Specification Document

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Contents

1 Processor

1.1 Instruction Set

In this instruction syntax X=Not used, K=Constant, A=Instruction Address, P=Data Address

Table 1: Instruction Set of the Simple CPU

Opcode	**Instruction**	**RTL**
Load ACC kk	0000 XXXX KKKKKKKK	ACC <- KK
Add ACC kk	0100 XXXX KKKKKKKK	ACC <- ACC + KK
And ACC kk	0001 XXXX KKKKKKKK	ACC <- ACC & KK
Sub ACC kk	0110 XXXX KKKKKKKK	ACC <- ACC - KK
Input ACC pp	1010 XXXX PPPPPPPP	ACC <- M[PP]
Output ACC pp	1110 XXXX PPPPPPPP	M[PP] <- ACC
Jump U aa	1000 XXXX AAAAAAAA	PC <- AA
Jump Z aa	1001 00XX AAAAAAAA	IF Z=1 PC <- AA ELSE PC <- PC + 1
Jump C aa	1001 10XX AAAAAAAA	IF C=1 PC <- AA ELSE PC <- PC + 1
Jump NZ aa	1001 01XX AAAAAAAA	IF Z=0 PC <- AA ELSE PC <- PC + 1
Jump NC aa	1001 11XX AAAAAAAA	IF C=0 PC <- AA ELSE PC <- PC + 1

Here '->' indicates updated with .

The processor has an extra cycle to save on hardware which would have been required for incrementing the PC . So the processor follows **fetch-decode-execute-increment** cycle .

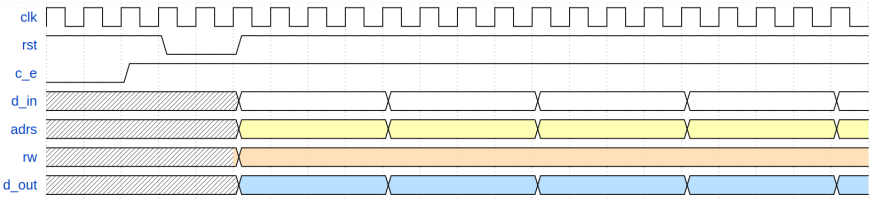
1.2 Input Output Interface

Table 2: I/O interface of the processor

Signals	Type	Size	Active	Description
clk	input	1 bit	-	square wave used to maintain synchronousity in the device
c_e	input	1 bit	High	enables the chip for input data
rst	input	1 bit	Low	resets the chip to a pre decided state
[15:0] d_in	input	16 bits	-	the instruction sent from memory
[7:0] adrs	output	8 bits	-	the address of the required instruction sent to memory
rw	output	1 bit	-	read write control signal sent to memory
[7:0] d_out	output	8 bits	-	output data from the processor

1.3 Timing Diagrams

Figure 1: Timing Diagrams of the processor



2 Memory

2.1 Description

Size of RAM -> 4 Kilobytes
RAM used is DDR5 Synchronous Dynamic RAM .
Instruction length is *16 bit* , maximum number of instructions and data than

can be stored is **256** (address 0 to 255). Address length required is 8 bits.

2.2 I/O of the Memory device

Table 3: I/O of the Memory device

Signals	**Type**	**Size**	**Active**	**Description**
clk	input	1 bit	-	square wave used to maintain synchronousity in the device
c_e	input	1 bit	High	enables the memory functioning
rst	input	1 bit	Low	resets the memory to a pre decided state
[15:0] mem_in	input	16 bits	-	the data sent by chip
[7:0] adrs	input	8 bits	-	the address of the required instruction
rw	input	1 bit	-	read write control signal sent to memory
[15:0] mem_out	output	16 bits	-	output data/instruction from the memory