

General Description

The IPU (Intra-Prediction Unit) examines the data in the neighboring macroblocks to predict the data for the current macroblock. The IPU IP block is capable of predicting 1 element per 4 clock cycles,

The IPU works on several block sizes: Luma 4x4, Luma 16x16 and Chroma 8x8. It also predicts the mode of Luma 4x4 based on the modes of the neighboring blocks.

Applications

H.264 High Quality Video

Low Power Applications

Wireless Video

Video Streaming

Video Conferencing

Video Surveillance

Features

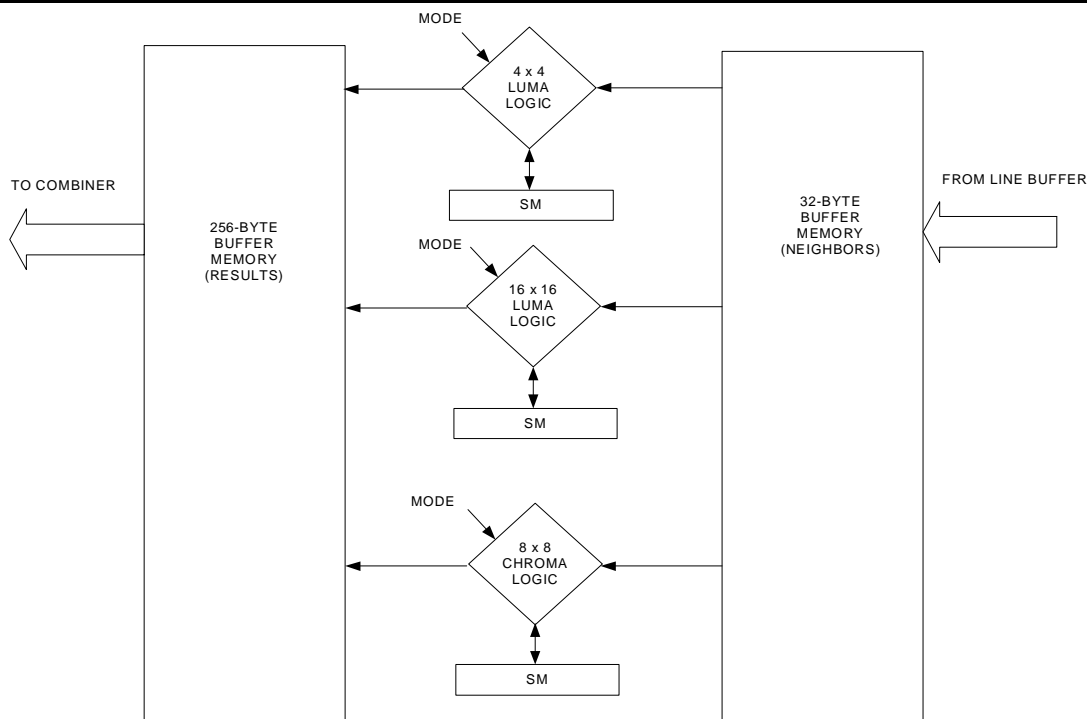
- * Intra-Prediction Unit compliant with H.264 decoder
- * Predicts all H.264 modes of Luma and Chroma Macro-Blocks

Functional Description

The IPU block performs three prediction types:

- Luma 4 x 4 intra prediction.
- Luma 16 x 16 intra prediction.
- Chroma 8 x 8
- Indicates when the end of the macroblock is reached.

Fig. 1 Intra-Prediction Unit Block Diagram



The IPU is memory-based. The memory assignments are shown in the table below.

Table 1: Memory Input Buffer

Addr. Neighbor Neighbor Neighbor
Luma 16x16 Chroma 8x8 Luma 4x4

0	P(0,-1)	P(0,-1)	P(0,-1)
1	P(1,-1)	P(1,-1)	P(1,-1)
2	P(2,-1)	P(2,-1)	P(2,-1)
3	P(3,-1)	P(3,-1)	P(3,-1)
4	P(4,-1)	P(4,-1)	P(-1,0)
5	P(5,-1)	P(5,-1)	P(-1,1)
6	P(6,-1)	P(6,-1)	P(-1,2)
7	P(7,-1)	P(7,-1)	P(-1,3)
8	P(8,-1)	P(-1,0)	P(-1,-1)
9	P(9,-1)	P(-1,1)	Avail_N
A	P(A,-1)	P(-1,2)	Avail_W
B	P(B,-1)	P(-1,3)	Mode_N
C	P(C,-1)	P(-1,4)	Mode_W
D	P(D,-1)	P(-1,5)	
E	P(E,-1)	P(-1,6)	
F	P(F,-1)	P(-1,7)	
10	P(-1,0)	P(-1,-1)	
11	P(-1,1)	Avail_N	
12	P(-1,2)	Avail_W	
13	P(-1,3)	Mode_N	
14	P(-1,4)	Mode_W	
15	P(-1,5)		
16	P(-1,6)		
17	P(-1,7)		
18	P(-1,8)		
19	P(-1,9)		
1A	P(-1,A)		
1B	P(-1,B)		
1C	P(-1,C)		
1D	P(-1,D)		
1E	P(-1,E)		
1F	P(-1,F)		
20	P(-1,-1)		
21	Avail_N		
22	Avail_W		
23	Mode_N		
24	Mode_W		

For Luma 16x16 mode, the result of the transformation will write to the 256 bytes of "Mem_out_buf" with the following memory address (x,y) sequence: (0,0), (0,1), (0,2), (0,3), (0,4), (0,5).....(15,14), (15,15).

For Chroma 8x8 mode, the result of the transformation will write to the first 64 bytes of "Mem_out_buf" with the following memory address (x,y) sequence: (0,0), (0,1), (0,2), (0,3), (0,4), (0,5).....(15,14), (15,15).

For Luma 4x4 mode, the result of the transformation will write to the first 16 bytes of "Mem_out_buf" with the following memory address (x,y) sequence: (0,0), (0,1), (0,2), (0,3), (1,1), (1,2).....(4,3), (4,4).

For each intra-prediction macroblock, a prediction mode is assigned. These modes describe how the prediction is done. The encoder will select the best intra-prediction mode for the data in that particular block to minimize the residual.

Table 2:Luma 16x16 Mode

Luma_16x16_mode	Description
0	Vertical prediction.
1	Horizontal prediction.
2	DC prediction.
3	Plane prediction.

The input/output signals for the IPU are indicated in the following table.

Table 3: Chroma 8x8 Mode

Chroma_mode	Description
0	DC prediction.
1	Horizontal prediction.
2	Vertical prediction
3	Plane prediction.

Table 4: Luma 4x4 Mode

Luma_4x4_mode	Description
0	Vertical prediction.
1	Horizontal prediction.
2	DC prediction.
3	Diagonal Down/Left prediction.
4	Diagonal Down/Left prediction.
5	Vertical Right prediction.
6	Horizontal Down prediction
7	Vertical Left prediction.
8	Horizontal Up prediction.

Table 5: Input/Output Description

SIGNAL	Dir.	Wid.	DESCRIPTION
ipu_start	Input	1	Start ipu prediction for macroblock
Luma_4x4	Input	1	Luma 4x4 block
Luma_16x16	Input	1	Luma 16x16 block
Chroma_8x8	Input	1	Chroma 8x8 block
Mode	Input	4	Mode
Wr_data_in	Input	8	Data Input
Wr	Input	1	Write pulse
Wr_addr	Input	6	Write address
Rd_data_out	Output	8	Data output
Rd	Input		Read
Rd_addr	Input	8	Read_address
IPU_busy	Output	1	Busy signal
Data_rdy	Output	1	Results are ready in output memory
Ack	Input	1	Acknowledge pulse finished reading result
Clk	Input	1	Clock
Rst	Input	1	Reset

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