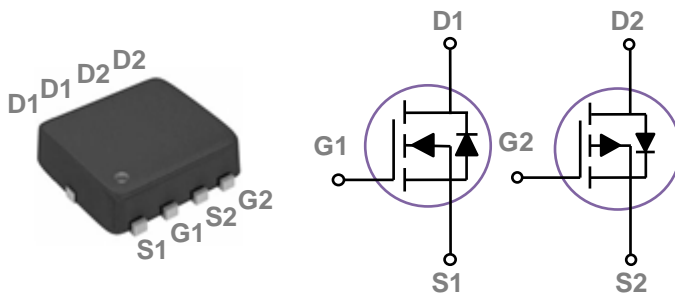


### General Description

These N+P dual Channel enhancement mode power field effect transistors are using trench DMOS technology. This advanced technology has been especially tailored to minimize on-state resistance, provide superior switching performance, and withstand high energy pulse in the avalanche and commutation mode. These devices are well suited for high efficiency fast switching applications.

### PPAK2.8X2.9 Dual NEP Pin Configuration



BVDSS	RDSON	ID
30V	19mΩ	8A
-30V	48mΩ	-5A

### Features

- Fast switching
- Green Device Available
- Suit for 4.5V Gate Drive Applications

### Applications

- DC Fan
- Motor Drive Applications
- Networking
- Half / Full Bridge Topology

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

Symbol	Parameter	Rating		Units
$V_{DS}$	Drain-Source Voltage	30	-30	V
$V_{GS}$	Gate-Source Voltage	$\pm 20$	$\pm 20$	V
$I_D$	Drain Current – Continuous ( $T_A=25^\circ\text{C}$ )	8	-5	A
	Drain Current – Continuous ( $T_A=70^\circ\text{C}$ )	6.4	-4	A
$I_{DM}$	Drain Current – Pulsed <sup>1</sup>	32	-20	A
$P_D$	Power Dissipation ( $T_A=25^\circ\text{C}$ )	2.5		W
	Power Dissipation – Derate above $25^\circ\text{C}$	0.02		W/°C
$T_{STG}$	Storage Temperature Range	-55 to 150		°C
$T_J$	Operating Junction Temperature Range	-55 to 150		°C

### Thermal Characteristics

Symbol	Parameter	Typ.	Max.	Unit
$R_{\theta JA}$	Thermal Resistance Junction to ambient	---	50	°C/W

**N-CH Electrical Characteristics (T<sub>J</sub>=25 °C, unless otherwise)**
**Off Characteristics**

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	---	---	V
I <sub>DSS</sub>	Drain-Source Leakage Current	V <sub>DS</sub> =30V, 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> =125°C	---	---	10	uA
I <sub>GSS</sub>	Gate-Source Leakage Current	V <sub>GS</sub> =±20V, V <sub>DS</sub> =0V	---	---	±100	nA

**On Characteristics**

R <sub>DS(ON)</sub>	Static Drain-Source On-Resistance	V <sub>GS</sub> =10V, I <sub>D</sub> =8A	---	16	19	mΩ
		V <sub>GS</sub> =4.5V, I <sub>D</sub> =6A	---	22	28	mΩ
V <sub>GS(th)</sub>	Gate Threshold Voltage	V <sub>GS</sub> =V <sub>DS</sub> , I <sub>D</sub> =250uA	1.2	1.6	2.5	V
g <sub>fs</sub>	Forward Transconductance	V <sub>DS</sub> =10V, I <sub>D</sub> =5A	---	6	---	S

**Dynamic and switching Characteristics**

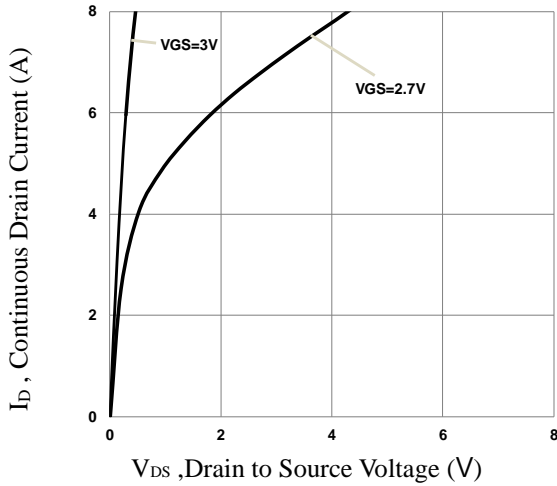
Q <sub>g</sub>	Total Gate Charge <sup>2,3</sup>	V <sub>DS</sub> =15V, V <sub>GS</sub> =10V, I <sub>D</sub> =4A	---	5.2	8	nC
Q <sub>gs</sub>	Gate-Source Charge <sup>2,3</sup>		---	0.6	3	
Q <sub>gd</sub>	Gate-Drain Charge <sup>2,3</sup>		---	2	4	
T <sub>d(on)</sub>	Turn-On Delay Time <sup>2,3</sup>	V <sub>DD</sub> =15V, V <sub>GS</sub> =10V, R <sub>G</sub> =6Ω I <sub>D</sub> =4A	---	3	5	ns
T <sub>r</sub>	Rise Time <sup>2,3</sup>		---	7	11	
T <sub>d(off)</sub>	Turn-Off Delay Time <sup>2,3</sup>		---	16	25	
T <sub>f</sub>	Fall Time <sup>2,3</sup>		---	5	8	
C <sub>iss</sub>	Input Capacitance	V <sub>DS</sub> =15V, V <sub>GS</sub> =0V, F=1MHz	---	465	700	pF
C <sub>oss</sub>	Output Capacitance		---	65	100	
C <sub>rss</sub>	Reverse Transfer Capacitance		---	50	75	
R <sub>g</sub>	Gate resistance	V <sub>GS</sub> =0V, V <sub>DS</sub> =0V, F=1MHz	---	2	---	Ω

**Drain-Source Diode Characteristics and Maximum Ratings**

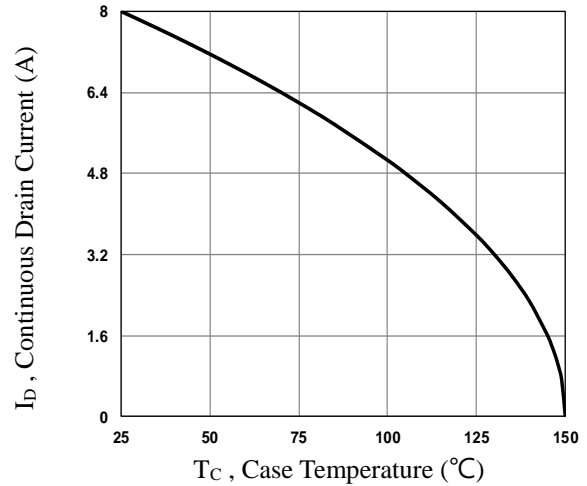
Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
I <sub>S</sub>	Continuous Source Current	V <sub>G</sub> =V <sub>D</sub> =0V, Force Current	---	---	8	A
I <sub>SM</sub>	Pulsed Source Current		---	---	16	A
V <sub>SD</sub>	Diode Forward Voltage	V <sub>GS</sub> =0V, I <sub>S</sub> =1A, T <sub>J</sub> =25°C	---	---	1	V
T <sub>rr</sub>	Reverse Recovery Time	V <sub>R</sub> =30V, I <sub>S</sub> =4A	---	110	---	ns
Q <sub>rr</sub>	Reverse Recovery Charge	di/dt=100A/μs, T <sub>J</sub> =25°C	---	145	---	nC

Note :

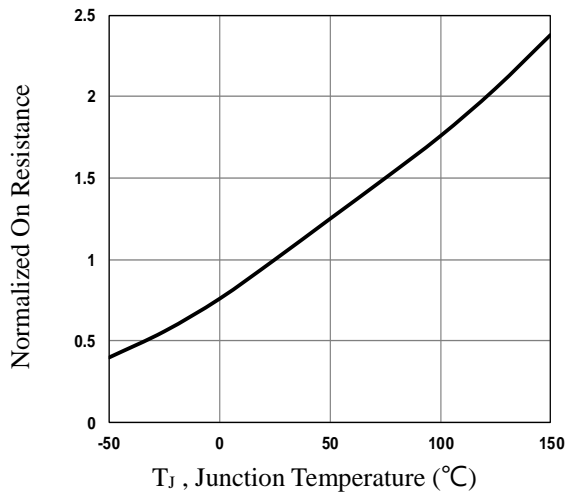
1. Repetitive Rating : Pulsed width limited by maximum junction temperature.
2. The data tested by pulsed, pulse width ≤ 300us, duty cycle ≤ 2%.
3. Essentially independent of operating temperature.



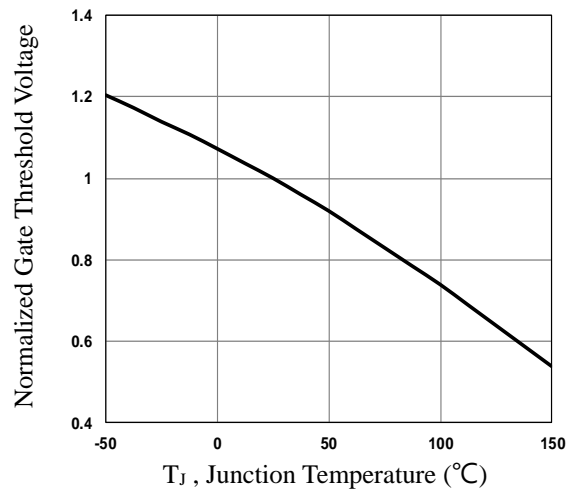
**Fig.1 Typical Output Characteristics**



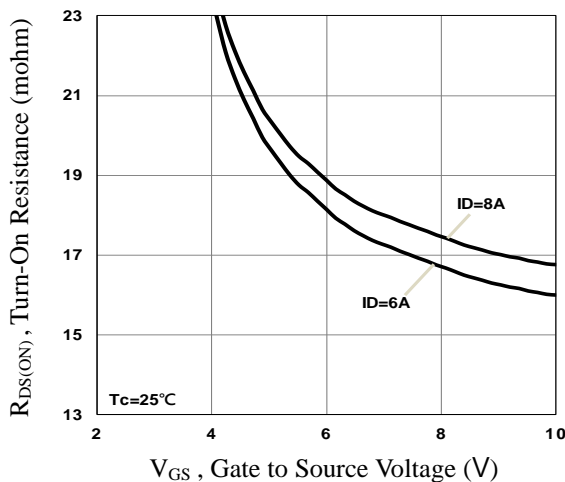
**Fig.2 Continuous Drain Current vs. T<sub>c</sub>**



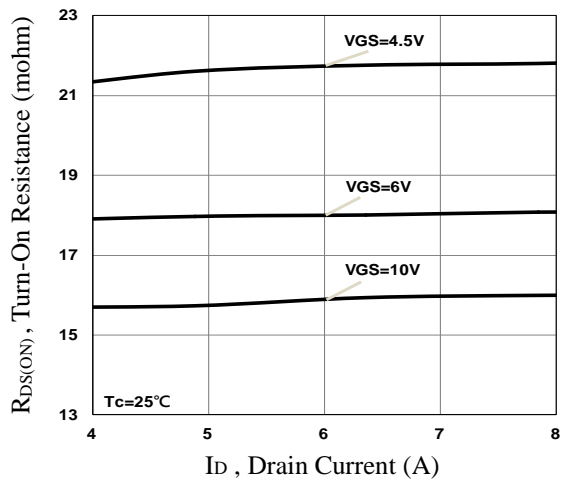
**Fig.3 Normalized R<sub>DS(on)</sub> vs. T<sub>j</sub>**



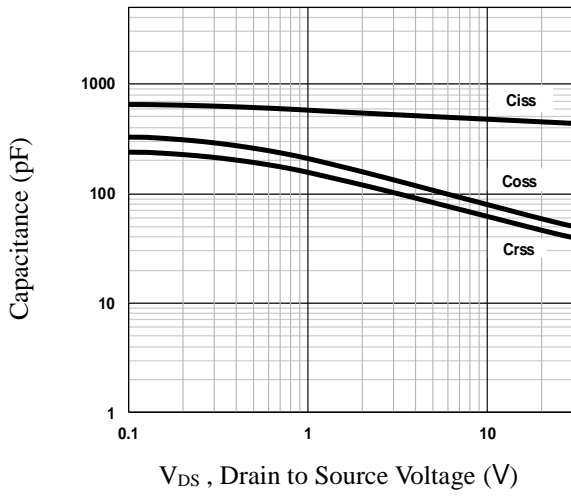
**Fig.4 Normalized V<sub>th</sub> vs. T<sub>j</sub>**



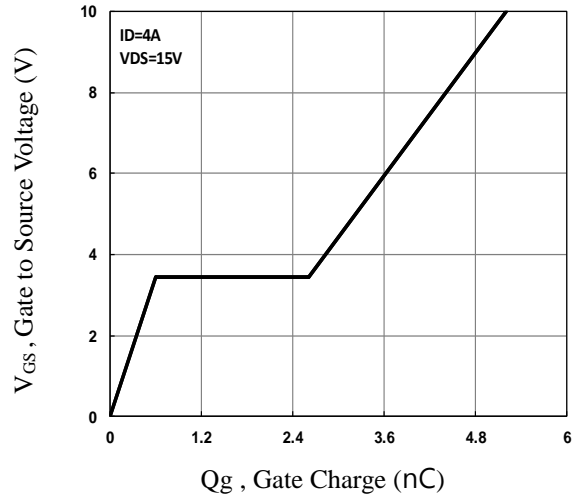
**Fig.5 Turn-On Resistance vs. V<sub>GS</sub>**



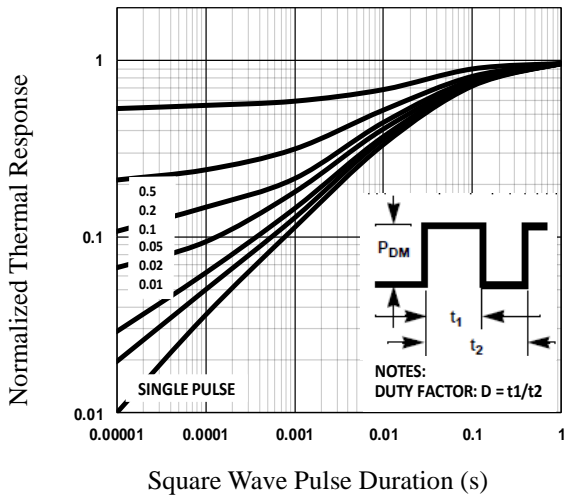
**Fig.6 Turn-On Resistance vs. I<sub>D</sub>**



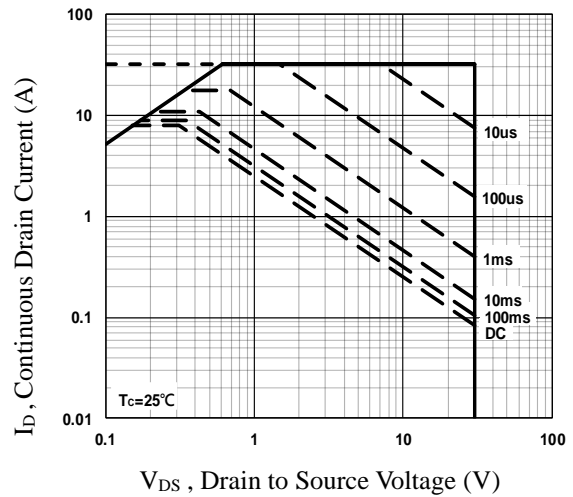
**Fig.7 Capacitance Characteristics**



**Fig.8 Gate Charge Characteristics**



**Fig.9 Normalized Transient Impedance**



**Fig.10 Maximum Safe Operation Area**

**P-CH Electrical Characteristics (T<sub>J</sub>=25 °C, unless otherwise)**
**Off Characteristics**

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	---	---	V
I <sub>DSS</sub>	Drain-Source Leakage Current	V <sub>DS</sub> =-30V, 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> =125°C	---	---	-10	uA
I <sub>GSS</sub>	Gate-Source Leakage Current	V <sub>GS</sub> =±20V, V <sub>DS</sub> =0V	---	---	±100	nA

**On Characteristics**

R <sub>DS(ON)</sub>	Static Drain-Source On-Resistance	V <sub>GS</sub> =-10V, I <sub>D</sub> =-5A	---	40	48	mΩ
		V <sub>GS</sub> =-4.5V, I <sub>D</sub> =-3A	---	60	78	mΩ
V <sub>GS(th)</sub>	Gate Threshold Voltage	V <sub>GS</sub> =V <sub>DS</sub> , I <sub>D</sub> =-250uA	-1.2	-1.6	-2.5	V
g <sub>fs</sub>	Forward Transconductance	V <sub>DS</sub> =-10V, I <sub>D</sub> =-3A	---	6	---	S

**Dynamic and switching Characteristics**

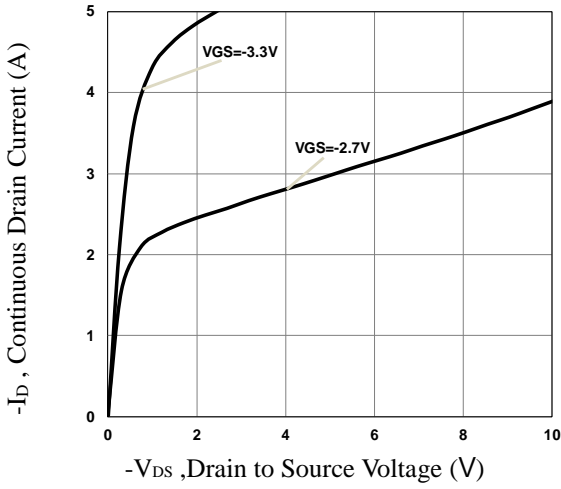
Q <sub>g</sub>	Total Gate Charge <sup>4, 5</sup>	V <sub>DS</sub> =-15V, V <sub>GS</sub> =-10V, I <sub>D</sub> =-3A	---	6.2	10	nC
Q <sub>gs</sub>	Gate-Source Charge <sup>4, 5</sup>		---	1	3	
Q <sub>gd</sub>	Gate-Drain Charge <sup>4, 5</sup>		---	1.6	4	
T <sub>d(on)</sub>	Turn-On Delay Time <sup>4, 5</sup>	V <sub>DD</sub> =-15V, V <sub>GS</sub> =-10V, R <sub>G</sub> =6Ω I <sub>D</sub> =-3A	---	4	6	ns
T <sub>r</sub>	Rise Time <sup>4, 5</sup>		---	11	20	
T <sub>d(off)</sub>	Turn-Off Delay Time <sup>4, 5</sup>		---	27	40	
T <sub>f</sub>	Fall Time <sup>4, 5</sup>		---	7	11	
C <sub>iss</sub>	Input Capacitance	V <sub>DS</sub> =-15V, V <sub>GS</sub> =0V, F=1MHz	---	510	765	pF
C <sub>oss</sub>	Output Capacitance		---	70	105	
C <sub>rss</sub>	Reverse Transfer Capacitance		---	50	75	

**Drain-Source Diode Characteristics and Maximum Ratings**

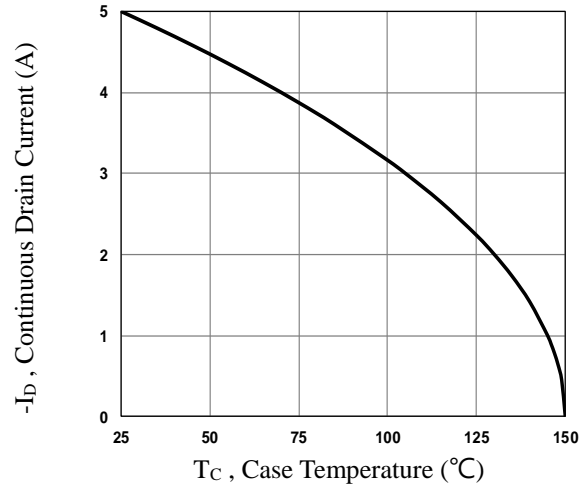
Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
I <sub>S</sub>	Continuous Source Current	V <sub>G</sub> =V <sub>D</sub> =0V, Force Current	---	---	-5	A
I <sub>SM</sub>	Pulsed Source Current		---	---	-10	A
V <sub>SD</sub>	Diode Forward Voltage	V <sub>GS</sub> =0V, I <sub>S</sub> =-1A, T <sub>J</sub> =25°C	---	---	-1	V
t <sub>rr</sub>	Reverse Recovery Time	V <sub>R</sub> =-30V, I <sub>S</sub> =-3A	---	155	---	ns
Q <sub>rr</sub>	Reverse Recovery Charge	di/dt=100A/μs, T <sub>J</sub> =25°C	---	250	---	nC

Note :

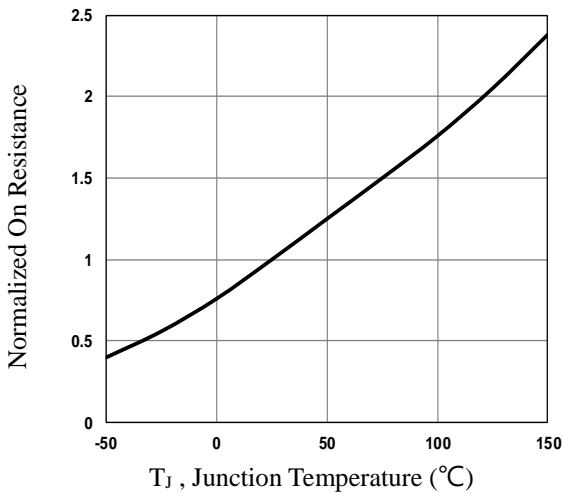
4. The data tested by pulsed, pulse width ≤ 300us, duty cycle ≤ 2%.
5. Essentially independent of operating temperature.



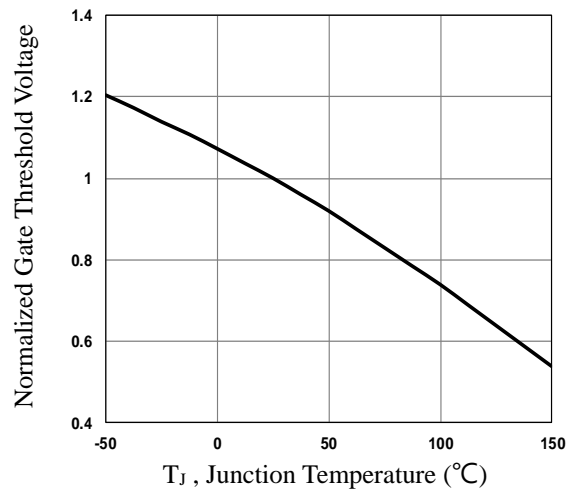
**Fig.11 Typical Output Characteristics**



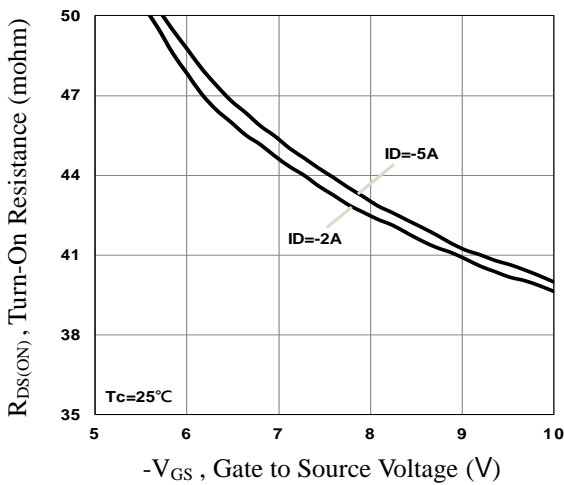
**Fig.12 Continuous Drain Current vs. T<sub>c</sub>**



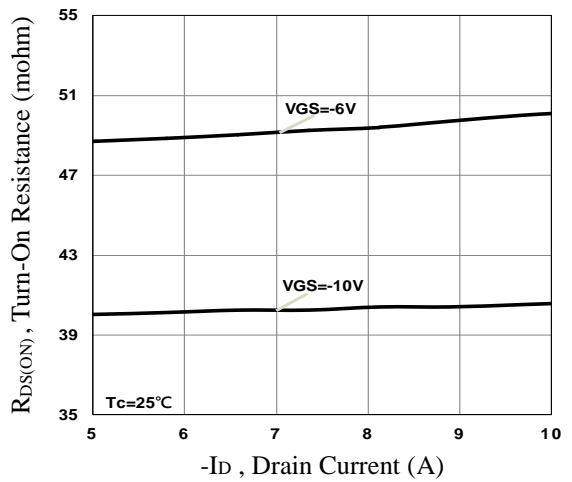
**Fig.13 Normalized R<sub>DS(on)</sub> vs. T<sub>j</sub>**



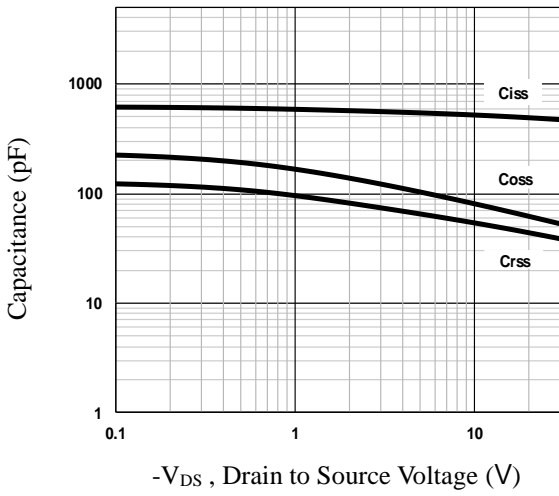
**Fig.14 Normalized V<sub>th</sub> vs. T<sub>j</sub>**



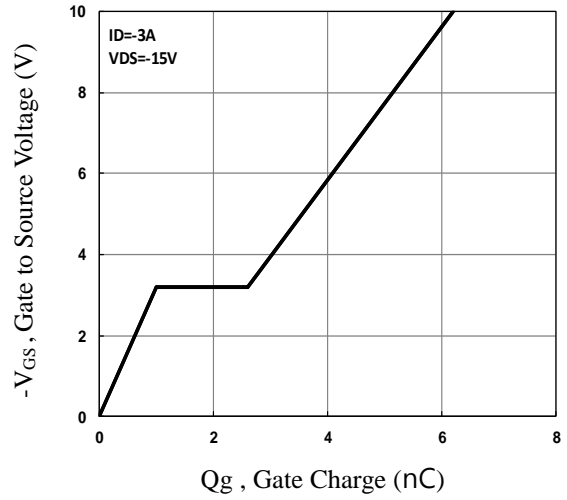
**Fig.15 Turn-On Resistance vs. V<sub>GS</sub>**



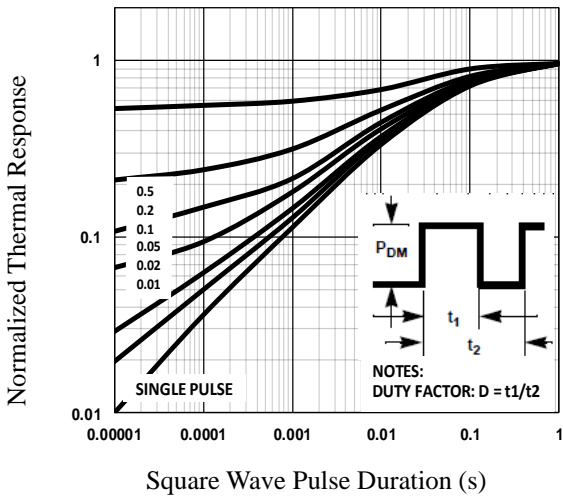
**Fig.16 Turn-On Resistance vs. I<sub>D</sub>**



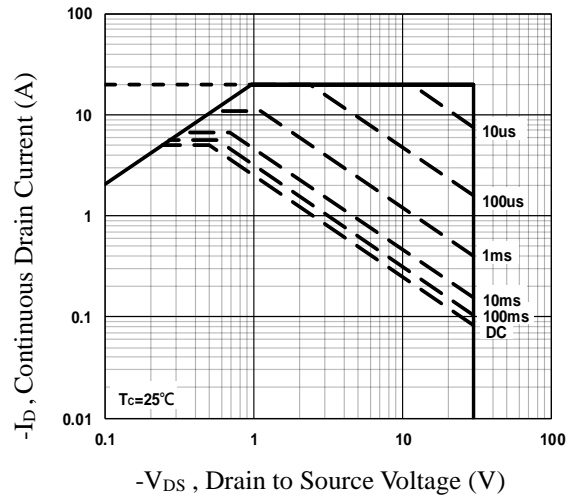
**Fig.17 Capacitance Characteristics**



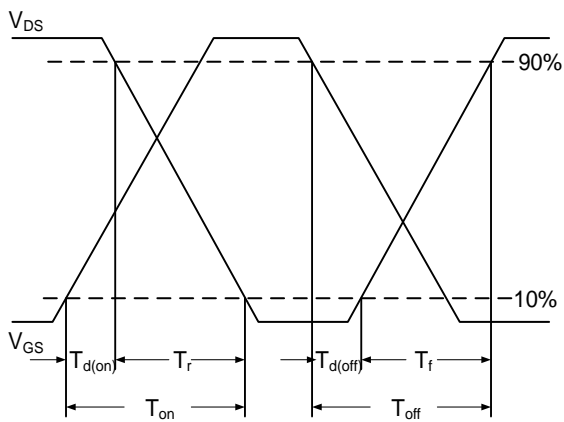
**Fig.18 Gate Charge Characteristics**



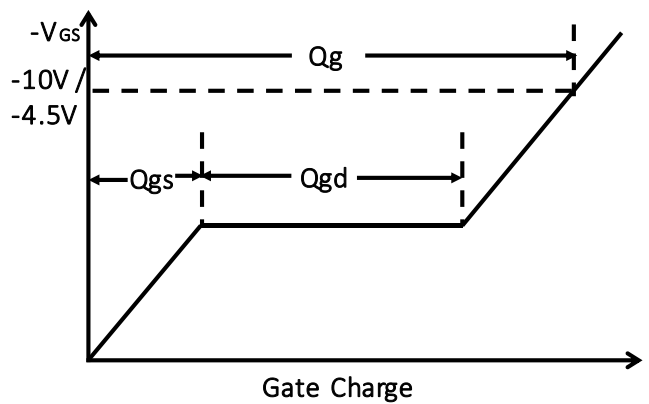
**Fig.19 Normalized Transient Impedance**



**Fig.20 Maximum Safe Operation Area**

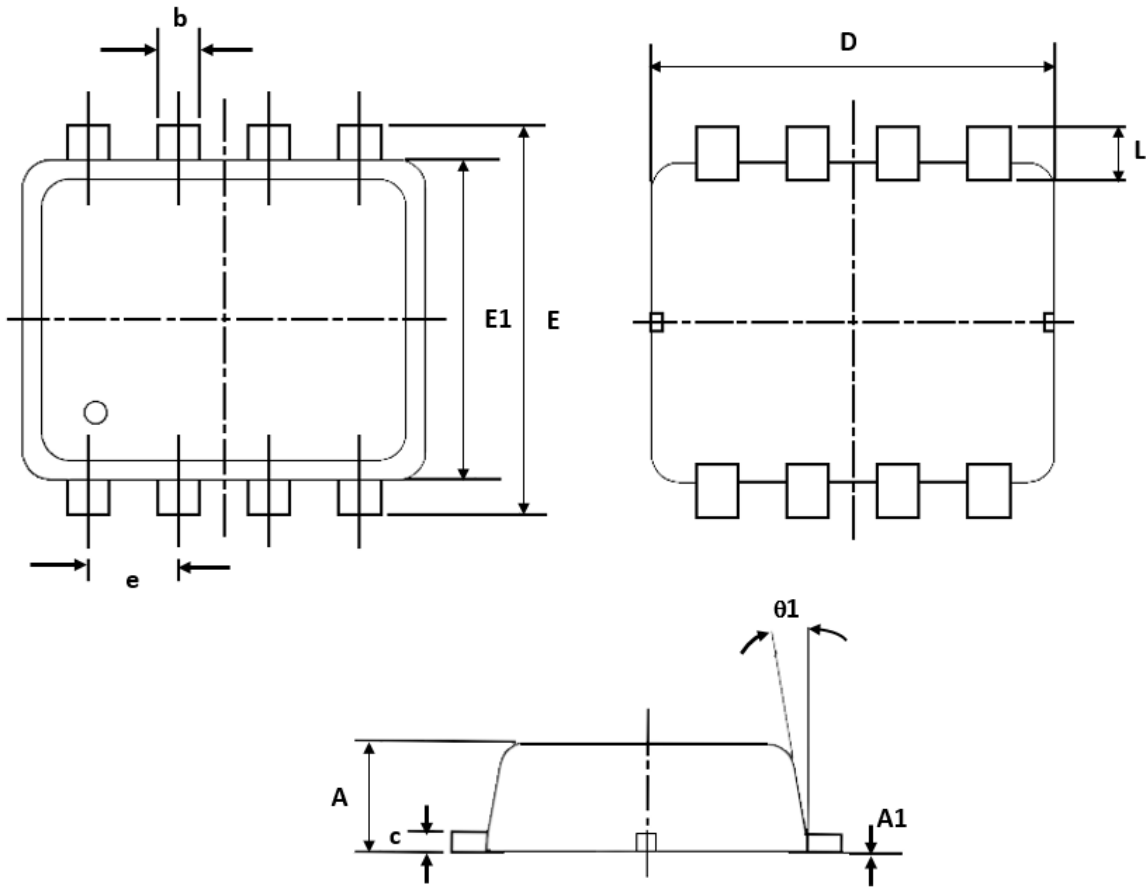


**Fig.21 Switching Time Waveform**



**Fig.22 Gate Charge Waveform**

### PPAK2.8x2.9 Dual NEP PACKAGE INFORMATION



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	MIN	MAX	MIN	MAX
A	0.700	0.900	0.028	0.035
A1	0.000	0.050	0.000	0.002
b	0.240	0.350	0.009	0.014
c	0.080	0.250	0.003	0.010
D	2.800	3.000	0.110	0.118
E	2.700	2.900	0.106	0.114
E1	2.200	2.400	0.087	0.095
e	0.65 BSC		0.026 BSC	
L	0.200	0.450	0.008	0.018
$\theta$	0°	12°	0°	12°