Getting Hands-On With the M5Stack Core Platform

DAY 1: Introduction to the M5Stack Core

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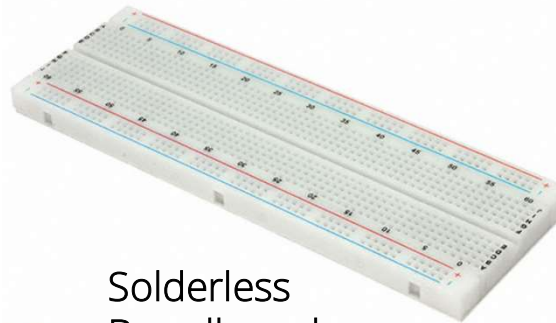- Participate in 'Attendee Chat' by maximizing the chat widget in your dock.

Dr. Don Wilcher

Visit 'Lecturer Profile' in your console for more details.

Course Kit and Materials

M5Go IoT Starter Kit V2.6
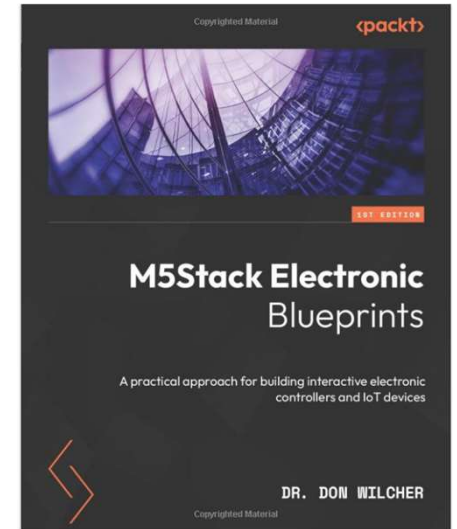
Solderless Breadboard

Adafruit Parts Pal Kit

2 Channel SPST Relay Unit

M5Stack Electronic Blueprints

A practical approach for building interactive electronic controllers and IoT devices

DR. DON WILCHER

Agenda:

- M5Stack Core Overview
    - a) The Internal System Architecture
    - b) ESP32 microcontroller
- UIFlow Software Overview
    - a) Download Site
   - b) Communications Setup
- Lab: Hello World

M5Stack Core UIs

"An important note in designing and developing M5Stack Core UIs is simplicity. Simplicity is the design consideration consisting of using the important UI elements for communicating features and functions of your M5Stack Core device. (Wilcher, 2023, p. 24)."

M5Stack Core Overview

- The M5Stack Core is a small and powerful microcontroller development platform.
  - a) Uses the Espressif ESP32 microcontroller
  - b) Allows Wi-Fi-operated devices, wearables, robots, and portable electronics to be created.
- Software applications can be created using
  - a) Arduino IDE- C++
  - b) MicroPython
  - c) UI Flow Blockly code
- Visually appealing graphics and creative sounds effects can be developed with the M5Stack Core
  - a) A Thin Film Transistor (TFT) LCD provides visually appealing graphics.
  - b) A powerful audio speaker to provide creative sound effects.

M5Stack Core Overview. . .
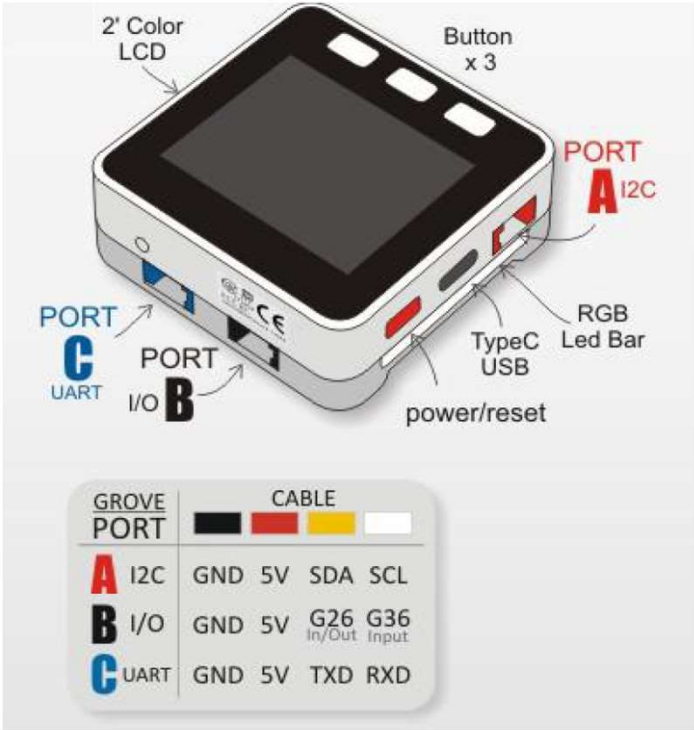
M5Stack Ports

Images courtesy of M5Stack

Question 1

What port on the M5Stack Core supports I2C?
a) Port B
b) Port C
c) Port A
d) Port D

M5Stack Core Overview. . .

Visually appealing graphics:
Primary Flight Display

Project Link:

Images courtesy of M5Stack

M5Stack Core Overview. . .

Creative Sound Effects:
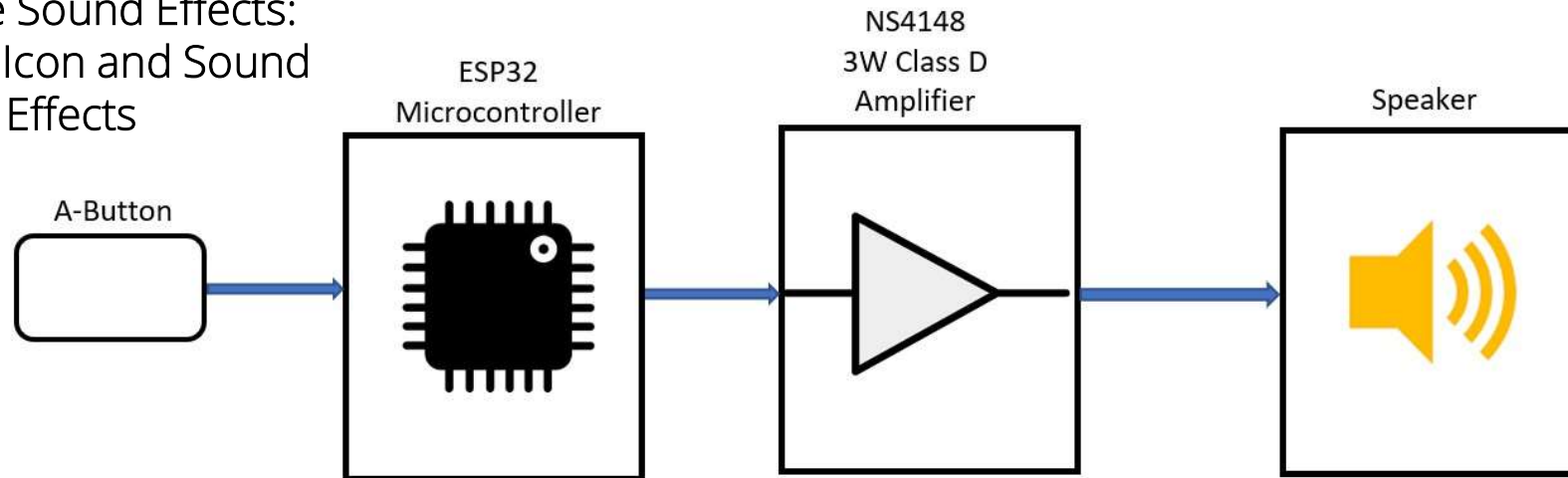Speaker Icon and Sound
Effects

Image courtesy of the author

Project:
Programming the M5Stack Core to produce a sound:
Wilcher, D. (2023, pp. 84-88). *M5Stack Electronic Blueprints*. Packt.

M5Stack Core Overview. . .
A Key User Interface Design Basic:
Visibility Factors

Visibility Factors:
UI elements that allow
multiple representations
to aid the user in
interacting with a UI
based on styles of
learning and
comprehension.

UI elements
for the
M5Stack Core

Image courtesy of M5Stack

Wilcher, D. (2023, pp 23-25). *M5Stack Electronic Blueprints*. Packt.

M5Stack Core Overview. . .

Creative Sound Effects:
Speaker Icon and Sound
Effects

A-Button → ESP32 Microcontroller → NS4148 3W Class D Amplifier → Speaker

Image courtesy of the author

Project:
Programming the M5Stack Core to produce a sound:
Wilcher, D. (2023, pp. 84-88). *M5Stack Electronic Blueprints*. Packt.

M5Stack Core Overview. . .

The M5Stack Core Hardware Architecture consists of the following electronic subcircuits.

- Power management
- Audio amplifier
- ESP32 subsystem
- USB-UART and accessories

Wilcher, D. (2023, pp.12-16). *M5Stack Electronic Blueprints*. Packt.

Question 2

Multiple representations and assisted by _____
a)Pushbuttons
b)Human Input Devices
c)UI elements
d)none of the above

M5Stack Core Overview. . .

M5Stack Core Hardware Architecture System Block Diagram
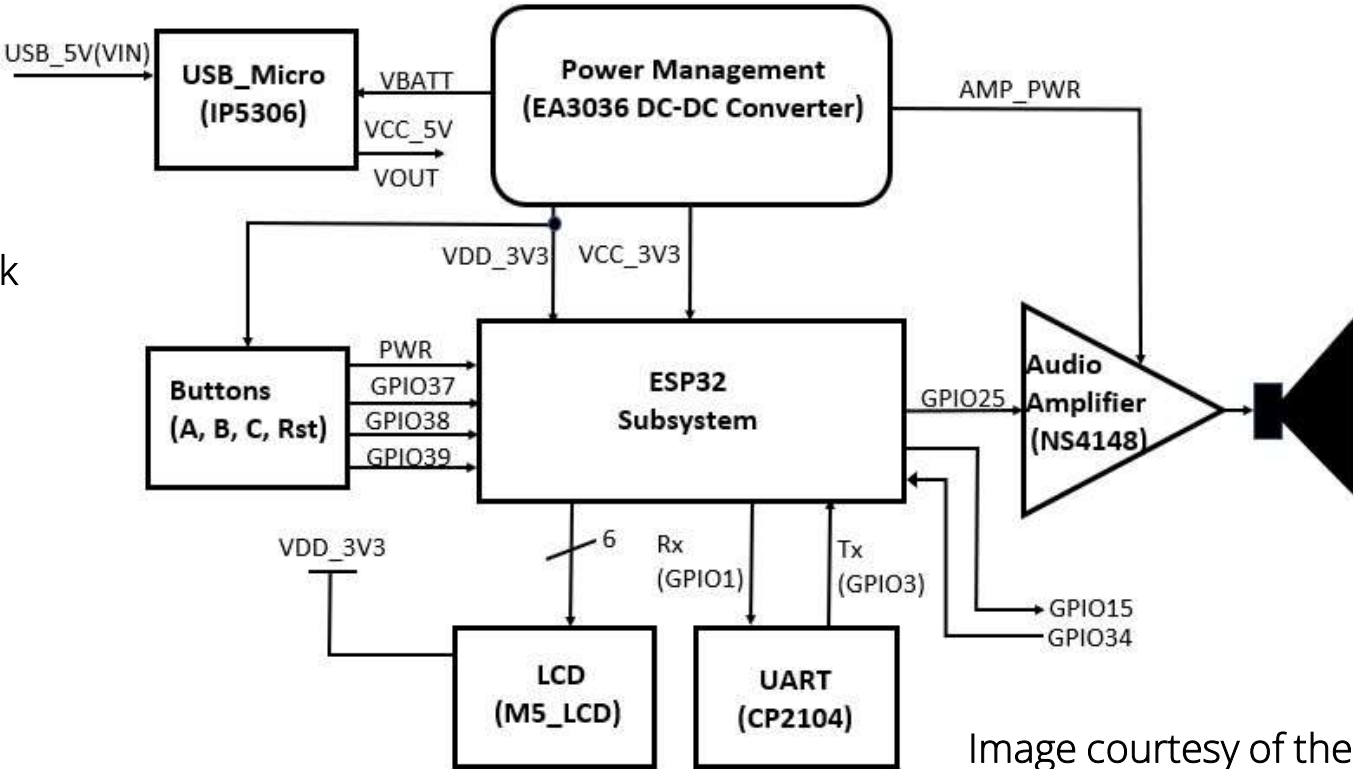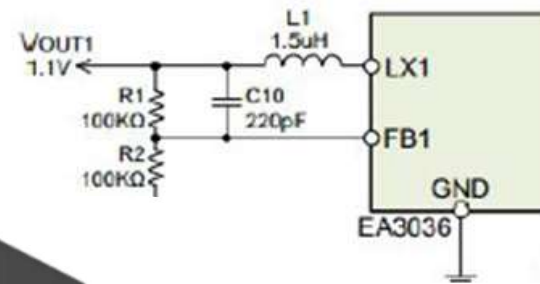

Image courtesy of the author

Wilcher, D. (2023, p12). *M5Stack Electronic Blueprints*. Packt.

Power Management:
EA3036 DC-DC Converter subcircuit:
Provides 3.3V to operate the ESP32
and support electronic circuit
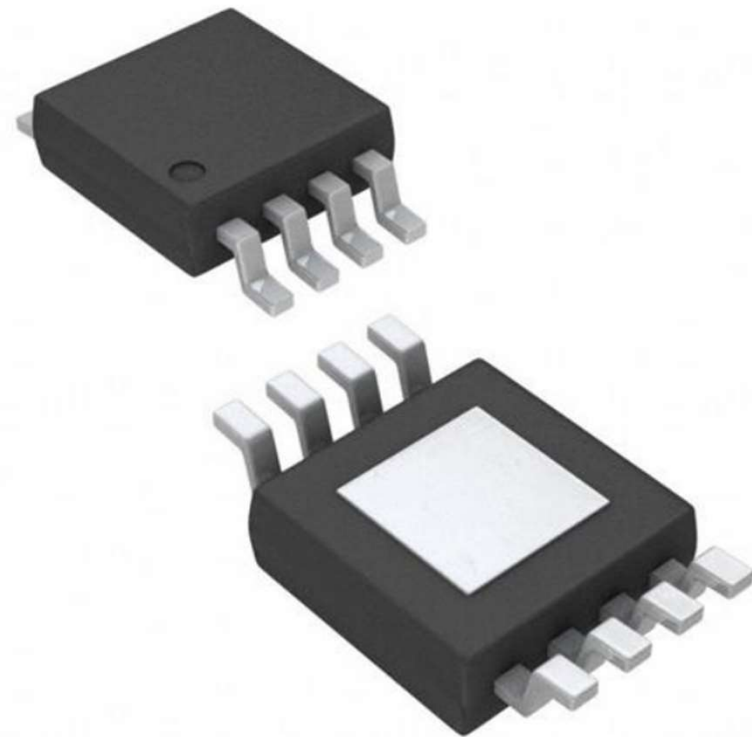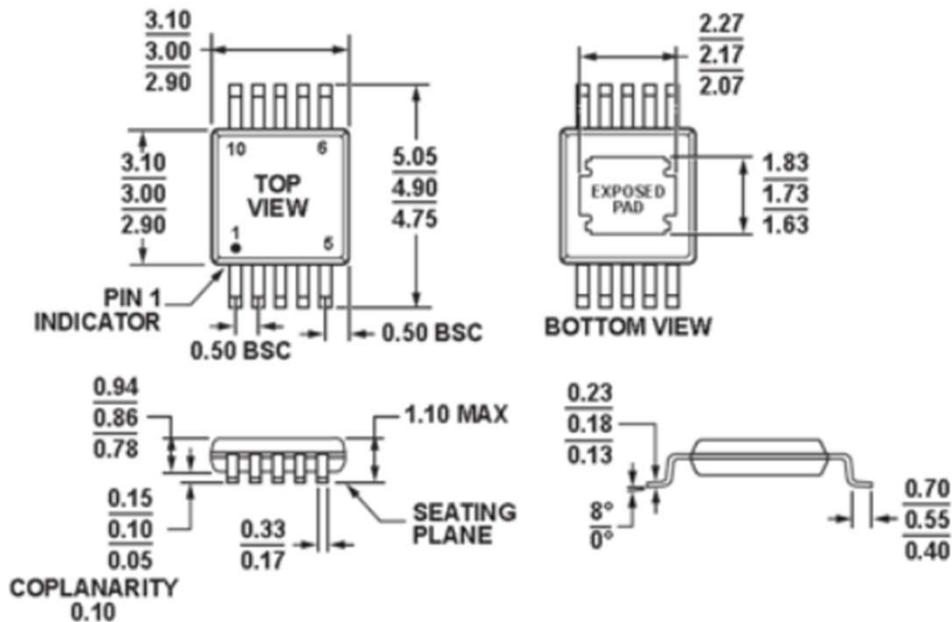peripherals.

M5Stack Core Overview. . .
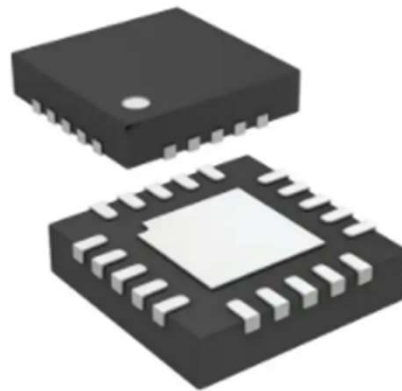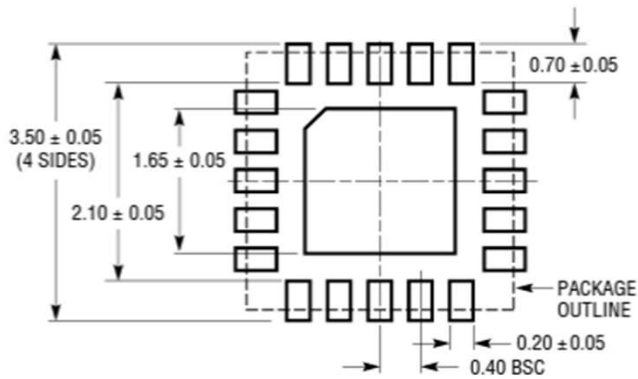
Images courtesy INJOINIC Technology

Wilcher, D. (2023, p.13). *M5Stack Electronic Blueprints*. Packt.
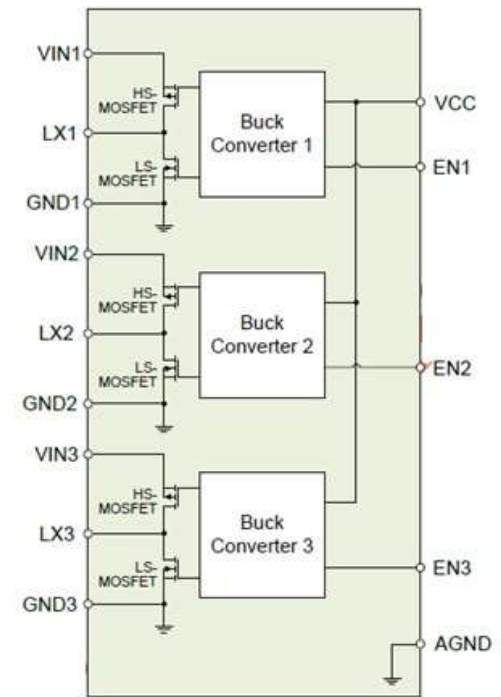
Audio Amplifier:
The NS4148 is a 3-Watt (W) Class D audio power amplifier IC package.
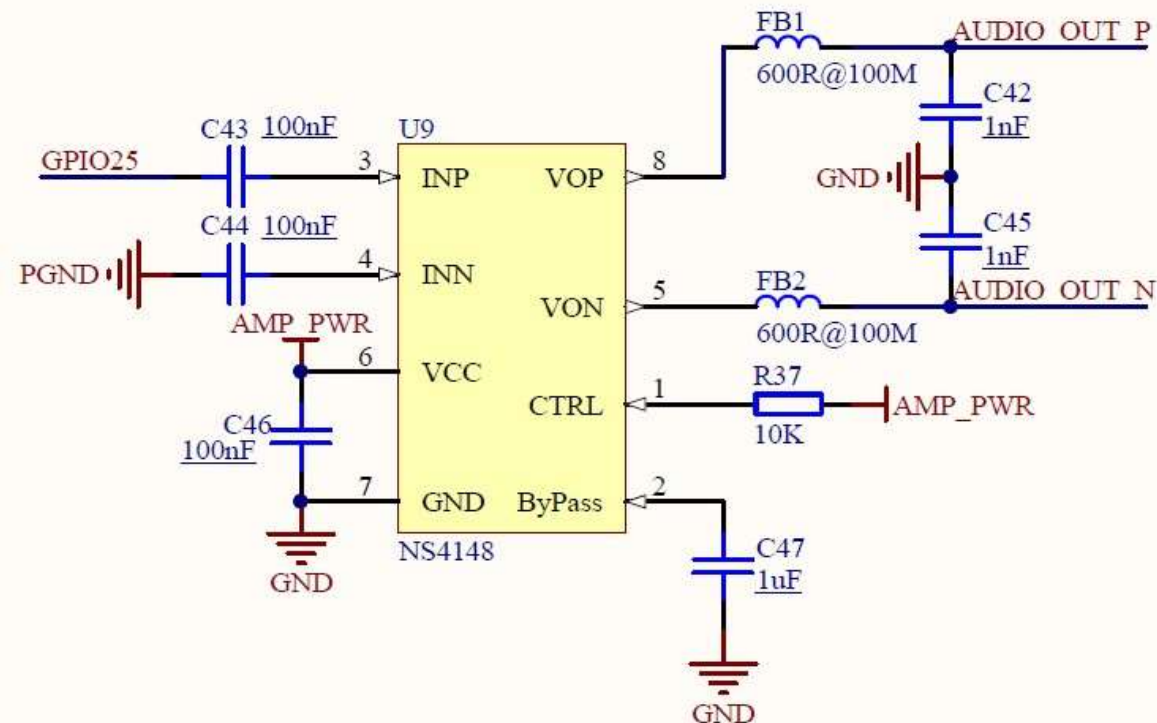
M5Stack Core Overview. . .

Wilcher, D. (2023, p15). *M5Stack Electronic Blueprints*. Packt.

Images courtesy of ChipSourceTek Technology Co

Audio Amplifier:
The NS4148 is a 3-Watt (W) Class D audio power amplifier electronic circuit schematic diagram.

Wilcher, D. (2023, p.16). *M5Stack Electronic Blueprints*. Packt.

Question 3

Reviewing slide 19, what type of circuit is used at Audio OUT P and Audio OUT N connected to the NS4148 Class D audio power amplifier?
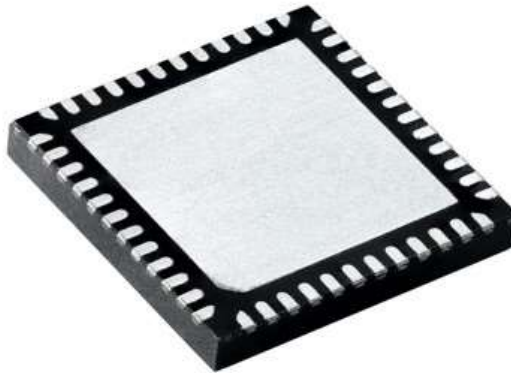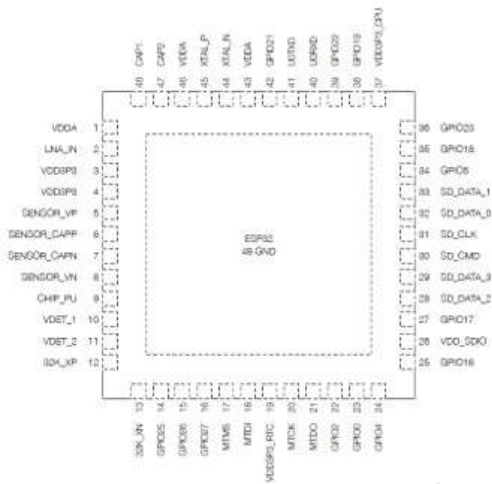   a) Voltage Divider
   b) High Pass Filter
   c) Low Pass Filter
   d) Pi Filter

ESP32 microcontroller subsystem:
A 2.4 gigahertz (GHz) Wi-Fi and
Bluetooth combination chip.

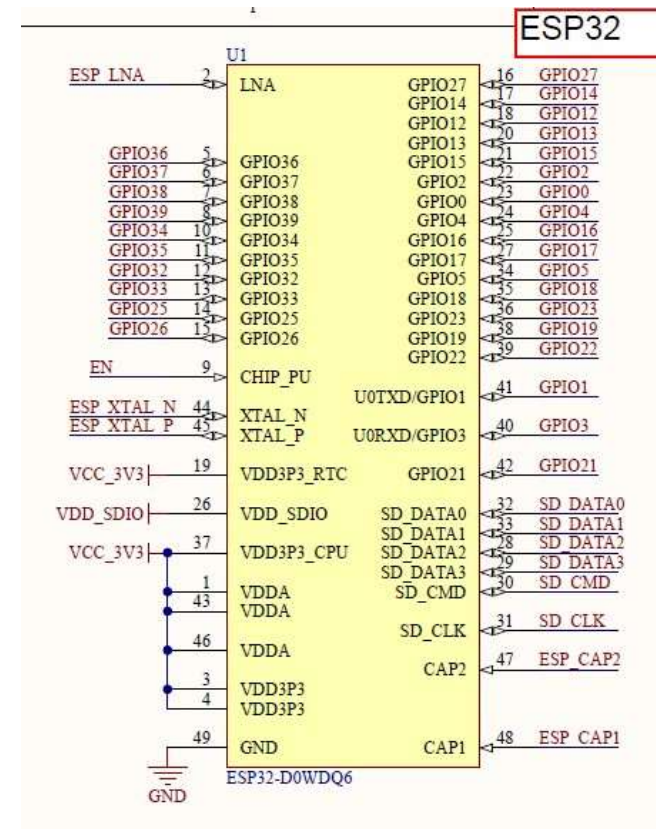# M5Stack Core Overview. . .

Electronic Circuit
Schematic Diagram

QFN48 package

Images courtesy of Espressif and M5Stack

Wilcher, D. (2023, p17). *M5Stack Electronic Blueprints*. Packt.

M5Stack Core Overview. . .

Port A allows inter-integrated circuit capabilities to communicate with M5Stack Units

Image courtesy of M5Stack

Wilcher, D. (2023, pp.18-19). *M5Stack Electronic Blueprints*. Packt.

M5Stack Core Overview. . .

The IP53306 USB-I2C Communication Electronic Circuit Schematic Diagram

Port A allows inter-integrated circuit capabilities to communicate with M5Stack Units
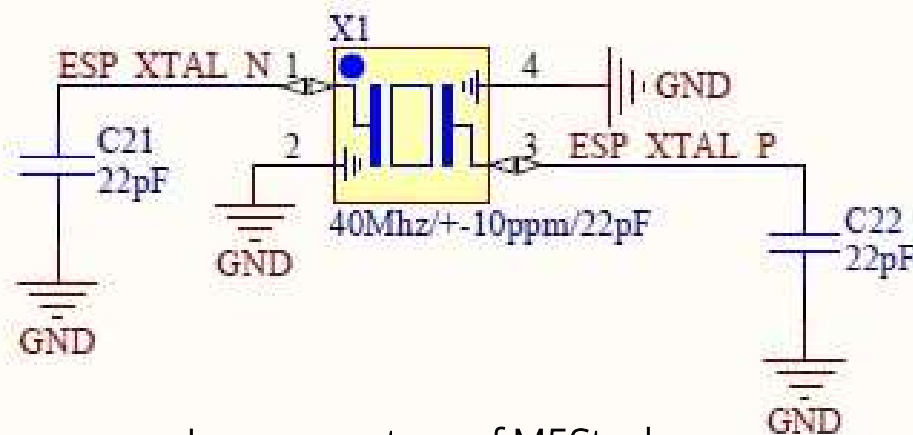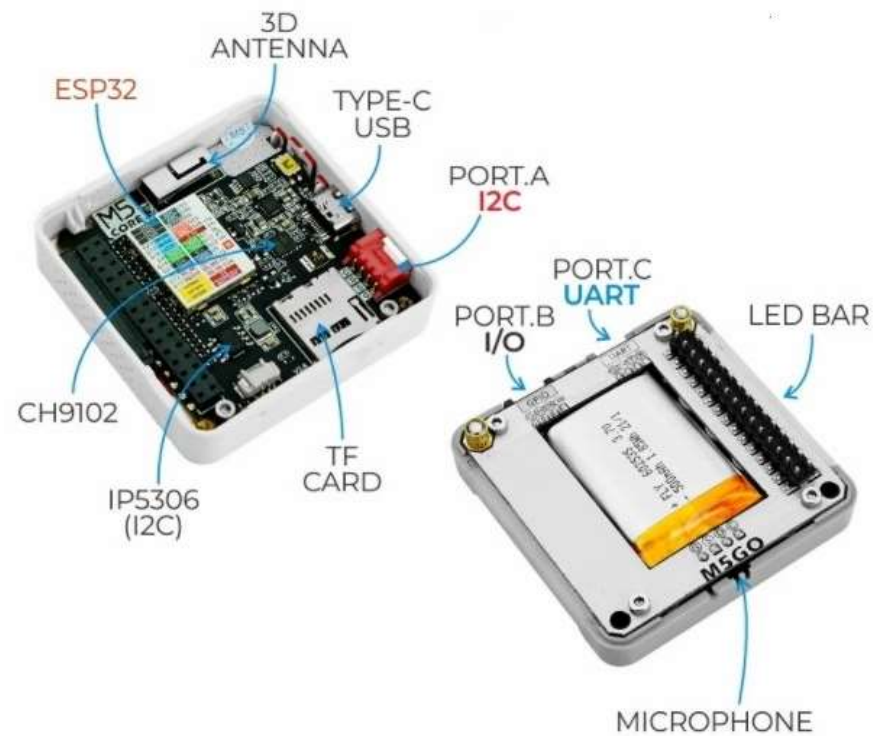
Image courtesy of JOINIC Technology

Wilcher, D. (2023, pp.18-19). *M5Stack Electronic Blueprints*. Packt.

Physical location of key electronic components and M5 Communication bus of the M5Stack Core

M5Stack Core Overview. . .

Wilcher, D. (2023, p.20). *M5Stack Electronic Blueprints.* Packt.

UIFlow Software Overview

- The are several design approaches to designing UIs to provide interaction for your M5Stack Core prototype or application.
- The design basics provide suggested guidelines for developing uncluttered UI layouts.
- The design basics can be considered the developmental theory to assist in creating UIs with the following attributes for the M5Stack Core.
    - a) purposeful
    - b) engaging
    - c) interactive

Wilcher, D. (2023, p.20). *M5Stack Electronic Blueprints*. Packt.

UIFlow Software

UIFLOW SOFTWARES

NO	Name	Download
1	UIFlow Web IDE	🔗
2	Desktop IDE Win10 x64 (update is terminated)	⬇
3	Desktop IDE MacOS (update is terminated)	⬇
4	Desktop IDE Linux (update is terminated)	⬇

*A software driver may be needed and can be found under this software packages listings.

Software Download Link:
https://docs.m5stack.com/en/download

UIFlow Software. . .

Version 1.9.5
Blockly Code
Editor

Image courtesy of M5Stack

https://docs.m5stack.com/en/download

UIFlow Software. . .

Partial Blockly Code Blocks Categories

Image courtesy of M5Stack

Wilcher, D. (2023, p.29). *M5Stack Electronic Blueprints*. Packt.

UIFlow Software. . .

UIFlow Blockly Code program sequence blocks

Setup

The setup block is essential for any program to run. It defines the first thing that will happen when the code is uploaded or the device is switched on. It will only run once.

Setup

Loop

The loop block will run any code placed inside it indefinitely . That means unless you turn off the device it will continue to run without stopping.

Loop

Wait

The wait block will delay your program for however many seconds you input. Sometimes this is necessary to see the result of some code that might have otherwise run so fast that you blinked and missed it.

Wait 1 s

Wilcher, D. (2023, p.29). *M5Stack Electronic Blueprints*. Packt.

Image courtesy of M5Stack

UIFlow Software. . .

UIFlow Blockly Code program sequence diagram: A Mental Model for M5Stack Core code development.

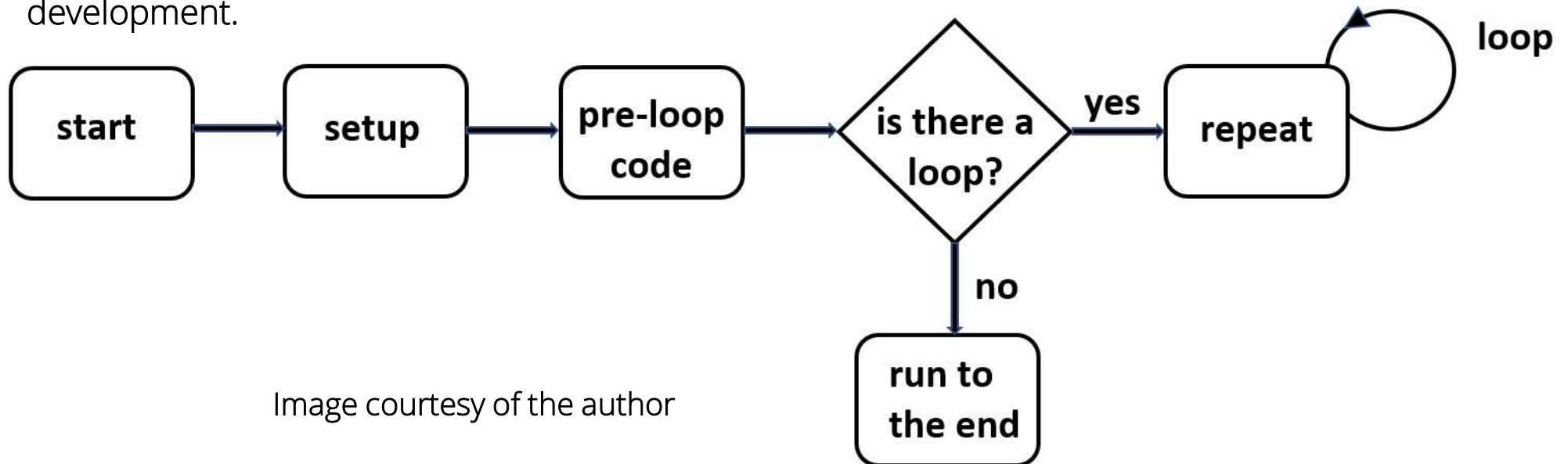Image courtesy of the author

Wilcher, D. (2023, p.30). *M5Stack Electronic Blueprints*. Packt.

Question 4

In slide 30, the UIFlow Blockly Code program sequence diagram is an example of Multiple Representations.
  a)True
  b)False

Communication Setup

Turn On the M5Stack Core

Power
ON
button

Image courtesy of the author

Wilcher, D. (2023, p.32-34). *M5Stack Electronic Blueprints*. Packt.

Communication Setup. . .

Establishing USB Mode

Image courtesy of the author

Wilcher, D. (2023, p.32-34). *M5Stack Electronic Blueprints*. Packt.

Communication Setup. . .

Establishing USB Mode. . .

Image courtesy of the author

Wilcher, D. (2023, p.32-34). *M5Stack Electronic Blueprints*. Packt.

Communication Setup. . .

Setting up the COM port

Image courtesy of the author

Wilcher, D. (2023, p.32-34). *M5Stack Electronic Blueprints*. Packt.

Lab: Hello World

Lab: Hello World

Lab Objectives:
- Participants will learn to design a Hello World text on a M5Stack Core.
- Participants will learn to select the **Label** UI blockly code block.
- Participants will learn to modify the **Label** blockly code block to display Hello World! message on a M5Stack Core TFT LCD.
- Participants will learn to run the Blockly code blocks to display the Hello World! message on a M5Stack Core TFT LCD.

Lab: Hello World
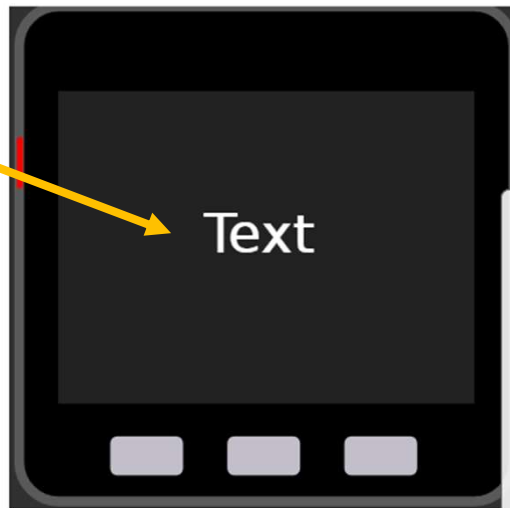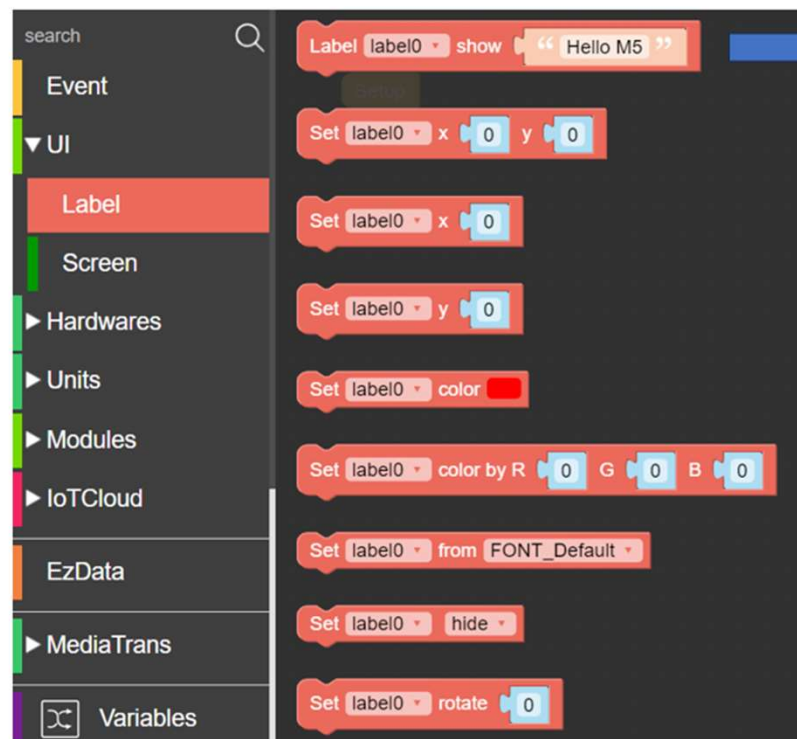
Placing Label UI on to M5Stack Core TFT

Lab: Hello World. . .

Place the first code block on the editor

Lab: Hello World. . .

Change text

Lab: Hello World. . .

Click here to run the program
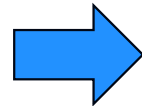
Lab: Hello World. . .

The text needs to be moved to the left!

Lab: Hello World. . .

Final Output

The text moved to the left!

Question 5

What UI element displays the "Hello World!" message on the M5Stack Core TFT LCD?
  a)Text
  b)Label
  c) Title
  d) Rect

Thank you for attending

Please consider the resources below:

Wilcher, D. (2023, p.32-34). *M5Stack Electronic Blueprints*. Packt.

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Thank You

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