

# Small Signal MOSFET

## 115 mAmps, 60 Volts

### N-Channel SOT-23

- We declare that the material of product are Halogen Free and compliance with RoHS requirements.
- ESD Protected:1000V

#### MAXIMUM RATINGS

| Rating                                                | Symbol    | Value     | Unit            |
|-------------------------------------------------------|-----------|-----------|-----------------|
| Drain-Source Voltage                                  | $V_{DSS}$ | 60        | V <sub>dc</sub> |
| Drain-Gate Voltage ( $R_{GS} = 1.0 \text{ M}\Omega$ ) | $V_{DGR}$ | 60        | V <sub>dc</sub> |
| Drain Current                                         | $I_D$     | $\pm 115$ | mAdc            |
| – Continuous $T_C = 25^\circ\text{C}$ (Note 1.)       | $I_D$     | $\pm 75$  |                 |
| – Pulsed (Note 2.)                                    | $I_{DM}$  | $\pm 800$ |                 |
| Gate-Source Voltage                                   | $V_{GS}$  | $\pm 20$  | V <sub>dc</sub> |
| – Continuous                                          | $V_{GSM}$ | $\pm 40$  | V <sub>pk</sub> |
| – Non-repetitive ( $t_p \leq 50 \mu\text{s}$ )        |           |           |                 |

#### THERMAL CHARACTERISTICS

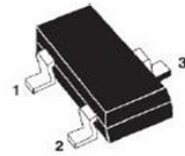
| Characteristic                                                                                                       | Symbol          | Max            | Unit                       |
|----------------------------------------------------------------------------------------------------------------------|-----------------|----------------|----------------------------|
| Total Device Dissipation FR-5 Board<br>(Note 3.) $T_A = 25^\circ\text{C}$<br>Derate above $25^\circ\text{C}$         | $P_D$           | 225<br>1.8     | mW<br>mW/ $^\circ\text{C}$ |
| Thermal Resistance, Junction to Ambient                                                                              | $R_{\theta JA}$ | 556            | $^\circ\text{C/W}$         |
| Total Device Dissipation<br>Alumina Substrate, (Note 4.) $T_A = 25^\circ\text{C}$<br>Derate above $25^\circ\text{C}$ | $P_D$           | 300<br>2.4     | mW<br>mW/ $^\circ\text{C}$ |
| Thermal Resistance, Junction to Ambient                                                                              | $R_{\theta JA}$ | 417            | $^\circ\text{C/W}$         |
| Junction and Storage Temperature                                                                                     | $T_J, T_{stg}$  | -55 to<br>+150 | $^\circ\text{C}$           |

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 =  $1.0 \times 0.75 \times 0.062 \text{ in.}$
4. Alumina =  $0.4 \times 0.3 \times 0.025 \text{ in}$  99.5% alumina.

#### ORDERING INFORMATION

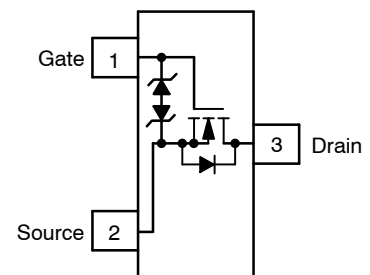
| Device     | Marking | Shipping          |
|------------|---------|-------------------|
| 2N7002LT1G | 702     | 3000 Tape & Reel  |
| 2N7002LT3G | 702     | 10000 Tape & Reel |

**2N7002LT1G**



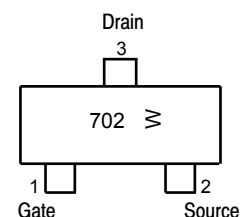
SOT-23

#### Simplified Schematic



(Top View)

#### MARKING DIAGRAM & PIN ASSIGNMENT



702 = Device Code  
W = Month Code

## 2N7002LT1G

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

| Characteristic                                                                  | Symbol        | Min | Typ | Max | Unit            |
|---------------------------------------------------------------------------------|---------------|-----|-----|-----|-----------------|
| <b>OFF CHARACTERISTICS</b>                                                      |               |     |     |     |                 |
| Drain–Source Breakdown Voltage<br>( $V_{GS} = 0$ , $I_D = 10\ \mu\text{Adc}$ )  | $V_{(BR)DSS}$ | 60  | –   | –   | Vdc             |
| Zero Gate Voltage Drain Current<br>( $V_{GS} = 0$ , $V_{DS} = 60\ \text{Vdc}$ ) | $I_{DSS}$     | –   | –   | 1.0 | $\mu\text{Adc}$ |
|                                                                                 |               | –   | –   | 500 |                 |
| Gate–Body Leakage Current, Forward<br>( $V_{GS} = 20\ \text{Vdc}$ )             | $I_{GSSF}$    | –   | –   | 1   | $\mu\text{Adc}$ |
| Gate–Body Leakage Current, Reverse<br>( $V_{GS} = -20\ \text{Vdc}$ )            | $I_{GSSR}$    | –   | –   | -1  | $\mu\text{Adc}$ |

### ON CHARACTERISTICS (Note 2.)

|                                                                                                                                                                                                                                                                           |              |     |     |       |       |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|-----|-----|-------|-------|
| Gate Threshold Voltage<br>( $V_{DS} = V_{GS}$ , $I_D = 250\ \mu\text{Adc}$ )                                                                                                                                                                                              | $V_{GS(th)}$ | 1.0 | 1.6 | 2     | Vdc   |
| On–State Drain Current<br>( $V_{DS} \geq 2.0\ V_{DS(on)}$ , $V_{GS} = 10\ \text{Vdc}$ )                                                                                                                                                                                   | $I_{D(on)}$  | 500 | –   | –     | mA    |
| Static Drain–Source On–State Voltage<br>( $V_{GS} = 10\ \text{Vdc}$ , $I_D = 500\ \text{mAdc}$ )<br>( $V_{GS} = 5.0\ \text{Vdc}$ , $I_D = 50\ \text{mAdc}$ )                                                                                                              | $V_{DS(on)}$ | –   | –   | 3.75  | Vdc   |
|                                                                                                                                                                                                                                                                           |              | –   | –   | 0.375 |       |
| Static Drain–Source On–State Resistance<br>( $V_{GS} = 10\ \text{V}$ , $I_D = 500\ \text{mAdc}$ ) $T_C = 25^\circ\text{C}$<br>$T_C = 125^\circ\text{C}$<br>( $V_{GS} = 5.0\ \text{Vdc}$ , $I_D = 50\ \text{mAdc}$ ) $T_C = 25^\circ\text{C}$<br>$T_C = 125^\circ\text{C}$ | $r_{DS(on)}$ | –   | 1.4 | 7.5   | Ohms  |
|                                                                                                                                                                                                                                                                           |              | –   | –   | 13.5  |       |
|                                                                                                                                                                                                                                                                           |              | –   | 1.8 | 7.5   |       |
|                                                                                                                                                                                                                                                                           |              | –   | –   | 13.5  |       |
| Forward Transconductance<br>( $V_{DS} \geq 2.0\ V_{DS(on)}$ , $I_D = 200\ \text{mAdc}$ )                                                                                                                                                                                  | $g_{FS}$     | 80  | –   | –     | mmhos |

### DYNAMIC CHARACTERISTICS

|                                                                                                      |           |   |     |     |    |
|------------------------------------------------------------------------------------------------------|-----------|---|-----|-----|----|
| Input Capacitance<br>( $V_{DS} = 25\ \text{Vdc}$ , $V_{GS} = 0$ , $f = 1.0\ \text{MHz}$ )            | $C_{iss}$ | – | 17  | 50  | pF |
| Output Capacitance<br>( $V_{DS} = 25\ \text{Vdc}$ , $V_{GS} = 0$ , $f = 1.0\ \text{MHz}$ )           | $C_{oss}$ | – | 10  | 25  | pF |
| Reverse Transfer Capacitance<br>( $V_{DS} = 25\ \text{Vdc}$ , $V_{GS} = 0$ , $f = 1.0\ \text{MHz}$ ) | $C_{rss}$ | – | 2.5 | 5.0 | pF |

### SWITCHING CHARACTERISTICS (Note 2.)

|                     |                                                                                                                                     |              |   |    |    |    |
|---------------------|-------------------------------------------------------------------------------------------------------------------------------------|--------------|---|----|----|----|
| Turn–On Delay Time  | $(V_{DD} = 25\ \text{Vdc}$ , $I_D \cong 500\ \text{mAdc}$ ,<br>$R_G = 25\ \Omega$ , $R_L = 50\ \Omega$ , $V_{gen} = 10\ \text{V}$ ) | $t_{d(on)}$  | – | 7  | 20 | ns |
| Turn–Off Delay Time |                                                                                                                                     | $t_{d(off)}$ | – | 11 | 40 | ns |

### BODY–DRAIN DIODE RATINGS

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

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

## TYPICAL ELECTRICAL CHARACTERISTICS

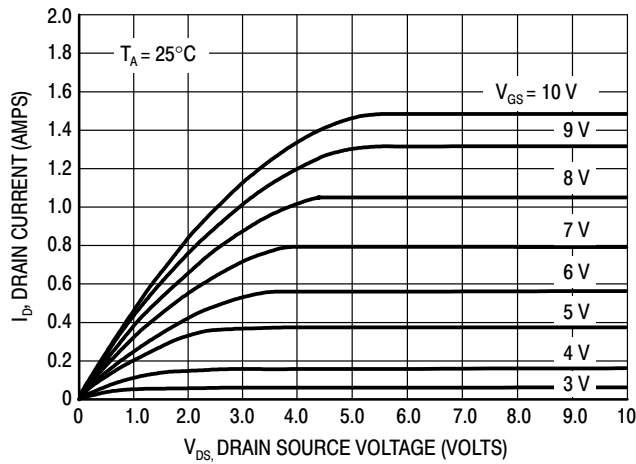


Figure 1. Ohmic Region

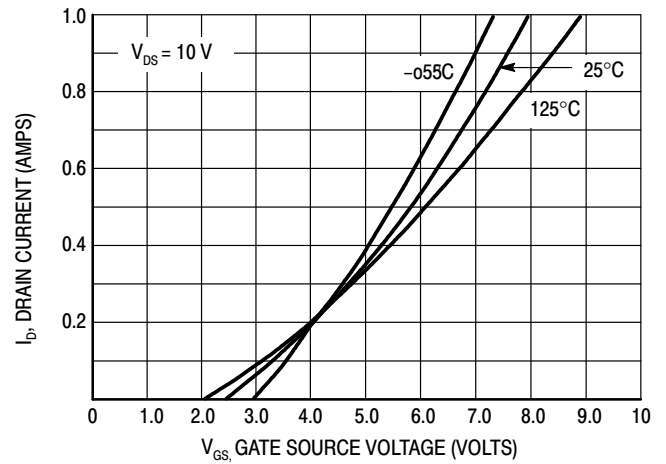


Figure 2. Transfer Characteristics

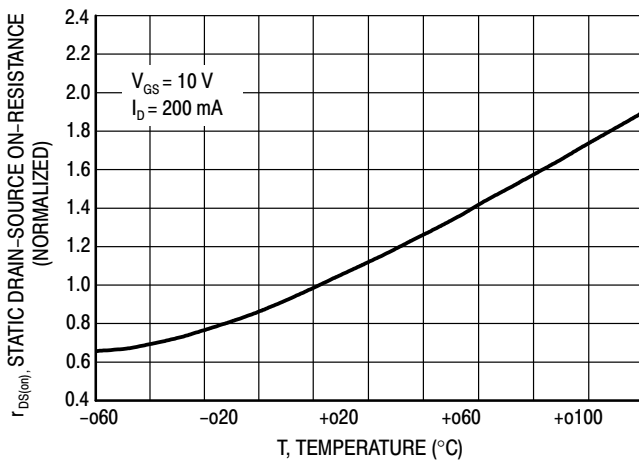


Figure 3. Temperature versus Static Drain-Source On-Resistance

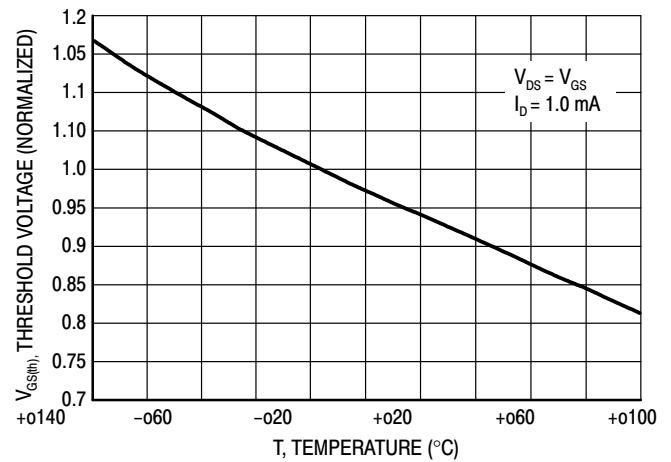


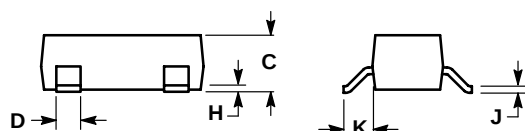
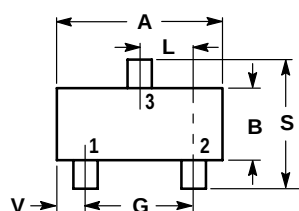
Figure 4. Temperature versus Gate Threshold Voltage

## 2N7002LT1G

### SOT-23

#### NOTES:

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



| 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  |

