2N7002W

Small Signal MOSFET

60 V, 340 mA, Single, N−Channel, SC−70

Features

- ESD Protected
- Low $R_{DS(on)}$
- Small Footprint Surface Mount Package
- This is a Pb−Free Device

Applications

- Low Side Load Switch
- Level Shift Circuits
- DC−DC Converter
- Portable Applications i.e. DSC, PDA, Cell Phone, etc.

MAXIMUM RATINGS (T_J = 25°C unless otherwise stated)

Rating		Symbol	Value	Unit
Drain−to−Source Voltage		V_{DSS}	60	V
Gate−to−Source Voltage		V_{GS}	±20	V
Drain Current (Note 1)		I_D		mA
Steady State	T_A = 25°C		310	
	T_A = 85°C		220	
t < 5 s	T_A = 25°C		340	
	T_A = 85°C		240	
Power Dissipation (Note 1)		P_D		mW
Steady State			280	
t < 5 s			330	
Pulsed Drain Current (t_p = 10 μs)		I_{DM}	1.4	A
Operating Junction and Storage Temperature Range		T_J, T_{STG}	−55 to +150	°C
Source Current (Body Diode)		I_S	250	mA
Lead Temperature for Soldering Purposes (1/8″ from case for 10 s)		T_L	260	°C
Gate−Source ESD Rating (HBM, Method 3015)		ESD	900	V

Stresses exceeding Maximum Ratings may damage the device. Maximum Ratings are stress ratings only. Functional operation above the Recommended Operating Conditions is not implied. Extended exposure to stresses above the Recommended Operating Conditions may affect device reliability.

THERMAL CHARACTERISTICS

Characteristic	Symbol	Max	Unit
Junction−to−Ambient − Steady State (Note 1)	$R_{\theta JA}$	450	°C/W
Junction−to−Ambient − t ≤ 5 s (Note 1)	$R_{\theta JA}$	375	

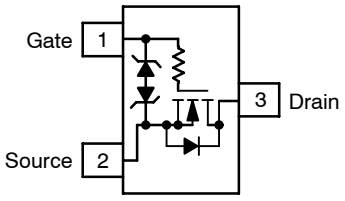
1. Surface−mounted on FR4 board using 1 in sq pad size (Cu area = 1.127 in sq [1 oz] including traces)

ON Semiconductor®

http://onsemi.com

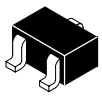
$V_{(BR)DSS}$	$R_{DS(on)}$ MAX	I_D MAX (Note 1)
60 V	1.6 Ω @ 10 V	340 mA
	2.5 Ω @ 4.5 V	

Simplified Schematic

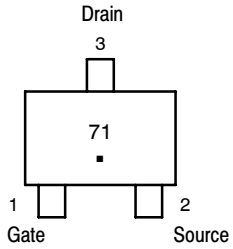


(Top View)

MARKING DIAGRAM & PIN ASSIGNMENT



SC−70/SOT−323
CASE 419
STYLE 8



71 = Device Code
▪ = Pb−Free Package

ORDERING INFORMATION

Device	Package	Shipping†
2N7002WT1G	SC−70 (Pb−Free)	3000/Tape & Reel

†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.

ELECTRICAL CHARACTERISTICS (T_J = 25°C unless otherwise specified)

Parameter	Symbol	Test Condition		Min	Typ	Max	Units
OFF CHARACTERISTICS							
Drain−to−Source Breakdown Voltage	$V_{(BR)DSS}$	V_{GS} = 0 V, I_D = 250 μA		60			V
Drain−to−Source Breakdown Voltage Temperature Coefficient	$V_{(BR)DSS}/T_J$				71		mV/°C
Zero Gate Voltage Drain Current	I_{DSS}	V_{GS} = 0 V, V_{DS} = 60 V	T_J = 25°C			1	μA
			T_J = 125°C			500	μA
		V_{GS} = 0 V, V_{DS} = 50 V	T_J = 25°C			100	nA
Gate−to−Source Leakage Current	I_{GSS}	V_{DS} = 0 V, V_{GS} = ±20 V				±10	μA
		V_{DS} = 0 V, V_{GS} = ±10 V				450	nA
		V_{DS} = 0 V, V_{GS} = ±5.0 V				150	nA
ON CHARACTERISTICS (Note 2)							
Gate Threshold Voltage	$V_{GS(TH)}$	V_{GS} = V_{DS}, I_D = 250 μA		1.0		2.5	V
Negative Threshold Temperature Coefficient	$V_{GS(TH)}/T_J$				4.0		mV/°C
Drain−to−Source On Resistance	$R_{DS(on)}$	V_{GS} = 10 V, I_D = 500 mA			1.19	1.6	Ω
		V_{GS} = 4.5 V, I_D = 200 mA			1.33	2.5	
Forward Transconductance	g_{FS}	V_{DS} = 5 V, I_D = 200 mA			80		S
CHARGES AND CAPACITANCES							
Input Capacitance	C_{ISS}	V_{GS} = 0 V, f = 1 MHz, V_{DS} = 20 V			24.5		pF
Output Capacitance	C_{OSS}				4.2		
Reverse Transfer Capacitance	C_{RSS}				2.2		
Total Gate Charge	$Q_{G(TOT)}$	V_{GS} = 4.5 V, V_{DS} = 10 V; I_D = 200 mA			0.7		nC
Threshold Gate Charge	$Q_{G(TH)}$				0.1		
Gate−to−Source Charge	Q_{GS}				0.3		
Gate−to−Drain Charge	Q_{GD}				0.1		
SWITCHING CHARACTERISTICS, V_{GS} = V (Note 3)							
Turn−On Delay Time	$t_{d(ON)}$	V_{GS} = 10 V, V_{DD} = 25 V, I_D = 500 mA, R_G = 25 Ω			12.2		ns
Rise Time	t_r				9.0		
Turn−Off Delay Time	$t_{d(OFF)}$				55.8		
Fall Time	t_f				29		
DRAIN−SOURCE DIODE CHARACTERISTICS							
Forward Diode Voltage	V_{SD}	V_{GS} = 0 V, I_S = 200 mA	T_J = 25°C		0.8	1.2	V
			T_J = 85°C		0.7		

2. Pulse Test: pulse width ≤ 300 μs, duty cycle ≤ 2%
3. Switching characteristics are independent of operating junction temperatures

TYPICAL CHARACTERISTICS

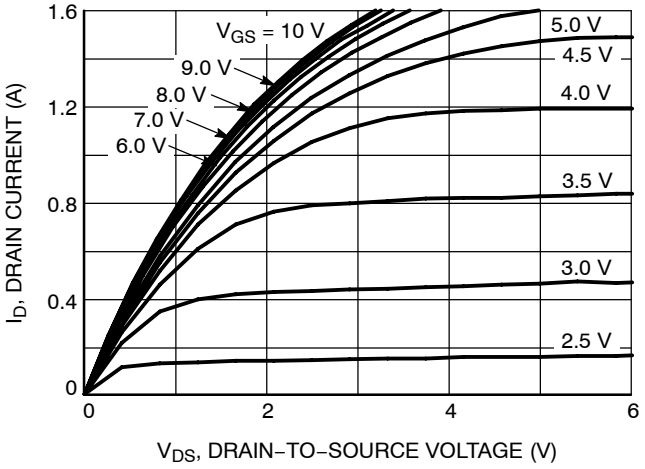


Figure 1. On−Region Characteristics

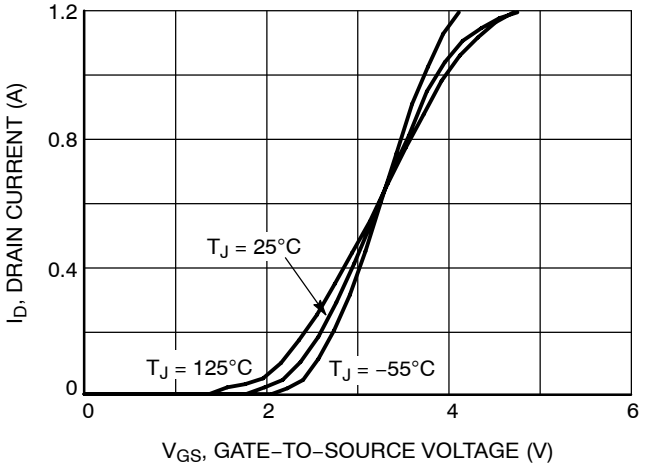


Figure 2. Transfer Characteristics

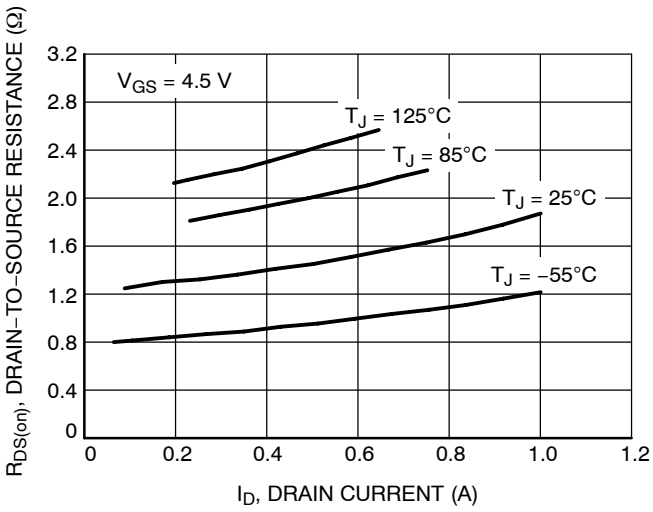


Figure 3. On−Resistance vs. Drain Current and Temperature

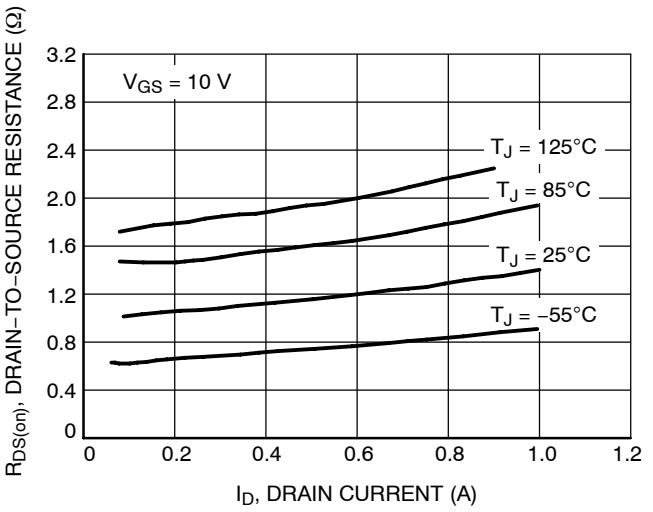


Figure 4. On−Resistance vs. Drain Current and Temperature

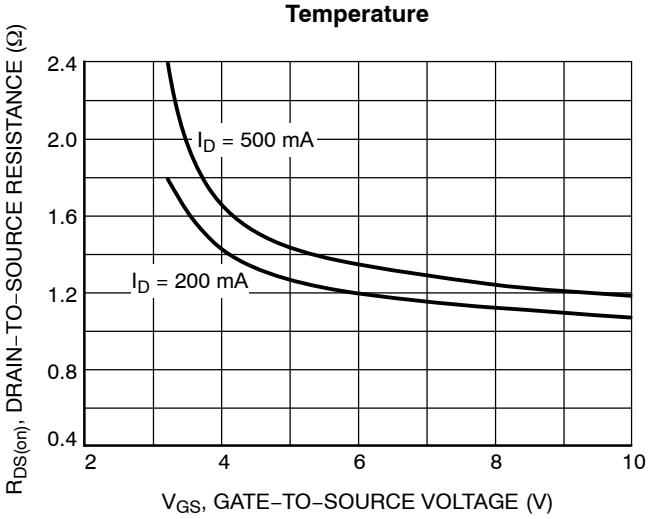


Figure 5. On−Resistance vs. Gate−to−Source Voltage

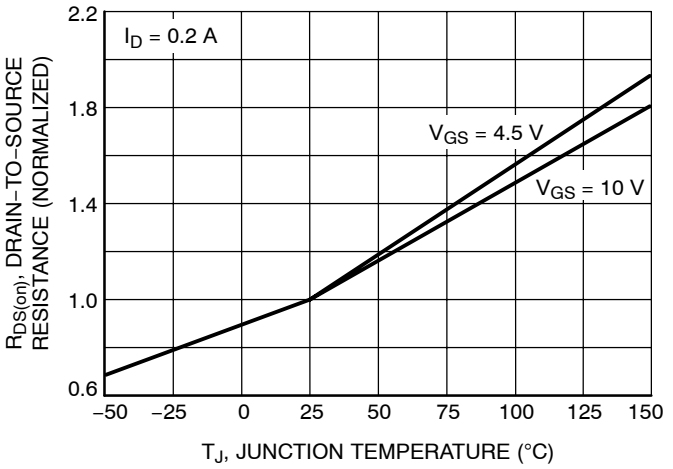


Figure 6. On−Resistance Variation with Temperature

TYPICAL CHARACTERISTICS

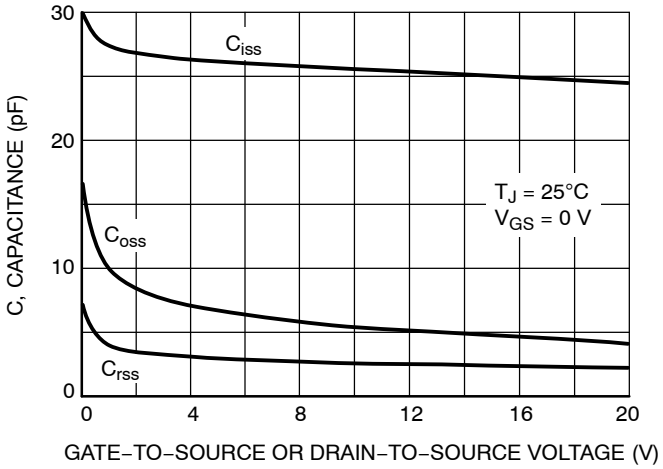


Figure 7. Capacitance Variation

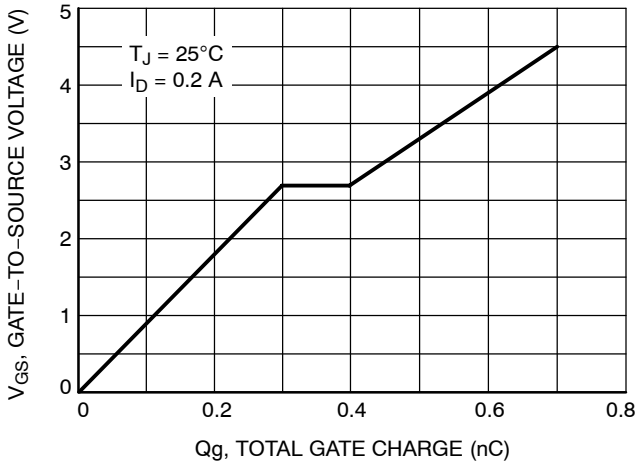


Figure 8. Gate−to−Source and Drain−to−Source Voltage vs. Total Charge

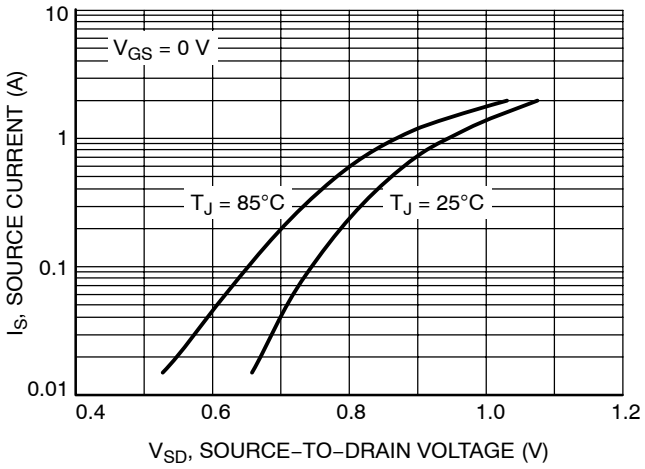
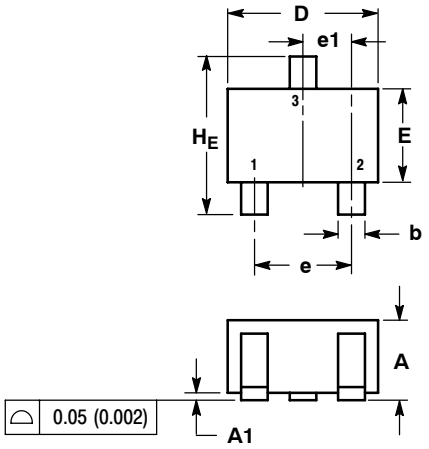
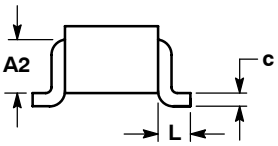


Figure 9. Diode Forward Voltage vs. Current

PACKAGE DIMENSIONS

SC−70 (SOT−323)
CASE 419−04
ISSUE M



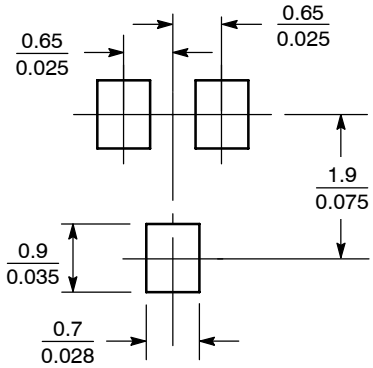


NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.

	MILLIMETERS			INCHES		
DIM	MIN	NOM	MAX	MIN	NOM	MAX
A	0.80	0.90	1.00	0.032	0.035	0.040
A1	0.00	0.05	0.10	0.000	0.002	0.004
A2		0.7 REF			0.028 REF	
b	0.30	0.35	0.40	0.012	0.014	0.016
c	0.10	0.18	0.25	0.004	0.007	0.010
D	1.80	2.10	2.20	0.071	0.083	0.087
E	1.15	1.24	1.35	0.045	0.049	0.053
e	1.20	1.30	1.40	0.047	0.051	0.055
e1		0.65 BSC			0.026 BSC	
L		0.425 REF			0.017 REF	
H_E	2.00	2.10	2.40	0.079	0.083	0.095

STYLE 8:
PIN 1. GATE
2. SOURCE
3. DRAIN

SOLDERING FOOTPRINT*



SCALE 10:1 $\left(\frac{mm}{inches}\right)$

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

PUBLICATION ORDERING INFORMATION

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: orderlit@onsemi.com

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

Japan: ON Semiconductor, Japan Customer Focus Center
2−9−1 Kamimeguro, Meguro−ku, Tokyo, Japan 153−0051
Phone: 81−3−5773−3850

ON Semiconductor Website: http://onsemi.com

Order Literature: http://www.onsemi.com/litorder

For additional information, please contact your local Sales Representative.