

## FEATURES

### MitySOM-5CSX Embedded Vision Development Kit for Basler dart

#### MitySOM-5CSX Module

##### Additional Hardware Included:

- Micro B USB Cable
- Ethernet Cable
- AC to DC 12V 3A Adapter
- Option A
  - 1 Basler dart Color Camera
- Option B
  - 2 Basler dart Mono Cameras

##### Digital Interfaces:

- 10/100/1000 MBit Ethernet Interface
- Debug UART to USB
- USB OTG Interface
- HDMI Interface
- Dual Basler dart BCON Camera Interfaces
- SD/MMC Card Socket
- M.2 Quad PCIe Connector
  - Supports NVME SSDs
- GPIO connector



##### Software and Documentation:

- Linux Kernel
- uBoot
- Development Environment - Virtual Machine
- Development Board Schematics
- Development Board Gerber Files
- Development Board BOM

## APPLICATIONS

- Basler dart BCON Camera Evaluation
- Intelligent Imaging
- Factory Automation
- Industrial Automation
- Embedded Instrumentation
- Test and Measurement

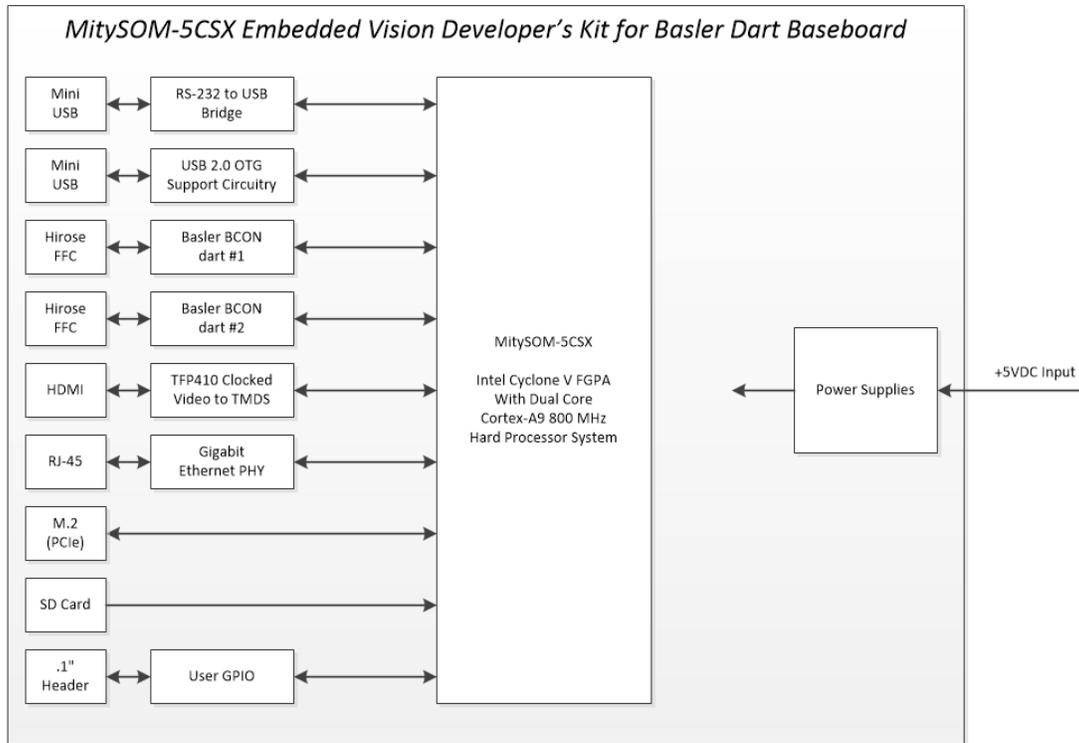
## DESCRIPTION

The MitySOM-5CSX Embedded Vision Development Kit (VDK) for Basler dart provides all the hardware and software support for system designers and developers to implement an embedded vision system utilizing the dart series cameras from Basler. The kit comes complete with the MitySOM-5CSX module, camera(s), and necessary cabling to start working on your project.

The MitySOM-5CSX Embedded VDK for Basler dart includes on-board Debug UART to USB converter, 10/100/1000 Ethernet, Universal Serial Bus (USB 2.0) USB-On-The-Go (OTG) communication interfaces.

The device, including attached Basler dart BCON cameras, is powered from a single +5VDC input (adapter included).

A block diagram of the MitySOM-5CSX Embedded VDK Baseboard is illustrated in Figure 1.



**Figure 1: MitySOM-5CSX Embedded VDK for Basler dart Block Diagram**

Additional details about the Cyclone V SoC, available peripherals, their features and FPGA IO details are provided in the data sheet at the Intel website (<http://www.altera.com/devices/processor/soc-fpga/cyclone-v-soc/cyclone-v-soc.html>).

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#### **Debug UART to USB Interface Description**

The on-board UART to USB Bridge, FTDI FT230X, provides a serial interface at data rates up to 115,200 baud using a mini USB type B connector. The USB serial interface, J1, is routed to the MitySOM serial boot loading port, UART0. It allows for general module debug, remote code download and flash upgrades on an attached MitySOM from this connector when interfaced with a PC.

When connected to a Windows XP, Vista, 7 or 8 PC no drivers are required as Windows Update is used to obtain the drivers.

#### **USB 2.0 Interface Description**

The on-board USB OTG interface utilizes a mini B type connector J401 and interfaces with the USB PHY on the MitySOM-5CSX module. This PHY is connected to the USB0 controller within the Cyclone V SoC HPS. Linux drivers are available. This interface allows for a connection to either a PC or a USB device using an USB OTG to USB A type adapter, not included.

#### **MultiMedia Card (SD) Interface Description**

The on-board MultiMedia Card (MMC) slot uses a Secure Digital connector J403 which supports standard (3.3V) cards. U-Boot configuration information and Linux drivers are available.

#### **Gigabit Ethernet Interface Description**

The on-board Ethernet interface features a Micrel KSZ9031 Ethernet PHY capable of running at 10/100/1000Mbit, including link auto-negotiation and RGMII/MDIO capability. An industry standard RJ-45 connector is provided for external connection. This Ethernet interface may be used to perform remote code download via U-Boot and flash upgrades on an attached MitySOM-5CSX module in addition to standard network interfacing.

#### **M.2 PCIe Interface Description**

The on-board M.2 standard connector allows for connection to the MitySOM-5CSX module gigabit transceivers configured in PCIe x4 (Gen 1) mode. This allows interfacing to M.2 NVME SSD cards for data recording and playback.

#### **Dual Basler dart Interface Description**

Two Basler dart BCON camera flat flex cable (FFC) interfaces, J101 and J102, are provided to allow capturing video data from 1 or 2 Basler dart BCON camera systems.

#### **GPIO Connector Description**

Connector P1 includes 6 pins connected, via a 1 K series resistor, to spare FPGA pins on Bank 4A of the MitySOM-5CSX. These pins can be programmed as inputs or outputs for end application use. The connector also includes +5V, +2.5V and ground reference pins for powering of external circuitry.

**Dual +5V Fan Interface Description**

Two connectors, J2 and J3, are included that provide +5V power. The intent for these connectors is to power simple +5V fans (not included) in the situation that the system must be cooled.

**Reset Switch Description**

S41 is for the Cold Reset which causes the MitySOM input power supply to be toggled.

**Boot Configuration Description**

The baseboard is designed to configure the MitySOM-5CSX module to boot from the MMC/SD card.

**ELECTRICAL CHARACTERISTICS**

Symbol	Parameter	Conditions	Typical	Limit	Units (Limits)
<b>Maximum Power Supply Output</b>					
I <sub>Max</sub>	5.0V Supply (AC Adapter) all components			3.0	A
I <sub>Max</sub>	5.0V Supply <sup>1</sup> for external components			2.0	A
I <sub>Max</sub>	3.3V Supply <sup>1</sup> for external components			3.3	A
<b>Power Dissipation</b>					
V <sub>s</sub>	Supply Voltage		5±5%		V
I <sub>s</sub>	Supply Current <sup>2</sup>		1000		mA

**Notes:**

- The maximum current supplied to external components should be limited to the specified maximum for all externally connected power supplies. Total power delivered to externally connected 5.0V and 3.3V supplies cannot exceed 10 Watts (5 Watts are reserved for on-board components including the MitySOM-5CSX daughter card). External power connections must comply with the maximum rated current per pin for a given connector.
- M.2 NVME cards not attached, 100% ARM utilization, RS-232 and Ethernet are enabled and active. 1 Basler dart BCON connected, HDMI monitor attached and displaying live data.

**ELECTRICAL INTERFACE DESCRIPTIONS**

**Input Power – J601**

The MitySOM-5CSX Embedded VDK power interface, J601, requires a single +5 Volt power supply. A recommended input supply rating of at least 3A is recommended and a 3A supply with universal AC plugs is included with each kit. The pinout for J601 is listed in Table 1.

**Table 1: J601 Input Power Interface Pin Description**

Signal	J601 Position
+5 V	1
GND	2

**Main Power Switch – S2**

An input power switch is present on the kit, S2, which controls the power input, on or off, from J601.

### MultiMedia Card (SD) Interface – J403

The MitySOM-5CSX Embedded VDK provides an MMC interface that uses a standard Secure Digital (SD) card slot for the physical interface. SD card adapters can be used to allow using MicroSD and MiniSD cards in this slot. The slot is supplied with 3.3V for use with standard SD cards.

### Debug/Boot UART – USB Interface – J1

The Debug UART – USB interface, J1, uses a standard USB Mini-B pinout as shown in Table 2.

**Table 2: J400 Mini USB Connector Pin Assignments**

Pin	Signal	Type	Standard	Notes
1	VBUS	Power	-	
2	D-	I/O	USB 2.0	USB data minus line
3	D+	I/O	USB 2.0	USB data plus line
4	GND	GND	-	
5	SHIELD	GND	-	

### USB 2.0 Interface (OTG) – J401

The MitySOM-5CSX USB 2.0 On-The-Go port uses a standard USB Mini-B pinout as shown in Table 3.

**Table 3: J401 Pin Assignments**

Pin	Signal	Type	Standard	Notes
1	USB1_VBUS	POWER	-	
2	USB1_D_N	I/O	USB 2.0	USB data minus line
3	USB1_D_P	I/O	USB 2.0	USB data plus line
4	USB1_ID	I/O	-	
5	GND	POWER	-	

### M.2 PCIe Interface – CN400

Table 4 describes the pin-out of the M.2 PCIe connector on the MitySOM-5CSX Embedded VDK development board. This connector provides a x4 lane Gen 1 PCIe interface to support the use of NVME style solid state disks (SSDs).

**Table 4: J402 Pin Assignments**

Pin	Signal	SoM Pin	Type	Standard	Notes
1	GND	-	POWER	-	
2	+3.3V	-	POWER	-	
3	GND	-	POWER	-	
4	+3.3V	-	POWER	-	
5	PCIE1_RX_3_N	228	I	CML	
6	N/C	-	-	-	
7	PCIE1_RX_3_P	226	I	CML	
8	N/C	-	-	-	
9	GND	-	-	-	
10	M2LED	-	O	+3.3V max	>1V Drives D2 Green LED.
11	PCIE1_TX_3_N	235	O	CML	
12	+3.3V	-	POWER	-	
13	PCIE1_TX_3_P	233	O	CML	
14	+3.3V	-	POWER	-	
15	GND	-	POWER	-	

Pin	Signal	SoM Pin	Type	Standard	Notes
16	+3.3V	-	POWER	-	
17	PCIE1_RX_2_N	216	I	CML	
18	+3.3V	-	POWER	-	
19	PCIE1_RX_2_P	214	I	CML	
20	N/C	-	-	-	
21	GND	-	POWER	-	
22	N/C	-	-	-	
23	PCIE1_TX_2_N	223	O	CML	
24	N/C	-	-	-	
25	PCIE1_TX_2_P	221	O	CML	
26	N/C	-	-	-	
27	GND	-	POWER	-	
28	N/C	-	-	-	
29	PCIE1_RX_1_N	210	I	CML	
30	N/C	-	-	-	
31	PCIE1_RX_1_P	208	I	CML	
32	N/C	-	-	-	
33	GND	-	POWER	-	
34	N/C	-	-	-	
35	PCIE1_TX_1_N	217	O	CML	
36	N/C	-	-	-	
37	PCIE1_TC_1_P	215	O	CML	
38	N/C	-	-	-	
39	GND	-	POWER	-	
40	SMB_CLK	76	IO	1.8V	
41	PCIE1_RX_0_N	204	I	CML	
42	SMB_DATA	78	IO	1.8V	
43	PCIE1_RX_0_P	202	I	CML	
44	SMB_ALERTn	177	I	1.8V	
45	GND	-	POWER	-	
46	N/C	-	-	-	
47	PCIE1_TX_0_N	211	O	CML	
48	N/C	-	-	-	
49	PCIE1_TX_0_P	209	O	CML	
50	PERSTn	21	O	+3.3V	
51	GND	-	POWER	-	
52	M.2_CLKREQn	-	O	GND	This signal is pulled to ground.
53	PCIE_M2_REFCLK_N	-	O	CML	100 MHz
54	M.2_WAKEn	10	O	+3.3V	1K pull down.
55	PCIE_M2_REFCLK_P	-	O	CML	
56	N/C	-	-	-	
57	GND	-	POWER	-	
58	N/C	-	-	-	
59	N/C	-	-	-	
60	N/C	-	-	-	
61	N/C	-	-	-	
62	+3.3V	-	POWER	-	
63	GND	-	POWER	-	
64	+3.3V	-	POWER	-	
65	GND	-	POWER	-	
66	+3.3V	-	POWER	-	
67	GND	-	POWER	-	

## BCON LVDS Camera Interface J101 & J102

Table 5 describes the pin-out of the J101 and J102 Basler BCON LVDS camera interfaces. For additional information on the interface, see the [Basler dart BCON User's Manual](#).

**Table 5: J101 and J102 Connector Pin Assignments**

Pin	Schematic Signal	J101 SoM Pin	J102 SoM Pin	Type	Standard	Notes
1	GND	-	-	POWER	-	
2	CAM_X0_P	93	123	I	LVDS	
3	CAM_X0_N	91	121	I	LVDS	
4	GND	-	-	POWER	-	
5	CAM_X1_P	89	115	I	LVDS	
6	CAM_X1_N	87	113	I	LVDS	
7	GND	-	-	POWER	-	
8	CAM_X2_P	85	111	I	LVDS	
9	CAM_X2_N	83	109	I	LVDS	
10	GND	-	-	POWER	-	
11	CAM_XCLK_P	101	119	I	LVDS	
12	CAM_XCLK_N	99	117	I	LVDS	
13	GND	-	-	POWER	-	
14	CAM_X3_P	85	107	I	LVDS	
15	CAM_X3_N	83	105	I	LVDS	
16	GND	-	-	POWER	-	
17	CAM1_CC_P	112	120	O	LVDS	
18	CAM1_CC_N	110	118	O	LVDS	
19	GND	-	-	POWER	-	
20	I2C1_SCL	28	28	IO	+3.3V	
21	GND	-	-	POWER	-	
22	I2C1_SDA	30	30	IO	+3.3V	
23	CAM_ID	32	34	O	+3.3V	J101 1K Pull Down, J102 1K Pull Up
24	GND	-	-	POWER	-	
25	+5.0V	-	-	POWER	-	Note 1
26	+5.0V	-	-	POWER	-	Note 1
27	+5.0V	-	-	POWER	-	Note 1
28	GND	-	-	POWER	-	
29	GND	-	-	POWER	-	

**Notes:**

1. The maximum total current supplied to external components from the +5.0V supply should be limited to less than 2 A . The maximum current allowed per connector pin is 1A.

**10/100/1000 Ethernet Interface – J500**

The MitySOM-5CSX Embedded VDK provides an RJ-45 connection for a 10/100/1000 Mbps Ethernet connection. This connection follows standard TIA/EIA-568B pinout as shown in Table 6 below. The Ethernet PHY, Micrel KSZ9031, will auto negotiate the speed and duplex of the connected device.

**Table 6: J500 Ethernet RJ45 Pin Assignments**

Pin	Signal	Type	Notes
1	TXRXA_P	I/O	
2	TXRXA_N	I/O	
3	TXRXB_P	I/O	
4	TXRXB_N	I/O	
5	TXRXC_P	I/O	

Pin	Signal	Type	Notes
6	TXRXC_N	I/O	
7	TXRXD_P	I/O	
8	TXRXD_N	I/O	

### User GPIO Interface – P1

The MitySOM-5CSX Development Kit provides an 11 pin 0.1” header for use with custom design IO boards such as LED controllers or external trigger interfaces, etc. The connector provides 5.0V and 2.5V supplies for external circuitry and 6 ESD protected connections to the FPGA I/O. Note that there is a 1K series resistor in-line with the I/O signals.

**Table 7: J500 User GPIO Pin Assignments**

Pin	Signal	SOM Pin	Type	Standard	Notes
1	+5.0V	-	POWER	-	250 mA max current
2	GND	-	POWER	-	
3	+2.5V	-	POWER	-	100 mA max current
4	GND	-	POWER	-	
5	UGPIO0	52	I/O	+2.5V	Bank 4A. 1K series resistor to FPGA
6	UGPIO1	54	I/O	+2.5V	Bank 4A. 1K series resistor to FPGA
7	UGPIO2	56	I/O	+2.5V	Bank 4A. 1K series resistor to FPGA
8	UGPIO3	60	I/O	+2.5V	Bank 4A. 1K series resistor to FPGA
9	UGPIO4	62	I/O	+2.5V	Bank 4A. 1K series resistor to FPGA
10	UGPIO5	64	I/O	+2.5V	Bank 4A. 1K series resistor to FPGA
11	UGPIO6	66	I/O	+2.5V	Bank 4A. 1K series resistor to FPGA

### Included Components

The following table lists the components that are included with the MitySOM-5CSX Embedded Vision Development Kit for Basler dart series cameras. See Table 9 for specific development kit ordering information.

**Table 8: Included Items**

Description	Interface Port	Qty. Included
MitySOM-5CSX Embedded Vision Development Kit Board	n/a	Qty. 1
MitySOM-5CSX Module	J100	Qty. 1
Mini USB Cable for Debug Console	J1	Qty. 1
+5.0V 3A AC to DC Supply	J601	Qty. 1
Development Kit Schematic Files	n/a	accessible via wiki
Development Kit Gerber Drawings	n/a	accessible via wiki
Development Kit Bill Of Materials	n/a	Qty. 1
Development Kit Quick Start Guide	n/a	Qty. 1
Dual Monochrome Camera Option	-	-
Camera – Basler daA1280-54bm Aptina AR0134 / 1280x960x54fps monochrome S-mount	n/a	Qty 2
Camera Lens	n/a	Qty 2
FFC Cable, 200mm	J101/J102	Qty 2
Single Color Camera Option	-	-
Camera – Basler daA2500-14bc Aptina MT9P031 / 2592x1944x14fps color S-mount	n/a	Qty 1
Camera Lens	n/a	Qty 1
FFC Cable, 200mm	J101/J102	Qty 1



## ORDERING INFORMATION

### Development Kits

The following table lists the standard MitySOM-5CSX Embedded Vision Development Kit for Basler dart BCON configurations. For shipping status, availability, and lead time of these or other configurations please contact Critical Link via [info@criticallink.com](mailto:info@criticallink.com).

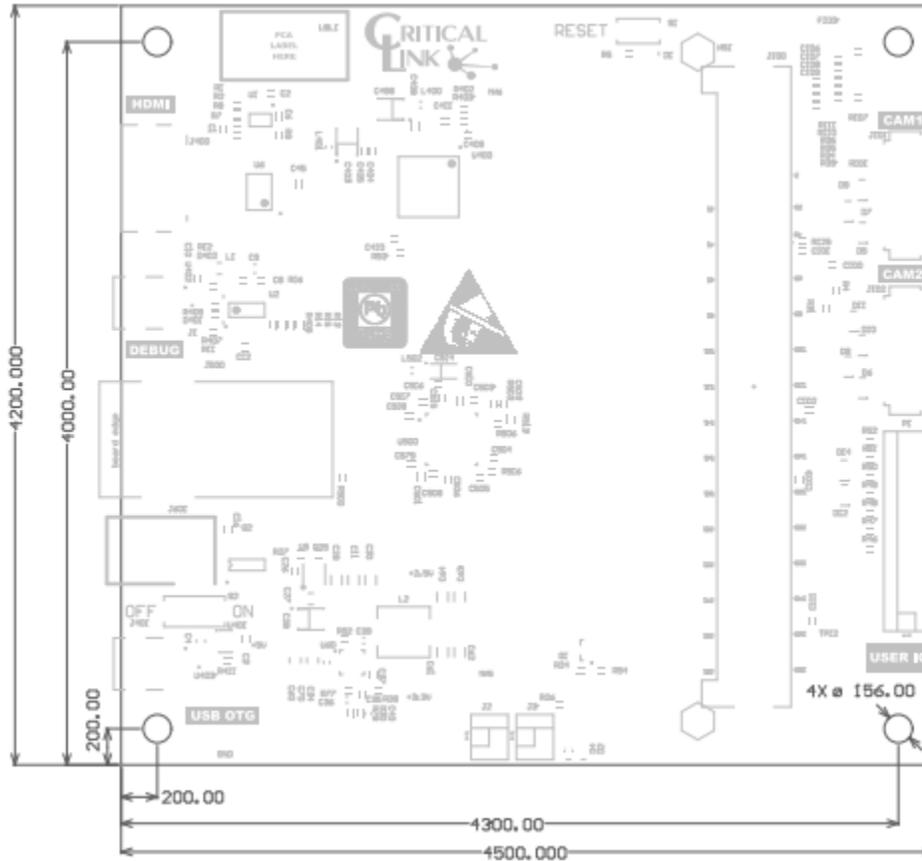
**Table 9: Standard Model Numbers**

Development Kit Model	Basler dart BCON Camera Option
80-001005	Single Color Camera, daA2500-14bc, S-Mount
80-001002	Dual Monochrome Cameras, daA1280-54bm, S-Mount

## MECHANICAL INTERFACE DESCRIPTION

### Main Board Interface / Mounting

Figure 2 illustrates the location of the mounting holes and the outer dimensions of the Embedded VDK Baseboard (all dimensions are in mils).



**Figure 2: MitySOM-5CSX VDK Baseboard, Mounting Hole Locations (Top View)**

## REVISION HISTORY

Date	Rev	Change Description
10-AUG-2017	1	Initial revision.
2-APR-2018	2	Corrected camera options A & B (pg 1), added electrical data. Resolved TBDs.