1. Overview

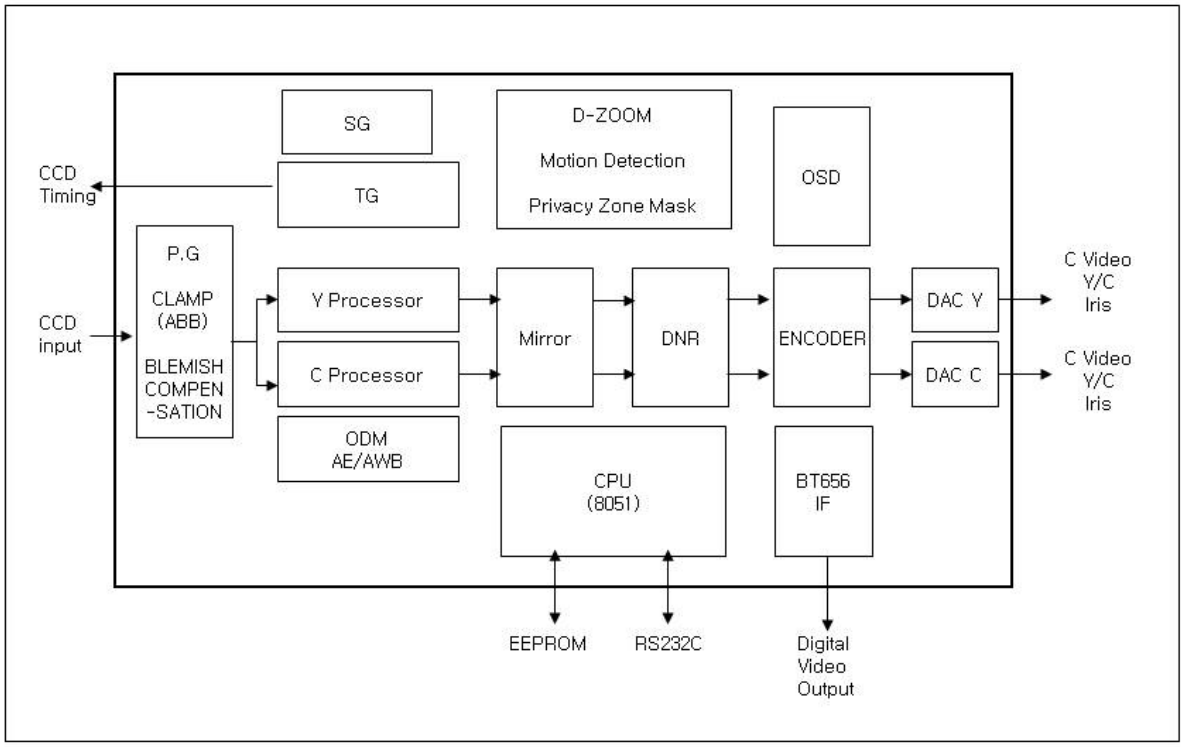
1.1 GENERAL DESCRIPTION

The Ai7152S is a high performance CCD image signal processor for color video camera. It includes MCU, timing generator, 2 channel 10bit digital to analog converter and all other functions for camera system. Supports 250K/380K NTSC system CCD sensors and 290K/410K PAL system CCD sensors with complementary color filter. It also provided programmable OSD function for convenient camera setup. DNR function provide clean image even in low light condition.

1.2 FEATURES

- Support Ye, Cyan, Magenta, Green complementary color filter CCD sensors for
  NTSC : A*i*338, A*i*325CA, ICX632, ICX638, RJ2315, RJ2355
  PAL : A*i*339, A*i*329CA , ICX633, ICX639, RJ2325, RJ2365
- Support external EEPROM to store parameter.
- Video Adjustment (brightness, contrast, sharpness, saturation, gamma, hue)
- Built-in auto white balance control.
- Color rolling, breathing compensation
- Built-in auto exposure control.
- Built-in Motion Detection
- Built-in Privacy Mask Function
- 2x, 4x Digital Zoom Function
- Built-in Digital Noise Reduction.
- Built-in 2-channel 10bit digital to analog converter.
- Built-in mirror function.
- Built-in blemish compensation circuit storing the data in EEPROM.
- Support composite / YC separate analog video output and BT.656 digital output.
- Built-in timing generator for vertical driver and CDS/AGC/ADC peripheral chips.
- Support line lock function.
- Single 3.3V power supply. (Horizontal drive pins can be 3.3V/5V)
- LQFP-80. (0.4mm pin pitch)
- Support user Definable GPIO.
- Programmable CCD Timing Driving Current.
- Programmable pull-up GPIO pin

2. Block Diagram



3. PIN DESCRIPTION

NO	SYMBOL	I/O	DESCRIPTION
1	ADC_D5	I	CCD Image Data 5
2	ADC_D4	I	CCD Image Data 4
3	ADC_D3	I	CCD Image Data 3
4	ADC_D2	I	CCD Image Data 2
5	ADC_D1	I	CCD Image Data 1
6	ADC_D0	I	CCD Image Data 0
7	VSS	G	Digital GND
8	CLPOB	IO	Optical black clamp pulse
9	EXT_9	IO	Pre Blanking pulse / PBLK Out / EXTIO_9
10	ADC_SLD	IO	ADC Serial enable/ External CPU VD
11	ADC_SCL	IO	ADC Serial clock (Camera mode input) / External CPU FLD
12	ADC_SDA	IO	ADC Serial data (Camera mode input) / External CPU HD
13	VDD33	P	3.3V Power
14	I2C_SDA	IO	I2C Data / External CPU Input
15	I2C_SCL	IO	I2C Clock / External CPU Input
16	GPIO5	IO	RX232C TX / External CPU Input
17	GPIO6	I	RX232C RX / External CPU Input
18	RESET_IN	I	System Reset
19	GPIO2	IO	Key Right / External CPU Serial Data Output
20	GPIO4	I	Key Down / External CPU Input
21	GPIO3	I	Key Up / / External CPU Serial Data Input
22	GPIO1	I	Key Left / External CPU Serial Clock
23	GPIO0	I	Key Select / External CPU Chip Select
24	VSS	G	Digital GND
25	XTALO	IO	X-Tal output
26	XTALI	I	X-Tal input (NTSC : 28.6363MHz, PAL : 28.375MHz, 27Mhz)
27	VDD18	P	1.8V Power
28	VDD33	P	3.3V Power
29	VSS	G	Digital GND
30	RSET	I	DAC Register set

NO	SYMBOL	I/O	DESCRIPTION
31	VREF	IO	DAC Voltage reference input or output
32	COMP	O	DAC Compensation for the internal reference amplifier
33	VCC_DAC	P	AVDD for DAC
34	DAC1	O	DAC 1 out
35	GND_DAC	G	AGND for DAC
36	VCC_DAC	P	AVDD for DAC
37	DAC2	O	DAC 2 out
38	GND_DAC	G	AGND for DAC
39	VSS	G	Digital GND
40	CPU_MODE	I	External CPU mode
41	EXT_7	IO	Digital video out 7 / VD Out
42	EXT_6	IO	Digital video out 6 / FLD Out
43	EXT_5	IO	Digital video out 5 / HD Out
44	EXT_4	IO	Digital video out 4 / CSYNC Out
45	VDD33	P	3.3V Power
46	EXT_3	IO	Digital video out 3 / Day Out / EXTIO_3
47	EXT_2	IO	Digital video out 2 / IR In
48	EXT_1	IO	Digital video out 1 / MD Out
49	EXT_0	IO	Digital video out 0 / IR PWM Out / EXTIO_0
50	EXT_8	IO	Digital video clock out / IRIS PWM Out
51	VSS	G	Digital GND
52	VRI	I	External V sync input for Line Lock
53	VDD33	P	3.3V Power
54	V1	O	CCD Vertical driving pulse phase 1
55	V2	O	CCD Vertical driving pulse phase 2
56	V3	O	CCD Vertical driving pulse phase 3
57	V4	O	CCD Vertical driving pulse phase 4
58	SG1	O	CCD Read out pulse 1
59	SG2	O	CCD Read out pulse 2
60	SUB	O	CCD Shutter speed control pulse

NO	SYMBOL	I/O	DESCRIPTION
61	VSS	G	Digital GND
62	H1	O	CCD Horizontal driving pulse phase 1
63	VDD50	P	3.3V / 5.0V Power for RG, H1, H2
64	H2	O	CCD Horizontal driving pulse phase 2
65	RG	O	CCD Reset gate pulse
66	VSS	G	Digital GND
67	VDD33	P	3.3V Power
68	VDD18	P	1.8V Power
69	OSCI	I	Line Lock clock input
70	OSCO	O	Line Lock clock output
71	VSS	G	Digital GND
72	PCOMP	O	Phase comparator out / Day_ Out
73	SHD	O	CDS Sample & Hold pulse for data
74	SHP	O	CDS Sample & Hold pulse for pre-charge
75	ADC_CLK	O	ADC Sampling clock
76	VDD33	P	3.3V Power
77	ADC_D9	I	CCD Image data 9
78	ADC_D8	I	CCD Image data 8
79	ADC_D7	I	CCD Image data 7
80	ADC_D6	I	CCD Image data 6

I : Input
O: Output
P: Power
IO: Bi direction
G: Ground

4. DSP REGISTER TABLE

	7	6	5	4	3	2	1	0
0	CAT 1							
1	ADC_CLK_INV	A1_HIGH_ON	ADC_S1S2	ADC_CRCB	ADC_DATA_DLY	ADC_INVERSE	CCD_Hi_NOR	NTSC_PAL
2	PLL_CLK	SYS_CLK	DAC_ENABLE	DZM_TBR	DZM_ONOFF	DN_BURST_OFF	DN_C_OFF	MIR
3	x	x	AWB_RESULT_R(H)[9:8]		x	x	AWB_RESULT_B(H)[9:8]	
4	AWB_RESULT_R(L)[7:0]							
5	AWB_RESULT_B(L)[7:0]							
6	x	SHT_FRAC[10:8]			x	x	x	SHT_INTEGER(H)[8]
7	SHT_INTEGER(L)[7:0]							
8	SHT_FRAC[7:0]							
9	CSPRS_RESULT Cgain							
10	DZM_VSTART				DZM_V3FL	DZM_HSTART(H)[10:8]		
11	DZM_HSTART(L)[7:0]							
12	DZM_HMAG							
13	DZM_HOFF							
14	DZM_VMAG							
15	DZM_VOFFO							
16	DZM_VOFFE							
17	DZM_FRMSHFT							
18	Y_GAIN_CTRL							

	7	6	5	4	3	2	1	0
0	CAT 2							
1	SHT_COEF		ODM_WIND		ODM_WIND_NUM			
2	Y_LEVEL_CRAWL[7:0]							
3	Y_DIFF_CRAWL[7:0]							
4	AWB_PREFLT	x	C_CORING				AWB_RESULT_G(H)[9:8]	
5	AWB_RESULT_G(L)[7:0]							
6	AWB_IGNORE_Y_MAX							
7	AWB_IGNORE_Y_MIN							
8	CSPRS_SYS_DLY			HL_GAIN_SLP	EDGE_SLOP	HL_ONOFF	EDGE_VER	EDGE_HOR
9	CSPRS_Y_HL_THRESH							
10	CSPRS_YEDGE_THRESH_H				CSPRS_YEDGE_THRESH_V			
11	LLSPRS_SLP	LLSPRS_ON	x	x	x	x	x	x
12	CSPRS_Y_LL_THRESH							
13	DZM_HITRANWID					x	x	DZM_HVAL_CHG
14	DZM_MRBS							
15	DZM_MRBW							
16	DZM_VSCV		x	DZM_VDELAY	DZM_BILINV	DZM_BILNH	DZM_V3FL_METHOD	

	7	6	5	4	3	2	1	0
0	CAT 3							
1	x	HAPC0_GAIN			x	HAPC1_GAIN		
2	VAPC_GAIN				VAPC_RMX_GAIN			
3	APT_REMIX_SLICE				APT_MIX_SLICE			
4	HPF_SEL		DTL_WEIGHT	DTL_ONOFF	x	RMX_DTL_GN	RMX_DTL_ON	V_APT_LPF
5	HI_RESOL_GAIN				LPF2_OFF	LPF2_TYPE		HIGH_RESOL
6	H_APER_CLIP_POSI							
7	H_APER_CLIP_NEGA							
8	HAPC1_RMX_GAIN				HAPC0_RMX_GAIN			
9	RMX_APT_NEGA_CLIP							
10	RMX_APT_POSI_CLIP							
11	HIGH_RESOL_RMX_GAIN				SIG_DLY_C			
12	SIG_BURST_DLY				SIG_DLY_YC			
13	SIG_CLIP_C							
14	x	x	x	x	ECLPS_THRESH(H)[9:6]			
15	ECLPS_THRESH(L)[5:0]						ECLPS_MASK_GAIN(H)[9:8]	
16	ECLPS_MASK_GAIN(L)[7:0]							
17	x	x	x	SHADING_RATIO_X				SHADING_PT_X(H)[8]
18	SHADING_PT_X(L)[7:0]							
19	SHADING_PT_Y							
20	SHADING_R1							
21	SHADING_G1							

	7	6	5	4	3	2	1	0
0	CAT 4							
1	MTRX_RED_Y							
2	MTRX_RED_CR							
3	MTRX_RED_CB							
4	MTRX_GREEN_Y							
5	MTRX_GREEN_CR							
6	MTRX_GREEN_CB							
7	MTRX_BLUE_Y							
8	MTRX_BLUE_CR							
9	MTRX_BLUE_CB							
10	AWB_WIND_HOFF							
11	AWB_WIND_WIDTH							
12	AWB_XYSL							
13	AWB_YABS0							
14	AWB_RYTH0							
15	AWB_BYTH0							
16	AWB_YABS1							
17	AWB_RYTH1							
18	AWB_BYTH1							
19	Y_INTERCEPT							

	7	6	5	4	3	2	1	0
0	CAT 5							
1	COLOR_AREA1_GAIN							
2	COLOR_AREA2_GAIN							
3	COLOR_AREA3_GAIN							
4	COLOR_AREA4_GAIN							
5	COLOR_AREA5_GAIN							
6	COLOR_AREA6_GAIN							
7	COLOR_AREA7_GAIN							
8	COLOR_AREA8_GAIN							
9	x	x	COLOR_AREA1_ANGLE					
10	x	x	COLOR_AREA2_ANGLE					
11	x	x	COLOR_AREA3_ANGLE					
12	x	x	COLOR_AREA4_ANGLE					
13	x	x	COLOR_AREA5_ANGLE					
14	x	x	COLOR_AREA6_ANGLE					
15	x	x	COLOR_AREA7_ANGLE					
16	x	x	COLOR_AREA8_ANGLE					

	7	6	5	4	3	2	1	0
0	CAT 6							
1	GAMMA_Y1							
2	GAMMA_Y2							
3	GAMMA_Y3							
4	GAMMA_Y4							
5	GAMMA_Y5							
6	GAMMA_Y6							
7	GAMMA_Y7							
8	GAMMA_Y8							
9	GAMMA_Y9							
10	GAMMA_Y10							
11	GAMMA_Y11							
12	GAMMA_Y12							
13	GAMMA_Y13							
14	GAMMA_Y14							
15	GAMMA_C1							
16	GAMMA_C2							
17	GAMMA_C3							
18	GAMMA_C4							
19	GAMMA_C5							
20	GAMMA_C6							
21	GAMMA_C7							
22	GAMMA_C8							
23	GAMMA_C9							
24	GAMMA_C10							
25	GAMMA_C11							
26	GAMMA_C12							
27	GAMMA_C13							
28	GAMMA_C14							

	7	6	5	4	3	2	1	0
0	CAT 7							
1	HIGH_RESOL_SLICE				VAPC_SLICE			
2	HAPC1_SLICE				HAPC0_SLICE			
3	APT_REMIX_GAIN				APT_MIX_GAIN			
4	IIR_ON_2D	IIR_WEIGHT_2D		FILTER_SEL_2D			MDFLT_SEL	
5	K_COEF_2D							
6	IRIS_OUT_TYPE	x	x	IRIS_GAIN[4:3]		IRIS_GAIN[2:0]		
7	IRIS_REV_SHIFT			IRIS_OFFSET[4:0]				
8	IRIS_REV_COEF							
9	PWM1_ON	x	x	x	x	x	PWM1_DUTY_RATE[9:8]	
10	PWM1_DUTY_RATE[7:0]							
11	PWM2_ON	x	x	x	x	x	PWM2_DUTY_RATE[9:8]	
12	PWM2_DUTY_RATE[7:0]							
13	NEG REF VALUE							
14	ECLPS_ONOFF	ECLPS_Y_REMOVE	ECLPS_MASK_ONOFF	x	x	DNR MODE	600TV_ON	NEGA_ONOFF
15	AE_Y_CUT(AE_ODM_MIN_IGNORE_PIXEL)							
16	AE_TH_H(AE_ODM_MAX_PIXEL)							
17	S1_S2_GAIN_CTRL							
18	ABB_S1							
19	ABB_S2							

	7	6	5	4	3	2	1	0
0	CAT 8							
1	x	x	x	x	x	x	x	EHNC_MODE
2	600_LPF_TH							
3	600_FLAT							
4	SIDE_ON	SKIP_TH						
5	x							
6	x							
7	x	x	x	x	x	x	x	
8	ODM_CLPOB_DLY				x	x	x	x
9	ON	MODE	CLAMP_OFFSET					

	7	6	5	4	3	2	1	0
0	CAT 9							
1	HOFF							
2	HWID							
3	WNDAHE				WNDAHS			
4	WNDBHE				WNDBHS			
5	WNDAVE				WNDAVS			
6	WNDBVE				WNDBVS			
7	VOFF							
8	VWID							
9	FCLV1				FCLV0			
10	HPFBNDB		HPFBNDA		FCOS1	FCOS0	F_SEL	FLPFS
11	FPVAL							
12	AFD_LINE_AVR_MODE		AF_SMPLE_CEOF		x	VLINE		
13	HL_GATE_TH				HL_CNT_TH			

	7	6	5	4	3	2	1	0
0	10							
1	x							
2	x							
3	x							
4	x							
5	x							
6	x							
7	x							
8	x							
9	x							
10	x							
11	x							
12	HISTO_LOW_LIMIT							
13	HISTO_HIGH_LIMIT							

	7	6	5	4	3	2	1	0
0	CAT 11							
1	ADC_CLAMP_WIDTH		ADC_CLAMP_POS					
2	SIG_DLY_Y				SIG_SYNC_GAIN			
3	SIG_FLD_NUM		SIG_MOVE_VER					SIG_MOVE_HOR(H)[8]
4	SIG_MOVE_HOR(L)[7:0]							
5	SIG_SETUP_LVL					FIX_VSHIFTON	SYNC_VSHIFT(H)[9:3]	
6	SYNC_VSHIFT[7:3]					SYNC_VSHIFT(L)[2:0]		
7	CCD_DATA_DLY			ADC_OUT_MODE	FIX_HSHIFTON	HSHIFT(H)[10:8]		
8	HSHIFT(L)[7:0]							
9	x			SIG_CLIP_Y				
10	x			SIG_BURST_GAIN_RY				
11	SYNC_LPF_ON	DZOOM_PID_DLY	x	SIG_BURST_GAIN_BY				
12	AE_WIND_H_START							
13	AE_WIND_H_WIDTH							
14	AE_SPOT_AREA_V_OFFSET				AE_SPOT_AREA_H_OFFSET			
15	AE_SPOT_AREA_V_WIDTH				AE_SPOT_AREA_H_WIDTH			
16	AE_WIND_V_START							
17	AE_WIND_V_WIDTH							
18	PORT2 PIN_MODE		PORT3 PIN_MODE		oEXTIO0_MODE			
19	oEXTIO3_MODE				oEXTIO9_MODE			

	7	6	5	4	3	2	1	0
0	CAT 12							
1	x	PIN_CCD_H1_WIDTH			PIN_CCD_H1_DLY			
2	PIN_CCD_12_INV	PIN_CCD_H2_WIDTH			PIN_CCD_H2_DLY			
3	PIN_CCD_RG_INV	PIN_CCD_RG_WIDTH			PIN_CCD_RG_DLY			
4	x	ADC_XSHP_WIDTH			ADC_XSHP_DLY			
5	ADC_ADCLK_DLY				ADC_XSHD_DLY			

	7	6	5	4	3	2	1	0
0	CAT 13							
1	ADC							
2	ADC_SLD							
3	ADC_SDA							
4	ADC_SCL							
5	CLP_PB							
6	I2C_SCL							
7	I2C_SDA							
8	GPIO_I							
9	GPIO_O							
10	GPIO_IO							
11	EXT_O							
12	EXT_IO							
13	CPU							
14	VRI							
15	PCOMP							
16	CCD_DRV							
17	x	x	x	x	RG_CURRENT		H_CURRENT	

	7	6	5	4	3	2	1	0
0	CAT 14							
1	SHADING_ON	SHADING_GAIN_ENHANCE						
2	SHADING_CG1				SHADING_CG2			
3	SHADING_CG3				SHADING_CG4			
4	SHADING_CG5				SHADING_CG6			
5	SHADING_CG7				SHADING_CG8			
6	MD_OPER_ON	MD_THRESH						
7	MD_MANUAL_MSCENE	MD_MSCENE_UPDATE(H)[14:8]						
8	MD_MSCENE_UPDATE(L)[7:0]							
9	MD_SS_DISP MODE	x	MD_AS_ALPHA		MD_ASDISP_ON	MD_SS_ALPHA		MD_SSDISP_ON

	7	6	5	4	3	2	1	0
0	CAT 15							
1	oDWDR_Y_AREA0							
2	oDWDR_Y_AREA1							
3	oDWDR_Y_AREA2							
4	oDWDR_Y_AREA3							
5	oDWDR_Y_AREA4							
6	oDWDR_Y_AREA4							
7	oDWDR_Y_AREA6							
8	oDWDR_Y_AREA7							
9	oDWDR_Y_AREA8							
10	oDWDR_Y_AREA9							
11	oDWDR_Y_AREA10							
12	oDWDR_Y_AREA11							
13	oDWDR_Y_AREA12							
14	oDWDR_C_AREA0							
15	oDWDR_C_AREA1							
16	oDWDR_C_AREA2							
17	oDWDR_C_AREA3							
18	oDWDR_C_AREA4							
19	oDWDR_C_AREA5							
20	oDWDR_C_AREA6							
21	oDWDR_C_AREA7							
22	oDWDR_C_AREA8							
23	oDWDR_C_AREA9							
24	oDWDR_C_AREA10							
25	oDWDR_C_AREA11							
26	oDWDR_C_AREA12							

	7	6	5	4	3	2	1	0
0	CAT 16							
1	x	x	x	x	PZONE_SEL			
2	PZONE_DISP_ON	x	x	x	PZONE_COLOR			
3	PZONE_SX							
4	PZONE_SY							
5	PZONE_EX							
6	PZONE_EY							
7	x	x	x	PZONE_CURSOR_POS	PZONE_CURSOR_SETNUM			PZONE_CURSOR_ON

	7	6	5	4	3	2	1	0
0	CAT 17							
1	MD_SENSOR0_ON(L)[7:0]							
2	MD_SENSOR1_ON(L)[7:0]							
3	MD_SENSOR2_ON(L)[7:0]							
4	MD_SENSOR3_ON(L)[7:0]							
5	MD_SENSOR4_ON(L)[7:0]							
6	MD_SENSOR5_ON(L)[7:0]							
7	MD_SENSOR6_ON(L)[7:0]							
8	MD_SENSOR7_ON(L)[7:0]							
9	x	x	MD_LINE_DLY			MD_PIXEL_DLY		
10	MD_SS_HEIGHT				MD_SS_WIDTH			
11	MD_AS_HEIGHT				MD_AS_WIDTH			
12	MD_SS_CB				MD_SS_CR			
13	x	x	x	x	MD_SS_Y			
14	MD_AS_CB				MD_AS_CR			
15	x	x	x	x	MD_AS_Y			

	7	6	5	4	3	2	1	0
0	CAT 18							
1	PTN_FRONT_COLOR			PTN_FRONT_GAIN		PTN_FRONT_TYPE		
2	DAC2_OUTPUT_SIG		DAC1_OUTPUT_SIG		FIX_BILINEAR	ENC_656_DATA_DLY		ENC_656_CLK_INV
3	x	x	TS_APT_SEL	PATTERN_SEL		TEST_PASS_SEL		
4	LPF01_TYPE		PTN_FRONT_ON	PTN_FRONT_PID	x	TEST_PASS_COLOR		
5	BYPASS_SEL							
6	MANU_Y							
7	MANU_CB							
8	MANU_CR							
9	x	FIX_LRIPAT		FIX_CMPOFF	SYNC_POL	FIX_SYNCOFF	FIX_FLFR	FIX_VCLAMP
10	FIX_PLLPOL	FIX_EXSPOL	LPF01_OFF	FIX_LALTMODE	FIX_EXTDET	FIX_PLL	FIX_EXSIGNAL	FIX_RSTMODE
11	PWM1_STEP_FREQ_IRIS				PWM2_STEP_FREQ_LED			
12	IRIS_SYNC_GAIN					x	IRIS_SUM_GAIN	

	7	6	5	4	3	2	1	0
0	CAT 19							
1	MDBOX_ON	x	MDBOX_EY(H)[8]	MDBOX_EX(H)[9:8]		MDBOX_SY(H)[8]	MDBOX_SX(H)[9:8]	
2	MDBOX_SX(L)[7:0]							
3	MDBOX_SY(L)[7:0]							
4	MDBOX_EX(L)[7:0]							
5	MDBOX_EY(L)[7:0]							
6	MDBOX_CB				MDBOX_CR			
7	MDBOX_ALPHA		x	x	MDBOX_Y			

	7	6	5	4	3	2	1	0
0	CAT 21							
1	DEF_MEM_ADDR							
2	DEF_H_ADDR(H)[9:2]							
3	DEFP_H_ADDR(L)[1:0]		DEF_V_ADDR(H)[8:3]					
4	DEF_V_ADDR(L)[2:0]			FIELD_ODD	x	x	RD_EN	WR_EN

	7	6	5	4	3	2	1	0
0	22							
1	MAN_CURSORON	REAL_TIME_DEFECT	COUNT_REQ	DEF_RELE	COMP_ON	DEF_TYPE		DEF_REQ
2	DEF_DATA_TH(H)[9:2]							
3	DEF_DATA_TH(L)[1:0]		x	x	x	x	DEF_DATA_TH(H)[9:8]	
4	DEF_DATA_TH(L)[7:0]							
5	MAN_ADDRH(H)[9:2]							
6	MAN_ADDRH(L)[1:0]		MAN_ADDRV(H)[8:3]					
7	MAN_ADDRV(L)[2:0]			FIELD_FLAG	x	x	x	x
8	VIEWMODE	x	x	x	x	x	x	x
9	COMP_COUNT							
10	DEF_REALDEF_VALTHRESH(H)[9:2]							
11	DEF_REALDEF_VALTHRESH(L)[7:0]			x	x	x	DEF_REALDEF_DIFFTHRESH(H)[9:8]	
12	DEF_REALDEFTHRESH(L)[7:0]							
13	DEF_HEDGE_TH							
14	DEF_VEDGE_TH							
15	REAL_HEDGE_TH							
16	REAL_VEDGE_TH							

	7	6	5	4	3	2	1	0
0	CAT102							
1	E2_AE_MODE							
2	AID_ORGAETAR_NRM_H							
3	AID_ORGAETAR_NRM_L							
4	AID_SVAGCMX							
5	E2_AGC_MIN							
6	E2_RST_SHTSPDH							
7	E2_RST_SHTSPDL							
8	E2_SHT_HOLD_VAL_H							
9	E2_SHT_HOLD_VAL_L							
10	E2_SHT_FLK_VAL_H							
11	E2_SHT_FLK_VAL_L							
12	E2_AE_STABLE_RANGE							
13	E2_AE_HYST_GAP							
14	E2_SHT_FRACNUM_H							
15	E2_SHT_FRACNUM_L							
16	E2_SHT_FRAC_START_LINE_H							
17	E2_SHT_FRAC_START_LINE_L							
18	E2_IRIS_GAIN							
19	x				E2_IRIS_OFFSET_1			
20	E2_PWM0_DUTY							
21	x		SHD_GAIN_H		SHD_GAIN_M		SHD_GAIN_L	
22	SHADING_CG1_L				SHADING_CG2_L			
23	SHADING_CG3_L				SHADING_CG4_L			
24	SHADING_CG5_L				SHADING_CG6_L			
25	SHADING_CG7_L				SHADING_CG8_L			
26	SHADING_CG1_M				SHADING_CG2_M			
27	SHADING_CG3_M				SHADING_CG4_M			
28	SHADING_CG5_M				SHADING_CG6_M			
29	SHADING_CG7_M				SHADING_CG8_M			
30	SHADING_CG1_H				SHADING_CG2_H			
31	SHADING_CG3_H				SHADING_CG4_H			
32	SHADING_CG5_H				SHADING_CG6_H			
33	SHADING_CG7_H				SHADING_CG8_H			
34	FOG_LUM_X1_X2							
35	FOG_LUM_Y1							
36	FOG_LUM_Y2							
37	FOG_GMA_GAP							
38	DWDR_X1_X2							
39	DWDR_Y1_L							
40	DWDR_Y2_L							
41	x		FOG_SHD_ON	DWDR_SHD_ON	FOG_GAIN		DWDR_GAIN	
42	FOG_SHADING_CG1				FOG_SHADING_CG2			
43	FOG_SHADING_CG3				FOG_SHADING_CG4			
44	FOG_SHADING_CG5				FOG_SHADING_CG6			
45	FOG_SHADING_CG7				FOG_SHADING_CG8			
46	DWDR_SHADING_CG1				DWDR_SHADING_CG2			
47	DWDR_SHADING_CG3				DWDR_SHADING_CG4			
48	DWDR_SHADING_CG5				DWDR_SHADING_CG6			
49	DWDR_SHADING_CG7				DWDR_SHADING_CG8			
50	SHT_SPD (0x00(Slow)~0xFF(Fast))							
51	AGC_SPD (0x00(Slow)~0xFF(Fast))							
52	E2_YGAP_SPD							

	7	6	5	4	3	2	1	0
0	CAT103							
1	AID_WB_R8500_BND_NRM							
2	AID_WB_B8500_BND_NRM							
3	AID_WB_R2500_BND_NRM							
4	AID_WB_B2500_BND_NRM							
5	AID_WB_LINE1_PLUS							
6	AID_WB_LINE2_PLUS							
7	AID_WB_LINE1_MINUS							
8	AID_WB_LINE2_MINUS							
9	AID_WB_R2500_LINE							
10	AID_WB_B2500_LINE							
11	AID_WB_R8500_LINE							
12	AID_WB_B8500_LINE							
13	E2_WB_SCALE_R							
14	E2_WB_SCALE_G							
15	E2_WB_SCALE_B							
16	AID_RGAIN_DRT							
17	AID_BGAIN_DRT							
18	AID_PUSH_R							
19	AID_PUSH_B							
20	E2_ATW_FILTER_BX_DOWN							
21	E2_ATW_FILTER_BX_RIGHT							
22	E2_ATW_FILTER_BX_UP							
23	E2_ATW_FILTER_BX_LEFT							
24	AID_AWB_SPD							
25	AID_C_GAIN_MENU							
26	E2_WB_SLWMV_GAP							
27	E2_WB_SLWMV_TM							
28	E2_WB_UNSTBL_GAP							
29	E2_WB_UNSTBL_TM							
30	E2_WB_STBLE_TM							
31	DAY_OUT_H/L	QUICK_BT_EN	x	x	DM_ON_FLD	IV_ADC	ATW_WIN	ADC_TYPE
32	ADC_REG0_H							
33	ADC_REG0_L							
34	ADC_REG1_H							
35	ADC_REG1_L							
36	ADC_REG2_H							
37	ADC_REG2_L							
38	ADC_REG3_H							
39	ADC_REG3_L							
40	ADC_REG4_H							
41	ADC_REG4_L							

	7	6	5	4	3	2	1	0
0	CAT104							
1	AID_HCENT_H							
2	AID_HCENT_L							
3	AID_VCENT_H							
4	AID_VCENT_L							
5	AID_HOFFSET							
6	AID_VOFFSET							
7	MENU_DZOOM_SEL							
8	AID_DZMAXRAT							
9	AID_MAX_DZOOM							
10	WB_LED_ADJ_OFFSET							
11	x							
12	MENU_ZM_SPD							
13	E2_DZOOM_ONOFF							
14	E2_LINEAR_ZOOM_SAVE							

	7	6	5	4	3	2	1	0
0	CAT105							
1	AID_DN_MODE							
2	E2_DAYNIGHT_NIGHT_AGC							
3	E2_DAYNIGHT_DAY_AGC							
4	E2_DN_SOURCE							
5	E2_DN_SENSOR_ACTIVE							
6	x							
7	E2_DN_DLY_SECOND							
8	x							
9	E2_APT_AGC_START_GAIN							
10	E2_APT_AGC_END_GAIN							
11	E2_AE_STABLE_FLD_CNT							
12	E2_DNR_START_AGC							
13	E2_DNR_END_AGC							
14	x							
15	E2_2DNR_COEF_H							
16	x							
17	E2_2DNR_COEF_L							
18	E2_SPRS_END_COLOR_GAIN							
19	E2_SPRS_AGC_START							
20	E2_SPRS_AGC_END							
21	E2_APT_SLC_VER_MAX				E2_APT_SLC_VER_MIN			
22	E2_APT_SLC_HOR0_MAX				E2_APT_SLC_HOR0_MIN			
23	E2_APT_SLC_HOR1_MAX				E2_APT_SLC_HOR1_MIN			
24	E2_APT_SLC_600H_MAX				E2_APT_SLC_600H_MIN			
25	E2_APT_GAIN_MAX				E2_APT_GAIN_MIN			
26	E2_APT_GAIN_RMX_MAX				E2_APT_GAIN_RMX_MIN			

	7	6	5	4	3	2	1	0
0	CAT106							
1	E2_NEGA_ONOFF							
2	E2_MIRROR_ONOFF							
3	AID_SHP_MENU							
4	E2_MMENU_BLC_MODE							
5	AID_END_ADJUST							
6	AID_CAM_ID							
7	E2_MMENU_PROTOCOL_SEL							
8	E2_MMENU_BAUDRATE_SEL							
9	E2_MMENU_DEBUG_OSD_ON							

	7	6	5	4	3	2	1	0
0	CAT120							
1	Menu Horizontal Position							
2	Menu Vertical Position							
3	Select Item Color Y							
4	Select Item Color Cr							
5	Select Item Color Cb							
6	Menu Left Item Position(ENG)							
7	Menu Right Item Position(ENG)							
8	Menu Left Item Position(CHN)							
9	Menu Right Item Position(CHN)							
10	Motion Detect Menu Horizontal Position							
11	Motion Detect Menu Vertical Position							
12	Privacy Zone Menu Horizontal Position							
13	Privacy Zone Menu Vertical Position							
14	Camera Title Menu Horizontal Position							
15	Camera Title Menu Vertical Position							
16	EXT_MENU_ON	x	x	x	x	x	x	DC IRIS RESET_ON
17	DC Level Reset Value							
18	x							

	7	6	5	4	3	2	1	0
0	CAT121							
1	Shutter							
2	Brightness(Shutter)							
3	AGC On/Off							
4	White Bal							
5	Brightness(IRIS Gain)							
6	BLC Level							
7	HLC Level							
8	DNR							
9	Flickerless							
10	Language							
11	DWDR Level							
12	Lens Shading							
13	Anti Fog							
14	NightMode							
15	Smart IR Saturation							
16	DC IRIS							
17	Sync							
18	DZoom							
19	Exposure							
20	Burst							
21	Monitor							
22	ID Display							

	7	6	5	4	3	2	1	0
0	CAT122							
1	PZone Operation On/Off							
2	PZone7 On	PZone6 On	PZone5 On	PZone4 On	PZone3 On	PZone2 On	PZone1 On	PZone0 On
3	PZone Color							
4	MD Operation On/Off							
5	MD7 On	MD6 On	MD5 On	MD4 On	MD3 On	MD2 On	MD1 On	MD0 On
6	MD Sensitivity Select Value							
7	MD Sensitivity Low Value							
8	MD Sensitivity Mid Value							
9	MD Sensitivity High Value							
10	MD Refresh Rate Select Value							
11	MD Refresh Rate0 Value							
12								
13	MD Refresh Rate1 Value							
14								
15	MD Refresh Rate2 Value							
16								
17	MD Refresh Rate3 Value							
18								
19	MD Refresh Rate4 Value							
20								
21	MD Refresh Rate5 Value							
22								
23	MD Refresh Rate6 Value							
24								
25	MD Refresh Rate7 Value							
26								
27	MD Refresh Rate8 Value							
28								
29	MD Alarm Out							
30	MD Alarm Hold Time							
31	MD Output Threshold							

	7	6	5	4	3	2	1	0
0	CAT123							
1	PZone0 Position Sx							
2	PZone0 Position Sy							
3	PZone0 Position Ex							
4	Pzone0 Position Ey							
5	PZone1 Position Sx							
6	PZone1 Position Sy							
7	PZone1 Position Ex							
8	Pzone1 Position Ey							
9	PZone2 Position Sx							
10	PZone2 Position Sy							
11	PZone2 Position Ex							
12	Pzone2 Position Ey							
13	PZone3 Position Sx							
14	PZone3 Position Sy							
15	PZone3 Position Ex							
16	Pzone3 Position Ey							
17	PZone4 Position Sx							
18	PZone4 Position Sy							
19	PZone4 Position Ex							
20	Pzone4 Position Ey							
21	PZone5 Position Sx							
22	PZone5 Position Sy							
23	PZone5 Position Ex							
24	Pzone5 Position Ey							
25	PZone6 Position Sx							
26	PZone6 Position Sy							
27	PZone6 Position Ex							
28	Pzone6 Position Ey							
29	PZone7 Position Sx							
30	PZone7 Position Sy							
31	PZone7 Position Ex							
32	Pzone7 Position Ey							

	7	6	5	4	3	2	1	0
0	CAT124							
1	MD0 Position Sx							
2	MD0 Position Sy							
3	MD0 Position Ex							
4	MD0 Position Ey							
5	MD1 Position Sx							
6	MD1 Position Sy							
7	MD1 Position Ex							
8	MD1 Position Ey							
9	MD2 Position Sx							
10	MD2 Position Sy							
11	MD2 Position Ex							
12	MD2 Position Ey							
13	MD3 Position Sx							
14	MD3 Position Sy							
15	MD3 Position Ex							
16	MD3 Position Ey							
17	MD4 Position Sx							
18	MD4 Position Sy							
19	MD4 Position Ex							
20	MD4 Position Ey							
21	MD5 Position Sx							
22	MD5 Position Sy							
23	MD5 Position Ex							
24	MD5 Position Ey							
25	MD6 Position Sx							
26	MD6 Position Sy							
27	MD6 Position Ex							
28	MD6 Position Ey							
29	MD7 Position Sx							
30	MD7 Position Sy							
31	MD7 Position Ex							
32	MD7 Position Ey							

	7	6	5	4	3	2	1	0
0	CAT126							
1	Title Operation On/Off							
2	Title H Position							
3	Title V Position							
4	Title String							
5								
6								
7								
8								
9								
10								
11								
12								
13								
14								
15								
16								
17								
18								
19								

	7	6	5	4	3	2	1	0
0	CAT127							
1	Static Defect StartThreshold							
2								
3	Static Defect Threshold Gap							
4	Static Defect Max Threshold							
5								
6	Static Defect Sensitivity							
7	Compensation On							
8	Compensation View Mode							
9	Dynamic Defect							
10	Real Defect							
11	Dynamic Defect Value Threshold							
12								
13	Dynamic Defect Min Different Threshold							
14								
15	Dynamic Defect Max Different Threshold							
16								
17	Dynamic Defect AGC Min							
18	Dynamic Defect AGC Max							
19	Dynamic Diff_H Min							
20	Dynamic Diff_H Max							
21	Dynamic Diff_V Min							
22	Dynamic Diff_V Max							
23	Dynamic Defect User Count							
24	Recheck Detect Count				Dynamic Defect Detect Count			
25	Dynamic Defect Interval							
26	Dynamic Defect Recheck Interval							
27	Min Horizontal Position							
28	Max Horizontal Position							
29								
30	Real Defect Value Threshold							
31								
32	Real Defect Min Different Threshold							
33								
34	Real Defect Max Different Threshold							
35								
36	Real Defect AGC Min							
37	Real Defect AGC Max							
38	Real Diff_H Min							
39	Real Diff_H Max							
40	Real Diff_V Min							
41	Real Diff_V Max							
42	Recheck Defect Value Threshold							
43								
44	Recheck Defect Min Different Threshold							
45								
46	Recheck Defect Max Different Threshold							
47								
48	Recheck Defect AGC Min							
49	Recheck Defect AGC Max							
50	Recheck Diff_H Min							
51	Recheck Diff_H Max							
52	Recheck Diff_V Min							
53	Recheck Diff_V Max							

	7	6	5	4	3	2	1	0
0	CAT128							
1	0: Key Mode, 1: GPIO Mode for DIP Switch							
2	GROUP0 Size			GROUP0 Start				GROUP0_ON
3	GROUP1 Size			GROUP1 Start				GROUP1_ON
4	GROUP2 Size			GROUP2 Start				GROUP2_ON
5	GROUP3 Size			GROUP3 Start				GROUP3_ON
6	GPIO0_CATNUM(0x00: Disable)							
7	GPIO0_BYTENUM							
8	GPIO0_BITWIDTH					GPIO0_BITNUM		
9	GPIO0_LOWVAL(H)[15:8]							
10	GPIO0_LOWVAL(L)[7:0]							
11	GPIO0_HIGHVAL(H)[15:8]							
12	GPIO0_HIGHVAL(L)[7:0]							
13	GPIO1_CATNUM(0x00: Disable)							
14	GPIO1_BYTENUM							
15	GPIO1_BITWIDTH					GPIO1_BITNUM		
16	GPIO1_LOWVAL(H)[15:8]							
17	GPIO1_LOWVAL(L)[7:0]							
18	GPIO1_HIGHVAL(H)[15:8]							
19	GPIO1_HIGHVAL(L)[7:0]							
20	GPIO2_CATNUM(0x00: Disable)							
21	GPIO2_BYTENUM							
22	GPIO2_BITWIDTH					GPIO2_BITNUM		
23	GPIO2_LOWVAL(H)[15:8]							
24	GPIO2_LOWVAL(L)[7:0]							
25	GPIO2_HIGHVAL(H)[15:8]							
26	GPIO2_HIGHVAL(L)[7:0]							
27	GPIO3_CATNUM(0x00: Disable)							
28	GPIO3_BYTENUM							
29	GPIO3_BITWIDTH					GPIO3_BITNUM		
30	GPIO3_LOWVAL(H)[15:8]							
31	GPIO3_LOWVAL(L)[7:0]							
32	GPIO3_HIGHVAL(H)[15:8]							
33	GPIO3_HIGHVAL(L)[7:0]							
34	GPIO4_CATNUM(0x00: Disable)							
35	GPIO4_BYTENUM							
36	GPIO4_BITWIDTH					GPIO4_BITNUM		
37	GPIO4_LOWVAL(H)[15:8]							
38	GPIO4_LOWVAL(L)[7:0]							
39	GPIO4_HIGHVAL(H)[15:8]							
40	GPIO4_HIGHVAL(L)[7:0]							
41	GPIO5_CATNUM(0x00: Disable)							
42	GPIO5_BYTENUM							
43	GPIO5_BITWIDTH					GPIO5_BITNUM		
44	GPIO5_LOWVAL(H)[15:8]							
45	GPIO5_LOWVAL(L)[7:0]							
46	GPIO5_HIGHVAL(H)[15:8]							
47	GPIO5_HIGHVAL(L)[7:0]							
48	GPIO6_CATNUM(0x00: Disable)							
49	GPIO6_BYTENUM							
50	GPIO6_BITWIDTH					GPIO6_BITNUM		
51	GPIO6_LOWVAL(H)[15:8]							
52	GPIO6_LOWVAL(L)[7:0]							
53	GPIO6_HIGHVAL(H)[15:8]							
54	GPIO6_HIGHVAL(L)[7:0]							
55	GPIO7_CATNUM(0x00: Disable)							
56	GPIO7_BYTENUM							
57	GPIO7_BITWIDTH					GPIO7_BITNUM		
58	GPIO7_LOWVAL(H)[15:8]							
59	GPIO7_LOWVAL(L)[7:0]							
60	GPIO7_HIGHVAL(H)[15:8]							
61	GPIO7_HIGHVAL(L)[7:0]							

5. Electrical Specification

5.1 ABSOLUTE MAXIMUM RATINGS

Parameter	Rating	Unit
Power supply of 3.3V	-0.3 to 4.0	V
Input voltage of 3.3V	-0.3 to 4.0	V
Storage temperature	-40 to 150	℃
DC input current	20	mA
Output short circuit current	20	mA

5.2 RECOMMEND OPERATING CONDITIONS

Parameter	Min	Typ	Max	Unit
Power supply of 3.3V I/O	2.97	3.3	3.63	V
Input voltage of 3.3V I/O	2.97	3.3	3.63	V
Operation temperature	-20	25	75	℃

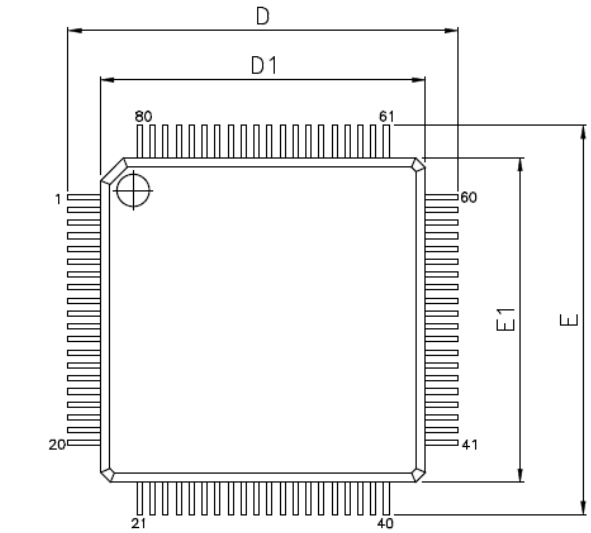
5.3 DC ELECTRICAL CHARACTERISTICS

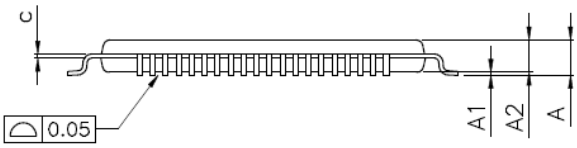
(Under Recommended Operating condition and Vcc = 3.0 ~ 3.6V)

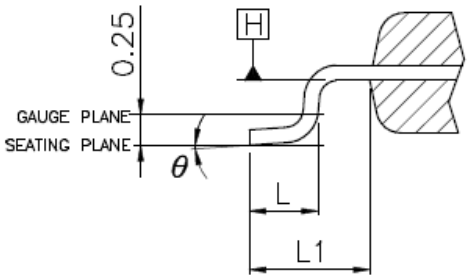
Parameter	Min	Typ	Max	Unit
3.3V Pins				
Power supply	2.97	3.3	3.63	V
Input low voltage			0.8	V
Input high voltage	2.0			V
Output low voltage			0.4	V
Output high voltage	2.4			V
5.0V Pins *Note1				
Power supply	4.5	5.0	5.5	V
Output low voltage			0.4	V
Output high voltage	4.6			V

*Note1 : When operating 5V pins (RG, H1, H2)

6. PACKAGE DIMENSION







VARIATIONS (ALL DIMENSIONS SHOWN IN MM)

SYMBOLS	MIN.	NOM.	MAX.
A	—	—	1.20
A1	0.05	—	0.15
A2	0.95	1.00	1.05
D		12.00 BSC	
D1		10.00 BSC	
E		12.00 BSC	
E1		10.00 BSC	
b	0.13	0.18	0.23
c	0.09	—	0.20
L	0.45	0.60	0.75
L1		1.00 REF	
e		0.40 BSC	
θ	0°	3.5°	7°

NOTES:

1. JEDEC OUTLINE : MS-026 ACE.
2. DATUM PLANE [H] IS LOCATED AT THE BOTTOM OF THE MOLD PARTING LINE COINCIDENT WITH WHERE THE LEAD EXITS THE BODY.
3. DIMENSIONS D1 AND E1 DO NOT INCLUDE MOLD PROTRUSION. ALLOWABLE PROTRUSION IS 0.25 mm PER SIDE. DIMENSIONS D1 AND E1 DO INCLUDE MOLD MISMATCH AND ARE DETERMINED AT DATUM PLANE [H].
4. DIMENSION b DOES NOT INCLUDE DAMBAR PROTRUSION.