User Guide
ECB32 Single Board Computer



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1. Overview

This article focuses on how to test and use the functions provided by the ECB32 series single-board computers of Ebyte. If users need to transplant and adapt specific functions on this basis, please also refer to the "ECK32_T527_Software_Development_Guide". The "Software Development Guide" refers to this document in the following text. This article can be used as a preliminary evaluation guide, and can also be used as a test guide for general system development.

1.1.Software Resources

ECB32 is equipped with an operating system based on the Linux 5.15 kernel. The development board comes with the cross-compilation tool chain required for embedded Linux system development, U-boot source code, source code of the Linux kernel and various driver modules, as well as various development and debugging tools suitable for Windows desktop environment and Linux desktop environment, application development samples, etc.

2. Preparation before use

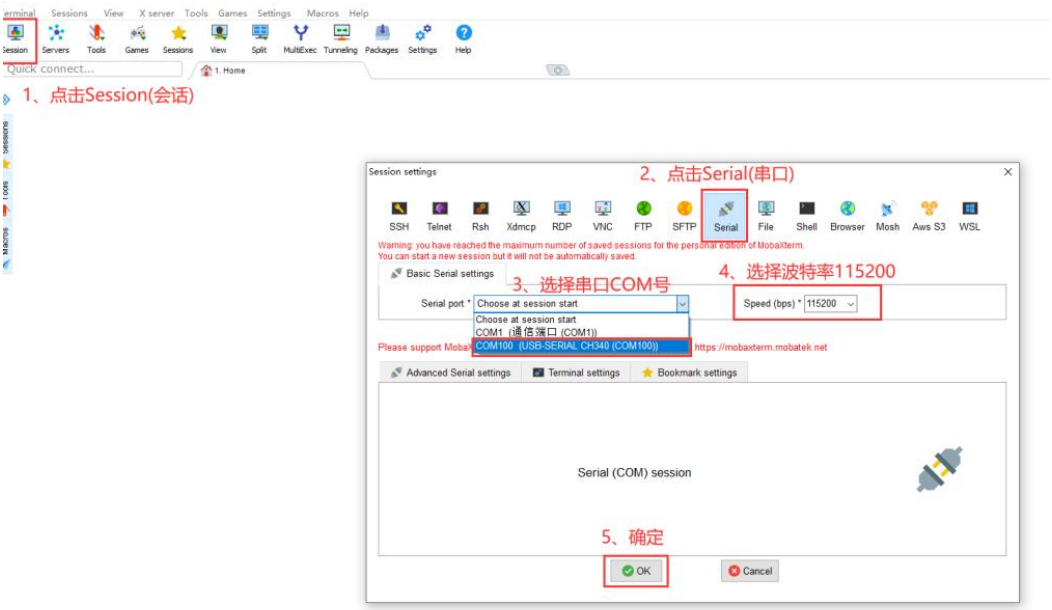
2.1.Serial port software installation

Before using the serial port, you need to install the CH340 serial port driver and MobaXterm serial port terminal. For detailed installation and usage methods, see the Software Development Guide .

After connecting the serial port, install MobaXterm and configure it, and open the serial port as follows.

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3. Quick Start

3.1.Serial port configuration

The baud rate of the serial port used by T527 is 115200, and there is no hardware f low control.

3.2.Image Burning

The single-board computer produced by Ebyte do not provided with boot firmwa re by default, and users need to burn a firmware by themselves. Users can choose to burn firmware according to the single-board computer model. Here we mainly help users quickly start the single-board computer and only explain how to use official tools to bur n firmware to eMMC. For more burning methods and problems in burning, see the Softw are Development Guide.

3.2.1. Burn the development board Flash

First, you need to use a USB data cable to connect the single-board computer and th e computer, and access the OTG interface of the single-board computer . Then use the Al lwinner Technology Company’s official tool PhoenixSuit to achieve USB fast burning.

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Click the "One-click flash" item above to enter the image selection. For T527, we pr ovide two images, corresponding to the debian 11 system using HDMI & DP interfaces as display output, and the buildroot 2022.05 system using MIPI-DSI as display output. The two are stored in the disp_hdmi directory and the disp_mipi directory respectively.

No need to click the Upgrade Now button after selecting!!!

No need to click the Upgrade Now button after selecting!!!

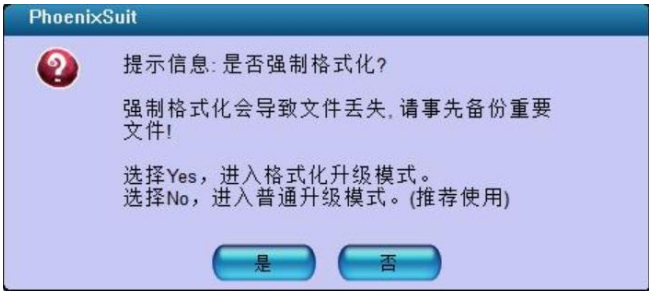
No need to click the Upgrade Now button after selecting!!!

Next we connect two USB-TypeC cables, one for viewing the flash log and one for flashing the board. After the connection is complete, we need to enter the flash mode.

ECB32 introduces the FEL button. The user can press FEL and hold it, then press th e reset button or power on the board to enter the programming mode, and a programming inquiry box will pop up. If it is inconvenient for the user to press the FEL button, you can first open the serial terminal software, then press and hold the keypad 2 on the serial terminal, and then press the reset button or power on the board to enter the programmin g mode, and the programming tool will pop up a programming inquiry box.

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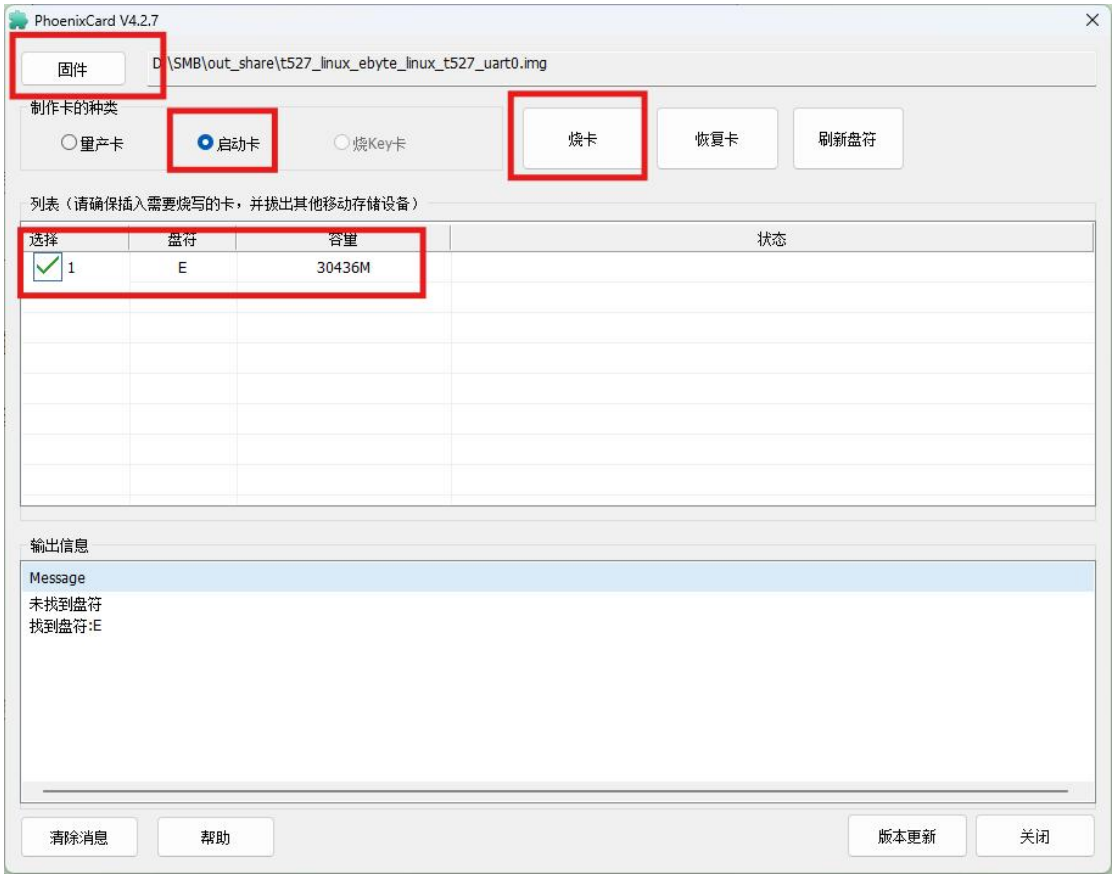
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Users can choose whether to format and upgrade as needed and wait for the burning to be completed.

3.2.2. Burn SD card

In addition to directly burning it onto the eMMC on the board, you can also choose to burn it onto an SD card and then boot from it. Here, we use PhoenixCard provided by Allwinner to burn the SD card.



Users select the firmware to be burned in turn. The firmware can be selected according to the corresponding image of the board to be burned. Select the card type as "startup card", and then select the SD card device to be burned. The software will automatically scan the available mobile storage devices. Please be careful not to select the wrong device. Finally, click the "burn card" button. The current progress will be displayed in real time

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during the burning process until the progress bar turns green to indicate that the burning i s completed.

It should be noted that T527 starts from the SD card first. After burning to the onboard FLASH, the SD card must be removed to start from the onboard FLASH.

3.3.Power on

Please note that if users choose to use HDMI & DP interface as display output, you need to connect at least one of them before powering on, otherwise uboot cannot boot into the kernel.

4. Quick Experience

This chapter will test according to functional modules and provide a preliminary funct ion application method. When the Debian system is not explicitly specified, the system bu ilt by buildroot is used for verification by default.

4.1. CPU

4.1.1. Check CPU information

Run the following command to view CPU information.

```
# cat /proc/cpuinfo
processor : 0
BogoMIPS: 48.00
Features: fp asimd aes pmull sha1 sha2 crc32 atomics fphp asimdhp cpuid asimdrdm lrcpc dcpop asimddp
CPU implementer : 0x41
CPU architecture: 8
CPU variant: 0x2
CPU part: 0xd05
CPU revision : 0

processor : 1
BogoMIPS: 48.00
```

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```
Features: fp asimd aes pmull sha1 sha2 crc32 atomics fphp asimdhp cpuid asimdrdm lrcpc dcpop asimddp
CPU implementer : 0x41
CPU architecture: 8
CPU variant: 0x2
CPU part: 0xd05
CPU revision : 0
.....
processor : 7
BogoMIPS: 48.00
Features: fp asimd aes pmull sha1 sha2 crc32 atomics fphp asimdhp cpuid asimdrdm lrcpc dcpop asimddp
CPU implementer : 0x41
CPU architecture: 8
CPU variant: 0x2
CPU part: 0xd05
CPU revision : 0
```

processor: The serial number of the logical processing core in the system. For a multi-core processor, it can be a physical core or a virtualized logical core using hyperthreading technology.

BogoMIPS: A rough estimate of the number of instructions per second that the CPU runs when the system kernel is booted (MillionInstructions Per Second)

Features: instruction functions supported by the CPU

4.1.2. Check CPU usage

Use the following command to check CPU usage

```
# htop
0[0.0%] 4[**************************100.0%]
1[ 0.0%] 5[ 0.0%]
```

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```
2[  0.0%]  6[  0.0%]
3[  0.0%]  7[  0.0%]
Mem[|||||#*@@@@@  258M/1.88G]  Tasks:  20,  45  thr,  124  kthr;  1  running
Swp[  0K/0K]  Load  average:  1.41  0.31  0.10
Uptime:  00:00:13


[Main]  [I/O]
PID  USER  PRI  NI  VIRT  RES  SHR  S  CPU%  -MEM%  TIME+  Command
626  root  20  0  4268  2552  2068  R  66.7  0.1  0:00.08  htop
1  root  20  0  3316  1688  1552  S  0.0  0.1  0:00.63  init
178  root  20  0  3316  528  456  S  0.0  0.0  0:00.02  /sbin/syslogd  -
182  root  20  0  3316  556  488  S  0.0  0.0  0:00.03  /sbin/klogd  -n
194  root  20  0  15968  2676  1656  S  0.0  0.1  0:00.33  /sbin/udevd  -d
284  root  20  0  3744  228  0  S  0.0  0.0  0:00.00  dbus-daemon  --s
288  root  20  0  2536  176  0  S  0.0  0.0  0:00.00  /usr/sbin/rpcbi
303  root  20  0  404M  77012  59384  S  0.0  3.9  0:00.41  weston  --backen
307  root  20  0  3196  2364  1784  S  0.0  0.1  0:00.04  dhcpcd:  [manage
327  root  20  0  404M  77012  59384  S  0.0  3.9  0:00.00  weston  --backen
328  root  20  0  404M  77012  59384  S  0.0  3.9  0:00.00  weston  --backen
329  root  20  0  404M  77012  59384  S  0.0  3.9  0:00.00  weston  --backen
```

4.1.3. Check CPU temperature

Use the following command to check the current CPU temperature:

```
#  cat  /sys/class/thermal/thermal_zone*/type
cpul_thermal_zone
cpub_thermal_zone
gpu_thermal_zone
npu_thermal_zone
```

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```
ddr_thermal_zone
AXP2202-USB
# cat /sys/class/thermal/thermal_zone*/temp
38702
38036
38480
38480
33374
32900
```

Through the string of type, we can find out which node corresponds to the module we need to focus on, and then the temp return value of the corresponding node is divided by 1000 to get the actual temperature. For example, the temp value corresponding to cpub_thermal_zone is 38036, and the actual temperature is 38 degrees Celsius.

4.2. GPU

The GPU (mali-g57) carried by T527 can be used through buildroot + weston. When the corresponding display is connected and the desktop is started, execute the following command to view the GPU usage:

```
# Start weston's smoke program
# XDG_RUNTIME_DIR="/tmp/wayland" weston-smoke &
# View gpu usage
# mtop
```

4.3. NPU

Our company provides an NPU that supports up to 2 TOPS for the 527BN product. For the relevant test usage process, please refer to the "t527_npu" document in the development notes, which will not be repeated in this article.

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4.4. Memory

4.4.1. Memory information

Use the following command to view memory information:

```
# cat /proc/meminfo
MemTotal: 1968224 kB
MemFree: 1491108 kB
MemAvailable: 1661780 kB
Buffers: 5272 kB
Cached: 180740 kB
SwapCached: 0 kB
Active: 15232 kB
Inactive: 261972 kB
Active(anon): 520 kB
Inactive(anon): 108548 kB
Active(file): 14712 kB
Inactive(file): 153424 kB
Unevictable: 0 kB
Mlocked: 0 kB
SwapTotal: 0 kB
SwapFree: 0 kB
Dirty: 0 kB
Writeback: 0 kB
AnonPages: 91280 kB
Mapped: 110508 kB
Shmem: 17876 kB
KReclaimable: 27216 kB
Slab: 87728 kB
```

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```
SReclaimable:  27216 kB
SUnreclaim:  60512 kB
KernelStack:  3104 kB
PageTables:  1872 kB
NFS_Unstable:  0 kB
Bounce:  0 kB
WritebackTmp:  0 kB
CommitLimit:  984112 kB
Committed_AS:  630164 kB
VmallocTotal:  259653632 kB
VmallocUsed:  6476 kB
VmallocChunk:  0 kB
Percpu:  864 kB
CmaTotal:  65536 kB
CmaFree:  64356 kB
```

MemTotal: Total memory. The value shown here is 498788 kB, indicating that the system has a total of about 487 MB of physical memory available . Since the conversion method here is 1024, and the conventional sales process generally uses 1000, the size here can also be regarded as 510.76MB, plus some memory is reserved for other uses, the size here is also normal .

MemFree: The amount of free memory. The value shown here is 369352 kB, which means that there are about 360 MB of memory in the current system that is free and not in use.

MemAvailable: The amount of available memory. The value shown here is 396952 kB, which represents the total amount of memory currently available to the system, including cached memory and free memory.

Buffers: Buffer usage. The value shown here is 0 kB, indicating that the system is not currently using any memory as a buffer.

Cached: The amount of cached memory. The value shown here is 39208 kB, which i

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ndicates the amount of memory currently used by the system for caching.

SwapCached: The amount of memory used for swap cache. The value shown here is 0 kB, indicating memory that is not currently cached in swap space.

Active: The amount of active memory. The value shown here is 8576 kB , which in dicates the amount of memory currently in use.

4.4.2. Memory Test

Use the following command to get the memory size available for testing:

```
# free -h
total used free shared buff/cache available
Mem: 1.9G 257.2M 1.4G 17.5M 208.2M 1.6G
Swap: 0 0 0
```

The maximum memory size that can be used for testing here is 1.6G, but considering the stable operation of other subsequent programs, the following takes 100MB as an exa mple for a memory test:

```
# memtester 100M 1
memtester version 4.5.0 (64-bit)
Copyright (C) 2001-2020 Charles Cazabon.
Licensed under the GNU General Public License version 2 (only).

pagesize is 4096
pagesizemask is 0xfffffffffffff000
want 100MB (104857600 bytes)
got 100MB (104857600 bytes), trying mlock ...locked.
Loop 1/1:
Stuck Address : ok
Random Value : ok
Compare XOR : ok
Compare SUB : ok
```

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```
Compare MUL : ok
Compare DIV : ok
Compare OR : ok
Compare AND : ok
Sequential Increment: ok
Solid Bits : ok
Block Sequential : ok
Checkerboard: ok
Bit Spread : ok
Bit Flip : ok
Walking Ones : ok
Walking Zeroes : ok
8-bit Writes : ok
16-bit Writes : ok

Done.
```

You can see that all the test items here are in the `ok` state, which means the test passed and there are no obvious errors in the memory.

4.5. eMMC Test

4.5.1. View eMMC information

Use the following command to obtain the eMMC device capacity and partition status table. **For users who use SD card to boot, use /dev/mmcblk1 to view eMMC information** :

```
# fdisk -l /dev/mmcblk0
Disk /dev/mmcblk0: 14.58 GiB, 15655239680 bytes, 30576640 sectors
Units: sectors of 1 * 512 = 512 bytes
Sector size (logical/physical): 512 bytes / 512 bytes
```

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```
I/O size (minimum/optimal): 512 bytes / 512 bytes
Disklabel type: gpt
Disk identifier: AB6F3888-569A-4926-9668-80941DCB40BC

Device Start End Sectors Size Type
/dev/mmcblk0p1 73728 139263 65536 32M Microsoft basic data
/dev/mmcblk0p2 139264 172031 32768 16M Microsoft basic data
/dev/mmcblk0p3 172032 368639 196608 96M Microsoft basic data
/dev/mmcblk0p4 368640 17145855 16777216 8G Microsoft basic data
/dev/mmcblk0p5 17145856 30576606 13430751 6.4G Microsoft basic data
```

Here, the eMMC is divided into five partitions, and the p4 partition is used for the file system. You can get the partition type through the following command:

```
# lsblk -f
NAME FSTYPE FSVER LABEL UUID FSAVAIL FSUSE% MOUNTPOINTS
mmcblk0
|-mmcblk0p1 vfat FAT16 Volumen
|-mmcblk0p2
|-mmcblk0p3
|-mmcblk0p4 ext4 1.0 57f8f4bc-abf4-655f-bf67-946fc0f9f25b 7.2G 7% /var/lib/docker
| /
`-mmcblk0p5
```

4.5.2. eMMC read and write

You can use the following command to test the eMMC read and write performance:

```
# time dd if=/dev/zero of=test.bin bs=1M count=1024 conv=fsync
1024+0 records in
1024+0 records out
```

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```
real 0m9.172s
user 0m0.023s
sys 0m3.991s
# echo 3 > /proc/sys/vm/drop_caches
# time dd if=test.bin of=/dev/null bs=1M
1024+0 records in
1024+0 records out

real 0m4.573s
user 0m0.000s
sys 0m1.192s
```

According to the above content, we can know that the current single board computer's write speed is 1024/ 9.172 = 111.6MB/s, and the read speed is 1024/4.572 = 223.9MB/s.

At the same time, the above `echo 3 > /proc/sys/vm/drop_caches` is to eliminate the influence of system cache and obtain the actual reading speed.

4.6.Watchdog

Use the following command to configure the watchdog timeout to 5 seconds and rest art the single board computer after the timeout:

```
# watchdog -T 5 -t 10 /dev/watchdog
```

In this process, the system will automatically restart after about 5 seconds.

4.7. Power Management

This chapter demonstrates the Suspend function of Linux power management, which a llows the development board to sleep and be awakened by external events.

The Linux kernel provides multiple suspend modes. The following are supported on t he ECB32 series single-board computers:

```
# cat /sys/power/state
```

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```
freeze mem
```

In user space, write "freeze" and "mem" to the "/sys/power/state" file respectively to enter the corresponding sleep mode. After entering this mode, you will find that the power is reduced. **Please note: If you use mem to enter sleep mode, only the PL group pins will continue to supply power. If you need the wake-up function, please use these pins to implement**:

```
# Provides wake-up function after freeze sleep. After sleep, any input from the serial port can wake up
# echo enabled > /sys/class/tty/ttyAS0/power/wakeup
# echo freeze > /sys/power/state
# echo mem > /sys/power/state
```

4.8. RTC

The Linux system is divided into system clock (software clock) and RTC clock (hardware clock). The system clock will disappear when the power is off, and the RTC clock will run for a long time if the battery is installed. If you need to use an external RTC clock, please install the ML2032 (3V rechargeable) or CR2032 (3V non-rechargeable) battery into the RTC button battery holder, which is marked as `VBAT` on the single board computer.

1. Set the current time:

```
# date -s "2010-10-10 10:10:10"
Sun Oct 10 10:10:10 CST 2010
```

2. Write the system time to the external RTC and check whether it is written:

```
# hwclock -w -f /dev/rtc1
# hwclock -f /dev/rtc1
Sun Oct 10 10:10:12 2010 0.000000 seconds
```

3. Shut down the device, unplug the power supply, wait for a while, then power on again to check the RTC time:

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```
# hwclock -f /dev/rtc1
Sun Oct 10 10:11:24 2010 0.000000 seconds
```

4.9.ETH

The current single-board computer has two network ports. Use ifconfig in the net-tools toolkit to manually configure the network. First, use the ifconfig command to view the network device information as follows:

```
# ifconfig
docker0 Link encap:Ethernet HWaddr 02:42:29:6D:EC:BD
inet addr:172.17.0.1 Bcast:172.17.255.255 Mask:255.255.0.0
UP BROADCAST MULTICAST MTU:1500 Metric:1
RX packets:0 errors:0 dropped:0 overruns:0 frame:0
TX packets:0 errors:0 dropped:0 overruns:0 carrier:0
collisions:0 txqueuelen:0
RX bytes:0 (0.0 B) TX bytes:0 (0.0 B)

eth0 Link encap:Ethernet HWaddr D2:09:15:64:BA:64
inet addr:192.168.20.31 Bcast:192.168.20.255 Mask:255.255.255.0
inet6 addr: fe80::2a5:c1ad:5f72:115a/64 Scope:Link
UP BROADCAST RUNNING MULTICAST MTU:1500 Metric:1
RX packets:538 errors:0 dropped:0 overruns:0 frame:0
TX packets:102 errors:0 dropped:0 overruns:0 carrier:0
collisions:0 txqueuelen:1000
RX bytes:274417 (267.9 KiB) TX bytes:8614 (8.4 KiB)
Interrupt:98

eth1 Link encap:Ethernet HWaddr 46:3E:24:75:A2:77
UP BROADCAST MULTICAST MTU:1500 Metric:1
RX packets:0 errors:0 dropped:0 overruns:0 frame:0
```

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```
TX packets:0 errors:0 dropped:0 overruns:0 carrier:0
collisions:0 txqueuelen:1000
RX bytes:0 (0.0 B) TX bytes:0 (0.0 B)
Interrupt:99

lo Link encap:Local Loopback
inet addr:127.0.0.1 Mask:255.0.0.0
inet6 addr: ::1/128 Scope:Host
UP LOOPBACK RUNNING MTU:65536 Metric:1
RX packets:130 errors:0 dropped:0 overruns:0 frame:0
TX packets:130 errors:0 dropped:0 overruns:0 carrier:0
collisions:0 txqueuelen:1000
RX bytes:9612 (9.3 KiB) TX bytes:9612 (9.3 KiB)
```

The current root file system is configured with automatic DHCP, but users can also manually obtain an IP address by using `udhcpc`, or manually configure a static IP.

4.9.1. Automatic acquisition

```
# udhcpc -i eth0
udhcpc: started, v1.35.0
udhcpc: broadcasting discover
udhcpc: broadcasting select for 192.168.1.135, server 192.168.1.1
udhcpc: lease of 192.168.1.135 obtained from 192.168.1.1, lease time 7200
deleting routers
adding dns 114.114.114.114
adding dns 61.139.2.69
```

For users who do not use the eth0 network port, please be sure not to omit the `-i eth0` parameter here.

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4.9.2. Manual Configuration

The following is a method to manually configure the IP address 192.168.1.253 for eth0. The command is as follows:

```
# ifconfig eth0 192.168.0.253 netmask 255.255.255.0 up
# ifconfig
eth0 Link encap:Ethernet HWaddr 4E:42:0B:5A:EE:7F
inet addr:192.168.0.253 Bcast:192.168.0.255 Mask:255.255.255.0
UP BROADCAST MULTICAST MTU:1500 Metric:1
RX packets:118 errors:0 dropped:0 overruns:0 frame:0
TX packets:92 errors:0 dropped:0 overruns:0 carrier:0
collisions:0 txqueuelen:1000
RX bytes:13846 (13.5 KiB) TX bytes:8610 (8.4 KiB)
```

4.10.Display

HDMI & DP display: The currently provided HDMI display corresponds to using debian 11 + gnome.

MIPI display: The currently provided MIPI display corresponds to using buildroot + weston.

4.10.1. HDMI

When displaying through HDMI and DP interfaces, it is important to note that **the monitor must be connected before powering on** , otherwise the subsequent startup will be stopped because the screen parameters cannot be obtained through EDID . Considering the DP display function, the gnome desktop of Debian is used to provide support.

After connecting to the screen, the screen parameters will be obtained through EDID information, and the best resolution will be automatically selected for display. Users can also configure different resolutions through gnome after entering the system.

If gnome fails, you can restart the desktop by executing the following command in the serial port:

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```
systemctl restart gdm3
```

At the same time, since the DP interface needs to be trained, if the DP monitor can' not display content after the system is started, you can try to reset the system and retrain, or it may display normally. However, it does not rule out the possibility of incompatibilit y of some monitors.

4.10.2. MIPI

The system used by MIPI-DSI is buildroot, the desktop environment is weston, and t he configuration file is located in /etc/xdg/weston.

After entering the system normally, the following image is displayed:



For more specific usage of weston, please check the relevant information yourself.

4.11.Camera

T527 provides a MIPI-CSI interface with a maximum speed of 8M@30fps RAW12 2 F-WDR, size up to 3264(H) x 2448(V). For detailed usage, please refer to the "T527_CSI " document in the development notes. This article will not go into details.

4.12.TF card

The SD card is located on the back of the single-board computer, and the silkscreen is TF Card.

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4.12.1. View TF card information

You can view the current TF card status information through the following command:

```
# mount -t debugfs debugfs /sys/kernel/debug/
# cat /sys/kernel/debug/mmc*/ios
# fdisk -l
```

Among them, after checking the ios information, the nodes related to SD are displaye d as SD cards, and the nodes related to MMC are displayed as eMMC. Remember wheth er mmc is 0 or 1 at this time. If you boot from an SD card, the device node correspondi ng to the SD card is generally mmc0, and its corresponding block device is /dev/mmcblk 0.

4.12.2. Test TF card speed

Test the SD card read and write speed through the following command:

```
# mkdir -p /root/tmp
# mount /dev/mmcblk0p4 /root/tmp
# time dd if=/dev/zero of=/root/tmp/test.bin bs=1M count=4096 conv=fsync
# echo 3 > /proc/sys/vm/drop_caches
# time dd if=/mnt/test.bin of=/dev/zero bs=1M
# umount /root/tmp
```

4.13.PCIE

The ECB32 series supports the MINI-PCI interface and can be connected to an m.2 hard disk through an adapter board. Here we use the hard disk as an example. The hard disk model is Yangtze Memory, PC210. Test the read and write status with the following command:

```
# fdisk /dev/nvme0n1

Welcome to fdisk (util-linux 2.38).
Changes will remain in memory only, until you decide to write them.
```

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Be careful before using the write command.

Command (m for help): n

Partition type

p primary (0 primary, 0 extended, 4 free)

e extended (container for logical partitions)

Select (default p): p

Partition number (1-4, default 1): 1

First sector (2048-250069679, default 2048): 2048

Last sector, +/-sectors or +/-size{K,M,G,T,P} (2048-250069679, default 250069679): +10G

Created a new partition 1 of type 'Linux' and of size 10 GiB.

Partition #1 contains an ext4 signature.

Do you want to remove the signature? [Y]es/[N]o: Y

The signature will be removed by a write command.

Command (m for help): w

The partition table has been altered.

Calling ioctl() to re-read partition table.

Syncing disks.

mkfs.ext4 /dev/nvme0n1p1

mkdir -p /root/tmp

mount /dev/nvme0n1p1 /root/tmp

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```
# time dd if=/dev/zero of=/root/tmp/test.bin bs=1M count=4096 conv=fsync
# echo 3 > /proc/sys/vm/drop_caches
# time dd if=/mnt/test.bin of=/dev/zero bs=1M
4096+0 records in
4096+0 records out


real 0m10.157s
user 0m0.032s
sys 0m6.226s
# umount /root/tmp
```

From the above situation, we can find that the read speed of the hard disk in the current environment is 4096/10.157=403MB/s.

4.14.USB

4.14.1. OTG

There is a USB-OTG interface on the single-board computer. If you connect a USB device through a type-c to USB connector, it will be automatically mounted, such as a mouse or a USB flash drive.

Connect the PC to the OTG interface of the single-board computer, open the Allwinner programming software PhoenixSuit, and you will find the following information by default, indicating that the OTG function is working properly:

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4.14.2. HOST

This section verifies the feasibility of the USB Host driver through related commands or hot plugging and USB HUB, and realizes the functions of reading and writing U disk and USB enumeration.

After inserting the USB flash drive, you can use the following command to search for storage devices.

```
#lsblk
NAME MAJ:MIN RM SIZE RO TYPE MOUNTPOINTS
sda 8:0 1 28.7G 0 disk
`-sda1 8:1 1 28.7G 0 part
mmcblk0 179:0 0 14.6G 0 disk
|-mmcblk0p1 179:1 0 32M 0 part
|-mmcblk0p2 179:2 0 16M 0 part
|-mmcblk0p3 179:3 0 96M 0 part
|-mmcblk0p4 179:4 0 8G 0 part /var/lib/docker
```

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```
| /
`-mmcblk0p5 179:5 0 6.4G 0 part
nvme0n1 259:0 0 119.2G 0 disk
`-nvme0n1p1 259:1 0 10G 0 part /mnt
```

You can see that there is an additional sda device here. Mount sda1 to /root/tmp. Enter the directory to find the files in the USB flash drive. You can also test the read and write performance of the current USB flash drive with the following command:

```
# time dd if=/dev/zero of=/root/tmp/dd.bin bs=1M count=128 conv=fsync
# echo 3 > /proc/sys/vm/drop_caches
# time dd of=/dev/zero if=/root/tmp/dd.bin bs=1M
128+0 records in
128+0 records out


real 0m3.881s
user 0m0.000s
sys 0m0.236s
```

It can be seen that the reading speed of the USB flash drive at this time is 32.98MB/s, which is in line with the normal reading speed of a USB 2.0 USB flash drive.

4.15.Audio

The single-board computer provides audio function, supports audio output from HPOUT, and records audio through MIC1. The default settings have been completed and users do not need to worry about it.

You can use the following command to view the functions supported by the current codec:

```
# aplay --dump-hw-params /dev/zero
Playing raw data '/dev/zero' : Unsigned 8 bit, Rate 8000 Hz, Mono
HW Params of device "PlaybackHP":
--------------------
```

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```
ACCESS: MMAP_INTERLEAVED RW_INTERLEAVED
FORMAT: S16_LE S24_LE S32_LE
SUBFORMAT: STD
SAMPLE_BITS: [16 32]
FRAME_BITS: [16 64]
CHANNELS: [1 2]
RATE: (0 4294967295]
PERIOD_TIME: (0 4294967295]
PERIOD_SIZE: [32 32768]
PERIOD_BYTES: [256 65536]
PERIODS: [1 8]
BUFFER_TIME: (0 4294967295]
BUFFER_SIZE: [32 65536]
BUFFER_BYTES: [256 131072]
TICK_TIME: ALL
--------------------
aplay: set_params:1352: Sample format non available
Available formats:
- S16_LE
- S24_LE
- S32_LE
```

After the user plugs in the headset, the following command can be used to test the a udio output function:

```
# speaker-test -c 2 -t wav


speaker-test 1.2.6


Playback device is default
```

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```
Stream parameters are 48000Hz, S16_LE, 2 channels
Using 16 octaves of pink noise
Rate set to 48000Hz (requested 48000Hz)
Buffer size range from 64 to 32768
Period size range from 64 to 16384
Using max buffer size 32768
Periods = 4
was set period_size = 8192
was set buffer_size = 32768
0 - Front Left
1 - Front Right
```

Use the following command to record a 5-second audio:

```
# arecord -f S16_LE -r 48000 -d 5 test.wav
Recording WAVE 'test.wav' : Signed 16 bit Little Endian, Rate 48000 Hz, Mono
```

4.16.LED

The Linux system provides an independent subsystem to facilitate the operation of LED devices from user space. This subsystem provides operation interfaces for LED devices in the form of files. These interfaces are located in the /sys/class/leds directory. In the hardware resource list, we have listed all the LEDs on the development board. Next, we test the LED by reading and writing sysfs commands.

The following commands are all common commands and are also common methods for controlling LEDs.

View all LEDs configured in the current system

```
ls /sys/class/leds/
```

View the current status of the user LED

```
cat /sys/class/leds/user/brightness
```

Control the user LED to light up

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```
echo 1 > /sys/class/leds/user/brightness
```

Restore the LED to off

```
echo 0 > /sys/class/leds/user/brightness
```

Check the working status of the peripherals according to which the user LED supports breathing and flashing

```
cat /sys/class/leds/user/trigger
```

Control the user LED to flash according to the working status of mmc0

```
echo mmc 0 > /sys/class/leds/user/trigger
```

#Test whether the LED flashes according to the working status of mmc0. Use the following method to make the LED stay on for a short time when writing data until the writing is completed.

```
dd if=/dev/zero of=test.bin bs=1M count=10 conv=fsync
```

4.17.Button

There are three buttons on the single board computer: RESET, FEL and POWER, which correspond to the reset function, burning function and power on/off function respectively.

4.17.1. Reset

When the RESET button is pressed, the system will restart immediately.

```
# memtester 100M 1
memtester version 4.5.0 (64-bit)
Copyright (C) 2001-2020 Charles Cazabon.
Licensed under the GNU General Public License version 2 (only).

pagesize is 4096
pagesizemask is 0xfffffffffffff000
want 100MB (104857600 bytes)
```

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```
got 100MB (104857600 bytes), trying mlock ...locked.
Loop 1/1:
Stuck Address : ok
Random Value: |[80]HELLO! BOOT0 is starting!
[83]BOOT0 commit : ad8b4b44ac
[87]periph0 has been enabled
[90]set pll end
[92]PL gpio voltage: 3.3V
[96][pmu]: bus read error
[99]PMU: AXP2202
[104]PMU: AXP1530
[109]power mode:33, sys_vol:920
[114]vaild para:1 select dram para0
[117]board init ok
[120]rtc[3] value = 0xb00f
[123]rtc[7] value = 0x1
[125]enable_jtag
```

From the above log information, we can see that the system is still executing memtes ter, but immediately enters the boot0 information printing. This is the time for me to pres s the RESET button.

4.17.2. Power supply

The power button is used to power on the system after it is turned off, or to force a shutdown by long pressing. After the system is turned off, the system cannot be restarted by RESET and must be started using the POWER button.

```
Requesting system power off
[146.085755] reboot: Power down
[80]HELLO! BOOT0 is starting!
[83]BOOT0 commit : ad8b4b44ac
```

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```
[87]periph0 has been enabled
[90]set pll end
[92]PL gpio voltage: 3.3V
[96][pmu]: bus read error
[99]PMU: AXP2202
[104]PMU: AXP1530
[109]power mode:33, sys_vol:920
[114]vaild para:1 select dram para0
[117]board init ok
[120]rtc[3] value = 0xa300
[122]rtc[7] value = 0x2
[125]enable_jtag
```

The above log information is the process from system shutdown to restarting by press ing the POWER button.

4.17.3. FEL

Refer to the Quick Start section above.

4.18.GPIO

Use the following command to control an IO, here we take PK23 as an example:

```
# mount -t debugfs debugfs /sys/kernel/debug/
# grep PK23 /sys/kernel/debug/pinctrl/2000000.pinctrl/pinmux-pins
pin 343 (PK23): UNCLAIMED
# cd /sys/class/gpio/
# echo 343 > export
# echo out > gpio343/direction
# echo 1 > gpio343/value
```

At this time, the voltage checked by the multimeter does not change according to the actual situation. This is due to the conflict between the PK group pins and the sensor m

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odule. After restarting, long press `s` to enter the uboot command line and execute the fol lowing command to turn off the sensor function:

```
=> fdt set /soc/vind status disabled
=> fdt set /soc/pd-vi-test status disabled
```

The above command is equivalent to shutting down the vind0 and pd-vi-test nodes in the device tree.

5. References

- Linux kernel open source community: https://www.kernel.org/
- Allwinner Development Community: https://bbs.aw-ol.com/
- Buildroot-manual: https://buildroot.org/downloads/manual/manual.html
- Debian wiki: https://wiki.debian.org/

6. Revision Notes

Revision Notes Table

Version	Modifications	Modification time	prepared by	Proofreading	Approval
V1.0	First Draft	25.03.19	Wlq	HSL	WFX

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