Agilent ADCM-1700-0000 Landscape CIF Resolution
CMOS Camera Module

Data Sheet

Description

The ADCM-1700-0000 ultra compact CMOS camera module is an advanced, low-power CIF resolution camera component for embedded applications. The camera module combines an Agilent CMOS image sensor and image processing design with a high quality lens to deliver images in formats that are ready for storage or transmission. Output data can be transmitted using a serial or parallel port.

The ADCM-1700-0000 camera module features a quality, integral lens in a tightly integrated sensor and image processing design. The camera module is optimized for use in a variety of embedded applications from cell phones and handheld wireless devices to image-enabled appliances and automotive design.

Incorporating a CCIR 656-compatible 8-bit parallel interface, or an RGB or YCbCr interface (serial or parallel), the ADCM-1700-0000 supports industry-leading data resolutions as well as subsampling.

The ADCM-1700-0000 camera module also supports a range of programmable modes, including support for embedded or external synchronization capabilities, extending design flexibility.

Features

- 352 x 288 landscape CIF resolution
- 24 bit color depth (16 million colors)
- Bayer color filters – blue, red and green
- Frame rate – 15 frames per second at CIF resolution
- Programmable to many image formats:
  - CIF (352 x 288) landscape only
  - QVGA (320 x 240) landscape only
  - QCIF (176 x 144)
  - QQVGA (160 x 120)
  - QQCIF (88 x 72)
  - Any other format 352 x 288 or smaller
- Flexible orientation
- Panning – window can be placed anywhere in the 352 x 288 array
- Low power – 42 mW typical at 13 MHz input clock
- Single 2.8V power supply with internal voltage regulation
- High quality F/2.8 lens
- Fully configurable image processing
- Direct RGB or YCbCr 8-bit parallel output port (CCIR 656-compatible)
- Embedded synchronization capability – CCIR 656
- Horizontal/vertical mirroring and subsampling
- Excellent image quality
- Noise adaptive processing
- Statistics gathering – automatic gathering of frame statistics including histograms for each color channel
- Image resizer
- Auto exposure and auto white balance
- High intrinsic sensitivity for enhanced low light performance
- Integrated IR filter
- Compact size – 8.0 x 7.0 x 5.4 mm

Applications

- Mobile phones
- Video phones
- Personal Digital Assistants
- Digital still mini cameras
- Image-enabled appliances
- Embedded automotive
- Monitoring equipment

General Specifications

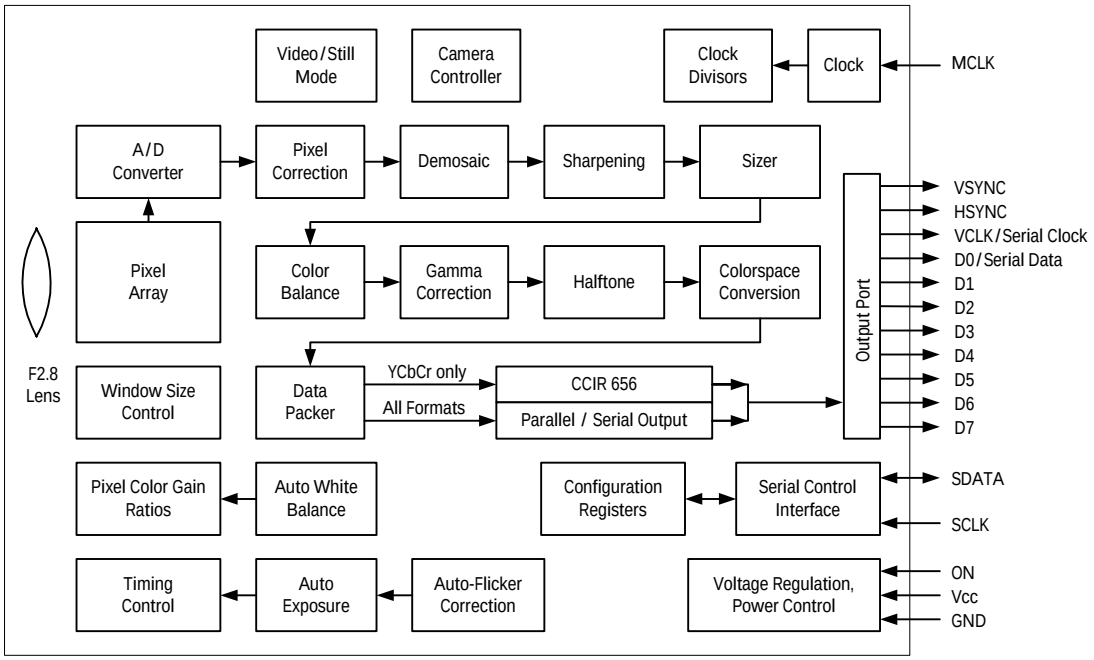
Feature	Value
Output format	8-bit parallel YCbCr CCIR 656-compliant 8-bit parallel YCbCr or RGB
Maximum frame rates	15 fps at 352 x 288 (CIF)
Image modes	Grayscale and full color
YCbCr (YUV) formats	4:4:4 YCbCr 4:2:2 $Y_1Cb_{12}Y_2Cr_{12}$ 4:2:2 $Cb_{12}Y_1Cr_{12}Y_2$ 4:2:2 $Y_1Cr_{12}Y_2Cb_{12}$ 4:2:2 $Cr_{12}Y_1Cb_{12}Y_2$
Gamma correction	33 value programmable interpolated table
Data synchronization	End_of_Line, End_of_Frame, Data_Clock
Video synchronization	HSYNC, VSYNC, VCLK
Serial control identification	0x51
Supply voltage requirements	2.65 to 3.1 V
External clock frequency	4 to 32 MHz
Power consumption	42 mW typical, CIF output, 13 MHz clock
Scene illumination (minimum)	5 lux

Optical Specifications

Function	Description
Pixel count	352 x 288 (CIF landscape mode)
Pixel size	5.6 μm x 5.6 μm
Effective fill factor	~ 80%
IR filter	Integrated
Lens type	Plastic singlet aspheric
Focal length	2.10 mm
F/#	2.8
Focus	Fixed focus
Depth of focus	100 mm to infinity
Field of view	52° full angle (horizontal)
Distortion	≤ 4%

Block Diagram

The ADCM-1700-0000 camera module is a complete image processing system.



ADCM-1700-0000 block diagram descriptions

Feature	Description
A/D converter	Converts the analog pixel voltages to 8-bit digital values
Auto exposure	Adjusts the image sensor to the amount of light present in the window using both exposure time and pixel gain
Auto white balance	Accommodates the slight color shifts that affect white in different kinds of light (daylight, fluorescent, incandescent). The camera module performs white balancing by digitally changing the gain ratio of the red, green and blue channels and by adjusting the color balancing matrix. White objects in the scene always look white in the final image.
Camera controller	Overall functions of the camera module are centrally controlled
CCIR 656 output	Parallel port with CCIR 656 formatted data. Data can be output with either external horizontal and vertical synchronization signals or using embedded synchronization codes.
Clock divisors	User controllable divisors to control the clock
Color balance	Physical properties of optics dictate that images from the image sensor are not perfectly matched to the human eye; this block improves the color fidelity of the image and increases saturation
Color space conversion	Programmable color space conversion function to convert RGB values to a different color space. RGB values are multiplied by a 3 x 3 transform coefficient matrix and then offset. RGB to YCbCr is the default color space conversion.
Configuration registers	Controls all camera module features
Data packer	Data can be output in a variety of formats that use between 8 and 24 bits/pixel

ADCM-1700-0000 block diagram descriptions (continued)

Feature	Description
Demosaic	Performs color interpolation to produce all three color components for each pixel location. The image sensor produces a single red, green or blue pixel value for each location. The data is reduced to 8 bits per color per pixel at this stage.
Gamma correction	Pixel values acquired from the image sensor are a linear function of the light present in the original window. For computer monitors, the intensity produced by the display is a non-linear function of the pixel value and is characterized by a "gamma" curve. The gamma corrects the image data for display and can also make corrections to the contrast of the image. Conceptually, gamma correction is a 33-entry lookup table translating the linear response of the sensor into the non-linear characteristics of the display.
Halftone	Introduces pseudo random noise to bit reduced outputs to eliminate banding
Lens	High quality F/2.8 lens singlet
Output port	Parallel output is eight data lines, two handshake lines and a video clock line.
Pixel array	Image sensor consists of a 352 x 288 pixel array, which can be windowed to any size between 352 x 288 and 24 x 24. The array can be mirrored in both the horizontal and vertical directions. The pixel array is actually 366 x 296 with the extra pixels being used for the Bayer pattern needed at the edges of the picture for the demosaic.
Pixel color gain	Analog gain controlled by the auto exposure block that sets the differential gains of color channels
Pixel correction	Reduces the effects of pixel mismatch
Pixel gain	Analog gain controlled by the auto exposure block
Sharpening	Applies a variable sharpening filter to the image
Sizer	Allows the output size of the image to be scaled from the sensor input. The scaling occurs after the demosaic operation and before the color balance.
Timing control	Exposure control for the image sensor with exposure in row times
Video / still mode	Video mode is nominally QCIF, still mode is CIF
Voltage regulation	Internal voltage regulator
Window size control	Allows the image sensor output to be windowed to any location on the sensor. Beginning and ending rows and columns can be specified, allowing the window to be any size, in any location.

Image Data Flow

The following table shows the flow of data from the sensor, through the image processor and out of the camera module.

Function	Description	Settings / Options
Image data from the sensor	Raw data from the image sensor is input to the image processor	
Auto exposure	Adjusts image sensor gain and exposure time to meet target average pixel luminance	Enable/disable using the AF_CTRL1 register
Auto white balance	Equalizes average pixel luminance among color bands	
Auto flicker	Adjusts exposure time to eliminate flicker	
Statistics	Collects image statistics such as peak values, pixel sums and histograms on a one-to-many frame basis	Enable/disable using the statistics functions using the STAT_CAP_CNTL and STAT_MODE_CTRL registers
Pixel correction	Corrects pixel values for mismatched pixels	Enable/disable using the PROC_CTRL_V or PROC_CTRL_S registers
Demosaic	Converts raw Bayer pattern pixel data into red, green and blue image planes	Enable/disable using the PROC_CTRL_V or PROC_CTRL_S registers
Sharpening	Edges in the image are intensified	Enable/disable using the PROC_CTRL_V or PROC_CTRL_S registers
Sizer	Resizes the image	Enable/disable using the PROC_CTRL_V or PROC_CTRL_S registers. Select the input and output height and width using the SRZ_IN and SZR_OUT registers.
Color balance	Adjusts for color filter response of the image sensor	Use default or custom color correction matrices
Gamma correction	Applies a non-linear transfer function to the image data	Enable/disable selecting linear or bottom weighting using the PROC_CTRL_V or PROC_CTRL_S registers; use default or custom table
Halftone	Adds pseudo random noise to reduced bit depth images to eliminate banding	Enable/disable using the PROC_CTRL_V and PROC_CTRL_S registers
Color space conversion	Converts RGB data to the desired color space	Use default (RGB to YCbCr) or custom conversion matrices. Conversion to YCbCr prepares the data for down sampling.
Data packer	Determines the data output format	16 possible formats controlled by the OUTPUT_CTRL_V and OUTPUT_CTRL_S registers
Data output	Outputs using parallel, synchronous serial or CCIR	Several options

Electrical Specifications

Absolute maximum ratings

Parameter	Symbol	Minimum	Typical	Maximum	Units	Notes
Storage temperature	T_S	-40		85	°C	
Operating temperature	T_A	-25		70	°C	
Humidity	RH	5		95	%	Non-condensing
Supply voltage	V_{CC}	-0.5		3.3	V	
ESD				2	kV	All pins, human body model MIL 883 Method 3015
Input voltage	V_{IN}	-0.3		V_{CC} +0.3	V	All input pins

Recommended operating conditions

Parameter	Symbol	Minimum	Typical	Maximum	Units	Notes
Operating temperature	T_A	-25		70	°C	
V_{CC} voltage	V_{CC}	2.65	2.8	3.1	V	
V_{CC} rise time	V_{CC_RT}			50	ms	
V_{CC} supply noise	V_{CC_N}			50	mV	Vp-p within 0 - 1 MHz
External clock frequency Duty cycle	MCLK	4 45	13 50	26 55	MHz %	13 MHz needed for 15 frames/sec. CIF. Clock can be 4 MHz at 5 fps CIF
Serial control clock frequency	SCLK			400	kHz	

DC electrical specifications (typical values at 25°C, V_{CC} = 2.8 V)

Parameter	Symbol	Minimum	Typical	Maximum	Units	Notes
Supply current	I_{CC}		15		mA	At 13 MHz, 15 fps, CIF
All pins except SCLK and SDATA						
Input low voltage	V_{IL}			0.8	V	
Input high voltage	V_{IH}	2.0			V	
Output low voltage	V_{OL}	0		0.4	V	
Output high voltage	V_{OH}	2.2			V	
Input low current	I_{IL}	< - 10		< 10	µA	At 0.4 V
Input high current	I_{IH}	< - 10		< 10	µA	At 2.4 V

DC electrical specifications (typical values at 25°C, V_{CC} = 2.8 V) (continued)

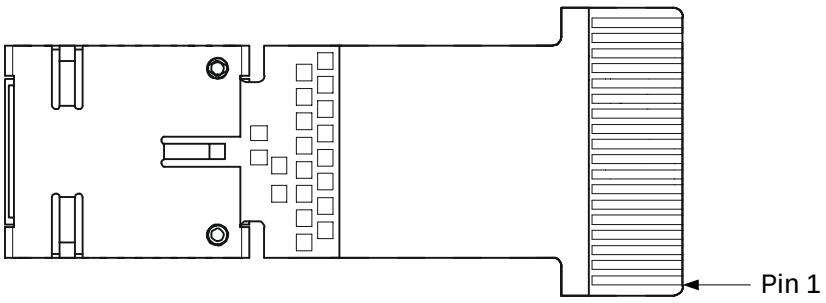
Parameter	Symbol	Minimum	Typical	Maximum	Units	Notes
SCLK and SDATA						
Input low voltage	V_{IL_S}			0.3 x V_{CC}	V	
Input high voltage	V_{IH_S}	0.7 xV_{CC}			V	
Output low voltage	V_{OL_S}	0		0.4	V	At 3 mA sink current
Output high voltage	V_{OH_S}			3.6	V	Output voltage depends on external pull-up resistor and V_{CC} value

AC Electrical Specifications (typical values at 25°C, V_{CC} = 2.8 V)

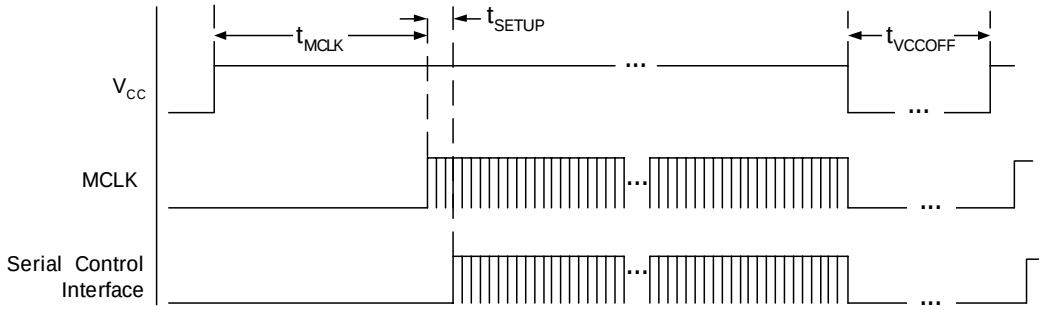
Parameter	Symbol	Minimum	Typical	Maximum	Units	Notes
Video clock frequency	V_{CLK}	4	13	26	MHz	User programmable
Frame rate				15	frame/s	User programmable
Data output (DATA_[7:0], VCLK, HSYNC, VSYNC)						
Rise time	t_{DR}	7			ns	V_{OH} = 2.4 V, 25 pF load
Fall time	t_{DF}	7			ns	V_{OH} = 2.4 V, 25 pF load
SCLK, SDATA						
Rise time	t_{DCR}				ns	Depends on external pull-up resistor, V_{CC} value, line capacitance
Fall time	t_{DCF}	20		250	ns	
Input pin capacitance			1.6		pF	

Pinout

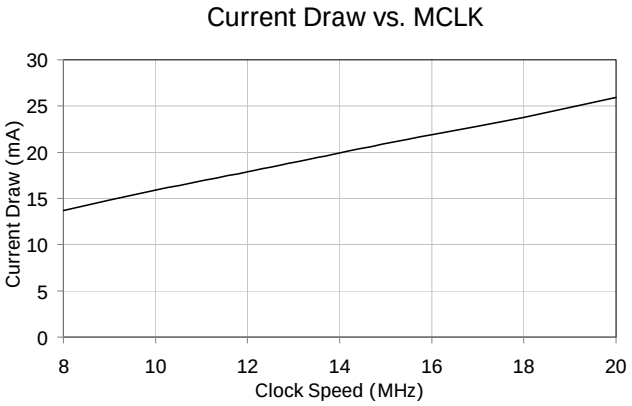
Location	Signal	Type	Description
1	GND	Common	Ground
2	MCLK	Input	Module clock
3	VSYNC	Output	Vertical synchronization
4	DATA0	Output	Parallel data 0
5	DATA1	Output	Parallel data 1
6	DATA2	Output	Parallel data 2
7	DATA3	Output	Parallel data 3
8	DATA4	Output	Parallel data 4
9	DATA5	Output	Parallel data 5
10	DATA6	Output	Parallel data 6
11	DATA7	Output	Parallel data 7
12	DSYNC	Output	Video clock / serial clock
13	HSYNC	Output	Horizontal synchronization
14	TEST	Output	Reserved
15	SCLK	Input	Serial control clock
16	SDATA	Input/output	Serial control data
17	V_{CC}	Input	Voltage input
18	GND	Common	Ground

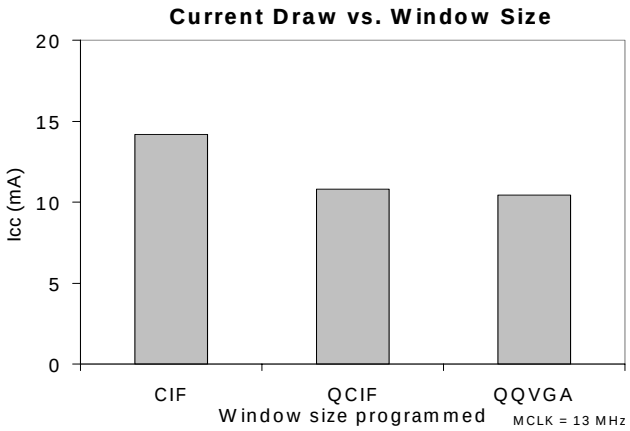


Power Up Timing

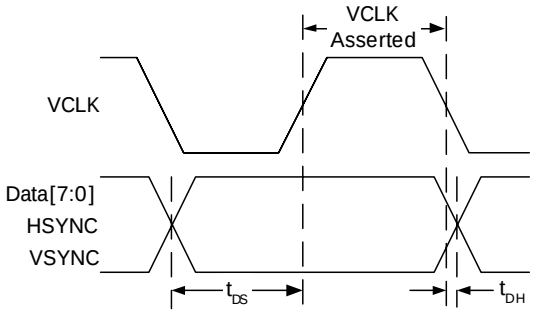


Parameter	Symbol	Minimum	Units
V_{CC} on to MCLK on	t_{M_CLK}	3	ms
MCLK on to first serial communication	t_{SETUP}	2048	MCLK cycles
Time from V_{CC} off to V_{CC} on	t_{VCCOFF}	600	ms

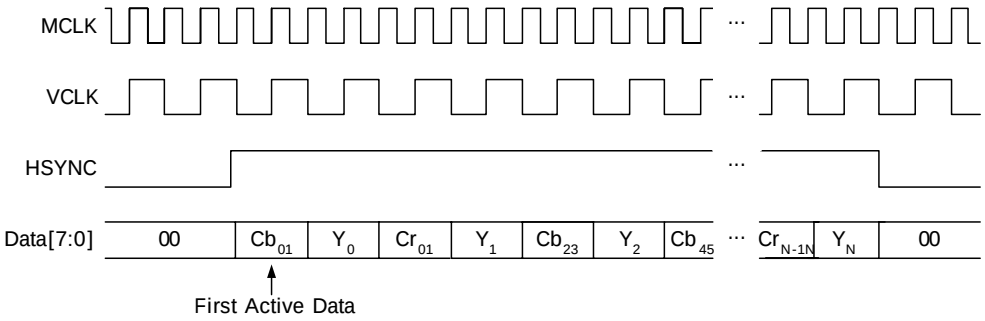




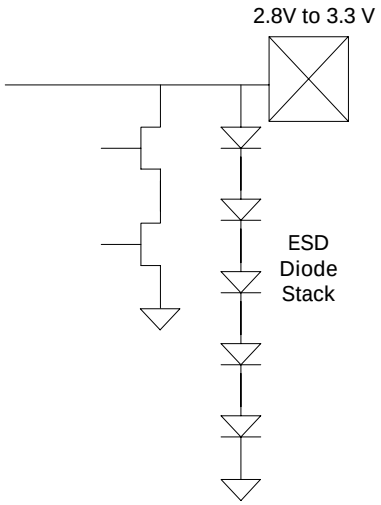
VCLK Timing



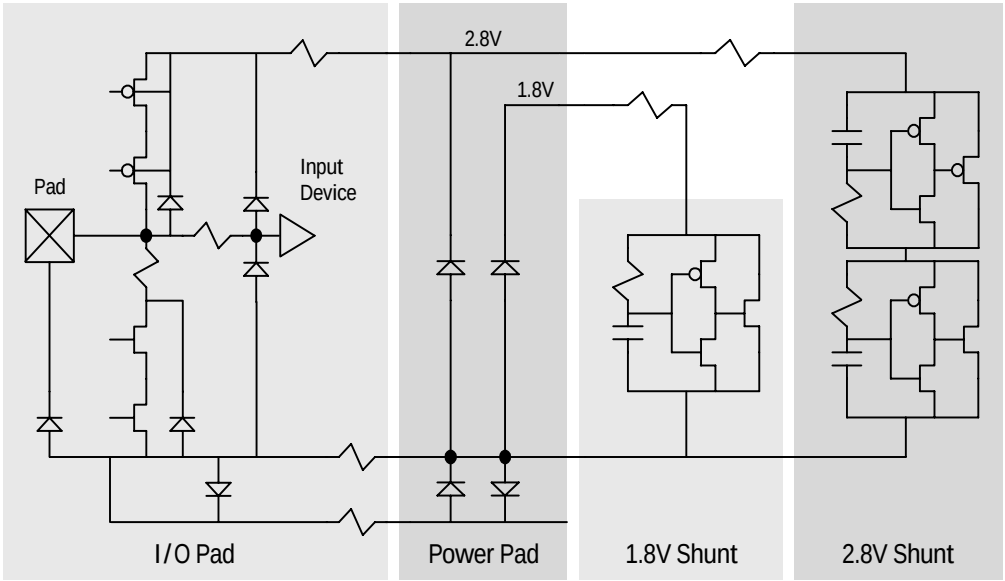
VSYNC, HSYNC Timing



Serial Control Pads Equivalent Circuits

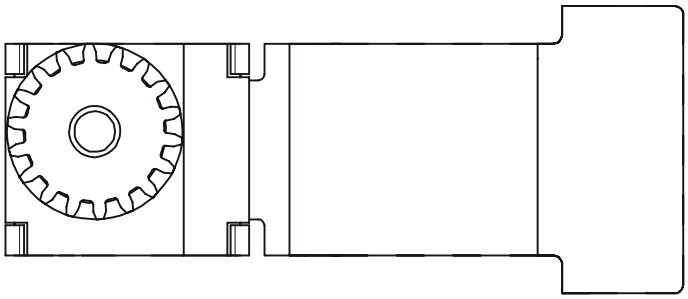


I/O Pad Equivalent Circuit



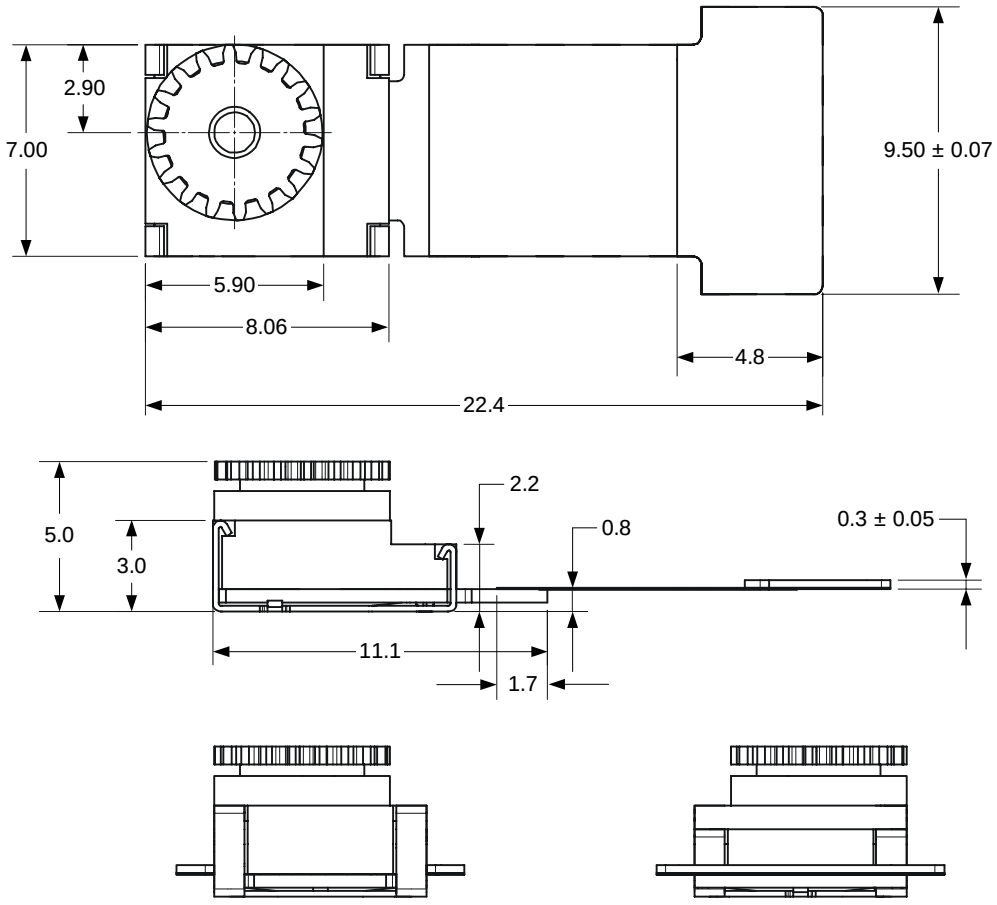
Camera Orientation

To take pictures “right side up”, orient the camera as shown below. The image can be electronically flipped horizontally, vertically or both.



Mechanical Drawings

The following illustration shows the ADCM-1700-0000. Dimensions and design are subject to change.



NOTE

The camera housing is not fully shielded for ambient light and can allow light leak from the sides and the back. The final application must shield the camera module on all 4 sides and the back from visible and infrared light (350 - 1100nm)

Programmable Registers

The ADCM-1700-0000 has programmable registers that control the image processor and the image sensor. See the ADCM-1700 Technical Reference Manual for details on usage and programming of the registers.

Programmable registers

Mnemonic	Description	Mnemonic	Description
ABL_MAX_BIN	Auto black level maximum bin	B_CR_MAX_MIN	Chrominance, Cr (or blue) maximum/minimum
ABL_MAX_BLACK	Auto black level maximum black	BIAS_TRM	Bias trim
ABL_TARGET	Auto black level target	BLUE_SUM	Blue pixel sum
ADC_CTRL	ADC control	BPA_BADPIX_CNT	BPA bad pixel count (read only)
AE_DOE_FACTOR	AE deliberate overexposure factor	BPA_D2_THRESH	BPA second derivative threshold
AE_DOE_MARGIN	AE deliberate overexposure margin	BPA_OUTL_PED	BPA outlier, pedestal
AE_ETIME_DFLT	Auto exposure time default	BPA_SF_GTHRESH	BPA scale factor, green filter threshold
AE_ETIME_MAX	Auto exposure time maximum	CC_COEF_00	Color correction coefficient 00
AE_ETIME_MIN	Auto exposure time minimum	CC_COEF_01	Color correction coefficient 01
AE_GAIN_DFLT	Auto exposure gain default	CC_COEF_02	Color correction coefficient 02
AE_GAIN_MAX	Auto exposure gain maximum	CC_COEF_10	Color correction coefficient 10
AE_GAIN_MIN	Auto exposure gain minimum	CC_COEF_11	Color correction coefficient 11
AE_GAIN_MIN_P	Auto exposure gain minimum, preferred	CC_COEF_12	Color correction coefficient 12
AE_MARGIN	Auto exposure margin	CC_COEF_20	Color correction coefficient 20
AE_TARGET	Auto exposure target	CC_COEF_21	Color correction coefficient 21
AE_TOL_ACQ	Auto exposure tolerance acquire	CC_COEF_22	Color correction coefficient 22
AE_TOL_MON	Auto exposure tolerance monitor	CC_POST_OS_0	Color correction post-offset 0
AF_CTRL1	Auto functions control 1	CC_POST_OS_1	Color correction post-offset 1
AF_CTRL2	Auto functions control 2	CC_POST_OS_2	Color correction post-offset 2
AF_STATUS	Auto functions status	CC_PRE_OS_0	Color correction pre-offset 0
APS_COEF_BLUE	Blue AWB gain	CC_PRE_OS_1	Color correction pre-offset 1
APS_COEF_GRN1	Green 1 AWB gain	CC_PRE_OS_2	Color correction pre-offset 2
APS_COEF_GRN2	Green 2 AWB gain	CCIR_TIMIG	CCIR interface timing
APS_COEF_RED	Red AWB gain	CCIR_TIMING2	CCIR interface timing 2
AWB_BLUE_DFLT	AWB default blue/green ratio	CCIR_TIMING3	CCIR interface timing 3
AWB_BLUE_MAX	AWB maximum blue/green ratio	CLK_DIV	Clock dividers for top level registers
AWB_BLUE_MIN	AWB minimum blue/green ratio	CLK_DIV_S	Clock divisors, still
AWB_RED_DFLT	AWB default red/green ratio	CLK_DIV_V	Clock divisors, video
AWB_RED_MAX	AWB maximum red/green ratio	CLK_FREQ	Input clock frequency
AWB_RED_MIN	AWB minimum red/green ratio	CLK_GATE_DIS	Clock gate disable

Programmable registers (continued)

Mnemonic	Description	Mnemonic	Description
AWB_TOL_ACQ	Auto white balance tolerance acquire	CLK_PIXEL	Clocks per pixel
AWB_TOL_MON	Auto white balance tolerance monitor	CMD_1	Main command 1
CMD_2	Main command 2 (write 1's only)	CSC_OS_2	Color space conversion offset 2
CONFIG_1	Image sensor configuration 1	CSC_OS0_S	Color space conversion offset 0, still
CONFIG_2	Image sensor configuration 2	CSC_OS1_S	Color space conversion offset 1, still
CONTROL	Camera control	CSC_OS2_S	Color space conversion offset 2, still
CONTROL_1	Image sensor control 1	CSC_OS0_V	Color space conversion offset 0, video
CPP_S	Clocks per pixel, still	CSC_OS1_V	Color space conversion offset 1, video
CPP_V	Clocks per pixel, video	CSC_OS2_V	Color space conversion offset 2, video
CSC_00_S	Color space conversion coefficient 00, still	CTL_CLK_DIV	Clock dividers for control and serial interfaces
CSC_01_S	Color space conversion coefficient 01, still	DATA_GEN	Test data generator
CSC_02_S	Color space conversion coefficient 02, still	EOF_CODES	End of frame codes
CSC_10_S	Color space conversion coefficient 10, still	EOF_CODES_W	Working copy of end of frame codes
CSC_11_S	Color space conversion coefficient 11, still	EREC_PGA	Even row, even column (green 1) PGA gain
CSC_12_S	Color space conversion coefficient 12, still	EROC_PGA	Even row, odd column (red) PGA gain
CSC_20_S	Color space conversion coefficient 20, still	ERROR	Error control
CSC_21_S	Color space conversion coefficient 21, still	EXP_ADJ	Exposure adjustment
CSC_22_S	Color space conversion coefficient 22, still	EXP_GR_E0	Exposure, ground reference edge 0
CSC_00_V	Color space conversion coefficient 00, video	EXP_GR_E1	Exposure, ground reference edge 1
CSC_01_V	Color space conversion coefficient 01, video	EXP_PRST_E0	Exposure, preset edge 1
CSC_02_V	Color space conversion coefficient 02, video	EXP_PRST_E1	Exposure, preset edge 1
CSC_10_V	Color space conversion coefficient 10, video	EXP_RST_E0	Exposure, reset edge 1
CSC_11_V	Color space conversion coefficient 11, video	EXP_RST_E1	Exposure, reset edge 1
CSC_12_V	Color space conversion coefficient 12, video	EXPOSURE	Exposure
CSC_20_V	Color space conversion coefficient 20, video	FIRMWARE_REV	Current firmware revision
CSC_21_V	Color space conversion coefficient 21, video	FLICK_CFG_1	Flicker configuration 1
CSC_22_V	Color space conversion coefficient 22, video	FLICK_CFG_2	Flicker configuration 2
CSC_COEF_00	Color space conversion coefficient 00	FRAME_RATE	Frame rate
CSC_COEF_01	Color space conversion coefficient 01	FWCOL	Window first column address
CSC_COEF_02	Color space conversion coefficient 02	FWROW	Window first row address
CSC_COEF_10	Color space conversion coefficient 10	G_CB_MAX_MIN	Chrominance, Cb (or green) maximum/minimum
CSC_COEF_11	Color space conversion coefficient 11	G1G2_DIAG_THRESH	Green 1 / green 2 diagonal threshold
CSC_COEF_12	Color space conversion coefficient 12	GR_POL	Ground reference polarity
CSC_COEF_20	Color space conversion coefficient 20	GREEN_1_SUM	Green 1 pixel sum
CSC_COEF_21	Color space conversion coefficient 21	GREEN_2_SUM	Green 2 pixel sum
CSC_COEF_22	Color space conversion coefficient 22	GRR_CTRL	Ground reset reference control

Programmable registers (continued)

Mnemonic	Description	Mnemonic	Description
CSC_OS_0	Color space conversion offset 0	HBLANK	Horizontal blanking period
CSC_OS_1	Color space conversion offset 1	HBLANK_S	Horizontal blanking period, still
HBLANK_V	Horizontal blanking period, video	NACC_EGP_3	Noise adaptive color correction, EGP 3
HSYNC_PER	Horizontal synchronization period	NACC_EGP_4	Noise adaptive color correction, EGP 4
HYSNC_PER_S	HSYNC period, still	NACC_EGP_5	Noise adaptive color correction, EGP 5
HYSNC_PER_V	HSYNC period, video	NACC_EGP_6	Noise adaptive color correction, EGP 6
I_HEIGHT	Current image height	NACC_EGP_7	Noise adaptive color correction, EGP 7
I_WIDTH	Current image width	NACC_EGP_8	Noise adaptive color correction, EGP 8
ICTRL	Interface control	NACC_SAT_1	Noise adaptive color correction, saturation 1
ID	Chip ID	NACC_SAT_2	Noise adaptive color correction, saturation 2
IDENT	Image sensor ID	NACC_SAT_3	Noise adaptive color correction, saturation 3
ILLUM	Illumination	NACC_SAT_4	Noise adaptive color correction, saturation 4
IP_CLK_DIV	Clock dividers for image processor	NACC_SAT_5	Noise adaptive color correction, saturation 5
LWCOL	Window last column address	NACC_SAT_6	Noise adaptive color correction, saturation 6
LWROW	Window last row address	NACC_SAT_7	Noise adaptive color correction, saturation 7
MAX_SCLK	Maximum sensor clock	NACC_SAT_8	Noise adaptive color correction, saturation 8
MIN_MAX_F_S	Frame convergence rates, still	OREC_PGA	Odd row, even column (blue) PGA gain
MIN_MAX_F_V	Frame convergence rates, video	OROC_PGA	Odd row, odd column (green 2) PGA gain
NACC_BC_00	NACC bright coefficients 00	OUT_CTRL	Output control, simple control register
NACC_BC_01	NACC bright coefficients 01	OUTPUT_CTRL	Output control
NACC_BC_02	NACC bright coefficients 02	OUTPUT_CTRL_S	Output control, still
NACC_BC_10	NACC bright coefficients 10	OUTPUT_CTRL_V	Output control, video
NACC_BC_11	NACC bright coefficients 11	OUTPUT_FORMAT	Output style
NACC_BC_12	NACC bright coefficients 12	PARALLEL_CTRL	Parallel output control
NACC_BC_20	NACC bright coefficients 20	PARALLEL_CTRL_S	Parallel output control, still
NACC_BC_21	NACC bright coefficients 21	PARALLEL_CTRL_V	Parallel output control, video
NACC_BC_22	NACC bright coefficients 22	PRESET_POL	Preset polarity enable
NACC_DC_00	NACC dark coefficients 00	PROC_CTRL_S	Processing control, still
NACC_DC_01	NACC dark coefficients 01	PROC_CTRL_V	Processing control, video
NACC_DC_02	NACC dark coefficients 02	PROCESS_CTRL	Processing control
NACC_DC_10	NACC dark coefficients 10	R_Y_MAX_MIN	Luminance, Y (or red) maximum/minimum
NACC_DC_11	NACC dark coefficients 11	RED_SUM	Red pixel sum
NACC_DC_12	NACC dark coefficients 12	RESET_POL	Reset polarity enable
NACC_DC_20	NACC dark coefficients 20	ROWEXP_H	Row exposure high
NACC_DC_21	NACC dark coefficients 21	ROWEXP_L	Row exposure low
NACC_DC_22	NACC dark coefficients 22	RPT_S	Row processing time, still

Programmable registers (continued)

Mnemonic	Description	Mnemonic	Description
NACC_EGP_1	Noise adaptive color correction, EGP 1	RPT_V	Row processing time, video
NACC_EGP_2	Noise adaptive color correction, EGP 2	SEN_CLK_DIV	Clock dividers for sensor
SEN_CTRL_S	Sensor control, still	TM_COEF_01_V	Tonemap coefficient 01, video
SEN_CTRL_V	Sensor control, video	TM_COEF_02_V	Tonemap coefficient 02, video
SER_ADDR	Serial interface device address	TM_COEF_03_V	Tonemap coefficient 03, video
SERIAL_CTRL	Serial control	TM_COEF_04_V	Tonemap coefficient 04, video
SER_PARM	Serial Interface parameters	TM_COEF_05_V	Tonemap coefficient 05, video
SIZE	Image size and orientation	TM_COEF_06_V	Tonemap coefficient 06, video
SMP_GR_E0	Sample ground reference edge 0	TM_COEF_07_V	Tonemap coefficient 07, video
SMP_GR_E1	Sample ground reference edge 1	TM_COEF_08_V	Tonemap coefficient 08, video
SMP_GR_E2	Sample ground reference edge 2	TM_COEF_09_V	Tonemap coefficient 09, video
SMP_PRST_E0	Sample, preset edge 0	TM_COEF_10_V	Tonemap coefficient 10, video
SMP_PRST_E1	Sample, preset edge 1	TM_COEF_11_V	Tonemap coefficient 11, video
SMP_PRST_E2	Sample, preset edge 2	TM_COEF_12_V	Tonemap coefficient 12, video
SMP_RST_E0	Sample, reset edge 0	TM_COEF_13_V	Tonemap coefficient 13, video
SMP_RST_E1	Sample, reset edge 1	TM_COEF_14_V	Tonemap coefficient 14, video
SMP_RST_E2	Sample, reset edge 2	TM_COEF_15_V	Tonemap coefficient 15, video
SOF_CODES	Start of frame codes	TM_COEF_16_V	Tonemap coefficient 16, video
SOF_CODE_W	Start of frame codes working copy	TM_COEF_17_V	Tonemap coefficient 17, video
SROWEXP	Sub row exposure	TM_COEF_18_V	Tonemap coefficient 18, video
STAT_CAP_CTRL	Image statistics capture control	TM_COEF_19_V	Tonemap coefficient 19, video
STAT_MODE_CTRL	Image statistics mode control	TM_COEF_20_V	Tonemap coefficient 20, video
STATUS	Camera status	TM_COEF_21_V	Tonemap coefficient 21, video
STATUS	Image sensor status	TM_COEF_22_V	Tonemap coefficient 22, video
STATUS_FLAGS	Status flags (read only)	TM_COEF_23_V	Tonemap coefficient 23, video
SZR_IN_H	Sizer input height	TM_COEF_24_V	Tonemap coefficient 24, video
SZR_IN_HGT_S	Sizer input height, still	TM_COEF_25_V	Tonemap coefficient 25, video
SZR_IN_HGT_V	Sizer input height, video	TM_COEF_26_V	Tonemap coefficient 26, video
SZR_IN_W	Sizer input width	TM_COEF_27_V	Tonemap coefficient 27, video
SZR_IN_WID_S	Sizer input width, still	TM_COEF_28_V	Tonemap coefficient 28, video
SZR_IN_WID_V	Sizer input width, video	TM_COEF_29_V	Tonemap coefficient 29, video
SZR_OUT_H	Sizer output height	TM_COEF_30_V	Tonemap coefficient 30, video
SZR_OUT_HGT_S	Sizer output height, still	TM_COEF_31_V	Tonemap coefficient 31, video
SZR_OUT_HGT_V	Sizer output height, video	TM_COEF_32_V	Tonemap coefficient 32, video
SZR_OUT_W	Sizer output width	TM_COEF_00_S	Tonemap coefficient 00, still
SZR_OUT_WID_S	Sizer output width, still	TM_COEF_01_S	Tonemap coefficient 01, still

Programmable registers (continued)

Mnemonic	Description	Mnemonic	Description
SZR_OUT_WID_V	Sizer output width, video	TM_COEF_02_S	Tonemap coefficient 02, still
TM_COEF_00_V	Tonemap coefficient 00, video	TM_COEF_03_S	Tonemap coefficient 03, still
TM_COEF_04_S	Tonemap coefficient 04, still	TM_COEF_21_S	Tonemap coefficient 21, still
TM_COEF_05_S	Tonemap coefficient 05, still	TM_COEF_22_S	Tonemap coefficient 22, still
TM_COEF_06_S	Tonemap coefficient 06, still	TM_COEF_23_S	Tonemap coefficient 23, still
TM_COEF_07_S	Tonemap coefficient 07, still	TM_COEF_24_S	Tonemap coefficient 24, still
TM_COEF_08_S	Tonemap coefficient 08, still	TM_COEF_25_S	Tonemap coefficient 25, still
TM_COEF_09_S	Tonemap coefficient 09, still	TM_COEF_26_S	Tonemap coefficient 26, still
TM_COEF_10_S	Tonemap coefficient 10, still	TM_COEF_27_S	Tonemap coefficient 27, still
TM_COEF_11_S	Tonemap coefficient 11, still	TM_COEF_28_S	Tonemap coefficient 28, still
TM_COEF_12_S	Tonemap coefficient 12, still	TM_COEF_29_S	Tonemap coefficient 29, still
TM_COEF_13_S	Tonemap coefficient 13, still	TM_COEF_30_S	Tonemap coefficient 30, still
TM_COEF_14_S	Tonemap coefficient 14, still	TM_COEF_31_S	Tonemap coefficient 31, still
TM_COEF_15_S	Tonemap coefficient 15, still	TM_COEF_32_S	Tonemap coefficient 32, still
TM_COEF_16_S	Tonemap coefficient 16, still	TST_MODE	Latched test mode
TM_COEF_17_S	Tonemap coefficient 17, still	VBLANK	Vertical blanking period
TM_COEF_18_S	Tonemap coefficient 18, still	VBLANK_S	Vertical blanking period, still
TM_COEF_19_S	Tonemap coefficient 19, still	VBLANK_V	Vertical blanking period, video
TM_COEF_20_S	Tonemap coefficient 20, still		

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Data subject to change.

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