

## N-Channel Enhancement Mode MOSFET

### Description

The NP2312 uses advanced trench technology to provide excellent  $R_{DS(ON)}$ , low gate charge and operation with gate voltages as low as 2.5V. This device is suitable for use as a load switch or in PWM applications.

### General Features

- ◆  $V_{DS} = 20V$ ,  $I_D = 6A$   
 $R_{DS(ON)}(Typ.) = 13.5m\Omega$  @  $V_{GS} = 4.5V$   
 $R_{DS(ON)}(Typ.) = 17m\Omega$  @  $V_{GS} = 2.5V$
- ◆ High power and current handling capability
- ◆ Lead free product is acquired
- ◆ Surface mount package

### Application

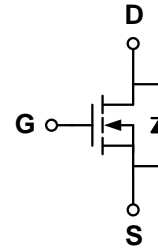
- ◆ PWM applications
- ◆ Load switch

### Package

- ◆ SOT-23-3L

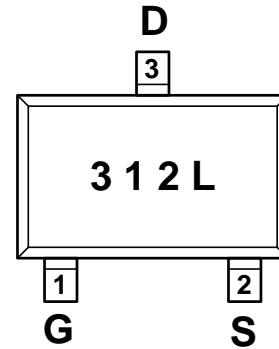


### Schematic diagram



### Marking and pin assignment

SOT-23-3L  
(TOP VIEW)



### Ordering Information

Part Number	Storage Temperature	Package	Devices Per Reel
NP2312MR-G	-55°C to +150°C	SOT-23-3L	3000

### 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
Continuous Drain Current	$I_D$	$T_C = 25^\circ C$	6
		$T_C = 70^\circ C$	5
Pulsed Drain Current <sup>C</sup>	$I_{DP}$	24	A
power dissipation <sup>B</sup>	$P_D$	$T_C = 25^\circ C$	1.4
		$T_C = 70^\circ C$	0.9
Junction and Storage Temperature Range	$T_J, T_{SGT}$	-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	0.9	V
Drain-source on-state resistance	$R_{DS(on)}$	$V_{GS}=4.5V, I_D=6A$	-	13.5	18	m $\Omega$
		$V_{GS}=2.5V, I_D=5.5A$	-	17	24	
Forward transconductance	gfs	$V_{GS}=5V, I_D=6A$	-	10	-	S
<b>Dynamic Characteristics</b>						
Input capacitance	$C_{ISS}$	$V_{DS}=10V, V_{GS}=0V$ $f=1.0MHz$	-	900	-	pF
Output capacitance	$C_{OSS}$		-	220	-	
Reverse transfer capacitance	$C_{RSS}$		-	100	-	
<b>Switching Characteristics</b>						
Turn-on delay time	$t_{D(ON)}$	$V_{DD}=10V$ $I_D=6A$ $V_{GEN}=4.5V$ $R_{GEN}=6ohm$	-	10	20	ns
Rise time	$t_r$		-	11	25	
Turn-off delay time	$t_{D(OFF)}$		-	35	70	
Fall time	$t_f$		-	30	60	
Total gate charge	Qg	$V_{DS}=10V, I_D=6A$ $V_{GS}=4.5V$	-	12	15	nC
Gate-source charge	Qgs		-	2.3	-	
Gate-drain charge	Qgd		-	1	-	
<b>DRAIN-SOURCE DIODE CHARACTERISTICS</b>						
Diode forward voltage	$V_{SD}$	$V_{GS}=0V, I_S=6A$	-	-	1.2	V

**Thermal Characteristics**

Parameter	Symbol	Typ.	Max.	Unit
Maximum Junction-to-Ambient <sup>A</sup>	$R_{\theta JA}$	70	90	°C/W
Maximum Junction-to-Ambient <sup>A D</sup>		Steady-State	100	
Maximum Junction-to-Lead	$R_{\theta JL}$	62	80	

A. The value of  $R_{\theta JA}$  is measured with the device mounted on 1in<sup>2</sup> FR-4 board with 2oz. Copper, in a still air environment with  $T_A=25^\circ C$ . The value in any given application depends on the user's specific board design.

B. The power dissipation PD is based on  $T_{J(MAX)}=150^\circ C$ , using  $\leq 10s$  junction-to-ambient thermal resistance.

C. Repetitive rating, pulse width limited by junction temperature  $T_{J(MAX)}=150^\circ C$ . Ratings are based on low frequency and duty

## Typical Performance Characteristics

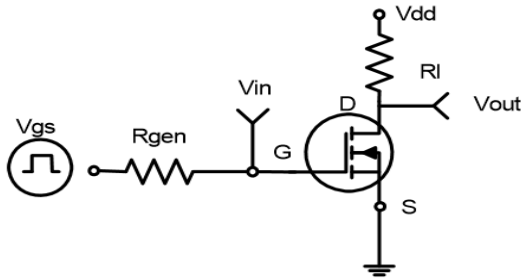


Figure 1: Switching Test Circuit

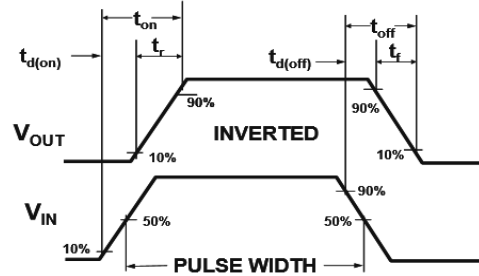
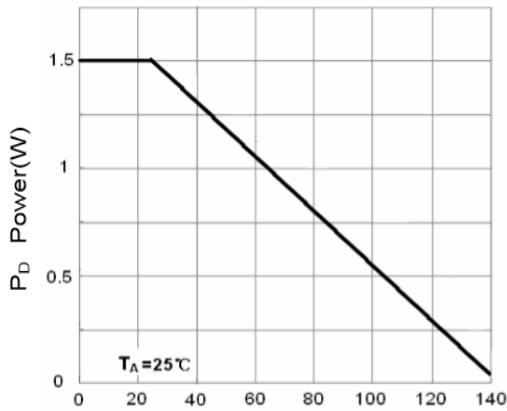
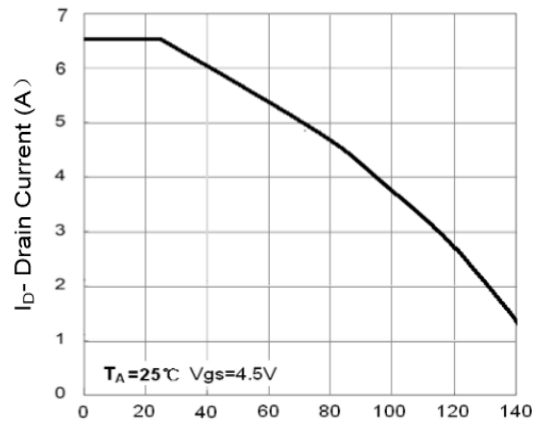


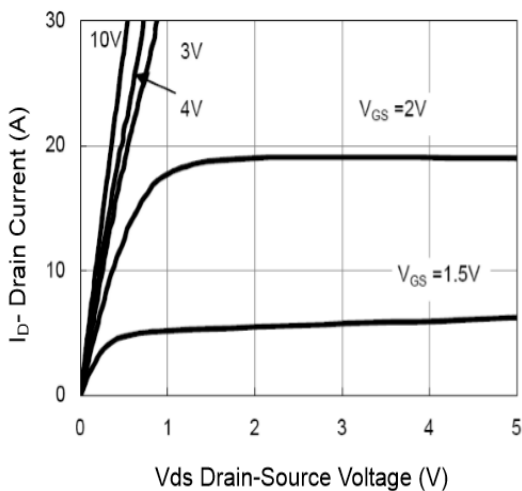
Figure 2: Switching Waveforms



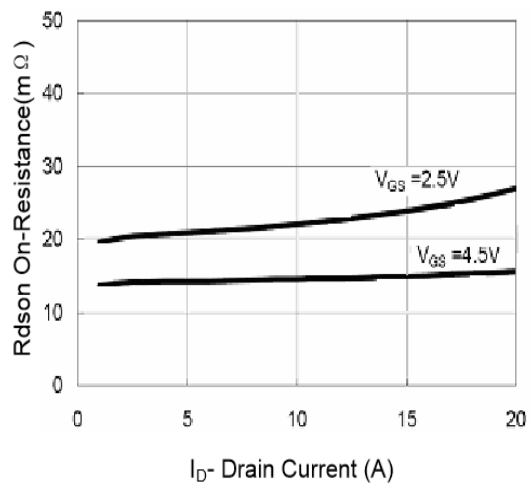
T<sub>J</sub>-Junction Temperature(°C)  
Figure 3 Power Dissipation



T<sub>J</sub>-Junction Temperature(°C)  
Figure 4 Drain Current



V<sub>ds</sub> Drain-Source Voltage (V)  
Figure 5 Output Characteristics



I<sub>D</sub>- Drain Current (A)  
Figure 6 Drain-Source On-Resistance

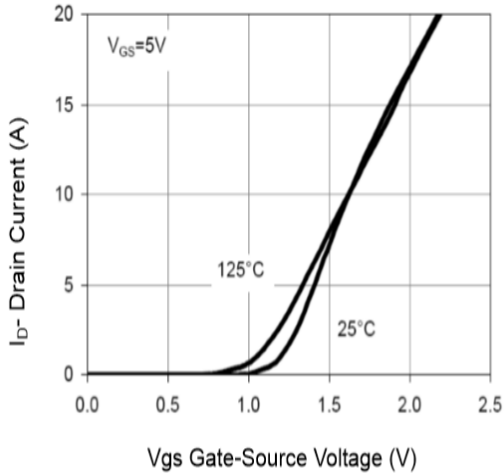


Figure 7 Transfer Characteristics

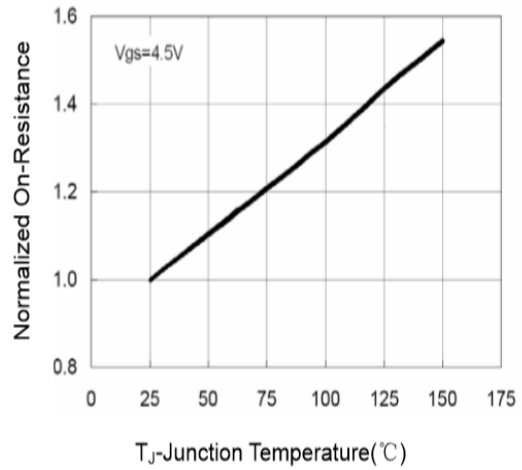


Figure 8 Drain-Source On-Resistance

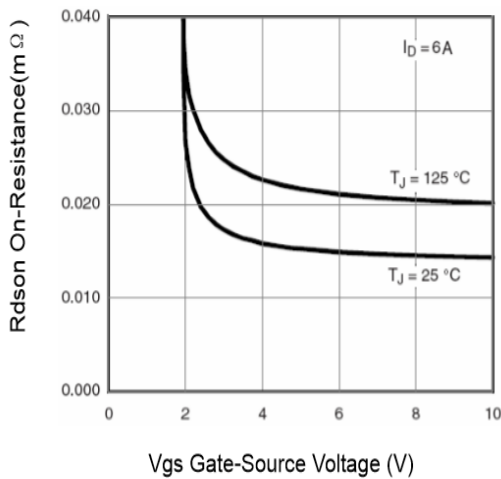


Figure 9 Rdson vs Vgs

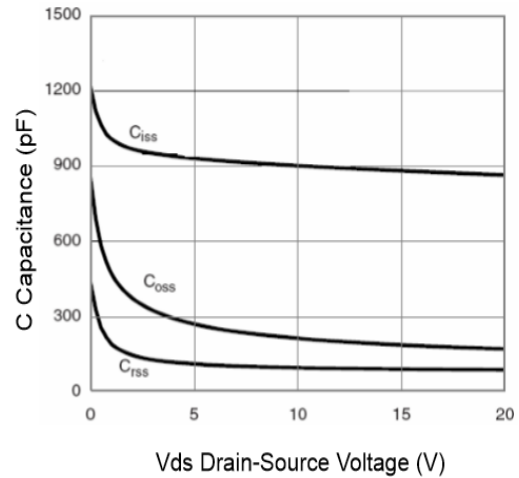


Figure 10 Capacitance vs Vds

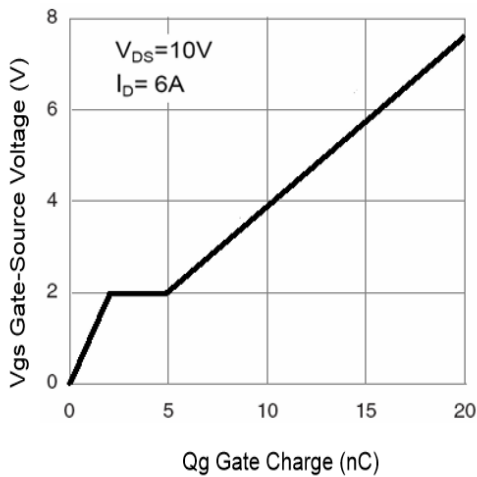


Figure 11 Gate Charge

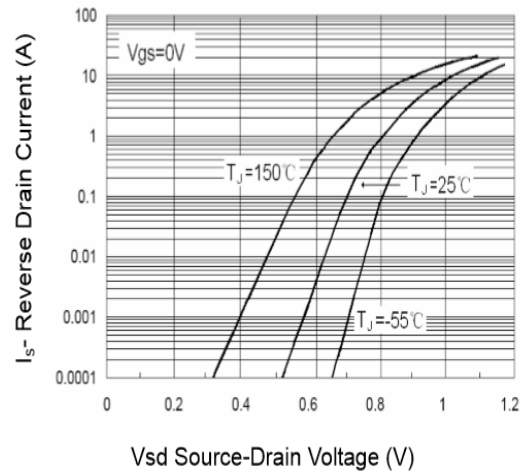


Figure 12 Source- Drain Diode Forward

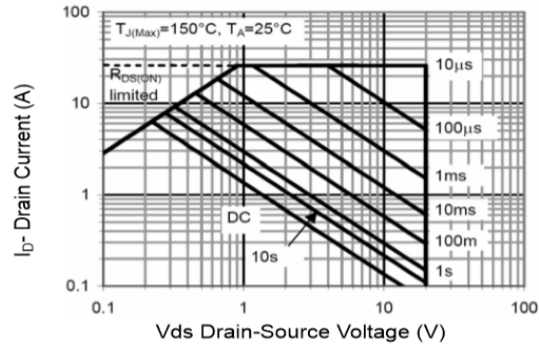


Figure 13 Safe Operation Area

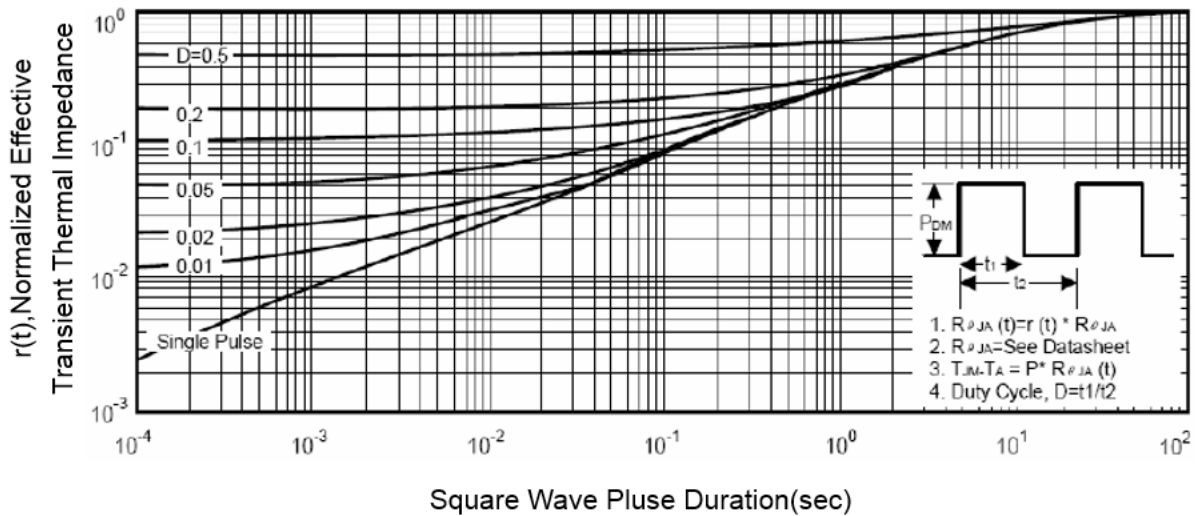
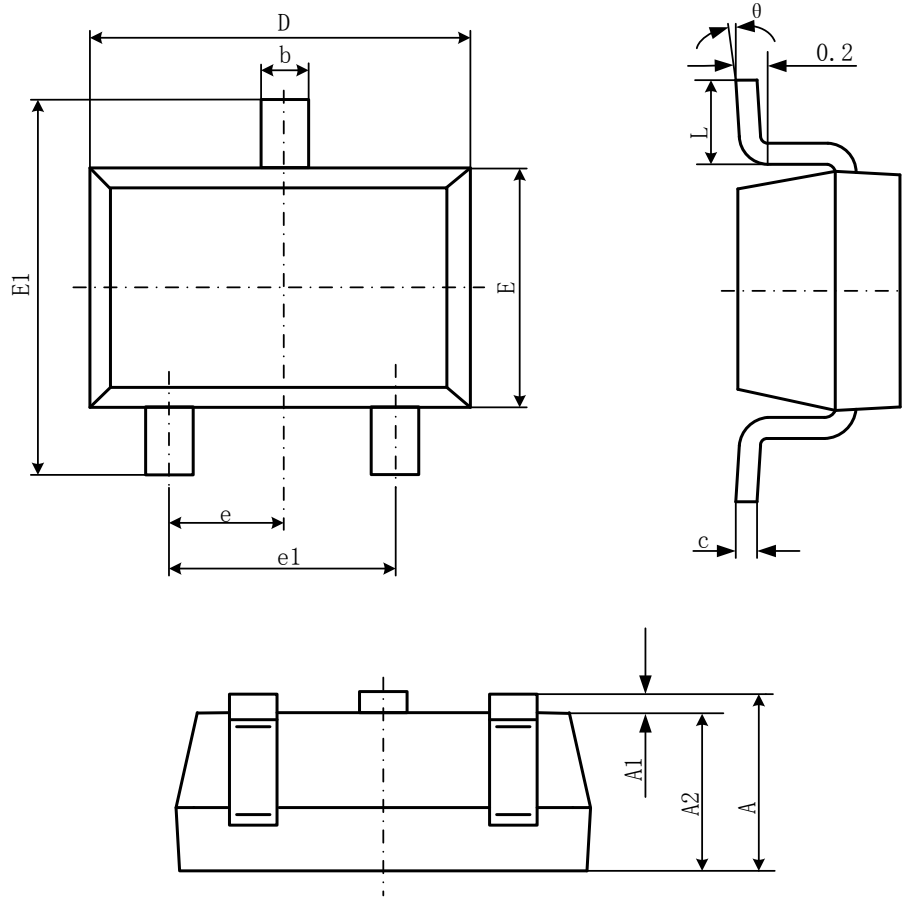


Figure 14 Normalized Maximum Transient Thermal Impedance

## Package Information

## ● SOT-23-3L



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	1.050	1.250	0.041	0.049
A1	0.000	0.100	0.000	0.004
A2	1.050	1.150	0.041	0.045
b	0.300	0.500	0.012	0.020
c	0.100	0.200	0.004	0.008
D	2.820	3.020	0.111	0.119
E	1.500	1.700	0.059	0.067
E1	2.650	2.950	0.104	0.116
e	0.950(BSC)		0.037(BSC)	
e1	1.800	2.000	0.071	0.079
L	0.300	0.600	0.012	0.024
$\theta$	0°	8°	0°	8°