

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

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

Application

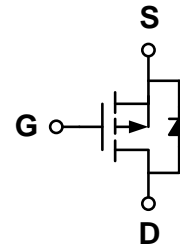
- ◆ PWM applications
- ◆ Load switch

Package

- ◆ SOT-23-3L

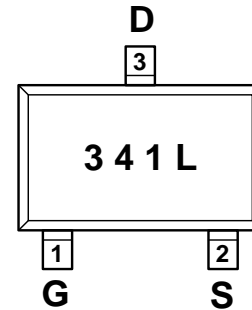


Schematic diagram



Marking and pin assignment

SOT-23-3L
(TOP VIEW)



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°C unless otherwise noted)

| parameter | symbol | limit | unit | |
|--|----------------|---------|------|---|
| Drain-source voltage | V_{DS} | -30 | V | |
| Gate-source voltage | V_{GS} | ±12 | V | |
| Continuous Drain Current | I_D | TC=25°C | -4.2 | A |
| | | TC=70°C | -3.0 | |
| Pulsed Drain Current ^C | I_{DP} | -16.8 | A | |
| power dissipation ^B | P_D | TC=25°C | 1.4 | W |
| | | TC=70°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 |
|------------------------------------|--------------|---|------|-------|-----------|------------|
| OFF Characteristics | | | | | | |
| Drain-source breakdown voltage | BV_{DSS} | $V_{GS}=0V, I_D=-250\mu A$ | -30 | - | - | V |
| Zero gate voltage drain current | I_{DSS} | $V_{DS}=-30V, V_{GS}=0V$ | - | - | -1 | μA |
| Gate-body leakage | I_{GSS} | $V_{DS}=0V, V_{GS}=\pm 12V$ | - | - | ± 100 | nA |
| ON Characteristics | | | | | | |
| Gate threshold voltage | $V_{GS(th)}$ | $V_{DS}=V_{GS}, I_D=-250\mu A$ | -0.5 | -0.9 | -1.5 | V |
| Drain-source on-state resistance | $R_{DS(ON)}$ | $V_{GS}=-10V, I_D=-4A$ | - | 39 | 50 | m Ω |
| | | $V_{GS}=-4.5V, I_D=-3A$ | - | 48 | 60 | |
| | | $V_{GS}=-2.5V, I_D=-1A$ | - | 60 | 75 | |
| Forward transconductance | g_{fs} | $V_{DS}=-5V, I_D=-4.2A$ | - | 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 | R_g | $V_{DS}=15mV, f=1.0MHz$ | - | 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 | t_r | | - | 31 | 35 | |
| Turn-off delay time | $t_{D(OFF)}$ | | - | 50 | 55 | |
| Fall time | t_f | | - | 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} | $V_{GS}=0V, I_S=-4.2A$ | - | -0.81 | -1.2 | V |

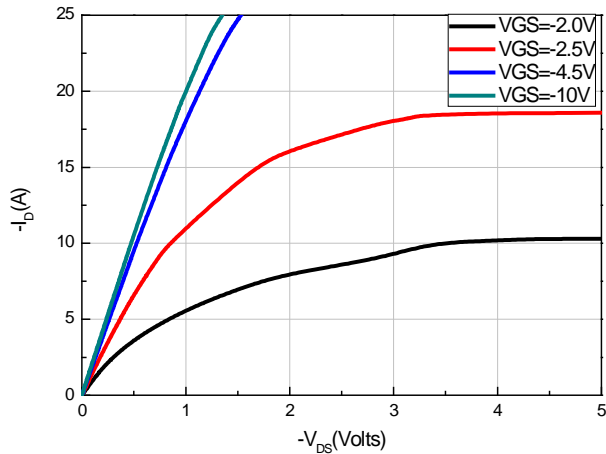
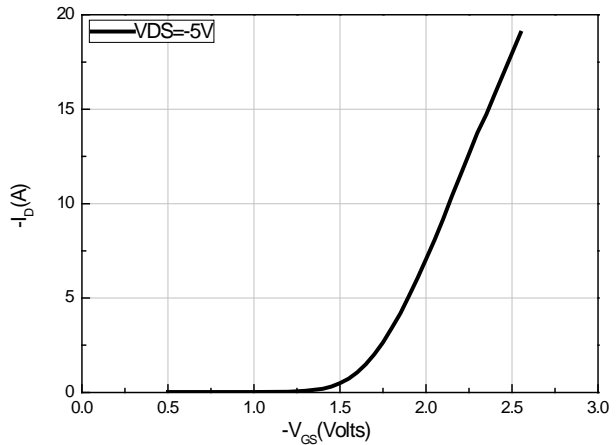
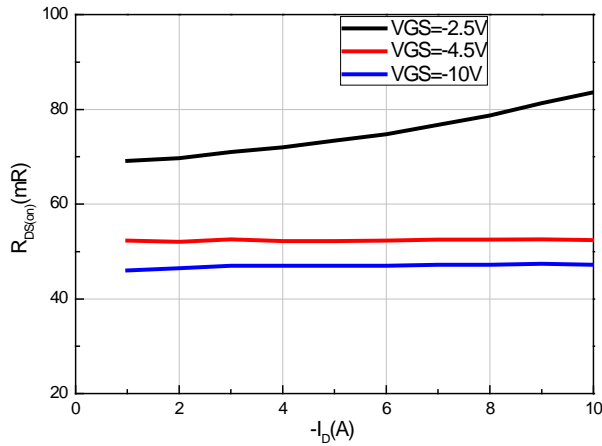
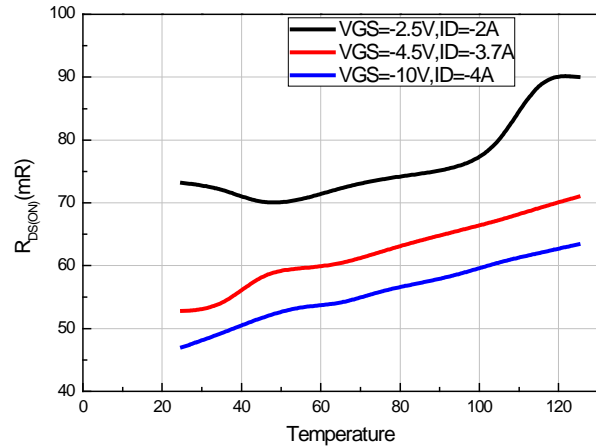
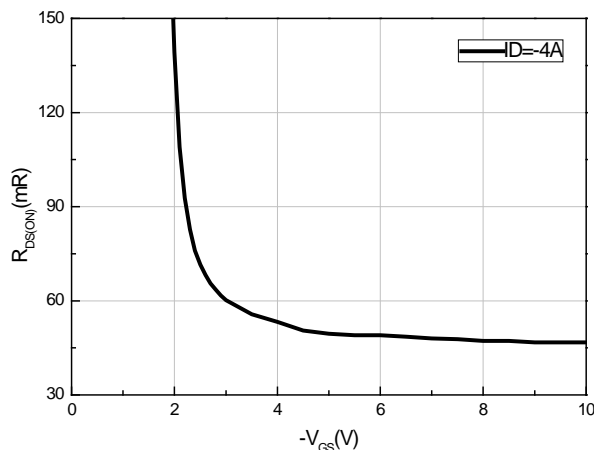
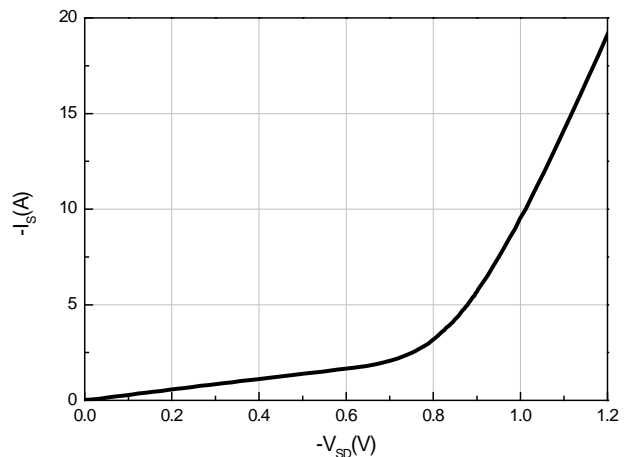
Thermal Characteristics

| Parameter | Symbol | Typ. | Max. | Unit |
|--|--------------|------|------|---------------|
| Maximum Junction-to-Ambient ^A | $t \leq 10s$ | 70 | 90 | $^{\circ}C/W$ |
| Maximum Junction-to-Ambient ^{A D} | Steady-State | | 100 | |
| Maximum Junction-to-Lead | Steady-State | 62 | 80 | |

A. The value of $R_{\theta JA}$ is measured with the device mounted on 1in² 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.

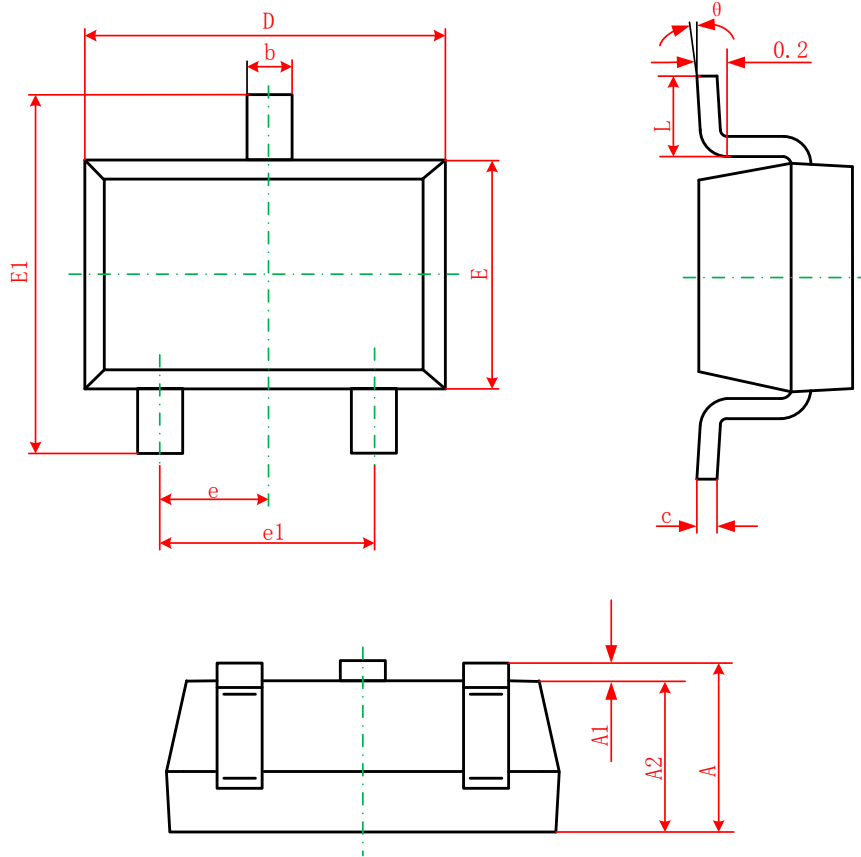
- B. The power dissipation PD is based on $T_{J(MAX)}=150^{\circ}\text{C}$, using $\leq 10\text{s}$ junction-to-ambient thermal resistance.
- C. Repetitive rating, pulse width limited by junction temperature $T_{J(MAX)}=150^{\circ}\text{C}$. Ratings are based on low frequency and duty cycles to keep initial $T_J=25^{\circ}\text{C}$.
- D. The $R_{\theta JA}$ is the sum of the thermal impedance 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° |