Wristwatch with OLED display **Sevastian Bortsevich 323793**

Components

1. USB Power Supply and Battery Charger

- **Connector: USB_Type B_(Micro) (MOLEX 47346-0001)**
  - **Pin 1 (VBUS)**: Connected to the input of the battery charger IC with a bypass capacitor (C1, 0.47µF) to ground. This provides the initial power supply for charging the battery.
  - **Pins 2 and 3 (D- and D+)**: Direct connections for USB data lines, though not used for this application (connected to MCU for future modifications).
  - **Pin 5 (GND)**: Ground connection.
- **Battery Charger IC: BQ24012DRCR (U1)**
  - **IN**: Receives power from the VBUS of the USB connector.
  - **OUT**: Provides regulated output to the battery (BT1) and directly to two voltage regulators that power the MCU and the OLED Display.
  - **BAT**: Connected to the battery (BT1), ensuring the battery is charged with proper voltage and current.
  - **STATS1 and STATS2**: Status indicators for charging states, which could be connected to LEDs or MCU pins for monitoring.
  - **CAP (C2, 0.1µF)**: Decoupling capacitor for stability.
  - **R1 (9.09kΩ)**: Pull-down resistor to set specific configurations.

2. Power Management

- **DC-DC Converter: MP2155GG-P (U2)**
  - **Function**: Converts battery voltage (BAT) to a stable 3.3V MCU power supply (MCU_PWR).
  - **L1 (3.3µH)**: Inductor used in the buck-boost converter circuit.
  - **Capacitors**: C3 (10µF), C4 (20µF), C6 (20µF) for input and output filtering to stabilize the voltage.
  - **Resistors**: R2 (820kΩ), R3 (143kΩ), R4 (750kΩ) for feedback and configuration.
  - **Capacitor**: C5 (68pF) for loop compensation.
- **Voltage Regulator: TPS60151DRV (U3)**
  - **Function**: Converts battery voltage (BAT) to a stable 5V Display power supply (DISP_PWR).
  - **Capacitors**: C7 (4.7µF), C8 (2.2µF), C9 (2.2µF) for voltage regulator operation, ensuring stable voltage output.

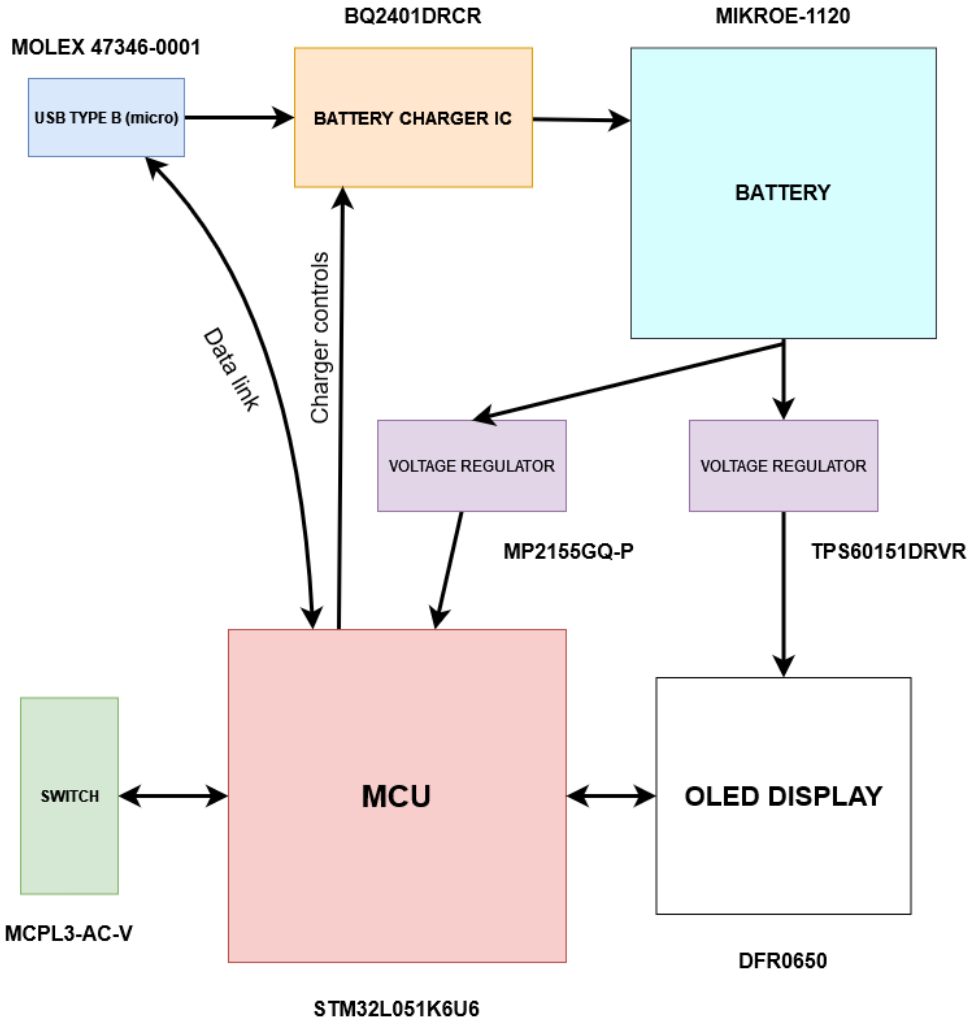
3. Microcontroller Unit (MCU)

- **STM32L051K6U6 (U3)**
  - **Power Supply**: Powered by MCU_PWR (3.3V).

- **GPIO Pins**: Configured to control the OLED display and read input from the switch.
- **RTC**: Real-time clock functionality for timekeeping, essential for the wristwatch application.
- **Capacitors**: C10 (100nF), C11 (100nF) for power stability and noise reduction.
- **Switch**: MCP13-AC-V tactile switch (S1) connected to GPIO for user input.

4. OLED Display

- **Module: SKU_DFR0650 (U4)**
  - **Interface**: Connected via SPI interface to the MCU.
  - **Pins**:
    - **VCC**: Connected to DISP_PWR (3.3V).
    - **GND**: Ground connection.
    - **SCL (Serial Clock), SDA (Serial Data), D/C (Data/Command), CS (Chip Select)**: Connected to corresponding MCU pins for SPI communication.



Draft of the Device's Algorithm of Operation

Initialization

1. **Power-Up Check**
    - Detect whether power is supplied via USB or battery.
    - If USB is connected, manage battery charging.
2. **MCU Initialization**
    - Set up GPIO pins.
    - Initialize communication interface (SPI) with the Display.
    - Start the RTC and Timer.
3. **Peripheral Initialization**
    - Send initialization commands to the OLED display.
    - Ensure the display is off initially to save power and insure its longevity.
    - Configure the switch input for interrupt-based wake-up.

Main Operation Loop

1. **Enter Low Power Mode**
    - Enable low power mode in the MCU.
2. **Wake-Up Handling**
    - On switch press (middle), wake up the MCU from the low power mode, and turn on the Display.
3. **Display Time/Date**
    - Read time and date from the RTC.
    - Send data to the OLED display to update the current time and date.
    - Repeat the above 2 steps until timeout or double press in the first position of the switch.
4. **User Interaction for Time/Date Setting**
    - Detect a first position (up direction) press of the switch to enter setting mode.
    - In setting mode:
        - Each first position press increments the current field (hours, minutes, date).
        - Each second position press decrements the current field (hours, minutes, date).
        - The third position press confirms the picked value for the current field.
        - Update the display with the new value.
        - Save the new settings to the RTC after last confirmation or time out and return the device into the Display Time/Date.
5. **Return to Low Power Mode**
    - After a timeout period of inactivity double press of the switch (middle), turn off the OLED display.
    - Re-enter low power mode to extend battery life.

*Remark: Switch debouncing is going to be accounted for on software level (check after a small delay if the state of the switch is the same).