



NX7002BKS

60 V, dual N-channel Trench MOSFET

12 May 2015

Product data sheet

1. General description

Dual N-channel enhancement mode Field-Effect Transistor (FET) in a very small SOT363 (SC-88) 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

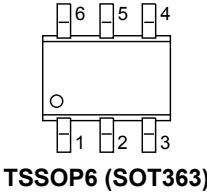
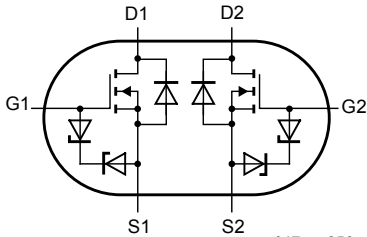
Table 1. Quick reference data

| Symbol | Parameter | Conditions | | Min | Typ | Max | Unit |
|---|----------------------------------|---|-----|-----|-----|-----|------|
| Per transistor | | | | | | | |
| V _{DS} | drain-source voltage | T _j = 25 °C | | - | - | 60 | V |
| V _{GS} | gate-source voltage | | | -20 | - | 20 | V |
| I _D | drain current | V _{GS} = 10 V; T _{sp} = 25 °C | | - | - | 330 | mA |
| | | V _{GS} = 10 V; T _{amb} = 25 °C | [1] | - | - | 240 | mA |
| Static characteristics (per transistor) | | | | | | | |
| R _{DSon} | drain-source on-state resistance | V _{GS} = 10 V; I _D = 200 mA; T _j = 25 °C | | - | 2.2 | 2.8 | Ω |

[1] Device mounted on an FR4 Printed-Circuit Board (PCB), single-sided copper, tin-plated and mounting pad for drain 1 cm^2 .

5. Pinning information

Table 2. Pinning information

| Pin | Symbol | Description | Simplified outline | Graphic symbol |
|-----|--------|-------------|--|--|
| 1 | S1 | source TR1 |  <p>TSSOP6 (SOT363)</p> |  <p>017aaa256</p> |
| 2 | G1 | gate TR1 | | |
| 3 | D2 | drain TR2 | | |
| 4 | S2 | source TR2 | | |
| 5 | G2 | gate TR2 | | |
| 6 | D1 | drain TR1 | | |

6. Ordering information

Table 3. Ordering information

| Type number | Package | | |
|-------------|---------|--|---------|
| | Name | Description | Version |
| NX7002BKS | TSSOP6 | plastic surface-mounted package; 6 leads | SOT363 |

7. Marking

Table 4. Marking codes

| Type number | Marking code |
|-------------|--------------|
| NX7002BKS | LT% |

[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 |
|--------------------|-------------------------|--|-----|-----|-----|------|
| Per transistor | | | | | | |
| V _{DS} | drain-source voltage | T _j = 25 °C | | - | 60 | V |
| V _{GS} | gate-source voltage | | | -20 | 20 | V |
| I _D | drain current | V _{GS} = 10 V; T _{sp} = 25 °C | | - | 330 | mA |
| | | V _{GS} = 10 V; T _{amb} = 25 °C | [1] | - | 240 | mA |
| | | V _{GS} = 10 V; T _{amb} = 100 °C | [1] | - | 150 | mA |
| I _{DM} | peak drain current | T _{amb} = 25 °C; single pulse; t _p ≤ 10 μs | | - | 0.8 | A |
| P _{tot} | total power dissipation | T _{amb} = 25 °C | [2] | - | 285 | mW |
| | | | [1] | - | 320 | mW |
| | | T _{sp} = 25 °C | | - | 870 | mW |
| Source-drain diode | | | | | | |
| I _S | source current | T _{amb} = 25 °C | [1] | - | 200 | mA |
| Per device | | | | | | |
| T _j | junction temperature | | | -55 | 150 | °C |
| T _{amb} | ambient temperature | | | -55 | 150 | °C |
| T _{stg} | storage temperature | | | -65 | 150 | °C |

[1] Device mounted on an FR4 Printed-Circuit Board (PCB), single-sided copper, tin-plated and mounting pad for drain 1 cm^2 .

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

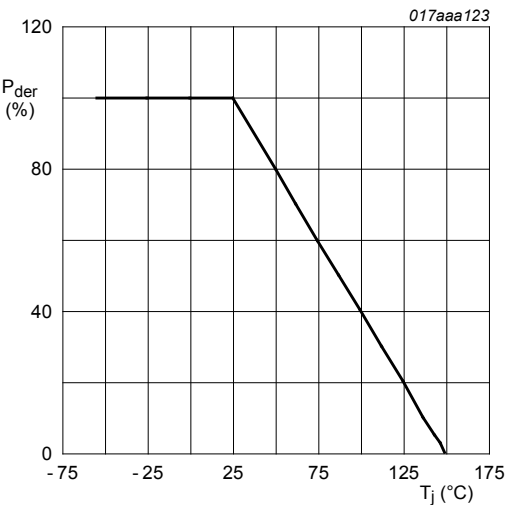


Fig. 1. MOSFET transistor: Normalized total power dissipation as a function of junction temperature

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

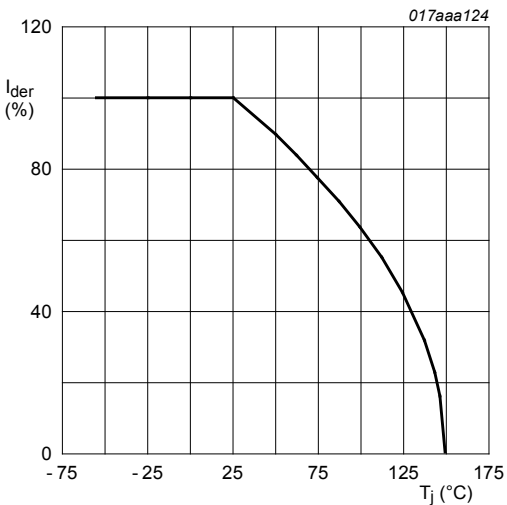


Fig. 2. MOSFET transistor: Normalized continuous drain current as a function of junction temperature

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

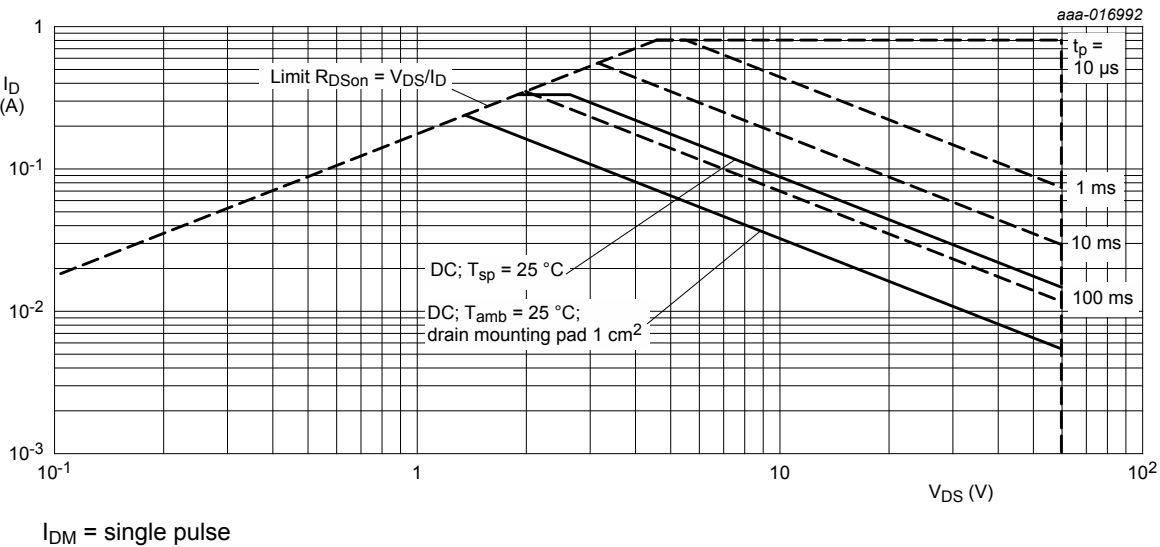


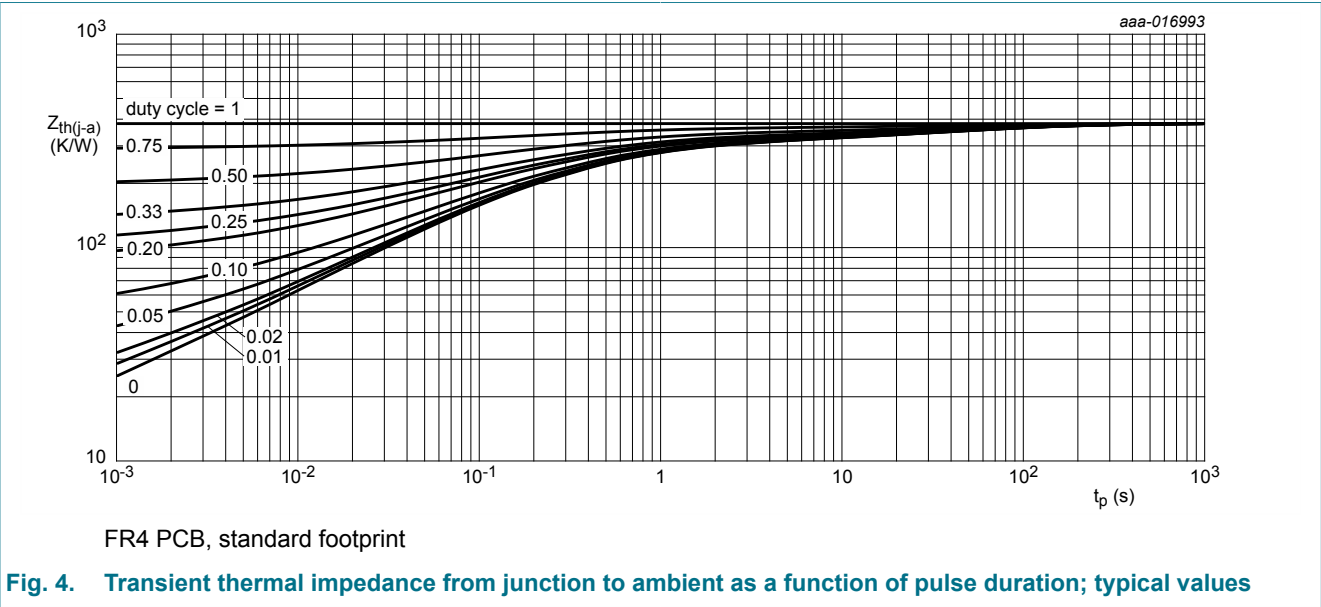
Fig. 3. Safe operating area; junction to ambient; continuous and peak drain currents as a function of drain-source voltage

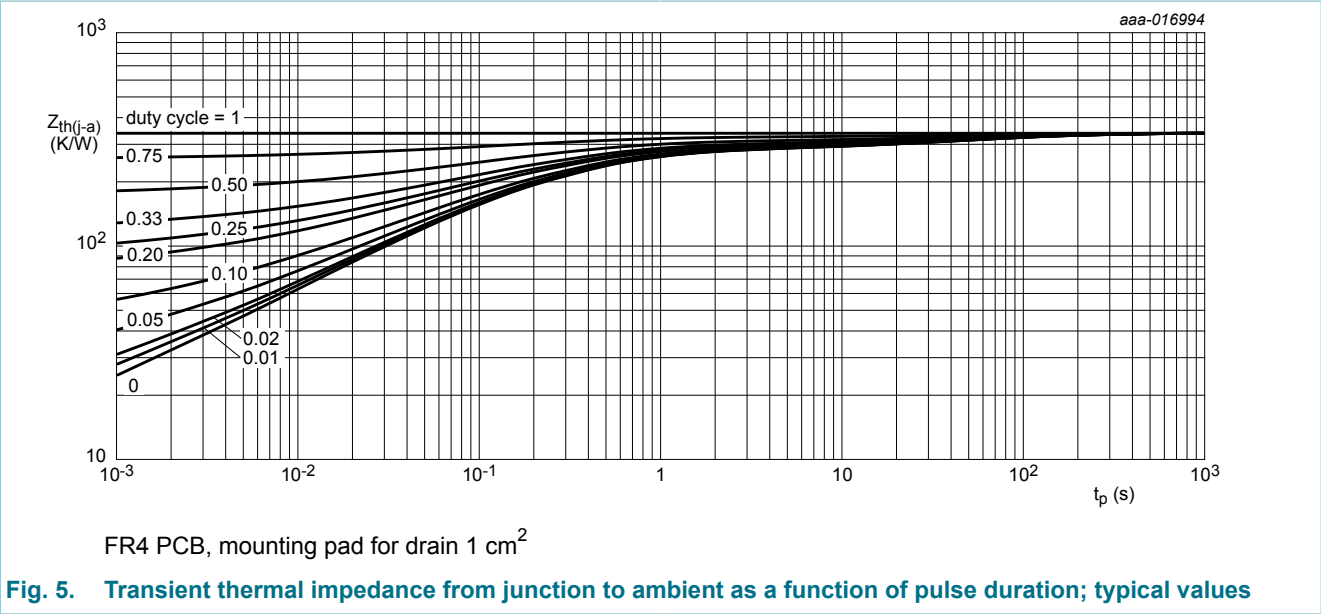
9. Thermal characteristics

Table 6. Thermal characteristics

| Symbol | Parameter | Conditions | | Min | Typ | Max | Unit |
|----------------|--|-------------|-----|-----|-----|-----|------|
| Per transistor | | | | | | | |
| $R_{th(j-a)}$ | thermal resistance from junction to ambient | in free air | [1] | - | 380 | 440 | K/W |
| | | | [2] | - | 340 | 390 | K/W |
| $R_{th(j-sp)}$ | thermal resistance from junction to solder point | | | - | 125 | 145 | 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 cm².





10. Characteristics

Table 7. Characteristics

| Symbol | Parameter | Conditions | | Min | Typ | Max | Unit |
|--|----------------------------------|--|--|-----|------|------|------|
| Static characteristics (per transistor) | | | | | | | |
| V _{(BR)DSS} | drain-source breakdown voltage | I _D = 250 μA; V _{GS} = 0 V; T _j = 25 °C | | 60 | - | - | V |
| V _{GSth} | gate-source threshold voltage | I _D = 250 μA; V _{DS} = V _{GS} ; T _j = 25 °C | | 1.1 | 1.6 | 2.1 | V |
| I _{DSS} | drain leakage current | V _{DS} = 60 V; V _{GS} = 0 V; T _j = 25 °C | | - | - | 1 | μA |
| I _{GSS} | gate leakage current | V _{GS} = 20 V; V _{DS} = 0 V; T _j = 25 °C | | - | - | 10 | μA |
| | | V _{GS} = -20 V; V _{DS} = 0 V; T _j = 25 °C | | - | - | -10 | μA |
| | | V _{GS} = 10 V; V _{DS} = 0 V; T _j = 25 °C | | - | - | 1 | μA |
| | | V _{GS} = -10 V; V _{DS} = 0 V; T _j = 25 °C | | - | - | -1 | μA |
| | | V _{GS} = 5 V; V _{DS} = 0 V; T _j = 25 °C | | - | - | 0.3 | μA |
| | | V _{GS} = -5 V; V _{DS} = 0 V; T _j = 25 °C | | - | - | -0.3 | μA |
| R _{DSon} | drain-source on-state resistance | V _{GS} = 10 V; I _D = 200 mA; T _j = 25 °C | | - | 2.2 | 2.8 | Ω |
| | | V _{GS} = 10 V; I _D = 200 mA; T _j = 150 °C | | - | 4.5 | 5.7 | Ω |
| | | V _{GS} = 5 V; I _D = 200 mA; T _j = 25 °C | | - | 2.5 | 3.2 | Ω |
| g _{fs} | forward transconductance | V _{DS} = 10 V; I _D = 200 mA; T _j = 25 °C | | - | 600 | - | mS |
| R _G | gate resistance | f = 1 MHz | | - | 2.5 | - | Ω |
| Dynamic characteristics (per transistor) | | | | | | | |
| Q _{G(tot)} | total gate charge | V _{DS} = 30 V; I _D = 200 mA; V _{GS} = 10 V; T _j = 25 °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 °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 Ω; T _j = 25 °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 |
| Source-drain diode (per transistor) | | | | | | | |
| V _{SD} | source-drain voltage | I _S = 50 mA; V _{GS} = 0 V; T _j = 25 °C | | - | 0.87 | 1.2 | V |

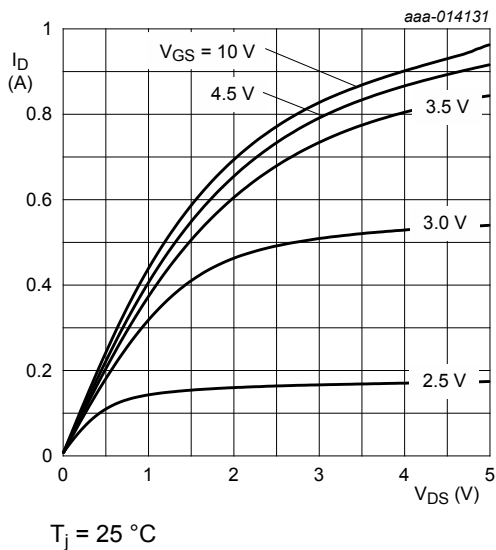


Fig. 6. Output characteristics: drain current as a function of drain-source voltage; typical values

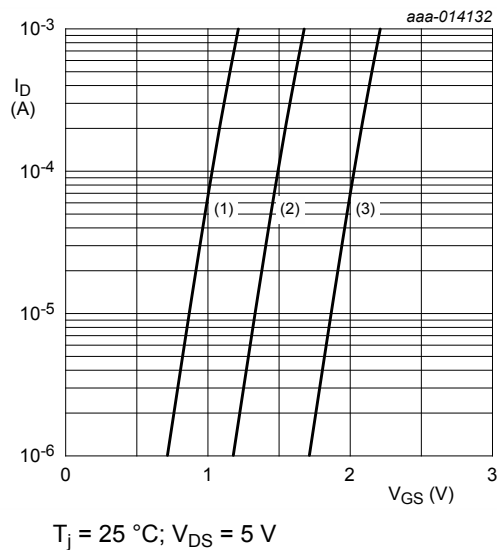


Fig. 7. Sub-threshold drain current as a function of gate-source voltage

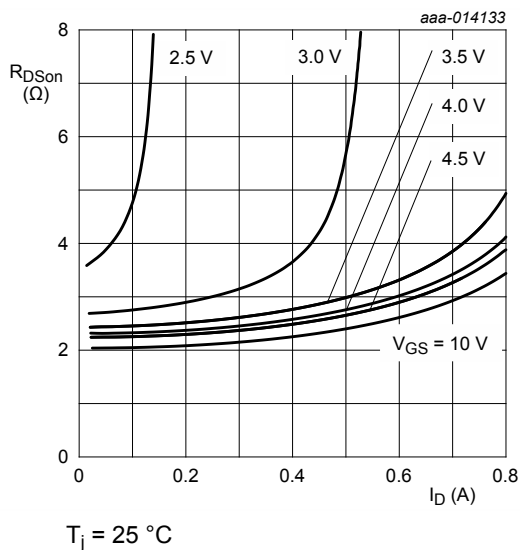


Fig. 8. Drain-source on-state resistance as a function of drain current; typical values

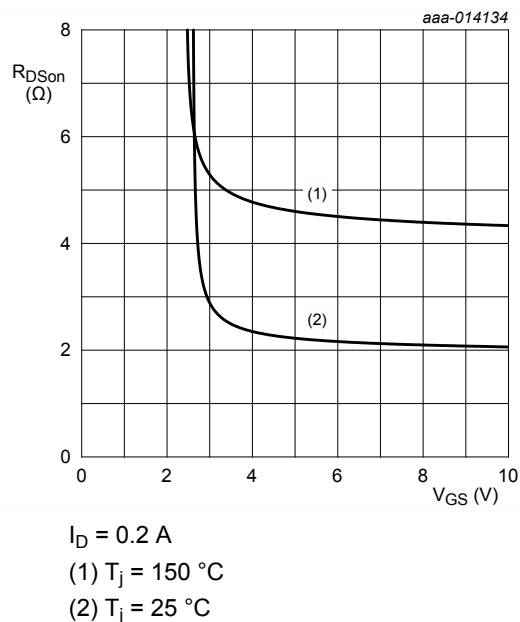
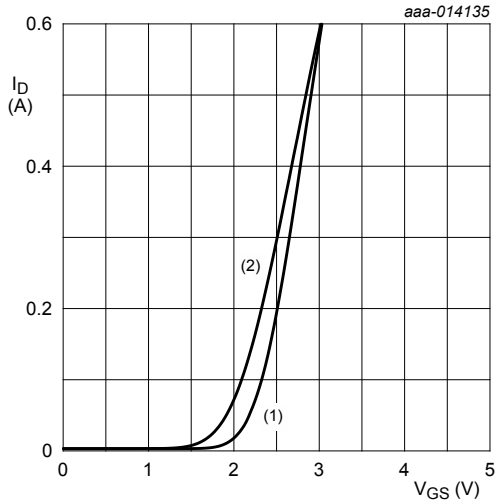


Fig. 9. Drain-source on-state resistance as a function of gate-source voltage; typical values



$V_{DS} > I_D \times R_{DS(on)}$

(1) $T_j = 25\text{ °C}$

(2) $T_j = 150\text{ °C}$

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

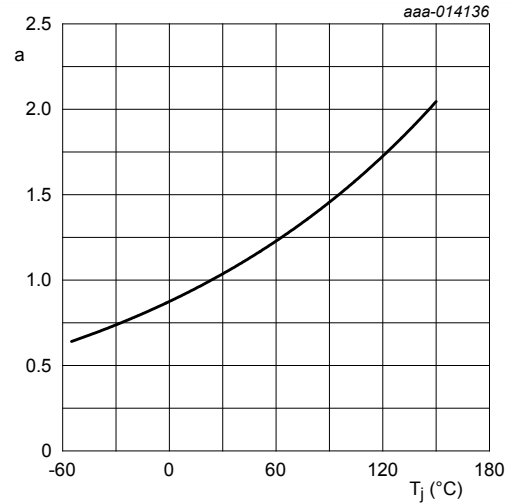
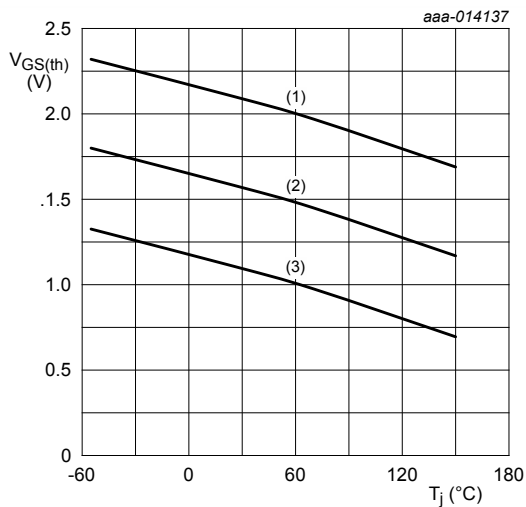


Fig. 11. Normalized drain-source on-state resistance as a function of junction temperature; typical values

$$a = \frac{R_{DS(on)}}{R_{DS(on)25^\circ C}}$$



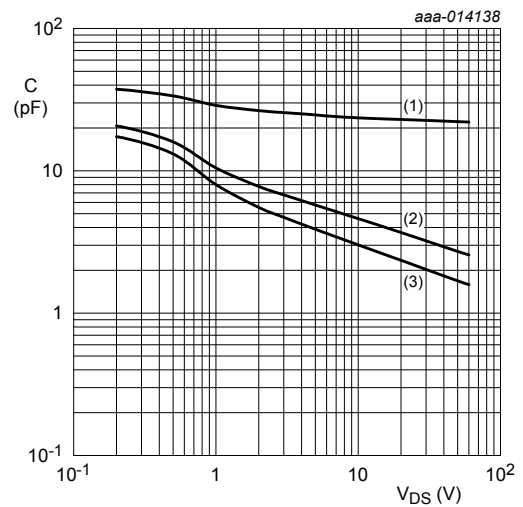
$I_D = 0.25\text{ mA}; V_{DS} = V_{GS}$

(1) maximum values

(2) typical values

(3) minimum values

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



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

(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

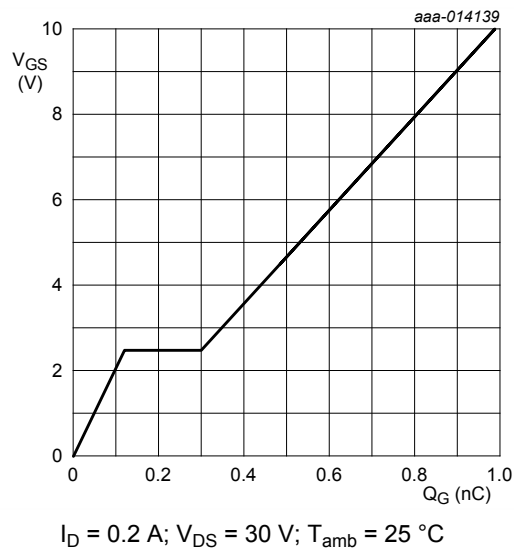


Fig. 14. Gate-source voltage as a function of gate charge; typical values

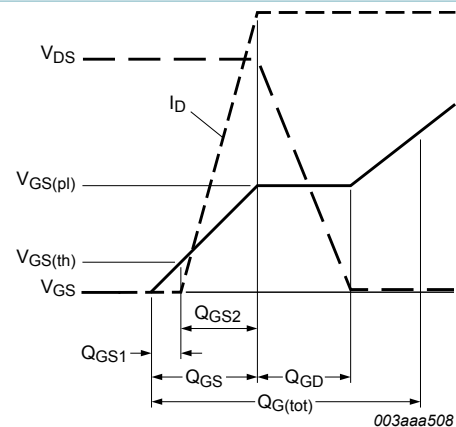
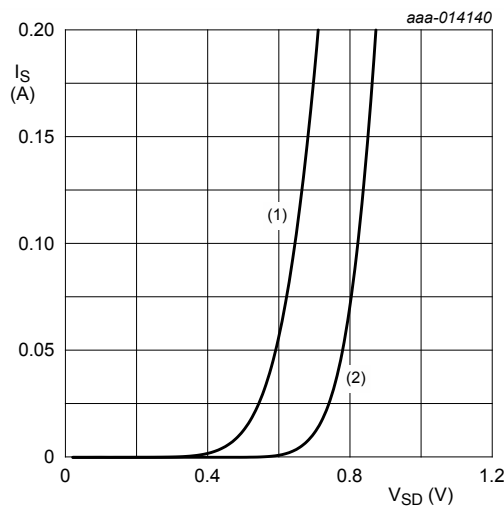


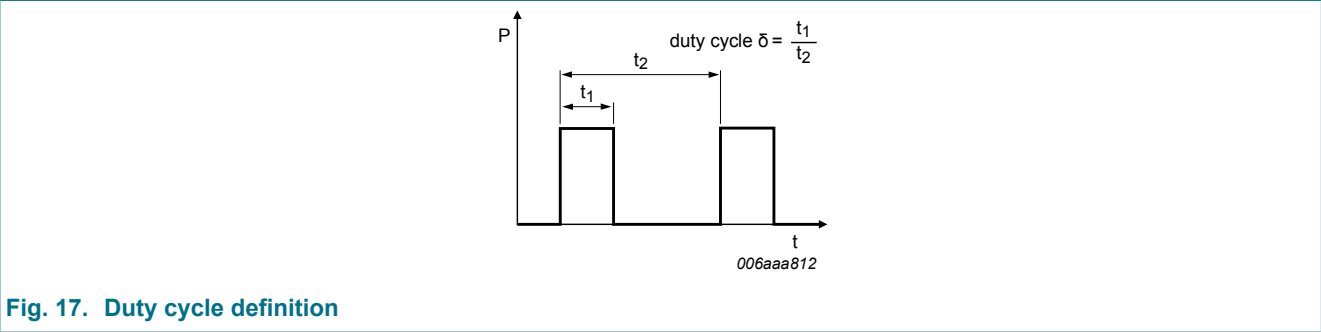
Fig. 15. MOSFET transistor: Gate charge waveform definitions



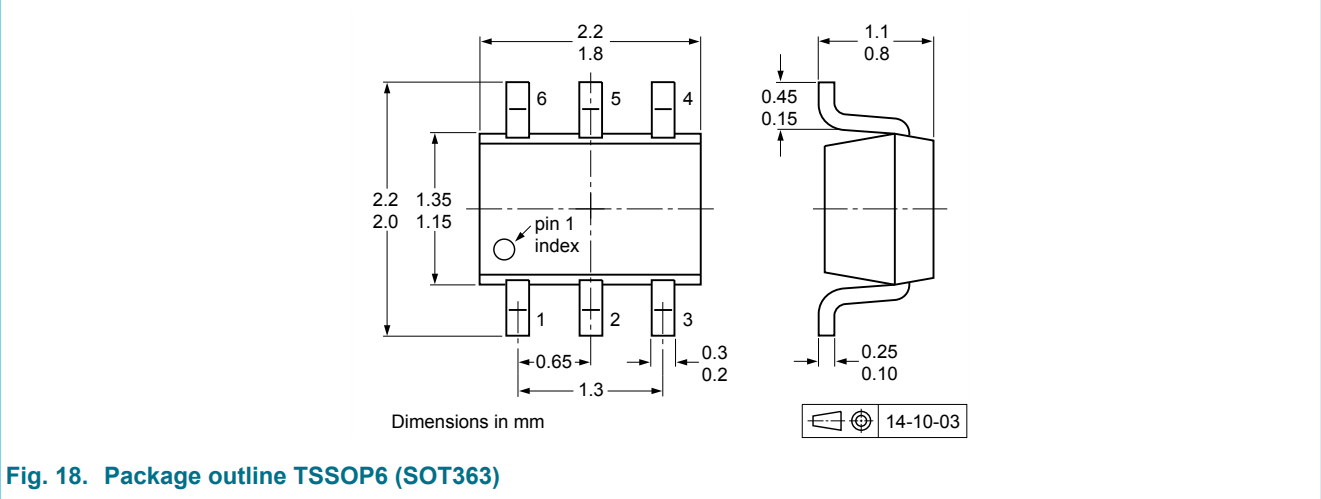
$V_{GS} = 0\text{ V}$
(1) $T_j = 150\text{ }^{\circ}\text{C}$
(2) $T_j = 25\text{ }^{\circ}\text{C}$

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

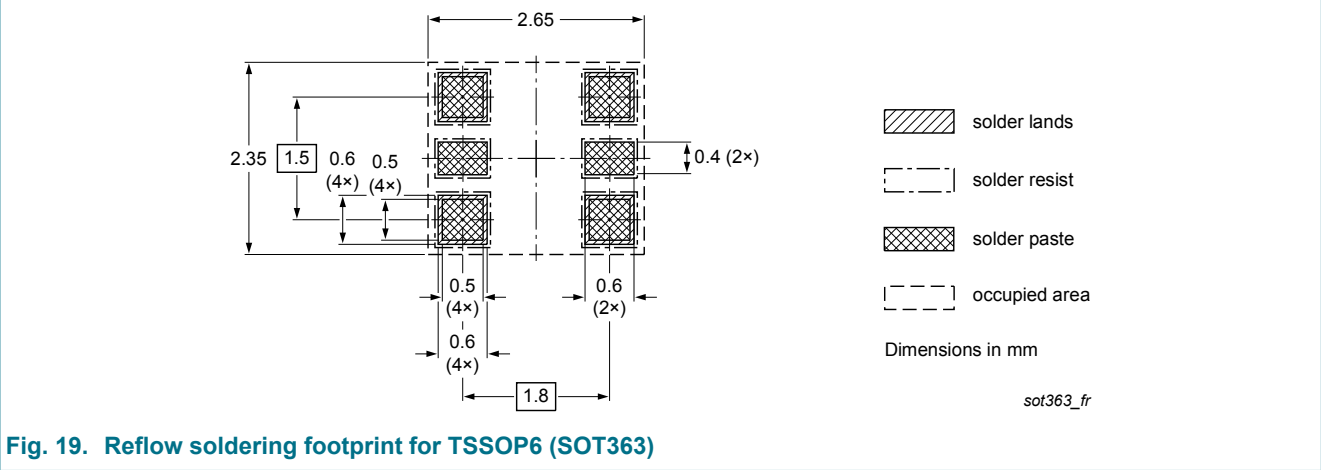
11. Test information

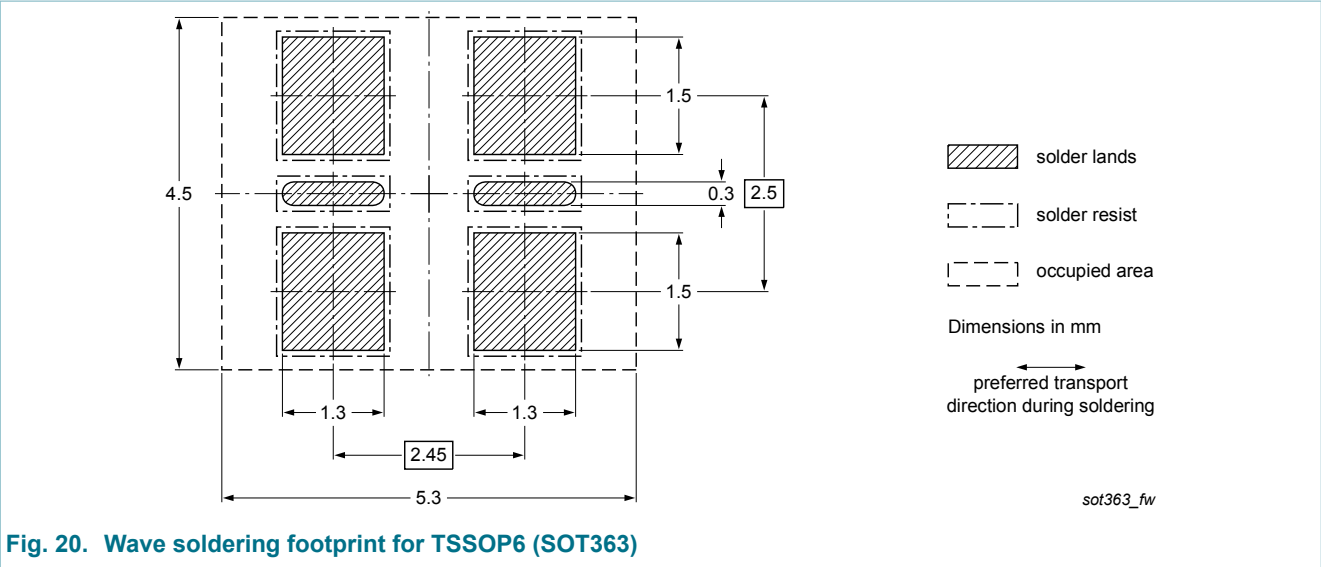


12. Package outline



13. Soldering





14. Revision history

Table 8. Revision history

| Data sheet ID | Release date | Data sheet status | Change notice | Supersedes |
|---------------|--------------|--------------------|---------------|------------|
| NX7002BKS v.1 | 20150512 | Product data sheet | - | - |

15. Legal information

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|--------------------------------|--------------------|---|
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16. Contents

1 General description 1

2 Features and benefits 1

3 Applications 1

4 Quick reference data 1

5 Pinning information 2

6 Ordering information 2

7 Marking 2

8 Limiting values 3

9 Thermal characteristics 5

10 Characteristics 7

11 Test information 11

12 Package outline 11

13 Soldering 11

14 Revision history 13

15 Legal information 14

15.1 Data sheet status 14

15.2 Definitions 14

15.3 Disclaimers 14

15.4 Trademarks 15

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Date of release: 12 May 2015