PRODUCT INFORMATION

PRODUCT SUMMARY

KS7333 is a product used in video camera systems, such as camcorders and surveillance camera systems that use charge coupled devices (CCD). It takes the CCD input as digital data and performs 3-D interpolation, image scaling, and minimization of resolution potential using horizontal/vertical line interpolation on the data. In addition, it detects the amount of movement caused by shaking while held by the hands through 1-D projection pattern matching and corrects for it. It also has the 1/16 picture-in-picture function as well as the digital effect function that uses field memory.

FEATURE

- NTSC/PAL, normal/hi-band, DVC correspondence
- 10 bit S1S2 format A/D signal input (new)
- 10 bit S1S2 signal output for DCP I/F
- Sub-pixel resolution animation_movement detection and compensation (new)
- Adaptable IIR filtering for shaking/panning compensation
- 1/16 picture in picture function (new)
- 256 step linear interpolation
- High resolution digital zoom using TIIR (temporal IIR) filter (new)
- Uses 1 field memory (16M SDRAM) (new)
- DPCM compression and recovery for effective memory use (80%) (new)
- Movement adaptable field noise reducer (new)
- Any point quick zoom (new)
- Any area motion detection
- Line graphic (free line draw) using motion (new)
- Digital effect strobe (external micom control), afterimage, still image, mirror)
- Serial micom interface
- Dual shutter source mix and individual gamma compensation (histogram output)
- Low shutter speed control correspondence
- 64 CCD white defect detection and compensation function
- Digital clamp function
- AE/AF operation function
- OSD visual interpretation tool etc. (motion vector, window mark, etc)

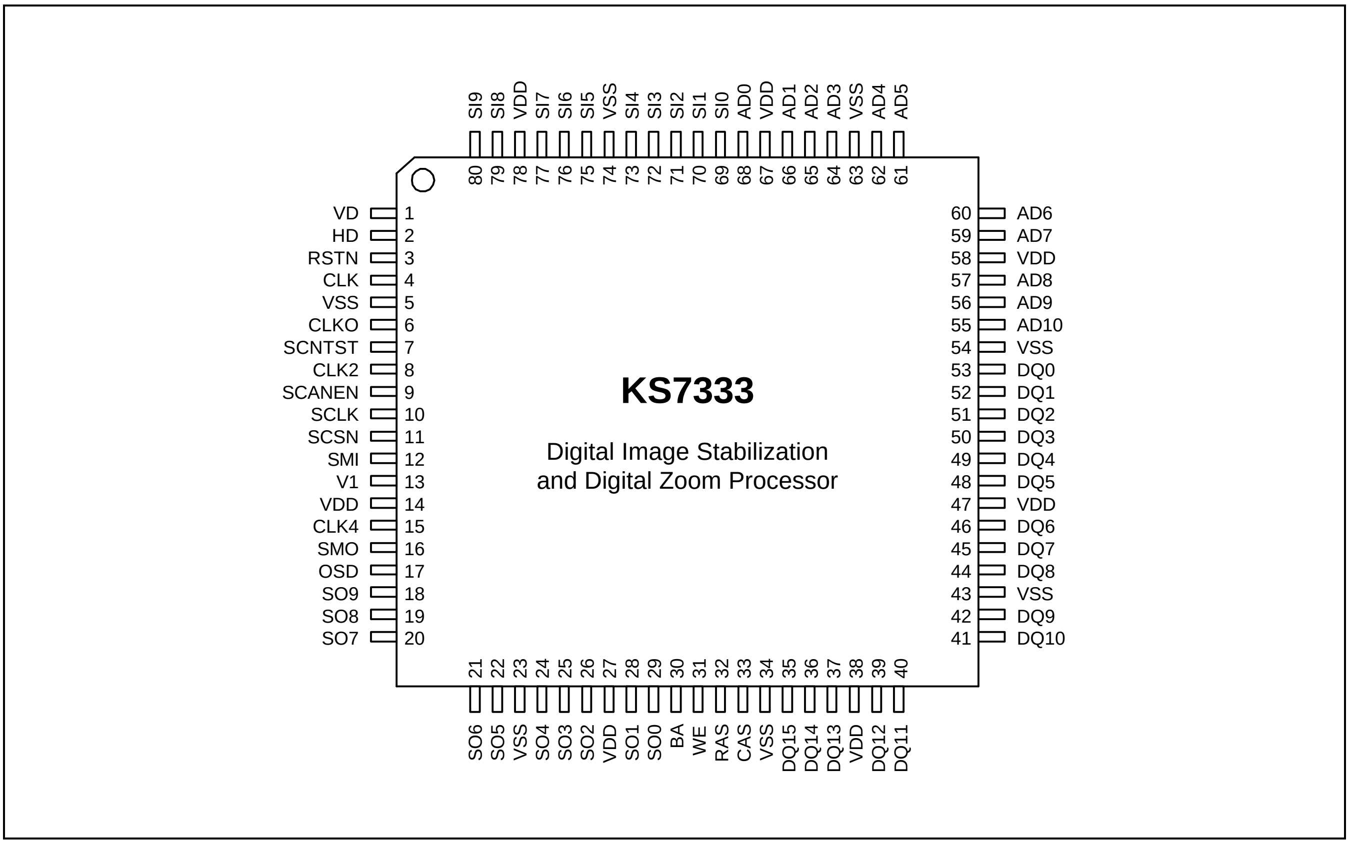
PROCESSING AND PACKAGE

Processing: 0.35um, TLM, 3.3V CMOS prodessing (CSP7L)

APPLICATIONS

- Camcorder systems
- Surveillance cameras
- PC cameras

PIN DIAGRAM


KS7333
Digital Image Stabilization
and Digital Zoom Processor
VD 1
HD 2
RSTN 3
CLK 4
VSS 5
CLKO 6
SCNTST 7
CLK2 8
SCANEN 9
SCLK 10
SCSN 11
SMI 12
V1 13
VDD 14
CLK4 15
SMO 16
OSD 17
SO9 18
SO8 19
SO7 20
21 SO6
22 SO5
23 VSS
24 SO4
25 SO3
26 SO2
27 VDD
28 SO1
29 SO0
30 BA
31 WE
32 RAS
33 CAS
34 VSS
35 DQ15
36 DQ14
37 DQ13
38 VDD
39 DQ12
40 DQ11
41 DQ10
42 DQ9
43 VSS
44 DQ8
45 DQ7
46 DQ6
47 VDD
48 DQ5
49 DQ4
50 DQ3
51 DQ2
52 DQ1
53 DQ0
54 VSS
55 AD10
56 AD9
57 AD8
58 VDD
59 AD7
60 AD6
61 AD5
62 AD4
63 VSS
64 AD3
65 AD2
66 AD1
67 VDD
68 AD0
69 SI0
70 SI1
71 SI2
72 SI3
73 SI4
74 VSS
75 SI5
76 SI6
77 SI7
78 VDD
79 SI8
80 SI9

PIN DESCRIPTION

Table 1. Pin Description

Pin No.	Pin Name	I/O	Function	Comments
1	VD	I	Vertical driving pulse	
2	HD	I	Horizontal driving pulse	
3	RSTN	I	System reset	Low active
4	CLK	I	System clock	Max: 18MHz
5	VSS	P	Ground	
6	CLKO	O	2x CLK output	Max: 36MHz
7	SCNTST	I	Scan test enable	Normal operation "0"
8	CLK2	I	2x CLK input	
9	SCANEN	I	Scan cell enable signal	Normal operation "0"
10	SCLK	I	System micom clock	Max freq: CLK/6
11	SCSN	I	System micom reset	
12	SMI	I	Serial data input from system micom	
13	V1	I	Vertical skip line pulse from DCP	
14	VDD	P	Power	
15	CLK4	O	9 divided CLK output	
16	SMO	O	Serial data output to system micom	
17	OSD	O	On screen display signal to system micom	
18	SO9	O	S1S2 data output 9 for DCP	
19	SO8	O	S1S2 data output 8 for DCP	
20	SO7	O	S1S2 data output 7 for DCP	
21	SO6	O	S1S2 data output 6 for DCP	
22	SO5	O	S1S2 data output 5 for DCP	
23	VSS	P	Ground	
24	SO4	O	S1S2 data output 4 for DCP	
25	SO3	O	S1S2 data output 3 for DCP	
26	SO2	O	S1S2 data output 2 for DCP	
27	VDD	P	Power	
28	SO1	O	S1S2 data output 1 for DCP	
29	SO0	O	S1S2 data output 0 for DCP	
30	BA	O	SDRAM bank select address	
31	WE	O	SDRAM write enable	
32	RAS	O	SDRAM row address strobe	
33	CAS	O	SDRAM column address strobe	
34	VSS	P	Ground	

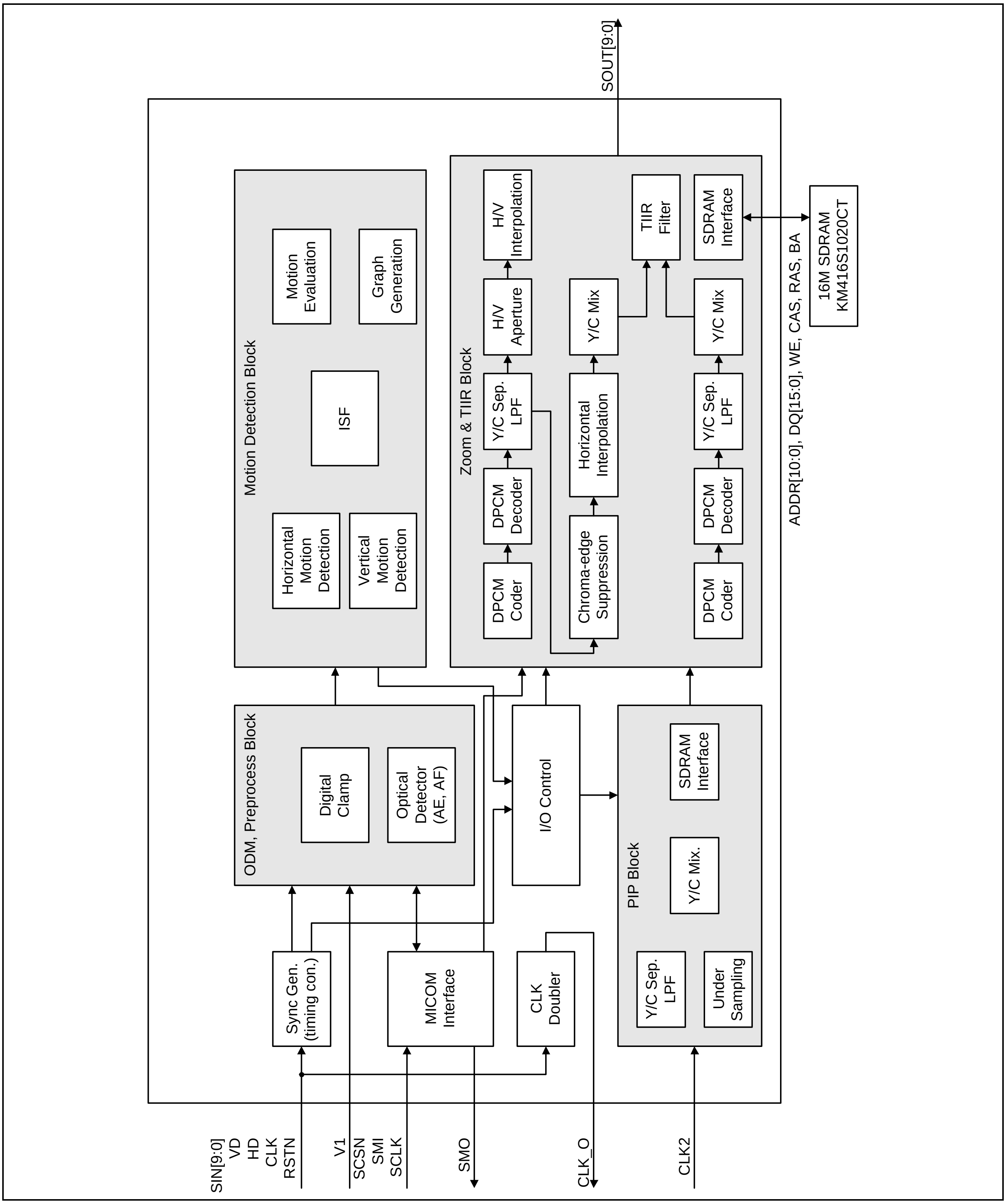
Table 1. Pin Description (Continued)

Pin No.	Pin Name	I/O	Function
35	DQ15	I/O	SDRAM input/output data 15
36	DQ14	I/O	SDRAM input/output data 14
37	DQ13	I/O	SDRAM input/output data 13
38	VDD	P	Power
39	DQ12	I/O	SDRAM input/output data 12
40	DQ11	I/O	SDRAM input/output data 11
41	DQ10	I/O	SDRAM input/output data 10
42	DQ9	I/O	SDRAM input/output data 9
43	VSS	P	Ground
44	DQ8	I/O	SDRAM input/output data 8
45	DQ7	I/O	SDRAM input/output data 7
46	DQ6	I/O	SDRAM input/output data 6
47	VDD	P	Power
48	DQ5	I/O	SDRAM input/output data 5
49	DQ4	I/O	SDRAM input/output data 4
50	DQ3	I/O	SDRAM input/output data 3
51	DQ2	I/O	SDRAM input/output data 2
52	DQ1	I/O	SDRAM input/output data 1
53	DQ0	I/O	SDRAM input/output data 0
54	VSS	P	Ground
55	AD10	O	SDRAM address 10
56	AD9	O	SDRAM address 9
57	AD8	O	SDRAM address 8
58	VDD	P	Power
59	AD7	O	SDRAM address 7
60	AD6	O	SDRAM address 6
61	AD5	O	SDRAM address 5
62	AD4	O	SDRAM address 4
63	VSS	P	Ground
64	AD3	O	SDRAM address 3
65	AD2	O	SDRAM address 2
66	AD1	O	SDRAM address 1
67	VDD	P	Power
68	AD0	O	SDRAM address 0
69	SI0	I	S1S2 data input 0 from ADC

Table 1. Pin Description (Continued)

Pin No.	Pin Name	I/O	Function
70	SI1	I	S1S2 data input 1 from ADC
71	SI2	I	S1S2 data input 2 from ADC
72	SI3	I	S1S2 data input 3 from ADC
73	SI4	I	S1S2 data input 4 from ADC
74	VSS	P	Ground
75	SI5	I	S1S2 data input 5 from ADC
76	SI6	I	S1S2 data input 6 from ADC
77	SI7	I	S1S2 data input 7 from ADC
78	VDD	P	Power
79	SI8	I	S1S2 data input 8 from ADC
80	SI9	I	S1S2 data input 9 from ADC

BLOCK DIAGRAM



DESIGN CHARACTERISTICS

MAXIMUM ABSOLUTE RATING

Item	Symbol	Rating	Unit	Remark
DC supply voltage (digital)	V_{DD}	-0.3 - 3.6	V	-
DC input voltage	V_{IN}	-0.3 - V_{DD} + 0.3	V	-
Storage temperature	T_{STG}	-40 - 125	°C	-
Latch-up current	I_{LU}	±280	mA	-

OPERATING TEMPERATURE

Functions and AC/DC characteristics must satisfy the specs between 0°C - +70°C.

ELECTRO-STATIC CHARACTERISTICS

Types	Electrostatic Levels		Unit	Comments
	Pin No.	Design Value		
Human body model (HBM)	All	±2000	V	
Machine model (MM)		±300		
CDM		±800		

ELECTRICAL CHARACTERISTICS (DC)

V_{SS} = 0V, V_{DD} = 3.3V ± 0.3V, Ta = 0 - 70°C

Item		Symbol	Condition	Min	Typ	Max	Unit	Remark
Supply voltage		V_{DD}	-	3.0	3.3	3.6	V	V_{DD}, V_{DDA}
Input voltage	High level	V_{IH}	-	2.0	-	-		(1)
	Low level	V_{IL}	-	-	-	0.8		
Output voltage	High level	V_{OH}	I_{OH} = -1mA	2.4	-	-		(2)
			I_{OH} = -4mA					(3), (4)
			I_{OH} = -8mA					(6)
	Low level	V_{OL}	I_{OL} = 1mA	-	-	0.4		(2)
			I_{OL} = 4mA					(3), (4)
			I_{OL} = 8mA					(6)
Input current	High level	I_{IH}	V_{IN} = VDD	-10	-	10	µA	(1), (4)
	Low level	I_{IL}	V_{IN} = VSS	-10	-	10		
Output leakage current	Tri-state	I_{OZ}	V_{OUT} = V_{SS} or V_{DD}	-10	-	10	µA	(4), (5)
Operating current		I_{DD}	-	-	-	280	mA	-
Static current		I_{SS}	-	-	-	35	µA	-

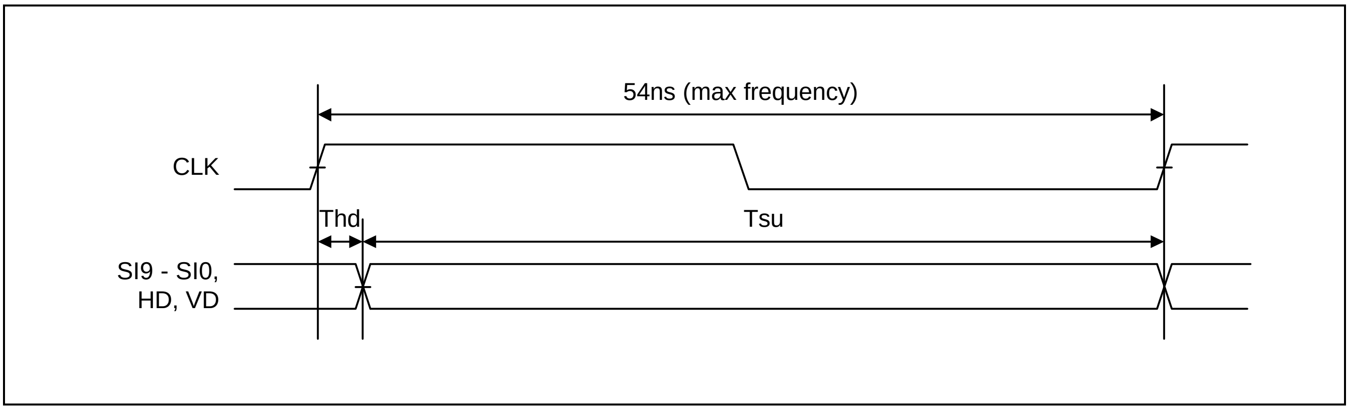
NOTES:

1. All input pin
2. All output pin without (3), (4), (5), (6)
3. DRAM I/F pin (AD[10:0], RAS, CAS, BA, WE)
4. DRAM I/F pin (DQ[15:0]) bi-directional
5. SMO (tri-state)
6. CLK4

ELECTRICAL CHARACTERISTICS (AC)

V_{SS} = 0V, V_{DD} = 3.3V ± 0.3V, Ta = 0 - 70°C

Item	Signal	Symbol	Design Value Characteristics			Unit	Comment
			Lower Limit	Middle	Upper Limit		
Input data setup time	SI9 - SI0, HD, VD, V1	Tsu	5	-	-	ns	VDD = 3.3V ± 0.3V Ta = 0 - 70°C
Input data hold time	SI9 - SI0, HD, VD	Thd	5	-	-	ns	VDD = 3.3V ± 0.3V Ta = 0 - 70°C



SYSTEM CONFIGURATION & OPERATION DESCRIPTION

MOTION DETECTION BLOCK

The motion detection block can be divided into the horizontal motion vector detection block and the vertical motion vector detection block. Its input is the upper 4 bits of the 8-bit luminance signal which is the LPF-handled part of the 10-bit S1S2 format signal. The block uses the difference between the previous image and the current image to find the motion vector. To find the motion vector, the current image's luminance value during the input image's active period must be projected in both horizontal and vertical direction to the current line memory, and put through correlation matching with the value stored in the previous line memory. In this process, the location with the smallest correlation error becomes the motion vector. The search for the motion vector is limited to ±64 in the horizontal direction, and ±23 in the vertical direction.

To reduce the calculation amount and the time spent in operation, the coarse-to-fine correlation operation is carried out within the search area. The correlation operation is put into effect within the vertical blank section, and the motion vector that is finally output has the horizontal value of 7 bits and vertical value of 6 bits.

- 1-D projection to horizontal/vertical
- Coarse-to-fine correlation matching
- MSB 4-bit luminance signal input
- ±64(H), ±23(V) search area
- Full/Zoom area motion detection according to the zoom ratio
- MVX[6:0], MVY[5:0] output
- Max, min correlation value output for adaptive image stabilization

ISF BLOCK

The ISF block accumulates the motion vectors (VX, VY) between the image fields to first calculate the integration value (GX, GY), which is the actual correction value used. If you use the motion vector's integration value, the motion is corrected flawlessly. However, if the camera user's deliberate movements (panning) are also corrected, a memory should have compensation limit in image.

To correct such a problem, the accumulated image movement is divided into high frequency and low frequency components, and only the high frequency components are corrected. To effectively divide these high frequency components, IIR filtering is independently carried out horizontally and vertically.

At this time, The feedback coefficient of the filter can be selected in MICOM.

- 10 degree LPF coefficient
- Horizontal/Vertical IIR filtering
- Temporal filtering output (UX, UY)
- Motion vector evaluation (MD_EVAL. V) carried out first
- Graphic movement information display (MD_GRAPH. V)

DIGITAL ZOOM BLOCK

This block receives the AD-converted S1S2 format image as its input, puts it through DPCM compression, and uses the external SDRAM to store the compressed image signal in real time, 1 field at a time. It then restores the stored image signal and magnifies it to maximum 255 times the original, using the zoom coefficient controlled by MICOM. The magnified image is divided into Y/C using the LPF and goes through the 256-step linear interpolation.

The aperture feature precedes the linear interpolation, and the interpolated image signal is output through the temporal IIR filter. At the same time, the output is stored in 2 fields of the SDRAM.

- 256-step linear interpolation
- Y/C separation through LPF
- Aperture feature for Y signals
- 1 field memory (16M SDRAM) used
- DPCM compression/restoration for efficient memory use
- Color edge suppression (5 tabs)

DCPM compression/restoration for efficient memory use

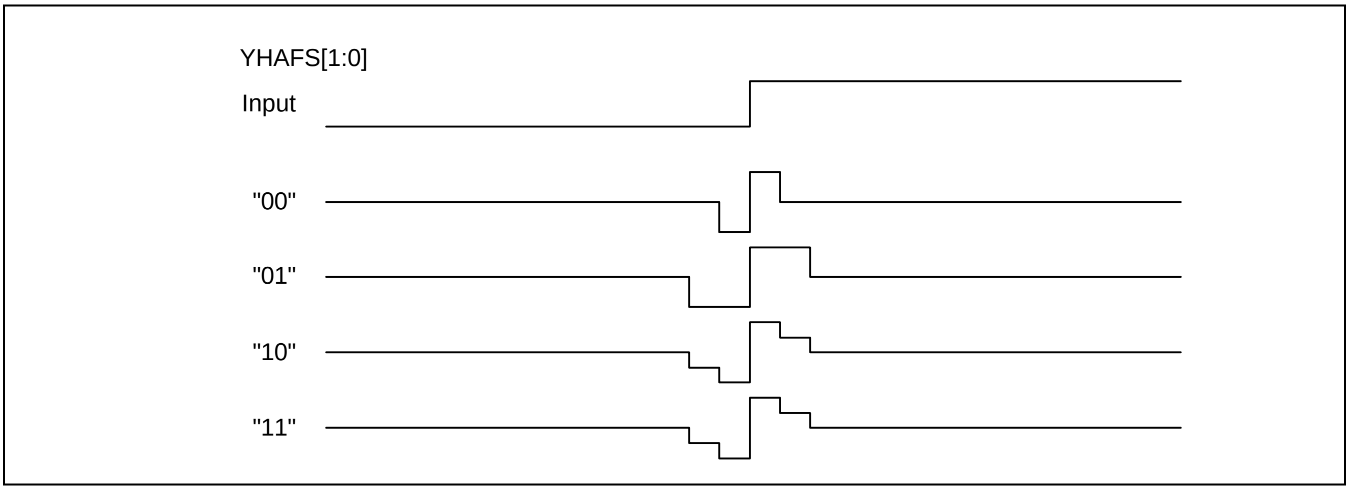
It's not matched between SDRAM data width (16 bits) for store and inputted image signal data width-10 bit. Therefore, in case of storing inputted image, itself (10 bit) data, it's inefficient. To solve that, it compresses 20% from 10 bit to 8 bit with that inputted image data width by adopting DPCM compression technology.

Y/C separation through LPF

Restored DPCM data which is S1 S2 format needs to separate Y/C for image processing, at this time, Y signal is separated by LPF and C signal is separated by HPF.

Aperture feature for Y signals

This system is 4 line processing to vertical direction. Aperture to vertical direction decides to considering by impulse response with using the spline method (refer the micom mode operation part). Horizontal aperture is obtained by adjusting the gain with edge information by adopting 5 tabs.



PICTURE-IN-PICTURE BLOCK

This block uses the AD-converted S1S2 format image as an 8-bit input, divides it into Y/C, and finds the typical value for each Y/C through low pass filtering. The filtered Y/C signal is synthesized into S1S2 format and stored in real time, 2 fields at a time, using the SDRAM. The compression-stored image signal is overlayed on the real image using the location value which comes from the MICOM control value.

- 1/16 compression
- 4-line, 4-pixel sampling
- 1 field memory (16M SDRAM) used (2 fields stored)

TEMPORAL IIR FILTER BLOCK

This block receives the image's output signal, stores it in SDRAM through DPCM compression, reads the stored signal in real time, then restores it. The restored image signal is divided into Y/C, and it goes through the 255-step linear interpolation to be synthesized into S1S2 format. This synthesized image signal and the zoom output are
3-D interpolated using the sub-pixel information output by the motion detection and the zoom.

- DPCM compression/restoration
- 1 field memory (16M SDRAM) used (2 fields stored)
- 3D-interpolation
- 2-line interpolation of Y signal
- 2-line selection of C signal

MICOM INTERFACE BLOCK

This block which interfaces with the external MICOM, selects this system's internal register and receives internal characteristic factors as feedback. Its basic signals are SMI, SMO, SCLK, and SCSN. The first byte of the input data is the register's address, and the data which follows is valid only when SCSN is high.

- Address control method
- 122-byte input register
- 70-byte output register
- Internal register initializing feature by reset
- Possible to control both read only by R/W flag and read & write simultaneity mode.

SYNC GENERATION BLOCK

This block generates the image's horizontal/vertical count information using the sync signal from the Timing Generator (TG) as the standard. It uses DVC, HIGH, PAL, and AP_ADJ (start point adjustment) from the system MICOM to generate the SP (Start Point) information by getting height value, image start point, image width and generate HD, VD, and FLD (FIELD) signals.

- Internal vertical counter (VCNT: line counter)
- Internal horizontal counter (HCNT: pixel counter)
- Internal field signal (FLD)

OSD SIGNAL CONTROL BLOCK

This block controls the 1-bit output of the OSD signal using the internal register value. The form of the output signal is the center position of the PIP box and AF, and the testing graph of the motion vector.

- Motion test vector graph output
- PIP box output
- AF center position output

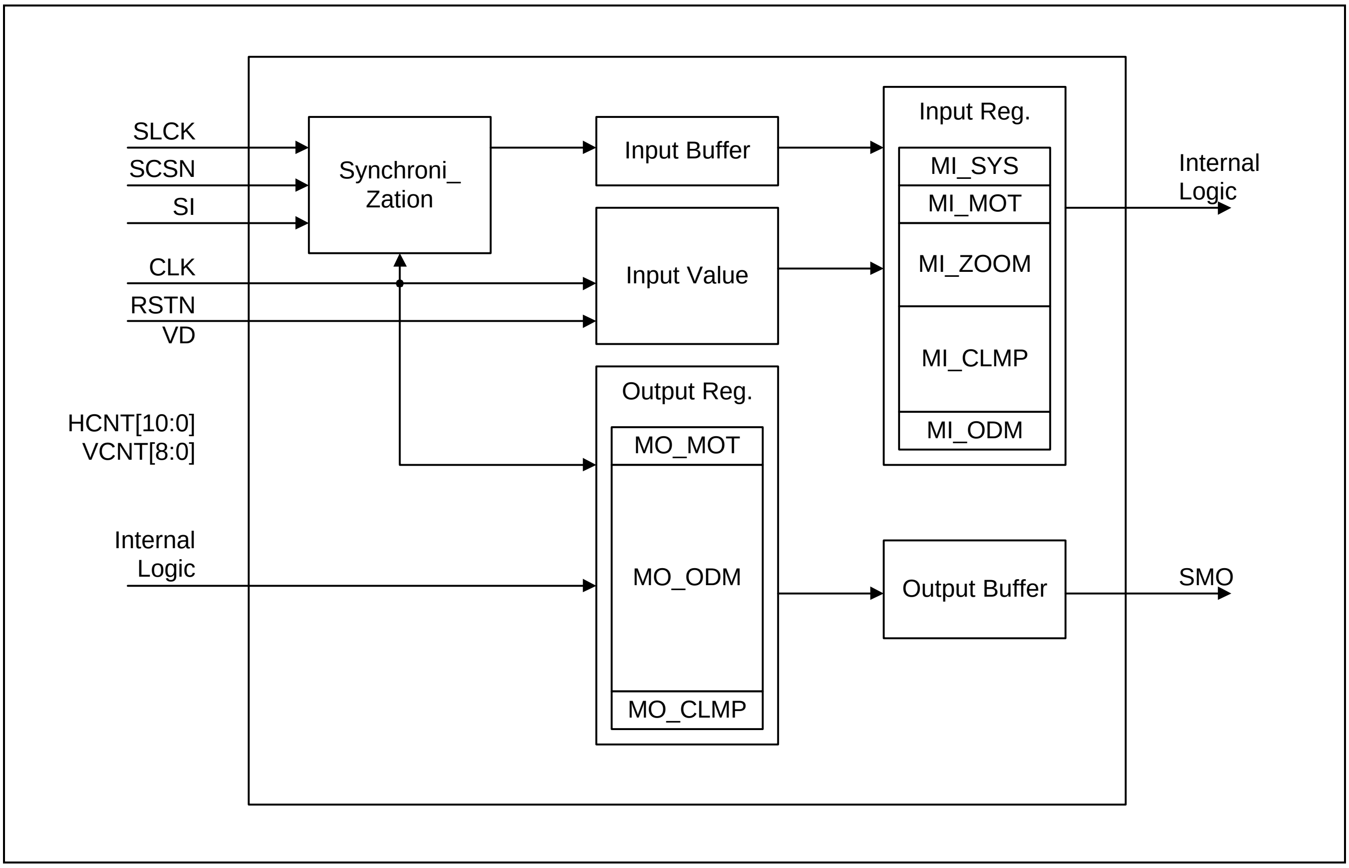
MICOM INTERFACE

SUMMARY

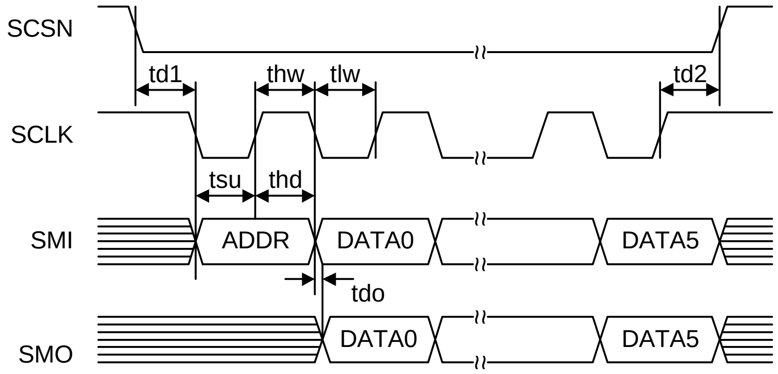
System Micom Interface

- Converts the system micom serial data to parallel data.
- Input buffer: 122 byte
- Output buffer: 70 byte
- 4 wire processing
  SCSN: Chip select (active low)
  SCLK: Data clock
  SMI: Input data
  SMO: Output data

Micom Block Diagram

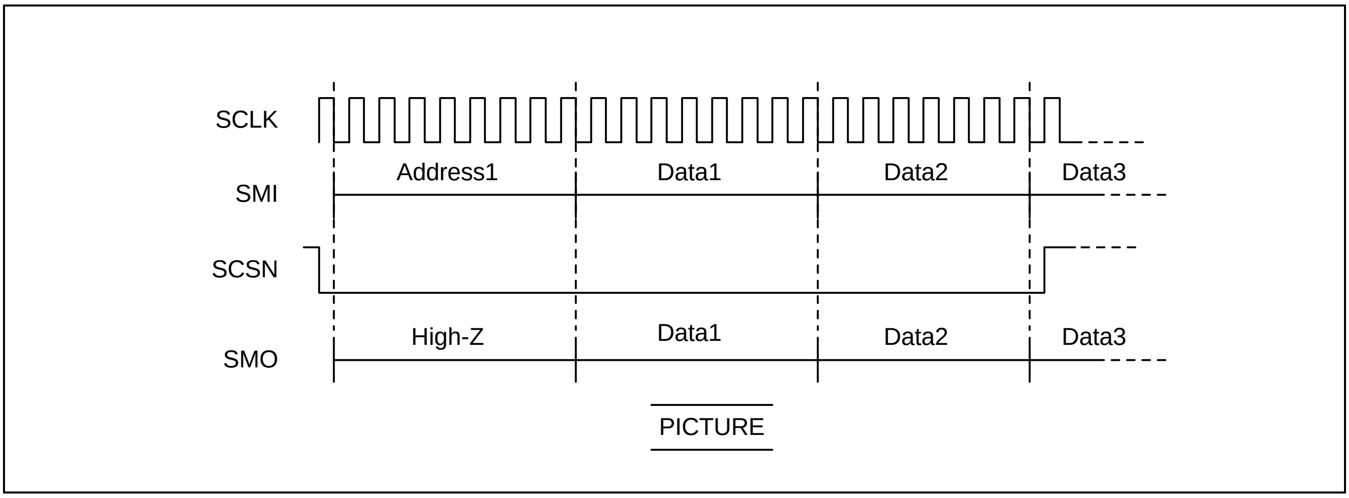


TIMING DIAGRAM



Symbol	Description	Standard (ms)	
		Min	Max
td1	SCSN low edge to SCLK low edge	0.2	¡¤
td2	SCLK high edge to SCSN high edge	0.2	¡¤
thw	SCLK high width	0.2	¡¤
tlw	SCLK low width	0.2	¡¤
tsu	SI data setup time	0.1	¡¤
thd	SI data hold time	0.1	¡¤
tdo	SO data out delay time	¡¤	0.05

FUNCTIONS OF EACH BLOCK

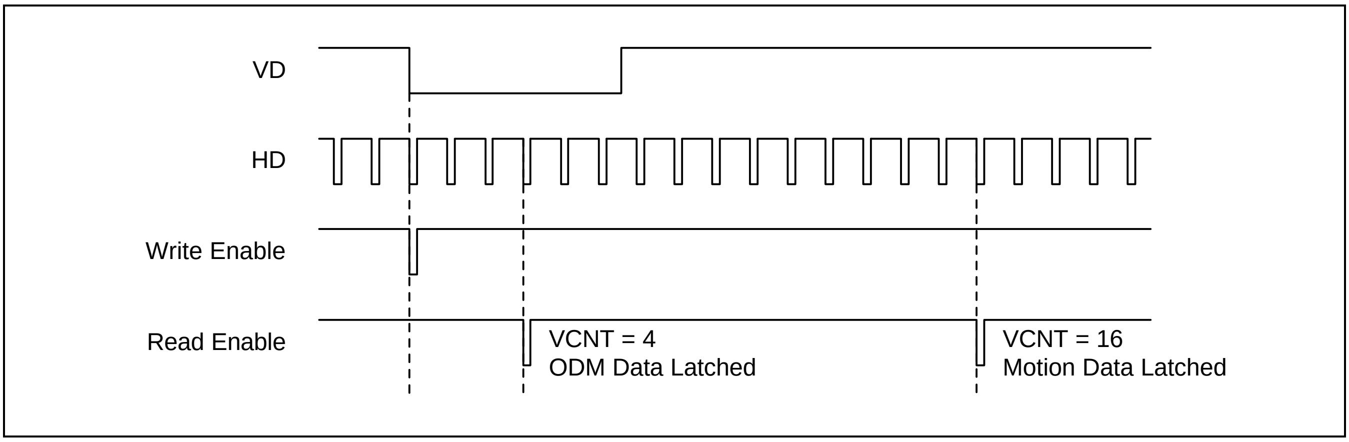


SCLK: System micom's main clock, whose cycle corresponds to the timing diagram.

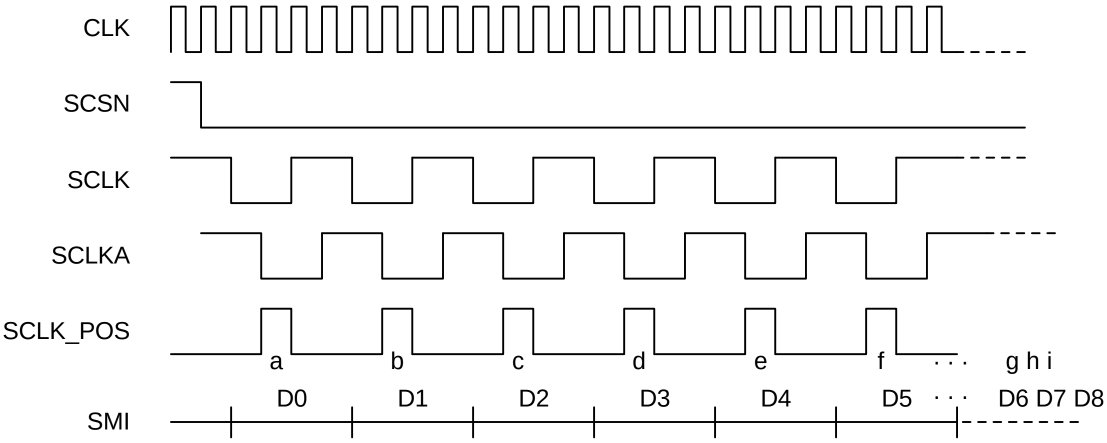
SMI: Input through triggering at the SCLK's negative edge and valid only when SCSN is low. The first bit can be either "H' (Read Mode) or "L" (Read/Write mode) and the next 7 bits specify the address of the register to be controlled. Starting from the start address, the address reduces by one every time an 8bit data arrives.
Data is valid only when it becomes an 8bit data. However, if SCSN becomes high before an 8 bit data is sent, that data becomes invalid.

SCSN: Data enable signal which is low active.

SMO: Output through triggering at the SCLK's negative edge and valid only when SCSN is low.



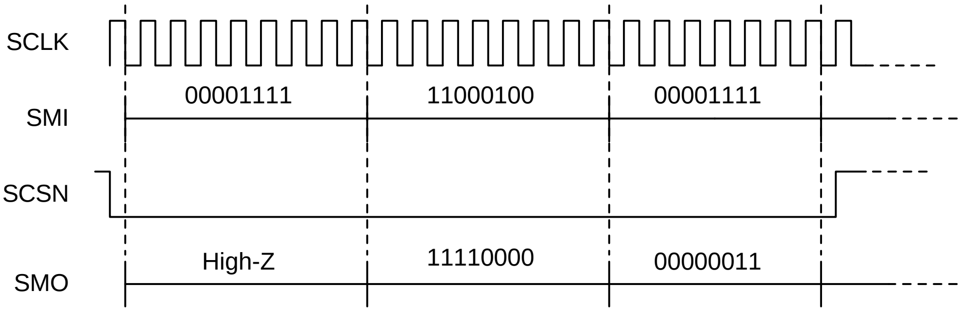
Input Data Detection



Input Data Buffer Latch

a:	D0							
b:	D1	D0						
c:	D2	D1	D0					
d:	D3	D2	D1	D0				
e:	D4	D3	D2	D1	D0			
f:	D5	D4	D3	D2	D1	D0		
g:	D6	D5	D4	D3	D2	D1	D0	
h:	D7	D6	D5	D4	D3	D2	D1	D0
i:	D8	D7	D6	D5	D4	D3	D2	D1

The SMI data is detected at the rising edge in the order shown above only when both SCLK and 1clock delayed SCLKA are low.



Address	78H	78H	77H
Input Data		23H	FOH
Output Data		OFH	COH

EXAMPLE

MICOM MODE OPERATION

Zoom Input Register

Table 2. Zoom Input Register

<table>
<tr><th>Address</th><th>Function</th></tr>
<tr><td>00H</td><td>
<table>
<tr><td>DIS_ON</td><td>ZOOM_ON</td><td>LSSC_ON</td><td>MIRR_ON</td><td>PIP_ON</td><td>POWER</td><td>PIP_MIRR</td><td>BYPASS</td></tr>
<tr><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td></tr>
</table>
DIS_ON: Digital image stabilization on/off
ZOOM_ON: Digital zoom on/off
LSSC_ON: Low shutter speed control on/off
Speed grade control register: 1DH[6:0]
MIRR_ON: Horizontal image mirror on/off
PIP_ON: Picture in picture display on/off
POWER: Power save mode on/off
PIP_MIRR: PIP image horizontal mirror on/off
BYPASS: Input image bypass on/off (no latched)
</td></tr>
<tr><td>01H</td><td>
<table>
<tr><td>FRAME</td><td>STILL1</td><td>STILL2</td><td>CEDGE_ON</td><td>APT_ON</td><td>OSD_ON</td><td>TRA_ON</td><td>TEST_GM</td></tr>
<tr><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td></tr>
</table>
FRAME: Field(0)/Frame(1) mode selection of field memory 2 (for feedback image)
STILL1: Field memory1 (for main image) still on/off
STILL2: Field memory2 (for feedback image) still on/off
CEDGE_ON: Color edge suppression on/off
APT_ON: Aperture on/off
OSD_ON: OSD output on/off
TRA_ON: Tracer on/off
TEST_GM: Gamma on/off
</td></tr>
<tr><td>02H</td><td>
<table>
<tr><td>DVC</td><td>PAL</td><td>HIGH</td><td>FLD_SEL</td><td>BIST</td><td>PN_SEL</td><td>CUR_HOLD</td><td>CLEAR</td></tr>
<tr><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td></tr>
</table>
DVC: DVC/8MM mode for ODM block
PAL: PAL/NTSC mode for ODM block
HIGH: High/Normal mode for ODM block
FLD_SEL: Internal field signal inverting
BIST: Internal RAM test on/off
PN_SEL: Clock double latch point select (high/low)
CUR_HOLD: Tracer cursor on/off
CLEAR: Tracer image initialization
</td></tr>
</table>

Table 2. Zoom Input Register (Continued)

Address	Function
03H	KX 1000_0000 KX: Horizontal zoom coefficient value
04H	KY 1000_0000 KY: Vertical zoom coefficient value
05H	SP_H 0110_0000 SP_H: Horizontal start point for zoom
06H	SP_V 0001_0101 SP_V: Vertical start point for zoom
07H	WIDTH[7:0] 1111_1110 WIDTH: Horizontal width LSB
08H	WIDTH[9:8] 0000_0001 WIDTH: Horizontal width MSB
09H	HEIGHT[7:0] 1111_0010 HEIGHT: Vertical height LSB
0AH	HEIGHT[8] 0000_0000 HEIGHT: Vertical height MSB
0BH	PIP_HSP[7:0] 0000_0000 PIP image horizontal start point LSB
0CH	PIP_HSP[9:8] 0000_0000 PIP image horizontal start point MSB
0DH	PIP_VSP[7:0] 0000_0000 PIP image vertical start point LSB
0EH	PIP_VSP[8] 0000_0000 PIP image vertical start point MSB

Table 2. Zoom Input Register (Continued)

Address	Function
OFH	PBOX_HSP[7:0] 0000_0000 PIP box horizontal start point LSB
10H	PBOX_HSP[9:8] 0000_0000 PIP box horizontal start point MSB
11H	PBOX_VSP[7:0] 0000_0000 PIP box vertical start point LSB
12H	PBOX_VSP[8] 0000_0000 PIP box vertical start point MSB
13H	PIP_DSP_HADJ 0000_0000 PIP image width adjust
14H	PIP_DSP_VADJ 0000_0000 PIP image height adjust
15H	PBOX_DSP_HADJ 0000_0000 PIP box width adjust
16H	PBOX_DSP_VADJ 0000_0000 PIP box height adjust
17H	OUT_OFF 0100_0000 OUT_OFF: Field memory1 horizontal output S/P
18H	OUT_OFF1 0100_0000 OUT_OFF: Field memory1 horizontal output S/P

Table 2. Zoom Input Register (Continued)

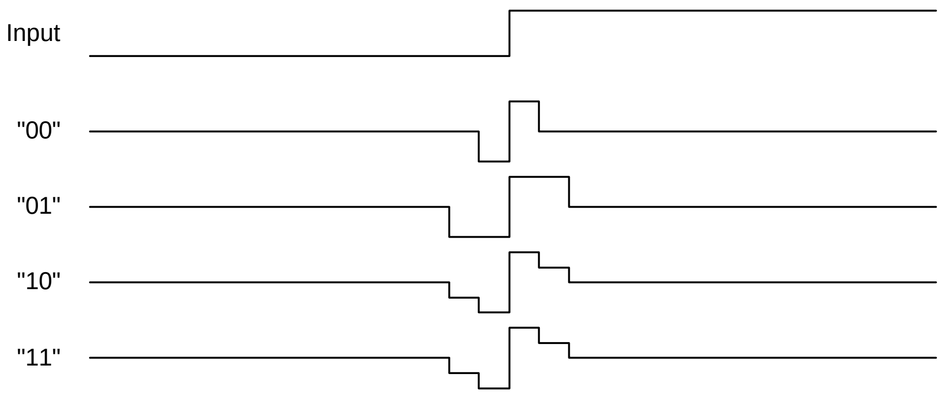
<table>
<tr><th>Address</th><th>Function</th></tr>
<tr><td>19H</td><td>
<table>
<tr><td>GR_MODE</td><td>OSD_VAL</td></tr>
<tr><td>0000</td><td>1000</td></tr>
</table>
GR_MODE: Internal image select mode
"0": Full mode output image
"1": Horizontal count image
"2": Vertical count image
"3": Field memory output image
"4": 1 pixel clock delayed field memory output image
"5": Y signal output image except interpolation
"6": Y signal output image with vertical interpolation
"7": Y signal output image with horizontal aperture
"8": Y signal output image with h/v interpolation
"9": Zoom output image
"10": Field memory2 output image
"etc": Bypass mode clocked by CLK
OSD_VAL: OSD luminance level
OSD Display Level = {OSD_VAL[3:0], 6'b000000}
</td></tr>
<tr><td>1AH</td><td>
<table>
<tr><td>CLK2_SEL</td></tr>
<tr><td>0000_0111</td></tr>
</table>
CLK2_SEL[6:0]: CLK delay adjust (unit:1ns)
CLK2_SEL[7]: CLK2 inverting
</td></tr>
<tr><td>1BH</td><td>
<table>
<tr><td>S1S2_SEL0</td><td>CRCB_SEL0</td><td>S1S2_SEL1</td><td>CRCB_SEL1</td><td>LINE_SEL0</td><td>LINE_SEL1</td><td>LINE_SEL2</td><td>LINE_SEL3</td></tr>
<tr><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td></tr>
</table>
S1S2_SEL0: S1S2 format select flag for field memory1 (ZOOM) image
CRCB_SEL0: CRCB line select flag for field memory1 (ZOOM) image
S1S2_SEL1: S1S2 format select flag for field memory2 (TIIR) image
CRCB_SEL1: CRCB line select flag for field memory2 (TIIR) image
LINE_SEL0: CRCB line select flag for field memory1 image when the "FLD" is low.
LINE_SEL1: CRCB line select flag for field memory1 image when the "FLD" is high.
LINE_SEL2: CRCB line select flag for field memory2 image when the "FLD" is low.
LINE_SEL3: CRCB line select flag for field memory2 image when the "FLD" is high.
</td></tr>
</table>

Table 2. Zoom Input Register (Continued)

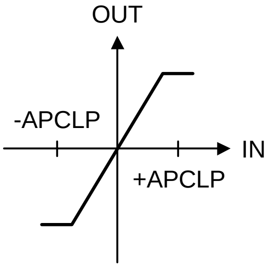
<table>
<tr><th>Address</th><th>Function</th></tr>
<tr><td>1CH</td><td>
<table>
<tr><td>OSD_SEL</td><td>HVD_ADJ</td></tr>
<tr><td>111</td><td>00000</td></tr>
</table>
OSD_SEL[2]: PIP box display on/off
OSD_SEL[1]: Motion graph display on/off
OSD_SEL[0]: AF zone display on/off
HVD_ADJ[4:0]: Register that can delay the HD internally when the externally input image is HD standby delayed.
</td></tr>
<tr><td>1DH</td><td>
<table>
<tr><td>PIP_S1S2_SEL</td><td>LS_CNT</td></tr>
<tr><td>0</td><td>0000000</td></tr>
</table>
PIP_S1S2_SEL: S1S2 format select flag for pip image
LS_CNT: Low shutter speed control register
Shutter Speed = LS_CNT/30 sec.
</td></tr>
<tr><td>1EH</td><td>
<table>
<tr><td>DCLP_R</td></tr>
<tr><td>0000_0000</td></tr>
</table>
Rising edge time control for ODM
<table>
<tr><td>PAL</td><td>DVC</td><td>HIGH</td><td>RISING</td><td>FALLING</td></tr>
<tr><td>0</td><td>0</td><td>0</td><td>76</td><td>84</td></tr>
<tr><td>0</td><td>0</td><td>1</td><td>118</td><td>126</td></tr>
<tr><td>0</td><td>1</td><td>0</td><td>112</td><td>120</td></tr>
<tr><td>0</td><td>1</td><td>1</td><td>30</td><td>36</td></tr>
<tr><td>1</td><td>0</td><td>0</td><td>82</td><td>90</td></tr>
<tr><td>1</td><td>0</td><td>1</td><td>132</td><td>140</td></tr>
<tr><td>1</td><td>1</td><td>0</td><td>118</td><td>126</td></tr>
<tr><td>1</td><td>1</td><td>1</td><td>30</td><td>36</td></tr>
</table>
Table 1
</td></tr>
<tr><td>1FH</td><td>
<table>
<tr><td>DCLP_F</td></tr>
<tr><td>0000_0000</td></tr>
</table>
Falling edge time control for ODM (Refer to Table 1)
</td></tr>
</table>

Table 2. Zoom Input Register (Continued)

<table>
<tr><th>Address</th><th>Function</th></tr>
<tr><td>20H</td><td>
<table>
<tr><td>HAPG</td><td>YLPFS</td><td>YHAFS</td></tr>
<tr><td>0010</td><td>01</td><td>00</td></tr>
</table>
YHAFS: EDGE detection filter selection for horizontal aperture



YLPFS: Y signal separation filter selection
"00": (X[n] + X[n-1])/2
"01": (-X[n-2] +2 X[n-1] +2 X[n] - X[n+1])/2
"etc": (-X[n-2] +5 X[n-1] +5 X[n] - X[n+1])/8
HAPG: Horizontal aperture gain control
</td></tr>
<tr><td>21H</td><td>
<table>
<tr><td>APCLP</td></tr>
<tr><td>1000_0000</td></tr>
</table>
APCLP: Horizontal aperture clip level



</td></tr>
</table>

Table 2. Zoom Input Register (Continued)

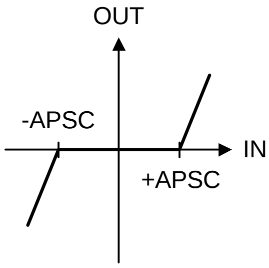
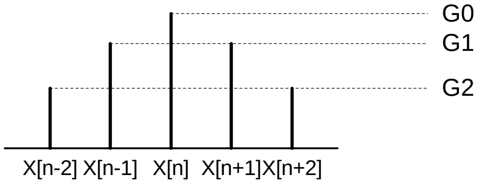
<table>
<tr><th>Address</th><th>Function</th></tr>
<tr><td>22H</td><td><table><tr><td>APSC</td></tr><tr><td>0000_0100</td></tr></table>APSC: Horizontal aperture slice level
 </td></tr>
<tr><td>23H</td><td><table><tr><td>ECST</td></tr><tr><td>0000_0000</td></tr></table>ECST: Color edge suppression clip level</td></tr>
<tr><td>24H</td><td><table><tr><td>ECSG</td><td>ECSGV</td></tr><tr><td>0010</td><td>0010</td></tr></table>ECSG: Horizontal color edge suppression gain
ECSGV: Vertical color edge suppression gain</td></tr>
<tr><td>25H
26H</td><td><table><tr><td>G1</td><td>G2</td></tr><tr><td>1000</td><td>0011</td></tr></table><table><tr><td>EDGE_SEL</td><td></td><td></td><td>G0</td></tr><tr><td>0</td><td></td><td></td><td>01010</td></tr></table>G0, G1, G2: Color horizontal spline gain control

EDGE_SEL: CRCB selection for black balance</td></tr>
<tr><td>27H</td><td><table><tr><td>HUE1_OFF</td><td>HUE2_OFF</td></tr><tr><td>0000</td><td>0000</td></tr></table>HUE1_OFF: Offset of CR for black balance
HUE2_OFF: Offset of CB for black balance</td></tr>
</table>

Table 2. Zoom Input Register (Continued)

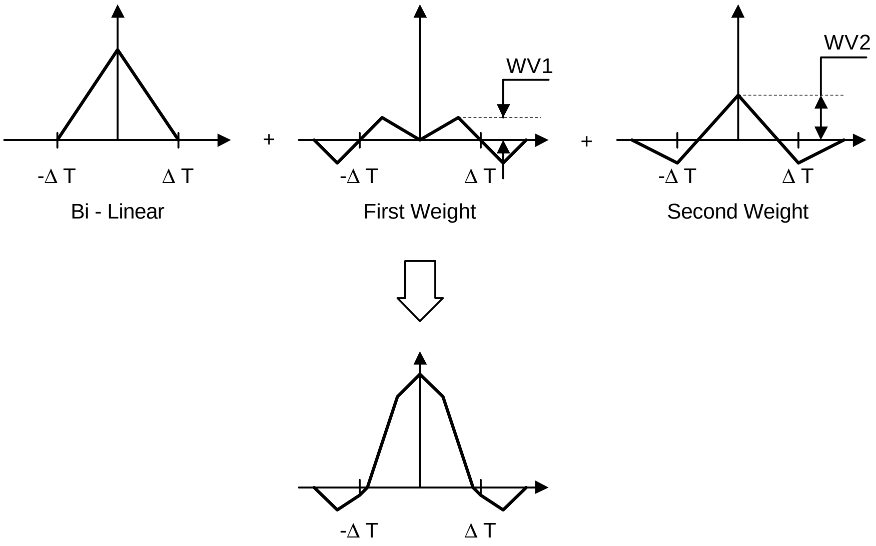
<table>
<tr><th>Address</th><th>Function</th></tr>
<tr><td>28H</td><td><table><tr><td>ECHUE1</td></tr><tr><td>0000_0000</td></tr></table>ECHUE1: Gain of CR for black balance</td></tr>
<tr><td>29H</td><td><table><tr><td>ECHUE2</td></tr><tr><td>0000_0000</td></tr></table>ECHUE2: Gain of CB for black balance</td></tr>
<tr><td>2AH</td><td><table><tr><td>APSCV</td></tr><tr><td>0000_0100</td></tr></table>APSCV: Vertical aperture slice level</td></tr>
<tr><td>2BH</td><td><table><tr><td>WV1</td><td>WV2</td></tr><tr><td>0111</td><td>0100</td></tr></table>WV1: Vertical spline gain control1
WV2: Vertical spline gain control2 (vertical aperture)
 </td></tr>
<tr><td>2CH</td><td><table><tr><td>WH1</td><td>KT_DIV</td></tr><tr><td>0111</td><td>0000</td></tr></table>WH1: Horizontal spline gain control1
KT_DIV: sub pixel coefficient gain in motion vector</td></tr>
</table>

Table 2. Zoom Input Register (Continued)

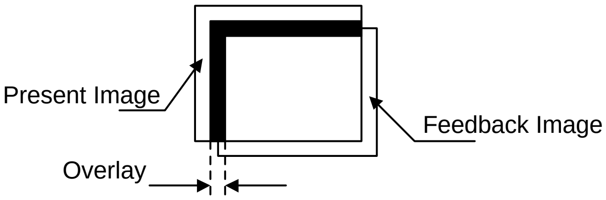
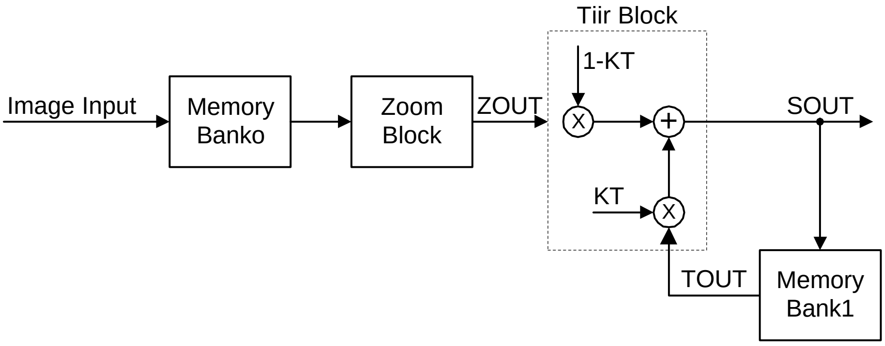
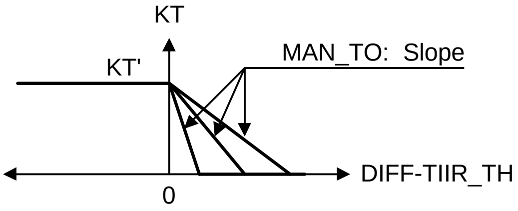
Address	Function
2DH	OVERLAY 0000_0010 OVERLAY: Feed back image(TIIR filter) boundary adjust To perform the TIIR filtering, the feedback image and the present image must match precisely. Therefore, to compensate for the visual movement between fields, the feedback image is compensated based on the detected motion vector. Garbage data, the image boundary section, is not compensated during TIIR filtering, so boundary detection is required for processing at a valid area. 
2EH	TO 0000_0000 TO: TIIR coefficient value  KT = {TO + KT_DIV (horizontal sub pixel + vertical sub pixel)}/256

Table 2. Zoom Input Register (Continued)

<table>
<tr><th>Address</th><th>Function</th></tr>
<tr><td>2FH</td><td>
<table>
<tr><td>MAN_TO</td></tr>
<tr><td>0001_0000</td></tr>
</table>
MAN_TO: TIIR filter clip gain
DIFF = Feedback image - current input image
KT' = {TO + KT_DIV (horizontal sub pixel + vertical sub pixel) }/256
KT" = KT' - {(DIFF-TIIR_TH)*MAN_TO}
where, it is assumed as 0 if DIFF-TIIR_TH is less than 0


</td></tr>
<tr><td>30H</td><td>
<table>
<tr><td>TIIR_TH</td></tr>
<tr><td>0000_0100</td></tr>
</table>
TIIR_TH : TIIR filter slice level
</td></tr>
<tr><td>31H</td><td>
<table>
<tr><td>LINEAR</td><td>FM2_FLD</td><td>TIIR_INT</td><td>DIR_CURX</td><td>DIR_CURY</td><td></td><td></td><td></td></tr>
<tr><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td></td><td></td><td></td></tr>
</table>
LINEAR: Bi-linear interpolation/spline interpolation on/off
FM2_FLD: FLD selection in field memory2
TIIR_INT: TIIR filter coefficient value inverting
DIR_CURX: Cursor direction (horizontal) select in tracer mode
DIR_CURY: Cursor direction (vertical) select in tracer mode
</td></tr>
</table>

Table 2. Zoom Input Register (Continued)

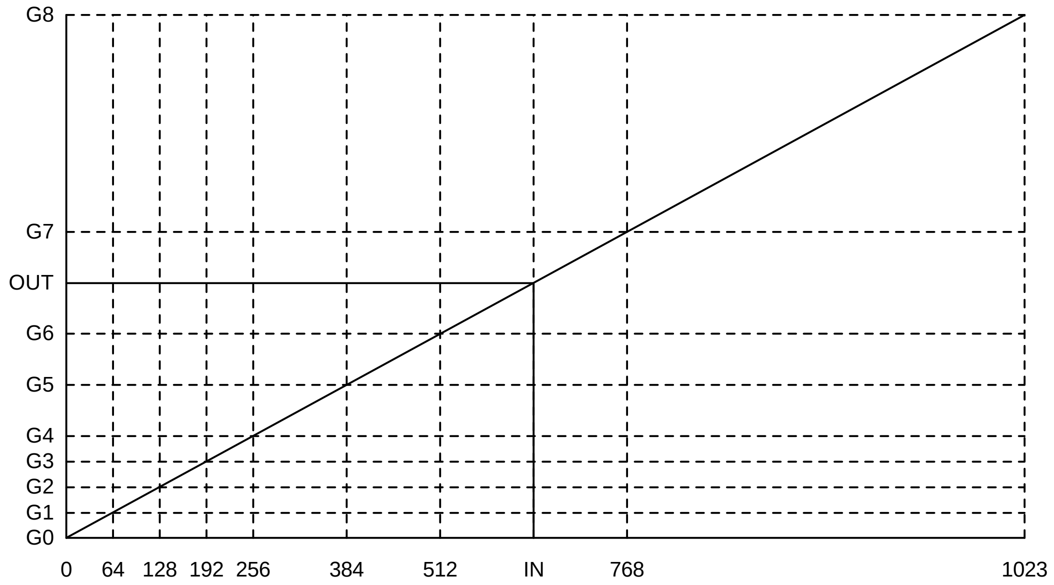
Address	Function
32H	GA0 0000_0000 GA0: Image1 GAMMA gain 
33H	GA1 0000_1000 GA1: Image1 GAMMA gain
34H	GA2 0001_0000 GA2: Image1 GAMMA gain
35H	GA3 0001_1000 GA3: Image1 GAMMA gain
36H	GA4 0010_0000 GA4: Image1 GAMMA gain
37H	GA5 0011_0000 GA5: Image1 GAMMA gain
38H	GA6 0100_0000 GA6: Image1 GAMMA gain

Table 2. Zoom Input Register (Continued)

Address	Function
39H	GA7 0110_0000 GA7: Image1 GAMMA gain
3AH	GA8 0111_1111 GA8: Image1 GAMMA gain
3BH	GB0 0000_0000 GB0: Image2 GAMMA gain
3CH	GB1 0000_1000 GB1: Image2 GAMMA gain
3DH	GB2 0001_0000 GB2: Image2 GAMMA gain
3EH	GB3 0001_1000 GB3: Image2 GAMMA gain
3FH	GB4 0010_0000 GB4: Image2 GAMMA gain
4H	GB5 0011_0000 GB5: Image2 GAMMA gain
41H	GB6 0100_0000 GB6: Image2 GAMMA gain
42H	GB7 0110_0000 GB7: Image2 GAMMA gain
43H	GB8 0111_1111 GB8: Image2 GAMMA gain

Motion Input Register

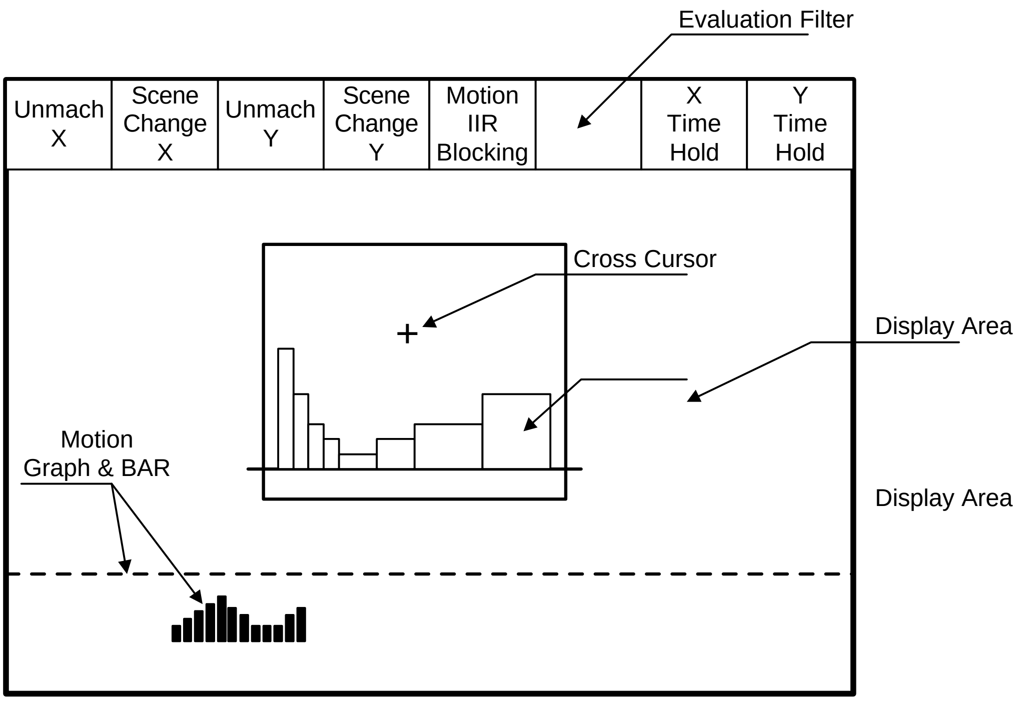
Table 3. Motion Input Register

Address	Function
44H	SP_HM 0110_0000 SP_HM: Horizontal start point for motion
45H	SP_VM 0001_0101 SP_VM: Vertical start point for motion
46H	HEIGHTM[7:0] 1111_0010 HEIGHTM: Image height for motion
47H	HEIGHTM[8] 0000_0000 HEIGHTM: Image height for motion
48H	WIDTHM[7:0] 1111_1110 WIDTHM: Image width for motion
49H	WIDTHM[9:8] 0000_0001 WIDTHM: Image width for motion
4AH	KX_MD 1000_0000 KX_M: Motion detection zoom coefficient for horizontal
4BH	KY_MD 1000_0000 KY_M: Motion detection zoom coefficient for vertical

Table 3. Motion Input Register (Continued)

Address	Function
4CH	OSD_MODE 0000_0000 [7]: Box display - Motion detection area display [6]: Cross cursor display - motion trajectory display [5]: Motion information display - bar graph [4:2]: Bar display menu 0 → DX vector info 1 → DY vector info 2 → UX vector info 3 → UY vector info 4 → Horizontal correlation min/threshold info 5 → Vertical correlation min/threshold info 6 → Motion IIR filter and threshold info [1]: Evaluation filter display (head line) 1/8 → Unmatch X 2/8 → Scene change X 3/8 → Unmatch Y 4/8 → Scene change Y 5/8 → Motion IIR blocking 7/8 → X holding 8/8 → Y holding [0]: Histogram display

Table 3. Motion Input Register (Continued)

<table>
<tr><th>Address</th><th>Function</th></tr>
<tr><td>4CH</td><td>


</td></tr>
<tr><td>4DH</td><td>
<table>
<tr><th>DIS_ENX</th><th>DIS_DNY</th><th>DIR_VX</th><th>DIR_VY</th><th>DXYSET</th><th>F_PROJ</th><th>HLF_SFT</th><th>FRM_VY</th></tr>
<tr><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
</table>
DIS_ENX: DIS mode enable (if not current DX holding), horizontal
DIS_ENY: DIS mode enable (if not current DX holding), vertical
DIR_VX: Direction control 1: inverse
DIR_VY: Direction control 1: inverse
DXYSET: DX, DY temporally set mode (if 1, CX, CY used the shift point)
F_PROJ: Full projection on
HLF_SFT: Vertical half shift use (0)
FRM_VY: Vertical motion detection mode (0: field, 1: Frame) → if high zoom magnifying, frame mode will be more stable
</td></tr>
<tr><td>4EH</td><td>
<table>
<tr><th>OX[7:0]</th></tr>
<tr><td>0000_0000</td></tr>
</table>
OX : Area offset of motion detection area in X direction
</td></tr>
<tr><td>4FH</td><td>
<table>
<tr><th>OX[9:8]</th></tr>
<tr><td>0000_0000</td></tr>
</table>
OX: Area offset of motion detection area in X direction
</td></tr>
</table>

Table 3. Motion Input Register (Continued)

<table>
<tr><th>Address</th><th>Function</th></tr>
<tr><td>50H</td><td><table><tr><td>OY</td></tr><tr><td>0000_0000</td></tr></table>OY: Area offset of motion detection area in Y direction</td></tr>
<tr><td>51H</td><td><table><tr><td>CX</td></tr><tr><td>0000_0000</td></tr></table>CX: Assigned motion vector for X → usage: motion centering, artificial image bounding</td></tr>
<tr><td>52H</td><td><table><tr><td>CY</td></tr><tr><td>0000_0000</td></tr></table>CY: Assigned motion vector for Y</td></tr>
<tr><td>53H</td><td><table><tr><td>AX</td><td>AY</td></tr><tr><td>0000</td><td>0000</td></tr></table>AX: Extending motion compensation margin X
AY: Extending motion compensation margin Y</td></tr>
<tr><td>54H</td><td><table><tr><td>AUTO_CENT</td></tr><tr><td>0000_0000</td></tr></table>AUTO_CENT: Auto centering</td></tr>
<tr><td>55H</td><td><table><tr><td>VGGAINX</td><td>VGGAINY</td></tr><tr><td>0000</td><td>0000</td></tr></table>VGGAINX: Motion gain (X) (8 → 1.0, 0 → 0.0) 1/8 degree
VGGAINY: Motion gain (Y)</td></tr>
<tr><td>56H</td><td><table><tr><td>VGSTEP</td><td>GSPEED</td></tr><tr><td>0000</td><td>0000</td></tr></table>VGSTEP: Motion gain recovery step. (0 → rapid, 15 → slow)
GSPEED: Display bar graph speed</td></tr>
<tr><td>57H</td><td><table><tr><td>THR_SEL</td></tr><tr><td>0000_0000</td></tr></table>THR_SEL: Threshold control
[7:6] Display scaling shift X
[5:4] Threshold scaling shift X
[3:2] Display scaling shift Y
[1:0] Threshold scaling shift Y</td></tr>
<tr><td>58H</td><td><table><tr><td>CXY_BIAS</td></tr><tr><td>0000_0000</td></tr></table>CXY_BIAS: Scene change filter offset for threshold</td></tr>
</table>

Table 3. Motion Input Register (Continued)

<table>
<tr><th>Address</th><th>Function</th></tr>
<tr><td>59H</td><td>
<table>
<tr><td>MATCHX_EN</td><td>MVX_FMIN</td><td>QUART_X</td><td>MVX_GAP</td></tr>
<tr><td>0</td><td>0</td><td>00</td><td>0000</td></tr>
</table>
MATCHX_EN: Secondary motion mismatch filter enable X
MVX_FMIN: Motion value assign: 1 → Full motion 0 → minimum secondary motions
QUART_X: Secondary motion area selection (0 → 1/4, 1 → 2/3, 2 → 3/4, 3 → 3/4 splited)
MVX_GAP: Mismatch threshold. If secondary motion difference is larger than GAP, unmatch alarm out
</td></tr>
<tr><td>5AH</td><td>
<table>
<tr><td>MATCHX_EN</td><td>MVY_FMIN</td><td>QUART_X</td><td>MVX_GAP</td></tr>
<tr><td>0</td><td>0</td><td>00</td><td>0000</td></tr>
</table>
Same as 59H
</td></tr>
<tr><td>5BH</td><td>
<table>
<tr><td>SHMFBC</td><td>SHMITT</td></tr>
<tr><td>0000</td><td>0000</td></tr>
</table>
SHMFBC: Motion absolute sum filter feed back coefficient (8: FF, 7: 8F, ···· , 1: 01, 0: 00)
SHMITT: Motion absolute sum filter threshold (display when OSD_MODE[4:2] == 11X)
</td></tr>
<tr><td>5CH</td><td>
<table>
<tr><td>MVIIR_EN</td><td>SCENE_X</td><td>SCENE_Y</td><td>FRM_DIS</td><td>F_SELECT</td><td>MVIIR_EN</td><td>HIST_SFT</td></tr>
<tr><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>00</td></tr>
</table>
MVIIR_EN: Motion absolute sum filter mode enable (SHMFBC, SHMITT control)
SCENE_X: Scene change detect filter on X
SCENE_Y: Scene change detect filter on Y
FRM_DIS: Frame DIS mode motion output (dual shutter mode or low shutter X2 mode)
F_SELECT: Frame DIS mode field selection
HLD_HIST: Histogram display and register hold
HIST_SFT: Histogram display and register level shift
</td></tr>
</table>

ODM Input Register

Table 4. ODM Input Register

<table>
<tr><th>Address</th><th>Function</th></tr>
<tr><td>5DH</td><td><table><tr><td colspan="3">OZNSEL</td><td>OYISEL</td><td>OFILPASS</td><td>OLPFSEL</td><td></td><td></td></tr><tr><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td></td><td></td></tr></table>OZNSEL: AF/AE display window selection signal from MICOM
OYISEL: OPT_DET module Y input selection signal from MICOM
OFILPASS: OPT_DET module filter pass enable signal from MICOM
OLPFSEL: OPT_DET module LPF selection signal from MICOM</td></tr>
<tr><td>5EH</td><td><table><tr><td>OAEVE_WB</td></tr><tr><td>0000_0000</td></tr></table>AE window B's vertical end point</td></tr>
<tr><td>5FH</td><td><table><tr><td>OAEVS_WB</td></tr><tr><td>0000_0000</td></tr></table>AE window B's vertical start point</td></tr>
<tr><td>60H</td><td><table><tr><td>OAEHE_WB</td></tr><tr><td>0000_0000</td></tr></table>AE window B's horizontal end point</td></tr>
<tr><td>61H</td><td><table><tr><td>OAEHS_WB</td></tr><tr><td>0000_0000</td></tr></table>AE window B's horizontal start point</td></tr>
<tr><td>62H</td><td><table><tr><td>OAEVE_WA</td></tr><tr><td>0000_0000</td></tr></table>AE window A's vertical end point</td></tr>
<tr><td>63H</td><td><table><tr><td>OAEVS_WA</td></tr><tr><td>0000_0000</td></tr></table>AE window A's vertical start point</td></tr>
<tr><td>64H</td><td><table><tr><td>OAEHE_WA</td></tr><tr><td>0000_0000</td></tr></table>AE window A's horizontal end point</td></tr>
<tr><td>65H</td><td><table><tr><td>OAEHS_WA</td></tr><tr><td>0000_0000</td></tr></table>AE window A's horizontal start point</td></tr>
<tr><td>66H</td><td><table><tr><td>OAFVE_W2</td></tr><tr><td>0000_0000</td></tr></table>AF window 2's vertical end point</td></tr>
</table>

Table 4. ODM Input Register (Continued)

Address	Function
67H	OAFVS_W2 0000_0000 AF window 2's vertical start point
68H	OAFHE_W2 0000_0000 AF window 2's horizontal end point
69H	OAFHS_W2 0000_0000 AF window 2's horizontal start point
6AH	OAFVE_W1 0000_0000 AF window 1's vertical end point
6BH	OAFVS_W1 0000_0000 AF window 1's vertical start point
6CH	OAFHE_W1 0000_0000 AF window 1's horizontal end point
6DH	OAFHS_W1 0000_0000 AF window 1's horizontal start point
6EH	OYL_TH 0000_0000 Low threshold value of the luminance signal for AE
6FH	OYH_TH 0000_0000 High threshold value of the luminance signal for AE
70H	OAECLIP_TH 0000_0000 Threshold value for AE clip count
71H	OAFCLIP_TH 0000_0000 Threshold value for AF clip count
72H	PFCNT_MI 0 0 0 0 0 0 0 0 Defect count value from MICOM

Table 4. ODM Input Register (Continued)

<table>
<tr><th>Address</th><th>Function</th></tr>
<tr><td>73H</td><td><table><tr><td>PTHRESH</td></tr><tr><td>0000_0000</td></tr></table>Digital clamp threshold value from MICOM</td></tr>
<tr><td>74H</td><td><table><tr><td>POFFSET</td></tr><tr><td>0000_0000</td></tr></table>Digital clamp offset value from MICOM</td></tr>
<tr><td>75H</td><td><table><tr><td></td><td colspan="7">PCMD</td></tr><tr><td></td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td></tr></table>Preprocess command from MICOM</td></tr>
<tr><td>76H</td><td><table><tr><td>PRAMIL</td></tr><tr><td>0000_0000</td></tr></table>Defect position value [7:0] from MICOM</td></tr>
<tr><td>77H</td><td><table><tr><td>PRAMIM</td></tr><tr><td>0000_0000</td></tr></table>Defect position value [15:8] from MICOM</td></tr>
<tr><td>78H</td><td><table><tr><td></td><td></td><td></td><td></td><td colspan="4">PRAMIH</td></tr><tr><td></td><td></td><td></td><td></td><td>0</td><td>0</td><td>0</td><td>0</td></tr></table>Defect position value [19:16] from MICOM</td></tr>
<tr><td>79H</td><td><table><tr><td></td><td></td><td colspan="6">PRAMA_MI</td></tr><tr><td></td><td></td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td></tr></table>Line memory address from MICOM</td></tr>
</table>

Motion Output Register

Table 5. Motion Output Register

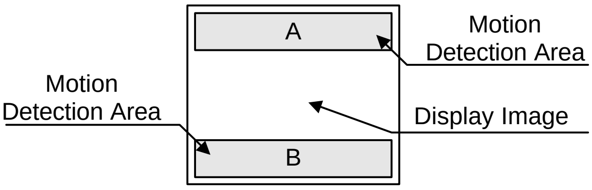
Address	Function
00H	UY[7:0] Correction value of vertical vibration (field memory2)
01H	UY[15:8] Correction value of vertical vibration (field memory2)
02H	UY[17:16] Correction value of vertical vibration (field memory2)
03H	UX[7:0] Correction value of horizontal vibration (field memory2)
04H	UX[15:8] Correction value of horizontal vibration (field memory2)
05H	UX[17:16] Correction value of horizontal vibration (field memory2)
06H	DY[7:0] Correction value of vertical vibration (field memory1)
07H	DY[15:8] Correction value of vertical vibration (field memory1)
08H	DY[17:16] Correction value of vertical vibration (field memory1)
09H	DX[7:0] Correction value of horizontal vibration (field memory1)
0AH	DX[15:8] Correction value of horizontal vibration (field memory1)
0BH	DX[17:16] Correction value of horizontal vibration (field memory1)
0CH	MVY_MB[5:0] Frame motion vector for vertical area "B" 

Table 5. Motion Output Register (Continued)

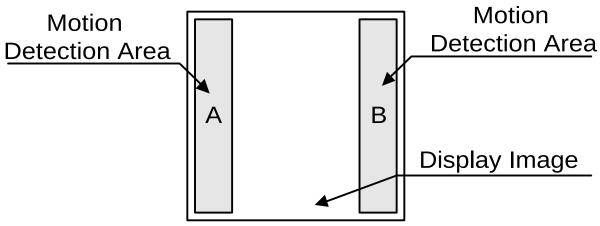
Address	**Function**
0DH	MVY_MA[5:0] Frame motion vector for vertical area "A"
0EH	MVY_LB[5:0] Field motion vector for vertical area "B"
0FH	MVY_LA[5:0] Field motion vector for vertical area "A"
10H	MVY_B[6:0] Motion vector for horizontal area "B" 
11H	MVX_A[6:0] Motion vector for horizontal area "A"
12H	MVX_F[6:0] Motion vector for horizontal full area
13H	MV_THR Threshold level of "MV_IIR" register
14H	MV_IIR IIR LPF result of motion vector
15H	HI7 Accumulated luminance level of input image (max = luminance maximum value) (MAX*12/16) ≤ HI7 < (MAX*16/16)
16H	HI6 Accumulated luminance level of input image (MAX*8/16) ≤ HI7 < (MAX*12/16)
17H	HI5 Accumulated luminance level of input image (MAX*6/16) ≤ HI7 < (MAX*8/16)
18H	HI4 Accumulated luminance level of input image (MAX*4/16) ≤ HI7 < (MAX*6/16)

Table 5. Motion Output Register (Continued)

Address	Function
19H	HI3 Accumulated luminance level of input image (MAX*3/16) ≤ HI7 < (MAX*4/16)
1AH	HI2 Accumulated luminance level of input image (MAX*2/16) ≤ HI7 < (MAX*3/16)
1BH	HI1 Accumulated luminance level of input image (MAX*1/16) ≤ HI7 < (MAX*2/16)
1CH	HI0 Accumulated luminance level of input image 0 ≤ HI7 < (MAX*1/16)
1DH	CY_MIN Minimum correlation error for vertical After matching between visual fields, the smaller this value, the better the matching.
1EH	CX_MIN Minimum correlation error for horizontal After matching between visual fields, the smaller this value, the better the matching.
1FH	TY_MIN Threshold of "CY_MIN"
20H	TX_MIN Threshold of "CX_MIN"
21H	VY Field vertical motion vector
22H	VX Field horizontal motion vector
23H	EVAL_SIGN Evaluation filter result [7] Unmatch X [6] Empty pattern X [5] unmatch Y [4] Empty pattern Y [3:2] MV IIR hold [1] VX holding [0] VY holding

Preprocess Output Register

Table 6. Preprocess Output Register

<table>
<tr><th>Address</th><th colspan="8">Function</th></tr>
<tr><td rowspan="2">42H</td><td></td><td colspan="7">PFINDCNT[6:0]</td></tr>
<tr><td colspan="8">Defect count value to MICOM</td></tr>
<tr><td rowspan="2">43H</td><td colspan="8">PRAMOL</td></tr>
<tr><td colspan="8">Defect position value [7:0] to MICOM</td></tr>
<tr><td rowspan="2">44H</td><td colspan="8">PRAMOM</td></tr>
<tr><td colspan="8">Defect position value [15:8] to MICOM</td></tr>
<tr><td rowspan="3">45H</td><td></td><td></td><td></td><td></td><td colspan="4">PRAMOH</td></tr>
<tr><td></td><td></td><td></td><td></td><td>0</td><td>0</td><td>0</td><td>0</td></tr>
<tr><td colspan="8">Defect position value [19:16] to MICOM</td></tr>
</table>

OPT_DET Output [239:0]-12byte

Table 7. OPT_DET Output [239:0]-12byte

Address	Function
24H	OAECLIPL Clip count value for AE[7:0]
25H	OAECLIPH Clip count value for AE[7:0]
26H	OAEWBL Window B's total integration value for AE[7:0]
27H	OAEWBM Window B's total integration value for AE[15:8]
28H	OAEWBH Window B's total integration value for AE [23:16]
29H	OAEWAL Window A's total integration value for AE [7:0]
2AH	OAEWAM Window A's total integration value for AE [15:8]
2BH	OAEWAH Window A's total integration value for AE [23:16]
2CH	OAFCLIPL Clip count value for AF [7:0]
2DH	OAFCLIPH Clip count value for AF [15:8]
2EH	OAF2WPKL Peak integration value for window 2's each line for AF2 [7:0]
2FH	OAF2W2PKH Peak integration value for window 2's each line for AF2 [15:8]
30H	OAF2W2L Window 2's total integration value for AF2 [7:0]
31H	OAF2W2M Window 2's total integration value for AF2 [15:8]
32H	OAF2W2H Window 2's total integration value for AF2 [23:16]
33H	OAF1W2PKL Window 2's total integration value for AF1 [7:0]

Table 7. OPT_DET Output [239:0]-12byte (Continued)

Address	Function
34H	OAF1W2PKH Window 2's total integration value for AF1 [15:8]
35H	OAF1W2L Window 2's total integration value for AF1 [7:0]
36H	OAF1W2M Window 2's total integration value for AF1 [15:8]
37H	OAF1W2H Window 2's total integration value for AF1 [23:16]
38H	OAF2W1PKL Peak integration value for window 1's each line for AF2 [7:0]
39H	OAF2W1PKH Peak integration value for window 1's each line for AF2 [15:8]
3AH	OAF2W1L Window 1's total integration value for AF2 [7:0]
3BH	OAF2W1M Window 1's total integration value for AF2 [15:8]
3CH	OAF2W1H Window 1's total integration value for AF2 [23:16]
3DH	OAF1W1PKL Peak integration value for window 1's each line for AF1 [7:0]
3EH	OAF1W1PKH Peak integration value for window 1's each line for AF1 [15:8]
3FH	OAF1W1L Window 1's total integration value for AF1 [7:0]
40H	OAF1W1M Window 1's total integration value for AF1 [15:8]
41H	OAF1W1H Window 1's total integration value for AF1 [23:16]

APPLICATION CIRCUIT