

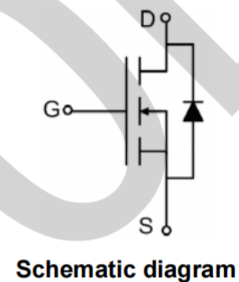
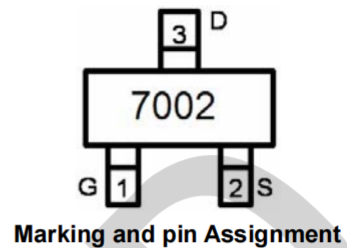
**GENERAL FEATURES**

- $V_{DS} = 60V, I_D = 400mA$
- $R_{DS(ON)} < 3\Omega @ V_{GS}=4.5V$
- $R_{DS(ON)} < 2\Omega @ V_{GS}=10V$

- Lead free product is acquired
- Surface Mount Package

**Application**

- Direct Logic-Level Interface: TTL/CMOS
- Drivers: Relays, Solenoids, Lamps, Hammers, Display, Memories, Transistors, etc.
- Battery Operated Systems
- Solid-State Relays

**Absolute Maximum Ratings (TA=25°C unless otherwise noted)**

| Parameter                                         | Symbol         | Limit      | Unit |
|---------------------------------------------------|----------------|------------|------|
| Drain-Source Voltage                              | $V_{DS}$       | 60         | V    |
| Gate-Source Voltage                               | $V_{GS}$       | $\pm 20$   | V    |
| Drain Current-Continuous@ Current-Pulsed (Note 1) | $I_D$          | 0.4        | A    |
|                                                   | $I_{DM}$       | 0.8        | A    |
| Maximum Power Dissipation                         | $P_D$          | 0.2        | W    |
| Operating Junction and Storage Temperature Range  | $T_J, T_{STG}$ | -55 To 150 | °C   |

**Thermal Characteristic**

|                                                  |                 |     |      |
|--------------------------------------------------|-----------------|-----|------|
| Thermal Resistance, Junction-to-Ambient (Note 2) | $R_{\theta JA}$ | 625 | °C/W |
|--------------------------------------------------|-----------------|-----|------|

**Electrical Characteristics (TA=25°C unless otherwise noted)**

| Parameter                       | Symbol     | Condition                 | Min | Typ | Max | Unit    |
|---------------------------------|------------|---------------------------|-----|-----|-----|---------|
| <b>Off Characteristics</b>      |            |                           |     |     |     |         |
| Drain-Source Breakdown Voltage  | $BV_{DSS}$ | $V_{GS}=0V, I_D=250\mu A$ | 60  |     |     | V       |
| Zero Gate Voltage Drain Current | $I_{DSS}$  | $V_{DS}=60V, V_{GS}=0V$   |     |     | 1   | $\mu A$ |



|                                    |              |                                                          |      |     |           |          |
|------------------------------------|--------------|----------------------------------------------------------|------|-----|-----------|----------|
| Gate-Body Leakage Current          | $I_{GSS}$    | $V_{GS}=\pm 20V, V_{DS}=0V$                              |      |     | $\pm 100$ | nA .     |
| On Characteristics (Note 3)        |              |                                                          |      |     |           |          |
| Gate Threshold Voltage             | $V_{GS(th)}$ | $V_{DS}=V_{GS}, I_D=250\mu A$                            | 1    |     | 2         | V        |
| Drain-Source On-State Resistance   | $R_{DS(ON)}$ | $V_{GS}=5V, I_D=0.05A$                                   |      |     | 3         | $\Omega$ |
|                                    |              | $V_{GS}=10V, I_D=0.5A$                                   |      |     | 2         | $\Omega$ |
| Forward Transconductance           | $g_{FS}$     | $V_{DS}=10V, I_D=0.2A$                                   | 0.08 |     |           | S        |
| Dynamic Characteristics (Note4)    |              |                                                          |      |     |           |          |
| Input Capacitance                  | $C_{ISS}$    | $V_{DS}=30V, V_{GS}=0V,$<br>$F=1.0MHz$                   |      | 20  | 50        | PF       |
| Output Capacitance                 | $C_{OSS}$    |                                                          |      | 10  | 20        | PF       |
| Reverse Transfer Capacitance       | $C_{RSS}$    |                                                          |      | 3.6 | 5         | PF       |
| Switching Characteristics (Note 4) |              |                                                          |      |     |           |          |
| Turn-on Delay Time                 | $t_{d(on)}$  | $V_{DD}=30V, I_D=0.2A$<br>$V_{GS}=10V, R_{GEN}=10\Omega$ |      | 10  |           | nS       |
| Turn-on Rise Time                  | $t_r$        |                                                          |      | 50  |           | nS       |
| Turn-Off Delay Time                | $t_{d(off)}$ |                                                          |      | 17  |           | nS       |
| Turn-Off Fall Time                 | $t_f$        |                                                          |      | 10  |           | nS       |
| Total Gate Charge                  | $Q_g$        | $V_{DS}=10V, I_D=0.115A,$<br>$V_{GS}=4.5V$               |      | 1.7 | 3         | nC       |
| Drain-Source Diode Characteristics |              |                                                          |      |     |           |          |
| Diode Forward Voltage (Note 3)     | $V_{SD}$     | $V_{GS}=0V, I_S=0.115A$                                  |      |     | 1.2       | V        |
| Diode Forward Current (Note 2)     | $I_S$        |                                                          |      |     | 0.4       | A        |

**Notes:**

1. Repetitive Rating: Pulse width limited by maximum junction temperature.
2. Surface Mounted on FR4 Board,  $t \leq 10$  sec.
3. Pulse Test: Pulse Width  $\leq 300\mu s$ , Duty Cycle  $\leq 2\%$ .
4. Guaranteed by design, not subject to production



## TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

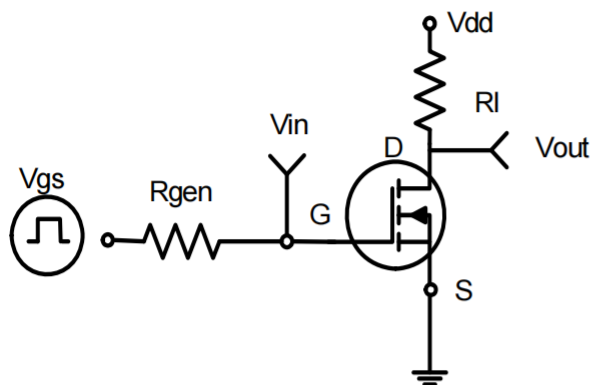


Figure 1: Switching Test Circuit

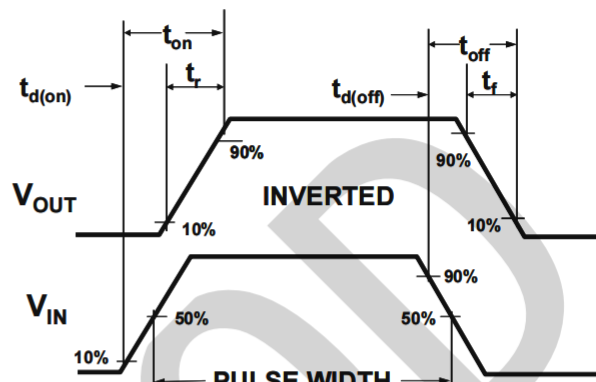


Figure 2: Switching Waveforms

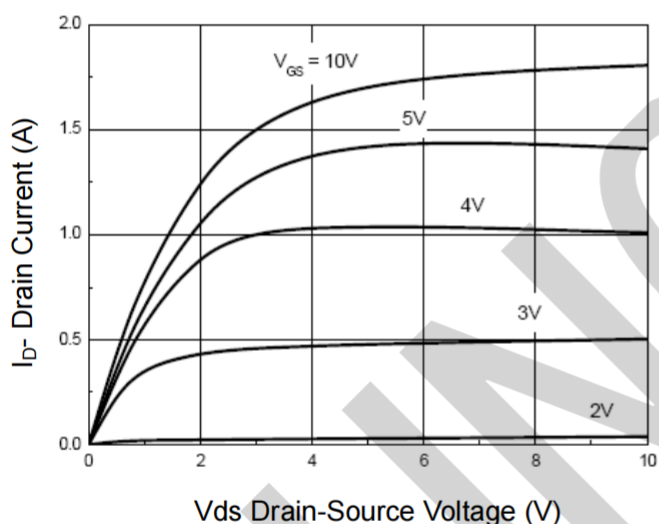


Figure 3 Output CHARACTERISTICS

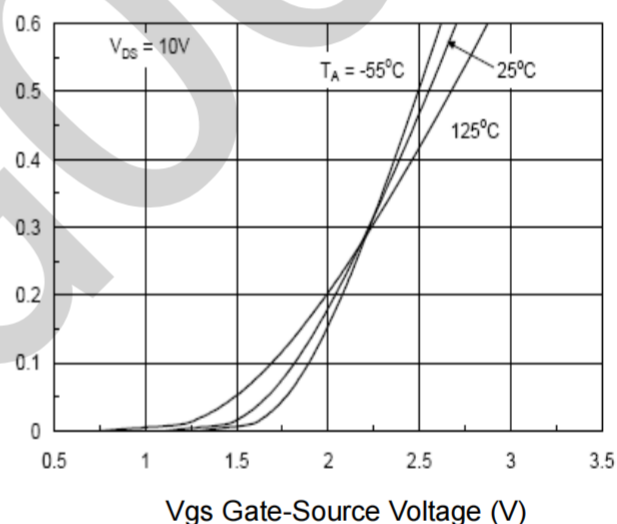


Figure 4 Transfer Characteristics

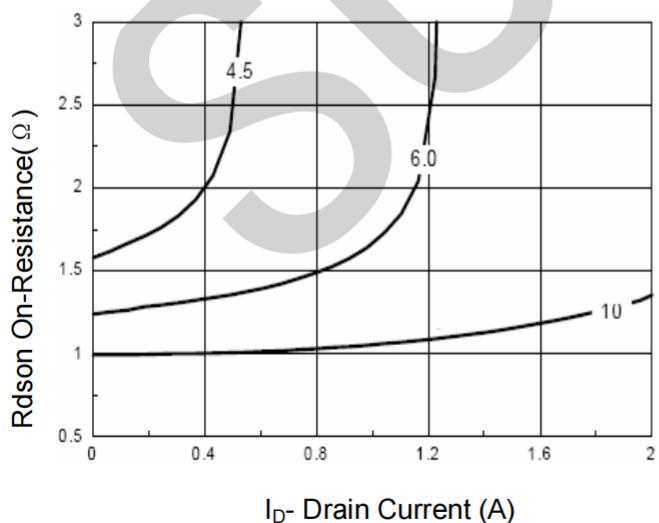


Figure 5 Drain-Source On-Resistance

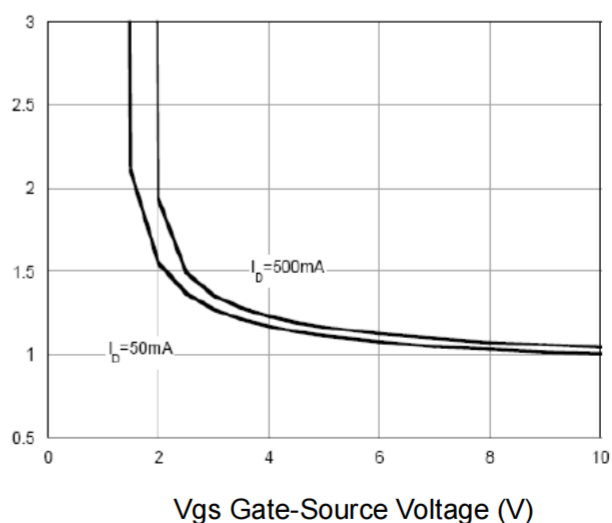


Figure 6 Rds(on) vs Vgs

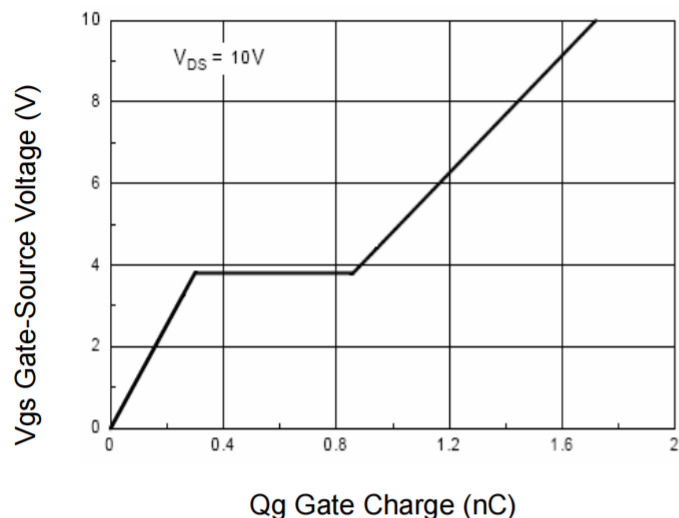


Figure 7 Gate Charge

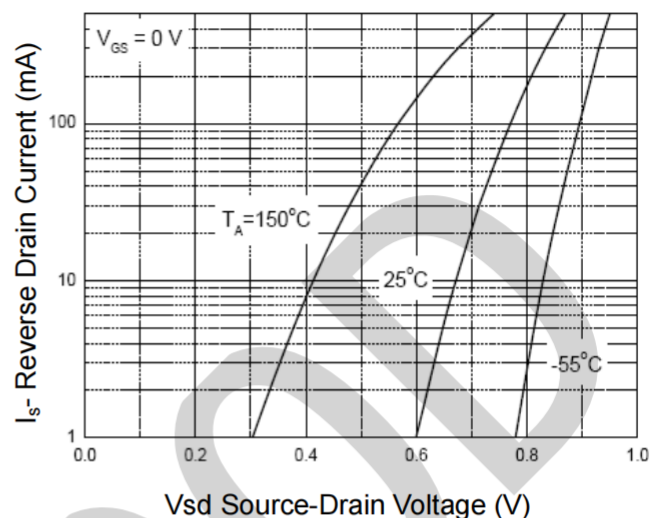


Figure 8 Source-Drain Diode Forward

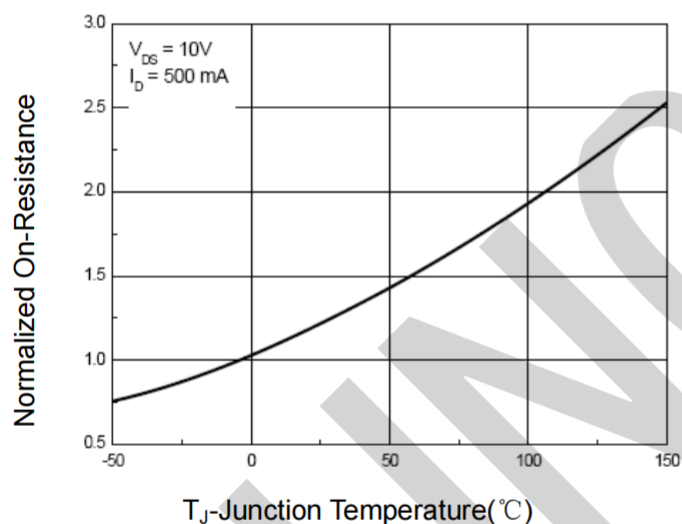


Figure 9 Drain-Source On-Resistance

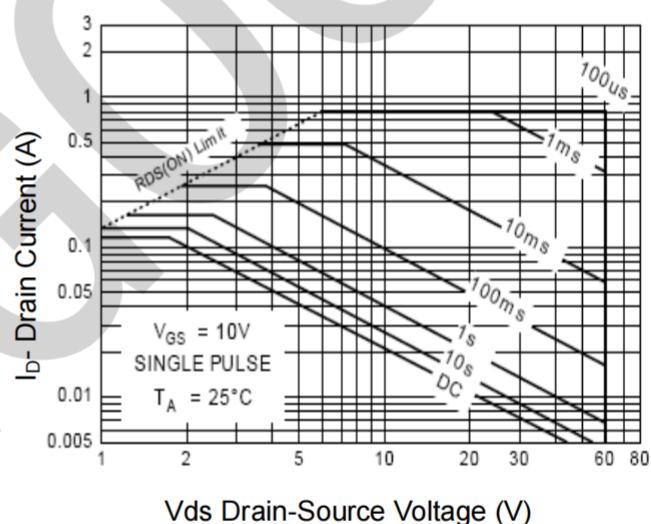


Figure 10 Safe Operation Area

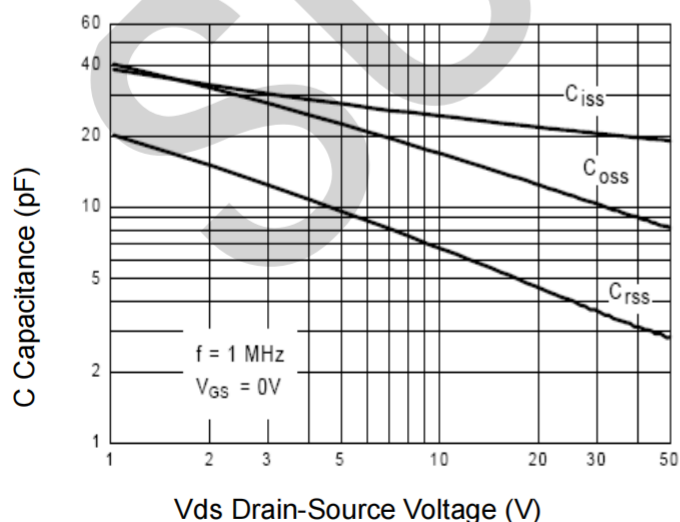


Figure 11 Capacitance vs Vds

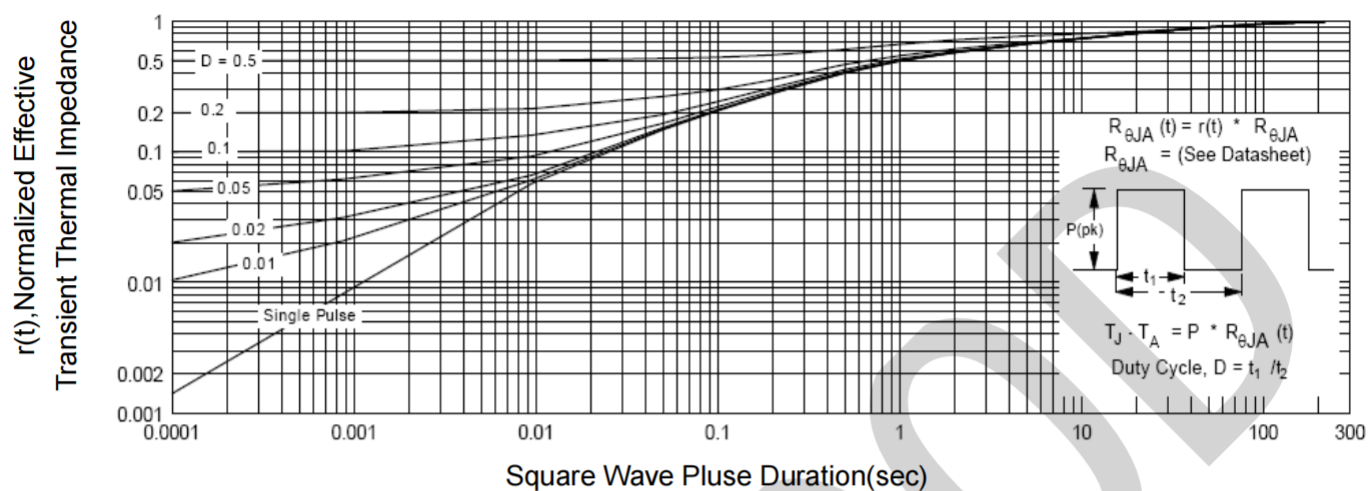


Figure 12 Normalized Maximum Transient Thermal Impedance



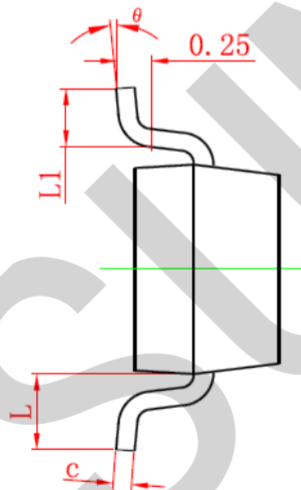
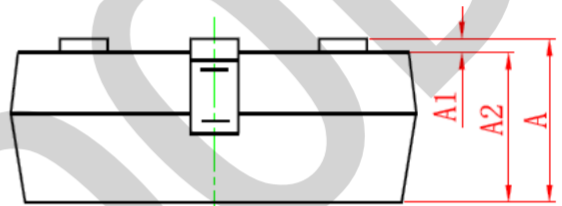
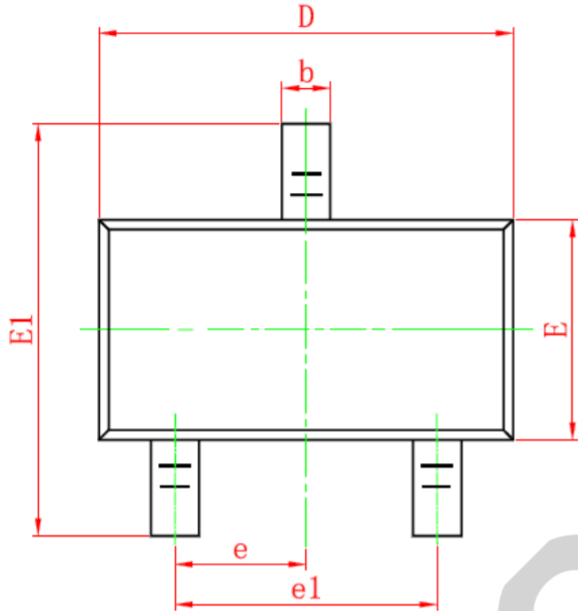
SUNGOOD

2N7002-7-F

N-Channel Enhancement Mode Power MOSFET

## SOT-23 PACKAGE INFORMATION

Dimensions in Millimeters (UNIT:mm)



| Symbol   | Dimensions in Millimeters |       |
|----------|---------------------------|-------|
|          | MIN.                      | MAX.  |
| A        | 0.900                     | 1.150 |
| A1       | 0.000                     | 0.100 |
| A2       | 0.900                     | 1.050 |
| b        | 0.300                     | 0.500 |
| c        | 0.080                     | 0.150 |
| D        | 2.800                     | 3.000 |
| E        | 1.200                     | 1.400 |
| E1       | 2.250                     | 2.550 |
| e        | 0.950TYP                  |       |
| e1       | 1.800                     | 2.000 |
| L        | 0.550REF                  |       |
| L1       | 0.300                     | 0.500 |
| $\theta$ | 0°                        | 8°    |

### NOTES

1. All dimensions are in millimeters.
2. Tolerance  $\pm 0.10\text{mm}$  (4 mil) unless otherwise specified
3. Package body sizes exclude mold flash and gate burrs. Mold flash at the non-lead sides should be less than 5 mils.
4. Dimension L is measured in gauge plane.
5. Controlling dimension is millimeter, converted inch dimensions are not necessarily exact.