ArduCam

CMOS OV5640D AF Camera Module
1/4-Inch 5-Megapixel Module Datasheet

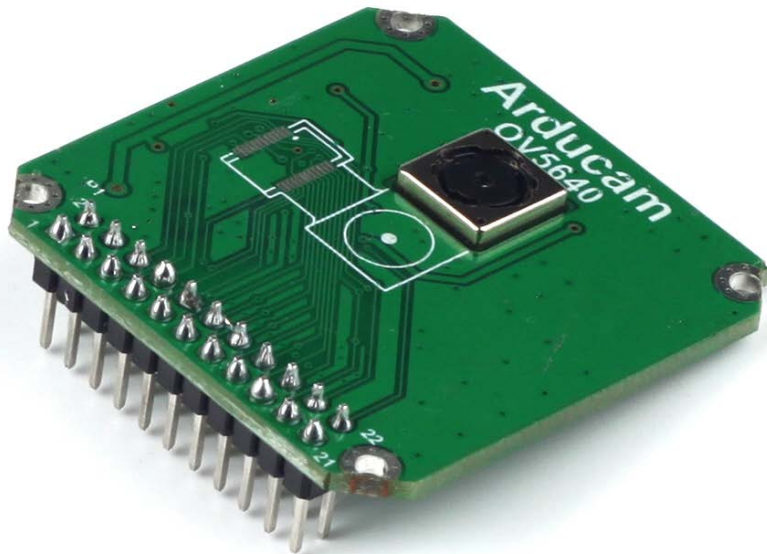Rev 1.0, Nov 2017

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1 Introduction

ArduCAM now released a new 5MegaPixel AutoFocus CMOS camera module with JPEG output. The camera module is based on Omnivision OV5640 image sensor and can be used with ArduCAM shields and other platforms like Freescale i.MX6 develop board.

The OV5640 (color) image sensor is a low voltage, high-performance, 1/4-inch 5 megapixel CMOS image sensor that provides the full functionality of a single chip 5 megapixel (2592x1944) camera using OmniBSI™ technology in a small footprint package. It provides full-frame, sub-sampled, windowed or arbitrarily scaled 8-bit/10-bit images in various formats via the control of the Serial Camera Control Bus (SCCB) interface.

The OV5640 has an image array capable of operating at up to 15 frames per second (fps) in 5 megapixel resolution with complete user control over image quality, formatting and output data transfer. All required image processing functions, including exposure control, gamma, white balance, color saturation, hue control, defective pixel canceling, noise canceling, etc., are programmable through the SCCB interface or embedded microcontroller. The OV5640 also includes a compression engine for increased processing power. In addition, Omnivision image sensors use proprietary sensor technology to improve image quality by reducing or eliminating common lighting/electrical sources of image contamination, such as fixed pattern noise, smearing, etc., to produce a clean, fully stable, color image.

2 Features

- 1.4 µm x 1.4 µm pixel with OmniBSI technology for high performance (high sensitivity, low crosstalk, low noise, improved quantum efficiency)
- optical size of 1/4"
- automatic image control functions: automatic exposure control (AEC), automatic white balance (AWB), automatic band filter (ABF), automatic 50/60 Hz luminance detection, and automatic black level calibration (ABLC)
- programmable controls for frame rate, AEC/AGC 16-zone size/position/weight control, mirror and flip, cropping, windowing, and panning
- image quality controls: color saturation, hue, gamma, sharpness (edge enhancement), lens correction, defective pixel canceling, and noise canceling
- support for output formats: RAW RGB, RGB565/555/444, CCIR656, YUV422/420, YCbCr422, and compression
- support for video or snapshot operations
- support for LED and flash strobe mode
- support for internal and external frame synchronization for frame exposure mode

- support for horizontal and vertical sub-sampling, binning
- support for minimizing artifacts on binned image
- support for data compression output
- support for anti-shake
- standard serial SCCB interface
- digital video port (DVP) parallel output interface and dual lane MIPI output interface
- embedded 1.5V regulator for core power
- programmable I/O drive capability, I/O tri-state configurability
- support for black sun cancellation
- support for images sizes: 5 megapixel, and any arbitrary size scaling down from 5 megapixel
- support for auto focus control (AFC) with embedded AF VCM driver
- embedded microcontroller
- suitable for module size of 8.5 x 8.5 x <6mm with both CSP and RW packaging

3 Key Specifications

- **active array size:** 2592 x 1944
- **power supply:**
  core: 1.5V ± 5% (with embedded 1.5V regulator)
  analog: 2.6 ~ 3.0V (2.8V typical)
  I/O: 1.8V / 2.8V
- **power requirements:**
  active: TBD
  standby: TBD
- **temperature range:**
  operating: -30°C to 70°C (see **table 8-1**)
  stable image: 0°C to 50°C (see **table 8-1**)
- **output formats:** 8-/10-bit RGB RAW output
- **lens size:** 1/4"
- **lens chief ray angle:** 24° (see **figure 10-2**)
- **input clock frequency:** 6~27 MHz
- **S/N ratio:** TBD
- **dynamic range:** TBD

- **maximum image transfer rate:**
  QSXGA (2592x1944): 15 fps
  1080p: 30 fps
  1280x960: 45 fps
  720p: 60 fps
  VGA (640x480): 90 fps
  QVGA (320x240): 120 fps
- **sensitivity:** TBD
- **shutter:** rolling shutter / frame exposure
- **maximum exposure interval:** 1964 x t_{ROW}
- **pixel size:** 1.4 µm x 1.4 µm
- **well capacity:** TBD
- **dark current:** TBD
- **fixed pattern noise (FPN):** TBD
- **image area:** 3673.6 µm x 2738.4 µm
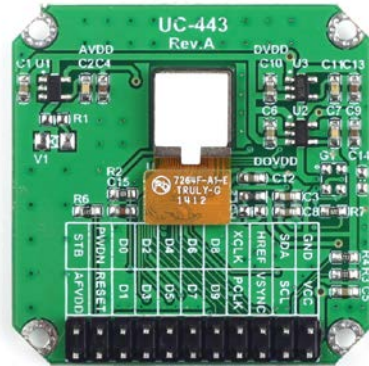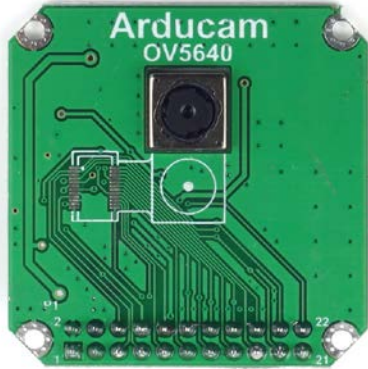- **package dimensions:** 5985 µm x 5835 µm

4 Block Diagram
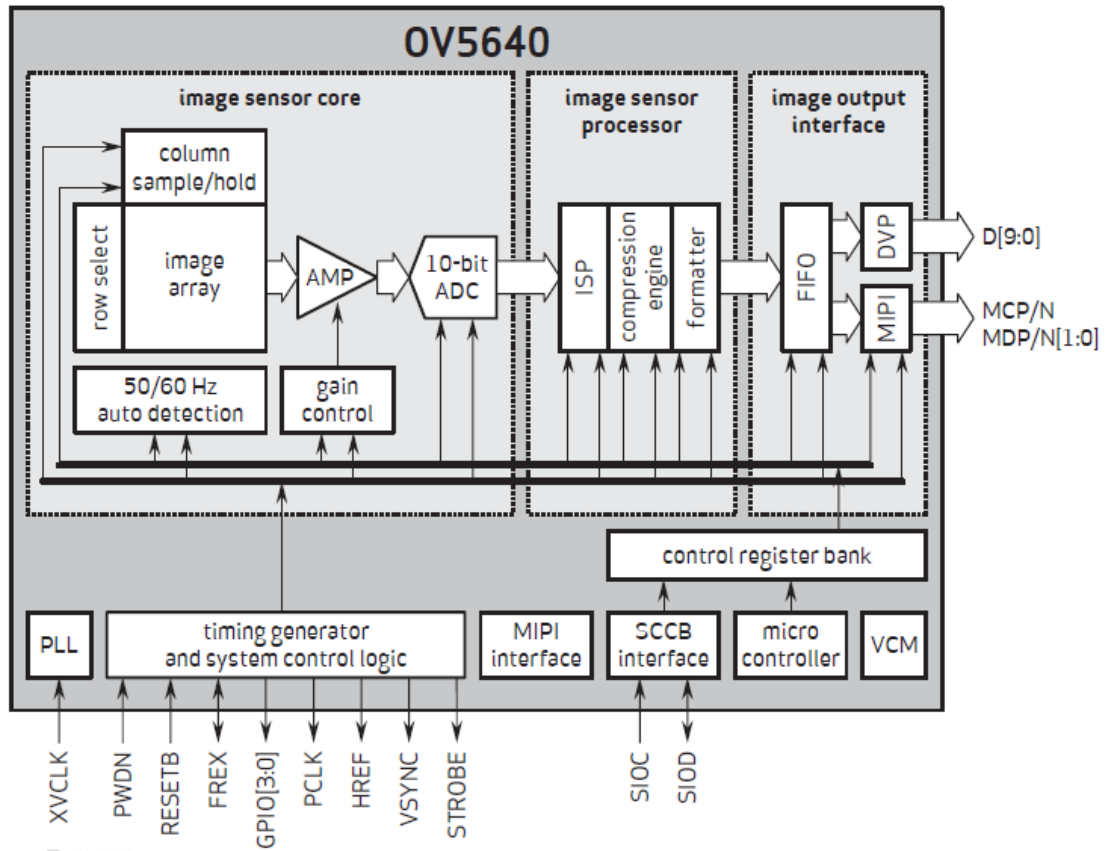
5 Application

➢ Cellular phones
➢ PDAs
➢ Toys
➢ Other battery-powered products
➢ ARM based platforms

6 Product Pictures

7 Pin Definition

The OV5640 module uses standard ArduCAM camera pin out. And the OV5640 support both DVP (parallel) and MIPI interface with some shared pins. User can configure the module with different interface mode and pin out definition is list as follows.

DVP interface

Pin No.	PIN NAME	TYPE	DESCRIPTION
1	VCC	POWER	3.3v Power supply
2	GND	Ground	Power ground
3	SCL	Input	Two-Wire Serial Interface Clock
4	SDATA	Bi-directional	Two-Wire Serial Interface Data I/O
5	VSYNC	Output	Active High: Frame Valid; indicates active frame
6	HREF	Output	Active High: Line/Data Valid; indicates active pixels
7	PCLK	Output	Pixel Clock output from sensor
8	XCLK	Input	Master Clock into Sensor
9	DOUT9	Output	Pixel Data Output 9 (MSB)
10	DOUT8	Output	Pixel Data Output 8
11	DOUT7	Output	Pixel Data Output 7
12	DOUT6	Output	Pixel Data Output 6
13	DOUT5	Output	Pixel Data Output 5
14	DOUT4	Output	Pixel Data Output 4
15	DOUT3	Output	Pixel Data Output 3
16	DOUT2	Output	Pixel Data Output 2 (LSB)
17	DOUT1	Output	Pixel Data Output 1 (10bit mode)
18	DOUT0	Output	Pixel Data Output 0 (10bit mode)
19	RESET	Input	Sensor reset signal, active low
20	PWDN	Input	Power down input, active high
21	AFVDD	POWER	Power for VCM 2.8~3.3V
22	STB	Output	Strobe output

MIPI interface

Pin No.	PIN NAME	TYPE	DESCRIPTION
1	VCC	POWER	3.3v Power supply
2	GND	Ground	Power ground
3	SCL	Input	Two-Wire Serial Interface Clock
4	SDATA	Bi-directional	Two-Wire Serial Interface Data I/O
5	VSYNC	Output	NA
6	HREF	Output	NA
7	PCLK	Output	NA
8	XCLK	Input	Master Clock into Sensor
9	DOUT9	Output	MIPI port MDP1
10	DOUT8	Output	MIPI port MDN1
11	DOUT7	Output	MIPI port MCP

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12	D_{OUT}6	Output	MIPI port MCN
13	D_{OUT}5	Output	MIPI port MDP0
14	D_{OUT}4	Output	MIPI port MDN0
15	D_{OUT}3	Output	NA
16	D_{OUT}2	Output	NA
17	D_{OUT}1	Output	NA
18	D_{OUT}0	Output	NA
19	RESET	Input	Sensor reset signal, active low
20	PWDN	Input	Power down input, active high
21	AFVDD	POWER	Power for VCM 2.8~3.3V
22	STB	Output	Strobe output

8 Mechanical Dimension