

## FEATURES

- Flexible Platform
  - Smart Camera Platform
  - Production Ready Board-Set
  - Sensor Evaluation Kit
- High-performance sCMOS sensors from Fairchild Imaging (Div. of BAE)
  - Sensitivity: 55% QE @ 600 nm
  - Wide dynamic range: 15,000:1
  - Low noise: < 1.2 e<sup>-</sup>
  - High speed: 75 fps
  - 2.1M Pixel: 1920(H) x 1080(V)
  - Monochrome / Color
  - Rolling / Global Shutter
- Altera Cyclone V SoC standard processing includes:
  - 1x1, 2x2, 4x4, and 8x8 binning
  - Noise reduction
- Can be customized for application Interface Options
  - Camera Link
  - Gigabit Ethernet
  - USB 2.0
- Programmable General Purpose I/O
  - 4 External GPIO Pins Available
  - Support trigger input or drive as expose / frame strobes



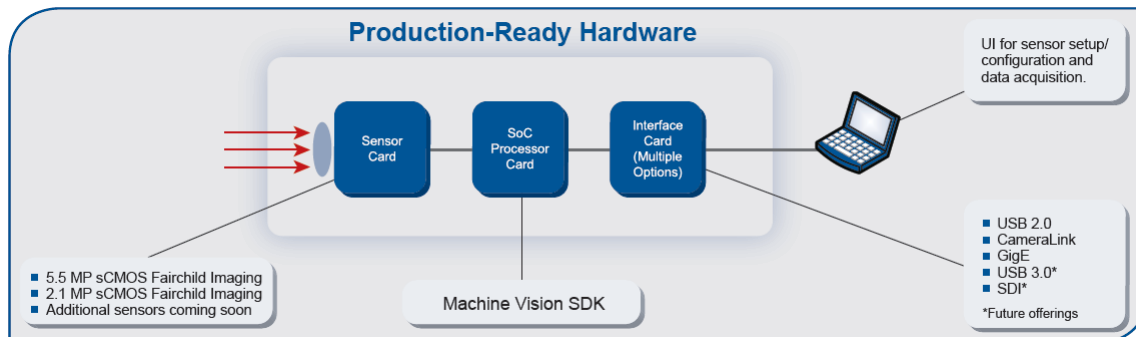
Figure 1: MityCAM-B1910F (Camera Body)

## APPLICATIONS

- Low-light Imaging
- Machine Vision
- Embedded Instrumentation
- Scientific Imaging
- Surveillance Imaging

## DESCRIPTION

The MityCAM Vision Solution from Critical Link features a high performance sCMOS image sensor from Fairchild Imaging (a division of BAE Systems). The kit is available with a 2.1MP CIS-1910F sensor, USB 2.0 interface and your choice of either Dual Camera Link or Gigabit Ethernet interfaces.



MityCAM is a trademark of Critical Link, LLC.

Combined with Critical Link’s Machine Vision SDK software tools design for our Altera Cyclone V SoC based processor card, the MityCAM makes sensor evaluation and integration quick and easy. The enclosed body model features a standard C mount, while the board set version allows quick and easy custom integration into your product with our production-ready hardware.

Detailed datasheets regarding the sensor performance curves for sensitivity, well depth, quantum efficiency and dark current, etc. may be located on the manufacturer’s website [1] and within the CIS-1910F datasheet [2].

The block diagram in Figure 2 shows the structure of the MityCAM-B1910F.

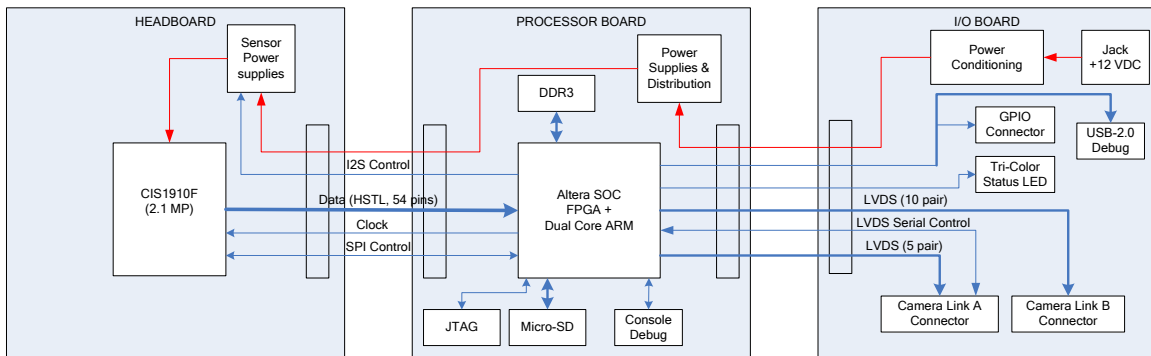


Figure 2: MityCAM-B1910F System Diagram

## TECHNICAL SPECIFICATIONS

A summary of the imaging performance of the MityCAM-B1910F family is included below.

### PERFORMANCE

|  | Min    | Typical             | Max  | Units                     |
|--|--------|---------------------|------|---------------------------|
| Active Pixels (CIS-1910F)                | -      | 1920 x 1080         | -    | H x V                     |
| Pixel Size                               | -      | 6.5 x 6.5           | -    | W x H ; $\mu\text{m}$     |
| Imaging Area (CIS-1910F)                 | -      | 12.5 x 7.1          | -    | W x H ; mm                |
| Dark current @20C                        |        | < 35                |      | e <sup>-</sup> /pixel/sec |
| ADC resolution (low gain: 1X)            | -      | 11                  | -    | bits                      |
| (high gain: 30X)                         | -      | 11                  | -    |                           |
| (combined gain: 30X)                     | -      | 16                  | -    |                           |
| Read-out Noise (@30 fps rolling shutter) | -      | < 1.2               |      | e <sup>-</sup>            |
| Peak Quantum efficiency @ 600nm          | -      | > 55%               | -    | %                         |
| Dynamic Range                            |        | 15,000:1            |      |                           |
| Full Well Capacity                       | 30,000 | -                   | -    | e <sup>-</sup>            |
| Cooling Method                           |        | Single Stage<br>TEC |      |                           |
| Full Frame Rate (Rolling Shutter)        | -      | -                   | 75   | Frames / s                |
| Full Frame Rate (Global Shutter)         | -      | -                   | 37   | Frames / s                |
| Power Utilization                        | 7.8    | 9.2                 | 13.5 | Watts                     |
| Power Input                              | 10.8   | 12                  | 13.2 | V DC                      |

Table 1: MityCAM-B1910F Performance

## WEIGHT

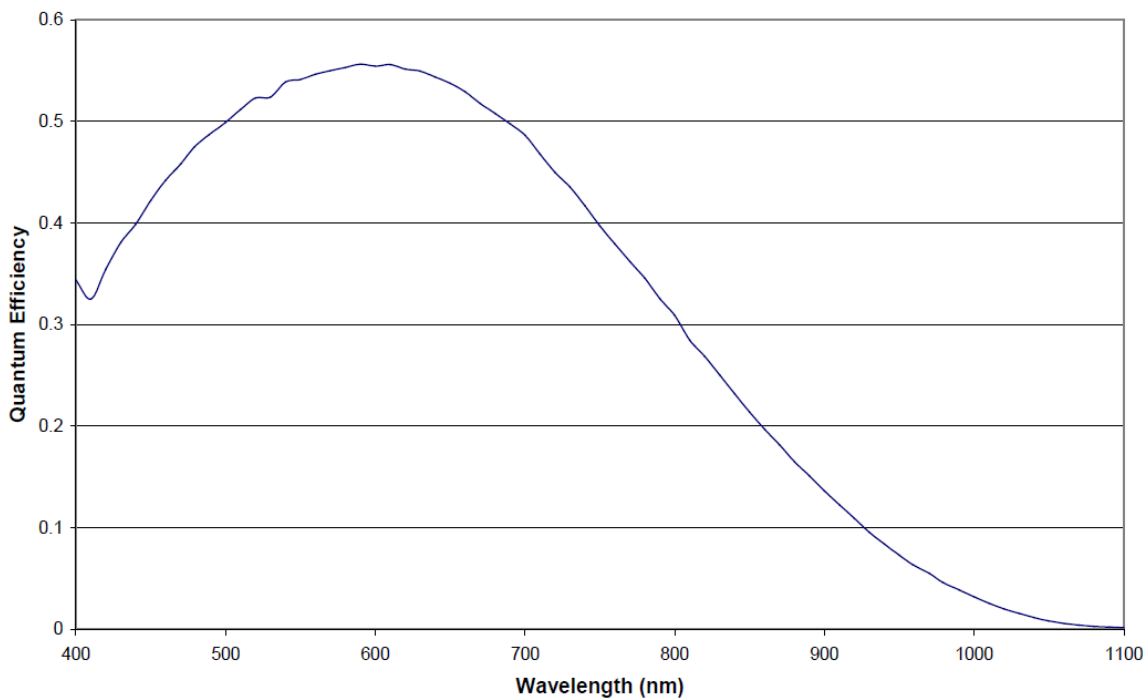
| Configuration                     | Typical        | Units             |
|-----------------------------------|----------------|-------------------|
| Gigabit Ethernet with Mechanicals | 612<br>(21.55) | grams<br>(ounces) |
| Camera Link with Mechanicals      | 589<br>(20.75) | grams<br>(ounces) |
| Gigabit Ethernet Board Stack      | 95<br>(3.35)   | grams<br>(ounces) |
| Camera Link Board Stack           | 106<br>(3.70)  | Grams<br>(ounces) |

**Table 2: MityCAM-B1910F Weight**

## QUANTUM EFFICIENCY

A typical monochromatic QE curve is shown below in Figure 3.

**Quantum Efficiency of CIS1910 Monochromatic Sensor with Sealed Window on**



**Figure 3: Spectral Response for a CIS1910F Monochromatic Sensor [1]**

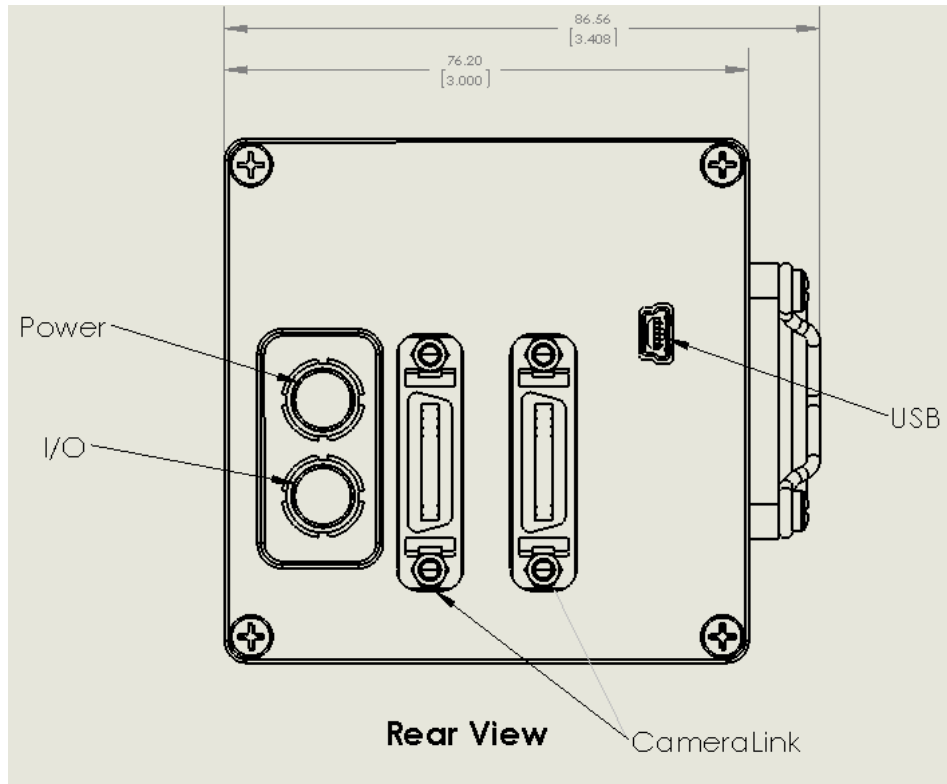
## OPERATING AND STORAGE CONDITIONS

|                                     |                       |
|-------------------------------------|-----------------------|
| Ambient Operating Temperature Range | 0 °C to 50 °C         |
| Humidity                            | < 80%, Non-Condensing |
| Storage Temperature Range           | -40 °C to 85 °C       |

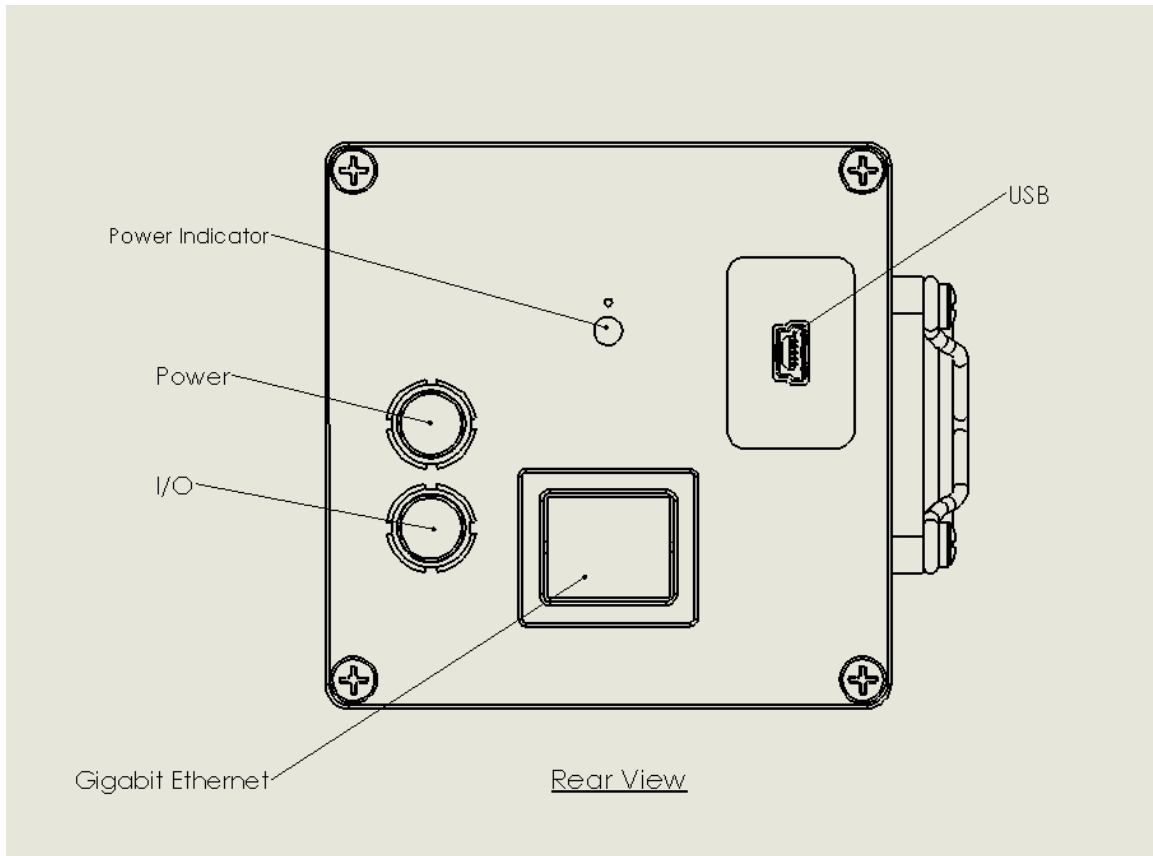
**Table 3: MityCAM-B1910F Operating and Storage Conditions**

## ELECTRICAL CONNECTIONS

The MityCAM-B1910F has the following electrical connections on the back panel:



**Figure 4: Input / Output Connections on Rear – Dual Camera Link version**



**Figure 5: Input / Output Connections on Rear – Gigabit Ethernet version**

### High-Speed Interface Options

The MityCAM is offered with a number of high-speed interface options.

#### Camera Link (J201 and J202)

The Camera Link serializer outputs on the camera operate at 85MHz. The camera does not output a DVAL signal. This port is not configurable and requires a frame grabber capable of handling the 85MHz and ignoring DVAL.

When the Dual Camera Link version of the MityCAM-B1910F is utilized both ports, J201 and J202, need to be utilized for maximum frame-rate capabilities. Note that J201 contains the serial data control lines and is the only port required for Base mode operation.

At full 1920x1080 resolution the camera is capable of output in the following modes:

| Mode              | Bits Per Pixel x Pixels Per Clock |
|-------------------|-----------------------------------|
| Expanded (10 Tap) | 16 x 5                            |
| Expanded (10 Tap) | 8 x 10                            |
| Base              | 16 x 1                            |
| Base              | 12 x 2                            |
| Base              | 8 x 2                             |

### Gigabit Ethernet (J4)

For the Gigabit Ethernet based MityCAM-B1910F a standard RJ45 Ethernet connector is used, J4.

### Power Input (P200)

The MityCAM has a single power input connector on the rear of the units. This 4-pin LEMO ECG.0B.304.CLN connector, P200, utilizes 2-positive power input pins and 2-ground connections as shown below in Figure 6 and Table 4. Each kit includes an AC to 12V DC (3.3A) power adapter. Maximum current draw should be less than 1.4A.

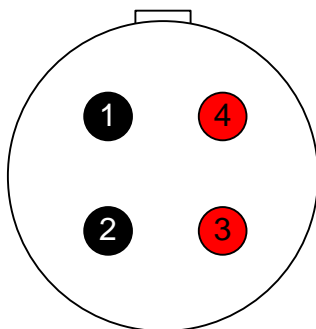


Figure 6: P200 Power Input Connector

| Pin | Type | Description |
|-----|------|-------------|
| 1   | GND  | Ground      |
| 2   | GND  | Ground      |
| 3   | PWR  | +12VDC      |
| 4   | PWR  | +12VDC      |

Table 4: P200 Input power connector pin-out (P200)

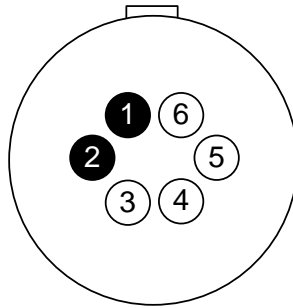
Note that over voltage, under-voltage, and reverse polarity protection is provided within the kit, however care should be taken if a non-standard adapter is used. The mating connector is a LEMO FGG.0B.304.CLAD52 or similar connector.

### USB 2.0 Interface (J1)

The MityCAM features a standard Mini-B type USB connector on the rear of the unit. This interface is used for development purposes (e.g., software and firmware updates, low level access to camera functions) and supports lower speed image acquisition via a Windows PC application provided by Critical Link.

### General Purpose IO (P201)

A total of 4 general purpose IOs are made available for the user via the P201 connector, LEMO ECG.0B.306.CLN, on the rear of the unit. The GPIOs utilize 5V TTL logic level and are ESD protected to standards exceeding JESD 22. Table 5 and Figure 7 show the pin-out for the GPIO interface connector. The GPIO signals are pulled up in the camera to +5V via a 1k Ohm resistor. A minimum voltage of 4.6V is required to drive the GPIO inputs to logic high, a maximum voltage of 0.15V is required to drive the GPIO inputs to logic low.



**Figure 7: GPIO Interface Connector Pin Out (P201)**

| Pin | Type | Description  | Altera SoC Pin |
|-----|------|--|----------------|
| 1   | GND  | Ground   |                |
| 2   | GND  | Ground   |                |
| 3   | I/O  | IO 3 - 5V TTL Logic Level                              | B3B_RX_B27_N   |
| 4   | I/O  | IO 2 - 5V TTL Logic Level                              | B3B_RX_B27_P   |
| 5   | I/O  | IO 1 - 5V TTL Logic Level                              | B3B_RX_B39_N   |
| 6   | I/O  | IO 0 - 5V TTL Logic Level<br>Supports external trigger | B3B_RX_B39_P   |

**Table 5: GPIO connector pin-out (P201)**

The mating connector is a LEMO FGG.0B.306.CLAD52 or similar connector.

Table 6 shows the ESD protection specifications built into the MityCAM-B1910F for the GPIO pins.

| ESD Standard                | Rating |
|-----------------------------|--------|
| Human-Body Model (A114-B)   | 15-kV  |
| Machine Model (A115-A)      | 200-V  |
| Charged-Device Model (C101) | 1000-V |

**Table 6: GPIO ESD Protection Standards**

### Cooling

The MityCAM-B1910F features an integrated single stage TEC cooler and low profile 50mm fan for the compact body style units, with an integrated heat sink via the case body. The TEC cooler is capable of holding the temperature to within +/- 0.5 degrees C of a setpoint that is no lower than 10 degrees above the ambient temperature. The fan can be enabled or disabled through the I<sup>2</sup>C based LED status light and fan controller. Accessing the fan controls is accomplished via the I<sup>2</sup>C bus 1 address 1100 010. The Camera Link serial interface and USB control interface provides a TEC and fan enable control command.

If using the board set only version in your custom design, proper cooling must be considered to ensure that the imaging sensor does not exceed the specified maximum temperature of **Table 3**.

**Read-out rates (Rolling Shutter)**

| Array Size           | Camera Link 10-tap | Camera Link Base Mode | Gigabit Ethernet | USB     |
|----------------------|--------------------|-----------------------|------------------|---------|
| 2.1Mpixels x 16 bits | 75.2 fps           | 30.1 fps              | 7.2 fps          | 12 MB/s |
| 2.1Mpixels x 12 bits | N/A                | 75.2 fps              | N/A              | --      |
| 2.1Mpixels x 8 bits  | 75.2 fps           | 75.2 fps              | N/A              | --      |

\*75.2 fps is qualified with TEC designs, 100 fps has been demonstrated with board set (no TEC)

**Read-out rates (Global Shutter)**

| Array Size           | Camera Link 10-tap | Camera Link Base Mode | Gigabit Ethernet | USB |
|----------------------|--------------------|-----------------------|------------------|-----|
| 5.5Mpixels x 16 bits | 37.0 fps           | 14.8 fps              | 7.2 fps          | TBD |
| 5.5Mpixels x 12 bits | N/A                | 37.0 fps              | N/A              | TBD |
| 5.5Mpixels x 8 bits  | 37.0 fps           | 37.0 fps              | N/A              | TBD |

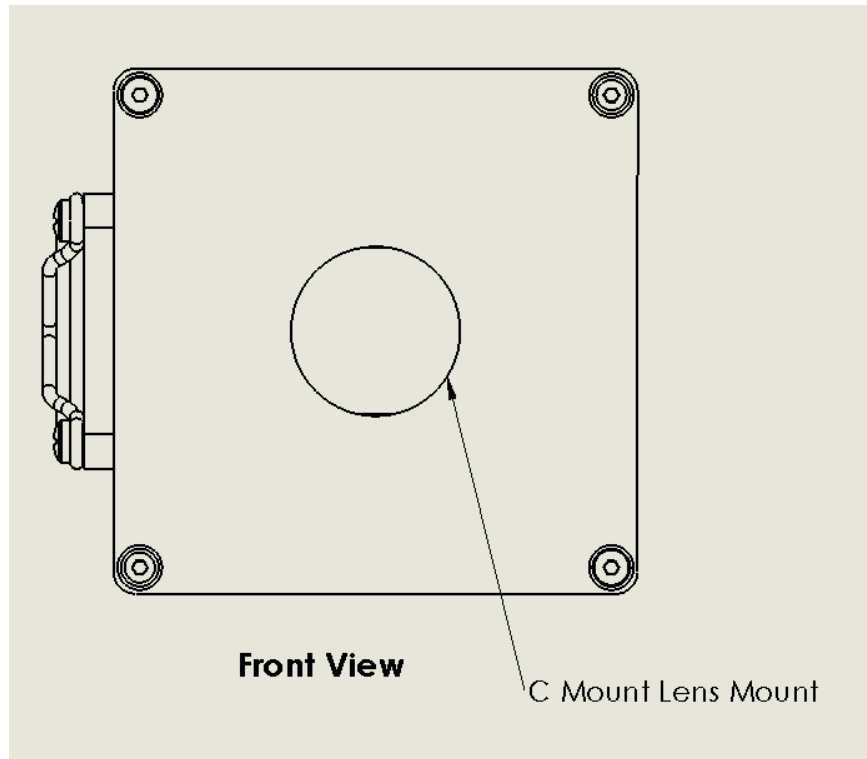
\*37.0 fps is qualified with TEC designs, 50 fps has been demonstrated with board set (no TEC)

**EXTERNAL DIMENSIONS – BODY**

Unless otherwise noted, all dimensions are in mm[inches].

Front Face Dimensions (Figure 8): 76.20[3.000] x 76.20[3.000]

Side Dimensions (Figure 9) Front Face to External Connectors: 72.28[2.846]



**Figure 8: Body with 'C' Mount Lens Mount - Front View**



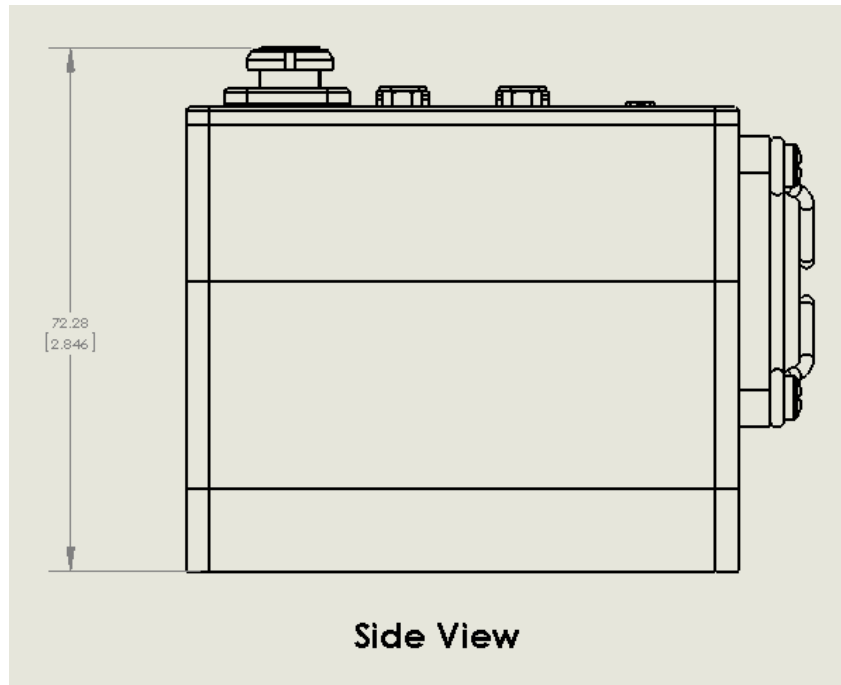


Figure 9: Body with 'C' Mount Lens Mount – Side View

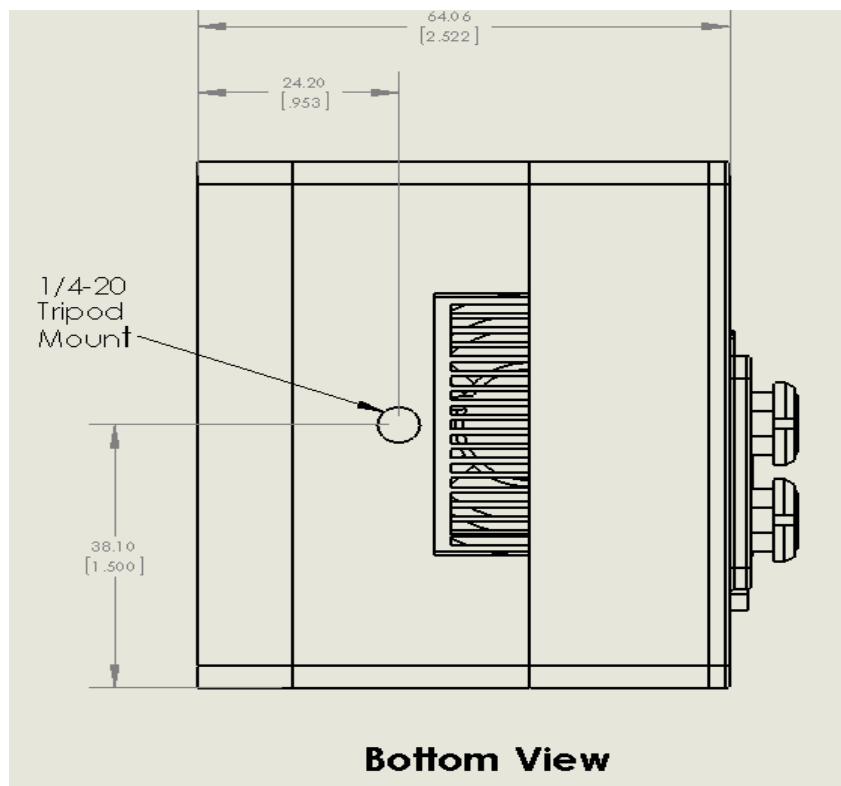


Figure 10: Body with Tripod Mount – Bottom View



**Figure 11: Camera Body Model**

## EXTERNAL DIMENSIONS – BOARD SET ONLY

Critical Link can provide board set solutions if the compact body mechanical arrangement does not meet your application needs. Please contact your Critical Link representative for detailed drawings for a particular MityCAM-B1910F board set.

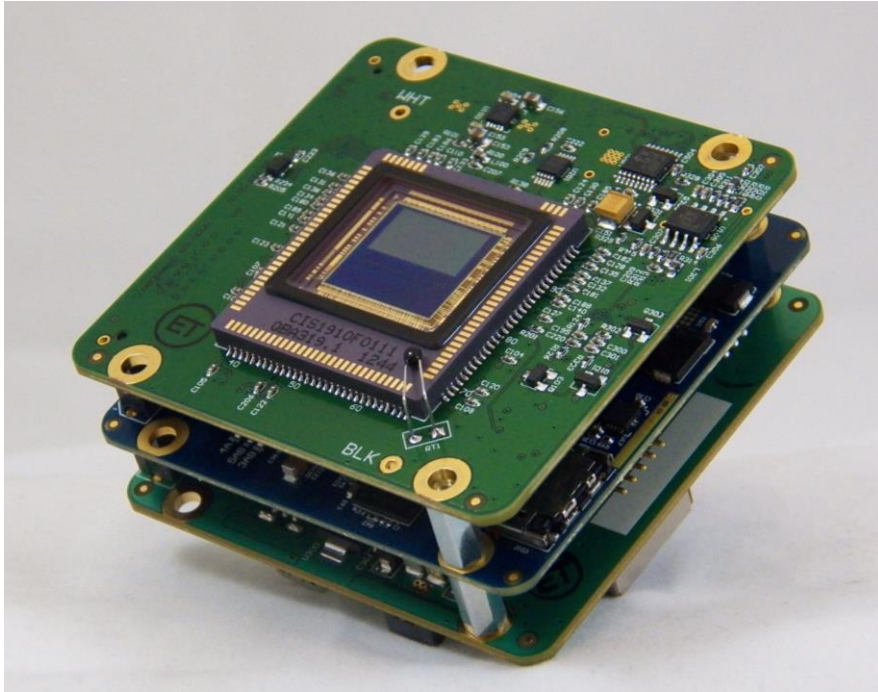


Figure 12: Board set photo

## ORDERING INFORMATION

Table 7 below lists the standard configurations for the MityCAM-B1910F. For shipping status, availability, and lead time of these or other configurations please contact your Critical Link representative.

Table 8 below provides an accessory kit part number for the MityCAM-B1910F. This kit is required when evaluating the sensor or doing development, and is compatible with the camera body models listed in Table 7. It is not required for cameras that are being integrated into a working design.

**Table 7: MityCAM-B1910F Standard Model Numbers**

| Model Number    | Sensor Package | Sensor Window | Chroma | High Speed Interface | Body      |
|-----------------|----------------|---------------|--------|----------------------|-----------|
| B1910FTS-CM-C-S | Scientific     | Sealed        | Mono   | Dual Camera Link     | Camera    |
| B1910FTS-CM-B-S | Scientific     | Sealed        | Mono   | Dual Camera Link     | Board-Set |
| B1910FTS-GM-C-S | Scientific     | Sealed        | Mono   | Gigabit Ethernet     | Camera    |
| B1910FTS-GM-B-S | Scientific     | Sealed        | Mono   | Gigabit Ethernet     | Board-Set |
| B1910FTS-CC-C-S | Scientific     | Sealed        | Color  | Dual Camera Link     | Camera    |
| B1910FTS-CC-B-S | Scientific     | Sealed        | Color  | Dual Camera Link     | Board-Set |
| B1910FTT-CM-C-S | Scientific     | Temporary     | Mono   | Dual Camera Link     | Camera    |
| B1910FTT-CM-B-S | Scientific     | Temporary     | Mono   | Dual Camera Link     | Board-Set |
| B1910FTT-GM-C-S | Scientific     | Temporary     | Mono   | Gigabit Ethernet     | Camera    |
| B1910FTT-GM-B-S | Scientific     | Temporary     | Mono   | Gigabit Ethernet     | Board-Set |

**Table 8: MityCAM-B1910F Accessory Kit Part Number**

| Part Number | MityCAM Compatibility  | Kit Contents  |
|-------------|--|---|
| 80-000783   | Compatible with all Camera Body models:<br>B1910FTS-CM-C-S<br>B1910FTS-GM-C-S<br>B1910FTS-CC-C-S<br>B1910FTT-CM-C-S<br>B1910FTT-GM-C-S | Canon EF 50mm f/1.8 II Lens<br>Lens Mount Adapter<br>Tripod<br>I/O Cable<br>USB Cable<br>Power Supply<br>Ethernet Cable |

## REVISION HISTORY

| Date      | Change Description  |
|-----------|---|
| 27-Jan-14 | Initial preliminary revision.   |
| 26-Jan-15 | Updated specifications, images and drawings.  |
| 24-Mar-15 | Updated standard model numbers, accessory kit part number, read-out rates, and GPIO pin out descriptions. |
|           |   |

## REFERENCES

- [1] Fairchild Imaging, Available: <http://www.fairchildimaging.com>. [Accessed: January, 2014]
- [2] BAE Systems, “MAN 0103 CIS1910F Standard and Scientific Package Datasheet\_RevD.PDF”, October 2013.