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class Pin – control I/O pins

A pin object is used to control I/O pins (also known as GPIO - general-purpose input/output). Pin objects are commonly associated with a physical pin that can drive an output voltage and read input voltages. The pin class has methods to set the mode of the pin (IN, OUT, etc) and methods to get and set the digital logic level. For analog control of a pin, see the [ADC](#) class.

A pin object is constructed by using an identifier which unambiguously specifies a certain I/O pin. The allowed forms of the identifier and the physical pin that the identifier maps to are port-specific. Possibilities for the identifier are an integer, a string or a tuple with port and pin number.

Usage Model:

```
from machine import Pin

# create an output pin on pin #0
p0 = Pin(0, Pin.OUT)

# set the value low then high
p0.value(0)
p0.value(1)

# create an input pin on pin #2, with a pull up resistor
p2 = Pin(2, Pin.IN, Pin.PULL_UP)

# read and print the pin value
print(p2.value())

# reconfigure pin #0 in input mode with a pull down resistor
p0.init(p0.IN, p0.PULL_DOWN)

# configure an irq callback
p0.irq(lambda p:print(p))
```

Constructors

```
class machine.Pin(id, mode=-1, pull=-1, *, value=None, drive=0, alt=-1)
```

Access the pin peripheral (GPIO pin) associated with the given `id`. If additional arguments are given in the constructor then they are used to initialise the pin. Any settings that are not specified will remain in their previous state.

The arguments are:

- `id` is mandatory and can be an arbitrary object. Among possible value types are: int (an internal Pin identifier), str (a Pin name), and tuple (pair of [port, pin]).
- `mode` specifies the pin mode, which can be one of:
 - `Pin.IN` - Pin is configured for input. If viewed as an output the pin is in high-impedance state.
 - `Pin.OUT` - Pin is configured for (normal) output.
 - `Pin.OPEN_DRAIN` - Pin is configured for open-drain output. Open-drain output works in the following way: if the output value is set to 0 the pin is active at a low level; if the output value is 1 the pin is in a high-impedance state. Not all ports implement this mode, or some might only on certain pins.
 - `Pin.ALT` - Pin is configured to perform an alternative function, which is port specific. For a pin configured in such a way any other Pin methods (except `Pin.init()`) are not applicable (calling them will lead to undefined, or a hardware-specific, result). Not all ports implement this mode.
 - `Pin.ALT_OPEN_DRAIN` - The Same as `Pin.ALT`, but the pin is configured as open-drain. Not all ports implement this mode.
 - `Pin.ANALOG` - Pin is configured for analog input, see the `ADC` class.
- `pull` specifies if the pin has a (weak) pull resistor attached, and can be one of:
 - `None` - No pull up or down resistor.
 - `Pin.PULL_UP` - Pull up resistor enabled.
 - `Pin.PULL_DOWN` - Pull down resistor enabled.
- `value` is valid only for `Pin.OUT` and `Pin.OPEN_DRAIN` modes and specifies initial output pin value if given, otherwise the state of the pin peripheral remains unchanged.
- `drive` specifies the output power of the pin and can be one of: `Pin.DRIVE_0`, `Pin.DRIVE_1`, etc., increasing in drive strength. The actual current driving capabilities are port dependent. Not all ports implement this argument.
- `alt` specifies an alternate function for the pin and the values it can take are port dependent. This argument is valid only for `Pin.ALT` and `Pin.ALT_OPEN_DRAIN` modes. It may be used when a pin supports more than one alternate function. If only one pin alternate function is supported the this argument is not required. Not all ports implement this argument.

As specified above, the Pin class allows to set an alternate function for a particular pin, but it does not specify any further operations on such a pin. Pins configured in alternate-function mode are usually not used as GPIO but are instead driven by other hardware peripherals. The only operation supported on such a pin is re-initialising, by calling the constructor or `Pin.init()` method. If a pin that is configured in alternate-function mode is re-initialised with `Pin.IN`, `Pin.OUT`, or `Pin.OPEN_DRAIN`, the alternate function will be removed from the pin.

Methods

`Pin.init(mode=-1, pull=-1, *, value=None, drive=0, alt=-1)`

Re-initialise the pin using the given parameters. Only those arguments that are specified will be set. The rest of the pin peripheral state will remain unchanged. See the constructor documentation for details of the arguments.

Returns `None`.

`Pin.value([x])`

This method allows to set and get the value of the pin, depending on whether the argument `x` is supplied or not.

If the argument is omitted then this method gets the digital logic level of the pin, returning 0 or 1 corresponding to low and high voltage signals respectively. The behaviour of this method depends on the mode of the pin:

- `Pin.IN` - The method returns the actual input value currently present on the pin.
- `Pin.OUT` - The behaviour and return value of the method is undefined.
- `Pin.OPEN_DRAIN` - If the pin is in state '0' then the behaviour and return value of the method is undefined. Otherwise, if the pin is in state '1', the method returns the actual input value currently present on the pin.

If the argument is supplied then this method sets the digital logic level of the pin. The argument `x` can be anything that converts to a boolean. If it converts to `True`, the pin is set to state '1', otherwise it is set to state '0'. The behaviour of this method depends on the mode of the pin:

- `Pin.IN` - The value is stored in the output buffer for the pin. The pin state does not change, it remains in the high-impedance state. The stored value will become active on the pin as soon as it is changed to `Pin.OUT` or `Pin.OPEN_DRAIN` mode.
- `Pin.OUT` - The output buffer is set to the given value immediately.
- `Pin.OPEN_DRAIN` - If the value is '0' the pin is set to a low voltage state. Otherwise the pin is set to high-impedance state.

When setting the value this method returns `None`.

`Pin.__call__([x])`

Pin objects are callable. The call method provides a (fast) shortcut to set and get the value of the pin. It is equivalent to `Pin.value([x])`. See [Pin.value\(\)](#) for more details.

`Pin.on()`

Set pin to “1” output level.

`Pin.off()`

Set pin to “0” output level.

`Pin.irq(handler=None, trigger=Pin.IRQ_FALLING | Pin.IRQ_RISING, *, priority=1, wake=None, hard=False)`

Configure an interrupt handler to be called when the trigger source of the pin is active. If the pin mode is `Pin.IN` then the trigger source is the external value on the pin. If the pin mode is `Pin.OUT` then the trigger source is the output buffer of the pin. Otherwise, if the pin mode is `Pin.OPEN_DRAIN` then the trigger source is the output buffer for state ‘0’ and the external pin value for state ‘1’.

The arguments are:

- `handler` is an optional function to be called when the interrupt triggers. The handler must take exactly one argument which is the `Pin` instance.
- `trigger` configures the event which can generate an interrupt. Possible values are:
 - `Pin.IRQ_FALLING` interrupt on falling edge.
 - `Pin.IRQ_RISING` interrupt on rising edge.
 - `Pin.IRQ_LOW_LEVEL` interrupt on low level.
 - `Pin.IRQ_HIGH_LEVEL` interrupt on high level.

These values can be OR’ed together to trigger on multiple events.

- `priority` sets the priority level of the interrupt. The values it can take are port-specific, but higher values always represent higher priorities.
- `wake` selects the power mode in which this interrupt can wake up the system. It can be `machine.IDLE`, `machine.SLEEP` or `machine.DEEPSLEEP`. These values can also be OR’ed together to make a pin generate interrupts in more than one power mode.
- `hard` if true a hardware interrupt is used. This reduces the delay between the pin change and the handler being called. Hard interrupt handlers may not allocate memory; see [Writing interrupt handlers](#). Not all ports support this argument.

This method returns a callback object.

The following methods are not part of the core Pin API and only implemented on certain ports.

Pin.low()

Set pin to “0” output level.

Availability: nrf, rp2, stm32 ports.

Pin.high()

Set pin to “1” output level.

Availability: nrf, rp2, stm32 ports.

Pin.mode([mode])

Get or set the pin mode. See the constructor documentation for details of the `mode` argument.

Availability: cc3200, stm32 ports.

Pin.pull([pull])

Get or set the pin pull state. See the constructor documentation for details of the `pull` argument.

Availability: cc3200, stm32 ports.

Pin.drive([drive])

Get or set the pin drive strength. See the constructor documentation for details of the `drive` argument.

Availability: cc3200 port.

Constants

The following constants are used to configure the pin objects. Note that not all constants are available on all ports.

Pin.IN

Pin.OUT

Pin.OPEN_DRAIN

Pin.ALT

Pin.ALT_OPEN_DRAIN

Pin.ANALOG

Selects the pin mode.

Pin.PULL_UP

Pin.PULL_DOWN

Pin.PULL_HOLD

Selects whether there is a pull up/down resistor. Use the value `None` for no pull.

Pin.DRIVE_0

Pin.DRIVE_1

Pin.DRIVE_2

Selects the pin drive strength. A port may define additional drive constants with increasing number corresponding to increasing drive strength.

Pin.IRQ_FALLING

Pin.IRQ_RISING

Pin.IRQ_LOW_LEVEL

Pin.IRQ_HIGH_LEVEL

Selects the IRQ trigger type.