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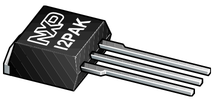



# PSMN3R0-60ES

## N-channel 60 V 3.0 mΩ standard level MOSFET in I2PAK.

3 June 2014 Product data sheet

## 1. General description

Standard level N-channel MOSFET in a I2PAK package qualified to 175 °C. This product is designed and qualified for use in a wide range of industrial, communications and domestic equipment.

## 2. Features and benefits

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

## 3. Applications

- DC-to-DC converters
- Load switching
- Motor control
- Server power supplies

## 4. Quick reference data

**Table 1. Quick reference data**

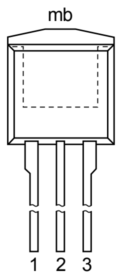
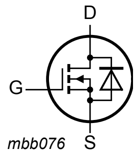
| Symbol | Parameter | Conditions | | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|---|
| $V_{DS}$ | drain-source voltage | $T_j$ ≥ 25 °C; $T_j$ ≤ 175 °C | | - | - | 60 | V |
| $I_D$ | drain current | $T_{mb}$ = 25 °C; $V_{GS}$ = 10 V; Fig. 2 | [1] | - | - | 100 | A |
| $P_{tot}$ | total power dissipation | $T_{mb}$ = 25 °C; Fig. 1 | | - | - | 306 | W |
| **Static characteristics** | | | | | | | |
| $R_{DSon}$ | drain-source on-state resistance | $V_{GS}$ = 10 V; $I_D$ = 25 A; $T_j$ = 25 °C; Fig. 11; Fig. 12 | | - | 2.4 | 3 | mΩ |
| **Dynamic characteristics** | | | | | | | |
| $Q_{GD}$ | gate-drain charge | $V_{GS}$ = 10 V; $I_D$ = 80 A; $V_{DS}$ = 12 V; Fig. 13; Fig. 14 | | - | 28 | - | nC |

[1] Continuous current is limited by package.

Scan or click this QR code to view the latest information for this product

## 5. Pinning information

**Table 2. Pinning information**

| Pin | Symbol | Description | Simplified outline | Graphic symbol |
|---|---|---|---|---|
| 1 | G | gate |   I2PAK (SOT226) |   |
| 2 | D | drain | | |
| 3 | S | source | | |
| mb | D | mounting base; connected to drain | | |

## 6. Ordering information

**Table 3. Ordering information**

| Type number | Package | | |
|---|---|---|---|
| | Name | Description | Version |
| PSMN3R0-60ES | I2PAK | plastic single-ended package (I2PAK); TO-262 | SOT226 |

## 7. Marking

**Table 4. Marking codes**

| Type number | Marking code |
|---|---|
| PSMN3R0-60ES | PSMN3R0-60ES |

## 8. Limiting values

**Table 5. Limiting values**

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

| Symbol | Parameter | Conditions | | Min | Max | Unit |
|---|---|---|---|---|---|---|
| $V_{DS}$ | drain-source voltage | $T_j \geq 25$ °C; $T_j \leq 175$ °C | | - | 60 | V |
| $V_{DGR}$ | drain-gate voltage | $T_j \geq 25$ °C; $T_j \leq 175$ °C; $R_{GS}$ = 20 kΩ | | - | 60 | V |
| $V_{GS}$ | gate-source voltage | | | -20 | 20 | V |
| $P_{tot}$ | total power dissipation | $T_{mb}$ = 25 °C; Fig. 1 | | - | 306 | W |
| $I_D$ | drain current | $V_{GS}$ = 10 V; $T_{mb}$ = 100 °C; Fig. 2 | | - | 83.4 | A |
| | | $V_{GS}$ = 10 V; $T_{mb}$ = 25 °C; Fig. 2 | [1] | - | 100 | A |
| $I_{DM}$ | peak drain current | pulsed; $t_p \leq 10$ µs; $T_{mb}$ = 25 °C; Fig. 3 | | - | 824 | A |
| $T_{stg}$ | storage temperature | | | -55 | 175 | °C |

| Symbol | Parameter | Conditions | | Min | Max | Unit |
|---|---|---|---|---|---|---|
| $T_j$ | junction temperature | | | -55 | 175 | °C |
| **Source-drain diode** | | | | | | |
| $I_S$ | source current | $T_{mb}$ = 25 °C | [1] | - | 100 | A |
| $I_{SM}$ | peak source current | pulsed; $t_p$ ≤ 10 µs; $T_{mb}$ = 25 °C | | - | 824 | A |
| **Avalanche ruggedness** | | | | | | |
| $E_{DS(AL)S}$ | non-repetitive drain-source avalanche energy | $V_{GS}$ = 10 V; $T_{j(init)}$ = 25 °C; $I_D$ = 100 A; $V_{sup}$ ≤ 60 V; $R_{GS}$ = 50 Ω; unclamped | | - | 800 | mJ |

[1] Continuous current is limited by package.

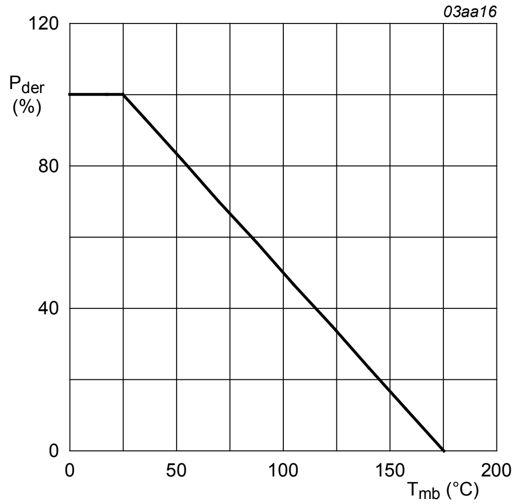



**Fig. 1. Normalized total power dissipation as a function of mounting base temperature**

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

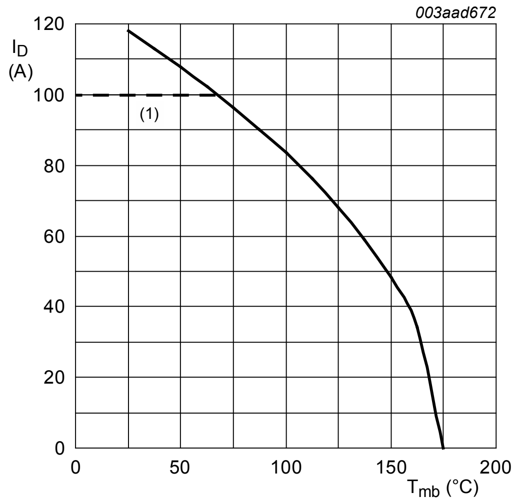



**Fig. 2. Continuous drain current as a function of mounting base temperature.**

$V_{GS}$ ≥ 10 V; (1) Capped at 100 A due to package

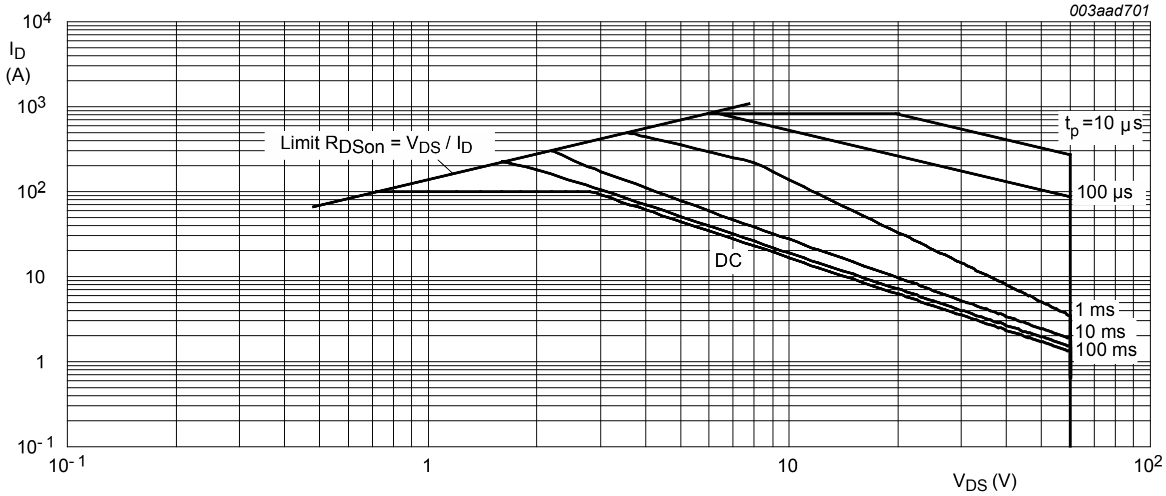



**Fig. 3. Safe operating area; continuous and peak drain currents as a function of drain-source voltage**

$T_{mb} = 25$ °C; $I_{DM}$ is a single pulse; Capped at 100 A due to package

## 9. Thermal characteristics

**Table 6. Thermal characteristics**

| Symbol | Parameter | Conditions | | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|---|
| $R_{th(j-mb)}$ | thermal resistance from junction to mounting base | Fig. 4 | | - | 0.3 | 0.49 | K/W |

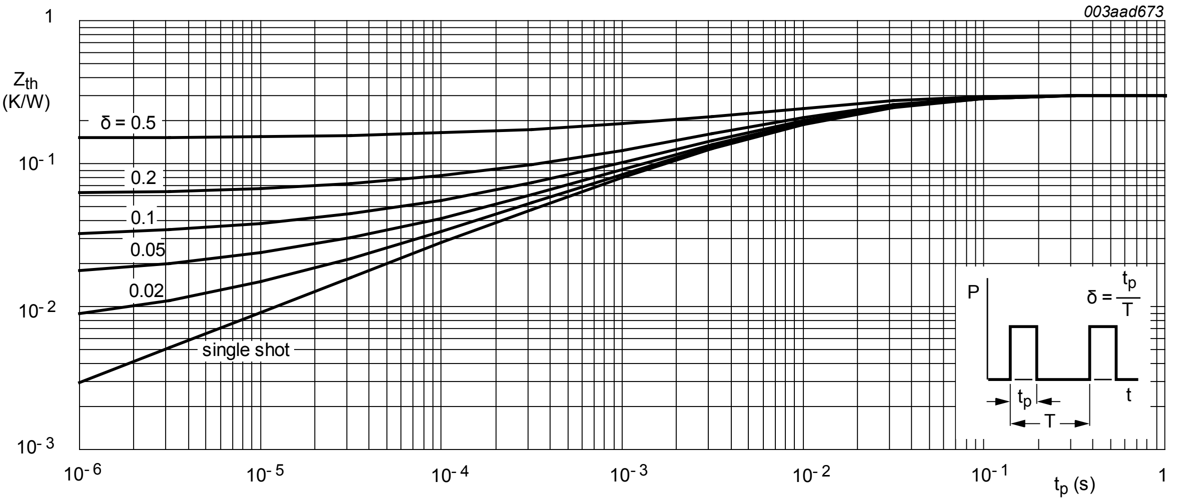



**Fig. 4. Transient thermal impedance from junction to mounting base as a function of pulse duration**

## 10. Characteristics

**Table 7. Characteristics**

| Symbol | Parameter | Conditions | | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|---|
| **Static characteristics** | | | | | | | |
| $V_{(BR)DSS}$ | drain-source breakdown voltage | $I_D$ = 250 µA; $V_{GS}$ = 0 V; $T_j$ = -55 °C | | 54 | - | - | V |
| | | $I_D$ = 250 µA; $V_{GS}$ = 0 V; $T_j$ = 25 °C | | 60 | - | - | V |
| $V_{GS(th)}$ | gate-source threshold voltage | $I_D$ = 1 mA; $V_{DS}$ = $V_{GS}$; $T_j$ = 25 °C; Fig. 8; Fig. 9 | | 2 | 3 | 4 | V |
| $V_{GSth}$ | gate-source threshold voltage | $I_D$ = 1 mA; $V_{DS}$ = $V_{GS}$; $T_j$ = 175 °C; Fig. 9 | | 1 | - | - | V |
| | | $I_D$ = 1 mA; $V_{DS}$ = $V_{GS}$; $T_j$ = -55 °C; Fig. 9 | | - | - | 4.6 | V |
| $I_{DSS}$ | drain leakage current | $V_{DS}$ = 60 V; $V_{GS}$ = 0 V; $T_j$ = 25 °C | | - | 0.05 | 10 | µA |
| | | $V_{DS}$ = 60 V; $V_{GS}$ = 0 V; $T_j$ = 175 °C | | - | - | 500 | µA |
| $I_{GSS}$ | gate leakage current | $V_{GS}$ = -20 V; $V_{DS}$ = 0 V; $T_j$ = 25 °C | | - | 2 | 100 | nA |
| | | $V_{GS}$ = 20 V; $V_{DS}$ = 0 V; $T_j$ = 25 °C | | - | 2 | 100 | nA |
| $R_{DSon}$ | drain-source on-state resistance | $V_{GS}$ = 10 V; $I_D$ = 25 A; $T_j$ = 175 °C; Fig. 10 | | - | - | 7.2 | mΩ |
| | | $V_{GS}$ = 10 V; $I_D$ = 25 A; $T_j$ = 25 °C; Fig. 11; Fig. 12 | | - | 2.4 | 3 | mΩ |
| $R_G$ | gate resistance | f = 1 MHz | | 0.55 | 1.1 | 2.2 | Ω |
| **Dynamic characteristics** | | | | | | | |
| $Q_{G(tot)}$ | total gate charge | $I_D$ = 80 A; $V_{DS}$ = 12 V; $V_{GS}$ = 10 V; Fig. 13; Fig. 14 | | - | 130 | - | nC |
| $Q_{GS}$ | gate-source charge | $I_D$ = 80 A; $V_{DS}$ = 12 V; $V_{GS}$ = 10 V; Fig. 14; Fig. 13 | | - | 43 | - | nC |
| $Q_{GD}$ | gate-drain charge | $I_D$ = 80 A; $V_{DS}$ = 12 V; $V_{GS}$ = 10 V; Fig. 13; Fig. 14 | | - | 28 | - | nC |
| $C_{iss}$ | input capacitance | $V_{DS}$ = 30 V; $V_{GS}$ = 0 V; f = 1 MHz; $T_j$ = 25 °C; Fig. 15; Fig. 16 | | - | 8079 | - | pF |
| $C_{oss}$ | output capacitance | $V_{DS}$ = 30 V; $V_{GS}$ = 0 V; f = 1 MHz; $T_j$ = 25 °C; Fig. 15 | | - | 971 | - | pF |
| $C_{rss}$ | reverse transfer capacitance | $V_{DS}$ = 30 V; $V_{GS}$ = 0 V; f = 1 MHz; $T_j$ = 25 °C; Fig. 15; Fig. 16 | | - | 492 | - | pF |
| $t_{d(on)}$ | turn-on delay time | $V_{DS}$ = 30 V; $R_L$ = 0.5 Ω; $V_{GS}$ = 10 V; $R_{G(ext)}$ = 1.5 Ω | | - | 31 | - | ns |
| $t_r$ | rise time | | | - | 26 | - | ns |
| $t_{d(off)}$ | turn-off delay time | | | - | 77 | - | ns |
| $t_f$ | fall time | | | - | 22 | - | ns |

| Symbol | Parameter | Conditions | | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|---|
| **Source-drain diode** | | | | | | | |
| $V_{SD}$ | source-drain voltage | $I_S$ = 25 A; $V_{GS}$ = 0 V; $T_j$ = 25 °C; Fig. 17 | | - | 0.88 | 1.2 | V |
| $t_{rr}$ | reverse recovery time | $I_S$ = 25 A; $dI_S/dt$ = -100 A/µs; $V_{GS}$ = 0 V; $V_{DS}$ = 30 V | | - | 54 | - | ns |
| $Q_r$ | recovered charge | | | - | 97 | - | nC |

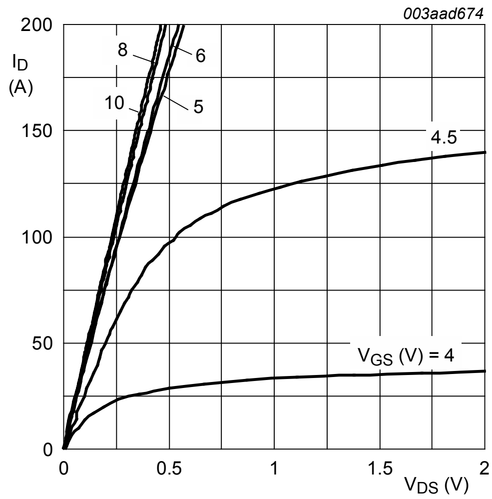



**Fig. 5. Output characteristics: drain current as a function of drain-source voltage; typical values**

$T_j = 25\,°C$

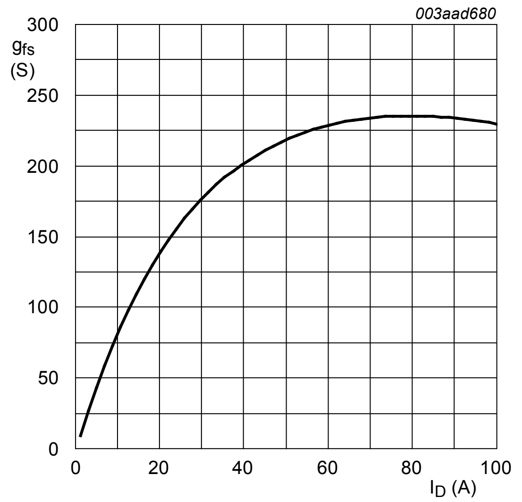



**Fig. 6. Forward transconductance as a function of drain current; typical values**

$T_j = 25\,°C; V_{DS} = 30V$

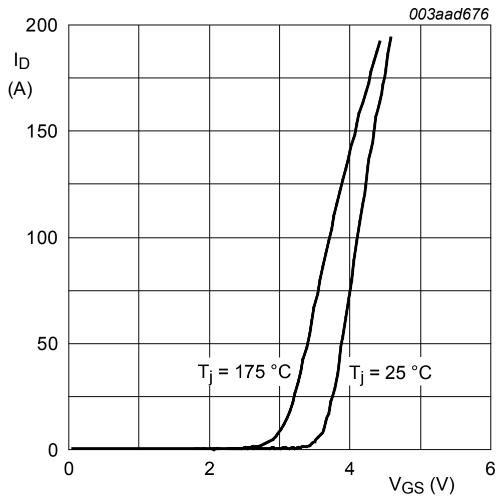



**Fig. 7. Transfer characteristics: drain current as a function of gate-source voltage; typical values**

$V_{DS} > I_D \times R_{DSon}$

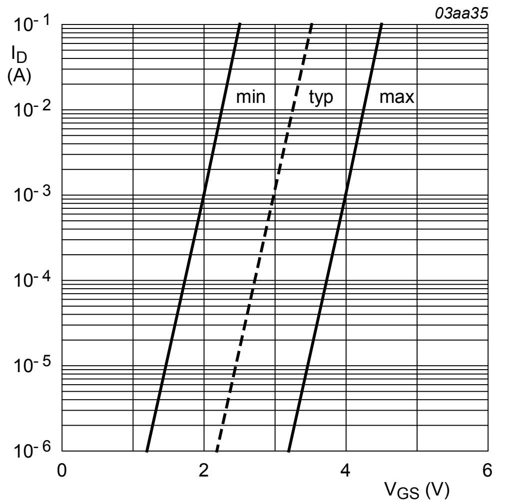



**Fig. 8. Sub-threshold drain current as a function of gate-source voltage**

$T_j = 25\,°C; V_{DS} = 5V$

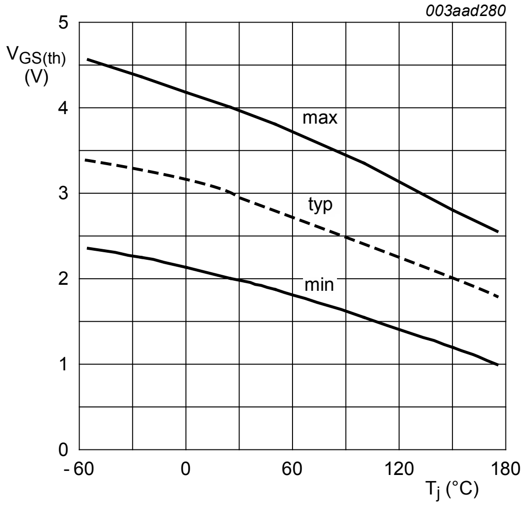



**Fig. 9. Gate-source threshold voltage as a function of junction temperature**

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

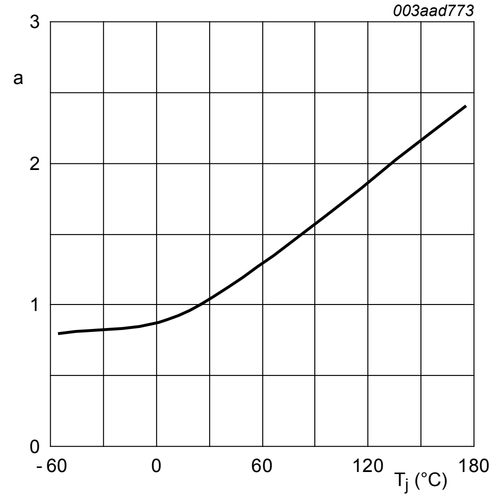



**Fig. 10. Normalized drain-source on-state resistance factor as a function of junction temperature**

$$a = \frac{R_{DSon}}{R_{DSon(25\,°C)}}$$

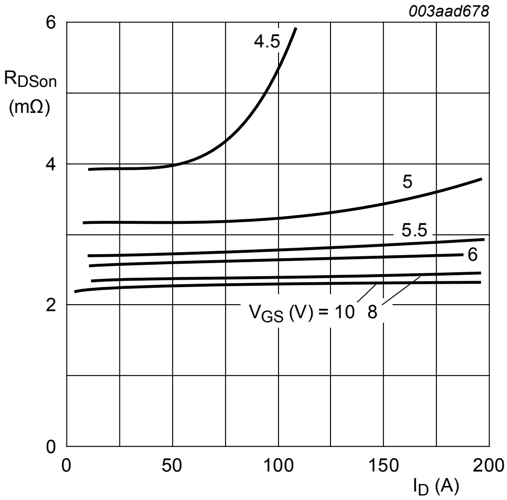



**Fig. 11. Drain-source on-state resistance as a function of drain current; typical values**

$T_j = 25\,°C$

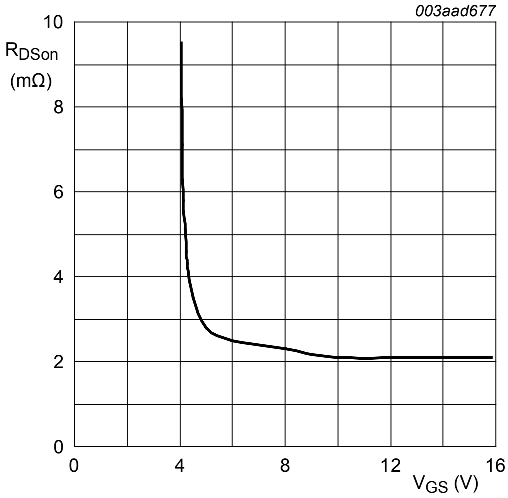



**Fig. 12. Drain-source on-state resistance as a function of gate-source voltage; typical values**

$T_j = 25\ °C;\ I_D = 25\ \text{A}$

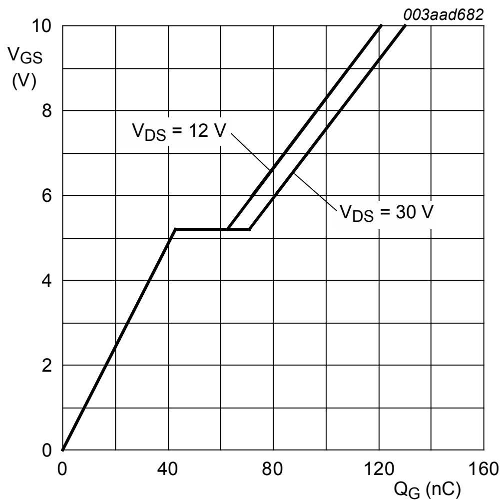



**Fig. 13. Gate-source voltage as a function of gate charge; typical values**

$T_j = 25$ °C; $I_D = 25$ A

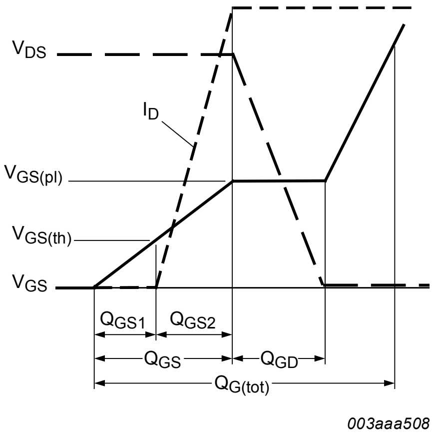



**Fig. 14. Gate charge waveform definitions**

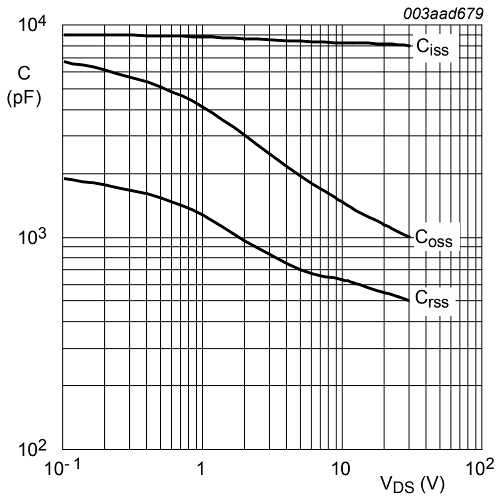



**Fig. 15. Input, output and reverse transfer capacitances as a function of drain-source voltage; typical values**

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

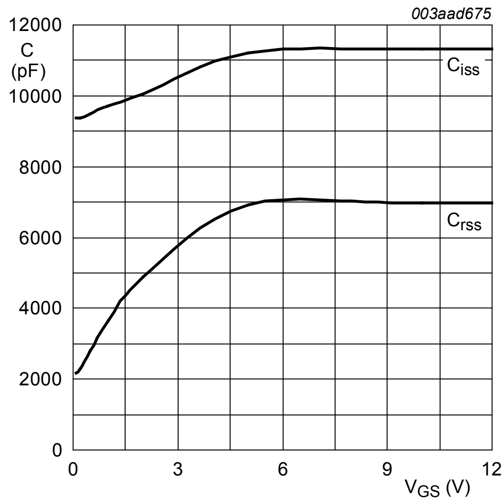



**Fig. 16. Input and reverse transfer capacitances as a function of gate-source voltage, typical values**

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

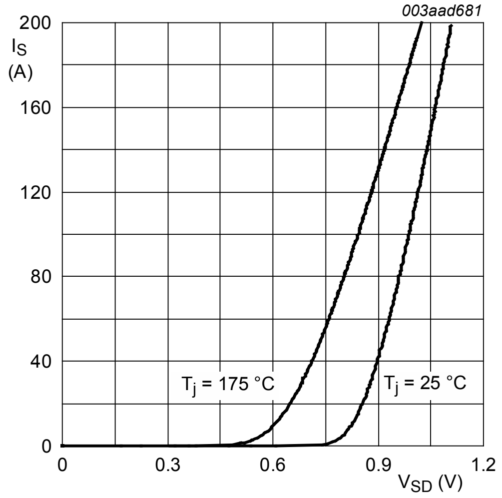
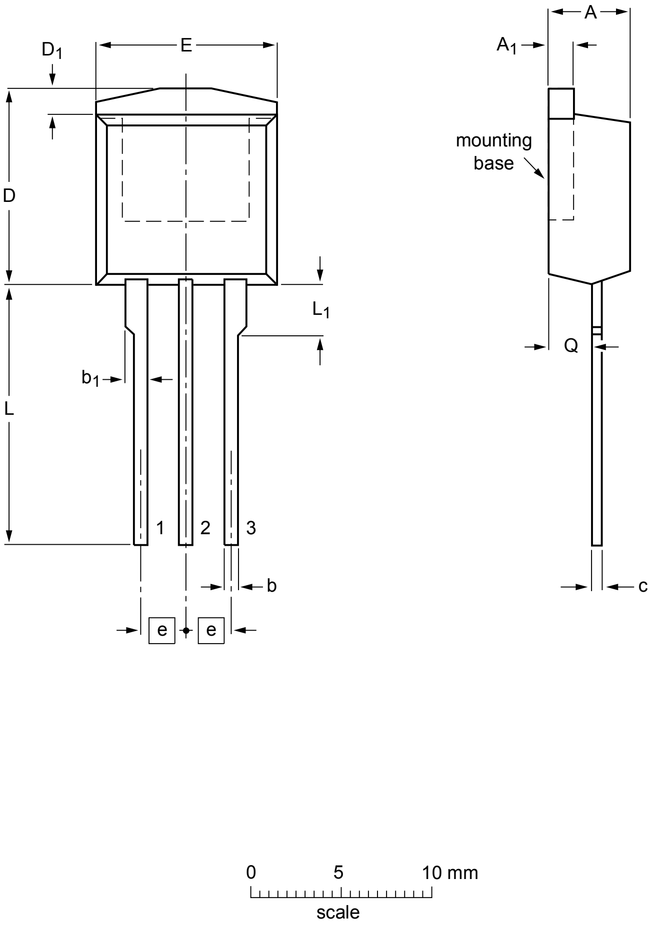



**Fig. 17. Source current as a function of source-drain voltage; typical values**

$V_{GS} = 0$ V

# 11. Package outline

**Plastic single-ended package (I2PAK); low-profile 3-lead TO-262** SOT226




**DIMENSIONS (mm are the original dimensions)**

| UNIT | A | $A_1$ | b | $b_1$ | c | D max | $D_1$ | E | e | L | $L_1$ | Q |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| mm | 4.5<br>4.1 | 1.40<br>1.27 | 0.85<br>0.60 | 1.3<br>1.0 | 0.7<br>0.4 | 11 | 1.6<br>1.2 | 10.3<br>9.7 | 2.54 | 15.0<br>13.5 | 3.30<br>2.79 | 2.6<br>2.2 |

| OUTLINE VERSION | REFERENCES | | | | EUROPEAN PROJECTION | ISSUE DATE |
|---|---|---|---|---|---|---|
| | IEC | JEDEC | JEITA | | | |
| SOT226 | | TO-262 | | | | ~~06-02-14~~<br>09-08-25 |

Fig. 18. Package outline I2PAK (SOT226)

# 12. Legal information

## 12.1 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. |
| 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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