



# PSMN102-200Y

N-channel TrenchMOS SiliconMAX standard level FET

Rev. 03 — 16 March 2011

Product data sheet

## 1. Product profile

### 1.1 General description

SiliconMAX standard level N-channel enhancement mode Field-Effect Transistor (FET) in a plastic package using TrenchMOS technology. This product is designed and qualified for use in computing, communications, consumer and industrial applications only.

### 1.2 Features and benefits

- Higher operating power due to low thermal resistance
- Suitable for high frequency applications due to fast switching characteristics

### 1.3 Applications

- Class D amplifier
- DC-to-DC converters
- Motion control
- Switched-mode power supplies

### 1.4 Quick reference data

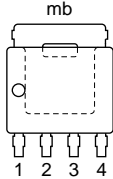
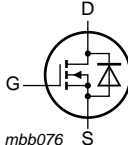
Table 1. Quick reference data

| Symbol                         | Parameter                        | Conditions   | Min | Typ  | Max  | Unit       |
|--------------------------------|----------------------------------|--|-----|------|------|------------|
| $V_{DS}$                       | drain-source voltage             | $T_j \geq 25\text{ °C}$ ; $T_j \leq 150\text{ °C}$   | -   | -    | 200  | V          |
| $I_D$                          | drain current                    | $T_{mb} = 25\text{ °C}$ ; $V_{GS} = 10\text{ V}$ ; see <a href="#">Figure 1</a> ; see <a href="#">Figure 3</a>                         | -   | -    | 21.5 | A          |
| $P_{tot}$                      | total power dissipation          | $T_{mb} = 25\text{ °C}$ ; see <a href="#">Figure 2</a>   | -   | -    | 113  | W          |
| <b>Static characteristics</b>  |                                  |  |     |      |      |            |
| $R_{DS(on)}$                   | drain-source on-state resistance | $V_{GS} = 10\text{ V}$ ; $I_D = 12\text{ A}$ ; $T_j = 25\text{ °C}$ ; see <a href="#">Figure 9</a> ; see <a href="#">Figure 10</a>     | -   | 86   | 102  | m $\Omega$ |
| <b>Dynamic characteristics</b> |                                  |  |     |      |      |            |
| $Q_{GD}$                       | gate-drain charge                | $V_{GS} = 10\text{ V}$ ; $I_D = 12\text{ A}$ ; $V_{DS} = 100\text{ V}$ ; see <a href="#">Figure 11</a> ; see <a href="#">Figure 12</a> | -   | 10.1 | -    | 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 (LFAK)**

## 3. Ordering information

Table 3. Ordering information

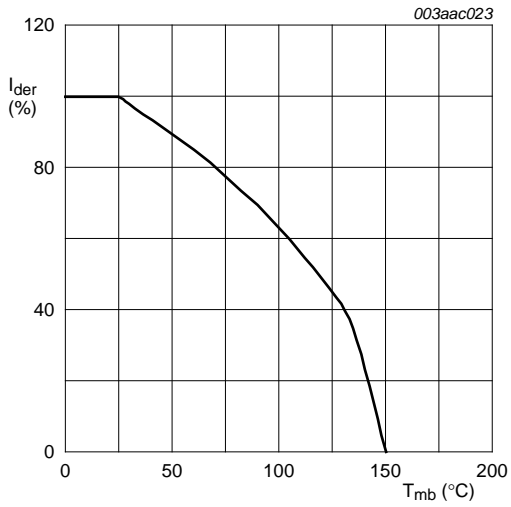
| Type number  | Package |  | Description  | Version |
|--------------|---------|--|--|---------|
|              | Name    |  |  |         |
| PSMN102-200Y | LFAK    |  | plastic single-ended surface-mounted package (LFAK); 4 leads | SOT669  |

## 4. Limiting values

Table 4. Limiting values

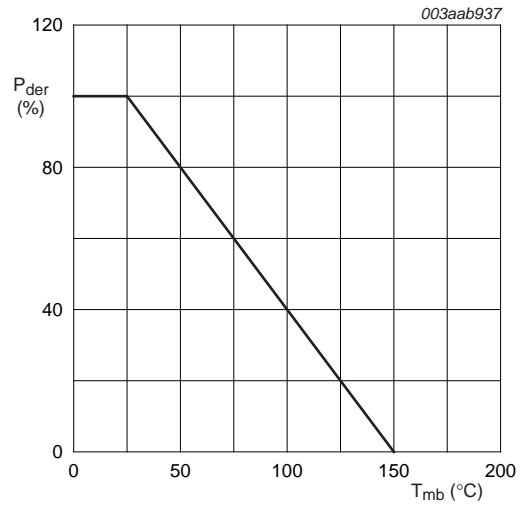
In accordance with the Absolute Maximum Rating System (IEC 60134).

| Symbol                      | Parameter                                    | Conditions  | Min | Max  | Unit |
|-----------------------------|--|---|-----|------|------|
| $V_{DS}$                    | drain-source voltage                         | $T_j \geq 25\text{ °C}; T_j \leq 150\text{ °C}$   | -   | 200  | V    |
| $V_{DGR}$                   | drain-gate voltage                           | $T_j \geq 25\text{ °C}; T_j \leq 150\text{ °C}; R_{GS} = 20\text{ k}\Omega$   | -   | 200  | V    |
| $V_{GS}$                    | gate-source voltage                          |   | -20 | 20   | V    |
| $I_D$                       | drain current                                | $V_{GS} = 10\text{ V}; T_{mb} = 25\text{ °C};$ see <a href="#">Figure 1</a> ;<br>see <a href="#">Figure 3</a>   | -   | 21.5 | A    |
|                             |  | $V_{GS} = 10\text{ V}; T_{mb} = 100\text{ °C};$ see <a href="#">Figure 1</a>  | -   | 13.6 | A    |
| $I_{DM}$                    | peak drain current                           | pulsed; $t_p \leq 10\text{ }\mu\text{s}; T_{mb} = 25\text{ °C};$<br>see <a href="#">Figure 3</a>  | -   | 65   | A    |
| $P_{tot}$                   | total power dissipation                      | $T_{mb} = 25\text{ °C};$ see <a href="#">Figure 2</a>   | -   | 113  | W    |
| $T_{stg}$                   | storage temperature                          |   | -55 | 150  | °C   |
| $T_j$                       | junction temperature                         |   | -55 | 150  | °C   |
| <b>Source-drain diode</b>   |  |   |     |      |      |
| $I_S$                       | source current                               | $T_{mb} = 25\text{ °C}$   | -   | 52   | A    |
| $I_{SM}$                    | peak source current                          | pulsed; $t_p \leq 10\text{ }\mu\text{s}; T_{mb} = 25\text{ °C}$   | -   | 208  | A    |
| <b>Avalanche ruggedness</b> |  |   |     |      |      |
| $E_{DS(AL)S}$               | non-repetitive drain-source avalanche energy | $V_{GS} = 10\text{ V}; T_{j(\text{init})} = 25\text{ °C}; I_D = 10.8\text{ A};$<br>$V_{sup} \leq 200\text{ V};$ unclamped; $t_p = 0.14\text{ ms};$<br>$R_{GS} = 50\text{ }\Omega$ | -   | 202  | mJ   |



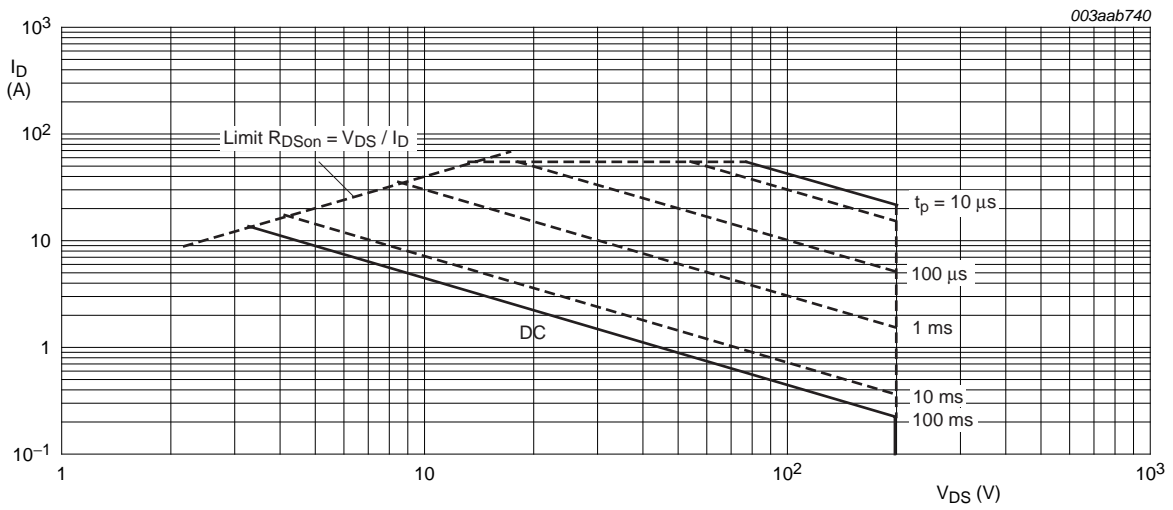
$$I_{der} = \frac{I_D}{I_{D(25^\circ\text{C})}} \times 100\%$$

Fig 1. Normalized 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 solder point temperature



$T_{mb} = 25^\circ\text{C}; I_{DM}$  is single pulse

Fig 3. 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 | Mounted on a printed-circuit board; vertical in still air; see <a href="#">Figure 4</a> | -   | -   | 1.1 | K/W  |

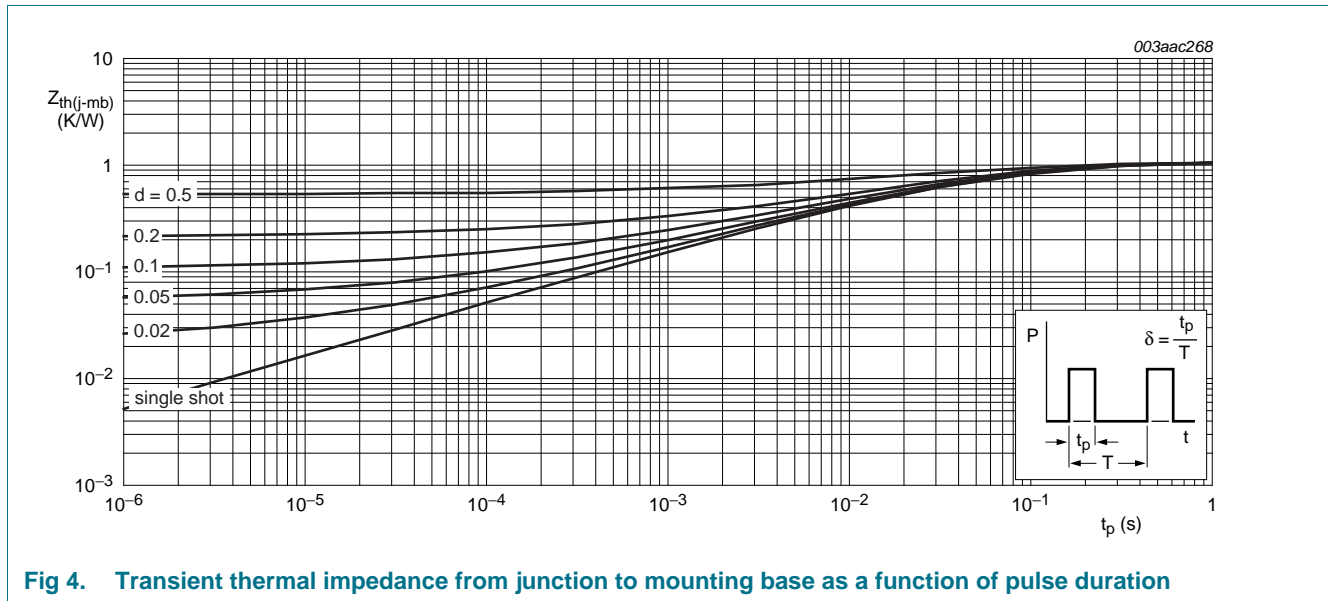


Fig 4. Transient thermal impedance from junction to mounting base as a function of pulse duration

## 6. Characteristics

Table 6. Characteristics

| Symbol                         | Parameter                        | Conditions   | Min | Typ  | Max | Unit          |
|--------------------------------|----------------------------------|--|-----|------|-----|---------------|
| <b>Static characteristics</b>  |                                  |  |     |      |     |               |
| $V_{(BR)DSS}$                  | drain-source breakdown voltage   | $I_D = 250 \mu\text{A}; V_{GS} = 0 \text{ V}; T_j = 25 \text{ }^\circ\text{C}$   | 200 | -    | -   | V             |
|                                |                                  | $I_D = 250 \mu\text{A}; V_{GS} = 0 \text{ V}; T_j = -55 \text{ }^\circ\text{C}$  | 178 | -    | -   | V             |
| $V_{GS(th)}$                   | gate-source threshold voltage    | $I_D = 1 \text{ mA}; V_{DS} = V_{GS}; T_j = 25 \text{ }^\circ\text{C};$<br>see <a href="#">Figure 7</a> ; see <a href="#">Figure 8</a>         | 2   | 3    | 4   | V             |
|                                |                                  | $I_D = 1 \text{ mA}; V_{DS} = V_{GS}; T_j = 150 \text{ }^\circ\text{C};$<br>see <a href="#">Figure 7</a> ; see <a href="#">Figure 8</a>        | 1   | -    | -   | V             |
|                                |                                  | $I_D = 1 \text{ mA}; V_{DS} = V_{GS}; T_j = -55 \text{ }^\circ\text{C};$<br>see <a href="#">Figure 7</a> ; see <a href="#">Figure 8</a>        | -   | -    | 4.4 | V             |
| $I_{DSS}$                      | drain leakage current            | $V_{DS} = 160 \text{ V}; V_{GS} = 0 \text{ V}; T_j = 25 \text{ }^\circ\text{C}$  | -   | -    | 1   | $\mu\text{A}$ |
|                                |                                  | $V_{DS} = 160 \text{ V}; V_{GS} = 0 \text{ V}; T_j = 150 \text{ }^\circ\text{C}$   | -   | -    | 100 | $\mu\text{A}$ |
| $I_{GSS}$                      | gate leakage current             | $V_{GS} = 20 \text{ V}; V_{DS} = 0 \text{ V}; T_j = 20 \text{ }^\circ\text{C}$   | -   | -    | 100 | nA            |
|                                |                                  | $V_{GS} = -20 \text{ V}; V_{DS} = 0 \text{ V}; T_j = 20 \text{ }^\circ\text{C}$  | -   | -    | 100 | nA            |
| $R_{DS(on)}$                   | drain-source on-state resistance | $V_{GS} = 10 \text{ V}; I_D = 12 \text{ A}; T_j = 25 \text{ }^\circ\text{C};$<br>see <a href="#">Figure 9</a> ; see <a href="#">Figure 10</a>  | -   | 86   | 102 | m $\Omega$    |
|                                |                                  | $V_{GS} = 10 \text{ V}; I_D = 12 \text{ A}; T_j = 150 \text{ }^\circ\text{C};$<br>see <a href="#">Figure 9</a> ; see <a href="#">Figure 10</a> | -   | 206  | 245 | m $\Omega$    |
| $R_G$                          | gate resistance                  | $f = 1 \text{ MHz}$  | -   | 1.1  | -   | $\Omega$      |
| <b>Dynamic characteristics</b> |                                  |  |     |      |     |               |
| $Q_{G(tot)}$                   | total gate charge                | $I_D = 12 \text{ A}; V_{DS} = 100 \text{ V}; V_{GS} = 10 \text{ V};$<br>see <a href="#">Figure 11</a> ; see <a href="#">Figure 12</a>          | -   | 30.7 | -   | nC            |
| $Q_{GS}$                       | gate-source charge               |  | -   | 6.3  | -   | nC            |
| $Q_{GD}$                       | gate-drain charge                |  | -   | 10.1 | -   | nC            |
| $V_{GS(pl)}$                   | gate-source plateau voltage      | $I_D = 12 \text{ A}; V_{DS} = 100 \text{ V};$ see <a href="#">Figure 11</a> ;<br>see <a href="#">Figure 12</a>                                 | -   | 4.6  | -   | V             |
| $C_{iss}$                      | input capacitance                | $V_{DS} = 30 \text{ V}; V_{GS} = 0 \text{ V}; f = 1 \text{ MHz};$<br>$T_j = 25 \text{ }^\circ\text{C};$ see <a href="#">Figure 13</a>          | -   | 1568 | -   | pF            |
| $C_{oss}$                      | output capacitance               |  | -   | 170  | -   | pF            |
| $C_{rSS}$                      | reverse transfer capacitance     |  | -   | 55   | -   | pF            |
| $t_{d(on)}$                    | turn-on delay time               | $V_{DS} = 100 \text{ V}; R_L = 5.8 \text{ } \Omega; V_{GS} = 10 \text{ V};$<br>$R_{G(ext)} = 5.6 \text{ } \Omega$                              | -   | 14.2 | -   | ns            |
| $t_r$                          | rise time                        |  | -   | 29.5 | -   | ns            |
| $t_{d(off)}$                   | turn-off delay time              |  | -   | 33   | -   | ns            |
| $t_f$                          | fall time                        |  | -   | 28   | -   | ns            |
| <b>Source-drain diode</b>      |                                  |  |     |      |     |               |
| $V_{SD}$                       | source-drain voltage             | $I_S = 12 \text{ A}; V_{GS} = 0 \text{ V}; T_j = 25 \text{ }^\circ\text{C};$<br>see <a href="#">Figure 14</a>                                  | -   | 0.9  | 1.2 | V             |
| $t_{rr}$                       | reverse recovery time            | $I_S = 20 \text{ A}; dI_S/dt = -100 \text{ A}/\mu\text{s}; V_{GS} = 0 \text{ V};$<br>$V_{DS} = 30 \text{ V}$                                   | -   | 143  | -   | ns            |
| $Q_r$                          | recovered charge                 | $I_S = 20 \text{ A}; dI_S/dt = -100 \text{ A}/\mu\text{s}; V_{GS} = 0 \text{ V}$   | -   | 268  | -   | nC            |

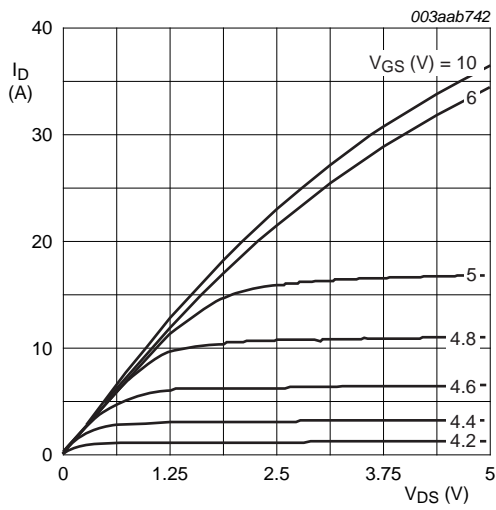


Fig 5. Output characteristics: drain current as a function of drain-source voltage; typical values

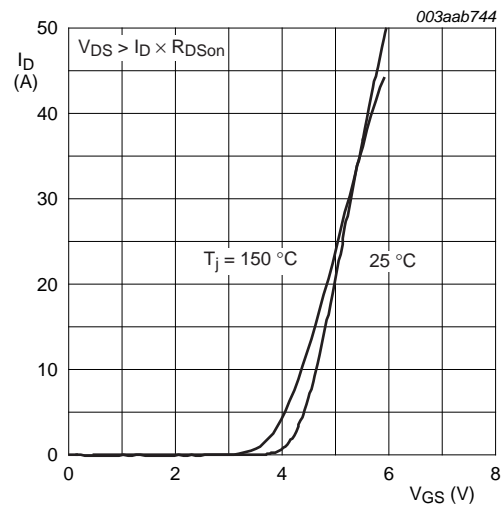


Fig 6. Transfer characteristics: drain current as a function of gate-source voltage; typical values

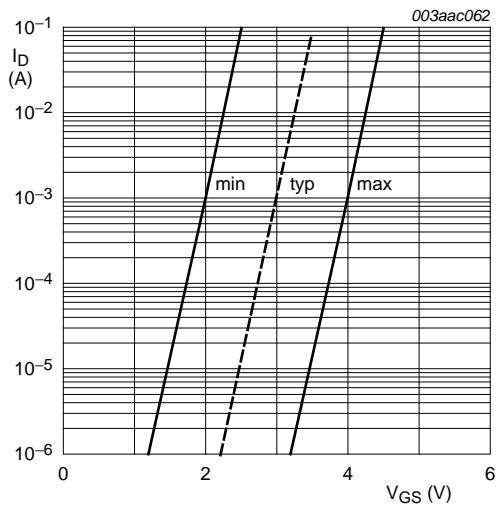


Fig 7. Sub-threshold drain current as a function of gate-source voltage

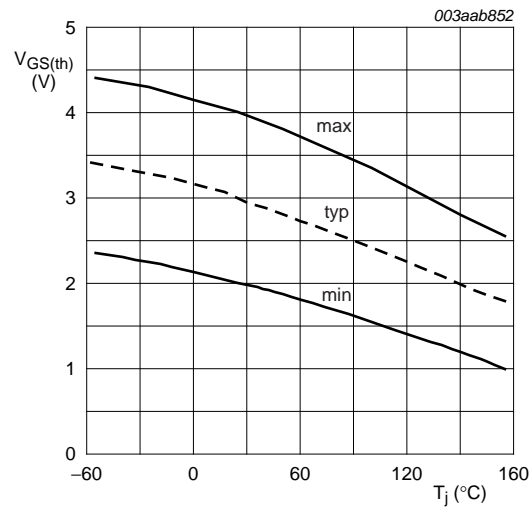
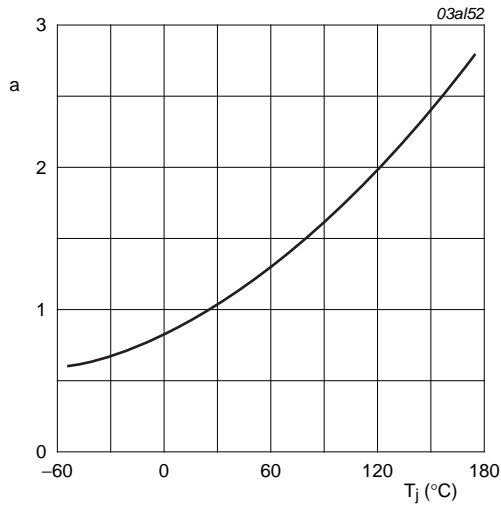
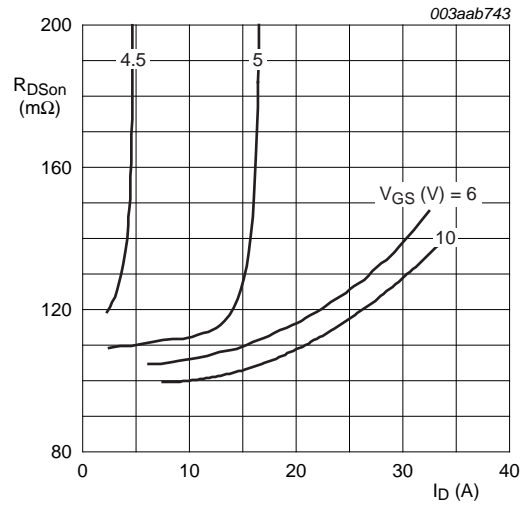


Fig 8. Gate-source threshold voltage as a function of junction temperature



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

Fig 9. Normalized drain-source on-state resistance factor as a function of junction temperature



$T_j = 25^{\circ}C$

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

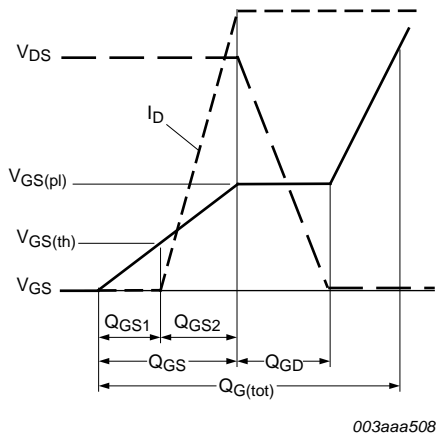
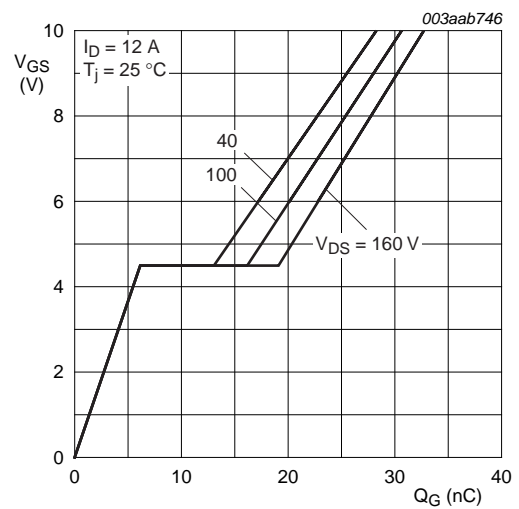
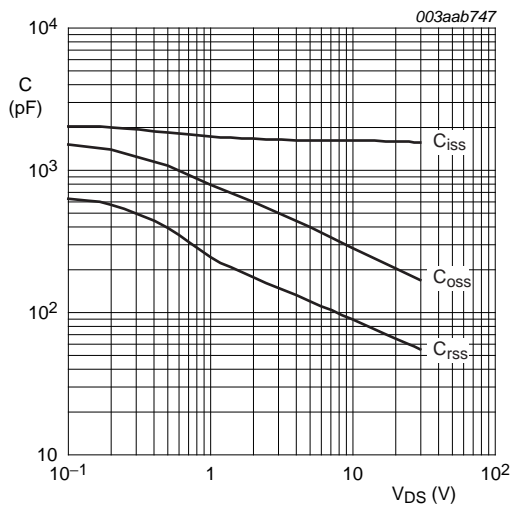


Fig 11. Gate charge waveform definitions



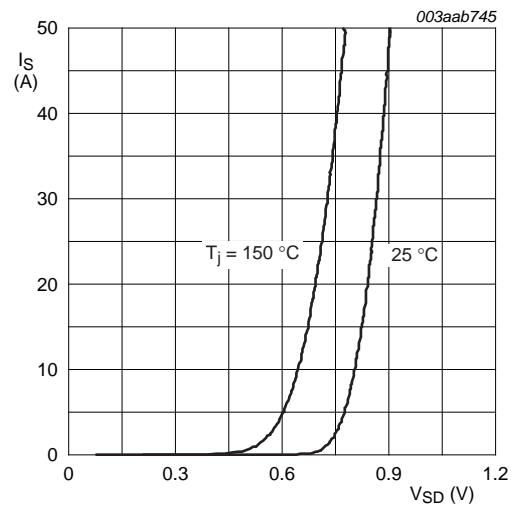
$I_D = 12 A; V_{DS} = 40, 100, \text{ and } 160 V$

Fig 12. Gate-source voltage as a function of gate charge; typical values



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

Fig 13. Input, output and reverse transfer capacitances as a function of drain-source voltage; typical values



$T_j = 25^\circ C \text{ and } 150^\circ C; V_{GS} = 0V$

Fig 14. Source current as a function of source-drain voltage; typical values



7. Package outline

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

SOT669

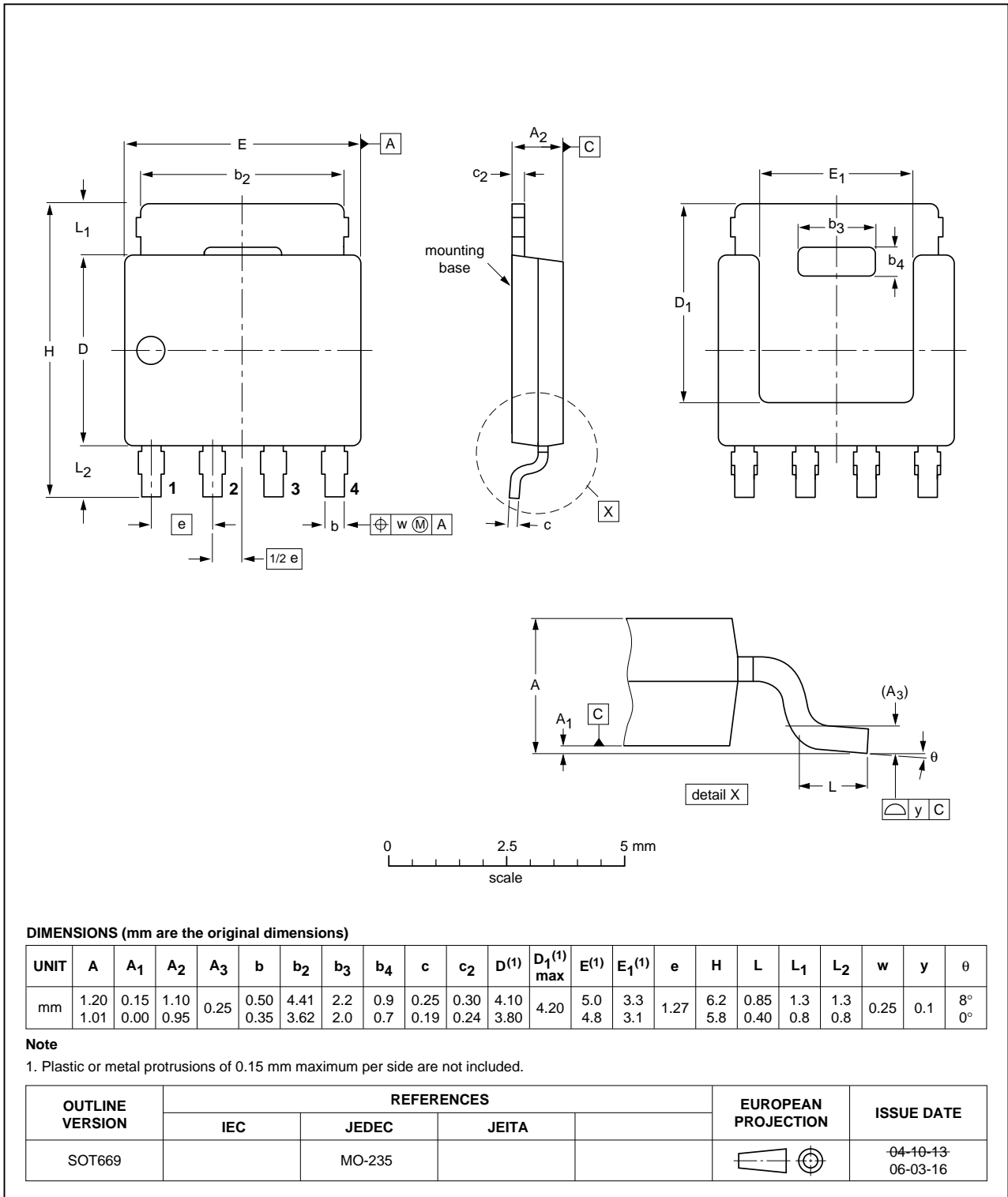


Fig 15. Package outline SOT669 (LFAK)

## 8. Revision history

Table 7. Revision history

| Document ID      | Release date                  | Data sheet status  | Change notice | Supersedes       |
|------------------|-------------------------------|--------------------|---------------|------------------|
| PSMN102-200Y v.3 | 20110316                      | Product data sheet | -             | PSMN102-200Y v.2 |
| Modifications:   | • Various changes to content. |                    |               |                  |
| PSMN102-200Y v.2 | 20101220                      | Product data sheet | -             | PSMN102-200Y v.1 |

## 9. Legal information

### 9.1 Data sheet status

| Document status <sup>[1]</sup> <sup>[2]</sup> | Product status <sup>[3]</sup> | 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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## 11. Contents

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

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