

OV7910 SINGLE-CHIP CMOS COLOR NTSC CAMERA OV7410/OV7411 SINGLE-CHIP CMOS B&W NTSC CAMERA

Features

- **Single-chip 1/3 inch format video camera**
 - High-sensitivity version (OV7411)
- **Composite video: NTSC or S-Video**
- **Component video: RGB or YUV**
- **Sensitivity boost (+18 dB) /AGC on-off**
- **Automatic exposure/gain/white balance**
- **External frame sync capability**
- **Aperture correction**
- **SCCB programmable:**
 - color sat., brightness, contrast, white balance, exposure time, gain
- **Gamma correction (0.45)-On/Off**
- **Low power consumption**
- **+5 volt-only power supply**

General Description

The OV7910 (color) and OV7410/OV7411 (black and white) Single-chip CMOS camera devices are designed to provide a high level of functionality in a single small-footprint package. All three devices support NTSC composite video and S-Video. The OV7910 imager also provides RGB and YCrCb video signals, and each device directly interfaces with a VCR TV monitor or other 75 ohm terminated input. A minimum of external components are required to complete a fully functional camera subsystem. The OV7910/OV7410/OV7411 video cameras require only a single 5-volt DC supply and have been designed for very low power operation. These products are ideal for all applications requiring a small footprint, low voltage, low power and low cost color or black and white video camera.

- **Video Conferencing**
- **Video Phones**
- **Video e-mail**
- **PC Multimedia**
- **Toys**
- **Security**
- **Surveillance**

<p style="text-align: center;">OV7910/OV7410/OV7411</p> <p style="text-align: center;">* NOTE: These pins are "no connect" in OV7410/OV7411 sensor.</p>	<table border="1"> <tr> <td>Array Size</td> <td>NTSC: 510 x 492 pixels</td> </tr> <tr> <td>Image Area</td> <td>NTSC: 4.69 x 3.54 mm</td> </tr> <tr> <td>Auto Electronic Exposure</td> <td>1/60 - 1/15000 sec.</td> </tr> <tr> <td>Min. Illumination (3000K)</td> <td>OV7910: < 3 lux @ f1.2 OV7410: < 0.5 lux @ f1.2 OV7411: < 0.2 lux @ f1.2</td> </tr> <tr> <td>S/N Ratio</td> <td>> 48 dB</td> </tr> <tr> <td>Fixed Pattern Noise (FPN)</td> <td>< 0.03% V_{P-P}</td> </tr> <tr> <td>Dark Current</td> <td>< 0.2 nA/cm²</td> </tr> <tr> <td>Dynamic Range</td> <td>> 72 dB</td> </tr> <tr> <td>Power Supply</td> <td>5VDC, ±5%</td> </tr> <tr> <td>Power Requirements</td> <td>200 mW</td> </tr> <tr> <td>Package Type</td> <td>48-pin LCC</td> </tr> </table>	Array Size	NTSC: 510 x 492 pixels	Image Area	NTSC: 4.69 x 3.54 mm	Auto Electronic Exposure	1/60 - 1/15000 sec.	Min. Illumination (3000K)	OV7910: < 3 lux @ f1.2 OV7410: < 0.5 lux @ f1.2 OV7411: < 0.2 lux @ f1.2	S/N Ratio	> 48 dB	Fixed Pattern Noise (FPN)	< 0.03% V _{P-P}	Dark Current	< 0.2 nA/cm ²	Dynamic Range	> 72 dB	Power Supply	5VDC, ±5%	Power Requirements	200 mW	Package Type	48-pin LCC
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OV7910/OV7410/OV7411 PIN ASSIGNMENT

Table 1. Pin Description

(Pins designated with "*" are "no connect" in OV7410/OV7411 sensor.)

Pin No.	Name	Pin Type	Function/Description																									
01	SGND	V _{in}	Analog ground																									
02	SVDD	V _{in}	Analog power (+5VDC)																									
03	VcBRT	1.2V	Image brightness adjustment. Default set by internal resistor (~50K). Default may be changed by applying external bias to this pin.																									
04	BPAVE	Function (Default = 0)	Internal 3-point average selection "0" - Use internal 3-point averaging "1" - Bypass internal 3-point averaging																									
05	Rsvd5	V _{ref}	Internal reference																									
06	AGND	V _{in}	Analog ground																									
07	AVDD	V _{in}	Analog power (+5VDC)																									
08	RGSW	Function (Default = 0)	"Raw" data pixel selection "0" - select non- "raw" pixel data "1" - select "raw" pixel data																									
09	CEXP	Function (Default = 0)	Central exposure selection "0" - select normal mode "1" - select central exposure mode																									
10*	HSAT	Function (Default = 0) <i>(N/C on OV7410/OV7411)</i>	Color Saturation selection "0" - select normal color saturation "1" - select increase color saturation by 25% Note: This function is not available on OV7410/OV7411 Image Sensor. This pin is "no connect".																									
11*	RGAMMA	Function (Default = 0) <i>(N/C on OV7410/OV7411)</i>	<table border="1"> <thead> <tr> <th>RGAMMA</th> <th>HSAT</th> <th>RGB-V</th> <th>COLOR KILL</th> <th>COLOR SAT</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>0</td> <td>ON</td> <td>OFF</td> <td>4.00</td> </tr> <tr> <td>1</td> <td>0</td> <td>ON</td> <td>OFF</td> <td>3.20</td> </tr> <tr> <td>1</td> <td>0</td> <td>OFF</td> <td>ON</td> <td>2.00</td> </tr> <tr> <td>1</td> <td>1</td> <td>OFF</td> <td>ON</td> <td>1.78</td> </tr> </tbody> </table>	RGAMMA	HSAT	RGB-V	COLOR KILL	COLOR SAT	0	0	ON	OFF	4.00	1	0	ON	OFF	3.20	1	0	OFF	ON	2.00	1	1	OFF	ON	1.78
RGAMMA	HSAT	RGB-V	COLOR KILL	COLOR SAT																								
0	0	ON	OFF	4.00																								
1	0	ON	OFF	3.20																								
1	0	OFF	ON	2.00																								
1	1	OFF	ON	1.78																								
12*	SMTawb	Function (Default = 0) <i>(N/C on OV7410/OV7411)</i>	Automatic White Balance (AWB) Smart mode selection "0" - Disable smart mode "1" - Enable smart mode. Count pixels which contain a luminance signal between 10-80% of max. value. Note: This function is not available on OV7410/OV7411 Image Sensor. This pin is "no connect".																									
13*	EVDD	V _{in} <i>(N/C on OV7410/OV7411)</i>	Analog power (+5VDC) Note: This function is not available on OV7410/OV7411 Image Sensor. This pin is "no connect".																									
14*	EGND	V _{in} <i>(N/C on OV7410/OV7411)</i>	Analog ground Note: This function is not available on OV7410/OV7411 Image Sensor. This pin is "no connect".																									
15	BUCO	Output	<p>Video Output: Output format determined by pins 38 and 39 (AMOD1, AMOD0)</p> <table border="1"> <thead> <tr> <th>AMOD1</th> <th>AMOD0</th> <th>Output Component</th> <th>Format</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>0</td> <td>S-Video CO channel</td> <td>Composite</td> </tr> <tr> <td>0</td> <td>1</td> <td>Blue component</td> <td>RGB</td> </tr> <tr> <td>1</td> <td>0</td> <td>Cb component</td> <td>YUV or B/W</td> </tr> <tr> <td>1</td> <td>1</td> <td>Blue component</td> <td>RGB</td> </tr> </tbody> </table> <p>Note: Modes (AMOD1, AMOD0) = 00, 01, 11 are not available for OV7410 Image Sensor</p>	AMOD1	AMOD0	Output Component	Format	0	0	S-Video CO channel	Composite	0	1	Blue component	RGB	1	0	Cb component	YUV or B/W	1	1	Blue component	RGB					
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0	0	S-Video CO channel	Composite																									
0	1	Blue component	RGB																									
1	0	Cb component	YUV or B/W																									
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Table 1. Pin Description

(Pins designated with "*" are "no connect" in OV7410/OV7411 sensor.)

Pin No.	Name	Pin Type	Function/Description																				
16	GYO	Output	<p>Video Output: Output format determined by pins 38 and 39 (AMOD1, AMOD0)</p> <table border="1"> <thead> <tr> <th>AMOD1</th> <th>AMOD0</th> <th>Output Component</th> <th>Format</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>0</td> <td>S-Video YO channel</td> <td>Composite</td> </tr> <tr> <td>0</td> <td>1</td> <td>Green component</td> <td>RGB</td> </tr> <tr> <td>1</td> <td>0</td> <td>Y component</td> <td>YUV or B/W</td> </tr> <tr> <td>1</td> <td>1</td> <td>Green component</td> <td>RGB</td> </tr> </tbody> </table> <p>Note: Modes (AMOD1, AMOD0) = 00, 01, 11 are not available for OV7410 Image Sensor</p>	AMOD1	AMOD0	Output Component	Format	0	0	S-Video YO channel	Composite	0	1	Green component	RGB	1	0	Y component	YUV or B/W	1	1	Green component	RGB
AMOD1	AMOD0	Output Component	Format																				
0	0	S-Video YO channel	Composite																				
0	1	Green component	RGB																				
1	0	Y component	YUV or B/W																				
1	1	Green component	RGB																				
17	RVCVO	Output	<p>Video Output: Output format determined by pins 38 and 39 (AMOD1, AMOD0)</p> <table border="1"> <thead> <tr> <th>AMOD1</th> <th>AMOD0</th> <th>Output Component</th> <th>Format</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>0</td> <td>CVBS signal</td> <td>Composite</td> </tr> <tr> <td>0</td> <td>1</td> <td>Red component</td> <td>RGB</td> </tr> <tr> <td>1</td> <td>0</td> <td>Cr component</td> <td>YUV or B/W</td> </tr> <tr> <td>1</td> <td>1</td> <td>Red component</td> <td>RGB</td> </tr> </tbody> </table> <p>Note: Modes (AMOD1, AMOD0) = 00, 01, 11 are not available for OV7410 Image Sensor</p>	AMOD1	AMOD0	Output Component	Format	0	0	CVBS signal	Composite	0	1	Red component	RGB	1	0	Cr component	YUV or B/W	1	1	Red component	RGB
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0	0	CVBS signal	Composite																				
0	1	Red component	RGB																				
1	0	Cr component	YUV or B/W																				
1	1	Red component	RGB																				
18	OVDD	V _{in}	Analog power for video output (+5VDC)																				
19	G2X	Function (Default = 0)	<p>Automatic Gain Control (AGC) gain selection. Affects range selected by HGAIN (p20). See HGAIN below.</p> <p>"0" - select normal AGC gain (1X) "1" - select enhanced AGC gain (1.5X)</p>																				
20	HGAIN	Function (Default = 0)	<p>Automatic Gain Control (AGC) gain range selection</p> <p>"0" - select normal AGC range (1X <-> 4X) "1" - select expanded AGC range (1X -> 8X)</p> <table border="1"> <thead> <tr> <th>HGAIN</th> <th>G2X</th> <th>AGC Range</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>0</td> <td>1X <-> 4X</td> </tr> <tr> <td>0</td> <td>1</td> <td>2X <-> 8X</td> </tr> <tr> <td>1</td> <td>0</td> <td>1X <-> 8X</td> </tr> <tr> <td>1</td> <td>1</td> <td>2X <-> 16X</td> </tr> </tbody> </table>	HGAIN	G2X	AGC Range	0	0	1X <-> 4X	0	1	2X <-> 8X	1	0	1X <-> 8X	1	1	2X <-> 16X					
HGAIN	G2X	AGC Range																					
0	0	1X <-> 4X																					
0	1	2X <-> 8X																					
1	0	1X <-> 8X																					
1	1	2X <-> 16X																					
21	BKLT	Function (Default = 0)	<p>Backlight selection</p> <p>"0" - Disable backlight compensation "1" - Enable backlight compensation</p>																				
22	XCLK1	CLK	Crystal clock input. Frequency is 4 x F _{sc} to meet NTSC subcarrier standards																				
23	XCLK2	CLK	Crystal clock output (4 x F _{sc} for NTSC = 14.31818 MHz)																				
24	Reserved	Function (Default = 0)																					
25	DVDD	V _{in}	Digital power																				
26	DGND	V _{in}	Digital ground																				
27	GAMMA	Function (Default = 1)	<p>GAMMA selection</p> <p>"0" - Disable GAMMA correction "1" - Enable GAMMA correction</p>																				
28	AGCEN	Function (Default = 1)	<p>Automatic Gain Control (AGC) selection</p> <p>"0" - Disable AGC "1" - Enable AGC</p>																				
29*	AWBEN	Function (Default = 1) (N/C on OV7410/OV7411)	<p>Automatic White Balance selection</p> <p>"0" - Disable AWB "1" - Enable AWB</p> <p>Note: This function is not available on OV7410/OV7411 Image Sensor. This pin is "no connect".</p>																				

Table 1. Pin Description*(Pins designated with "*" are "no connect" in OV7410/OV7411 sensor.)*

Pin No.	Name	Pin Type	Function/Description
30*	AWBTM	Function (Default = 0) (N/C on OV7410/OV7411)	Automatic White Balance speed selection "0" - Select normal AWB "1" - Select "fast" AWB Note: This function is not available on OV7410/OV7411 Image Sensor. This pin is "no connect".
31	VAXPXO	Output	Valid pixel detect output. CLK is asserted on this pin during active image period.
32	VHSYNC/MIR	Output/Function (Default = 0)	Vertical/horizontal sync output. Adding a pullup resistor on this pin enables mirror image
33	FSO/VSFR	Output/Function (Default = 0)	Vertical field/frame sync output, default to field sync. Adding a pullup resistor on this pin enables frame sync.
34	FODD/SBB	Output/Function (Default = 0)	Even/Odd field flag. Adding a 10K pullup resistor on this pin enables SCCB (Serial Camera Control Bus) control.
35	Reserved		
36	FSI	Input	Field sync input
37	PWDN	Function	Power Down mode selection "0" - Disable power down mode "1" - Enable power down mode
38	AMOD0	Function	AMOD0 (w/AMOD1) selects output mode. Note: This function is not available on OV7410/OV7411 Image Sensor. This pin is "no connect".
39	AMOD1	Function	AMOD1 (w/AMOD0) selects output mode. Note: Adding a 10K pullup resistor on this pin enables output signal(s) GYYO (pin 16).
40	HSHP	Function	Sharpness level selection "0" - select normal sharpness "1" - select x2 sharpness
41	DEVDD	V _{in}	Analog power
42	DEGNZD	V _{in}	Analog ground
43	SIO-1	Input/Output	SCCB control
44	SIO-0	Input/Output	SCCB data/address
45	VREF1	V _{ref}	Internal reference. Must be decoupled with 0.1 μF capacitor to analog ground.
46	VREF2	V _{ref}	Internal reference. Must be decoupled with 0.1 μF capacitor to analog ground.
47	VREF3	V _{ref}	Internal reference. Must be decoupled with 0.1 μF capacitor to analog ground.
48	VREF4	V _{ref}	Internal reference. Must be decoupled with 0.1 μF capacitor to analog ground.

1. Functional Description

(Note: All references to color functions apply only to OV7910 image sensor)

1.1 Video Standards

Two TV standards are implemented and available as output in the OV7910/OV7410/OV7411 imaging devices: NTSC (M). Table 2 below shows how to configure the standard of choice. Please note

that the accuracy and stability of the crystal clock frequency is important to avoid unwanted color shift in TV/video systems.

Table 2. Standard Configuration

Standard	(pin 24)	Clock	Comments
NTSC	0	14.31818MHz	clock in = 4 x Fsc

1.2 Video Formats

The OV7910/OV7410/OV7411 image sensors support a variety of formats including Composite (CVBS), S-Video (YO/CO), RGB components, YUV components, and B/W. Composite and S-Video signals are generated from the internal TV encoder and the RGB/YUV/BW outputs are generated from the color matrix prior to entering the encoder. The image sensor utilizes the RG/BG Bayer pattern sending raw pixel data through the color matrix, creating RGB or YUV component signals. At the same time, YUV signals are also processed to generate both composite and S-Video signals. (Note: Color format configuration is valid only for the OV7910 image sensor)

1.2.1 Composite and S-Video

The Composite/S-Video format is the power-up default configuration for the OV7910/OV7410/OV7411 image sensors. Pins AMOD0/AMOD1 (pins 38 and 39) select composite and S-Video formats. In this configuration, RVCVO (pin 17) outputs CVBS, GYYO (pin 16) outputs the YO component of the S-Video signal, and BUCO (pin 15) outputs the CO component. Table 3 below summarizes the formats available and the settings required on the appropriate pins.

1.2.2 RGB

Setting AMOD0 = 1 (w/AMOD1 = x) selects the RGB format. In this configuration, RVCVO outputs the Red component, GYYO outputs the Green component, and BUCO provides the Blue component.

1.2.3 YUV

Setting AMOD0=0 and AMOD1=1 configures the OV7910/OV7410/OV7411 sensors to operate in YUV or B/W mode. In this configuration, GYYO outputs the Y component, RVCVO provides the Cr component, and BUCO outputs the Cb component. On the OV7410 image sensor, only the GYYO (Y component) output is valid.

Table 3. Video Format Selection

Format Type	RVCVO Output (pin 17)	GYVO Output (pin 16)	BUCO Output (pin 15)	Pin Settings
Composite + S-Video	CVBS	YO	CO	AMOD0 = 0, AMOD1 = 0
RGB Components	Red	Green	Blue	AMOD0 = 1, AMOD1 = x
YUV Components	Cr	Y	Cb	AMOD0 = 0, AMOD1 = 1
Black and White	—	Y	—	AMOD0 = 0, AMOD1 = 1 (Pins 15 & 17 are undefined on the OV7410 sensor)

1.3 Configuring the OV7910/OV7410/OV7411 Image Sensors for Operation

The OV7910/OV7410/OV7411 sensors have been designed for easy-of-use in many stand-alone applications. Most of the on-chip functions are configurable by connecting appropriate pins high (logic “1”) or low (logic “0”) through a 10k Ohm resistor. The image sensor reads the input the pins at power up, which enables user-defined default configurations.

The OV7910/OV7410/OV7411 imaging devices also contain an SCCB interface for programmatic access to

all

register functions. By default, the SCCB port is disabled. To enable the SCCB for controlling the sensors, a 10K Ohm pull-up resistor must be connected to FODD/SBB. With FODD/SBB pulled high at power-up, the OV7910/OV7410/OV7411 image sensors will enable the SCCB port for access.

1.4 White Balance

The function of white balance in the OV7910 image sensor is to adjust and calibrate the image devices sensitivity on the primary (RGB) colors to match the color cast of the light source. The Auto White Balance (AWB) can be enabled or disabled either through an external pin (AWBEN, pin 29) or through the SCCB port. If AWB is enabled, the image sensors continuously perform white balancing. A fast or slow mode of white balancing may be user-selected (AWBTM, pin 30). Fast AWB updates color every 2 fields while slow

white balancing updates every 16 fields.

By using the SCCB port, the color temperature may be further fine tuned to the requirement of the application. Note that the “blue” (Blue and Blue bias registers) and “red” (Red and Red bias registers) bias control is available only through the SCCB port. This function enables the user to define a “cooler” or “warmer” background for image capture.

1.5 Additional Picture Control

A number of functions/registers are available which enable the user to configure OV7910/OV7410/OV7411 image capturing parameters. These functions include Automatic Gain Control (AGC), AGC Gain, Automatic Exposure Control (AEC), GAMMA, and Backlight control.

A “0” on G2X sets AGC gain at normal. A “1” enhances the AGC gain by 2 (Refer to Table 1, “Pin Description,” on page 2, pins 19 and 20 for further details). This function may be configured through the SCCB port, as well. GAMMA (pin 27) can be used to set the GAMMA correction. BKLT (pin 21) controls how the OV7910/OV7410/OV7411 image sensors manage backlight conditions. These functions may also be controlled through the SCCB interface.

HGAIN (pin 20) may be used to set the range of AGC Gain. A “0” on HGAIN sets AGC Gain range for 1X <-> 4X, while a “1” sets the range for 1X <-> 8X. G2X (pin 19) can then be used to enhance the AGC gain range.

At power up, AGC and AEC are enabled. AGC can be

disabled at power up by configuring the AGCEN pin (pin 28) as required. AEC cannot be enabled/disabled externally and must be reprogrammed through the SCCB port.

1.6 Other Image Sensor Control Functions

Additional programmable functions for the OV7910/OV7410/OV7411 image sensors include sharpness adjustment, brightness level fine tune, color saturation adjustment, mirror image control, and power down. All of these functions (except power down) can be configured either by an external pin or through the SCCB interface.

Specifications

Table 4. Electrical parameters (0°C to 70°C, all voltages referenced to GND)

Symbol	Descriptions	Max	Typ	Min	Units
Supply					
V _{DD}	Supply voltage (VDD, DVDD)	5.25	5.0	4.75	V
I _{DD}	Supply Current in VDDs	40	-	-	mA
SCCB					
f _{SIO-1}	SIO-1 clock frequency	400	-	-	kHz
t _f	SIO-0 fall time	300	-	20 + 0.1C _{SIO-0}	ns
t _{idle}	Bus idle time	-	-	1.3	us
t _{hdsta}	START hold time	-	-	0.6	us
t _{stps}	STOP set up time	-	-	0.6	us
t _{ds}	SIO-0 set up time	-	-	100	us
t _{dh}	SIO-0 hold time	-	-	0	us
Clock input / Crystal Oscillator					
f _{osc}	Resonator frequency	10	-	20	MHz
	Load capacitor	-	10	-	pF
	Parallel resistance		1M		W
	Rise/fall time for external clock input	-	5	-	ns
	Duty cycle for external clock input	60		40	%
Misc. timing					
t _{SYNC}	External FSI cycle time	-	2	-	frame
t _{PU}	Chip power up time	100	-	-	us
t _{PD}	Power up delay time	-	10	-	us
t _{PZ}	Power up low-z delay	-	1000	-	ns
VTO analog video output parameters					

V _{TO} analog video output parameters						
Symbol	Descriptions	Max	Typ (OV7910)	Typ (OV7410/OV7411)	Min	Units
V _{TO-P}	Video peak signal level	-	2.3	2.4	-	V
V _{TO-B}	Video black signal level	-	0.7	1.2	-	V
V _{SYNC}	Video sync pulse amplitude	-	0.7	0.4	-	V
R _o	Video output load		75	75		Ohm

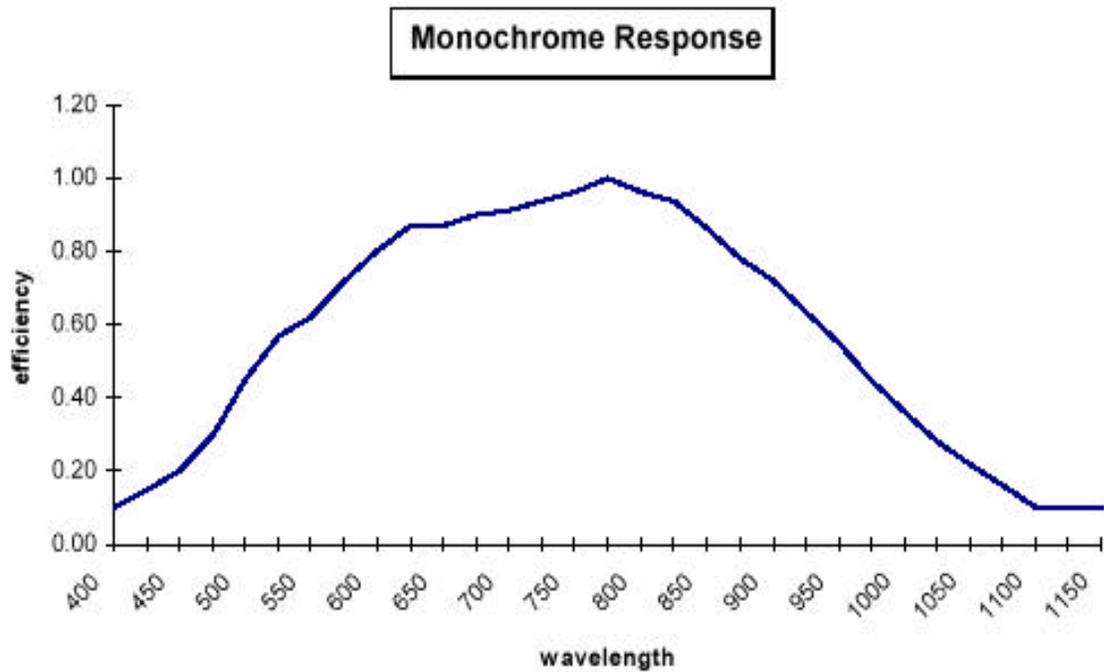
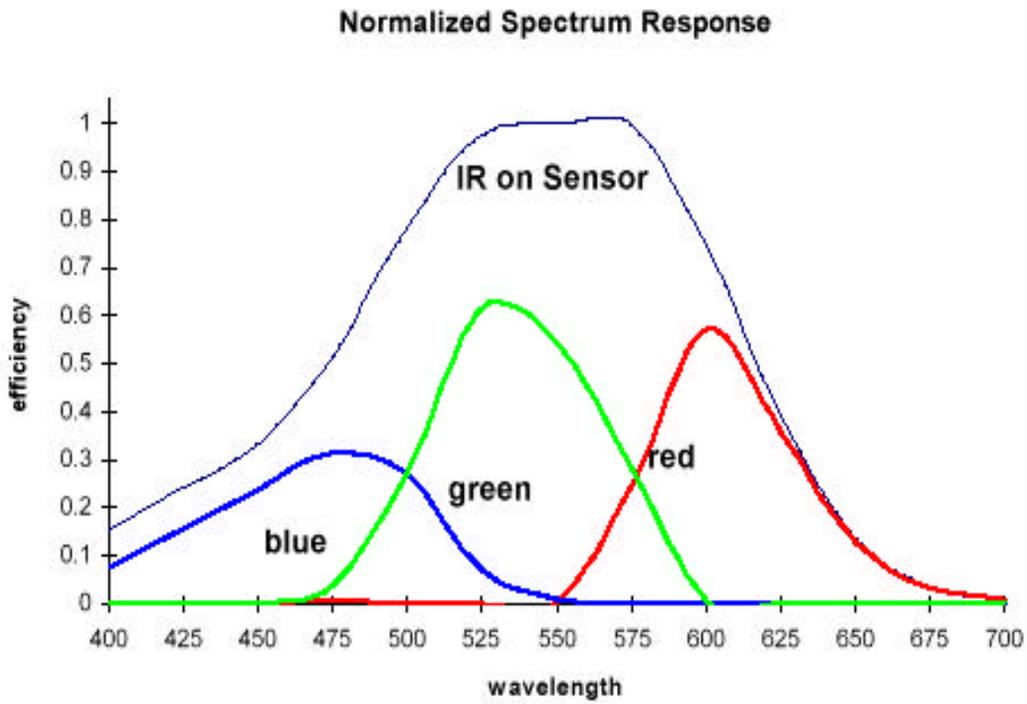


Figure 1. Spectrum Response

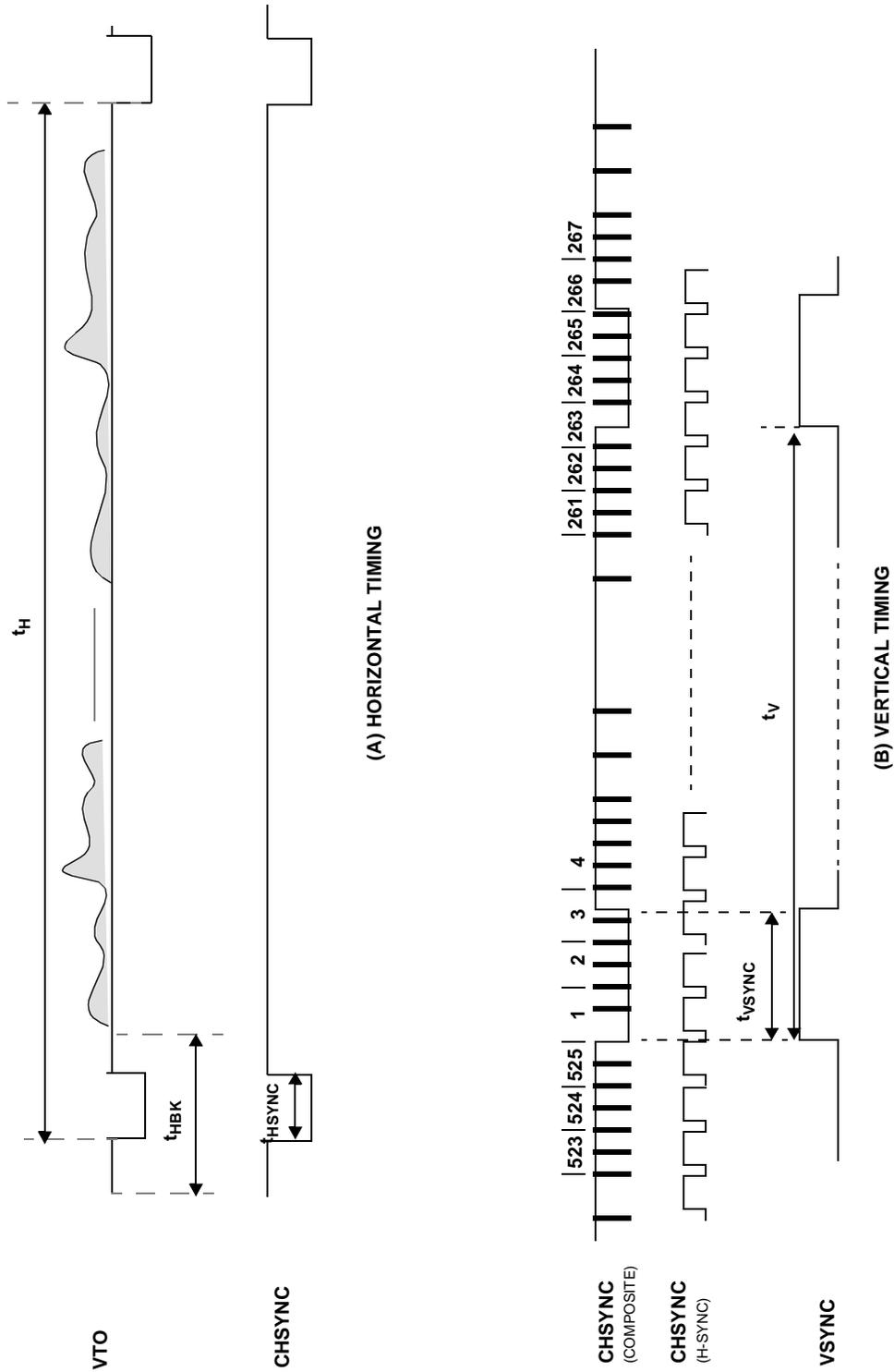


Figure 2. Video Timing Diagram

2. SCCB Bus

Many of the functions and configuration registers in the OV7910/OV7410/OV7411 image sensors are available through the SCCB high-speed serial interface. The SCCB port is enabled by asserting the SBB line (pin 34) through a 10K ohm resistor to V_{DD} . When the

SCCB capability is enabled ($SBB = 1$), the OV7910/OV7410/OV7411 imager operates as a slave device that supports up to 400 kbps serial transfer rate using a 7-bit address/data transfer protocol. Within each byte, MSB is always transferred first. Read/write control bit is the LSB of the first byte. The protocol requires that SIO-0 remain stable during the HIGH period of the

clock, SIO-1. Each bit is allowed to change state only when SIO-1 is LOW.

2.1 SCCB Bus Protocol Format

In SCCB operation, the master must perform the following operations:

- **Generate the start/stop condition**
- **Provide the serial clock on SIO-1**
- **Place the 7-bit slave address, the RW bit, and the 8-bit subaddress on SIO-0**

The receiver must pull down SIO-0 during the acknowledge bit time. During the write cycle, the OV7910/OV7410/OV7411 device returns the acknowledgment and, during read cycle, the master returns the acknowledgment except when the read data is the last byte. If the read data is the last byte, the master does not perform an acknowledge, indicating to the slave that the read cycle can be terminated.

Within each byte, MSB is always transferred first. Read/write control bit is the LSB of the first byte. The protocol requires that SIO-0 remain stable during the HIGH period of the clock, SIO-1. Each bit is allowed to change state only when SIO-1 is LOW.

The OV7910/OV7410/OV7411 SCCB supports multi-byte write and multi-byte read. The master must supply the subaddress in the write cycle, but not in the read cycle. Therefore, the OV7910/OV7410/OV7411 takes the read subaddress from the previous write cycle. In multi-byte write or multi-byte read cycles, the subaddress is automatically incremented after the first data byte so that continuous locations can be accessed in one bus cycle. A multi-byte cycle overwrites its original subaddress; therefore, if a read cycle immediately follows a multi-byte cycle, you must insert a single-byte write cycle that provides a new subaddress.

The OV7910/OV7410/OV7411 supports a single slave ID. The ID is preset to 80 for write and 81 for read.

In the write cycle, the second byte in SCCB bus is the subaddress for selecting the individual on-chip registers, and the third byte is the data associated with this register. Writing to an undefined subaddress is ignored.

In the read cycle, the second byte is the data associated with the previous stored subaddress. Reading of undefined subaddresses returns unknown data.

2.2 SCCB Register Set

OV7410/OV7411 image sensor.

The table below provides a list and description of available SCCB registers contained in the OV7910/

Subaddress (hex)	Register	Default (hex)	Read/Write	Descriptions
00	Gain[6:0]	00	RW	GC[7] - unimplemented bit, returns 'X' when read. GC[6:0] – Storage for the current AGC Gain setting. This register is updated automatically. If AGC is enabled, the internal control stores the optimal gain value in this register. If AGC is not enabled, a "00" is stored in this register.
01	Blue[7:0]	80	RW	Storage for the current blue channel setting for white balance control. BLU[7] – "0" decrease gain, "1" increase gain. BLU[6:0] – blue channel gain balance value. Note: This function is not available on the OV7410/OV7411 Image Sensor.
02	Red[7:0]	80	RW	Storage for the current red channel setting for white balance control. RED[7] – "0" decrease gain, "1" increase gain. RED[6:0] – red channel balance value. Note: This function is not available on the OV7410/OV7411 Image Sensor.

Subaddress (hex)	Register	Default (hex)	Read/Write	Descriptions
03	Sat	D0	RW	SAT[7:6] – saturation adjustment. "FFh"- highest, "00h"-lowest 00 = 1.78 01 = 2.00 10 = 3.20 11 = 4.00 Note: This function is not available on the OV7410/OV7411 Image Sensor.
04	Cnt	00	RW	CTR[7:0] – contrast adjustment. "FFh"-highest, "00h"-lowest
05	Brt	80	RW	BRT[7:0] – brightness adjustment. "FFh"-highest,"00h"-lowest
06	Rsvd06	E8	RW	reserved
07	Blue Bias	20	RW	BBS[7:6] – rsvd (BBS[7:6] = 00) BBS[5:0] – blue channel bias value. This value defines the fine tune adjustment for the blue tint in the white balance control. This register is the manual control portion of the AWB control Note: This function is not available on the OV7410/OV7411 Image Sensor.
08	Red Bias	20	RW	RBS[7:6] – rsvd (RBS[7:6] = 01) RBS[5:0] – red channel bias value. This value defines the fine tune adjustment for the red tint in the white balance control. This register is the manual control portion of the AWB control Note: This function is not available on the OV7410/OV7411 Image Sensor.
09	Rsvd09	37	RW	reserved
0A	Rsvd0A	45	RW	reserved
0B	Rsvd0B	—	W	reserved
0C	Rsvd0C	—	W	reserved
0D	Rsvd0D	4E	RW	reserved
0E	Rsvd0E	32	RW	reserved
0F	Rsvd0F	7A	RW	reserved
10	version	05	R	Version

Subaddress (hex)	Register	Default (hex)	Read/Write	Descriptions
11	Manufacture ID (H)	7F	R	MIDH[7:0] – manufacture ID high byte
12	Manufacture ID (L)	A2	R	MIDL[7:0] – manufacture ID low byte

Subaddress (hex)	Register	Default (hex)	Read/Write	Descriptions															
13	AEC	82	RW	AEC[7:0] – Manual exposure setting. “00” = lowest, 82 = Highest															
14	Common A	9F	RW	<p>COMA[7] - CEXP, “0” selects central exposure COMA[6:4] - rsvd COMA[3] - GAMMA, “1” selects gamma = 0.45, “0” select gamma=1.0 COMA[2] - AGCEN, “1” enables auto gain control COMA[1] - AWBEN “1” enables auto white balance* COMA[0] - AEC enable. If AEC is enabled, the AEC register (Reg. 13) is updated automatically. If AEC is disabled, AEC register remains unchanged.</p> <p>*Note: COMA[1], AWBEN is not available on the OV7410/OV7411 Image Sensor.</p>															
Subaddress (hex)	Register	Default (hex)	Read/Write	Descriptions															
15	Common B	00	RW	<p>COMB[7] - SRST, “1” initiates soft reset. Initiate soft reset. All registers are set to default values and chip is reset to known state and resumes normal operation. This bit is automatically cleared after reset. COMB[6] - MIRR, “1” selects mirror image COMB[5] - VSFR, “1” enables frame sync output to VSYNC (pin 32), “0” enables field sync output to VSYNC COMB[4] - BKLT, “1” selects backlight exposure mode COMB[3] - FREX, “1” disables the update of exposure and gain value COMB[2] - HGAIN. Automatic Gain Control (AGC) gain range selection. See COME[6] (G2X), below. “0” - select normal AGC range (1X <-> 4X) “1” - select expanded AGC range (1X -> 8X)</p> <table border="1"> <thead> <tr> <th>HGAIN</th> <th>G2X</th> <th>AGC Range</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>0</td> <td>1X <-> 4X</td> </tr> <tr> <td>0</td> <td>1</td> <td>2X <-> 8X</td> </tr> <tr> <td>1</td> <td>0</td> <td>1X <-> 8X</td> </tr> <tr> <td>1</td> <td>1</td> <td>2X <-> 16X</td> </tr> </tbody> </table> <p>COMB[1:0] - AMOD, select video output modes 00 - S-video and CVBS* 01 - RGB* 10 - YUV 11 - RGB*</p> <p>*Note: COMB[1:0] = 00, 01, 11 are not available on the OV7410/OV7411 Image Sensor.</p>	HGAIN	G2X	AGC Range	0	0	1X <-> 4X	0	1	2X <-> 8X	1	0	1X <-> 8X	1	1	2X <-> 16X
HGAIN	G2X	AGC Range																	
0	0	1X <-> 4X																	
0	1	2X <-> 8X																	
1	0	1X <-> 8X																	
1	1	2X <-> 16X																	
16	Common C	20	RW	<p>COMC[7] - Smart AWB. “0” disables SMTawb, “1” enables SMTawb COMC[6] - rsvd COMC[5] - Automatic Level Control. “0” disables ALC, “1” enables ALCAuto level control COMC[4:0] - rsvd</p>															
17	Common D	34	RW	<p>COMD[7:4] - rsvd COMD[3] - BPSHP. “0” enables sharpness control, “1” disables sharpness control COMD[2] - rsvd COMD[1] - AWBTM, “1” selects fast AWB update* COMD[0] - rsvd</p> <p>*Note: COMD[1], AWBTM is not available on the OV7410/OV7411 Image Sensor.</p>															
18	Rsvd18	A2	RW	reserved															
19	Rsvd19	66	RW	reserved															
1A	Rsvd1A	F0	RW	reserved															
1B	Rsvd1B	D0	RW	reserved															
1C	Rsvd1C	15	RW	reserved															
1D	Common E	20	RW	<p>COME[7] - rsvd COME[6] - G2XA. Automatic Gain Control (AGC) gain selection. Affects range selected by HGAIN. See COMB[2] (HGAIN), above. “0” - select normal AGC gain (1X) “1” - select enhanced AGC gain (2X) COME[5:0] - rsvd</p>															
1E	Rsvd1F	23	RW	reserved															
1F	Rsvd20	28	RW	reserved															
20 - 2F	Rsvd2X	N/A	RW	reserved															
30	Rsvd30	80	RW	reserved															
31	Rsvd31	80	RW	reserved															

Subaddress (hex)	Register	Default (hex)	Read/Write	Descriptions
32	Rsvd32	80	RW	reserved
33	Rsvd33	40	RW	reserved
34	Rsvd34	80	RW	reserved
35	Rsvd35	20	RW	reserved
36	Rsvd36	20	RW	reserved
37	Rsvd37	80	RW	reserved
38	Rsvd38	80	RW	reserved
39	Rsvd39	80	RW	reserved
3A	Rsvd3A	80	RW	reserved
3B	Rsvd3B	80	RW	reserved

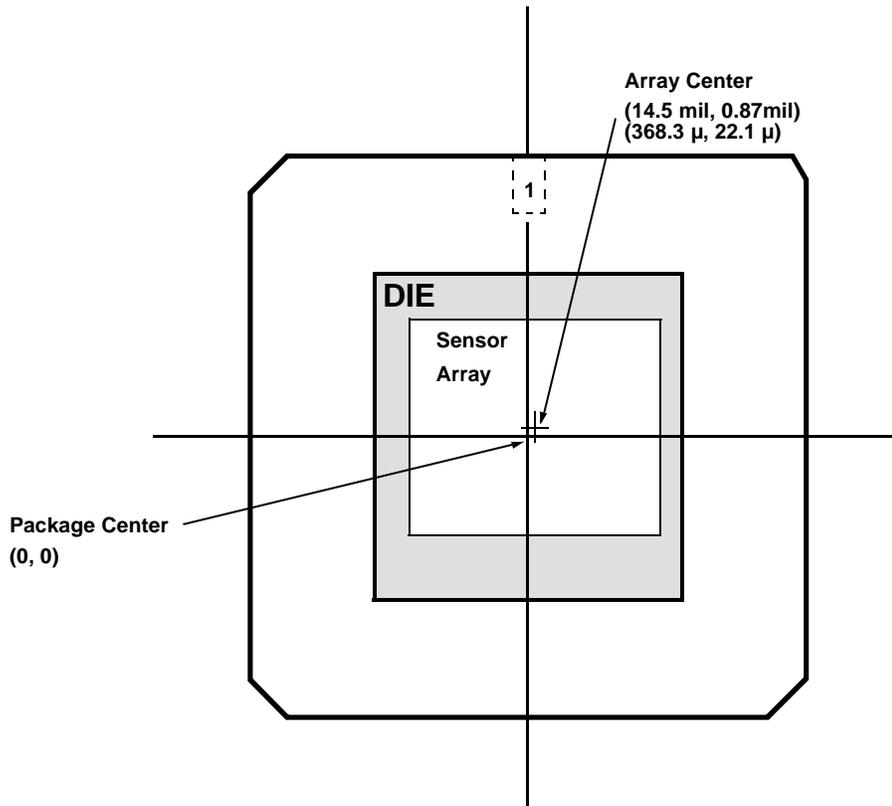


Figure 3. OV7910/OV7410/OV7411 Package Outline

Table 5. Ordering Information

Part Number	Description	Package
OV7910	Color Image Sensor, NTSC Analog, SCCB Bus Control	48 pin LCC
OV7410	B/W Image Sensor, NTSC Analog, SCCB Bus Control	48 pin LCC
OV7411	High sensitivity B/W Image Sensor w/micro lenses, NTSC Analog, SCCB Bus Control	48 pin LCC

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Revision History

Product	Product Version	Description	Date
OV7910/OV7410	AA	Product Release	10/1/98
OV7910/OV7410	AI	Process/performance change enhancements	1/1/99
OV7910/OV7410	AJ	Process/performance change enhancements, SCCB register changes: Regs. 03, 06, 08, x10	2/11/99
OV7910/OV7410	AK	Performance/manufacturability improvements	2/22/99
OV7910/OV7410	AK	Miscellaneous corrections	6/6/99
OV7910/OV7410/OV7411	AK	Add OV7411 release	6/17/99
OV7910	AL	Performance improvements	10/14/99