



PSMN4R4-30MLC

N-channel 30 V 4.65 mΩ logic level MOSFET in LFAK33 using NextPower Technology

Rev. 3 — 15 June 2012

Product data sheet

1. Product profile

1.1 General description

Logic level enhancement mode N-channel MOSFET in LFAK33 package. This product is designed and qualified for use in a wide range of industrial, communications and domestic equipment.

1.2 Features and benefits

- 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

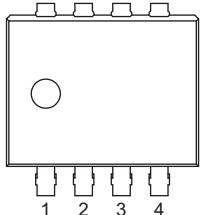
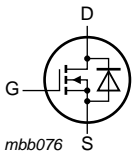
Table 1. Quick reference data

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|--------------------------------|----------------------------------|----------------------------------------------------------------------------------------------------------------------------------------|-----|------|------|------|
| V_{DS} | drain-source voltage | $T_j = 25\text{ °C}$ | - | - | 30 | V |
| I_D | drain current | $T_{mb} = 25\text{ °C}$; $V_{GS} = 10\text{ V}$; see Figure 1 | [1] | - | 70 | A |
| P_{tot} | total power dissipation | $T_{mb} = 25\text{ °C}$; see Figure 2 | - | - | 69 | W |
| T_j | junction temperature | | -55 | - | 175 | °C |
| Static characteristics | | | | | | |
| R_{DSon} | drain-source on-state resistance | $V_{GS} = 4.5\text{ V}$; $I_D = 25\text{ A}$; $T_j = 25\text{ °C}$; see Figure 10 | - | 5.2 | 6 | mΩ |
| | | $V_{GS} = 10\text{ V}$; $I_D = 25\text{ A}$; $T_j = 25\text{ °C}$; see Figure 10 | - | 4.05 | 4.65 | mΩ |
| Dynamic characteristics | | | | | | |
| Q_{GD} | gate-drain charge | $V_{GS} = 4.5\text{ V}$; $I_D = 25\text{ A}$; $V_{DS} = 15\text{ V}$; see Figure 12 ; see Figure 13 | - | 2.9 | - | nC |
| $Q_{G(tot)}$ | total gate charge | $V_{GS} = 4.5\text{ V}$; $I_D = 25\text{ A}$; $V_{DS} = 15\text{ V}$; see Figure 12 ; see Figure 13 | - | 10.6 | - | nC |

[1] Continuous current is limited by package.

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 | | |

SOT1210 (LFAK33)

3. Ordering information

Table 3. Ordering information

| Type number | Package | | Version |
|---------------|---------|----------------------------------------------------------------|---------|
| | Name | Description | |
| PSMN4R4-30MLC | LFAK33 | Plastic single ended surface mounted package (LFAK33); 4 leads | SOT1210 |

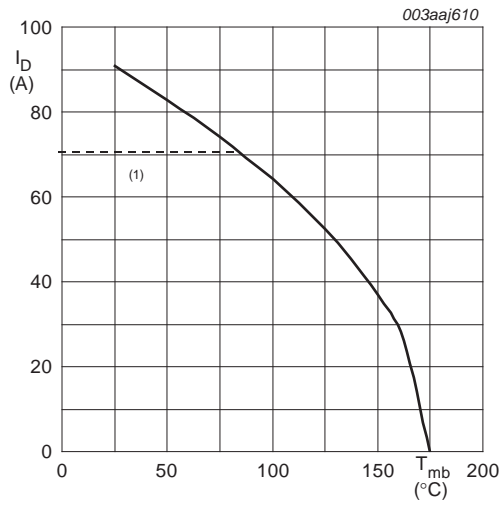
4. Limiting values

Table 4. Limiting values

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

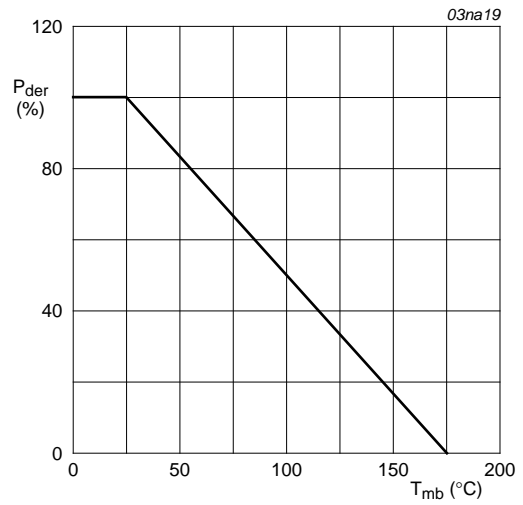
| Symbol | Parameter | Conditions | Min | Max | Unit |
|-----------------------------|----------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|------|------|
| V_{DS} | drain-source voltage | $T_j = 25\text{ °C}$ | - | 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 Figure 1 | [1] | 70 | A |
| | | $V_{GS} = 10\text{ V}$; $T_{mb} = 100\text{ °C}$; see Figure 1 | - | 64 | A |
| I_{DM} | peak drain current | pulsed; $t_p \leq 10\text{ }\mu\text{s}$; $T_{mb} = 25\text{ °C}$; see Figure 4 | - | 363 | A |
| P_{tot} | total power dissipation | $T_{mb} = 25\text{ °C}$; see Figure 2 | - | 69 | 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) | 240 | - | V |
| Source-drain diode | | | | | |
| I_S | source current | $T_{mb} = 25\text{ °C}$ | - | 63 | A |
| I_{SM} | peak source current | pulsed; $t_p \leq 10\text{ }\mu\text{s}$; $T_{mb} = 25\text{ °C}$ | - | 363 | A |
| Avalanche ruggedness | | | | | |
| $E_{DS(AL)S}$ | non-repetitive drain-source avalanche energy | $V_{GS} = 10\text{ V}$; $T_{j(\text{init})} = 25\text{ °C}$; $I_D = 70\text{ A}$; $V_{sup} \leq 30\text{ V}$; $R_{GS} = 50\text{ }\Omega$; unclamped; see Figure 3 | - | 28.6 | mJ |

[1] Continuous current is limited by package.



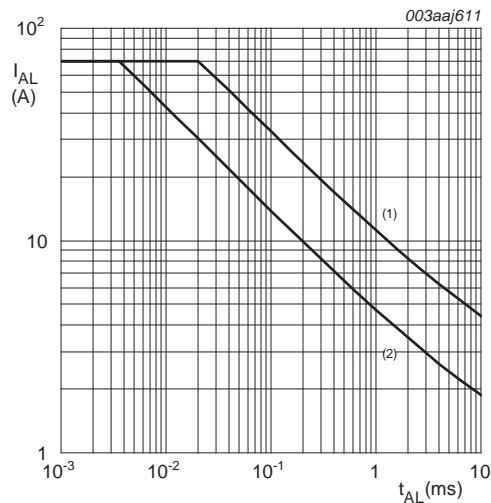
$V_{GS} \geq 10V$
 (1) Capped at 70 A due to package.

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



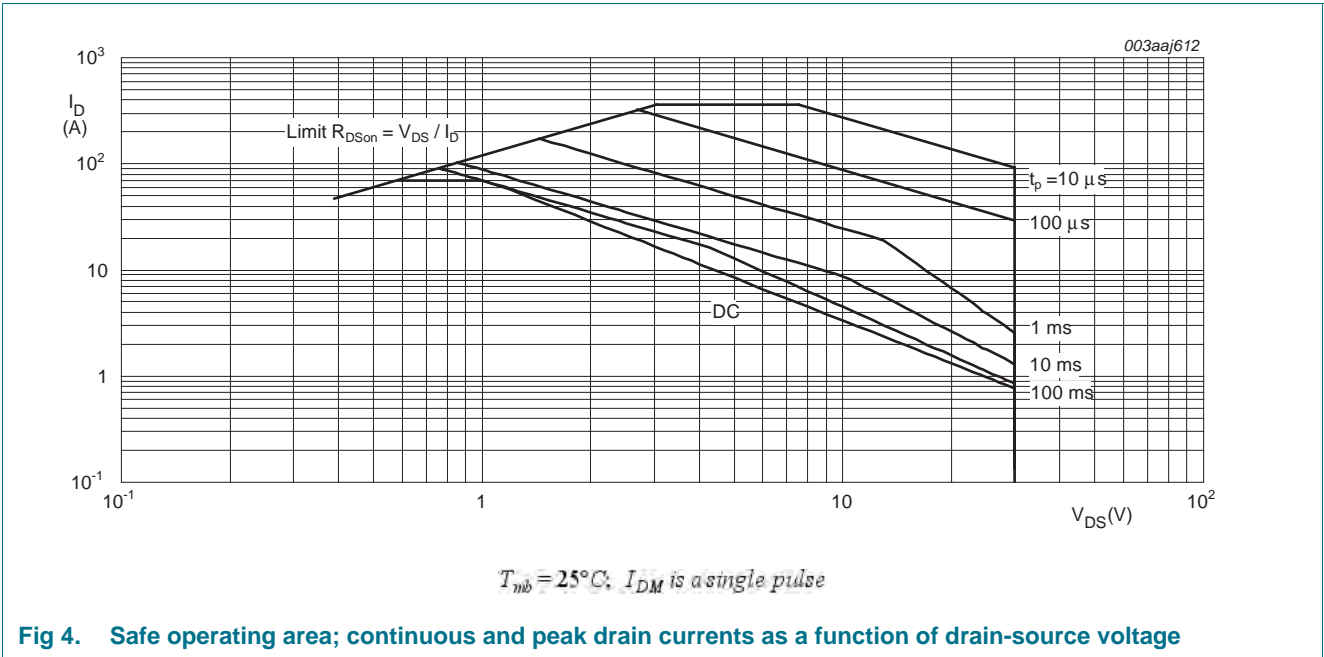
$$P_{der} = \frac{P_{Tot}}{P_{Tot(25^{\circ}C)}} \times 100\%$$

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



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

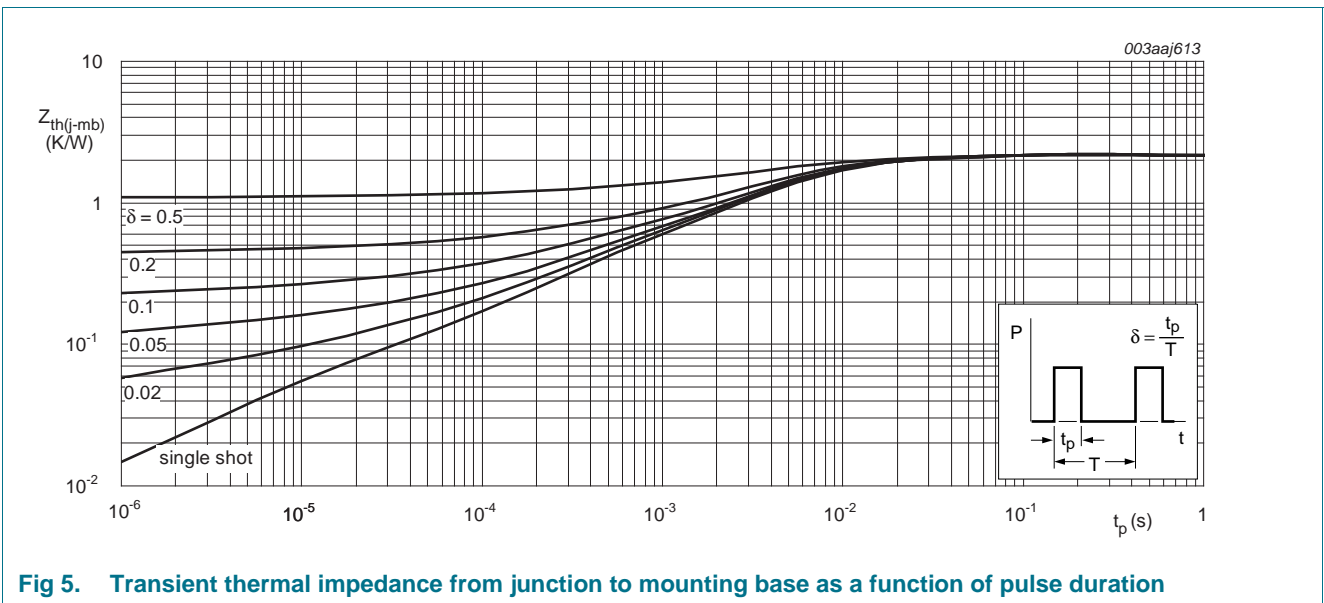
Fig 3. Single pulse avalanche rating; avalanche current as a function of avalanche time



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 | - | 1.95 | 2.18 | K/W |



6. Characteristics

Table 6. Characteristics

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|--------------------------------|----------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------|------|------|------|---------------|
| Static characteristics | | | | | | |
| $V_{(BR)DSS}$ | drain-source breakdown voltage | $I_D = 250 \mu\text{A}; V_{GS} = 0 \text{ V}; T_j = 25 \text{ }^\circ\text{C}$ | 30 | - | - | V |
| | | $I_D = 250 \mu\text{A}; V_{GS} = 0 \text{ V}; T_j = -55 \text{ }^\circ\text{C}$ | 27 | - | - | V |
| $V_{GS(th)}$ | gate-source threshold voltage | $I_D = 1 \text{ mA}; V_{DS} = V_{GS}; T_j = 25 \text{ }^\circ\text{C}$ | 1.45 | 1.8 | 2.15 | V |
| $\Delta V_{GS(th)}/\Delta T$ | gate-source threshold voltage variation with temperature | | - | -4.1 | - | mV/K |
| 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 | $V_{GS} = 4.5 \text{ V}; I_D = 25 \text{ A}; T_j = 25 \text{ }^\circ\text{C};$ see Figure 10 | - | 5.2 | 6 | mΩ |
| | | $V_{GS} = 4.5 \text{ V}; I_D = 25 \text{ A}; T_j = 150 \text{ }^\circ\text{C};$ see Figure 10 ; see Figure 11 | - | - | 10.2 | mΩ |
| | | $V_{GS} = 10 \text{ V}; I_D = 25 \text{ A}; T_j = 25 \text{ }^\circ\text{C};$ see Figure 10 | - | 4.05 | 4.65 | mΩ |
| | | $V_{GS} = 10 \text{ V}; I_D = 25 \text{ A}; T_j = 150 \text{ }^\circ\text{C};$ see Figure 10 ; see Figure 11 | - | - | 7.9 | mΩ |
| R_G | gate resistance | $f = 1 \text{ MHz}$ | 0.9 | 1.8 | 3.6 | Ω |
| Dynamic characteristics | | | | | | |
| $Q_{G(tot)}$ | total gate charge | $I_D = 25 \text{ A}; V_{DS} = 15 \text{ V}; V_{GS} = 10 \text{ V};$ see Figure 12 ; see Figure 13 | - | 23 | - | nC |
| | | $I_D = 25 \text{ A}; V_{DS} = 15 \text{ V}; V_{GS} = 4.5 \text{ V};$ see Figure 12 ; see Figure 13 | - | 10.6 | - | nC |
| | | $I_D = 0 \text{ A}; V_{DS} = 0 \text{ V}; V_{GS} = 10 \text{ V}$ | - | 22.9 | - | nC |
| Q_{GS} | gate-source charge | $I_D = 25 \text{ A}; V_{DS} = 15 \text{ V}; V_{GS} = 4.5 \text{ V};$ see Figure 12 ; see Figure 13 | - | 4.3 | - | nC |
| $Q_{GS(th)}$ | pre-threshold gate-source charge | | - | 3.9 | - | nC |
| $Q_{GS(th-pl)}$ | post-threshold gate-source charge | | - | 0.4 | - | nC |
| Q_{GD} | gate-drain charge | | - | 2.9 | - | nC |
| $V_{GS(pl)}$ | gate-source plateau voltage | $I_D = 25 \text{ A}; V_{DS} = 15 \text{ V};$ see Figure 12 ; see Figure 13 | - | 2.88 | - | V |
| C_{iss} | input capacitance | $V_{DS} = 15 \text{ V}; V_{GS} = 0 \text{ V}; f = 1 \text{ MHz};$ $T_j = 25 \text{ }^\circ\text{C};$ see Figure 14 | - | 1515 | - | pF |
| C_{oss} | output capacitance | | - | 333 | - | pF |
| C_{rss} | reverse transfer capacitance | | - | 122 | - | pF |

Table 6. Characteristics ...continued

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|---------------------------|----------------------------|-----------------------------------------------------------------------------------------------------------------------------------------|-----|------|-----|------|
| $t_{d(on)}$ | turn-on delay time | $V_{DS} = 15\text{ V}; R_L = 0.6\ \Omega; V_{GS} = 4.5\text{ V};$ $R_{G(ext)} = 5\ \Omega$ | - | 12.6 | - | ns |
| t_r | rise time | | - | 23.2 | - | ns |
| $t_{d(off)}$ | turn-off delay time | | - | 16 | - | ns |
| t_f | fall time | | - | 11.2 | - | ns |
| Q_{oss} | output charge | $V_{GS} = 0\text{ V}; V_{DS} = 15\text{ V}; f = 1\text{ MHz};$ $T_j = 25\text{ }^\circ\text{C}$ | - | 9.8 | - | nC |
| 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 15 | - | 0.82 | 1.1 | V |
| t_{rr} | reverse recovery time | $I_S = 25\text{ A}; di_S/dt = -100\text{ A}/\mu\text{s}; V_{GS} = 0\text{ V};$ $V_{DS} = 15\text{ V}$ | - | 18.3 | - | ns |
| Q_r | recovered charge | | - | 11 | - | nC |
| t_a | reverse recovery rise time | $V_{GS} = 0\text{ V}; I_S = 25\text{ A}; di_S/dt = -100\text{ A}/\mu\text{s};$ $V_{DS} = 15\text{ V};$ see Figure 16 | - | 11.3 | - | ns |
| t_b | reverse recovery fall time | | - | 7 | - | ns |

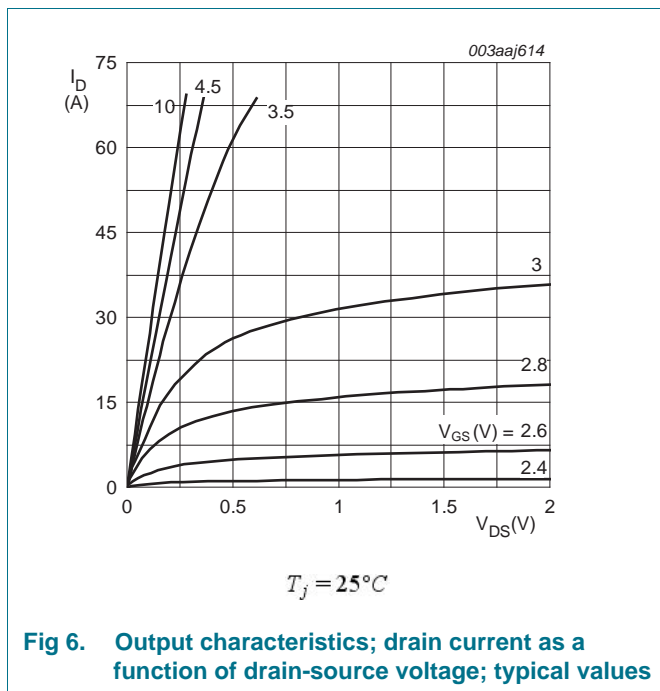


Fig 6. Output characteristics; drain current as a function of drain-source voltage; typical values

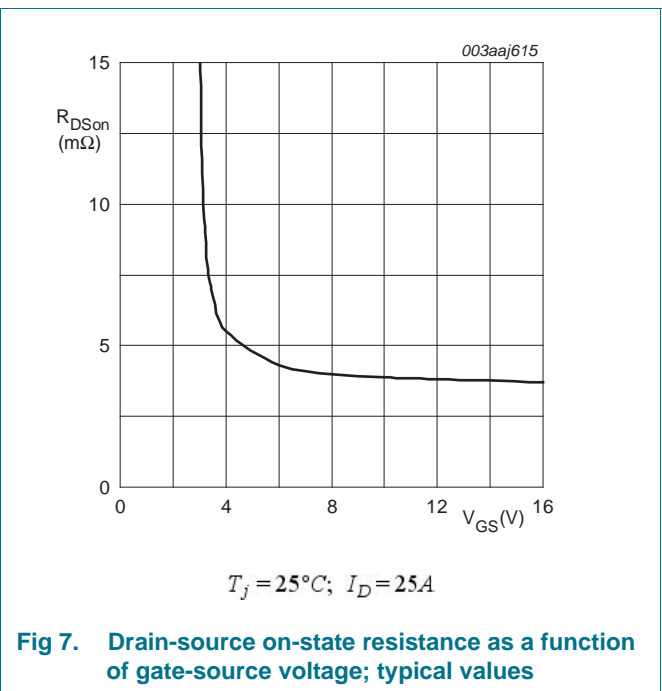
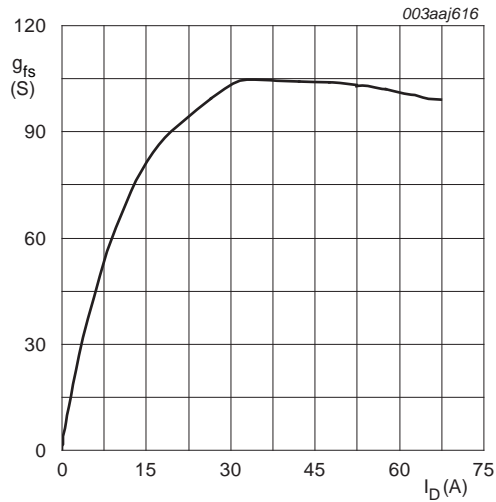
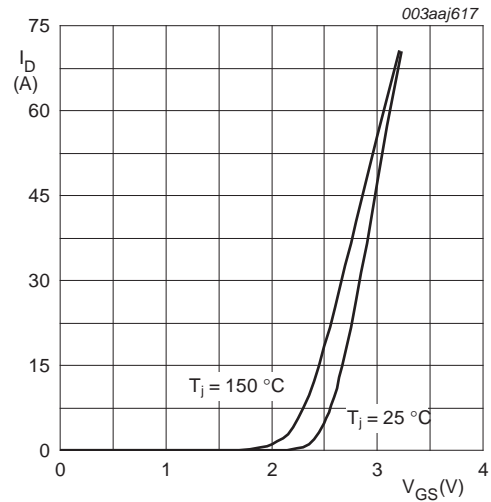


Fig 7. Drain-source on-state resistance as a function of gate-source voltage; typical values



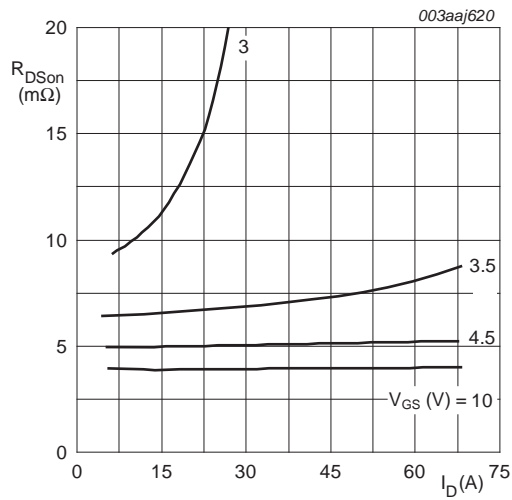
$T_j = 25^\circ C; V_{DS} = 10V$

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



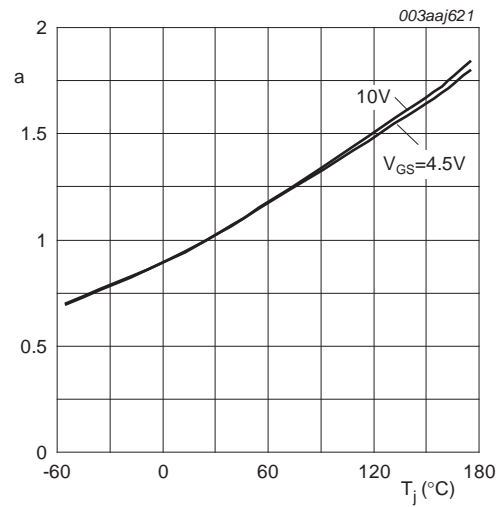
$V_{DS} = 10V$

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



$T_j = 25^\circ C$

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



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

Fig 11. Normalized drain-source on-state resistance factor as a function of junction temperature

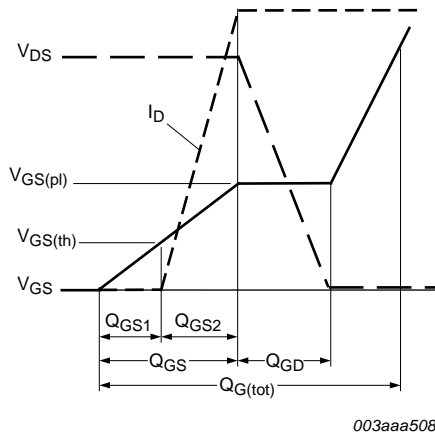
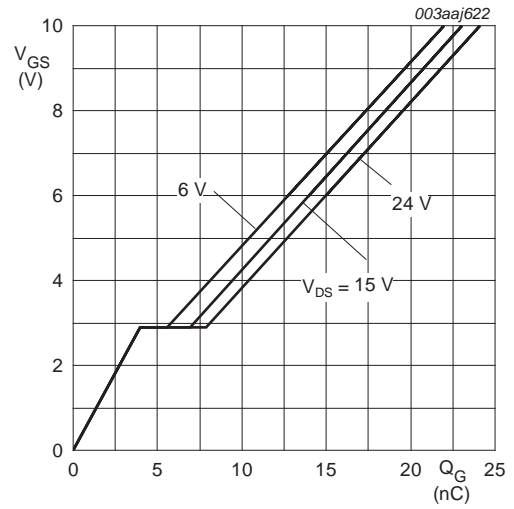
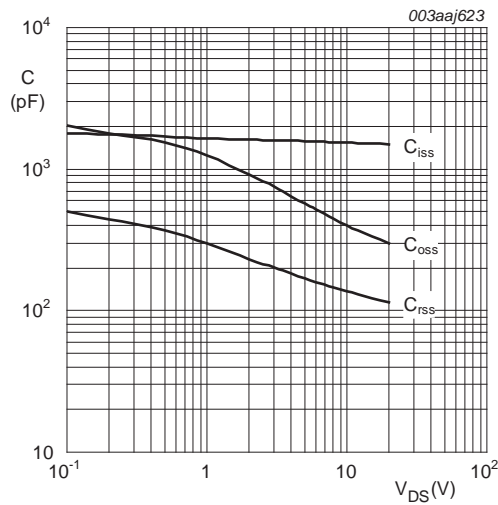


Fig 12. Gate charge waveform definitions



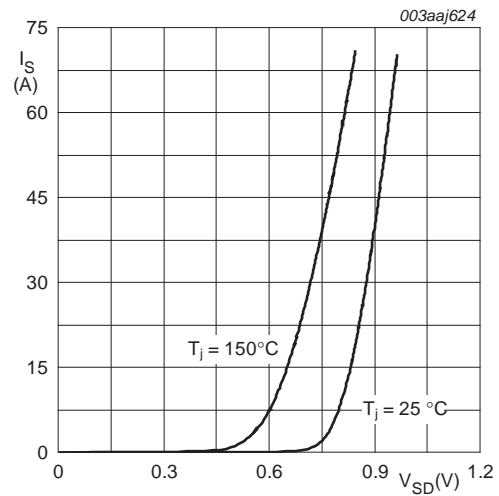
$T_j = 25^\circ\text{C}; I_D = 25\text{A}$

Fig 13. Gate-source voltage as a function of gate charge; typical values



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

Fig 14. Input, output and reverse transfer capacitances as a function of drain-source voltage; typical values



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

Fig 15. Source current as a function of source-drain voltage; typical values

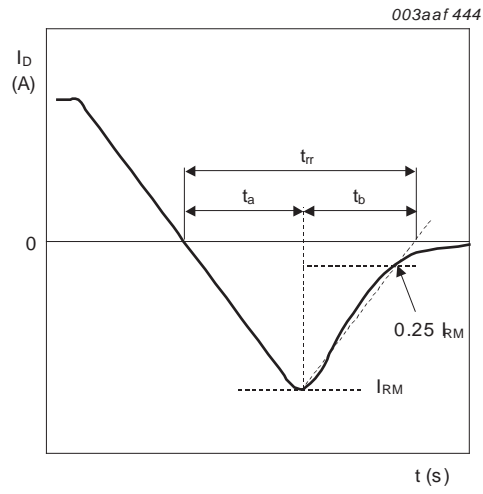


Fig 16. Reverse recovery timing definition

7. Package outline

Plastic single ended surface mounted package (LFAK33); 8 leads

SOT1210



Fig 17. Package outline SOT1210 (LFAK33)

8. Revision history

Table 7. Revision history

| Document ID | Release date | Data sheet status | Change notice | Supersedes |
|-------------------|-------------------------------|--------------------|---------------|-------------------|
| PSMN4R4-30MLC v.3 | 20120615 | Product data sheet | - | PSMN4R4-30MLC v.2 |
| Modifications: | • Various changes to content. | | | |
| PSMN4R4-30MLC v.2 | 20120606 | Product data sheet | - | PSMN4R4-30MLC v.1 |

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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[NTE2903](#) [NTE2941](#) [NTE2945](#) [NTE2946](#) [NTE2960](#) [NTE2967](#) [NTE2969](#) [NTE2976](#) [NTE455](#) [NTE6400A](#) [NTE2910](#) [NTE2916](#) [NTE2956](#)
[NTE2911](#) [US6M2GTR](#) [TK10A80W,S4X\(S](#) [SSM6P69NU,LF](#)