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Kind regards,

Team Nexperia

PSMN039-100YS

N-channel LPAK 100 V 39.5 m Ω standard level MOSFET

Rev. 02 — 2 April 2010

Product data sheet

1. Product profile

1.1 General description

Standard level N-channel MOSFET in LPAK 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 RDSon and low gate charge
- High efficiency gains in switching power converters
- Improved mechanical and thermal characteristics
- LPAK 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

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|--------------------------------|--|---|-----|-----|------|------|
| V _{DS} | drain-source voltage | T _j ≥ 25 °C; T _j ≤ 175 °C | - | - | 100 | V |
| I _D | drain current | T _{mb} = 25 °C; V _{GS} = 10 V; see Figure 1 | - | - | 28.1 | A |
| P _{tot} | total power dissipation | T _{mb} = 25 °C; see Figure 2 | - | - | 74 | W |
| T _j | junction temperature | | -55 | - | 175 | °C |
| Avalanche ruggedness | | | | | | |
| E _{DS(AL)S} | non-repetitive drain-source avalanche energy | V _{GS} = 10 V; T _{j(init)} = 25 °C; I _D = 28.1 A; V _{sup} ≤ 100 V; unclamped; R _{GS} = 50 Ω | - | - | 42 | mJ |
| Dynamic characteristics | | | | | | |
| Q _{GD} | gate-drain charge | V _{GS} = 10 V; I _D = 15 A; | - | 8 | - | nC |
| Q _{G(tot)} | total gate charge | V _{DS} = 50 V; see Figure 14 and 15 | - | 23 | - | nC |

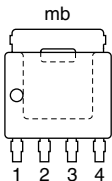
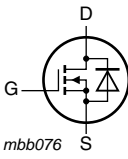


Table 1. Quick reference ...continued

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|-------------------------------|----------------------------------|--|-----|------|------|------|
| Static characteristics | | | | | | |
| R _{DSon} | drain-source on-state resistance | V _{GS} = 10 V; I _D = 15 A; T _j = 100 °C; see Figure 12 | - | - | 71 | mΩ |
| | | V _{GS} = 10 V; I _D = 15 A; T _j = 25 °C; see Figure 13 | - | 30.8 | 39.5 | mΩ |

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)

3. Ordering information

Table 3. Ordering information

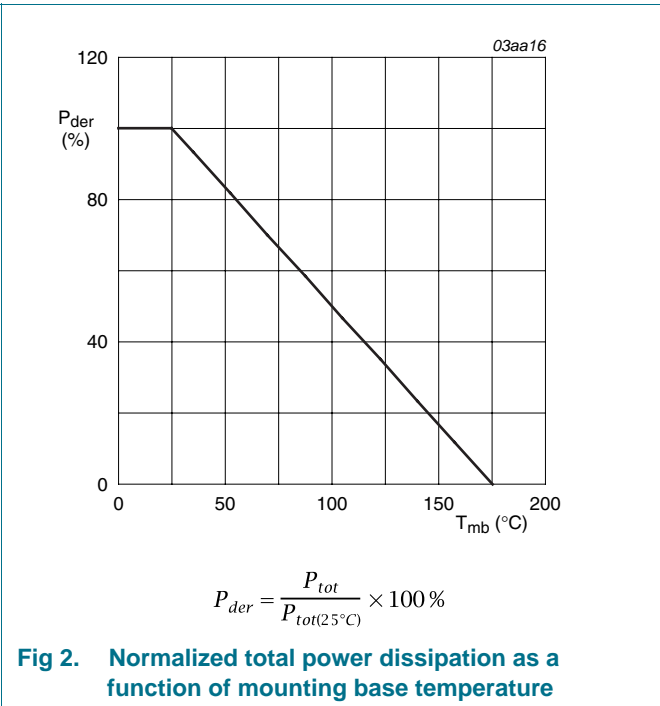
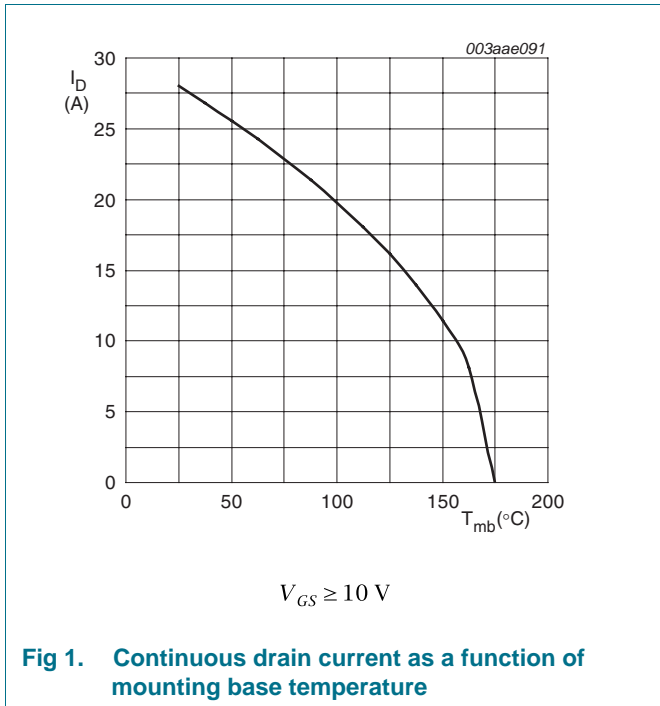
| Type number | Package | | Version |
|---------------|---------|--|---------|
| | Name | Description | |
| PSMN039-100YS | LPAK | plastic single-ended surface-mounted package (LPAK); 4 leads | SOT669 |

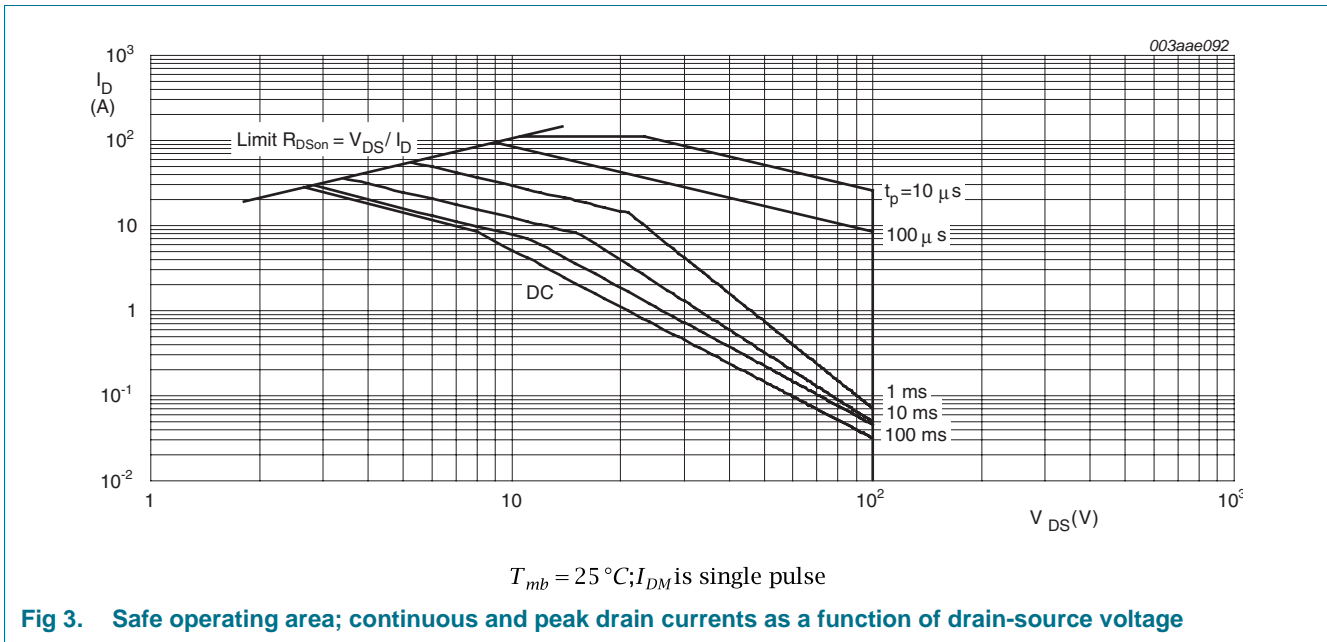
4. Limiting values

Table 4. Limiting values

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

| Symbol | Parameter | Conditions | Min | Max | Unit |
|-----------------------------|--|--|-----|------|------|
| V _{DS} | drain-source voltage | T _j ≥ 25 °C; T _j ≤ 175 °C | - | 100 | V |
| V _{DGR} | drain-gate voltage | T _j ≤ 175 °C; T _j ≥ 25 °C; R _{GS} = 20 kΩ | - | 100 | V |
| V _{GS} | gate-source voltage | | -20 | 20 | V |
| I _D | drain current | V _{GS} = 10 V; T _{mb} = 100 °C; see Figure 1 | - | 20 | A |
| | | V _{GS} = 10 V; T _{mb} = 25 °C; see Figure 1 | - | 28.1 | A |
| I _{DM} | peak drain current | t _p ≤ 10 μs; pulsed; T _{mb} = 25 °C; see Figure 3 | - | 112 | A |
| P _{tot} | total power dissipation | T _{mb} = 25 °C; see Figure 2 | - | 74 | W |
| T _{stg} | storage temperature | | -55 | 175 | °C |
| T _j | junction temperature | | -55 | 175 | °C |
| T _{slid(M)} | peak soldering temperature | | - | 260 | °C |
| Source-drain diode | | | | | |
| I _S | source current | T _{mb} = 25 °C | - | 28.1 | A |
| I _{SM} | peak source current | t _p ≤ 10 μs; pulsed; T _{mb} = 25 °C | - | 112 | A |
| Avalanche ruggedness | | | | | |
| E _{DS(AL)S} | non-repetitive drain-source avalanche energy | V _{GS} = 10 V; T _{j(init)} = 25 °C; I _D = 28.1 A; V _{sup} ≤ 100 V; unclamped; R _{GS} = 50 Ω | - | 42 | 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 Figure 4 | - | 1 | 2.03 | K/W |

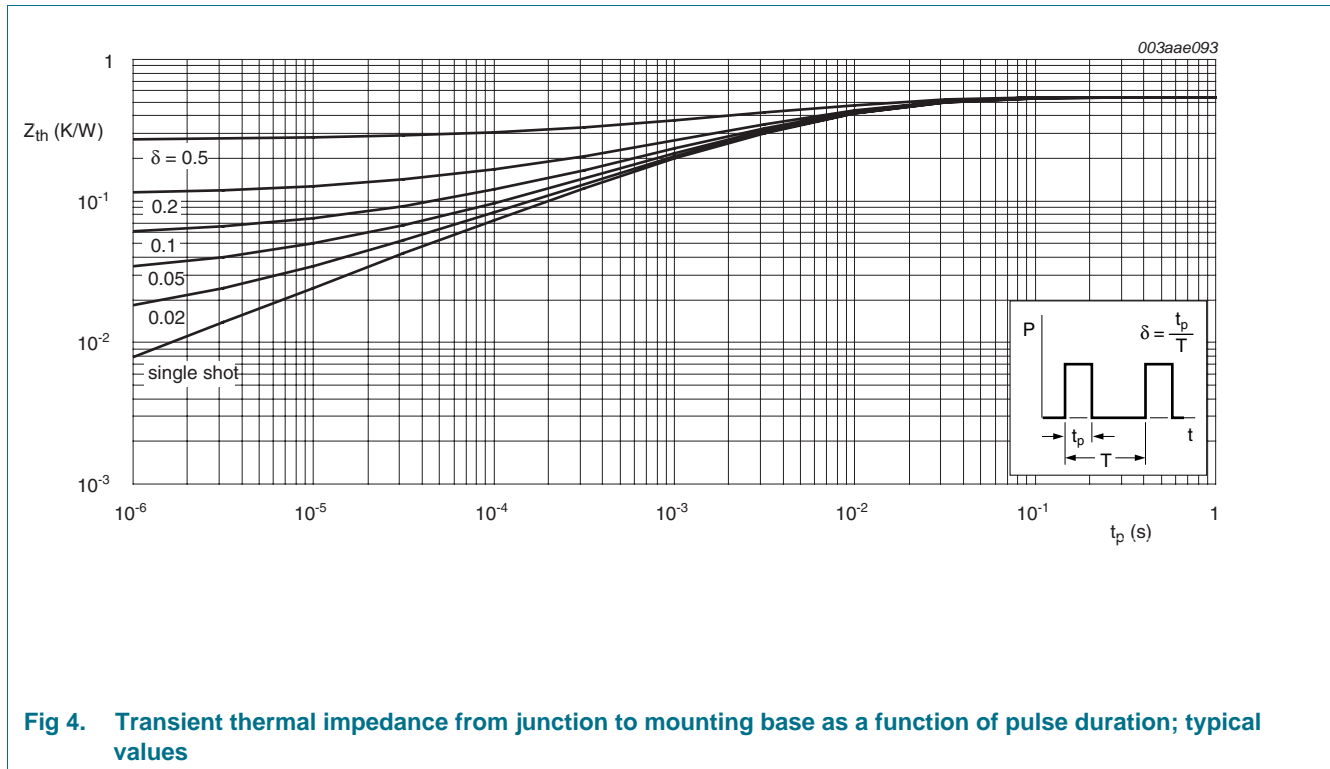


Fig 4. Transient thermal impedance from junction to mounting base as a function of pulse duration; typical values

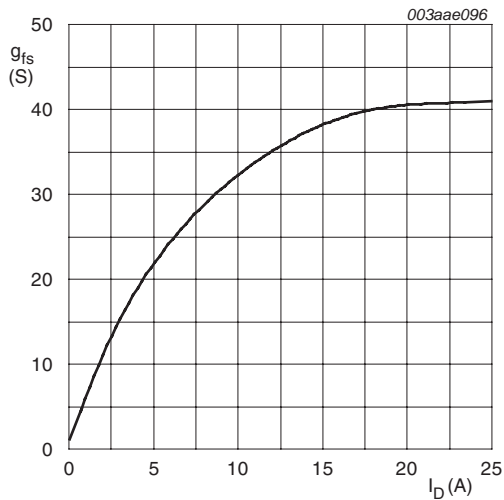
6. Characteristics

Table 6. Characteristics

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|--------------------------------|-----------------------------------|---|-----|------|------|---------------|
| Static characteristics | | | | | | |
| $V_{(BR)DSS}$ | drain-source breakdown voltage | $I_D = 0.25 \text{ mA}; V_{GS} = 0 \text{ V}; T_j = -55 \text{ }^\circ\text{C}$ | 90 | - | - | V |
| | | $I_D = 0.25 \text{ mA}; V_{GS} = 0 \text{ V}; T_j = 25 \text{ }^\circ\text{C}$ | 100 | - | - | V |
| $V_{GS(th)}$ | gate-source threshold voltage | $I_D = 1 \text{ mA}; V_{DS} = V_{GS}; T_j = 175 \text{ }^\circ\text{C};$ see Figure 10 | 1 | - | - | V |
| | | $I_D = 1 \text{ mA}; V_{DS} = V_{GS}; T_j = 25 \text{ }^\circ\text{C};$ see Figure 11 and 10 | 2 | 3 | 4 | V |
| | | $I_D = 1 \text{ mA}; V_{DS} = V_{GS}; T_j = -55 \text{ }^\circ\text{C};$ see Figure 10 | - | - | 4.7 | V |
| I_{DSS} | drain leakage current | $V_{DS} = 100 \text{ V}; V_{GS} = 0 \text{ V}; T_j = 125 \text{ }^\circ\text{C}$ | - | - | 50 | μA |
| | | $V_{DS} = 100 \text{ V}; V_{GS} = 0 \text{ V}; T_j = 25 \text{ }^\circ\text{C}$ | - | 0.01 | 2 | μA |
| I_{GSS} | gate leakage current | $V_{GS} = 20 \text{ V}; V_{DS} = 0 \text{ V}; T_j = 25 \text{ }^\circ\text{C}$ | - | 2 | 100 | nA |
| | | $V_{GS} = -20 \text{ V}; V_{DS} = 0 \text{ V}; T_j = 25 \text{ }^\circ\text{C}$ | - | 2 | 100 | nA |
| $R_{DS(on)}$ | drain-source on-state resistance | $V_{GS} = 10 \text{ V}; I_D = 15 \text{ A}; T_j = 100 \text{ }^\circ\text{C};$ see Figure 12 | - | - | 71 | mΩ |
| | | $V_{GS} = 10 \text{ V}; I_D = 15 \text{ A}; T_j = 175 \text{ }^\circ\text{C};$ see Figure 12 | - | 72.9 | 100 | mΩ |
| | | $V_{GS} = 10 \text{ V}; I_D = 15 \text{ A}; T_j = 25 \text{ }^\circ\text{C};$ see Figure 13 | - | 30.8 | 39.5 | mΩ |
| R_G | internal gate resistance (AC) | $f = 1 \text{ MHz}$ | - | 0.62 | 1.5 | Ω |
| Dynamic characteristics | | | | | | |
| $Q_{G(tot)}$ | total gate charge | $I_D = 15 \text{ A}; V_{DS} = 50 \text{ V}; V_{GS} = 10 \text{ V};$ see Figure 14 and 15 | - | 23 | - | nC |
| | | $I_D = 0 \text{ A}; V_{DS} = 0 \text{ V}; V_{GS} = 10 \text{ V}$ | - | 19 | - | nC |
| Q_{GS} | gate-source charge | $I_D = 15 \text{ A}; V_{DS} = 50 \text{ V}; V_{GS} = 10 \text{ V};$ see Figure 14 | - | 5 | - | nC |
| $Q_{GS(th)}$ | pre-threshold gate-source charge | | - | 3 | - | nC |
| $Q_{GS(th-pl)}$ | post-threshold gate-source charge | | - | 2 | - | nC |
| Q_{GD} | gate-drain charge | $I_D = 15 \text{ A}; V_{DS} = 50 \text{ V}; V_{GS} = 10 \text{ V};$ see Figure 14 and 15 | - | 8 | - | nC |
| $V_{GS(pl)}$ | gate-source plateau voltage | $V_{DS} = 50 \text{ V};$ see Figure 14 and 15 | - | 4.5 | - | V |
| C_{iss} | input capacitance | $V_{DS} = 50 \text{ V}; V_{GS} = 0 \text{ V}; f = 1 \text{ MHz};$ $T_j = 25 \text{ }^\circ\text{C};$ see Figure 16 | - | 1847 | - | pF |
| C_{oss} | output capacitance | | - | 86 | - | pF |
| C_{rss} | reverse transfer capacitance | | - | 64 | - | pF |
| $t_{d(on)}$ | turn-on delay time | $V_{DS} = 50 \text{ V}; R_L = 3.3 \text{ }^\circ\Omega; V_{GS} = 10 \text{ V};$ $R_{G(ext)} = 4.7 \text{ }^\circ\Omega; T_j = 25 \text{ }^\circ\text{C}$ | - | 11 | - | ns |
| t_r | rise time | | - | 8 | - | ns |
| $t_{d(off)}$ | turn-off delay time | | - | 22 | - | ns |
| t_f | fall time | | - | 7 | - | ns |

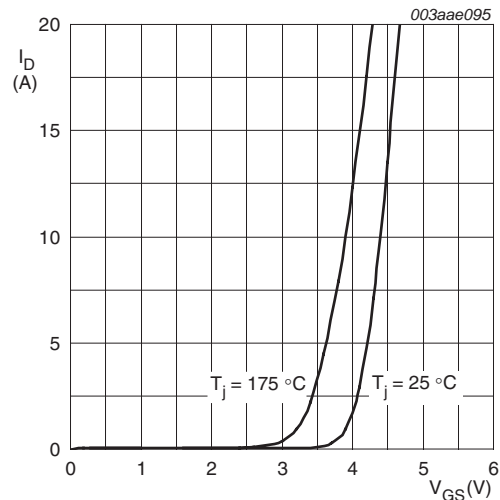
Table 6. Characteristics ...continued

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|---------------------------|-----------------------|--|-----|-----|-----|------|
| Source-drain diode | | | | | | |
| V_{SD} | source-drain voltage | $I_S = 15\text{ A}$; $V_{GS} = 0\text{ V}$; $T_j = 25\text{ °C}$; see Figure 17 | - | 0.8 | 1.2 | V |
| t_{rr} | reverse recovery time | $I_S = 5\text{ A}$; $di_S/dt = 100\text{ A}/\mu\text{s}$; $V_{GS} = 0\text{ V}$; | - | 44 | - | ns |
| Q_r | recovered charge | $V_{DS} = 50\text{ V}$ | - | 78 | - | nC |



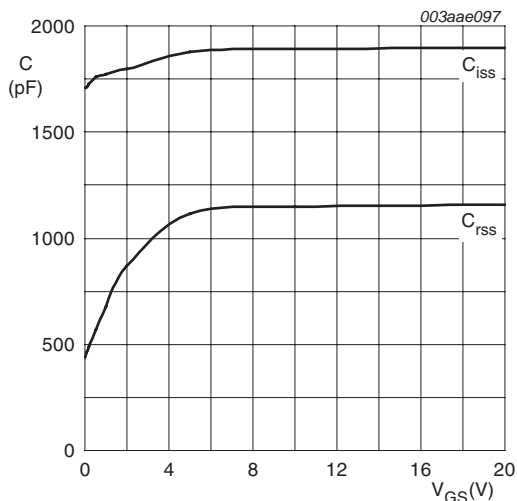
$T_j = 25\text{ °C}$; $V_{DS} = 10\text{ V}$

Fig 5. Forward transconductance as a function of drain current; typical values



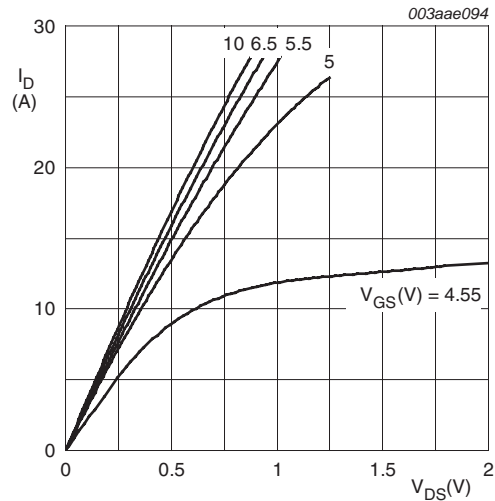
$V_{DS} > I_D \times R_{DSon}$

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



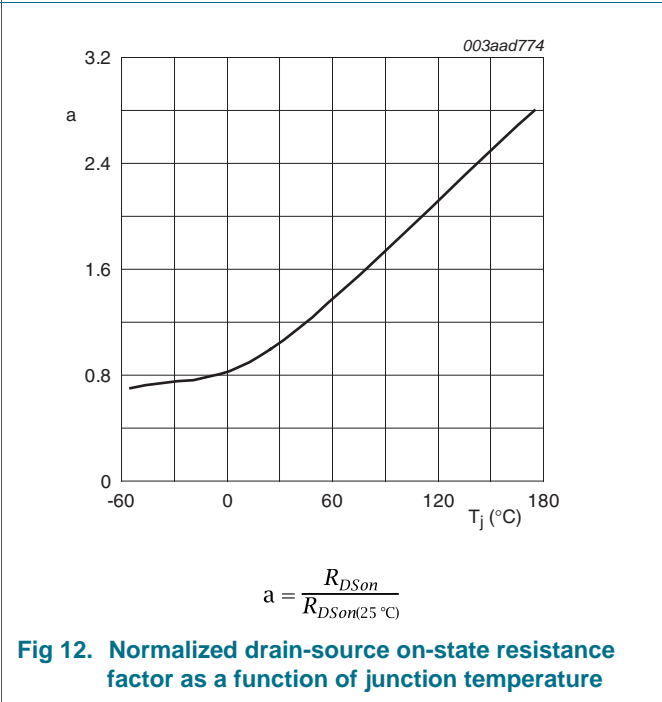
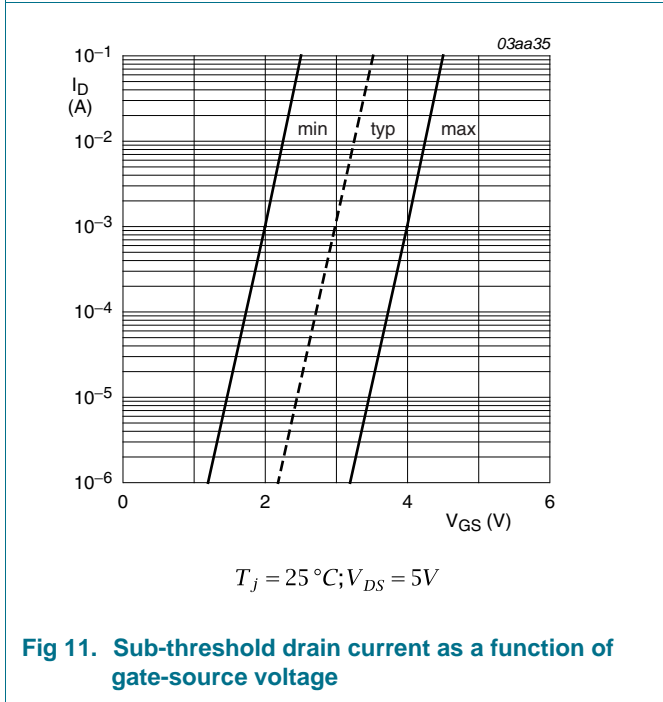
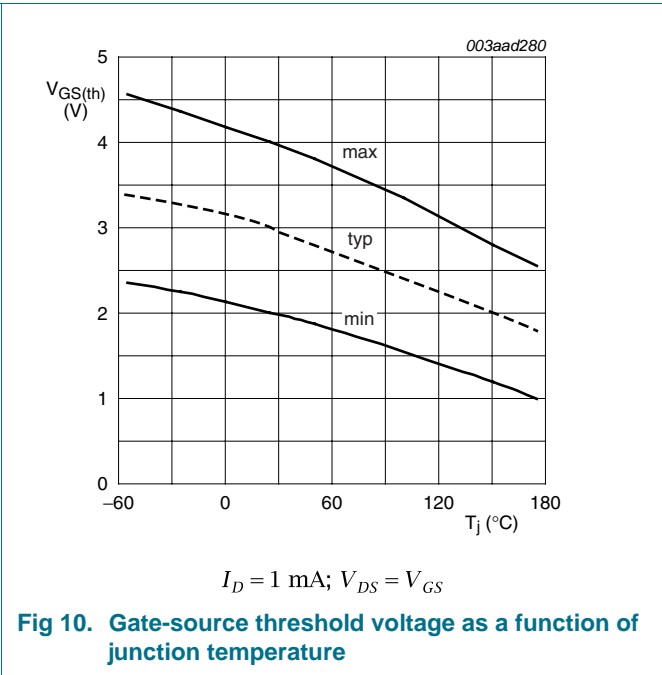
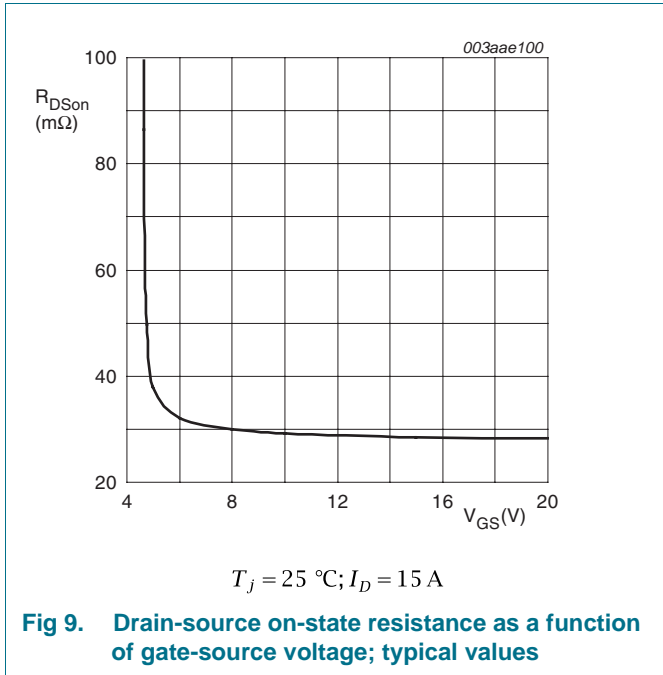
$V_{GS} = 0\text{ V}$; $f = 1\text{ MHz}$

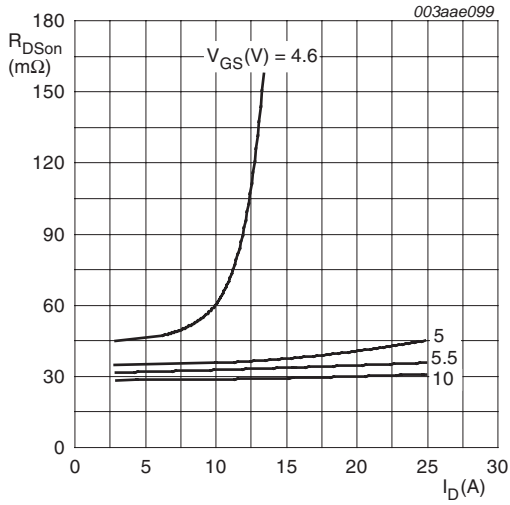
Fig 7. Input, output and reverse transfer capacitances as a function of drain-source voltage; typical values



$T_j = 25\text{ °C}$

Fig 8. Output characteristics: drain current as a function of drain-source voltage; typical values





$T_j = 25^\circ C$

Fig 13. Drain-source on-state resistance as a function of drain current; typical values

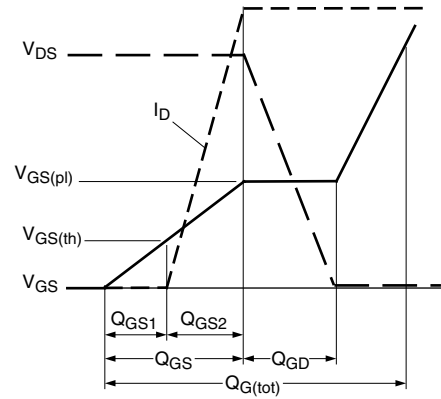
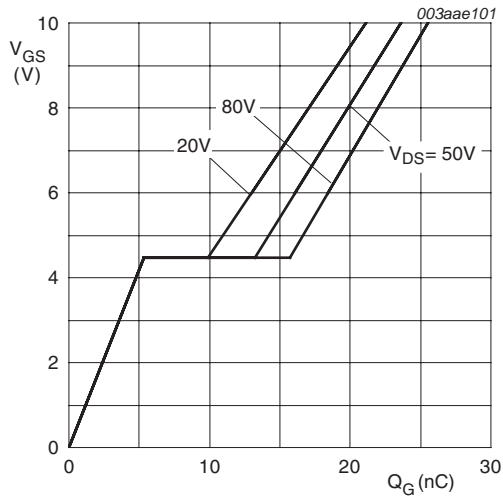
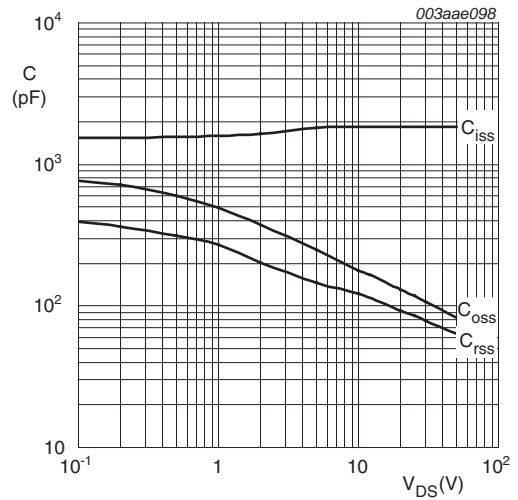


Fig 14. Gate charge waveform definitions



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

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



$T_j = 25^\circ C$

Fig 16. Drain-source on-state resistance as a function of drain current; typical values

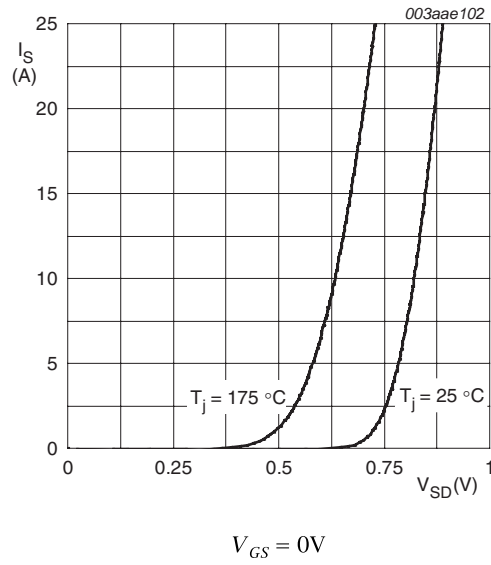


Fig 17. Source (diode forward) current as a function of source-drain (diode forward) voltage; typical values

7. Package outline

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

SOT669

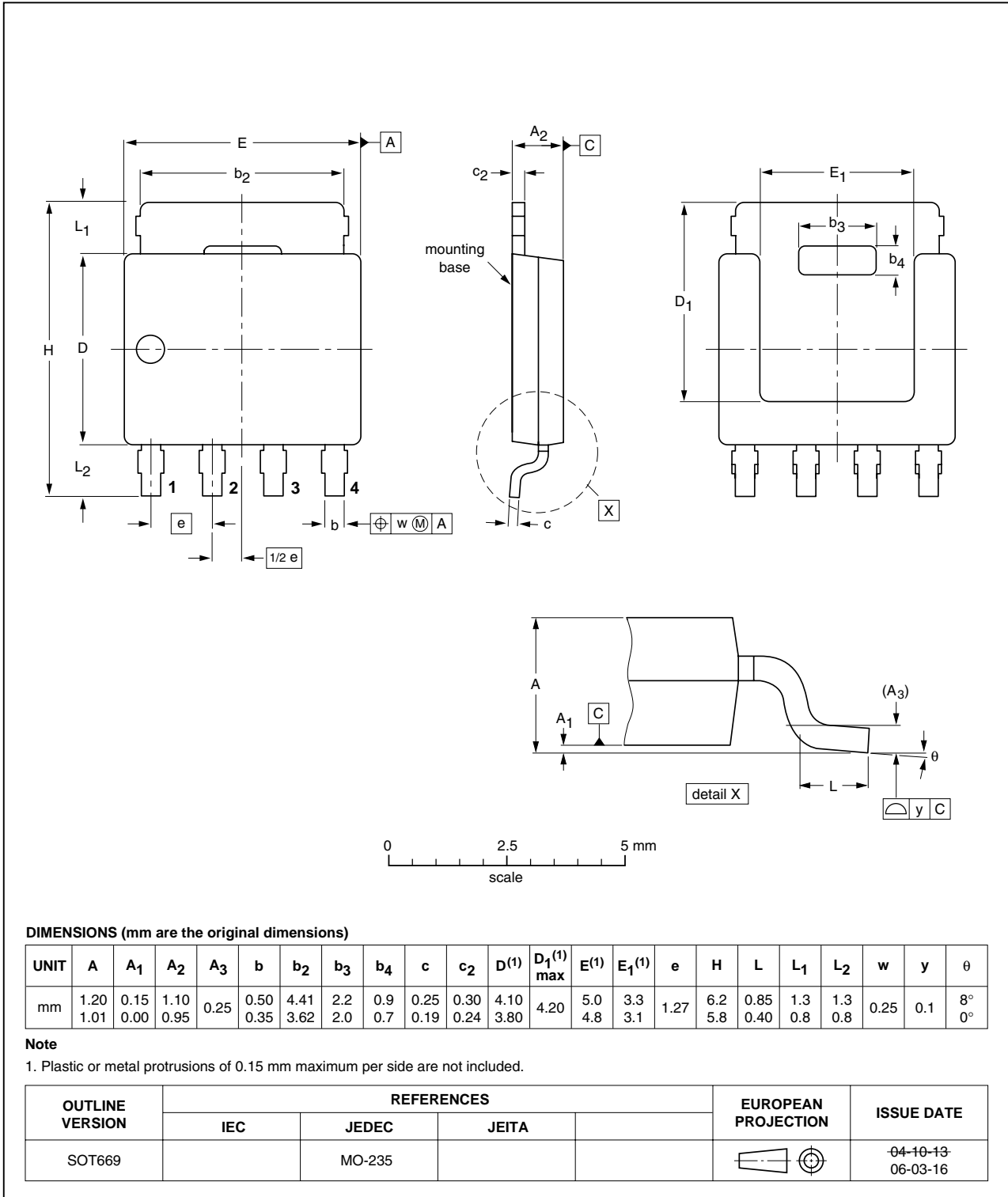


Fig 18. Package outline SOT669 (LPAK)

8. Revision history

Table 7. Revision history

| Document ID | Release date | Data sheet status | Change notice | Supersedes |
|-----------------|---|----------------------|---------------|-----------------|
| PSMN039-100YS_2 | 20100402 | Product data sheet | - | PSMN039-100YS_1 |
| Modifications: | • Status changed from Objective to Product. | | | |
| PSMN039-100YS_1 | 20100114 | Objective 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. |
| 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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