China Daheng Group, Inc. Beijing Image Vision Technology Branch

# VEN-134-90U3M-D Board Level Cameras User Manual

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DAHENG IMAGING 大恒图像

## Notice





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# Preface

We really appreciate you choosing the product of DAHENG IMAGING.

VEN-134-90U3M-D board level camera is DAHENG IMAGING’s CMOS board level binocular camera, featuring small size, flexible assembly, high definition and extremely low noise. The camera, which is equipped with a standard USB3.0 Micro-B interface, is easy to install and use. It could be used in a wide and diverse range of applications including industrial inspection, medical imaging, scientific research, education and other fields.

VEN-134-90U3M-D board level camera is small in size, supports binocular acquisition, and a variety of front-end data transmission cables (FPC) with optional length are available, which will be a good choice for users with board level binocular needs. Please read this manual carefully before using the VEN-134-90U3M-D board level camera.

# Contents

# 1. Introduction

## 1.1. General Specifications

| Specifications | VEN-134-90U3M-D |
|---|---|
| Resolution | 1280 × 1024 × 2 |
| Sensor Type | Onsemi PYTHON 1300, Global shutter CMOS |
| Optical Size | 1/2 inch |
| Pixel Size | 4.8μm × 4.8μm |
| Frame Rate | 90fps @ 1280 × 1024 × 2 |
| ADC Bit Depth | 10bit |
| Pixel Bit Depth | 8bit, 10bit |
| Shutter Time | 5μs~1s |
| Gain | 0dB~16dB |
| Pixel Data Formats | Mono 8/ Mono10 |
| Signal to Noise Ratio | 39dB |
| Definition | >951 lines |
| Synchronization | External trigger, Software trigger |
| I/O | 2 GPIOs |
| Operating Temp. | 0°C~45°C |
| Storage Temp. | -20°C~70°C |
| Operating Humidity | 10%~80% |
| Power Consumption | <3.5W@5V |
| Data Interface | USB3.0 |
| Regulations | CE, RoHS, USB3.0 Vision, GenICam |

Table 1-1: VEN-134-90U3M-D general specifications

## 1.2. Spectral Response

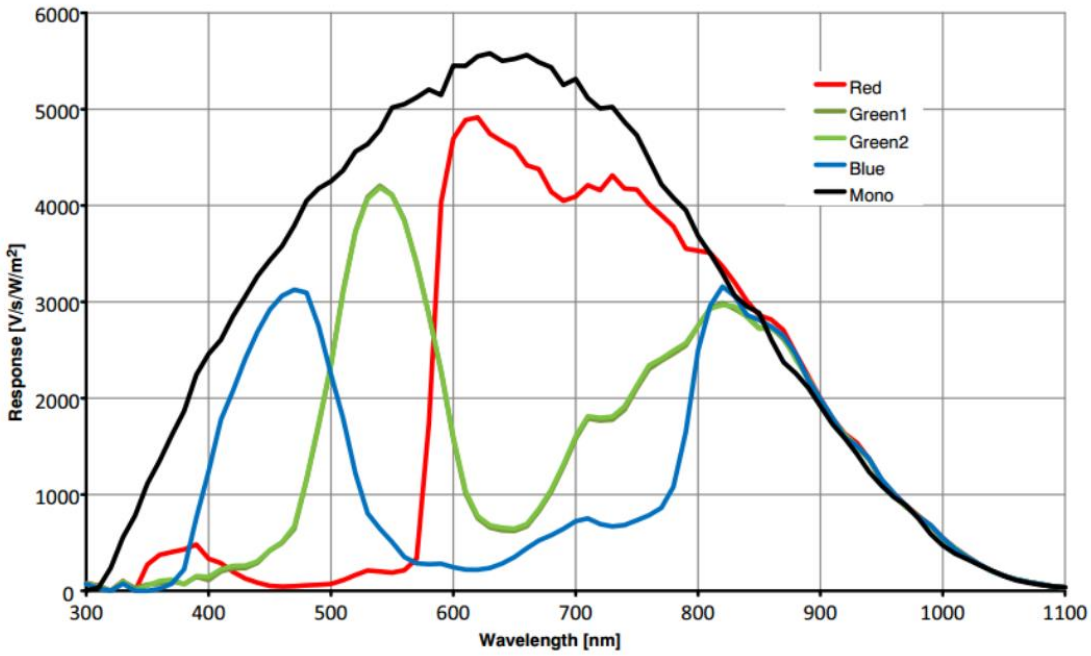



Figure 1-1: VEN-134-90U3M-D spectral response

## 1.3. Mechanical Interface

### 1.3.1. Acquisition Board Mechanical Dimensions

The following figure is the size of the acquisition board (units: mm).

4-φ2.2 is used for PCB board fixation. The maximum height of the top side (outside the screen) of the PCB board is 3, the maximum height of the bottom (in the screen) of the PCB board is 1.8.

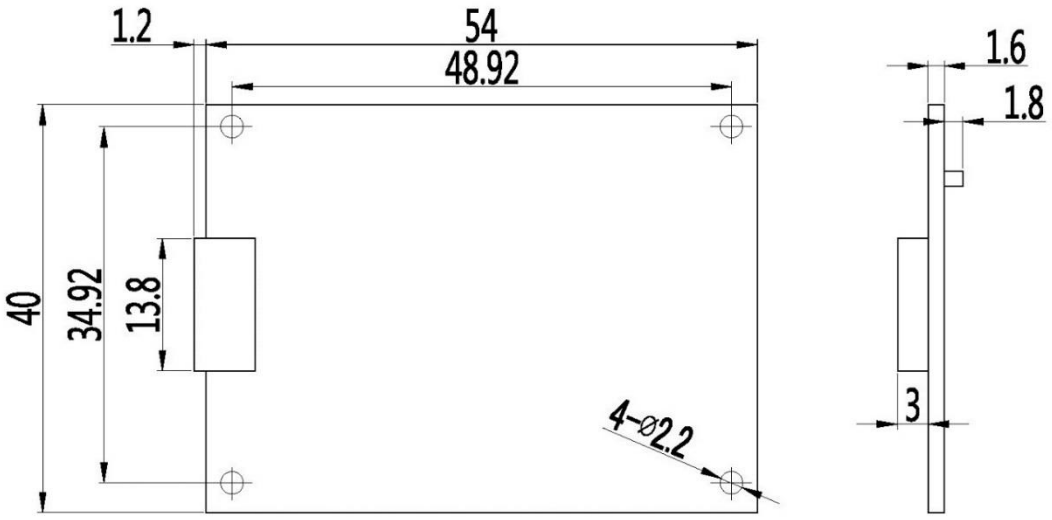



Figure 1-2: Acquisition board mechanical dimensions

### 1.3.2. Imaging Board Mechanical Dimensions

The following figure is the size of the imaging board (units: mm).

4-φ2.2 is used for PCB board fixation. The maximum height of the top side (outside the screen) of the PCB board is 2.4, the maximum height of the bottom (in the screen) of the PCB board is 3.7.

2-φ2.1 is the positioning hole for the installation and location of the optical center of the image sensor.

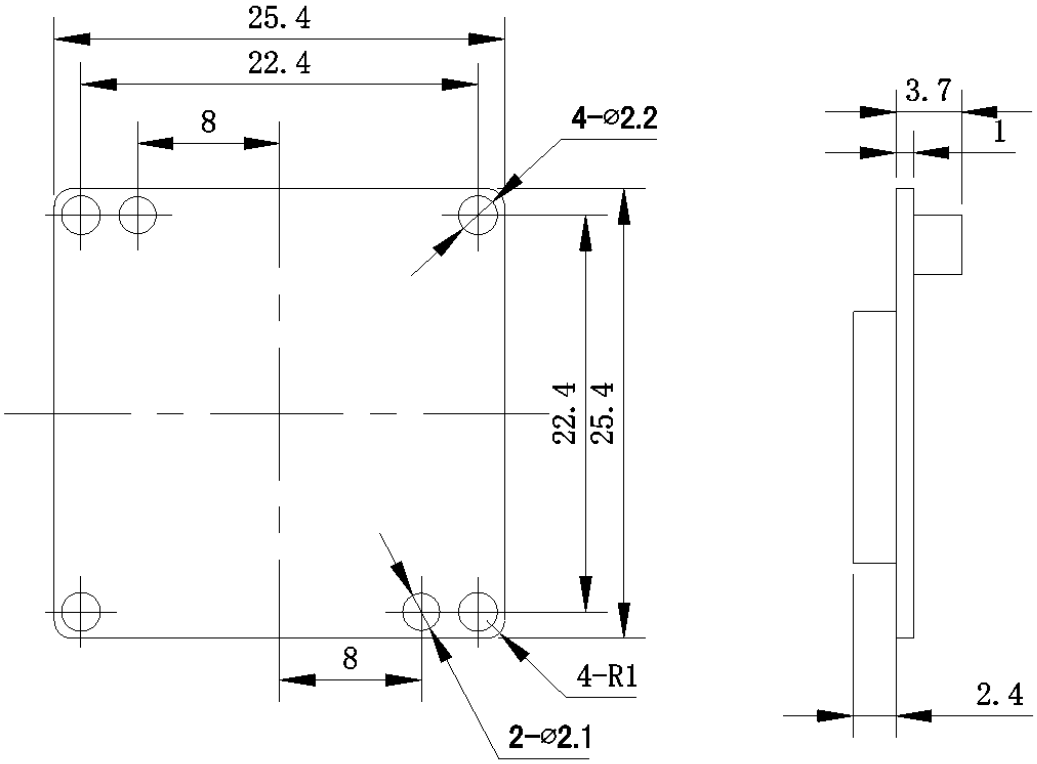



Figure 1-3: Imaging board mechanical dimensions

## 1.4. Software Interface

### 1.4.1. User Software Package

The Software package of DAHENG IMAGING is used to control the VEN series camera, is to provide a stable, real-time image transmission, and provides an easy-to-integrate SDK and abundant development example source codes. The package is composed of the following modules:

1) Driver Package (Driver): This package provides the VEN series camera driver program, such as: the USB3.0 cameras' driver program.

2) Application Program Interface (API): This package provides the camera control application program interface library and the image processing interface library, supports the user for secondary development.

3) Demonstration Program (GalaxyView.exe): This demonstration program is used to display the camera control, image acquisition and image processing functions, the user can control the camera directly by

the demonstration program, and also the user can develop their own control program based on the camera interface library.

4) Sample: The sample demonstrates the camera functions, the user can easily use these samples to control cameras, and also can refer to the samples to develop their own control program.

5) Programmer's Manual: This manual is the users programming guide that instructs the users how to configure the programming environment and how to control camera and acquisition images through the camera interface library.

You can download the latest camera package from the website: www.daheng-imaging.com/en/ Downloads/ Software Downloads.

### 1.4.2. Application Programming Interface

After installing the software package, the user can use the demonstration program and the samples to control the camera, also the user can control the camera by the program which is written by the user themselves. The software package provides three kinds of program interfaces, the user can select the suitable one for use according to their own requirements:

1) API Interface

In order to simplify the users' programming complexity, the package provides the general C programming interface GxIAPI and image processing algorithm interface DxImageProc for the user to control the camera, and also provides the samples and software development manuals which are based on these interfaces.

2) GenTL Interface

This interface is developed according to the standard of general transport layer in Gen<i>Cam standard, Daheng follows the Gen<i>Cam standard and provides the GenTL interface for the user, the user can use the GenTL interface directly to develop their own control program. The definition and usage of GenTL interfaces can be downloaded from the website of EMVA.

In addition, users can use some third-party software that supports Gen<i>Cam standard to control the camera, such as HALCON.

3) USB3.0 Vision Interface

The VEN series USB3.0 camera is compatible with the USB3.0 Vision protocol, which allows the user to control the camera directly through the USB3.0 Vision protocol. In addition, the user can use some third-party software that supports the USB3.0 Vision protocol to control the camera, such as HALCON.

**Note**:

GEN<i>CAM standard: GEN<i>CAM is administered by the European Machine Vision Association (EMVA). GenICam provides a generic programming interface for all kinds of cameras and devices. It provides a standard application programming interface (API), no matter what interface technology is being used. It mainly includes the following modules:

- GenAPI: an XML description file format defining how to capture the features of a device and how to access and control these features in a standard way.

- GenTL: a generic transport layer interface, between software drivers and libraries, that can be used for device enumeration, attribute control, and image acquisition.

- SFNC: common naming convention for camera features, which promotes interoperability between products from different manufactures.

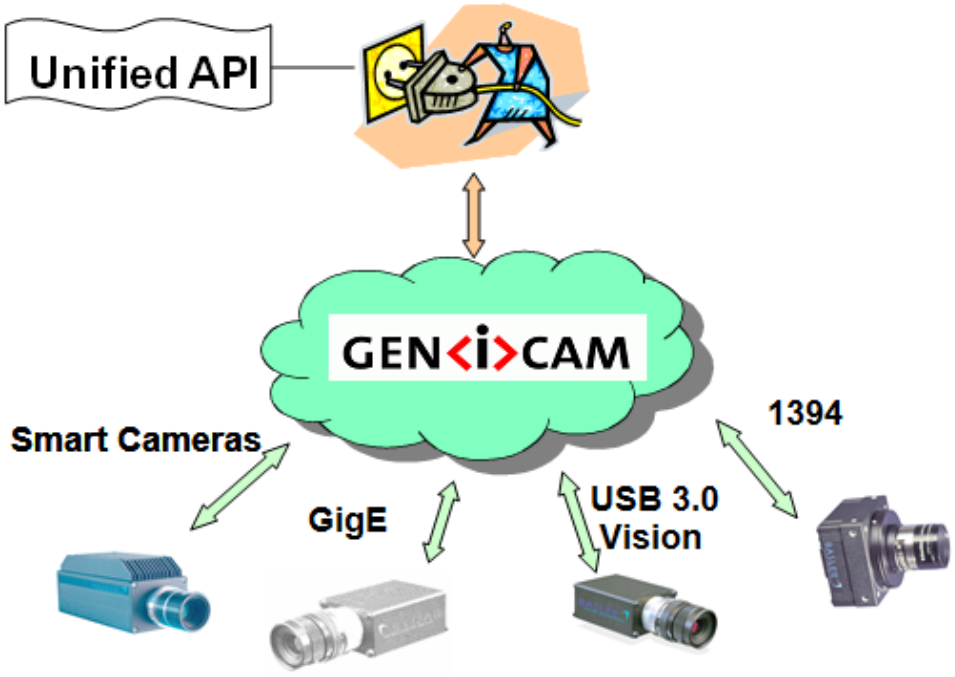



Figure 1- 1: GEN<i>CAM standard schematic diagram

## 1.5. Guideline for Avoiding EMI/ESD

You should consider the EMI (Electro Magnetic Interference) and ESD (Electro-Static discharge) problem in the process of using the camera, to guarantee the camera to work in a relatively good electromagnetic environment. The main measures are as follows:

1) USB cable certificated by USB-IF is recommended.

2) Connect I/O cable shield conductor to ground. Try to use camera cables that are the correct length. Avoid coiling camera cables. If the cables are too long, use a meandering path rather than coiling the cables.

3) Keep your cameras away from equipment with high voltage, or high current (as motor, inverter, relay, etc.). If necessary, use additional shielding protection.

4) ESD (electro-static discharge) may damage cameras permanently, so use suitable clothing (cotton) and shoes, and touch the metal to discharge the electro-static before operating cameras.

## 1.6. Environmental Requirements

1) Housing temperature during operation：0°C ~ 45°C, humidity during operation: 10% ~ 80% (relative, non-condensing), storage temperature: -20°C ~ 70°C.

2) PC requirement: Intel Core 2 Duo, 2.4GHz or above, and more than 2GB memory.

3) USB3.0 host controller requirement: Intel controller integrated in mainboard is recommend. Select Renesas controller if external frame grabber is needed.

4) Make sure that cameras are transported in the original factory packages.

## 1.7. Standards and Regulations: CE, ROHS

All parts of the camera (including components, PCB and housing) compliant with CE and RoHS standards.

# 2. Electrical Interface

Here are two parts in the electrical interface: USB3.0 interface and I/O interface. By the USB3.0 interface, the camera can exchange data with the host and can power the camera, and can receive trigger signal and sync signal by the I/O interface. The connector location is shown below.

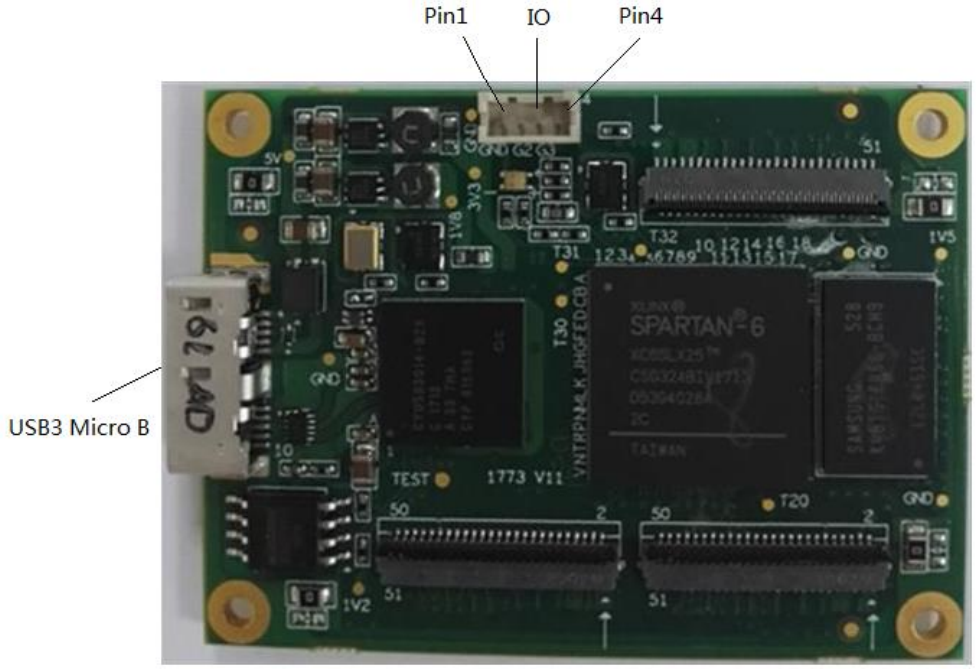



Figure 2-1: Electrical interface connector distribution diagram

## 2.1. USB3 Port

Recommend to use the cables officially recognized by USB IF.

## 2.2. IO Port

IO port uses 4pin connector for external trigger signal access and sync signal output.

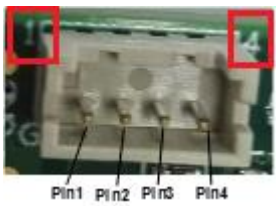
| Diagram | Pin | Definition | Description |
|---|---|---|---|
|  | 1 | GND | Signal GND |
| | 2 | Line2 | GPIO input/output |
| | 3 | Line3 | GPIO input/output |
| | 4 | NA | Reserved, not available |



Table 2-1: IO port definition

The polarity of IO pins cannot be reversed, otherwise, camera or other peripherals could burn out.

### 2.2.1. Line2/Line3 (bidirectional) Circuit

Line2 can be configured as input or output through the software interface. Line3 is the same. The internal equivalent circuit of the camera is illustrated as follow.

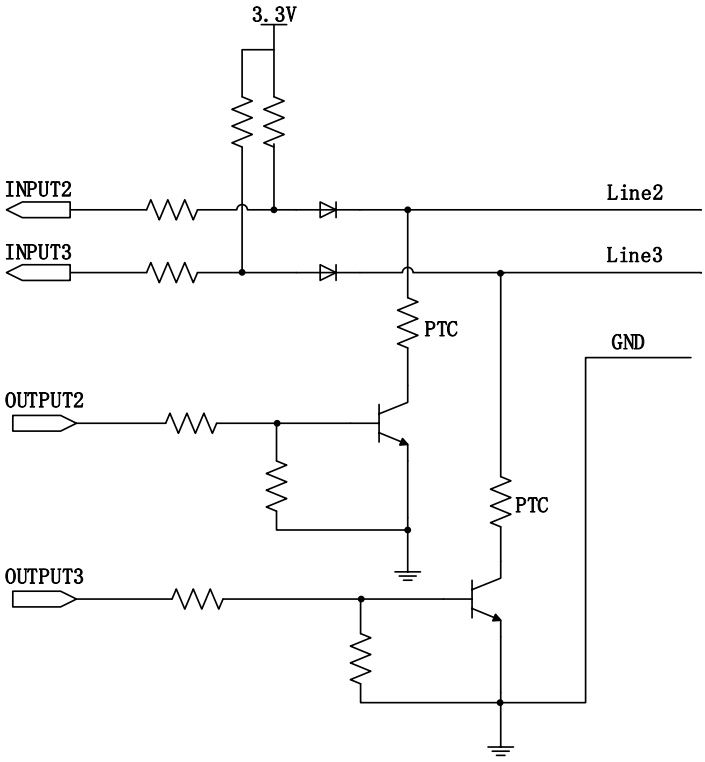



Figure 2-2 GPIO2/3 (bidirectional) circuit

### 2.2.2. Line2/3 configured as input

- Logic 0 input voltage: 0V~+0.6V (Line2/3).
- Logic 1 input voltage: +1.9V~+24V (Line2/3).
- The status is unstable when input voltage is between 0.6V and 1.9V, which should be avoided.
- When input of Line2/3 is high, input current is lower than 100uA; when input of Line2/3 is low , input current is lower than -1mA.
- When Line2/3 is configured as input, if the corresponding output device is common-anode connected, pull-down resistor over 1K should not be used, otherwise the input voltage of Line2/3 will be over 0.6V and logic 0 cannot be recognized stably
- When Line2/3 is configured as input, the equivalent circuit of camera is shown as Figure 2-3, for Line2 as an example.
- Input signal rising delay: <2μs (0°C~45°C), parameter description as shown in Figure 2-4.
- Input signal falling delay: <2μs (0°C~45°C), parameter description as shown in Figure 2-4.

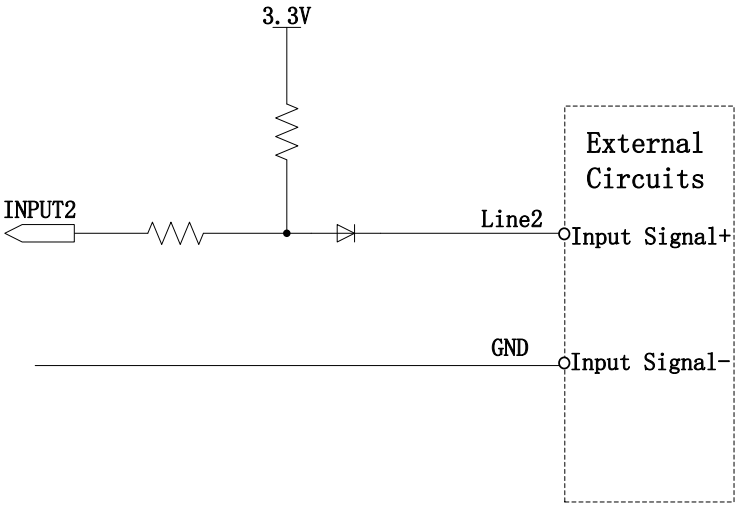



Figure 2-3 Equivalent circuit of camera when Line2 is configured as input

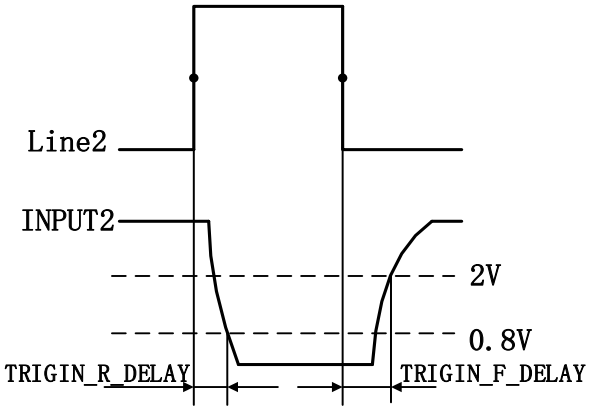



Figure 2-4 Time delay parameter of the circuit when Line2 is configured as input

**To avoid the damage of IO pins, please connect GND pin before supplying power to Line2/3.**

### 2.2.3. Line2/3 configured as output

- Range of external voltage (EXVCC) is 5V~24V
- Maximum output current of Line2/3 is 25mA, output impedance is 40Ω.
- Output voltage and output current in typical application conditions (temperature is25°C) are shown in Table 2-2

| External voltage EXVCC | External resistance $R_{external}$ | Line2/3 voltage（V） | Output current（mA） |
|---|---|---|---|
| 5V | 1kΩ | 0.19 | 4.8 |
| 12V | | 0.46 | 11.6 |
| 24V | | 0.92 | 23.1 |

Table 2-2 Voltage and output current of Line2/3 in typical application conditions

- Rising time delay = $t_r$+$t_d$: <20μs (0°C~45°C) (parameter description as shown in Figure 2-5).
- Falling time delay = $t_s$+$t_f$: <20μs (0°C~45°C) (parameter description as shown in Figure 2-5).
- Delay parameters are affected greatly by external voltage and resistance, but little by temperature. Output delays in typical application conditions (temperature is 25°C) are shown in Table 2-3.

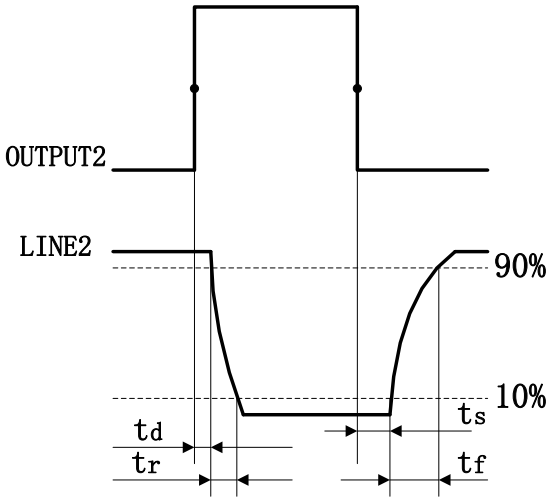



Figure 2-5 Time delay parameter of the circuit when Line2 is configured as output

| Parameter | Test Conditions | Value (us) | | |
|---|---|---|---|---|
| Storage time ($t_s$) | External power is 5V, pull-up resistor is 1kΩ | 0.17 | ~ | 0.18 |
| Delay time ($t_d$) | | 0.08 | ~ | 0.09 |
| Rising time ($t_r$) | | 0.11 | ~ | 0.16 |
| Falling time ($t_f$) | | 1.82 | ~ | 1.94 |
| Rising time delay = $t_r$+$t_d$ | | 0.19 | ~ | 0.26 |
| Falling time delay = $t_f$+$t_s$ | | 1.97 | ~ | 2.09 |

Table 2-3 Delay time when Line2 is configured as output in typical application conditions

- When Line2/3 is configured as output, the equivalent circuit of camera is shown as Figure 2-6, for Line2 as an example.

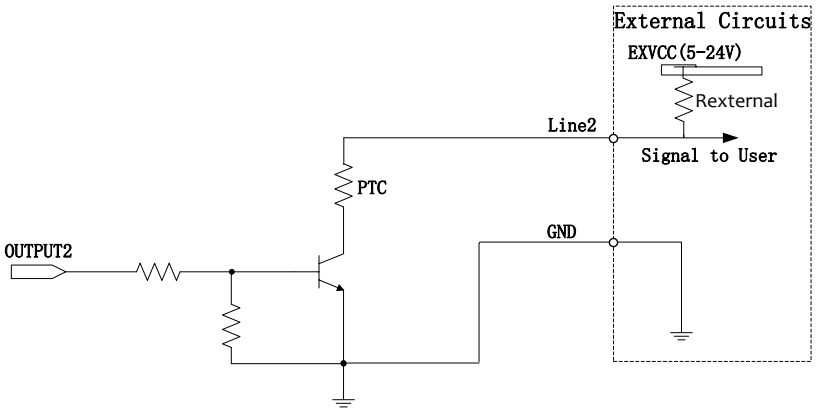



Figure 2-6 Equivalent circuit of camera when Line2 is configured as output

# 3. Installation and Use

## 3.1. Hardware Installation

1) Do not apply any force to the FPC cable at the end site (near FPC connector).

There is an FPC connector on the acquisition board and imaging board, respectively, which is connected by FPC cable. When the FPC connector is locked tightly, the cable will not fall off.

When the camera and the user structure are installed, near the FPC connector, the FPC cable should be free of external force, and the FPC cable and other structural parts are prohibited from contact, otherwise the electrical may be discontinue.

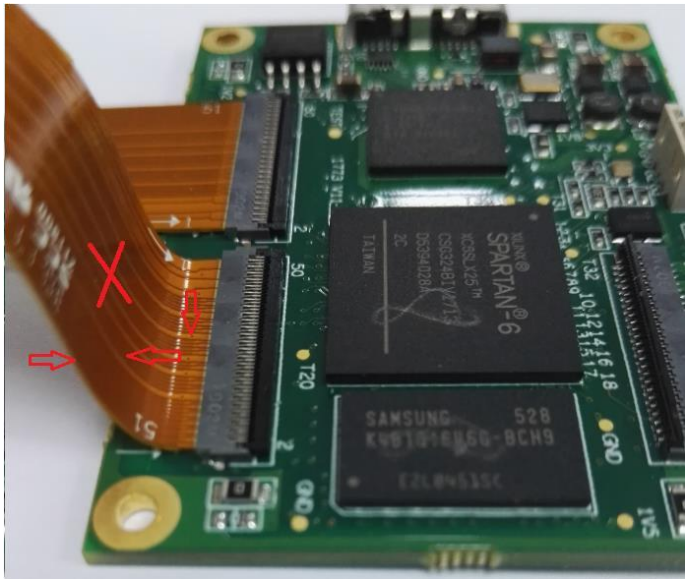



Figure 3-1: Schematic diagram of external force prohibition near FPC connector and FPC cable of acquisition board

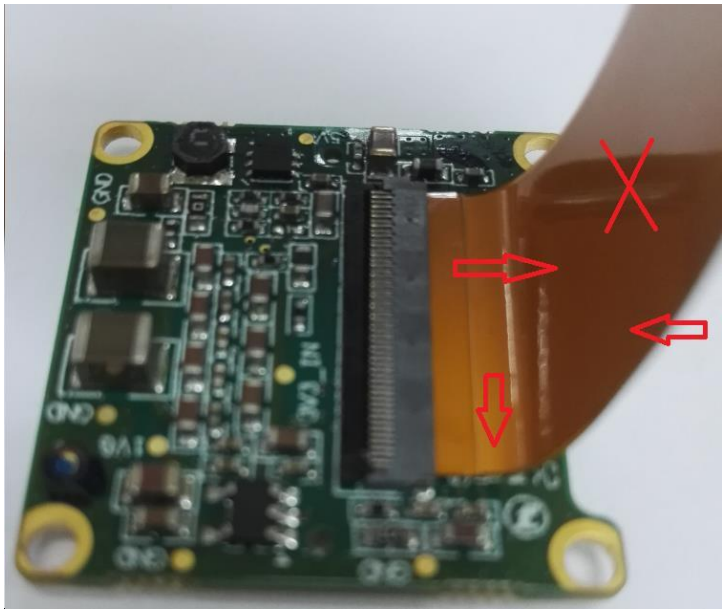



Figure 3-2: Schematic diagram of external force prohibition near FPC connector and FPC cable of imaging board

2) Optimization of FPC cable folding and installation

When the camera is installed into a specific position, the acquisition board and imaging board will have various relative positions of space. At this point, the FPC cable may be rotated or bent at middle site. In order to ensure that the FPC cable is in a free state, the FPC cable can be folded in advance according to the space position (avoiding the death fold, the turning radius above 1mm), and reducing the distortion and rotation of the stress to the FPC connector. The following figure is an example.

Figure 3-3: Schematic diagram of FPC cable folding and installation

3) Heat dissipation of imaging board

The image sensor is sensitive to temperature. In order to ensure good imaging quality, the structure of the user optical path system should use metal materials, and the mounting surface of the structure should be in good contact with the heat conduction region of the imaging board. The following is the heat conduction region of the imaging board:

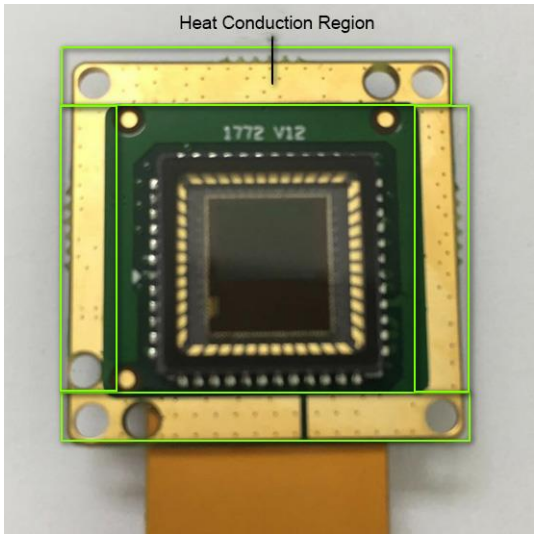



Figure 3-4: The heat conduction region of the imaging board

4) Heat dissipation of acquisition board

When the temperature around the acquisition board exceeds 45 degrees, it is recommended that the user dissipate heat on the main chip. Heat conductive material is used to couple heat of the main chip to the housing / radiator. The following is the heat conduction region of the imaging board with the heat conductive material:

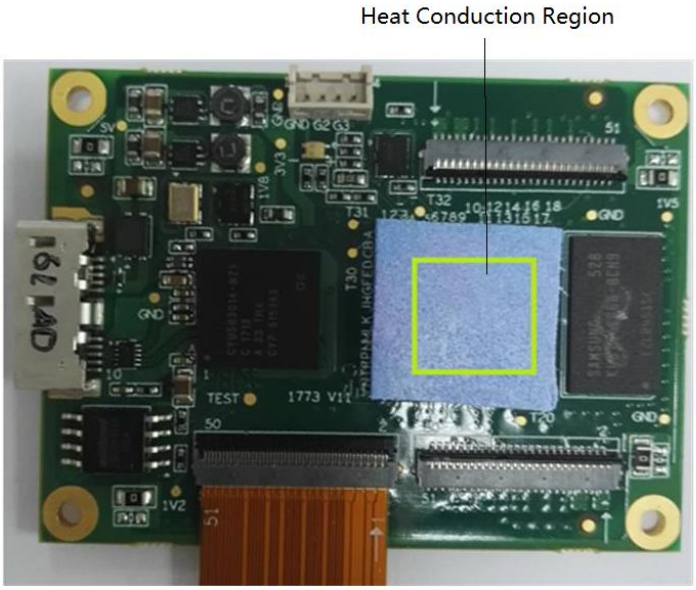



Figure 3-5: The heat conduction region of the imaging board with the heat conductive material

5) ESD electrostatic protection

During installation and debugging, the human body may discharge to the component on the PCB board, resulting in permanent damage to the camera. Therefore, before exposure to the camera, wear an antistatic bracelet. Or touch the metal rack first, and release the accumulated charge of the body.

## 3.2. Software Installation

In the Daheng Imaging Camera Software Suite, run Galaxy SDK installer to realize software installation. The installation process is relatively simple, but you have to take attention to the following matters:

1) The path of installation can only be ASCII characters, otherwise you will not start the application successfully.

2) When you are installing the setup suite, antivirus will ask you whether to allow some operations, then you must allow these operations. In addition, in the process of uninstalling the installation package, antivirus will also ask you whether to allow some operations, then you must allow these operations.

3) If you are using USB3.0 Vision Cameras in Windows XP, and you have installed the Daheng Imaging Camera Software Suite without cameras connected to your PC, you must run Galaxy UpdateDriver firstly.

The VEN-U3X series camera can’t work in USB2.0 mode. When the camera is connected to the USB2.0 host interface or USB2.0 HUB, you will not open, control the camera and acquisition images.

# 4. FAQ

| No. | General Question | Answer |
|---|---|---|
| 1 | In the non-activated Win7 64 bits OS, the installation of Galaxy SDK has been successfully, but open the demo program failed. | 1) After activating the Windows7 64 bits OS, uninstall the software, then restart the OS, reinstall the software and open the demo program again. |
| 2 | Cannot find cameras. | 1) Please check whether the LED indicator is green and check whether the USB cable is connected properly. Re-enumerate the device after the camera is re-plugged.<br>2) Please check whether the connected controller's driver is enabled and run properly, if not, reinstall the controller driver, and try again.<br>3) Please check whether the driver of host controller works well, and whether the camera displays as "USB3 Vision Digital Camera", if not, try to reinstall the setup driver. |
| 3 | Fail to open device, it shows "Load XML failed". | 1) Please use the upgrade tool to update the device, after this, reopen the device. You can ask the upgrade tool from our technical support. |
| 4 | Fail to open device, it shows that "The device has been opened". | 1) Please close the software which has opened the camera. |
| 5 | Fail to open device, it shows that "this device can only be operated on an USB3.0 Port". | 1) Please check that whether the camera is connected to USB2.0 port or USB2.0 hub. Be sure to connect the camera to USB3.0 interface. |
| 6 | No image after acquisition start. | 1) Please load the default setting, reopen the demo, acquisition start again, and check the frame rate.<br>2) Open the demo, switch to stream features page, and decrease the number of StreamTransferNumberUrb to 10. Then try to execute the command AcquisitionStart again and check the frame rate.<br>3) Open the demo, switch to stream features page, check the statistic information, and check if any packet has been received. If there are some incomplete frames, please refer to the section 1.6. |
| 7 | The frame rate is not up to the maximum value. | 1) Change another PC with high performance.<br>2) It's recommended to use Intel host controller.<br>3) Be sure the main board support PCIE2.0.<br>4) If you have any other questions, please contact us. |
| 8 | Frames are lost during multiple cameras are acquiring images at the same time. | 1) The bandwidth of the camera is more than the bandwidth of the host controller. You can decrease the bandwidth through the DeviceLinkThroughputLimit function.<br>2) Connect the camera to the host controller separately. |
| 9 | Camera crashes on Advantech AIIS-1440 (USB version) IPC. | 1) Be sure the driver version of AMD USB controller is later than 2.20. |

# 5. Revision History

| No. | Version | Changes | Data |
|---|---|---|---|
| 1 | V1.0.0 | Initial release | 2018-07-23 |
| 2 | V1.0.1 | Add description of GPIO output function | 2019-05-09 |
| 3 | V1.0.2 | Add 10bit Pixel Bit Depth in 1.1 | 2019-07-09 |