

# 2N7002L, 2V7002L

## Small Signal MOSFET

60 V, 115 mA, N-Channel SOT-23



ON Semiconductor®

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### Features

- 2V Prefix for Automotive and Other Applications Requiring Unique Site and Control Change Requirements; AEC-Q101 Qualified and PPAP Capable (2V7002L)
- These Devices are Pb-Free, Halogen Free/BFR Free and are RoHS Compliant

### MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Drain-Source Voltage	$V_{DS}$	60	Vdc
Drain-Gate Voltage ( $R_{GS} = 1.0 \text{ M}\Omega$ )	$V_{DGR}$	60	Vdc
Drain Current - Continuous $T_C = 25^\circ\text{C}$ (Note 1) $T_C = 100^\circ\text{C}$ (Note 1) - Pulsed (Note 2)	$I_D$ $I_{DM}$	$\pm 115$ $\pm 75$ $\pm 800$	mAdc
Gate-Source Voltage - Continuous - Non-repetitive ( $t_p \leq 50 \mu\text{s}$ )	$V_{GS}$ $V_{GSM}$	$\pm 20$ $\pm 40$	Vdc Vpk

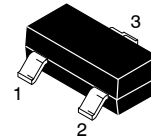
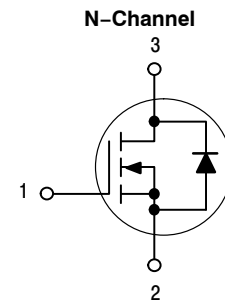
### THERMAL CHARACTERISTICS

Characteristic	Symbol	Max	Unit
Total Device Dissipation FR-5 Board (Note 3) $T_A = 25^\circ\text{C}$ Derate above $25^\circ\text{C}$	$P_D$	225	mW
Thermal Resistance, Junction-to-Ambient	$R_{\theta JA}$	1.8 556	$\text{mW}/^\circ\text{C}$ $^\circ\text{C}/\text{W}$
Total Device Dissipation (Note 4) Alumina Substrate, $T_A = 25^\circ\text{C}$ Derate above $25^\circ\text{C}$	$P_D$	300	mW
Thermal Resistance, Junction-to-Ambient	$R_{\theta JA}$	2.4 417	$\text{mW}/^\circ\text{C}$ $^\circ\text{C}/\text{W}$
Junction and Storage Temperature	$T_J, T_{stg}$	-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.

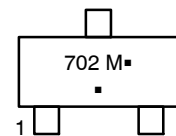
1. The Power Dissipation of the package may result in a lower continuous drain current.
2. Pulse Test: Pulse Width  $\leq 300 \mu\text{s}$ , Duty Cycle  $\leq 2.0\%$ .
3. FR-5 =  $1.0 \times 0.75 \times 0.062$  in.
4. Alumina =  $0.4 \times 0.3 \times 0.025$  in 99.5% alumina.

$V_{(BR)DSS}$	$R_{DS(on)}$ MAX	$I_D$ MAX
60 V	$7.5 \Omega @ 10 \text{ V}, 500 \text{ mA}$	115 mA



SOT-23  
CASE 318  
STYLE 21

### MARKING DIAGRAM



702 = Device Code  
M = Date Code\*  
▪ = Pb-Free Package

(Note: Microdot may be in either location)

\*Date Code orientation and/or position may vary depending upon manufacturing location.

### ORDERING INFORMATION

Device	Package	Shipping†
2N7002LT1G	SOT-23 (Pb-Free)	3,000 Tape & Reel
2N7002LT3G		10,000 Tape & Reel
2N7002LT7G		3,500 Tape & Reel
2V7002LT1G	SOT-23 (Pb-Free)	3,000 Tape & Reel
2V7002LT3G		10,000 Tape & Reel
2N7002LT1H*		3,000 Tape & Reel
2N7002LT7H*		3,500 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.

\*Not for new design.

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

Characteristic	Symbol	Min	Typ	Max	Unit
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#### OFF CHARACTERISTICS

Drain-Source Breakdown Voltage ( $V_{GS} = 0, I_D = 10 \mu\text{Adc}$ )	$V_{(BR)DSS}$	60	-	-	Vdc
Zero Gate Voltage Drain Current ( $V_{GS} = 0, V_{DS} = 60 \text{ Vdc}$ )	$I_{DSS}$	$T_J = 25^\circ\text{C}$	-	-	1.0
		$T_J = 125^\circ\text{C}$	-	-	500
Gate-Body Leakage Current, Forward ( $V_{GS} = 20 \text{ Vdc}$ )	$I_{GSSF}$	-	-	100	nAdc
Gate-Body Leakage Current, Reverse ( $V_{GS} = -20 \text{ Vdc}$ )	$I_{GSSR}$	-	-	-100	nAdc

#### ON CHARACTERISTICS (Note 5)

Gate Threshold Voltage ( $V_{DS} = V_{GS}, I_D = 250 \mu\text{Adc}$ )	$V_{GS(th)}$	1.0	-	2.5	Vdc
On-State Drain Current ( $V_{DS} \geq 2.0 V_{DS(on)}, V_{GS} = 10 \text{ Vdc}$ )	$I_{D(on)}$	500	-	-	mA
Static Drain-Source On-State Voltage ( $V_{GS} = 10 \text{ Vdc}, I_D = 500 \text{ mAdc}$ ) ( $V_{GS} = 5.0 \text{ Vdc}, I_D = 50 \text{ mAdc}$ )	$V_{DS(on)}$	-	-	3.75	Vdc
		-	-	0.375	
Static Drain-Source On-State Resistance ( $V_{GS} = 10 \text{ V}, I_D = 500 \text{ mAdc}$ )  ( $V_{GS} = 5.0 \text{ Vdc}, I_D = 50 \text{ mAdc}$ )	$r_{DS(on)}$	$T_C = 25^\circ\text{C}$	-	-	7.5
		$T_C = 125^\circ\text{C}$	-	-	13.5
		$T_C = 25^\circ\text{C}$	-	-	7.5
		$T_C = 125^\circ\text{C}$	-	-	13.5
Forward Transconductance ( $V_{DS} \geq 2.0 V_{DS(on)}, I_D = 200 \text{ mAdc}$ )	$g_{FS}$	80	-	-	mS

#### DYNAMIC CHARACTERISTICS

Input Capacitance ( $V_{DS} = 25 \text{ Vdc}, V_{GS} = 0, f = 1.0 \text{ MHz}$ )	$C_{iss}$	-	-	50	pF
Output Capacitance ( $V_{DS} = 25 \text{ Vdc}, V_{GS} = 0, f = 1.0 \text{ MHz}$ )	$C_{oss}$	-	-	25	pF
Reverse Transfer Capacitance ( $V_{DS} = 25 \text{ Vdc}, V_{GS} = 0, f = 1.0 \text{ MHz}$ )	$C_{rss}$	-	-	5.0	pF

#### SWITCHING CHARACTERISTICS (Note 5)

Turn-On Delay Time	$(V_{DD} = 25 \text{ Vdc}, I_D \cong 500 \text{ mAdc}, R_G = 25 \Omega, R_L = 50 \Omega, V_{gen} = 10 \text{ V})$	$t_{d(on)}$	-	-	20	ns
Turn-Off Delay Time		$t_{d(off)}$	-	-	40	ns

#### BODY-DRAIN DIODE RATINGS

Diode Forward On-Voltage ( $I_S = 11.5 \text{ mAdc}, V_{GS} = 0 \text{ V}$ )	$V_{SD}$	-	-	-1.5	Vdc
Source Current Continuous (Body Diode)	$I_S$	-	-	-115	mAdc
Source Current Pulsed	$I_{SM}$	-	-	-800	mAdc

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.

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

TYPICAL ELECTRICAL CHARACTERISTICS

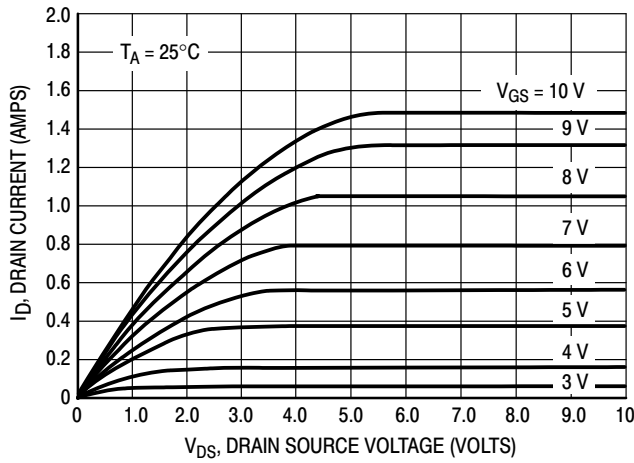


Figure 1. Ohmic Region

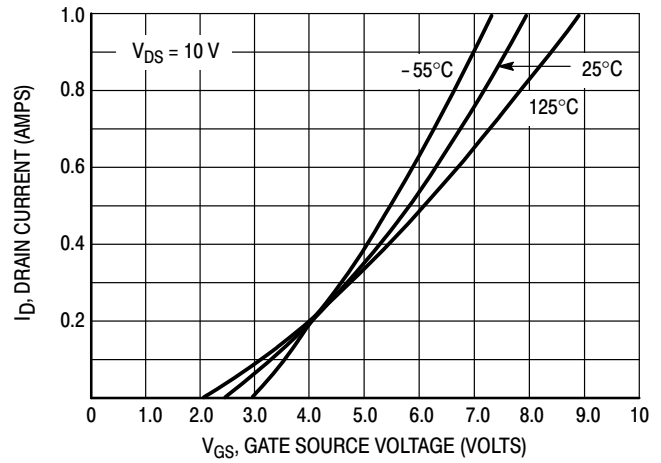


Figure 2. Transfer Characteristics

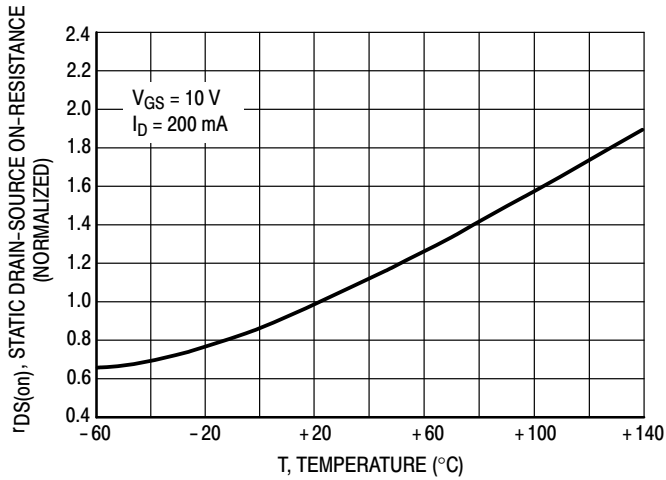


Figure 3. Temperature versus Static Drain-Source On-Resistance

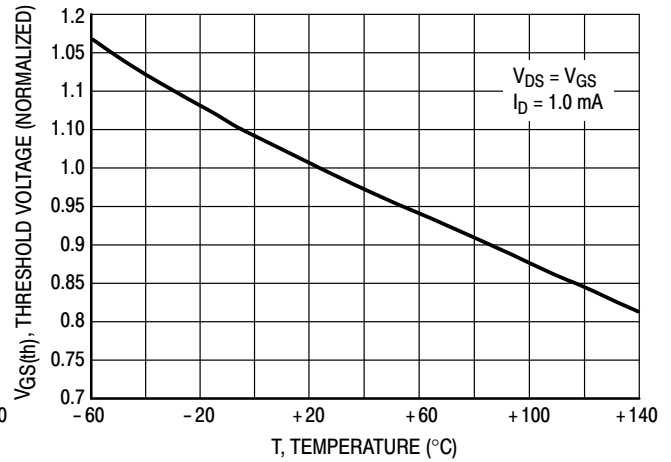
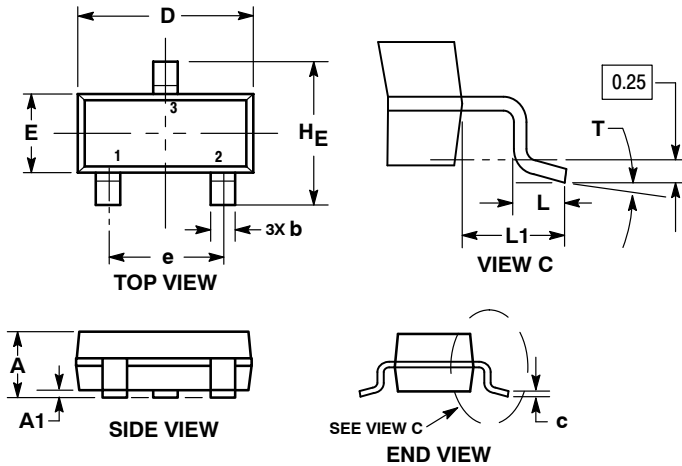


Figure 4. Temperature versus Gate Threshold Voltage

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## PACKAGE DIMENSIONS

### SOT-23 (TO-236) CASE 318-08 ISSUE AS

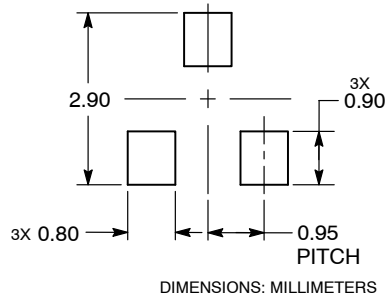


- NOTES:
1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
  2. CONTROLLING DIMENSION: MILLIMETERS.
  3. MAXIMUM LEAD THICKNESS INCLUDES LEAD FINISH. MINIMUM LEAD THICKNESS IS THE MINIMUM THICKNESS OF THE BASE MATERIAL.
  4. DIMENSIONS D AND E DO NOT INCLUDE MOLD FLASH, PROTRUSIONS, OR GATE BURRS.

DIM	MILLIMETERS			INCHES		
	MIN	NOM	MAX	MIN	NOM	MAX
A	0.89	1.00	1.11	0.035	0.039	0.044
A1	0.01	0.06	0.10	0.000	0.002	0.004
b	0.37	0.44	0.50	0.015	0.017	0.020
c	0.08	0.14	0.20	0.003	0.006	0.008
D	2.80	2.90	3.04	0.110	0.114	0.120
E	1.20	1.30	1.40	0.047	0.051	0.055
e	1.78	1.90	2.04	0.070	0.075	0.080
L	0.30	0.43	0.55	0.012	0.017	0.022
L1	0.35	0.54	0.69	0.014	0.021	0.027
HE	2.10	2.40	2.64	0.083	0.094	0.104
T	0°	---	10°	0°	---	10°

- STYLE 21:  
PIN 1. GATE  
2. SOURCE  
3. DRAIN

### RECOMMENDED SOLDERING FOOTPRINT



DIMENSIONS: MILLIMETERS

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