

daA1600-60um#

The daA1600-60um [Basler dart USB 3.0 camera module](#) with an e2v EV76C570 mono CMOS sensor delivers 60 frames per second at 2 MP resolution.



Variants#

The daA1600-60um is available in the following variants:

- **Bare board:** Consists of a circuit board only.
- **S-mount:** Consists of a circuit board and a camera front. S-mount lenses can be mounted in the lens mount on the camera front.
- **CS-mount:** Consists of a circuit board and a camera front. CS-mount lenses can be mounted in the lens mount on the camera front.

Specifications#

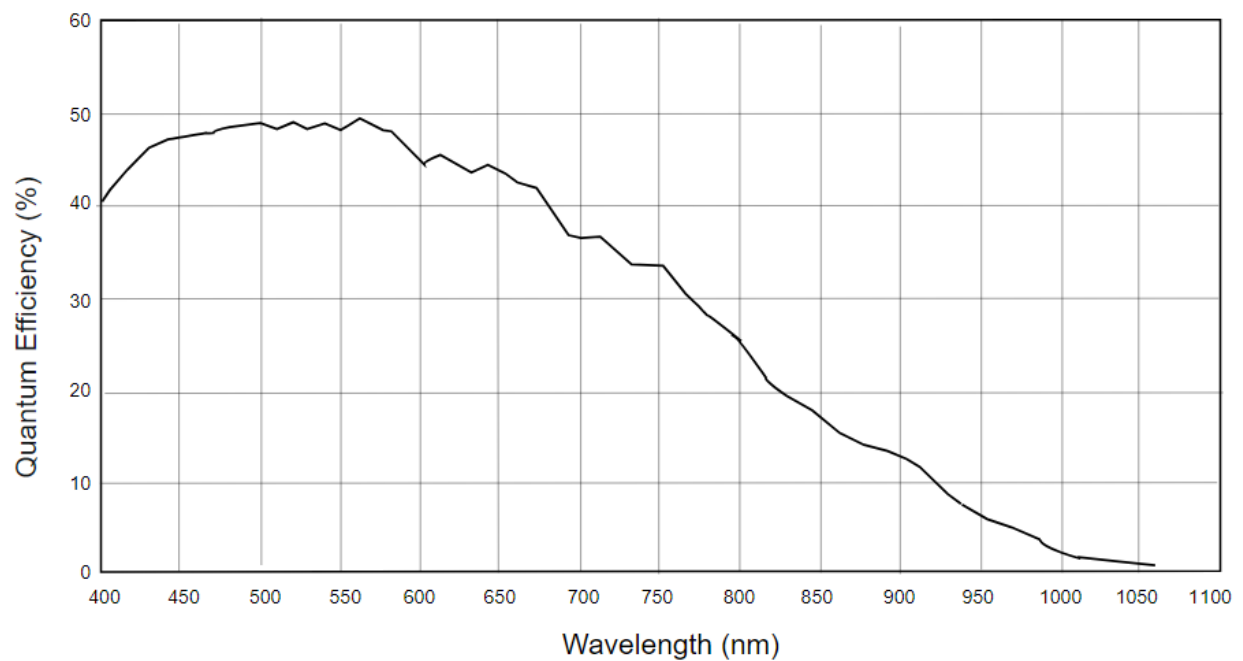
General Specifications#

	daA1600-60um
Resolution (H x V Pixels)	1600 x 1200
Sensor Type	e2v EV76C570 ABT Progressive scan CMOS Global shutter
Sensor Format	1/1.8"
Effective Sensor Diagonal	9 mm
Pixel Size (H x V)	4.5 μm x 4.5 μm
Frame Rate (at Default Settings)	60 fps
Mono / Color	Mono
Image Data Interface	USB 3.0, nominal max. 5 Gbit/s (SuperSpeed)
Pixel Formats	See Pixel Format .

	daA1600-60um
Synchronization	Via hardware trigger Via software trigger Via free run
Exposure Time Control	Programmable via the camera API
Camera Power Requirements	≈1.3 W (typical) @ 5 VDC
I/O Lines	2 general purpose I/O (GPIO) lines
Lens Mount	S-mount, CS-mount, without mount (bare board)
Size (L x W x H)	S-mount and CS-mount models: 20 mm x 29 mm x 29 mm Bare board model: ≈8.3 mm x 27 mm x 27 mm
Weight	S-mount and CS-mount models: <15 g Bare board model: <5 g
Conformity	CE (includes RoHS), EAC, UL Listed, GenICam 2.x (including PFNC 1.x and SFNC 2.x), USB3 Vision, REACH, KC Certificates for your camera model For more information, see the Compliance section of the Basler website.
Software	Basler pylon Camera Software Suite (version 4.2 or higher) Available for Windows, Linux x86, Linux ARM, macOS, and Android

	daA1600-60um
Accessories	Accessories for your camera model

Spectral Response

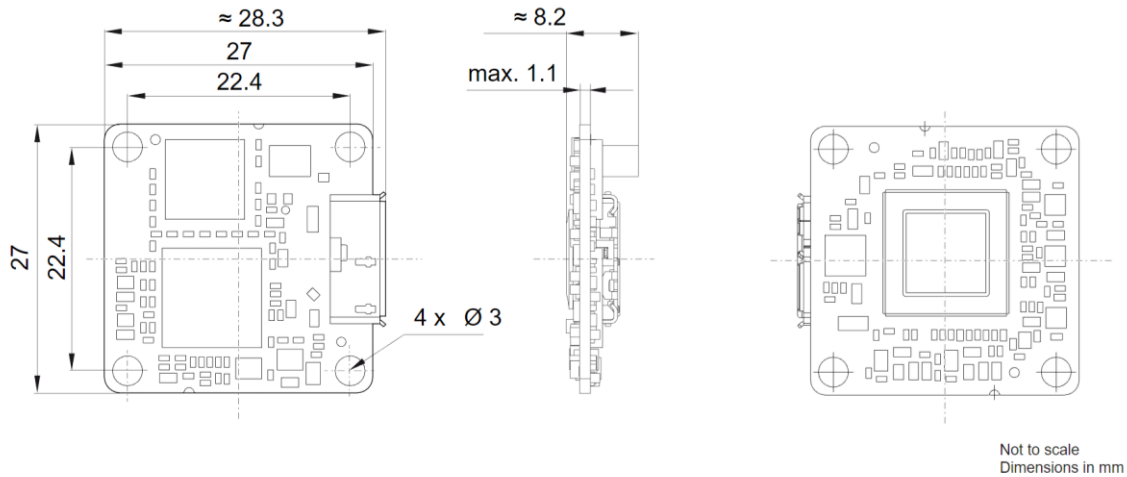


The spectral response curve excludes lens characteristics and light source characteristics.

Mechanical Specifications#

Dimensions and Mounting Points#

Bare Board Variant (daA1600-60um/uc Only)#

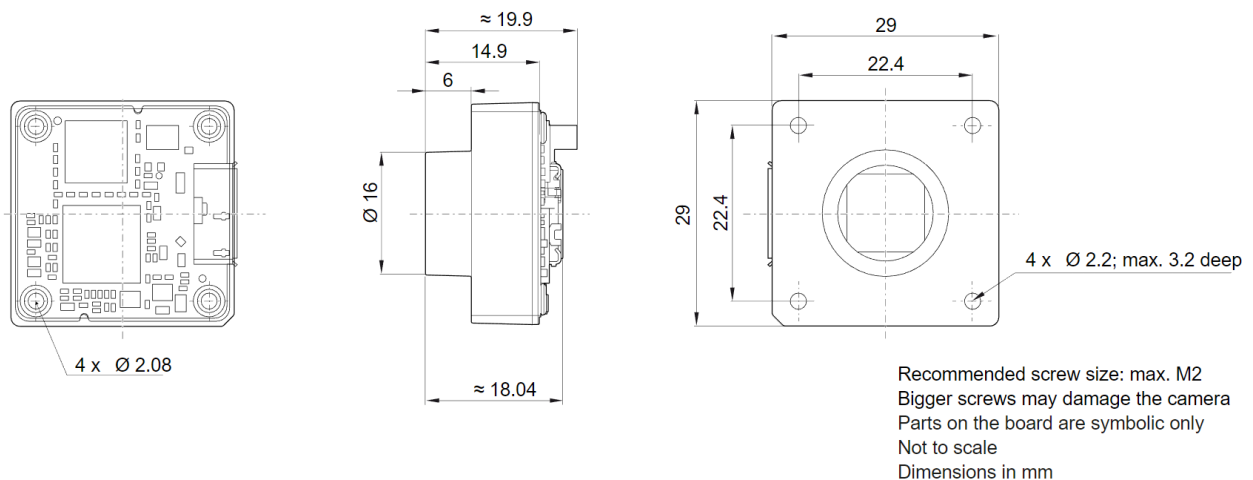


→ Download the [CAD/technical drawing for your Basler Camera](#).

Info

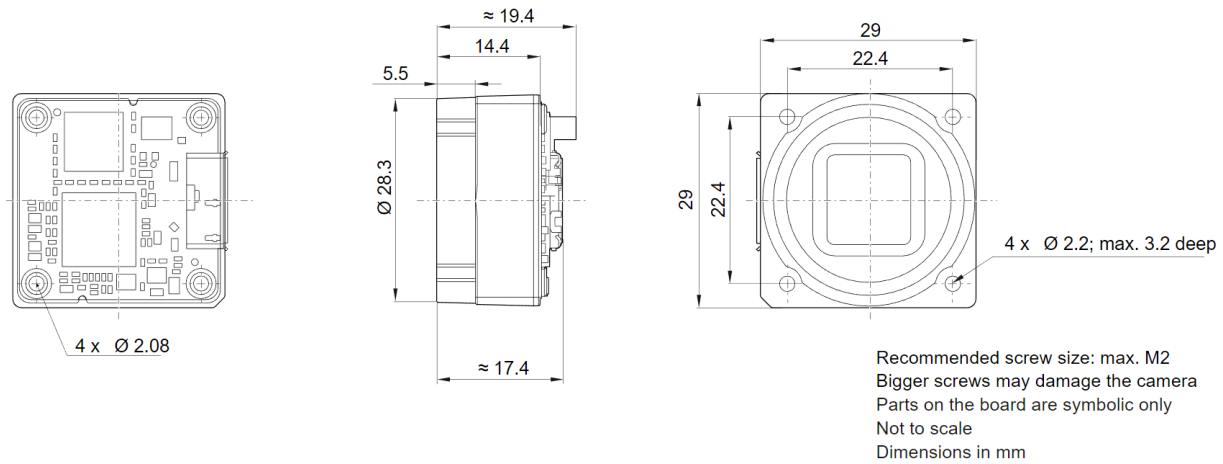
On daA1600-60um/uc camera models, side-fill material (Loctite E1172A 15G) is injected beneath the sensor. The side-fill material is visible around the sensor. This material optimizes the mechanical robustness of the camera and does not impair camera operation.

S-Mount Variant#



→ Download the [CAD/technical drawing for your Basler Camera](#).

CS-Mount Variant#



→ Download the [CAD/technical drawing for your Basler Camera](#).

Maximum Allowed Lens Intrusion#

→ See [Maximum Allowed Lens Intrusion](#).

Stress Test Results#

→ See [Stress Test Results](#).

Requirements#

Environmental Requirements#

Temperature and Humidity#

Description	Bare Board Variant	S-Mount and CS-Mount Variant
Device temperature during operation	0–75 °C (32–167 °F) ^a	0–50 °C (32–122 °F) ^b
Device temperature during storage	-20–80 °C (-4–176 °F)	-20–80 °C (-4–176 °F)

Description	Bare Board Variant	S-Mount and CS-Mount Variant
Humidity	20–80 %, relative, non-condensing	20–80 %, relative, non-condensing
Ambient temperature according to UL 60950-1	max. 50 °C (122 °F)	max. 50 °C (122 °F)

- a. Temperature measured at the [temperature measurement point](#), i.e., at the hottest point on the board. This point is significantly hotter than the other parts on the board.
- b. Temperature measured at the [temperature measurement point](#), i.e., at the camera front.

Heat Dissipation#

→ See [Providing Heat Dissipation \(dart\)](#).

Electrical Requirements#

WARNING – Electric Shock Hazard

Unapproved power supplies may cause electric shock. Serious injury or death may occur.

- You must use power supplies that meet the Safety Extra Low Voltage (SELV) and Limited Power Source (LPS) requirements.
- If you use a powered hub or powered switch, they must meet the SELV and LPS requirements.

WARNING – Fire Hazard

Unapproved power supplies may cause fire and burns.

- You must use power supplies that meet the Limited Power Source (LPS) requirements.
- If you use a powered hub or powered switch, they must meet the LPS requirements.

NOTICE – Incorrect voltage can damage the camera module.

You must supply camera and I/O power within the safe operating voltage ranges specified below.

Camera Power#

You must supply camera power that complies with the Universal Serial Bus 3.0 specification.

The nominal operating voltage is 5 VDC, effective on the camera module's connector.

General Purpose I/O Lines#

The camera module has two direct-coupled GPIO lines that are accessed via contact 3 and 4 of the I/O connector on the back of the board.

The GPIO lines have the following characteristics:

- They can be configured to operate as inputs or outputs.
- They are called line 1 and line 2.
- They are directly connected to the FPGA (unbuffered, see [circuit diagram](#)). Therefore, they are **not protected against overcurrent or overvoltage**.
- They are on the same electrical potential as the circuit board.
- They are compatible with low-voltage TTL (LVTTL) signals. To make the camera module compatible with standard TTL signals, attach the optional [dart I/O board](#).
- They are protected against electrostatic discharge (ESD) strikes of up to 2 kV (contact discharge). The tests were performed according to the EN61000-4-2 standard.
- By default, they are configured as input lines. Due to their high impedance, inputs are susceptible to noise and [electromagnetic interference \(EMI\)](#). For long cables or in harsh electromagnetic environments, the use of active converter circuits may be necessary.

If you require a specific output logic level at all times, add a suitable pull-up or pull-down resistor. If you use a pull-down resistor, the resistor value should be 1.8 k Ω or greater so that the current limit is not exceeded.

NOTICE – Applying incorrect electrical signals to the GPIO lines may severely damage the camera module.

Operation as Input#

Voltage	Description
4.2 VDC	Absolute maximum. This voltage must never be exceeded. Doing so may damage the camera and voids the warranty.
0–3.4 VDC	Safe operating range. The minimum external pull-up voltage is 3.3 VDC.

Voltage	Description
0–0.7 VDC	Indicates a logical 0 (with inverter disabled).
1.8– 3.4 VDC	Indicates a logical 1 (with inverter disabled).

- **Maximum input leakage current:** 10 μ A
- **Internal pull-up resistor:** 25 k Ω typical, 7 to 41 k Ω .
- To increase the voltage allowed on the I/O input lines, attach the optional [dart I/O board](#). The I/O board makes the camera module compatible with TTL input signals.

Operation as Output#

Voltage	Description
3.4 VDC	Absolute maximum. This voltage must never be exceeded. Doing so may damage the camera and voids the warranty.
0–0.5 VDC	Indicates a logical 0 (with inverter disabled).
2.4– 3.3 VDC	Indicates a logical 1 (with inverter disabled).

Maximum current allowed through the output circuit: 2 mA

For more information about the I/O lines, see the [I/O Control](#) section.

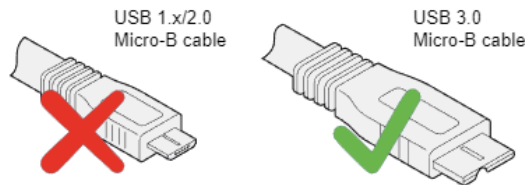
Circuit Diagrams#

→ See [Circuit Diagrams \(dart Cameras\)](#).

Cable Requirements#

USB 3.0 Cable#

- Use a high-quality USB 3.0 cable with a USB 3.0 Micro-B plug.
- Do **not** use cables with a USB 1.x/2.0 Micro-B cable plug, even if you are connecting the camera module to a USB 2.0 port. Otherwise, the module may not work properly.



- To **avoid EMI**, cables must be shielded, as specified in the USB 3.0 standard.
- Basler recommends using USB 3.0 cables from the [Basler Vision Components](#) range.

For more information, see the [Recommended Accessories for Basler USB 3.0 Cameras](#) document.

I/O Cable#

- The camera-side connector must be terminated with a 1.27 mm pitch dual-row plug. If you need other I/O connectors, use the [dart I/O board](#).
- The cable must be wired to conform with the pin assignments shown below.

USB 2.0 Compatibility#

All Basler dart USB 3.0 camera modules are USB 2.0 backward compatible.

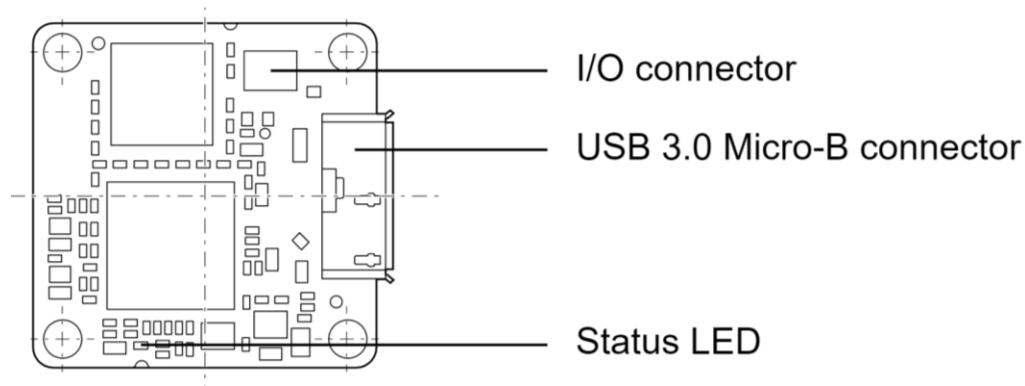
However, performance is limited when connected to a USB 2.0 port:

- In order to handle the lower USB 2.0 bandwidth, the [DeviceLinkThroughputLimit](#) parameter value is set to 32 000 000 (32 MByte/s).
- This reduces the maximum possible [frame rate](#).
- This also affects other aspects of the performance, e.g., the sensor readout time, trigger delay, jitter, or the precision of the exposure time set.
- If you operate a **daA1280-54um/uc** camera module on a USB 2.0 port, image noise may increase. This is because the image sensor produces more image noise at low frame rates. To reduce image noise at low frame rates, try the following:
 - Disable [free run image acquisition](#) and use [triggered image acquisition](#) instead.
 - Disable overlapping image acquisition by setting the [OverlapMode](#) parameter to Off.

For information about suitable USB 2.0 host controllers and about optimizing the USB 2.0 data transmission rate, see the [Recommended USB 2.0 Host Controllers for Basler dart and pulse Cameras](#) application note.

Physical Interface#

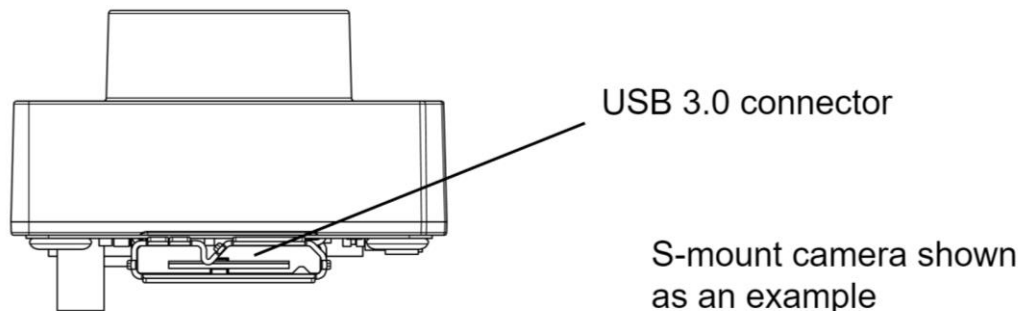
Connectors and Status LED#



I/O Connector#

6-pin socket connector with a 1.27-mm pitch dual-row receptacle. Provides access to the I/O lines.

USB 3.0 Connector#



The camera module's USB 3.0 connector is a standard Micro-B USB 3.0 connector. It provides a nominal 5 Gbit/s SuperSpeed data transfer connection to supply power to the device and to transmit video data and control signals.

Connection assignments and numbering adhere to the Universal Serial Bus 3.0 standard. The recommended mating connector is any standard Micro-B USB 3.0 plug.

Depending on how you integrate the Basler dart into your system, you must select a corresponding USB 3.0 connector that matches the orientation of the dart USB 3.0 connector in the mounted position. The orientation of the USB 3.0 connector is shown in the figure above.

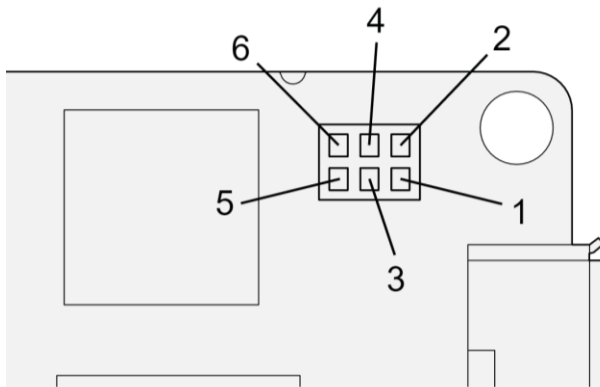
Status LED#

Indicates operation:

- LED is blinking slowly: Device is being configured.
- LED is lit permanently: Device is configured and operative.
- LED is blinking rapidly: Internal error.

The LED can be turned off permanently by setting the [DeviceIndicatorMode](#) parameter to Inactive.

I/O Connector Pin Numbering and Assignments#



Pin	Line	Function
1	-	3.3 VDC; max. 20 mA Power output. Do not apply any external voltage.
2	-	Ground
3	Line 1	General purpose I/O (GPIO) line Preset: Input line
4	Line 2	General purpose I/O (GPIO) line Preset: Input line

Pin	Line	Function
5	-	Not connected
6	-	Not connected

I/O Board#

The **dart I/O board** is available from Basler. It has the following benefits:

- Offers additional I/O connectors instead of the single standard I/O connector.
- Increases the voltage allowed on the I/O input lines (TTL compatibility).
- Allows you to trigger multiple dart USB 3.0 camera modules simultaneously.
- Protects the camera module against short circuits.

The board can be mounted on the back of the Basler dart circuit board. The connectors of the I/O board replace the standard I/O connector.

Contact your Basler sales representative to order the dart I/O board.

For more information, see the [dart I/O board Technical Specification](#).

Precautions#

→ See [Safety Instructions \(dart Cameras\)](#).

Installation#

→ See [Camera Installation](#).

Features#

→ See [Features](#).