



PSMN4R6-60BS

N-channel 60 V, 4.4 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

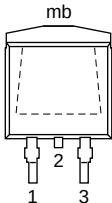
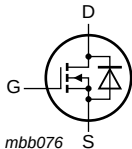
Table 1. Quick reference data

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	$T_{mb} = 25\text{ °C}$; see Figure 1	[1]	-	100	A
P_{tot}	total power dissipation	$T_{mb} = 25\text{ °C}$; see Figure 2	-	-	211	W
T_j	junction temperature		-55	-	175	°C
Static characteristics						
$R_{DS(on)}$	drain-source on-state resistance	$V_{GS} = 10\text{ V}$; $I_D = 25\text{ A}$; $T_j = 100\text{ °C}$; see Figure 12 ; see Figure 13	-	5.98	7	mΩ
		$V_{GS} = 10\text{ V}$; $I_D = 25\text{ A}$; $T_j = 25\text{ °C}$; see Figure 13	-	3.74	4.4	mΩ
Dynamic characteristics						
Q_{GD}	gate-drain charge	$V_{GS} = 10\text{ V}$; $I_D = 25\text{ A}$; $V_{DS} = 30\text{ V}$; see Figure 14 ; see Figure 15	-	14.8	-	nC
$Q_{G(tot)}$	total gate charge		-	70.8	-	nC
Avalanche ruggedness						
$E_{DS(AL)S}$	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	-	-	266	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		
2	D	drain ^[1]		
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
PSMN4R6-60BS	D2PAK	plastic single-ended surface-mounted package (D2PAK); 3 leads (one lead cropped)	SOT404

4. Marking

Table 4. Marking codes

Type number	Marking code
PSMN4R6-60BS	PSMN4R6-60BS

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	$T_{mb} = 100\text{ °C}$; see Figure 1	[1]	99.7	A
		$T_{mb} = 25\text{ °C}$; see Figure 1	[1]	100	A
I_{DM}	peak drain current	pulsed; $t_p = 10\text{ }\mu\text{s}$; $T_{mb} = 25\text{ °C}$; see Figure 3	-	565	A
P_{tot}	total power dissipation	$T_{mb} = 25\text{ °C}$; see Figure 2	-	211	W
T_{stg}	storage temperature		-55	175	°C
T_j	junction temperature		-55	175	°C
$T_{sld(M)}$	peak soldering temperature		-	260	°C

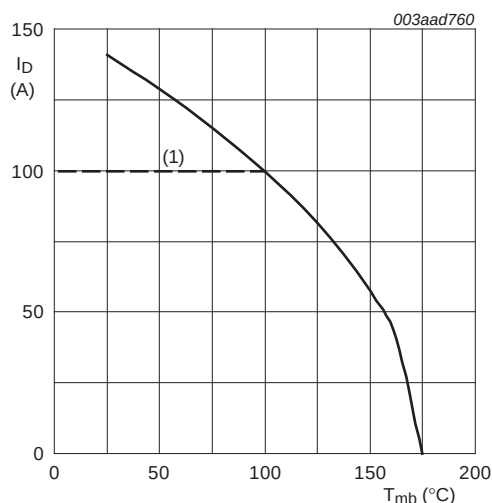
Source-drain diode

I_S	source current	$T_{mb} = 25\text{ °C}$	[1]	-	100	A
I_{SM}	peak source current	pulsed; $t_p = 10\text{ }\mu\text{s}$; $T_{mb} = 25\text{ °C}$	-	-	565	A

Avalanche ruggedness

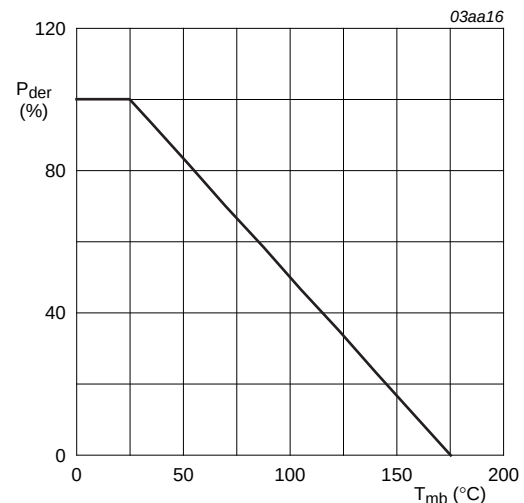
$E_{DS(AL)S}$	non-repetitive drain-source avalanche energy	$V_{GS} = 10\text{ V}$; $T_{j(\text{init})} = 25\text{ °C}$; $I_D = 100\text{ A}$; $V_{sup} \leq 60\text{ V}$; $R_{GS} = 50\text{ }\Omega$; unclamped	-	-	266	mJ
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[1] Continuous current is limited by package.



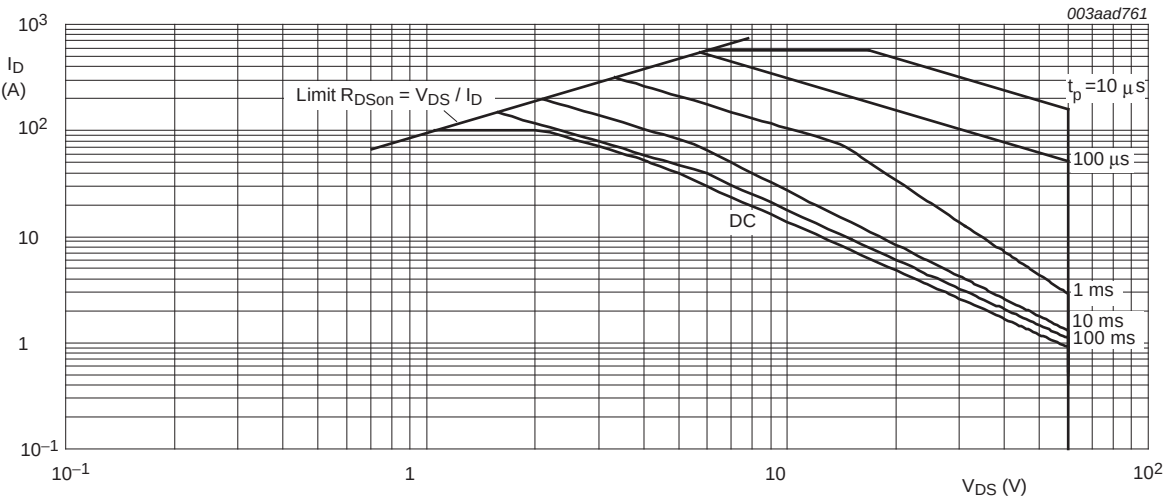
$V_{GS} \geq 10\text{ V}$; (1) capped at 100 A due to package.

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



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

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



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

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 Figure 4	-	0.38	0.71	K/W
$R_{th(j-a)}$	thermal resistance from junction to ambient	minimum footprint; mounted on a printed circuit board	-	50	-	K/W

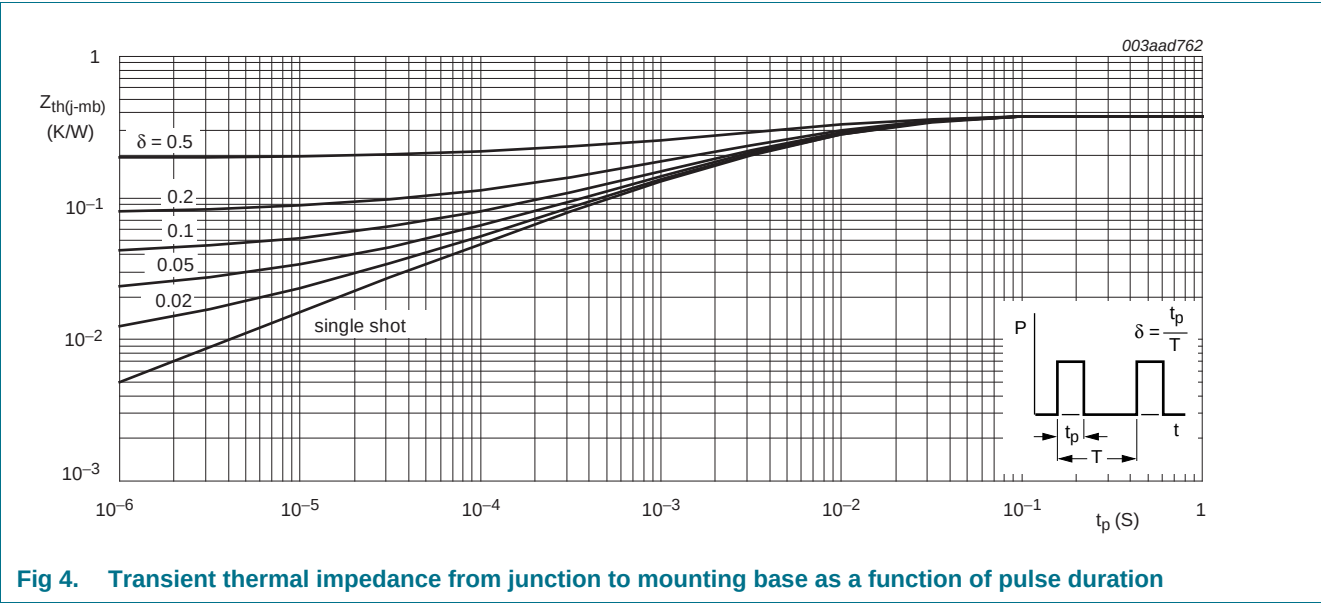


Fig 4. Transient thermal impedance from junction to mounting base as a function of pulse duration

7. Characteristics

Table 7. Characteristics

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
Static characteristics						
$V_{(BR)DSS}$	drain-source breakdown voltage	$I_D = 250\ \mu\text{A}$; $V_{GS} = 0\ \text{V}$; $T_j = -55\ ^\circ\text{C}$	54	-	-	V
		$I_D = 250\ \mu\text{A}$; $V_{GS} = 0\ \text{V}$; $T_j = 25\ ^\circ\text{C}$	60	-	-	V
$V_{GS(th)}$	gate-source threshold voltage	$I_D = 1\ \text{mA}$; $V_{DS} = V_{GS}$; $T_j = 25\ ^\circ\text{C}$; see Figure 10 ; see Figure 11	2	3	4	V
V_{GSth}	gate-source threshold voltage	$I_D = 1\ \text{mA}$; $V_{DS} = V_{GS}$; $T_j = -55\ ^\circ\text{C}$; see Figure 11	-	-	4.8	V
		$I_D = 1\ \text{mA}$; $V_{DS} = V_{GS}$; $T_j = 175\ ^\circ\text{C}$; see Figure 11	1	-	-	V
I_{DSS}	drain leakage current	$V_{DS} = 60\ \text{V}$; $V_{GS} = 0\ \text{V}$; $T_j = 25\ ^\circ\text{C}$	-	0.05	10	μA
		$V_{DS} = 60\ \text{V}$; $V_{GS} = 0\ \text{V}$; $T_j = 125\ ^\circ\text{C}$	-	-	200	μA
I_{GSS}	gate leakage current	$V_{GS} = -20\ \text{V}$; $V_{DS} = 0\ \text{V}$; $T_j = 25\ ^\circ\text{C}$	-	10	100	nA
		$V_{GS} = 20\ \text{V}$; $V_{DS} = 0\ \text{V}$; $T_j = 25\ ^\circ\text{C}$	-	10	100	nA
R_{DSon}	drain-source on-state resistance	$V_{GS} = 10\ \text{V}$; $I_D = 25\ \text{A}$; $T_j = 175\ ^\circ\text{C}$; see Figure 12 ; see Figure 13	-	8.6	10.1	mΩ
		$V_{GS} = 10\ \text{V}$; $I_D = 25\ \text{A}$; $T_j = 100\ ^\circ\text{C}$; see Figure 12 ; see Figure 13	-	5.98	7	mΩ
		$V_{GS} = 10\ \text{V}$; $I_D = 25\ \text{A}$; $T_j = 25\ ^\circ\text{C}$; see Figure 13	-	3.74	4.4	mΩ
R_G	gate resistance	$f = 1\ \text{MHz}$	-	0.79	-	Ω
Dynamic characteristics						
$Q_{G(tot)}$	total gate charge	$I_D = 0\ \text{A}$; $V_{DS} = 0\ \text{V}$; $V_{GS} = 10\ \text{V}$	-	63	-	nC
		$I_D = 25\ \text{A}$; $V_{DS} = 30\ \text{V}$; $V_{GS} = 10\ \text{V}$; see Figure 14 ; see Figure 15	-	70.8	-	nC
Q_{GS}	gate-source charge		-	19.5	-	nC
$Q_{GS(th)}$	pre-threshold gate-source charge		-	13.5	-	nC
$Q_{GS(th-pl)}$	post-threshold gate-source charge		-	6	-	nC
Q_{GD}	gate-drain charge		-	14.8	-	nC
$V_{GS(pl)}$	gate-source plateau voltage	$I_D = 25\ \text{A}$; $V_{DS} = 30\ \text{V}$; see Figure 14 ; see Figure 15	-	4.3	-	V
C_{iss}	input capacitance	$V_{DS} = 30\ \text{V}$; $V_{GS} = 0\ \text{V}$; $f = 1\ \text{MHz}$; $T_j = 25\ ^\circ\text{C}$; see Figure 16	-	4426	-	pF
C_{oss}	output capacitance		-	567	-	pF
C_{rss}	reverse transfer capacitance		-	293	-	pF
$t_{d(on)}$	turn-on delay time	$V_{DS} = 30\ \text{V}$; $R_L = 1.2\ \Omega$; $V_{GS} = 10\ \text{V}$; $R_{G(ext)} = 4.7\ \Omega$	-	26	-	ns
t_r	rise time		-	24	-	ns
$t_{d(off)}$	turn-off delay time		-	58	-	ns
t_f	fall time		-	22	-	ns

Table 7. 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	-	0.81	1.1	V
t_{rr}	reverse recovery time	$I_S = 25\text{ A}$; $dI_S/dt = -100\text{ A/}\mu\text{s}$;	-	45	-	ns
Q_r	recovered charge	$V_{GS} = 0\text{ V}$; $V_{DS} = 30\text{ V}$	-	64	-	nC

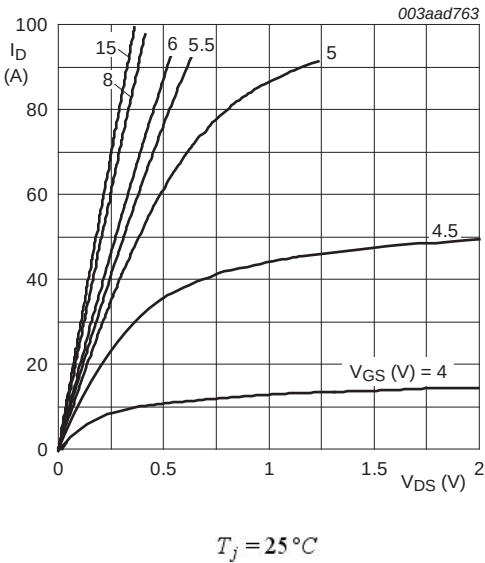


Fig 5. Output characteristics: drain current as a function of drain-source voltage; typical values

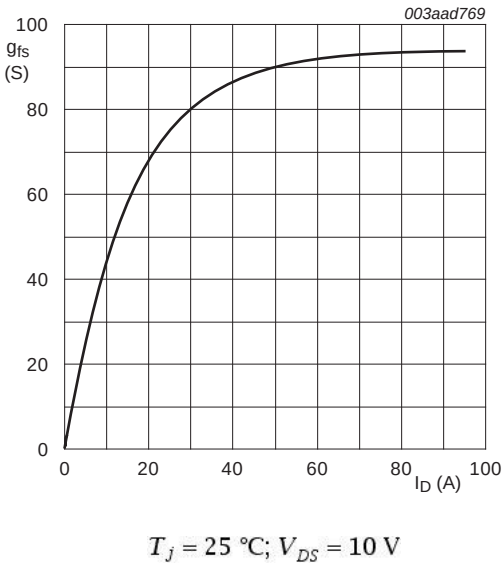


Fig 6. Forward transconductance as a function of drain current; typical values

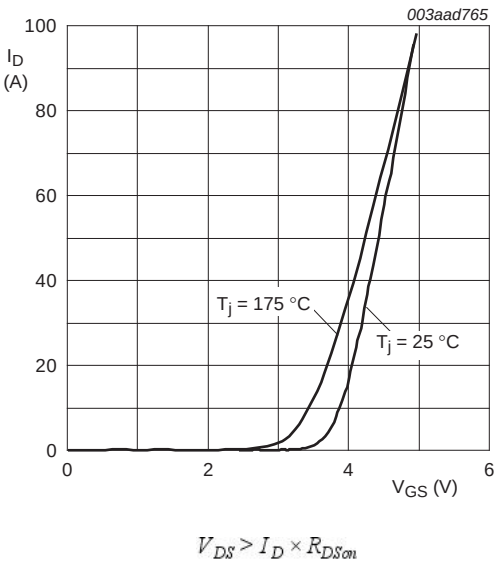


Fig 7. Transfer characteristics: drain current as a function of gate-source voltage; typical values

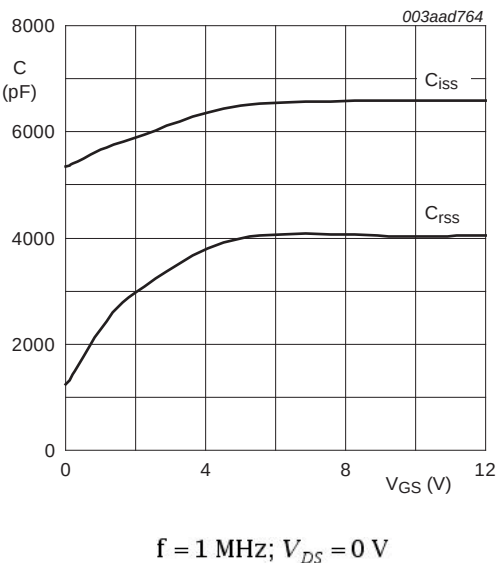
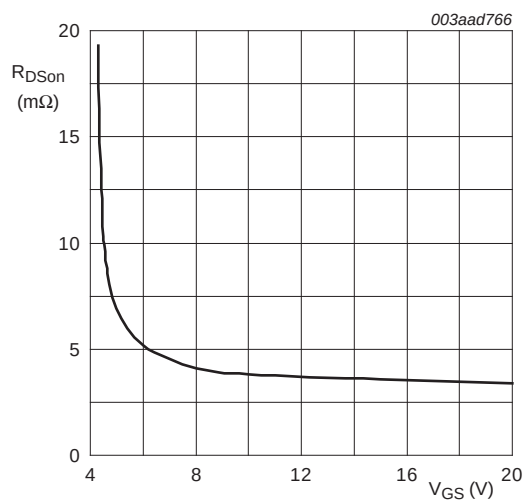
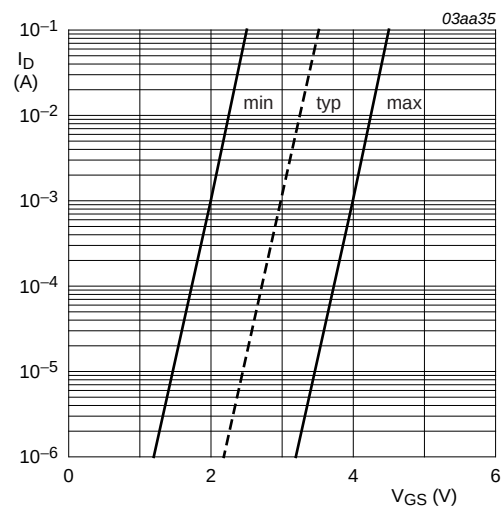


Fig 8. Input and reverse transfer capacitances as a function of gate-source voltage, typical values



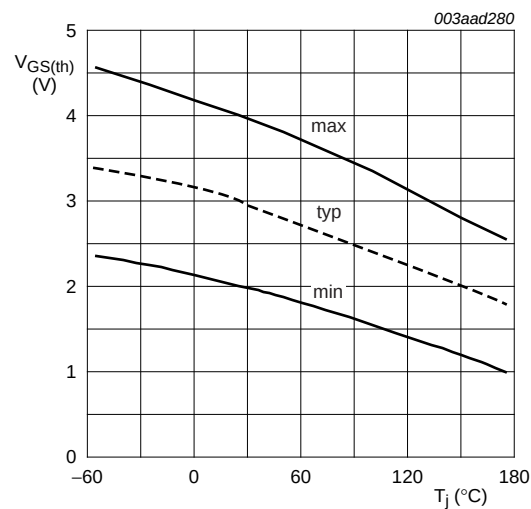
$T_j = 25\text{ }^{\circ}\text{C}; I_D = 25\text{ A}$

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



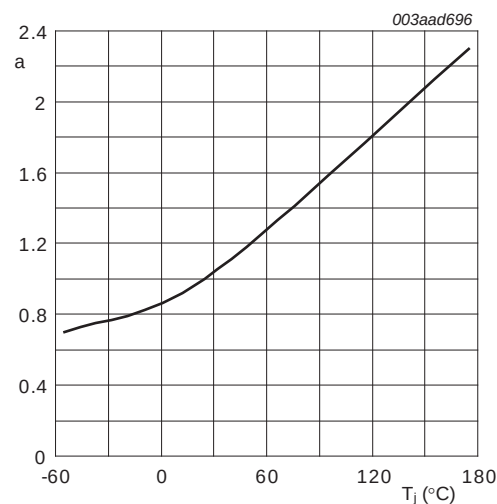
$T_j = 25\text{ }^{\circ}\text{C}; V_{DS} = 5\text{ V}$

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



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

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

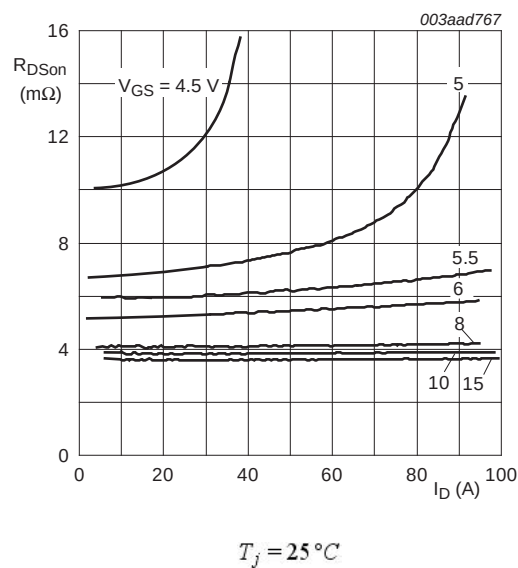


Fig 13. Drain-source on-state resistance as a function of drain current; typical values

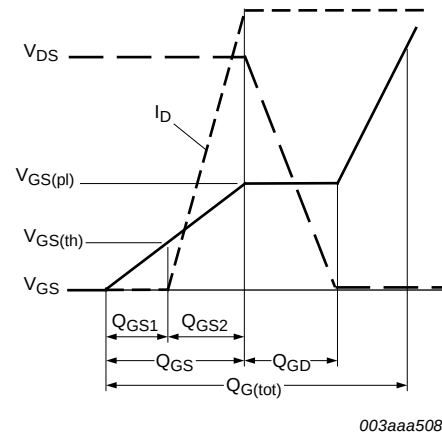


Fig 14. Gate charge waveform definitions

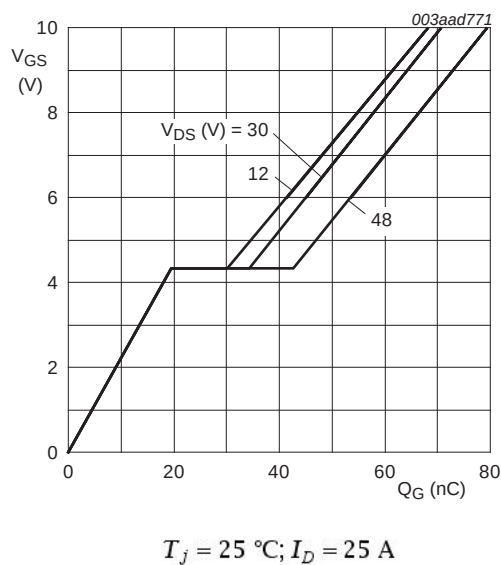


Fig 15. Gate-source voltage as a function of gate charge; typical values

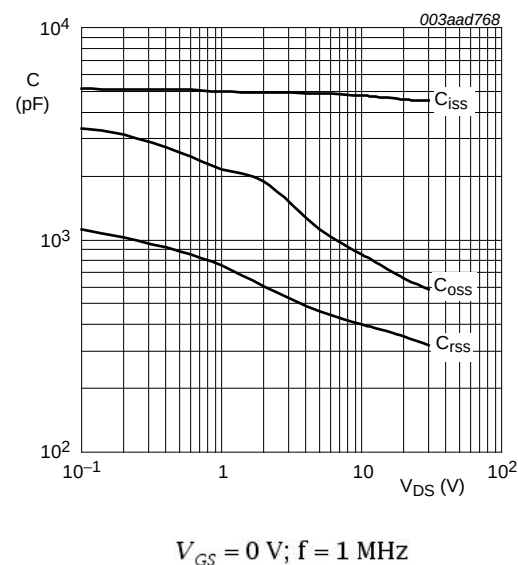


Fig 16. Input, output and reverse transfer capacitances as a function of drain-source voltage; typical values

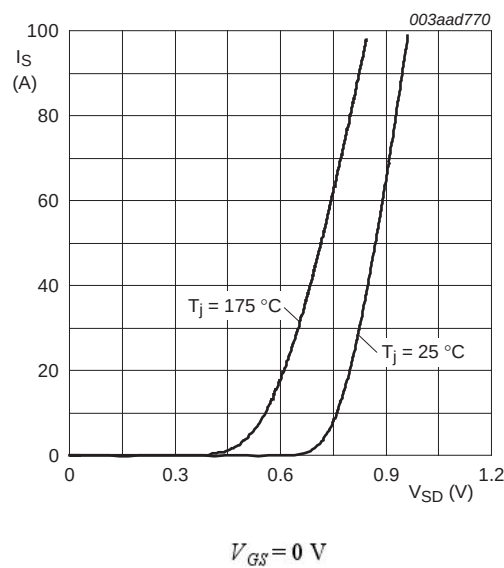


Fig 17. Source current as a function of source-drain voltage; typical values

8. Package outline

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

SOT404

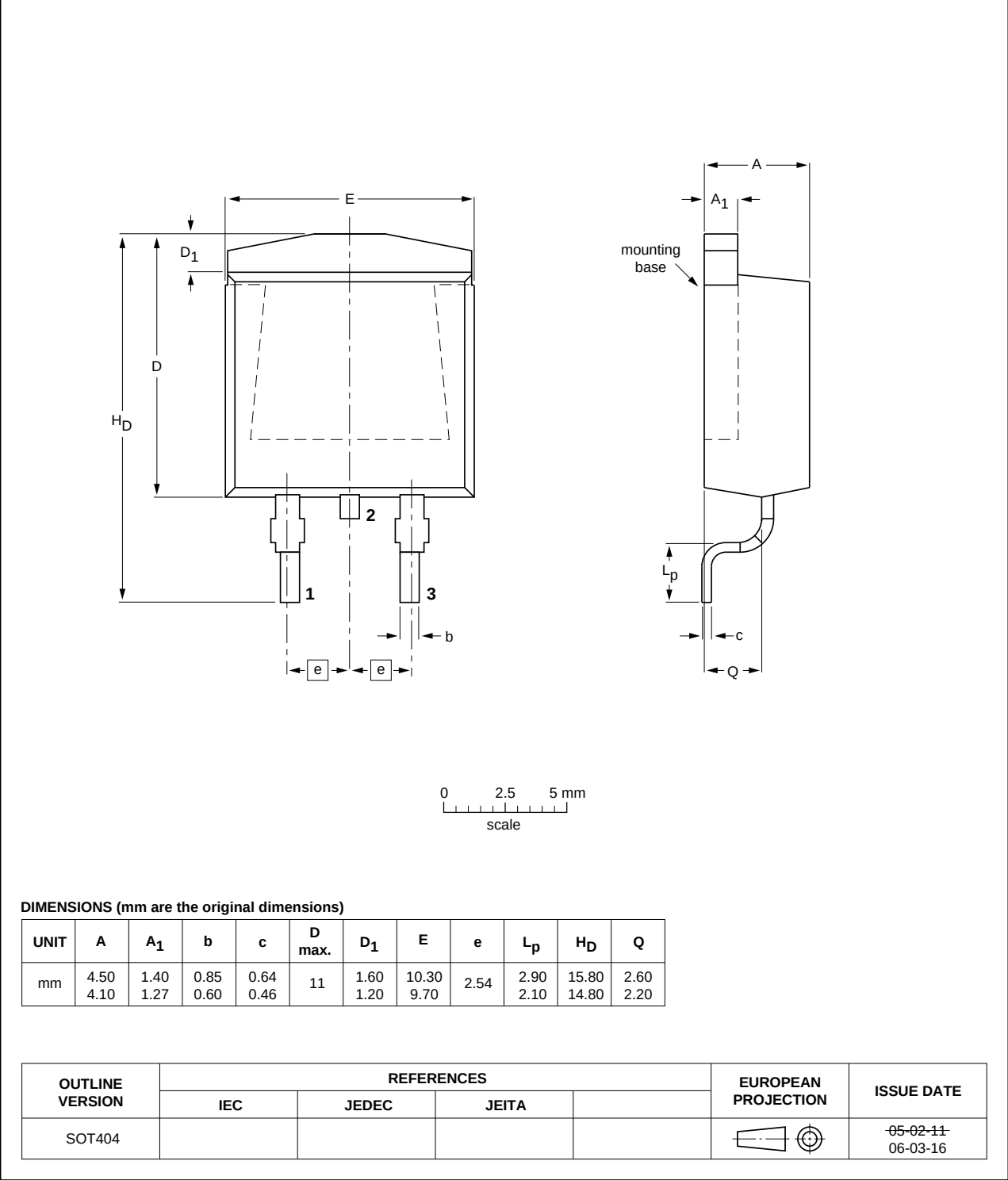


Fig 18. Package outline SOT404 (D2PAK)

9. Revision history

Table 8. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
PSMN4R6-60BS v.1	20120322	Product data sheet	-	-

10. Legal information

10.1 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".

[3] The product status of device(s) described in this document may have changed since this document was published and may differ in case of multiple devices. The latest product status information is available on the Internet at URL <http://www.nexperia.com>.

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For sales office addresses, please send an email to: salesaddresses@nexperia.com

12. Contents

1	Product profile	1
1.1	General description	1
1.2	Features and benefits	1
1.3	Applications	1
1.4	Quick reference data	1
2	Pinning information	2
3	Ordering information	2
4	Marking	2
5	Limiting values	3
6	Thermal characteristics	5
7	Characteristics	6
8	Package outline	11
9	Revision history	12
10	Legal information	13
10.1	Data sheet status	13
10.2	Definitions	13
10.3	Disclaimers	13
10.4	Trademarks	14
11	Contact information	14