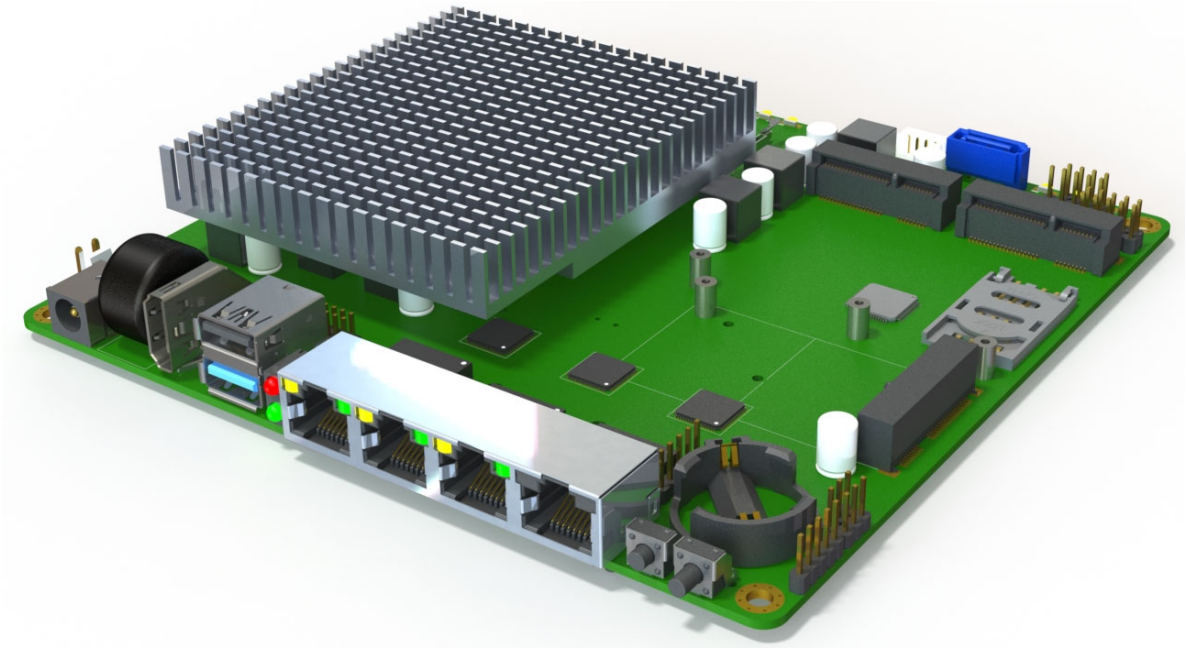


# Broachlink NOAH3 Router Motherboard

# Quick Hardware Manual

V1.0.4

## ORDER INFORMATION

| NO. | Model | Processor | Frequency | Memory | HDMI | LAN | USB | COM | MiniPCIe ( wifi ) | DC IN |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | BL-NOAH3-E3845V10 | E3845 | 1.91GHz | 1 | 1 | 3*WGI211AT | 4 | 3 | 1 | DC12V |

**DESC.**

160*152mm Noah E3845 Motherboard,3wgi211at,3 MiniPCIE slot ( 1 4GLte, 1wifi, 1mSATA/wifi Mux ), without button battery,HDMI,24 CH GPIO,3 serial ( 1rs232 rj45 , 2ttl ),1sata,1 External pluggable SIM holder / 1 internal hinged SIM holder Mux

# Chapter 1 Introduction

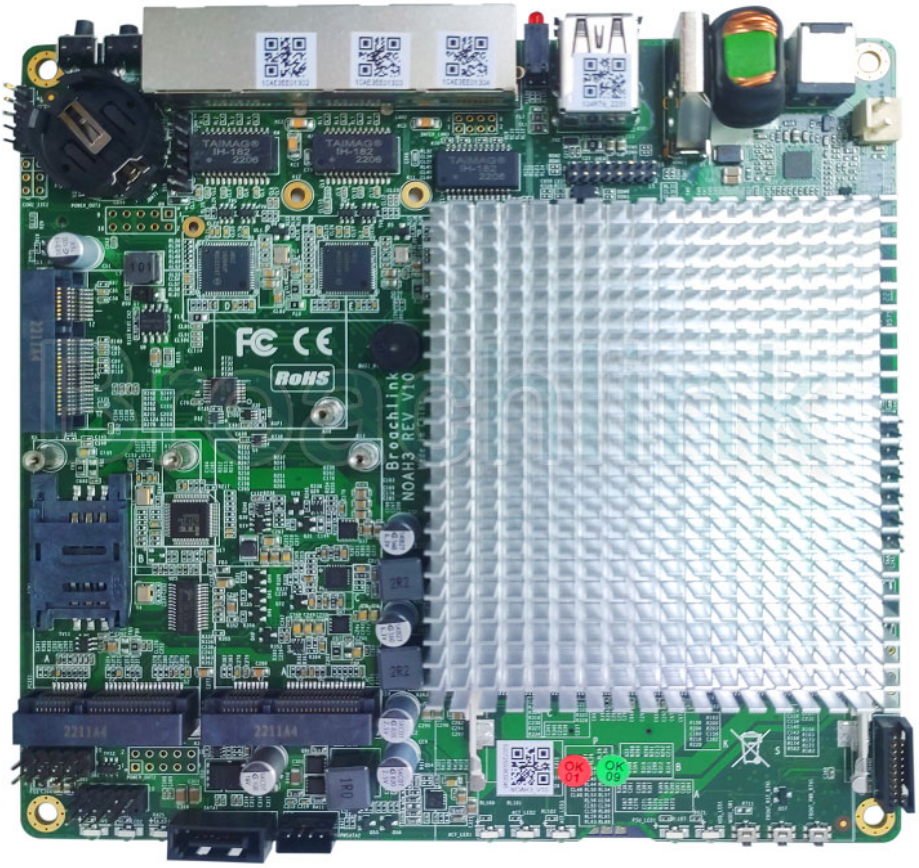
## 1.1 About Noah

Broachlink NOAH series motherboard are designed for fanless network appliance, like router, firewall, VPN, IPBX, IoT gateway etc. Deeply electronic, mechanical, and software optimized for perfect operation on open source operating systems such as CentOS, OpenBSD, OPNsense, and FreeBSD. The ideal choice for open source community users and geek users. The optimized electronic design enables the product to have ultra-low power consumption, which is 20 % lower than competitive products. The enhanced thermal design gives the product a significant stability advantage in a compact housing, especially in a closed housing. The rich extension features allow end users to flexibly respond to various communication scenarios. In order to help customers quickly achieve product launch, we can provide .step 3D files of the product.

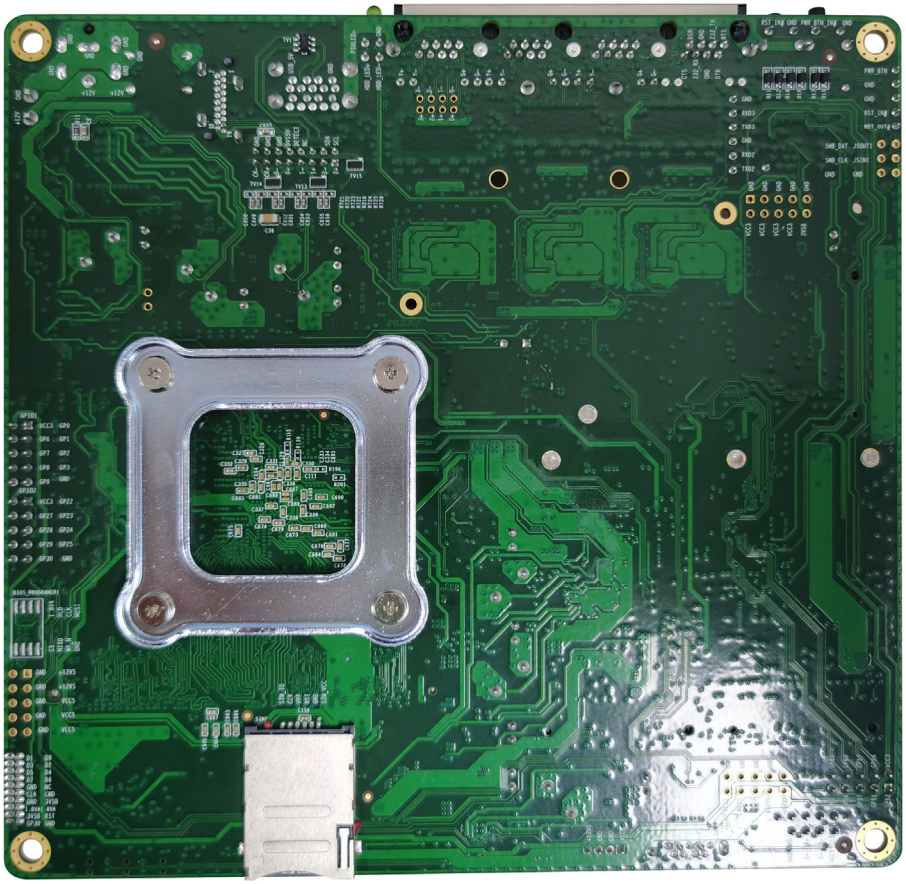
## 1.2 Specification

| | |
|---|---|
| Processor | CPU: Intel Atom E3845 Core: 4 Frequency: 1.91GHz L2 Cache: 2MB AES: AES-NI |
| | BIOS: AMI 64 Mbit |
| Memory | Technology: DDR3L 1333MHz |
| | Max. Capacity: 8 GB |
| | Socket: 1 x 204 pin SODIMM |
| Display | 1 x HDMI Maximum Resolution: up to 2560x1600 at 60 Hz |
| Ethernet | Interface: Up to 3 |
| | Controller: Intel I211 |
| | Connector: RJ45 |
| WatchDog Timer | Output: System reset |
| | Internal Watchdog timer: programmable 1-255s,1-255min, disable |
| Storage | mSATA: 1 x full size mSATA |
| | eMMC: 1 (eMMC 4.5, Support Broachlink eMMC Module) |
| | SATA: 1 x SATAII (Max. Data Transfer Rate up to 3.0 Gb/s) |
| Internal I/O | Up to 3 Serial: 1 x RS-232 ,2xTTL (Transfer rate up to 1 Mbit/s) |
| | HDMI: 1 |
| | Reset Button: 2 |
| | Power Button: 2 (For system wake) |
| | USB: 3 x USB2.0 + 1 x USB3.0 |
| | GPIO: 24-bit GPIOs |
| Expansion | MINI_PCIE1 for 4G / Lte MINI_PCIE2 for Wifi |
| Power | Power input: 12V ±10% only |
| | Power Consumption (Typical,Minimum system) Noah with E3845: 0.5A @ 12V (5.28W) |
| | Power Consumption (Max, test in pfSense) Noah with E3845: 1A @ 12V (12W) |
| Environment | Operating 0 ~ 60° C (32 ~ 140° F) (Operating humidity: 40° C @ 95% RH non-condensing) |
| | Non-Operating -40° C ~ 85° C and 60° C @ 95% RH non-condensing |
| Physical Characteristics | Dimensions (L x W): 160 x 152 mm (6.3" x 5.99") |
| | Weight: 0.45 kg (0.99 lb) (with heatsink) |
| | Total Height: (with cooler + PCB + Bottom) 33mm |

## 1.3 Actual photo



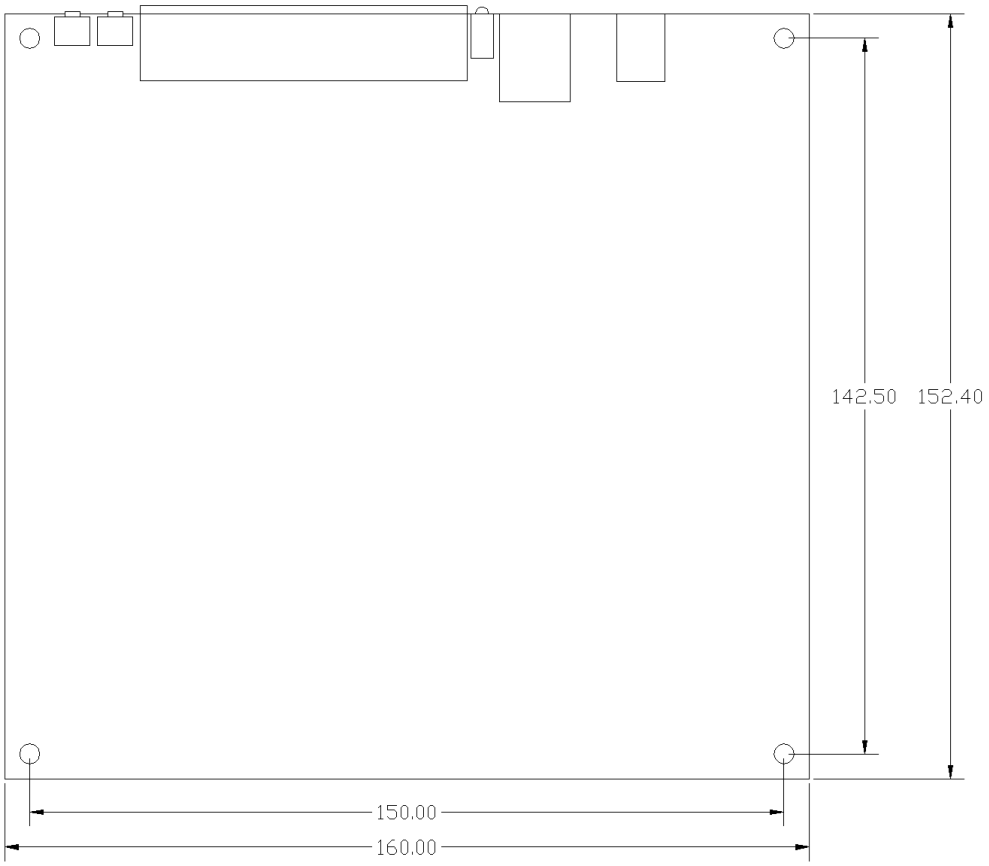

Actual photo at top



Actual photo at bottom

# Chapter 2 Connectors

## 2.1 Dimension

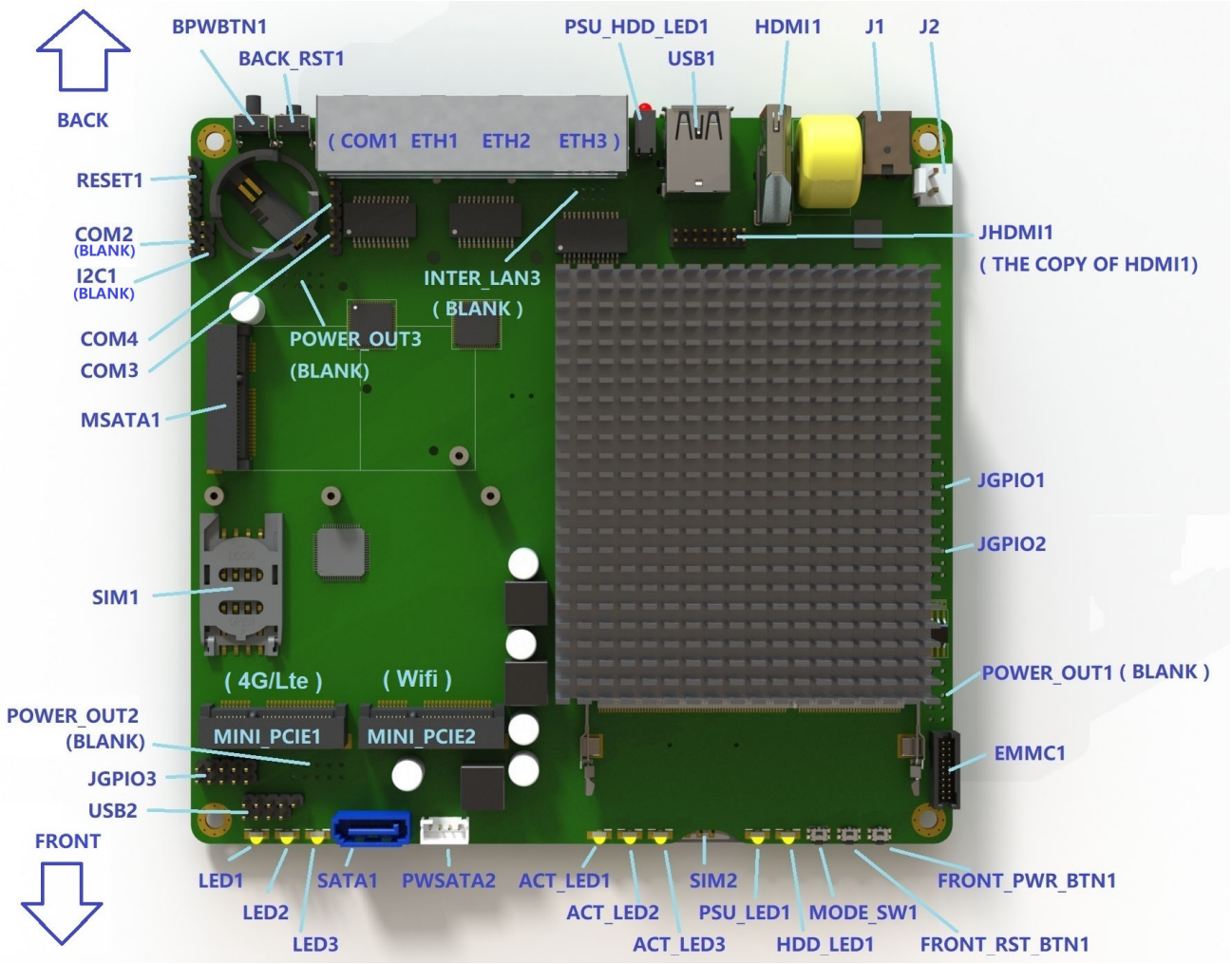



NOAH3 Dimension

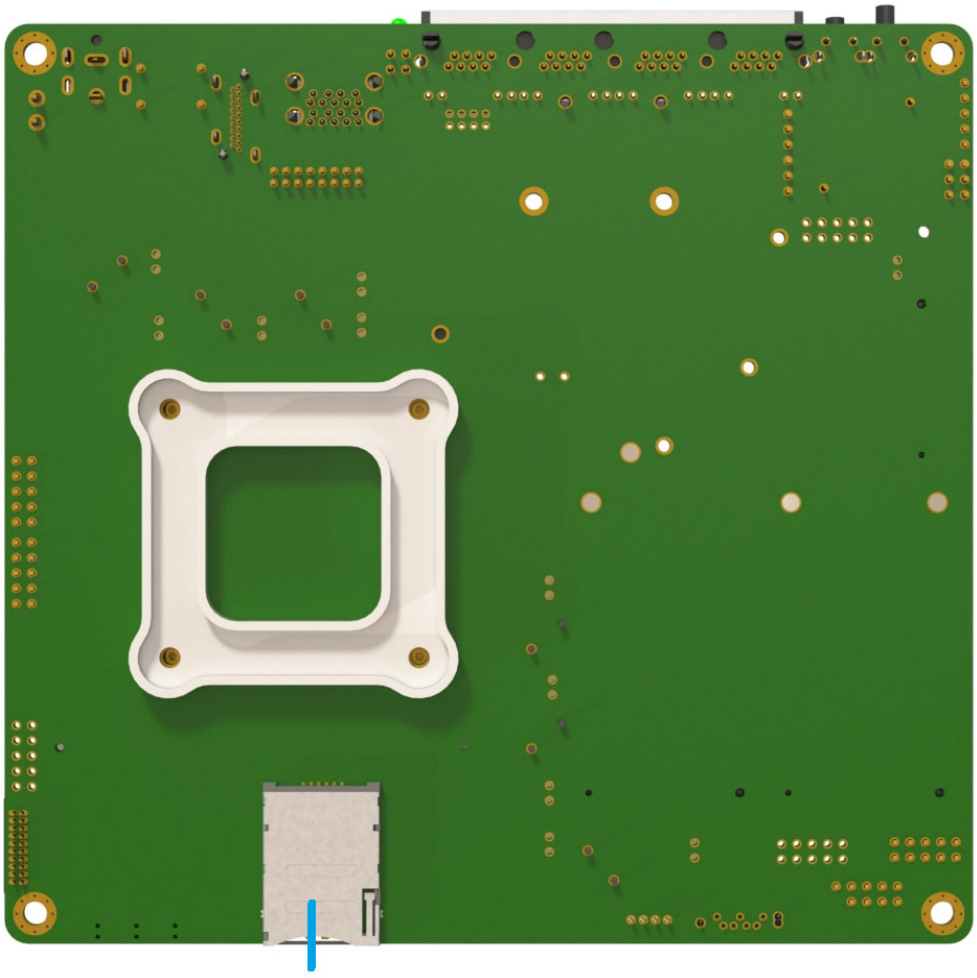
2D/3D file are available. Please contact factory for more info.

broachlink@gmail.com

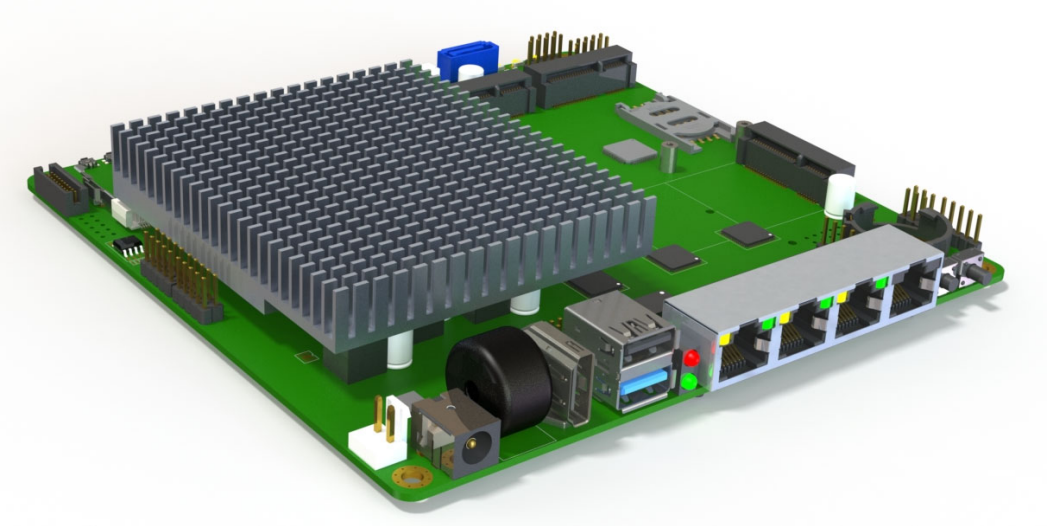
## 2.2 NOAH3 Connector F




NOAH3 connectors layout at top




NOAH3 connectors layout at bottom

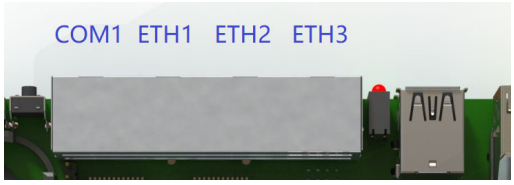


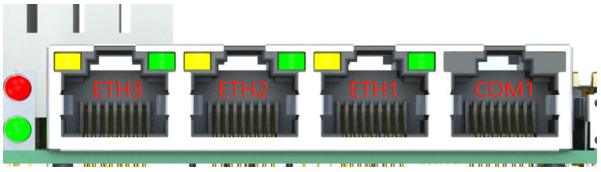
NOAH3 I/O ports layout at back

## 2.3 Connectors List

### COM1 and ETH1,ETH2,ETH3

Compact design for small enclosures.



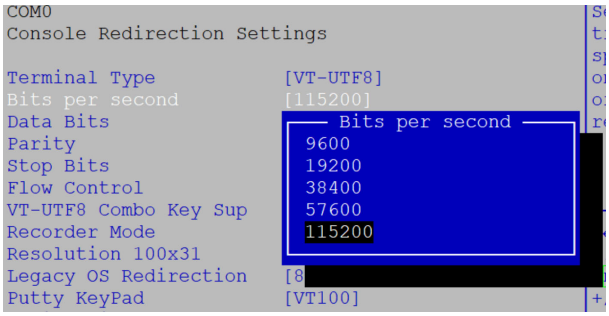

### COM1

RJ45 console port. Support remote PC accessing.

| PIN | NAME | PIN | NAME |
|---|---|---|---|
| 1 | RTS | 2 | DTR |
| 3 | TXD | 4 | GND |
| 5 | GND | 6 | RXD |
| 7 | DSR | 8 | CTS |

Support typical baud rate from 9600bps ~ 115200bps ( 115200 default ).

### Baud rate setting in BIOS




### Baud rate setting in freeBSD

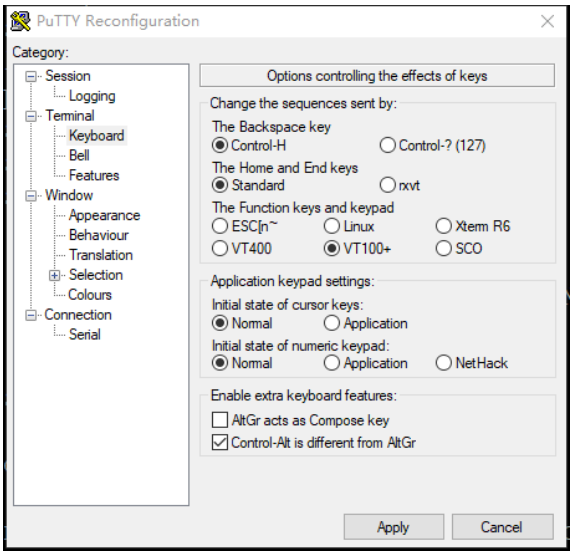
root@:/ # vi /boot/loader.conf

console="comconsole" // select serial port as console

comconsole_speed=115200 // 115200 is recommended

autoboot_delay="0" // waiting time setting

### Recommended settings on PuTTY ( remote windows PC )




**LAN1(ETH1 ~ ETH3) :**

| PIN | NAME | PIN | NAME |
|---|---|---|---|
| 1 | MDI_0+ | 2 | MDI_0- |
| 3 | MDI_1+ | 4 | MDI_2+ |
| 5 | MDI_2- | 6 | MDI_1- |
| 7 | MDI_3+ | 8 | MDI_3- |

In FreeBSD, ETH1~ETH3 correspond to igb0~igb2 respectively.

root@:~ # uname -a

FreeBSD 12.0-RELEASE FreeBSD 12.0-RELEASE r341666 GENERIC amd64

root@:~ # dmesg | grep address

igb0: Ethernet address: 1c:ae:3e:e0:13:7a **ETH1 the network port close to COM1**

igb1: Ethernet address: 1c:ae:3e:e0:13:7b **ETH2**

igb2: Ethernet address: 1c:ae:3e:e0:13:7c **ETH3 network port close to USB connector**

**IP setting**

root@:/ # vi /etc/rc.conf

```
clear_tmp_enable="YES"
sendmail_enable="NONE"
hostname=""
#ifconfig_igb0="DHCP"                                    // dhcp
ifconfig_igb0="inet 192.168.1.210 netmask 255.255.255.0"   // static IP of igb0
ifconfig_igb1="inet 192.168.7.210 netmask 255.255.255.0"
ifconfig_igb2="inet 192.168.8.210 netmask 255.255.255.0"
```

sshd_enable=#"YES"

# Set dumpdev to "AUTO" to enable crash dumps, "NO" to disable

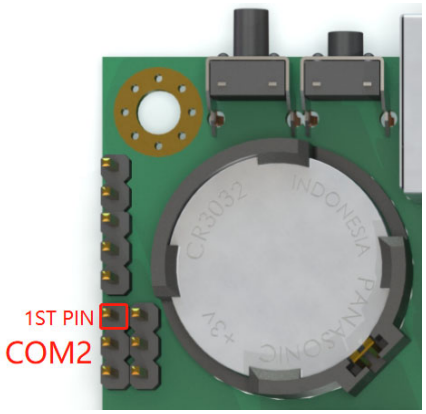
dumpdev="AUTO"

sshd_enable=yes // sshd

### COM2 (BLANK)

It's the copy of RJ45 console port COM1, RS232 level.

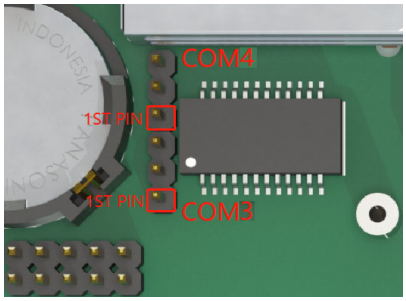
The port would be available as soon as pin header soldered.




| PIN | NAME |
|---|---|
| 1 | TXD |
| 2 | RXD |
| 3 | GND |

### COM3 ~ COM4 (TTL level)

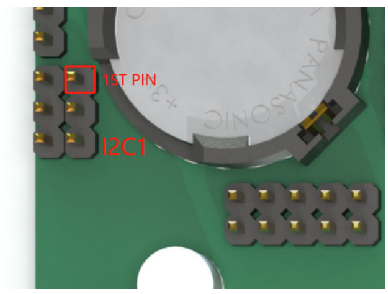
The both TTL level serial pin headers are from a USB bus convert chip CH340.




| PIN | NAME |
|---|---|
| 1 | TXD |
| 2 | RXD |
| 3 | GND |

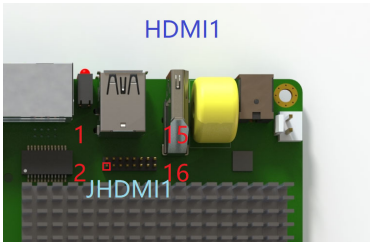
### I2C1(BLANK):

The port would be available as soon as pin header soldered.




| PIN | NAME |
|---|---|
| 1 | DATA |
| 2 | CLK |
| 3 | GND |

## HDMI Connector ( HDMI1 )

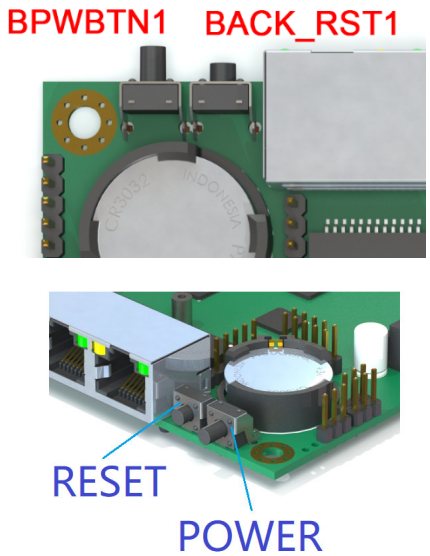



JHDMI is the copy of HDMI1, prepared for the client who needs HDMI pin header inside. User can enable JHDMI by removing 8 resistors RDM1 ~ RDM8.

### JHDMI1

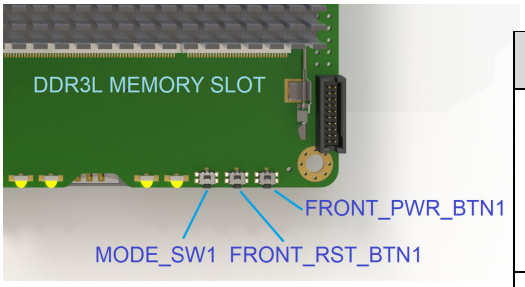
| PIN | NAME | PIN | NAME |
|---|---|---|---|
| 1 | 2+ | 2 | HDMI_SCL |
| 3 | 2+ | 4 | HDMI_SDA |
| 5 | 1+ | 6 | NC |
| 7 | 1- | 8 | DETECT |
| 9 | 0+ | 10 | DVI_5V (OFF IN S4) |
| 11 | 0- | 12 | GND |
| 13 | CLK+ | 14 | GND |
| 15 | CLK- | 16 | GND |

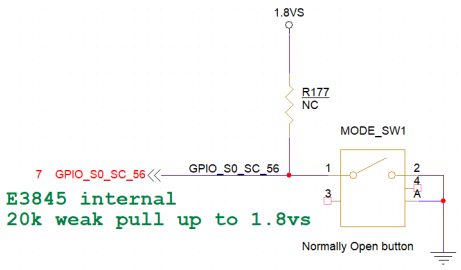
### BPWBTN1 & BACK_RST1




| PIN | NAME |
|---|---|
| BPWBTN1 | Power button |
| BACK_RST1 | Reset button |

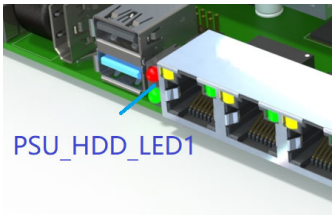
## FRONT_PWR_BTN1 & FRONT_RST_BTN1 & MODE_SW1



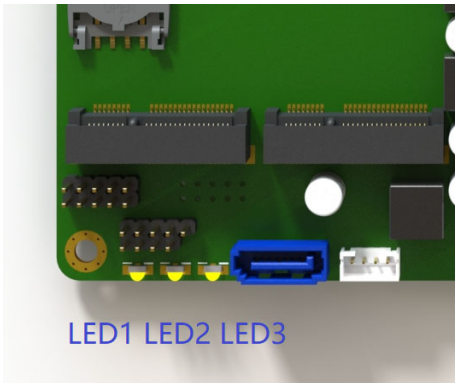

| PIN | NAME |
|---|---|
| FRONT_PWR _BTN1 | POWER BUTTON . the copy of the BPWBTN1 |
| FRONT_RST _BTN1 | RESET BUTTON the copy of the BACK_RST1 |
| MODE_SW1 | GPIO pin. Wired out from GPIO_S0_SC56 of SOC ( pin BC12 ). |

## PSU_HDD_LED1

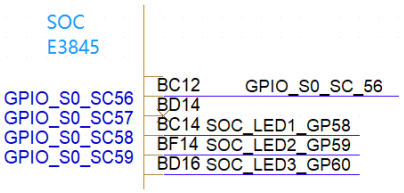

| NAME | FUNCTION |
|---|---|
| RED LED | HDD Activity light, blink when HDD in reading/writing. |
| GREEN LED | Power Status. Light off in case system is in shutdown |

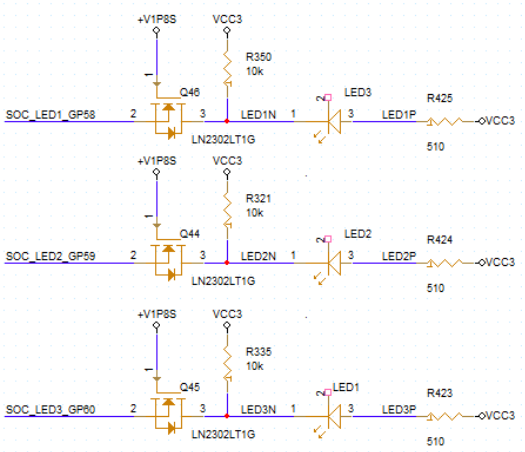
## LED1,LED2,LED3

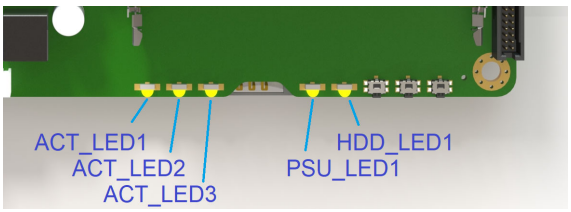



| NAME | FUNCTION |
|---|---|
| LED1 | GPIO pin. Wired out from GPIO_S0_SC60 of SOC ( pin BD16 ). |
| LED2 | GPIO pin. Wired out from GPIO_S0_SC59 of SOC ( pin BF14 ). |
| LED3 | GPIO pin. Wired out from GPIO_S0_SC58 of SOC ( pin BC14 ). |

## HDD_LED1,PSU_LED1,ACT_LED1,ACT_LED2,ACT_LED3



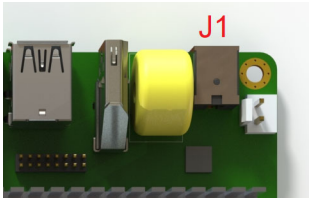



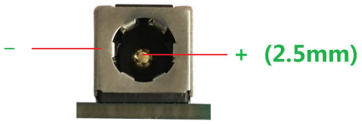




| NAME | FUNCTION |
|---|---|
| HDD_LED1 | HDD Activity light, blink when HDD in reading/writing. |
| PSU_LED1 | Power Status. Always on when the PSU is plugged in, regardless of whether the system is in shutdown ( S4 ). |
| ACT_LED1~3 | Activity LED1~3 of ETH1~3 |

### J1

12V power in connector, 5.5mm/2.5mm.



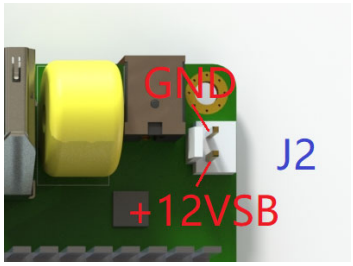




| PIN | NAME |
|---|---|
| Central pin | +12VSB ( ALWAYS ON) |
| Another pin | GND |

### J2

J2 is the copy of J1, it can be arranged for input or output, depends on client's demand.

Compatible with Broachlink UPS,POE,PSE cards.




| PIN | NAME |
|---|---|
| 1 | +12VSB ( ALWAYS ON ) |
| 2 | GND |

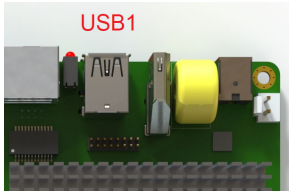
Caution:

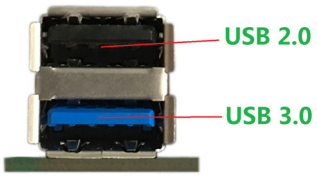
**12V_S** ( OFF IN S4) and +12VSB ( ALWAYS ON) are different power rail.

Must not wire +12VSB to 12V_S , Short them would damage the motherboard.

## USB1

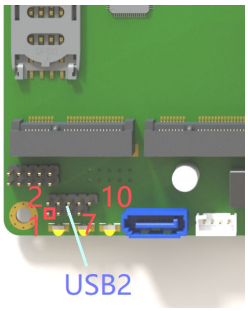
The port consists of 1* USB2.0 and 1* USB3.0.




| Position | USB Speed |
|---|---|
| Upper port | USB2.0 |
| Lower port | USB3.0 |

## USB2

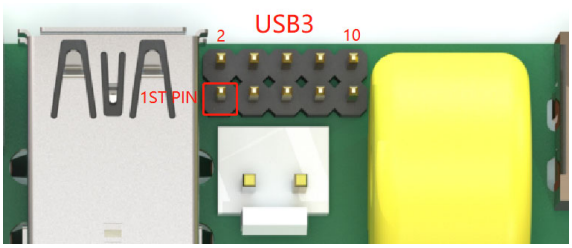



| PIN | NAME | PIN | NAME |
|---|---|---|---|
| 1 | VCC | 2 | VCC |
| 3 | D0- | 4 | D1- |
| 5 | D0+ | 6 | D1+ |
| 7 | GND | 8 | GND |
| 9 | / | 10 | GND |

## USB3 ( BLANK )

The pin header is not soldered by default. The port is the copy of USB3.0 of USB1.

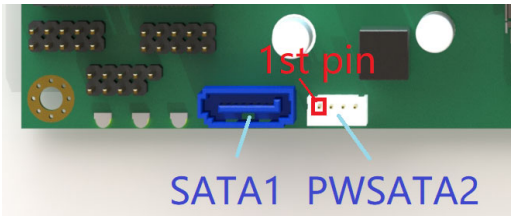
The port would be available as soon as pin header soldered.




| PIN | NAME | PIN | NAME |
|---|---|---|---|
| 1 | VCC | 2 | USB3_RXP0 |
| 3 | USB_N0 | 4 | USB3_RXN0 |
| 5 | USB_P0 | 6 | GND |
| 7 | GND | 8 | USB3_TXP0 |
| 9 | GND | 10 | USB3_TXN0 |

## SATA1,PWSATA2

Support SATA 3.5/2.5 inch Hard drive. SATA 2.0 , 3.0 Gb/s (300 MB/s)




### SATA1 definition

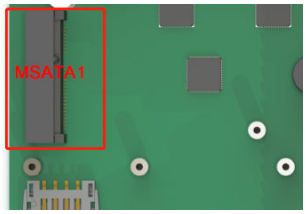
| PIN | NAME |
|---|---|
| 1 | GND |
| 2 | TXP |
| 3 | TXN |
| 4 | GND |
| 5 | RXN |
| 6 | RXP |
| 7 | GND |

### PWSATA2 definition

| PIN | NAME |
|---|---|
| 1 | VCC |
| 2 | GND |
| 3 | GND |
| 4 | 12V_S |

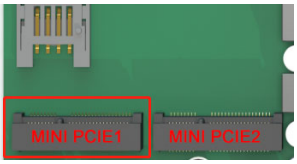
## mSATA1 (SSD)

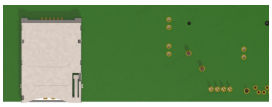
Support mSATA SSD. SATA 2.0 , 3.0 Gb/s (300 MB/s)



## MINI_PCIe1 (4G/Lte)

Support 4G/LTE module with SIM1/2 SIM holder.SIM2 ( bottom ) is the copy of SIM1, prepared for the client who needs inserting the SIM card from outside the enclosure.

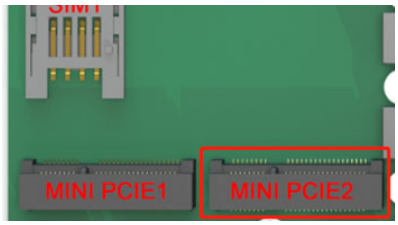


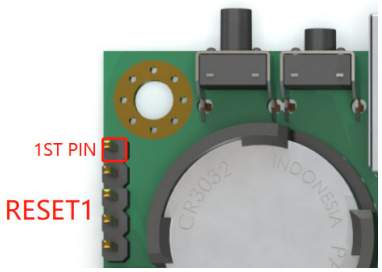
SIM2 ( COPY OF SIM1 )

## MINI_PCIe2 (Wifi)

The slot support the wifi cards, PCIe Gen2. Broachlink mini PCIe cards are compatible with it.



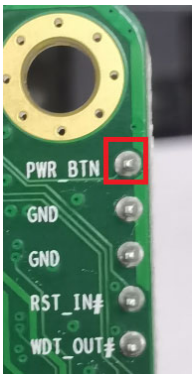

## RESET1




| PIN | NAME |
|---|---|
| 1 | Power button |
| 2 | GND |
| 3 | GND |
| 4 | RESET# |
| 5 | Watchdog_trigger# out.<br>Active-Low level |

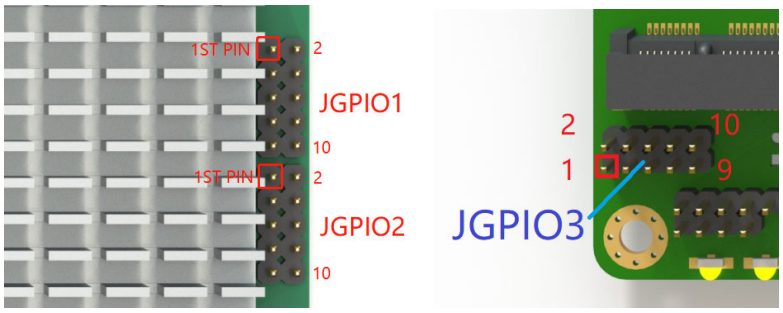
Shorting pin 4~5 means the watchdog will trigger a system reset after WDT timeout.

Users can refer to the marks on the PCB to wire out the pin headers.




## JGPIO1,JGPIO2,JGPIO3

NOAH3 has three 10-pin headers that support up to 24 channels 3.3V GPIO signals. 16 channels are controlled by SOC E3845, and the remaining 8 channels are controlled by SUPER IO IT8772.




**JGPIO1 (SOC source)**

| PIN | NAME | PIN | NAME |
|---|---|---|---|
| 1 | GP0 | 2 | VCC3 |
| 3 | GP1 | 4 | GP6 |
| 5 | GP2 | 6 | GP7 |
| 7 | GP3 | 8 | GP8 |
| 9 | GND | 10 | GP9 |

**JGPIO2 (SOC source)**

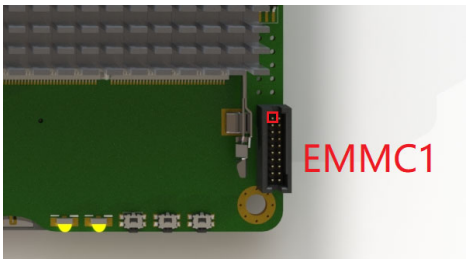
| PIN | NAME | PIN | NAME |
|---|---|---|---|
| 1 | GP22 | 2 | VCC3 |
| 3 | GP23 | 4 | GP27 |
| 5 | GP24 | 6 | GP28 |
| 7 | GP25 | 8 | GP29 |
| 9 | GND | 10 | GP30 |

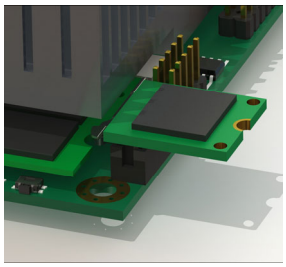
**JGPIO3 (Super I/O source)**

| PIN | NAME | PIN | NAME |
|---|---|---|---|
| 1 | GP52 | 2 | 3.3V |
| 3 | GP51 | 4 | GP56 |
| 5 | GP37 | 6 | GP57 |
| 7 | GP36 | 8 | GP60 |
| 9 | GND | 10 | GP61 |

*In order to help developers carry out secondary development on NOAH, broachlink has released GPIO development tools, including BL-GPIO-KIT (purchase separately) 3 x 8 CH GPIO card, and FreeBSD, Linux, windows demo code. Contact broachlink@gmail.com for more info.*

**eMMC1**



| PIN | NAME | PIN | NAME |
|---|---|---|---|
| 1 | eMMC_D0 | 2 | eMMC_D1 |
| 3 | eMMC_D2 | 4 | eMMC_D3 |
| 5 | eMMC_D4 | 6 | eMMC_D5 |
| 7 | eMMC_D6 | 8 | eMMC_D7 |
| 9 | NC | 10 | GND |
| 11 | eMMC_CMD | 12 | eMMC_CLK |
| 13 | 3.3VSB | 14 | GND |
| 15 | 1.8VSB | 16 | 1.8VSB |
| 17 | eMMC_RESET | 18 | 3.3VSB |
| 19 | GND | 20 | GND |

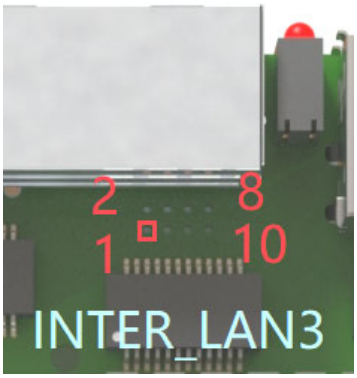
# Appendix:

*Some pin headers are not soldered by default. Developers & system integrators can use them flexibly as needed.*

### *INTER_LAN3 ( BLANK )*

*The pin header is not soldered by default.*

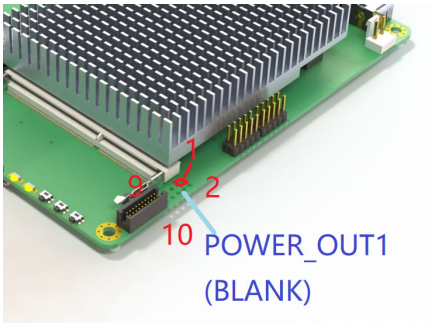
*It's the copy of ETH3.Some user need to internal interconnect it to other cards inside appliance.*




| PIN | NAME | PIN | NAME |
|---|---|---|---|
| 1 | MDI_0+ | 2 | MDI_0- |
| 3 | MDI_1+ | 4 | MDI_1- |
| 5 | MDI_2+ | 6 | MDI_2- |
| 7 | MDI_3+ | 8 | MDI_3- |

### *POWER_OUT1 (BLANK)*

*The pin header is not soldered by default.*




| PIN | NAME | PIN | NAME |
|---|---|---|---|
| 1 | 12V_S ( OFF IN S4) | 2 | GND |
| 3 | 12V_S ( OFF IN S4) | 4 | GND |
| 5 | VCC | 6 | GND |
| 7 | VCC | 8 | GND |
| 9 | VCC | 10 | GND |

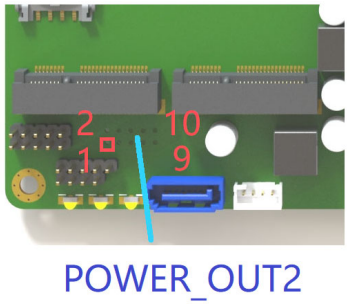
Caution:

**12V_S** ( OFF IN S4) and +12VSB ( ALWAYS ON) are different power rail.

Must not wire +12VSB to 12V_S , Short them would damage the motherboard.

### *POWER_OUT2 ( BLANK )*

*The pin header is not soldered by default.*

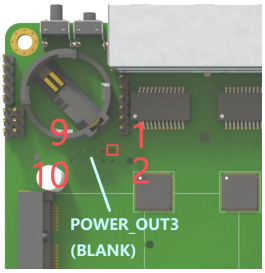



| PIN | NAME | PIN | NAME |
|---|---|---|---|
| 1 | 12V_S ( OFF IN S4) | 2 | GND |
| 3 | 12V_S ( OFF IN S4) | 4 | GND |
| 5 | VCC | 6 | GND |
| 7 | VCC | 8 | GND |
| 9 | VCC | 10 | GND |

*VCC ( 5V voltage , OFF IN S4 )*

### *POWER_OUT3 ( BLANK )*

*The pin header is not soldered by default.*




| PIN | NAME | PIN | NAME |
|---|---|---|---|
| 1 | GND | 2 | 3.3V |
| 3 | GND | 4 | 3.3V |
| 5 | GND | 6 | 3.3V |
| 7 | GND | 8 | 3.3V |
| 9 | GND | 10 | 3.3VSB (ALWAYS ON) |

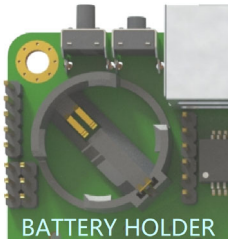
Caution:

**3.3V** ( Alias VCC3, Off in S4) and 3.3VSB ( ALWAYS ON) are different power rail.

Must not wire 3.3V to 3.3VSB , Short the both rail would damage the motherboard.

### *Battery slot ( No battery )*

*For safe transportation reasons, the button battery is not assembled by default.*




| PIN | NAME |
|---|---|
| Central pin | Negative |
| Another pin | Positive |