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

- Logic-level compatible
- 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 load switch
- Switching circuits

4. Quick reference data

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Parameter</th>
<th>Conditions</th>
<th>Min</th>
<th>Typ</th>
<th>Max</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>$V_{DS}$</td>
<td>drain-source voltage</td>
<td>$T_J = 25 , ^\circ\text{C}$</td>
<td>-</td>
<td>-</td>
<td>60</td>
<td>V</td>
</tr>
<tr>
<td>$V_{GS}$</td>
<td>gate-source voltage</td>
<td></td>
<td>-20</td>
<td>-</td>
<td>20</td>
<td>V</td>
</tr>
<tr>
<td>$I_D$</td>
<td>drain current</td>
<td>$V_{GS} = 10 , \text{V}; , T_{amb} = 25 , ^\circ\text{C}$</td>
<td>[1]</td>
<td>-</td>
<td>350</td>
<td>mA</td>
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</table>

Static characteristics

<table>
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<th>Min</th>
<th>Typ</th>
<th>Max</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>$R_{DSon}$</td>
<td>drain-source on-state resistance</td>
<td>$V_{GS} = 10 , \text{V}; , I_D = 200 , \text{mA}; , T_J = 25 , ^\circ\text{C}$</td>
<td>-</td>
<td>2</td>
<td>2.8</td>
<td>Ω</td>
</tr>
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</table>

5. Pinning information

Table 2. Pinning information

<table>
<thead>
<tr>
<th>Pin</th>
<th>Symbol</th>
<th>Description</th>
<th>Simplified outline</th>
<th>Graphic symbol</th>
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<tr>
<td>1</td>
<td>G</td>
<td>gate</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>S</td>
<td>source</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>D</td>
<td>drain</td>
<td></td>
<td></td>
</tr>
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</table>

6. Ordering information

Table 3. Ordering information

<table>
<thead>
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<th>Type number</th>
<th>Package</th>
<th>Name</th>
<th>Description</th>
<th>Version</th>
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</thead>
<tbody>
<tr>
<td>NX7002BKH</td>
<td>DFN0606-3</td>
<td>plastic, leadless ultra small package; 3 terminals; body 0.62 x 0.62 x 0.37 mm</td>
<td>SOT8001</td>
<td></td>
</tr>
</tbody>
</table>

7. Marking

Table 4. Marking codes

<table>
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<th>Type number</th>
<th>Marking code</th>
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<tr>
<td>NX7002BKH</td>
<td>0001 0011</td>
</tr>
</tbody>
</table>

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).

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Parameter</th>
<th>Conditions</th>
<th>Min</th>
<th>Max</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>V_DS</td>
<td>drain-source voltage</td>
<td>T_j = 25 °C</td>
<td>-</td>
<td>60</td>
<td>V</td>
</tr>
<tr>
<td>V_GS</td>
<td>gate-source voltage</td>
<td>-20 to 20 V</td>
<td></td>
<td></td>
<td>V</td>
</tr>
<tr>
<td>I_D</td>
<td>drain current</td>
<td>V_GS = 10 V; T_amb = 25 °C</td>
<td>-350</td>
<td>350</td>
<td>mA</td>
</tr>
<tr>
<td></td>
<td></td>
<td>V_GS = 10 V; T_amb = 100 °C</td>
<td>-220</td>
<td>220</td>
<td>mA</td>
</tr>
<tr>
<td>I_DDM</td>
<td>peak drain current</td>
<td>T_amb = 25 °C; single pulse; t_p ≤ 10 µs</td>
<td>-1.4</td>
<td>1.4</td>
<td>A</td>
</tr>
<tr>
<td>P_tot</td>
<td>total power dissipation</td>
<td>T_amb = 25 °C; T_sp = 25 °C</td>
<td>-380</td>
<td>710</td>
<td>mW</td>
</tr>
<tr>
<td></td>
<td></td>
<td>[1] T_amb = 25 °C</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>T_j</td>
<td>junction temperature</td>
<td>-55 to 150 °C</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>T_amb</td>
<td>ambient temperature</td>
<td>-55 to 150 °C</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>T_stg</td>
<td>storage temperature</td>
<td>-65 to 150 °C</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Source-drain diode

| I_S    | source current          | T_amb = 25 °C                                                              | -350 | 350  | mA   |

[1] Device mounted on an FR4 Printed-Circuit Board (PCB), single-sided copper, tin-plated and mounting pad for drain 1 cm².

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

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

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

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

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Parameter</th>
<th>Conditions</th>
<th>Min</th>
<th>Typ</th>
<th>Max</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>$R_{th(j-a)}$</td>
<td>thermal resistance from junction to ambient</td>
<td>in free air</td>
<td>[1]</td>
<td>285</td>
<td>330</td>
<td>K/W</td>
</tr>
<tr>
<td>$R_{th(j-sp)}$</td>
<td>thermal resistance from junction to solder point</td>
<td></td>
<td>[2]</td>
<td>150</td>
<td>175</td>
<td>K/W</td>
</tr>
</tbody>
</table>


---

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

---

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

### Table 7. Characteristics

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Parameter</th>
<th>Conditions</th>
<th>Min</th>
<th>Typ</th>
<th>Max</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>$V_{(BR)DSS}$</td>
<td>drain-source breakdown voltage</td>
<td>$I_D = 250 \mu A; V_{GS} = 0 \text{ V}; T_j = 25 \degree \text{C}$</td>
<td>60</td>
<td>-</td>
<td>-</td>
<td>V</td>
</tr>
<tr>
<td>$V_{GSth}$</td>
<td>gate-source threshold voltage</td>
<td>$I_D = 250 \mu A; V_{DS} = V_{GS}; T_j = 25 \degree \text{C}$</td>
<td>1.1</td>
<td>1.6</td>
<td>2.1</td>
<td>V</td>
</tr>
<tr>
<td>$I_{DSS}$</td>
<td>drain leakage current</td>
<td>$V_{DS} = 60 \text{ V}; V_{GS} = 0 \text{ V}; T_j = 25 \degree \text{C}$</td>
<td>-</td>
<td>-</td>
<td>1</td>
<td>µA</td>
</tr>
<tr>
<td>$I_{GSS}$</td>
<td>gate leakage current</td>
<td>$V_{GS} = 20 \text{ V}; V_{DS} = 0 \text{ V}; T_j = 25 \degree \text{C}$</td>
<td>-</td>
<td>-</td>
<td>10</td>
<td>µA</td>
</tr>
<tr>
<td></td>
<td></td>
<td>$V_{GS} = -20 \text{ V}; V_{DS} = 0 \text{ V}; T_j = 25 \degree \text{C}$</td>
<td>-</td>
<td>-</td>
<td>10</td>
<td>µA</td>
</tr>
<tr>
<td></td>
<td></td>
<td>$V_{GS} = 10 \text{ V}; V_{DS} = 0 \text{ V}; T_j = 25 \degree \text{C}$</td>
<td>-</td>
<td>-</td>
<td>1</td>
<td>µA</td>
</tr>
<tr>
<td></td>
<td></td>
<td>$V_{GS} = -10 \text{ V}; V_{DS} = 0 \text{ V}; T_j = 25 \degree \text{C}$</td>
<td>-</td>
<td>-</td>
<td>1</td>
<td>µA</td>
</tr>
<tr>
<td></td>
<td></td>
<td>$V_{GS} = 4.5 \text{ V}; V_{DS} = 0 \text{ V}; T_j = 25 \degree \text{C}$</td>
<td>-</td>
<td>-</td>
<td>100</td>
<td>nA</td>
</tr>
<tr>
<td></td>
<td></td>
<td>$V_{GS} = -4.5 \text{ V}; V_{DS} = 0 \text{ V}; T_j = 25 \degree \text{C}$</td>
<td>-</td>
<td>-</td>
<td>-100</td>
<td>nA</td>
</tr>
<tr>
<td>$R_{DSon}$</td>
<td>drain-source on-state resistance</td>
<td>$V_{GS} = 10 \text{ V}; I_D = 200 \text{ mA}; T_j = 25 \degree \text{C}$</td>
<td>2</td>
<td>2.8</td>
<td>-</td>
<td>Ω</td>
</tr>
<tr>
<td></td>
<td></td>
<td>$V_{GS} = 10 \text{ V}; I_D = 200 \text{ mA}; T_j = 150 \degree \text{C}$</td>
<td>-</td>
<td>4.3</td>
<td>6</td>
<td>Ω</td>
</tr>
<tr>
<td></td>
<td></td>
<td>$V_{GS} = 4.5 \text{ V}; I_D = 200 \text{ mA}; T_j = 25 \degree \text{C}$</td>
<td>-</td>
<td>2.1</td>
<td>3</td>
<td>Ω</td>
</tr>
<tr>
<td>$g_{fs}$</td>
<td>forward transconductance</td>
<td>$V_{DS} = 10 \text{ V}; I_D = 200 \text{ mA}; T_j = 25 \degree \text{C}$</td>
<td>600</td>
<td>-</td>
<td>-</td>
<td>mS</td>
</tr>
<tr>
<td>$R_G$</td>
<td>gate resistance</td>
<td>$f = 1 \text{ MHz}$</td>
<td>2.4</td>
<td>-</td>
<td>-</td>
<td>Ω</td>
</tr>
<tr>
<td>$Q_{G(tot)}$</td>
<td>total gate charge</td>
<td>$V_{DS} = 30 \text{ V}; I_D = 200 \text{ mA}; V_{GS} = 10 \text{ V}; T_j = 25 \degree \text{C}$</td>
<td>-</td>
<td>0.55</td>
<td>1</td>
<td>nC</td>
</tr>
<tr>
<td>$Q_{GS}$</td>
<td>gate-source charge</td>
<td></td>
<td>0.05</td>
<td>-</td>
<td>-</td>
<td>nC</td>
</tr>
<tr>
<td>$Q_{GD}$</td>
<td>gate-drain charge</td>
<td></td>
<td>0.11</td>
<td>-</td>
<td>-</td>
<td>nC</td>
</tr>
<tr>
<td>$C_{iss}$</td>
<td>input capacitance</td>
<td>$V_{DS} = 30 \text{ V}; f = 1 \text{ MHz}; V_{GS} = 0 \text{ V}; T_j = 25 \degree \text{C}$</td>
<td>-</td>
<td>22.2</td>
<td>-</td>
<td>pF</td>
</tr>
<tr>
<td>$C_{oss}$</td>
<td>output capacitance</td>
<td></td>
<td>2.7</td>
<td>-</td>
<td>-</td>
<td>pF</td>
</tr>
<tr>
<td>$C_{rss}$</td>
<td>reverse transfer capacitance</td>
<td></td>
<td>1.7</td>
<td>-</td>
<td>-</td>
<td>pF</td>
</tr>
<tr>
<td>$t_{d(on)}$</td>
<td>turn-on delay time</td>
<td>$V_{DS} = 30 \text{ V}; I_D = 200 \text{ mA}; V_{GS} = 10 \text{ V}; R_{G(ext)} = 6 \text{ Ω}; T_j = 25 \degree \text{C}$</td>
<td>-</td>
<td>1</td>
<td>-</td>
<td>ns</td>
</tr>
<tr>
<td>$t_r$</td>
<td>rise time</td>
<td></td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>ns</td>
</tr>
<tr>
<td>$t_{d(off)}$</td>
<td>turn-off delay time</td>
<td></td>
<td>3</td>
<td>-</td>
<td>-</td>
<td>ns</td>
</tr>
<tr>
<td>$t_f$</td>
<td>fall time</td>
<td></td>
<td>5</td>
<td>-</td>
<td>-</td>
<td>ns</td>
</tr>
</tbody>
</table>

### Source-drain diode

| $V_{SD}$     | source-drain voltage                       | $I_S = 350 \text{ mA}; V_{GS} = 0 \text{ V}; T_j = 25 \degree \text{C}$     | 0.9  | 1.2  | -    | V    |
**NX7002BKH**

60 V, N-channel Trench MOSFET

---

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

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

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

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

---

All information provided in this document is subject to legal disclaimers.
Fig. 11. Transfer characteristics: drain current as a function of gate-source voltage; typical values

\[ V_{DS} > I_D \times R_{DSon} \]

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

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

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

\[ I_D = 250 \, \mu A; \ V_{DS} = V_{GS} \]

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

\[ f = 1 \, MHz; \ V_{GS} = 0 \, V \]
I_D = 400 mA; V_DS = 30 V; T_amb = 25 °C

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

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

Dimensions (mm are the original dimensions)

<table>
<thead>
<tr>
<th>Unit</th>
<th>A</th>
<th>A₁</th>
<th>b</th>
<th>b₁</th>
<th>D</th>
<th>E</th>
<th>e</th>
<th>e₁</th>
<th>e₂</th>
<th>L</th>
<th>L₁</th>
<th>u</th>
<th>v</th>
<th>w</th>
<th>Y</th>
</tr>
</thead>
<tbody>
<tr>
<td>max</td>
<td>0.40</td>
<td>0.04</td>
<td>0.20</td>
<td>0.55</td>
<td>0.62</td>
<td>0.62</td>
<td>0.35</td>
<td>0.186</td>
<td>0.155</td>
<td>0.15</td>
<td>0.21</td>
<td>0.05</td>
<td>0.1</td>
<td>0.05</td>
<td>0.05</td>
</tr>
<tr>
<td>nom</td>
<td>0.37</td>
<td>0.15</td>
<td>0.50</td>
<td>0.62</td>
<td>0.62</td>
<td>0.35</td>
<td>0.186</td>
<td>0.155</td>
<td>0.15</td>
<td>0.21</td>
<td>0.05</td>
<td>0.1</td>
<td>0.05</td>
<td>0.05</td>
<td></td>
</tr>
<tr>
<td>min</td>
<td>0.34</td>
<td>0.10</td>
<td>0.45</td>
<td>0.62</td>
<td>0.62</td>
<td>0.35</td>
<td>0.186</td>
<td>0.155</td>
<td>0.15</td>
<td>0.21</td>
<td>0.05</td>
<td>0.1</td>
<td>0.05</td>
<td>0.05</td>
<td></td>
</tr>
</tbody>
</table>

Fig. 19. Package outline DFN0606-3 (SOT8001)
13. Soldering

Footprint information for reflow soldering of DFN0606-3 package

Fig. 20. Reflow soldering footprint for DFN0606-3 (SOT8001)
14. Revision history

<table>
<thead>
<tr>
<th>Data sheet ID</th>
<th>Release date</th>
<th>Data sheet status</th>
<th>Change notice</th>
<th>Supersedes</th>
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<tbody>
<tr>
<td>NX7002BKH v.1</td>
<td>20190312</td>
<td>Product data sheet</td>
<td>-</td>
<td>-</td>
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</tbody>
</table>
15. Legal information

Data sheet status

<table>
<thead>
<tr>
<th>Document status</th>
<th>Product status</th>
<th>Definition</th>
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<tbody>
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<td>Objective [short]</td>
<td>Development</td>
<td>This document contains data from the definitive specification for product development.</td>
</tr>
<tr>
<td>Preliminary [short]</td>
<td>Qualification</td>
<td>This document contains data from the preliminary specification.</td>
</tr>
<tr>
<td>Product [short]</td>
<td>Production</td>
<td>This document contains the product specification.</td>
</tr>
</tbody>
</table>

[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 https://www.nexperia.com.

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