



## Description

The HSQ7415AEN 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

$V_{DS} = -60V$   $I_D = -20A$

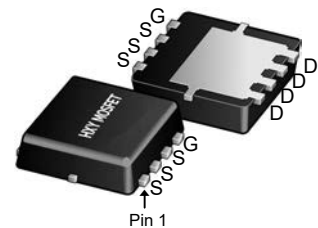
$R_{DS(ON)} < 65\text{ m}\Omega$  @  $V_{GS}=4.5V$

## Application

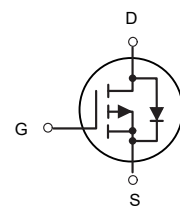
Battery protection

Load switch

Uninterruptible power supply



DFN3X3-8L  
(PowerPAK1212-8)



P-Channel MOSFET

## Package Marking and Ordering Information

Product ID	Pack	Brand	Qty(PCS)
HSQ7415AEN	DFN3X3-8L (PowerPAK1212-8)	HXY MOSFET	5000

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

Symbol	Parameter	Rating	Units
$V_{DS}$	Drain-Source Voltage	-60	V
$V_{GS}$	Gate-Source Voltage	$\pm 20$	V
$I_D@T_C=25^\circ\text{C}$	Continuous Drain Current, $V_{GS}$ @ 10V <sup>1</sup>	-20	A
$I_D@T_C=100^\circ\text{C}$	Continuous Drain Current, $V_{GS}$ @ 10V <sup>1</sup>	-12	A
IDM	Pulsed Drain Current <sup>2</sup>	-30	A
$P_D@T_C=25^\circ\text{C}$	Total Power Dissipation <sup>4</sup>	25	W
TSTG	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>	62	$^\circ\text{C/W}$
$R_{\theta JC}$	Thermal Resistance Junction-Case <sup>1</sup>	5	$^\circ\text{C/W}$



**Electrical Characteristics ( $T_J=25^\circ\text{C}$ , unless otherwise noted)**

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
$BV_{DSS}$	Drain-Source Breakdown Voltage	$V_{GS}=0V$ , $I_D=-250\mu A$	-60	---	---	V
$\Delta BV_{DSS}/\Delta T_J$	$BV_{DSS}$ Temperature Coefficient	Reference to $25^\circ\text{C}$ , $I_D=-1mA$	---	-0.023	---	$V/^\circ\text{C}$
$R_{DS(ON)}$	Static Drain-Source On-Resistance <sup>2</sup>	$V_{GS}=-10V$ , $I_D=-10A$	---	55	65	$m\Omega$
		$V_{GS}=-4.5V$ , $I_D=-6A$	---	83	90	
$V_{GS(th)}$	Gate Threshold Voltage	$V_{GS}=V_{DS}$ , $I_D=-250\mu A$	-1.2	---	-2.5	V
$\Delta V_{GS(th)}$	$V_{GS(th)}$ Temperature Coefficient		---	4	---	$mV/^\circ\text{C}$
$I_{DSS}$	Drain-Source Leakage Current	$V_{DS}=-24V$ , $V_{GS}=0V$ , $T_J=25^\circ\text{C}$	---	---	-1	$\mu A$
		$V_{DS}=-24V$ , $V_{GS}=0V$ , $T_J=55^\circ\text{C}$	---	---	-5	
$I_{GSS}$	Gate-Source Leakage Current	$V_{GS}=\pm 20V$ , $V_{DS}=0V$	---	---	$\pm 100$	nA
$g_{fs}$	Forward Transconductance	$V_{DS}=-5V$ , $I_D=-15A$	---	12	---	S
$Q_g$	Total Gate Charge (-4.5V)	$V_{DS}=-15V$ , $V_{GS}=-4.5V$ , $I_D=-15A$	---	6.1	---	nC
$Q_{gs}$	Gate-Source Charge		---	3.1	---	
$Q_{gd}$	Gate-Drain Charge		---	1.8	---	
$T_{d(on)}$	Turn-On Delay Time	$V_{DD}=-15V$ , $V_{GS}=-10V$ , $R_G=3.3\Omega$ , $I_D=-15A$	---	2.6	---	ns
$T_r$	Rise Time		---	8.6	---	
$T_{d(off)}$	Turn-Off Delay Time		---	33.6	---	
$T_f$	Fall Time		---	6	---	
$C_{iss}$	Input Capacitance	$V_{DS}=-15V$ , $V_{GS}=0V$ , $f=1MHz$	---	585	---	pF
$C_{oss}$	Output Capacitance		---	100	---	
$C_{rss}$	Reverse Transfer Capacitance		---	85	---	

**Diode Characteristics**

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
$I_S$	Continuous Source Current <sup>1,5</sup>	$V_G=V_D=0V$ , Force Current	---	---	-20	A
$I_{SM}$	Pulsed Source Current <sup>2,5</sup>		---	---	-30	A
$V_{SD}$	Diode Forward Voltage <sup>2</sup>	$V_{GS}=0V$ , $I_S=-1A$ , $T_J=25^\circ\text{C}$	---	---	-1.2	V
$t_{rr}$	Reverse Recovery Time	$I_F=-15A$ , $dI/dt=100A/\mu s$ ,	---	6.1	---	nS
$Q_{rr}$	Reverse Recovery Charge	$T_J=25^\circ\text{C}$	---	1.4	---	nC

Note :

- 1.The data tested by surface mounted on a 1 inch<sup>2</sup> FR-4 board with 20Z copper.
- 2.The data tested by pulsed , pulse width  $\leq 300\mu s$  , duty cycle  $\leq 2\%$
- 3.The EAS data shows Max. rating . The test condition is  $V_{DD}=-25V$ ,  $V_{GS}=-10V$ ,  $L=0.1mH$ ,  $I_{AS}=-19A$
- 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

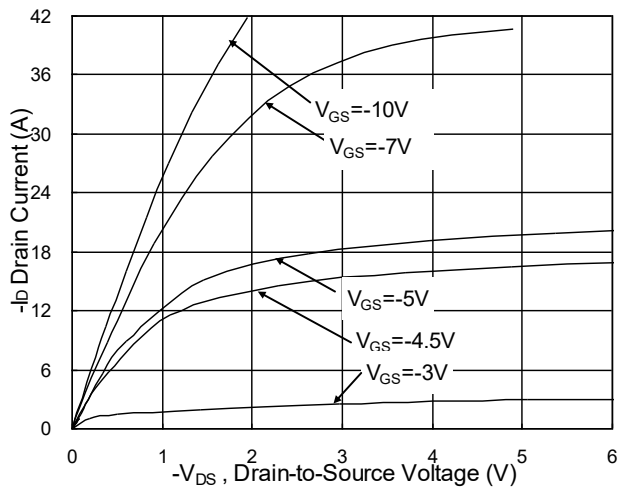


Fig.1 Typical Output Characteristics

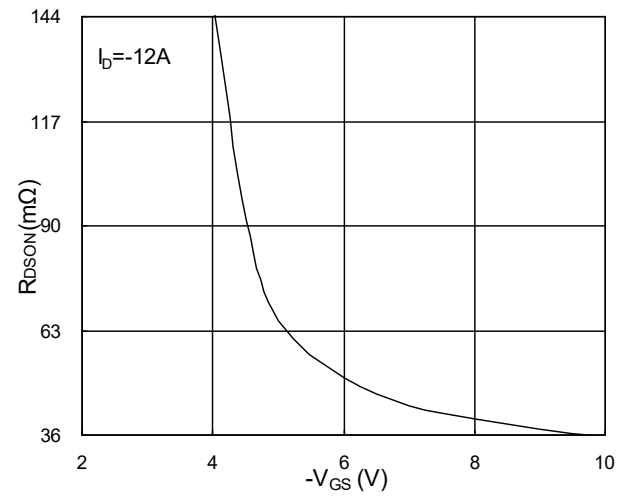


Fig.2 On-Resistance v.s Gate-Source

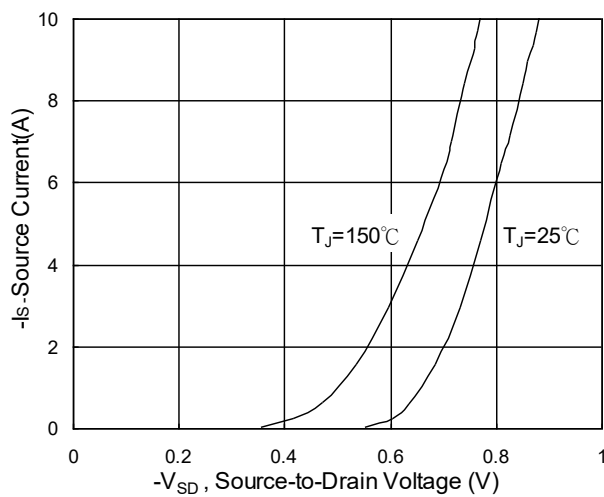


Fig.3 Forward Characteristics Of Reverse

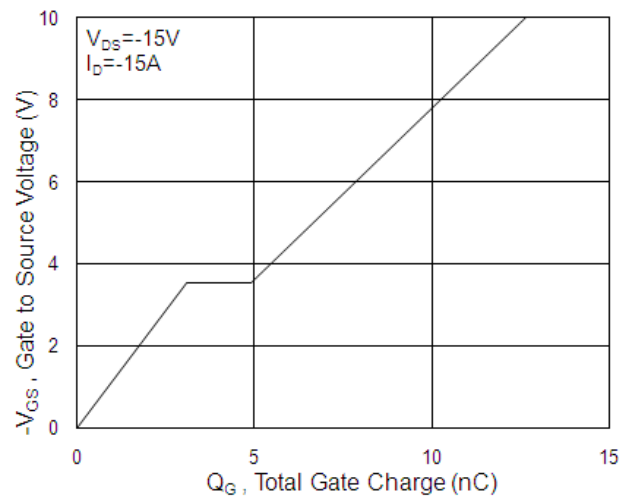


Fig.4 Gate Charge Characteristics

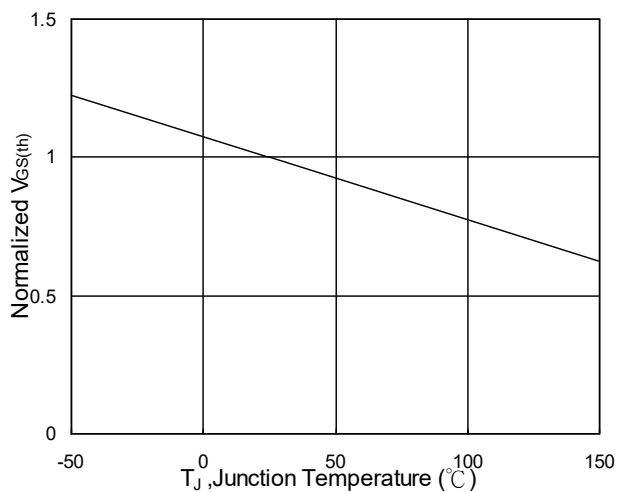


Fig.5 Normalized  $V_{GS(th)}$  vs.  $T_J$

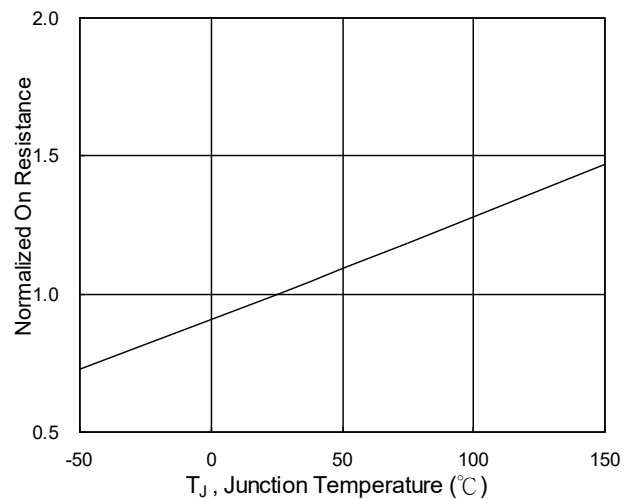


Fig.6 Normalized  $R_{DS(on)}$  vs.  $T_J$

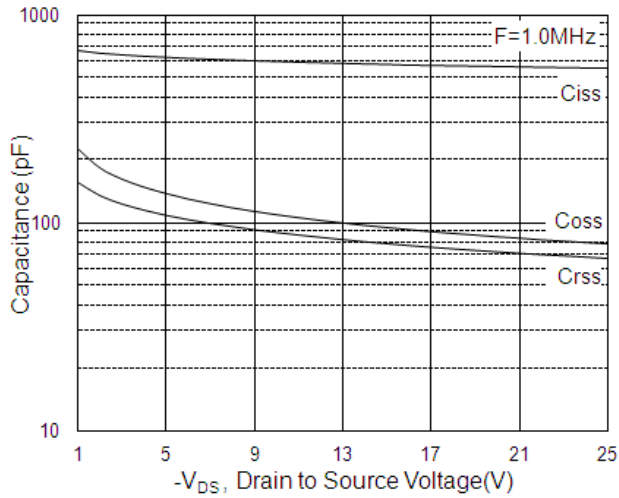


Fig.7 Capacitance

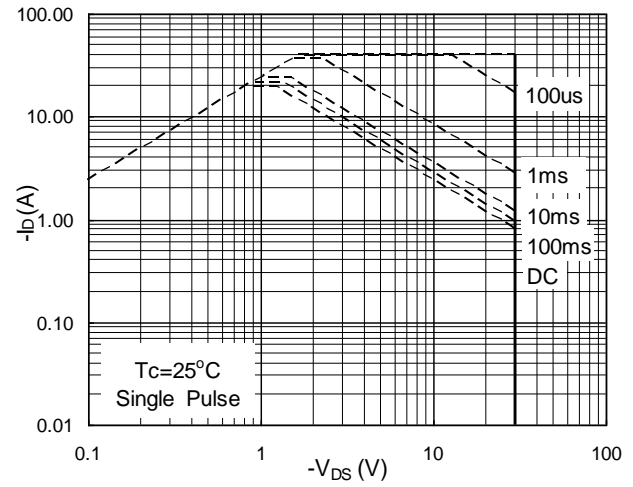


Fig.8 Safe Operating Area

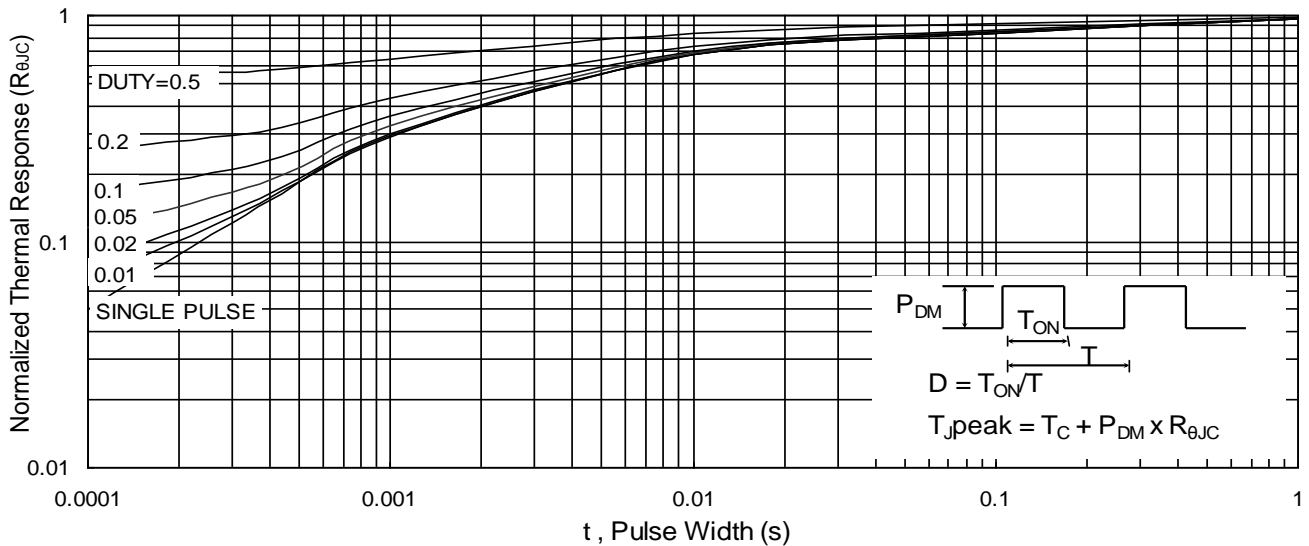


Fig.9 Normalized Maximum Transient Thermal Impedance

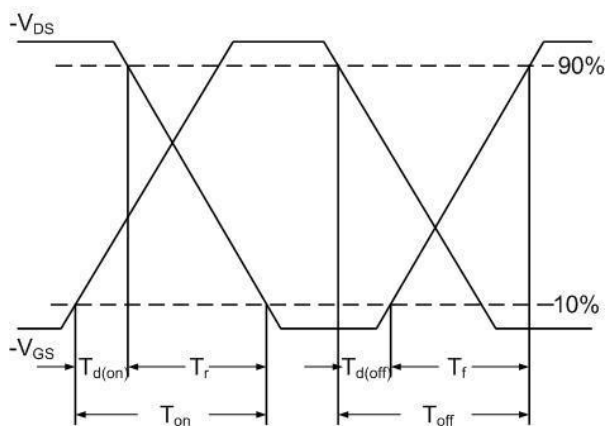


Fig.10 Switching Time Waveform

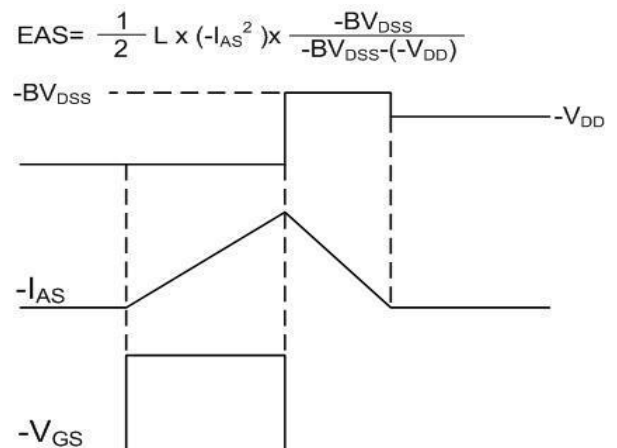
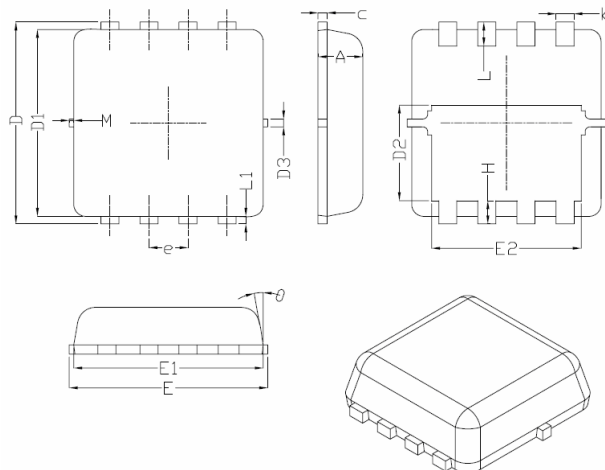


Fig.11 Unclamped Inductive Switching Waveform



## DFN3X3-8L(PowerPAK1212-8) Package Information



Symbol	Dimensions In Millimeters		
	Min.	Nom.	Max.
A	0.70	0.75	0.80
b	0.25	0.30	0.35
c	0.10	0.15	0.25
D	3.25	3.35	3.45
D1	3.00	3.10	3.20
D2	1.48	1.58	1.68
D3	-	0.13	-
E	3.20	3.30	3.40
E1	3.00	3.15	3.20
E2	2.39	2.49	2.59
e	0.65BSC		
H	0.30	0.39	0.50
L	0.30	0.40	0.50
L1	-	0.13	-
M	*	*	0.15
θ		10°	12°



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