CMOS MT9F002 Camera Module

1/2.3-Inch 14MP Color Module Datasheet

Rev 1.0, Mar 2017

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1 Introduction

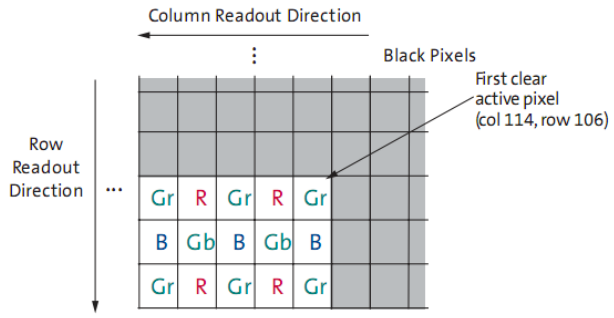
The MT9F002 camera module features Aptina's breakthrough low-noise CMOS imaging technology that achieves near-CCD image quality (based on signal-to-noise ratio and low-light sensitivity) while maintaining the inherent size, cost, and integration advantages of CMOS.

When operated in its default 4:3 still-mode, the sensor generates a full resolution (4384x3288)image at 6.5 frames per second (fps) using the Parallel interface. An on-chip analog-to-digital converter (ADC) generates a 12-bit value for each pixel.

The MT9F002 is a progressive-scan sensor that generates a stream of pixel data at a constant frame rate. It uses an on-chip, phase-locked loop (PLL) to generate all internal clocks from a single master input clock running between 2 and 64 MHz. The maximum output pixel rate is 96 Mp/s for parallel I/F, corresponding to a pixel clock rate of 96 MHz. It incorporates sophisticated on-chip camera functions such as windowing, mirroring, binning and skip modes, and snapshot mode. It is programmable through a simple two-wire serial interface and has very low power consumption.

The camera uses a Bayer color pattern, as shown in the following figure. The even-numbered rows contain green and red pixels; odd-numbered rows contain blue and green pixels. Even-numbered columns contain green and blue pixels; odd-numbered columns contain red and green pixels.

Pixel Color Pattern Detail (Top Right Corner)



The output resolution frame rate and FOV are listed below:

Common Parallel Readout Modes

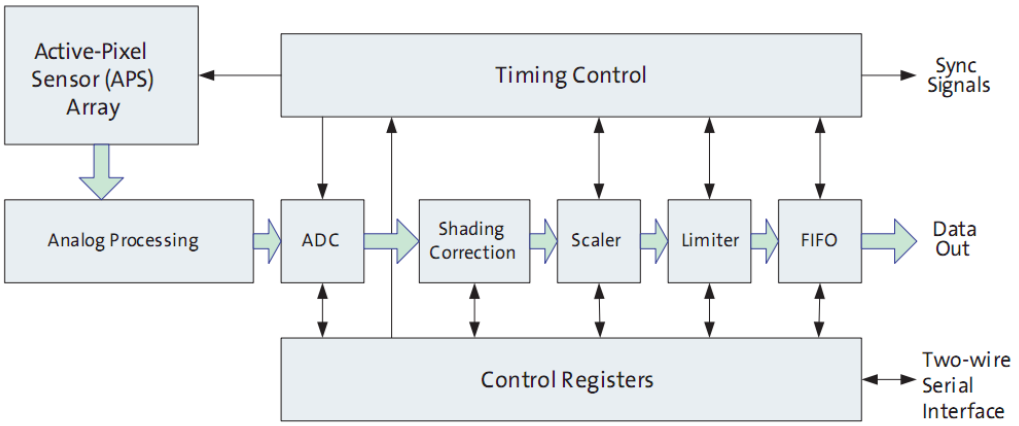
No	Working Mode Name	Aspect Ratio	Original Size H	Original Size V	FOV H [%]	FOV V [%]	Output Resolution H [pixel]	Output Resolution V [pixel]	Frame Rate (FPS)	Bit Depth	Sub-sampling H	Sub-sampling V	Power Mode Context
1	14.1 Mp Full resolution	4:3	4384	3288	100	100	4384	3288	6	12	None	None	1
2	HD 1080p + 17% EIS (2.8 Mp) at 30 fps	16:9	4456	2508	100	100	2228	1254	30	10	Bin2	Bin2	1
3	EVF1 Preview VGA Low-power (1 Mp) at 30 fps	4:3	4384	3288	100	100	1096	822	30	10	Skip2Bin2	Bin4	2

2 Features

Parameter		Value
Optical format		1/2.3-inch (4:3)
Active pixels and imager size		• 4608H x 3288V: (entire array): 6.451mm (H) x 4.603mm (V), 7.925mm diagonal • 4384H x 3288V (4:3, still mode): 6.138mm (H) x 4.603mm (V), 7.672mm diagonal • 4608H x 2592V (16:9, video mode): 6.451mm (H) x 3.629mm (V), 7.402mm diagonal
Pixel size		1.4 µm x 1.4µm
Chief ray angle		0°, 11.4°, and 25°
Color filter array		RGB Bayer pattern
Shutter type		Electronic rolling shutter (ERS) with global reset release (GRR)
Input clock frequency		2–64 MHz
Maximum data rate	Parallel	96 Mp/s at 96 MHz PIXCLK
	HiSPi (4-lane)	700 Mbps/lane

Parameter		Value
Frame rate	14M resolution (4384H x 3288V)	Programmable up to 13.7 fps for HiSPi I/F, 6.3 fps for parallel I/F
	Preview VGA mode	• 30 fps with binning • 60 fps with skip2bin2
	1080p mode:	• 60 fps using HiSPi interface 2304H x 1296V (1080p +20%EIS) • 30 fps using parallel interface 2256H x 1268V (1080p +17%EIS)
ADC resolution		12-bit, on-chip
Responsivity		0.724 V/lux-sec (550nm)
Dynamic range		65.3dB
SNR_{MAX}		35.5dB
Operating temperature		–30°C to +70°C (at junction)
Power Consumption	Full resolution 13.65 fps(HiSPi serial I/F, 12-bit)	720 mW
	1080p60 (HiSPi serial I/F, 10-bit)	XYbin2: 600mW
	1080p30 (HiSPi serial I/F, 10-bit)	XYbin2: 420mW

3 Block Diagram



4 Application

- Digital video cameras
- Digital still cameras
- Industrial camera
- Medical camera
- Microscopy camera
- UAV camera

5 Pin Definition

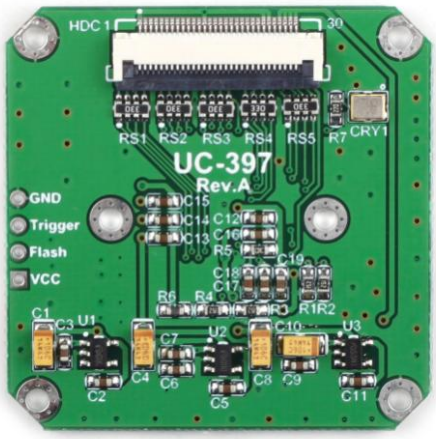
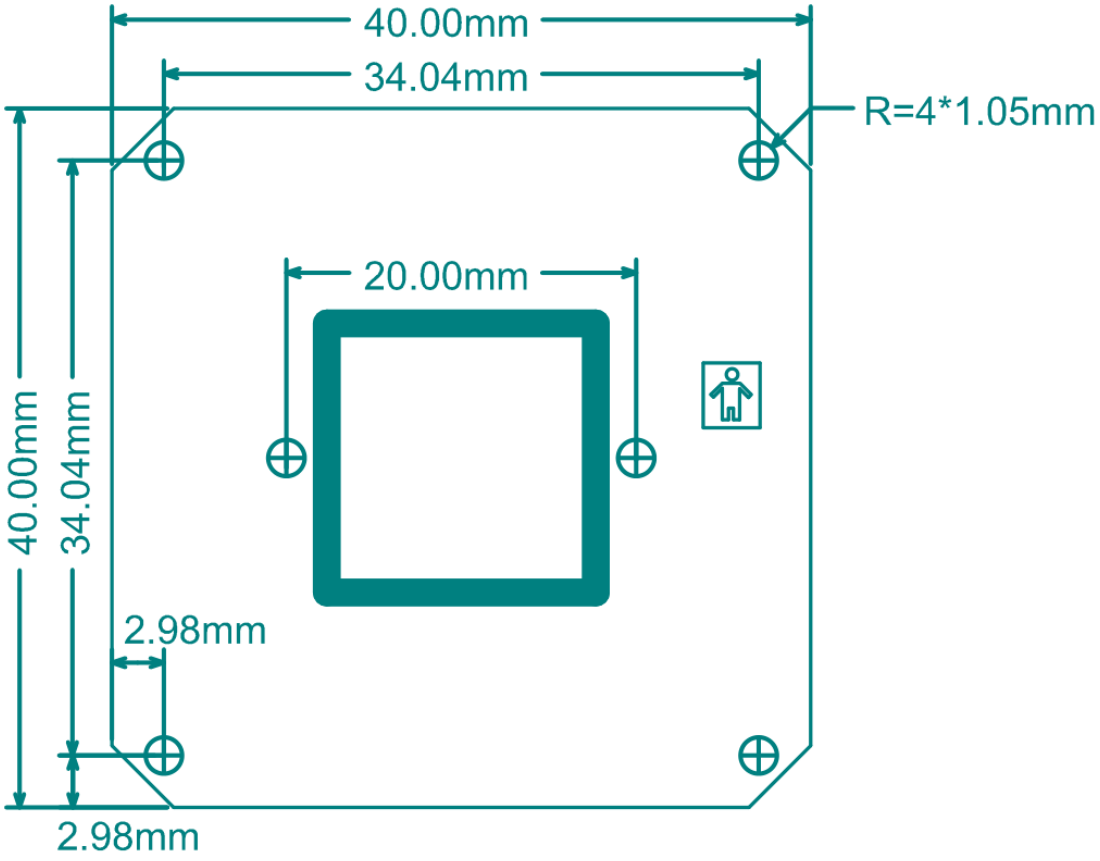


Table 1 HDC1 Connector Pin Definition

Pin No.	PIN NAME	TYPE	DESCRIPTION
1	GND	Ground	Power ground
2	FLASH	Output	Flash output control
3	Trigger	Input	Exposure synchronization input
4	VSYNC	Output	Active High: Frame Valid; indicates active frame
5	HREF	Output	Active High: Line/Data Valid; indicates active pixels
6	DOUT11	Output	Pixel Data Output 11 (MSB)
7	DOUT10	Output	Pixel Data Output 10
8	DOUT9	Output	Pixel Data Output 9
9	DOUT8	Output	Pixel Data Output 8
10	DOUT7	Output	Pixel Data Output 7
11	DOUT6	Output	Pixel Data Output 6
12	DOUT5	Output	Pixel Data Output 5
13	GND	Ground	Power ground
14	DOUT4	Output	Pixel Data Output 4
15	DOUT3	Output	Pixel Data Output 3
16	DOUT2	Output	Pixel Data Output 2
17	DOUT1	Output	Pixel Data Output 1
18	DOUT0	Output	Pixel Data Output 0(LSB)
19	XCLK	Input	Master Clock into Sensor
20	PCLK	Output	Pixel Clock output from sensor
21	SCL	Input	Two-Wire Serial Interface Clock
22	SDATA	Bi-directional	Two-Wire Serial Interface Data I/O
23	RST	Input	Sensor reset signal, active low
24	GND	Ground	Power ground
25	GND	Ground	Power ground
26	STANDBY	Input	Standby-mode enable pin (active HIGH)
27~30	VCC	POWER	3.3v Power supply

6 Mechanical Dimension



7 Lens Options

The camera board shipped with default LS-18023M12, optional CS mount lens LS-18023CS is also available. Lens specification list as follows. Please contact us admin@arducam.com for more lens options or visit www.arducam.com/downloads/Lenses/.