



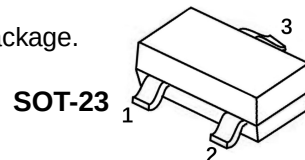
# CCX2N7002K

## 60V N-Channel MOSFETs

Product data sheet

### 1. General description

The CCX2N7002K is N-Channel enhancement MOS Field Effect Transistor. Uses advanced technology and design to provide excellent  $R_{DS(ON)}$  with low gate charge. Device is suitable for use in DC-DC conversion, power switch and charging circuit. Standard Product CCX7002K is Pb-free. encapsulated in a small SOT-23 Surface-Mounted Device (SMD) plastic package.



### 2. Features

- Use trench MOSFET technology
- High density cell design for low  $R_{DS(on)}$
- ESD Protection - HBM : 2kV
- Reliable and rugged
- Avalanche Rated
- Low leakage current

### 3. Applications

- PWM applications
- Load switch
- Power management in portable/desktop PCs
- DC/DC conversion

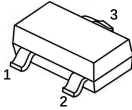
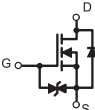
### 4. Quick reference data

Table 1. Quick reference data

| $V_{(BR)DSS}$ | $R_{DS(on)}$ Typ.            |
|---------------|------------------------------|
| 60V           | $1.85\Omega @ V_{GS} = 10V$  |
|               | $2.05\Omega @ V_{GS} = 4.5V$ |

### 5. Pinning information

Table 2. Pinning information

| Pin | Name   | SOT-23 Simplified outline                                                         | Graphic symbol                                                                      |
|-----|--------|-----------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|
| 1   | Gate   |  |  |
| 2   | Source |                                                                                   |                                                                                     |
| 3   | Drain  |                                                                                   |                                                                                     |

### 6. Ordering information

Table 3. Ordering information

| Part number | Package | Material     | Packing     | Quantity per reel | Flammability rating | Reel size |
|-------------|---------|--------------|-------------|-------------------|---------------------|-----------|
| CCX2N7002K  | SOT-23  | halogen free | tape & reel | 3,000pcs          | UL 94V-0            | 7 inches  |

### 7. Marking

Table 4. Marking codes

| Part number | Marking code |       |
|-------------|--------------|-------|
| CCX2N7002K  | 72K          | 7002K |

## 8. Limiting values and electrical Characteristics

Table 5. Limiting values

$T_a=25^{\circ}\text{C}$

| Parameter                                                | Symbol          | Value    | Unit                 |
|----------------------------------------------------------|-----------------|----------|----------------------|
| Drain-Source Voltage                                     | $V_{DS}$        | 60       | V                    |
| Gate-Source Voltage                                      | $V_{GS}$        | $\pm 20$ | V                    |
| Continuous Drain Current                                 | $I_D$           | 0.3      | A                    |
| Drain Current-Pulsed(note 1)                             | $I_{DM}$        | 1.2      | A                    |
| Power Dissipation                                        | $P_D$           | 350      | mW                   |
| Thermal Resistance from Junction to Ambient ( $t < 5s$ ) | $R_{\theta JA}$ | 357      | $^{\circ}\text{C/W}$ |
| Operation Junction and Storage Temperature Range         | $T_J, T_{STG}$  | -55~+150 | $^{\circ}\text{C}$   |

Table 6. Electrical characteristics

$T_a=25^{\circ}\text{C}$

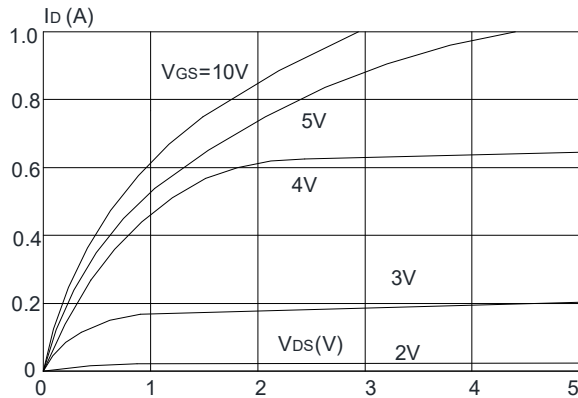
| Parameter                                              | Symbol        | Condition                                                     | Min | Typ  | Max      | Unit     |
|--------------------------------------------------------|---------------|---------------------------------------------------------------|-----|------|----------|----------|
| Off characteristics                                    |               |                                                               |     |      |          |          |
| Drain-source breakdown voltage                         | $V_{(BR)DSS}$ | $V_{GS} = 0V, I_D = 250\mu A$                                 | 60  |      |          | V        |
| Zero gate voltage drain current                        | $I_{DSS}$     | $V_{DS} = 60V, V_{GS} = 0V$                                   |     |      | 1.0      | $\mu A$  |
| Gate-source leakage current                            | $I_{GSS}$     | $V_{GS} = \pm 20V, V_{DS} = 0V$                               |     |      | $\pm 10$ | $\mu A$  |
| On characteristics                                     |               |                                                               |     |      |          |          |
| Drain-source on-resistance (note 1)                    | $R_{DS(on)}$  | $V_{GS} = 10V, I_D = 0.3A$                                    |     | 1.85 | 2.2      | $\Omega$ |
|                                                        |               | $V_{GS} = 4.5V, I_D = 0.2A$                                   |     | 2.05 | 3.0      | $\Omega$ |
| Gate threshold voltage                                 | $V_{GS(th)}$  | $V_{DS} = V_{GS}, I_D = 250\mu A$                             | 1.0 | 1.6  | 2.0      | V        |
| Dynamic characteristics (note 2)                       |               |                                                               |     |      |          |          |
| Input capacitance                                      | $C_{iss}$     | $V_{DS} = 25V, V_{GS} = 0V, f = 1MHz$                         |     | 28   |          | pF       |
| Output capacitance                                     | $C_{oss}$     |                                                               |     | 11   |          | pF       |
| Reverse transfer capacitance                           | $C_{rss}$     |                                                               |     | 4    |          | pF       |
| Total Gate Charge                                      | $Q_{G(TOT)}$  | $V_{DS} = 10V, V_{GS} = 4.5V, I_D = 0.3A$                     |     | 1.8  |          | nC       |
| Gate-to-Sorce Charge                                   | $Q_{GS}$      |                                                               |     | 0.3  |          | nC       |
| Reverse transfer capacitance                           | $Q_{GD}$      |                                                               |     | 0.6  |          | nC       |
| Switching characteristics (note 2)                     |               |                                                               |     |      |          |          |
| Turn-on delay time                                     | $t_{d(on)}$   | $V_{GS} = 10V, V_{DS} = 10V, I_D = 0.2A \quad R_G = 10\Omega$ |     | 2    |          | ns       |
| Turn-on rise time                                      | $t_r$         |                                                               |     | 15   |          | ns       |
| Turn-off delay time                                    | $t_{d(off)}$  |                                                               |     | 7    |          | ns       |
| Turn-off fall Time                                     | $t_f$         |                                                               |     | 20   |          | ns       |
| Drain-source diode characteristics and maximum ratings |               |                                                               |     |      |          |          |
| Diode forward voltage (note 1)                         | $V_{SD}$      | $I_S = 0.3A, V_{GS} = 0V$                                     |     |      | 1.5      | V        |

**Note :**

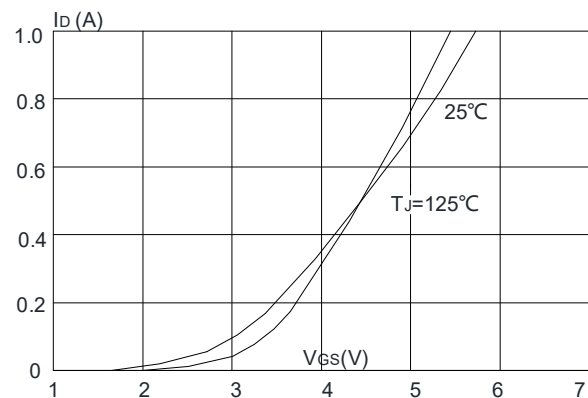
1. Pulse Test : Pulse width  $\leq 300\mu s$ , duty cycle  $\leq 2\%$ .
2. These parameters have no way to verify.

## 9. Typical characteristics

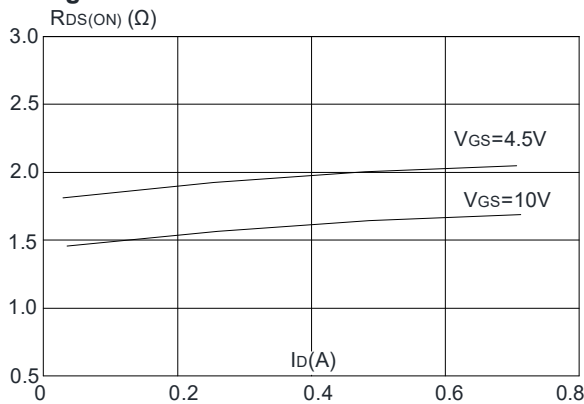
**Figure1: Output Characteristics**



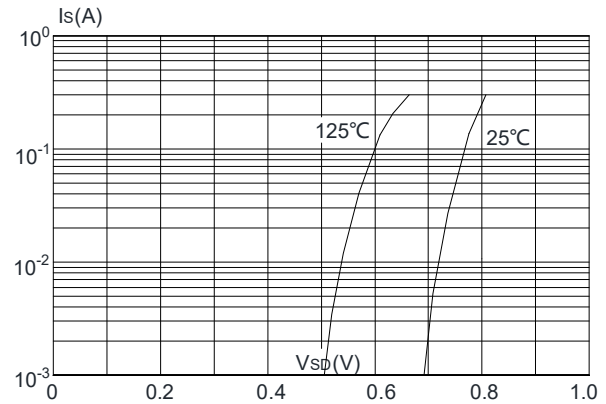
**Figure 2: Typical Transfer Characteristics**



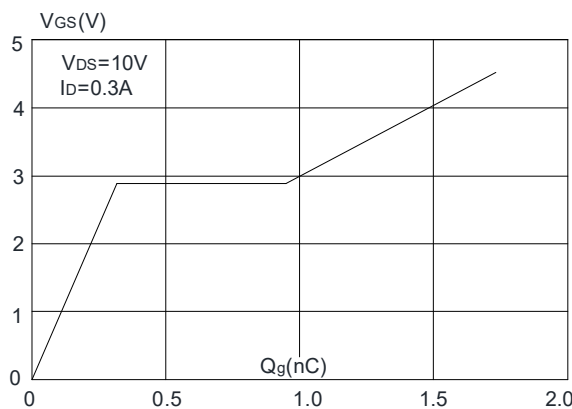
**Figure 3: On-resistance vs. Drain Current**



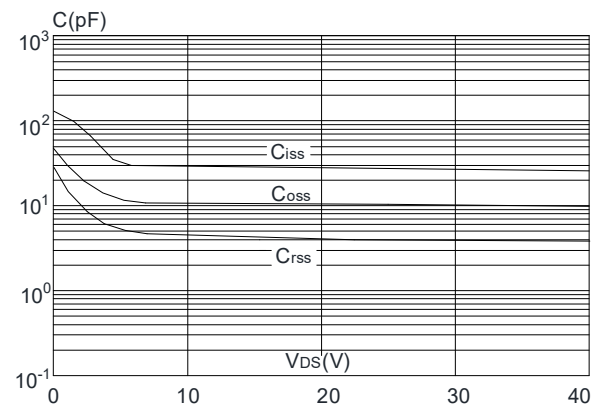
**Figure 4: Body Diode Characteristics**



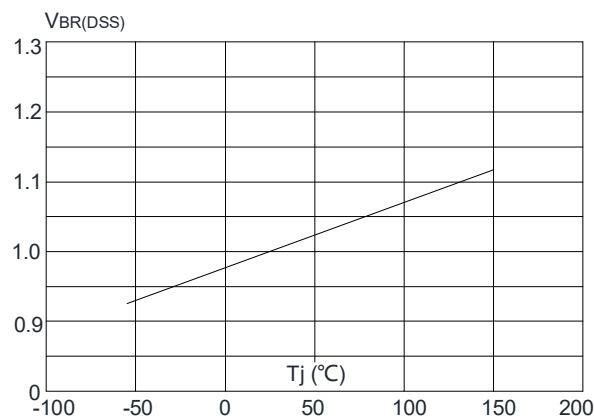
**Figure 5: Gate Charge Characteristics**



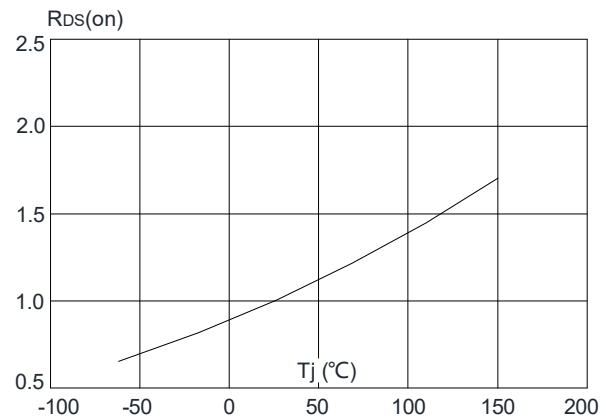
**Figure 6: Capacitance Characteristics**

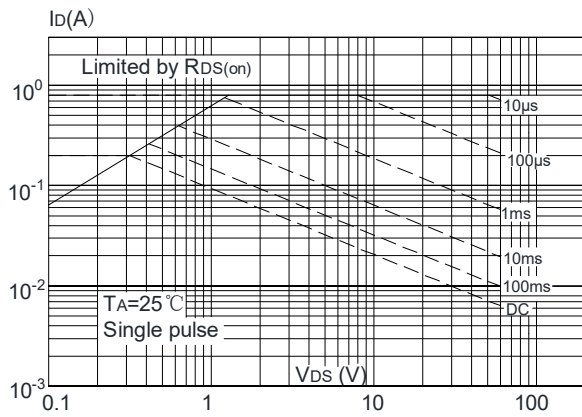
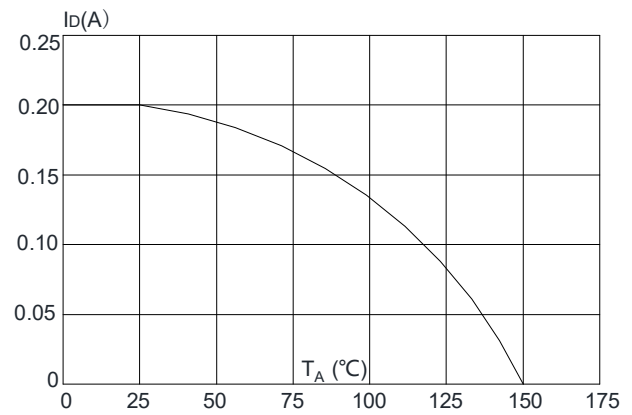
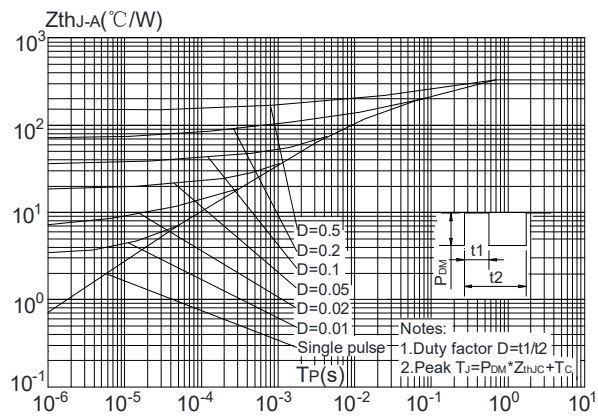


**Figure 7: Normalized Breakdown Voltage vs. Junction Temperature**



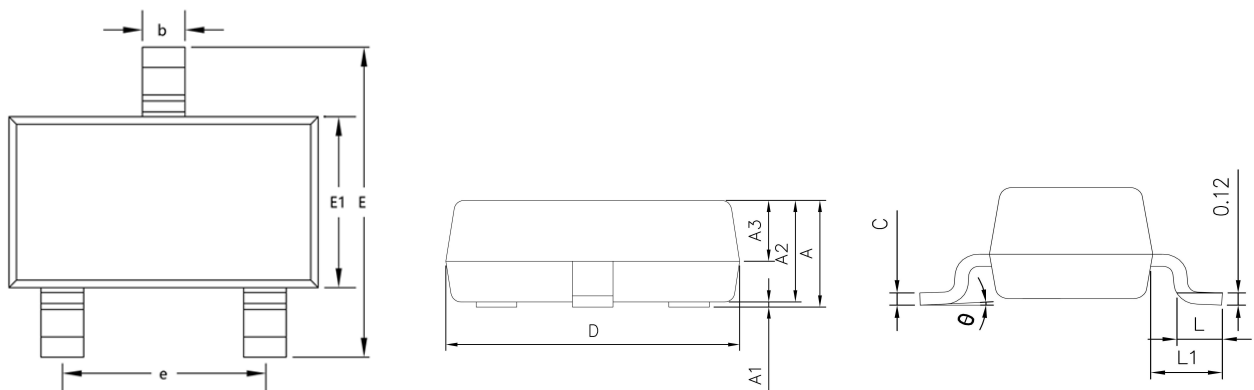
**Figure 8: Normalized on Resistance vs. Junction Temperature**



**Figure 9: Maximum Safe Operating Area**

**Figure 10: Maximum Continuous Drain Current vs. Ambient Temperature**

**Figure.11: Maximum Effective Transient Thermal Impedance, Junction-to-Ambient**


## 10.Package outline

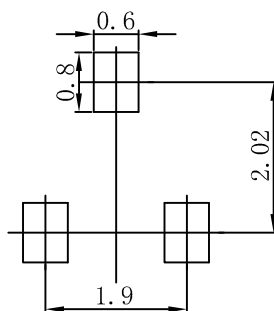
Table 7. SOT-23 Package outline



| Symbol | Dimension in millimeter |      |       |
|--------|-------------------------|------|-------|
|        | Min                     | Nom  | Max   |
| A      | 0.9                     | 1.05 | 1.2   |
| A1     | 0.0                     | 0.05 | 0.1   |
| A2     | 0.9                     | 1.00 | 1.10  |
| A3     | 0.55                    | 0.60 | 0.65  |
| b      | 0.30                    | 0.40 | 0.50  |
| c      | 0.10                    | 0.11 | 0.12  |
| D      | 2.80                    | 2.90 | 3.0   |
| E      | 2.25                    | 2.40 | 2.55  |
| E1     | 1.20                    | 1.30 | 1.40  |
| e      | 1.8                     | 1.9  | 2.0   |
| L      | 0.30                    | 0.40 | 0.50  |
| L1     | 0.475                   | 0.55 | 0.625 |
| θ      | 0°                      | 3°   | 6°    |

## 11.Suggested pad layout

Table 8. Suggested pad layout



**Note:**

1. Controlling dimension: in millimeters
2. General tolerance:  $\pm 0.05\text{mm}$
3. The pad layout is for reference purposes only

## 12. Disclaimer

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