

1 Characteristic

- 1-channel to 4K60 (3840x2160) camera input (4-lane MIPI)
 - Or 1080P 3D camera input (2x2Lane Mipi)
 - 1 HDMI output, supports up to 4K60 (3840x2160) resolution
 - 1-channel MIC input, supports differential or single-ended passive MIC
 - 4 USB3.0 ports: supports USB storage, USB WiFi dongle, and more
 - ADC input: supports up to 16 key extensions
 - RS232 port 2: Enables light source synchronization and serial port screen menu operations
 - A clock battery interface: to keep the real-time clock running after a power failure
 - An interface expansion port for connecting to other systems or adding more interfaces to support various applications (depending on the project requirements).
 - Power input: 12V 2A (5V~12V)
 - Size: 65mmx70mm
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- Multiple metering modes: average, center, and peak
 - One-click white balance adjustment with built-in color styles and manual color parameters
 - Prevents color spillage, ensuring surgical details remain visible even when blood-red dominates during bleeding procedures.
 - Support horizontal and vertical mirroring
 - Image freeze, video recording, snapshot, and image comparison
 - Dimming level is adjustable, and smoke elimination
 - Store multiple scenario parameters for easy direct access in different scenarios
 - Customize shortcut keys
 - The system menu can be hidden and authorized for login, providing a set of serial port commands for system control, enabling users to develop customized serial port screen menu applications.

2 Summary

The ZM4 v2.1x is a compact yet powerful single-board solution featuring the latest fifth-generation image processing system. With advanced ISP capabilities, it delivers real-time low-latency image processing for up to 4K60+1080P 60FPS streams. The system incorporates a 2.5TOPS@INT8 intelligent video analysis acceleration engine, providing essential hardware support for intelligent image processing applications. This ensures seamless upgrades and facilitates distributed deployment planning for future implementations.

For close-up applications such as endoscopy, surgical microscopy, and industrial inspection, the system has been optimized for white balance locking, automatic metering, bright light suppression, smoke elimination, and red coverage in large bleeding environments, ensuring maximum recognition of tissue or object details in the field of view.

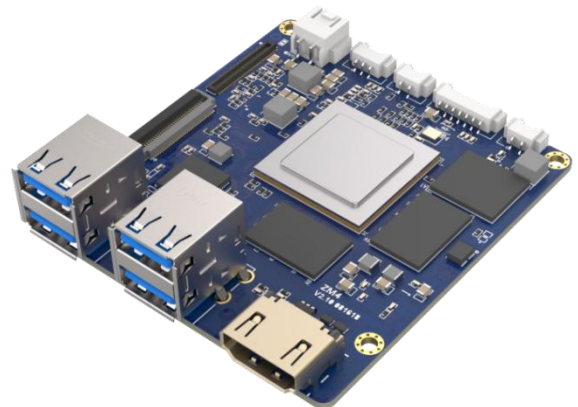
The 80Pin Hirose B2W connector delivers a scalable interface architecture, supporting UVC, MIPI DSI, and Gigabit Ethernet Application Extensions.

3 Main Application Scenarios

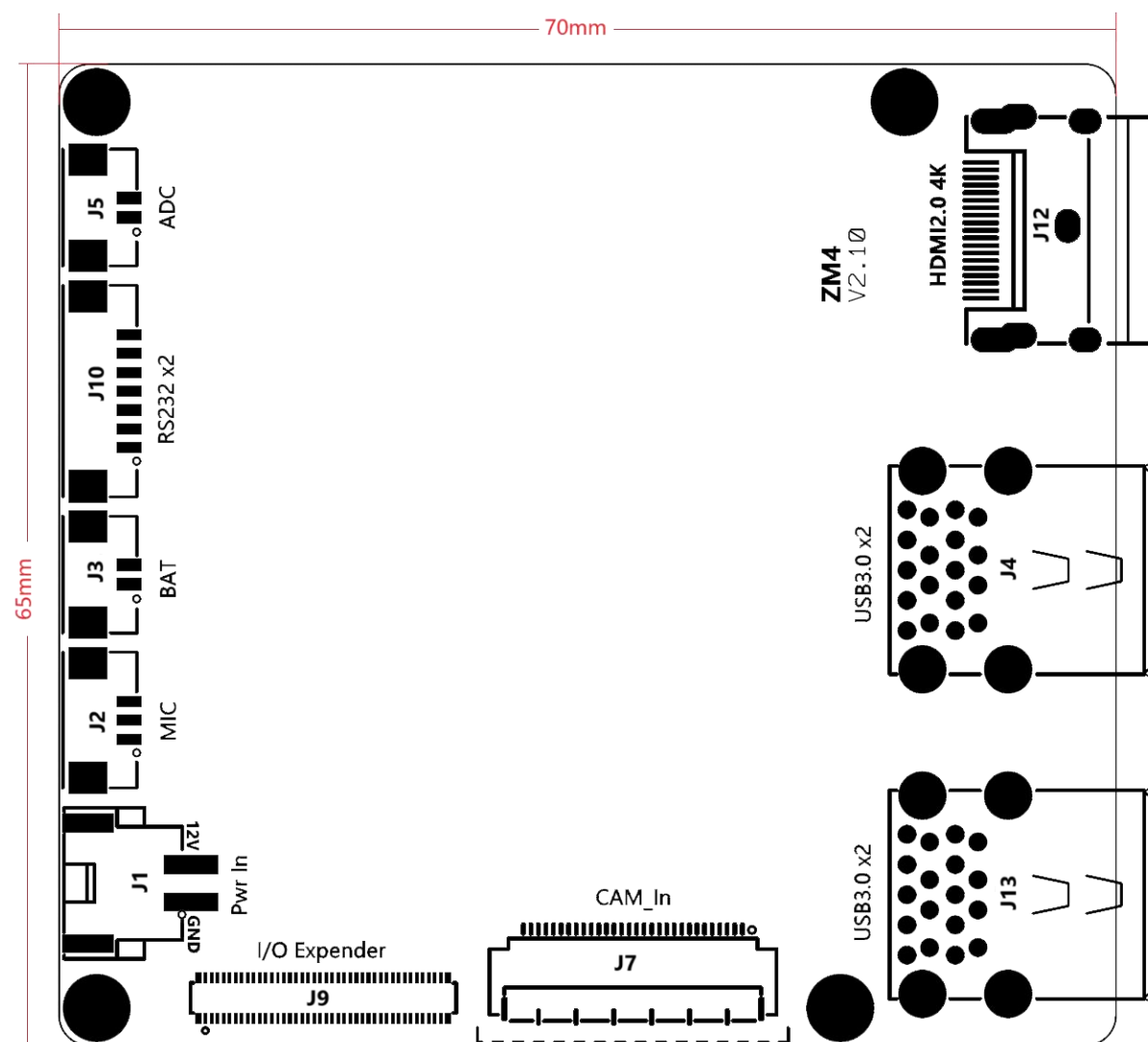
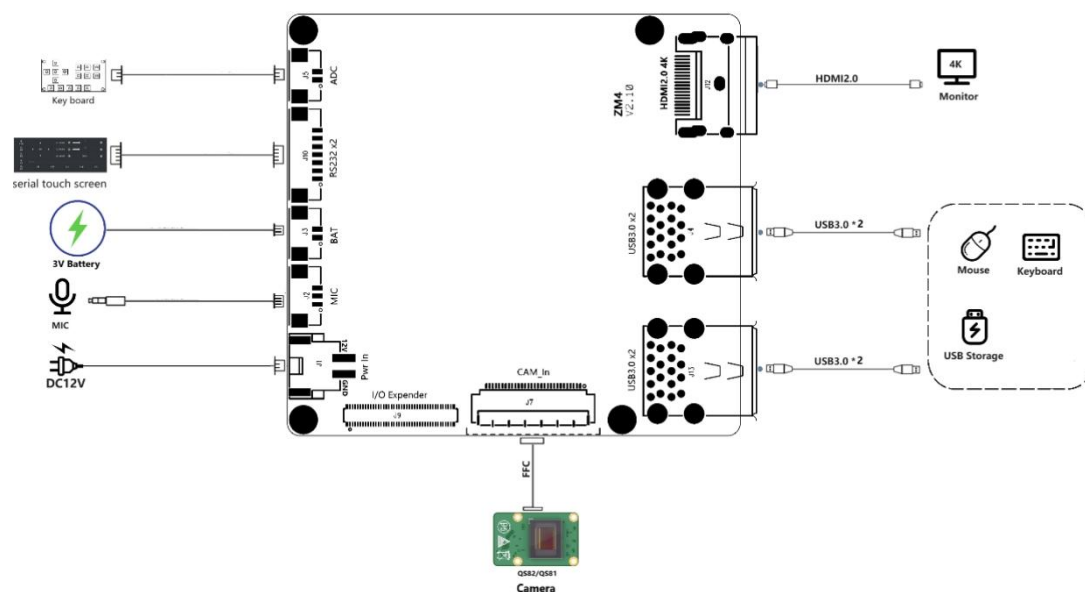
surgical microscope

Industrial Mirror

Electronic endoscope



4 Apply Block Diagram



5 Interface Definition

Note: The "△" is marked as the first pin (Pin1).

name	item	Pin definition	direction for use
power input	J1	2pin 2.5mm wafer: A2512WR-S-2P Pin1: GND Pin2: Power Input (Type: 12VDC, Range: 7.5~13.5VDC)	To ensure stable system operation, the 12V power supply must provide a minimum current of 2A with ripple voltage not exceeding 60mVp-p.
MIC import	J2	3pin 1.25mm wafer: A1251WR-S-3P Pin1: Differential MIC input negative (N) Pin2: Positive (P) differential MIC input Pin3: GND	To minimize input noise in the MIC, prefer differential MICs. When using a single-ended microphone, connect the microphone signal to Pin1 or Pin2, and connect the microphone ground to Pin3.
Battery socket	J3	2pin 1.25mm wafer: A1251WR-S-2P Pin1: VBAT+ (Battery Positive, +3V) Pin2: GND	The battery's maximum voltage should not exceed 3.3V, and 3V button batteries are typically used.
name	item	Pin definition	direction for use
gorge line : RS232	J10	7pin 1.25mm wafer: A1251WR-S-7P Pin1: 5V(4.5V~5.1V) Drive capacity ≤150mA Pin2: GND Pin3: RXD2 serial port 2 data reception Pin4: TXD2 serial port 2 data transmission Pin5: GND Pin6: RXD1 serial port 1 data reception Pin7: TXD1 serial port 1 data transmission	The system provides two RS232 standard level interfaces - Designed to adjust the parameters of the MLS0xx series light source, it connects to the constant current board (EP1) via a serial port. - Connect the serial port touch screen and access the touch screen operating system menu. - Others include linkage autofocus drive plate, etc.
ADC	J5	2pin 1.25mm wafer: A1251WR-S-2P Pin1: ADC IN Pin2: GND	The ADC level does not exceed 5V You can customize button functions through the system menu. No more than 10 operation buttons can be expanded.
HDMI	J12	HDMI 2.0: Supports up to 4K 60Hz resolution output	
USB	J4、J13	4 USB 3.0 Hosts	Supports USB storage devices, snapshot capture, and wireless dongle expansion via Wi-Fi. Compatible with USB mouse and keyboard operations.
Camera input	J7	FPC30 flat cable connector: FH41-30S-0.5SH Signal format: 4Lane Mipi	Supports dedicated cameras such as QS82/QS81 series
Extension	J9	80Pin B-to-B/FPC-to-B: DF40C-80DP-0.4V Scalable: USB3.0 Dev (UVC support), DSI, 1000MHz Ethernet, and MIPI CSI electronic mirror interface	Define in detail in specific projects

6 Electrical Specifications

1) work environment

parameter	minimum	typical case	maximum	explain
input voltage (V)	7.5	12	13.5	
working current (mA)		2000		
ambient temperature (°C)	5	25	45	
humidity (%rh)	5	55	85	
atmos (kPa)	50	101	106	

2) Electromagnetic compatibility (YY9706.102-2021:6.1.1 Electromagnetic Interference: Conductive and Radiated Emissions; 6.2.x Antenna Interference)

Test conditions: AC 220V/50Hz, external power supply (GSM18U05), ZM4 V2.10 (shielded housing)

A. electromagnetic disturbance :

a) Conduction emission: Meets the GB 4824-2019 power terminal electromagnetic interference (EMI) voltage limit (Group 1, Class B) requirements

Voltage Mains Test GB 4824-2019

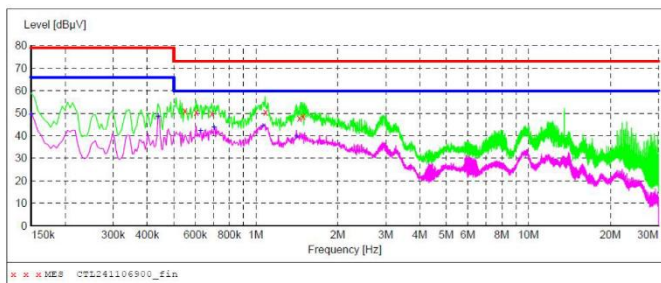
EUT: ZM4 V2.10
Operating Condition: WORKING
Operator: LOONG
Test Specification: AC 220V/50Hz
Start of Test: 11/6/2024 / 9:50:48AM

Power Port: Line L

频率 (MHz)	Level	CLASS A	CLASS B	Level	CLASS A	CLASS B
0.15~0.50	<59	79	<66~56	<49.6	66	<56~46
0.50~3.00	<51.2	73	56	<44.4	60	46
5.00~30.00	<51	73	60	<31	60	50

SCAN TABLE: "Voltage (9K-30M)FIN"

Short Description: 150K-30M Voltage



Voltage Mains Test GB 4824-2019

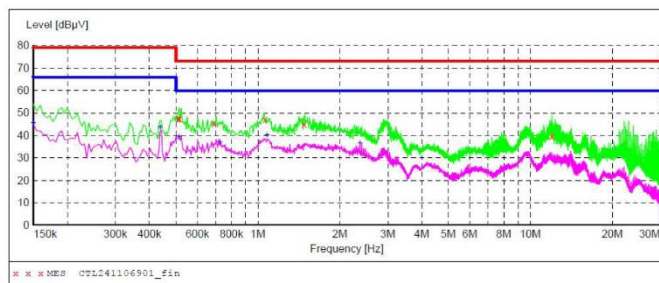
EUT: ZM4 V2.10
Operating Condition: WORKING
Operator: LOONG
Test Specification: AC 220V/50Hz
Start of Test: 11/6/2024 / 9:53:43AM

Power Port: Line N

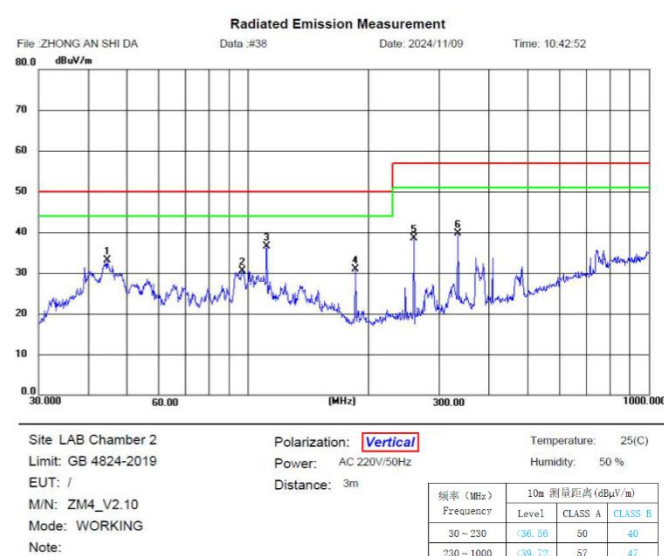
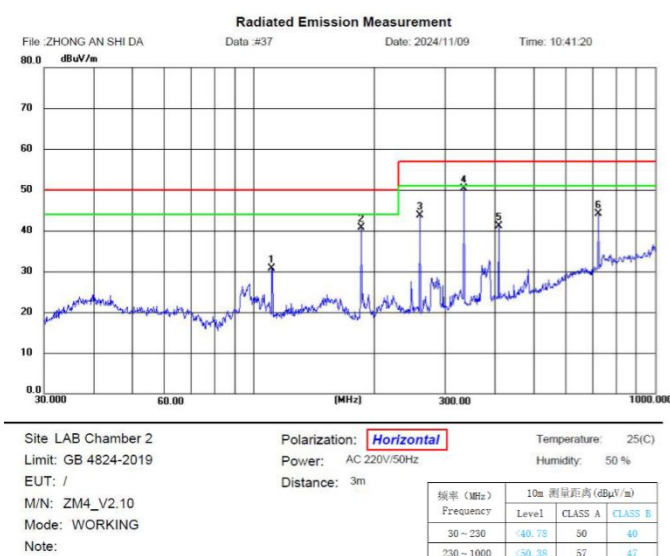
频率 (MHz)	Level	CLASS A	CLASS B	Level	CLASS A	CLASS B
0.15~0.50	<51	79	<66~56	<45.7	66	<56~46
0.50~5.00	<47.6	73	56	<40.3	60	46
5.00~30.00	<31	73	60	<31	60	50

SCAN TABLE: "Voltage (9K-30M)FIN"

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b) Radiation emission: Meets the radiation disturbance (Group 1, Class A) limit requirements specified in GB 4824-2019



B. Robustness: Meets the performance criteria specified in YY 9706.102-2021

YY 9706.102-2021	project	grade	bear fruit
6.2.2	electrostatic discharge	Contact discharge (± 6 kV) Air discharge (Air): ± 8 KV	qualified
6.2.3	Radio frequency electromagnetic field radiation immunity	3V/m, 80%AM (1kHz)	qualified
6.2.4	Fast transient pulse cluster	At the AC power supply port: Test voltage peak ± 2 kV, repetition frequency 5 kHz or 100 kHz, 5/50 ns Tr/Td waveform	qualified
6.2.5	surge	At the AC power supply port: Line-to-line: ± 1 kV peak voltage, open-circuit voltage waveform 1.2/50 μ s Line-to-ground: ± 2 kV peak voltage, open-circuit voltage waveform 1.2/50 μ s	qualified
6.2.6	RF field induced conducted immunity	3V,80%AM (1kHz)	qualified
6.2.7	The voltage on the power supply input line is temporarily Down, short interruptions, and voltage changes	1. Test voltage $<5\%U_t$, lasting 0.5 cycles 2. Test voltage at 40% of U_t for 5 cycles 3. Test voltage at 70% of U_t for 25 cycles 4. Test voltage $<5\%U_t$, for 250 cycles	qualified
6.2.8.1	Power frequency magnetic field	3A/m	qualified

7 Related components: QS82, QS81, MLS0xx