32 kHz clock circuit   PCA153X series

FEATURES

- 32 kHz oscillator frequency
- Low current consumption; typically 2 μA, maximum 5 μA
- 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

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PINNING

SYMBOL	PIN	DESCRIPTION
OSC OUT	1	oscillator output
V_{SS}	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_{DD}	7	supply voltage
OSC IN	8	oscillator input

Fig.1 Pin configuration.
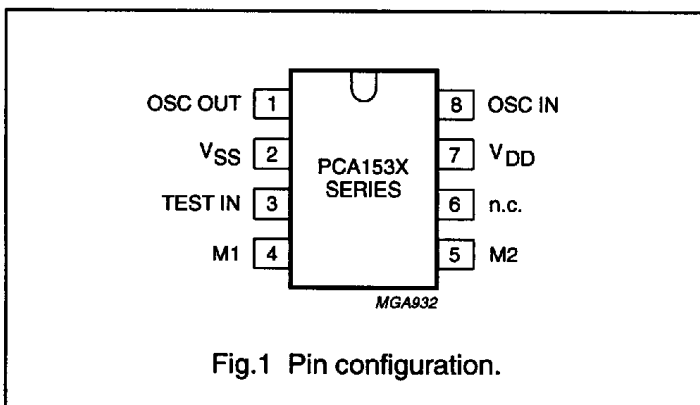
FUNCTIONAL DESCRIPTION AND TESTING

Operating mode

In the operating mode pin 3 must be left open-circuit or connected to V_{DD}.

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.
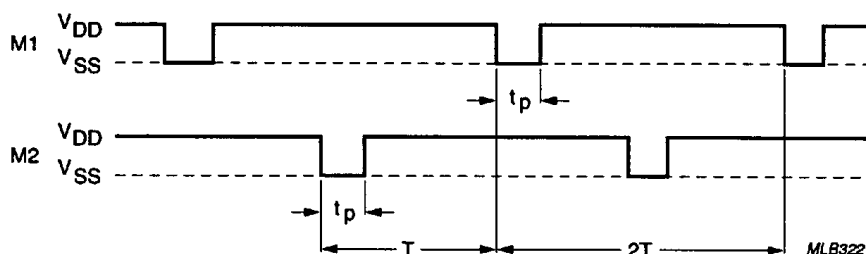

Fig.2 Motor output waveforms.
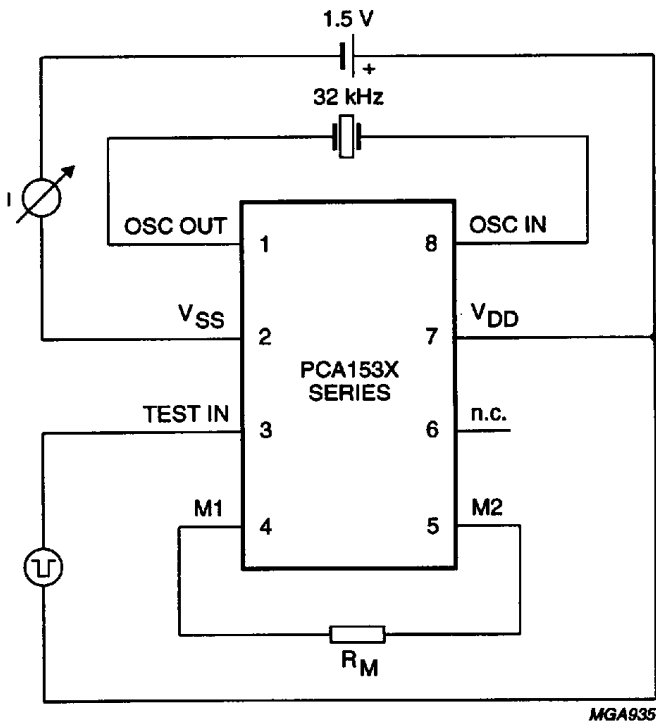
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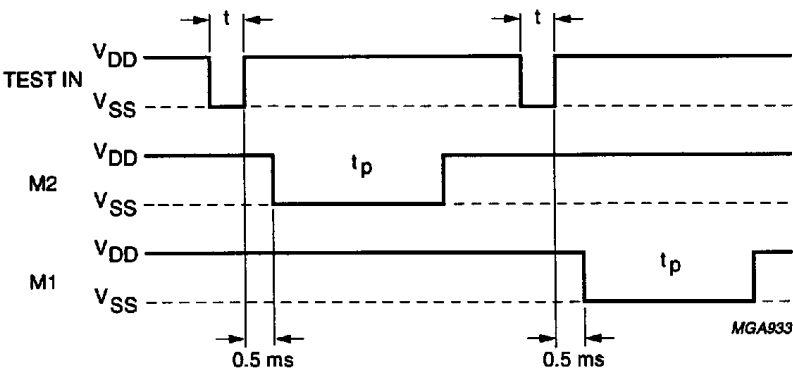
Fig.3 Test speed-up circuit.

Fig.4 Test speed-up signals.

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LIMITING VALUES

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

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{SS}	supply voltage	V_{DD} = 0 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').

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CHARACTERISTICS

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

| SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
Supply (pins 2 and 7)						
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	μA
Motor outputs (pins 4 and 5)						
T	period		−	1.0	−	s
t_p	pulse width					
	PCA1532		−	23.4	−	ms
	PCA1534		−	46.8	−	ms
I_M	current into load	$R_M = 200$ Ω; $V_{SS} = -1.2$ V	±4	−	−	mA
R_O	output resistance	$R_M = 200$ Ω	−	60	−	Ω
Test input (pin 3)						
I_I	input current	TEST IN at V_{SS}	−	70	−	μA
Oscillator (pins 1 and 8)						
R_p	polarization resistance		3	10	30	MΩ
C_o	output capacitance (pin 1)	note 1				
	PCA1532		−	24.0	−	pF
	PCA1534		−	24.0	−	pF
C_i	input capacitance (pin 8)	note 1				
	PCA1532		−	3.0	−	pF
	PCA1534		−	3.0	−	pF
Δf/f	frequency stability	$\Delta V_{SS} = 100$ mV	−	0.4×10^{-6}	−	

Note to the "Characteristics"

1. Sum of C_i and C_o limited to 40 pF.

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CHIP DIMENSIONS AND BONDING PAD LOCATIONS

Chip area: 1.20 μm^2.
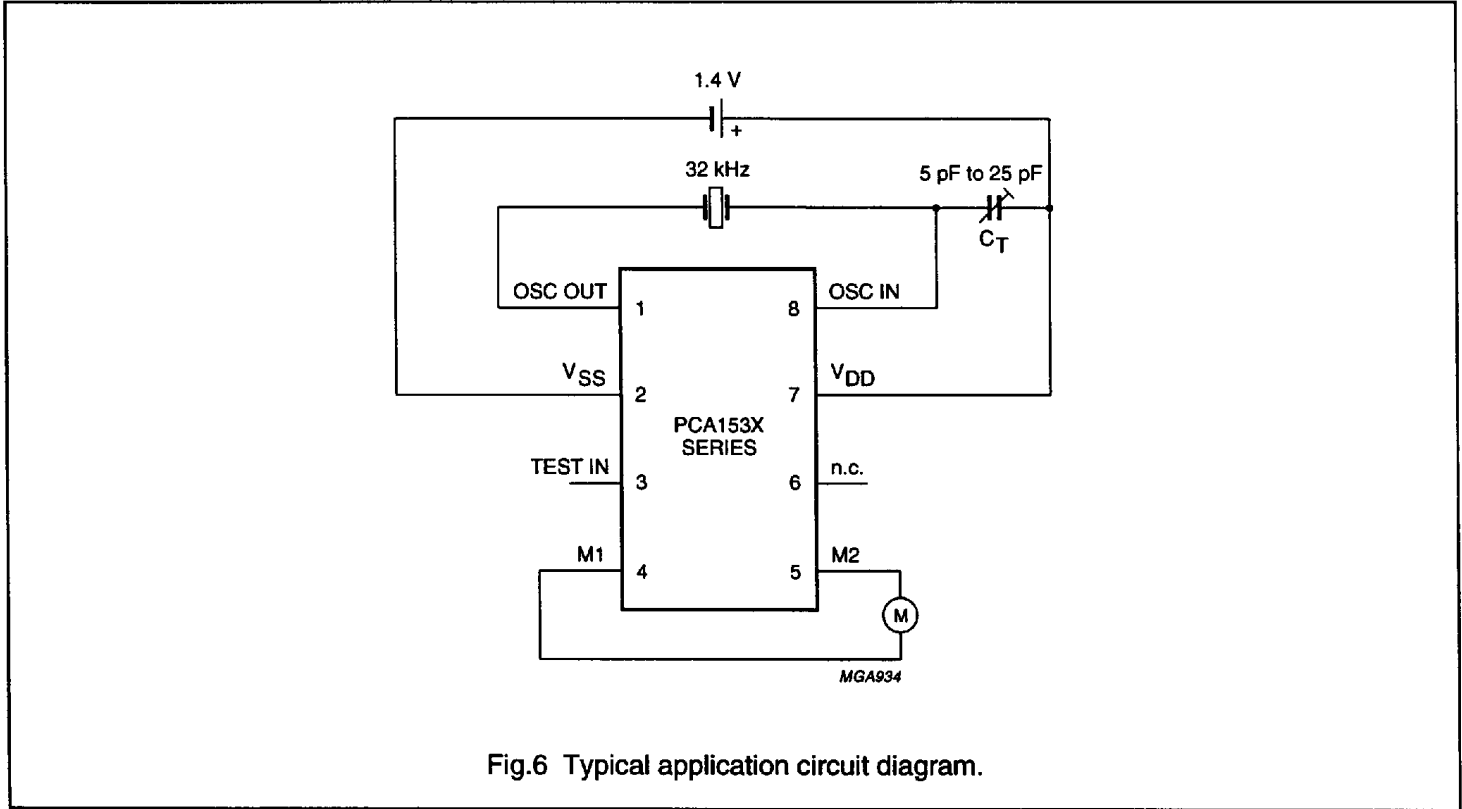
Bonding pad dimensions: 120 μm x 120 μm.

Fig.5 Bonding pad locations; 7 pins.
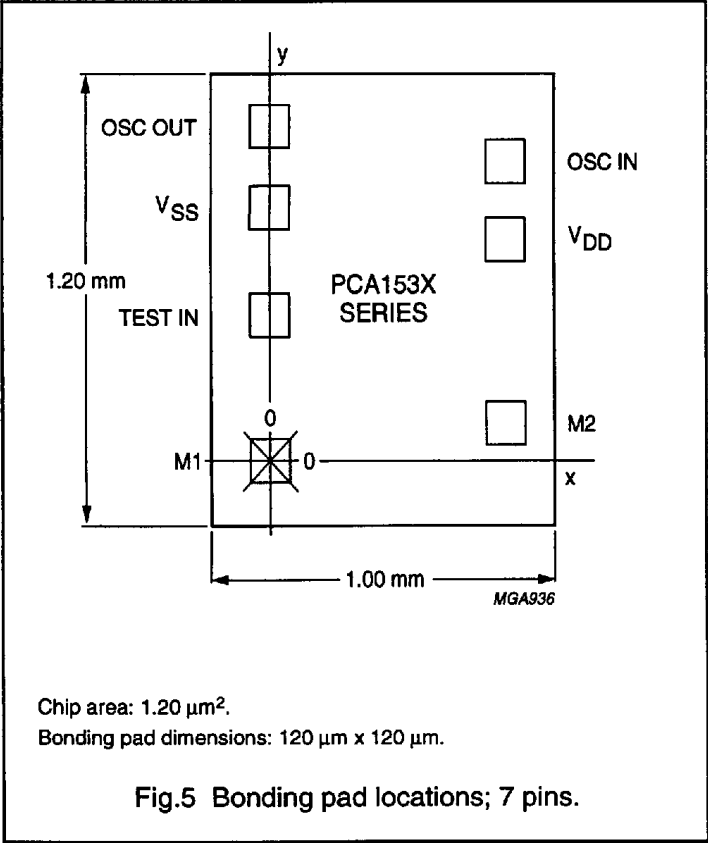
Bonding pad locations (dimensions in μm).

All x/y coordinates are referenced to bottom left pad (M1), see Fig.6.

PAD	x	y
OSC OUT	0	880
V_{SS}	0	670
TEST IN	0	380
M1	0	0
M2	675	94
V_{DD}	675	575
OSC IN	675	785
chip corner (max. value)	−180	−180

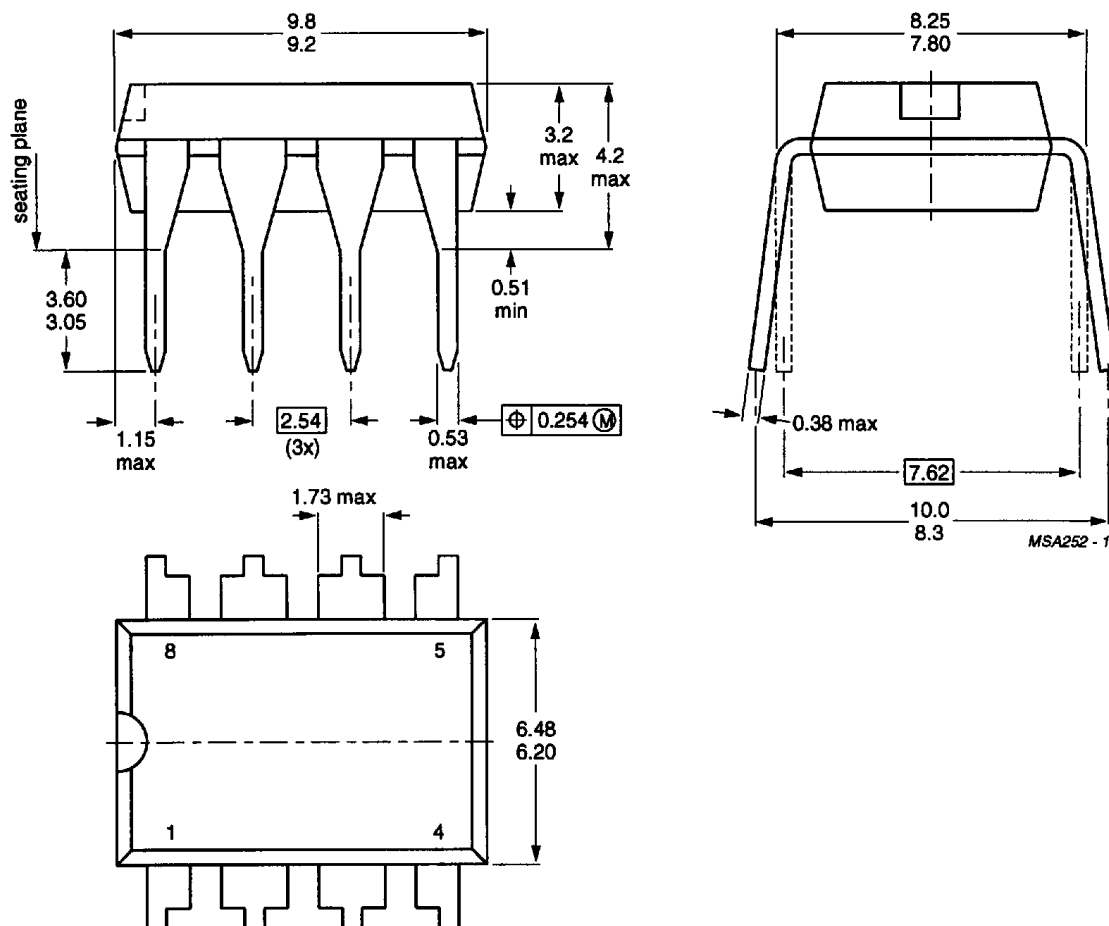## APPLICATION INFORMATION

Fig.6 Typical application circuit diagram.

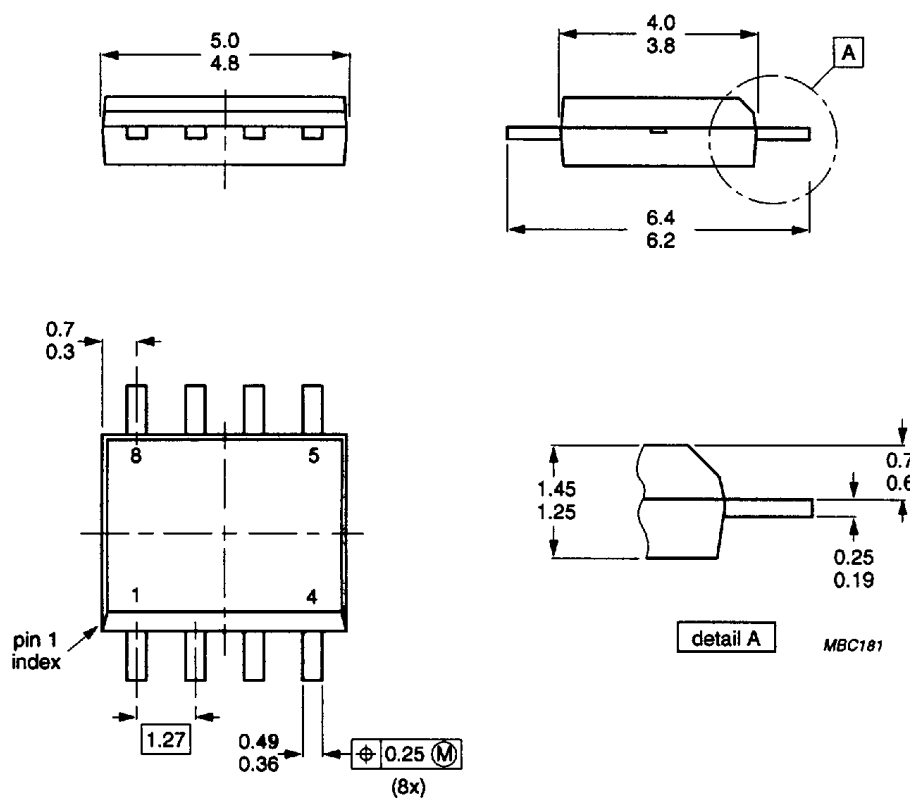## 32 kHz clock circuit

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PACKAGE OUTLINES

Dimensions in mm.

Fig.7 8-lead dual in-line; plastic (SOT97).

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Dimensions in mm.

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

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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.

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DEFINITIONS

Data sheet status	
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.
Limiting values	
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.	
Application information	
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.