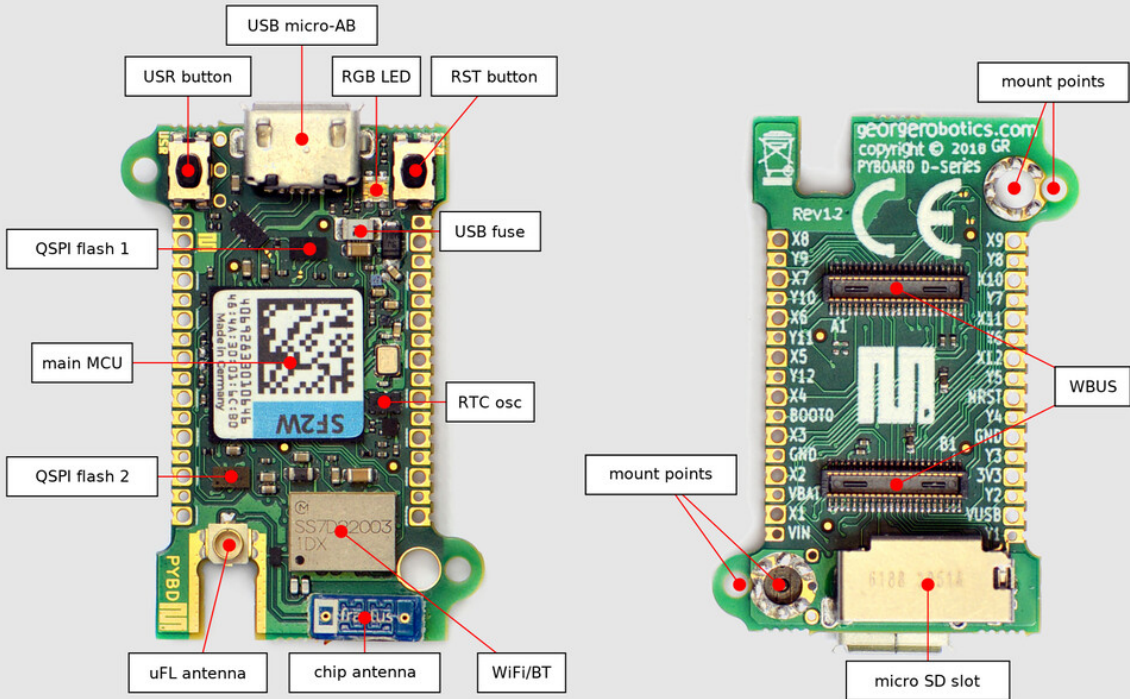


# Pyboard D-series reference

This reference is valid for all PYBD models.



# PYBD-SFxW

pyboard D-series

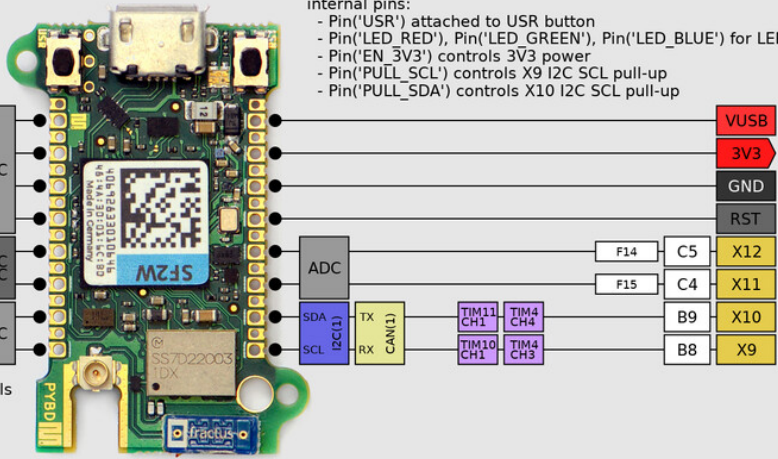
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## X positions

pin name	CPU name	CPU extra	available timers	peripherals
X1	A0		TIM2 CH1, TIM5 CH1	UART(4) TX, ADC
X2	A1		TIM2 CH2, TIM5 CH2	UART(2) TX, ADC
X3	A2		TIM3 CH3, TIM5 CH3, TIM9 CH1	ADC
X4	A3		TIM2 CH4, TIM5 CH4, TIM9 CH2	ADC
X5	A4	G7		/SS, ADC DAC
X6	A5		TIM2 CH1, TIM8 CH1N	SPI(1) SCK, ADC
X7	A6		TIM3 CH1, TIM8 CH1N, TIM13 CH1, TIM14 CH1	MISO, ADC
X8	A7		TIM1 CH1N, TIM3 CH2, TIM8 CH1N, TIM14 CH1	MOSI, ADC

### internal pins:

- Pin('USR') attached to USR button
- Pin('LED\_RED'), Pin('LED\_GREEN'), Pin('LED\_BLUE') for LEDs
- Pin('EN\_3V3') controls 3V3 power
- Pin('PULL\_SCL') controls X9 I2C SCL pull-up
- Pin('PULL\_SDA') controls X10 I2C SCL pull-up

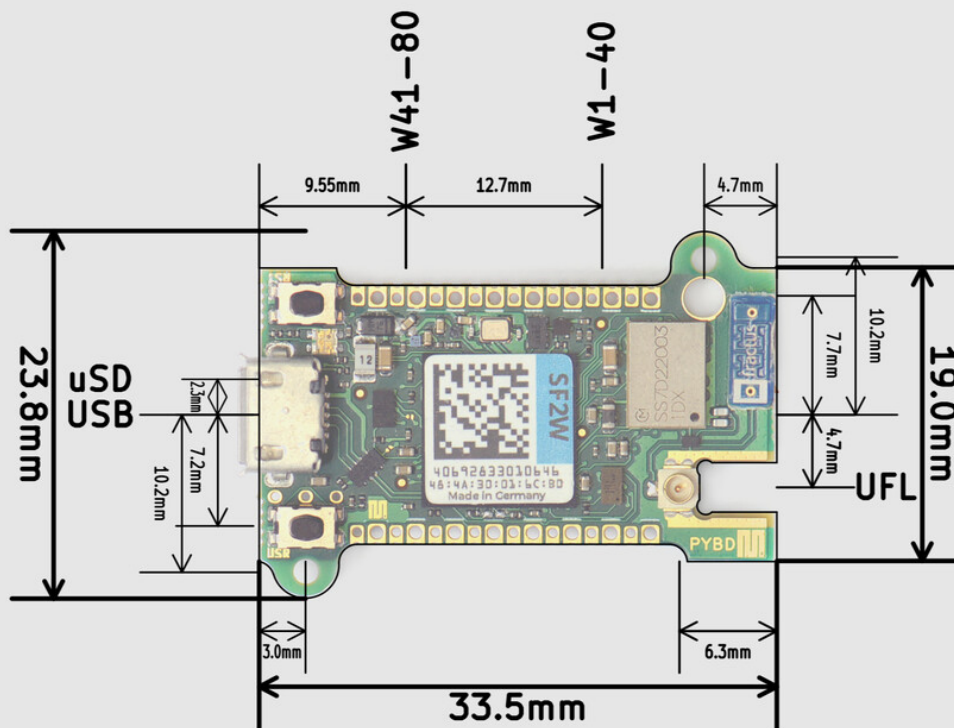


## Y positions

CPU extra	CPU name	pin name	peripherals	available timers	CPU extra	CPU name	pin name
VIN			TX UART(1)	TIM2 CH2		A9	Y1
VBAT			RX UART(1)	TIM1 CH3		A10	Y2
GND				TIM3 CH1, TIM3 CH2		B4	Y3
BOOT0						B5	Y4
Y12	B1	D9	/SS		E14/H8	B12	Y5
Y11	B0	C0/F9/F11	SCK SPI(2)			B13	Y6
Y10	B11		MISO SPI(2)	TIM1 CH1N	F8	C2	Y7
Y9	B10		MOSI		F13	C3	Y8

# PYBD-SFxW

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## PYBD-SFxW

pyboard D-series

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For the schematics see: [PYBD\\_SFxW\\_schematics.pdf](#)

## Power supply

### Note

Please take note of the following power supply options:

- The simplest way is to plug a USB cable into the USB port on the PYBD. That will power the PYBD and allow communication with the PC.
- You can power the PYBD via the VUSB port (see X-positions). The voltage on this port must be between 4.8V and 5.2V. This port contains a protective diode and a 1A fast/0.22Ohm fuse.
- You can power the PYBD via the VIN port (see Y-positions). The voltage on this port must be between 3.2V and 4.8V.

The 3V3 pin is *output only* and should not be used to power the board. It can be used as a regulated 3.3V output supply, maximum 300mA total output current including power consumed by the SD card or eMMC.

General recommendations for powering PYBD from a custom power source:

- For best performance provide 3.4V on VIN (3.3V is also ok but 3.4V will benefit from LDO filtering). If there is a chance that the USB port (or VUSB) will provide power as well as VIN, then VIN should be protected with a diode (eg Schottky diode or a FET reverse protector).
- If supply voltage is 5V then either provide it on VUSB (only available on the X-position through-holes) or put a diode inline and feed into VIN (diode should drop voltage to 4.8V or below).

A summary of the power ports is provided in the table below. For full details please consult the schematics.

Port	Use	Voltage	Notes
USB conn	power and comms	5V	connect to PC or USB power brick
VUSB	power in	4.8V-5.2V	1A fast/0.22Ohm fuse and protective diode
VIN	power in	3.2V-4.8V	also on WBUS
VBAT	backup battery	1.65V-3.6V	also on WBUS
3V3	output only	3.3V	user switchable LDO max 300mA total

Warning: If the USB host port which powers PYBD is capable of delivering more than 1A, a shortcut on VIN would trip the built-in fuse on the PYBD.

Note: VIN may also be used as a non switchable power supply output as long as total current is below 1A.

## Power control

The 3V3 output port is connected internally to an LDO which is switchable on and off via the `Pin('EN_3V3')` pin. It is turned on by default during the boot sequence.

The CPU frequency can be set to any multiple of 2MHz between 48MHz and 216MHz, via `machine.freq(<freq>)`. By default the SF2 model runs at 120MHz and the SF6 model at 144MHz in order to conserve electricity. It is possible to go below 48MHz but then the WiFi cannot be used.

## Filesystem

The PYBD has an internal 2MiB filesystem which is FAT formatted and available to Python at the path `'/flash'`. The underlying block device for this filesystem is available via the `pyb.Flash()` object.

## USB ports

There are two USB interfaces: FS and HS. The USB HS port is the main one and is available on the PYBD itself. The FS port is made available on the WBUS-DIP28 adapter. By default the USB port to use will be auto-detected based on the presence of a cable plugged in. It can be selected manually, eg in `boot.py`:

```
import pyb

pyb.usb_mode('VCP+MSC', port=-1) # default, auto-detect port
pyb.usb_mode('VCP+MSC', port=0) # select FS port
pyb.usb_mode('VCP+MSC', port=1) # select HS port
```

`pyb.usb_mode()` can be called at anytime, from any script, but is usually put in `boot.py` to configure the USB as early as possible in the boot sequence. You can use `pyb.usb_mode(None)` to completely disable and turn off the USB peripheral (this saves power).

When MSC mode is enabled the connected PC will be able to see the filesystem of the PYBD. By default this is the internal 2MiB flash, unless an SD card is inserted in which case it is the SD card. This can be selected manually via the `msc` keyword argument which should be a tuple or list of one element, for example:

```
pyb.usb_mode('VCP+MSC', msc=(pyb.Flash(),)) # expose internal flash to the PC
pyb.usb_mode('VCP+MSC', msc=(pyb.SDCard(),)) # expose SD card to the PC
pyb.usb_mode('VCP+MSC', msc=(pyb.MMCARD(),)) # expose MMC to the PC
```

## WiFi control

In your `boot.py` file you should configure the country for the allowed WiFi channels in your region:

```
import pyb

pyb.country('US') # 2-char code, eg: US, GB, DE, NL, FR, AU, CA
```

To use the WiFi station interface:

### import network

```
wl = network.WLAN()
wl.active(1)           # bring up the interface

wl.config('mac')      # get the MAC address
wl.config(antenna=0)  # select antenna, 0=chip, 1=external
wl.scan()             # scan for access points, returning a list
wl.connect('ssid', 'password') # connect to an access point
wl.isconnected()     # check if connected to an access point
wl.disconnect()      # disconnect from an access point
```

To use the WiFi access-point interface:

### import network

```
wl_ap = network.WLAN(1)
wl_ap.config(essid='PYBD')      # set AP SSID
wl_ap.config(password='pybd0123') # set AP password
wl_ap.config(channel=6)         # set AP channel
wl_ap.active(1)                 # enable the AP

wl_ap.status('stations')       # get a list of connection stations
wl_ap.active(0)                 # shut down the AP
```

See `network` for more details.

## Internal LEDs

See `pyb.LED`.

### from pyb import LED

```
led = LED(1) # 1=red, 2=green, 3=blue
led.toggle()
led.on()
led.off()
```

## Internal USR button

See `pyb.Switch`.

### from pyb import Switch

```
sw = Switch()
sw.value() # returns True or False
sw.callback(lambda: pyb.LED(1).toggle())
```

# Pins and GPIO

All pins are available via their WBUS name, eg `Pin('W19')`. Some pins also have other names for convenience, such as `Pin('X1')`. See [pinouts](#) for a full list of accessible pin names. See [pyb.Pin](#) for details of pin use.

```
from machine import Pin

x1 = Pin('X1', Pin.OUT)
x1.value(1) # set pin digital high

x2 = Pin('X2', Pin.IN, Pin.PULL_UP)
print(x2.value()) # read digital value
```

## I2C buses

The I2C bus on the X position, pins X9 and X10, has two independent user selectable pull-up resistors on SCL and SDA, of 5.6kOhm each. They are connected on their high side to `Pin('PULL_SCL')` and `Pin('PULL_SDA')` and are disabled by default. To enable them use:

```
from machine import Pin

Pin('PULL_SCL', Pin.OUT, value=1) # enable 5.6kOhm X9/SCL pull-up
Pin('PULL_SDA', Pin.OUT, value=1) # enable 5.6kOhm X10/SDA pull-up
```

## RTC (real time clock)

The internal RTC is driven by a high precision, pre-calibrated oscillator. See [pyb.RTC](#) for details of RTC use.

```
from pyb import RTC

rtc = RTC()
rtc.datetime((2017, 8, 23, 1, 12, 48, 0, 0)) # set a specific date and time
rtc.datetime() # get date and time
```

## SD card

The board has a built-in micro SD card slot. If an SD card is inserted, by default it will not be automatically mount in the board's filesystem but it will be exposed as a mass storage device if USB is used. To automatically mount the SD card if it is inserted, put the following in your

`boot.py`:

```
import sys, os, pyb
if pyb.SDCard().present():
    os.mount(pyb.SDCard(), '/sd')
    sys.path[1:1] = ['/sd', '/sd/lib']
```

The above code will also put the SD card's filesystem in the path list so Python scripts can be imported from the SD card. You can remove or change this as desired.

## Differences to the original PYBv1.x

The main differences between PYBD and the original PYBv1.x pyboard are:

- If inserted, the SD card is not automatically mounted on PYBD.
- The last (8th) element of `pyb.RTC().datetime()` is microseconds and counts up on PYBD.

### ISED RSS Warning:

This device complies with Innovation, Science and Economic Development Canada licence-exempt RSS standard(s). Operation is subject to the following two conditions: (1) this device may not cause interference, and (2) this device must accept any interference, including interference that may cause undesired operation of the device.

Le présent appareil est conforme aux CNR d'ISED applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes:

- (1) l'appareil ne doit pas produire de brouillage, et
- (2) l'utilisateur de l'appareil doit accepter tout brouillage radio électrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

### ISED RF exposure statement:

This equipment complies with ISED radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with minimum distance 20cm between the radiator & your body. This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.

Le rayonnement de la classe B respecte ISED fixaient un environnement non contrôlé. Installation et mise en œuvre de ce matériel devrait avec un changement de distance minimale entre 20 cm de votre corps. Lanceurs ou ne peuvent pas coexister cette antenne ou capteurs avec d'autres.

### IC Label Instructions:

The outside of final products that contains this module device must display a label referring to the enclosed module. This exterior label can use wording such as:

“Contains Transmitter Module IC: 25382-PYBD” ,or “Contains IC: 25382-PYBD” , Any similar wording that expresses the same meaning may be used.

Instructions d'étiquetage IC:

L'extérieur des produits finis contenant ce module doit afficher une étiquette faisant référence au module inclus. Cette étiquette extérieure peut utiliser des libellés tels que: contient le module émetteur IC: 25382-PYBD” ou “contient: IC: 25382-PYBD” , tout libellé similaire exprimant le même sens peut être utilisé

### Summarize the specific operational use conditions

This module can be used in household electrical appliances as well as lighting equipment. The input voltage to the module should be nominally 4.5~5.5 VDC ,typical value 5.0VDC and the ambient temperature of the module should not exceed 85 ° C. This module using only two kind of antennas, with maximum gain is 2.2 dBi .Other antenna arrangement is not covered by this certification. The antennas are not field replaceable. If the antennas need to be changed, the certification should be re-applied.

### Limited module procedures

This module can be used in lighting equipment, smart front panel, household electrical appliances. Normally host device should provide a power supply in range 4.5~5.5V, typically 5.0V for this module. The limited module manufacturer will review detailed test data or host designs prior to giving the host manufacturer approval.



## **Regulatory Module Integration Instructions**

### **2.2 List of applicable FCC rules**

This device complies with part 15.247 of the FCC Rules.

### **2.3 Summarize the specific operational use conditions**

This module can be used in household electrical appliances as well as lighting equipment.

The input voltage to the module should be nominally 4.5~5.5 V<sub>DC</sub>, typical value 5.0V<sub>DC</sub> and the ambient temperature of the module should not exceed 85°C.

This module using only two kind of antennas, with maximum gain is 2.2 dBi .Other antenna arrangement is not covered by this certification.

The antennas are not field replaceable. If the antennas need to be changed, the certification should be re-applied.

### **2.4 Limited module procedures**

This module can be used in lighting equipment, smart front panel, household electrical appliances. Normally host device should provide a power supply in range 4.5~5.5V, typically 5.0V for this module. The limited module manufacturer will review detailed test data or host designs prior to giving the host manufacturer approval.

### **2.5 Trace antenna designs Not applicable**

### **2.6 RF exposure considerations**

This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with minimum distance 20cm between the radiator& your body. If the device built into a host as a portable usage, the additional RF exposure evaluation may be required as specified by§ 2.1093.

### **2.7 Antennas**

Module only contains one SMD chip antenna and one u.fl connector for the installation of an external antenna.

### **2.8 Label and compliance information**

The outside of final products that contains this module device must display a label referring to the enclosed module. This exterior label can use wording such as: "Contains Transmitter Module FCC ID: 2AT9I-PYBD", or "Contains FCC ID: 2AT9I-PYBD", Any similar wording that expresses the same meaning may be used.

## 2.9 Information on test modes and additional testing requirements

a) The modular transmitter has been fully tested by the module grantee on the required number of channels, modulation types, and modes, it should not be necessary for the host installer to re-test all the available transmitter modes or settings. It is recommended that the host product manufacturer, installing the modular transmitter, perform some investigative measurements to confirm that the resulting composite system does not exceed the spurious emissions limits or band edge limits (e.g., where a different antenna may be causing additional emissions).

b) The testing should check for emissions that may occur due to the intermixing of emissions with the other transmitters, digital circuitry, or due to physical properties of the host product (enclosure). This investigation is especially important when integrating multiple modular transmitters where the certification is based on testing each of them in a stand-alone configuration. It is important to note that host product manufacturers should not assume that because the modular transmitter is certified that they do not have any responsibility for final product compliance.

c) If the investigation indicates a compliance concern the host product manufacturer is obligated to mitigate the issue. Host products using a modular transmitter are subject to all the applicable individual technical rules as well as to the general conditions of operation in Sections 15.5, 15.15, and 15.29 to not cause interference. The operator of the host product will be obligated to stop operating the device until the interference has been corrected

Below are steps for TX verification:

```
wl4343WA1.exe --serial 99 down
wl4343WA1.exe --serial 99 country ALL
wl4343WA1.exe --serial 99 band b
wl4343WA1.exe --serial 99 chanspec -c 1 -b 2 -w 20 -s 0
wl4343WA1.exe --serial 99 mpc 0
wl4343WA1.exe --serial 99 ampdu 1
wl4343WA1.exe --serial 99 bi 65000
wl4343WA1.exe --serial 99 frameburst 1
wl4343WA1.exe --serial 99 rateset 11b
wl4343WA1.exe --serial 99 up
wl4343WA1.exe --serial 99 txant 0
wl4343WA1.exe --serial 99 antdiv 0
wl4343WA1.exe --serial 99 nrate -r 11
wl4343WA1.exe --serial 99 phy_watchdog 0
wl4343WA1.exe --serial 99 disassoc
wl4343WA1.exe --serial 99 txpwr1 -1

wl4343WA1.exe --serial 99 pkteng_start 00:90:4c:aa:bb:cc tx 40 1000 0
```

**To stop transmitting:**

```
wl4343WA1.exe --serial 99 pkteng_stop tx
```

## **2.10 Additional testing, Part 15 subpart B disclaimer**

The final host / module combination needs to be evaluated against the FCC Part 15B criteria for unintentional radiators in order to be properly authorized for operation as a Part 15 digital device.

The host integrator installing this module into their product must ensure that the final composite product complies with the FCC requirements by a technical assessment or evaluation to the FCC rules, including the transmitter operation and should refer to guidance in KDB 996369.

### **Frequency spectrum to be investigated**

For host products with certified modular transmitter, the frequency range of investigation of the composite system is specified by rule in Sections 15.33(a)(1) through (a)(3), or the range applicable to the digital device, as shown in Section 15.33(b)(1), whichever is the higher frequency range of investigation.

### **Operating the host product**

When testing the host product, all the transmitters must be operating. The transmitters can be enabled by using publicly-available drivers and turned on, so the transmitters are active. In certain conditions it might be appropriate to use a technology-specific call box (test set) where accessory devices or drivers are not available.

When testing for emissions from the unintentional radiator, the transmitter shall be placed in the receive mode or idle mode, if possible. If receive mode only is not possible then, the radio shall be passive (preferred) and/or active scanning. In these cases, this would need to enable activity on the communication BUS (i.e., PCIe, SDIO, USB) to ensure the unintentional radiator circuitry is enabled. Testing laboratories may need to add attenuation or filters depending on the signal strength of any active beacons (if applicable) from the enabled radio(s). See ANSI C63.4, ANSI C63.10 and ANSI C63.26 for further general testing details.

The product under test is placed into a normal WiFi station mode and connected to a WiFi router, as per the normal intended use of the product (for example, transferring data).

### **FCC Statement**

Any Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions:

- (1) This device may not cause harmful interference, and
- (2) This device must accept any interference received, including interference that may cause undesired operation.