



# PSMN7R6-60BS

N-channel 60 V 7.8 mΩ standard level MOSFET in D2PAK

Rev. 2 — 2 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

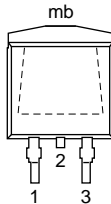
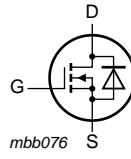
Table 1. Quick reference data

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>	-	-	92	A
$P_{tot}$	total power dissipation	$T_{mb} = 25\text{ °C}$ ; see <a href="#">Figure 2</a>	-	-	149	W
$T_j$	junction temperature		-55	-	175	°C
<b>Static characteristics</b>						
$R_{DS(on)}$	drain-source on-state resistance	$V_{GS} = 10\text{ V}$ ; $I_D = 25\text{ A}$ ; $T_j = 25\text{ °C}$ ; see <a href="#">Figure 13</a> ; see <a href="#">Figure 9</a>	-	5.9	7.8	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 15</a> ; see <a href="#">Figure 14</a>	-	10.6	-	nC
$Q_{G(tot)}$	total gate 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>	-	38.7	-	nC
<b>Avalanche ruggedness</b>						
$E_{DS(AL)S}$	non-repetitive drain-source avalanche energy	$V_{GS} = 10\text{ V}$ ; $T_{j(init)} = 25\text{ °C}$ ; $I_D = 92\text{ A}$ ; $V_{sup} \leq 100\text{ V}$ ; $R_{GS} = 50\text{ Ω}$ ; unclamped	-	-	110	mJ



## 2. Pinning information

Table 2. Pinning information

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

**SOT404 (D2PAK)**

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

## 3. Ordering information

Table 3. Ordering information

Type number	Package		
	Name	Description	Version
PSMN7R6-60BS	D2PAK	plastic single-ended surface-mounted package (D2PAK); 3 leads (one lead cropped)	SOT404

## 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	$T_j \geq 25\text{ °C}$ ; $T_j \leq 175\text{ °C}$	-	60	V
$V_{DGR}$	drain-gate voltage	$R_{GS} = 20\text{ k}\Omega$	-	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>	-	65	A
		$V_{GS} = 10\text{ V}$ ; $T_{mb} = 25\text{ °C}$ ; see <a href="#">Figure 1</a>	-	92	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>	-	389	A
$P_{tot}$	total power dissipation	$T_{mb} = 25\text{ °C}$ ; see <a href="#">Figure 2</a>	-	149	W
$T_{stg}$	storage temperature		-55	175	°C
$T_j$	junction temperature		-55	175	°C
$T_{sld(M)}$	peak soldering temperature		-	260	°C

### Source-drain diode

$I_S$	source current	$T_{mb} = 25\text{ °C}$	-	92	A
$I_{SM}$	peak source current	pulsed; $t_p \leq 10\text{ }\mu\text{s}$ ; $T_{mb} = 25\text{ °C}$	-	389	A

### Avalanche ruggedness

$E_{DS(AL)S}$	non-repetitive drain-source avalanche energy	$V_{GS} = 10\text{ V}$ ; $T_{j(\text{init})} = 25\text{ °C}$ ; $I_D = 92\text{ A}$ ; $V_{sup} \leq 100\text{ V}$ ; $R_{GS} = 50\text{ }\Omega$ ; unclamped	-	110	mJ
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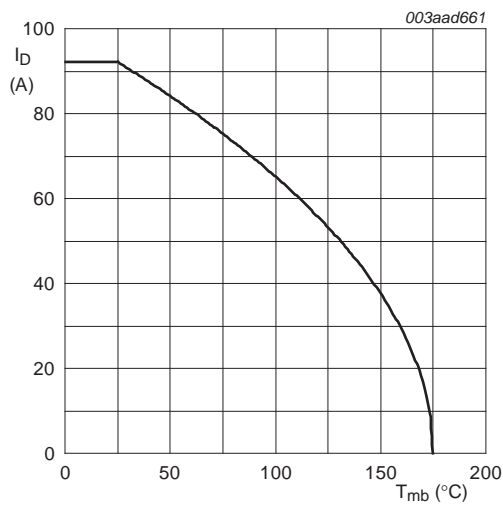
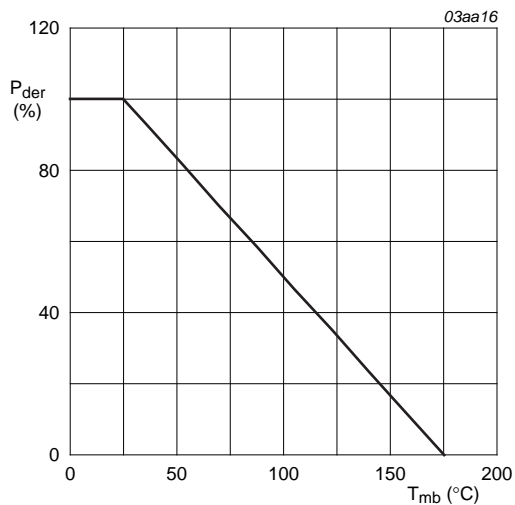
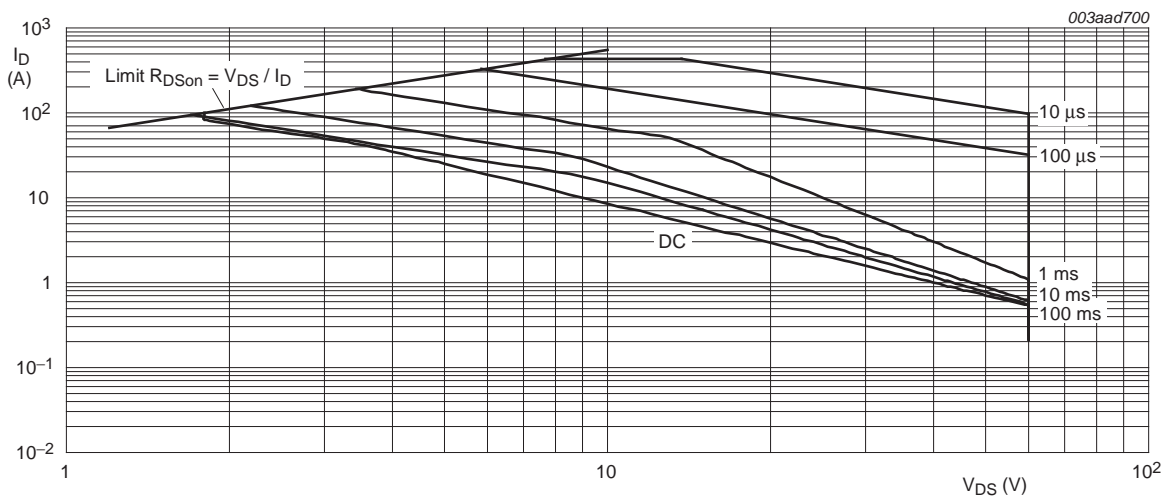


Fig 1. Continuous drain current as a function of mounting base temperature



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

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



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

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>	-	0.49	1.01	K/W
$R_{th(j-a)}$	thermal resistance from junction to ambient	Minimum footprint; mounted on a printed circuit board	-	50	-	K/W

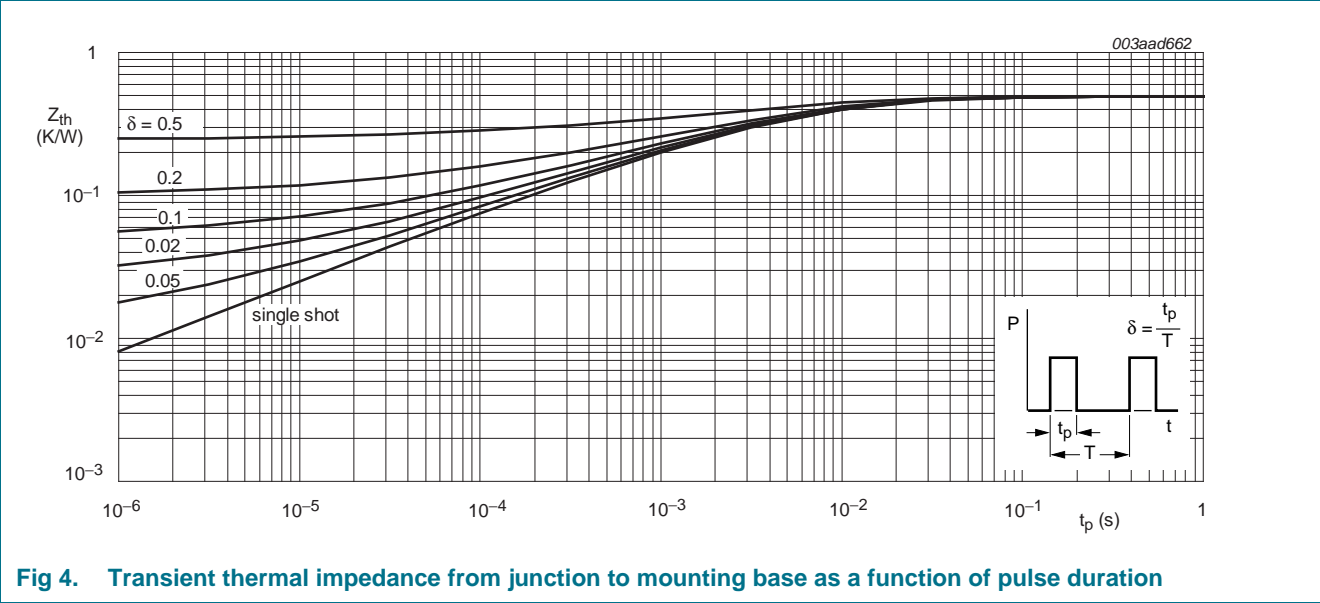


Fig 4. Transient thermal impedance from junction to mounting base as a function of pulse duration

## 6. Characteristics

**Table 6. Characteristics**

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
<b>Static characteristics</b>						
$V_{(BR)DSS}$	drain-source breakdown voltage	$I_D = 250\ \mu A; V_{GS} = 0\ V; T_j = -55\ ^\circ C$	54	-	-	V
		$I_D = 250\ \mu A; V_{GS} = 0\ V; T_j = 25\ ^\circ C$	60	-	-	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 10</a> ; see <a href="#">Figure 11</a>	2	3	4	V
$V_{GSth}$	gate-source threshold voltage	$I_D = 1\ mA; V_{DS} = V_{GS}; T_j = 175\ ^\circ C$ ; see <a href="#">Figure 11</a>	1	-	-	V
		$I_D = 1\ mA; V_{DS} = V_{GS}; T_j = -55\ ^\circ C$ ; see <a href="#">Figure 11</a>	-	-	4.6	V
$I_{DSS}$	drain leakage current	$V_{DS} = 60\ V; V_{GS} = 0\ V; T_j = 25\ ^\circ C$	-	0.05	10	$\mu A$
		$V_{DS} = 60\ V; V_{GS} = 0\ V; T_j = 125\ ^\circ C$	-	-	100	$\mu A$
$I_{GSS}$	gate leakage current	$V_{GS} = 20\ V; V_{DS} = 0\ V; T_j = 25\ ^\circ C$	-	2	100	nA
		$V_{GS} = -20\ V; V_{DS} = 0\ V; T_j = 25\ ^\circ C$	-	2	100	nA
$R_{DSon}$	drain-source on-state resistance	$V_{GS} = 10\ V; I_D = 25\ A; T_j = 175\ ^\circ C$ ; see <a href="#">Figure 12</a>	-	13.3	18	mΩ
		$V_{GS} = 10\ V; I_D = 25\ A; T_j = 25\ ^\circ C$ ; see <a href="#">Figure 13</a> ; see <a href="#">Figure 9</a>	-	5.9	7.8	mΩ
$R_G$	gate resistance	$f = 1\ MHz$	-	0.98	-	Ω
<b>Dynamic characteristics</b>						
$Q_{G(tot)}$	total gate charge	$I_D = 25\ A; V_{DS} = 30\ V; V_{GS} = 10\ V$ ; see <a href="#">Figure 14</a> ; see <a href="#">Figure 15</a>	-	38.7	-	nC
$Q_{GS}$	gate-source charge		-	12.9	-	nC
$Q_{GS(th)}$	pre-threshold gate-source charge		-	6.9	-	nC
$Q_{GS(th-pl)}$	post-threshold gate-source charge		-	6	-	nC
$Q_{GD}$	gate-drain charge	$I_D = 25\ A; V_{DS} = 30\ V; V_{GS} = 10\ V$ ; see <a href="#">Figure 15</a> ; see <a href="#">Figure 14</a>	-	10.6	-	nC
$V_{GS(pl)}$	gate-source plateau voltage	$I_D = 25\ A; V_{DS} = 30\ V$ ; see <a href="#">Figure 14</a> ; see <a href="#">Figure 15</a>	-	5.6	-	V
$C_{iss}$	input capacitance	$V_{DS} = 30\ V; V_{GS} = 0\ V; f = 1\ MHz$ ; $T_j = 25\ ^\circ C$ ; see <a href="#">Figure 16</a> ; see <a href="#">Figure 8</a>	-	2651	-	pF
$C_{oss}$	output capacitance	$V_{DS} = 30\ V; V_{GS} = 0\ V; f = 1\ MHz$ ; $T_j = 25\ ^\circ C$ ; see <a href="#">Figure 16</a>	-	342	-	pF
$C_{rss}$	reverse transfer capacitance	$V_{DS} = 30\ V; V_{GS} = 0\ V; f = 1\ MHz$ ; $T_j = 25\ ^\circ C$ ; see <a href="#">Figure 16</a> ; see <a href="#">Figure 8</a>	-	183	-	pF
$t_{d(on)}$	turn-on delay time	$V_{DS} = 30\ V; R_L = 1.2\ \Omega; V_{GS} = 10\ V$ ; $R_{G(ext)} = 4.7\ \Omega$	-	19	-	ns
$t_r$	rise time		-	21	-	ns
$t_{d(off)}$	turn-off delay time		-	37	-	ns
$t_f$	fall time		-	13	-	ns

Table 6. Characteristics ...continued

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
Source-drain diode						
$V_{SD}$	source-drain voltage	$I_S = 25\text{ A}$ ; $V_{GS} = 0\text{ V}$ ; $T_j = 25\text{ °C}$ ; see Figure 17	-	0.86	1.2	V
$t_{rr}$	reverse recovery time	$I_S = 25\text{ A}$ ; $dI_S/dt = 100\text{ A/}\mu\text{s}$ ; $V_{GS} = 0\text{ V}$ ;	-	40.4	-	ns
$Q_r$	recovered charge	$V_{DS} = 30\text{ V}$	-	56	-	nC

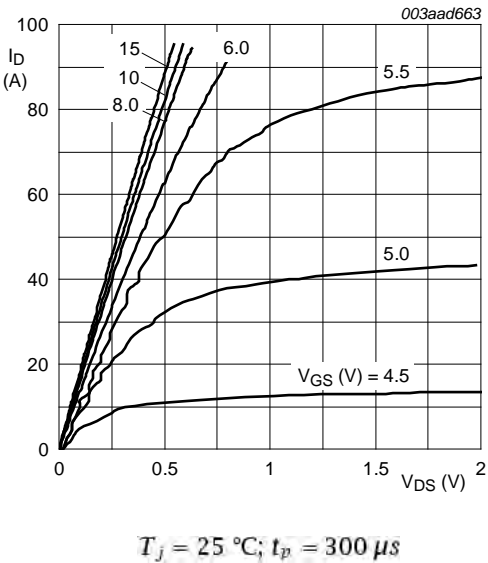


Fig 5. Output characteristics: drain current as a function of drain-source voltage; typical values

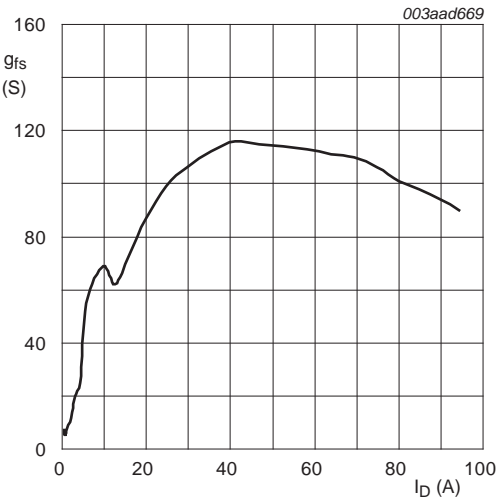


Fig 6. Forward transconductance as a function of drain current; typical values

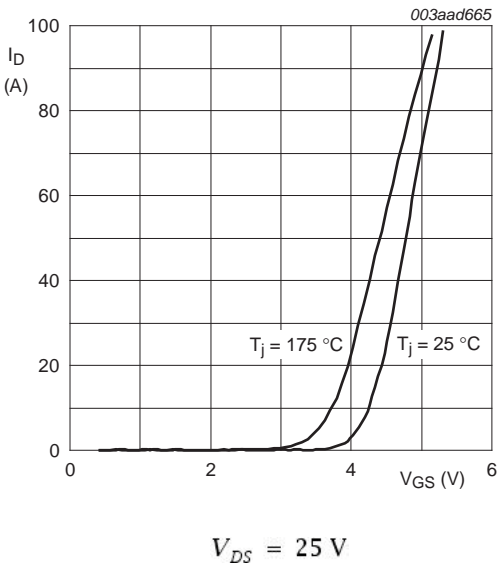


Fig 7. Transfer characteristics: drain current as a function of gate-source voltage; typical values

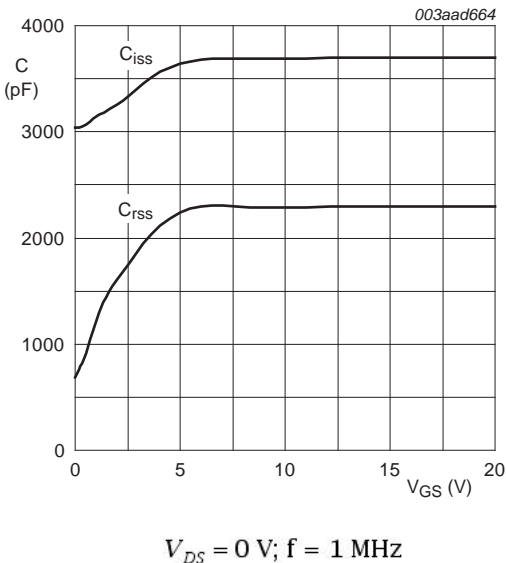
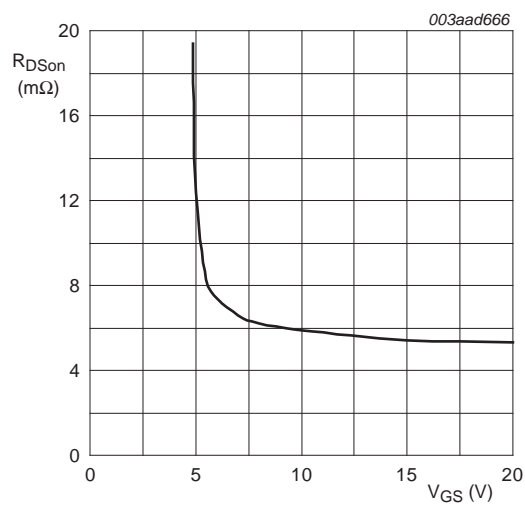
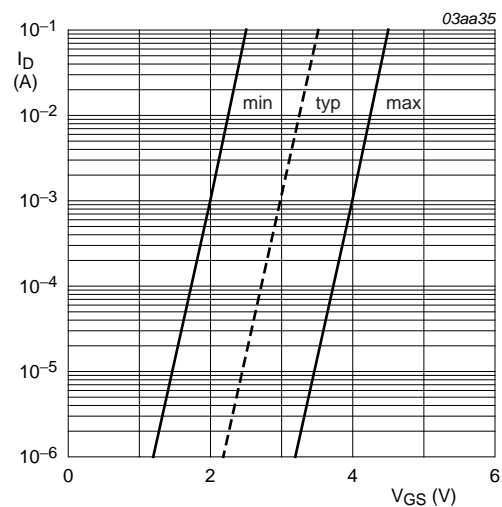


Fig 8. Input and reverse transfer capacitances as a function of gate-source voltage; typical values



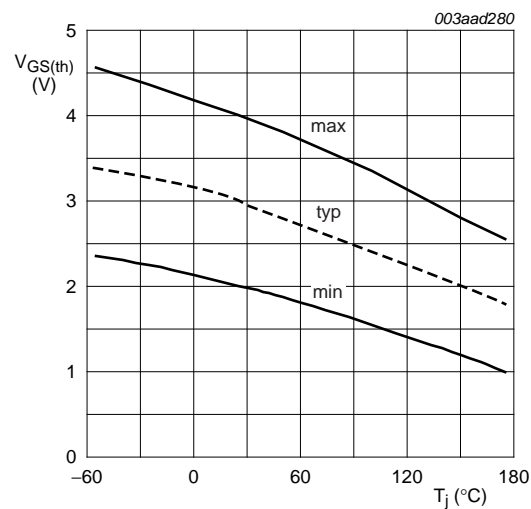
$T_j = 25^\circ\text{C}$

Fig 9. Drain-source on-state resistance as a function of gate-source voltage; typical values



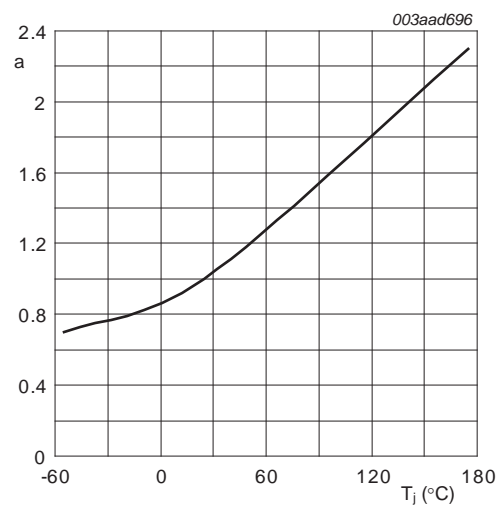
$T_j = 25^\circ\text{C}; V_{DS} = 5\text{V}$

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



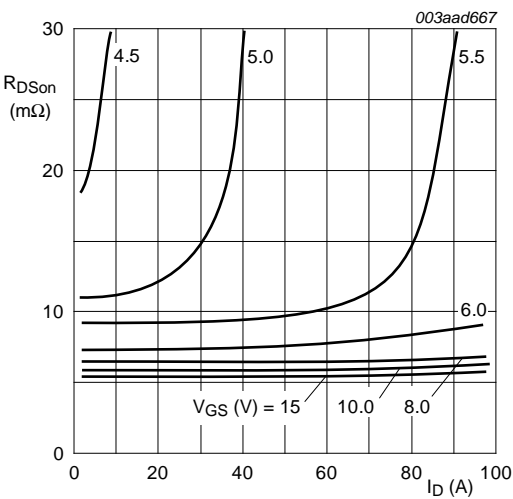
$I_D = 1\text{ mA}; V_{DS} = V_{GS}$

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



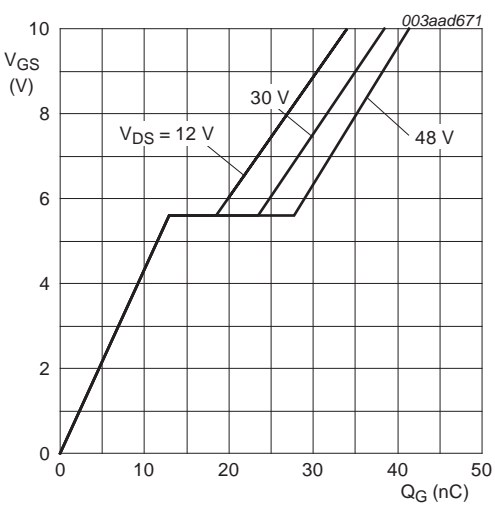
$$a = \frac{R_{DS(on)}}{R_{DS(on)(25^\circ\text{C})}}$$

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



$T_j = 25^\circ\text{C}; t_p = 300\mu\text{s}$

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



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

Fig 14. Gate-source voltage as a function of gate charge; typical values

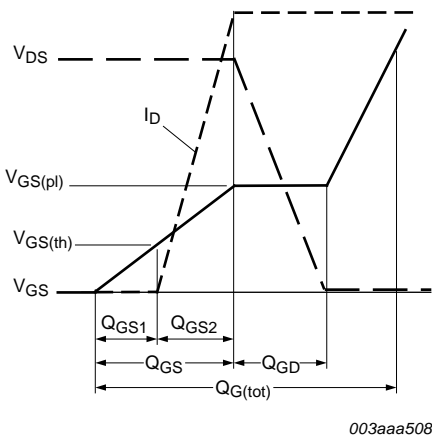
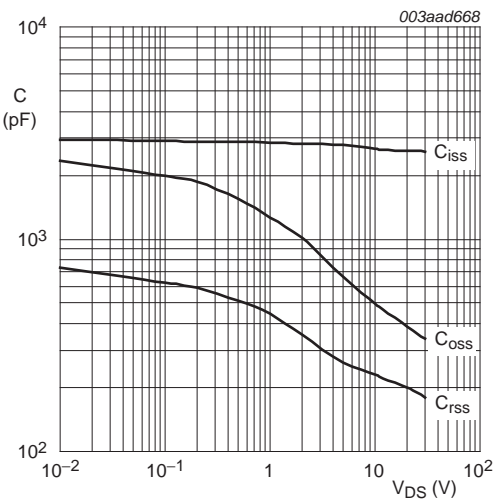


Fig 15. Gate charge waveform definitions



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

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



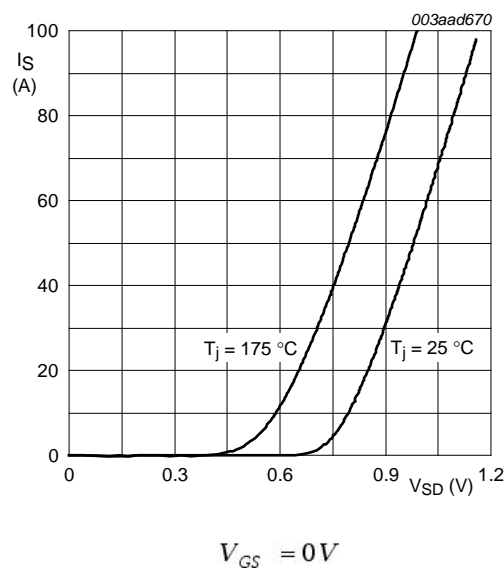


Fig 17. Source (diode forward) current as a function of source-drain (diode forward) voltage; typical values

7. Package outline

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

SOT404

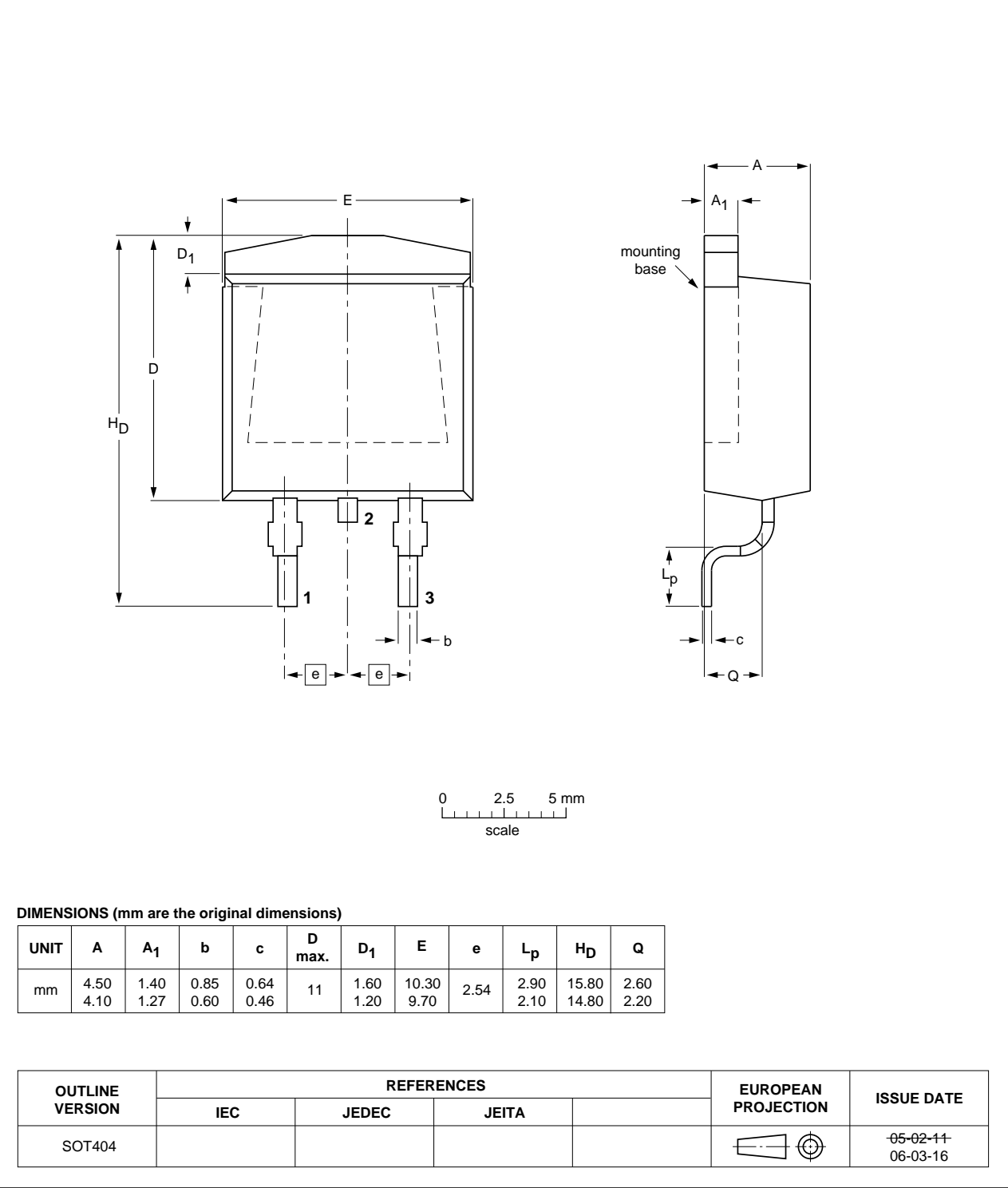


Fig 18. Package outline SOT404 (D2PAK)

## 8. Revision history

Table 7. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
PSMN7R6-60BS v.2	20120302	Product data sheet	-	PSMN7R6-60BS v.1
Modifications:	<ul style="list-style-type: none"><li>• Status changed from objective to product.</li><li>• Various changes to content.</li></ul>			
PSMN7R6-60BS v.1	20111020	Objective 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.

[2] The term 'short data sheet' is explained in section "Definitions".

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Please be aware that important notices concerning this document and the product(s) described herein, have been included in section 'Legal information'.

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For sales office addresses, please send an email to: [salesaddresses@nxp.com](mailto:salesaddresses@nxp.com)

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