FEATURES

- High-performance sCMOS sensor from Fairchild Imaging (Div. of BAE)
  - Sensitivity: 55% QE @ 600 nm
  - Wide dynamic range: 15,000:1
  - Low noise: < 2 e⁻
  - High speed: 70 fps
  - 5.5M Pixel: 2560(H) x 2160(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 / GigE Vision
  - USB 2.0
- Programmable General Purpose I/O
  - 4 External GPIO Pins Available
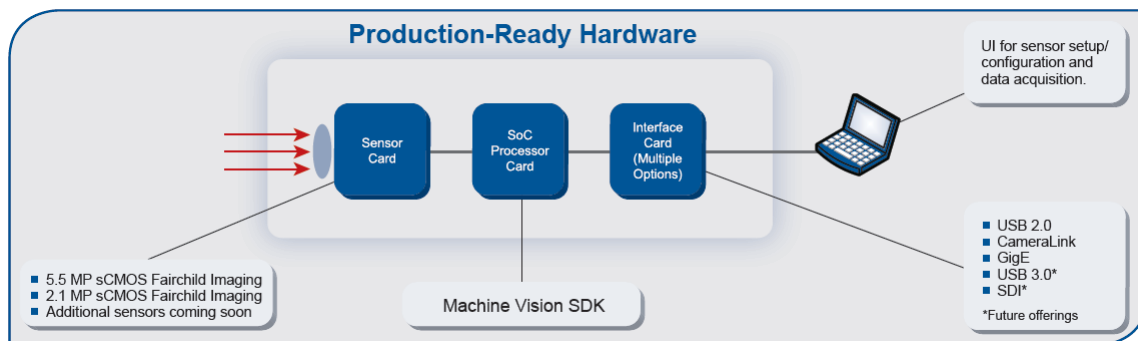 - Support trigger input or drive as expose / frame strobes

Figure 1: **MityCAM-B2521F (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 5.5MP CIS-2521F sensor, USB 2.0 interface and your choice of either Dual Camera Link or Gigabit Ethernet / GigE Vision interfaces.


MityCAM is a trademark of Critical Link, LLC.

6712 Brooklawn Parkway   PHONE 315.425.4045
Syracuse, NY 13211   FAX   315.425.4048
www.CriticalLink.com
Document # 60-000001-1E

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 MityCAM features a standard C mount lens, with an optional F mount lens available upon request. Critical Link also supports a board set version of the camera for customers designing their own mechanicals or managing other integrations; contact us for more details.

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-2521F datasheet[2].

The block diagram in Figure 2 shows the structure of the MityCAM-B2521F.
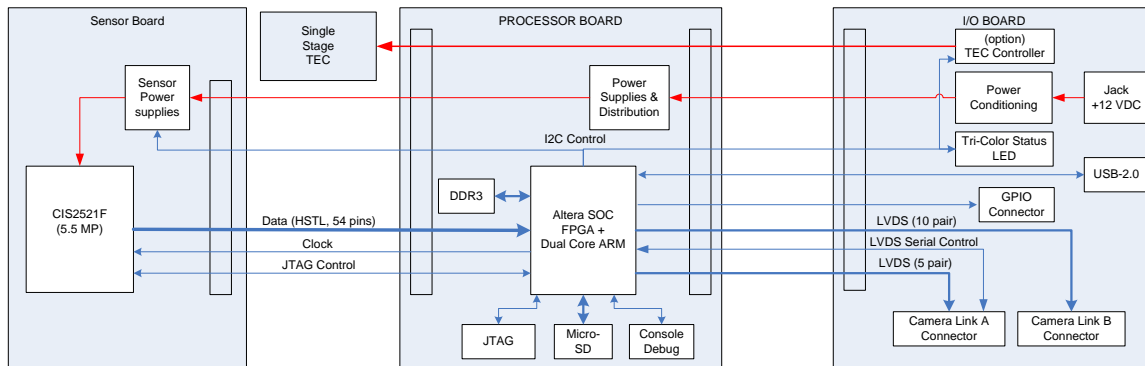
Figure 2: MityCAM-B2521F System Diagram

TECHNICAL SPECIFICATIONS

A summary of the imaging performance of the MityCAM-B2521F family is included below.

PERFORMANCE

|	Min	Typical	Max	Units
Active Pixels (CIS-2521F)	-	2560 x 2160	-	H x V
Pixel Size	-	6.5 x 6.5	-	W x H ; μm
Imaging Area (CIS-2521F)	-	16.8 x 14.2	-	W x H ; mm
Dark current @20C		< 35		e-/pixel/sec
ADC resolution (low gain: 1X)	-	11	-	bits
(high gain: 30X)	-	11	-	
(combined gain: 30X)	-	16	-	
Read-out Noise (@30 fps rolling shutter)	-	< 2		e-
Peak Quantum efficiency @ 600nm	-	> 55%	-	%
Dynamic Range		15,000:1		
Conversion Gain (Rolling Shutter)		1.7		counts / e-
(Global Shutter)		0.57		
Full Well Capacity	30,000	-	-	e-
Cooling Method	Forced Air / Single Stage TEC			
Full Frame Rate (Rolling Shutter)	-	-	70*	Frames / s
Full Frame Rate (Global Shutter)	-	-	35*	Frames / s
Power Utilization (with TEC enabled)	-	13.5	15	Watts
Camera Body Weight		524 (18.5)		g (oz.)
Power Input (12 V +/- 10%)	10.8	12	13.2	V DC
*data rates up to 100 / 50 fps (rolling / shutter mode) are possible but not yet qualified				

Table 1: MityCAM-B2521F Performance

QUANTUM EFFICIENCY

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

Quantum Efficiency of CIS2521 Monochromatic Sensor with Sealed Window on
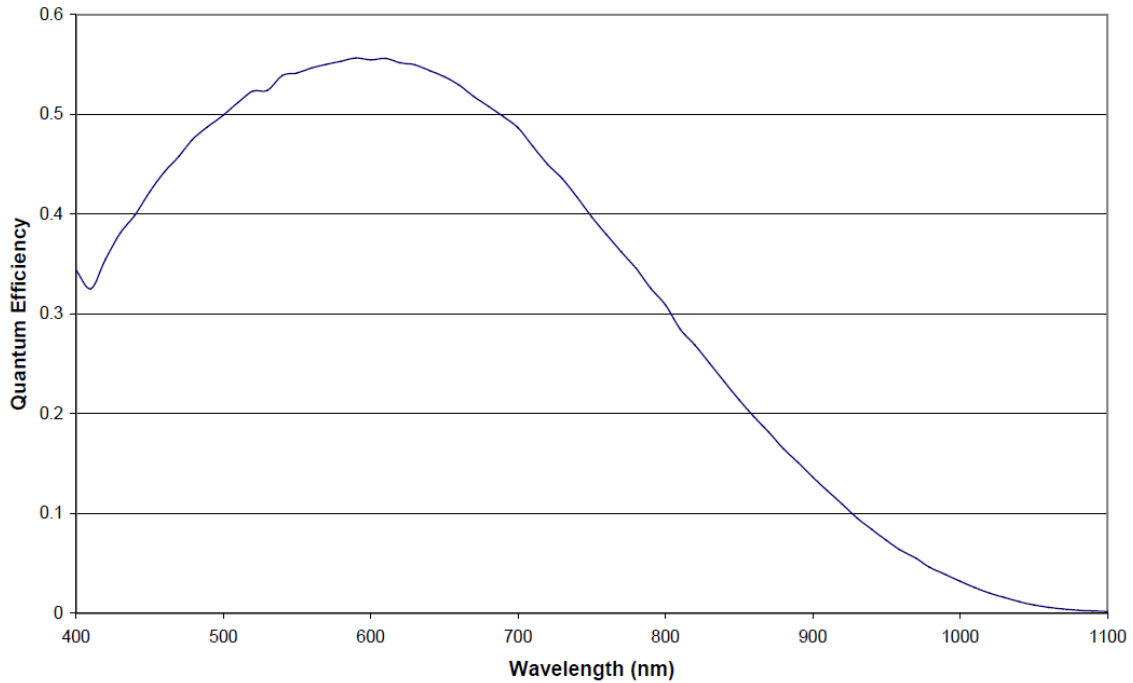
Figure 3: Spectral Response for a CIS2521F Monochromatic Sensor [1]
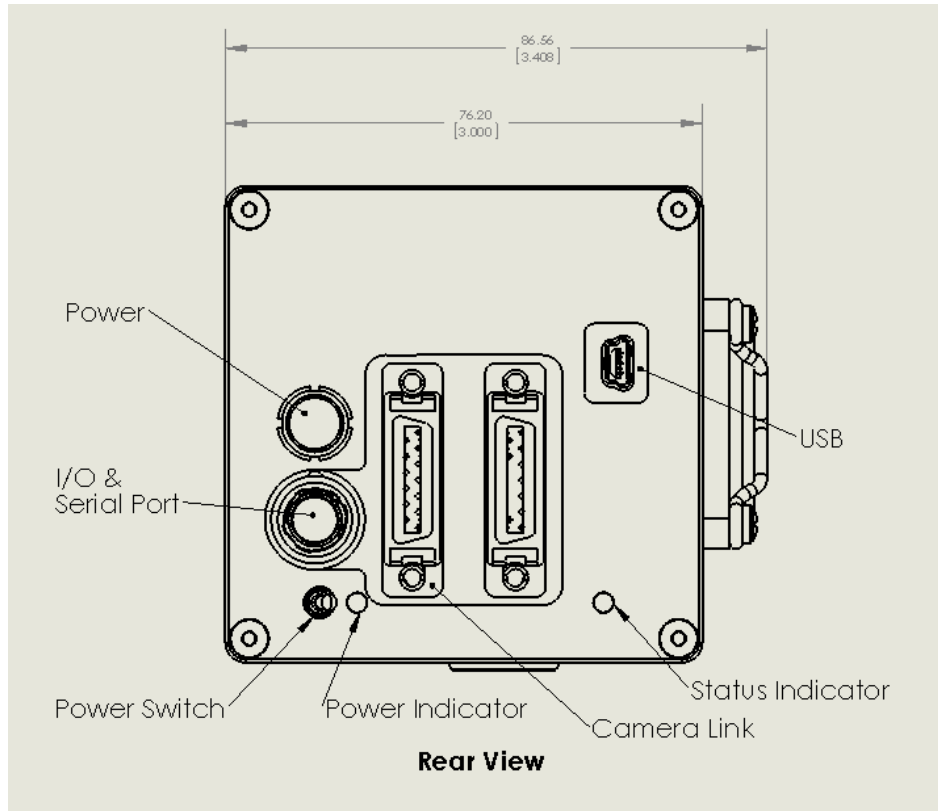
OPERATING AND STORAGE CONDITIONS

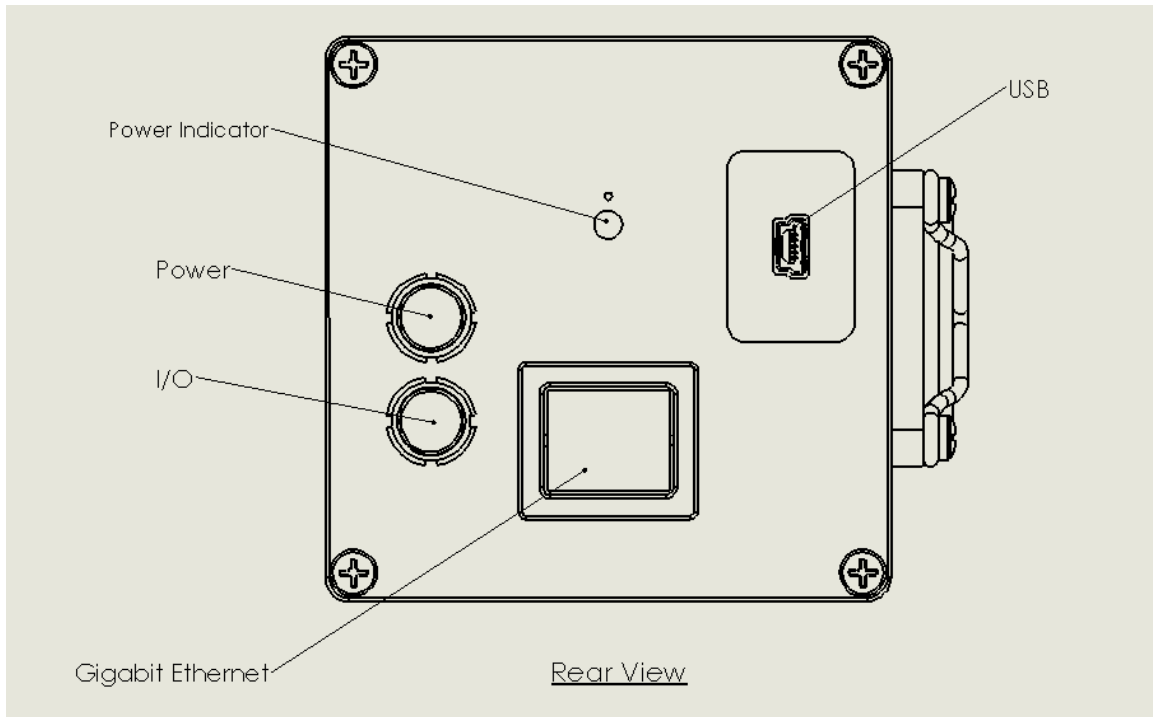|	
Ambient Operating Temperature Range	0 °C to 50 °C
Humidity	< 80%, Non-Condensing
Storage Temperature Range	-40 °C to 85 °C

Table 2: MityCAM-B2521F Operating and Storage Conditions

ELECTRICAL CONNECTIONS

The MityCAM-B2521F 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.

Dual Camera Link (J201 and J202) – 10-Tap Mode

The MityCAM-B2521F provides a dual Camera Link I/O adaptor that supports expanded 10-tap mode using an 85 MHz clock to output pixel depths of 8 bits (10 pixels per clock), 16 bits (5 pixels per clock), and 12 bits (6.6 pixels per clock) for full resolution images (2560x2160). Expanded 10-tap mode requires the use of both J201 and J202.

The Dual Camera Link interface can handle a maximum data rate of 6.8Gbps using 10-tap mode.

In addition, the MityCAM-B2521F supports base mode configurations for pixel depths of 16 bits (1 pixel per clock), 12 bits (2 pixels per clock), and 8 bits (2 pixels per clock).

Gigabit Ethernet (J4)

For the Gigabit Ethernet based MityCAM-B2521F a standard RJ45 Ethernet connector is used, J4. The MityCAM-B2521F Ethernet interface supports both the AIA GigE interface protocol as well as a Critical Link legacy protocol used by the MityViewer application.

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 3. Each kit includes an AC to 12V DC (3.3A) power adapter. Maximum current draw should be less than 1.4A.
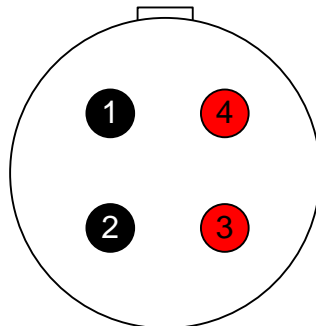

Figure 6: P200 Power Input Connector

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

Table 3: 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 4 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.
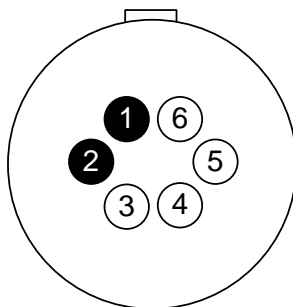

Figure 7: GPIO Interface Connector Pin Out, Mating Side, Gigabit Ethernet (P201)

Pin	Type	Description	Altera SoC Pin (via level translator)
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 Supports external trigger	B3B_RX_B39_P

Table 4: GPIO connector pin-out (P201)

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

Table 5 shows the ESD protection specifications built into the MityCAM-B2521F 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 5: GPIO ESD Protection Standards

Cooling

The MityCAM-B2521F 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^{2}C based LED status light and fan controller. Accessing the fan controls is accomplished via the I^{2}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 taken to ensure that the imaging sensor does not exceed the specified maximum temperature of **Table 2**.

Read-out rates (Rolling Shutter)

Array Size	Camera Link 10-tap	Camera Link Base Mode	Gigabit Ethernet	USB
5.5Mpixels x 16 bits	70 fps*	14 fps	3.6 fps	TBD
5.5Mpixels x 12 bits	70 fps*	28 fps (2 per clock)	N/A	TBD
5.5Mpixels x 8 bits	70 fps*	28 fps (2 per clock)	N/A	TBD
*70 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	34.7 fps*	6.9 fps	3.6 fps	TBD
5.5Mpixels x 12 bits	34.7 fps*	13.9 fps	N/A	TBD
5.5Mpixels x 8 bits	34.7 fps*	13.9 fps	N/A	TBD
*34.7 fps is qualified with TEC designs, 50 fps has been demonstrated with board set (no TEC)				

EXTERNAL DIMENSIONS – CAMERA BODY

For customers desiring a complete camera assembly, Critical Link offers enclosed body models that can be used for final application development as shown in the figure below.

Figure 8 Camera Body shown with example lens and small tripod, side view

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

Front Face Dimensions (Figure 9): 76.20[3.000] x 76.20[3.000]
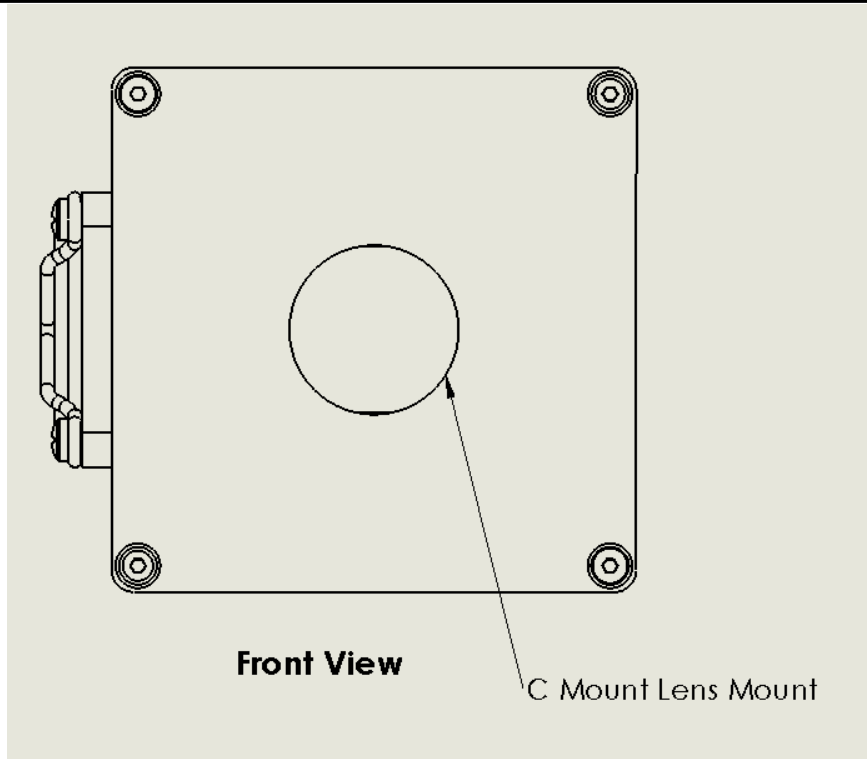Side Dimensions (Figure 10) Front Face to External Connectors: 72.77[2.865]

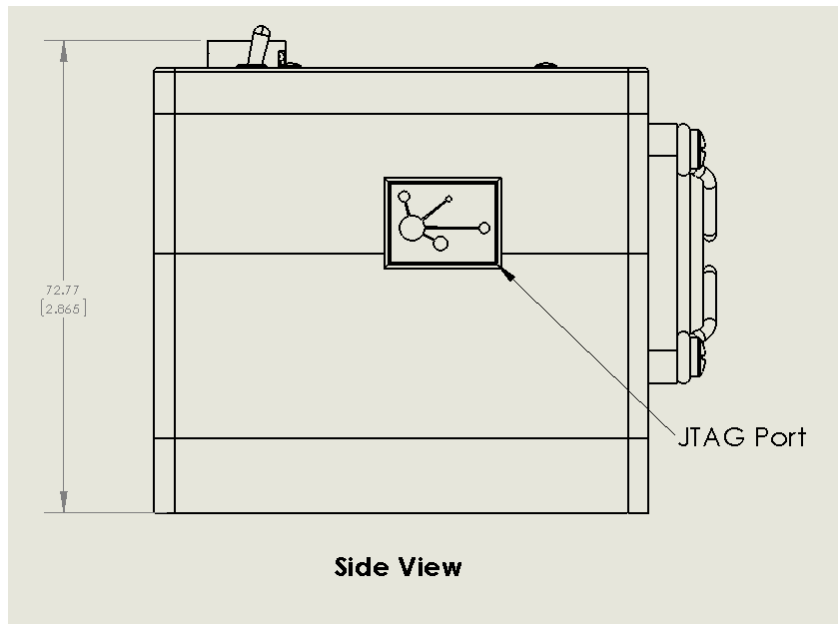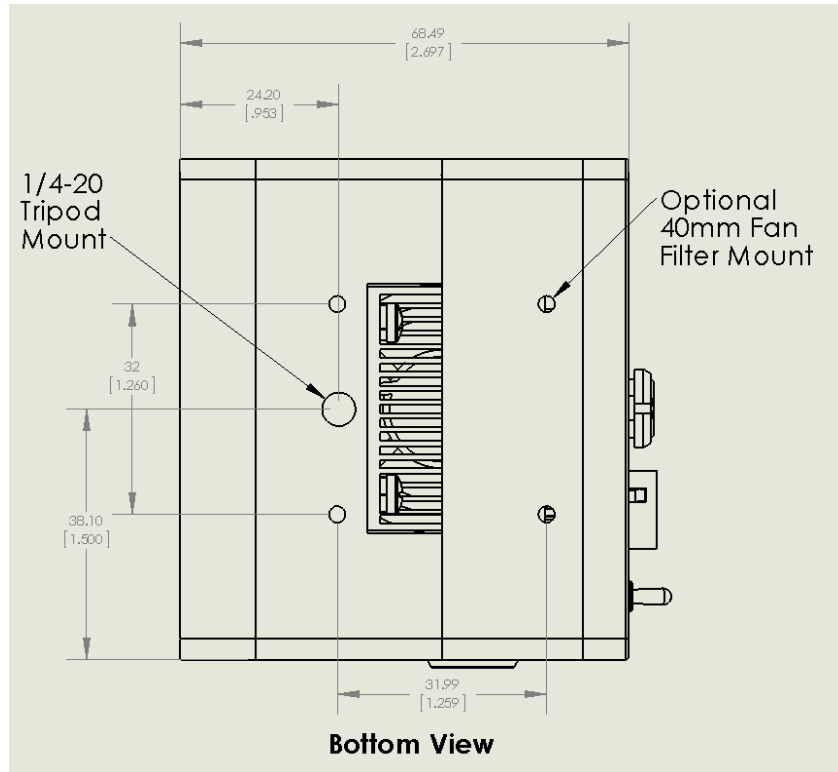**Figure 9: Body with 'C' Mount Lens Mount - Front View**

Figure 10: Dual Camera Link Body with 'C' Mount Lens Mount – Side View

Figure 11: Dual Camera Link Body with Tripod Mount – Bottom View

The exhaust port of the fan should not be obstructed when utilizing the Tripod Mount. The 40 mm Fan filter mount holes support M3 screws and are 2.5 mm deep.

EXTERNAL DIMENSIONS – BOARD SET

Critical Link can provide board set solutions if the compact body mechanical arrangement does not meet your application needs. Board sets do not include a TEC device as part of the base offering. Please contact your Critical Link representative for detailed drawings for a particular MityCAM-B2521F board set.
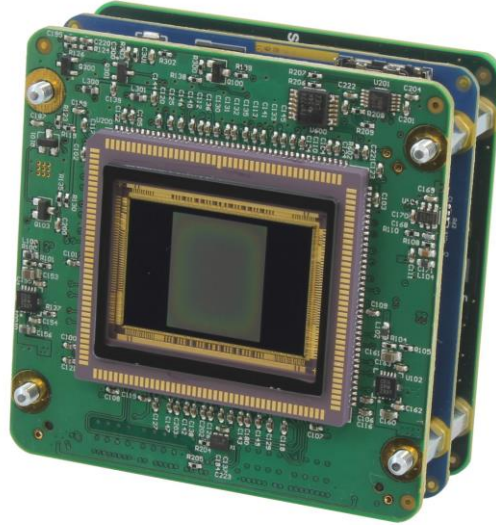

Figure 12: Board set photo

ORDERING INFORMATION

Table 6 below lists the standard configurations for the MityCAM-B2521F. For shipping status, availability, and lead time of these or other configurations please contact your Critical Link representative.

Table 7 below provides an accessory kit part number for the MityCAM-B2521F. This kit is required when evaluating the sensor or doing development, and is compatible with the models listed in Table 6. It is not required for cameras that are being integrated into a working design.

Table 67: MityCAM-B2521F Standard Model Numbers

Model Number	Sensor Package	Sensor Window	Chroma	High Speed Interface	Body
B2521FTS-CM-C-S	Scientific	Sealed	Mono	Dual Camera Link	Camera
B2521FTT-CM-C-S	Scientific	Temporary	Mono	Dual Camera Link	Camera

Table 7: MityCAM-B2521F Accessory Kit Part Number

Part Number	MityCAM Compatibility	Kit Contents
80-000783	Compatible with Gigabit Ethernet / GigE Vision models	Canon EF 50mm f/1.8 II Lens Lens Mount Adapter Tripod I/O Cable USB Cable Power Supply Ethernet Cable
80-000899	Compatible with Camera Link models	Canon EF 50mm f/1.8 II Lens Lens Mount Adapter Tripod I/O / USB Cable Power Supply Ethernet Cable

REVISION HISTORY

Revision	Date	Change Description
-1A	27-Jan-14	Initial preliminary revision.
-1B	15-Jul-14	Updated per current measured performance.
-1C	02-Sep-14	Updated power supply requirements for TEC design. Updated Model Numbers. Clarified voltage inputs (12V +/- 10%). Clarified GPIO requirements.
-1D	24-Mar-15	Updated standard model numbers, accessory kit part number, read-out rates, and GPIO pin out descriptions.
-1E	23-Jan-17	Added conversion gain to performance tables. Add revision dash numbers to revision history. Incorporated design changes as outlined in PCN20151030000 and PCN20151030001. Clarified that board set solutions do not include a TEC device. Updated standard model numbers.

REFERENCES

[1] Fairchild Imaging, Available: http://www.fairchildimaging.com. [Accessed: January, 2014]

[2] BAE Systems, "MAN 0101 CIS2521F Standard and Scientific Package Datasheet_RevF.pdf", October 2013.