CMOS OV7660 Camera Module

1/5-Inch 0.3-Megapixel Module Datasheet

Rev 1.0, June 2013

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1 Introduction

The OV7660/OV7161 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 OV7660/OV7161 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 1/5 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 / 8mm lens
- Output support for Raw RGB, RGB (GRB 4:2:2, RGB565/555), 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, QVGA,QQVGA,CIF,QCIF,QQCIF
- 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

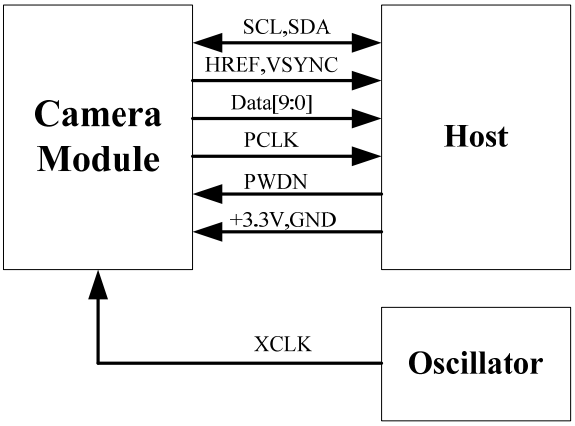
3 Key Specifications

Array Element (VGA)		664 x 492
Power Supply	Digital Core	1.8VDC
	Analog	2.45V to 2.8V
	I/O	2.5V to (V_{DD-A}+0.3V)
Power Requirements	Active	40 mW without loading
	Standby	< 10 µA
Temperature Range	Operation	-20°C to 80°C
	Stable Image	-10°C to 60°C
Output Formats (8-bit)		• YUV/YCbCr 4:2:2 • RGB 4:2:2 • Raw RGB Data
Lens Size		1/5"
Lens Chief Ray Angle		~20°
Max Image Transfer Rate	VGA, CIF, QCIF, QQCIF	30 fps
	QVGA, QQVGA	60 fps
Sensitivity		1.0 V/Lux-sec
S/N Ratio		> 48 dB (AGC off, Gamma=1)
Dynamic Range		> 72 dB
Scan Mode		Progressive
Electronics Exposure		Up to 510:1 (for selected fps)
Gamma Correction		0.45/0.55/1.00
Pixel Size		4.2 µm x 4.2 µm
Dark Current		30 mV/s at 60°C
Well Capacity		35 K e
Fixed Pattern Noise		< 0.03% of $V_{PEAK-TO-PEAK}$
Image Area		2.76 mm x 2.05 mm
Package Dimensions		4155 µm x 3975 µm

4 Application

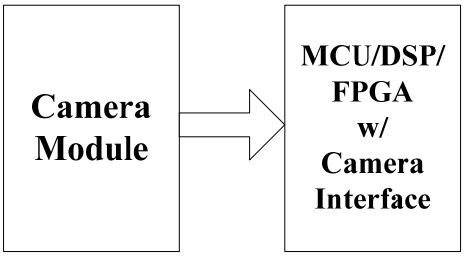
- Cellular phones
- PDAs
- Toys
- Other battery-powered products
- Can be used in Arduino, Maple, ChipKit, STM32, ARM, DSP, FPGA platforms

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.

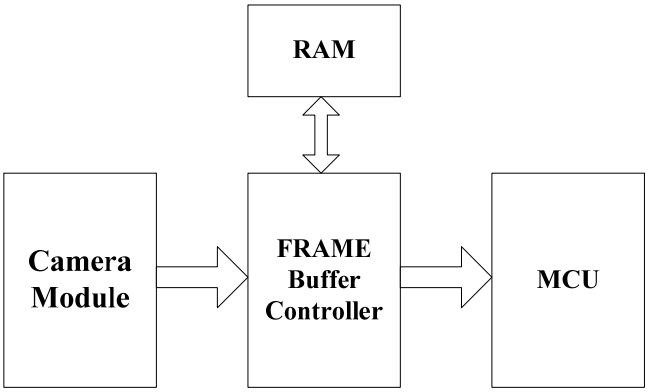


The host may have integrate camera interface like STM32F2 or STM32F4 series MCUs, or ARM9/11 which has dedicate camera port, and DPS like TI TMS320DM series, as well as FPGAs that user can design special logic for camera application. The typical connection between these

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)
17	PWDN	Input	Power down
18	RSV	NC	Reserved
19	RSV	NC	Reserved
20	RSV	NC	Reserved

6 Mechanical Dimension