

# DATA SHEET

## **PCF1174C** 4-digit static LCD car clock

Product specification  
Supersedes data of September 1993  
File under Integrated Circuits, IC16

1997 Apr 16

## 4-digit static LCD car clock

## PCF1174C

## FEATURES

- Internal voltage regulator is electrically programmable for various LCD voltages
- Time calibration is electrically programmable (no trimming capacitor required)
- LCD voltage adjusts with temperature for good contrast
- 4.19 MHz oscillator
- 12-hour or 24-hour mode
- Operating ambient temperature: -40 to +85 °C
- 40-lead plastic SMD, face down (VSO40).

## GENERAL DESCRIPTION

The PCF1174C is a single chip, 4.19 MHz CMOS car clock circuit providing hours, minutes and seconds functions. It is designed to drive a 4-digit static liquid crystal display (LCD).

Two external single-pole, single-throw switches will accomplish all time setting functions. Time calibration and voltage regulator are electrically programmable via an on-chip EEPROM. The circuit is battery-operated via an internal voltage regulator and an external resistor.

## ORDERING INFORMATION

TYPE NUMBER	PACKAGE		
	NAME	DESCRIPTION	VERSION
PCF1174CT	VSO40	plastic very small outline package; 40 leads; face down <sup>(1)</sup>	SOT158-2
PCF1174CU	–	uncased chip in tray <sup>(2)</sup>	–

## Notes

1. See Fig.1 and Chapter "Package outline" for pin layout and package details.
2. See Chapter "Chip dimensions and bonding pad locations" for pad layout and package details.

## 4-digit static LCD car clock

## PCF1174C

## PINNING

SYMBOL	PIN	DESCRIPTION
BP	1	backplane output
PM	2	segment driver
AM	3	segment driver
ADEG1	4	segment driver
C1	5	segment driver
E2	6	segment driver
D2	7	segment driver
C2	8	segment driver
E3	9	segment driver
C3	10	segment driver
E4	11	segment driver
D4	12	segment driver
C4	13	segment driver
B4	14	segment driver
S1	15	hour adjustment input
DATA	16	EEPROM data input
OSC IN	17	oscillator input
OSC OUT	18	oscillator output
V <sub>SS</sub>	19	negative supply
MODE	20	12/24-hour mode select input
V <sub>PP</sub>	21	programming voltage input
TS	22	test speed-up mode input
ENABLE	23	set enable input for S1 and S2
V <sub>DD</sub>	24	positive supply voltage
FLASH	25	colon option input
SEL	26	EEPROM select input
S2	27	minute adjustment input
A4	28	segment driver
F4	29	segment driver
G4	30	segment driver
B3	31	segment driver
AD3	32	segment driver
F3	33	segment driver
G3	34	segment driver
COL	35	segment driver
B2	36	segment driver
A2	37	segment driver
F2	38	segment driver
G2	39	segment driver
B1	40	segment driver

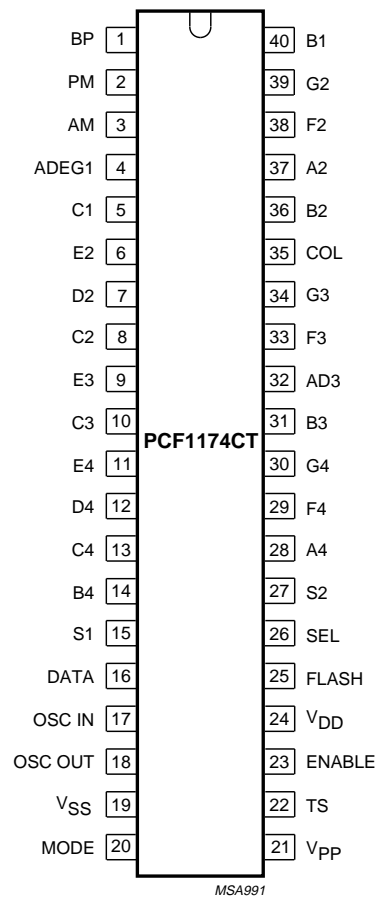


Fig.1 Pin configuration, PCF1174CT, (VSO40).

# 4-digit static LCD car clock

# PCF1174C

## FUNCTIONAL DESCRIPTION AND TESTING

### Outputs

The circuit outputs static data to the LCD. Generation of BP and the output signals are shown in Fig.4.

The average voltages across the segments are:

1.  $V_{ON(RMS)} = V_{DD}$
2.  $V_{OFF(RMS)} = 0\text{ V}$ .

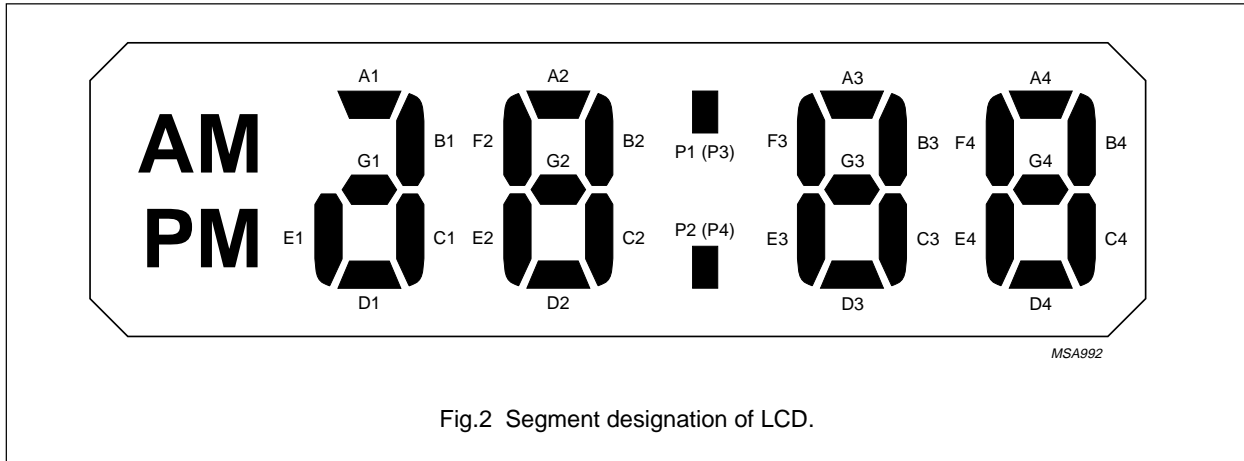
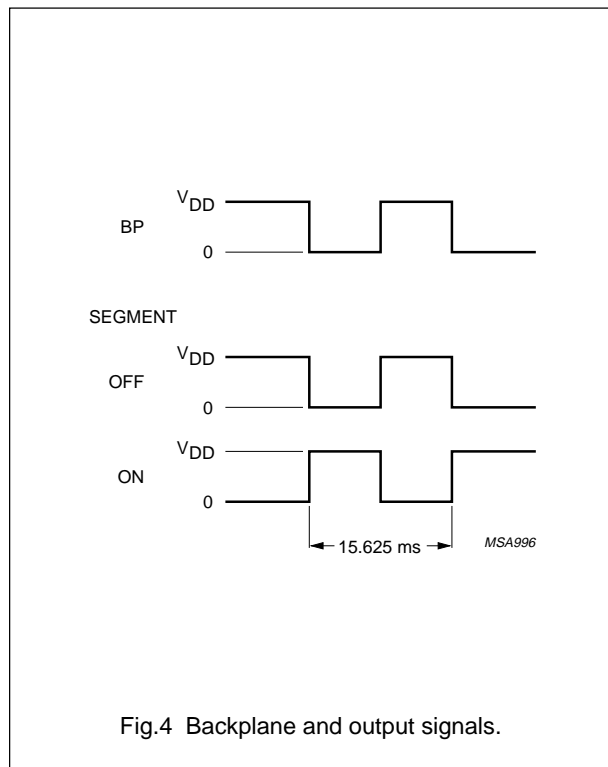
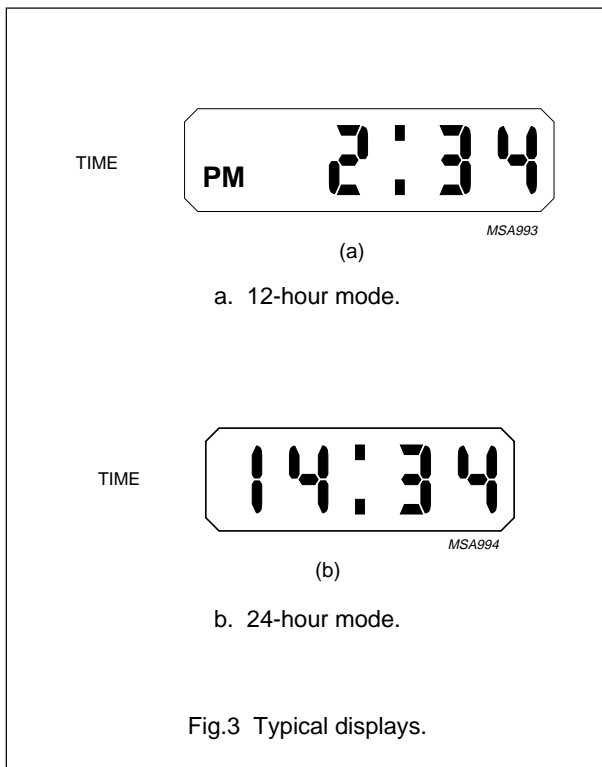


Fig.2 Segment designation of LCD.



## 4-digit static LCD car clock

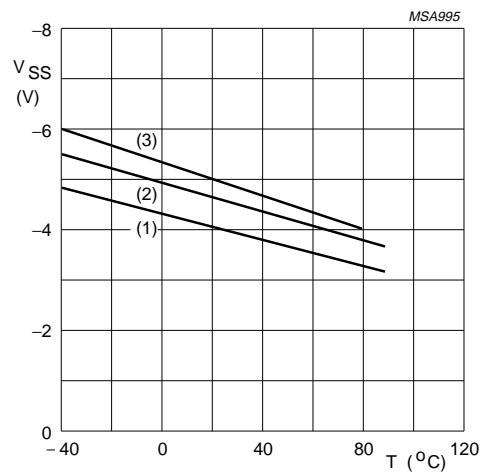
PCF1174C

**LCD voltage** (see Fig.5)

The adjustable voltage regulator controls the supply voltage (see Section "LCD voltage programming") in relation to temperature for good contrast, for example when  $V_{DD} = 4.5$  V at  $+25$  °C, then:

$V_{DD} = 3$  to  $4$  V at  $+85$  °C.

$V_{DD} = 5$  to  $6$  V at  $-40$  °C.



- (1) Programmed to 4.0 V at 25 °C (value within the specified operating range).
- (2) Programmed to 4.5 V at 25 °C (value within the specified operating range).
- (3) Programmed to 5.0 V at 25 °C (value within the specified operating range).

Fig.5 Regulated voltage as a function of temperature (typical).

## 4-digit static LCD car clock

PCF1174C

### 12/24-hour mode

Operation in 12-hour or 24-hour mode is selected by connecting MODE to  $V_{DD}$  or  $V_{SS}$  respectively.

### Power-on

After connecting the supply, the start-up mode is:

1:00 AM; 12-hour mode.

0:00; 24-hour mode.

### Colon

If FLASH is connected to  $V_{DD}$  the colon pulses at 1 Hz.  
If FLASH is connected to  $V_{SS}$  the colon is static.

### Time setting

Switch inputs S1 and S2 have a pull-up resistor to facilitate the use of single-pole, single-throw contacts. A debounce circuit is incorporated to protect against contact bounce and parasitic voltages.

### Set enable

Inputs S1 and S2 are enabled by connecting ENABLE to  $V_{DD}$  or disabled by connecting to  $V_{SS}$ .

### Set hours

When S1 is connected to  $V_{SS}$  the hours displayed advances by one and after one second continues with one advance per second until S1 is released (auto-increment).

### Set minutes

When S2 is connected to  $V_{SS}$  the time displayed in minutes advances by one and after one second continues with one advance per second until S2 is released (auto-increment). In addition to minute correction, the seconds counter is reset to zero.

### Segment test/reset

When S1 and S2 are connected to  $V_{SS}$ , all LCD segments are switched ON. Releasing switches S1 and S2 resets the display. No reset occurs when DATA is connected to  $V_{SS}$  (overlapping S1 and S2).

### Test mode

When TS is connected to  $V_{DD}$ , the device is in normal operating mode. When connecting TS to  $V_{SS}$  all counters (seconds, minutes and hours) are stopped, allowing quick testing of the display via S1 and S2 (debounce and auto-increment times are 64 times faster). TS has a pull-up resistor but for reasons of safety it should be connected to  $V_{DD}$ .

### EEPROM

$V_{PP}$  has a pull-up resistor but for reasons of safety it should be connected to  $V_{DD}$ .

### LCD voltage programming

To enable LCD voltage programming, SEL is set to open-circuit and a level of  $V_{DD} - 5\text{ V}$  is applied to  $V_{PP}$  (see Fig.6). The first pulse ( $t_E$ ) applied to the DATA input clears the EEPROM to give the lowest voltage output. Further pulses ( $t_L$ ) will increment the output voltage by steps of typically 150 mV ( $T_{amb} = 25\text{ }^\circ\text{C}$ ). For programming, measure  $V_{DD} - V_{SS}$  and apply a store pulse ( $t_W$ ) when the required value is reached. If the maximum number of steps ( $n = 31$ ) is reached and an additional pulse is applied the voltage will return to the lowest value.

### Time calibration

To compensate for the tolerance in the quartz crystal frequency which has been positively offset (nominal deviation  $+60 \times 10^{-6}$ ) by capacitors at the oscillator input and output, a number ( $n$ ) of 262144 Hz pulses are inhibited every second of operation.

## 4-digit static LCD car clock

## PCF1174C

The number (n) is stored in a non-volatile memory which is achieved by the following steps (see Fig.6):

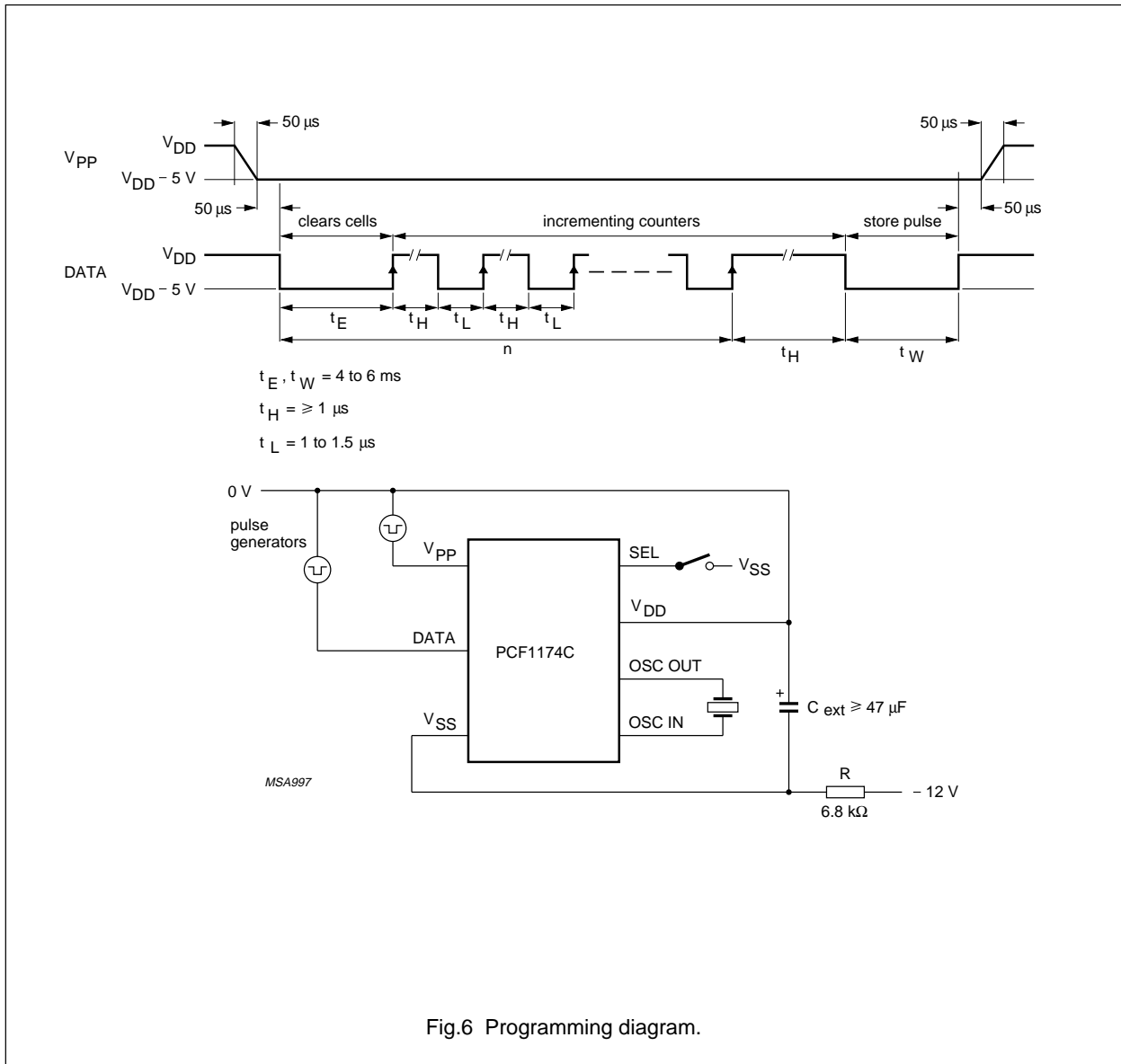
1. Set SEL to  $V_{SS}$  and a level of  $V_{DD} - 5\text{ V}$  to  $V_{PP}$
2. The quartz-frequency deviation  $\Delta f/f$  is measured and (n) is calculated (see Table 1)
3. A first pulse  $t_E$  is applied to the DATA input clears the EEPROM to give the highest backplane frequency
4. The calculated pulses (n) are entered in ( $t_H$ ,  $t_L$ ). If the maximum backplane period is reached and an additional pulse is applied the period will return to the lowest value.
5. The backplane period is controlled and (when correct) fixed by applying the store pulse  $t_W$
6. Release SEL and  $V_{PP}$ .

**Table 1** Time calibration ( $\Delta t = 3.81\ \mu\text{s}$ ; SEL at  $V_{SS}$ )

OSCILLATOR-FREQUENCY DEVIATION $\Delta f/f$ ( $\times 10^{-6}$ )	NUMBER OF PULSES (n)	BACKPLANE PERIOD (ms)
0	0	15.625
+3.8	1	15.629
+7.6	2	15.633
+11.4	3	15.636
.	.	.
.	.	.
.	.	.
+117.8	31	15.743

4-digit static LCD car clock

PCF1174C





## 4-digit static LCD car clock

PCF1174C

**LIMITING VALUES**

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
$V_{DD}$	supply voltage	with respect to $V_{SS}$	–	8	V
$I_{DD}$	supply current	$V_{SS} = 0$ V; note 1	–	3	mA
$V_I$	input voltage	all pins except $V_{PP}$ and DATA	–0.3	$V_{DD} + 0.3$	V
		pins $V_{PP}$ and DATA	–3	$V_{DD} + 0.3$	V
$T_{amb}$	operating ambient temperature		–40	+85	°C
$T_{stg}$	storage temperature		–55	+125	°C

**Note**

1. Connecting the supply voltage with reverse polarity, will not harm the circuit, provided the current is limited to 10 mA by the external resistor.

**HANDLING**

Inputs and outputs are protected against electrostatic discharges in normal handling. However, to be totally safe, it is advisable to take handling precautions appropriate to handling MOS devices. Advice can be found in "Data Handbook IC16, General, Handling MOS Devices".

## 4-digit static LCD car clock

## PCF1174C

**CHARACTERISTICS**

$V_{DD} = 3$  to  $6$  V;  $V_{SS} = 0$  V;  $T_{amb} = -40$  to  $+85$  °C; crystal:  $f = 4.194304$  MHz;  $R_s = 50$  Ω;  $C_L = 12$  pF; maximum frequency tolerance =  $\pm 30 \times 10^{-6}$ ; unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
<b>Supply</b>						
$V_{DD}$	supply voltage	voltage regulator programmed to 4.5 V at $T_{amb} = 25$ °C	3	–	6	V
$\Delta V_{DD}$	supply voltage variation	S1 or S2 closed	–	–	50	mV
TC	supply voltage variation due to temperature		–	–0.35	–	%/K
		$V_{DD} = 4.5$ V	–	–16	–	mV/K
$I_{DD}$	supply current	note 1	700	950	–	μA
$C_{EXT}$	capacitance	external capacitor	47	–	–	μF
<b>Oscillator</b>						
$t_{osc}$	start time		–	–	200	ms
$\Delta f/f$	frequency deviation	nominal $n = 0$	0	$60 \times 10^{-6}$	$110 \times 10^{-6}$	
$\Delta f/f$	frequency stability	$\Delta V_{DD} = 100$ mV	–	–	$1 \times 10^{-6}$	
$R_{fb}$	feedback resistance		300	1000	3000	kΩ
$C_i$	input capacitance		–	16	–	pF
$C_o$	output capacitance		–	27	–	pF
<b>Inputs</b>						
$R_O$	pull-up resistance	S1, S2, TS, SEL and DATA	45	90	180	kΩ
$I_{IL}$	leakage current	FLASH, ENABLE, MODE	–	–	2	μA
$t_d$	debounce time	S1 and S2 only	30	65	100	ms
<b><math>V_{PP}</math> programming voltage</b>						
$I_{O2}$	output current	$V_{PP} = V_{DD} - 5$ V	70	–	700	μA
		during programming	–	500	–	μA
<b>Backplane (high and low levels)</b>						
$R_{BP}$	output resistance	$\pm 100$ μA	–	–	3	kΩ
<b>Segment</b>						
$R_{SEG}$	output resistance	$\pm 100$ μA	–	–	5	kΩ
<b>LCD</b>						
$V_{offset(DC)}$	DC offset voltage	200 kΩ/1 nF	–	–	50	mV

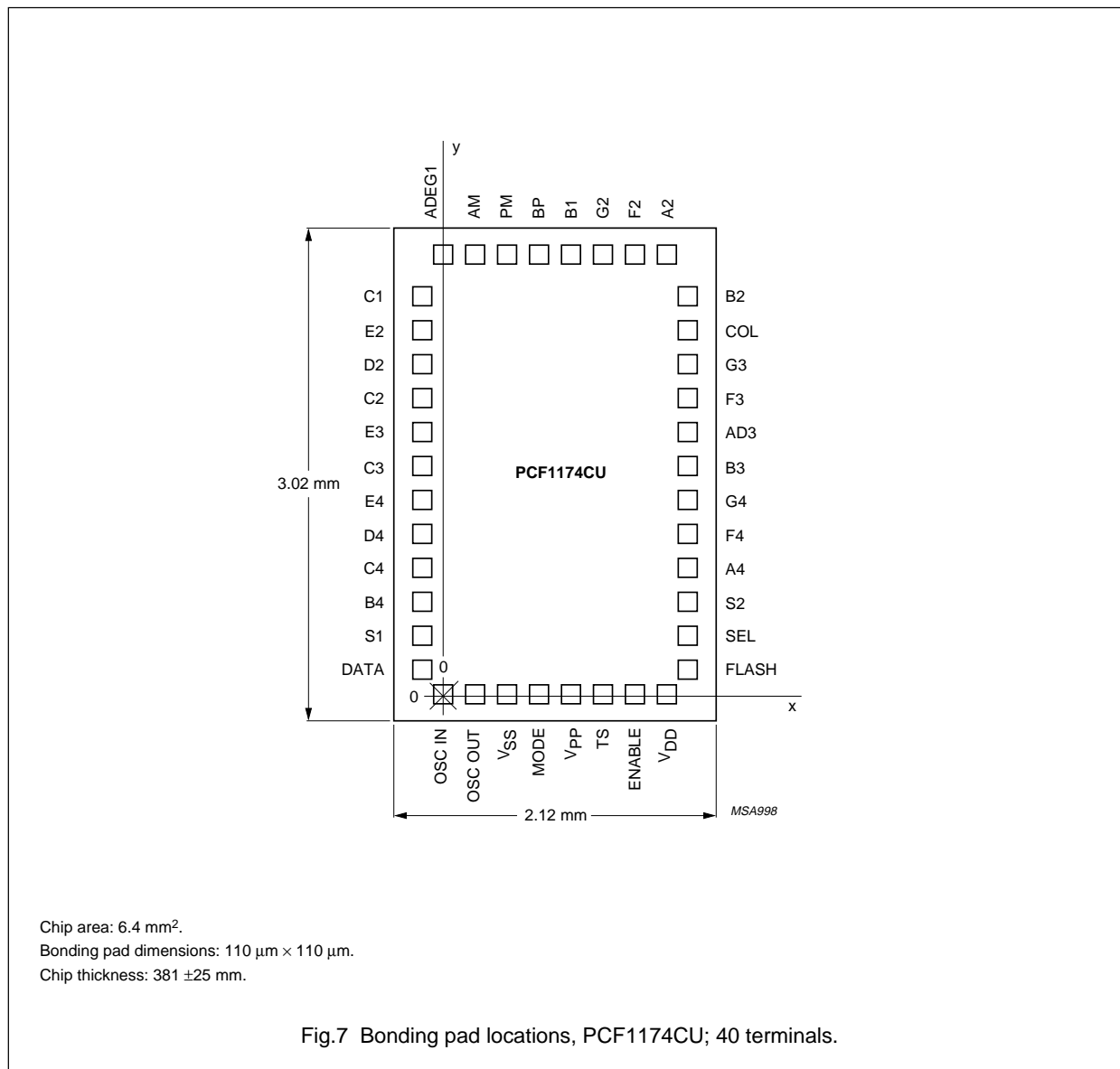
**Note**

1. A suitable resistor (R) must be selected (example):
  - a)  $V_{DD} = 5$  V; R max.  $(12 \text{ V} - 5 \text{ V})/700 \text{ μA} = 10 \text{ kΩ}$ .
  - b)  $V_{DD} = 5$  V; R typ.  $(12 \text{ V} - 5 \text{ V})/900 \text{ μA} = 7.8 \text{ kΩ}$  (more reserve).
  - c)  $I_{DD}$  must not exceed 3 mA.

4-digit static LCD car clock

PCF1174C

CHIP DIMENSIONS AND BONDING PAD LOCATIONS



## 4-digit static LCD car clock

## PCF1174C

**Table 2** Bonding pad locations (dimensions in  $\mu\text{m}$ )

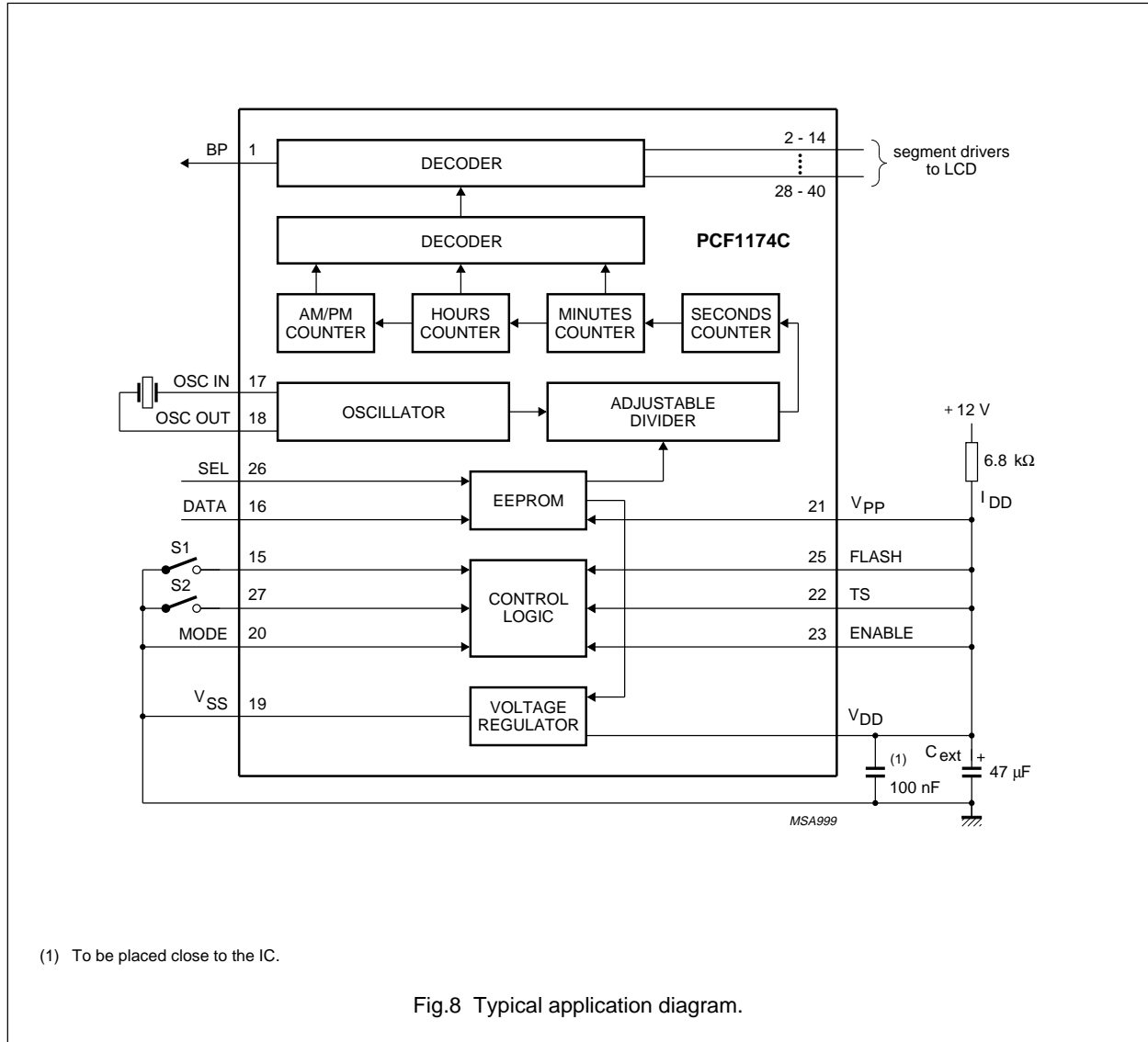
All x/y coordinates are referenced to the bottom left pad (OSC IN), see Fig.7.

PAD	x	y	PAD	x	y
BP	600	2676	V <sub>PP</sub>	800	0
PM	400	2676	TS	1000	0
AM	200	2676	ENABLE	1200	0
ADEG1	0	2676	V <sub>DD</sub>	1400	0
C1	-138	2448	FLASH	1538	168
E2	-138	2228	SEL	1538	388
D2	-138	2008	S2	1538	608
C2	-138	1808	A4	1538	808
E3	-138	1608	F4	1538	1008
C3	-138	1408	G4	1538	1208
E4	-138	1208	B3	1538	1408
D4	-138	1008	AD3	1538	1608
C4	-138	808	F3	1538	1808
B4	-138	608	G3	1538	2008
S1	-138	388	COL	1538	2208
DATA	-138	168	B2	1538	2448
OSC IN	0	0	A2	1400	2676
OSC OUT	200	0	F2	1200	2676
V <sub>SS</sub>	400	0	G2	1000	2676
MODE	600	0	B1	800	2676
chip corner (max. value)	-360	-170			

4-digit static LCD car clock

PCF1174C

APPLICATION INFORMATION



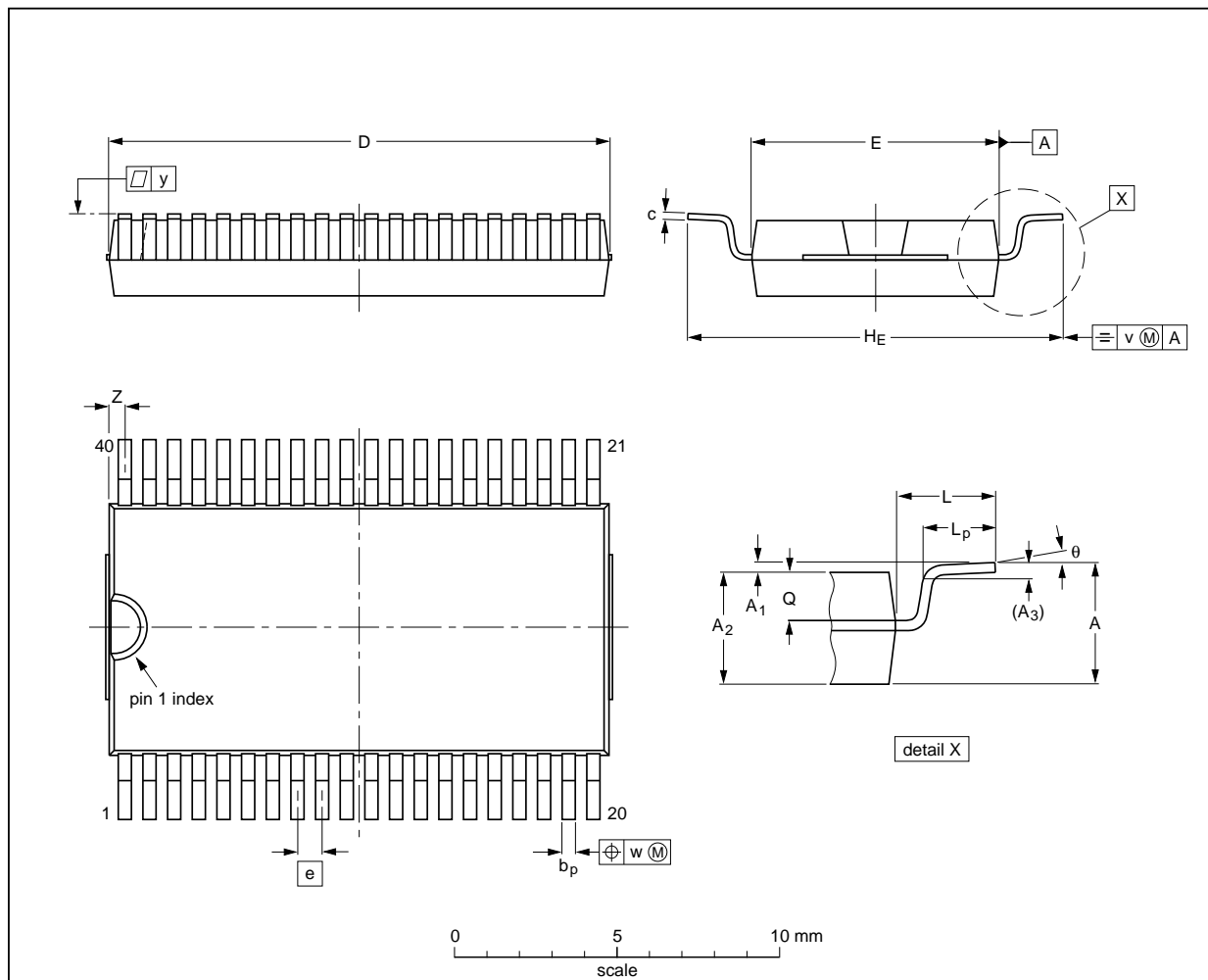
# 4-digit static LCD car clock

# PCF1174C

## PACKAGE OUTLINE

VSO40: plastic very small outline package; 40 leads; face down

SOT158-2



**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>(2)</sup>	e	HE	L	L <sub>p</sub>	Q	v	w	y	Z <sup>(1)</sup>	θ
mm	2.70	0.3 0.1	2.45 2.25	0.25	0.42 0.30	0.22 0.14	15.6 15.2	7.6 7.5	0.762	12.3 11.8	2.25	1.7 1.5	1.15 1.05	0.2	0.1	0.1	0.6 0.3	7° 0°
inches	0.11	0.012 0.004	0.096 0.089	0.010	0.017 0.012	0.0087 0.0055	0.61 0.60	0.30 0.29	0.03	0.48 0.46	0.089	0.067 0.059	0.045 0.041	0.008	0.004	0.004	0.024 0.012	

**Note**

1. Plastic or metal protrusions of 0.4 mm maximum per side are not included.
2. Plastic interlead protrusions of 0.25 mm maximum per side are not included.

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	EIAJ			
SOT158-2						92-11-17 95-01-24

---

## 4-digit static LCD car clock

PCF1174C

---

### 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).

#### Reflow soldering

Reflow soldering techniques are suitable for all VSO 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 VSO 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.

---

**4-digit static LCD car clock**

---

**PCF1174C**

---

**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.



4-digit static LCD car clock

PCF1174C

---

**NOTES**

---

4-digit static LCD car clock

PCF1174C

---

**NOTES**

---

4-digit static LCD car clock

PCF1174C

---

**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 0044

**Finland:** Sinikalliontie 3, FIN-02630 ESPOO,  
Tel. +358 9 615800, Fax. +358 9 61580920

**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, PO Box 18053,  
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 2865, 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

SCA54

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

417087/1200/02/pp20

Date of release: 1997 Apr 16

Document order number: 9397 750 01528

*Let's make things better.*

**Philips  
Semiconductors**



**PHILIPS**