# 30V P-Channel Enhancement Mode MOSFET

## Description

The NP3401MR 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

- $V_{DS}$ =-30V，$I_D$ =-4.2A
  $R_{DS(ON)}$(Typ.)=39mΩ @$V_{GS}$=-10V
  $R_{DS(ON)}$(Typ.)=48mΩ @$V_{GS}$=-4.5V
  $R_{DS(ON)}$(Typ.)=60mΩ @$V_{GS}$=-2.5V
- High power and current handing capability
- Lead free product is acquired
- Surface mount package

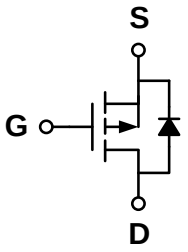
## Application

- PWM applications
- Load switch

## Package

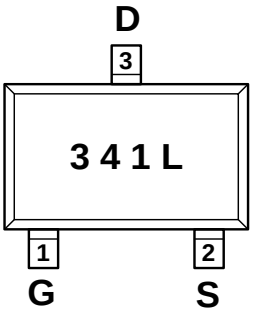
- SOT-23-3L

## Schematic diagram




## Marking and pin assignment

SOT-23-3L
(TOP VIEW)




341—NP3401

L—Package Information

## Ordering Information

| Part Number | Storage Temperature | Package | Devices Per Reel |
|---|---|---|---|
| NP3401MR-G | -55°C to +150°C | SOT-23-3L | 3000 |

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

| parameter | | symbol | limit | unit |
|---|---|---|---|---|
| Drain-source voltage | | $V_{DS}$ | -30 | V |
| Gate-source voltage | | $V_{GS}$ | ±12 | V |
| Continuous Drain Current | TC=25°C | $I_D$ | -4.2 | A |
| | TC=70°C | | -3.0 | |
| Pulsed Drain Current [C] | | $I_{DP}$ | -16.8 | A |
| power dissipation [B] | TC=25°C | $P_D$ | 1.4 | W |
| | TC=70°C | | 0.9 | |
| Junction and Storage Temperature Range | | $T_J$,$T_{SGT}$ | -55—150 | ℃ |

## Electrical Characteristics (TA=25℃ unless otherwise noted)

| Parameter | Symbol | Condition | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| OFF Characteristics | | | | | | |
| Drain-source breakdown voltage | $BV_{DSS}$ | $V_{GS}$=0V, $I_D$=-250μA | -30 | - | - | V |
| Zero gate voltage drain current | $I_{DSS}$ | $V_{DS}$=-30V, $V_{GS}$=0V | - | - | -1 | μA |
| Gate-body leakage | $I_{GSS}$ | $V_{DS}$=0V, $V_{GS}$=±12V | - | - | ±100 | nA |
| ON Characteristics | | | | | | |
| Gate threshold voltage | $V_{GS(th)}$ | $V_{DS}$=$V_{GS}$, $I_D$=-250μA | -0.5 | -0.9 | -1.5 | V |
| Drain-source on-state resistance | $R_{DS(ON)}$ | $V_{GS}$=-10V, $I_D$=-4A | - | 39 | 50 | mΩ |
| | | $V_{GS}$=-4.5V, $I_D$=-3A | - | 48 | 60 | |
| | | $V_{GS}$=-2.5V, $I_D$=-1A | - | 60 | 75 | |
| Forward transconductance | gfs | $V_{DS}$=-5V, $I_D$=-4.2A | - | 5 | - | S |
| Dynamic Characteristics | | | | | | |
| Input capacitance | $C_{ISS}$ | $V_{DS}$=-10V ,$V_{GS}$=0V f=1.0MHz | - | 900 | - | pF |
| Output capacitance | $C_{OSS}$ | | - | 85 | - | |
| Reverse transfer capacitance | $C_{RSS}$ | | - | 65 | - | |
| Gate resistance | Rg | $V_{DS}$=15mV， f=1.0MHz | | 1 | | Ω |
| Switching Characteristics | | | | | | |
| Turn-on delay time | $t_{D(ON)}$ | $V_{DD}$=-15V $I_D$=-4.2A $V_{GEN}$=-10V $R_L$=10ohm $R_{GEN}$=6ohm | - | 2.8 | 3.5 | ns |
| Rise time | tr | | - | 31 | 35 | |
| Turn-off delay time | $t_{D(OFF)}$ | | - | 50 | 55 | |
| Fall time | tf | | - | 8 | 12 | |
| Total gate charge | $Q_g$ | $V_{DS}$=-15V,$I_D$=-4.2A $V_{GS}$=-4.5V | - | 8.8 | - | nC |
| Gate-source charge | $Q_{gs}$ | | - | 1.8 | - | |
| Gate-drain charge | $Q_{gd}$ | | - | 2.7 | - | |
| Body Diode Reverse Recovery Time | $t_{rr}$ | $I_F$=-4.2A, dI/dt=100A/ms | | 22 | | nS |
| Body Diode Reverse Recovery Charge | $Q_{rr}$ | $I_F$=-4.2A, dI/dt=100A/ms | | 1.8 | | nC |
| DRAIN-SOURCE DIODE CHARACTERISTICS | | | | | | |
| Diode forward voltage | $V_{SD}$ | $V_{GS}$=0V,Is=-4.2A | - | -0.81 | -1.2 | V |

## Thermal Characteristics

| Parameter | | Symbol | Typ. | Max. | Unit |
|---|---|---|---|---|---|
| Maximum Junction-to-Ambient [A] | t≤ 10s | $R_{\theta JA}$ | 70 | 90 | ℃/W |
| Maximum Junction-to-Ambient [A D] | Steady-State | | 100 | 125 | |
| Maximum Junction-to-Lead | Steady-State | $R_{\theta JL}$ | 62 | 80 | |

A. The value of $R_{\theta JA}$ is measured with the device mounted on 1in$^2$ FR-4 board with 2oz. Copper, in a still air environment with $T_A$ =25°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°C, using ≤ 10s junction-to-ambient thermal resistance.

C. Repetitive rating, pulse width limited by junction temperature $T_{J(MAX)}$=150°C. Ratings are based on low frequency and duty cycles to keep initial$T_J$=25°C.

D. The $R_{\theta JA}$ is the sum of the thermal impedence from junction to lead $R_{\theta JL}$ and lead to ambient.

## Typical Performance Characteristics

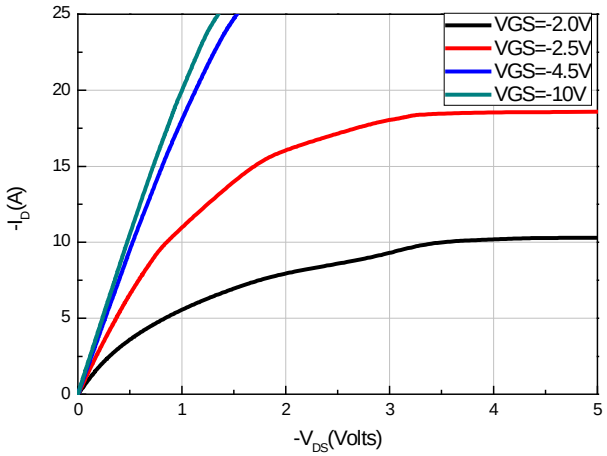



**Fig 1: On-Region Characteristics**

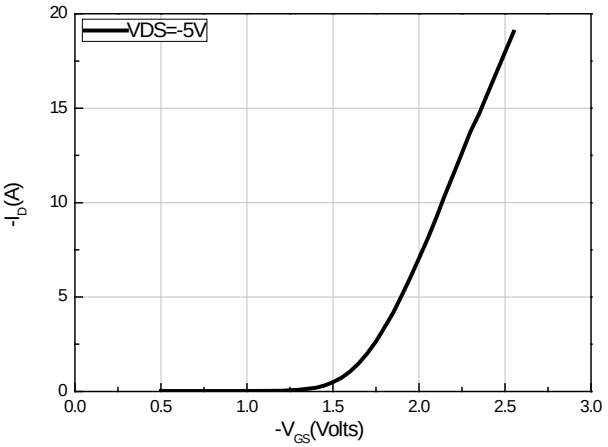



**Figure 2: Transfer Characteristics**

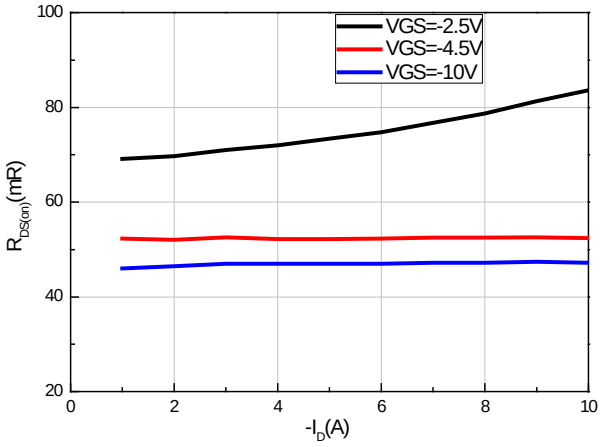



**Figure 3: On-Resistance vs. Drain Current and Gate Voltage**

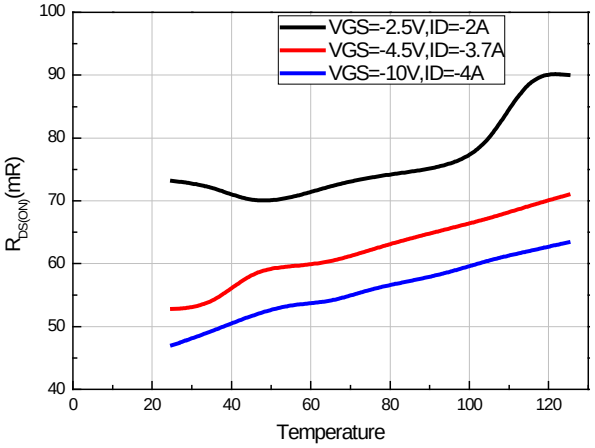



**Figure 4: On-Resistance vs. Junction Temperature**

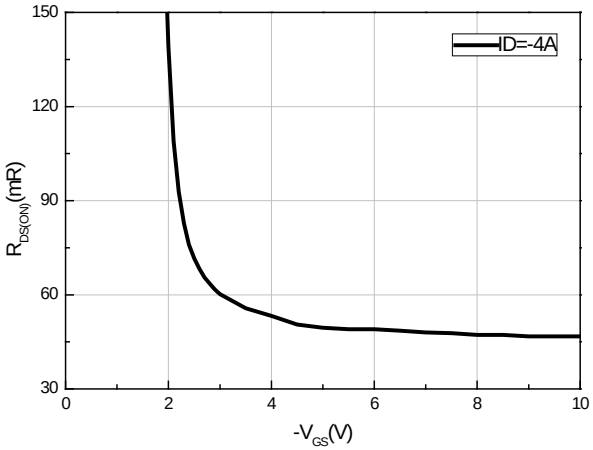



**Figure 5: On-Resistance vs. Gate-Source Voltage**

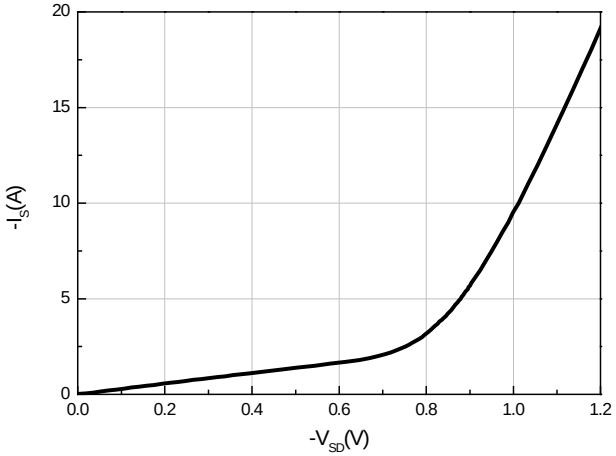
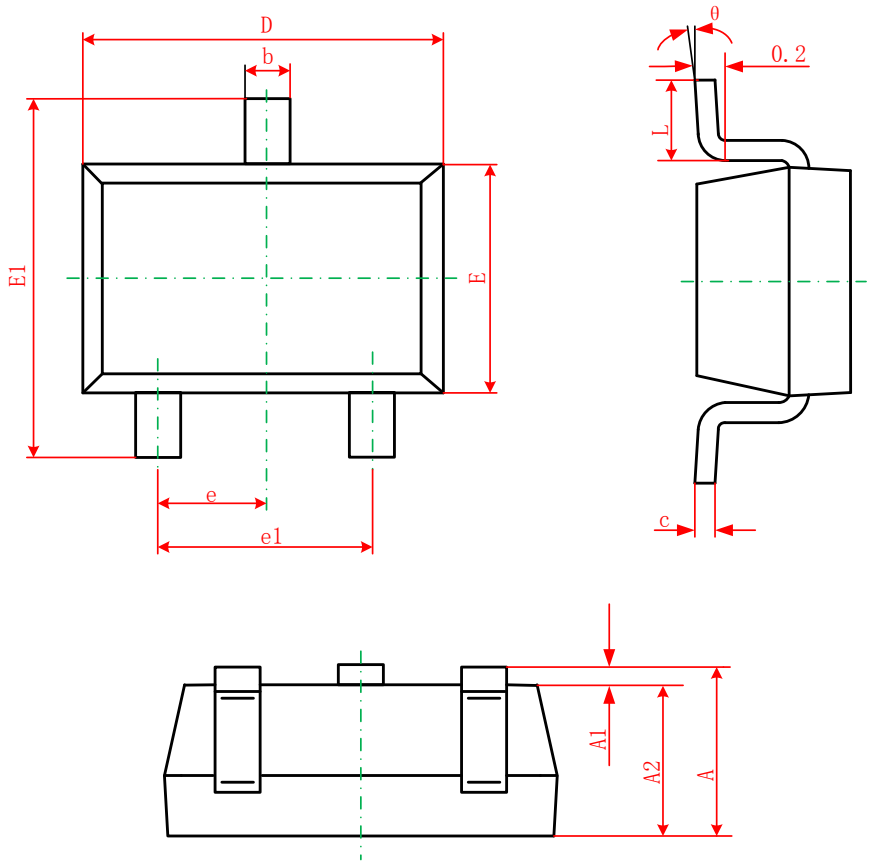



**Figure 6: Body-Diode Characteristics**

## 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 |
| θ | 0° | 8° | 0° | 8° |

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