

## 2N7002KW-AU

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

**Voltage**

**60 V**

**Current**

**250mA**

#### Features

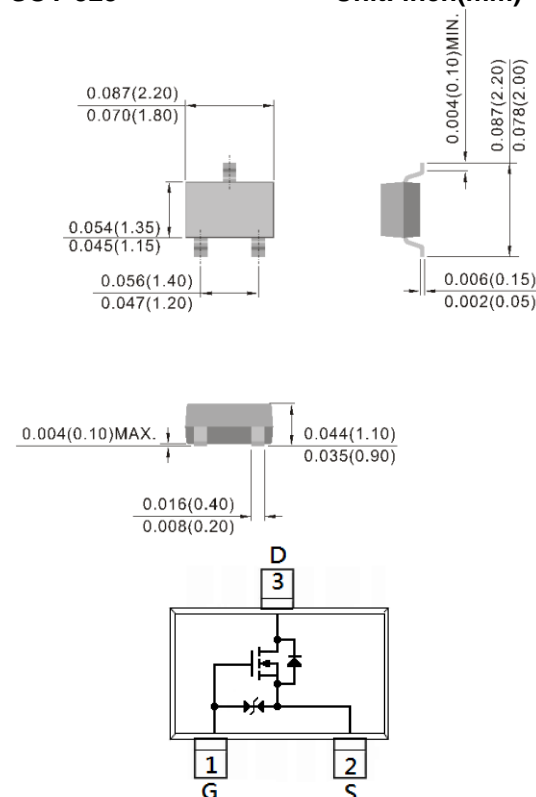
- $R_{DS(ON)}$ ,  $V_{GS}@10V$ ,  $I_D@500mA < 3\Omega$
- $R_{DS(ON)}$ ,  $V_{GS}@4.5V$ ,  $I_D@200mA < 4\Omega$
- Advanced Trench Process Technology
- High Density Cell Design For Ultra Low On-Resistance
- Very Low Leakage Current In Off Condition
- Specially Designed for Battery Operated Systems, Solid-State Relays Drivers: Relay, Displays, Memories, etc
- ESD Protected 2KV HBM
- AEC-Q101 qualified
- Lead free in compliance with EU RoHS 2.0
- Green molding compound as per IEC 61249 standard

#### Mechanical Data

- Case : SOT-323 Package
- Terminals : Solderable per MIL-STD-750, Method 2026
- Approx. Weight : 0.0002 ounces, 0.005 grams

**SOT-323**

**Unit: inch(mm)**



### Maximum Ratings and Thermal Characteristics ( $T_A=25^\circ\text{C}$ unless otherwise noted)

| PARAMETER  |                      | SYMBOL                            | LIMIT   | UNITS |
|--|----------------------|-----------------------------------|---------|-------|
| Drain-Source Voltage                             |                      | V <sub>DS</sub>                   | 60      | V     |
| Gate-Source Voltage                              |                      | V <sub>GS</sub>                   | ±20     |       |
| Continuous Drain Current                         |                      | I <sub>D</sub>                    | 250     | mA    |
| Pulsed Drain Current                             |                      | I <sub>DM</sub>                   | 1000    |       |
| Power Dissipation                                | T <sub>a</sub> =25°C | P <sub>D</sub>                    | 350     | mW    |
|  | Derate above 25°C    |                                   | 2.8     | mW/°C |
| Operating Junction and Storage Temperature Range |                      | T <sub>J</sub> , T <sub>STG</sub> | -55~150 | °C    |
| Typical Thermal Resistance                       |                      | R <sub>θJA</sub>                  | 357     | °C/W  |
| - Junction to Ambient <sup>(Note 3)</sup>        |                      |                                   |         |       |



## 2N7002KW-AU

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

| PARAMETER   | SYMBOL              | TEST CONDITION   | MIN. | TYP. | MAX. | UNITS |
|---|---------------------|--|------|------|------|-------|
| Static  |                     |  |      |      |      |       |
| Drain-Source Breakdown Voltage                        | BV <sub>DSS</sub>   | V <sub>GS</sub> =0V, I <sub>D</sub> =10uA  | 60   | -    | -    | V     |
| Gate Threshold Voltage                                | V <sub>GS(th)</sub> | V <sub>DS</sub> =V <sub>GS</sub> , I <sub>D</sub> =250uA   | 1    | -    | 2.5  |       |
| Drain-Source On-State Resistance                      | R <sub>DS(on)</sub> | V <sub>GS</sub> =10V, I <sub>D</sub> =500mA  | -    | -    | 3    | Ω     |
|   |                     | V <sub>GS</sub> =4.5V, I <sub>D</sub> =200mA   | -    | -    | 4    |       |
| Zero Gate Voltage Drain Current                       | I <sub>DSS</sub>    | V <sub>DS</sub> =60V, V <sub>GS</sub> =0V  | -    | -    | 1    | uA    |
| Gate-Source Leakage Current                           | I <sub>GSS</sub>    | V <sub>GS</sub> =±20V, V <sub>DS</sub> =0V   | -    | -    | ±10  |       |
| Forward Transconductance                              | g <sub>fs</sub>     | V <sub>DS</sub> =15V, I <sub>D</sub> =250mA  | 100  | -    | -    | mS    |
| Dynamic <sup>(Note 5)</sup>                           |                     |  |      |      |      |       |
| Total Gate Charge                                     | Q <sub>g</sub>      | V <sub>DS</sub> =15V, I <sub>D</sub> =250mA,<br>V <sub>GS</sub> =5V <sup>(Note 1,2)</sup>                          | -    | 0.8  | -    | nC    |
| Gate-Source Charge                                    | Q <sub>gs</sub>     |  | -    | 0.35 | -    |       |
| Gate-Drain Charge                                     | Q <sub>gd</sub>     |  | -    | 0.2  | -    |       |
| Input Capacitance                                     | C <sub>iss</sub>    | V <sub>DS</sub> =25V, V <sub>GS</sub> =0V,<br>f=1MHZ   | -    | 24   | -    | pF    |
| Output Capacitance                                    | C <sub>oss</sub>    |  | -    | 13   | -    |       |
| Reverse Transfer Capacitance                          | C <sub>rss</sub>    |  | -    | 8    | -    |       |
| Turn-On Delay Time                                    | td <sub>(on)</sub>  | V <sub>DD</sub> =30V, I <sub>D</sub> =200mA,<br>V <sub>GS</sub> =10V,<br>R <sub>G</sub> =10Ω <sup>(Note 1,2)</sup> | -    | 3    | -    | ns    |
| Turn-On Rise Time                                     | tr                  |  | -    | 19   | -    |       |
| Turn-Off Delay Time                                   | td <sub>(off)</sub> |  | -    | 15   | -    |       |
| Turn-Off Fall Time                                    | tf                  |  | -    | 23   | -    |       |
| Drain-Source Diode                                    |                     |  |      |      |      |       |
| Maximum Continuous Drain-Source Diode Forward Current | I <sub>S</sub>      | ---  | -    | -    | 250  | mA    |
| Diode Forward Voltage                                 | V <sub>SD</sub>     | I <sub>S</sub> =200mA, V <sub>GS</sub> =0V   | -    | 0.82 | 1.3  | V     |

#### NOTES :

1. Pulse width  $\leq 300\mu s$ , Duty cycle  $\leq 2\%$ .
2. Essentially independent of operating temperature typical characteristics.
3.  $R_{\theta JA}$  is the sum of the junction-to-case and case-to-ambient thermal resistance where the case thermal reference is defined as the solder mounting surface of the drain pins mounted on a 1 inch FR-4 with 2oz. square pad of copper.
4. The maximum current rating is package limited.
5. Guaranteed by design, not subject to production testing.

## 2N7002KW-AU

### TYPICAL CHARACTERISTIC CURVES

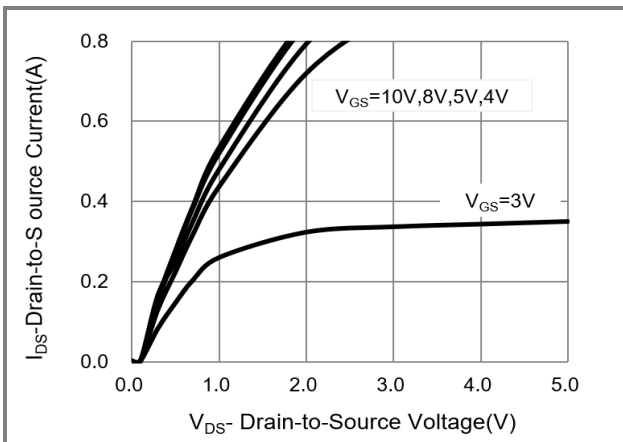


Fig.1 On-Region Characteristics

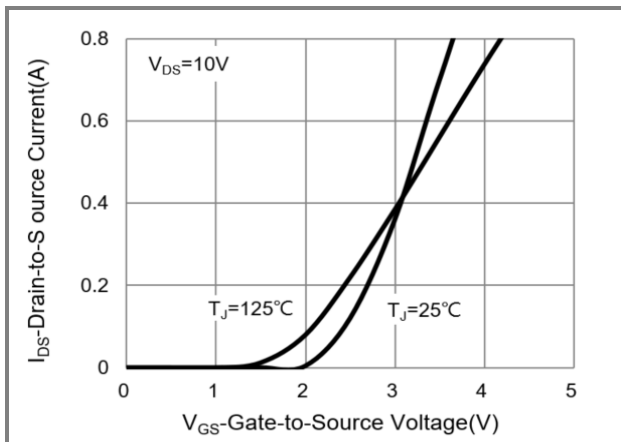


Fig.2 Transfer Characteristics

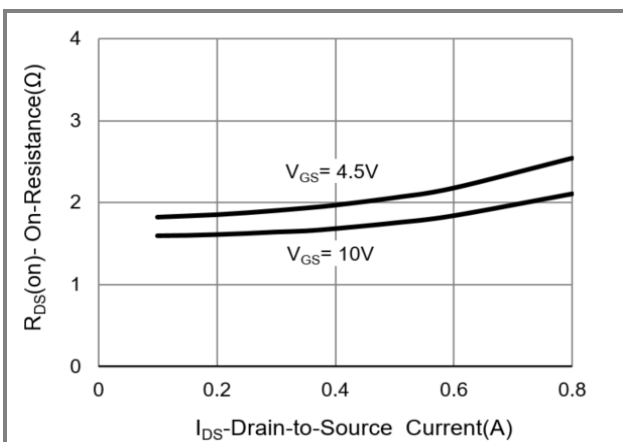


Fig.3 On-Resistance vs. Drain Current

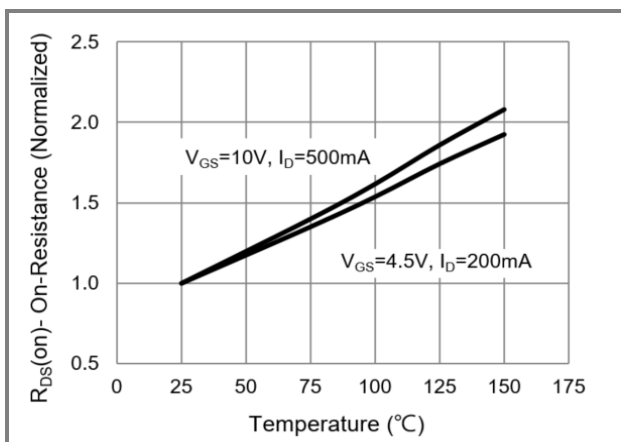


Fig.4 On-Resistance vs. Junction temperature

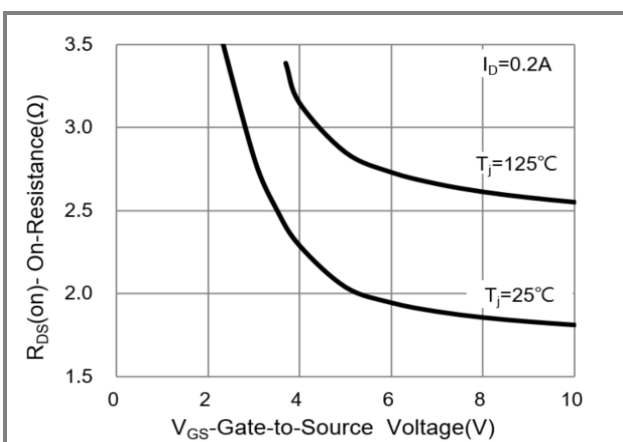


Fig.5 On-Resistance Variation with  $V_{GS}$

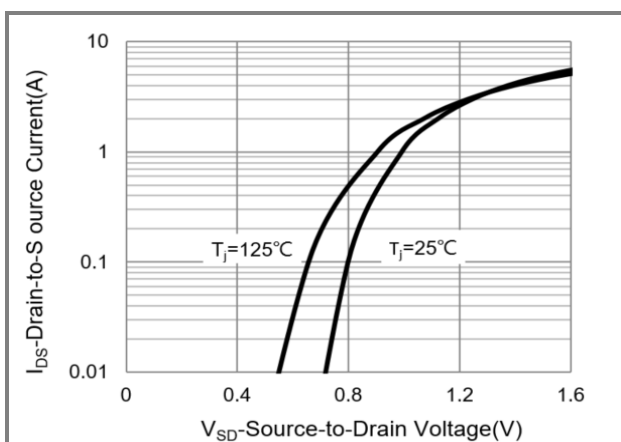


Fig.6 Body Diode Characteristics

## 2N7002KW-AU

### TYPICAL CHARACTERISTIC CURVES

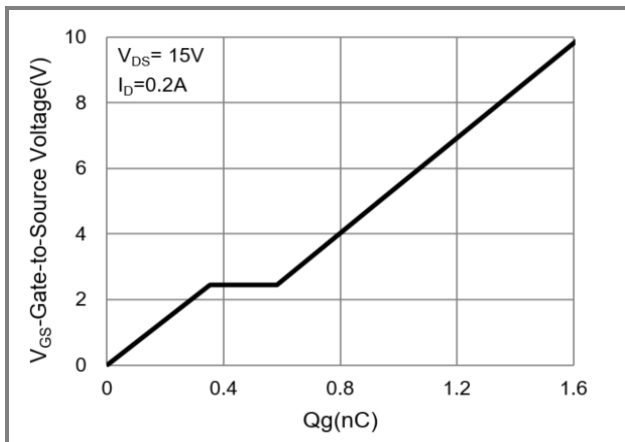


Fig.7 Gate-Charge Characteristics

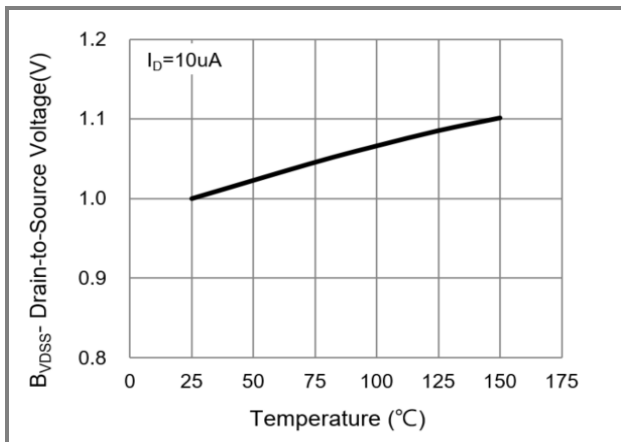


Fig.8 Breakdown Voltage Variation vs. Temperature

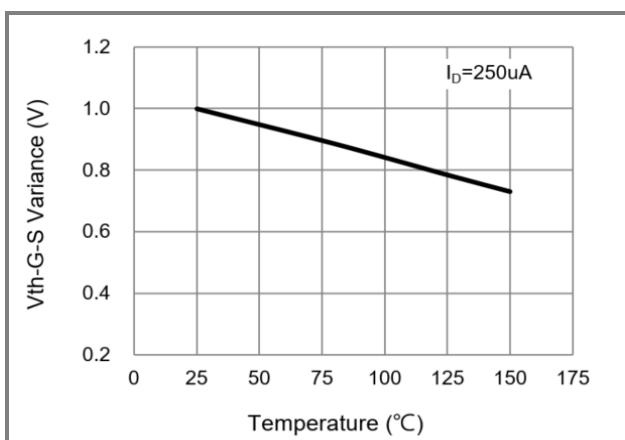


Fig.9 Threshold Voltage Variation with Temperature

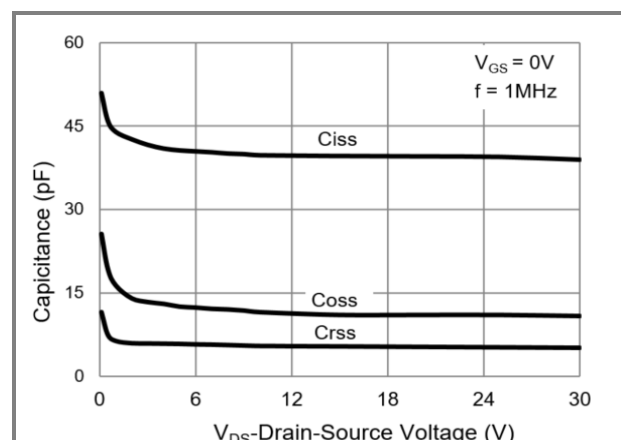


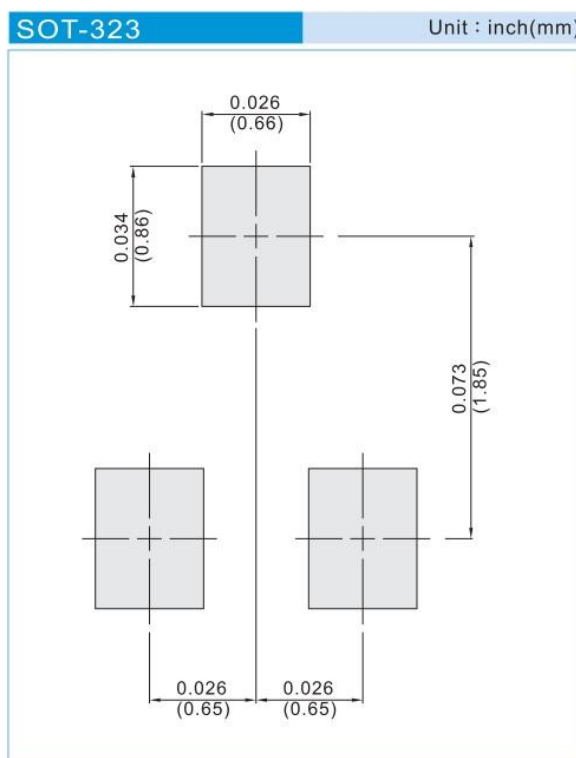
Fig.10 Capacitance vs. Drain-Source Voltage

## 2N7002KW-AU

### Part No Packing Code Version

| Part No Packing Code | Package Type | Packing Type     | Marking | Version      |
|----------------------|--------------|------------------|---------|--------------|
| 2N7002KW-AU_R1_000A1 | SOT-323      | 3K pcs / 7" reel | K72     | Halogen free |

### Mounting Pad Layout





## 2N7002KW-AU

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