# WNM4001

**Small Signal N-Channel, 20V, 0.5A, MOSFET**

**Http://www.willsemi.com**

| $V_{(BR)DSS}$ | $R_{DS(on)}$ Max. | $I_D$ MAX |
|---|---|---|
| 20 V | 0.7Ω@ 4.5V | 0.5A |
| | 0.85Ω@ 2.5V | 0.3A |
| | 1.25Ω@ 1.8V | 0.1A |

Top



**SOT-523**
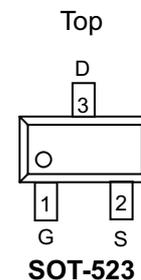
## Descriptions

The WNM4001 is the N-Channel enhancement MOS Field Effect Transistor, uses advanced trench technology and design to provide excellent $R_{DS(ON)}$ with low gate charge. This device is suitable for use in small signal switch. Standard product WNM4001 is Pb-free.
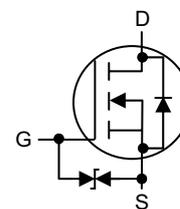


**Pin Configuration**

## Features

- Trench N-Channel
- Supper high density cell design for extremely low Rds(on)
- Exceptional ON resistance and maximum DC current capability
- Small package design with SOT-523
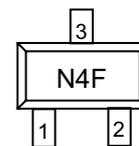


N4 = Device Code
F = Month
**Marking**

## Applications

- Driver: Relays, Solenoids, Lamps, Hammers
- Power supply converters circuit
- Load/Power Switching for potable device

## Order Information

| Device | Package | Shipping |
|---|---|---|
| WNM4001-3/TR | SOT-523 | 3000/Tape&Reel |

## Absolute Maximum Ratings

**($T_A$=25$^o$C unless otherwise noted)**

| Symbol | Parameter | Ratings | Unit |
|---|---|---|---|
| $V_{DSS}$ | Drain-to-Source Voltage | 20 | V |
| $V_{GSS}$ | Gate-to-Source Voltage | $\pm$6.0 | V |
| $I_D$ | Drain Current – Continue **Note1** | 0.5 | A |
| | Drain Current – Pulsed (t<300us, Duty<2%) **Note1** | 0.8 | A |
| $P_D$ | Power Dissipation – **Note1** | 0.25 | W |
| $T_J$ | Operation junction temperature range | 150 | $^o$C |
| $T_{SG}$ | Storage temperature range | -55~150 | $^o$C |

## Thermal Resistance Ratings

**($T_A$=25$^o$C unless otherwise noted)**

| Symbol | Parameter | Typ. | Max. | Unit |
|---|---|---|---|---|
| $R_{\theta JA}$ | Thermal Resistance, Junction to Ambient – **Note1** | 500 | 620 | $^o$C/W |

**Note1**: Surface mounted on a 2 oz copper, 1 in$^2$ pad, FR-4 board.

## Electronics Characteristics

**($T_A$=25$^o$C unless otherwise noted)**

| Symbol | Parameter | Test Condition | Min | Typ. | Max | Unit |
|--------|-----------|----------------|-----|------|-----|------|
| **Off Characteristics** | | | | | | |
| $V_{(BR)DSS}$ | Drain-Source Breakdown Voltage | $V_{GS}$=0V, $I_D$=250uA | 20 | | | V |
| $I_{DSS}$ | Zero Gate Voltage Drain Current | $V_{DS}$=20V, $V_{GS}$=0V | | | 1 | uA |
| $I_{GSS}$ | Gate –Source leakage current | $V_{DS}$=0V, $V_{GS}$=±12 | | | 100 | nA |
| **ON Characteristics** | | | | | | |
| $V_{GS(th)}$ | Gate Threshold Voltage | $V_{DS}$= $V_{GS}$, $I_D$=250uA | 0.35 | | 1.0 | V |
| $R_{DS(on)}$ | Drain-Source On-Resistance | $V_{GS}$=4.5V, $I_D$=0.5A | | 410 | 700 | mΩ |
| | | $V_{GS}$=2.5V, $I_D$=0.3A | | 530 | 850 | mΩ |
| | | $V_{GS}$=1.8V, $I_D$=0.1A | | 700 | 1250 | mΩ |
| $g_{FS}$ | Forward Transconductance | $V_{DS}$=10V, $I_D$=0.4A | | 1.0 | | S |
| **Dynamic Characteristics** | | | | | | |
| Ciss | Input Capacitance | $V_{DS}$=10V, $V_{GS}$=0V, F=1MHz | | 67 | | pF |
| Coss | Output Capacitance | | | 10 | | pF |
| Crss | Reverse Transfer Capacitance | | | 8 | | pF |
| $Q_{G(TOT)}$ | Total Gate Charge | $V_{DS}$=10V, $V_{GS}$=4.5V, $I_D$=0.25A | | 0.75 | | nC |
| $Q_{GS}$ | Gate-Source Charge | | | 0.075 | | nC |
| $Q_{GD}$ | Gate-Drain Charge | | | 0.225 | | nC |
| **Switching Characteristics** | | | | | | |
| td(on) | Turn-On Delay Time | $V_{DD}$=10V, $V_{GS}$=4.5V, $I_D$=0.25A, $R_L$=10Ω, $R_G$=6Ω | | 5 | | ns |
| tr | Turn-On Rise Time | | | 5 | | ns |
| td(off) | Turn-Off Delay Time | | | 25 | | ns |
| tf | Turn-Off Fall Time | | | 11 | | ns |
| **Drain-to-Source Diode Characteristics** | | | | | | |
| $V_{SD}$ | Forward Diode Voltage | $V_{GS}$=0V, $I_S$=0.15A | | -0.7 | | V |

## Typical Performance Graph
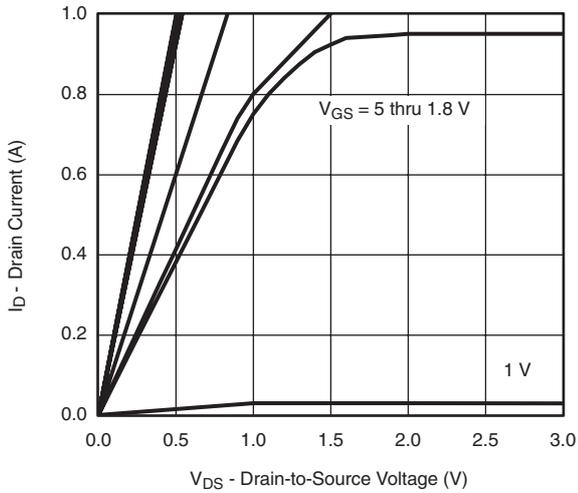


**Output Characteristics**
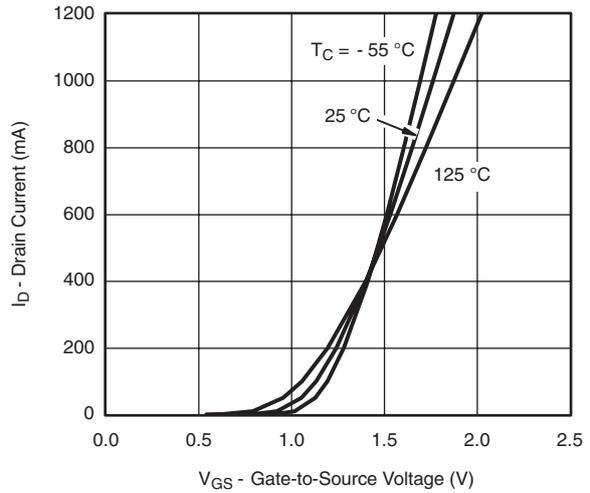


**Transfer Characteristics**
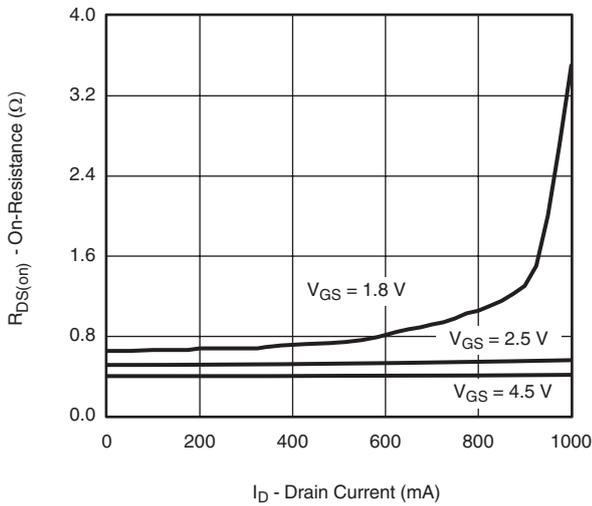


**On Resistance vs. Drain Current**
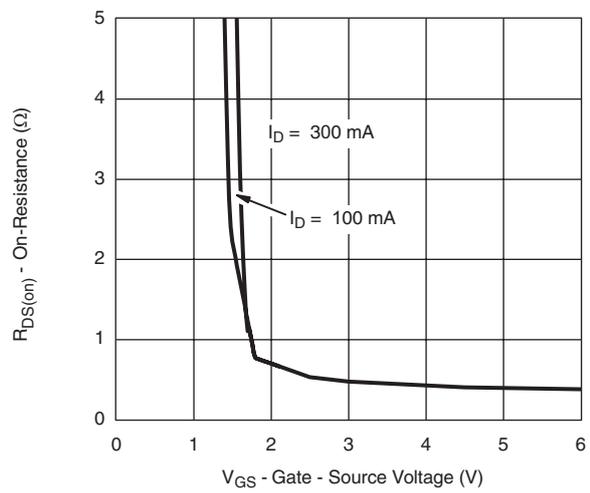


**On Resistance vs. Gate - Source Voltage**
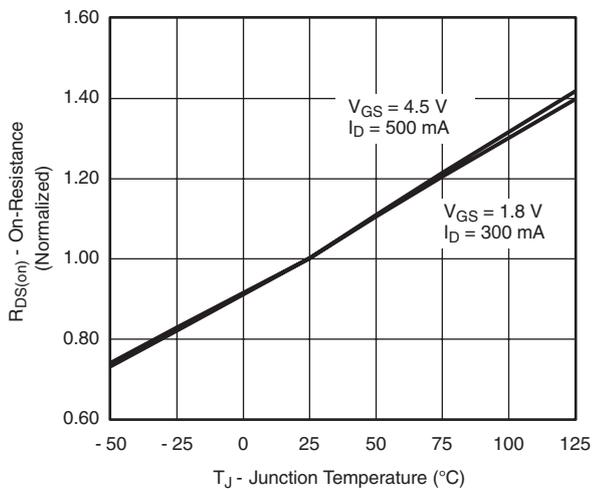


**On Resistance vs. Junction Temperature**



**Threshold Voltage**

**Capacitance**



**Gate Charge**



**Source-Drain Diode Forward Voltage**



**Safe Operation Area, Junction-to-Ambient**



Notes:

1. Duty Cycle, $D = \dfrac{t_1}{t_2}$
2. Per Unit Base = $R_{thJA}$ = 500 °C/W
3. $T_{JM} - T_A = P_{DM}Z_{thJA}^{(t)}$
4. Surface Mounted

**Normalized Thermal Transient Impedance,**

**Junction-to-Ambient**
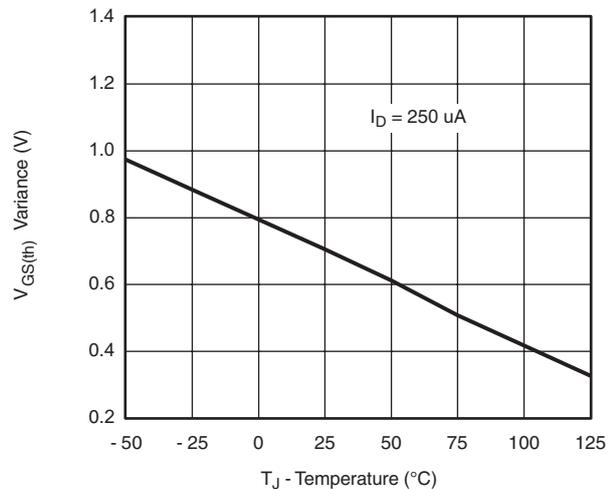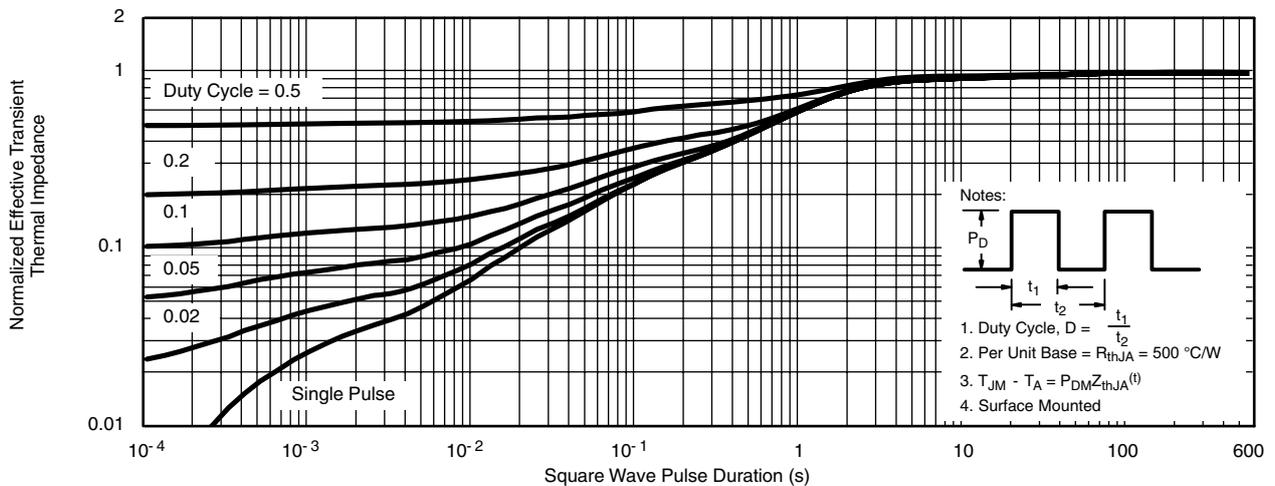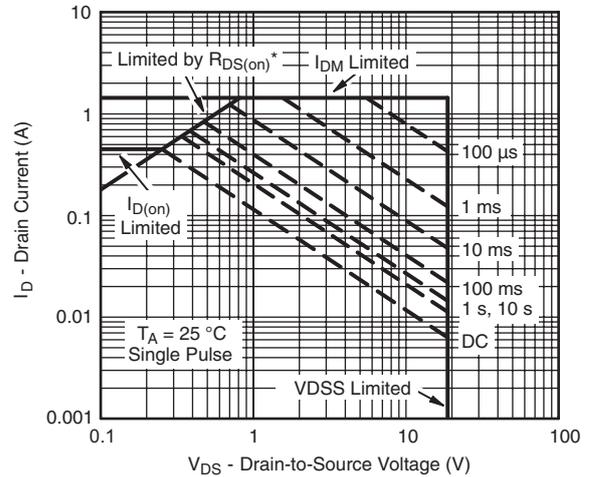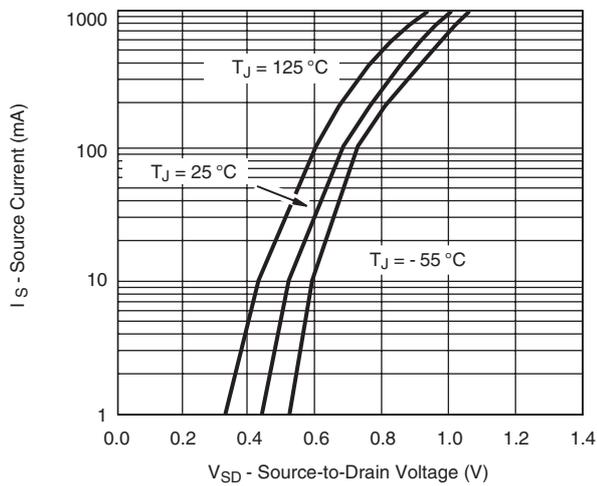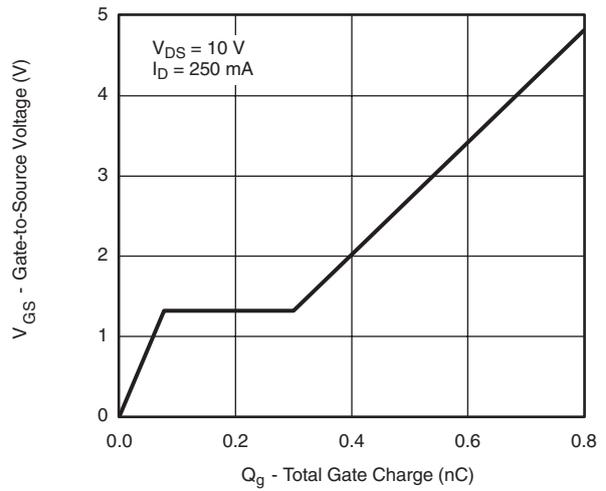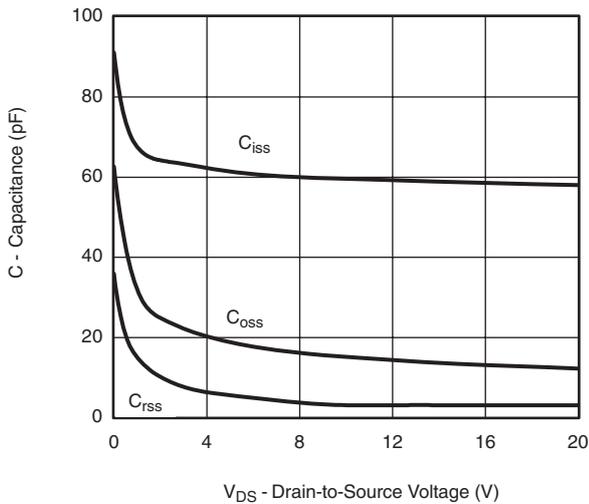
## Package Outline Dimension

### SOT-523
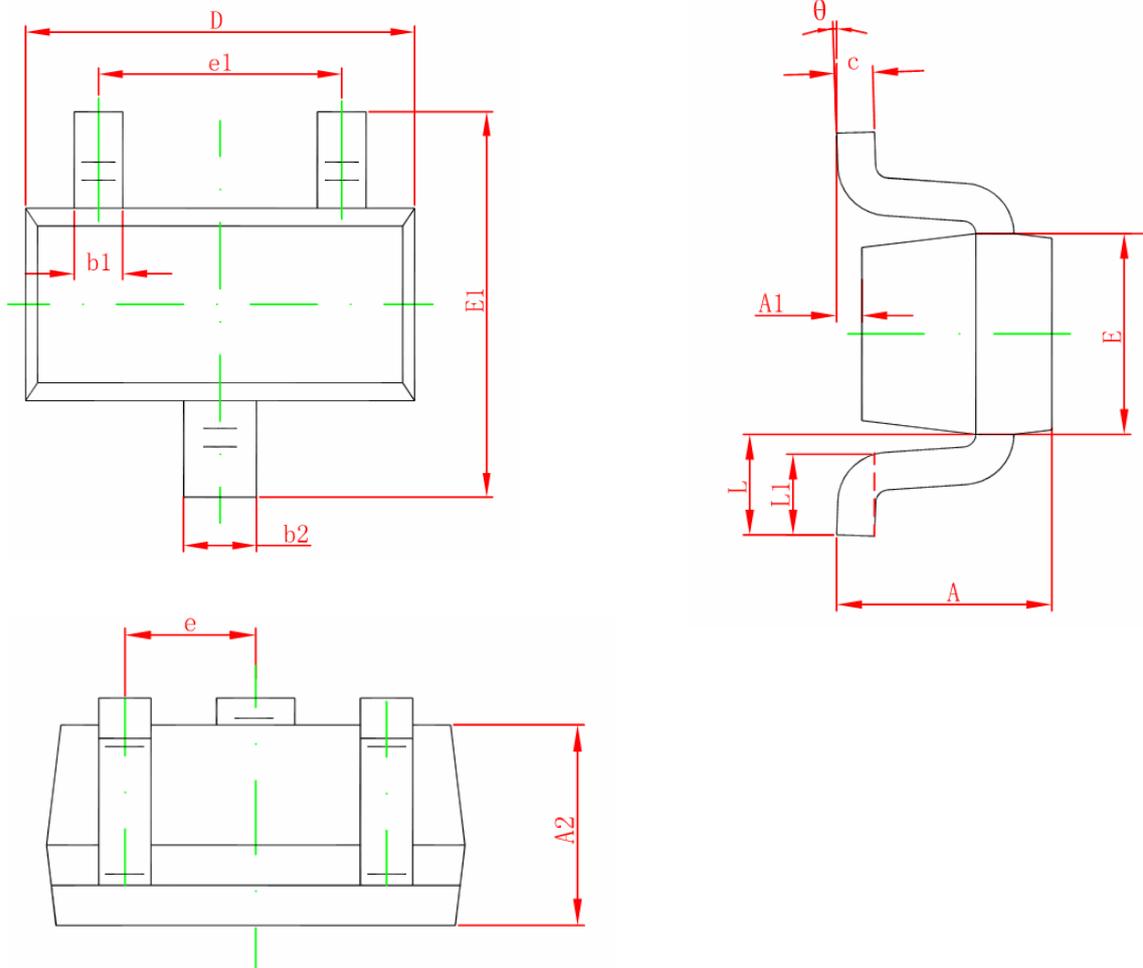


| Symbol | Dimension in Millimeters | |
|---|---|---|
| | **Min.** | **Max.** |
| A | 0.700 | 0.900 |
| A1 | 0.000 | 0.100 |
| A2 | 0.700 | 0.800 |
| b1 | 0.150 | 0.250 |
| b2 | 0.250 | 0.350 |
| c | 0.100 | 0.200 |
| D | 1.500 | 1.700 |
| E | 0.700 | 0.900 |
| E1 | 1.450 | 1.750 |
| e | 0.500 Typ. | |
| e1 | 0.900 | 1.100 |
| L | 0.400 Ref. | |
| L1 | 0.260 | 0.460 |
| θ | 0° | 8° |