

# 2N7000

Preferred Device

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

### MAXIMUM RATINGS

| Rating                                                                                | Symbol                | Value                | Unit                       |
|---------------------------------------------------------------------------------------|-----------------------|----------------------|----------------------------|
| Drain Source Voltage                                                                  | $V_{DSS}$             | 60                   | Vdc                        |
| Drain-Gate Voltage ( $R_{GS} = 1.0 \text{ M}\Omega$ )                                 | $V_{DGR}$             | 60                   | Vdc                        |
| Gate-Source Voltage<br>– Continuous<br>– Non-repetitive ( $t_p \leq 50 \mu\text{s}$ ) | $V_{GS}$<br>$V_{GSM}$ | $\pm 20$<br>$\pm 40$ | Vdc<br>Vpk                 |
| Drain Current<br>– Continuous<br>– Pulsed                                             | $I_D$<br>$I_{DM}$     | 200<br>500           | mA dc                      |
| Total Power Dissipation @ $T_C = 25^\circ\text{C}$<br>Derate above $25^\circ\text{C}$ | $P_D$                 | 350<br>2.8           | mW<br>mW/ $^\circ\text{C}$ |
| Operating and Storage Temperature Range                                               | $T_J, T_{stg}$        | $-55$ to $+150$      | $^\circ\text{C}$           |

### THERMAL CHARACTERISTICS

| Characteristic                                                                  | Symbol          | Max | Unit               |
|---------------------------------------------------------------------------------|-----------------|-----|--------------------|
| Thermal Resistance, Junction to Ambient                                         | $R_{\theta JA}$ | 357 | $^\circ\text{C/W}$ |
| Maximum Lead Temperature for Soldering Purposes, 1/16" from case for 10 seconds | $T_L$           | 300 | $^\circ\text{C}$   |

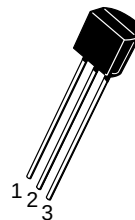
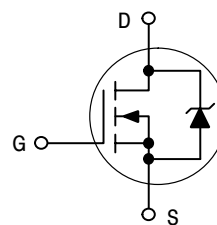


ON Semiconductor

<http://onsemi.com>

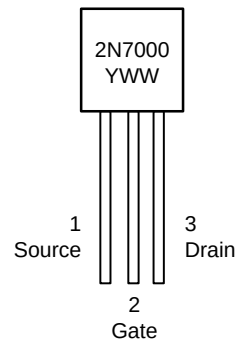
**200 mAmps**  
**60 VOLTS**  
 **$R_{DS(on)} = 5 \Omega$**

N-Channel



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 ( $T_C = 25^\circ\text{C}$ unless otherwise noted)

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

#### OFF CHARACTERISTICS

|                                                                                                                                                             |               |        |            |                         |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|--------|------------|-------------------------|
| Drain–Source Breakdown Voltage<br>( $V_{GS} = 0$ , $I_D = 10\ \mu\text{Adc}$ )                                                                              | $V_{(BR)DSS}$ | 60     | –          | Vdc                     |
| Zero Gate Voltage Drain Current<br>( $V_{DS} = 48\ \text{Vdc}$ , $V_{GS} = 0$ )<br>( $V_{DS} = 48\ \text{Vdc}$ , $V_{GS} = 0$ , $T_J = 125^\circ\text{C}$ ) | $I_{DSS}$     | –<br>– | 1.0<br>1.0 | $\mu\text{Adc}$<br>mAdc |
| Gate–Body Leakage Current, Forward<br>( $V_{GSF} = 15\ \text{Vdc}$ , $V_{DS} = 0$ )                                                                         | $I_{GSSF}$    | –      | –10        | nAdc                    |

#### ON CHARACTERISTICS (Note 1.)

|                                                                                                                                                          |              |        |             |                  |
|----------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|--------|-------------|------------------|
| Gate Threshold Voltage<br>( $V_{DS} = V_{GS}$ , $I_D = 1.0\ \text{mAdc}$ )                                                                               | $V_{GS(th)}$ | 0.8    | 3.0         | Vdc              |
| Static Drain–Source On–Resistance<br>( $V_{GS} = 10\ \text{Vdc}$ , $I_D = 0.5\ \text{Adc}$ )<br>( $V_{GS} = 4.5\ \text{Vdc}$ , $I_D = 75\ \text{mAdc}$ ) | $r_{DS(on)}$ | –<br>– | 5.0<br>6.0  | Ohm              |
| Drain–Source On–Voltage<br>( $V_{GS} = 10\ \text{Vdc}$ , $I_D = 0.5\ \text{Adc}$ )<br>( $V_{GS} = 4.5\ \text{Vdc}$ , $I_D = 75\ \text{mAdc}$ )           | $V_{DS(on)}$ | –<br>– | 2.5<br>0.45 | Vdc              |
| On–State Drain Current<br>( $V_{GS} = 4.5\ \text{Vdc}$ , $V_{DS} = 10\ \text{Vdc}$ )                                                                     | $I_{d(on)}$  | 75     | –           | mAdc             |
| Forward Transconductance<br>( $V_{DS} = 10\ \text{Vdc}$ , $I_D = 200\ \text{mAdc}$ )                                                                     | $g_{fs}$     | 100    | –           | $\mu\text{mhos}$ |

#### DYNAMIC CHARACTERISTICS

|                              |                                                                     |           |   |     |    |
|------------------------------|---------------------------------------------------------------------|-----------|---|-----|----|
| Input Capacitance            | $(V_{DS} = 25\ \text{V}$ , $V_{GS} = 0$ ,<br>$f = 1.0\ \text{MHz})$ | $C_{iss}$ | – | 60  | pF |
| Output Capacitance           |                                                                     | $C_{oss}$ | – | 25  |    |
| Reverse Transfer Capacitance |                                                                     | $C_{rss}$ | – | 5.0 |    |

#### SWITCHING CHARACTERISTICS (Note 1.)

|                     |                                                                                                                            |           |   |    |    |
|---------------------|----------------------------------------------------------------------------------------------------------------------------|-----------|---|----|----|
| Turn–On Delay Time  | $(V_{DD} = 15\ \text{V}$ , $I_D = 500\ \text{mA}$ ,<br>$R_G = 25\ \Omega$ , $R_L = 30\ \Omega$ , $V_{gen} = 10\ \text{V})$ | $t_{on}$  | – | 10 | ns |
| Turn–Off Delay Time |                                                                                                                            | $t_{off}$ | – | 10 |    |

1. Pulse Test: Pulse Width  $\leq 300\ \mu\text{s}$ , Duty Cycle  $\leq 2.0\%$ .

## 2N7000

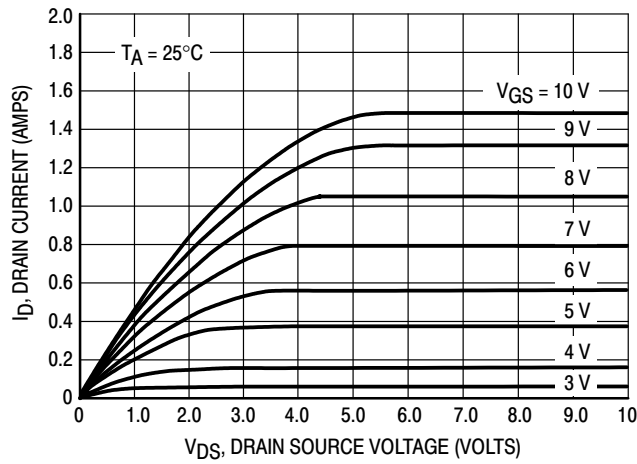


Figure 1. Ohmic Region

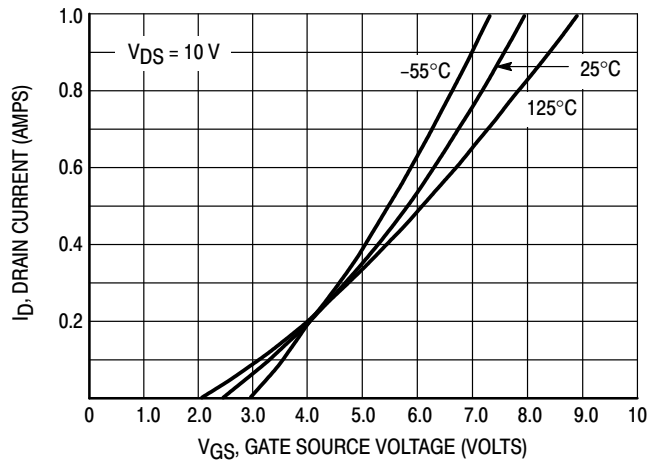


Figure 2. Transfer Characteristics

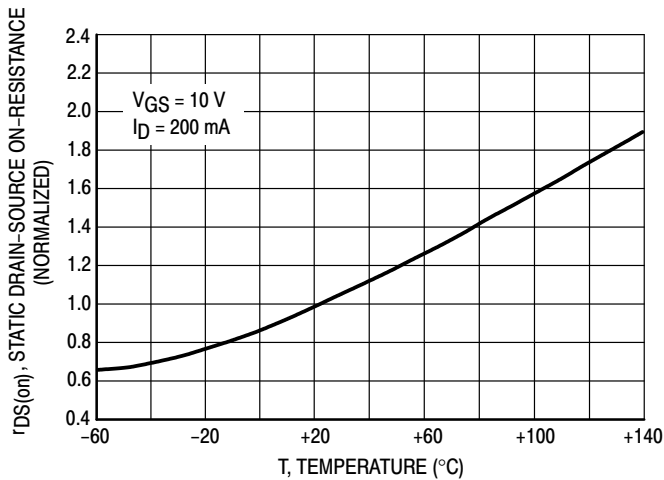


Figure 3. Temperature versus Static Drain-Source On-Resistance

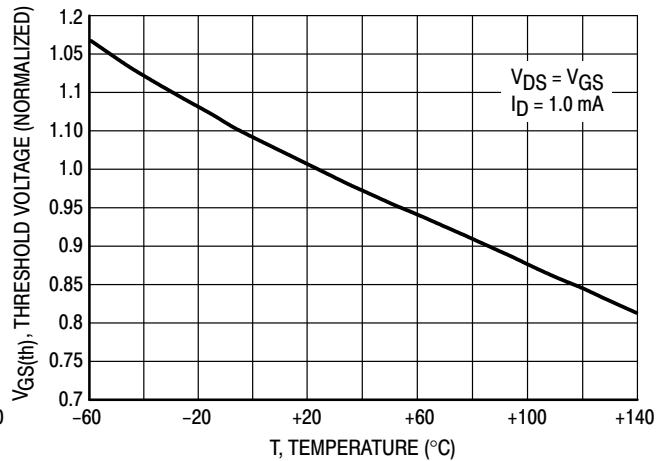


Figure 4. Temperature versus Gate Threshold Voltage

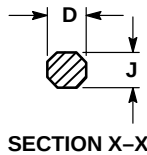
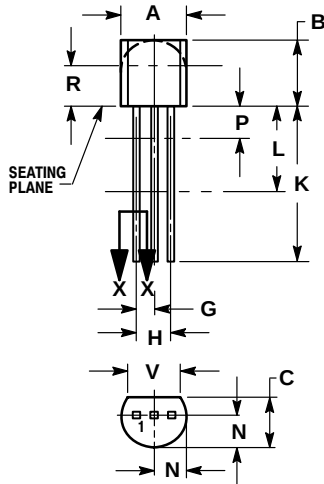
## ORDERING INFORMATION

| 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

ON Semiconductor and  are trademarks of Semiconductor Components Industries, LLC (SCILLC). SCILLC reserves the right to make changes without further notice to any products herein. SCILLC makes no warranty, representation or guarantee regarding the suitability of its products for any particular purpose, nor does SCILLC assume any liability arising out of the application or use of any product or circuit, and specifically disclaims any and all liability, including without limitation special, consequential or incidental damages. "Typical" parameters which may be provided in SCILLC data sheets and/or specifications can and do vary in different applications and actual performance may vary over time. All operating parameters, including "Typicals" must be validated for each customer application by customer's technical experts. SCILLC does not convey any license under its patent rights nor the rights of others. SCILLC products are not designed, intended, or authorized for use as components in systems intended for surgical implant into the body, or other applications intended to support or sustain life, or for any other application in which the failure of the SCILLC product could create a situation where personal injury or death may occur. Should Buyer purchase or use SCILLC products for any such unintended or unauthorized application, Buyer shall indemnify and hold SCILLC and its officers, employees, subsidiaries, affiliates, and distributors harmless against all claims, costs, damages, and expenses, and reasonable attorney fees arising out of, directly or indirectly, any claim of personal injury or death associated with such unintended or unauthorized use, even if such claim alleges that SCILLC was negligent regarding the design or manufacture of the part. SCILLC is an Equal Opportunity/Affirmative Action Employer.

## PUBLICATION ORDERING INFORMATION

### NORTH AMERICA Literature Fulfillment:

Literature Distribution Center for ON Semiconductor  
P.O. Box 5163, Denver, Colorado 80217 USA  
**Phone:** 303-675-2175 or 800-344-3860 Toll Free USA/Canada  
**Fax:** 303-675-2176 or 800-344-3867 Toll Free USA/Canada  
**Email:** ONlit@hibbertco.com  
Fax Response Line: 303-675-2167 or 800-344-3810 Toll Free USA/Canada

**N. American Technical Support:** 800-282-9855 Toll Free USA/Canada

**EUROPE:** LDC for ON Semiconductor – European Support

**German Phone:** (+1) 303-308-7140 (Mon-Fri 2:30pm to 7:00pm CET)  
**Email:** ONlit-german@hibbertco.com  
**French Phone:** (+1) 303-308-7141 (Mon-Fri 2:00pm to 7:00pm CET)  
**Email:** ONlit-french@hibbertco.com  
**English Phone:** (+1) 303-308-7142 (Mon-Fri 12:00pm to 5:00pm GMT)  
**Email:** ONlit@hibbertco.com

**EUROPEAN TOLL-FREE ACCESS\*: 00-800-4422-3781**

\*Available from Germany, France, Italy, UK, Ireland

### CENTRAL/SOUTH AMERICA:

**Spanish Phone:** 303-308-7143 (Mon-Fri 8:00am to 5:00pm MST)  
**Email:** ONlit-spanish@hibbertco.com  
**Toll-Free from Mexico:** Dial 01-800-288-2872 for Access –  
then Dial 866-297-9322

**ASIA/PACIFIC:** LDC for ON Semiconductor – Asia Support

**Phone:** 303-675-2121 (Tue-Fri 9:00am to 1:00pm, Hong Kong Time)  
**Toll Free from Hong Kong & Singapore:**  
**001-800-4422-3781**  
**Email:** ONlit-asia@hibbertco.com

**JAPAN:** ON Semiconductor, Japan Customer Focus Center

4-32-1 Nishi-Gotanda, Shinagawa-ku, Tokyo, Japan 141-0031  
**Phone:** 81-3-5740-2700  
**Email:** r14525@onsemi.com

**ON Semiconductor Website:** <http://onsemi.com>

For additional information, please contact your local Sales Representative.