User Guide V1.1 for Mini212G2 Cores

(Observation & Temperature Measuring Type)

27 pages in total

Dec 2024

1. Version Management

Revision No.	Date	Revision	Sig.
V1.0	202412	First issue	
V1.1	202504	Fix errors	

The ownership and final explanation right of this file belong to company and the some parameters may be updated due to products iteration and upgrading without prior notice.

2. Scope of Application

Mini212G2 cores are the standard infrared thermal camera cores of company This file provides information and technical support for core integration and secondary development and application.

3. Instructions

 Precautions for Safe Use

The purpose of the instructions is to ensure that users use this product correctly to avoid danger or property damage. Before using this product, read this User Guide carefully and keep it properly for future reference.

As shown below, preventive actions include "Warning" and "Caution".

Warning: ignoring the Warning may result in death or serious injury.

Caution: ignoring the Caution may cause injury or property damage.

	
Warning: Alert users to the potential risk of death or serious injuries.	Caution: Alert users to the potential risks of injuries or property loss.

 Warning

- During the use of this product, all electrical safety regulations of the country and the region of users must be strictly observed.

- Please use the power adapter provided by the regular manufacturer. The power supply of the demonstration equipment must be DC 5V/1A.
- Do not connect multiple cores to the same power adapter (exceeding the load of the adapter may cause excessive heating or fire).
- Cut off the power supply of the core before wiring, disassembly and other operations.
- In case of smoke, stink or noise during use of cores, cut off the power immediately and contact the dealer or service center to deal with relevant matters.
- If the device fails to work properly, please contact the store where the device is purchased or the nearest service center. Do not disassemble or modify the device in any way. (We are not responsible for the problems caused by unauthorized modification or maintenance).

Caution

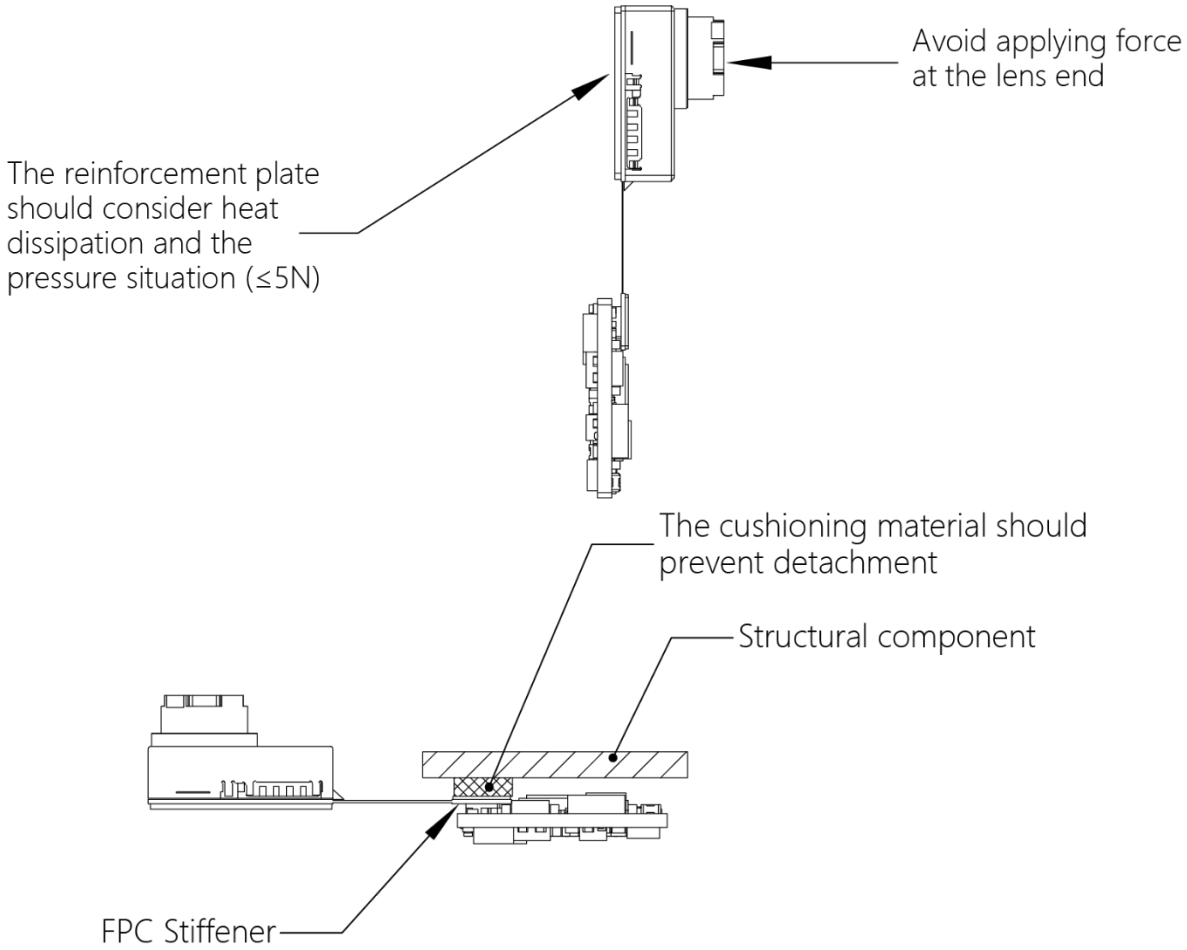
- Do not aim the core at strong energy sources, such as the sun, lava and laser beam. The target observation temperature of standard cores shall be lower than 600℃, and overtemperature target observation will cause irreversible burn damage to the cores. For target observation at the temperature higher than 600℃, please choose the customized cores.
- Do not drop any object onto the device or shake the device vigorously. Keep the device away from the place with magnetic field interference. Avoid installation of the device at any place where the surface is vulnerable to vibration or impact. (Ignoring this item may damage the device).
- Fix the TIMO module by gluing, and use Φ1.4 ㎜×0.3 screws to fix the PCBA plate with the torsion of 3cN·m.
- Do not use the device in environment of high temperature (higher than 60 ° C), low temperature (lower than -20 ° C), or high humidity (higher than 95%).
- Do not place the device in direct sunlight or in poorly ventilated places, or near heat sources such as heaters or radiators (ignoring this may result in fire hazard).

- Do not frequently turn on or off the power supply of the device. After the device is shut down, the restart interval shall not be less than 30 seconds. Otherwise, the service life of the core will be affected.
- Do not hot plug the 40PIN interface, which will cause damage to the core.
- Do not directly touch the surface coating of core lens with your hands, or scratch the lens with hard objects, which may lead to blurred images and affect the image quality.
- When cleaning the core, use a soft dry cloth or other substitutes to wipe the lens surface, and do not use alkaline detergent to wash.

4. Installation precautions

MEMS infrared chips are very sensitive to external mechanical stress, so do not directly apply external force or fix the infrared module base plate during installation to prevent chip failure. It is recommended to use adhesive bonding to fix the module. Therefore, please follow the following requirements:

- The module should be securely fixed without applying external force to squeeze the lens and PCB parts of the module. Use glue to fix it and avoid pressure.
- Please pay attention to the anti-loosening design of the connector between the module and the mainboard to prevent the external vibration impact from causing the rear connector to become loose, resulting in abnormal signal transmission.
- The external shutter is fixed with glue, and glue should not be applied to the four corners of the shutter, otherwise, it will penetrate into the interior, causing the shutter to become invalid.
- The module's heat dissipation uses a thermal pad, and it is not recommended to use thermal grease. The module casing cannot prevent dust and water. Once the thermal grease is squeezed into the interior of the module, it may cause the shutter to malfunction, resulting in abnormal temperature measurement, image residual phenomena, etc.



5. Disclaimer

Please ensure that the user has read and fully understood the instructions and the Disclaimer before using the product, and shall install and use the product in strict accordance with the instructions of the product. If the user fails to install and use the product in strict accordance with the instructions, this may cause great inconvenience to use, and even property loss and personal injury. Guide shall not assume any legal liability for property loss and personal injury caused by improper installation or use of the product.

6. Principles of Service

This series of products can be returned within one month with one year warranty. For specific principles of service, see the accompanying warranty card or the warranty policy on our official website.

The time of production shutdown, obsoleting, special offer and treatment shall be implemented as notified by the Company.

Contents

1 Product Overview

Mini212G2 series is the uncooled far-infrared thermal imaging module developed by company, with the spectral response wave band of 8~14μm, and the detector adopts advanced wafer-level packaging. It has the following features.

- Mini size: the PCB size is not larger than 17mm×17mm×4.7mm
- Light weight: the module + PCB weight is as low as 3.8g
- Fast imaging speed: the start-up time is less than 5s
- Power consumption: as low as 0.33W
- Support nonuniformity correction (NUC)
- 3D image noise reduction (3DNR)
- 2D denoising (DNS)
- Wide dynamic range compression (DRC)
- EE enhancement
- SFFC correction
- Support standard USB and plug and play for easy integration

Mini212G2 series is suitable for many fields including power monitoring, industrial automation, security and protection monitoring, UAV loading, wearable devices and thermal scopes, and accelerates the popularization of thermal imaging technology in the emerging fields.

The basic frame of Mini212G2 series cores is shown in the figure below:

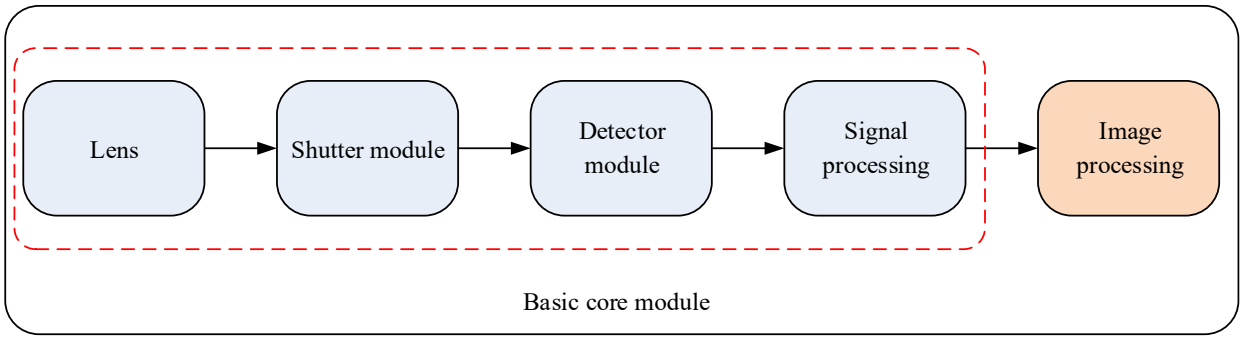


Figure 1 Basic Frame of Mini212G2 Cores

The basic core module of Mini212G2 series is the basic unit of the core, mainly completing the basic imaging functions of the thermographic camera, including four parts: lens, shutter module, detector module, signal processing module and image processing module.

The lens, shutter module, detector module and signal processing module form the TIMO212 module, featuring low power consumption, small size and high level of integration;

The image processing module can realize the functions of image algorithm processing, video display and output.

2 Product Configuration

2.1 Key technical parameters

Table- 1 Key Technical Parameters

Product model	Mini212G2 series			
Resolution	256×192			
Pixel size	12μm			
Response wave band	8~14μm			
NETD	≤50mK@ F1.0，300K			
Frame rate	9Hz / 25Hz / 30Hz（default） / 50Hz			
Focusing mode	Without focusing			
Lens (field of view/focal length)	2.1mm/F1.0-FF	3.2mm/F1.0-FF	7mm/F1.0-FF	10mm/F1.0-FF
Weight (unit: g)	8.8	3.8	6.9	8.5
PCB size	≤17mm*17mm*4.7mm (length*width*height)			

Product model	Mini212G2 series
Digital video interface	USB2.0 / DVP / BT.656 / LVDS
Analog Video	PAL / NTSC
Startup time	＜5s
Image algorithm	NUC/3DNR/DNS/DRC/EE/SFFC
Pseudo color	11 colors - support custom colors
Working voltage	3.3V±0.1V
Typical power consumption	330mW/3.3V @23±3℃
Temperature measurement range	-20℃~+550℃(-20℃~+150℃ | +100℃~550℃ two modes)
Temperature measurement accuracy	± 2 ℃/± 2% (whichever is greater) Need to check the temperature of complete machine
Temperature measurement analysis	Support point/area temperature measurement, including the maximum/minimum/average value
SDK	Android/Linux/Windows version
temperature matrix	Support
Isotherm	Support
Working temperature	-40℃~+70℃
Humidity	5%~95% (noncondensing)
Storage temperature	-40℃~+85℃
Certification	RoHS 2.0 / Reach

2.2 Optical configuration

Table- 2 Optical Configuration

No.	Type of Lens	Focal Length	F Value	Field of Angle (H×V, ±5°)	IP Grade	Weight (g)
1	Without focusing	10mm	1.0	17.5°×13.2° D：22°	Lens IP67	6.6±0.5

No.	Type of Lens	Focal Length	F Value	Field of Angle (H×V, ±5°)	IP Grade	Weight (g)
2	Without focusing	7mm	1.0	24.7°×18.9° D：31.2°	Lens IP67	5.9±0.5
3	Without focusing	3.2mm	1.0	56.2°×42.2° D：72°	Lens IP67	3.5±0.3
4	Without focusing	2.1mm	1.0	90°×65.3° D：118.3°	Lens IP67	6.3±0.5

2.3 PC software

UncooledInfraredCameraApplication.exe can realize on-line control of Mini212G2 cores.

Operating system: Windows 7/8/10/11.

Language: Chinese/English.

Recommended hardware configuration: i5 processor and above.

2.4 Unpacking

The standard configuration includes the Mini212G2 core and product certificate.

Since the core contains static-sensitive electronic components, please unpack and use it in an environment of good electrostatic protection to avoid core damage.

The product packing box is filled with anti-static foam to prevent the cores from being damaged during transportation.

3 Interfaces

3.1 Electrical interfaces

The external interface of the mainboard of the Mini212G2 core is 40PIN and the external interface model is WP7B-S040VA1-R8000. The recommended interface model is WP7B-P040VA1-R8000. The specific definition of PINs is shown in Table- 3 below:

Table- 3 Definitions of PINs

PIN No.	Signal Definition	Signal Direction	Electric Level	Description
1	LVDS_DATA0_P	O	1.2V	LVDS

PIN No.	Signal Definition	Signal Direction	Electric Level	Description
2	LVDS_DATA0_N	O	1.2V	LVDS
3	VIDEO	O	1.8/3.3V	Analog video
4	VIDEO GND	O	1.8/3.3V	Analog video GND
5	LVDS_DATA1_P	O	1.2V	LVDS
6	LVDS_DATA1_N	O	1.2V	LVDS
7	SPI_0_MISO	I	1.8/3.3V	SPI (reserved, not implemented for the moment)
8	SPI_0_CLK	O	36PIN I/O input voltage	SPI (reserved, not implemented for the moment)
9	DATA_OUT0	O	36PIN I/O input voltage	DVP data bit 0 2 4 6
10	DATA_OUT2	O	36PIN I/O input voltage	
11	DATA_OUT4	O	36PIN I/O input voltage	
12	DATA_OUT6	O	36PIN I/O input voltage	
13	EXT_SYNC	I/O	1.8V	External synchronization signal
14	DGND	DGND	DGND	DGND
15	USB_DM	I/O	USB	USB
16	USB_DP	I/O		
17	DGND	DGND	DGND	DGND
18	DIGITAL_HSY	O	36PIN I/O input voltage	DVP line signal
19	LVDS_CLK_P	O	1.2V	LVDS
20	LVDS_CLK_N	O	1.2V	LVDS
21	DIGITAL_VSY	O	36PIN I/O input voltage	DVP field signal
22	EXT_RST	I	3.3V	Module reset, low level reset
23	TX_TTL0	O	3.3V	Chip debugging serial port
24	RX_TTL0	I	3.3V	
25	VDD33	POWER_IN	3.3V	Digital external power supply 3.3V
26	VDD33	POWER_IN	3.3V	Digital external power supply 3.3V

PIN No.	Signal Definition	Signal Direction	Electric Level	Description
27	DGND	DGND	DGND	DGND
28	DGND	DGND	DGND	DGND
29	DATA_OUT7	O	36PIN I/O input voltage	DVP data bit 1 3 5 7
30	DATA_OUT5	O	36PIN I/O input voltage	
31	DATA_OUT3	O	36PIN I/O input voltage	
32	DATA_OUT1	O	36PIN I/O input voltage	
33	DGND	DGND	DGND	DGND
34	DATA_OUT_CLK	O	36PIN I/O input voltage	DVP clock signal
35	DGND	DGND	DGND	DGND
36	I/O 1.8V/3.3V	POWER_IN	I/O voltage: 1.8V/3.3V	IO level voltage
37	UART_2_TXD	O	1.8/3.3V	User communication serial port
38	UART_2_RXD	I	1.8/3.3V	
39	DGND	DGND	DGND	DGND
40	DGND	DGND	DGND	DGND

Note:

1. In signal direction column, O means output and I means input; in signal definition column, NC means PIN suspension and TBD means to be determined.
2. EXT_SYNC only applies when external synchronization is required, not required for digital interfaces, supporting external synchronization input mode. External synchronization must be disabled when external synchronization interface is not used.

3.2 Video interface

3.2.1 USB2.0

USB2.0 output is adopted for video output and communication control. It is recommended that customers use LibUSB for development and design. The specific configuration of the USB device is as follows:

1) VID: 0x04B4;

2）PID: 0xF7F7;

3) Endpoint 1: receiving; image output;

4) Endpoint 2: instructions;

5) Endpoint 3: sending instructions.

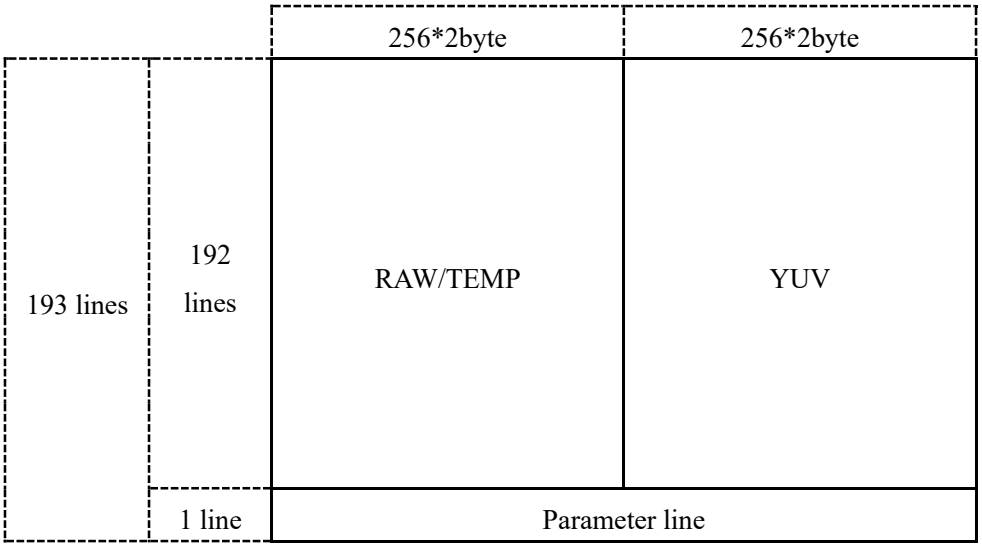
USB video output supports the following table combinations:

	RAW	YUV[①]	TEMP
RAW	◯	✓	×
YUV	✓	◯	✓
TEMP	×	✓	◯

Tips:

1. "◯" means single transmission; "✓" indicates composable output; "×" indicates that the output cannot be combined;
2. The above output can be selected with or without parameter rows.

Take RAW+YUV+ parameter behavior as an example. The specific video format is as follows:



3.2.2 DVP

3.2.2.1 CMOS8 without parameter lines

① YUV is in YUV422 format and the data is arranged UYVY.

DVP 8bit digital video timing parameter (without parameter line) is shown in Table- 4, Table- 5 and Table- 6:

Table- 4 Digital Interface 8bit Timing Parameter (without parameter lines) (25HZ)

Video format (data source)	25Hz （RAW16/YUV422）			25Hz （RAW16+YUV422）		
Description	Typical value	Unit	Remarks	Typical value	Unit	Remarks
Resolution	256×192			512×192		
NW	256			512		
NH	192			192		
DIGITAL_CLK	6	MHz		12	MHz	
TLine	150	us	900 CLK	150	us	1800CLK
TLine_Valid	85.3	us	512 CLK	85.3	us	1024 CLK
TLine_Blank	64.7	us	388 CLK	64.7	us	776 CLK
TPixel	0.167	us	1 CLK	0.083	us	1 CLK
TStart	/	us	/	/	us	/
TFrame	40	ms	266 Line	40	ms	266 Line
TField_Valid	28.8	ms	192 Line	28.8	ms	192 Line
TField_Blank	11.2	ms	74Line	11.2	ms	74Line

Table- 5 Digital Interface 8bit Timing Parameter (without parameter lines) (30HZ)

Video format (data source)	30Hz （RAW16/YUV422）			30Hz （RAW16+YUV422）		
Description	Typical value	Unit	Remarks	Typical value	Unit	Remarks
Resolution	256×192			512×192		
NW	256			512		
NH	192			192		
DIGITAL_CLK	6	MHz		12	MHz	
TLine	150	us	900 CLK	150	us	1536 CLK
TLine_Valid	85.3	us	512 CLK	42.67	us	1024 CLK
TLine_Blank	64.7	us	388 CLK	21.33	us	512 CLK
TPixel	0.167	us	1 CLK	0.083	us	1 CLK
TStart	/	us	/	/	us	/

TFrame	33.33	ms	222 Line	33.33	ms	222 Line
TField_Valid	28.8	ms	192 Line	28.8	ms	192 Line
TField_Blank	4.5	ms	30 Line	4.5	ms	30 Line

Table- 6 Digital Interface 8bit Timing Parameter (without parameter lines) (50HZ)

Video format (data source)	50Hz （RAW16/YUV422）			50Hz （RAW16+YUV422）		
Description	Typical value	Unit	Remarks	Typical value	Unit	Remarks
Resolution	256×192			512×192		
NW	256			512		
NH	192			192		
DIGITAL_CLK	10	MHz		20	MHz	
TLine	90	us	900 CLK	90	us	1800 CLK
TLine_Valid	51.2	us	512 CLK	51.2	us	1024 CLK
TLine_Blank	38.8	us	388 CLK	38.8	us	388CLK
TPixel	0.1	us	1 CLK	0.05	us	1 CLK
TStart	/	us	/	/	us	/
TFrame	20	ms	222Line	20	ms	222Line
TField_Valid	17.28	ms	192 Line	17.28	ms	192 Line
TField_Blank	2.7	ms	30Line	2.7	ms	30Line

The line-field timing diagram of Y16 or YUV422 without parameter lines is shown in Figure 2:

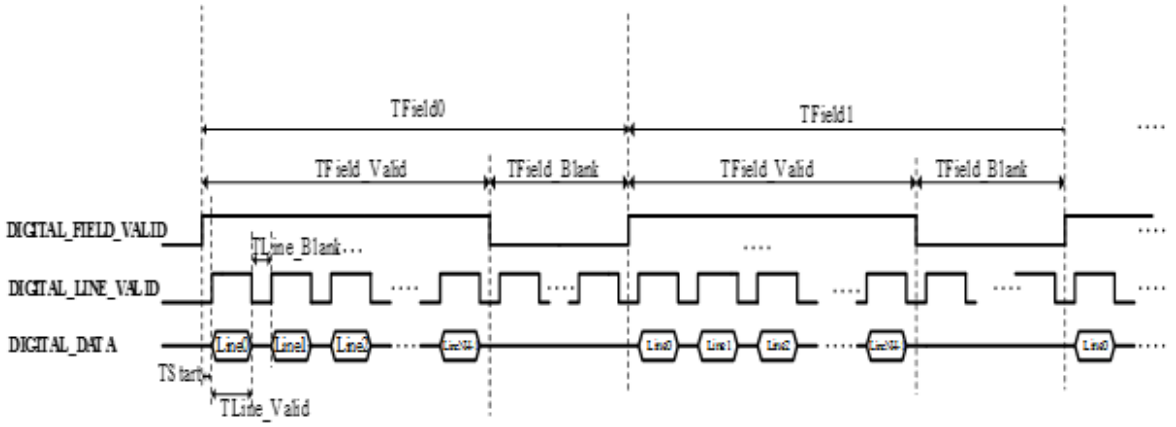


Figure 2 Line-Field Timing Diagram of RAW16/YUV422 Without Parameter Lines

The line-data timing diagram of RAW16 is shown in Figure 3 and Figure 4:

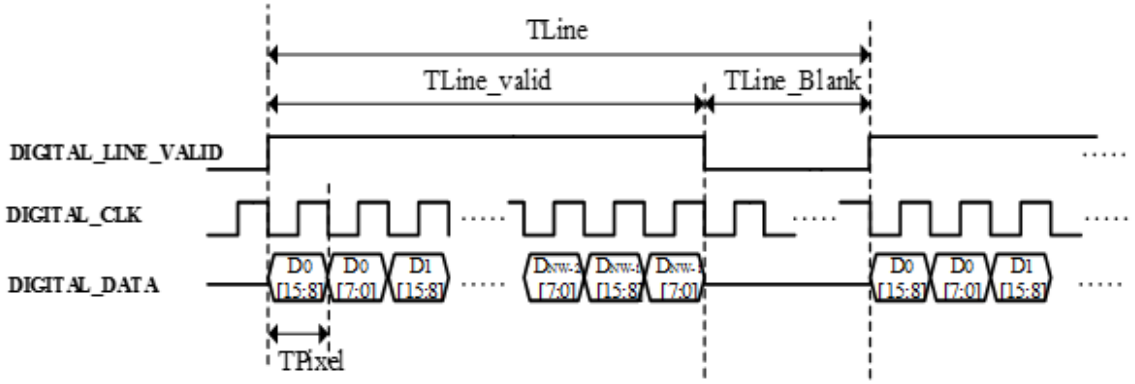


Figure 3 Line - Data Timing Diagram of RAW16 (MSB)

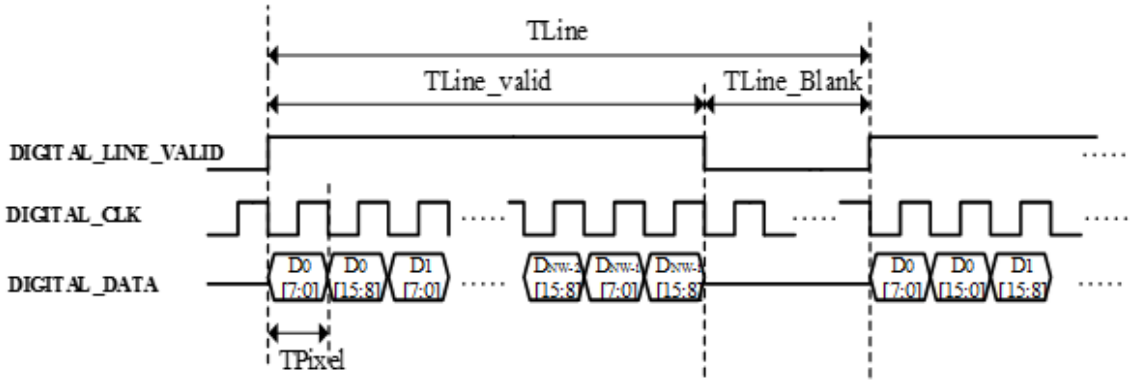


Figure 4 Line - Data Timing Diagram of RAW16 (LSB)

The line-data timing diagram of YUV422 is shown in Figure 5 and Figure 6:

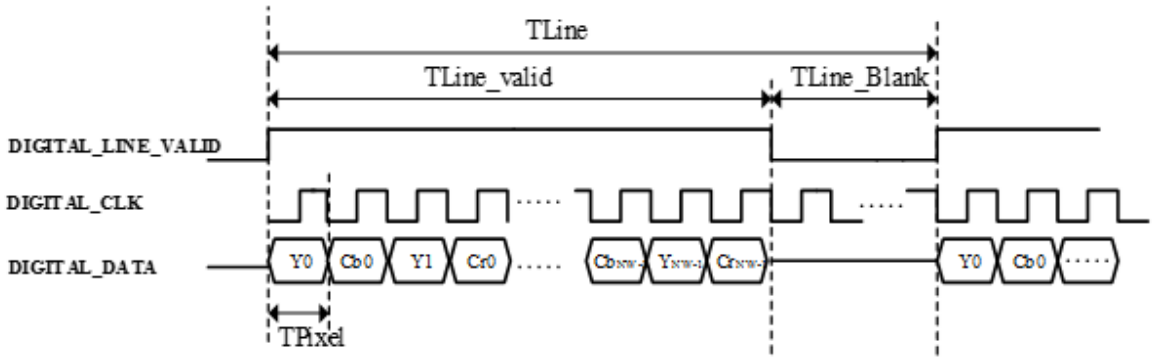


Figure 5 Line - Data Timing Diagram of YUV422 (MSB)

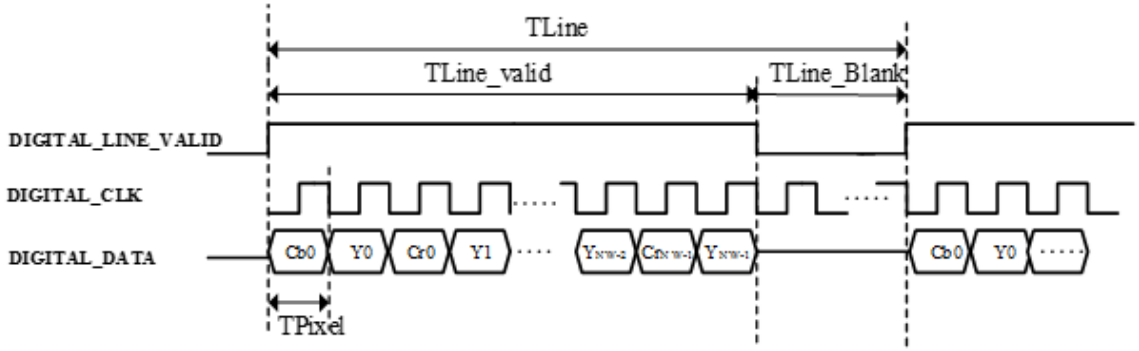


Figure 6 Line - Data Timing Diagram of YUV422 (LSB)

The line-data timing diagram of YUV422+RAW16 is shown in Figure 7 and Figure 8:

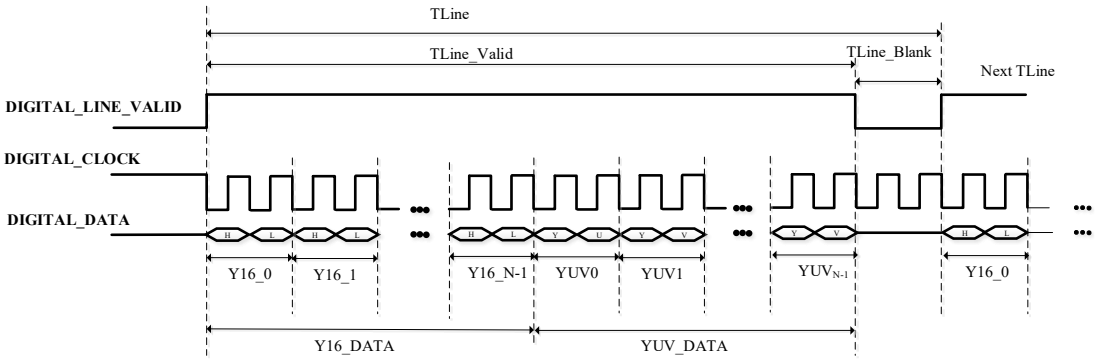


Figure 7 Line - Data Timing Diagram of YUV422+RAW16(MSB)

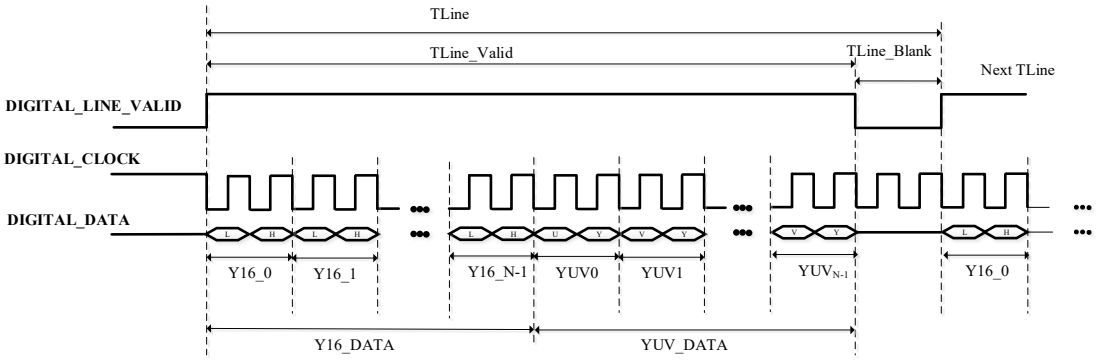


Figure 8 Line - Data Timing Diagram of YUV422+RAW16(LSB)

3.2.2.2 CMOS8 with parameter lines

Parallel 8bit digital video timing parameter (with parameter lines) is shown in Table-7, Table-8 and Table-9:

Table- 7 Digital Interface 8bit Timing Parameter (with parameter lines) (25HZ)

Video format (data source)	25Hz （RAW16/YUV422）	25Hz （RAW16+YUV422）

Description	Typical value	Unit	Remarks	Typical value	Unit	Remarks
Resolution	256×193			512×193		
NW	256			512		
NH	193			193		
DIGITAL_CLK	6	MHz		12	MHz	
TLine	150	us	900 CLK	150	us	1800CLK
TLine_Valid	85.3	us	512 CLK	85.3	us	1024 CLK
TLine_Blank	64.7	us	388 CLK	64.7	us	776 CLK
TPixel	0.167	us	1 CLK	0.083	us	1 CLK
TStart	/	us	/	/	us	/
TFrame	40	ms	266 Line	40	ms	266 Line
TField_Valid	28.95	ms	193 Line	28.95	ms	193 Line
TField_Blank	10.95	ms	73Line	10.95	ms	73Line

Table- 8 Digital Interface 8bit Timing Parameter (with parameter lines) (30HZ)

Video format (data source)	30Hz （RAW16/YUV422）			30Hz （RAW16+YUV422）		
Description	Typical value	Unit	Remarks	Typical value	Unit	Remarks
Resolution	256×193			512×193		
NW	256			512		
NH	193			193		
DIGITAL_CLK	6	MHz		12	MHz	
TLine	150	us	900 CLK	150	us	1536 CLK
TLine_Valid	85.3	us	512 CLK	42.67	us	1024 CLK
TLine_Blank	64.7	us	388 CLK	21.33	us	512 CLK
TPixel	0.167	us	1 CLK	0.083	us	1 CLK
TStart	/	us	/	/	us	/
TFrame	33.33	ms	222 Line	33.33	ms	222 Line
TField_Valid	28.95	ms	193 Line	28.8	ms	193 Line
TField_Blank	5.597	ms	29Line	5.597	ms	29 Line

Table-9 Digital Interface 8bit Timing Parameter (with parameter lines) (50HZ)

Video format (data source)	50Hz （RAW16/YUV422）			50Hz （RAW16+YUV422）		
Description	Typical value	Unit	Remarks	Typical value	Unit	Remarks
Resolution	256×193			512×193		
NW	256			512		
NH	193			193		
DIGITAL_CLK	10	MHz		20	MHz	
TLine	90	us	900 CLK	90	us	1800 CLK
TLine_Valid	51.2	us	512 CLK	51.2	us	1024 CLK
TLine_Blank	38.8	us	388 CLK	38.8	us	388CLK
TPixel	0.1	us	1 CLK	0.05	us	1 CLK
TStart	/	us	/	/	us	/
TFrame	20	ms	222Line	20	ms	222Line
TField_Valid	17.37	ms	193Line	17.37	ms	193 Line
TField_Blank	2.61	ms	29Line	2.61	ms	29Line

The line-field timing diagram of RAW16 or YUV422 with parameter lines is shown in Figure 9:

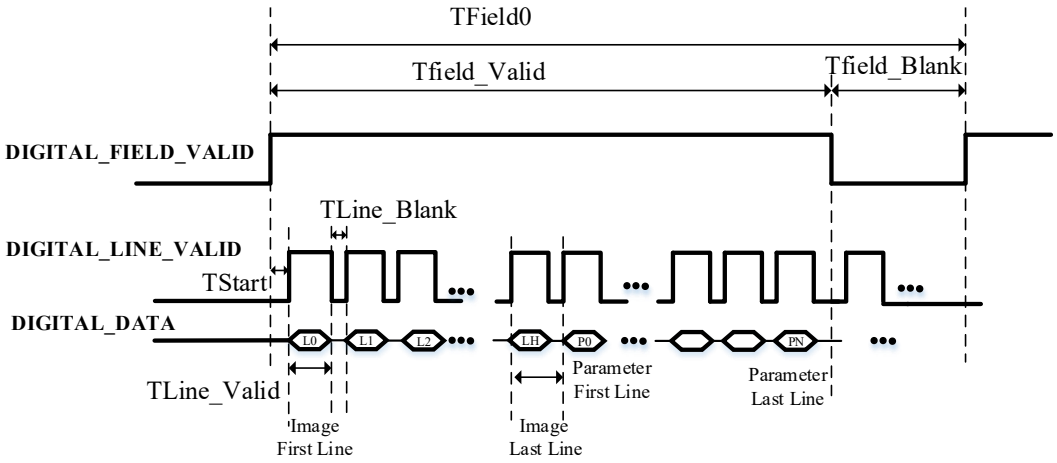


Figure 9 Line-Field Timing Diagram of RAW16/YUV422+ Parameter Lines

The line-data timing diagram of RAW16+parameter lines is shown in Figure 10 and Figure 11:

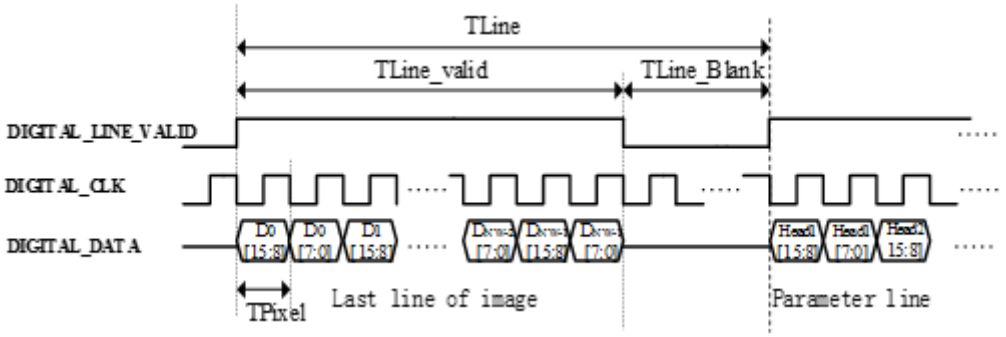


Figure 10 Line - Data Timing Diagram of RAW16+Parameter Lines (MSB)

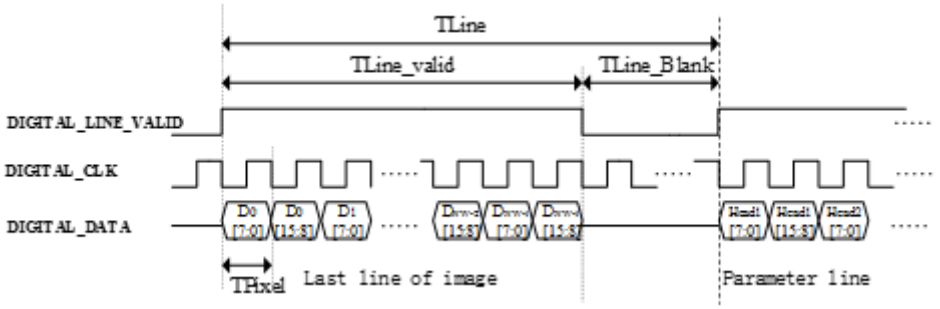


Figure 11 Line - Data Timing Diagram of RAW16+Parameter Lines (LSB)

The line-data timing diagram of YUV422+ parameter lines is shown in Figure 12 and Figure 13:

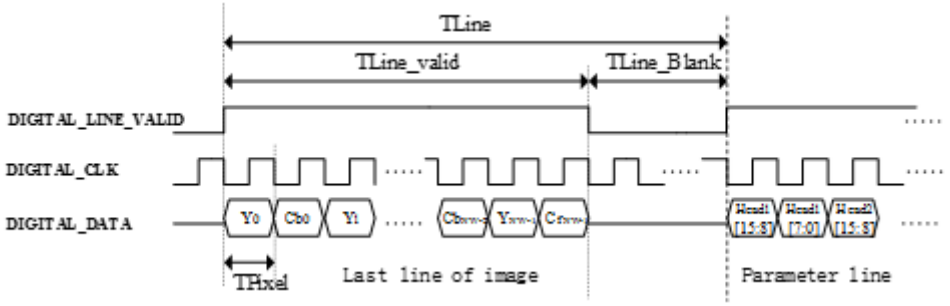


Figure 12 Line - Data Timing Diagram of YUV422+Parameter Lines (MSB)

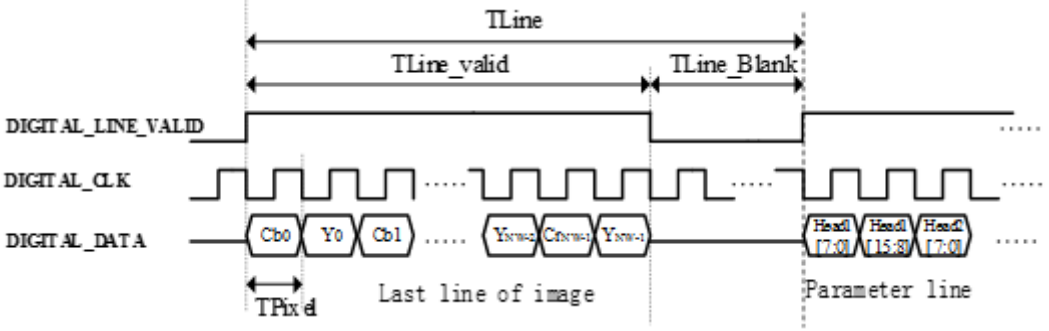


Figure 13 Line - Data Timing Diagram of YUV422+Parameter Lines (LSB)

The timing diagram of RAW16+parameter lines+YUV422 is shown in Figure 14, Figure 15 and Figure 16:

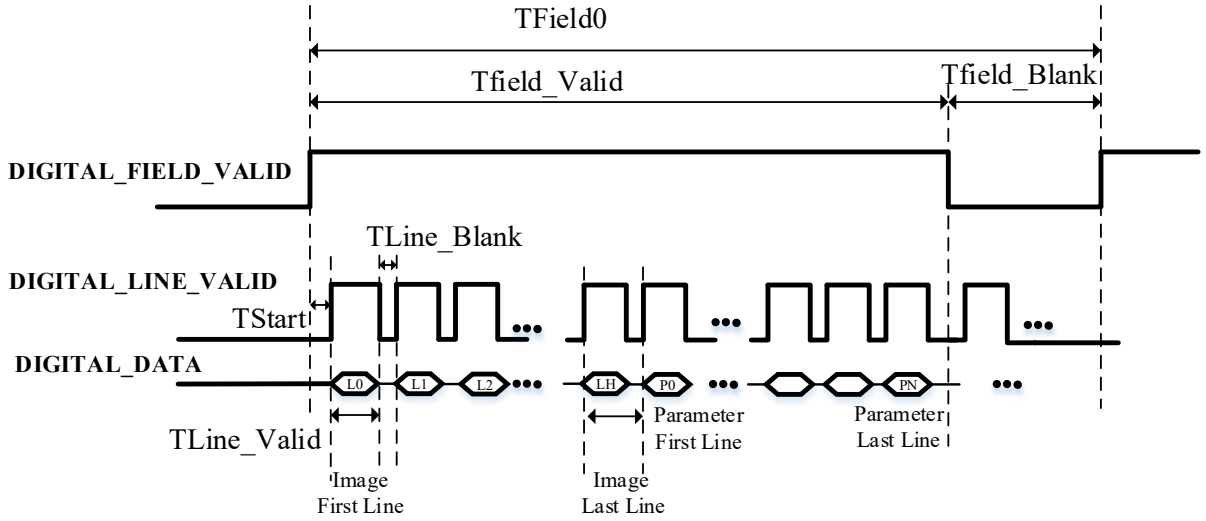


Figure 14 Timing Diagram of YUV422+RAW16+Parameter Lines

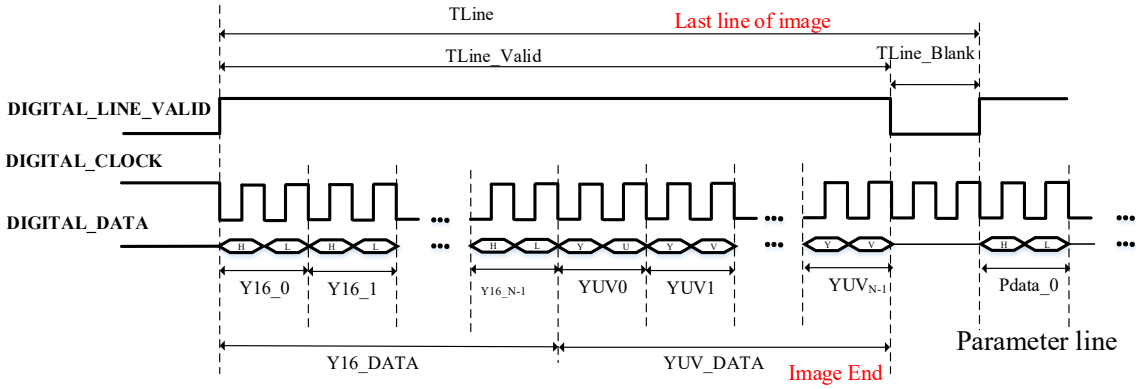


Figure 15 Line - Data Timing Diagram of YUV422+RAW16(MSB)+Parameter Lines

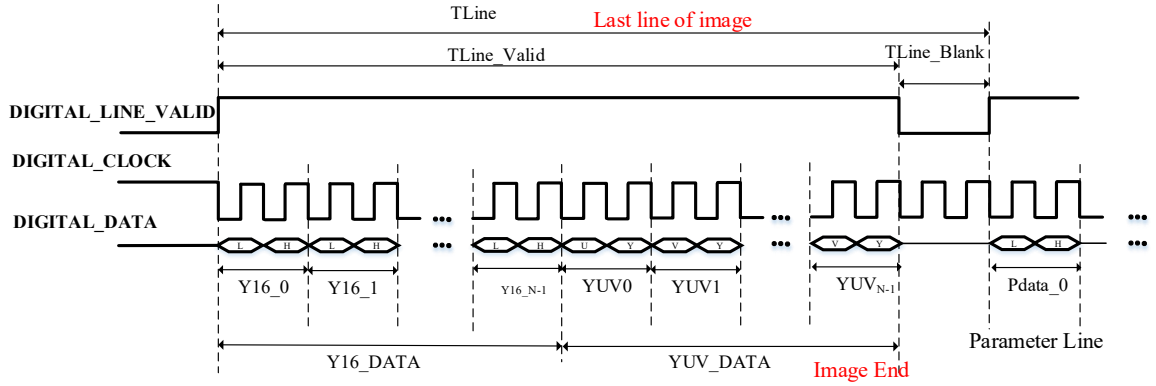


Figure 16 Line - Data Timing Diagram of YUV422+RAW16(LSB)+Parameter Lines

3.2.3 BT.656

Display of boot screen is supported YUV422

Non-standard line by line is supported and standard interlacing is not supported;

BT.656 clock is consistent with DVP 8bit output;

BT.656 output video data is consistent with DVP 8bit;

BT.656 adopts internal synchronization, as shown in Figure 17

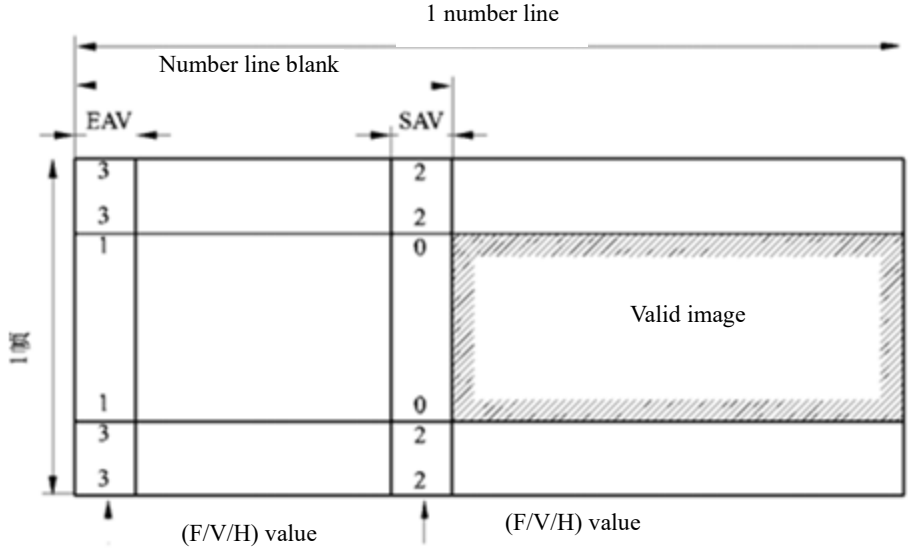


Figure 17 BT.656 Internal Synchronization

3.2.4 LVDS

Mini212G2 supports LVDS 2-Lane output mode, 1 pair of LVDS_CLK, 2 pairs of LVDS_DATA, with data output by double-edge sampling. The common mode voltage of LVDS is 1.25V, with a swing of 350mV.

The frame output format is shown in Figure 18.

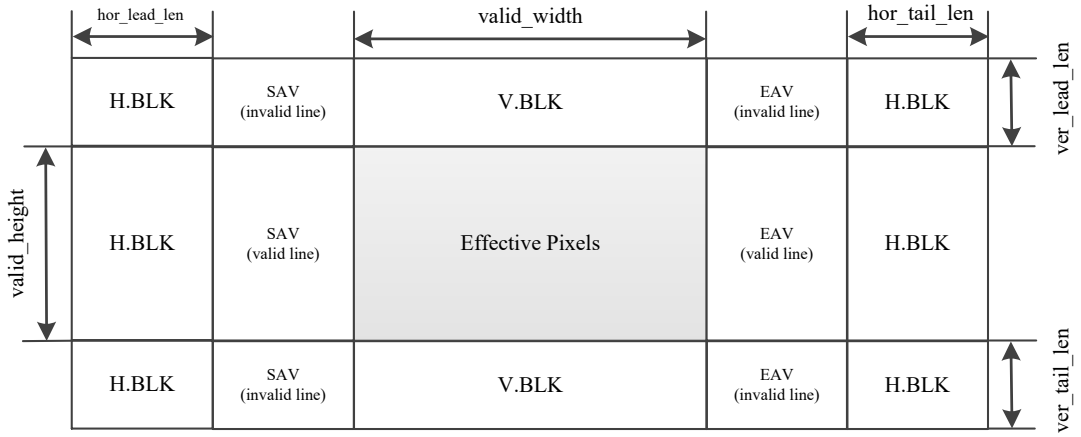


Figure 18 Frame Output Format

ver_lead_len means the number of blank lines above the valid image, and ver_tail_len means the number of blank lines below the valid image; hor_lead_len means the number of

blank pixels before the synchronization code of the line head, and hor_tail_len means the number of pixels after the synchronization code of the line end.

The 4 pixels of the internal synchronization code share the 4 synchronization codes: SAV_VALID: start synchronization code of the valid data line; EAV_VALID: end synchronization code of the valid data line; SAV_INVALID: start synchronization code of the invalid data line; EAV_INVALID: end synchronization code of the invalid data line. LVDS synchronization codes are shown in Table -10.

Table-10 LVDS Synchronization Codes

Synchronization code	1st code	2nd code	3rd code	4th code
SAV_VALID	0xFFFF	0x0000	0x0000	0x8000
EAV_VALID	0xFFFF	0x0000	0x0000	0x9D00
SAV_INVALID	0xFFFF	0x0000	0x0000	0xAB00
EAV_INVALID	0xFFFF	0x0000	0x0000	0XB600

Data transmission through LVDS channels is shown in Figure 19.

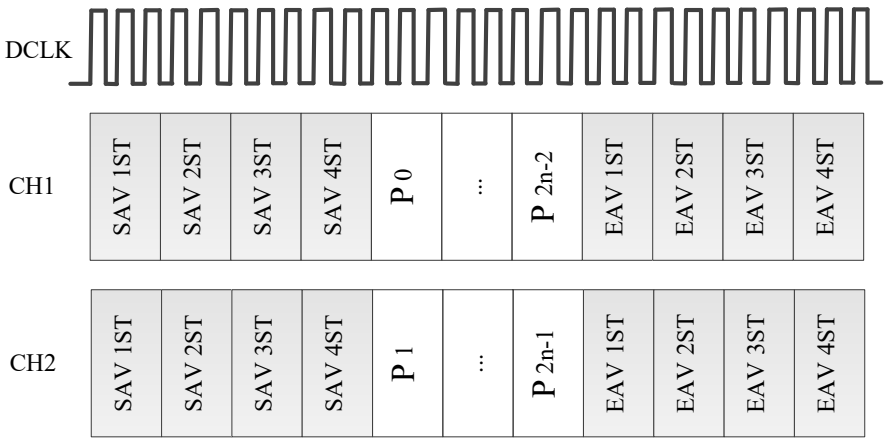


Figure 19 lane Transmission Format

The data is 16bit by default of big endian output. The data format is shown in Figure 20.

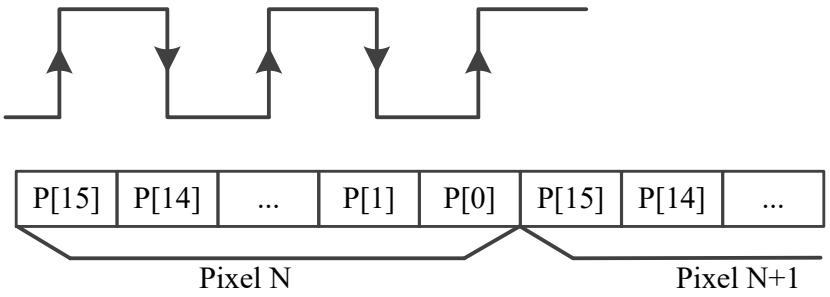


Figure 20 Timing Sequence of 16bit Pixel Transmission

3.2.5 Analog video

The system supports seamless switching between standard PAL and standard NTSC (switching can be done through the demo software, please refer to the operating instructions of the demo software for details). The default state is set to open (can be closed or opened through the demo software, please refer to the operating instructions of the demo software for details).

PAL output effective resolution: 720×540;

NTSC output effective resolution: 640×480;

3.3 Mechanical interface

Onboard 40PIN connector type: WP7B-S040VA1-R8000

The buckled connector type: WP7B-P040VA1-R8000

See the specifications of the above connectors for details.

4 Serial communication protocol

For detailed information, please refer to the Serial Communication Protocol Documentation.

5 FAQ

5.1 How to confirm the successful installation of USB driver?

After the software is successfully installed, open the device manager of the computer, and connect the core to see libusb-win32 devices; double-click to display Mars, indicating that the driver is functioning correct.

5.2 How to switch digital interfaces

- Select digital interface format (USB2.0 or CMOS);
- If the USB2.0 format is selected, the core will automatically switch to the USB2.0 format data matching the corresponding frame rate and video format; if the CMOS format is selected, the CMOS content and CMOS interface type need to be additionally selected for working properly.

5.3 Failed to establish a connection to the device prompted by the host computer software

Figure 21 Host Computer Software Interface

- Check that the USB driver is successfully installed, which can be confirmed in the device manager;
- The user needs to check whether the computer has a built-in camera, which needs to be disabled if any;
- Check that the PC interface and USB cable meet the requirements;

- Check that the PC host computer software is completely closed before the equipment is connected and powered on
- Try to manually connect the serial port or power off and restart;

6 Mechanical Drawings

For detailed information, please refer to the 2D mechanical drawing.

7 Packing Instructions

For details, please refer to the "Packaging Solution Description".

8 Appendix

8.1 Introduction to infrared protection window materials

The infrared protection window can be plated with 8-12um band films, such as germanium and silicon. For example, the 56° lens matching window of Timo 256 module is a square germanium window with a typical size of 9×9mm and a diameter of 1mm (the window size shall be sufficient to completely cover the light according to the installation position of the lens and the window), and the typical iDLC (diamond-like carbon protective film) transmittance parameters can be used for reference:

Table-11 Coating Transmittance Reference

	Thickness	Transmission/%		
Waveband		8-12um	9-12um	9.5-12um
Silicon	1.0mm	81	79	77.6
	1.2mm	79.3	77	75
	1.5mm	76.8	74.5	72.6
Germanium	1.0mm	92.8	92.5	92.8
	1.2mm	92	92.2	92.3
	1.5mm	91.5	91.3	91.5

8.2 Specific emissivity of common materials

Table-12 Specific Emissivity of Common Materials

S/N	Materials	Emissivity	S/N	Materials	Emissivity
1	Wood	0.85	12	Black paper	0.86
2	Water	0.96	13	Polycarbonate	0.8
3	Brick	0.75	14	Concrete	0.97
4	Stainless steel	0.14	15	Copper oxide	0.78
5	Adhesive tape	0.96	16	Cast iron	0.81
6	Aluminum sheet	0.09	17	Rust	0.8
7	Copper sheet	0.06	18	Gypsum	0.75
8	Black aluminum	0.95	19	Oil paint	0.9
9	Human skin	0.98	20	Rubber	0.95
10	Asphalt	0.96	21	Soil	0.93
11	PVC plastics	0.93			

8.3 Thermal design considerations

1) The infrared module is very sensitive to external thermal radiation, and attention shall be paid to heat dissipation and insulation in use to prevent uneven imaging or inaccurate temperature measurement. In structure, heat dissipation and insulation shall be considered.

2) If several cameras share a bracket and the spacing is relatively close, the temperature rise of the white light camera may affect the imaging of the infrared module. Suggestion: different heat sinks are used for infrared and visible light respectively, and thermal insulation structure is preferred between them.

3) Temperature rise control: according to the thermal simulation analysis, the temperature rise of the infrared module shall be controlled within 8℃ within 30 minutes under the working environment of the whole machine, and reach the thermal stability state;

4) For equipment with rechargeable batteries, attention shall be paid to the impact of battery charging heating on the temperature measurement accuracy of the equipment, which shall be avoided by isolation or separate charging.

8.4 Precautions for use of thermal conductive silicone grease/gasket

The thermal conductive gasket shall be used as far as possible. It is not recommended to use thermal conductive silicone grease. The module shell cannot be dust-proof and waterproof.

Once the thermal conductive silicone grease is squeezed into the module, it may affect the proper actuation of the shutter, and there may be image sticking and other anomalies during temperature measurement.

Figure 22 Example of Improper Use of Thermal Conductive Silicone Grease