

60V N-Channel Enhancement Mode MOSFET

Description

The NP6003VR uses advanced trench technology and design to provide excellent $R_{DS(ON)}$ with low gate charge. It can be used in a wide variety of applications.

General Features

- ◆ $V_{DS} = 60V$ $I_D = 3A$
 $R_{DS(ON)} = 78m\Omega$ @ $V_{GS} = 10V$ (Typ: $76m\Omega$)
 $R_{DS(ON)} = 88m\Omega$ @ $V_{GS} = 4.5V$ (Typ: $88m\Omega$)
- ◆ High density cell design for ultra low R_{dson} .
- ◆ Fully characterized avalanche voltage and current.
- ◆ Low gate to drain charge to reduce switching losses.

Application

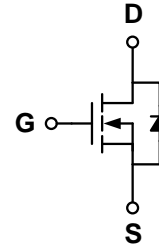
- ◆ Power switching application.
- ◆ Hard switched and high frequency circuits.
- ◆ Uninterruptible power supply.

Package

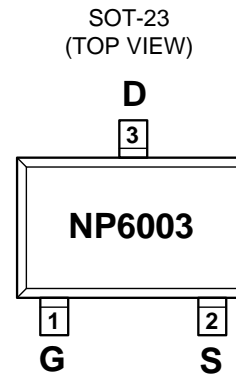
- ◆ SOT-23



Schematic diagram



Marking and pin assignment



Ordering Information

| Part Number | Storage Temperature | Package | Devices Per Reel |
|-------------|---------------------|---------|------------------|
| NP6003VR-G | -55°C to +150°C | SOT-23 | 3000 |

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

| parameter | symbol | limit | unit |
|--|----------|----------------------|--------------------|
| Drain-source voltage | V_{DS} | 60 | V |
| Gate-source voltage | V_{GS} | ±20 | V |
| Continuous Drain Current (T _J = 150 °C) | I_D | T _C =25°C | 3 |
| | | T _C =70°C | 2 |
| | | T _A =25°C | 1.6 ^{b,c} |
| | | T _A =70°C | 1.3 ^{b,c} |
| Continuous Source-Drain Diode Current | I_S | T _C =25°C | 2.1 |
| | | T _A =25°C | 1 ^{b,c} |
| Pulsed Drain Current (t = 300 μs) | I_{DM} | 12 | |
| Maximum power dissipation | P_D | 2.5 | W |

| | | | | |
|--|------------------------|----------------|---------------------|------------------|
| | $T_C=70^\circ\text{C}$ | | 1.6 | |
| | $T_A=25^\circ\text{C}$ | | 1.25 ^{b,c} | |
| | $T_A=70^\circ\text{C}$ | | 0.8 ^{b,c} | |
| Operating Junction and Storage Temperature Range | | T_J, T_{STG} | -55—150 | $^\circ\text{C}$ |

Thermal Characteristics

| Parameter | Symbol | Typical | Maximum | Unit |
|---|-----------------|---------|---------|--------------------|
| Maximum Junction-to-Ambient ^{b, d} | $R_{\theta JA}$ | 100 | 130 | $^\circ\text{C/W}$ |
| Maximum Junction-to-Foot (Drain) | $R_{\theta JF}$ | 60 | 75 | |

Notes:

- a: $T_C = 25^\circ\text{C}$. b: Surface mounted on 1" x 1" FR4 board.
 c: $t = 5\text{ s}$. d: Maximum under steady state conditions is 175°C/W .

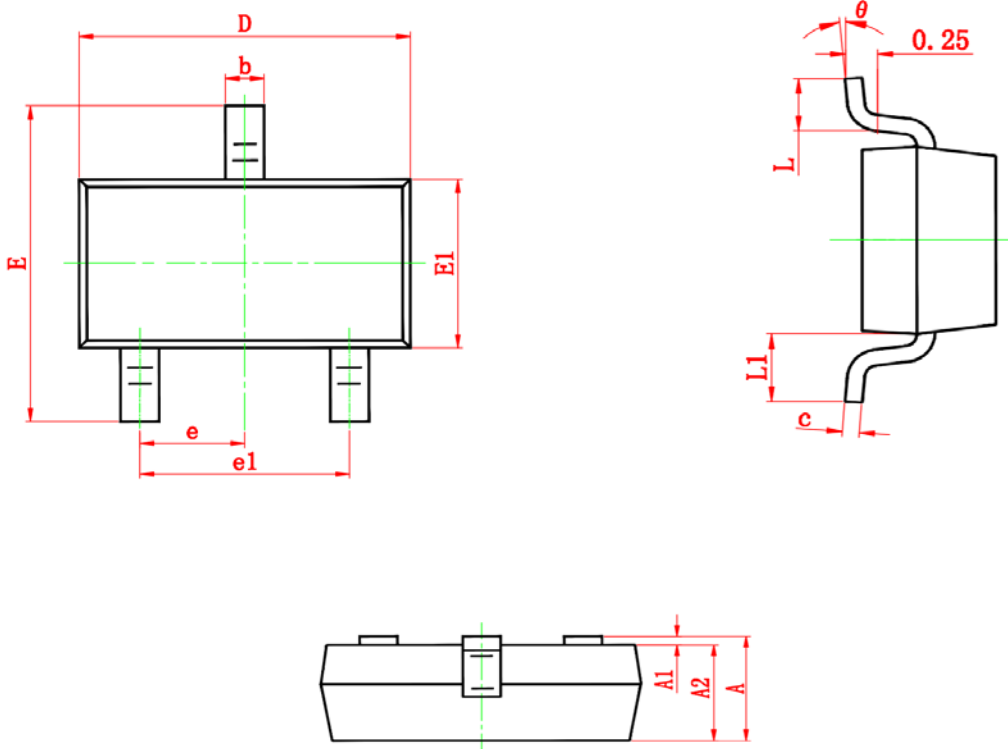
Electrical Characteristics (TA=25°C unless otherwise noted)

| Parameter | Symbol | Condition | Min | Typ | Max | Unit |
|---|------------------------------|--|-----|------|-----------|----------------------------|
| Static Characteristics | | | | | | |
| Drain-source breakdown voltage | BV_{DSS} | $V_{GS}=0V, I_D=250\mu\text{A}$ | 60 | - | - | V |
| BVDSS Temperature Coefficient | $\Delta BV_{DSS}/\Delta T_J$ | Reference to $25^\circ\text{C}, I_D=1\text{mA}$ | | 33 | | $\text{mV}/^\circ\text{C}$ |
| Zero gate voltage drain current | I_{DSS} | $V_{DS}=60V, V_{GS}=0V$ | - | - | 1 | μA |
| | | $T_J=85^\circ\text{C}$ | - | - | 30 | |
| Gate Leakage Current | I_{GSS} | $V_{DS}=0V, V_{GS}=\pm 20V$ | - | - | ± 100 | nA |
| Gate threshold voltage | $V_{GS(th)}$ | $V_{DS}=V_{GS}, I_D=250\mu\text{A}$ | 1.2 | 1.9 | 2.5 | V |
| Drain-source on-state resistance ¹ | $R_{DS(ON)}$ | $V_{GS}=10V, I_D=3A$ | - | 78 | 90 | mΩ |
| | | $V_{GS}=4.5V, I_D=2A$ | | 88 | 100 | |
| On Status Drain Current | $I_{D(ON)}$ | $V_{DS}=10V, V_{GS}=10V$ | 3 | - | - | A |
| Diode Characteristics | | | | | | |
| Diode Forward Voltage | V_{SD} | $I_{SD}=1A, V_{GS}=0V$ | - | 0.75 | 1.1 | V |
| Diode Continuous Forward Current | I_S | | - | - | 3 | A |
| Reverse Recovery Time | t_{rr} | $I_F=1.5A,$ | - | 15 | - | ns |
| Reverse Recovery Charge | Q_{rr} | $dI/dt=100A/\mu\text{s}$ | - | 12 | - | nC |
| Dynamic Characteristics² | | | | | | |
| Gate Resistance | R_G | $V_{GS}=0V, V_{DS}=0V, f=1\text{MHz}$ | - | 2.0 | - | Ω |
| Input capacitance | C_{ISS} | $V_{GS}=0V, V_{DS}=25V$ $f=1.0\text{MHz}$ | - | 175 | - | pF |
| Output capacitance | C_{OSS} | | - | 21 | - | |
| Reverse transfer capacitance | C_{RSS} | | - | 13 | - | |
| Turn-on delay time | $t_{D(ON)}$ | $V_{GS}=10V, V_{DD}=30V,$ $R_L=4.7\Omega, I_D=1.5A,$ $R_G=3.3\Omega$ | - | 15 | - | ns |
| Turn-on Rise time | t_r | | - | 16 | - | |
| Turn-off delay time | $t_{D(OFF)}$ | | - | 10 | - | |
| Turn-off Fall time | t_f | | - | 10 | - | |

| | | | | | |
|--------------------|----------|--------------------------------------|---|-----|----|
| Total gate charge | Q_g | $V_{GS}=10V, I_D=2A$ $V_{DS}=30V$ | - | 4.1 | nC |
| Gate-source charge | Q_{gs} | | | 0.8 | |
| Gate-drain charge | Q_{gd} | | - | 1 | |

Package Information

- SOT-23



| Symbol | Dimensions In Millimeters | | Dimensions In Inches | |
|----------|---------------------------|-------|----------------------|-------|
| | Min. | Max. | Min. | Max. |
| A | 0.900 | 1.150 | 0.035 | 0.045 |
| A1 | 0.000 | 0.100 | 0.000 | 0.004 |
| A2 | 0.900 | 1.050 | 0.035 | 0.041 |
| b | 0.300 | 0.500 | 0.012 | 0.020 |
| c | 0.080 | 0.150 | 0.003 | 0.006 |
| D | 2.800 | 3.000 | 0.110 | 0.118 |
| E | 2.250 | 2.550 | 0.089 | 0.100 |
| E1 | 1.200 | 1.400 | 0.047 | 0.055 |
| e | 0.950 TYP. | | 0.037 TYP. | |
| e1 | 1.800 | 2.000 | 0.071 | 0.079 |
| L | 0.300 | 0.500 | 0.012 | 0.020 |
| L1 | 0.550 REF. | | 0.022 REF. | |
| θ | 0° | 8° | 0° | 8° |