# SPI

- Operation confirmed with our
  - **ODROID-XU4** on **4.14.40** kernel.
  - **ODROID-C1+** on **3.10.107** kernel.
  - **ODROID-C2** on **3.14.79** kernel.
  - **ODROID-N2** on **4.9.141** kernel.

This guide lets you know that how to **make the SPI feature ready** and that how to **test the SPI feature** including **loopback test**.

## Enable the SPI feature on your board

The SPI feature can be simply enabled by loading a module.

# ODROID-XU4

Load the modules with the following commands.

```
root@odroid:~# modprobe spidev
root@odroid:~# modprobe spi_s3c64xx
```

And you can check if the module loaded.

```
root@odroid:~# lsmod | grep spi
spidev                  20480
spi_s3c64xx             20480
```

And the device file **/dev/spidev1.0** has been created as well.

```
root@odroid:~# ls /dev/spidev*
/dev/spidev1.0
```

# ODROID-C1+

Load the modules with the following commands.

```
root@odroid:~# modprobe spidev
root@odroid:~# modprobe spicc
```

And you can check if the module loaded.

```
root@odroid:~# lsmod | grep spi
spicc                   8279
spidev                  5442
```

And the device file **/dev/spidev0.0** has been created as well.

```
root@odroid:~# ls /dev/spidev*
/dev/spidev0.0
```

# ODROID-C2

Load the modules with the following commands.

```
root@odroid64:~# modprobe spidev
root@odroid64:~# modprobe spi_gpio
root@odroid64:~# modprobe spi_bitbang
```

And you can check if the module loaded.

```
root@odroid64:~# lsmod | grep spi
spi_gpio                6778
spi_bitbang             4063  1 spi_gpio
spidev                  6475
```

And the device file **/dev/spidev0.0** has been created as well.

```
root@odroid64:~# ls /dev/spidev*
/dev/spidev0.0
```

# ODROID-N2

Enable the modules using **device-tree-compiler**.

```
root@odroid:~# apt install device-tree-compiler
```

Change the status to **okay** of the SPI nodes on the device tree.

```
# SPICC0
root@odroid:~# fdtput -t s /media/boot/meson64_odroidn2.dtb
/soc/cbus@ffd00000/spi@13000 status okay

# SPIDEV0
root@odroid:~# fdtput -t s /media/boot/meson64_odroidn2.dtb
/soc/cbus@ffd00000/spi@13000/spidev@0 status okay
```

Check if it changed.

```
# SPICC0
root@odroid:~# fdtget /media/boot/meson64_odroidn2.dtb
/soc/cbus@ffd00000/spi@13000 status
okay

# SPIDEV0
root@odroid:~# fdtget /media/boot/meson64_odroidn2.dtb
/soc/cbus@ffd00000/spi@13000/spidev@0 status
okay
```

Then reboot to apply the changes.

Then you can check if the modules loaded.

```
root@odroid:~# lsmod | grep spi
spidev                  20480
spi_meson_spicc         20480
```

Check the **/dev/spidev0.0** file out as the below.

```
root@odroid:~# ls /dev/spidev*
/dev/spidev0.0
```

# Test if the SPI feature works

- You can use the **wild card character(*)** when you select **spidev** file, but **be careful** with using that due to the unexpected situation on your board.
- This guide uses the wild card to give you the **unified** simple instruction for those 3 boards.

## Preparation

Download a source code and compile.

```
root@odroid:~# wget http://dn.odroid.com/Accessory/examples/spidev_test.c
root@odroid:~# gcc -o spidev_test spidev_test.c
```

The help of the test utility.

```
# There's no option to show the help on this file.
# It shows if you enter this command with invalid arguments.
# So the '--help' option will show the help.
root@odroid:~# ./spidev_test --help
./spidev_test: unrecognized option '--help'
Usage: ./spidev_test [-DsbdlHOLC3]
  -D --device   device to use (default /dev/spidev1.1)
```

```
  -s --speed    max speed (Hz)
  -d --delay    delay (usec)
  -b --bpw      bits per word
  -l --loop     loopback
  -H --cpha     clock phase
  -O --cpol     clock polarity
  -L --lsb      least significant bit first
  -C --cs-high  chip select active high
  -3 --3wire    SI/SO signals shared
```

## Loopback test

Even though you haven't any SPI hardware device, you can test if the SPI feature works with a jump cable.

Before testing, **make sure** that a jump cable is connected between SPI **MOSI** and **MISO** pin directly.

- XU4: Connect between pin **#7** and **#9** at CON10 pin header.
- XU4 with Shifter Shield/C1+/C2: Connect between pin **#19** and **#21**

Please refer to each wiki page about expansion connectors.

- XU4: Expansion Connectors
- C1+: Expansion Connectors
- C2: Expansion Connectors
- N2: Expansion Connectors

Run to test.
The spidev number is different by which board you use.

- XU4: /dev/spidev**1.0**
- C1+/C2: /dev/spidev**0.0**
- N2: /dev/spidev**0.0**

```
# XU4
root@odroid:~# ./spidev_test -D /dev/spidev1.0

# C1+
root@odroid:~# ./spidev_test -D /dev/spidev0.0

# C2
root@odroid64:~# ./spidev_test -D /dev/spidev0.0

# N2
root@odroid:~# ./spidev_test -D /dev/spidev0.0
```

These results should be the same.

```
root@odroid:~# ./spidev_test -D /dev/spidev*
spi mode:
bits per word: 8
```

```
max speed: 500000 Hz (500 KHz)

01 02 03 04
```

If the module isn't loaded and/or spidev file isn't created, it results like the below.

```
root@odroid:~# ./spidev_test -D /dev/spidev*
can't open device: No such file or directory
Aborted
```

If the jump cable isn't connected well, it results like the below.

```
root@odroid:~# ./spidev_test -D /dev/spidev*
spi mode:
bits per word: 8
max speed: 500000 Hz (500 KHz)

FF FF FF FF
```

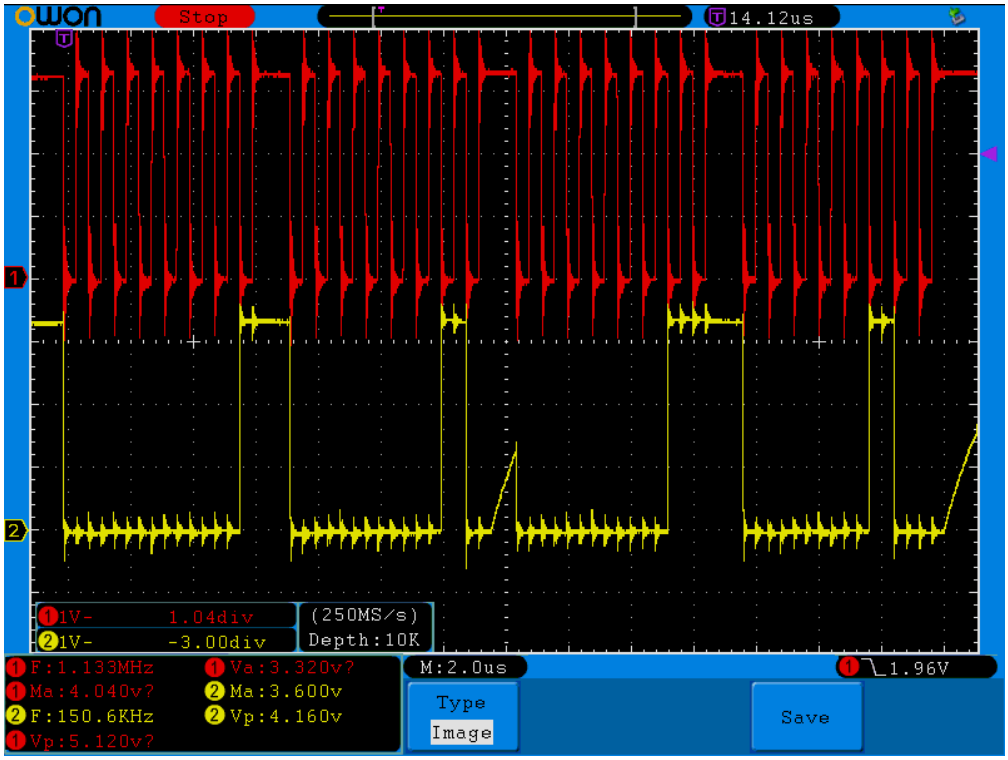
### Various tests

#### Bits per word

# 8 bits

1MHz max speed and **8** bits per word.

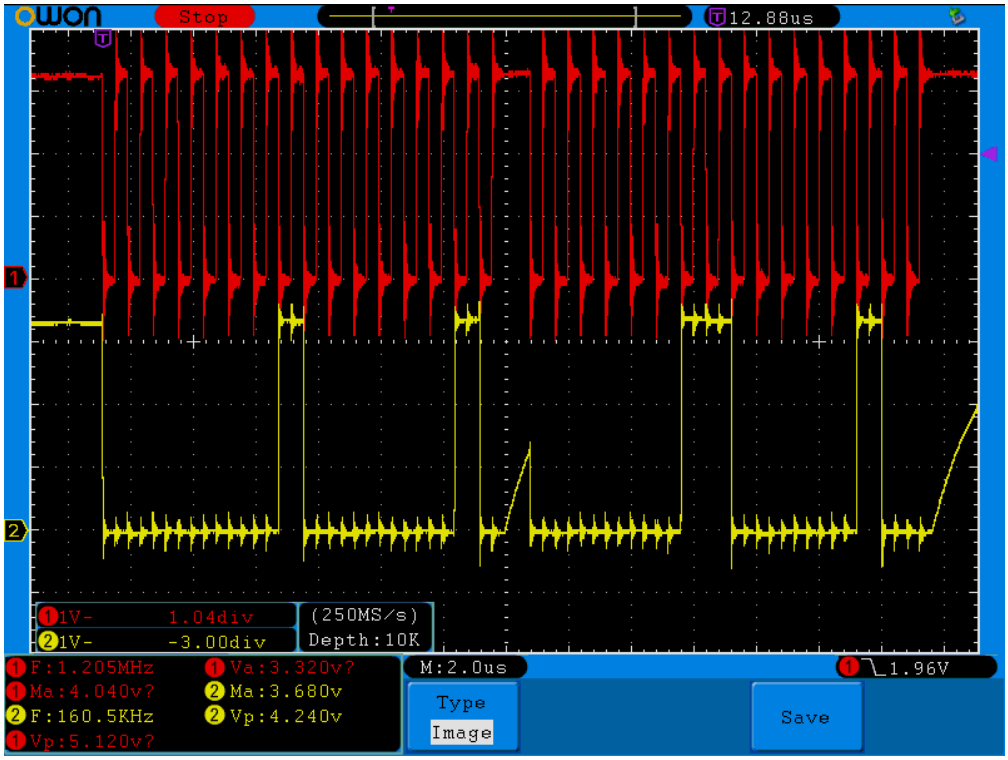
```
root@odroid:~# ./spidev_test -D /dev/spidev* -s 1000000 -b 8
spi mode:
bits per word: 8
max speed: 1000000 Hz (1000 KHz)
```




# 16 bits

1MHz max speed and **16** bits per word.

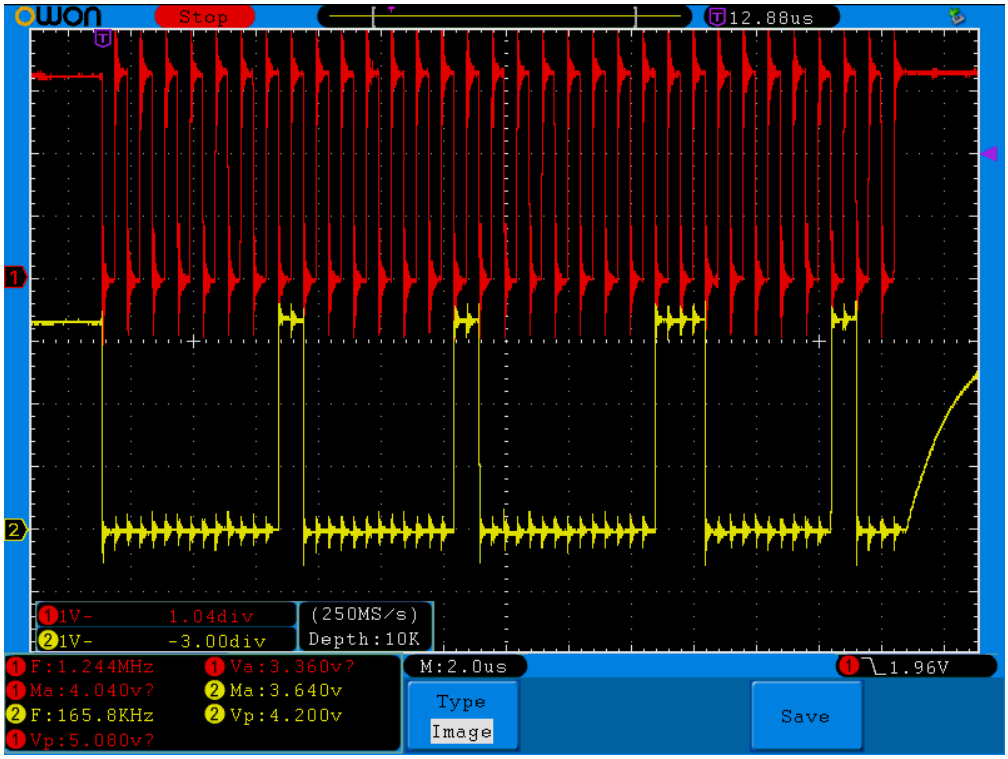
```
root@odroid:~# ./spidev_test -D /dev/spidev* -s 1000000 -b 16
spi mode:
bits per word: 16
max speed: 1000000 Hz (1000 KHz)
```



# 32 bits

1MHz max speed and **32** bits per word.

```
root@odroid:~# ./spidev_test -D /dev/spidev* -s 1000000 -b 32
spi mode:
bits per word: 32
max speed: 1000000 Hz (1000 KHz)
```

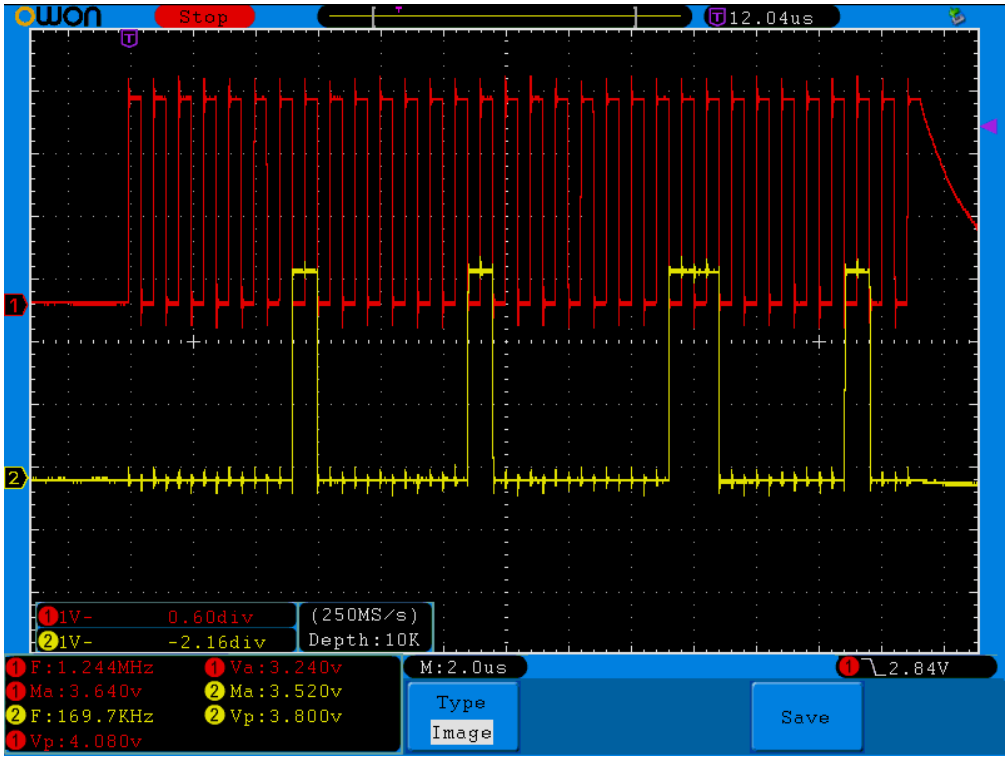



#### SPI mode

# Mode 0

1MHz max speed, 32 bits per word and SPI mode .

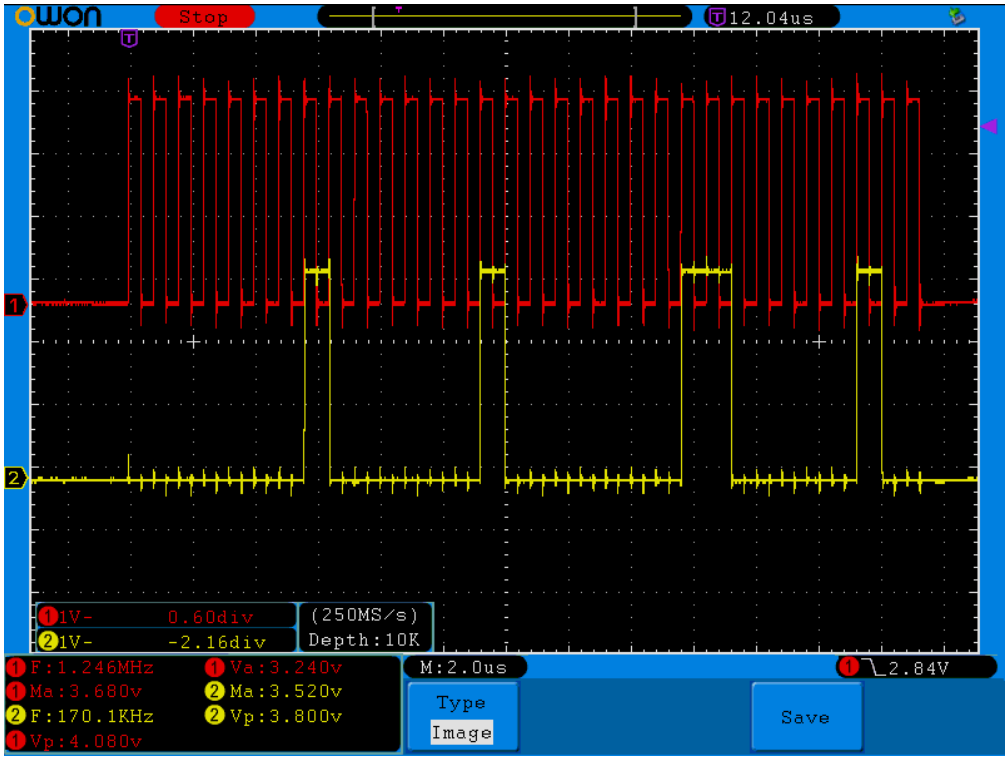
```
root@odroid:~# ./spidev_test -D /dev/spidev* -s 1000000 -b 32
spi mode:
bits per word: 32
max speed: 1000000 Hz (1000 KHz)
```




# Mode 1

1MHz max speed, 32 bits per word and SPI mode **1**.

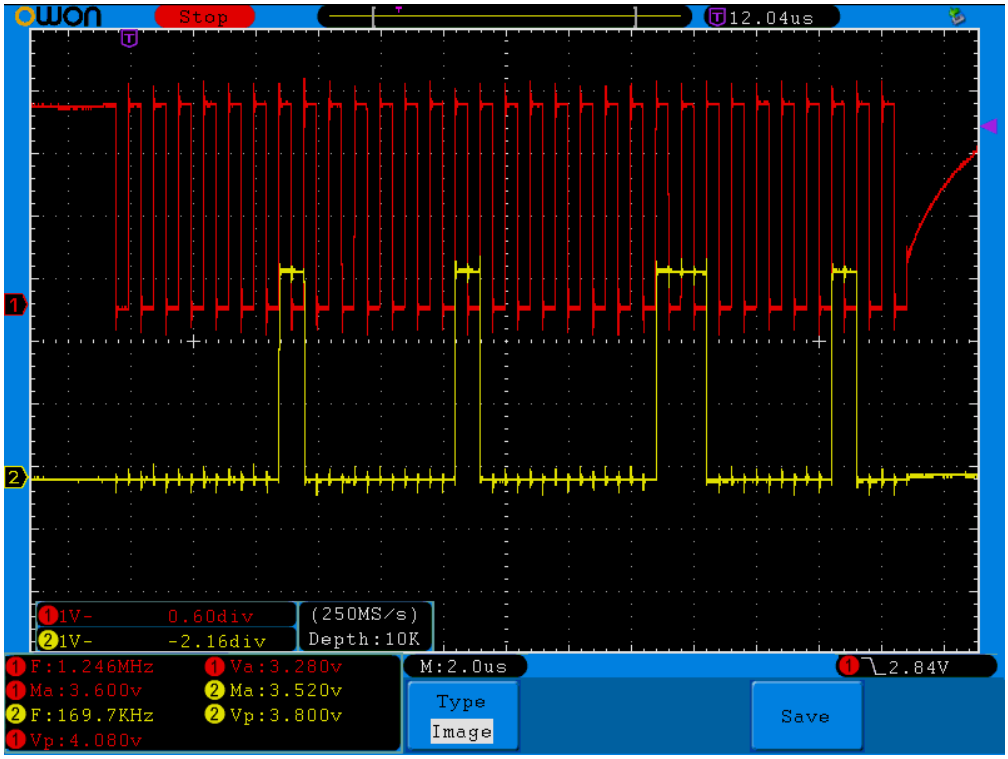
```
root@odroid:~# ./spidev_test -D /dev/spidev* -s 1000000 -b 32 -H
spi mode: 1
bits per word: 32
max speed: 1000000 Hz (1000 KHz)
```



# Mode 2

1MHz max speed, 32 bits per word and SPI mode **2**.

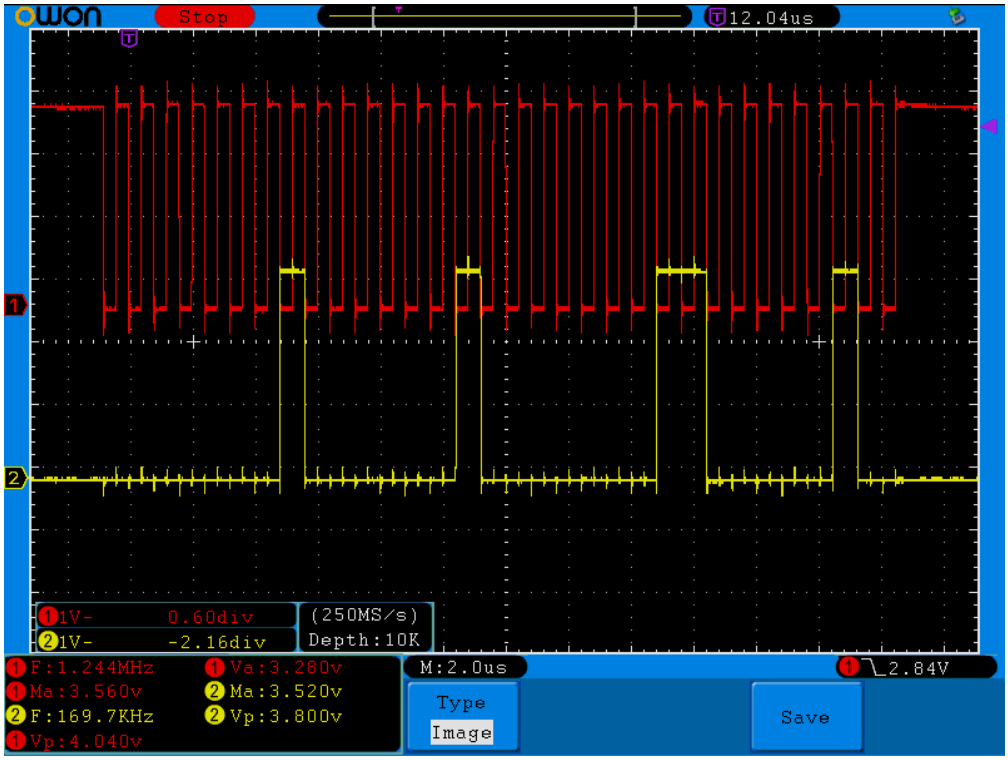
```
root@odroid:~# ./spidev_test -D /dev/spidev* -s 1000000 -b 32 -O
spi mode: 2
bits per word: 32
max speed: 1000000 Hz (1000 KHz)
```




# Mode 3

1MHz max speed, 32 bits per word and SPI mode **3**.

```
root@odroid:~# ./spidev_test -D /dev/spidev* -s 1000000 -b 32 -H -O
spi mode: 3
bits per word: 32
max speed: 1000000 Hz (1000 KHz)
```




# References

[1] https://www.kernel.org/doc/Documentation/spi/spi-summary

2018/05/21 08:56 · joshua