

# 2N7000

Preferred Device

## Small Signal MOSFET 200 mAmps, 60 Volts N-Channel TO-92

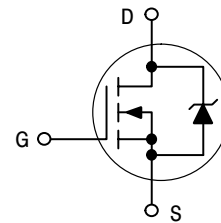


ON Semiconductor

<http://onsemi.com>

**200 mAmps**  
**60 Volts**  
**RDS(on) = 5 Ω**

N-Channel

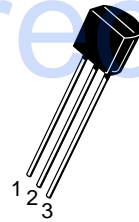


### MAXIMUM RATINGS

| Rating   | Symbol                              | Value          | Unit             |
|--|-------------------------------------|----------------|------------------|
| Drain-Source Voltage   | V <sub>DSS</sub>                    | 60             | Vdc              |
| Drain-Gate Voltage (R <sub>GS</sub> = 1.0 MΩ)                                    | V <sub>DGR</sub>                    | 60             | Vdc              |
| Gate-Source Voltage<br>- Continuous<br>- Non-repetitive (t <sub>p</sub> ≤ 50 μs) | V <sub>GS</sub><br>V <sub>GSM</sub> | ±20<br>±40     | Vdc<br>Vpk       |
| Drain Current<br>- Continuous<br>- Pulsed  | I <sub>D</sub><br>I <sub>DM</sub>   | 200<br>500     | mA <sub>dc</sub> |
| Total Power Dissipation @ T <sub>C</sub> = 25°C<br>Derate above 25°C             | P <sub>D</sub>                      | 350<br>2.8     | mW<br>mW/°C      |
| Operating and Storage Temperature Range  | T <sub>J</sub> , T <sub>stg</sub>   | -55 to<br>+150 | °C               |

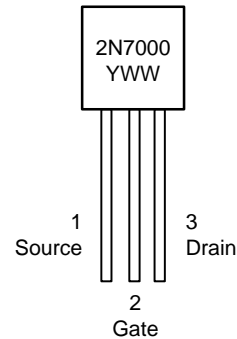
### THERMAL CHARACTERISTICS

| Characteristic  | Symbol           | Max | Unit |
|---|------------------|-----|------|
| Thermal Resistance, Junction to Ambient   | R <sub>θJA</sub> | 357 | °C/W |
| Maximum Lead Temperature for Soldering Purposes, 1/16" from case for 10 seconds | T <sub>L</sub>   | 300 | °C   |



TO-92  
CASE 29  
Style 22

### MARKING DIAGRAM & PIN ASSIGNMENT



Y = Year  
WW = Work Week

### ORDERING INFORMATION

See detailed ordering and shipping information in the package dimensions section on page 3 of this data sheet.

Preferred devices are recommended choices for future use and best overall value.

# 2N7000

## ELECTRICAL CHARACTERISTICS (T<sub>C</sub> = 25°C unless otherwise noted)

| Characteristic | Symbol | Min | Max | Unit |
|----------------|--------|-----|-----|------|
|----------------|--------|-----|-----|------|

### OFF CHARACTERISTICS

|   |                      |        |            |                                      |
|---|----------------------|--------|------------|--------------------------------------|
| Drain–Source Breakdown Voltage<br>(V <sub>GS</sub> = 0, I <sub>D</sub> = 10 μA <sub>dc</sub> )  | V <sub>(BR)DSS</sub> | 60     | –          | V <sub>dc</sub>                      |
| Zero Gate Voltage Drain Current<br>(V <sub>DS</sub> = 48 V <sub>dc</sub> , V <sub>GS</sub> = 0)<br>(V <sub>DS</sub> = 48 V <sub>dc</sub> , V <sub>GS</sub> = 0, T <sub>J</sub> = 125°C) | I <sub>DSS</sub>     | –<br>– | 1.0<br>1.0 | μA <sub>dc</sub><br>mA <sub>dc</sub> |
| Gate–Body Leakage Current, Forward<br>(V <sub>GSS</sub> = 15 V <sub>dc</sub> , V <sub>DS</sub> = 0)   | I <sub>GSSF</sub>    | –      | –10        | nA <sub>dc</sub>                     |

### ON CHARACTERISTICS (Note 1.)

|  |                     |        |             |                  |
|--|---------------------|--------|-------------|------------------|
| Gate Threshold Voltage<br>(V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = 1.0 mA <sub>dc</sub> )   | V <sub>GS(th)</sub> | 0.8    | 3.0         | V <sub>dc</sub>  |
| Static Drain–Source On–Resistance<br>(V <sub>GS</sub> = 10 V <sub>dc</sub> , I <sub>D</sub> = 0.5 A <sub>dc</sub> )<br>(V <sub>GS</sub> = 4.5 V <sub>dc</sub> , I <sub>D</sub> = 75 mA <sub>dc</sub> ) | r <sub>DS(on)</sub> | –<br>– | 5.0<br>6.0  | Ohm              |
| Drain–Source On–Voltage<br>(V <sub>GS</sub> = 10 V <sub>dc</sub> , I <sub>D</sub> = 0.5 A <sub>dc</sub> )<br>(V <sub>GS</sub> = 4.5 V <sub>dc</sub> , I <sub>D</sub> = 75 mA <sub>dc</sub> )           | V <sub>DS(on)</sub> | –<br>– | 2.5<br>0.45 | V <sub>dc</sub>  |
| On–State Drain Current<br>(V <sub>GS</sub> = 4.5 V <sub>dc</sub> , V <sub>DS</sub> = 10 V <sub>dc</sub> )  | I <sub>d(on)</sub>  | 75     | –           | mA <sub>dc</sub> |
| Forward Transconductance<br>(V <sub>DS</sub> = 10 V <sub>dc</sub> , I <sub>D</sub> = 200 mA <sub>dc</sub> )  | g <sub>fs</sub>     | 100    | –           | μmhos            |

### DYNAMIC CHARACTERISTICS

|                              |   |                  |   |     |    |
|------------------------------|---|------------------|---|-----|----|
| Input Capacitance            | (V <sub>DS</sub> = 25 V, V <sub>GS</sub> = 0,<br>f = 1.0 MHz) | C <sub>iss</sub> | – | 60  | pF |
| Output Capacitance           |   | C <sub>oss</sub> | – | 25  |    |
| Reverse Transfer Capacitance |   | C <sub>rss</sub> | – | 5.0 |    |

### SWITCHING CHARACTERISTICS (Note 1.)

|                     |   |                  |   |    |    |
|---------------------|---|------------------|---|----|----|
| Turn–On Delay Time  | (V <sub>DD</sub> = 15 V, I <sub>D</sub> = 500 mA,<br>R <sub>G</sub> = 25 Ω, R <sub>L</sub> = 30 Ω, V <sub>gen</sub> = 10 V) | t <sub>on</sub>  | – | 10 | ns |
| Turn–Off Delay Time |   | t <sub>off</sub> | – | 10 |    |

1. Pulse Test: Pulse Width ≤ 300 μs, Duty Cycle ≤ 2.0%.

# 2N7000

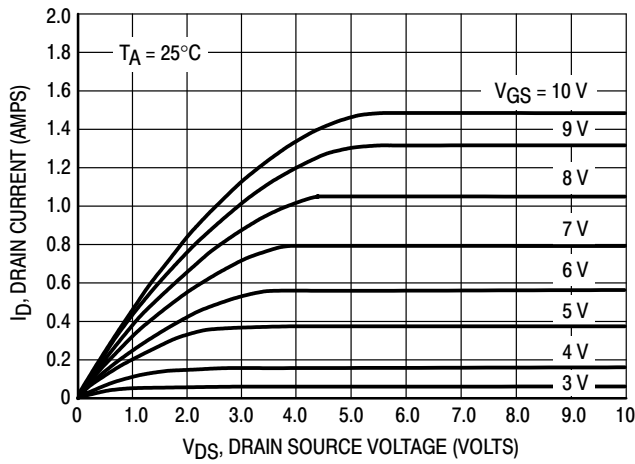


Figure 1. Ohmic Region

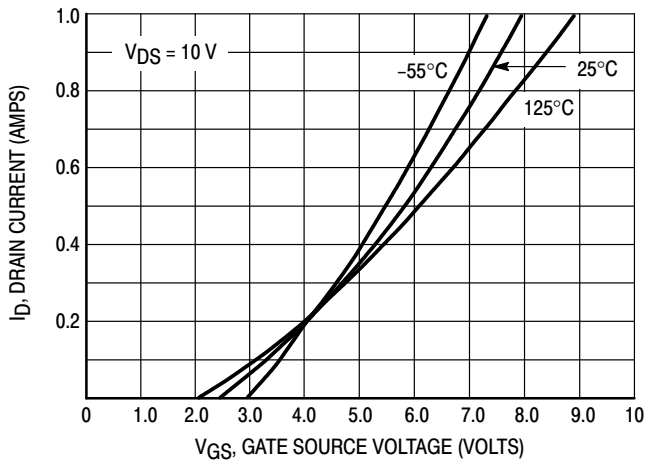


Figure 2. Transfer Characteristics

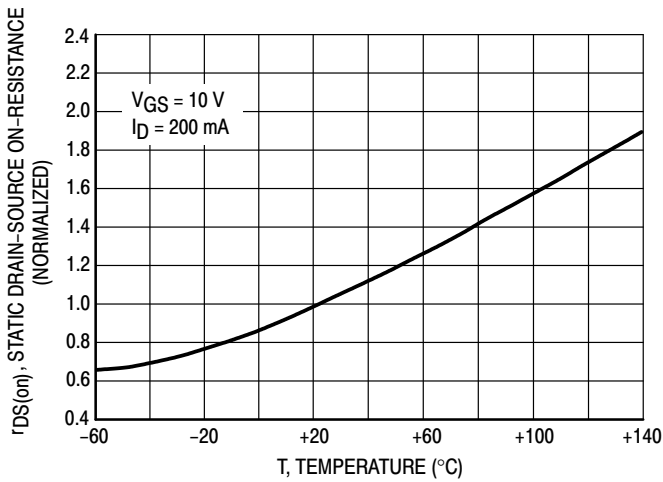


Figure 3. Temperature versus Static Drain-Source On-Resistance

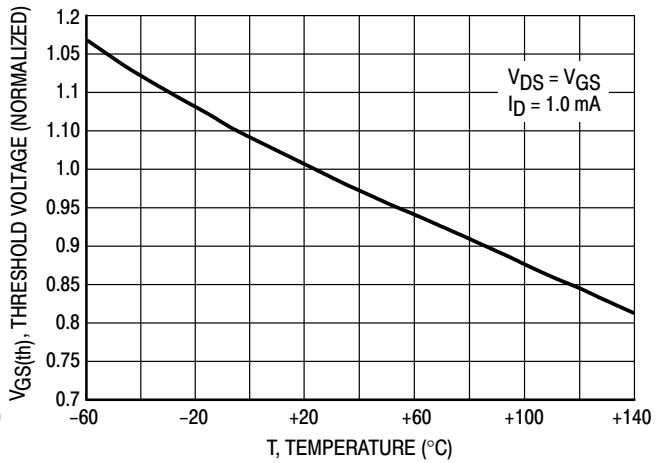


Figure 4. Temperature versus Gate Threshold Voltage

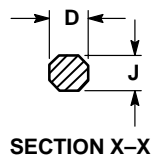
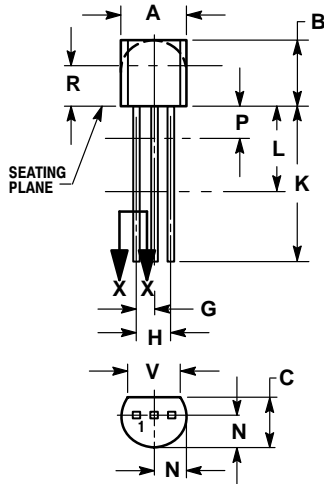
## ORDERING INFORMATION

| Device     | Package | Shipping         |
|------------|---------|------------------|
| 2N7000     | TO-92   | 1000 Unit/Box    |
| 2N7000RLRA | TO-92   | 2000 Tape & Reel |
| 2N7000RLRM | TO-92   | 2000 Ammo Pack   |
| 2N7000RLRP | TO-92   | 2000 Ammo Pack   |
| 2N7000ZL1  | TO-92   | 2000 Ammo Pack   |

# 2N7000

## PACKAGE DIMENSIONS

TO-92  
CASE 29-11  
ISSUE AL




### NOTES:

1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.
3. CONTOUR OF PACKAGE BEYOND DIMENSION R IS UNCONTROLLED.
4. LEAD DIMENSION IS UNCONTROLLED IN P AND BEYOND DIMENSION K MINIMUM.

| DIM | INCHES |       | MILLIMETERS |       |
|-----|--------|-------|-------------|-------|
|     | MIN    | MAX   | MIN         | MAX   |
| A   | 0.175  | 0.205 | 4.45        | 5.20  |
| B   | 0.170  | 0.210 | 4.32        | 5.33  |
| C   | 0.125  | 0.165 | 3.18        | 4.19  |
| D   | 0.016  | 0.021 | 0.407       | 0.533 |
| G   | 0.045  | 0.055 | 1.15        | 1.39  |
| H   | 0.095  | 0.105 | 2.42        | 2.66  |
| J   | 0.015  | 0.020 | 0.39        | 0.50  |
| K   | 0.500  | ---   | 12.70       | ---   |
| L   | 0.250  | ---   | 6.35        | ---   |
| N   | 0.080  | 0.105 | 2.04        | 2.66  |
| P   | ---    | 0.100 | ---         | 2.54  |
| R   | 0.115  | ---   | 2.93        | ---   |
| V   | 0.135  | ---   | 3.43        | ---   |

### STYLE 22:

1. SOURCE
2. GATE
3. DRAIN

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