

# Enhancement Mode Field Effect Transistor

N-Channel

## 2N7002W

### Features

- Low On-Resistance
- Low Gate Threshold Voltage
- Low Input Capacitance
- Fast Switching Speed
- Low Input/Output Leakage
- Ultra-Small Surface Mount Package
- These Devices are Pb-Free and are RoHS Compliant

### ABSOLUTE MAXIMUM RATINGS (T<sub>A</sub> = 25°C unless otherwise noted)

| Parameter   | Symbol                            | Value            | Unit |
|---|-----------------------------------|------------------|------|
| Drain-to-Source Voltage   | V <sub>DSS</sub>                  | 60               | V    |
| Drain-Gate Voltage R <sub>GS</sub> ≤ 1.0 MΩ                       | V <sub>DGR</sub>                  | 60               | V    |
| Gate-Source Voltage<br>Continuous<br>Pulsed                       | V <sub>GSS</sub>                  | ±20<br>±40       | V    |
| Gate-Source Voltage<br>Continuous<br>Continuous @ 100°C<br>Pulsed | I <sub>D</sub>                    | 115<br>73<br>800 | mA   |
| Junction and Storage Temperature Range                            | T <sub>J</sub> , T <sub>STG</sub> | -55 to<br>+150   | °C   |

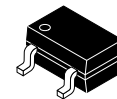
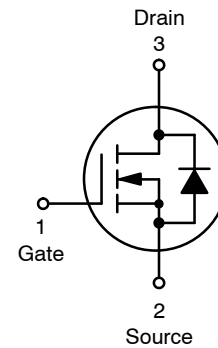
Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

### THERMAL CHARACTERISTICS

| Parameter  | Symbol           | Max        | Unit        |
|--|------------------|------------|-------------|
| Total Device Dissipation<br>Derating above T <sub>A</sub> = 25°C | P <sub>D</sub>   | 200<br>1.6 | MW<br>mW/°C |
| Thermal Resistance, Junction-to-Ambient<br>(Note 1)              | R <sub>θJA</sub> | 625        | °C/W        |

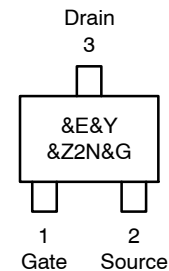
1. Device mounted on FR-4 PCB, 1 inch × 0.85 inch × 0.062 inch. Minimum land pad size.

### SIMPLIFIED SCHEMATIC



SC-70  
CASE 419AB

### MARKING DIAGRAM & PIN ASSIGNMENT



Line 1:  
&E = Space  
&Y = Binary Year Code

Line 2:  
&Z = Designates the Assembly Plant Code  
**2N** = **Specific Device Code**  
&G = 1-digit Week Code

### ORDERING INFORMATION

| Device  | Package            | Shipping <sup>†</sup> |
|---------|--------------------|-----------------------|
| 2N7002W | SC-70<br>(Pb-Free) | 3000 / Tape & Reel    |

<sup>†</sup>For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, BRD8011/D.

## 2N7002W

### ELECTRICAL CHARACTERISTICS ( $T_A = 25^\circ\text{C}$ unless otherwise noted)

| Parameter | Symbol | Test Condition | Min | Typ | Max | Units |
|-----------|--------|----------------|-----|-----|-----|-------|
|-----------|--------|----------------|-----|-----|-----|-------|

#### OFF CHARACTERISTICS (Note 2)

|                                 |            |   |                           |     |          |     |               |
|---------------------------------|------------|---|---------------------------|-----|----------|-----|---------------|
| Drain-Source Breakdown Voltage  | $BV_{DSS}$ | $V_{GS} = 0\text{ V}, I_D = 10\ \mu\text{A}$    | 60                        | 78  | -        | V   |               |
| Zero Gate Voltage Drain Current | $I_{DSS}$  | $V_{GS} = 0\text{ V}, V_{DS} = 60\text{ V}$     | $T_C = 25^\circ\text{C}$  | -   | 0.001    | 1.0 | $\mu\text{A}$ |
|                                 |            |   | $T_C = 125^\circ\text{C}$ | -   | 7        | 500 |               |
| Gate-Body Leakage Current       | $I_{GSS}$  | $V_{GS} = \pm 20\text{ V}, V_{DS} = 0\text{ V}$ | -                         | 0.2 | $\pm 10$ | nA  |               |

#### ON CHARACTERISTICS (Note 2)

|                                   |              |   |     |       |      |          |
|-----------------------------------|--------------|---|-----|-------|------|----------|
| Gate Threshold Voltage            | $V_{GS(th)}$ | $V_{GS} = V_{DS}, I_D = 250\ \mu\text{A}$                             | 1.0 | 1.76  | 2.0  | V        |
| Static Drain-Source On-Resistance | $R_{DS(ON)}$ | $V_{GS} = 5\text{ V}, I_D = 0.05\text{ A}$                            | -   | 1.6   | 7.5  | $\Omega$ |
|                                   |              | $V_{GS} = 10\text{ V}, I_D = 0.5\text{ A}, @ T_J = 125^\circ\text{C}$ | -   | 2.53  | 13.5 |          |
| On-State Drain Current            | $I_{D(ON)}$  | $V_{GS} = 10\text{ V}, V_{DS} = 7.5\text{ V}$                         | 0.5 | 1.43  | -    | A        |
| Forward Transconductance          | $g_{FS}$     | $V_{DS} = 10\text{ V}, I_D = 0.2\text{ A}$                            | 80  | 356.5 | -    | mS       |

#### DYNAMIC CHARACTERISTICS

|                              |           |   |   |      |     |    |
|------------------------------|-----------|---|---|------|-----|----|
| Input Capacitance            | $C_{ISS}$ | $V_{GS} = 0\text{ V}, V_{DS} = 25\text{ V}, f = 1.0\text{ MHz}$ | - | 37.8 | 50  | pF |
| Output Capacitance           | $C_{OSS}$ |   | - | 12.4 | 25  |    |
| Reverse Transfer Capacitance | $C_{RSS}$ |   | - | 6.5  | 7.0 |    |

#### SWITCHING CHARACTERISTICS

|                     |              |  |   |      |    |    |
|---------------------|--------------|--|---|------|----|----|
| Turn-On Delay Time  | $t_{D(ON)}$  | $V_{GEN} = 10\text{ V}, V_{DD} = 30\text{ V}, I_D = 0.2\text{ A}, R_L = 150\ \Omega, R_{GEN} = 25\ \Omega$ | - | 5.85 | 20 | ns |
| Turn-Off Delay Time | $t_{D(OFF)}$ |  | - | 12.5 | 20 |    |

Product parametric performance is indicated in the Electrical Characteristics for the listed test conditions, unless otherwise noted. Product performance may not be indicated by the Electrical Characteristics if operated under different conditions.

2. Short duration test pulse used to minimize self-heating effect.

TYPICAL PERFORMANCE CHARACTERISTICS

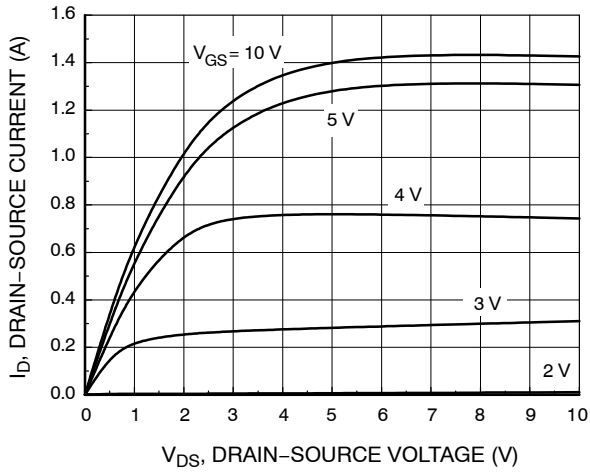


Figure 1. On-Region Characteristics

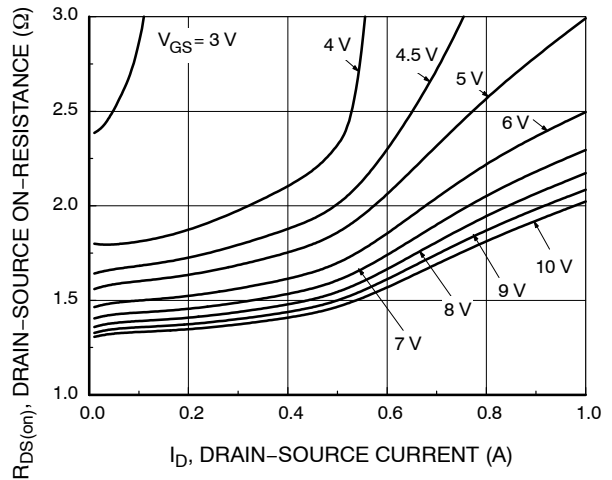


Figure 2. On-Resistance Variation with Gate Voltage and Drain Current

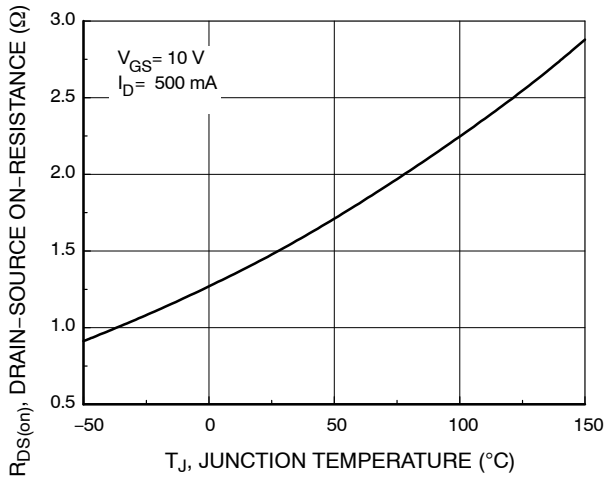


Figure 3. On-Resistance Variation with Temperature

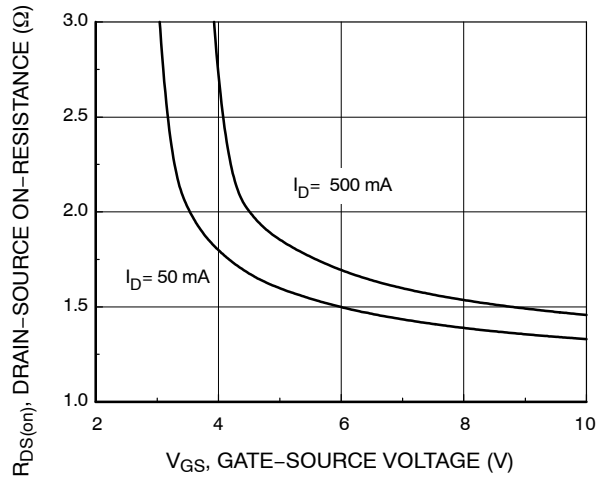


Figure 4. On-Resistance Variation with Gate-Source Voltage

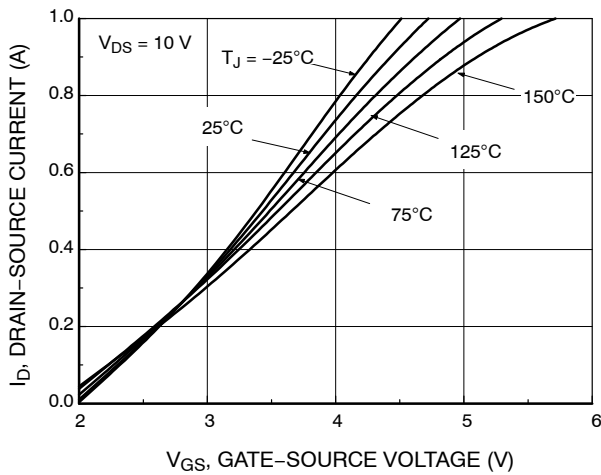


Figure 5. Transfer Characteristics

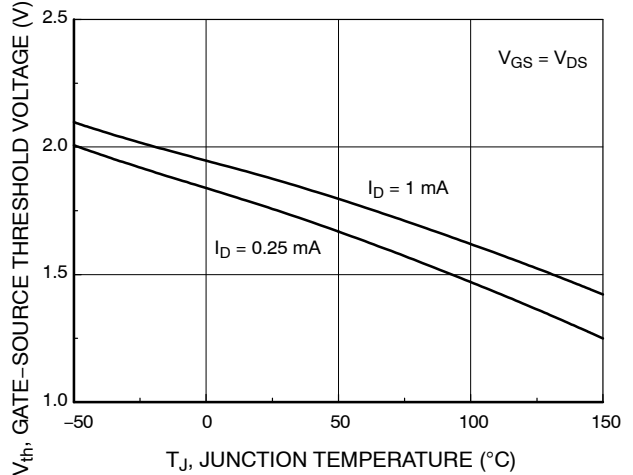


Figure 6. Gate Threshold Variation with Temperature

TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

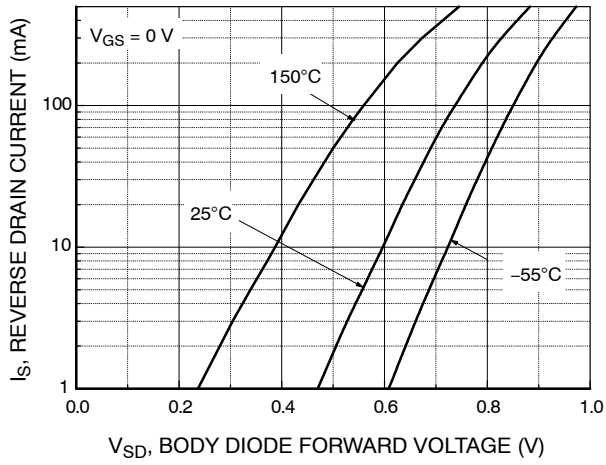


Figure 7. Reverse Drain Current Variation with Diode Forward Voltage and Temperature

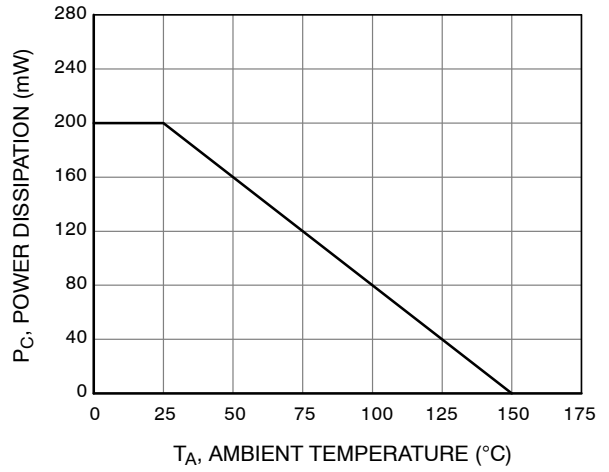
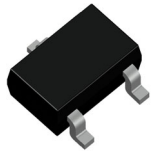


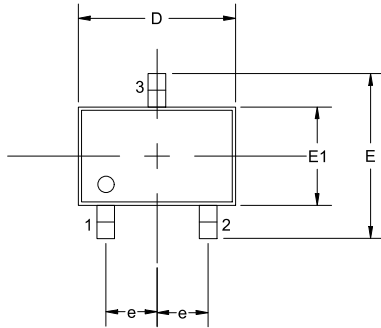
Figure 8. Power Derating

**MECHANICAL CASE OUTLINE**  
**PACKAGE DIMENSIONS**

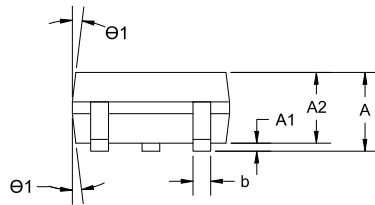


**SC-70, 3 Lead, 1.25x2**  
**CASE 419AB**  
**ISSUE A**

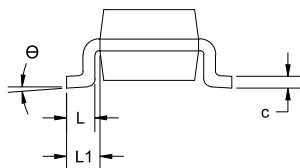
DATE 13 FEB 2023



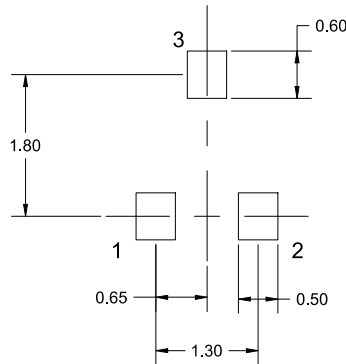
TOP VIEW



SIDE VIEW



END VIEW



SOLDERING FOOTPRINT

NOTES:

1. ALL DIMENSIONS ARE IN MILLIMETERS. ANGLES IN DEGREES.
2. COMPLIES WITH JEDEC MO-203

| DIM | MILLIMETERS |      |      |
|-----|-------------|------|------|
|     | MIN.        | NOM. | MAX. |
| A   | 0.80        |      | 1.10 |
| A1  | 0.00        |      | 0.10 |
| A2  | 0.80        | 0.90 | 1.00 |
| b   | 0.15        |      | 0.30 |
| c   | 0.08        |      | 0.22 |
| D   | 1.80        | 2.00 | 2.20 |
| E   | 1.80        | 2.10 | 2.40 |
| E1  | 1.15        | 1.25 | 1.35 |
| e   | 0.65 BSC    |      |      |
| L   | 0.26        | 0.36 | 0.46 |
| L1  | 0.42 REF    |      |      |
| θ   | 0°          |      | 8°   |
| θ1  | 4°          |      | 10°  |

\* For additional information on our Pb-Free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.

|                         |                              |  |
|-------------------------|------------------------------|--|
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