

# Image sensor modules

## C16090/C16091 series

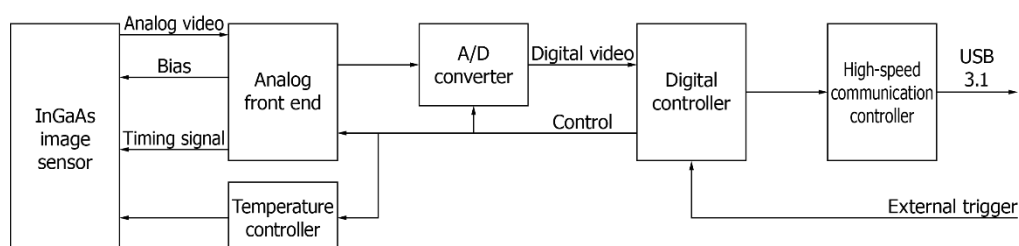
### 1. Overview

The C16090 series is an image sensor module incorporating an InGaAs area image sensor, and the C16091 series is an image sensor module incorporating an InGaAs linear image sensor. Analog video signals from InGaAs image sensors are output as digital signals. From a PC connected via USB, various settings can be configured, images can be retrieved, and the temperature of InGaAs image sensors can be controlled. The C16090/C16091 series are equipped with a C mount plate, which allows a lens to be mounted with ease.

### 2. Structure

The C16090/C16091 series are composed of a driver circuit, temperature controller, and high-speed communication controller. The driver circuit consists of an analog front end that drives the InGaAs image sensor, A/D converter that converts analog video signals into digital signals, and digital controller that processes digital video signals and generate control timing signals. The temperature controller controls the sensor temperature by driving the TE-cooler of the InGaAs image sensor. The high-speed communication controller outputs digital video signals through the USB 3.1 Gen 1 interface.

[Figure 2-1] Block diagram



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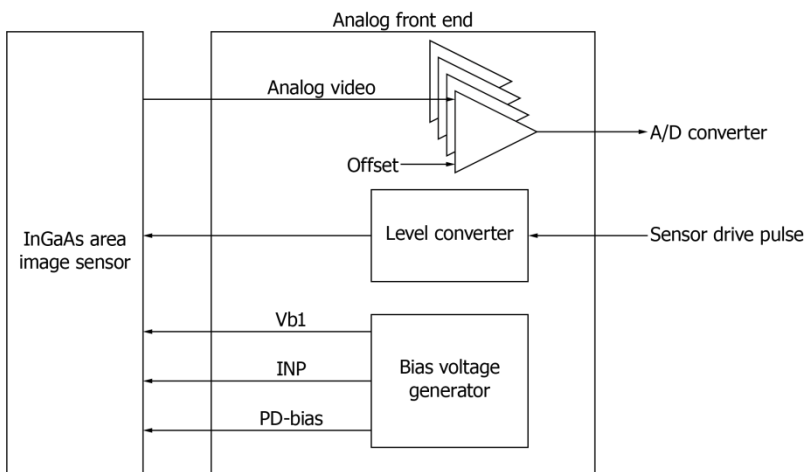
#### 2-1. Analog front end

The analog front end supplies power, bias voltage, and clock signals for driving the InGaAs image sensor. In addition, it adjusts the amplitude level and offset voltage of the analog video output from the sensor and applies the signal to the latter-stage A/D converter.

- Analog video output amplifier and offset adjustment of the InGaAs area image sensor. Up to four ports are supported.
- Converts the timing signal generated by the digital controller into a voltage suitable for the sensor.
- Supplies bias voltage to the sensor (Vb1, inp, PD-bias)

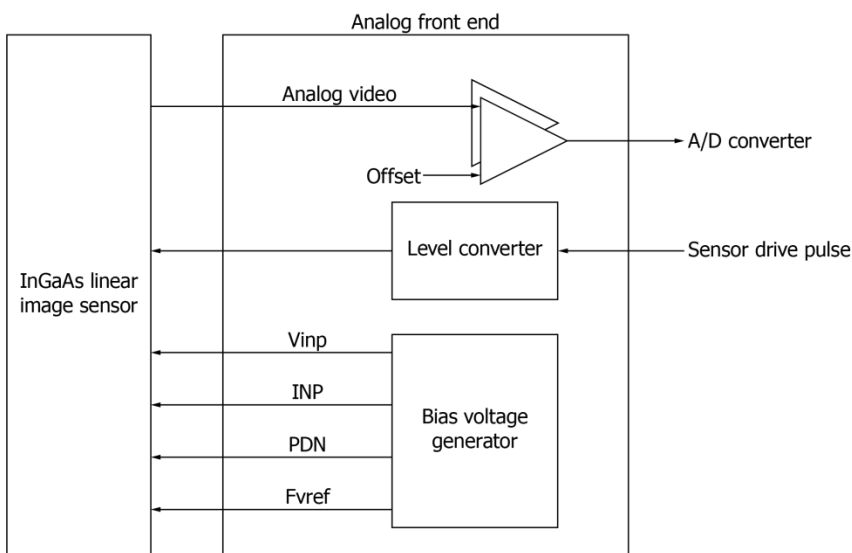
[Figure 2-2] Analog front end

(a) C16090 series



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(b) C16091 series



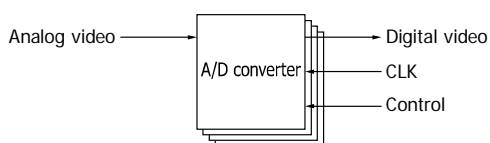
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## 2-2. A/D converter

The A/D converter converts analog video signals from the analog front end into digital signals at high speeds.

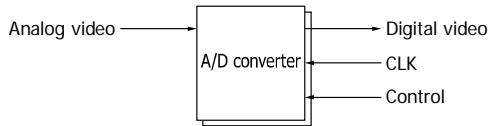
[Figure 2-3] A/D converter

(a) C16090 series (16-bit, clock: 12.5 MHz, 4 ports)



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(b) C16091 series (16-bit, clock: 1.25, 2, 5 MHz, 2 ports)

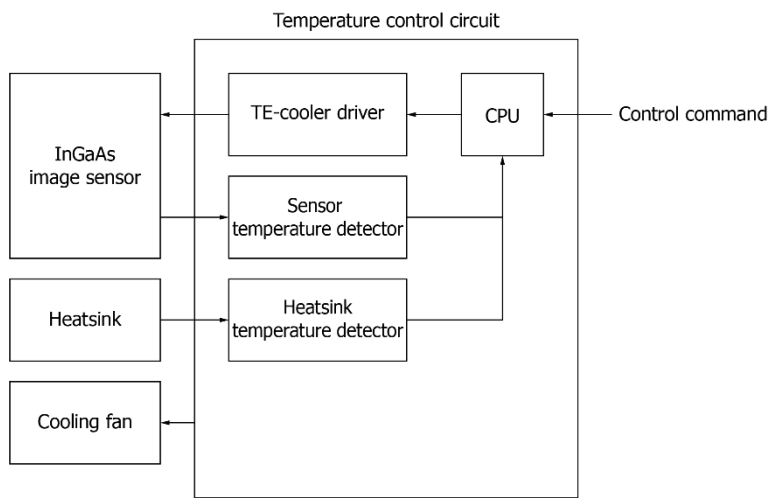


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### 2-3. Temperature controller

The temperature control circuit drives the TE-cooler in the InGaAs image sensor to adjust the sensor temperature. High-sensitivity detection becomes possible by reducing the dark current through sensor cooling.

[Figure 2-4] Temperature controller



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- TE-cooler drive: 4.8 V, 2.8 A max.
- Sensor temperature control: Uses a thermistor (in the sensor)
- Heatsink temperature control: Uses a thermistor (external)
- Heatsink cooling fan (built-in) drive
- CPU control: TE-cooler drive, temperature detection, error detection
- Cooling temperature: -20 °C to +15 °C, 1 °C steps

[Table 2-1] Temperature controller specifications (Ta=25 °C unless otherwise noted)

Parameter	Min.	Typ.	Max.	単位
Temperature accuracy <sup>*1</sup>	-1	-	+1	°C
Temperature stability <sup>*2</sup>	-0.1	-	+0.1	°C
Setting temperature achievement time	-	-	5	min

\*1: Deviation of the actual temperature from the setting temperature

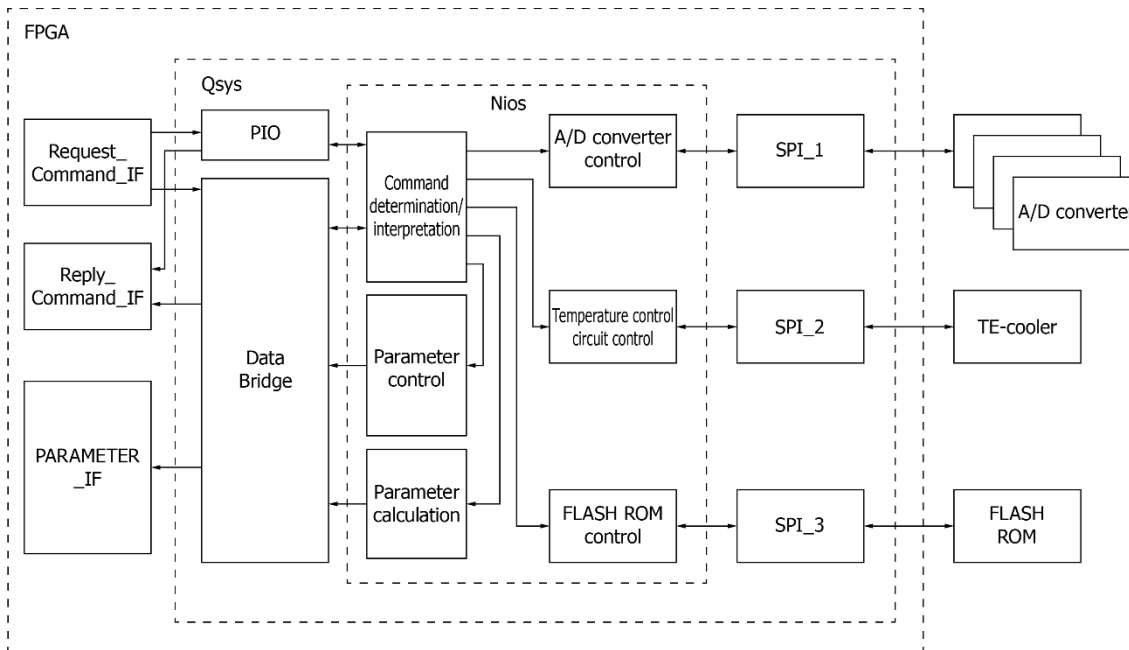
\*2: Temperature fluctuation after temperature stabilization

## 2-4. Digital controller

The FPGA contains a digital logical controller and embedded processor controller. They control the following:

- DCAM command processing: Communication with a PC
- Control of temperature controller: Cooling start/stop, cooling temperature setting
- A/D converter control: Timing signal generation, data processing, parameter setting
- FLASH ROM control: Management information setting and saving

[Figure 2-5] Digital controller



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## 2-5. High-speed communication controller

USB 3.1 (5 Gbps data transmission rate) is supported to send image data at a high frame rate.

- USB 3.1 Gen 1: Data and control command transmission, maximum data transmission rate: 5 Gbps
- Power supply for the digital control block: Supplied through USB

## 3. Operation method

### 3-1. Required peripheral devices

- PC: Windows 10, USB 3.1 interface
- USB 3.1 cable: with micro B connector
- Trigger signal generator (when trigger operation is necessary): An SMA cable is necessary.
- DC power supply Uses the included AC adapter (+12 V, 3.8 A)

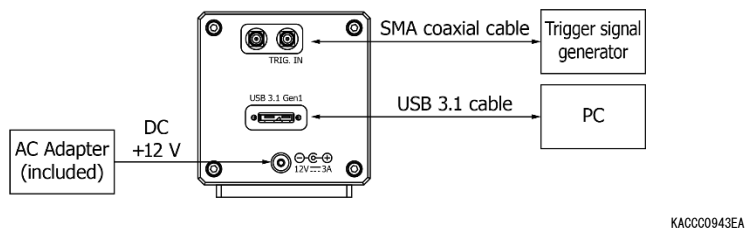
### 3-2. Connection example

A USB 3.1 interface is required on the PC. Connect to the PC using the USB 3.1 cable, and install the driver software in the PC. The digital control block runs on the bus power through the USB 3.1 cable. When the digital

controller starts, the power supply input from the AC adapter turns on. Power is supplied to the analog front end and temperature controller from the AC adapter.

Connect an external trigger generator to TRIG IN using an SMA coaxial cable. Apply an LVTTTL level input (3.3 V) signal.

[Figure 3-1] Connection example



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### 3-3. Software

- Compatible OS: Windows 10
- D-CAM API (digital camera application programming interface): Download from <http://dcam-api.com>. It includes Hamamatsu driver software DLL, and image capture software. DCAM-SDK, which includes the function manual and sample software, is available.

Note: Image processing library is not provided.

### 3-4. C mount

C mount lens can be attached using the C mount holder included with the product.