



# PSMN013-30YLC

N-channel 30 V 13.6 mΩ logic level MOSFET in LPAK using NextPower technology

Rev. 3 — 24 October 2011

Product data sheet

## 1. Product profile

### 1.1 General description

Logic level enhancement mode N-channel MOSFET in LPAK package. This product is designed and qualified for use in a wide range of industrial, communications and domestic equipment.

### 1.2 Features and benefits

- High reliability Power SO8 package, qualified to 175°C
- Low parasitic inductance and resistance
- Optimised for 4.5V Gate drive utilising NextPower Superjunction technology
- Ultra low QG, QGD, & QOSS for high system efficiencies at low and high loads

### 1.3 Applications

- DC-to-DC converters
- Load switching
- Synchronous buck regulator

### 1.4 Quick reference data

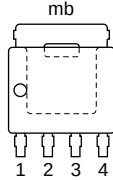
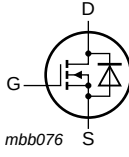
Table 1. Quick reference data

| Symbol                         | Parameter                        | Conditions                                                                                                                             | Min | Typ  | Max  | Unit |
|--------------------------------|----------------------------------|----------------------------------------------------------------------------------------------------------------------------------------|-----|------|------|------|
| $V_{DS}$                       | drain-source voltage             | $25\text{ °C} \leq T_j \leq 175\text{ °C}$                                                                                             | -   | -    | 30   | V    |
| $I_D$                          | drain current                    | $T_{mb} = 25\text{ °C}$ ; $V_{GS} = 10\text{ V}$ ; see <a href="#">Figure 1</a>                                                        | -   | -    | 32   | A    |
| $P_{tot}$                      | total power dissipation          | $T_{mb} = 25\text{ °C}$ ; see <a href="#">Figure 2</a>                                                                                 | -   | -    | 26   | W    |
| $T_j$                          | junction temperature             |                                                                                                                                        | -55 | -    | 175  | °C   |
| <b>Static characteristics</b>  |                                  |                                                                                                                                        |     |      |      |      |
| $R_{DS(on)}$                   | drain-source on-state resistance | $V_{GS} = 4.5\text{ V}$ ; $I_D = 10\text{ A}$ ; $T_j = 25\text{ °C}$ ; see <a href="#">Figure 12</a>                                   | -   | 14.4 | 16.9 | mΩ   |
|                                |                                  | $V_{GS} = 10\text{ V}$ ; $I_D = 10\text{ A}$ ; $T_j = 25\text{ °C}$ ; see <a href="#">Figure 12</a>                                    | -   | 11.6 | 13.6 | mΩ   |
| <b>Dynamic characteristics</b> |                                  |                                                                                                                                        |     |      |      |      |
| $Q_{GD}$                       | gate-drain charge                | $V_{GS} = 4.5\text{ V}$ ; $I_D = 10\text{ A}$ ; $V_{DS} = 15\text{ V}$ ; see <a href="#">Figure 14</a> ; see <a href="#">Figure 15</a> | -   | 1.2  | -    | nC   |
| $Q_{G(tot)}$                   | total gate charge                | $V_{GS} = 4.5\text{ V}$ ; $I_D = 10\text{ A}$ ; $V_{DS} = 15\text{ V}$ ; see <a href="#">Figure 14</a> ; see <a href="#">Figure 15</a> | -   | 4    | -    | nC   |



## 2. Pinning information

Table 2. Pinning information

| Pin | Symbol | Description                       | Simplified outline                                                                | Graphic symbol                                                                      |
|-----|--------|-----------------------------------|-----------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|
| 1   | S      | source                            |  |  |
| 2   | S      | source                            |                                                                                   |                                                                                     |
| 3   | S      | source                            |                                                                                   |                                                                                     |
| 4   | G      | gate                              |                                                                                   |                                                                                     |
| mb  | D      | mounting base; connected to drain |                                                                                   |                                                                                     |

SOT669 (LPAK; Power-SO8)

## 3. Ordering information

Table 3. Ordering information

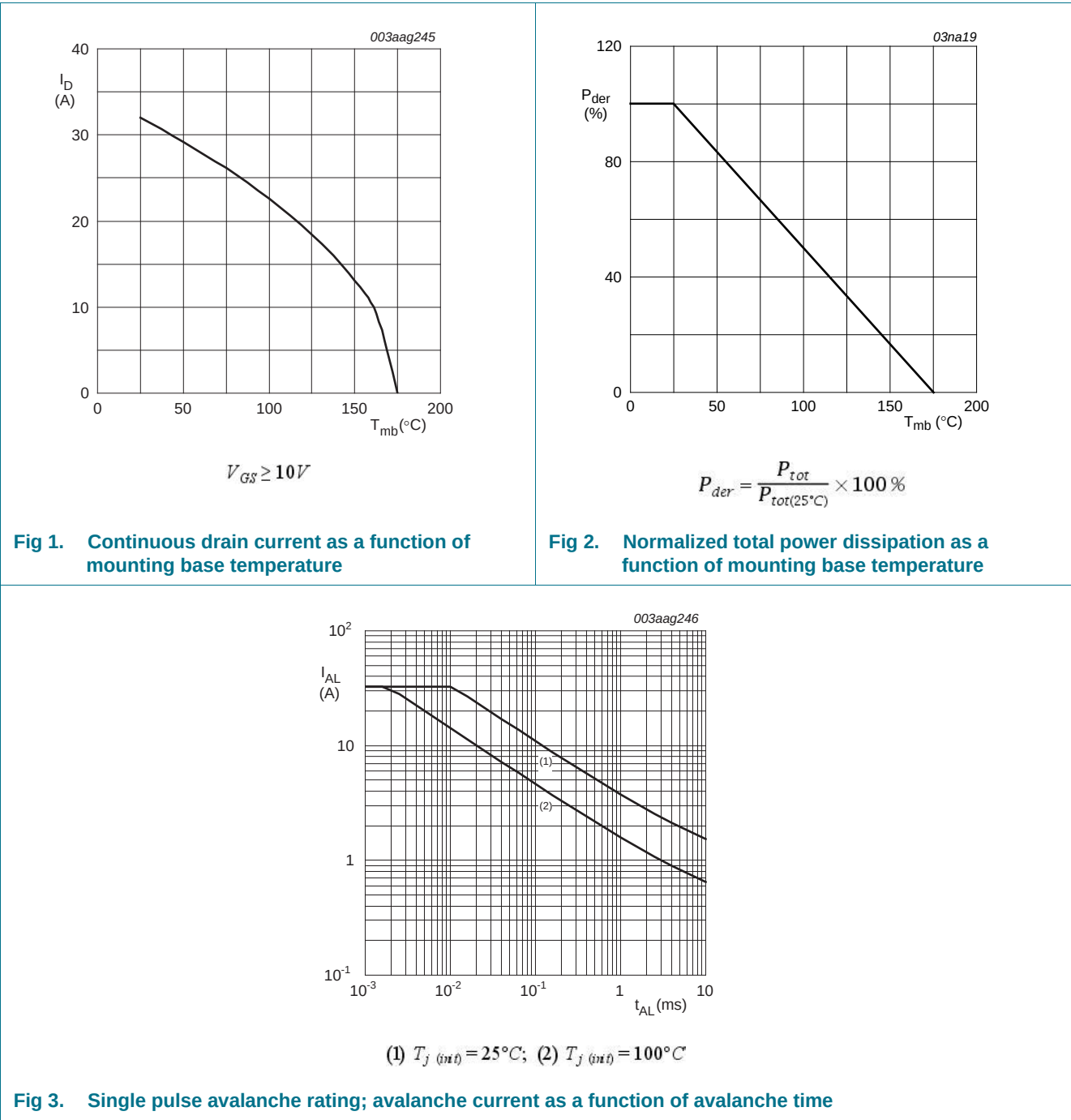
| Type number   | Package         |                                                       |         |
|---------------|-----------------|-------------------------------------------------------|---------|
|               | Name            | Description                                           | Version |
| PSMN013-30YLC | LPAK; Power-SO8 | plastic single-ended surface-mounted package; 4 leads | SOT669  |

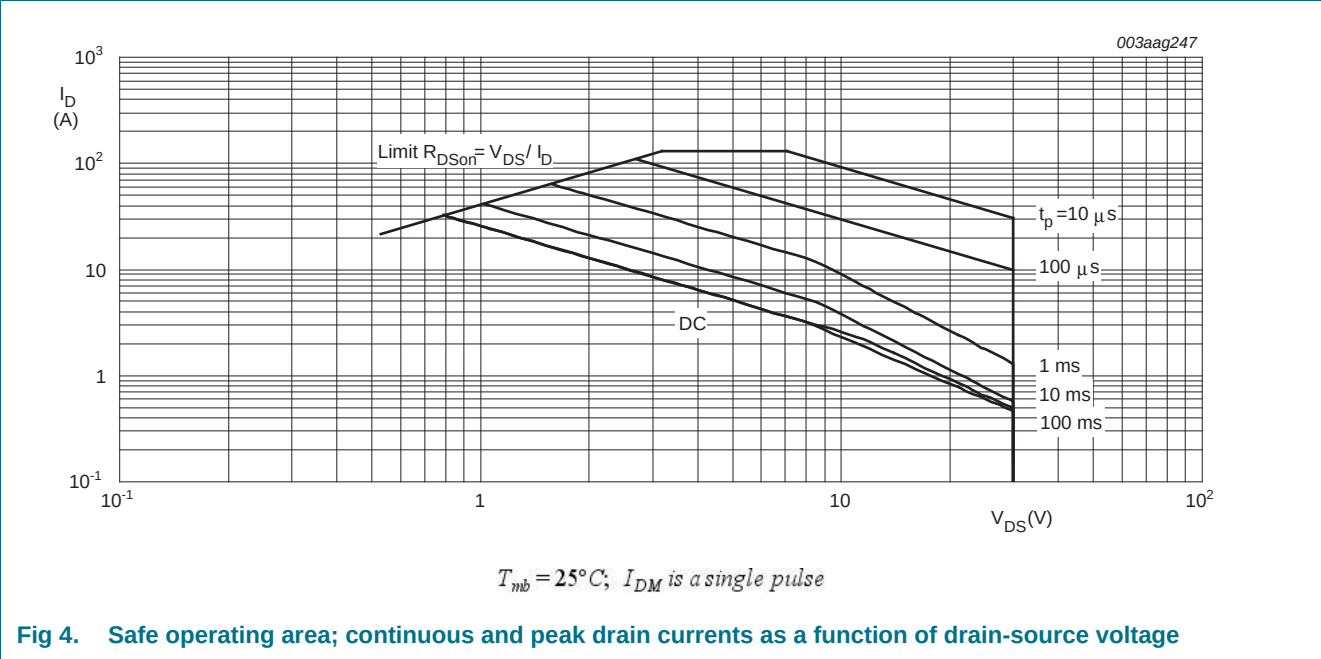
## 4. Limiting values

Table 4. Limiting values

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

| Symbol                      | Parameter                                    | Conditions                                                                                                                                                                              | Min | Max | Unit |
|-----------------------------|----------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|-----|------|
| $V_{DS}$                    | drain-source voltage                         | $25\text{ °C} \leq T_j \leq 175\text{ °C}$                                                                                                                                              | -   | 30  | V    |
| $V_{DGR}$                   | drain-gate voltage                           | $25\text{ °C} \leq T_j \leq 175\text{ °C}$ ; $R_{GS} = 20\text{ k}\Omega$                                                                                                               | -   | 30  | V    |
| $V_{GS}$                    | gate-source voltage                          |                                                                                                                                                                                         | -20 | 20  | V    |
| $I_D$                       | drain current                                | $V_{GS} = 10\text{ V}$ ; $T_{mb} = 25\text{ °C}$ ; see <a href="#">Figure 1</a>                                                                                                         | -   | 32  | A    |
|                             |                                              | $V_{GS} = 10\text{ V}$ ; $T_{mb} = 100\text{ °C}$ ; see <a href="#">Figure 1</a>                                                                                                        | -   | 23  | A    |
| $I_{DM}$                    | peak drain current                           | pulsed; $t_p \leq 10\text{ }\mu\text{s}$ ; $T_{mb} = 25\text{ °C}$ ; see <a href="#">Figure 4</a>                                                                                       | -   | 130 | A    |
| $P_{tot}$                   | total power dissipation                      | $T_{mb} = 25\text{ °C}$ ; see <a href="#">Figure 2</a>                                                                                                                                  | -   | 26  | W    |
| $T_{stg}$                   | storage temperature                          |                                                                                                                                                                                         | -55 | 175 | °C   |
| $T_j$                       | junction temperature                         |                                                                                                                                                                                         | -55 | 175 | °C   |
| $T_{sld(M)}$                | peak soldering temperature                   |                                                                                                                                                                                         | -   | 260 | °C   |
| $V_{ESD}$                   | electrostatic discharge voltage              | MM (JEDEC JESD22-A115)                                                                                                                                                                  | 130 | -   | V    |
| <b>Source-drain diode</b>   |                                              |                                                                                                                                                                                         |     |     |      |
| $I_S$                       | source current                               | $T_{mb} = 25\text{ °C}$                                                                                                                                                                 | -   | 23  | A    |
| $I_{SM}$                    | peak source current                          | pulsed; $t_p \leq 10\text{ }\mu\text{s}$ ; $T_{mb} = 25\text{ °C}$                                                                                                                      | -   | 130 | A    |
| <b>Avalanche ruggedness</b> |                                              |                                                                                                                                                                                         |     |     |      |
| $E_{DS(AL)S}$               | non-repetitive drain-source avalanche energy | $V_{GS} = 10\text{ V}$ ; $T_{j(\text{init})} = 25\text{ °C}$ ; $I_D = 32\text{ A}$ ; $V_{sup} \leq 30\text{ V}$ ; $R_{GS} = 50\text{ }\Omega$ ; unclamped; see <a href="#">Figure 3</a> | -   | 7   | mJ   |





5. Thermal characteristics

Table 5. Thermal characteristics

| Symbol         | Parameter                                         | Conditions                   | Min | Typ  | Max  | Unit |
|----------------|---------------------------------------------------|------------------------------|-----|------|------|------|
| $R_{th(j-mb)}$ | thermal resistance from junction to mounting base | see <a href="#">Figure 5</a> | -   | 5.66 | 5.83 | K/W  |

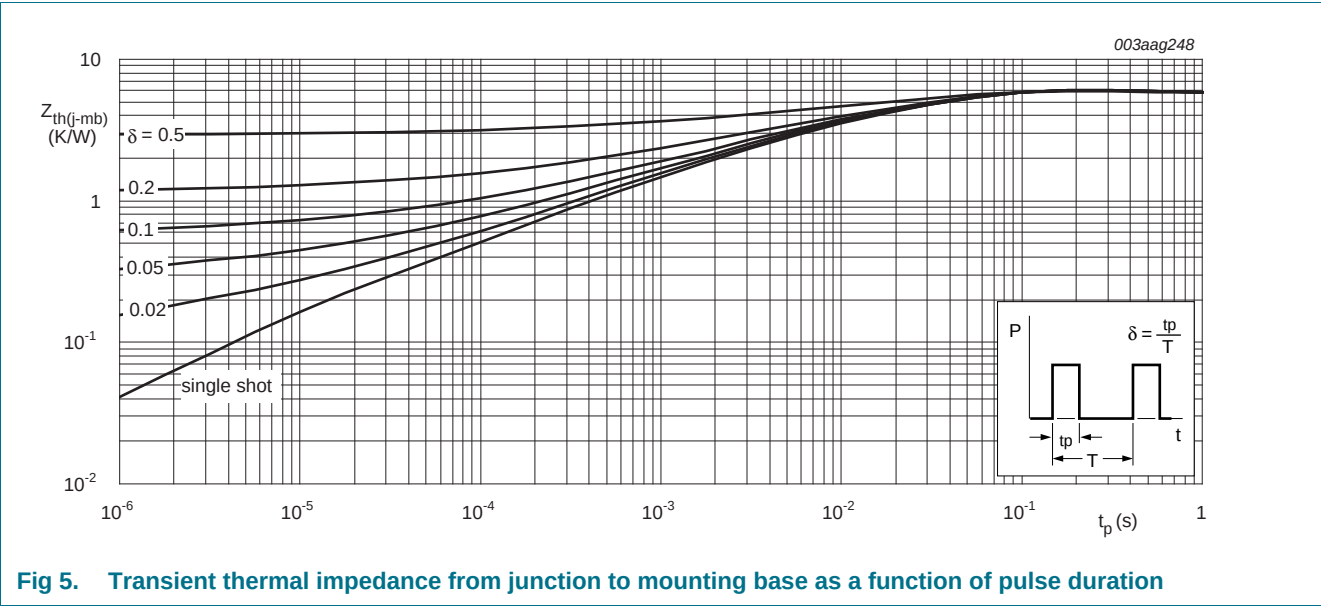


Fig 5. Transient thermal impedance from junction to mounting base as a function of pulse duration

## 6. Characteristics

Table 6. Characteristics

| Symbol                         | Parameter                         | Conditions                                                                                                                                    | Min  | Typ  | Max  | Unit          |
|--------------------------------|-----------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------|------|------|------|---------------|
| <b>Static characteristics</b>  |                                   |                                                                                                                                               |      |      |      |               |
| $V_{(BR)DSS}$                  | drain-source breakdown voltage    | $I_D = 250\ \mu\text{A}$ ; $V_{GS} = 0\ \text{V}$ ; $T_j = 25\ ^\circ\text{C}$                                                                | 30   | -    | -    | V             |
|                                |                                   | $I_D = 250\ \mu\text{A}$ ; $V_{GS} = 0\ \text{V}$ ; $T_j = -55\ ^\circ\text{C}$                                                               | 27   | -    | -    | V             |
| $V_{GS(th)}$                   | gate-source threshold voltage     | $I_D = 1\ \text{mA}$ ; $V_{DS} = V_{GS}$ ; $T_j = 25\ ^\circ\text{C}$ ; see <a href="#">Figure 10</a> ; see <a href="#">Figure 11</a>         | 1.05 | 1.68 | 1.95 | V             |
|                                |                                   | $I_D = 10\ \text{mA}$ ; $V_{DS} = V_{GS}$ ; $T_j = 150\ ^\circ\text{C}$                                                                       | 0.5  | -    | -    | V             |
|                                |                                   | $I_D = 1\ \text{mA}$ ; $V_{DS} = V_{GS}$ ; $T_j = -55\ ^\circ\text{C}$                                                                        | -    | -    | 2.25 | V             |
| $I_{DSS}$                      | drain leakage current             | $V_{DS} = 30\ \text{V}$ ; $V_{GS} = 0\ \text{V}$ ; $T_j = 25\ ^\circ\text{C}$                                                                 | -    | -    | 1    | $\mu\text{A}$ |
|                                |                                   | $V_{DS} = 30\ \text{V}$ ; $V_{GS} = 0\ \text{V}$ ; $T_j = 150\ ^\circ\text{C}$                                                                | -    | -    | 100  | $\mu\text{A}$ |
| $I_{GSS}$                      | gate leakage current              | $V_{GS} = 16\ \text{V}$ ; $V_{DS} = 0\ \text{V}$ ; $T_j = 25\ ^\circ\text{C}$                                                                 | -    | -    | 100  | nA            |
|                                |                                   | $V_{GS} = -16\ \text{V}$ ; $V_{DS} = 0\ \text{V}$ ; $T_j = 25\ ^\circ\text{C}$                                                                | -    | -    | 100  | nA            |
| $R_{DS(on)}$                   | drain-source on-state resistance  | $V_{GS} = 4.5\ \text{V}$ ; $I_D = 10\ \text{A}$ ; $T_j = 25\ ^\circ\text{C}$ ; see <a href="#">Figure 12</a>                                  | -    | 14.4 | 16.9 | mΩ            |
|                                |                                   | $V_{GS} = 4.5\ \text{V}$ ; $I_D = 10\ \text{A}$ ; $T_j = 150\ ^\circ\text{C}$ ; see <a href="#">Figure 12</a> ; see <a href="#">Figure 13</a> | -    | -    | 27.2 | mΩ            |
|                                |                                   | $V_{GS} = 10\ \text{V}$ ; $I_D = 10\ \text{A}$ ; $T_j = 25\ ^\circ\text{C}$ ; see <a href="#">Figure 12</a>                                   | -    | 11.6 | 13.6 | mΩ            |
|                                |                                   | $V_{GS} = 10\ \text{V}$ ; $I_D = 10\ \text{A}$ ; $T_j = 150\ ^\circ\text{C}$ ; see <a href="#">Figure 12</a> ; see <a href="#">Figure 13</a>  | -    | -    | 22.1 | mΩ            |
| $R_G$                          | gate resistance                   | $f = 1\ \text{MHz}$                                                                                                                           | -    | 2.12 | 4.24 | Ω             |
| <b>Dynamic characteristics</b> |                                   |                                                                                                                                               |      |      |      |               |
| $Q_{G(tot)}$                   | total gate charge                 | $I_D = 10\ \text{A}$ ; $V_{DS} = 15\ \text{V}$ ; $V_{GS} = 10\ \text{V}$ ; see <a href="#">Figure 14</a> ; see <a href="#">Figure 15</a>      | -    | 8.3  | -    | nC            |
|                                |                                   | $I_D = 10\ \text{A}$ ; $V_{DS} = 15\ \text{V}$ ; $V_{GS} = 4.5\ \text{V}$ ; see <a href="#">Figure 14</a> ; see <a href="#">Figure 15</a>     | -    | 4    | -    | nC            |
|                                |                                   | $I_D = 0\ \text{A}$ ; $V_{DS} = 0\ \text{V}$ ; $V_{GS} = 10\ \text{V}$                                                                        | -    | 7.7  | -    | nC            |
| $Q_{GS}$                       | gate-source charge                | $I_D = 10\ \text{A}$ ; $V_{DS} = 15\ \text{V}$ ; $V_{GS} = 4.5\ \text{V}$ ; see <a href="#">Figure 14</a> ; see <a href="#">Figure 15</a>     | -    | 1.3  | -    | nC            |
| $Q_{GS(th)}$                   | pre-threshold gate-source charge  |                                                                                                                                               | -    | 0.9  | -    | nC            |
| $Q_{GS(th-pl)}$                | post-threshold gate-source charge |                                                                                                                                               | -    | 0.4  | -    | nC            |
| $Q_{GD}$                       | gate-drain charge                 |                                                                                                                                               | -    | 1.2  | -    | nC            |
| $V_{GS(pl)}$                   | gate-source plateau voltage       | $I_D = 10\ \text{A}$ ; $V_{DS} = 15\ \text{V}$ ; see <a href="#">Figure 14</a> ; see <a href="#">Figure 15</a>                                | -    | 2.7  | -    | V             |
| $C_{iss}$                      | input capacitance                 | $V_{DS} = 15\ \text{V}$ ; $V_{GS} = 0\ \text{V}$ ; $f = 1\ \text{MHz}$ ; $T_j = 25\ ^\circ\text{C}$ ; see <a href="#">Figure 16</a>           | -    | 521  | -    | pF            |
| $C_{oss}$                      | output capacitance                |                                                                                                                                               | -    | 128  | -    | pF            |
| $C_{rss}$                      | reverse transfer capacitance      |                                                                                                                                               | -    | 39   | -    | pF            |
| $t_{d(on)}$                    | turn-on delay time                | $V_{DS} = 15\ \text{V}$ ; $R_L = 0.6\ \Omega$ ; $V_{GS} = 4.5\ \text{V}$ ; $R_{G(ext)} = 4.7\ \Omega$                                         | -    | 11.6 | -    | ns            |
| $t_r$                          | rise time                         |                                                                                                                                               | -    | 9.9  | -    | ns            |
| $t_{d(off)}$                   | turn-off delay time               |                                                                                                                                               | -    | 16.3 | -    | ns            |
| $t_f$                          | fall time                         |                                                                                                                                               | -    | 6.2  | -    | ns            |

Table 6. Characteristics ...continued

| Symbol             | Parameter                  | Conditions                                                                                            | Min | Typ  | Max | Unit |
|--------------------|----------------------------|-------------------------------------------------------------------------------------------------------|-----|------|-----|------|
| $Q_{oss}$          | output charge              | $V_{GS} = 0\text{ V}$ ; $V_{DS} = 15\text{ V}$ ; $f = 1\text{ MHz}$ ;<br>$T_j = 25\text{ °C}$         | -   | 3.3  | -   | nC   |
| Source-drain diode |                            |                                                                                                       |     |      |     |      |
| $V_{SD}$           | source-drain voltage       | $I_S = 10\text{ A}$ ; $V_{GS} = 0\text{ V}$ ; $T_j = 25\text{ °C}$ ;<br>see <a href="#">Figure 17</a> | -   | 0.86 | 1.1 | V    |
| $t_{rr}$           | reverse recovery time      | $I_S = 10\text{ A}$ ; $di_S/dt = -100\text{ A/}\mu\text{s}$ ;                                         | -   | 16   | -   | ns   |
| $Q_r$              | recovered charge           | $V_{GS} = 0\text{ V}$ ; $V_{DS} = 15\text{ V}$                                                        | -   | 6    | -   | nC   |
| $t_a$              | reverse recovery rise time | $V_{GS} = 0\text{ V}$ ; $I_S = 10\text{ A}$ ;                                                         | -   | 9.5  | -   | ns   |
| $t_b$              | reverse recovery fall time | $di_S/dt = -100\text{ A/}\mu\text{s}$ ; $V_{DS} = 15\text{ V}$ ;<br>see <a href="#">Figure 18</a>     | -   | 6.5  | -   | ns   |

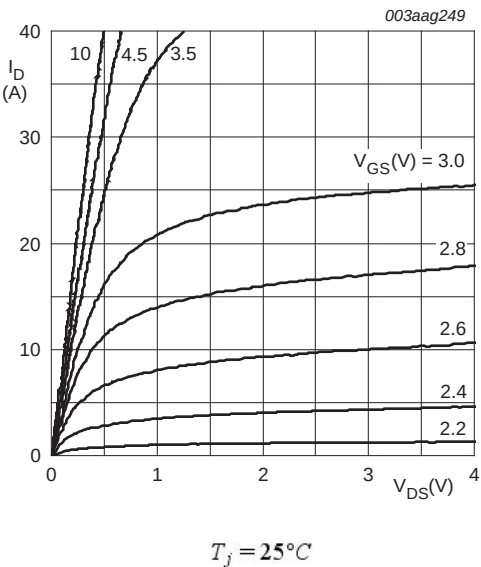


Fig 6. Output characteristics; drain current as a function of drain-source voltage; typical values

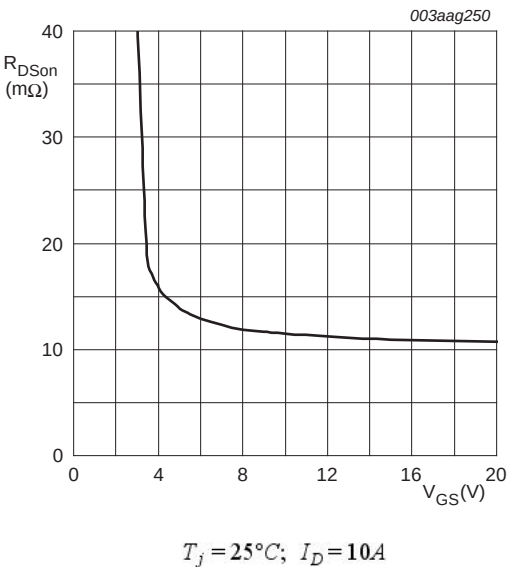


Fig 7. Drain-source on-state resistance as a function of gate-source voltage; typical values

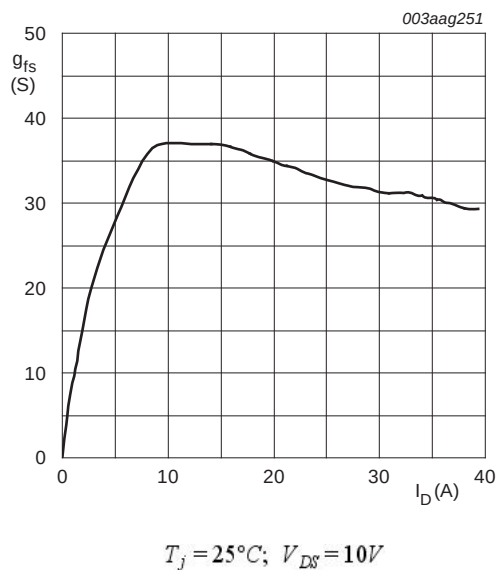


Fig 8. Forward transconductance as a function of drain current; typical values

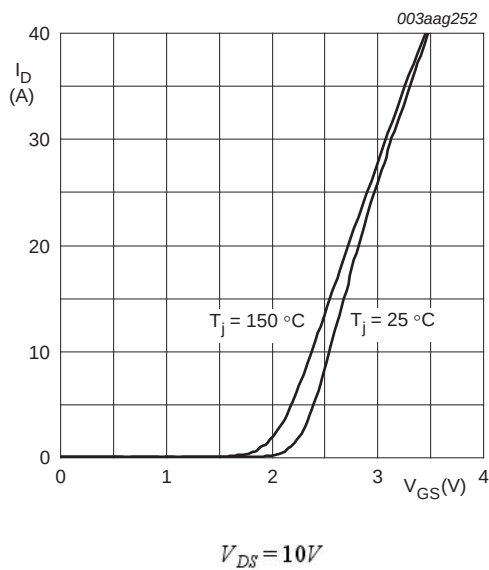


Fig 9. Transfer characteristics; drain current as a function of gate-source voltage; typical values

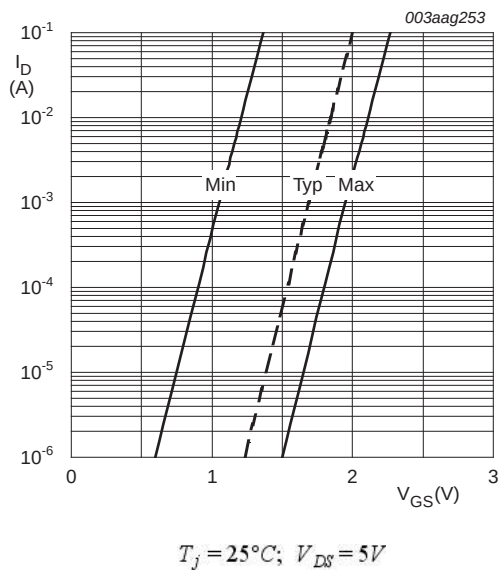


Fig 10. Sub-threshold drain current as a function of gate-source voltage

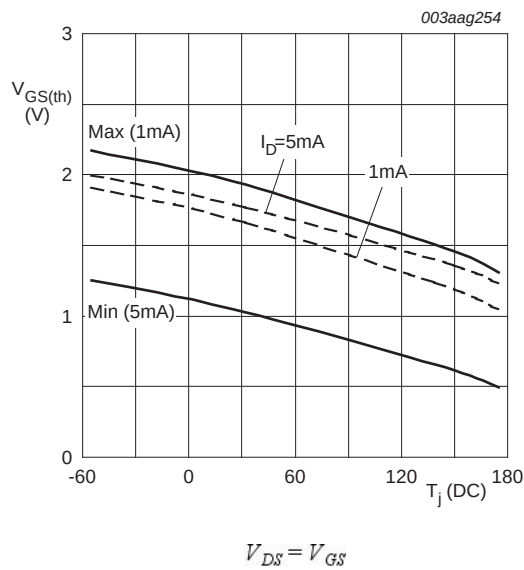
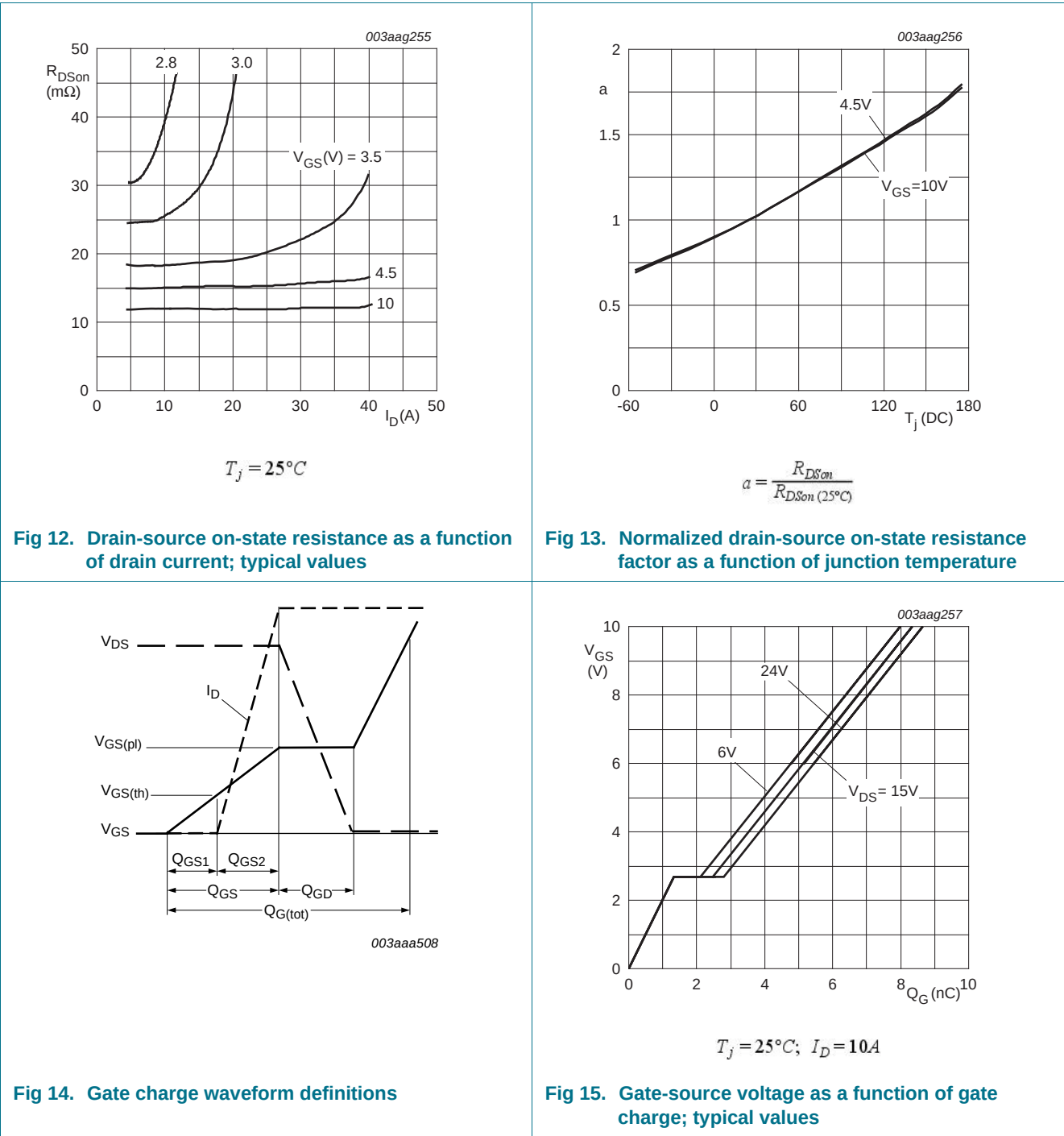


Fig 11. Gate-source threshold voltage as a function of junction temperature





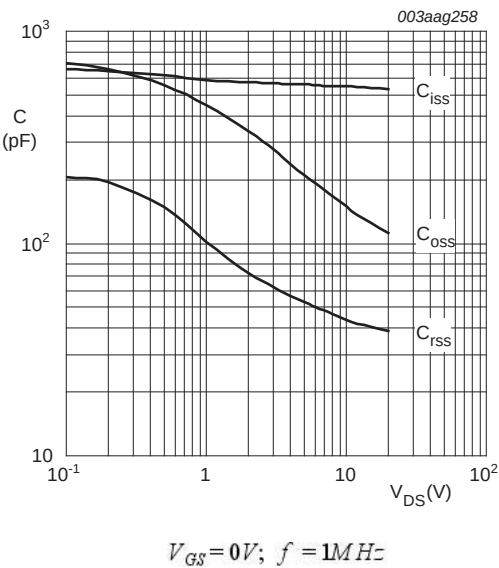


Fig 16. Input, output and reverse transfer capacitances as a function of drain-source voltage; typical values

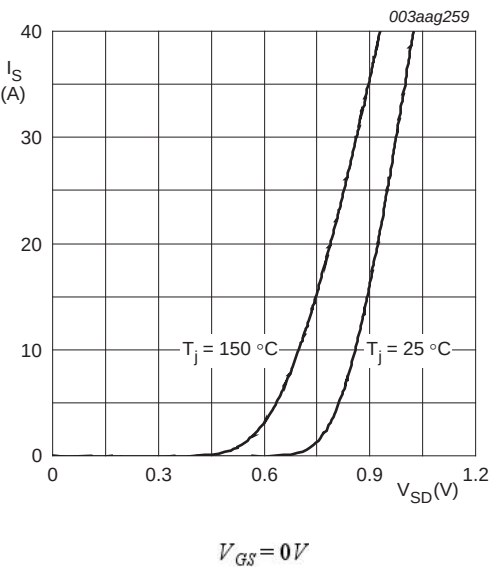


Fig 17. Source current as a function of source-drain voltage; typical values

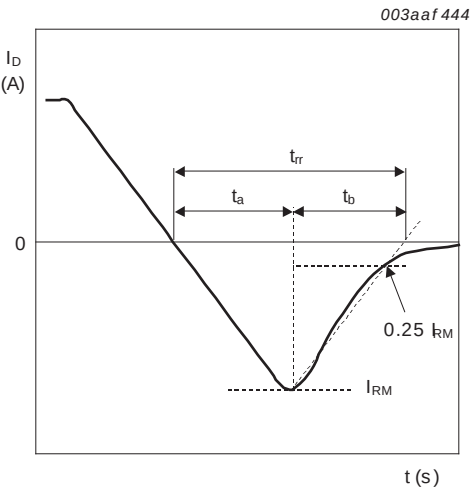


Fig 18. Reverse recovery timing definition

7. Package outline

Plastic single-ended surface-mounted package (LPAK; Power-SO8); 4 leads SOT669

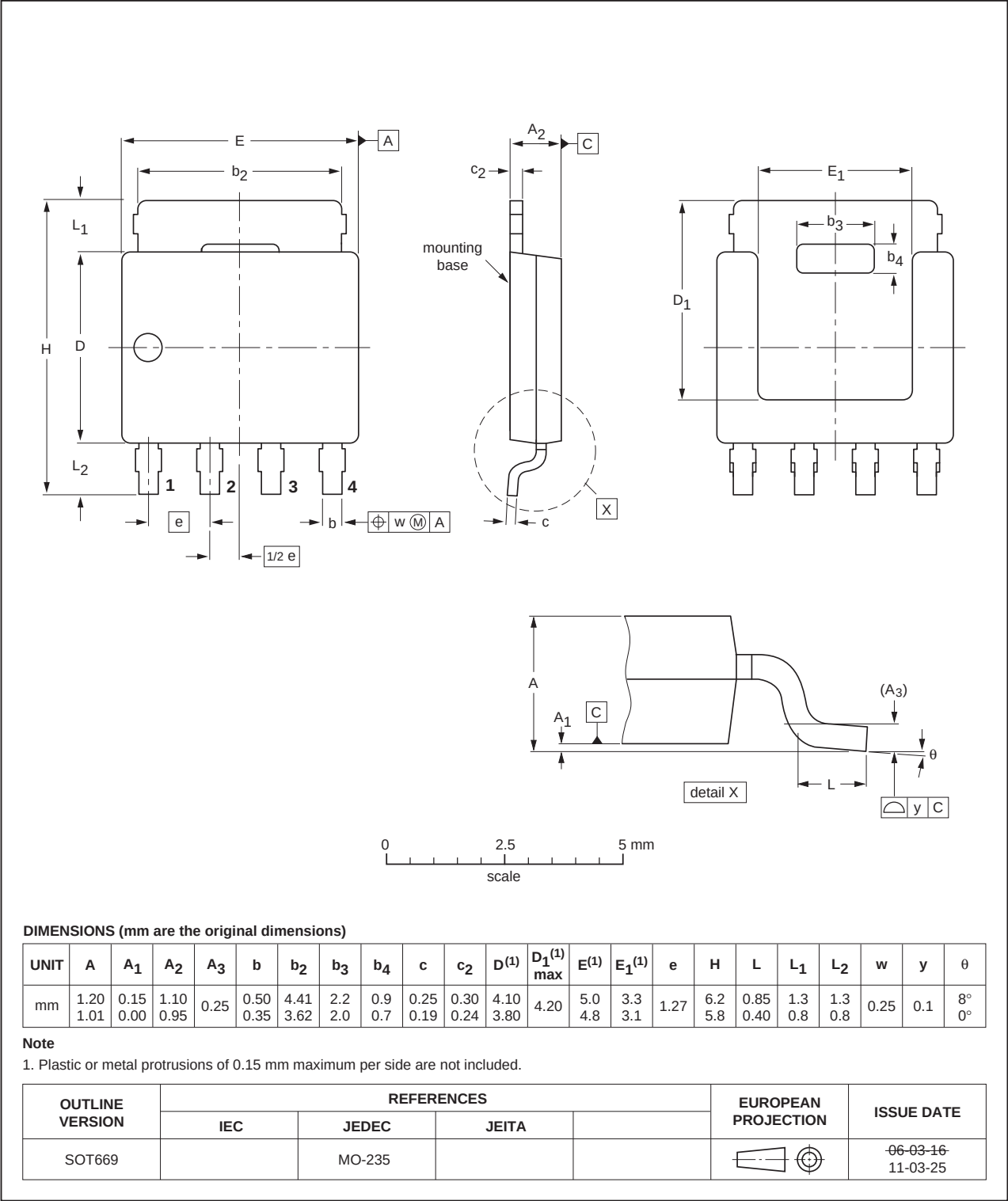


Fig 19. Package outline SOT669 (LPAK; Power-SO8)

## 8. Revision history

Table 7. Revision history

| Document ID       | Release date                                                                                                                        | Data sheet status      | Change notice | Supersedes        |
|-------------------|-------------------------------------------------------------------------------------------------------------------------------------|------------------------|---------------|-------------------|
| PSMN013-30YLC v.3 | 20111024                                                                                                                            | Product data sheet     | -             | PSMN013-30YLC v.2 |
| Modifications:    | <ul style="list-style-type: none"><li>• Status changed from preliminary to product.</li><li>• Various changes to content.</li></ul> |                        |               |                   |
| PSMN013-30YLC v.2 | 20110929                                                                                                                            | Preliminary data sheet | -             | PSMN013-30YLC v.1 |

## 9. Legal information

### 9.1 Data sheet status

| Document status <sup>[1]</sup> <sup>[2]</sup> | Product status <sup>[3]</sup> | 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.nxp.com>.

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