



PSMN7R5-25YLC

N-channel 25 V 7.4 m Ω logic level MOSFET in LPAK using NextPower technology

Rev. 2 — 31 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

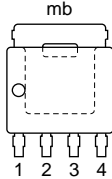
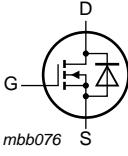
Table 1. Quick reference data

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|--------------------------------|----------------------------------|---|-----|-----|-----|------------|
| V _{DS} | drain-source voltage | 25 °C ≤ T _j ≤ 175 °C | - | - | 25 | V |
| I _D | drain current | T _{mb} = 25 °C; V _{GS} = 10 V; see Figure 1 | - | - | 56 | A |
| P _{tot} | total power dissipation | T _{mb} = 25 °C; see Figure 2 | - | - | 42 | W |
| T _j | junction temperature | | -55 | - | 175 | °C |
| Static characteristics | | | | | | |
| R _{DSon} | drain-source on-state resistance | V _{GS} = 4.5 V; I _D = 15 A; T _j = 25 °C; see Figure 12 | - | 8.4 | 9.8 | m Ω |
| | | V _{GS} = 10 V; I _D = 15 A; T _j = 25 °C; see Figure 12 | - | 6.3 | 7.4 | m Ω |
| Dynamic characteristics | | | | | | |
| Q _{GD} | gate-drain charge | V _{GS} = 4.5 V; I _D = 15 A; V _{DS} = 12 V; see Figure 14 ; see Figure 15 | - | 2.2 | - | nC |
| Q _{G(tot)} | total gate charge | | - | 7 | - | 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

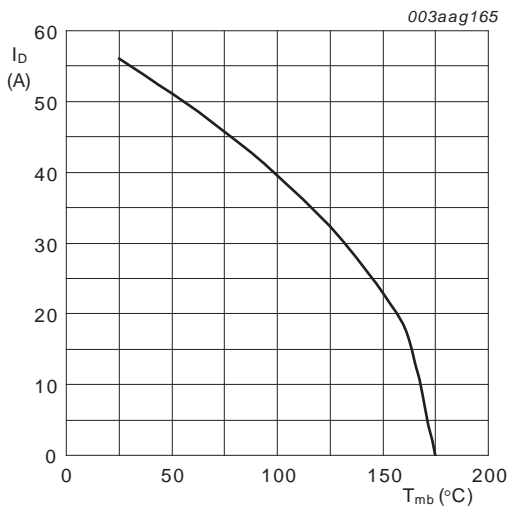
| Type number | Package | | Description | Version |
|---------------|-----------------|--|---|---------|
| | Name | | | |
| PSMN7R5-25YLC | LPAK; Power-SO8 | | plastic single-ended surface-mounted package; 4 leads | SOT669 |

4. Limiting values

Table 4. Limiting values

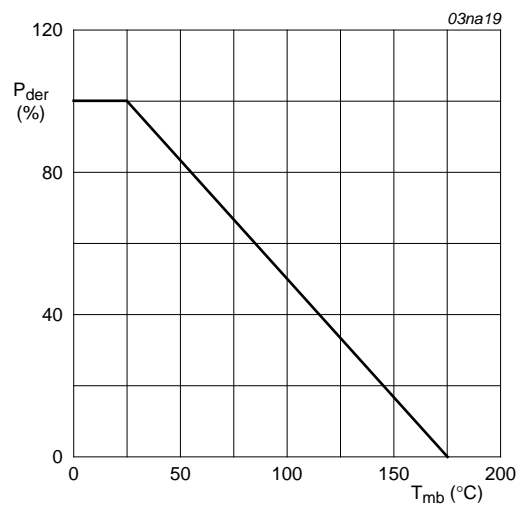
In accordance with the Absolute Maximum Rating System (IEC 60134).

| Symbol | Parameter | Conditions | Min | Max | Unit |
|-----------------------------|--|--|-----|-----|------|
| V_{DS} | drain-source voltage | $25\text{ °C} \leq T_j \leq 175\text{ °C}$ | - | 25 | V |
| V_{DGR} | drain-gate voltage | $25\text{ °C} \leq T_j \leq 175\text{ °C}; R_{GS} = 20\text{ k}\Omega$ | - | 25 | V |
| V_{GS} | gate-source voltage | | -20 | 20 | V |
| I_D | drain current | $V_{GS} = 10\text{ V}; T_{mb} = 25\text{ °C};$ see Figure 1 | - | 56 | A |
| | | $V_{GS} = 10\text{ V}; T_{mb} = 100\text{ °C};$ see Figure 1 | - | 40 | A |
| I_{DM} | peak drain current | pulsed; $t_p \leq 10\text{ }\mu\text{s}; T_{mb} = 25\text{ °C};$ see Figure 4 | - | 224 | A |
| P_{tot} | total power dissipation | $T_{mb} = 25\text{ °C};$ see Figure 2 | - | 42 | W |
| T_{stg} | storage temperature | | -55 | 175 | °C |
| T_j | junction temperature | | -55 | 175 | °C |
| $T_{slid(M)}$ | peak soldering temperature | | - | 260 | °C |
| V_{ESD} | electrostatic discharge voltage | MM (JEDEC JESD22-A115) | 190 | - | V |
| Source-drain diode | | | | | |
| I_S | source current | $T_{mb} = 25\text{ °C}$ | - | 38 | A |
| I_{SM} | peak source current | pulsed; $t_p \leq 10\text{ }\mu\text{s}; T_{mb} = 25\text{ °C}$ | - | 224 | A |
| Avalanche ruggedness | | | | | |
| $E_{DS(AL)S}$ | non-repetitive drain-source avalanche energy | $V_{GS} = 10\text{ V}; T_{j(\text{init})} = 25\text{ °C}; I_D = 56\text{ A}; V_{sup} \leq 25\text{ V};$ unclamped; $R_{GS} = 50\text{ }\Omega;$ see Figure 3 | - | 13 | mJ |



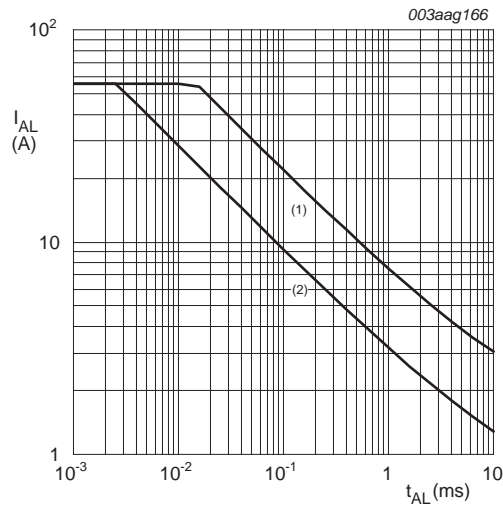
$$V_{GS} \geq 10V$$

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



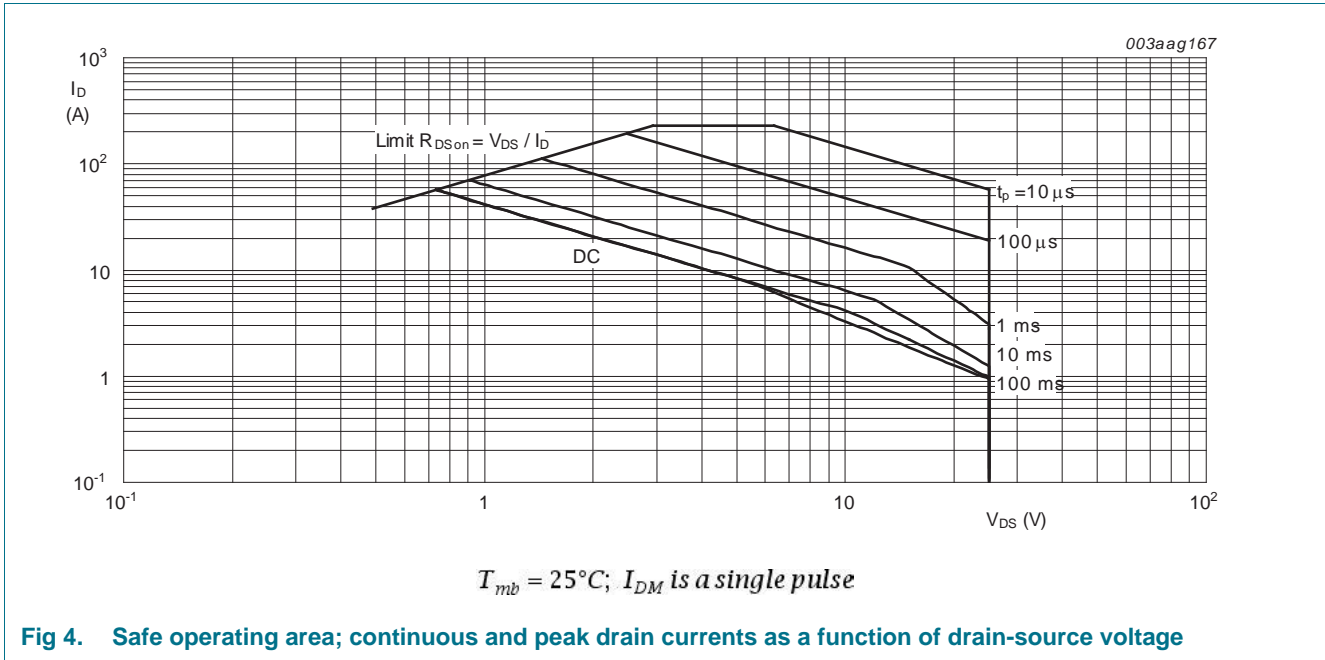
$$P_{der} = \frac{P_{tot}}{P_{tot(25^\circ C)}} \times 100\%$$

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



(1) $T_{j (trnt)} = 25^\circ C$; (2) $T_{j (trnt)} = 100^\circ C$

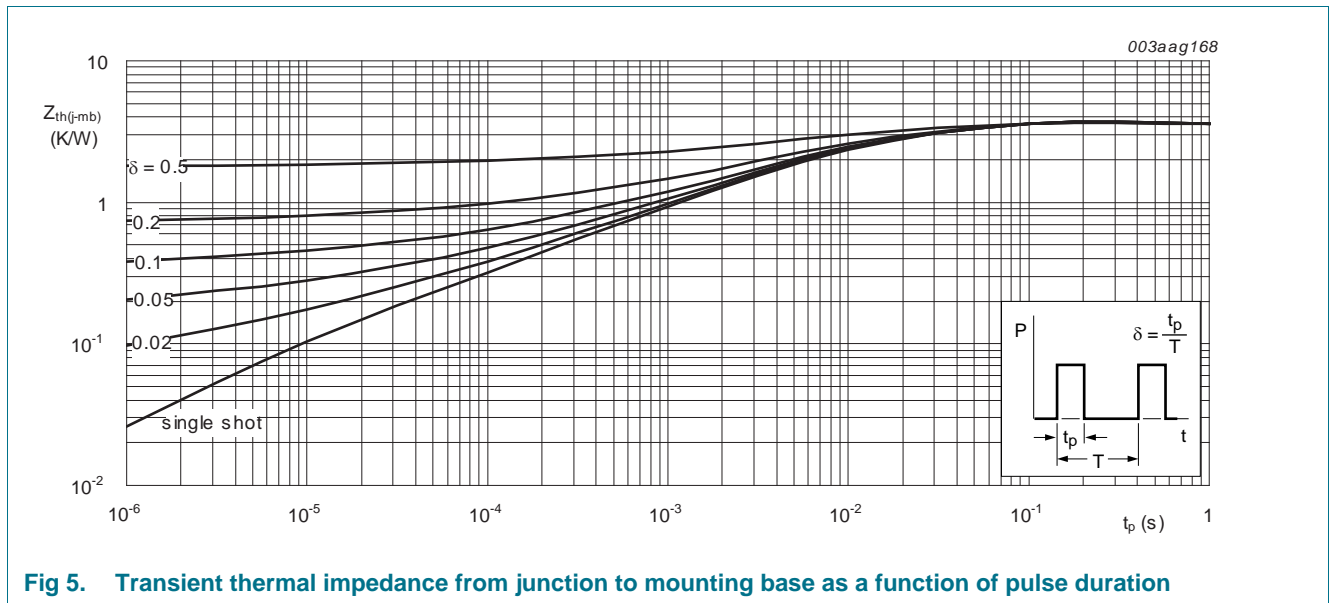
Fig 3. Single pulse avalanche rating; avalanche current as a function of avalanche time



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 | - | 3.38 | 3.61 | K/W |



6. Characteristics

Table 6. Characteristics

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|--------------------------------|-----------------------------------|--|------|------|------|---------|
| Static characteristics | | | | | | |
| $V_{(BR)DSS}$ | drain-source breakdown voltage | $I_D = 250 \mu A; V_{GS} = 0 V; T_j = 25 \text{ }^\circ\text{C}$ | 25 | - | - | V |
| | | $I_D = 250 \mu A; V_{GS} = 0 V; T_j = -55 \text{ }^\circ\text{C}$ | 22.5 | - | - | 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 10 ; see Figure 11 | 1.05 | 1.55 | 1.95 | V |
| | | $I_D = 10 \text{ mA}; V_{DS} = V_{GS}; T_j = 150 \text{ }^\circ\text{C}$ | 0.5 | - | - | V |
| | | $I_D = 1 \text{ mA}; V_{DS} = V_{GS}; T_j = -55 \text{ }^\circ\text{C}$ | - | - | 2.25 | V |
| I_{DSS} | drain leakage current | $V_{DS} = 25 \text{ V}; V_{GS} = 0 \text{ V}; T_j = 25 \text{ }^\circ\text{C}$ | - | - | 1 | μA |
| | | $V_{DS} = 25 \text{ V}; V_{GS} = 0 \text{ V}; T_j = 150 \text{ }^\circ\text{C}$ | - | - | 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 | $V_{GS} = 4.5 \text{ V}; I_D = 15 \text{ A}; T_j = 25 \text{ }^\circ\text{C};$ see Figure 12 | - | 8.4 | 9.8 | mΩ |
| | | $V_{GS} = 4.5 \text{ V}; I_D = 15 \text{ A}; T_j = 150 \text{ }^\circ\text{C};$ see Figure 12 ; see Figure 13 | - | - | 15.9 | mΩ |
| | | $V_{GS} = 10 \text{ V}; I_D = 15 \text{ A}; T_j = 25 \text{ }^\circ\text{C};$ see Figure 12 | - | 6.3 | 7.4 | mΩ |
| | | $V_{GS} = 10 \text{ V}; I_D = 15 \text{ A}; T_j = 150 \text{ }^\circ\text{C};$ see Figure 12 ; see Figure 13 | - | - | 11.9 | mΩ |
| R_G | internal gate resistance (AC) | $f = 1 \text{ MHz}$ | - | 2.2 | 4.4 | Ω |
| Dynamic characteristics | | | | | | |
| $Q_{G(tot)}$ | total gate charge | $I_D = 15 \text{ A}; V_{DS} = 12 \text{ V}; V_{GS} = 10 \text{ V};$ see Figure 14 ; see Figure 15 | - | 15 | - | nC |
| | | $I_D = 15 \text{ A}; V_{DS} = 12 \text{ V}; V_{GS} = 4.5 \text{ V};$ see Figure 14 ; see Figure 15 | - | 7 | - | nC |
| | | $I_D = 0 \text{ A}; V_{DS} = 0 \text{ V}; V_{GS} = 10 \text{ V}$ | - | 14 | - | nC |
| Q_{GS} | gate-source charge | $I_D = 15 \text{ A}; V_{DS} = 12 \text{ V}; V_{GS} = 4.5 \text{ V};$ see Figure 14 ; see Figure 15 | - | 2.3 | - | nC |
| $Q_{GS(th)}$ | pre-threshold gate-source charge | | - | 1.6 | - | nC |
| $Q_{GS(th-pl)}$ | post-threshold gate-source charge | | - | 0.7 | - | nC |
| Q_{GD} | gate-drain charge | | - | 2.2 | - | nC |
| $V_{GS(pl)}$ | gate-source plateau voltage | $I_D = 15 \text{ A}; V_{DS} = 12 \text{ V};$ see Figure 14 ; see Figure 15 | - | 2.52 | - | 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 16 | - | 921 | - | pF |
| C_{oss} | output capacitance | | - | 255 | - | pF |
| C_{riss} | reverse transfer capacitance | | - | 84 | - | pF |
| $t_{d(on)}$ | turn-on delay time | $V_{DS} = 12 \text{ V}; R_L = 0.8 \text{ } \Omega; V_{GS} = 4.5 \text{ V};$ $R_{G(ext)} = 4.7 \text{ } \Omega$ | - | 13.7 | - | ns |
| t_r | rise time | | - | 11.2 | - | ns |
| $t_{d(off)}$ | turn-off delay time | | - | 19.5 | - | ns |
| t_f | fall time | | - | 6.5 | - | ns |

Table 6. Characteristics ...continued

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|---------------------------|----------------------------|--|-----|------|-----|------|
| Q_{OSS} | output charge | $V_{GS} = 0\text{ V}; V_{DS} = 12\text{ V}; f = 1\text{ MHz}$ | - | 6.2 | - | nC |
| Source-drain diode | | | | | | |
| V_{SD} | source-drain voltage | $I_S = 15\text{ A}; V_{GS} = 0\text{ V}; T_j = 25\text{ }^\circ\text{C};$ see Figure 17 | - | 0.85 | 1.1 | V |
| t_{rr} | reverse recovery time | $I_S = 15\text{ A}; di_S/dt = -100\text{ A}/\mu\text{s};$ | - | 21.2 | - | ns |
| Q_r | recovered charge | $V_{GS} = 0\text{ V}; V_{DS} = 12\text{ V}$ | - | 11.6 | - | nC |
| t_a | reverse recovery rise time | $V_{GS} = 0\text{ V}; I_S = 15\text{ A};$ | - | 11.6 | - | ns |
| t_b | reverse recovery fall time | $di_S/dt = -100\text{ A}/\mu\text{s}; V_{DS} = 12\text{ V};$ see Figure 18 | - | 9.6 | - | ns |

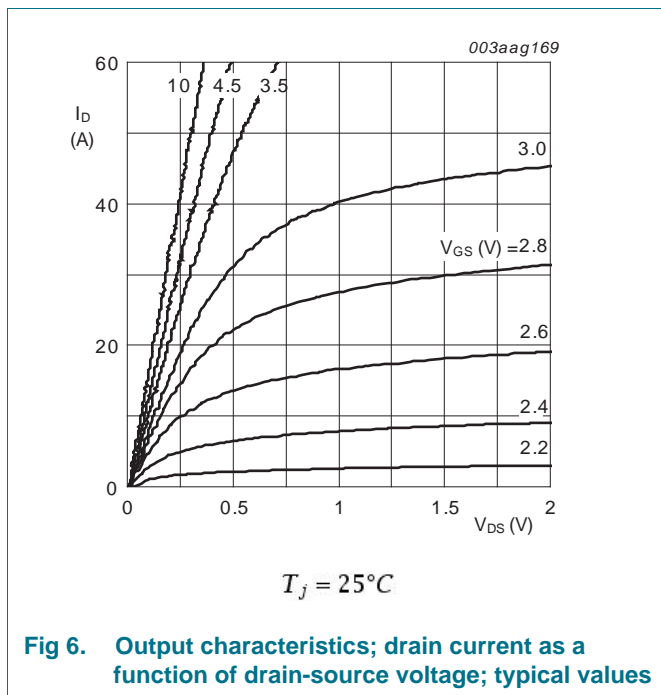


Fig 6. Output characteristics; drain current as a function of drain-source voltage; typical values

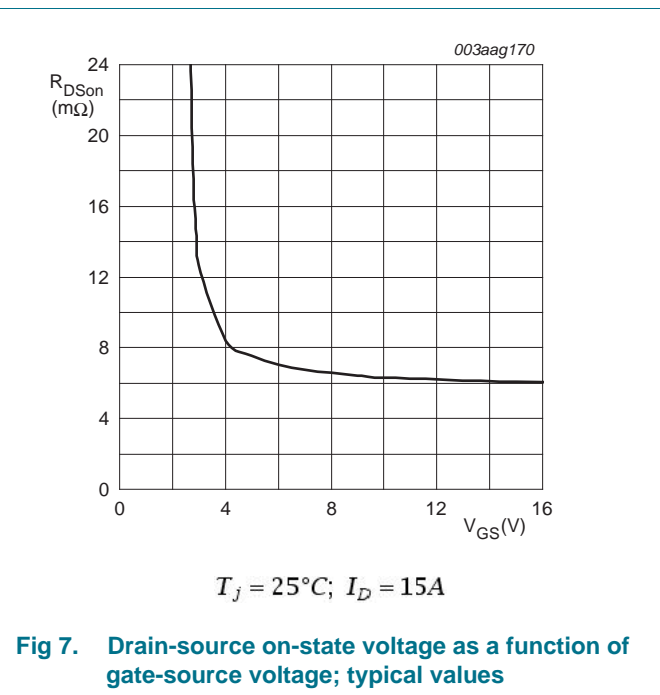
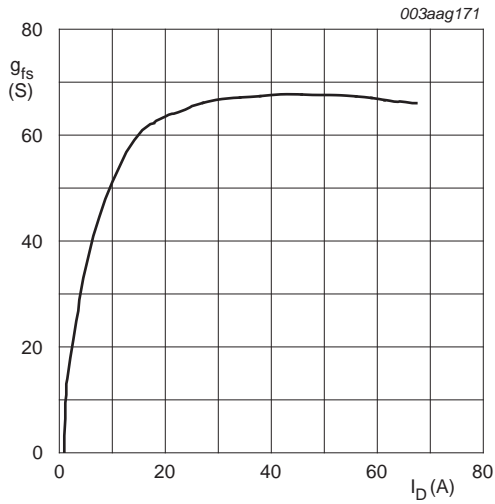
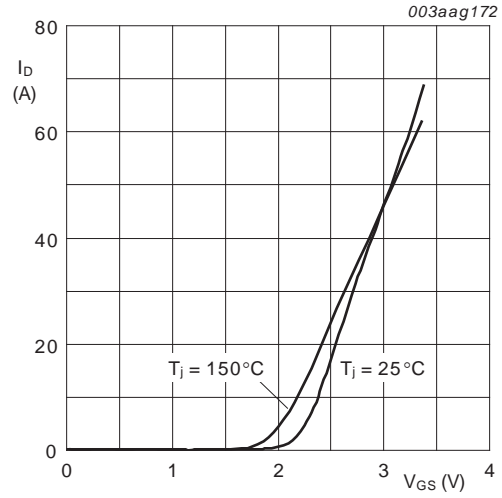


Fig 7. Drain-source on-state voltage as a function of gate-source voltage; typical values



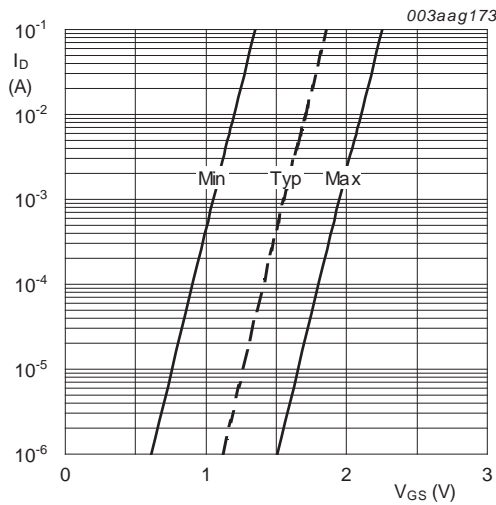
$T_j = 25^\circ\text{C}; V_{DS} = 10\text{V}$

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



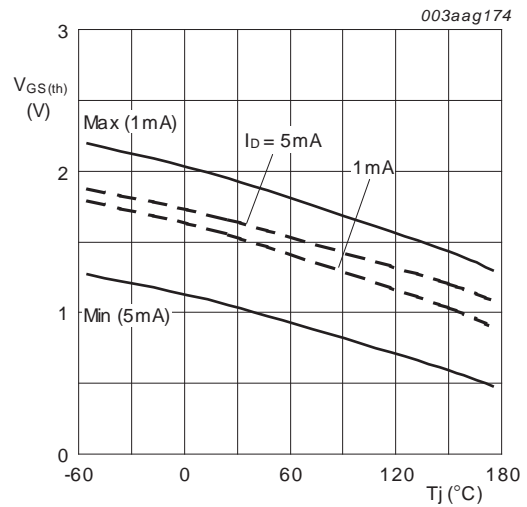
$V_{DS} = 10\text{V}$

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



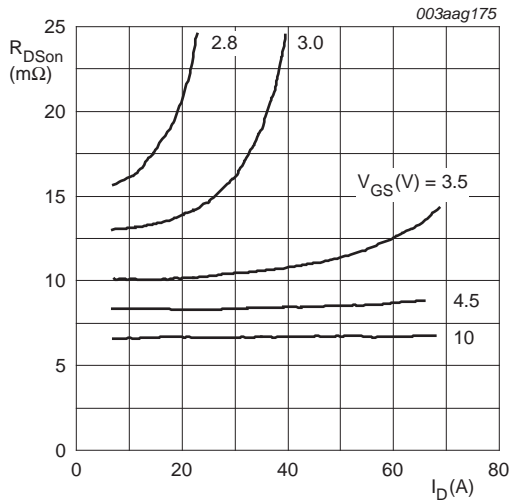
$T_j = 25^\circ\text{C}; V_{DS} = 5\text{V}$

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



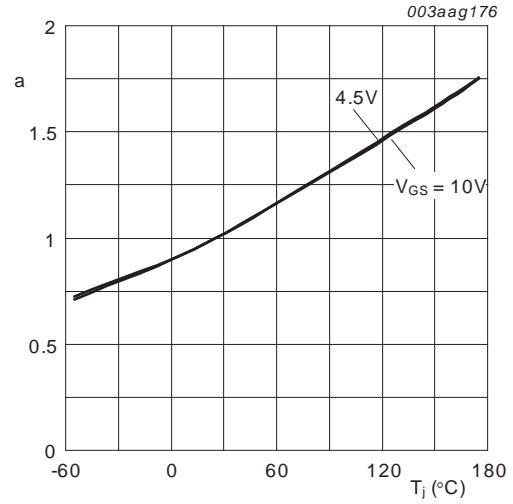
$V_{DS} = V_{GS}$

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



$T_j = 25^\circ C$

Fig 12. Drain-source on-state resistance as a function of drain current; typical values



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

Fig 13. Normalized drain-source on-state resistance factor as a function of junction temperature

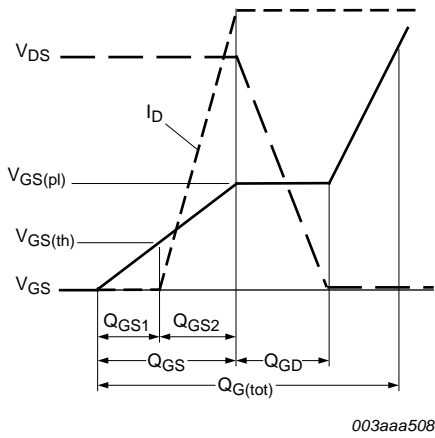
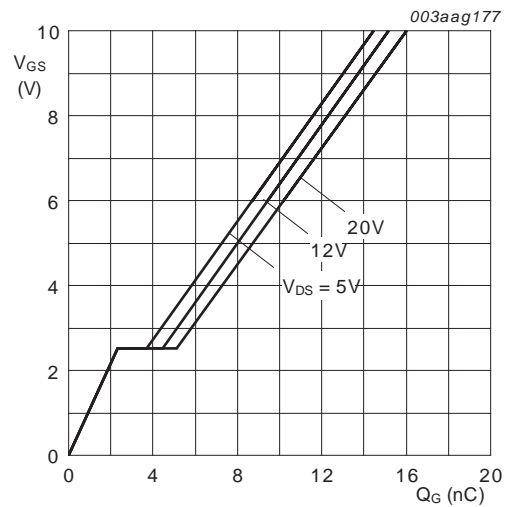


Fig 14. Gate charge waveform definitions



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

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

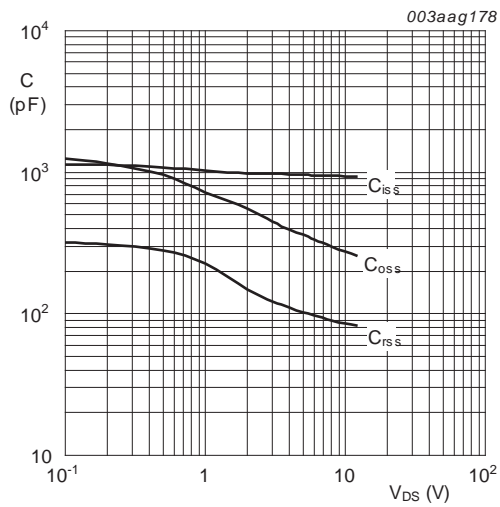


Fig 16. Input, output and reverse transfer capacitances as a function of drain-source voltage; typical values

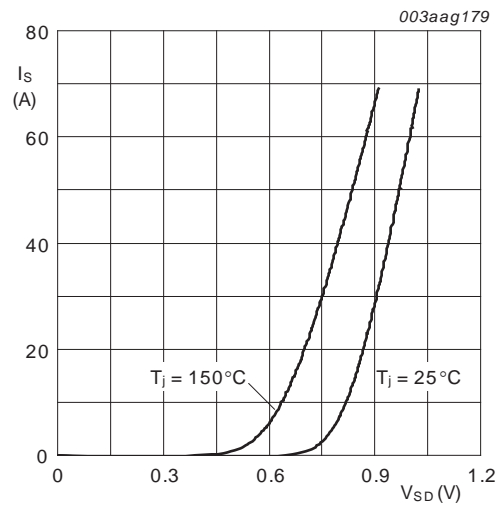


Fig 17. Source current as a function of source-drain voltage; typical values

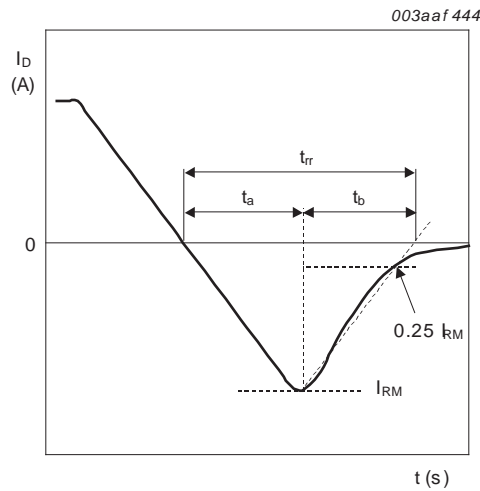


Fig 18. Reverse recovery timing definition

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 |
|-------------------|---|------------------------|---------------|-------------------|
| PSMN7R5-25YLC v.2 | 20111031 | Product data sheet | - | PSMN7R5-25YLC v.1 |
| Modifications: | <ul style="list-style-type: none">• Status changed from preliminary to product.• Various changes to content. | | | |
| PSMN7R5-25YLC v.1 | 20110712 | Preliminary data sheet | - | - |

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| Document status ^[1] ^[2] | Product status ^[3] | Definition |
|---|-------------------------------|---|
| Objective [short] data sheet | Development | This document contains data from the objective specification for product development. |
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| 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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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 | 2 |
| 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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