



PSMN7R0-100XS

N-channel 100V 6.8 mΩ standard level MOSFET in TO220F (SOT186A)

Rev. 2 — 21 October 2011

Preliminary data sheet

1. Product profile

1.1 General description

Standard level N-channel MOSFET in TO220F (SOT186A) 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

- High efficiency due to low switching and conduction losses
- Isolated package
- Suitable for standard level gate drive

1.3 Applications

- AC-to-DC power supply equipment
- Server power supplies
- Motor control
- Synchronous rectification

1.4 Quick reference data

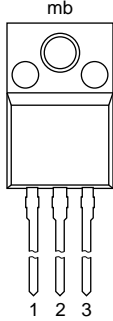
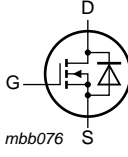
Table 1. Quick reference data

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|--------------------------------|--|--|-----|-----|------|------|
| V_{DS} | drain-source voltage | $T_j \geq 25\text{ °C}$; $T_j \leq 175\text{ °C}$ | - | - | 100 | V |
| I_D | drain current | $T_{mb} = 25\text{ °C}$; $V_{GS} = 10\text{ V}$; see Figure 1 | - | - | 55 | A |
| P_{tot} | total power dissipation | $T_{mb} = 25\text{ °C}$; see Figure 2 | - | - | 57.7 | W |
| Static characteristics | | | | | | |
| $R_{DS(on)}$ | drain-source on-state resistance | $V_{GS} = 10\text{ V}$; $I_D = 15\text{ A}$; $T_j = 25\text{ °C}$; see Figure 12 ; see Figure 13 | - | 5.4 | 6.8 | mΩ |
| Dynamic characteristics | | | | | | |
| Q_{GD} | gate-drain charge | $V_{GS} = 10\text{ V}$; $I_D = 15\text{ A}$; $V_{DS} = 50\text{ V}$; see Figure 14 ; see Figure 15 | - | 34 | - | nC |
| $Q_{G(tot)}$ | total gate charge | see Figure 14 ; see Figure 15 | - | 121 | - | nC |
| Avalanche ruggedness | | | | | | |
| $E_{DS(AL)S}$ | non-repetitive drain-source avalanche energy | $V_{GS} = 10\text{ V}$; $T_{j(init)} = 25\text{ °C}$; $I_D = 55\text{ A}$; $V_{sup} \leq 100\text{ V}$; unclamped; $R_{GS} = 50\text{ Ω}$; see Figure 3 | - | - | 420 | mJ |



2. Pinning information

Table 2. Pinning information

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

SOT186A (TO-220F)

3. Ordering information

Table 3. Ordering information

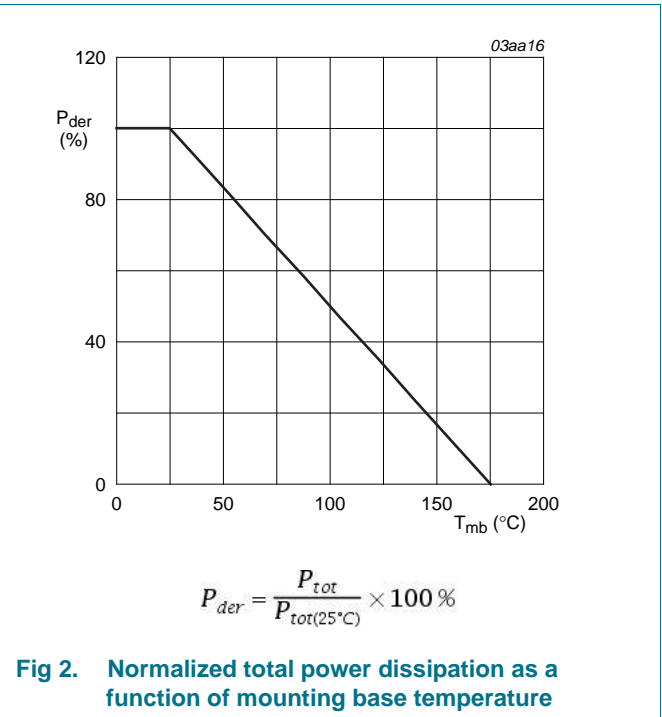
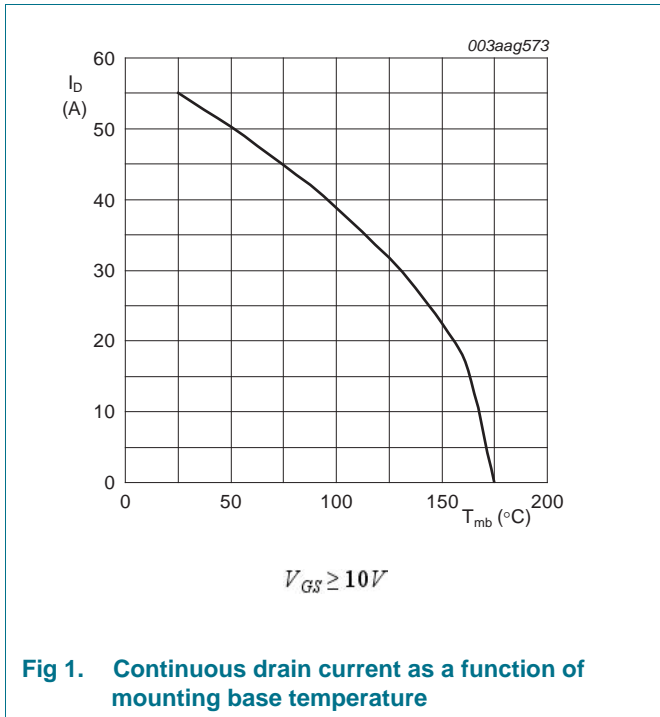
| Type number | Package | | |
|---------------|---------|---|---------|
| | Name | Description | Version |
| PSMN7R0-100XS | TO-220F | plastic single-ended package; isolated heatsink mounted; 1 mounting hole; 3-lead TO-220 "full pack" | SOT186A |

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 ≥ 25 °C; T _j ≤ 175 °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} = 25 °C; see Figure 1 | - | 55 | A |
| | | V _{GS} = 10 V; T _{mb} = 100 °C; see Figure 1 | - | 38.9 | A |
| I _{DM} | peak drain current | pulsed; t _p ≤ 10 μs; T _{mb} = 25 °C; see Figure 4 | - | 220 | A |
| P _{tot} | total power dissipation | T _{mb} = 25 °C; see Figure 2 | - | 57.7 | W |
| T _{stg} | storage temperature | | -55 | 175 | °C |
| T _j | junction temperature | | -55 | 175 | °C |
| T _{sld(M)} | peak soldering temperature | | - | 260 | °C |
| Source-drain diode | | | | | |
| I _S | source current | T _{mb} = 25 °C | - | 48 | A |
| I _{SM} | peak source current | pulsed; t _p ≤ 10 μs; T _{mb} = 25 °C | - | 220 | A |
| Avalanche ruggedness | | | | | |
| E _{DS(AL)S} | non-repetitive drain-source avalanche energy | V _{GS} = 10 V; T _{j(initial)} = 25 °C; I _D = 55 A; V _{sup} ≤ 100 V; unclamped; R _{GS} = 50 Ω; see Figure 3 | - | 420 | mJ |



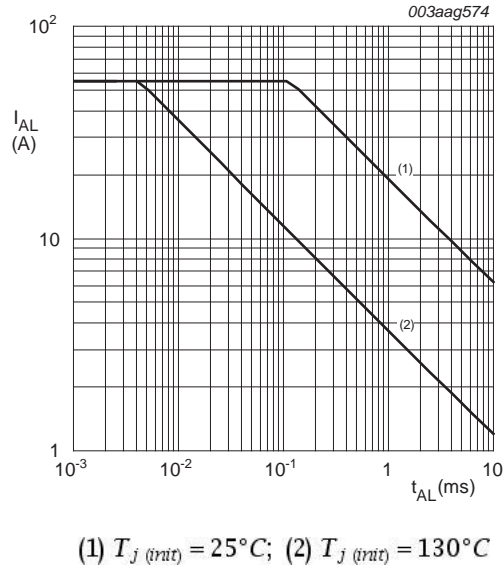


Fig 3. Single pulse avalanche rating; avalanche current as a function of avalanche time

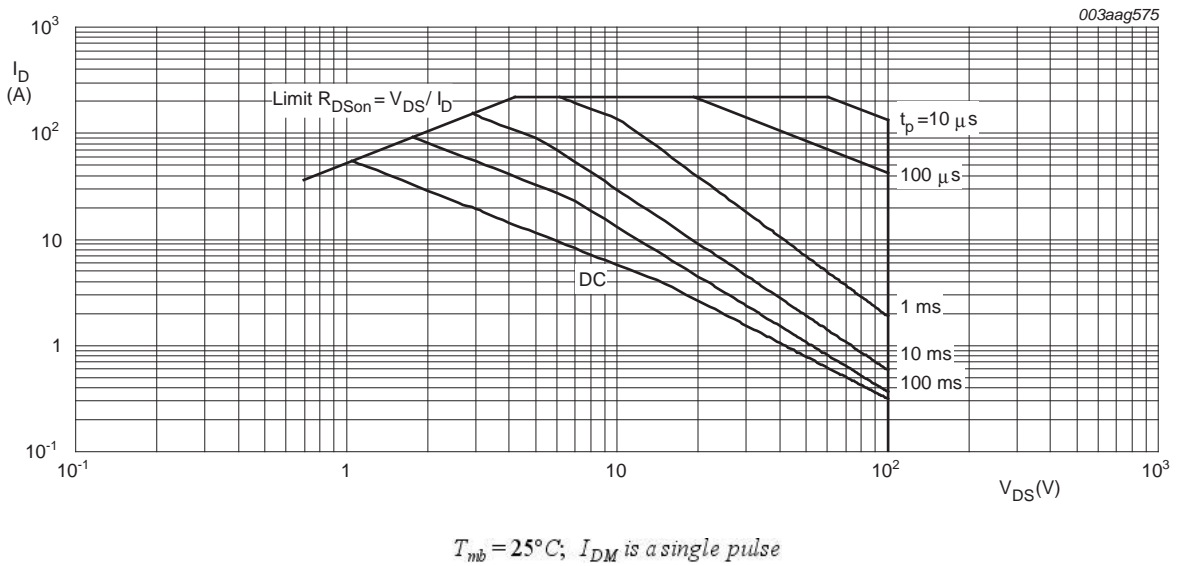


Fig 4. Safe operating area; continuous and peak drain currents as a function of drain-source voltage

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 | - | 2.35 | 2.6 | K/W |
| $R_{th(j-a)}$ | thermal resistance from junction to ambient | vertical in free air | - | 55 | - | K/W |

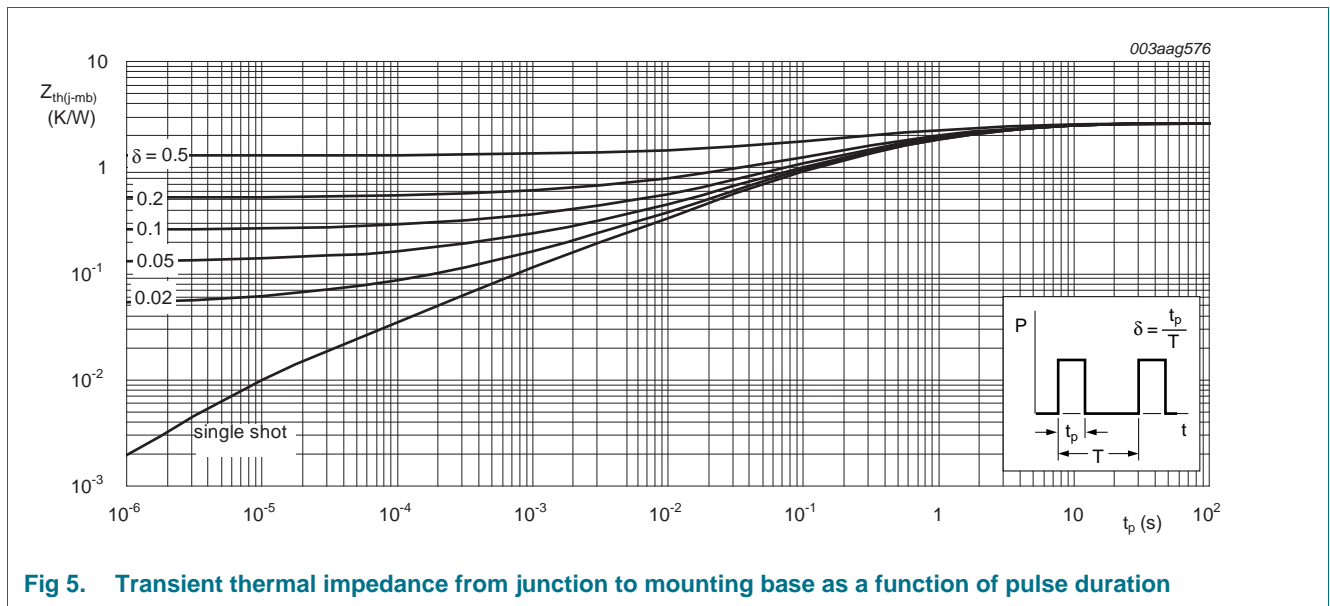


Fig 5. Transient thermal impedance from junction to mounting base as a function of pulse duration

6. Isolation characteristics

Table 6. Isolation characteristics

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|-----------------|-----------------------|--|-----|-----|------|------|
| C_{isol} | isolation capacitance | | [1] | 10 | - | pF |
| $V_{isol(RMS)}$ | RMS isolation voltage | 50 Hz ≤ f ≤ 60 Hz; RH ≤ 65 %; sinusoidal waveform; clean and dust free | - | - | 2500 | V |

[1] f = 1 MHz

7. Characteristics

Table 7. Characteristics

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|--------------------------------|-----------------------------------|---|-----|------|------|---------------|
| Static characteristics | | | | | | |
| $V_{(BR)DSS}$ | drain-source breakdown voltage | $I_D = 250 \mu\text{A}; V_{GS} = 0 \text{ V}; T_j = 25 \text{ }^\circ\text{C}$ | 100 | - | - | V |
| | | $I_D = 250 \mu\text{A}; V_{GS} = 0 \text{ V}; T_j = -55 \text{ }^\circ\text{C}$ | 90 | - | - | 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 | 2 | 3 | 4 | V |
| | | $I_D = 1 \text{ mA}; V_{DS} = V_{GS}; T_j = 175 \text{ }^\circ\text{C};$ see Figure 10 | 1 | - | - | V |
| | | $I_D = 1 \text{ mA}; V_{DS} = V_{GS}; T_j = -55 \text{ }^\circ\text{C};$ see Figure 10 | - | - | 4.6 | V |
| I_{DSS} | drain leakage current | $V_{DS} = 100 \text{ V}; V_{GS} = 0 \text{ V}; T_j = 25 \text{ }^\circ\text{C}$ | - | - | 5 | μA |
| | | $V_{DS} = 100 \text{ V}; V_{GS} = 0 \text{ V}; T_j = 100 \text{ }^\circ\text{C}$ | - | - | 100 | 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 | $V_{GS} = 10 \text{ V}; I_D = 15 \text{ A}; T_j = 25 \text{ }^\circ\text{C};$ see Figure 12 ; see Figure 13 | - | 5.4 | 6.8 | mΩ |
| | | $V_{GS} = 10 \text{ V}; I_D = 15 \text{ A}; T_j = 100 \text{ }^\circ\text{C};$ see Figure 13 | - | 9.45 | 11.9 | mΩ |
| | | $V_{GS} = 10 \text{ V}; I_D = 15 \text{ A}; T_j = 175 \text{ }^\circ\text{C};$ see Figure 13 | - | 15.1 | 19 | mΩ |
| R_G | internal gate resistance (AC) | $f = 1 \text{ MHz}$ | - | 0.74 | - | 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 ; see Figure 15 | - | 121 | - | nC |
| Q_{GS} | gate-source charge | | - | 26.3 | - | nC |
| $Q_{GS(th)}$ | pre-threshold gate-source charge | | - | 11 | - | nC |
| $Q_{GS(th-pl)}$ | post-threshold gate-source charge | | - | 15.3 | - | nC |
| Q_{GD} | gate-drain charge | | - | 34 | - | nC |
| $V_{GS(pl)}$ | gate-source plateau voltage | $I_D = 15 \text{ A}; V_{DS} = 50 \text{ V};$ see Figure 14 ; see Figure 15 | - | 4.1 | - | 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 ; see Figure 17 | - | 6686 | - | pF |
| C_{oss} | output 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 | - | 438 | - | pF |
| C_{rss} | reverse transfer 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 ; see Figure 17 | - | 272 | - | pF |
| $t_{d(on)}$ | turn-on delay time | $V_{DS} = 50 \text{ V}; R_L = 4 \text{ }^\circ\Omega; V_{GS} = 10 \text{ V};$ $R_{G(ext)} = 4.7 \text{ }^\circ\Omega; T_j = 25 \text{ }^\circ\text{C}$ | - | 29 | - | ns |
| t_r | rise time | | - | 30 | - | ns |
| $t_{d(off)}$ | turn-off delay time | | - | 94 | - | ns |
| t_f | fall time | | - | 43 | - | ns |

Table 7. Characteristics ...continued

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|---------------------------|-----------------------|---|-----|------|-----|------|
| Source-drain diode | | | | | | |
| V_{SD} | source-drain voltage | $I_S = 10\text{ A}$; $V_{GS} = 0\text{ V}$; $T_j = 25\text{ °C}$; see Figure 18 | - | 0.76 | 1.2 | V |
| t_{rr} | reverse recovery time | $I_S = 10\text{ A}$; $di_S/dt = -100\text{ A}/\mu\text{s}$; $V_{GS} = 0\text{ V}$; | - | 64 | - | ns |
| Q_r | recovered charge | $V_{DS} = 50\text{ V}$ | - | 167 | - | nC |

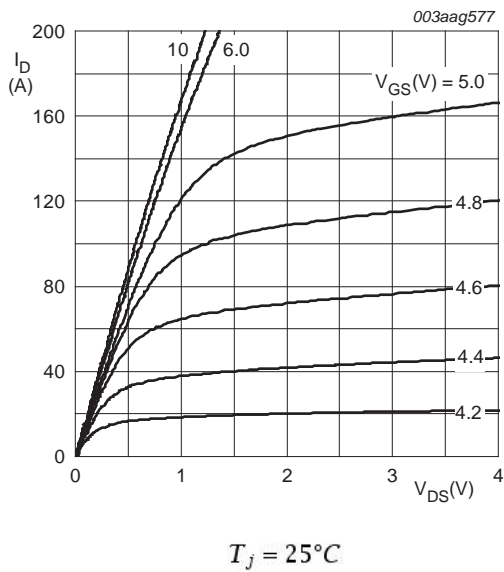


Fig 6. Output characteristics; drain current as a function of drain-source voltage; typical values

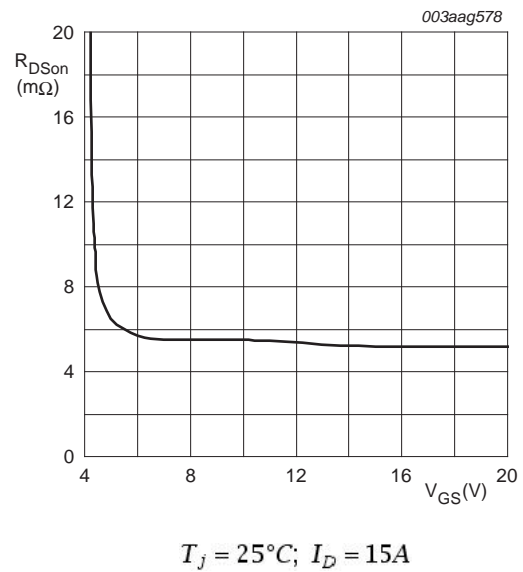


Fig 7. Drain-source on-state resistance as a function of gate-source voltage; typical values

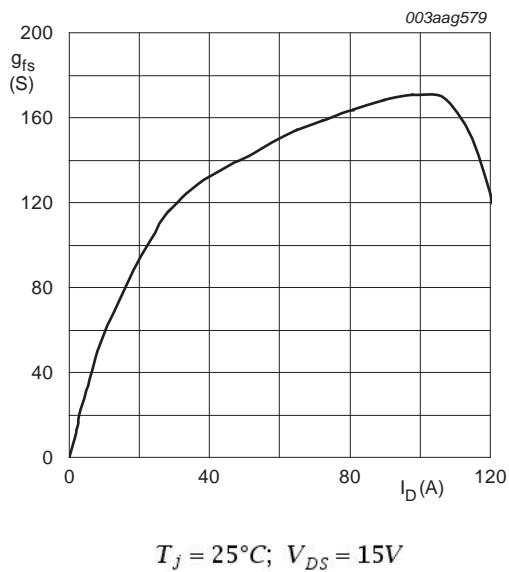


Fig 8. Forward transconductance as a function of drain current; typical values

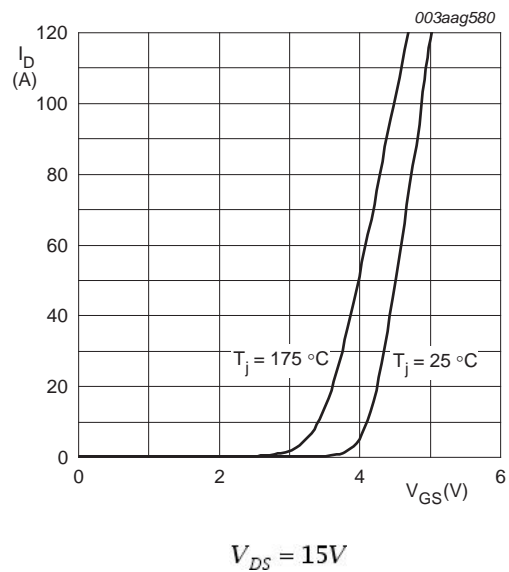
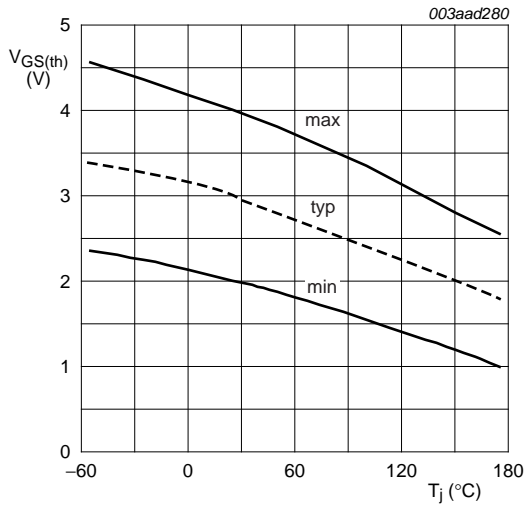
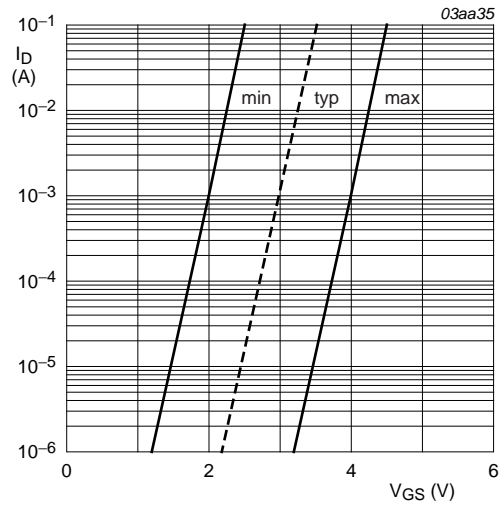


Fig 9. Transfer characteristics; drain current as a function of gate-source voltage; typical values



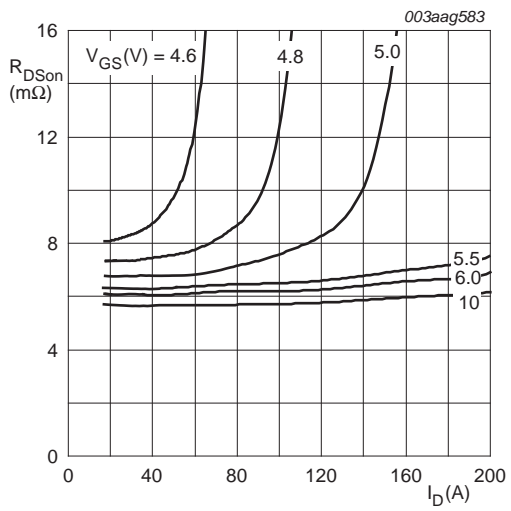
$$I_D = 1 \text{ mA}; V_{DS} = V_{GS}$$

Fig 10. Gate-source threshold voltage as a function of junction temperature



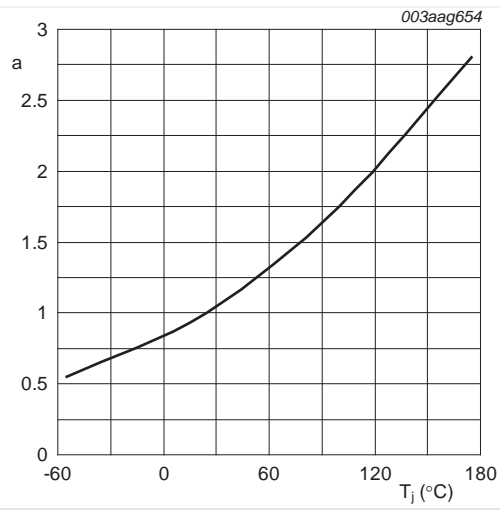
$$T_j = 25^\circ\text{C}; V_{DS} = 5\text{V}$$

Fig 11. Sub-threshold drain current as a function of gate-source voltage



$$T_j = 25^\circ\text{C}$$

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



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

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

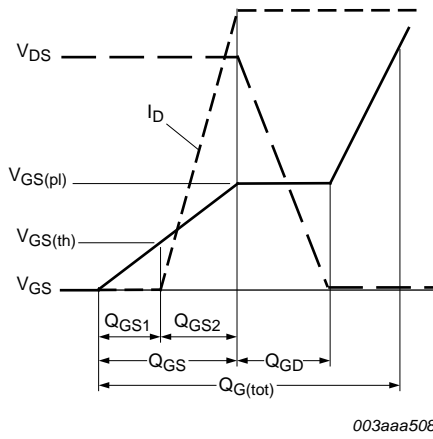
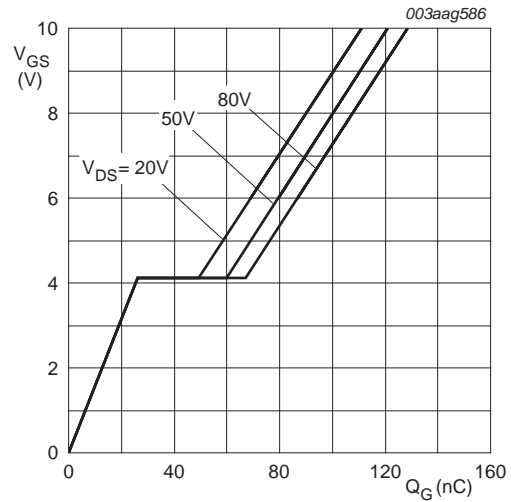
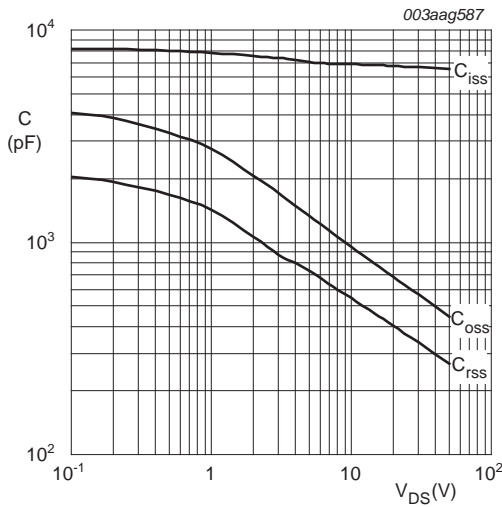


Fig 14. Gate charge waveform definitions



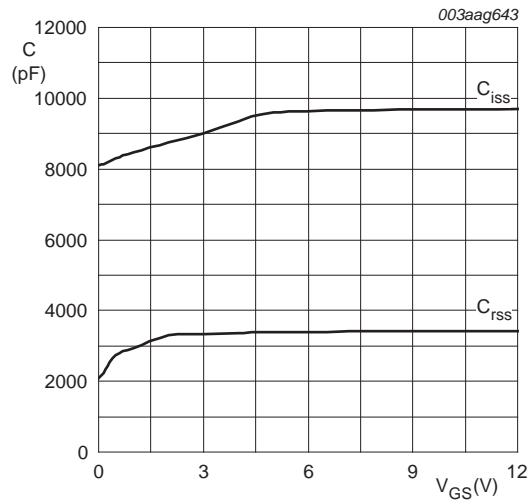
$T_j = 25^\circ C; I_D = 15A$

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



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

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



$f = 1MHz, V_{DS} = 0V$

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

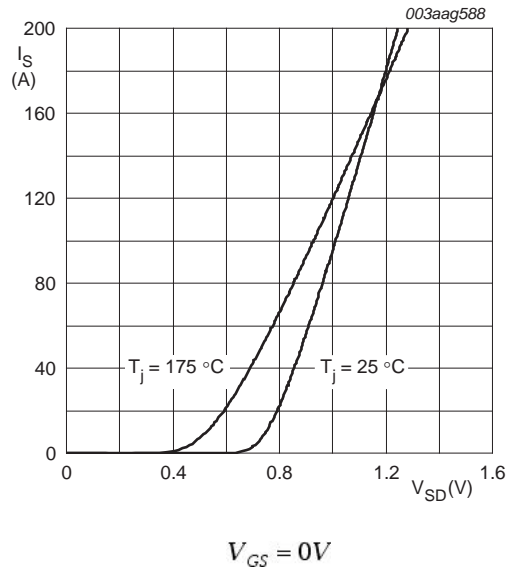


Fig 18. Source current as a function of source-drain voltage; typical values

8. Package outline

Plastic single-ended package; isolated heatsink mounted;
1 mounting hole; 3-lead TO-220 'full pack'

SOT186A

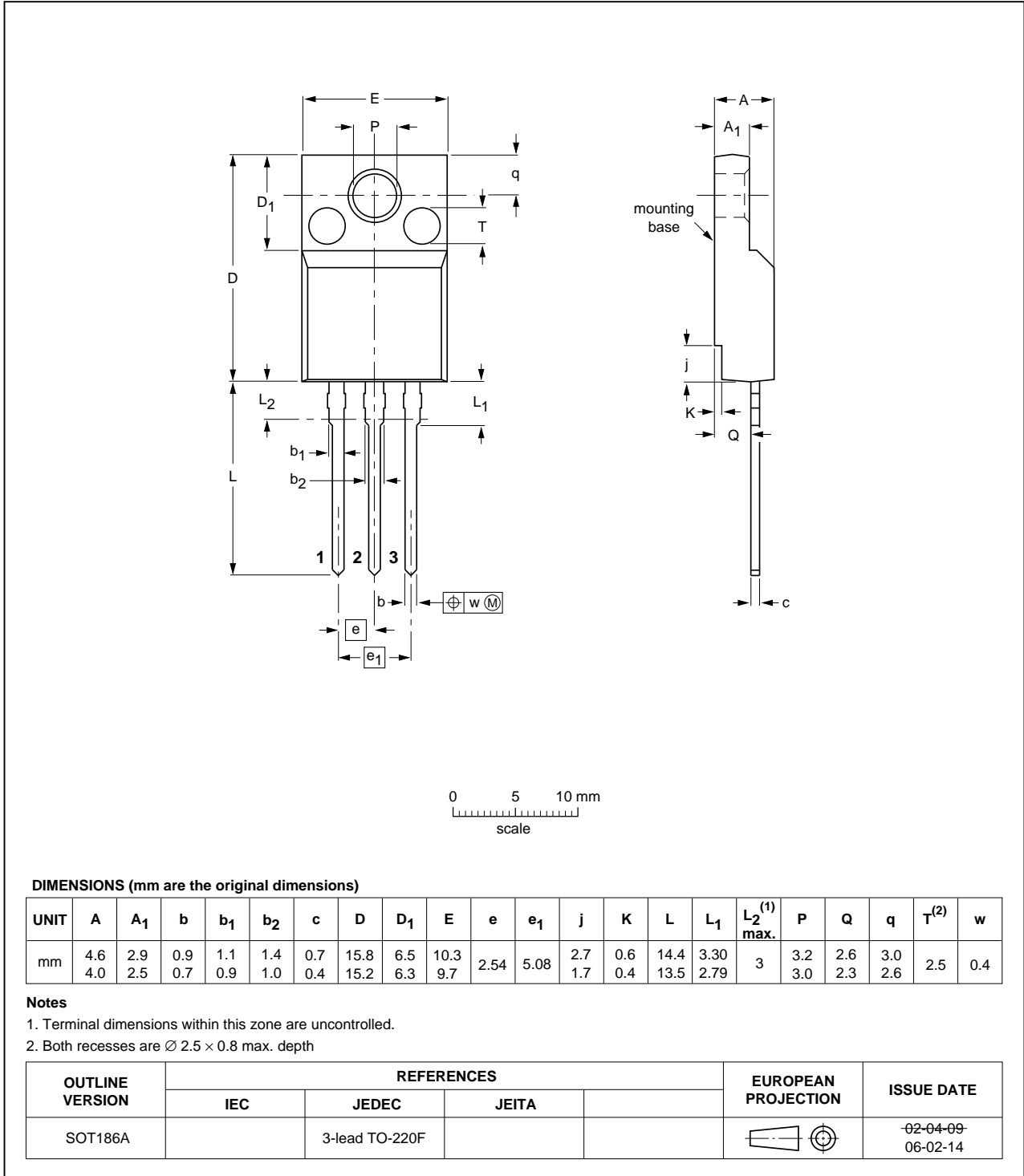


Fig 19. Package outline SOT186A (TO-220F)

9. Revision history

Table 8. Revision history

| Document ID | Release date | Data sheet status | Change notice | Supersedes |
|-------------------|-------------------------------|------------------------|---------------|-------------------|
| PSMN7R0-100XS v.2 | 20111021 | Preliminary data sheet | - | PSMN7R0-100XS v.1 |
| Modifications: | • Various changes to content. | | | |
| PSMN7R0-100XS v.1 | 20110721 | Objective data sheet | - | - |

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|---|-------------------------------|---|
| 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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[2] The term 'short data sheet' is explained in section "Definitions".

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