



# THE DATASHEET OF PSMN3R0-60BS





# PSMN3R0-60BS

N-channel 60 V 3.2 mΩ standard level MOSFET in D2PAK

Rev. 1 — 22 March 2012

Product data sheet

## 1. Product profile

### 1.1 General description

Standard level N-channel MOSFET in a D2PAK 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
- Suitable for standard level gate drive sources

### 1.3 Applications

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

### 1.4 Quick reference data

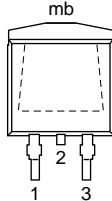
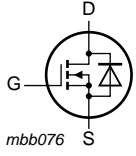
Table 1. Quick reference data

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$V_{DS}$	drain-source voltage	$T_j \geq 25\text{ °C}; T_j \leq 175\text{ °C}$	-	-	60	V
$I_D$	drain current	$T_{mb} = 25\text{ °C}; V_{GS} = 10\text{ V};$ see <a href="#">Figure 1</a>	[1]	-	100	A
$P_{tot}$	total power dissipation	$T_{mb} = 25\text{ °C};$ see <a href="#">Figure 2</a>	-	-	306	W
$T_j$	junction temperature		-55	-	175	°C
<b>Static characteristics</b>						
$R_{DS(on)}$	drain-source on-state resistance	$V_{GS} = 10\text{ V}; I_D = 25\text{ A}; T_j = 100\text{ °C};$ see <a href="#">Figure 12</a> ; see <a href="#">Figure 13</a>	-	4.32	5.1	mΩ
		$V_{GS} = 10\text{ V}; I_D = 25\text{ A}; T_j = 25\text{ °C};$ see <a href="#">Figure 13</a>	-	2.7	3.2	mΩ
<b>Dynamic characteristics</b>						
$Q_{GD}$	gate-drain charge	$V_{GS} = 10\text{ V}; I_D = 25\text{ A}; V_{DS} = 30\text{ V};$ see <a href="#">Figure 14</a> ; see <a href="#">Figure 15</a>	-	28	-	nC
$Q_{G(tot)}$	total gate charge		-	130	-	nC
<b>Avalanche ruggedness</b>						
$E_{DS(AL)S}$	non-repetitive drain-source avalanche energy	$V_{GS} = 10\text{ V}; T_{j(init)} = 25\text{ °C};$ $I_D = 100\text{ A}; V_{sup} \leq 60\text{ V}; R_{GS} = 50\text{ Ω};$ unclamped	-	-	800	mJ

[1] Continuous current is limited by package

## 2. Pinning information

Table 2. Pinning information

Pin	Symbol	Description	Simplified outline	Graphic symbol
1	G	gate	 <p>SOT404 (D2PAK)</p>	 <p>mbb076</p>
2	D	drain <sup>[1]</sup>		
3	S	source		
mb	D	mounting base; connected to drain		

[1] It is not possible to make connection to pin 2

## 3. Ordering information

Table 3. Ordering information

Type number	Package		
	Name	Description	Version
PSMN3R0-60BS	D2PAK	plastic single-ended surface-mounted package (D2PAK); 3 leads (one lead cropped)	SOT404

## 4. Marking

Table 4. Marking codes

Type number	Marking code
PSMN3R0-60BS	PSMN3R0-60BS

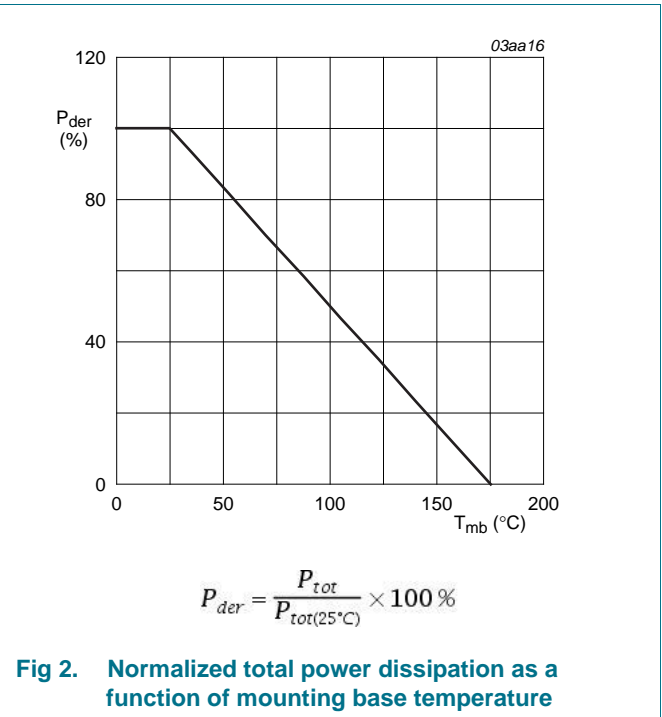
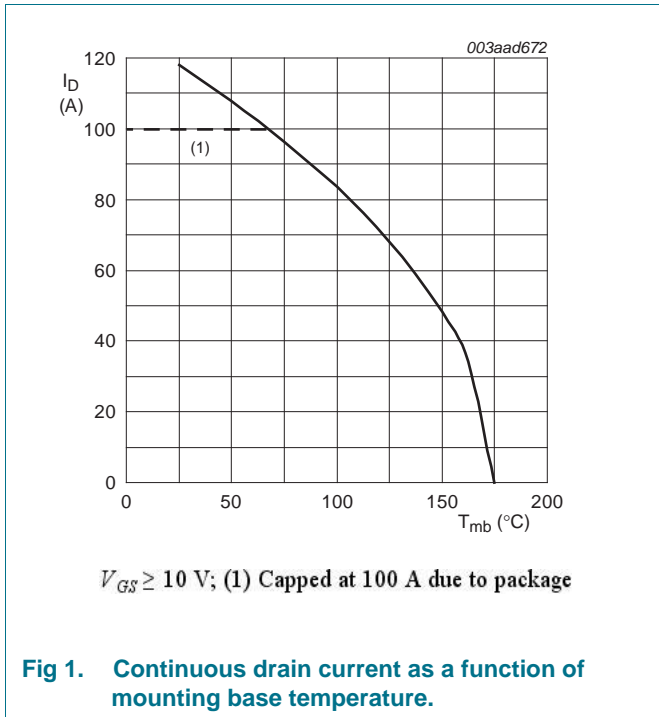
## 5. Limiting values

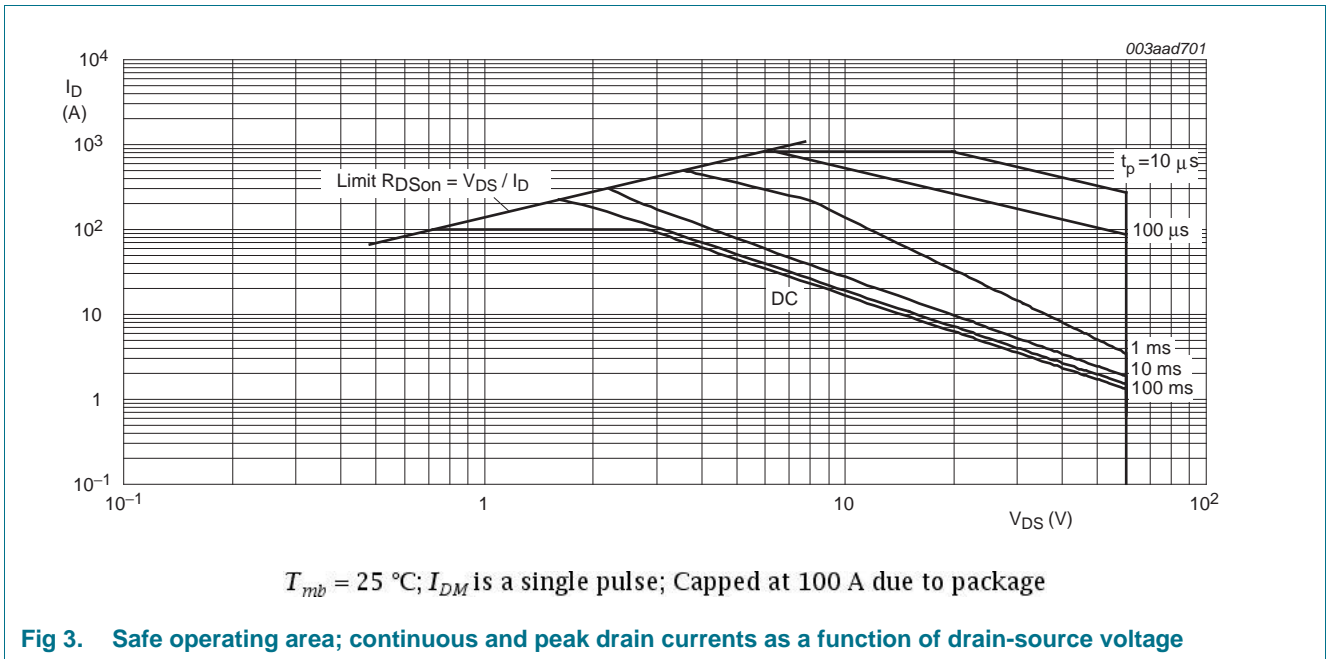
**Table 5. Limiting values**

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

Symbol	Parameter	Conditions	Min	Max	Unit	
$V_{DS}$	drain-source voltage	$T_j \geq 25\text{ °C}; T_j \leq 175\text{ °C}$	-	60	V	
$V_{DGR}$	drain-gate voltage	$T_j \geq 25\text{ °C}; T_j \leq 175\text{ °C}; R_{GS} = 20\text{ k}\Omega$	-	60	V	
$V_{GS}$	gate-source voltage		-20	20	V	
$I_D$	drain current	$V_{GS} = 10\text{ V}; T_{mb} = 100\text{ °C}$ ; see <a href="#">Figure 1</a>	[1]	-	83.4	A
		$V_{GS} = 10\text{ V}; T_{mb} = 25\text{ °C}$ ; see <a href="#">Figure 1</a>	[1]	-	100	A
$I_{DM}$	peak drain current	pulsed; $t_p \leq 10\text{ }\mu\text{s}$ ; $T_{mb} = 25\text{ °C}$ ; see <a href="#">Figure 3</a>	-	824	A	
$P_{tot}$	total power dissipation	$T_{mb} = 25\text{ °C}$ ; see <a href="#">Figure 2</a>	-	306	W	
$T_{stg}$	storage temperature		-55	175	°C	
$T_j$	junction temperature		-55	175	°C	
$T_{sld(M)}$	peak soldering temperature		-	260	°C	
<b>Source-drain diode</b>						
$I_S$	source current	$T_{mb} = 25\text{ °C}$	[1]	-	100	A
$I_{SM}$	peak source current	pulsed; $t_p \leq 10\text{ }\mu\text{s}$ ; $T_{mb} = 25\text{ °C}$	-	824	A	
<b>Avalanche ruggedness</b>						
$E_{DS(AL)S}$	non-repetitive drain-source avalanche energy	$V_{GS} = 10\text{ V}; T_{j(\text{init})} = 25\text{ °C}; I_D = 100\text{ A}; V_{sup} \leq 60\text{ V}; R_{GS} = 50\text{ }\Omega$ ; unclamped	-	800	mJ	

[1] Continuous current is limited by package

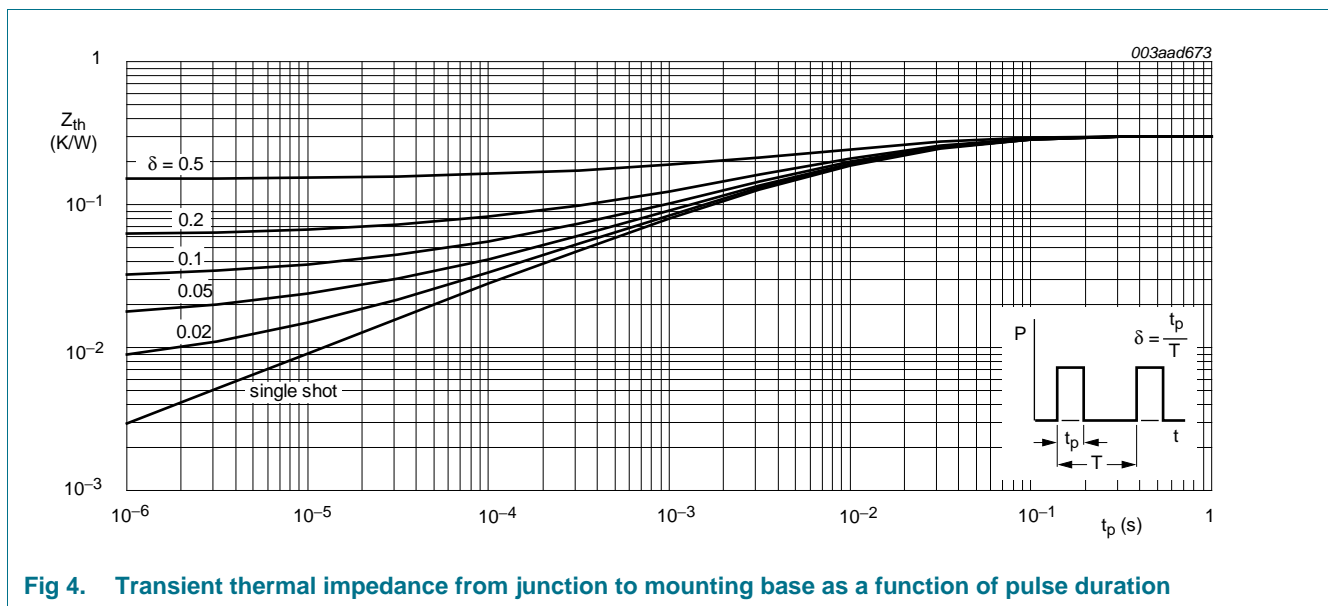




## 6. Thermal characteristics

**Table 6. 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>	-	0.3	0.49	K/W
$R_{th(j-a)}$	thermal resistance from junction to ambient	Minimum footprint; mounted in a printed circuit board	-	50	-	K/W



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

## 7. Characteristics

Table 7. Characteristics

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
<b>Static characteristics</b>						
$V_{(BR)DSS}$	drain-source breakdown voltage	$I_D = 250 \mu\text{A}; V_{GS} = 0 \text{ V}; T_j = -55 \text{ }^\circ\text{C}$	54	-	-	V
		$I_D = 250 \mu\text{A}; V_{GS} = 0 \text{ V}; T_j = 25 \text{ }^\circ\text{C}$	60	-	-	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 <a href="#">Figure 10</a> ; see <a href="#">Figure 11</a>	2	3	4	V
$V_{GSth}$	gate-source threshold voltage	$I_D = 1 \text{ mA}; V_{DS} = V_{GS}; T_j = 175 \text{ }^\circ\text{C}$ ; see <a href="#">Figure 11</a>	1	-	-	V
		$I_D = 1 \text{ mA}; V_{DS} = V_{GS}; T_j = -55 \text{ }^\circ\text{C}$ ; see <a href="#">Figure 11</a>	-	-	4.6	V
$I_{DSS}$	drain leakage current	$V_{DS} = 60 \text{ V}; V_{GS} = 0 \text{ V}; T_j = 25 \text{ }^\circ\text{C}$	-	0.05	10	$\mu\text{A}$
		$V_{DS} = 60 \text{ V}; V_{GS} = 0 \text{ V}; T_j = 175 \text{ }^\circ\text{C}$	-	-	500	$\mu\text{A}$
$I_{GSS}$	gate leakage current	$V_{GS} = -20 \text{ V}; V_{DS} = 0 \text{ V}; T_j = 25 \text{ }^\circ\text{C}$	-	10	100	nA
		$V_{GS} = 20 \text{ V}; V_{DS} = 0 \text{ V}; T_j = 25 \text{ }^\circ\text{C}$	-	10	100	nA
$R_{DSon}$	drain-source on-state resistance	$V_{GS} = 10 \text{ V}; I_D = 25 \text{ A}; T_j = 100 \text{ }^\circ\text{C}$ ; see <a href="#">Figure 12</a> ; see <a href="#">Figure 13</a>	-	4.32	5.1	mΩ
		$V_{GS} = 10 \text{ V}; I_D = 25 \text{ A}; T_j = 175 \text{ }^\circ\text{C}$ ; see <a href="#">Figure 12</a> ; see <a href="#">Figure 13</a>	-	6.21	7.3	mΩ
		$V_{GS} = 10 \text{ V}; I_D = 25 \text{ A}; T_j = 25 \text{ }^\circ\text{C}$ ; see <a href="#">Figure 13</a>	-	2.7	3.2	mΩ
$R_G$	gate resistance	$f = 1 \text{ MHz}$	-	1.1	-	Ω
<b>Dynamic characteristics</b>						
$Q_{G(tot)}$	total gate charge	$I_D = 0 \text{ A}; V_{DS} = 0 \text{ V}; V_{GS} = 10 \text{ V}$	-	110	-	nC
		$I_D = 25 \text{ A}; V_{DS} = 30 \text{ V}; V_{GS} = 10 \text{ V}$ ; see <a href="#">Figure 14</a> ; see <a href="#">Figure 15</a>	-	130	-	nC
$Q_{GS}$	gate-source charge		-	43	-	nC
$Q_{GS(th-pl)}$	post-threshold gate-source charge		-	21	-	nC
$Q_{GD}$	gate-drain charge		-	28	-	nC
$V_{GS(pl)}$	gate-source plateau voltage	$I_D = 25 \text{ A}; V_{DS} = 30 \text{ V}$ ; see <a href="#">Figure 14</a> ; see <a href="#">Figure 15</a>	-	5.2	-	V
$C_{iss}$	input capacitance	$V_{DS} = 30 \text{ V}; V_{GS} = 0 \text{ V}; f = 1 \text{ MHz}; T_j = 25 \text{ }^\circ\text{C}$ ; see <a href="#">Figure 16</a> ; see <a href="#">Figure 9</a>	-	8079	-	pF
$C_{oss}$	output capacitance	$V_{DS} = 30 \text{ V}; V_{GS} = 0 \text{ V}; f = 1 \text{ MHz}; T_j = 25 \text{ }^\circ\text{C}$ ; see <a href="#">Figure 16</a>	-	971	-	pF
$C_{rss}$	reverse transfer capacitance	$V_{DS} = 30 \text{ V}; V_{GS} = 0 \text{ V}; f = 1 \text{ MHz}; T_j = 25 \text{ }^\circ\text{C}$ ; see <a href="#">Figure 16</a> ; see <a href="#">Figure 9</a>	-	492	-	pF
$t_{d(on)}$	turn-on delay time	$V_{DS} = 30 \text{ V}; R_L = 0.5 \text{ } \Omega; V_{GS} = 10 \text{ V}$ ;	-	31	-	ns
$t_r$	rise time	$R_{G(ext)} = 1.5 \text{ } \Omega$	-	26	-	ns
$t_{d(off)}$	turn-off delay time		-	77	-	ns
$t_f$	fall time		-	22	-	ns

Table 7. Characteristics ...continued

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
<b>Source-drain diode</b>						
$V_{SD}$	source-drain voltage	$I_S = 25\text{ A}$ ; $V_{GS} = 0\text{ V}$ ; $T_j = 25\text{ °C}$ ; see <a href="#">Figure 17</a>	-	0.88	1.2	V
$t_{rr}$	reverse recovery time	$I_S = 25\text{ A}$ ; $di_S/dt = -100\text{ A}/\mu\text{s}$ ;	-	54	-	ns
$Q_r$	recovered charge	$V_{GS} = 0\text{ V}$ ; $V_{DS} = 30\text{ V}$	-	97	-	nC

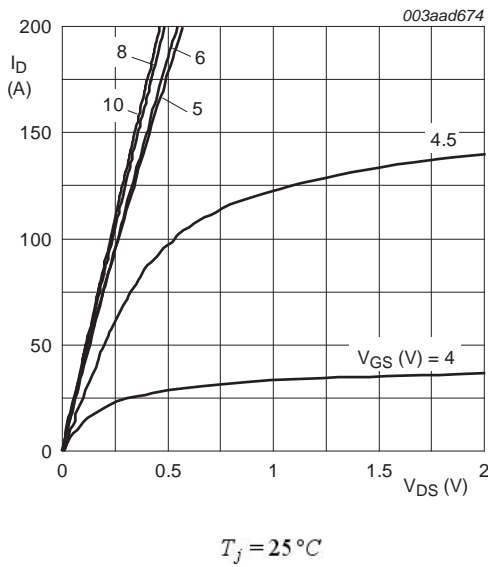


Fig 5. Output characteristics: drain current as a function of drain-source voltage; typical values

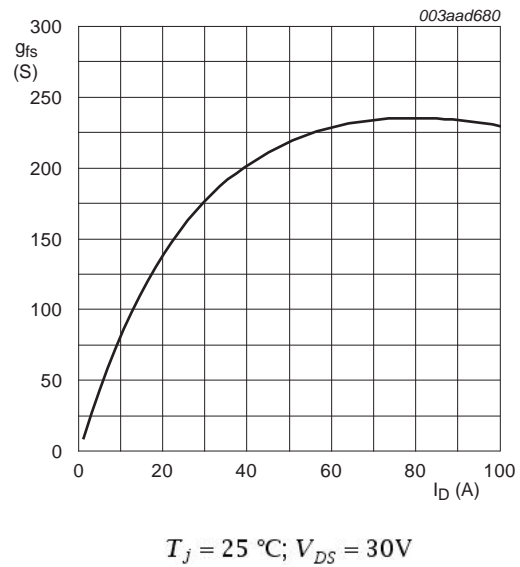


Fig 6. Forward transconductance as a function of drain current; typical values

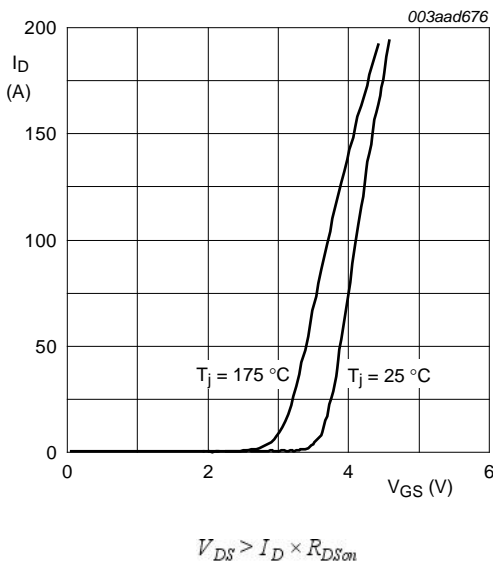


Fig 7. Transfer characteristics: drain current as a function of gate-source voltage; typical values

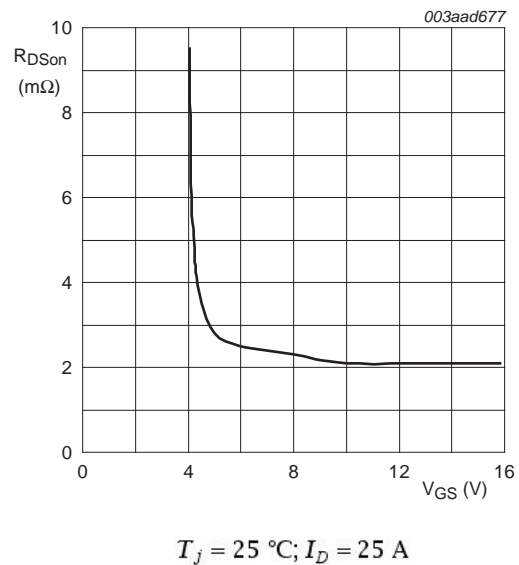
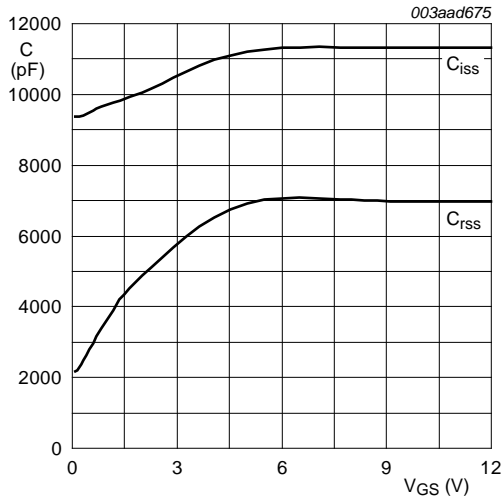
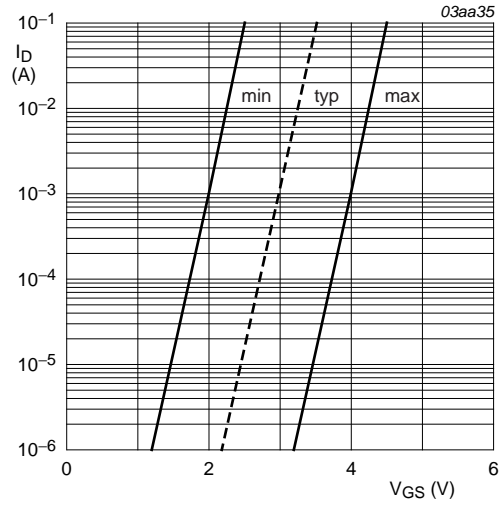


Fig 8. Drain-source on-state resistance as a function of gate-source voltage; typical values



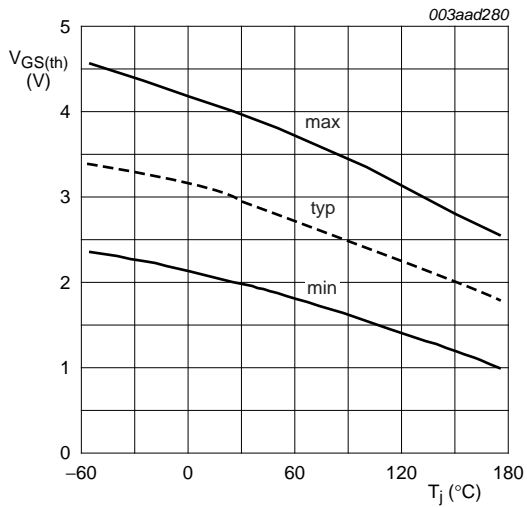
V<sub>DS</sub> = 0 V; f = 1 MHz

Fig 9. Input and reverse transfer capacitances as a function of gate-source voltage, typical values



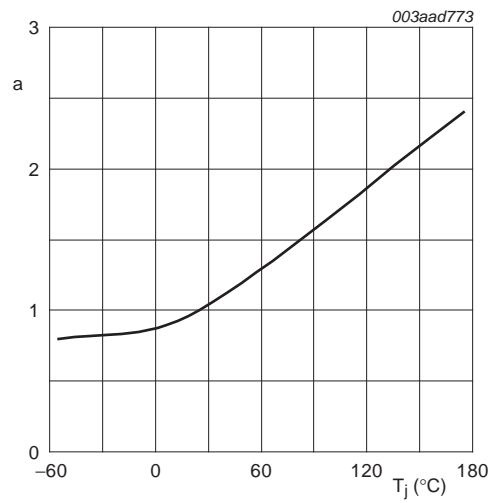
T<sub>j</sub> = 25 °C; V<sub>DS</sub> = 5V

Fig 10. Sub-threshold drain current as a function of gate-source voltage



I<sub>D</sub> = 1 mA; V<sub>DS</sub> = V<sub>GS</sub>

Fig 11. Gate-source threshold voltage as a function of junction temperature



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

Fig 12. Normalized drain-source on-state resistance factor as a function of junction temperature

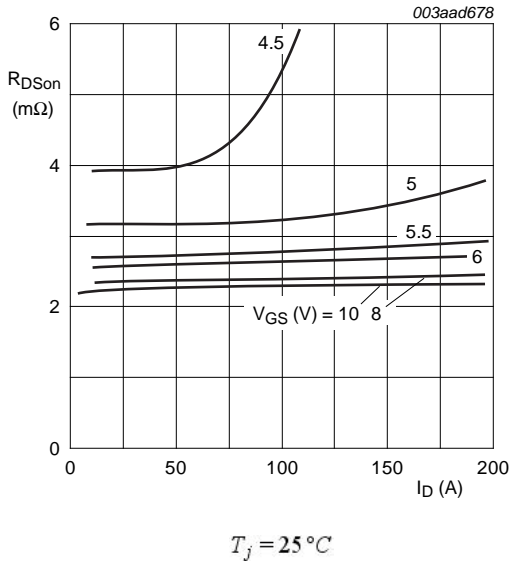


Fig 13. Drain-source on-state resistance as a function of drain current; typical values

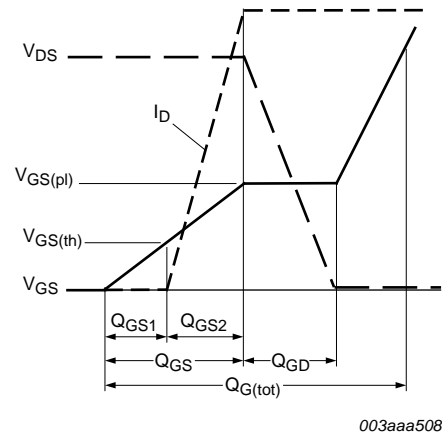


Fig 14. Gate charge waveform definitions

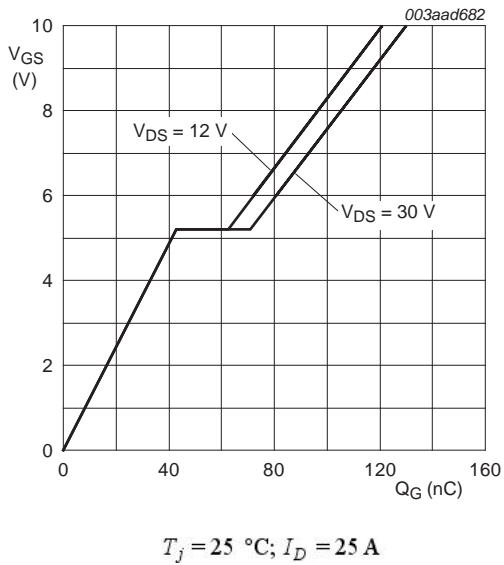


Fig 15. Gate-source voltage as a function of gate charge; typical values

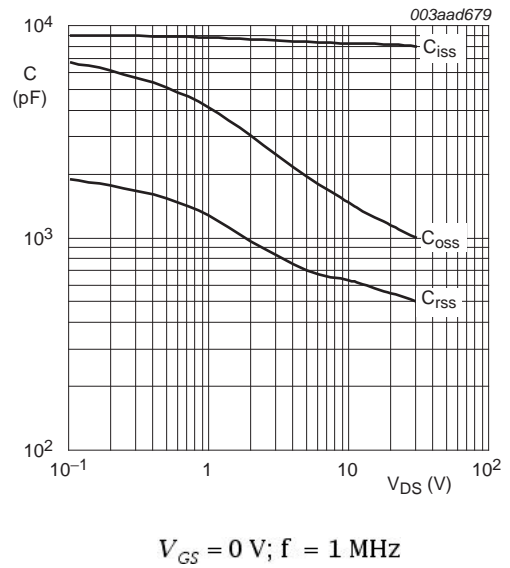


Fig 16. Input, output and reverse transfer capacitances as a function of drain-source voltage; typical values

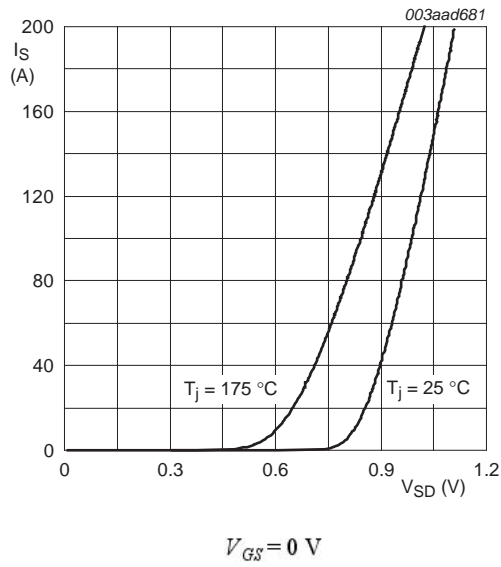


Fig 17. Source current as a function of source-drain voltage; typical values

8. Package outline

Plastic single-ended surface-mounted package (D2PAK); 3 leads (one lead cropped)

SOT404

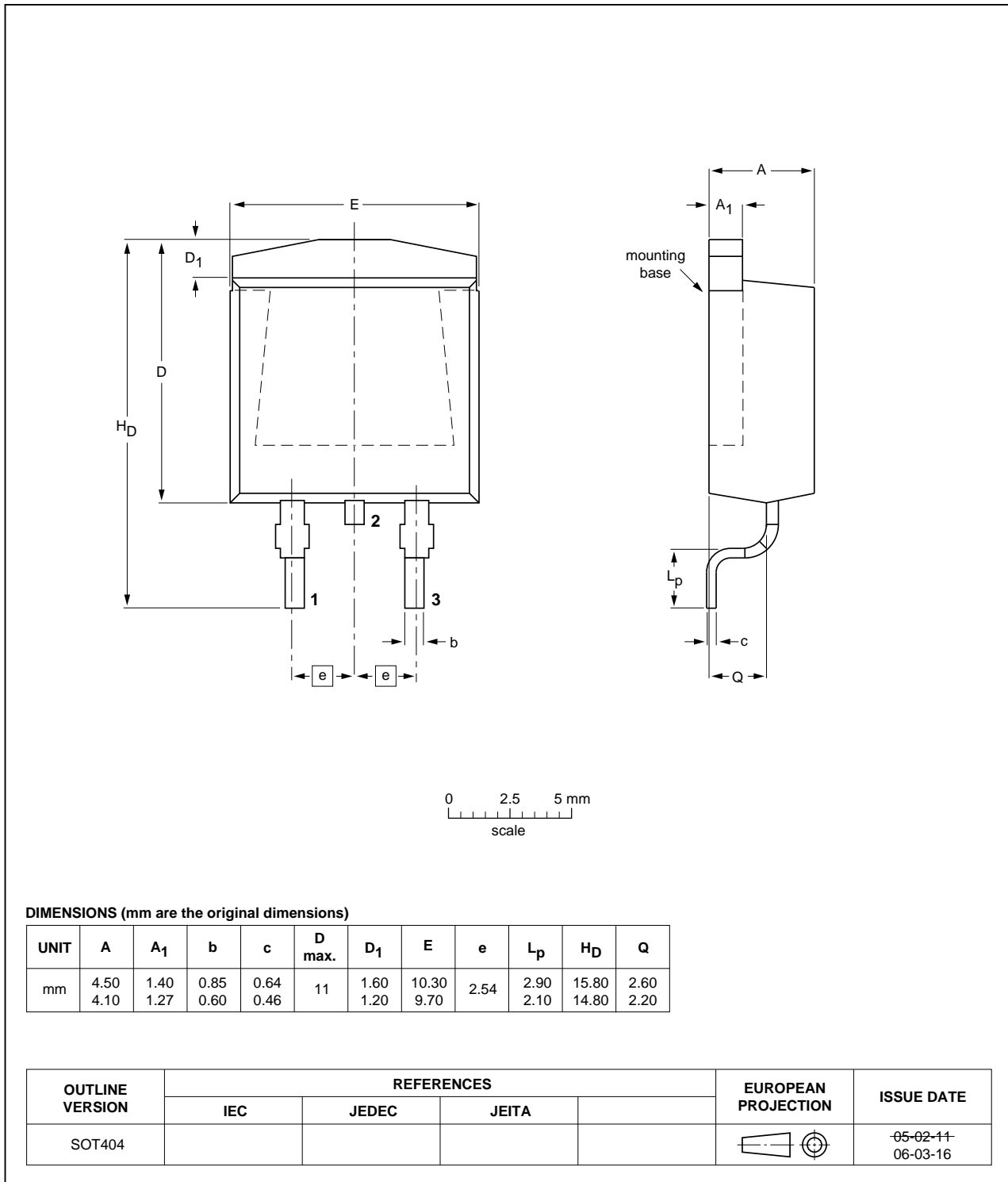


Fig 18. Package outline SOT404 (D2PAK)

## 9. Revision history

Table 8. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
PSMN3R0-60BS v.1	20120322	Product data sheet	-	-

## 10. Legal information

### 10.1 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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## 12. Contents

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<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>Marking</b> . . . . .	<b>2</b>
<b>5</b>	<b>Limiting values</b> . . . . .	<b>3</b>
<b>6</b>	<b>Thermal characteristics</b> . . . . .	<b>5</b>
<b>7</b>	<b>Characteristics</b> . . . . .	<b>6</b>
<b>8</b>	<b>Package outline</b> . . . . .	<b>11</b>
<b>9</b>	<b>Revision history</b> . . . . .	<b>12</b>
<b>10</b>	<b>Legal information</b> . . . . .	<b>13</b>
10.1	Data sheet status . . . . .	13
10.2	Definitions . . . . .	13
10.3	Disclaimers . . . . .	13
10.4	Trademarks . . . . .	14
<b>11</b>	<b>Contact information</b> . . . . .	<b>14</b>

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-  Shortage Management
-  Alternative Solution
-  Excess Inventory Management