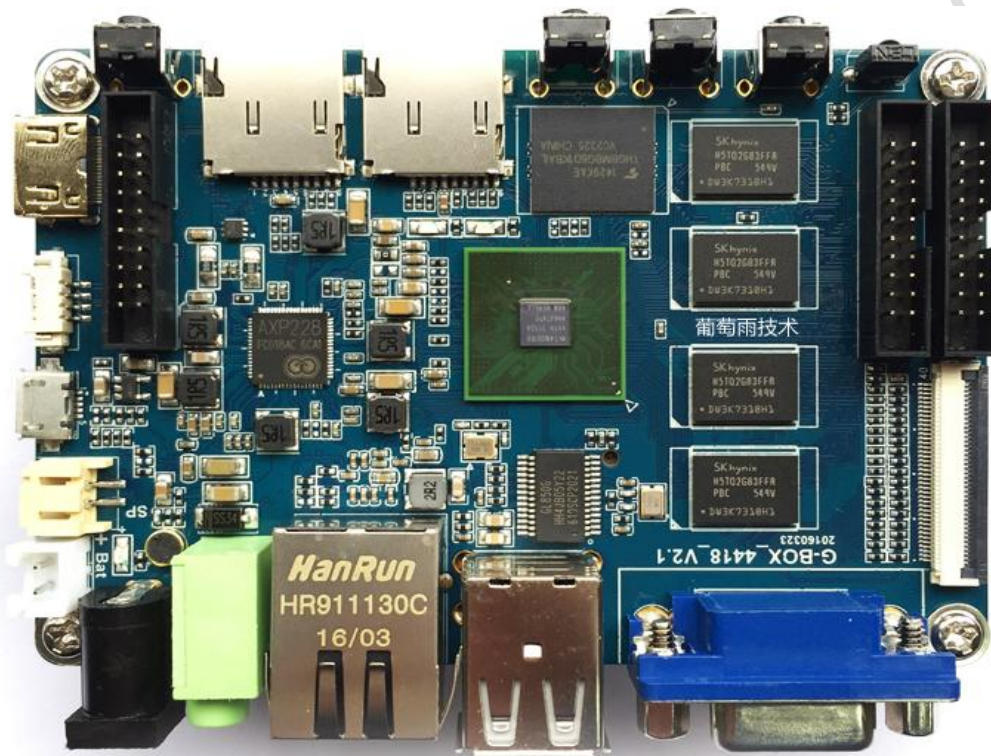


G4418 Single Board Computer Hardware Manual



Shenzhen Graperain Technology Co., Ltd.

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Release notes

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Chapter 1 G4418 Single Board Computer Introduction

The G4418 single board computer is almost one third of the G4418 development board size, but with better performance than the G4418 development board. It nearly covers all the peripheral function of the development board, as well as onboard VGA, USB WIFI/BT two in one module, etc.

Software: G4418 is completely compatible with G4418 development board, it's unnecessary to make any modification.

Hardware: G4418 is completely compatible with G6818, it's only needed to change the SoC to upgrade A9 Quad Core to A53 Octa Core, convenient for clients to upgrade their products.

This manual tells the hardware resources of G4418 single board computer, and its circuit schematics and supported interfaces.

G4418 single board computer uses the latest S5P4418 SoC design from Samsung, same ARM Core as Exynos4412, however, there is still great difference in the internal and external designs of the SoC.

Comparison

	Exynos4412	S5P4418
On market	2012	2014
Technology based	32nm	28nm
CPU frequency	1.4Ghz	1.4Ghz
Package	0.65mm ball pitch , 18*20mm body size 786-FCFBGA package	0.65mm ball pitch, 17*17mm body size 513-FCBGA package
CPU architecture	Cortex-A9 Quad Core	Cortex-A9 Quad Core
Cache capacity	32KB*4 I/D cache ,1MB second level cache	32KB*4 I/D cache , 1MB second level cache
DDR3 interface	2 Channels 4pcs DDR3 32bits data bus, 800MHz working frequency	1 Channel 2pcs DDR3 32bits data bus, 800MHz working frequency
Multimedia Decoding	H.263 H.264 MPEG2, MPEG4, VCI	H.263 H.264 MPEG1, MPEG2, MPEG4, VCI, VP8, Theora, AVS (all format)
Multimedia Coding	H.263 H.264 MPEG	H.263 H.264 MPEG4, MJPEG
Display Interface	RGB, MIPI	RGB/MIPI/LVDS
Max resolution	1920*1200	2048*1280
Ethernet	Expend through IP address bus	Integrated 1000M Ethernet control
GPIO level	1.8V	3.3V
ADC	4 channel 12bit 0-1.8V	8 channel 12bit 0-1.8V

USB Interface	1Channel HOST, 1 Channel HSIC, 1Channel OTG	1 Channel HSIC, 1 Channel OTG
Chip ID	No unique ID number	Support 128bit unique ID number
Slim bus	Supported	Not supported
C2C interface	Supported(only for cell phone)	Not supported
GPS	Supported	Not supported
ISP	Supported	Not supported

From the above chart we can see clearly that SoC S5P4418 is not simply a tailored Exynos4412, but a brand new SoC. Compared with Exynos4412, it cuts such interfaces like slim bus, C2C, GPS, ISP, widely used on cell phone while seldom used on industry control or tablet PC. These interfaces take up too much cost. At the same time, SoC S5P4418 adds gigabyte Ethernet PHY, improves LCD interface driver ability and multimedia decoding ability. There is one more lane of USB HOST, while Exynos4412 needs extra adapter IC chip. GPIO level has been modified from 1.8V to 3.3V, more suitable for the current peripheral solutions.

As for the cost, Exynos4412 SoC is about 10 USD, and S5P4418 is only half the cost.

Shenzhen Graperain Technology Co., Ltd. is the first company that launched S5P4418 development platform, on software it comes with complete and stable android4.4 OS (linux+qt, ubuntu optional), on hardware it adapts famous Chinese company x-powers AXP228 as power management chip to ensure the stability and reliability of the platform. G4418 and Gbox6818 are 100% compatible, it's only needed to change the SoC to upgrade A9 Quad Core to A53 Octa Core, convenient for clients to upgrade their products.

1.1 Product Introduction

G4418 single board computer is very suitable for the field which does not need other industry peripheral extension, such as industry control, electricity, communication, medical, media, security, vehicle device, financial, consumer electronics, advertising machine, set top box, hand held device, gaming device, display control and so on. Free of secondary development, users can embed the SBC directly into their own products. Meanwhile, it's also applicable for universities, embedded engineers study or DIY.

G4418 single board computer size: 100.66mm*68.80mm

1.2 Functions and features

Core: ARM Cortex-A9 quad core;

Frequency: 1.4GHz * 4;

Memory: 1GB DDR3, 2GB DDR3 optional;

Flash: 4GB / 8GB / 16GB EMMC optional, default 8GB emmc;

24bit RGB interface;
 8bit LVDS interface;
 VGA interface supported
 MIPI CSI interface
 2 channels USB HOST interface, support more USB devices used together;
 USB OTG interface;
 2 channels TTL electrical level UART interface;
 2 channels TF card interface;
 Reset key;
 Software switch;
 Support external speaker;
 Support MIC input;
 Support earphone output interface;
 Support the launch configuration switch design;
 Support backlit stepless adjustment;
 Support HDMI interface;
 Support 5 points capacitive touch screen;
 Support USB interface WIFI/BT two-in-one module;
 Support SPI, I2C, UART etc.;
 Support MPEG4, H.263, H.264, MJPEG video decoding;
 Support all most video decoding;
 Support 2D, 3D high-performance graphics acceleration;
 Support RTC;
 Support gigabit Ethernet RTL8211E;
 Support BT656/BT601/MIPI camera interface;
 Support GPS interface;
 Support GPRS interface;
 Support USB 3G module;
 Support USB mouse and USB keyboard;
 Support Integration of infrared receiving;

1.3 Software support

G4418 single board computer support three main operating systems: android4.4.2 OS, linux3.4.39 + QT5.4 system and ubuntu12.04. The supported drivers are as follows:

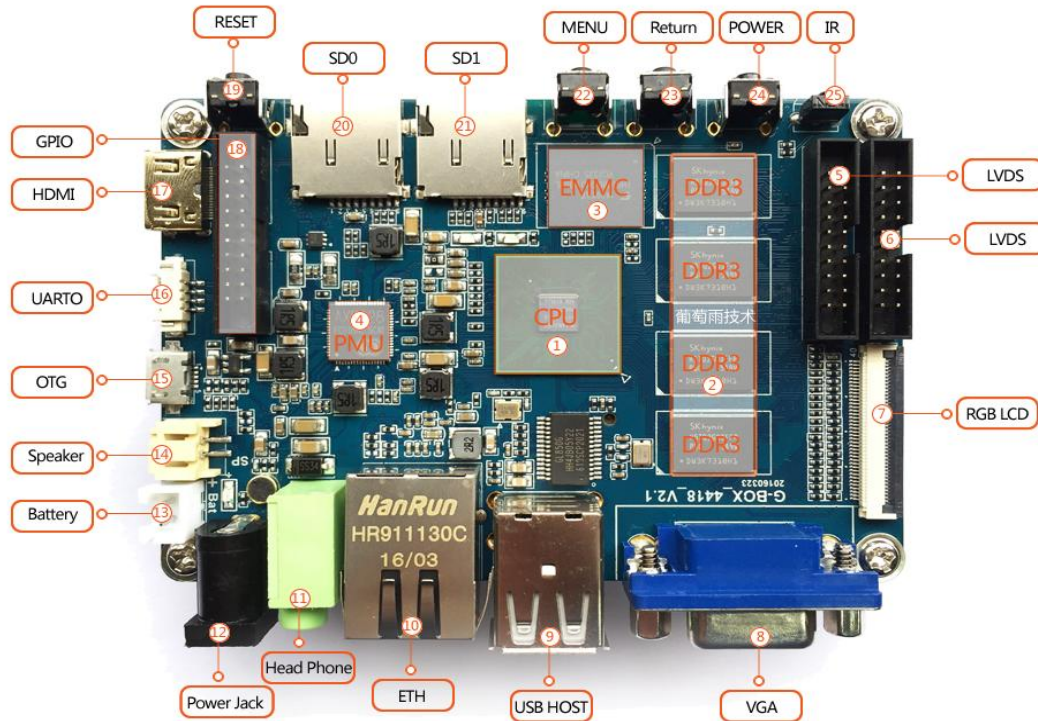
Development platform supported drivers list			
System Drivers	Linux3.4.39 android4.4.2	Linux3.4.39 QT5.4	Linux3.4.39 Ubuntu12.04
7"LCD(1024*600)	√	√	√
4.3"LCD(480*272)	√	√	√
5"LCD(800*480)	√	√	√
LVDS display 10.1"	√	√	√
LVDS display 8"	√	√	√

MIPI display 7"	√	√	√
MIPI display 5.5"	√	√	√
PMIC driver (AXP228)	√	√	√
Capacitive touch	√	√	√
Resistive touch	√	√	√
EMMC driver	√	√	√
SD card driver	√	√	√
Independent key	√	√	√
LED	√	√	√
Buzzer driver	√	√	√
Infrared remote control	√	Application development required	Application development required
Power ON/OFF	√	√	√
Sleep/wake up	√	√	√
2 lane USB HOST driver	√	√	√
1 lane USB OTG driver	√	√	√
Audio (ALC5621)	√	√	√
Recording (ALC5621)	√	√	√
USB WIFI/BT4.0	√	√	√
Parallel port camera driver	√	Application development required	Application development required
Macro camera	√	Application development required	Application development required
Dual lane parallel port camera	Application development required	Application development required	Application development required
USB camera	√	Application development required	√
Dual USB camera	Application development required	Application development required	√
Serial port	√	√	√
HDMI	√	√	√
3G module (USB 3G dongle)	√	Application development required	√
GPS module	√	Application development required	Application development required
Gigabyte Ethernet	√	√	√
USB mouse/keypad	√	√	√
TVIN module(TVP5150)	√	Application development required	Application development required
VGA (SDA7123)	√	√	√

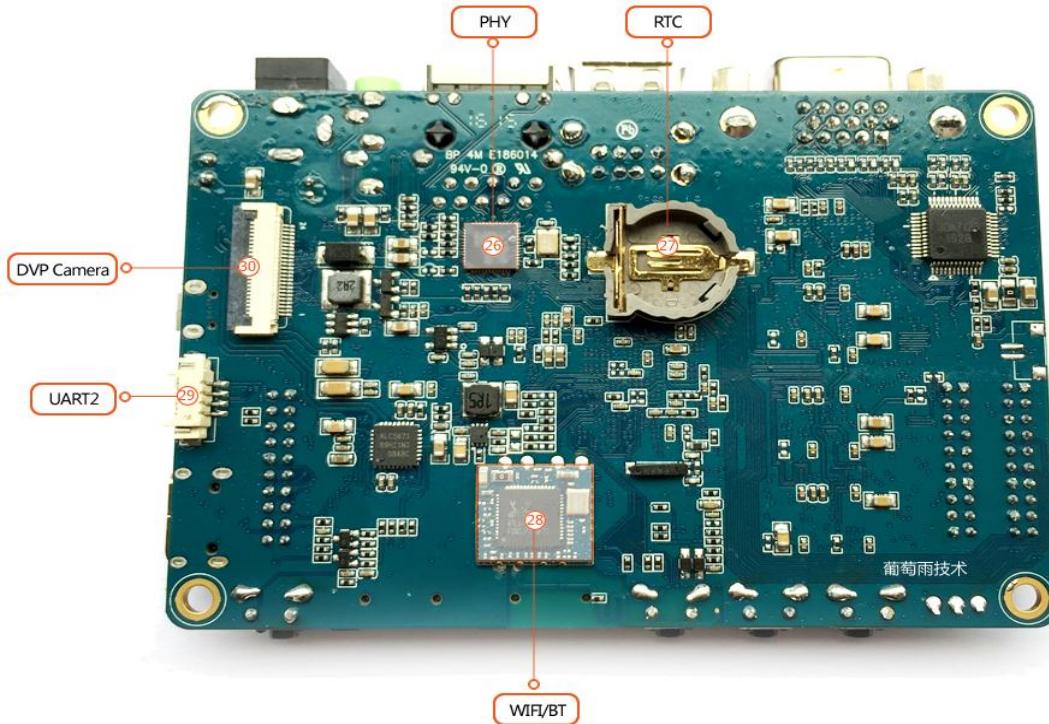
Remarks: The latest released OS is Android, version 4.4.2. And android5.1 is only for customized service clients for the moment.

Chapter 2 Hardware resources

2.1 Hardware interfaces description



G4418 SBC Front View



G4418 SBC Back View

G4418 hardware (front)		
No.	Name	Remarks
【1】	SoC	S5P4418, ARM Cortex A9, 4*1.4GHz
【2】	RAM	DDR3 ,1GB, 2GB optional
【3】	FLASH	8GB , eMMC
【4】	PMU	AXP228
【5】	LVDS interface	For LVDS interface LCD
【6】	MIPI interface	For MIPI interface LCD
【7】	RGB interface	RGB output
【8】	VGA interface	SDA7123
【9】	USB HOST	Double lane HOST
【10】	Gigabyte Ethernet	RJ45
【11】	Head phone interface	Head phone output
【12】	5V in jack	DC power input
【13】	Battery interface	Single 4.2V lithium ion
【14】	Speaker interface	External speaker output
【15】	USB OTG	USB OTG interface
【16】	UART0	Serial port 0, for debugging
【17】	HDMI interface	HDMI output
【18】	Extension GPIO	UART, SPI, I2C, ADC
【19】	Hard reset key	Hard reset
【20】	TF card , SD0	TF card, uses channel 0

【21】	TF card , SD1	TF card, uses channel 1
【22】	Key, user-define	Independent key, as MENU
【23】	Key, user-define	Independent key, as Return
【24】	Power on/off	Sleep/wake up
【25】	IR module	HS0038B IR port

G4418 SBC hardware (back)		
No.	Name	Remarks
【26】	Gigabyte PHY	RT8211E
【27】	RTC	RTC backup battery
【28】	Wifi Bluetooth	RT8723BU, Wifi Bluetooth two-in-one module
【29】	UART2	Serial port 2 , ttl level
【30】	Camera interface	BT601 , BT656 camera interface

2.2 Single board computer start guide

G4418 supports the non-configuration mode of startup, when the development board starts, it will search for bootloader from SD0, SD2 and USB device successively till it gets started. The default SD0 leads to the external TF card, SD2 to EMMC on the SoM. USB device can be connected to PC by OTG cable, we can take the online programming through fastboot.

When there is nothing in EMMC, we can program by an external TF card. Program uboot to TF card, then plug the TF card to the SD0 channel of the development board, start by SD card. Then we can use micro USB extension cable to upgrade the complete img through fastboot. In either way, we can take an off-line upgrade by TF card(boot card), the specific steps can be referred to the document *G4418(Gbox) Upgrade (Program) Manual.pdf*

The development board with normally programmed img can get started after POWER on.

2.3 Extension interface definition

2.3.1 J11 (UART2 interface)

J11 pin definition			
Pin No.	Signal	Pin No.	Signal
1	GND	3	UARTTXD2
2	UARTRXD2	4	VCC3P3_SYS

2.3.2 J10(UART0 interface)

J10 pin definition			
Pin No.	Signal	Pin No.	Signal
1	GND	3	UARTTXD0
2	UARTRXD0	4	VCC3P3_SYS

2.3.3 J15(GPIO interface)

J15 pin definition			
Pin No.	Signal	Pin No.	Signal
1	GND	11	UARTRXD1
2	VBAT_SYS	12	MCU_SPIFRM0
3	PWM2	13	UARTTXD3
4	MCU_SCL_2	14	MCU_SPITXD0
5	GPIOE13	15	UARTRXD3
6	MCU_SDA_2	16	MCU_SPIRXD0
7	GPIOC11	17	MCU_SEN0_INT
8	MCU_SPI_WP	18	ADC0
9	UARTTXD1	19	GPIOB9
10	MCU_SPICLK0	20	ADC1

2.3.4 J14(LVDS extension port)

J14 pin definition			
Pin No.	Signal	Pin No.	Signal
1	VCC3P3_SYS	11	MCU_LVDS_Y2M
2	LCD_5V	12	MCU_LVDS_Y2P
3	MCU_SCL_1	13	GND
4	BL_PWM	14	GND
5	MCU_SDA_1	15	MCU_LVDS_CLKM
6	MCU_TOUCH_INT	16	MCU_LVDS_CLKP
7	MCU_LVDS_Y0M	17	MCU_LVDS_Y3M
8	MCU_LVDS_Y0P	18	MCU_LVDS_Y3P
9	MCU_LVDS_Y1M	19	MCU_NRESETOUT
10	MCU_LVDS_Y1P	20	GND

2.3.5 J13(MIPI extension port)

J13 pin definition			
Pin No.	Signal	Pin No.	Signal
1	VCC3P3_SYS	11	MIPIDSI_DN2
2	LCD_5V	12	MIPIDSI_DP2
3	MCU_SCL_1	13	GND
4	BL_PWM	14	GND
5	MCU_SDA_1	15	MIPIDSI_DNCLK
6	MCU_TOUCH_INT	16	MIPIDSI_DPCLK
7	MIPIDSI_DN0	17	MCU_NRESETOUT
8	MIPIDSI_DP0	18	GND
9	MIPIDSI_DN1	19	MIPIDSI_DN3
10	MIPIDSI_DP1	20	MIPIDSI_DP3

2.3.6 LCD1(LCD & VGA interface)

LCD1 pin definition			
Pin No.	Signal	Pin No.	Signal
1	MCU_BACKLIGHT_PWM	21	L_B0
2	LCD_5V	22	L_B1
3	GND	23	L_B2
4	VCC3P3_SYS	24	L_B3
5	L_R0	25	L_B4
6	L_R1	26	L_B5
7	L_R2	27	L_B6
8	L_R3	28	L_B7
9	L_R4	29	GND
10	L_R5	30	L_DCLK
11	L_R6	31	LCD_EN
12	L_R7	32	LCD_HSYNC
13	L_G0	33	LCD_VSYNC
14	L_G1	34	DE
15	L_G2	35	NC
16	L_G3	36	GND
17	L_G4	37	MCU_SCL_1
18	L_G5	38	MCU_SDA_1
19	L_G6	39	MCU_NRESETOUT
20	L_G7	40	MCU_TOUCH_INT

2.3.7 U451 (Camera interface)

U451 pin definition			
Pin No.	Signal	Pin No.	Signal
1	CAM_PN	13	MCU_CAM1_MCLK
2	GND	14	CAM_D6
3	MCU_SDA_0	15	GND
4	VCC2P8_CAM	16	CAM_D5
5	MCU_SCL_0	17	CAM_CLK
6	CAM_RST	18	CAM_D4
7	CAM_V	19	CAM_D0
8	CAM_PD	20	CAM_D3
9	CAM_H	21	CAM_D1
10	VPP1P8_CAM	22	CAM_D2
11	VPP2P8_CAM	23	NC
12	CAM_D7	24	CAM_PN

2.4 Hardware interface

2.4.1 Power switch and socket



G4418 uses 5V DC power supply, the black socket as shown in the above picture.

2.4.2 Serial port for debugging



G4418 SBC does not reserve RS232 serial port, but the TTL level serial port. There is a 4pin at right below of front of the SBC, its 1.25mm spacing SMT connector corresponds to UART0, there is also a same connector at the opposite side which corresponds to UART1. When using the debugging serial port, please make sure apply the matched serial port pinboard to connect to the corresponding UART0 connector via 4PIN cable. Users can also debug the serial port by modifying the program.

2.4.3 HDMI interface



The universal 24PIN camera interface supports OV, HIMX camera, and leaves out the camera adapter pinboard. It's only needed to adjust the output voltage according to the specification of the camera to adapt different types of camera. Meanwhile, the interface is compatible with TVIN modules TVP5150 and so on.

2.4.4 Camera interface



Camera interface is located on back side of the SBC.

The universal 24PIN camera interface supports OV, HIMX camera, and leaves out the camera adapter pinboard. It's only needed to adjust the output voltage according to the specification of the camera to adapt different types of camera. Meanwhile, the interface is compatible with TVIN modules TVP5150 and so on.

2.4.5 Ethernet interface



G4418 supports gigabyte LAN Ethernet, and onboard RTL8211E chip.

2.4.6 Head phone interface



Plug the headphone in and realize the audio output. Certainly it can be directly connected to the power amplifier input, such as audio input of the home theater to show the audio signal.

2.4.7 Speaker interface



Connect a specified speaker to the interface we can get the speaker output.

2.4.8 Recording interface



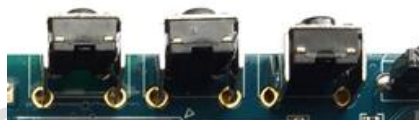
The development board supports recording input. The microphone is soldered onboard, so an external microphone input will not be needed.

2.4.9 TF card slot



G4418 exposes two external TF card slots, matches the channel 0 and 1 of SoC, we can upgrade or store some media files by the channels.

2.4.10 Independent keys



G4418 comes with two independent keys(keys on the left), in schematics, the relationship is as follows:

Switch	Function	Switch	Function
SW1	MEMU(1 st key)	SW2	Return(2 nd key)

The above two independent keys function can be user defined.

The 3rd (on the right) is POWER key, not a programmable independent key.

2.4.11 Debugging LED light



G4418 comes with two debugging LED light, ON/OFF controlled by the IO port program.

2.4.12 Power indicator



There is a power indicator under the power socket. When the power is plugged, system gets started and the indicator turns on.

2.4.13 USB OTG interface



The interface is used for programming, sync, etc, also can be functioned as HOST by a OTG cable.

2.4.14 USB HOST interface



S5P4418 comes with USB HOST interface. It expands to 4 channel of USB HOST2.0 interfaces via it, one of them connects to the onboard USB WIFI Bluetooth 2-in-1 module, two channels are exported and reserved via double-layer USB interface, the last one is left hanging.

2.4.15 Power key



When plugged the external power adapter, system get started automatically. After entering android system, press POWER button to sleep, awake by pressing again. Then press and hold the POWER button and it will show the power off interface, user can shut down according to the display. The left key in the picture above is the POWER.

2.4.16 RESET key



When system is on, press the RESET button to reboot the G4418 SBC, it's a hard reset. The RESET key is on the right side of the TF card slot.

2.4.17 LCD interface



G4418 SBC reserves one 40PIN LCD interface in default, it connects relevant RGB signal to the LCD controller via flexible flat cable, in this way the LCD is controlled. At the same time, the first pin of this 40PIN interface is PWM pin, it's used for controlling the LCD back light and get multi-level light adjust. VGA and LVDS interface are functioned by the interface.

2.4.18 Backup battery



The backup battery is used for keep the RTC working when G4418 SBC power is off, and system time won't lose. When ibox4418 is connected to the lithium ion battery, the RTC will get powered by the lithium ion battery, as long as the lithium ion battery is working, RTC won't lose, so the G6818 does not offer a RTC backup battery in default.

2.4.19 Integrated infrared receiver module



Here HS0038B integrative infrared receiver module is used, featured high sensitivity, convenient to use. Through this module users can realize the wireless remote control.

2.4.20 LVDS interface



S5P4418 chip has LVDS controller onboard, when connected to a LVDS display, it's not needed to add LVDS converter IC. So G4418 SBC has LVDS interface onboard, LCD with LVDS

interface can be driven directly.

2.4.21 MIPI interface



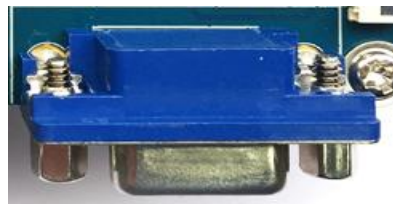
S5P4418 chip has MIPI controller onboard, G4418 SBC has MIPI interface onboard already, LCD with MIPI interface can be driven directly.

2.4.22 Battery socket



G4418 SoM has onboard PMU AXP228 from x-powers, charging and discharging function is supported, and battery interface is reserved for the single board computer power supply. At the same time when connected to a external power adapter, the battery will get charged. The battery socket is located beside the power socket.

2.4.23 VGA interface



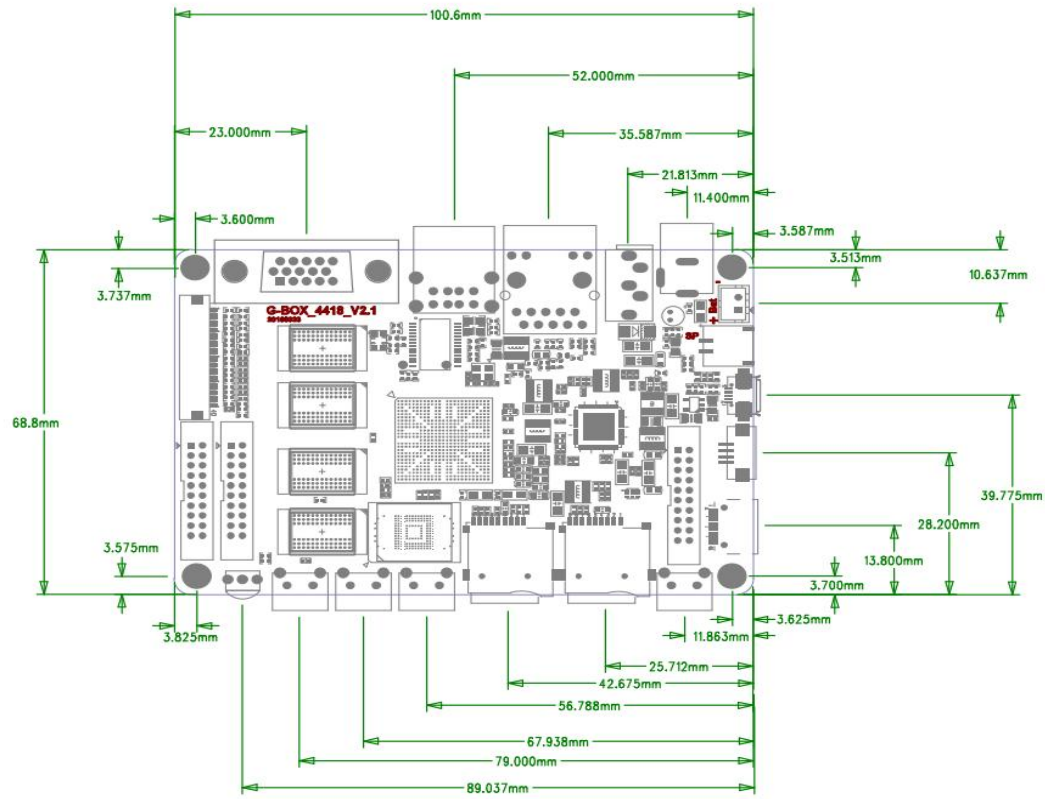
G4418 SBC has onboard VGA interface, which supports 1024x768, 1280x1024, 1920x1080.

2.4.24 WIFI_BT4.0 module



G4418 SBC has onboard WiFi Bluetooth two-in-one module with default PCB antenna, fair average performance in ordinary situation.

2.5 Hardware dimensions



Chapter 3 Packing list

3.1 Standard packing list

Please refer to our website or contact Graperain for details.

3.2 Optional packing list

Please refer to our website or contact Graperain for details.

3.3 Cloud files list

All relevant development data are stored on specified cloud disc, clients can contact Graperain for download links.

The files include complete source codes, building environment, user manuals, detailed step-by-step tutorial, circuit schematics for SoM and development board, programming tools, etc.

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Chapter 4 Product Portfolio

4.1 System-on-Modules

G4418 SoM (SoC is Samsung S5P4418)
G6818 SoM (SoC is Samsung S5P6818)
G210 SoM (SoC is Samsung S5PV210)
M9 SoM (SoC is Qualcomm MSM8916)

4.2 Development Boards

G4418 development board (SoC is Samsung S5P4418)
G6818 development board (SoC is Samsung S5P6818)
G210 development board (SoC is Samsung S5PV210)
M9 development board (SoC is Qualcomm MSM8916)

4.3 Single Board Computers

G4418 SBC (SoC is Samsung S5P4418)
G6818 SBC (SoC is Samsung S5P6818)
G3188 SBC (SoC is Rockchip RK3188)

Instructions: For more detailed specifications and other products, please pay attention to www.graperain.com or contact us directly.