

# **RESEARCHING PROJECT**

## **“ SOIL PH METER DESIGN ”**

**[WEEKLY REPORT ]**

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**BY: NHIM CHANRENGSEY**

**2020-2021**

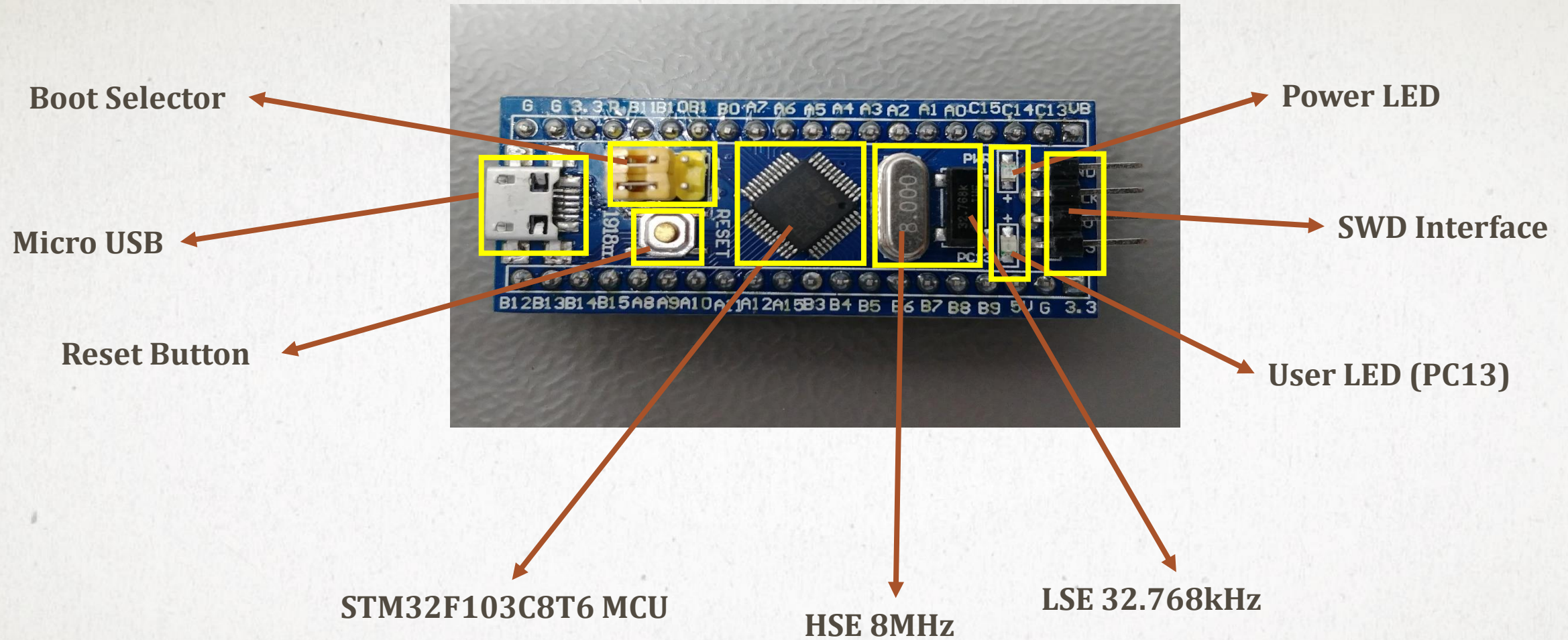
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# OUTLINE

- ❖ STM32F103C8TX
- ❖ STM32CUBEide:
  - Configure
  - Use
- ❖ STM32F1 & Components
- ❖ DHT22 Communication
- ❖ DHT22's Data Transmission



# ➤ STM32F103C8T6(Blue Pill)

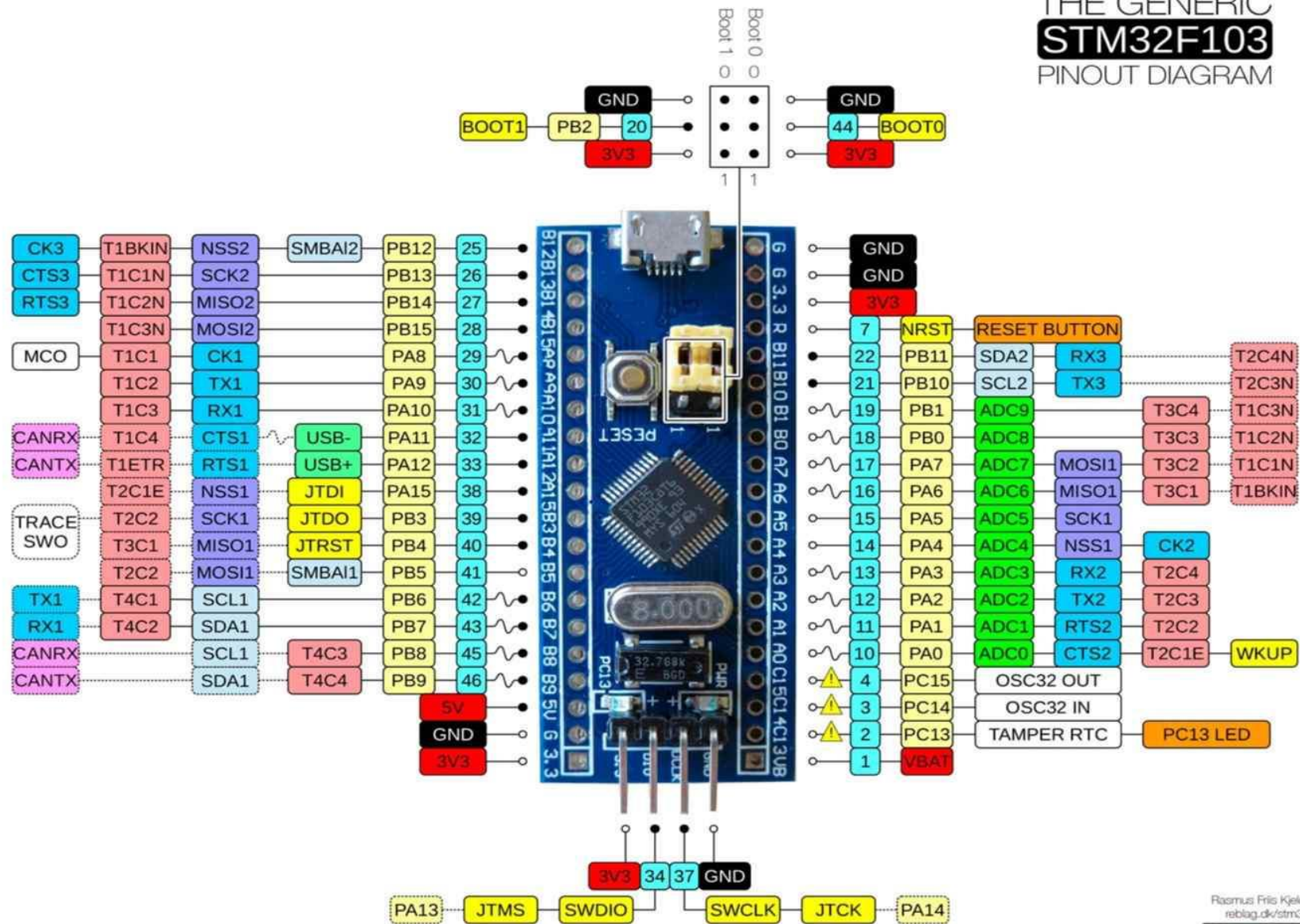




# LEGEND

POWER
GROUND
PHYSICAL PIN
PIN NAME
CONTROL
ANALOG
TIMER & CHANNEL
USART
SPI
I2C
CAN BUS
USB
MISC
BOARD HARDWARE
● 5V tolerant
○ Not 5V tolerant
~ PWM pin
----- Alternate function
⚠ PC13,PC14,PC15: Sink max 3mA, source 0mA, max 2mhz, max 30pF
Absolute MAX 150mA total source/sink for entire CPU
Max ±20mA per pin, ±8mA recommended

## THE GENERIC STM32F103 PINOUT DIAGRAM



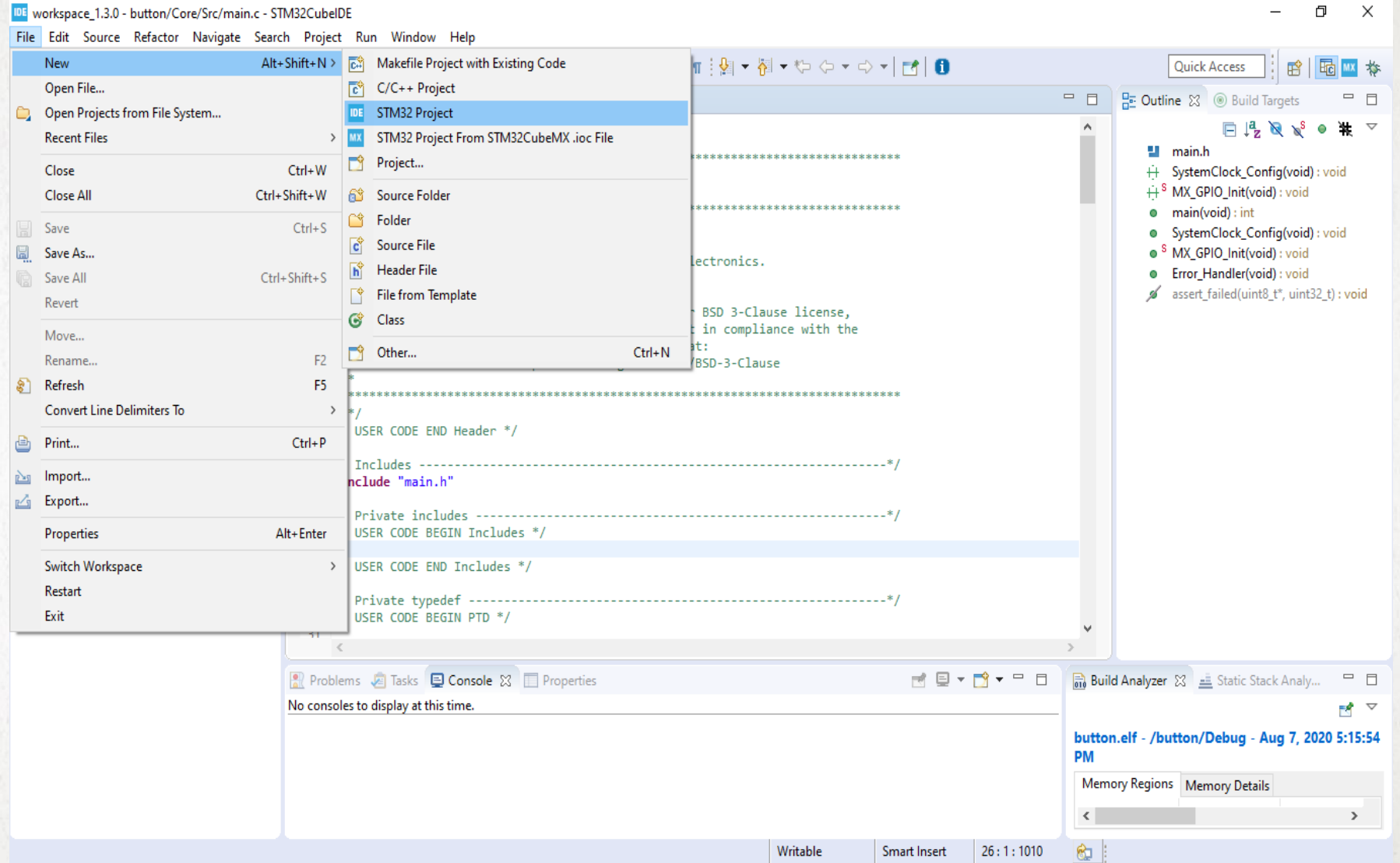
Rasmus Friis Kjeldsen  
reblog.dk/stm32



V1.0

# STM32CUBE IDE

- Configure



IDE STM32 Project

Target Selection

Select STM32 target

IDE

# STM32CUBE IDE

MCU/MPU SelectorBoard SelectorCross Selector

MCU/MPU Filters

★📄🔍🔄

Part Number Search

STM32F103C8

Core>

Series>

Line>

Package>

Other

Price From 1.999 to 1.999

1.999

IO = 37

Eeprom = 0 (Bytes)

Flash = 64 (kBytes)

Features


Block Diagram

Docs & Resources

Datasheet

Buy


★ STM32F103C8



Mainstream Performance line, ARM Cortex-M3 MCU with 64 Kbytes Flash, 72 MHz CPU, motor control, USB and CAN

ACTIVE Active  
Product is in mass production

Unit Price for 10kU (US\$) : 1.999

 LQFP48

MCUs/MPUs List: 1 item

+ Display similar items

Export

*	Part No	Reference	Marketing Status	Unit Price for 10kU (US\$)	Board	Package	Flash	RAM	IO	Freq.
☆	STM32F103C8	STM32F103C8Tx	Active	1.999		LQFP48	64 kBytes	20 kBytes	37	72 MHz

ⓘ < Back Next > Finish Cancel

IDE STM32 Project

Setup STM32 project

Project

Project Name: LED Blink

☒ Use default location

Location: C:/Users/Dell/STM32CubeIDE/workspace\_1.3.0

Browse...

Options

Targeted Language

☒ C ☐ C++

Targeted Binary Type

☒ Executable ☐ Static Library

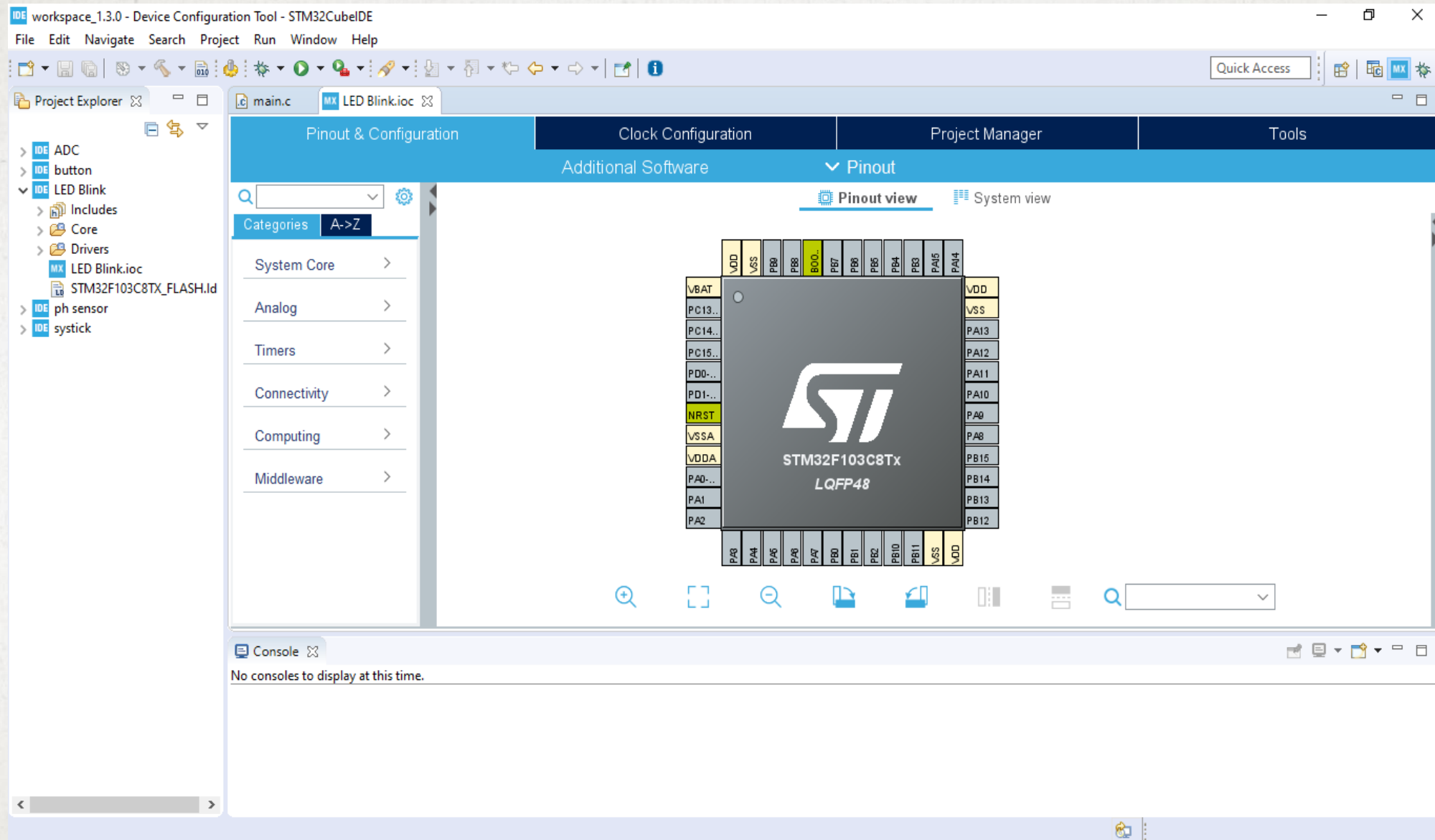
Targeted Project Type

☒ STM32Cube ☐ Empty

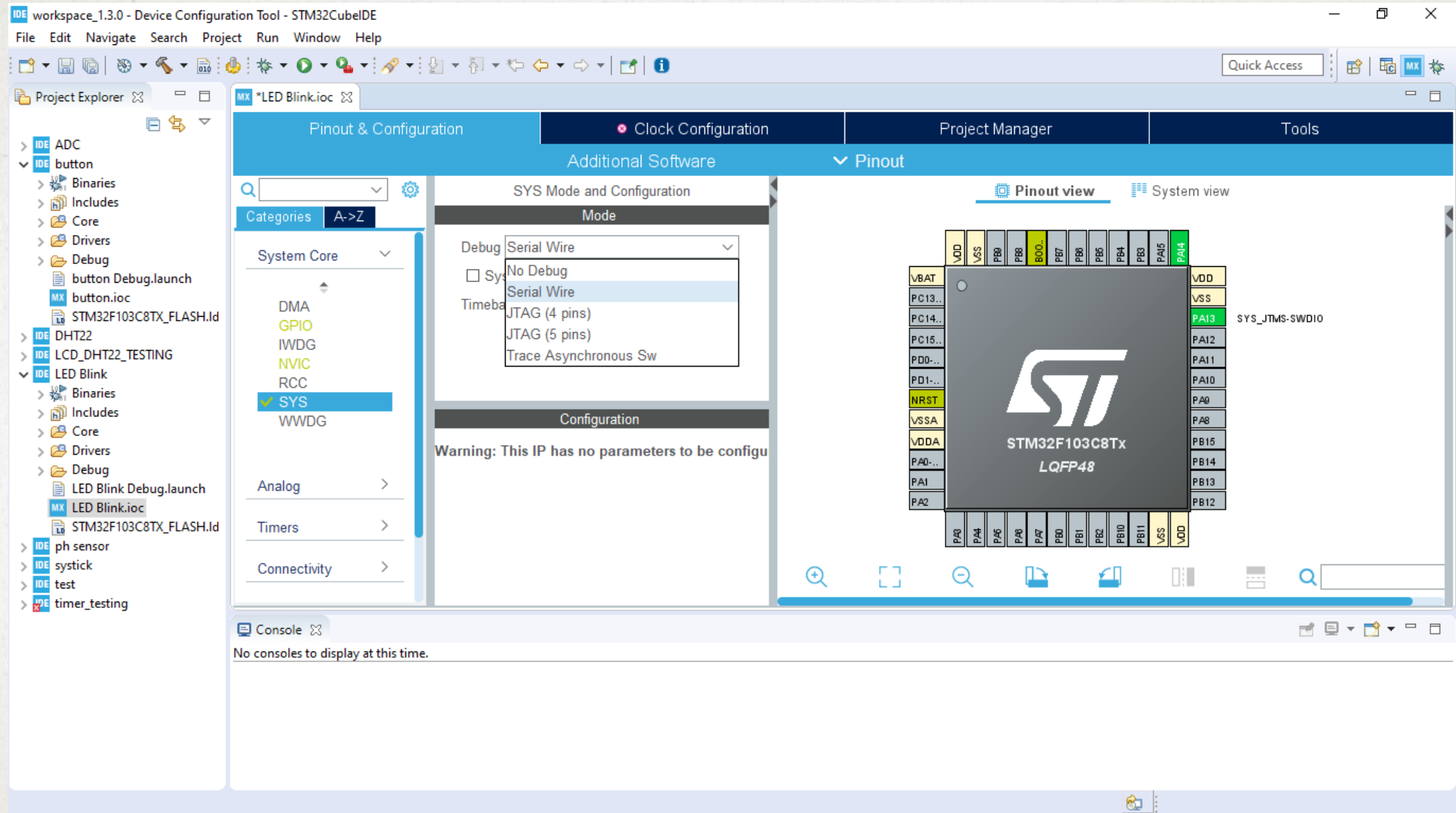
ⓘ < Back Next > Finish Cancel



# STM32CUBE IDE

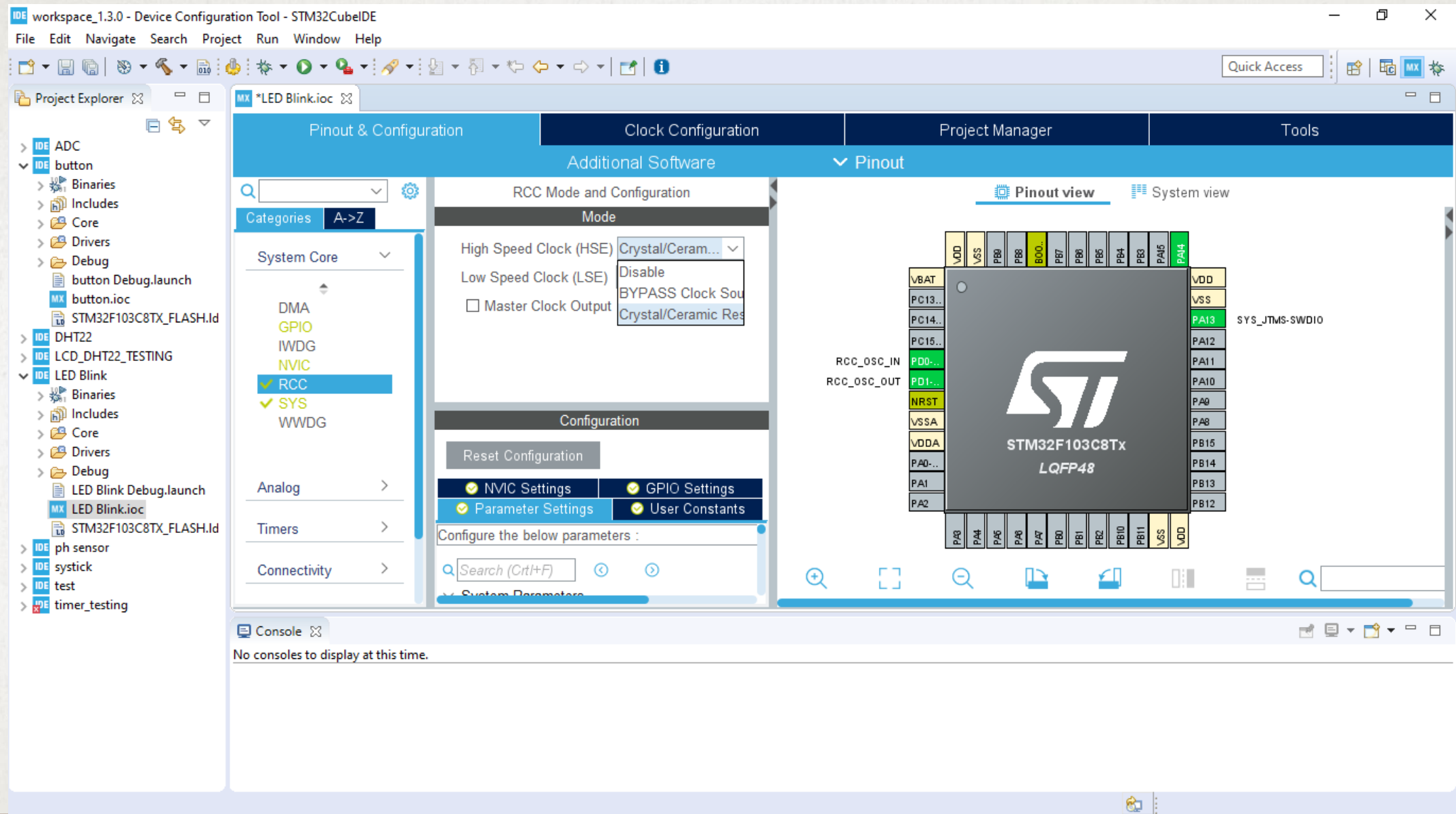


# STM32CUBE IDE





# STM32CUBE IDE



# STM32CUBE IDE

workspace\_1.3.0 - Device Configuration Tool - STM32CubeIDE

File Edit Navigate Search Project Run Window Help

Quick Access

Project Explorer

- > IDE ADC
- > IDE button
  - > Binaries
  - > Includes
  - > Core
  - > Drivers
  - > Debug
    - button Debug.launch
    - button.ioc
    - STM32F103C8TX\_FLASH.Id
- > IDE DHT22
- > IDE LCD\_DHT22\_TESTING
- > IDE LED Blink
  - > Binaries
  - > Includes
  - > Core
  - > Drivers
  - > Debug
    - LED Blink Debug.launch
    - LED Blink.ioc
    - STM32F103C8TX\_FLASH.Id
- > IDE ph sensor
- > IDE systick
- > IDE test
- > IDE timer\_testing

MX \*LED Blink.ioc

Pinout & Configuration Clock Configuration Project Manager Tools

Additional Software

Pinout

Pinout view System view

GPIO Mode and Configuration

Configuration

Group By Peripherals

✓ RCC ✓ SYS

Search Signals

Search (Ctrl+F) ☐ Show only Modified Pins

...	Sig...	GPI...	GPI...	GPI...	Ma...	Use...	Mo...
PD...	RC...	n/a	n/a	n/a	n/a		<input type="checkbox"/>
PD...	RC...	n/a	n/a	n/a	n/a		<input type="checkbox"/>

Select Pins from table to configure them.  
Multiple selection is Allowed.

PC13-TAMPER-RTC

Reset\_State

RTC\_OUT

RTC\_TAMPER

GPIO\_Input

GPIO\_Output

GPIO\_Analog

EVENTOUT

GPIO\_EXTI13

VBAT

VDD

VSS

PA13 SYS\_JTMS-SWDIO

PA12

PA11

PA10

PA9

PA8

PB15

PB14

PB13

PB12

RCC\_OSC\_IN

RCC\_OSC\_OUT

Console

No consoles to display at this time.

# STM32CUBE IDE

workspace\_1.3.0 - Device Configuration Tool - STM32CubeIDE

File Edit Navigate Search Project Run Window Help

Project Explorer

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Pinout & Configuration

Additional Software

Pinout

GPIO Mode and Configuration

Configuration

Group By Peripherals

Categories A-Z

System Core

- DMA
- GPIO
- IWDG
- NVIC
- ✓ RCC
- ✓ SYS
- WWDG

Analog

Timers

Connectivity

Search Signals

Search (Ctrl+F)

Show only Modified Pins

...	Sig...	GPI...	GPI...	GPI...	Ma...	Use...	Mo...
PD...	RC...	n/a	n/a	n/a	n/a		<input type="checkbox"/>
PD...	RC...	n/a	n/a	n/a	n/a		<input type="checkbox"/>

Select Pins from table to configure them.  
Multiple selection is Allowed.

Pinout view

System view

STM32F103C8Tx

LQFP48

PA15

- Reset\_State
- ADC1\_EXTI15
- ADC2\_EXTI15
- SPI1\_NSS
- SYS\_JTDI
- TIM2\_CH1
- TIM2\_ETR
- GPIO\_Input
- GPIO\_Output
- GPIO\_Analog
- EVENTOUT
- GPIO\_EXTI15

Console

No consoles to display at this time.



# STM32CUBE IDE

workspace\_1.3.0 - Device Configuration Tool - STM32CubeIDE

File Edit Navigate Search Project Run Window Help

Project Explorer

- IDE ADC
- IDE button
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- IDE systick
- IDE test
- IDE timer\_testing

Pinout & Configuration

Additional Software

GPIO Mode and Configuration

Configuration

Group By Peripherals

GPIO RCC SYS

Search Signals

Search (Ctrl+F) ☐ Show only Modified Pins

	Sig...	GPI...	GPI...	GPI...	Ma...	Use...	Mo...
PC...	n/a	Low	Out...	No ...	Low		<input type="checkbox"/>

Select Pins from table to configure them.  
Multiple selection is Allowed.

Pinout view

System view

STM32F103C8Tx LQFP48

GPIO\_Output

RCC\_OSC\_IN

RCC\_OSC\_OUT

VBAT

PC13...

PC14...

PC15...

PD0...

PD1...

NRST

VSSA

VDDA

PA0...

PA1

PA2

VDD

VSS

PB0

PB8

PB7

PB6

PB5

PB4

PB3

PA16

PA14

VDD

VSS

PA13

PA12

PA11

PA10

PA9

PA8

PB15

PB14

PB13

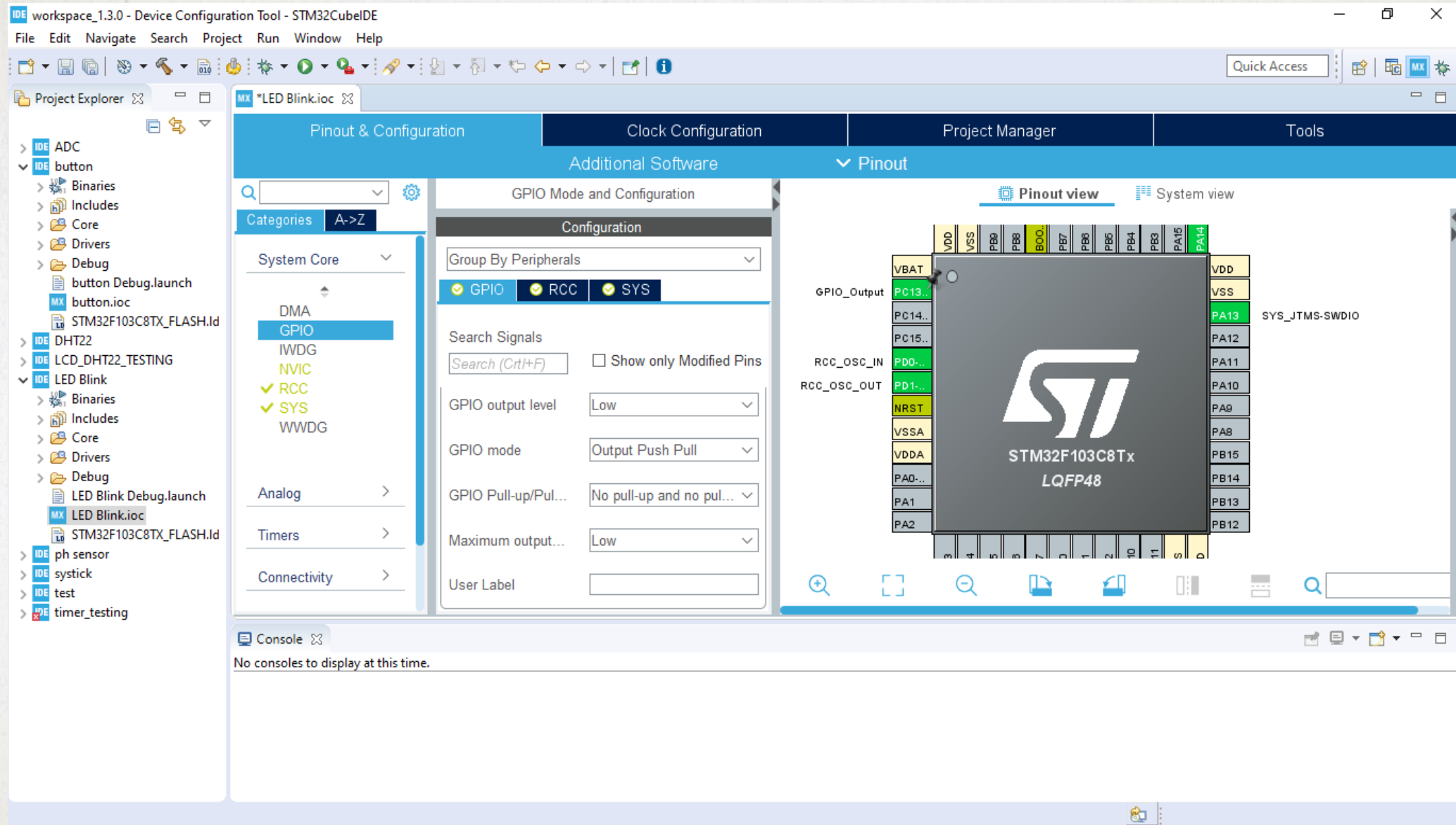
PB12

SYS\_JTMS-SWDIO

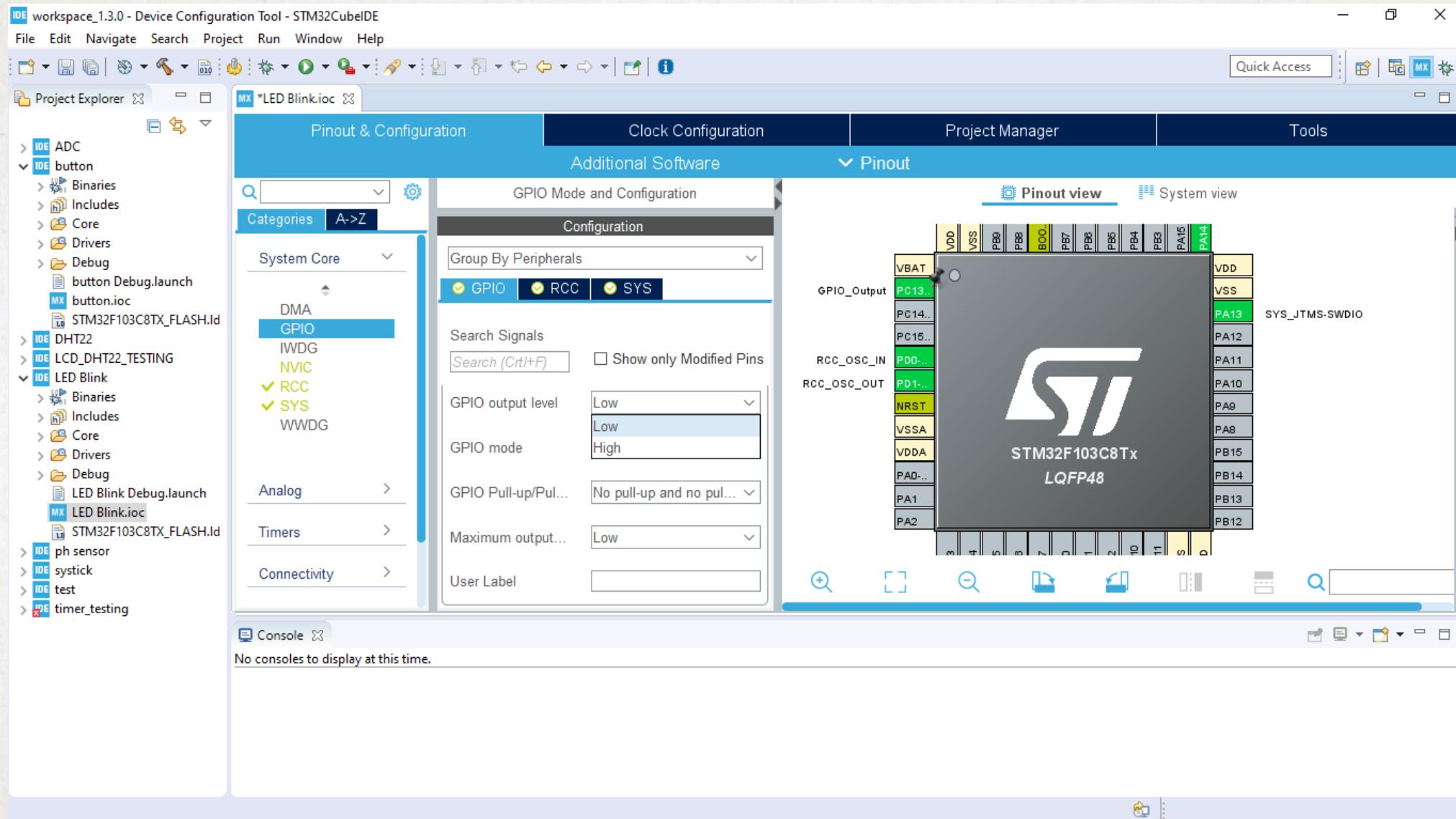
Console

No consoles to display at this time.

# STM32CUBE IDE

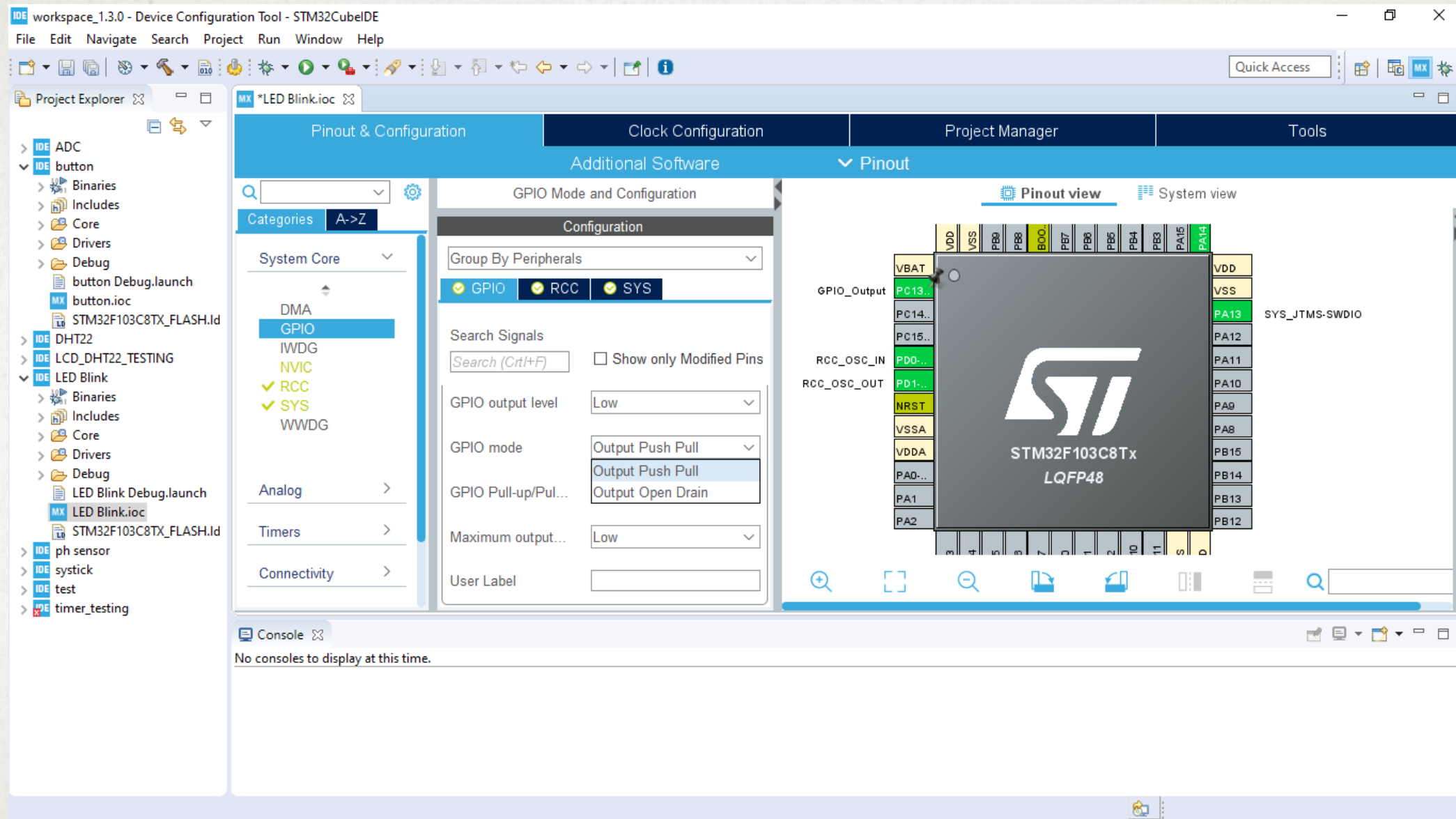


# STM32CUBE IDE

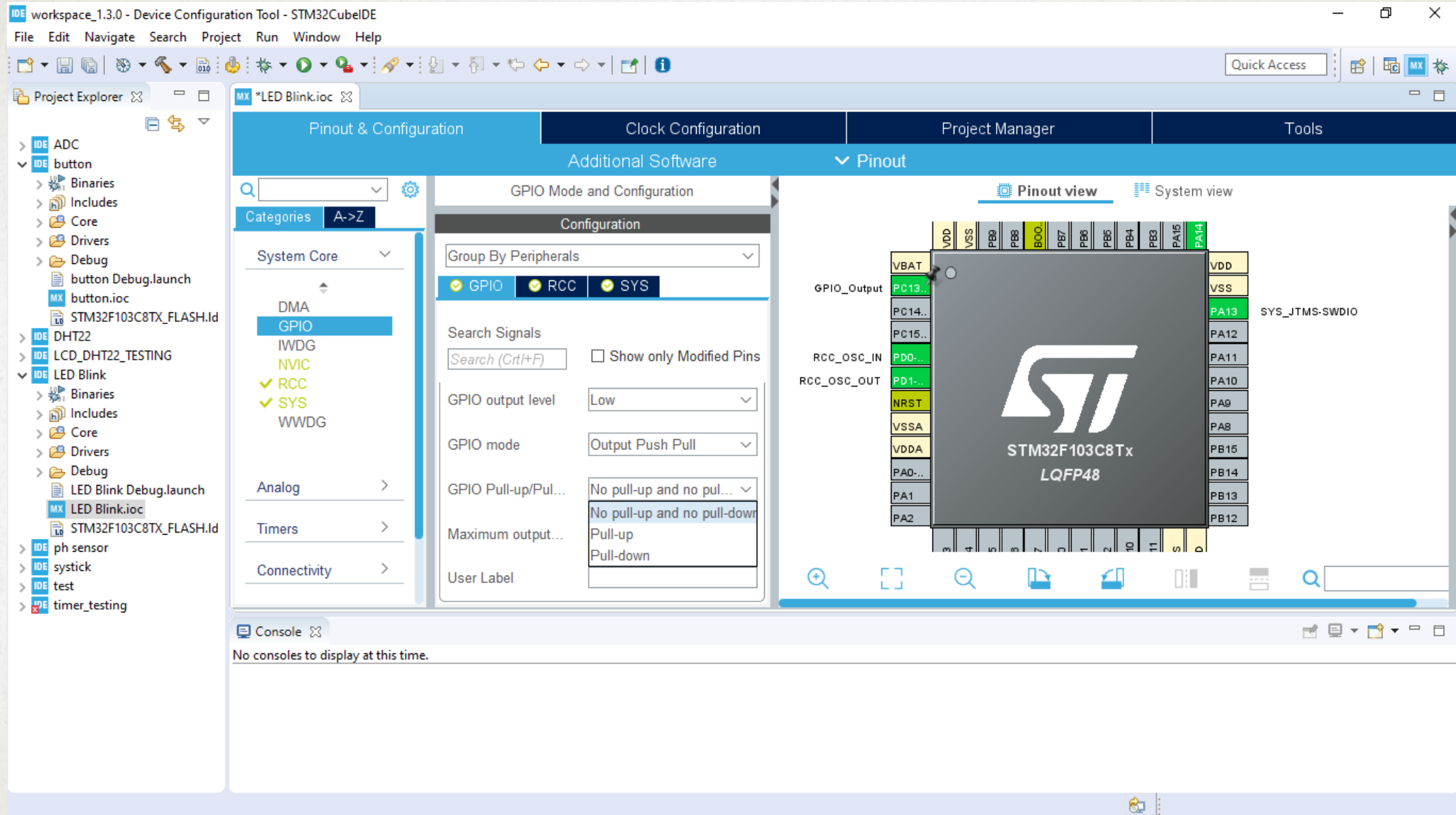




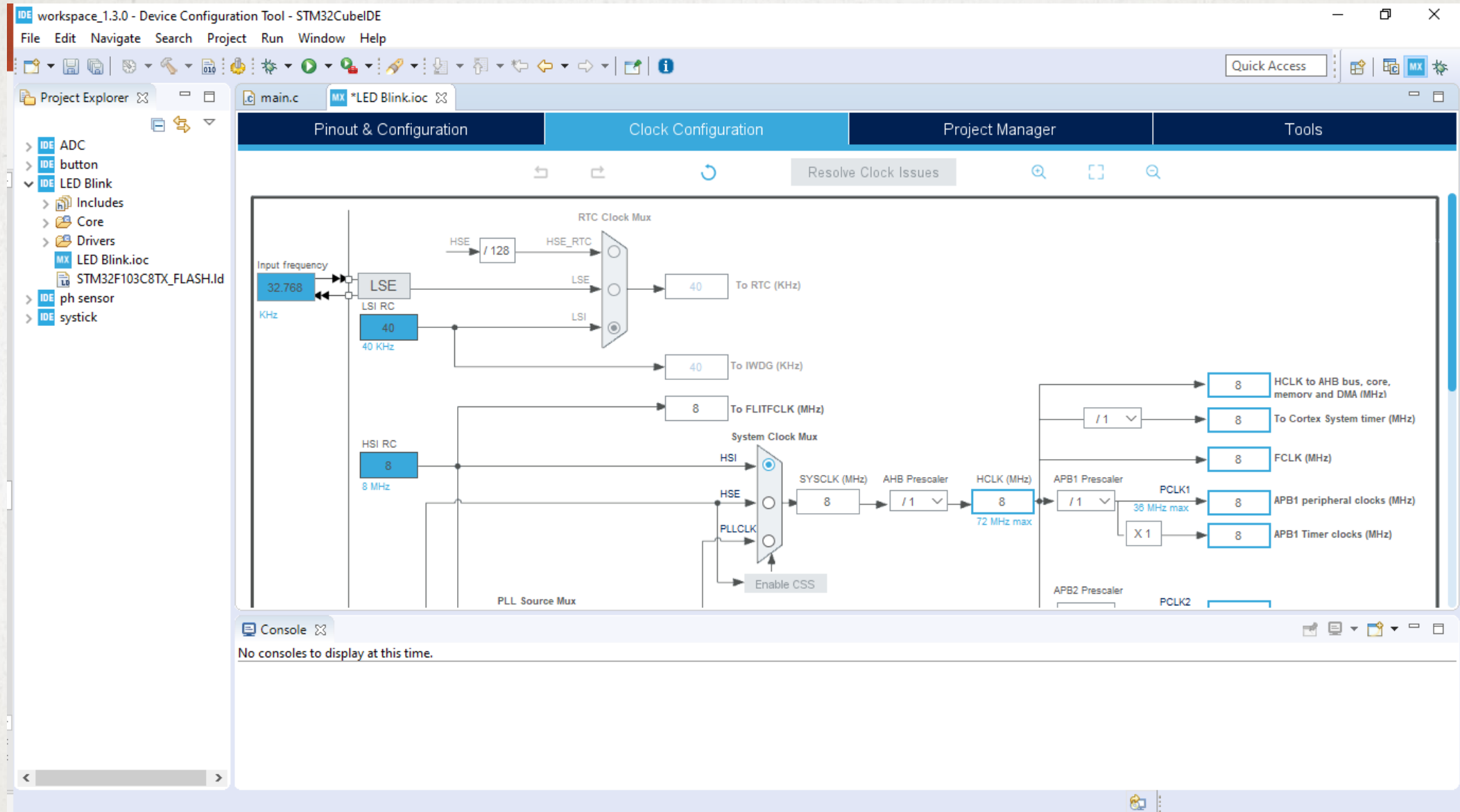
# STM32CUBE IDE



# STM32CUBE IDE

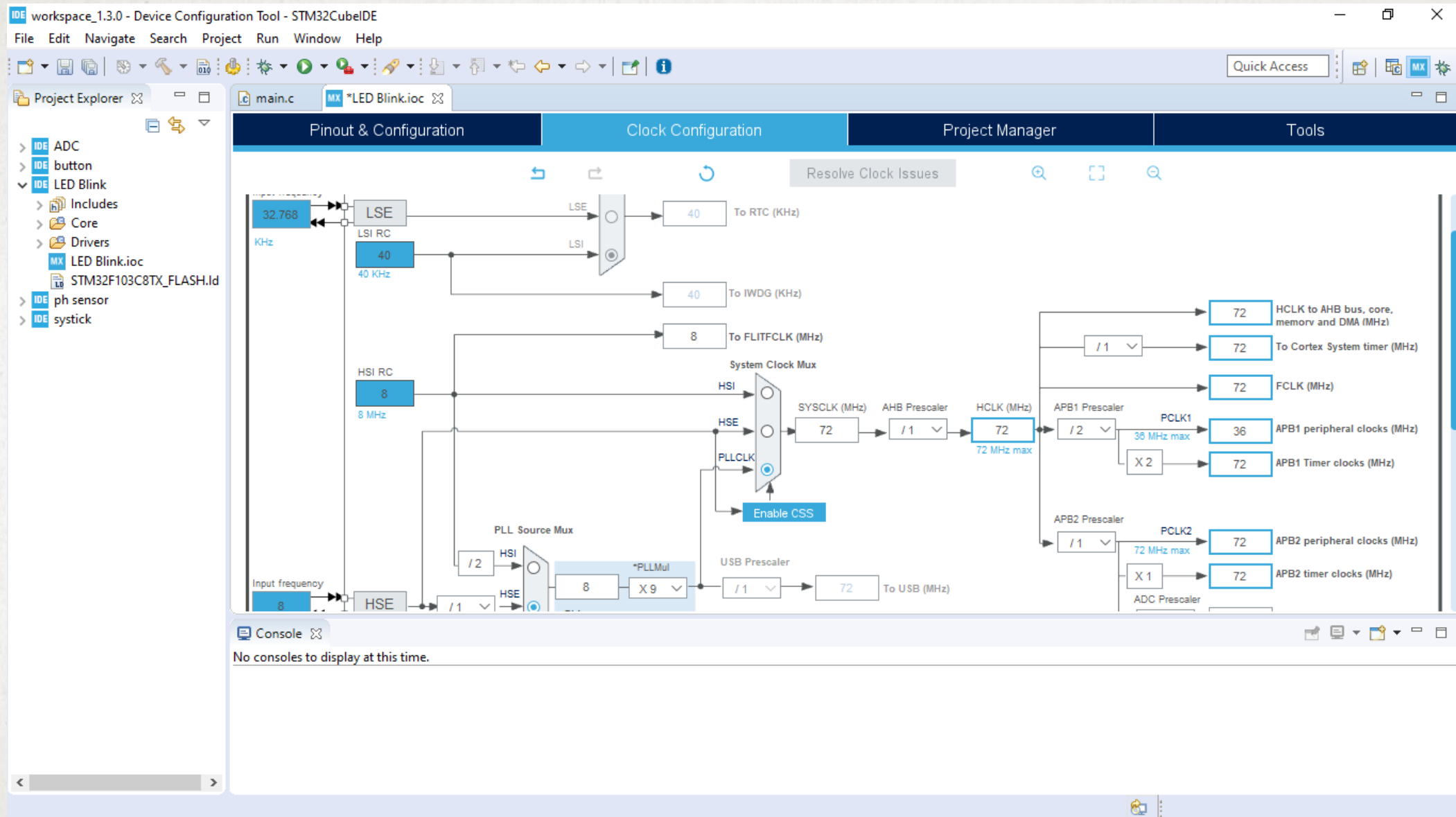


# STM32CUBE IDE

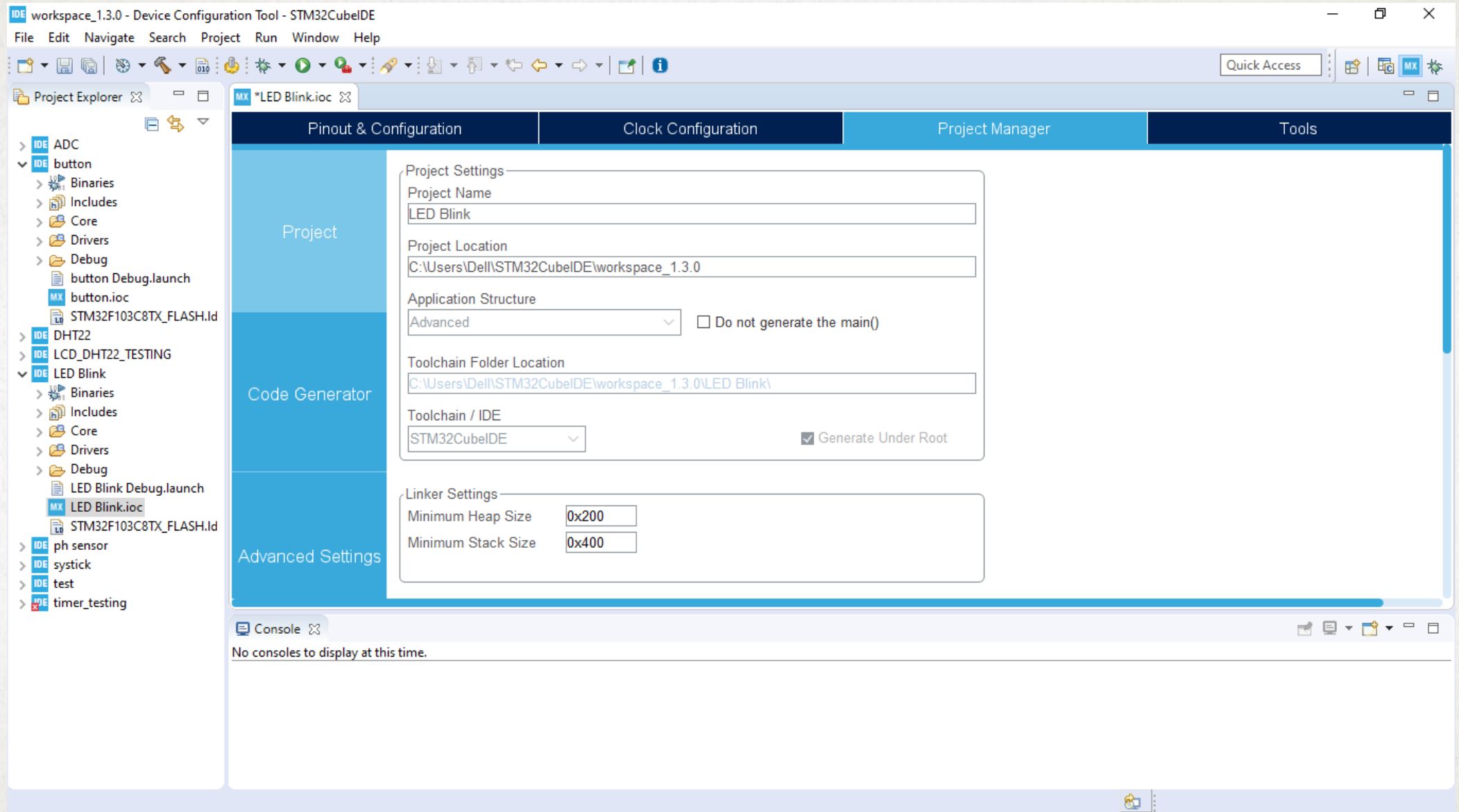




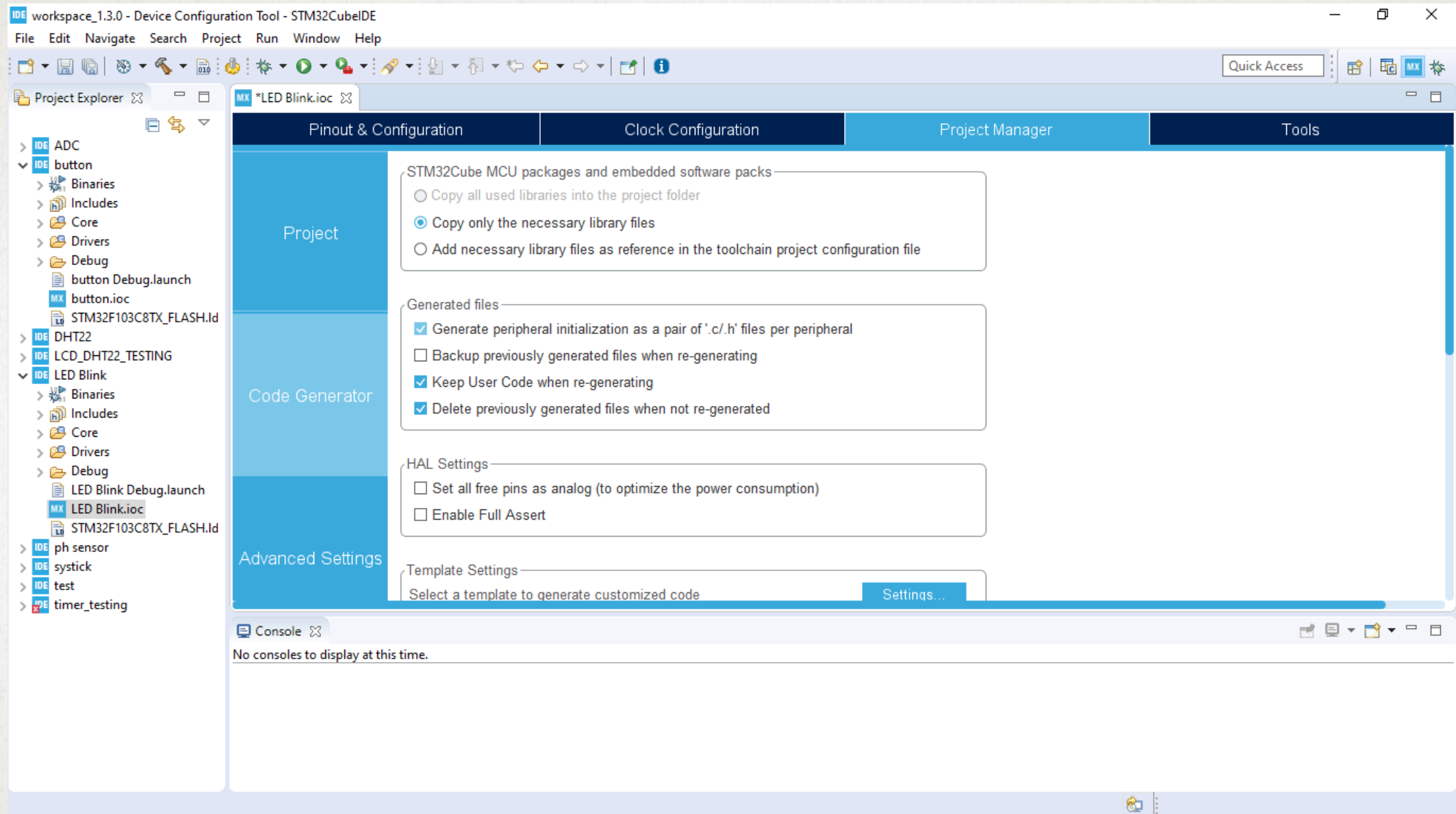
# STM32CUBE IDE



# STM32CUBE IDE



# STM32CUBE IDE





# STM32CUBE IDE

The screenshot displays the STM32CubeIDE interface for a project named "LED Blink.ioc". The top menu bar includes File, Edit, Navigate, Search, Project, Run, Window, and Help. Below the menu is a toolbar with various icons for file operations and development tools.

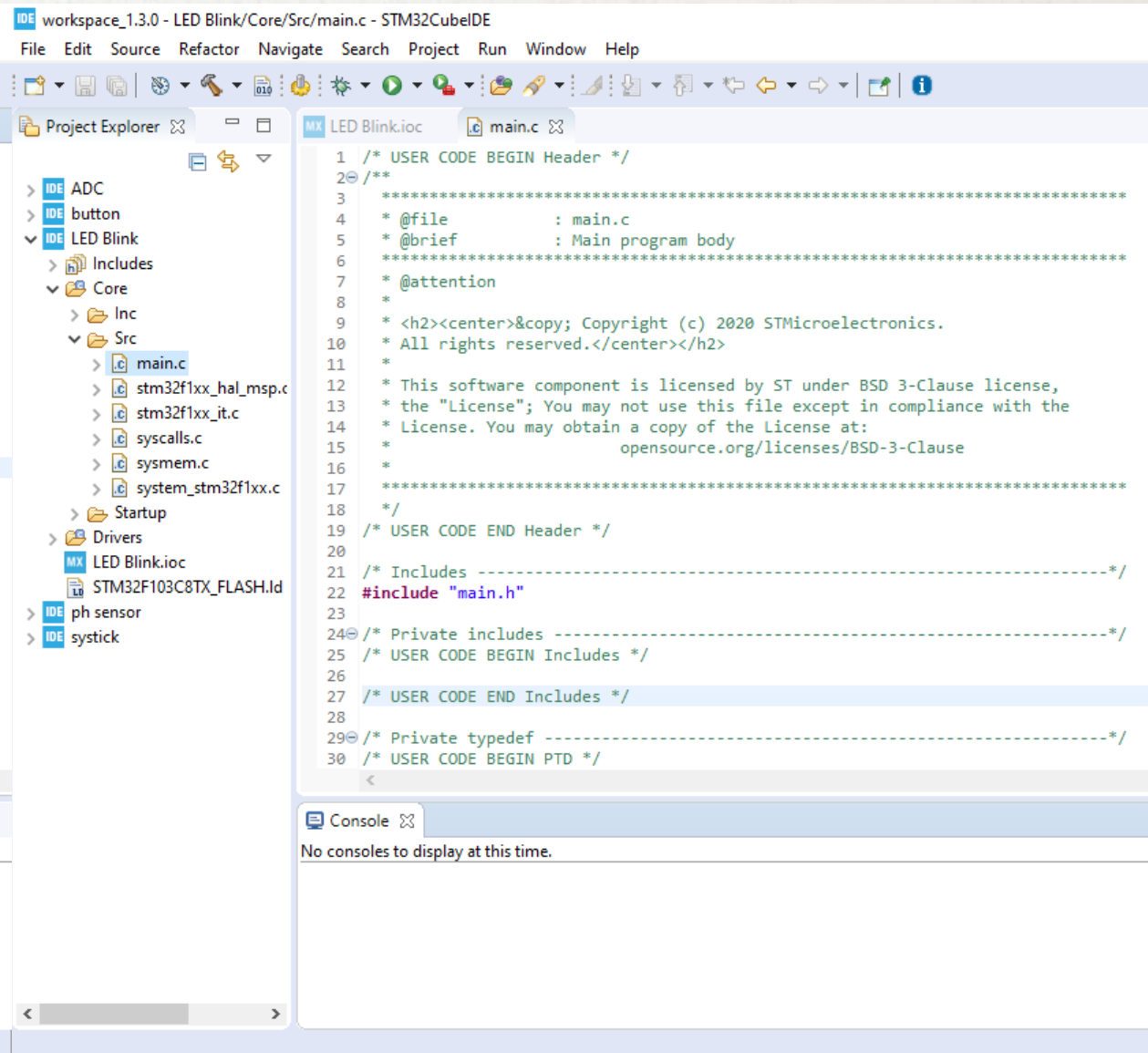
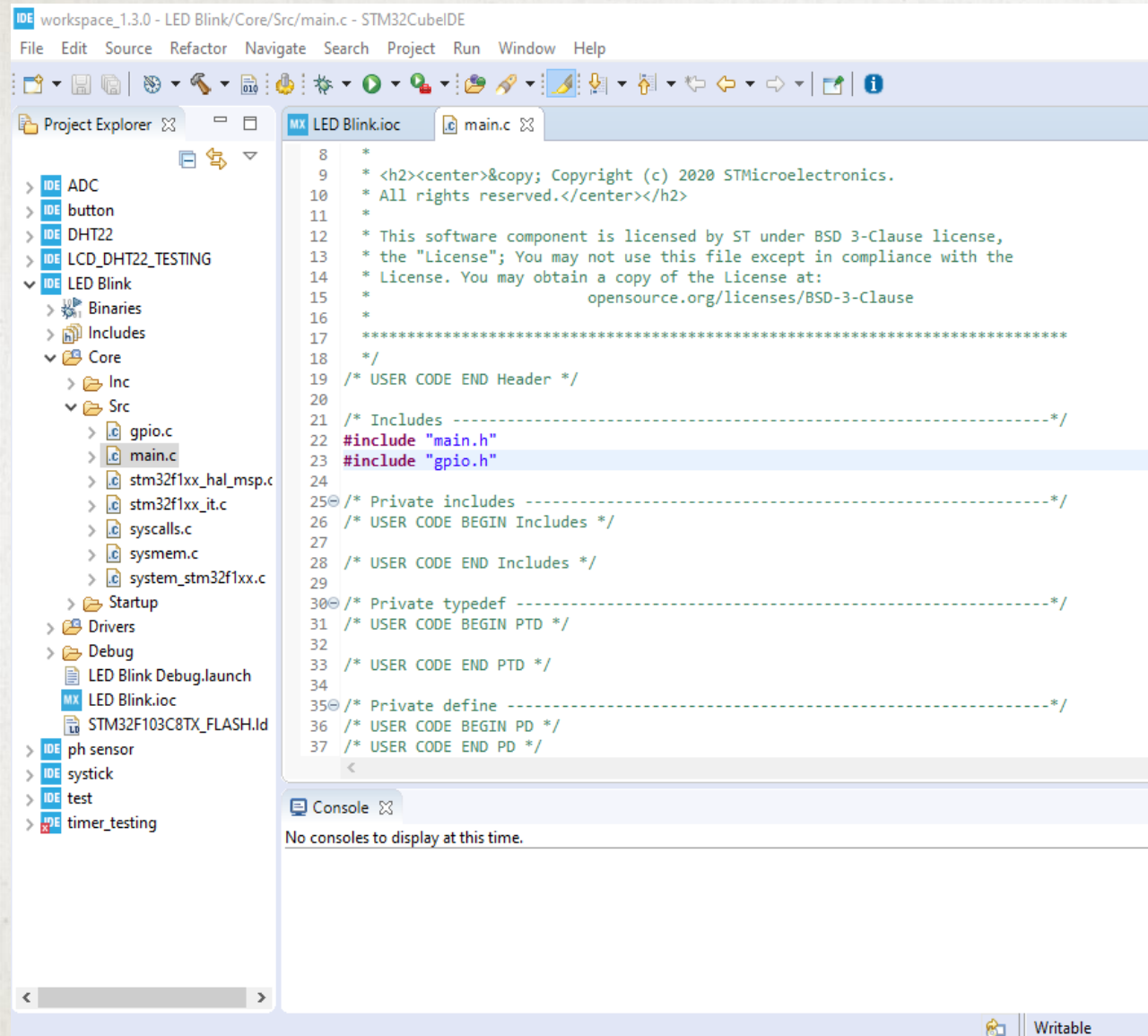
The left sidebar, labeled "Project Explorer", shows a tree view of the project files. The "LED Blink" folder is expanded, revealing subfolders like "Binaries", "Includes", "Core", "Inc", "Src", "Startup", "Drivers", "Debug", and "test". The "Src" folder contains files such as "gpio.c", "main.c", "stm32f1xx\_hal\_msp.c", "stm32f1xx\_it.c", "syscalls.c", "system.c", and "system\_stm32f1xx.c".

The main workspace is divided into several panes. The top pane, "Pinout & Configuration", is active and shows the "GPIO Mode and Configuration" settings. The "Configuration" tab is selected, displaying a "Group By Peripherals" dropdown and checkboxes for "GPIO", "RCC", and "SYS". The "GPIO" checkbox is checked. Below this, the "Search Signals" field is empty, and the "Show only Modified Pins" checkbox is unchecked. The "GPIO output level" is set to "Low", the "GPIO mode" is "Output Push Pull", the "GPIO Pull-up/Pul..." is "No pull-up and no pul...", the "Maximum output..." is "Low", and the "User Label" field is empty.

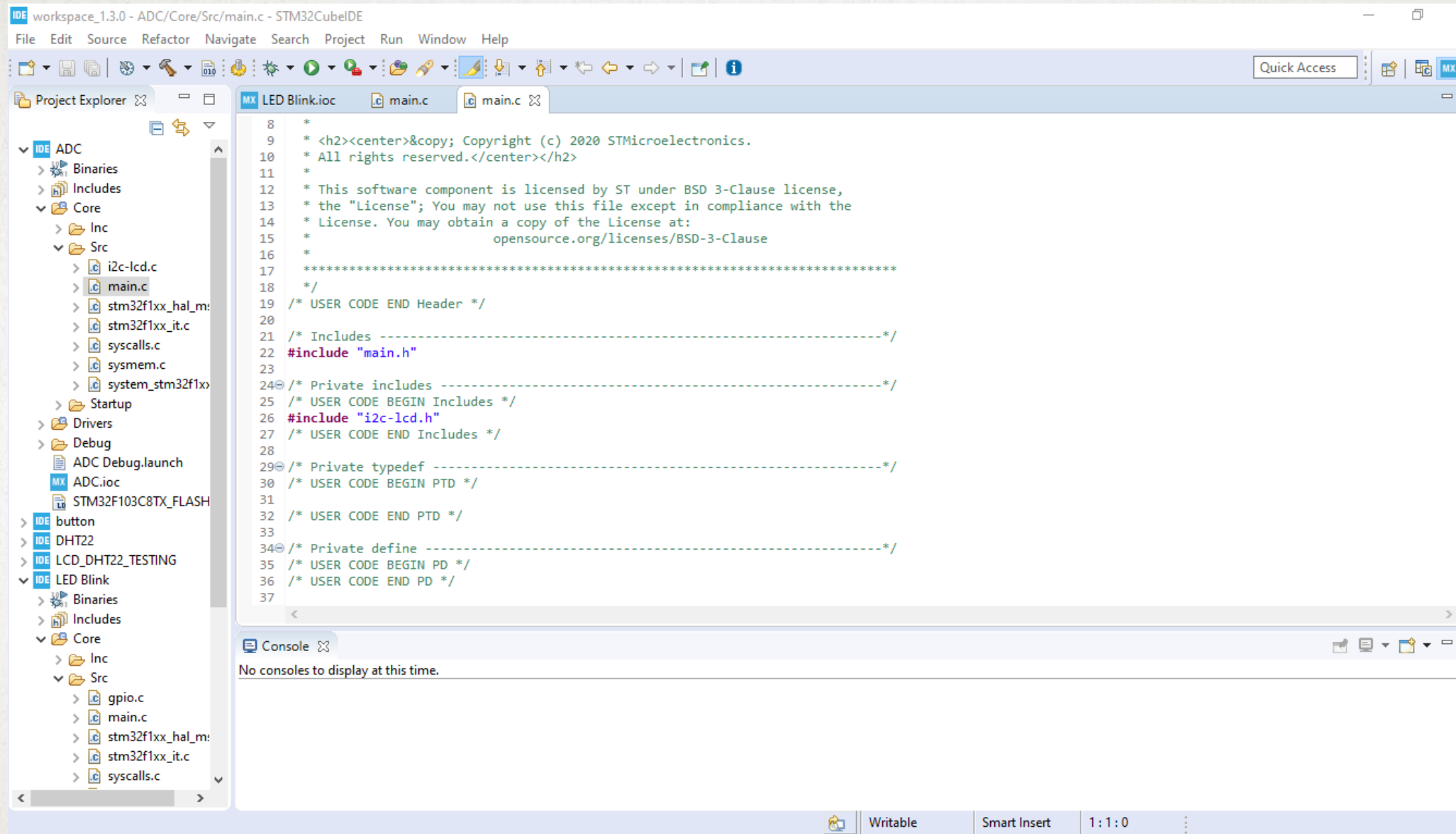
The right pane, "Pinout view", shows a diagram of the STM32F103C8Tx microcontroller. The pins are color-coded: VDD (yellow), VSS (blue), PA0-PA15 (green), PB0-PB15 (grey), and PC0-PC15 (blue). The "GPIO\_Output" pin is highlighted in green, and the "RCC\_OSC\_IN" and "RCC\_OSC\_OUT" pins are highlighted in blue. The "NRST" pin is highlighted in yellow. The "SYS\_JTMS-SWDIO" pin is highlighted in green.

The bottom pane, "Console", shows the message "No consoles to display at this time."

# STM32CUBE IDE

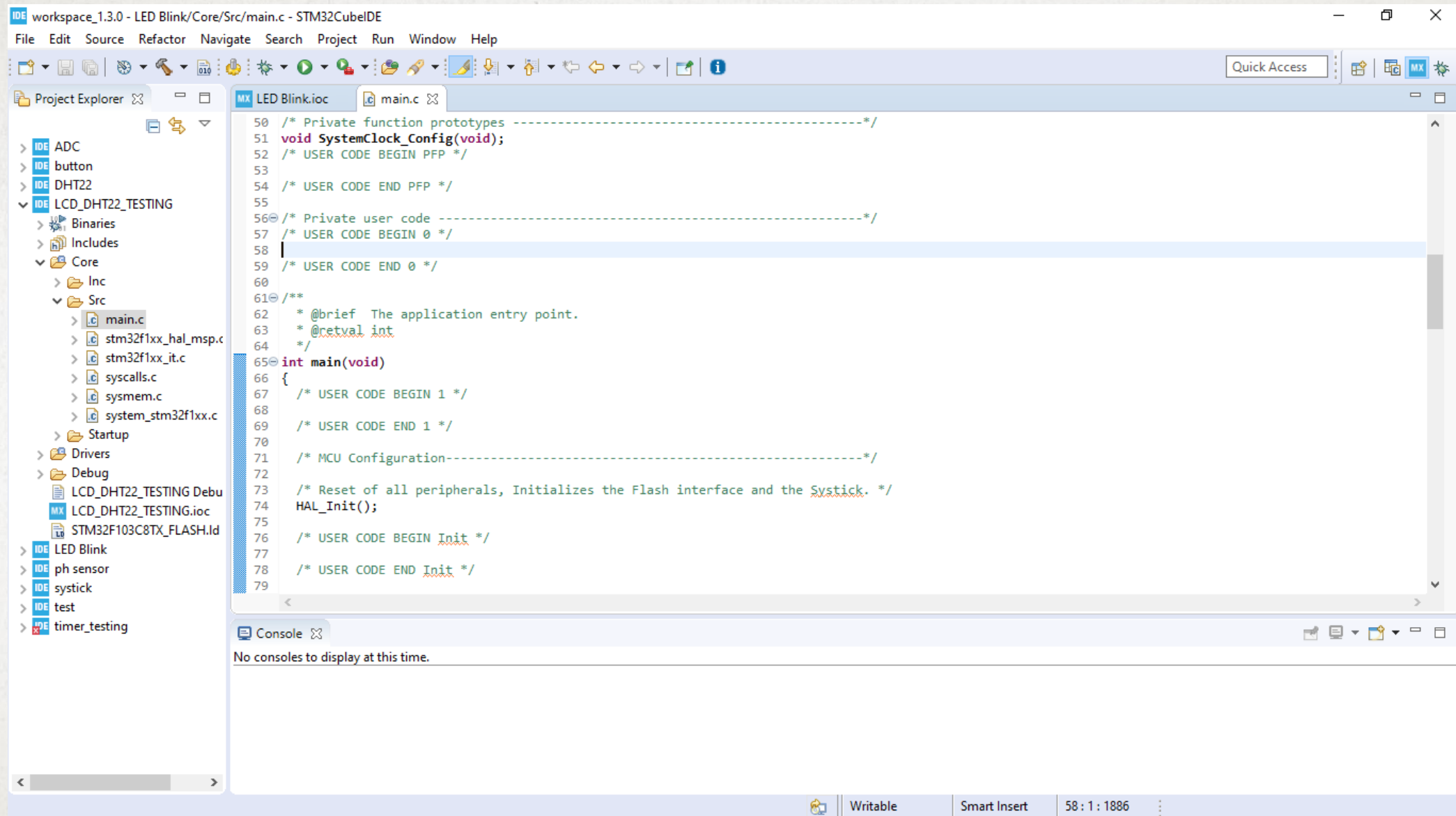


# STM32CUBE IDE

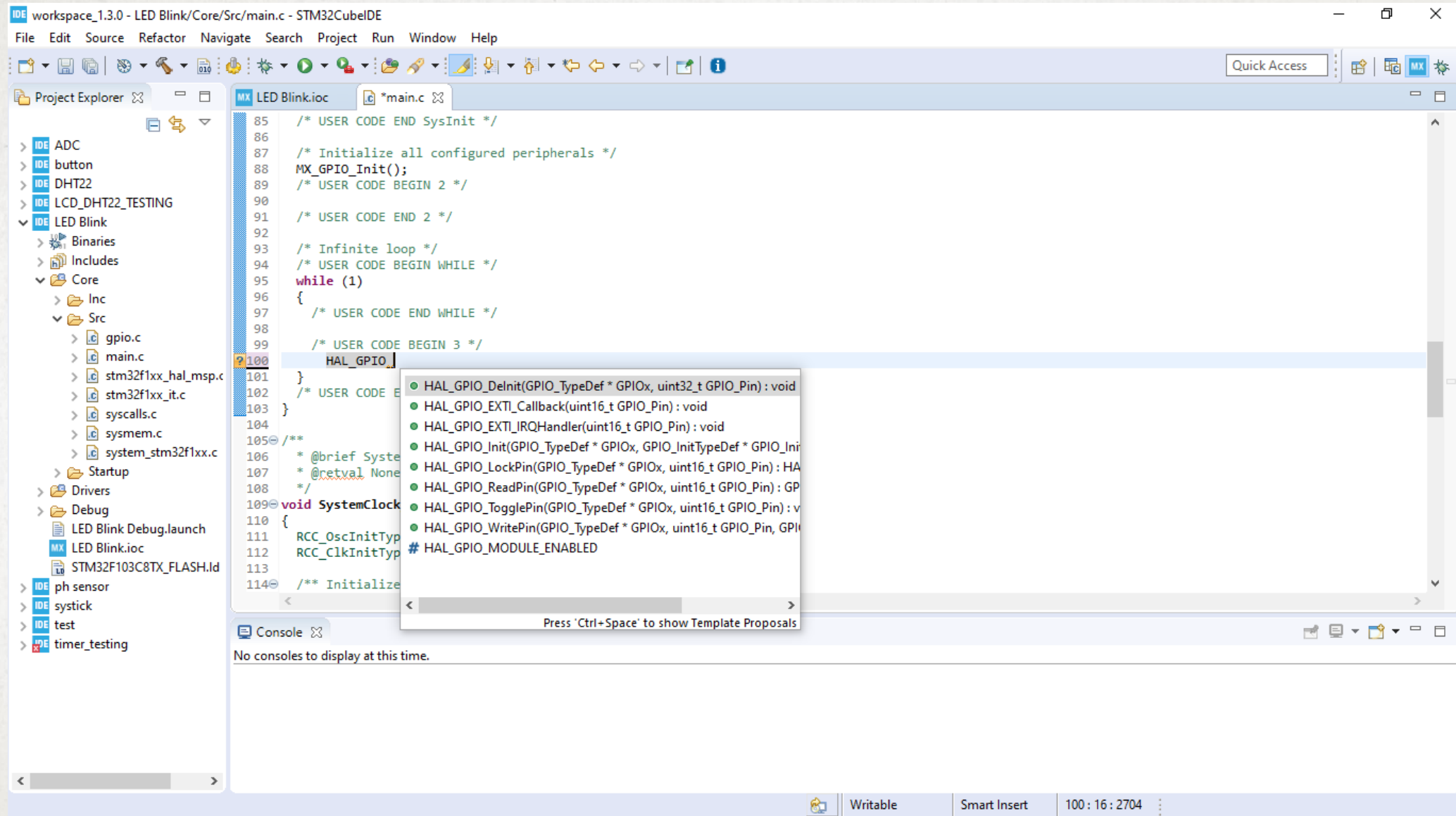




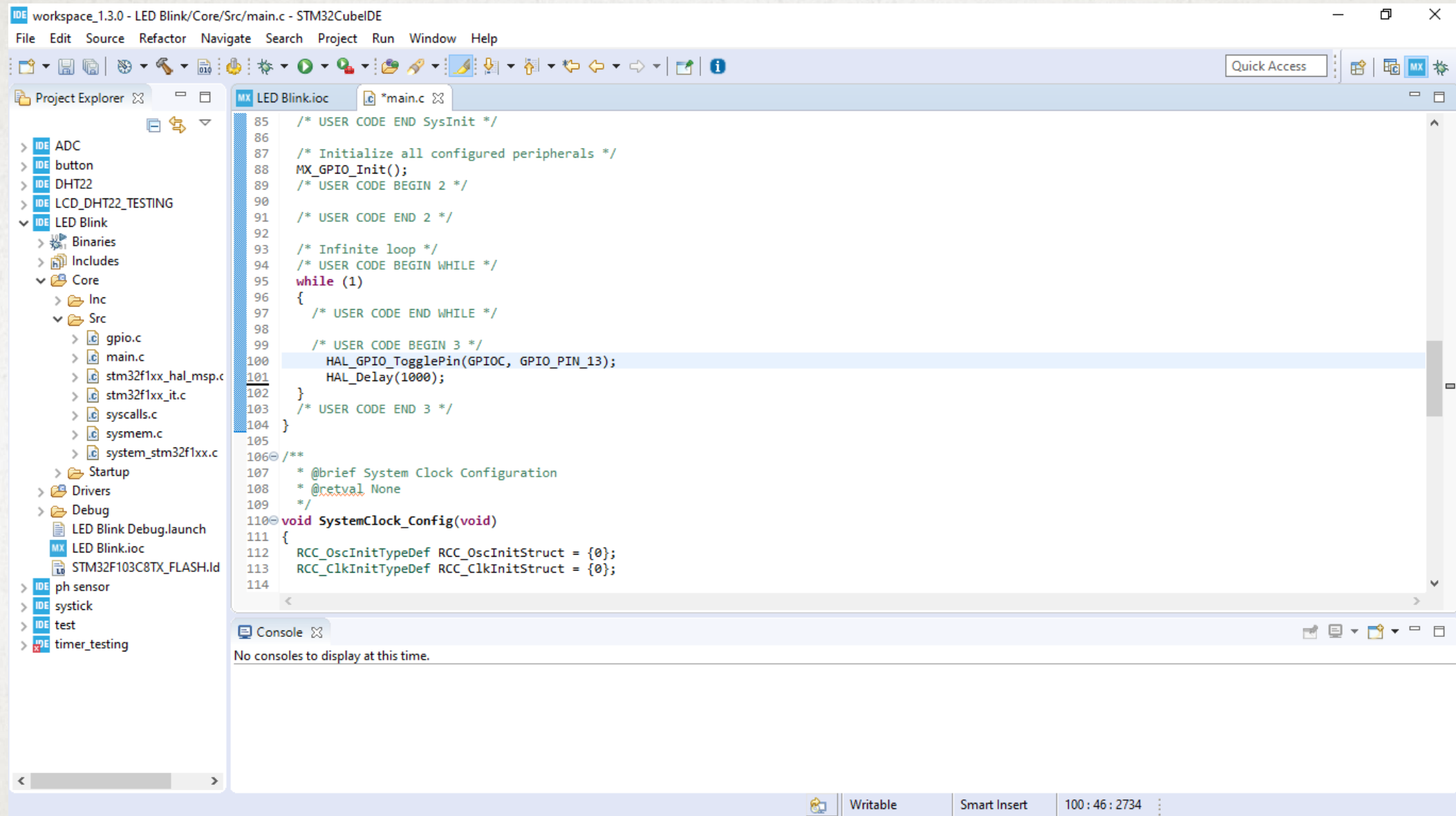
# STM32CUBE IDE



# STM32CUBE IDE



# STM32CUBE IDE





# STM32F1 MCU & COMPONENTS

1. GPIO to set pin I/O
2. TIMER to set  $\mu s$  or  $ns$  and PMW
3. Communication:
  - ADC
  - UART
  - I<sup>2</sup>C
  - SPI



ADC (Analog)



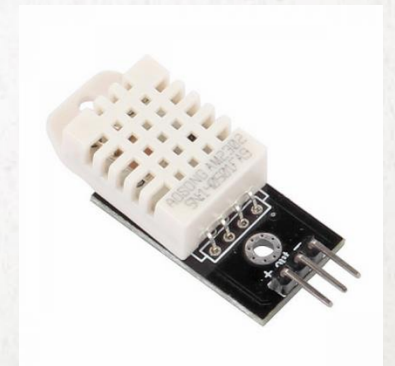
RS485 to UART  
(UART)



Micro-Controller



I<sup>2</sup>C

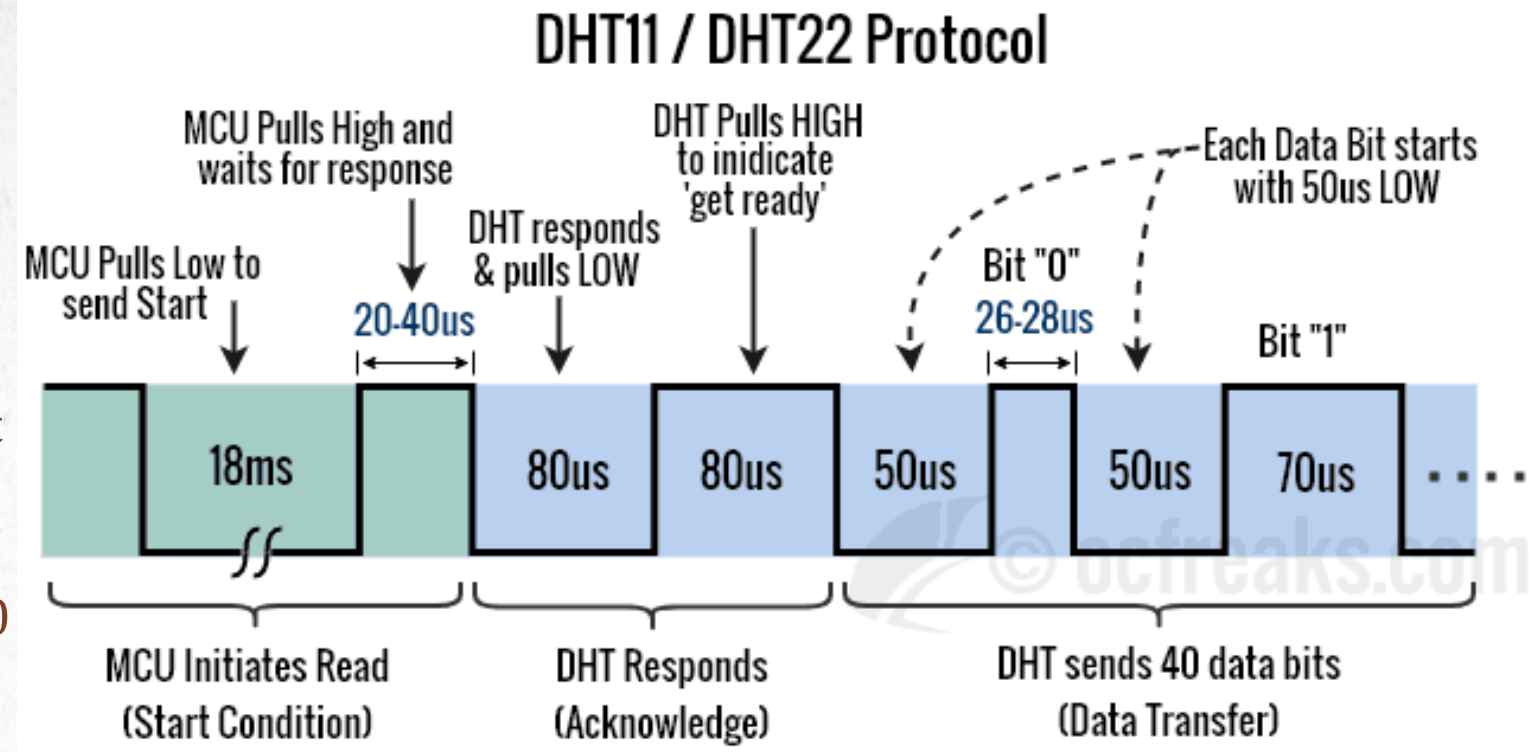


Single-bus

# DHT22 COMMUNICATION

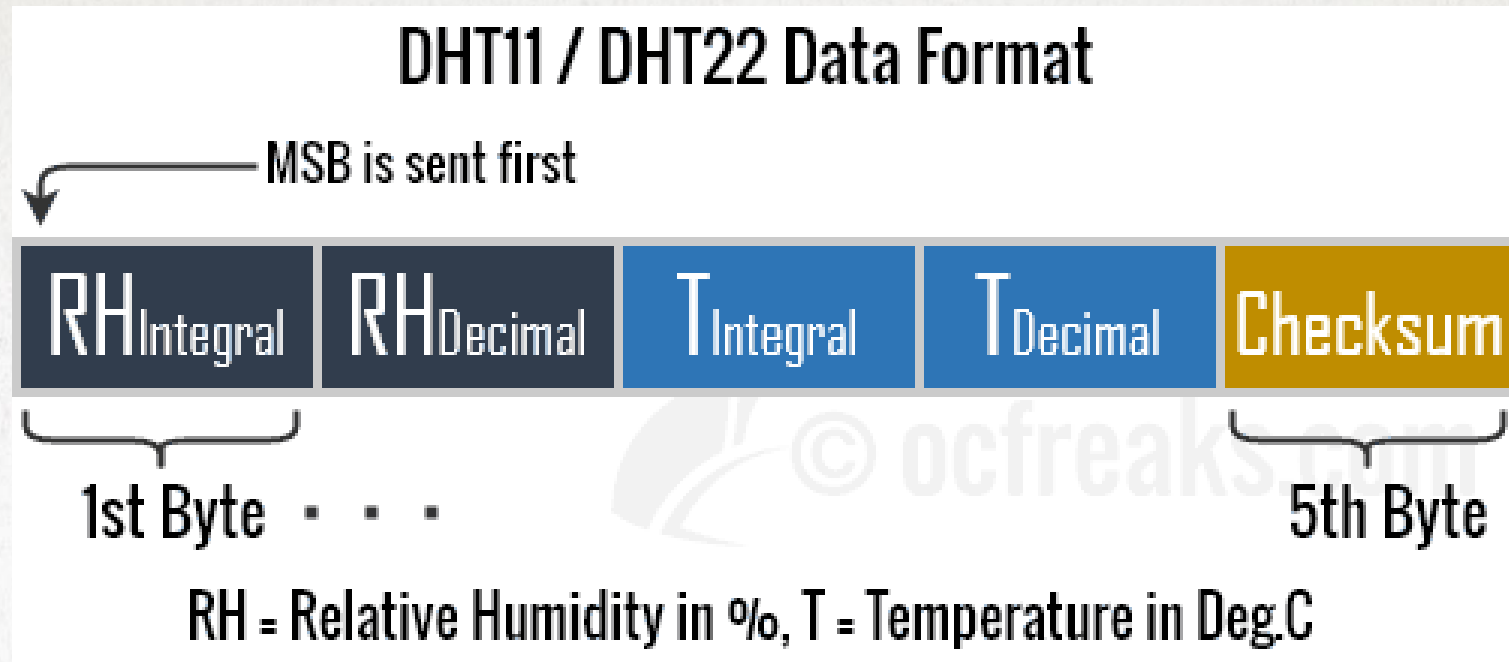
There are 3 steps to make communication MCU with DHT22:

1. MCU send out start signal to DHT22:
  - Set the (data) pin as output
  - Pull the pin low and wait 1-18ms
  - Pull the pin high and wait 20-40 $\mu$ s
  - Release the pin by setting it as input
2. DHT22 send responds signal :
  - Wait for 40  $\mu$ s
  - Check if the pin is low, then wait 80  $\mu$ s this will totally delay 120 $\mu$ s and the pin should be high now.
  - If the pin is high then response is OK
  - Then wait for the pin to low.
3. DHT22 send data to MCU:
  - Wait for the pin to high
  - Wait for the 40  $\mu$ s. if the pin is still high after 40  $\mu$ s so, bit is '1' because the length of '0' bit is 26-28 $\mu$ s.
  - Write the respective values to the variable.





# DHT22'S DATA TRANSMISSION



- DHT22 will send 40 bits of data as follows:  
DATA = 8 bit integral RH data + 8 bit decimal RH data + 8 bit integral T data + 8 bit decimal T data + 8 bit checksum. If the transmission data is right, checksum should be the last 8 bit.
- Each bit's transmission begins with low-voltage-level that lasts 50  $\mu$ s
- If the length of high-voltage is around 26-28  $\mu$ s, the bit is '0'
- If the length of high-voltage is around 70  $\mu$ s, then the bit is '1'





**THANK  
YOU**