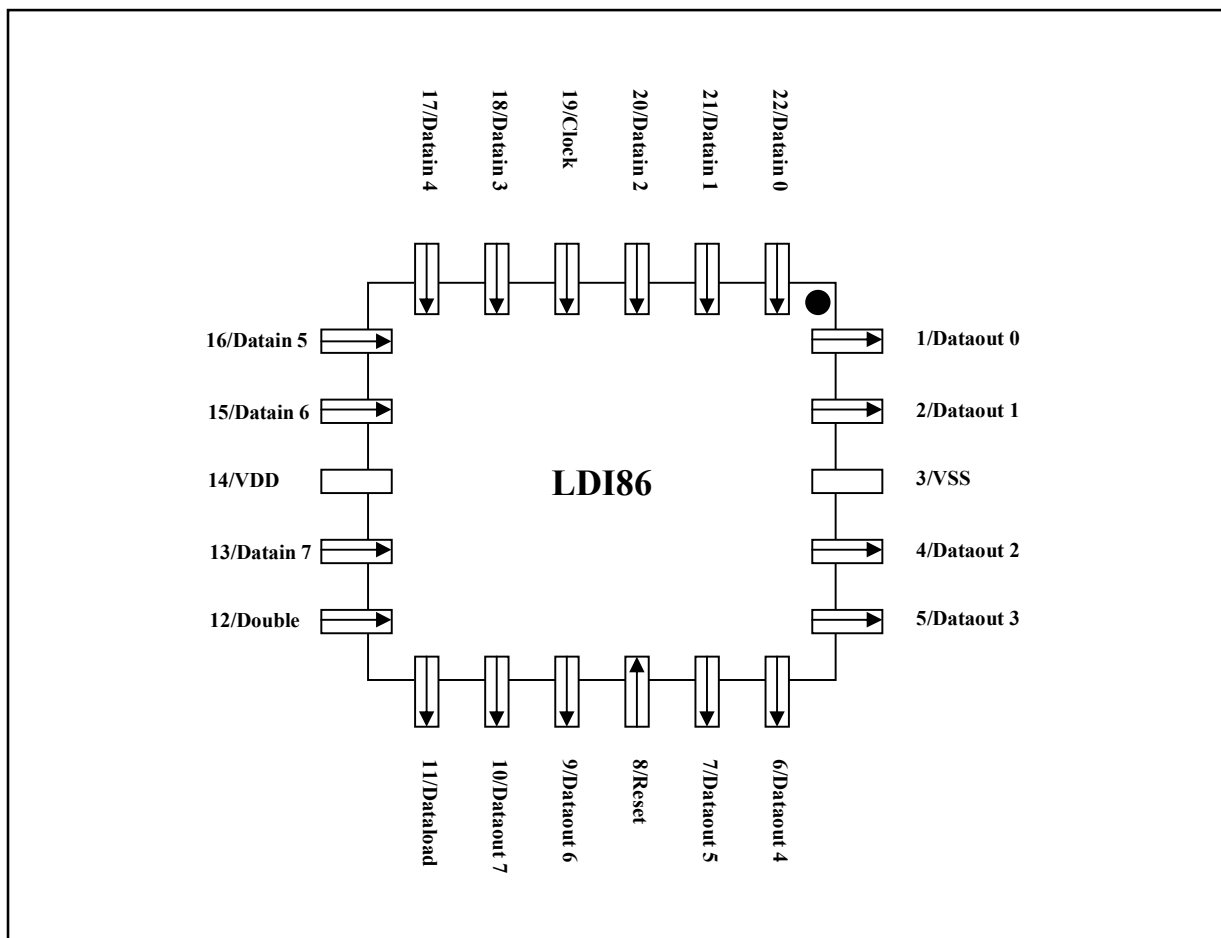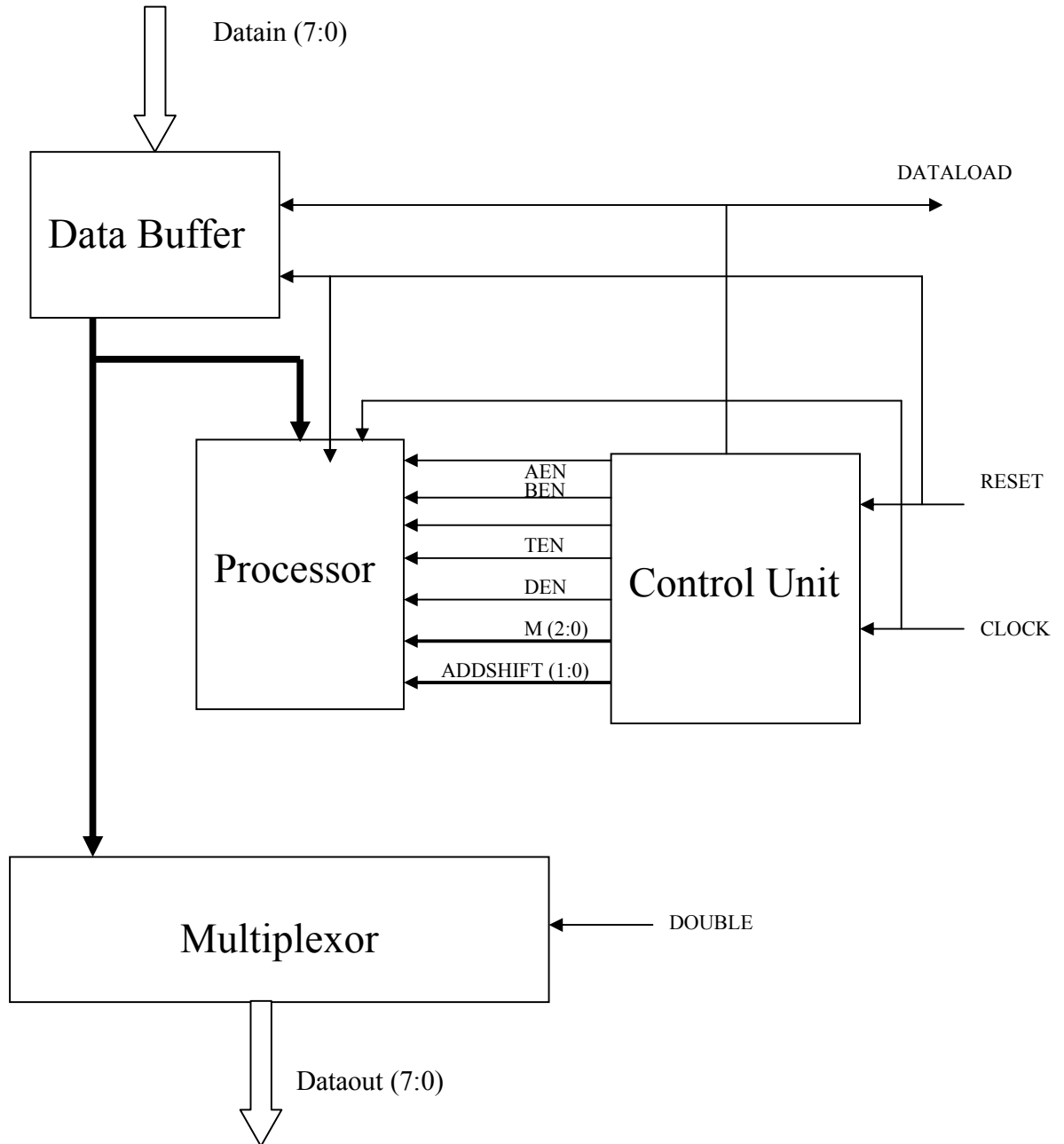Introduction:
- Single sample mode
- Sampling frequency which is set at 44.1 kHz
- Successive data samples/ Double sample mode
- Dataload signal is provided as a start conversion signal.
- 8-bit input data buffer.
- Built-in High speed processor.
- Single Power Supply: +5V

LDI86 is 8-bit linear interpolator. Linear interpolation is a common technique used in the processing of digital audio and video data. Consecutive data samples are analysed and intermediate values computed to improve sound quality or enhance video imagery. The following block diagram details an 8-bit data interpolator suitable for doubling the number of samples in an audio system.

Pin Configuration:

Block Diagram:

Datain (7:0)

Data Buffer

DATALOAD

Processor

AEN
BEN
TEN
DEN
M (2:0)
ADDSHIFT (1:0)

Control Unit

RESET

CLOCK

Multiplexor

DOUBLE

Dataout (7:0)

Pin Description:

Pin No.	Symbol	I/O	Description
1	Dataout 0	O	Output Data 0
2	Dataout 1	O	Output Data 1
3	VSS	P	Ground
4	Dataout 2	O	Output Data 2
5	Dataout 3	O	Output Data 3
6	Dataout 4	O	Output Data 4
7	Dataout 5	O	Output Data 5
8	Reset	I	Active low System Reset
9	Dataout 6	O	Output Data 6
10	Dataout 7	O	Output Data 7
11	Dataload	O	Synchronises the External device
12	Double	I	Selecting the Single or Double mode
13	Datain 7	I	Input Data 7
14	VDD	P	Supply Voltage
15	Datain 6	I	Input Data 6
16	Datain 5	I	Input Data 5
17	Datain 4	I	Input Data 4
18	Datain 3	I	Input Data 3
19	Clock	I	System Clock
20	Datain 2	I	Input Data 2
21	Datain 1	I	Input Data 1
22	Datain 0	I	Input Data 0

Technology: MIETEC 2u
Chip Area: 244mm X 244mm

ABSOLUTE MAXIMUM RATINGS

Characteristic	Symbol	MIN	MAX	Unit
Supply Voltage	V_{DD}	-0.5	7.5	V
Low Voltage		-0.5	7.5	V
High Voltage		-0.5	12.5	V
Input Voltage	V_I	-0.5	$V_{DD} + 0.5$	V
Output Voltage	V_O	-0.5	7.5	V
Operating Temperature	T_{OPR}	-55	125	˚C
Storage Temperature	T_{STG}	-65	150	˚C

OPERATING CONDITIONS

Characteristic	Symbol	MIN	MAX	Unit
Supply Voltage	V_{DD}	3	7	V
Low Voltage		3	7	V
High Voltage		7	12	V

ELECTRICAL CHARACTERISTICS

DC Characteristics
(V_{DD} = 5V, V_{SS} = 0V, T_a = 25˚C, unless otherwise specified)

Characteristic	Symbol	Conditions	Min	Typ	Max	Unit
High Input Voltage	V_{IH}		3.5		5.5	V
Low Input Voltage	V_{IL}		-0.5		1.5	V
High Output Voltage	V_{OH}	(I_{OL} < 1mA)	4.95			V
Low Output Voltage	V_{OL}	(I_{OH} < 1mA)			0.05	V
Input Capacitance	C_{IN}				10	pF
I_{OL}	I_{OL}	V_{OUT} = 0.4	3.2			mA
I_{OH}	I_{OH}	V_{OUT} = 4.6	1.6			mA
I_{OS}	I_{OS}	Source	-40			mA
	I_{OS}	Sink	74			mA

AC Characteristics
(V_{DD} = 5V, V_{SS} = 0V, T_a = 25˚C, unless otherwise specified)

Characteristic	Symbol	Min	Typ	Max	Unit
Rising & Falling Time	t_R, t_F				
Clock Frequency	f_{CK}				
Setup Time	t_{SU}				
Hold Time	t_H				
Delay Time	t_D				

Functional Description:

Linear interpolation is a common technique used in the processing of digital audio and video data. Linear interpolation allows predicting an unknown value, if any two particular values are know and assume that the rate of change is constant.

```
   New
  Sample
              Difference
                          ( - ) ——— ( ÷2 )

  Stored
  Sample

                    ( + )

                   Output
```
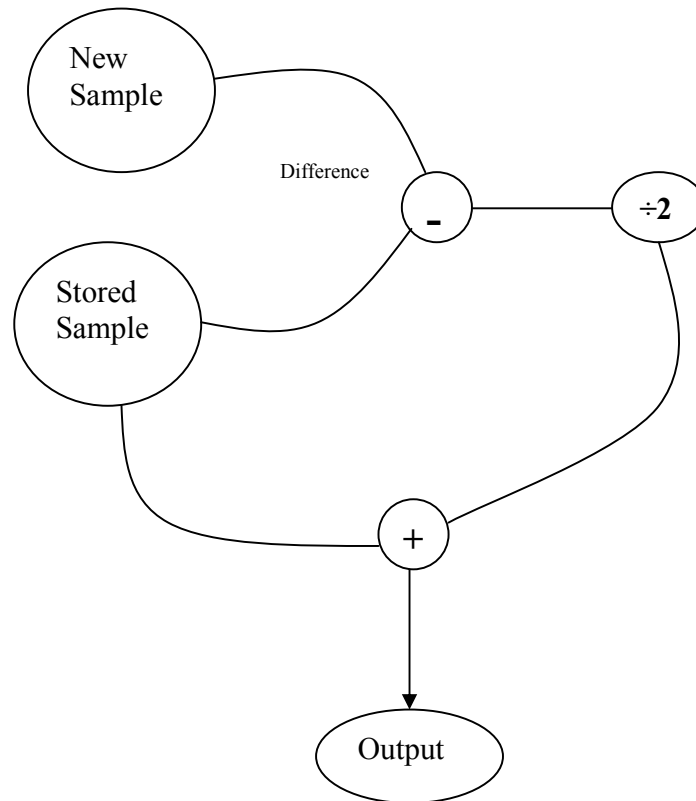
The Processor takes each sample in turn, computes the difference between it and the previous value, divides this difference by 2 and adds to the previous value to form a new intermediate value.

The free running system Clock operates at 8 times the sample frequency thereby allowing the control unit eight clock cycles between samples to issue the required computational instructions. The Dataload signal synchronises the arrival of new data with the start of the next computational cycle. This signal is also provided as a chip output to act as a Start Conversion signal to an external analogue to digital converter during testing of the manufactured device.

Samples comprising alternate original and intermediate values are output at twice the sampling frequency.

The following block diagram details the data flow. Information to be sampled is first buffered and transferred to processor and multiplexor. The computed data from processor is fed to multiplexor. Depends upon the requirement by Double signal, a data can be selected to pass it to output pins.

Data Flow Diagram:

Datain (7:0)

| Data Buffer | ⟹ | Processor | ⟸⋯ | Control Unit |

Multiplexor

Dataout (7:0)
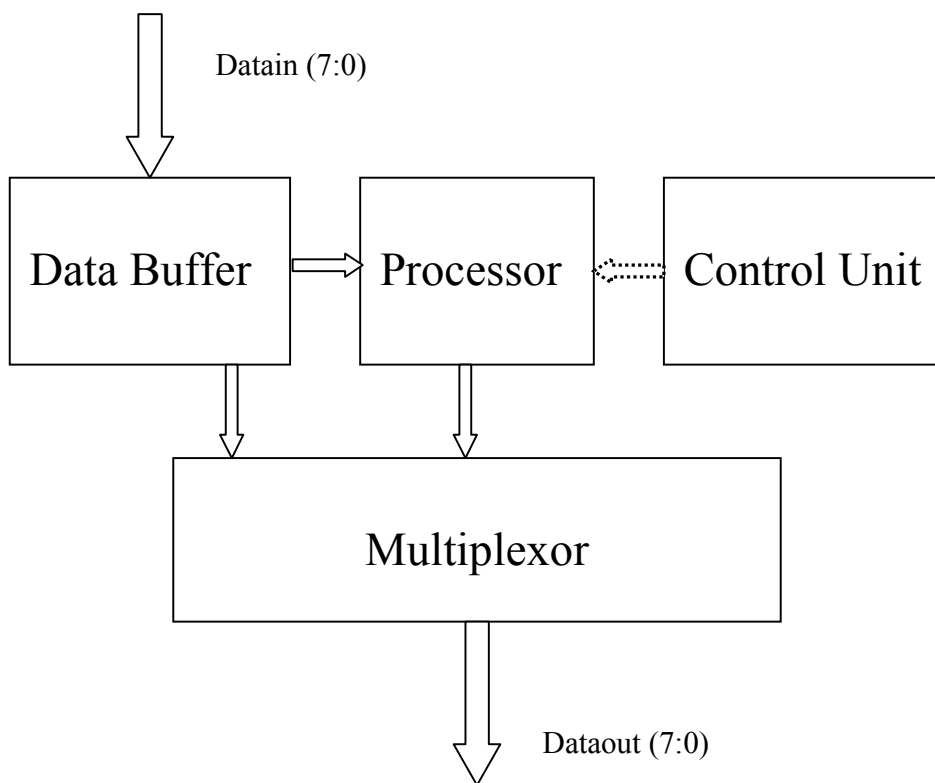
An active LOW system Reset is also provided to initialise the control unit and to clear the processor and data buffer registers for simulation and device testing.

LDI86 is divided into following four major blocks.

1. Data Buffer
2. Processor
3. Control Unit
4. Multiplexor

1. Data Buffer: It is an 8-bit positive edged triggered register. Internally Dataload is used as a clock to sample the data. This sampling frequency is set to 44.1 kHz. An active LOW system Reset is provided internally, to initialize the buffer with set value.

2. Processor:

LDI86 contain an 8-bit RISC processor. Processor is high speed mathematical operator. It can perform addition, subtraction, multiplication (x 2) and divider (÷ 2). Processor compromises the multiplexor, 8-bit adder, 8-bit shifter, Complimentor, and 8-bit registers. Every unit in processor is driven by Control unit.
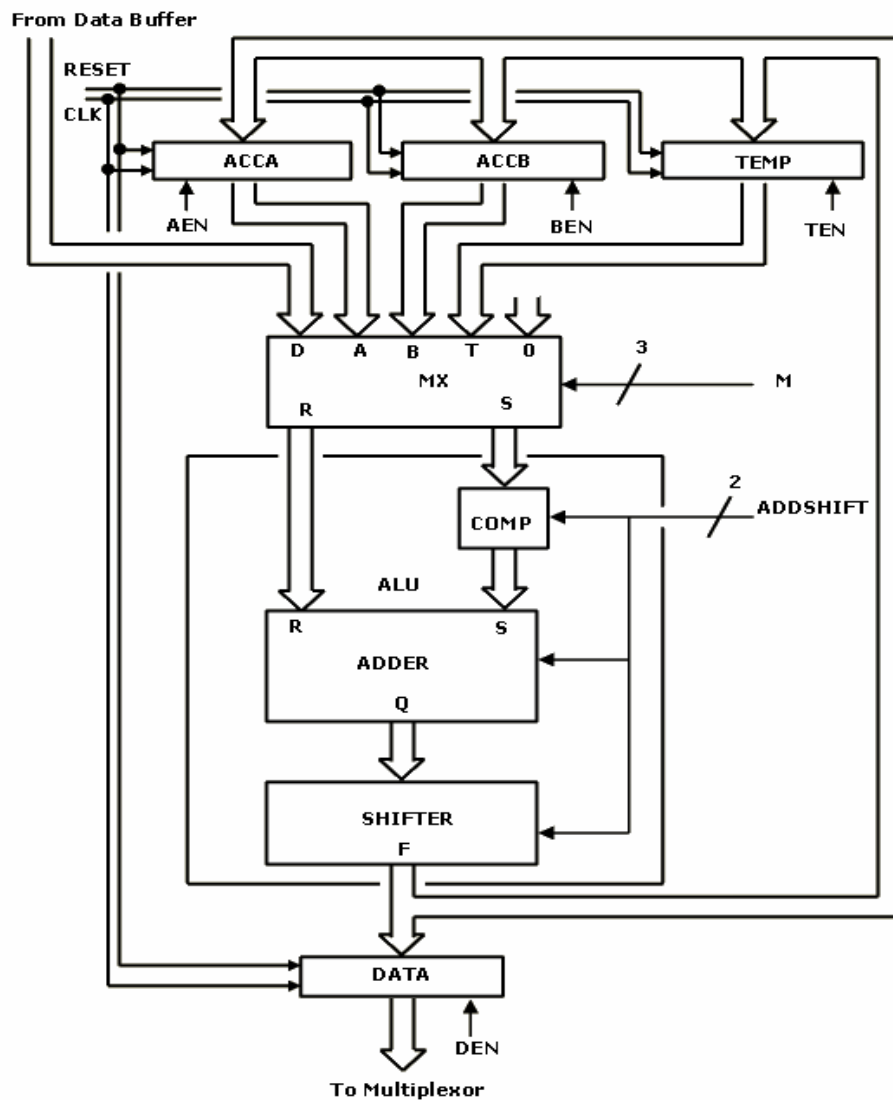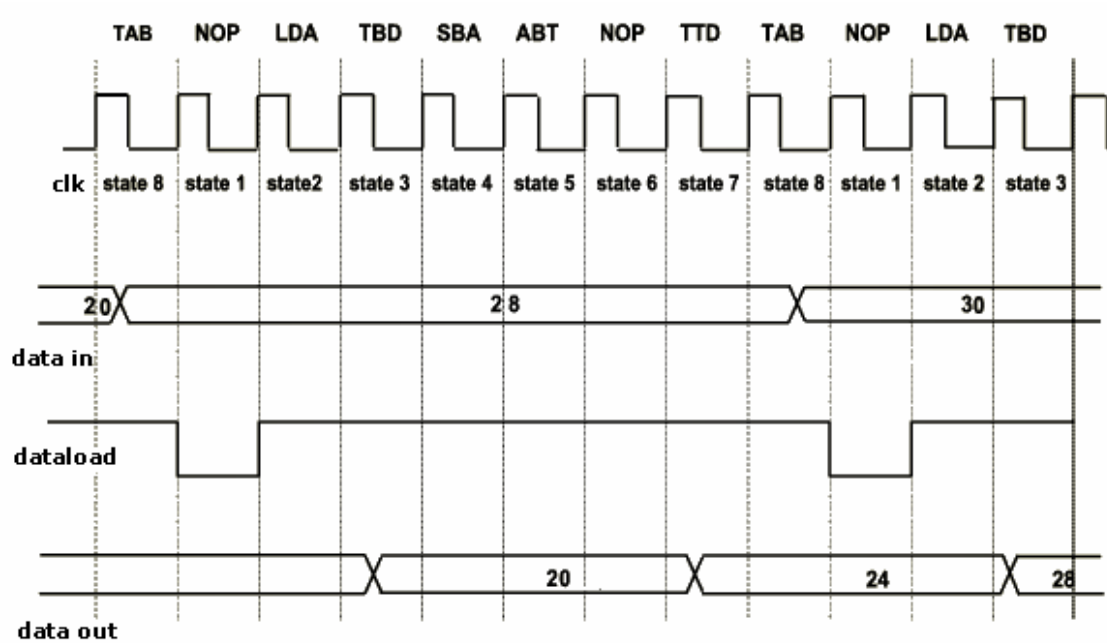
3. Control Unit:

Control unit is the heart of the LDI86. It is design with 8-state finite state machine. Eight different states are sequenced to control the processor of LDI86.

STATE	NOP	LDA	TBD	SBA	ABT	NOP	TTD	TAB
SIGNAL								
M(2:0)	110	100	011	000	001	110	101	010
ADDSHIFT(1:0)	01	01	01	10	01	01	01	01
AEN		1	0	0	0		0	0
BEN		0	0	0	0		0	1
TEN		0	0	1	1		0	0
DEN		0	1	0	0		1	0
DATALOAD	0	1	1	1	1	1	1	1

Dataload is generated on every new sample cycle.

4. Multiplexor: It is a two channel, 8-bit multiplxor with Double as input. Whether the user wants single sample or double sample mode, it can be chose from double signal.

Glossary

Linear interpolation: The simplest kind of automatic inbetweening is linear inbetweening which is done with a mathematical process of guessing intermediate locations called linear interpolation. To interpolate simple means to calculate a new value inbetween two known values. Linear interpolation creates new values at equal distances along a line between two known values.