Imaging Diagnostics
Total vision solutions

Auto Focus Camelot Camera

- **High Resolution 5Mp Sensor**
- **Manual/Auto Focus Option**
- **Superior Image Quality**
- **Uses Standard Commercial M12 lens**
- **Unlimited Auto Focus Repeatability**
- **Embedded DSP Capability**
- **Available With USB or IP Interface**

INTRODUCTION

Camelot's Auto Focus Camera is part of a family of digital cameras for machine vision applications with fast USB2.0 or Ethernet connection and embedded Digital Signal Processor capable of performing advanced image processing algorithms on the camera. The cameras are intended for medical and industrial applications requiring superior image quality high performance and yet attractive pricing.

Camera Features

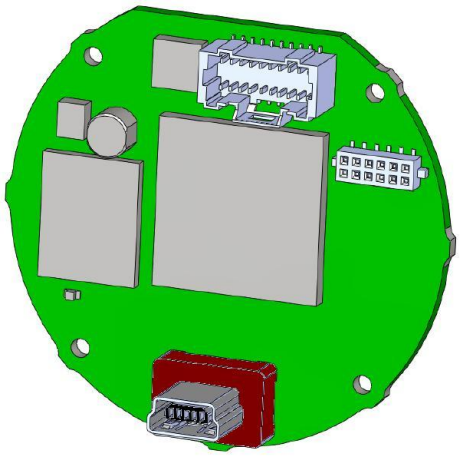
- Motorized Focus Module
- Auto/Manual focus with 3000 positions
- Supports standard M12 lens
- Configurable ROI
- External trigger support
- 6 Programmable PWM Timers
- 9 Programmable GPIOs
- USB 2.0 or Ethernet connection
- Electronic shutter
- Controllable Gain
- On board 64MByte DDR
- On board 16MByte Flash
- DirectShow Interface
- Software Development Kit
- Multiple camera support
- Standalone mode

AUTO FOCUS CAMELOT CAMERA

The Auto Focus Camelot Camera consists of

- Digital Signal Processing board with USB connector, and optional Ethernet extension board
- 5Mp image sensor board (other sensors will be available in future and/or per demand)
- Motorized focus mechanism, enabling movement of M12 lens

USB DSP Board



The Camelot series is based on the Analog devices BF548 Blackfin DSP processor, providing high performance and a large number of interfaces. This processor was chosen in order to perform advanced image processing algorithms in limited space and power limitations. It is therefore possible to run the camera on USB power without any need of adding an additional power supply.

Processor Specifications

- Up to 1066MMAC (533MHz)
- RISC-like register and instruction model
- Programmable on-chip voltage regulator
- DDR SDRAM Support
- Two 16-bit MACs, two 40-bit ALUs, four 8-bit video ALUs
- 4 DMA pairs
- High-speed USB On-the-Go (OTG) with integrated PHY
- On board RAM 64MByte DDR-167MHz-8 Meg x 16 x 4 Banks

Flash memory

- 16MByte serial flash
- 32 sectors
- Page program (1024/1056 bytes)
- Sector erase (256Kbyte)

Communications interface

- USB2 high speed (480Mbps)

Power source

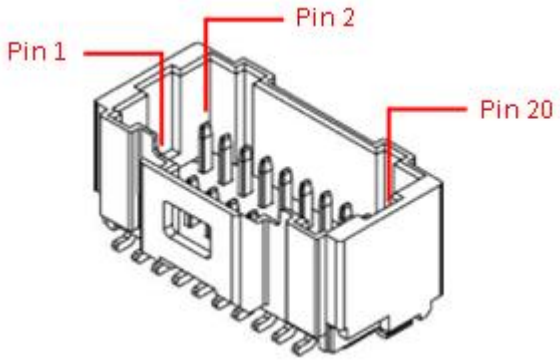
- USB / Via 20 pin Molex connector

Connectors

- JTAG–Female 12 pin (2x6) 1.27mm pitch
- Expansion connector–100 pin-0.4mm pitch 4mm board stacking-Samtec SS4
- Expansion connector–20 pin-0.4mm pitch 4mm board stacking-Samtec SS4
- Images sensor board connector-40 pin-0.5mm pitch 4mm board stacking-Hirose DF12
- USB–Cable connection (modified according to customer requirements)
- GPIO-20 pin Molex Pico-clasp 1mm Pitch board to wire connector ,Molex PN : 5011902017 , mating connector : 501189-2010 .
- Mini – USB Connector
- DC Jack (for 5V Input only) .

Interfaces available

- USB2.0
- 9 x GPIO , 3.3V logic levels
- 2 x SPI (via expansion connector)
- PPI (via expansion connector)
- JTAG (via expansion connector)
- 6 x PWM (via expansion connector)
- 2 x UART (via expansion connector)
- I2C (via expansion connector)
- Image sensor board (via expansion connector)



USB GPIO connector

The GPIO connector on the Main board uses a 20 pin Molex Pico-clasp 1mm Pitch board to wire connector.

Molex PN : 5011902017, mating connector : 501189-2010

And crimp pins. PN: 501193-2000

Each GPIO can be configured as strobe or trigger.

Pin	Pin name	Pin description	Remarks	Pin	Pin name	Pin description	Remarks
1	PB0	GPIO- Open-drain	10K Pull-Up	**2**	Power		5V
3	PC7	GPIO		**4**	Power		5V
5	PC8	GPIO		**6**	PB9	TMR1 (PWM)	
7	PG6	SPI1_SEL2#		**8**	PB10	TMR2 (PWM)	
9	PG8	SPI1_SCK		**10**	PG11	SPI1_SS#	
11	PG9	SPI1_MISO		**12**	PC9	GPIO	
13	PG10	SPI1_MOSI		**14**	PC10	GPIO	
15	PB4	UART2-TX	10K Pull-Up	**16**	PC11	GPIO	
17	GND			**18**	PH3	TMR9 (PWM)	10K Pull-Up
19	GND			**20**	PB5	UART2-RX	10K Pull-Up

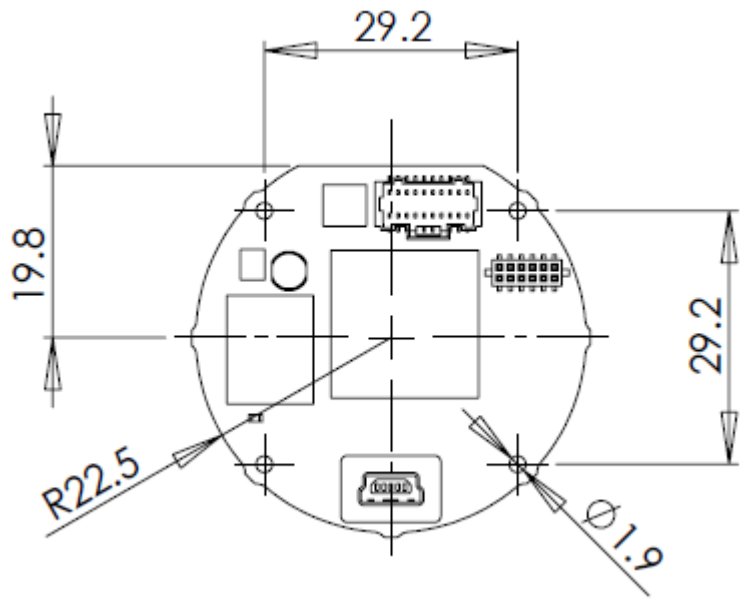
The interface connector 20 pin on the main board is a 20 pin Board to board connector from Samtec , PN : SS4-10-3.00-L-D-P-TR. It connects the sensor board to the main board.

Pin	Signal	Pin	Signal
1	SD_D0	**2**	SP_TF0
3	SD_D1	**4**	SP_DT0SEC
5	SD_D2	**6**	SP_DT0PRI
7	SD_D3	**8**	SP_DTSCLK0
9	SD_CLK	**10**	SP_RFS0
11	SD_CMD	**12**	SP_DR0SEC
13	DSP_GPIO10	**14**	SP_DR0PRI
15	TMR9	**16**	SP_RSCLK0
17	TMR10	**18**	TMR8
19	DGND	**20**	VCC_IN

Physical Characteristics

- Circular design with a diameter of 45mm

Main board physical dimensions



5MP SENSOR BOARD

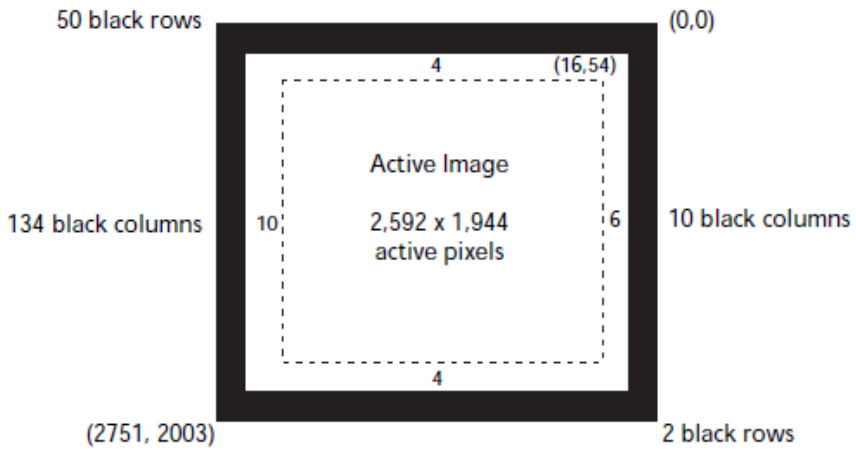
The 5Mpixel sensor board is based on the Aptina sensor MT9P031, which incorporates sophisticated camera functions on-chip.

Item	Description or Value
Sensor	Aptina MT9P031
Resolution	5Mpixel
Optical Format	1/2.5-inch (4:3)
Active Image Size	5.7mm (H) x 4.28mm (V) 7.13mm diagonal
Active Pixels	2,592H x 1,944V
Pixel Size	2.2 x 2.2µm
Color Filter Array	RGB Bayer pattern
Shutter Type	Electronic rolling shutter (ERS) Snapshot only Global reset release (GRR)
Maximum Data Rate	96 Mp/s at 96MHz
Sensor Frame Rate	14 fps
ADC Resolution	12-bit-on-chip. Board can work in either 12 bit or 8 bit.
Responsivity	1.4V/lux-sec (550nm)
Pixel Dynamic Range	70.1db
SNR Max	38.1db
Power Consumption	381mW
LEDs	Four 5mm LEDs on board.
LED Drivers	Four separately controlled LED Drivers-programmable current source up to 30mA (current sink).
External Illumination	Optional connector for external illumination using the four LED drivers.

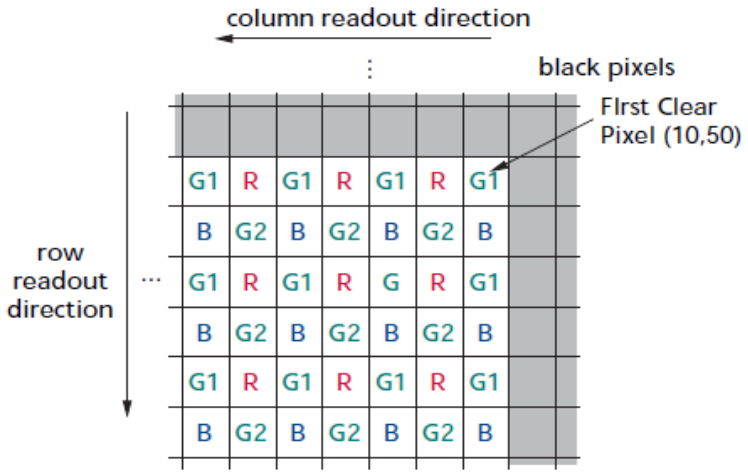
Sensor Board Components

Component	Description
Auto Focus Module	▪ M12 micro lens adaptor

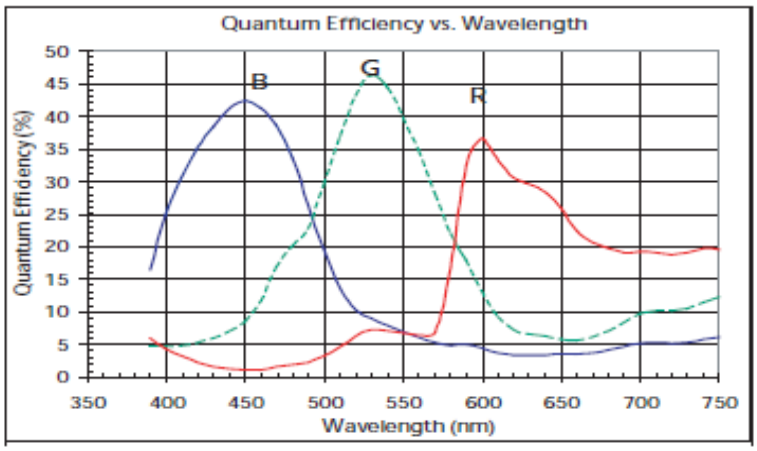
Pixel array description



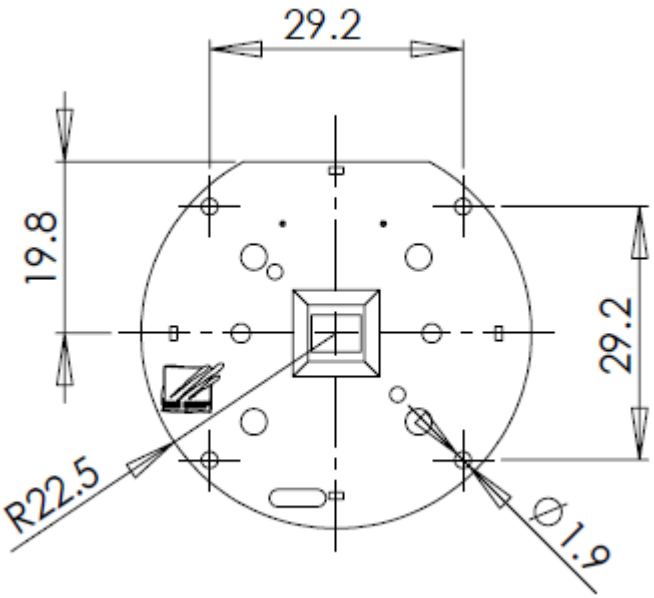
Pixel Color Pattern Detail (Top Right Corner)



Typical Spectral Characteristics



Board dimensions



External illuminator connector

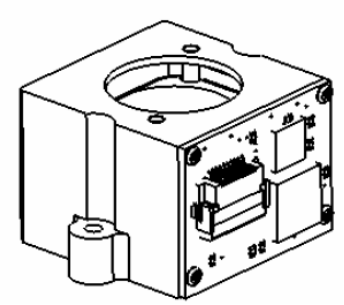
In order to use the external illuminator connector, use Samtec wire to board connector.
PN (of mating wire to board connector): SFSD-05-28-H-10.00-DR-NDX

Change the PN according to cable length.

Pin	Signal Description	Pin	Signal Description
1	VCC_LIGHT	**2**	LED1
3	VCC_LIGHT	**4**	LED2
5	NC	**6**	LED3
7	LGND	**8**	LED4
9	LGND	**10**	NC

AUTO FOCUS MECHANISM

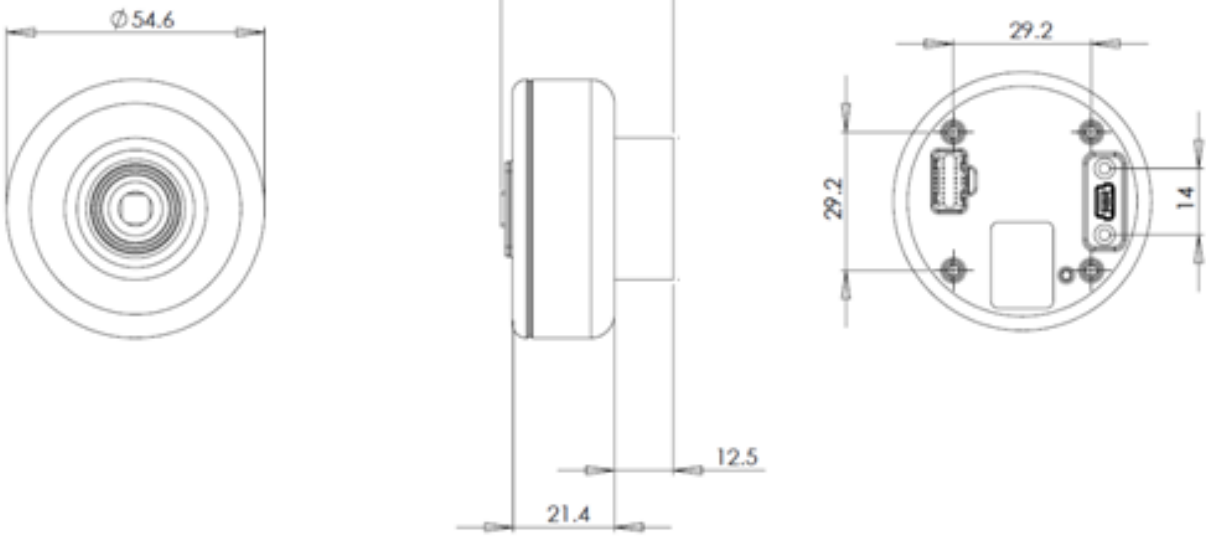
Features



- Precision lens control; superior image quality
- Single-lens focus solution with minimal external processing requirements
- Precise lens position control (0.5 micron resolution),
- Best-in-class bi-directional repeatability
- No hysteresis enabling you to capture the sharpest images from your camera
- High performance that is not susceptible to temperature or power variations.

CAMERA HOUSING

Camera housing physical dimensions and locations



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