

# 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 Continuous Pulsed	V <sub>GSS</sub>	±20 ±40	V
Gate-Source Voltage Continuous Continuous @ 100°C Pulsed	I <sub>D</sub>	115 73 800	mA
Junction and Storage Temperature Range	T <sub>J</sub> , T <sub>STG</sub>	-55 to +150	°C

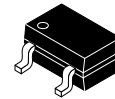
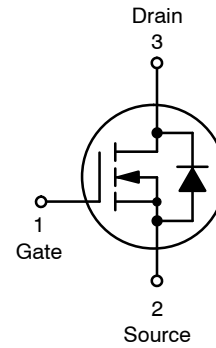
Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

#### THERMAL CHARACTERISTICS

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

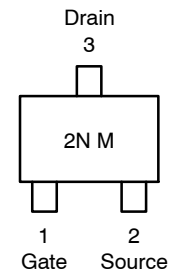
1. Device mounted on FR-4 PCB, 1 inch × 0.85 inch × 0.062 inch. Minimum land pad size.

#### SIMPLIFIED SCHEMATIC



SC-70  
CASE 419AB

#### MARKING DIAGRAM & PIN ASSIGNMENT



2N = Device Code  
M = Date Code

#### ORDERING INFORMATION

Device	Package	Shipping <sup>†</sup>
2N7002W	SC-70 (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
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#### 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

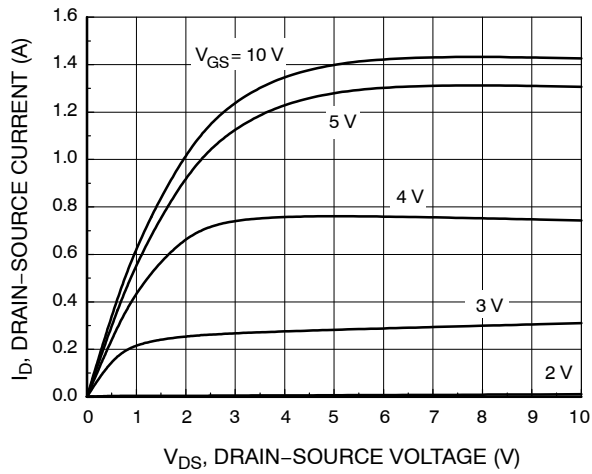


Figure 1. On-Region Characteristics

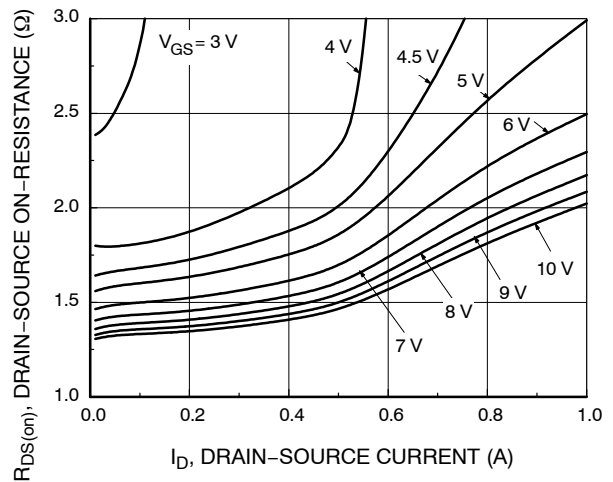


Figure 2. On-Resistance Variation with Gate Voltage and Drain Current

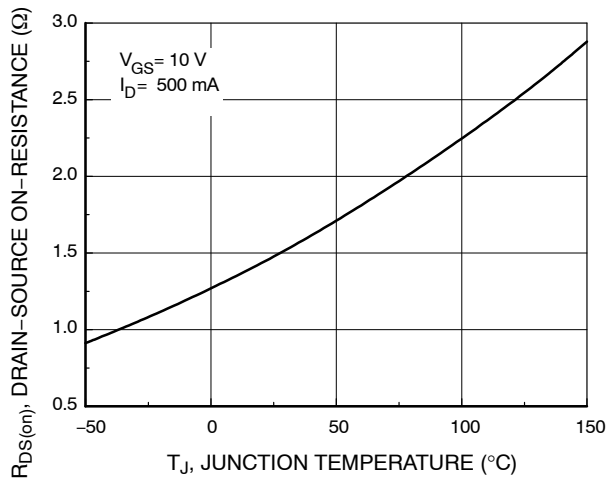


Figure 3. On-Resistance Variation with Temperature

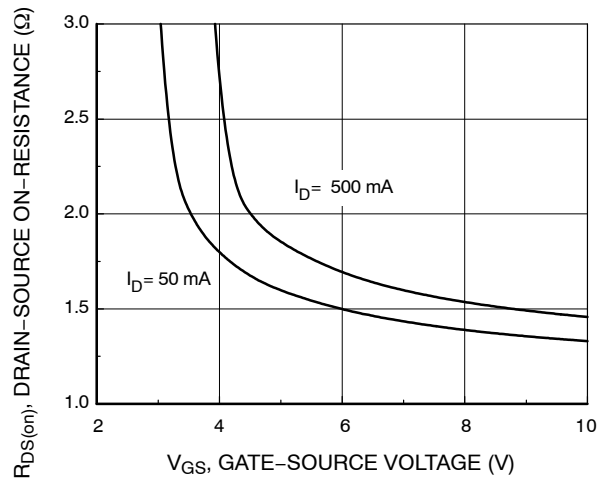


Figure 4. On-Resistance Variation with Gate-Source Voltage

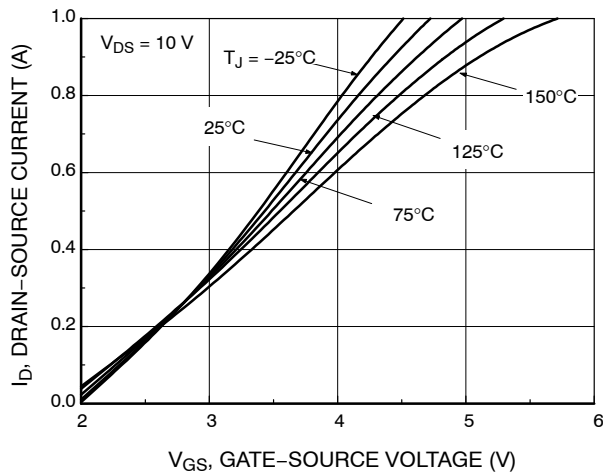


Figure 5. Transfer Characteristics

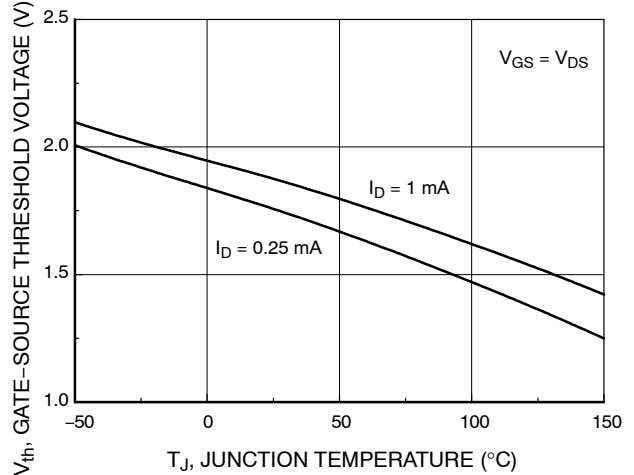


Figure 6. Gate Threshold Variation with Temperature

TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

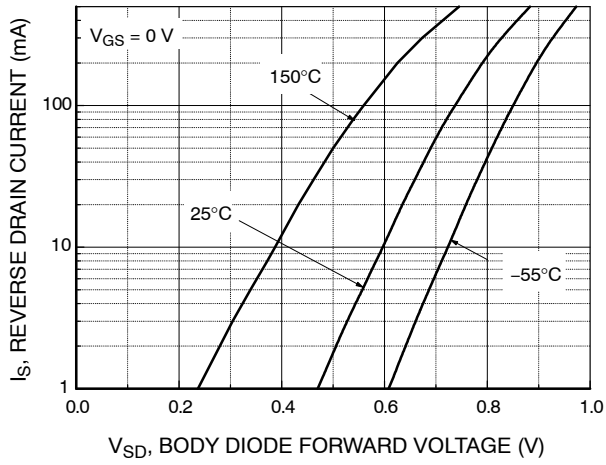


Figure 7. Reverse Drain Current Variation with Diode Forward Voltage and Temperature

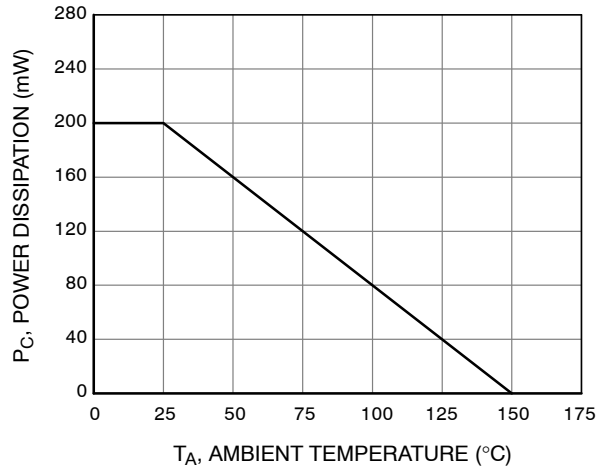
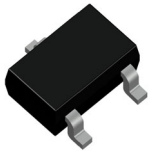
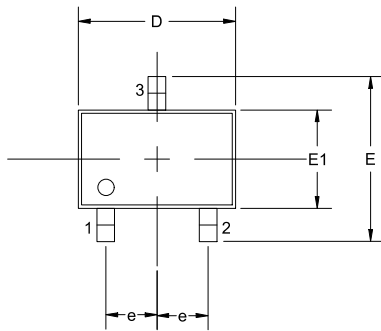


Figure 8. Power Derating

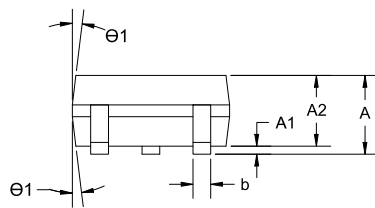


**SC-70, 3 Lead, 1.25x2**  
**CASE 419AB**  
**ISSUE A**

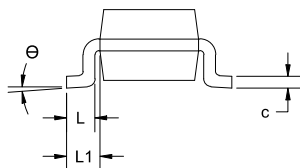
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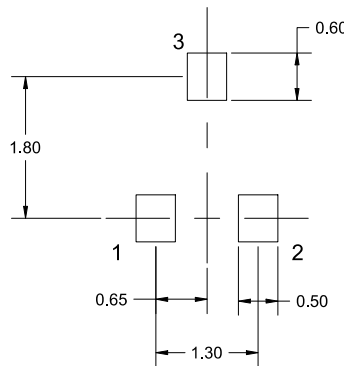
TOP VIEW



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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