

Raspberry Pi display connector

This interposer connects a Waveshare 1.69-inch 240 x 280 touch LCD module (ST7789V2 display controller and CST816S touch controller) to the first 24 pins of the Raspberry Pi GPIO header.

Wiring

Device-tree settings use BCM GPIO numbers, not physical header pin numbers.

Signal	Raspberry Pi physical pin	BCM function
VCC	1 and 17	3.3 V
GND	6, 9, 14 and 20	Ground
TP_SDA	3	GPIO2 / I2C1 SDA
TP_SCL	5	GPIO3 / I2C1 SCL
LCD_BL	12	GPIO18 / PWM0
LCD_RST	13	GPIO27
TP_RST	16	GPIO23
TP_IRQ	18	GPIO24
LCD_DIN	19	GPIO10 / SPI0 MOSI
LCD_DC	22	GPIO25
LCD_CLK	23	GPIO11 / SPI0 SCLK
LCD_CS	24	GPIO8 / SPI0 CE0

Power the module from **3.3 V only** in this design. The module's logic-side voltage follows VCC; powering it from 5 V would expose Raspberry Pi GPIOs to 5 V logic.

I2C pull-ups

Do not add another pair of I2C pull-ups to this interposer.

- Raspberry Pi GPIO2 and GPIO3 have fixed pull-ups on a normal 40-pin-header board.
- The Waveshare module schematic also shows 4.7 kOhm pull-ups around its I2C level shifter.

The existing pull-ups are therefore sufficient and already appear in parallel. If a later board revision adds optional pull-up footprints, fit them as DNP by default. Populate them only after measuring the assembled bus, or when using a Compute Module carrier that does not provide the standard header pull-ups.

Raspberry Pi OS overlays

The display uses Raspberry Pi's in-tree `mipi-dbi-spi` DRM overlay. Touch uses the custom `cst816s-overlay.dts` in the `dtoverlays` repository.

1. Build and install the CST816S overlay

On the Raspberry Pi:

```
sudo apt install device-tree-compiler
git clone https://github.com/onmcu/dtoverlays.git
dtc -@ -I dts -O dtb \
    -o cst816s.dtbo dtoverlays/cst816s-overlay.dts
sudo install -m 0644 cst816s.dtbo /boot/firmware/overlays/cst816s.dtbo
```

On Raspberry Pi OS releases older than Bookworm, use /boot/overlays/ instead of /boot/firmware/overlays/.

2. Build and install the ST7789V2 initialization firmware

mipi-dbi-spi needs panel-specific initialization commands in /lib/firmware/panel.bin. The supplied waveshare-1.69-st7789v2.txt is transcribed from Waveshare's driver. The overlay configuration below also applies the 20-pixel row offset used by this 240 x 280 panel in the controller's 240 x 320 RAM.

Use the mipi-dbi-cmd tool from the panel driver author's repository:

```
git clone https://github.com/notro/panel-mipi-dbi.git
python3 panel-mipi-dbi/mipi-dbi-cmd panel.bin \
    dtoverlays/waveshare-1.69-st7789v2.txt
sudo install -m 0644 panel.bin /lib/firmware/panel.bin
```

3. Configure boot overlays

Append this to /boot/firmware/config.txt:

```
# CST816S on I2C1: SDA=GPI02, SCL=GPI03, reset=GPI023, IRQ=GPI024
dtparam=i2c_arm=on
dtoverlay=cst816s

# ST7789V2 on SPI0 CE0: MOSI=GPI010, SCLK=GPI011
dtoverlay=mipi-dbi-spi,spi0-0,speed=32000000,write-only
dtparam=width=240,height=280,y-offset=20
dtparam=reset-gpio=27,dc-gpio=25
dtparam=backlight-gpio=18
```

The 32 MHz SPI setting is a conservative starting point. Increase it only after testing the final PCB and cable. The write-only flag is required because this module does not expose LCD MISO.

GPIO18 can instead provide PWM brightness. Replace the last display parameter with the following two lines if PWM backlight control is wanted:

```
dtparam=backlight-pwm
dtparam=backlight-pwm-gpio=18,backlight-def-brightness=16
```

Reboot after installing the files and editing `config.txt`.

4. Driver availability and checks

The ST7789V2 path uses the mainline `panel-mipi-dbi` DRM driver. The CST816S binding and `hynitron-cst816x` input driver are also in current Linux, using compatible string `hynitron,cst816s` at I2C address `0x15`.

The current Raspberry Pi kernel tree contains the CST816S driver, but its stock Raspberry Pi defconfigs do not currently enable `CONFIG_TOUCHSCREEN_HYNITRON_CST816X`. Check the running image before relying on the touch overlay:

```
grep CONFIG_TOUCHSCREEN_HYNITRON_CST816X /boot/config-$(uname -r)
modinfo hynitron-cst816x
```

If the option is absent, build/install a Raspberry Pi kernel or matching module with `CONFIG_TOUCHSCREEN_HYNITRON_CST816X=m`. The overlay alone cannot create a driver that is missing from the kernel.

There is one upstream-driver limitation relevant to this particular display: the current driver declares both touch axes as 0..240, although this panel is 240 x 280. Expect the bottom 40 rows to need a small driver fix before touch is pixel-accurate over the full panel.

After reboot, useful checks are:

```
i2cdetect -y 1                                # should show 15
dmesg | grep -Ei 'mipi|panel|cst816|hynitron|firmware'
ls /sys/class/drm
grep -H . /proc/bus/input/devices
```

References

- Raspberry Pi GPIO documentation
- Raspberry Pi `mipi-dbi-spi` overlay parameters
- Waveshare 1.69-inch touch LCD documentation
- Waveshare module schematic
- CST816S device-tree binding
- `panel-mipi-dbi` firmware format and tool