



# NX7002BKW

60 V, single N-channel Trench MOSFET

10 December 2015

Product data sheet

## 1. General description

N-channel enhancement mode Field-Effect Transistor (FET) in a very small SOT323 (SC-70) Surface-Mounted Device (SMD) plastic package using Trench MOSFET technology.

## 2. Features and benefits

- Logic-level compatible
- Very fast switching
- Trench MOSFET technology
- ElectroStatic Discharge (ESD) protection > 2 kV HBM

## 3. Applications

- Relay driver
- High-speed line driver
- Low-side loadswitch
- Switching circuits

## 4. Quick reference data

Table 1. Quick reference data

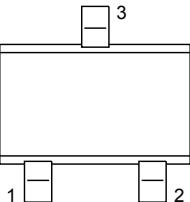
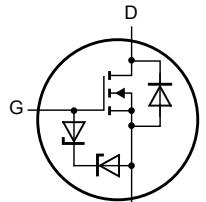
| Symbol                        | Parameter                        | Conditions   |                     | Min | Typ | Max | Unit     |
|-------------------------------|----------------------------------|--|---------------------|-----|-----|-----|----------|
| $V_{DS}$                      | drain-source voltage             | $T_j = 25 \text{ }^\circ\text{C}$  |                     | -   | -   | 60  | V        |
| $V_{GS}$                      | gate-source voltage              |  |                     | -20 | -   | 20  | V        |
| $I_D$                         | drain current                    | $V_{GS} = 10 \text{ V}; T_{sp} = 25 \text{ }^\circ\text{C}$                    |                     | -   | -   | 330 | mA       |
|                               |                                  |  | <a href="#">[1]</a> | -   | -   | 240 | mA       |
| <b>Static characteristics</b> |                                  |  |                     |     |     |     |          |
| $R_{DSon}$                    | drain-source on-state resistance | $V_{GS} = 10 \text{ V}; I_D = 200 \text{ mA}; T_j = 25 \text{ }^\circ\text{C}$ |                     | -   | 2.2 | 2.8 | $\Omega$ |

[1] Device mounted on an FR4 PCB, single-sided copper, tin-plated and mounting pad for drain 1 cm<sup>2</sup>.

**nexperia**

## 5. Pinning information

Table 2. Pinning information

| Pin | Symbol | Description | Simplified outline   | Graphic symbol   |
|-----|--------|-------------|--|--|
| 1   | G      | gate        |  |  |
| 2   | S      | source      |  |  |
| 3   | D      | drain       | <br><b>SC-70 (SOT323)</b> | <br>017aaa255 |

## 6. Ordering information

Table 3. Ordering information

| Type number | Package |  |         |
|-------------|---------|--|---------|
|             | Name    | Description                              | Version |
| NX7002BKW   | SC-70   | plastic surface-mounted package; 3 leads | SOT323  |

## 7. Marking

Table 4. Marking codes

| Type number | Marking code |
|-------------|--------------|
| NX7002BKW   | [1] B6%      |

[1] % = placeholder for manufacturing site code

## 8. Limiting values

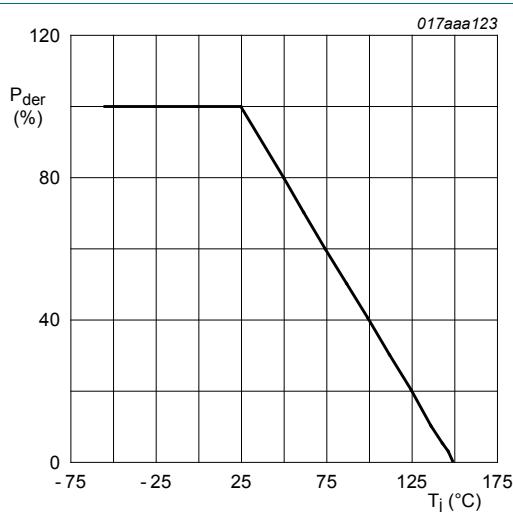
**Table 5. Limiting values**

In accordance with the Absolute Maximum Rating System (IEC 60134).

| Symbol                    | Parameter               | Conditions  |     | Min | Max  | Unit |
|---------------------------|-------------------------|---|-----|-----|------|------|
| $V_{DS}$                  | drain-source voltage    | $T_j = 25^\circ\text{C}$  |     | -   | 60   | V    |
| $V_{GS}$                  | gate-source voltage     |   |     | -20 | 20   | V    |
| $I_D$                     | drain current           | $V_{GS} = 10\text{ V}; T_{sp} = 25^\circ\text{C}$                             |     | -   | 330  | mA   |
|                           |                         | $V_{GS} = 10\text{ V}; T_{amb} = 25^\circ\text{C}$                            | [1] | -   | 240  | mA   |
|                           |                         | $V_{GS} = 10\text{ V}; T_{amb} = 100^\circ\text{C}$                           | [1] | -   | 150  | mA   |
| $I_{DM}$                  | peak drain current      | $T_{amb} = 25^\circ\text{C}$ ; single pulse; $t_p \leq 10\text{ }\mu\text{s}$ |     | -   | 0.8  | A    |
| $P_{tot}$                 | total power dissipation | $T_{amb} = 25^\circ\text{C}$  | [2] | -   | 265  | mW   |
|                           |                         | $T_{sp} = 25^\circ\text{C}$   | [1] | -   | 322  | mW   |
|                           |                         |   |     | -   | 1449 | mW   |
| $T_j$                     | junction temperature    |   |     | -55 | 150  | °C   |
| $T_{amb}$                 | ambient temperature     |   |     | -55 | 150  | °C   |
| $T_{stg}$                 | storage temperature     |   |     | -65 | 150  | °C   |
| <b>Source-drain diode</b> |                         |   |     |     |      |      |
| $I_S$                     | source current          | $T_{amb} = 25^\circ\text{C}$  | [1] | -   | 200  | mA   |

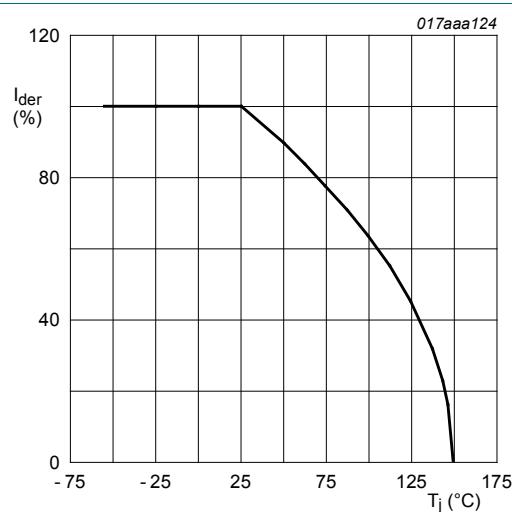
[1] Device mounted on an FR4 PCB, single-sided copper, tin-plated and mounting pad for drain 1 cm<sup>2</sup>.

[2] Device mounted on an FR4 Printed-Circuit Board (PCB), single-sided copper, tin-plated and standard footprint.



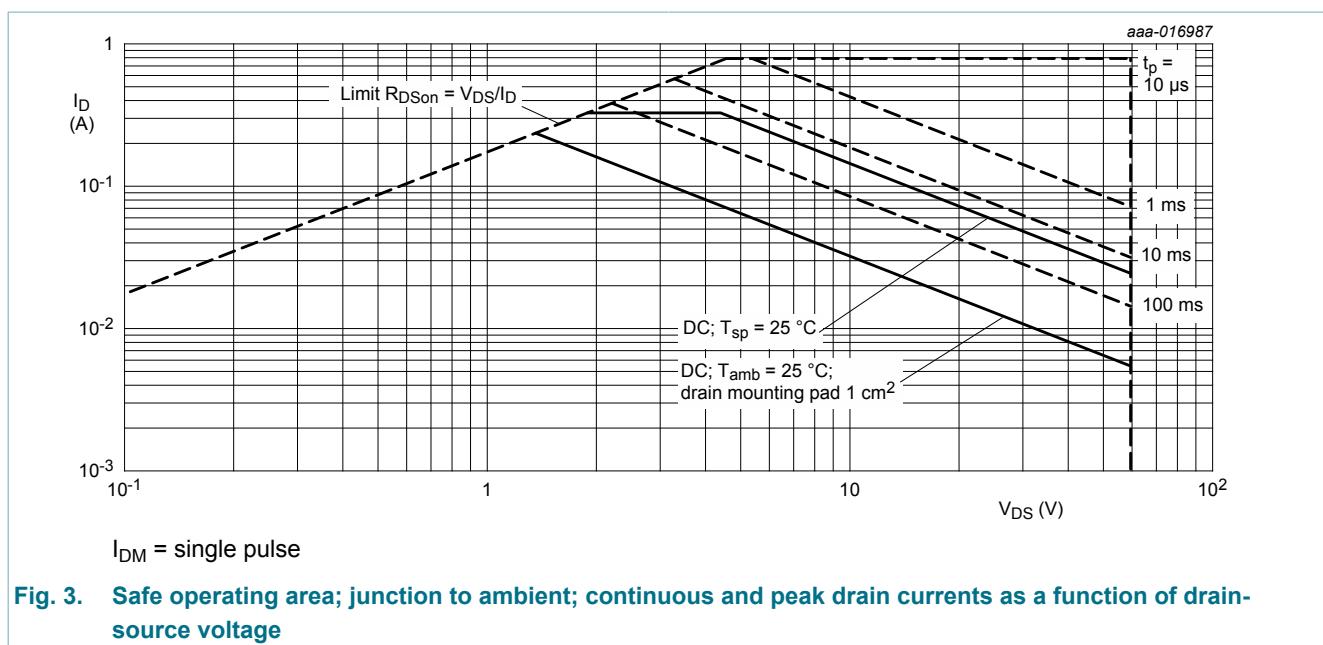
**Fig. 1. Normalized total power dissipation as a function of junction temperature**

$$P_{der} = \frac{P_{tot}}{P_{tot}(25^\circ\text{C})} \times 100 \text{ %}$$



**Fig. 2. Normalized continuous drain current as a function of junction temperature**

$$I_{der} = \frac{I_D}{I_D(25^\circ\text{C})} \times 100 \text{ %}$$



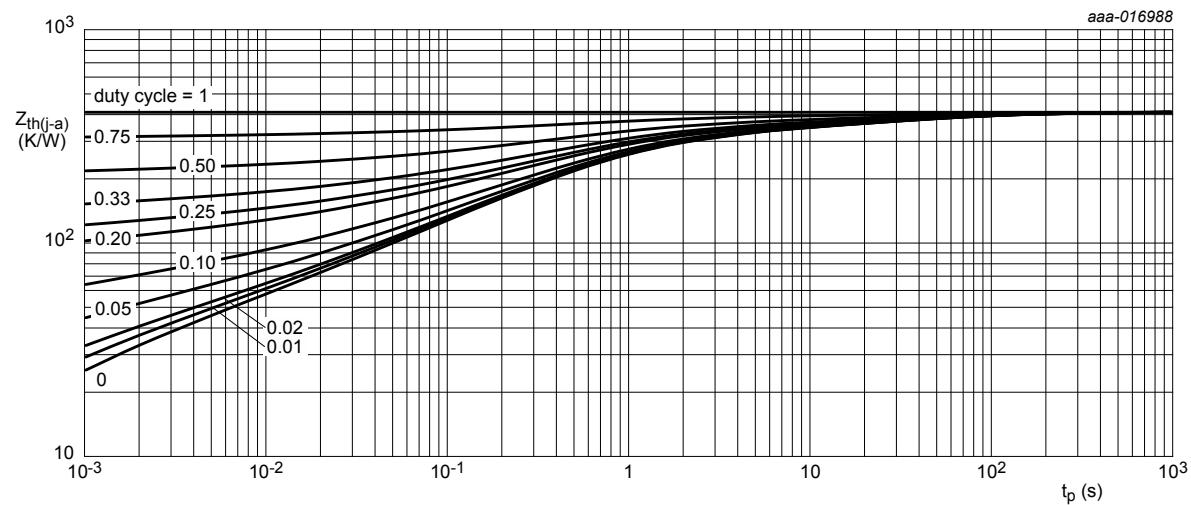
## 9. Thermal characteristics

Table 6. Thermal characteristics

| Symbol         | Parameter  | Conditions  |     | Min | Typ | Max | Unit |
|----------------|--|-------------|-----|-----|-----|-----|------|
| $R_{th(j-a)}$  | thermal resistance from junction to ambient      | in free air | [1] | -   | 410 | 470 | K/W  |
|                |  |             | [2] | -   | 340 | 390 | K/W  |
| $R_{th(j-sp)}$ | thermal resistance from junction to solder point |             |     | -   | 75  | 85  | K/W  |

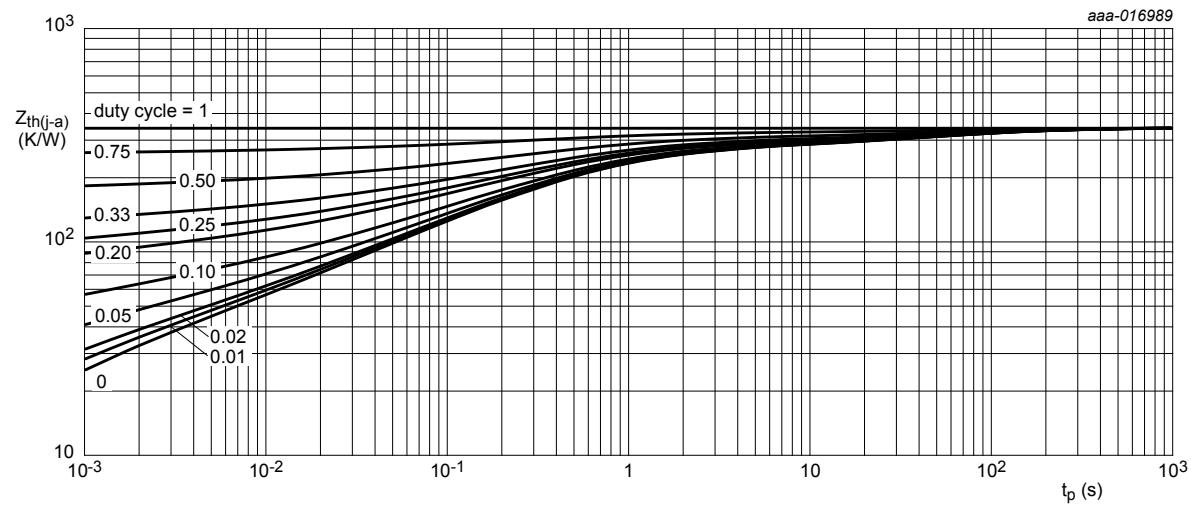
[1] Device mounted on an FR4 PCB, single-sided copper, tin-plated and standard footprint.

[2] Device mounted on an FR4 PCB, single-sided copper, tin-plated and mounting pad for drain  $1\text{ cm}^2$ .



FR4 PCB, standard footprint

**Fig. 4. Transient thermal impedance from junction to ambient as a function of pulse duration; typical values**



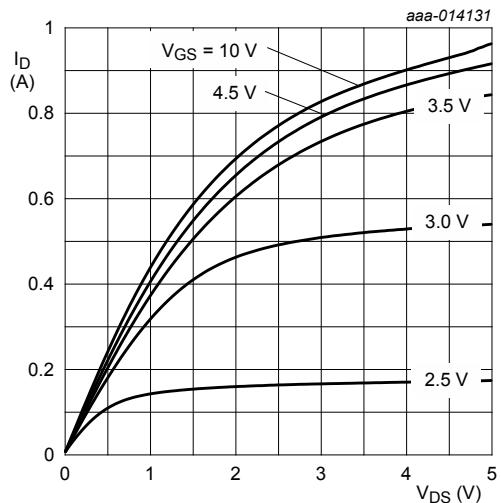
FR4 PCB, mounting pad for drain 1 cm<sup>2</sup>

**Fig. 5. Transient thermal impedance from junction to ambient as a function of pulse duration; typical values**

## 10. Characteristics

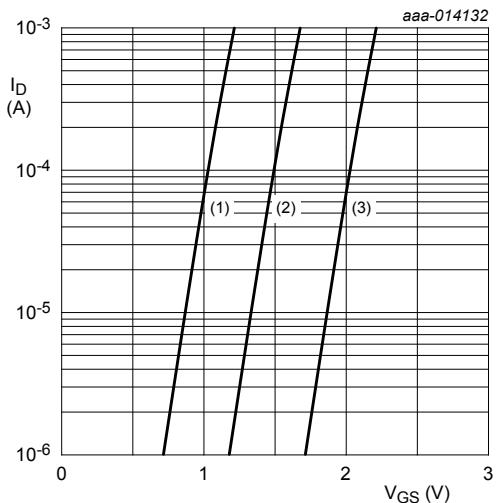
Table 7. Characteristics

| Symbol                         | Parameter                        | Conditions  |  | Min | Typ  | Max  | Unit     |
|--------------------------------|----------------------------------|---|--|-----|------|------|----------|
| <b>Static characteristics</b>  |                                  |   |  |     |      |      |          |
| $V_{(BR)DSS}$                  | drain-source breakdown voltage   | $I_D = 250 \mu A$ ; $V_{GS} = 0 V$ ; $T_j = 25^\circ C$   |  | 60  | -    | -    | V        |
| $V_{GSth}$                     | gate-source threshold voltage    | $I_D = 250 \mu A$ ; $V_{DS}=V_{GS}$ ; $T_j = 25^\circ C$  |  | 1.1 | 1.6  | 2.1  | V        |
| $I_{DSS}$                      | drain leakage current            | $V_{DS} = 60 V$ ; $V_{GS} = 0 V$ ; $T_j = 25^\circ C$   |  | -   | -    | 1    | $\mu A$  |
| $I_{GSS}$                      | gate leakage current             | $V_{GS} = 20 V$ ; $V_{DS} = 0 V$ ; $T_j = 25^\circ C$   |  | -   | -    | 10   | $\mu A$  |
|                                |                                  | $V_{GS} = -20 V$ ; $V_{DS} = 0 V$ ; $T_j = 25^\circ C$  |  | -   | -    | -10  | $\mu A$  |
|                                |                                  | $V_{GS} = 10 V$ ; $V_{DS} = 0 V$ ; $T_j = 25^\circ C$   |  | -   | -    | 1    | $\mu A$  |
|                                |                                  | $V_{GS} = -10 V$ ; $V_{DS} = 0 V$ ; $T_j = 25^\circ C$  |  | -   | -    | -1   | $\mu A$  |
|                                |                                  | $V_{GS} = 5 V$ ; $V_{DS} = 0 V$ ; $T_j = 25^\circ C$  |  | -   | -    | 0.3  | $\mu A$  |
|                                |                                  | $V_{GS} = -5 V$ ; $V_{DS} = 0 V$ ; $T_j = 25^\circ C$   |  | -   | -    | -0.3 | $\mu A$  |
| $R_{DSon}$                     | drain-source on-state resistance | $V_{GS} = 10 V$ ; $I_D = 200 mA$ ; $T_j = 25^\circ C$   |  | -   | 2.2  | 2.8  | $\Omega$ |
|                                |                                  | $V_{GS} = 10 V$ ; $I_D = 100 mA$ ; $T_j = 150^\circ C$  |  | -   | 4.5  | 5.7  | $\Omega$ |
|                                |                                  | $V_{GS} = 5 V$ ; $I_D = 200 mA$ ; $T_j = 25^\circ C$  |  | -   | 2.5  | 3.2  | $\Omega$ |
| $g_{fs}$                       | forward transconductance         | $V_{DS} = 10 V$ ; $I_D = 200 mA$ ; $T_j = 25^\circ C$   |  | -   | 600  | -    | $mS$     |
| $R_G$                          | gate resistance                  | $f = 1 MHz$   |  | -   | 2.5  | -    | $\Omega$ |
| <b>Dynamic characteristics</b> |                                  |   |  |     |      |      |          |
| $Q_{G(tot)}$                   | total gate charge                | $V_{DS} = 30 V$ ; $I_D = 200 mA$ ; $V_{GS} = 10 V$ ; $T_j = 25^\circ C$                           |  | -   | 1    | -    | nC       |
| $Q_{GS}$                       | gate-source charge               |   |  | -   | 0.12 | -    | nC       |
| $Q_{GD}$                       | gate-drain charge                |   |  | -   | 0.18 | -    | nC       |
| $C_{iss}$                      | input capacitance                | $V_{DS} = 10 V$ ; $f = 1 MHz$ ; $V_{GS} = 0 V$ ; $T_j = 25^\circ C$                               |  | -   | 23.6 | -    | pF       |
| $C_{oss}$                      | output capacitance               |   |  | -   | 4.6  | -    | pF       |
| $C_{rss}$                      | reverse transfer capacitance     |   |  | -   | 3    | -    | pF       |
| $t_{d(on)}$                    | turn-on delay time               | $V_{DS} = 50 V$ ; $I_D = 200 mA$ ; $V_{GS} = 10 V$ ; $R_{G(ext)} = 6 \Omega$ ; $T_j = 25^\circ C$ |  | -   | 4.7  | -    | ns       |
| $t_r$                          | rise time                        |   |  | -   | 4.3  | -    | ns       |
| $t_{d(off)}$                   | turn-off delay time              |   |  | -   | 6.9  | -    | ns       |
| $t_f$                          | fall time                        |   |  | -   | 2.9  | -    | ns       |
| <b>Source-drain diode</b>      |                                  |   |  |     |      |      |          |
| $V_{SD}$                       | source-drain voltage             | $I_S = 200 mA$ ; $V_{GS} = 0 V$ ; $T_j = 25^\circ C$  |  | -   | 0.87 | 1.2  | V        |



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

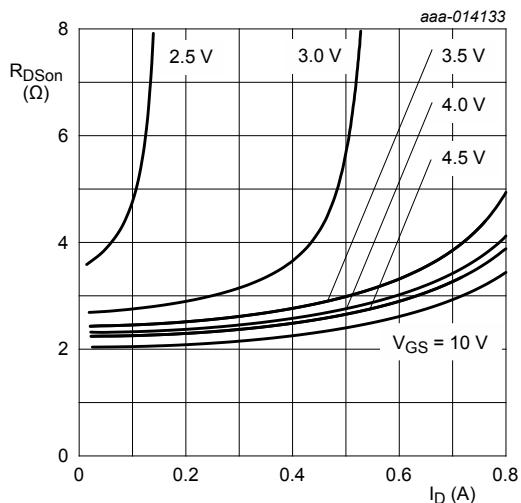
**Fig. 6. Output characteristics: drain current as a function of drain-source voltage; typical values**



$T_j = 25^\circ\text{C}; V_{DS} = 5\text{ V}$

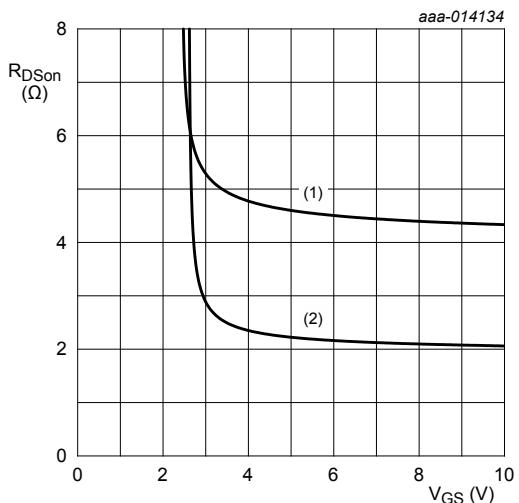
- (1) minimum values
- (2) typical values
- (3) maximum values

**Fig. 7. Sub-threshold drain current as a function of gate-source voltage**



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

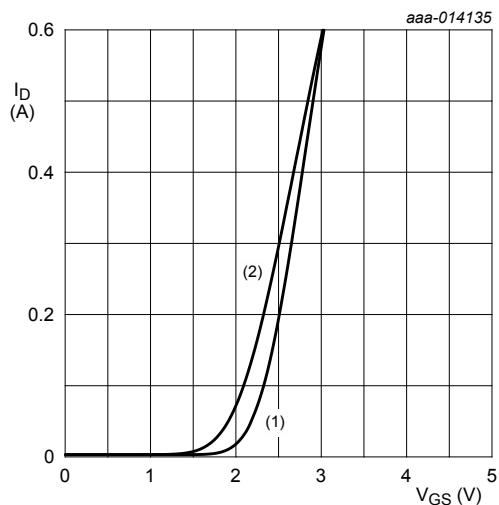
**Fig. 8. Drain-source on-state resistance as a function of drain current; typical values**



$I_D = 0.2\text{ A}$

- (1)  $T_j = 150^\circ\text{C}$
- (2)  $T_j = 25^\circ\text{C}$

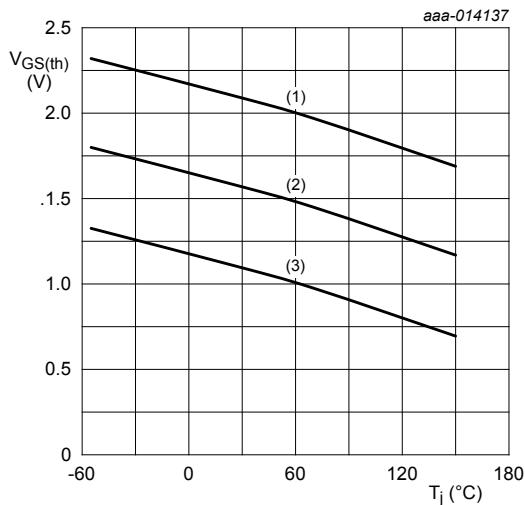
**Fig. 9. Drain-source on-state resistance as a function of gate-source voltage; typical values**



$V_{DS} > I_D \times R_{DSon}$

- (1)  $T_j = 25^\circ\text{C}$
- (2)  $T_j = 150^\circ\text{C}$

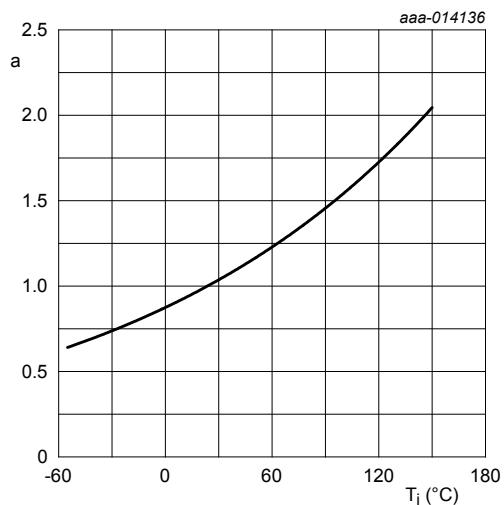
**Fig. 10. Transfer characteristics: drain current as a function of gate-source voltage; typical values**



$I_D = 0.25 \text{ mA}; V_{DS} = V_{GS}$

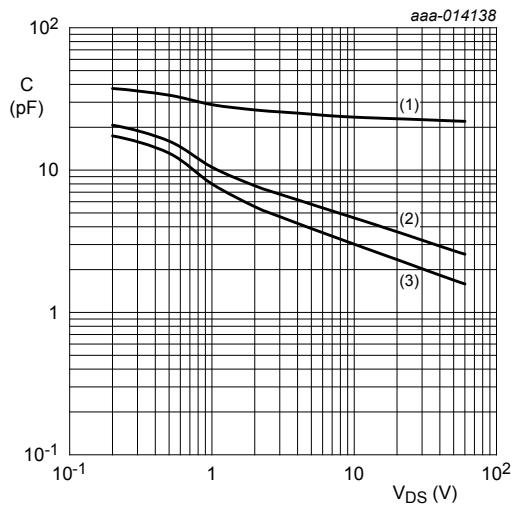
- (1) maximum values
- (2) typical values
- (3) minimum values

**Fig. 12. Gate-source threshold voltage as a function of junction temperature**



**Fig. 11. Normalized drain-source on-state resistance as a function of junction temperature; typical values**

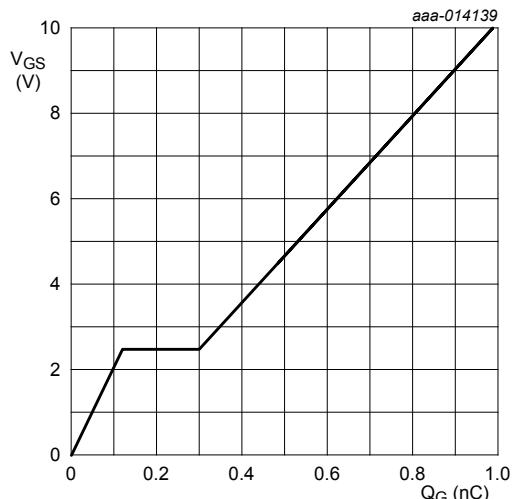
$$a = \frac{R_{DSon}}{R_{DSon}(25^\circ\text{C})}$$



$f = 1 \text{ MHz}; V_{GS} = 0 \text{ V}$

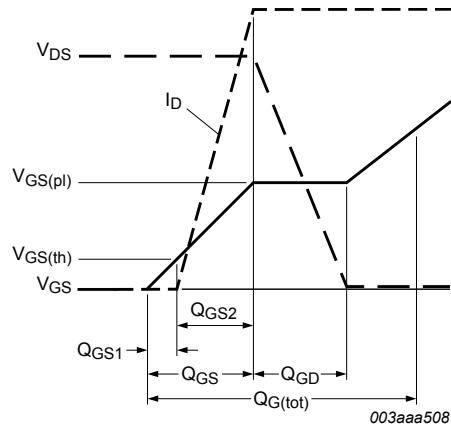
- (1)  $C_{iss}$
- (2)  $C_{oss}$
- (3)  $C_{rss}$

**Fig. 13. Input, output and reverse transfer capacitances as a function of drain-source voltage; typical values**

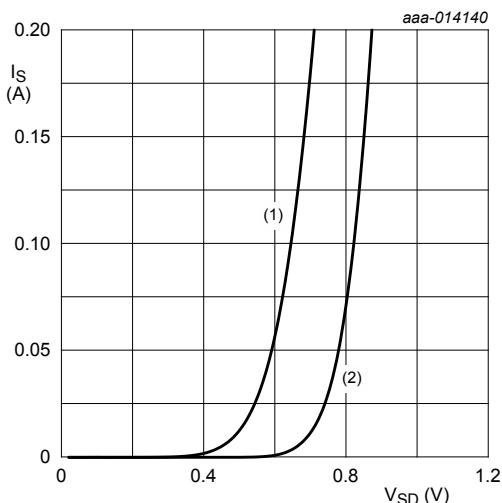


$I_D = 0.2 \text{ A}$ ;  $V_{DS} = 30 \text{ V}$ ;  $T_{amb} = 25 \text{ }^\circ\text{C}$

**Fig. 14. Gate-source voltage as a function of gate charge; typical values**



**Fig. 15. MOSFET transistor: Gate charge waveform definitions**



$V_{GS} = 0 \text{ V}$   
 (1)  $T_j = 150 \text{ }^\circ\text{C}$   
 (2)  $T_j = 25 \text{ }^\circ\text{C}$

**Fig. 16. Source current as a function of source-drain voltage; typical values**

## 11. Test information

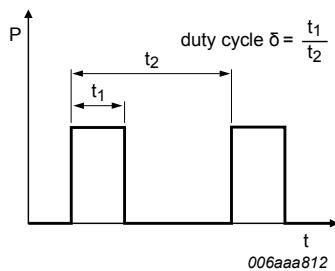
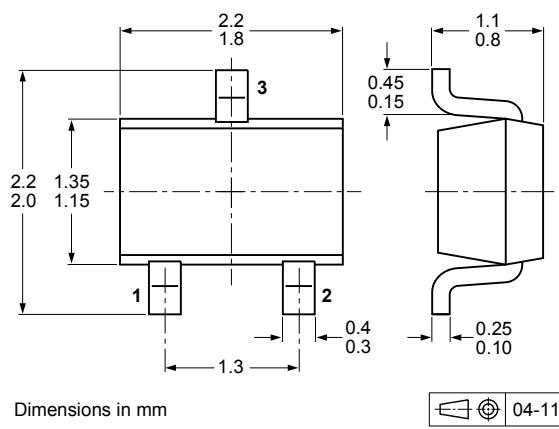


Fig. 17. Duty cycle definition

## 12. Package outline



**Fig. 18. Package outline SC-70 (SOT323)**

## 13. Soldering

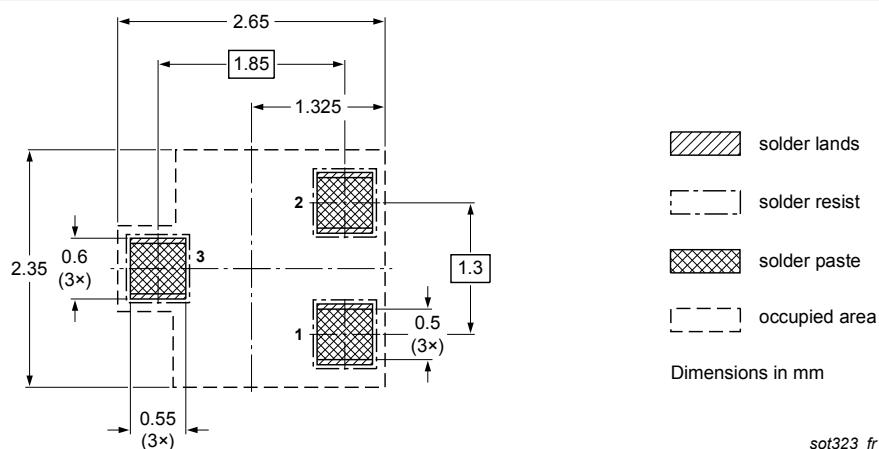


Fig. 19. Reflow soldering footprint for SC-70 (SOT323)

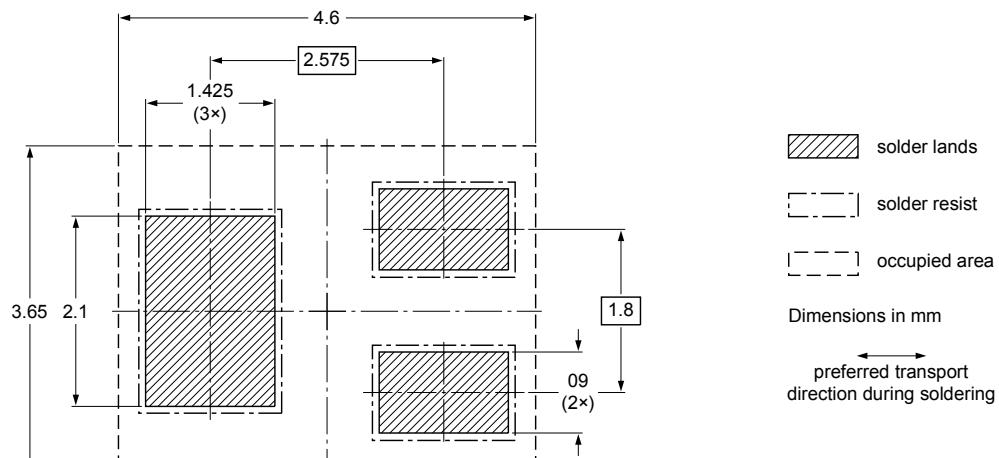


Fig. 20. Wave soldering footprint for SC-70 (SOT323)

## 14. Revision history

Table 8. Revision history

| Data sheet ID  | Release date   | Data sheet status  | Change notice | Supersedes    |
|----------------|--|--------------------|---------------|---------------|
| NX7002BKW v.2  | 20151210   | Product data sheet | -             | NX7002BKW v.1 |
| Modifications: | <ul style="list-style-type: none"><li>• Marking code revised</li><li>• Editorial updates</li></ul> |                    |               |               |
| NX7002BKW v.1  | 20150320   | Product data sheet | -             | -             |

## 15. Legal information

### 15.1 Data sheet status

| Document status [1][2]         | Product status [3] | Definition  |
|--------------------------------|--------------------|---|
| Objective [short] data sheet   | Development        | This document contains data from the objective specification for product development. |
| Preliminary [short] data sheet | Qualification      | This document contains data from the preliminary specification.                       |
| Product [short] data sheet     | Production         | This document contains the product specification.                                     |

- [1] Please consult the most recently issued document before initiating or completing a design.
- [2] The term 'short data sheet' is explained in section "Definitions".
- [3] The product status of device(s) described in this document may have changed since this document was published and may differ in case of multiple devices. The latest product status information is available on the Internet at URL <http://www.nexperia.com>.

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## 16. Contents

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Компания «ЭлектроПласт» предлагает заключение долгосрочных отношений при поставках импортных электронных компонентов на взаимовыгодных условиях!

#### Наши преимущества:

- Оперативные поставки широкого спектра электронных компонентов отечественного и импортного производства напрямую от производителей и с крупнейших мировых складов;
- Поставка более 17-ти миллионов наименований электронных компонентов;
- Поставка сложных, дефицитных, либо снятых с производства позиций;
- Оперативные сроки поставки под заказ (от 5 рабочих дней);
- Экспресс доставка в любую точку России;
- Техническая поддержка проекта, помошь в подборе аналогов, поставка прототипов;
- Система менеджмента качества сертифицирована по Международному стандарту ISO 9001;
- Лицензия ФСБ на осуществление работ с использованием сведений, составляющих государственную тайну;
- Поставка специализированных компонентов (Xilinx, Altera, Analog Devices, Intersil, Interpoint, Microsemi, Aeroflex, Peregrine, Syfer, Eurofarad, Texas Instrument, Miteq, Cobham, E2V, MA-COM, Hittite, Mini-Circuits, General Dynamics и др.);

Помимо этого, одним из направлений компании «ЭлектроПласт» является направление «Источники питания». Мы предлагаем Вам помошь Конструкторского отдела:

- Подбор оптимального решения, техническое обоснование при выборе компонента;
- Подбор аналогов;
- Консультации по применению компонента;
- Поставка образцов и прототипов;
- Техническая поддержка проекта;
- Защита от снятия компонента с производства.



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