

# PSMN050-80PS

N-channel 80 V 50 mΩ standard level MOSFET

Rev. 01 — 10 June 2009

Product data sheet

## 1. Product profile

### 1.1 General description

Standard 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
- Repetitive avalanche rated
- Suitable for standard level gate drive sources

### 1.3 Applications

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

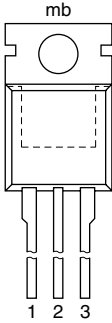
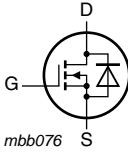
### 1.4 Quick reference data

Table 1. Quick reference

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$I_D$	drain current	$T_{mb} = 25\text{ °C}$ ; $V_{GS} = 10\text{ V}$ ; see <a href="#">Figure 1</a>	-	-	22	A
<b>Dynamic characteristics</b>						
$Q_{GD}$	gate-drain charge	$V_{GS} = 10\text{ V}$ ; $I_D = 25\text{ A}$ ; $V_{DS} = 40\text{ V}$ ; see <a href="#">Figure 14</a> ; see <a href="#">Figure 15</a>	-	2.3	-	nC

## 2. Pinning information

**Table 2. Pinning information**

Pin	Symbol	Description	Simplified outline	Graphic symbol
1	G	gate	 <p style="text-align: center;"><b>SOT78</b> (TO-220AB; SC-46)</p>	 <p style="text-align: center;"><i>mbb076</i></p>
2	D	drain		
3	S	source		

## 3. Ordering information

**Table 3. Ordering information**

Type number	Package		Version
	Name	Description	
PSMN050-80PS	TO-220AB; SC-46	plastic single-ended package; heatsink mounted; 1 mounting hole; 3-lead TO-220AB	SOT78

## 4. Limiting values

**Table 4. Limiting values**

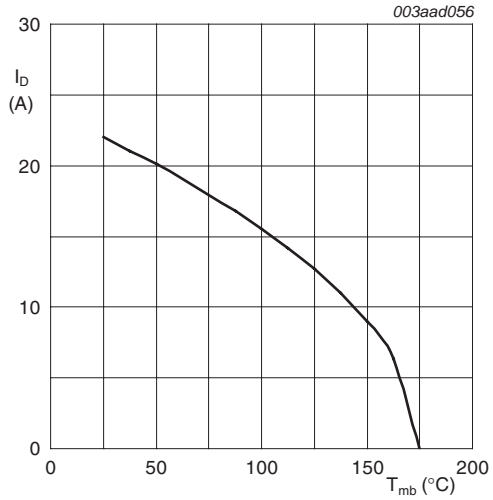
In accordance with the Absolute Maximum Rating System (IEC 60134).

Symbol	Parameter	Conditions	Min	Max	Unit
$V_{DS}$	drain-source voltage	$T_j \geq 25\text{ °C}$ ; $T_j \leq 175\text{ °C}$	-	80	V
$V_{DGR}$	drain-gate voltage	$T_j \geq 25\text{ °C}$ ; $T_j \leq 175\text{ °C}$ ; $R_{GS} = 20\text{ k}\Omega$	-	80	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>	-	16	A
		$V_{GS} = 10\text{ V}$ ; $T_{mb} = 25\text{ °C}$ ; see <a href="#">Figure 1</a>	-	22	A
$I_{DM}$	peak drain current	$t_p \leq 10\text{ }\mu\text{s}$ ; pulsed; $T_{mb} = 25\text{ °C}$	-	88	A
$P_{tot}$	total power dissipation	$T_{mb} = 25\text{ °C}$ ; see <a href="#">Figure 2</a>	-	56	W
$T_{stg}$	storage temperature		-55	175	°C
$T_j$	junction temperature		-55	175	°C
<b>Source-drain diode</b>					
$I_S$	source current	$T_{mb} = 25\text{ °C}$	-	22	A
$I_{SM}$	peak source current	$t_p \leq 10\text{ }\mu\text{s}$ ; pulsed; $T_{mb} = 25\text{ °C}$	-	88	A
<b>Avalanche ruggedness</b>					
$E_{DS(AL)R}$	repetitive drain-source avalanche energy	see <a href="#">Figure 3</a>	<a href="#">[1]</a> <a href="#">[2]</a> <a href="#">[3]</a>	-	J
$E_{DS(AL)S}$	non-repetitive drain-source avalanche energy	$V_{GS} = 10\text{ V}$ ; $T_{j(\text{init})} = 25\text{ °C}$ ; $I_D = 22\text{ A}$ ; $V_{sup} \leq 80\text{ V}$ ; $R_{GS} = 50\text{ }\Omega$ ; unclamped	-	18	mJ

[1] Single-pulse avalanche rating limited by maximum junction temperature of 175 °C.

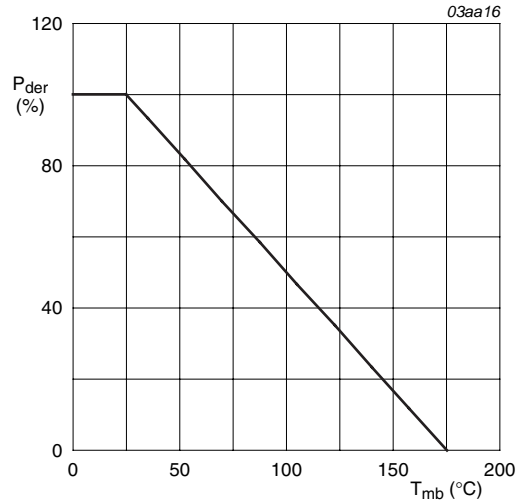
[2] Repetitive avalanche rating limited by average junction temperature of 170 °C.

[3] Refer to application note AN10273 for further information.



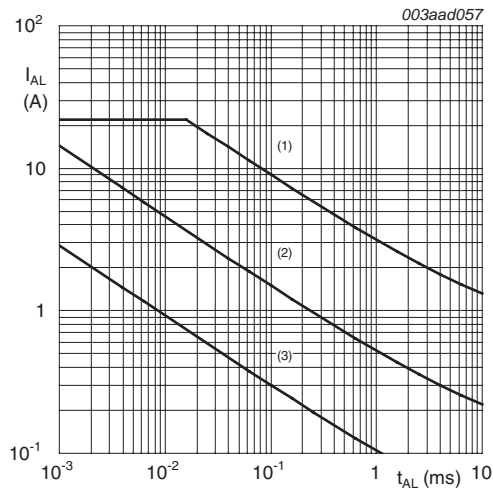
$$V_{GS} \geq 10V$$

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



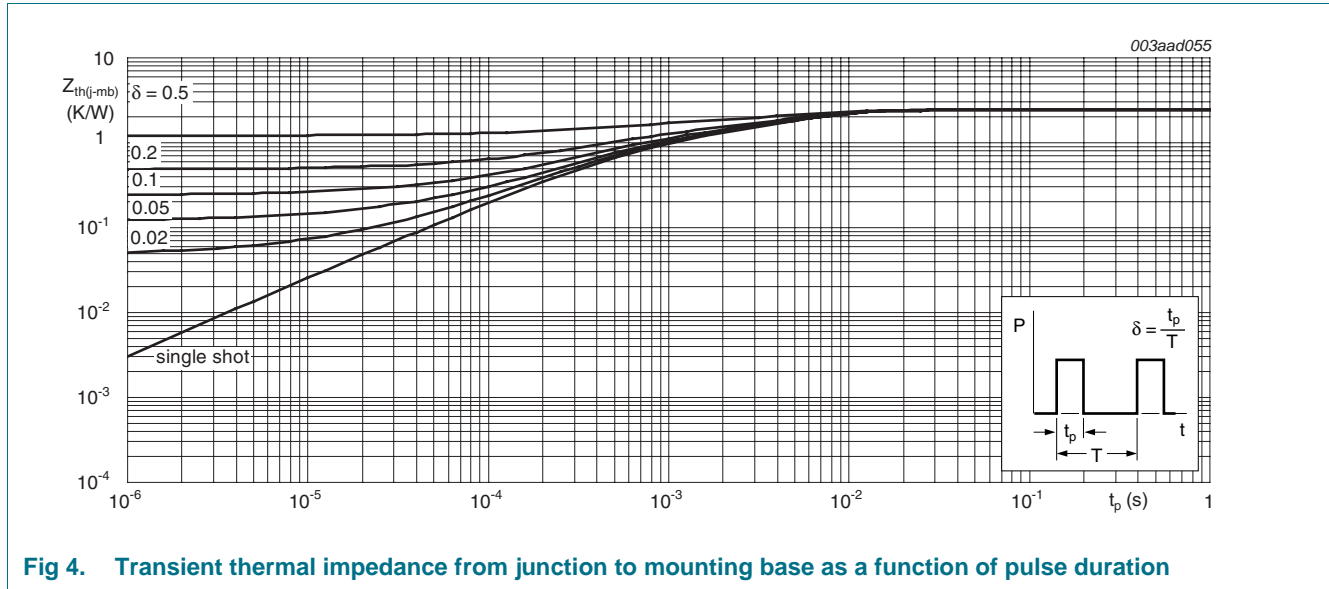
- (1) Single-pulse; T<sub>j</sub> = 25 °C.
- (2) Single-pulse; T<sub>j</sub> = 150 °C.
- (3) Repetitive.

Fig 3. Single-pulse and repetitive avalanche rating; avalanche current as a function of avalanche time

### 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>	-	-	2.7	K/W



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

## 6. Characteristics

**Table 6. Characteristics**

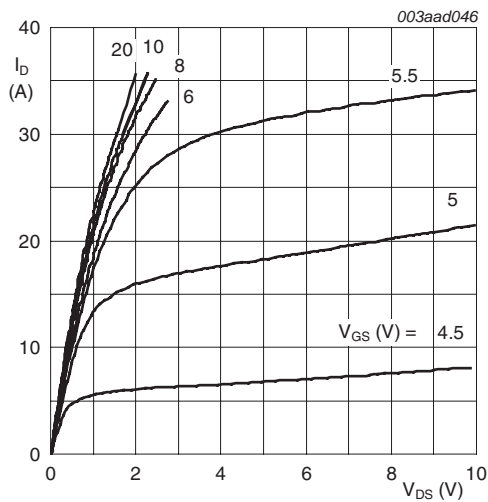
Symbol	Parameter	Conditions	Min	Typ	Max	Unit
<b>Static characteristics</b>						
$V_{(BR)DSS}$	drain-source breakdown voltage	$I_D = 250 \mu\text{A}; V_{GS} = 0 \text{ V}; T_j = -55 \text{ }^\circ\text{C}$	73	-	-	V
		$I_D = 250 \mu\text{A}; V_{GS} = 0 \text{ V}; T_j = 25 \text{ }^\circ\text{C}$	80	-	-	V
$V_{GS(th)}$	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> ; see <a href="#">Figure 12</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> ; see <a href="#">Figure 12</a>	-	-	4.4	V
		$I_D = 1 \text{ mA}; V_{DS} = V_{GS}; T_j = 25 \text{ }^\circ\text{C};$ see <a href="#">Figure 11</a> ; see <a href="#">Figure 12</a>	2	3	4	V
$I_{DSS}$	drain leakage current	$V_{DS} = 80 \text{ V}; V_{GS} = 0 \text{ V}; T_j = 25 \text{ }^\circ\text{C}$	-	-	1	$\mu\text{A}$
		$V_{DS} = 80 \text{ V}; V_{GS} = 0 \text{ V}; T_j = 100 \text{ }^\circ\text{C}$	-	-	100	$\mu\text{A}$
$I_{GSS}$	gate leakage current	$V_{GS} = -20 \text{ V}; V_{DS} = 0 \text{ V}; T_j = 25 \text{ }^\circ\text{C}$	-	-	100	nA
		$V_{GS} = 20 \text{ V}; V_{DS} = 0 \text{ V}; T_j = 25 \text{ }^\circ\text{C}$	-	-	100	nA
$R_{DS(on)}$	drain-source on-state resistance	$V_{GS} = 10 \text{ V}; I_D = 10 \text{ A}; T_j = 100 \text{ }^\circ\text{C};$ see <a href="#">Figure 13</a>	-	-	81	mΩ
		$V_{GS} = 10 \text{ V}; I_D = 10 \text{ A}; T_j = 25 \text{ }^\circ\text{C}$	[2]	37	51	mΩ
$R_G$	internal gate resistance (AC)	$f = 1 \text{ MHz}$	-	2	-	Ω
<b>Dynamic characteristics</b>						
$Q_{G(tot)}$	total gate charge	$I_D = 0 \text{ A}; V_{DS} = 0 \text{ V}; V_{GS} = 10 \text{ V}$	-	9	-	nC
		$I_D = 25 \text{ A}; V_{DS} = 40 \text{ V}; V_{GS} = 10 \text{ V};$ see <a href="#">Figure 14</a> ; see <a href="#">Figure 15</a>	-	11	-	nC
$Q_{GS}$	gate-source charge	$I_D = 25 \text{ A}; V_{DS} = 40 \text{ V}; V_{GS} = 10 \text{ V};$ see <a href="#">Figure 14</a> ; see <a href="#">Figure 15</a>	-	3.8	-	nC
$Q_{GS(th)}$	pre-threshold gate-source charge		-	1.9	-	nC
$Q_{GS(th-pl)}$	post-threshold gate-source charge		-	1.9	-	nC
$Q_{GD}$	gate-drain charge		-	2.3	-	nC
$V_{GS(pl)}$	gate-source plateau voltage	$V_{DS} = 40 \text{ V}$	-	5.2	-	V
$C_{iss}$	input capacitance	$V_{DS} = 12 \text{ V}; V_{GS} = 0 \text{ V}; f = 1 \text{ MHz};$ $T_j = 25 \text{ }^\circ\text{C};$ see <a href="#">Figure 16</a>	-	633	-	pF
$C_{oss}$	output capacitance		-	100	-	pF
$C_{rss}$	reverse transfer capacitance		-	50	-	pF
$t_{d(on)}$	turn-on delay time	$V_{DS} = 12 \text{ V}; R_L = 0.5 \text{ } \Omega; V_{GS} = 10 \text{ V};$ $R_{G(ext)} = 4.7 \text{ } \Omega$	-	9.2	-	ns
$t_r$	rise time		-	1	-	ns
$t_{d(off)}$	turn-off delay time		-	16	-	ns
$t_f$	fall time		-	2.4	-	ns

Table 6. Characteristics ...continued

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
<b>Source-drain diode</b>						
$V_{SD}$	source-drain voltage	$I_S = 15\text{ A}$ ; $V_{GS} = 0\text{ V}$ ; $T_j = 25\text{ °C}$ ; see <a href="#">Figure 17</a>	-	0.86	1.2	V
$t_{rr}$	reverse recovery time	$I_S = 50\text{ A}$ ; $di_S/dt = 100\text{ A}/\mu\text{s}$ ; $V_{GS} = 0\text{ V}$ ;	-	32	-	ns
$Q_r$	recovered charge	$V_{DS} = 40\text{ V}$	-	28	-	nC

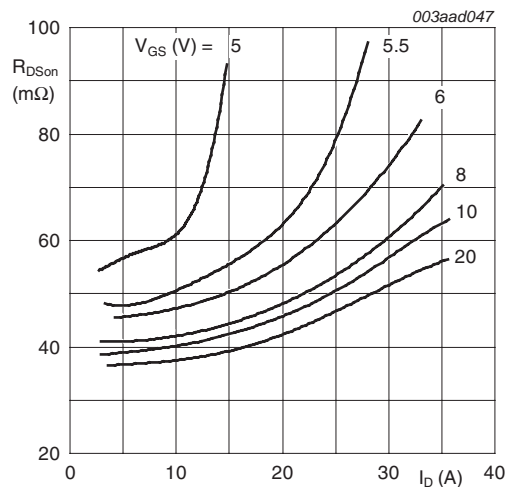
[1] Tested to JEDEC standards where applicable.

[2] Measured 3 mm from package.



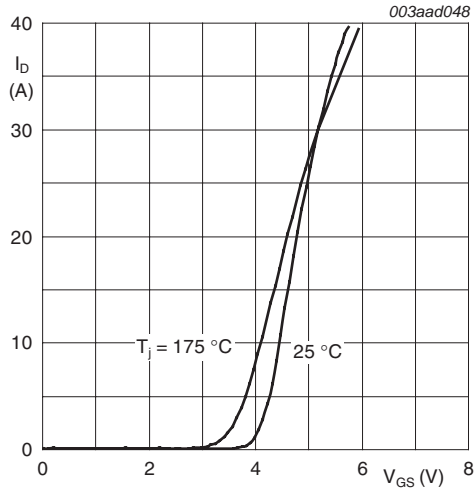
$T_j = 25\text{ °C}$ ;  $t_p = 300\mu\text{s}$

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



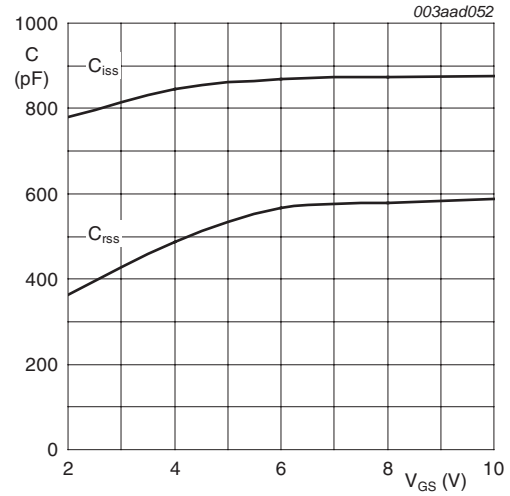
$T_j = 25\text{ °C}$ ;  $t_p = 300\mu\text{s}$

Fig 6. Drain-source on-state resistance as a function of drain current; typical values



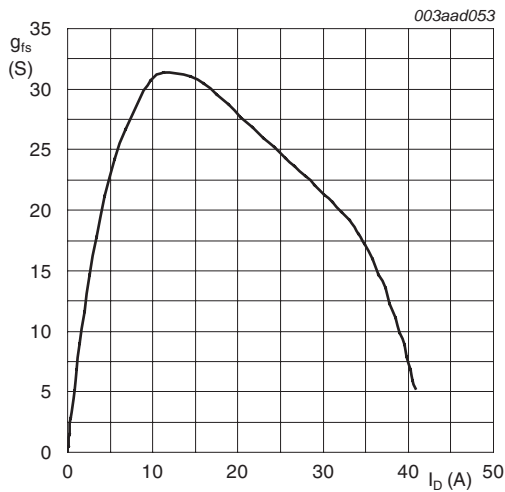
$V_{GS} = 0V$

**Fig 7. Source (diode forward) current as a function of source-drain (diode forward) voltage; typical values**



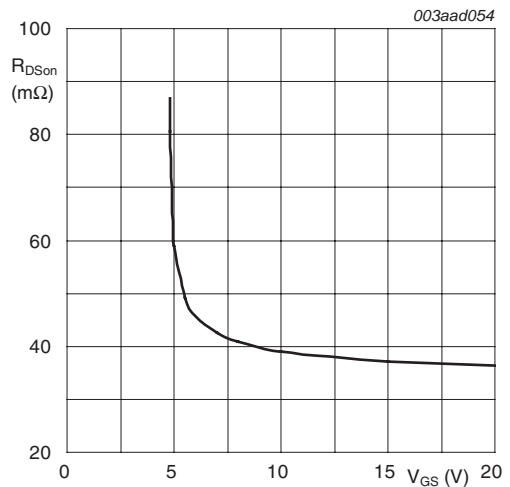
$V_{DS} = 0V; f = 1MHz$

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



$T_j = 25 °C; V_{DS} = 15V$

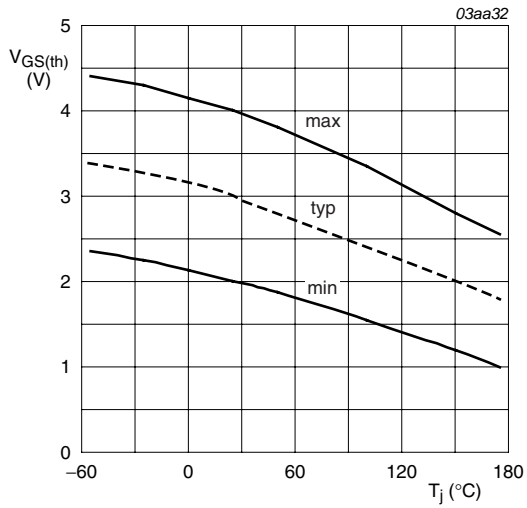
**Fig 9. Forward transconductance as a function of drain current; typical values**



$T_j = 25 °C; I_D = 10A$

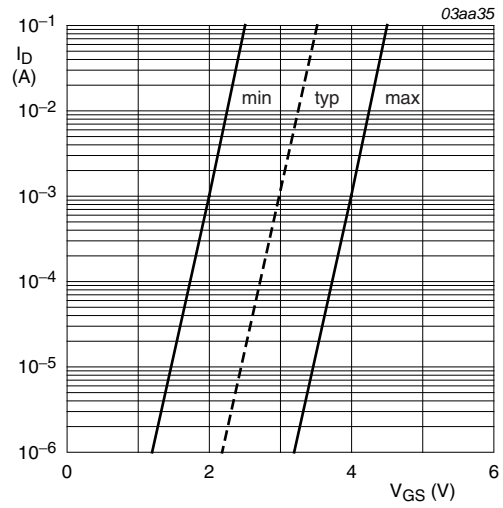
**Fig 10. Drain-source on-state resistance as a function of gate-source voltage; typical values**





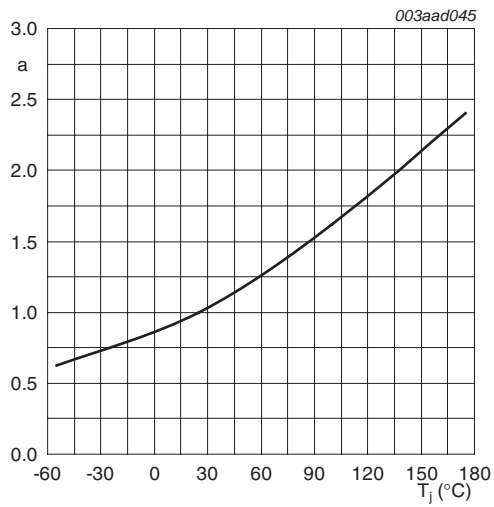
$$I_D = 1\text{ mA}; V_{DS} = V_{GS}$$

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



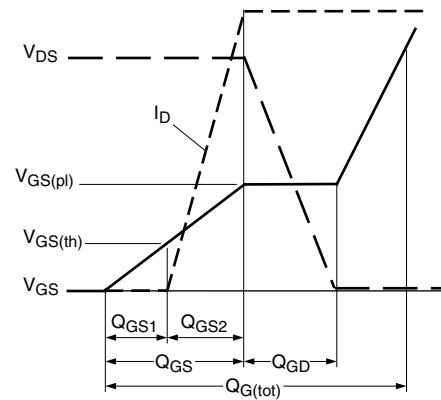
$$T_j = 25\text{ }^\circ\text{C}; V_{DS} = 5\text{ V}$$

Fig 12. Sub-threshold drain current as a function of gate-source voltage



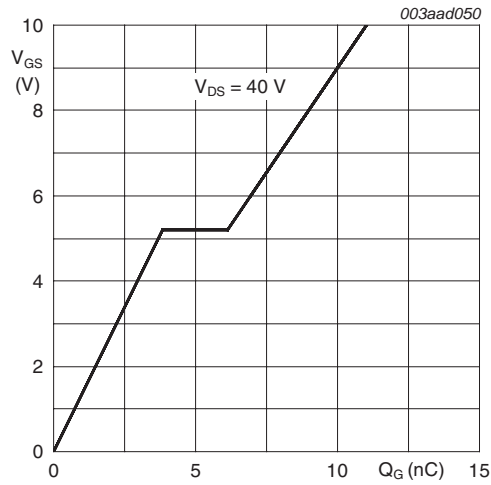
$$a = \frac{R_{DSon}}{R_{DSon(25^\circ\text{C})}}$$

Fig 13. Normalized drain-source on-state resistance factor as a function of junction temperature



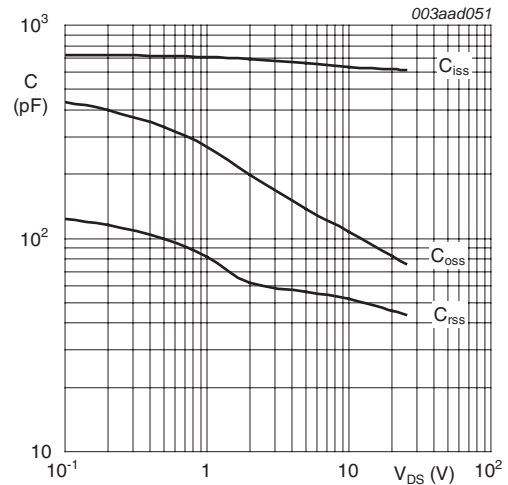
003aaa508

Fig 14. Gate charge waveform definitions



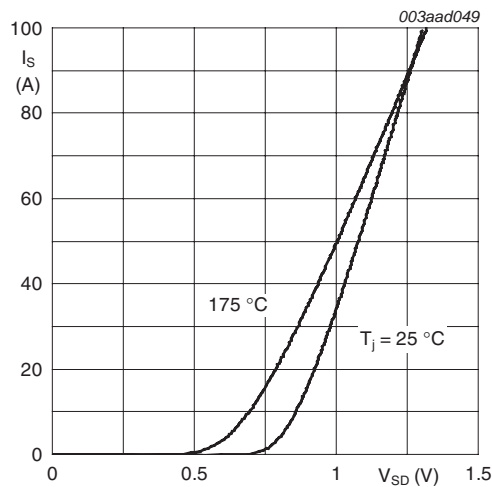
$T_j = 25\text{ }^\circ\text{C}; I_D = 25\text{ A}$

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

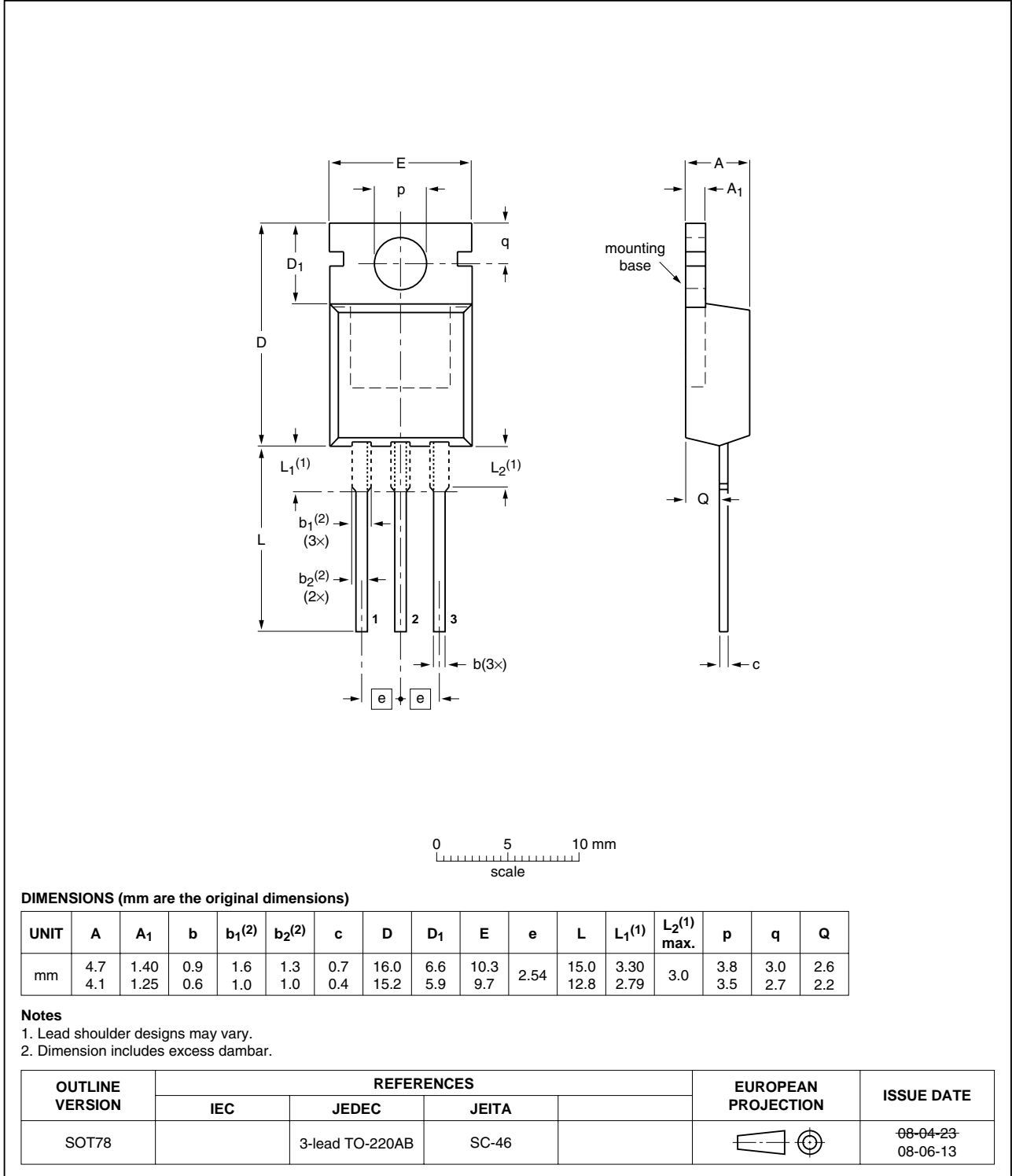


Fig 18. Package outline SOT78 (TO-220AB)

## 8. Revision history

Table 7. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
PSMN050-80PS_1	20090610	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".

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