

# DATA SHEET

## **PCA153X series** **32 kHz clock circuit**

Product specification  
Supersedes data of October 1988  
File under Integrated Circuits, IC16

January 1994

**Philips Semiconductors**



**PHILIPS**

**32 kHz clock circuit****PCA153X series****FEATURES**

- 32 kHz oscillator frequency
- Low current consumption; typically 2  $\mu\text{A}$ , maximum 5  $\mu\text{A}$
- Low minimum supply voltage: 1.1 V
- Output for bipolar stepping motor
  - output frequency 1 Hz
  - pulse duration: see Table 1 Available types
- Test mode speed-up with an input frequency up to 20 Hz (unchanged pulse duration).

**GENERAL DESCRIPTION**

The PCA153X series are silicon-gate CMOS integrated circuits specially suited for battery-operated, quartz-crystal-controlled clocks, with a bipolar stepping motor.

**ORDERING INFORMATION**

EXTENDED TYPE NUMBER	PACKAGE			
	PINS	PIN POSITION	MATERIAL	CODE
PCA1532P	8	DIL	plastic	SOT97
PCA1534P	8	DIL	plastic	SOT97
PCA1532T	8	SO	plastic	SO8; SOT96C
PCA1534T	8	SO	plastic	SO8; SOT96C
PCA1532U/10	–	chip on film frame carrier (FFC)	–	–
PCA1534U/10	–	chip on film frame carrier (FFC)	–	–

**Table 1** Available types.

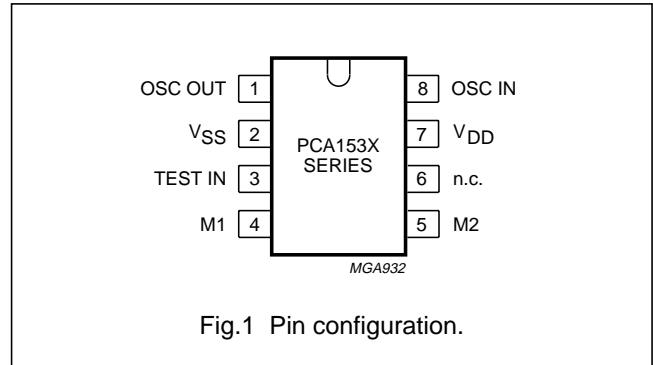
TYPE NUMBER	PULSE WIDTH $t_p$ (ms)	CAPACITANCE OUTPUT $C_o$ (pF)	CAPACITANCE INPUT $C_i$ (pF)
PCA1532	23.4	24.0	3.0
PCA1534	46.8	24.0	3.0

32 kHz clock circuit

PCA153X series

**PINNING**

SYMBOL	PIN	DESCRIPTION
OSC OUT	1	oscillator output
V <sub>SS</sub>	2	ground (0 V)
TEST IN	3	test input
M1	4	motor 1 output
M2	5	motor 2 output
n.c.	6	not connected
V <sub>DD</sub>	7	supply voltage
OSC IN	8	oscillator input



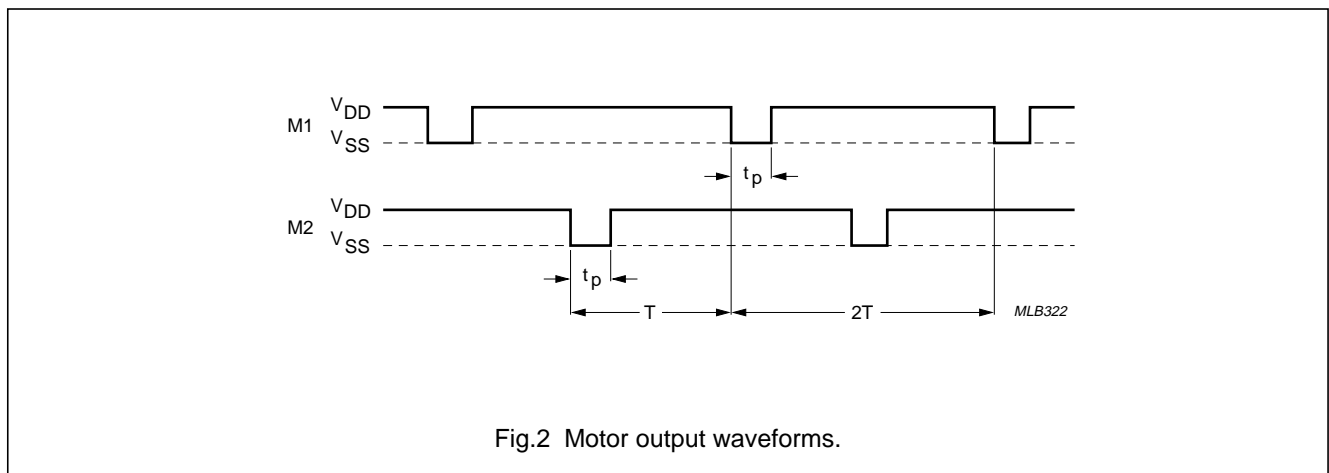
**FUNCTIONAL DESCRIPTION AND TESTING**

**Operating mode**

In the operating mode pin 3 must be left open-circuit or connected to V<sub>DD</sub>.

**Test mode**

When testing the motor, a test frequency can be applied to TEST IN (pin 3) which allows the motor outputs to be accelerated up to 20 Hz.



32 kHz clock circuit

PCA153X series

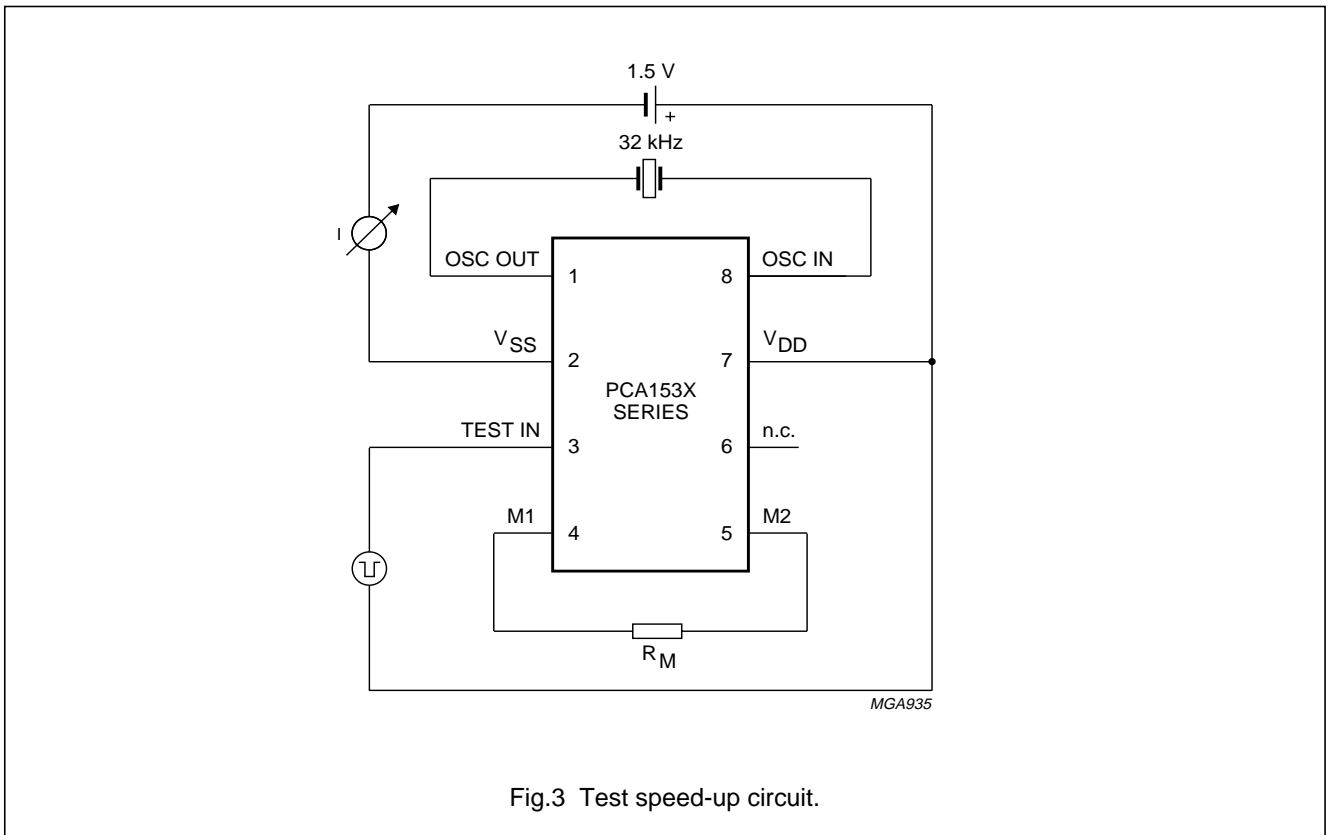


Fig.3 Test speed-up circuit.

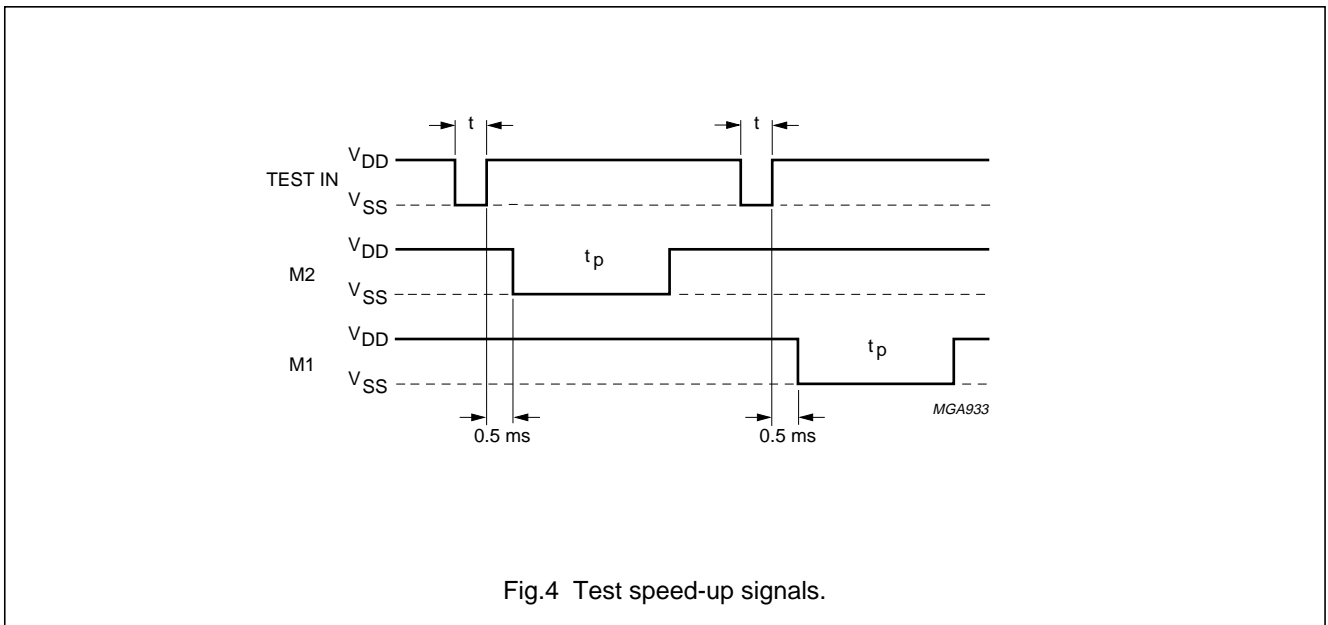


Fig.4 Test speed-up signals.

## 32 kHz clock circuit

## PCA153X series

**LIMITING VALUES**

In accordance with the Absolute Maximum Rating System (IEC134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
$V_{SS}$	supply voltage	$V_{DD} = 0\text{ V}$ ; note 1	+1.8	-6.0	V
$V_I$	input voltage		$V_{SS}$	$V_{DD}$	V
	output short-circuit duration at pins 4 and 5		indefinite		
$T_{amb}$	operating ambient temperature		-10	+60	°C
$T_{stg}$	storage temperature		-30	+125	°C

**Note to the "Limiting values"**

1. Connecting the battery at 1.8 V maximum with reversed polarity does not destroy the circuit, but in this condition a large current flows, which will rapidly discharge the battery.

**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 (see 'Handling MOS Devices').

## 32 kHz clock circuit

## PCA153X series

**CHARACTERISTICS**

$V_{DD} = 0$  V;  $V_{SS} = -1.4$  V;  $f_{osc} = 32.768$  kHz;  $T_{amb} = 25$  °C; crystal:  $R_S = 20$  k $\Omega$ ;  $C_i = 2$  to 3 fF;  $C_o = 1$  to 3 pF;  $C_L = 10$  pF; unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
<b>Supply (pins 2 and 7)</b>						
$V_{SS1}$	supply voltage	operating	-1.1	-	-1.8	V
$V_{SS2}$	supply voltage	starting	-1.2	-	-	V
$I_{DD}$	supply current	$R_L = \infty$	-	2	5	$\mu$ A
<b>Motor outputs (pins 4 and 5)</b>						
T	period		-	1.0	-	s
$t_p$	pulse width PCA1532 PCA1534		-	23.4	-	ms
			-	46.8	-	ms
$I_M$	current into load	$R_M = 200$ $\Omega$ ; $V_{SS} = -1.2$ V	$\pm 4$	-	-	mA
$R_O$	output resistance	$R_M = 200$ $\Omega$	-	60	-	$\Omega$
<b>Test input (pin 3)</b>						
$I_I$	input current	TEST IN at $V_{SS}$	-	70	-	$\mu$ A
<b>Oscillator (pins 1 and 8)</b>						
$R_p$	polarization resistance		3	10	30	M $\Omega$
$C_o$	output capacitance (pin 1) PCA1532 PCA1534	note 1	-	24.0	-	pF
			-	24.0	-	pF
$C_i$	input capacitance (pin 8) PCA1532 PCA1534	note 1	-	3.0	-	pF
			-	3.0	-	pF
$\Delta f/f$	frequency stability	$\Delta V_{SS} = 100$ mV	-	$0.4 \times 10^{-6}$	-	

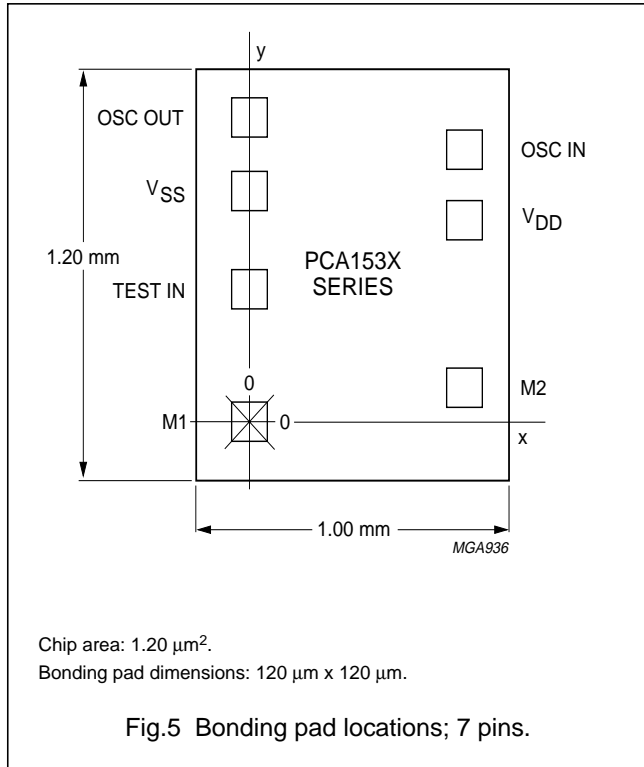
**Note to the "Characteristics"**

- Sum of  $C_i$  and  $C_o$  limited to 40 pF.

32 kHz clock circuit

PCA153X series

CHIP DIMENSIONS AND BONDING PAD LOCATIONS

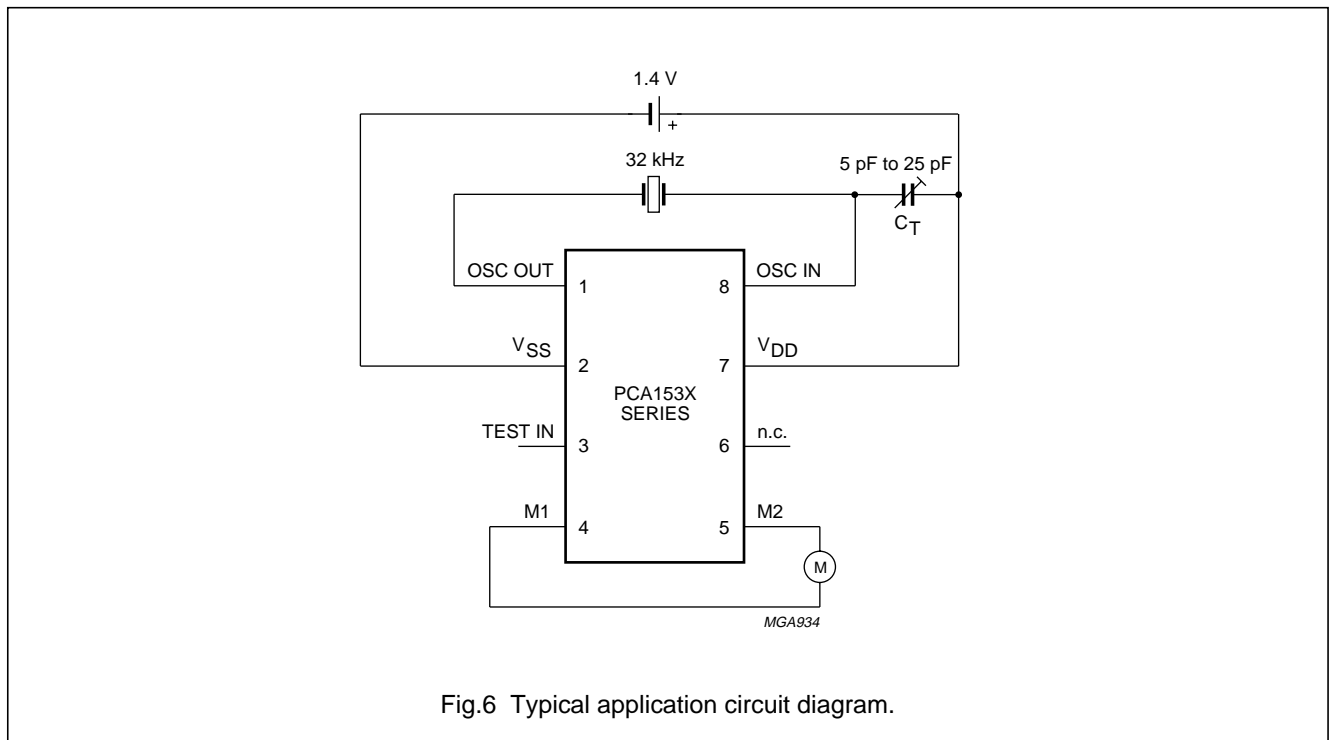


Bonding pad locations (dimensions in  $\mu\text{m}$ ).

All x/y coordinates are referenced to bottom left pad (M1), see Fig.5.

PAD	x	y
OSC OUT	0	880
V <sub>SS</sub>	0	670
TEST IN	0	380
M1	0	0
M2	675	94
V <sub>DD</sub>	675	575
OSC IN	675	785
chip corner (max. value)	-180	-180

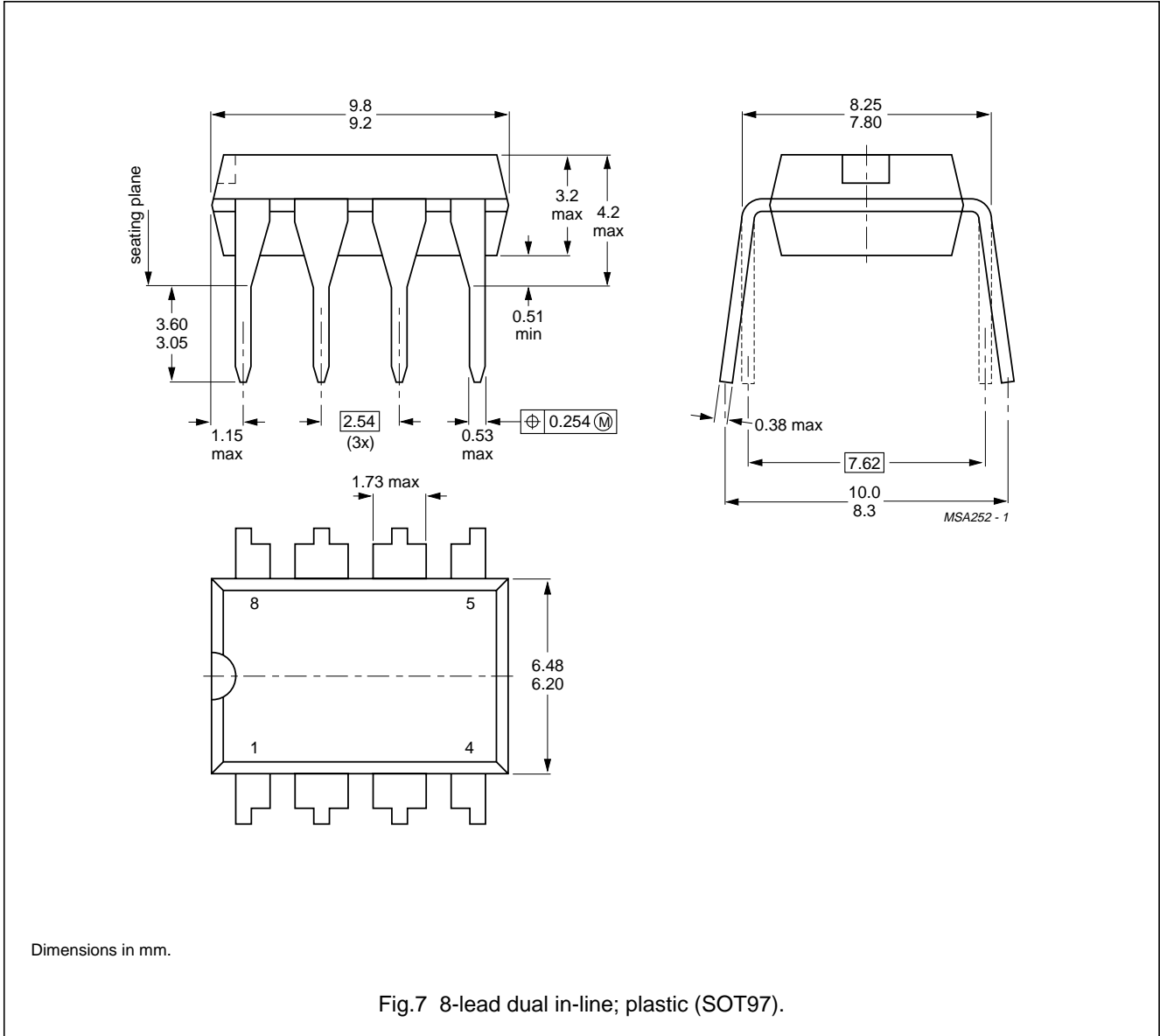
APPLICATION INFORMATION



32 kHz clock circuit

PCA153X series

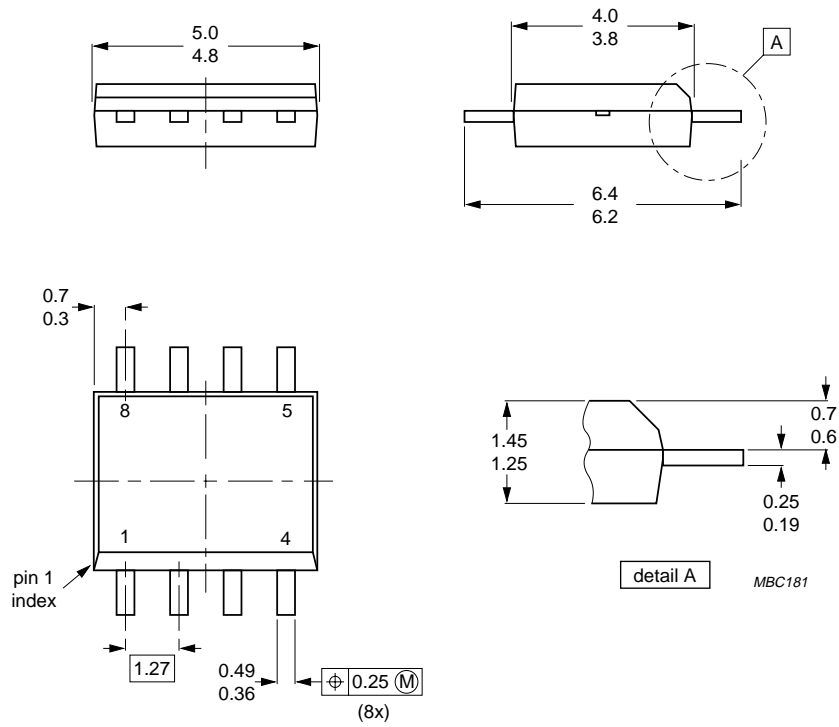
PACKAGE OUTLINES





32 kHz clock circuit

PCA153X series



Dimensions in mm.

Fig.8 8-lead small outline; plastic (SO8; SOT96C).

---

## 32 kHz clock circuit

## PCA153X series

---

### SOLDERING

#### Plastic dual in-line packages

BY DIP OR WAVE

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

The device may be mounted up to the seating plane, but the temperature of the plastic body must not exceed the specified storage maximum. 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 the soldering iron below the seating plane (or not more than 2 mm above it). If its temperature is below 300 °C, it must not be in contact for more than 10 s; if between 300 and 400 °C, for not more than 5 s.

#### Plastic small outline

BY WAVE

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

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

A modified wave soldering technique is recommended using two solder waves (dual-wave), in which a turbulent wave with high upward pressure is followed by a smooth laminar wave. Using a mildly-activated flux eliminates the need for removal of corrosive residues in most applications.

BY SOLDER PASTE REFLOW

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

Several techniques exist for reflowing; for example, thermal conduction by heated belt, infrared, and vapour-phase reflow. Dwell times vary between 50 and 300 s according to 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 min. at 45 °C.

REPAIRING SOLDERED JOINTS (BY HAND-HELD SOLDERING IRON OR PULSE-HEATED SOLDER TOOL)

Fix the component by first soldering two, diagonally opposite, end pins. Apply the heating tool to the flat part of the pin only. Contact time must be limited to 10 s at up to 300 °C. When using proper tools, all other pins can be soldered in one operation within 2 to 5 s at between 270 and 320 °C. (Pulse-heated soldering is not recommended for SO packages.)

For pulse-heated solder tool (resistance) soldering of VSO packages, solder is applied to the substrate by dipping or by an extra thick tin/lead plating before package placement.

## 32 kHz clock circuit

## PCA153X series

**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.

## Philips Semiconductors – a worldwide company

**Argentina:** IEROD, Av. Juramento 1992 - 14.b, (1428)  
BUENOS AIRES, Tel. (541)786 7633, Fax. (541)786 9367

**Australia:** 34 Waterloo Road, NORTH RYDE, NSW 2113,  
Tel. (02)805 4455, Fax. (02)805 4466

**Austria:** Triester Str. 64, A-1101 WIEN, P.O. Box 213,  
Tel. (01)60 101-1236, Fax. (01)60 101-1211

**Belgium:** Postbus 90050, 5600 PB EINDHOVEN, The Netherlands,  
Tel. (31)40 783 749, Fax. (31)40 788 399

**Brazil:** Rua do Rocio 220 - 5<sup>th</sup> floor, Suite 51,  
CEP: 04552-903-SÃO PAULO-SP, Brazil.  
P.O. Box 7383 (01064-970).

Tel. (011)829-1166, Fax. (011)829-1849

**Canada:** INTEGRATED CIRCUITS:

Tel. (800)234-7381, Fax. (708)296-8556

DISCRETE SEMICONDUCTORS: 601 Milner Ave,  
SCARBOROUGH, ONTARIO, M1B 1M8,  
Tel. (416)292 5161 ext. 2336, Fax. (416)292 4477

**Chile:** Av. Santa Maria 0760, SANTIAGO,  
Tel. (02)773 816, Fax. (02)777 6730

**Colombia:** Carrera 21 No. 56-17, BOGOTÁ, D.E., P.O. Box 77621,  
Tel. (571)217 4609, Fax. (01)217 4549

**Denmark:** Prags Boulevard 80, PB 1919, DK-2300 COPENHAGEN S,  
Tel. (032)88 2636, Fax. (031)57 1949

**Finland:** Sinikalliontie 3, FIN-02630 ESPOO,  
Tel. (9)0-50261, Fax. (9)0-520971

**France:** 4 rue du Port-aux-Vins, BP317,  
92156 SURESNES Cedex,  
Tel. (01)4099 6161, Fax. (01)4099 6427

**Germany:** P.O. Box 10 63 23, 20095 HAMBURG ,  
Tel. (040)3296-0, Fax. (040)3296 213

**Greece:** No. 15, 25th March Street, GR 17778 TAVROS,  
Tel. (01)4894 339/4894 911, Fax. (01)4814 240

**Hong Kong:** 15/F Philips Ind. Bldg., 24-28 Kung Yip St.,  
KWAI CHUNG, Tel. (0)4245 121, Fax. (0)4806 960

**India:** PEICO ELECTRONICS & ELECTRICALS Ltd.,  
Components Dept., Shivsagar Estate, Block 'A',  
Dr. Annie Besant Rd., Worli, BOMBAY-400 018,  
Tel. (022)4938 541, Fax. (022)4938 722

**Indonesia:** Philips House, Jalan H.R. Rasuna Said Kav. 3-4,  
P.O. Box 4252, JAKARTA 12950,  
Tel. (021)5201 122, Fax. (021)5205 189

**Ireland:** Newstead, Clonskeagh, DUBLIN 14,  
Tel. (01)640 000, Fax. (01)640 200

**Italy:** Viale F. Testi, 327, 20162-MILANO,  
Tel. (02)6752.1, Fax. (02)6752.3350

**Japan:** Philips Bldg 13-37, Kohnan2-chome, Minato-ku, KOKIO 108,  
Tel. (03)3740 5101, Fax. (03)3740 0570

**Korea:** (Republic of) Philips House, 260-199 Itaewon-dong,  
Yongsan-ku, SEOUL, Tel. (02)794-5011, Fax. (02)798-8022

**Malaysia:** No. 76 Jalan Universiti, 46200 PETALING JAYA,  
SELANGOR, Tel. (03)757 5511, Fax. (03)757 4880

**Mexico:** Philips Components, 5900 Gateway East, Suite 200,  
EL PASO, TX 79905, Tel. 9-5(800)234-7381, Fax. (708)296-8556

**Netherlands:** Postbus 90050, 5600 PB EINDHOVEN,  
Tel. (040)78 37 49, Fax. (040)78 83 99

**New Zealand:** 2 Wagener Place, C.P.O. Box 1041, AUCKLAND,  
Tel. (09)849-4160, Fax. (09)849-7811

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

**Pakistan:** Philips Markaz, M.A. Jinnah Rd., KARACHI-3,  
Tel. (021)577 039, Fax. (021)569 1832

**Philippines:** PHILIPS SEMICONDUCTORS PHILIPPINES Inc,  
106 Valero St. Salcedo Village, P.O. Box 911, MAKATI,  
Metro MANILA, Tel. (02)810 0161, Fax. (02)817 3474

**Portugal:** Av. Eng. Duarte Pacheco 6, 1009 LISBOA Codex,  
Tel. (01)683 121, Fax. (01)658 013

**Singapore:** Lorong 1, Toa Payoh, SINGAPORE 1231,  
Tel. (65)350 2000, Fax. (65)251 6500

**South Africa:** 195-215 Main Road, Martindale,  
P.O. Box 7430, JOHANNESBURG 2000,  
Tel. (011)470-5433, Fax. (011)470-5494

**Spain:** Balmes 22, 08007 BARCELONA,  
Tel. (03)301 6312, Fax. (03)301 4243

**Sweden:** Kottbygatan 7, Akalla. S-164 85 STOCKHOLM,  
Tel. (0)8-632 2000, Fax. (0)8-632 2745

**Switzerland:** Allmendstrasse 140, CH-8027 ZÜRICH,  
Tel. (01)488 2211, Fax. (01)481 7730

**Taiwan:** 69, Min Sheng East Road, Sec 3, P.O. Box 22978,  
TAIPEI 10446, Tel. (2)509 7666, Fax. (2)500 5899

**Thailand:** PHILIPS ELECTRONICS (THAILAND) Ltd.,  
60/14 MOO 11, Bangna - Trad Road Km. 3  
Prakanong, BANGKOK 10260,

Tel. (2)399-3280 to 9, (2)398-2083, Fax. (2)398-2080

**Turkey:** Talatpasa Cad. No. 5, 80640 LEVENT/ISTANBUL,  
Tel. (0212)279 2770, Fax. (0212)269 3094

**United Kingdom:** Philips Semiconductors Limited, P.O. Box 65,  
Philips House, Torrington Place, LONDON, WC1E 7HD,  
Tel. (071)436 41 44, Fax. (071)323 03 42

**United States:** INTEGRATED CIRCUITS:

811 East Arques Avenue, SUNNYVALE, CA 94088-3409,

Tel. (800)234-7381, Fax. (708)296-8556

DISCRETE SEMICONDUCTORS: 2001 West Blue Heron Blvd.,  
P.O. Box 10330, RIVIERA BEACH, FLORIDA 33404,

Tel. (800)447-3762 and (407)881-3200, Fax. (407)881-3300

**Uruguay:** Coronel Mora 433, MONTEVIDEO,  
Tel. (02)70-4044, Fax. (02)92 0601

**For all other countries apply to:** Philips Semiconductors,  
International Marketing and Sales, Building BAF-1,  
P.O. Box 218, 5600 MD, EINDHOVEN, The Netherlands,  
Telex 35000 phicnl, Fax. +31-40-724825

SCD26

© Philips Electronics N.V. 1993

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

9397 725 30011

# Philips Semiconductors



# PHILIPS