



# PSMN022-30PL

N-channel 30 V 22 mΩ logic level MOSFET

Rev. 02 — 1 November 2010

Product data sheet

## 1. Product profile

### 1.1 General description

Logic level N-channel MOSFET in TO220 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 logic level gate drive sources

### 1.3 Applications

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

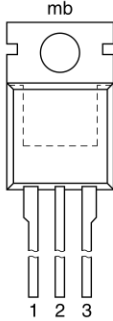
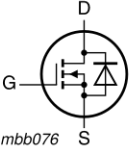
### 1.4 Quick reference data

Table 1. Quick reference data

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
V <sub>DS</sub>	drain-source voltage	T <sub>j</sub> ≥ 25 °C; T <sub>j</sub> ≤ 175 °C	-	-	30	V
I <sub>D</sub>	drain current	T <sub>mb</sub> = 25 °C; V <sub>GS</sub> = 10 V; see <a href="#">Figure 1</a>	-	-	30	A
P <sub>tot</sub>	total power dissipation	T <sub>mb</sub> = 25 °C; see <a href="#">Figure 2</a>	-	-	41	W
T <sub>j</sub>	junction temperature		-55	-	175	°C
Static characteristics						
R <sub>DSon</sub>	drain-source on-state resistance	V <sub>GS</sub> = 4.5 V; I <sub>D</sub> = 5 A; T <sub>j</sub> = 25 °C; see <a href="#">Figure 13</a>	-	27	34	mΩ
		V <sub>GS</sub> = 10 V; I <sub>D</sub> = 5 A; T <sub>j</sub> = 25 °C; see <a href="#">Figure 13</a>	-	19	22	mΩ
Dynamic characteristics						
Q <sub>GD</sub>	gate-drain charge	V <sub>GS</sub> = 4.5 V; I <sub>D</sub> = 5 A;	-	1.4	-	nC
Q <sub>G(tot)</sub>	total gate charge	V <sub>DS</sub> = 15 V; see <a href="#">Figure 14</a> ; see <a href="#">Figure 15</a>	-	4.4	-	nC
Avalanche ruggedness						
E <sub>DS(AL)S</sub>	non-repetitive drain-source avalanche energy	V <sub>GS</sub> = 10 V; T <sub>j(init)</sub> = 25 °C; I <sub>D</sub> = 30 A; V <sub>sup</sub> ≤ 30 V; R <sub>GS</sub> = 50 Ω; unclamped	-	-	7	mJ

2. Pinning information

Table 2. Pinning information

Pin	Symbol	Description	Simplified outline	Graphic symbol
1	G	gate		
2	D	drain		
3	S	source		
mb	D	mounting base; connected to drain		

SOT78 (TO-220AB)

3. Ordering information

Table 3. Ordering information

Type number	Package		
	Name	Description	Version
PSMN022-30PL	TO-220AB	plastic single-ended package; heatsink mounted; 1 mounting hole; 3-lead TO-220AB	SOT78

4. Limiting values

Table 4. Limiting values  
In accordance with the Absolute Maximum Rating System (IEC 60134).

Symbol	Parameter	Conditions	Min	Max	Unit
V <sub>DS</sub>	drain-source voltage	T <sub>j</sub> ≥ 25 °C; T <sub>j</sub> ≤ 175 °C	-	30	V
V <sub>DGR</sub>	drain-gate voltage	T <sub>j</sub> ≥ 25 °C; T <sub>j</sub> ≤ 175 °C; R <sub>GS</sub> = 20 kΩ	-	30	V
V <sub>GS</sub>	gate-source voltage		-20	20	V
I <sub>D</sub>	drain current	V <sub>GS</sub> = 10 V; T <sub>mb</sub> = 100 °C; see Figure 1	-	22	A
		V <sub>GS</sub> = 10 V; T <sub>mb</sub> = 25 °C; see Figure 1	-	30	A
I <sub>DM</sub>	peak drain current	pulsed; t <sub>p</sub> ≤ 10 μs; T <sub>mb</sub> = 25 °C; see Figure 3	-	125	A
P <sub>tot</sub>	total power dissipation	T <sub>mb</sub> = 25 °C; see Figure 2	-	41	W
T <sub>stg</sub>	storage temperature		-55	175	°C
T <sub>j</sub>	junction temperature		-55	175	°C
Source-drain diode					
I <sub>S</sub>	source current	T <sub>mb</sub> = 25 °C	-	30	A
I <sub>SM</sub>	peak source current	pulsed; t <sub>p</sub> ≤ 10 μs; T <sub>mb</sub> = 25 °C	-	125	A
Avalanche ruggedness					
E <sub>DS(AL)S</sub>	non-repetitive drain-source avalanche energy	V <sub>GS</sub> = 10 V; T <sub>j(initial)</sub> = 25 °C; I <sub>D</sub> = 30 A; V <sub>sup</sub> ≤ 30 V; R <sub>GS</sub> = 50 Ω; unclamped	-	7	mJ

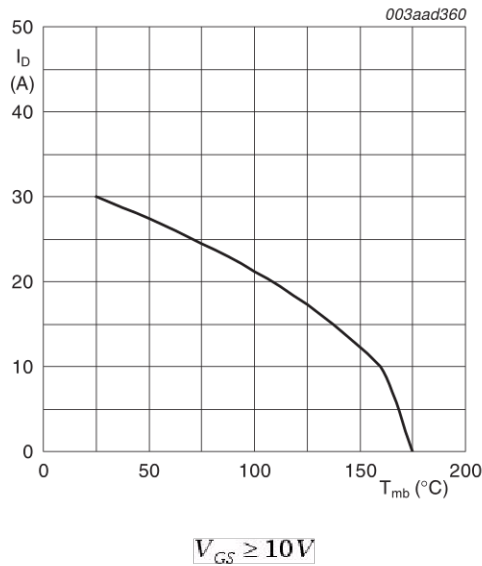


Fig 1. Continuous drain current as a function of mounting base temperature

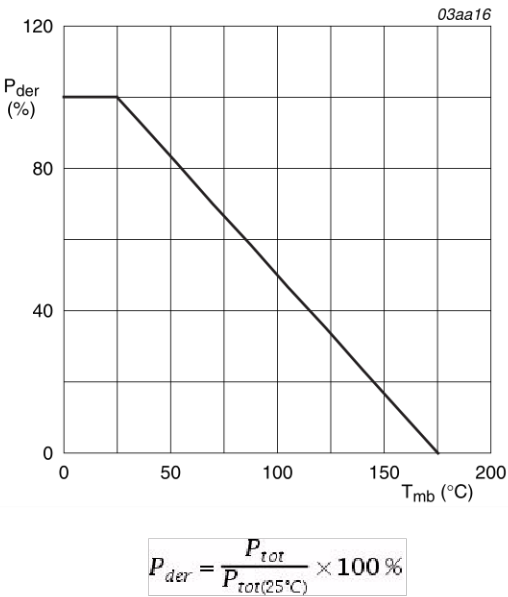
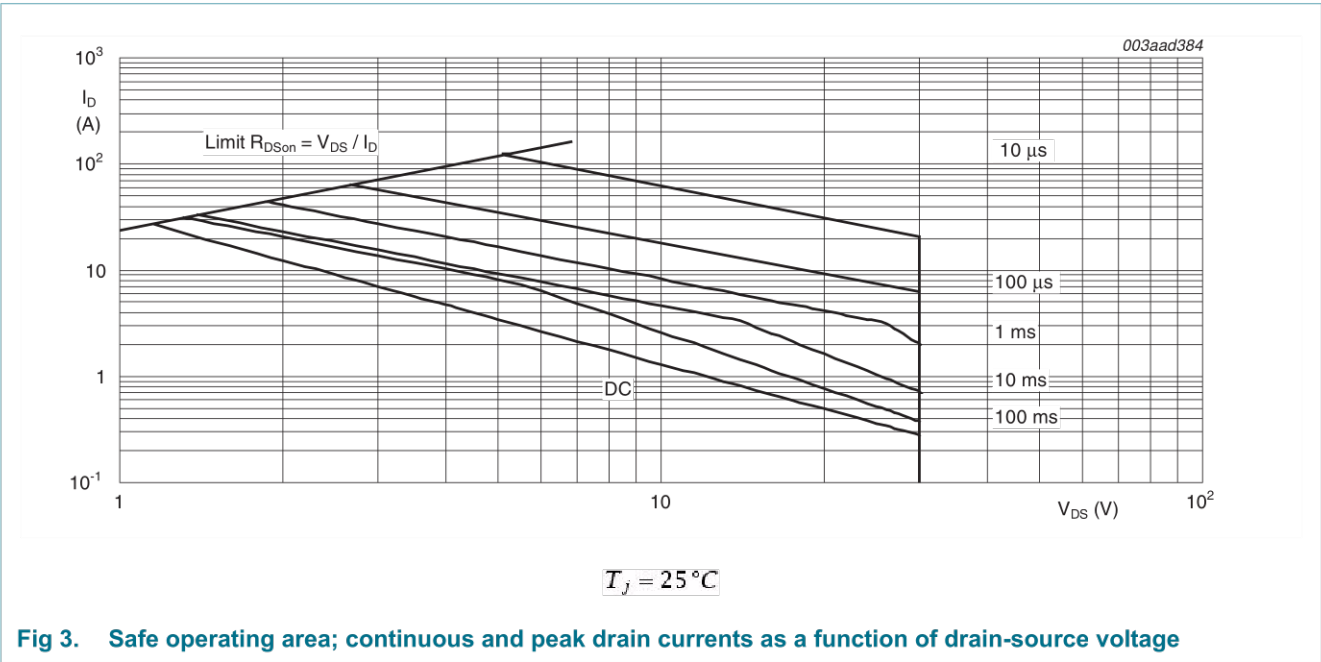


Fig 2. Normalized total power dissipation as a function of mounting base temperature



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>	-	3.1	3.6	K/W

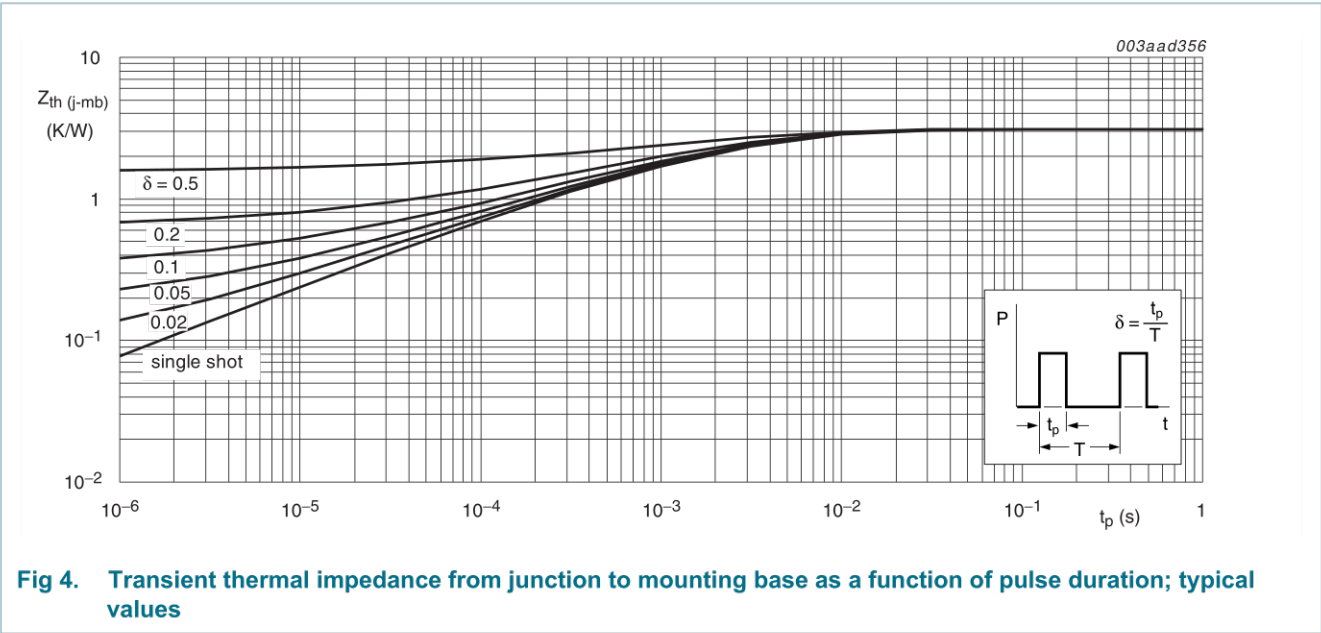


Fig 4. Transient thermal impedance from junction to mounting base as a function of pulse duration; typical values

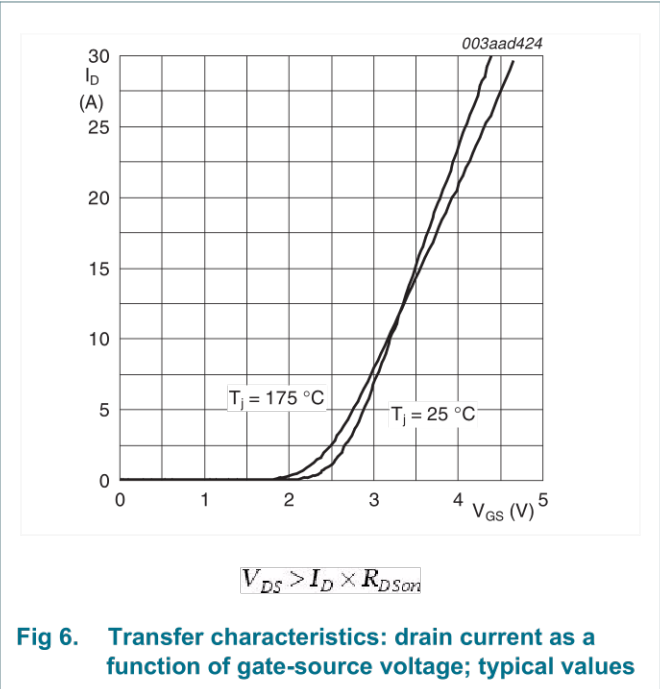
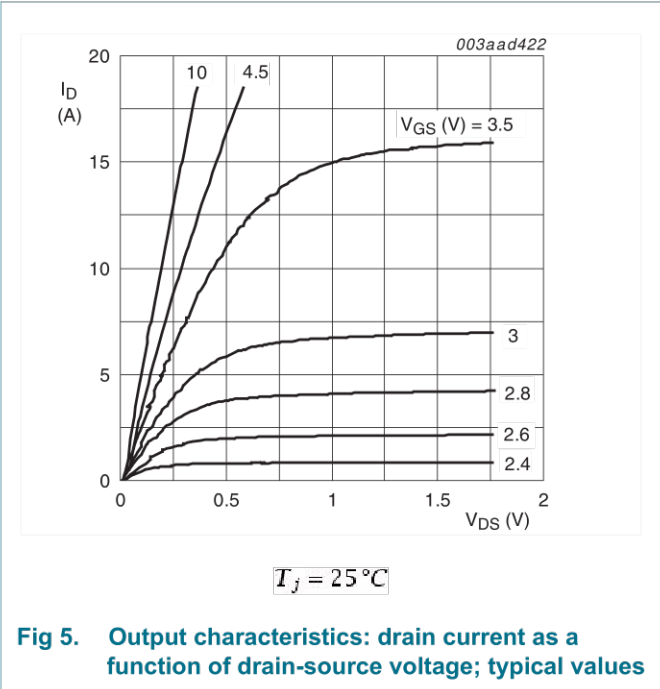
## 6. Characteristics

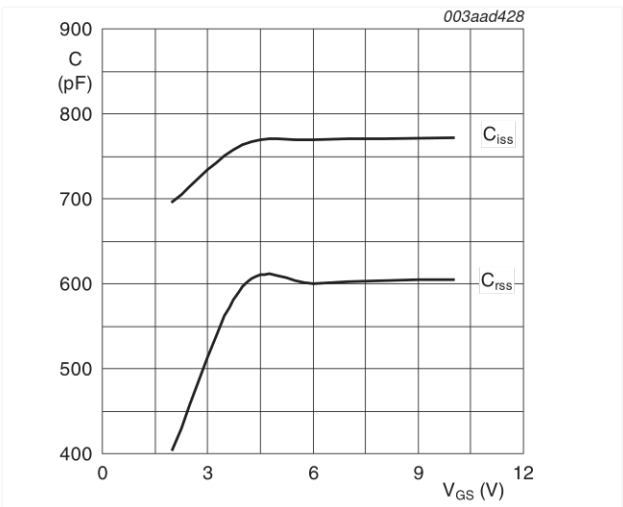
Table 6. Characteristics

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
<b>Static characteristics</b>						
$V_{(BR)DSS}$	drain-source breakdown voltage	$I_D = 250\ \mu\text{A}$ ; $V_{GS} = 0\ \text{V}$ ; $T_j = 25\ ^\circ\text{C}$	30	-	-	V
		$I_D = 250\ \mu\text{A}$ ; $V_{GS} = 0\ \text{V}$ ; $T_j = -55\ ^\circ\text{C}$	27	-	-	V
$V_{GS(th)}$	gate-source threshold voltage	$I_D = 1\ \text{mA}$ ; $V_{DS} = V_{GS}$ ; $T_j = 25\ ^\circ\text{C}$ ; see <a href="#">Figure 10</a> ; see <a href="#">Figure 11</a>	1.3	1.7	2.15	V
		$I_D = 1\ \text{mA}$ ; $V_{DS} = V_{GS}$ ; $T_j = 175\ ^\circ\text{C}$ ; see <a href="#">Figure 11</a>	0.5	-	-	V
		$I_D = 1\ \text{mA}$ ; $V_{DS} = V_{GS}$ ; $T_j = -55\ ^\circ\text{C}$ ; see <a href="#">Figure 11</a>	-	-	2.45	V
$I_{DSS}$	drain leakage current	$V_{DS} = 30\ \text{V}$ ; $V_{GS} = 0\ \text{V}$ ; $T_j = 25\ ^\circ\text{C}$	-	0.3	1	$\mu\text{A}$
		$V_{DS} = 30\ \text{V}$ ; $V_{GS} = 0\ \text{V}$ ; $T_j = 125\ ^\circ\text{C}$	-	-	50	$\mu\text{A}$
$I_{GSS}$	gate leakage current	$V_{GS} = 16\ \text{V}$ ; $V_{DS} = 0\ \text{V}$ ; $T_j = 25\ ^\circ\text{C}$	-	10	100	nA
		$V_{GS} = -16\ \text{V}$ ; $V_{DS} = 0\ \text{V}$ ; $T_j = 25\ ^\circ\text{C}$	-	10	100	nA
$R_{DS(on)}$	drain-source on-state resistance	$V_{GS} = 4.5\ \text{V}$ ; $I_D = 5\ \text{A}$ ; $T_j = 175\ ^\circ\text{C}$ ; see <a href="#">Figure 12</a>	-	-	64.6	mΩ
		$V_{GS} = 4.5\ \text{V}$ ; $I_D = 5\ \text{A}$ ; $T_j = 25\ ^\circ\text{C}$ ; see <a href="#">Figure 13</a>	-	27	34	mΩ
		$V_{GS} = 10\ \text{V}$ ; $I_D = 5\ \text{A}$ ; $T_j = 175\ ^\circ\text{C}$ ; see <a href="#">Figure 12</a>	-	35	41.8	mΩ
		$V_{GS} = 10\ \text{V}$ ; $I_D = 5\ \text{A}$ ; $T_j = 100\ ^\circ\text{C}$ ; see <a href="#">Figure 12</a>	-	-	31	mΩ
		$V_{GS} = 10\ \text{V}$ ; $I_D = 5\ \text{A}$ ; $T_j = 25\ ^\circ\text{C}$ ; see <a href="#">Figure 13</a>	-	19	22	mΩ
$R_G$	gate resistance	$f = 1\ \text{MHz}$	-	2	-	Ω
<b>Dynamic characteristics</b>						
$Q_{G(tot)}$	total gate charge	$I_D = 5\ \text{A}$ ; $V_{DS} = 15\ \text{V}$ ; $V_{GS} = 10\ \text{V}$ ; see <a href="#">Figure 14</a> ; see <a href="#">Figure 15</a>	-	9	-	nC
		$I_D = 0\ \text{A}$ ; $V_{DS} = 0\ \text{V}$ ; $V_{GS} = 10\ \text{V}$	-	8	-	nC
		$I_D = 5\ \text{A}$ ; $V_{DS} = 15\ \text{V}$ ; $V_{GS} = 4.5\ \text{V}$ ; see <a href="#">Figure 14</a> ; see <a href="#">Figure 15</a>	-	4.4	-	nC
$Q_{GS}$	gate-source charge		-	1.6	-	nC
$Q_{GS(th)}$	pre-threshold gate-source charge	$I_D = 5\ \text{A}$ ; $V_{DS} = 15\ \text{V}$ ; $V_{GS} = 4.5\ \text{V}$ ; see <a href="#">Figure 14</a>	-	0.8	-	nC
$Q_{GS(th-pl)}$	post-threshold gate-source charge		-	0.8	-	nC
$Q_{GD}$	gate-drain charge	$I_D = 5\ \text{A}$ ; $V_{DS} = 15\ \text{V}$ ; $V_{GS} = 4.5\ \text{V}$ ; see <a href="#">Figure 14</a> ; see <a href="#">Figure 15</a>	-	1.4	-	nC
$V_{GS(pl)}$	gate-source plateau voltage	$V_{DS} = 15\ \text{V}$ ; see <a href="#">Figure 14</a> ; see <a href="#">Figure 15</a>	-	3	-	V
$C_{iss}$	input capacitance	$V_{DS} = 15\ \text{V}$ ; $V_{GS} = 0\ \text{V}$ ; $f = 1\ \text{MHz}$ ; $T_j = 25\ ^\circ\text{C}$ ; see <a href="#">Figure 16</a>	-	447	-	pF
$C_{oss}$	output capacitance		-	96	-	pF
$C_{rss}$	reverse transfer capacitance		-	61	-	pF

Table 6. Characteristics ...continued

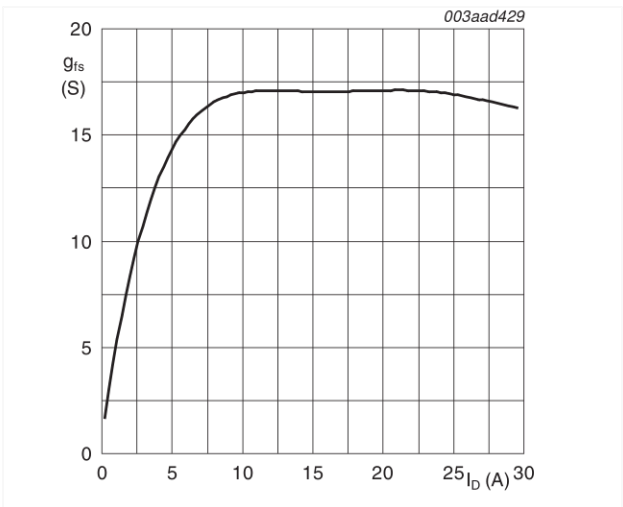
Symbol	Parameter	Conditions	Min	Typ	Max	Unit
t <sub>d(on)</sub>	turn-on delay time	V <sub>DS</sub> = 15 V; R <sub>L</sub> = 1.5 Ω; V <sub>GS</sub> = 4.5 V; R <sub>G(ext)</sub> = 4.7 Ω	-	12	-	ns
t <sub>r</sub>	rise time		-	29	-	ns
t <sub>d(off)</sub>	turn-off delay time		-	17	-	ns
t <sub>f</sub>	fall time		-	7	-	ns
Source-drain diode						
V <sub>SD</sub>	source-drain voltage	I <sub>S</sub> = 5 A; V <sub>GS</sub> = 0 V; T <sub>j</sub> = 25 °C; see <a href="#">Figure 17</a>	-	0.7	1.2	V
t <sub>rr</sub>	reverse recovery time	I <sub>S</sub> = 5 A; dI <sub>S</sub> /dt = -100 A/μs;	-	22	-	ns
Q <sub>r</sub>	recovered charge	V <sub>GS</sub> = 0 V; V <sub>DS</sub> = 20 V	-	10	-	nC





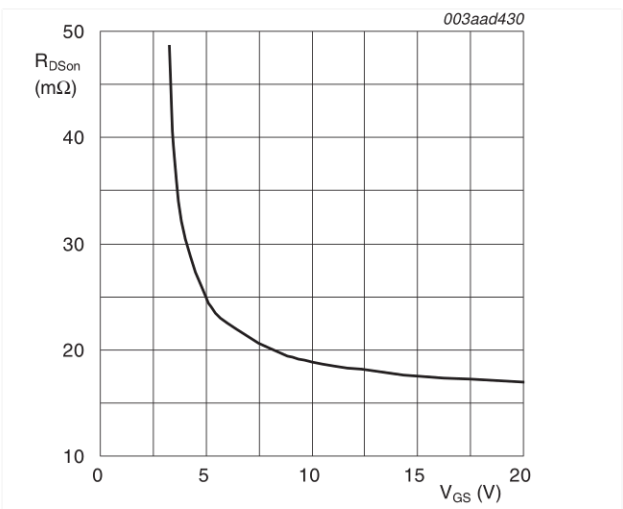
$V_{DS} = 0\text{ V}; f = 1\text{ MHz}$

Fig 7. Input and reverse transfer capacitances as a function of gate-source voltage; typical values



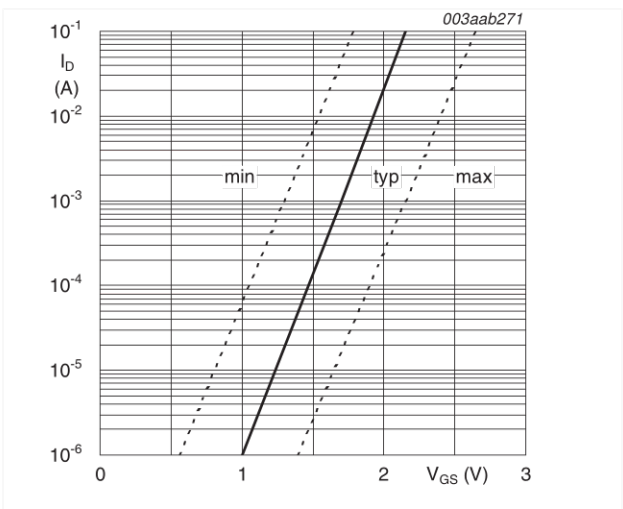
$T_J = 25^\circ\text{C}; V_{DS} = 10\text{ V}$

Fig 8. Forward transconductance as a function of drain current; typical values



$T_J = 25^\circ\text{C}; I_D = 5\text{ A}$

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



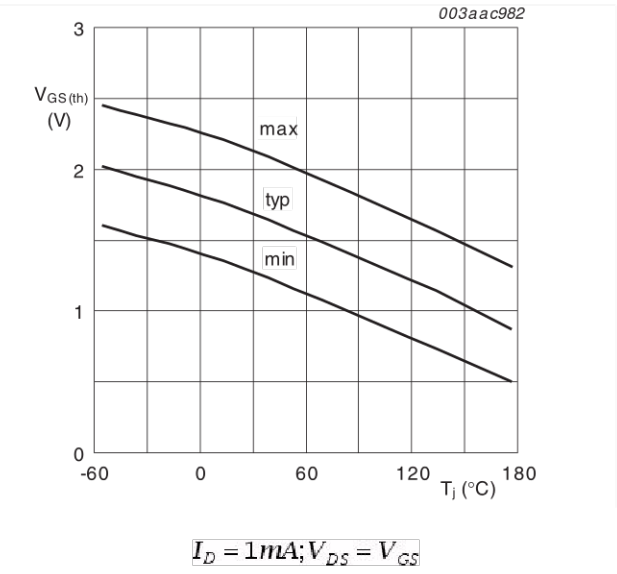


Fig 11. Gate-source threshold voltage as a function of junction temperature

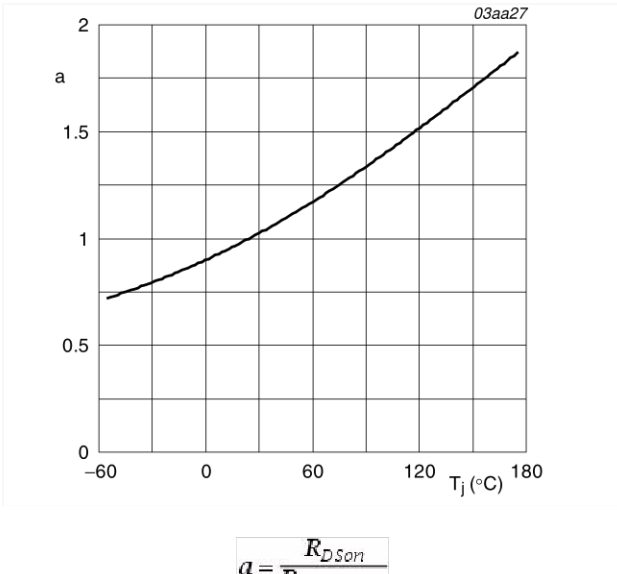


Fig 12. Normalized drain-source on-state resistance factor as a function of junction temperature

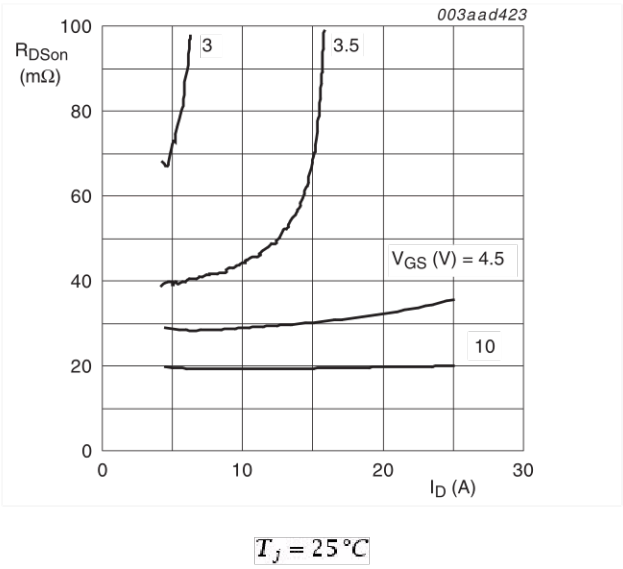


Fig 13. Drain-source on-state resistance as a function of drain current; typical values

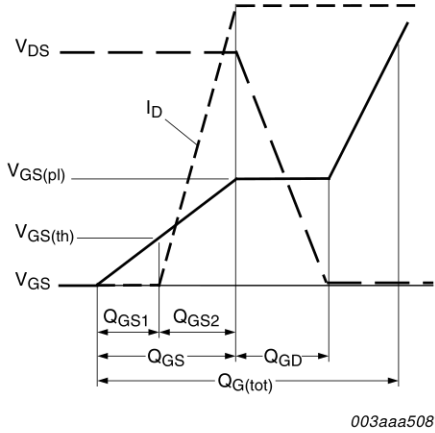
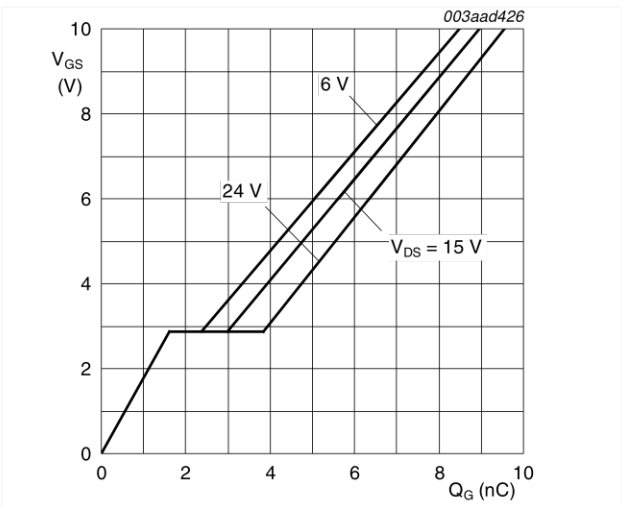
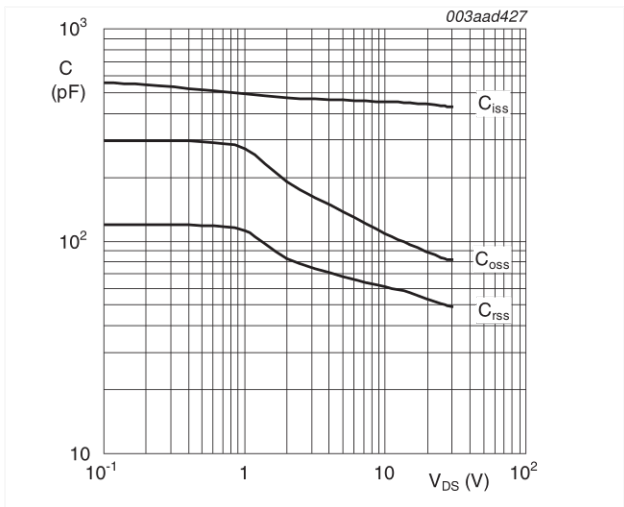


Fig 14. Gate charge waveform definitions



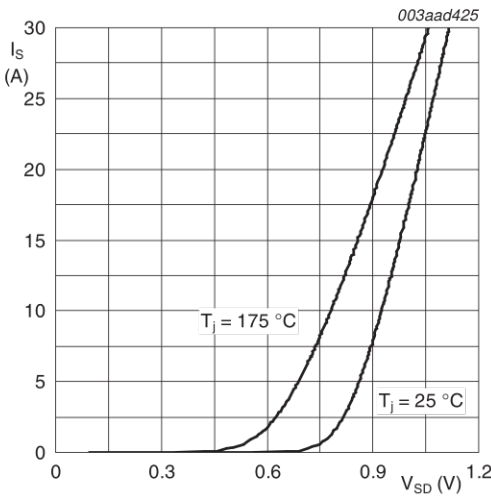
$T_j = 25^\circ\text{C}; I_D = 5\text{ A}$

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



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

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



$V_{GS} = 0\text{ V}$

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

7. Package outline

Plastic single-ended package; heatsink mounted; 1 mounting hole; 3-lead TO-220AB

SOT78

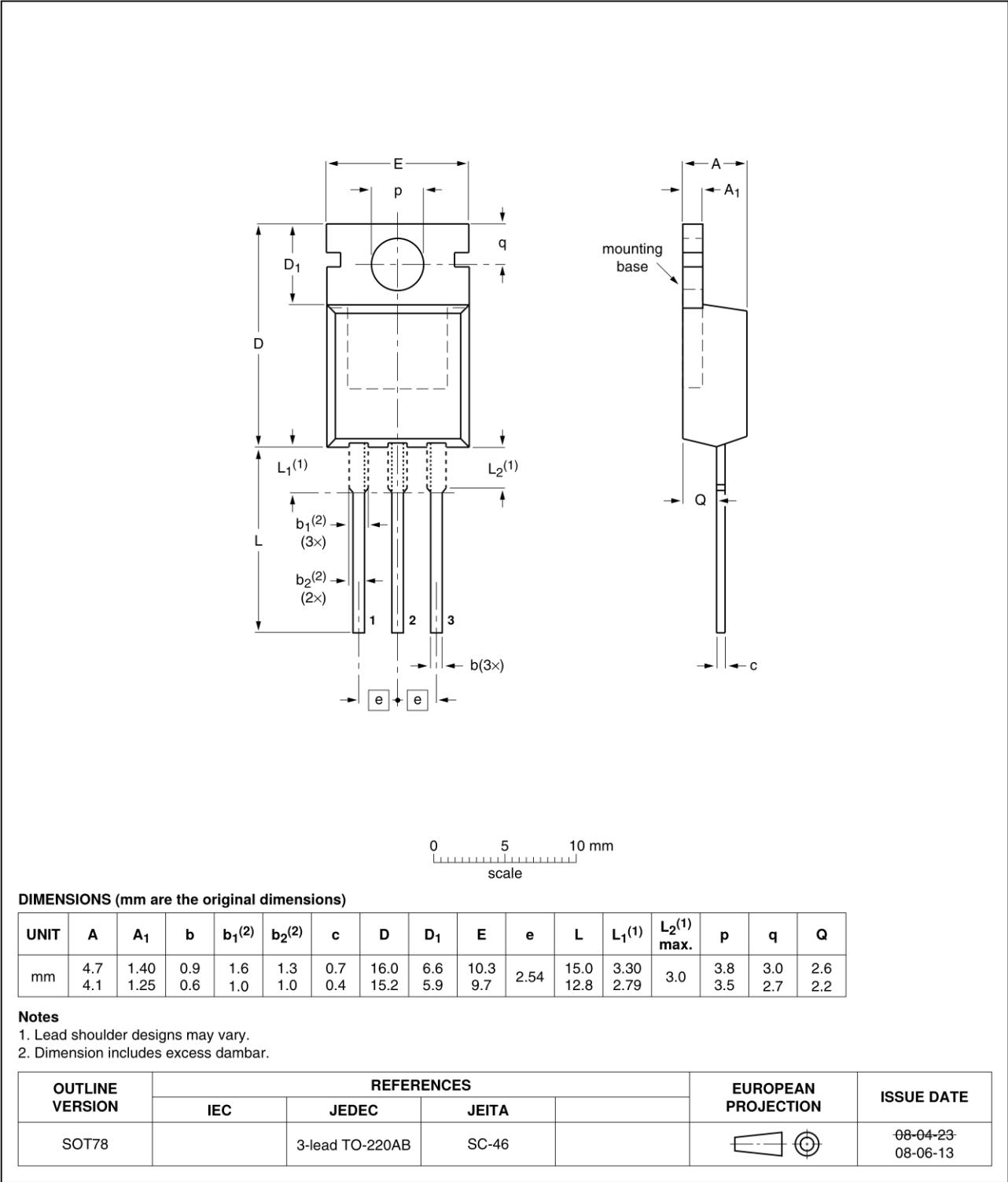


Fig 18. Package outline SOT78 (TO-220AB)

8. Revision history

Table 7. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
PSMN022-30PL v.2	20101101	Product data sheet	-	PSMN022-30PL v.1
Modifications:	• Various changes to content.			
PSMN022-30PL v.1	20101018	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.

[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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