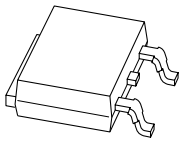


PHD98N03LT

N-channel TrenchMOS logic level FET

Rev. 05 — 1 December 2006 Product data sheet

1. Product profile

1.1 General description

Logic level N-channel enhancement mode Field-Effect Transistor (FET) in a plastic package using TrenchMOS technology.

1.2 Features

- Low on-state resistance
- Fast switching

1.3 Applications

- Computer motherboard high-frequency DC-to-DC converters

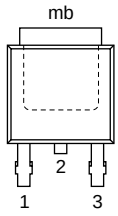
1.4 Quick reference data

- $V_{DS} \leq 25$ V
- $I_D \leq 75$ A
- $R_{DSon} \leq 5.9$ mΩ
- Q_{GD} = 15 nC (typ)

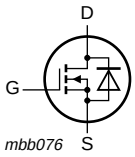
2. Pinning information

Table 1. Pinning

Pin	Description	Simplified outline	Symbol
1	gate (G)		
2	drain (D) [1]		
3	source (S)		
mb	mounting base; connected to drain (D)		



SOT428 (DPAK)



[1] It is not possible to make a connection to pin 2.

founded by Philips

3. Ordering information

Table 2. Ordering information

Type number	Package		
	Name	Description	Version
PHD98N03LT	DPAK	plastic single-ended surface-mounted package; 3 leads (one lead cropped)	SOT428

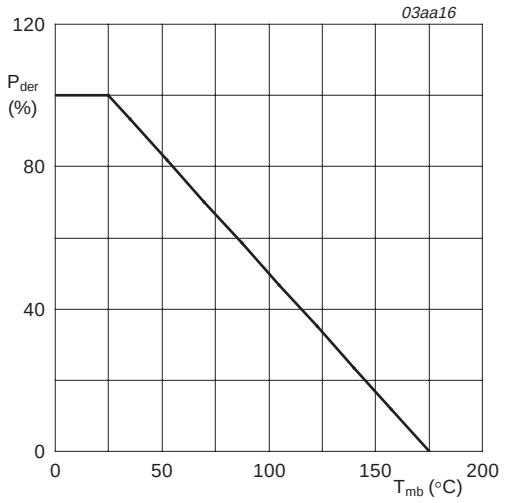
4. Limiting values

Table 3. Limiting values

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

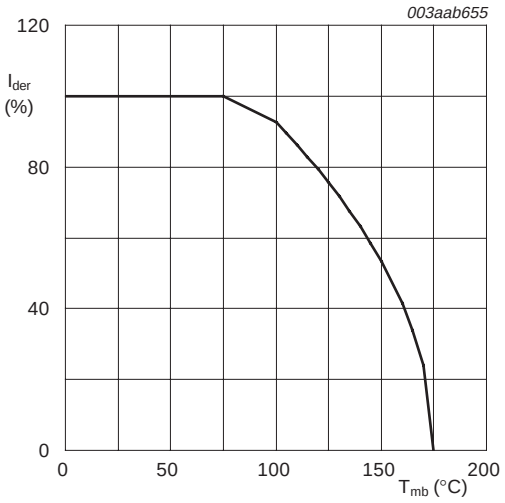
Symbol	Parameter	Conditions	Min	Max	Unit
V_{DS}	drain-source voltage	25 °C ≤ T_j ≤ 175 °C	-	25	V
V_{DGR}	drain-gate voltage (DC)	25 °C ≤ T_j ≤ 175 °C; R_{GS} = 20 kΩ	-	25	V
V_{GS}	gate-source voltage		-	±20	V
I_D	drain current	T_{mb} = 25 °C; V_{GS} = 5 V; see Figure 2 and 3	-	75	A
		T_{mb} = 100 °C; V_{GS} = 5 V; see Figure 2	-	66	A
I_{DM}	peak drain current	T_{mb} = 25 °C; pulsed; t_p ≤ 10 µs; see Figure 3	-	240	A
P_{tot}	total power dissipation	T_{mb} = 25 °C; see Figure 1	-	111	W
T_{stg}	storage temperature		–55	+175	°C
T_j	junction temperature		–55	+175	°C
Source-drain diode					
I_S	source current	T_{mb} = 25 °C	-	75	A
I_{SM}	peak source current	T_{mb} = 25 °C; pulsed; t_p ≤ 10 µs	-	240	A
Avalanche ruggedness					
$E_{DS(AL)S}$	non-repetitive drain-source avalanche energy	unclamped inductive load; I_D = 43 A; t_p = 0.27 ms; V_{DS} = 15 V; R_{GS} = 50 Ω; V_{GS} = 5 V; starting at T_j = 25 °C	-	183	mJ

© NXP B.V. 2006. All rights reserved.



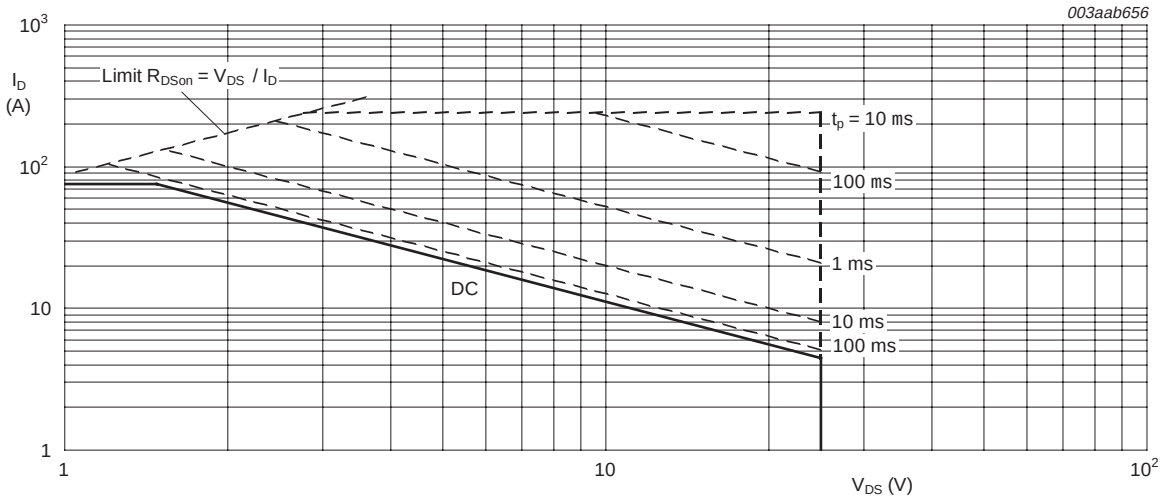
$$P_{der} = \frac{P_{tot}}{P_{tot(25°C)}} \times 100\ \%$$

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



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

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



T_{mb} = 25 °C; I_{DM} is single pulse

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

© NXP B.V. 2006. All rights reserved.

5. Thermal characteristics

Table 4. Thermal characteristics

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
$R_{th(j\text{-}mb)}$	thermal resistance from junction to mounting base	see Figure 4		-	-	1.35	K/W
$R_{th(j\text{-}a)}$	thermal resistance from junction to ambient						
	SOT428	minimum footprint		-	75	-	K/W
		SOT404 minimum footprint	[1]	-	50	-	K/W

[1] Mounted on a printed-circuit board; vertical in still air.

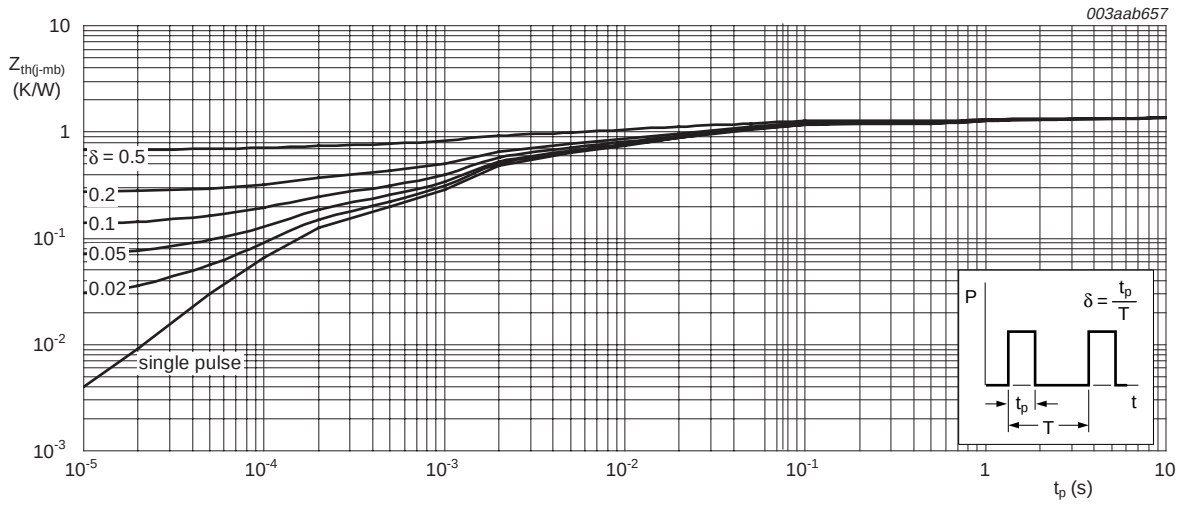


Fig 4. Transient thermal impedance from junction to mounting base as a function of pulse duration

© NXP B.V. 2006. All rights reserved.

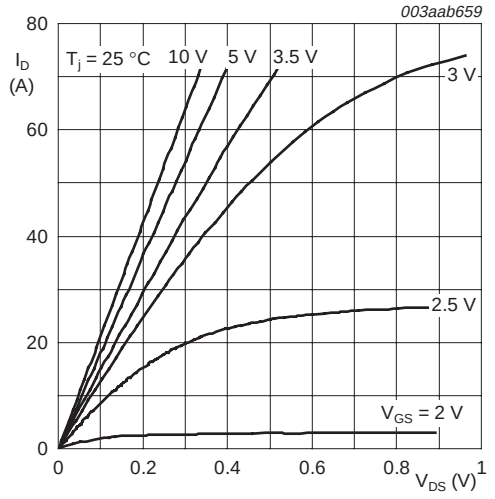
6. Characteristics

Table 5. Characteristics

T_j = 25 °C unless otherwise specified.

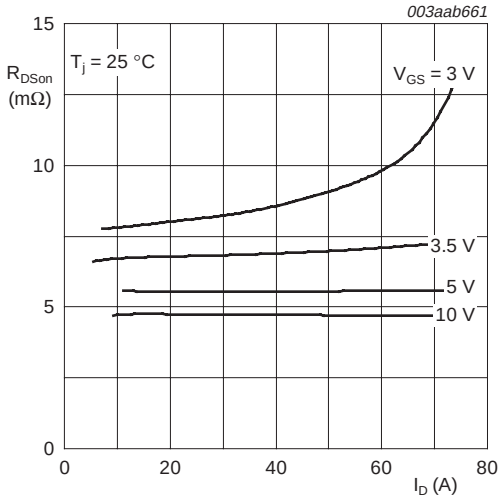
Symbol	Parameter	Conditions	Min	Typ	Max	Unit
Static characteristics						
$V_{(BR)DSS}$	drain-source breakdown voltage	I_D = 250 µA; V_{GS} = 0 V				
		T_j = 25 °C	25	-	-	V
		T_j = −55 °C	22	-	-	V
$V_{GS(th)}$	gate-source threshold voltage	I_D = 1 mA; V_{DS} = V_{GS}; see Figure 9 and 10				
		T_j = 25 °C	1	1.5	2	V
		T_j = 175 °C	0.5	-	-	V
		T_j = −55 °C	-	-	2.3	V
I_{DSS}	drain leakage current	V_{DS} = 25 V; V_{GS} = 0 V				
		T_j = 25 °C	-	0.05	1	µA
		T_j = 175 °C	-	-	500	µA
I_{GSS}	gate leakage current	V_{GS} = ±15 V; V_{DS} = 0 V	-	10	100	nA
R_{DSon}	drain-source on-state resistance	V_{GS} = 5 V; I_D = 25 A; see Figure 6 and 8				
		T_j = 25 °C	-	6.2	7.3	mΩ
		T_j = 175 °C	-	10.5	12.4	mΩ
		V_{GS} = 10 V; I_D = 25 A; see Figure 6 and 8	-	5.2	5.9	mΩ
Dynamic characteristics						
$Q_{G(tot)}$	total gate charge	I_D = 50 A; V_{DS} = 15 V; V_{GS} = 5 V; see Figure 11 and 12	-	40	-	nC
Q_{GS}	gate-source charge		-	16	-	nC
Q_{GD}	gate-drain charge		-	15	-	nC
C_{iss}	input capacitance	V_{GS} = 0 V; V_{DS} = 20 V; f = 1 MHz; see Figure 14	-	3000	-	pF
C_{oss}	output capacitance		-	710	-	pF
C_{rss}	reverse transfer capacitance		-	510	-	pF
$t_{d(on)}$	turn-on delay time	V_{DS} = 15 V; I_D = 12.5 A; V_{GS} = 5 V; R_G = 5.6 Ω	-	18	-	ns
t_r	rise time		-	80	-	ns
$t_{d(off)}$	turn-off delay time		-	104	-	ns
t_f	fall time		-	104	-	ns
Source-drain diode						
V_{SD}	source-drain voltage	I_S = 25 A; V_{GS} = 0 V; see Figure 13	-	0.9	1.2	V
t_{rr}	reverse recovery time	I_S = 10 A; dI_S/dt = −100 A/µs; V_{GS} = 0 V	-	37	-	ns
Q_r	recovered charge		-	20	-	nC

© NXP B.V. 2006. All rights reserved.



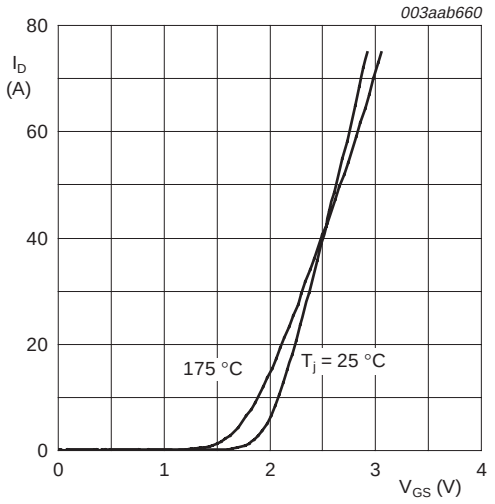
T_j = 25 °C

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



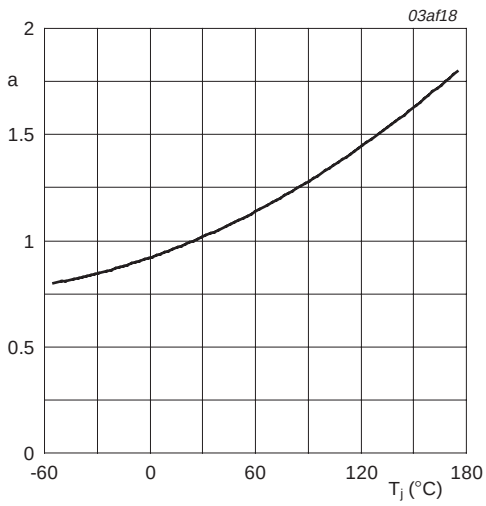
T_j = 25 °C

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



T_j = 25 °C and 175 °C; $V_{DS} > I_D \times R_{DSon}$

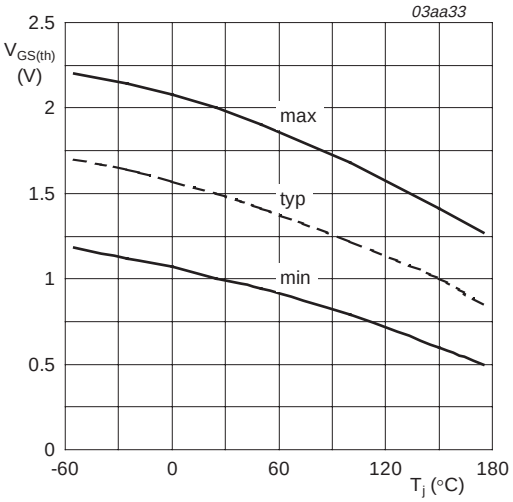
Fig 7. Transfer characteristics: drain current as a function of gate-source voltage; typical values



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

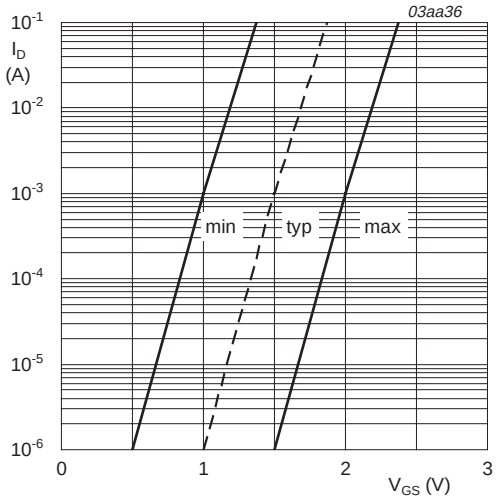
Fig 8. Normalized drain-source on-state resistance factor as a function of junction temperature

© NXP B.V. 2006. All rights reserved.



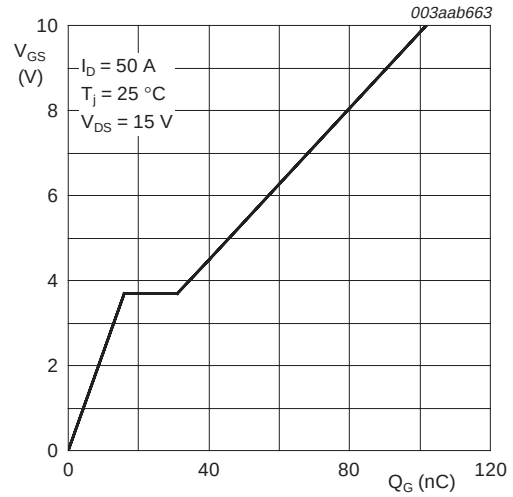
I_D = 1 mA; V_{DS} = V_{GS}

Fig 9. Gate-source threshold voltage as a function of junction temperature



T_j = 25 °C; V_{DS} = 5 V

Fig 10. Sub-threshold drain current as a function of gate-source voltage



I_D = 50 A; V_{DS} = 15 V

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

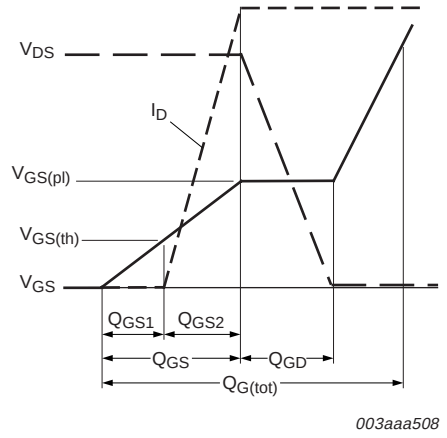
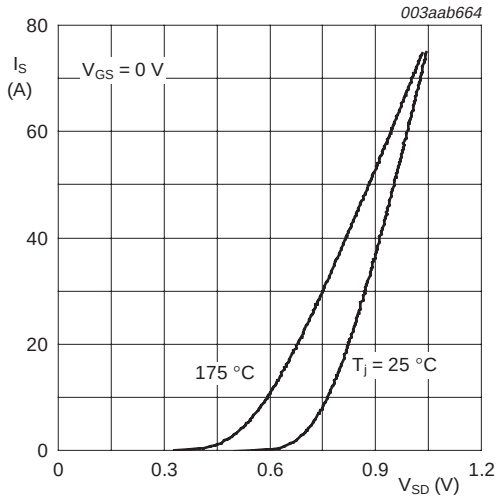


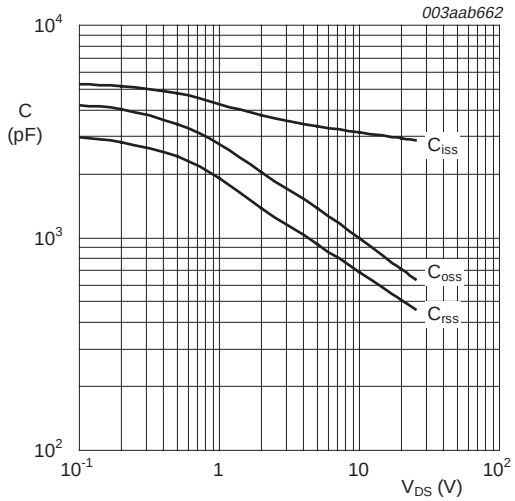
Fig 12. Gate charge waveform definitions

© NXP B.V. 2006. All rights reserved.



T_j = 25 °C and 175 °C; V_{GS} = 0 V

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



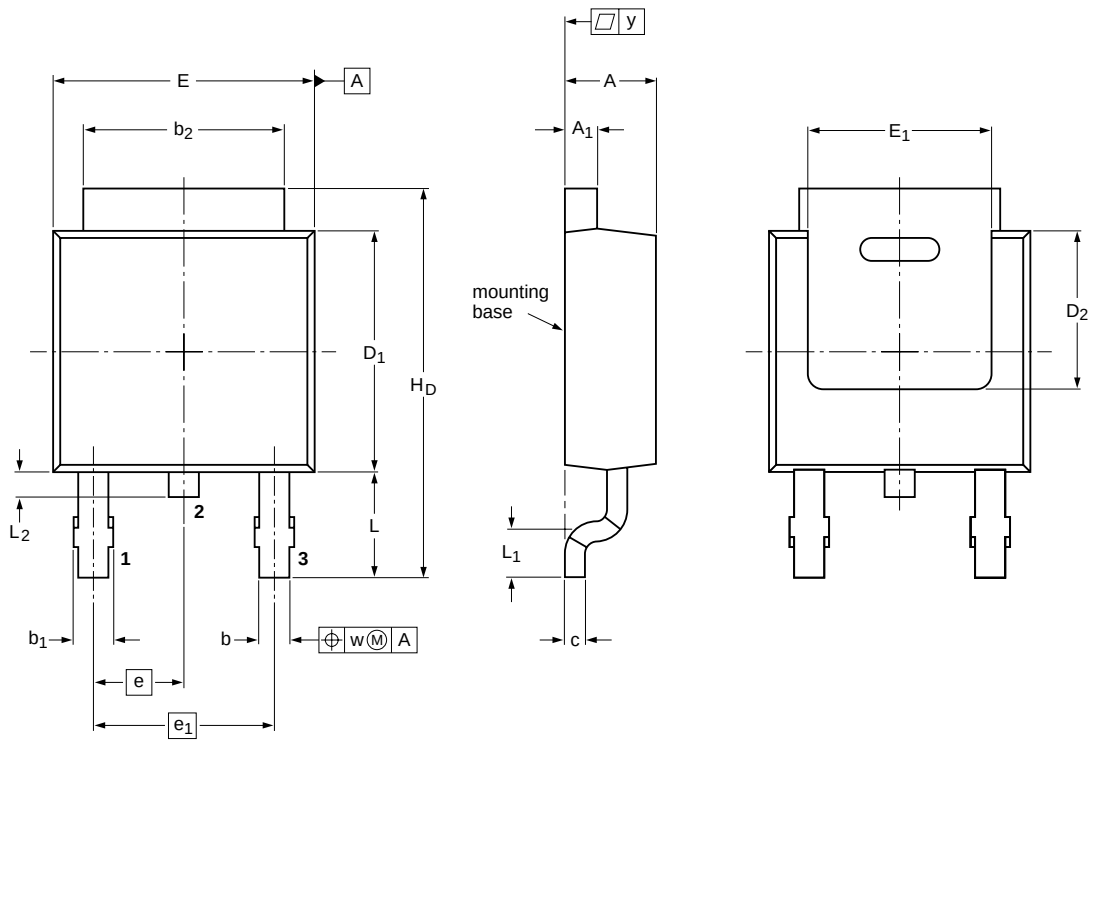
V_{GS} = 0 V; f = 1 MHz

Fig 14. Input, output and reverse transfer capacitances as a function of drain-source voltage; typical values

© NXP B.V. 2006. All rights reserved.

7. Package outline

Plastic single-ended surface-mounted package (DPAK); 3 leads (one lead cropped) **SOT428**



DIMENSIONS (mm are the original dimensions)

UNIT	A	A_1	b	b_1	b_2	c	D_1	D_2 min	E	E_1 min	e	e_1	H_D	L	L_1 min	L_2	w	y max
mm	2.38 2.22	0.93 0.46	0.89 0.71	1.1 0.9	5.46 5.00	0.56 0.20	6.22 5.98	4.0	6.73 6.47	4.45	2.285	4.57	10.4 9.6	2.95 2.55	0.5	0.9 0.5	0.2	0.2

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	JEITA			
SOT428		TO-252	SC-63			~~06-02-14~~ 06-03-16

Fig 15. Package outline SOT428 (DPAK)

© NXP B.V. 2006. All rights reserved.

8. Revision history

Table 6. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
PHD98N03LT_5	20061201	Product data sheet	-	PHP98N03LT-04
Modifications:	• The format of this data sheet has been redesigned to comply with the new identity guidelines of NXP Semiconductors. • Legal texts have been adapted to the new company name where appropriate. • PHP_PHB98N03LT have been discontinued.			
PHP98N03LT-04	20021021	Product data	-	PHP98N03LT-03
PHP98N03LT-03 (9397 750 09287)	20020220	Product data	-	PHP98N03LT-02
PHP98N03LT-02 (9397 750 08726)	20011018	Product data	-	PHP98N03LT-01
PHP98N03LT-01 (9397 750 08338)	20010716	Product data	-	-

© NXP B.V. 2006. 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.nxp.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. NXP Semiconductors 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 NXP Semiconductors sales office. In case of any inconsistency or conflict with the short data sheet, the full data sheet shall prevail.

9.3 Disclaimers

General — Information in this document is believed to be accurate and reliable. However, NXP Semiconductors 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.

Right to make changes — NXP Semiconductors 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 — NXP Semiconductors 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 NXP Semiconductors product can reasonably be expected to result in personal injury, death or severe property or environmental damage. NXP Semiconductors accepts no liability for inclusion and/or use of NXP Semiconductors 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. NXP Semiconductors makes no representation or warranty that such applications will be suitable for the specified use without further testing or modification.

Limiting values — Stress above one or more limiting values (as defined in the Absolute Maximum Ratings System of IEC 60134) may cause permanent damage to the device. Limiting values are stress ratings only and operation of the device at these or any other conditions above those given in the Characteristics sections of this document is not implied. Exposure to limiting values for extended periods may affect device reliability.

Terms and conditions of sale — NXP Semiconductors products are sold subject to the general terms and conditions of commercial sale, as published at http://www.nxp.com/profile/terms, including those pertaining to warranty, intellectual property rights infringement and limitation of liability, unless explicitly otherwise agreed to in writing by NXP Semiconductors. In case of any inconsistency or conflict between information in this document and such terms and conditions, the latter will prevail.

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.

9.4 Trademarks

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

TrenchMOS — is a trademark of NXP B.V.

10. Contact information

For additional information, please visit: **http://www.nxp.com**

For sales office addresses, send an email to: **salesaddresses@nxp.com**

© NXP B.V. 2006. All rights reserved.

11. Contents

Please be aware that important notices concerning this document and the product(s) described herein, have been included in section 'Legal information'.

© NXP B.V. 2006. **All rights reserved.**

For more information, please visit: http://www.nxp.com
For sales office addresses, please send an email to: salesaddresses@nxp.com

Date of release: 1 December 2006
Document identifier: PHD98N03LT_5

founded by

PHILIPS