

PSMN1R5-30YL

N-channel 30 V 1.5 mΩ logic level MOSFET in LFPAK

Rev. 01 — 9 April 2010

Product data sheet

1. Product profile

1.1 General description

Logic level N-channel MOSFET in LFPAK package qualified to 175 °C. This product is designed and qualified for use in a wide range of industrial, communications and domestic equipment.

1.2 Features and benefits

- Advanced TrenchMOS provides low R_{DSon} and low gate charge
- High efficiency gains in switching power convertors
- Improved mechanical and thermal characteristics
- LFPAK provides maximum power density in a Power SO8 package

1.3 Applications

- DC-to-DC converters
- Lithium-ion battery protection
- Load switching
- Motor control
- Server power supplies

1.4 Quick reference data

Table 1. Quick reference data

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|--------------------------------|----------------------------------|---|-----|-----|-----|------|
| V_{DS} | drain-source voltage | $T_j \geq 25\text{ °C}$; $T_j \leq 175\text{ °C}$ | - | - | 30 | V |
| I_D | drain current | $T_{mb} = 25\text{ °C}$; $V_{GS} = 10\text{ V}$; see [1] Figure 1 | - | - | 100 | A |
| P_{tot} | total power dissipation | $T_{mb} = 25\text{ °C}$; see Figure 2 | - | - | 109 | W |
| T_j | junction temperature | | -55 | - | 175 | °C |
| Static characteristics | | | | | | |
| R_{DSon} | drain-source on-state resistance | $V_{GS} = 10\text{ V}$; $I_D = 15\text{ A}$; $T_j = 100\text{ °C}$; see Figure 14 | - | - | 2.4 | mΩ |
| | | $V_{GS} = 10\text{ V}$; $I_D = 15\text{ A}$; $T_j = 25\text{ °C}$ | - | 1.3 | 1.5 | mΩ |
| Dynamic characteristics | | | | | | |
| Q_{GD} | gate-drain charge | $V_{GS} = 4.5\text{ V}$; $I_D = 10\text{ A}$; $V_{DS} = 12\text{ V}$; see Figure 15 ; see Figure 16 | - | 8.7 | - | nC |



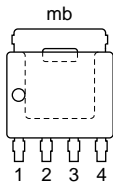
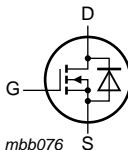
Table 1. Quick reference data ...continued

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|-----------------------------|--|--|-----|------|-----|------|
| $Q_{G(\text{tot})}$ | total gate charge | $V_{GS} = 4.5 \text{ V}; I_D = 10 \text{ A};$ $V_{DS} = 12 \text{ V};$ see Figure 15 | - | 36.2 | - | nC |
| Avalanche ruggedness | | | | | | |
| $E_{DS(\text{AL})S}$ | non-repetitive drain-source avalanche energy | $V_{GS} = 10 \text{ V}; T_{j(\text{init})} = 25 \text{ }^\circ\text{C};$ $I_D = 100 \text{ A}; V_{\text{sup}} \leq 30 \text{ V};$ $R_{GS} = 50 \text{ } \Omega;$ unclamped | - | - | 241 | mJ |

[1] Continuous current is limited by package.

2. Pinning information

Table 2. Pinning information

| Pin | Symbol | Description | Simplified outline | Graphic symbol |
|-----|--------|-----------------------------------|---|--|
| 1 | S | source |  <p>SOT669 (LPAK)</p> |  <p>mbb076</p> |
| 2 | S | source | | |
| 3 | S | source | | |
| 4 | G | gate | | |
| mb | D | mounting base; connected to drain | | |

3. Ordering information

Table 3. Ordering information

| Type number | Package | | |
|--------------|---------|--|---------|
| | Name | Description | Version |
| PSMN1R5-30YL | LPAK | plastic single-ended surface-mounted package (LPAK); 4 leads | SOT669 |

4. Limiting values

Table 4. Limiting values

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

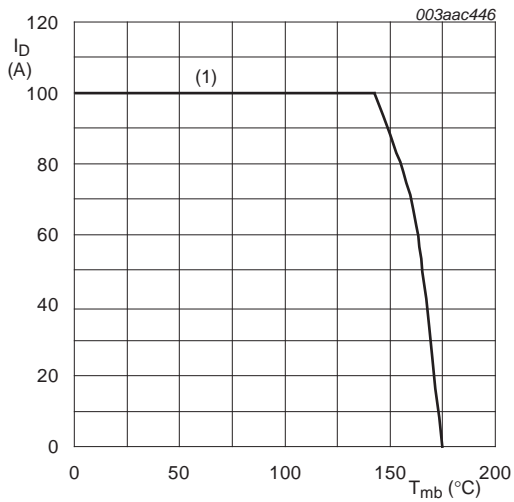
| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|-----------------------------|--|--|-----|-----|-----|------|
| V_{DS} | drain-source voltage | $T_j \geq 25\text{ °C}$; $T_j \leq 175\text{ °C}$ | - | - | 30 | V |
| V_{DGR} | drain-gate voltage | $T_j \geq 25\text{ °C}$; $T_j \leq 175\text{ °C}$; $R_{GS} = 20\text{ k}\Omega$ | - | - | 30 | V |
| V_{GS} | gate-source voltage | | -20 | - | 20 | V |
| I_D | drain current | $V_{GS} = 10\text{ V}$; $T_{mb} = 100\text{ °C}$; see Figure 1 [1] | - | - | 100 | A |
| | | $V_{GS} = 10\text{ V}$; $T_{mb} = 25\text{ °C}$; see Figure 1 [1] | - | - | 100 | A |
| I_{DM} | peak drain current | $t_p \leq 10\text{ }\mu\text{s}$; pulsed; $T_{mb} = 25\text{ °C}$; see Figure 4 | - | - | 790 | A |
| P_{tot} | total power dissipation | $T_{mb} = 25\text{ °C}$; see Figure 2 | - | - | 109 | W |
| T_{stg} | storage temperature | | -55 | - | 175 | °C |
| T_j | junction temperature | | -55 | - | 175 | °C |
| Source-drain diode | | | | | | |
| I_S | source current | $T_{mb} = 25\text{ °C}$ [1] | - | - | 100 | A |
| I_{SM} | peak source current | $t_p \leq 10\text{ }\mu\text{s}$; pulsed; $T_{mb} = 25\text{ °C}$ | - | - | 790 | A |
| Avalanche ruggedness | | | | | | |
| $E_{DS(AL)R}$ | repetitive drain-source avalanche energy | see Figure 3 [2][3][4] | - | - | - | J |
| $E_{DS(AL)S}$ | non-repetitive drain-source avalanche energy | $V_{GS} = 10\text{ V}$; $T_{j(\text{init})} = 25\text{ °C}$; $I_D = 100\text{ A}$; $V_{sup} \leq 30\text{ V}$; $R_{GS} = 50\text{ }\Omega$; unclamped | - | - | 241 | mJ |

[1] Continuous current is limited by package.

[2] Single-pulse avalanche rating limited by maximum junction temperature of 175 °C.

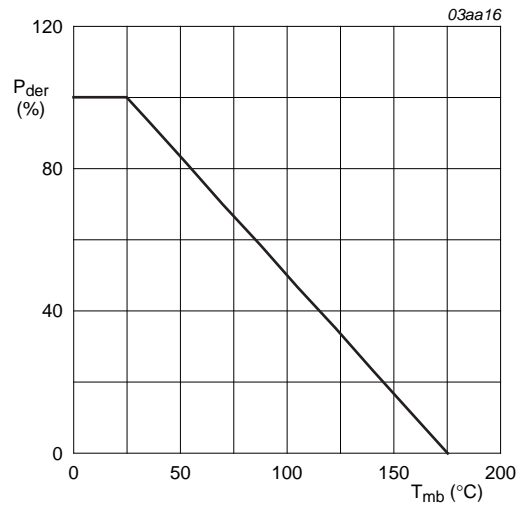
[3] Repetitive avalanche rating limited by average junction temperature of 170 °C.

[4] Refer to application note AN10273 for further information.



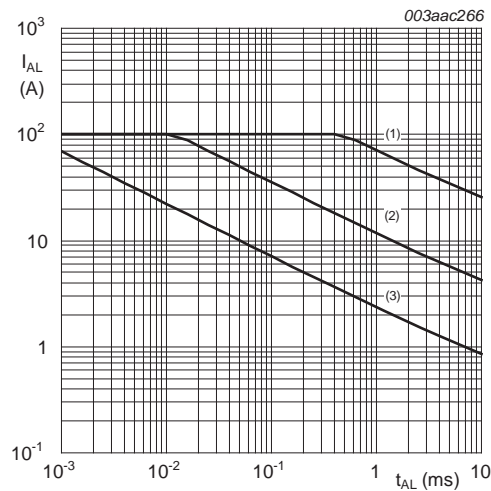
$V_{GS} \geq 10\text{ V}$; (1) Capped at 100 A due to package

Fig 1. Continuous drain current as a function of mounting base temperature



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

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



- (1) Single-pulse; $T_j = 25^\circ\text{C}$.
- (2) Single-pulse; $T_j = 175^\circ\text{C}$.
- (3) Repetitive.

Fig 3. Single-pulse and repetitive avalanche rating; avalanche current as a function of avalanche time

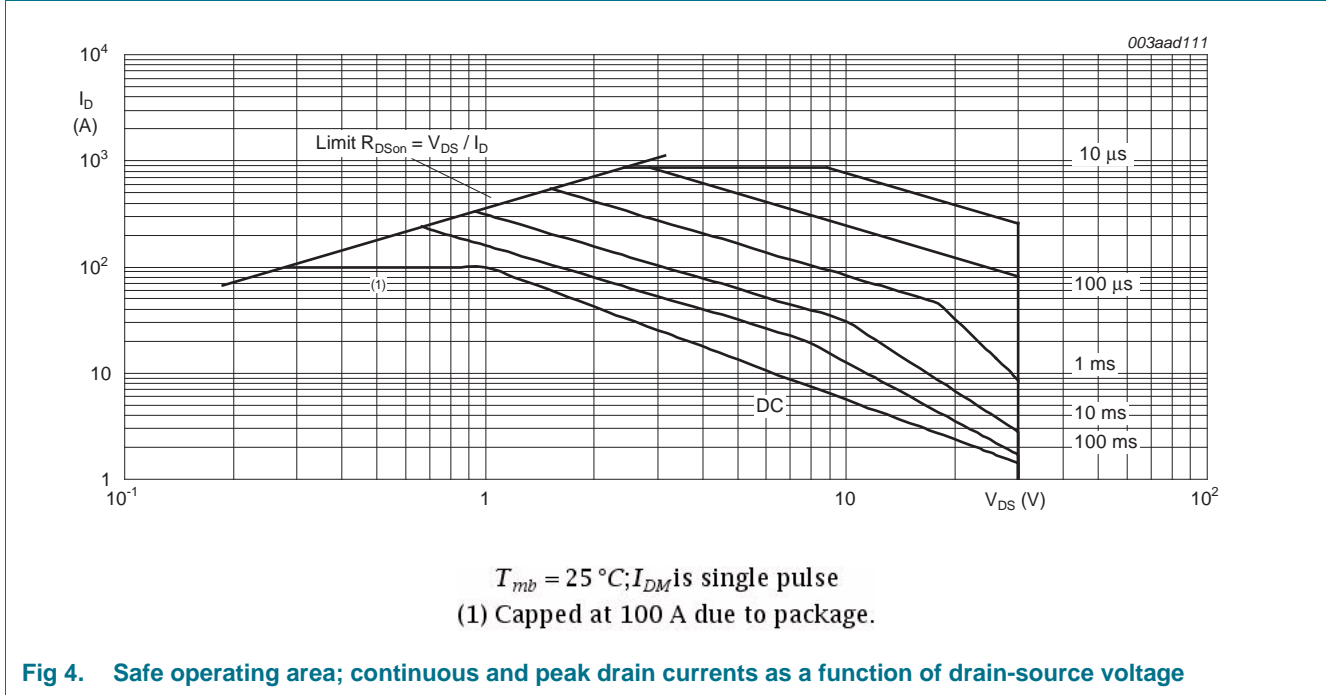


Fig 4. Safe operating area; continuous and peak drain currents as a function of drain-source voltage

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 Figure 5 | - | 0.5 | 1.1 | K/W |

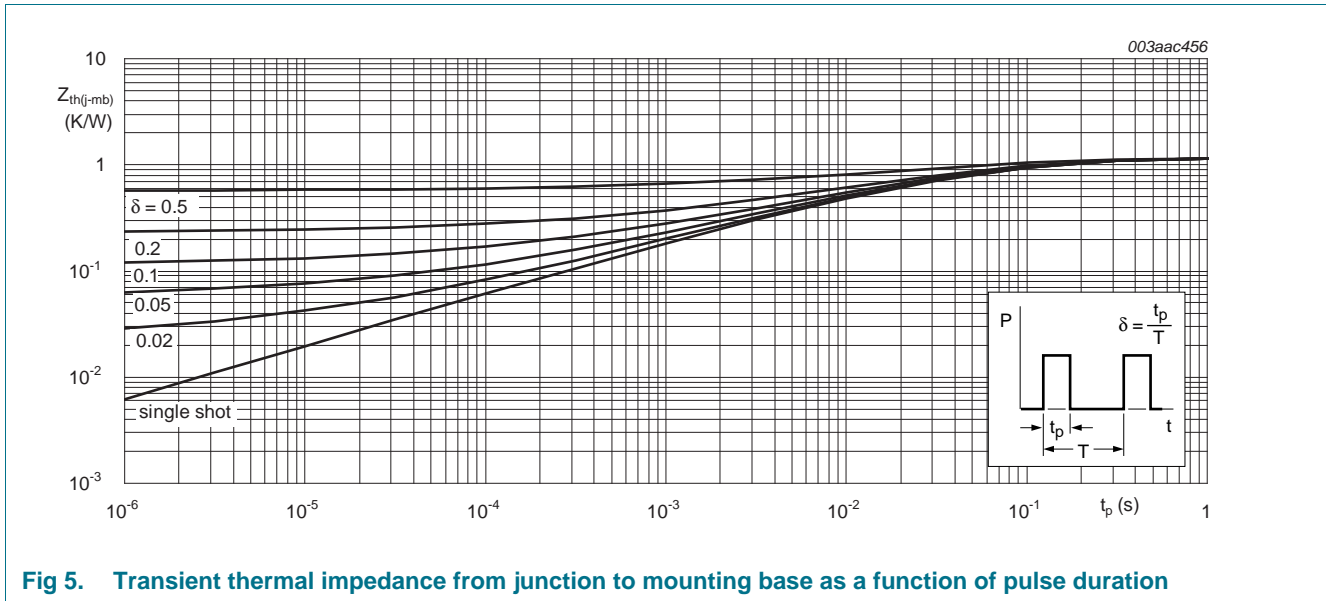


Fig 5. Transient thermal impedance from junction to mounting base as a function of pulse duration

6. Characteristics

Table 6. Characteristics
Tested to JEDEC standards where applicable.

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|--------------------------------|-----------------------------------|--|------|------|------|---------------|
| Static characteristics | | | | | | |
| $V_{(BR)DSS}$ | drain-source breakdown voltage | $I_D = 20\text{ A}; V_{GS} = 0\text{ V}; T_j = 25\text{ }^\circ\text{C}; t_{av} = 100\text{ ns}$ | 35 | - | - | V |
| | | $I_D = 250\text{ }\mu\text{A}; V_{GS} = 0\text{ V}; T_j = 25\text{ }^\circ\text{C}$ | 30 | - | - | V |
| | | $I_D = 250\text{ }\mu\text{A}; V_{GS} = 0\text{ V}; T_j = -55\text{ }^\circ\text{C}$ | 27 | - | - | V |
| $V_{GS(th)}$ | gate-source threshold voltage | $I_D = 1\text{ mA}; V_{DS} = V_{GS}; T_j = 25\text{ }^\circ\text{C};$ see Figure 12 ; see Figure 13 | 1.3 | 1.7 | 2.15 | V |
| | | $I_D = 1\text{ mA}; V_{DS} = V_{GS}; T_j = 150\text{ }^\circ\text{C};$ see Figure 13 | 0.65 | - | - | V |
| | | $I_D = 1\text{ mA}; V_{DS} = V_{GS}; T_j = -55\text{ }^\circ\text{C};$ see Figure 13 | - | - | 2.45 | V |
| I_{DSS} | drain leakage current | $V_{DS} = 30\text{ V}; V_{GS} = 0\text{ V}; T_j = 25\text{ }^\circ\text{C}$ | - | - | 1 | μA |
| | | $V_{DS} = 30\text{ V}; V_{GS} = 0\text{ V}; T_j = 150\text{ }^\circ\text{C}$ | - | - | 100 | μA |
| I_{GSS} | gate leakage current | $V_{GS} = 16\text{ V}; V_{DS} = 0\text{ V}; T_j = 25\text{ }^\circ\text{C}$ | - | - | 100 | nA |
| | | $V_{GS} = -16\text{ V}; V_{DS} = 0\text{ V}; T_j = 25\text{ }^\circ\text{C}$ | - | - | 100 | nA |
| $R_{DS(on)}$ | drain-source on-state resistance | $V_{GS} = 4.5\text{ V}; I_D = 15\text{ A}; T_j = 25\text{ }^\circ\text{C}$ | - | 1.8 | 1.9 | mΩ |
| | | $V_{GS} = 10\text{ V}; I_D = 15\text{ A}; T_j = 150\text{ }^\circ\text{C};$ see Figure 14 | - | - | 2.8 | mΩ |
| | | $V_{GS} = 10\text{ V}; I_D = 15\text{ A}; T_j = 100\text{ }^\circ\text{C};$ see Figure 14 | - | - | 2.4 | mΩ |
| | | $V_{GS} = 10\text{ V}; I_D = 15\text{ A}; T_j = 25\text{ }^\circ\text{C}$ | - | 1.3 | 1.5 | mΩ |
| R_G | gate resistance | $f = 1\text{ MHz}$ | - | 0.77 | 1.5 | Ω |
| Dynamic characteristics | | | | | | |
| $Q_{G(tot)}$ | total gate charge | $I_D = 10\text{ A}; V_{DS} = 12\text{ V}; V_{GS} = 10\text{ V};$ see Figure 15 ; see Figure 16 | - | 77.9 | - | nC |
| | | $I_D = 0\text{ A}; V_{DS} = 0\text{ V}; V_{GS} = 10\text{ V}$ | - | 70 | - | nC |
| | | $I_D = 10\text{ A}; V_{DS} = 12\text{ V}; V_{GS} = 4.5\text{ V};$ see Figure 15 | - | 36.2 | - | nC |
| Q_{GS} | gate-source charge | $I_D = 10\text{ A}; V_{DS} = 12\text{ V}; V_{GS} = 4.5\text{ V};$ see Figure 15 ; see Figure 16 | - | 11.6 | - | nC |
| $Q_{GS(th)}$ | pre-threshold gate-source charge | | - | 8 | - | nC |
| $Q_{GS(th-pl)}$ | post-threshold gate-source charge | | - | 3.6 | - | nC |
| Q_{GD} | gate-drain charge | | - | 8.7 | - | nC |
| $V_{GS(pl)}$ | gate-source plateau voltage | $V_{DS} = 12\text{ V};$ see Figure 15 ; see Figure 16 | - | 2.34 | - | V |
| C_{iss} | input capacitance | $V_{DS} = 12\text{ V}; V_{GS} = 0\text{ V}; f = 1\text{ MHz};$ $T_j = 25\text{ }^\circ\text{C};$ see Figure 17 | - | 5057 | - | pF |
| C_{oss} | output capacitance | | - | 1082 | - | pF |
| C_{rss} | reverse transfer capacitance | | - | 398 | - | pF |

Table 6. Characteristics ...continued
 Tested to JEDEC standards where applicable.

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|---------------------------|-----------------------|--|-----|------|-----|------|
| $t_{d(on)}$ | turn-on delay time | $V_{DS} = 12\text{ V}; R_L = 0.5\ \Omega; V_{GS} = 4.5\text{ V};$ | - | 46 | - | ns |
| t_r | rise time | $R_{G(ext)} = 4.7\ \Omega$ | - | 72 | - | ns |
| $t_{d(off)}$ | turn-off delay time | | - | 76 | - | ns |
| t_f | fall time | | - | 34 | - | ns |
| Source-drain diode | | | | | | |
| V_{SD} | source-drain voltage | $I_S = 25\text{ A}; V_{GS} = 0\text{ V}; T_j = 25\text{ }^\circ\text{C};$ see Figure 18 | - | 0.78 | 1.2 | V |
| t_{rr} | reverse recovery time | $I_S = 20\text{ A}; dI_S/dt = -100\text{ A}/\mu\text{s}; V_{GS} = 0\text{ V};$ | - | 45 | - | ns |
| Q_r | recovered charge | $V_{DS} = 20\text{ V}$ | - | 56 | - | nC |

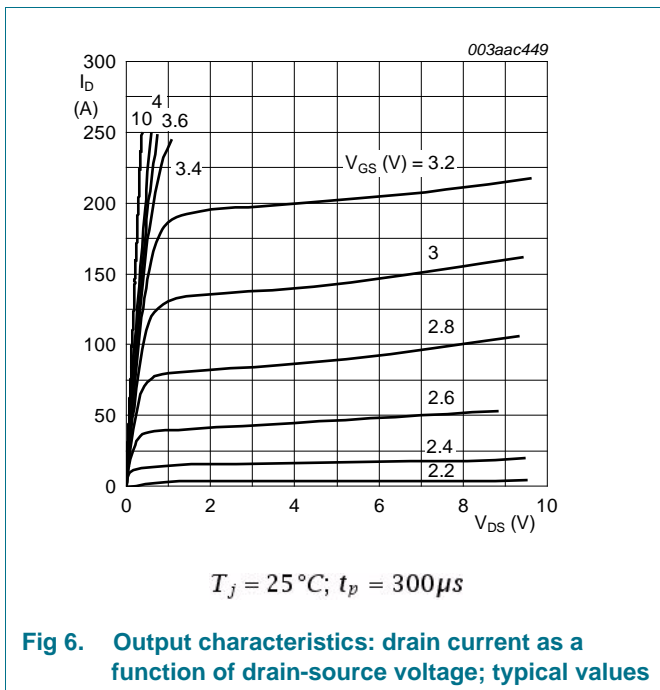


Fig 6. Output characteristics: drain current as a function of drain-source voltage; typical values

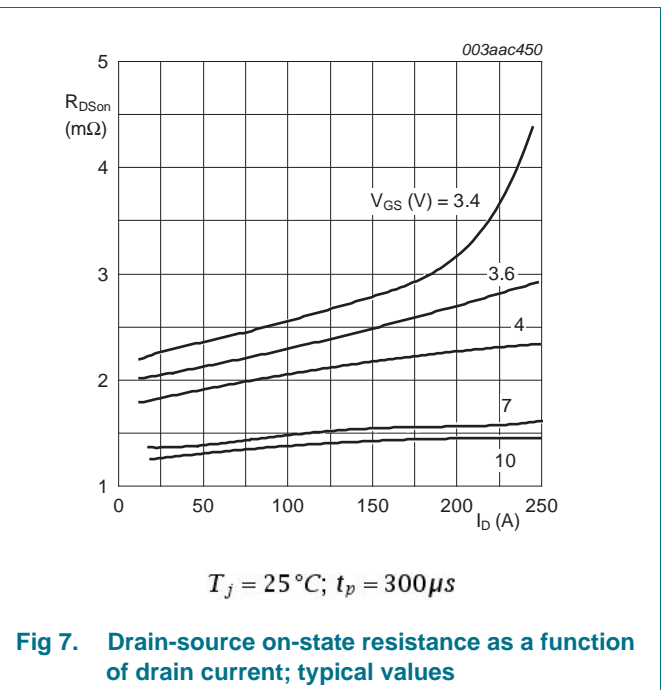
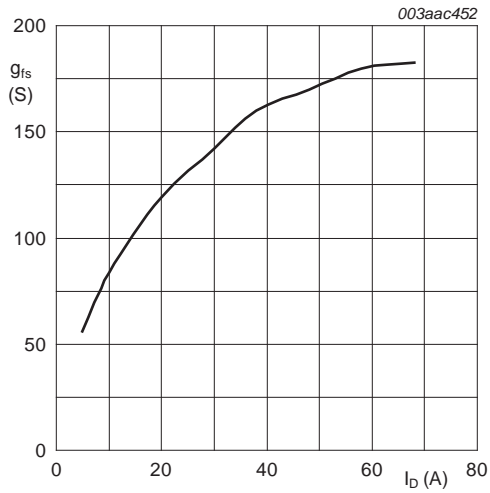
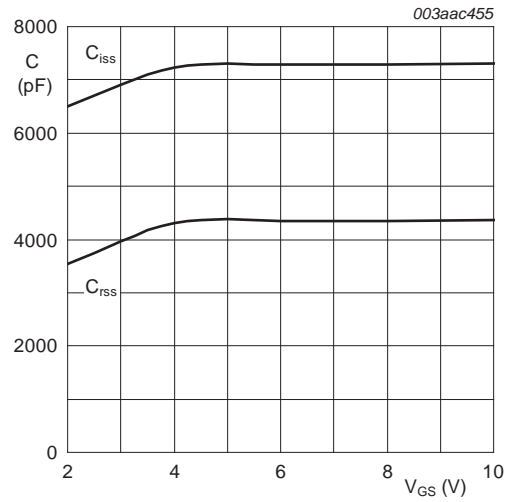


Fig 7. Drain-source on-state resistance as a function of drain current; typical values



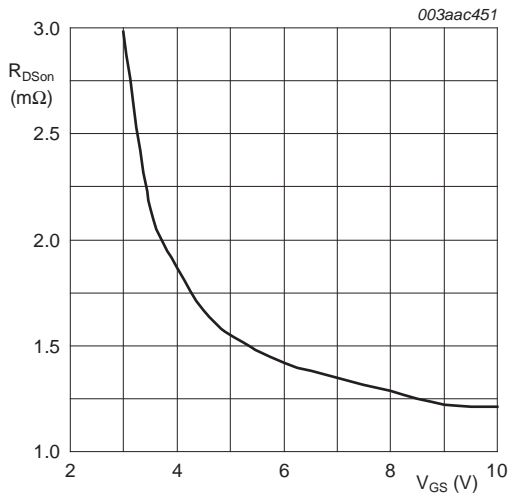
$T_j = 25^\circ\text{C}; V_{DS} = 15\text{V}$

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



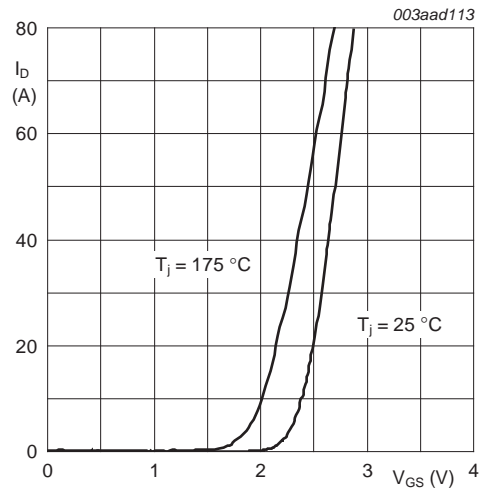
$V_{DS} = 0\text{V}; f = 1\text{MHz}$

Fig 9. Input and reverse transfer capacitances as a function of gate-source voltage; typical values



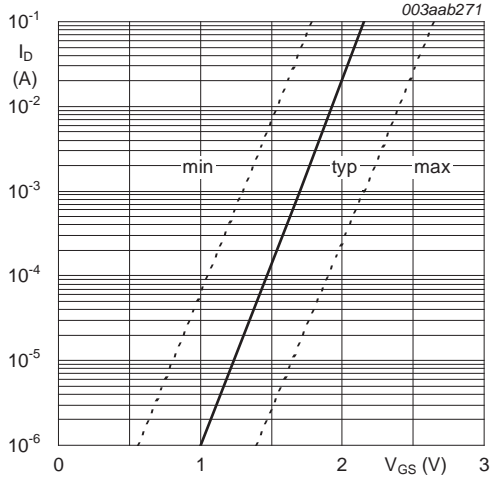
$T_j = 25^\circ\text{C}; I_D = 15\text{A}$

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



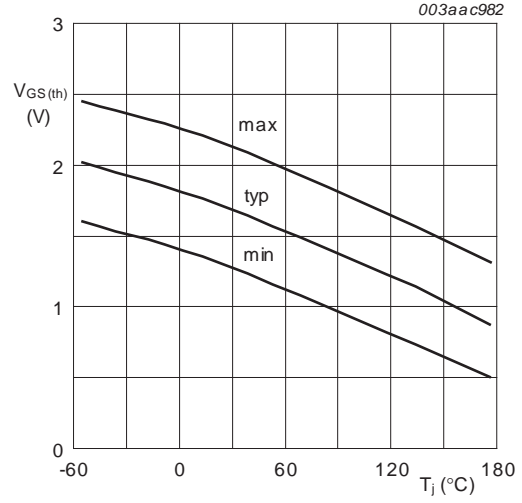
$V_{DS} = 15\text{V}$

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



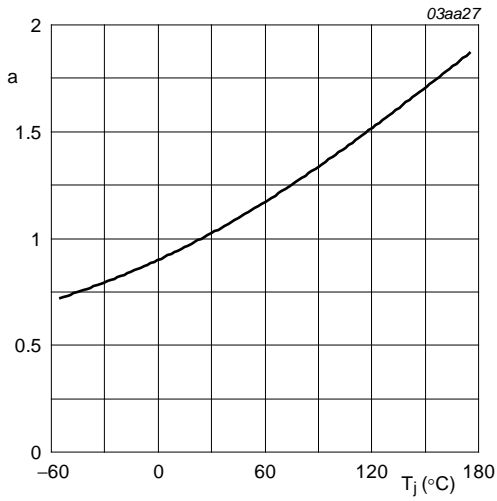
$T_j = 25^\circ\text{C}; V_{DS} = 5\text{V}$

Fig 12. Sub-threshold drain current as a function of gate-source voltage



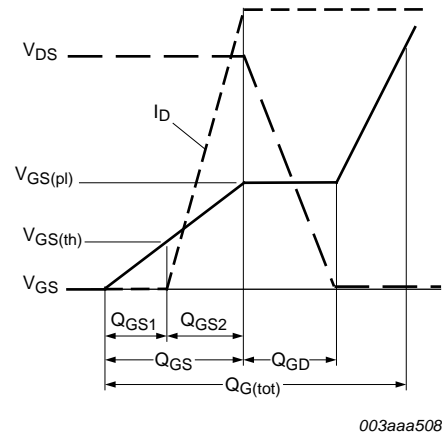
$I_D = 1\text{mA}; V_{DS} = V_{GS}$

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



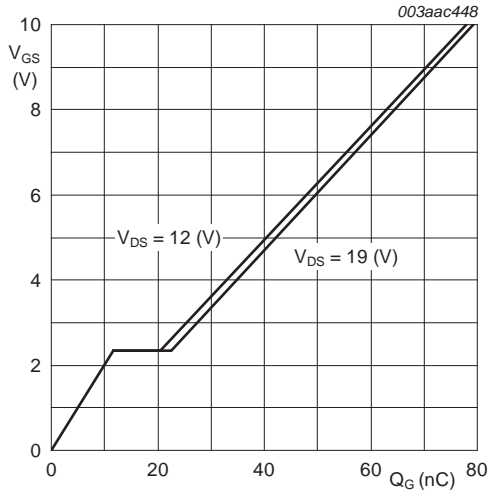
$$a = \frac{R_{DSon}}{R_{DSon(25^\circ\text{C})}}$$

Fig 14. Normalized drain-source on-state resistance factor as a function of junction temperature



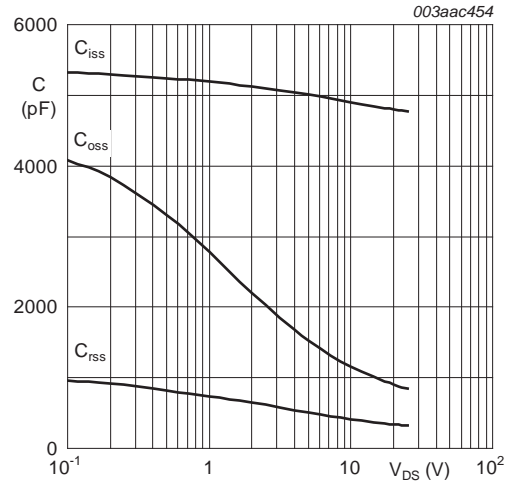
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Fig 15. Gate charge waveform definitions



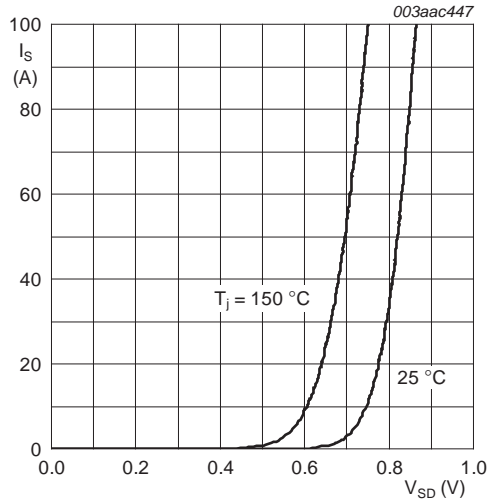
$T_j = 25\text{ }^\circ\text{C}; I_D = 10\text{ A}$

Fig 16. Gate-source voltage as a function of gate charge; typical values



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

Fig 17. Input, output and reverse transfer capacitances as a function of drain-source voltage; typical values



$V_{GS} = 0\text{ V}$

Fig 18. Source (diode forward) current as a function of source-drain (diode forward) voltage; typical values

7. Package outline

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

SOT669

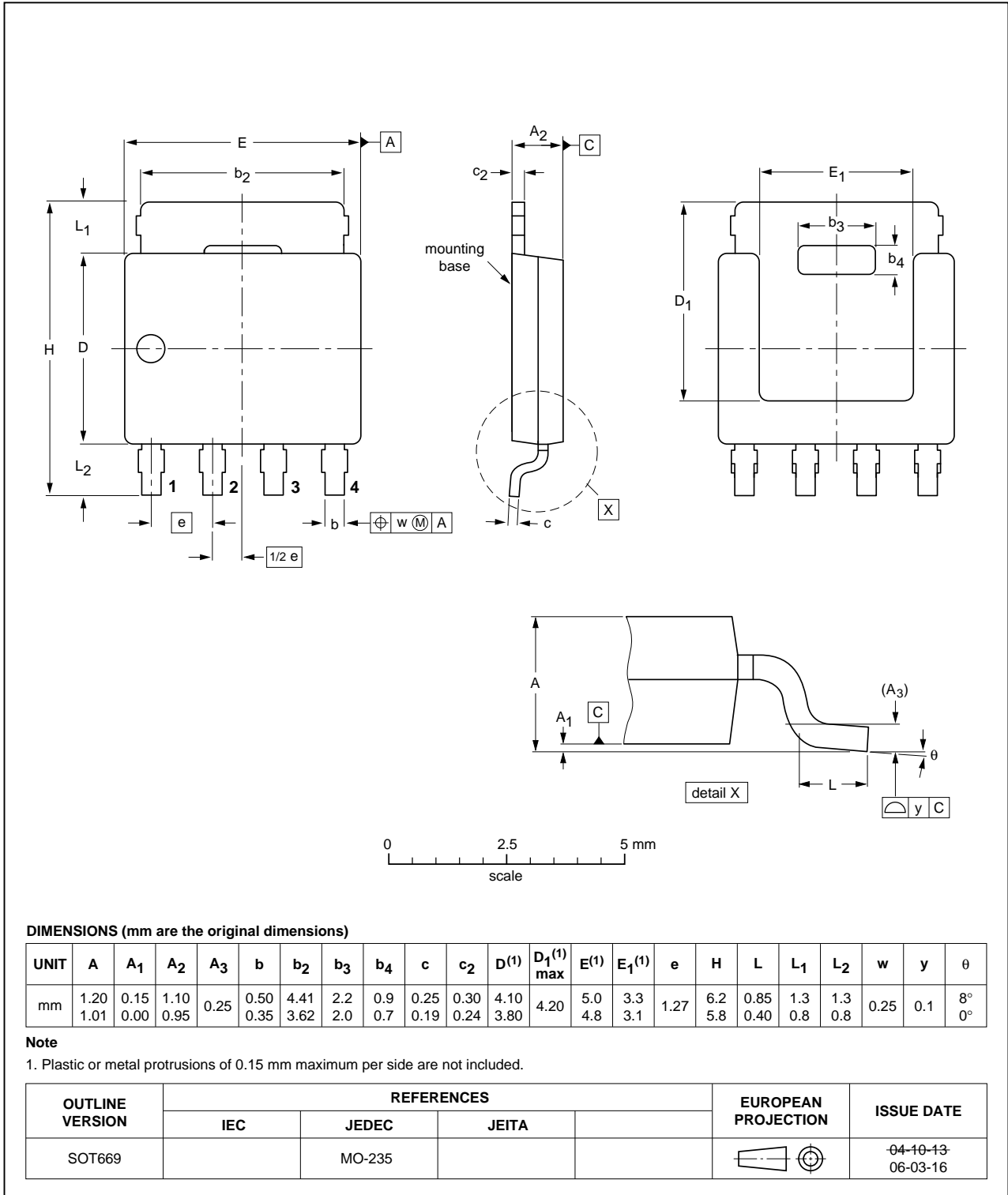


Fig 19. Package outline SOT669 (LPAK)

8. Revision history

Table 7. Revision history

| Document ID | Release date | Data sheet status | Change notice | Supersedes |
|----------------|--------------|--------------------|---------------|------------|
| PSMN1R5-30YL_1 | 20100409 | Product data sheet | - | - |

9. Legal information

9.1 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. |
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[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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10. Contact information

For more information, please visit: <http://www.nxp.com>

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11. Contents

| | | |
|-----------|--|-----------|
| 1 | Product profile | 1 |
| 1.1 | General description | 1 |
| 1.2 | Features and benefits | 1 |
| 1.3 | Applications | 1 |
| 1.4 | Quick reference data | 1 |
| 2 | Pinning information | 2 |
| 3 | Ordering information | 2 |
| 4 | Limiting values | 3 |
| 5 | Thermal characteristics | 5 |
| 6 | Characteristics | 6 |
| 7 | Package outline | 11 |
| 8 | Revision history | 12 |
| 9 | Legal information | 13 |
| 9.1 | Data sheet status | 13 |
| 9.2 | Definitions | 13 |
| 9.3 | Disclaimers | 13 |
| 9.4 | Trademarks | 14 |
| 10 | Contact information | 14 |

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