Allied Vision Prosilica GS

Technical Manual

GigE Vision Cameras

V2.2.4

2019-Jul-08

Allied Vision Technologies GmbH
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Allied Vision

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Allied Vision Technologies GmbH 07/2019

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Introduction

Read this manual carefully

Learn how to protect your Prosilica GS camera from damage and fully understand its functions.

This Prosilica GS Technical Manual describes in depth the technical specifications of the Prosilica GS camera family including dimensions, feature overview, I/O definition, trigger timing waveforms, and frame rate performance.

For information on software installation read the *GigE Installation Manual*. For detailed information on camera features and controls specific to the Prosilica GS refer to the GigE Features Reference and GigE Camera and Driver Attributes documents.

www

Prosilica GS documentation:
www.alliedvision.com/en/support/technical-documentation/prosilica-gs-documentation

Document history

Version	Date	Remarks
V2.2.4	2019-Jul-08	• Editorial changes
V2.2.3	2019-Mar-08	• Added Supplier Declaration of Conformity to Compliance and intended use chapter • Added EMC compliance statement to Interfaces chapter • Editorial changes
V2.2.2	2018-Jun-19	• Updated RoHS statement to include amendment 2015/863/EU
V2.2.1	2018-Jan-16	• Removed references to the Modular Concept
V2.2.0	2018-Jan-02	• Added Specifications common to all models to simplify the model specific tables • Various minor updates and corrections

Table 1: Document history

Version	Date	Remarks
V2.1.1	2017-Apr-07	• Updated absolute QE plots and added spectral response plots • Updated contact information and address for Allied Vision Canada • Added cable color to camera I/O connector pin assignment including pin assignment figure and cross reference to the Allied Vision I/O cable data sheet
V2.1.0	2015-Mar-20	• Updated Allied Vision logo • Replaced old links with new Allied Vision website links • Changed file name from 'GigE Camera and Driver Features' to 'GigE Features Reference' • Changed chapter name from 'Description of data path' to 'Camera data path' • Replaced the optical flange focal distance section with C-Mount flange focal distance section • Updated datapath diagram for Color Prosilica GS cameras
V2.0.5	2013-Nov-26	• Added chapter Description of the data path on page 49 • Updated Index
V2.0.4	2013-Oct-02	• Added optical flange focal distance and maximum lens protrusion information on page 25 • Updated Cleaning optics section • Updated vertical binning value for Prosilica GS660 series • Updated table 8 on page 24 • Updated links to PvAPI SDK
V2.0.3	2013-Jul-05	• Added contact information for Allied Vision Technologies (Shanghai) Co. Ltd. • Updated the links to GigE Installation Manual • Added links to GigE Camera and Driver Features document
V2.0.2	2013-Apr-22	• Updated the RoHS directive • Updated the exposure control values in the Specifications chapter • Added the Status LEDs section • Updated the pixel format naming according to the GenICam naming convention • Added frame rate formulas in the Resolution and ROI frame rates chapter • Added Vimba SDK link in Additional references section • Updated Allied Vision recommended cabling to Category 6 or higher in the Gigabit Ethernet interface section
V2.0.1	2013-Jan-28	• Renamed Camera IO signals • Reworked cleaning optics section • Reworked the spectral plots and Frame rate versus Height graphs • Removed the internal I/O circuit diagram

Table 1: Document history (continued)

Version	Date	Remarks
V2.0.0	2011-Jul-14	New Manual- Release status

Table 1: Document history (continued)

Manual conventions

To give this manual an easily understood layout and to emphasize important information, the following typographical styles and symbols are used:

Styles

Style	Function	Example
Bold	Programs, inputs, or highlighting important information	**bold**
Courier	Code listings	Input
Upper case	Register	REGISTER
Italics	Modes, fields	*Mode*
Parentheses and/or blue	Links	(Link)

Table 2: Styles

Symbols

Note This symbol highlights important information.

Caution This symbol highlights important instructions. You have to follow these instructions to avoid malfunctions.

www This symbol highlights URLs for further information.

Precautions

Caution

Do not disassemble the camera housing. Warranty is void if camera has been disassembled.

This camera contains sensitive internal components.

Caution

Keep shipping material

Poor packaging of the product may cause damage during shipping.

Caution

Verify all external connections

Verify all external connections in terms of voltage levels, power requirements, voltage polarity, and signal integrity prior to powering the device.

Caution

Cleaning

This product can be damaged by some volatile cleaning agents. Avoid cleaning the image sensor unless absolutely necessary. Please see instructions on optics cleaning in this document.

Caution

Do not exceed environmental specifications

See environmental specifications limits in the Specifications section of this document. Special care must be taken to maintain a reasonable operating temperature. If the camera is operated in temperatures higher than the specified range, the camera should be mounted on a heat sink.

Cleaning optics

Caution

Allied Vision does not warranty against any physical damage to the sensor, filter, protection glass, or lenses. Use utmost care when cleaning optical components.

Caution Do not touch any optics with fingers. Oil from fingers can damage fragile optical coatings.

Identifying debris

Debris on the image sensor or optical components appears as a darkened area or smudge on a camera image. Do not confuse this with a pixel defect which appears as a distinct point.

Locating debris

First determine whether the debris is on the sensor glass, IR filter (if used), or lens. The farther away the debris is from the sensor, the blurrier the debris appears on a camera image.

Stream a live image from the camera using a uniform target, such as a piece of paper. To determine if the debris is on the camera lens, rotate the lens independent of the camera. If the spot moves, the debris is on the lens. Otherwise, the debris is on the IR filter (if used) or sensor glass.

Color cameras with IR filter

Prosilica GS color cameras are equipped with an IR filter. With no lens or lens cap on a camera, the IR filter is exposed and debris can accumulate on it. This is the most probable location for debris. It should not be necessary to remove the IR filter for cleaning. Clean the outside of the IR filter glass using the techniques explained in the next section.

If it is determined that the debris is on the inside surface of the filter glass, or on the sensor glass, IR filter removal is necessary. Depending on the manufacturing date of your Prosilica GS camera, the IR filter may be slot type, or pinhole type. Slot type filters can be removed using a small flat head screw driver. Pinhole type filters require a pin spanner wrench for removal.

Note A pin spanner wrench suitable for IR filter removal is available for purchase from Allied Vision.
Order code: E9020001

Cleaning with air

Blow directly on the contaminated surface with moderate pressure, clean compressed air.

Caution

Do not exceed 6 bar (90 psi). If using canned air, approximately ~ 4.8 bar (70 psi) when full, do not shake or tilt the can, as extreme changes in temperature due to sudden cold air can crack the optic glass.

View a live image with the camera after blowing. If debris is still present, repeat the process until it is determined that the particulate cannot be dislodged. If this is the case, proceed to the contact cleaning technique.

Contact cleaning

Only use this method if the above air cleaning method does not sufficiently clean the surface. Use 99% pure isopropyl alcohol and clean cotton swabs. Wet the swab in the alcohol. Quickly wipe the optics in a single stroke. Prolonged exposure of alcohol on the swab can cause the swab glue to loosen and transfer to the optic glass. Do not reuse the same swab. Repeat this process until the debris is removed. If this process fails to remove the debris, contact Allied Vision.

Compliance notifications

For customers in Europe

CE

Allied Vision has demonstrated the fulfillment of the requirements relating to the Prosilica GS camera family:

- Directive 2014/30/EU (Electromagnetic compatibility)
- Directive 2011/65/EU, including amendment 2015/863/EU (RoHS)

For customers in the US

Supplier Declaration of Conformity

Prosilica GS GigE cameras comply with Part 15 of the FCC Rules. Operation is subject to the following two conditions:

1. This device may not cause harmful interference, and
2. This device must accept any interference received, including interference that may cause undesired operation.

Responsible Party – US Contact Information

Allied Vision Technologies, Inc.
102 Pickering Way – Suite 502
Exton, PA 19341
United States

T// +1 (978) 225-2030

Class A digital device

Note: This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

We caution the user that changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

Avoid electromagnetic interferences

For all power and interface connections, only use shielded cables or cables recommended by Allied Vision.

Camera applications and intended use

General use

- The user is responsible for operating the camera within the specifications that are defined in this document, and within appropriate environmental conditions and technical prerequisites, to ensure trouble-free camera operation.
- The camera is compliant with current data communication standards; however, those standards do not allow for self-monitoring. Thus, the camera cannot be used as a standalone device for security-related monitoring operations.
- The camera is a hardware product. Only when used with appropriate accompanying software, the camera will produce the desired results. The realization of intelligent solutions requires additional software that is suitable to run with the camera.
- The camera is a component, it is neither a complete product, nor is it a ready-made technical solution.
- The camera-supporting software can be obtained and installed separately from the camera. Usage of the software is solely the responsibility of the user.
- The camera must not be opened. For all repair tasks, contact Allied Vision or one of Allied Vision's authorized representatives.

- Observe the intended use. The camera must only be used for purposes that are in conformity with the stated intended use.
- Additionally, refer to the warranty information on the Allied Vision website.
- For usage in product with specific safety requirements a Quality Assurance Agreement with Allied Vision is required.
- The camera is intended for use in a commercial, industrial, or business environment. The test phase and programming should be carried out by advanced users.

Use in medical devices

The camera provides basic adequacy to be used in medical devices as well, however, is not specially designated for operation in medical devices. When used as part of a medical device, a review of the specific application is necessary. For usage in medical product, a Quality Assurance Agreement with Allied Vision is required. Users who integrate the camera into an application must comply with the rules and regulations concerning medical devices.

Specifications

Specifications common to all models

Feature	Specification
Lens mount	C-Mount (adjustable)
TTL I/Os	1 input, 1 output
Opto-coupled I/Os	1 input, 1 output
RS232	1
Voltage requirements	5 to 16 VDC: Cameras serial number: 02-22XXA 5 to 25 VDC: Cameras serial number: 02-22XXB
Operating temperature	0 to +70 °C ambient temperature (without condensation)
Storage temperature	-10 to +70 °C ambient temperature (without condensation)
Operating humidity	20 to 80% non-condensing
Dimensions	96 × 56 × 26 mm (including connectors)
Interface	IEEE 802.3 1000BASE-T (Gigabit Ethernet), 100BASE-TX (Fast Ethernet)
Interface standard	GigE Vision Standard 1.2

Table 3: Specifications common to all Prosilica GS models

Prosilica GS650 series

Feature	Specification	
	Prosilica GS650	Prosilica GS650C
Sensor model	Sony ICX424AL with HAD CCD™ technology	Sony ICX424AQ with Wfine HAD CCD™ technology
Resolution (H × V)	659 × 493 0.3 MP	
Sensor type	Interline CCD, Progressive Scan	
Shutter type	Global	
Sensor format	Type 1/3	
Sensor size	6.0 mm diagonal	
Pixel size	7.4 µm × 7.4 µm	
Optical filter	No filter	IRC30 IR cut filter
Maximum frame rate at full resolution	120 frames per second	
A/D	14-bit	
Image buffer	16 MB	
Bit depth	8/12 bit	
Monochrome pixel formats	Mono8, Mono12, Mono12Packed	Mono8
YUV color pixel formats	(not applicable)	YUV411Packed, YUV422Packed, YUV444Packed
RGB color pixel formats	(not applicable)	RGB8Packed, BGR8Packed
RAW pixel formats	(not applicable)	BayerRG8, BayerRG12, BayerGR12Packed
Exposure control	10 µs to 78.5 s; 1 µs increments	
Gain control	0 to 30 dB	
Binning (Sum)	Horizontal: 1 to 8 columns Vertical: 1 to 14 rows	
Power consumption	3 W	
Mass (typical)	184 g	
Sensor orientations	Landscape, portrait	
Connector orientations	Inline, vertical	
Trigger latency	1.0 µs for non-isolated I/O, 9 µs for isolated I/O	
Trigger jitter	±20 ns for non-isolated I/O, ±0.5 µs for isolated I/O	
Propagation delay (t_{pd})	10 ns for non-isolated I/O, 1.3 µs for isolated I/O	

Table 4: Prosilica GS650 model series specifications

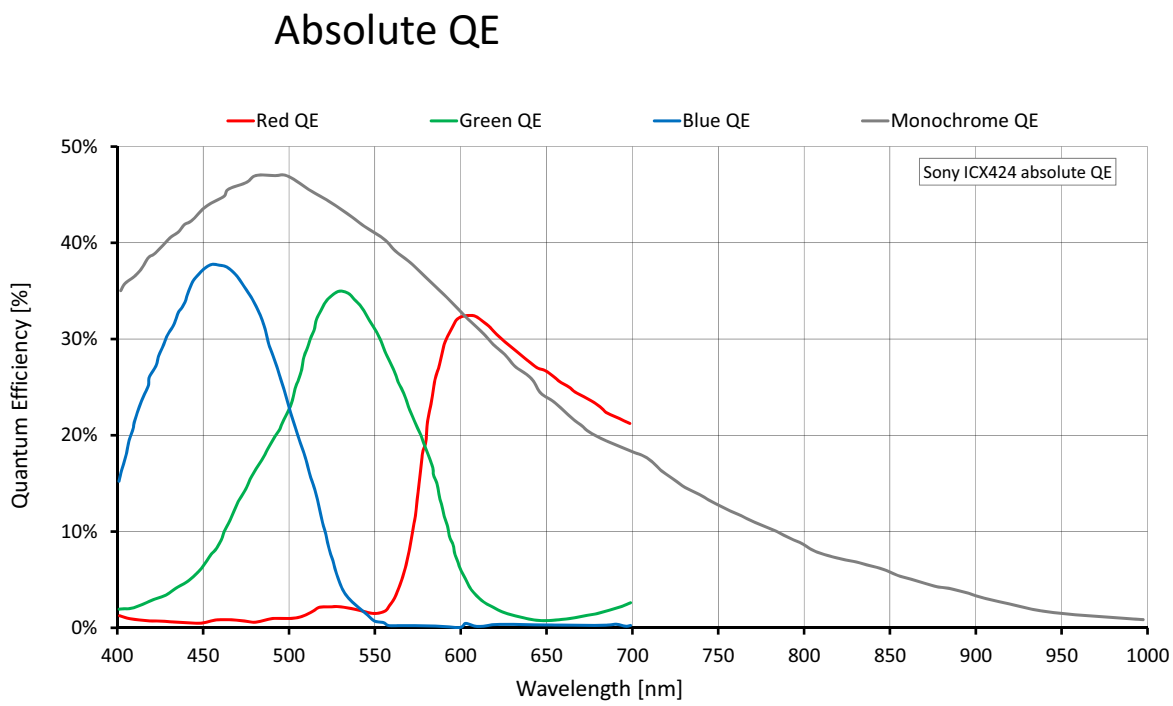


Figure 1: Prosilica GS650 (Sony ICX424) absolute QE

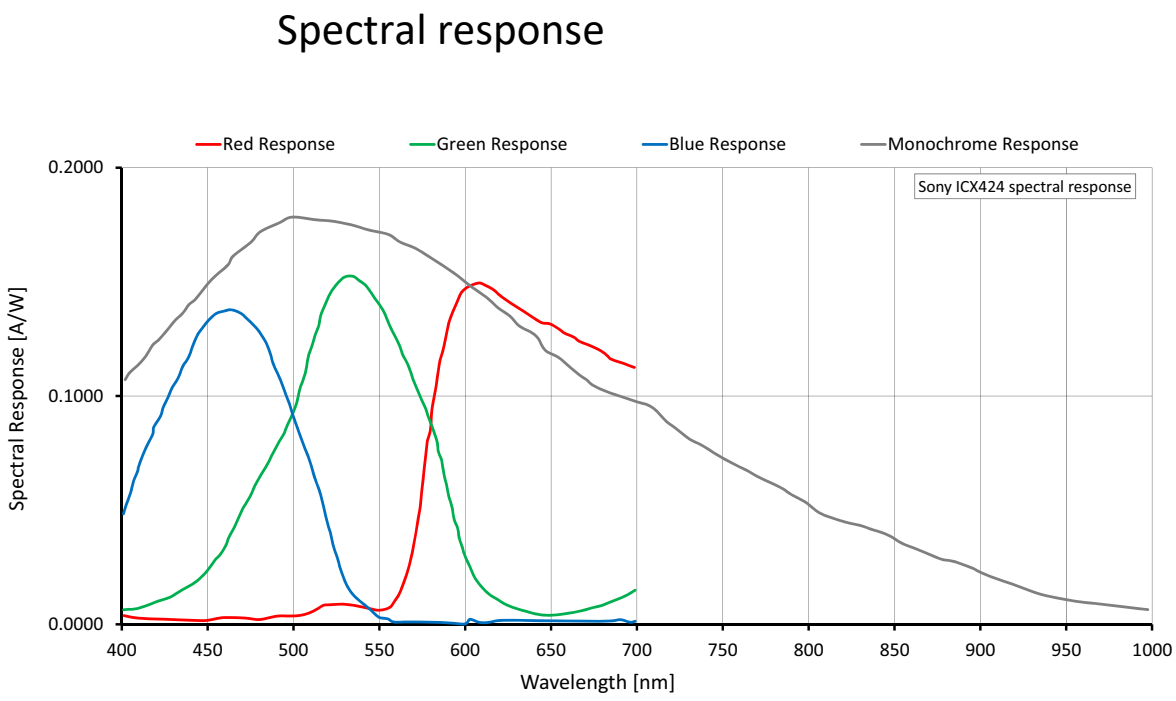


Figure 2: Prosilica GS650 (Sony ICX424) spectral response

Prosilica GS660 series

Feature	Specification	
	Prosilica GS660	Prosilica GS660C
Sensor model	Sony ICX618ALA with EXview HAD CCD™ technology	Sony ICX618AQ with EXview HAD CCD™ technology
Resolution (H × V)	659 × 493 0.3 MP	
Sensor type	Interline CCD, Progressive Scan	
Shutter type	Global	
Sensor format	Type 1/4	
Sensor size	4.5 mm diagonal	
Pixel size	5.6 µm × 5.6 µm	
Optical filter	No filter	IRC30 IR cut filter
Maximum frame rate at full resolution	119 frames per second	
A/D	14-bit	
Image buffer	16 MB	
Bit depth	8/12 bit	
Monochrome pixel formats	Mono8, Mono12, Mono12Packed	Mono8
YUV color pixel formats	(not applicable)	YUV411Packed, YUV422Packed, YUV444Packed
RGB color pixel formats	(not applicable)	RGB8Packed, BGR8Packed
RAW pixel formats	(not applicable)	BayerRG8, BayerRG12, BayerGR12Packed
Exposure control	10 µs to 78.5 s; 1 µs increments	
Gain control	0 to 30 dB	
Binning (Sum)	Horizontal: 1 to 8 columns Vertical: 1 to 14 rows	
Power consumption	3 W	
Mass (typical)	184 g	
Sensor orientations	Landscape	
Trigger latency	2 µs for non-isolated I/O, 10 µs for isolated I/O	
Trigger jitter	±20 ns for non-isolated I/O, ±0.5 µs for isolated I/O	
Propagation delay (t_{pd})	10 ns for non-isolated I/O, 1.3 µs for isolated I/O	

Table 5: Prosilica GS660 model series specifications

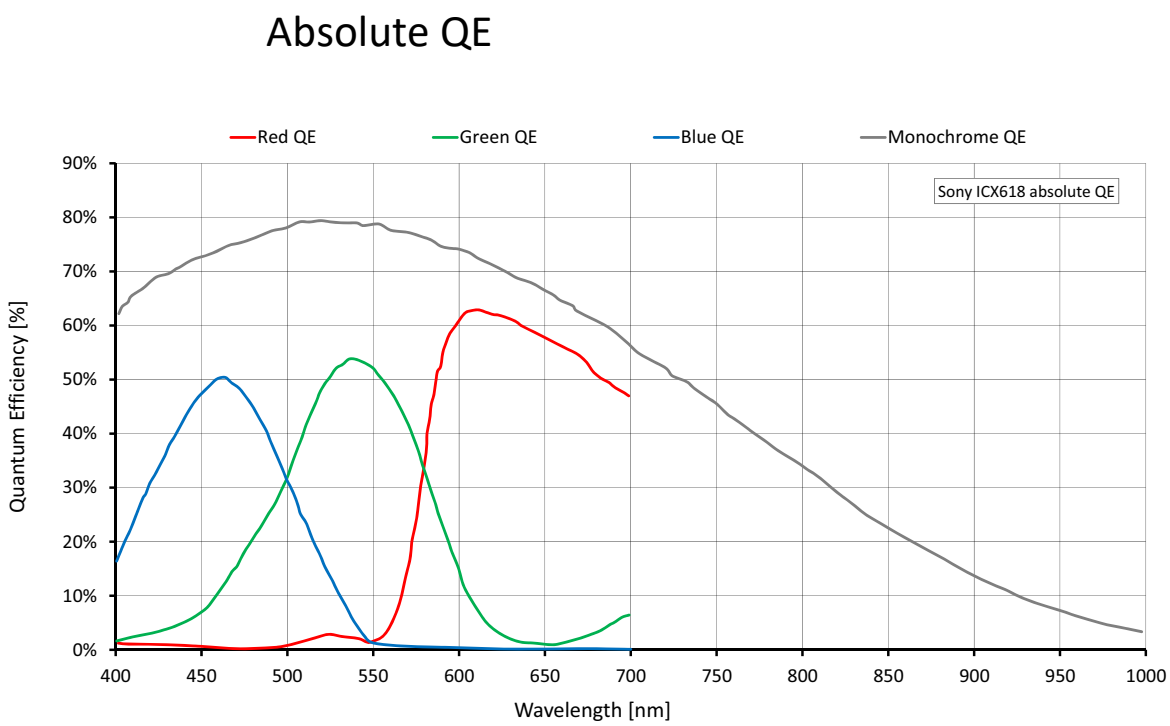


Figure 3: Prosilica GS660 (Sony ICX618) absolute QE

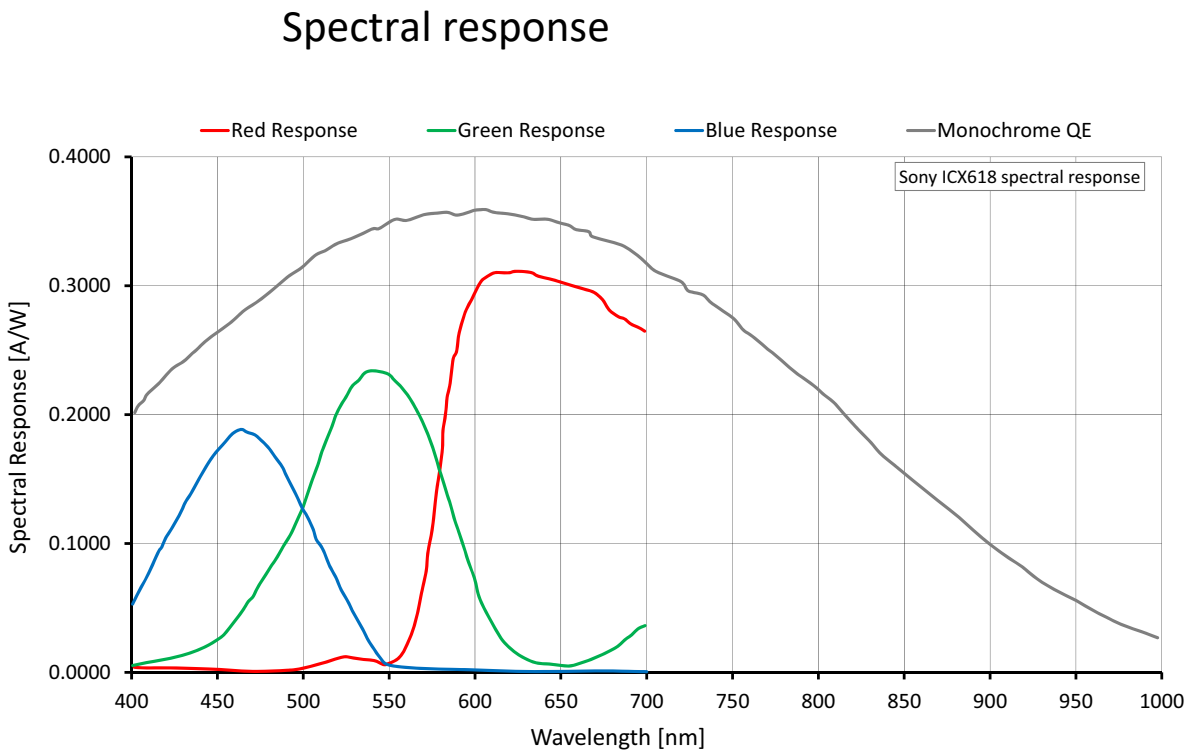


Figure 4: Prosilica GS660 (Sony ICX618) spectral response

Prosilica GS1380 series

Feature	Specification	
	Prosilica GS1380	**Prosilica GS1380C**
Sensor model	Sony ICX285AL with EXview HAD CCD™ technology	Sony ICX285AQ with EXview HAD CCD™ technology
Resolution (H × V)	1360 × 1024 1.4 MP	
Sensor type	Interline CCD, Progressive Scan	
Shutter type	Global	
Sensor format	Type 2/3	
Sensor size	11.0 mm diagonal	
Pixel size	6.45 µm × 6.45 µm	
Optical filter	No filter	IRC30 IR cut filter
Maximum frame rate at full resolution	30 frames per second	
A/D	14-bit	
Image buffer	16 MB	
Bit depth	8/12 bit	
Monochrome pixel formats	Mono8, Mono12, Mono12Packed	Mono8
YUV color pixel formats	(not applicable)	YUV411Packed, YUV422Packed, YUV444Packed
RGB color pixel formats	(not applicable)	RGB8Packed, BGR8Packed
RAW pixel formats	(not applicable)	BayerRG8, BayerRG12, BayerGR12Packed
Exposure control	10 µs to 78.5 s; 1 µs increments	
Gain control	0 to 30 dB	
Binning (Sum)	Horizontal: 1 to 8 columns Vertical: 1 to 14 rows	
Power consumption	3 W	
Mass (typical)	187 g	
Sensor orientations	Landscape, portrait	
Trigger latency	1 µs for non-isolated I/O, 9 µs for isolated I/O	
Trigger jitter	±20 ns for non-isolated I/O, ±0.5 µs for isolated I/O	
Propagation delay (t_{pd})	10 ns for non-isolated I/O, 1.3 µs for isolated I/O	

Table 6: Prosilica GS1380 model series specifications

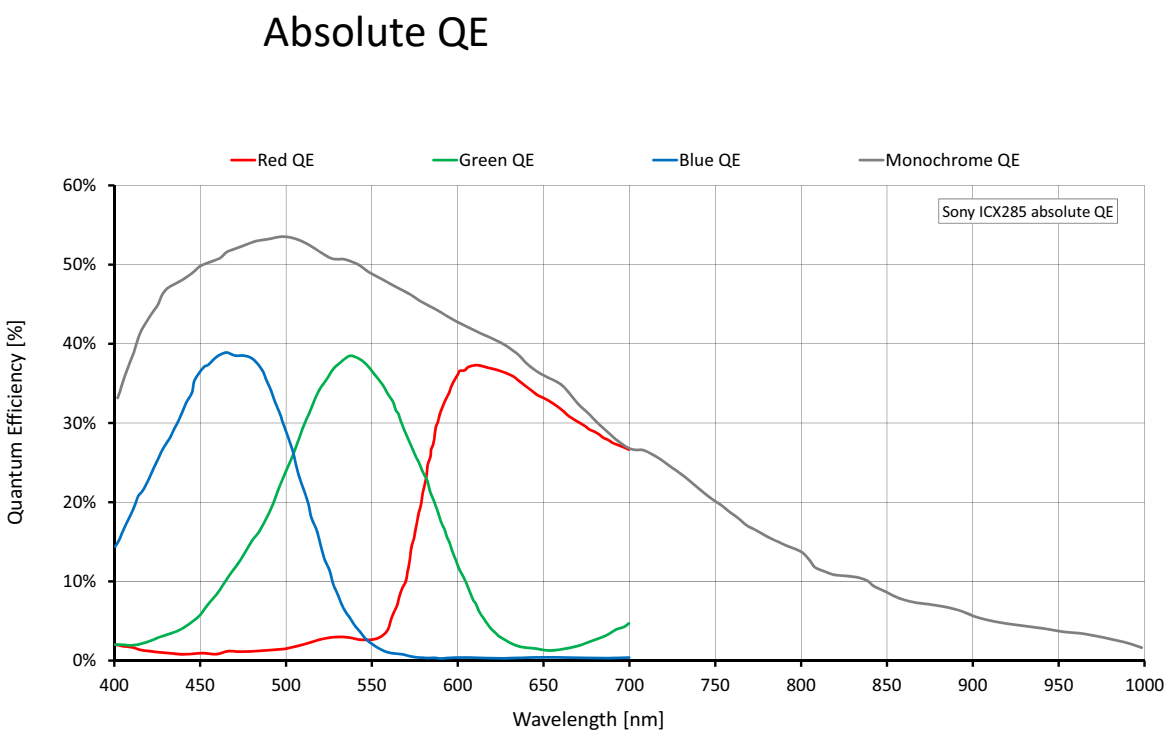


Figure 5: Prosilica GS1380 (Sony ICX285) absolute QE

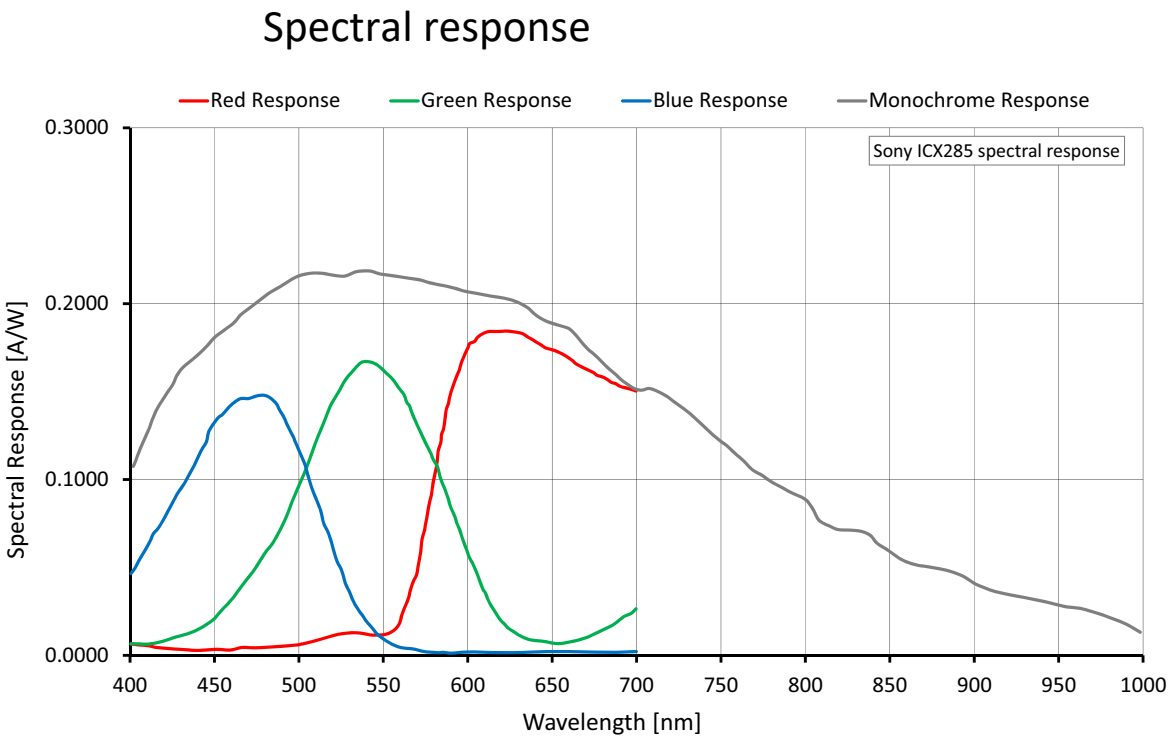


Figure 6: Prosilica GS1380 (Sony ICX285) spectral response

Prosilica GS2450 series

Feature	Specification	
	Prosilica GS2450	Prosilica GS2450C
Sensor model	Sony ICX625ALA with Super HAD CCD™ technology	Sony ICX625AQA with Super HAD CCD™ technology
Resolution (H × V)	2448 × 2050 5.0 MP	
Sensor type	Interline CCD, Progressive Scan	
Shutter type	Global	
Sensor format	Type 2/3	
Sensor size	11.016 mm diagonal	
Pixel size	3.45 µm × 3.45 µm	
Optical filter	No filter	IRC30 IR cut filter
Maximum frame rate at full resolution	15 frames per second	
A/D	14-bit	
Image buffer	16 MB	
Bit depth	8/12 bit	
Monochrome pixel formats	Mono8, Mono12, Mono12Packed	Mono8
YUV color pixel formats	(not applicable)	YUV411Packed, YUV422Packed, YUV444Packed
RGB color pixel formats	(not applicable)	RGB8Packed, BGR8Packed
RAW pixel formats	(not applicable)	BayerRG8, BayerRG12, BayerGR12Packed
Exposure control	10 µs to 42.9 s; 1 µs increments	
Gain control	0 to 30 dB	
Binning (Sum)	Horizontal: 1 to 8 columns Vertical: 1 to 14 rows	
Power consumption	3 W	
Mass (typical)	186 g	
Sensor orientation	Landscape	
Trigger latency	2 µs for non-isolated I/O, 10 µs for isolated I/O	
Trigger jitter	±20 ns for non-isolated I/O, ±0.5 µs for isolated I/O	
Propagation delay (t_{pd})	10 ns for non-isolated I/O, 1.3 µs for isolated I/O	

Table 7: Prosilica GS2450 model series specifications

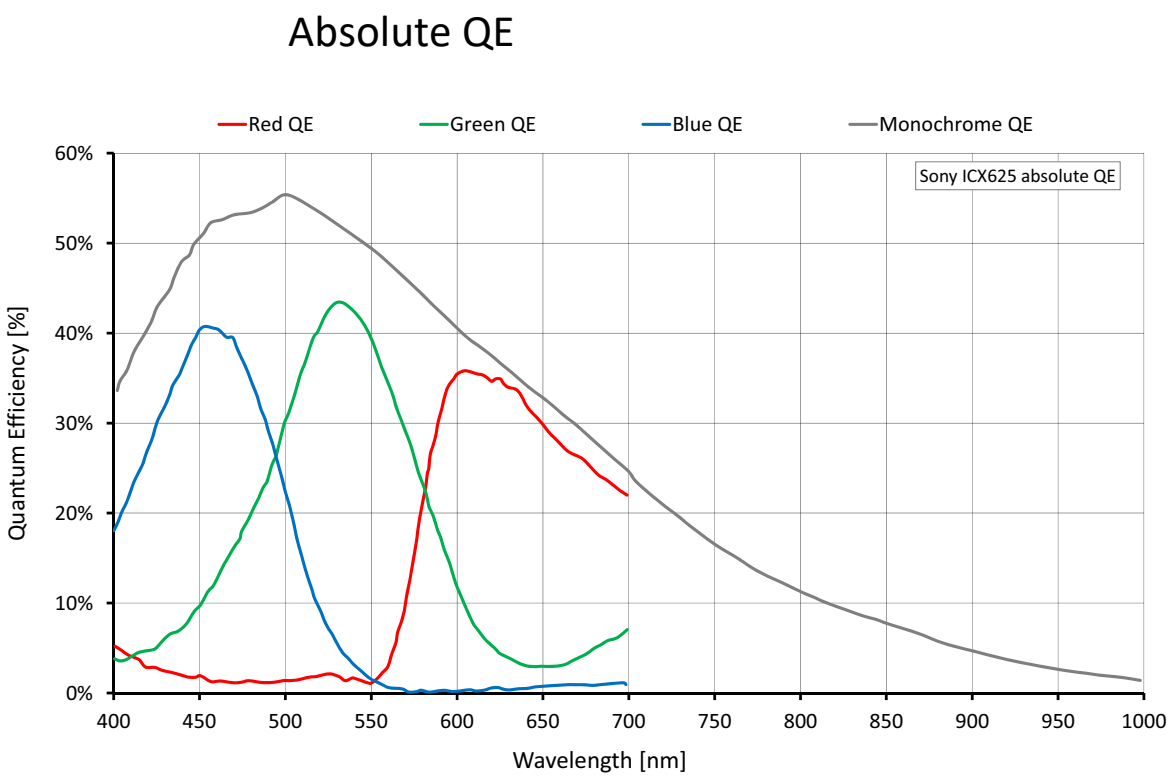


Figure 7: Prosilica GS2450 (Sony ICX625) absolute QE

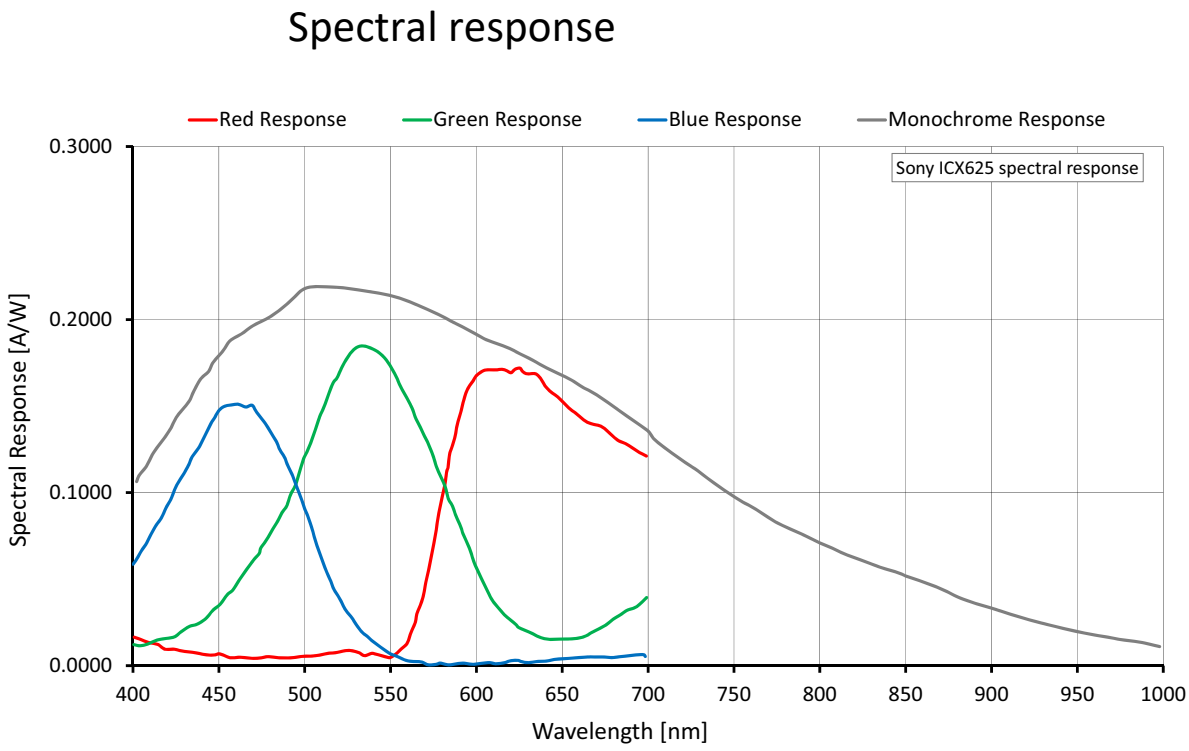


Figure 8: Prosilica GS2450 (Sony ICX625) spectral response

Camera attribute highlights

Allied Vision cameras support a number of standard and extended features. The table below identifies a selection of interesting capabilities of the Prosilica GS camera family.

www

A complete listing of camera controls, including control definitions can be found online:

PvAPI users: GigE Camera and Driver Attributes document

Vimba users: GigE Features Reference document

Control	Description
Gain control	Manual and auto
Exposure control	Manual and auto
White balance	Red and blue channel; manual and auto control
External trigger event	Rising edge, falling edge, any edge, level high, level low
External trigger delay	0 to 60* s; 1 µs increments
Fixed rate control	0.001 fps to maximum frame rate
Imaging modes	Free-running, external trigger, fixed rate, software trigger
Sync out modes	Trigger ready, trigger input, exposing, readout, imaging, strobe, GPO
Region of interest	Independent x and y control with 1 pixel resolution
Multicast	Streaming to multiple computers
Event channel	In-camera events including exposure start and trigger are asynchronously broadcasted to the host computer
*May vary depending on the camera model	

Table 8: Prosilica GS camera and driver attribute highlights

Optical filter

All Prosilica GS color models are equipped with an infrared block filter (IR filter). This filter is employed to prevent infrared wavelength photons from passing to the sensor. In the absence of IR filter, images are dominated by red and incapable of being properly color balanced. Monochrome cameras do not employ an IR filter.

The figure below shows the filter transmission response for the IRC30 filter employed in the Prosilica GS cameras.

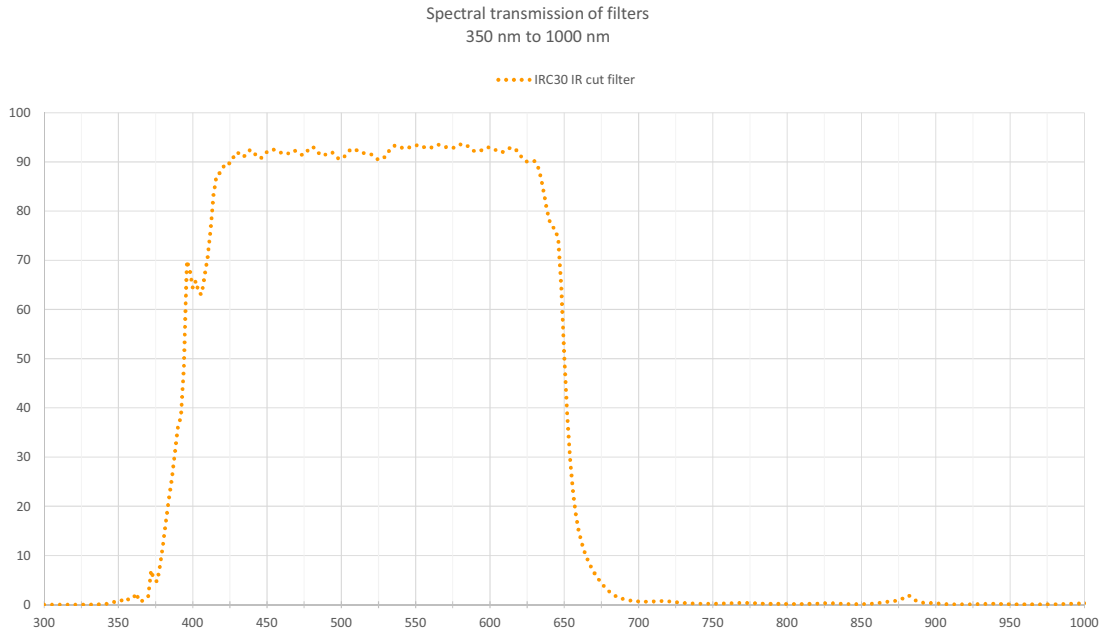


Figure 9: IRC30 filter transmission response

Camera dimensions

The Prosilica GS camera family offers several sensor orientation options. The camera variations are described below and detailed dimension drawings are provided in Mechanical drawings in the next section.

Sensor orientation	Model	Description	Example
Landscape 	GS	Sensor mounted in landscape orientation	GS1380
Portrait 	GS-P	Sensor mounted in portrait orientation	GS1380-P

Table 9: Prosilica GS sensor orientations

Note

Prosilica GS660, GS660C, GS2450, and GS2450C do not support portrait sensor orientation.

Mechanical drawings

Landscape sensor

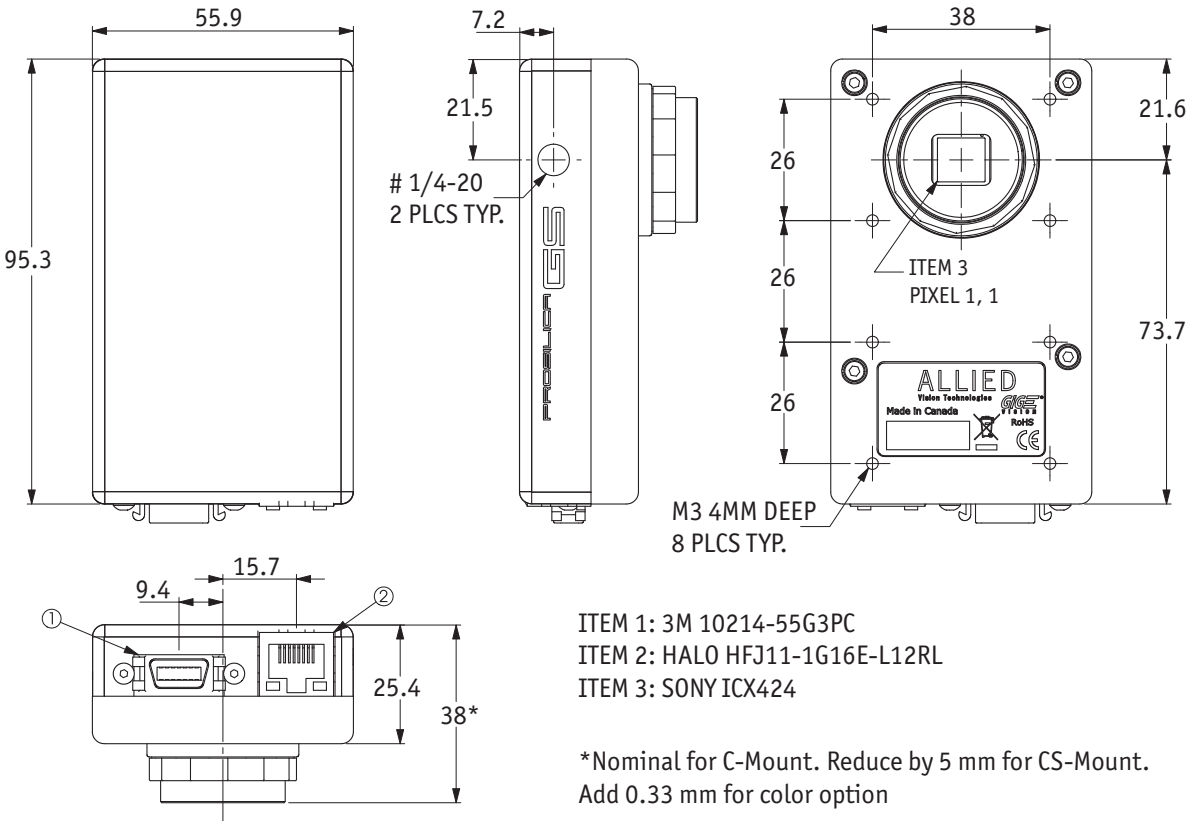


Figure 10: Prosilica GS650 series mechanical drawing

Portrait sensor

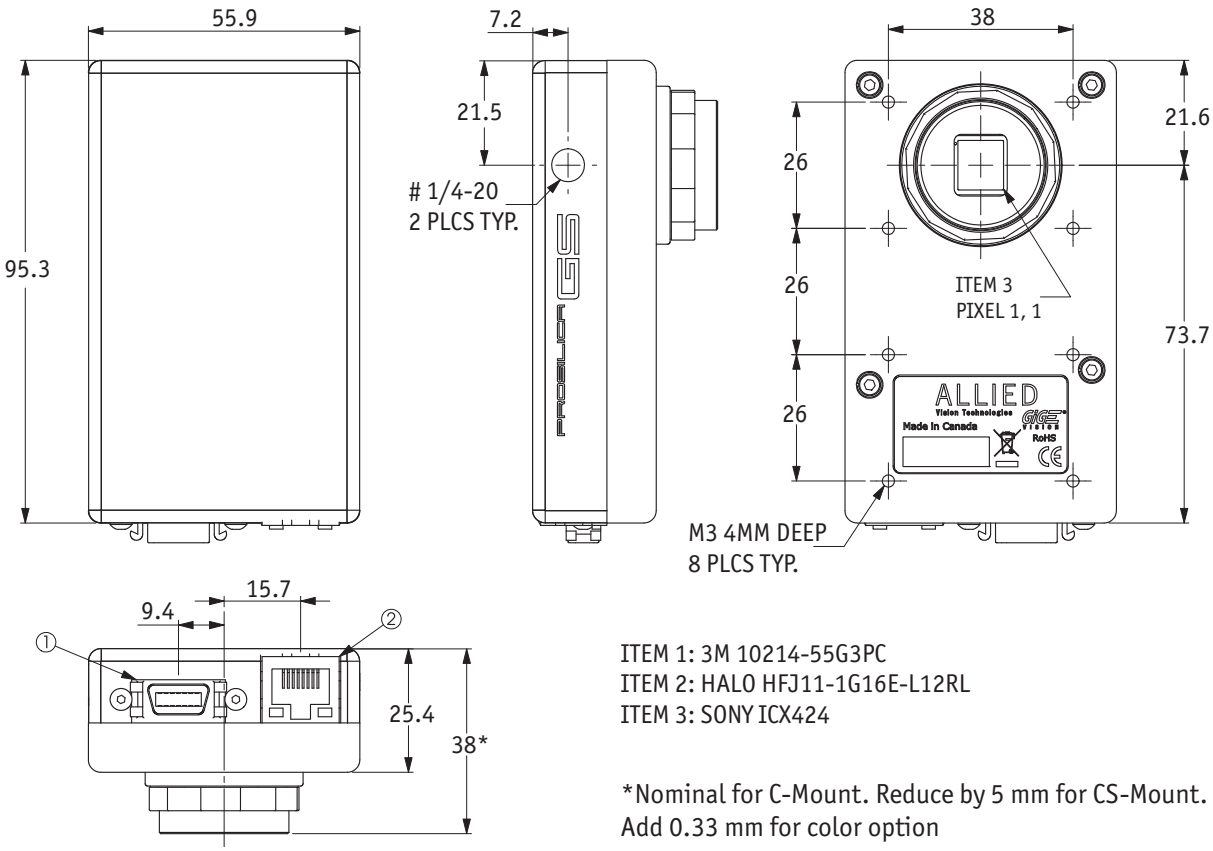


Figure 11: Prosilica GS650-P series mechanical drawing

C-Mount flange focal distance

Flange focal distance is the optical distance from the mounting flange to image sensor die. Prosilica GS C-Mount cameras are optically calibrated to a standard 17.526 mm optical flange focal distance, with a ±10 µm tolerance.

Prosilica GS cameras are shipped with adjustable C-Mount.

Adjustment of C-Mount

The C-Mount is adjusted at the factory and should not require adjusting. If for some reason the lens mount requires adjustment, use the following method.

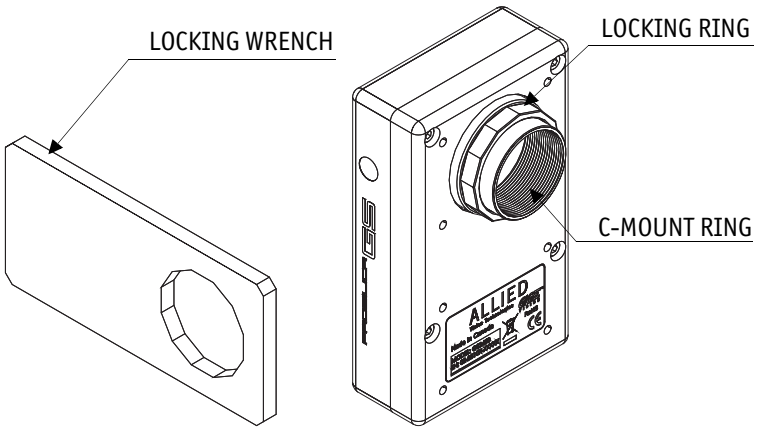


Figure 12: Prosilica GS camera front view

Loosen locking ring

Use an adjustable wrench to loosen the locking ring. Be careful not to scratch the camera. When the locking ring is loose, unthread the ring a few turns from the camera face.

Note

A wrench suitable for this procedure is available for purchase from Allied Vision.
Order code: 02-5003A

Image to infinity

Use a C-Mount compatible lens that allows an infinity focus. Set the lens to infinity and image a distant object; 10 to 15 meters should suffice. Make sure the lens is firmly threaded onto the C-Mount ring. Rotate the lens and C-Mount ring until the image is focused. Carefully tighten the locking ring and recheck focus.

Lens protrusion for C-Mount cameras

Lens protrusion is the distance from outer edge of C-Mount ring to contact point of first surface internal to C-Mount ring. For color cameras this surface is the IR-filter holder, and for mono cameras this surface is the internal camera front plate (see figure 13:). Table 10: presents lens protrusion values for Prosilica GS cameras with C-Mount.

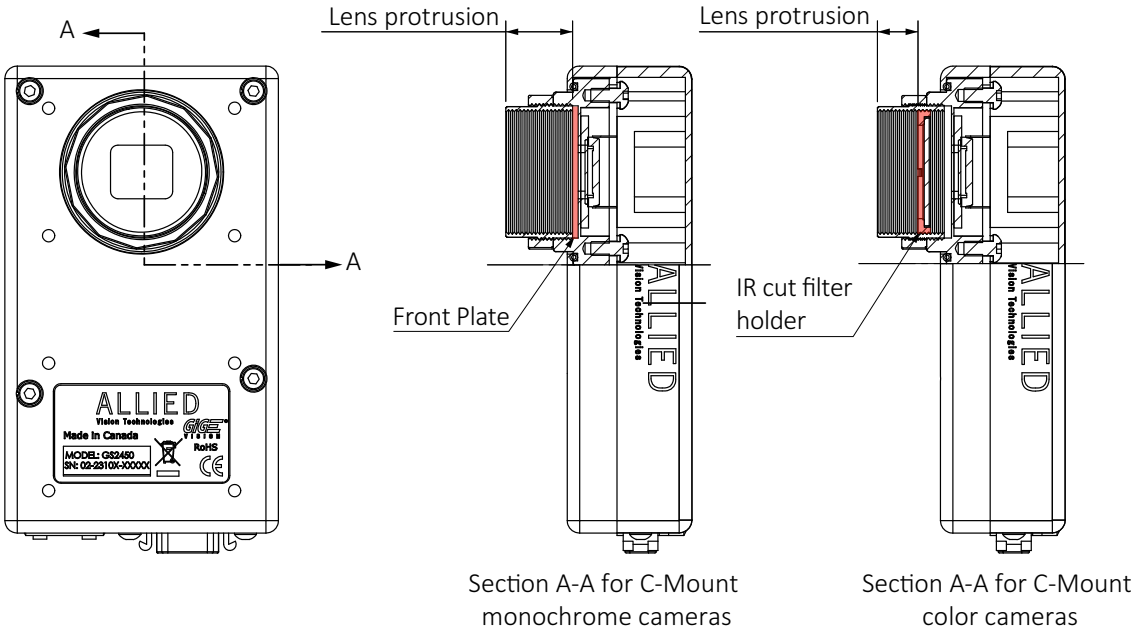


Figure 13: : Cross section of typical Prosilica GS assembly with C-Mount

Model	Sensor orientation	Lens protrusion [mm]
GS650-P	Portrait	13.64
GS650	Landscape	13.64
GS650C	Landscape	8.95
GS650C-P	Portrait	9.27
GS660	Landscape	13.64
GS660C	Landscape	8.41

Model	Sensor orientation	Lens protrusion [mm]
GS1380	Landscape	13.64
GS1380-P	Portrait	13.64
GS1380C	Landscape	9.00
GS1380C-P	Portrait	9.32
GS2450	Landscape	13.64
GS2450C	Landscape	8.29

Table 10: : Lens protrusion for Prosilica GS cameras with C-Mount

Camera interfaces

This chapter provides information on Gigabit Ethernet interface, inputs and outputs, and trigger features.

www

Accessories:

Please contact Allied Vision Sales representative or your local Allied Vision distribution partner for information on accessories:

www.alliedvision.com/en/about-us/where-we-are.html

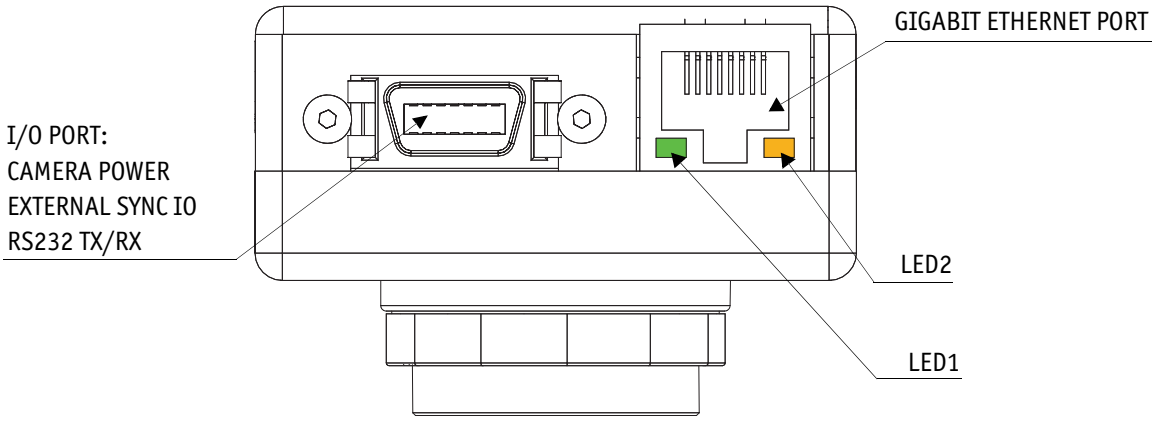


Figure 14: Prosilica GS connection port and interface

Status LEDs

The color of the LEDs have the following meaning:

	LED Color	Status
LED1	Flashing green	Camera is powered
	Solid green	Camera is booted, and link with the host is established
LED2	Flashing/solid orange	Ethernet activity

Table 11: Status of LEDs in Prosilica GS

Note

Once the camera is booted, LED1 will remain solid green as long as the camera is powered, even if connection with the host is lost.

Gigabit Ethernet interface

The Gigabit Ethernet interface conforms to the IEEE 802.3 1000BASE-T standard for Gigabit Ethernet over copper. We recommend using Category 6 or higher compatible cabling and connectors for best performance.

www

GigE Installation Manual offers detailed instructions for using Prosilica GS cameras.

www.alliedvision.com/fileadmin/content/documents/products/cameras/various/installation-manual/GigE_Installation_Manual.pdf

Note

See Hardware Selection for Allied Vision GigE Cameras application note for a list of recommended Ethernet adapters:

www.alliedvision.com/fileadmin/content/documents/products/cameras/various/appnote/Hardware_Selection_for_Allied_Vision_GigE_Cameras.pdf

A standard Ethernet adapter is available for purchase from Allied Vision:
Order code: 02-3002A
Model: Intel Pro 1000/PT

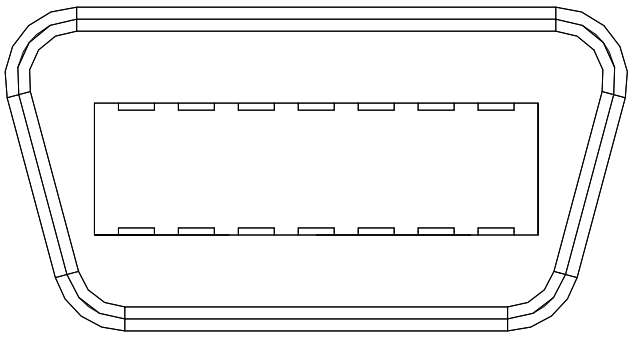
Note

Cable lengths up to 100 meters are supported.

The 8-pin RJ-45 jack has the pin assignment according to the Ethernet standard (IEEE 802.3 1000BASE-T).

Allied Vision recommends using locking-screw cables from Components Express, Inc. for a perfect fit. Visit the CEI product configurator to customize the cable according to your needs.

Camera I/O connector pin assignment



Camera side 3M MDR 10214-55G3PC connector					
Pin	**Signal**	**Direction**	**Level**	**Description**	**I/O cable color code**
1	Camera Power	In	5 to 16* VDC	Power supply	Red
2	Camera GND	In	GND for ext. power	Ground for camera power supply	Black
3	In 1	In	U_{in}(high) = 5 to 24 V U_{in}(low) = 0 to 0.8 V	Input 1 opto-isolated (SyncIn1)	White
4	Isolated IO GND	In/Out	Common GND for In/Out	Isolated input and output signal ground	Brown
5	Out 1	Out	Open emitter max. 20 mA	Output 1 opto-isolated (SyncOut1)	Green
6	Video Iris	Out	---	PWM signal for iris control	Blue
7	Reserved	---	---	---	Orange
8	---	---	---	---	---
9	---	---	---	---	---
10	TxD RS232	Out	RS232	Terminal transmit data	Yellow
11	RxD RS232	In	RS232	Terminal receive data	White/Brown
12	In 2	In	LVTTL max. 3.3 V	Input 2 non-isolated (SyncIn2)	Pink
13	Out 2	Out	LVTTL max. 3.3 V	Output 2 non-isolated (SyncOut2)	White/Black

Table 12: Camera I/O connector pin assignment and cable color coding

Camera side 3M MDR 10214-55G3PC connector					
Pin	**Signal**	**Direction**	**Level**	**Description**	**I/O cable color code**
14	Signal GND	---	---	Ground for RS232 and non-isolated outputs	Grey
*Some models offer 5 to 25 VDC. See Camera power section for details.					

Table 12: Camera I/O connector pin assignment and cable color coding (continued)

The General Purpose I/O port uses a 3M 10214-55G3PC (or 3M 10214-6212PC) connector on the camera side. The mating cable connector is 3M 10114-3000PE or a connector with shielded housing 3M 10314-3210-00X (X indicates color preference).

Note

The camera is not intended to be connected to a DC distribution network. The maximum length for I/O cables must not exceed 30 meters.

Note

The cable side connector is available for purchase from Allied Vision.
Order code: 02-7003A

Note

For cable color and pin out information, see the *Allied Vision I/O cable data sheet*:

www.alliedvision.com/en/support/technical-documentation/accessories-data-sheets.html

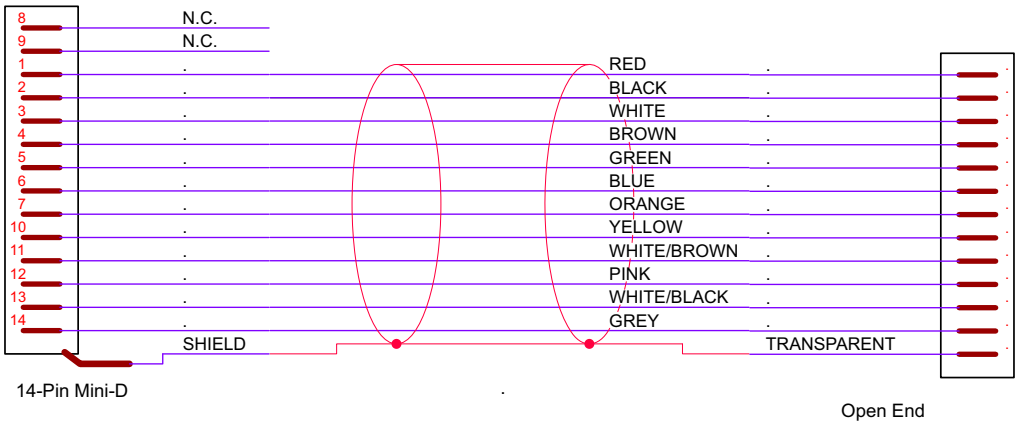


Figure 15: Prosilica GS cable color coding

I/O definition

Camera power

The Prosilica GS camera family has recently been updated to offer an expanded input power voltage range. The camera serial number is used to differentiate between cameras that offer 5 to 16 VDC and those that offer 5 to 25 VDC.

Caution

Serial number: 02-22XXA, 5 to 16 Volts. 12 Volts nominal.

Serial number: 02-22XXB, 5 to 25 Volts. 12 Volts nominal.

Note

A 12 Volt power adapter with camera connector is available for purchase from Allied Vision:

- Order code: 02-8007A North America Supply.
- Order code: 02-8008A Universal Supply.

Isolated IO ground

The Isolated IO GND connection provides the user ground reference and return path for In 1, and Out 1. It is recommended that the ground wiring be physically close to the In/Out wiring to prevent parasitic coupling. For example, a good cable design connects In 1 to one conductor of a twisted pair, Isolated IO GND to the second conductor of the same twisted pair.

RxD RS232 and TxD RS232

These signals are RS232 compatible. These signals allow communication from the host system via the Ethernet interface to a peripheral device connected to the camera. These signals are not isolated; therefore, careful attention should be used when designing cabling in noisy environments.

www

For complete RS232 description and usage, see:

www.alliedvision.com/fileadmin/content/documents/products/cameras/various/appnote/RS232_Port_GigE_Cameras.pdf

Input triggers

Input triggers allow the camera to be synchronized to an external event. The camera can be programmed to trigger on the rising edge, falling edge, both edges, or level of the signal. The camera can also be programmed to capture an image at some programmable delay time after the trigger event.

In 1 – opto-isolated

In 1 is optically isolated and can be used in electrically noisy environments to prevent false trigger events. Tie Camera GND to Isolated IO GND to complete the trigger circuit. Compare to the non-isolated trigger, In 1 has a longer propagation time. It can be driven from 5 to 24 Volts with a minimum current source of 10 mA. See Camera I/O opto-isolated user circuit example for more information.

In 2 – non-isolated

In 2 is non-isolated and can be used when a faster trigger is required and when environmental noise is inconsequential. The required signal is low voltage TTL 3.3 Volts. Tie Signal GND to Camera GND to complete the trigger circuit. See Video iris user circuit example for more wiring information.

Caution Do not exceed 5.5 Volts on signal inputs unless otherwise indicated.

Output signals

Output signals can be assigned to a variety of internal camera signals via software. They can be configured to active high or active low. The internal camera signals are listed as follows:

Exposing	Corresponds to when camera is integrating light
Trigger Ready	Indicates when the camera is ready to accept a trigger signal
Trigger Input	A relay of the trigger input signal used to “daisy chain” the trigger signal for multiple cameras
Readout	Valid when camera is reading out data
Imaging	Valid when camera is exposing or reading out
Strobe	Programmable pulse based on one of the above events
GPO	User programmable binary output

Out 1 – opto-isolated

Out 1 is optically isolated and should be used in noisy environments. Out 1 requires a pull up resistor of greater than 1 KΩ to the user’s 5 Volts logic supply. Tie Camera GND to Isolated IO GND to complete the external circuit. See Camera I/O opto-isolated user circuit example for more information.

Out 2– non-isolated

Out 2 signal is not electrically isolated and can be used when environmental electrical noise is inconsequential and faster trigger response is required. Use Signal GND to complete the external circuit. The output signal is a low voltage TTL, maximum 3.3 Volts. Not suitable for driving loads in excess of 24 mA. See Video iris user circuit example for more wiring information.

Signal ground

Signal Ground must be connected to the user's external circuit ground if In 2 or Out 2 is to be used, or if the RS232 port is to be used. Note that Signal Ground is common with Camera GND; however, it is good practice to provide a separate ground connection for power and signal.

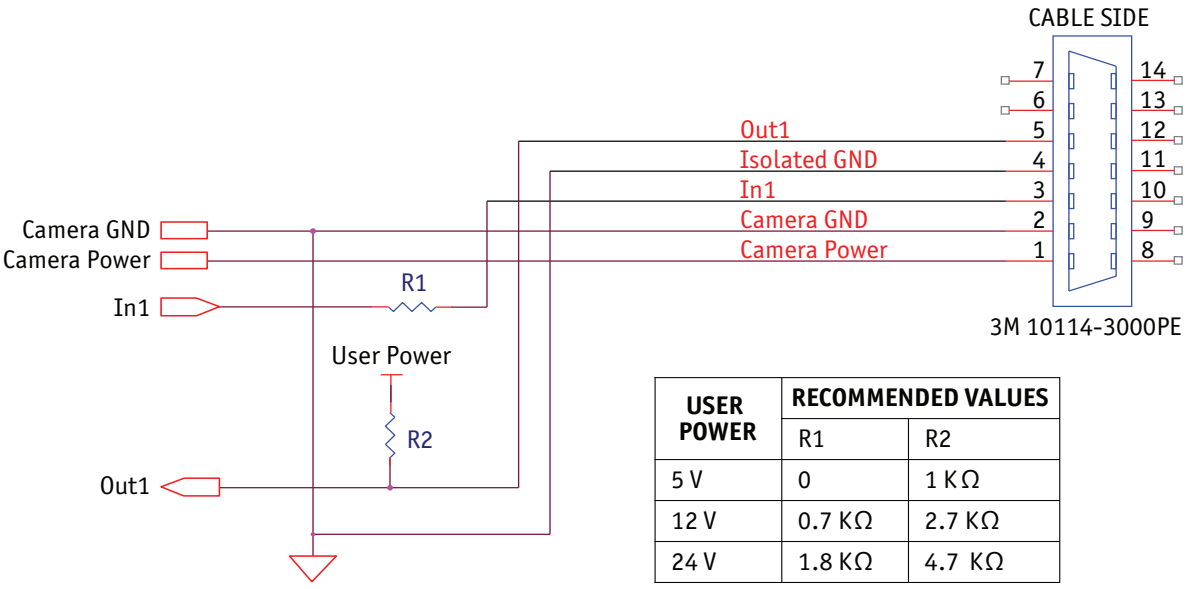
Video iris

This signal can be used to drive the video input of a video iris lens. See Video iris user circuit example section for wiring information.

Reserved

These signals are reserved for future use and should be left disconnected.

Camera I/O opto-isolated user circuit example



USER POWER	RECOMMENDED VALUES	
	R1	R2
5 V	0	1 KΩ
12 V	0.7 KΩ	2.7 KΩ
24 V	1.8 KΩ	4.7 KΩ

Figure 16: Prosilica GS isolated trigger user circuit

*Cameras with serial number: 02-XXXXX-0XXXX, R1 necessary for input greater than 5 Volts, see table above. Cameras with serial number: 02-XXXXX-1XXXX, no R1 is necessary, 5 to 24 Volts.

Caution

Input: Incoming trigger must be able to source 10 mA.

Output: User power, with pull-up resistor R2 is required.

Isolated output is connected to the open collector of Fairchild MOCD207. The corresponding transistor emitter is connected to isolated ground. See the Fairchild MOCD207 data sheet for more detailed information.

Camera I/O non-isolated user circuit example

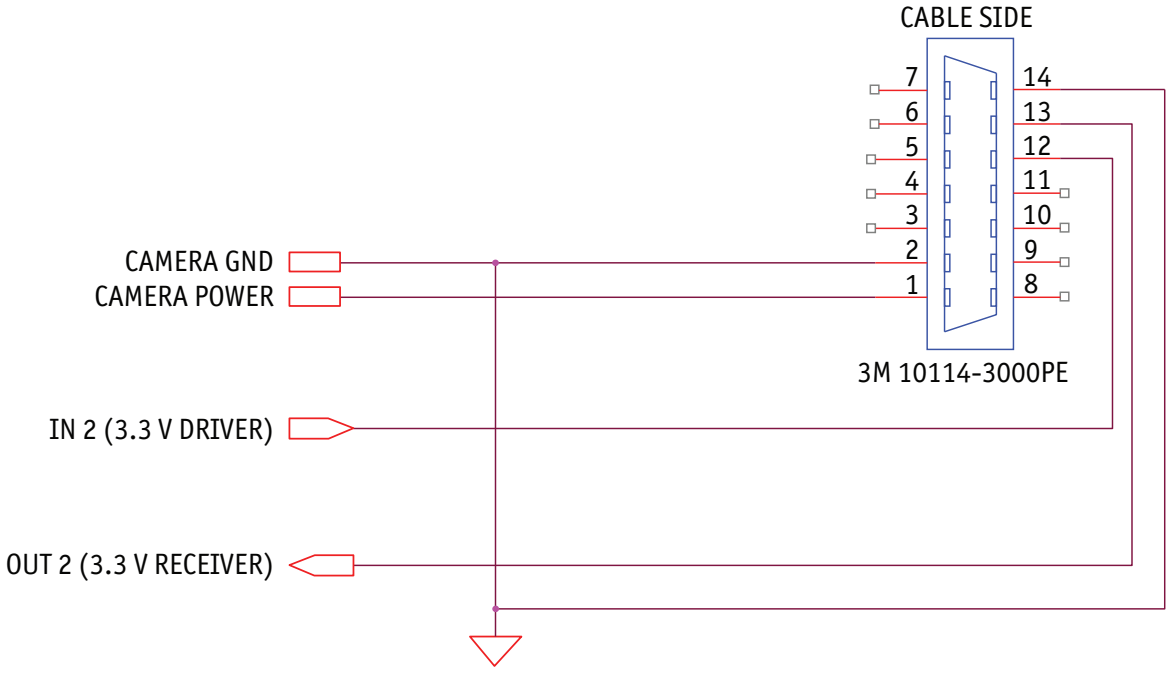


Figure 17: Prosilica GS non-isolated trigger user circuit

Caution

Input: Incoming trigger must be able to source 10 µA, at 3.3 Volts. Input trigger voltage greater than 5.5 Volts will damage the camera.

Output: The maximum sync output current is 24 mA, at 3.3 Volts.

The non-isolated trigger circuit is connected to a Texas Instruments SN74LVC2G241 buffer/driver inside the camera. See the Texas Instruments SN74LVC2G241 for more detailed information.

Video iris user circuit example

Prosilica GS series cameras provide built-in auto iris controls for controlling video-type auto-iris lenses. These lenses are available from many popular security lens companies including Pentax, Fujinon, Tamron, Schneider and others.

Remote iris lens control allows the camera to be more adaptable to changing light conditions. It allows the user to manually control the exposure and gain values and rely solely on the auto iris for adjustment to ambient lighting.

Caution

The following schematic uses CAMERA POWER to power the video iris lens, and assumes CAMERA POWER = 12 Volts. Most video iris lenses operate at a 8 to 16 Volts input voltage. Therefore, this circuit is not appropriate if using a 24 Volts camera power supply. Doing so may irreparably damage your lens. Please consult your video iris lens specifications for the appropriate drive voltage.

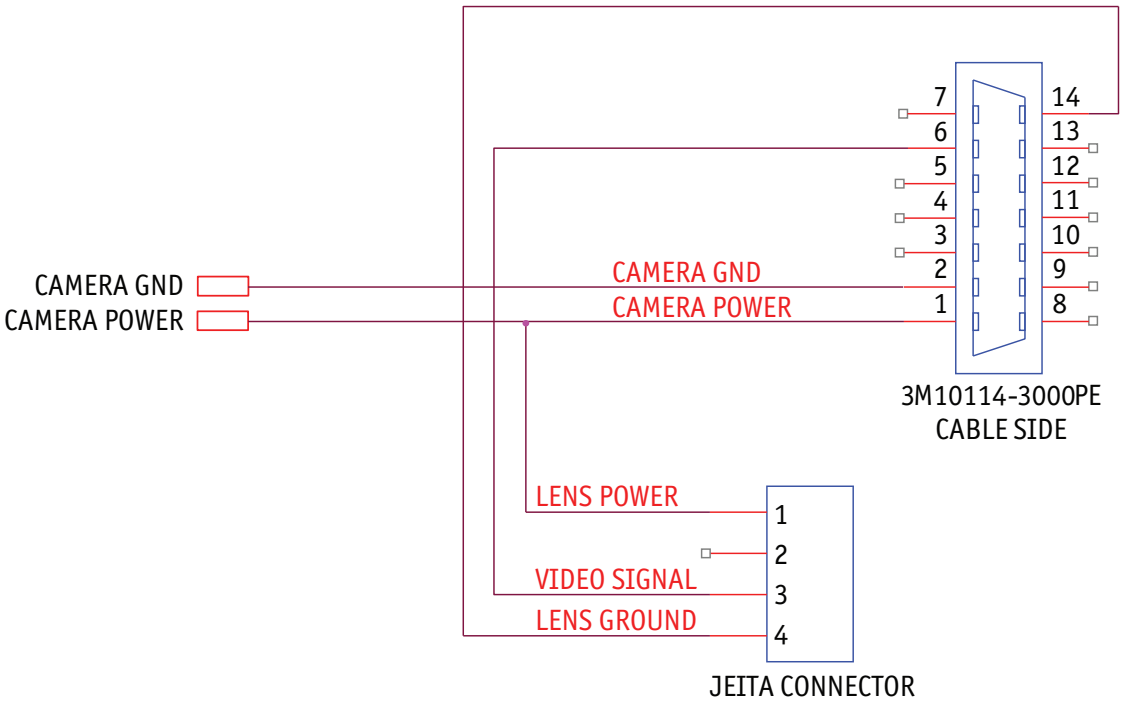


Figure 18: Prosilica GS video iris user circuit diagram

Trigger timing diagram

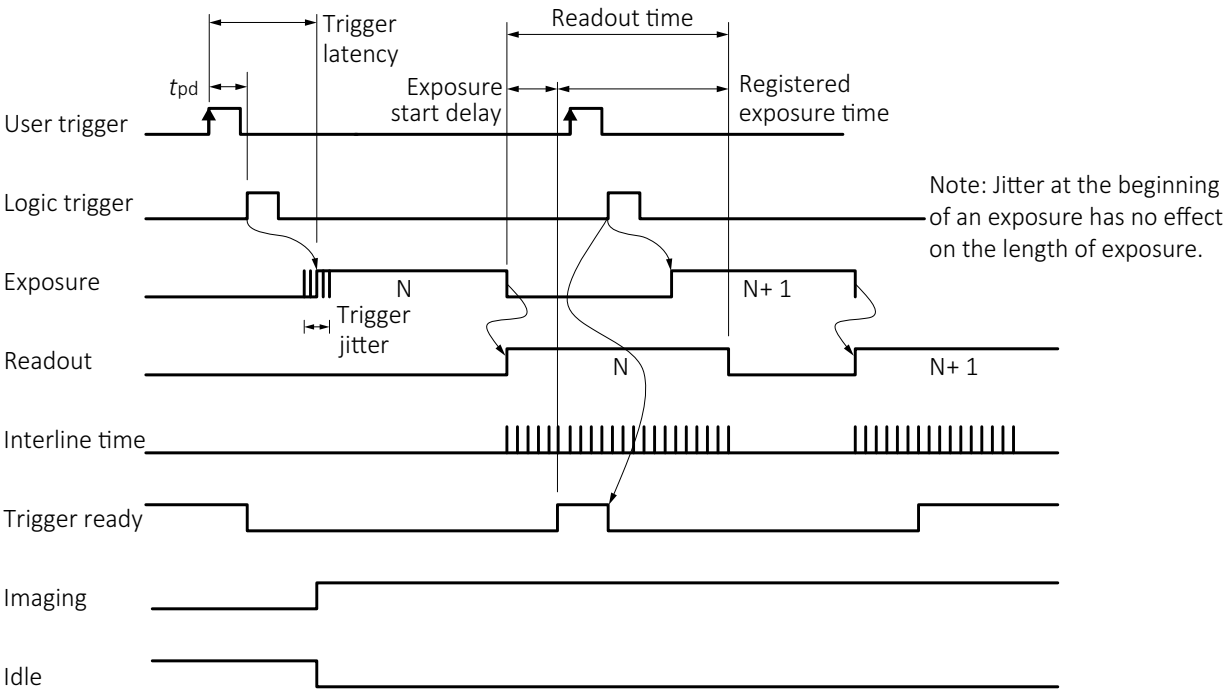


Figure 19: Prosilica GS internal signal timing waveforms

Notes on triggering

Term	Definition
User trigger	Trigger signal applied by the user (hardware trigger, software trigger)
Logic trigger	Trigger signal seen by the camera internal logic (not visible to the user)
Propagation delay (t_{pd})	Propagation delay between the user trigger and the logic trigger
Exposure	High when the camera image sensor is integrating light
Readout	High when the camera image sensor is reading out data
Trigger Latency	Time delay between the user trigger and the start of exposure
Trigger jitter	Error in the trigger latency time

Table 13: Explanation of signals in timing diagram

Term	Definition
Trigger ready	Indicates to the user that the camera will accept the next trigger
Registered exposure time	Exposure time value currently stored in the camera memory
Exposure start delay	Registered exposure time subtracted from the readout time and indicates when the next exposure cycle can begin such that the exposure will end after the current readout
Interline time	Time between sensor row readout cycles
Imaging	High when the camera image sensor is either exposing and/or reading out data
Idle	High if the camera image sensor is not exposing and/or reading out data

Table 13: Explanation of signals in timing diagram (continued)

Trigger rules

Note

The user trigger pulse width should be at least three times the width of the trigger latency.

- The end of exposure will always trigger the next readout.
- The end of exposure must always end after the current readout.
- The start of exposure must always correspond with the interline time if readout is true.
- Exposure start delay equals the readout time minus the registered exposure time.

Triggering during the idle state

For applications requiring the shortest possible *Trigger Latency* and the smallest possible *Trigger Jitter* the *User Trigger* signal should be applied when *Imaging* is false and *Idle* is true. In this case, *Trigger Latency* and *Trigger Jitter* are as indicated in camera specifications.

Triggering during the readout state

For applications requiring the fastest triggering cycle time whereby the camera image sensor is exposing and reading out simultaneously, apply the *User Trigger* signal as soon as a valid *Trigger Ready* is detected. In this case, *Trigger Latency* and *Trigger Jitter* can be up to 1 row time since *Exposure* must always begin on an *Interline* boundary.

Firmware update

Firmware updates are carried out via the GigE connection. Allied Vision provides an application for all Prosilica GS cameras that loads firmware to the camera using a simple interface. New feature introductions and product improvements motivate new firmware releases. All users are encouraged to use the newest firmware available and complete the firmware update if necessary.

www

Download the latest GigE firmware loader from the Allied Vision website:
www.alliedvision.com/en/support/firmware

www

For more information on GigE firmware update:
www.alliedvision.com/fileadmin/content/documents/products/cameras/various/appnote/GigE_Firmware_Update.pdf

Resolution and ROI frame rates

This section charts the resulting frame rate from changing sensor region of interest (ROI), from full image to a single line.

Note

- Frame rate data was generated using StreamBytesPerSecond = 124 MB/s and an 8 bit pixel format such as Mono8 or BayerRG8. Frame rates may be lower if using network hardware incapable of 124 MB/s.
- The camera frame rate can be increased by reducing the camera's Height attribute, resulting in a decreased region of interest (ROI) or “window”.
- The camera frame rate can also be increased by increasing the camera's BinningY attribute, resulting in a vertically scaled image (less overall height with same field of view).
- There is no frame rate increase with reduced width.

Prosilica GS650

$$\text{Frame rate} = \frac{1}{14.39\ \mu s \times \text{Height} + 1114.28\ \mu s}$$

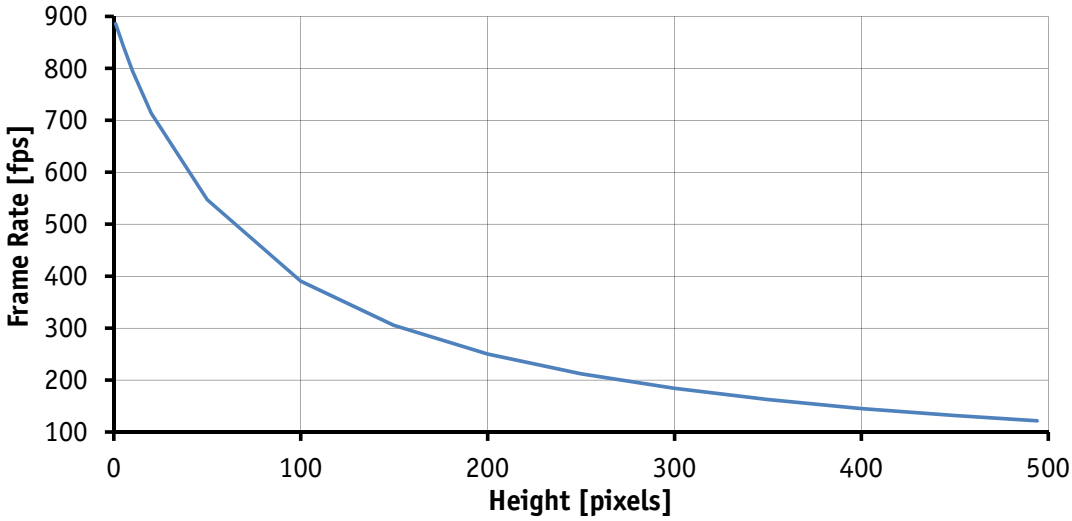


Figure 20: Frame rate versus height for Prosilica GS650 series

Prosilica GS660

$$\text{Frame rate} = \frac{1}{13.26\ \mu s \times \text{Height} + 1844.78\ \mu s}$$

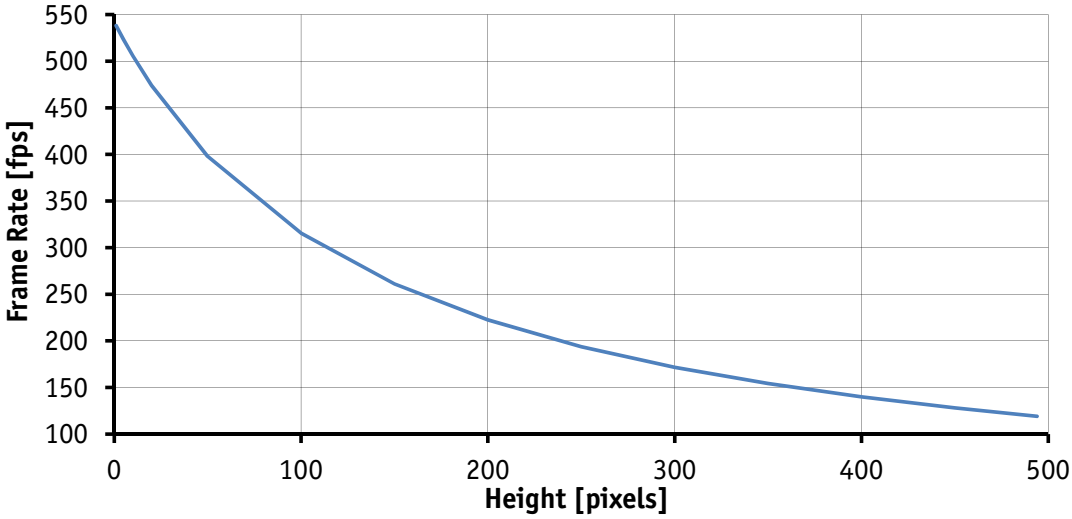


Figure 21: Frame rate versus height for Prosilica GS660 series

Prosilica GS1380

$$\text{Frame rate} = \frac{1}{27.79\ \mu s \times \text{Height} + 4881.40\ \mu s}$$

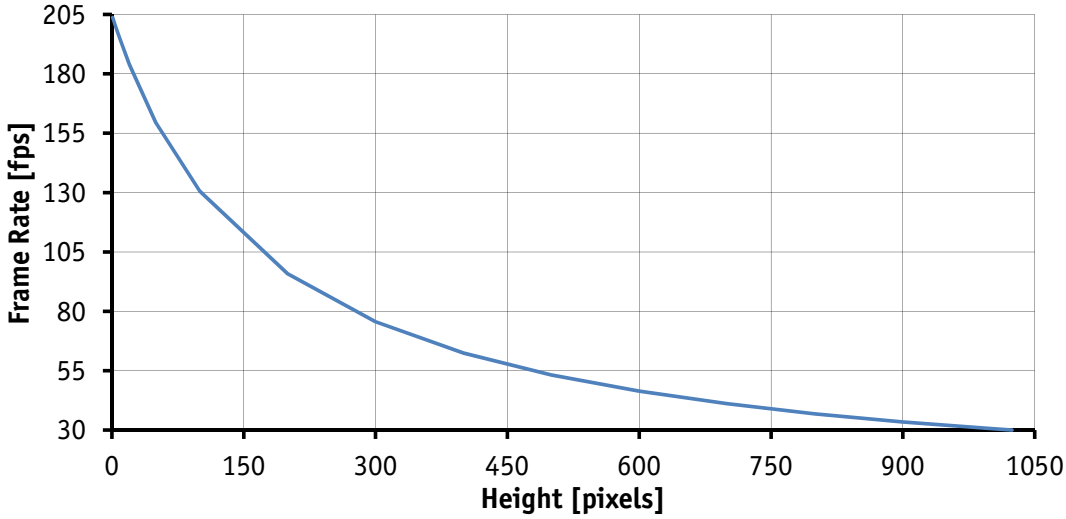


Figure 22: Frame rate versus height for Prosilica GS1380 series

Prosilica GS2450

$$\text{Frame rate} = \frac{1}{26.63\ \mu s \times \text{Height} + 12079.91\ \mu s}$$

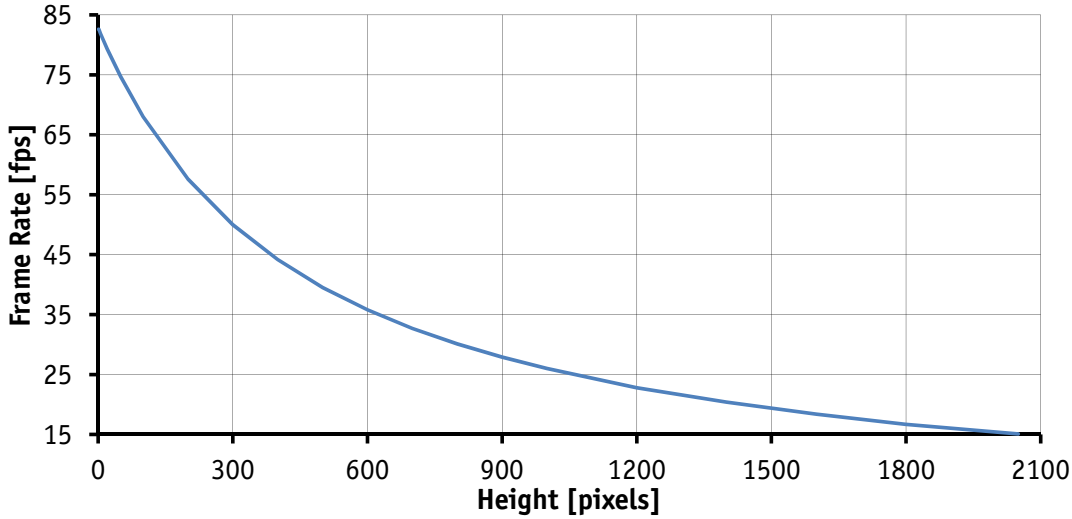


Figure 23: Frame rate versus height for Prosilica GS2450 series

Prosilica GS model comparison

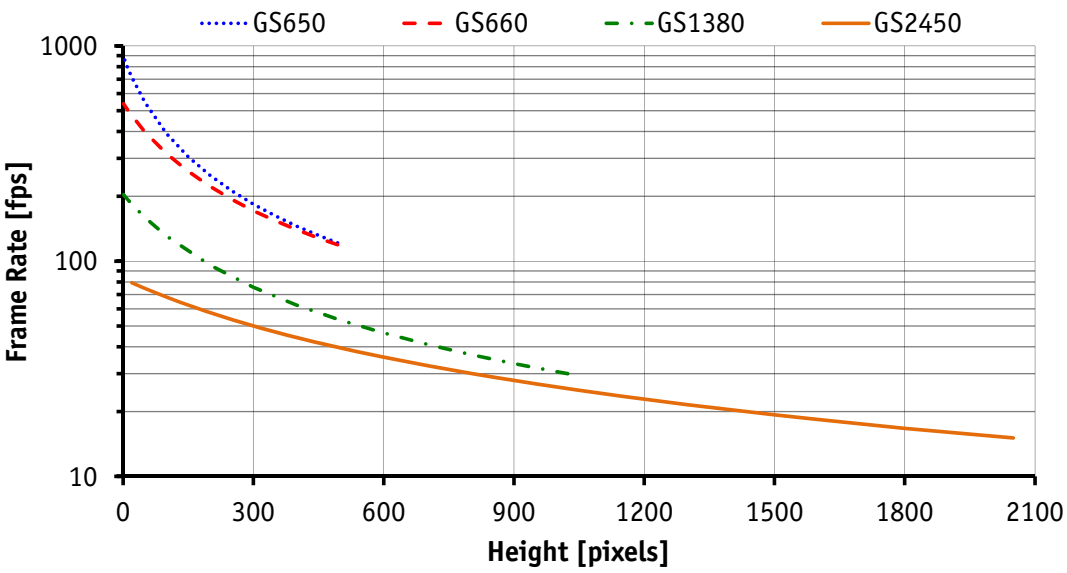


Figure 24: Maximum frame rate versus region height for all Prosilica GS cameras

Description of the data path

The following diagrams illustrate the data flow and the bit resolution of image data. The individual blocks are described in more detail in the GigE Features Reference document.

Monochrome Prosilica GS cameras

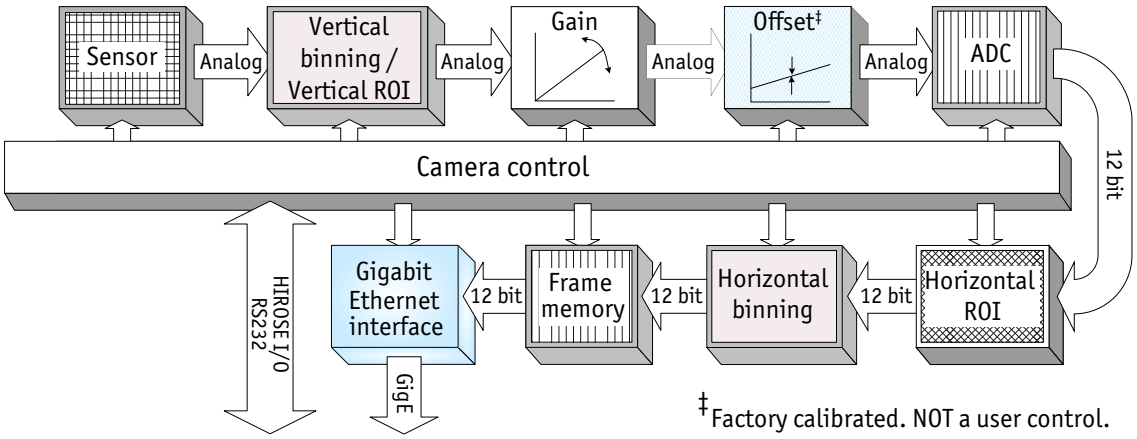


Figure 25: Block diagram of Prosilica GS monochrome cameras

Color Prosilica GS cameras

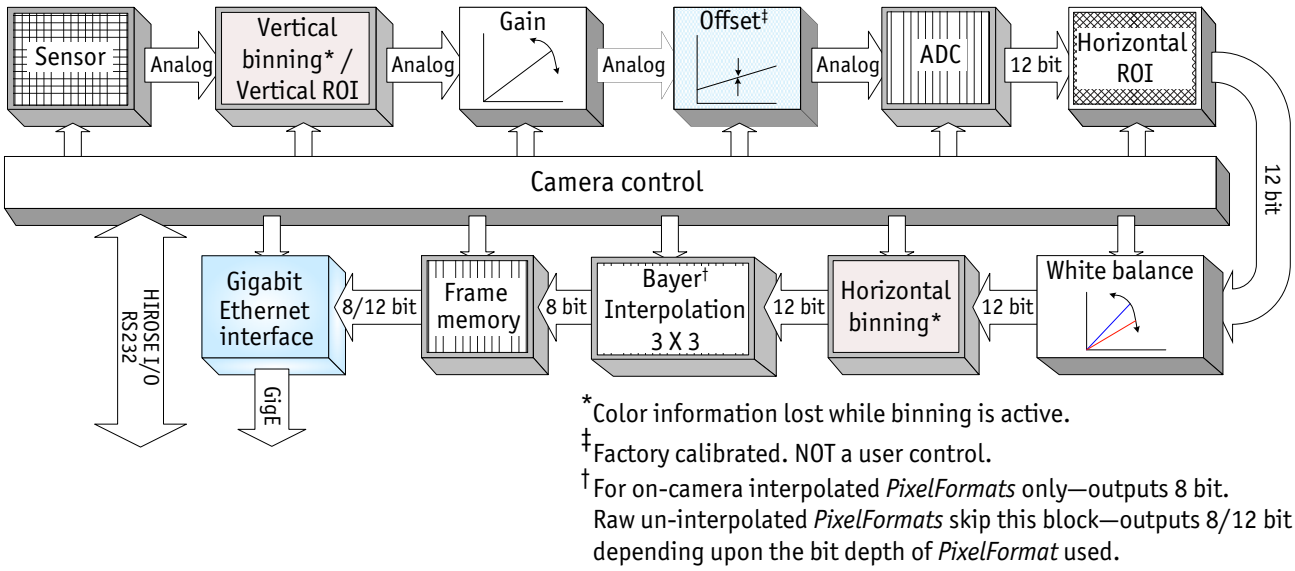


Figure 26: Block diagram of Prosilica GS color cameras

Additional references

Prosilica GS webpage

www.alliedvision.com/en/products/cameras

Prosilica GS documentation

www.alliedvision.com/en/support/technical-documentation/prosilica-gs-documentation

Vimba SDK

www.alliedvision.com/en/products/software

PvAPI SDK (Under Legacy Software)

www.alliedvision.com/en/support/software-downloads

Knowledge base

www.alliedvision.com/en/support/technical-papers-knowledge-base

Case studies

www.alliedvision.com/en/applications

Firmware

www.alliedvision.com/en/support/firmware

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