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Connecting ethernet LAN8720 and ESP32 Devkit C, ESP32 Devkit V1

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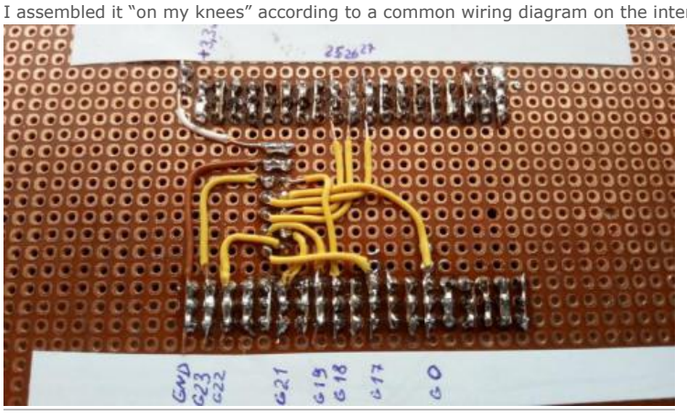
Fri, 21/02/2020 - 16:57

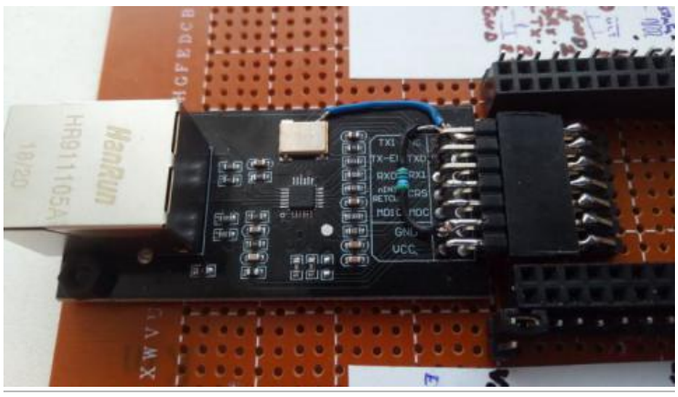
slider
Offline
Registered: 06/17/2014

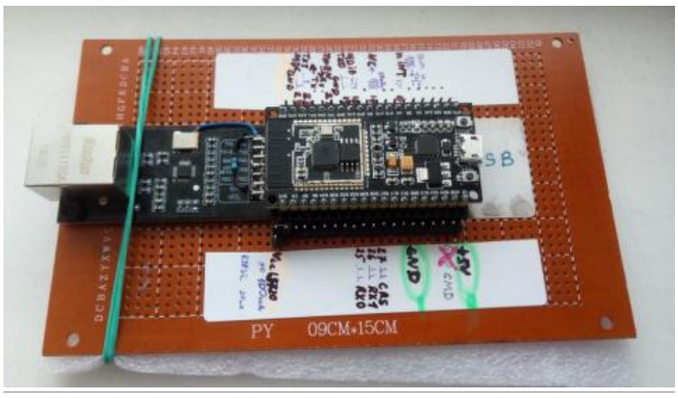
The module is much cheaper than the W5500, but there may be connection problems.
I spent a lot of time investigating why the scheme from the internet didn't work, so I'll save my experience here. I came across unanswered questions on the internet why this scheme also didn't work for some people, I had to figure it out myself.

On the Internet, the main connection diagrams for the module are **ESP32 Devkit C** , and it is an extended version of **ESP32 Devkit V1** . It additionally contains 7 pins, which are not desirable for the average user, otherwise they will clog the ESP32.
- one is GPIO0, if there is log.0 on it (or even log1 from external 1.8V logic, or this logic itself hangs on it), then when the ESP32 starts, it will be regarded as an input to programming, and it will not start the program . On the module, GPIO0 is connected to the FLASH (BOOT) button, and is pulled by a 4.7k...10k resistor to +3.3V. Sometimes the button on the module goes through a 470 ohm resistor, which may be too much for the module to respond to it when connected to something else. As is the Reset button.
- 6 pins along which the ESP32 is loaded from its memory chip. And then the problem was that the Chinese signed one pin - "GND" instead of CMD. + the usual jamb is a small 0.1 µF condenser or its absence parallel to the Reset button, but it should be 1 µF, because of this I had to press the FLASH (BOOT) button to load the sketch.
The use of **Devkit C** was chosen due to the possibility of 50 MHz clocking (synchronization) from the LAN8720 towards the ESP32, thanks to the hardware capabilities of GPIO0. But this can be bypassed with settings in the sketch, perhaps. not for the sake of ethernet stability in conjunction with the **Devkit V1** module .

I assembled it "on my knees" according to a common wiring diagram on the internet (checking it later with the diagram)







One 4.7k resistor between GND and NC (pin not connected anywhere, reserve), with wiring to the Enable pin of the active quartz. He turns off the quartz while the program starts, then the program via GPIO17 sends log1 through this NC pin, and it starts the quartz, taking it out of the Z-state. Otherwise, when power is applied, the quartz output via the nINT/RETCLK pin will go to GPIO0, and the ESP32 will refuse to start.
The second resistor is already on the ESP32 module (it pulls GPIO0 BOOT to +3.3V), I did not install it.

The standard sketch *\WiFi\examples\ETH_LAN8720_internal_clock* from the ESP32 Arduino kit appears after selecting the ESP32 board
// in my case, the very first one in the list is ESP32 Dev Module, because it will then allow you to select a soldered flash from 32Mbit (4MByte) to 128Mbit (16MByte) in the "tools" tab. mikruhi in chipdeep GD25Q127csigr, GD25Q127cyigr, W25Q128jveiq, ...

The sketch receives a dynamic IP from your router via LAN, contacts Google, and receives the date and time from it. The entire process is output to the port monitor.

In the sketch you need to set the pins correctly:

```
#include <ETH.h>

/*  куда выдавать синус 50МГц для модуля интернет
   * ETH_CLOCK_GPIO0_IN   - default: external clock from crystal oscillator
   * ETH_CLOCK_GPIO0_OUT  - 50MHz clock from internal APLL output on GPIO0 - possibly an inverter is needed for LAN8720
   * ETH_CLOCK_GPIO16_OUT - 50MHz clock from internal APLL output on GPIO16 - possibly an inverter is needed for LAN8720
   * ETH_CLOCK_GPIO17_OUT - 50MHz clock from internal APLL inverted output on GPIO17 - tested with LAN8720
*/

#define ETH_CLK_MODE    ETH_CLOCK_GPIO0_IN

// Pin# of the enable signal for the external crystal oscillator (-1 to disable for internal APLL source)
#define ETH_POWER_PIN  17  // -1

// Type of the Ethernet PHY (LAN8720 or TLK110)
#define ETH_TYPE        ETH_PHY_LAN8720

// I²C-address of Ethernet PHY (0 or 1 for LAN8720, 31 for TLK110)
#define ETH_ADDR 1 //  0- не работает  E (1034) emac: Timed out waiting for PHY register 0x2 to have value 0x0007(mask 0xffff). Current value 0xffff

// Pin# of the I²C clock signal for the Ethernet PHY
#define ETH_MDC_PIN     23 // 15

// Pin# of the I²C IO signal for the Ethernet PHY
#define ETH_MDIO_PIN    18 // 2
```

And there is a second type of working connection, when clocking occurs from the ESP32 to the LAN8720. I don't know about its effect on processor load and stability.
here are several variations:

1. clocking from GPIO0.
In the sketch, on the contrary, you need to output 50 MHz on GPIO0, and not receive it. and quartz control will not be needed,

```
#define ETH_CLK_MODE    ETH_CLOCK_GPIO0_OUT

// Pin# of the enable signal for the external crystal oscillator (-1 to disable for internal APLL source)
#define ETH_POWER_PIN  -1 // 17 -1
```

the wire from GPIO17 must be disconnected, this pin is released.
It turns out that you can do without resistors by short-circuiting the Enable pin of the quartz on the LAN8720 to a nearby GND. The NC pin is not used.

2. clocking from GPIO17.
This option is suitable if you only have **ESP32 Devkit V1,** and wiring the module on GPIO0 to implement the first option is somehow ugly.
in the sketch we indicate the clocking from GPIO17

```
#define ETH_CLK_MODE    ETH_CLOCK_GPIO17_OUT

// Pin# of the enable signal for the external crystal oscillator (-1 to disable for internal APLL source)
#define ETH_POWER_PIN  -1 // 17 -1
```

In hardware, same as above, the quartz must be turned off, the nINT/RETCLK pin must be connected to GPIO17, not to GPIO0. The NC pin is not used. Judging by the comment in the sketch, this option has been tested normally.

// I also noticed that the LAN8720 module can rarely freeze, so if the object is remote, it would be good to juggle its power supply with a free ESP32 pin. The current consumption of the LAN8720 in operation is up to 90mA, which is much less than the W5500. The ESP32 stub is on the module, it can be easily removed. Perhaps the current depends a little on the length of the wire to the router/switch.

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Sun, 17/05/2020 - 12:17 #1

workpage
Offline
Registered: 05/17/2020

I started dev v1 + 8720 with clocking from pin 17. I confirm. Works. This is probably the best connection option. There is no dancing with a tambourine around gpio0. A huge advantage of this connection is the fact that all software written for wifi works on ethernet with virtually no modifications. For this reason, I had to hack up the finished w5500 board and redo everything on the 8720.

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Sat, 06/27/2020 - 23:44 #2

Igor Igor
Offline
Registered: 06/27/2020

I have a LOLIN32 Lite board. It lacks GPIO21!

Is it possible to override the EMAC_TX_EN signal to another GPIO?

I read somewhere that in ESP32 you can override any GPIO.

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Thu, 02/07/2020 - 09:40 #3

workpage
Offline
Registered: 05/17/2020

slider, Tell me. How do you detect that the 8720 is frozen?

I encountered the fact that sometimes during startup the activity indicator constantly blinks and there is no connection. Sees cable disconnection/connection. Reset solves it.

Update

Found the reason for the bad start. Resistor R1 at 12.1k must EXACTLY match the nominal value. Otherwise there will be glitches. The issue with the reboot detection remains.

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Thu, 04/14/2022 - 12:12 #4

d13lider

Offline
Registered: 10/19/2015

tell me where I can reassign the pins and whether they will work on other ports

all the necessary pins are already occupied under rs485(uart2), spi, i2c, uart0.

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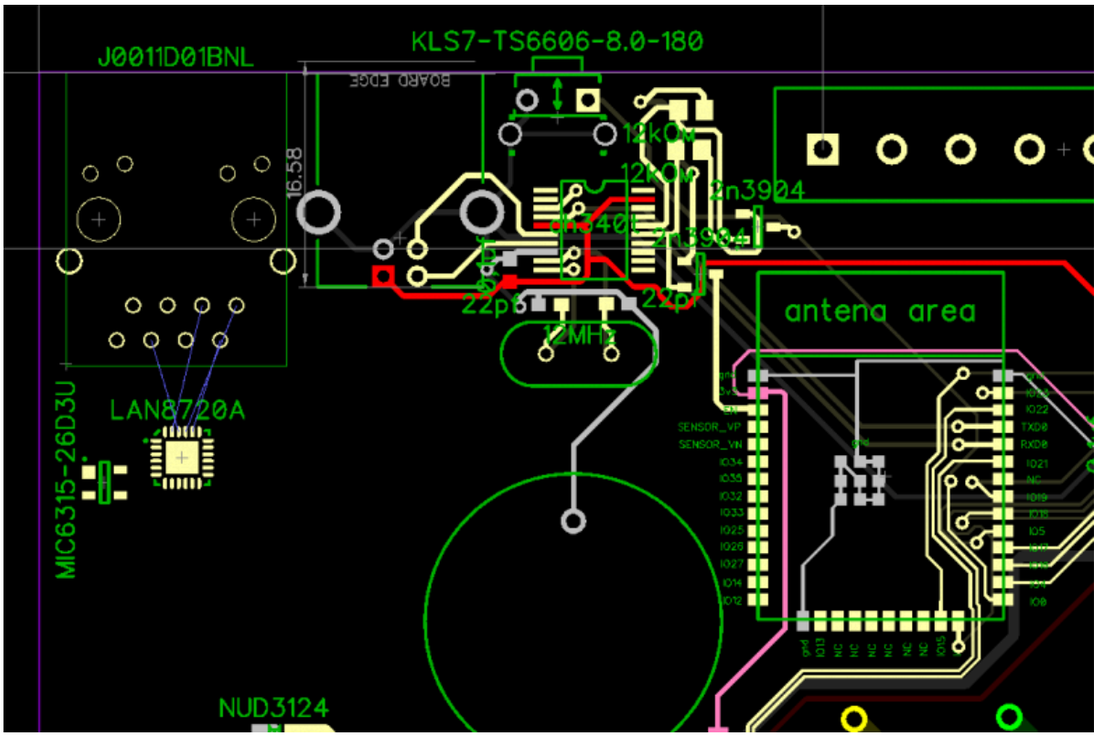
Thu, 04/14/2022 - 12:14 #5

d13lider

Offline
Registered: 10/19/2015



> ***slider* writes:**

Please tell me, I'm currently developing a board, there are only free pins 12,13,14, 25,26,27, 32,33, 34,35, VN, VP.

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Mon, 15/08/2022 - 21:04 #6

ua6em

somehow the topic died out!

Offline

Registered:
08/17/2016

It didn’t start right away, in the port monitor -
rst:0x1 (POWERON_RESET),boot:0x13 (SPI_FAST_FLASH_BOOT)
configsip: 0, SPIWP:0xee
clk_drv:0x00,q_drv:0x00,d_drv:0x00,cs0_drv:0x00,hd_drv:0x00, wp_drv: 0x00
mode:DIO, clock div:1
load:0x3fff0030,len:1420
ho 0 tail 12 room 4
load:0x40078000,len:13540
load:0x40080400,len:3604
entry 0x400805f0
ets Jun 8 2016 00:22:57

rst:0x1 (POWERON_RESET),boot:0x3 (DOWNLOAD_BOOT(UART0/UART1/SDIO_REI_REO_V2))
waiting for download

sketch:

show code

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Tue, 16/08/2022 - 02:29 #7

rkit

Offline

Registered:
11/23/2016

IO0 release.

On the Chinese module you need to turn off the quartz with an additional pin. Search, all the information is there.

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Login to post comments

Tue, 16/08/2022 - 19:16 #8

ua6em

Offline

Registered:
08/17/2016

> ***rkit* writes:**
>
> IO0 release.
>
> On the Chinese module you need to turn off the quartz with an additional pin. Search, all the information is there.

pin not connected:

However, zhzh... and then nothing... on the LAN the yellow light is on and the green blinks...

setCpuFrequencyMhz(): PLL: 480 / 2 = 240 Mhz, APB: 80000000 Hz
[1650][V][WiFiGeneric.cpp:352] _arduino_event_cb(): Ethernet Started
[1651][D][WiFiGeneric.cpp:831] _eventCallback (): Arduino Event: 18 - ETH_START
[1653][V][WiFiGeneric.cpp:344] _arduino_event_cb(): Ethernet Link Up
[1659][D][WiFiGeneric.cpp:831] _eventCallback(): Arduino Event: 20 - ETH_CONNECTED
[1664][V][WiFiGeneric.cpp:359] _arduino_event_cb(): Ethernet got newip:192.168.1.197
[1674][D][WiFiGeneric.cpp:831] _eventCallback(): Arduino Event: 22 - ETH_GOT_IP
[1681][D][WiFiGeneric.cpp:916] _eventCallback(): ETH IP: 192.168.1.197, MASK: 255.255.255.0, GW: 192.168.1.1

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Tue, 16/08/2022 - 19:37 #9

ua6em

Offline

Registered:
08/17/2016

It wasn't the bobbin :)))

show code

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Tue, 16/08/2022 - 19:40 #10

workpage

Offline

Registered:
05/17/2020

17 pin is an excellent solution. With zero there is a lot of hassle with entering the programming mode.

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Thu, 18/08/2022 - 10:07 #eleven

ua6em

Offline

I interrupted here, corrected it to digital codes, but not everything:

```
01 void WiFiEvent(WiFiEvent_t event) {
02   switch (event) {
03 //     case SYSTEM_EVENT_ETH_START:
04       case 18:
05       Serial.println("ETH Started");
06       //set eth hostname here
07       ETH.setHostname("esp32-LAN8720");
08       break;
```

Registered:
08/17/2016

```
//   case SYSTEM_EVENT_ETH_CONNECTED:
      case 20:
      Serial.println("ETH Connected");
      break;
//    case SYSTEM_EVENT_ETH_GOT_IP:
      case 22:
      Serial.print("ETH MAC: ");
      Serial.print(ETH.macAddress());
      Serial.print(", IPv4: ");
      Serial.print(ETH.localIP());
      if (ETH.fullDuplex()) {
        Serial.print(", FULL_DUPLEX");
      }
      Serial.print(", ");
      Serial.print(ETH.linkSpeed());
      Serial.println("Mbps");
      eth_connected = true;
      break;
//   case SYSTEM_EVENT_ETH_DISCONNECTED:
    case 21:
      Serial.println("ETH Disconnected");
      eth_connected = false;
      break;
    case SYSTEM_EVENT_ETH_STOP:
      Serial.println("ETH Stopped");
      eth_connected = false;
      break;
    default:
      break;
  }
}
```

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Wed, 17/08/2022 - 12:44 #12

ua6em

Offline

Registered:
08/17/2016

Interestingly, WIFI and ETH do not conflict

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Wed, 17/08/2022 - 12:50 #13

workpage
Offline

Registered:
05/17/2020

Either one interface or another.

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Wed, 17/08/2022 - 13:06 #14

ua6em

Offline

Registered:
08/17/2016

> ***workpage* writes:**
>
> Either one interface or another.

I just needed a copper coin, on a budget)))

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Wed, 17/08/2022 - 16:21 #15

rkit
Offline

Registered:
11/23/2016

No, they don't conflict.

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Thu, 18/08/2022 - 00:14 #16

Ant123
Offline

Registered:
11/23/2021

I'm also struggling with connecting a LAN8720 card to the ESP32 Wrover, the same as in the first message.

On Wrover, GPIO16 and 17 are occupied, so you have to use GPIO0.

I connected the control of the quartz oscillator to an unused contact of the connector and then to GPIO4 with a pull-up to ground.

The 50 MHz clock is connected to GPIO0 with a pull-up to VCC through 10 kOhm.

However, in 99% of cases everything is set to Ethernet Started. Tried it in Arduino and ESP IDF 4.4.

The green LED on the network connector of the PHY board is constantly lit. The connection indicator flashes periodically on the switch.

In rare cases, the connection is still established (the orange LED lights up, pings pass), but after resetting the ESP32 or reconnecting the cable, it disappears. Sometimes the connection appears tens of seconds or minutes after switching on.

The cable seems to be a couple of meters, other devices connect through it normally.

It seems like there are problems with auto-detection of speed/duplex.

What else can you recommend?

PS The LAN8720 board I have is not the best version - the chip reset pin is not connected to the RC circuit near the resonator. The resistor values in the MDIO and nRST circuits are mixed up (if we take the board diagram from waveshare as a basis).

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Thu, 18/08/2022 - 00:14 #17

workpage
Offline
Registered: 05/17/2020

Minimize the length of the wires between the esp and 8720. 50 MHz is no joke.

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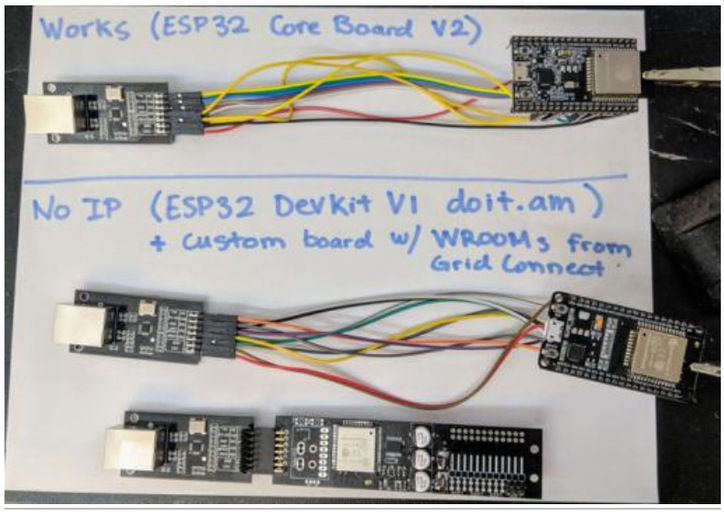
Thu, 18/08/2022 - 00:40 #18

Ant123
Offline
Registered: 11/23/2021

I can’t say that they are long - maximum 6 cm.

In people it happens even longer:



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Thu, 18/08/2022 - 00:54 #19

rkit
Offline
Registered: 11/23/2016

In principle, you can’t collect such things with snot and expect at least some kind of reliability.

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Thu, 18/08/2022 - 02:26 #20

Ant123
Offline
Registered: 11/23/2021

Can anyone check their known good module as indicated there: https://www.youtube.com/watch?v=J7V16B0BAHI

I have an empty module (only power is supplied) that connects to different network devices with different stability.

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Thu, 18/08/2022 - 07:29 #21

ua6em

Offline
Registered: 08/17/2016

I have the same black modules (a pair), I connected them to the router, I look at it, today I’ll try it and report back

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Thu, 18/08/2022 - 12:25 #22

Ant123
Offline
Registered: 11/23/2021

Also, please measure the inductor resistance between VCC and AVDD. I have about 2 ohms DC there.

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Thu, 18/08/2022 - 12:54 #23

ua6em

> ***Ant123* writes:**
>
> Also, please measure the inductor resistance between VCC and AVDD. I have about 2 ohms DC there.

Offline

Registered:
08/17/2016

where can I look at the module diagram?

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Thu, 18/08/2022 - 13:17 #24

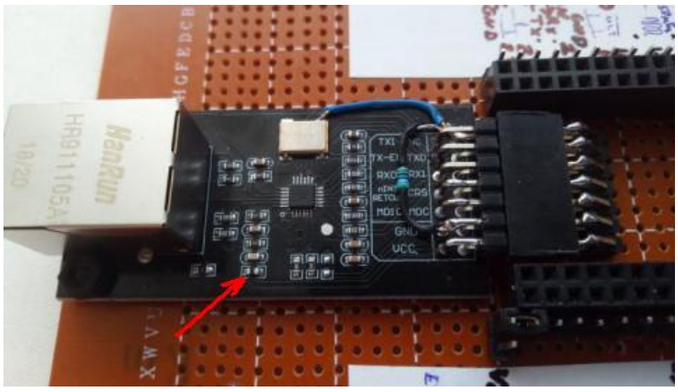
Ant123

Offline

Registered:
11/23/2021

I did not find the module diagram as in the photo in the first message of this topic. There is a module diagram from Waveshare:
https://www.waveshare.com/w/upload/0/08/LAN8720-ETH-Board-Schematic.pdf

In the photo the throttle is located at the bottom left, but I already managed to change it, which, however, did not give positive results.



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Fri, 19/08/2022 - 10:31 #25

ua6em

Offline

Registered:
08/17/2016

choke - 2.5 ohm

The modules are buggy, go to 10 megabits, DNS falls off, and behave extremely unstable after working for 5-10 minutes.
Assembled on duponts, needs to be reassembled onto a board to eliminate the influence of wires

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Fri, 19/08/2022 - 10:49 #26

workpage

Offline

Registered:
05/17/2020

It worked fine for me on short wires. But that was a couple of years ago. I don't remember the exact details, but on gpio0 I was never able to launch it normally. In the end, I did everything on gpio17. I definitely soldered something in the module itself. Something with a crystal oscillator.
But, of course, he drank my blood. Complex module. But in terms of software, everything is great.

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Fri, 19/08/2022 - 13:24 #27

ua6em

Offline

Registered:
08/17/2016

I still have some unanswered questions about **the ESP8266-WiFi-UART-Bridge**

I want to try to remake it on ESP32 and on ETH...)))
There was such a problem that was solved for 1.5 kilo rubles, but there is an STM processor

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Fri, 19/08/2022 - 15:54 #28

Ant123

Offline

Registered:
11/23/2021

I connected it with short wires (maximum 25-30 mm to the Wrover module itself) - no change.

It connects with some devices, but not with others. Connects best with Orange Pi PC.

So it's something else. I suspect that *auto - negotiation is not working properly...*

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Tue, 08/23/2022 - 15:32 #29

ua6em

I dug into the libraries, for kernel version 2.0.1 this code would be more correct:

Yes, another mode, we pretend that we are clocked from GPIO17 but leave the pin unconnected, it works however)))

Offline

Registered: 08/17/2016

show code

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Wed, 08/24/2022 - 00:24 #thirty

Ant123
Offline

Registered: 11/23/2021

Yes, the names of events have changed in the new libraries. I tried different timing options - it didn't help.

And I adjusted the electrolytes for the power supply, and the chip reset signal from the ESP started. After a forced hardware reset, the link is established, the address changes to 0, but restarting *auto - negotiation* during initialization leads to a break in the connection.

When turned on for the first time, there was a short-term (for 1-2 seconds) power failure. Maybe the chip is partially burnt?

Although, if the link is installed, it works quite stably (until reconnecting the cable).

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Wed, 08/24/2022 - 00:38 #31

workpage
Offline

Registered: 05/17/2020

Out of a batch of 50 pieces, one of the devices did not pass the ethernet test. The link LEDs worked fine. But there was something wrong with the program. It took a long time to establish a connection. After which the device worked normally, but until the first cable disconnection. AFTER which the connection was no longer established, although the link LEDs indicated otherwise.
Replacing the chip solved the problem.
What I mean is that marriage still exists.

Top | **Login to** post comments

Wed, 24/08/2022 - 01:24 #32

Ant123
Offline

Registered: 11/23/2021

> ***workpage* writes:**
>
> Replacing the chip solved the problem. What I mean is that marriage still exists.

Were the boards the same as in the photos shown here?

It feels like a crooked Chinese developer was given the task of rearranging the Waveshare module so that the parts were on the same side, so he did it the best he could...

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Wed, 24/08/2022 - 07:38 #33

workpage
Offline

Registered: 05/17/2020

Not. This is my commercial hardware.

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Wed, 08/24/2022 - 23:08 #34

Ant123
Offline

Registered: 11/23/2021

While the new replacement chip is on its way, we managed to achieve a quick and stable connection by disabling Auto-MDIX and Auto Negotiation in the PHY driver. Perhaps the circuits responsible for these functions have failed in the chip. It was also necessary to connect the LAN8720 reset signal via a diode to the generator control signal so that the connection was restored after restarting the ESP32.

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Wed, 08/24/2022 - 23:10 #35

workpage
Offline

Registered: 05/17/2020

Why through a diode? IMHO resistor 75-150 ohm to taste...

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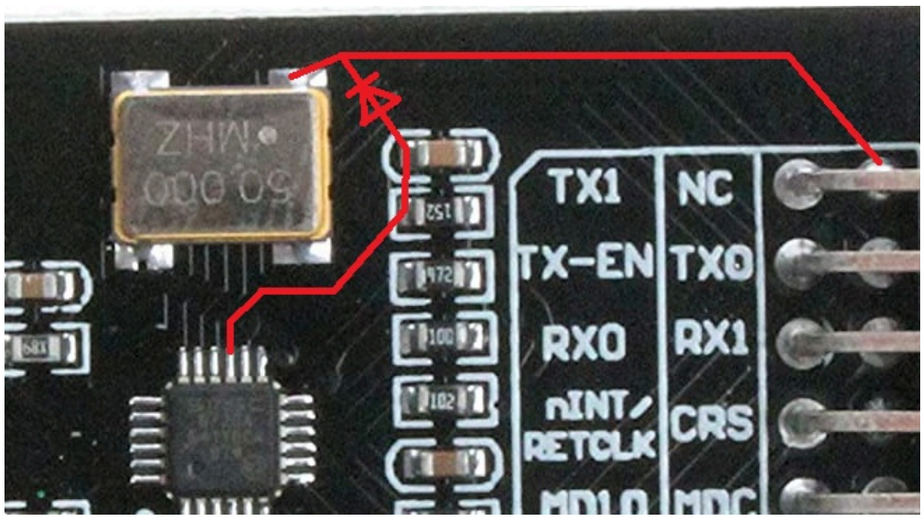
Wed, 08/24/2022 - 23:49 #36

Ant123
Offline

Registered: 11/23/2021

Just in case, so that the reset signal rises a little later than the generator is turned on (I restored the connection to the RC reset chain that was not routed on this version of the board)



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Wed, 24/08/2022 - 23:50 #37

workpage
Offline
Registered: 05/17/2020

A. The same rake.
Remove the condenser from the reset circuit.

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Wed, 24/08/2022 - 23:57 #38

Ant123
Offline
Registered: 11/23/2021

With the aim of?

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Wed, 24/08/2022 - 23:59 #39

workpage
Offline
Registered: 05/17/2020

The RC circuit generates a reset signal (that's what it was designed for). But since the reset is external, there may be nuances.

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Thu, 08/25/2022 - 00:03 #40

workpage
Offline
Registered: 05/17/2020

I had to manually desolder the condensers from the first batch. There were problems with the launch. About every 20th time I didn't start.

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Thu, 08/25/2022 - 00:12 #41

Ant123
Offline
Registered: 11/23/2021

What are the nuances? Without a capacitor, the clog and reset will appear simultaneously.

For me to reset normally only from RC, I would have to increase the capacitor to 10 - 20 uF.

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Thu, 08/25/2022 - 00:18 #42

Ant123
Offline
Registered: 11/23/2021

By the way, in the document "Schematic Checklist for the LAN8720" from the manufacturer it is generally written: "SMSC does not recommend the use of an RC circuit for this required pin reset. A reset generator / voltage monitor is one option to provide a proper reset."

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Thu, 08/25/2022 - 00:20 #43

workpage
Offline
Registered: 05/17/2020

I'm sharing my experience. You can do as you wish.

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Thu, 08/25/2022 - 00:28 #44

Ant123
Offline
Registered: 11/23/2021

Thanks for that, as they say...

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Thu, 08/25/2022 - 08:36 #45

ua6em

Offline

Registered: 08/17/2016

> ***Ant123* writes:**
>
> Yes, the names of events have changed in the new libraries. I tried different timing options - it didn't help.

It turns out that now I don’t use synchronization at all, I’m clocked from an internal oscillator of 50 megahertz and, surprisingly, everything works much more stable, a loss of connection with the LAN works stably, I simulated it by repeatedly disconnecting the cable, that is, the modules work asynchronously...
ESP32 processor frequency is set to 240 megahertz

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Thu, 08/25/2022 - 14:27 #46

Ant123

Offline

Registered: 11/23/2021

Is the data transmitted accurately? After all, information about the connection is transmitted via SMI, which may not be so dependent on 50 MHz. However, this mode still won’t suit me, because... APLL is already occupied for its main purpose.

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Thu, 09/07/2023 - 19:27 #47

Euronimus

Offline

Registered: 12/18/2016

Good afternoon.

I would like to provide for the possibility that the lan8720 has fallen off and needs to be reinitialized.
I tried removing 3.3VDC from it and selling it again, but it stopped working for me.
As far as I understand, the ETH library is not a class, but only external functions. That is, I cannot create a variable with type ETH and clear it if necessary, therefore, having executed the ETH.begine() function once, I cannot call this function again. Is there any way to get the lan8720 running again without rebooting the esp32?

If my conclusions are wrong, please correct me.

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