

## 20V P-Channel Enhancement Mode MOSFET

### Description

The NP3415EHR uses advanced trench technology to provide excellent  $R_{DS(ON)}$ , low gate charge and operation with gate voltages as low as 1.8V. This device is suitable for use as a load switch or in PWM applications.

### General Features

- ◆  $V_{DS} = -20V$ ,  $I_D = -3A$   
 $R_{DS(ON)}(Typ.) = 40\ m\Omega @ V_{GS} = -4.5V$   
 $R_{DS(ON)}(Typ.) = 50\ m\Omega @ V_{GS} = -2.5V$
- ◆ High power and current handling capability
- ◆ Lead free product is acquired
- ◆ Surface mount package
- ◆ ESD Rating: 2500V HBM

### Application

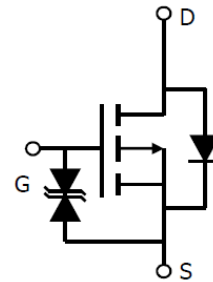
- ◆ PWM applications
- ◆ Load switch

### Package

- ◆ ESOT-23

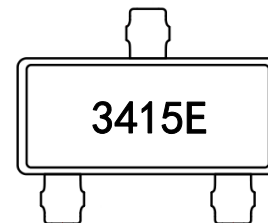


### Schematic diagram



### Marking and pin assignment

ESOT-23  
(TOP VIEW)



### Ordering Information

Part Number	Storage Temperature	Package	Devices Per Reel
NP3415EHR-G	-55°C to +150°C	ESOT-23	5000

### Absolute Maximum Ratings (TA=25°C unless otherwise noted)

parameter	symbol	limit	unit
Drain-source voltage	$V_{DS}$	-20	V
Gate-source voltage	$V_{GS}$	±8	V
Continuous Drain Current (T <sub>J</sub> = 150 °C)	$I_D$	T <sub>C</sub> =25°C	-3
		T <sub>C</sub> =70°C	-2.5
Pulsed Drain Current (t = 300 μs)	$I_{DM}$	-12	A
Maximum power dissipation	$P_D$	T <sub>C</sub> =25°C	1.7
		T <sub>C</sub> =70°C	1.1
Operating Junction and Storage Temperature Range	T <sub>J</sub> , T <sub>STG</sub>	-55—150	°C

## Thermal Characteristics

Parameter		Symbol	Typical	Maximum	Unit
Maximum Junction-to-Ambient	$t \leq 5 \text{ s}$	$R_{\theta JA}$	100	130	°C/W
Maximum Junction-to-Foot (Drain)	Steady State	$R_{\theta JF}$	60	75	

## Electrical Characteristics (TA=25°C unless otherwise noted)

Parameter	Symbol	Condition	Min	Typ	Max	Unit
<b>OFF Characteristics</b>						
Drain-source breakdown voltage	$BV_{DSS}$	$V_{GS}=0V, I_D=-250\mu A$	-20	-	-	V
Zero gate voltage drain current	$I_{DSS}$	$V_{DS}=-20V, V_{GS}=0V$	-	-	-1	$\mu A$
Gate-body leakage	$I_{GSS}$	$V_{DS}=0V, V_{GS}=\pm 8V$	-	-	$\pm 10$	$\mu A$
<b>ON Characteristics</b>						
Gate threshold voltage	$V_{GS(th)}$	$V_{DS}=V_{GS}, I_D=-250\mu A$	-0.4	-0.75	-1.0	V
Drain-source on-state resistance	$R_{DS(ON)}$	$V_{GS}=-4.5V, I_D=-3A$	-	40	51	m $\Omega$
		$V_{GS}=-2.5V, I_D=-3A$	-	50	61	
Forward transconductance	$g_{fs}$	$V_{DS}=-5V, I_D=-3A$	8	-	-	S
<b>Dynamic Characteristics</b>						
Input capacitance	$C_{ISS}$	$V_{DS}=-10V, V_{GS}=0V$ $f=1.0MHz$	-	1129	-	pF
Output capacitance	$C_{OSS}$		-	89	-	
Reverse transfer capacitance	$C_{RSS}$		-	46	-	
<b>Switching Characteristics</b>						
Turn-on delay time	$t_{D(ON)}$	$V_{DD}=-10V$ $I_D=-2.8A$ $V_{GEN}=-4.5V$ $R_L=10ohm$ $R_{GEN}=60ohm$	-	13	-	ns
Rise time	$t_r$		-	9	-	
Turn-off delay time	$t_{D(OFF)}$		-	19	-	
Fall time	$t_f$		-	29	-	
Total gate charge	$Q_g$	$V_{DS}=-10V, I_D=-3A$ $V_{GS}=-4.5V$	-	13.5	-	nC
Gate-source charge	$Q_{gs}$		-	1.0	-	
Gate-drain charge	$Q_{gd}$		-	1.9	-	
<b>DRAIN-SOURCE DIODE CHARACTERISTICS</b>						
Diode forward voltage	$V_{SD}$	$V_{GS}=0V, I_S=-1.25A$	-	-0.81	-1.2	V

## Typical Performance Characteristic

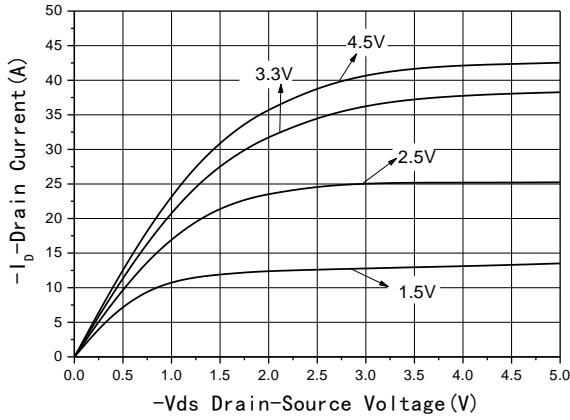


Fig1 Output Characteristics

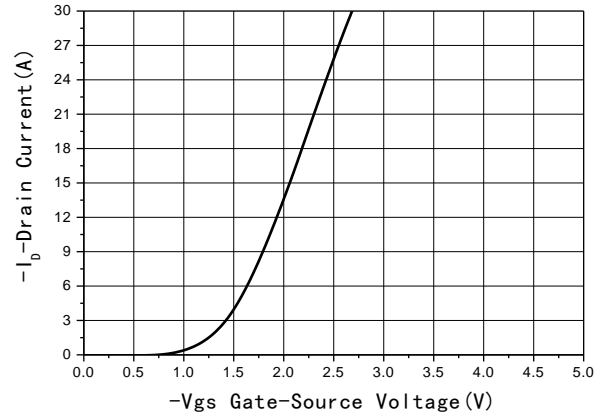


Fig2 Transfer Characteristics

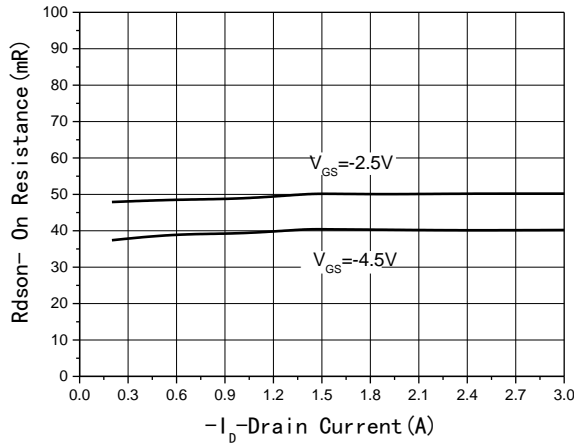


Fig3  $R_{DS(on)}$ -Drain current

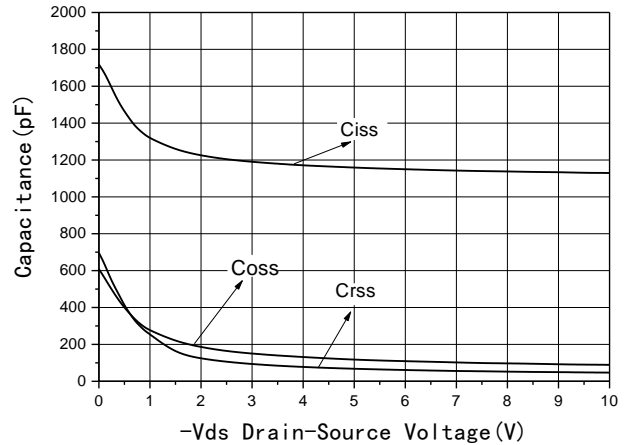


Fig4 Capacitance vs  $V_{DS}$

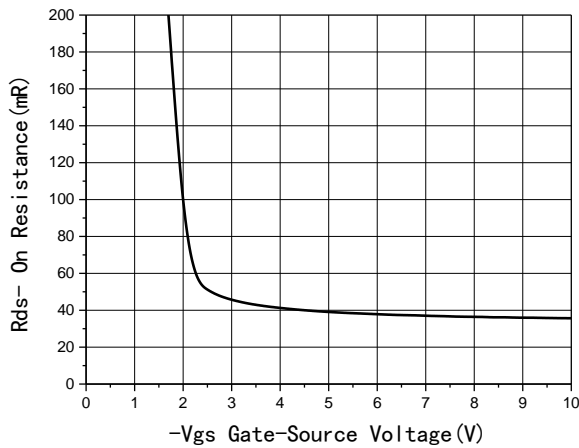


Fig5  $R_{DS(on)}$ -Gate Drain voltage

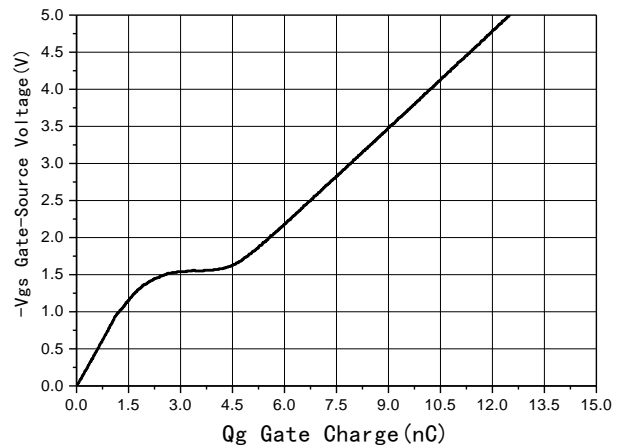
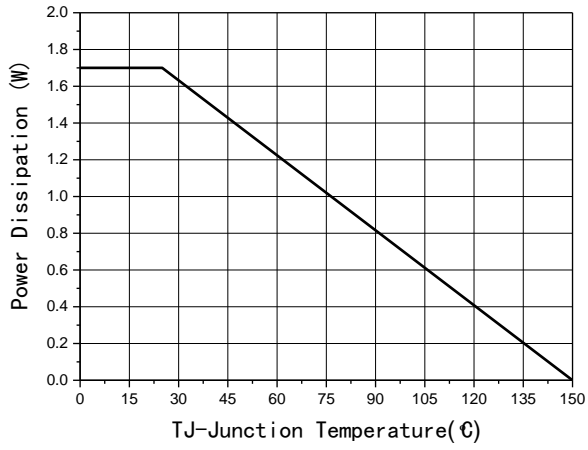
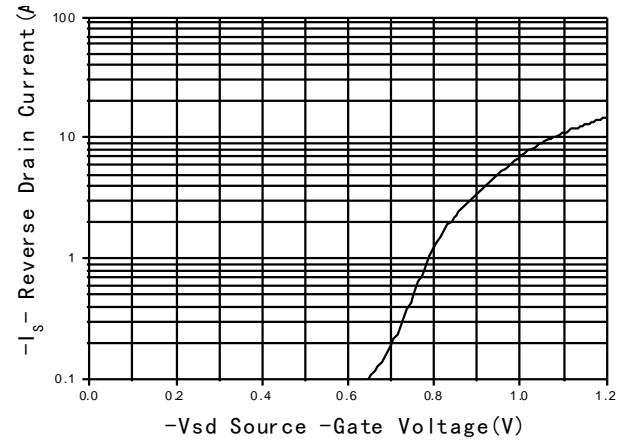


Fig6 Gate Charge



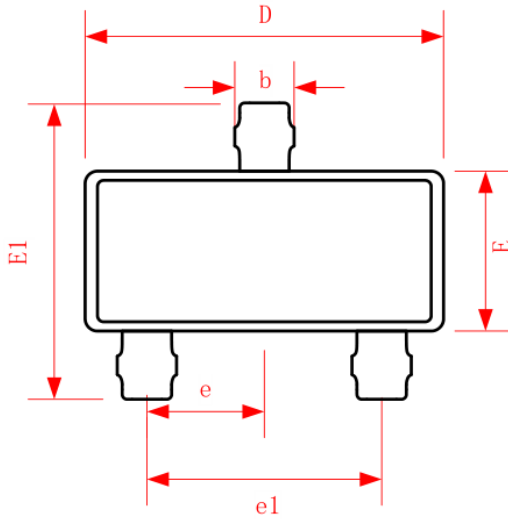
**Fig7 Power De-rating**



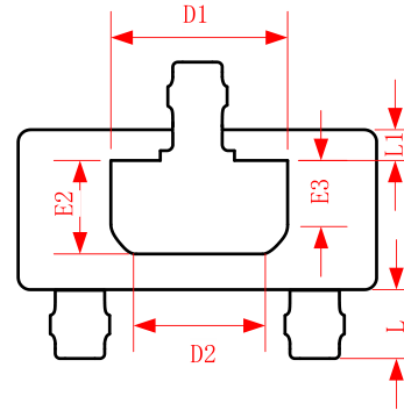
**Fig8 Source-Drain Diode Forward**

## Package Information

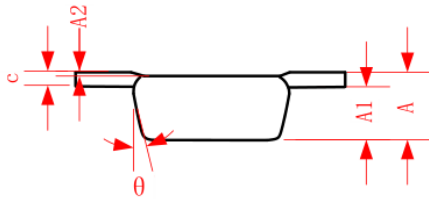
- ESOT-23



Top View  
【顶视图】



Bottom View  
【背视图】



Side View  
【侧视图】

Symbol	Dimensions In Millimeters		
	Min.	REF.	Max.
A	0.500	0.550	0.600
A1	0.368	0.398	0.428
A2	-0.030	0.000	0.030
c	0.152Ref		
D	2.850	2.900	2.950
E	1.250	1.300	1.350
E1	2.350	2.400	2.450
D1	1.405	1.430	1.455
D2	0.995	1.020	1.045
E2	0.735	0.760	0.785
E3	0.490	0.520	0.545
L	0.525	0.550	0.575
L1	0.235	0.260	0.285
e	0.950Ref		
e1	1.800	1.900	2.000
b	0.410	0.480	0.550
$\theta$	14°	15°	16°