

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

### Description

The AP40G03NF 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

$V_{DS} = 30V$   $I_D = 42A$

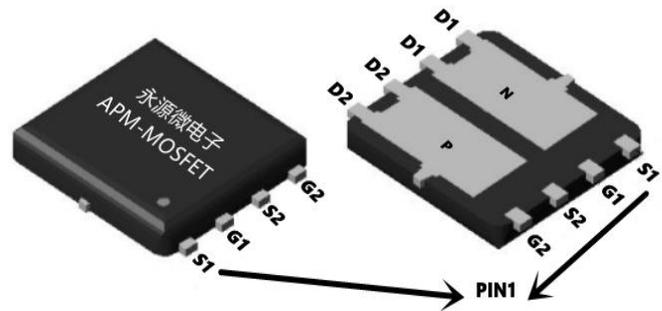
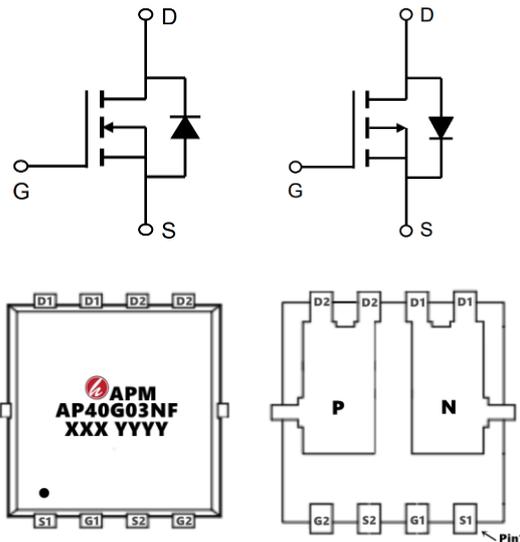
$R_{DS(ON)} < 10m\Omega$  @  $V_{GS}=10V$  (Type: 6.5m $\Omega$ )

$V_{DS} = -30V$   $I_D = -38A$

$R_{DS(ON)} < 13m\Omega$  @  $V_{GS}=-10V$  (Type: 9.0m $\Omega$ )

### Application

Wireless charging  
 Boost driver  
 Brushless motor



### Package Marking and Ordering Information

Product ID	Pack	Marking	Qty(PCS)
AP40G03NF	PDFN5*6-8L	AP40G03NF XXX YYYY	5000

### Absolute Maximum Ratings ( $T_C=25^\circ C$ 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
$I_D@T_C=25^\circ C$	Continuous Drain Current, $V_{GS} @ 10V^1$	42	-38	A
$I_D@T_C=100^\circ C$	Continuous Drain Current, $V_{GS} @ 10V^1$	32.5	-27.5	A
$I_{DM}$	Pulsed Drain Current <sup>2</sup>	123	-115	A
EAS	Single Pulse Avalanche Energy <sup>3</sup>	289	378	mJ
$I_{AS}$	Avalanche Current	42	50	A
$P_D@T_C=25^\circ C$	Total Power Dissipation <sup>4</sup>	46	41.3	W
$T_{STG}$	Storage Temperature Range	-55 to 150	-55 to 150	$^\circ C$
$T_J$	Operating Junction Temperature Range	-55 to 150	-55 to 150	$^\circ C$
$R_{\theta JA}$	Thermal Resistance Junction-Ambient <sup>1</sup>	25		$^\circ C/W$
$R_{\theta JC}$	Thermal Resistance Junction-Case <sup>1</sup>	2.3		$^\circ C/W$

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

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
BVDSS	Drain-Source Breakdown Voltage	V <sub>GS</sub> =0V, I <sub>D</sub> =250uA	30	---	---	V
ΔBVDSS/ΔTJ	BVDSS Temperature Coefficient	Reference to 25°C, I <sub>D</sub> =1mA	---	0.027	---	V/°C
RDS(ON)	Static Drain-Source On-Resistance <sup>2</sup>	V <sub>GS</sub> =10V, I <sub>D</sub> =12A	---	6.5	10	mΩ
		V <sub>GS</sub> =4.5V, I <sub>D</sub> =10A	---	10	13	
VGS(th)	Gate Threshold Voltage	V <sub>GS</sub> =V <sub>DS</sub> , I <sub>D</sub> =250uA	1.0	---	2.5	V
ΔVGS(th)	V <sub>GS(th)</sub> Temperature Coefficient		---	-5.8	---	mV/°C
IDSS	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	
IGSS	Gate-Source Leakage Current	V <sub>GS</sub> =±20V, V <sub>DS</sub> =0V	---	---	±100	nA
gfs	Forward Transconductance	V <sub>DS</sub> =5V, I <sub>D</sub> =15A	---	9.8	---	S
R <sub>g</sub>	Gate Resistance	V <sub>DS</sub> =0V, V <sub>GS</sub> =0V, f=1MHz	---	1.7	---	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> =12A	---	12.8	---	nC
Q <sub>gs</sub>	Gate-Source Charge		---	3.3	---	
Q <sub>gd</sub>	Gate-Drain Charge		---	6.5	---	
Td(on)	Turn-On Delay Time	V <sub>DD</sub> =12V, V <sub>GS</sub> =10V, R <sub>G</sub> =3.3Ω I <sub>D</sub> =5A	---	4.5	---	ns
T <sub>r</sub>	Rise Time		---	10.8	---	
Td(off)	Turn-Off Delay Time		---	25.5	---	
T <sub>f</sub>	Fall Time		---	9.6	---	
Ciss	Input Capacitance	V <sub>DS</sub> =15V, V <sub>GS</sub> =0V, f=1MHz	---	1317	---	pF
Coss	Output Capacitance		---	163	---	
Crss	Reverse Transfer Capacitance		---	131	---	
IS	Continuous Source Current <sup>1,6</sup>	V <sub>G</sub> =V <sub>D</sub> =0V, Force Current	---	---	46	A
ISM	Pulsed Source Current <sup>2,6</sup>		---	---	92	A
VSD	Diode Forward Voltage <sup>2</sup>	V <sub>GS</sub> =0V, I <sub>S</sub> =1A, T <sub>J</sub> =25°C	---	---	1	V

**Note :**

- 1、 The data tested by surface mounted on a 1 inch 2 FR-4 board with 2OZ copper.
- 2、 The data tested by pulsed , pulse width .The EAS data shows Max. rating .
- 3、 The power dissipation is limited by 175°C junction temperature
- 4、 EAS condition: T<sub>J</sub>=25°C, V<sub>DD</sub>= 24V, V<sub>G</sub>= 10V, R<sub>G</sub>=25Ω, L=0.1mH, I<sub>AS</sub>= 34A
- 5、 The data is theoretically the same as ID and IDM , in real applications , should be limited by total power dissipation.

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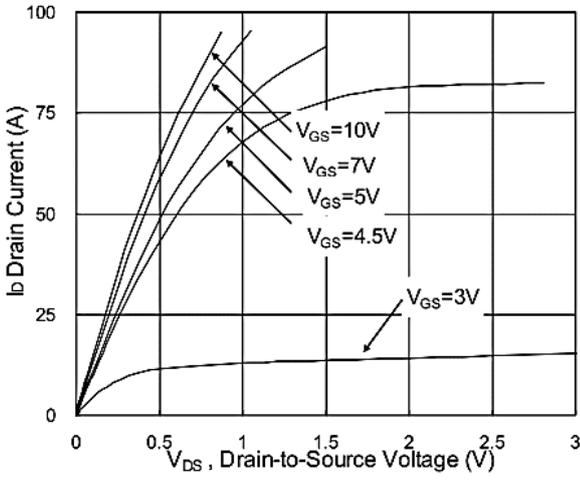
### P-Electrical Characteristics (T<sub>J</sub>=25 °C, unless otherwise noted)

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	---	-0.0232	---	V/°C
RDS(ON)	Static Drain-Source On-Resistance	V <sub>GS</sub> =-10V, I <sub>D</sub> =-30A	---	9.0	13	mΩ
		V <sub>GS</sub> =-4.5V, I <sub>D</sub> =-15A	---	16	20	
V <sub>GS(th)</sub>	Gate Threshold Voltage	V <sub>GS</sub> =V <sub>DS</sub> , I <sub>D</sub> =-250uA	-1.2	-1.4	-2.5	V
ΔV <sub>GS(th)</sub>	V <sub>GS(th)</sub> Temperature Coefficient		---	4.6	---	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> =-30A	---	30	---	S
R <sub>g</sub>	Gate Resistance	V <sub>DS</sub> =0V, V <sub>GS</sub> =0V, f=1MHz	---	9	---	Ω
Q <sub>g</sub>	Total Gate Charge (-4.5V)	V <sub>DS</sub> =-15V, V <sub>GS</sub> =-4.5V, I <sub>D</sub> =-15A	---	22	---	nC
Q <sub>gs</sub>	Gate-Source Charge		---	8.7	---	
Q <sub>gd</sub>	Gate-Drain Charge		---	7.2	---	
T <sub>d(on)</sub>	Turn-On Delay Time	V <sub>DD</sub> =-15V, V <sub>GS</sub> =-10V, R <sub>G</sub> =3.3Ω, I <sub>D</sub> =-15A	---	8	---	ns
T <sub>r</sub>	Rise Time		---	73.7	---	
T <sub>d(off)</sub>	Turn-Off Delay Time		---	61.8	---	
T <sub>f</sub>	Fall Time		---	24.4	---	
C <sub>iss</sub>	Input Capacitance	V <sub>DS</sub> =-15V, V <sub>GS</sub> =0V, f=1MHz	---	2215	---	pF
C <sub>oss</sub>	Output Capacitance		---	310	---	
C <sub>rss</sub>	Reverse Transfer Capacitance		---	237	---	
I <sub>s</sub>	Continuous Source Current	V <sub>G</sub> =V <sub>D</sub> =0V, Force Current	---	---	-42	A
I <sub>SM</sub>	Pulsed Source Current		---	---	-130	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	I <sub>F</sub> =-15A, dI/dt=100A/μs, T <sub>J</sub> =25°C	---	19	---	nS
Q <sub>rr</sub>	Reverse Recovery Charge		---	9	---	nC

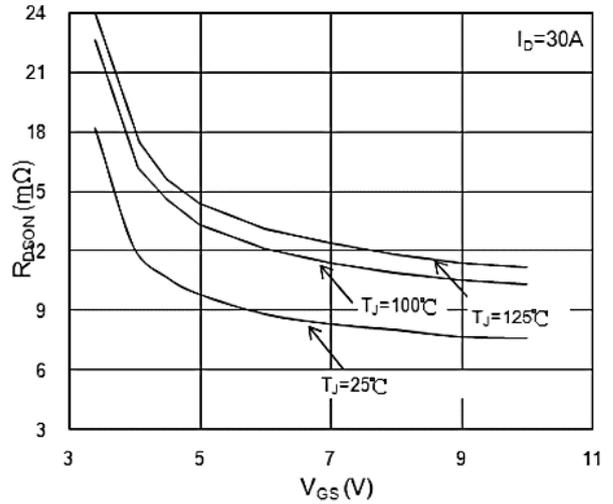
#### Note :

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- 2、 The data tested by pulsed , pulse width .The EAS data shows Max. rating .
- 3、 The power dissipation is limited by 175°C junction temperature
- 4、 EAS condition: T<sub>J</sub>=25°C, V<sub>DD</sub>= -24V, V<sub>G</sub>= -10V, R<sub>G</sub>=7Ω, L=0.1mH, I<sub>AS</sub>= -50A
- 5、 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.

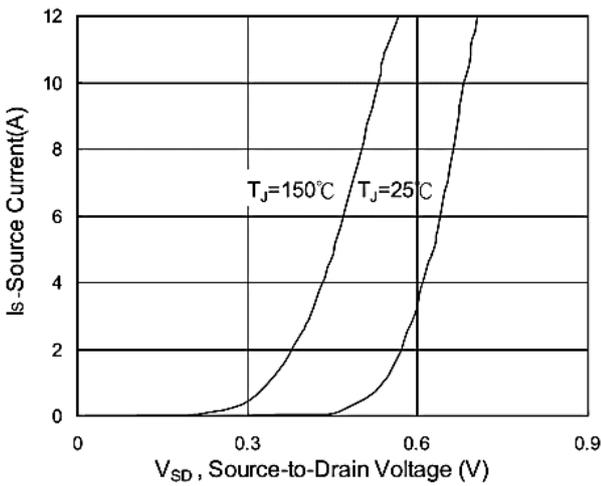
**N-Typical Characteristics**



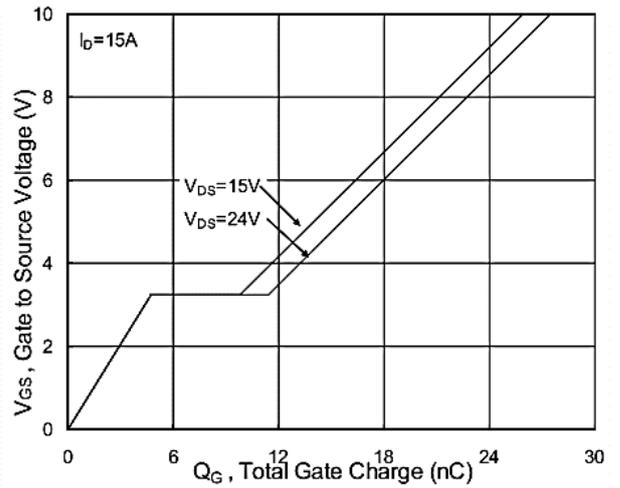
**Fig.1 Typical Output Characteristics**



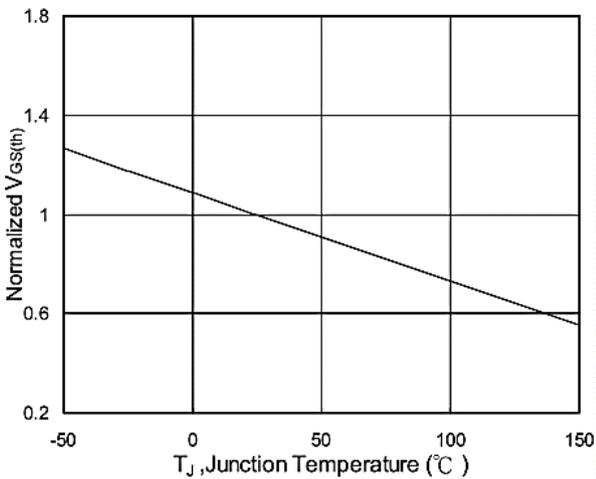
**Fig.2 On-Resistance vs. Gate-Source**



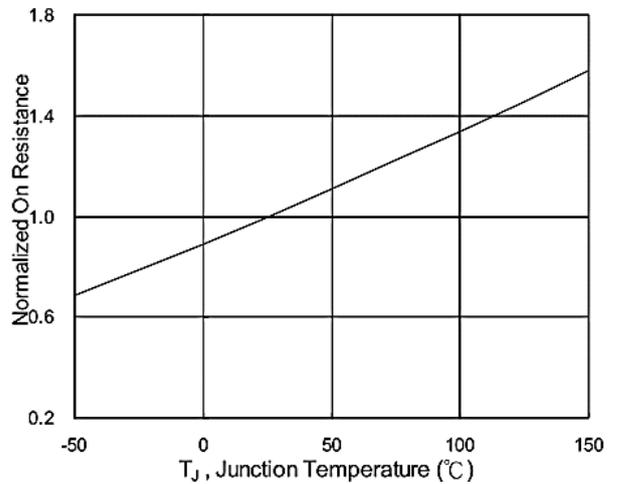
**Fig.3 Forward Characteristics of reverse**



**Fig.4 Gate-Charge Characteristics**

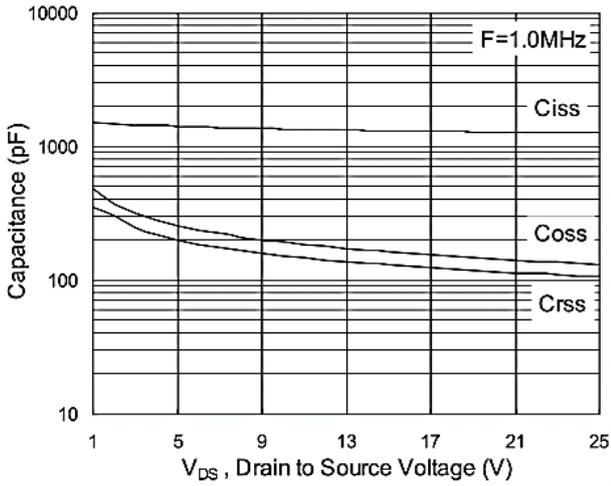


**Fig.5 Normalized  $V_{GS(th)}$  vs.  $T_J$**

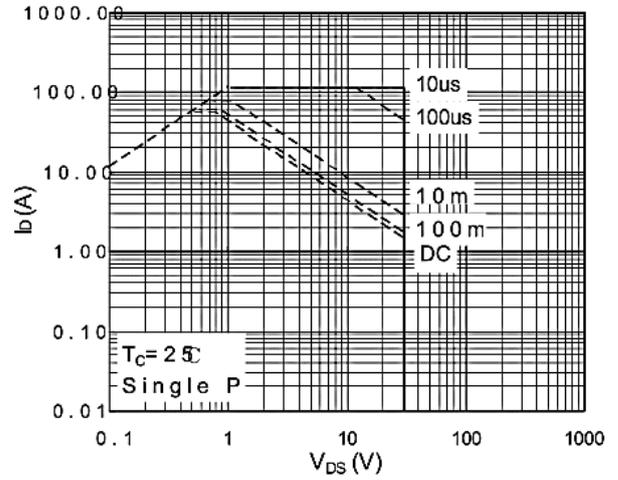


**Fig.6 Normalized  $R_{DS(on)}$  vs.  $T_J$**

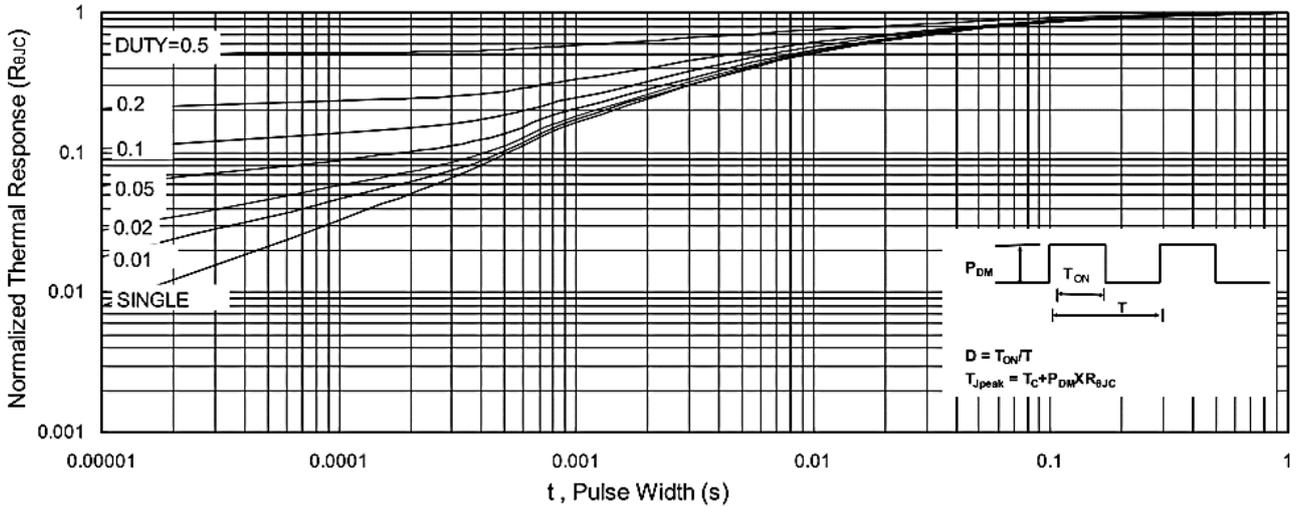
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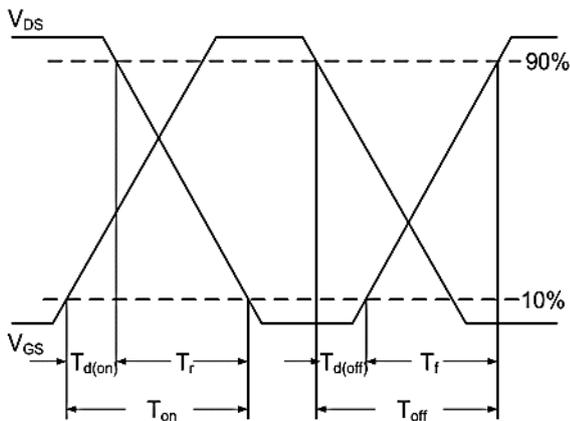
**Fig.7 Capacitance**



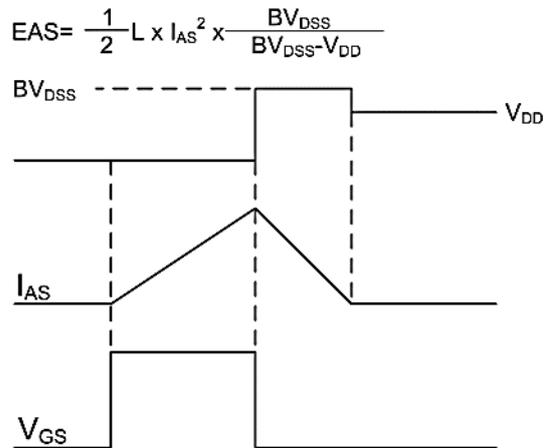
**Fig.8 Safe Operating Area**



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

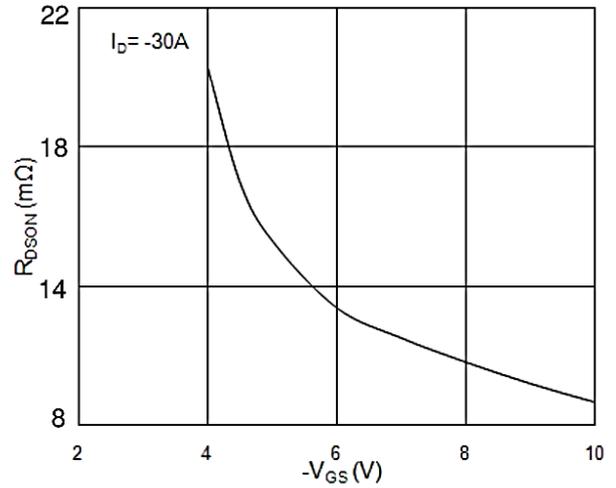
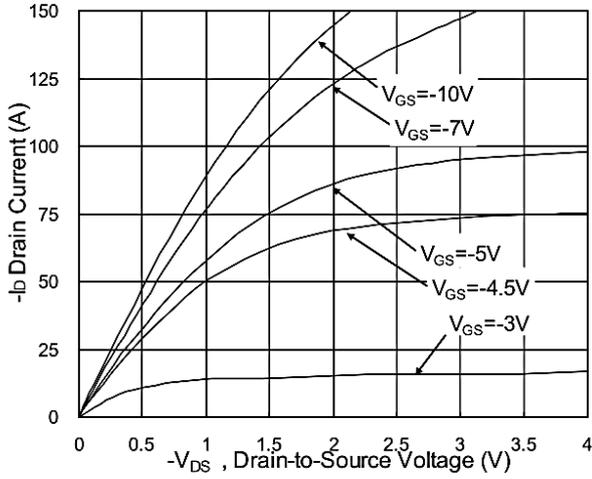


**Fig.10 Switching Time Waveform**

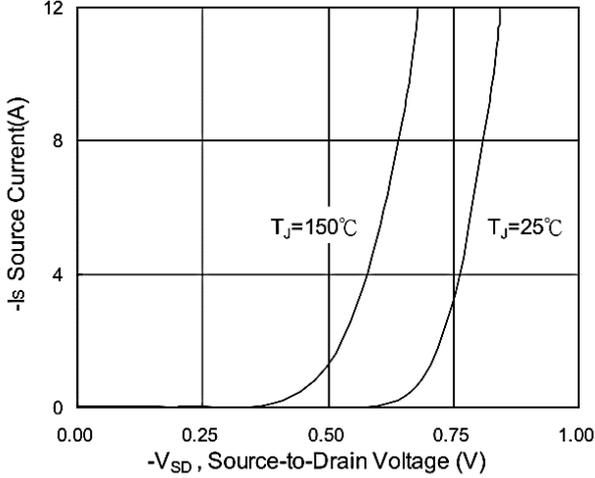


**Fig.17 Unclamped Inductive Switching Waveform**

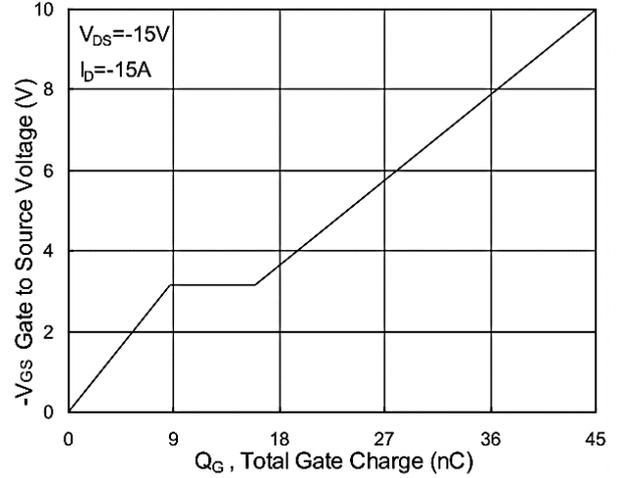
**P-Typical Characteristics**



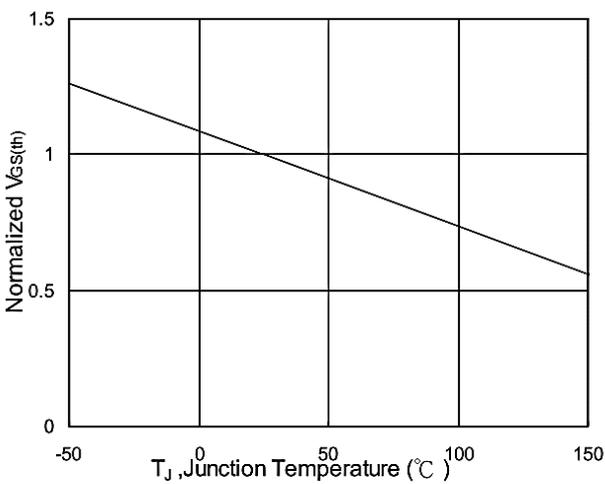
**Fig.1 Typical Output Characteristics**



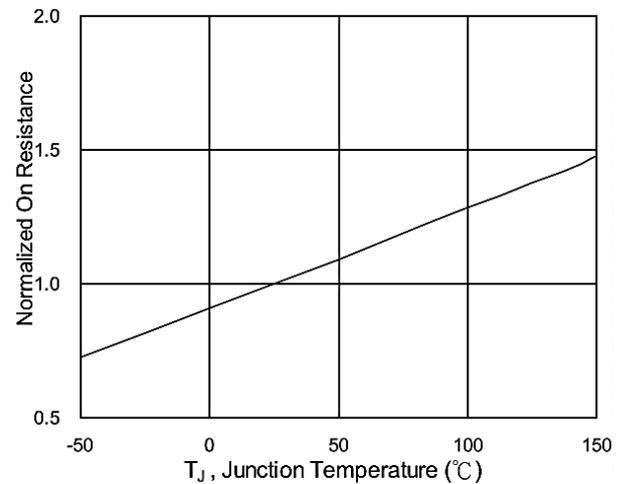
**Fig.2 On-Resistance vs. G-S Voltage**



**Fig.3 Forward Characteristics of Reverse**



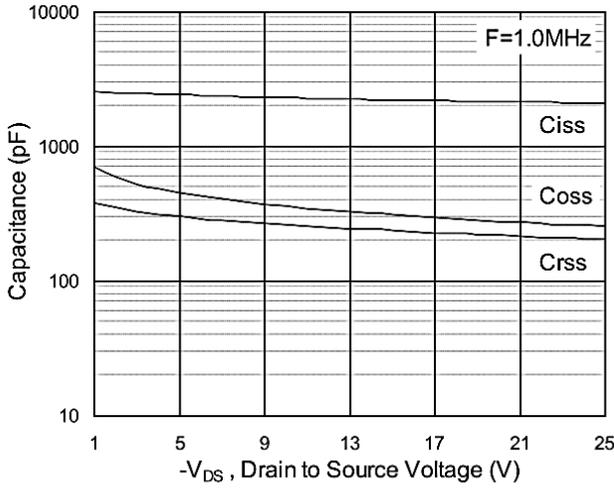
**Fig.4 Gate-Charge Characteristics**



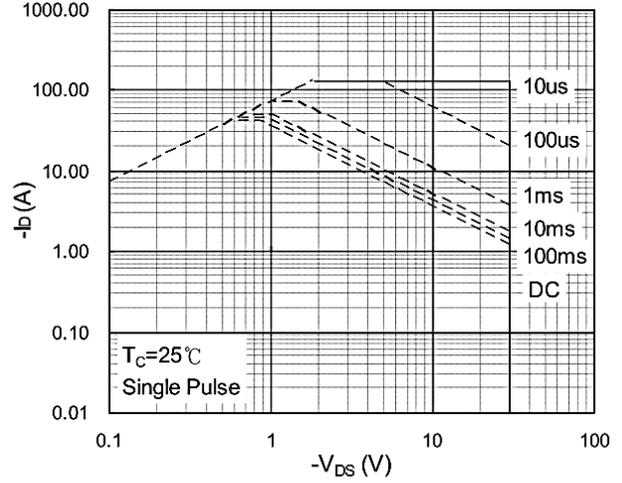
**Fig.5 Normalized  $V_{GS(th)}$  vs.  $T_J$**

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

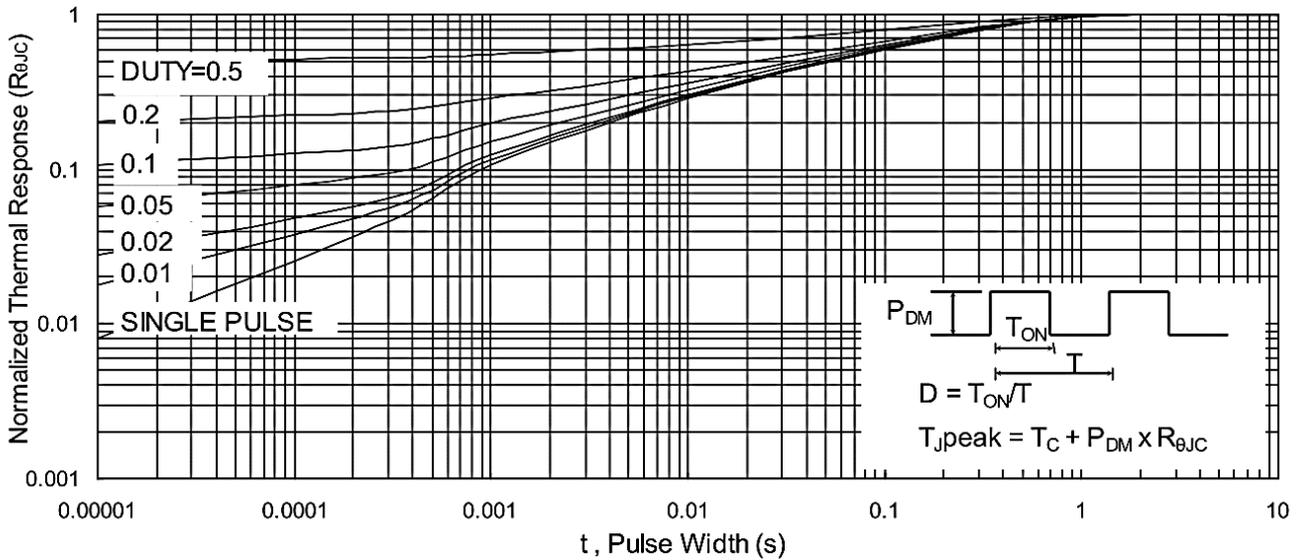
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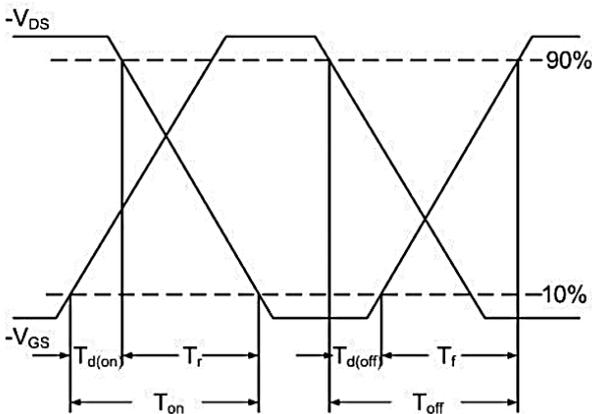
**Fig.7 Capacitance**



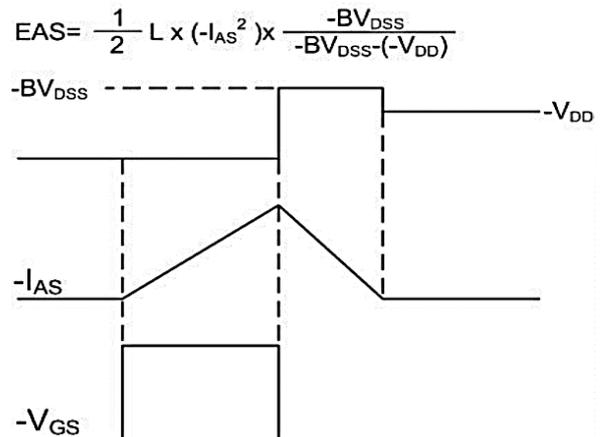
**Fig.8 Safe Operating Area**



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

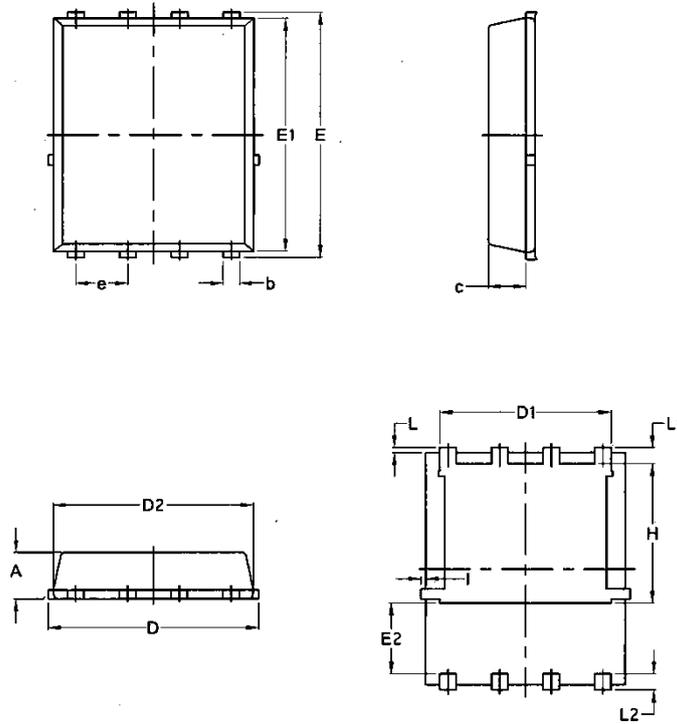


**Fig.10 Switching Time Waveform**



**Fig.11 Unclamped Inductive Switching Waveform**

### Package Mechanical Data-PDFN5\*6-8L-JQ



Symbol	Common			
	mm		Inch	
	Min	Max	Min	Max
A	1.03	1.17	0.0406	0.0461
b	0.34	0.48	0.0134	0.0189
c	0.824	0.0970	0.0324	0.082
D	4.80	5.40	0.1890	0.2126
D1	4.11	4.31	0.1618	0.1697
D2	4.80	5.00	0.1890	0.1969
E	5.95	6.15	0.2343	0.2421
E1	5.65	5.85	0.2224	0.2303
E2	1.60	/	0.0630	/
e	1.27 BSC		0.05 BSC	
L	0.05	0.25	0.0020	0.0098
L1	0.38	0.50	0.0150	0.0197
L2	0.38	0.50	0.0150	0.0197
H	3.30	3.50	0.1299	0.1378
I	/	0.18	/	0.0070

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

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

Edition	Date	Change
Rve1.0	2021/4/30	Initial release

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