

# DATA SHEET

## **SAA6579** Radio Data System (RDS) demodulator

Product specification  
Supersedes data of January 1994  
File under Integrated Circuits, IC01

1997 Feb 24

## Radio Data System (RDS) demodulator

SAA6579

## FEATURES

- Anti-aliasing filter (2nd order)
- Integrated 57 kHz band-pass filter (8th order)
- Reconstruction filter (2nd order)
- Clocked comparator with automatic offset compensation
- 57 kHz carrier regeneration
- Synchronous demodulator for 57 kHz modulated RDS signals
- Selectable 4.332/8.664 MHz crystal oscillator with variable dividers
- Clock regeneration with lock on biphase data rate
- Biphase symbol decoder with integrate and dump functions
- Differential decoder
- Signal quality detector
- Subcarrier output.

## GENERAL DESCRIPTION

The integrated CMOS circuit SAA6579 is an RDS demodulator. It recovers the additional inaudible RDS information which is transmitted by FM radio broadcasting.

The data signal RDDA and the clock signal RDCL are provided as outputs for further processing by a suitable decoder (microcomputer).

The operational functions of the device are in accordance with the "CENELEC EN 50067".

## QUICK REFERENCE DATA

SYMBOL	PARAMETER	MIN.	TYP.	MAX.	UNIT
V <sub>DDA</sub>	analog supply voltage (pin 5)	3.6	5.0	5.5	V
V <sub>DDD</sub>	digital supply voltage (pin 12)	3.6	5.0	5.5	V
I <sub>tot</sub>	total supply current	–	6	–	mA
V <sub>i(rms)</sub>	RDS input amplitude (RMS value; pin 4)	1	–	–	mV
V <sub>OH</sub>	HIGH level output voltage for signals RDDA, RDCL, QUAL and T57	4.4	–	–	V
V <sub>OL</sub>	LOW level output voltage for signals RDDA, RDCL, QUAL and T57	–	–	0.4	V
T <sub>amb</sub>	operating ambient temperature	–40	–	+85	°C

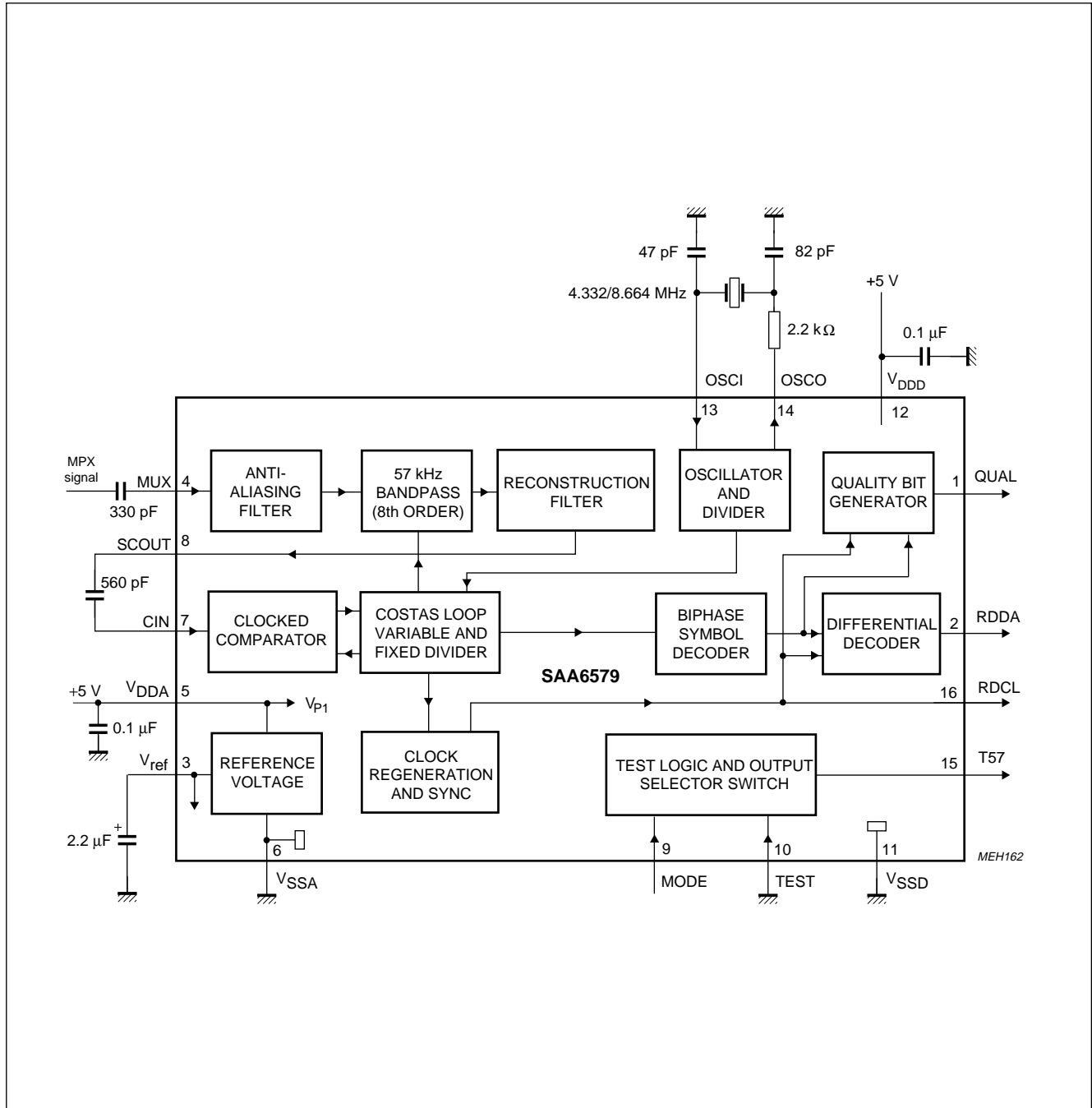
## ORDERING INFORMATION

TYPE NUMBER	PACKAGE		
	NAME	DESCRIPTION	VERSION
SAA6579	DIP16	plastic dual in-line package; 16 leads (300 mil); long body	SOT38-1
SAA6579T	SO16	plastic small outline package; 16 leads; body width 7.5 mm	SOT162-1

Radio Data System (RDS) demodulator

SAA6579

BLOCK DIAGRAM



Via pin MODE two different crystal frequencies can be used.

MODE	CRYSTAL CLOCK
LOW	4.332 MHz
HIGH	8.664 MHz

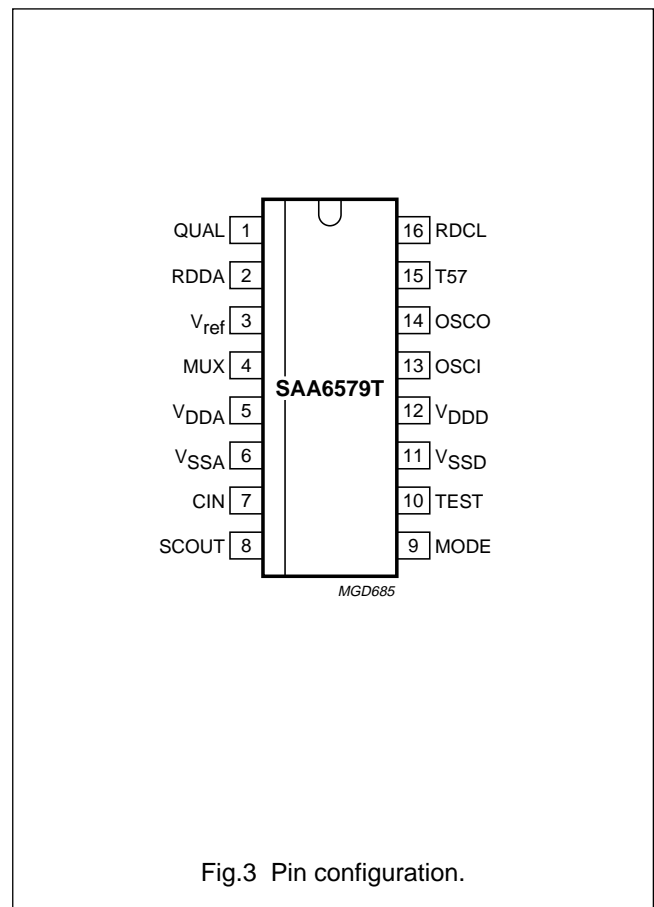
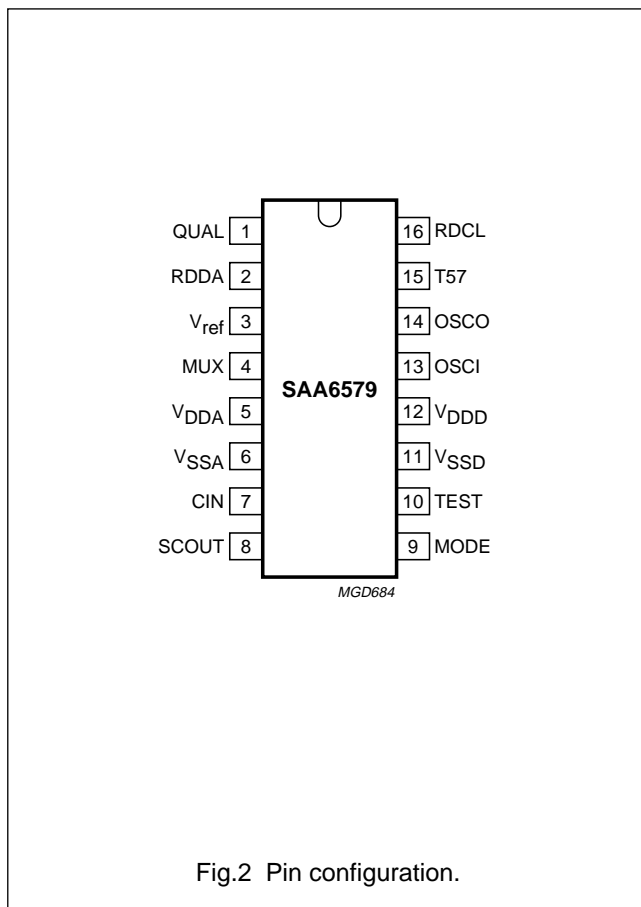
Fig.1 Block diagram and application circuit.

# Radio Data System (RDS) demodulator

# SAA6579

## PINNING

SYMBOL	PIN	DESCRIPTION
QUAL	1	quality indication output
RDDA	2	RDS data output
V <sub>ref</sub>	3	reference voltage output (0.5V <sub>DDA</sub> )
MUX	4	multiplex signal input
V <sub>DDA</sub>	5	+5 V supply voltage for analog part
V <sub>SSA</sub>	6	ground for analog part (0 V)
CIN	7	subcarrier input to comparator
SCOUT	8	subcarrier output of reconstruction filter
MODE	9	oscillator mode/test control input
TEST	10	test enable input
V <sub>SSD</sub>	11	ground for digital part (0 V)
V <sub>DDD</sub>	12	+5 V supply voltage for digital part
OSCI	13	oscillator input
OSCO	14	oscillator output
T57	15	57 kHz clock signal output
RDCL	16	RDS clock output



# Radio Data System (RDS) demodulator

# SAA6579

## LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134); ground pins 6 and 11 connected together.

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V <sub>DDA</sub>	analog supply voltage (pin 5)		0	6	V
V <sub>DDD</sub>	digital supply voltage (pin 12)		0	6	V
V <sub>n</sub>	voltage on all pins; grounds excluded		-0.5	V <sub>DDX</sub> + 0.5	V
T <sub>stg</sub>	storage temperature		-40	+150	°C
T <sub>amb</sub>	operating ambient temperature		-40	+85	°C
V <sub>es</sub>	electrostatic handling for all pins except pins 9 and 10	note 1	±300	-	V
		note 2	+1500	-3000	V

### Notes

1. Equivalent to discharging a 200 pF capacitor via a 0 Ω series resistor.
2. Equivalent to discharging a 100 pF capacitor via a 1.5 kΩ series resistor.

## FUNCTIONAL DESCRIPTION

The SAA6579 is a demodulator circuit for RDS applications. It contains a 57 kHz bandpass filter and a digital demodulator to regenerate the RDS data stream out of the multiplex signal (MPX).

### Filter part

The MUX signal is band-limited by a second-order anti-aliasing-filter and fed through a 57 kHz band-pass filter (8th order band-pass filter with 3 kHz bandwidth) to separate the RDS signals. This filter uses switched capacitor technique and is clocked by a clock frequency of 541.5 kHz derived from the 4.332/8.664 MHz crystal oscillator. Then the signal is fed to the reconstruction filter to smooth the sampled and filtered RDS signal before it is output on pin 8. The signal is AC-coupled to the comparator (pin 7). The comparator is clocked with a frequency of 228 kHz (synchronized by the 57 kHz of the demodulator).

### Digital part

The synchronous demodulator (Costas loop circuit) with carrier regeneration demodulates the internal coupled, digitized signal. The suppressed carrier is recovered from the two sidebands (Costas loop). The demodulated signal is low-pass-filtered in such a way that the overall pulse shape (transmitter and receiver) approaches a cosinusoidal form in conjunction with the following Integrate and dump circuit.

The data-spectrum shaping is split into two equal parts and handled in the transmitter and in the receiver. Ideally, the data filtering should be equal in both of these parts.

The overall data-channel-spectrum shaping of the transmitter and the receiver is approximately 100% roll-off.

The Integrate and dump circuit performs an integration over a clock period. This results in a demodulated and valid RDS signal in form of biphasic symbols being output from the integrate and dump circuit. The final stages of RDS data processing are the biphasic symbol decoding and the differential decoding. After synchronization by data clock RDCL (pin 16) data appears on the RDDA output (pin 2). The output of the biphasic symbol decoder is evaluated by a special circuit to provide an indication of good data (QUAL = HIGH) or corrupt data (QUAL = LOW).

### Timing

Fixed and variable dividers are applied to the 4.332/8.664 MHz crystal oscillator to generate the 1.1875 kHz RDS clock RDCL, which is synchronized by the incoming data. Which ever clock edge is considered (positive or negative going edge) the data will remain valid for 399 μs after the clock transition. The timing of data change is 4 μs before a clock change. Which clock transition (positive or negative going clock) the data change occurs in, depends on the lock conditions and is arbitrary (bit slip).

During poor reception it is possible that faults in phase occur, then the clock signal stays uninterrupted, and data is constant for 1.5 clock periods. Normally, faults in phase do not occur on a cyclic basis. If however, faults in phase occur in this way, the minimum spacing between two possible faults in phase depends on the data being transmitted. The minimum spacing cannot be less than 16 clock periods. The quality bit changes only at the time of a data change.

## Radio Data System (RDS) demodulator

SAA6579

**CHARACTERISTICS**

$V_{DDA} = V_{DDD} = 5\text{ V}$ ;  $T_{\text{amb}} = 25\text{ °C}$  and measurements taken in Fig.1; unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
$V_{DDA}$	analog supply voltage (pin 5)		3.6	5.0	5.5	V
$V_{DDD}$	digital supply voltage (pin 12)		3.6	5.0	5.5	V
$I_{\text{tot}}$	total supply current	$I_5 + I_{12}$	–	6	–	mA
$V_{\text{ref}}$	reference voltage (pin 3)	$V_{DDA} = 5\text{ V}$	–	2.5	–	V
<b>MPX input (signal before the capacitor on pin 4)</b>						
$V_{i\text{ MPX(rms)}}$	RDS amplitude (RMS value)	$\Delta f = \pm 1.2\text{ kHz RDS}$ ; $\Delta f = \pm 3.5\text{ kHz ARI}$ ; see Fig.5	1	–	–	mV
$V_{i\text{ MPX(p-p)}}$	maximum input signal capability (peak-to-peak value)	$f = 57 \pm 2\text{ kHz}$	200	–	–	mV
		$f < 50\text{ kHz}$	1.4	–	–	V
		$f < 15\text{ kHz}$	2.8	–	–	V
		$f > 70\text{ kHz}$	3.5	–	–	V
$R_{4-6}$	input resistance	$f = 0\text{ to }100\text{ kHz}$	40	–	–	k $\Omega$
$G_{8-4}$	signal gain	$f = 57\text{ kHz}$	17	20	23	dB
<b>57 kHz band-pass filter</b>						
$f_c$	centre frequency	$T_{\text{amb}} = -40\text{ to }+85\text{ °C}$	56.5	57.0	57.5	kHz
B	–3 dB bandwidth		2.5	3.0	3.5	kHz
G	stop band gain	$\Delta f = \pm 7\text{ kHz}$	31	–	–	dB
		$f < 45\text{ kHz}$	40	–	–	dB
		$f < 20\text{ kHz}$	50	–	–	dB
		$f > 70\text{ kHz}$	40	–	–	dB
$R_{o(8)}$	output resistance (pin 8)	$f = 57\text{ kHz}$	–	26	–	$\Omega$
<b>Comparator input (pin 7)</b>						
$V_{i(\text{rms})}$	minimum input level (RMS value)	$f = 57\text{ kHz}$	–	1	10	mV
$R_i$	input resistance		70	110	150	k $\Omega$
<b>Oscillator input (pin 13)</b>						
$V_{IH}$	HIGH level input voltage	$V_{DDD} = 5.0\text{ V}$	4.0	–	–	V
$V_{IL}$	LOW level input voltage	$V_{DDD} = 5.0\text{ V}$	–	–	1.0	V
$I_I$	input current	$V_{DDD} = 5.5\text{ V}$	–	–	$\pm 1$	$\mu\text{A}$

## Radio Data System (RDS) demodulator

SAA6579

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
<b>Digital demodulator and outputs QUAL, RDDA, T57, OSCO and RDCL (pins 1, 2, 14, 15 and 16)</b>						
V <sub>OH</sub>	HIGH level output voltage	I <sub>Q</sub> = -20 μA; V <sub>DDD</sub> = 4.5 V	4.4	–	–	V
V <sub>OL</sub>	LOW level output voltage	I <sub>Q</sub> = 3.2 mA; V <sub>DDD</sub> = 5.5 V	–	–	0.4	V
f <sub>RDCL</sub>	nominal clock frequency RDCL		–	1 187.5	–	Hz
Δt <sub>RDCL</sub>	jitter of RDCL		–	–	18	μs
f <sub>T57</sub>	nominal subcarrier frequency T57	note 1	–	57.0	–	kHz
I <sub>O</sub>	output current OSCO (pin 14)	V <sub>DDD</sub> = 4.5 V; V <sub>14</sub> = 0.4 V	1.5	–	–	mA
		V <sub>DDD</sub> = 4.5 V; V <sub>14</sub> = 4.1 V	-1.6	–	–	mA
	output current QUAL, RDDA, T57, RDCL (pins 1, 2, 15 and 16)	V <sub>DDD</sub> = 4.5 V; V <sub>14</sub> = 0.4 V	5.9	–	–	mA
		V <sub>DDD</sub> = 4.5 V; V <sub>14</sub> = 4.1 V	-5.3	–	–	mA
<b>4.332 MHz crystal parameters</b>						
f <sub>0</sub>	XTAL frequency		–	4.332	–	MHz
Δf <sub>max</sub>	maximum permitted tolerance		–	±50	–	10 <sup>-6</sup>
Δf <sub>0</sub>	adjustment tolerance of f <sub>0</sub>	T <sub>amb</sub> = 25 °C	–	–	±20	10 <sup>-6</sup>
		T <sub>amb</sub> = -40 to +85 °C	–	–	±25	10 <sup>-6</sup>
C <sub>L</sub>	load capacitance		–	30	–	pF
R <sub>xtal</sub>	resonance resistance		–	–	60	Ω
<b>8.664 MHz crystal parameters</b>						
f <sub>0</sub>	XTAL frequency		–	8.664	–	MHz
Δf <sub>max</sub>	maximum permitted tolerance		–	±50	–	10 <sup>-6</sup>
Δf <sub>0</sub>	adjustment tolerance of f <sub>0</sub>	T <sub>amb</sub> = 25 °C	–	–	±30	10 <sup>-6</sup>
		T <sub>amb</sub> = -40 to +85 °C	–	–	±30	10 <sup>-6</sup>
C <sub>L</sub>	load capacitance		–	30	–	pF
R <sub>xtal</sub>	resonance resistance		–	–	60	Ω

**Note**

1. The signal T57 has a phase lead of 123° (±180°) relative to the ARI carrier at output SCOUT.

Radio Data System (RDS) demodulator

SAA6579

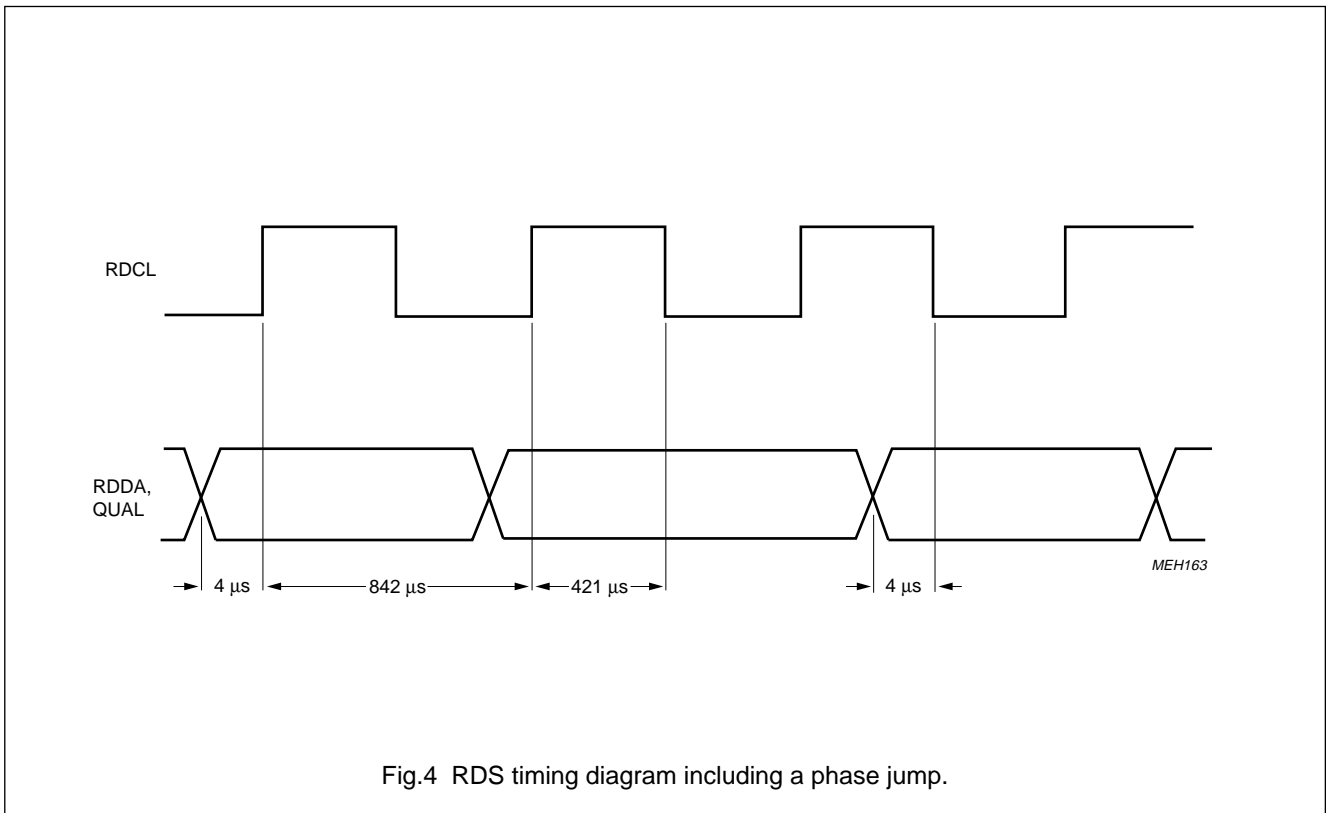


Fig.4 RDS timing diagram including a phase jump.

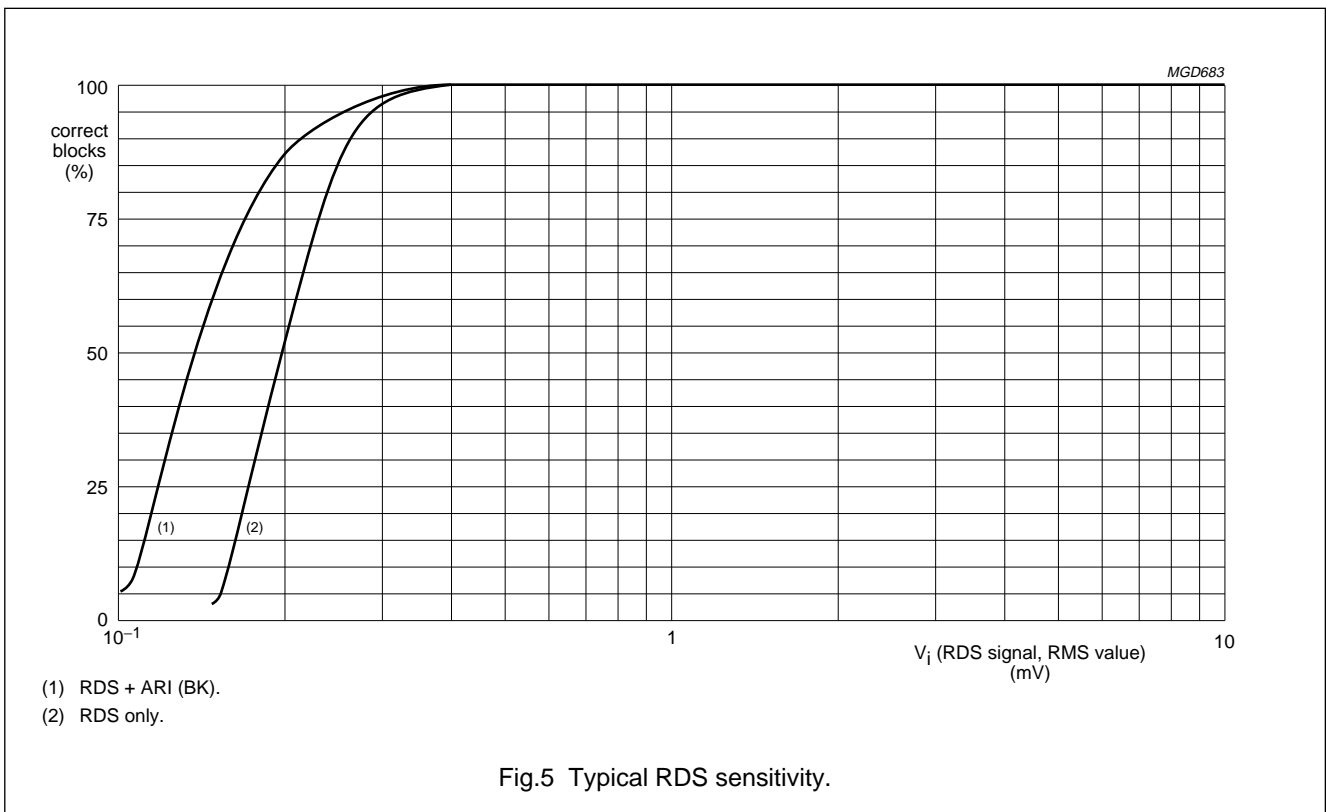


Fig.5 Typical RDS sensitivity.



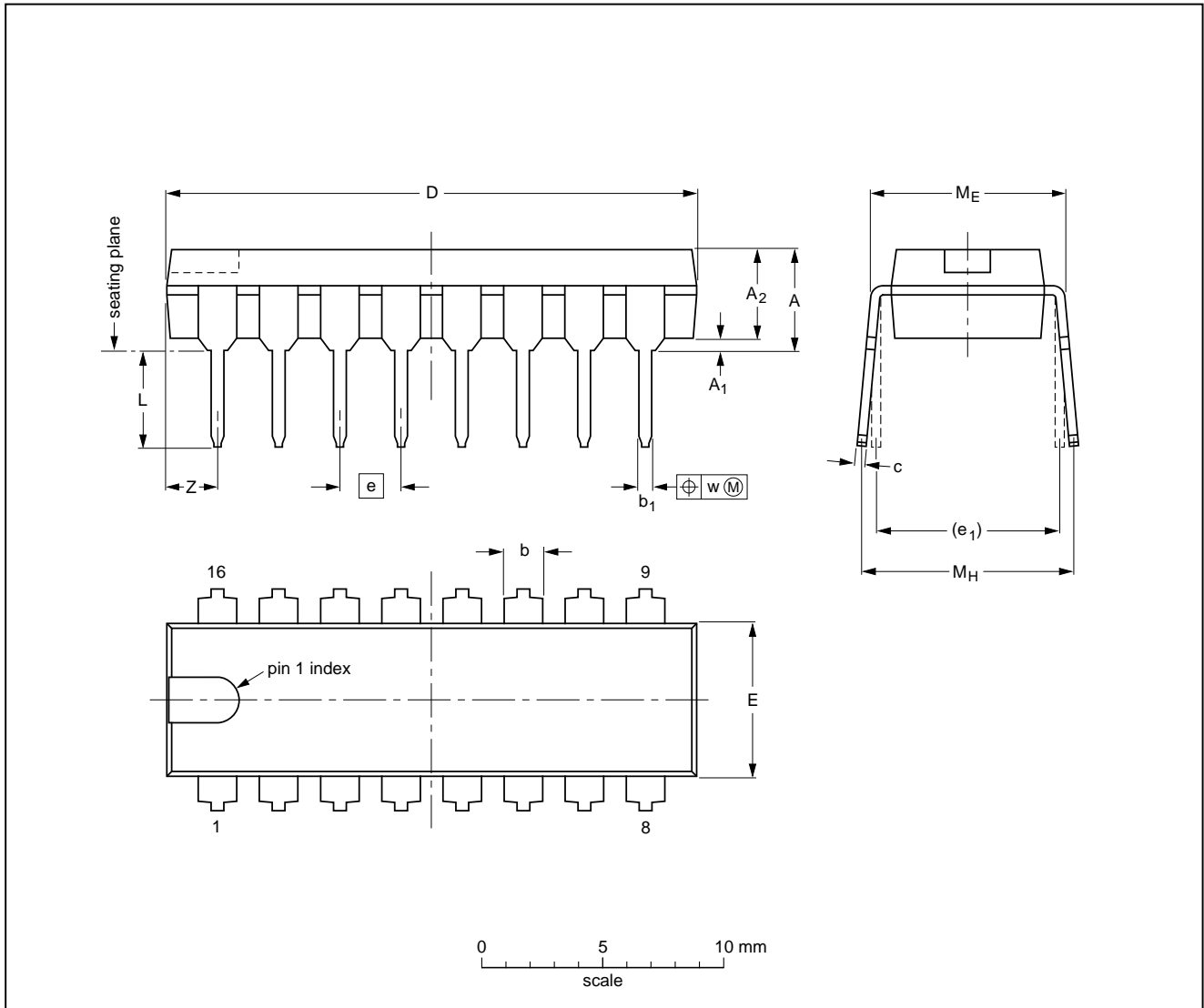
Radio Data System (RDS) demodulator

SAA6579

PACKAGE OUTLINES

DIP16: plastic dual in-line package; 16 leads (300 mil); long body

SOT38-1



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

UNIT	A max.	A <sub>1</sub> min.	A <sub>2</sub> max.	b	b <sub>1</sub>	c	D <sup>(1)</sup>	E <sup>(1)</sup>	e	e <sub>1</sub>	L	M <sub>E</sub>	M <sub>H</sub>	w	Z <sup>(1)</sup> max.
mm	4.7	0.51	3.7	1.40 1.14	0.53 0.38	0.32 0.23	21.8 21.4	6.48 6.20	2.54	7.62	3.9 3.4	8.25 7.80	9.5 8.3	0.254	2.2
inches	0.19	0.020	0.15	0.055 0.045	0.021 0.015	0.013 0.009	0.86 0.84	0.26 0.24	0.10	0.30	0.15 0.13	0.32 0.31	0.37 0.33	0.01	0.087

Note

1. Plastic or metal protrusions of 0.25 mm maximum per side are not included.

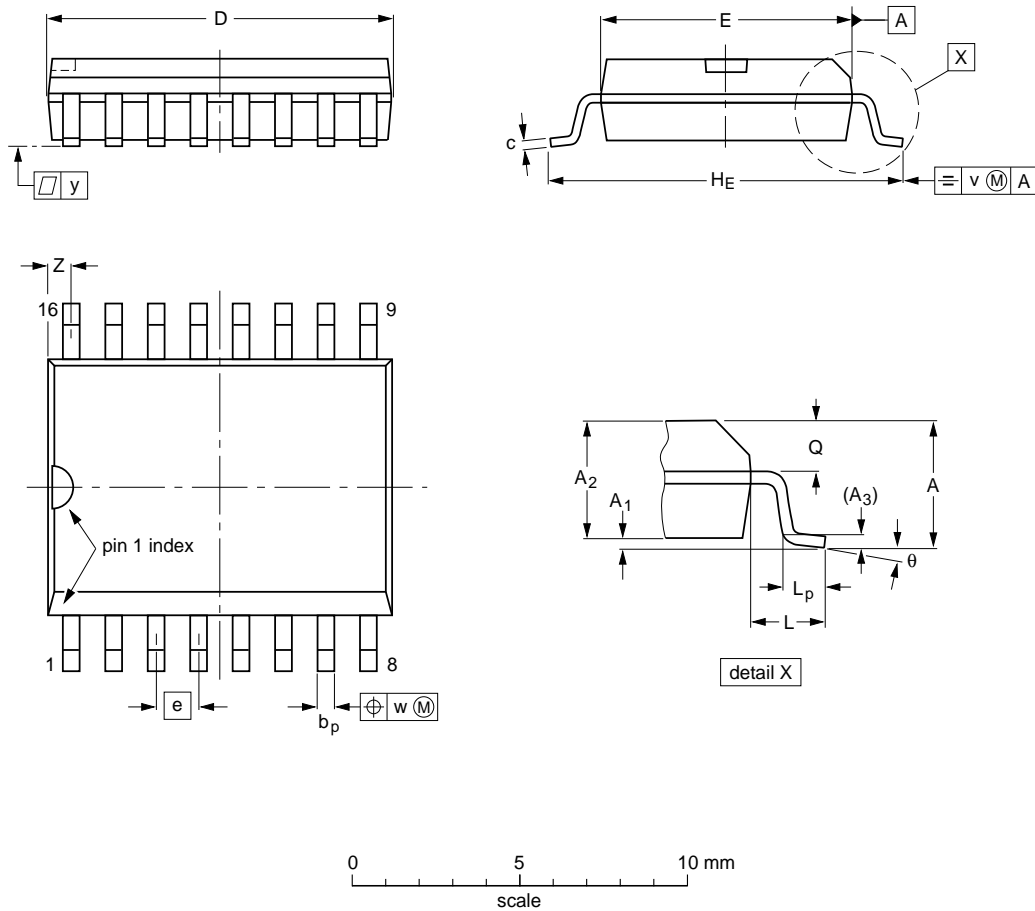
OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	EIAJ			
SOT38-1	050G09	MO-001AE				92-10-02 95-01-19

Radio Data System (RDS) demodulator

SAA6579

SO16: plastic small outline package; 16 leads; body width 7.5 mm

SOT162-1



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

UNIT	A max.	A <sub>1</sub>	A <sub>2</sub>	A <sub>3</sub>	b <sub>p</sub>	c	D <sup>(1)</sup>	E <sup>(1)</sup>	e	H <sub>E</sub>	L	L <sub>p</sub>	Q	v	w	y	Z <sup>(1)</sup>	θ
mm	2.65	0.30 0.10	2.45 2.25	0.25	0.49 0.36	0.32 0.23	10.5 10.1	7.6 7.4	1.27	10.65 10.00	1.4	1.1 0.4	1.1 1.0	0.25	0.25	0.1	0.9 0.4	8° 0°
inches	0.10	0.012 0.004	0.096 0.089	0.01	0.019 0.014	0.013 0.009	0.41 0.40	0.30 0.29	0.050	0.42 0.39	0.055	0.043 0.016	0.043 0.039	0.01	0.01	0.004	0.035 0.016	

**Note**

1. Plastic or metal protrusions of 0.15 mm maximum per side are not included.

OUTLINE VERSION	REFERENCES			EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	EIAJ		
SOT162-1	075E03	MS-013AA			92-11-17 95-01-24

## Radio Data System (RDS) demodulator

SAA6579

### SOLDERING

#### Introduction

There is no soldering method that is ideal for all IC packages. Wave soldering is often preferred when through-hole and surface mounted components are mixed on one printed-circuit board. However, wave soldering is not always suitable for surface mounted ICs, or for printed-circuits with high population densities. In these situations reflow soldering is often used.

This text gives a very brief insight to a complex technology. A more in-depth account of soldering ICs can be found in our "IC Package Databook" (order code 9398 652 90011).

#### DIP

##### SOLDERING BY DIPPING OR BY WAVE

The maximum permissible temperature of the solder is 260 °C; solder at this temperature must not be in contact with the joint for more than 5 seconds. The total contact time of successive solder waves must not exceed 5 seconds.

The device may be mounted up to the seating plane, but the temperature of the plastic body must not exceed the specified maximum storage temperature ( $T_{stg\ max}$ ). If the printed-circuit board has been pre-heated, forced cooling may be necessary immediately after soldering to keep the temperature within the permissible limit.

##### REPAIRING SOLDERED JOINTS

Apply a low voltage soldering iron (less than 24 V) to the lead(s) of the package, below the seating plane or not more than 2 mm above it. If the temperature of the soldering iron bit is less than 300 °C it may remain in contact for up to 10 seconds. If the bit temperature is between 300 and 400 °C, contact may be up to 5 seconds.

#### SO

##### REFLOW SOLDERING

Reflow soldering techniques are suitable for all SO packages.

Reflow soldering requires solder paste (a suspension of fine solder particles, flux and binding agent) to be applied to the printed-circuit board by screen printing, stencilling or pressure-syringe dispensing before package placement.

Several techniques exist for reflowing; for example, thermal conduction by heated belt. Dwell times vary between 50 and 300 seconds depending on heating method. Typical reflow temperatures range from 215 to 250 °C.

Preheating is necessary to dry the paste and evaporate the binding agent. Preheating duration: 45 minutes at 45 °C.

##### WAVE SOLDERING

Wave soldering techniques can be used for all SO packages if the following conditions are observed:

- A double-wave (a turbulent wave with high upward pressure followed by a smooth laminar wave) soldering technique should be used.
- The longitudinal axis of the package footprint must be parallel to the solder flow.
- The package footprint must incorporate solder thieves at the downstream end.

During placement and before soldering, the package must be fixed with a droplet of adhesive. The adhesive can be applied by screen printing, pin transfer or syringe dispensing. The package can be soldered after the adhesive is cured.

Maximum permissible solder temperature is 260 °C, and maximum duration of package immersion in solder is 10 seconds, if cooled to less than 150 °C within 6 seconds. Typical dwell time is 4 seconds at 250 °C.

A mildly-activated flux will eliminate the need for removal of corrosive residues in most applications.

##### REPAIRING SOLDERED JOINTS

Fix the component by first soldering two diagonally-opposite end leads. Use only a low voltage soldering iron (less than 24 V) applied to the flat part of the lead. Contact time must be limited to 10 seconds at up to 300 °C. When using a dedicated tool, all other leads can be soldered in one operation within 2 to 5 seconds between 270 and 320 °C.

## Radio Data System (RDS) demodulator

SAA6579

**DEFINITIONS**

<b>Data sheet status</b>	
Objective specification	This data sheet contains target or goal specifications for product development.
Preliminary specification	This data sheet contains preliminary data; supplementary data may be published later.
Product specification	This data sheet contains final product specifications.
<b>Limiting values</b>	
Limiting values given are in accordance with the Absolute Maximum Rating System (IEC 134). 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.	
<b>Application information</b>	
Where application information is given, it is advisory and does not form part of the specification.	

**LIFE SUPPORT APPLICATIONS**

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 customers using or selling these products for use in such applications do so at their own risk and agree to fully indemnify Philips for any damages resulting from such improper use or sale.

Radio Data System (RDS) demodulator

SAA6579

---

**NOTES**

Radio Data System (RDS) demodulator

SAA6579

---

**NOTES**

Radio Data System (RDS) demodulator

SAA6579

---

**NOTES**

# Philips Semiconductors – a worldwide company

**Argentina:** see South America

**Australia:** 34 Waterloo Road, NORTH RYDE, NSW 2113,  
Tel. +61 2 9805 4455, Fax. +61 2 9805 4466

**Austria:** Computerstr. 6, A-1101 WIEN, P.O. Box 213,  
Tel. +43 1 60 101, Fax. +43 1 60 101 1210

**Belarus:** Hotel Minsk Business Center, Bld. 3, r. 1211, Volodarski Str. 6,  
220050 MINSK, Tel. +375 172 200 733, Fax. +375 172 200 773

**Belgium:** see The Netherlands

**Brazil:** see South America

**Bulgaria:** Philips Bulgaria Ltd., Energoproject, 15th floor,  
51 James Bourchier Blvd., 1407 SOFIA,  
Tel. +359 2 689 211, Fax. +359 2 689 102

**Canada:** PHILIPS SEMICONDUCTORS/COMPONENTS,  
Tel. +1 800 234 7381

**China/Hong Kong:** 501 Hong Kong Industrial Technology Centre,  
72 Tat Chee Avenue, Kowloon Tong, HONG KONG,  
Tel. +852 2319 7888, Fax. +852 2319 7700

**Colombia:** see South America

**Czech Republic:** see Austria

**Denmark:** Prags Boulevard 80, PB 1919, DK-2300 COPENHAGEN S,  
Tel. +45 32 88 2636, Fax. +45 31 57 1949

**Finland:** Sinikalliontie 3, FIN-02630 ESPOO,  
Tel. +358 9 615800, Fax. +358 9 61580/xxx

**France:** 4 Rue du Port-aux-Vins, BP317, 92156 SURESNES Cedex,  
Tel. +33 1 40 99 6161, Fax. +33 1 40 99 6427

**Germany:** Hammerbrookstraße 69, D-20097 HAMBURG,  
Tel. +49 40 23 53 60, Fax. +49 40 23 536 300

**Greece:** No. 15, 25th March Street, GR 17778 TAVROS/ATHENS,  
Tel. +30 1 4894 339/239, Fax. +30 1 4814 240

**Hungary:** see Austria

**India:** Philips INDIA Ltd, Shivsagar Estate, A Block, Dr. Annie Besant Rd.  
Worli, MUMBAI 400 018, Tel. +91 22 4938 541, Fax. +91 22 4938 722

**Indonesia:** see Singapore

**Ireland:** Newstead, Clonskeagh, DUBLIN 14,  
Tel. +353 1 7640 000, Fax. +353 1 7640 200

**Israel:** RAPAC Electronics, 7 Kehilat Saloniki St, TEL AVIV 61180,  
Tel. +972 3 645 0444, Fax. +972 3 649 1007

**Italy:** PHILIPS SEMICONDUCTORS, Piazza IV Novembre 3,  
20124 MILANO, Tel. +39 2 6752 2531, Fax. +39 2 6752 2557

**Japan:** Philips Bldg 13-37, Kohnan 2-chome, Minato-ku, TOKYO 108,  
Tel. +81 3 3740 5130, Fax. +81 3 3740 5077

**Korea:** Philips House, 260-199 Itaewon-dong, Yongsan-ku, SEOUL,  
Tel. +82 2 709 1412, Fax. +82 2 709 1415

**Malaysia:** No. 76 Jalan Universiti, 46200 PETALING JAYA, SELANGOR,  
Tel. +60 3 750 5214, Fax. +60 3 757 4880

**Mexico:** 5900 Gateway East, Suite 200, EL PASO, TEXAS 79905,  
Tel. +9-5 800 234 7381

**Middle East:** see Italy

**Netherlands:** Postbus 90050, 5600 PB EINDHOVEN, Bldg. VB,  
Tel. +31 40 27 82785, Fax. +31 40 27 88399

**New Zealand:** 2 Wagener Place, C.P.O. Box 1041, AUCKLAND,  
Tel. +64 9 849 4160, Fax. +64 9 849 7811

**Norway:** Box 1, Manglerud 0612, OSLO,  
Tel. +47 22 74 8000, Fax. +47 22 74 8341

**Philippines:** Philips Semiconductors Philippines Inc.,  
106 Valero St. Salcedo Village, P.O. Box 2108 MCC, MAKATI,  
Metro MANILA, Tel. +63 2 816 6380, Fax. +63 2 817 3474

**Poland:** Ul. Lukiska 10, PL 04-123 WARSZAWA,  
Tel. +48 22 612 2831, Fax. +48 22 612 2327

**Portugal:** see Spain

**Romania:** see Italy

**Russia:** Philips Russia, Ul. Usatcheva 35A, 119048 MOSCOW,  
Tel. +7 095 755 6918, Fax. +7 095 755 6919

**Singapore:** Lorong 1, Toa Payoh, SINGAPORE 1231,  
Tel. +65 350 2538, Fax. +65 251 6500

**Slovakia:** see Austria

**Slovenia:** see Italy

**South Africa:** S.A. PHILIPS Pty Ltd., 195-215 Main Road Martindale,  
2092 JOHANNESBURG, P.O. Box 7430 Johannesburg 2000,  
Tel. +27 11 470 5911, Fax. +27 11 470 5494

**South America:** Rua do Rocio 220, 5th floor, Suite 51,  
04552-903 São Paulo, SÃO PAULO - SP, Brazil,  
Tel. +55 11 821 2333, Fax. +55 11 829 1849

**Spain:** Balmes 22, 08007 BARCELONA,  
Tel. +34 3 301 6312, Fax. +34 3 301 4107

**Sweden:** Kottbygatan 7, Akalla, S-16485 STOCKHOLM,  
Tel. +46 8 632 2000, Fax. +46 8 632 2745

**Switzerland:** Allmendstrasse 140, CH-8027 ZÜRICH,  
Tel. +41 1 488 2686, Fax. +41 1 481 7730

**Taiwan:** Philips Semiconductors, 6F, No. 96, Chien Kuo N. Rd., Sec. 1,  
TAIPEI, Taiwan Tel. +886 2 2134 2870, Fax. +886 2 2134 2874

**Thailand:** PHILIPS ELECTRONICS (THAILAND) Ltd.,  
209/2 Sanpavuth-Bangna Road Prakanong, BANGKOK 10260,  
Tel. +66 2 745 4090, Fax. +66 2 398 0793

**Turkey:** Talatpasa Cad. No. 5, 80640 GÜLTEPE/ISTANBUL,  
Tel. +90 212 279 2770, Fax. +90 212 282 6707

**Ukraine:** PHILIPS UKRAINE, 4 Patrice Lumumba str., Building B, Floor 7,  
252042 KIEV, Tel. +380 44 264 2776, Fax. +380 44 268 0461

**United Kingdom:** Philips Semiconductors Ltd., 276 Bath Road, Hayes,  
MIDDLESEX UB3 5BX, Tel. +44 181 730 5000, Fax. +44 181 754 8421

**United States:** 811 East Arques Avenue, SUNNYVALE, CA 94088-3409,  
Tel. +1 800 234 7381

**Uruguay:** see South America

**Vietnam:** see Singapore

**Yugoslavia:** PHILIPS, Trg N. Pasica 5/v, 11000 BEOGRAD,  
Tel. +381 11 625 344, Fax. +381 11 635 777

**For all other countries apply to:** Philips Semiconductors, Marketing & Sales Communications,  
Building BE-p, P.O. Box 218, 5600 MD EINDHOVEN, The Netherlands, Fax. +31 40 27 24825

**Internet:** <http://www.semiconductors.philips.com>

© Philips Electronics N.V. 1997

SCA53

All rights are reserved. Reproduction in whole or in part is prohibited without the prior written consent of the copyright owner.

The information presented in this document does not form part of any quotation or contract, is believed to be accurate and reliable and may be changed without notice. No liability will be accepted by the publisher for any consequence of its use. Publication thereof does not convey nor imply any license under patent- or other industrial or intellectual property rights.

Printed in The Netherlands

547027/1200/02/pp16

Date of release: 1997 Feb 24

Document order number: 9397 750 00913

*Let's make things better.*

**Philips  
Semiconductors**



**PHILIPS**