

# FH4407A2

- 30V P-Channel Power MOSFET

## Description

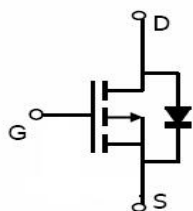
The FH4407A2 is the P-Channel enhancement mode MOSFET in a plastic package (SO-8) using the Trench technology.

## Applications

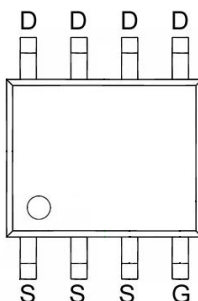
- ◆ High Speed Switch
- ◆ DC-DC Converters
- ◆ Lithium-Ion Battery

## Features

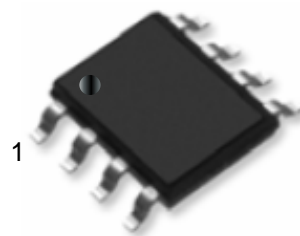
- ◆  $V_{DS} = -30V$  ;  $I_D = -11.5A$
- $R_{DS(ON)(MAX.)} \leq 15 m\Omega$  @  $V_{GS} = -10V$
- $R_{DS(ON)(MAX.)} \leq 25 m\Omega$  @  $V_{GS} = -4.5V$
- ◆ LogicLevelCompatible
- ◆ SMDPackage(SO-8)
- ◆ TrenchTechnology
- ◆ FastSwitching



Schematic diagram



Marking and Pin Assignment



SO-8 top view

## Absolute Maximum Rating

Symbol	Parameter	Rating	Units
$V_{DS}$	Drain-Source Voltage	-30	V
$V_{GS}$	Gate-Source Voltage	$\pm 20$	V
$I_D @ T_A = 25^\circ C$	Continuous Drain Current, $V_{GS} @ -10V$ <sup>1</sup>	-11.5	A
$I_D @ T_A = 70^\circ C$	Continuous Drain Current, $V_{GS} @ -10V$ <sup>1</sup>	-9	A
$I_{DM}$	Pulsed Drain Current <sup>2</sup>	-46	A
EAS	Single Pulse Avalanche Energy <sup>3</sup>	125	mJ
$I_{AS}$	Avalanche Current	-40	A
$P_D @ T_A = 25^\circ C$	Total Power Dissipation <sup>4</sup>	1.5	W
$T_{STG}$	Storage Temperature Range	-55 to 150	$^\circ C$
$T_J$	Operating Junction Temperature Range	-55 to 150	$^\circ C$

## Thermal Data

Symbol	Parameter	Typ.	Max.	Unit
$R_{\theta JA}$	Thermal Resistance Junction-Ambient <sup>1</sup>	---	75	$^\circ C/W$
	Thermal Resistance Junction-Ambient <sup>1</sup> ( $t \leq 10s$ )	---	40	$^\circ C/W$
$R_{\theta JC}$	Thermal Resistance Junction-Case <sup>1</sup>	---	24	$^\circ C/W$

## 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	---	---	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> =-10A	---	9.5	15	mΩ
		V <sub>GS</sub> =-4.5V, I <sub>D</sub> =-10A	---	14	25	
V <sub>GS(th)</sub>	Gate Threshold Voltage	V <sub>GS</sub> =V <sub>DS</sub> , I <sub>D</sub> =-250uA	-1.0	---	-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> =-10A	---	24	---	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> =-10A	---	20	---	nC
Q <sub>gs</sub>	Gate-Source Charge		---	5.1	---	
Q <sub>gd</sub>	Gate-Drain Charge		---	7.3	---	
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> =-1A	---	33.8	---	ns
T <sub>r</sub>	Rise Time		---	35.8	---	
T <sub>d(off)</sub>	Turn-Off Delay Time		---	72.8	---	
T <sub>f</sub>	Fall Time		---	10.6	---	
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	---	

## Diode Characteristics

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
I <sub>S</sub>	Continuous Source Current <sup>1,5</sup>	V <sub>G</sub> =V <sub>D</sub> =0V, Force Current	---	---	-11.5	A
I <sub>SM</sub>	Pulsed Source Current <sup>2,5</sup>		---	---	-46	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	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 EAS data shows Max. rating. The test condition is V<sub>DD</sub>=-25V, V<sub>GS</sub>=-10V, L=0.1mH, I<sub>AS</sub>=-50A
- 4.The power dissipation is limited by 150°C junction temperature
- 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.

Typical Characteristics

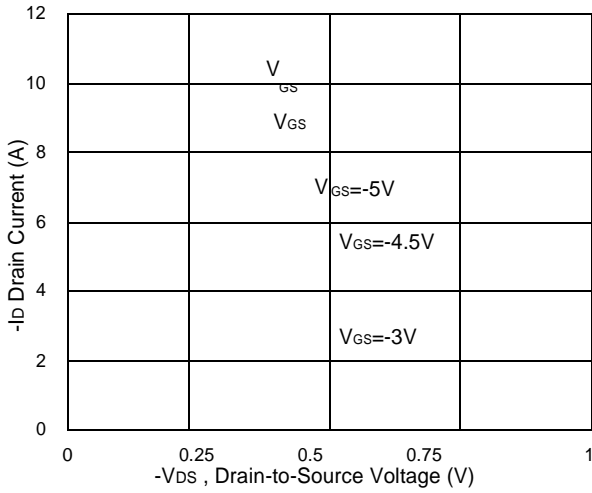


Fig.1 Typical Output Characteristics

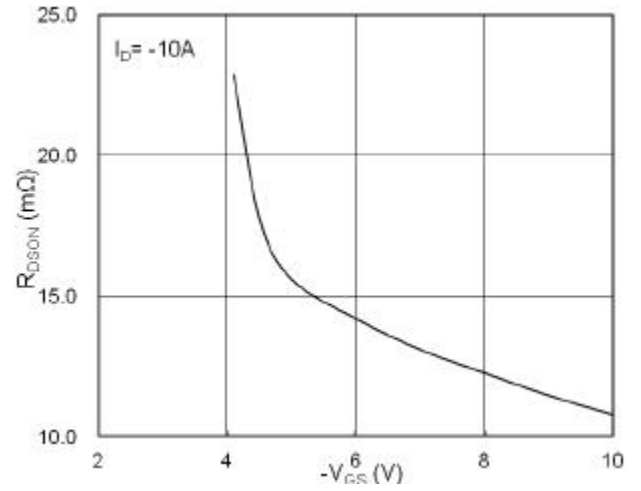


Fig.2 On-Resistance vs. G-S Voltage

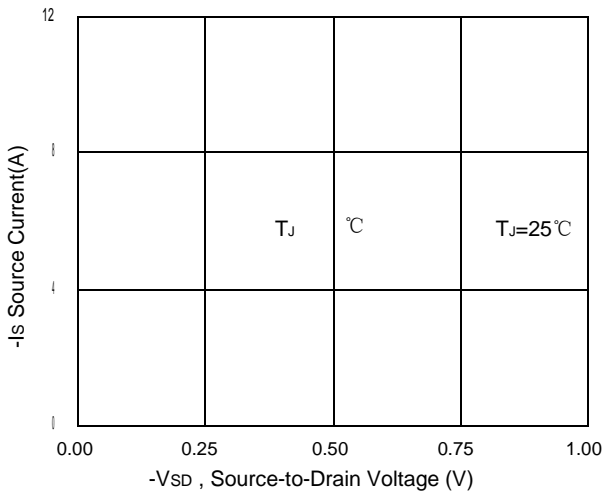


Fig.3 Forward Characteristics of Reverse

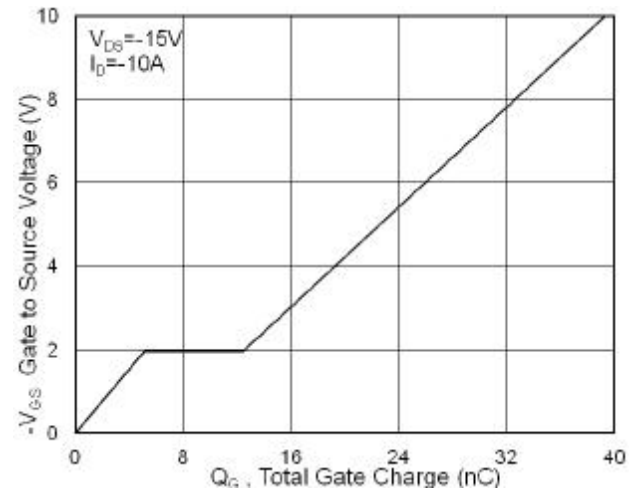


Fig.4 Gate-charge Characteristics

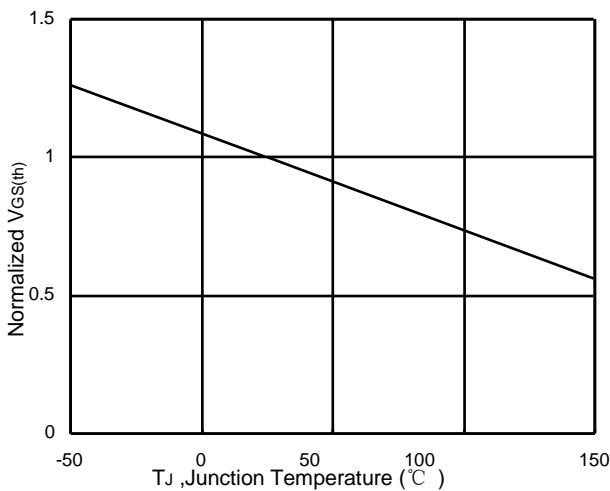


Fig.5 Normalized  $V_{GS(th)}$  vs.  $T_J$

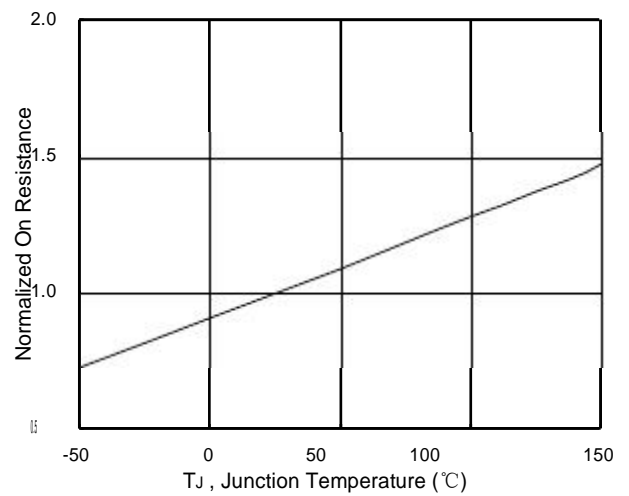


Fig.6 Normalized  $R_{DS(on)}$  vs.  $T_J$

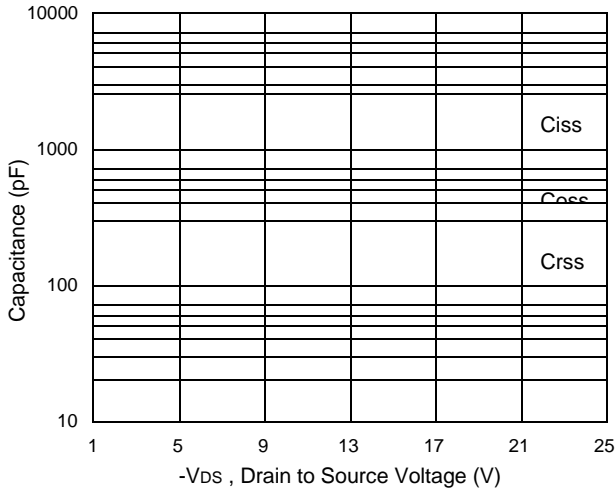


Fig.7 Capacitance

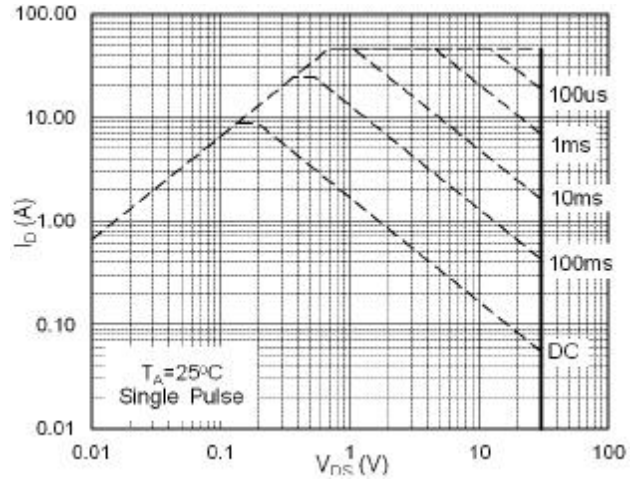


Fig.8 Safe Operating Area

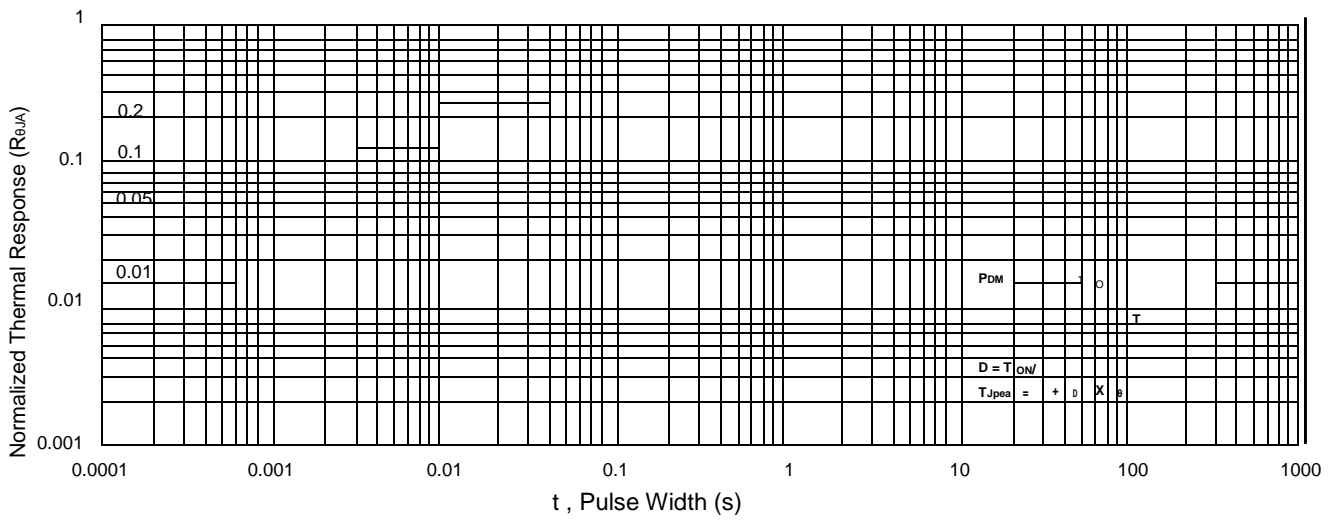


Fig.9 Normalized Maximum Transient Thermal Impedance

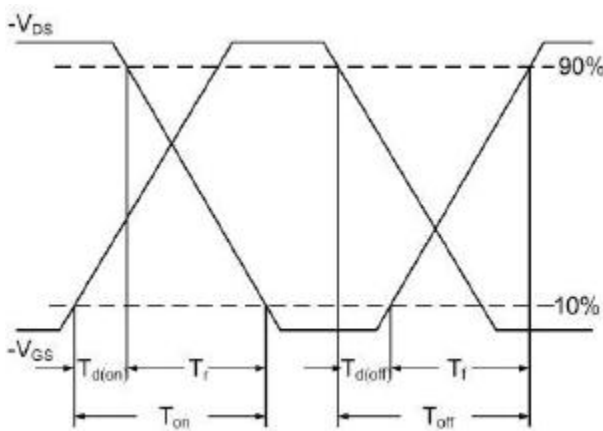


Fig.10 Switching Time Waveform

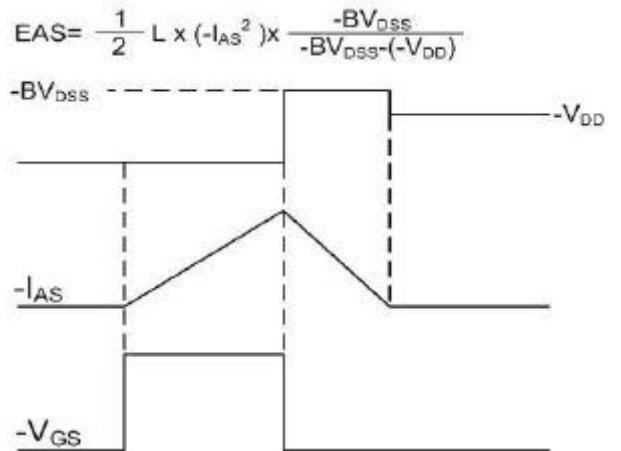
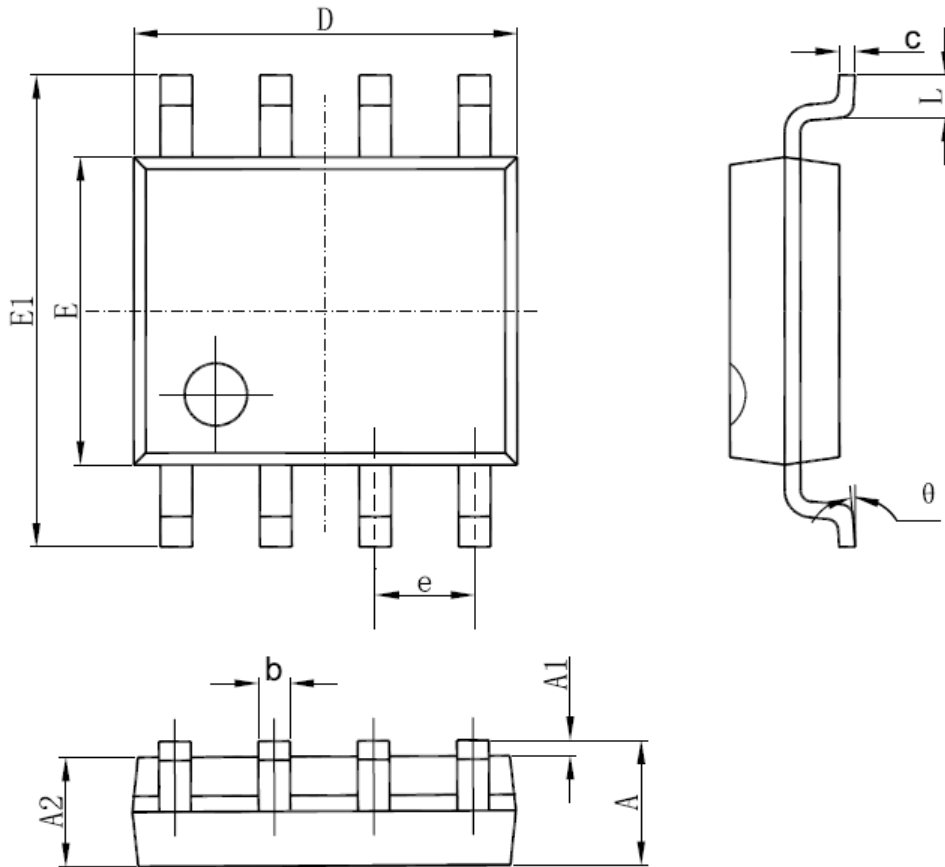


Fig.11 Unclamped Inductive Waveform

## Package Information : SO-8



SYMBOL	MM		INCH		SYMBOL	MM		INCH	
	MIN	MAX	MIN	MAX		MIN	MAX	MIN	MAX
A	1.350	1.750	0.053	0.069	E	3.800	4.000	0.150	0.157
A1	0.100	0.250	0.004	0.010	E1	5.800	6.200	0.228	0.244
A2	1.350	1.550	0.053	0.061	e	1.270 (BSC)		0.050 (BSC)	
b	0.330	0.510	0.013	0.020	L	0.400	1.270	0.016	0.050
c	0.170	0.250	0.006	0.010	theta	0°	8°	0°	8°
D	4.700	5.100	0.185	0.200					