

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

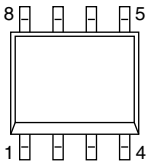
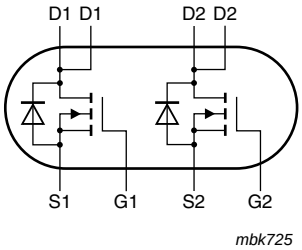
Symbol	Parameter	Conditions		Min	Typ	Max	Unit
V_{DS}	drain-source voltage	$T_j \geq 25$ °C; $T_j \leq 150$ °C		-	-	30	V
I_D	drain current	$T_{amb} = 25$ °C; pulsed; see Figure 1; see Figure 3	[1]	-	-	6.3	A
P_{tot}	total power dissipation	$T_{amb} = 25$ °C; pulsed; see Figure 2	[1]	-	-	2	W
Static characteristics							
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.

nexperia

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

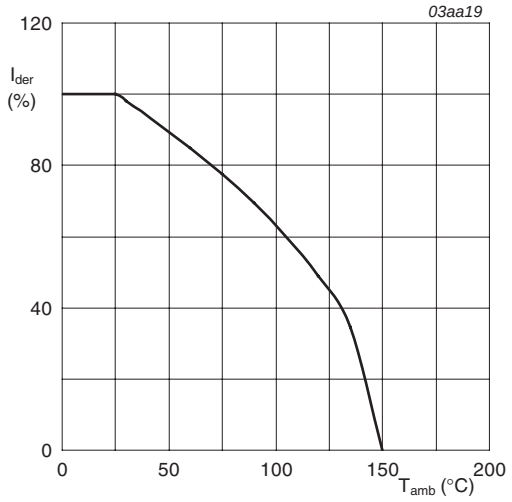
In accordance with the Absolute Maximum Rating System (IEC 60134).

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.

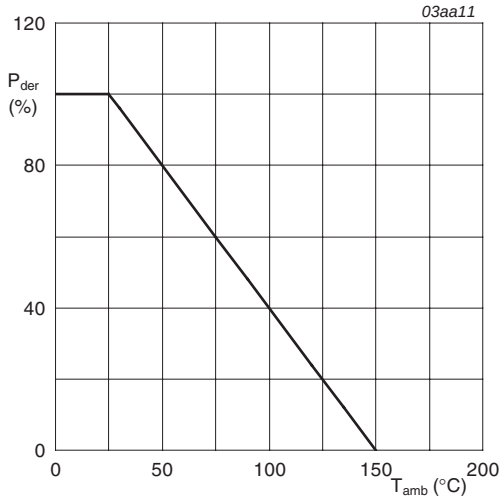
All information provided in this document is subject to legal disclaimers.

© Nexperia B.V. 2017. All rights reserved



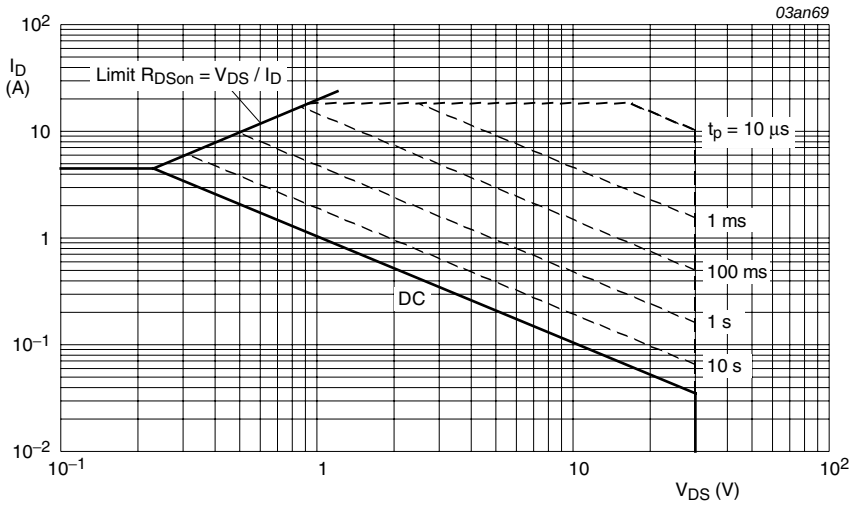
$$I_{der} = \frac{I_D}{I_{D(25°C)}} \times 100\,\%$$

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

All information provided in this document is subject to legal disclaimers.

© Nexperia B.V. 2017. All rights reserved

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

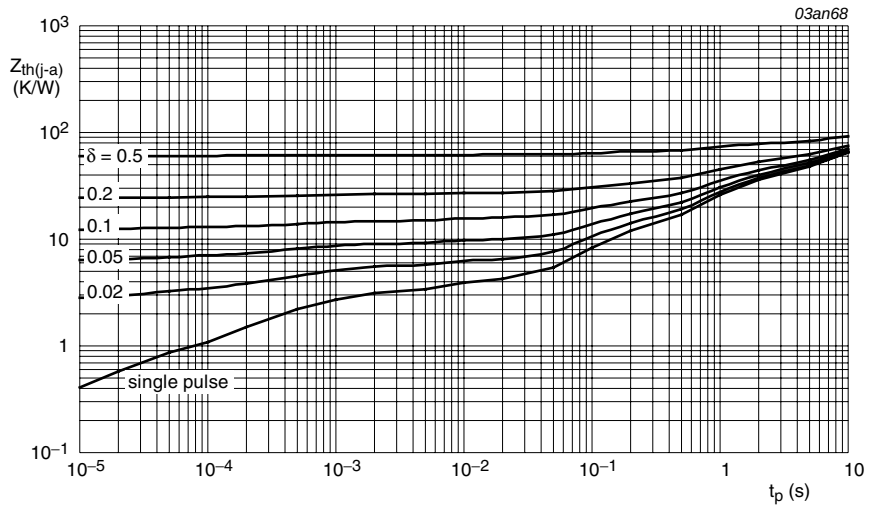


Fig 4. Transient thermal impedance from junction to ambient as a function of pulse duration

All information provided in this document is subject to legal disclaimers.

© Nexperia B.V. 2017. All rights reserved

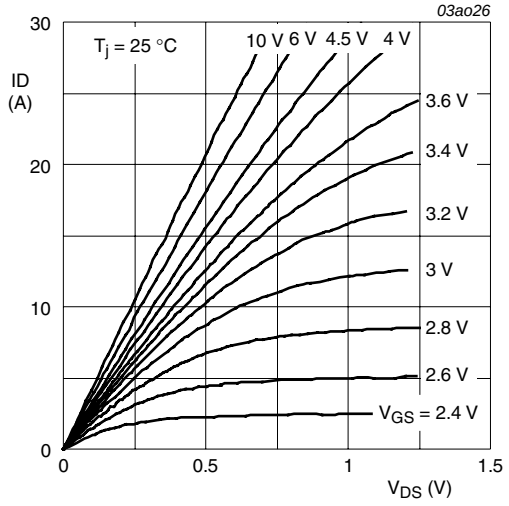
6. Characteristics

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

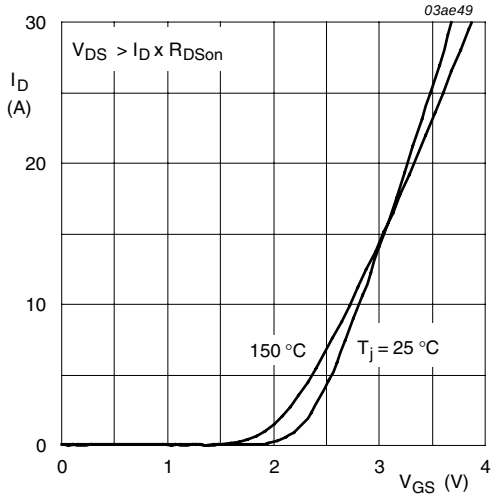
All information provided in this document is subject to legal disclaimers.

© Nexperia B.V. 2017. All rights reserved



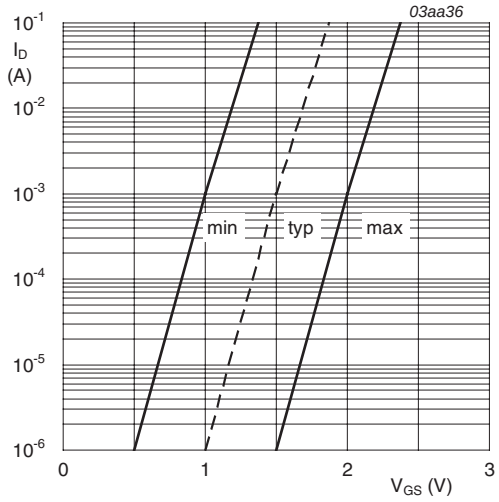
$T_j = 25°C$

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



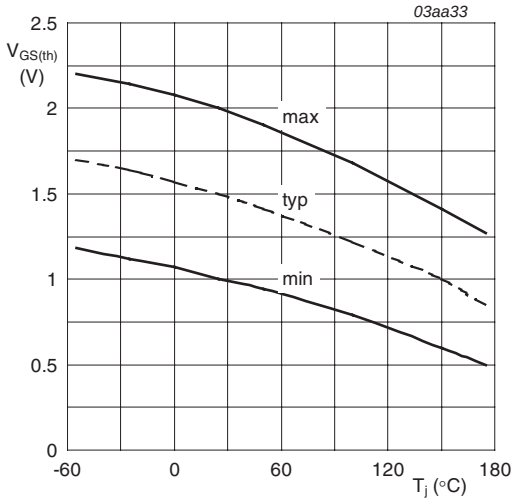
$T_j = 25°C \text{ and } 150°C; V_{DS} > I_D \times R_{DSon}$

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

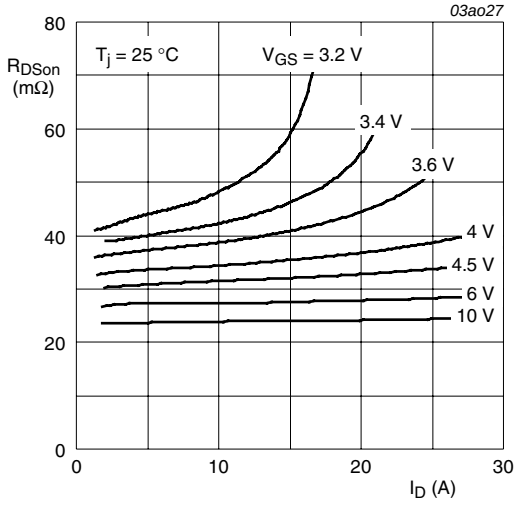


$I_D = 1mA; V_{DS} = V_{GS}$

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

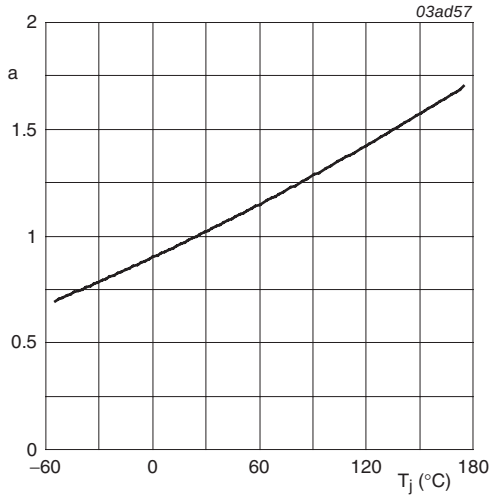
All information provided in this document is subject to legal disclaimers.

© Nexperia B.V. 2017. All rights reserved



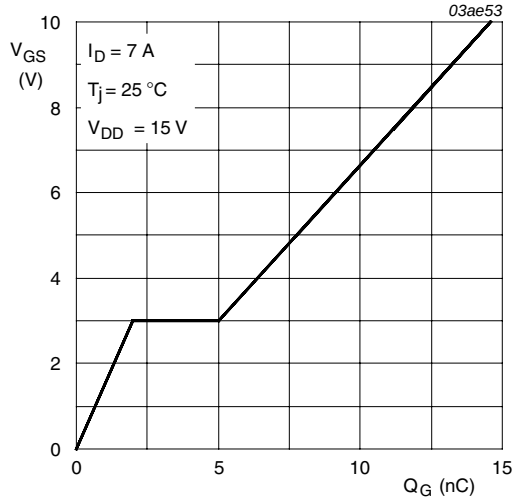
$T_j = 25°C$

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



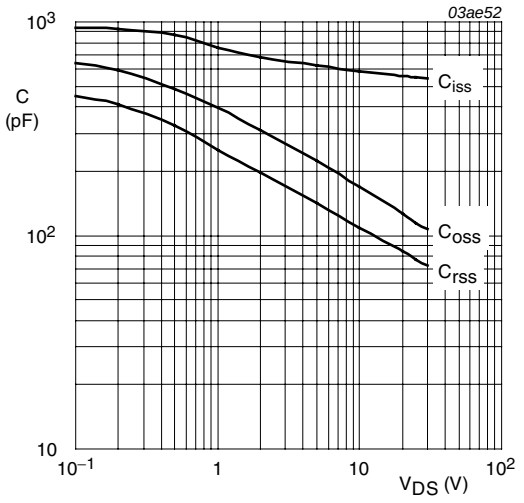
$$a = \frac{R_{DSon}}{R_{DSon(25°C)}}$$

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

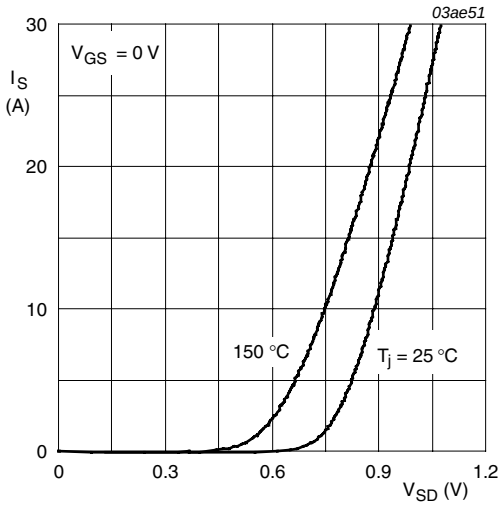


$V_{GS} = 0V; f = 1MHz$

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

All information provided in this document is subject to legal disclaimers.

© Nexperia B.V. 2017. All rights reserved



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

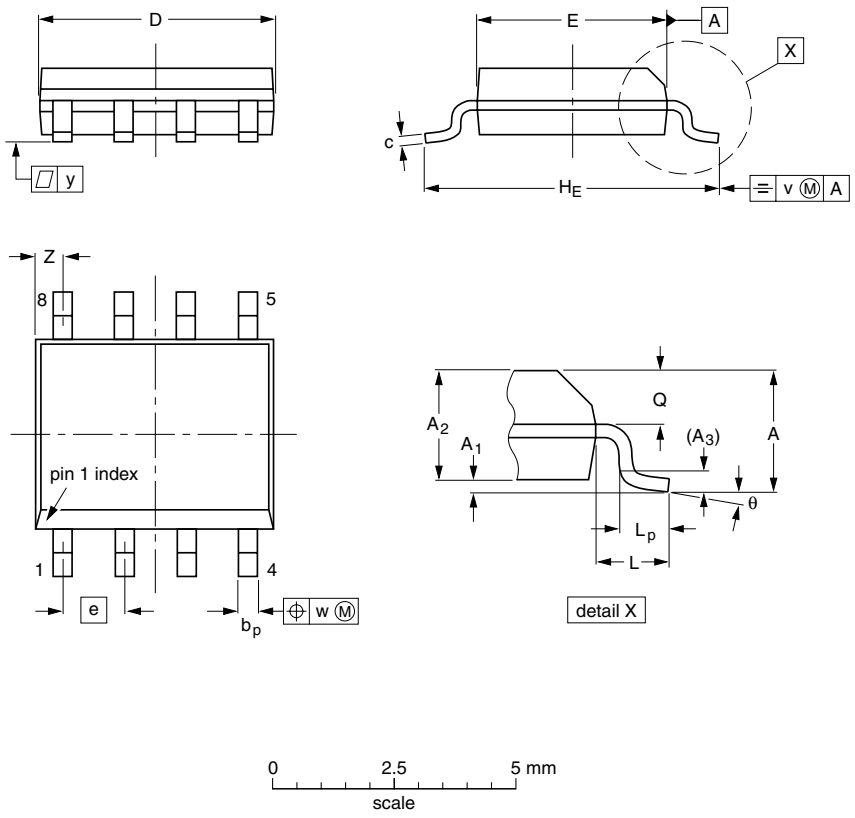
Fig 13. Source current as a function of source-drain voltage; typical values

All information provided in this document is subject to legal disclaimers.

© Nexperia B.V. 2017. All rights reserved

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)

All information provided in this document is subject to legal disclaimers.

© Nexperia B.V. 2017. All rights reserved

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	-	-

All information provided in this document is subject to legal disclaimers.

© Nexperia B.V. 2017. All rights reserved

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.

9.2 Definitions

Draft — The document is a draft version only. The content is still under internal review and subject to formal approval, which may result in modifications or additions. Nexperia does not give any representations or warranties as to the accuracy or completeness of information included herein and shall have no liability for the consequences of use of such information.

Short data sheet — A short data sheet is an extract from a full data sheet with the same product type number(s) and title. A short data sheet is intended for quick reference only and should not be relied upon to contain detailed and full information. For detailed and full information see the relevant full data sheet, which is available on request via the local Nexperia sales office. In case of any inconsistency or conflict with the short data sheet, the full data sheet shall prevail.

Product specification — The information and data provided in a Product data sheet shall define the specification of the product as agreed between Nexperia and its customer, unless Nexperia and customer have explicitly agreed otherwise in writing. In no event however, shall an agreement be valid in which the Nexperia product is deemed to offer functions and qualities beyond those described in the Product data sheet.

9.3 Disclaimers

Limited warranty and liability — Information in this document is believed to be accurate and reliable. However, Nexperia does not give any representations or warranties, expressed or implied, as to the accuracy or completeness of such information and shall have no liability for the consequences of use of such information.

In no event shall Nexperia be liable for any indirect, incidental, punitive, special or consequential damages (including - without limitation - lost profits, lost savings, business interruption, costs related to the removal or replacement of any products or rework charges) whether or not such damages are based on tort (including negligence), warranty, breach of contract or any other legal theory.

Notwithstanding any damages that customer might incur for any reason whatsoever, Nexperia's aggregate and cumulative liability towards customer for the products described herein shall be limited in accordance with the *Terms and conditions of commercial sale* of Nexperia.

Right to make changes — Nexperia reserves the right to make changes to information published in this document, including without limitation specifications and product descriptions, at any time and without notice. This document supersedes and replaces all information supplied prior to the publication hereof.

Suitability for use — Nexperia products are not designed, authorized or warranted to be suitable for use in medical, military, aircraft, space or life support equipment, nor in applications where failure or malfunction of a Nexperia product can reasonably be expected to result in personal injury, death or severe property or environmental damage. Nexperia accepts no liability for inclusion and/or use of Nexperia products in such equipment or applications and therefore such inclusion and/or use is at the customer's own risk.

Applications — Applications that are described herein for any of these products are for illustrative purposes only. Nexperia makes no representation or warranty that such applications will be suitable for the specified use without further testing or modification.

Nexperia does not accept any liability related to any default, damage, costs or problem which is based on a weakness or default in the customer application/use or the application/use of customer's third party customer(s) (hereinafter both referred to as "Application"). It is customer's sole responsibility to check whether the Nexperia product is suitable and fit for the Application planned. Customer has to do all necessary testing for the Application in order to avoid a default of the Application and the product. Nexperia does not accept any liability in this respect.

Quick reference data — The Quick reference data is an extract of the product data given in the Limiting values and Characteristics sections of this document, and as such is not complete, exhaustive or legally binding. Limiting values — Stress above one or more limiting values (as defined in the Absolute Maximum Ratings System of IEC 60134) will cause permanent damage to the device. Limiting values are stress ratings only and (proper) operation of the device at these or any other conditions above those given in the Recommended operating conditions section (if present) or the Characteristics sections of this document is not warranted. Constant or repeated exposure to limiting values will permanently and irreversibly affect the quality and reliability of the device.

Terms and conditions of commercial sale — Nexperia products are sold subject to the general terms and conditions of commercial sale, as published at http://www.nexperia.com/profile/terms, unless otherwise agreed in a valid written individual agreement. In case an individual agreement is concluded only the terms and conditions of the respective agreement shall apply. Nexperia hereby expressly objects to applying the customer's general terms and conditions with regard to the purchase of Nexperia products by customer.

No offer to sell or license — Nothing in this document may be interpreted or construed as an offer to sell products that is open for acceptance or the grant, conveyance or implication of any license under any copyrights, patents or other industrial or intellectual property rights.

Export control — This document as well as the item(s) described herein may be subject to export control regulations. Export might require a prior authorization from national authorities.

All information provided in this document is subject to legal disclaimers.

© Nexperia B.V. 2017. All rights reserved

Non-automotive qualified products — Unless this data sheet expressly states that this specific Nexperia product is automotive qualified, the product is not suitable for automotive use. It is neither qualified nor tested in accordance with automotive testing or application requirements. Nexperia accepts no liability for inclusion and/or use of non-automotive qualified products in automotive equipment or applications.

In the event that customer uses the product for design-in and use in automotive applications to automotive specifications and standards, customer (a) shall use the product without Nexperia's warranty of the product for such automotive applications, use and specifications, and (b) whenever customer uses the product for automotive applications beyond Nexperia's specifications such use shall be solely at customer's own risk, and (c) customer fully indemnifies Nexperia for any liability, damages or failed product claims resulting from customer design and use of the product for automotive applications beyond Nexperia's standard warranty and Nexperia's product specifications.

9.4 Trademarks

Notice: All referenced brands, product names, service names and trademarks are the property of their respective owners.

10. Contact information

For more information, please visit: http://www.nexperia.com

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

All information provided in this document is subject to legal disclaimers.

© Nexperia B.V. 2017. All rights reserved

11. 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 Limiting values 2
5 Thermal characteristics 4
6 Characteristics 5
7 Package outline 9
8 Revision history 10
9 Legal information 11
9.1 Data sheet status 11
9.2 Definitions 11
9.3 Disclaimers 11
9.4 Trademarks 12
10 Contact information 12

© **Nexperia B.V. 2017. All rights reserved**

For more information, please visit: http://www.nexperia.com
For sales office addresses, please send an email to: salesaddresses@nexperia.com
Date of release: 27 April 2010