Contents

1 Introduction

This package provides a way to make beautiful block circuit diagrams using the CeTZ package.

2 Usage

Simply import src/lib.typ and call the `circuit` function:

```
#import "src/lib.typ"
#lib.circuit({
  import lib: *
  ...
})
```

3 Reference

3.1 circuit

3.1.1 circuit

Draws a block circuit diagram

This function is also available at the package root

Parameters

```
circuit(
  body: none array element,
  length: length ratio
) -> none
```

body `none` or `array` or `element`

A code block in which draw functions have been called

length `length` or `ratio`

Optional base unit

Default: `2em`

3.2 util

Variables:

3.2.1 lpad

Pads a string on the left with 0s to the given length

```
#util.lpad("0100", 8)
```

```
00000100
```

Parameters

```
lpad(
  string: str,
  len: int
) -> str
```

string `str`

The string to pad

len `int`

The target length

3.2.2 opposite-anchor

Returns the anchor on the opposite side of the given one

```
#util.opposite-anchor("west")
```

```
east
```

Parameters

```
opposite-anchor(anchor: str) -> str
```

anchor `str`

The input anchor

3.2.3 rotate-anchor

Returns the anchor rotated 90 degrees clockwise relative to the given one

```
#util.rotate-anchor("west")
```

```
north
```

Parameters

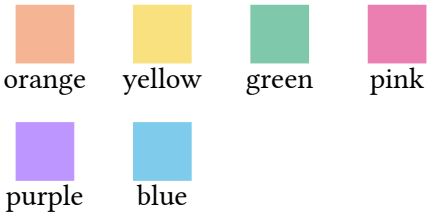
```
rotate-anchor(anchor: str) -> str
```

anchor `str`

The anchor to rotate

3.2.4 colors

Predefined color palette

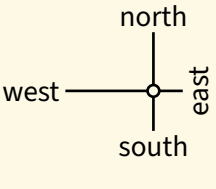


3.3 wire

Variables:

3.3.1 stub

Draws a wire stub (useful for unlinked ports)




```
draw.circle((0, 0), radius: .1, name: "p")
wire.stub("p", "north", name: "north", length: 1)
wire.stub("p", "east", name: "east", vertical: true)
wire.stub("p", "south", name: "south", length: 15pt)
wire.stub("p", "west", name: "west", length: 3em)
```

Parameters

```
stub(
  port-id: str,
  side: str,
  name: none str,
  vertical: bool,
  length: number,
  name-offset: number
)
```

port-id `str`

The port anchor

side `str`

The side on which the port is (one of “north”, “east”, “south”, “west”)

name `none` or `str`

Optional name displayed at the end of the stub

Default: `none`

vertical `bool`

Whether the name should be displayed vertically

Default: `false`

length `number`

The length of the stub

Default: `1em`

name-offset `number`

The name offset, perpendicular to the stub

Default: `0`

3.3.2 wire

Draws a wire between two points

Parameters

```
wire(
  id: str,
  pts: array,
  bus: bool,
  name: none str array,
  name-pos: str,
  slice: none array,
  color: color,
  dashed: bool,
  style: str,
  reverse: bool,
  directed: bool,
  rotate-name: bool,
  zigzag-ratio: ratio,
  zigzag-dir: str,
  dodge-y: number,
  dodge-sides: array,
  dodge-margins: array
)
```

id `str`

The wire's id, for future reference (anchors)

pts `array`

The two points (as CeTZ compatible coordinates, i.e. XY, relative positions, ids, etc.)

bus `bool`

Whether the wire is a bus (multiple bits) or a simple signal (single bit)

Default: `false`

name `none` or `str` or `array`

Optional name of the wire. If it is an array, the first name will be put at the start of the wire, and the second at the end

Default: `none`

name-pos `str`

Position of the name. One of: “middle”, “start” or “end”

Default: `"middle"`

slice `none` or `array`

Optional bits slice (start and end bit indices). If set, it will be displayed at the start of the wire

Default: `none`

color `color`

The stroke color

Default: `black`

dashed `bool`

Whether the stroke is dashed or not

Default: `false`

style `str`

The wire’s style (see wire-styles for possible values)

Default: `"direct"`

reverse `bool`

If true, the start and end points will be swapped (useful in cases where the start point depends on the end point, for example with perpendiculars)

Default: `false`

directed `bool`

If true, the wire will be directed, meaning an arrow will be drawn at the endpoint

Default: `false`

rotate-name `bool`

If true, the name will be rotated according to the wire's slope

Default: `true`

zigzag-ratio `ratio`

Position of the zigzag vertical relative to the horizontal span (only with style "zigzag")

Default: `50%`

zigzag-dir `str`

The zigzag's direction. As either "vertical" or "horizontal" (only with dstyle "zigzag")

Default: `"vertical"`

dodge-y `number`

Y position to dodge the wire to (only with style "dodge")

Default: `0`

dodge-sides `array`

The start and end sides (going out of the connected element) of the wire (only with style "dodge")

Default: `("east", "west")`

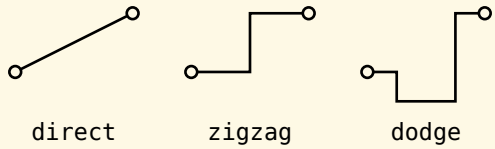
dodge-margins `array`

The start and end margins (i.e. space before dodging) of the wire (only with style "dodge")

Default: `(5%, 5%)`

3.3.3 wire-styles

List of valid wire styles




```
for i in range(3) {
  draw.circle((i * 3, 0), radius: .1, name: "p" + str(i * 2))
  draw.circle((i * 3 + 2, 1), radius: .1, name: "p" + str(i * 2 + 1))
  draw.content((i * 3 + 1, -1), raw(wire.wire-styles.at(i)))
}
wire.wire("w1", ("p0", "p1"), style: "direct")
wire.wire("w2", ("p2", "p3"), style: "zigzag")
wire.wire("w3", ("p4", "p5"), style: "dodge",
          dodge-y: -0.5, dodge-margins: (0.5, 0.5))
```

3.4 element

3.4.1 elmt

Draws an element

Parameters

```
elmt(
  draw-shape: function,
  x: number dictionary,
  y: number dictionary,
  w: number,
  h: number,
  name: none str,
  name-anchor: str,
  ports: dictionary,
  ports-margins: dictionary,
  fill: none color,
  stroke: stroke,
  id: str,
  auto-ports: bool,
  ports-y: dictionary,
  debug: dictionary
)
```

draw-shape `function`

Draw function

Default: `default-draw-shape`

x `number` or `dictionary`

The x position (bottom-left corner).

If it is a dictionary, it should be in the format `(rel: number, to: str)`, where `rel` is the offset and `to` the base anchor

Default: `none`

y `number` or `dictionary`

The y position (bottom-left corner).

If it is a dictionary, it should be in the format `(from: str, to: str)`, where `from` is the base anchor and `to` is the id of the port to align with the anchor

Default: `none`

w `number`

Width of the element

Default: `none`

h `number`

Height of the element

Default: `none`

name `none` or `str`

Optional name of the block

Default: `none`

name-anchor `str`

Anchor for the optional name

Default: `"center"`

ports `dictionary`

Dictionary of ports. The keys are cardinal directions (“north”, “east”, “south” and/or “west”). The values are arrays of ports (dictionaries) with the following fields:

- `id` (`str`): (Required) Port id
- `name` (`str`): Optional name displayed **in** the block
- `clock` (`bool`): Whether it is a clock port (triangle symbol)
- `vertical` (`bool`): Whether the name should be drawn vertically

Default: `()`

ports-margins `dictionary`

Dictionary of ports margins (used with automatic port placement). They keys are cardinal directions (“north”, “east”, “south”, “west”). The values are tuples of (`<start>`, `<end>`) margins (numbers)

Default: `()`

fill `none` or `color`

Fill color

Default: `none`

stroke `stroke`

Border stroke

Default: `black + 1pt`

id `str`

The block id (for future reference)

Default: `""`

auto-ports `bool`

Whether to use auto port placements or not. If false, `draw-shape` is responsible for adding the appropiate ports

Default: `true`

ports-y `dictionary`

Dictionary of the ports y offsets (used with `auto-ports: false`)

Default: `()`

debug `dictionary`

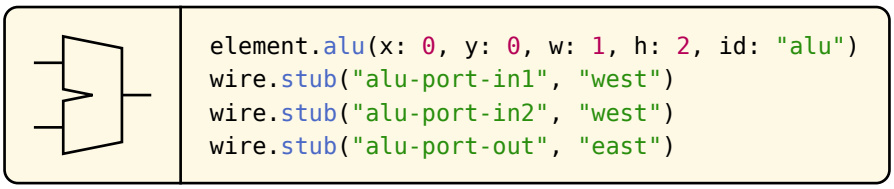
Dictionary of debug options.

Supported fields include:
- `ports`: if true, shows dots on all ports of the element

Default:
```
(
  ports: false
)
```

3.4.2 alu

Draws an ALU with two inputs



```
element.alu(x: 0, y: 0, w: 1, h: 2, id: "alu")
wire.stub("alu-port-in1", "west")
wire.stub("alu-port-in2", "west")
wire.stub("alu-port-out", "east")
```

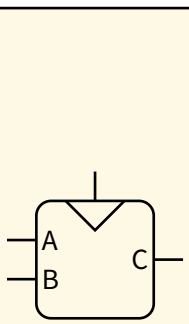
For parameters description, see elmt()

Parameters

```
alu(
  x,
  y,
  w,
  h,
  name,
  name-anchor,
  fill,
  stroke,
  id,
  debug
)
```

3.4.3 block

Draws a block element




```
element.block(
  x: 0, y: 0, w: 2, h: 2, id: "block",
  ports: (
    north: ((id: "clk", clock: true),),
    west: ((id: "in1", name: "A"),
           (id: "in2", name: "B")),
    east: ((id: "out", name: "C"),)
  )
)
wire.stub("block-port-clk", "north")
wire.stub("block-port-in1", "west")
wire.stub("block-port-in2", "west")
wire.stub("block-port-out", "east")
```

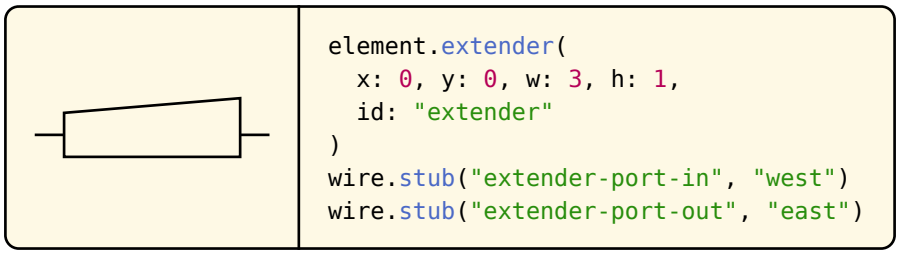
For parameters description, see elmt()

Parameters

```
block(
  x,
  y,
  w,
  h,
  name,
  name-anchor,
  ports,
  ports-margins,
  fill,
  stroke,
  id,
  debug
)
```

3.4.4 extender

Draws a bit extender



```
element.extender(
  x: 0, y: 0, w: 3, h: 1,
  id: "extender"
)
wire.stub("extender-port-in", "west")
wire.stub("extender-port-out", "east")
```

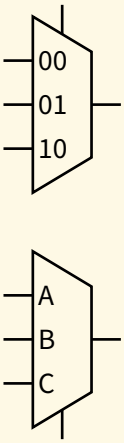
For parameters description, see elmt()

Parameters

```
extender(
  x,
  y,
  w,
  h,
  name,
  name-anchor,
  fill,
  stroke,
  id,
  debug
)
```

3.4.5 multiplexer

Draws a multiplexer




```
element.multiplexer(
  x: 0, y: 0, w: 1, h: 3,
  id: "multiplexer",
  entries: 3
)
wire.stub("multiplexer.north", "north")
wire.stub("multiplexer-port-out", "east")

element.multiplexer(
  x: 0, y: -4, w: 1, h: 3,
  id: "multiplexer2",
  entries: ("A", "B", "C")
)
wire.stub("multiplexer2.south", "south")
wire.stub("multiplexer2-port-out", "east")

for i in range(3) {
  wire.stub("multiplexer-port-in" + str(i), "west")
  wire.stub("multiplexer2-port-in" + str(i), "west")
}
```

For other parameters description, see elmt()

Parameters

```
multiplexer(
  x,
  y,
  w,
  h,
  name,
  name-anchor,
  entries: int array,
  fill,
  stroke,
  id,
  debug
)
```

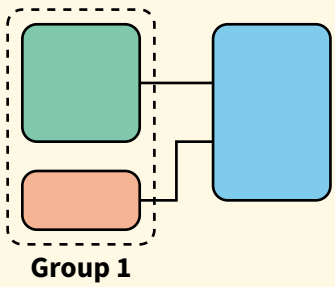
entries `int` or `array`

If it is an integer, it defines the number of input ports (automatically named with their binary index). If it is an array of strings, it defines the name of each input.

Default: 2

3.4.6 group

Draws a group of elements




```
element.group(
  id: "g1", name: "Group 1", stroke: (dash: "dashed"),
  {
    element.block(id: "b1", w: 2, h: 2,
      x: 0, y: 1.5,
      ports: (east: ((id: "out"),)),
      fill: util.colors.green
    )
    element.block(id: "b2", w: 2, h: 1,
      x: 0, y: 0,
      ports: (east: ((id: "out"),)),
      fill: util.colors.orange
    )
  }
)
element.block(id: "b3", w: 2, h: 3,
  x: (rel: 1, to: "g1.east"),
  y: (from: "b1-port-out", to: "in1"),
  ports: (west: ((id: "in1"), (id: "in2"))),
  fill: util.colors.blue
)
wire.wire("w1", ("b1-port-out", "b3-port-in1"))
wire.wire("w2", ("b2-port-out", "b3-port-in2"),
          style: "zigzag")
```

Parameters

```
group(
  body: elements function,
  id: str,
  name: str,
  name-anchor: str,
  fill: color,
  stroke: stroke,
  padding: float length array dictionary,
  radius: number
)
```

body `elements` or `function`

Elements to group

id `str`

see elmt()

Default: `""`

name `str`

The group's name

Default: `none`

name-anchor `str`

The anchor for the name.
Note: the name will be placed on the **outside** of the group

Default: `"south"`

fill `color`

see elmt()

Default: `none`

stroke `stroke`

see elmt()

Default: `black + 1pt`

padding `float` or `length` or `array` or `dictionary`

The inside padding:
- float / length: same for all sides
- array: either (<all>,), (<vertical>, <horizontal>) or (<top>, <right>, <bottom>, <left>)
- dictionary: valid keys are “top”, “right”, “bottom” and “left”

Default: `0.5em`

radius `number`

The corner radius

Default: `0.5em`

3.5 gates

3.5.1 gate

Draws a logic gate. This function is also available as `element.gate()`

Parameters

```
gate(
  draw-shape: function,
  x: number dictionary,
  y: number dictionary,
  w: number,
  h: number,
  inputs: int,
  fill: none color,
  stroke: stroke,
  id: str,
  inverted: str array,
  inverted-radius: number,
  debug: dictionary
)
```

draw-shape `function`

see elmt()

Default: `default-draw-shape`

x `number` or `dictionary`

see elmt()

Default: none

y `number` or `dictionary`

see elmt()

Default: none

w `number`

see elmt()

Default: `none`

h `number`

see elmt()

Default: `none`

inputs `int`

The number of inputs

Default: `2`

fill `none` or `color`

see elmt()

Default: `none`

stroke `stroke`

see elmt()

Default: `black + 1pt`

id `str`

see elmt()

Default: `""`

inverted `str` or `array`

Either “all” or an array of port ids to display as inverted

Default: `()`

inverted-radius `number`

The radius of inverted ports dot

Default: `0.2`

debug `dictionary`

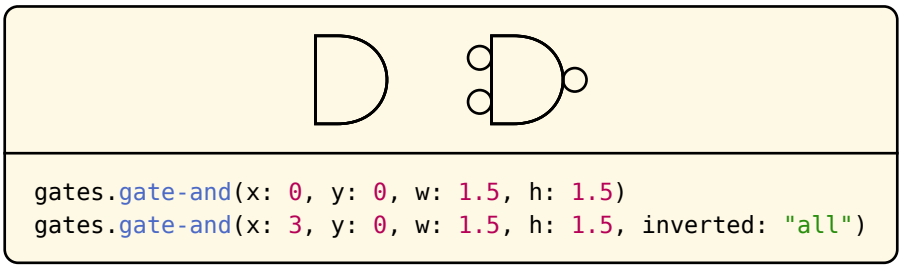
see elmt()

Default: `(`
```
    ports: false
  )
```

3.5.2 gate-and

Draws an AND gate. This function is also available as `element.gate-and()`

For parameters, see gate()



```
gates.gate-and(x: 0, y: 0, w: 1.5, h: 1.5)
gates.gate-and(x: 3, y: 0, w: 1.5, h: 1.5, inverted: "all")
```

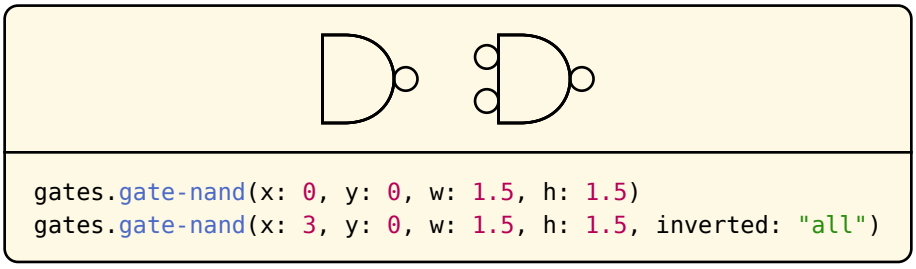
Parameters

```
gate-and(
  x,
  y,
  w,
  h,
  inputs,
  fill,
  stroke,
  id,
  inverted,
  debug
)
```

3.5.3 gate-nand

Draws an NAND gate. This function is also available as `element.gate-nand()`

For parameters, see gate()



```
gates.gate-nand(x: 0, y: 0, w: 1.5, h: 1.5)
gates.gate-nand(x: 3, y: 0, w: 1.5, h: 1.5, inverted: "all")
```

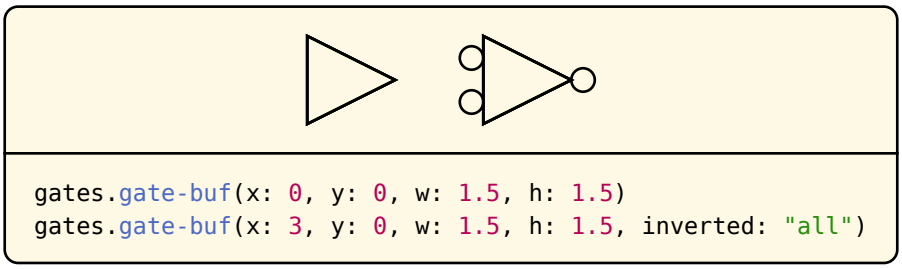
Parameters

```
gate-nand(
  x,
  y,
  w,
  h,
  inputs,
  fill,
  stroke,
  id,
  inverted,
  debug
)
```

3.5.4 gate-buf

Draws a buffer gate. This function is also available as `element.gate-buf()`

For parameters, see gate()



```
gates.gate-buf(x: 0, y: 0, w: 1.5, h: 1.5)
gates.gate-buf(x: 3, y: 0, w: 1.5, h: 1.5, inverted: "all")
```

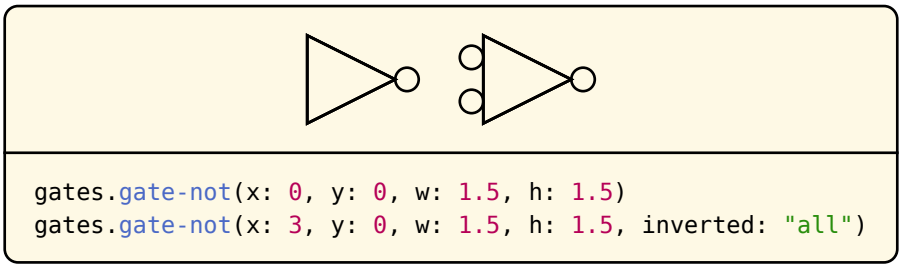
Parameters

```
gate-buf(
  x,
  y,
  w,
  h,
  inputs,
  fill,
  stroke,
  id,
  inverted,
  debug
)
```

3.5.5 gate-not

Draws a NOT gate. This function is also available as `element.gate-not()`

For parameters, see gate()



```
gates.gate-not(x: 0, y: 0, w: 1.5, h: 1.5)
gates.gate-not(x: 3, y: 0, w: 1.5, h: 1.5, inverted: "all")
```

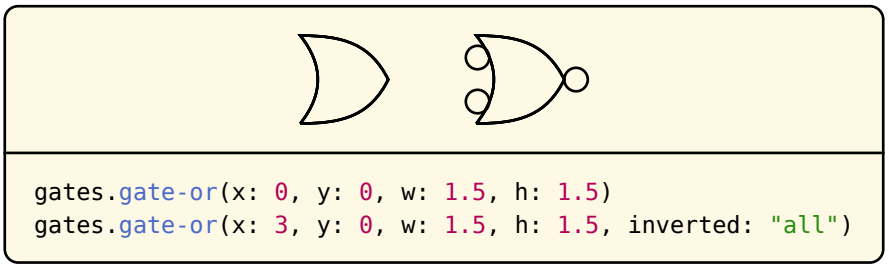
Parameters

```
gate-not(
  x,
  y,
  w,
  h,
  inputs,
  fill,
  stroke,
  id,
  inverted,
  debug
)
```

3.5.6 gate-or

Draws an OR gate. This function is also available as `element.gate-or()`

For parameters, see gate()



```
gates.gate-or(x: 0, y: 0, w: 1.5, h: 1.5)
gates.gate-or(x: 3, y: 0, w: 1.5, h: 1.5, inverted: "all")
```

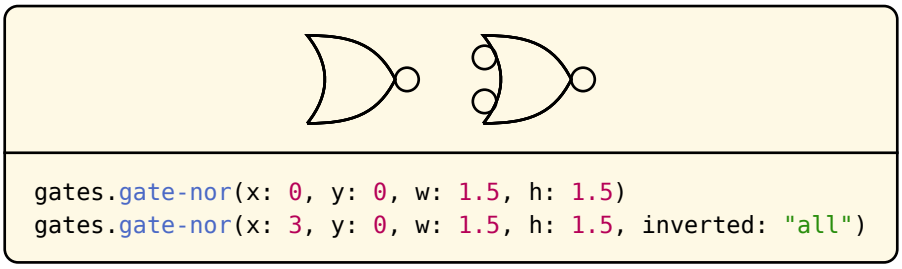
Parameters

```
gate-or(
  x,
  y,
  w,
  h,
  inputs,
  fill,
  stroke,
  id,
  inverted,
  debug
)
```

3.5.7 gate-nor

Draws a NOR gate. This function is also available as `element.gate-nor()`

For parameters, see gate()



```
gates.gate-nor(x: 0, y: 0, w: 1.5, h: 1.5)
gates.gate-nor(x: 3, y: 0, w: 1.5, h: 1.5, inverted: "all")
```

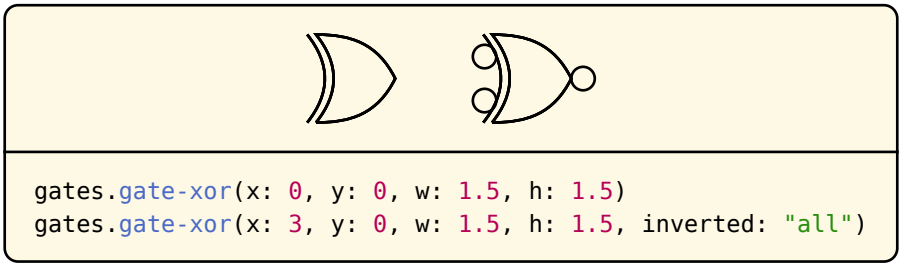
Parameters

```
gate-nor(
  x,
  y,
  w,
  h,
  inputs,
  fill,
  stroke,
  id,
  inverted,
  debug
)
```

3.5.8 gate-xor

Draws a XOR gate. This function is also available as `element.gate-xor()`

For parameters, see gate()



```
gates.gate-xor(x: 0, y: 0, w: 1.5, h: 1.5)
gates.gate-xor(x: 3, y: 0, w: 1.5, h: 1.5, inverted: "all")
```

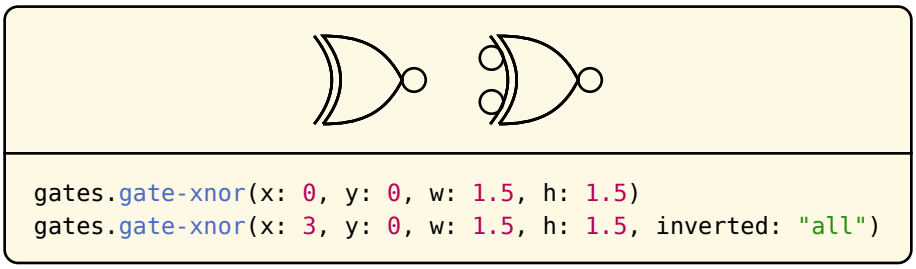
Parameters

```
gate-xor(
  x,
  y,
  w,
  h,
  inputs,
  fill,
  stroke,
  id,
  inverted,
  debug
)
```

3.5.9 gate-xnor

Draws a XNOR gate. This function is also available as `element.gate-xnor()`

For parameters, see gate()



```
gates.gate-xnor(x: 0, y: 0, w: 1.5, h: 1.5)
gates.gate-xnor(x: 3, y: 0, w: 1.5, h: 1.5, inverted: "all")
```

Parameters

```
gate-xnor(
  x,
  y,
  w,
  h,
  inputs,
  fill,
  stroke,
  id,
  inverted,
  debug
)
```