

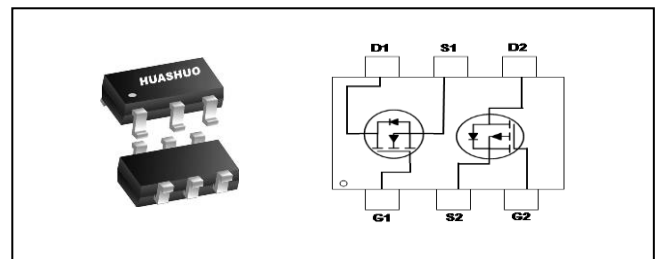
N-Ch and P-Ch Fast Switching MOSFETs
Description

The HSW2004 uses advanced trench technology to provide excellent RDS(ON) and low gate charge. The complementary MOSFETs may be used to form a level shifted high side switch, and for a host of other applications.

- PWM applications
- Load switch

Product Summary

BVDSS	RDSON	ID
20V	19mΩ	4A
-20V	35mΩ	-4A

SOT23-6L Pin Configuration

Absolute Maximum Ratings

Symbol	Parameter	Rating		Units
		N-Channel	P-Channel	
		Steady State	Steady State	
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	4	-4	A
I _D @T _A =70°C	Continuous Drain Current, V _{GS} @ -4.5V ¹	2.4	-2.4	A
I _{DM}	Pulsed Drain Current ²	12	-12	A
P _D @T _A =25°C	Total Power Dissipation ³	1.4	1.4	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	---	125	°C/W

N-Ch and P-Ch 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
$R_{DS(ON)}$	Static Drain-Source On-Resistance ²	$V_{GS}=4.5V, I_D=4A$	---	19	24	m Ω
		$V_{GS}=2.5V, I_D=3A$	---	26	34	
$V_{GS(th)}$	Gate Threshold Voltage	$V_{GS}=V_{DS}, I_D=250\mu A$	0.5	0.8	1.2	V
I_{DSS}	Drain-Source Leakage Current	$V_{DS}=16V, V_{GS}=0V, T_J=25^\circ C$	---	---	1	uA
		$V_{DS}=16V, V_{GS}=0V, T_J=55^\circ C$	---	---	5	
I_{GSS}	Gate-Source Leakage Current	$V_{GS}=\pm 12V, V_{DS}=0V$	---	---	± 100	nA
g_{fs}	Forward Transconductance	$V_{DS}=5V, I_D=4A$	---	10	---	S
Q_g	Total Gate Charge (4.5V)	$V_{DS}=10V, V_{GS}=4.5V, I_D=4A$	---	10	---	nC
Q_{gs}	Gate-Source Charge		---	2.4	---	
Q_{gd}	Gate-Drain Charge		---	2.9	---	
$T_{d(on)}$	Turn-On Delay Time	$V_{DD}=10V, V_{GS}=4.5V, R_G=6\Omega$ $I_D=3A$	---	13	---	ns
T_r	Rise Time		---	31	---	
$T_{d(off)}$	Turn-Off Delay Time		---	34	---	
T_f	Fall Time		---	12	---	
C_{iss}	Input Capacitance	$V_{DS}=10V, V_{GS}=0V, f=1MHz$	---	500	---	pF
C_{oss}	Output Capacitance		---	299	---	
C_{rss}	Reverse Transfer Capacitance		---	93	---	

Diode Characteristics

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
V_{SD}	Diode Forward Voltage ²	$V_{GS}=0V, I_S=1A, T_J=25^\circ C$	---	---	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 $\leq 300\mu s$, duty cycle $\leq 2\%$
- 3.The power dissipation is limited by 150 $^\circ\text{C}$ 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-Channel Typical Characteristics

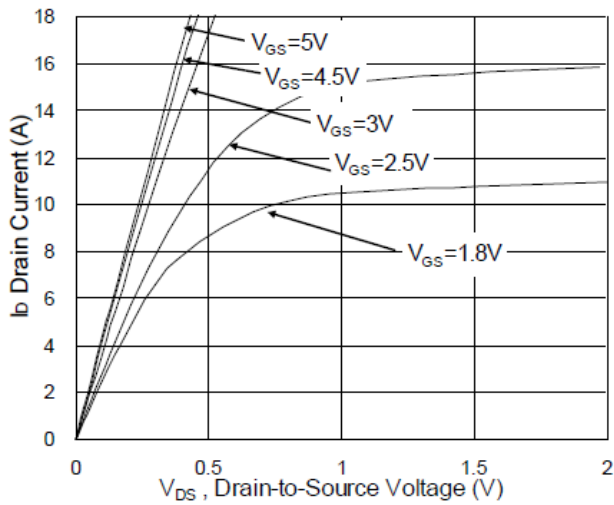


Fig.1 Typical Output Characteristics

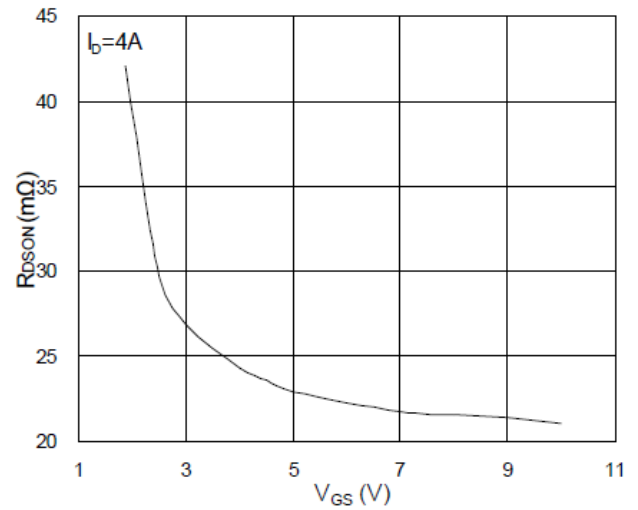


Fig.2 On-Resistance vs G-S Voltage

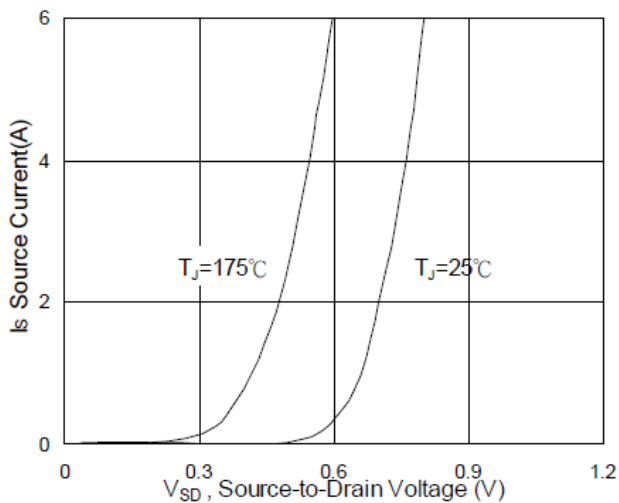


Fig.3 Source Drain Forward Characteristics

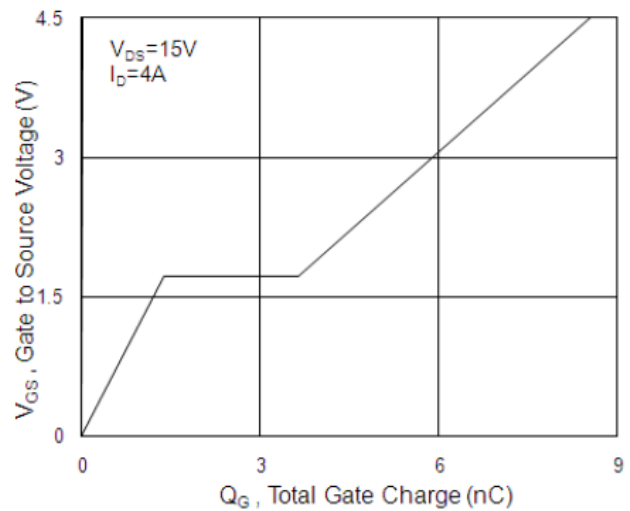


Fig.4 Gate-Charge Characteristics

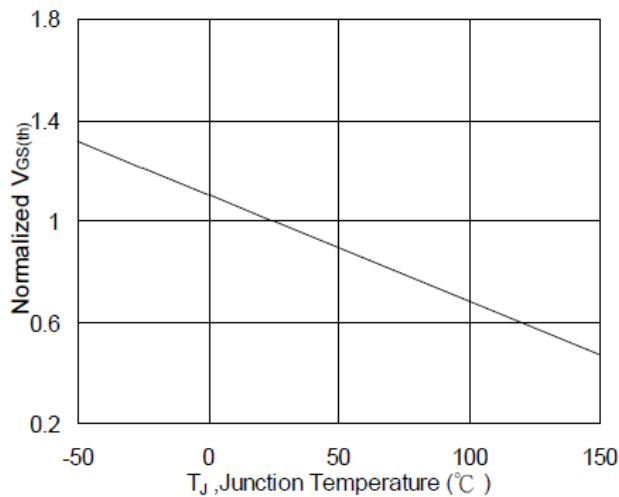


Fig.5 Normalized $V_{GS(th)}$ vs T_J

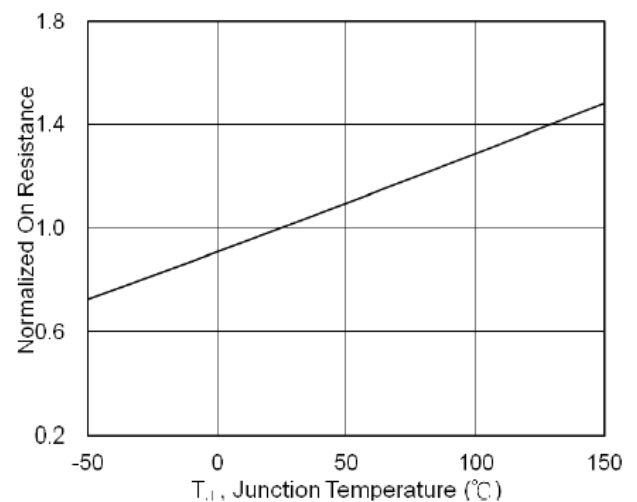


Fig.6 Normalized $R_{DS(on)}$ vs T_J

N-Ch and P-Ch Fast Switching MOSFETs

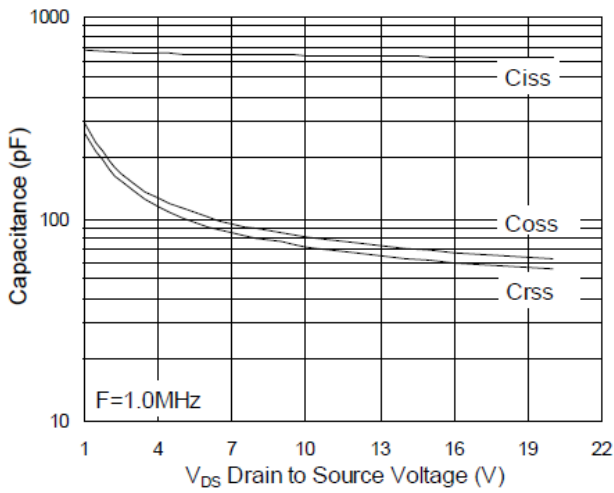


Fig.7 Capacitance

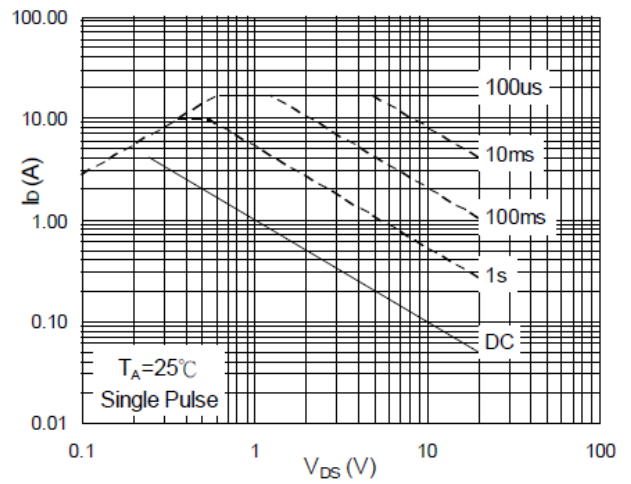


Fig.8 Safe Operating Area

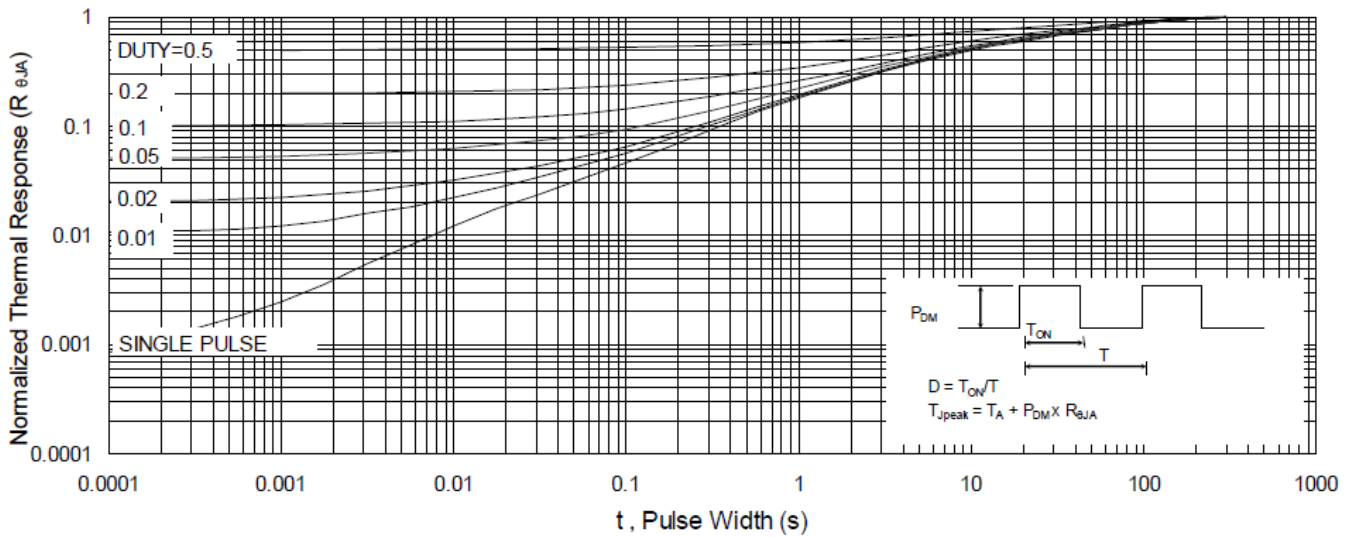


Fig.9 Normalized Maximum Transient Thermal Impedance

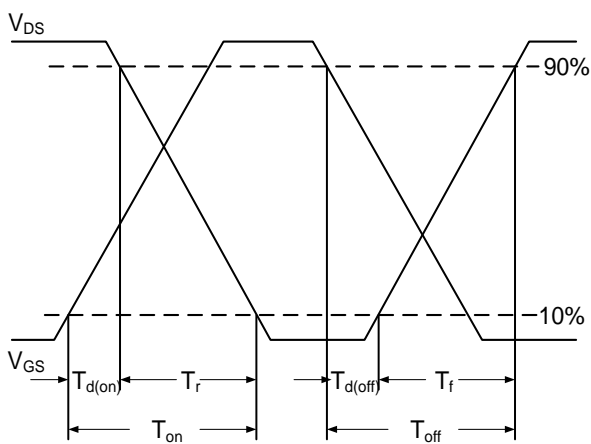


Fig.10 Switching Time Waveform

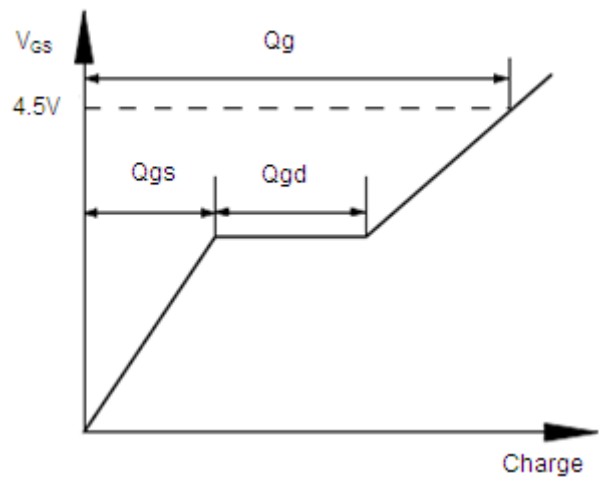


Fig.11 Gate Charge Waveform

N-Ch and P-Ch Fast Switching MOSFETs
P-Channel Electrical Characteristics (T_J=25 °C, unless otherwise noted)

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
BV _{DSS}	Drain-Source Breakdown Voltage	V _{GS} =0V, I _D =-250uA	-20	---	---	V
R _{DS(on)}	Static Drain-Source On-Resistance ²	V _{GS} =-4.5V, I _D =-4A	---	35	45	mΩ
		V _{GS} =-2.5V, I _D =-3A	---	50	65	
V _{GS(th)}	Gate Threshold Voltage	V _{GS} =V _{DS} , I _D =-250uA	-0.4	-0.7	-1.0	V
I _{DSS}	Drain-Source Leakage Current	V _{DS} =-16V, V _{GS} =0V, T _J =25°C	---	---	-1	uA
		V _{DS} =-16V, V _{GS} =0V, T _J =55°C	---	---	-5	
I _{GSS}	Gate-Source Leakage Current	V _{GS} =±12V, V _{DS} =0V	---	---	±100	nA
g _{fs}	Forward Transconductance	V _{DS} =-5V, I _D =-4A	---	5	---	S
Q _g	Total Gate Charge (-4.5V)	V _{DS} =-10V, V _{GS} =-4.5V, I _D =-4A	---	6.9	---	nC
Q _{gs}	Gate-Source Charge		---	1.2	---	
Q _{gd}	Gate-Drain Charge		---	1.5	---	
T _{d(on)}	Turn-On Delay Time	V _{DD} =-10V, V _{GS} =-4.5V, R _G =6Ω I _D =-4A	---	12	---	ns
T _r	Rise Time		---	34	---	
T _{d(off)}	Turn-Off Delay Time		---	33	---	
T _f	Fall Time		---	6	---	
C _{iss}	Input Capacitance	V _{DS} =-10V, V _{GS} =0V, f=1MHz	---	661	---	pF
C _{oss}	Output Capacitance		---	101	---	
C _{rss}	Reverse Transfer Capacitance		---	92	---	

Diode Characteristics

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
V _{SD}	Diode Forward Voltage ²	V _{GS} =0V, I _S =-1A, T _J =25°C	---	-0.81	-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 ≤ 300us , duty cycle ≤ 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 Fast Switching MOSFETs

P-Channel Typical Characteristics

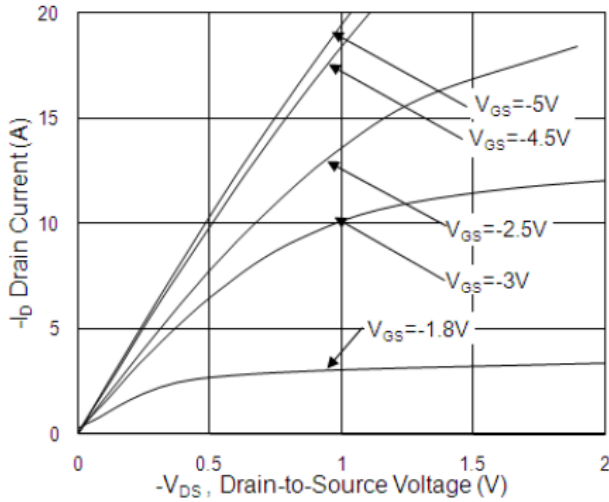


Fig.1 Typical Output Characteristics

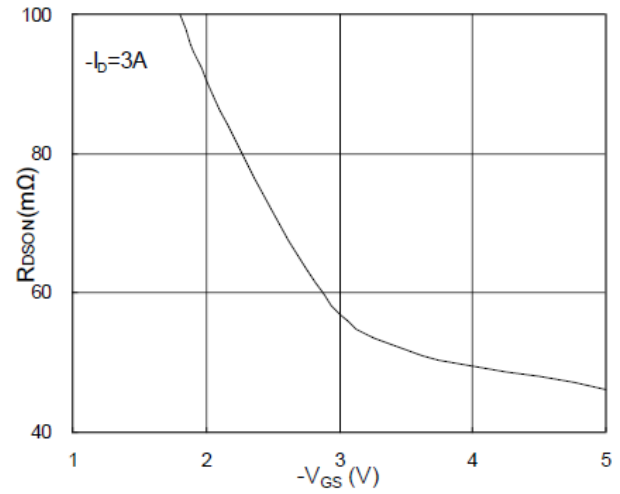


Fig.2 On-Resistance vs G-S Voltage

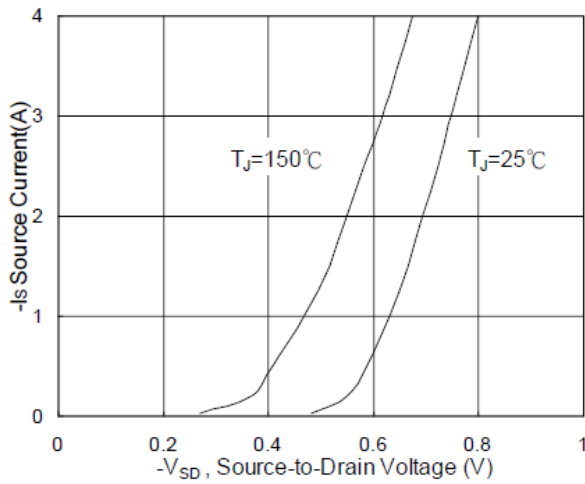


Fig.3 Source Drain Forward Characteristics

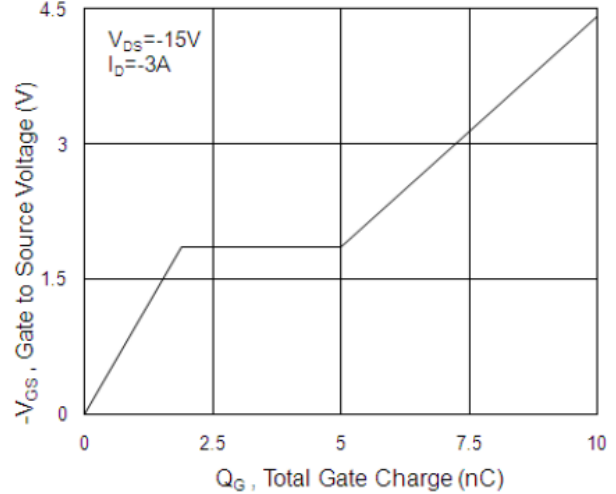


Fig.4 Gate-Charge Characteristics

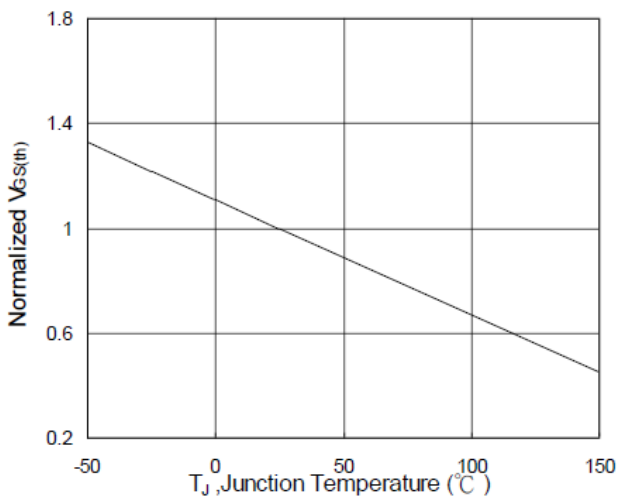


Fig.5 Normalized $V_{GS(th)}$ vs T_J

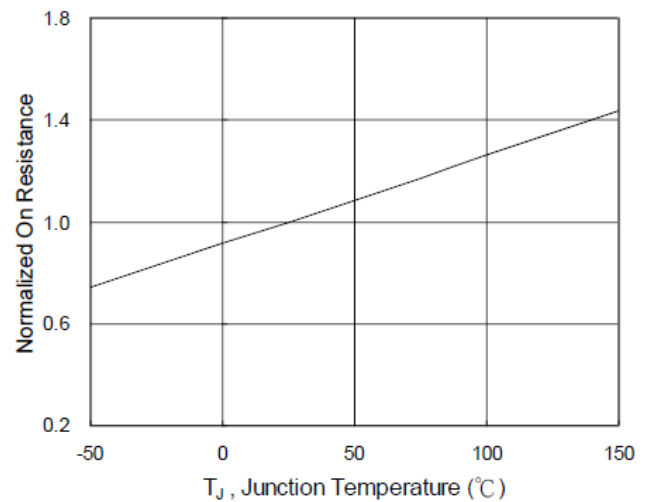


Fig.6 Normalized $R_{DS(on)}$ vs T_J

N-Ch and P-Ch Fast Switching MOSFETs

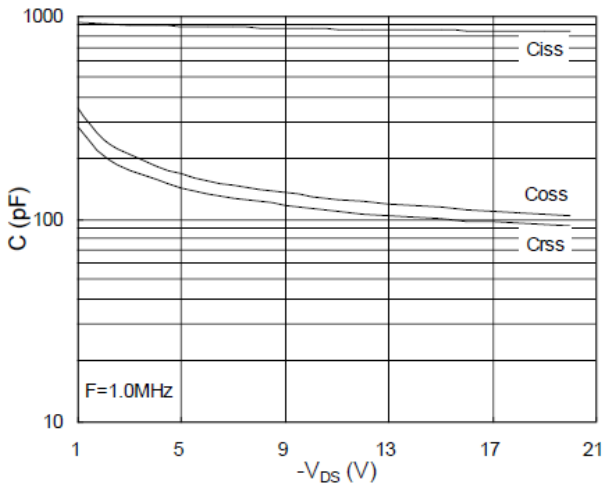


Fig.7 Capacitance

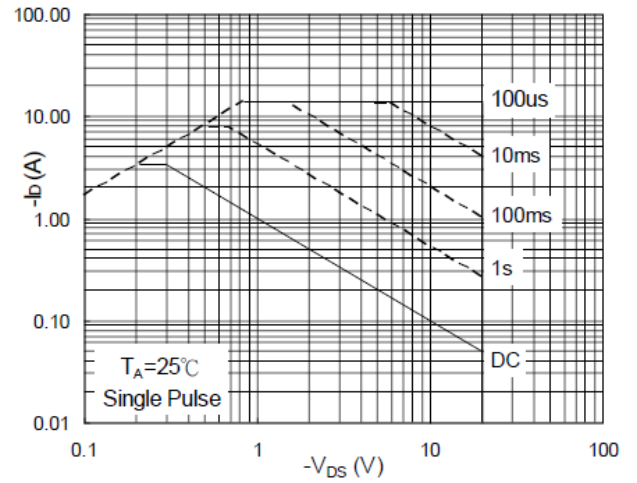


Fig.8 Safe Operating Area

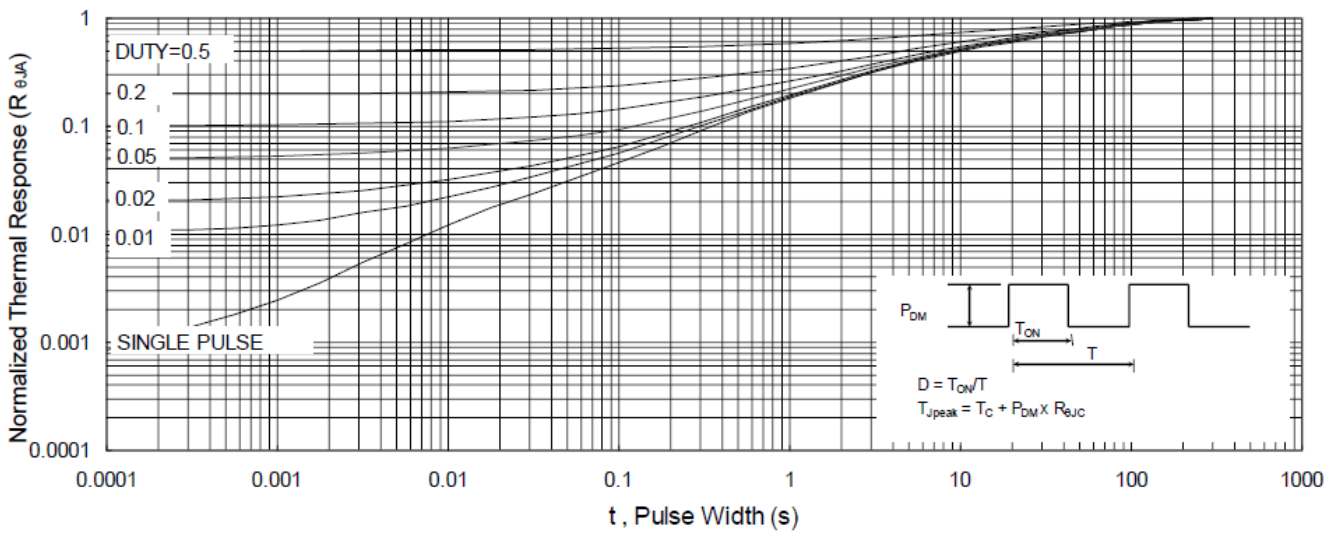


Fig.9 Normalized Maximum Transient Thermal Impedance

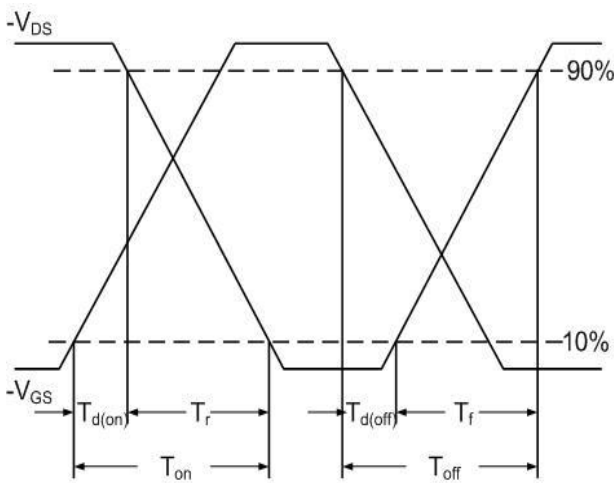


Fig.10 Switching Time Waveform

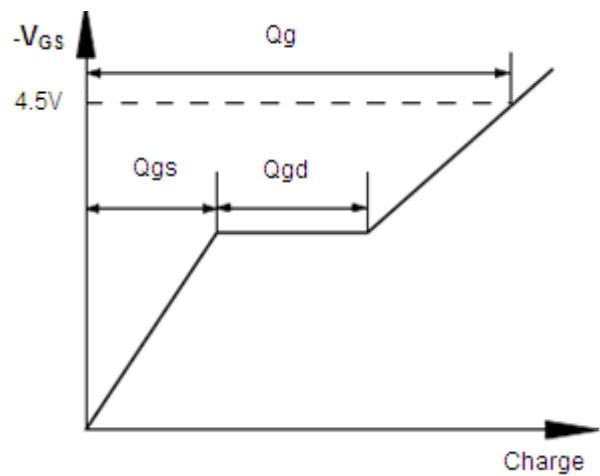
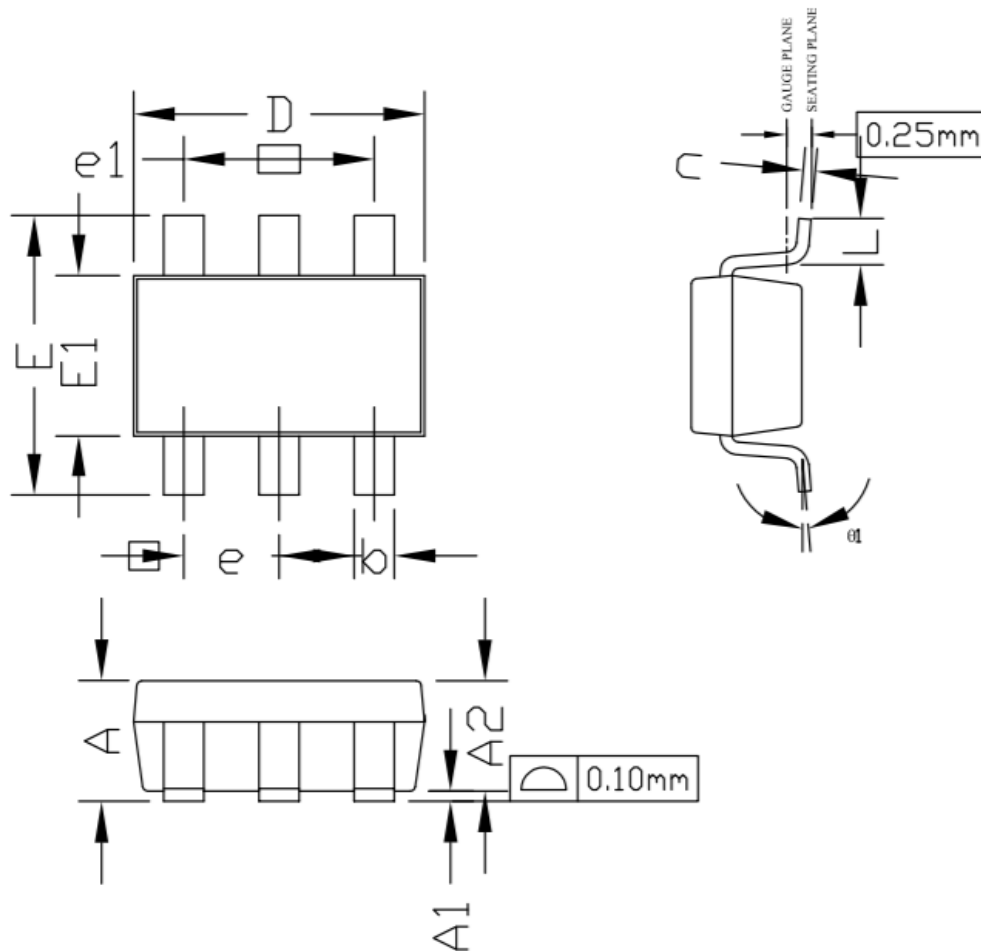
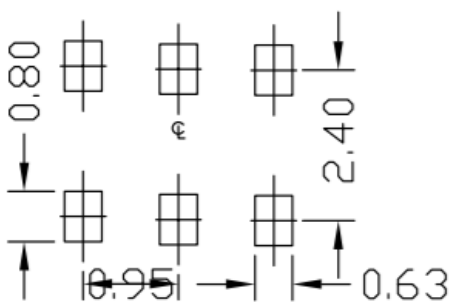


Fig.11 Gate Charge Waveform

SOT23-6 Package Outline Dimensions



RECOMMENDED LAND PATTERN



UNIT: mm

SYMBOLS	DIMENSIONS IN MILLIMETERS			DIMENSIONS IN INCHES		
	MIN	NOM	MAX	MIN	NOM	MAX
A	0.80	—	1.25	0.031	—	0.049
A1	0.00	—	0.15	0.000	—	0.006
A2	0.70	1.10	1.20	0.028	0.043	0.047
b	0.30	0.40	0.50	0.012	0.016	0.020
c	0.08	0.13	0.20	0.003	0.005	0.008
D	2.70	2.90	3.10	0.106	0.114	0.122
E	2.50	2.80	3.10	0.098	0.110	0.122
E1	1.50	1.60	1.70	0.059	0.063	0.067
e	0.95 BSC.			0.037BSC.		
e1	1.90 BSC.			0.075 BSC.		
L	0.30	—	0.60	0.012	—	0.024
θ1	0°	—	8°	0°	—	8°

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