

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

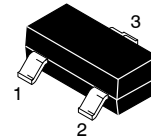
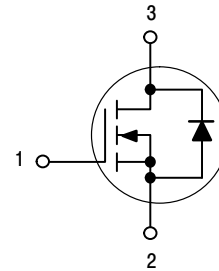
| Characteristic | Symbol | Max | Unit |
|---|-----------------|----------------|----------------------------|
| Total Device Dissipation FR-5 Board (Note 3) $T_A = 25^\circ\text{C}$ Derate above 25°C | P_D | 225 1.8 | mW mW/ $^\circ\text{C}$ |
| Thermal Resistance, Junction-to-Ambient | $R_{\theta JA}$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

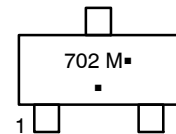
| $V_{(BR)DSS}$ | $R_{DS(on)}$ MAX | I_D MAX |
|---------------|---|-----------|
| 60 V | $7.5 \Omega @ 10 \text{ V}, 500 \text{ mA}$ | 115 mA |

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 | μAdc |
| | | $T_J = 125^\circ\text{C}$ | - | - | 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 | Ohms |
| | | $T_C = 125^\circ\text{C}$ | - | - | 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 $\leq 2.0\%$.

2N7002L, 2V7002L

TYPICAL ELECTRICAL CHARACTERISTICS

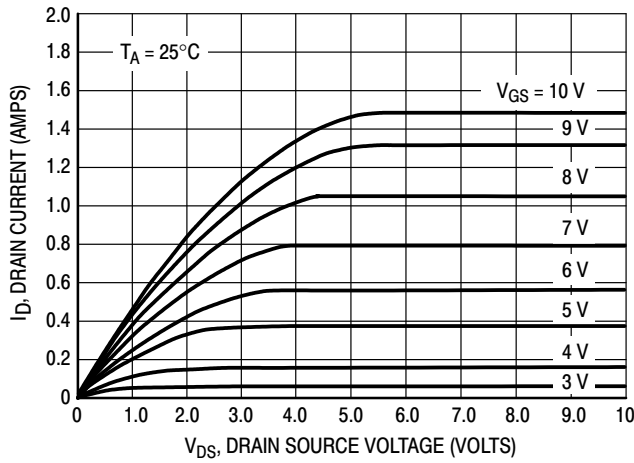


Figure 1. Ohmic Region

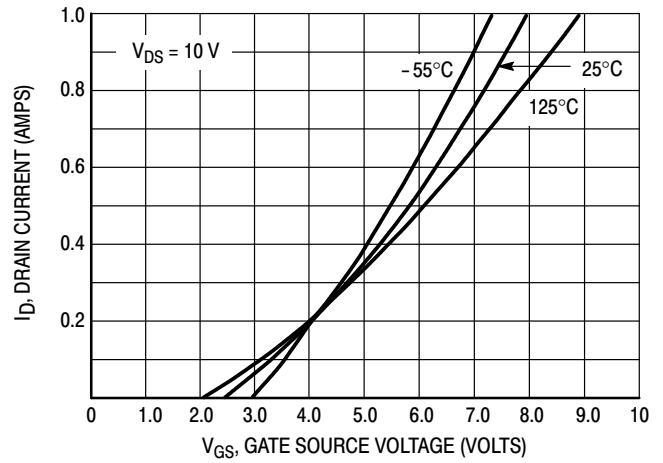


Figure 2. Transfer Characteristics

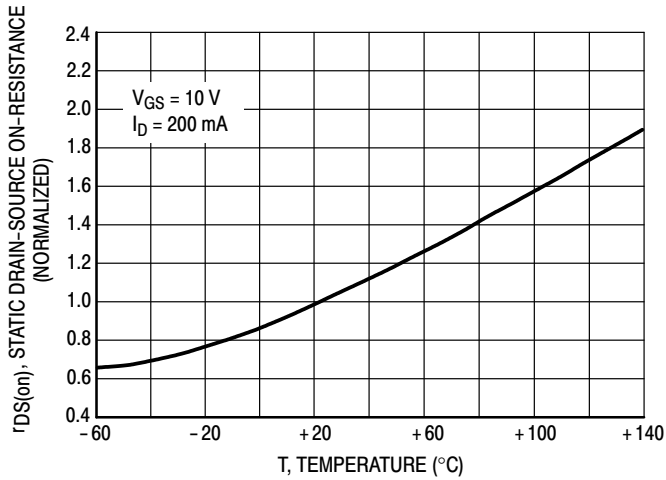


Figure 3. Temperature versus Static Drain-Source On-Resistance

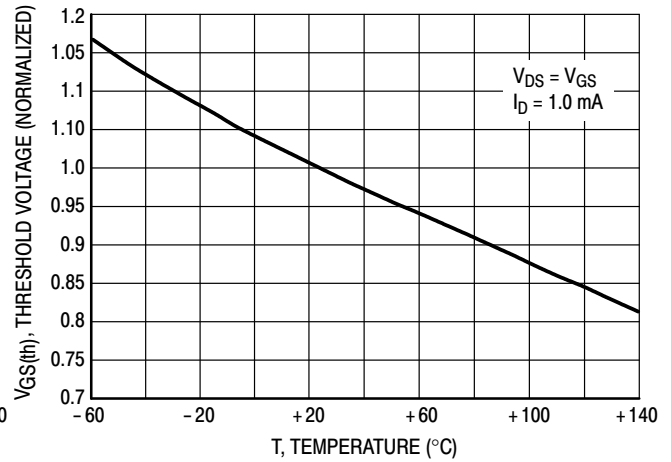
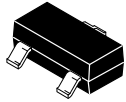


Figure 4. Temperature versus Gate Threshold Voltage

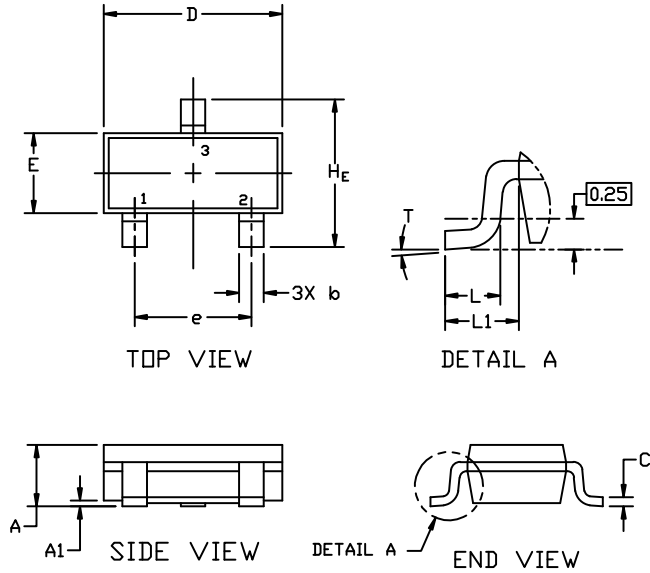
MECHANICAL CASE OUTLINE PACKAGE DIMENSIONS



SOT-23 (TO-236)
CASE 318
ISSUE AT

DATE 01 MAR 2023

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.

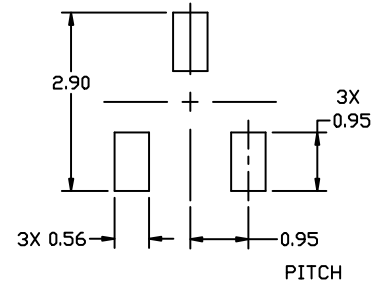
| DIM | MILLIMETERS | | | INCHES | | |
|----------------|-------------|------|------|--------|-------|-------|
| | MIN. | NOM. | MAX. | MIN. | NOM. | MAX. |
| A | 0.89 | 1.00 | 1.11 | 0.035 | 0.039 | 0.044 |
| A1 | 0.01 | 0.06 | 0.10 | 0.000 | 0.002 | 0.004 |
| b | 0.37 | 0.44 | 0.50 | 0.015 | 0.017 | 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 |
| H _E | 2.10 | 2.40 | 2.64 | 0.083 | 0.094 | 0.104 |
| T | 0° | --- | 10° | 0° | --- | 10° |

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. Some products may not follow the Generic Marking.



RECOMMENDED MOUNTING FOOTPRINT

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

STYLES ON PAGE 2

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**MECHANICAL CASE OUTLINE
PACKAGE DIMENSIONS**



**SOT-23 (TO-236)
CASE 318
ISSUE AT**

DATE 01 MAR 2023

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