

MOSFET – N-Channel, Small Signal, SOT-23

60 V, 115 mA



ON Semiconductor®

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2N7002L, 2V7002L

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_{D1} I_{DM} | ± 115 ± 75 ± 800 | mAdc |
| Gate-Source Voltage – Continuous – Non-repetitive ($t_p \leq 50 \mu\text{s}$) | V_{GS} V_{GSM} | ± 20 ± 40 | Vdc Vpk |

THERMAL CHARACTERISTICS

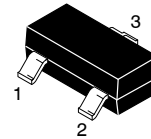
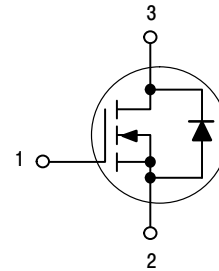
| Characteristic | Symbol | Max | Unit |
|---|-----------------|----------------|----------------------------|
| Total Device Dissipation FR-5 Board (Note 3) $T_A = 25^\circ\text{C}$ Derate above 25°C | P_D | 225 1.8 | mW mW/ $^\circ\text{C}$ |
| Thermal Resistance, Junction-to-Ambient | $R_{\theta JA}$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

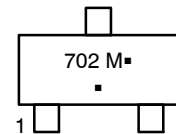
| $V_{(BR)DSS}$ | $R_{DS(on)}$ MAX | I_D MAX |
|---------------|---|-----------|
| 60 V | $7.5 \Omega @ 10 \text{ V}, 500 \text{ mA}$ | 115 mA |

N-Channel



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.

2N7002L, 2V7002L

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

| Characteristic | Symbol | Min | Typ | Max | Unit |
|----------------|--------|-----|-----|-----|------|
|----------------|--------|-----|-----|-----|------|

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 ($I_S = 115 \text{ mAdc}, V_{GS} = 0 \text{ V}$) | 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

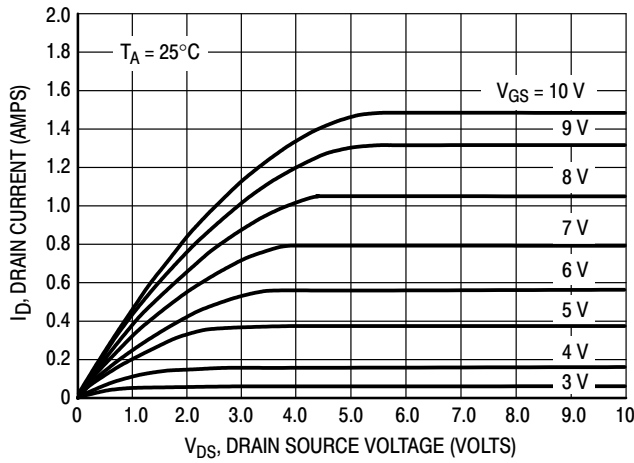


Figure 1. Ohmic Region

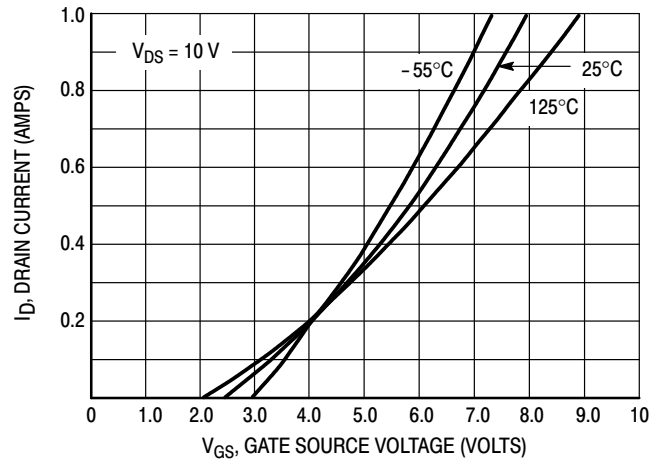


Figure 2. Transfer Characteristics

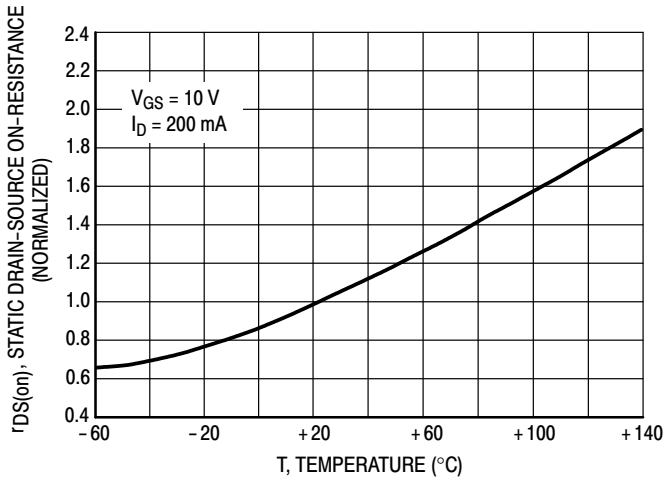


Figure 3. Temperature versus Static Drain-Source On-Resistance

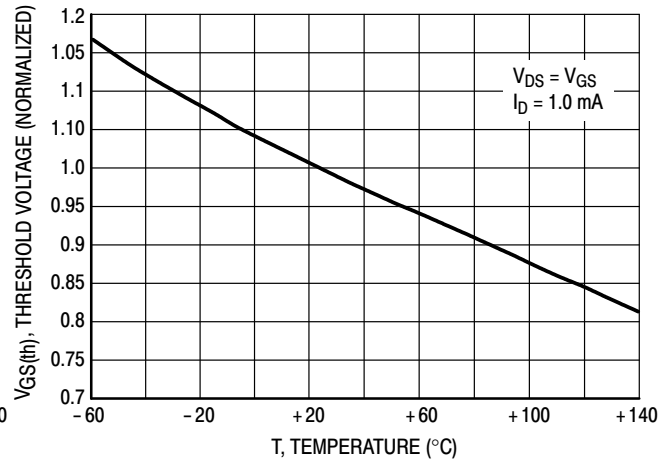


Figure 4. Temperature versus Gate Threshold Voltage

MECHANICAL CASE OUTLINE

PACKAGE DIMENSIONS

ON Semiconductor®



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

DATE 30 JAN 2018

SCALE 4:1



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° |

RECOMMENDED SOLDERING FOOTPRINT



GENERIC MARKING DIAGRAM*



XXX = Specific Device Code
M = Date Code
▪ = Pb-Free Package

*This information is generic. Please refer to device data sheet for actual part marking. Pb-Free indicator, "G" or microdot "▪", may or may not be present.

STYLE 1 THRU 5:
CANCELLED

STYLE 6:
PIN 1. BASE
2. EMITTER
3. COLLECTOR

STYLE 7:
PIN 1. EMITTER
2. BASE
3. COLLECTOR

STYLE 8:
PIN 1. ANODE
2. NO CONNECTION
3. CATHODE

STYLE 9:
PIN 1. ANODE
2. ANODE
3. CATHODE

STYLE 10:
PIN 1. DRAIN
2. SOURCE
3. GATE

STYLE 11:
PIN 1. ANODE
2. CATHODE
3. CATHODE-ANODE

STYLE 12:
PIN 1. CATHODE
2. CATHODE
3. ANODE

STYLE 13:
PIN 1. SOURCE
2. DRAIN
3. GATE

STYLE 14:
PIN 1. CATHODE
2. GATE
3. ANODE

STYLE 15:
PIN 1. GATE
2. CATHODE
3. ANODE

STYLE 16:
PIN 1. ANODE
2. CATHODE
3. CATHODE

STYLE 17:
PIN 1. NO CONNECTION
2. ANODE
3. CATHODE

STYLE 18:
PIN 1. NO CONNECTION
2. CATHODE
3. ANODE

STYLE 19:
PIN 1. CATHODE
2. ANODE
3. CATHODE-ANODE

STYLE 20:
PIN 1. CATHODE
2. ANODE
3. GATE

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

STYLE 22:
PIN 1. RETURN
2. OUTPUT
3. INPUT

STYLE 23:
PIN 1. ANODE
2. ANODE
3. CATHODE

STYLE 24:
PIN 1. GATE
2. DRAIN
3. SOURCE

STYLE 25:
PIN 1. ANODE
2. CATHODE
3. GATE

STYLE 26:
PIN 1. CATHODE
2. ANODE
3. NO CONNECTION

STYLE 27:
PIN 1. CATHODE
2. CATHODE
3. CATHODE

STYLE 28:
PIN 1. ANODE
2. ANODE
3. ANODE

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