



# CMOS OV7670 Camera Module

## 1/6-Inch 0.3-Megapixel Module Datasheet

Rev 3.0, May 2015

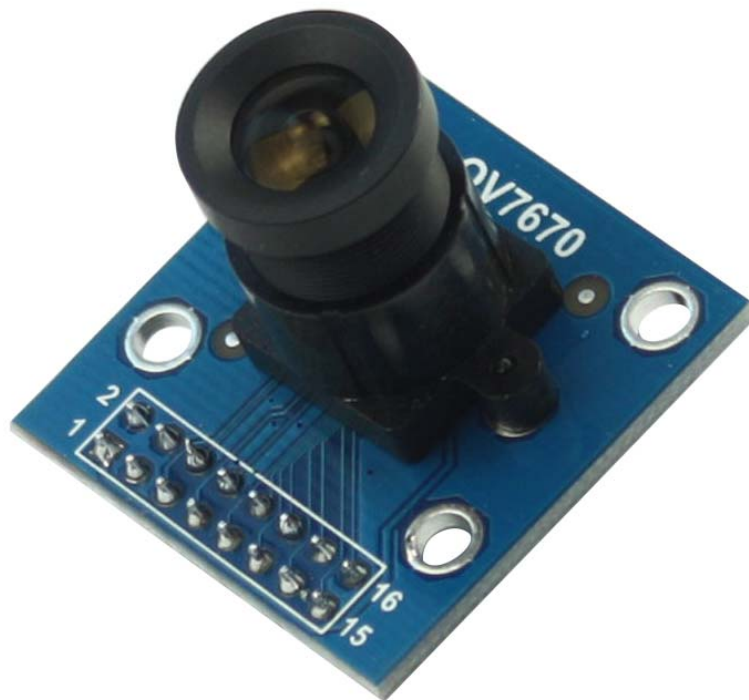
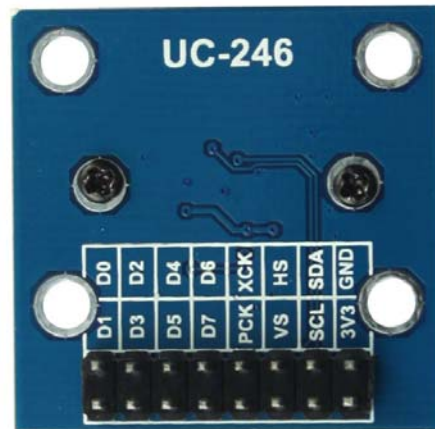


Table of Contents

|          |                                   |          |
|----------|-----------------------------------|----------|
| <b>1</b> | <b>Introduction</b> .....         | <b>2</b> |
| <b>2</b> | <b>Features</b> .....             | <b>3</b> |
| <b>3</b> | <b>Key Specifications</b> .....   | <b>4</b> |
| <b>4</b> | <b>Application</b> .....          | <b>4</b> |
| <b>5</b> | <b>Pin Definition</b> .....       | <b>6</b> |
| <b>6</b> | <b>Mechanical Dimension</b> ..... | <b>7</b> |

# 1 Introduction

The OV7670/OV7171 CAMERACHIPTM is a low voltage CMOS image sensor that provides the full functionality of a single-chip VGA camera and image processor in a small footprint package. The OV7670/OV7171 provides full-frame, sub-sampled or windowed 8-bit images in a wide range of formats, controlled through the Serial Camera Control Bus (SCCB) interface. This product has an image array capable of operating at up to 30 frames per second (fps) in VGA 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 and more, are also programmable through the SCCB interface. In addition, OmniVision CAMERACHIPs use proprietary sensor technology to improve image quality by reducing or eliminating common lighting/electrical sources of image contamination, such as fixed pattern noise (FPN), smearing, blooming, etc., to produce a clean, fully stable color image.



## 2 Features

- Optical size 1/6 inch
- Resolution 640x480 VGA
- Onboard regulator, only single 3.3V supply needed
- Standard 0.1inch (2.54mm) pin pitch header connector
- Mounted with high quality F1.8 / 6mm lens
- Output support for Raw RGB, RGB (GRB 4:2:2, RGB565/555/444), YUV (4:2:2) and YCbCr (4:2:2) formats
- High sensitivity for low-light operation
- Low operating voltage for embedded portable apps
- Standard SCCB interface compatible with I2C interface
- Supports image sizes: VGA, CIF, and any size scaling down from CIF to 40x30
- VarioPixel® method for sub-sampling
- Automatic image control functions including: Automatic
- Exposure Control (AEC), Automatic Gain Control (AGC), Automatic White Balance (AWB), Automatic
- Band Filter (ABF), and Automatic Black-Level Calibration (ABLC)
- Image quality controls including color saturation, hue, gamma, sharpness (edge enhancement), and anti-blooming
- ISP includes noise reduction and defect correction
- Supports LED and flash strobe mode
- Supports scaling
- Lens shading correction
- Flicker (50/60 Hz) auto detection
- Saturation level auto adjust (UV adjust)
- Edge enhancement level auto adjust
- De-noise level auto adjust

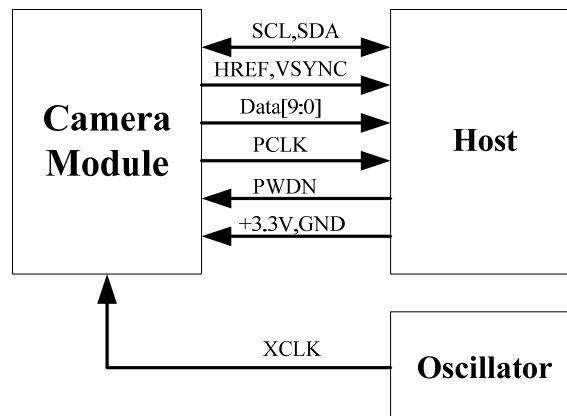
### 3 Key Specifications

|                                    |                     |  |
|------------------------------------|---------------------|--|
| <b>Active Array Size</b>           |                     | 640 x 480  |
| <b>Power Supply</b>                | <b>Digital Core</b> | 1.8VDC ±10%  |
|                                    | <b>Analog</b>       | 2.45V to 3.0V  |
|                                    | <b>I/O</b>          | 1.7V to 3.0V <sup>d</sup>  |
| <b>Power Requirements</b>          | <b>Active</b>       | 60 mW typical<br>(15fps VGA YUV format)  |
|                                    | <b>Standby</b>      | < 20 µA  |
| <b>Temperature Range</b>           | <b>Operation</b>    | -30°C to 70°C  |
|                                    | <b>Stable Image</b> | 0°C to 50°C  |
| <b>Output Formats (8-bit)</b>      |                     | <ul style="list-style-type: none"> <li>• YUV/YCbCr 4:2:2</li> <li>• RGB565/555/444</li> <li>• GRB 4:2:2</li> <li>• Raw RGB Data</li> </ul> |
| <b>Lens Size</b>                   |                     | 1/6"   |
| <b>Chief Ray Angle</b>             |                     | 25°  |
| <b>Maximum Image Transfer Rate</b> |                     | 30 fps for VGA   |
| <b>Sensitivity</b>                 |                     | 1.3 V/(Lux • sec)  |
| <b>S/N Ratio</b>                   |                     | 46 dB  |
| <b>Dynamic Range</b>               |                     | 52 dB  |
| <b>Scan Mode</b>                   |                     | Progressive  |
| <b>Electronics Exposure</b>        |                     | Up to 510:1 (for selected fps)   |
| <b>Pixel Size</b>                  |                     | 3.6 µm x 3.6 µm  |
| <b>Dark Current</b>                |                     | 12 mV/s at 60°C  |
| <b>Well Capacity</b>               |                     | 17 K e   |
| <b>Image Area</b>                  |                     | 2.36 mm x 1.76 mm  |
| <b>Package Dimensions</b>          |                     | 3785 µm x 4235 µm  |

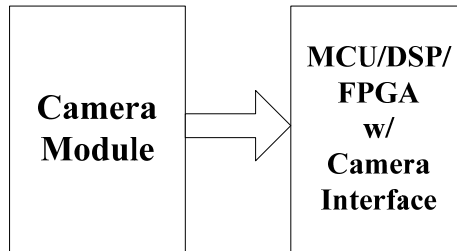
### 4 Application

- Cellular phones
- PDAs
- Toys
- Other battery-powered products
- Can be used in Arduino, Maple, ChipKit, STM32, ARM, DSP, FPGA platforms

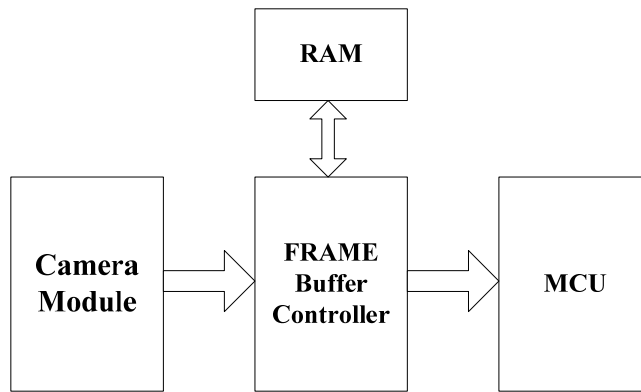
The following schematic diagram show a basic camera based system. The camera module is powered from a single +3.3V power supply. An external oscillator provide the clock source for camera module XCLK pin. With proper configuration to the camera internal registers via I2C bus, then the camera supply pixel clock (PCLK) and camera data (Data[9:0]) back to the host with synchronize signal like HREF and VSYNC.



The host may have integrate camera interface like STM32F2 or STM32F4 series MCUs, or ARM9/11 which has dedicate camera port, and DPS like TI TMS320DM series, as well as FPGAs that user can design special logic for camera application. The typical connection between these system and camera module would show like following diagram.



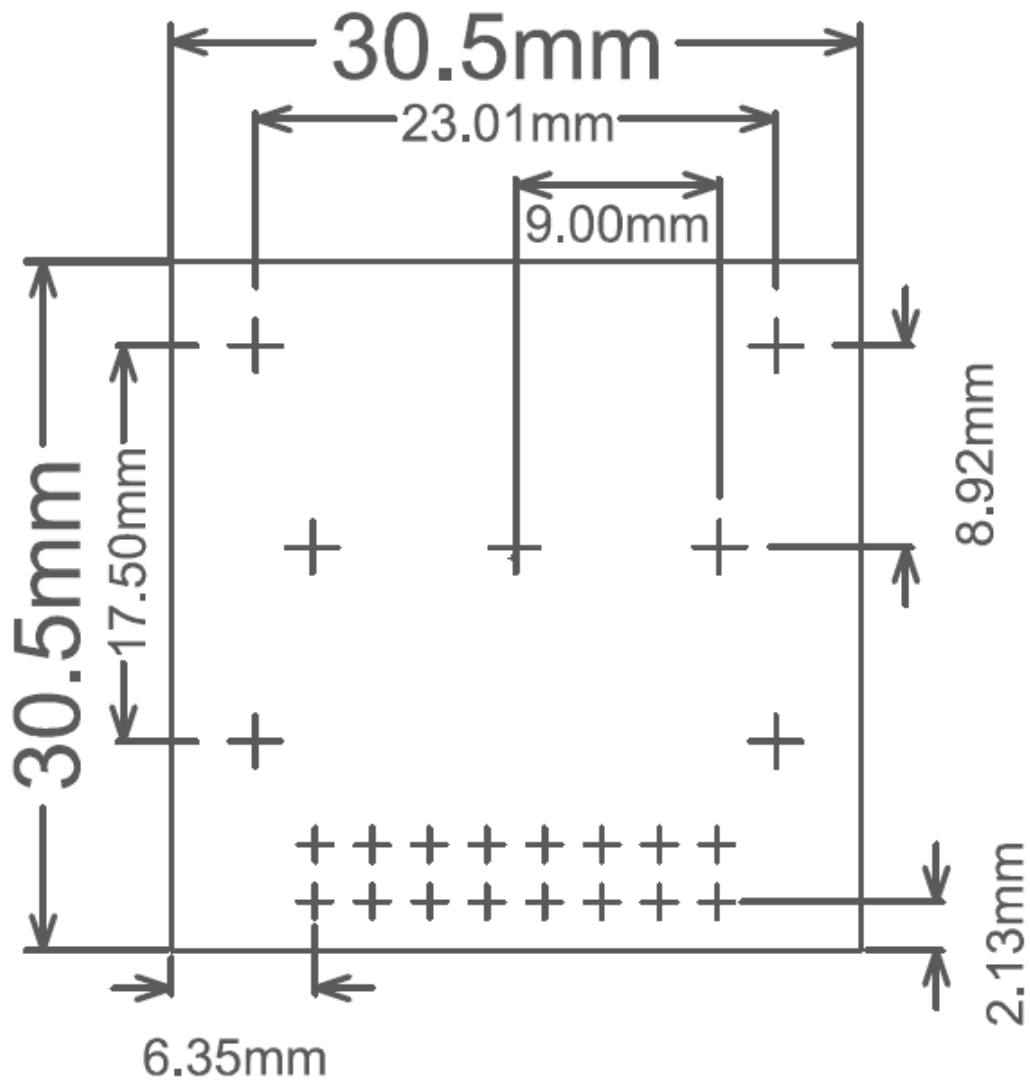
For the host that doesn't have a dedicate camera interface, additional hardware is needed. User need to buffer a entire frame before read them out with low speed MCUs. For example ArduCAM shield is a additional hardware that can be connected to Arduino UNO/Mega board, user can take a photo or something like that easily. The following diagram show the system without dedicate camera interface.



## 5 Pin Definition

| 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)                             |

## 6 Mechanical Dimension



## 6 Arducam Team:

Website: <http://www.arducam.com>

Email: [admin@arducam.com](mailto:admin@arducam.com) Skype: fpga4u Tel: +86 025 84271192