

# **DATA SHEET**

## **PCF8574**

**Remote 8-bit I/O expander for  
I<sup>2</sup>C-bus**

Product specification

1997 Apr 02

Supersedes data of September 1994

File under Integrated Circuits, IC12

**Remote 8-bit I/O expander for I<sup>2</sup>C-bus****PCF8574****CONTENTS**

- 1 FEATURES
- 2 GENERAL DESCRIPTION
- 3 ORDERING INFORMATION
- 4 BLOCK DIAGRAM
- 5 PINNING
- 6 CHARACTERISTICS OF THE I<sup>2</sup>C-BUS
  - 6.1 Bit transfer
  - 6.2 Start and stop conditions
  - 6.3 System configuration
  - 6.4 Acknowledge
- 7 FUNCTIONAL DESCRIPTION
  - 7.1 Addressing
  - 7.2 Interrupt
  - 7.3 Quasi-bidirectional I/Os
- 8 LIMITING VALUES
- 9 HANDLING
- 10 DC CHARACTERISTICS
- 11 I<sup>2</sup>C-BUS TIMING CHARACTERISTICS
- 12 PACKAGE OUTLINES
- 13 SOLDERING
  - 13.1 Introduction
  - 13.2 DIP
    - 13.2.1 Soldering by dipping or by wave
    - 13.2.2 Repairing soldered joints
  - 13.3 SO and SSOP
    - 13.3.1 Reflow soldering
    - 13.3.2 Wave soldering
    - 13.3.3 Repairing soldered joints
- 14 DEFINITIONS
- 15 LIFE SUPPORT APPLICATIONS
- 16 PURCHASE OF PHILIPS I<sup>2</sup>C COMPONENTS



Remote 8-bit I/O expander for I<sup>2</sup>C-bus

PCF8574

**1 FEATURES**

- Operating supply voltage 2.5 to 6 V
- Low standby current consumption of 10 µA maximum
- I<sup>2</sup>C to parallel port expander
- Open-drain interrupt output
- 8-bit remote I/O port for the I<sup>2</sup>C-bus
- Compatible with most microcontrollers
- Latched outputs with high current drive capability for directly driving LEDs
- Address by 3 hardware address pins for use of up to 8 devices (up to 16 with PCF8574A)
- DIP16, or space-saving SO16 or SSOP20 packages.

**2 GENERAL DESCRIPTION**

The PCF8574 is a silicon CMOS circuit. It provides general purpose remote I/O expansion for most microcontroller families via the two-line bidirectional bus (I<sup>2</sup>C).

The device consists of an 8-bit quasi-bidirectional port and an I<sup>2</sup>C-bus interface. The PCF8574 has a low current consumption and includes latched outputs with high current drive capability for directly driving LEDs. It also possesses an interrupt line (INT) which can be connected to the interrupt logic of the microcontroller. By sending an interrupt signal on this line, the remote I/O can inform the microcontroller if there is incoming data on its ports without having to communicate via the I<sup>2</sup>C-bus. This means that the PCF8574 can remain a simple slave device.

The PCF8574 and PCF8574A versions differ only in their slave address as shown in Fig.9.

**3 ORDERING INFORMATION**

TYPE NUMBER	PACKAGE		
	NAME	DESCRIPTION	VERSION
PCF8574P; PCF8574AP	DIP16	plastic dual in-line package; 16 leads (300 mil)	SOT38-1
PCF8574T; PCF8574AT	SO16	plastic small outline package; 16 leads; body width 7.5 mm	SOT162-1
PCF8574TS	SSOP20	plastic shrink small outline package; 20 leads; body width 4.4 mm	SOT266-1

Remote 8-bit I/O expander for I<sup>2</sup>C-bus

PCF8574

## 4 BLOCK DIAGRAM

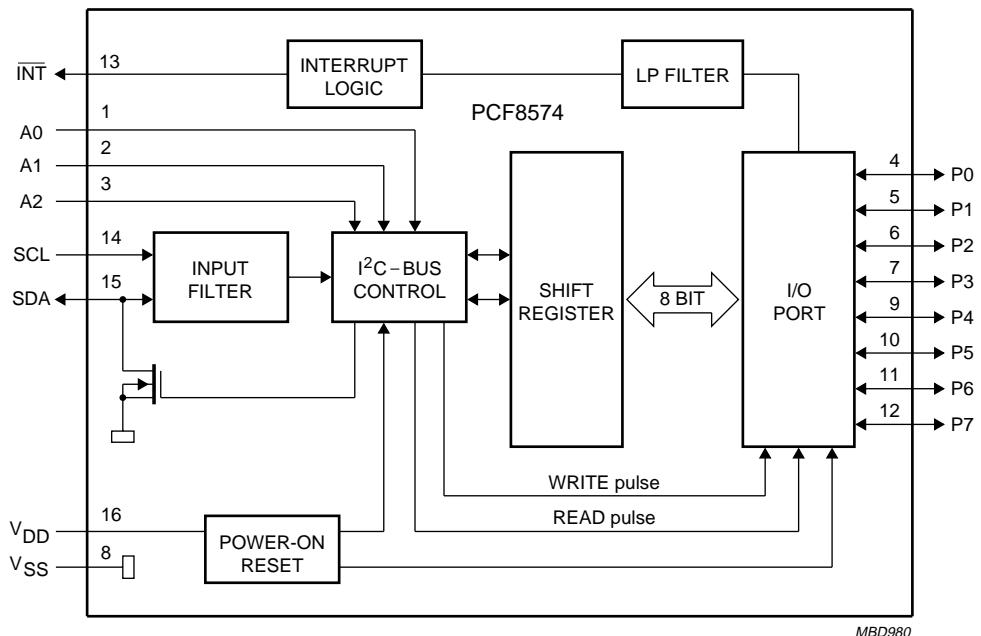


Fig.1 Block diagram (SOT38-1 and SOT162-1).

Remote 8-bit I/O expander for I<sup>2</sup>C-bus

PCF8574

## 5 PINNING

SYMBOL	PIN		DESCRIPTION
	DIP16; SO16	SSOP20	
A0	1	6	address input 0
A1	2	7	address input 1
A2	3	9	address input 2
P0	4	10	quasi-bidirectional I/O 0
P1	5	11	quasi-bidirectional I/O 1
P2	6	12	quasi-bidirectional I/O 2
P3	7	14	quasi-bidirectional I/O 3
V <sub>SS</sub>	8	15	supply ground
P4	9	16	quasi-bidirectional I/O 4
P5	10	17	quasi-bidirectional I/O 5
P6	11	19	quasi-bidirectional I/O 6
P7	12	20	quasi-bidirectional I/O 7
INT	13	1	interrupt output (active LOW)
SCL	14	2	serial clock line
SDA	15	4	serial data line
V <sub>DD</sub>	16	5	supply voltage
n.c.	—	3	not connected
n.c.	—	8	not connected
n.c.	—	13	not connected
n.c.	—	18	not connected

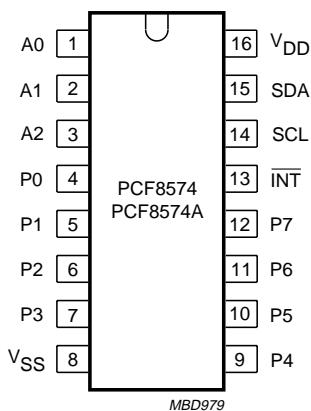


Fig.2 Pin configuration (DIP16; SO16).

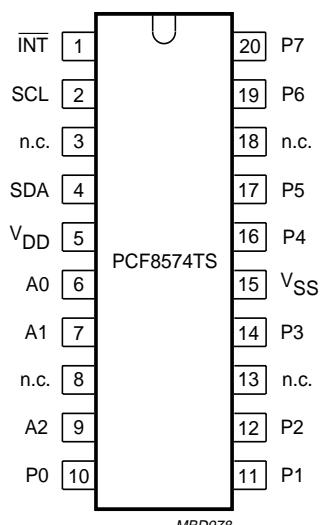


Fig.3 Pin configuration (SSOP20).

Remote 8-bit I/O expander for I<sup>2</sup>C-bus

PCF8574

6 CHARACTERISTICS OF THE I<sup>2</sup>C-BUS

The I<sup>2</sup>C-bus is for 2-way, 2-line communication between different ICs or modules. The two lines are a serial data line (SDA) and a serial clock line (SCL). Both lines must be connected to a positive supply via a pull-up resistor when connected to the output stages of a device. Data transfer may be initiated only when the bus is not busy.

## 6.1 Bit transfer

One data bit is transferred during each clock pulse. The data on the SDA line must remain stable during the HIGH period of the clock pulse as changes in the data line at this time will be interpreted as control signals (see Fig.4).

## 6.2 Start and stop conditions

Both data and clock lines remain HIGH when the bus is not busy. A HIGH-to-LOW transition of the data line, while the clock is HIGH is defined as the start condition (S). A LOW-to-HIGH transition of the data line while the clock is HIGH is defined as the stop condition (P) (see Fig.5).

## 6.3 System configuration

A device generating a message is a 'transmitter', a device receiving is the 'receiver'. The device that controls the message is the 'master' and the devices which are controlled by the master are the 'slaves' (see Fig.6).

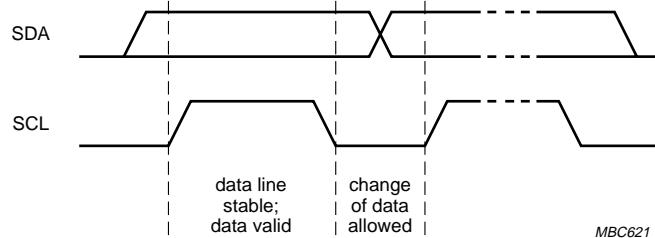


Fig.4 Bit transfer.

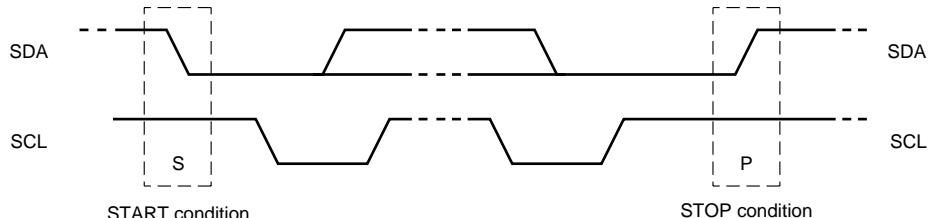


Fig.5 Definition of start and stop conditions.

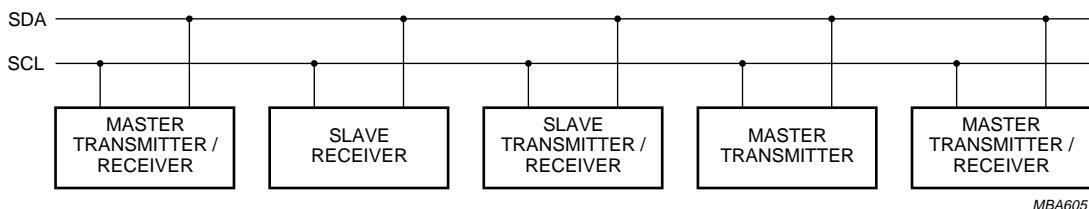


Fig.6 System configuration.

Remote 8-bit I/O expander for I<sup>2</sup>C-bus

PCF8574

## 6.4 Acknowledge

The number of data bytes transferred between the start and the stop conditions from transmitter to receiver is not limited. Each byte of eight bits is followed by one acknowledge bit. The acknowledge bit is a HIGH level put on the bus by the transmitter whereas the master generates an extra acknowledge related clock pulse.

A slave receiver which is addressed must generate an acknowledge after the reception of each byte. Also a master must generate an acknowledge after the reception of each byte that has been clocked out of the slave

transmitter. The device that acknowledges has to pull down the SDA line during the acknowledge clock pulse, so that the SDA line is stable LOW during the HIGH period of the acknowledge related clock pulse, set-up and hold times must be taken into account.

A master receiver must signal an end of data to the transmitter by **not** generating an acknowledge on the last byte that has been clocked out of the slave. In this event the transmitter must leave the data line HIGH to enable the master to generate a stop condition.

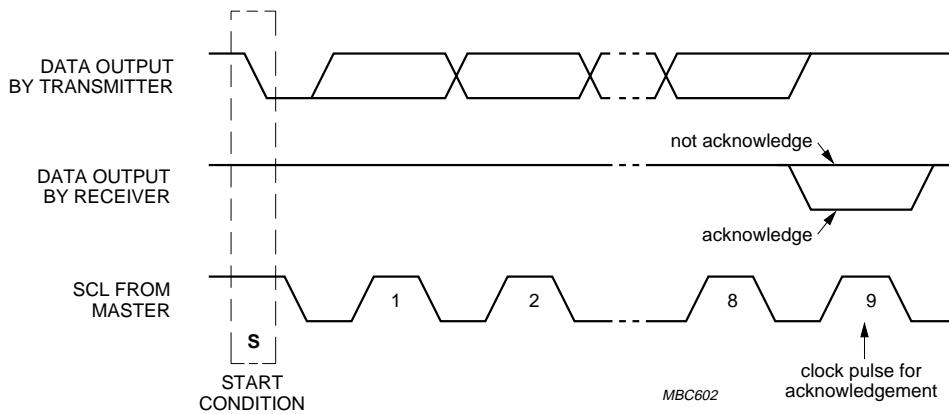


Fig.7 Acknowledgment on the I<sup>2</sup>C-bus.

Remote 8-bit I/O expander for I<sup>2</sup>C-bus

PCF8574

## 7 FUNCTIONAL DESCRIPTION

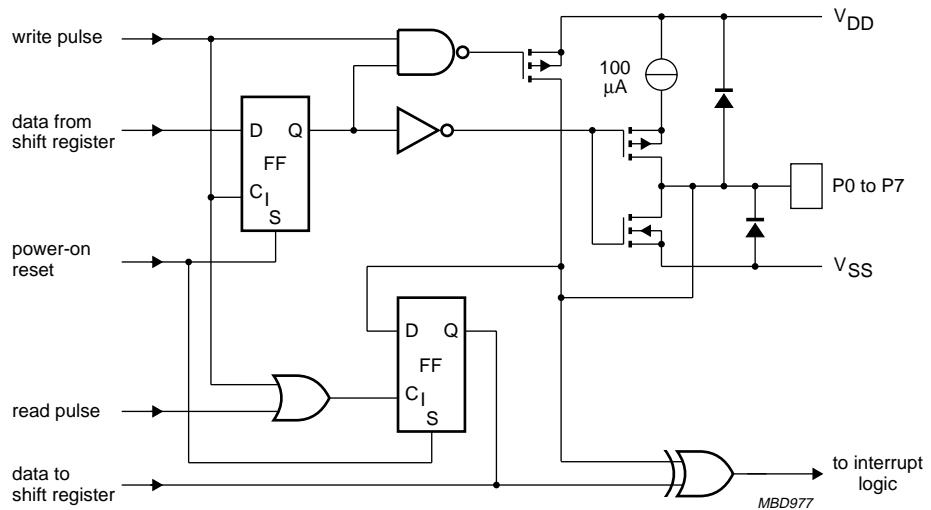


Fig.8 Simplified schematic diagram of each I/O.

## 7.1 Addressing

For addressing see Figs 9, 10 and 11.

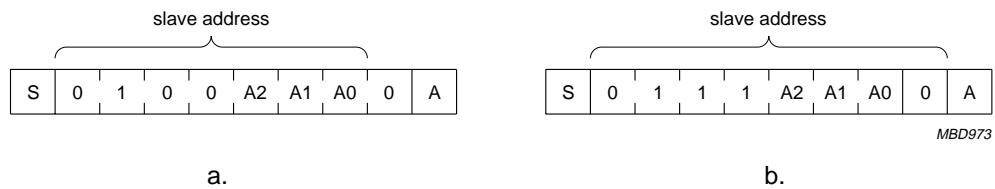
(a) PCF8574.  
(b) PCF8574A.

Fig.9 PCF8574 and PCF8574A slave addresses.

Each of the PCF8574's eight I/Os can be independently used as an input or output. Input data is transferred from the port to the microcontroller by the READ mode (see Fig.11). Output data is transmitted to the port by the WRITE mode (see Fig.10).

Remote 8-bit I/O expander for I<sup>2</sup>C-bus

PCF8574

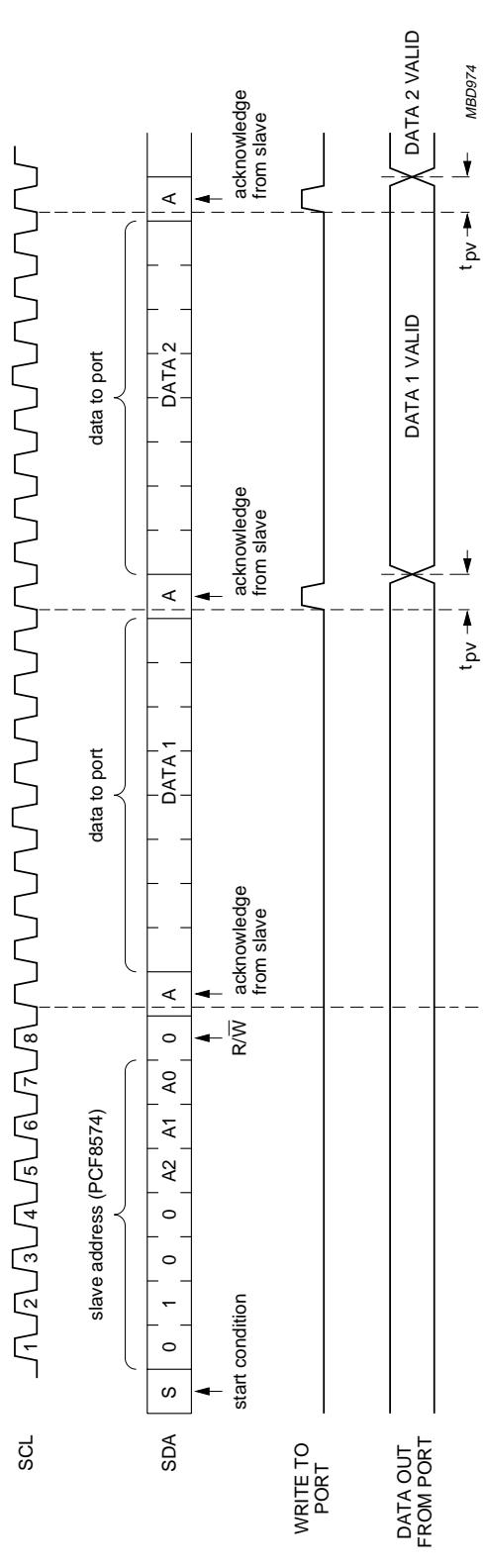
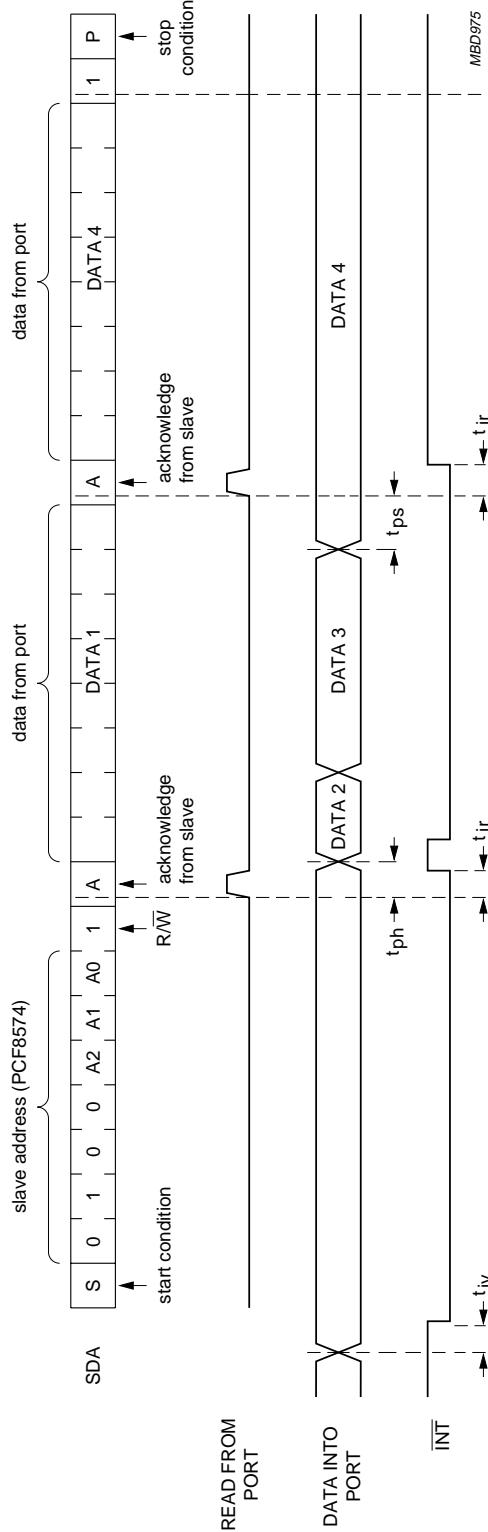


Fig.10 WRITE mode (output).

Remote 8-bit I/O expander for I<sup>2</sup>C-bus

PCF8574



A LOW-to-HIGH transition of SDA, while SCL is HIGH is defined as the stop condition (P). Transfer of data can be stopped at any moment by a stop condition. When this occurs, data present at the last acknowledge phase is valid (output mode). Input data is lost.

Fig.11 READ mode (input).

Remote 8-bit I/O expander for I<sup>2</sup>C-bus

PCF8574

## 7.2 Interrupt (see Figs 12 and 13)

The PCF8574 provides an open drain output ( $\overline{\text{INT}}$ ) which can be fed to a corresponding input of the microcontroller. This gives these chips a type of master function which can initiate an action elsewhere in the system.

An interrupt is generated by any rising or falling edge of the port inputs in the input mode. After time  $t_{iv}$  the signal  $\overline{\text{INT}}$  is valid.

Resetting and reactivating the interrupt circuit is achieved when data on the port is changed to the original setting or data is read from or written to the port which has generated the interrupt.

Resetting occurs as follows:

- In the READ mode at the acknowledge bit after the rising edge of the SCL signal
- In the WRITE mode at the acknowledge bit after the HIGH-to-LOW transition of the SCL signal

- Interrupts which occur during the acknowledge clock pulse may be lost (or very short) due to the resetting of the interrupt during this pulse.

Each change of the I/Os after resetting will be detected and, after the next rising clock edge, will be transmitted as  $\overline{\text{INT}}$ . Reading from or writing to another device does not affect the interrupt circuit.

## 7.3 Quasi-bidirectional I/Os (see Fig.14)

A quasi-bidirectional I/O can be used as an input or output without the use of a control signal for data direction.

At power-on the I/Os are HIGH. In this mode only a current source to  $V_{DD}$  is active. An additional strong pull-up to  $V_{DD}$  allows fast rising edges into heavily loaded outputs. These devices turn on when an output is written HIGH, and are switched off by the negative edge of SCL. The I/Os should be HIGH before being used as inputs.

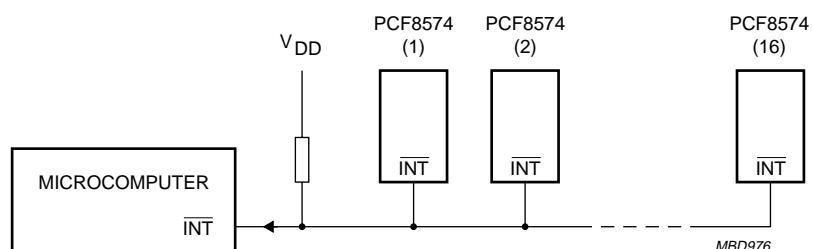


Fig.12 Application of multiple PCF8574s with interrupt.

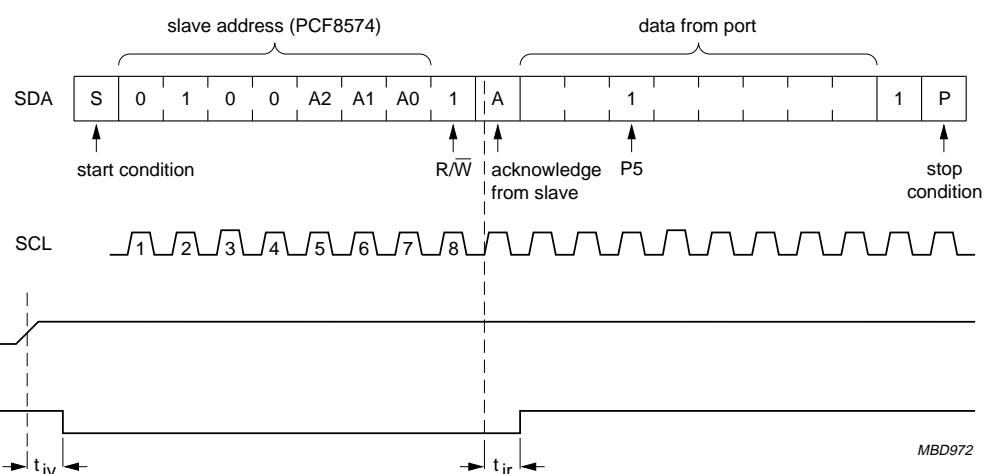


Fig.13 Interrupt generated by a change of input to I/O P5.

## Remote 8-bit I/O expander for I<sup>2</sup>C-bus

## PCF8574

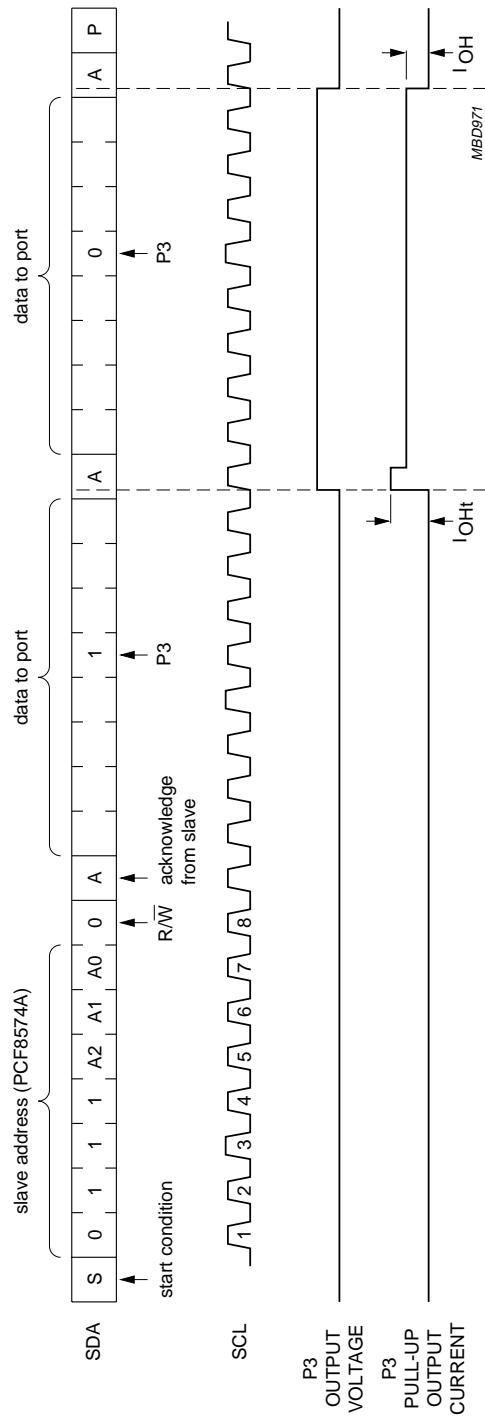


Fig.14 Transient pull-up current  $I_{QH}$  while P3 changes from LOW-to-HIGH and back to LOW.

Remote 8-bit I/O expander for I<sup>2</sup>C-bus

PCF8574

**8 LIMITING VALUES**

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

SYMBOL	PARAMETER	MIN.	MAX.	UNIT
V <sub>DD</sub>	supply voltage	-0.5	+7.0	V
V <sub>I</sub>	input voltage	V <sub>SS</sub> - 0.5	V <sub>DD</sub> + 0.5	V
I <sub>I</sub>	DC input current	-	±20	mA
I <sub>O</sub>	DC output current	-	±25	mA
I <sub>DD</sub>	supply current	-	±100	mA
I <sub>SS</sub>	supply current	-	±100	mA
P <sub>tot</sub>	total power dissipation	-	400	mW
P <sub>O</sub>	power dissipation per output	-	100	mW
T <sub>stg</sub>	storage temperature	-65	+150	°C
T <sub>amb</sub>	operating ambient temperature	-40	+85	°C

**9 HANDLING**

Inputs and outputs are protected against electrostatic discharge in normal handling. However, to be totally safe, it is desirable to take precautions appropriate to handling MOS devices. Advice can be found in Data Handbook IC12 under "Handling MOS Devices".

**10 DC CHARACTERISTICS**V<sub>DD</sub> = 2.5 to 6 V; V<sub>SS</sub> = 0 V; T<sub>amb</sub> = -40 to +85 °C; unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
<b>Supply</b>						
V <sub>DD</sub>	supply voltage		2.5	-	6.0	V
I <sub>DD</sub>	supply current	operating mode; V <sub>DD</sub> = 6 V; no load; V <sub>I</sub> = V <sub>DD</sub> or V <sub>SS</sub> ; f <sub>SCL</sub> = 100 kHz	-	40	100	µA
I <sub>stb</sub>	standby current	standby mode; V <sub>DD</sub> = 6 V; no load; V <sub>I</sub> = V <sub>DD</sub> or V <sub>SS</sub>	-	2.5	10	µA
V <sub>POR</sub>	Power-on reset voltage	V <sub>DD</sub> = 6 V; no load; V <sub>I</sub> = V <sub>DD</sub> or V <sub>SS</sub> ; note 1	-	1.3	2.4	V
<b>Input SCL; input/output SDA</b>						
V <sub>IL</sub>	LOW level input voltage		-0.5	-	+0.3V <sub>DD</sub>	V
V <sub>IH</sub>	HIGH level input voltage		0.7V <sub>DD</sub>	-	V <sub>DD</sub> + 0.5	V
I <sub>OL</sub>	LOW level output current	V <sub>OL</sub> = 0.4 V	3	-	-	mA
I <sub>L</sub>	leakage current	V <sub>I</sub> = V <sub>DD</sub> or V <sub>SS</sub>	-1	-	+1	µA
C <sub>i</sub>	input capacitance	V <sub>I</sub> = V <sub>SS</sub>	-	-	7	pF

Remote 8-bit I/O expander for I<sup>2</sup>C-bus

PCF8574

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
<b>I/Os</b>						
V <sub>IL</sub>	LOW level input voltage		-0.5	-	+0.3V <sub>DD</sub>	V
V <sub>IH</sub>	HIGH level input voltage		0.7V <sub>DD</sub>	-	V <sub>DD</sub> + 0.5	V
I <sub>IHL(max)</sub>	maximum allowed input current through protection diode	V <sub>I</sub> ≥ V <sub>DD</sub> or V <sub>I</sub> ≤ V <sub>SS</sub>	-	-	±400	µA
I <sub>OL</sub>	LOW level output current	V <sub>OL</sub> = 1 V; V <sub>DD</sub> = 5 V	10	25	-	mA
I <sub>OH</sub>	HIGH level output current	V <sub>OH</sub> = V <sub>SS</sub>	30	-	300	µA
I <sub>OHt</sub>	transient pull-up current	HIGH during acknowledge (see Fig.14); V <sub>OH</sub> = V <sub>SS</sub> ; V <sub>DD</sub> = 2.5 V	-	-1	-	mA
C <sub>i</sub>	input capacitance		-	-	10	pF
C <sub>o</sub>	output capacitance		-	-	10	pF
<b>Port timing; C<sub>L</sub> ≤ 100 pF</b> (see Figs 10 and 11)						
t <sub>pv</sub>	output data valid		-	-	4	µs
t <sub>su</sub>	input data set-up time		0	-	-	µs
t <sub>h</sub>	input data hold time		4	-	-	µs
<b>Interrupt INT</b> (see Fig.13)						
I <sub>OL</sub>	LOW level output current	V <sub>OL</sub> = 0.4 V	1.6	-	-	mA
I <sub>L</sub>	leakage current	V <sub>I</sub> = V <sub>DD</sub> or V <sub>SS</sub>	-1	-	+1	µA
<b>TIMING; C<sub>L</sub> ≤ 100 pF</b>						
t <sub>iv</sub>	input data valid time		-	-	4	µs
t <sub>ir</sub>	reset delay time		-	-	4	µs
<b>Select inputs A0 to A2</b>						
V <sub>IL</sub>	LOW level input voltage		-0.5	-	+0.3V <sub>DD</sub>	V
V <sub>IH</sub>	HIGH level input voltage		0.7V <sub>DD</sub>	-	V <sub>DD</sub> + 0.5	V
I <sub>LI</sub>	input leakage current	pin at V <sub>DD</sub> or V <sub>SS</sub>	-250	-	+250	nA

**Note**

1. The Power-on reset circuit resets the I<sup>2</sup>C-bus logic with V<sub>DD</sub> < V<sub>POR</sub> and sets all I/Os to logic 1 (with current source to V<sub>DD</sub>).

Remote 8-bit I/O expander for I<sup>2</sup>C-bus

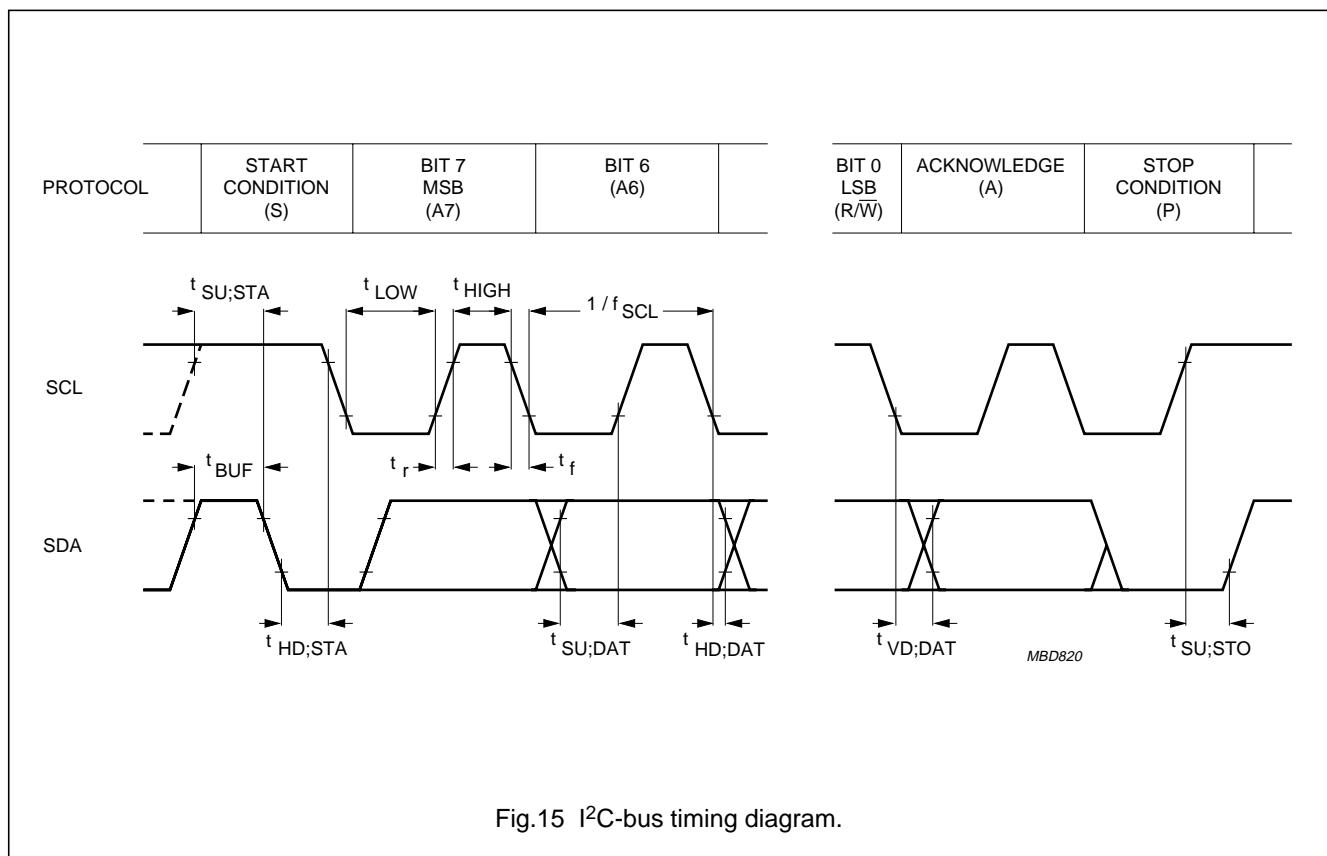
PCF8574

11 I<sup>2</sup>C-BUS TIMING CHARACTERISTICS

SYMBOL	PARAMETER	MIN.	TYP.	MAX.	UNIT
I <sup>2</sup> C-BUS TIMING (see Fig.15; note 1)					
$f_{SCL}$	SCL clock frequency	—	—	100	kHz
$t_{SW}$	tolerable spike width on bus	—	—	100	ns
$t_{BUF}$	bus free time	4.7	—	—	μs
$t_{SU;STA}$	START condition set-up time	4.7	—	—	μs
$t_{HD;STA}$	START condition hold time	4.0	—	—	μs
$t_{LOW}$	SCL LOW time	4.7	—	—	μs
$t_{HIGH}$	SCL HIGH time	4.0	—	—	μs
$t_r$	SCL and SDA rise time	—	—	1.0	μs
$t_f$	SCL and SDA fall time	—	—	0.3	μs
$t_{SU;DAT}$	data set-up time	250	—	—	ns
$t_{HD;DAT}$	data hold time	0	—	—	ns
$t_{VD;DAT}$	SCL LOW to data out valid	—	—	3.4	μs
$t_{SU;STO}$	STOP condition set-up time	4.0	—	—	μs

## Note

1. All the timing values are valid within the operating supply voltage and ambient temperature range and refer to  $V_{IL}$  and  $V_{IH}$  with an input voltage swing of  $V_{SS}$  to  $V_{DD}$ .



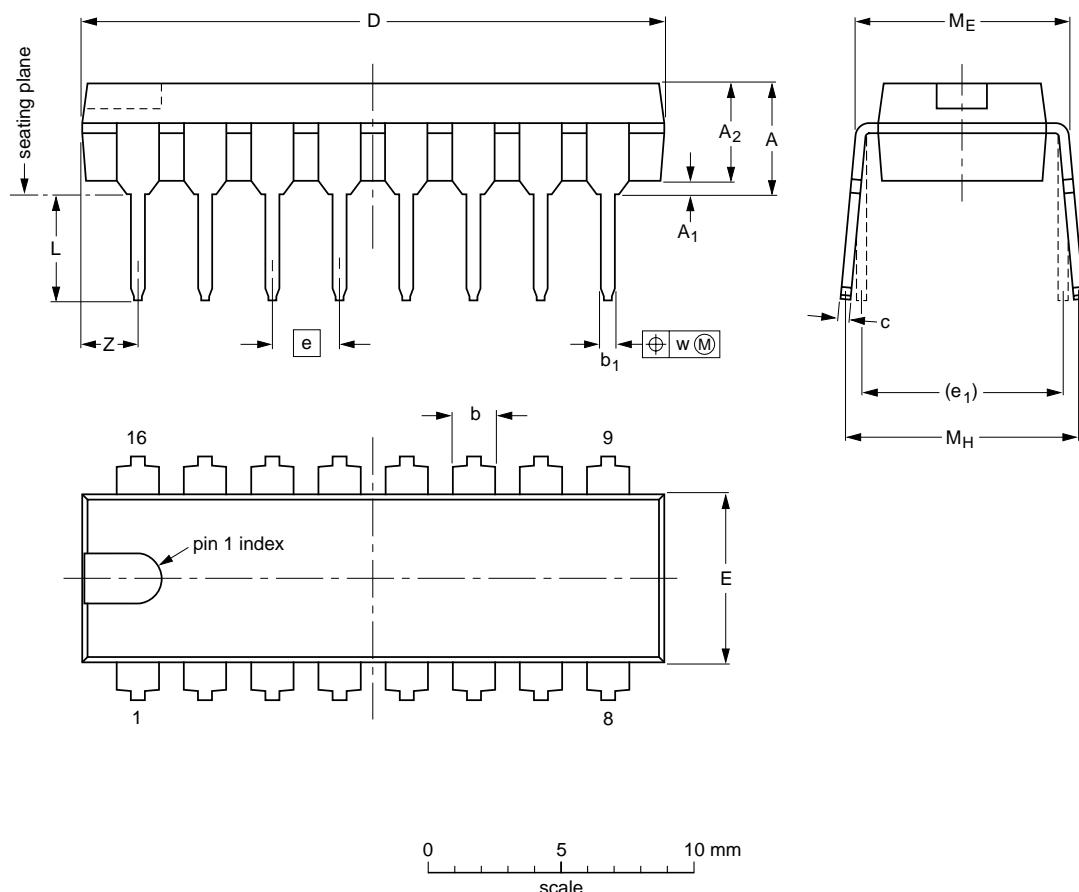
Remote 8-bit I/O expander for I<sup>2</sup>C-bus

PCF8574

## 12 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.

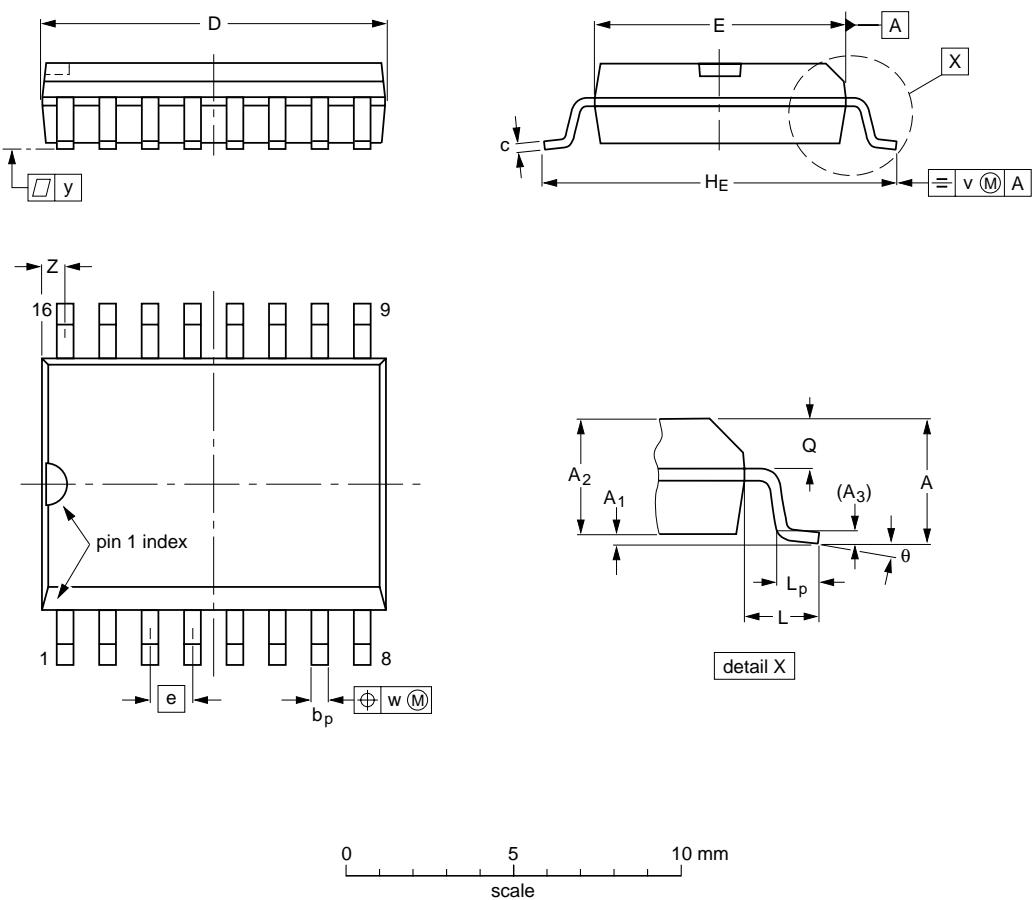
OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	EIAJ			
SOT38-1	050G09	MO-001AE				-92-10-02- 95-01-19

## Remote 8-bit I/O expander for I<sup>2</sup>C-bus

## PCF8574

**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 <sub>max.</sub>	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	0.419 0.394	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.

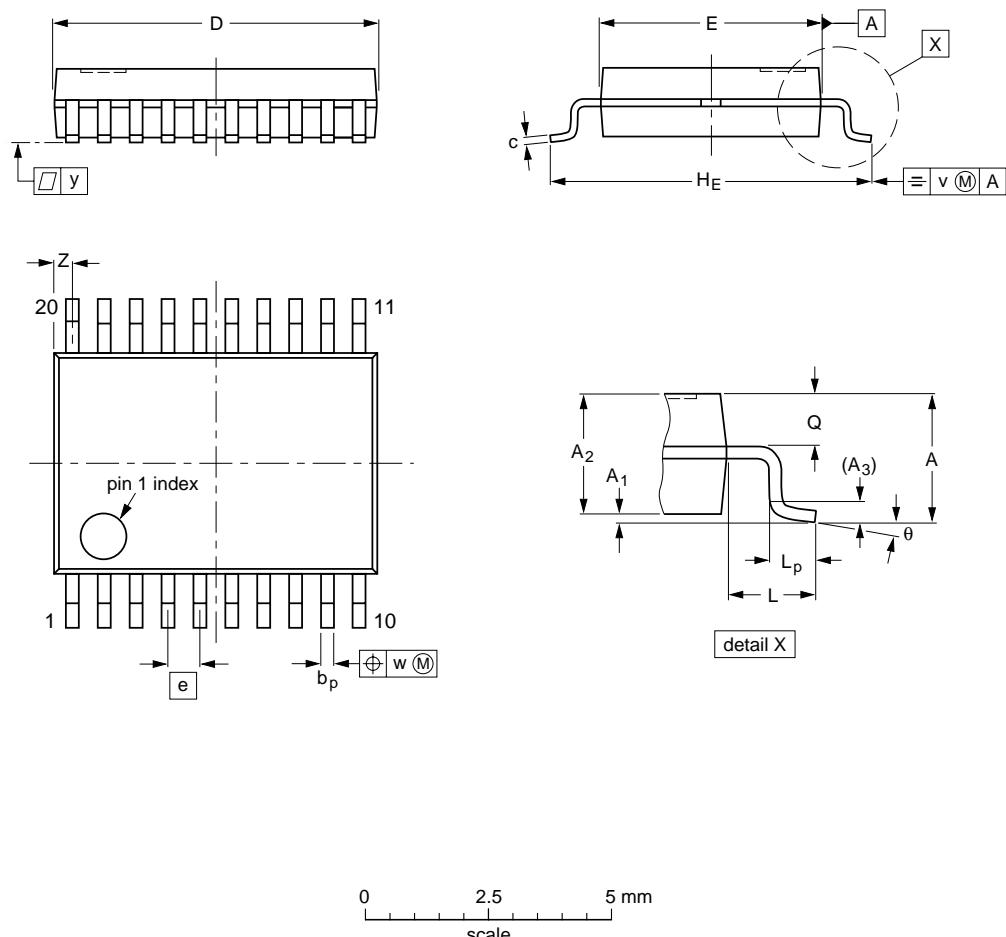
OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	EIAJ			
SOT162-1	075E03	MS-013AA				95-01-24 97-05-22

Remote 8-bit I/O expander for I<sup>2</sup>C-bus

PCF8574

SSOP20: plastic shrink small outline package; 20 leads; body width 4.4 mm

SOT266-1



## DIMENSIONS (mm are the original 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	1.5	0.15 0	1.4 1.2	0.25	0.32 0.20	0.20 0.13	6.6 6.4	4.5 4.3	0.65	6.6 6.2	1.0	0.75 0.45	0.65 0.45	0.2	0.13	0.1	0.48 0.18	10° 0°

## Note

1. Plastic or metal protrusions of 0.20 mm maximum per side are not included.

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	EIAJ			
SOT266-1						-90-04-05 95-02-25

# Remote 8-bit I/O expander for I<sup>2</sup>C-bus

PCF8574

## 13 SOLDERING

### 13.1 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).

### 13.2 DIP

#### 13.2.1 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.

#### 13.2.2 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.

### 13.3 SO and SSOP

#### 13.3.1 REFLOW SOLDERING

Reflow soldering techniques are suitable for all SO and SSOP 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.

#### 13.3.2 WAVE SOLDERING

Wave soldering is **not** recommended for SSOP packages. This is because of the likelihood of solder bridging due to closely-spaced leads and the possibility of incomplete solder penetration in multi-lead devices.

**If wave soldering cannot be avoided, the following conditions must be 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 and must incorporate solder thieves at the downstream end.**

**Even with these conditions, only consider wave soldering SSOP packages that have a body width of 4.4 mm, that is SSOP16 (SOT369-1) or SSOP20 (SOT266-1).**

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.

#### 13.3.3 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.

Remote 8-bit I/O expander for I<sup>2</sup>C-bus

PCF8574

**14 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.	

**15 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.

**16 PURCHASE OF PHILIPS I<sup>2</sup>C COMPONENTS**

Purchase of Philips I<sup>2</sup>C components conveys a license under the Philips' I<sup>2</sup>C patent to use the components in the I<sup>2</sup>C system provided the system conforms to the I<sup>2</sup>C specification defined by Philips. This specification can be ordered using the code 9398 393 40011.

Remote 8-bit I/O expander for I<sup>2</sup>C-bus

PCF8574

---

**NOTES**

Remote 8-bit I/O expander for I<sup>2</sup>C-bus

PCF8574

---

**NOTES**

Remote 8-bit I/O expander for I<sup>2</sup>C-bus

PCF8574

---

**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 Sanpavut-Bangna Road Prakanong, BANGKOK 10260, Tel. +66 2 745 4090, Fax. +66 2 398 0793

**Turkey:** Talatpasa Cad. No. 5, 80640 GÜLTEPE/İSTANBUL, 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

417067/1200/02/PP24

Date of release: 1997 Apr 02

Document order number: 9397 750 01758

Let's make things better.

Philips  
Semiconductors



PHILIPS