

2N7002L

Small Signal MOSFET

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

Features

- Pb-Free Packages are Available

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} | ± 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 |

Maximum ratings are those values beyond which device damage can occur. Maximum ratings applied to the device are individual stress limit values (not normal operating conditions) and are not valid simultaneously. If these limits are exceeded, device functional operation is not implied, damage may occur and reliability may be affected.

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 Alumina Substrate, (Note 4) $T_A = 25^\circ\text{C}$ 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 | $^\circ\text{C}$ |

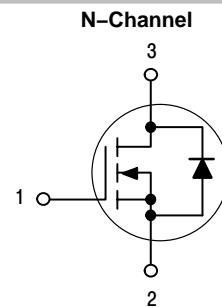
- The Power Dissipation of the package may result in a lower continuous drain current.
- Pulse Test: Pulse Width $\leq 300 \mu\text{s}$, Duty Cycle $\leq 2.0\%$.
- FR-5 = 1.0 x 0.75 x 0.062 in.
- Alumina = 0.4 x 0.3 x 0.025 in 99.5% alumina.



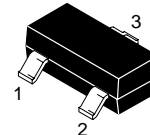
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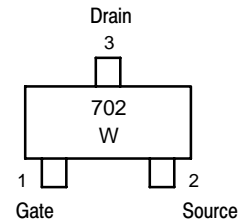
| $V_{(BR)DSS}$ | $R_{DS(on)}$ MAX | I_D MAX |
|---------------|--|-----------|
| 60 V | $7.5 \Omega @ 10 \text{ V},$ 500 mA | 115 mA |



MARKING DIAGRAM & PIN ASSIGNMENT



SOT-23
CASE 318
STYLE 21



702 = Device Code
W = Work Week

ORDERING INFORMATION

| Device | Package | Shipping† |
|------------|---------------------|--------------------|
| 2N7002LT1 | SOT-23 | 3000 Tape & Reel |
| 2N7002LT3 | | 10,000 Tape & Reel |
| 2N7002LT1G | SOT-23 (Pb-free) | 3000 Tape & Reel |
| 2N7002LT3G | | 10,000 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.

2N7002L

ELECTRICAL CHARACTERISTICS (T_A = 25°C unless otherwise noted)

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

OFF CHARACTERISTICS

| | | | | | |
|--|----------------------|----|---|------|------|
| Drain–Source Breakdown Voltage (V _{GS} = 0, I _D = 10 μAdc) | V _{(BR)DSS} | 60 | – | – | Vdc |
| Zero Gate Voltage Drain Current (V _{GS} = 0, V _{DS} = 60 Vdc) | I _{DSS} | – | – | 1.0 | μAdc |
| | | – | – | 500 | |
| Gate–Body Leakage Current, Forward (V _{GS} = 20 Vdc) | I _{GSSF} | – | – | 100 | nAdc |
| Gate–Body Leakage Current, Reverse (V _{GS} = –20 Vdc) | I _{GSSR} | – | – | –100 | nAdc |

ON CHARACTERISTICS (Note 5)

| | | | | | |
|---|---------------------|-----|---|----------------------------|-------|
| Gate Threshold Voltage (V _{DS} = V _{GS} , I _D = 250 μAdc) | V _{GS(th)} | 1.0 | – | 2.5 | Vdc |
| On–State Drain Current (V _{DS} ≥ 2.0 V _{DS(on)} , V _{GS} = 10 Vdc) | I _{D(on)} | 500 | – | – | mA |
| Static Drain–Source On–State Voltage (V _{GS} = 10 Vdc, I _D = 500 mAdc) (V _{GS} = 5.0 Vdc, I _D = 50 mAdc) | V _{DS(on)} | – | – | 3.75 0.375 | Vdc |
| Static Drain–Source On–State Resistance (V _{GS} = 10 V, I _D = 500 mAdc) (V _{GS} = 5.0 Vdc, I _D = 50 mAdc) | r _{DS(on)} | – | – | 7.5 13.5 7.5 13.5 | Ohms |
| | | – | – | – | |
| | | – | – | – | |
| | | – | – | – | |
| Forward Transconductance (V _{DS} ≥ 2.0 V _{DS(on)} , I _D = 200 mAdc) | g _{FS} | 80 | – | – | mmhos |

DYNAMIC CHARACTERISTICS

| | | | | | |
|--|------------------|---|---|-----|----|
| Input Capacitance (V _{DS} = 25 Vdc, V _{GS} = 0, f = 1.0 MHz) | C _{iss} | – | – | 50 | pF |
| Output Capacitance (V _{DS} = 25 Vdc, V _{GS} = 0, f = 1.0 MHz) | C _{oss} | – | – | 25 | pF |
| Reverse Transfer Capacitance (V _{DS} = 25 Vdc, V _{GS} = 0, f = 1.0 MHz) | C _{rss} | – | – | 5.0 | pF |

SWITCHING CHARACTERISTICS (Note 5)

| | | | | | | |
|---------------------|---|---------------------|---|---|----|----|
| Turn–On Delay Time | (V _{DD} = 25 Vdc, I _D ≅ 500 mAdc, R _G = 25 Ω, R _L = 50 Ω, V _{gen} = 10 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 mAdc, V _{GS} = 0 V) | V _{SD} | – | – | –1.5 | Vdc |
| Source Current Continuous (Body Diode) | I _S | – | – | –115 | mAdc |
| Source Current Pulsed | I _{SM} | – | – | –800 | mAdc |

5. Pulse Test: Pulse Width ≤ 300 μs, Duty Cycle ≤ 2.0%.

TYPICAL ELECTRICAL CHARACTERISTICS

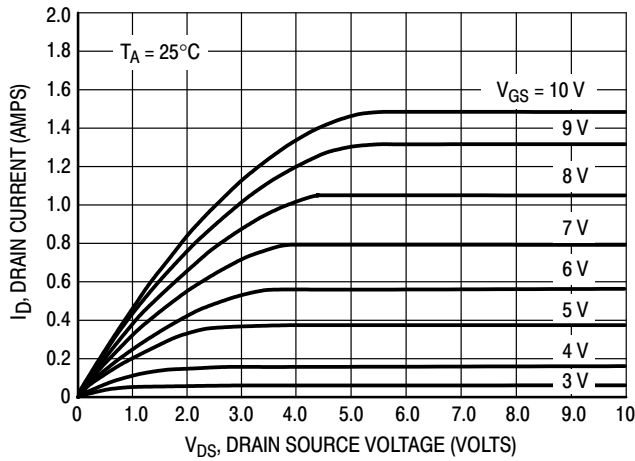


Figure 1. Ohmic Region

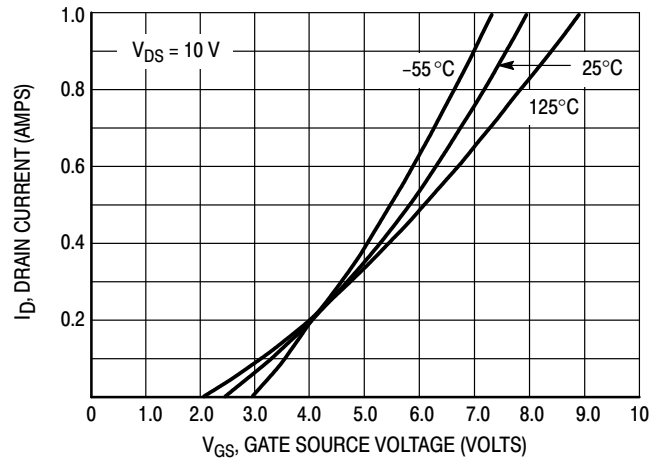


Figure 2. Transfer Characteristics

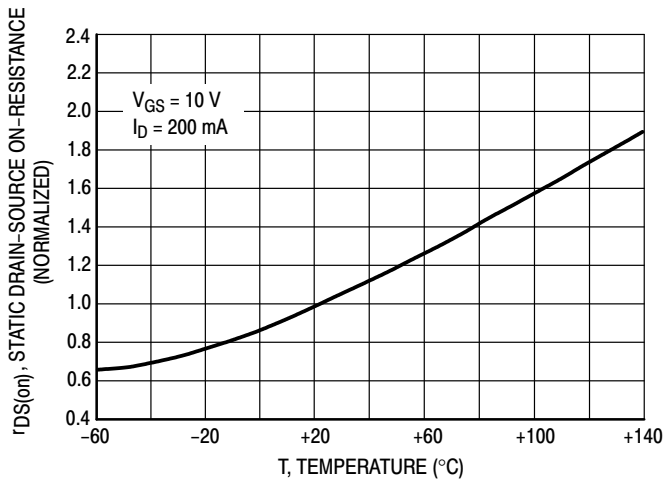


Figure 3. Temperature versus Static Drain-Source On-Resistance

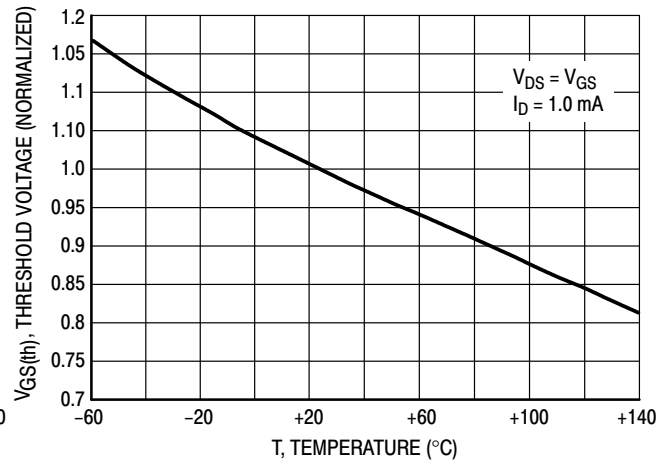


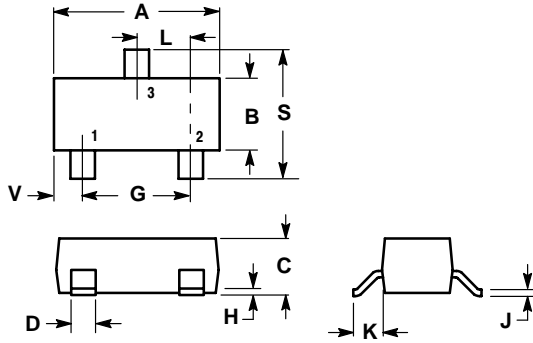
Figure 4. Temperature versus Gate Threshold Voltage

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PACKAGE DIMENSIONS

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

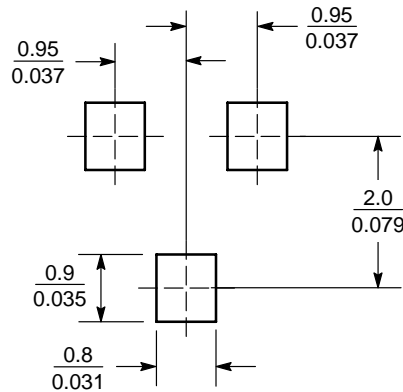
- NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
 2. CONTROLLING DIMENSION: INCH.
 3. MAXIMUM LEAD THICKNESS INCLUDES LEAD FINISH THICKNESS. MINIMUM LEAD THICKNESS IS THE MINIMUM THICKNESS OF BASE MATERIAL.
 4. 318-03 AND -07 OBSOLETE, NEW STANDARD 318-08.




| DIM | INCHES | | MILLIMETERS | |
|-----|--------|--------|-------------|-------|
| | MIN | MAX | MIN | MAX |
| A | 0.1102 | 0.1197 | 2.80 | 3.04 |
| B | 0.0472 | 0.0551 | 1.20 | 1.40 |
| C | 0.0350 | 0.0440 | 0.89 | 1.11 |
| D | 0.0150 | 0.0200 | 0.37 | 0.50 |
| G | 0.0701 | 0.0807 | 1.78 | 2.04 |
| H | 0.0005 | 0.0040 | 0.013 | 0.100 |
| J | 0.0034 | 0.0070 | 0.085 | 0.177 |
| K | 0.0140 | 0.0285 | 0.35 | 0.69 |
| L | 0.0350 | 0.0401 | 0.89 | 1.02 |
| S | 0.0830 | 0.1039 | 2.10 | 2.64 |
| V | 0.0177 | 0.0236 | 0.45 | 0.60 |

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

SOLDERING 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.

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