PHN203

Dual N-channel TrenchMOS logic level FET

Rev. 05 — 27 April 2010 Product data sheet

1. Product profile

1.1 General description

Dual logic 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

- Suitable for high frequency applications due to fast switching characteristics
- Suitable for logic level gate drive sources

1.3 Applications

- DC-to-DC converters
- Lithium-ion battery applications

1.4 Quick reference data

Table 1. Quick reference data

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
V_{DS}	drain-source voltage	$T_j \geq 25$ °C; $T_j \leq 150$ °C		-	-	30	V
I_D	drain current	$T_{amb} = 25$ °C; pulsed; see Figure 1; see Figure 3	[1]	-	-	6.3	A
P_{tot}	total power dissipation	$T_{amb} = 25$ °C; pulsed; see Figure 2	[1]	-	-	2	W
Static characteristics							
R_{DSon}	drain-source on-state resistance	$V_{GS} = 10$ V; $I_D = 7$ A; $T_j = 25$ °C; see Figure 9; see Figure 10		-	24	30	mΩ
Dynamic characteristics							
Q_{GD}	gate-drain charge	$V_{GS} = 10$ V; $I_D = 7$ A; $V_{DS} = 15$ V; $T_j = 25$ °C; see Figure 11		-	3	-	nC

[1] Single device conducting.

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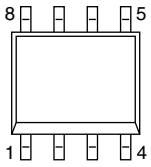
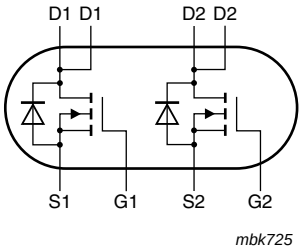
2. Pinning information

Table 2. Pinning information

Pin	Symbol	Description	Simplified outline	Graphic symbol
1	S1	source1	 SOT96-1 (SO8)	 mbk725
2	G1	gate1		
3	S2	source2		
4	G2	gate2		
5	D2	drain2		
6	D2	drain2		
7	D1	drain1		
8	D1	drain1		

3. Ordering information

Table 3. Ordering information

Type number	Package		
	Name	Description	Version
PHN203	SO8	plastic small outline package; 8 leads; body width 3.9 mm	SOT96-1

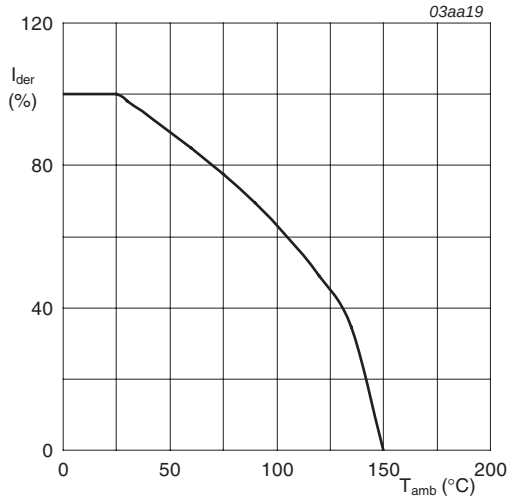
4. Limiting values

Table 4. Limiting values

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

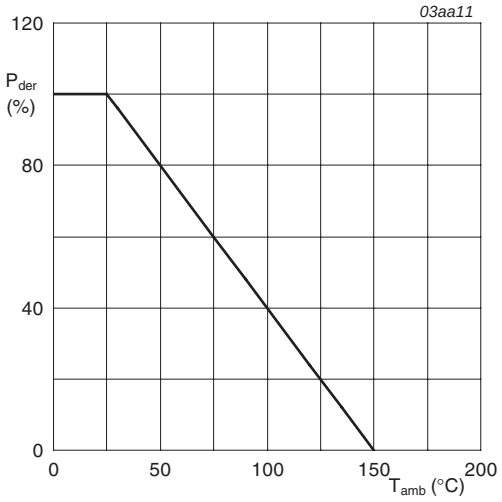
Symbol	Parameter	Conditions		Min	Typ	Max	Unit
V_{DS}	drain-source voltage	$T_j \geq 25$ °C; $T_j \leq 150$ °C		-	-	30	V
V_{DGR}	drain-gate voltage	$T_j \leq 150$ °C; $T_j \geq 25$ °C; $R_{GS} = 20$ kΩ		-	-	30	V
V_{GS}	gate-source voltage			-20	-	20	V
I_D	drain current	$T_{amb} = 70$ °C; pulsed; see Figure 1	[1]	-	-	5	A
		$T_{amb} = 25$ °C; pulsed; see Figure 1; see Figure 3	[1]	-	-	6.3	A
I_{DM}	peak drain current	$t_p \leq 10$ µs; pulsed; $T_{amb} = 25$ °C; see Figure 3	[1]	-	-	18	A
P_{tot}	total power dissipation	$T_{amb} = 25$ °C; pulsed; see Figure 2	[1]	-	-	2	W
T_{stg}	storage temperature			-55	-	150	°C
T_j	junction temperature			-55	-	150	°C
Source-drain diode							
I_S	source current	$T_{amb} = 25$ °C; pulsed	[1]	-	-	2	A
I_{SM}	peak source current	$t_p \leq 10$ µs; pulsed; $T_{amb} = 25$ °C	[1]	-	-	4.1	A
Avalanche ruggedness							
$E_{DS(AL)S}$	non-repetitive drain-source avalanche energy	$V_{GS} = 10$ V; $T_{j(init)} = 25$ °C; $I_D = 8.7$ A; $V_{sup} \leq 30$ V; unclamped; $t_p = 0.2$ ms; $R_{GS} = 50$ Ω		-	-	37.8	mJ

[1] Single device conducting.



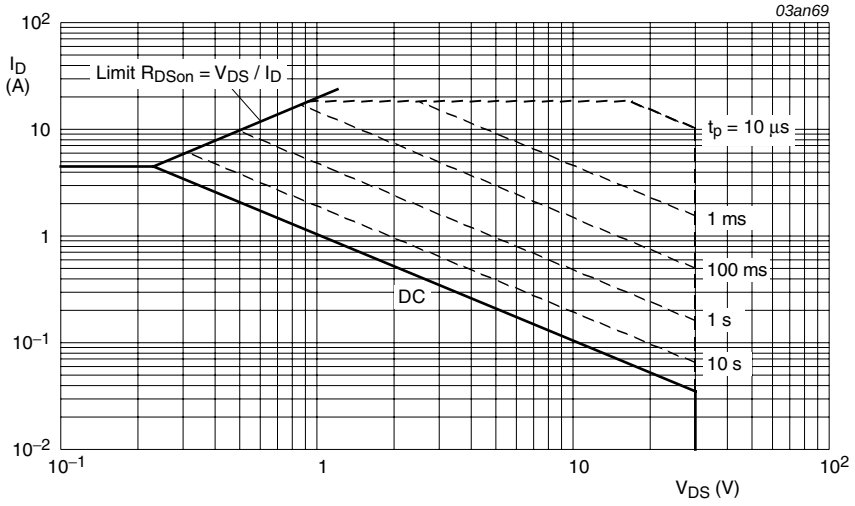
$$I_{der} = \frac{I_D}{I_{D(25°C)}} \times 100\,\%$$

Fig 1. Normalized continuous drain current as a function of ambient temperature



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

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



$$T_{amb} = 25°C; I_{DM} \text{is single pulse}; V_{GS} = 10V$$

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
$R_{th(j-sp)}$	thermal resistance from junction to solder point		-	-	-	K/W
$R_{th(j-a)}$	thermal resistance from junction to ambient	mounted on a printed-circuit board; minimum footprint; see Figure 4	-	-	62.5	K/W

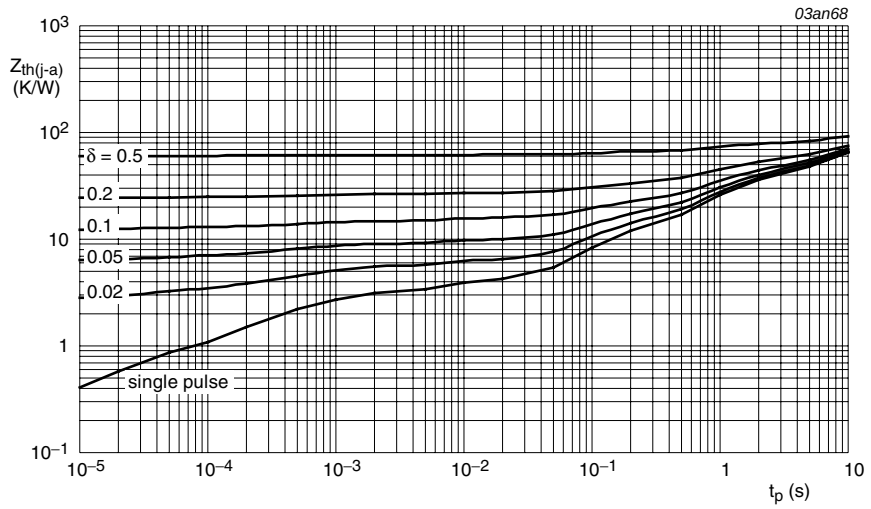
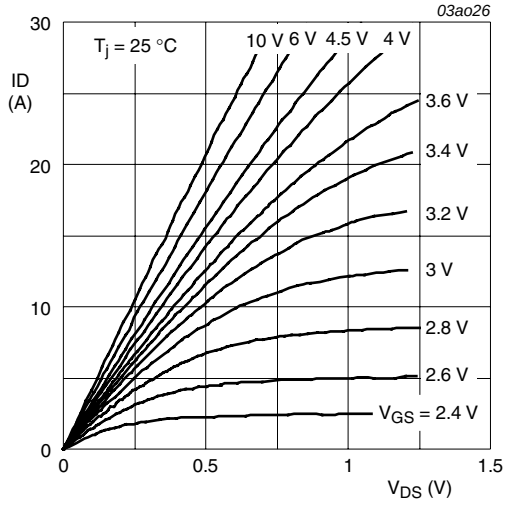


Fig 4. Transient thermal impedance from junction to ambient as a function of pulse duration

6. Characteristics

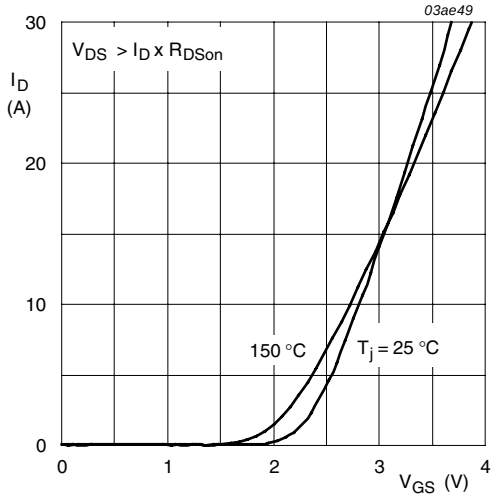
Table 6. Characteristics

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
Static characteristics						
$V_{(BR)DSS}$	drain-source breakdown voltage	I_D = 250 µA; V_{GS} = 0 V; T_j = -55 °C	27	-	-	V
		I_D = 250 µA; V_{GS} = 0 V; T_j = 25 °C	30	-	-	V
$V_{GS(th)}$	gate-source threshold voltage	I_D = 1 mA; V_{DS} = V_{GS}; T_j = -55 °C; see Figure 8	-	-	2.2	V
		I_D = 1 mA; V_{DS} = V_{GS}; T_j = 150 °C; see Figure 8	0.6	-	-	V
		I_D = 1 mA; V_{DS} = V_{GS}; T_j = 25 °C; see Figure 8	1	1.5	2	V
I_{DSS}	drain leakage current	V_{DS} = 24 V; V_{GS} = 0 V; T_j = 25 °C	-	-	1	µA
		V_{DS} = 24 V; V_{GS} = 0 V; T_j = 150 °C	-	-	10	µA
I_{GSS}	gate leakage current	V_{GS} = 20 V; V_{DS} = 0 V; T_j = 25 °C	-	10	100	nA
		V_{GS} = -20 V; V_{DS} = 0 V; T_j = 25 °C	-	10	100	nA
R_{DSon}	drain-source on-state resistance	V_{GS} = 10 V; I_D = 7 A; T_j = 25 °C; see Figure 9; see Figure 10	-	24	30	mΩ
		V_{GS} = 4.5 V; I_D = 3.5 A; T_j = 25 °C; see Figure 9; see Figure 10	-	30	55	mΩ
		V_{GS} = 10 V; I_D = 7 A; T_j = 150 °C; see Figure 9; see Figure 10	-	40.8	51	mΩ
Dynamic characteristics						
$Q_{G(tot)}$	total gate charge	I_D = 7 A; V_{DS} = 15 V; V_{GS} = 10 V; T_j = 25 °C; see Figure 11	-	14.6	-	nC
Q_{GS}	gate-source charge		-	2	-	nC
Q_{GD}	gate-drain charge		-	3	-	nC
C_{iss}	input capacitance	V_{DS} = 20 V; V_{GS} = 0 V; f = 1 MHz; T_j = 25 °C; see Figure 12	-	560	-	pF
C_{oss}	output capacitance		-	125	-	pF
C_{rss}	reverse transfer capacitance	V_{DS} 20 V; V_{GS} = 0 V; f = 1 MHz; T_j = 25 °C; see Figure 12	-	85	-	pF
$t_{d(on)}$	turn-on delay time	V_{DS} = 25 V; R_L = 25 Ω; V_{GS} = 10 V; $R_{G(ext)}$ = 6 Ω; T_j = 25 °C	-	5	-	ns
t_r	rise time		-	6	-	ns
$t_{d(off)}$	turn-off delay time		-	21	-	ns
t_f	fall time		-	11	-	ns
Source-drain diode						
V_{SD}	source-drain voltage	I_S = 1.25 A; V_{GS} = 0 V; T_j = 25 °C; see Figure 13	-	0.75	1	V
t_{rr}	reverse recovery time	I_S = 2 A; dI_S/dt = -100 A/µs; V_{GS} = 0 V; V_{DS} = 25 V; T_j = 25 °C	-	30	-	ns



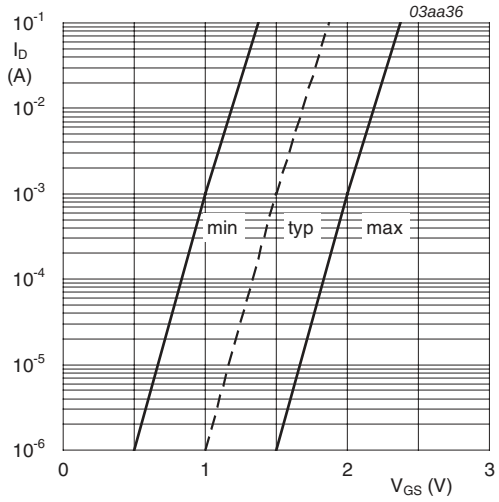
$T_j = 25°C$

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



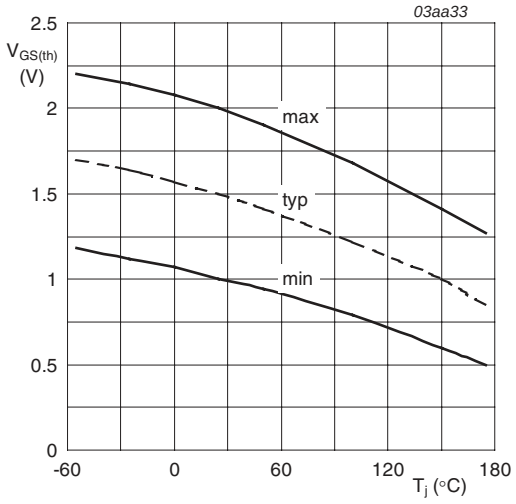
$T_j = 25°C \text{ and } 150°C; V_{DS} > I_D \times R_{DSon}$

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



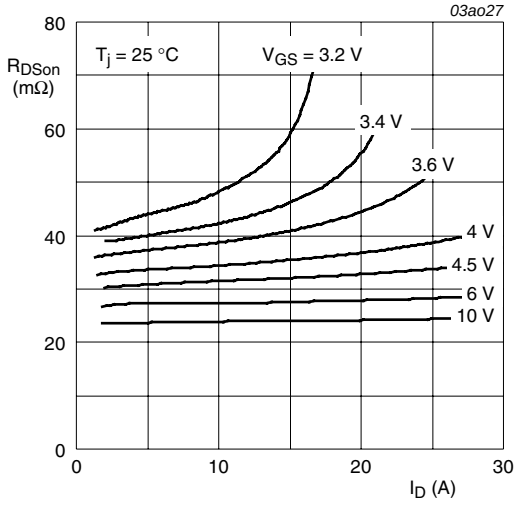
$T_j = 25°C; V_{DS} = V_{GS}$

Fig 7. Sub-threshold drain current as a function of gate-source voltage



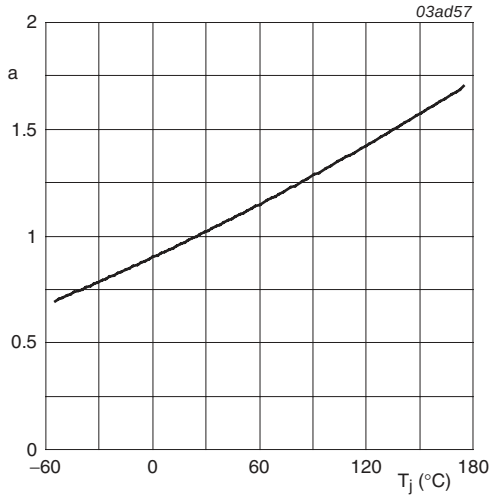
$I_D = 1mA; V_{DS} = V_{GS}$

Fig 8. Gate-source threshold voltage as a function of junction temperature



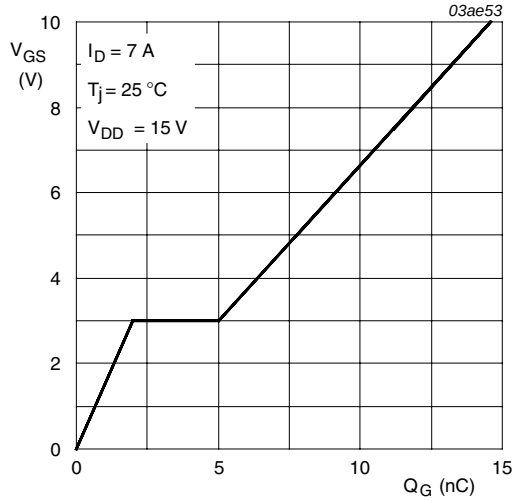
$T_j = 25°C$

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



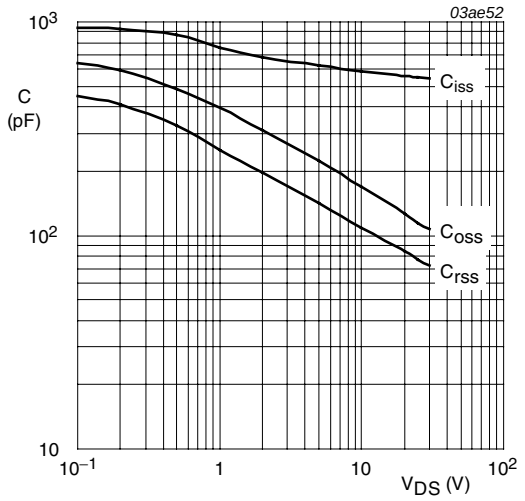
$$a = \frac{R_{DSon}}{R_{DSon(25°C)}}$$

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



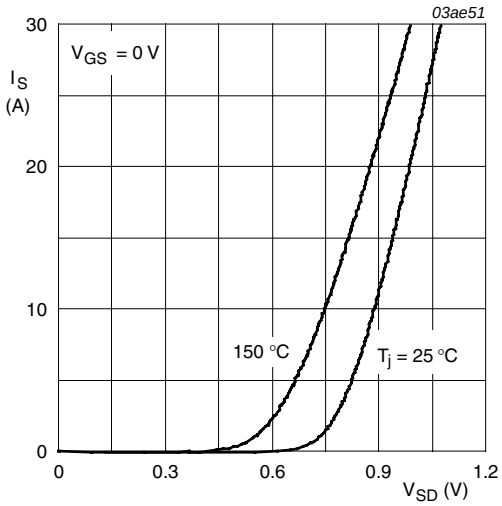
$I_D = 7A; V_{DS} = 15V$

Fig 11. Gate-source voltage as a function of gate charge; typical values



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

Fig 12. Input, output and reverse transfer capacitances as a function of drain-source voltage; typical values

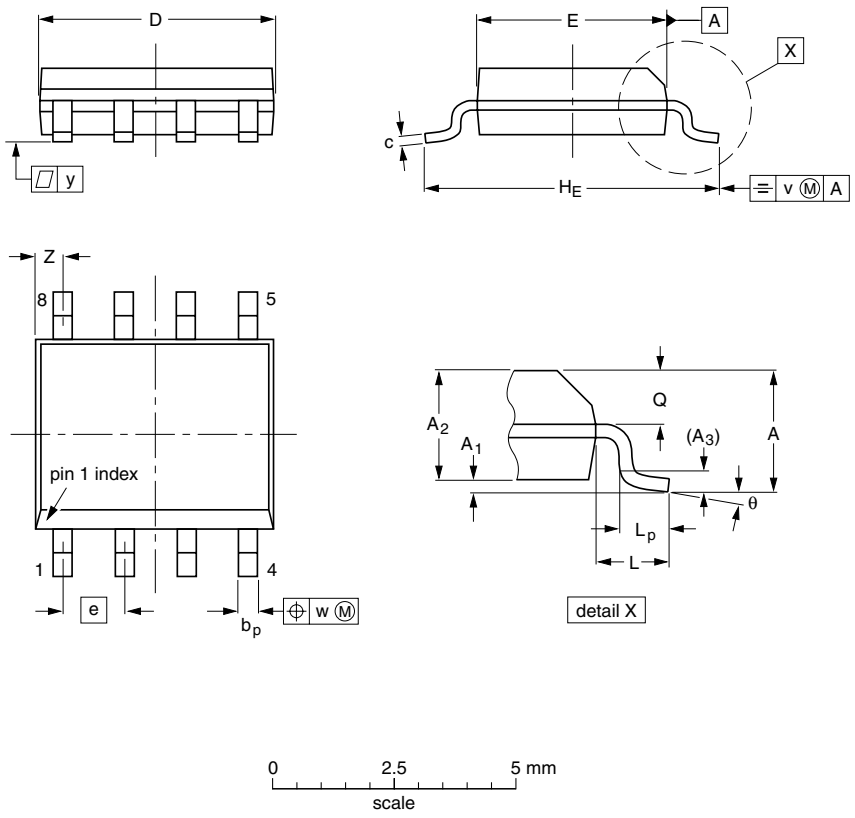


$T_j = 25°C \text{ and } 150°C; V_{GS} = 0V$

Fig 13. Source current as a function of source-drain voltage; typical values

7. Package outline

SO8: plastic small outline package; 8 leads; body width 3.9 mm **SOT96-1**



DIMENSIONS (inch dimensions are derived from the original mm dimensions)

UNIT	A max.	A_1	A_2	A_3	b_p	c	$D^{(1)}$	$E^{(2)}$	e	H_E	L	L_p	Q	v	w	y	$Z^{(1)}$	θ
mm	1.75	0.25 0.10	1.45 1.25	0.25	0.49 0.36	0.25 0.19	5.0 4.8	4.0 3.8	1.27	6.2 5.8	1.05	1.0 0.4	0.7 0.6	0.25	0.25	0.1	0.7 0.3	8^o 0^o
inches	0.069	0.010 0.004	0.057 0.049	0.01	0.019 0.014	0.0100 0.0075	0.20 0.19	0.16 0.15	0.05	0.244 0.228	0.041	0.039 0.016	0.028 0.024	0.01	0.01	0.004	0.028 0.012	

Notes

1. Plastic or metal protrusions of 0.15 mm (0.006 inch) maximum per side are not included.
2. Plastic or metal protrusions of 0.25 mm (0.01 inch) maximum per side are not included.

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	JEITA			
SOT96-1	076E03	MS-012				~~99-12-27~~ 03-02-18

Fig 14. Package outline SOT96-1 (SO8)

8. Revision history

Table 7. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
PHN203 _5	20100427	Product data sheet	-	PHN203 _4
Modifications:	• Various changes to content.			
PHN203 _4	20091208	Product data sheet	-	PHN203-03
PHN203 -03	20040126	Product data	-	PHN203 _2
PHN203_2	19990101	Product specification	-	PHN203 _1
PHN203 _1	19980204	Objective specification	-	-

9. Legal information

9.1 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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11. Contents

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Date of release: 27 April 2010