

Lierda IC610 EVK 快速上手应用指导

产品名称：ST-A35-IC610 工业核心板

产品型号：L-IDMIM0-AA185

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文件修订历史

文档版本	变更日期	修订人	审核人	变更内容
Rev1.0	25-03-15	YQA		初始版本
Rev1.1	25-08-29	YQA		增加 M33 核测试
Rev1.2	25-09-11	YQA		增加树莓派接口及更新 4g 模组 redcap

Lierda
利 尔 达

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1 引言

本文档依托于硬件 ST-A35-IC610 evk，介绍了 evk 硬件及软件参数及相关外设接口，及产品 boot 配置、供电需求及其他外设功能测试。

2 产品介绍

2.1 简介

IC610 核心板系列嵌入式工控机，是基于 stm32mp25 系列处理器，面向工业控制，HMI 显示等应用场景的工控机产品。

IM610 为主板，主要包括核心板 IC610、Debug、4G、USB、LVDS、232、485、can、SD 卡、SIM、NET、按键、mipi、摄像头、音频、hdmi 等。软件版本为 linux-6.1.82、u-boot-2022.10，支持 QT，在 ubunut1804 下，可实现对 uboot、kernel、QT 进行开发。下面章节将对开发板硬件、软件开发、驱动测试等做详细介绍。



2.2 实物图与接口说明

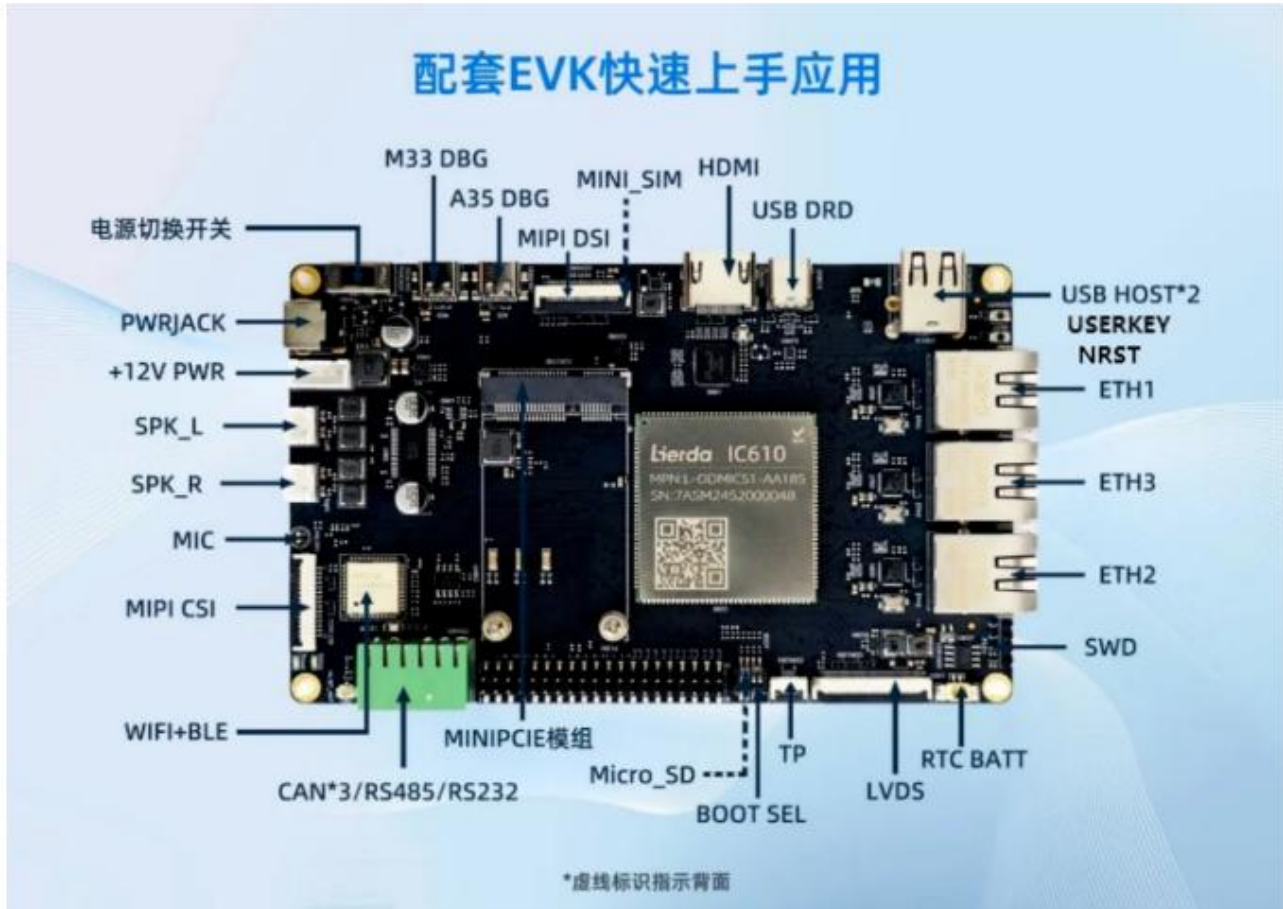


图 1.1 evk 正面实物图

2.3 硬件参数

表 1-1 硬件参数

序号	项目	参数说明	备注
1	处理器	STM32MP255DAK3	双核 A35+M33
2	内存	1024MB	DDR3L
3	Flash 存储器	8GB	eMMC
4	电源接口	DC 12-28V / 2A	防反接，低压、过压保护
5	指示灯	2 个	DCIN、heartbeat
6	以太网	3 个	千兆以太网，eth3 使用需要与 cpu 匹配
7	SIM 卡插槽	1 个	MiniSIM
8	USB HOST	1 个	Usb2.0 Type-A
9	USB OTG	1 个	Type-C
10	Mini PCI-e	1 个	和 3G/4G 模块同一个接口
11	RTC	2 个	cpu 自带 1 个，硬件 rtc 1 个
12	看门狗	1 个	cpu 自带
13	MicroSD 插槽	1 个	内部板载
14	A35 调试口	1 个	Type-C
15	LVDS	1 个	1280*800
16	RS232	1 路	插针
17	CAN	3 路	插针
18	RS485	1 路	插针
19	MIPI	1 路	800*1280
20	KEY	2 个	Reset 复位按键、用户按键
21	HDMI	1 路	自适应
22	Camera	1 路	ov5640、 ov5647
23	触摸	1 路	Lvds 和 mipi 共用 1 路，不可同时使用
24	M33 调试口	1 路	Type-C
25	Audio	1 路	AUX 接口

26	WiFi	1 路	SDIO 接口
27	蓝牙	1 路	Uart 接口
28	树莓派插针	1 路	Spi*2 、 i2c、 uart、 gpio*3

2.4 软件参数

表 1-2 软件参数

类别	版本	描述
TF-A	tf-a-stm32mp-v2.10.5	保护设备启动过程的安全
OPTEE	optee-os-stm32mp-4.0.0	硬件隔离保护敏感数据，防止非安全世界的访问
Bootloader	u-boot-2023.10	系统引导程序，负责系统初始化和引导内核启动
Kernel	Linux-6.6.48	ST 官方内核版本
文件系统	ext4	基于 st 官方 yocto 定制的文件系统，支持 SD 启动更新 emmc 固件

3 功能测试

外设接口请参考 1.2 实物图与接口说明。

3.1 Boot

本产品默认存储为 emmc，sd 卡启动可用于生产测试或镜像烧录等功能。

引脚实物图，拨码 1234 分别对应 boot0-boot3。



启动方式	Boot0 boot1 boot2 boot3			
Emmc	off	on	off	off
Sd 卡	on	off	off	off
Otg 烧录	off	off	off	off

Sd 卡启动



Emmc 启动:



OTG 烧录模式:



emmc 或 sd 卡启动模式下，上电后，按住 USERKEY，自动进入烧录模式。

3.2 供电

适配器 DC 插头， 12-28V / 2A

3.3 系统登录

板子内使用的 usb 转串口芯片为 CH340G，pc 端需要安装该芯片驱动，驱动下载地址：

https://www.wch.cn/downloads/CH341SER_ANDROID_ZIP.html。

使用 typec 接口的 usb 线连接 A35 DBG 接口（如下），使用串口工具打开对应 com 口，设置参数：波特率 115200 、数据位 8、奇偶位 0、停止位 1、流控无，如下。

端口可以手动输入或从列表中选择。

端口 (P): COM3 USB-SERIAL CH340

波特率 (B): 115200

数据位 (D): 8

奇偶位 (A): 无

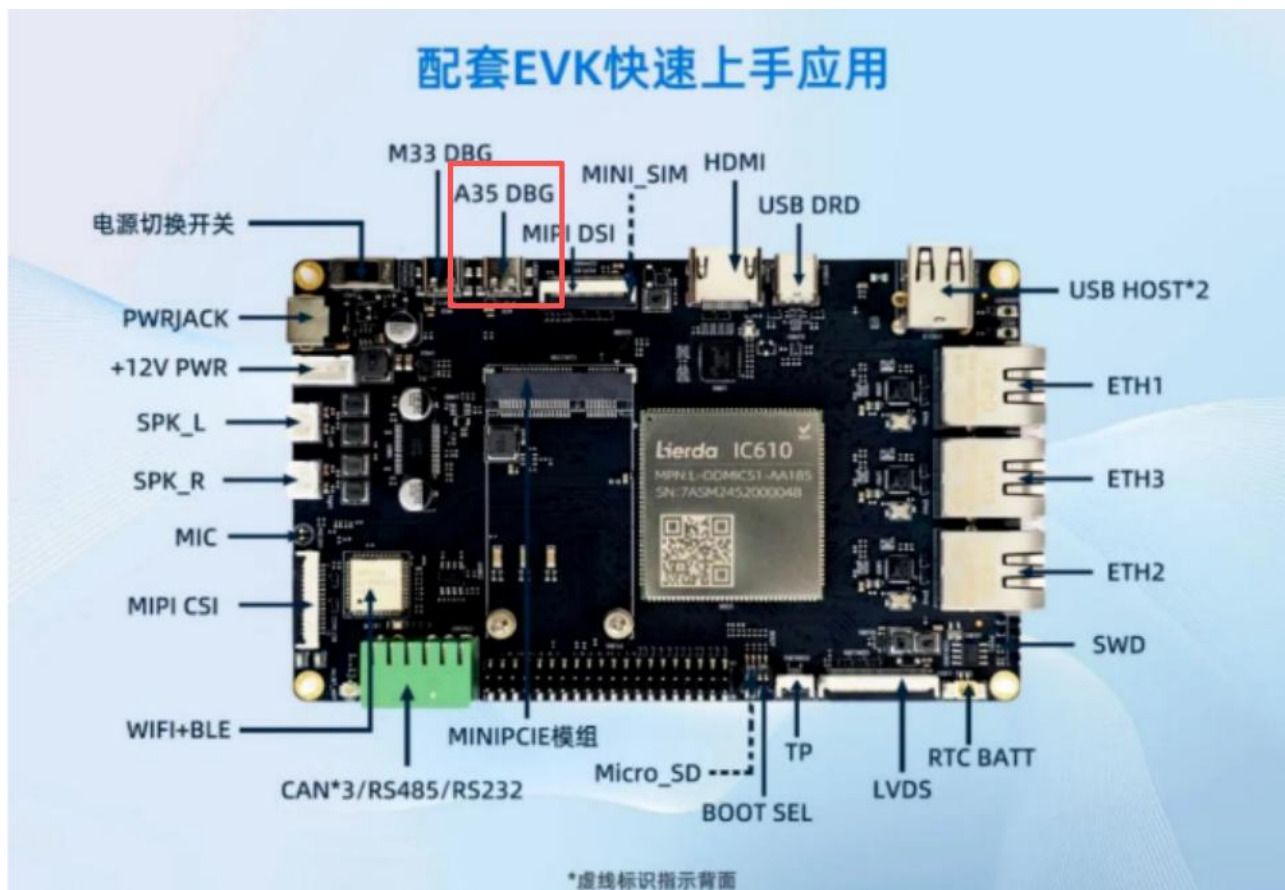
停止位 (S): 1

流量控制

☐ DTR/DSR

☐ RTS/CTS

☐ XON/XOFF



3.4 以太网

章节 2.2 实物图与接口说明中 eth1 对应节点为 end0, eth2 对应节点为 end1。

网线插入 end0 网卡, 另一侧连接路由器, link 信息如下:

```
root@stm32mp2:~#  
root@stm32mp2:~#  
root@stm32mp2:~# [ 1144.569169] stm32-dwmac 482d0000.eth2 end0 Link is Up - 1Gbps/Full - flow control rx/tx  
root@stm32mp2:~# ifconfig
```

自动获取路由器分配 ip 地址:

```
root@stm32mp2:~# udhcpc -i end0
```

```

AC
root@stm32mp2:~# udhcpc -i end0
udhcpc: started, v1.36.1
Dropped protocol specifier '.udhcpc' from 'end0.udhcpc'. Using 'end0' (ifindex=6).
udhcpc: broadcasting discover
udhcpc: broadcasting select for 192.168.2.126, server 192.168.2.1
udhcpc: lease of 192.168.2.126 obtained from 192.168.2.1, lease time 7200
/etc/udhcpc.d/50default: Adding DNS 114.114.114.114
/etc/udhcpc.d/50default: Adding DNS 8.8.8.8
Dropped protocol specifier '.udhcpc' from 'end0.udhcpc'. Using 'end0' (ifindex=6).
root@stm32mp2:~#
root@stm32mp2:~# ifconfig end0
end0      Link encap:Ethernet  HWaddr 62:A0:29:7D:3C:B8
          inet addr:192.168.2.126  Bcast:192.168.2.255  Mask:255.255.255.0
          UP BROADCAST RUNNING MULTICAST  MTU:1500  Metric:1
          RX packets:159 errors:0 dropped:0 overruns:0 frame:0
          TX packets:65 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1000
          RX bytes:14627 (14.2 KiB)  TX bytes:10708 (10.4 KiB)
          Interrupt:71 Base address:0x8000
root@stm32mp2:~#

```

网络联通性测试：

```
root@stm32mp2:~# ping www.baidu.com -c 5
```

```

root@stm32mp2:~# ping www.baidu.com -c 5
PING www.a.shifen.com (153.3.238.102) 56(84) bytes of data:
64 bytes from 153.3.238.102 (153.3.238.102): icmp_seq=1 ttl=52 time=22.0 ms
64 bytes from 153.3.238.102 (153.3.238.102): icmp_seq=2 ttl=52 time=21.1 ms
64 bytes from 153.3.238.102 (153.3.238.102): icmp_seq=3 ttl=52 time=18.8 ms
64 bytes from 153.3.238.102 (153.3.238.102): icmp_seq=4 ttl=52 time=17.2 ms
64 bytes from 153.3.238.102 (153.3.238.102): icmp_seq=5 ttl=52 time=15.1 ms

--- www.a.shifen.com ping statistics ---
5 packets transmitted, 5 received, 0% packet loss, time 4004ms
rtt min/avg/max/mdev = 15.135/18.860/22.001/2.520 ms
root@stm32mp2:~#

```

网速测试：

Pc 端安装 iperf3，电脑以太网设置静态 ip 地址为 192.168.1.1，pc 和板子通过网线连接 (请使用千兆网线)。

Pc 端：

```
D:\iperf-3.1.3-win64>iperf3.exe -s
```

开发板端设置静态 ip 地址及测速：

```
root@stm32mp2:~# ifconfig end0 192.168.1.2
```

```
root@stm32mp2:~# ping 192.168.1.1
```

```
root@stm32mp2:~# ifconfig end0 192.168.1.2
[ 2081.331361] stm32-dwmac 482d0000.eth2 end0: Register MEM_TYPE_PAGE_POOL RxQ-0
[ 2081.333534] stm32-dwmac 482d0000.eth2 end0: Register MEM_TYPE_PAGE_POOL RxQ-1
[ 2081.569020] stm32-dwmac 482d0000.eth2 end0: PHY [stm32-dwmac-0:06] driver [RTL8211F Gigabit Ethernet] (irq=POLL)
[ 2081.581656] dwmac4: Master AXI performs any burst length
[ 2081.581720] stm32-dwmac 482d0000.eth2 end0: No Safety Features support found
[ 2081.589936] stm32-dwmac 482d0000.eth2 end0: IEEE 1588-2008 Advanced Timestamp supported
[ 2081.597948] stm32-dwmac 482d0000.eth2 end0: registered PTP clock
[ 2081.604026] stm32-dwmac 482d0000.eth2 end0: FPE workqueue start
[ 2081.609768] stm32-dwmac 482d0000.eth2 end0: configuring for phy/rgmii-id link mode
root@stm32mp2:~# ping 192.168.1.1
PING 192.168.1.1 (192.168.1.1) 56(84) bytes of data:
[ 2087.787739] stm32-dwmac 482d0000.eth2 end0: Link is Up - 1Gbps/Full - flow control rx/tx
64 bytes from 192.168.1.1: icmp_seq=1 ttl=128 time=1025 ms
64 bytes from 192.168.1.1: icmp_seq=2 ttl=128 time=1.21 ms
64 bytes from 192.168.1.1: icmp_seq=3 ttl=128 time=5.91 ms
64 bytes from 192.168.1.1: icmp_seq=4 ttl=128 time=0.607 ms
^C
--- 192.168.1.1 ping statistics ---
4 packets transmitted, 4 received, 0% packet loss, time 3027ms
rtt min/avg/max/mdev = 0.607/258.109/1024.713/442.603 ms, pipe 2
```

```
root@stm32mp2:~# iperf3 -c 192.168.1.1
```

```
root@stm32mp2:~# iperf3 -c 192.168.1.1
Connecting to host 192.168.1.1, port 5201
[ 5] local 192.168.1.2 port 59254 connected to 192.168.1.1 port 5201
[ ID] Interval Transfer Bitrate Retr Cwnd
[ 5] 0.00-1.00 sec 110 MBytes 919 Mb/s 1 216 KBytes
[ 5] 1.00-2.00 sec 106 MBytes 888 Mb/s 0 216 KBytes
[ 5] 2.00-3.00 sec 108 MBytes 905 Mb/s 0 216 KBytes
[ 5] 3.00-4.00 sec 109 MBytes 916 Mb/s 0 216 KBytes
[ 5] 4.00-5.00 sec 112 MBytes 941 Mb/s 0 216 KBytes
[ 5] 5.00-6.00 sec 110 MBytes 920 Mb/s 0 216 KBytes
[ 5] 6.00-7.00 sec 107 MBytes 900 Mb/s 0 216 KBytes
[ 5] 7.00-8.00 sec 80.0 MBytes 671 Mb/s 1 216 KBytes
[ 5] 8.00-9.00 sec 112 MBytes 937 Mb/s 0 216 KBytes
[ 5] 9.00-10.00 sec 110 MBytes 924 Mb/s 0 216 KBytes
- - - - -
[ ID] Interval Transfer Bitrate Retr
[ 5] 0.00-10.00 sec 1.04 GBytes 892 Mb/s 2
[ 5] 0.00-10.00 sec 1.04 GBytes 891 Mb/s
sender
receiver
```

网卡 end1 测试方法同上，测试网卡 end1 时需要将 end0 关闭，

```
ifconfig end0 down
```

3.5 LVDS

Lvds hdmi mipi 等只支持单显，故切换显示需要手动修改 dts 及更换设备树。

Lvds 和 hdmi 可以在相同配置下显示，插入 hdmi，显示自动切换到 hdmi 显示，lvds 无法显示，hdmi 移除后恢复 lvds 显示。

Dts 修改参考 kernel 下，修改 display_value 宏定义参数

```
arch/arm64/boot/dts/st/stm32mp257f-ic610.dts
```

```
#define display_value 1
```

```
// 1:lvds_hdmi 2:mipi
```

Kernel 编译脚本 build.sh 自动生成

```
stm32mp257f-ic610-mipi.dtb
```

```
stm32mp257f-ic610-lvds.dtb
```

默认为 lvds 显示。

板子烧录后切换显示方式

```
root@stm32mp2:~# cd /boot/
```

```
root@stm32mp2:/boot# md5sum stm32mp257f-ic610*
```

```
root@stm32mp2:/boot# md5sum stm32mp257f-ic610*
b4bd3617af756463b808ac37742139d3 stm32mp257f-ic610-hdmi.dtb
02c87b04af44d2c195e01be65f0d58d2 stm32mp257f-ic610-lvds.dtb
09bf8a24fca01ebfaefd488866d76e58 stm32mp257f-ic610-mipi.dtb
f5cab3c98b6e46e0a56af63e971c0a45 stm32mp257f-ic610-rgb.dtb
02c87b04af44d2c195e01be65f0d58d2 stm32mp257f-ic610.dtb
root@stm32mp2:/boot#
```

如切换为 lvds 显示

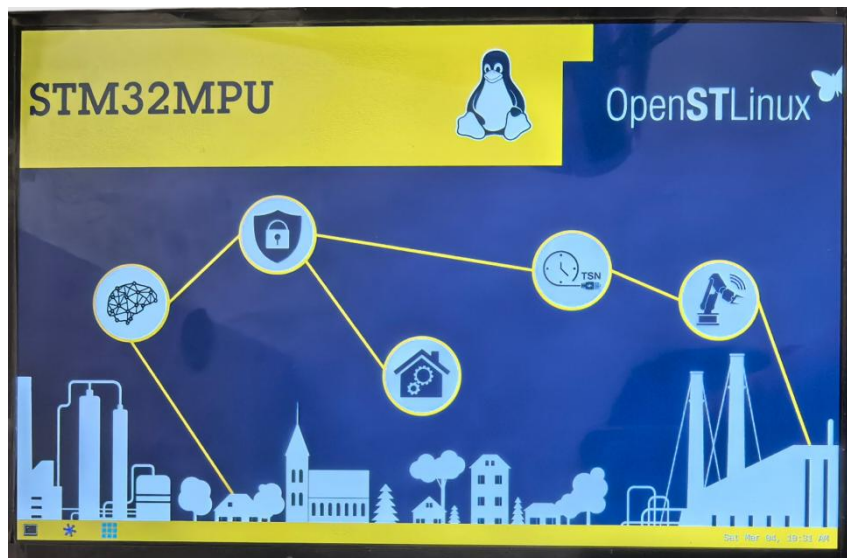
```
root@stm32mp2:/boot# cp stm32mp257f-ic610-lvds.dtb stm32mp257f-ic610.dtb
root@stm32mp2:/boot# sync
root@stm32mp2:/boot# reboot
```

切换为 hdmi 显示

```
root@stm32mp2:/boot# cp stm32mp257f-ic610-hdmi.dtb stm32mp257f-ic610.dtb
root@stm32mp2:/boot# sync
root@stm32mp2:/boot# reboot
```

lvds 座子参考章节 2.2 实物图与接口说明。

系统启动自动显示 demo:



使用 **killall weston** 关闭 demo。

weston ui 关闭:

```
systemctl stop weston-graphical-session.service
```

重新打开 weston ui:

```
systemctl restart weston-graphical-session.service
```

```
root@stm32mp2:~# systemctl stop weston-graphical-session.service
```

```
root@stm32mp25:~# modetest -M stm -s 34@44:1280x800
```



三色 rgb 测试:

```
systemctl stop weston-graphical-session.service
```

```
drm-lcd-test 34 44
```

测试完自动退出

触摸屏幕测试:

触摸节点为/dev/input/event0

```
systemctl stop weston-graphical-session.service
```

```
ts_tests
```

3.6 Hdmi

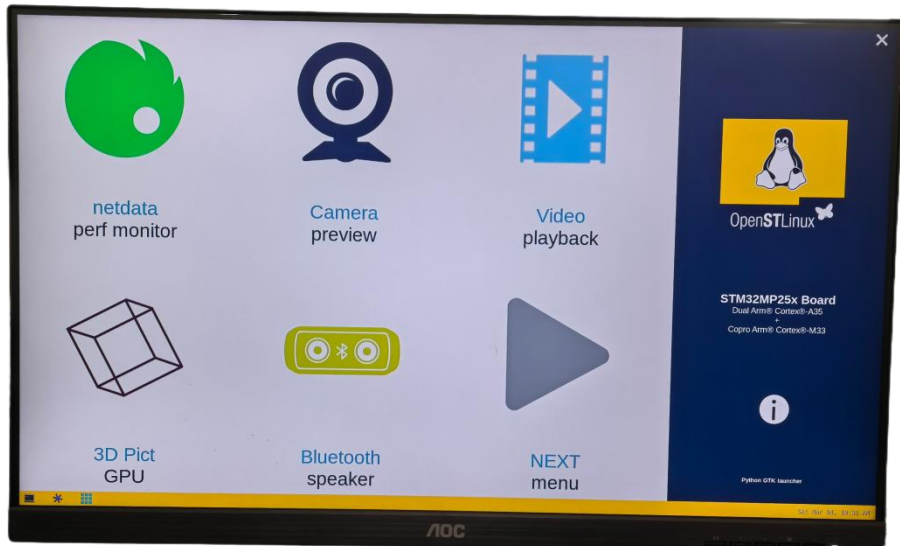
本平台无 HDMI 接口, hdmi 通过 mipi 转 hdmi 芯片实现, 故 hdmi 和 mipi 无法共同使用,

使用 hdmi 时需要切换 dtb 文件，hdmi 连接后自动显示 demo。

切换 hdmi 显示 dtbs 文件：

```
cp /boot/stm32mp257f-ic610-lvds.dtb /boot/stm32mp257f-ic610.dtb
sync
```

板子断电重启即可。



三色 rgb 测试：

```
systemctl stop weston-graphical-session.service
drm-lcd-test 32 44
```

测试完自动退出

3.7 Mipi

配套显示屏为 7 寸 MIPI 屏模块 1080*1920，硬件接口参考章节 2.2 实物图与接口说明。

```
cp /boot/stm32mp257f-ic610-mipi.dtb /boot/stm32mp257f-ic610.dtb
sync
```

板子断电重启即可。

Mipi 自带触摸屏，可通过桌面 UI 进行测试。

三色 rgb 测试：

```
systemctl stop weston-graphical-session.service
drm-lcd-test 32 41
```

测试完自动退出

触摸屏幕测试：

触摸节点为/dev/input/event0

```
systemctl stop weston-graphical-session.service
ts_tests
```

3.8 Aduio

音频支持 codec 和 hdmi，切换到 hdmi 显示下才可以使用 hdmi 音频。

查看声卡：

```
aplay -l
```

```
root@stm32mp2:~#
root@stm32mp2:~#
root@stm32mp2:~# aplay -l
**** List of PLAYBACK Hardware Devices ****
card 0: ES8388SOUNDCARD [ES8388-SOUND-CARD], device 0: 40230000.audio-controller-es8328-hifi-analog es8328-hifi-analog [40230000.audio-controller-
Subdevices: 1/1
Subdevice #0: subdevice #0
card 1: HDMI0SOUNDCARD [HDMI-SOUND-CARD], device 0: 400b0000.audio-controller-i2s-hifi i2s-hifi-0 [400b0000.audio-controller-i2s-hifi i2s-hifi-0]
Subdevices: 1/1
Subdevice #0: subdevice #0
root@stm32mp2:~#
```

声卡 0 为 es8388，该声卡具有录音功能，声卡 1 为 hdmi。

es8388 播放音频：

```
aplay -D hw:0 /share/1231.wav
```

音量调节：

```
aplay -D hw:0 /share/1231.wav &
amixer -c 0 cset numid=10 15
```

15 为音量值，音量调节范围为 0-36

自动录音 10s：

```
arecord -D plughw:0 -f dat 1.wav -d 10
```

录音音量调节：

```
amixer -c 0 cset numid=12 15
```

15 为音量值，音量调节范围为 0-36

录音播放：

```
aplay -D hw:0 1.wav
```

Hdmi 播放音频：

```
aplay -D hw:1 /share/1231.wav
```

3.9 Camera

配套摄像头模块为 ov5640，接口参考章节 2.2 实物图与接口说明。

摄像头预览,可实时输出摄像头内容到屏幕：

```
/usr/local/demo/application/camera/bin/launch_camera_preview_mp25.sh
```

3.10 Minipcie

本 evk 默认配套的模组为 redcap NR90-HCN。

4g 模组电源通过 gpio 控制，系统上电默认使能。

板子上电前插入 sim 卡，系统启动后 lsusb 查询模组是否识别，如下：

```
root@stm32mp2:~# lsusb
Bus 001 Device 001: ID 1d6b:0002 Linux Foundation 2.0 root hub
Bus 002 Device 001: ID 1d6b:0002 Linux Foundation 2.0 root hub
Bus 002 Device 002: ID 1a86:8091 QinHeng Electronics USB HUB
Bus 002 Device 004: ID 3505:1101 Lierda NR90-HCN
Bus 003 Device 001: ID 1d6b:0003 Linux Foundation 3.0 root hub
root@stm32mp2:~#
```

```
root@stm32mp2:~# echo -e "at+lwandial=1,1,0 \r\n" > /dev/ttyUSB0
```

```
root@stm32mp2:~# udhcpc -i usb0
```

```
root@stm32mp2:~# udhcpc -i usb0
udhcpc: started, v1.36.1
Dropped protocol specifier '.udhcpc' from 'usb0.udhcpc'. Using 'usb0' (ifindex=7).
udhcpc: broadcasting discover
udhcpc: broadcasting select for 100.79.13.193, server 100.0.0.1
udhcpc: lease of 100.79.13.193 obtained from 100.0.0.1, lease time 86400
RTNETLINK answers: File exists
/etc/udhcpc.d/50default: Adding DNS 100.0.0.1
Dropped protocol specifier '.udhcpc' from 'usb0.udhcpc'. Using 'usb0' (ifindex=7).
root@stm32mp2:~#
```

网络连通性测试：

```
root@stm32mp2:~# ping -I usb0 www.baidu.com
```

```
root@stm32mp2:~# ping -I usb0 www.baidu.com
PING www.baidu.com (240e:e9:6002:1ac:0:ff:b07e:36c5) from 240e:471:e10:52fc:e5b:8fff:fe27:9a64 usb0: 56 data bytes
64 bytes from 240e:e9:6002:1ac:0:ff:b07e:36c5: icmp_seq=1 ttl=53 time=40.5 ms
64 bytes from 240e:e9:6002:1ac:0:ff:b07e:36c5: icmp_seq=2 ttl=53 time=44.9 ms
64 bytes from 240e:e9:6002:1ac:0:ff:b07e:36c5: icmp_seq=3 ttl=53 time=43.9 ms
64 bytes from 240e:e9:6002:1ac:0:ff:b07e:36c5: icmp_seq=4 ttl=53 time=43.7 ms
64 bytes from 240e:e9:6002:1ac:0:ff:b07e:36c5: icmp_seq=5 ttl=53 time=40.9 ms
64 bytes from 240e:e9:6002:1ac:0:ff:b07e:36c5: icmp_seq=6 ttl=53 time=39.8 ms
64 bytes from 240e:e9:6002:1ac:0:ff:b07e:36c5: icmp_seq=7 ttl=53 time=38.0 ms
64 bytes from 240e:e9:6002:1ac:0:ff:b07e:36c5: icmp_seq=8 ttl=53 time=56.7 ms
64 bytes from 240e:e9:6002:1ac:0:ff:b07e:36c5: icmp_seq=9 ttl=53 time=55.0 ms
64 bytes from 240e:e9:6002:1ac:0:ff:b07e:36c5: icmp_seq=10 ttl=53 time=54.3 ms
```

模组硬件串口为/dev/ttySTM5

```
minicom -b 115200 -D /dev/ttySTM5
```

```
welcome to minicom 2.9

OPTIONS: I18n
Compiled on Sep 22 2023, 21:10:41.
Port /dev/ttySTM5, 17:26:07

Press CTRL-A Z for help on special keys

ATI
Manufacturer: Lierda
Model: NR90-HCN
Revision: NR90HCNA00NNA-Q0604
IMEI: 861693070001631
+GCAP: +CGSM,+DS,+ES

OK
```

CTRL+A 然后输入 x 可退出 minicom

3.11 SD 卡

节点为 /dev/mmcblk0p1，支持热插拔及自动挂载。

```

root@stm32mp2:~# cc[ 1041.355894] mmc0: new high speed SDHC card at address aaaa
[ 1041.364486] mmcblk0: mmc0:aaaa SC16G 14.8 GiB
[ 1041.373823] mmcblk0: p1 p2 p3 p4 p5 p6 p7 p8 p9 p10 p11
[ 1041.721742] VFS: could not find a valid V7 on mmcblk0p2.
[ 1041.771523] VFS: could not find a valid V7 on mmcblk0p4.
[ 1041.788838] VFS: could not find a valid V7 on mmcblk0p1.
[ 1041.806012] VFS: could not find a valid V7 on mmcblk0p7.
[ 1041.821256] VFS: could not find a valid V7 on mmcblk0p3.
[ 1041.873412] VFS: could not find a valid V7 on mmcblk0p5.
[ 1041.890013] VFS: could not find a valid V7 on mmcblk0p6.
[ 1042.062141] EXT4-fs (mmcblk0p8): recovery complete
[ 1042.062192] EXT4-fs (mmcblk0p8): mounted filesystem with ordered data mode. Quota mode: none.
[ 1042.098463] EXT4-fs (mmcblk0p9): recovery complete
[ 1042.100027] EXT4-fs (mmcblk0p9): mounted filesystem with ordered data mode. Quota mode: none.
sh: cc: not found

```

3.12 Usb

U 盘测试脚本如下：

```

root@stm32mp25:~# usb_test.sh

cat usb_test.sh

#!/bin/sh

if [ -b /dev/sda1 ] ; then

    ret=$(mount|grep sda)

    if [ -z "$ret" ] ; then

        mount /dev/sda1 /mnt

    else

        dd if=/dev/zero of=/mnt/test bs=64K count=16K

        echo 3 > /proc/sys/vm/drop_caches

        dd if=/mnt/test of=/dev/null bs=4K count=256K

    fi

fi

```

```
root@stm32mp25:~# chmod 775 usb_test.sh
root@stm32mp25:~# ls
usb_test.sh
root@stm32mp25:~# ./usb_test.sh
16384+0 records in
16384+0 records out
1073741824 bytes (1.1 GB, 1.0 GiB) copied, 92.7152 s, 11.6 MB/s
[ 1325.553819] exe (790): drop_caches: 3
real    0m 49.51s
user    0m 0.06s
sys     0m 11.54s
[ 1375.822529] exe (790): drop_caches: 3
262144+0 records in
262144+0 records out
1073741824 bytes (1.1 GB, 1.0 GiB) copied, 29.8377 s, 36.0 MB/s
root@stm32mp25:~#
```

3.13 Wifi

板载 Wifi 模组为 ap6256，该模组为 sdio 接口。

驱动开机启动加载脚本/etc/rc.local 已自动加载/ap6256/ap6256.sh 加载 wifi 驱动。

Wifi sta 及 ap 修改相关配置请查看《Lierda_IC610_WIFI 应用指导》。

3.13.1 STA 模式

配置文件为/etc/wpa_supplicant.conf，ssid 为要连接的热点名称，psk 为热点密码，

```
root@stm32mp2:~# vi /etc/wpa_supplicant.conf
```

热点信息修改后执行以下自动连接热点。

```
root@stm32mp2:~# wifi_sta_ap.sh sta
```

```
root@stm32mp2:~#
root@stm32mp2:~#
root@stm32mp2:~#
root@stm32mp2:~# wifi_sta_ap.sh sta
[12457.804311] [dhd] [wlan0] wl_cfg80211_disconnect : Reason 3, act 1, bssid b8:f8:83:c3:8b:ca
[12457.815115] [dhd] [wlan0] wl_3w_event : [1 times] disconnected with b8:f8:83:c3:8b:ca, event 11, reason 8
[12457.816105] [dhd] [wlan0] wl_handle_link_down : Link down: WLC_E_LINK(16), reason 2 from b8:f8:83:c3:8b:ca
[12457.819222] [dhd] [wlan0] wl_ext_iapsta_link : [S] Link down with b8:f8:83:c3:8b:ca, WLC_E_DISASSOC(11), reason 8
[12457.829373] [dhd] [wlan0] wl_handle_link_down : Disconnect event sent to upper layer event:16 e->reason=33554432 reason=2 ie_len=0 loc_gen=1 from b8:f8:83:c3:8b:ca
[12457.839546] [dhd] [wlan0] wl_3w_event : Link down with b8:f8:83:c3:8b:ca, reason=2
[12457.861313] [dhd] [wlan0] wl_ext_iapsta_link : [S] Link down with b8:f8:83:c3:8b:ca, WLC_E_LINK(16), reason 2
[12457.871143] [dhd] [wlan0] wl_ext_iapsta_link : [S] Link down with b8:f8:83:c3:8b:ca, WLC_E_DEAUTH(5), reason 7
[12457.874296] [dhd] [wlan0] wl_notify_connect_status_sta : Unexpected event:5 in assoc idle state
[12458.057984] [dhd] [wlan0] dhd_pri_stop : tx queue stopped
[12458.058033] [dhd] [wlan0] dhd_stop : Enter
wlan0: CTRL-EVENT-DISCONNECTED bssid=b8:f8:83:c3:8b:ca reason=2 [12458.068575] [dhd] dhd_stop: ##### called for ifidx=0 #####
locally generated:
[12458.078600] [dhd] dhd_stop: making dhdpub up FALSE
[12458.080244] [dhd] dhd_tcpack_suppress_set: TCP ACK Suppress mode 1 -> mode 0
[12458.087322] [dhd] dhd_tcpack_suppress_set: TCPACK_INFO_MAXNUM=40, TCPDATA_INFO_MAXNUM=40
[12458.095455] [dhd] [wlan0] wl_android_wifi_off : g_wifi_on=1 force_off=1
[12458.102757] [dhd] dhd_wific_deinit() 3992, maintain HOST RXRERODER flag in tvl
[12458.110789] [dhd] dhd_bus_devreset: == Power OFF ==
[12458.114182] [dhd] dhd_bus_stop: making DHD_BUS_DOWN
[12458.118956] [dhd] dhd_bus_devreset: making dhdpub up FALSE
[12458.124418] [dhd] dhd_txglom_enable: enable 0
[12458.129157] [dhd] dhd_bus_devreset: making DHD_BUS_DOWN
[12458.134196] [dhd] wifi_platform_set_power = 0, delay: 10 msec
[12458.139759] [dhd] ===== PULL WL_REG_ON(-1) Low! =====
[12458.156329] [dhd] wifi_platform_set_power = 0, sleep done: 10 msec
[12458.159664] [dhd] [wlan0] wl_android_wifi_off : out
[12458.161833] [dhd] [wlan0] dhd_stop : Exit
wlan0: do not deauthenticate as part of interface deinit since WOWLAN is enabled
[12458.296670] [dhd] dhd_pri_open : no mutex held
[12458.299196] [dhd] dhd_pri_open : set mutex lock
[12458.303978] [dhd] [wlan0] dhd_open : Enter
[12458.307756] [dhd] Dongle Host Driver, version 101.10.591.68.32 (20240712-1)(429fcb0)
[12458.307756] /home/yq/qc/stm32mp2/sdk_v24.11.06/linux-6.6.48/linux-6.6.48/drivers/net/wireless/ap6256 compiled on Jun 5 2025 at 09:42:47
[12458.329260] [dhd] dhd_open: ##### called for ifidx=0 #####
[12458.335507] [dhd] [wlan0] wl_android_wifi_on : in g_wifi_on=0
[12458.341209] [dhd] wifi_platform_set_power = 1, delay: 200 msec
```

```
[12531.029323] [dhd] [wlan0] wl_fw_event : Link UP with b8:f8:83:c3:8b:ca
[12531.030409] [dhd] [wlan0] wl_ext_iapsta_link : [S] Link UP with b8:f8:83:c3:8b:ca
[12531.032598] [dhd] [wlan0] wl_bss_connect_done : Report connect result - connection succeeded
[12531.051377] [dhd] Cfg80211-ERROR) wl_mkeep_alive_update : Get mkeep_alive failed (error=-2)
wlan0: Associated with b8:f8:83:c3:8b:ca
wlan0: CTRL-Event-SUBNET-STATUS-UPDATE status=0
[12531.139348] [dhd] [wlan0] wl_add_keyext : key index (0) for b8:f8:83:c3:8b:ca
wlan0: WPA: Key negotiation completed with b8:f8:83:c3:8b:ca [PTK=CCMP GTK=TKIP]
wlan0: CTRL-Event[12531.164311] [dhd] [wlan0] wl_cfg80211_set_suspend_bcn_li_dtim : bcn_li_dtim:0 lps:0 b
T-CONNECTED - Connection to b8:f8:83:c3:8b:ca completed [id=0 id_str=]
udhcpc: started, v1.36.1
Dropped protocol specifier '.udhcpc' from 'wlan0.udhcpc'. Using 'wlan0' (ifindex=7).
udhcpc: broadcasting discover
udhcpc: broadcasting select for 192.168.2.101, server 192.168.2.1
udhcpc: lease of 192.168.2.101 obtained from 192.168.2.1, lease time 7200
/etc/udhcpc.d/50default: Adding DNS 114.114.114.114
/etc/udhcpc.d/50default: Adding DNS 8.8.8.8
Dropped protocol specifier '.udhcpc' from 'wlan0.udhcpc'. Using 'wlan0' (ifindex=7).
root@stm32mp2:~# ifconfig wlan0
wlan0      Link encap:Ethernet  HWaddr 9C:B8:B4:35:D2:6A
           inet addr:192.168.2.101  Bcast:192.168.2.255  Mask:255.255.255.0
           inet6 addr: fe80::9eb8:b4ff:fe35:d26a/64  Scope:Link
           UP BROADCAST RUNNING MULTICAST  MTU:1500  Metric:1
           RX packets:1546 errors:0 dropped:3837 overruns:0 frame:0
           TX packets:1986 errors:0 dropped:0 overruns:0 carrier:0
           collisions:0 txqueuelen:1000
           RX bytes:169478 (165.5 KiB)  TX bytes:354142 (345.8 KiB)

root@stm32mp2:~#
```

Wifi ip 地址为 192.168.2.154

wlan0 ping 网关测试:

```
root@stm32mp2:~# ping -I wlan0 192.168.2.1
```

如下表示板子与网关通信正常。

```
root@stm32mp2:~#
root@stm32mp2:~#
root@stm32mp2:~#
root@stm32mp2:~#
root@stm32mp2:~# ping -I wlan0 192.168.2.1
PING 192.168.2.1 (192.168.2.1) from 192.168.2.154 wlan0: 56(84) bytes of data.
64 bytes from 192.168.2.1: icmp_seq=1 ttl=64 time=4.41 ms
64 bytes from 192.168.2.1: icmp_seq=2 ttl=64 time=7.95 ms
64 bytes from 192.168.2.1: icmp_seq=3 ttl=64 time=12.9 ms
64 bytes from 192.168.2.1: icmp_seq=4 ttl=64 time=8.12 ms
64 bytes from 192.168.2.1: icmp_seq=5 ttl=64 time=11.4 ms
```

网速测试:

Pc 端安装下载 iperf3.exe, 且 pc 的 wifi 与板子 wifi 在同一个局域网内。

如 D:\iperf-3.1.3-win64\存在 iperf3.exe 搜索框输入 cmd 进入命令提示符



进入 D:\iperf-3.1.3-win64

d:

cd iperf-3.1.3-win64

```
Microsoft Windows [版本 10.0.22631.5189]
(c) Microsoft Corporation. 保留所有权利。

C:\Users\10274>d:

D:\>cd iperf-3.1.3-win64

D:\iperf-3.1.3-win64>|
```

板子端运行 iperf3 作为 server

```
root@stm32mp2:~# iperf3 -s
warning: this system does not seem to support IPv6 - trying IPv4
-----
Server listening on 5201 (test #1)
-----
```

Pc 端作为 client

```
iperf3.exe -c 192.168.2.154
```

```
D:\iperf-3.1.3-win64>iperf3.exe -c 192.168.2.154
Connecting to host 192.168.2.154, port 5201
[ 4] local 192.168.2.124 port 53232 connected to 192.168.2.154 port 5201
[ ID] Interval      Transfer    Bandwidth
[ 4]  0.00-1.01    sec  1.00 MBytes  8.31 Mbits/sec
[ 4]  1.01-2.00    sec   512 KBytes  4.23 Mbits/sec
[ 4]  2.00-3.04    sec  1.88 MBytes  15.2 Mbits/sec
[ 4]  3.04-4.02    sec  1.25 MBytes  10.6 Mbits/sec
[ 4]  4.02-5.02    sec  1.25 MBytes  10.5 Mbits/sec
[ 4]  5.02-6.01    sec  1.50 MBytes  12.6 Mbits/sec
[ 4]  6.01-7.01    sec  1.25 MBytes  10.5 Mbits/sec
[ 4]  7.01-8.01    sec  1.00 MBytes  8.36 Mbits/sec
[ 4]  8.01-9.02    sec  1.38 MBytes  11.5 Mbits/sec
[ 4]  9.02-10.01   sec  1.25 MBytes  10.6 Mbits/sec
-----
[ ID] Interval      Transfer    Bandwidth
[ 4]  0.00-10.01   sec  12.2 MBytes  10.3 Mbits/sec
[ 4]  0.00-10.01   sec  12.0 MBytes  10.1 Mbits/sec
sender
receiver
```

```

RX bytes:23942 (23.3 KiB)  TX bytes:7780 (7.6 KiB)

root@stm32mp2:~# iperf3 -s
warning: this system does not seem to support IPv6 - trying IPv4
-----
Server listening on 5201 (test #1)
-----
Accepted connection from 192.168.2.124, port 53230
[ 5] local 192.168.2.154 port 5201 connected to 192.168.2.124 port 53232
[ ID] Interval           Transfer             Bitrate
[ 5] 0.00-1.00    sec    768 KBytes        6.28 Mbits/sec
[ 5] 1.00-2.00    sec    640 KBytes        5.25 Mbits/sec
[ 5] 2.00-3.00    sec    1.75 MBytes       14.7 Mbits/sec
[ 5] 3.00-4.00    sec    1.50 MBytes       12.6 Mbits/sec
[ 5] 4.00-5.00    sec    1.00 MBytes        8.39 Mbits/sec
[ 5] 5.00-6.00    sec    1.75 MBytes       14.7 Mbits/sec
[ 5] 6.00-7.00    sec    1.00 MBytes        8.40 Mbits/sec
[ 5] 7.00-8.00    sec    1.00 MBytes        8.39 Mbits/sec
[ 5] 8.00-9.00    sec    1.50 MBytes       12.6 Mbits/sec
[ 5] 9.00-10.00   sec    1.12 MBytes        9.45 Mbits/sec
-----
[ ID] Interval           Transfer             Bitrate
[ 5] 0.00-10.06   sec   12.0 MBytes       10.0 Mbits/sec
-----
Server listening on 5201 (test #2)
-----

```

3.13.2 AP 模式

默认热点名称为 lierda-ic610，密码为 12345678。

```
root@stm32mp2:~# wifi_sta_ap.sh ap
```

```

root@stm32mp2:~#
root@stm32mp2:~#
root@stm32mp2:~# wifi_sta_ap.sh ap
wlan0: Do not deauthenticate as part of interface deinit since wowLAN is enabled
[12671.320452] [dhd] [wlan0] wl_cfg80211_disconnect : Reason 3, act 1, bssid b8:f8:83:c3:8b:ca
[12671.332481] [dhd] [wlan0] wl_iw_event : [5 times] disconnected with b8:f8:83:c3:8b:ca, event 11, reason 8
[12671.332500] [dhd] [wlan0] wl_handle_link_down : Link down: WLC_E_LINK(16), reason 2 from b8:f8:83:c3:8b:ca
[12671.332564] [dhd] [wlan0] wl_handle_link_down : Disconnect event sent to upper layer event:16 e->reason=33554
[12671.336709] [dhd] [wlan0] wl_ext_iapsta_link : [S] Link down with b8:f8:83:c3:8b:ca, WLC_E_DISASSOC(11), rea
[12671.362271] [dhd] CFG80211-ERROR wl_notify_connect_status_sta : Unexpected event:5 in assoc idle state
[12671.370967] [dhd] [wlan0] wl_iw_event : Link Down with b8:f8:83:c3:8b:ca, reason=2
[12671.370999] [dhd] [wlan0] wl_ext_iapsta_link : [S] Link down with b8:f8:83:c3:8b:ca, WLC_E_LINK(16), reason
[12671.380559] [dhd] CFG80211-ERROR wl_notify_connect_status_sta : Unexpected event:5 in assoc idle state
[12671.388090] [dhd] [wlan0] wl_ext_iapsta_link : [S] Link down with b8:f8:83:c3:8b:ca, WLC_E_DEAUTH(5), reason
[12671.417829] [dhd] [wlan0] wl_ext_iapsta_link : [S] Link down with b8:f8:83:c3:8b:ca, WLC_E_DEAUTH(5), reason
[12671.581990] [dhd] [wlan0] dhd_pri_stop : tx queue stopped
[12671.582040] [dhd] [wlan0] dhd_stop : Enter
[12671.588745] [dhd] dhd_stop: ##### called for ifidx=0 #####
[12671.596656] [dhd] dhd_stop: making dhdpub up FALSE
[12671.596900] [dhd] dhd_tcpack_suppress_set: TCP ACK Suppress mode 1 -> mode 0
[12671.603878] [dhd] dhd_tcpack_suppress_set: TCPACK_INFO_MAXNUM=40, TCPDATA_INFO_MAXNUM=40
[12671.611978] [dhd] [wlan0] wl_android_wifi_off : g_wifi_on=1 force_off=1
[12671.619042] [dhd] dhd_wlfc_deinit():3992, maintain HOST RXRORDER flag in tvl
[12671.627146] [dhd] dhd_bus_devreset: == Power OFF ==
[12671.631275] [dhd] dhd_bus_devreset: making dhdpub up FALSE
[12671.635553] [dhd] dhd_bus_devreset: making dhdpub up FALSE
[12671.641002] [dhd] dhd_txglom_enable: enable 0
[12671.645351] [dhd] dhd_bus_devreset: making DHD_BUS_DOWN
[12671.650686] [dhd] wifi_platform_set_power = 0, delay: 10 msec
[12671.656246] [dhd] ===== PULL WL_REG_ON(-1) LOW! =====
[12671.672841] [dhd] wifi_platform_set_power = 0, sleep done: 10 msec
[12671.673477] [dhd] [wlan0] wl_android_wifi_off : out
[12671.678350] [dhd] [wlan0] dhd_stop : Exit
wlan0: CTRL-Event-DSCP-POLICY clear_all
nl80211: deinit ifname=wlan0 disabled_11b_rates=0
wlan0: CTRL-Event-TERMINATING
[12671.756964] [dhd] dhd_pri_open : no mutex held
[12671.757012] [dhd] dhd_pri_open : set mutex lock

```



3.14 蓝牙

驱动开机启动加载脚本：

```
/ap6256/ap6256.sh
```

开机后

```
root@stm32mp2:~# hciconfig
```

```
root@stm32mp2:~#  
root@stm32mp2:~# hciconfig  
hci0: Type: Primary Bus: UART  
BD Address: 9C:B8:B4:35:D2:59 ACL MTU: 1021:8 SCO MTU: 64:1  
DOWN  
RX bytes:740 acl:0 sco:0 events:42 errors:0  
TX bytes:463 acl:0 sco:0 commands:42 errors:0  
root@stm32mp2:~#
```

```
root@stm32mp2:~# bluetoothctl
```

```
[bluetooth]# power on
```

Changing power on succeeded

```
[bluetooth]# scan on
```

Discovery started

```
[NEW] Device 1C:C9:92:E7:8E:31 sttest
```

```
[bluetooth]# pair 1C:C9:92:E7:8E:31
```

Attempting to pair with 1C:C9:92:E7:8E:31

```
[CHG] Device 1C:C9:92:E7:8E:31 Connected: yes
```

Request confirmation

```
[agent] Confirm passkey 079880 (yes/no): yes
```

手机端确认配对，

```
[bluetooth]# pair 1C:C9:92:E7:8E:31
Attempting to pair with 1C:C9:92:E7:8E:31
[00CHG00] Device 1C:C9:92:E7:8E:31 Connected: yes
Request confirmation
[agent] Confirm passkey 079880 (yes/no): yes
[00CHG00] Device 1C:C9:92:E7:8E:31 Bonded: yes
[00CHG00] Device 1C:C9:92:E7:8E:31 Modalias: bluetooth:v09C6p107Ed1436
[00CHG00] Device 1C:C9:92:E7:8E:31 UUIDs: 0000046a-0000-1000-8000-00805f9b34fb
[00CHG00] Device 1C:C9:92:E7:8E:31 UUIDs: 00001105-0000-1000-8000-00805f9b34fb
[00CHG00] Device 1C:C9:92:E7:8E:31 UUIDs: 0000110a-0000-1000-8000-00805f9b34fb
[00CHG00] Device 1C:C9:92:E7:8E:31 UUIDs: 0000110c-0000-1000-8000-00805f9b34fb
[00CHG00] Device 1C:C9:92:E7:8E:31 UUIDs: 0000110e-0000-1000-8000-00805f9b34fb
[00CHG00] Device 1C:C9:92:E7:8E:31 UUIDs: 00001112-0000-1000-8000-00805f9b34fb
[00CHG00] Device 1C:C9:92:E7:8E:31 UUIDs: 00001115-0000-1000-8000-00805f9b34fb
[00CHG00] Device 1C:C9:92:E7:8E:31 UUIDs: 00001116-0000-1000-8000-00805f9b34fb
[00CHG00] Device 1C:C9:92:E7:8E:31 UUIDs: 0000111f-0000-1000-8000-00805f9b34fb
[00CHG00] Device 1C:C9:92:E7:8E:31 UUIDs: 0000112f-0000-1000-8000-00805f9b34fb
[00CHG00] Device 1C:C9:92:E7:8E:31 UUIDs: 00001132-0000-1000-8000-00805f9b34fb
[00CHG00] Device 1C:C9:92:E7:8E:31 UUIDs: 00001200-0000-1000-8000-00805f9b34fb
[00CHG00] Device 1C:C9:92:E7:8E:31 UUIDs: 00001800-0000-1000-8000-00805f9b34fb
[00CHG00] Device 1C:C9:92:E7:8E:31 UUIDs: 00001801-0000-1000-8000-00805f9b34fb
[00CHG00] Device 1C:C9:92:E7:8E:31 UUIDs: 00001855-0000-1000-8000-00805f9b34fb
[00CHG00] Device 1C:C9:92:E7:8E:31 UUIDs: 0000fe35-0000-1000-8000-00805f9b34fb
[00CHG00] Device 1C:C9:92:E7:8E:31 UUIDs: 11c8b310-80e4-4276-afc0-f81590b2177f
[00CHG00] Device 1C:C9:92:E7:8E:31 UUIDs: 8ce255c0-200a-11e0-ac64-0800200c9a66
[00CHG00] Device 1C:C9:92:E7:8E:31 UUIDs: 9664aa26-d76c-43ad-9775-d310f253a408
[00CHG00] Device 1C:C9:92:E7:8E:31 ServicesResolved: yes
[00CHG00] Device 1C:C9:92:E7:8E:31 Paired: yes
Pairing successful
[00CHG00] Device 1C:C9:92:E7:8E:31 ServicesResolved: no
[00CHG00] Device 1C:C9:92:E7:8E:31 Connected: no
[01DEL00] Device 58:2b:34:4c:03:fe ClearGrass Temp RH Barometer
[00CHG00] Device 30:1b:97:ae:7e:d3 Name: LierdaBeacon
[00CHG00] Device 30:1b:97:ae:7e:d3 Alias: LierdaBeacon
[00CHG00] Device 30:1b:97:ae:7e:d3 UUIDs: 0000feaa-0000-1000-8000-00805f9b34fb
[00CHG00] Device 30:1b:97:ae:7e:d3 UUIDs: 00001b30-0000-1000-8000-00805f9b34fb
[00CHG00] Device 30:1b:97:ae:7e:d3 UUIDs: 0000ae97-0000-1000-8000-00805f9b34fb
[00CHG00] Device 30:1b:97:ae:7e:d3 UUIDs: 0000d37e-0000-1000-8000-00805f9b34fb
[00CHG00] Device 30:1b:97:ae:7e:d3 ServiceData Key: 0000feaa-0000-1000-8000-00805f9b34fb
[00CHG00] Device 30:1b:97:ae:7e:d3 ServiceData Value:
00 ca 11 22 33 44 55 66 77 88 99 00 aa bb cc dd ... "3Dufw.....
ee ff
[00NEW00] Device 5b:4f:3f:d4:e6:53 5B-4F-3F-D4-E6-53
[00NEW00] Device 75:d0:d5:62:38:4d 75-D0-D5-62-38-4D
[01DEL00] Device 30:89:4a:82:00:a9 DESKTOP-V09JILB
[01DEL00] Device 90:f0:52:9a:6a:91 MEIZU 21 Pro
[00NEW00] Device 30:89:4a:82:00:a9 DESKTOP-V09JILB
```

[bluetooth]# trust 1C:C9:92:E7:8E:31

```
[bluetooth]# trust 1C:C9:92:E7:8E:31
[00CHG00] Device 1C:C9:92:E7:8E:31 Trusted: yes
Changing 1C:C9:92:E7:8E:31 trust succeeded
[01DEL00] Device d4:54:8b:e3:b2:9f HZ-005238
[00NEW00] Device d4:54:8b:e3:b2:9f HZ-005238
[00NEW00] Device 90:f0:52:9a:6a:91 MEIZU 21 Pro
[00CHG00] Device 90:f0:52:9a:6a:91 UUIDs: 00001105-0000-1000-8000-00805f9b34fb
[00CHG00] Device 90:f0:52:9a:6a:91 UUIDs: 0000110a-0000-1000-8000-00805f9b34fb
[00CHG00] Device 90:f0:52:9a:6a:91 UUIDs: 0000110c-0000-1000-8000-00805f9b34fb
[00CHG00] Device 90:f0:52:9a:6a:91 UUIDs: 0000110e-0000-1000-8000-00805f9b34fb
[00CHG00] Device 90:f0:52:9a:6a:91 UUIDs: 00001112-0000-1000-8000-00805f9b34fb
[00CHG00] Device 90:f0:52:9a:6a:91 UUIDs: 00001115-0000-1000-8000-00805f9b34fb
[00CHG00] Device 90:f0:52:9a:6a:91 UUIDs: 00001116-0000-1000-8000-00805f9b34fb
[00CHG00] Device 90:f0:52:9a:6a:91 UUIDs: 0000111f-0000-1000-8000-00805f9b34fb
[00CHG00] Device 90:f0:52:9a:6a:91 UUIDs: 0000112d-0000-1000-8000-00805f9b34fb
[00CHG00] Device 90:f0:52:9a:6a:91 UUIDs: 0000112f-0000-1000-8000-00805f9b34fb
[00CHG00] Device 90:f0:52:9a:6a:91 UUIDs: 00001200-0000-1000-8000-00805f9b34fb
[00CHG00] Device 90:f0:52:9a:6a:91 UUIDs: 00001132-0000-1000-8000-00805f9b34fb
[00CHG00] Device 90:f0:52:9a:6a:91 UUIDs: 00000000-0000-0000-0000-000000000000
```

[bluetooth]# connect 1C:C9:92:E7:8E:31

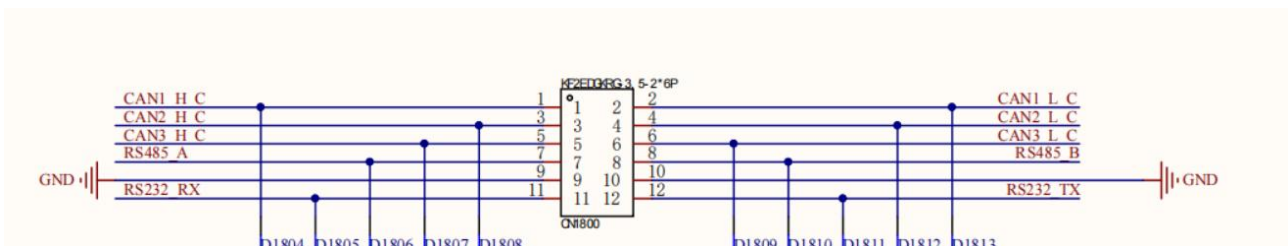
```
[00CHG00] Device 90:F0:52:9A:6A:91 UUIDs: 00000000-0000-0000-0000-000000000000
[bluetooth]# connect 1C:C9:92:E7:8E:31
Attempting to connect to 1C:C9:92:E7:8E:31
[00CHG00] Device 1C:C9:92:E7:8E:31 connected: yes
[00NEW00] Endpoint /org/bluez/hci0/dev_1C_C9_92_E7_8E_31/sep1
[00NEW00] Endpoint /org/bluez/hci0/dev_1C_C9_92_E7_8E_31/sep2
[00NEW00] Endpoint /org/bluez/hci0/dev_1C_C9_92_E7_8E_31/sep3
[00NEW00] Endpoint /org/bluez/hci0/dev_1C_C9_92_E7_8E_31/sep4
[00NEW00] Endpoint /org/bluez/hci0/dev_1C_C9_92_E7_8E_31/sep5
[00NEW00] Transport /org/bluez/hci0/dev_1C_C9_92_E7_8E_31/sep2/fd0
Connection successful
[00NEW00] Player /org/bluez/hci0/dev_1C_C9_92_E7_8E_31/player0 [default]
[00CHG00] Device 1C:C9:92:E7:8E:31 ServicesResolved: yes
[00CHG00] Transport /org/bluez/hci0/dev_1C_C9_92_E7_8E_31/sep2/fd0 volume: 0x003c (60)
[00CHG00] Player /org/bluez/hci0/dev_1C_C9_92_E7_8E_31/player0 Equalizer: off
[00CHG00] Player /org/bluez/hci0/dev_1C_C9_92_E7_8E_31/player0 Repeat: off
[00CHG00] Player /org/bluez/hci0/dev_1C_C9_92_E7_8E_31/player0 Shuffle: off
[00CHG00] Player /org/bluez/hci0/dev_1C_C9_92_E7_8E_31/player0 Scan: off
[00CHG00] Player /org/bluez/hci0/dev_1C_C9_92_E7_8E_31/player0 Type: Audio
[00CHG00] Player /org/bluez/hci0/dev_1C_C9_92_E7_8E_31/player0 Subtype: None
[00CHG00] Player /org/bluez/hci0/dev_1C_C9_92_E7_8E_31/player0 Status: paused
[00CHG00] Player /org/bluez/hci0/dev_1C_C9_92_E7_8E_31/player0 Name: Bluetooth Player
[00CHG00] Player /org/bluez/hci0/dev_1C_C9_92_E7_8E_31/player0 Title: Not Provided
[00CHG00] Player /org/bluez/hci0/dev_1C_C9_92_E7_8E_31/player0 TrackNumber: 0x00000001 (1)
[00CHG00] Player /org/bluez/hci0/dev_1C_C9_92_E7_8E_31/player0 NumberOfTracks: 0x00000001 (1)
[00CHG00] Player /org/bluez/hci0/dev_1C_C9_92_E7_8E_31/player0 Duration: 0x00000000 (0)
[00CHG00] Player /org/bluez/hci0/dev_1C_C9_92_E7_8E_31/player0 Position: 0x00000000 (0)
[00CHG00] Player /org/bluez/hci0/dev_1C_C9_92_E7_8E_31/player0 Position: 0x00000000 (0)
[00DEL00] Device AC:23:3F:21:50:FB AC-23-3F-21-50-FB
[00NEW00] Device AC:23:3F:21:50:FB AC-23-3F-21-50-FB
[sttest]# quit
```

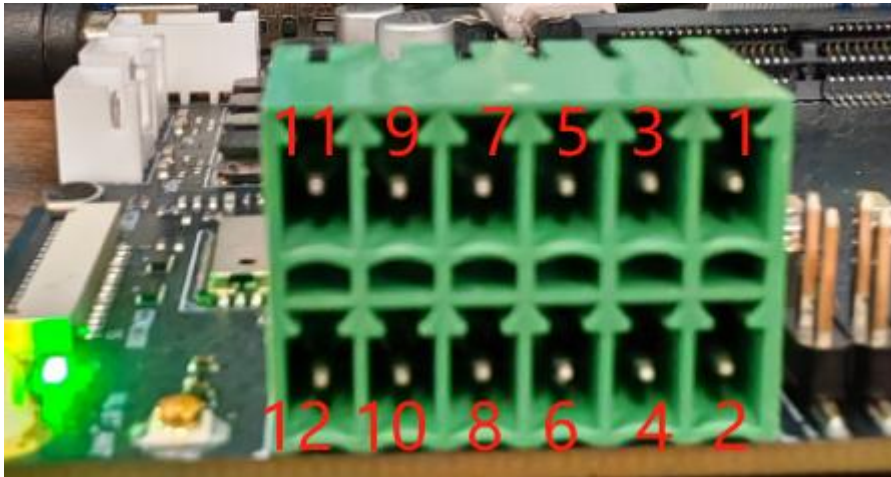
[sttest]# quit

```
^C0 sent, 0 received, 0% loss
root@stm32mp2:~# l2ping 1C:C9:92:E7:8E:31
Ping: 1C:C9:92:E7:8E:31 from 9C:B8:B4:35:D2:6B (data size 44) ...
44 bytes from 1C:C9:92:E7:8E:31 id 0 time 6.30ms
44 bytes from 1C:C9:92:E7:8E:31 id 1 time 74.91ms
44 bytes from 1C:C9:92:E7:8E:31 id 2 time 12.32ms
44 bytes from 1C:C9:92:E7:8E:31 id 3 time 34.88ms
44 bytes from 1C:C9:92:E7:8E:31 id 4 time 13.60ms
44 bytes from 1C:C9:92:E7:8E:31 id 5 time 14.85ms
^C6 sent, 6 received, 0% loss
root@stm32mp2:~#
```

root@stm32mp2:~# l2ping 1C:C9:92:E7:8E:31

3.15 Can





测试脚本 can_test.sh

```
#!/bin/sh

if [ $1 == "can01" ] ; then
    ip link set can0 up down
    ip link set can0 up type can bitrate 125000
    ifconfig can0 up
    ip -d link show can0
    candump can0 &

    ip link set can1 up down
    ip link set can1 up type can bitrate 125000
    ifconfig can1 up
    ip -d link show can1
    cansend can1 123#1122334455667788

else
    ip link set can0 up down
    ip link set can0 up type can bitrate 125000
    ifconfig can0 up
    ip -d link show can0
```

```
candump can0 &
```

```
ip link set can2 up down
```

```
ip link set can2 up type can bitrate 125000
```

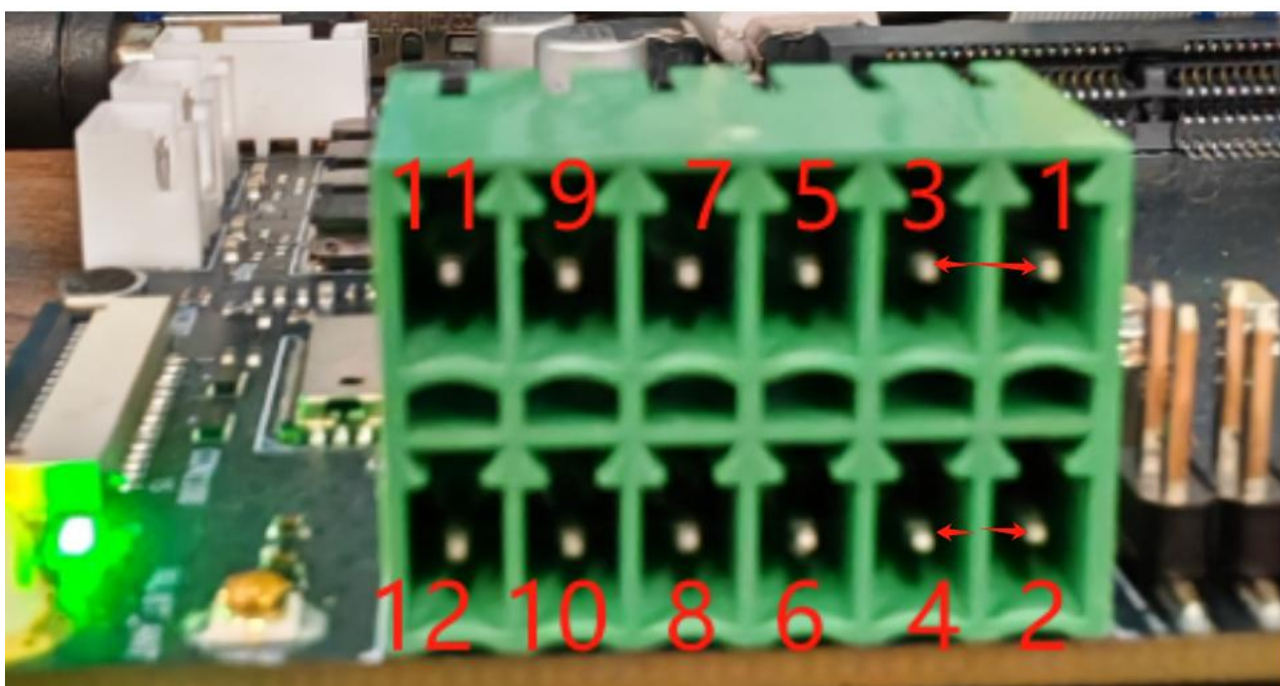
```
ifconfig can2 up
```

```
ip -d link show can2
```

```
cansend can2 123#1122334455667788
```

```
fi
```

测试 pin1 连接 pin3 pin2 连接 pin4



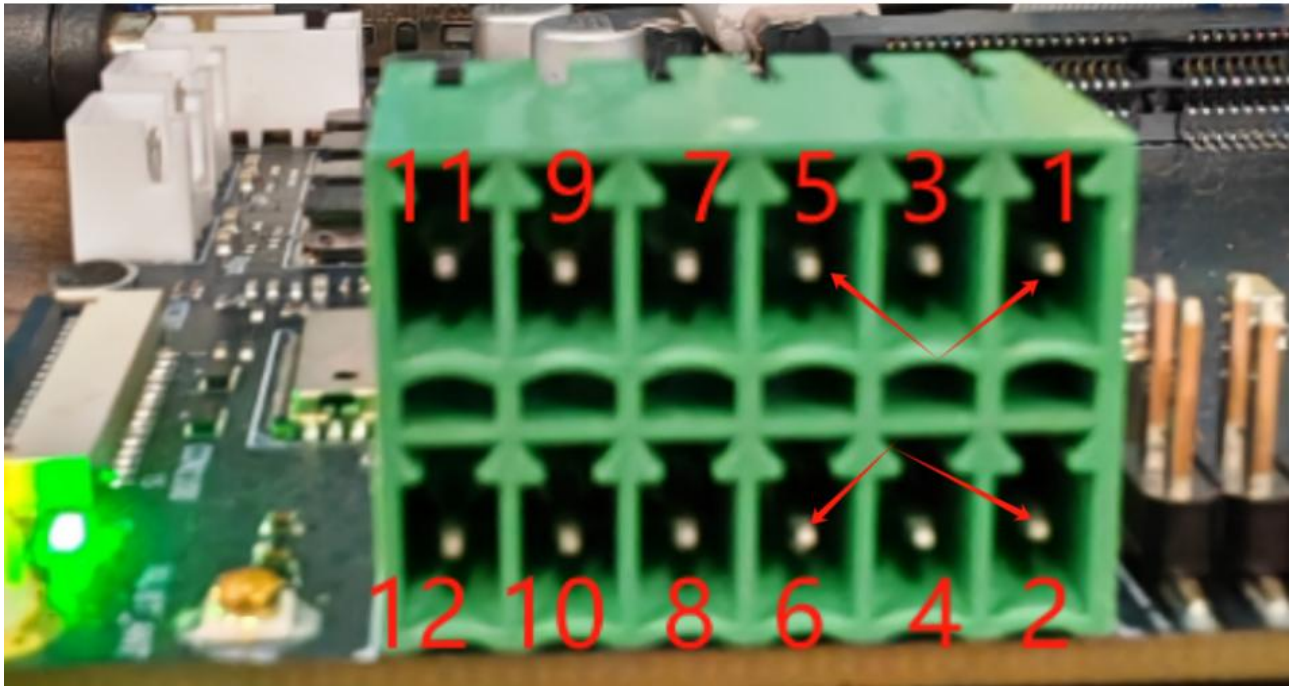
```
root@stm32mp25:~# can_test.sh can01
```

```

root@stm32mp2:~# can0 123 [8] 11 22 33 44 55 66 77 88
root@stm32mp2:~# ./can_test.sh can01
read: Network is down
2: can0: <NOARP,UP,LOWER_UP,ECHO> mtu 16 qdisc pfifo_fast state UP mode DEFAULT group default qlen 10
    link/can promiscuity 0 allmulti 0 minmtu 0 maxmtu 0
    can state ERROR-ACTIVE (berr-counter tx 0 rx 0) restart-ms 0
        bitrate 125000 sample-point 0.875
        tq 40 prop-seg 87 phase-seg1 87 phase-seg2 25 sjw 1 brp 4
        m_can: tseg1 2..256 tseg2 2..128 sjw 1..128 brp 1..512 brp_inc 1
        m_can: dtseg1 1..32 dtseg2 1..16 dsjw 1..16 dbrp 1..32 dbrp_inc 1
        clock 100000000 numtxqueues 1 numrxqueues 1 gso_max_size 65536 gso_max_segs 65535 tso_max_size 65536 tso_max_segs 65535
3: can1: <NOARP,UP,LOWER_UP,ECHO> mtu 16 qdisc pfifo_fast state UP mode DEFAULT group default qlen 10
    link/can promiscuity 0 allmulti 0 minmtu 0 maxmtu 0
    can state ERROR-ACTIVE (berr-counter tx 0 rx 0) restart-ms 0
        bitrate 125000 sample-point 0.875
        tq 40 prop-seg 87 phase-seg1 87 phase-seg2 25 sjw 1 brp 4
        m_can: tseg1 2..256 tseg2 2..128 sjw 1..128 brp 1..512 brp_inc 1
        m_can: dtseg1 1..32 dtseg2 1..16 dsjw 1..16 dbrp 1..32 dbrp_inc 1
        clock 100000000 numtxqueues 1 numrxqueues 1 gso_max_size 65536 gso_max_segs 65535 tso_max_size 65536 tso_max_segs 65535
can0 123 [8] 11 22 33 44 55 66 77 88
root@stm32mp2:~#
root@stm32mp2:~# sync

```

测试 pin1 连接 pin5 pin2 连接 pin6



root@stm32mp25:~# can_test.sh can02

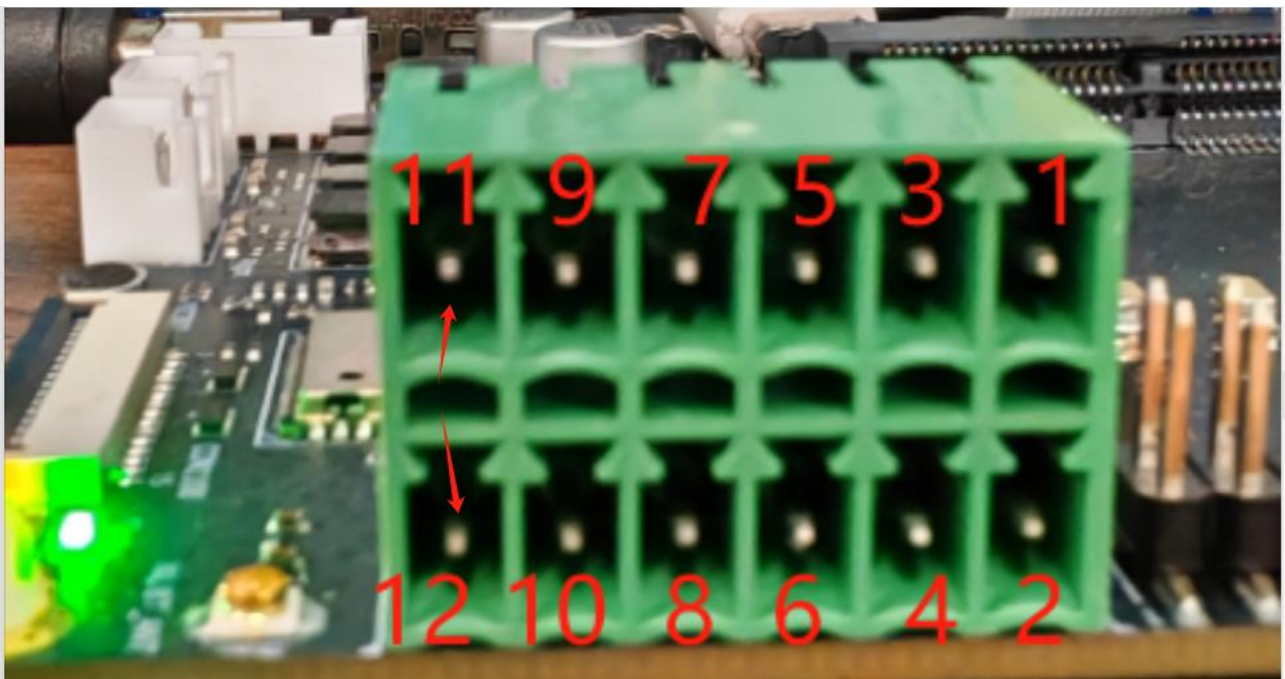
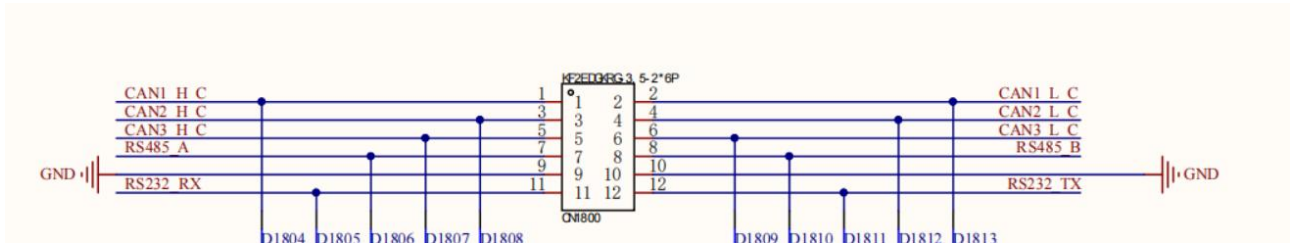
```

fi
root@stm32mp2:~# ./can_test.sh can02
2: can0: <NOARP,UP,LOWER_UP,ECHO> mtu 16 qdisc pfifo_fast state UP mode DEFAULT group default qlen 10
    link/can promiscuity 0 allmulti 0 minmtu 0 maxmtu 0
    can state ERROR-ACTIVE (berr-counter tx 0 rx 0) restart-ms 0
        bitrate 125000 sample-point 0.875
        tq 40 prop-seg 87 phase-seg1 87 phase-seg2 25 sjw 1 brp 4
        m_can: tseg1 2..256 tseg2 2..128 sjw 1..128 brp 1..512 brp_inc 1
        m_can: dtseg1 1..32 dtseg2 1..16 dsjw 1..16 dbrp 1..32 dbrp_inc 1
        clock 100000000 numtxqueues 1 numrxqueues 1 gso_max_size 65536 gso_max_segs 65535 tso_max_size 65536 tso_max_segs 65535
4: can2: <NO-CARRIER,NOARP,UP,LOWER_UP,ECHO> mtu 16 qdisc pfifo_fast state DOWN mode DEFAULT group default qlen 10
    link/can promiscuity 0 allmulti 0 minmtu 0 maxmtu 0
    can state ERROR-ACTIVE (berr-counter tx 0 rx 0) restart-ms 0
        bitrate 125000 sample-point 0.875
        tq 40 prop-seg 87 phase-seg1 87 phase-seg2 25 sjw 1 brp 4
        m_can: tseg1 2..256 tseg2 2..128 sjw 1..128 brp 1..512 brp_inc 1
        m_can: dtseg1 1..32 dtseg2 1..16 dsjw 1..16 dbrp 1..32 dbrp_inc 1
        clock 100000000 numtxqueues 1 numrxqueues 1 gso_max_size 65536 gso_max_segs 65535 tso_max_size 65536 tso_max_segs 65535
can0 123 [8] 11 22 33 44 55 66 77 88
root@stm32mp2:~#

```

3.16 232&485

232:



```
root@stm32mp25:~#microcom -s 115200 /dev/ttySTM1
```

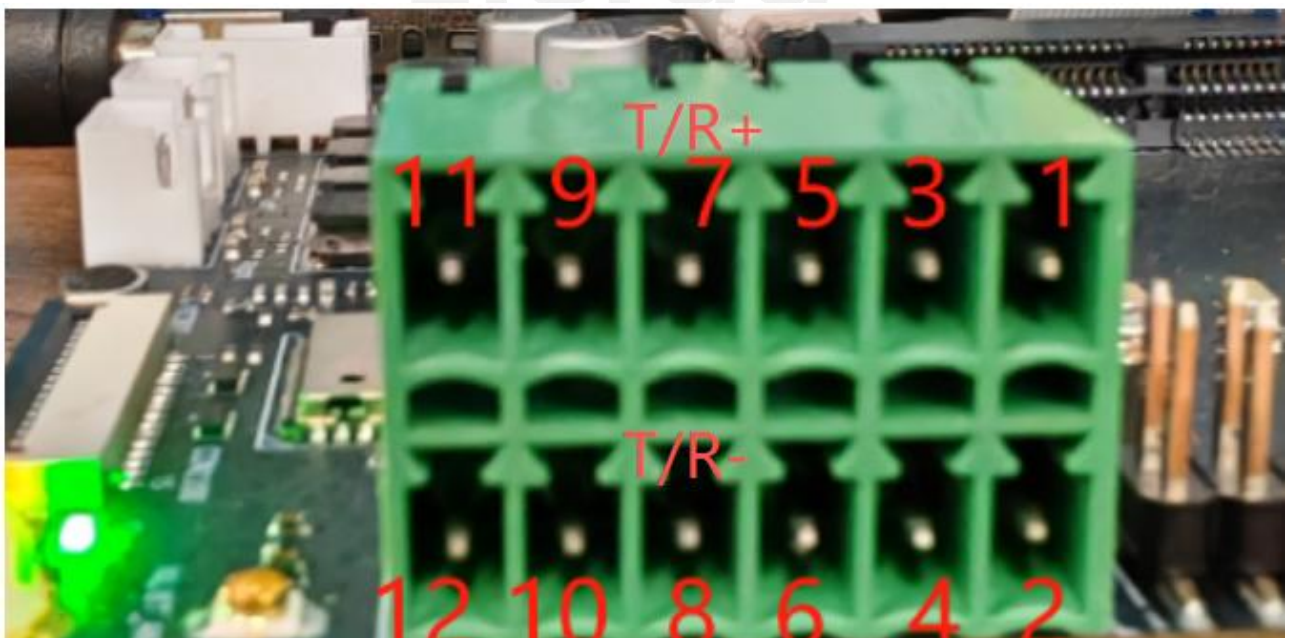
```
root@stm32mp2:~# microcom -s 115200 /dev/ttySTM1
sdsd12345
```

退出为 ctrl+x

短接 11、12 引脚，执行上述指令，键盘输入后回显显示正常，芯片最大支持 250Kbps。

485:

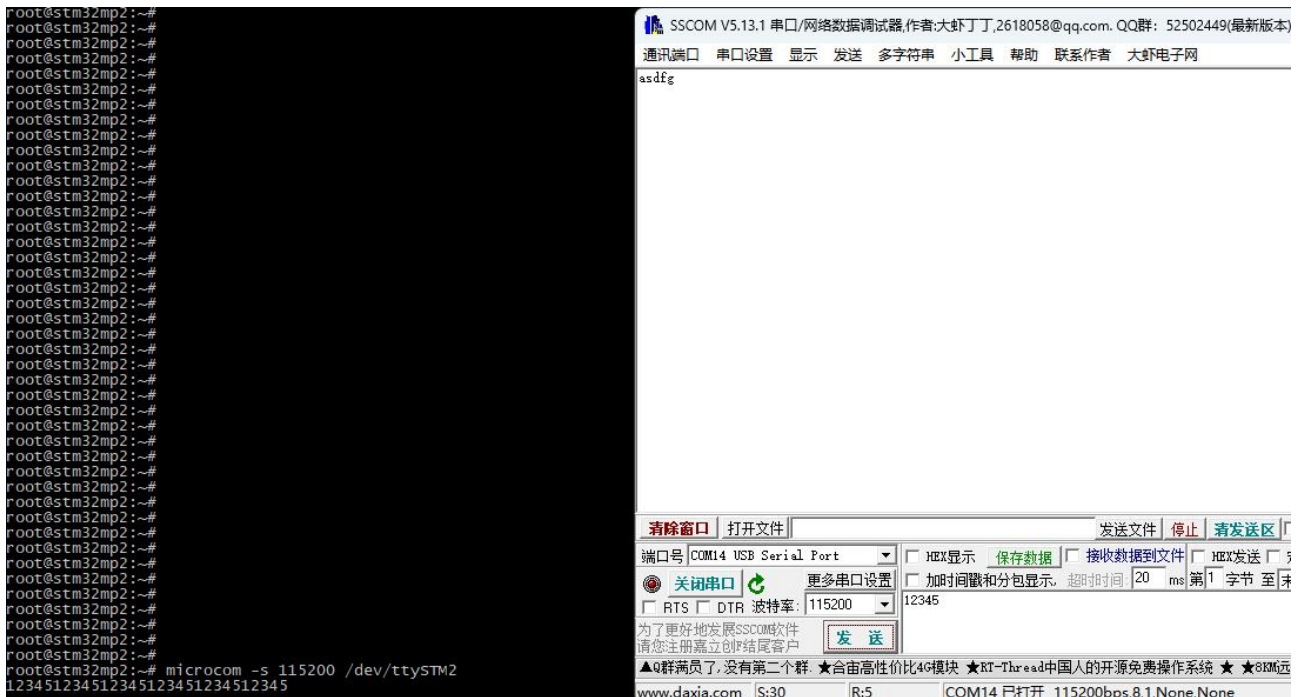
测试工具 usb 转 485 T/R-连接 8 引脚，T/R+连接 10 引脚，如下图：



开发板端运行：

```
root@stm32mp25:~#microcom -s 115200 /dev/ttySTM2
```

Ctrl+x 退出。



键盘输入任意信息，则 pc 端接收到键盘信息；pc 端点击发送，板子端接收相应信息。

芯片最大支持 250Kbps 。

3.17 RTC

Cpu 自带 rtc 的节点为/dev/rtc0，外部硬件 rtc 节点为/dev/rtc1。若需保存时间需要安装电池。

系统时间设置：

```
date -s "2025-3-14 10:10:10"
```

同步系统时间到 rtc 内部：

```
hwclock -f /dev/rtc0 -w
```

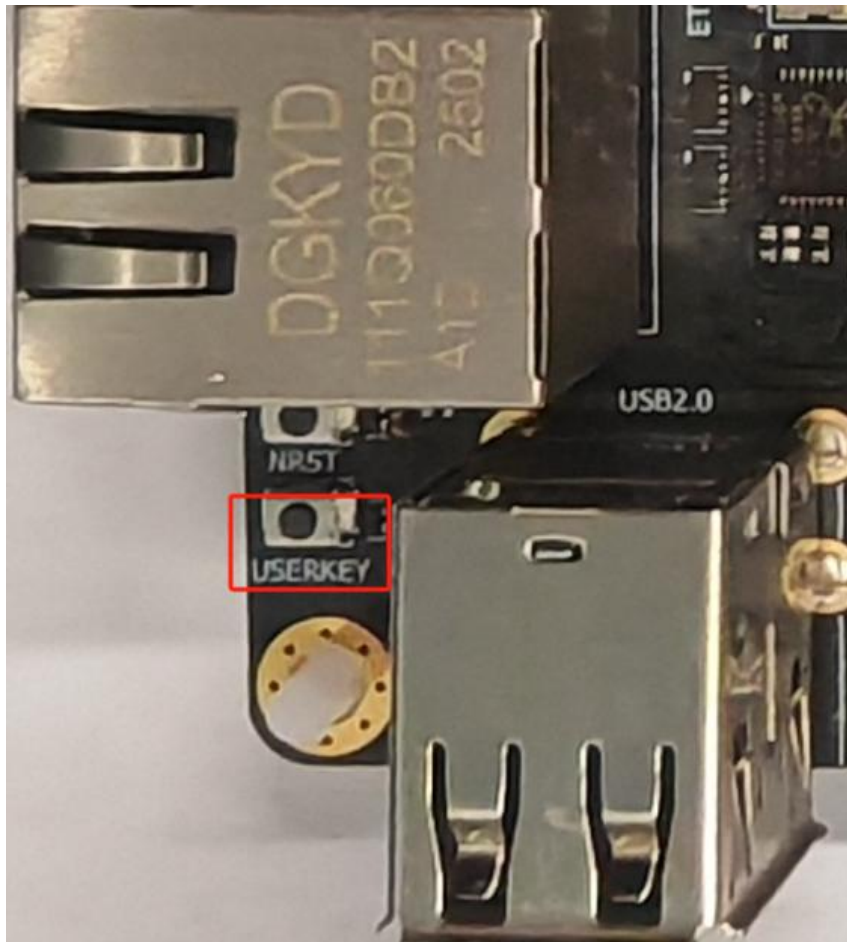
```
hwclock -f /dev/rtc1 -w
```

读取 rtc 内部时间

```
hwclock -f /dev/rtc0
```

```
hwclock -f /dev/rtc1
```

3.18 Button



若连接触摸屏用户按键节点为：

/dev/input/event1

```
root@stm32mp25:~# cat /dev/input/event1
v0d0g0000v0d0gv0d0000v0d0v0dq0000v0dq0d000v0dw0dnc0000w0dncw0d000w0d
```

未连接任何触摸屏则节点为：

```
^C
root@stm32mp2:~# cat /dev/input/event0
d0000dd8r000d8rd0000dda000da
```

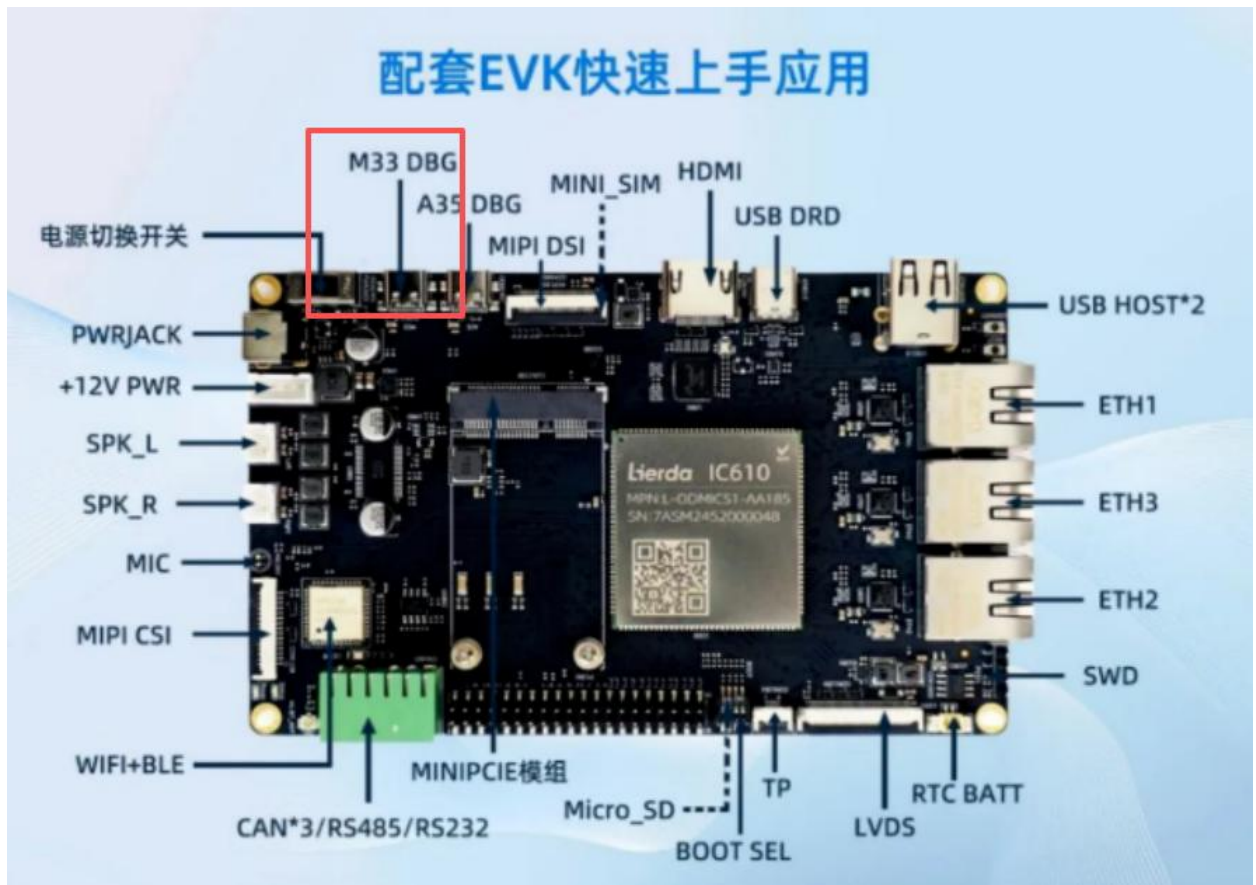
u-boot 启动中，按住 USERKEY，则会自动进入烧录模式。

复位按键为 NRST，按后系统自动复位重启。

3.19 M33 核

PC 端使用 typec 连接 M33 DBG 引脚，串口工具打开对应 com 口，设置参数：波特特

115200 、数据位 8、奇偶位 0、停止位 1、流控无。



A35 端:

```
root@stm32mp2:~# cd /OpenAMP_TTY_echo/
```

```
root@stm32mp2:/OpenAMP_TTY_echo# ./fw_cortex_m33.sh start
```

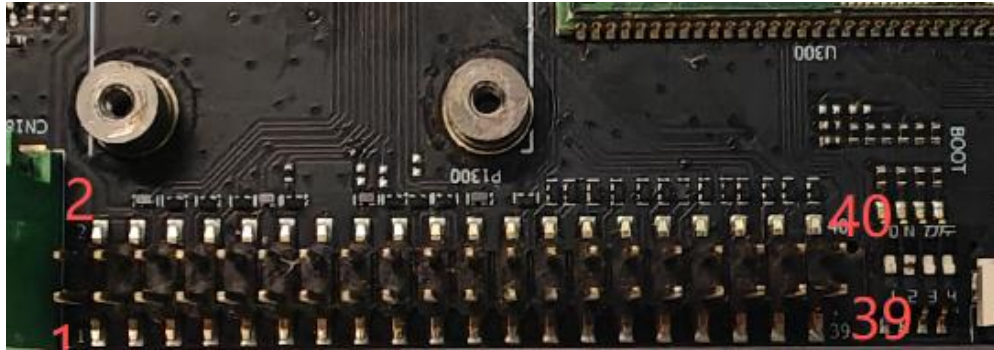
```
root@stm32mp2:/OpenAMP_TTY_echo#
root@stm32mp2:/OpenAMP_TTY_echo# ./fw_cortex_m33.sh start
fw_cortex_m33.sh: fwm_name=OpenAMP_TTY_echo_CM33_NonSecure.elf
st[ 4361.132631] remoteproc remoteproc0: stopped remote processor m33
opping running fw ...
[ 4361.264173] remoteproc remoteproc0: powering up m33
[ 4361.360029] remoteproc remoteproc0: Booting fw image OpenAMP_TTY_echo_CM33_NonSecure.elf, size 3413720
[ 4361.364648] rproc-virtio rproc-virtio.2.auto: assigned reserved memory node vdev0buffer@812fa000
[ 4361.373171] virtio_rpmsg_bus virtio0: rpmsg host is online
[ 4361.378289] rproc-virtio rproc-virtio.2.auto: registered virtio0 (type 7)
[ 4361.378578] virtio_rpmsg_bus virtio0: creating channel rpmsg-tty addr 0x400
[ 4361.384991] remoteproc remoteproc0: remote processor m33 is now up
[ 4361.392317] virtio_rpmsg_bus virtio0: creating channel rpmsg-tty addr 0x401
root@stm32mp2:/OpenAMP_TTY_echo#
root@stm32mp2:/OpenAMP_TTY_echo#
root@stm32mp2:/OpenAMP_TTY_echo#
```

M33 端:

```
starting openAMP application (Nov 29 2024: 16:50:11)
virtual UART0 OpenAMP-rpmsg channel creation
virtual UART1 OpenAMP-rpmsg channel creation
```

如上 M33 核运行正常。

3.20 树莓派 40Pin



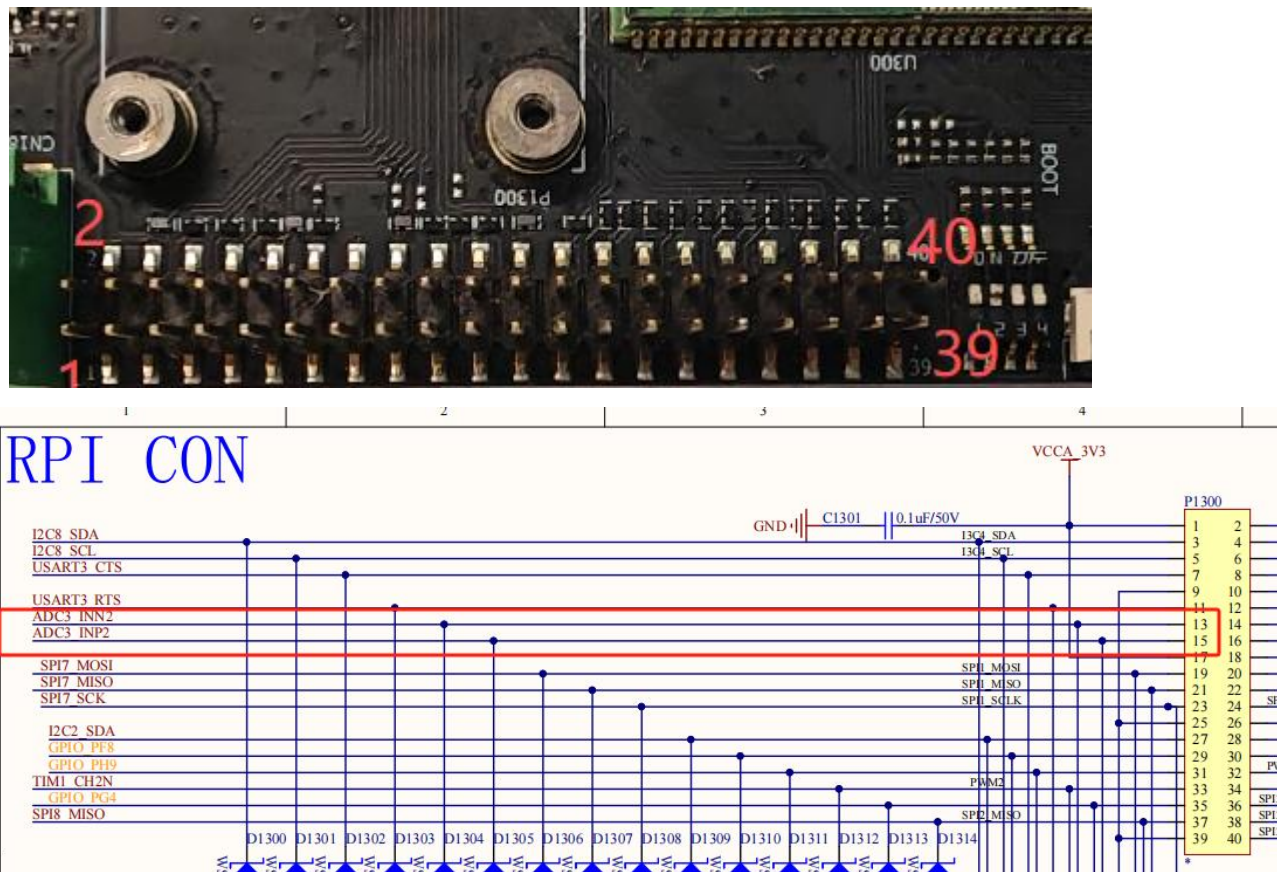
引脚号	GPIO 号	复用功能	引脚号	GPIO 号	复用功能
1	NC	3V3	2	NC	5v
3	PZ0	I2C8_SDA	4	NC	5v
5	PZ2	I2C8_SCL	6	NC	GND
7	PF13	USART3_CTS	8	PI6	USART3_TX
9	NC	GND	10	PI7	USART3_RX
11	PF14	USART3_RTS	12	PB6	GPIO_PB6
13	PF11	ADC3_INN2	14	NC	GND
15	PF10	ADC3_INP2	16	PI5	UART9_RX
17	NC	3V3	18	PG8	UART9_TX
19	PG11	SPI7_MOSI	20	NC	GND
21	PG12	SPI7_MISO	22	PG15	GPIO_PG15
23	PG13	SPI7_SCK	24	PI1	SPI7_NSS
25	PB4	I2C2_SDA	26	PB1	GPIO_PB1
27	NC	GND	28	PF2	I2C2_SCL
29	PF8	GPIO_PF8	30	NC	GND
31	PH9	GPIO_PH9	32	PD7	TIM1_CH1N(PWM1)
33	PD6	TIM1_CH2N(PWM2)	34	NC	GND
35	PG4	GPIO_PG4	36	PZ6	SPI8_NSS
37	PZ8	SPI8_MISO	38	PZ7	SPI8_MOSI
39	NC	GND	40	PZ5	SPI8_SCK

注意：16、18 和 22 引脚当前硬件用于 4g 模组，若要使用此 3 引脚需要修改硬件。

3.20.1 树莓派 ADC

IC610 adc 采样输入范围为 0-1.8v，超过该电压有可能会损坏硬件。

ADC 引脚在树莓派插座座子上，具体引脚如下：



ADC_INN2 对应插针座子 13 引脚，ADC_INP2 对应插针座子 15 引脚。

该 2 路 adc 引脚可工作在差分输入和单端输入。

可在 kernel 的 arch/arm64/boot/dts/st/stm32mp255d-ic610-mx.dts 修改宏定义 ADC_DIFF 进行修改，定义 ADC_DIFF 则 adc 工作在差分输入模式，若注释则工作在单端输入模式，默认为差分输入模式。

单端输入模式：

ADC_INN2 对应为 channel6

```
cat /sys/bus/iio/devices/iio:device0/in_voltage6_raw
```

ADC_INP2 对应为 channel2

```
cat /sys/bus/iio/devices/iio:device0/in_voltage2_raw
```

```
root@stm32mp2:~# cat /sys/bus/iio/devices/iio:device0/in_voltage2_raw
1890
root@stm32mp2:~# cat /sys/bus/iio/devices/iio:device0/in_voltage2_raw
4087
root@stm32mp2:~# cat /sys/bus/iio/devices/iio:device0/in_voltage6_raw
3081
root@stm32mp2:~# cat /sys/bus/iio/devices/iio:device0/in_voltage6_raw
4087
root@stm32mp2:~# cat /sys/bus/iio/devices/iio:device0/in_voltage6_raw
4087
root@stm32mp2:~# cat /sys/bus/iio/devices/iio:device0/in_voltage6_raw
4087
```

差分输入模式：

ADC_INN2 接入 GND ,ADC_INP2 接入 1.8v, 读取如下

```
cat /sys/bus/iio/devices/iio:device0/in_voltage2-voltage3_raw
```

```
root@stm32mp2:~# cat /sys/bus/iio/devices/iio:device0/in_voltage2-voltage3_raw
4092
root@stm32mp2:~# cat /sys/bus/iio/devices/iio:device0/in_voltage2-voltage3_raw
4092
root@stm32mp2:~# cat /sys/bus/iio/devices/iio:device0/in_voltage2-voltage3_raw
4091
root@stm32mp2:~# cat /sys/bus/iio/devices/iio:device0/in_voltage2-voltage3_raw
2155
```

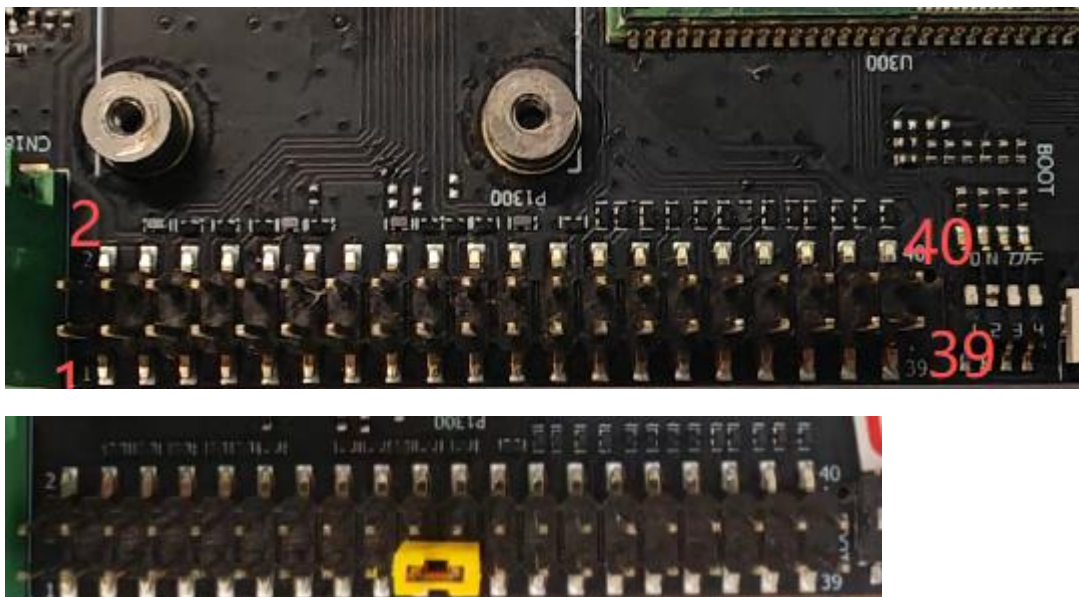
3.20.2 树莓派 SPI 总线

本 evk 预留 2 路 spi 总线，参考 3.20 树莓派座子引脚介绍

系统默认使能 spidev 测试 spi 总线。

spi7 总线测试：

将 spi7 的 mosi 和 miso 短接，即树莓派 Pin19 和 Pin21 如下图



```
./spidev_test -D /dev/spidev0.0 -s 1000000 -v -p "Hello"
```

```

root@stm32mp2:~#
root@stm32mp2:~#
root@stm32mp2:~# ./spidev_test -D /dev/spidev0.0 -s 1000000 -v -p "Hello"
spi mode: 0x0
bits per word: 8
max speed: 1000000 Hz (1000 kHz)
TX | 48 65 6C 6C 6F |-----|
RX | 48 65 6C 6C 6F |-----|
root@stm32mp2:~#
root@stm32mp2:~#
root@stm32mp2:~#

```

短接miso和mosi后

```

root@stm32mp2:~#
root@stm32mp2:~# ./spidev_test -D /dev/spidev0.0 -s 1000000 -v -p "Hello"
spi mode: 0x0
bits per word: 8
max speed: 1000000 Hz (1000 kHz)
TX | 48 65 6C 6C 6F |-----|
RX | 7F FF FF FF FF |-----|
root@stm32mp2:~#

```

未短接mosi和miso

Spi8 总线测试：

将 spi8 的 mosi 和 miso 短接，即树莓派 Pin37 和 Pin38，如下图



```
./spidev_test -D /dev/spidev1.0 -s 1000000 -v -p "Hello"
```

```

root@stm32mp2:~#
root@stm32mp2:~# ./spidev_test -D /dev/spidev1.0 -s 1000000 -v -p "Hello"
spi mode: 0x0
bits per word: 8
max speed: 1000000 Hz (1000 kHz)
TX | 48 65 6C 6C 6F |-----|
RX | 48 65 6C 6C 6F |-----|
root@stm32mp2:~#

```

3.20.3 树莓派 串口

该串口 usart3 系统启动后设备节点为/dev/ttySTM4

```
root@stm32mp25:~#microcom -s 115200 /dev/ttySTM4
```

Pin6 和 Pin8 引脚短接测试：

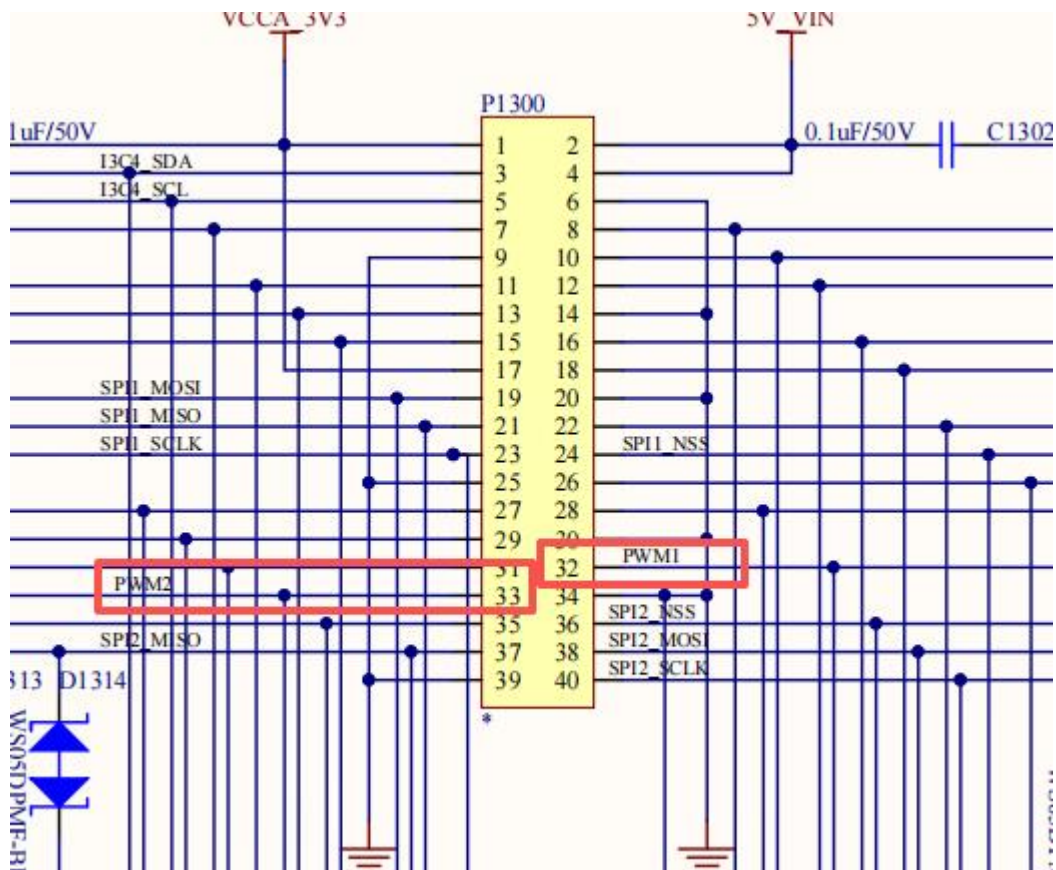


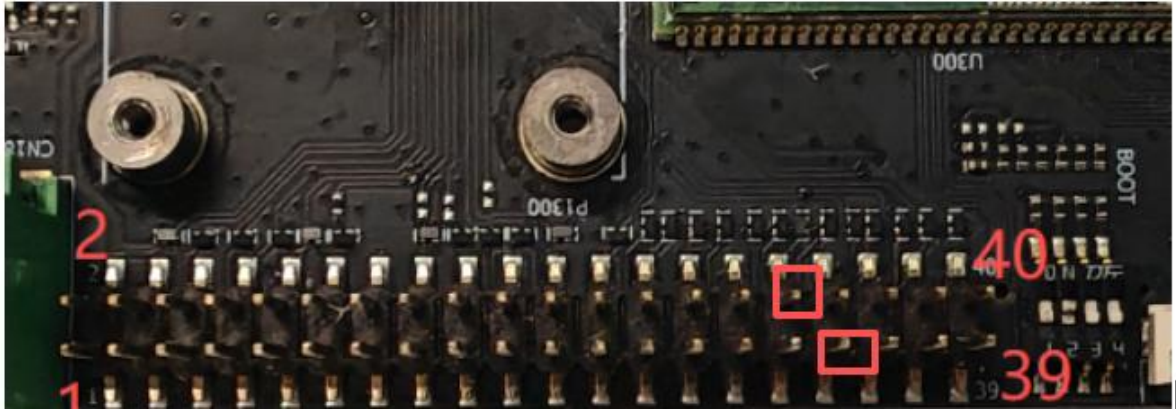


3.20.4 树莓派 pwm

参考《Lierda_IC610_PWM 应用指导_Rev1.0.pdf》

树莓派 33 32 引脚为 pwm 输出引脚





应用层控制如下：

```
/usr/sbin/pwm.sh
```

默认输出频率为 10000000 占空比为 50%，具体可修改脚本内频率及占空比参数。

3.20.5 树莓派 gpio

除 i2c2、pwm、spi 总线、串口外其他 io 暂作为 gpio 进行测试：

树莓派引脚号	GPIO-number	定义功能
12	PB6	GPIO_PB6
22	PG15	GPIO_PG15
26	PB1	GPIO_PB1
29	PF8	GPIO_PF8
31	PH9	GPIO_PH9
35	PG4	GPIO_PG4



GPIO 拉高:

```
gpioset --hold-period 20ms -t0 -c gpiochip1 6=1
gpioset --hold-period 20ms -t0 -c gpiochip6 15=1
gpioset --hold-period 20ms -t0 -c gpiochip1 1=1
gpioset --hold-period 20ms -t0 -c gpiochip5 8=1
gpioset --hold-period 20ms -t0 -c gpiochip7 9=1
gpioset --hold-period 20ms -t0 -c gpiochip6 4=1
```

GPIO 拉低:

```
gpioset --hold-period 20ms -t0 -c gpiochip1 6=0
gpioset --hold-period 20ms -t0 -c gpiochip6 15=0
gpioset --hold-period 20ms -t0 -c gpiochip1 1=0
gpioset --hold-period 20ms -t0 -c gpiochip5 8=0
gpioset --hold-period 20ms -t0 -c gpiochip7 9=0
gpioset --hold-period 20ms -t0 -c gpiochip6 4=0
```

Lierda
利 尔 达