Analog Voice Scrambler/Descrambler
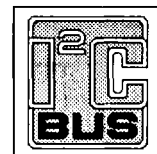
PCD4440T

FEATURES

- Scrambler or descrambler function
- Scrambling in frequency domain
- Selectable split frequency (up to 10 selections per second)
- Telephony-band filtering included
- No increase in bandwidth
- No external components required
- Small signal delay
- Insensitive to distortion and group delay of transmission channel
- Control via serial (I²C) bus
- Low transfer loss of speech
- Mute option
- Transparent mode
- High signal input impedance
- Low signal output impedance
- Low power consumption

APPLICATIONS

- Cordless telephones
- Security telephones
- Portable phones
- PMR

GENERAL DESCRIPTION

The PCD4440 is a silicon gate CMOS integrated circuit intended to be used in radio, mobile- and line powered telecommunications products utilizing a microcontroller for the control functions. Analog scrambling/descrambling is based on the split frequency method realized in a sophisticated switched-capacitor technology. The PCD4440 is compatible with most microcontrollers and communicates via a two line bidirectional bus (I²C).
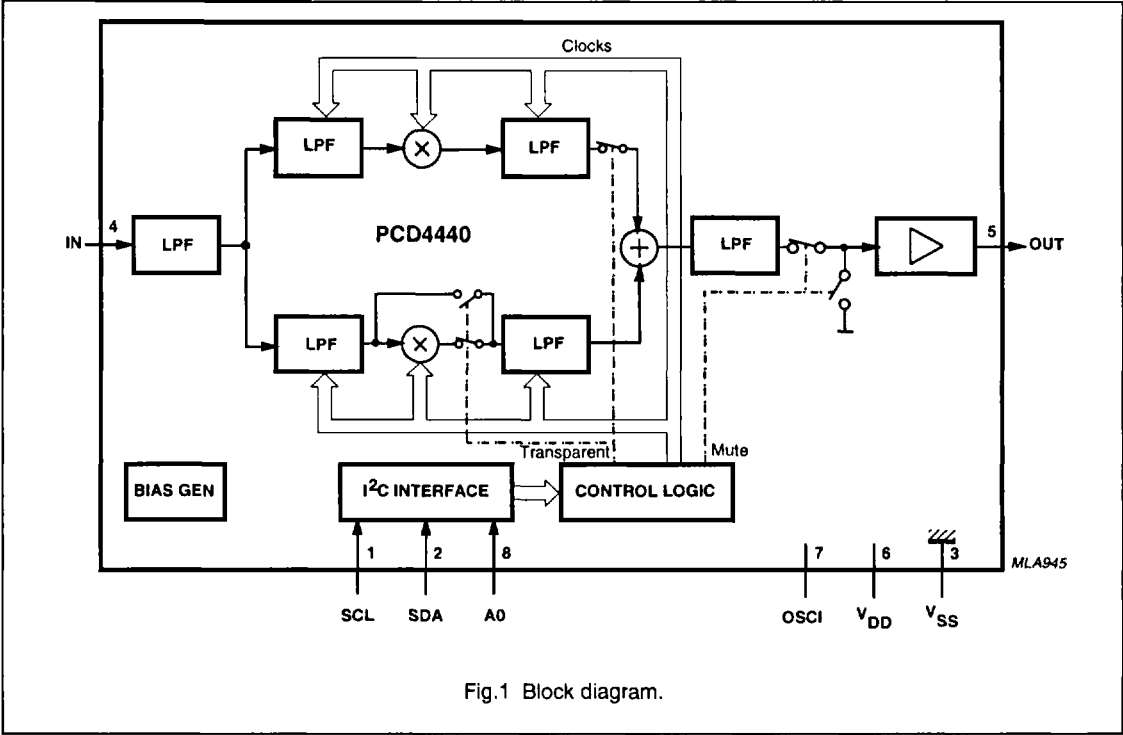
ORDERING INFORMATION

EXTENDED TYPE NUMBER	PACKAGE			
	PINS	PIN POSITION	MATERIAL	CODE
PCD4440T	8	mini-pack	plastic	SOT176C

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BLOCK DIAGRAM

Fig.1 Block diagram.

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PINNING

Fig.2 Pin configuration.
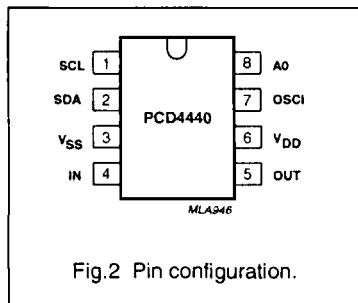
Pin Description

SYMBOL	PIN	FUNCTION
SCL	1	serial clock line (I²C)
SDA	2	serial data line (I²C)
V_{SS}	3	negative Supply
IN	4	signal input
OUT	5	signal output
V_{DD}	6	positive supply
OSCI	7	oscillator input
A0	8	slave address input (I²C)

FUNCTIONAL DESCRIPTION

To provide privacy for the end user of a cordless telephone set, the radio-link audio signal must be scrambled. In the microphone and the incoming telephone line audio path a scrambler circuit has to be implemented. Consequently the audio signal to the telephone line and to the earpiece must be descrambled. Both functions can be fulfilled by the PCD4440 by simply inserting it in the audio path.

The PCD4440 accomplishes this task by first filtering the incoming signal, limiting the bandwidth to 3500 Hz. Then the signal is split into a high (> f_S) and a low (< f_S) frequency band. Both frequency bands are inverted and added again to provide a single output signal.

Values for 9 split frequencies f_S can be controlled by a scramble code table in the microcontroller. Control of these split frequencies is accomplished via the serial two wire I²C-bus. In addition to the split frequencies (fs), a transparent mode and mute instruction can be selected.

In Fig.3, the signal path for both bands is drawn. The lower band path (on the left side of the diagram) operates on frequencies f ≤ f_S (Split Frequency), the upper band path (on the right side) on frequencies f ≥ f_S.

The input signal contains frequencies from f_1 up to f_2. The output signal is band limited (only in scrambling mode) from f_l (300 Hz) to f_h (3500 Hz). In the left path, the input signal is first limited to f_S. The following modulator inverts the lower band. f_l is folded up to f_S, f_S down to f_l. In general, an input frequency f_{in} is folded to $f_{out} = f_S + f_l - f_{in}$. Finally the folded signal is band limited to f_S again.

In the right path, the input signal is first limited to f_h. The following modulator inverts the upper band. f_S is folded up to f_h, f_h down to f_S. In general, an input frequency f_{in} is folded to $f_{out} = f_S + f_h - f_{in}$. Finally, the folded signal is band limited to f_h again. In the last step, the bands are added and buffered.

In the transparent mode, the input signal is band limited to 3500 Hz. Frequencies form 0 - 300 Hz are not filtered out.
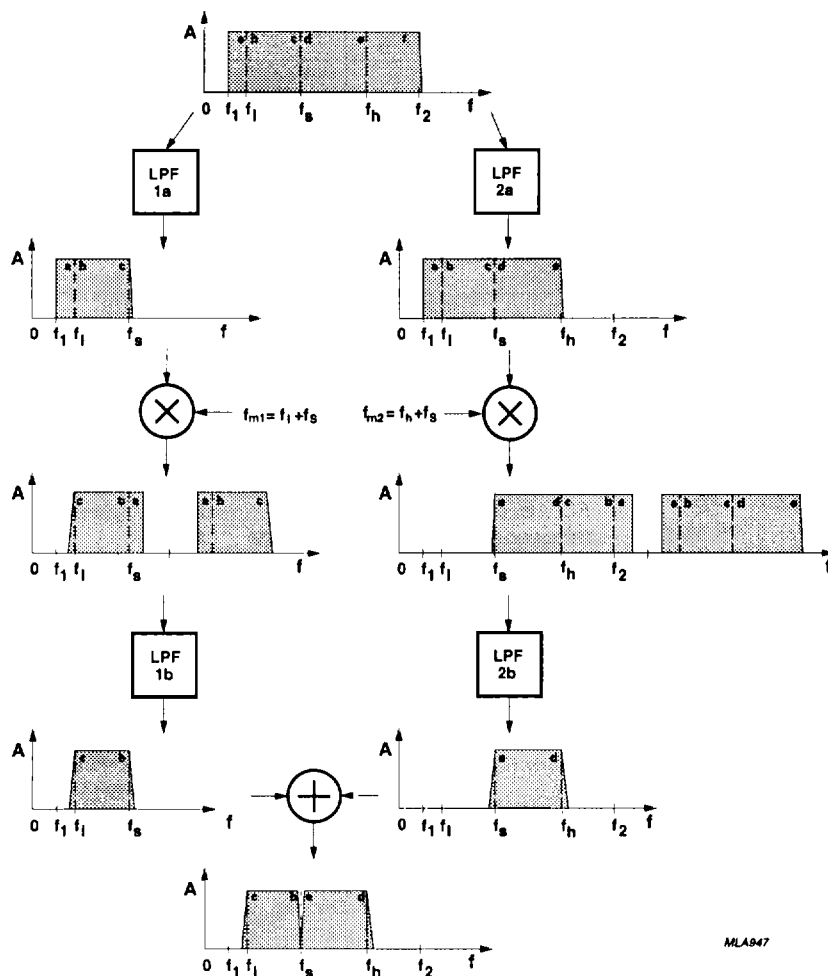
Fig.3 Scrambler signal path.

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APPLICATIONS
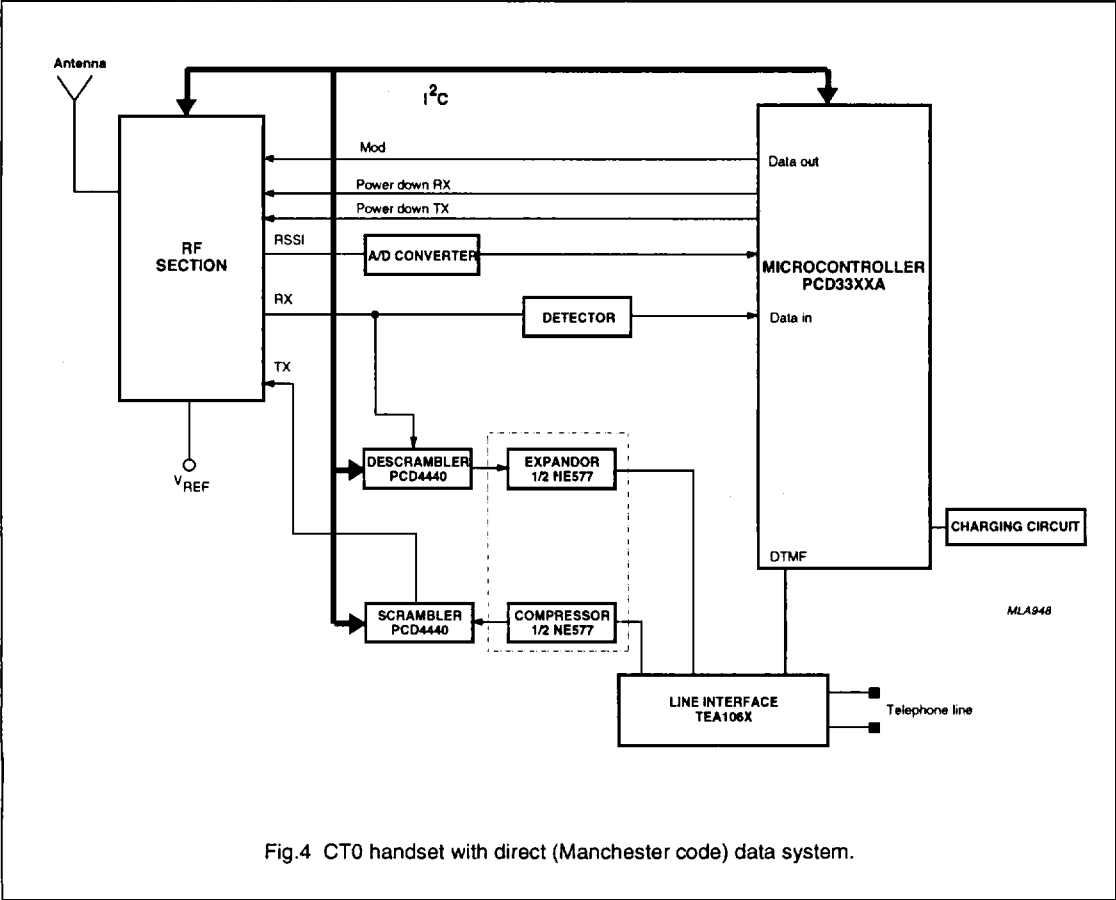
Fig.4 CT0 handset with direct (Manchester code) data system.

Fig.5 CT0 Base unit with direct (Manchester code) data system.
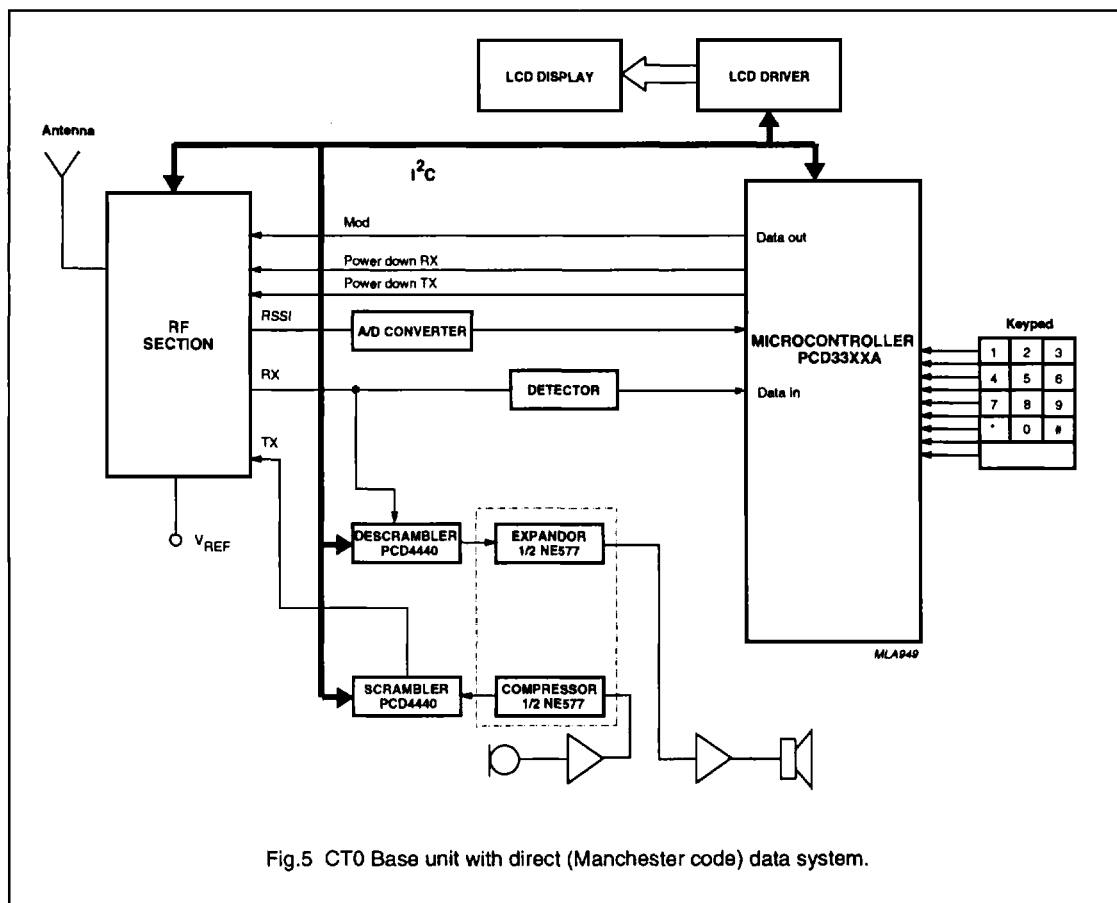
HANDLING

Handling MOS devices

Inputs and outputs are protected against electrostatic discharge in normal handling. However, it is good practice to take normal precautions appropriate to handling MOS devices.

PURCHASE OF PHILIPS I²C COMPONENTS

Purchase of Philips I²C components conveys a license under the Philips' I²C patent to use the components in the I²C system provided the system conforms to the I²C specification defined by Philips. This specification can be ordered using the code 9398 393 40011.