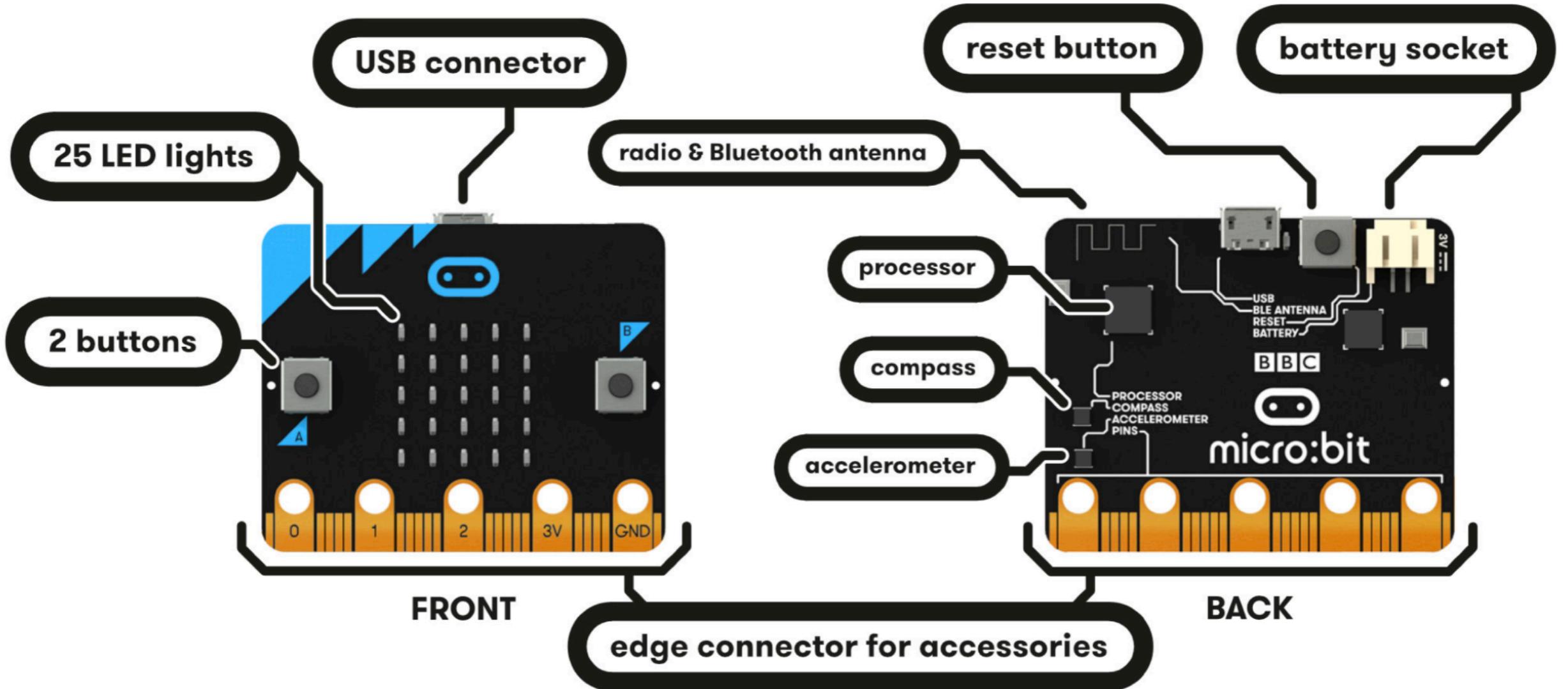


Introduction to IoT for Non-Programmer

Objectives

- Introduction to Micro:bit.
- Build a simple system with input (e.g. sensors and buttons) and output (e.g. display).
- Network communication with the Micro:bit (e.g. Radio, and Bluetooth).



source: <https://microbit.org/guide/features>

Basic Structure & Components

The Basic Package

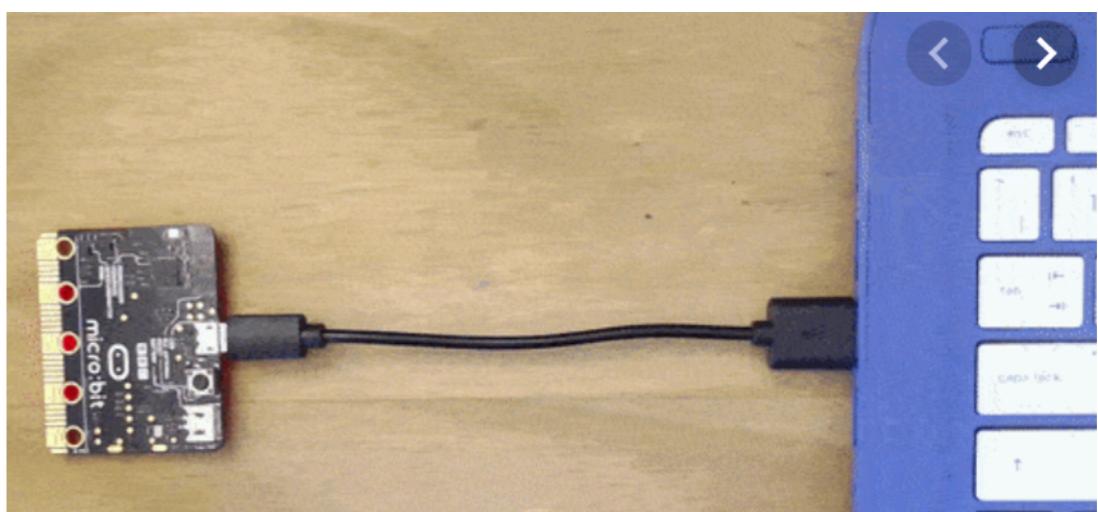
source: <https://geekworm.com>



Connecting a Micro:bit to the Computer via USB

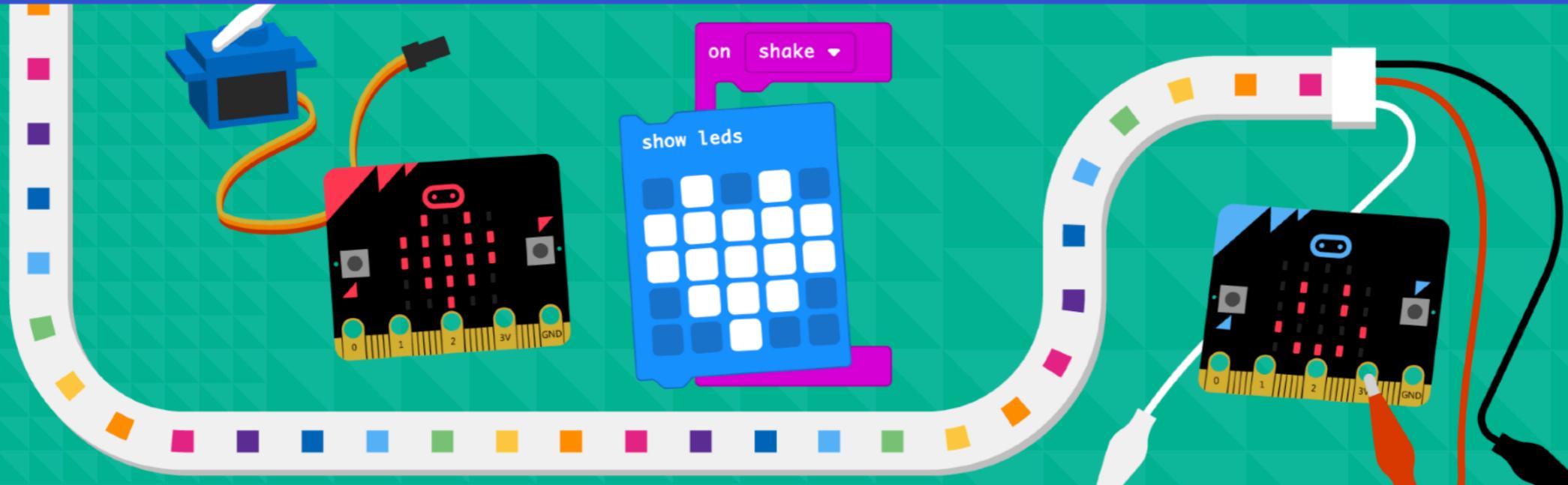
For the newer Macintosh laptop,
we need a USB-C connector.

source: <https://support.microbit.org>





The User Interface for Operating a Micro:bit



My Projects >

 Import

New Project

<https://makecode.microbit.org>

micro:bit

Home

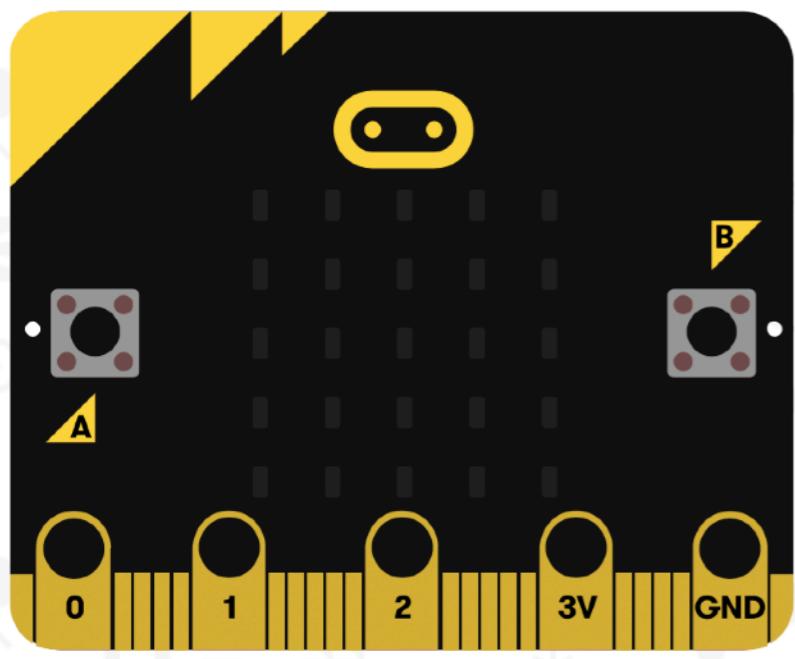
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Blocks

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Microsoft



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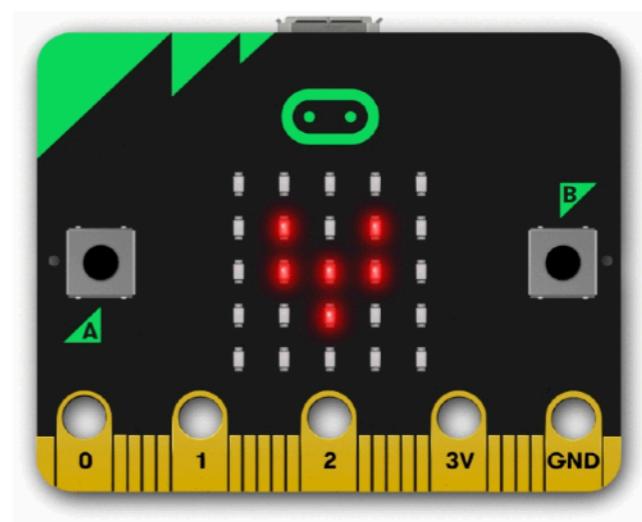
Untitled



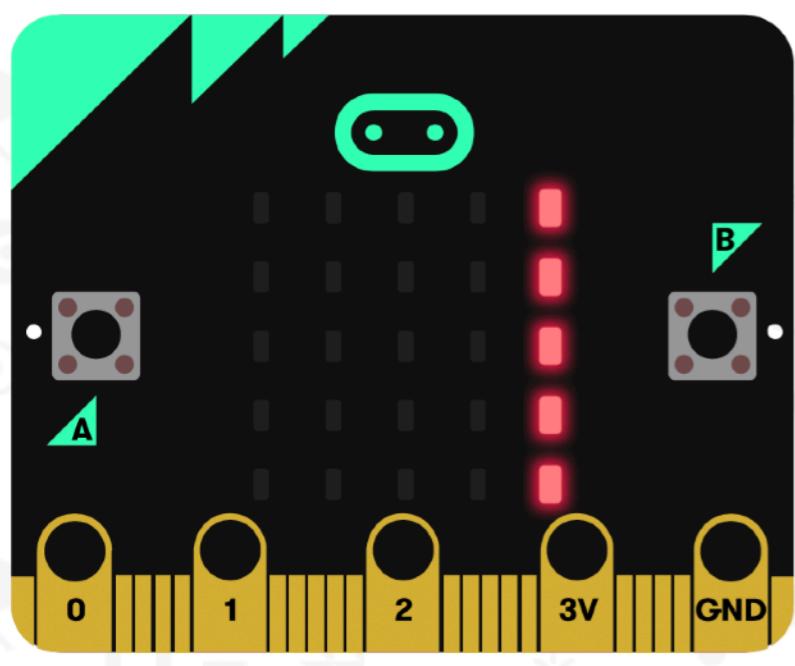
Key Features and Examples

LEDs

The micro:bit has **25 individually-programmable LEDs** (Light Emitting Diode), allowing it to display text, numbers, and patterns.



Exercises on LEDs



Search...



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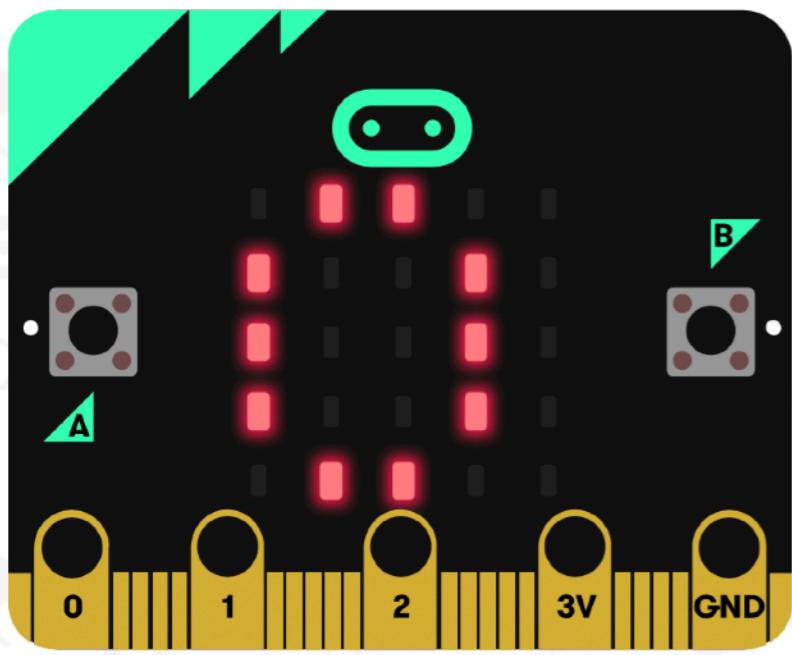
forever

show string "Hello world!"

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show number 0

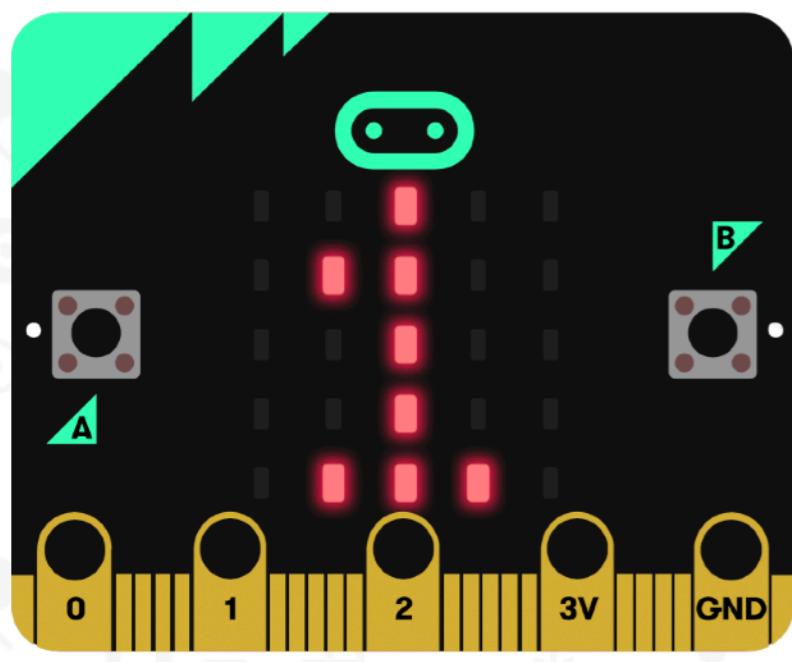
pause (ms) 100 ▾

show number 1

Download

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show number 0

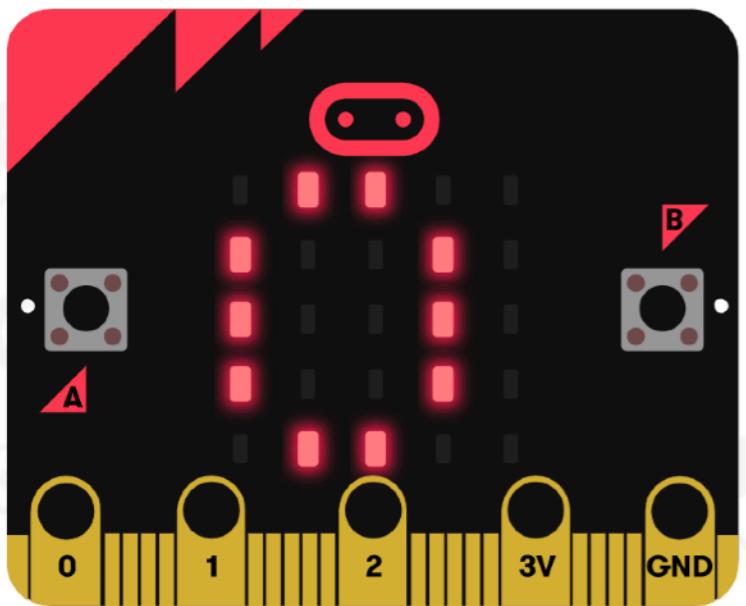
pause (ms) 100 ▾

show number 1

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show number 0

pause (ms) 100

show number 1

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Show Number



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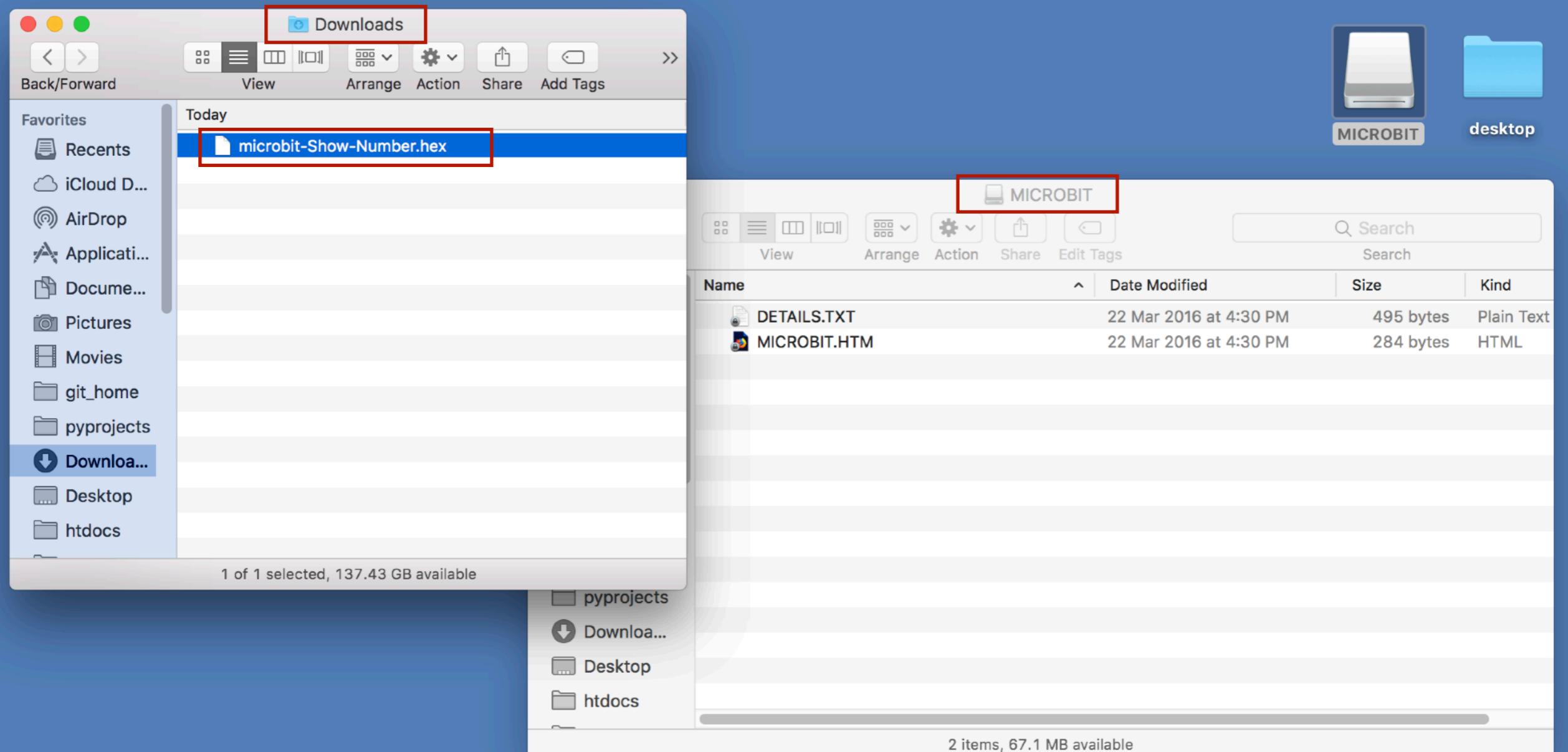
Favorites

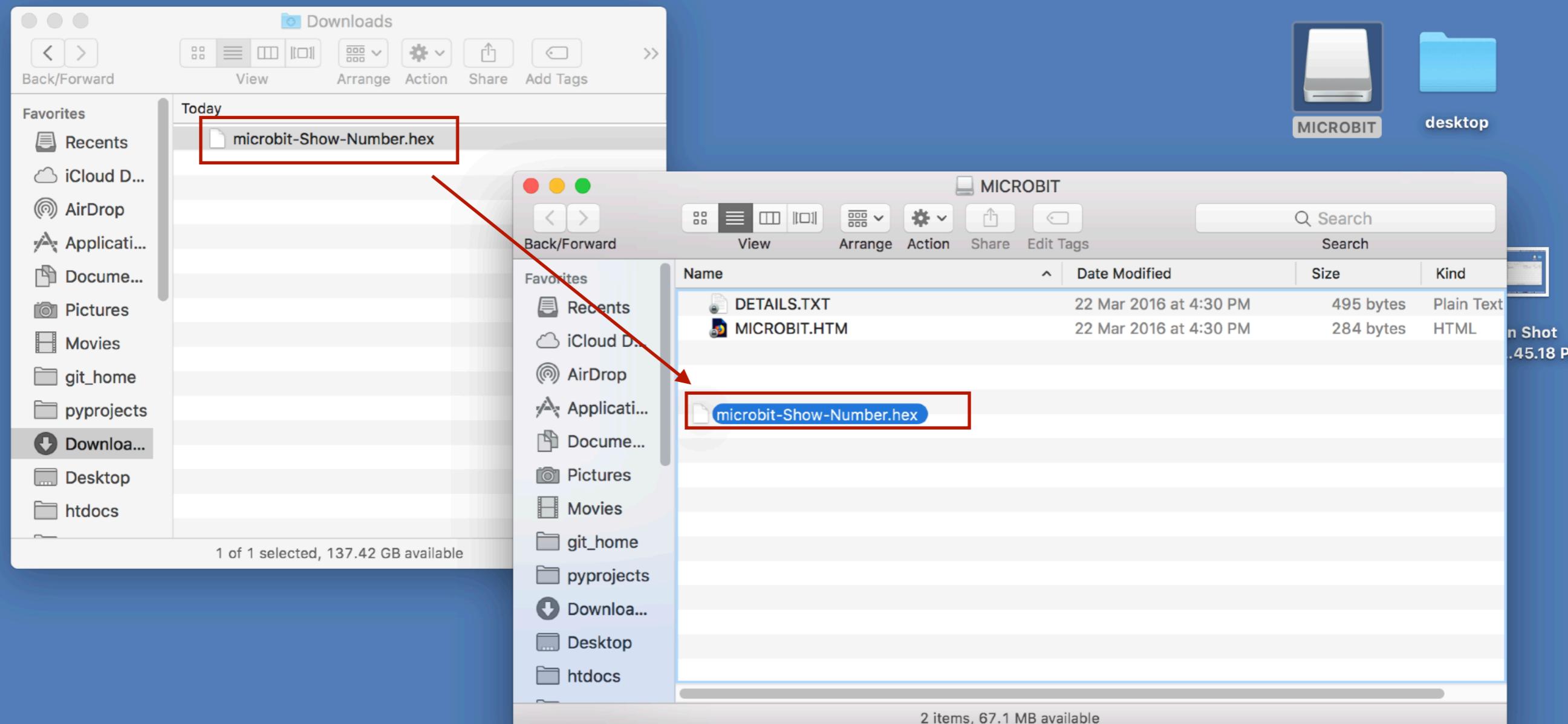
- Recents
- iCloud D...
- AirDrop
- Applicati...
- Docume...
- Pictures
- Movies
- git_home
- pyprojects
- Download...
- Desktop
- htdocs

| Name | Date Modified | Size | Kind |
|--------------|------------------------|-----------|------------|
| DETAILS.TXT | 22 Mar 2016 at 4:30 PM | 495 bytes | Plain Text |
| MICROBIT.HTM | 22 Mar 2016 at 4:30 PM | 284 bytes | HTML |

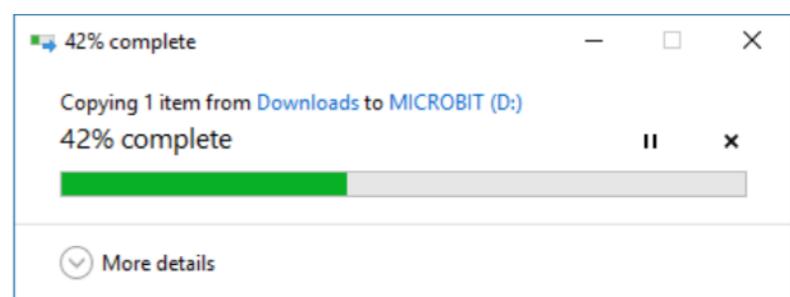
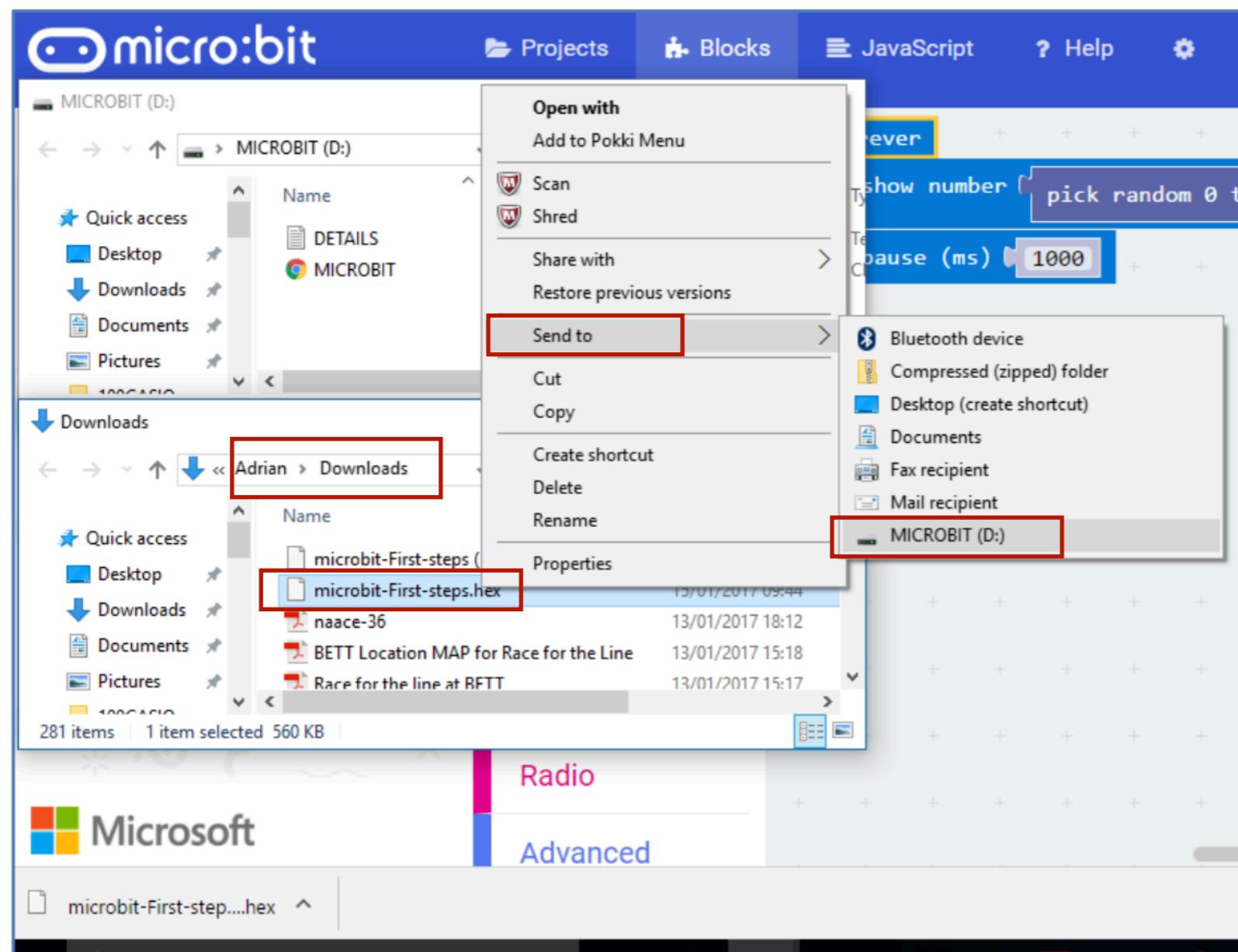
2 items, 67.1 MB available

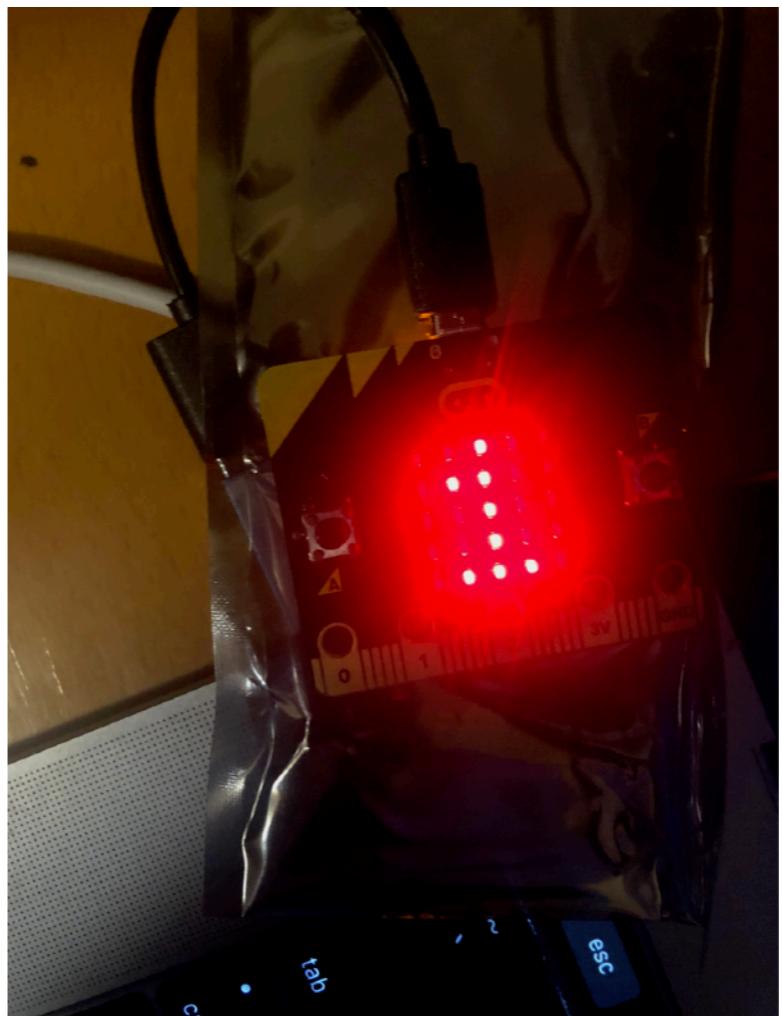




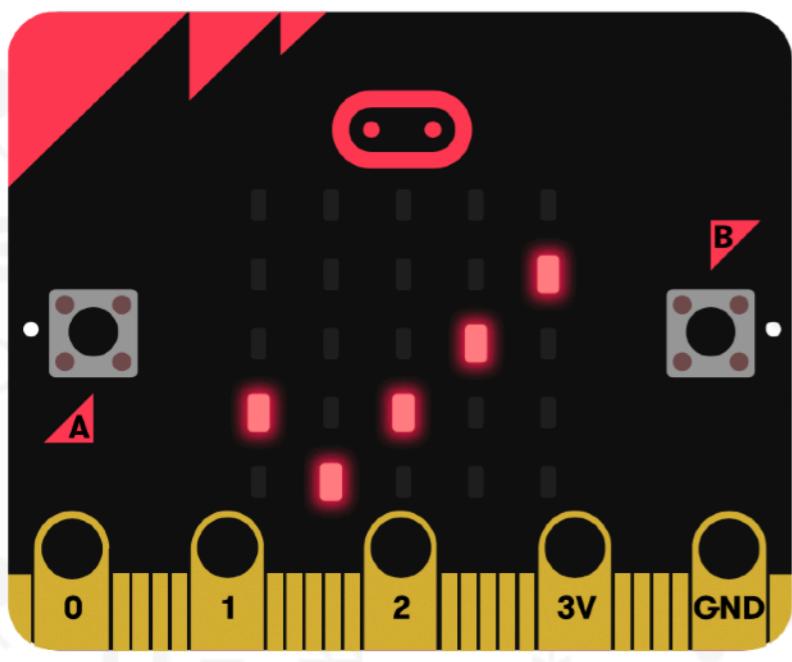


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More Exercises on LEDs



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show icon

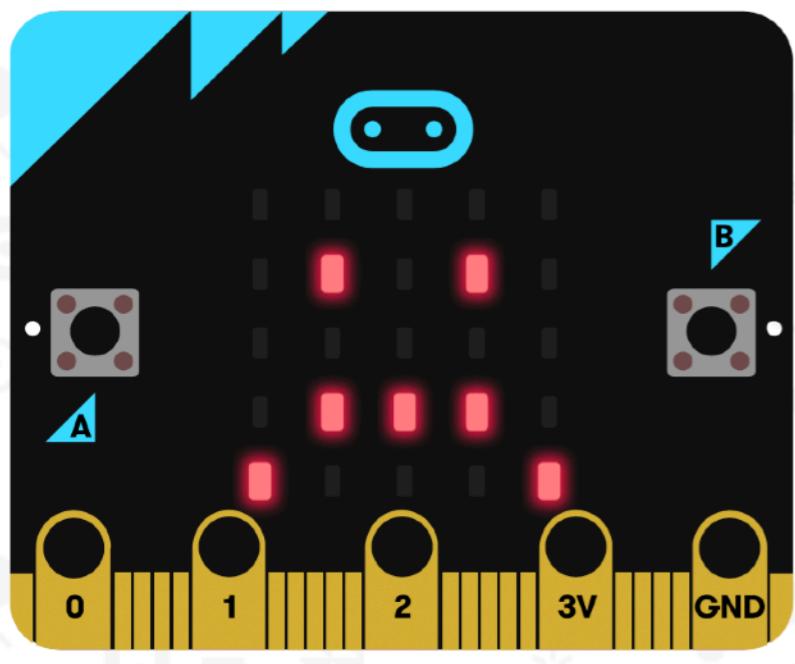
pause (ms) 100

show icon



Untitled





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```
forever
  show leds
    [grid of 25 squares]
    pause (ms) 100
  show leds
    [grid of 25 squares]
```

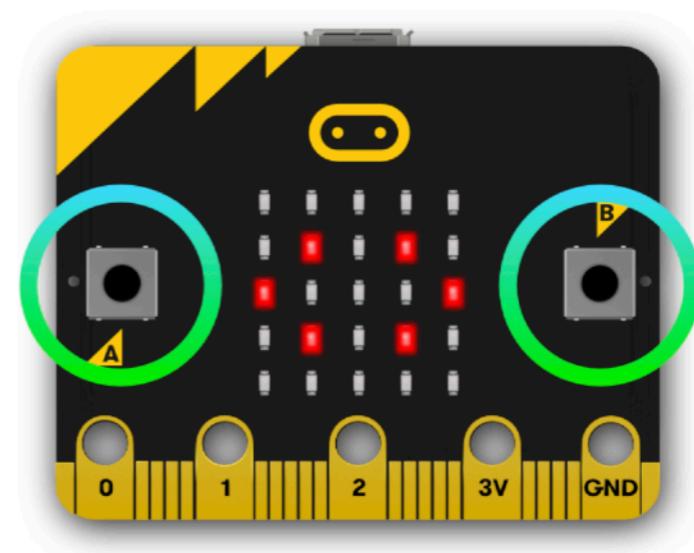
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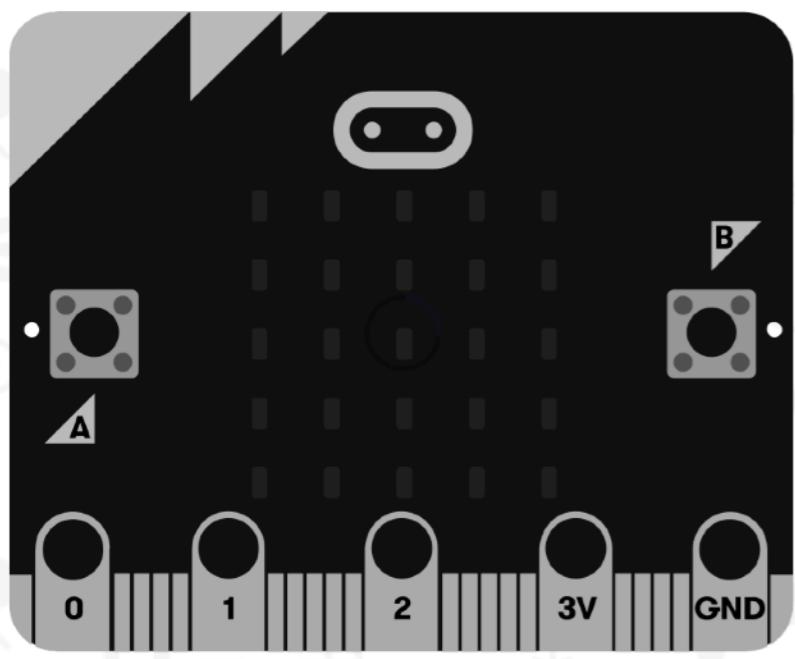
[5](#) [↶](#) [↶](#) [+ ↶](#)

Buttons

There are two buttons on the front of the micro:bit. These buttons can be detected when pressed.



Exercise on buttons.



▶ ⏪ ⏴ ⏵ ⏹

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on button A pressed

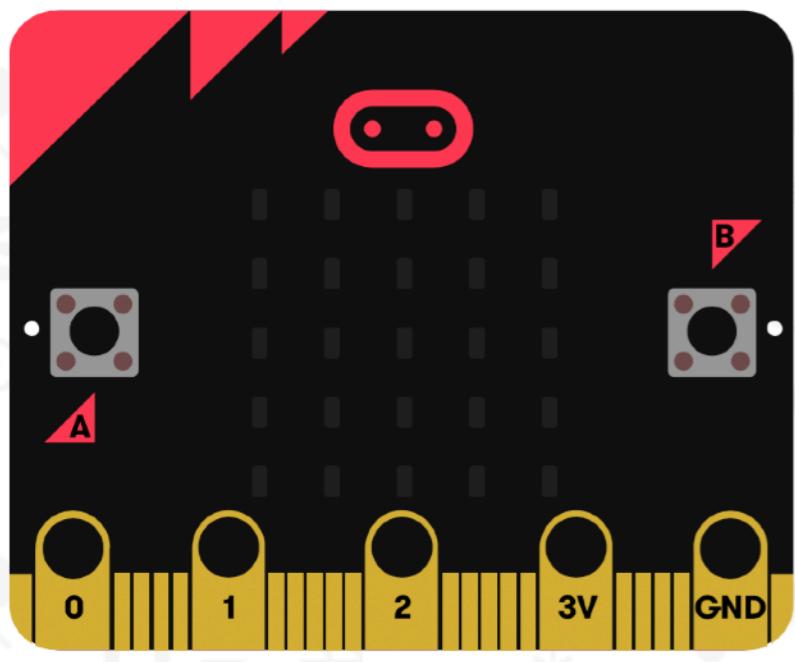
forever

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Make a Variable...

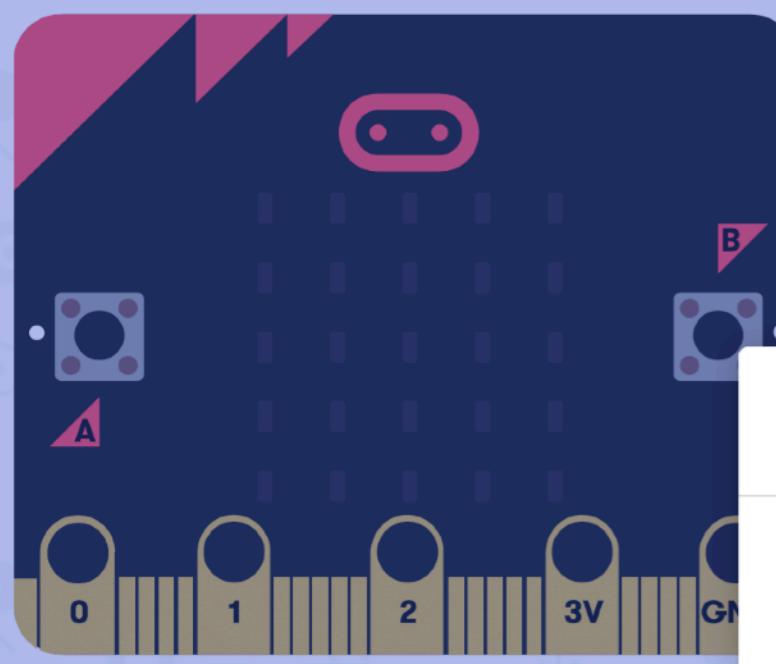
ssed

forever

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Make a Variable...

ssed

ssed

forever



New variable name:

count

Ok



Cancel

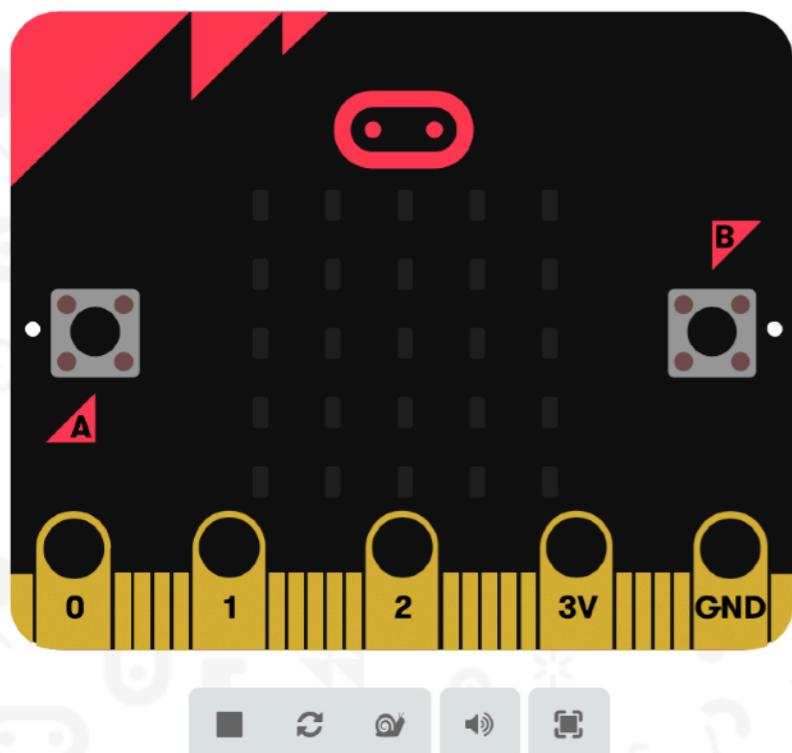


Advanced

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Make a Variable...

count ▾

set count ▾ to 0

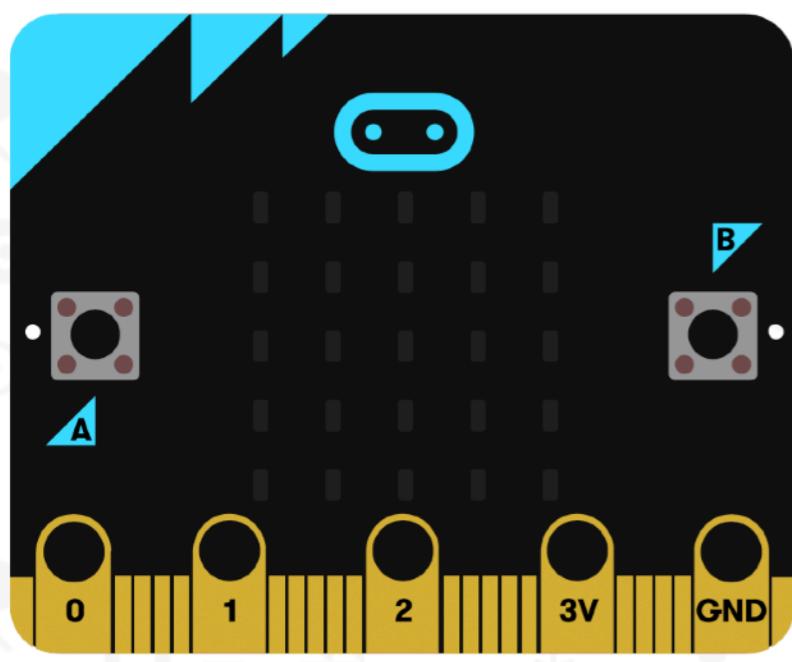
change count ▾ by 1

forever

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on button A pressed

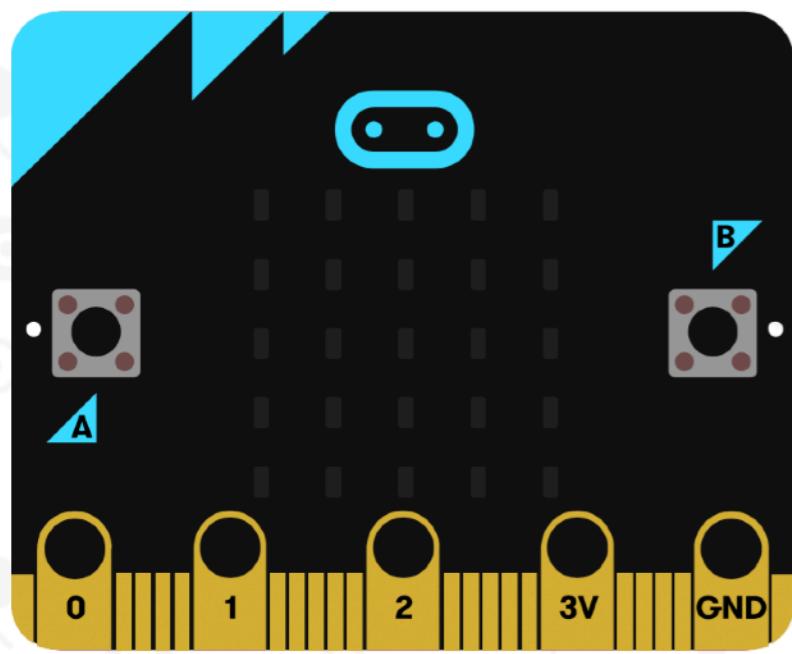
change count by 1

forever

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show number 0

show leds

show icon

show string "Hello!"

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ed

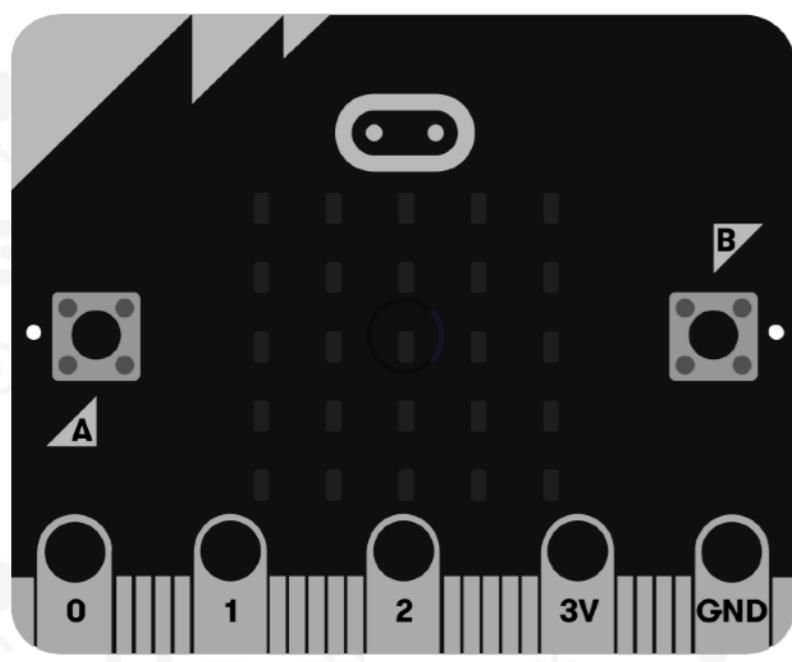
1

forever

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on button A pressed

change count by 1

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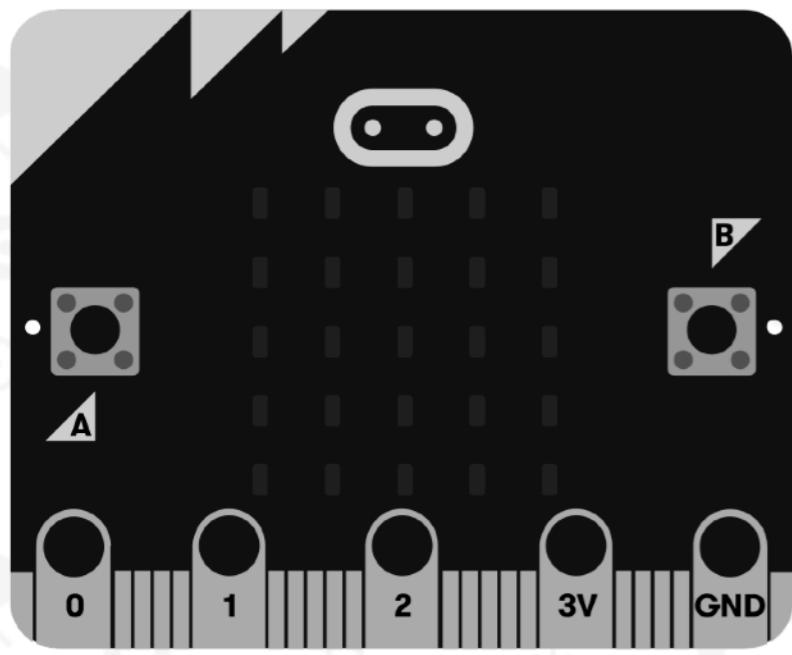
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on button A pressed

change count by 1

show number count

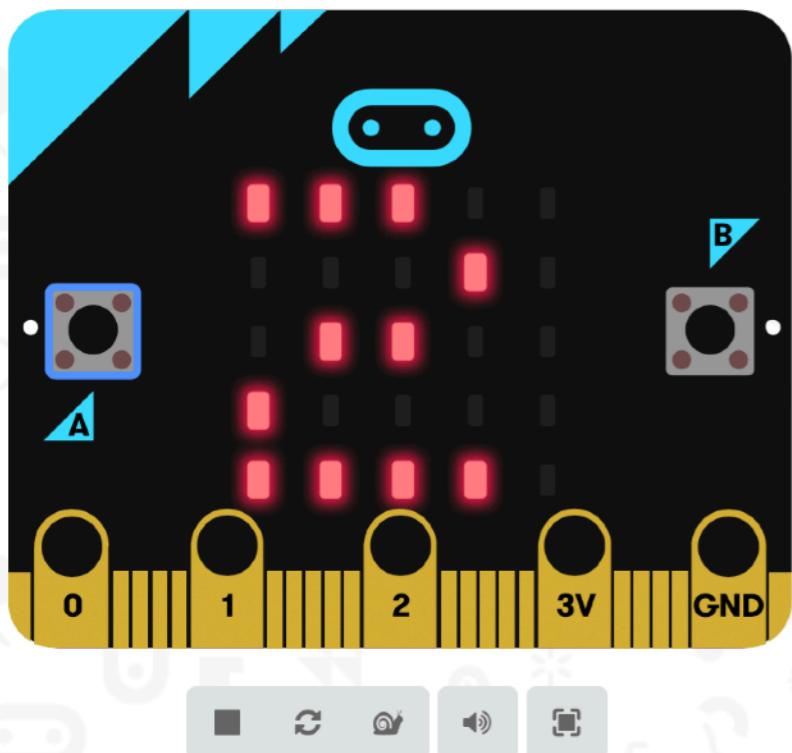
forever

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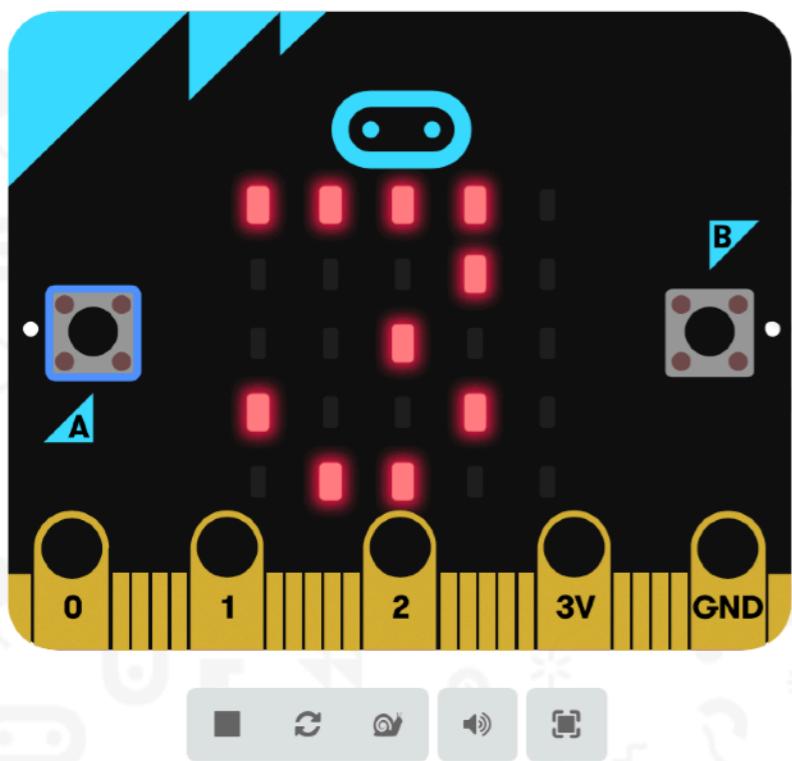
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```
on button A pressed
  change count by 1
  show number count
forever
  show number count
```

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on button A pressed

change count by 1

show number count

forever

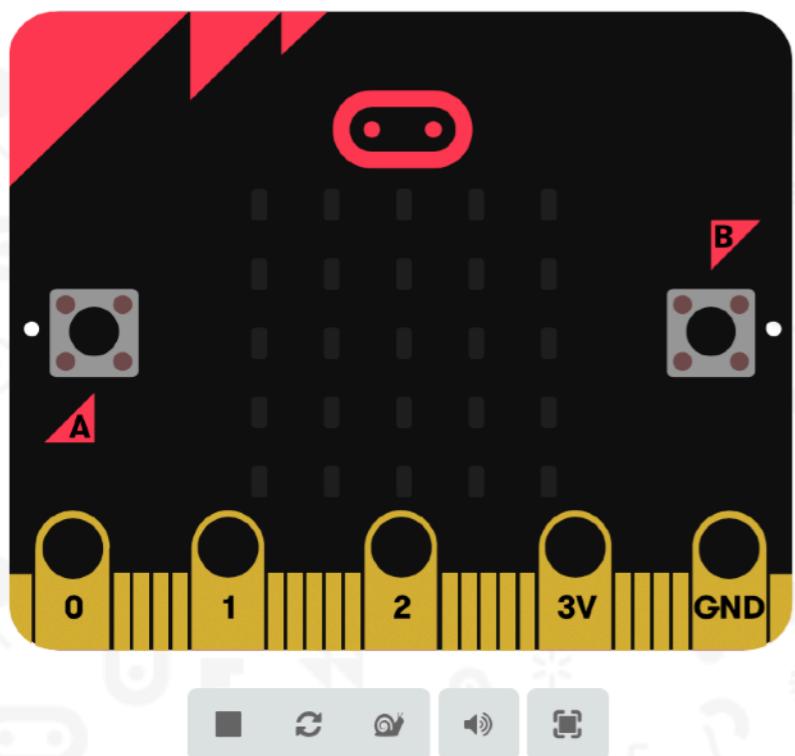
show number count

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Exercise on random number.



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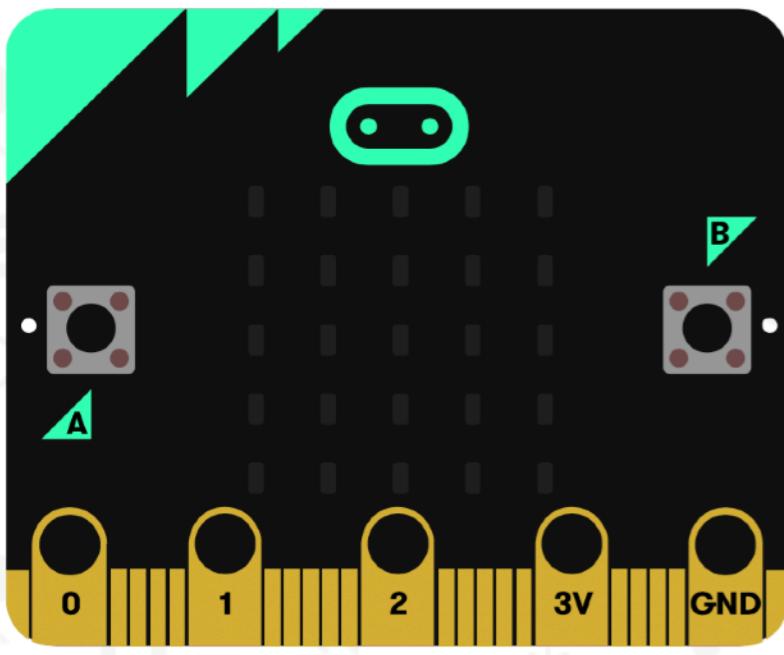
Advanced

on button A pressed

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Make a Variable...

dice ▾

set dice ▾ to 0

change dice ▾ by 1

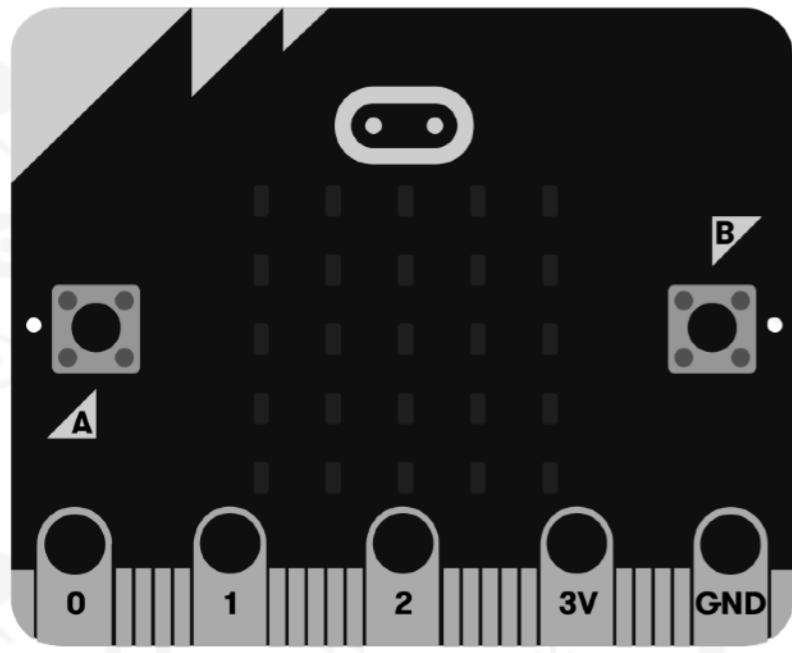
pressed



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on button A pressed

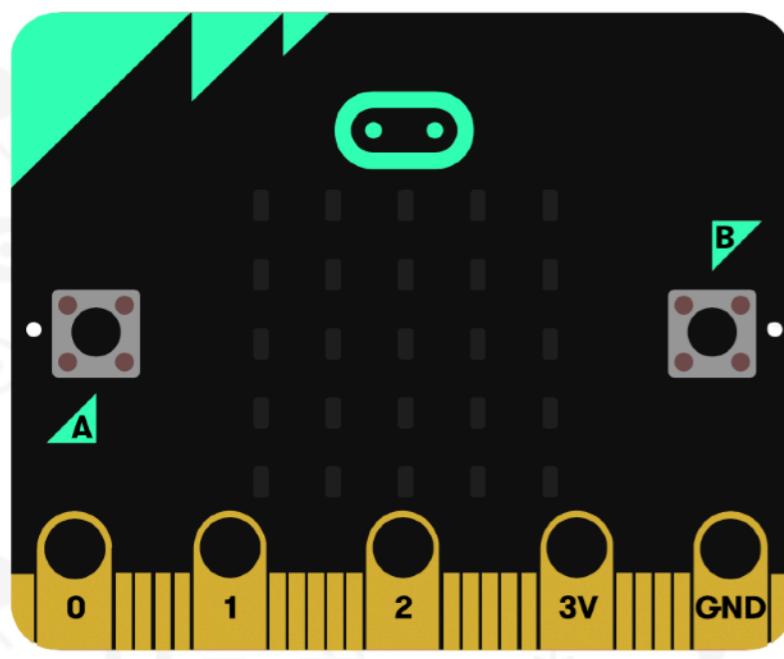
set dice to 0

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0

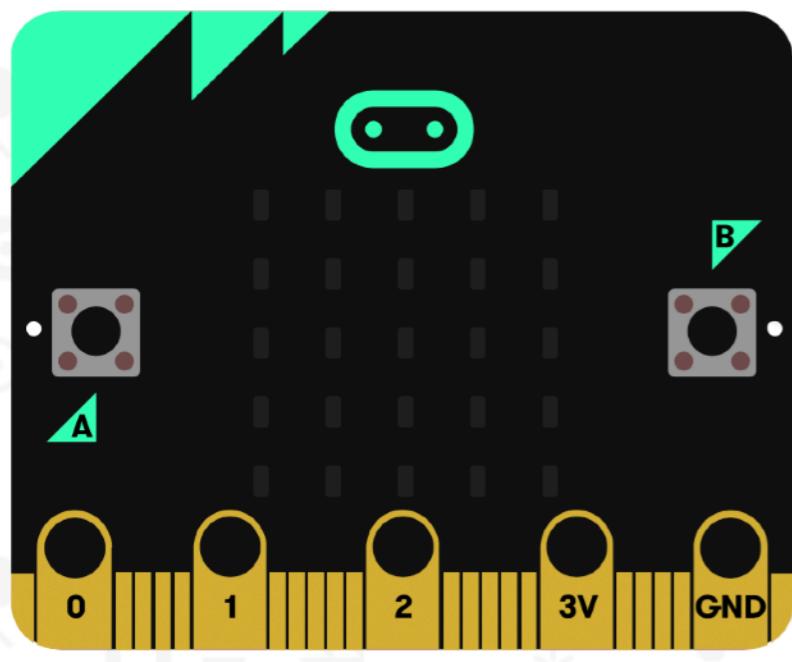
remainder of $0 \div 1$ min \downarrow of 0 and 0 max \downarrow of 0 and 0 absolute of 0 square root \downarrow 0 round \downarrow 0 pick random 0 to 10 constrain 0 between 0 and 0 map 0 from low 0 high 1023 to low 0 high 4

pick random true or false

Download

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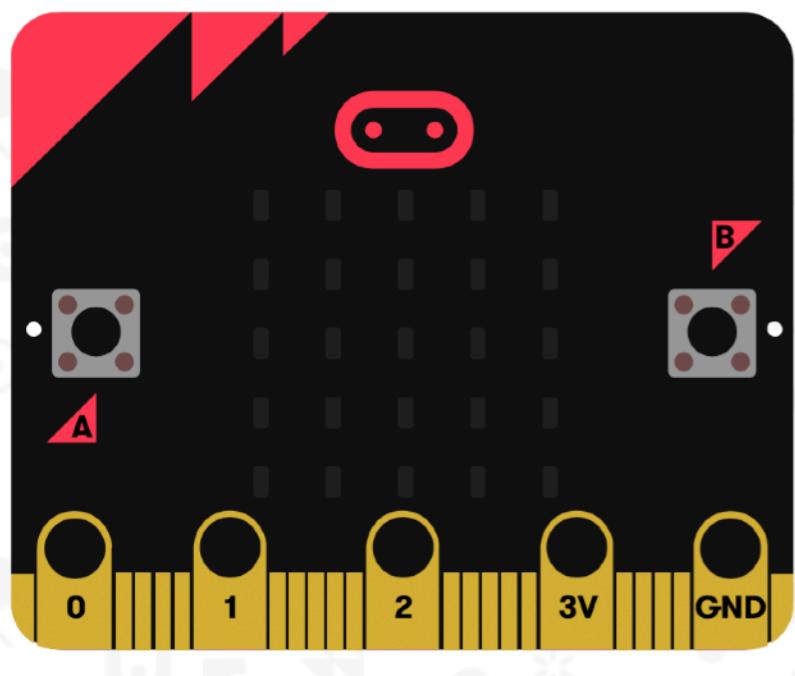
on button A pressed

set dice to pick random 0 to 10

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on button A pressed

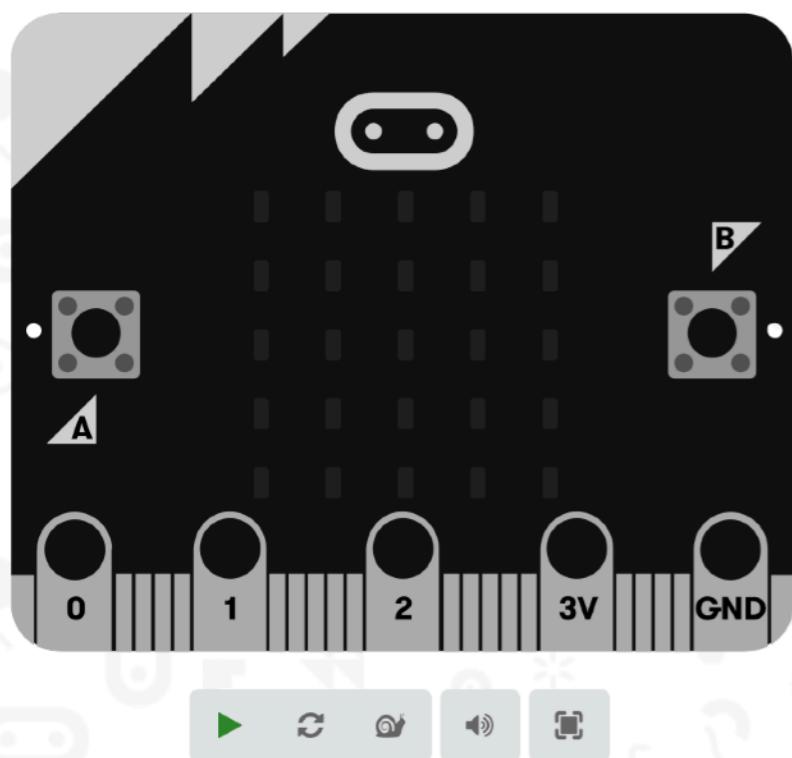
set dice to pick random 1 to 6

show number 0

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on button A pressed

set dice to pick random 1 to 6

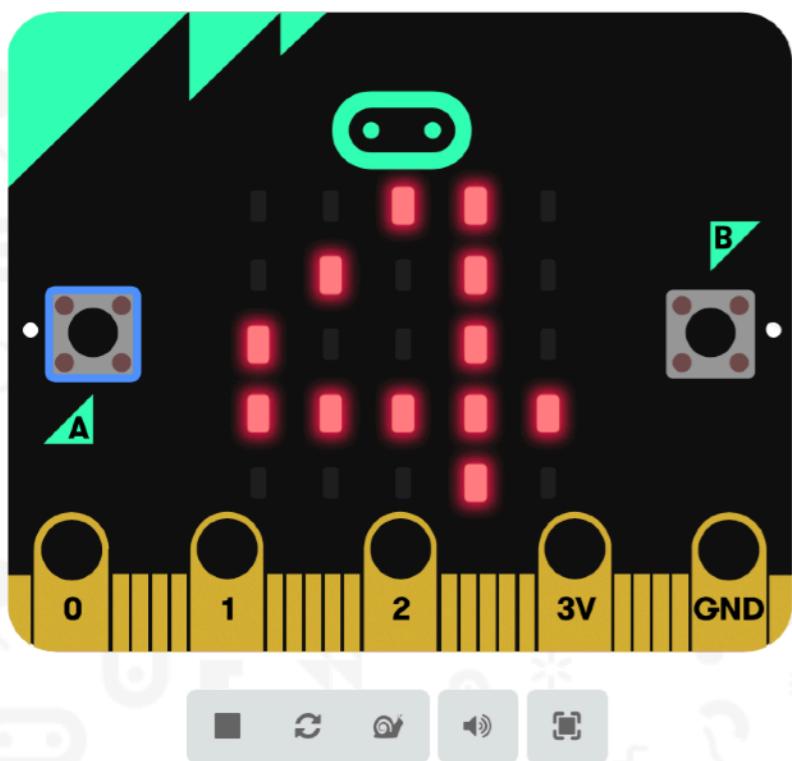
show number dice



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on button A pressed

set dice to pick random 1 to 6

show number dice

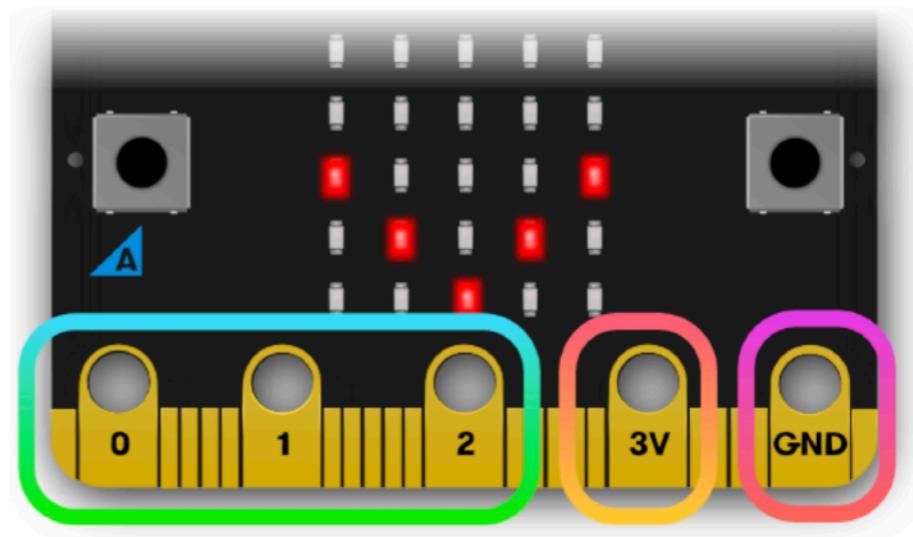
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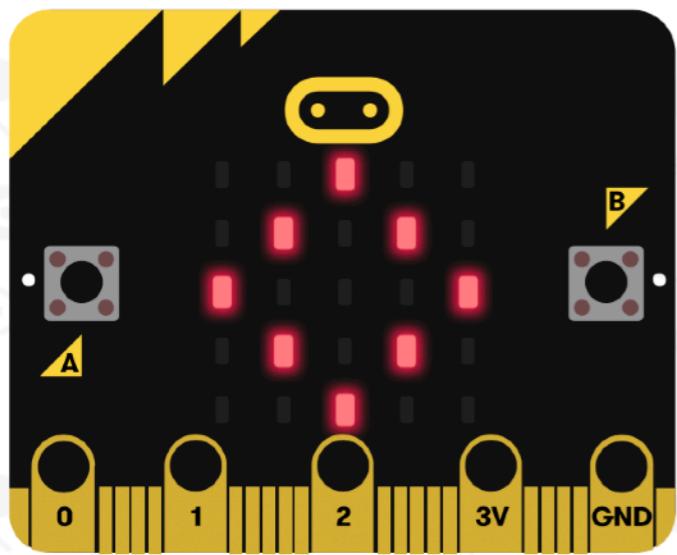


Pins

There are **25 external** connectors on the edge connector of the micro:bit referred as '**pins**'. Other electrical components can be connected to the Micro:bit through these pins.



Exercise on pins.



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pause (ms) 200

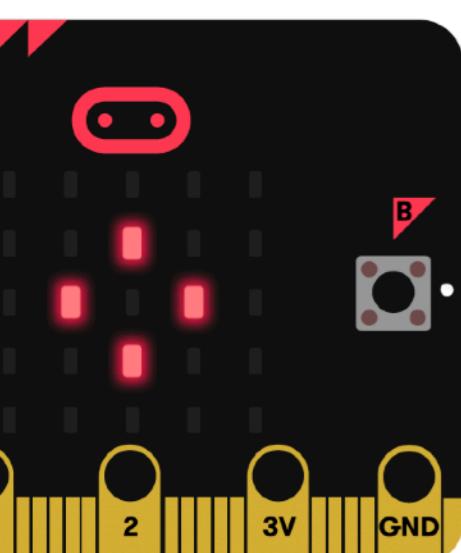
show icon



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pin testing





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on button A pressed

on shake

on pin P0 pressed

button A is pressed

pin P0 is pressed

acceleration (mg) x

light level

compass heading (°)

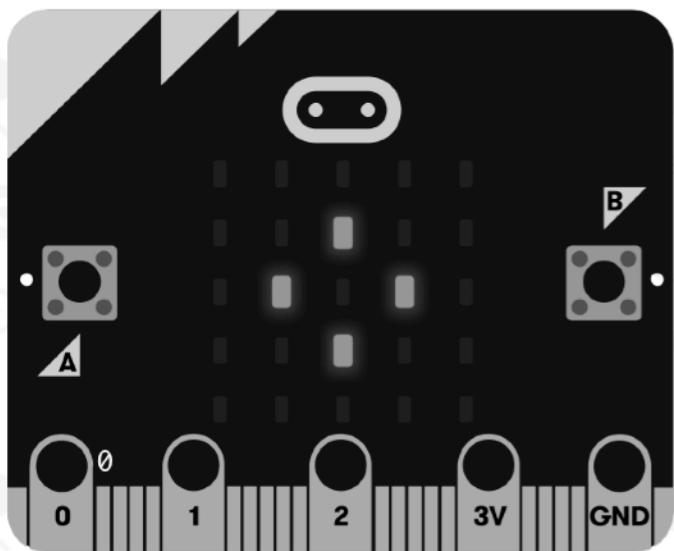
temperature (°C)

is shake gesture

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pin testing





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```
forever
  show icon [grid icon]
  pause (ms) 200
  show icon [grid icon]
```

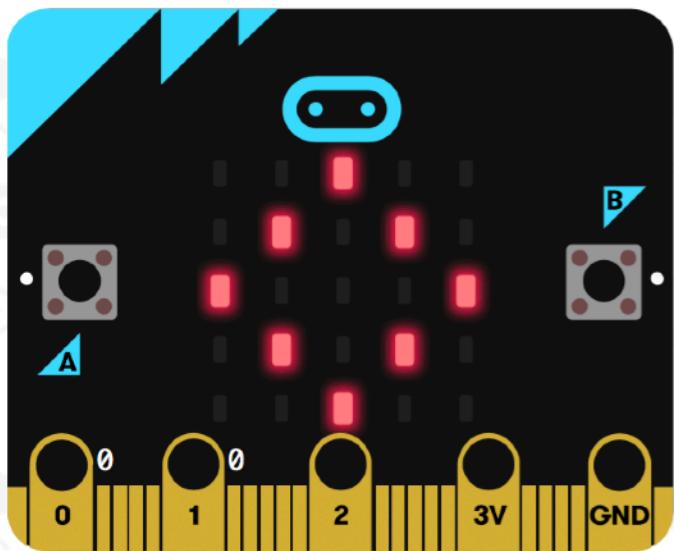
```
on pin P0 pressed
```

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show icon



pause (ms) 200

show icon



on pin P0 pressed



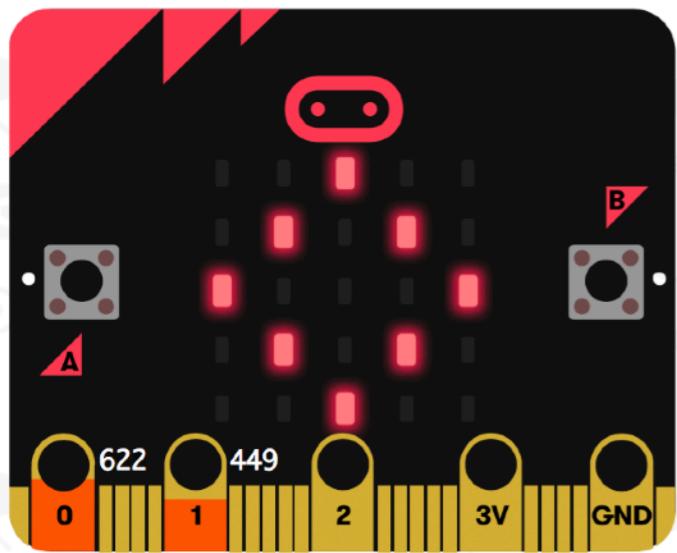
on pin P1 pressed



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pin testing





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```
forever
  show icon [ ] v
  pause (ms) [ 200 ] v
  show icon [ ] v
```

```
on pin [ P0 ] v pressed
  show icon [ ] v
  pause (ms) [ 100 ] v
```

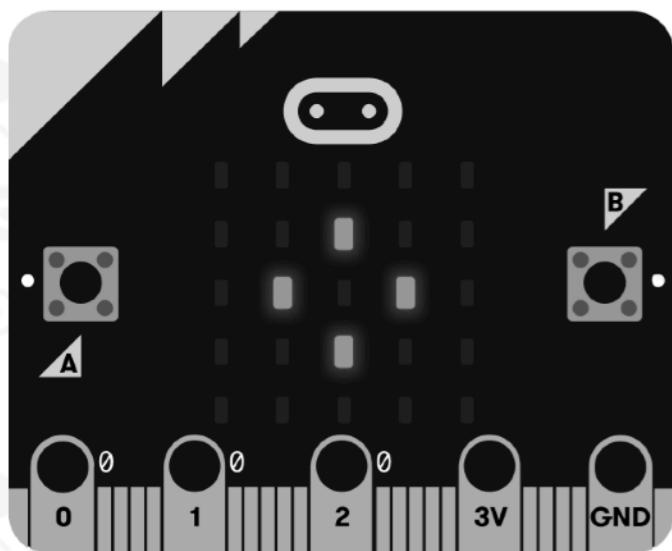
```
on pin [ P1 ] v pressed
  show icon [ ] v
  pause (ms) [ 100 ] v
```

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pin testing



Another way of doing it.



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```
forever
  show icon [ ] v
  pause (ms) [200 v]
  show icon [ ] v
end

forever
  if [pin P0 v is pressed] then
    show icon [ ] v
    pause (ms) [100 v]
  else if [pin P1 v is pressed] then
    show icon [ ] v
    pause (ms) [100 v]
  else if [pin P2 v is pressed] then
    show icon [ ] v
    pause (ms) [100 v]
  end
```

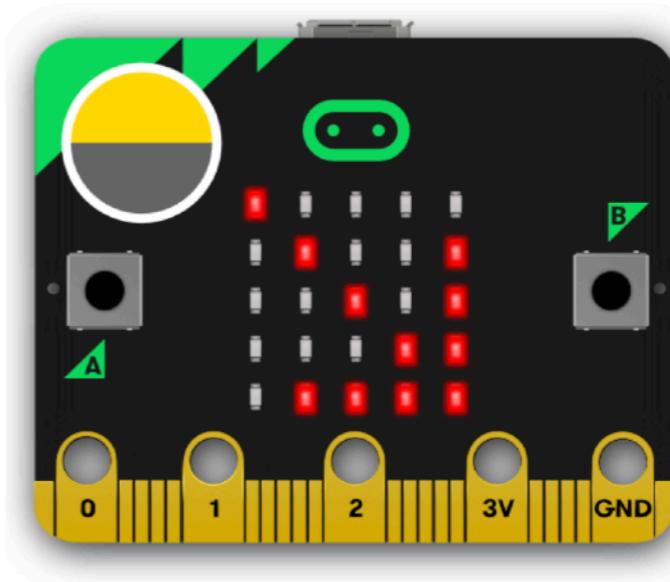
Download

pin testing

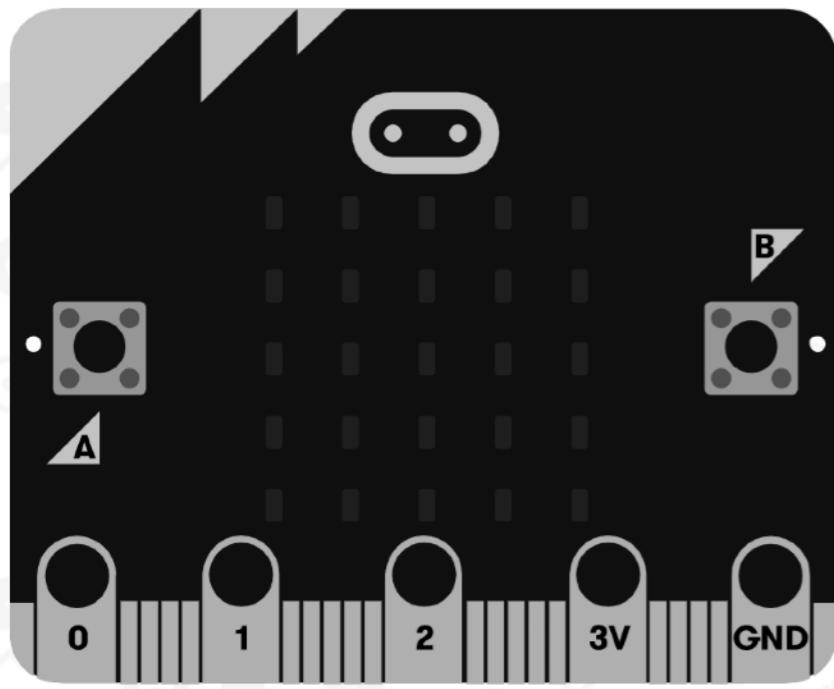


Light Sensor

The LEDs of the screen, working as light sensors, can become input units, allowing detection of ambient light.



Exercise on light sensor.



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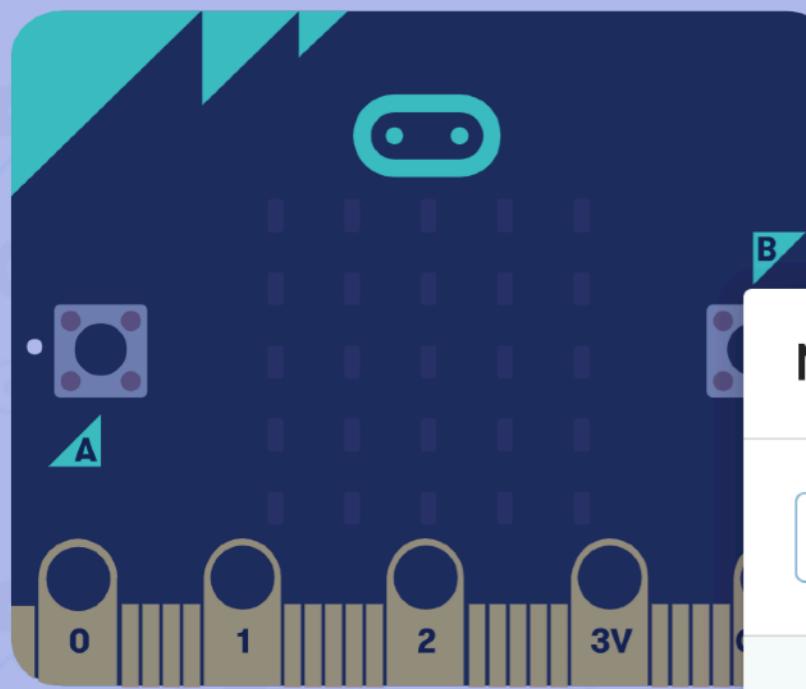
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Light Level Meter

forever



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Variables

Make a Variable...

New variable name:

reading

Ok



Cancel



Math

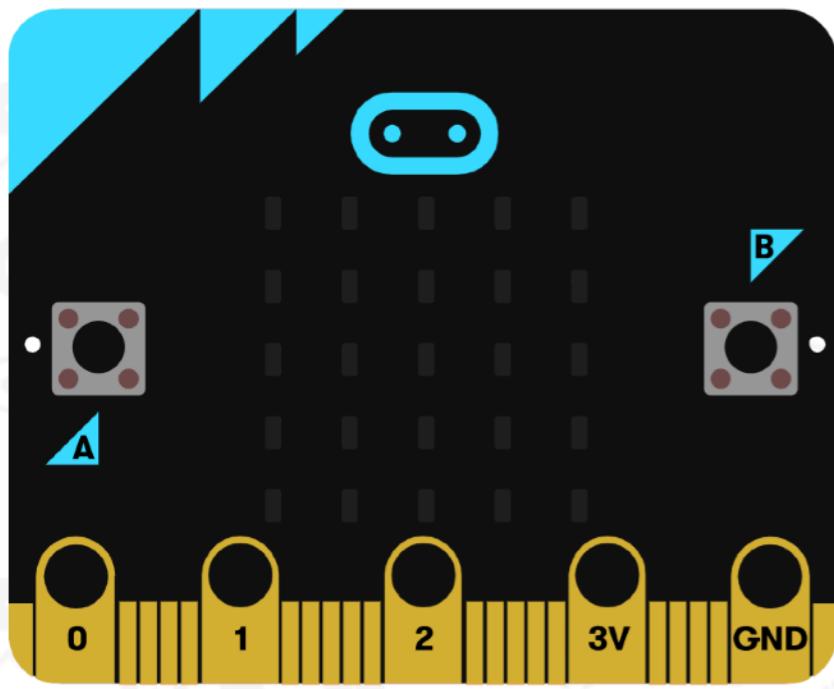
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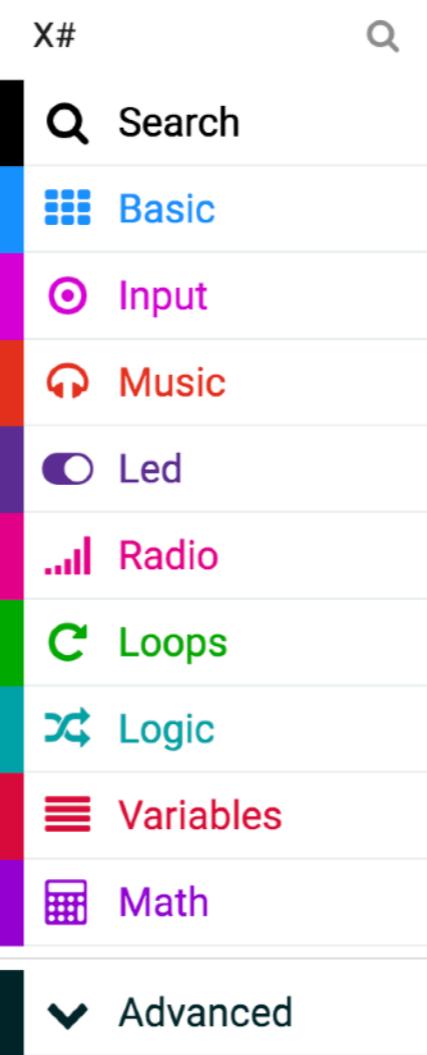
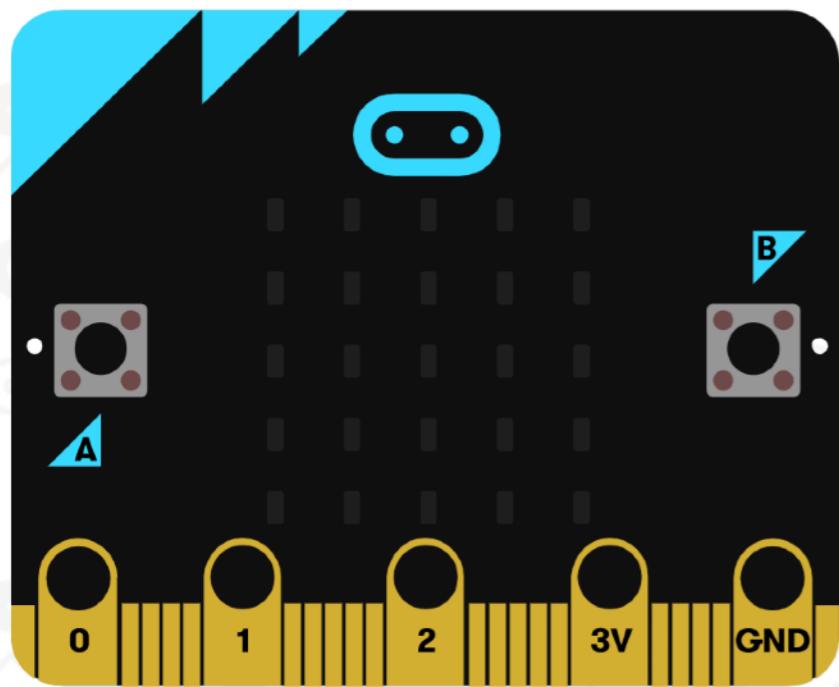
reading ▾

set reading ▾ to 0

change reading ▾ by 1

Light Level Meter





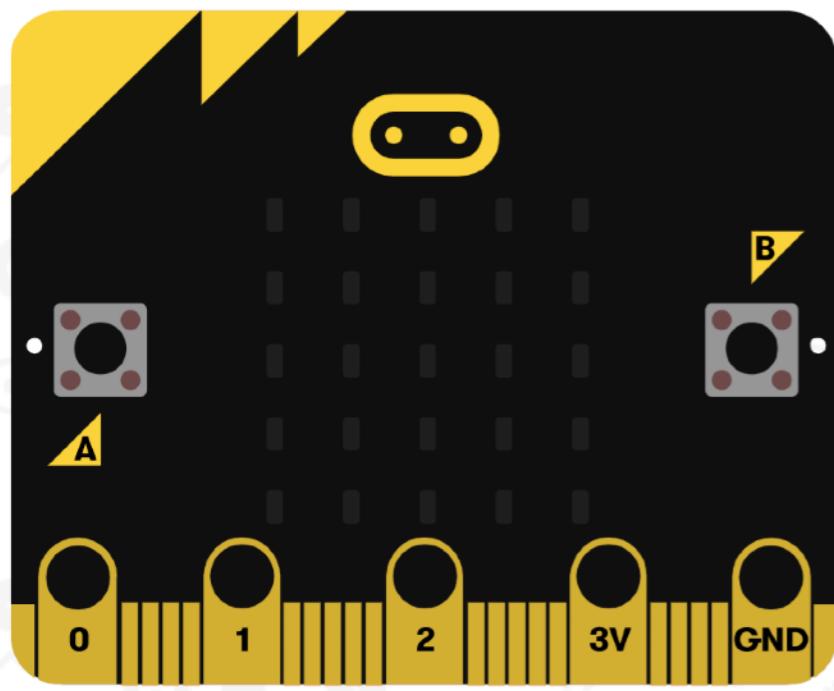
```
forever
  set reading to 0
```

Download

Light Level Meter



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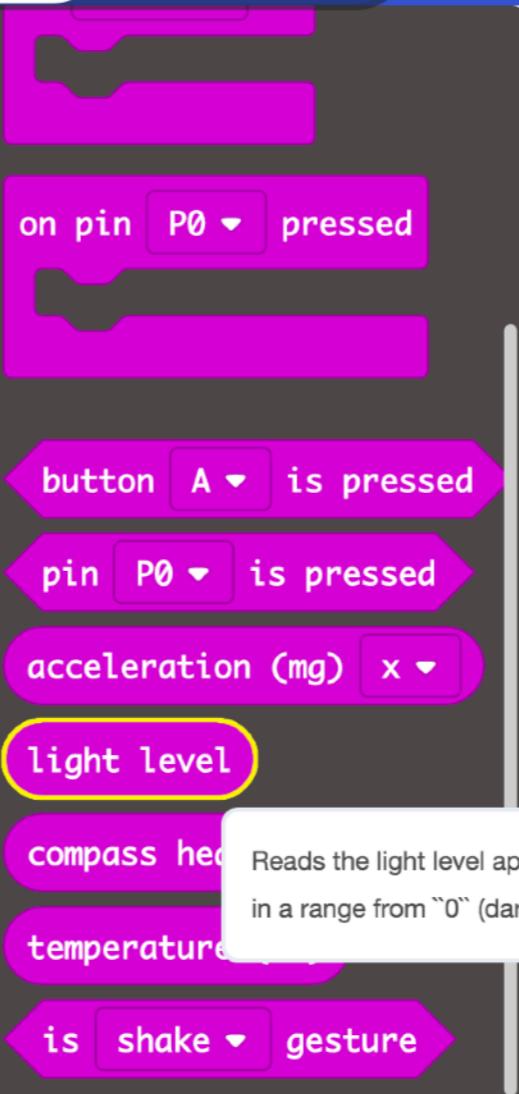
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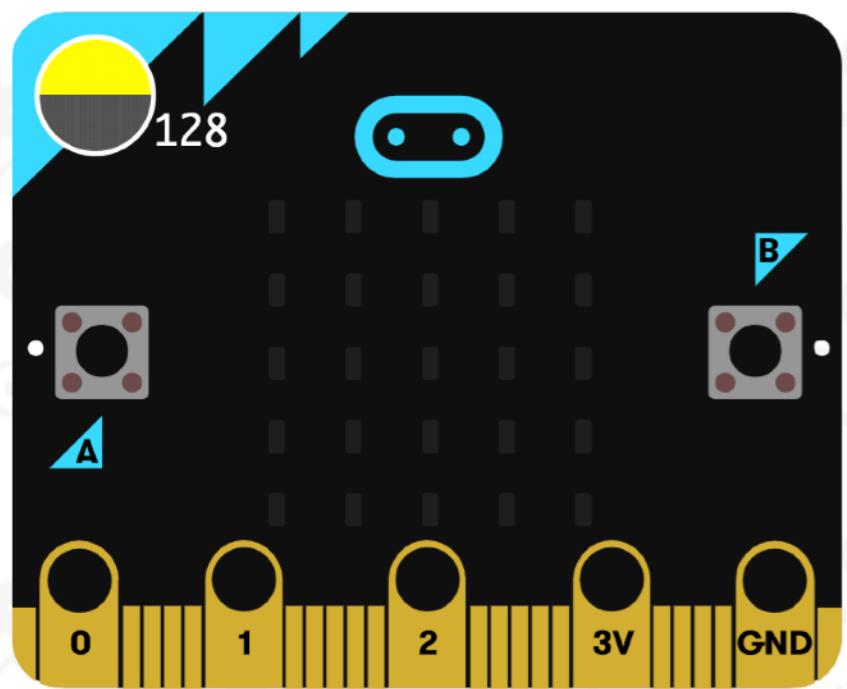
Advanced

Light Level Meter



Reads the light level applied to the LED screen
in a range from "0" (dark) to "255" bright.





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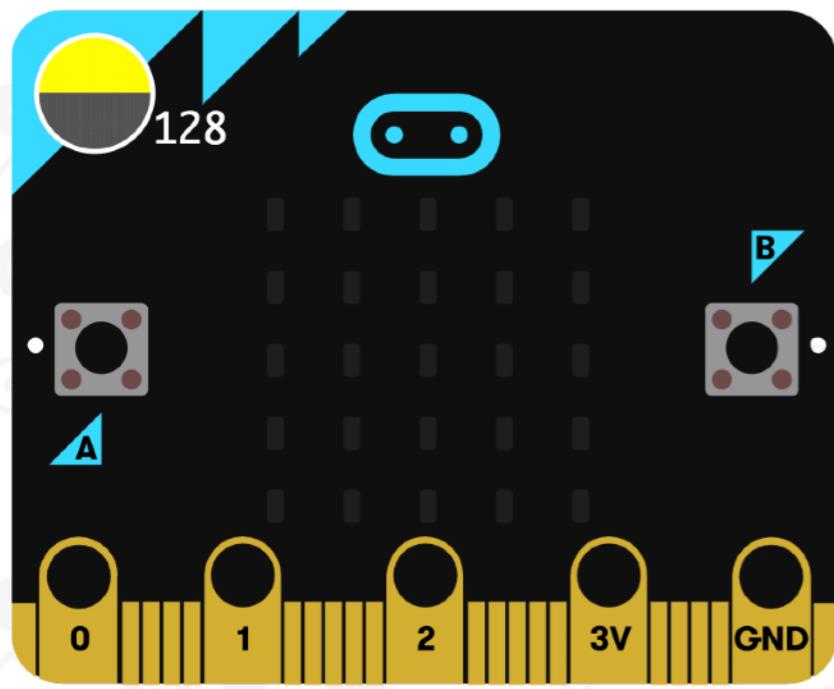
set reading ▾ to light level



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Light Level Meter





X#

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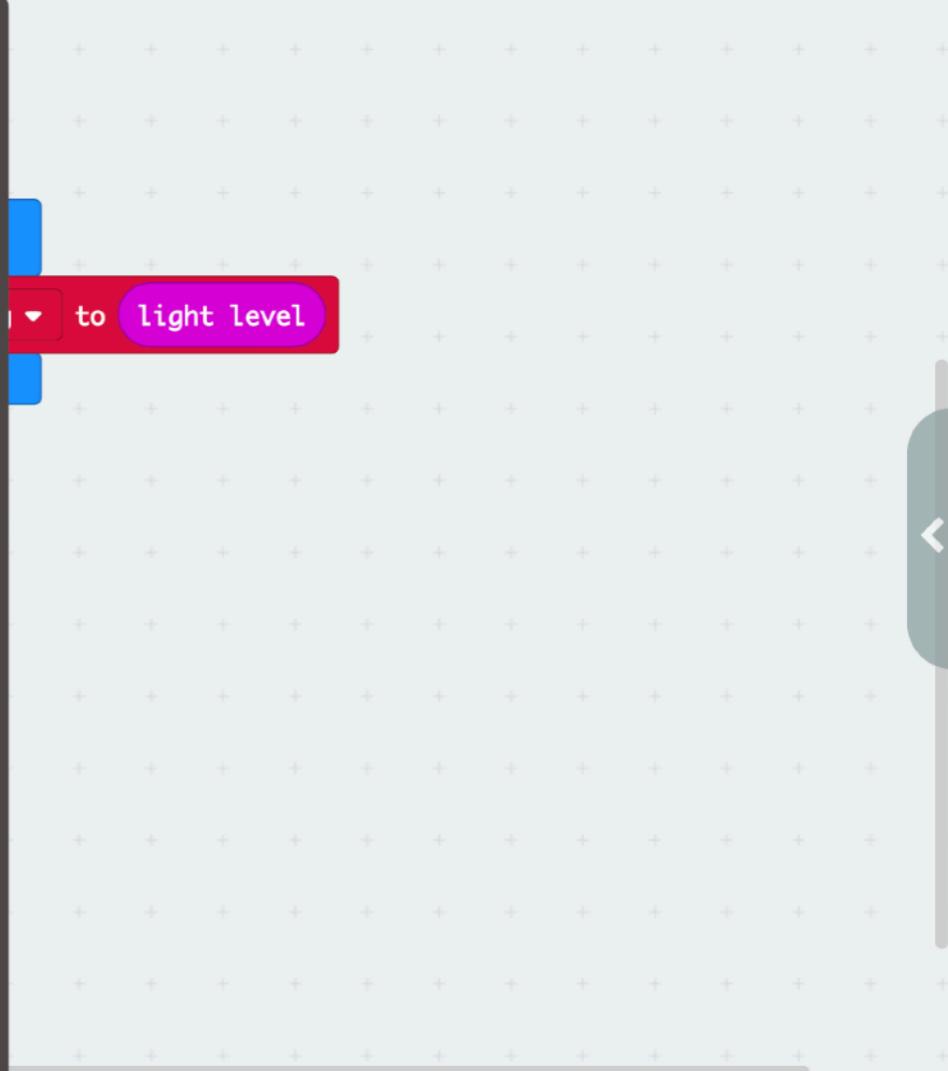
Variables

Math

Led

- plot x 0 y 0
- unplot x 0 y 0
- toggle x 0 y 0
- point x 0 y 0

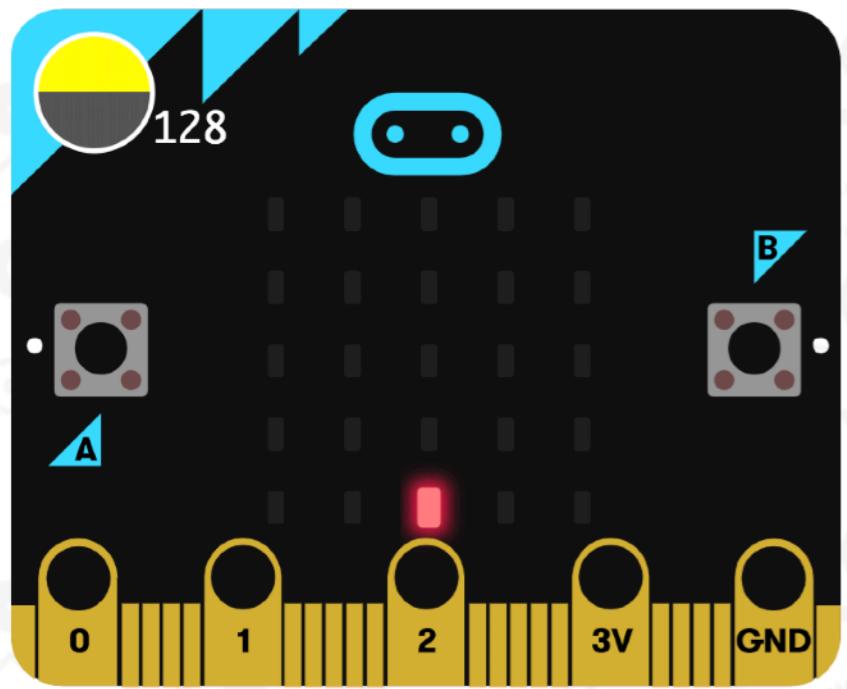
plot bar graph of 0
up to 0



Download

Light Level Meter

↶ ↶ ⏪ ⏫



X#



Search

Basic

Input

Music

Led

Radio

Loops

Logic

Variables

Math

Advanced

forever

set reading ▾ to light level

plot bar graph of 0

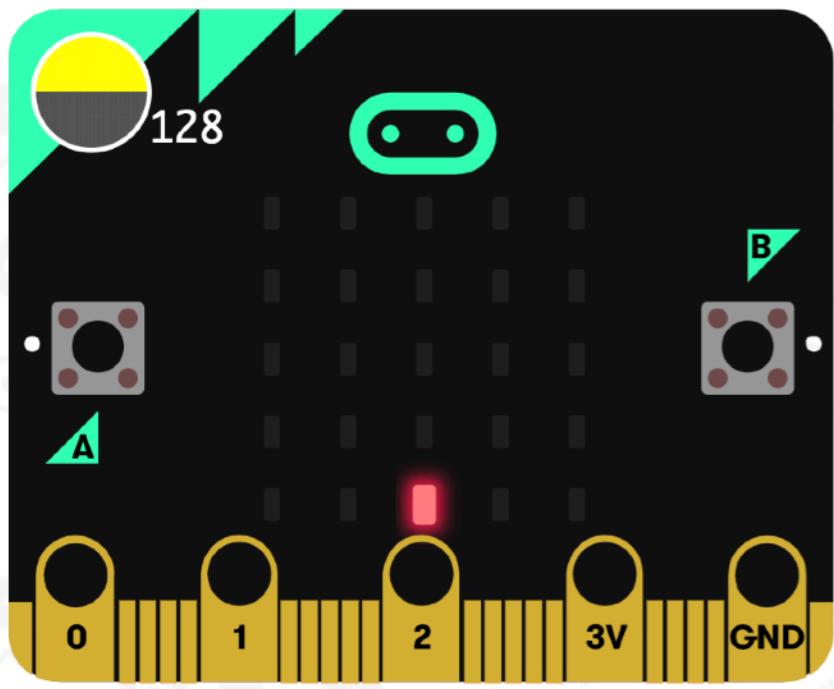
up to 0

Show console Simulator

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Light Level Meter





Search...



Variables

Make a Variable...

reading ▾

set reading ▾ to 0

change reading ▾ by 1

to light level

f 0

Basic

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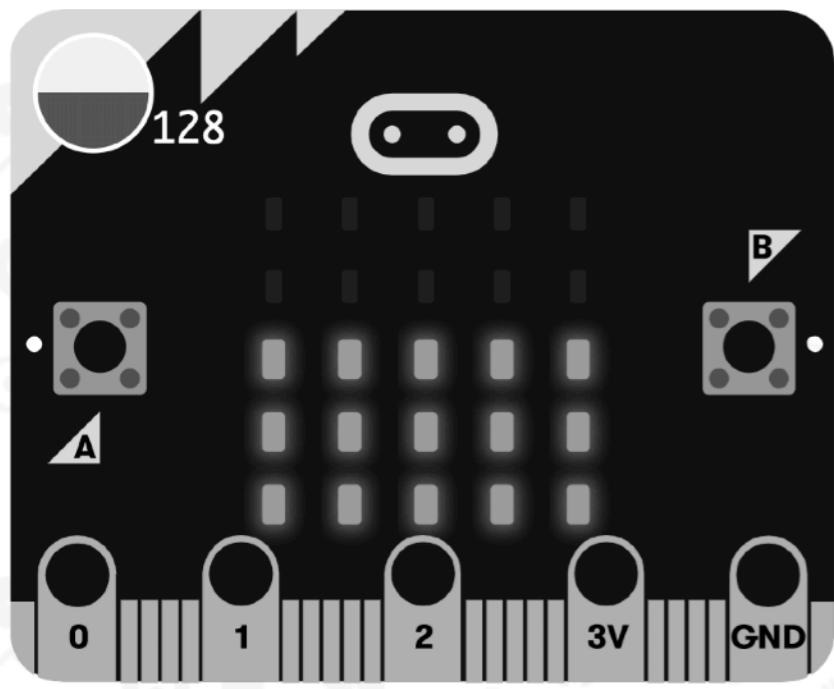
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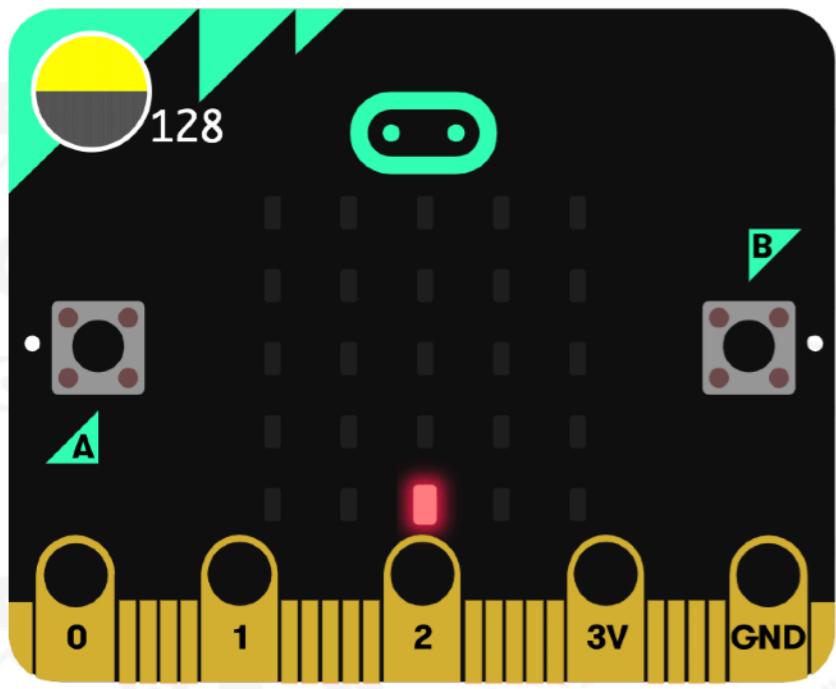
Advanced

forever

set reading ▾ to light level

plot bar graph of 0

up to 255



Search...



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forever

set reading ▾ to light level

plot bar graph of reading ▾

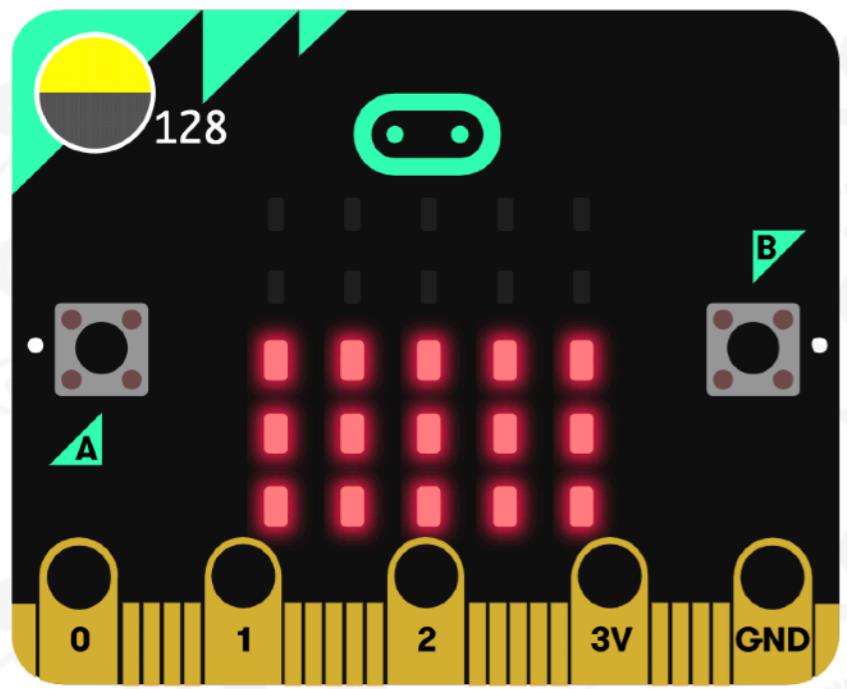
up to 255

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Search...



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Logic

Conditionals

if true then

If a value is true, then do some statements.

if true then

else

Comparison

0 = 0

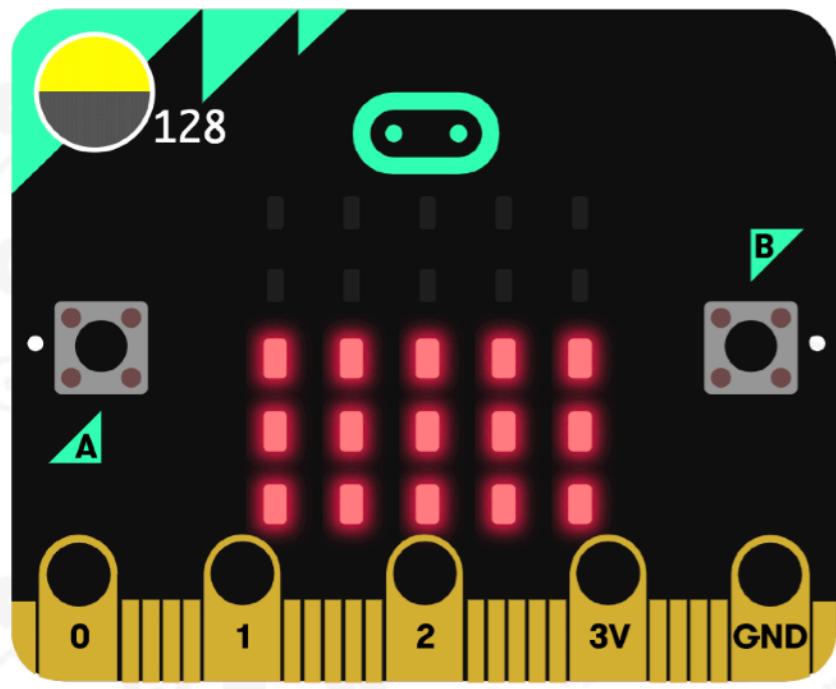
0 < 0

" " = "

Light Level Meter



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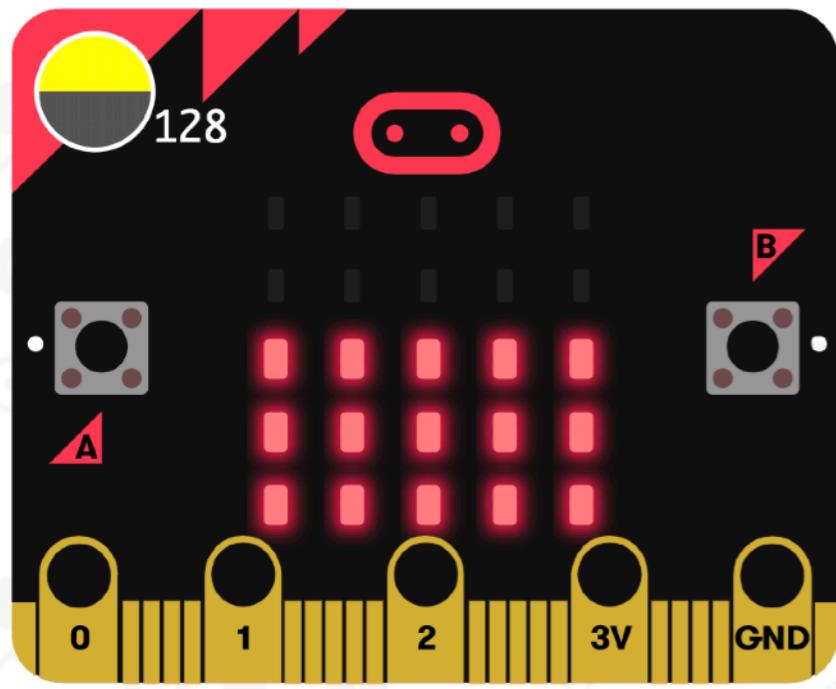
set reading ▾ to light level

plot bar graph of reading ▾

up to 255

if true ▾ then





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Search...

Basic

Input

more

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Loops

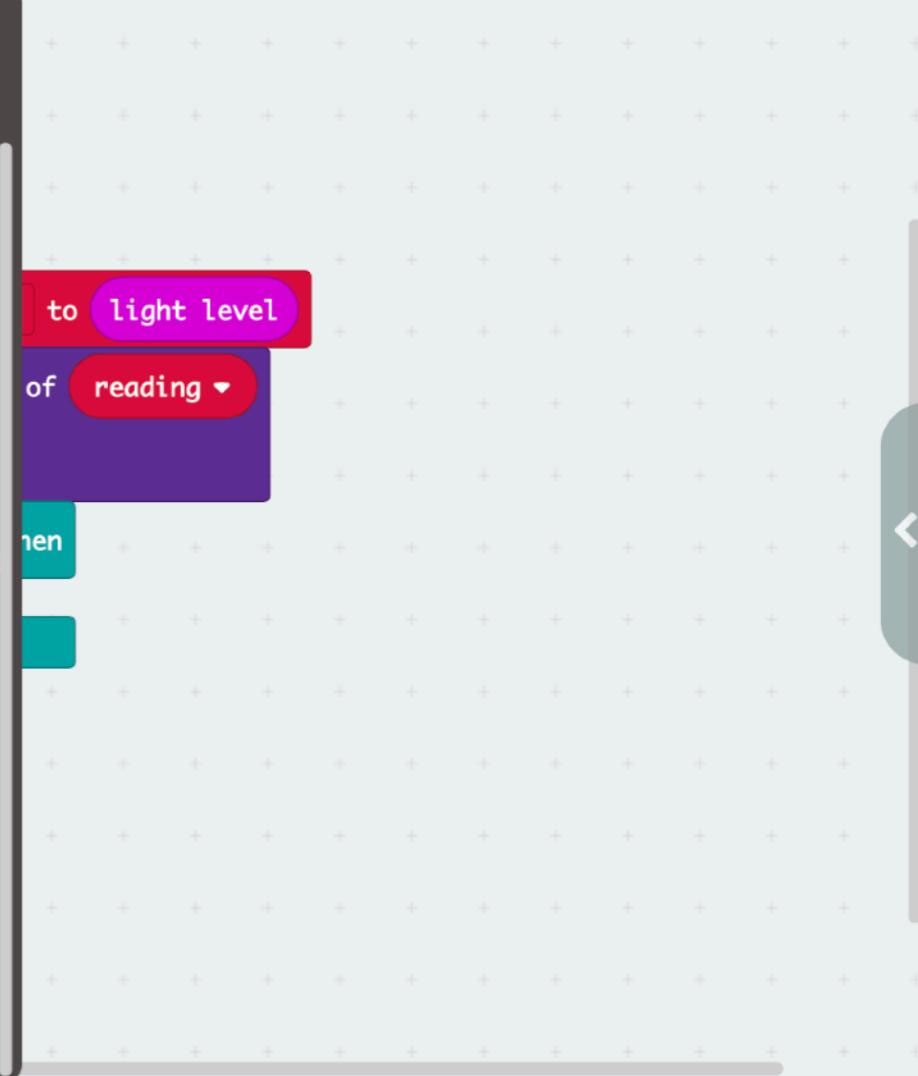
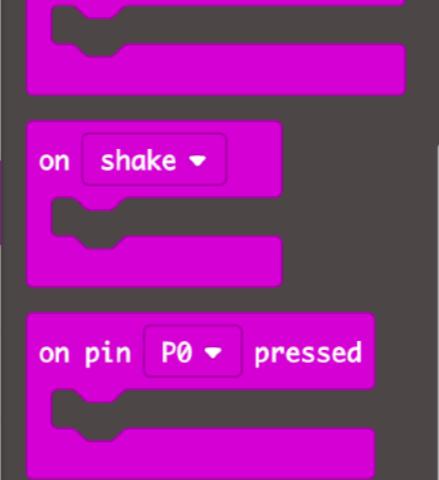
Logic

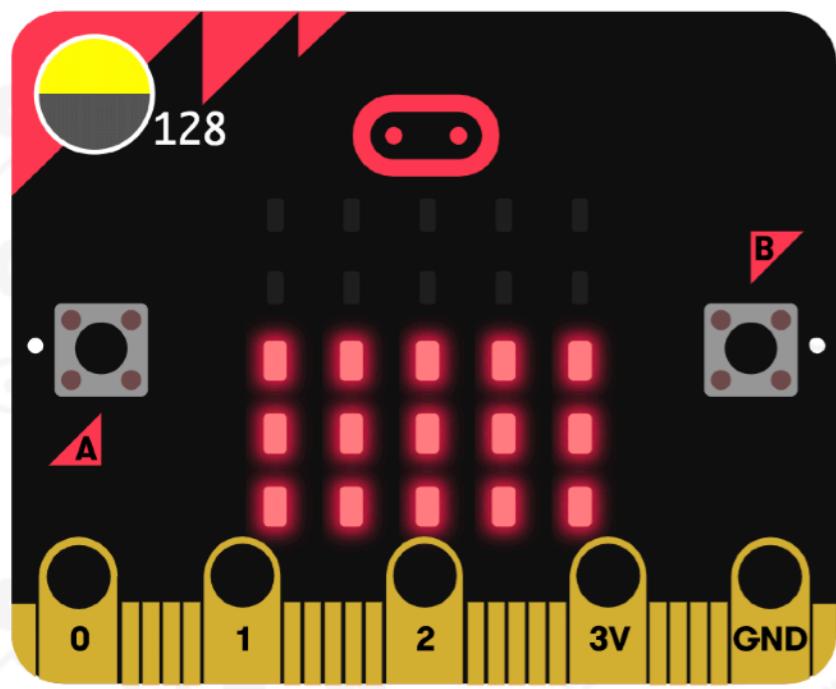
Variables

Math

Advanced

Search...



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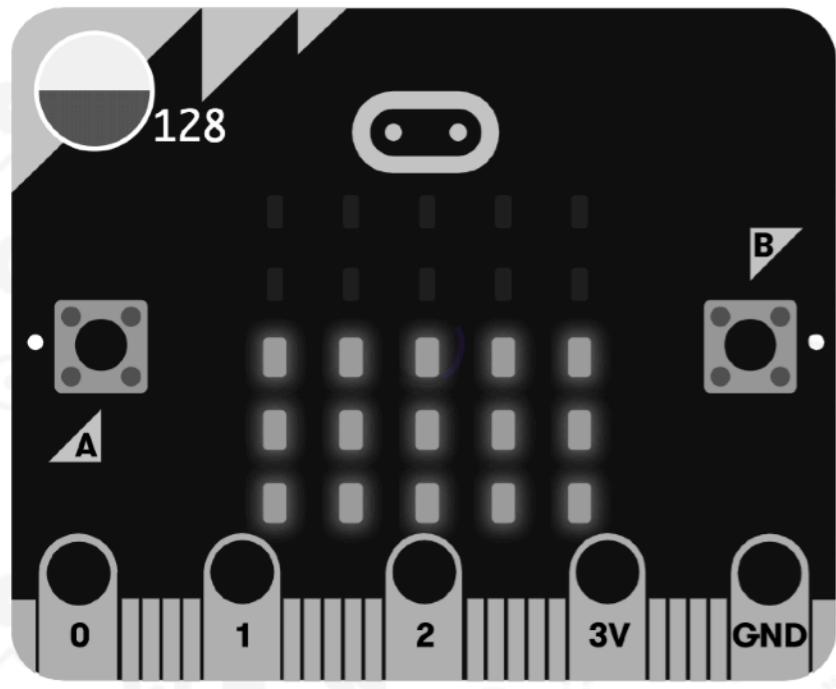
forever

set reading ▾ to light level

plot bar graph of reading ▾

up to 255

if true ▾ then
button A ▾ is pressed



Show console Simulator

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Search...



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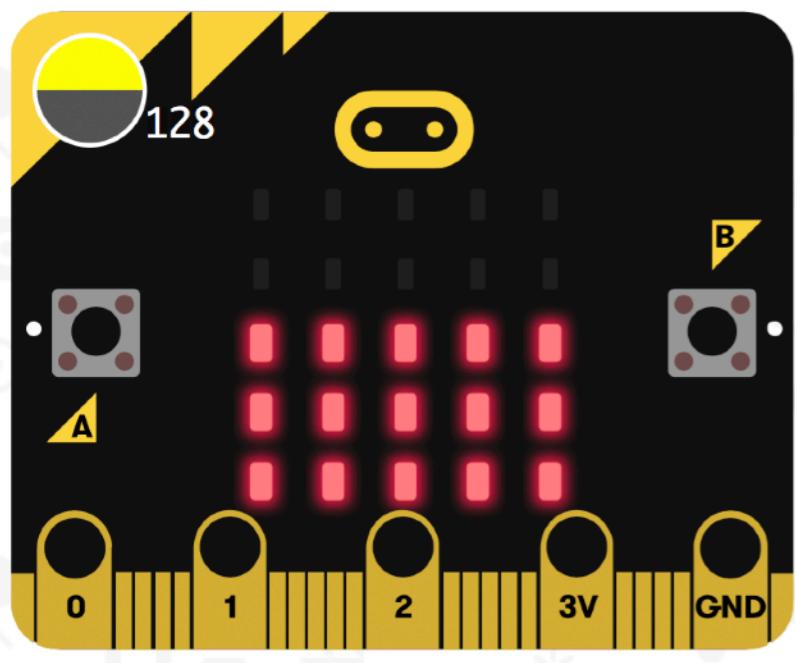
set reading ▾ to light level

plot bar graph of reading ▾

up to 255

if button A ▾ is pressed then

+ [empty slot]



Show console Simulator

Download

Basic

- ... more
 - Input
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 - Text

Untitled

Basic

show number 0

show led

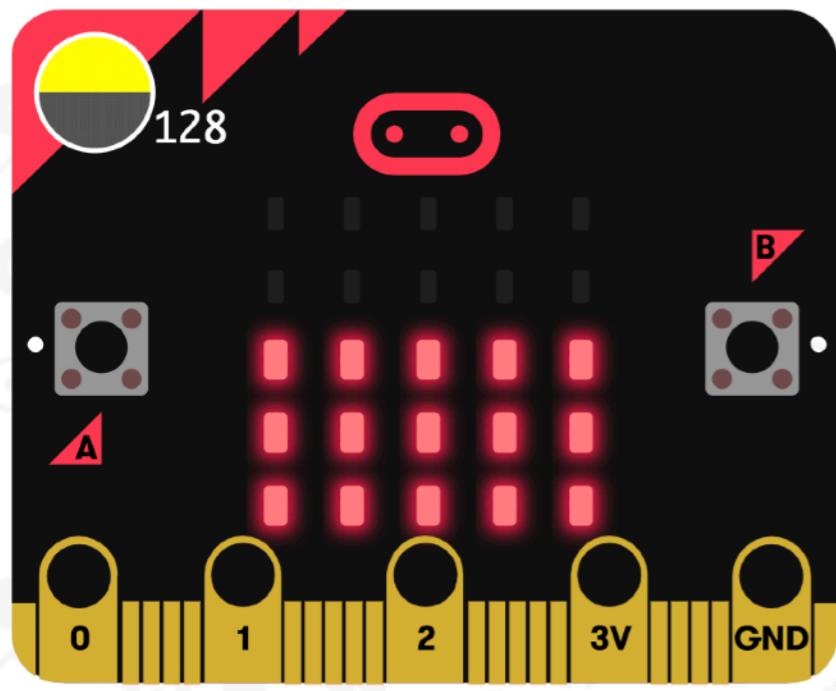
Scroll a number on the screen. If the number fits on the screen (i.e. is a single digit), do not scroll.

show icon

show string "Hello!"

forever

end
then



Search...



Basic

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forever

set reading ▾ to light level

plot bar graph of reading ▾

up to 255

if button A ▾ is pressed then

show number 0

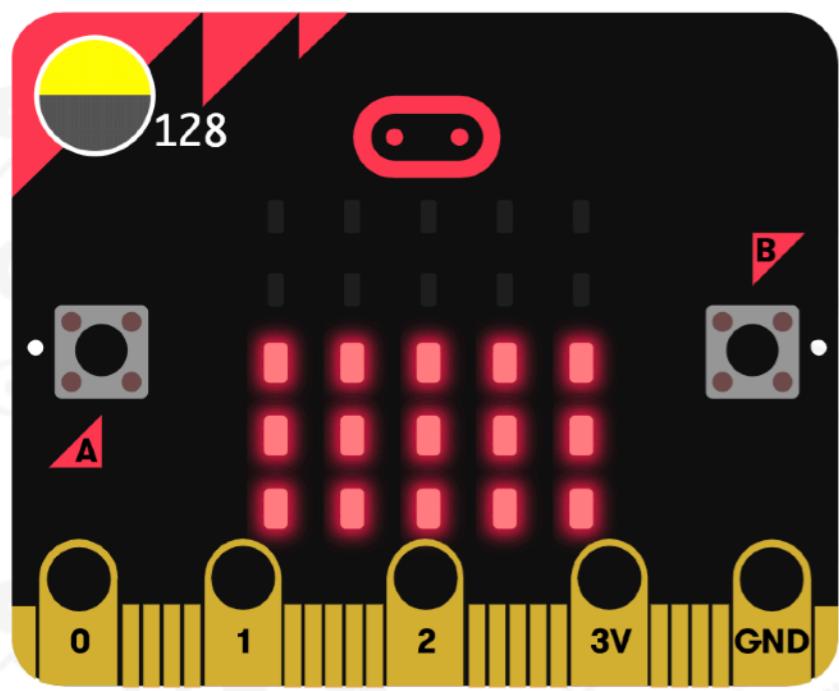
+ (green)

Show console Simulator

Download

Light Level Meter





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Advanced

Variables

Make a Variable...

reading ▾

set reading ▾ to 0

change reading ▾ by 1

to light level

for reading ▾

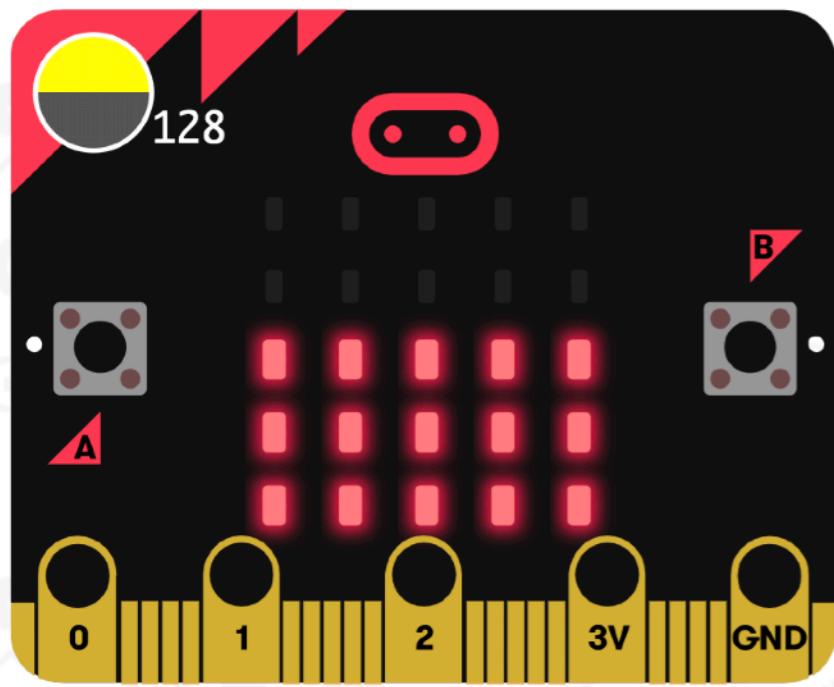
is pressed then

Show console Simulator

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Light Level Meter





Search...



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Advanced

forever

set reading ▾ to light level

plot bar graph of reading ▾

up to 255

if button A ▾ is pressed then

show number 0 reading ▾

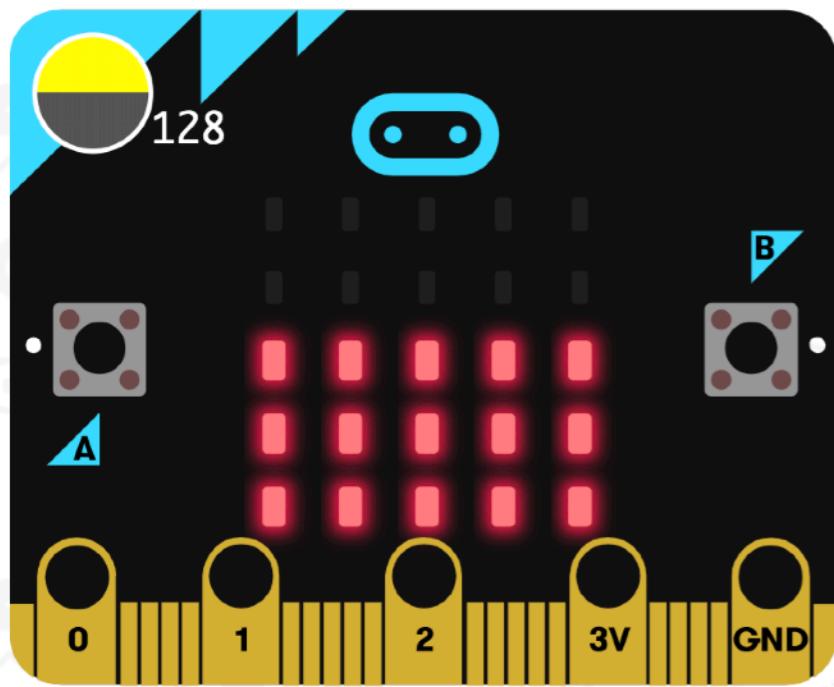


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Light Level Meter





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set reading ▾ to light level

plot bar graph of reading ▾

up to 255

if button A ▾ is pressed then

show number reading ▾



Show console Simulator

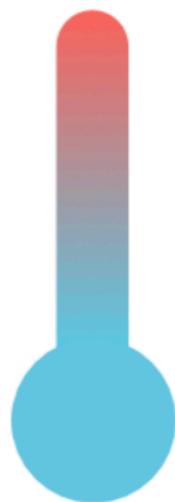
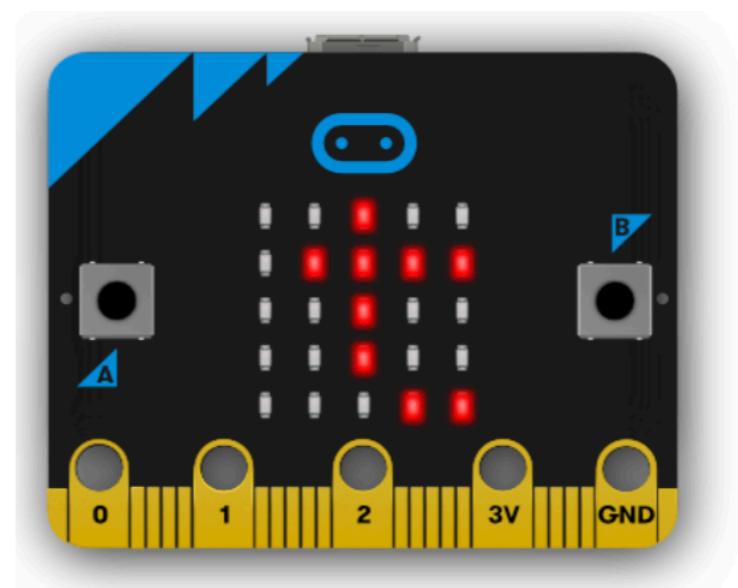
Download

Light Level Meter

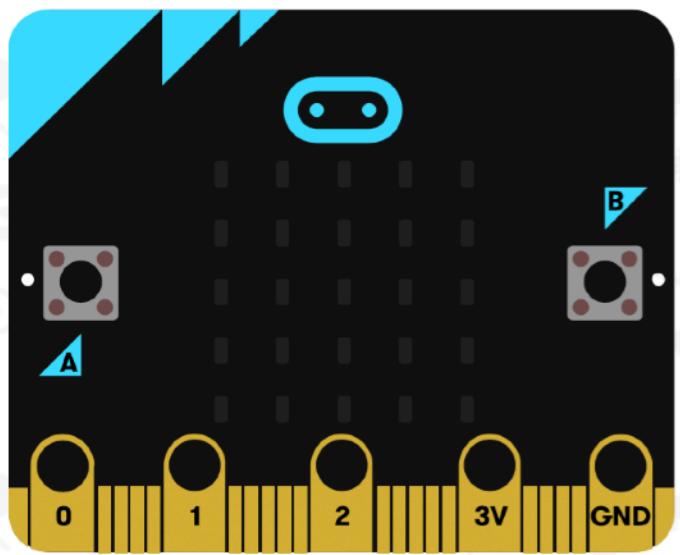


Temperature Sensor

The temperature sensor can be used to detect the current temperature of the device in degrees and Celsius.



Exercise on temperature sensor.

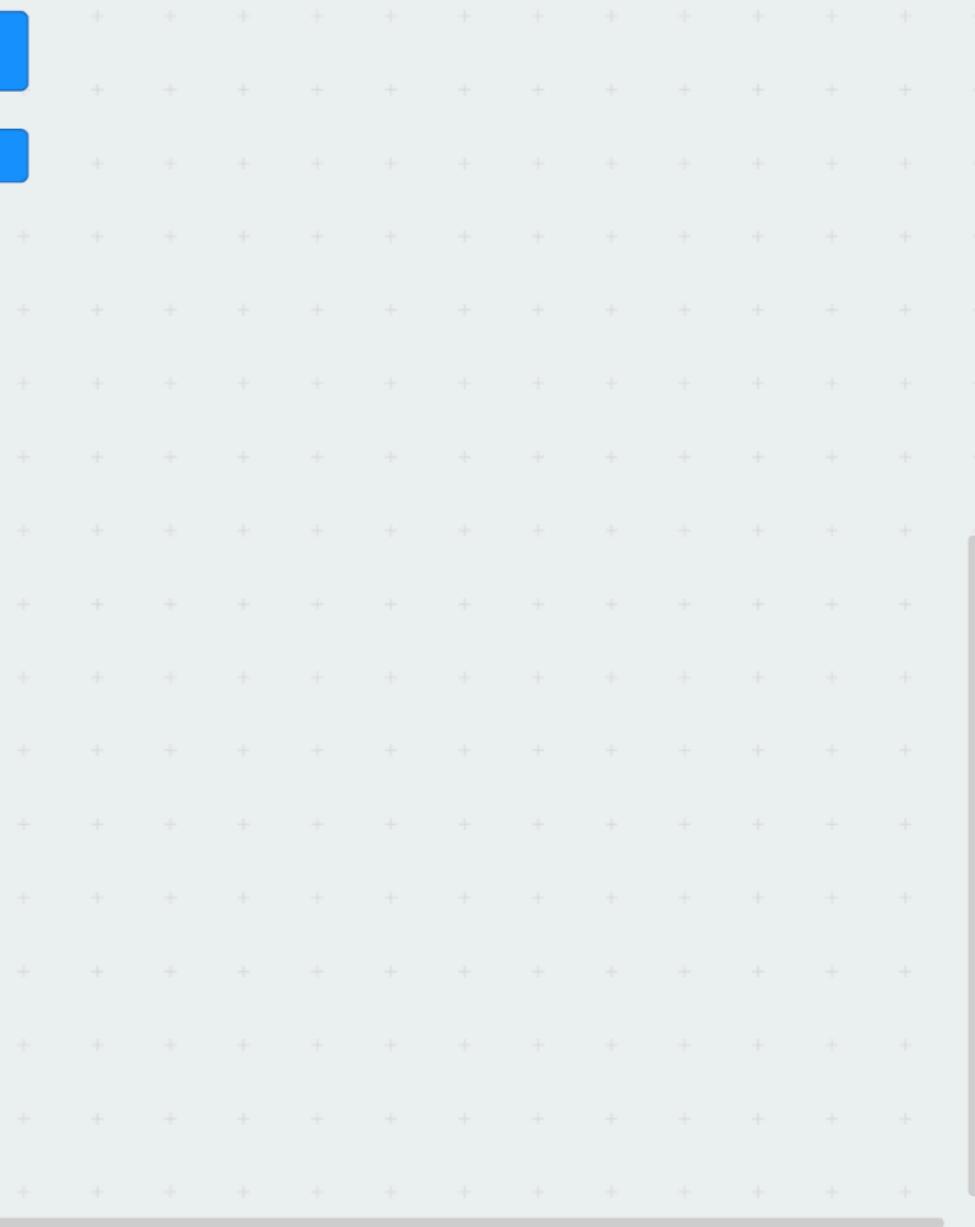


- Search... 🔍
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 - Logic
 - Variables (selected)
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 - Functions
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 - Text
 - Game
 - Images
 - Pins

Variables

Make a Variable...

forever

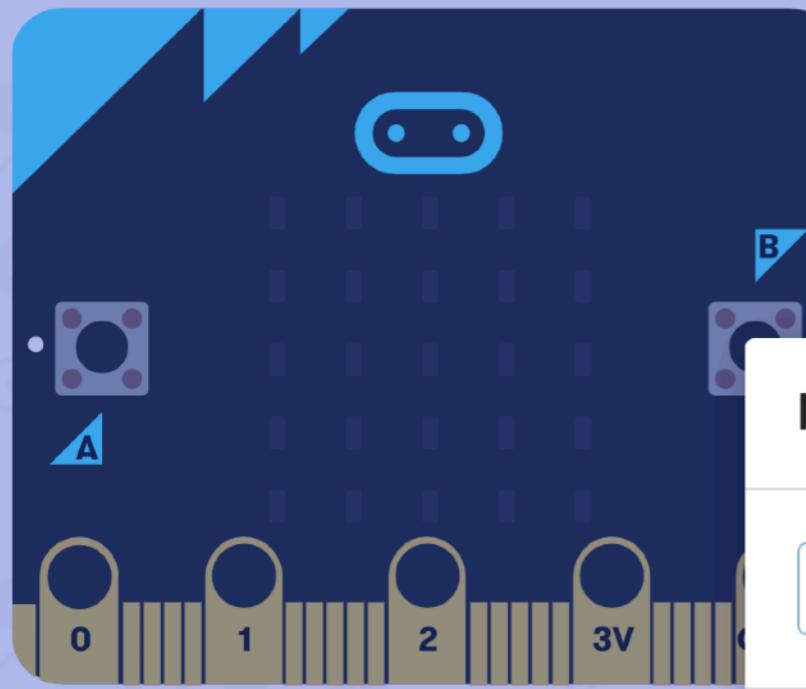


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Search...



Basic

Input

Music

Variables

Make a Variable...

Forever

New variable name:

temperature

Ok



Cancel



Advanced

Functions

Arrays

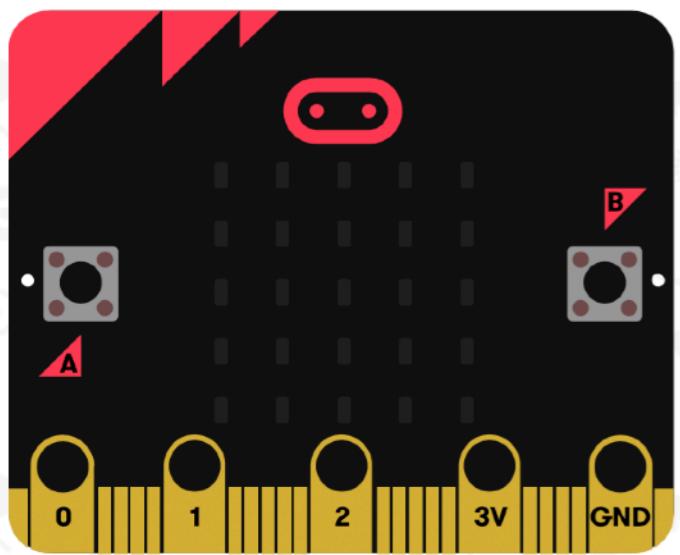
Text

Untitled



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- Search...
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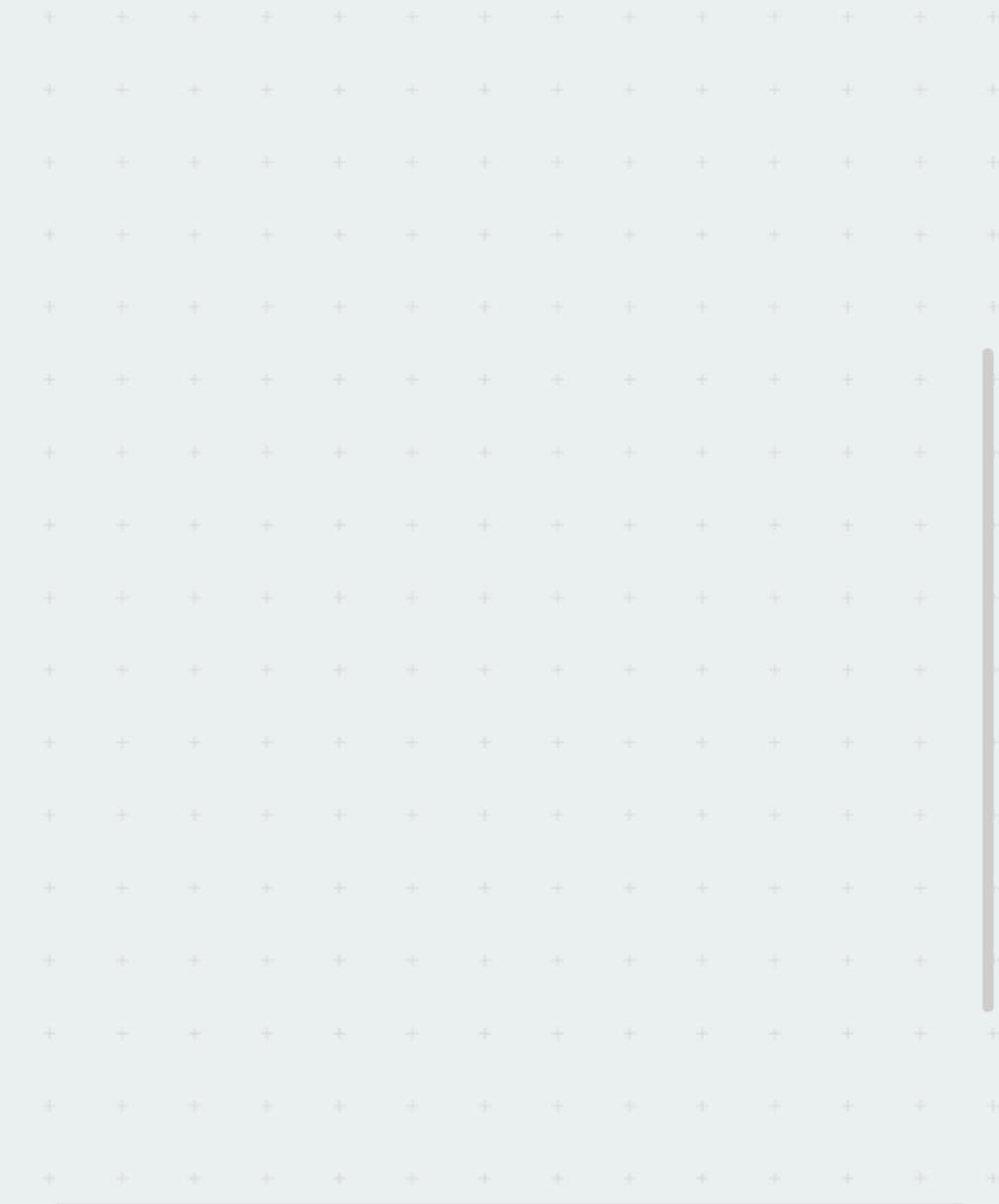
Variables

Make a Variable...

temperature ▾

set temperature ▾ to 0

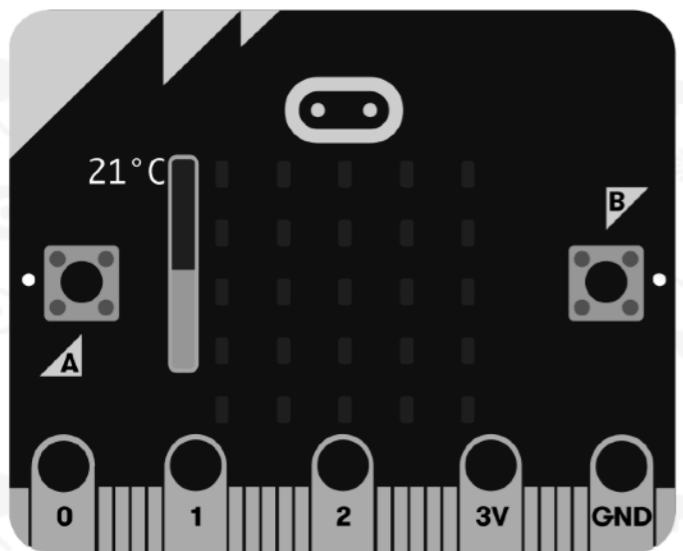
change temperature ▾ by 1



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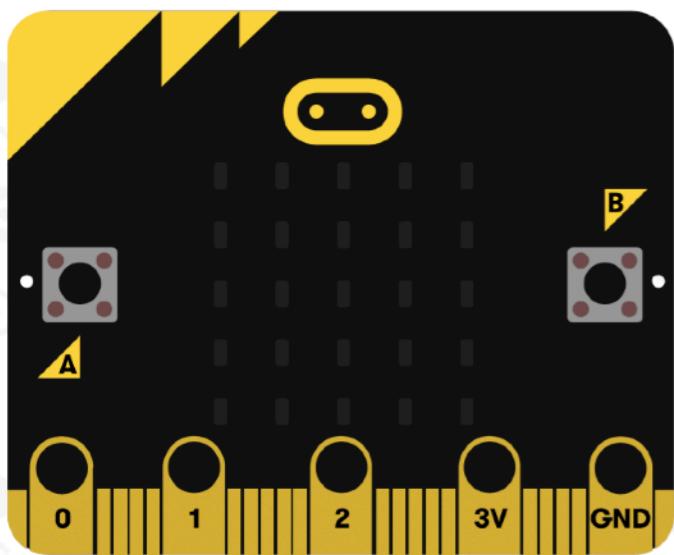
- Music
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- Game
- Images
- Pins
- Serial
- Control
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```
forever
  set [temperature v] to [0]
```

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Untitled

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Search...



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Game

Images

Input

on button A pressed

on shake

on pin P0 pressed

button A is pressed

pin P0 is pressed

acceleration (mg) x

light level

compass heading (°)

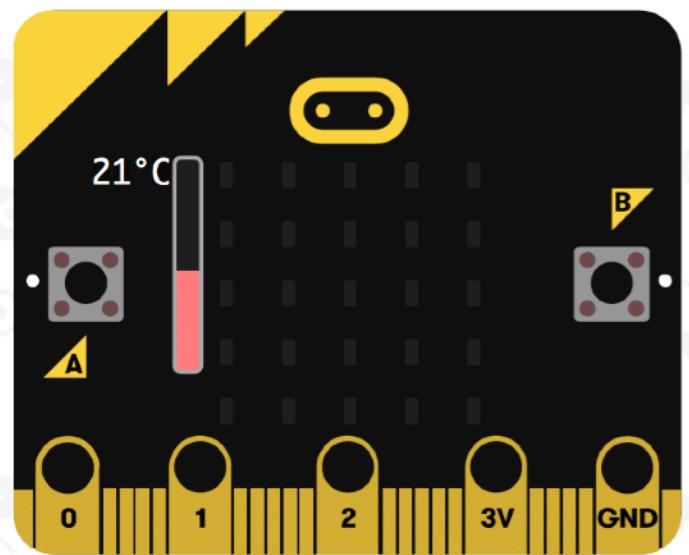
temperature (°C)

is shake gesture

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Search...



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forever

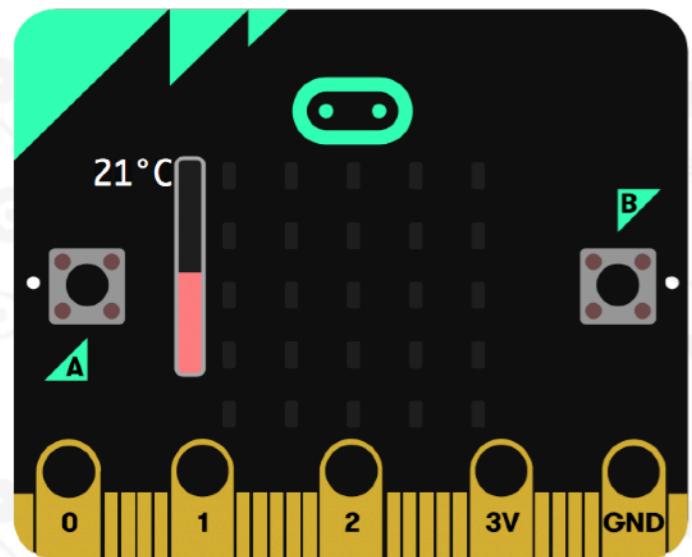
set [temperature] to [temperature (°C)]

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Search...

**Basic**

... more

Input**Music****Led****Radio****Loops****Logic****Variables****Math****Advanced****Functions****Arrays****Text****Game****Images****Basic**

show number 0

show leds

show icon

show string "Hello!"

forever

pause (ms) 100

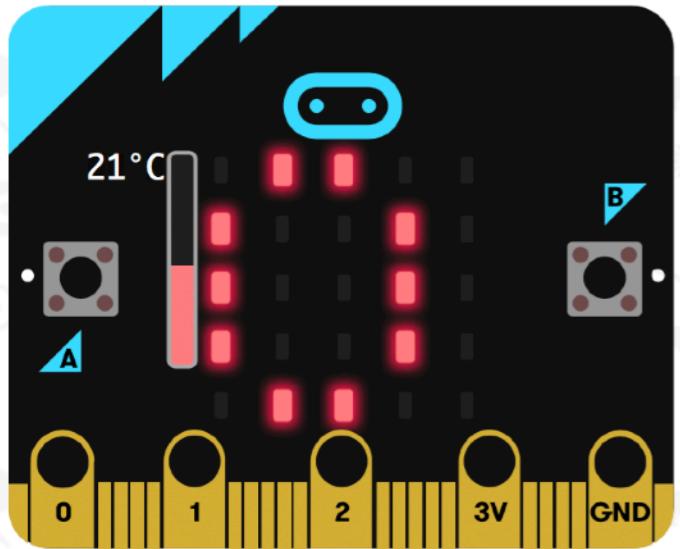
on start

temperature (°C)

Download

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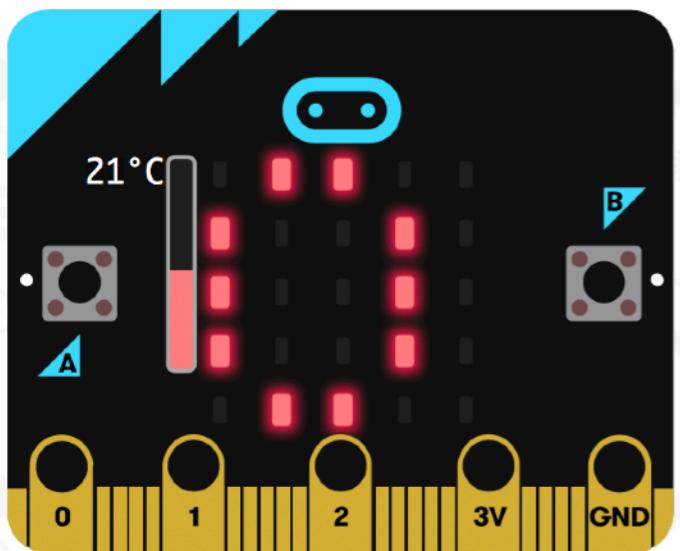
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```
forever
  set [temperature v] to [temperature (°C)]
  show number [0]
```

Download

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Variables

Make a Variable...

temperature ▾

set temperature ▾ to 0

change temperature ▾ by 1

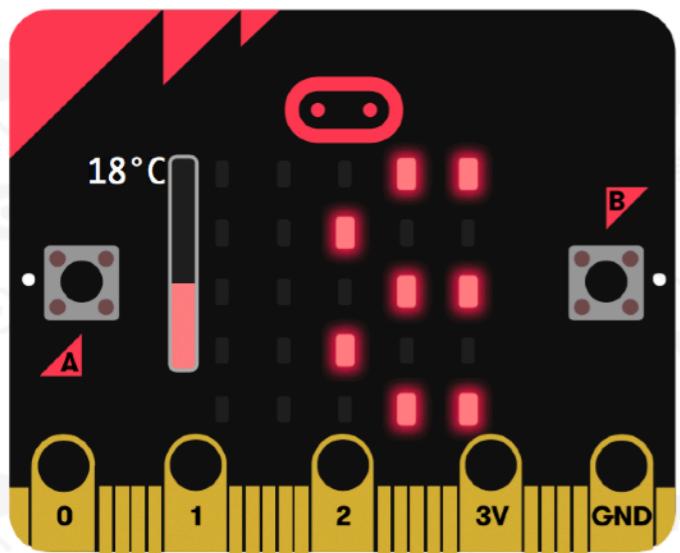
to temperature (°C)

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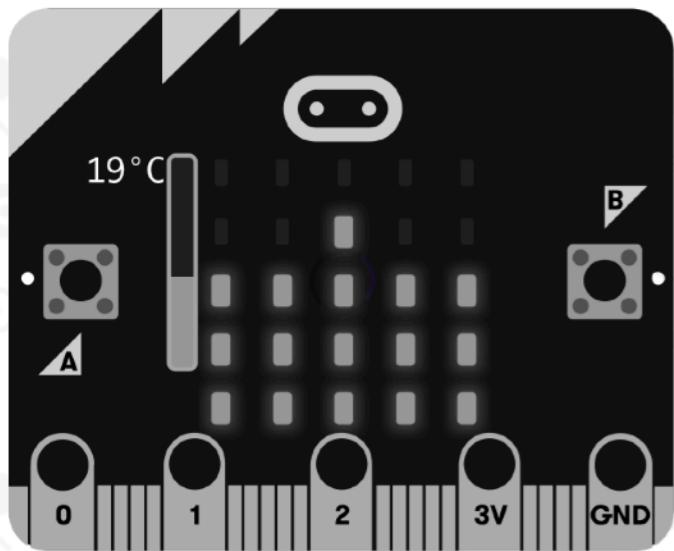
```
forever
  set [temperature v] to [temperature (°C)]
  show number [temperature v]
```

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Another way of showing the temperature.



Show console Simulator

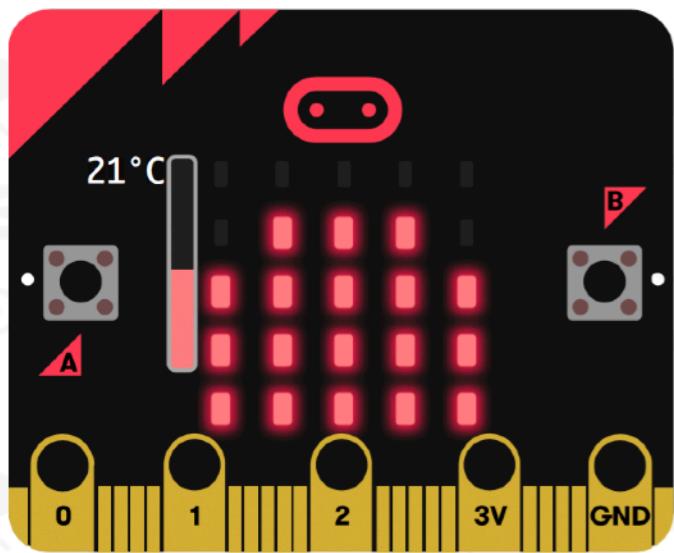
Download

- Music
- Led
- Radio
- Loops
- Logic
- Variables
- Math
- Advanced
- Functions
- Arrays
- Text
- Game
- Images
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```
forever
  set [temperature v] to [temperature (°C)]
  plot bar graph of [temperature v]
    up to [32]
```

Untitled





Show console Simulator

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Serial

forever

set temperature to temperature (°C)

if DisplayBusy ≠ true then

plot bar graph of temperature

up to 32

on button A pressed

set DisplayBusy to true

show number temperature

pause (ms) 100

set DisplayBusy to false

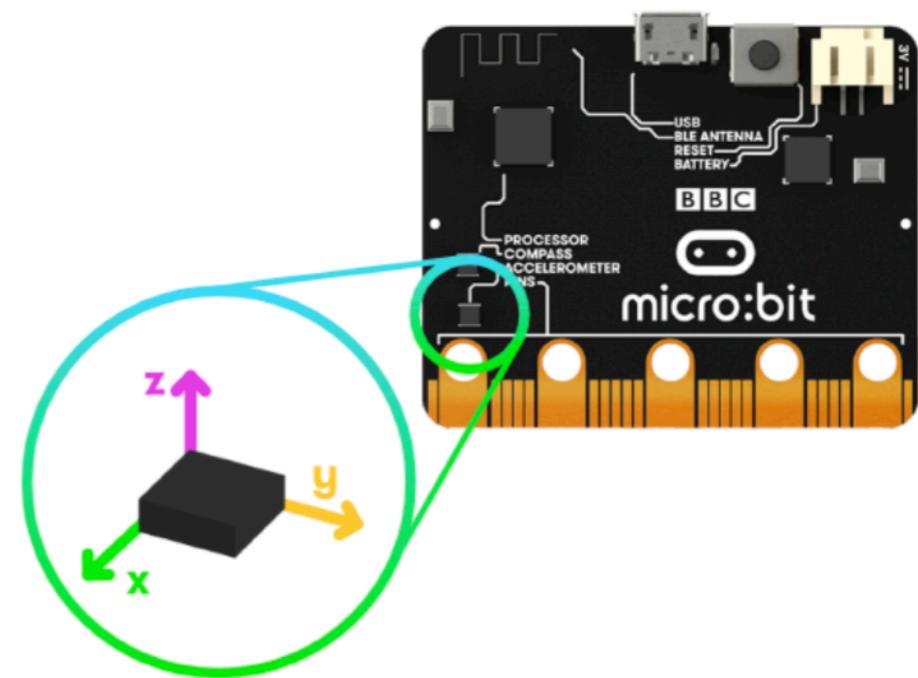
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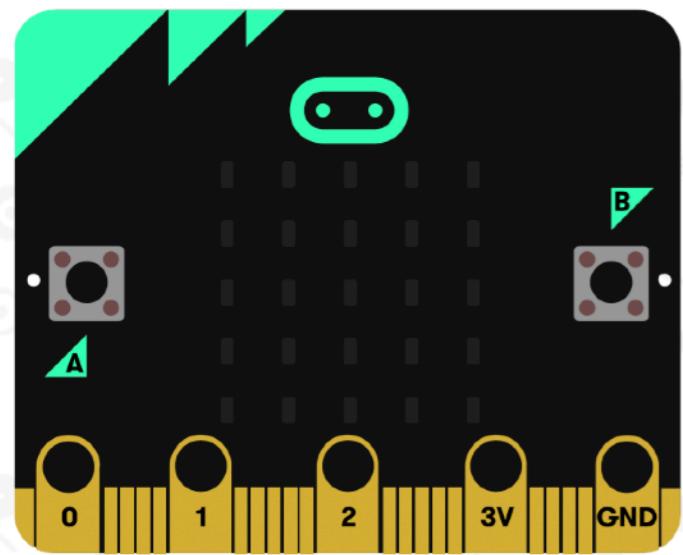


Accelerometer

This feature measures the acceleration of the micro:bit when it is moved, shaked, tilted, and dropped.



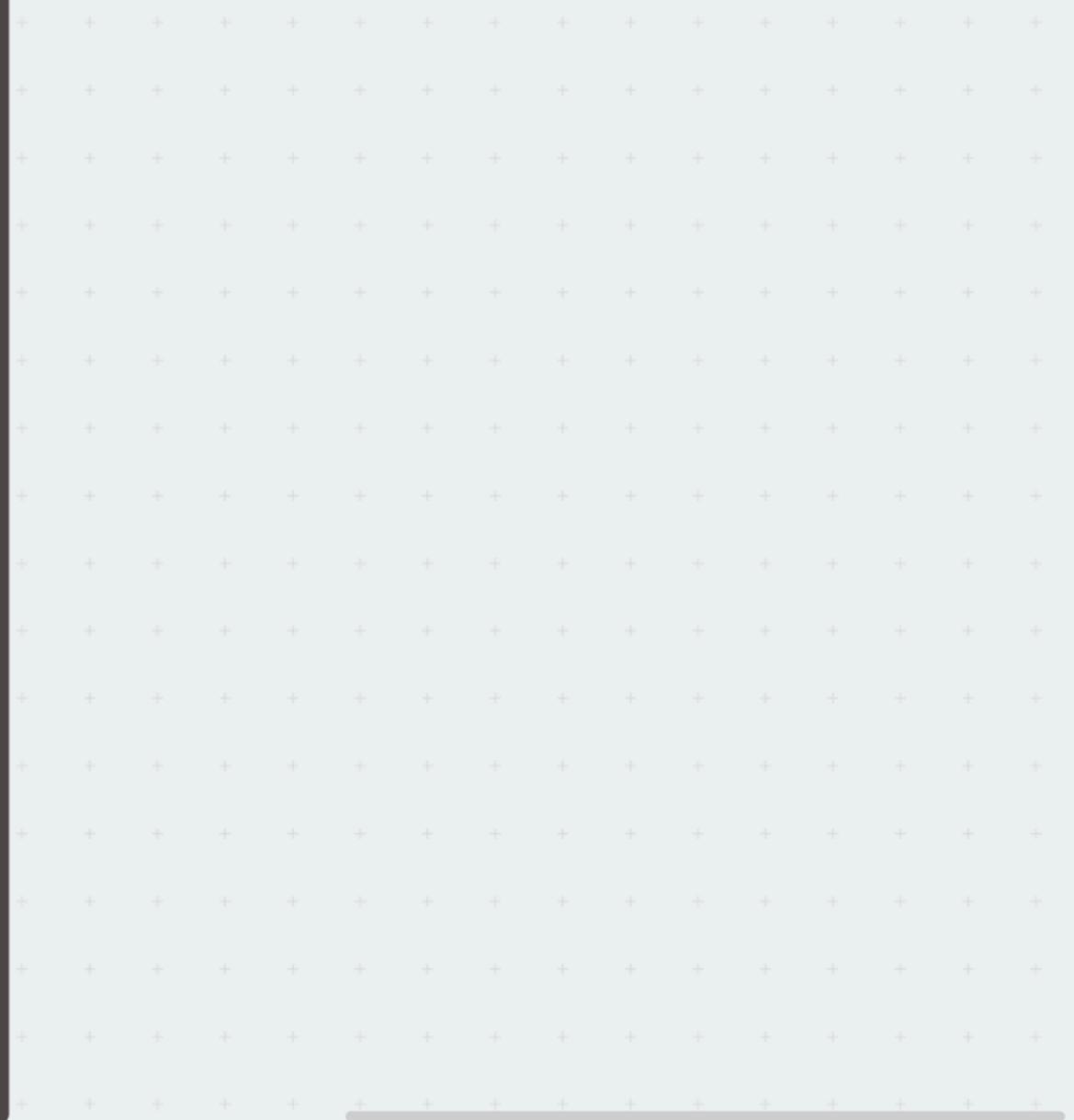
Exercise on accelerometer.



- Search... Q
- grid icon Basic
 - circle icon Input
 - speaker icon Music
 - led icon Led
 - radio icon Radio
 - loop icon Loops
 - logic icon Logic
 - variables icon Variables
 - calculator icon Math
 - up arrow icon Advanced
 - function icon Functions
 - array icon Arrays
 - text icon Text
 - game icon Game
 - image icon Images
 - pin icon Pins

Variables

Make a Variable...

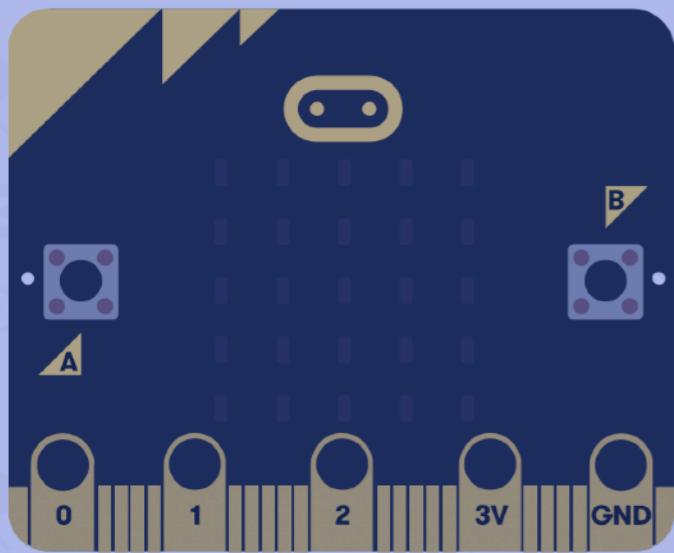


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Search... Variables

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New variable name:

dice|

Ok ✓

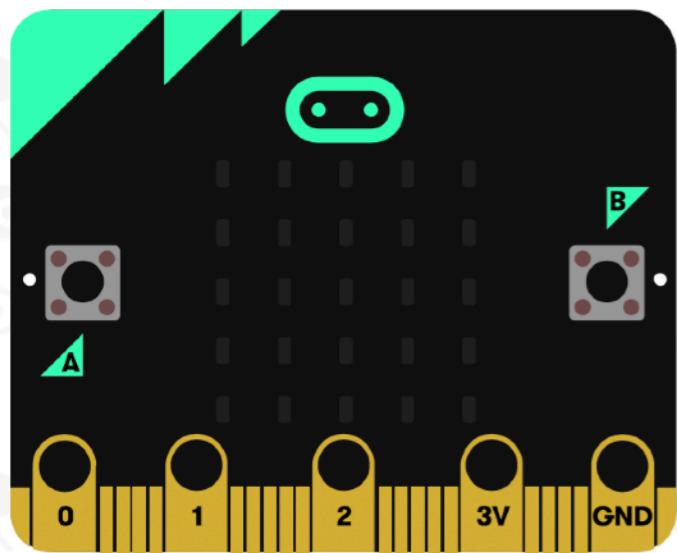
Cancel ✕

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Search... 🔍

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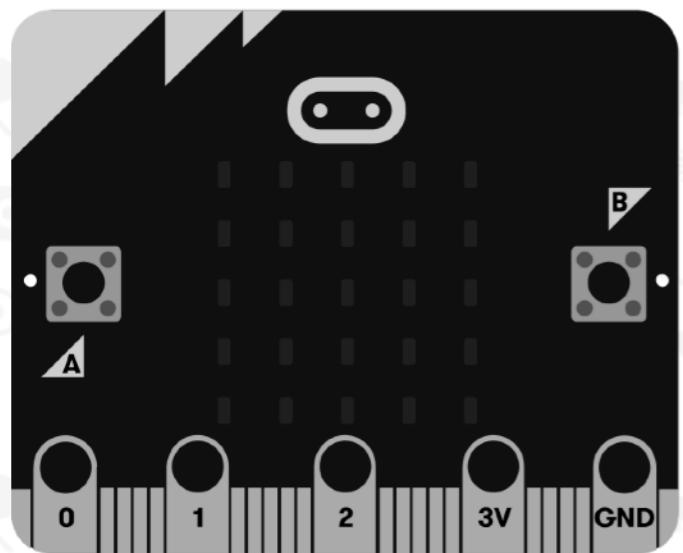
Input

- on button A pressed
- on shake
- on pin P0 pressed
- button A is pressed
- pin P0 is pressed
- acceleration (mg) x
- light level
- compass heading (°)
- temperature (°C)
- is shake gesture

Download

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Search...



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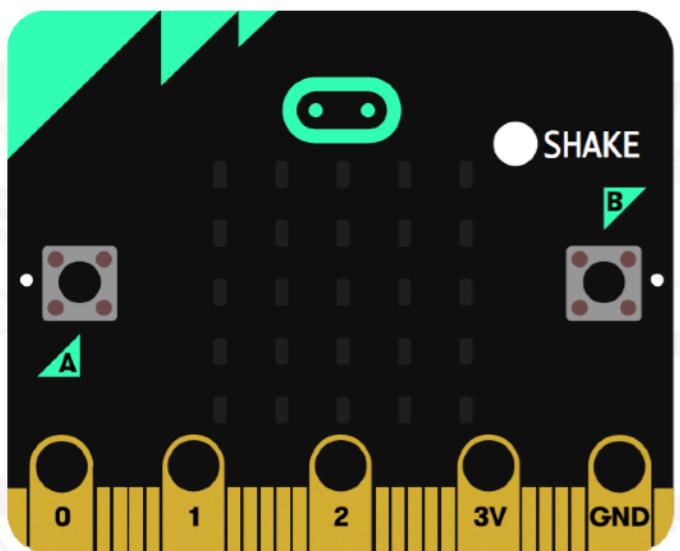
Pins

on shake ▾

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Search...



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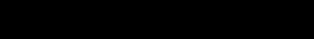
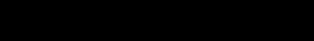
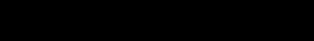
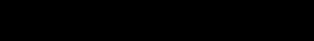
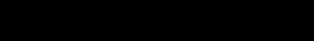
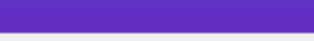
Variables

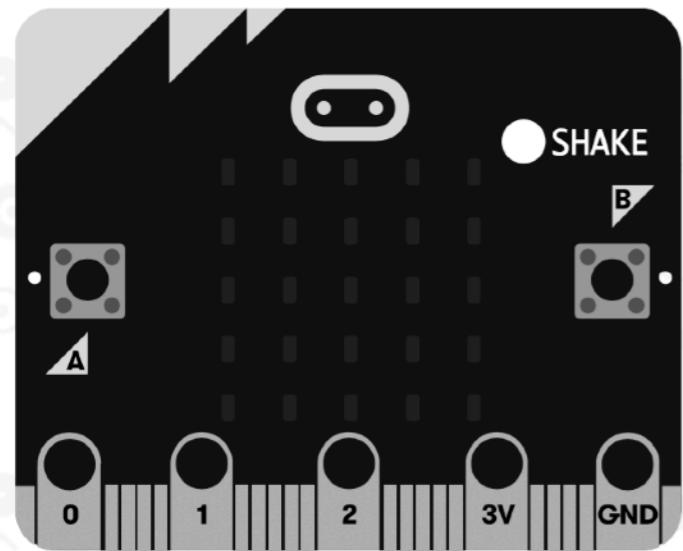
Make a Variable...

dice ▾

set dice ▾ to 0

change dice ▾ by 1





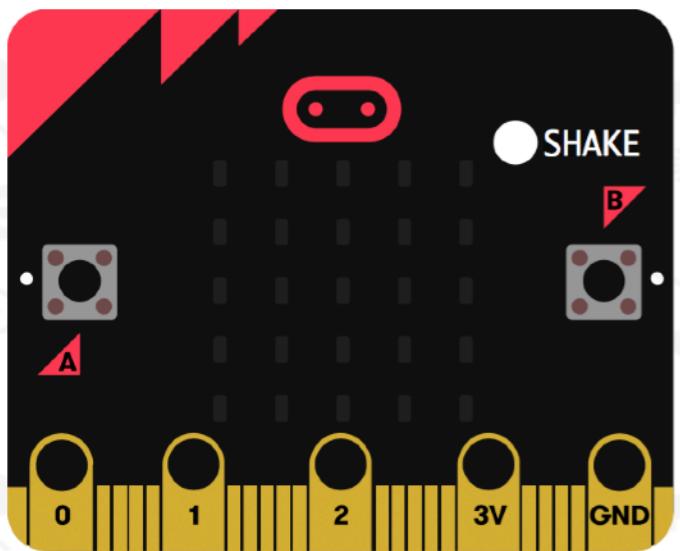
- Search... Q
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on shake ▾
set dice ▾ to 0

Download

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0 - ▾ 0

0 × ▾ 0

0 ÷ ▾ 0

0

remainder of 0 ÷ 1

min ▾ of 0 and 0

max ▾ of 0 and 0

absolute of 0

square root ▾ 0

round ▾ 0

pick random 0 to 10

Returns a pseudorandom number between min and max included. If both numbers are integral, the result is integral.

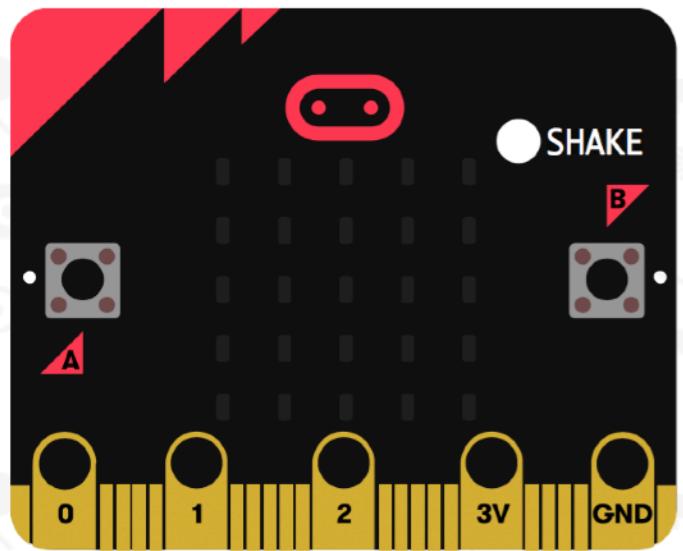
map from low to high 0 low 0 high 4

pick random true or false

Download

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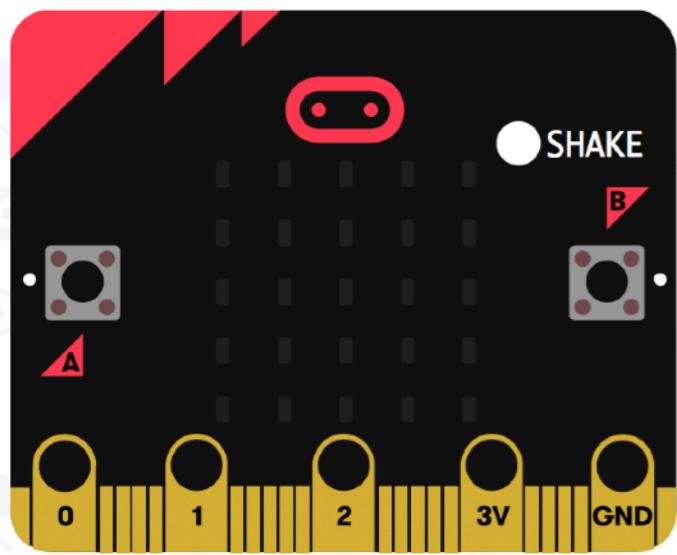
- Search... 🔍
- Basic
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```
on shake
set dice to pick random 1 to 6
```

Download

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Search...

**Basic**

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Input**Music****Led****Radio****Loops****Logic****Variables****Math****Advanced****Functions****Arrays****Text****Game****Images****Basic**

show number 0

show leds

show icon

show string "Hello!"

forever

pause (ms) 100

on start

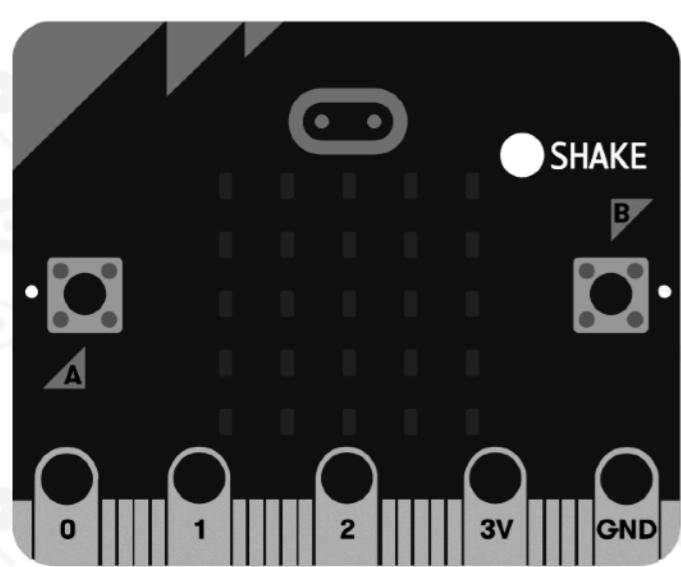
{ } JavaScript

```
show number 0
show leds
show icon
show string "Hello!"
forever
  pause (ms) 100
on start
```

Download

Untitled





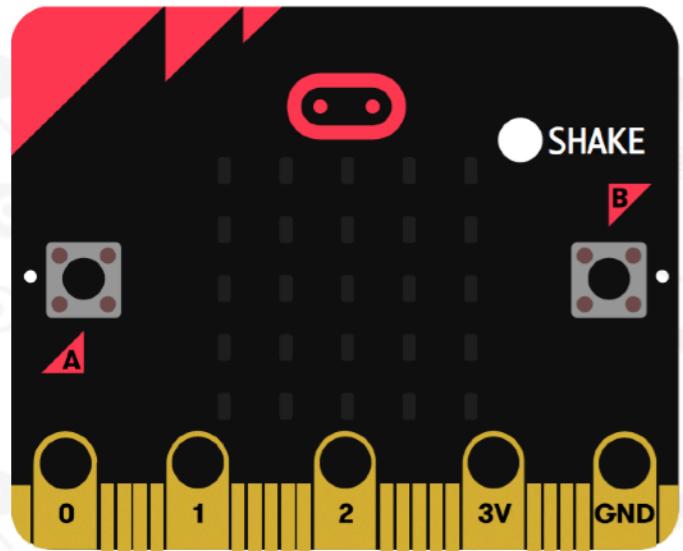
- Search...
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- [Input](#)
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- [Logic](#)
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```
on shake
  set dice to pick random 1 to 6
    show number 0
```

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Untitled

[5](#) [↶](#) [⊖](#) [⊕](#)



Search...



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- ▶ Music
- toggle Led
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- C Loops
- X Logic
- ☰ Variables
- calculator Math
- ▲ Advanced
- f(x) Functions
- [] Arrays
- T Text
- game controller Game
- camera Images
- circle Pins

Variables

Make a Variable...

dice ▾

set dice ▾ to 0

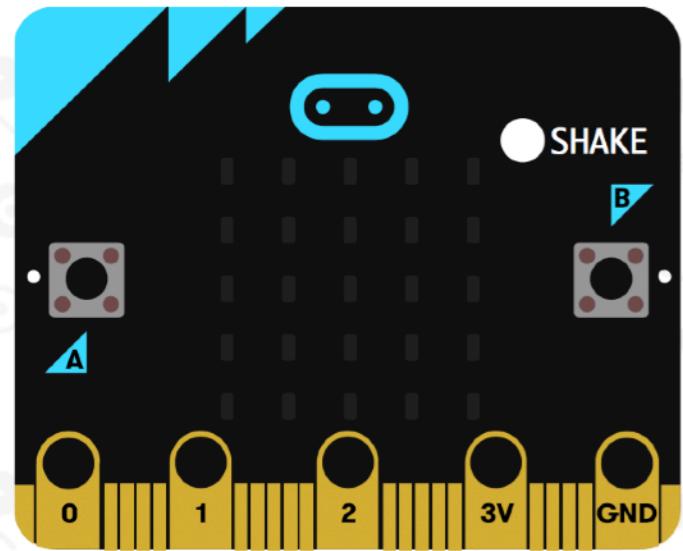
change dice ▾ by 1

pick random 1 to 6

Download

Dice





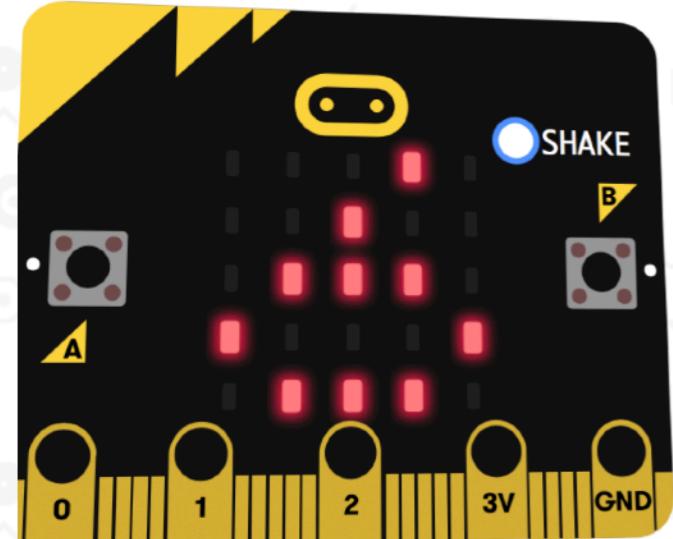
- Search...
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 - Images
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```
on shake ▾  
  set dice ▾ to pick random 1 to 6  
  show number dice ▾
```

Download

Dice





-
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- Arrays
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- Images
- Pins

```
on shake ▾  
  set dice ▾ to pick random 1 to 6  
  show number dice ▾
```

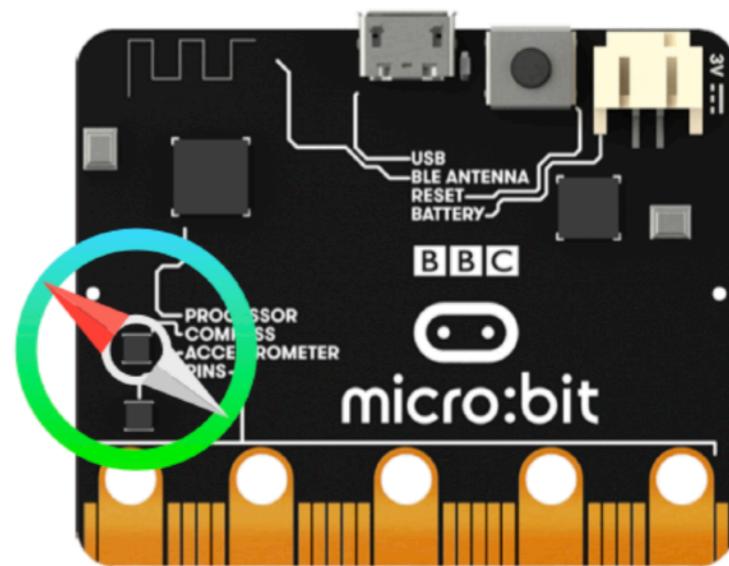
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Dice

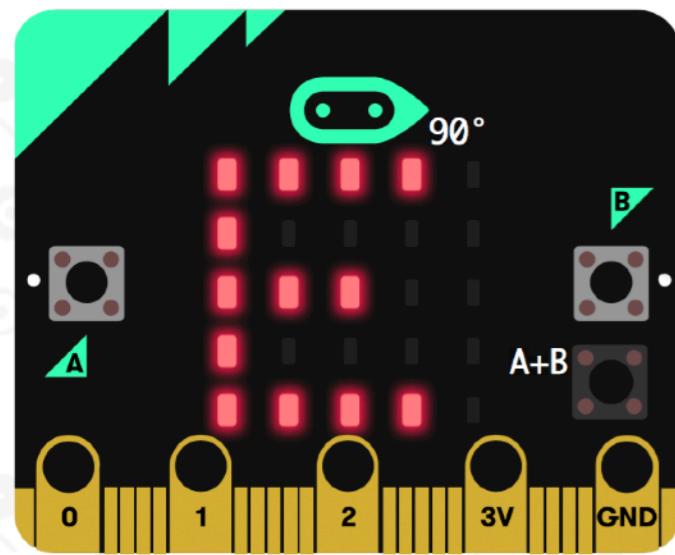


Compass

The compass has to be calibrated before it can be used to detect the earth's magnetic field, pointing out which direction the micro:bit is facing.



Exercise on compass.



Search...



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forever

set degrees to compass heading (°)

if degrees < 45 then

show string "N"

else if degrees < 135 then -

show string "E"

else if degrees < 225 then -

show string "S"

else if degrees < 315 then -

show string "W"

else -

show string "N"

on button A+B pressed

calibrate compass

Download

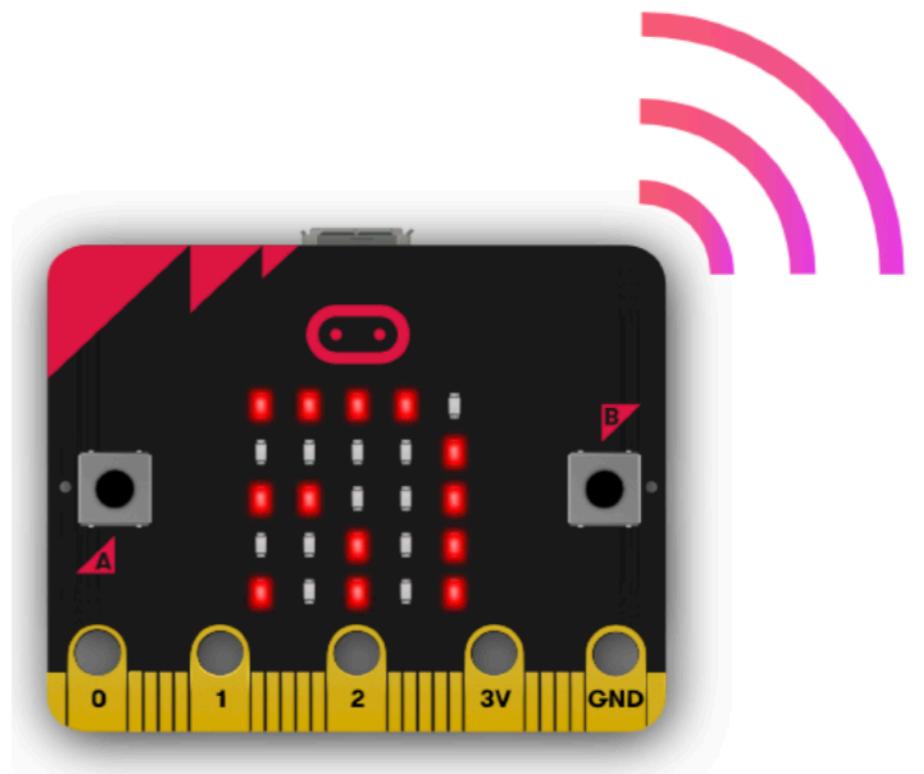
Untitled



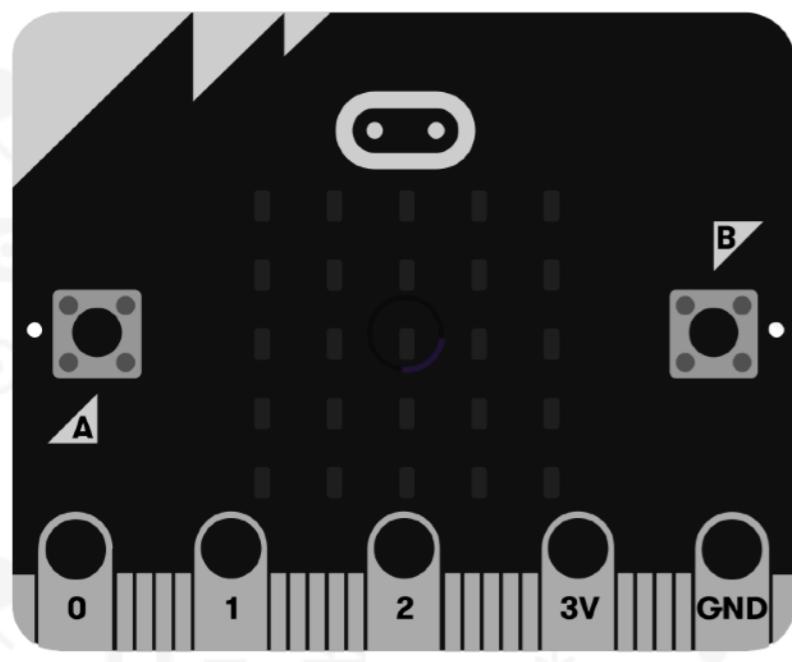
↶ ↻ ⏷ ⏸

Radio

The radio feature enables different micro:bits to communicate wirelessly among each other.



Exercise on radio.



Search...



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Advanced

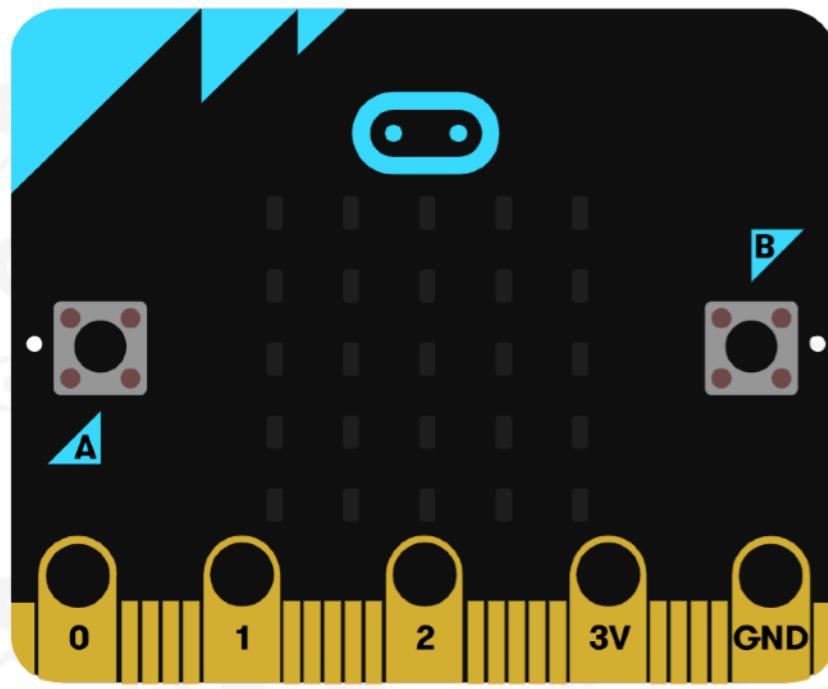
on button A pressed



Download

Untitled





A row of small icons representing various micro:bit functions: a black square, a circular arrow, a speaker, and a camera.

Download

Search...

Basic

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Radio

... more

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Micro Chat

Search...

Radio

radio set group 1

radio send number 0

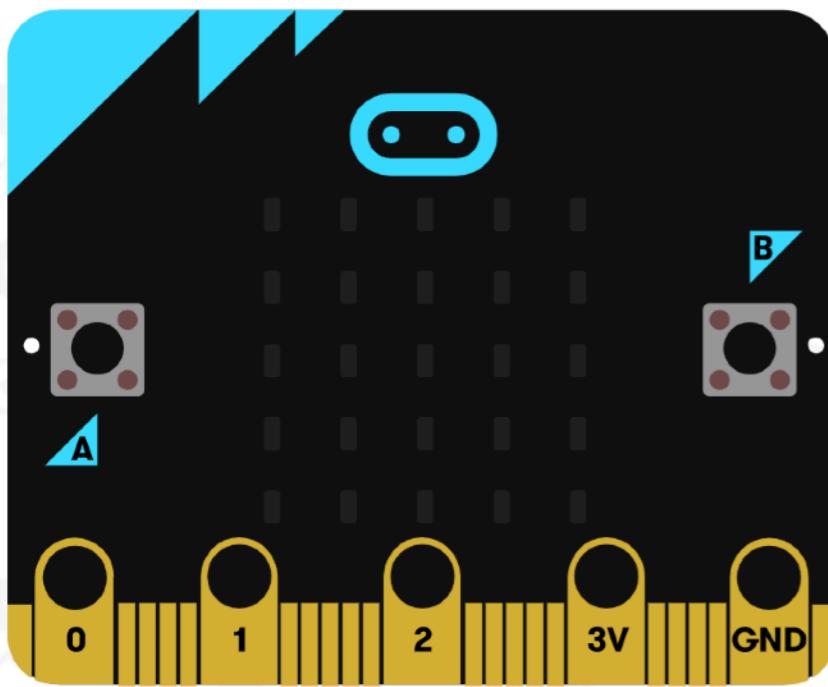
radio send value "name" = 0

radio send string ""

Broadcasts a string along with the device serial number and running time to any connected micro:bit in the group.

on radio received name value

A row of control icons: a left arrow, a right arrow, a minus sign, and a plus sign.



Search...



Basic

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1

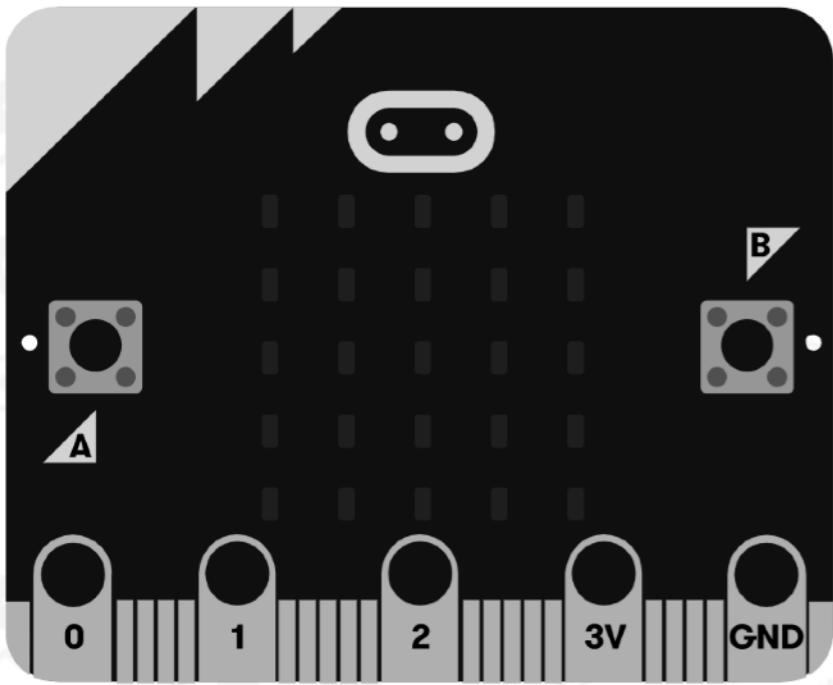
on button A pressed

radio send string " "



Micro Chat



**Download**

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Advanced

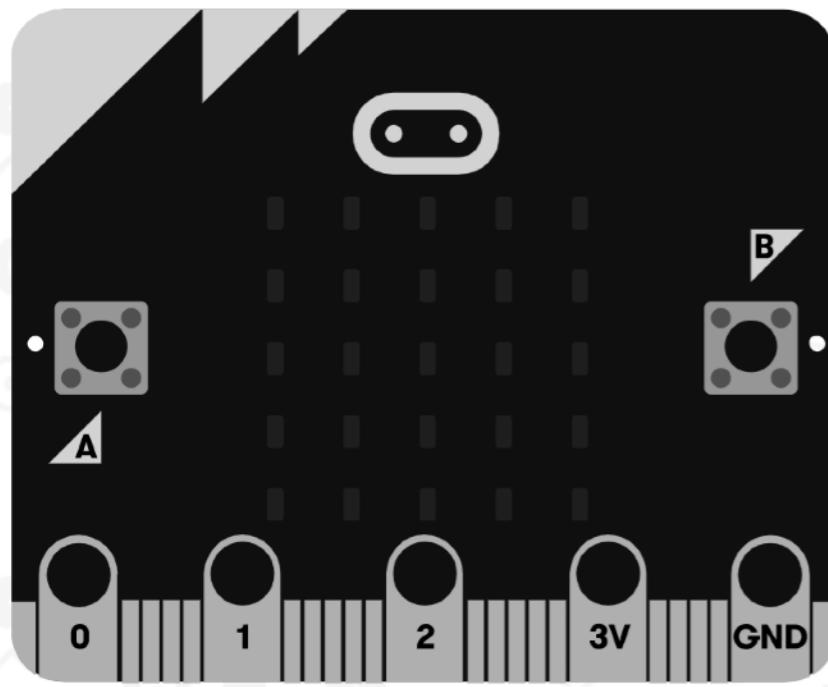
Functions

Q

on button A pressed

radio send string "Good morning!"





Download

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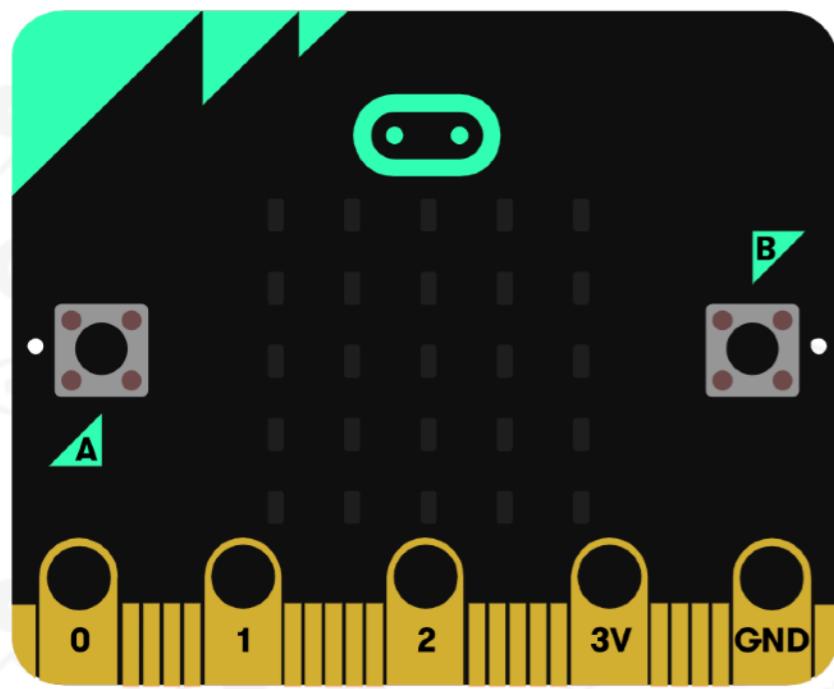
Micro Chat

on button A pressed

radio send string "Good morning!"

on radio received receivedString

radio receive string



Download

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Micro Chat



radio send value "name" = 0

radio send string ""

on radio received receivedNumber

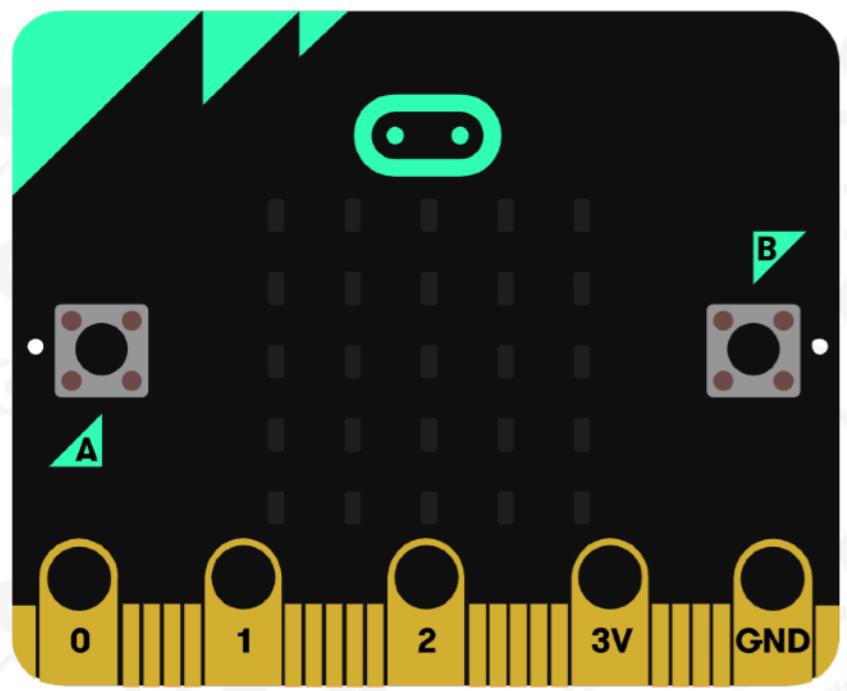
on radio received name value

on radio received receivedString

Registers code to run when the radio receives a string.

received packet signal strength ▾





Search...

**Basic**

... more

Input**Music****Led****Radio****Loops****Logic****Variables****Math****Advanced**

Micro Chat

Basic

show number 0

show leds

show icon

show string "Hello!"

forever

Scroll a number on the screen. If the number fits on the screen (i.e. is a single digit), do not scroll.

A

pressed

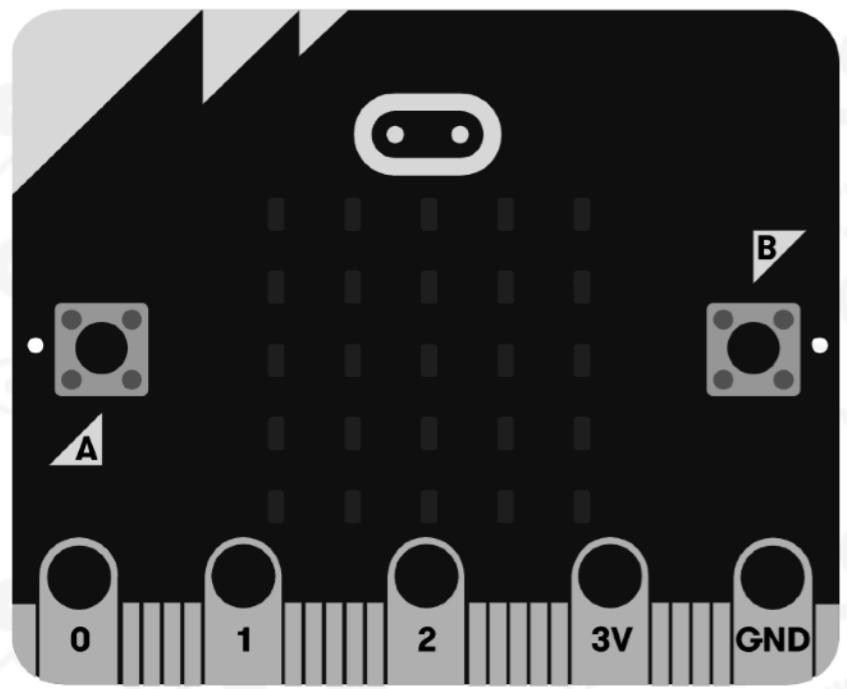
morning!"

B

released

received receivedString

Download



Search...

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1

Q

on button A pressed

radio send string "Good morning!"

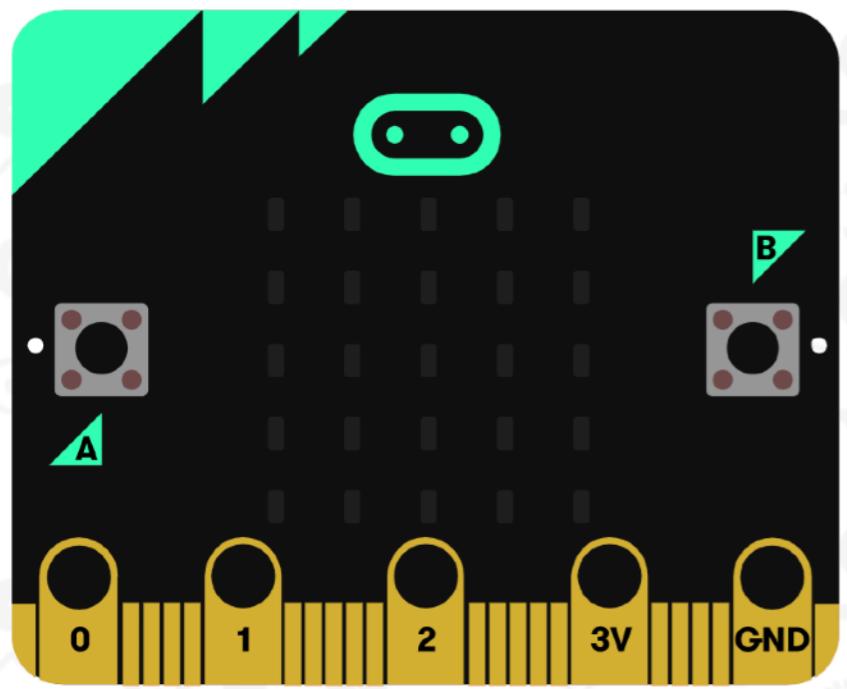
on radio received receivedString

show string receivedString

Download

Micro Chat





Search...

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Functions

1

Q

on button A pressed

radio send string "Good morning!"

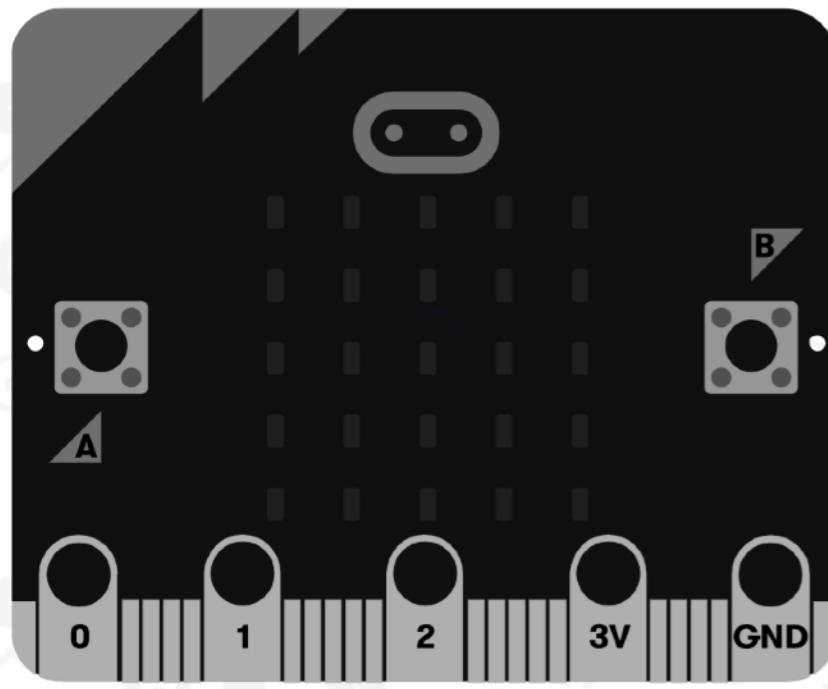
on radio received receivedString

show string "Hello!"

Download

Micro Chat





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Micro Chat

Search...

on button A pressed

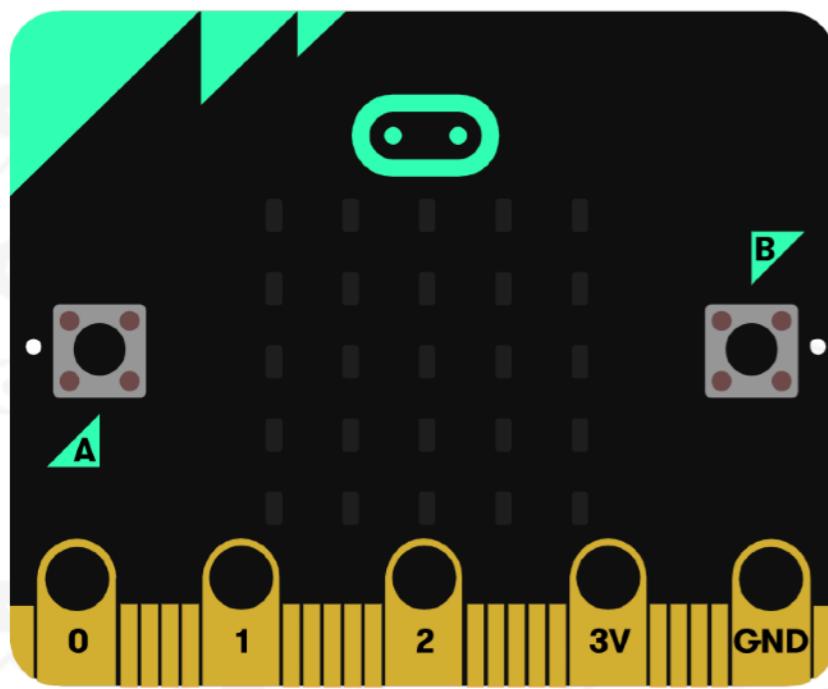
radio send string "Good morning!"

on radio received receivedString

show string receivedString

Download





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Advanced

Q

Radio

radio set group 1

Sets the group id for radio communications. A micro:bit can only listen to one group ID at any time.

radio send value "name" = 0

radio send string ""

on radio received receivedNumber

on radio received name value

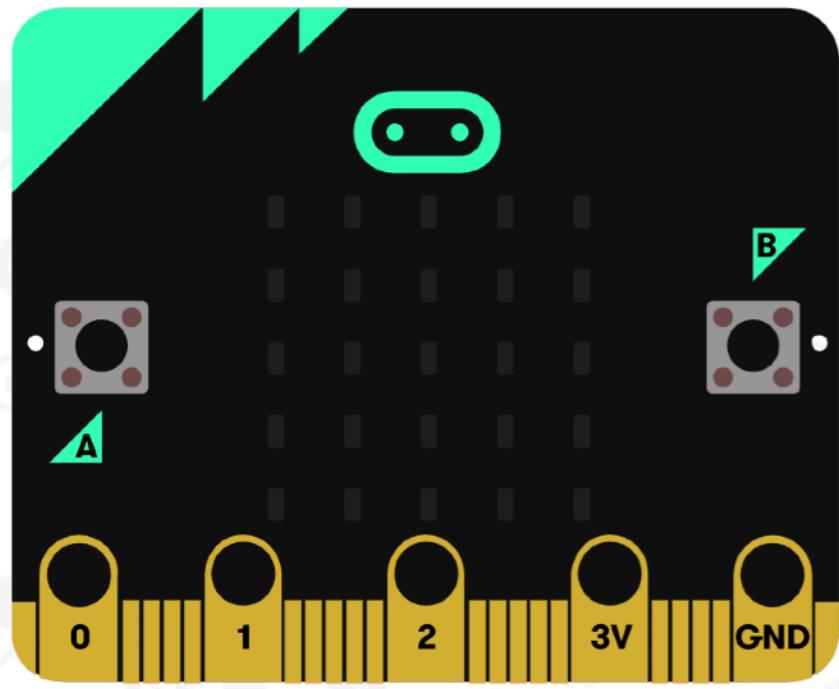
on start



Download

Micro Chat





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Q

on button A pressed

radio send string "Good morning!"

on radio received receivedString

show string receivedString

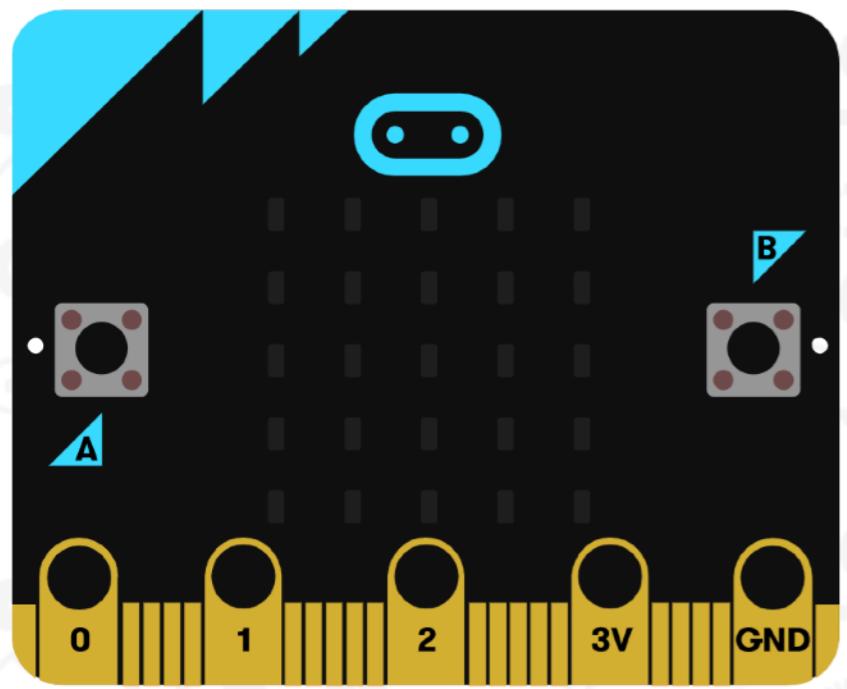
on start

radio set group 1

Download

Micro Chat





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Q

on button A pressed

radio send string "Good morning!"

on start

radio set group 1

on radio received receivedString

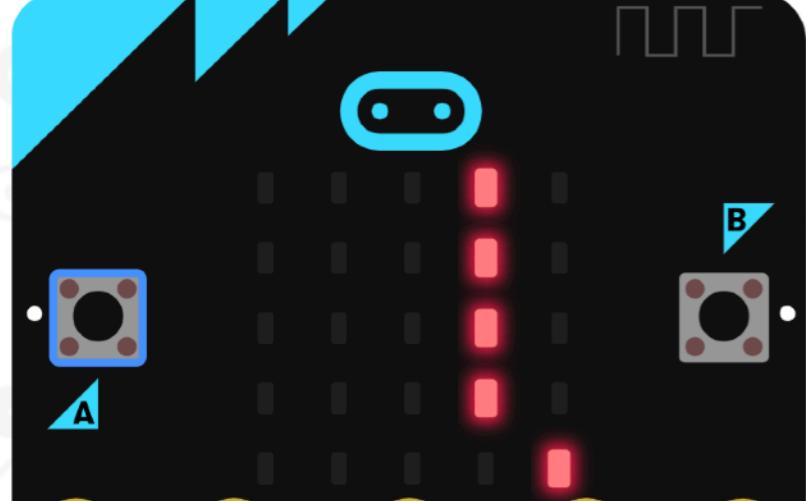
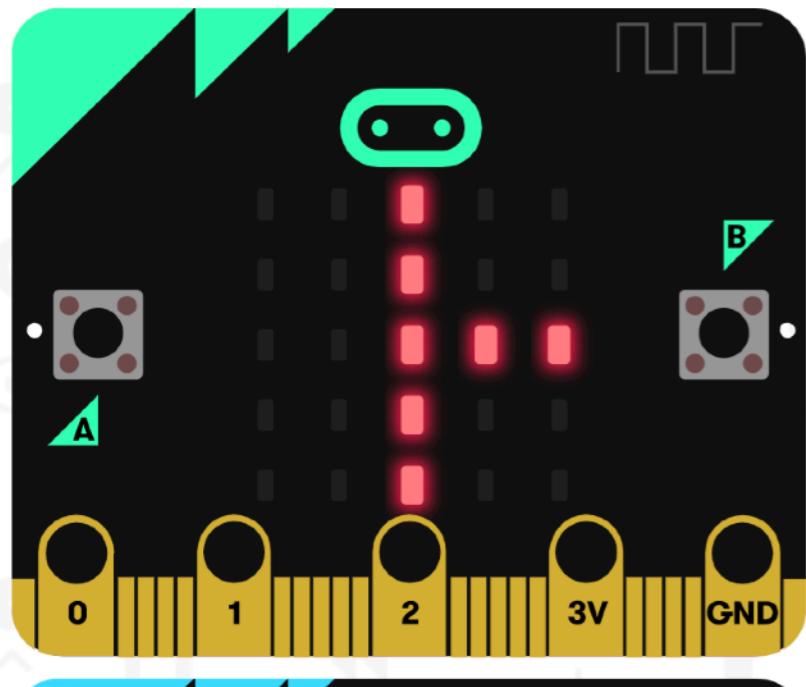
show string receivedString



Download

Micro Chat



**Download**

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Text

Micro Chat



on button A pressed

radio send string "Hello!"

on radio received receivedString

show string receivedString

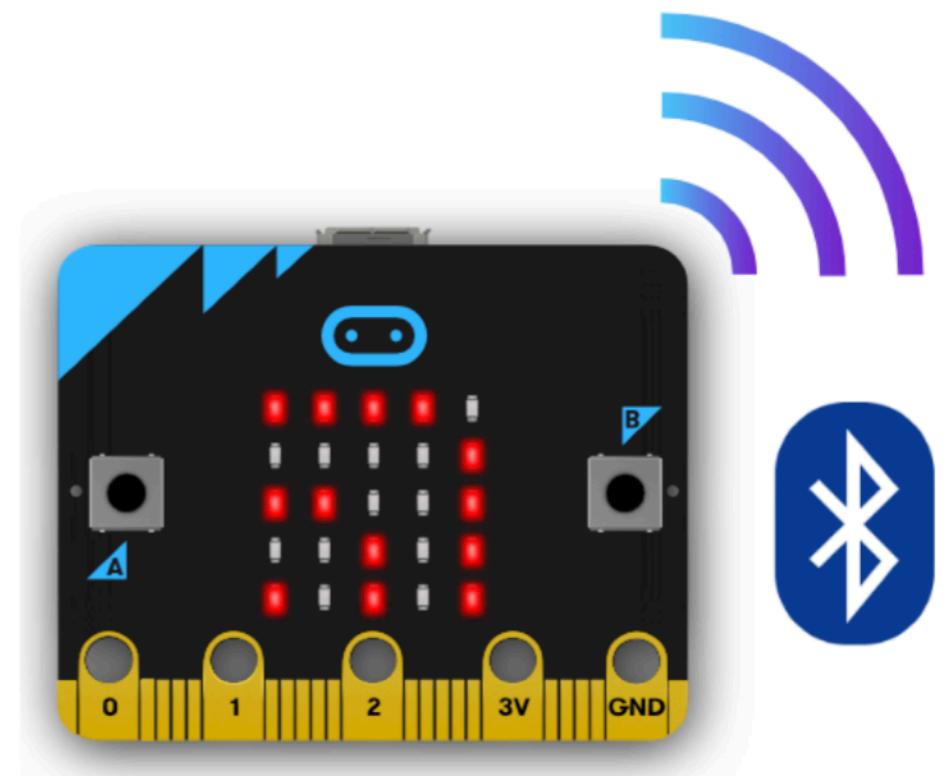
on start

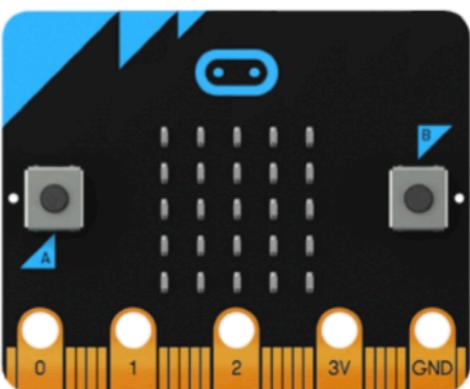
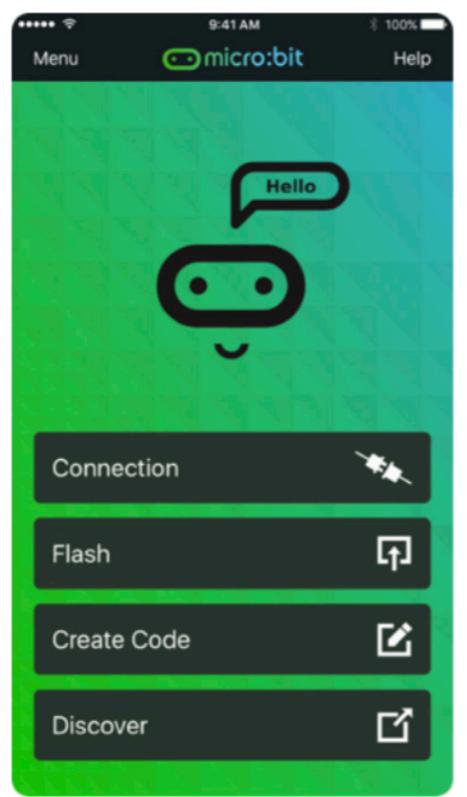
radio set group 1



Bluetooth

The BLE (Bluetooth Low Energy) feature allows the micro:bit to control mobile devices over Bluetooth. Conversely, these devices can also send code and messages to the micro:bit wirelessly.





Apps

Categories ▾

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My Play activity

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micro:bit

Micro:bit Educational Foundation Education

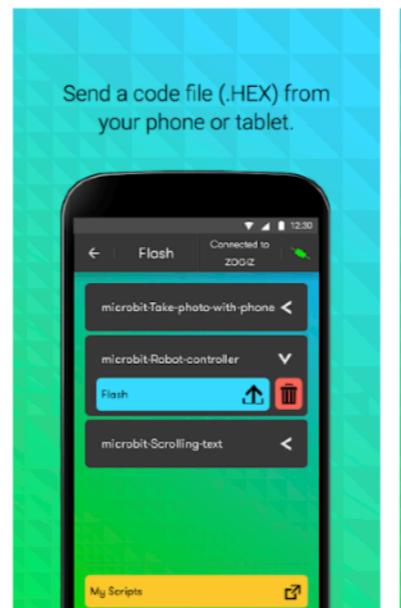
★★★★★ 577

3+

⚠ You don't have any devices.

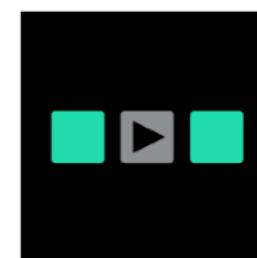
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planet-h.com

'Ableton Link' to 'MIDI-
Clock' Synchronization

★★★★★ HK\$23.00



Practice Player L1
sk lee

Play sheet music from
Midi and MusicXml.- As
an accompaniment or for

★★★★★ HK\$33.00

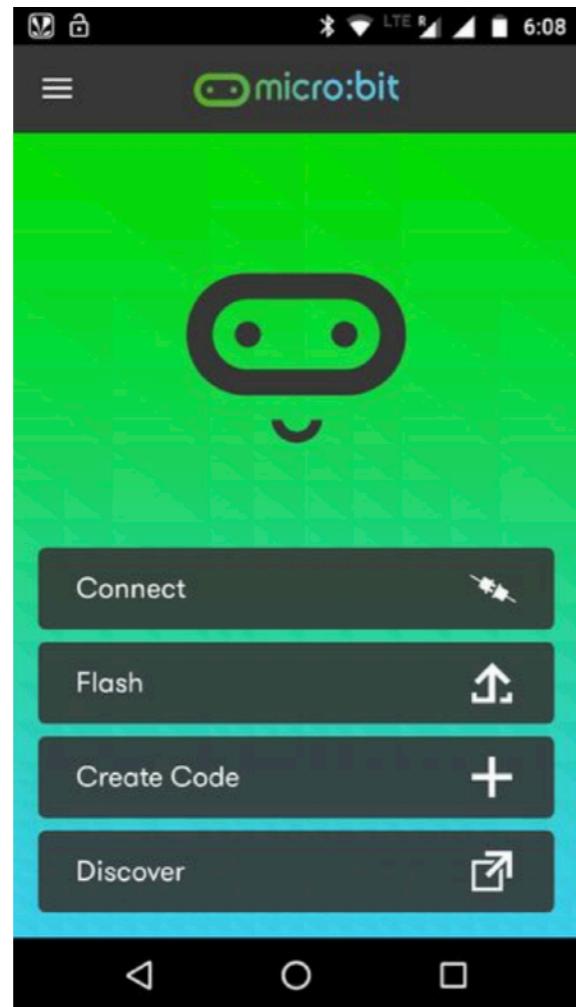


Remuda - USB G
Triton Interactive

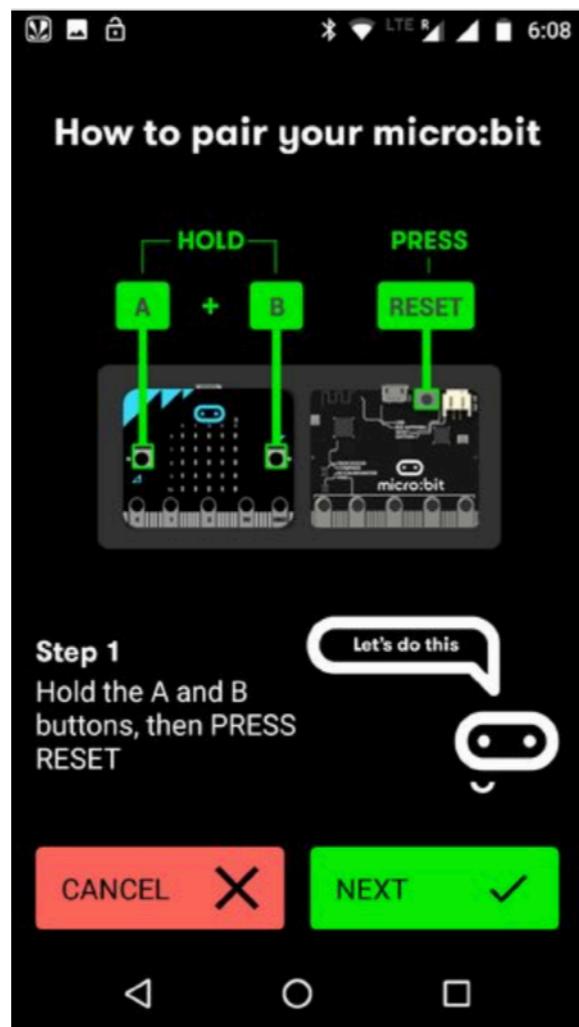
Control/Edit your
compatible USB guitar
amplifier with your tablet

★★★★★ HK\$38.00

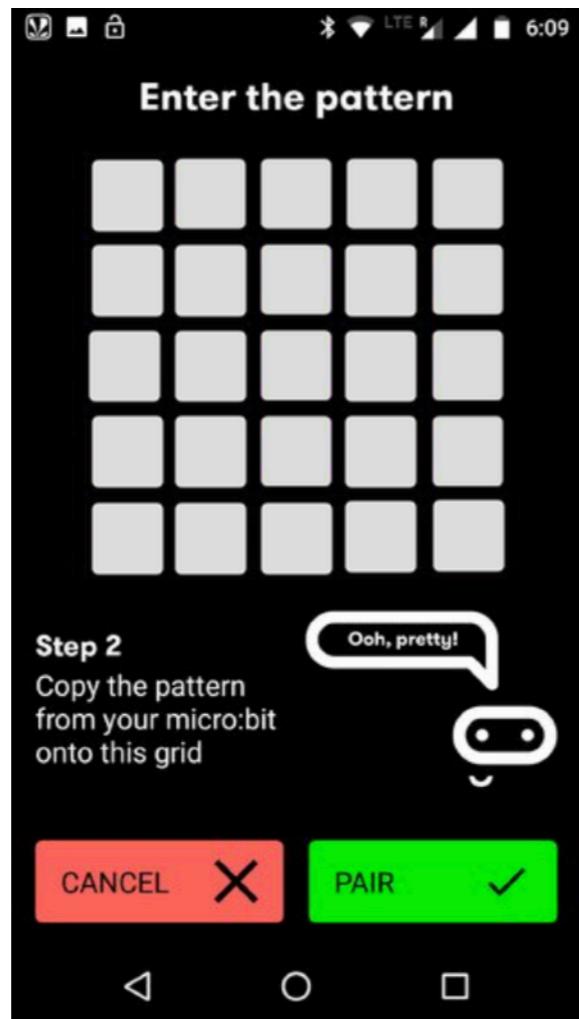
Step1: Download the App.



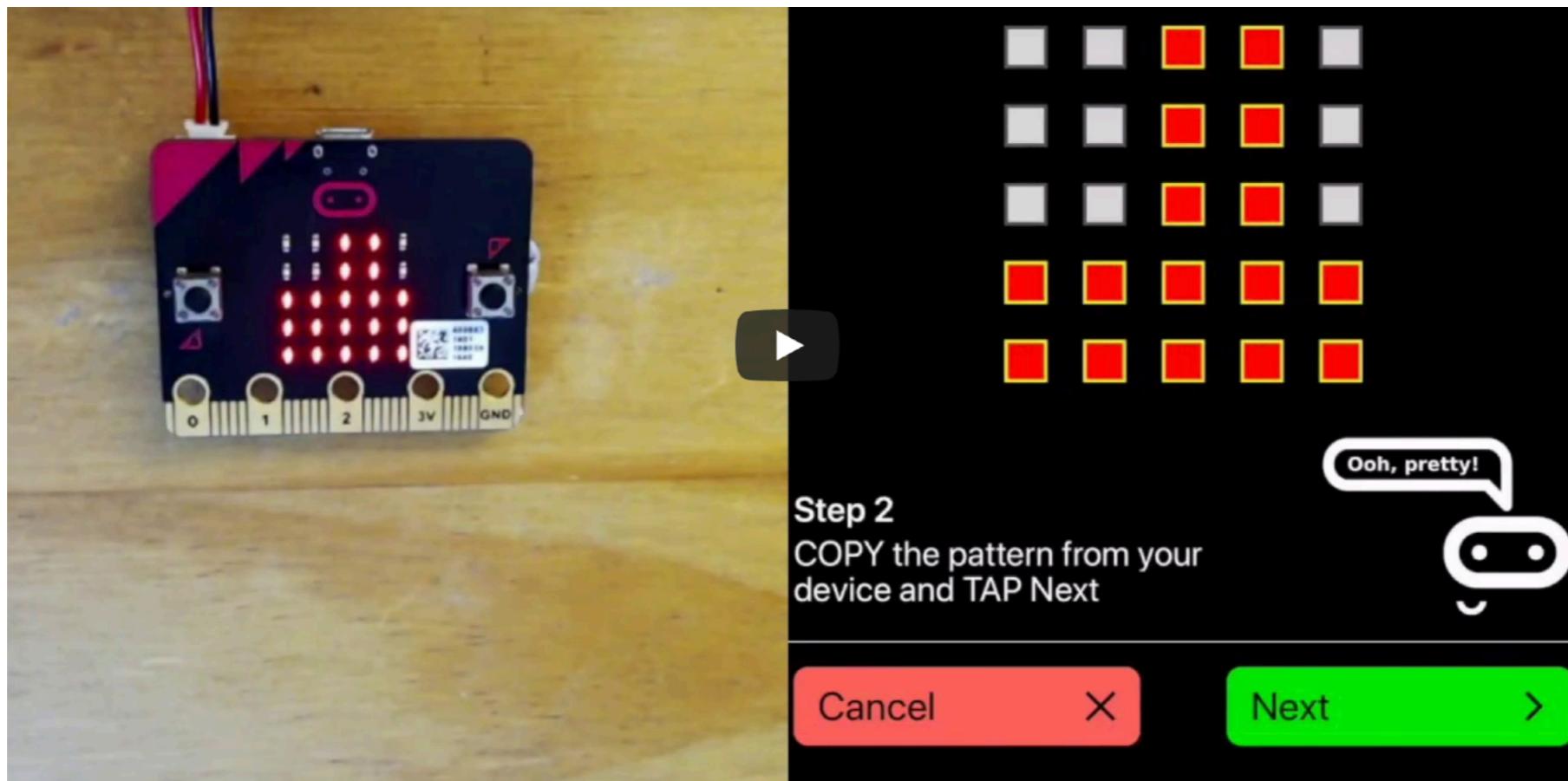
Step 2: Pair up the Micro:bit with the smart phone through Bluetooth.



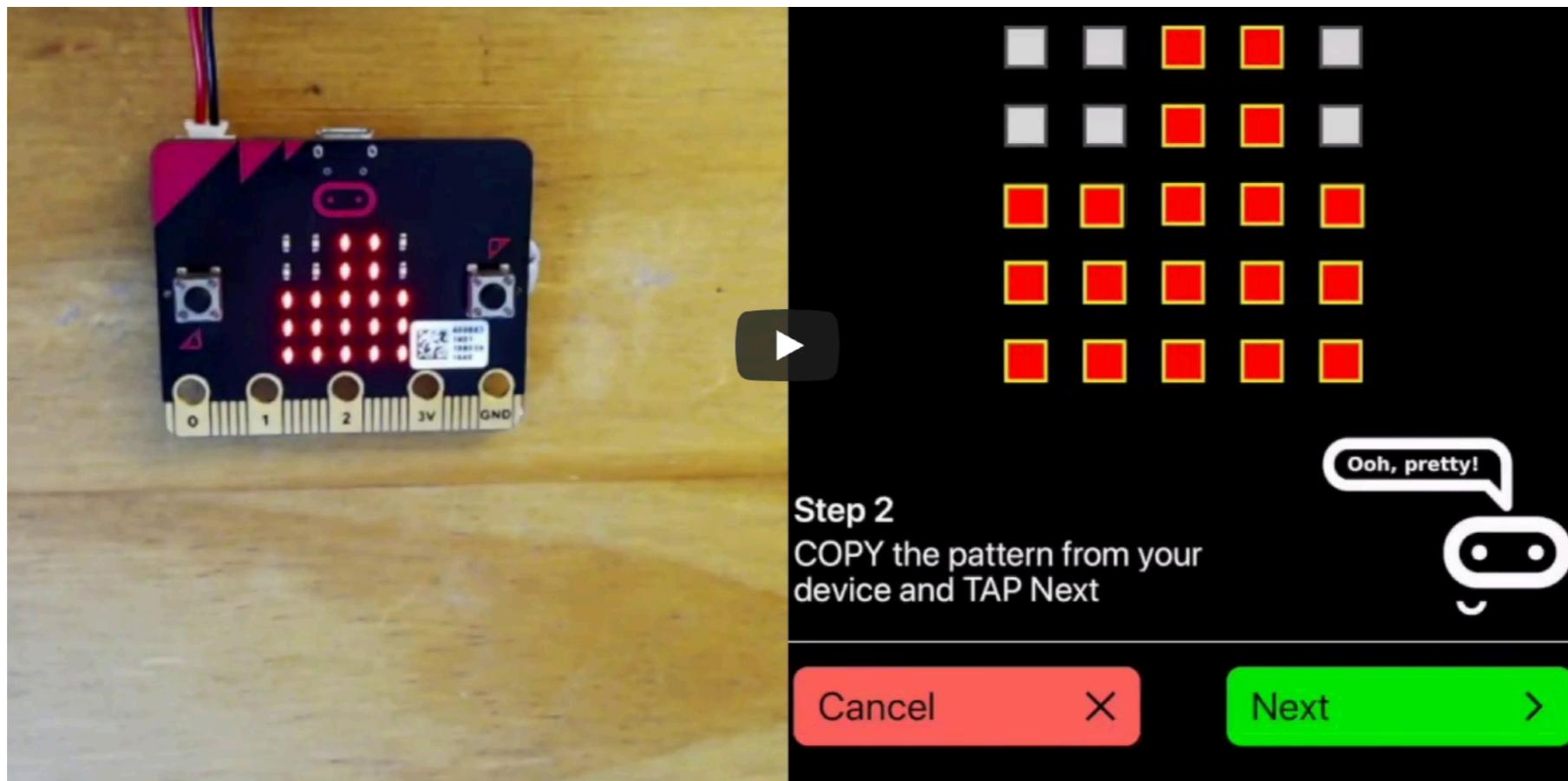
Step 3: Press A, B and RESET buttons simultaneously. Release the RESET button in one second and hold on to the A and B buttons until a pattern show up on the Micro:bit LEDs.



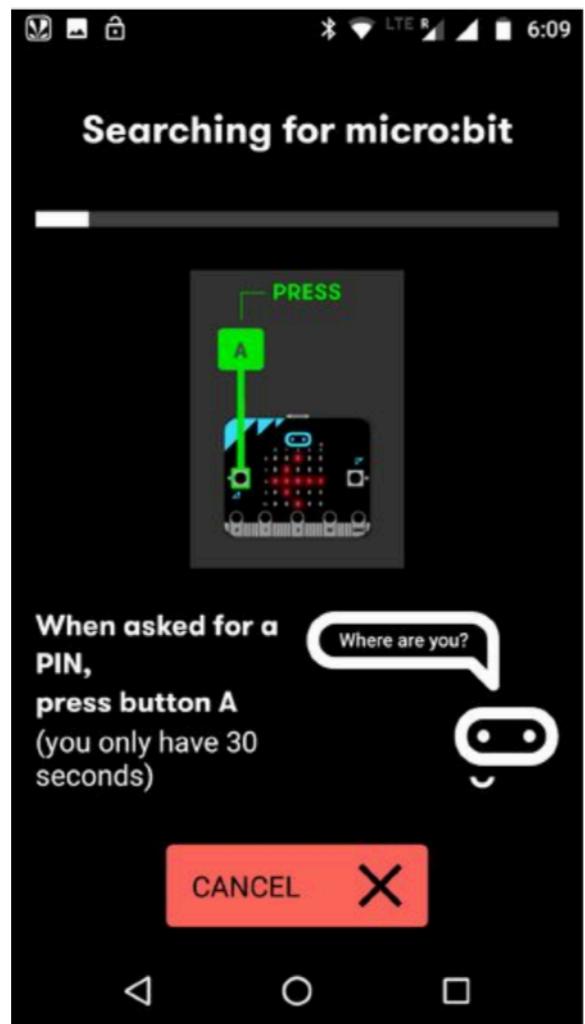
Step 3: Copy the pattern on the Micro:bit and enter it into the grid space displayed on the app. Once the two patterns become identical, press “PAIR”.



Step 4: Once paired up, hit “Next”.

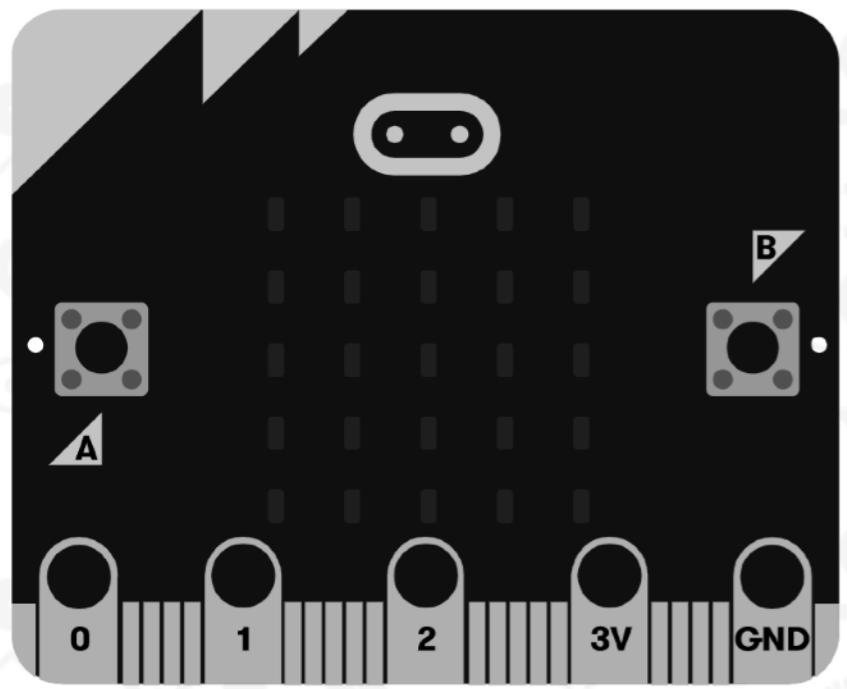


Step 4: Once paired up, hit “Next”.



Step 5: Searching and pairing in process.

Exercise on Bluetooth.



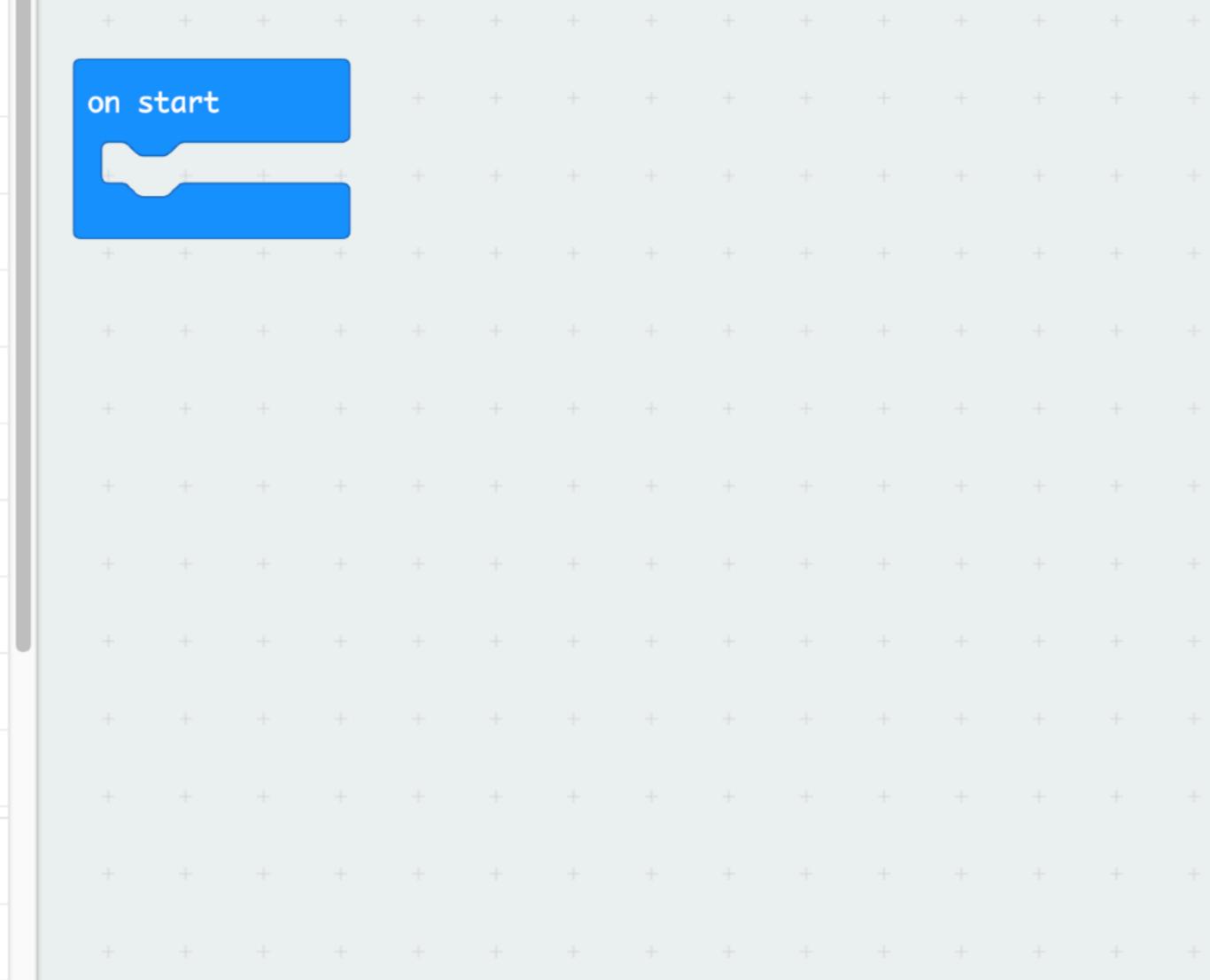
Search...

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- ▢ Led
- Bluetooth
- 📱 Devices
- ⌚ Loops
- ✖ Logic
- ☰ Variables
- 寁 Math
- ▲ Advanced
- ƒ(x) Functions
- ≡ Arrays

blue_tooth1

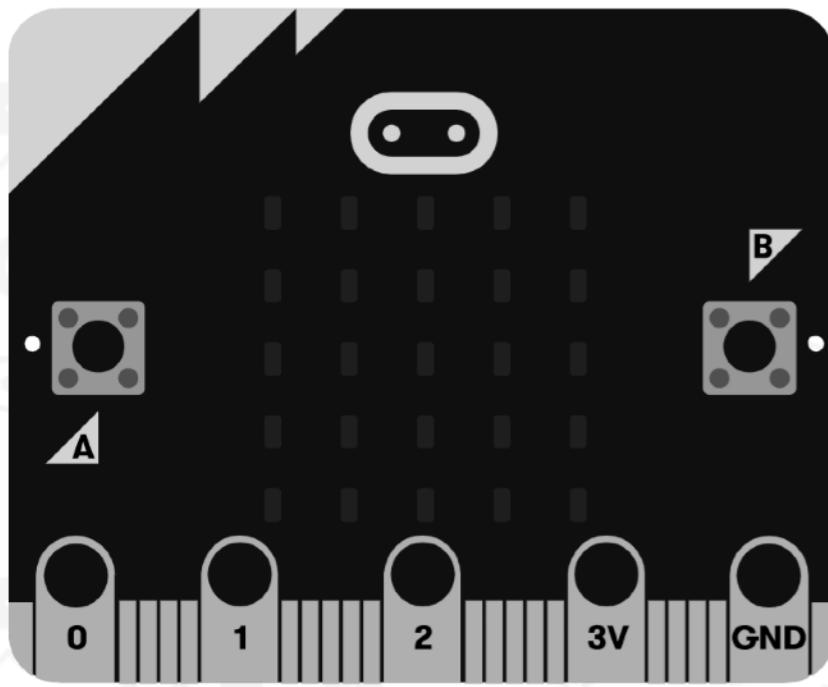


on start



Download





Search...



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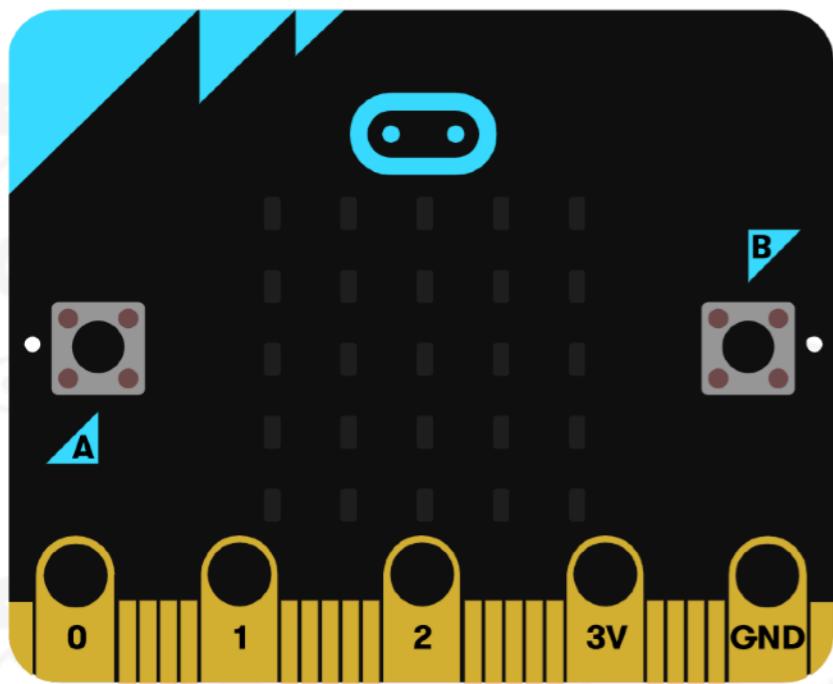
Download

blue_tooth1



on start

bluetooth button service



Search... 🔍

- Basic
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- Loops
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blue_tooth1

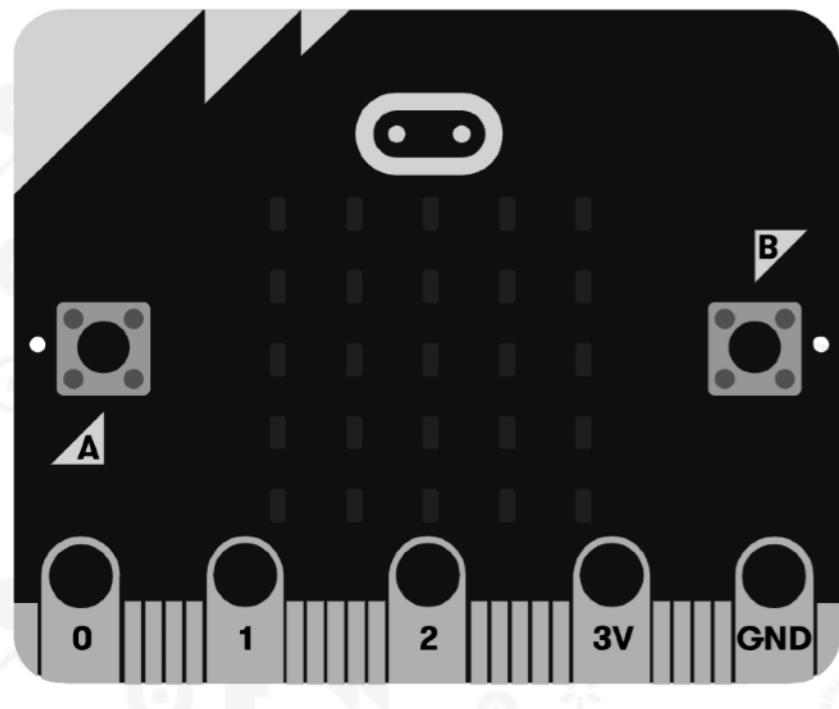
on start

```
on start
  bluetooth button service
  bluetooth accelerometer service
  bluetooth temperature service
  bluetooth led service
  bluetooth temperature service
```

Download

undo redo clear +

This part of the interface shows the code workspace. It features a search bar at the top. To the right is a vertical stack of color-coded categories: Basic (blue), Input (pink), Music (red), Led (purple), Bluetooth (light blue), Devices (teal), Loops (green), Logic (orange), Variables (dark red), Math (magenta), Advanced (dark blue), Functions (dark purple), and Arrays (dark orange). Below these categories is a workspace containing a sequence of blue blocks. The first block is 'on start'. Following it are four 'bluetooth [service]' blocks: 'button', 'accelerometer', 'temperature', and 'led'. Finally, another 'bluetooth temperature service' block is placed below the fourth one. At the bottom of the workspace are standard file operations: 'Download', 'undo', 'redo', 'clear', and a '+' sign.



Search...

- Basic
- Input
- Music
- Led
- Bluetooth
- Devices
- Loops
- Logic
- Variables
- Math
- Advanced
- Functions
- Arrays

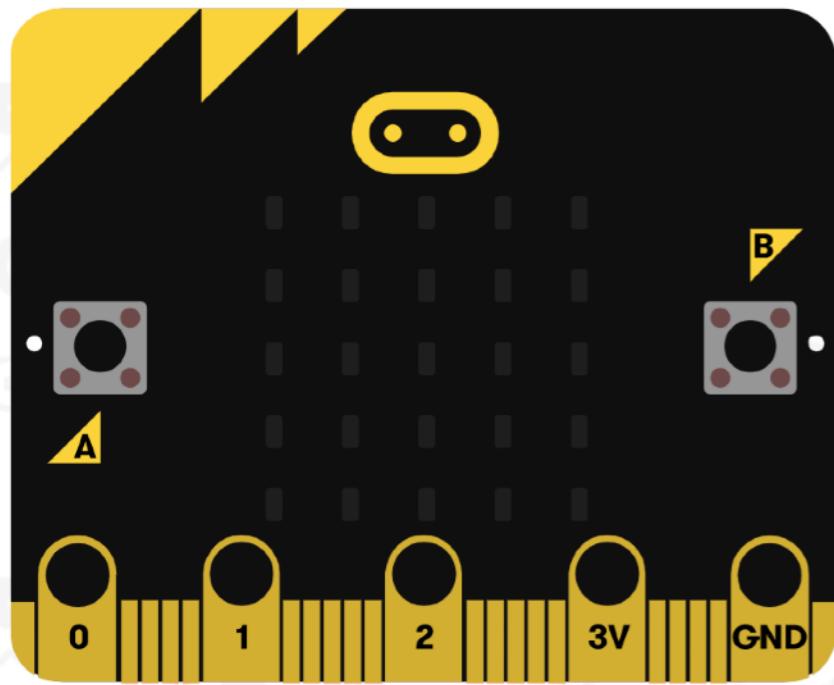


on start

- bluetooth button service
- bluetooth accelerometer service
- bluetooth temperature service
- bluetooth led service
- bluetooth temperature service

on bluetooth connected

- show string "C"



Search...



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blue_tooth1

Download

on start

bluetooth button service

bluetooth accelerometer service

bluetooth temperature service

bluetooth led service

bluetooth temperature service

on bluetooth connected

show string "C"

on bluetooth disconnected

show string "D"

More Fun with Micro:bit Apps

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App Store Preview

This app is only available on the App Store for iOS devices.

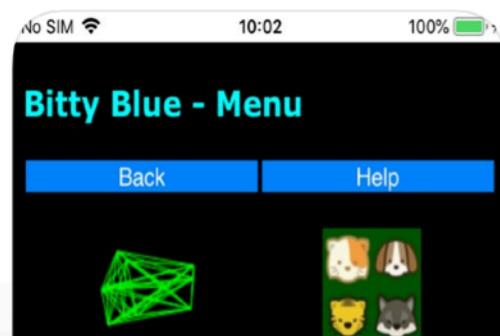


bitty blue 4+

Martin Woolley

Free

Screenshots

[iPhone](#)[iPad](#)

Thank You!