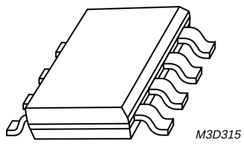


Si9925DY

N-channel enhancement mode field-effect transistor

Rev. 01 — 20 July 2001 **Product data**

1. Description

Dual N-channel enhancement mode field-effect transistor in a plastic package using TrenchMOS™[1] technology.

Product availability:

Si9925DY in SOT96-1 (SO8).

2. Features

- Low on-state resistance
- Fast switching
- TrenchMOS™ technology.

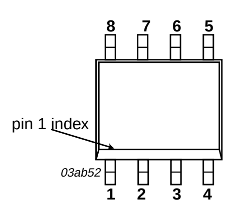
3. Applications

- DC to DC convertors
- DC motor control
- Lithium-ion battery applications
- Notebook PC
- Portable equipment applications.

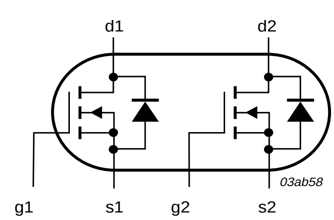
4. Pinning information

Table 1: Pinning - SOT96-1, simplified outline and symbol

Pin	Description	Simplified outline	Symbol
1	source 1 (s_1)		
2	gate 1 (g_1)		
3	source 2 (s_2)		
4	gate 2 (g_2)		
5,6	drain 2 (d_2)		
7,8	drain 1 (d_1)		



SOT96-1 (SO8)



1. TrenchMOS is a trademark of Royal Philips Electronics.

PHILIPS

5. Quick reference data

Table 2: Quick reference data

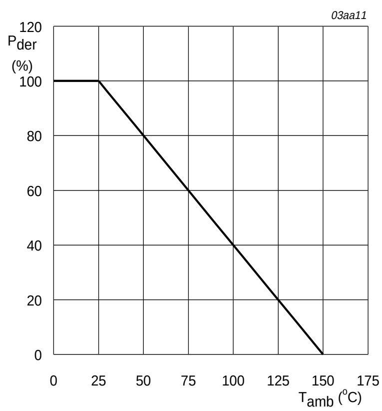
Symbol	Parameter	Conditions	Typ	Max	Unit
V_{DS}	drain-source voltage (DC)	T_j = 25 to 150 °C	–	20	V
I_D	drain current (DC)	T_{amb} = 25 °C; pulsed; $t_p \leq$ 10 s	–	5	A
P_{tot}	total power dissipation	T_{amb} = 25 °C; pulsed; $t_p \leq$ 10 s	–	2	W
T_j	junction temperature		–	150	°C
R_{DSon}	drain-source on-state resistance	V_{GS} = 7.2 V; I_D = 5 A	38	45	mΩ
		V_{GS} = 4.5 V; I_D = 5 A	41	50	mΩ
		V_{GS} = 3 V; I_D = 3.9 A	50	60	mΩ
		V_{GS} = 2.5 V; I_D = 1 A	62	80	mΩ

6. Limiting values

Table 3: Limiting values

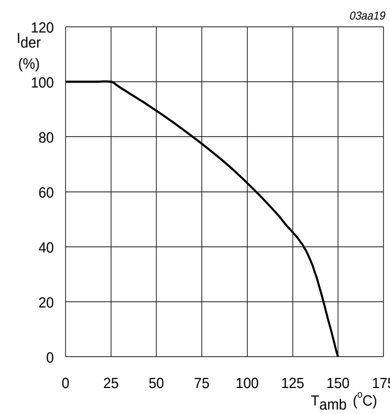
In accordance with the Absolute Maximum Rating System (IEC 60134).

Symbol	Parameter	Conditions	Min	Max	Unit
V_{DS}	drain-source voltage (DC)	T_j = 25 to 150 °C	–	20	V
V_{GS}	gate-source voltage (DC)		–	±12	V
I_D	drain current (DC)	T_{amb} = 25 °C; pulsed; $t_p \leq$ 10 s; Figure 2 and 3	–	5	A
		T_{amb} = 70 °C; pulsed; $t_p \leq$ 10 s; Figure 2	–	4	A
I_{DM}	peak drain current	T_{amb} = 25 °C; pulsed; $t_p \leq$ 10 µs; Figure 3	–	48	A
P_{tot}	total power dissipation	T_{amb} = 25 °C; pulsed; $t_p \leq$ 10 s; Figure 1	–	2	W
		T_{amb} = 70 °C; pulsed; $t_p \leq$ 10 s; Figure 1	–	1.3	W
T_{stg}	storage temperature		–55	+150	°C
T_j	operating junction temperature		–55	+150	°C
Source-drain diode					
I_S	source (diode forward) current (DC)	T_{amb} = 25 °C	–	1.3	A



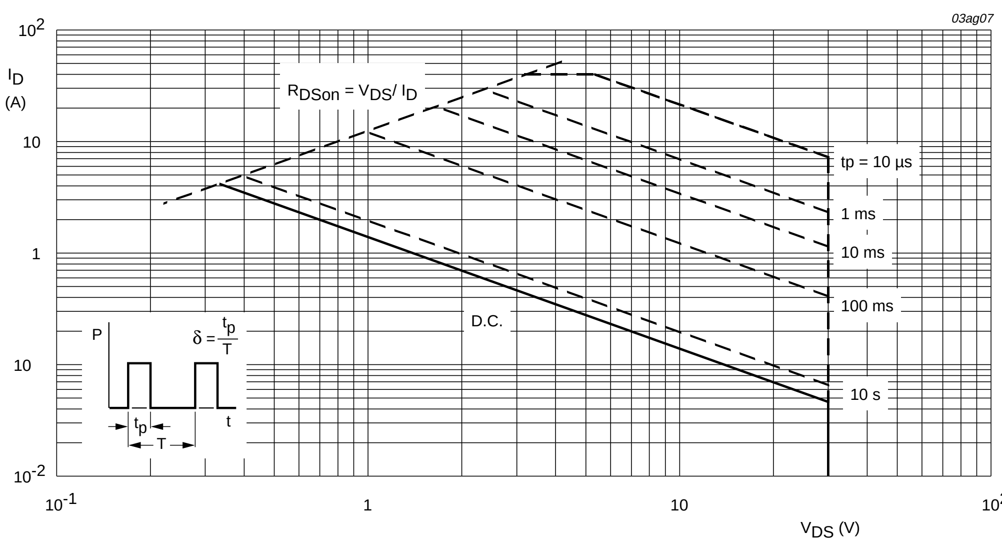
$$P_{der} = \frac{P_{tot}}{P_{tot(25^{\circ}C)}} \times 100\%$$

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



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

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



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

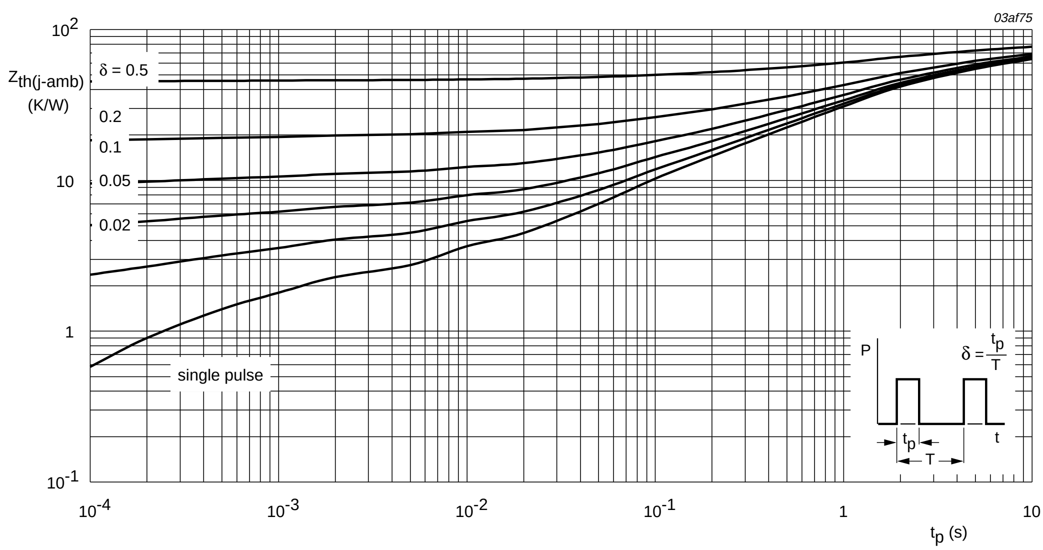
Fig 3. Safe operating area; continuous and peak drain currents as a function of drain-source voltage.

7. Thermal characteristics

Table 4: Thermal characteristics

Symbol	Parameter	Conditions	Value	Unit
$R_{th(j-a)}$	thermal resistance from junction to ambient	mounted on a printed circuit board; minimum footprint; Figure 4	62.5	K/W

7.1 Transient thermal impedance



T_{amb} = 25 °C

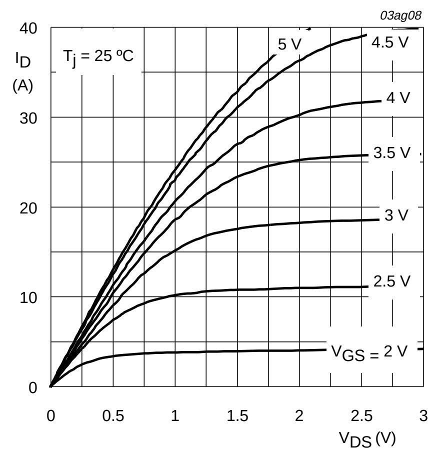
Fig 4. Transient thermal impedance from junction to ambient as a function of pulse duration.

8. Characteristics

Table 5: Characteristics

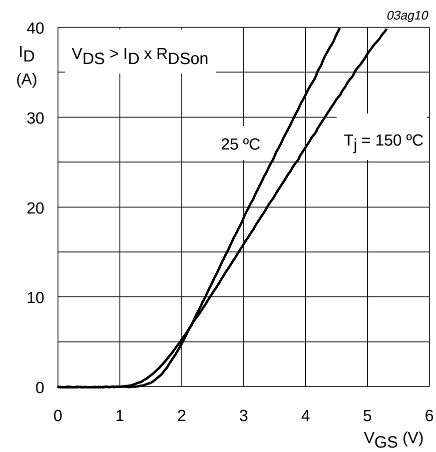
T_j = 25 °C unless otherwise specified

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
Static characteristics						
$V_{GS(th)}$	gate-source threshold voltage	I_D = 250 µA; V_{DS} = V_{GS}; Figure 9	0.8	–	–	V
I_{DSS}	drain-source leakage current	V_{DS} = 16 V; V_{GS} = 0 V; T_j = 25 °C	–	–	1	µA
		V_{DS} = 10 V; V_{GS} = 0 V; T_j = 70 °C	–	–	5	µA
I_{GSS}	gate-source leakage current	V_{GS} = ±12 V; V_{DS} = 0 V	–	–	100	nA
R_{DSon}	drain-source on-state resistance	V_{GS} = 10 V; I_D = 10 A; Figure 7 and 8	25	38	45	mΩ
		V_{GS} = 4.5 V; I_D = 5 A; Figure 7 and 8	–	41	50	mΩ
		V_{GS} = 3 V; I_D = 3.9 A; Figure 7 and 8	–	50	60	mΩ
		V_{GS} = 2.5 V; I_D = 1 A; Figure 7 and 8	–	62	80	mΩ
Dynamic characteristics						
g_{fs}	forward transconductance	V_{DS} = 15 V; I_D = 10 A	–	14	–	S
$Q_{g(tot)}$	total gate charge	I_D = 5 A; V_{DS} = 6 V; V_{GS} = 4.5 V; Figure 13	–	9	20	nC
Q_{gs}	gate-source charge		–	2	–	nC
Q_{gd}	gate-drain (Miller) charge		–	2.6	–	nC
$t_{d(on)}$	turn-on delay time	V_{DD} = 6 V; R_D = 6 Ω; V_{GS} = 10 V; R_G = 6 Ω	–	14	40	ns
t_r	turn-on rise time		–	13	30	ns
$t_{d(off)}$	turn-off delay time		–	35	60	ns
t_f	turn-off fall time		–	9	30	ns
Source-drain (reverse) diode						
V_{SD}	source-drain (diode forward) voltage	I_S = 2.3A; V_{GS} = 0 V; Figure 12	–	0.81	1.2	V
t_{rr}	reverse recovery time	I_S = 5 A; dI_S/dt = –100 A/µs; V_{GS} = 0 V	–	60	150	ns



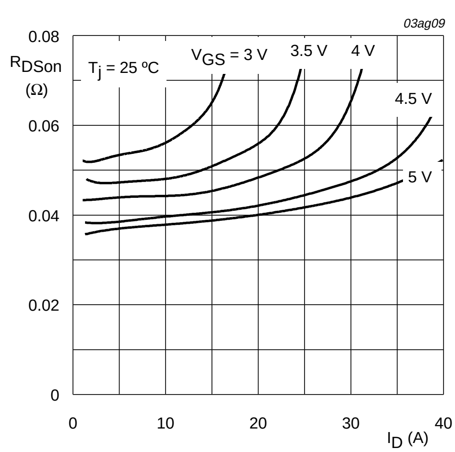
T_j = 25 °C

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



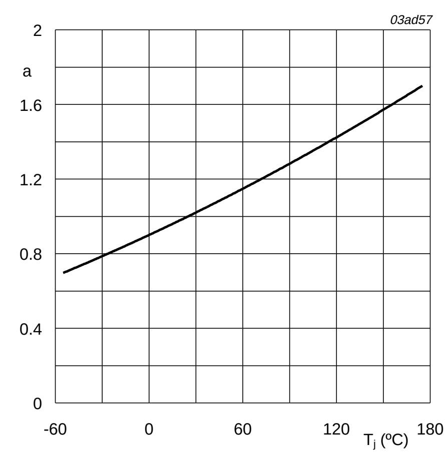
T_j = 25 °C and 150 °C; $V_{DS} > I_D \times R_{DSon}$

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



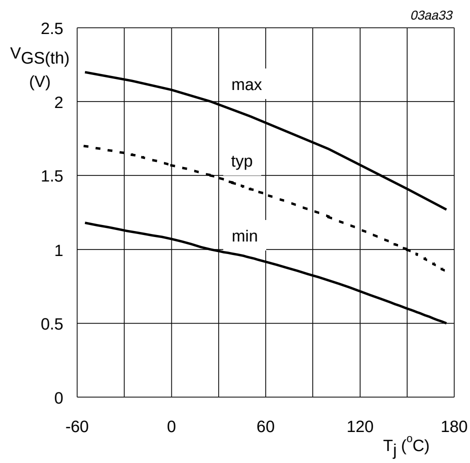
T_j = 25 °C

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



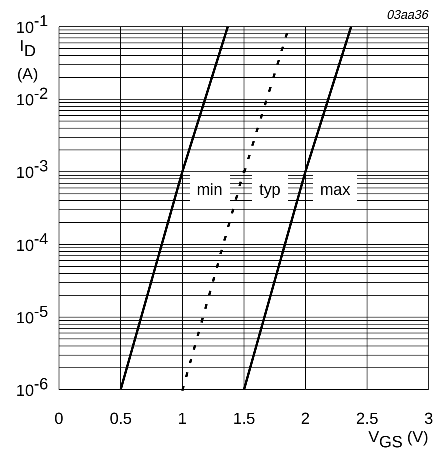
$$a = \frac{R_{DSon}}{R_{DSon(25^{\circ}C)}}$$

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



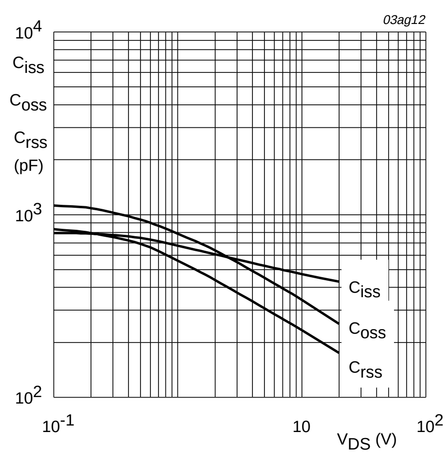
I_D = 250 µA; $V_{DS} = V_{GS}$

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



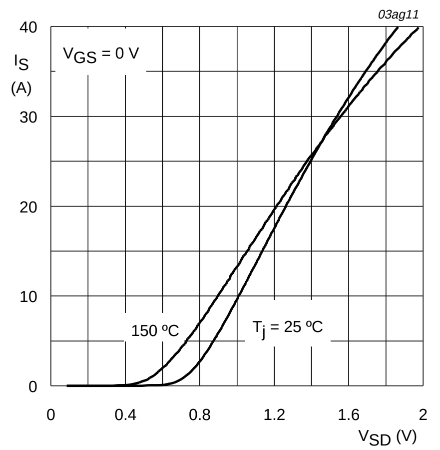
T_j = 25 °C; V_{DS} = 5 V

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



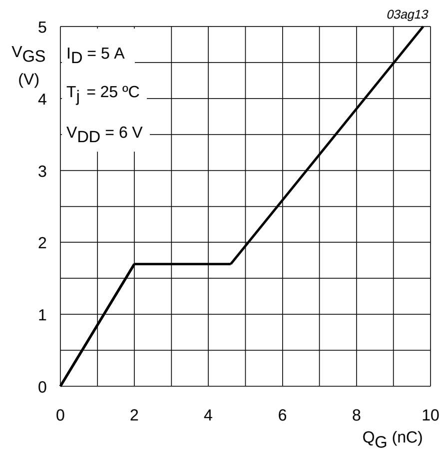
V_{GS} = 0 V; f = 1 MHz

Fig 11. Input, output and reverse transfer capacitances as a function of drain-source voltage; typical values.



T_j = 25 °C and 150 °C; V_{GS} = 0 V

Fig 12. Source (diode forward) current as a function of source-drain (diode forward) voltage; typical values.

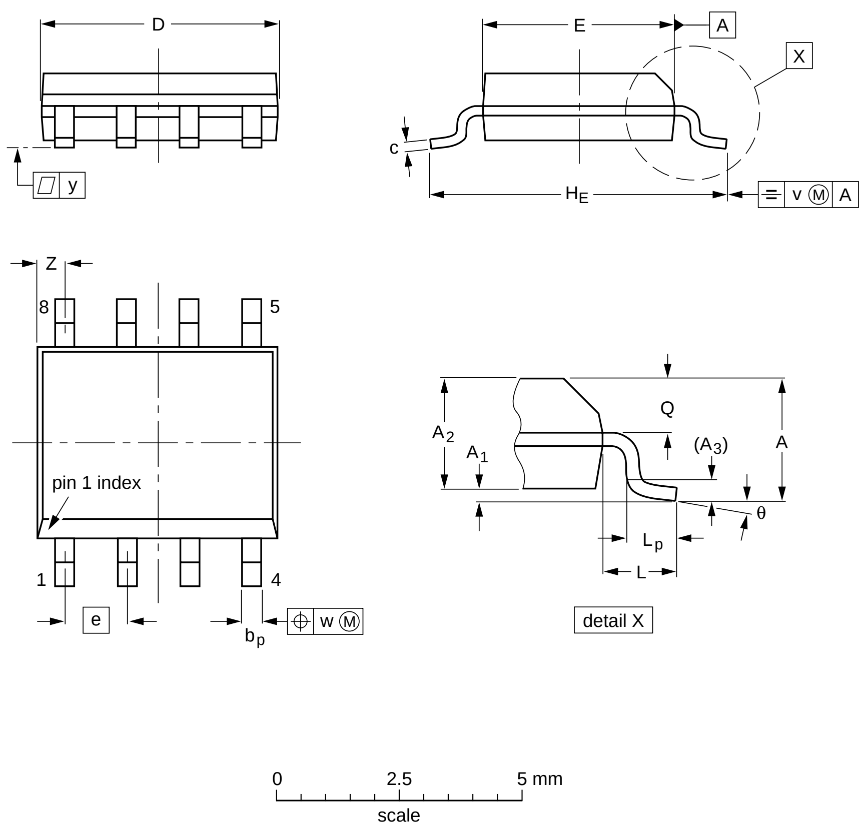


I_D = 5 A; V_{DD} = 6 V

Fig 13. Gate-source voltage as a function of gate charge; typical values.

9. 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	0.050	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 maximum per side are not included.
2. Plastic or metal protrusions of 0.25 mm maximum per side are not included.

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	EIAJ			
SOT96-1	076E03	MS-012				~~97-05-22~~ 99-12-27

Fig 14. SOT96-1 (SO8).

10. Revision history

Table 6: Revision history

Rev	Date	CPCN	Description
01	20010720	-	Product data; initial version

11. Data sheet status

Data sheet status [1]	Product status [2]	Definition
Objective data	Development	This data sheet contains data from the objective specification for product development. Philips Semiconductors reserves the right to change the specification in any manner without notice.
Preliminary data	Qualification	This data sheet contains data from the preliminary specification. Supplementary data will be published at a later date. Philips Semiconductors reserves the right to change the specification without notice, in order to improve the design and supply the best possible product.
Product data	Production	This data sheet contains data from the product specification. Philips Semiconductors reserves the right to make changes at any time in order to improve the design, manufacturing and supply. Changes will be communicated according to the Customer Product/Process Change Notification (CPCN) procedure SNW-SQ-650A.

[1] Please consult the most recently issued data sheet before initiating or completing a design.

[2] The product status of the device(s) described in this data sheet may have changed since this data sheet was published. The latest information is available on the Internet at URL http://www.semiconductors.philips.com.

12. Definitions

Short-form specification — The data in a short-form specification is extracted from a full data sheet with the same type number and title. For detailed information see the relevant data sheet or data handbook.

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

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

13. Disclaimers

Life support — These products are not designed for use in life support appliances, devices, or systems where malfunction of these products can reasonably be expected to result in personal injury. Philips Semiconductors customers using or selling these products for use in such applications do so at their own risk and agree to fully indemnify Philips Semiconductors for any damages resulting from such application.

Right to make changes — Philips Semiconductors reserves the right to make changes, without notice, in the products, including circuits, standard cells, and/or software, described or contained herein in order to improve design and/or performance. Philips Semiconductors assumes no responsibility or liability for the use of any of these products, conveys no licence or title under any patent, copyright, or mask work right to these products, and makes no representations or warranties that these products are free from patent, copyright, or mask work right infringement, unless otherwise specified.

Philips Semiconductors - a worldwide company

Argentina: see South America
Australia: Tel. +61 2 9704 8141, Fax. +61 2 9704 8139
Austria: Tel. +43 160 101, Fax. +43 160 101 1210
Belarus: Tel. +375 17 220 0733, Fax. +375 17 220 0773
Belgium: see The Netherlands
Brazil: see South America
Bulgaria: Tel. +359 268 9211, Fax. +359 268 9102
Canada: Tel. +1 800 234 7381
China/Hong Kong: Tel. +852 2 319 7888, Fax. +852 2 319 7700
Colombia: see South America
Czech Republic: see Austria
Denmark: Tel. +45 3 288 2636, Fax. +45 3 157 0044
Finland: Tel. +358 961 5800, Fax. +358 96 158 0920
France: Tel. +33 1 4728 6600, Fax. +33 1 4728 6638
Germany: Tel. +49 40 23 5360, Fax. +49 402 353 6300
Hungary: Tel. +36 1 382 1700, Fax. +36 1 382 1800
India: Tel. +91 22 493 8541, Fax. +91 22 493 8722
Indonesia: see Singapore
Ireland: Tel. +353 17 64 0000, Fax. +353 17 64 0200
Israel: Tel. +972 36 45 0444, Fax. +972 36 49 1007
Italy: Tel. +39 039 203 6838, Fax +39 039 203 6800
Japan: Tel. +81 33 740 5130, Fax. +81 3 3740 5057
Korea: Tel. +82 27 09 1412, Fax. +82 27 09 1415
Malaysia: Tel. +60 37 50 5214, Fax. +60 37 57 4880
Mexico: Tel. +9-5 800 234 7381
Middle East: see Italy
Netherlands: Tel. +31 40 278 2785, Fax. +31 40 278 8399
New Zealand: Tel. +64 98 49 4160, Fax. +64 98 49 7811
Norway: Tel. +47 22 74 8000, Fax. +47 22 74 8341
Philippines: Tel. +63 28 16 6380, Fax. +63 28 17 3474
Poland: Tel. +48 22 5710 000, Fax. +48 22 5710 001
Portugal: see Spain
Romania: see Italy
Russia: Tel. +7 095 755 6918, Fax. +7 095 755 6919
Singapore: Tel. +65 350 2538, Fax. +65 251 6500
Slovakia: see Austria
Slovenia: see Italy
South Africa: Tel. +27 11 471 5401, Fax. +27 11 471 5398
South America: Tel. +55 11 821 2333, Fax. +55 11 829 1849
Spain: Tel. +34 33 01 6312, Fax. +34 33 01 4107
Sweden: Tel. +46 86 32 2000, Fax. +46 86 32 2745
Switzerland: Tel. +41 14 88 2686, Fax. +41 14 81 7730
Taiwan: Tel. +886 22 134 2451, Fax. +886 22 134 2874
Thailand: Tel. +66 23 61 7910, Fax. +66 23 98 3447
Turkey: Tel. +90 216 522 1500, Fax. +90 216 522 1813
Ukraine: Tel. +380 44 264 2776, Fax. +380 44 268 0461
United Kingdom: Tel. +44 208 730 5000, Fax. +44 208 754 8421
United States: Tel. +1 800 234 7381
Uruguay: see South America
Vietnam: see Singapore
Yugoslavia: Tel. +381 11 3341 299, Fax. +381 11 3342 553

For all other countries apply to: Philips Semiconductors, Marketing Communications,
Building BE, P.O. Box 218, 5600 MD EINDHOVEN,
The Netherlands, Fax. +31 40 272 4825

Internet: http://www.semiconductors.philips.com

(SCA72)

Contents

Date of release: 20 July 2001 **Document order number: 9397 750 08415**