

## 20V P-Channel Enhancement Mode MOSFET

### Description

The NP2301FHR 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

- ◆  $V_{DS} = -20V$ ,  $I_D = -3A$   
 $R_{DS(ON)}(Typ.) = 97\ m\Omega$  @  $V_{GS} = -4.5V$   
 $R_{DS(ON)}(Typ.) = 137\ m\Omega$  @  $V_{GS} = -2.5V$
- ◆ High power and current handling capability
- ◆ Lead free product is acquired
- ◆ Surface mount package

### Application

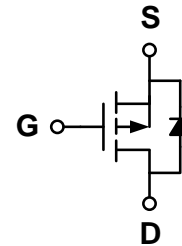
- ◆ PWM applications
- ◆ Load switch

### Package

- ◆ ESOT-23-3L

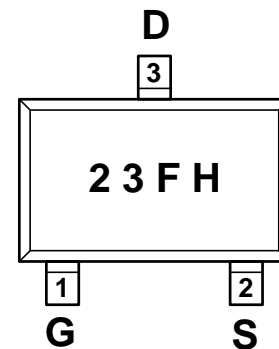


### Schematic diagram



### Marking and pin assignment

ESOT-23-3L  
(TOP VIEW)



### Ordering Information

Part Number	Storage Temperature	Package	Devices Per Reel
NP2301FHR-G	-55°C to +150°C	ESOT-23-3L	5000

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

parameter	symbol	limit	unit
Drain-source voltage	$V_{DS}$	-20	V
Gate-source voltage	$V_{GS}$	±12	V
Drain current-continuous <sup>a</sup> @ $T_j = 125^\circ C$ -pulse <sup>b</sup>	$I_D$	-3	A
	$I_{DM}$	-7.5	A
Drain-source Diode forward current	$I_S$	-1.25	A
Maximum power dissipation	$P_D$	1	W
Operating junction Temperature range	$T_j$	-55—150	°C

**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	$I_{GSS}$	$V_{DS}=0V, V_{GS}=\pm 12V$	-	-	$\pm 100$	nA
<b>ON Characteristics</b>						
Gate threshold voltage	$V_{GS(th)}$	$V_{DS}=V_{GS}, I_D=-250\mu A$	-0.5	-0.7	-1.2	V
Drain-source on-state resistance	$R_{DS(ON)}$	$V_{GS}=-4.5V, I_D=-1.8A$	-	97	180	m $\Omega$
		$V_{GS}=-2.5V, I_D=-1A$	-	137	275	
Forward transconductance	gfs	$V_{GS}=-5V, I_D=-1.8A$	-	5	-	S
<b>Dynamic Characteristics</b>						
Input capacitance	$C_{ISS}$	$V_{DS}=-10V, V_{GS}=0V$ $f=1.0MHz$	-	148	-	pF
Output capacitance	$C_{OSS}$		-	26	-	
Reverse transfer capacitance	$C_{RSS}$		-	20	-	
<b>Switching Characteristics</b>						
Turn-on delay time	$t_{D(ON)}$	$V_{DD}=-10V$ $I_D=-1A$ $V_{GEN}=-4.5V$ $R_L=10ohm$ $R_{GEN}=-60ohm$	-	11	-	ns
Rise time	$t_r$		-	5.5	-	
Turn-off delay time	$t_{D(OFF)}$		-	22	-	
Fall time	$t_f$		-	8	-	
Total gate charge	Qg	$V_{DS}=-10V, I_D=-1A$ $V_{GS}=-4.5V$	-	4.3	-	nC
Gate-source charge	Qgs		-	0.39	-	
Gate-drain charge	Qgd		-	0.35	-	
<b>DRAIN-SOURCE DIODE CHARACTERISTICS</b>						
Diode forward voltage	$V_{SD}$	$V_{GS}=0V, I_S=-1.25A$	-	-0.81	-1.2	V

**Notes:**

- surface mounted on FR4 board,  $t \leq 10sec$
- pulse test: pulse width  $\leq 300\mu s$ , duty  $\leq 2\%$
- guaranteed by design, not subject to production testing

**Thermal Characteristics**

Thermal Resistance junction-to ambient	Rth JA	100	$^{\circ}C/W$
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## Typical Performance Characteristics

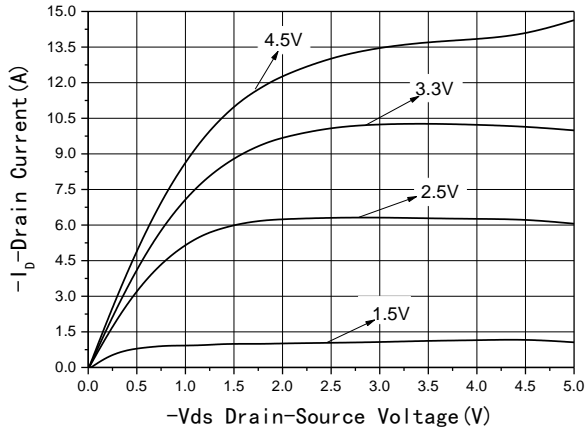


Fig1 Output Characteristics

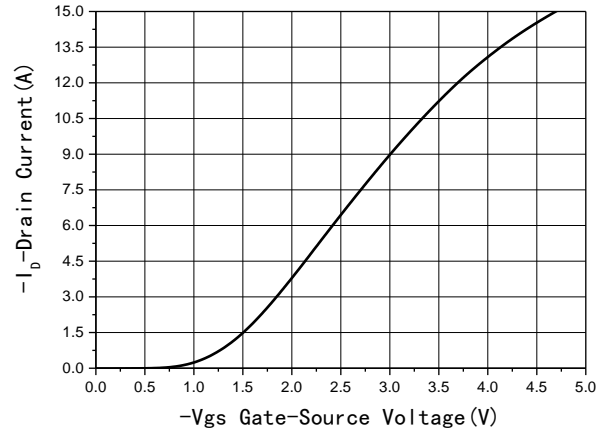


Fig2 Transfer Characteristics

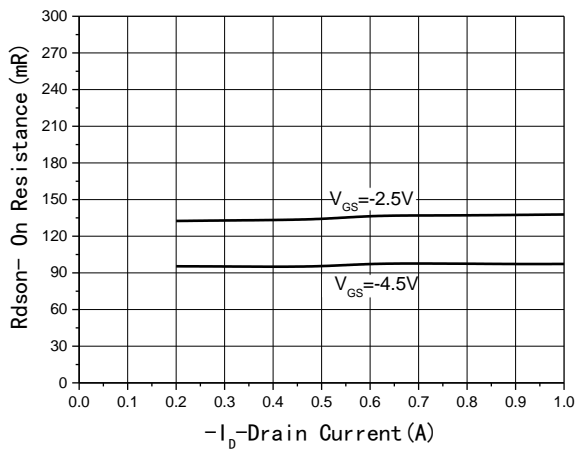


Fig3  $R_{DS(on)}$ -Drain current

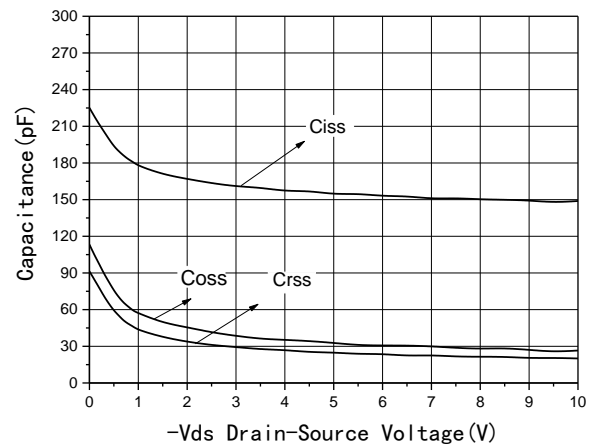


Fig4 Capacitance vs  $V_{DS}$

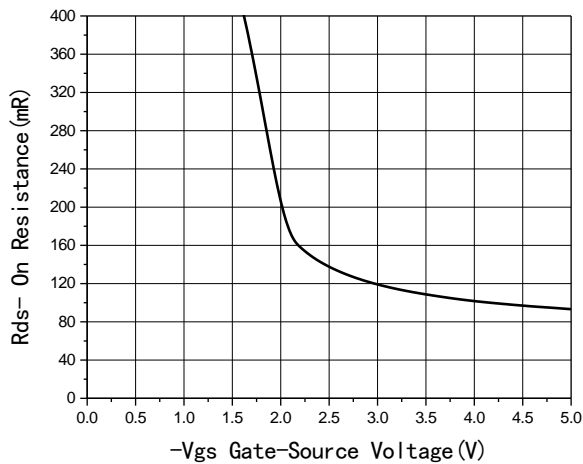


Fig5  $R_{DS(on)}$ -Gate Drain voltage

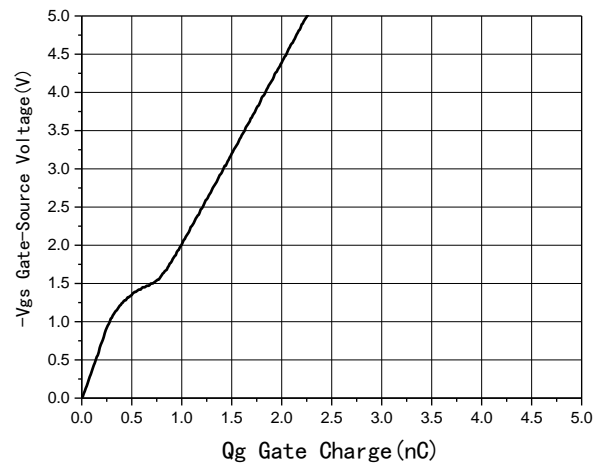


Fig6 Gate Charge

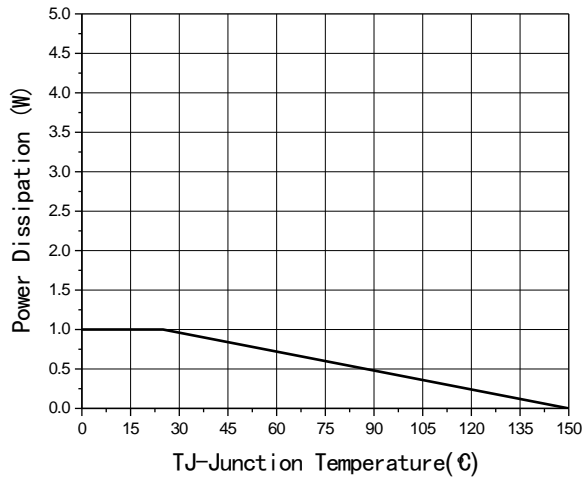


Fig7 Power De-rating

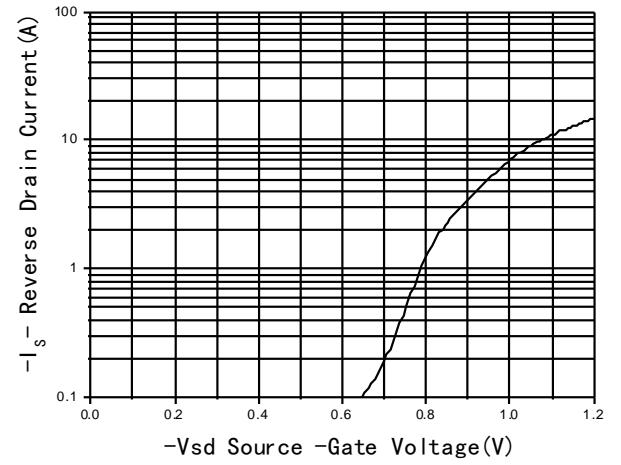
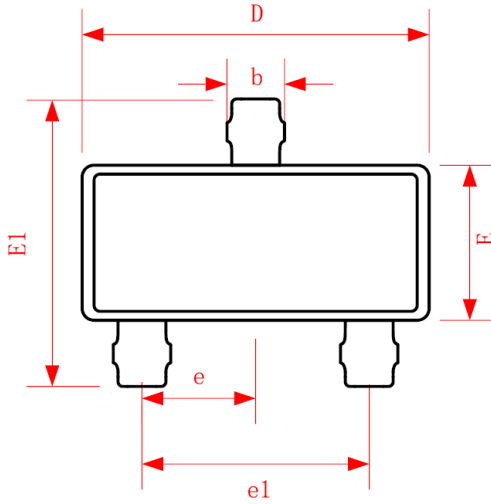


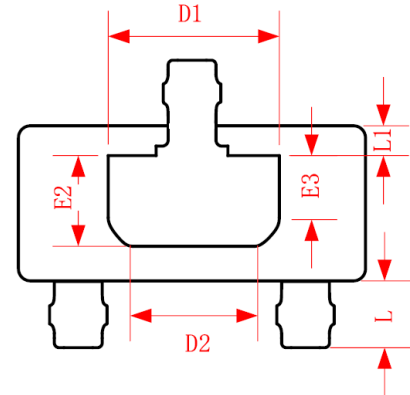
Fig8 Source-Drain Diode Forward

## Package Information

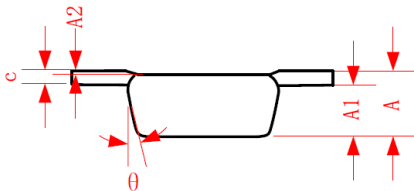
- ESOT-23-3L



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
θ	14°	15°	16°