# NX5008NBKH

## 50 V, N-channel Trench MOSFET

6 February 2023 **Product data sheet**

## 1. General description

N-channel enhancement mode Field-Effect Transistor (FET) in a leadless ultra small DFN0606-3 (SOT8001) Surface-Mounted Device (SMD) plastic package using Trench MOSFET technology.

## 2. Features and benefits

- Low threshold voltage
- Very fast switching
- Trench MOSFET technology
- ElectroStatic Discharge (ESD) protection > 2 kV HBM
- Leadless ultra small and ultra thin SMD plastic package: 0.62 x 0.62 x 0.37 mm

## 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 °C | | - | - | 50 | V |
| $V_{GS}$ | gate-source voltage | | | -8 | - | 8 | V |
| $I_D$ | drain current | $V_{GS}$ = 4.5 V; $T_{amb}$ = 25 °C | [1] | - | - | 350 | mA |
| **Static characteristics** | | | | | | | |
| $R_{DSon}$ | drain-source on-state resistance | $V_{GS}$ = 4.5 V; $I_D$ = 200 mA; $T_j$ = 25 °C | | - | 2 | 2.8 | Ω |

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

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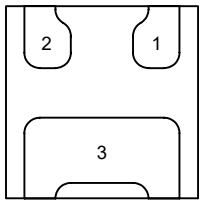
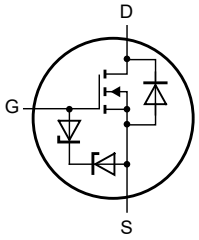
## 5. Pinning information

**Table 2. Pinning information**

| Pin | Symbol | Description | Simplified outline | Graphic symbol |
|---|---|---|---|---|
| 1 | G | gate |  Transparent top view **DFN0606-3 (SOT8001)** |  *017aaa255* |
| 2 | S | source | | |
| 3 | D | drain | | |

## 6. Ordering information

**Table 3. Ordering information**

| Type number | Package | | |
|---|---|---|---|
| | Name | Description | Version |
| NX5008NBKH | DFN0606-3 | plastic, leadless ultra small package; 3 terminals; body 0.62 x 0.62 x 0.37 mm | SOT8001 |

## 7. Marking

**Table 4. Marking codes**

| Type number | Marking code |
|---|---|
| NX5008NBKH | 0001 1101 |

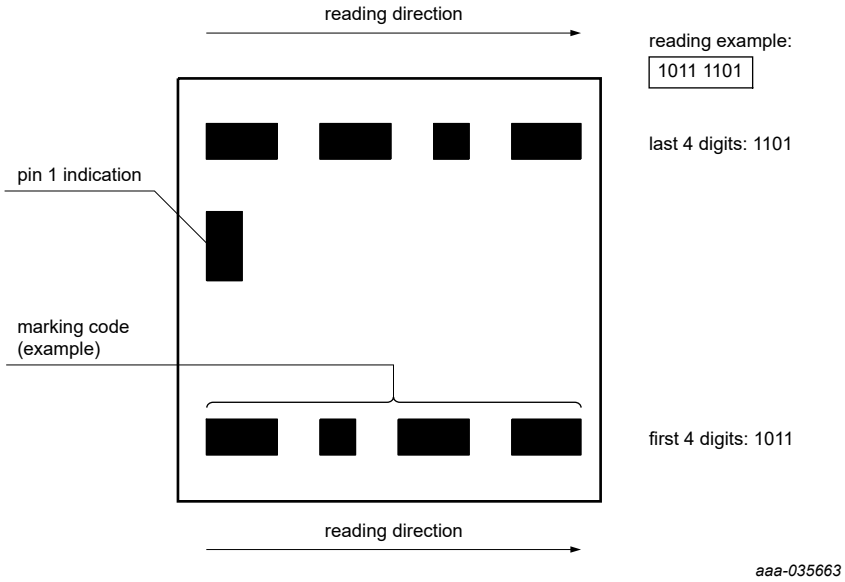



**Fig. 1. DFN0606-3 (SOT8001) binary marking code description**

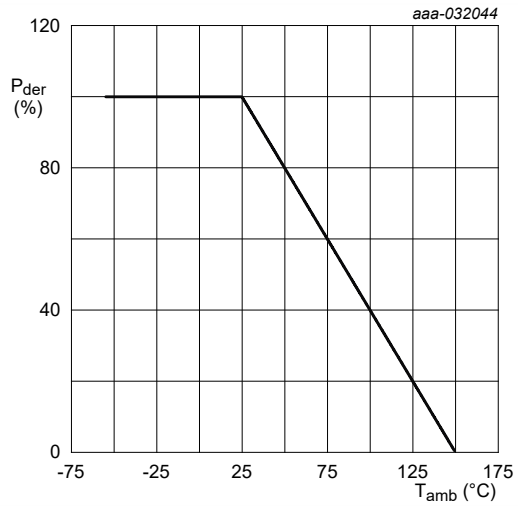
# 8. Limiting values

**Table 5. Limiting values**

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

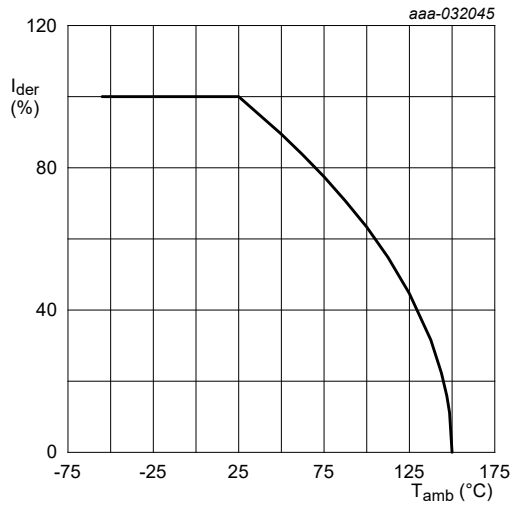
| Symbol | Parameter | Conditions | | Min | Max | Unit |
|---|---|---|---|---|---|---|
| $V_{DS}$ | drain-source voltage | $T_j$ = 25 °C | | - | 50 | V |
| $V_{GS}$ | gate-source voltage | | | -8 | 8 | V |
| $I_D$ | drain current | $V_{GS}$ = 4.5 V; $T_{amb}$ = 25 °C | [1] | - | 350 | mA |
| | | $V_{GS}$ = 4.5 V; $T_{amb}$ = 100 °C | [1] | - | 220 | mA |
| $I_{DM}$ | peak drain current | $T_{amb}$ = 25 °C; single pulse; $t_p \leq$ 10 µs | | - | 1 | A |
| $P_{tot}$ | total power dissipation | $T_{amb}$ = 25 °C | [2] | - | 380 | mW |
| | | | [1] | - | 710 | mW |
| | | $T_{sp}$ = 25 °C | | - | 2.8 | W |
| $T_j$ | junction temperature | | | -55 | 150 | °C |
| $T_{amb}$ | ambient temperature | | | -55 | 150 | °C |
| $T_{stg}$ | storage temperature | | | -65 | 150 | °C |
| **Source-drain diode** | | | | | | |
| $I_S$ | source current | $T_{amb}$ = 25 °C | [1] | - | 350 | mA |

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




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

**Fig. 2. Normalized total power dissipation as a function of ambient temperature**




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

**Fig. 3. Normalized continuous drain current as a function of ambient temperature**

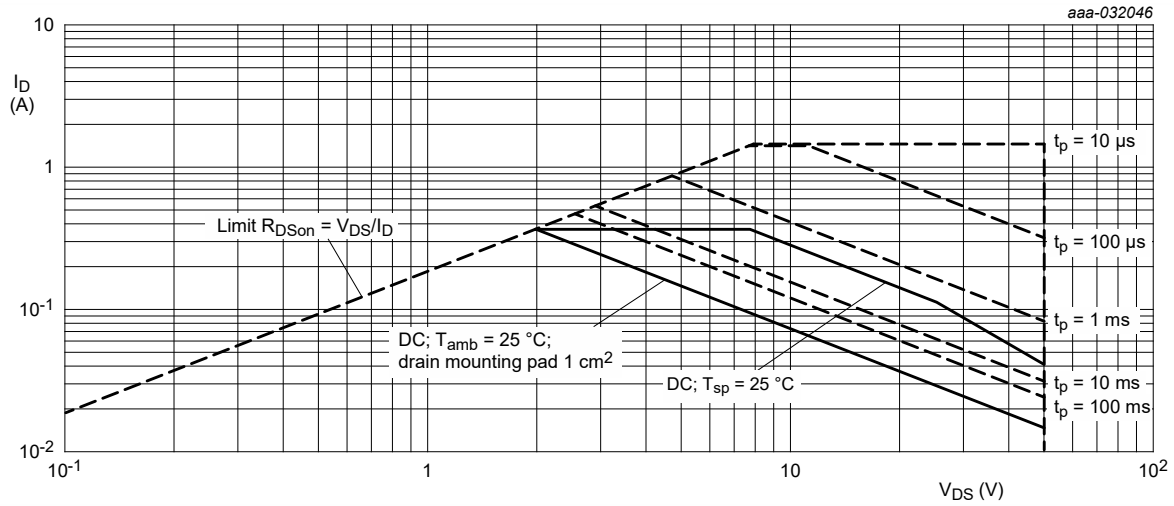


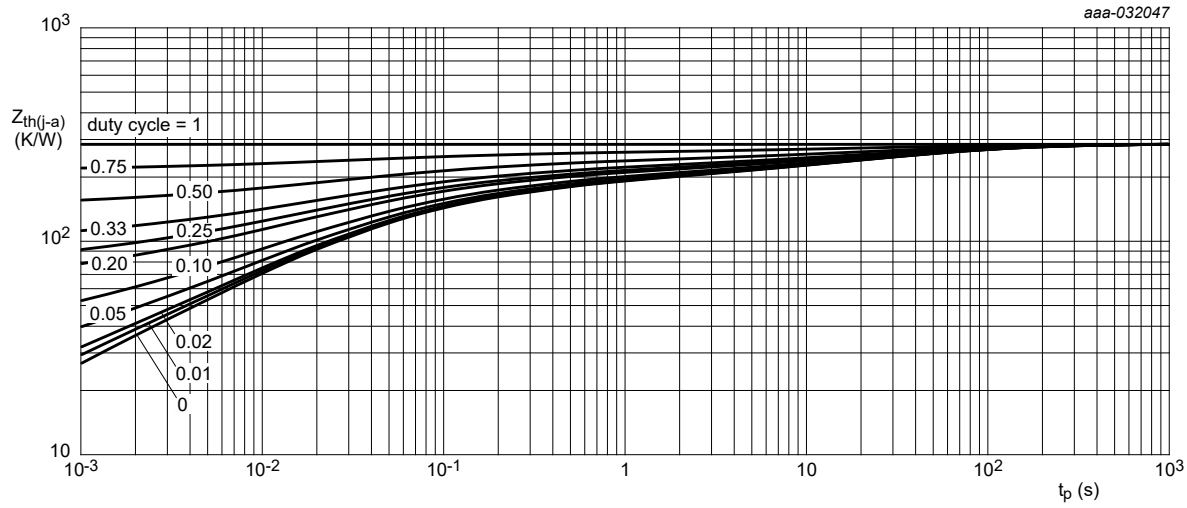

**Fig. 4. Safe operating area; junction to ambient; continuous and peak drain currents as a function of drain-source voltage**

# 9. Thermal characteristics

**Table 6. Thermal characteristics**

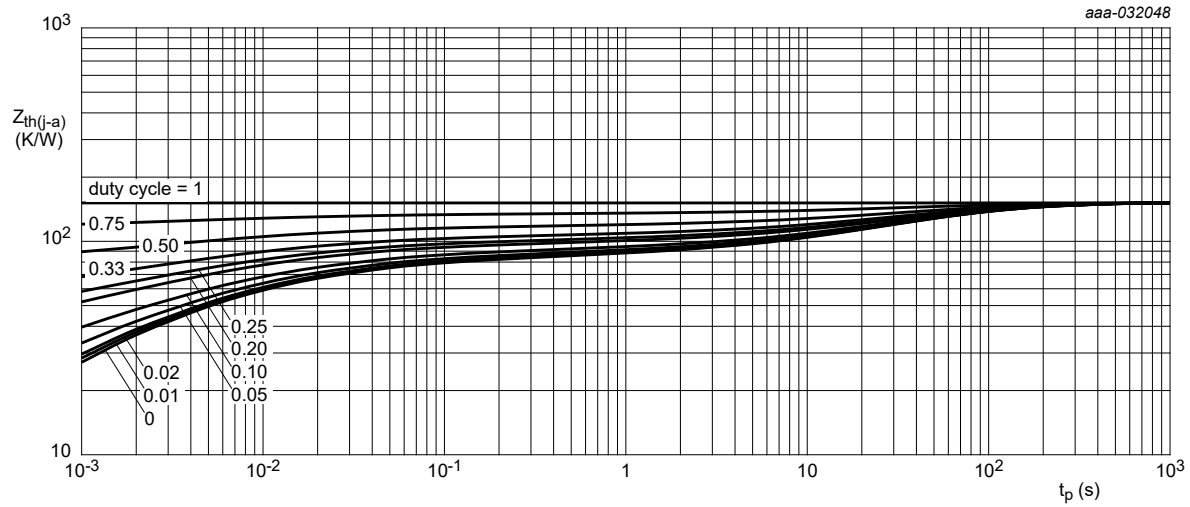
| Symbol | Parameter | Conditions | | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|---|
| $R_{th(j-a)}$ | thermal resistance from junction to ambient | in free air | [1] | - | 285 | 330 | K/W |
| | | | [2] | - | 150 | 175 | K/W |
| $R_{th(j-sp)}$ | thermal resistance from junction to solder point | | | - | 40 | 45 | 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 $cm^2$.




FR4 PCB, standard footprint

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



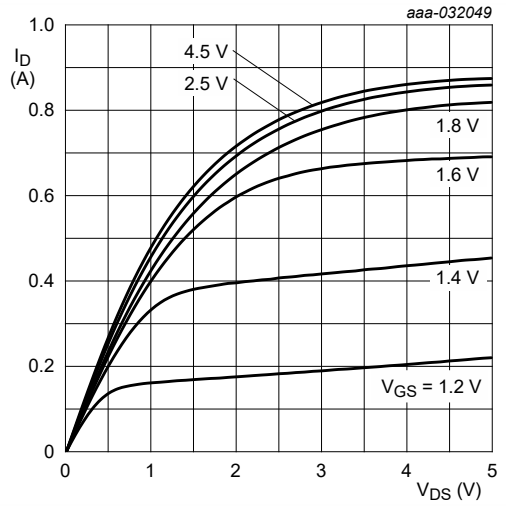

FR4 PCB, mounting pad for drain 1 $cm^2$

**Fig. 6. Transient thermal impedance from junction to ambient as a function of pulse duration; typical values**

## 10. Characteristics

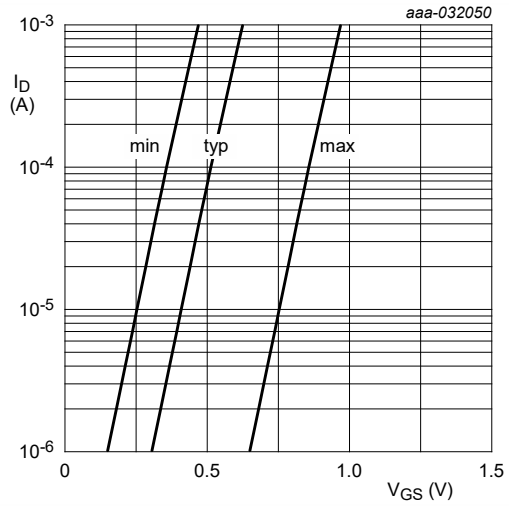
**Table 7. Characteristics**

| Symbol | Parameter | Conditions | | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|---|
| **Static characteristics** | | | | | | | |
| $V_{(BR)DSS}$ | drain-source breakdown voltage | $I_D$ = 250 µA; $V_{GS}$ = 0 V; $T_j$ = 25 °C | | 50 | - | - | V |
| $V_{GSth}$ | gate-source threshold voltage | $I_D$ = 250 µA; $V_{DS}$ = $V_{GS}$; $T_j$ = 25 °C | | 0.4 | 0.7 | 0.9 | V |
| $I_{DSS}$ | drain leakage current | $V_{DS}$ = 50 V; $V_{GS}$ = 0 V; $T_j$ = 25 °C | | - | - | 1 | µA |
| $I_{GSS}$ | gate leakage current | $V_{GS}$ = 8 V; $V_{DS}$ = 0 V; $T_j$ = 25 °C | | - | - | 10 | µA |
| | | $V_{GS}$ = -8 V; $V_{DS}$ = 0 V; $T_j$ = 25 °C | | - | - | -10 | µA |
| | | $V_{GS}$ = 4.5 V; $V_{DS}$ = 0 V; $T_j$ = 25 °C | | - | - | 1 | µA |
| | | $V_{GS}$ = -4.5 V; $V_{DS}$ = 0 V; $T_j$ = 25 °C | | - | - | -1 | µA |
| | | $V_{GS}$ = 2.5 V; $V_{DS}$ = 0 V; $T_j$ = 25 °C | | - | - | 100 | nA |
| | | $V_{GS}$ = -2.5 V; $V_{DS}$ = 0 V; $T_j$ = 25 °C | | - | - | -100 | nA |
| $R_{DSon}$ | drain-source on-state resistance | $V_{GS}$ = 4.5 V; $I_D$ = 200 mA; $T_j$ = 25 °C | | - | 2 | 2.8 | Ω |
| | | $V_{GS}$ = 4.5 V; $I_D$ = 200 mA; $T_j$ = 150 °C | | - | 4.3 | 6 | Ω |
| | | $V_{GS}$ = 2.5 V; $I_D$ = 200 mA; $T_j$ = 25 °C | | - | 2.1 | 3 | Ω |
| $g_{fs}$ | forward transconductance | $V_{DS}$ = 10 V; $I_D$ = 200 mA; $T_j$ = 25 °C | | - | 1.1 | - | S |
| **Dynamic characteristics** | | | | | | | |
| $Q_{G(tot)}$ | total gate charge | $V_{DS}$ = 25 V; $I_D$ = 200 mA; $V_{GS}$ = 4.5 V; $T_j$ = 25 °C | | - | 0.47 | 0.7 | nC |
| $Q_{GS}$ | gate-source charge | | | - | 0.04 | - | nC |
| $Q_{GD}$ | gate-drain charge | | | - | 0.11 | - | nC |
| $C_{iss}$ | input capacitance | $V_{DS}$ = 25 V; f = 1 MHz; $V_{GS}$ = 0 V; $T_j$ = 25 °C | | - | 30 | - | pF |
| $C_{oss}$ | output capacitance | | | - | 2.5 | - | pF |
| $C_{rss}$ | reverse transfer capacitance | | | - | 1.9 | - | pF |
| $t_{d(on)}$ | turn-on delay time | $V_{DS}$ = 25 V; $I_D$ = 200 mA; $V_{GS}$ = 4.5 V; $R_{G(ext)}$ = 6 Ω; $T_j$ = 25 °C | | - | 1 | - | ns |
| $t_r$ | rise time | | | - | 2 | - | ns |
| $t_{d(off)}$ | turn-off delay time | | | - | 5 | - | ns |
| $t_f$ | fall time | | | - | 4 | - | ns |
| **Source-drain diode** | | | | | | | |
| $V_{SD}$ | source-drain voltage | $I_S$ = 400 mA; $V_{GS}$ = 0 V; $T_j$ = 25 °C | | - | 0.9 | 1.2 | V |



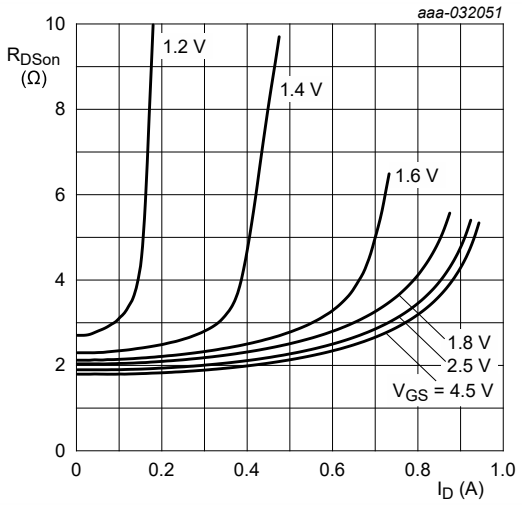

$T_j$ = 25 °C

**Fig. 7. Output characteristics: drain current as a function of drain-source voltage; typical values**



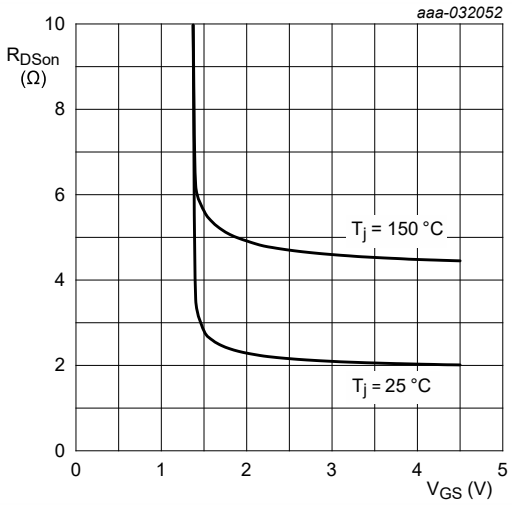

$T_j$ = 25 °C; $V_{DS}$ = 5 V

**Fig. 8. Sub-threshold drain current as a function of gate-source voltage**



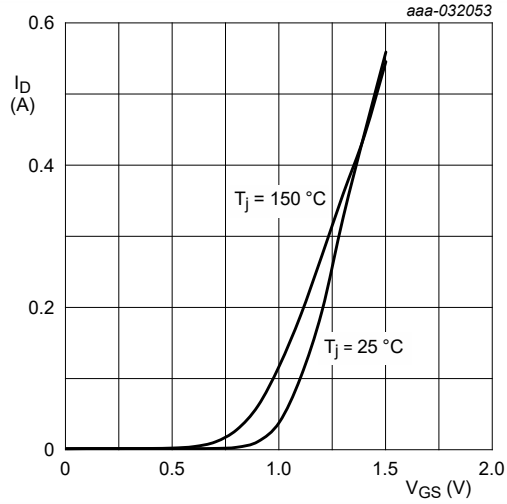

$T_j$ = 25 °C

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



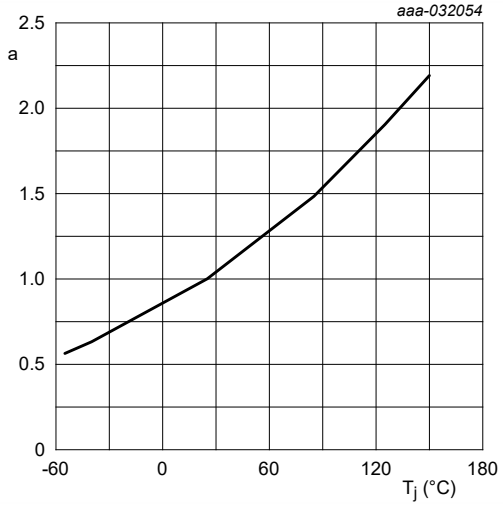

$I_D$ = 0.4 A

**Fig. 10. Drain-source on-state resistance as a function of gate-source voltage; typical values**



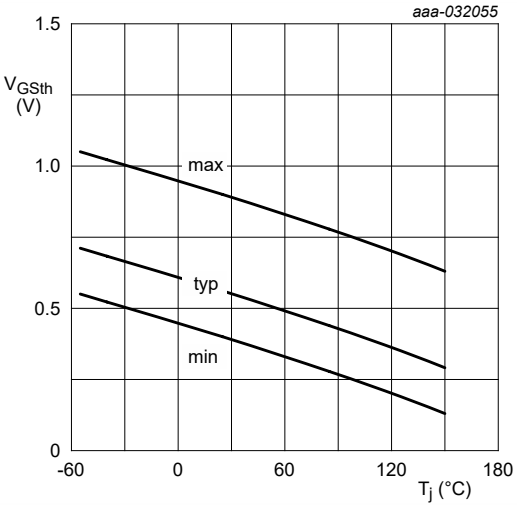

$V_{DS}$ = 5 V

**Fig. 11. Transfer characteristics: drain current as a function of gate-source voltage; typical values**



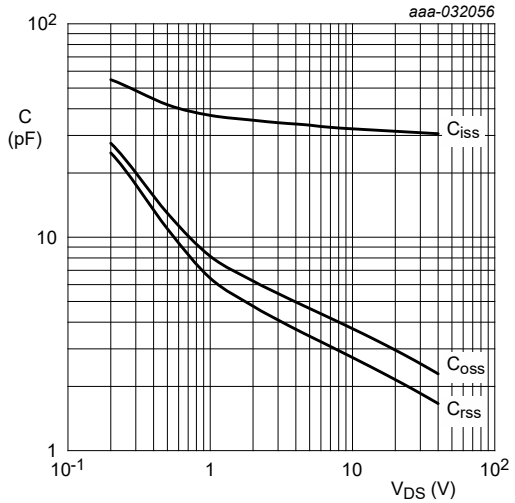

$$a = \frac{R_{DSon}}{R_{DSon(25°C)}}$$

**Fig. 12. Normalized drain-source on-state resistance as a function of junction temperature; typical values**



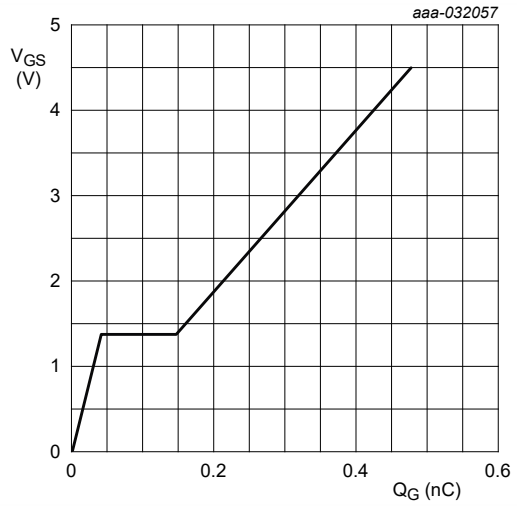

$I_D$ = 250 µA; $V_{DS}$ = $V_{GS}$

**Fig. 13. Gate-source threshold voltage as a function of junction temperature**




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

**Fig. 14. Input, output and reverse transfer capacitances as a function of drain-source voltage; typical values**




$I_D$ = 0.4 A; $V_{DS}$ = 25 V; $T_j$ = 25 °C

**Fig. 15. Gate-source voltage as a function of gate charge; typical values**

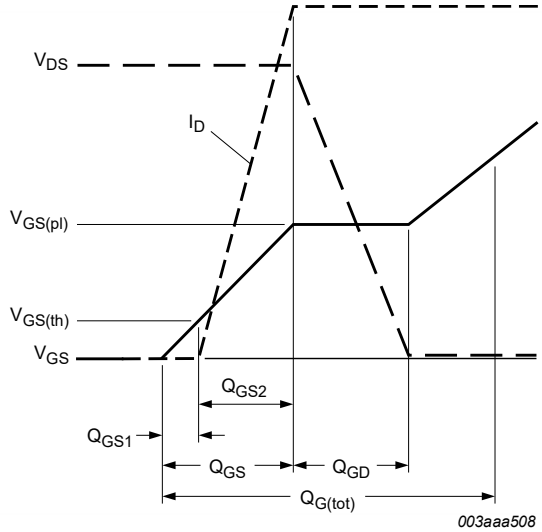
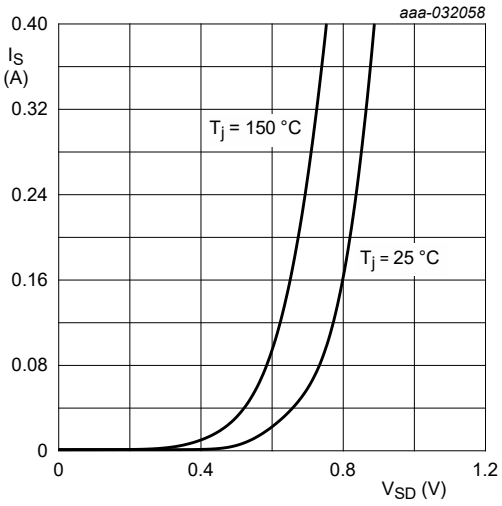



**Fig. 16. Gate charge waveform definitions**




$V_{GS}$ = 0 V

**Fig. 17. Source current as a function of source-drain voltage; typical values**

## 11. Test information

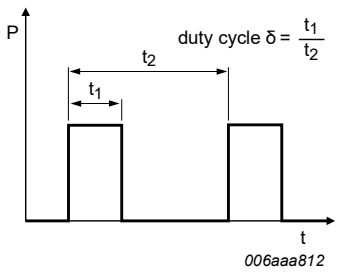
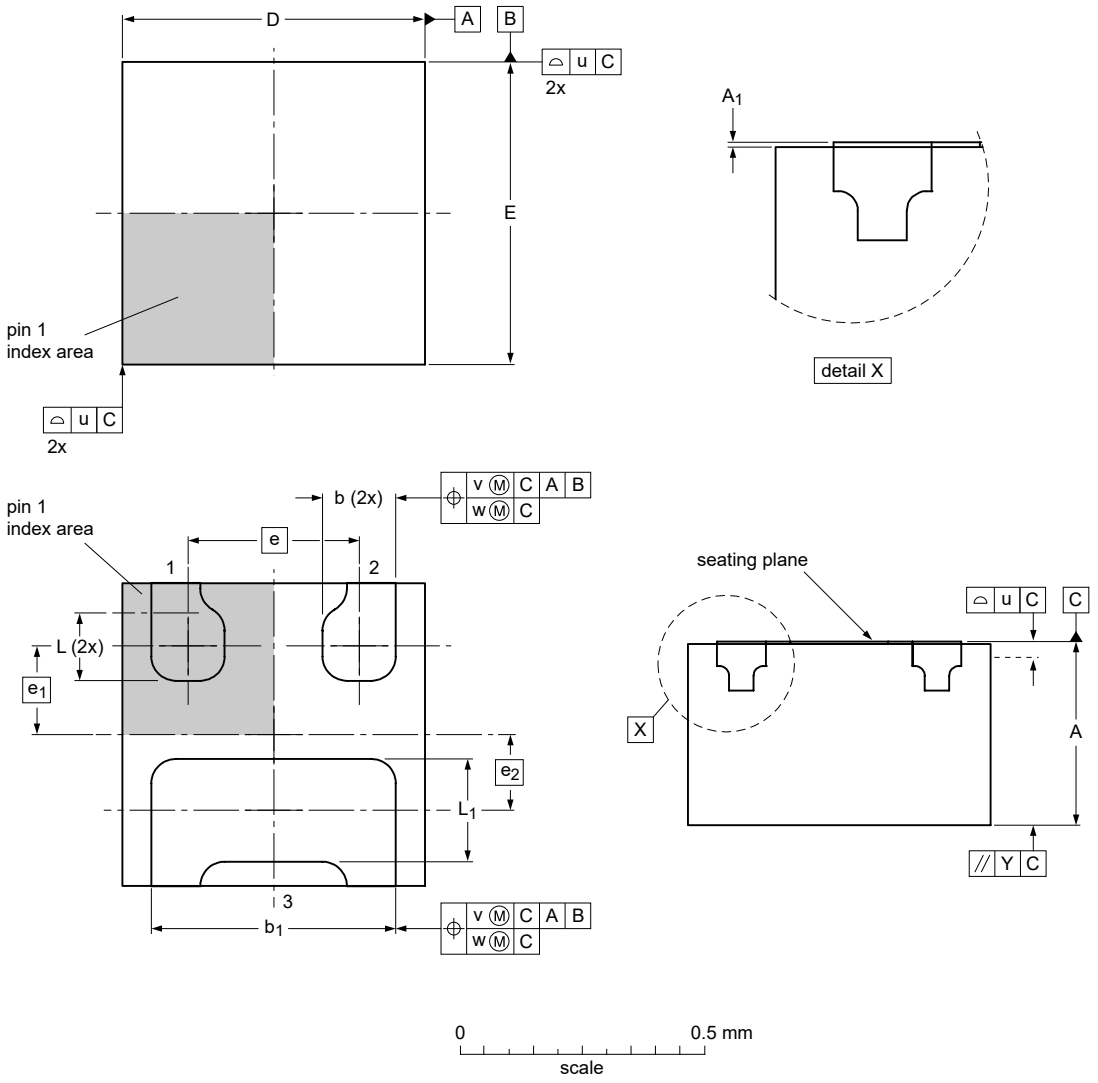



**Fig. 18. Duty cycle definition**

## 12. Package outline

**DFN0606-3, plastic, leadless ultra small package; 3 terminals; body 0.62 x 0.62 x 0.37 mm** **SOT8001**




Dimensions (mm are the original dimensions)

| Unit | | A | $A_1$ | b | $b_1$ | D | E | e | $e_1$ | $e_2$ | L | $L_1$ | u | v | w | Y |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | max | 0.40 | 0.04 | 0.20 | 0.55 | | | | | | 0.20 | 0.26 | | | | |
| mm | nom | 0.37 | | 0.15 | 0.50 | 0.62 | 0.62 | 0.35 | 0.186 | 0.155 | 0.15 | 0.21 | 0.05 | 0.1 | 0.05 | 0.05 |
| | min | 0.34 | | 0.10 | 0.45 | | | | | | 0.10 | 0.16 | | | | |

*sot8001_po*

| Outline version | References | | | | European projection | Issue date |
|---|---|---|---|---|---|---|
| | IEC | JEDEC | JEITA | | | |
| SOT8001 | | --- | | | | ~~18-12-03~~ 18-12-05 |

**Fig. 19. Package outline DFN0606-3 (SOT8001)**

## 13. Soldering

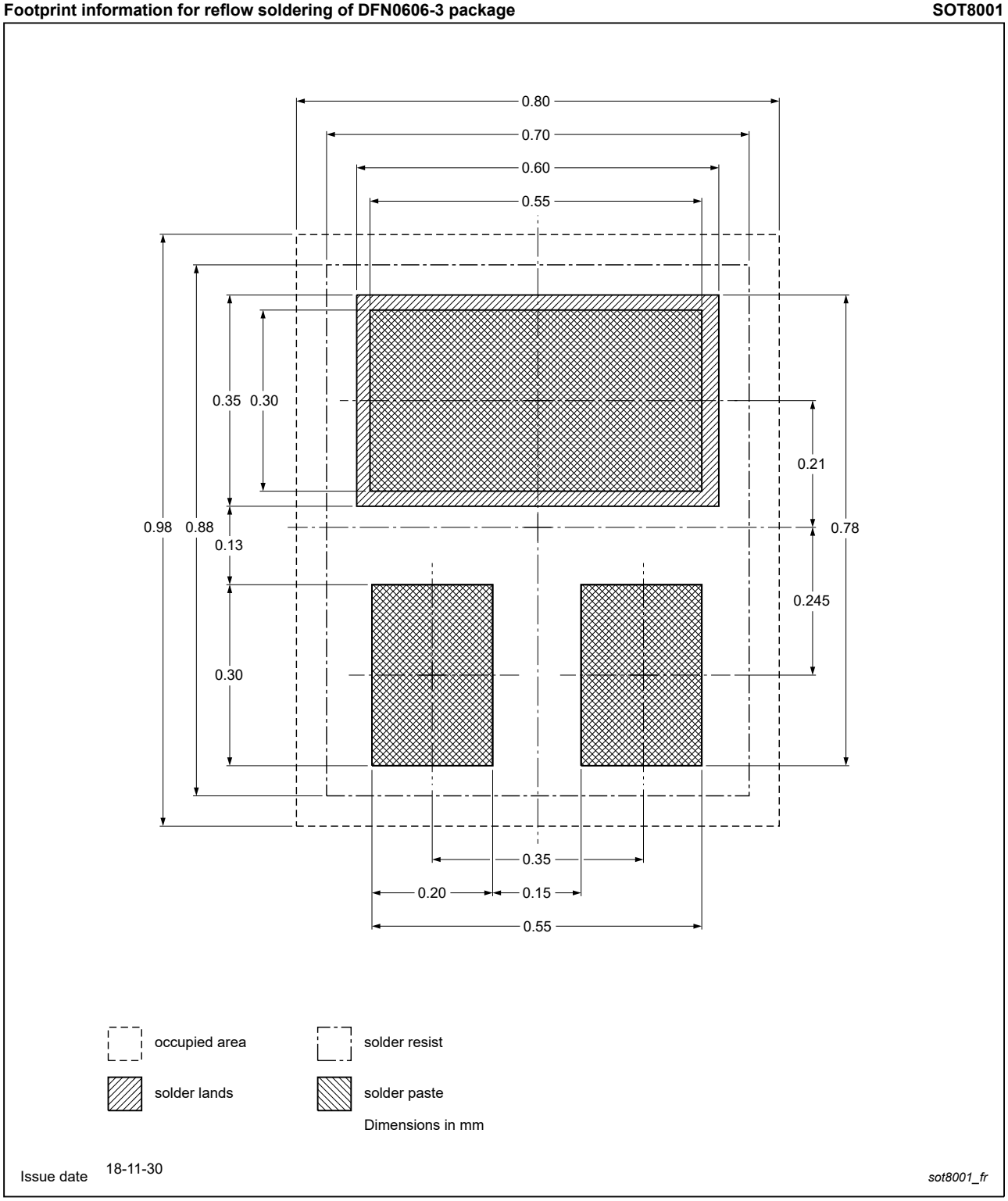



**Fig. 20. Reflow soldering footprint for DFN0606-3 (SOT8001)**

## 14. Revision history

**Table 8. Revision history**

| Data sheet ID | Release date | Data sheet status | Change notice | Supersedes |
|---|---|---|---|---|
| NX5008NBKH v.2 | 20230206 | Product data sheet | - | NX5008NBKH v.1 |
| Modifications: | • Fig. 1, clarifying the reading example | | | |
| NX5008NBKH v.1 | 20200901 | Product data sheet | - | - |

# 15. Legal information

## 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".
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