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Kind regards,

Team Nexperia

## 1. Product profile

### 1.1 General description

Logic 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

- High efficiency due to low switching and conduction losses
- Suitable for logic level gate drive sources

### 1.3 Applications

- DC-to-DC convertors
- Notebook computers
- Portable equipment
- Switched-mode power supplies

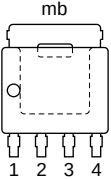
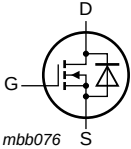
### 1.4 Quick reference data

Table 1. Quick reference

| Symbol                         | Parameter                        | Conditions                                                                                                                                   | Min | Typ | Max  | Unit |
|--------------------------------|----------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------|-----|-----|------|------|
| $V_{DS}$                       | drain-source voltage             | $25\text{ °C} \leq T_j \leq 150\text{ °C}$                                                                                                   | -   | -   | 30   | V    |
| $I_D$                          | drain current                    | $T_{mb} = 25\text{ °C}$ ; $V_{GS} = 10\text{ V}$ ;<br>see <a href="#">Figure 1</a> ; see <a href="#">Figure 3</a>                            | -   | -   | 63   | A    |
| $P_{tot}$                      | total power dissipation          | $T_{mb} = 25\text{ °C}$ ; see <a href="#">Figure 2</a>                                                                                       | -   | -   | 62.5 | W    |
| <b>Dynamic characteristics</b> |                                  |                                                                                                                                              |     |     |      |      |
| $Q_{GD}$                       | gate-drain charge                | $V_{GS} = 4.5\text{ V}$ ; $I_D = 10\text{ A}$ ;<br>$V_{DS} = 12\text{ V}$ ; see <a href="#">Figure 10</a> ;<br>see <a href="#">Figure 11</a> | -   | 3.2 | -    | nC   |
| <b>Static characteristics</b>  |                                  |                                                                                                                                              |     |     |      |      |
| $R_{DSon}$                     | drain-source on-state resistance | $V_{GS} = 10\text{ V}$ ; $I_D = 25\text{ A}$ ;<br>$T_j = 25\text{ °C}$ ; see <a href="#">Figure 8</a> ; see <a href="#">Figure 9</a>         | -   | 7   | 9    | mΩ   |

## 2. Pinning information

Table 2. Pinning information

| Pin   | Symbol | Description                       | Simplified outline                                                                                                 | Graphic symbol                                                                                    |
|-------|--------|-----------------------------------|--------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------|
| 1,2,3 | S      | source                            |  <p><b>SOT669<br/>(LPAK)</b></p> |  <p>mbb076</p> |
| 4     | G      | gate                              |                                                                                                                    |                                                                                                   |
| mb    | D      | mounting base; connected to drain |                                                                                                                    |                                                                                                   |

## 3. Ordering information

Table 3. Ordering information

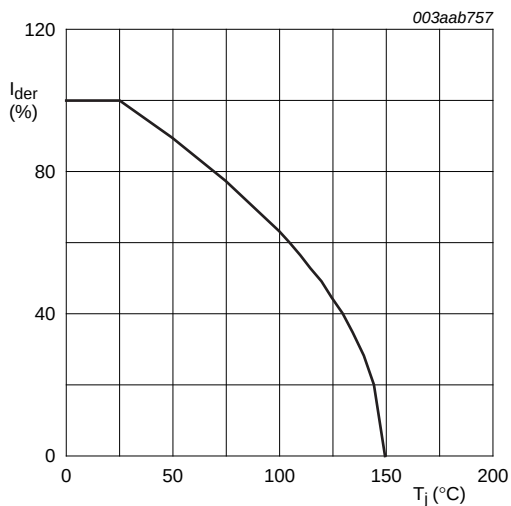
| Type number | Package     | Description                                                  | Version |
|-------------|-------------|--------------------------------------------------------------|---------|
|             | <b>Name</b> |                                                              |         |
| PH9030L     | LPAK        | Plastic single-ended surface-mounted package (LPAK); 4 leads | SOT669  |

## 4. Limiting values

Table 4. Limiting values

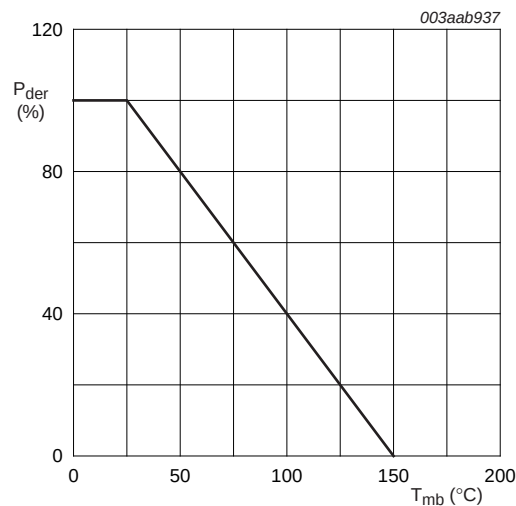
In accordance with the Absolute Maximum Rating System (IEC 60134).

| Symbol                      | Parameter                                    | Conditions                                                                                                                                                                 | Min | Max  | Unit |
|-----------------------------|----------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|------|------|
| $V_{DS}$                    | drain-source voltage                         | $25\text{ °C} \leq T_j \leq 150\text{ °C}$                                                                                                                                 | -   | 30   | V    |
| $V_{DGR}$                   | drain-gate voltage                           | $25\text{ °C} \leq T_j \leq 150\text{ °C}$ ; $R_{GS} = 20\text{ k}\Omega$                                                                                                  | -   | 30   | V    |
| $V_{GS}$                    | gate-source voltage                          |                                                                                                                                                                            | -20 | 20   | V    |
| $I_D$                       | drain current                                | $V_{GS} = 10\text{ V}$ ; $T_j = 100\text{ °C}$ ; see <a href="#">Figure 1</a>                                                                                              | -   | 39   | A    |
|                             |                                              | $V_{GS} = 10\text{ V}$ ; $T_{mb} = 25\text{ °C}$ ; see <a href="#">Figure 1</a> ; see <a href="#">Figure 3</a>                                                             | -   | 63   | A    |
| $I_{DM}$                    | peak drain current                           | $t_p \leq 10\text{ }\mu\text{s}$ ; pulsed; $T_{mb} = 25\text{ °C}$ ; see <a href="#">Figure 3</a>                                                                          | -   | 214  | A    |
| $P_{tot}$                   | total power dissipation                      | $T_{mb} = 25\text{ °C}$ ; see <a href="#">Figure 2</a>                                                                                                                     | -   | 62.5 | 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                          | $t_p \leq 10\text{ }\mu\text{s}$ ; pulsed; $T_{mb} = 25\text{ °C}$                                                                                                         | -   | 208  | A    |
| <b>Avalanche Ruggedness</b> |                                              |                                                                                                                                                                            |     |      |      |
| $E_{DS(AL)S}$               | non-repetitive drain-source avalanche energy | $V_{GS} = 10\text{ V}$ ; $T_{j(init)} = 25\text{ °C}$ ; $I_D = 33\text{ A}$ ; $V_{sup} \leq 30\text{ V}$ ; unclamped; $t_p = 0.08\text{ ms}$ ; $R_{GS} = 50\text{ }\Omega$ | -   | 53   | mJ   |



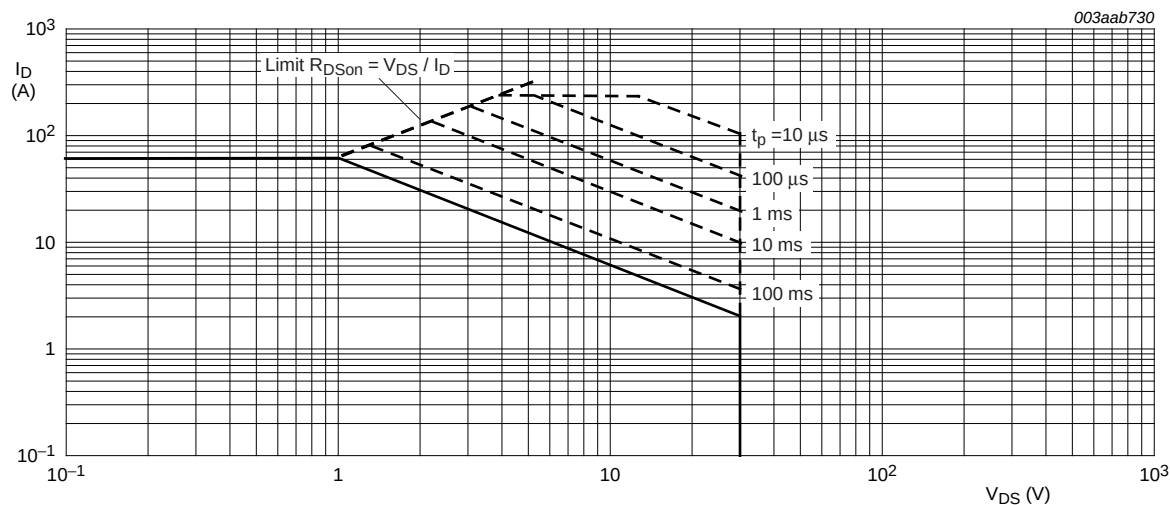
$$I_{der} = \frac{I_D}{I_{D(25^\circ\text{C})}} \times 100\%$$

**Fig 1. Normalized continuous drain current as a function of solder point 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**



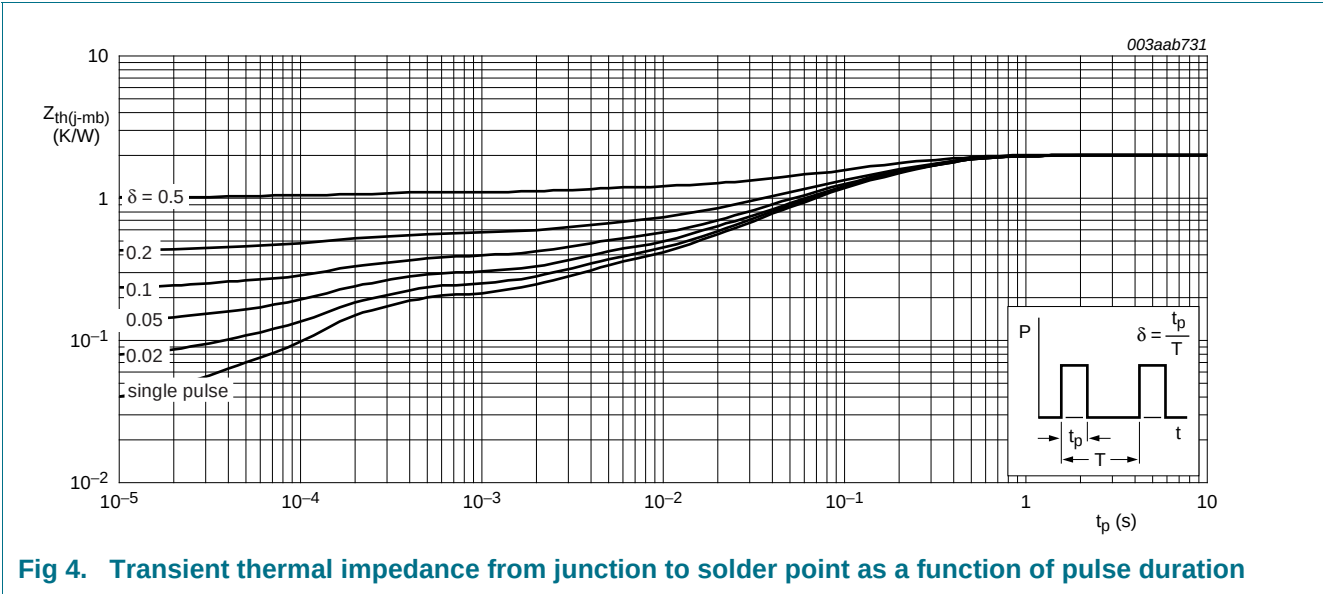
$T_{mb} = 25^\circ\text{C}; I_{DM}$  is single pulse

**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 | see <a href="#">Figure 4</a> | -   | -   | 2   | K/W  |



## 6. Characteristics

**Table 6. Characteristics**

| Symbol                         | Parameter                         | Conditions                                                                                                              | Min | Typ  | Max  | Unit       |
|--------------------------------|-----------------------------------|-------------------------------------------------------------------------------------------------------------------------|-----|------|------|------------|
| <b>Static characteristics</b>  |                                   |                                                                                                                         |     |      |      |            |
| $V_{(BR)DSS}$                  | drain-source breakdown voltage    | $I_D = 250\ \mu A$ ; $V_{GS} = 0\ V$ ; $T_j = 25\ ^\circ C$                                                             | 30  | -    | -    | V          |
|                                |                                   | $I_D = 250\ \mu A$ ; $V_{GS} = 0\ V$ ; $T_j = -55\ ^\circ C$                                                            | 27  | -    | -    | V          |
| $V_{GS(th)}$                   | gate-source threshold voltage     | $I_D = 1\ mA$ ; $V_{DS} = V_{GS}$ ; $T_j = 25\ ^\circ C$ ; see <a href="#">Figure 6</a> ; see <a href="#">Figure 7</a>  | 1.3 | 1.7  | 2    | V          |
| $V_{GSth}$                     | gate-source threshold voltage     | $I_D = 1\ mA$ ; $V_{DS} = V_{GS}$ ; $T_j = -55\ ^\circ C$ ; see <a href="#">Figure 7</a> ; see <a href="#">Figure 6</a> | -   | -    | 2.6  | V          |
|                                |                                   | $I_D = 1\ mA$ ; $V_{DS} = V_{GS}$ ; $T_j = 150\ ^\circ C$ ; see <a href="#">Figure 7</a> ; see <a href="#">Figure 6</a> | 0.8 | -    | -    | V          |
| $I_{DSS}$                      | drain leakage current             | $V_{DS} = 30\ V$ ; $V_{GS} = 0\ V$ ; $T_j = 25\ ^\circ C$                                                               | -   | -    | 1    | $\mu A$    |
| $I_{GSS}$                      | gate leakage current              | $V_{GS} = 16\ V$ ; $V_{DS} = 0\ V$ ; $T_j = 25\ ^\circ C$                                                               | -   | -    | 100  | nA         |
|                                |                                   | $V_{GS} = -16\ V$ ; $V_{DS} = 0\ V$ ; $T_j = 25\ ^\circ C$                                                              | -   | -    | 100  | nA         |
| $R_{DSon}$                     | drain-source on-state resistance  | $V_{GS} = 10\ V$ ; $I_D = 25\ A$ ; $T_j = 150\ ^\circ C$ ; see <a href="#">Figure 8</a> ; see <a href="#">Figure 9</a>  | -   | 11.9 | 15.8 | m $\Omega$ |
|                                |                                   | $V_{GS} = 4.5\ V$ ; $I_D = 25\ A$ ; $T_j = 25\ ^\circ C$ ; see <a href="#">Figure 8</a> ; see <a href="#">Figure 9</a>  | -   | 10   | 12.5 | m $\Omega$ |
|                                |                                   | $V_{GS} = 10\ V$ ; $I_D = 25\ A$ ; $T_j = 25\ ^\circ C$ ; see <a href="#">Figure 8</a> ; see <a href="#">Figure 9</a>   | -   | 7    | 9    | m $\Omega$ |
| $I_{DSS}$                      | drain leakage current             | $V_{DS} = 30\ V$ ; $V_{GS} = 0\ V$ ; $T_j = 150\ ^\circ C$                                                              | -   | -    | 100  | $\mu A$    |
| $R_G$                          | internal gate resistance (AC)     | $f = 1\ MHz$                                                                                                            | -   | 0.56 | -    | $\Omega$   |
| <b>Dynamic characteristics</b> |                                   |                                                                                                                         |     |      |      |            |
| $Q_{G(tot)}$                   | total gate charge                 | $I_D = 10\ A$ ; $V_{DS} = 12\ V$ ; $V_{GS} = 4.5\ V$ ; see <a href="#">Figure 10</a> ; see <a href="#">Figure 11</a>    | -   | 13.3 | -    | nC         |
| $Q_{GS}$                       | gate-source charge                |                                                                                                                         | -   | 4.8  | -    | nC         |
| $Q_{GD}$                       | gate-drain charge                 |                                                                                                                         | -   | 3.2  | -    | nC         |
| $Q_{GS(th)}$                   | pre-threshold gate-source charge  |                                                                                                                         | -   | 1.8  | -    | nC         |
| $Q_{GS(th-pl)}$                | post-threshold gate-source charge |                                                                                                                         | -   | 3    | -    | nC         |
| $V_{GS(pl)}$                   | gate-source plateau voltage       | $I_D = 10\ A$ ; $V_{DS} = 12\ V$ ; see <a href="#">Figure 10</a> ; see <a href="#">Figure 11</a>                        | -   | 2.72 | -    | V          |
| $C_{iss}$                      | input capacitance                 | $V_{DS} = 12\ V$ ; $V_{GS} = 0\ V$ ; $f = 1\ MHz$ ; $T_j = 25\ ^\circ C$ ; see <a href="#">Figure 12</a>                | -   | 1565 | -    | pF         |
|                                |                                   | $V_{DS} = 0\ V$ ; $V_{GS} = 0\ V$ ; $f = 1\ MHz$ ; $T_j = 25\ ^\circ C$                                                 | -   | 1839 | -    | pF         |
| $C_{oss}$                      | output capacitance                | $V_{DS} = 12\ V$ ; $V_{GS} = 0\ V$ ; $f = 1\ MHz$ ; $T_j = 25\ ^\circ C$ ; see <a href="#">Figure 12</a>                | -   | 355  | -    | pF         |
| $C_{rss}$                      | reverse transfer capacitance      |                                                                                                                         | -   | 186  | -    | pF         |
| $t_{d(on)}$                    | turn-on delay time                | $V_{DS} = 12\ V$ ; $R_L = 0.5\ \Omega$ ; $V_{GS} = 4.5\ V$ ; $R_{G(ext)} = 5.6\ \Omega$                                 | -   | 20   | -    | ns         |
| $t_r$                          | rise time                         |                                                                                                                         | -   | 41   | -    | ns         |
| $t_{d(off)}$                   | turn-off delay time               |                                                                                                                         | -   | 15   | -    | ns         |

Table 6. Characteristics ...continued

| Symbol                    | Parameter             | Conditions                                                                                                                          | Min | Typ  | Max  | Unit |
|---------------------------|-----------------------|-------------------------------------------------------------------------------------------------------------------------------------|-----|------|------|------|
| $t_f$                     | fall time             | $V_{DS} = 12\text{ V}$ ; $R_L = 0.5\ \Omega$ ; $R_L = 0.5\ \Omega$ ;<br>$V_{GS} = 4.5\text{ V}$ ; $R_{G(\text{ext})} = 5.6\ \Omega$ | -   | 25   | -    | ns   |
| <b>Source-drain diode</b> |                       |                                                                                                                                     |     |      |      |      |
| $V_{SD}$                  | source-drain voltage  | $I_S = 25\text{ A}$ ; $V_{GS} = 0\text{ V}$ ; $T_j = 25\text{ }^\circ\text{C}$ ; see<br><a href="#">Figure 14</a>                   | -   | 0.89 | 1.16 | V    |
| $t_{rr}$                  | reverse recovery time | $I_S = 20\text{ A}$ ; $di_S/dt = -100\text{ A/s}$ ; $V_{GS} = 0\text{ V}$ ;                                                         | -   | 43   | -    | ns   |
| $Q_r$                     | recovered charge      | $V_{DS} = 30\text{ V}$                                                                                                              | -   | 15   | -    | nC   |

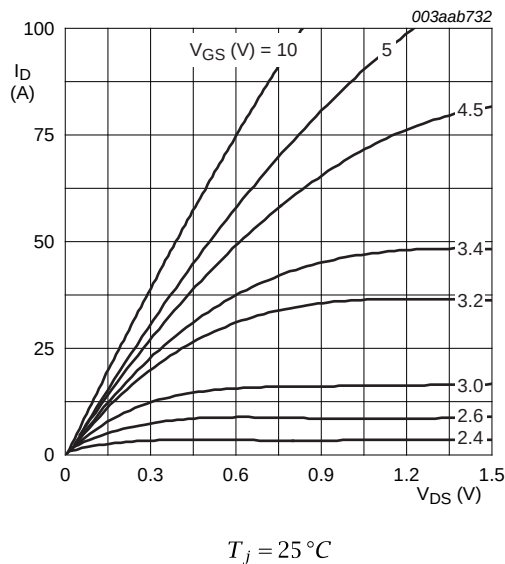


Fig 5. Output characteristics: drain current as a function of drain-source voltage; typical values

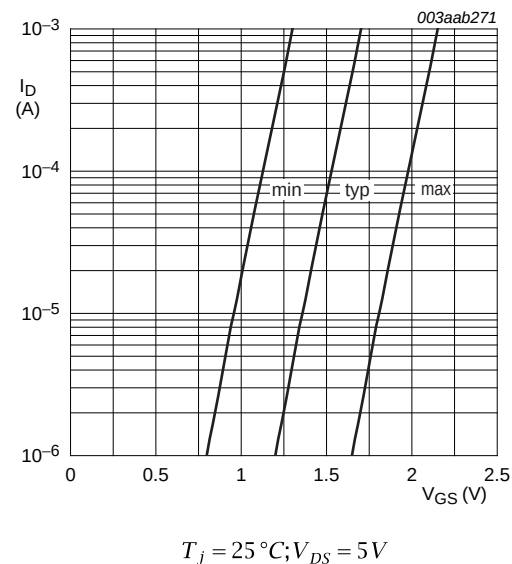
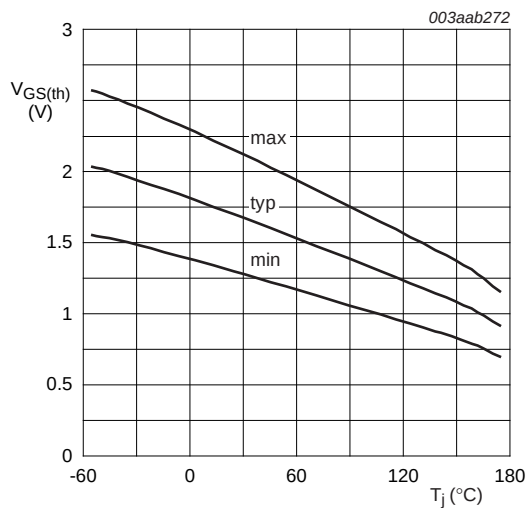
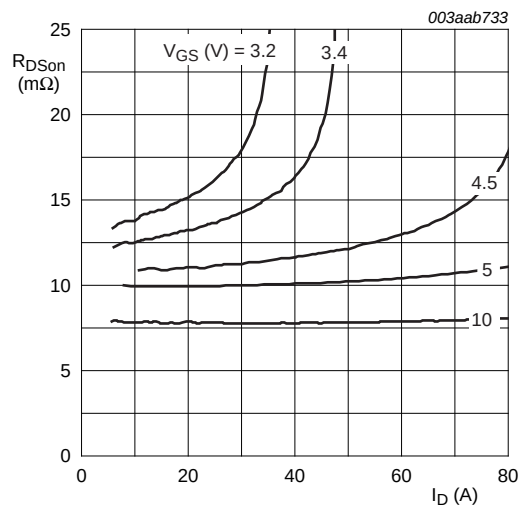


Fig 6. Sub-threshold drain current as a function of gate-source voltage



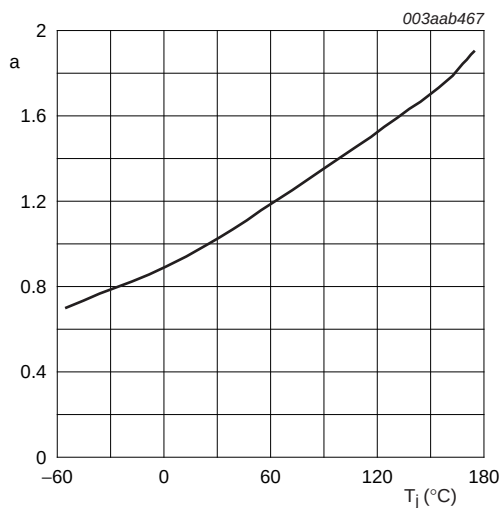
$$I_D = 1 \text{ mA}; V_{DS} = V_{GS}$$

**Fig 7. Gate-source threshold voltage as a function of junction temperature**



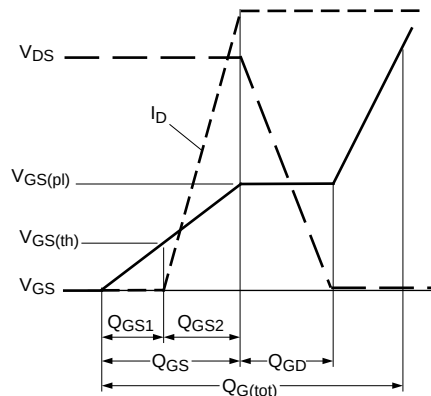
$$T_j = 25^\circ \text{C}$$

**Fig 8. Drain-source on-state resistance as a function of drain current; typical values**



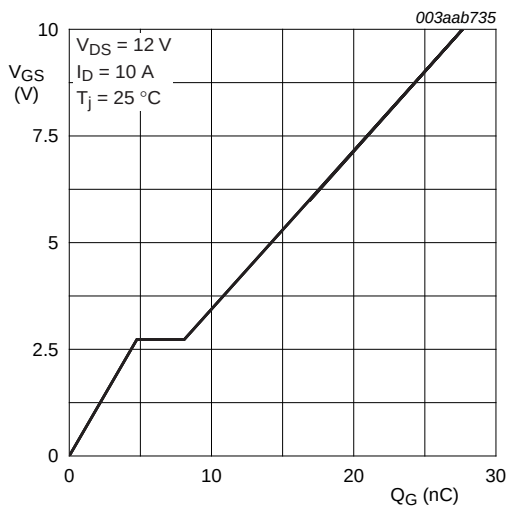
$$a = \frac{R_{DSon}}{R_{DSon(25^\circ \text{C})}}$$

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



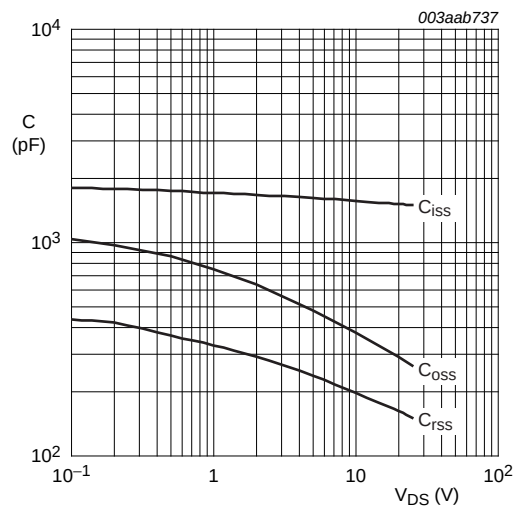
003aaa508

**Fig 10. Gate charge waveform definitions**



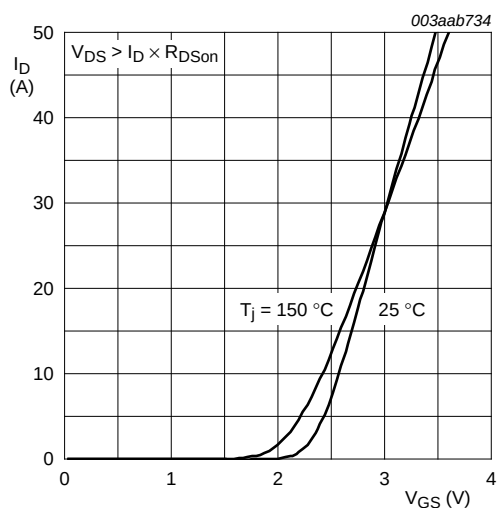
$$I_D = 10 \text{ A}; V_{DS} = 12 \text{ V}$$

**Fig 11. Gate-source voltage as a function of gate charge; typical values**



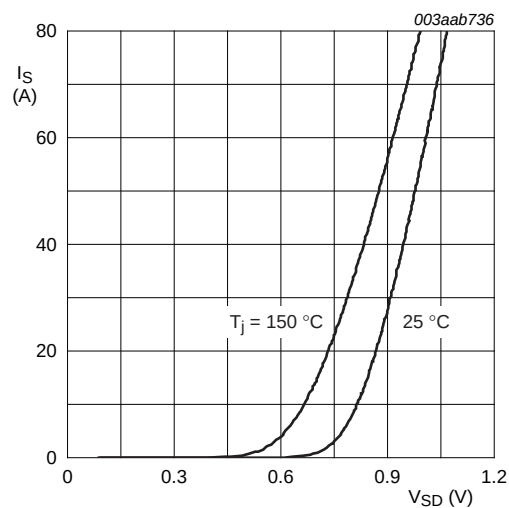
$$V_{GS} = 0 \text{ V}; f = 1 \text{ MHz}$$

**Fig 12. Input, output and reverse transfer capacitances as a function of drain-source voltage; typical values**



$$T_J = 25 \text{ °C and } 150 \text{ °C}; V_{DS} > I_D \times R_{DSon}$$

**Fig 13. Transfer characteristics: drain current as a function of gate-source voltage; typical values**



$$T_J = 25 \text{ °C and } 150 \text{ °C}; V_{GS} = 0 \text{ V}$$

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

# 7. Package outline

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

SOT669

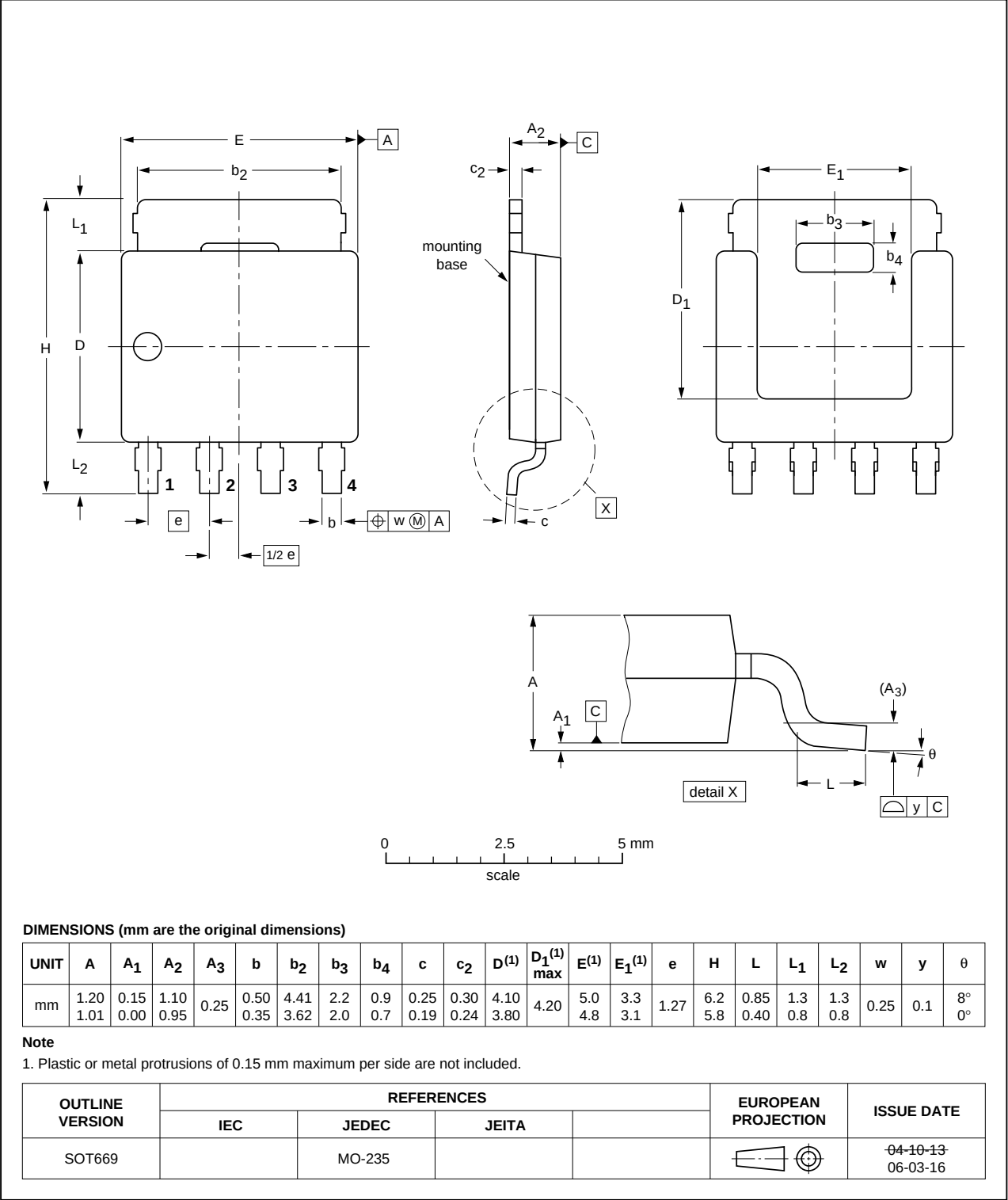


Fig 15. Package outline SOT669 (LPAK)

## 8. Revision history

Table 7. Revision history

| Document ID | Release date | Data sheet status  | Change notice | Supersedes |
|-------------|--------------|--------------------|---------------|------------|
| PH9030L_1   | 20080729     | Product data sheet | -             | -          |

## 9. Legal information

### 9.1 Data sheet status

| Document status <sup>[1][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.

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