



# PSMN057-200P

N-channel TrenchMOS SiliconMAX standard level FET

Rev. 02 — 4 January 2011

Product data sheet

## 1. Product profile

### 1.1 General description

SiliconMAX standard level N-channel enhancement mode Field-Effect Transistor (FET) in a plastic package using TrenchMOS technology. This product is designed and qualified for use in computing, communications, consumer and industrial applications only.

### 1.2 Features and benefits

- Higher operating power due to low thermal resistance
- Low conduction losses due to low on-state resistance
- Suitable for high frequency applications due to fast switching characteristics

### 1.3 Applications

- DC-to-DC converters
- Switched-mode power supplies

### 1.4 Quick reference data

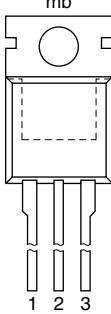
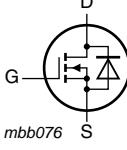
Table 1. Quick reference data

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$V_{DS}$	drain-source voltage	$T_j \geq 25^\circ\text{C}; T_j \leq 175^\circ\text{C}$	-	-	200	V
$I_D$	drain current	$T_{mb} = 25^\circ\text{C}$	-	-	39	A
$P_{tot}$	total power dissipation		-	-	250	W
<b>Static characteristics</b>						
$R_{DSon}$	drain-source on-state resistance	$V_{GS} = 10\text{ V}; I_D = 17\text{ A}; T_j = 25^\circ\text{C}$	-	41	57	$\text{m}\Omega$
<b>Dynamic characteristics</b>						
$Q_{GD}$	gate-drain charge	$V_{GS} = 10\text{ V}; I_D = 39\text{ A}; V_{DS} = 160\text{ V}; T_j = 25^\circ\text{C}$	-	37	50	$\text{nC}$

**nexperia**

## 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

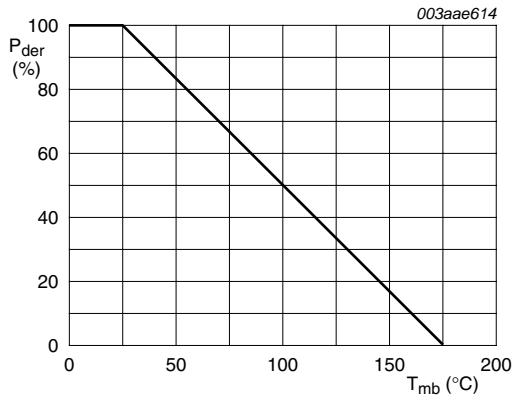
Type number	Package			Version
	Name	Description		
PSMN057-200P	TO-220AB	plastic single-ended package; heatsink mounted; 1 mounting hole; 3-lead TO-220AB		SOT78

## 4. Limiting values

**Table 4. Limiting values**

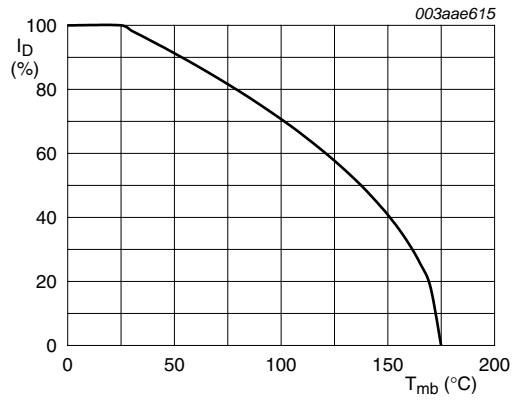
In accordance with the Absolute Maximum Rating System (IEC 60134).

Symbol	Parameter	Conditions	Min	Max	Unit
$V_{DS}$	drain-source voltage	$T_j \geq 25^\circ\text{C}; T_j \leq 175^\circ\text{C}$	-	200	V
$V_{DGR}$	drain-gate voltage	$T_j \geq 25^\circ\text{C}; T_j \leq 175^\circ\text{C}; R_{GS} = 20\text{ k}\Omega$	-	200	V
$V_{GS}$	gate-source voltage		-20	20	V
$I_D$	drain current	$T_{mb} = 100^\circ\text{C}$	-	27.5	A
		$T_{mb} = 25^\circ\text{C}$	-	39	A
$I_{DM}$	peak drain current	pulsed; $T_{mb} = 25^\circ\text{C}$	-	156	A
$P_{tot}$	total power dissipation	$T_{mb} = 25^\circ\text{C}$	-	250	W
$T_{stg}$	storage temperature		-55	175	°C
$T_j$	junction temperature		-55	175	°C
<b>Source-drain diode</b>					
$I_S$	source current	$T_{mb} = 25^\circ\text{C}$	-	39	A
$I_{SM}$	peak source current	pulsed; $T_{mb} = 25^\circ\text{C}$	-	156	A
<b>Avalanche ruggedness</b>					
$E_{DS(AL)S}$	non-repetitive drain-source avalanche energy	$V_{GS} = 10\text{ V}; T_{j(init)} = 25^\circ\text{C}; I_D = 35\text{ A}; V_{sup} \leq 50\text{ V}; \text{unclamped}; t_p = 100\text{ }\mu\text{s}; R_{GS} = 50\Omega$	-	300	mJ
$I_{AS}$	non-repetitive avalanche current	$V_{sup} \leq 50\text{ V}; V_{GS} = 10\text{ V}; T_{j(init)} = 25^\circ\text{C}; R_{GS} = 50\Omega; \text{unclamped}$	-	35	A



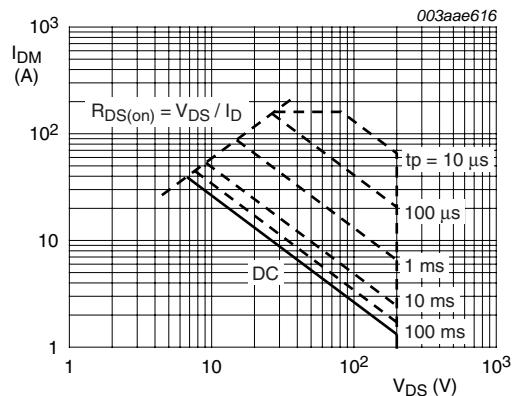
$$P_{der} = \frac{P_{tot}}{P_{tot}(25^\circ\text{C})} \times 100\%$$

**Fig 1. Normalized total power dissipation as a function of mounting base temperature**



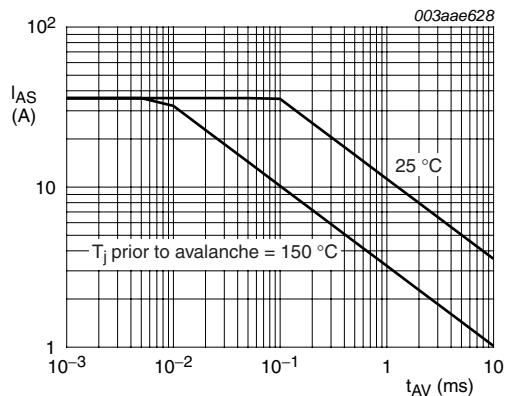
$$I_{der} = \frac{I_D}{I_D(25^\circ\text{C})} \times 100\%$$

**Fig 2. Normalized continuous drain current as a function of mounting base temperature**



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

**Fig 3.** Safe operating area; continuous and peak drain currents as a function of drain-source voltage



unclamped inductive load

**Fig 4.** Single-shot avalanche rating; avalanche current as a function of avalanche period

## 5. Thermal characteristics

Table 5. Thermal characteristics

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$R_{th(j\text{-}mb)}$	thermal resistance from junction to mounting base		-	-	0.6	K/W
$R_{th(j\text{-}a)}$	thermal resistance from junction to ambient	in free air	-	60	-	K/W

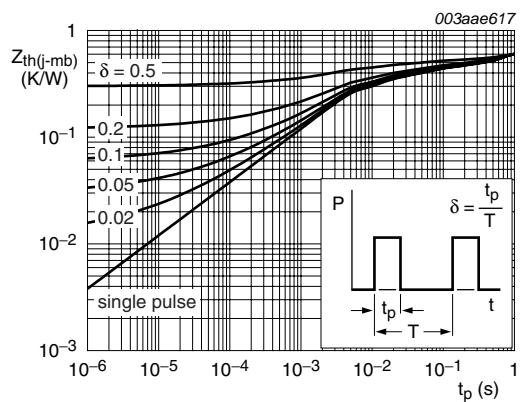
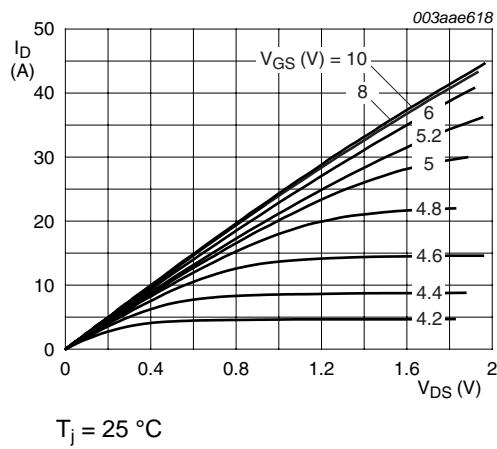


Fig 5. Transient thermal impedance from junction to mounting base as a function of pulse duration

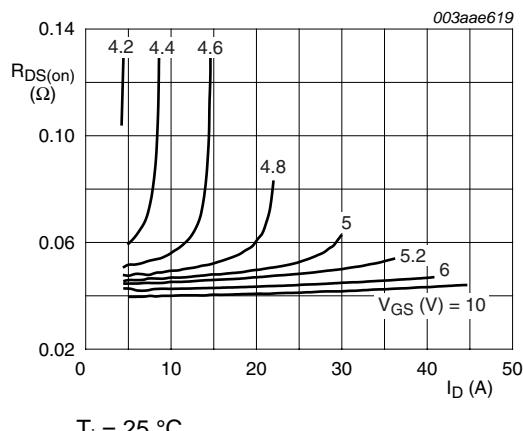
## 6. Characteristics

Table 6. Characteristics

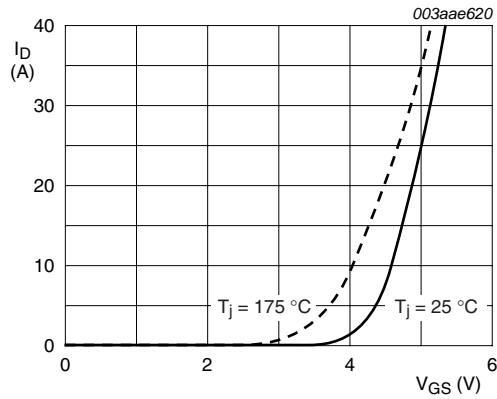
Symbol	Parameter	Conditions	Min	Typ	Max	Unit
<b>Static characteristics</b>						
$V_{(BR)DSS}$	drain-source breakdown voltage	$I_D = 0.25 \text{ mA}; V_{GS} = 0 \text{ V}; T_j = -55 \text{ }^\circ\text{C}$ $I_D = 0.25 \text{ mA}; V_{GS} = 0 \text{ V}; T_j = 25 \text{ }^\circ\text{C}$	178	-	-	V
$V_{GS(\text{th})}$	gate-source threshold voltage	$I_D = 1 \text{ mA}; V_{DS} = V_{GS}; T_j = -55 \text{ }^\circ\text{C}$ $I_D = 1 \text{ mA}; V_{DS} = V_{GS}; T_j = 175 \text{ }^\circ\text{C}$ $I_D = 1 \text{ mA}; V_{DS} = V_{GS}; T_j = 25 \text{ }^\circ\text{C}$	-	-	6	V
$I_{DSS}$	drain leakage current	$V_{DS} = 200 \text{ V}; V_{GS} = 0 \text{ V}; T_j = 25 \text{ }^\circ\text{C}$ $V_{DS} = 200 \text{ V}; V_{GS} = 0 \text{ V}; T_j = 175 \text{ }^\circ\text{C}$	-	0.03	10	$\mu\text{A}$
$I_{GSS}$	gate leakage current	$V_{GS} = 10 \text{ V}; V_{DS} = 0 \text{ V}; T_j = 25 \text{ }^\circ\text{C}$ $V_{GS} = -10 \text{ V}; V_{DS} = 0 \text{ V}; T_j = 25 \text{ }^\circ\text{C}$	-	2	100	nA
$R_{DSon}$	drain-source on-state resistance	$V_{GS} = 10 \text{ V}; I_D = 17 \text{ A}; T_j = 175 \text{ }^\circ\text{C}$ $V_{GS} = 10 \text{ V}; I_D = 17 \text{ A}; T_j = 25 \text{ }^\circ\text{C}$	-	-	165	$\text{m}\Omega$
<b>Dynamic characteristics</b>						
$Q_{G(\text{tot})}$	total gate charge	$I_D = 39 \text{ A}; V_{DS} = 160 \text{ V}; V_{GS} = 10 \text{ V}; T_j = 25 \text{ }^\circ\text{C}$	-	96	-	nC
$Q_{GS}$	gate-source charge	$T_j = 25 \text{ }^\circ\text{C}$	-	13	-	nC
$Q_{GD}$	gate-drain charge		-	37	50	nC
$C_{iss}$	input capacitance	$V_{DS} = 25 \text{ V}; V_{GS} = 0 \text{ V}; f = 1 \text{ MHz}; T_j = 25 \text{ }^\circ\text{C}$	-	3750	-	pF
$C_{oss}$	output capacitance	$T_j = 25 \text{ }^\circ\text{C}$	-	385	-	pF
$C_{rss}$	reverse transfer capacitance		-	180	-	pF
$t_{d(on)}$	turn-on delay time	$V_{DS} = 100 \text{ V}; R_L = 2.7 \Omega; V_{GS} = 10 \text{ V}; R_{G(\text{ext})} = 5.6 \Omega; T_j = 25 \text{ }^\circ\text{C}$	-	18	-	ns
$t_r$	rise time		-	58	-	ns
$t_{d(off)}$	turn-off delay time		-	105	-	ns
$t_f$	fall time		-	78	-	ns
$L_D$	internal drain inductance	measured from drain lead to centre of die ; $T_j = 25 \text{ }^\circ\text{C}$ measured from tab to centre of die ; $T_j = 25 \text{ }^\circ\text{C}$	-	4.5	-	nH
$L_S$	internal source inductance	measured from source lead to source bond pad ; $T_j = 25 \text{ }^\circ\text{C}$	-	7.5	-	nH
<b>Source-drain diode</b>						
$V_{SD}$	source-drain voltage	$I_S = 25 \text{ A}; V_{GS} = 0 \text{ V}; T_j = 25 \text{ }^\circ\text{C}$	-	0.85	1.2	V
$t_{rr}$	reverse recovery time	$I_S = 20 \text{ A}; dI_S/dt = -100 \text{ A}/\mu\text{s}; V_{GS} = 0 \text{ V}; V_{DS} = 30 \text{ V}; T_j = 25 \text{ }^\circ\text{C}$	-	133	-	ns
$Q_r$	recovered charge		-	895	-	nC



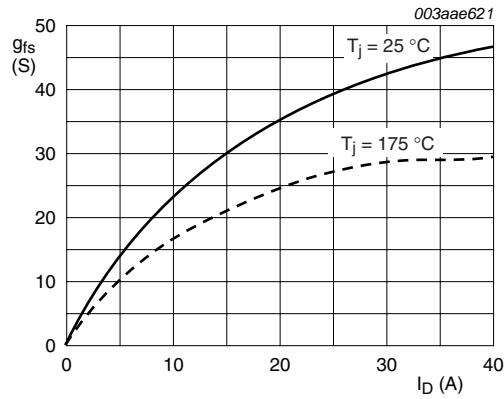
**Fig 6.** Output characteristics: drain current as a function of drain-source voltage; typical values



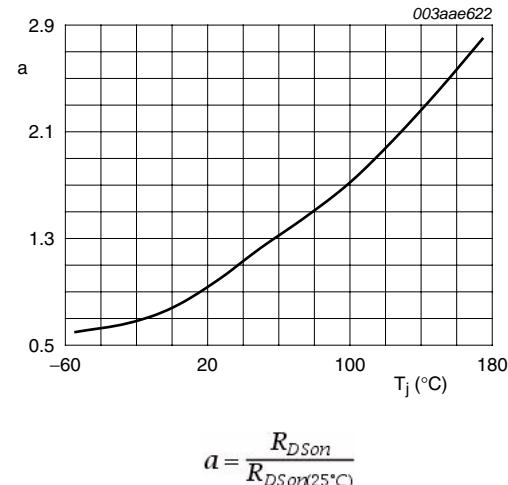
**Fig 7.** Drain-source on-state resistance as a function of drain current; typical values



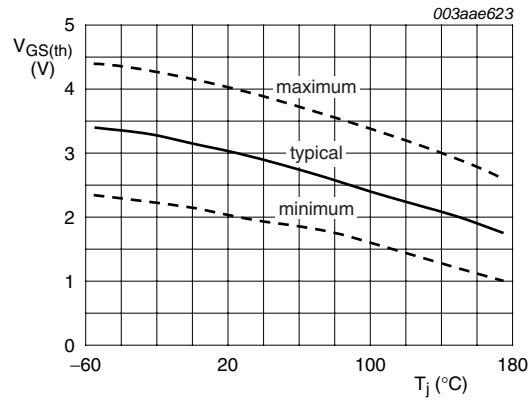
**Fig 8.** Transfer characteristics: drain current as a function of gate-source voltage; typical values



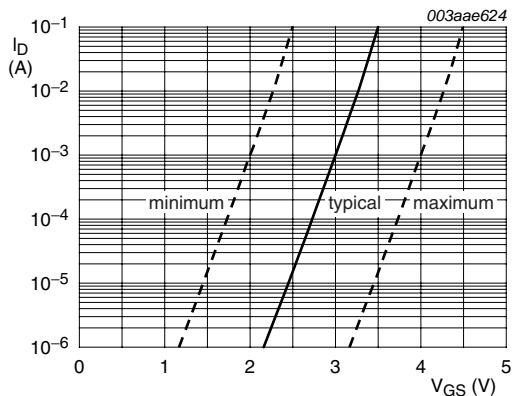
**Fig 9.** Forward transconductance as a function of drain current; typical values



**Fig 10.** Normalized drain-source on-state resistance factor as a function of junction temperature

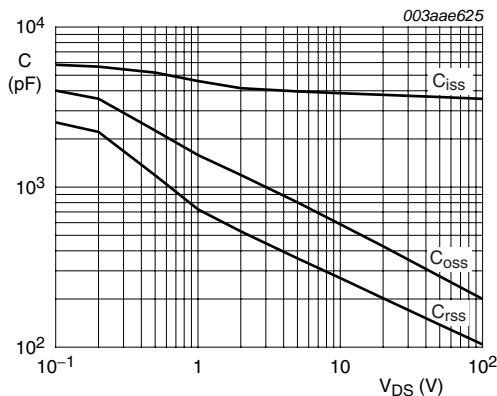


**Fig 11.** Gate-source threshold voltage as a function of junction temperature



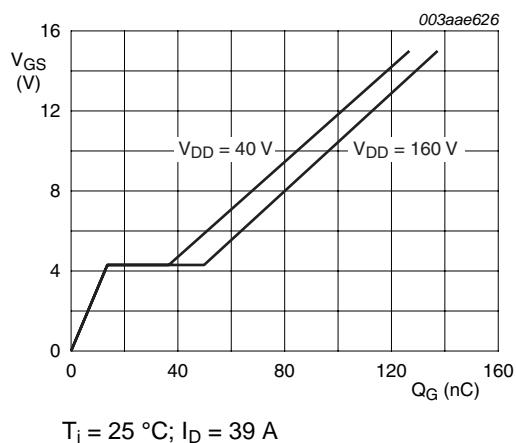
$T_j = 25^\circ\text{C}$ ;  $V_{DS} = V_{GS}$

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



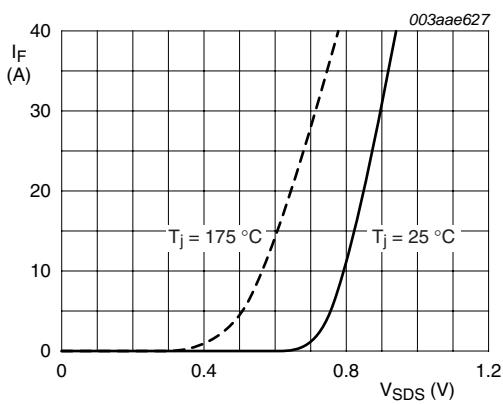
$V_{GS} = 0\text{ V}$ ;  $f = 1\text{ MHz}$

**Fig 13. Input, output and reverse transfer capacitances as a function of drain-source voltage; typical values**



$T_j = 25^\circ\text{C}$ ;  $I_D = 39\text{ A}$

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



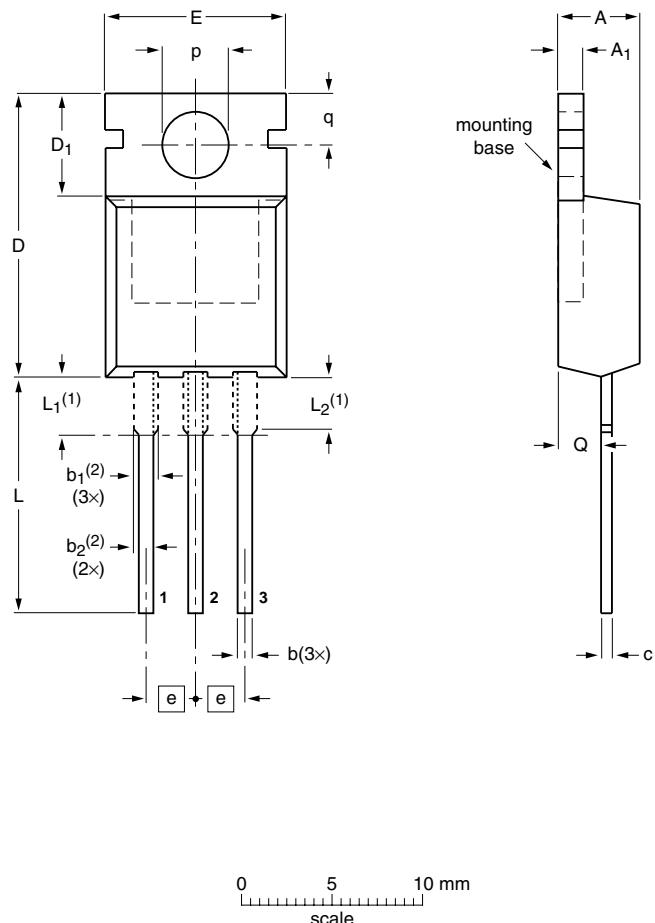
$V_{GS} = 0\text{ V}$

**Fig 15. 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



### DIMENSIONS (mm are the original dimensions)

UNIT	A	A <sub>1</sub>	b	b <sub>1(2)</sub>	b <sub>2(2)</sub>	c	D	D <sub>1</sub>	E	e	L	L <sub>1(1)</sub>	L <sub>2(1)</sub> max.	p	q	Q
mm	4.7	1.40	0.9	1.6	1.3	0.7	16.0	6.6	10.3	2.54	15.0	3.30	3.0	3.8	3.0	2.6
	4.1	1.25	0.6	1.0	1.0	0.4	15.2	5.9	9.7		12.8	2.79	3.0	3.5	2.7	2.2

### Notes

1. Lead shoulder designs may vary.
2. Dimension includes excess dambar.

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	JEITA			
SOT78		3-lead TO-220AB	SC-46			08-04-23 08-06-13

Fig 16. Package outline SOT78 (TO-220AB)

## 8. Revision history

**Table 7. Revision history**

Document ID	Release date	Data sheet status	Change notice	Supersedes
PSMN057-200P v.2	20110104	Product data sheet	-	PSMN057-200P v.1
Modifications:	<ul style="list-style-type: none"><li>• The format of this data sheet has been redesigned to comply with the new identity guidelines of NXP Semiconductors.</li><li>• Legal texts have been adapted to the new company name where appropriate.</li></ul>			
PSMN057-200P v.1	20000601	Product specification	-	-

## 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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