Cheetah3 Series Smart Camera Specifications

Document No. RSDN83501V107
Version 1.07
Feb 19, 2024

ROSEEK®

Release History

Document No.	Version	Date	Description
RSDN83501V107	1.07	Feb 19, 2024	(1) The frame rate of RSCT381S is changed from 25fps to 32.2fps. Refer to Table 3-1
RSDN83501V106	1.06	Dec 29, 2023	(1) Added customized product code in the part number. Refer to Chapter 3.2 Note [1]
RSDN83501V105	1.05	Nov 29, 2023	(1) All product support C and CS mount, refer Table 3-1 and Figure 3-1 (2) RSCT380S frame rate is changed from 25fps to 32.2fps. Refer to Table 3-1
RSDN83501V104	1.04	May 08, 2023	(1) The type of filters is described in detail (page 8)
RSDN83501V103	1.03	Mar 24, 2023	(1) Deleted the support for micro-SD card (2) Corrected some errors
RSDN83501V102	1.02	Jan 15, 2023	(1) Modified Table 3-3, 4GB-DDR upgrade to 8GB-DDR (2) Modified Table 3-4, updated encoding performance (3) Determined Linux version Ubuntu 20.04.1 Intel IoT
RSDN83501V101	1.01	Nov 12, 2022	(1) Modified Table 4-1 and Table 4-2
RSDN83501V100	1.00	Sep 14, 2022	(1) Original issue

Contents

1 Feature

1. Intel® ATOM™ SoC X6425E 3.0GHz, quad cores
2. OS support: Windows 10 IoT Enterprise, Ubuntu 20.04.1 Intel IoT
3. SONY CMOS global shutter sensors, resolution from 1.6MP to 20MP
4. Integrated GPU provides 4TOPs of computing power for AI algorithm
5. Enhanced hardware video encoder

   H.264 4K@55fps, H.265 4K@64fps
6. The software is compatible with Cheetah1 and Cheetah2
7. The dimensions and IO ports are compatible with Cheetah1 and Cheetah2
8. Wide operation temperature -40°C to +80°C, fanless
9. Detailed documents and mature SDK for users' embedded applications

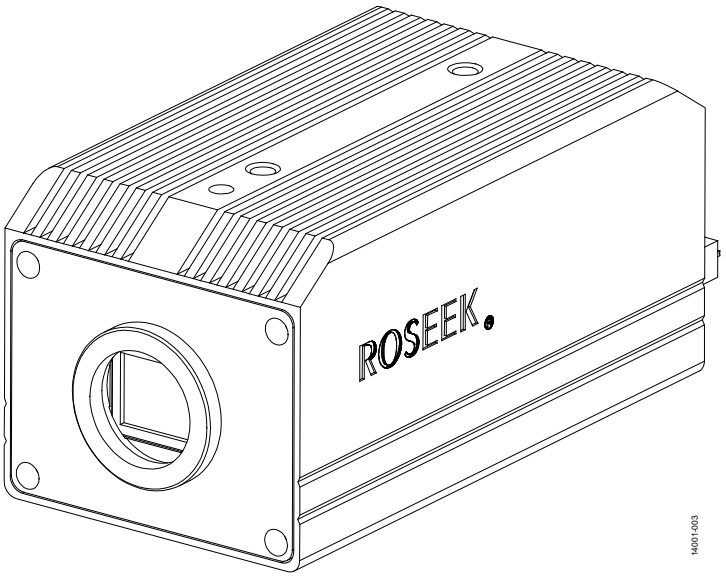

Figure 1-1 Cheetah3 Series Smart Camera

2 Application

2.1 Application

- Intelligent Transportation System (ITS)
- Intelligent Surveillance
- Machine Vision

2.2 Application Diagram

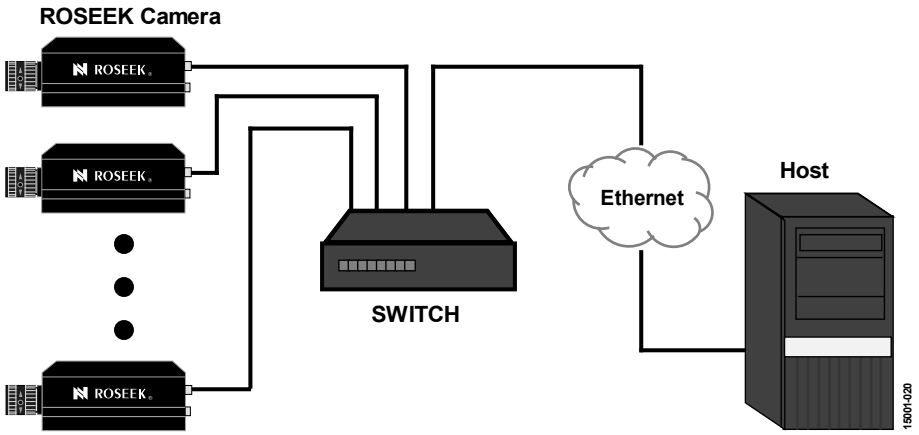

Figure 2-1 Application Diagram

2.3 Related Products

- Lynx2 Series Smart Camera
- Lynx1 Series Smart Camera
- TreeFrog3 Series Integrated Camera Housing
- TreeFrog1 Series Integrated Camera Housing
- Beaver3 Series Vision Controller

3 Specifications

3.1 Sensor Features

Table 3-1 Sensor Features

Model [1]	Type	Pixel	Sensitivity Ratio [2]	Max FPS	Shutter	Sensor Description	Resolution	ROI Function
RSCT313S	Color	1.6M	3.0	107	Global	Sony IMX273, 1/3”, 3.45um	1440x1080	Yes
RSCT313M	Mono	1.6M	4.9	107	Global	Sony IMX273, 1/3”, 3.45um	1440x1080	Yes
RSCT324S	Color	2M	6.0	60	Rolling	Sony IMX385, 1/2”, 3.75um	1920x1080	Yes
RSCT330S	Color	3.2M	3.0	55.6	Global	Sony IMX265, 1/1.8”, 3.45um	2048x1536	Yes
RSCT330M	Mono	3.2M	4.9	55.6	Global	Sony IMX265, 1/1.8”, 3.45um	2048x1536	Yes
RSCT350S	Color	5M	3.0	35.7	Global	Sony IMX264, 2/3”, 3.45um	2448x2048	Yes
RSCT350M	Mono	5M	4.9	35.7	Global	Sony IMX264, 2/3”, 3.45um	2448x2048	Yes
RSCT380S	Color	8.9M	3.0	32.2	Global	Sony IMX267, 1”, 3.45um	4096x2160	Yes
RSCT380M	Mono	8.9M	4.9	32.2	Global	Sony IMX267, 1”, 3.45um	4096x2160	Yes
RSCT381S	Color	8.9M	3.0	32.2	Global [3]	Sony IMX305, 1”, 3.45um	4096x2160	Yes
RSCT3G0S	Color	16M	2.3	17.7	Global	Sony IMX542, 1.1”, 2.74um	5328×3040	Yes
RSCT3G0M	Mono	16M	3.7	17.7	Global	Sony IMX542, 1.1”, 2.74um	5328×3040	Yes
RSCT3M1S	Color	20M	2.0	22	Rolling	Sony IMX183, 1”, 2.4um	5472×3648	No

3.2 Common Features

Table 3-2 Common Features

Lens Mount [6]	C or CS
Iris Control	P-Iris, DC-Iris
Removable Polarizer	Optional
Day-Night Function	Optional
Image Format	YUV420SP
Video Stream	H.264 4K2K@55fps, H.265 4K2K@50fps, Refer to Table 3-4
Shutter Time	20 microseconds to 1 second
Protocols	ONVIF, GB/T28181, RTSP, TCP/IP, NTP, etc.
Network Port	One 100/1000M RJ45 connector
Power Supply	20 to 50VDC (24V or 48V) [4], Max 18W
Power Line Requirement	The total resistance of the power supply wires (two-wire series) is not more than 4 ohms
Operation Condition	-40°C to +80°C [5], humidity 5%~95% (non-condensing)
Storage Condition	-50°C to +100°C
MTBF	350,000 hours
Dimensions and Weight	66.5x72.8x140mm, 0.8 kg
Standards	CE

Note:

[1] Ordering Information

RSCT 3 30 S C - H xxx G - yy

aaaa b cc d e f ggg h jj

P/N example for standard product RSCT330SC-H256S

P/N example for customized product RSCT330SC-H256S-05

aaaa Cheetah series smart camera

b the 3rd generation

cc Type number

d type of sensor

- S Color sensor
- M Monochrome sensor

e type of filter

- G switchable filters
  IR-cut filter (Figure 6-1) and anti-reflection optical glass
  for lens with IR-correction function (no IR-correction inside camera)
- K switchable filters
  IR-cut filter (Figure 6-1) and band-pass filter (Figure 6-3)
  for lens with IR-correction function (no IR-correction inside camera)
- P switchable filters
  IR-cut filter (Figure 6-1) and polarizer filter
  The polarizer filter also has IR-cut coating (Figure 6-1)
  for lens with IR-correction function (no IR-correction inside camera)
- D switchable filters
  IR-cut filter (Figure 6-1) and band-pass filter (Figure 6-2)
  for lens without IR-correction function (IR-correction inside camera)
- N switchable filters
  IR-cut filter (Figure 6-1) and band-pass filter (Figure 6-3)
  for lens without IR-correction function (IR-correction inside camera)
- C fixed IR-cut filter (Figure 6-1)
  for lens with IR-correction function (no IR-correction inside camera)

f type of lens mount

- H C lens mount
- S CS lens mount

ggg embedded storage capacity

- 000 no embedded storage
- xxx 256(GB) / 512(GB) / 001(TB)

h embedded storage type

- G No storage
- S M.2 SSD

jj customized product code

- Blank standard product
- yy customized product code

[2] The sensitivity ratio is a linear ratio based on the sensitivity value of SONY CCD ICX445AQA. The higher this ratio is, the more sensitive the camera will be.

[3] No trigger pin and no trigger mode for this global shutter CMOS image sensor.

[4] Recommend 50W switching power supply or above to ensure the system's long term operating stability. For example, the 50W switching power from Meanwell® (www.meanwell.com), number LRS-50-24 (output 24V, 2.2A). Also, TreeFrog1 series camera housing (including switching power supply and LED strobe light) is recommended for users.

[5] After being placed in the environment of -40°C for 12 hours, the camera can be started and run for 24 hours. The camera can run for 48 hours in the environment of +80°C. The camera can run for 48 hours in the cyclic environment (5 hours for a cycle) of the temperature from -40°C to +80°C.

[6] Cheetah3 smart cameras have two kinds of front covers, which support C mount and CS mount lenses respectively. The depth of the lens mounting hole of the two front covers is as shown in the figure below. When users choose lenses, please note that the rear end of some lenses is relatively long, which may damage the front cover.

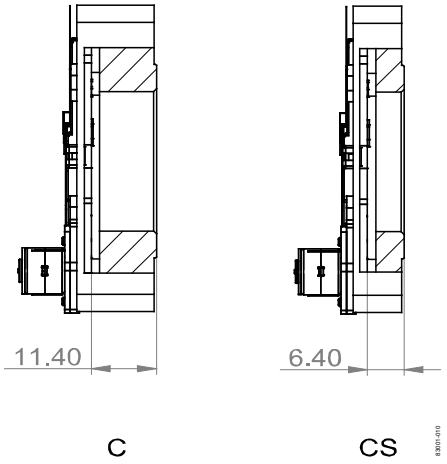

Figure 3-1 Depth of the Lens Mount

3.3 Hardware Resources

Table 3-3 Hardware

Item	Details
CPU Model	Intel® ATOM™ X6425E (named Elkhart Lake)
CPU Core Clock	Base 2.0GHz, Burst 3.0GHz
CPU L2	1.5M-byte
GPU	Generation 10 graphics, support Intel® free toolkit OpenVINO™
RAM	8GB LPDDR4X-3200, full-channel (128-bit)
Storage	64GB eMMC5.1 flash (soldered onboard) for OS 1x M.2 SSD slot for up to 1TB extended storage
Parameter Memory[2]	64K-byte EEPROM, formatting disk has no effect on data stored in it
Look Up Table	One programmable 8-bit LUT in FPGA
Encryption	Unique chip ID to prevent unauthorized copying of the program but strongly recommend USB dongle way
Temperature Monitoring	Embedded temperature sensor for internal temperature monitoring
Watch Dog	Hardware watch dog (adjustable from 1 to 256 second)
Serial Port	two RS232 ports and one isolated RS485 port for user
Digital IO Port	2 programmable digital IO ports (5V-TTL)
Photocoupler Input	2 photocoupler input port
Photocoupler Output	2 photocoupler output ports (100mA/50V)
Power Sync	Power sync function, 100 to 260VAC input (dedicated 2-pin connector)
Iris Control	P-Iris control
Switchable Polarizer [3]	Eliminate the reflected polarized light from car windshield and number plate to get clear face and number plate pictures
Day-Night Function[3]	Get color pictures at daytime, and monochrome pictures at night by IR flash
USB Port	One USB3.0 port (host), 1.5A@5V
Video Port	1 HDMI for max 4096x2160@ 60Hz
Network Port	One 100M/1000M RJ45 port
M.2 SSD slot	1 M.2 SSD slot for user, max 1TB
Wake on LAN (WoL)	Support Wake on LAN (WoL), remote debugging, program update and power on/off through Ethernet

Notes:

[1] User must use NTP protocol to sync the time every time the camera is powered on.

[2] The EEPROM is guaranteed for 1,000,000 cycles of writing. The camera has internal counting function. ROSEEK does not accept liability for any damage caused by over 1,000,000 writing cycles.

[3] The switch part is guaranteed for 40,000 cycles of switching. The camera has internal counting function. ROSEEK does not accept liability for any damage caused by over 40,000 switching cycles.

3.4 Software Resources

Cheetah3 series smart camera is based on x86 architecture. It supports general OS and applications.

3.4.1 Supported Operating System

Windows 10 IoT Enterprise (64-bit), Linux (Ubuntu 20.04.1 Intel IoT)

Default OS: Linux (Ubuntu 20.04.1 Intel IoT)

If Windows 10 IoT Enterprise license is needed, please specify in order. Users can also download the image file from ROSEEK website and install it yourself, and then activate it with a license. Please refer to the document *Cheeath2* **Series** *Smart Camera - OS Recovery Instructions for Windows* or *Cheeath2 Series Smart Camera - OS Recovery Instructions for Linux*

The Windows and Linux images have been deeply customized by ROSEEK, and the OS **does not crash** if the power is cut off while running. This means that users can cut off the power at any time without having to close the Windows software first.

CAUTION:

Users must only use the OS images from ROSEEK for system recovery or reinstallation. Installing any other version of operating system will cause system crash.

3.4.2 Recommended IDE

API functions are standard C language interfaces. ROSEEK developed the Demo with Microsoft Visual Studio 2013.

3.4.3 Abundant APIs

ROSEEK provides abundant APIs for ITS and intelligent surveillance. All these APIs are optimized and fully-tested for Cheetah3 camera platform. It will be convenient to use high-efficiency ROSEEK APIs for user's algorithm:

- Support network protocols including ONVIF, GB/T28181, RTSP, TCP/IP, NTP
- Hardware H.264/H.265/MJPEG video encoding (not occupying CPU resources)
- Hardware JPEG compress/uncompress (not occupying CPU resources)
- High-efficiency image scaling

3.4.4 Encoding performance

Cheetah3 Smart camera greatly improves the encoding and decoding performance. It supports H.264/H.265/JPEG encoding/decoding by hardware. The following table is its detailed encoding performance. So it can work as a high-end IP camera.

Table 3-4 Encoding performance

Item	Format	Windows 10 IoT Ent		Ubuntu 20.04.1 Intel IoT	
		2K(1920x1080)	4K(4096x2160)	2K(1920x1080)	4K(4096x2160)
Encode (fps)	H.264	195	55	213	59
	H.265	250	64	268	67
	JPEG	282	87	362	100

3.4.5 Accelerate AI workload

Cheetah3 Smart camera supports Intel® free AI toolkit OpenVINO™ to deploy high-performance deep learning inference. Cheetah3 can use the integrated GPU to achieve 4TOPs computing power, which is used to accelerate the user's deep learning algorithm.

Note: H.264/H.265 compression also uses GPU acceleration, so using GPU to implement AI inference will affect the frame rate of H.264/H.265 compression. The user needs to balance the performance of the two according to the actual application.

3.4.6 General Vision Software

Cheetah3 supports general software based on x86 architecture (Windows/Linux), such as: OpenCV, SimpleCV, Matlab, HALCON.

3.5 Camera Heat Dissipation

It’s strongly recommended using Body Heat Sink for camera heat dissipation when it is installed in housing. The Body Heat Sink way means sticking the top side of the camera to the metal internal surface of the housing to dissipate the heat. It’s recommended using a heat conductive silicone pad as conductive filling medium between camera case and the housing.

Also the camera support heat-pipe cooling. On the camera top there are two 6.3mm diameters holes for heat-pipes. It’s recommended using silicone thermal grease as conductive filling medium.

If the Cheetah3 camera does not dissipate heat well, the high temperature of the camera will cause CMOS image sensor noise and may even burn the camera.

3.6 System Block Diagram

The block diagram of Cheetah3 series smart camera is as follows:

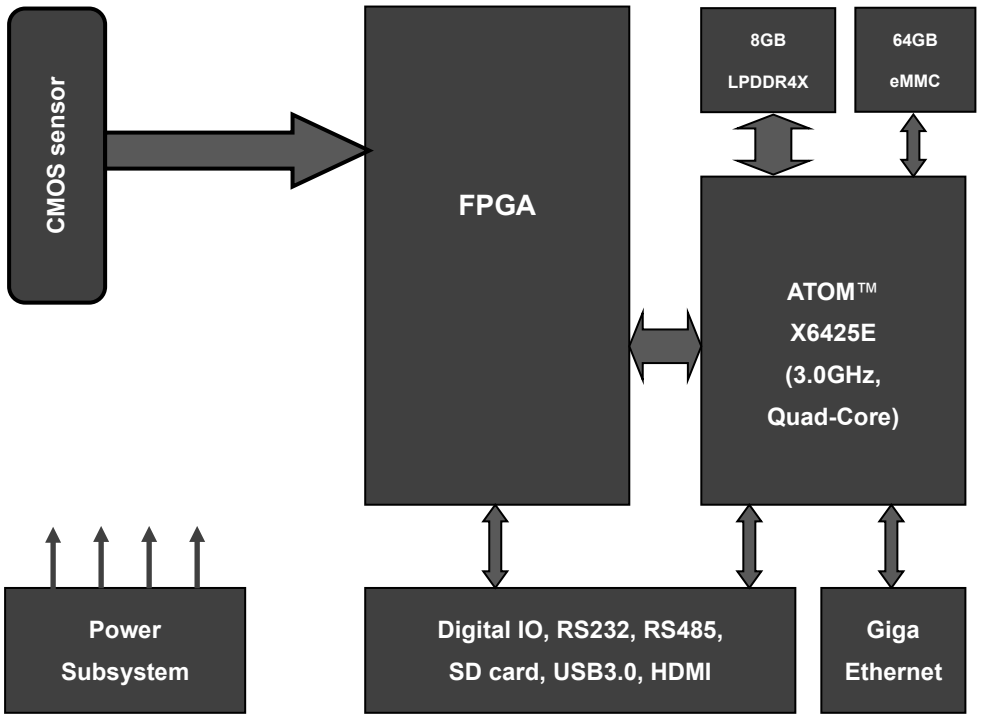

Figure 3-2 System Block Diagram

4 Interface

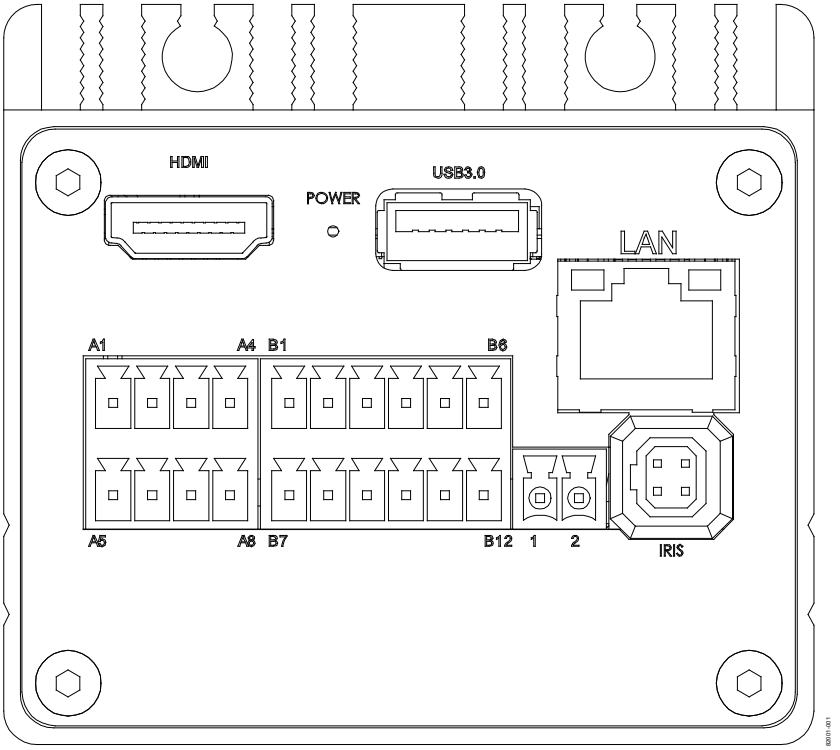

Figure 4-1 Rear Panel

4.1 8-pin Connector

The 8-pin connector (model: MCDN 1,5/4-G1-3,5) in rear panel is matched with a female connector (model: FMCD 1,5/4-ST-3,5) provided by ROSEEK. The matched wire size is 16~24AWG. The definition of the terminal is as below:

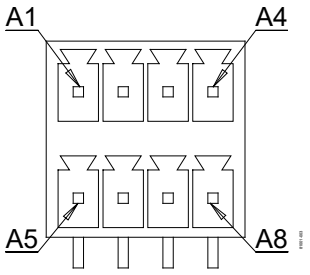

Figure 4-2 8-pin Connector

Table 4-1 Terminal Definition of 8-pin Digital IO Connector

Number	Name	Type	Description	Note
A1	POWER_IN	power	Power input: 20 to 50VDC (24VDC recommended)	[1]
A2	GND	power	Power ground (for power and RS232)	
A5	ISO_IN2+	in	Photocoupler input 2(+)	[2]
A6	ISO_IN2-	in	Photocoupler input2 (-)	
A4	RS232_RX1	in	RS232_COM1 input	[3]
A8	RS232_TX1	out	RS232_COM1 output	
A3	RS232_RX3	in	RS232_COM3 input	[4]
A7	RS232_TX3	out	RS232_COM3 output	

Note:

[1] In the device, there are reverse polarity protection, overvoltage protection and surge protection for power input. However, the input voltage is not allowed to be over 40VDC, otherwise the fuse will break and camera needs depot repair.

[2] Refer to Chapter 4.2 Note [2] [7].

[3] This no-isolated RS232 is COM1 serial port. The supported baud rate (bps) list is: 300, 600, 2400, 4800, 9600, 19200, 38400, 57600, 115200.

[4] This no-isolated RS232 is COM3 serial port. The supported baud rate (bps) list is: 300, 600, 2400, 4800, 9600, 19200, 38400, 57600, 115200.

4.2 12-pin Connector

The 12-pin connector (model: MCDN 1,5/6-G1-3,5) in rear panel is matched with a female connector (model: FMCD 1,5/6-ST-3,5) provided by ROSEEK. The matched wire size is 16~24AWG. The definition of the terminal is as below:

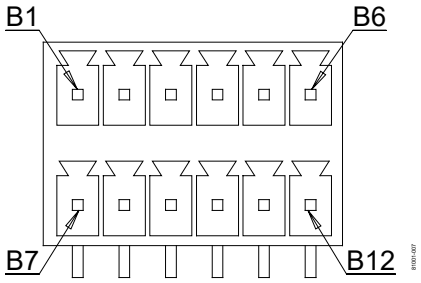

Figure 4-3 12-pin Connector

Table 4-2 Terminal Definition of 12-pin Connector

Number	Name	Type	Description	Note
B3	ISO_IN1+	in	Photocoupler input1 (+)	[1] [7]
B9	ISO_IN1-	in	Photocoupler input1 (-)	
B4	ISO_OUT1A	out	Photocoupler output 1 (+) (control flash)	[2] [7]
B10	ISO_OUT1B	out	Photocoupler output 1 (-) (control flash)	
B5	ISO_OUT2A	out	Photocoupler output 2 (+) (control flash)	
B11	ISO_OUT2B	out	Photocoupler output 2 (-) (control flash)	
B8	PORT1	in/out	Programmable IO port 1 (5V-TTL)	[3]
B2	PORT2	in/out	Programmable IO port 2 (5V-TTL)	
B1	GND	power	Signal Ground	[4]
B7	EARTH	NA	Earth of casing	[5]
B12	RS485_A	in/out	RS485_COM2 (A/+)	[6] [7]
B6	RS485_B	in/out	RS485_COM2 (B/-)	

Note:

[1] The photocoupler input can accept 5V-TTL, 3.3V-TTL or 12V input directly (series resistor is unnecessary). High tolerance: -50 to +1V is low level, +2.8V to +50V is high level. The input current is constant 2mA; and the voltage limit is from -50V to +50V. The block diagram is as follows:

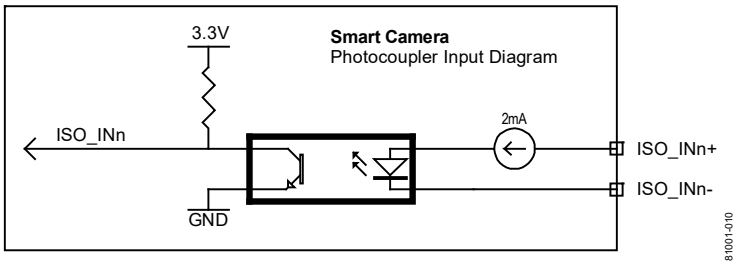

Figure 4-4 Photocoupler Input

[2] The two photocoupler outputs are primarily used to control flash. They can also be used as general isolated outputs (for example driving relay) also. The maximum load is 50V/30mA and the typical output delay is 10us. The block diagram is as follows:

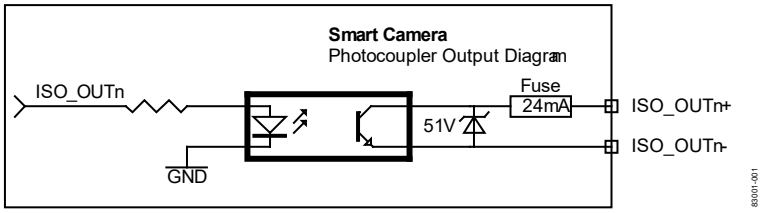

Figure 4-5 Photocoupler Output

[3] All IO ports can be programmed as input or output separately, and the default setting is input port with internal 1K pull-up resistor to 5V. The driving capability: 24mA output and sink current capability. All IO ports have overvoltage protection. The block diagram is as follows:

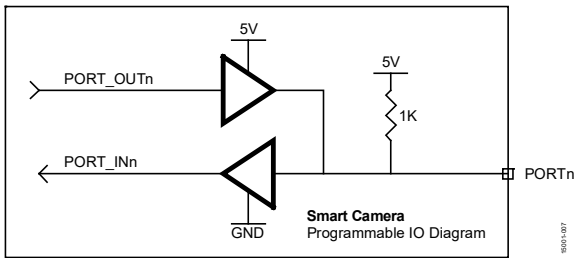

Figure 4-6 Digital IO Port

[4] The Signal Ground is public ground of digital IO and RS232. Internal the camera, the Signal Ground is connected with Power Ground.

[5] Casing earth is recommended to avoid earth leakage and interfering signal.

[6] This isolated RS485 is COM2 serial port. The supported baud rate (bps) list is: 300, 600, 2400, 4800, 9600, 19200, 38400, 57600, 115200.

[7] Some typical using methods for external devices are shown as below:

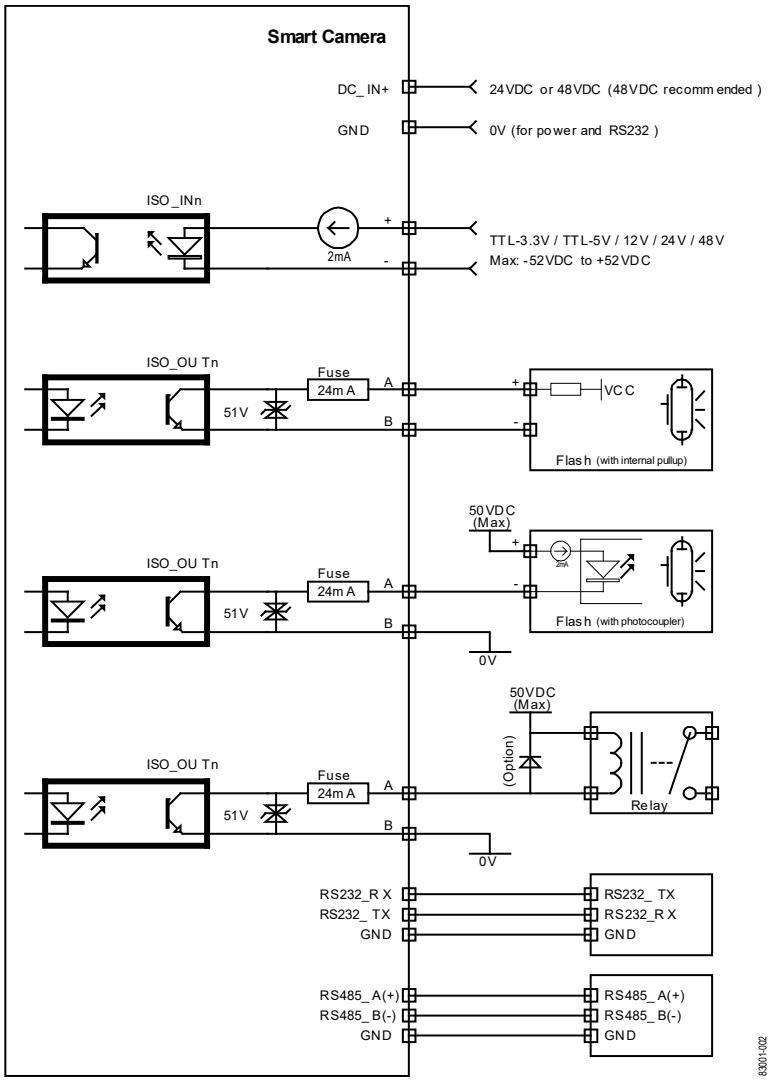

Figure 4-7 Typical External Devices Connection

4.3 Ethernet Port

There is one 100/1000M Ethernet ports in the rear panel which supports Wake on LAN (WoL).

If working in 1000M mode, CAT6 or CAT6A cables are recommended to achieve better communication and longer cable lengths.

The default IP address: 192.168.1.218. User can modify IP address, but the MAC address cannot be changed. For more information, please refer to *Cheetah3 Series Smart Camera SniperViewer Client Tools User Guide.*

4.4 Power Sync Connector

The 2-pin power sync connector at rear panel (model 1844210) is matched with a female connector (model 1952267) provided by ROSEEK. The matched wire size is 16~24AWG. The definition of the terminal is as below:

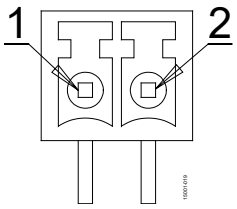

Figure 4-8 Power Sync Port

Internal power sync circuit inputs 100 to 260VAC to implement power sync function. 220VAC input power is 0.17W, and 110VAC input power is 0.05W.

Because of the sine wave feature of 50/60Hz AC, the brightness of general light is changing periodically. To capture continuous steady images, user can set to expose images at the same position of one AC phase. This is called power sync function.

4.5 USB3.0 Port

There is a USB3.0 port (host) for all kinds of peripherals, such as keyboard, mouse, USB flash drive, mobile HDD and 3G wireless module. USB HUB extension is supported. The output power capability is 1.5A@5V.

4.6 Display Port HDMI

There is a HDMI port for connection with monitor. This port supports resolution from VGA to 4K/30fps.

With a HDMI to VGA adapter, user can also connect with a monitor which only has VGA port. ROSEEK recommends HDMI to VGA adapters like: 0B47069 from Lenovo® and 40248 from UGREEN®. Other adapters are not recommended without any compatibility test.

4.7 Iris Control

This port is compatible with P-Iris lens and DC-Iris lens.

4.8 Storage M.2 SSD

There is a M.2 slot for SSD in the camera. The user can only specify the SSD capacity in the P/N, and the SSD card is pre-installed before leaving the factory.

4.9 Rear Panel LED

There is a red status LED on the rear Panel. Being on shows normal working status, and blink shows program updating or system recover status.

5 Dimensions

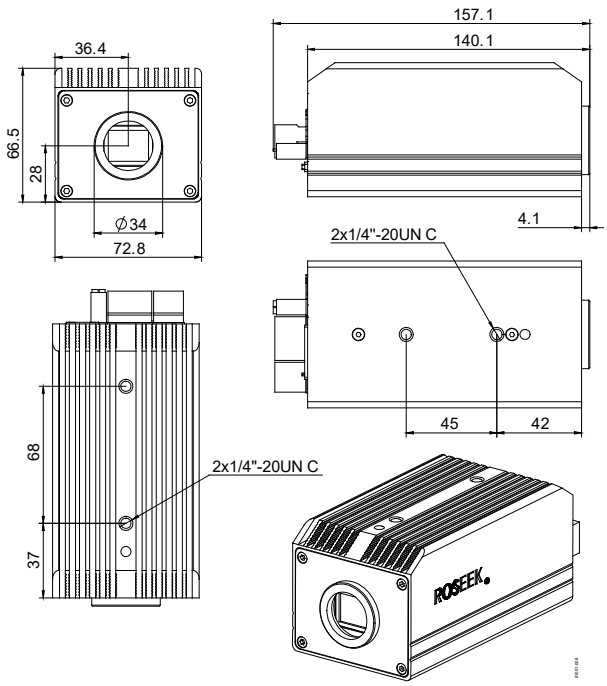

Figure 5-1 Outline Dimensions

Note:

[1] Unit: mm.

[2] Materials: aluminum alloy with anodizing process.

[3] Color: black

6 Spectral Transmission

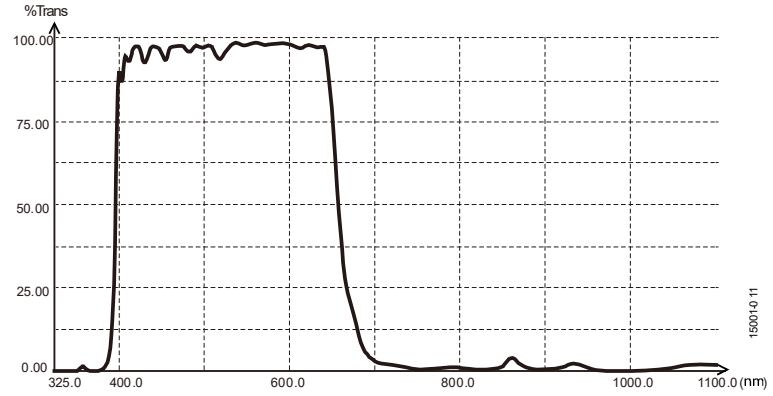

Figure 6-1 Transmission Curve of IR-cut Filter

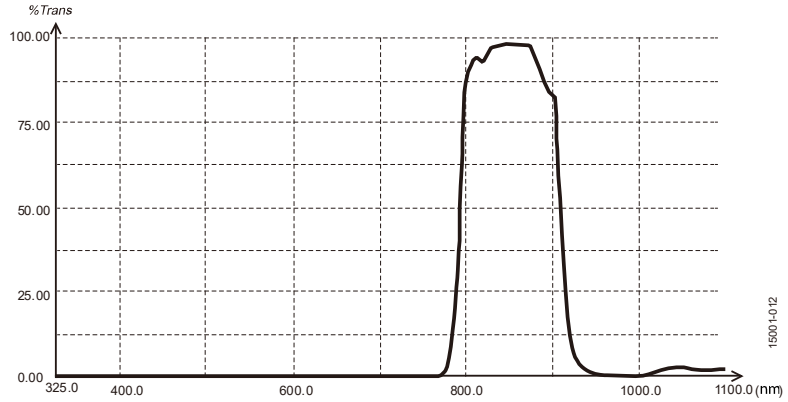

Figure 6-2 Transmission Curve of Band-pass Filter-1

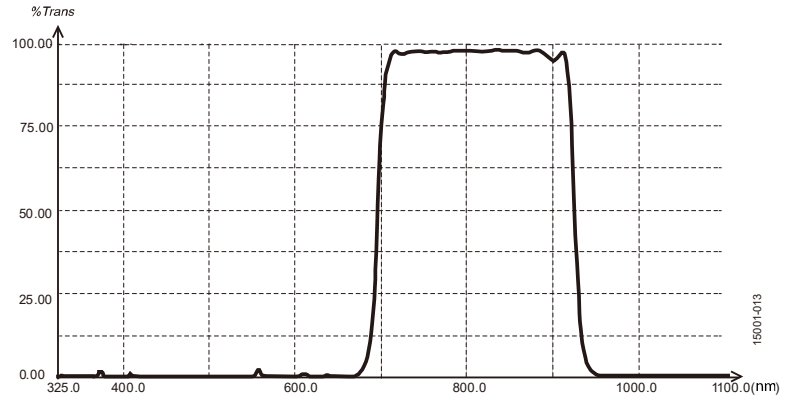

Figure 6-3 Transmission Curve of Band-pass Filter-2

Note:

[1] Light wave unit: nm

[2] The filter cannot be changed or removed after leaving the factory

7 Contact

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