

## 40V N+N-Channel Enhancement Mode MOSFET

### Description

The AP30H04DF 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.

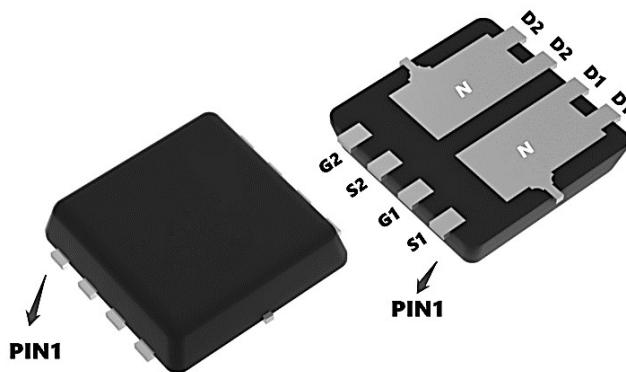
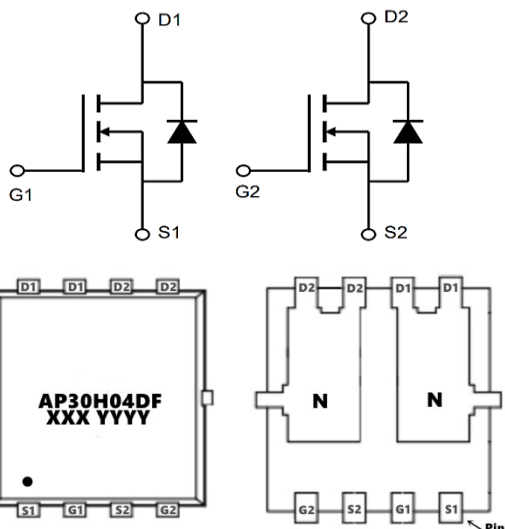
### General Features

$V_{DS} = 40V$   $I_D = 30A$

$R_{DS(ON)} < 14m\Omega$  @  $V_{GS}=10V$  (Type: 11m $\Omega$ )

### Application

- Wireless charging
- Boost driver
- Brushless motor



### Package Marking and Ordering Information

Product ID	Pack	Marking	Qty(PCS)
AP30H04DF	PDFN3*3-8L	AP30H04DF XXX YYYYY	5000

### Absolute Maximum Ratings ( $T_c=25^\circ C$ unless otherwise noted)

Symbol	Parameter	Rating	Units
V <sub>DS</sub>	Drain-Source Voltage	40	V
V <sub>GS</sub>	Gate-Source Voltage	±20	V
I <sub>D</sub> @T <sub>A</sub> =25°C	Continuous Drain Current <sup>1</sup>	30	A
I <sub>D</sub> @T <sub>A</sub> =70°C	Continuous Drain Current <sup>1</sup>	21	A
I <sub>DM</sub>	Pulsed Drain Current <sup>2</sup>	36	A
E <sub>AS</sub>	Single Pulse Avalanche Energy <sup>3</sup>	31	mJ
I <sub>AS</sub>	Avalanche Current	25	A
P <sub>D</sub> @T <sub>A</sub> =25°C	Total Power Dissipation <sup>4</sup>	1.9	W
T <sub>STG</sub>	Storage Temperature Range	-55 to 150	°C
T <sub>J</sub>	Operating Junction Temperature Range	-55 to 150	°C
R <sub>θJA</sub>	Thermal Resistance Junction-ambient <sup>1</sup> (t≤10s)	62.5	°C/W
R <sub>θJC</sub>	Thermal Resistance Junction-ambient <sup>1</sup>	8	°C/W

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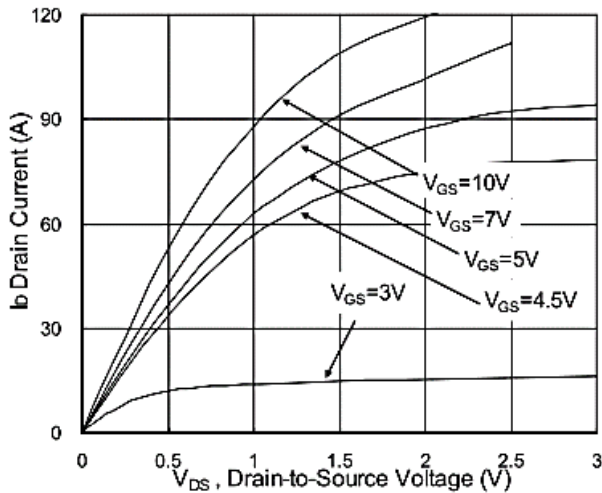
### Electrical Characteristics ( $T_c=25^\circ\text{C}$ unless otherwise noted)

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
BVDSS	Drain-Source Breakdown Voltage	$V_{GS}=0V, I_D=250\mu A$	40	44	---	V
$\Delta BVDSS/\Delta T_J$	BVDSS Temperature Coefficient	Reference to $25^\circ\text{C}, I_D=1\text{mA}$	---	0.034	---	$V/^\circ\text{C}$
RDS(ON)	Static Drain-Source On-Resistance <sup>2</sup>	$V_{GS}=10V, I_D=8A$	---	11	14	m $\Omega$
		$V_{GS}=4.5V, I_D=6A$	---	13	18	
VGS(th)	Gate Threshold Voltage	$V_{GS}=V_{DS}, I_D=250\mu A$	1.0	1.6	2.5	V
$\Delta V_{GS(th)}$	$V_{GS(th)}$ Temperature Coefficient		---	-5.64	---	$\text{mV}/^\circ\text{C}$
IDSS	Drain-Source Leakage Current	$V_{DS}=32V, V_{GS}=0V, T_J=25^\circ\text{C}$	---	---	1	$\mu\text{A}$
		$V_{DS}=32V, V_{GS}=0V, T_J=55^\circ\text{C}$	---	---	5	
IGSS	Gate-Source Leakage Current	$V_{GS}=\pm 20V, V_{DS}=0V$	---	---	$\pm 100$	nA
gfs	Forward Transconductance	$V_{DS}=5V, I_D=8A$	---	36	---	S
$R_g$	Gate Resistance	$V_{DS}=0V, V_{GS}=0V, f=1\text{MHz}$	---	2.1	---	$\Omega$
$Q_g$	Total Gate Charge (4.5V)	$V_{DS}=20V, V_{GS}=4.5V, I_D=8A$	---	10.7	---	nC
$Q_{gs}$	Gate-Source Charge		---	3.3	---	nC
$Q_{gd}$	Gate-Drain Charge		---	4.2	---	nC
$T_d(\text{on})$	Turn-On Delay Time	$V_{DD}=12V, V_{GS}=10V, R_G=3.3\Omega, I_D=6A$	---	8.6	---	ns
$T_r$	Rise Time		---	3.4	---	ns
$T_d(\text{off})$	Turn-Off Delay Time		---	24.8	---	ns
$T_f$	Fall Time		---	2.2	---	ns
$C_{iss}$	Input Capacitance	$V_{DS}=15V, V_{GS}=0V, f=1\text{MHz}$	---	1314	---	pF
$C_{oss}$	Output Capacitance		---	120	---	
$C_{rss}$	Reverse Transfer Capacitance		---	88	---	
IS	Continuous Source Current <sup>1,5</sup>	$V_G=V_D=0V, \text{Force Current}$	---	---	8.5	A
ISM	Pulsed Source Current <sup>2,5</sup>		---	---	34	A
VSD	Diode Forward Voltage <sup>2</sup>	$V_{GS}=0V, I_S=1A, T_J=25^\circ\text{C}$	---	---	1.2	V

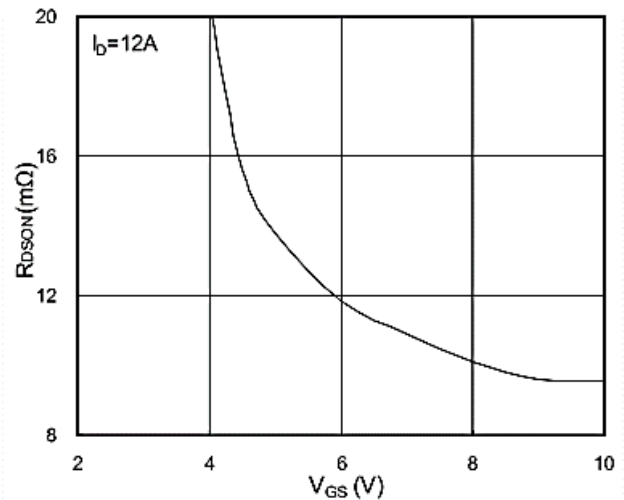
#### Note :

- 1、The data tested by surface mounted on a 1 inch<sup>2</sup> FR-4 board with 2OZ copper.
- 2、The data tested by pulsed , pulse width  $\leq 300\mu\text{s}$  , duty cycle  $\leq 2\%$
- 3、EAS condition:  $T_J=25^\circ\text{C}, V_{DD}=32V, V_{GS}=10V, L=0.1\text{Mh}, I_{AS}=22A$
- 4、The power dissipation is limited by  $150^\circ\text{C}$  junction temperature
- 5、The data is theoretically the same as  $I_D$  and  $I_{DM}$  , in real applications , should be limited by total power dissipation.

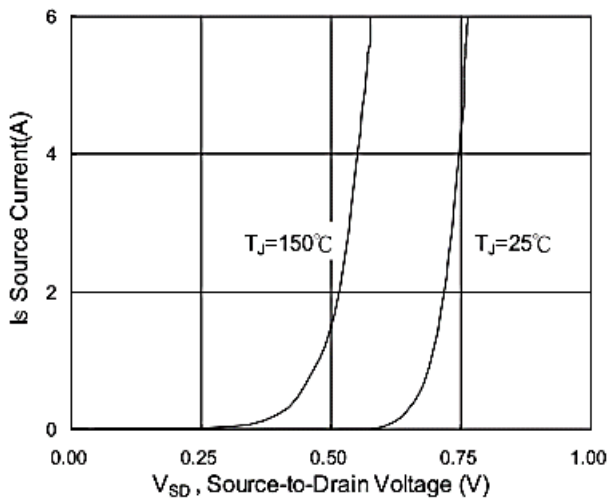
**Typical Characteristics**



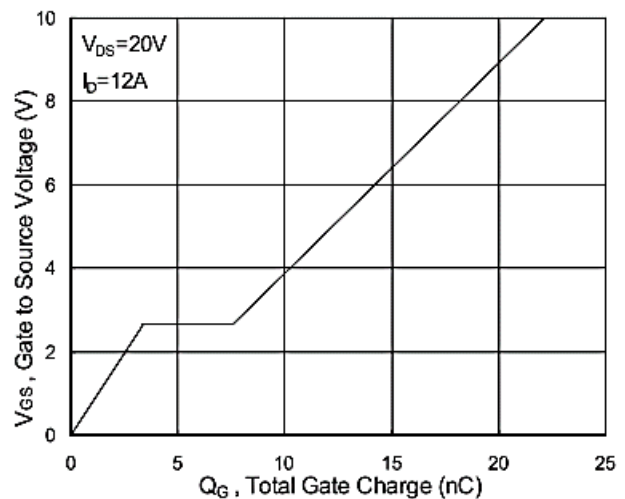
**Fig.1 Typical Output Characteristics**



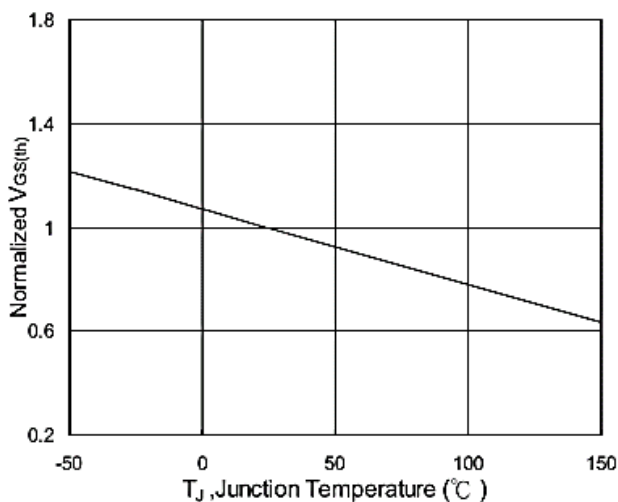
**Fig.2 On-Resistance vs. G-S Voltage**



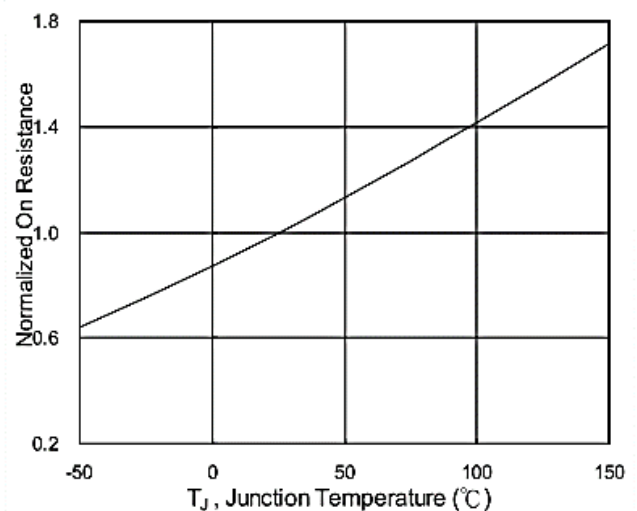
**Fig.3 Forward Characteristics of Reverse**



**Fig.4 Gate-Charge Characteristics**

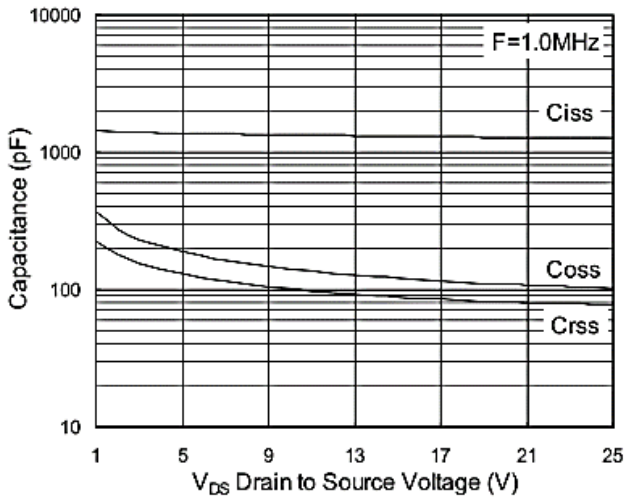


**Fig.5  $V_{GS(th)}$  vs.  $T_J$**

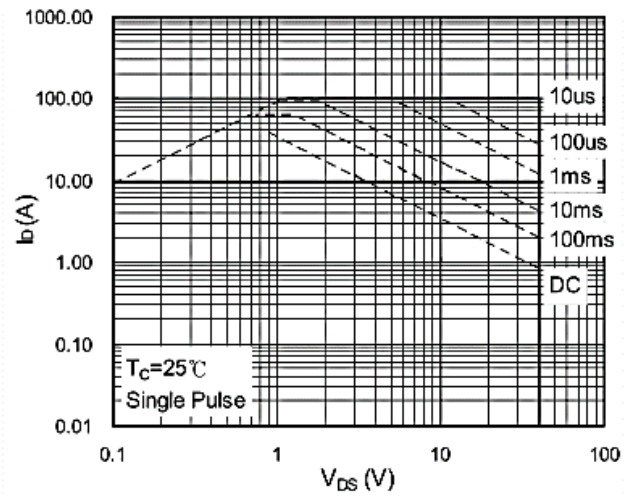


**Fig.6 Normalized  $R_{DS(on)}$  vs.  $T_J$**

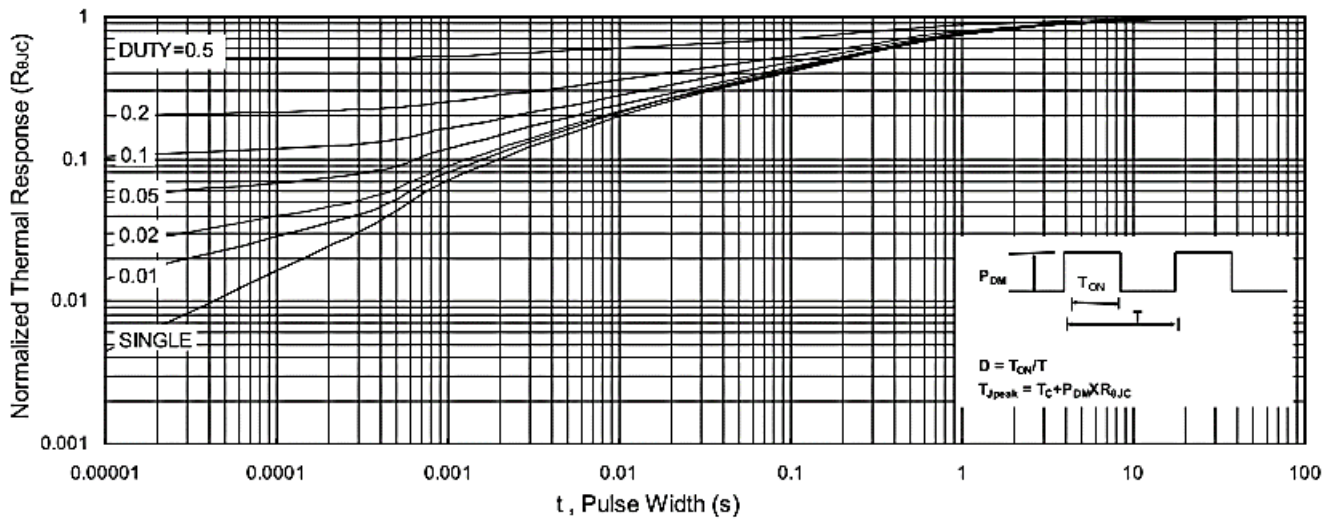
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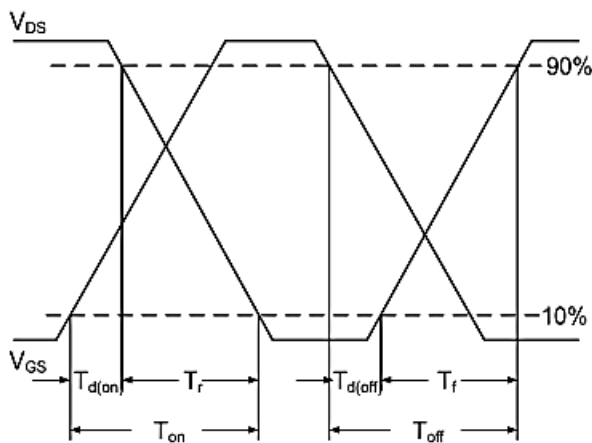
**Fig.7 Capacitance**



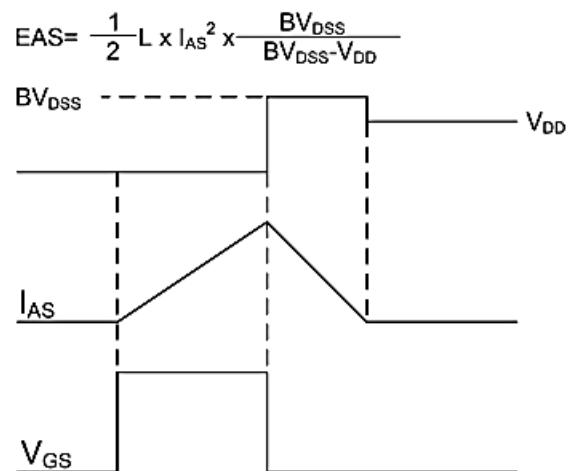
**Fig.8 Safe Operating Area**



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

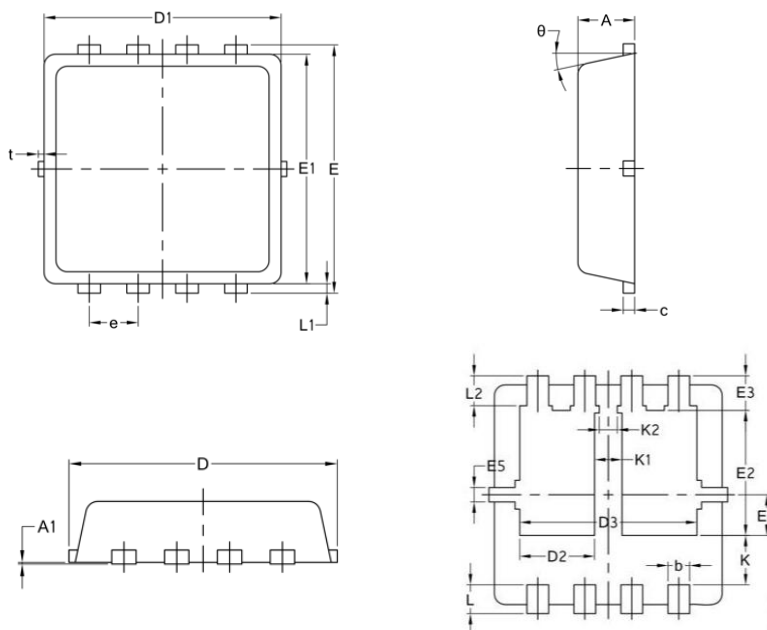


**Fig.10 Switching Time Waveform**



**Fig.11 Unclamped Inductive Switching Waveform**

### Package Mechanical Data-PDFN3\*3-8L Double



Symbol	Common		
	Mm		
	Min	Nom	Max
A	0.70	0.75	0.85
A1	/	/	0.05
b	0.25	0.30	0.39
c	0.14	0.152	0.20
D	3.20	3.30	3.45
D1	3.05	3.15	3.25
D2	0.84	1.04	1.24
D3	2.30	2.45	2.60
E	3.20	3.30	3.40
E1	2.95	3.05	3.15
E2	1.60	1.74	1.90
E3	0.28	0.48	0.65
E4	0.37	0.57	0.77
E5	0.10	0.20	0.30
e	0.60	0.65	0.70
K	0.50	0.69	0.80
K1	0.30	0.38	0.53
K2	0.15	0.25	0.35
L	0.30	0.40	0.50
L1	0.06	0.125	0.20
L2	0.27	0.42	0.57
t	0	0.075	0.13
Φ	10°	12°	14°