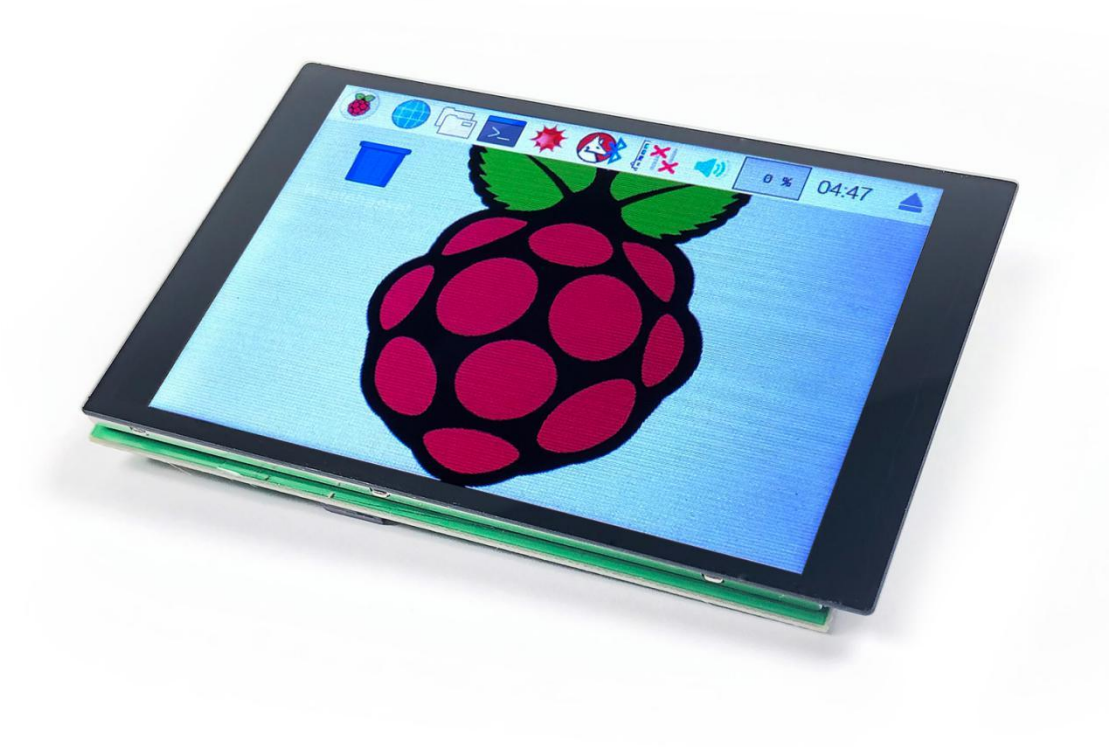
3.5 inch LCD for Raspberry PI User Manual



1. General Description

The Innomaker 3.5 inch screen is a optimized partner for Raspberr Pi 3/4 display output. It features an integrated capacitive touch panel, you can operate your Raspberry Pi without mouse and keyboard. much better user experience than resistive touch screen.

The screen work by the SPI interface of Raspberry Pi with separate framebuffer. So the Raspberry Pi can be programmed to display different interface through this 3.5 screen and HDMI port at the same time.

On-board high precision I2C real-time clock chip DS3231 and EEPROM extended function is reserved , make the display suit a variety of applications.

Notice:

1. Need to install the driver, If you are not familiar with the Raspberry Pi, it is strongly recommended you that use the system with the driver installed.

2. A few customers got wrong connection, so the screen will burn up in a minute.

3.Does not support other systems and single board computer . Only be applicable for Rapsberry Pi3 and Pi 4 product lines.

2. Features

1. Compatible with Raspberry Pi 3 and Pi 4 via the 28-pin connector. Connects directly to the Raspberry Pi board, no additional cables required, no soldering.

2. The screen work by SPI interface, support and display rotation function and display separately function for Raspberry Pi.

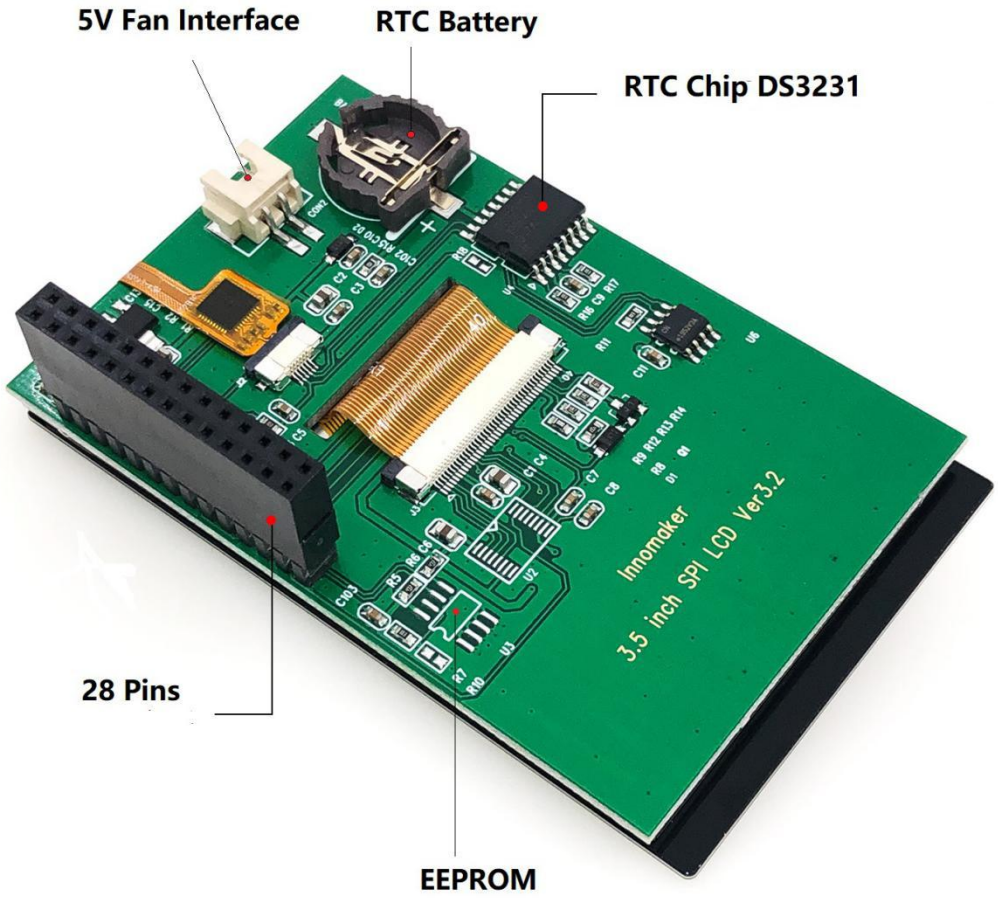
3. 480*320 Pixels highlight resolution and capacitive touch, allow you to control your raspberry Pi by touching the screen with your fingers , Accurate and easy operating.

4. On-board extremely accurate I2C real-time clock chip DS3231 and continuous timing battery backup. A EEPROM extended function is reserved.

5. Comes with user manual and friendly technology support. For more information please refer to our wiki.

3. Hardware Description

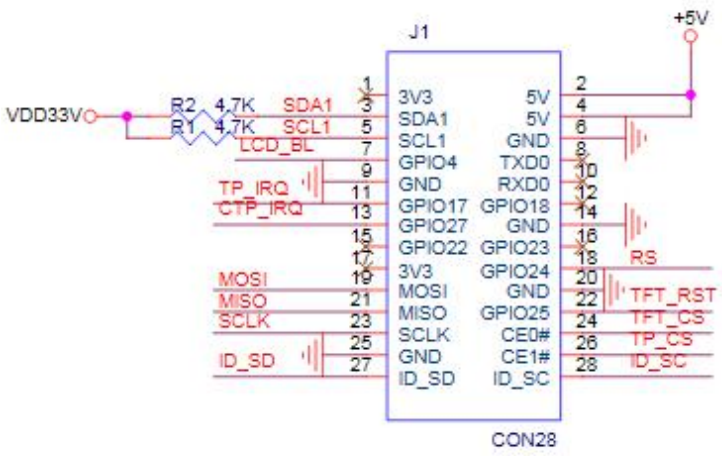
3.1 Overview



3.2 Screen Size(Only Screen, not contain PCBA backboard)

Item	Specification	Unit
Screen Size	53.30*83.32*2.26	mm
Display Area	49.00*73.40	mm
Resolution Ratio	320(RGB)*480 Dots	mm
Structure Type	COG + FPC + BL	mm
Operation Temperature	-20-70	℃
Storage Temperature	-30-70	℃
Display Type	Transmissive 3.5" QVGA TFT, COG	

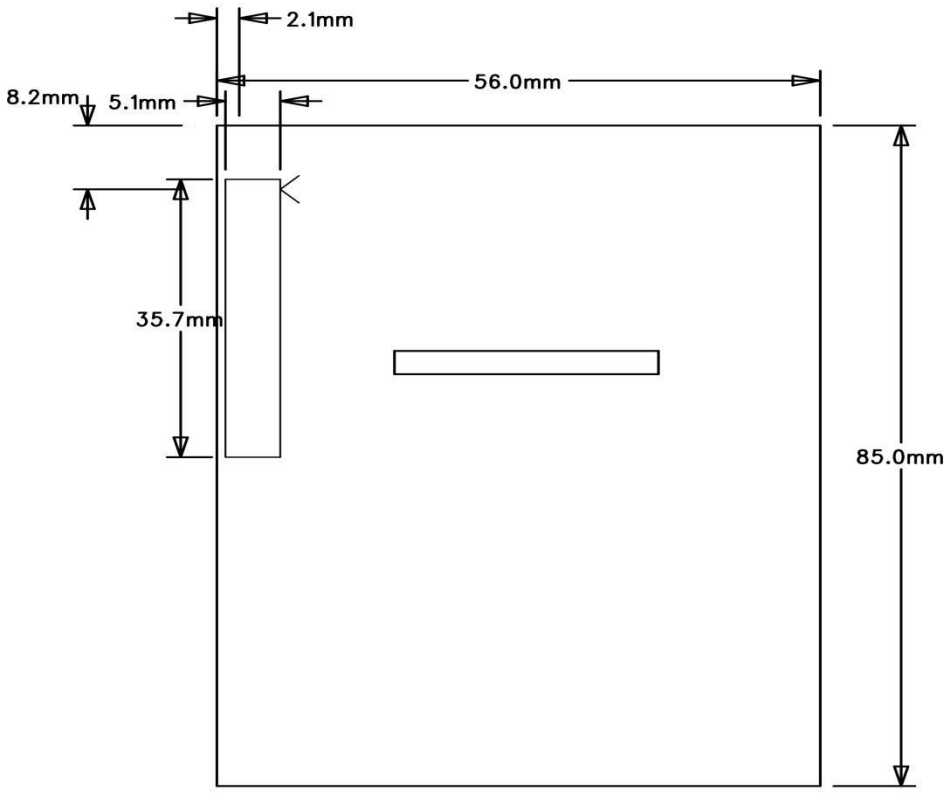
3.3 PINOUT USAGE- FEMALE 28 PIN CONNECTOR



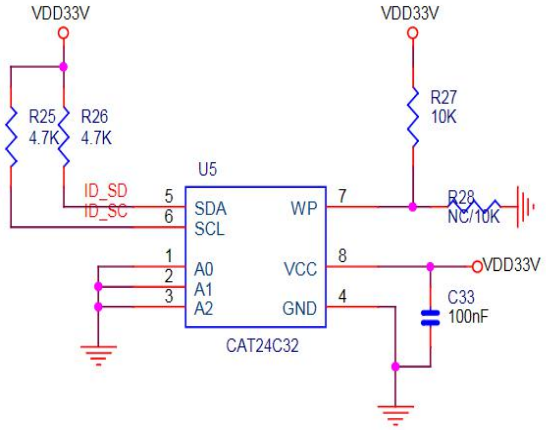
PIN	Symbol	Description
2,4	+5V	+5V Supply Pin, connected to the main 5V supply of the Raspberry Pi
3	SDA1	SDA, Used for Touch IC, RTC DS3231 and User EEPROM
5	SCL1	SCL, Used for Touch IC, RTC DS3231 and User EEPROM
7	GPIO_4	Screen Backlight Control
11	GPIO_17	Touch Interrupt

18	GPIO_24	Screen RS signal
19	GPIO_10/MOSI	MOSI Signal Used For Screen
21	GPIO_9/MISO	MISO Signal Used For Screen
22	GPIO_24	Screen Reset Signal
23	GPIO_11/SCLK	SCLK Signal, Used For Screen
26	GPIO_7/CE1	Screen CS Signal
27,28	ID SCL and ID SDA	Reserved for an ID EEPROM on the Raspberry Pi. These pins are always reserved and should never be used to connect external components

3.4 Physical Dimensions

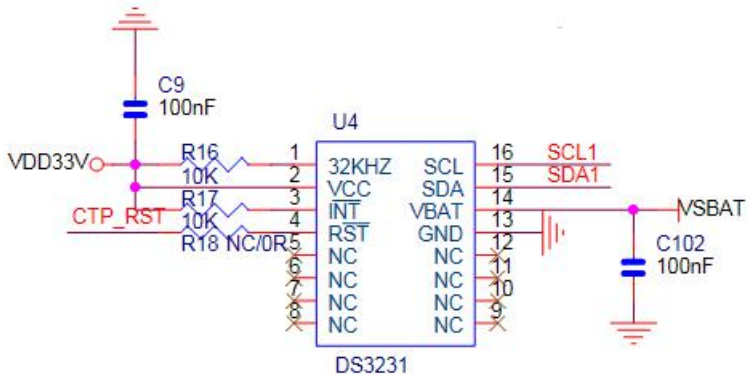


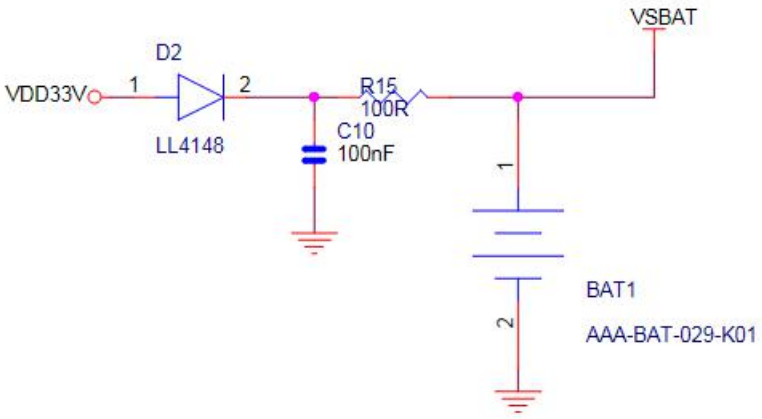
3.5 ID EEPROM: (U3, Default not welded)



Pin 27 and 28 are always reserved for an ID EEPROM on the Raspberry Pi. Independently which card you use. It's useless for most application. If you want to use this function, you need to solder the IC, resistance and capacitance by yourself.

3.6 RTC DS3231 And Battery(U4,Default not welded):

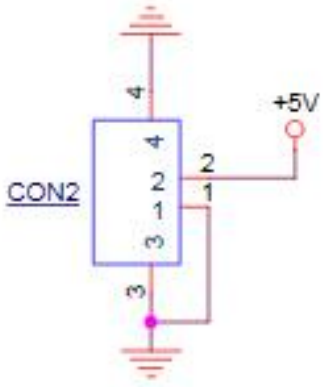


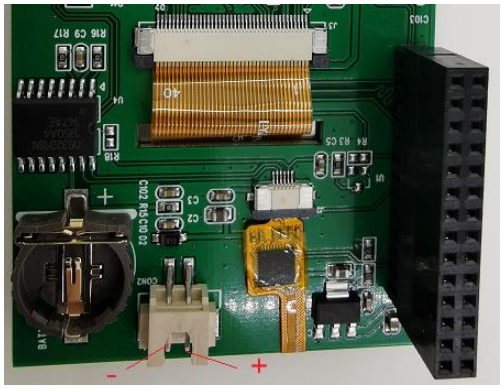


Battery Connector(CR2032)

3.7 Fan Intherface (CON2)

On-board a 5V Fan interface for Raspberry Pi heat dissipation.





4. Software Description

4.1 Overview

There are two methods to use the 3.5 screen with Raspberry Pi. One is load the innomaker release image, and the other is install the screen driver/tools to the Raspbian you're already using or a fresh Raspbian version.

4.2 DownLoad Inno-maker Release Image

Prepare a at least 16Gb Class 10 level TF card. Load the image file onto the TF card, using the instructions provided on the Raspberry Pi website for Linux, Mac or PC:

https://www.raspberrypi.org/documentation/installation/installing-images/README.md

Note: If you are using Raspberry Pi 4, Don't connect the HDMI port to other screen after install the 3.5 inch lcd driver. Otherwise the 3.5 screen will show nothing

4.3 Load Raspberry Pi Image

Prepare a at least 16Gb Class 10 level TF card. Load the image file onto the TF card, using the instructions provided on the Raspberry Pi website for Linux, Mac or PC:
https://www.raspberrypi.org/documentation/installation/installing-images/README.md

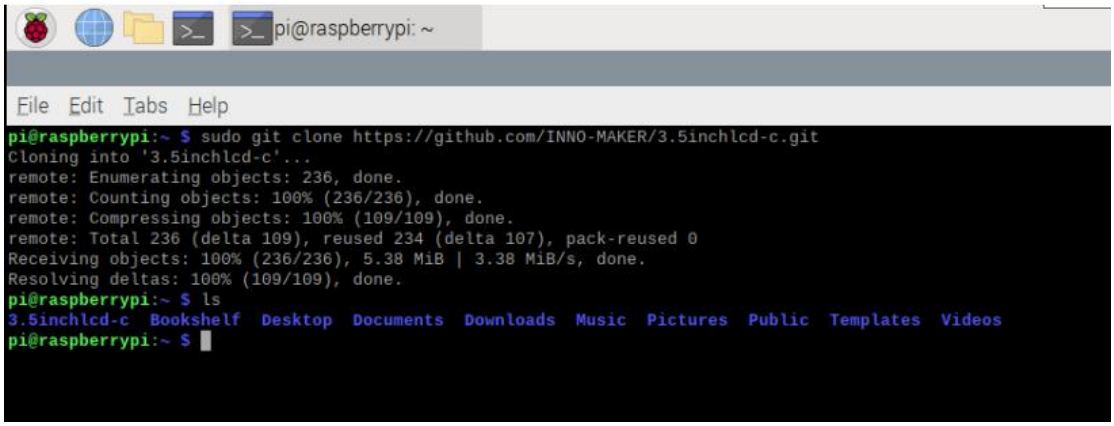
Raspbian Image download:
https://www.raspberrypi.org/downloads/

4.4 Driver Source Codes Compiled

4.4.1 Download Source Codes

Download the driver source codes from github Make sure your Raspberry Pi is connect to network. You could a new folder named '3.5inchlcd-c'.

```
sudo git clone https://github.com/INNO-MAKER/3.5inchlcd-c.git
```



4.4.2 Change Permissions

Go into the lcd-3.5-inch-r-c folder, Using chmod command set all the read, write, and execute permissions for these file.It's very important step, otherwise you could not to install properly.

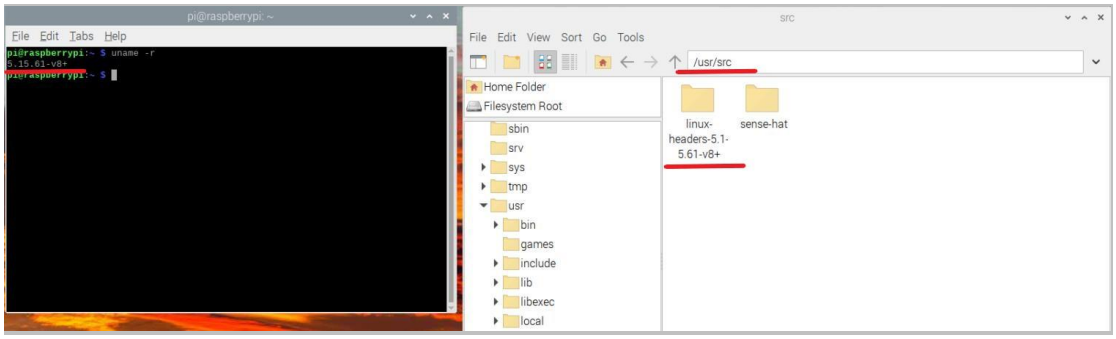
```
sudo chmod -R a+rwx *
```

4.4.3 Download Kernel Headers

Download the kernel header files. If you are using the

```
sudo apt-get install raspberrypi-kernel-headers
```

Check the hearders folder version is fully match your kernel. Otherwise you may compile failed.



If there isn't match, use below command to remove the kernel headers

```
sudo apt-get remove raspberrypi-kernel-headers
```

If you are using the previous version of Raspbian or unable to locate package, manually download the correct headers files from below link. We take kernel 5.15.32-v8+(64bit,released data 2020-0404) as an example.

https://archive.raspberrypi.org/debian/pool/main/r/raspberrypi-firmware/

raspberrypi-kernel-headers_1.20220331-1_amd64.deb	2022-04-04 12:55	37M
raspberrypi-kernel-headers_1.20220331-1_arm64.deb	2022-04-04 12:55	9.2M
raspberrypi-kernel-headers_1.20220331-1_armhf.deb	2022-04-04 12:56	27M

Download or copy the deb to Raspbery Pi, and then use dpkg tools install the headers deb files via below command.

```
sudo dpkg -i raspberry-kernel-headers_1,20220331-1_arm64.deb
```

4.4.4 Complied Driver Source Codes

Cd to 'source_code' folder and type command make and make installl

make

make install

```
pi@raspberrypi:~/3.5inchlcd-c $ cd source_code/
pi@raspberrypi:~/3.5inchlcd-c/source_code $ ls
clear.sh  fbtft  lcd35_spi.dtbo  lcd35_spi_ft6236at_bl_gpio4.dts  Makefile  modules.order  Module.symvers  touch
pi@raspberrypi:~/3.5inchlcd-c/source_code $ make
dtc -W no-unit_address_vs_reg -@ -I dts -O dtb -o lcd35_spi.dtbo lcd35_spi_ft6236at_bl_gpio4.dts
make -C /lib/modules/5.15.61-v8+/build M=/home/pi/3.5inchlcd-c/source_code modules
make[1]: Entering directory '/usr/src/linux-headers-5.15.61-v8+'
  CC [M]  /home/pi/3.5inchlcd-c/source_code/touch/ft6236.o
  CC [M]  /home/pi/3.5inchlcd-c/source_code/fbtft/fb_ili9486.o
  CC [M]  /home/pi/3.5inchlcd-c/source_code/fbtft/fbtft-core.o
  CC [M]  /home/pi/3.5inchlcd-c/source_code/fbtft/fbtft-sysfs.o
  CC [M]  /home/pi/3.5inchlcd-c/source_code/fbtft/fbtft-bus.o
  CC [M]  /home/pi/3.5inchlcd-c/source_code/fbtft/fbtft-io.o
  LD [M]  /home/pi/3.5inchlcd-c/source_code/fbtft/fbtft.o
  MODPOST /home/pi/3.5inchlcd-c/source_code/Module.symvers
  CC [M]  /home/pi/3.5inchlcd-c/source_code/fbtft/fb_ili9486.mod.o
  LD [M]  /home/pi/3.5inchlcd-c/source_code/fbtft/fb_ili9486.ko
  CC [M]  /home/pi/3.5inchlcd-c/source_code/fbtft/fbtft.mod.o
  LD [M]  /home/pi/3.5inchlcd-c/source_code/fbtft/fbtft.ko
  CC [M]  /home/pi/3.5inchlcd-c/source_code/touch/ft6236.mod.o
  LD [M]  /home/pi/3.5inchlcd-c/source_code/touch/ft6236.ko
make[1]: Leaving directory '/usr/src/linux-headers-5.15.61-v8+'
pi@raspberrypi:~/3.5inchlcd-c/source_code $ make install
dtc -W no-unit_address_vs_reg -@ -I dts -O dtb -o lcd35_spi.dtbo lcd35_spi_ft6236at_bl_gpio4.dts
make -C /lib/modules/5.15.61-v8+/build M=/home/pi/3.5inchlcd-c/source_code modules
make[1]: Entering directory '/usr/src/linux-headers-5.15.61-v8+'
make[1]: Leaving directory '/usr/src/linux-headers-5.15.61-v8+'
sudo install -p -m 644  lcd35_spi.dtbo  /boot/overlays
sudo install -p -m 644 touch/ft6236.ko   /lib/modules/5.15.61-v8+/kernel/drivers/input/touchscreen/
sudo install -p -m 644 lcd35_spi.dtbo  /boot/overlays/
sudo install -p -m 644  fbtft/fbtft.ko /lib/modules/5.15.61-v8+/kernel/drivers/staging/fbtft/
sudo install -p -m 644  fbtft/fb_ili9486.ko /lib/modules/5.15.61-v8+/kernel/drivers/staging/fbtft/
sudo /sbin/depmod -a 5.15.61-v8+
sudo /sbin/modprobe ft6236
sudo /sbin/modprobe fbtft
sudo /sbin/modprobe fb_ili9486
----------------------------------

  ADD 'dtparam=i2c_arm=on' and 'dtoverlay=lcd35_spi' to your /boot/config.txt

----------------------------------
pi@raspberrypi:~/3.5inchlcd-c/source_code $
```

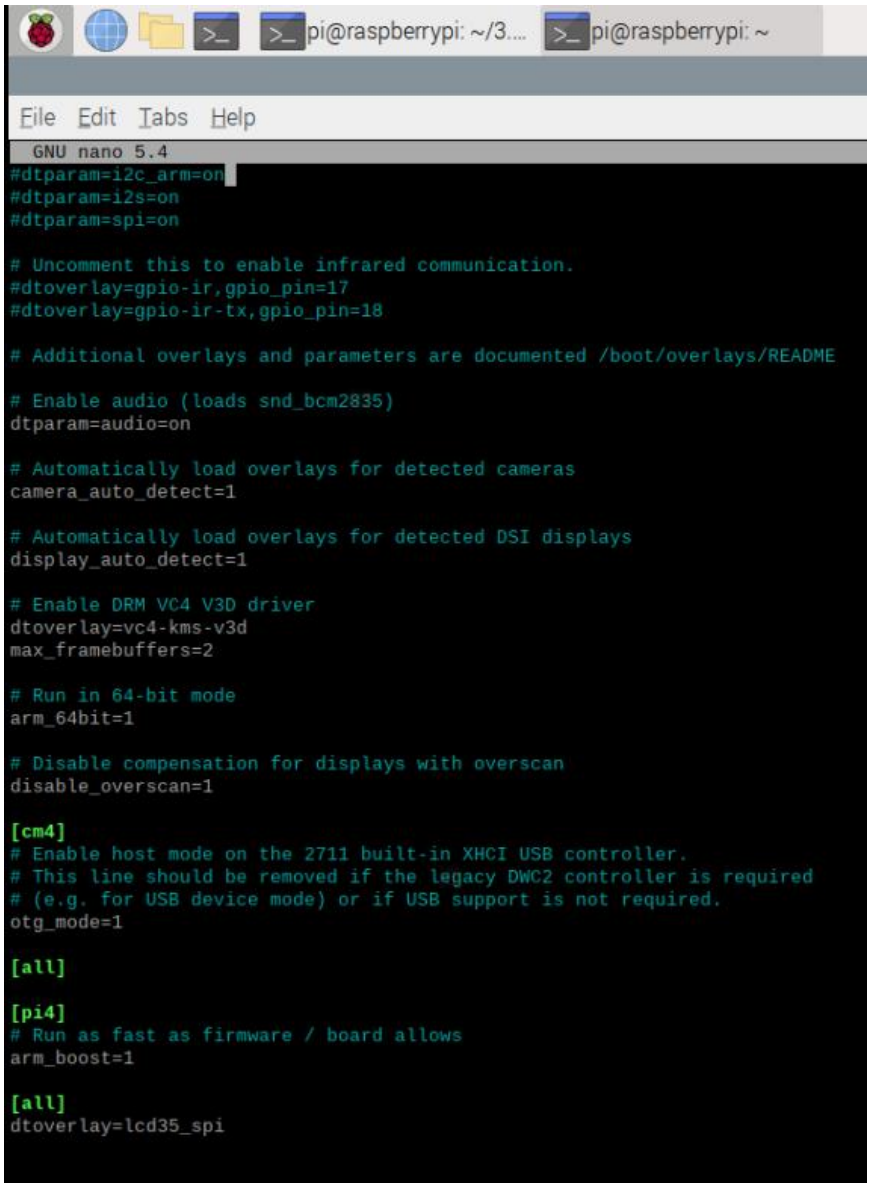
4.4.5 Modify config.txt

Open config.txt

```
sudo nano /boot/config.txt
```

Add below line on the bottom enable device tree. And press ctrl + x save & exit.

```
dtoverlay=lcd35_spi
```



4.4.6 Setup Lcd

Cd to lcd_setup folder and run the setup.sh to setup lcd.

```
pi@raspberrypi:~/3.5inchlcd-c/source_code $ cd ..
pi@raspberrypi:~/3.5inchlcd-c $ ls
lcd_setup  source_code
pi@raspberrypi:~/3.5inchlcd-c $ cd lcd_setup/
pi@raspberrypi:~/3.5inchlcd-c/lcd_setup $ ls
boot  etc  input_rule  overlays  rtc  setup.sh  user-app  usr
pi@raspberrypi:~/3.5inchlcd-c/lcd_setup $ ./setup.sh
Setup InnoMaker 3.5 inch TFT and touch panel on RPI!
xorg.conf.d Directory already exist!
Configure the LCD display 0 degrees
System setup is complete, restart the system!
pi@raspberrypi:~/3.5inchlcd-c/lcd_setup $
```

4.4.7 Setup Touch

Install Xorg-input-edev. Keep Raspberry PI always connect to the network and Execute following commands to terminal of Raspberry Pi.

```
sudo apt-get install xserver-xorg-input-evdev
```

```
sudo cp -rf /usr/share/X11/xorg.conf.d/10-evdev.conf /usr/share/X11/xorg.conf.d/45-evdev.conf
```

```
pi@raspberrypi:~/3.5inchlcd-c/lcd_setup $ sudo apt-get install xserver-xorg-input-evdev
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
The following package was automatically installed and is no longer required:
  libfuse2
Use 'sudo apt autoremove' to remove it.
The following NEW packages will be installed:
  xserver-xorg-input-evdev
0 upgraded, 1 newly installed, 0 to remove and 26 not upgraded.
Need to get 119 kB of archives.
After this operation, 182 kB of additional disk space will be used.
Get:1 http://deb.debian.org/debian bullseye/main arm64 xserver-xorg-input-evdev arm64 1:2.10.6-2 [119 kB]
Fetched 119 kB in 1s (145 kB/s)
Selecting previously unselected package xserver-xorg-input-evdev.
(Reading database ... 113853 files and directories currently installed.)
Preparing to unpack .../xserver-xorg-input-evdev_1%3a2.10.6-2_arm64.deb ...
Unpacking xserver-xorg-input-evdev (1:2.10.6-2) ...
Setting up xserver-xorg-input-evdev (1:2.10.6-2) ...
Processing triggers for man-db (2.9.4-2) ...
pi@raspberrypi:~/3.5inchlcd-c/lcd_setup $ sudo cp -rf /usr/share/X11/xorg.conf.d/10-evdev.conf /usr/share/X11/xorg.conf.d/45-evdev.conf
pi@raspberrypi:~/3.5inchlcd-c/lcd_setup $
```

4.4.8 Reboot and Disable The HDMI Output

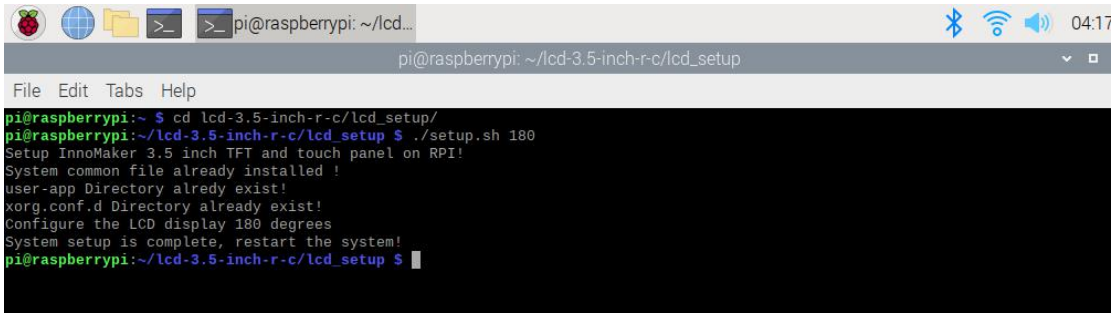
Finally, you need to reboot and enable the lcd. Please plug out the HDMI cable before reboot. Otherwise Raspberry Pi will continue to display via the HDMI not the 3.5 inch lcd.

```
sudo reboot
```

4.5 Dispaly Rotation

We can rotate the display mode for different applications. Changes will take effect after you reboot.

pi@raspberrypi:~/lcd-3.5-inch-r-c/lcd_setup $./setup.sh : display properly.
pi@raspberrypi:~/lcd-3.5-inch-r-c/lcd_setup $./setup.sh 90 : display is rotated 90 degrees.
pi@raspberrypi:~/lcd-3.5-inch-r-c/lcd_setup $ ./setup.sh 180 :display is rotated 180 degrees.
pi@raspberrypi:~/lcd-3.5-inch-r-c/lcd_setup $./setup.sh 270 : display is rotated 270 degrees.



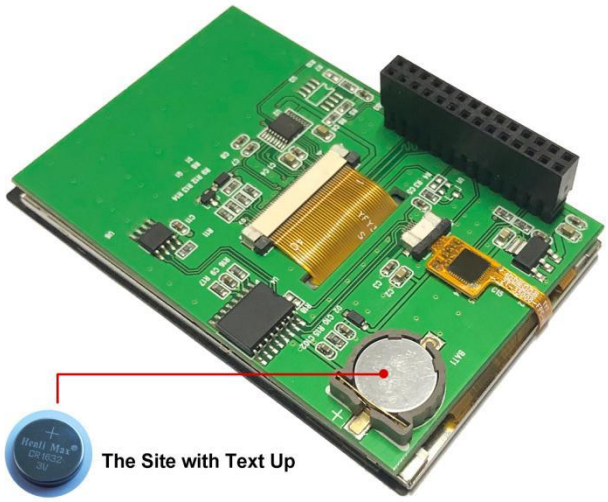
4.6 Blacklight Control

Turn off the backlight： echo 1 | sudo tee /sys/class/backlight/fb_ili9486/bl_power
Turn on the backlight： echo 0 | sudo tee /sys/class/backlight/fb_ili9486/bl_power

4.7 RTC Setting

Due to cost and size Raspberry pi didn't put hardware RTC on board. Updates the system time need to connect to the Internet via NTP time service. We added a DS3231 and on-board continuous timing battery backup

1) Install battery.

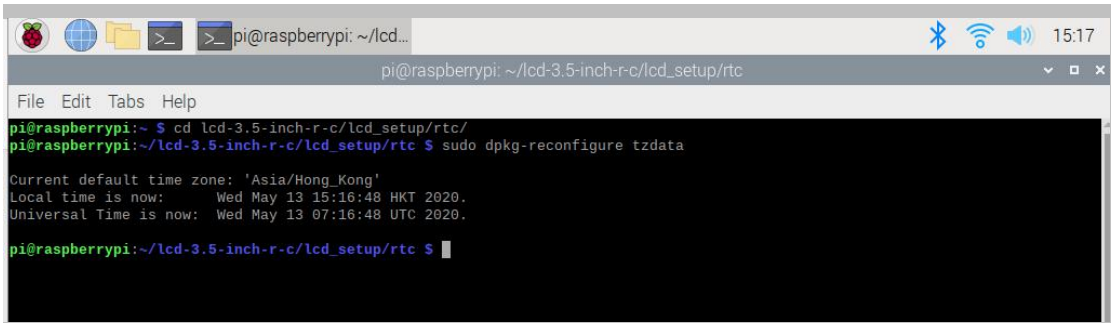


2) Go in the rtc folder .

```
cd lcd-3.5-inch-r-c/lcd_setup/rtc/
```

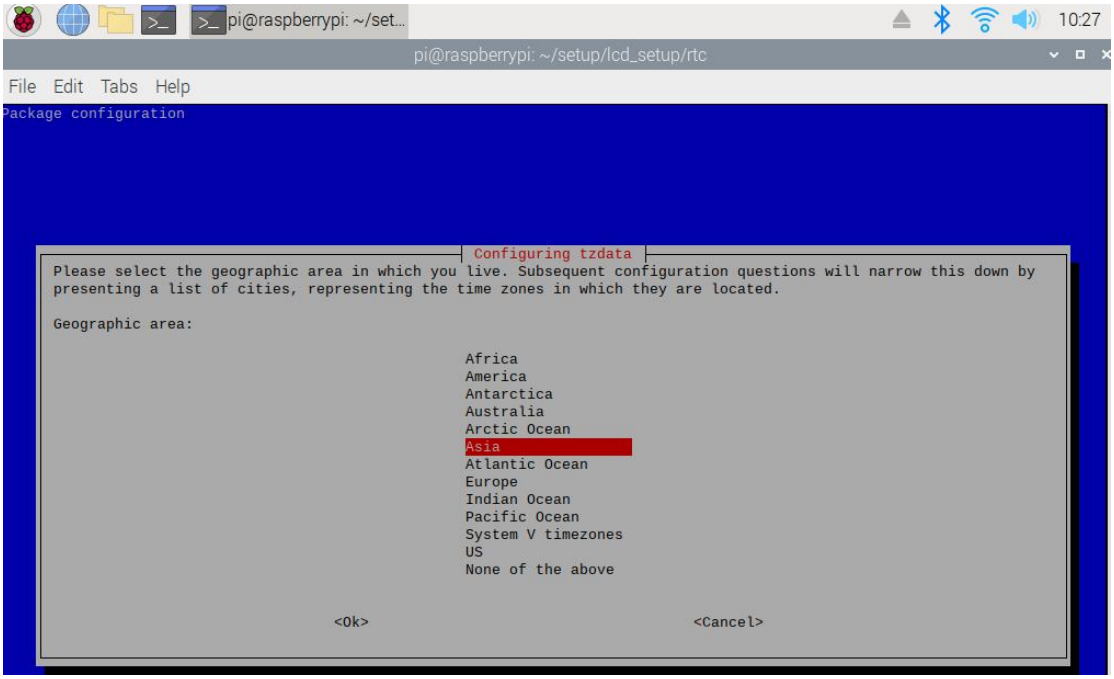
3) Initializes the hardware clock

```
sudo cp hwclock-set /lib/udev/hwclock-set
```



4) Select the correct time Zone.

```
sudo dpkg-reconfigure tzdata
```

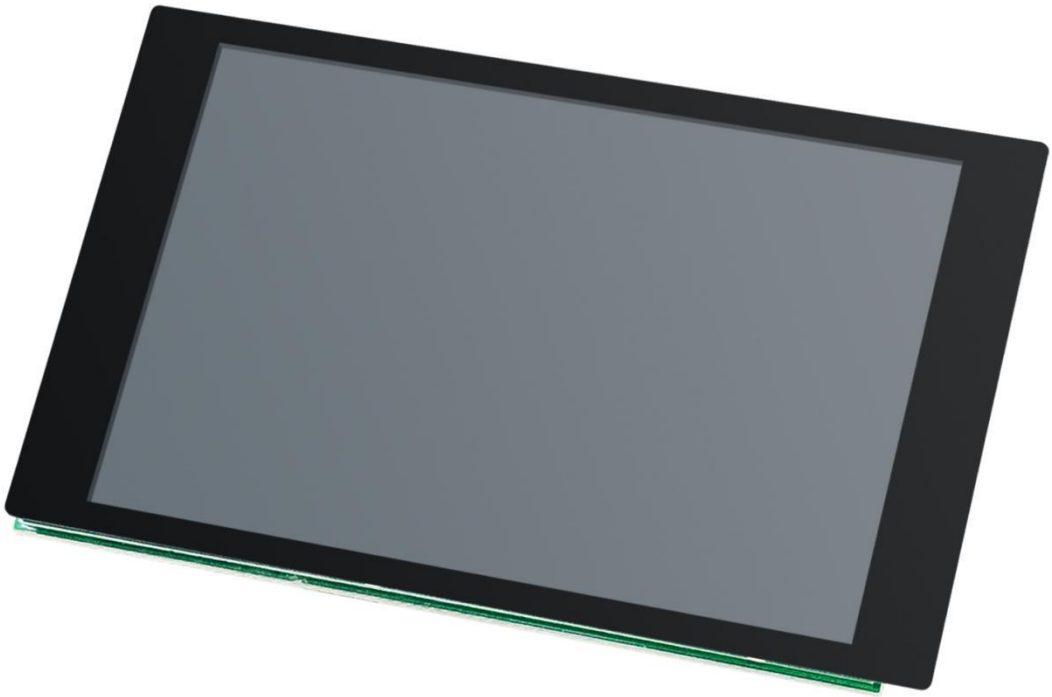


5) Set time: System will automatic update time from network. If you want to set the time different than current time, please disconnect from the network before setting. Otherwise the time will be overwritten.

For example, Set as July 01 2019 at 12:01:20

```
pi@raspberrypi:/setup/lcd_setup/rtc $ sudo date 070112012019.20    //Set time
pi@raspberrypi:/setup/lcd_setup/rtc $ sudo hwclock -w              //Write time to hardware
pi@raspberrypi:/setup/lcd_setup/rtc $ sudo hwclock -s              //Set System time syncing
                                                                     from //HW RTC
pi@raspberrypi:/setup/lcd_setup/rtc $ sudo hwclock -r              //Read time from hardware
```

5. Screw Installation



6. Version Descriptions

Version	Description	Date	E-mail
V1.1	Thoroughly Redid the driver and tools Installs way	2020.05.13	support@inno-maker.com sales@inno-maker.com
V1.3	Added the Automatic install script description	2021.2.26	support@inno-maker.com sales@inno-maker.com
V2.0	Open driver source code	2022.10.10	support@inno-maker.com sales@inno-maker.com

If you have any suggestions, ideas, codes and tools please feel free to email to me.