

General 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.

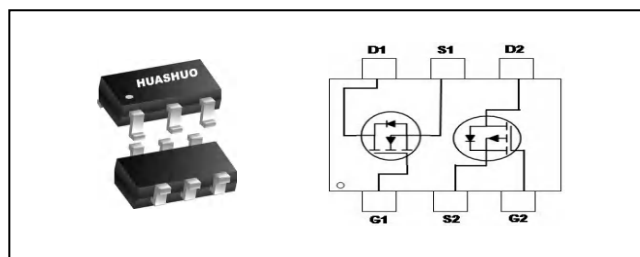
Features

- PWM applications
- Load switch

Product Summary

BVDSS	RDS(ON)	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 ($T_J=25^\circ\text{C}$, 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	$m\Omega$
		$V_{GS}=2.5V, I_D=3A$	---	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	$V_{DS}=16V, V_{GS}=0V, T_J=25^\circ\text{C}$	---	---	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	$V_{DS}=5V, I_D=4A$	---	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	$V_{DS}=10V, V_{GS}=0V, f=1\text{MHz}$	---	500	---	pF
C_{oss}	Output Capacitance		---	299	---	
C_{rss}	Reverse Transfer Capacitance		---	93	---	

Diode Characteristics

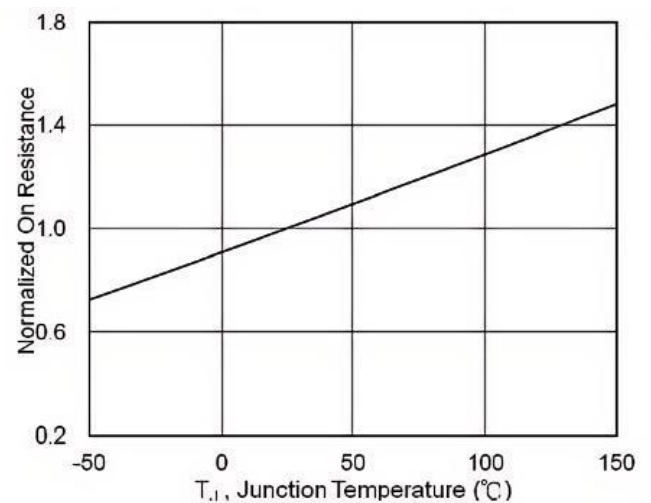
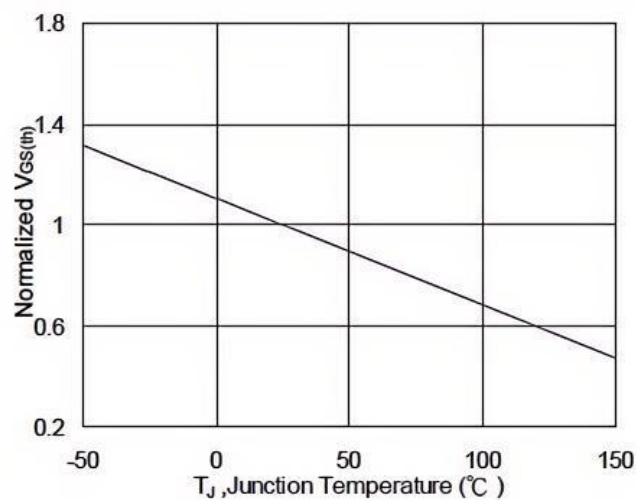
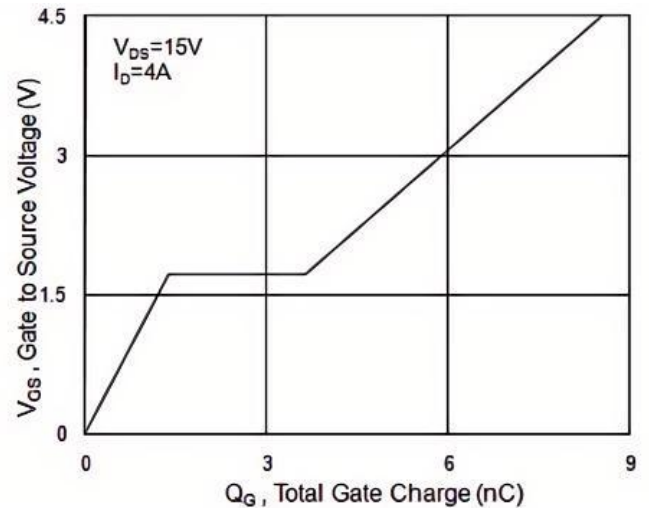
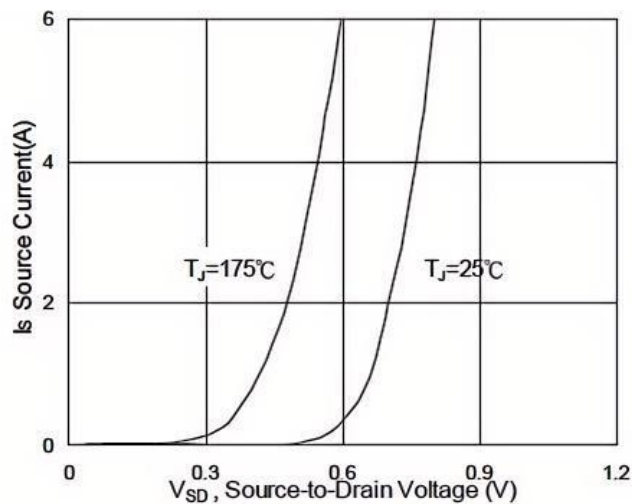
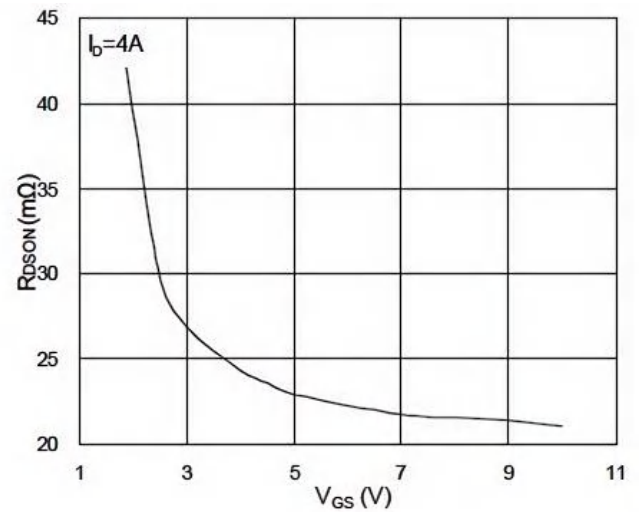
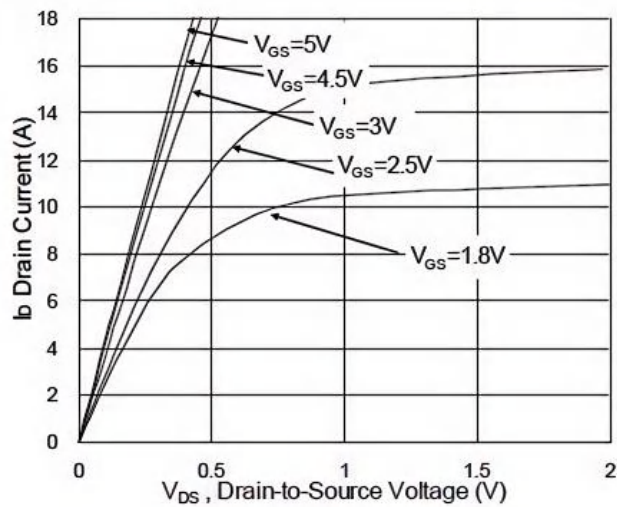
Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
V_{SD}	Diode Forward Voltage ²	$V_{GS}=0V, I_S=1A, T_J=25^\circ\text{C}$	---	---	1.2	V

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 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

N-Channel Typical Characteristics



N-Ch and P-Ch Fast Switching MOSFETs

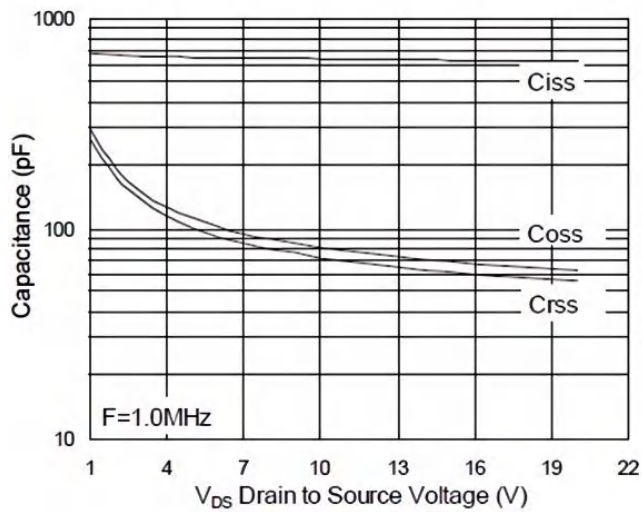


Fig.7 Capacitance

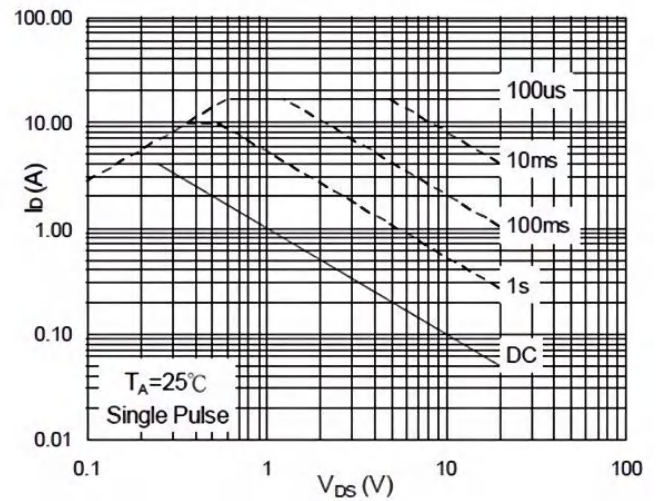


Fig.8 Safe Operating Area

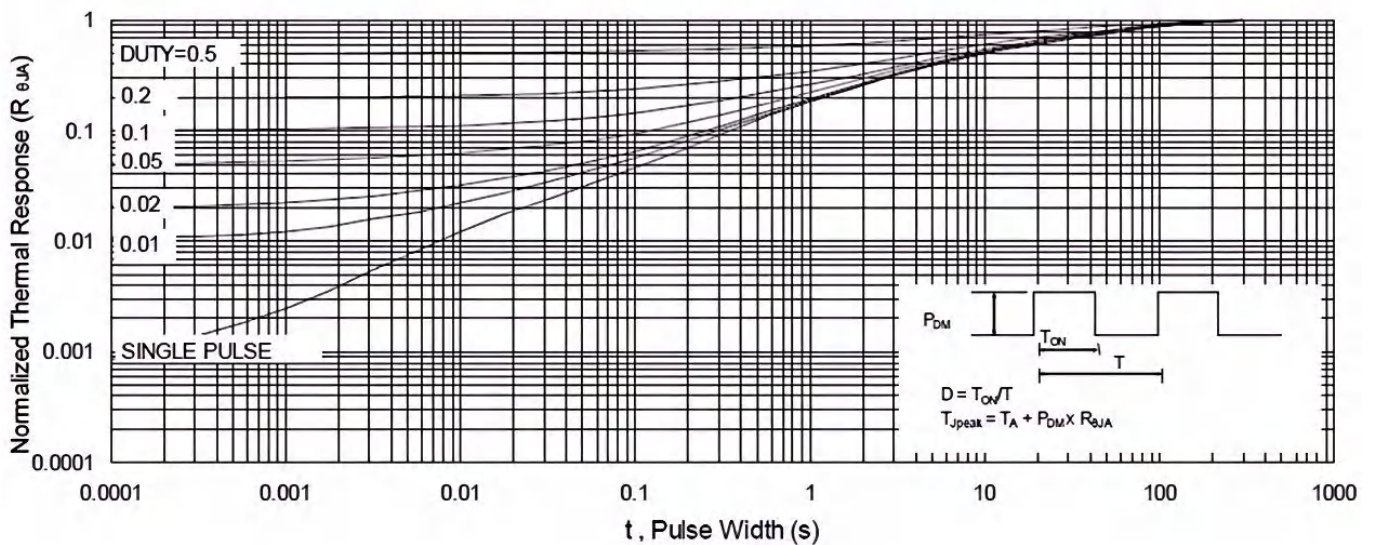


Fig.9 Normalized Maximum Transient Thermal Impedance

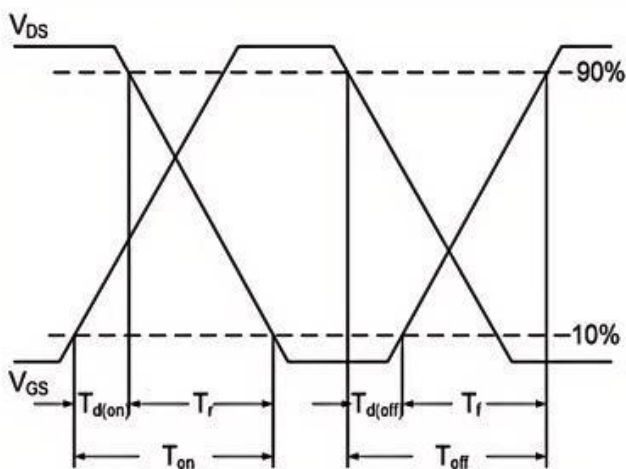


Fig.10 Switching Time Waveform

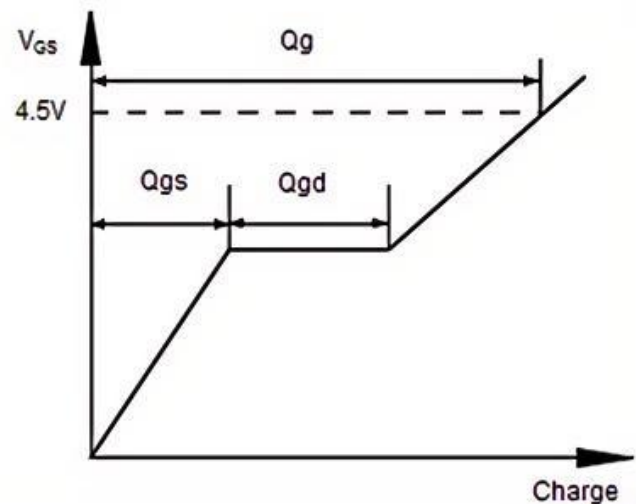


Fig.11 Gate Charge Waveform

N-Ch and P-Ch Fast Switching MOSFETs
P-Channel Electrical Characteristics ($T_J=25^\circ\text{C}$, 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	$V_{GS}=-4.5V$, $I_D=-4A$	---	35	45	$m\Omega$
		$V_{GS}=-2.5V$, $I_D=-3A$	---	50	65	
$V_{GS(th)}$	Gate Threshold Voltage	$V_{GS}=V_{DS}$, $I_D=-250\mu A$	-0.4	-0.7	-1.0	V
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	$V_{DS}=-5V$, $I_D=-4A$	---	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	$V_{DD}=-10V$, $V_{GS}=-4.5V$, $R_G=6\Omega$ $I_D=-4A$	---	12	---	ns
T_r	Rise Time		---	34	---	
$T_{d(off)}$	Turn-Off Delay Time		---	33	---	
T_f	Fall Time		---	6	---	
C_{iss}	Input Capacitance	$V_{DS}=-10V$, $V_{GS}=0V$, $f=1\text{MHz}$	---	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	$V_{GS}=0V$, $I_S=-1A$, $T_J=25^\circ\text{C}$	---	-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 $\leq 300\mu s$, 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 Typical Characteristics

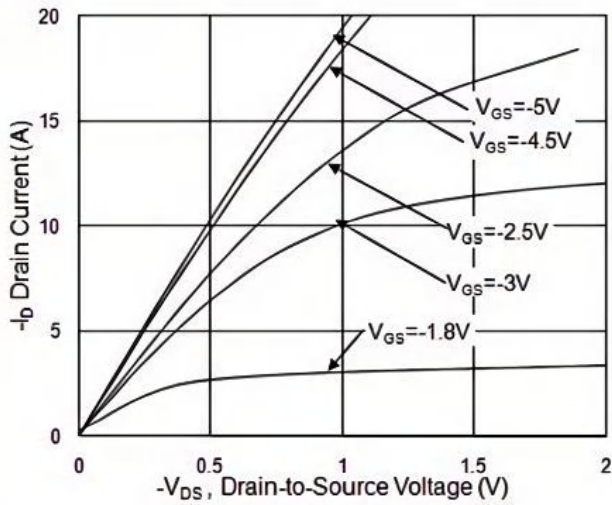


Fig.1 Typical Output Characteristics

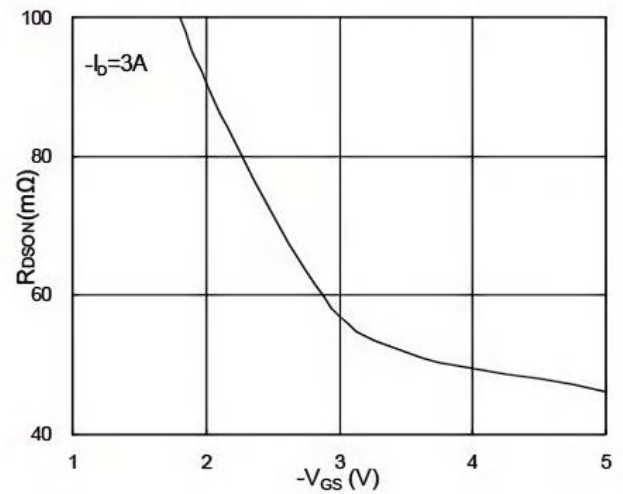


Fig.2 On-Resistance vs G-S Voltage

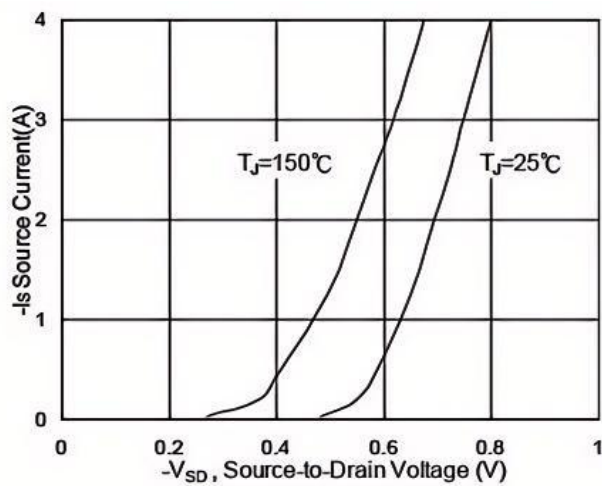


Fig.3 Source Drain Forward Characteristics

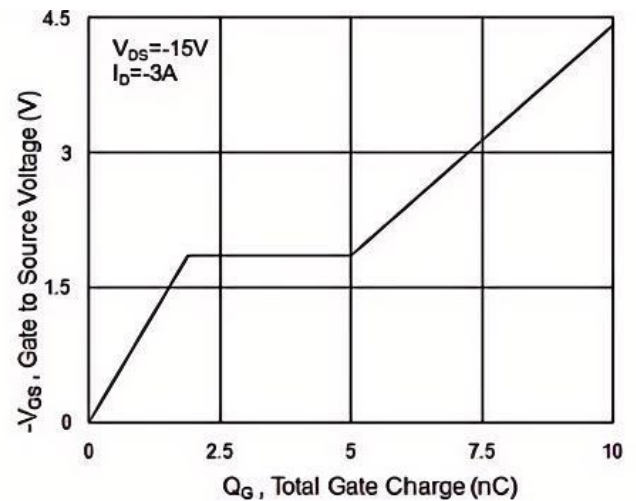


Fig.4 Gate-Charge Characteristics

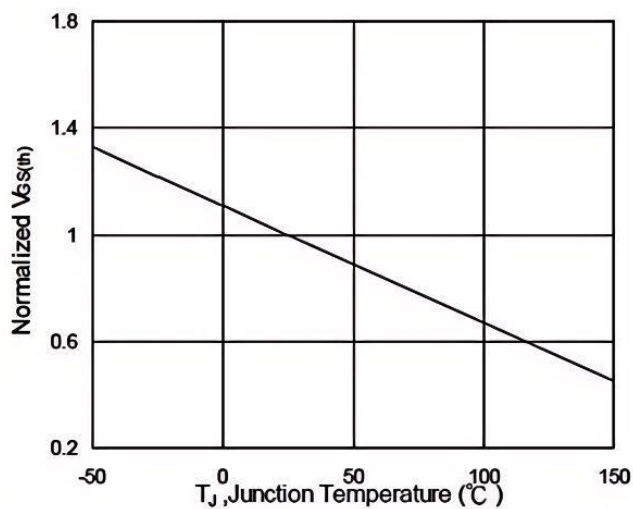


Fig.5 Normalized $V_{GS(th)}$ vs T_J

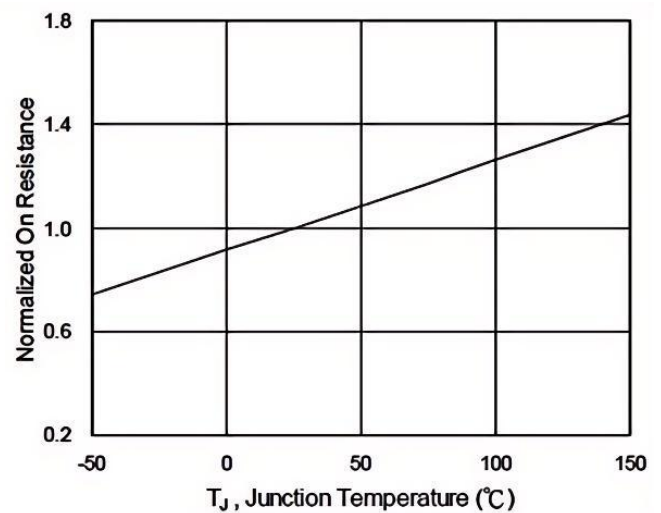


Fig.6 Normalized $R_{DS(on)}$ vs T_J

N-Ch and P-Ch Fast Switching MOSFETs

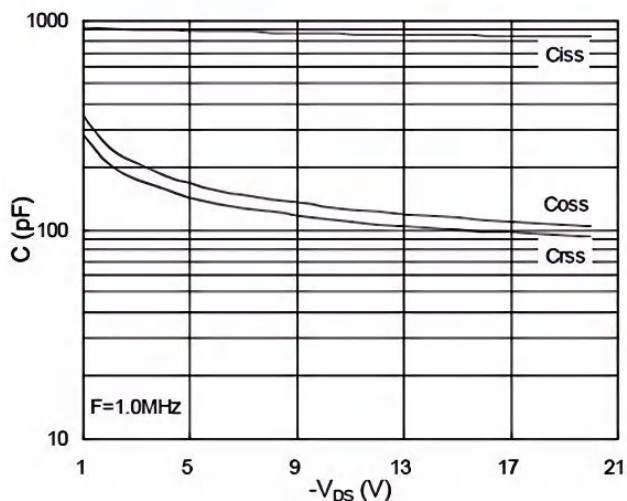


Fig.7 Capacitance

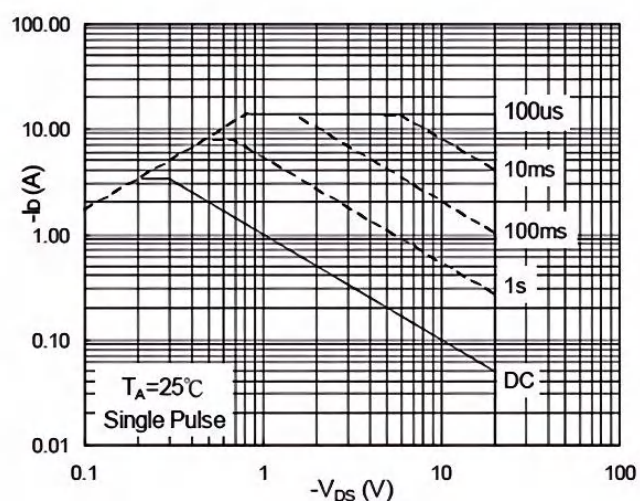


Fig.8 Safe Operating Area

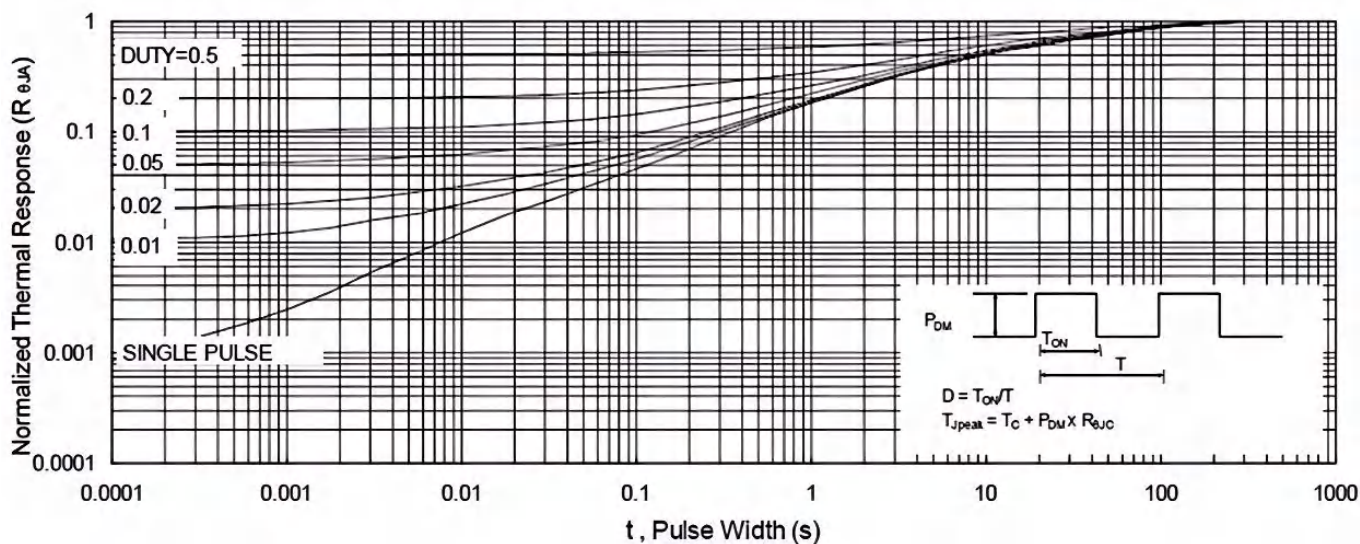


Fig.9 Normalized Maximum Transient Thermal Impedance

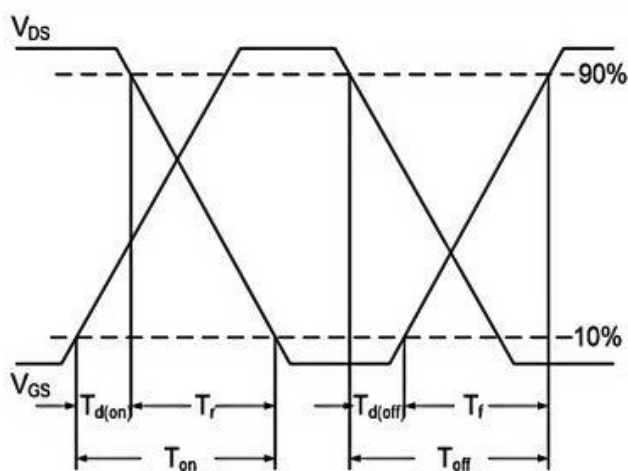


Fig.10 Switching Time Waveform

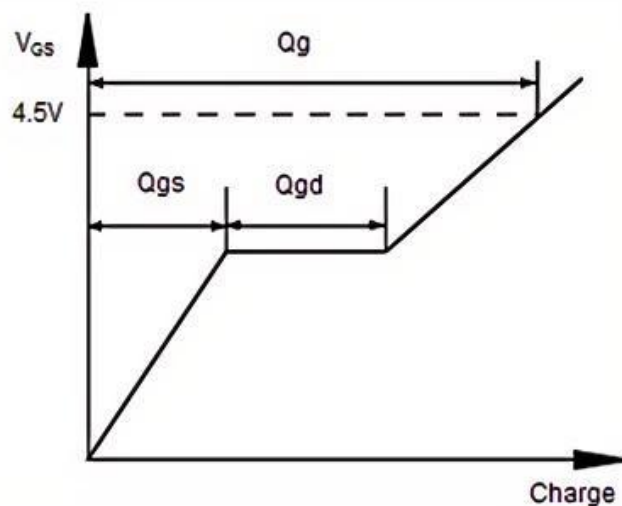
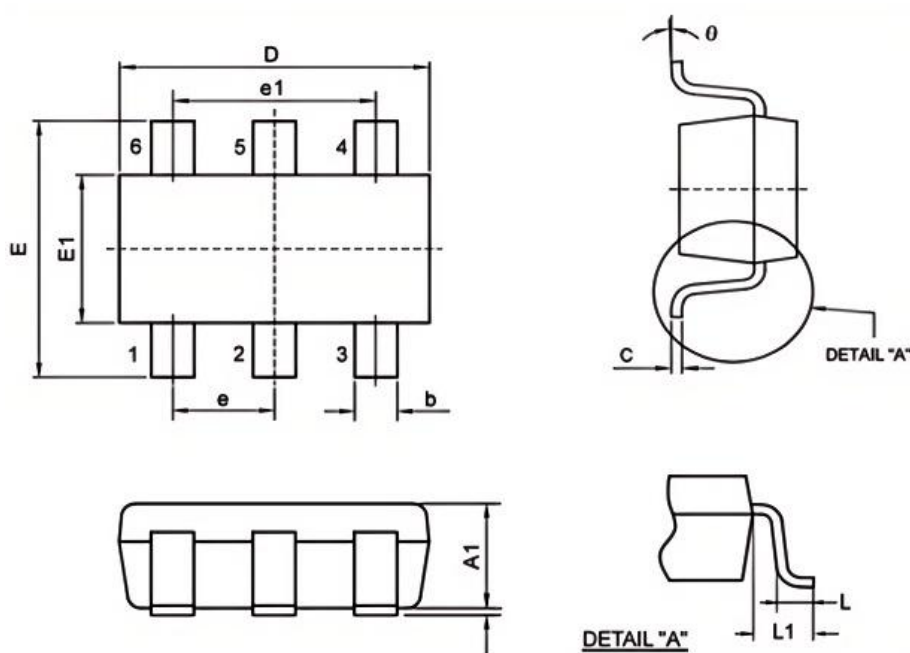


Fig.11 Gate Charge Waveform

Ordering Information

Part Number	Package code	Packaging
HSW2004	SOT23-6L	3000/Tape&Reel

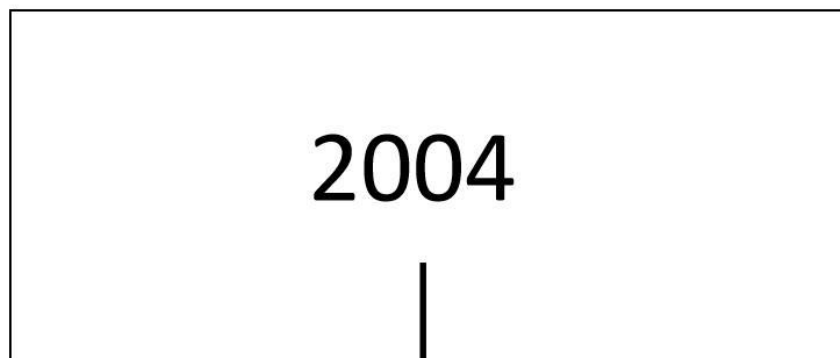
SOT23-6L Package Outline



SYMBOLS	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
D	2.692	3.099	0.106	0.122
E	2.591	3.000	0.102	0.118
E1	1.397	1.803	0.055	0.071
e	0.950 REF.		0.037 REF.	
e1	1.900 REF.		0.075 REF.	
b	0.300	0.500	0.012	0.020
C	0.080	0.200	0.003	0.008
A	0.000	0.100	0.000	0.004
A1	0.700	1.200	0.028	0.048
L	0.300	0.600	0.012	0.024
L1	0.600 REF.		0.023 REF.	
θ	0°	9°	0°	9°



HSW2004 TOP Marking



Part Number