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Data Sheet, DS 3, May 2002

SCOUT-DX

Siemens Codec with 2-Wire Data Transceiver Featuring Speakerphone Function

PSB 21373 Version 1.1

Wired Communications

Never stop thinking.

Data Sheet

Revision History:	**2002-05-13**	DS 3
Previous Version:	Prel. Data Sheet, DS2	

Page	**Subjects (major changes since last revision)**
Page 32	Figure 10 with clock signals added
Page 62	BCL=’ 0’ changed to BCL=’1’
Page 80	BCL changed from ’low’ to ’high’
Page 106	Note regarding AXI input added
Page 143	Recommendation regarding CRAM programming modified
Page 158	BCL is inverted compared to last description (DS1); figure 75 added
Page 161	’*Rising*’ BCL edge changed to ’*falling*’ edge
Page 232	Figure 80 (BCL)modified
Page 234	SDX output delay added
Page 236	DC charateristics of transceiver modified

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1 Overview

The SCOUT™-DX integrates all necessary functions for the completion of a cost effective digital voice terminal solution.

The SCOUT-DX combines the functionality of the ARCOFI®-SP PSB 2163 (Audio Ringing Codec Filter with Speakerphone) and a two wire line interface[1)] on a single chip.

The SCOUT-DX is suited for the use in basic PBX voice terminals just as, in combination with an additional device on the modular IOM®-2 interface, in high end featurephones e.g. with acoustic echo cancellation.

The transceiver implements the subscriber access functions for a digital terminal to be connected to the two wire line interface. It covers complete layer-1 and basic layer-2 functions for digital terminals.

The codec performs encoding, decoding, filtering functions and tone generation (ringing, audible feedback tones and DTMF signal). An analog front end offers three analog inputs and two analog outputs with programmable amplifiers.

The IOM-2 interface allows a modular design with functional extensions (e.g. acoustic echo cancellation, modem extension) by connecting other voice/data devices to the SCOUT-DX.

A serial microcontroller interface (SCI) is supported.

The SCOUT-DX is a CMOS device offered in a P-MQFP-44 package and operates with a 5 V supply.

1) compatible to TP3406 of *National Semiconductor Corporation*

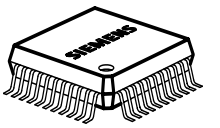
Siemens Codec with 2-Wire Data Transceiver Featuring Speakerphone Function SCOUT-DX

PSB 21373

Version 1.1

CMOS

1.1 Features



P-MQFP-44-1

- Serial control interface (SCI)
- IOM-2 interface in TE mode, single/double clock, two serial data strobe signals
- Various possibilities of microcontroller data access, data control and data manipulation to all IOM-2 timeslots
- Power supply 5 V
- Monitor channel handler (master/slave)
- Sophisticated power management for restricted power mode
- Programmable microcontroller clock output and reset (input/output) pins
- Advanced CMOS technology

Transceiver part

- Two wire transceiver with AMI coded 2B+D channels for loop length up to 1.8 km (6 kft)
- Conversion of the frame structure between the two wire line interface and IOM-2
- Receive timing recovery
- Continuously adapted receive thresholds
- Activation and deactivation procedures with automatic activation from power down state
- HDLC controller. Access to B1, B2 or D channels or the combination of them e.g. for 144 kbit data transmission (2B+D)
- FIFO buffer with 64 bytes per direction and programmable FIFO thresholds for efficient transfer of data packets

Type	Package
PSB 21373	P-MQFP-44-1

- Implementation of IOM-2 MONITOR and C/I-channel protocol to control peripheral devices
- Realization of layer 1 state machine in software possible
- Watchdog timer
- Programmable reset sources
- Test loops and functions

Codec part

- Applications in digital terminal equipment featuring voice functions
- Digital signal processing performs all CODEC functions
- Fully compatible with the ITU-T G.712 and ETSI (NET33) specification
- PCM A-Law/µ-Law (ITU-T G.711) and 8/16-bit linear data; maskable codec data
- Flexible configuration of all internal functions
- Three analog inputs for the handset microphone , the speakerphone and the headset
- Two differential outputs for a handset ear piece (200 Ω) and a loudspeaker (50 Ω)
- Flexible test and maintenance loopbacks in the analog front end and the digital signal processor
- Independent gain programmable amplifiers for all analog inputs and outputs
- Full digital speakerphone and loud hearing support without any external components (speakerphone test and optimization function is available)
- Enhanced voice data manipulation for features like:
  - Three-party conferencing
  - Voice monitoring
- Two transducer correction filters
- Side tone gain adjustment
- Flexible DTMF, tone and ringing generator
- Direct and indirect CRAM access

1.2 Pin Configuration

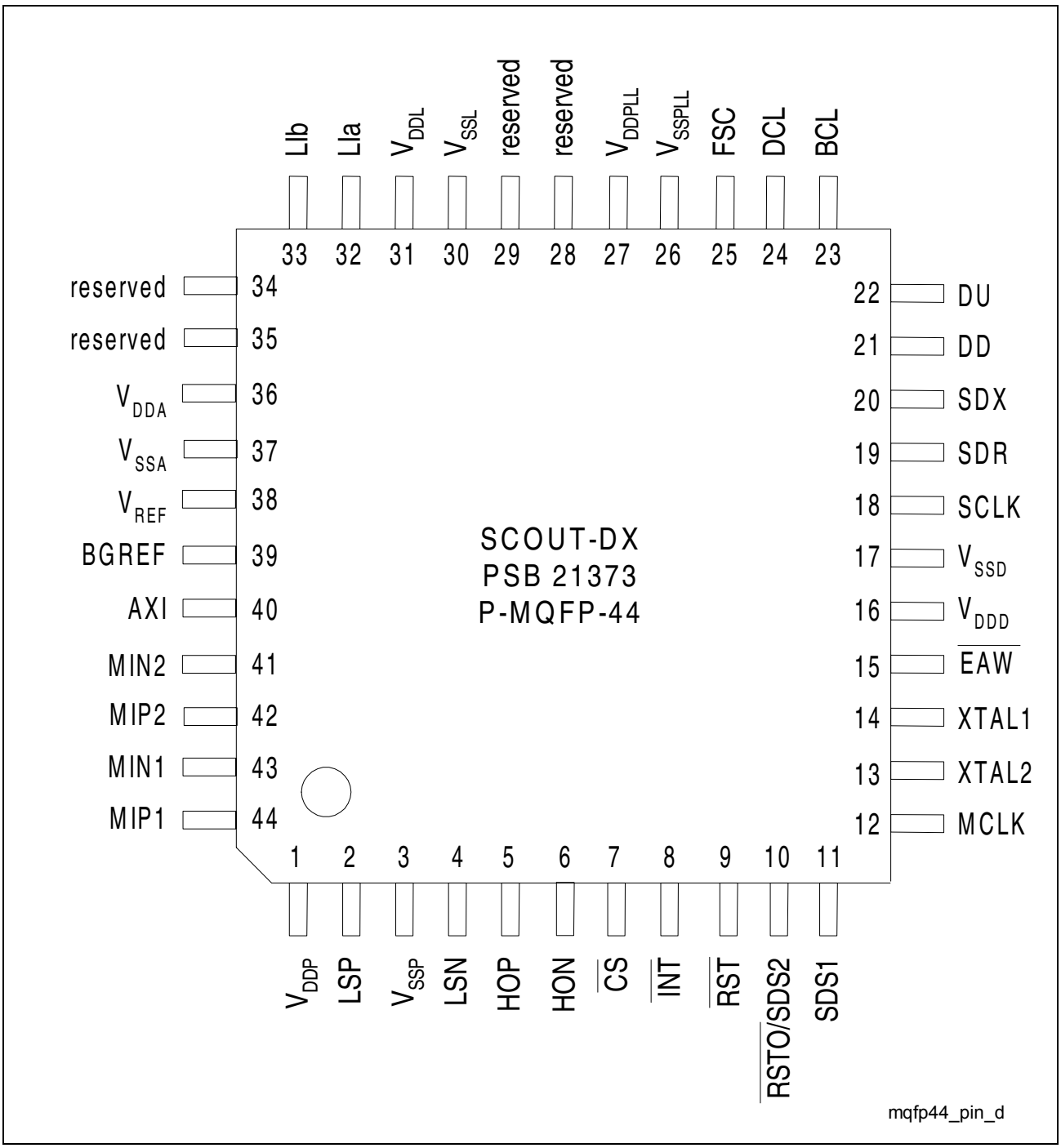


Figure 1
Pin Configuration

1.3 Logic Symbol

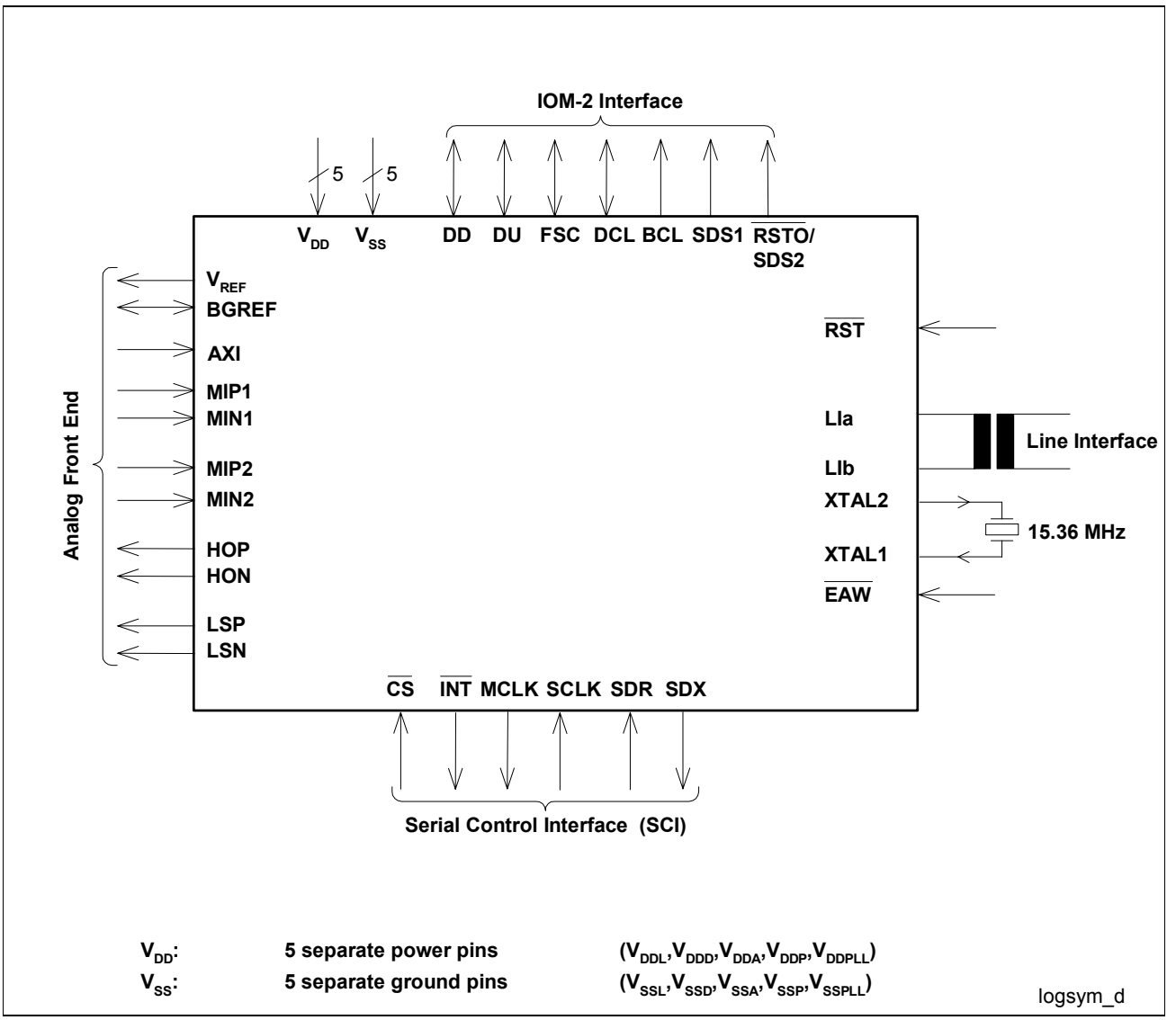


Figure 2
Logic Symbol of the SCOUT-DX in P-MQFP-44

1.4 Pin Definitions and Function

Table 1

Pin No.	Symbol	Input (I) Output (O) Open Drain (OD)	Function
			Power supply (5 V ± 5 %)
31	V_{DDL}	–	Supply voltage for line driver
16	V_{DDD}	–	Supply voltage for digital parts
36	V_{DDA}	–	Supply voltage for analog parts
1	V_{DDP}	–	Supply voltage for loudspeaker
27	V_{DDPLL}	–	Supply voltage for internal PLL
30	V_{SSL}	–	Ground for line driver
17	V_{SSD}	–	Ground for digital parts
37	V_{SSA}	–	Ground for analog parts
3	V_{SSP}	–	Ground for loudspeaker
26	V_{SSPLL}	–	Ground for internal PLL
			IOM-2 Interface
21	DD	I/OD/O	Data Downstream
22	DU	I/OD/O	Data Upstream
25	FSC	I/O	Frame Synchronization Clock (8 kHz)
24	DCL	I/O	Data Clock (double clock, 1.536 MHz)
23	BCL	O	Bit Clock (768kHz)
11	SDS1	O	**Programmable strobe signal or bit clock**
10	$\overline{\text{RSTO}}$/ SDS2	OD O	**Reset Output (active low) Strobe signal for each IOM® time slot and/or D channel indication (programmable)**
			RESET
9	$\overline{\text{RST}}$	I	Reset (active low)

Table 1

Pin No.	Symbol	Input (I) Output (O) Open Drain (OD)	Function
			Transceiver
32	LIa	I/O	Line Interface
33	LIb	I/O	
13	XTAL2	OI	Oscillator output
14	XTAL1	I	Oscillator or 15.36 MHz input
15	$\overline{\text{EAW}}$	I	External Awake. A low level on this input starts the oscillator from the power down state and generates a reset pulse if enabled (see **chapter 7.2.10**)
			Microcontroller Interface
7	$\overline{\text{CS}}$	I	Chip Select (active low)
8	$\overline{\text{INT}}$	OD	**Interrupt request** (active low)
12	MCLK	O	**Microcontroller Clock**
18	SCLK	I	Clock for the serial control interface
19	SDR	I	Serial Data Receive
20	SDX	OD/O	Serial Data Transmit

Table 1

Pin No.	Symbol	Input (I) Output (O) Open Drain (OD)	Function
			Analog Frontend
38	V_{REF}	O	2.4 V Reference voltage for biasing external circuitry. An external capacity of ≥ 100 nF has to be connected.
39	BGREF	I/O	Reference Bandgap voltage for internal references. An external capacity of ≥ 22 nF has to be connected.
40	AXI	I	Single-ended Auxiliary Input
44 43	MIP1 MIN1	I I	Symmetrical differential Microphone Input 1
42 41	MIP2 MIN2	I I	Symmetrical differential Microphone Input 2
5 6	HOP HON	O O	Differential Handset ear piece Output for 200 Ω transducers
2 4	LSP LSN	O O	Differential Loudspeaker output for 50 Ω
			Reserved Pins
28	reserved	I	This input is not used for normal operation and must be connected to *VDD*.
29	reserved	I	This input is not used for normal operation and must be connected to *VSS*.
34	reserved	I	This input is not used for normal operation and must be connected to *VDD*.
35	reserved	I	This input is not used for normal operation and must be connected to *VDD*.

1.5 Typical Applications

The SCOUT-DX can be used in a variety of applications like

- PBX voice terminal with speakerphone (**Figure 3**)
- PBX voice terminal as featurephone with acoustic echo cancellation (**Figure 4**)
- PBX voice terminal with tip/ring extension (**Figure 5**)

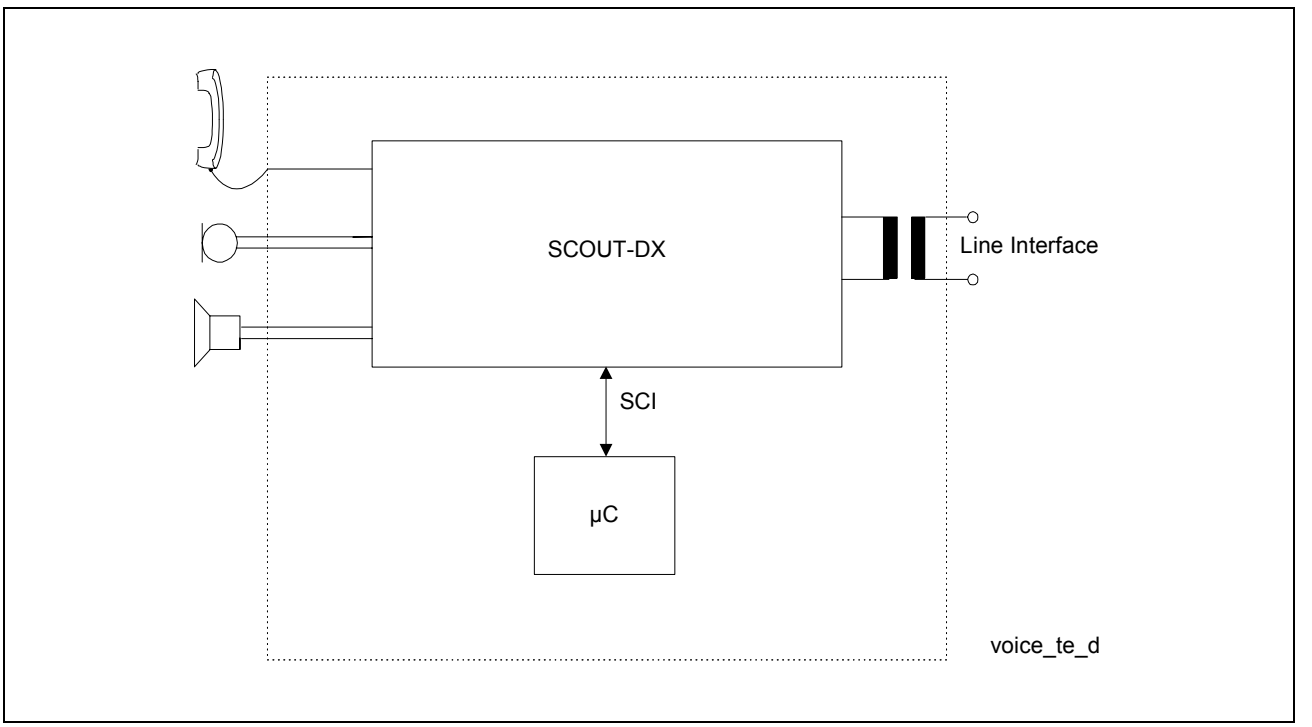


Figure 3
PBX Voice Terminal with Speakerphone

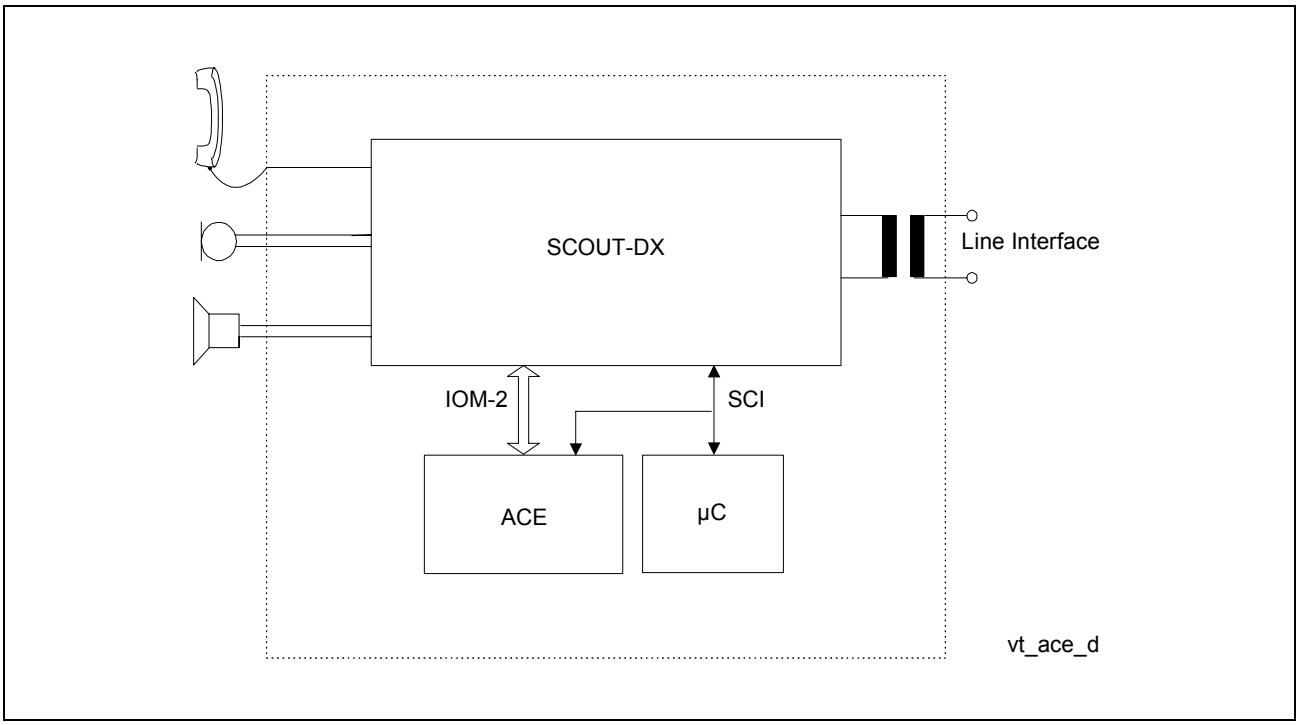


Figure 4
PBX Voice Terminal as Featurephone with Acoustic Echo Cancellation

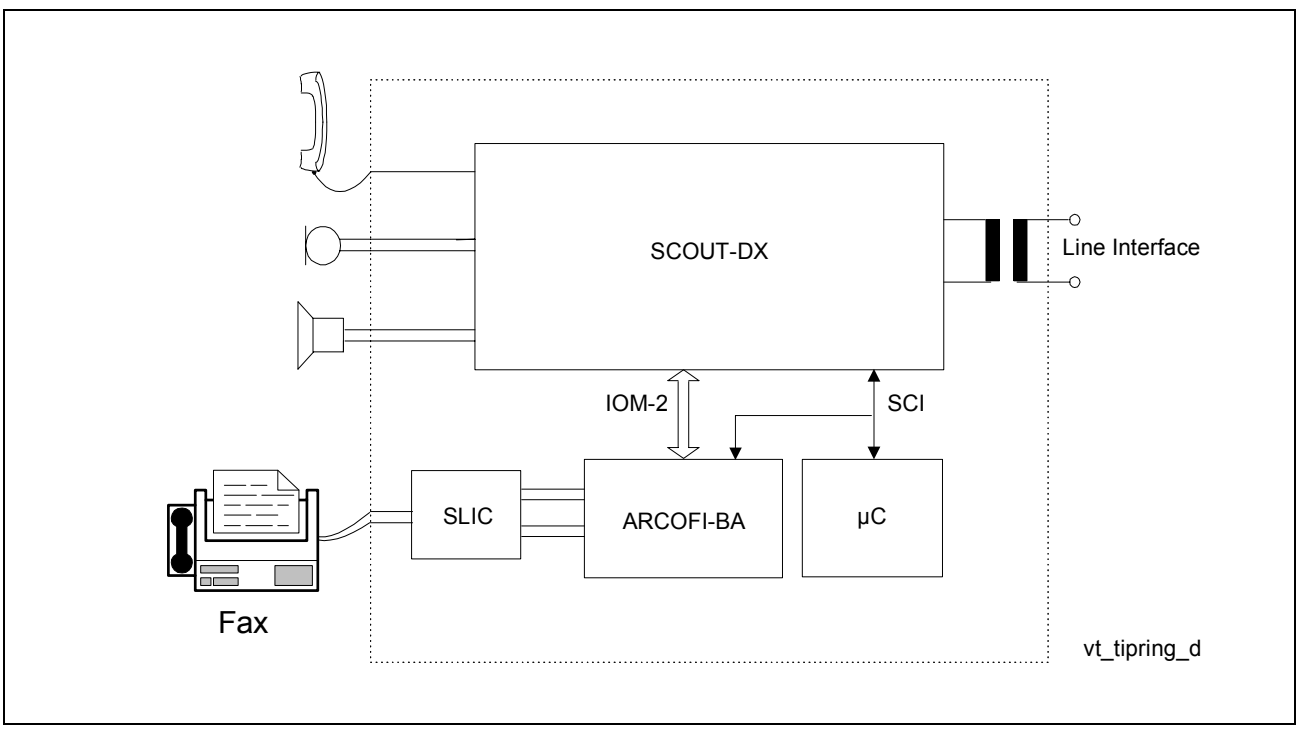


Figure 5
PBX Voice Terminal with Tip/Ring Extension

1.6 General Functions and Device Architecture

Figure 6 shows the architecture of the SCOUT-DX containing the following functional blocks:

- Two wire line interface
- Serial microcontroller interface
- HDLC controller with 64 byte FIFOs per direction and programmable FIFO threshold
- IOM-2 handler and interface for terminal application, MONITOR handler
- Clock and timing generation
- Digital PLL to synchronize IOM-2 to the line interface
- Reset generation (watchdog timer)
- Analog Front End (AFE) of the codec part
- Digital Signal Processor (DSP) for codec/filter functions, tone generation, voice data manipulation and speakerphone function

These functional blocks are described in the following chapters.

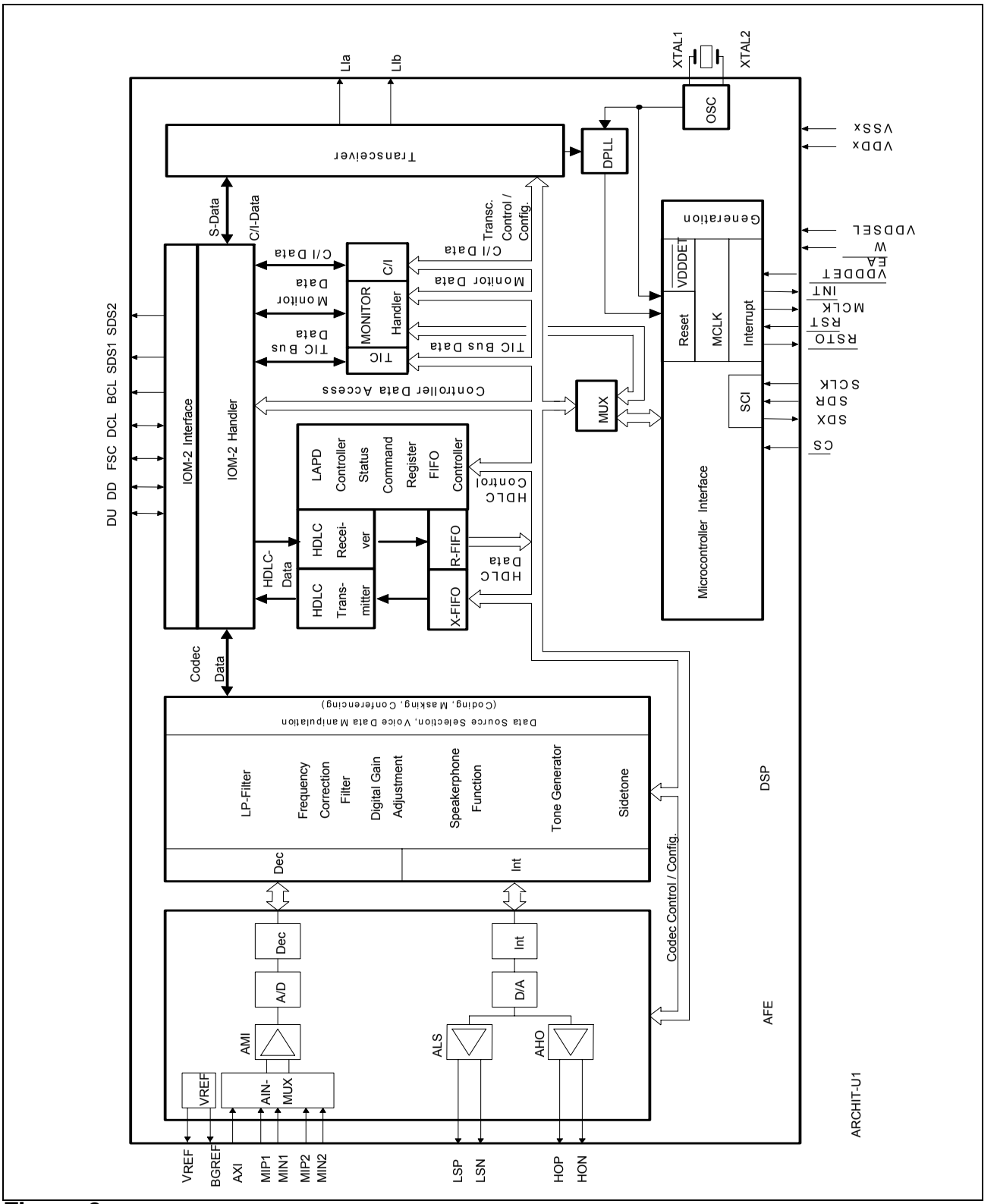


Figure 6
Architecture of the SCOUT-DX

2 Interfaces

The SCOUT-DX provides the following interfaces:

- Serial microcontroller interface together with a reset and microcontroller clock generation.
- IOM-2 interface as an universal backplane for terminals
- Line interface towards the two wire subscriber line
- Analog Front End (AFE) as interface between the analog transducers and the digital signal processor of the codec part

The microcontroller and IOM-2 interface are described in **chapter 2.1** or **2.2** respectively. The line interface is described in the **chapter 2.3**, the analog front end (AFE) in **chapter 4.1**

2.1 Microcontroller Interface

The SCOUT-DX supports a serial microcontroller interface. For applications where no controller is connected to the SCOUT-DX microcontroller interface programming is done via the IOM-2 MONITOR channel from a master device. In such applications the SCOUT-DX operates in the IOM-2 slave mode (refer to the corresponding chapter of the IOM-2 MONITOR handler).
The interface selections are all done by pinstrapping. The possible interface selections are listed in **table 2**. The selection pins are evaluated when the reset input $\overline{RST}$ is released. For the pin levels stated in the tables the following is defined:
'High': dynamic pin value which must be 'High' when the pin level is evaluated
V_{DD}, V_{SS}: static 'High' or 'Low' level

Table 2
Interface Selection

PIN $\overline{CS}$	**Interface Type/Mode**
'High'	Serial Control Interface (SCI)
V_{SS}	IOM-2 MONITOR Channel (Slave Mode)

The mapping of all accessible registers can be found in **figure 76** in **chapter 7**.
The microcontroller interface also consists of a microcontroller clock generation at pin MCLK and an interrupt request at pin $\overline{INT}$.

2.1.1 Serial Control Interface (SCI)

The serial control interface (SCI) is compatible to the SPI interface of Motorola or Siemens C510 family of microcontrollers.
The SCI consists of 4 lines: SCLK, SDX, SDR and $\overline{CS}$. Data are transferred via the lines SDR and SDX at the rate given by SCLK. The falling edge of $\overline{CS}$ indicates the beginning of a serial access to the registers. Incoming data is latched at the rising edge of SCLK and shifts out at the falling edge of SCLK. Each access must be terminated by a rising edge of $\overline{CS}$. Data is transferred in groups of 8-bits with the MSB first.
Figure 7 shows the timing of a one byte read/write access via the serial control interface.

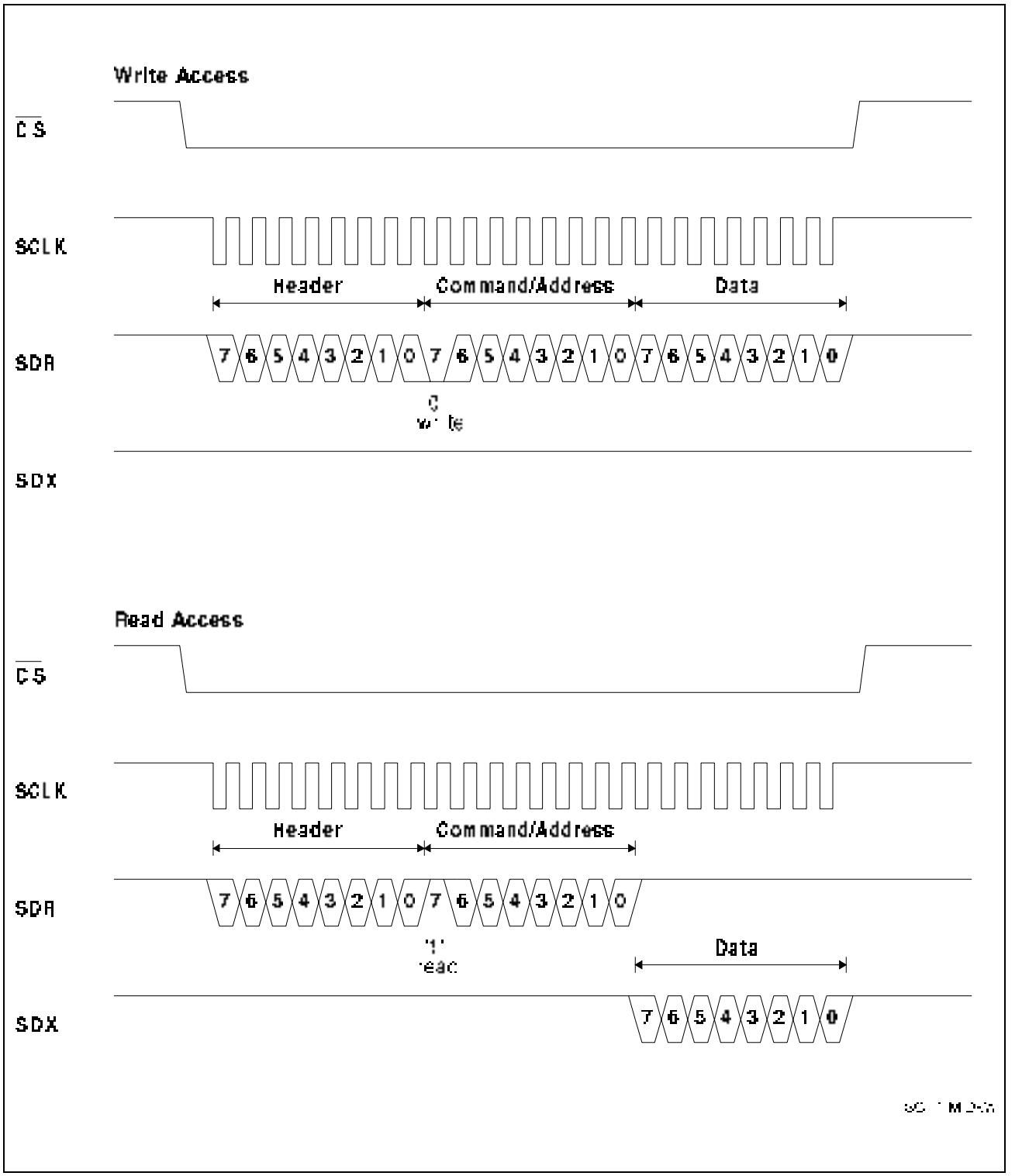


Figure 7
Serial Control Interface Timing

2.1.1.1 Programming Sequences

The principle structure of a read/write access to the SCOUT-DX registers via the serial control interface is shown in **figure 8**.

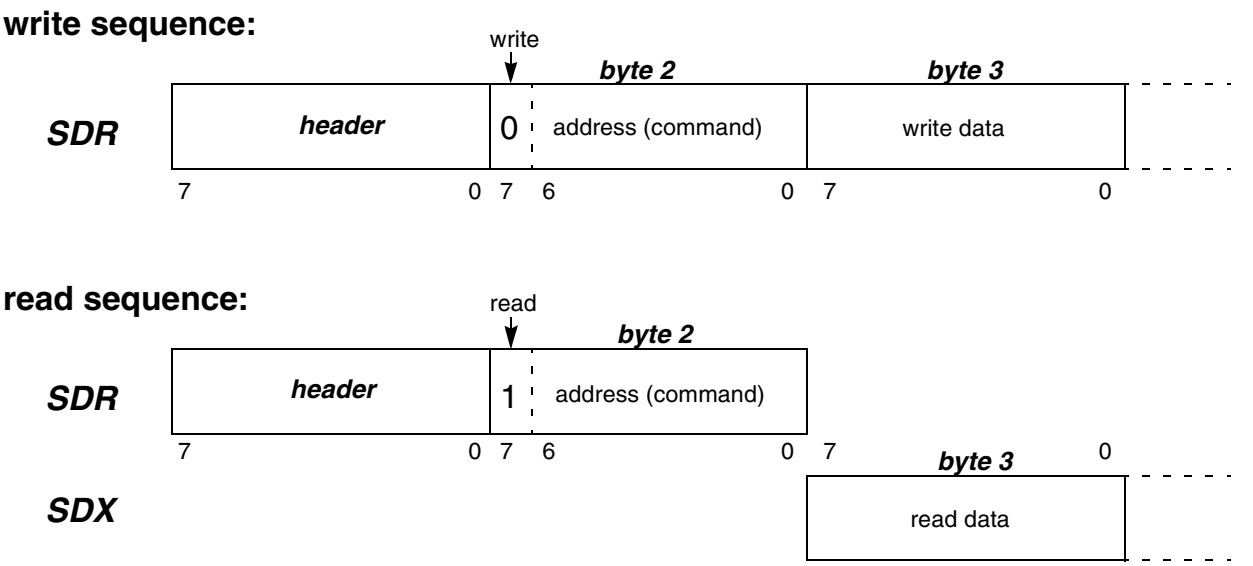


Figure 8
Serial Command Structure

A new programming sequence starts with the transfer of a header byte. The header byte specifies different programming sequences allowing a flexible and optimized access to the individual functional blocks of the SCOUT-DX.
The possible sequences are listed in **table 3** and are described afterwards.

Table 3
Header Byte Code

Header Byte	Sequence	Sequence Type	Access to
00_H	Cmd-Data-Data-Data	ARCOFI compatible, non-interleaved	Codec reg./CRAM (indirect)
08_H		ARCOFI compatible, interleaved	
40_H	Adr-Data-Adr-Data	non-interleaved	Address Range 00_H-$6F_H$
44_H			CRAM (80_H-FF_H)
48_H		interleaved	Address Range 00_H-$6F_H$
$4C_H$			CRAM (80_H-FF_H)