SiliconMAX

PSMN038-100K

N-channel enhancement mode field-effect transistor

Rev. 01 — 16 January 2001 **Product specification**

1. Description

SiliconMAX™[1] products use the latest Philips TrenchMOS™[2] technology to achieve the lowest possible on-state resistance in a SOT96-1 (SO8) package.

Product availability:

PSMN038-100K in SOT96-1 (SO8).

2. Features

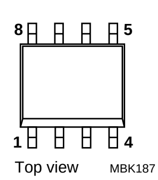
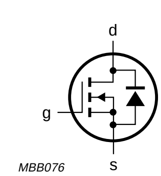
- Very low on-state resistance
- Fast switching
- TrenchMOS™ technology.

3. Applications

- DC to DC convertor
- Computer motherboards
- Switch mode power supplies.

4. Pinning information

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

Pin	Description	Simplified outline	Symbol
1,2,3	source (s)	 SOT96-1 (SO8)	
4	gate (g)		
5,6,7,8	drain (d)		

1. SiliconMAX is a trademark of Royal Philips Electronics.
2. TrenchMOS is a trademark of Royal Philips Electronics.

PHILIPS

5. Quick reference data

Table 2: Quick reference data

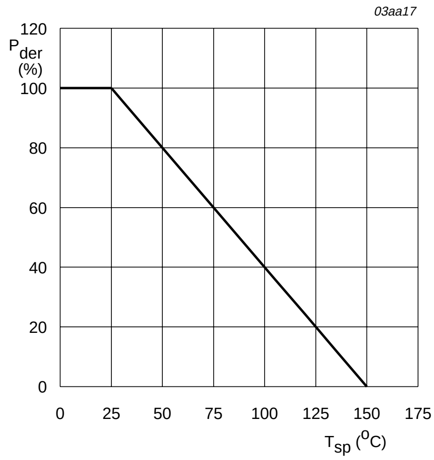
Symbol	Parameter	Conditions	Typ	Max	Unit
V_{DS}	drain-source voltage (DC)	T_j = 25 to 150 °C	–	100	V
I_D	drain current (DC)	T_{sp} = 80 °C; Figure 2 and 3	–	6.3	A
P_{tot}	total power dissipation	T_{sp} = 80 °C; Figure 1	–	3.5	W
T_j	junction temperature		–	150	°C
R_{DSon}	drain-source on-state resistance	V_{GS} = 10 V; I_D = 5.2 A; T_j = 25 °C	33	38	mΩ

6. Limiting values

Table 3: Limiting values

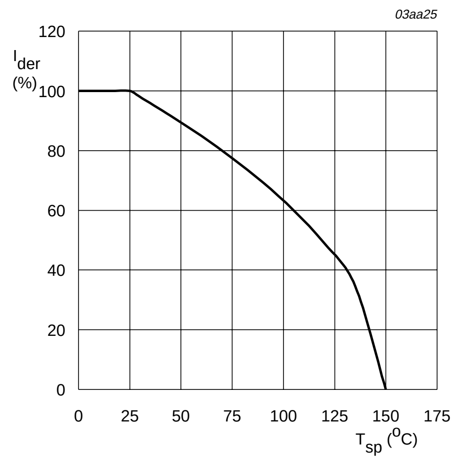
In accordance with the Absolute Maximum Rating System (IEC 60134).

Symbol	Parameter	Conditions	Min	Max	Unit
V_{DS}	drain-source voltage (DC)	T_j = 25 to 150 °C	–	100	V
V_{GS}	gate-source voltage (DC)		–	±20	V
I_D	drain current (DC)	T_{sp} = 80 °C	–	6.3	A
I_{DM}	peak drain current	T_{sp} = 25 °C; pulsed; $t_p \leq 10$ µs	–	50	A
P_{tot}	total power dissipation	T_{sp} = 80 °C	–	3.5	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_{sp} = 80 °C	–	3.1	A
I_{SM}	peak source (diode forward) current	T_{sp} = 25 °C; pulsed; $t_p \leq 10$ µs	–	50	A



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

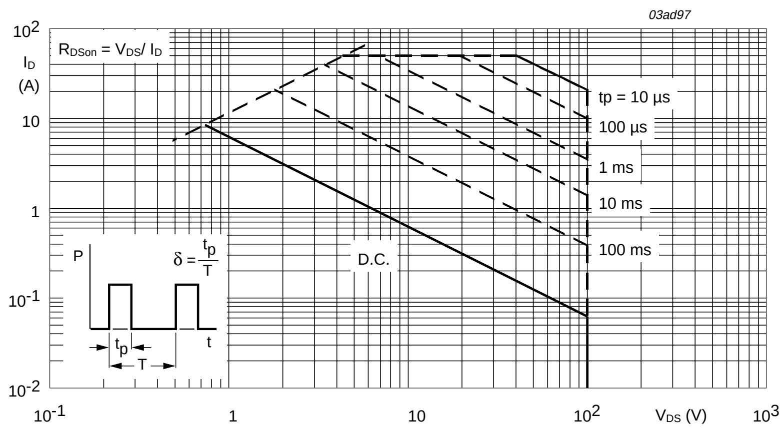
Fig 1. Normalized total power dissipation as a function of solder point temperature.



$V_{GS} \geq 5$ V

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

Fig 2. Normalized continuous drain current as a function of solder point temperature.



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

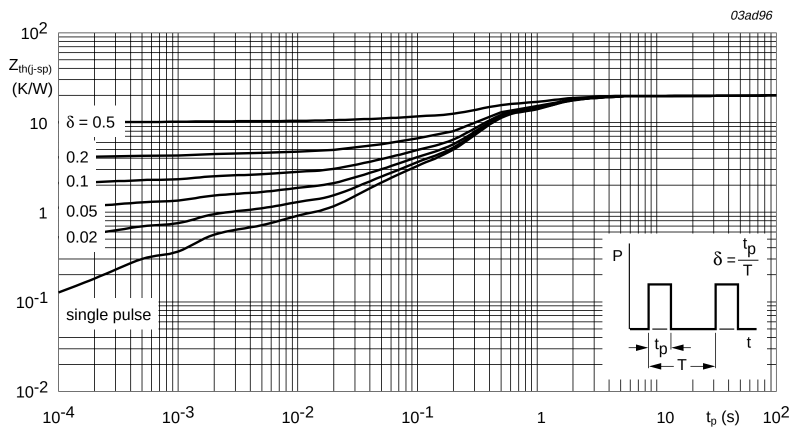
Fig 3. Safe operating area; continuous and peak drain currents as a function of drain-source voltage.

7. Thermal characteristics

Table 4: Thermal characteristics

Symbol	Parameter	Conditions	Value	Unit
$R_{th(j-sp)}$	thermal resistance from junction to solder point	mounted on a metal clad substrate; Figure 4	20	K/W

7.1 Transient thermal impedance



T_{sp} = 25 °C

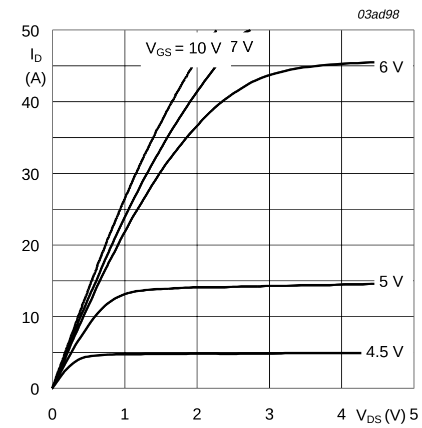
Fig 4. Transient thermal impedance from junction to solder point as a function of pulse duration.

8. Characteristics

Table 5: Characteristics

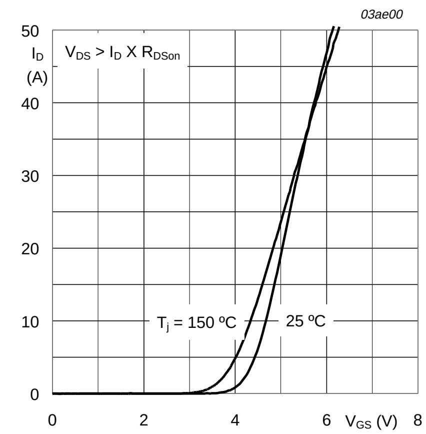
T_j = 25 °C unless otherwise specified

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
Static characteristics						
$V_{(BR)DSS}$	drain-source breakdown voltage	I_D = 250 µA; V_{GS} = 0 V	100	130	–	V
$V_{GS(th)}$	gate-source threshold voltage	I_D = 1 mA; V_{DS} = V_{GS}; Figure 9				
		T_j = 25 °C	2	–	4	V
		T_j = 150 °C	1.2	–	–	V
		T_j = –55 °C	–	–	6	V
I_{DSS}	drain-source leakage current	V_{DS} = 80 V; V_{GS} = 0 V; T_j = 25 °C	–	–	1	µA
		V_{DS} = 100 V; V_{GS} = 0 V; T_j = 150 °C	–	–	0.5	mA
I_{GSS}	gate-source leakage current	V_{GS} = ±20 V; V_{DS} = 0 V	–	–	100	nA
R_{DSon}	drain-source on-state resistance	V_{GS} = 10 V; I_D = 5.2 A; Figure 7 and 8				
		T_j = 25 °C	–	33	38	mΩ
		T_j = 150 °C	–	76	88	mΩ
Dynamic characteristics						
g_{fs}	forward transconductance	V_{DS} = 15 V; I_D = 6.3 A; Figure 11	–	20	–	S
$Q_{g(tot)}$	total gate charge	I_D = 6.3 A; V_{DD} = 50 V; V_{GS} = 10 V; Figure 14	–	43	–	nC
Q_{gs}	gate-source charge		–	6.5	–	nC
Q_{gd}	gate-drain (Miller) charge		–	16	21.5	nC
C_{iss}	input capacitance	V_{GS} = 0 V; V_{DS} = 25 V; f = 1 MHz; Figure 12	–	1740	–	pF
C_{oss}	output capacitance		–	220	–	pF
C_{rss}	reverse transfer capacitance		–	135	–	pF
$t_{d(on)}$	turn-on delay time	V_{DD} = 50 V; I_D = 1 A; V_{GS} = 10 V; R_G = 6 Ω	–	15	30	ns
t_r	rise time		–	13	25	ns
$t_{d(off)}$	turn-off delay time		–	50	80	ns
t_f	fall time		–	25	40	ns
Source-drain (reverse) diode						
V_{SD}	source-drain (diode forward) voltage	I_S = 2.3 A; V_{GS} = 0 V; Figure 13	–	0.7	1.1	V
t_{rr}	reverse recovery time	I_S = 6.3 A; dI_S/dt = –100 A/µs; V_{GS} = 0 V	–	85	–	ns
Q_r	recovery charge		–	0.3	–	µC



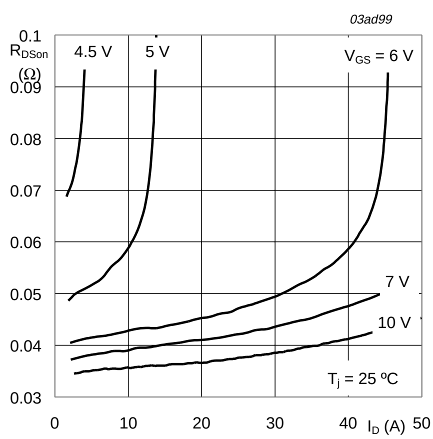
$T_j = 25\ °C$

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



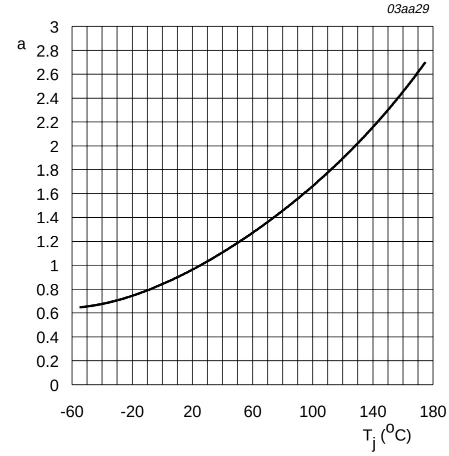
$T_j = 25\ °C$ and $150\ °C$; $V_{DS} > I_D \times R_{DSon}$

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



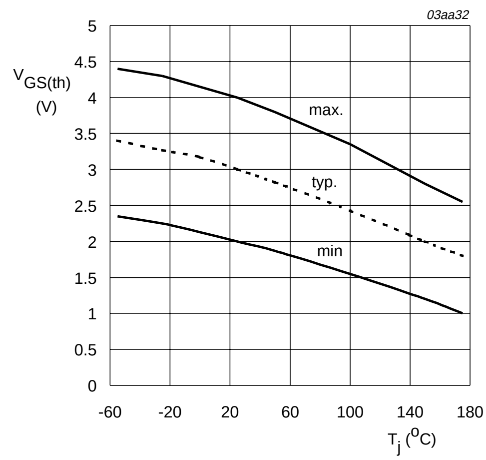
$T_j = 25\ °C$

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



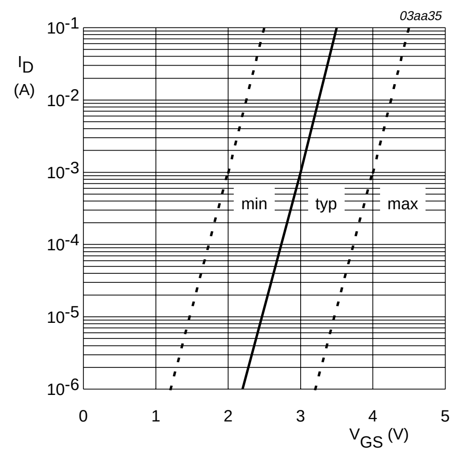
$$a = \frac{R_{DSon}}{R_{DSon(25^\circ C)}}$$

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



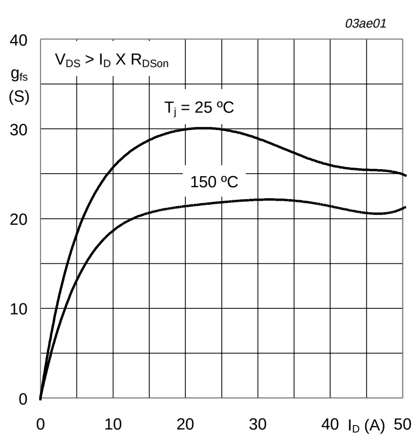
I_D = 1 mA; $V_{DS} = V_{GS}$

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



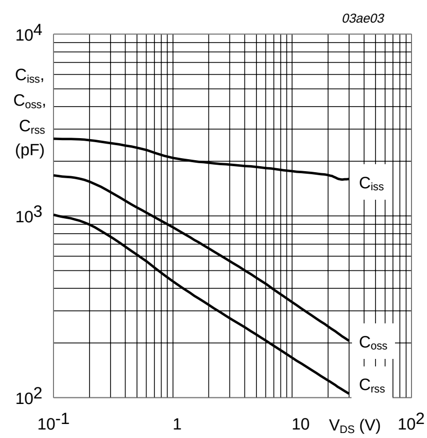
T_j = 25 °C; V_{DS} = 5 V

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



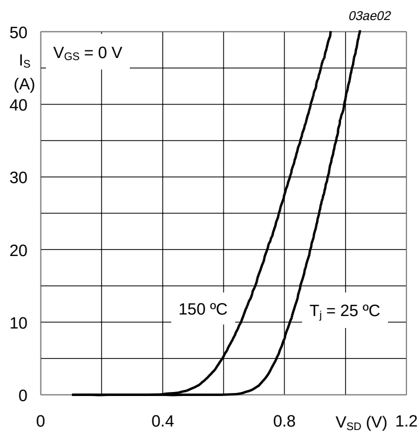
T_j = 25 °C and 150 °C; $V_{DS} > I_D \times R_{DSon}$

Fig 11. Forward transconductance as a function of drain current; typical values.



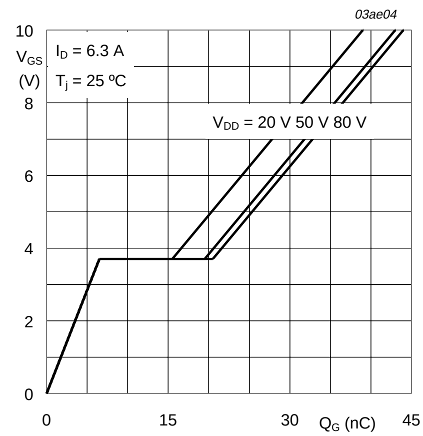
V_{GS} = 0 V; f = 1 MHz

Fig 12. 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 13. Source (diode forward) current as a function of source-drain (diode forward) voltage; typical values.

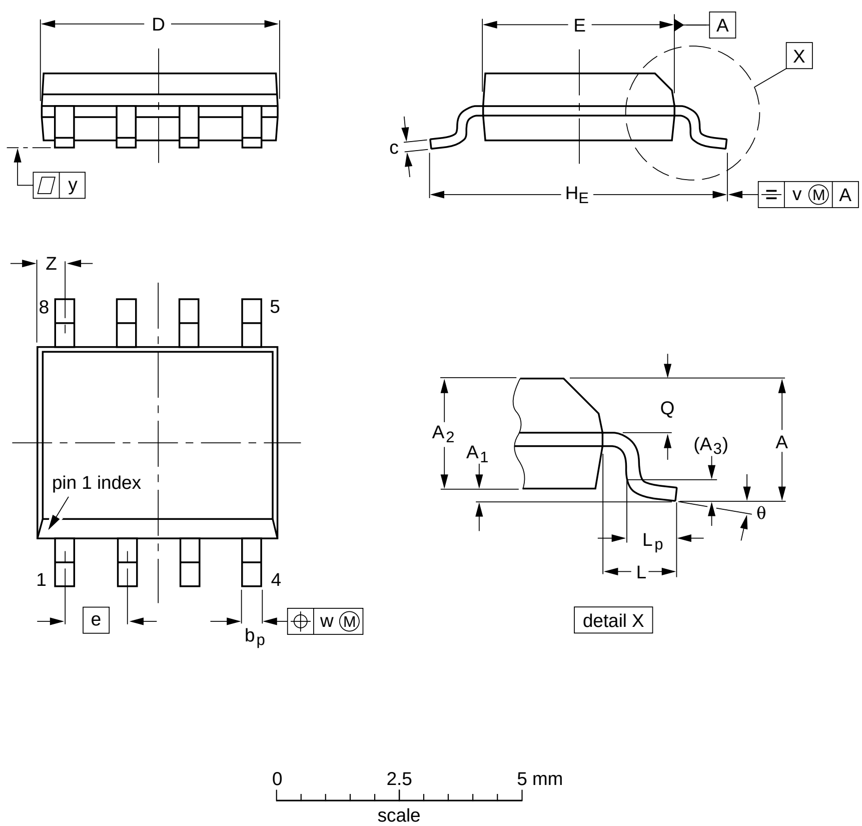


I_D = 6.3 A; V_{DD} = 20 V, 50 V and 80 V

Fig 14. 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 15. SOT96-1 (SO8).

10. Revision history

Table 6: Revision history

Rev	Date	CPCN	Description
01	20010116	-	Product specification; initial version

11. Data sheet status

Datasheet status	Product status	Definition [1]
Objective specification	Development	This data sheet contains the design target or goal specifications for product development. Specification may change in any manner without notice.
Preliminary specification	Qualification	This data sheet contains preliminary data, and supplementary data will be published at a later date. Philips Semiconductors reserves the right to make changes at any time without notice in order to improve design and supply the best possible product.
Product specification	Production	This data sheet contains final specifications. Philips Semiconductors reserves the right to make changes at any time without notice in order to improve design and supply the best possible product.

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

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 14 099 6161, Fax. +33 14 099 6427
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

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

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

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

(SCA71)

Contents

Date of release: 16 January 2001 **Document order number: 9397 750 07897**

PHILIPS

Let's make things better.