MultiFX

Image54.png

Codesign Methods and Tools - Nese10

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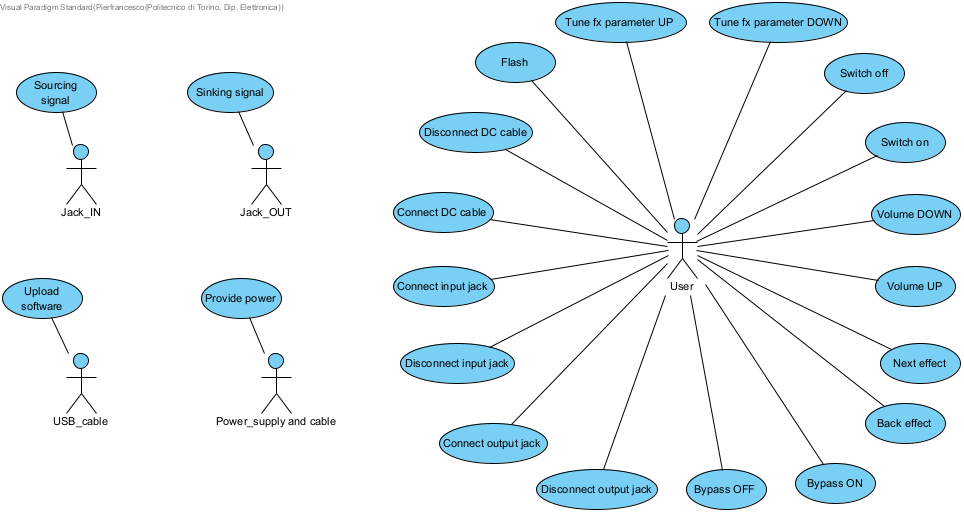
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Use Case Diagram

# Actors\_multifx



## Image1.png USB\_cable

A USB cable having a micro USB type B male connector.

## Image1.png Power\_supply and cable

Connector:

* male DC connector;
* internal diameter: 2.1 mm;
* external diameter: 5.5 mm;
* external pin length: 9.5 mm;
* central pin positive.



Power:

* DC;
* Voltage range: 4.5V to 17V ;
* max current at least 500 mA.

## Image1.png Jack\_IN



Standard mono TRS jack cable 6.35mm.

Nominal input level: −20dBm.

Max length: 6.0 m.

## Image1.png Jack\_OUT



Standard mono TRS jack cable 6.35mm.

Max output level: Line +5dBm (with output load 10 kΩ or more).

Max length 6.0 m.

## Image1.png User

Human being with full control of at least one hand.

Minimum age: 3 years old.

Language: basic English.

Non blind.

## Image5.png Upload software

Using the [USB\_cable](#AoMHtP6GAqBwAWmx) it is possible to transfer software to the [MultiFX\_nese10\_2122](#kYMHtP6GAqBwAWm4).

## Image5.png Provide power

[Power\_supply and cable](#soMHtP6GAqBwAWmy) provides a DC voltage in range +4.5V up to +17V referred to common ground, with max current at least 500 mA.

## Image5.png Sourcing signal

[Jack\_IN](#OoMHtP6GAqBwAWmz) provides an electric signal coming from a musical instrument with nominal input level -20dBm.

This signal is being processed by the system.

## Image5.png Sinking signal

[Jack\_OUT](#FoMHtP6GAqBwAWm0) receives an electric signal processed by the system with the following characteristics: Line +5dBm (with output load 10 kΩ or more).

## Image5.png Connect DC cable

The [User](#zoMHtP6GAqBwAWm1) can insert ([insertMaleConn()](#LYMHtP6GAqBwAWnB)) the [Power\_supply and cable](#soMHtP6GAqBwAWmy) inside the [CONN1: 5mm7\_2mm\_DC\_THT](#LYMHtP6GAqBwAWnC) in order to supply the [MultiFX\_nese10\_2122](#kYMHtP6GAqBwAWm4). However, before the system is turned ON ([switchOn()](#LYMHtP6GAqBwAWnD)) the supply voltage will not reach the internal circuit.

## Image5.png Disconnect DC cable

The [User](#zoMHtP6GAqBwAWm1) can remove the [Power\_supply and cable](#soMHtP6GAqBwAWmy) from the [CONN1: 5mm7\_2mm\_DC\_THT](#LYMHtP6GAqBwAWnC). In this way, the [MultiFX\_nese10\_2122](#kYMHtP6GAqBwAWm4) can not work, even if it is switched ON, because there is no voltage supply.

## Image5.png Connect input jack

The [User](#zoMHtP6GAqBwAWm1) can insert ([insertMaleJack()](#U4MHtP6GAqBwAWnI)) the [Jack\_IN](#OoMHtP6GAqBwAWmz) inside the [CONN2: 6mm35\_JACK\_Female\_THT](#U4MHtP6GAqBwAWnJ) in order to provide the audio signal to process to [MultiFX\_nese10\_2122](#kYMHtP6GAqBwAWm4).

It can be inserted before or after the system is turned ON, but until that moment there is no way to process the audio signal.

## Image5.png Disconnect input jack

The [User](#zoMHtP6GAqBwAWm1) can remove the [Jack\_IN](#OoMHtP6GAqBwAWmz) from the [CONN2: 6mm35\_JACK\_Female\_THT](#U4MHtP6GAqBwAWnJ). However, in this way he/she can not be able to provide any audio signal anymore.

If ON the [MultiFX\_nese10\_2122](#kYMHtP6GAqBwAWm4) will continue to work, but it will process noise or nothing.

## Image5.png Connect output jack

The [User](#zoMHtP6GAqBwAWm1) can insert ([insertMaleJack()](#U4MHtP6GAqBwAWnI)) the [Jack\_OUT](#FoMHtP6GAqBwAWm0) inside the [CONN3: 6mm35\_JACK\_Female\_THT](#p4MHtP6GAqBwAWnO) in order to acquire the audio signal processed by [MultiFX\_nese10\_2122](#kYMHtP6GAqBwAWm4).

It can be inserted before or after the system is turned on, but until that moment there is no way to use the processed audio signal.

## Image5.png Disconnect output jack

The [User](#zoMHtP6GAqBwAWm1) can remove the [Jack\_OUT](#FoMHtP6GAqBwAWm0) from the [CONN3: 6mm35\_JACK\_Female\_THT](#p4MHtP6GAqBwAWnO). However, in this way he/she can not be able to get the processed audio signal anymore.

If ON the [MultiFX\_nese10\_2122](#kYMHtP6GAqBwAWm4) will continue to work, but output will not be available.

## Image5.png Flash

The [User](#zoMHtP6GAqBwAWm1) in order to upload correctly the software must perform the following operations in the given order:

1. [pressBoot()](#P4MHtP6GAqBwAWnT)
2. [pressReset()](#P4MHtP6GAqBwAWnU)
3. [releaseReset()](#v4MHtP6GAqBwAWnV)
4. [releaseBoot()](#v4MHtP6GAqBwAWnW)

## Image5.png Switch on

The [User](#zoMHtP6GAqBwAWm1) toggles [SW1: SPDT\_ON-OFF\_ToggleSwitch\_THT](#kEMHtP6GAqBwAWnZ) in the ON position ([switchOn()](#LYMHtP6GAqBwAWnD)). If connected, [Power\_supply and cable](#soMHtP6GAqBwAWmy) provides power to the system.

The [MultiFX\_nese10\_2122](#kYMHtP6GAqBwAWm4) starts applying the default effect ([delay(&in: float): void](#kEMHtP6GAqBwAWna)) on input signal and [LD1: RedLED\_AlGaInP\_SMD](#kEMHtP6GAqBwAWnb) is kept OFF.

## Image5.png Switch off

The [User](#zoMHtP6GAqBwAWm1) toggles [SW1: SPDT\_ON-OFF\_ToggleSwitch\_THT](#kEMHtP6GAqBwAWnZ) in the OFF position ([switchOff()](#KEMHtP6GAqBwAWne)), so that the system is not supplied.

## Image5.png Tune fx parameter UP

[User](#zoMHtP6GAqBwAWm1) rotates [POT2: 10K\_t20%\_LOG\_POT\_H20mm\_THT](#hEMHtP6GAqBwAWnh) clockwise ([FxUp()](#REMHtP6GAqBwAWni)). Parameter value of the selected effect is increased until [User](#zoMHtP6GAqBwAWm1) stops the rotation and is sent to [MultiFX\_nese10\_2122](#kYMHtP6GAqBwAWm4) in order to obtain the desired signal processing:

* in case of [delay(&in: float): void](#kEMHtP6GAqBwAWna) time delay is increased
* in case of [tremolo(&in: float): void](#REMHtP6GAqBwAWnj) modulation frequency is increased
* in case of [phaser(&in: float): void](#xEMHtP6GAqBwAWnk) modulation frequency is increased

The new increased value is updated on the [I2C\_OLED\_Display\_SSD1306](#xEMHtP6GAqBwAWnl) ([updateDisplay(): void](#xEMHtP6GAqBwAWnm)).

## Image5.png Tune fx parameter DOWN

[User](#zoMHtP6GAqBwAWm1) rotates [POT2: 10K\_t20%\_LOG\_POT\_H20mm\_THT](#hEMHtP6GAqBwAWnh) counterclockwise ([FxDown()](#TEMHtP6GAqBwAWnp)). Parameter value of the selected effect is decreased until [User](#zoMHtP6GAqBwAWm1) stops the rotation and is sent to [MultiFX\_nese10\_2122](#kYMHtP6GAqBwAWm4) in order to obtain the desired signal processing:

* in case of [delay(&in: float): void](#kEMHtP6GAqBwAWna) time delay is increased
* in case of [tremolo(&in: float): void](#REMHtP6GAqBwAWnj) modulation frequency is increased
* in case of [phaser(&in: float): void](#xEMHtP6GAqBwAWnk) modulation frequency is increased

The new decreased value is updated on the [I2C\_OLED\_Display\_SSD1306](#xEMHtP6GAqBwAWnl) ([updateDisplay(): void](#xEMHtP6GAqBwAWnm)).

## Image5.png Volume UP

The [User](#zoMHtP6GAqBwAWm1) rotates [POT1: 10K\_t20%\_LOG\_POT\_H20mm\_THT](#AkMHtP6GAqBwAWns) clockwise ([volumeUp()](#AkMHtP6GAqBwAWnt)). Volume value is sent to [MultiFX\_nese10\_2122](#kYMHtP6GAqBwAWm4) so that amplitude of output signal increases until [User](#zoMHtP6GAqBwAWm1) stops the rotation. The new increased value of volume is updated ([updateDisplay(): void](#xEMHtP6GAqBwAWnm)) on the [I2C\_OLED\_Display\_SSD1306](#xEMHtP6GAqBwAWnl).

## Image5.png Volume DOWN

The [User](#zoMHtP6GAqBwAWm1) rotates [POT1: 10K\_t20%\_LOG\_POT\_H20mm\_THT](#AkMHtP6GAqBwAWns) counterclockwise ([volumeDown()](#MkMHtP6GAqBwAWnw)). Volume value is sent to [MultiFX\_nese10\_2122](#kYMHtP6GAqBwAWm4) so that amplitude of output signal decreases until [User](#zoMHtP6GAqBwAWm1) stops the rotation. The new decreased value of volume is updated ([updateDisplay(): void](#xEMHtP6GAqBwAWnm)) on the [I2C\_OLED\_Display\_SSD1306](#xEMHtP6GAqBwAWnl).

## Image5.png Next effect

[User](#zoMHtP6GAqBwAWm1) [pushNextFx()](#WkMHtP6GAqBwAWnz) and [releaseNextFx()](#WkMHtP6GAqBwAWn0). A digital signal is sent to [MultiFX\_nese10\_2122](#kYMHtP6GAqBwAWm4) in order to change to the next processing effect between the ones available, according to the effect sequence [delay(&in: float): void](#kEMHtP6GAqBwAWna)->[tremolo(&in: float): void](#REMHtP6GAqBwAWnj)->[phaser(&in: float): void](#xEMHtP6GAqBwAWnk).

The [delay(&in: float): void](#kEMHtP6GAqBwAWna) effect allows to apply a temporal delay to the input audio signal. Then the delayed signal is overlapped to the original one in order to have an effect that is similar to the echo.

The [tremolo(&in: float): void](#REMHtP6GAqBwAWnj) effect applies a little amplitude modulation to the input audio signal.

The [phaser(&in: float): void](#xEMHtP6GAqBwAWnk) effect applies a phase shift to the input audio signal.

The new effect name is displayed on the [I2C\_OLED\_Display\_SSD1306](#xEMHtP6GAqBwAWnl).

## Image5.png Back effect

[User](#zoMHtP6GAqBwAWm1) [pushBackFx()](#lkMHtP6GAqBwAWn3) and [releaseBackFx()](#lkMHtP6GAqBwAWn4). A digital signal is sent to [MultiFX\_nese10\_2122](#kYMHtP6GAqBwAWm4) in order to change to the previous processing effect between the ones available, according to the effect sequence [delay(&in: float): void](#kEMHtP6GAqBwAWna)->[phaser(&in: float): void](#xEMHtP6GAqBwAWnk)->[tremolo(&in: float): void](#REMHtP6GAqBwAWnj).

The [delay(&in: float): void](#kEMHtP6GAqBwAWna) effect allows to apply a temporal delay to the input audio signal. Then the delayed signal is overlapped to the original one in order to have an effect that is similar to the echo.

The [tremolo(&in: float): void](#REMHtP6GAqBwAWnj) effect applies a little amplitude modulation to the input audio signal.

The [phaser(&in: float): void](#xEMHtP6GAqBwAWnk) effect applies a phase shift to the input audio signal.

The new effect name is displayed on the [I2C\_OLED\_Display\_SSD1306](#xEMHtP6GAqBwAWnl).

## Image5.png Bypass ON

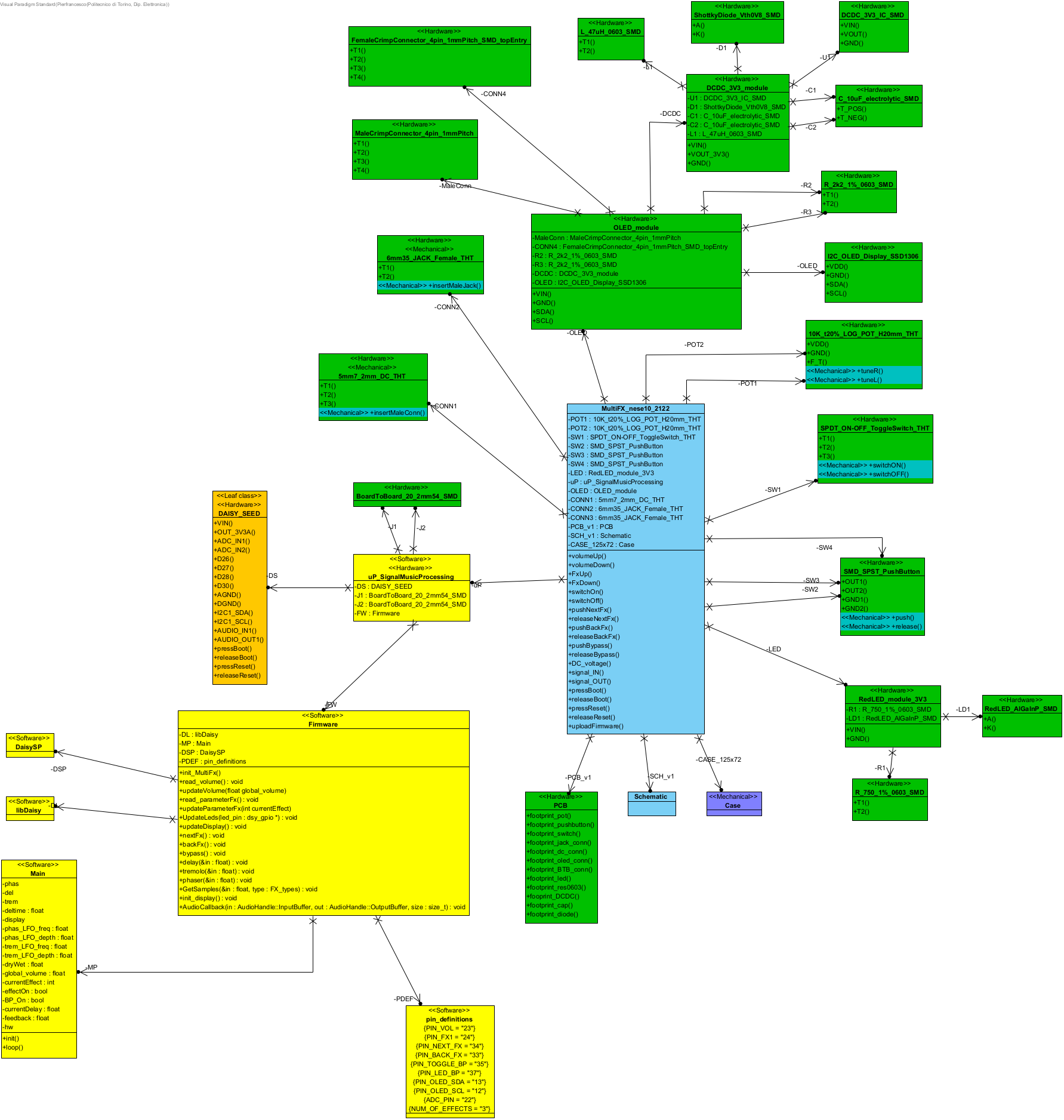
When [LD1: RedLED\_AlGaInP\_SMD](#kEMHtP6GAqBwAWnb) is OFF and [User](#zoMHtP6GAqBwAWm1) [pushBypass()](#7kMHtP6GAqBwAWn7), a digital signal is sent to [MultiFX\_nese10\_2122](#kYMHtP6GAqBwAWm4) such that it will not apply any processing on the input signal. Then [LD1: RedLED\_AlGaInP\_SMD](#kEMHtP6GAqBwAWnb) will turn ON since [bypass(): void](#HkMHtP6GAqBwAWn8) is active.

## Image5.png Bypass OFF

When [LD1: RedLED\_AlGaInP\_SMD](#kEMHtP6GAqBwAWnb) is ON and [User](#zoMHtP6GAqBwAWm1) [pushBypass()](#7kMHtP6GAqBwAWn7), a digital signal is sent to [MultiFX\_nese10\_2122](#kYMHtP6GAqBwAWm4) such that it will apply the selected processing effect on the input signal. Then [LD1: RedLED\_AlGaInP\_SMD](#kEMHtP6GAqBwAWnb) will turn OFF since [bypass(): void](#HkMHtP6GAqBwAWn8) is disabled.

Class Diagram

# Class\_multifx



## Image7.png DCDC\_3V3\_IC\_SMD

It is a DCDC converter that takes as input a DC voltage and it is able to provide as output a stable DC voltage, different from the input one.

It takes as input a DC voltage inside a range from 4.5V to 22V, in order to have a stable 3.3V DC voltage at the output.

To avoid noise on the output a decoupling capacitor can be needed, depending on the application.

**Electrical characteristics:**

* Max input DC voltage: 24V
* Output DC voltage: 3.3V
* Max output current: 2A
* Min efficiency: 75%

Operations

## Image8.png VIN

This is the positive input supply for the IC switching regulator. A suitable input bypass capacitor must be presented at this pin to minimize voltage transients and to supply the switching currents required by the regulator.

**Coding:** voltage, from 4.5V to 22V

**Periodicity:** continuous

## Image8.png VOUT

Output voltage fixed to 3.3V.

The voltage at this pin switches between approximately [VIN()](#mcMHtP6GAqBwAWoD) and -0.5V with a duty cycle of approximately [VOUT()](#1cMHtP6GAqBwAWoE)/[VIN()](#mcMHtP6GAqBwAWoD).

To minimize coupling to sensitive circuitry, the PCB copper area connected to this pin should be minimized.

**Coding:** voltage, 3.3V

**Periodicity:** continuous

## Image8.png GND

Reference ground voltage.

**Coding:** voltage

**Periodicity:** continuous

## Image7.png L\_47uH\_0603\_SMD

Surface mount inductor.

**Electrical characteristics:**

* Inductance: 47uH
* Tolerance: +/-20%

**Mechanical characteristics:**

* Length: 1.6mm
* Width: 0.8mm
* Height: 0.8mm

Operations

## Image8.png T1

Pin 1 inductor.

**Coding:** voltage

**Periodicity:** continuous

## Image8.png T2

Pin 2 inductor.

**Coding:** voltage

**Periodicity:** continuous

## Image7.png C\_10uF\_electrolytic\_SMD

Surface mount electrolytic capacitor.

**Electrical characteristics:**

* Capacitance: 10uF
* Max DC voltage: 25V
* Max ESR: 35mOhm
* Max leakage current: 125uA

**Mechanical characteristics:**

* Diameter: 8mm
* Height: 7mm

Operations

## Image8.png T\_POS

Electrolytic capacitor terminal connected to higher voltage.

**Coding:** voltage

**Periodicity:** continuous

## Image8.png T\_NEG

Electrolytic capacitor terminal connected to lower voltage.

**Coding:** voltage

**Periodicity:** continuous

## Image7.png ShottkyDiode\_Vth0V8\_SMD

Shottky diode having a threshold voltage (Vth) equal to 0.8V. When a voltage drop larger than Vth is applied to terminals of the diode, it turns ON and allows current to flow from anode ([A()](#pCMHtP6GAqBwAWoP)) to cathode ([K()](#pCMHtP6GAqBwAWoQ)). Otherwise, the current flows through the diode is negligible.

When diode is forward polarized the current can flow only from anode ([A()](#pCMHtP6GAqBwAWoP)) to cathode ([K()](#pCMHtP6GAqBwAWoQ)). However, if a reverse voltage so that [A()](#pCMHtP6GAqBwAWoP) - [K()](#pCMHtP6GAqBwAWoQ) < -80V is applied, the diode reach the breakdown point and a non-negligible current starts flowing from cathode ([K()](#pCMHtP6GAqBwAWoQ)) to anode ([A()](#pCMHtP6GAqBwAWoP)).

**Electrical characteristics:**

* Vth = 0.8V
* Forward current: 0.5A
* Max DC forward current: 30mA
* Max Reverse Voltage: 80V
* Max RMS forward voltage: 56V

Operations

## Image8.png A

Anode connected to the higher potential.

When voltage drop [A()](#pCMHtP6GAqBwAWoP) - [K()](#pCMHtP6GAqBwAWoQ) > 0.8V (threshold voltage of diode) diode turns on.

**Coding:** voltage

**Periodicity:** continuous

## Image8.png K

Cathode connected to the lower potential (ground).

Anode connected to the higher potential.

When voltage drop [A()](#pCMHtP6GAqBwAWoP) - [K()](#pCMHtP6GAqBwAWoQ) > 0.8V (threshold voltage of diode) diode turns on.

**Coding:** voltage

**Periodicity:** continuous

## Image7.png DCDC\_3V3\_module

This module allows to provide a stable DC voltage.

It takes as input a DC voltage inside a range from 4.5V to 22V, in order to have a stable 3.3V DC voltage at the output.

Attributes

## Image9.png U1

This DCDC converter is used to provide a stable 3.3V DC voltage.

## Image9.png D1

This diode is used to clamp the voltage at [VOUT()](#1cMHtP6GAqBwAWoE) pin of [U1: DCDC\_3V3\_IC\_SMD](#ciMHtP6GAqBwAWoU). In this way it is possible to limit overshoot and undershoot of supply voltage.

## Image9.png C1

Bypass capacitor connected at [VIN()](#mcMHtP6GAqBwAWoD) pin of [DCDC\_3V3\_IC\_SMD](#AcMHtP6GAqBwAWoC). It allows to filter out noise on power line in order to minimize voltage transient at the input of [DCDC\_3V3\_IC\_SMD](#AcMHtP6GAqBwAWoC).

This capacitor must be placed as close as possible to [VIN()](#mcMHtP6GAqBwAWoD) pin.

The [T\_POS()](#v8MHtP6GAqBwAWoL) pin must be connected to [VIN()](#mcMHtP6GAqBwAWoD), instead the [T\_NEG()](#ECMHtP6GAqBwAWoM) pin to [GND()](#biMHtP6GAqBwAWoZ).

## Image9.png C2

Decoupling capacitor connected at the [VOUT()](#1cMHtP6GAqBwAWoE) pin of [DCDC\_3V3\_IC\_SMD](#AcMHtP6GAqBwAWoC) in order to maintain stable the output voltage at 3.3V. In fact, if an high current is requested by the supplied circuit, the [DCDC\_3V3\_IC\_SMD](#AcMHtP6GAqBwAWoC) is not able to provide this current maintaining stable output voltage [VOUT()](#1cMHtP6GAqBwAWoE), but some fluctuations can happen.

The [T\_POS()](#v8MHtP6GAqBwAWoL) pin must be connected to [VOUT()](#1cMHtP6GAqBwAWoE), instead the [T\_NEG()](#ECMHtP6GAqBwAWoM) pin to [GND()](#biMHtP6GAqBwAWoZ).

## Image9.png L1

This inductor is placed between [VOUT()](#1cMHtP6GAqBwAWoE) pin of [DCDC\_3V3\_IC\_SMD](#AcMHtP6GAqBwAWoC) and [T\_POS()](#v8MHtP6GAqBwAWoL) pin of [C2: C\_10uF\_electrolytic\_SMD](#7iMHtP6GAqBwAWoa). It is required by [DCDC\_3V3\_IC\_SMD](#AcMHtP6GAqBwAWoC) to work correctly and can not be avoided.

Operations

## Image8.png VIN

It is the positive input supply. The [DCDC\_3V3\_module](#QiMHtP6GAqBwAWoT) can accept an input voltage between 4.5V and 22V.

It is connected to the [VIN()](#mcMHtP6GAqBwAWoD) pin on [DCDC\_3V3\_IC\_SMD](#AcMHtP6GAqBwAWoC).

**Coding:** voltage, 4.5V - 22V

**Periodicity:** continuous

## Image8.png VOUT\_3V3

Output voltage fixed to 3.3V.

It is connected to [VOUT()](#1cMHtP6GAqBwAWoE) pin of [DCDC\_3V3\_IC\_SMD](#AcMHtP6GAqBwAWoC).

**Coding:** voltage, 3.3V

**Periodicity:** continuous

## Image8.png GND

Reference ground voltage.

**Coding:** voltage

**Periodicity:** continuous

## Image7.png I2C\_OLED\_Display\_SSD1306

The display exploits the I2C protocol to communicate, so only 4 pins are needed. Two pull-up resistors are required: one for SDA (Serial DAta) line and the other one for SCL (Serial CLock) line.

Pins must be connected to a male connector having a pitch equal to 1mm.

**Basic specifications:**

* Size: 0.96''
* Supply voltage: [3, 5]V
* I2C interface
* Max module length: 40mm
* Max module width: 40mm
* 128x64 pixel
* Display size: 0.96"
* Display width: 10.86mm
* Display length: 21.74mm

Operations

## Image8.png VDD

Voltage supply pin.

A DC voltage 3.3V is require to supply the OLED display.

**Coding:** voltage, 3.3V

**Periodicity:** continuous

## Image8.png GND

Reference ground pin.

**Coding:** voltage

**Periodicity:** continuous

## Image8.png SDA

Serial DAta pin: data are sent and received in a serial way using this pin.

**Coding**: I2C

* Input logic levels:
  + '0': [DGND()](#fyMHtP6GAqBwAWom) - 0.99V
  + '1': 2.31V - 3.3V
* Output logic levels:
  + '0': [DGND()](#fyMHtP6GAqBwAWom) - 0.4V
  + '1': 2.9V - 3.3V

**Periodicity**: continuous

## Image8.png SCL

Serial CLock pin: a synchronous signal is connected to this pin in order to synchronize Master and Slave.

**Coding**: I2C

* Input logic levels:
  + '0': [DGND()](#fyMHtP6GAqBwAWom) - 0.99V
  + '1': 2.31V - 3.3V
* Output logic levels:
  + '0': [DGND()](#fyMHtP6GAqBwAWom) - 0.4V
  + '1': 2.9V - 3.3V

**Periodicity**: continuous

## Image7.png R\_2k2\_1%\_0603\_SMD

Surface mount resistor, it is a linear passive component.

**Electrical characteristics:**

* Resistance: 2.2kOhm
* Tolerance: +/-1%
* Max power: 0.1W
* Max voltage: 75V
* Temperature coefficient: +/-200ppm/°C

**Mechanical characteristics:**

* Length: 1.55mm
* Width: 0.8mm
* Height: 0.45mm

Operations

## Image8.png T1

Pin 1 resistor.

Max current: 1A

**Coding:** voltage

**Periodicity:** continuous

## Image8.png T2

Pin 2 resistor.

Max current: 1A

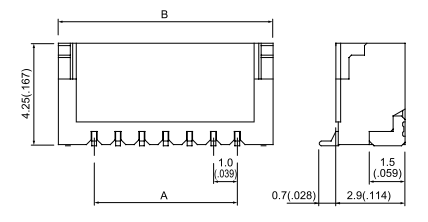
**Coding:** voltage

**Periodicity:** continuous

## Image7.png FemaleCrimpConnector\_4pin\_1mmPitch\_SMD\_topEntry

Crimp style female connector that allows to connect a [MaleCrimpConnector\_4pin\_1mmPitch](#kqMHtP6GAqBwAWou) from the top side. So it allows to connect 4 wires to a board, having 4 pins 1 mm pitch.

[FemaleCrimpConnector\_4pin\_1mmPitch\_SMD\_topEntry](#nKMHtP6GAqBwAWos) must be similar to the following one:



Looking at the side in which there are surface mount pins, the first pin ([T1()](#UqMHtP6GAqBwAWov)) is the first one starting from the right.

**Specifications:**

* Max contact resistance: 20mOhm
* Min insulation resistance: 100MOhm
* Max current: 0.7A
* Max DC voltage: 50V
* Height: 4.25mm
* External thickness: 2.9mm
* Width: 6mm

Operations

## Image8.png T1

Pin 1

**Coding:** voltage

**Periodicity:** continuous

## Image8.png T2

Pin 2

**Coding:** voltage

**Periodicity:** continuous

## Image8.png T3

Pin 3

**Coding:** voltage

**Periodicity:** continuous

## Image8.png T4

Pin 4

**Coding:** voltage

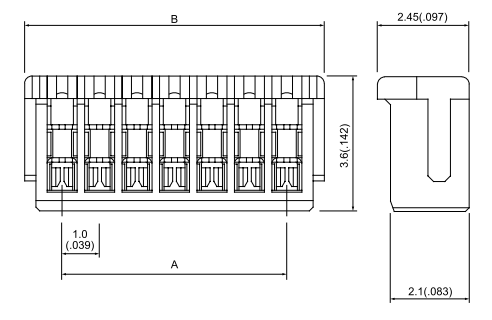
**Periodicity:** continuous

## Image7.png MaleCrimpConnector\_4pin\_1mmPitch

Crimp style male connector. It is a plastic connector with 4 pins 1mm pitch.

It is used to terminate 4 wires in order to connect them to a board, avoiding soldering them. For this purpose a [FemaleCrimpConnector\_4pin\_1mmPitch\_SMD\_topEntry](#nKMHtP6GAqBwAWos) is needed on the board.

[MaleCrimpConnector\_4pin\_1mmPitch](#kqMHtP6GAqBwAWou) must be similar to the following one:



**Specifications:**

* Max contact resistance: 20mOhm
* Min insulation resistance: 100MOhm
* Max current: 0.7A
* Max DC voltage: 50V
* Height: 3.6mm
* Thickness: 2.1mm
* Width: 5mm

Operations

## Image8.png T1

Pin 1.

It must be connected to [T1()](#UqMHtP6GAqBwAWov) of [FemaleCrimpConnector\_4pin\_1mmPitch\_SMD\_topEntry](#nKMHtP6GAqBwAWos).

**Coding:** voltage

**Periodicity:** continuous

## Image8.png T2

Pin 2.

It must be connected to [T2()](#GqMHtP6GAqBwAWow) of [FemaleCrimpConnector\_4pin\_1mmPitch\_SMD\_topEntry](#nKMHtP6GAqBwAWos).

**Coding:** voltage

**Periodicity:** continuous

## Image8.png T3

Pin 3.

It must be connected to [T3()](#JqMHtP6GAqBwAWox) of [FemaleCrimpConnector\_4pin\_1mmPitch\_SMD\_topEntry](#nKMHtP6GAqBwAWos).

**Coding:** voltage

**Periodicity:** continuous

## Image8.png T4

Pin 4.

It must be connected to [T4()](#DqMHtP6GAqBwAWoy) of [FemaleCrimpConnector\_4pin\_1mmPitch\_SMD\_topEntry](#nKMHtP6GAqBwAWos).

**Coding:** voltage

**Periodicity:** continuous

## Image7.png OLED\_module

OLED display module.

A DC voltage between 4.5V and 22V is required to supply this module.

The I2C protocol is exploited to establish a communication with the remaining part of the circuit.

Attributes

## Image9.png MaleConn

The 4 wires starting from the [OLED\_module](#vaMHtP6GAqBwAWo8) pins end in the [MaleCrimpConnector\_4pin\_1mmPitch](#kqMHtP6GAqBwAWou).

This male connector will be inserted inside the [CONN4: FemaleCrimpConnector\_4pin\_1mmPitch\_SMD\_topEntry](#W6MHtP6GAqBwAWo_), so that there is a direct mapping between pins of both connectors:

* [T4()](#jaMHtP6GAqBwAWo6)-> [GND()](#26MHtP6GAqBwAWpA)
* [T3()](#paMHtP6GAqBwAWo4)-> [SDA()](#26MHtP6GAqBwAWpB)
* [T2()](#maMHtP6GAqBwAWo2)-> [SCL()](#O6MHtP6GAqBwAWpC)
* [T1()](#saMHtP6GAqBwAWo0)-> [VOUT\_3V3()](#hSMHtP6GAqBwAWog)

## Image9.png CONN4

Female crimp style connector on the board that allows to connect [I2C\_OLED\_Display\_SSD1306](#xEMHtP6GAqBwAWnl) to the circuit. Pins of connector must be mapped in the following way:

* [T4()](#jaMHtP6GAqBwAWo6)-> [GND()](#26MHtP6GAqBwAWpA)
* [T3()](#paMHtP6GAqBwAWo4)-> [SDA()](#26MHtP6GAqBwAWpB)
* [T2()](#maMHtP6GAqBwAWo2)-> [SCL()](#O6MHtP6GAqBwAWpC)
* [T1()](#saMHtP6GAqBwAWo0)-> [VOUT\_3V3()](#hSMHtP6GAqBwAWog)

## Image9.png R2

Pull-up resistor to rise the [SCL()](#O6MHtP6GAqBwAWpC) line, required by I2C protocol.

## Image9.png R3

Pull-up resistor to rise the [SDA()](#26MHtP6GAqBwAWpB) line, required by I2C protocol.

## Image9.png DCDC

This DCDC regulator is used to supply correctly the [OLED\_module](#vaMHtP6GAqBwAWo8).

Therefore [DCDC: DCDC\_3V3\_module](#QGMHtP6GAqBwAWpI) provide the positive supply voltage to [I2C\_OLED\_Display\_SSD1306](#xEMHtP6GAqBwAWnl).

In fact, [VIN()](#SSMHtP6GAqBwAWoe) pin of [DCDC: DCDC\_3V3\_module](#QGMHtP6GAqBwAWpI) receives the DC voltage from [T1()](#8GMHtP6GAqBwAWpK) of [5mm7\_2mm\_DC\_THT](#8GMHtP6GAqBwAWpL) and provides on [VOUT\_3V3()](#hSMHtP6GAqBwAWog) pin a suitable supply voltage for [I2C\_OLED\_Display\_SSD1306](#xEMHtP6GAqBwAWnl).

## Image9.png OLED

OLED display that exploits the I2C protocol to communicate. This display is connected to the board using a [CONN4: FemaleCrimpConnector\_4pin\_1mmPitch\_SMD\_topEntry](#W6MHtP6GAqBwAWo_) in which it is possible to insert a [MaleConn: MaleCrimpConnector\_4pin\_1mmPitch](#U6MHtP6GAqBwAWo9), that is connected to the 4 pins of [OLED: I2C\_OLED\_Display\_SSD1306](#8GMHtP6GAqBwAWpM).

Operations

## Image8.png VIN

Positive voltage supply pin.

A supply voltage from 4.5V to 22V can be applied.

**Coding:** voltage, 4.5V - 22V

**Periodicity:** continuous

## Image8.png GND

Reference ground pin.

**Coding:** voltage

**Periodicity:** continuous

## Image8.png SDA

Serial DAta pin: data are sent and received in a serial way using this pin.

**Coding**: I2C

* Input logic levels:
  + '0': [DGND()](#fyMHtP6GAqBwAWom) - 0.99V
  + '1': 2.31V - 3.3V
* Output logic levels:
  + '0': [DGND()](#fyMHtP6GAqBwAWom) - 0.4V
  + '1': 2.9V - 3.3V

**Periodicity**: continuous

## Image8.png SCL

Serial CLock pin: a synchronous signal is connected to this pin in order to synchronize Master and Slave.

**Coding**: I2C

* Input logic levels:
  + '0': [DGND()](#fyMHtP6GAqBwAWom) - 0.99V
  + '1': 2.31V - 3.3V
* Output logic levels:
  + '0': [DGND()](#fyMHtP6GAqBwAWom) - 0.4V
  + '1': 2.9V - 3.3V

**Periodicity**: continuous

## Image7.png RedLED\_AlGaInP\_SMD

It is a surface mount LED. When a voltage drop larger than Vth is applied to terminals of the LED, it turns ON and emits red light (625nm), otherwise it is turned OFF.

**Electrical characteristics:**

* Vth = 1.8V
* Max DC forward current: 30mA
* Max Reverse Voltage: 5V
* Viewing angle: 120°

Operations

## Image8.png A

Anode connected to the higher potential.

When voltage drop [A()](#BmMHtP6GAqBwAWpS) - [K()](#NmMHtP6GAqBwAWpU) > 1.8V (threshold voltage of red LED) LED turns on.

**Coding:** voltage

**Periodicity:** continuous

## Image8.png K

Cathode connected to the lower potential (ground).

Anode connected to the higher potential.

When voltage drop [A()](#BmMHtP6GAqBwAWpS) - [K()](#NmMHtP6GAqBwAWpU) > 1.8V (threshold voltage of red LED) LED turns on.

**Coding:** voltage

**Periodicity:** continuous

## Image7.png R\_750\_1%\_0603\_SMD

Surface mount resistor, it is a linear passive component.

**Electrical characteristics:**

* Resistance: 750 Ohm
* Tolerance: +/-1%
* Max power: 0.1W
* Max voltage: 75V
* Temperature coefficient: +/-200ppm/°C

**Mechanical characteristics:**

* Length: 1.55mm
* Width: 0.8mm
* Height: 0.45mm

Operations

## Image8.png T1

Pin 1 resistor.

Max current: 1A

**Coding:** voltage

**Periodicity:** continuous

## Image8.png T2

Pin 2 resistor.

Max current: 1A

**Coding:** voltage

**Periodicity:** continuous

## Image7.png RedLED\_module\_3V3

Red LED module that allows to have a bright indication on the circuit.

A surface mount LED will require a guide in order to propagate the light until the surface of the package.

In order to limit the current flows in the LED a resistor is required.

A 3.3V DC voltage must be applied to [VIN()](#1WMHtP6GAqBwAWpb) pin in order to switch on the LED.

Attributes

## Image9.png R1

This resistor allows to limit the current that flows through the [RedLED\_AlGaInP\_SMD](#KmMHtP6GAqBwAWpR) up to 2mA, considering that [VIN()](#1WMHtP6GAqBwAWpb) = 3.3V when [RedLED\_AlGaInP\_SMD](#KmMHtP6GAqBwAWpR) must be switched ON.

The [T1()](#kWMHtP6GAqBwAWpX) pin must be connected to [VIN()](#1WMHtP6GAqBwAWpb) pin of [RedLED\_module\_3V3](#BWMHtP6GAqBwAWpZ), instead the [T2()](#KWMHtP6GAqBwAWpY) pin must be connected to [A()](#BmMHtP6GAqBwAWpS) pin of [LD1: RedLED\_AlGaInP\_SMD](#kEMHtP6GAqBwAWnb).

## Image9.png LD1

Red LED that switches ON when a voltage larger than 1.8V drops on it.

The anode [A()](#BmMHtP6GAqBwAWpS) must be connected to [T2()](#KWMHtP6GAqBwAWpY) pin of [R1: R\_750\_1%\_0603\_SMD](#1WMHtP6GAqBwAWpc), instead the cathode [K()](#NmMHtP6GAqBwAWpU) must be connected to [GND()](#o2MHtP6GAqBwAWpf).

Operations

## Image8.png VIN

Positive voltage pin.

**Coding:** voltage:

* 0V -> switched OFF
* 3.3V -> switched ON

**Periodicity:** continuous

## Image8.png GND

Reference ground pin.

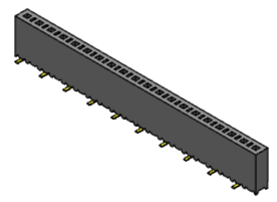
**Coding:** voltage

**Periodicity:** continuous

## Image7.png BoardToBoard\_20\_2mm54\_SMD

Surface mount socket to connect another board to the [PCB](#Z2MHtP6GAqBwAWpi) on which circuit is implemented.

20 inputs are aligned on a single row, with a pitch of 2.54mm.



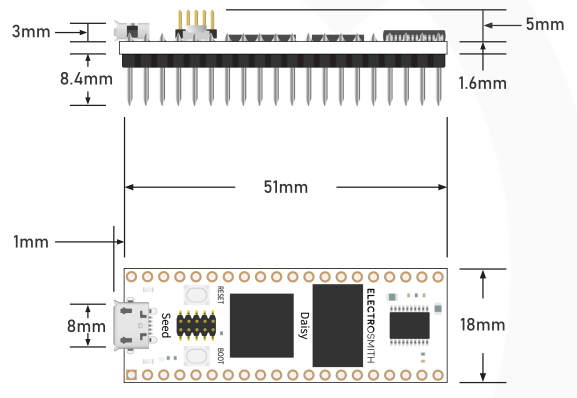
## Image7.png DAISY\_SEED

[DAISY\_SEED](#52MHtP6GAqBwAWpj) is an embedded platform for music. It features everything you need for creating high fidelity audio hardware devices. It integrates:

* SDRAM 64MB
* ARM Cortex-M7 MCU, running at 480MHz
* 31 GPIO
* 12 bit ADC

**Absolute maximum ratings:**

* Vin: [4, 17] V
* GPIO: [0, 5] V
* Audio inputs: [-1.8, 1.8] V



Operations

## Image8.png VIN

Voltage supply (DC) input terminal of [DAISY\_SEED](#52MHtP6GAqBwAWpj) board. It is pin 39.

VIN: 4.5V to 17V

**Coding:** voltage, 4.5V - 17V

**Periodicity:** continuous

## Image8.png OUT\_3V3A

Output DC voltage 3.3V provided by [DAISY\_SEED](#52MHtP6GAqBwAWpj). It can be used to supply other components. It corresponds to pin 21.

Maximum available current: 150mA.

**Coding:** voltage, 3.3V

**Periodicity:** continuous

## Image8.png ADC\_IN1

Input ADC. An analog signal can be connected to this input in order to be converted in digital (12 bit resolution).

Input voltage can be in the range from 0V to 3.3V.

**Coding:** voltage, 0V - 3.3V

**Periodicity:** continuous

## Image8.png ADC\_IN2

Input ADC. An analog signal can be connected to this input in order to be converted in digital (12 bit resolution).

Input voltage can be in the range from 0V to 3.3V.

**Coding:** voltage, 0V - 3.3V

**Periodicity:** continuous

## Image8.png D26

GPIO, digital pin 26, pin 33: 0V to 3.3V

When configured as input each pin can configure an internal pull-up, pull-down, or no pull resistor.

When configured as an output each pin can be configured for push-pull or open-drain configuration.

**Coding**: digital voltage

* Input logic levels:
  + '0': [DGND()](#fyMHtP6GAqBwAWom) - 0.99V
  + '1': 2.31V - 3.3V
* Output logic levels:
  + '0': [DGND()](#fyMHtP6GAqBwAWom) - 0.4V
  + '1': 2.9V - 3.3V

**Periodicity**: continuous

## Image8.png D27

GPIO, digital pin 27, pin 34: 0V to 3.3V

When configured as input each pin can configure an internal pull-up, pull-down, or no pull resistor.

When configured as an output each pin can be configured for push-pull or open-drain configuration.

**Coding**: digital voltage

* Input logic levels:
  + '0': [DGND()](#fyMHtP6GAqBwAWom) - 0.99V
  + '1': 2.31V - 3.3V
* Output logic levels:
  + '0': [DGND()](#fyMHtP6GAqBwAWom) - 0.4V
  + '1': 2.9V - 3.3V

**Periodicity**: continuous

## Image8.png D28

GPIO, digital pin 28, pin 35: 0V to 3.3V

When configured as input each pin can configure an internal pull-up, pull-down, or no pull resistor.

When configured as an output each pin can be configured for push-pull or open-drain configuration.

**Coding**: digital voltage

* Input logic levels:
  + '0': [DGND()](#fyMHtP6GAqBwAWom) - 0.99V
  + '1': 2.31V - 3.3V
* Output logic levels:
  + '0': [DGND()](#fyMHtP6GAqBwAWom) - 0.4V
  + '1': 2.9V - 3.3V

**Periodicity**: continuous

## Image8.png D30

GPIO, digital pin 30, pin 37: 0V to 3.3V

When configured as input each pin can configure an internal pull-up, pull-down, or no pull resistor.

When configured as an output each pin can be configured for push-pull or open-drain configuration.

**Coding**: digital voltage

* Input logic levels:
  + '0': [DGND()](#fyMHtP6GAqBwAWom) - 0.99V
  + '1': 2.31V - 3.3V
* Output logic levels:
  + '0': [DGND()](#fyMHtP6GAqBwAWom) - 0.4V
  + '1': 2.9V - 3.3V

**Periodicity**: continuous

## Image8.png AGND

Analog ground reference voltage of [DAISY\_SEED](#52MHtP6GAqBwAWpj) board. It corresponds to pin 20.

[AGND()](#UeMHtP6GAqBwAWpz) must be shorted to [DGND()](#fyMHtP6GAqBwAWom).

**Coding:** voltage

**Periodicity:** continuous

## Image8.png DGND

Digital ground reference voltage of [DAISY\_SEED](#52MHtP6GAqBwAWpj) board. It corresponds to pin 40.

[DGND()](#fyMHtP6GAqBwAWom) must be shorted to [AGND()](#UeMHtP6GAqBwAWpz).

**Coding:** voltage

**Periodicity:** continuous

## Image8.png I2C1\_SDA

GPIO pin dedicated for I2C Serial DAta line (SDA).

Input voltage can be in the range from 0V to 3.3V.

**Coding**: I2C

* Input logic levels:
  + '0': [DGND()](#fyMHtP6GAqBwAWom) - 0.99V
  + '1': 2.31V - 3.3V
* Output logic levels:
  + '0': [DGND()](#fyMHtP6GAqBwAWom) - 0.4V
  + '1': 2.9V - 3.3V

**Periodicity**: continuous

## Image8.png I2C1\_SCL

GPIO pin dedicated for I2C Serial CLock line (SCL).

Input voltage can be in the range from 0V to 3.3V.

**Coding**: I2C

* Input logic levels:
  + '0': [DGND()](#fyMHtP6GAqBwAWom) - 0.99V
  + '1': 2.31V - 3.3V
* Output logic levels:
  + '0': [DGND()](#fyMHtP6GAqBwAWom) - 0.4V
  + '1': 2.9V - 3.3V

**Periodicity**: continuous

## Image8.png AUDIO\_IN1

Line Level, AC Coupled analog audio.

Audio will begin to clip when input or output signal approach 3Vpp

For line level audio, the pins can be connected directly to jacks, etc.

**Coding:** voltage, -1.8V - 1.8V

**Periodicity:** continuous

## Image8.png AUDIO\_OUT1

Line Level, AC Coupled analog audio

Audio will begin to clip when input or output signal approach 3Vpp

For line level audio, the pins can be connected directly to jacks, etc.

**Coding:** voltage, -1.8V - 1.8V

**Periodicity:** continuous

## Image8.png pressBoot

Boot pushbutton on [DAISY\_SEED](#52MHtP6GAqBwAWpj) board is pressed. It can be useful to flash [uP: uP\_SignalMusicProcessing](#l.MHtP6GAqBwAWp.).

## Image8.png releaseBoot

Boot pushbutton on [DAISY\_SEED](#52MHtP6GAqBwAWpj) board is released.

## Image8.png pressReset

Reset pushbutton on [DAISY\_SEED](#52MHtP6GAqBwAWpj) board is pressed. It allows to reset the [DAISY\_SEED](#52MHtP6GAqBwAWpj) board and can be useful to flash [uP: uP\_SignalMusicProcessing](#l.MHtP6GAqBwAWp.).

## Image8.png releaseReset

Reset pushbutton on [DAISY\_SEED](#52MHtP6GAqBwAWpj) board is released.

## Image7.png pin\_definitions

Macro defines.

#### Tagged Values

|  |  |
| --- | --- |
| PIN\_VOL | |
| Backlog Activity Id | 0 |
| Type | Text |
| Value | 23 |
| Project Management | |  |  | | --- | --- | | Name | Value | | Author | Nese10B | | Create Date Time | 2022 Feb 24 20:50:26 | | Last Modified | 2022 Feb 24 20:51:55 | |

|  |  |
| --- | --- |
| PIN\_FX1 | |
| Backlog Activity Id | 0 |
| Type | Text |
| Value | 24 |
| Project Management | |  |  | | --- | --- | | Name | Value | | Author | Nese10B | | Create Date Time | 2022 Feb 24 20:50:26 | | Last Modified | 2022 Feb 24 20:51:55 | |

|  |  |
| --- | --- |
| PIN\_NEXT\_FX | |
| Backlog Activity Id | 0 |
| Type | Text |
| Value | 34 |
| Project Management | |  |  | | --- | --- | | Name | Value | | Author | Nese10B | | Create Date Time | 2022 Feb 24 20:50:26 | | Last Modified | 2022 Feb 24 20:51:55 | |

|  |  |
| --- | --- |
| PIN\_BACK\_FX | |
| Backlog Activity Id | 0 |
| Type | Text |
| Value | 33 |
| Project Management | |  |  | | --- | --- | | Name | Value | | Author | Nese10B | | Create Date Time | 2022 Feb 24 20:50:26 | | Last Modified | 2022 Feb 24 20:51:55 | |

|  |  |
| --- | --- |
| PIN\_TOGGLE\_BP | |
| Backlog Activity Id | 0 |
| Type | Text |
| Value | 35 |
| Project Management | |  |  | | --- | --- | | Name | Value | | Author | Nese10B | | Create Date Time | 2022 Feb 24 20:50:26 | | Last Modified | 2022 Feb 24 20:51:55 | |

|  |  |
| --- | --- |
| PIN\_LED\_BP | |
| Backlog Activity Id | 0 |
| Type | Text |
| Value | 37 |
| Project Management | |  |  | | --- | --- | | Name | Value | | Author | Nese10B | | Create Date Time | 2022 Feb 24 20:50:26 | | Last Modified | 2022 Feb 24 20:51:55 | |

|  |  |
| --- | --- |
| PIN\_OLED\_SDA | |
| Backlog Activity Id | 0 |
| Type | Text |
| Value | 13 |
| Project Management | |  |  | | --- | --- | | Name | Value | | Author | Nese10B | | Create Date Time | 2022 Feb 24 20:50:26 | | Last Modified | 2022 Feb 24 20:51:55 | |

|  |  |
| --- | --- |
| PIN\_OLED\_SCL | |
| Backlog Activity Id | 0 |
| Type | Text |
| Value | 12 |
| Project Management | |  |  | | --- | --- | | Name | Value | | Author | Nese10B | | Create Date Time | 2022 Feb 24 20:50:26 | | Last Modified | 2022 Feb 24 20:51:55 | |

|  |  |
| --- | --- |
| ADC\_PIN | |
| Backlog Activity Id | 0 |
| Type | Text |
| Value | 22 |
| Project Management | |  |  | | --- | --- | | Name | Value | | Author | Nese10B | | Create Date Time | 2022 Feb 24 20:50:26 | | Last Modified | 2022 Feb 24 20:51:55 | |

|  |  |
| --- | --- |
| NUM\_OF\_EFFECTS | |
| Backlog Activity Id | 0 |
| Type | Text |
| Value | 3 |
| Project Management | |  |  | | --- | --- | | Name | Value | | Author | Nese10B | | Create Date Time | 2022 Feb 24 20:50:26 | | Last Modified | 2022 Feb 24 20:51:55 | |

## Image7.png DaisySP

Set of functions to implement digital audio processing algorithms, available in Electrosmith's repository (<https://github.com/electro-smith/DaisySP>).

## Image7.png libDaisy

Set of functions to manage [DAISY\_SEED](#52MHtP6GAqBwAWpj) hardware, available in Electrosmith's repository (<https://github.com/electro-smith/libDaisy>).

## Image7.png Main

Main program in which all the functions to process audio signal are called.

It is divided in two sections:

* Setup part: in which all required HW and SW is initialized (ADC, display, buttons, led and DSP effects). At the end, we start the audio engine.
* Infinite while loop: every 6 ms, I2C\_OLED\_Display\_SSD1306 is updated, and push of buttons is detected.

Attributes

## Image9.png phas

Phaser object (see [DaisySP](#yhMHtP6GAqBwAWqD) for definition).

## Image9.png del

Delay object (see [DaisySP](#yhMHtP6GAqBwAWqD) for definition).

## Image9.png trem

Tremolo object (see [DaisySP](#yhMHtP6GAqBwAWqD) for definition).

## Image9.png deltime

Used to represent delay time for the delay effect. Its maximum value is 0.75 \* sample\_rate.

## Image9.png display

OledDisplay<SSD130xI2c128x64Driver> object. Its functions are used to control I2C\_OLED\_Display\_SSD1306.

## Image9.png phas\_LFO\_freq

float variable used to store value of LFO frequency (in Hz) of phaser modulation.

## Image9.png phas\_LFO\_depth

float variable used to store value of LFO depth (0 to 1) of phaser modulation.

## Image9.png trem\_LFO\_freq

float variable used to store value of LFO frequency (in Hz) of tremolo amplitude modulation.

## Image9.png trem\_LFO\_depth

float variable used to store value of LFO depth (0 to 1) of tremolo modulation.

## Image9.png dryWet

float variable. Sets the percentage of input signal which is sent to the output (percentage of processed signal is 1-dryWet).

Its values can range in [0, 1].

## Image9.png global\_volume

float variable. Contains the value of normalized output volume. Its value is in range [0;1].

## Image9.png currentEffect

integer variable. Contains the value of the activated effect. Its range is in [0; 2]. (0 for Delay, 1 for Phaser, 2 for tremolo).

Default value 0 (delay effect).

## Image9.png effectOn

bool vector of activated effects. Index 0 corresponds to delay, 1 to tremolo, 2 to phaser. Activated effect has true value on its index. Default effect is delay.

## Image9.png BP\_On

Bool variable. States if bypass condition is on (BP\_On == 1) or off (BP\_On == 0).

## Image9.png currentDelay

Stores interpolated version of [deltime: float](#WRMHtP6GAqBwAWqN).

## Image9.png feedback

Indicates amount of feedback in the delay effect.

## Image9.png hw

DaisySeed object (see [libDaisy](#OhMHtP6GAqBwAWqE) for definition).

Operations

## Image8.png init

Initialization [DAISY\_SEED](#52MHtP6GAqBwAWpj) ADC, [I2C\_OLED\_Display\_SSD1306](#xEMHtP6GAqBwAWnl), pushbuttons ([SW2: SMD\_SPST\_PushButton](#QpMHtP6GAqBwAWqf), [SW3: SMD\_SPST\_PushButton](#QpMHtP6GAqBwAWqg), [SW4: SMD\_SPST\_PushButton](#QpMHtP6GAqBwAWqh)), [LD1: RedLED\_AlGaInP\_SMD](#kEMHtP6GAqBwAWnb) and DSP effects ([delay(&in: float): void](#kEMHtP6GAqBwAWna), [tremolo(&in: float): void](#REMHtP6GAqBwAWnj), [phaser(&in: float): void](#xEMHtP6GAqBwAWnk)). The default effect is [delay(&in: float): void](#kEMHtP6GAqBwAWna).

Code Body:

init\_MultiFx();  
 init\_display();  
  
 float sr = hw.AudioSampleRate();  
 phas.Init(sr);  
 del.Init();  
 trem.Init(sr);  
  
 //Configure GPIO pins for buttons  
 Switch button\_BP;  
 Switch button\_SW\_NEXT;  
 Switch button\_SW\_BACK;  
  
 const int PB\_SR = 1000; //Sample rate to update pushbuttons  
 button\_BP.Init(hw.GetPin(PIN\_TOGGLE\_BP), PB\_SR);  
 button\_SW\_NEXT.Init(hw.GetPin(PIN\_NEXT\_FX), PB\_SR);  
 button\_SW\_BACK.Init(hw.GetPin(PIN\_BACK\_FX), PB\_SR);   
  
 //Configure GPIO pin for Bypass LED  
 dsy\_gpio led\_BP;  
  
 led\_BP.pin = hw.GetPin(PIN\_LED\_BP);  
 led\_BP.mode = DSY\_GPIO\_MODE\_OUTPUT\_PP;  
 led\_BP.pull = DSY\_GPIO\_PULLUP;  
 dsy\_gpio\_init(&led\_BP);  
 dsy\_gpio\_write(&led\_BP, 0); //Initially BP is off so also the led is off  
   
  
 //Set params  
 currentDelay = deltime = sr \* 0.75f;  
 del.SetDelay(currentDelay);  
  
 phas.SetLfoFreq(phas\_LFO\_freq);  
 phas.SetLfoDepth(phas\_LFO\_depth);  
  
 trem.SetFreq(trem\_LFO\_freq);  
 trem.SetDepth(trem\_LFO\_depth);  
  
  
 //Callback start  
 hw.StartAudio(AudioCallback);

## Image8.png loop

Infinite loop executed every 5ms. [I2C\_OLED\_Display\_SSD1306](#xEMHtP6GAqBwAWnl) is updated and state of pushbuttons is read ([SW2: SMD\_SPST\_PushButton](#QpMHtP6GAqBwAWqf), [SW3: SMD\_SPST\_PushButton](#QpMHtP6GAqBwAWqg), [SW4: SMD\_SPST\_PushButton](#QpMHtP6GAqBwAWqh)).

Code Body:

while(1) {  
 bool BP\_butt\_stop = false, NEXT\_butt\_stop = false, BACK\_butt\_stop = false;  
 updateDisplay();  
 //Debounce the button  
 button\_BP.Debounce();  
 //If the button is pressed, turn the LED on  
 if (button\_BP.Pressed() && !BP\_butt\_stop){  
 bypass();  
 UpdateLeds(led\_BP);  
 BP\_butt\_stop = true;  
 }  
 if (!button\_BP.Pressed()){  
 BP\_butt\_stop = false;  
 }  
   
 button\_SW\_NEXT.Debounce();  
 //If the button is pressed, turn the LED on  
 if (button\_SW\_NEXT.Pressed() && !NEXT\_butt\_stop){  
 nextFx();  
 NEXT\_butt\_stop = true;  
 }  
 if (!button\_SW\_NEXT.Pressed()){  
 NEXT\_butt\_stop = false;  
 }   
  
 button\_SW\_BACK.Debounce();  
 if (button\_SW\_BACK.Pressed() && !BACK\_butt\_stop){  
 backFx();  
 BACK\_butt\_stop = true;  
 }  
 if (!button\_SW\_BACK.Pressed()){  
 BACK\_butt\_stop = false;  
 }   
  
 System::Delay(5);  
  
 }

## Image7.png Firmware

Attributes

## Image9.png DL

Set of function called in [MP: Main](#GpMHtP6GAqBwAWqn) to handle [DAISY\_SEED](#52MHtP6GAqBwAWpj) hardware.

## Image9.png MP

Main program that is executed by [uP: uP\_SignalMusicProcessing](#l.MHtP6GAqBwAWp.) when it is working.

## Image9.png DSP

Set of function called in [MP: Main](#GpMHtP6GAqBwAWqn) to handle digital audio processing.

## Image9.png PDEF

Macro definitions.

Operations

## Image8.png init\_MultiFx

When [MultiFX\_nese10\_2122](#kYMHtP6GAqBwAWm4) is switched ON ([switchON()](#_pMHtP6GAqBwAWqu)), audio parameters and [DAISY\_SEED](#52MHtP6GAqBwAWpj) ADC channels are configured.

**Coding:** bit, interrupt

**Periodicity:** occasional (event driven)

## Image8.png read\_volume

The voltage sampled by the [ADC\_IN1()](#tOMHtP6GAqBwAWpp) is read from the ADC register, corresponding to the new value of volume.

The latter is compared with the previous value of volume:

* same volume, nothing happened
* different volume, the position of [POT1: 10K\_t20%\_LOG\_POT\_H20mm\_THT](#AkMHtP6GAqBwAWns) is changed. In this case, the input audio signal is processed in order to [updateVolume(float global\_volume)](#cZMHtP6GAqBwAWqx).

Then the [I2C\_OLED\_Display\_SSD1306](#xEMHtP6GAqBwAWnl) must be updated ([updateDisplay(): void](#xEMHtP6GAqBwAWnm)) in order to show the new value of volume.

**Coding:** int, integer variable to store the sampled value of volume

**Periodicity:** periodic (main loop delay)

Code Body:

global\_volume = hw.adc.GetFloat(0);

## Image8.png updateVolume

The magnitude of the input audio signal is adjusted in order to be proportional to the read volume ([read\_volume(): void](#AZMHtP6GAqBwAWqv)).

## Image8.png read\_parameterFx

The voltage sampled by the [ADC\_IN2()](#HOMHtP6GAqBwAWpq) is read from the ADC register, corresponding to the new effect parameter value.

The latter is compared with the previous effect parameter value:

* same value, nothing happened
* different value, the position of [POT2: 10K\_t20%\_LOG\_POT\_H20mm\_THT](#hEMHtP6GAqBwAWnh) is changed. In this case, the input audio signal is processed in order to [updateParameterFx(int currentEffect)](#5ZMHtP6GAqBwAWq1).

Then the [I2C\_OLED\_Display\_SSD1306](#xEMHtP6GAqBwAWnl) must be updated ([updateDisplay(): void](#xEMHtP6GAqBwAWnm)) in order to show the new effect parameter value.

**Coding:** int, integer variable storing the effect parameter value

**Periodicity:** periodic (main loop delay)

Code Body:

float parameter\_1 = hw.adc.GetFloat(1);  
deltime = hw.AudioSampleRate() \* 0.75f \* parameter\_1;  
trem\_LFO\_freq = parameter\_1 \* 20; //LFO rate should be in subaudio frequencies  
phas\_LFO\_freq = parameter\_1 \* 20;  
trem.SetFreq(trem\_LFO\_freq);  
phas.SetLfoFreq(phas\_LFO\_freq);

## Image8.png updateParameterFx

Based on the current effect and sampled parameter value ([read\_parameterFx(): void](#mZMHtP6GAqBwAWqz)) the input audio signal is adjusted in a different way:

* [delay(&in: float): void](#kEMHtP6GAqBwAWna): delay time between original audio signal and the delayed one is changed
* [tremolo(&in: float): void](#REMHtP6GAqBwAWnj): modulation frequency is changed
* [phaser(&in: float): void](#xEMHtP6GAqBwAWnk): phase shift applied to the input audio signal is changed

## Image8.png UpdateLeds

Toggles logic value of selected GPIO pin.

Voltage at pin [D30()](#HuMHtP6GAqBwAWpx) becomes 3.3V (logic level '1') in order to turn ON the [LD1: RedLED\_AlGaInP\_SMD](#kEMHtP6GAqBwAWnb).

Voltage at pin [D30()](#HuMHtP6GAqBwAWpx) becomes 0V (logic level '0') in order to turn OFF the [LD1: RedLED\_AlGaInP\_SMD](#kEMHtP6GAqBwAWnb).

**Coding:** bit

**Periodicity:** occasional (event driven)

Code Body: dsy\_gpio\_toggle(led\_pin);

## Image8.png updateDisplay

The [I2C\_OLED\_Display\_SSD1306](#xEMHtP6GAqBwAWnl) must be updated showing the current:

* effect name
* effect parameter value
* volume

**Coding:** bit, interrupt

**Periodicity:** occasional (event driven)

Code Body:

char strbuff[128];  
switch(currentEffect){  
 case 0: sprintf(strbuff, "Effect: Delay\nDel\_time: %f ms\nVolume: %f\n", deltime, global\_volume);  
 case 1: sprintf(strbuff, "Effect: Tremolo\nLFO\_freq: %f Hz\nVolume: %f\n",trem\_LFO\_freq, global\_volume);  
 case 2: sprintf(strbuff, "Effect: Phaser\nLFO\_freq: %f Hz\nVolume: %f\n",phas\_LFO\_freq, global\_volume);  
}  
display.Fill(true);  
display.SetCursor(0, 0);  
display.WriteString(strbuff, Font\_11x18, false);  
display.Update();

## Image8.png nextFx

Status of [SW3: SMD\_SPST\_PushButton](#QpMHtP6GAqBwAWqg) is read from [D27()](#quMHtP6GAqBwAWpt). Whenever a '0' logic level is read the next effect must be applied:

* [delay(&in: float): void](#kEMHtP6GAqBwAWna)->[tremolo(&in: float): void](#REMHtP6GAqBwAWnj)
* [tremolo(&in: float): void](#REMHtP6GAqBwAWnj)->[phaser(&in: float): void](#xEMHtP6GAqBwAWnk)
* [phaser(&in: float): void](#xEMHtP6GAqBwAWnk)->[delay(&in: float): void](#kEMHtP6GAqBwAWna)

Then the [I2C\_OLED\_Display\_SSD1306](#xEMHtP6GAqBwAWnl) is updated ([updateDisplay(): void](#xEMHtP6GAqBwAWnm)). The value of volume and effect remain the same of previous effect, based on the position of [POT1: 10K\_t20%\_LOG\_POT\_H20mm\_THT](#AkMHtP6GAqBwAWns) and [POT2: 10K\_t20%\_LOG\_POT\_H20mm\_THT](#hEMHtP6GAqBwAWnh) respectively.

Before [release()](#h5MHtP6GAqBwAWq8), even if a '0' logic level is read, the effect is not switched.

**Coding:** boolean

**Periodicity:** occasional (event driven)

Code Body:

int previousEffect = currentEffect;  
currentEffect = abs(currentEffect + 1) % NUM\_OF\_EFFECTS;  
effectOn[previousEffect] = false;  
effectOn[currentEffect] = true;

## Image8.png backFx

Status of [SW2: SMD\_SPST\_PushButton](#QpMHtP6GAqBwAWqf) is read from [D26()](#IuMHtP6GAqBwAWpr). Whenever a '0' logic level is read the previous effect must be applied:

* [delay(&in: float): void](#kEMHtP6GAqBwAWna)->[phaser(&in: float): void](#xEMHtP6GAqBwAWnk)
* [phaser(&in: float): void](#xEMHtP6GAqBwAWnk)->[tremolo(&in: float): void](#REMHtP6GAqBwAWnj)
* [tremolo(&in: float): void](#REMHtP6GAqBwAWnj)->[delay(&in: float): void](#kEMHtP6GAqBwAWna)

Then the [I2C\_OLED\_Display\_SSD1306](#xEMHtP6GAqBwAWnl) is updated ([updateDisplay(): void](#xEMHtP6GAqBwAWnm)). The value of volume and effect remain the same of previous effect, based on the position of [POT1: 10K\_t20%\_LOG\_POT\_H20mm\_THT](#AkMHtP6GAqBwAWns) and [POT2: 10K\_t20%\_LOG\_POT\_H20mm\_THT](#hEMHtP6GAqBwAWnh) respectively.

Before [release()](#h5MHtP6GAqBwAWq8), even if a '0' logic level is read, the effect is not switched.

**Coding:** boolean

**Periodicity:** occasional (event driven)

Code Body:

int previousEffect = currentEffect;  
if (previousEffect == 0){  
 currentEffect = NUM\_OF\_EFFECTS-1;  
}  
else {  
 currentEffect--;  
}  
effectOn[previousEffect] = false;  
effectOn[currentEffect] = true;

## Image8.png bypass

Status of [SW4: SMD\_SPST\_PushButton](#QpMHtP6GAqBwAWqh) is read from [D28()](#5uMHtP6GAqBwAWpv). Whenever a '0' logic level is read bypass value is toggled.

If bypass is OFF, it turns ON, and vice versa. When bypass turns ON, [LD1: RedLED\_AlGaInP\_SMD](#kEMHtP6GAqBwAWnb) turns ON, otherwise [LD1: RedLED\_AlGaInP\_SMD](#kEMHtP6GAqBwAWnb) turns OFF ([UpdateLeds(led\_pin: dsy\_gpio \*): void](#bZMHtP6GAqBwAWq3)).

The [I2C\_OLED\_Display\_SSD1306](#xEMHtP6GAqBwAWnl) is updated ([updateDisplay(): void](#xEMHtP6GAqBwAWnm)) in order to show that the input signal is not modified.

Before [release()](#h5MHtP6GAqBwAWq8), even if a '0' logic level is read, the effect is not switched.

**Coding:** boolean

**Periodicity:** occasional (event driven)

Code Body:

BP\_On = !BP\_On;

## Image8.png delay

Delay effect stores a copy of the input signal and applies a temporal delay to it. Then, the delayed signal is added to the input signal and this process can be replicated with a lowering amplitude of the reproduced replica.

The user-tunable parameter is Time delay, which sets the delay between the original signal and the copies.

This function takes in input one float sample and processes it according to the delay effect.

**Coding**: int, integer variable that corresponds to the delay effect (int currentEffect = 0)

**Periodicity**: occasional (event driven), when [nextFx(): void](#C5MHtP6GAqBwAWq6) or [backFx(): void](#R5MHtP6GAqBwAWq9) and effect variable is equal to the number that corresponds to delay effect

Code Body:

fonepole(currentDelay, deltime, .00007f);  
del.SetDelay(currentDelay);  
float outD = del.Read();  
  
del.Write((feedback \* outD) + in);  
in = (feedback \* outD) + ((1.0f - feedback) \* in);

## Image8.png tremolo

The tremolo effect applies a little amplitude modulation to the input signal, by means of a Low Frequency Oscillator (LFO).

The user-tunable parameters is Frequency, which sets the frequency of the LFO.

This function takes in input one float sample and processes it according to the tremolo effect.

**Coding**: int, integer variable that corresponds to the tremolo effect (int currentEffect = 1)

**Periodicity**: occasional (event driven), when [nextFx(): void](#C5MHtP6GAqBwAWq6) or [backFx(): void](#R5MHtP6GAqBwAWq9) and effect variable is equal to the number that corresponds to tremolo effect

Code Body:

in = trem.Process(in);

## Image8.png phaser

Phaser effect applies a phase shift to the input signal controlled by a Low Frequency Oscillator and then adds back the processed signal inverted by 180° with the original input signal.

The effect of this processing for the listener is a slow modulation of the signal.

There are two user-tunable parameters Frequency, which sets the frequency of the LFO.

This function takes in input one float sample and processes it according to the phaser effect.

**Coding**: int, integer variable that corresponds to the phaser effect (int currentEffect = 2)

**Periodicity**: occasional (event driven), when [nextFx(): void](#C5MHtP6GAqBwAWq6) or [backFx(): void](#R5MHtP6GAqBwAWq9) and effect variable is equal to the number that corresponds to phaser effect

Code Body:

in = phas.Process(in);

## Image8.png GetSamples

This function takes as input one float sample and one FX\_types enumeration, according to which it chooses which function to call among [delay(&in: float): void](#kEMHtP6GAqBwAWna), [tremolo(&in: float): void](#REMHtP6GAqBwAWnj) and [phaser(&in: float): void](#xEMHtP6GAqBwAWnk).

Code Body:

switch(type)  
 {  
 case PHAS: phaser(in); break;  
 case DEL: delay(in); break;  
 case TREM: tremolo(in); break;  
 default: break;  
 }

## Image8.png init\_display

When called, configures I2C [display](#x6VotP6GAqBwAWrr), with the following parameters:

* I2C address: 0x78;
* I2C peripheral: I2C\_1;
* I2C speed: 100 kHz;
* I2C mode: MASTER;
* SCL pin: [I2C1\_SCL()](#reMHtP6GAqBwAWp4);
* SDA pin: [I2C1\_SDA()](#JeMHtP6GAqBwAWp2).

Code Body:

OledDisp::Config disp\_cfg;  
disp\_cfg.driver\_config.transport\_config.i2c\_address = 0x78;  
disp\_cfg.driver\_config.transport\_config.i2c\_config.periph = I2CHandle::Config::Peripheral::I2C\_1;  
disp\_cfg.driver\_config.transport\_config.i2c\_config.speed = I2CHandle::Config::Speed::I2C\_100KHZ;  
disp\_cfg.driver\_config.transport\_config.i2c\_config.mode = I2CHandle::Config::Mode::I2C\_MASTER;  
disp\_cfg.driver\_config.transport\_config.i2c\_config.pin\_config.scl = {DSY\_GPIOB, 8};//hw.GetPin(12);  
disp\_cfg.driver\_config.transport\_config.i2c\_config.pin\_config.sda = {DSY\_GPIOB, 9};//hw.GetPin(13);  
/\*\* And Initialize \*/  
display.Init(disp\_cfg);

## Image8.png AudioCallback

This function takes the input signal to the system, processes it according to the selected effect, and sends it to output.

The function is called by StartAudio function of [DaisySP](#yhMHtP6GAqBwAWqD).

First of all, AudioCallback updates volume and effect parameter values through [read\_volume(): void](#AZMHtP6GAqBwAWqv) and [read\_parameterFx(): void](#mZMHtP6GAqBwAWqz).

Then, it cycles through all the samples of the input audio buffer and processes them. If [BP\_On: bool](#cJMHtP6GAqBwAWqX) == 1, output will be a perfect copy of input, otherwise it will be the sum of input signal and processed signal (according to the selected effect). The percentage of input and processed signals are controlled by [dryWet: float](#.xMHtP6GAqBwAWqT).

Code Body:

read\_volume(); //Each time a new audio buffer is to be processed,   
 //we check state of controls.  
read\_percentageFx();  
  
for (size\_t i = 0; i < size; i++) //Cycle each sample contained inside buffer  
{  
 float sig = in[0][i];  
 if (BP\_On){  
 out[0][i] = in[0][i];  
 }  
 else{  
 for (int j = 0; j <= PHAS; j++){  
 float originalSig = sig;  
  
 if (effectOn[j]){  
 GetSamples(sig, (FX\_types)j);  
 out[0][i] = (sig \* dryWet + originalSig \* (1 - dryWet)) \* global\_volume;  
 }  
 }   
 }  
}

## Image7.png uP\_SignalMusicProcessing

It is the microprocessor module must be able to process the input signal.

It exploits the [DAISY\_SEED](#52MHtP6GAqBwAWpj) board, available on the market.

Some digital signal processing algorithm are implemented in order to apply effects to the input signal.

Attributes

## DS



Board that is able to handle digital audio processing.

## Image9.png J1

Board to board connector used to connect pins from 21 to 40 of [DAISY\_SEED](#52MHtP6GAqBwAWpj) to the board.

## Image9.png J2

Board to board connector used to connect pins from 1 to 20 of [DAISY\_SEED](#52MHtP6GAqBwAWpj) to the board.

## Image9.png FW

## Image7.png 5mm7\_2mm\_DC\_THT

Female Jack connector for DC voltage.

The positive DC voltage is received at the core of the connector, instead the external metal cylinder provides the reference voltage.

On the pin [T1()](#8GMHtP6GAqBwAWpK) there is the DC voltage to supply the circuit. Instead pin [T2()](#uVMHtP6GAqBwAWrS) and [T3()](#uVMHtP6GAqBwAWrT) provide the reference ground.



**Basic characteristics:**

* External contact diameter: 5.7mm
* Internal contact diameter: 2mm
* Max voltage: 24V
* Max current: 5A
* 5000 cycles
* Through hole technology

Operations

## Image8.png T1

Terminal connected to the core of [5mm7\_2mm\_DC\_THT](#8GMHtP6GAqBwAWpL) connector.

It receives the positive DC supply voltage.

Max voltage: 24V

**Coding**: voltage

**Periodicity**: continuous

## Image8.png T2

Terminal connected to the external metallic cylinder of [5mm7\_2mm\_DC\_THT](#8GMHtP6GAqBwAWpL) connector.

It receives the ground reference.

**Coding**: voltage

**Periodicity**: continuous

## Image8.png T3

Terminal connected to the external metallic shell of [5mm7\_2mm\_DC\_THT](#8GMHtP6GAqBwAWpL) connector.

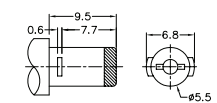
It receives the ground reference.

**Coding**: voltage

**Periodicity**: continuous

## Image8.png insertMaleConn

Male connector is inserted inside [5mm7\_2mm\_DC\_THT](#8GMHtP6GAqBwAWpL).



**Coding**: inserted/non-inserted

**Periodicity**: occasional

## Image7.png 6mm35\_JACK\_Female\_THT

Female Jack connector for Jack mono 6.35mm.

Signal is received from tip of male Jack mono connector 6.35mm, and it is made available at pin [T2()](#x1MHtP6GAqBwAWra). Instead the ground reference is on the sleeve.



**Basic characteristics:**

* Hole diameter: 6.4mm
* Max voltage: 12V
* Max current: 1A
* Max contact resistance: 30mOhm
* 5000 cycles
* Through hole technology

Operations

## Image8.png T1

Terminal connected to ground reference.

**Coding**: voltage

**Periodicity**: continuous

## Image8.png T2

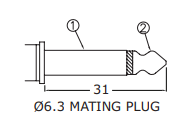
Terminal that receives the input signal.

**Coding**: voltage

**Periodicity**: continuous

## Image8.png insertMaleJack

Male Jack connector is inserted inside [6mm35\_JACK\_Female\_THT](#a1MHtP6GAqBwAWrY).

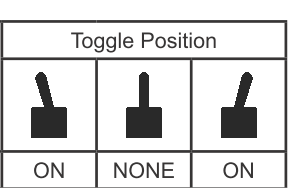


**Coding**: inserted/non-inserted

**Periodicity**: occasional

## Image7.png SPDT\_ON-OFF\_ToggleSwitch\_THT

The switch is an ON-OFF switch. There is a lever that can be in two different positions. When position of lever is modified, it remains in that position until lever is moved again in the opposite one.



So it can be in two states:

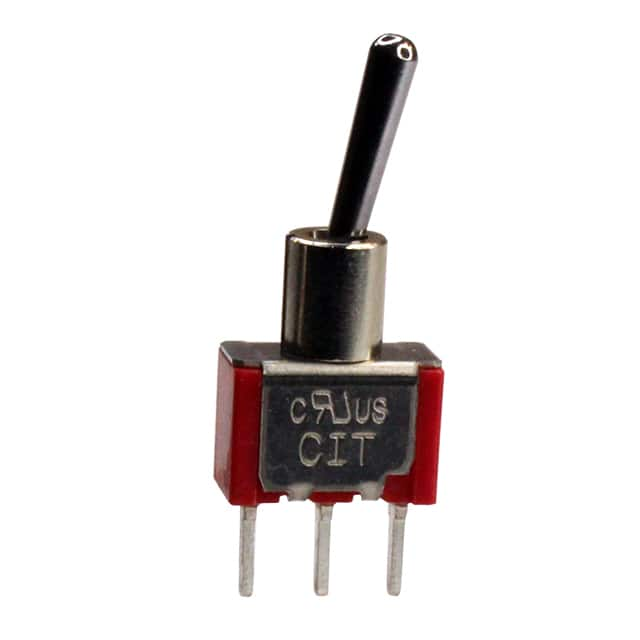
* ON: circuit is connected to voltage supply
* OFF: circuit is not supplied

The switch remains in a state until the lever is moved in the opposite position.

This switch is a SPDT (Single Pole Double Throw) with a common pin ([T2()](#RNMHtP6GAqBwAWrf)) that can be shorted to [T1()](#RNMHtP6GAqBwAWrg) or [T3()](#RNMHtP6GAqBwAWrh).

Body must be higher than approximately 20mm.

In the following image is reported an example of toggle switch.



**Electrical characteristics:**

* Insulation resistance: more than 1000MOhm
* Contact resistance: less than 20mOhm
* Maximum current: 5A

**Mechanical characteristics:**

* Through-hole technology
* 50000 cycles
* Total height (without considering lever): at least 2cm
* Circular diameter: 5.72mm

Operations

## Image8.png T1

Terminal connected to the voltage supply.

**Coding:** voltage

**Periodicity:** continuous

## Image8.png T2

Terminal connected to the circuit (common pin).

**Coding:** voltage

**Periodicity:** continuous

## Image8.png T3

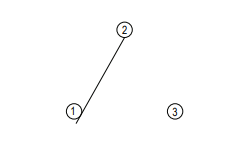
Terminal non-connected.

**Coding:** voltage

**Periodicity:** continuous

## Image8.png switchON

The lever is moved in ON position (towards the "ON" label) in order to connect [T1()](#RNMHtP6GAqBwAWrg) and [T2()](#RNMHtP6GAqBwAWrf).



**Coding:** force

**Periodicity:** occasional

## Image8.png switchOFF

The lever is moved in OFF position (towards the "OFF" label) in order to connect [T3()](#RNMHtP6GAqBwAWrh) and [T2()](#RNMHtP6GAqBwAWrf) (open circuit).

**Coding:** voltage

**Periodicity:** occasional

## Image7.png SMD\_SPST\_PushButton

It is a tactile (ON)-OFF switch. There is a button that can be pushed, for an arbitrary long time interval. When it is released it comes back in its original position.

Most of time it is in OFF position, it means that it sends a '1' logic level on [OUT1()](#HtMHtP6GAqBwAWrn) and [OUT2()](#HtMHtP6GAqBwAWro) pins (external pull-up can be required). Instead when button is pressed it sends a '0' logic level on [OUT1()](#HtMHtP6GAqBwAWrn) and [OUT2()](#HtMHtP6GAqBwAWro) pins.

**Basic characteristics:**

* Max contact resistance: 10mOhm
* Min insulation resistance: 100MOhm
* SPST (Single Pole Single Throw)
* Actuation force: 260gf
* Minimum height: 20mm

Operations

## Image8.png OUT1

This terminal provides the state of [SMD\_SPST\_PushButton](#ltMHtP6GAqBwAWrl):

* pressed: '0' logic level
* non-pressed: '1' logic level

It must be shortcircuited to [OUT2()](#HtMHtP6GAqBwAWro).

**Coding:** voltage

**Periodicity:** continuous

## Image8.png OUT2

This terminal provides the state of [SMD\_SPST\_PushButton](#ltMHtP6GAqBwAWrl):

* pressed: '0' logic level
* non-pressed: '1' logic level

It must be shortcircuited to [OUT1()](#HtMHtP6GAqBwAWrn).

**Coding:** voltage

**Periodicity:** continuous

## Image8.png GND1

Terminal connected to ground reference voltage.

It must be shortcircuited to [GND2()](#xdMHtP6GAqBwAWrt).

**Coding:** voltage

**Periodicity:** continuous

## Image8.png GND2

Terminal connected to ground reference voltage.

It must be shortcircuited to [GND1()](#GdMHtP6GAqBwAWrr).

**Coding:** voltage

**Periodicity:** continuous

## Image8.png push

When button is pressed the [OUT1()](#HtMHtP6GAqBwAWrn) and [OUT2()](#HtMHtP6GAqBwAWro) terminal are shortcircuited to [GND1()](#GdMHtP6GAqBwAWrr) and [GND2()](#xdMHtP6GAqBwAWrt).

**Coding:** force

**Periodicity:** occasional

## Image8.png release

When button is not pressed [OUT1()](#HtMHtP6GAqBwAWrn) and [OUT2()](#HtMHtP6GAqBwAWro) pins are float.

**Coding:** voltage

**Periodicity:** occasional

## Image7.png 10K\_t20%\_LOG\_POT\_H20mm\_THT

The [10K\_t20%\_LOG\_POT\_H20mm\_THT](#49MHtP6GAqBwAWry) is a logarithmic potentiometer that allows to have a variable resistance. The resistance value depends on the position of the knob, that can be rotated in clockwise and counterclockwise direction. Since [VDD()](#a9MHtP6GAqBwAWr0) must be connected to a voltage supply, the variable resistance allows to tune the voltage at pin [F\_T()](#a9MHtP6GAqBwAWr1).



**Electrical characteristics:**

* Minimum resistance: 20Ohm
* Maximum resistance: 10KOhm
* Tolerance: +/-20%
* Maximum voltage: 50V

**Mechanical characteristics:**

* Knob diameter: 6mm
* Total height: 20mm
* Total rotation: 280°
* 100000 cycles
* Through-hole technology

Operations

## Image8.png VDD

Voltage supply pin.

Max voltage: 50V

**Coding:** voltage

**Periodicity:** continuous

## Image8.png GND

Reference ground pin.

**Coding:** voltage

**Periodicity:** continuous

## Image8.png F\_T

Terminal at which the variable voltage can be read. Voltage at this pin can vary in the range from [F\_T()](#a9MHtP6GAqBwAWr1) = 20/10k \* [VDD()](#a9MHtP6GAqBwAWr0) = 2\*10^-3\*[VDD()](#a9MHtP6GAqBwAWr0) (due to the minimum resistance of potentiometer) to [F\_T()](#a9MHtP6GAqBwAWr1) = [VDD()](#a9MHtP6GAqBwAWr0).

**Coding:** voltage

**Periodicity:** continuous

## Image8.png tuneR

Knob is rotated in clockwise direction: voltage at pin [F\_T()](#a9MHtP6GAqBwAWr1) increases, so resistance is higher

**Coding:** force

**Periodicity:** occasional

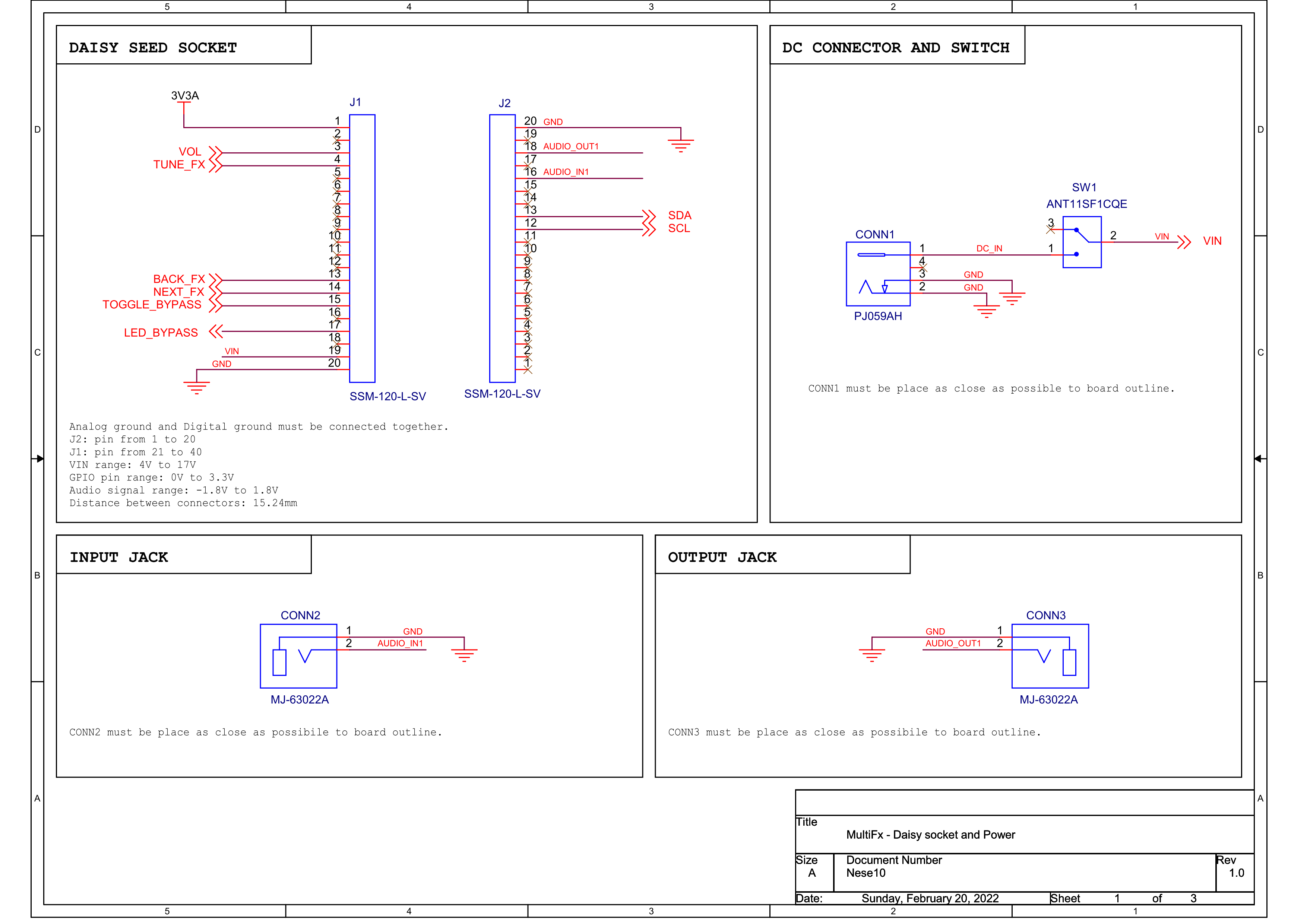
## Image8.png tuneL

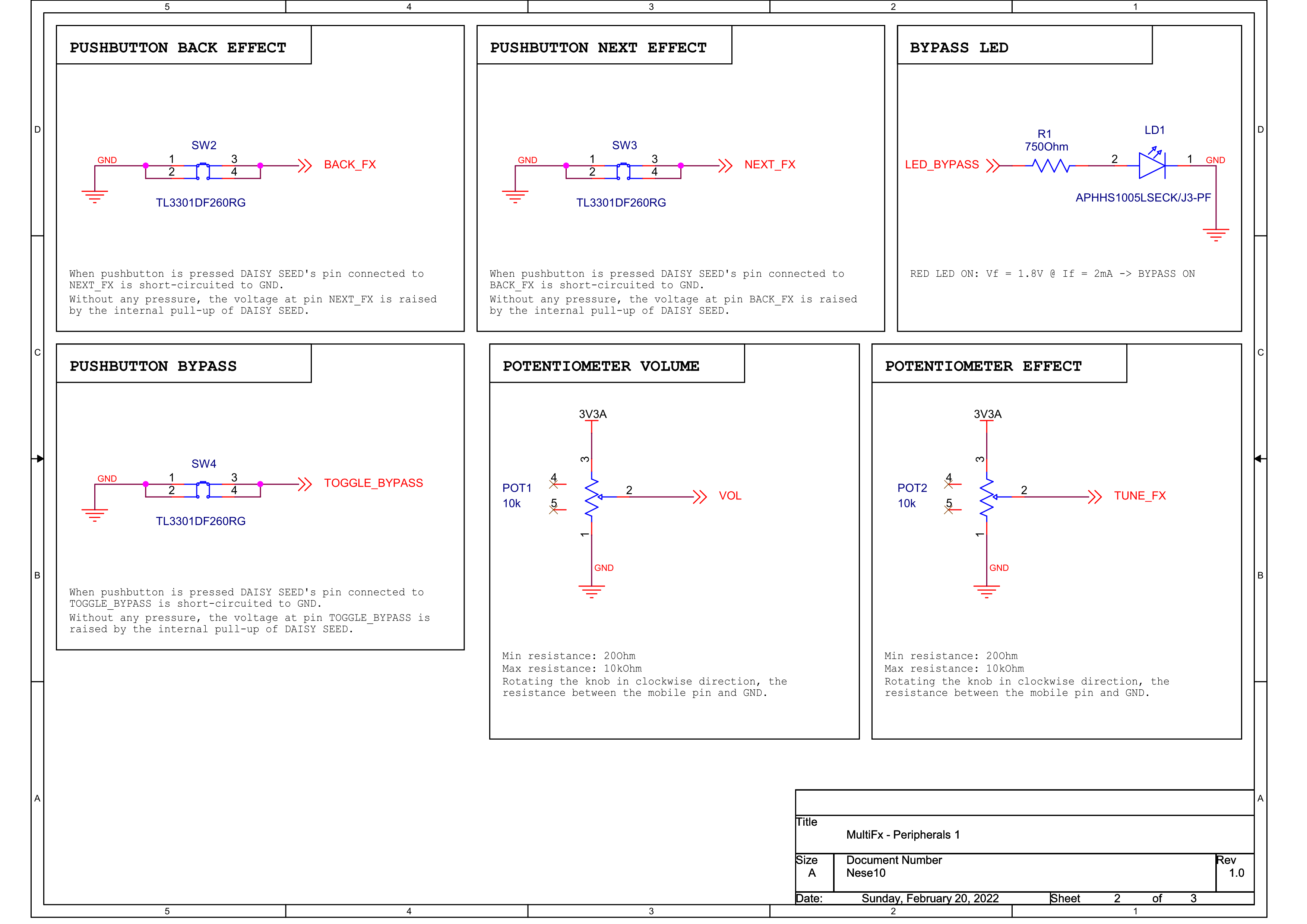
Knob is rotated in counterclockwise direction: voltage at pin [F\_T()](#a9MHtP6GAqBwAWr1) decreases, so resistance is lower

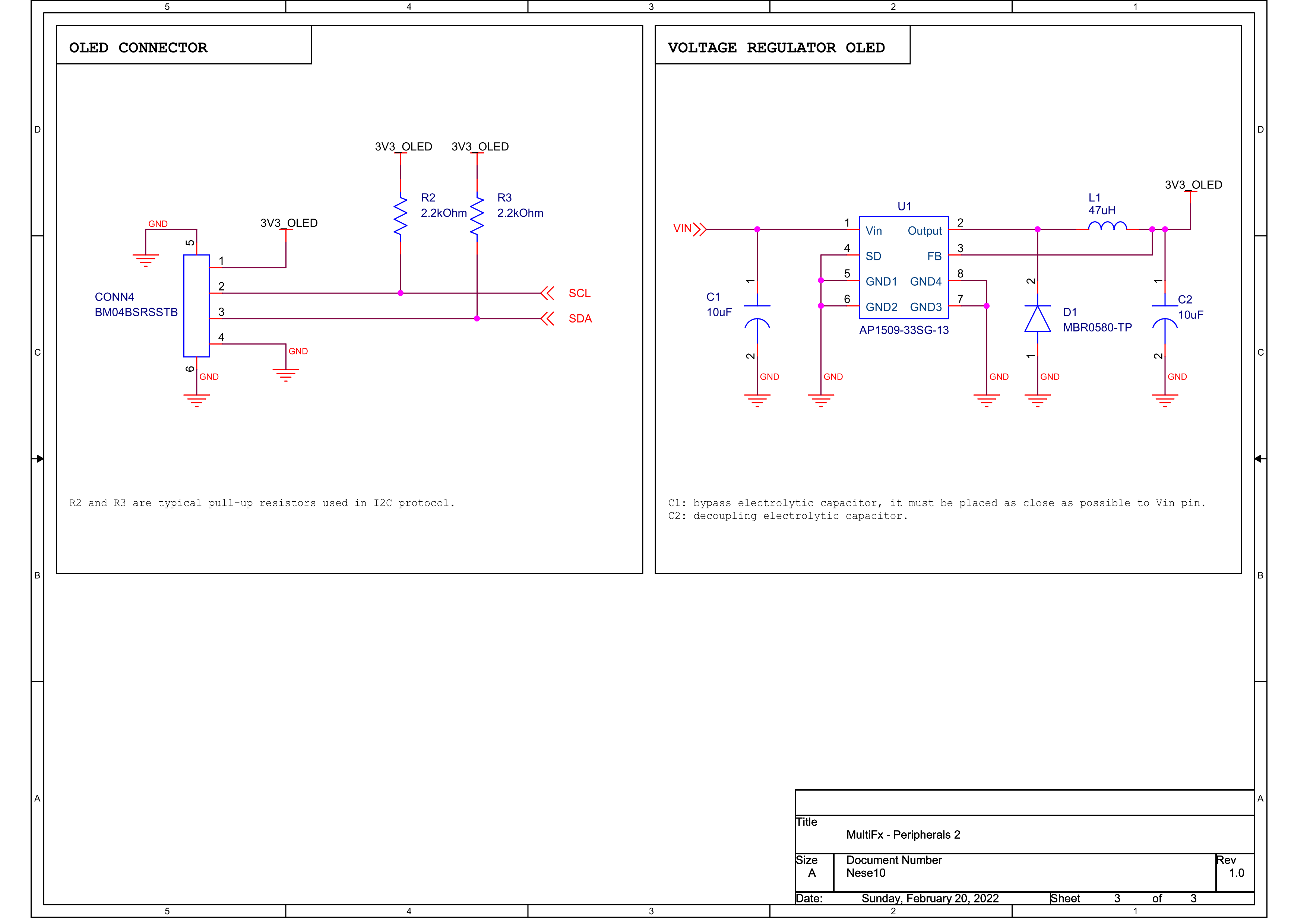
**Coding:** force

**Periodicity:** occasional

## Image7.png Schematic







## Image7.png Case

Plastic black case to protect the [PCB](#Z2MHtP6GAqBwAWpi) on which the circuit is assembled.

Since [DAISY\_SEED](#52MHtP6GAqBwAWpj) board height is approximately 15mm, we need a [Case](#WbMHtP6GAqBwAWr9) height at least equal to 20mm.

A break in the case 10.86mm x 21.74mm is needed for the [I2C\_OLED\_Display\_SSD1306](#xEMHtP6GAqBwAWnl).

On the top side of the case there are:

* 2 circular holes with a 9mm diameter
* 3 circular holes with a 6mm diameter
* 1 circular holes with a 5.72 diameter
* 1 rectangular hole 10.86mm x 21.74mm

On the left lateral side there is a circular hole with a 10.8mm diameter.

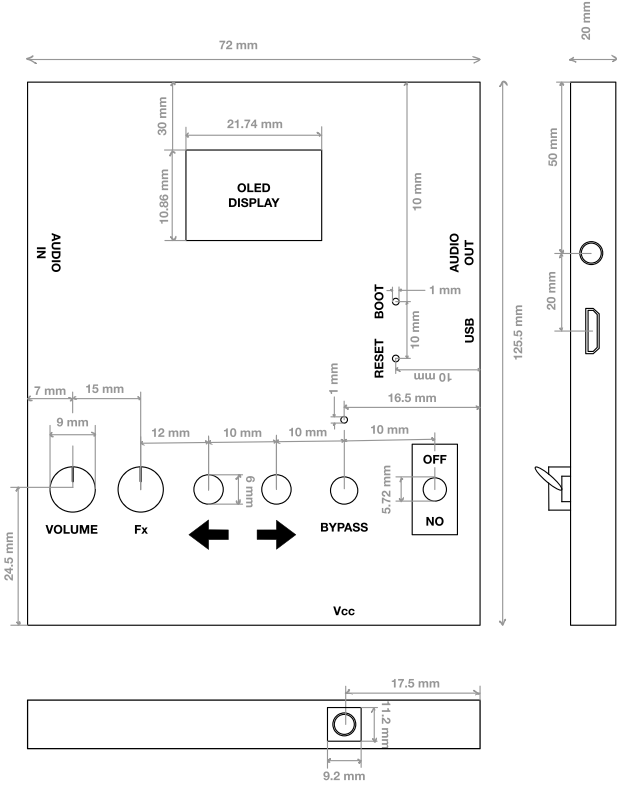
On the right lateral side there are:

* 1 circular hole with a 10.8mm diameter
* 1 hole for micro USB type B connector

Finally, on the lateral bottom side there is a rectangular hole 9.2mm x 11.2mm

**Specifications:**

* Thickness: 3mm
* Width: 72mm
* Length: 125.5mm



## Image7.png PCB

Printed Circuit Board to assembly all the components. It is a double layer PCB. A ground plane on the bottom layer is required to minimize the trace inductance.

[DAISY\_SEED](#52MHtP6GAqBwAWpj) board must be positioned as close as possible to the outline of the board so that the USB connector can be reached from the outside.

Components accessible from the outside must be Through-Hole devices (THT) because they provide a better mechanical attach to the board. Instead, for all the other components Surface Mount Technology (SMT) can be more useful in case of high speed signals.

The [PCB](#Z2MHtP6GAqBwAWpi) must have 4 holes to be fixed to the case. Hole diameter must be 5mm. the holes centers coordinates in mm (origin in the bottom left corner of the [PCB](#Z2MHtP6GAqBwAWpi)):

- 5,5

- 100.5, 5

- 64, 5

- 100.5, 64.5

No components in the next 5mm around these holes.

A couple of [BoardToBoard\_20\_2mm54\_SMD](#O2MHtP6GAqBwAWpg) useful to connect the [DAISY\_SEED](#52MHtP6GAqBwAWpj) must be placed in the middle of [PCB](#Z2MHtP6GAqBwAWpi), parallel to the shortest side of the board.

Then components that allows [User](#zoMHtP6GAqBwAWm1) to provide input must be placed on the left side. The [OLED\_module](#vaMHtP6GAqBwAWo8), instead, must be placed on the right. As far as connectors, they must be placed in order to have the entry oriented towards the outside:

- [5mm7\_2mm\_DC\_THT](#8GMHtP6GAqBwAWpL) for the [Power\_supply and cable](#soMHtP6GAqBwAWmy), on the left, having the entry exposed on the shorter side of the board

- [6mm35\_JACK\_Female\_THT](#a1MHtP6GAqBwAWrY) for the [Jack\_IN](#OoMHtP6GAqBwAWmz), on the right, having the entry exposed on the longest side of the board (left, looking at the board top layer)

- [6mm35\_JACK\_Female\_THT](#a1MHtP6GAqBwAWrY) for the [Jack\_OUT](#FoMHtP6GAqBwAWm0), on the right, having the entry exposed on the longest side of the board (right, looking at the board top layer)

**Specifications:**

- Width: 69mm

- Length: 105.5mm

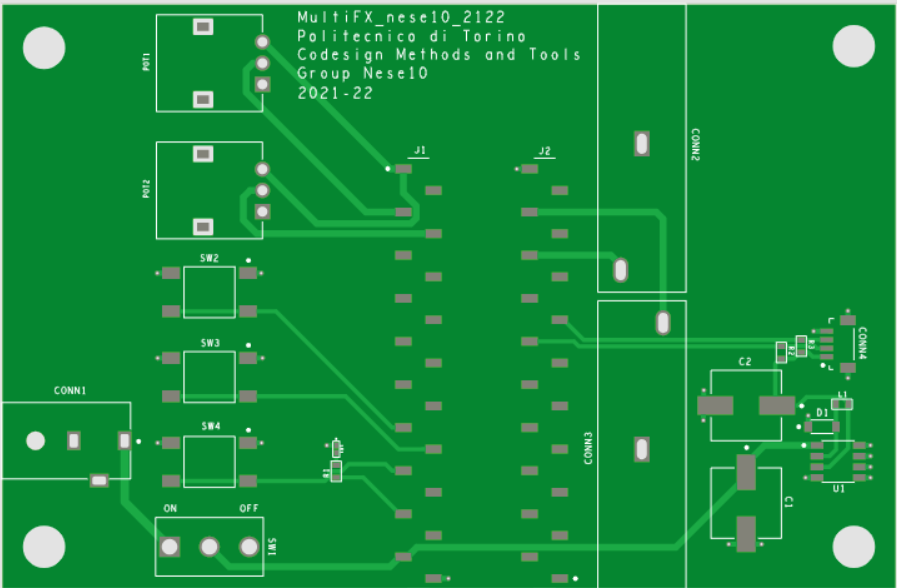
- Core material: FR-4

- Board thickness: 1.6mm

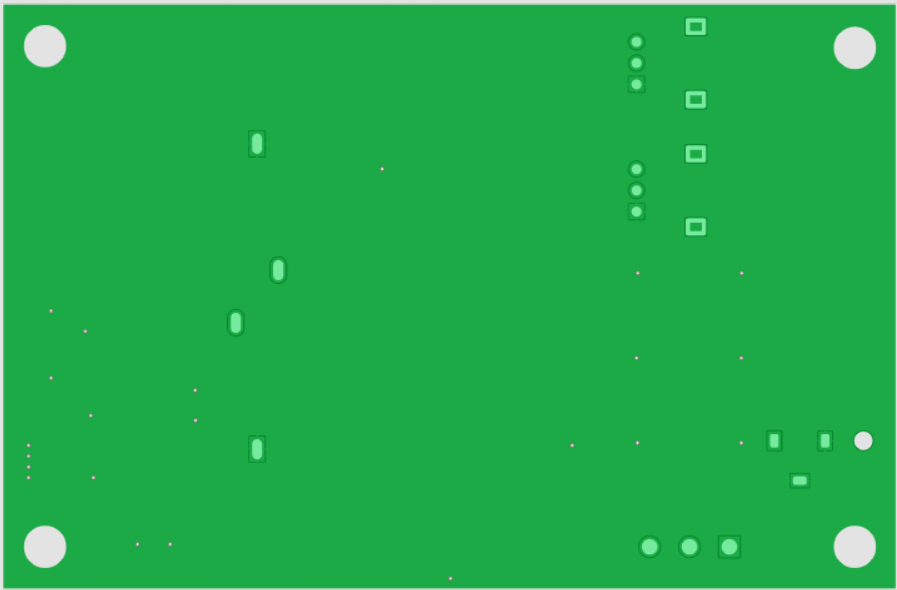
- Material TG: 145-150°C

- Copper thickness: 0.035mm

**Top view**



**Bottom view**

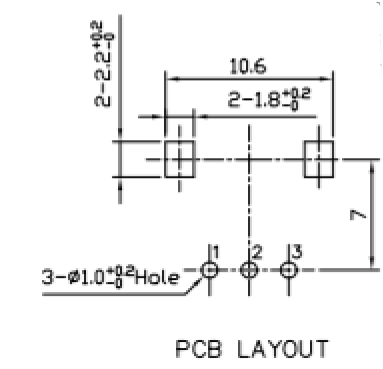


Operations

## Image8.png footprint\_pot

Footprint of [10K\_t20%\_LOG\_POT\_H20mm\_THT](#49MHtP6GAqBwAWry).

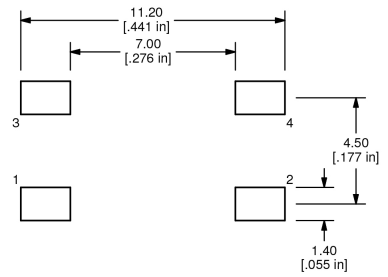
Since it is a through-hole component, 3 plated circular holes are required (diameter = 1.2mm), and 2 mechanical rectangular holes (2.4mm x 4.3mm) are required in order to have a better attach to the board.



## Image8.png footprint\_pushbutton

Footprint of [SMD\_SPST\_PushButton](#ltMHtP6GAqBwAWrl).

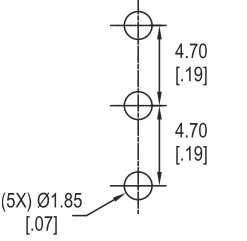
Since it is a surface mount component, 4 copper rectangular exposed pads are required (2.1mm x 1.4mm).



## Image8.png footprint\_switch

Footprint of [SPDT\_ON-OFF\_ToggleSwitch\_THT](#UNMHtP6GAqBwAWrd).

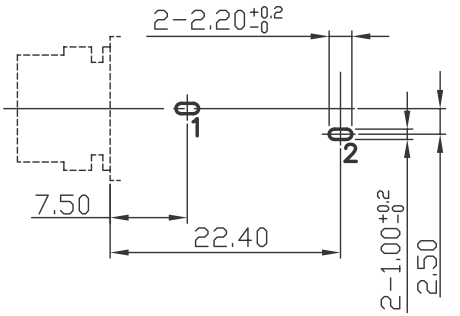
Since it is a through-hole component, 3 plated circular holes are required (diameter = 1.85mm).



## Image8.png footprint\_jack\_conn

Footprint of [6mm35\_JACK\_Female\_THT](#a1MHtP6GAqBwAWrY).

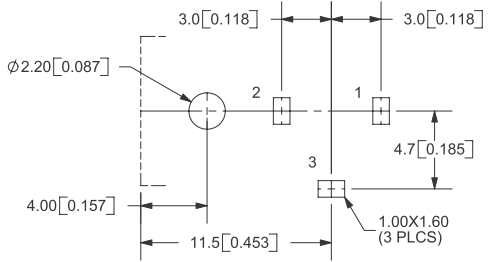
Since it is a through-hole component, 2 plated oval holes are required (1.2mm x 2.4mm).



## Image8.png footprint\_dc\_conn

Footprint of [5mm7\_2mm\_DC\_THT](#8GMHtP6GAqBwAWpL).

Since it is a through-hole component, 3 plated rectangular holes are required (1.6mm x 1mm), and 1 mechanical circular hole (diameter = 2.2mm) is required in order to have a better attach to the board.



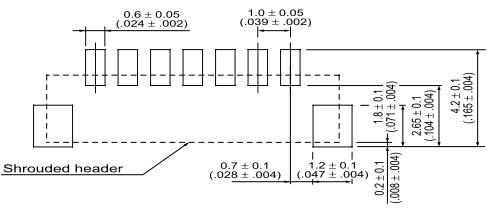
## Image8.png footprint\_oled\_conn

Footprint of [FemaleCrimpConnector\_4pin\_1mmPitch\_SMD\_topEntry](#nKMHtP6GAqBwAWos).

Since it is a surface mount component:

- 4 rectangular exposed copper pads (0.65mm x 1.55mm) are required for pins

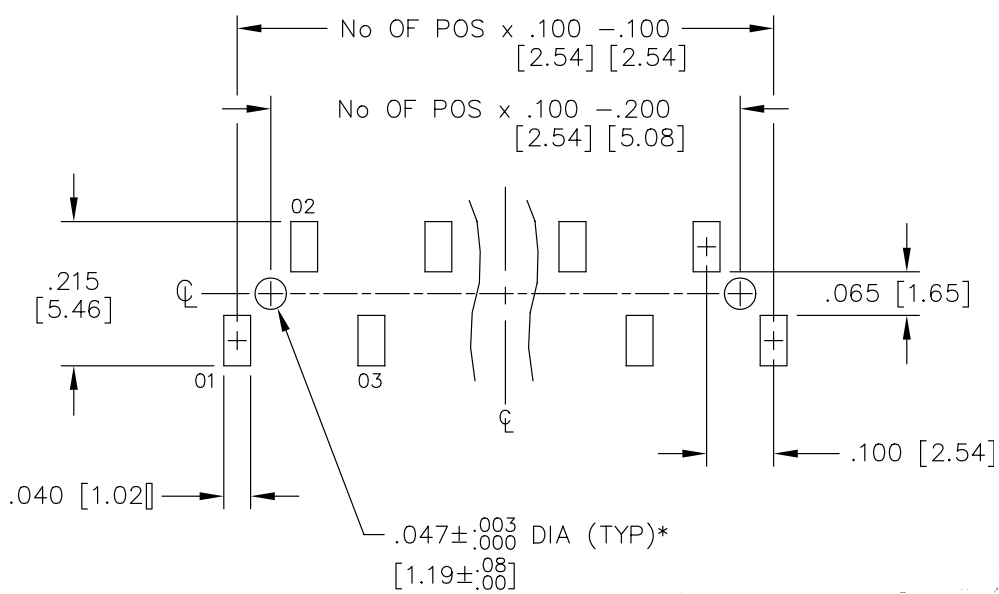
- 4 rectangular exposed copper pads (1.3mm x 1.9mm) are required for mechanical connection to the board



## Image8.png footprint\_BTB\_conn

Footprint of [BoardToBoard\_20\_2mm54\_SMD](#O2MHtP6GAqBwAWpg).

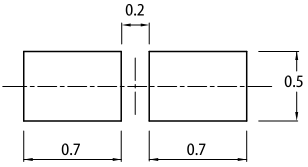
Since it is a surface mount component, 20 exposed rectangular copper pads (1.02mm x 1.975mm).



## Image8.png footprint\_led

Footprint of [RedLED\_module\_3V3](#BWMHtP6GAqBwAWpZ).

Since it is a surface mount component, 2 exposed rectangular copper pads (0.5mm x 0.7mm) are required.



## Image8.png footprint\_res0603

Footprint for 0603 resistors.

Since surface mount resistors are used, 2 copper rectangular exposed pads are required (0.9mm x 0.65mm).

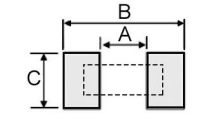
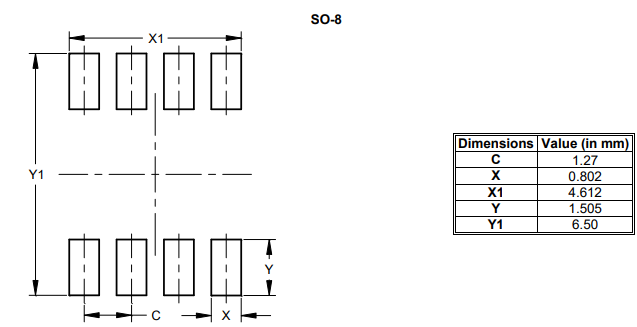


Image37.png

## Image8.png fooprint\_DCDC

Footprint of [DCDC\_3V3\_IC\_SMD](#AcMHtP6GAqBwAWoC).

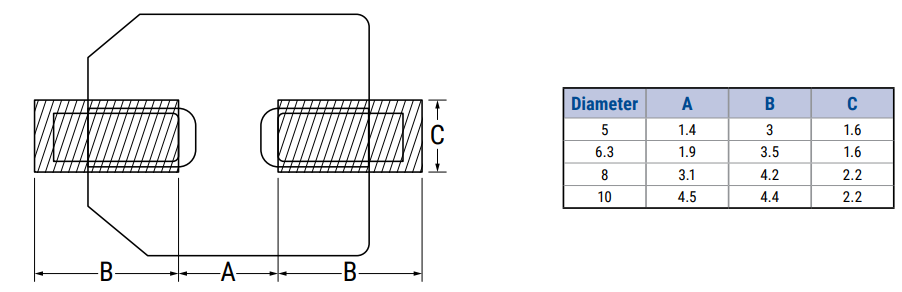
Since it is a surface mount component, 8 copper rectangular exposed pads are required (0.802mm x 1.505mm).



## Image8.png footprint\_cap

Footprint of [C\_10uF\_electrolytic\_SMD](#N8MHtP6GAqBwAWoK).

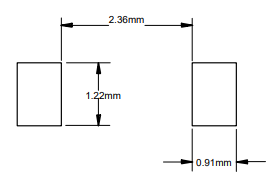
Since it is a surface mount component, 2 copper rectangular exposed pads are required (2.2mm x 4.2mm).



## Image8.png footprint\_diode

Footprint of [SMD\_SPST\_PushButton](#ltMHtP6GAqBwAWrl).

Since it is a surface mount component, 2 copper rectangular exposed pads are required (1.22mm x 0.91mm).



## Image7.png MultiFX\_nese10\_2122

[MultiFX\_nese10\_2122](#kYMHtP6GAqBwAWm4) is a system that allows to apply some effects to an input audio signal, so that a new audio signal can be provided as output.

The [User](#zoMHtP6GAqBwAWm1) can easily interface with the system using the knobs and pushbuttons on the top side of the [MultiFX\_nese10\_2122](#kYMHtP6GAqBwAWm4). Furthermore an OLED display allows to understand what is the current effect applied on the input audio signal, the parameter value of that effect and the volume.

Attributes

## Image9.png POT1

This [10K\_t20%\_LOG\_POT\_H20mm\_THT](#49MHtP6GAqBwAWry) allows to tune ([tuneR()](#v9MHtP6GAqBwAWr4) and [tuneL()](#EDMHtP6GAqBwAWr6)) the volume of the input signal processed by [uP: uP\_SignalMusicProcessing](#l.MHtP6GAqBwAWp.).

The pin [VDD()](#a9MHtP6GAqBwAWr0) must be connected to [OUT\_3V3A()](#.OMHtP6GAqBwAWpn) pin of [DAISY\_SEED](#52MHtP6GAqBwAWpj).

The pin [F\_T()](#a9MHtP6GAqBwAWr1) must be connected to [ADC\_IN1()](#tOMHtP6GAqBwAWpp). Due to the connection to [OUT\_3V3A()](#.OMHtP6GAqBwAWpn) the voltage at this pin can be tuned in the voltage range between 6.6mV (minimum volume) and 3.3V (maximum volume).

Finally, the pin [GND()](#p9MHtP6GAqBwAWr2) will be connected to ground reference provided by [CONN1: 5mm7\_2mm\_DC\_THT](#LYMHtP6GAqBwAWnC).

## Image9.png POT2

This [10K\_t20%\_LOG\_POT\_H20mm\_THT](#49MHtP6GAqBwAWry) allows to tune ([tuneR()](#v9MHtP6GAqBwAWr4) and [tuneL()](#EDMHtP6GAqBwAWr6)) the parameter value of the current effect applied to the input signal processed by [uP: uP\_SignalMusicProcessing](#l.MHtP6GAqBwAWp.).

The pin [VDD()](#a9MHtP6GAqBwAWr0) must be connected to [OUT\_3V3A()](#.OMHtP6GAqBwAWpn) pin of [DAISY\_SEED](#52MHtP6GAqBwAWpj).

The pin [F\_T()](#a9MHtP6GAqBwAWr1) must be connected to [ADC\_IN2()](#HOMHtP6GAqBwAWpq).

Due to the connection to [OUT\_3V3A()](#.OMHtP6GAqBwAWpn) the voltage at this pin can be tuned in the voltage range between 6.6mV (minimum volume) and 3.3V (maximum volume).

Finally, the pin [GND()](#p9MHtP6GAqBwAWr2) will be connected to ground reference provided by [CONN1: 5mm7\_2mm\_DC\_THT](#LYMHtP6GAqBwAWnC).

## Image9.png SW1

This [SPDT\_ON-OFF\_ToggleSwitch\_THT](#UNMHtP6GAqBwAWrd) is used to turn ON/OFF the device.

When device is turned ON ([switchON()](#_pMHtP6GAqBwAWqu)) the whole circuit is supplied, otherwise ([switchOFF()](#ytMHtP6GAqBwAWrj)) it is not connected to supply voltage.

## Image9.png SW2

This [SMD\_SPST\_PushButton](#ltMHtP6GAqBwAWrl) allows to switch to the previous effect.

When button is pressed ([push()](#DdMHtP6GAqBwAWrv)), there is a commutation ('1' -> '0') on [OUT1()](#HtMHtP6GAqBwAWrn) and [OUT2()](#HtMHtP6GAqBwAWro) pins, that indicate the previous effect must be applied.

Pins [OUT1()](#HtMHtP6GAqBwAWrn) and [OUT2()](#HtMHtP6GAqBwAWro) must be connected to [D26()](#IuMHtP6GAqBwAWpr).

## Image9.png SW3

This [SMD\_SPST\_PushButton](#ltMHtP6GAqBwAWrl) allows to switch to the next effect.

When button is pressed ([push()](#DdMHtP6GAqBwAWrv)), there is a commutation ('1' -> '0') on [OUT1()](#HtMHtP6GAqBwAWrn) and [OUT2()](#HtMHtP6GAqBwAWro) pins, that indicate the next effect must be applied.

Pins [OUT1()](#HtMHtP6GAqBwAWrn) and [OUT2()](#HtMHtP6GAqBwAWro) must be connected to [D27()](#quMHtP6GAqBwAWpt).

## Image9.png SW4

This [SMD\_SPST\_PushButton](#ltMHtP6GAqBwAWrl) that allows to switch ON bypass: the input audio signal is not processed.

When button is pressed ([push()](#DdMHtP6GAqBwAWrv)), there is a commutation ('1' -> '0') on [OUT1()](#HtMHtP6GAqBwAWrn) and [OUT2()](#HtMHtP6GAqBwAWro) pins, so it is possible to toggle between bypass ON and OFF, and vice versa.

Pins [OUT1()](#HtMHtP6GAqBwAWrn) and [OUT2()](#HtMHtP6GAqBwAWro) must be connected to [D28()](#5uMHtP6GAqBwAWpv).

## Image9.png LED

This LED provides a luminous indication about the bypass:

* LED is ON: input signal is bypassed without any processing
* LED is OFF: an effect in applied to input signal

The [VIN()](#1WMHtP6GAqBwAWpb) pin must be connected to [D30()](#HuMHtP6GAqBwAWpx).

The [GND()](#o2MHtP6GAqBwAWpf) pin must be connected to the reference ground voltage provided by [CONN1: 5mm7\_2mm\_DC\_THT](#LYMHtP6GAqBwAWnC).

## Image9.png uP

The [uP\_SignalMusicProcessing](#llMHtP6GAqBwAWrJ) module exploits the [DAISY\_SEED](#52MHtP6GAqBwAWpj) board to process input signal provided by [Jack\_IN](#OoMHtP6GAqBwAWmz), and make available a processed signal on [Jack\_OUT](#FoMHtP6GAqBwAWm0).

A suitable [Firmware](#cpMHtP6GAqBwAWqk) is uploaded inside the [DAISY\_SEED](#52MHtP6GAqBwAWpj) in order to process the audio signal based on the available effects.

## Image9.png OLED

The [OLED: OLED\_module](#APMHtP6GAqBwAWsh) is used to show:

* Current effect
* Volume percentage
* Current effect parameter value

In order to avoid digital noise on [OUT\_3V3A()](#.OMHtP6GAqBwAWpn) pin of [DAISY\_SEED](#52MHtP6GAqBwAWpj), the [OLED: OLED\_module](#APMHtP6GAqBwAWsh) is supplied directly by the DC voltage brought to [5mm7\_2mm\_DC\_THT](#8GMHtP6GAqBwAWpL) connector. Then a [DCDC\_3V3\_module](#QiMHtP6GAqBwAWoT) allows to provide the right supply voltage to the [I2C\_OLED\_Display\_SSD1306](#xEMHtP6GAqBwAWnl).

The I2C is exploited to communicate with the [uP: uP\_SignalMusicProcessing](#l.MHtP6GAqBwAWp.).

For these reasons, the [OLED: OLED\_module](#APMHtP6GAqBwAWsh) is connected in the following way:

* [VIN()](#OGMHtP6GAqBwAWpO): [T1()](#8GMHtP6GAqBwAWpK) of [5mm7\_2mm\_DC\_THT](#8GMHtP6GAqBwAWpL)
* [GND()](#26MHtP6GAqBwAWpA): [AGND()](#UeMHtP6GAqBwAWpz)
* [SDA()](#26MHtP6GAqBwAWpB): [I2C1\_SDA()](#JeMHtP6GAqBwAWp2)
* [SCL()](#O6MHtP6GAqBwAWpC): [I2C1\_SCL()](#reMHtP6GAqBwAWp4)

## Image9.png CONN1

Connector that receives the voltage supply from [Power\_supply and cable](#soMHtP6GAqBwAWmy) in order to supply the whole circuit.

## Image9.png CONN2

Connector that receives the signal from [Jack\_IN](#OoMHtP6GAqBwAWmz) (tip of male Jack connector 6.35mm) and send it to [uP: uP\_SignalMusicProcessing](#l.MHtP6GAqBwAWp.) at pin [AUDIO\_IN1()](#Y.MHtP6GAqBwAWp6).

## Image9.png CONN3

Connector that allows to send the processed audio signal, provided by [uP: uP\_SignalMusicProcessing](#l.MHtP6GAqBwAWp.) at pin [AUDIO\_OUT1()](#S.MHtP6GAqBwAWp7), to [Jack\_OUT](#FoMHtP6GAqBwAWm0).

## Image9.png PCB\_v1

Printed Circuit Board on which the circuit will be assembled.

## Image9.png SCH\_v1

Circuit schematics.

## Image9.png CASE\_125x72

Package to protect the circuit.

Operations

## Image8.png volumeUp

The knob of [POT1: 10K\_t20%\_LOG\_POT\_H20mm\_THT](#AkMHtP6GAqBwAWns) is rotated in clockwise direction ([tuneR()](#v9MHtP6GAqBwAWr4)). In this way, an higher voltage value will be sampled by [DAISY\_SEED](#52MHtP6GAqBwAWpj) at [ADC\_IN1()](#tOMHtP6GAqBwAWpp) pin, so it is possible to increase the volume (magnitude) of audio signal processed by [uP: uP\_SignalMusicProcessing](#l.MHtP6GAqBwAWp.).

## Image8.png volumeDown

The knob of [POT1: 10K\_t20%\_LOG\_POT\_H20mm\_THT](#AkMHtP6GAqBwAWns) is rotated in counterclockwise direction ([tuneL()](#EDMHtP6GAqBwAWr6)). In this way, a lower voltage value will be sampled by [DAISY\_SEED](#52MHtP6GAqBwAWpj) at [ADC\_IN1()](#tOMHtP6GAqBwAWpp) pin, so it is possible to decrease the volume (magnitude) of audio signal processed by [uP: uP\_SignalMusicProcessing](#l.MHtP6GAqBwAWp.).

## Image8.png FxUp

The knob of [POT2: 10K\_t20%\_LOG\_POT\_H20mm\_THT](#hEMHtP6GAqBwAWnh) is rotated in clockwise direction ([tuneR()](#v9MHtP6GAqBwAWr4)). In this way, an higher voltage value will be sampled by [DAISY\_SEED](#52MHtP6GAqBwAWpj) at [ADC\_IN2()](#HOMHtP6GAqBwAWpq) pin, so it is possible to increase the way in which the effect affects the audio signal processed by [uP: uP\_SignalMusicProcessing](#l.MHtP6GAqBwAWp.).

## Image8.png FxDown

The knob of [POT2: 10K\_t20%\_LOG\_POT\_H20mm\_THT](#hEMHtP6GAqBwAWnh) is rotated in clockwise direction ([tuneL()](#EDMHtP6GAqBwAWr6)). In this way, a lower voltage value will be sampled by [DAISY\_SEED](#52MHtP6GAqBwAWpj) at [ADC\_IN2()](#HOMHtP6GAqBwAWpq) pin, so it is possible to decrease the way in which the effect affects the audio signal processed by [uP: uP\_SignalMusicProcessing](#l.MHtP6GAqBwAWp.).

## Image8.png switchOn

The lever is moved in ON position (towards the "ON" label) in order to [switchON()](#_pMHtP6GAqBwAWqu) the circuit. In this way the circuit is supplied.

## Image8.png switchOff

The lever is moved in OFF position (towards the "OFF" label) in order to [switchOFF()](#ytMHtP6GAqBwAWrj) the circuit. In this way the circuit is not connected to any voltage supply.

## Image8.png pushNextFx

When [User](#zoMHtP6GAqBwAWm1) [push()](#DdMHtP6GAqBwAWrv) the [SW3: SMD\_SPST\_PushButton](#QpMHtP6GAqBwAWqg) the next effect is applied to the audio signal processed by [uP: uP\_SignalMusicProcessing](#l.MHtP6GAqBwAWp.). In particular, variation of voltage at [D27()](#quMHtP6GAqBwAWpt) pin is read like a request ([nextFx(): void](#C5MHtP6GAqBwAWq6)) to switch to the next effect.

One switch per each pressure, until [release()](#h5MHtP6GAqBwAWq8) of [SW3: SMD\_SPST\_PushButton](#QpMHtP6GAqBwAWqg).

## Image8.png releaseNextFx

The [User](#zoMHtP6GAqBwAWm1) [release()](#h5MHtP6GAqBwAWq8) the [SW3: SMD\_SPST\_PushButton](#QpMHtP6GAqBwAWqg), so the voltage value become again equal to the quiescent value ('1'). Only now a new [pushNextFx()](#WkMHtP6GAqBwAWnz) can lead to another effect switch.

## Image8.png pushBackFx

When [User](#zoMHtP6GAqBwAWm1) [push()](#DdMHtP6GAqBwAWrv) the [SW2: SMD\_SPST\_PushButton](#QpMHtP6GAqBwAWqf) the previous effect is applied to the audio signal processed by [uP: uP\_SignalMusicProcessing](#l.MHtP6GAqBwAWp.). In particular, variation of voltage at [D26()](#IuMHtP6GAqBwAWpr) pin is read like a request ([backFx(): void](#R5MHtP6GAqBwAWq9)) to switch to the next effect.

One switch per each pressure, until [release()](#h5MHtP6GAqBwAWq8) of [SW2: SMD\_SPST\_PushButton](#QpMHtP6GAqBwAWqf).

## Image8.png releaseBackFx

The [User](#zoMHtP6GAqBwAWm1) [release()](#h5MHtP6GAqBwAWq8) the [SW2: SMD\_SPST\_PushButton](#QpMHtP6GAqBwAWqf), so the voltage value become again equal to the quiescent value ('1'). Only now a new [pushBackFx()](#lkMHtP6GAqBwAWn3) can lead to another effect switch.

## Image8.png pushBypass

When [User](#zoMHtP6GAqBwAWm1) [push()](#DdMHtP6GAqBwAWrv) the [SW4: SMD\_SPST\_PushButton](#QpMHtP6GAqBwAWqh):

* if bypass is OFF ([LD1: RedLED\_AlGaInP\_SMD](#kEMHtP6GAqBwAWnb) OFF), it turns ON and no effect is applied to the audio signal
* if bypass is ON ([LD1: RedLED\_AlGaInP\_SMD](#kEMHtP6GAqBwAWnb) ON), it turns OFF and the current effect is applied to the audio signal

In particular, variation of voltage at [D28()](#5uMHtP6GAqBwAWpv) pin is read like a request ([bypass(): void](#HkMHtP6GAqBwAWn8)) to toggle the bypass state.

One toggle between ON and OFF states per each pressure, until [release()](#h5MHtP6GAqBwAWq8) of [SW4: SMD\_SPST\_PushButton](#QpMHtP6GAqBwAWqh).

## Image8.png releaseBypass

The [User](#zoMHtP6GAqBwAWm1) [release()](#h5MHtP6GAqBwAWq8) the [SW4: SMD\_SPST\_PushButton](#QpMHtP6GAqBwAWqh), so the voltage value become again equal to the quiescent value ('1'). Only now a new [pushBypass()](#7kMHtP6GAqBwAWn7) can lead to another variation of bypass state.

## Image8.png DC\_voltage

DC voltage between 4.5V and 17V is provided to the circuit.

## Image8.png signal\_IN

Input audio signal provided by [Jack\_IN](#OoMHtP6GAqBwAWmz).

Nominal input level: −20dBm.

## Image8.png signal\_OUT

Processed output audio signal provided to [Jack\_OUT](#FoMHtP6GAqBwAWm0).

Max output level: Line +5dBm (with output load 10 kΩ or more).

## Image8.png pressBoot

Boot pushbutton on [DAISY\_SEED](#52MHtP6GAqBwAWpj) board is pressed. It can be useful to flash [uP: uP\_SignalMusicProcessing](#l.MHtP6GAqBwAWp.).

## Image8.png releaseBoot

Boot pushbutton on [DAISY\_SEED](#52MHtP6GAqBwAWpj) board is released.

## Image8.png pressReset

Reset pushbutton on [DAISY\_SEED](#52MHtP6GAqBwAWpj) board is pressed. It allows to reset the [DAISY\_SEED](#52MHtP6GAqBwAWpj) board and can be useful to flash [uP: uP\_SignalMusicProcessing](#l.MHtP6GAqBwAWp.).

## Image8.png releaseReset

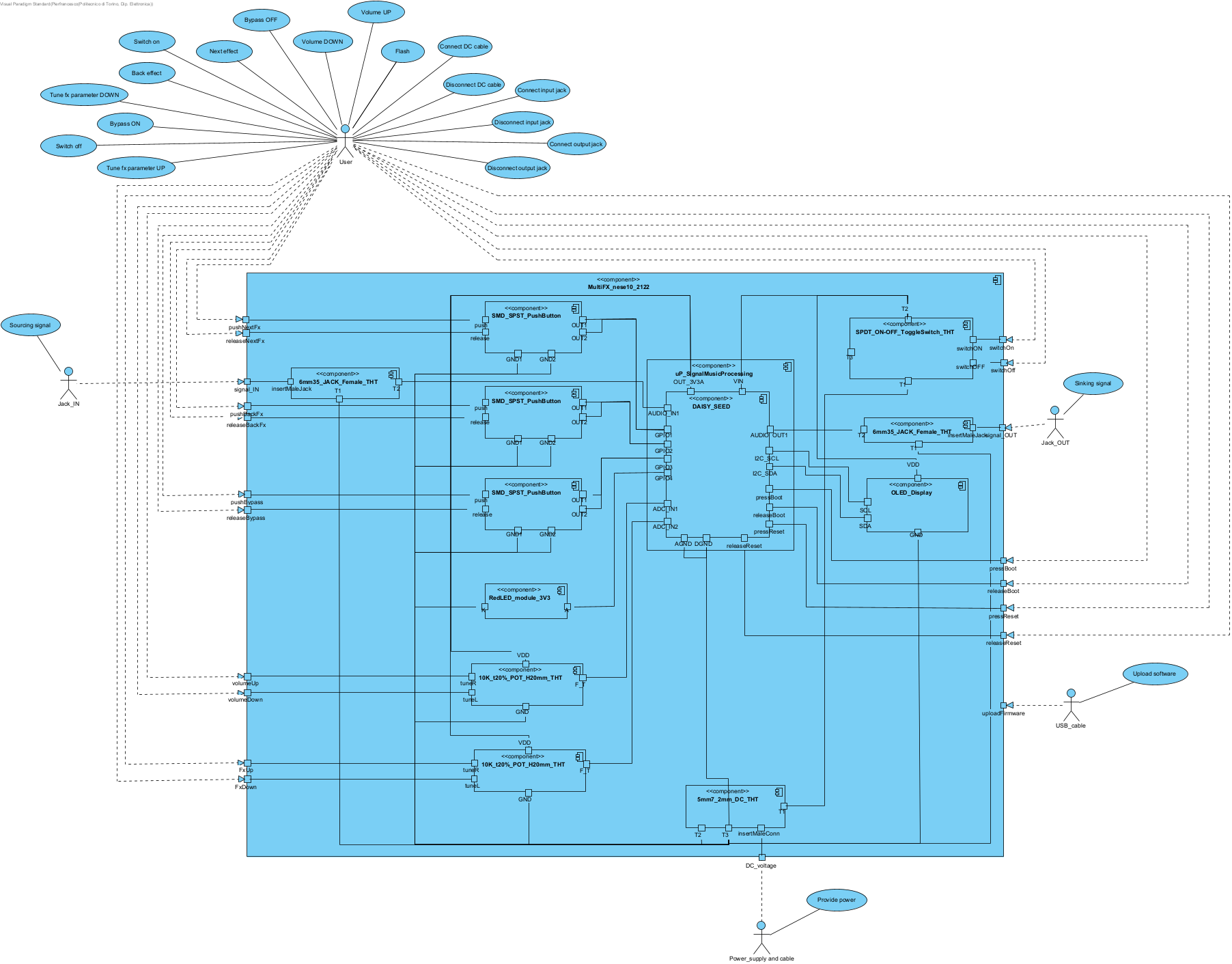
Reset pushbutton on [DAISY\_SEED](#52MHtP6GAqBwAWpj) board is released.

## Image8.png uploadFirmware

Connecting the [USB\_cable](#AoMHtP6GAqBwAWmx) to [DAISY\_SEED](#52MHtP6GAqBwAWpj) it is possible to upload a new firmware.

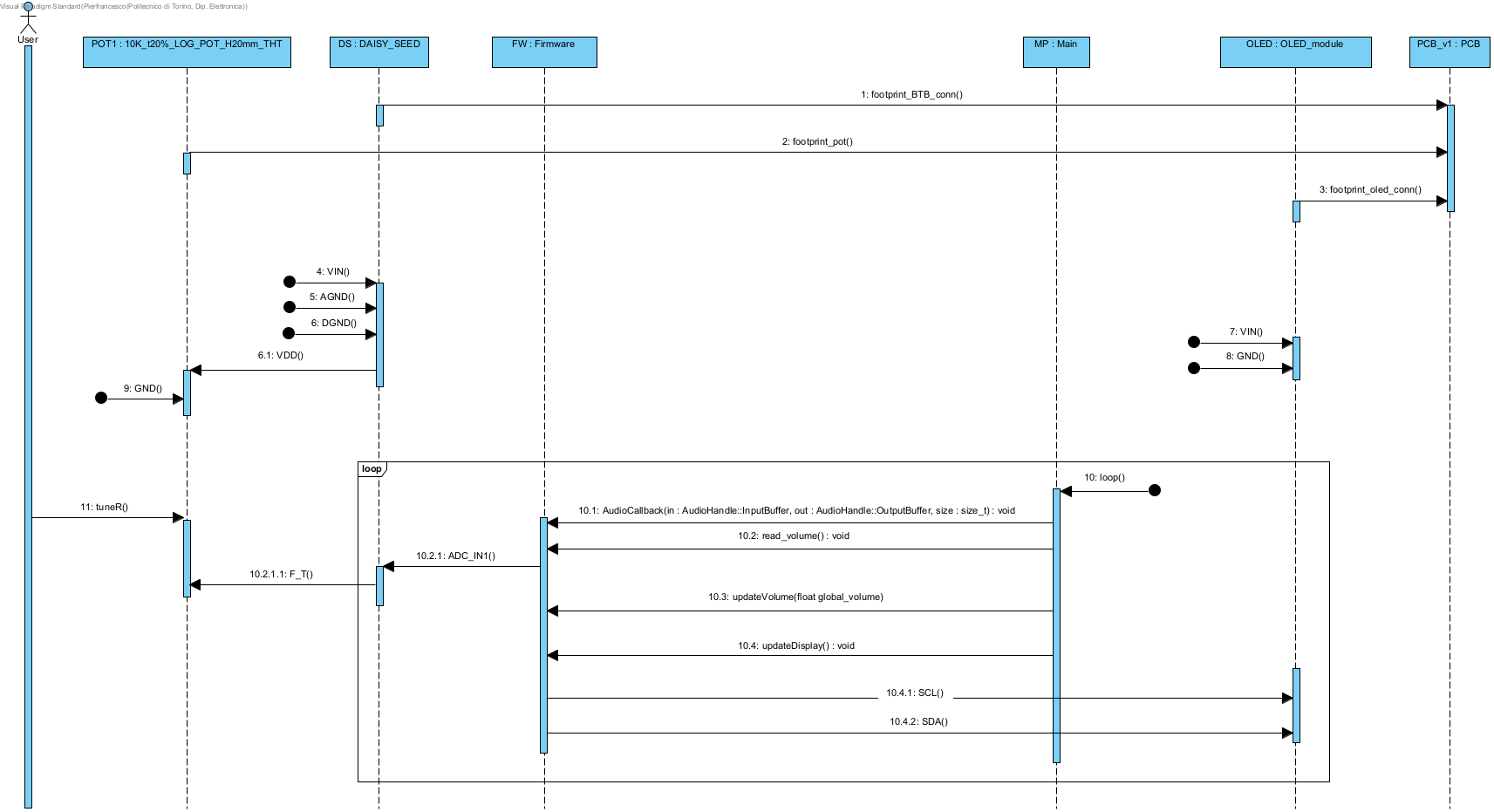
Component Diagram

# Components\_multiFx



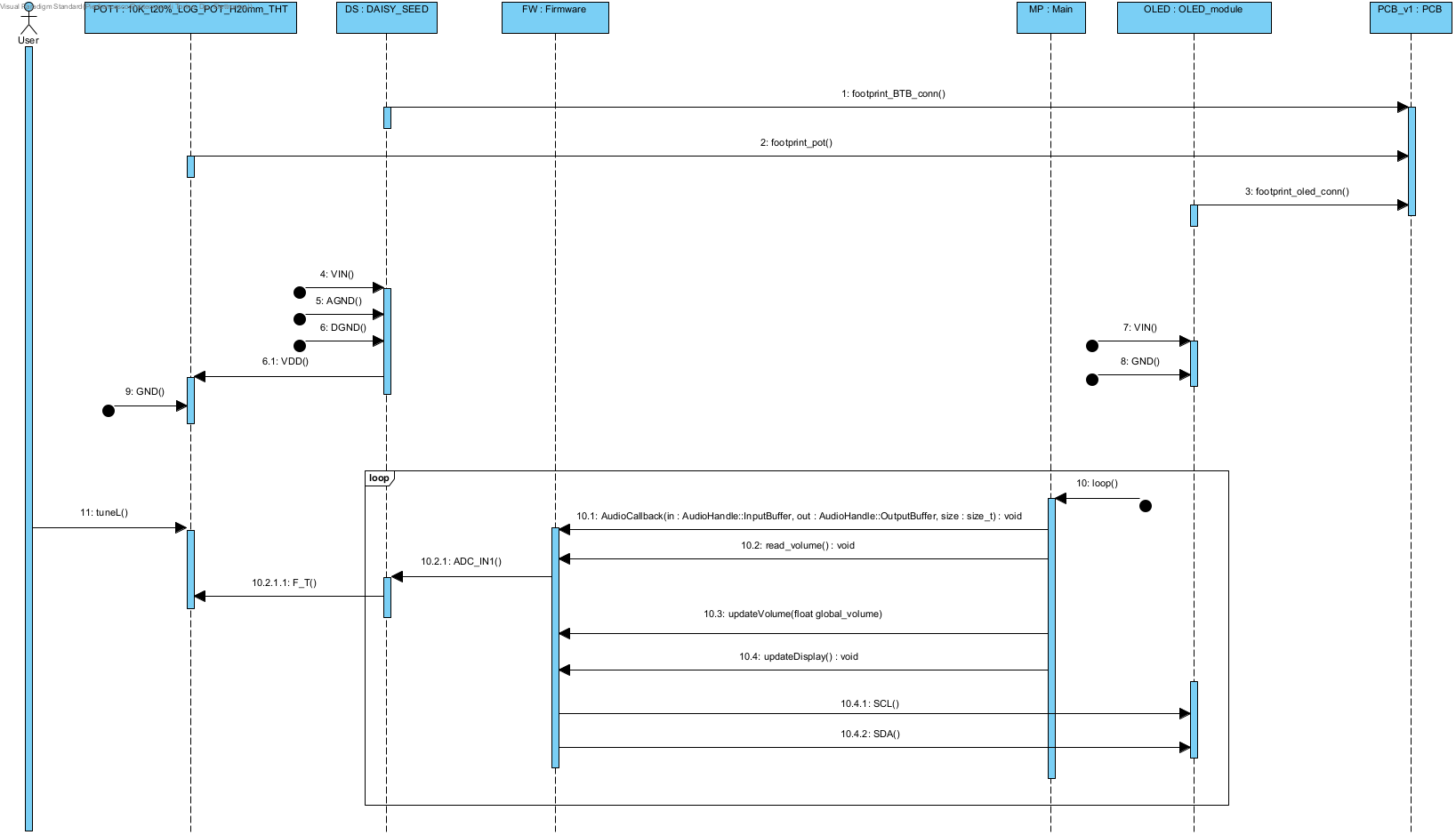
Sequence Diagram

# TuneVolumeUp



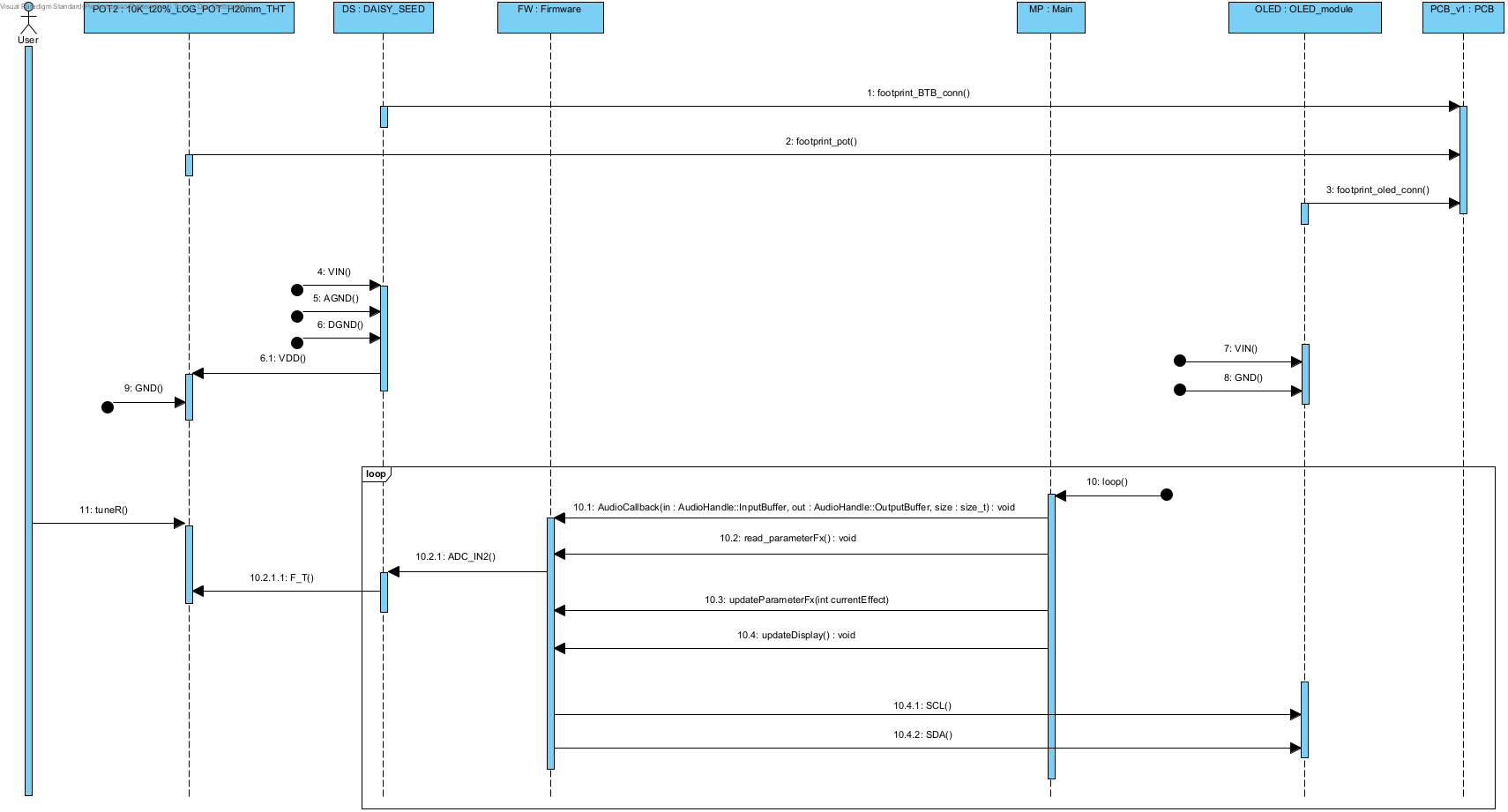
Sequence Diagram

# TuneVolumeDown



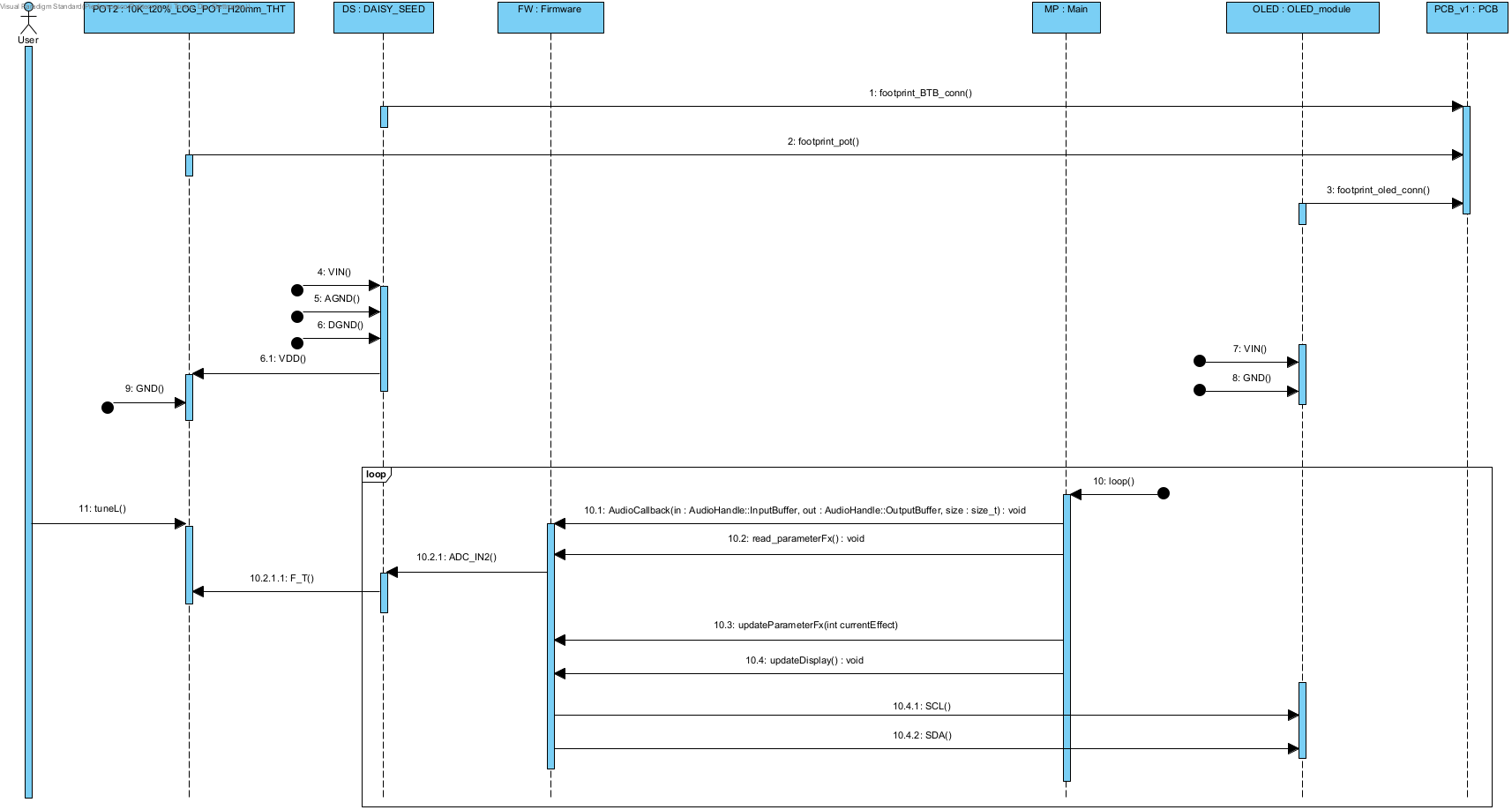
Sequence Diagram

# TuneParameterFxUp



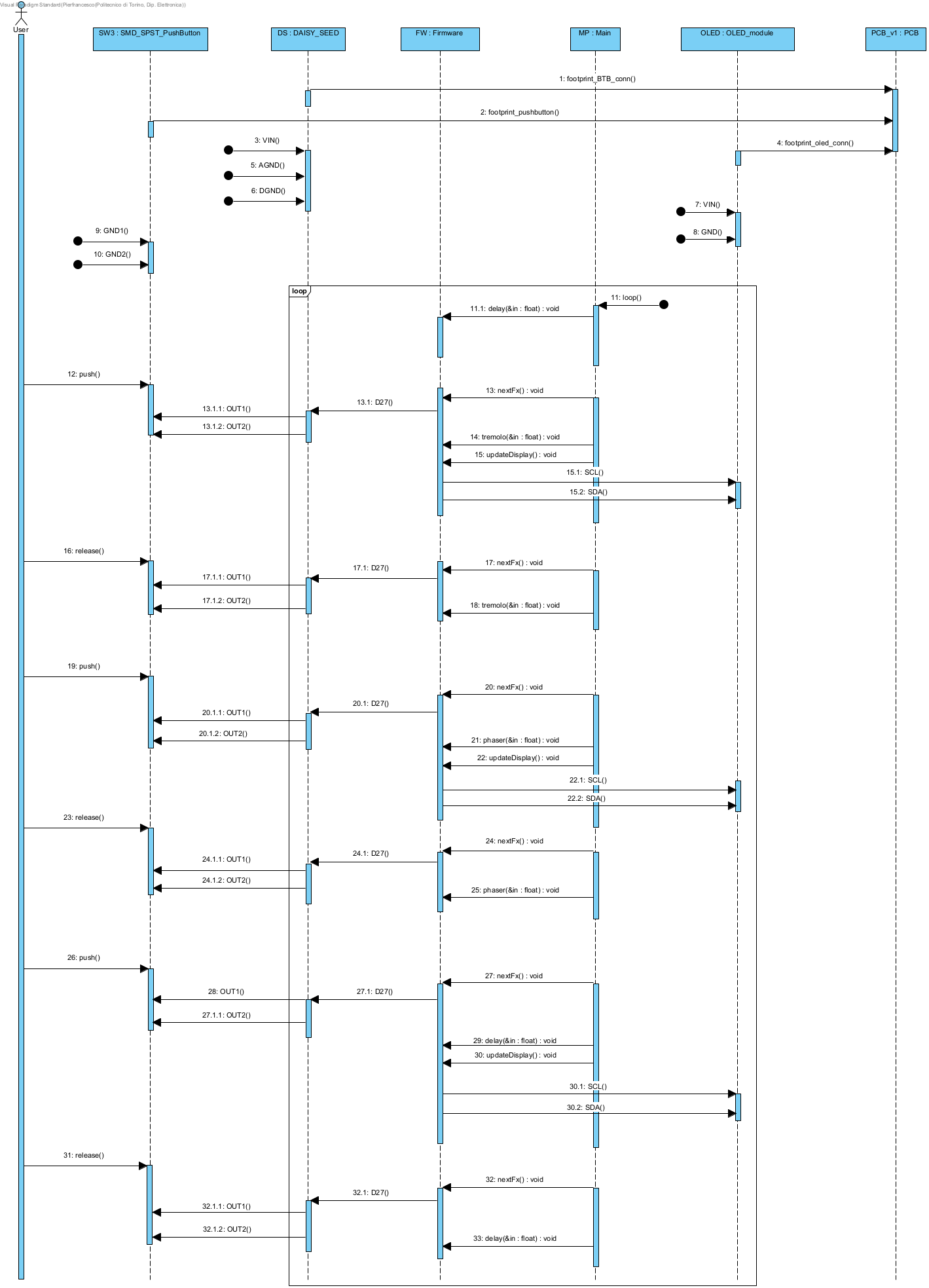
Sequence Diagram

# TuneParameterFxDown



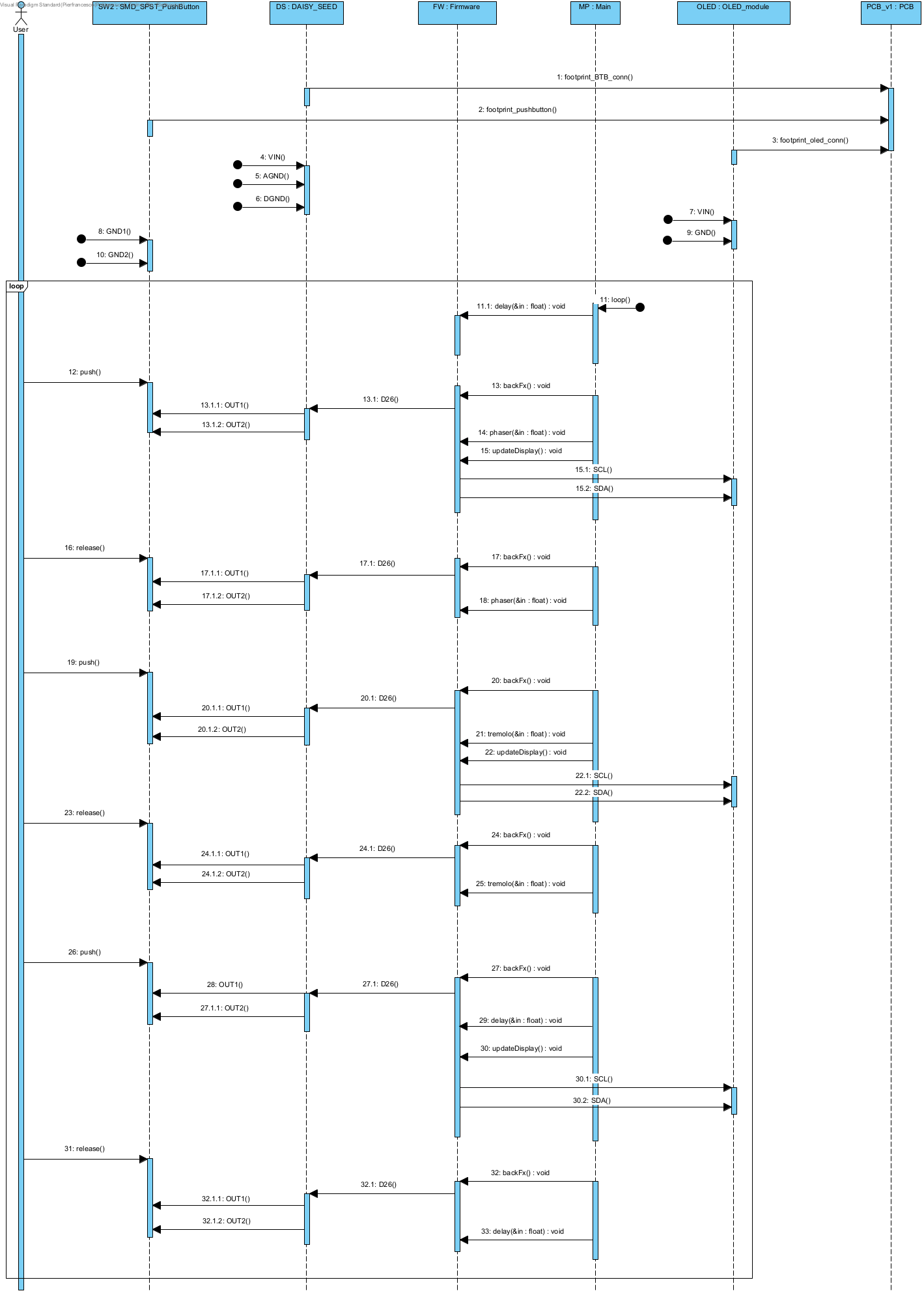
Sequence Diagram

# NextEffect



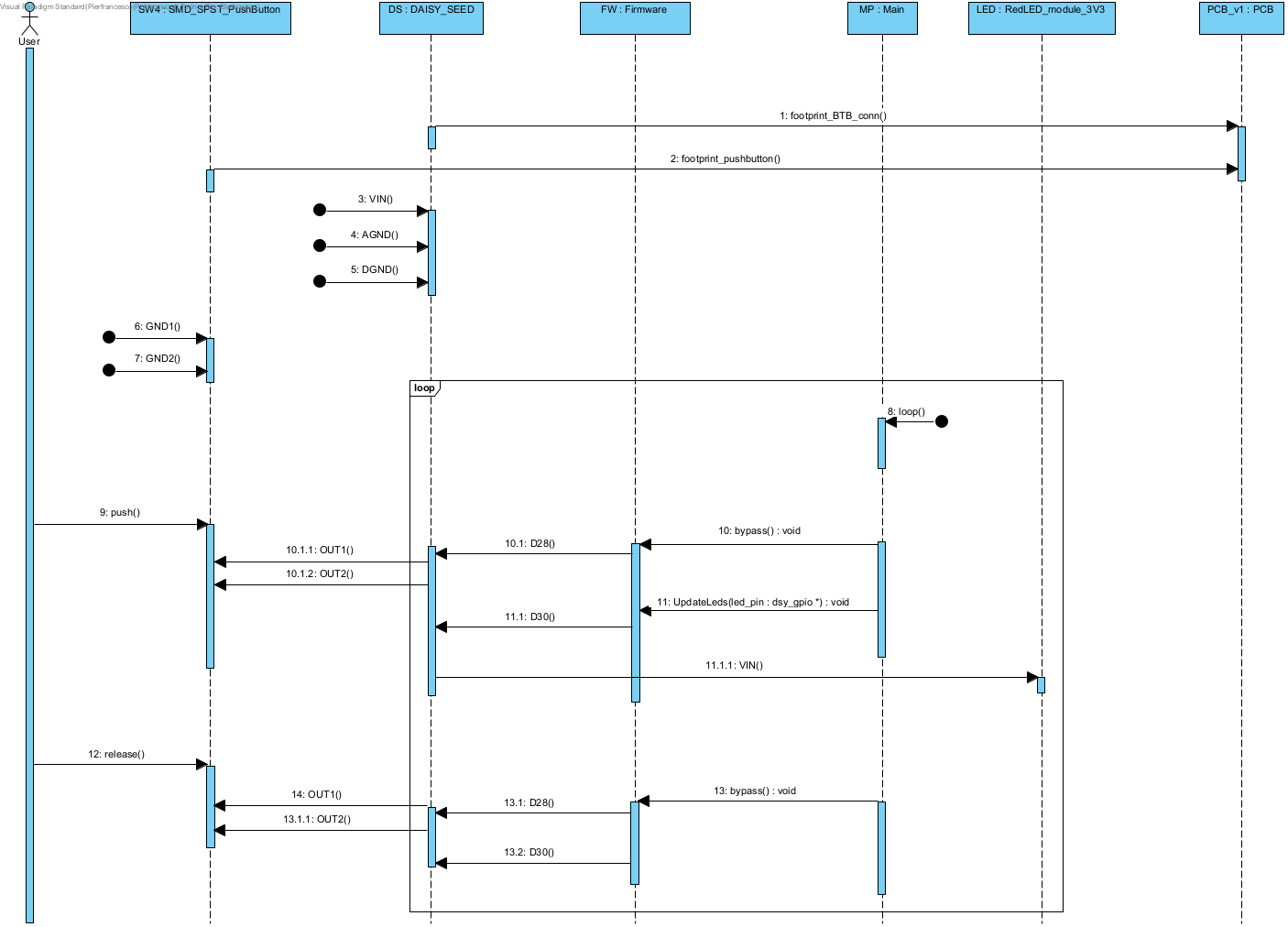
Sequence Diagram

# BackFx



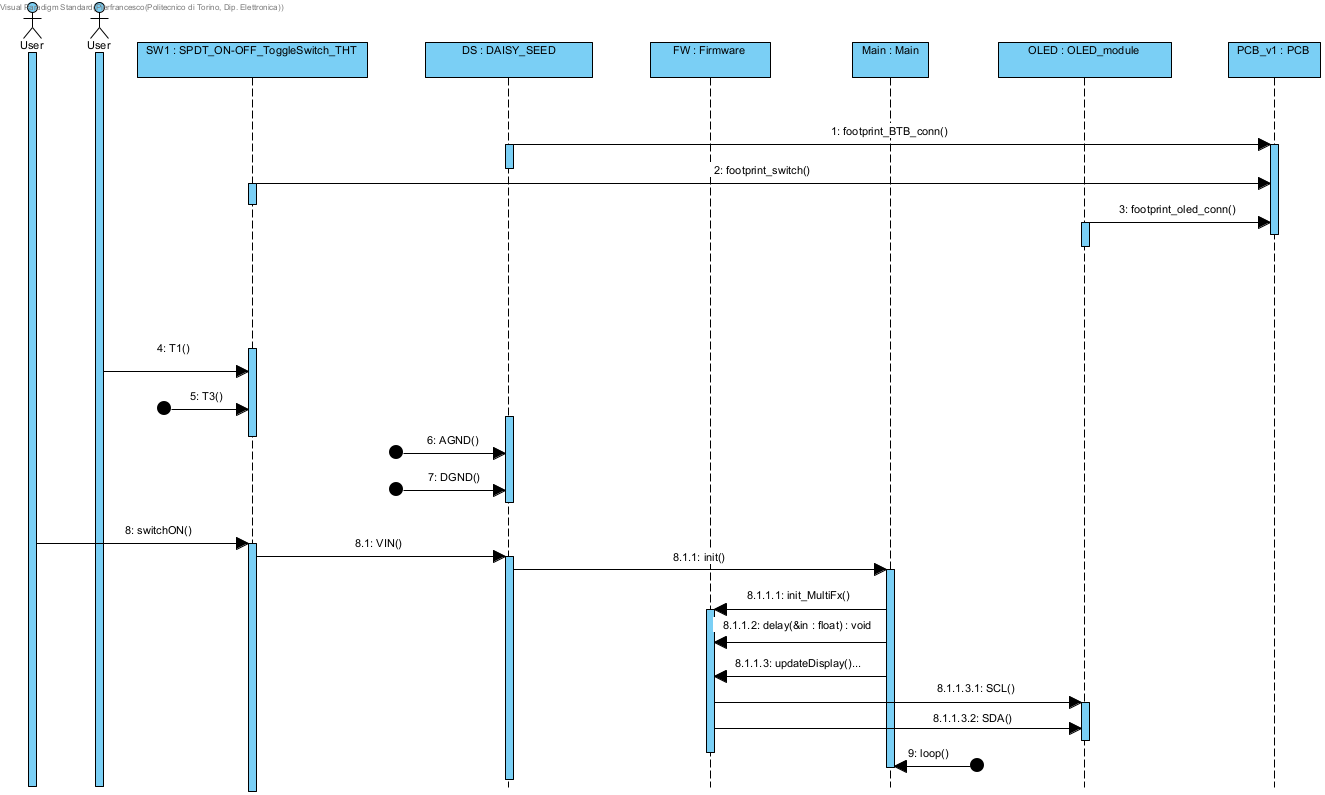
Sequence Diagram

# Bypass



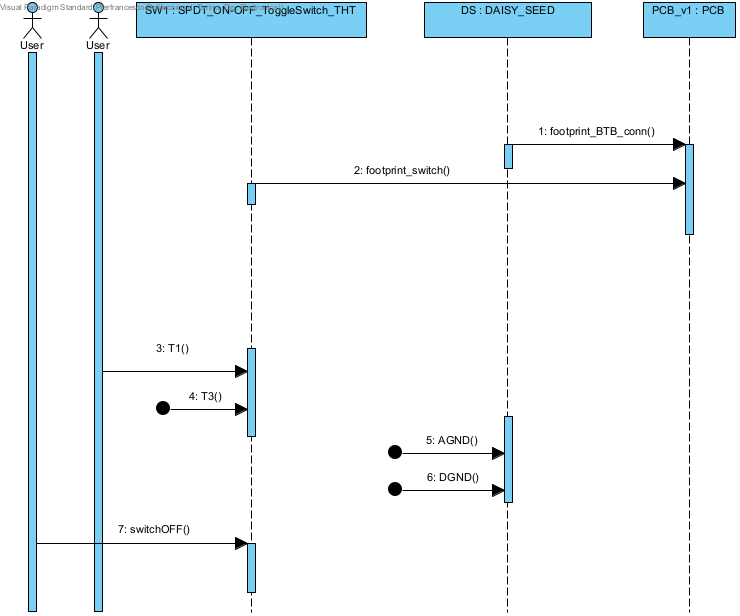
Sequence Diagram

# Switch\_ON



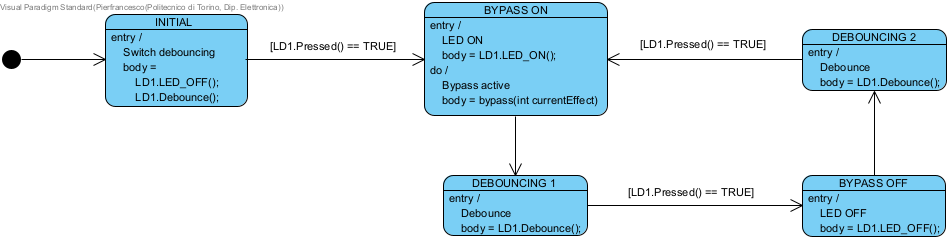
Sequence Diagram

# Switch\_OFF



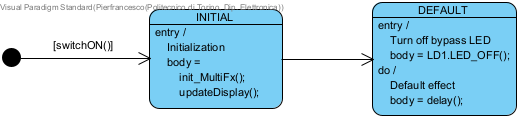
State Machine Diagram

# Bypass



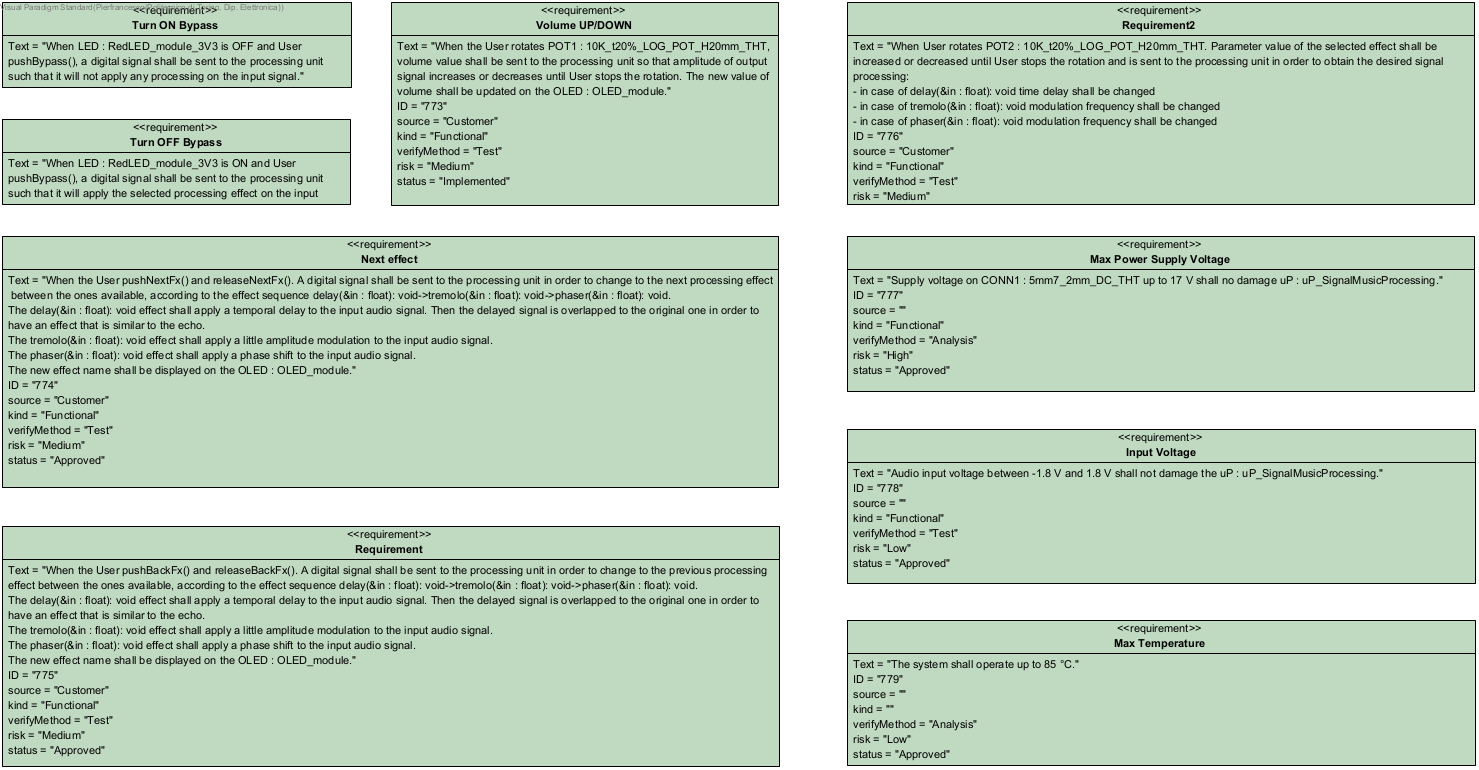
State Machine Diagram

# Switch ON



Requirement Diagram

# Requirement Diagram1



## Image55.png Turn ON Bypass

When [LED: RedLED\_module\_3V3](#EW2vtP6GAqBwAXsG) is OFF and [User](#EFWvtP6GAqBwAXmd) [pushBypass()](#v1WvtP6GAqBwAXnj), a digital signal shall be sent to the processing unit such that it will not apply any processing on the input signal.

## Image55.png Turn OFF Bypass

When [LED: RedLED\_module\_3V3](#EW2vtP6GAqBwAXsG) is ON and [User](#EFWvtP6GAqBwAXmd) [pushBypass()](#v1WvtP6GAqBwAXnj), a digital signal shall be sent to the processing unit such that it will apply the selected processing effect on the input signal.

## Image55.png Volume UP/DOWN

When the [User](#EFWvtP6GAqBwAXmd) rotates [POT1: 10K\_t20%\_LOG\_POT\_H20mm\_THT](#k1WvtP6GAqBwAXnU), volume value shall be sent to the processing unit so that amplitude of output signal increases or decreases until [User](#EFWvtP6GAqBwAXmd) stops the rotation. The new value of volume shall be updated on the [OLED: OLED\_module](#BW2vtP6GAqBwAXsJ).

## Image55.png Next effect

When the [User](#EFWvtP6GAqBwAXmd) [pushNextFx()](#R1WvtP6GAqBwAXnb) and [releaseNextFx()](#R1WvtP6GAqBwAXnc). A digital signal shall be sent to the processing unit in order to change to the next processing effect between the ones available, according to the effect sequence [delay(&in: float): void](#aVWvtP6GAqBwAXnC)->[tremolo(&in: float): void](#dVWvtP6GAqBwAXnL)->[phaser(&in: float): void](#dVWvtP6GAqBwAXnM).

The [delay(&in: float): void](#aVWvtP6GAqBwAXnC) effect shall apply a temporal delay to the input audio signal. Then the delayed signal is overlapped to the original one in order to have an effect that is similar to the echo.

The [tremolo(&in: float): void](#dVWvtP6GAqBwAXnL) effect shall apply a little amplitude modulation to the input audio signal.

The [phaser(&in: float): void](#dVWvtP6GAqBwAXnM) effect shall apply a phase shift to the input audio signal.

The new effect name shall be displayed on the [OLED: OLED\_module](#BW2vtP6GAqBwAXsJ).

## Image55.png Requirement

When the [User](#EFWvtP6GAqBwAXmd) [pushBackFx()](#D1WvtP6GAqBwAXnf) and [releaseBackFx()](#D1WvtP6GAqBwAXng). A digital signal shall be sent to the processing unit in order to change to the previous processing effect between the ones available, according to the effect sequence [delay(&in: float): void](#aVWvtP6GAqBwAXnC)->[tremolo(&in: float): void](#dVWvtP6GAqBwAXnL)->[phaser(&in: float): void](#dVWvtP6GAqBwAXnM).

The [delay(&in: float): void](#aVWvtP6GAqBwAXnC) effect shall apply a temporal delay to the input audio signal. Then the delayed signal is overlapped to the original one in order to have an effect that is similar to the echo.

The [tremolo(&in: float): void](#dVWvtP6GAqBwAXnL) effect shall apply a little amplitude modulation to the input audio signal.

The [phaser(&in: float): void](#dVWvtP6GAqBwAXnM) effect shall apply a phase shift to the input audio signal.

The new effect name shall be displayed on the [OLED: OLED\_module](#BW2vtP6GAqBwAXsJ).

## Image55.png Requirement2

When [User](#EFWvtP6GAqBwAXmd) rotates [POT2: 10K\_t20%\_LOG\_POT\_H20mm\_THT](#tVWvtP6GAqBwAXnJ). Parameter value of the selected effect shall be increased or decreased until [User](#EFWvtP6GAqBwAXmd) stops the rotation and is sent to the processing unit in order to obtain the desired signal processing:

- in case of [delay(&in: float): void](#aVWvtP6GAqBwAXnC) time delay shall be changed

- in case of [tremolo(&in: float): void](#dVWvtP6GAqBwAXnL) modulation frequency shall be changed

- in case of [phaser(&in: float): void](#dVWvtP6GAqBwAXnM) modulation frequency shall be changed

The new value is updated on the [OLED: OLED\_module](#BW2vtP6GAqBwAXsJ) ([updateDisplay(): void](#dVWvtP6GAqBwAXnO)).

## Image55.png Max Power Supply Voltage

Supply voltage on [CONN1: 5mm7\_2mm\_DC\_THT](#ElWvtP6GAqBwAXmq) up to 17 V shall no damage [uP: uP\_SignalMusicProcessing](#H_WvtP6GAqBwAXpm).

## Image55.png Input Voltage

Audio input voltage between -1.8 V and 1.8 V shall not damage the [uP: uP\_SignalMusicProcessing](#H_WvtP6GAqBwAXpm).

## Image55.png Max Temperature

The system shall operate up to 85 °C.