

## 30V N+P-Channel Enhancement Mode MOSFET

### Description

The AP6G03LI uses advanced trench technology to provide excellent  $R_{DS(ON)}$ , low gate charge and operation with gate voltages as low as 4.5V. This device is suitable for use as a Battery protection or in other Switching application.

### General Features

$V_{DS} = 30V$   $I_D = 6.8A$

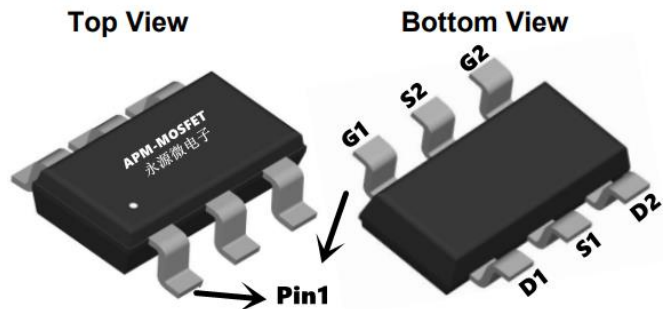
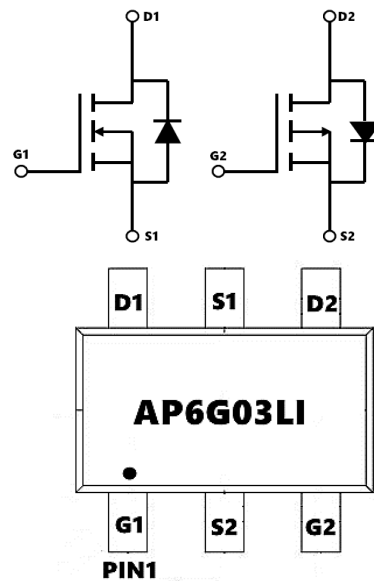
$R_{DS(ON)} < 25m\Omega$  @  $V_{GS}=10V$  (Type: 18m $\Omega$ )

$V_{DS} = -30V$   $I_D = -5.8A$

$R_{DS(ON)} < 52m\Omega$  @  $V_{GS}=-10V$  (Type: 42m $\Omega$ )

### Application

BLDC



### Package Marking and Ordering Information

Product ID	Pack	Marking	Qty(PCS)
AP6G03LI	SOT23-6L	AP6G03LI	3000

### Absolute Maximum Ratings ( $T_C=25^\circ\text{C}$ unless otherwise noted)

Symbol	Parameter	N-Ch	P-Ch	Units
$V_{DS}$	Drain-Source Voltage	30	-30	V
$V_{GS}$	Gate-Source Voltage	$\pm 20$	$\pm 20$	V
$I_D @ T_A=25^\circ\text{C}$	Continuous Drain Current, $V_{GS} @ 10V^1$	6.8	-5.8	A
$I_D @ T_A=70^\circ\text{C}$	Continuous Drain Current, $V_{GS} @ 10V^1$	3.8	-3	A
$I_{DM}$	Pulsed Drain Current <sup>2</sup>	52	-40	A
EAS	Single Pulse Avalanche Energy <sup>3</sup>	22	22	mJ
$P_D @ T_A=25^\circ\text{C}$	Total Power Dissipation <sup>4</sup>	1.5	1.5	W
$T_{STG}$	Storage Temperature Range	-55 to 150		$^\circ\text{C}$
$T_J$	Operating Junction Temperature Range	-55 to 150		$^\circ\text{C}$
$R_{\theta JA}$	Thermal Resistance Junction-Ambient <sup>1</sup>	105		$^\circ\text{C/W}$
$R_{\theta JC}$	Thermal Resistance Junction-Case <sup>1</sup>	36		$^\circ\text{C/W}$

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### N-Channel Electrical Characteristics (T<sub>J</sub>=25°C, unless otherwise noted)

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
BV <sub>DSS</sub>	Drain-Source Breakdown Voltage	V <sub>GS</sub> =0V, I <sub>D</sub> =250uA	30	34	---	V
ΔBV <sub>DSS</sub> /ΔT <sub>J</sub>	BVDSS Temperature Coefficient	Reference to 25°C, I <sub>D</sub> =1mA	---	0.023	---	V/°C
R <sub>DS(ON)</sub>	Static Drain-Source On-Resistance <sup>2</sup>	V <sub>GS</sub> =10V, I <sub>D</sub> =5A	---	18	25	mΩ
		V <sub>GS</sub> =4.5V, I <sub>D</sub> =3A	---	28	40	
V <sub>GS(th)</sub>	Gate Threshold Voltage	V <sub>GS</sub> =V <sub>DS</sub> , I <sub>D</sub> =250uA	1.0	1.6	2.5	V
ΔV <sub>GS(th)</sub>	V <sub>GS(th)</sub> Temperature Coefficient		---	-4.2	---	mV/°C
I <sub>DSS</sub>	Drain-Source Leakage Current	V <sub>DS</sub> =24V, V <sub>GS</sub> =0V, T <sub>J</sub> =25°C	---	---	1	uA
		V <sub>DS</sub> =24V, V <sub>GS</sub> =0V, T <sub>J</sub> =55°C	---	---	5	
I <sub>GSS</sub>	Gate-Source Leakage Current	V <sub>GS</sub> =±20V, V <sub>DS</sub> =0V	---	---	±100	nA
g <sub>fs</sub>	Forward Transconductance	V <sub>DS</sub> =5V, I <sub>D</sub> =6A	---	5.8	---	S
R <sub>g</sub>	Gate Resistance	V <sub>DS</sub> =0V, V <sub>GS</sub> =0V, f=1MHz	---	2.3	---	Ω
Q <sub>g</sub>	Total Gate Charge (4.5V)	V <sub>DS</sub> =20V, V <sub>GS</sub> =4.5V, I <sub>D</sub> =6A	---	5	---	nC
Q <sub>gs</sub>	Gate-Source Charge		---	1.11	---	
Q <sub>gd</sub>	Gate-Drain Charge		---	2.61	---	
T <sub>d(on)</sub>	Turn-On Delay Time	V <sub>DD</sub> =12V, V <sub>GS</sub> =10V, R <sub>G</sub> =3.3Ω I <sub>D</sub> =6A	---	7.7	---	ns
T <sub>r</sub>	Rise Time		---	46	---	
T <sub>d(off)</sub>	Turn-Off Delay Time		---	11	---	
T <sub>f</sub>	Fall Time		---	3.6	---	
C <sub>iss</sub>	Input Capacitance	V <sub>DS</sub> =15V, V <sub>GS</sub> =0V, f=1MHz	---	416	---	pF
C <sub>oss</sub>	Output Capacitance		---	62	---	
C <sub>rss</sub>	Reverse Transfer Capacitance		---	51	---	
I <sub>S</sub>	Continuous Source Current <sup>1,6</sup>	V <sub>G</sub> =V <sub>D</sub> =0V, Force Current	---	---	6.2	A
I <sub>SM</sub>	Pulsed Source Current <sup>2,6</sup>		---	---	24	A
V <sub>SD</sub>	Diode Forward Voltage <sup>2</sup>	V <sub>GS</sub> =0V, I <sub>S</sub> =1A, T <sub>J</sub> =25°C	---	---	1.2	V

#### Note :

- 1、The data tested by surface mounted on a 1 inch<sup>2</sup> 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<sub>D</sub> and I<sub>DM</sub>, in real applications, should be limited by total power dissipation.

## 30V N+P-Channel Enhancement Mode MOSFET

### P-Channel Electrical Characteristics ( $T_J=25^\circ\text{C}$ , unless otherwise noted)

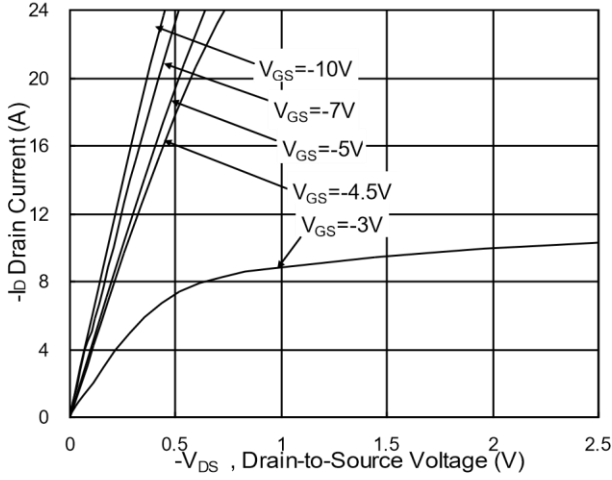
Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
BVDSS	Drain-Source Breakdown Voltage	$V_{GS}=0V, I_D=-250\mu A$	-30	-35	---	V
$\Delta BVDSS/\Delta T_J$	BVDSS Temperature Coefficient	Reference to $25^\circ\text{C}$ , $I_D=-1\text{mA}$	---	-0.02	---	V/ $^\circ\text{C}$
RDS(ON)	Static Drain-Source On-Resistance <sup>2</sup>	$V_{GS}=-10V, I_D=-4.1A$	---	42	52	m $\Omega$
		$V_{GS}=-4.5V, I_D=-3.5A$	---	58	70	
VGS(th)	Gate Threshold Voltage	$V_{GS}=V_{DS}, I_D=-250\mu A$	-1.0	-1.7	-2.5	V
$\Delta V_{GS(th)}$	$V_{GS(th)}$ Temperature Coefficient		---	4.32	---	mV/ $^\circ\text{C}$
IDSS	Drain-Source Leakage Current	$V_{DS}=-24V, V_{GS}=0V, T_J=25^\circ\text{C}$	---	---	-1	uA
		$V_{DS}=-24V, V_{GS}=0V, T_J=55^\circ\text{C}$	---	---	-5	
IGSS	Gate-Source Leakage Current	$V_{GS}=\pm 20V, V_{DS}=0V$	---	---	$\pm 100$	nA
gfs	Forward Transconductance	$V_{DS}=-5V, I_D=-3A$	---	4.7	---	S
R <sub>g</sub>	Gate Resistance	$V_{DS}=0V, V_{GS}=0V, f=1\text{MHz}$	---	24	---	$\Omega$
Q <sub>g</sub>	Total Gate Charge (-4.5V)	$V_{DS}=-20V, V_{GS}=-4.5V, I_D=-5A$	---	5.22	---	nC
Q <sub>gs</sub>	Gate-Source Charge		---	1.25	---	
Q <sub>gd</sub>	Gate-Drain Charge		---	2.3	---	
Td(on)	Turn-On Delay Time	$V_{DD}=-15V, V_{GS}=-10V, R_G=3.3\Omega, I_D=-1A$	---	18.4	---	ns
T <sub>r</sub>	Rise Time		---	11.4	---	
Td(off)	Turn-Off Delay Time		---	39.4	---	
T <sub>f</sub>	Fall Time		---	5.2	---	
C <sub>iss</sub>	Input Capacitance	$V_{DS}=-15V, V_{GS}=0V, f=1\text{MHz}$	---	463	---	pF
C <sub>oss</sub>	Output Capacitance		---	82	---	
C <sub>rss</sub>	Reverse Transfer Capacitance		---	68	---	
I <sub>s</sub>	Continuous Source Current <sup>1,6</sup>	$V_G=V_D=0V, \text{Force Current}$	---	---	-4	A
ISM	Pulsed Source Current <sup>2,6</sup>		---	---	-24	A
VSD	Diode Forward Voltage <sup>2</sup>	$V_{GS}=0V, I_S=-1A, T_J=25^\circ\text{C}$	---	---	-1	V

#### Note :

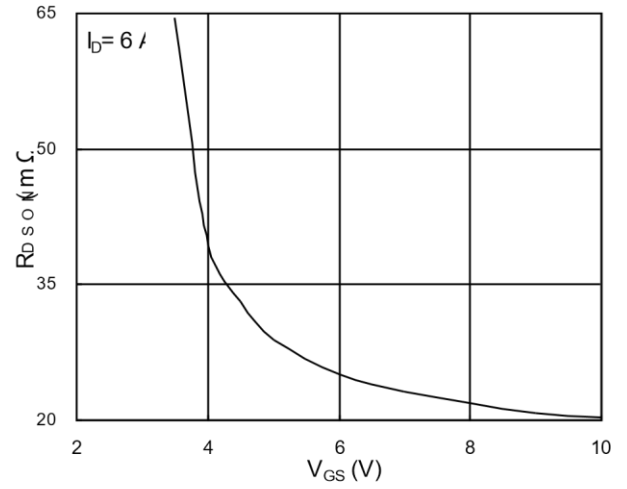
- 1、 The data tested by surface mounted on a 1 inch FR-4 board with 2OZ copper.
- 2、 The data tested by pulsed , pulse width  $\leq 300\mu s$  , duty cycle  $\leq 2\%$
- 3、 The power dissipation is limited by  $150^\circ\text{C}$  junction temperature
- 4、 The data is theoretically the same as  $I_D$  and  $I_{DM}$  , in real applications , should be limited by total power dissipation.

**30V N+P-Channel Enhancement Mode MOSFET**

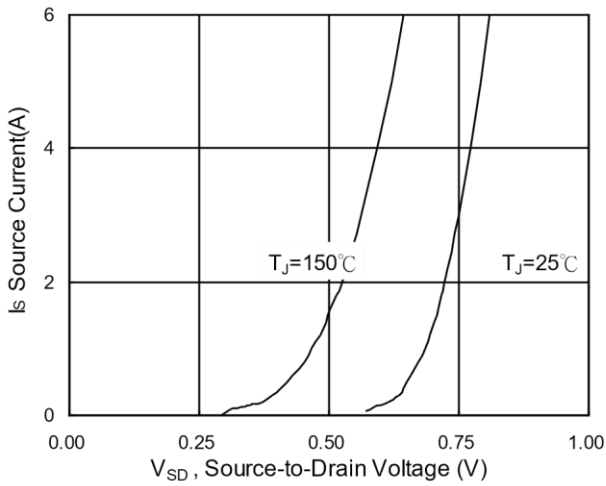
**N-Channel Typical Characteristics**



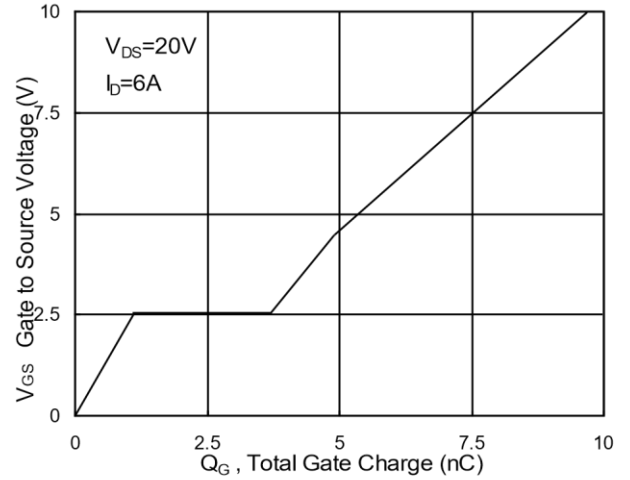
**Fig.1 Typical Output Characteristics**



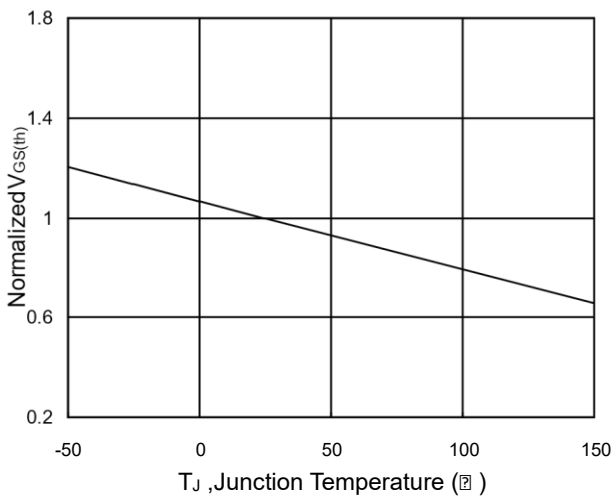
**Fig.2 On-Resistance vs. Gate-Source**



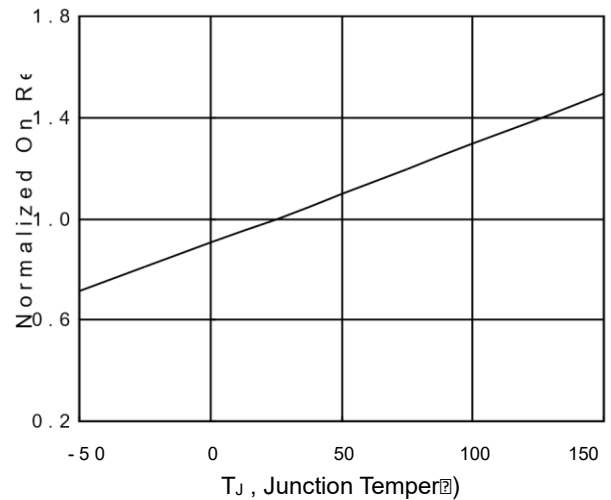
**Fig.3 Forward Characteristics Of Reverse**



**Fig.4 Gate-Charge Characteristics**

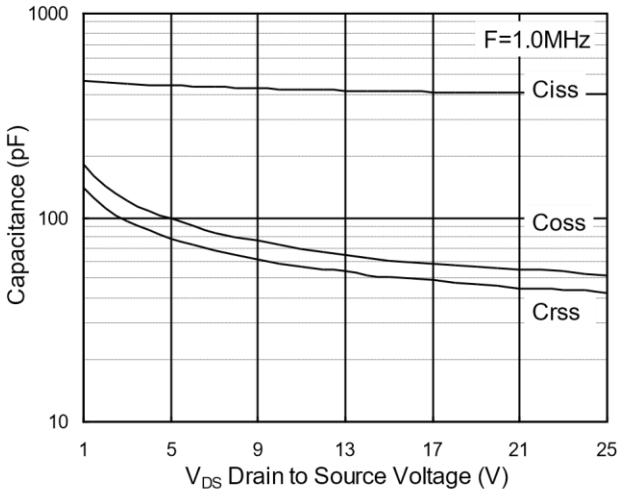


**Fig.5 Normalized  $V_{GS(th)}$  vs.  $T_J$**

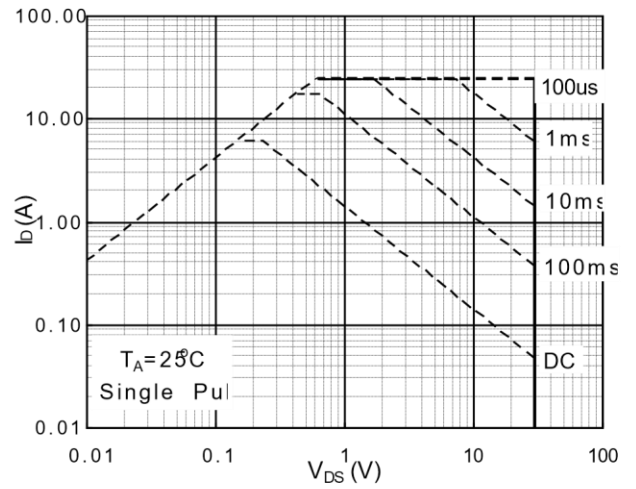


**Fig.6 Normalized  $R_{DS(on)}$  vs.  $T_J$**

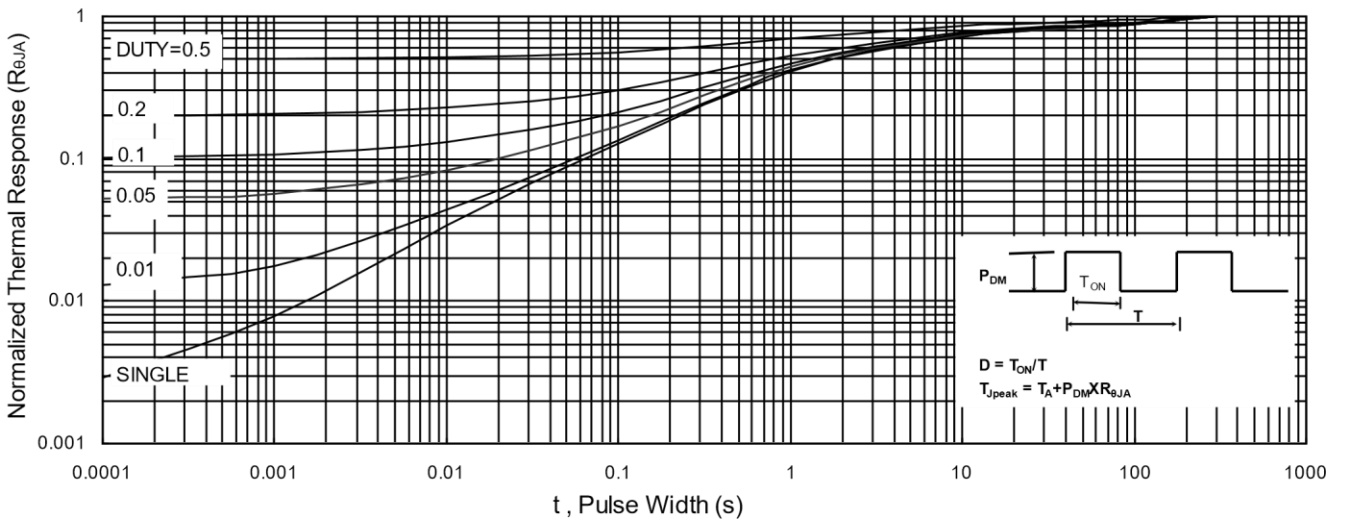
**30V N+P-Channel Enhancement Mode MOSFET**



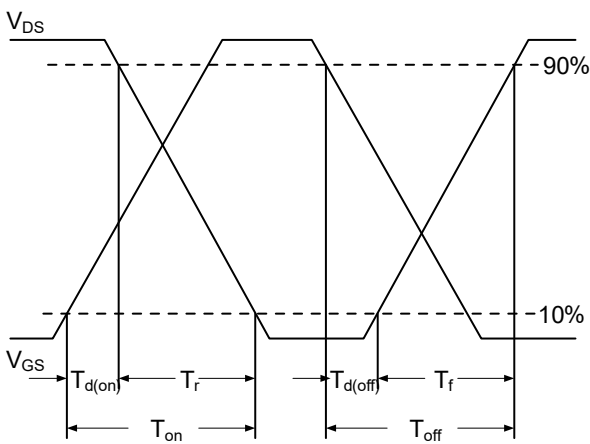
**Fig.7 Capacitance**



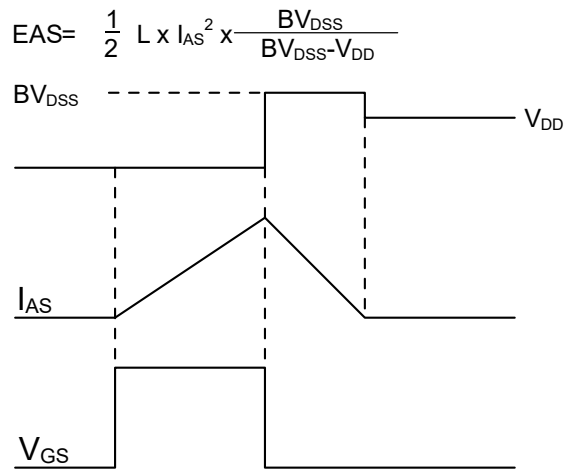
**Fig.8 Safe Operating Area**



**Fig.9 Normalized Maximum Transient Thermal Impedance**



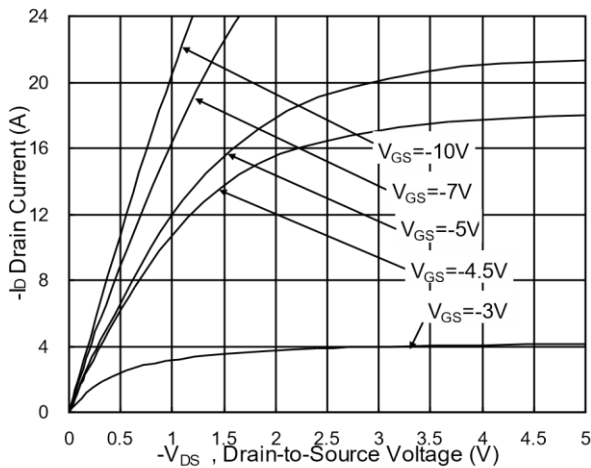
**Fig.10 Switching Time Waveform**



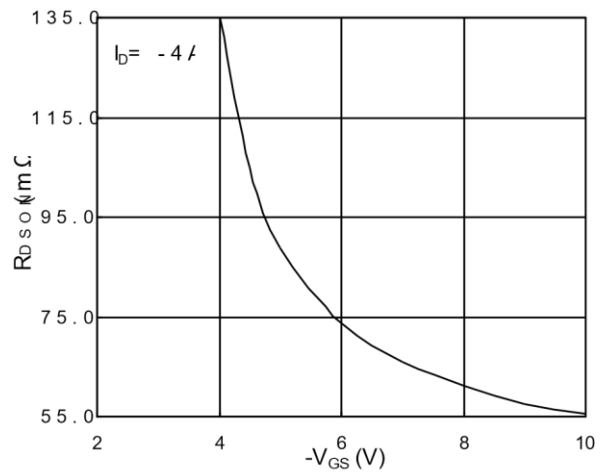
**Fig.11 Unclamped Inductive Switching Waveform**

**30V N+P-Channel Enhancement Mode MOSFET**

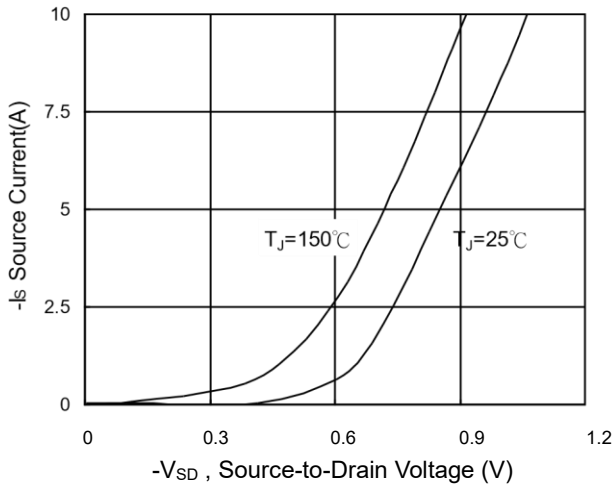
**P-Channel Typical Characteristics**



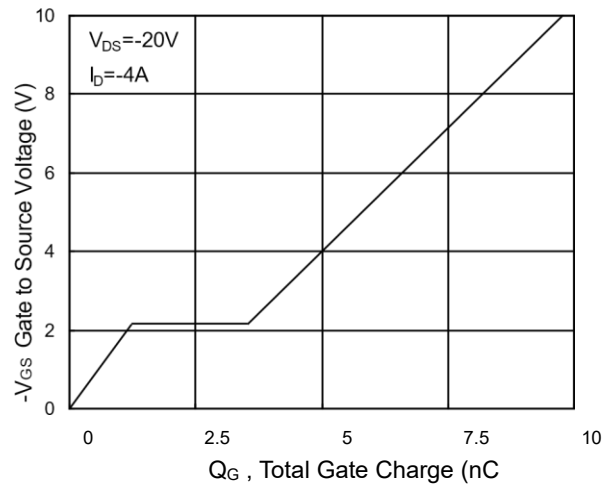
**Fig.1 Typical Output Characteristics**



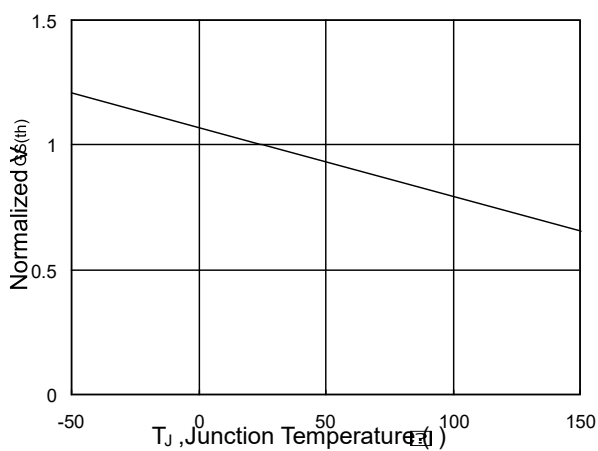
**Fig.2 On-Resistance vs. G-S Voltage**



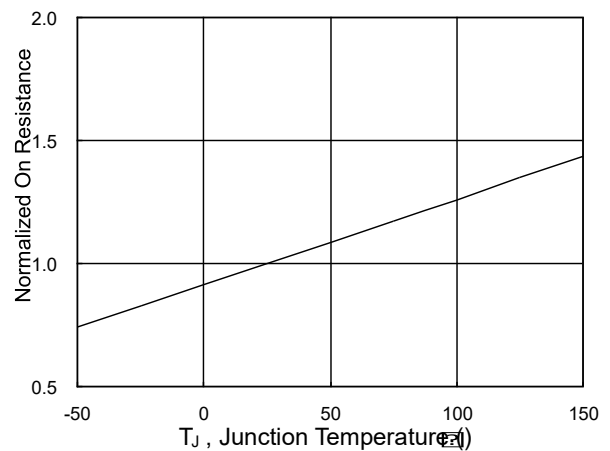
**Fig.3 Forward Characteristics of Reverse**



**Fig.4 Gate-Charge Characteristics**

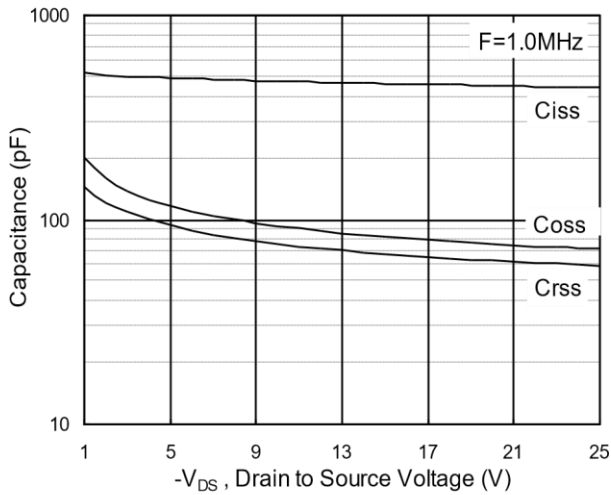


**Fig.5 Normalized  $V_{GS(th)}$  vs.  $T_J$**

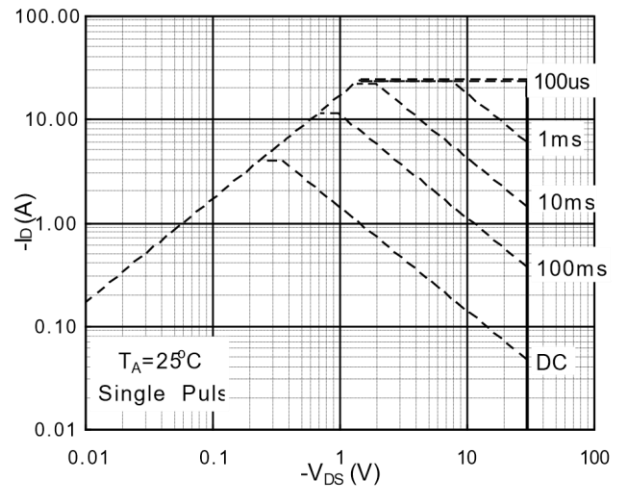


**Fig.6 Normalized  $R_{DS(on)}$  vs.  $T_J$**

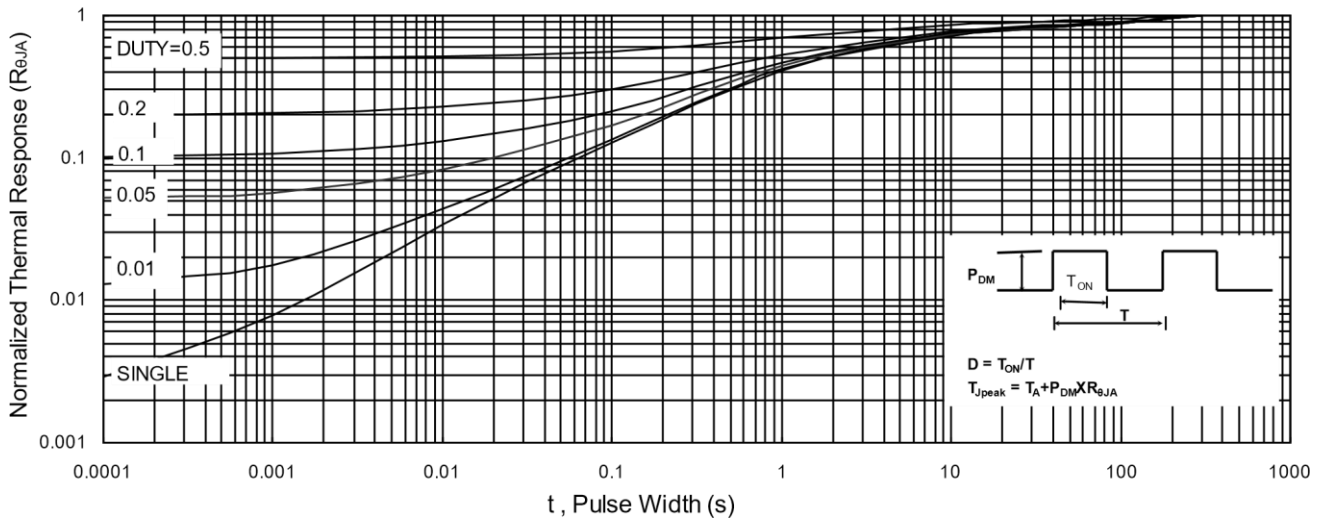
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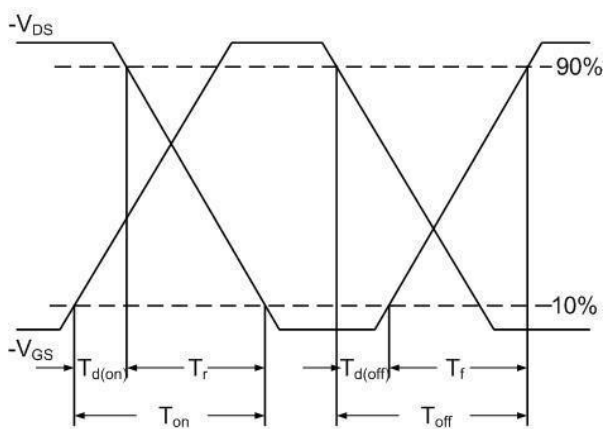
**Fig.7 Capacitance**



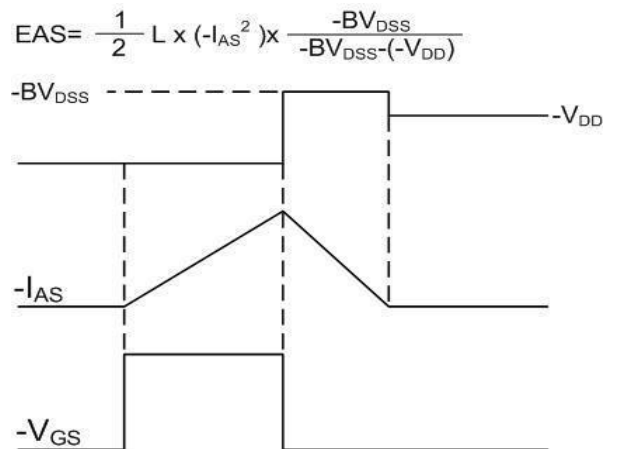
**Fig.8 Safe Operating Area**



**Fig.9 Normalized Maximum Transient Thermal Impedance**



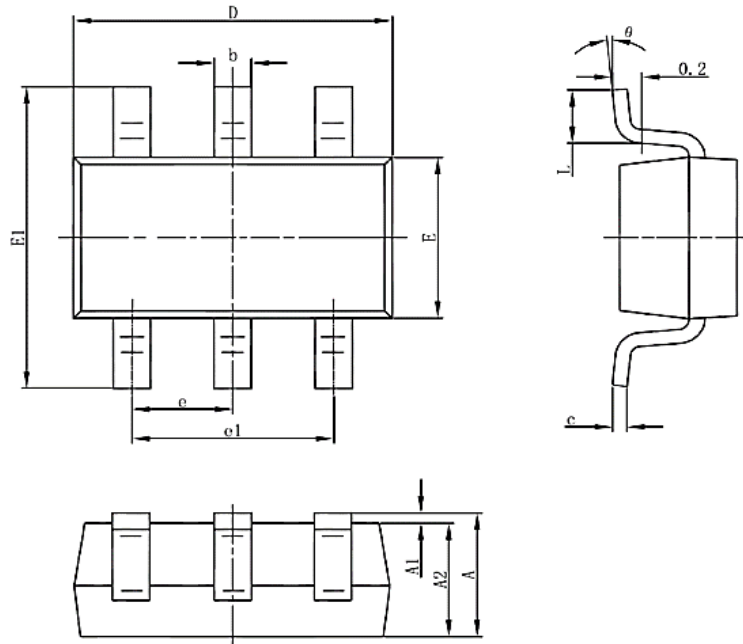
**Fig.10 Switching Time Waveform**



**Fig.11 Unclamped Inductive Switching Waveform**



**Package Mechanical Data-SOT23-6-Double**



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
θ	0	8	0	8



**30V N+P-Channel Enhancement Mode MOSFET****Attention**

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## 30V N+P-Channel Enhancement Mode MOSFET

Edition	Date	Change
Rve1.0	2021/12/21	Initial release

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