



# 2N7002K

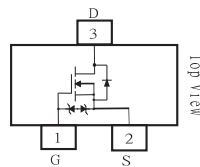
## 60V N-Channel Enhancement Mode MOSFET - ESD Protected

### FEATURES

- $R_{DS(ON)}, V_{GS}@10V, I_{DS}@500mA=3\Omega$
- $R_{DS(ON)}, V_{GS}@4.5V, I_{DS}@200mA=4\Omega$
- Advanced Trench Process Technology
- High Density Cell Design For Ultra Low On-Resistance
- Very Low Leakage Current In Off Condition
- Specially Designed for Battery Operated Systems, Solid-State Relays Drivers : Relays, Displays, Lamps, Solenoids, Memories, etc.
- ESD Protected 2KV HBM
- Lead free in comply with EU RoHS 2011/65/EU directives
- Green molding compound as per IEC61249 Std. . (Halogen Free)

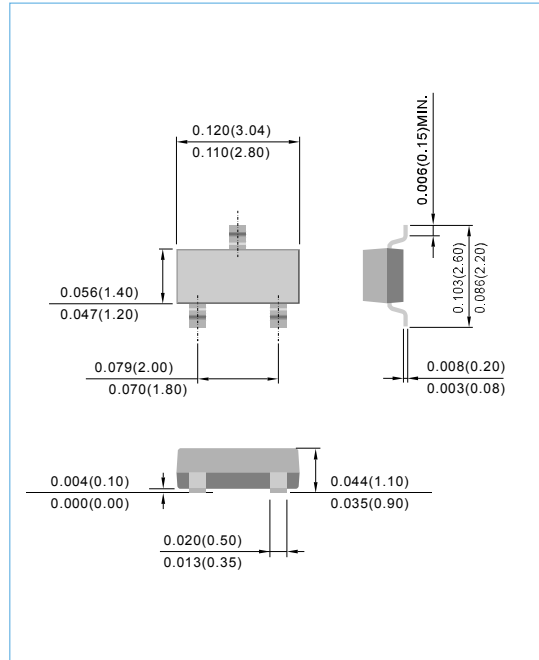
### MECHANICAL DATA

- Case: SOT-23 Package
- Terminals : Solderable per MIL-STD-750, Method 2026
- Apprx. Weight: 0.0003 ounces, 0.0084 grams
- Marking : K72



### SOT-23

Unit : inch(mm)



### Maximum RATINGS and Thermal Characteristics (T<sub>A</sub>=25°C unless otherwise noted)

| PARAMETER   | Symbol                            | Limit  | Units |
|---|-----------------------------------|--|-------|
| Drain-Source Voltage  | V <sub>DS</sub>                   | 60   | V     |
| Gate-Source Voltage   | V <sub>GS</sub>                   | ±20  | V     |
| Continuous Drain Current  | I <sub>D</sub>                    | 300  | mA    |
| Pulsed Drain Current <sup>1)</sup>                                | I <sub>DM</sub>                   | 2000   | mA    |
| Maximum Power Dissipation   | P <sub>D</sub>                    | 350<br>210                                   | mW    |
|   |                                   | T <sub>A</sub> =25°C<br>T <sub>A</sub> =75°C |       |
| Operating Junction and Storage Temperature Range                  | T <sub>J</sub> , T <sub>STG</sub> | -55 to + 150                                 | °C    |
| Junction-to Ambient Thermal Resistance(PCB mounted) <sup>2)</sup> | R <sub>θJA</sub>                  | 357  | °C/W  |

- Note: 1. Maximum DC current limited by the package  
2. Surface mounted on FR4 board, t < 5 sec

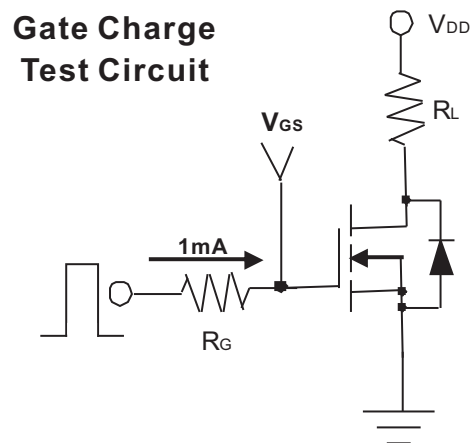
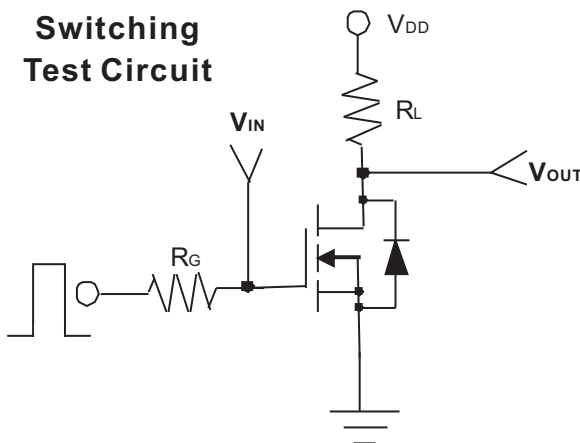
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## ELECTRICAL CHARACTERISTICS

| Parameter                        | Symbol       | Test Condition  | Min. | Typ. | Max. | Units |
|----------------------------------|--------------|---|------|------|------|-------|
| <b>Static</b>                    |              |   |      |      |      |       |
| Drain-Source Breakdown Voltage   | $BV_{DSS}$   | $V_{GS}=0V, I_D=10\mu A$  | 60   | -    | -    | V     |
| Gate Threshold Voltage           | $V_{GS(th)}$ | $V_{DS}=V_{GS}, I_D=250\mu A$   | 1    | -    | 2.5  | V     |
| Drain-Source On-State Resistance | $R_{DS(on)}$ | $V_{GS}=4.5V, I_D=200mA$  | -    | -    | 4.0  | Ω     |
| Drain-Source On-State Resistance | $R_{DS(on)}$ | $V_{GS}=10V, I_D=500mA$   | -    | -    | 3.0  |       |
| Zero Gate Voltage Drain Current  | $I_{DSS}$    | $V_{DS}=60V, V_{GS}=0V$   | -    | -    | 1    | μA    |
| Gate Body Leakage                | $I_{GSS}$    | $V_{GS}=\pm 20V, V_{DS}=0V$   | -    | -    | ±10  | μA    |
| Forward Transconductance         | $g_{fs}$     | $V_{DS}=15V, I_D=250mA$   | 100  | -    | -    | mS    |
| <b>Dynamic</b>                   |              |   |      |      |      |       |
| Total Gate Charge                | $Q_g$        | $V_{DS}=15V, I_D=200mA$<br>$V_{GS}=5V$                                    | -    | -    | 0.8  | nC    |
| Turn-On Time                     | $t_{on}$     | $V_{DD}=30V, R_L=150\Omega$<br>$I_D=200mA, V_{GEN}=10V$<br>$R_G=10\Omega$ | -    | -    | 20   | ns    |
| Turn-Off Time                    | $t_{off}$    |   | -    | -    | 40   |       |
| Input Capacitance                | $C_{iss}$    | $V_{DS}=25V, V_{GS}=0V$<br>$f=1.0MHz$                                     | -    | -    | 35   | pF    |
| Output Capacitance               | $C_{oss}$    |   | -    | -    | 10   |       |
| Reverse Transfer Capacitance     | $C_{rss}$    |   | -    | -    | 5    |       |
| <b>Source-Drain Diode</b>        |              |   |      |      |      |       |
| Diode Forward Voltage            | $V_{SD}$     | $I_S=200mA, V_{GS}=0V$  | -    | 0.82 | 1.3  | V     |
| Continuous Diode Forward Current | $I_S$        | -   | -    | -    | 300  | mA    |
| Pulse Diode Forward Current      | $I_{SM}$     | -   | -    | -    | 2000 | mA    |





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Typical Characteristics Curves ( $T_A=25^\circ\text{C}$ , unless otherwise noted)

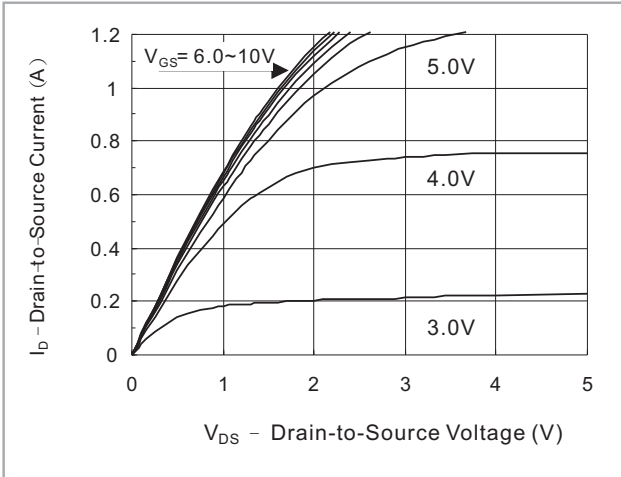


FIG.1- Output Characteristic

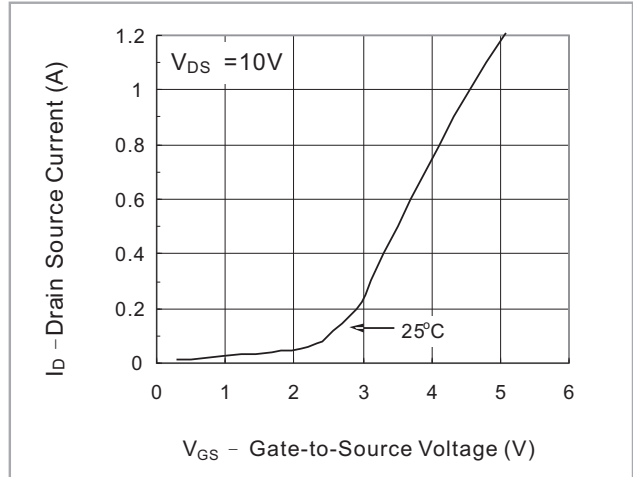


FIG.2- Transfer Characteristic

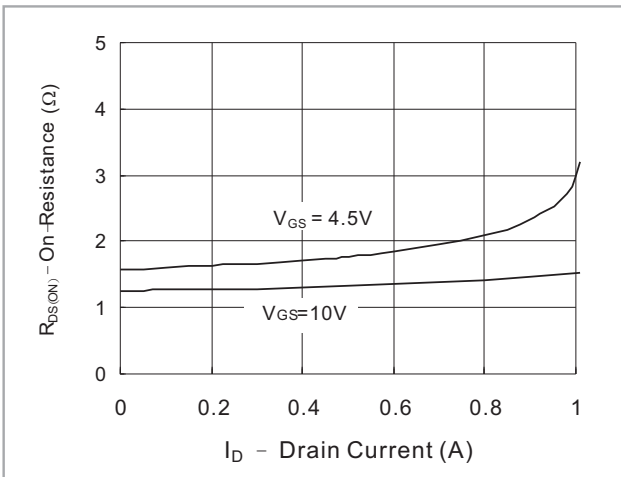


FIG.3- On Resistance vs Drain Current

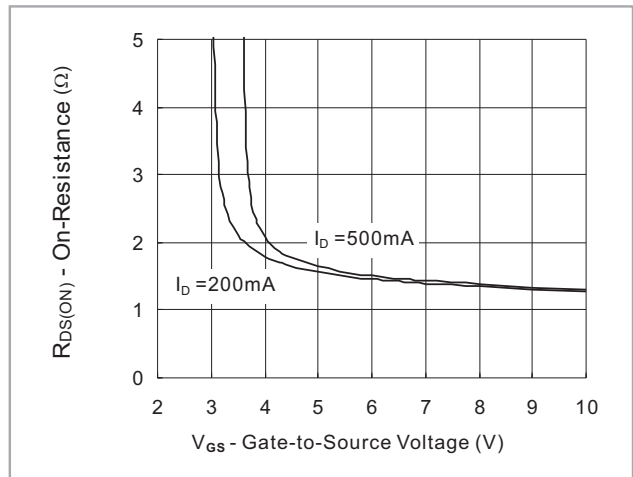


FIG.4- On Resistance vs Gate to Source Voltage

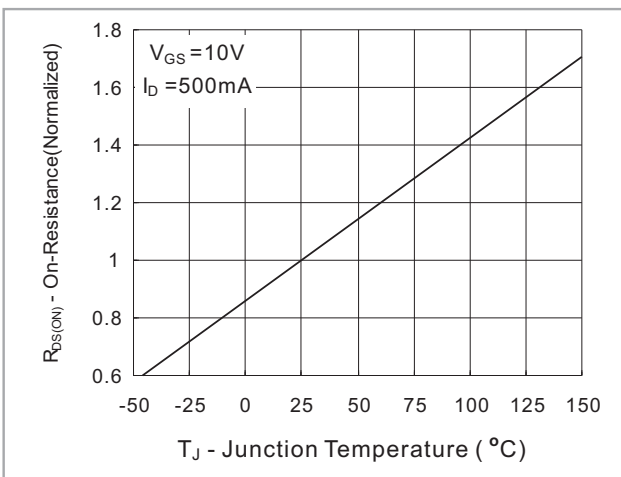


FIG.5- On Resistance vs Junction Temperature



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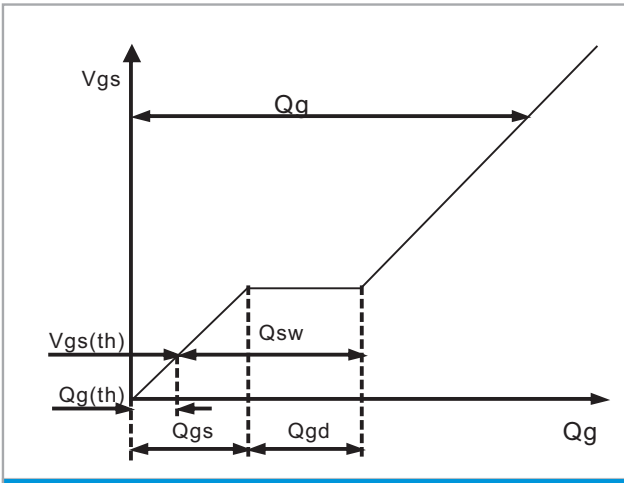


Fig. 6 - Gate Charge Waveform

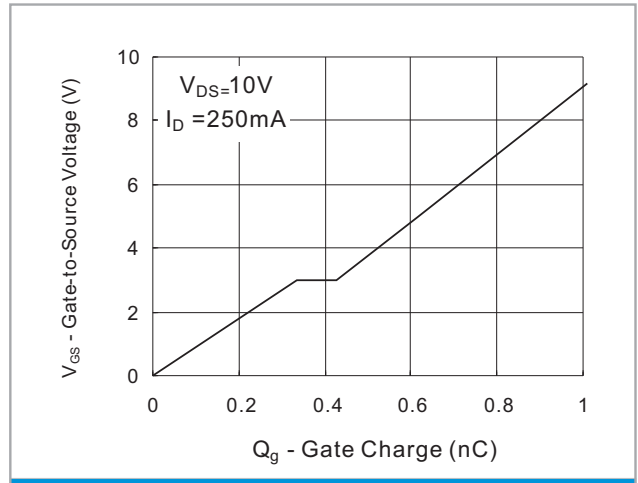


Fig. 7 - Gate Charge

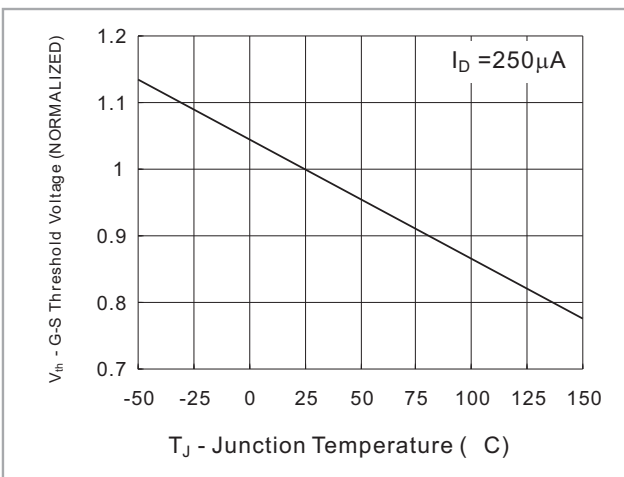


Fig. 8 - Threshold Voltage vs Temperature

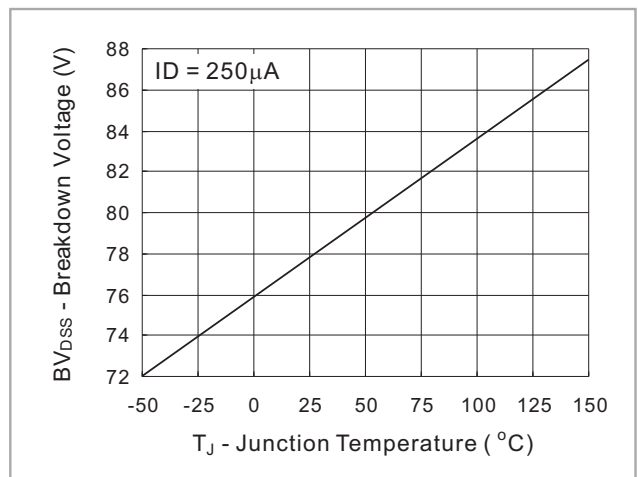


Fig. 9 - Breakdown Voltage vs Junction Temperature

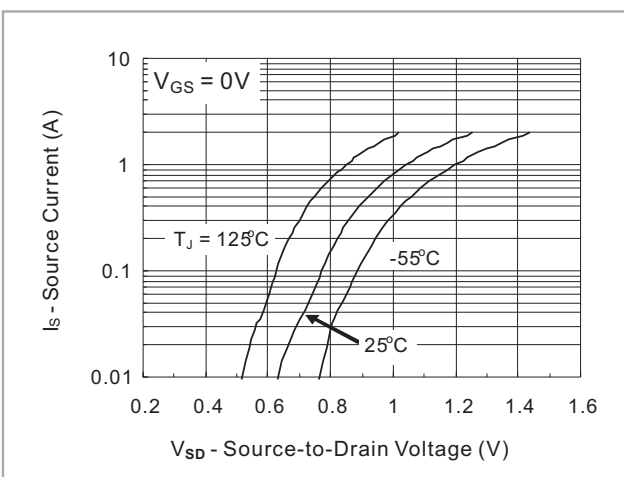


Fig. 10 - Source-Drain Diode Forward Voltage

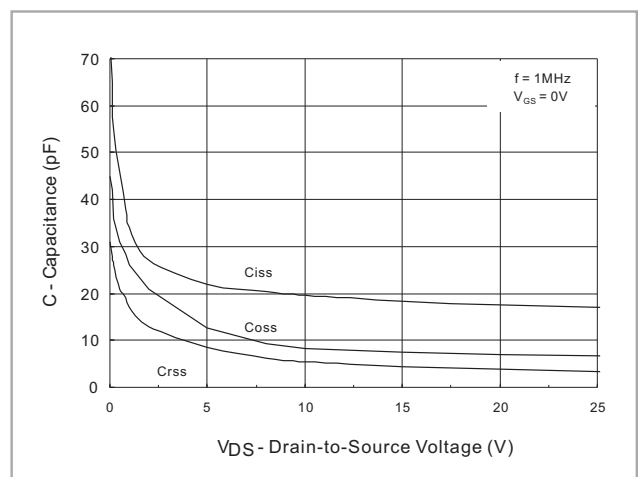
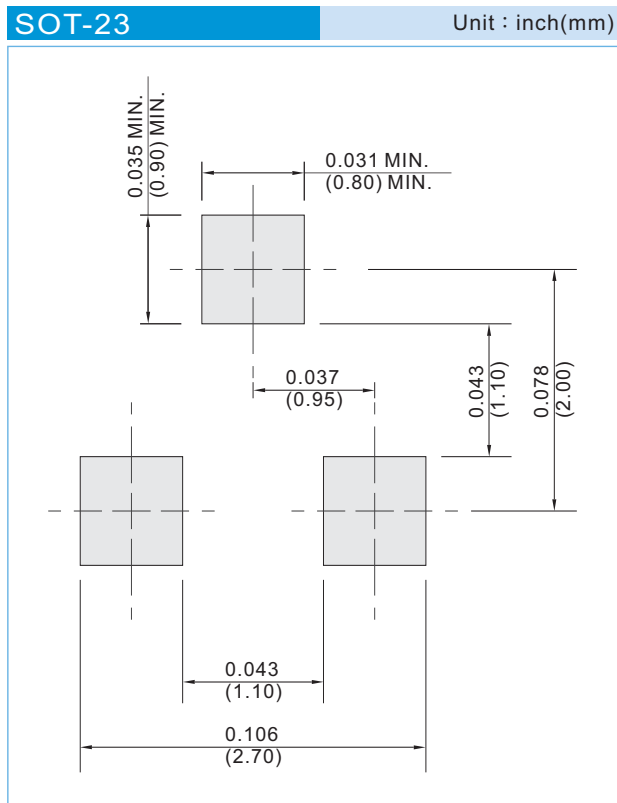


Fig. 11 - Capacitance vs Drain to Source Voltage



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## MOUNTING PAD LAYOUT



### ORDER INFORMATION

- Packing information  
T/R - 12K per 13" plastic Reel  
T/R - 3K per 7" plastic Reel



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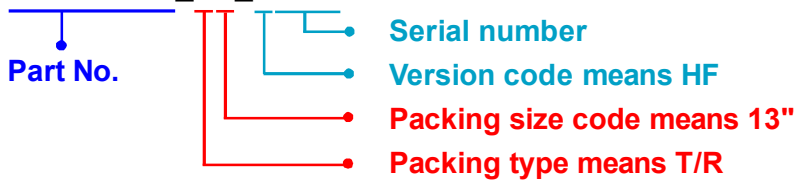
## Part No\_packing code\_Version

2N7002K\_R1\_00001

2N7002K\_R2\_00001

For example :

**RB500V-40\_R2\_00001**



| Packing Code <b>XX</b>               |                      |                                  |                      | Version Code <b>XXXXX</b> |                      |                                       |
|--------------------------------------|----------------------|----------------------------------|----------------------|---------------------------|----------------------|---------------------------------------|
| Packing type                         | 1 <sup>st</sup> Code | Packing size code                | 2 <sup>nd</sup> Code | HF or RoHS                | 1 <sup>st</sup> Code | 2 <sup>nd</sup> ~5 <sup>th</sup> Code |
| Tape and Ammunition Box (T/B)        | <b>A</b>             | N/A                              | <b>0</b>             | <b>HF</b>                 | <b>0</b>             | serial number                         |
| Tape and Reel (T/R)                  | <b>R</b>             | 7"                               | <b>1</b>             | <b>RoHS</b>               | <b>1</b>             | serial number                         |
| Bulk Packing (B/P)                   | <b>B</b>             | 13"                              | <b>2</b>             |                           |                      |                                       |
| Tube Packing (T/P)                   | <b>T</b>             | 26mm                             | <b>X</b>             |                           |                      |                                       |
| Tape and Reel (Right Oriented) (TRR) | <b>S</b>             | 52mm                             | <b>Y</b>             |                           |                      |                                       |
| Tape and Reel (Left Oriented) (TRL)  | <b>L</b>             | PANASERT T/B CATHODE UP (PBCU)   | <b>U</b>             |                           |                      |                                       |
| FORMING                              | <b>F</b>             | PANASERT T/B CATHODE DOWN (PBCD) | <b>D</b>             |                           |                      |                                       |



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