

## 20V/50mR@4.5V N-Channel And -20V/95mR@-4.5V P-Channel MOSFETs

### Features

#### N-Channel

- VDS(max)=20V
- ID(max)=4.7A
- RDS(ON) =50mΩ(max)@VGS = 4.5V
- RDS(ON) =65mΩ(max)@VGS = 2.5V
- Improved dv/dt capability
- Green Device Available
- Fast switching

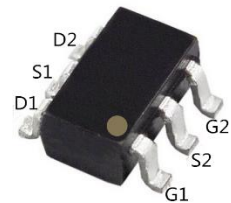
#### P-Channel

- VDS(max)= -20V
- ID(max)= -3.1A
- RDS(ON) =95mΩ(max)@VGS = -4.5V
- RDS(ON) =130mΩ(max)@VGS = -2.5V
- Improved dv/dt capability
- Green Device Available
- Fast switching

### Applications

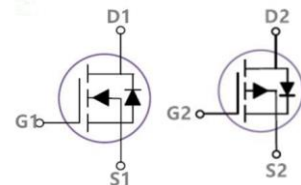
- Inverter
- Battery Protection
- Load Switch
- CCFL Driver

### SOT23-6 Pin Configuration



### Maximum Ratings (Tc = 25°C, Unless Otherwise Noted)

Parameters	Symbol	N	P	Unit
Drain-Source Voltage	V <sub>DS</sub>	20	-20	V
Gate-Source Voltage	V <sub>GS</sub>	±10	±20	V
Drain Current - Continuous	I <sub>D</sub>	4.7	-3.1	A
Drain Current - Pulsed	I <sub>DM</sub> <sup>1</sup>	18.8	-12.2	A
Power Dissipation(TC=25°C)	P <sub>D</sub>	1.6		W
Storage Temperature Range	T <sub>STG</sub>	-55~ 150		°C
Operating Junction Temperature Range	T <sub>j</sub>	-55~ 150		°C



Note:

1. Repetitive Rating: Pulsed width limited by maximum junction temperature.
2. The data tested by pulsed , pulse width  $\leq 300\mu s$  , duty cycle  $\leq 2\%$ .
3. Essentially independent of operating temperature.

### Thermal Characteristics

Parameter	Symbol	Max.	Typ.	Unit
Thermal Resistance Junction to ambient	R <sub>θJA</sub>	---	80	°C/W

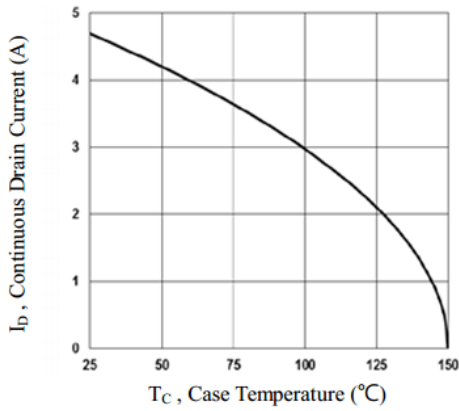
**N-Channel Electrical Characteristics**(T<sub>j</sub> = 25 °C, Unless Otherwise Noted)

<b>Off Characteristics</b>						
Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Drain to Source Breakdown Voltage	BV <sub>DSS</sub>	V <sub>GS</sub> =0V, I <sub>D</sub> =250μA	20	---	---	V
BV <sub>DSS</sub> Temperature Coefficient	ΔBV <sub>DSS</sub> /ΔT <sub>J</sub>	Reference to 25 °C , I <sub>D</sub> =1mA	---	0.02	---	V/°C
Drain-Source Leakage Current	I <sub>DSS</sub>	V <sub>DS</sub> =20V, V <sub>GS</sub> =0V, T <sub>J</sub> =25°C	---	---	1	μA
		V <sub>DS</sub> =16V, V <sub>GS</sub> =0V, T <sub>J</sub> =125°C	---	---	10	μA
Gate-Source Leakage Current	I <sub>GSS</sub>	V <sub>DS</sub> =0V, V <sub>GS</sub> =±10V	---	---	±100	nA
<b>On Characteristics</b>						
Static Drain-Source On-Resistance	R <sub>DS(ON)</sub>	V <sub>GS</sub> =4.5V, I <sub>D</sub> =3A	---	---	50	mΩ
		V <sub>GS</sub> =2.5V, I <sub>D</sub> =2A	---	---	65	
Gate Threshold Voltage	V <sub>GS(th)</sub>	V <sub>DS</sub> =V <sub>GS</sub> , I <sub>D</sub> =250μA	0.3	---	1	V
V <sub>GS(th)</sub> Temperature Coefficient	ΔV <sub>GS(th)</sub>		---	2	---	mV/°C
Forward Transconductance	g <sub>fs</sub>	V <sub>DS</sub> =10V, I <sub>S</sub> =2A	---	4.4	---	S
<b>Dynamic And Switching Characteristics</b>						
Total Gate Charge <sup>2,3</sup>	Q <sub>g</sub>	V <sub>DS</sub> =10V, V <sub>GS</sub> =4.5V, I <sub>D</sub> =4A	---	5.8	9	nC
Gate-Source Charge <sup>2,3</sup>	Q <sub>gs</sub>		---	0.6	1	
Gate-Drain Charge <sup>2,3</sup>	Q <sub>gd</sub>		---	1.5	3	
Turn-on Delay Time <sup>2,3</sup>	T <sub>d(on)</sub>	V <sub>DD</sub> =10V, I <sub>D</sub> =1A V <sub>GS</sub> =4.5V, R <sub>GEN</sub> =25Ω	---	2.9	6	nS
Turn-on Rise Time <sup>2,3</sup>	T <sub>r</sub>		---	8.4	16	
Turn-off Delay Time <sup>2,3</sup>	T <sub>d(off)</sub>		---	19.2	36	
Turn-off Fall Time <sup>2,3</sup>	T <sub>f</sub>		---	5.6	11	
Input Capacitance	C <sub>iss</sub>	V <sub>DS</sub> =15V, V <sub>GS</sub> =0V, F=1MHz	---	315	460	pF
Output Capacitance	C <sub>oss</sub>		---	50	75	
Reverse Transfer Capacitance	C <sub>rss</sub>		---	40	60	
<b>Drain-Source Diode Characteristics And Maximum Ratings</b>						
Parameter	Symbol	Test Condition	Min	Typ	Max	Unit
Continuous Source Current	I <sub>S</sub>	V <sub>G</sub> =V <sub>D</sub> =0V, Force Current	---	---	4.7	A
Pulsed Source Current <sup>3</sup>	I <sub>SM</sub>		---	---	18.8	A
Diode Forward Voltage <sup>3</sup>	V <sub>SD</sub>	V <sub>GS</sub> =0V, I <sub>S</sub> =1A, T <sub>J</sub> =25°C	---	---	1	V

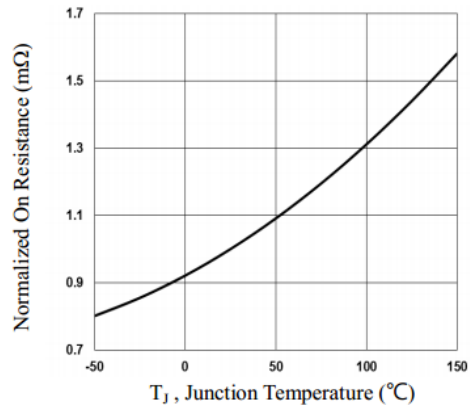
**P-Channel Electrical Characteristics** ( $T_j = 25^\circ\text{C}$ , Unless Otherwise Noted)

<b>Off Characteristics</b>						
Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Drain to Source Breakdown Voltage	$BV_{DSS}$	$V_{GS}=0V, I_D=-250\mu A$	-20	---	---	V
$BV_{DSS}$ Temperature Coefficient	$\Delta BV_{DSS}/\Delta T_j$	Reference to $25^\circ\text{C}$ , $I_D=-1mA$	---	-0.01	---	V/ $^\circ\text{C}$
Drain-Source Leakage Current	$I_{DSS}$	$V_{DS}=-20V, V_{GS}=0V,$ $T_j=25^\circ\text{C}$	---	---	-1	$\mu A$
		$V_{DS}=-16V, V_{GS}=0V,$ $T_j=125^\circ\text{C}$	---	---	-10	$\mu A$
Gate-Source Leakage Current	$I_{GSS}$	$V_{DS}=0V, V_{GS}=\pm 10V$	---	---	$\pm 100$	nA
<b>On Characteristics</b>						
Static Drain-Source On-Resistance	$R_{DS(ON)}$	$V_{GS}=-4.5V, I_D=-3A$	---	---	95	m $\Omega$
		$V_{GS}=-2.5V, I_D=-2A$	---	---	130	
Gate Threshold Voltage	$V_{GS(th)}$	$V_{DS}=V_{GS}, I_D=-250\mu A$	-0.3	---	-1	V
$V_{GS(th)}$ Temperature Coefficient	$\Delta V_{GS(th)}$		---	3	---	mV/ $^\circ\text{C}$
Forward Transconductance	$g_{fs}$	$V_{DS}=-10V, I_S=-1A$	---	2.2	---	S
<b>Dynamic And Switching Characteristics</b>						
Total Gate Charge <sup>2,3</sup>	$Q_g$	$V_{DS}=-10V,$ $V_{GS}=-4.5V,$ $I_D=-3A$	---	4.8	8	nC
Gate-Source Charge <sup>2,3</sup>	$Q_{gs}$		---	0.5	1	
Gate-Drain Charge <sup>2,3</sup>	$Q_{gd}$		---	1.9	4	
Turn-on Delay Time <sup>2,3</sup>	$T_{d(on)}$	$V_{DD}=-10V, I_D=-1A$ $V_{GS}=-4.5V,$ $R_{GEN}=25\Omega$	---	3.5	7	nS
Turn-on Rise Time <sup>2,3</sup>	$T_r$		---	12.6	24	
Turn-off Delay Time <sup>2,3</sup>	$T_{d(off)}$		---	32.6	62	
Turn-off Fall Time <sup>2,3</sup>	$T_f$		---	8.4	16	
Input Capacitance	$C_{iss}$	$V_{DS}=-10V, V_{GS}=0V,$ $F=1MHz$	---	350	510	pF
Output Capacitance	$C_{oss}$		---	65	95	
Reverse Transfer Capacitance	$C_{rss}$		---	50	75	
<b>Drain-Source Diode Characteristics And Maximum Ratings</b>						
Parameter	Symbol	Test Condition	Min	Typ	Max	Unit
Continuous Source Current	$I_S$	$V_G=V_D=0V,$ Force Current	---	---	-3.1	A
Pulsed Source Current <sup>3</sup>	$I_{SM}$		---	---	-12.2	A
Diode Forward Voltage <sup>3</sup>	$V_{SD}$	$V_{GS}=0V, I_S=-1A,$ $T_j=25^\circ\text{C}$	---	---	-1	V

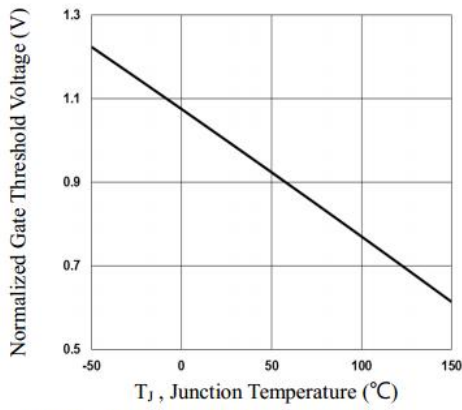
## N-channel Typical Performance Characteristics



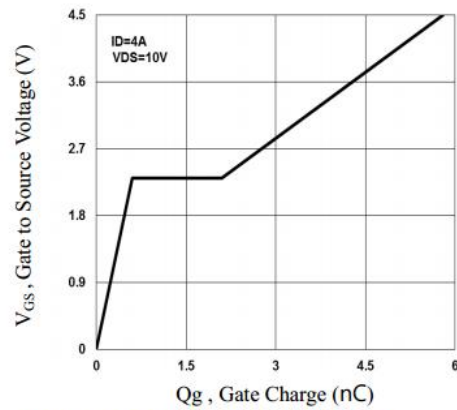
**Fig.1 Continuous Drain Current vs.  $T_C$**



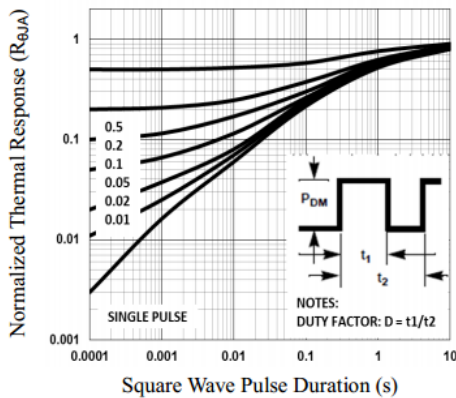
**Fig.2 Normalized  $R_{DS(on)}$  vs.  $T_J$**



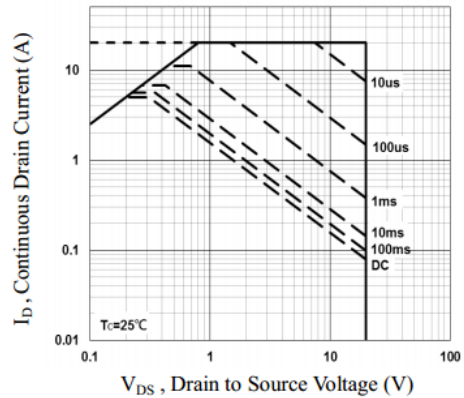
**Fig.3 Normalized  $V_{th}$  vs.  $T_J$**



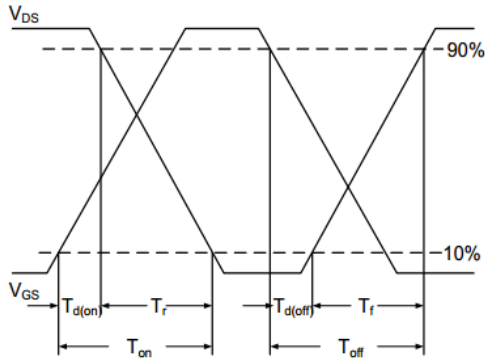
**Fig.4 Gate Charge Waveform**



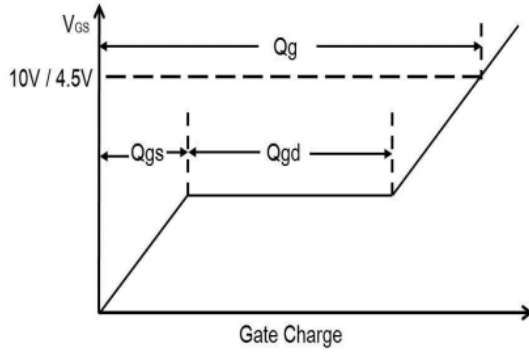
**Fig.5 Normalized Transient Impedance**



**Fig.6 Maximum Safe Operation Area**

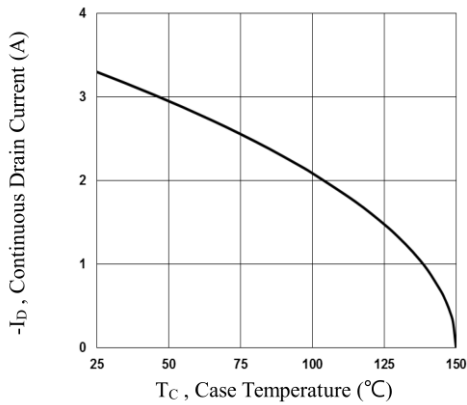


**Fig.7 Switching Time Waveform**

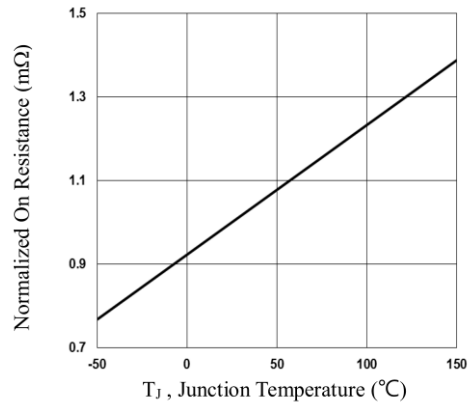


**Fig.8 Gate Charge Waveform**

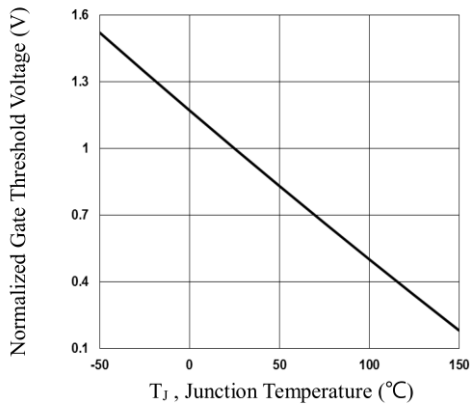
## P-channel Typical Performance Characteristics



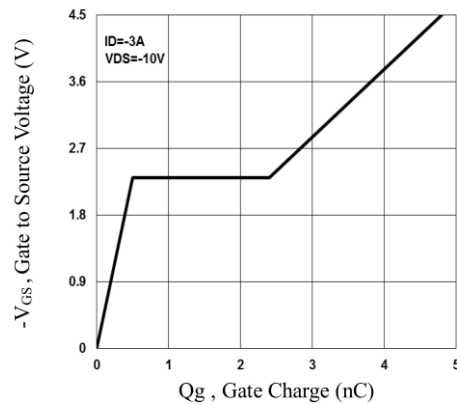
**Fig.1 Continuous Drain Current vs. Tc**



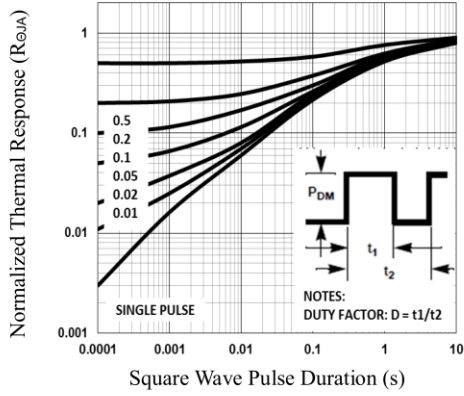
**Fig.2 Normalized RDS(on) vs. Tj**



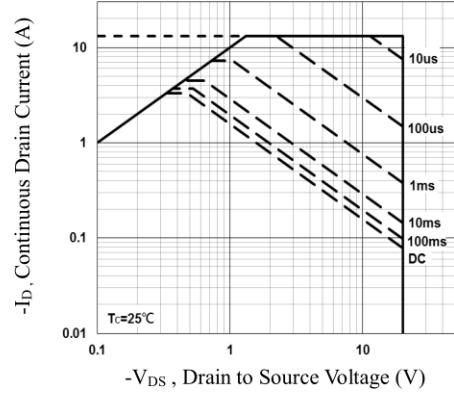
**Fig.3 Normalized V<sub>th</sub> vs. Tj**



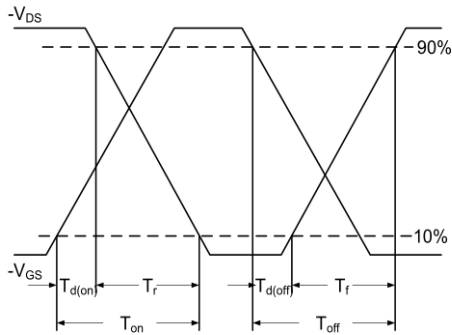
**Fig.4 Gate Charge Waveform**



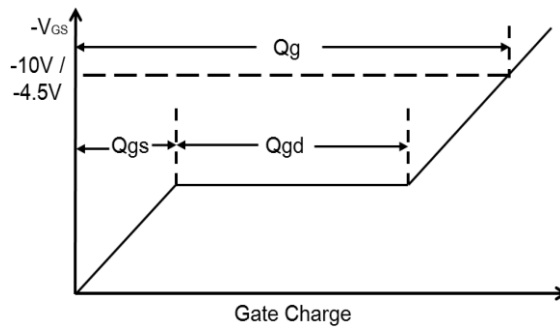
**Fig.5 Normalized Transient Impedance**



**Fig.6 Maximum Safe Operation Area**

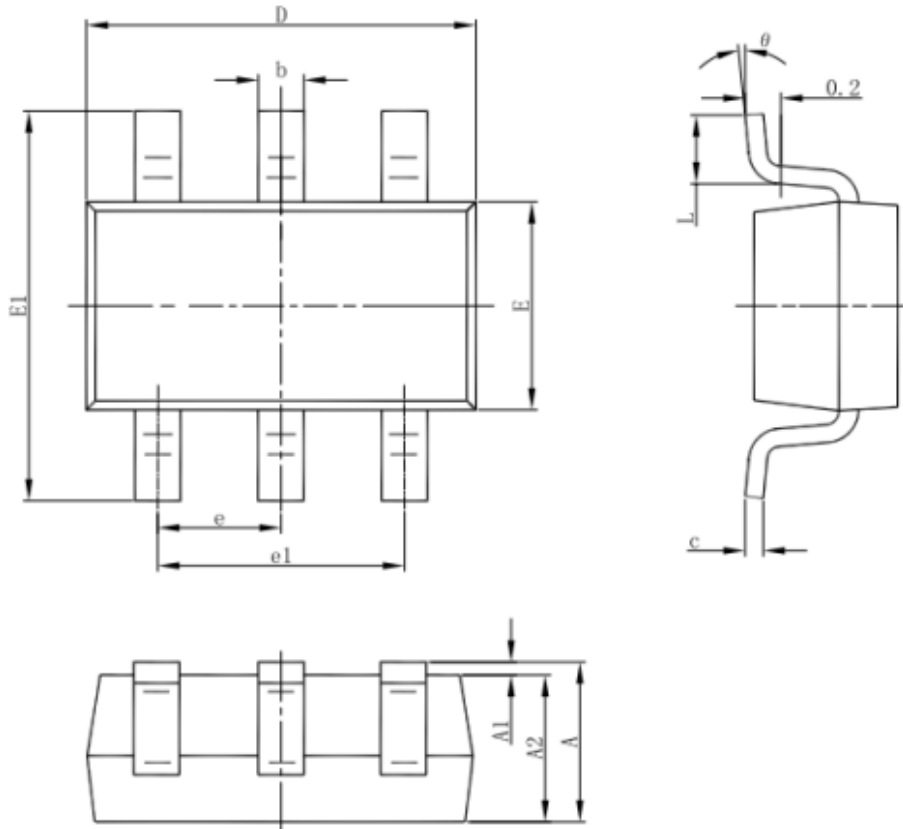


**Fig.7 Switching Time Waveform**



**Fig.8 Gate Charge Waveform**

**SOT23-6 PACKAGE INFORMATION**



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	1.050	1.250	0.041	0.049
A1	0.000	0.100	0.000	0.004
A2	1.050	1.150	0.041	0.045
b	0.300	0.500	0.012	0.020
c	0.100	0.200	0.004	0.008
D	2.820	3.020	0.111	0.119
E	1.500	1.700	0.059	0.067
E1	2.650	2.950	0.104	0.116
e	0.950(BSC)		0.037(BSC)	
e1	1.800	2.000	0.071	0.079
L	0.300	0.600	0.012	0.024
$\theta$	0°	8°	0°	8°