

# 2N7002KW

## N-Channel Enhancement Mode Field Effect Transistor

### 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
- ESD HBM = 1000 V as per JESD22 A114 and ESD CDM = 1500 V as per JESD22 C101

### ABSOLUTE MAXIMUM RATINGS ( $T_A = 25^\circ\text{C}$ unless otherwise noted)

Rating	Symbol	Value	Unit
Drain-Source Voltage	$V_{DSS}$	60	V
Gate-Source Voltage	$V_{GSS}$	$\pm 20$	V
Maximum Drain Current	$I_D$	310	mA
Continuous $T_J = 100^\circ\text{C}$		195	mA
Pulsed		1.2	A
Operating Junction Temperature Range	$T_J$	-55 to +150	$^\circ\text{C}$
Storage Temperature Range	$T_{STG}$	-55 to +150	$^\circ\text{C}$

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

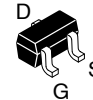
Parameter	Symbol	Value	Unit
Total Device Dissipation Derating above $T_A = 25^\circ\text{C}$	$P_D$	300 2.4	mW mW/ $^\circ\text{C}$
Thermal Resistance, Junction to Ambient*	$R_{\theta JA}$	410	$^\circ\text{C}/\text{W}$

\*Device mounted on FR-4 PCB, 1" x 0.85" x 0.062". Minimum land pad size



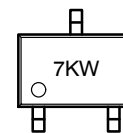
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SC-70  
3 LEAD  
CASE 419AB

### MARKING DIAGRAM



7KW = Specific Device Marking



### ORDERING INFORMATION†

Device	Package	Shipping†
2N7002KW	SC-70	3000 / Tape & Reel

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

## 2N7002KW

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

Symbol	Parameter	Test Conditions	Min	Typ	Max	Unit
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#### OFF CHARACTERISTICS

$BV_{DSS}$	Drain-Source Breakdown Voltage	$V_{GS} = 0\text{ V}, I_D = 10\ \mu\text{A}$	60	-	-	V
$I_{DSS}$	Zero Gate Voltage Drain Current	$V_{DS} = 60\text{ V}, V_{GS} = 0\text{ V}$ $V_{DS} = 60\text{ V}, V_{GS} = 0\text{ V}, T_J = 125^\circ\text{C}$	-	-	1.0 0.5	$\mu\text{A}$ mA
$I_{GSS}$	Gate-Body Leakage	$V_{DS} = 0\text{ V}, V_{GS} = \pm 20\text{ V}$	-	-	$\pm 10$	$\mu\text{A}$

#### ON CHARACTERISTICS (Note 1)

$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS} = V_{GS}, I_D = 250\ \mu\text{A}$	1.1	-	2.1	V
$R_{DS(on)}$	Static Drain-Source On-Resistance	$V_{GS} = 10\text{ V}, I_D = 500\text{ mA}$ $V_{GS} = 10\text{ V}, I_D = 500\text{ mA}, T_J = 100^\circ\text{C}$ $V_{GS} = 5\text{ V}, I_D = 50\text{ mA}$ $V_{GS} = 5\text{ V}, I_D = 50\text{ mA}, T_J = 100^\circ\text{C}$	-	-	1.6 2.4 2 3	$\Omega$
$V_{DS(on)}$	Drain-Source On-Voltage	$V_{GS} = 10\text{ V}, I_D = 500\text{ mA}$ $V_{GS} = 5\text{ V}, I_D = 50\text{ mA}$	-	-	3.75 1.5	V
$I_{D(on)}$	On-State Drain Current	$V_{GS} = 10\text{ V}, V_{DS} = 2\text{ V}$	500	-	-	mA
$g_{FS}$	Forward Transconductance	$V_{DS} = 2\text{ V}, I_D = 0.2\text{ A}$	80	-	-	mS

#### DYNAMIC CHARACTERISTICS

$C_{iss}$	Input Capacitance	$V_{DS} = 25\text{ V}, V_{GS} = 0\text{ V}, f = 1.0\text{ MHz}$	-	-	50	pF
$C_{oss}$	Output Capacitance		-	-	25	pF
$C_{rss}$	Reverse Transfer Capacitance		-	-	5	pF

#### SWITCHING CHARACTERISTICS

$t_{d(on)}$	Turn-On Delay Time	$V_{DD} = 30\text{ V}, R_L = 150\ \Omega, V_{GS} = 10\text{ V},$ $I_D = 200\text{ mA}, R_{GEN} = 25\ \Omega$	-	-	20	ns
$t_{d(off)}$	Turn-Off Delay Time		-	-	60	ns

#### DRAIN-SOURCE DIODE CHARACTERISTICS

$I_S$	Maximum Continuous Drain-Source Diode Forward Current	-	-	115	mA	
$I_{SM}$	Maximum Pulsed Drain-Source Diode Forward Current	-	-	0.8	A	
$V_{SD}$	Drain-Source Diode Forward Voltage	$V_{GS} = 0\text{ V}, I_S = 115\text{ mA}$	-	-	1.1	V

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.

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

TYPICAL PERFORMANCE CHARACTERISTICS

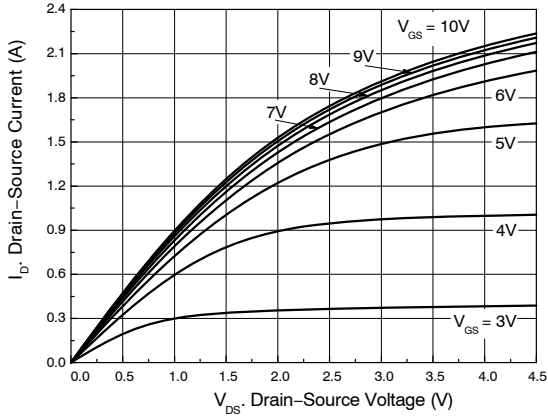


Figure 1. On-Region Characteristics

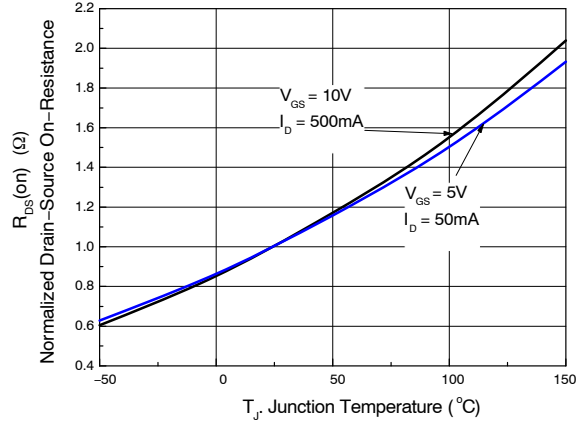


Figure 2. On-Resistance Variation with Temperature

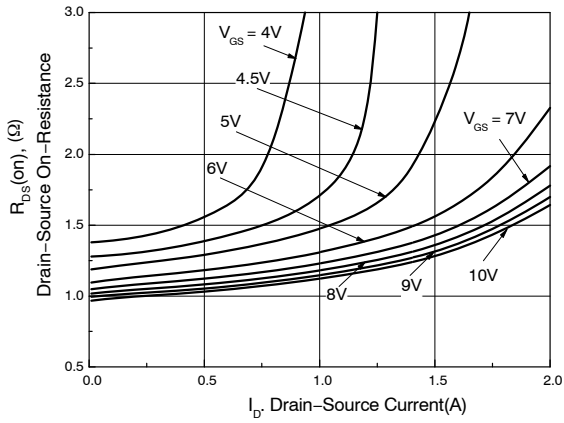


Figure 3. On-Resistance Variation with Gate Voltage and Drain Current

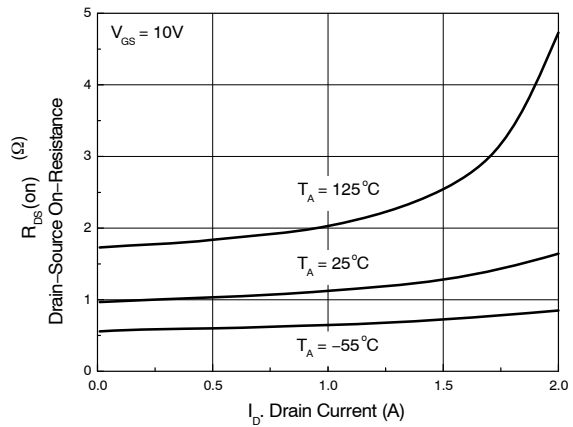


Figure 4. On-Resistance Variation with Drain Current and Temperature



Figure 5. Transfer Characteristics

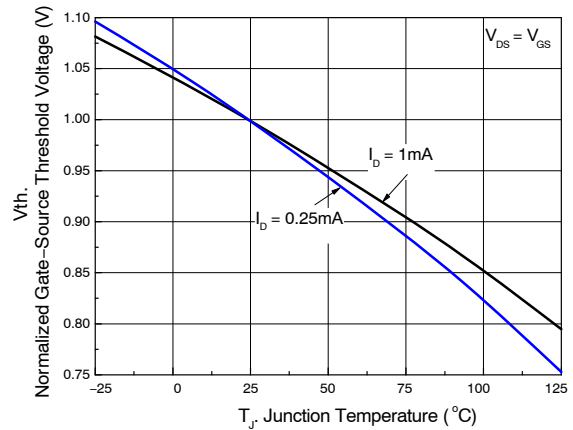


Figure 6. Gate Threshold Variation with Temperature

TYPICAL PERFORMANCE CHARACTERISTICS

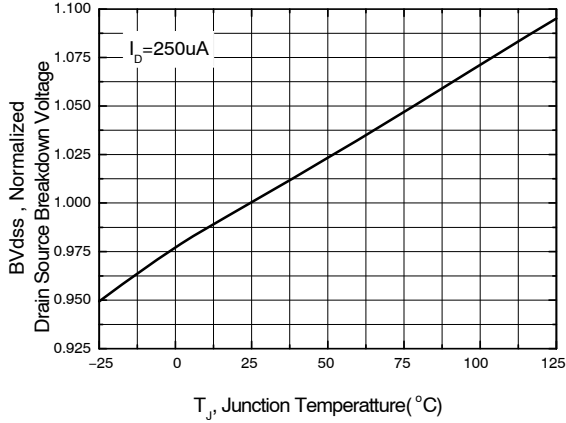


Figure 7. Breakdown Voltage Variation with Temperature

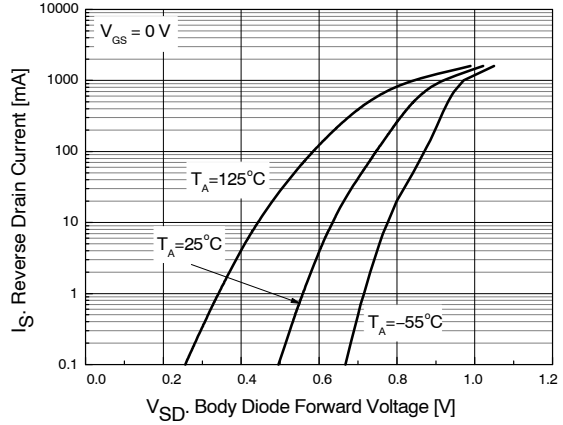


Figure 8. Body Diode Forward Voltage Variation with Source Current and Temperature

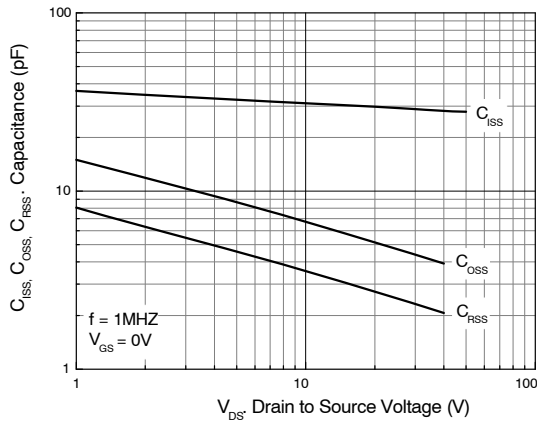


Figure 9. Capacitance Variation

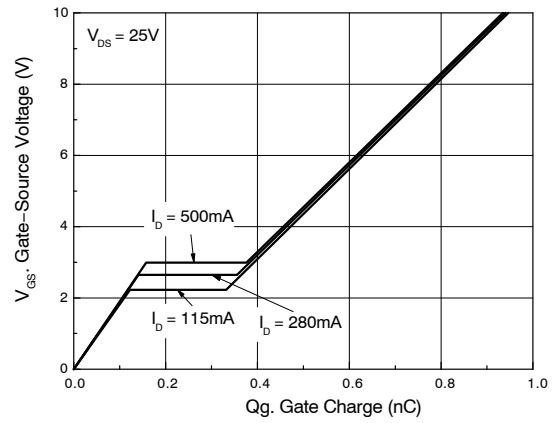


Figure 10. Gate Charge Characteristics

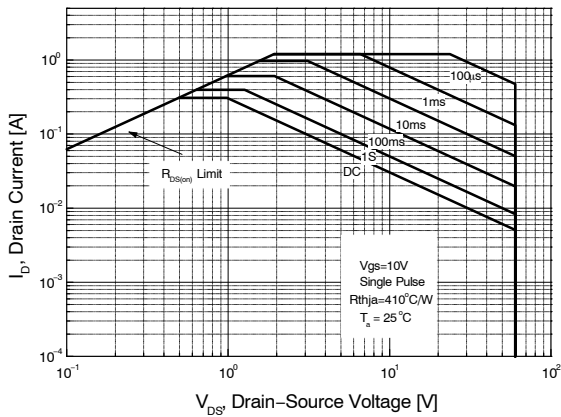


Figure 11. Maximum Safe Operating Area

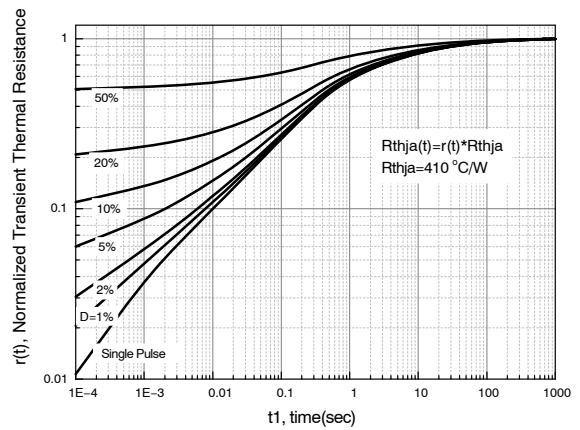


Figure 12. Transient Thermal Response Curve

# MECHANICAL CASE OUTLINE

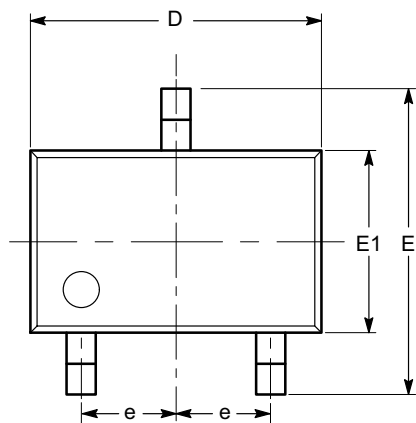
## PACKAGE DIMENSIONS

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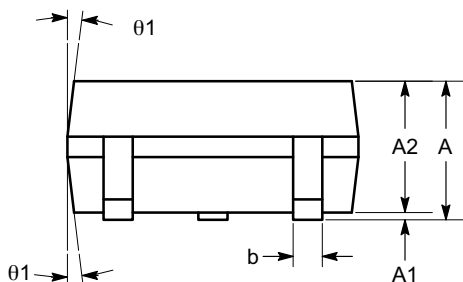
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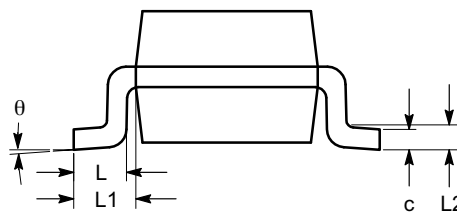


TOP VIEW

SYMBOL	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		
L2	0.15 BSC		
$\theta$	0°		8°
$\theta 1$	4°		10°



SIDE VIEW



END VIEW

**Notes:**

- (1) All dimensions are in millimeters. Angles in degrees.
- (2) Complies with JEDEC MO-203.

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