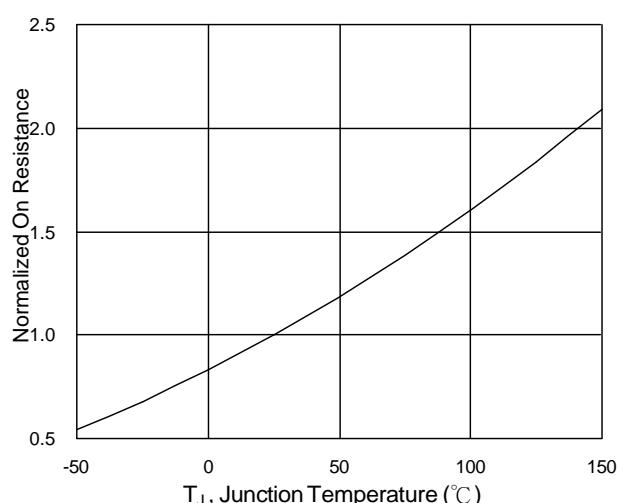


Fig.6 Normalized $R_{DS(on)}$ vs. T_J

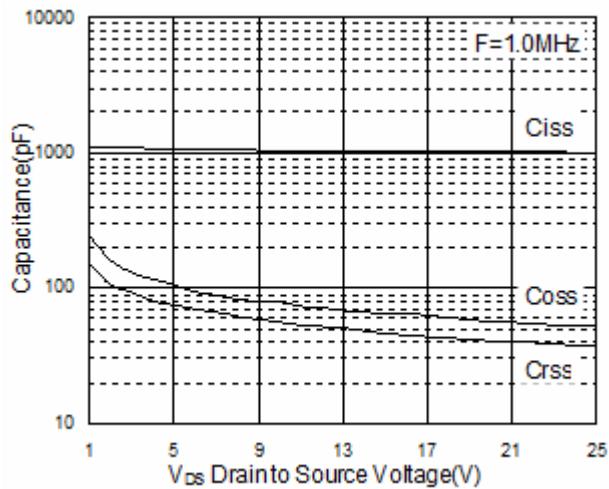


Fig.7 Capacitance

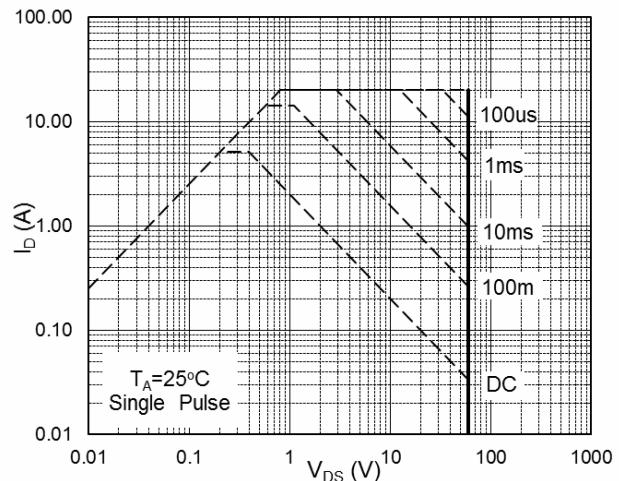


Fig.8 Safe Operating Area

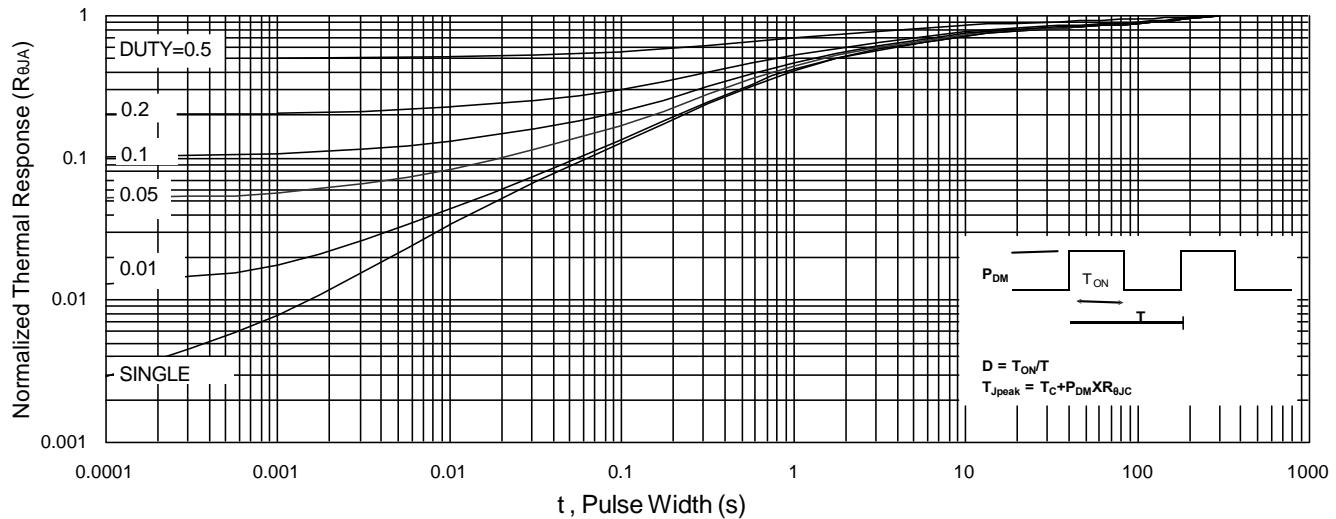


Fig.9 Normalized Maximum Transient Thermal Impedance

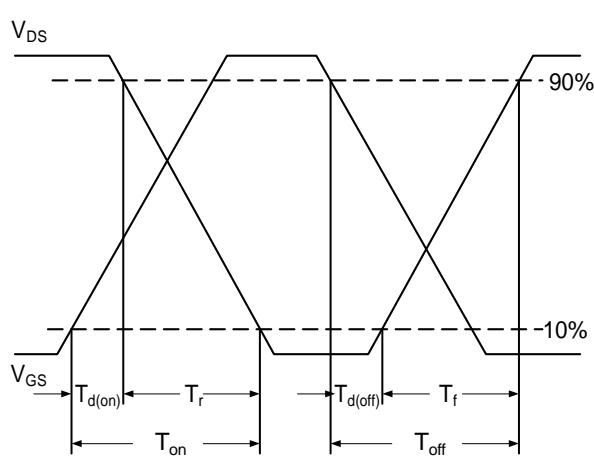
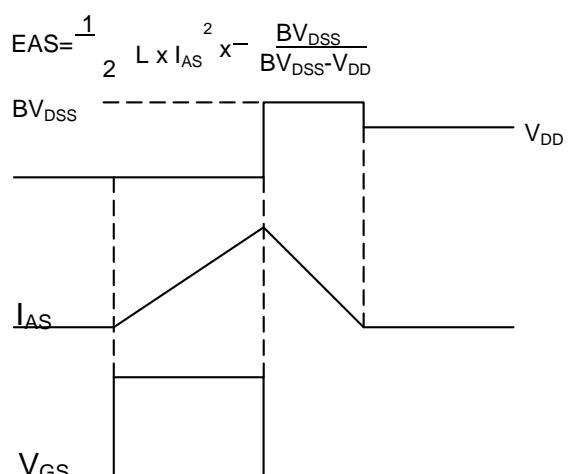


Fig.10 Switching Time Waveform



P-Channel Typical Characteristics

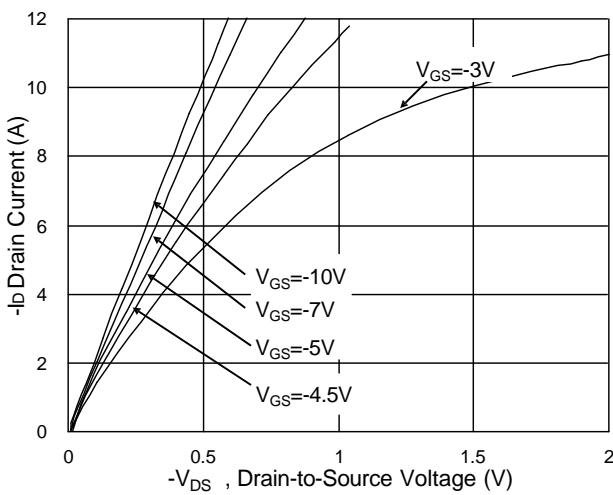


Fig.1 Typical Output Characteristics

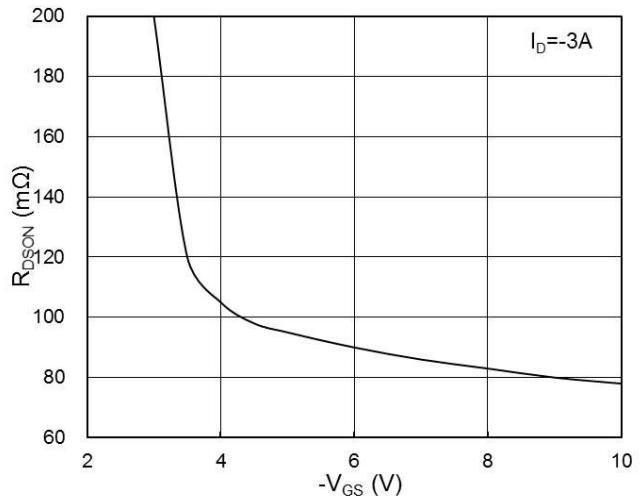


Fig.2 On-Resistance vs. G-S Voltage

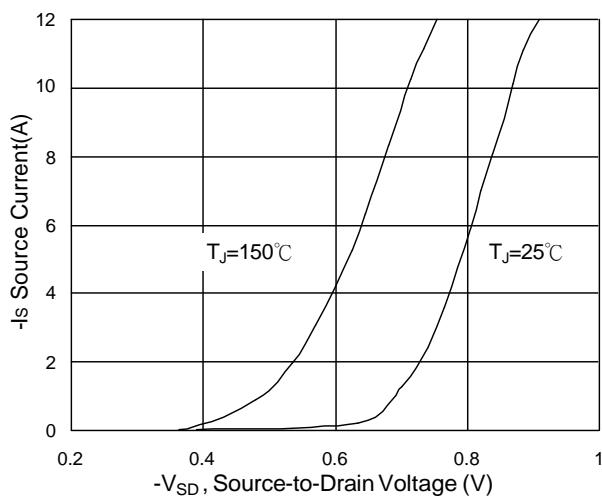


Fig.3 Source Drain Forward Characteristics

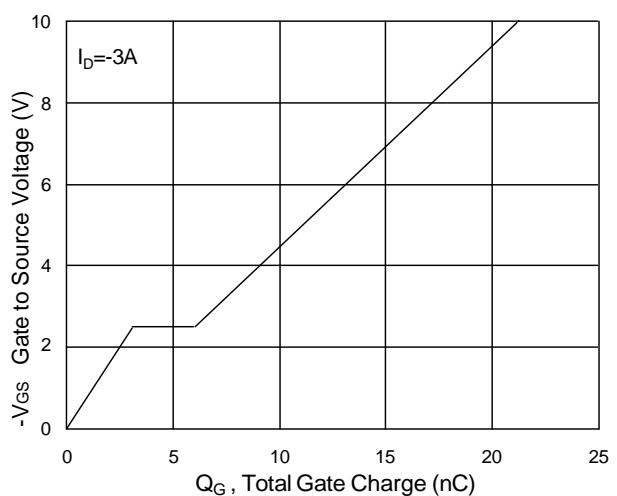


Fig.4 Gate-Charge Characteristics

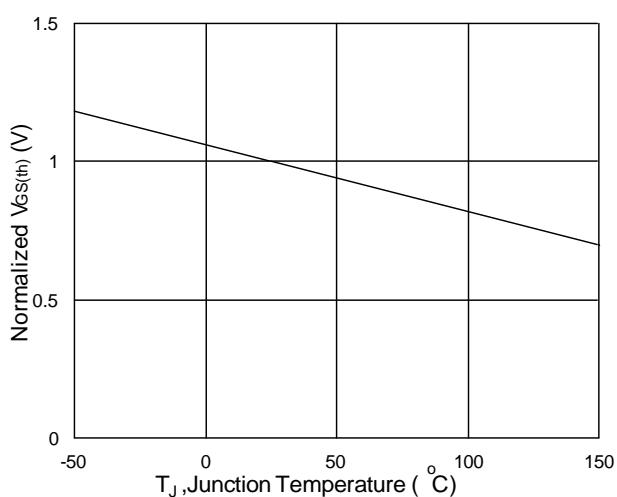


Fig.5 Normalized $V_{GS(th)}$ vs. T_J

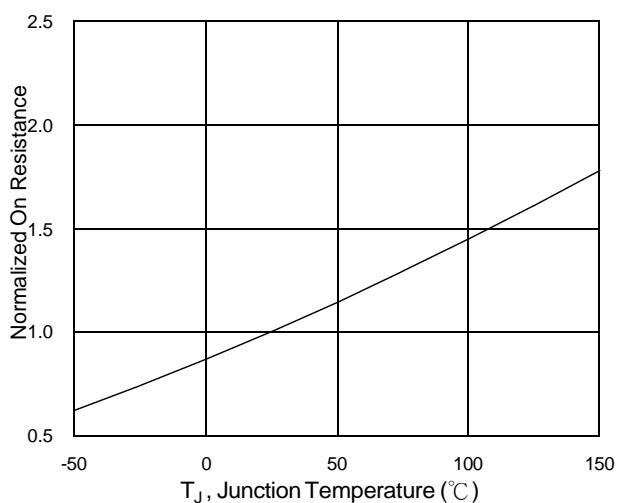


Fig.6 Normalized $R_{DS(on)}$ vs. T_J

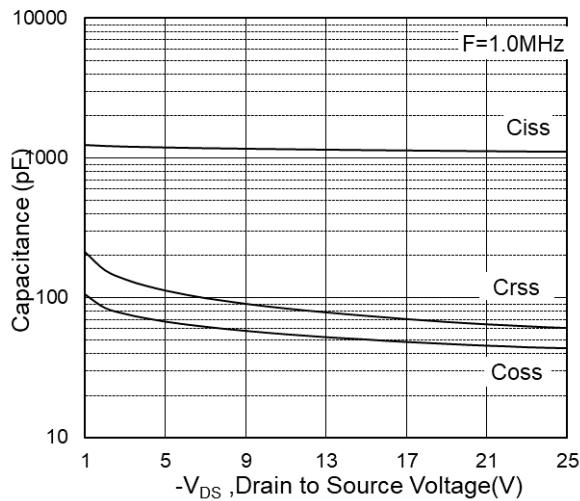


Fig.7 Capacitance

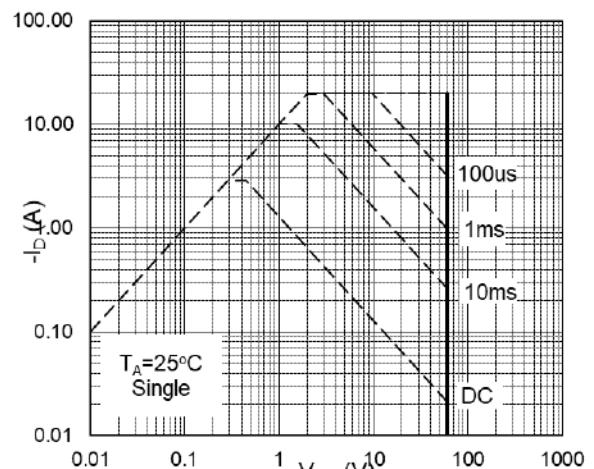


Fig.8 Safe Operating Area

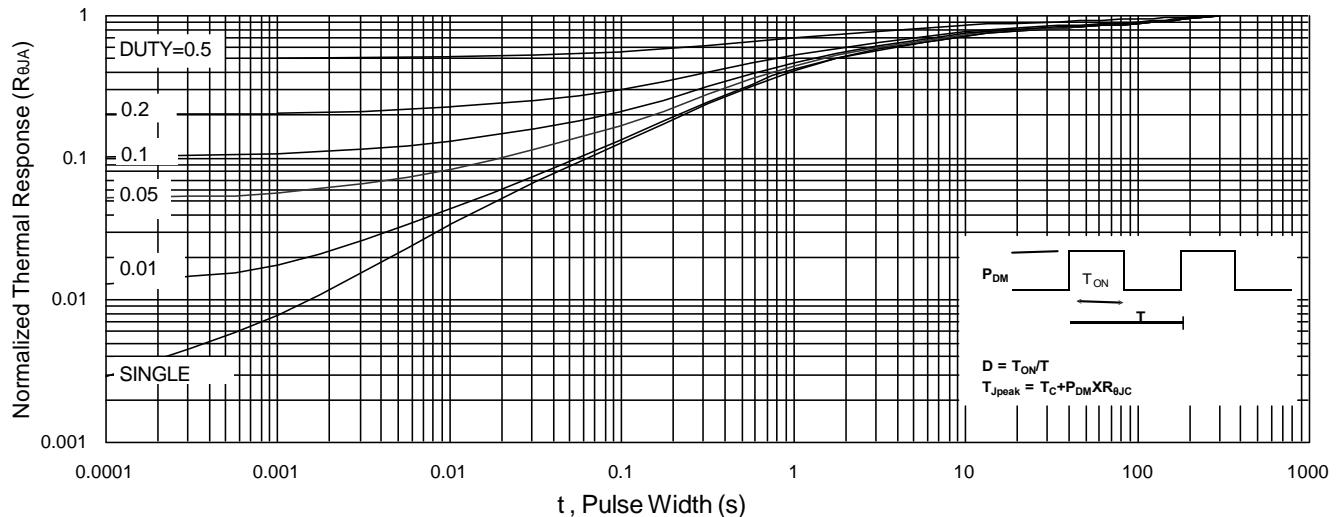


Fig.9 Normalized Maximum Transient Thermal Impedance

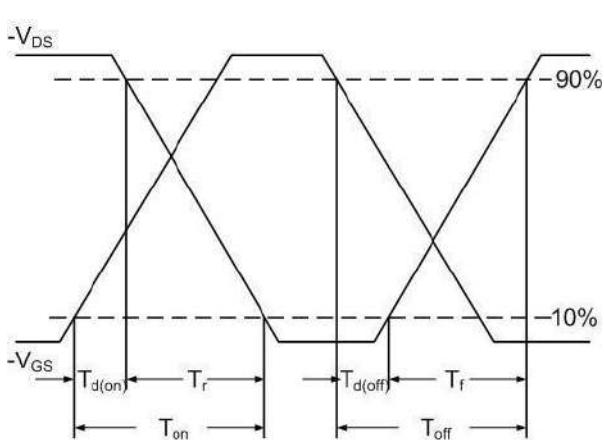


Fig.10 Switching Time Waveform

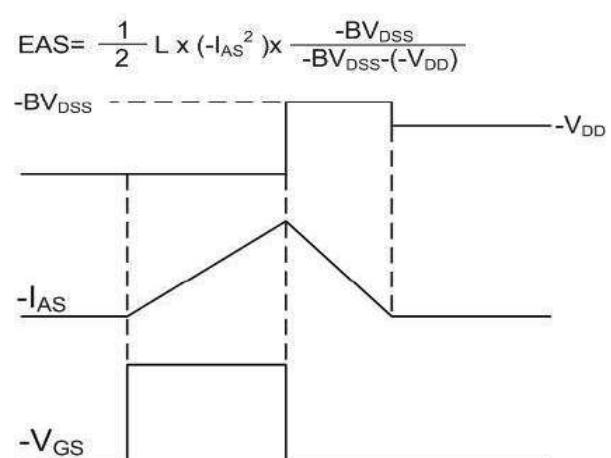


Fig.11 Unclamped Inductive Waveform