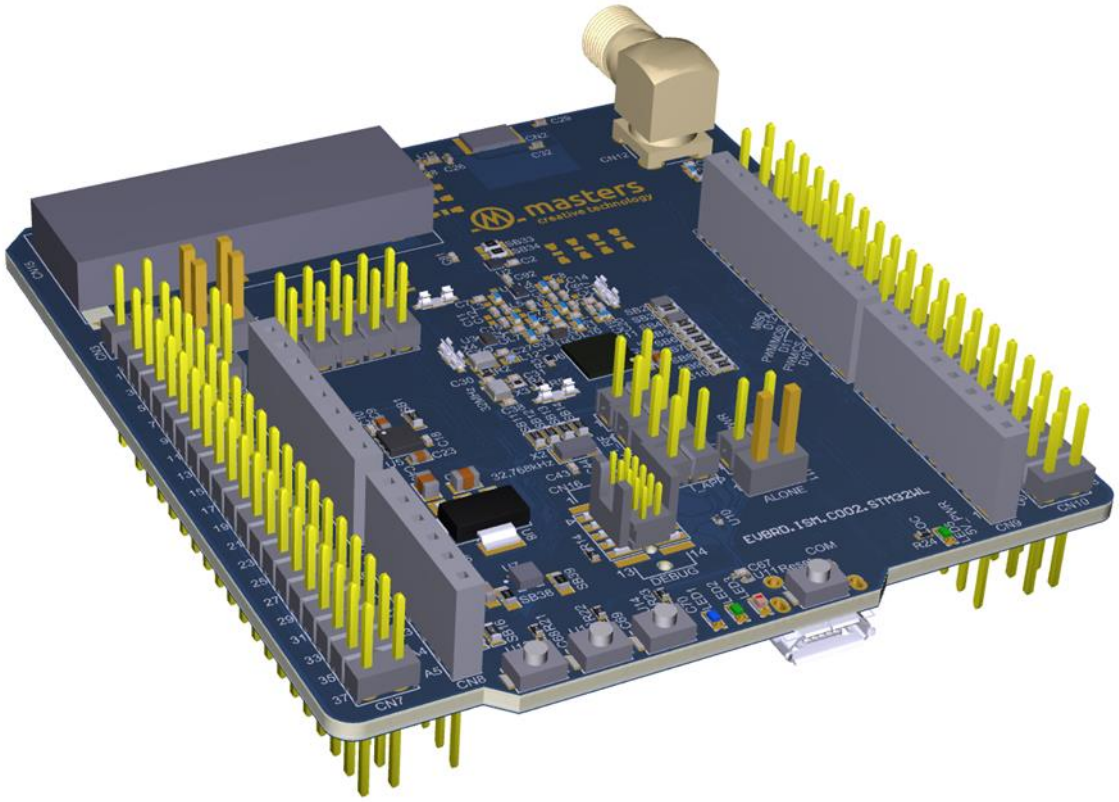


Masters STM32WL module datasheet

Rev 2.1

Masters Sp. z o.o., ul. Objazdowa 5B, 83-010 Straszyn, +48-502-825-627, www.masters.com.pl

For information on sales, delivery terms and conditions and prices, please contact us rd@masters.com.pl .
Masters offers consultation in designing and professional technical support.

1. Introduction

The STM32WLE5J8/JB/JC long-range wireless and ultra-low-power devices embed a powerful and ultra-low-power radio compliant LPWAN radio solution: LoRa®, (G)FSK, (G)MSK, and BPSK.

These devices are designed to be extremely low-power and are based on the high-performance Arm® Cortex®-M4 32-bit RISC core operating at a frequency of up to 48 MHz. This core implements a full set of DSP instructions and an independent memory protection unit (MPU) that enhances the application security.

Mechanical Parameters:

– Dimensions 70.310x76.115mm
– Mounting method – SMD
– Connector – Nucleo/Morpho, Arduino standard
– Antenna connector – SMA/PIFA/Ceramic

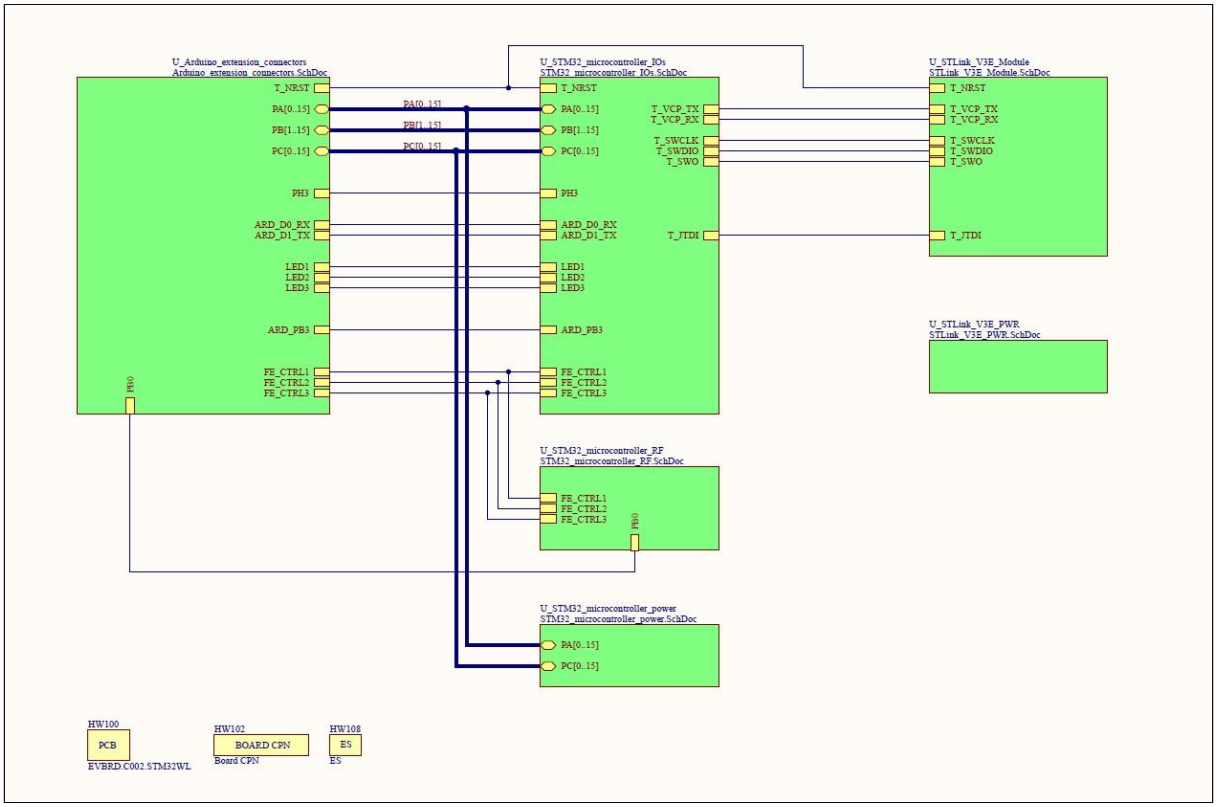
Electrical parameters:

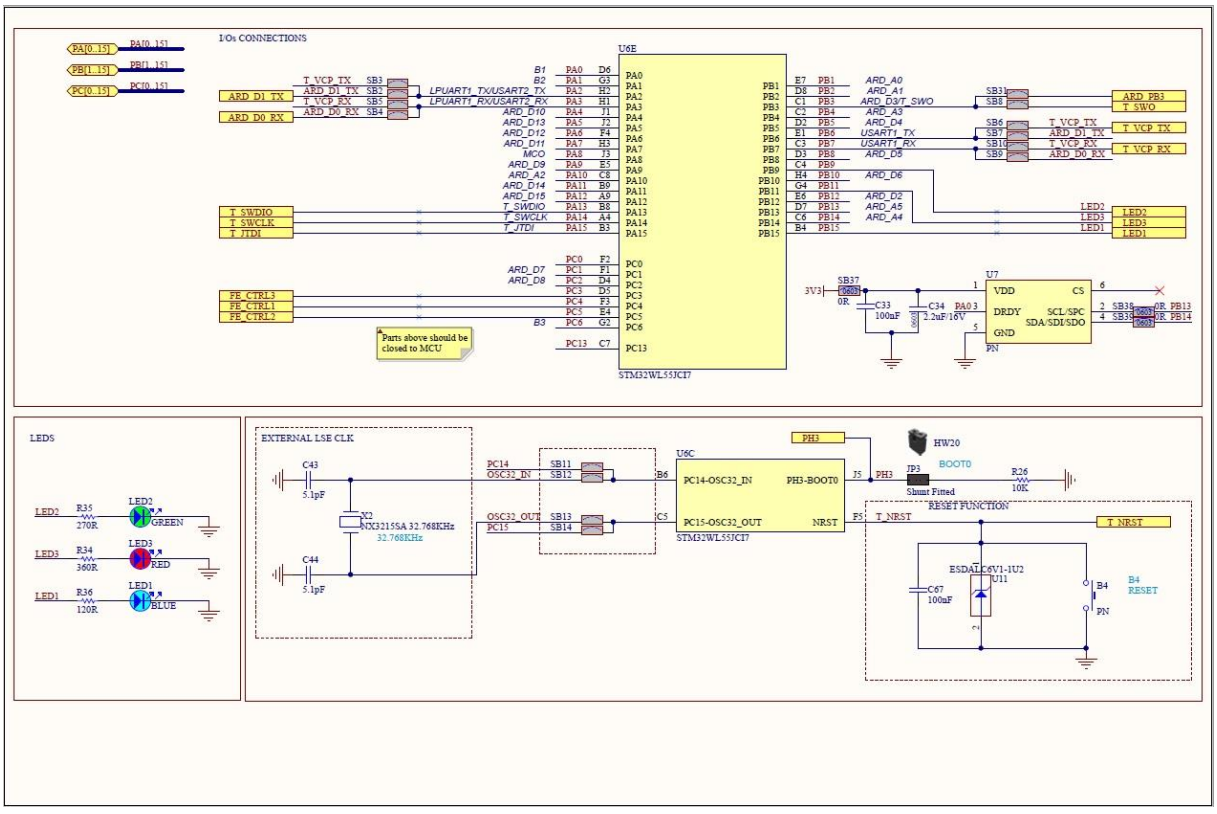
– Power supply – 5V
– Microcontroller interface – SPI
– Power consumption – in accordance with the documentation for STM32WL
– Other parameters – in accordance with the documentation for STM32WL
– https://www.st.com/resource/en/datasheet/stm32wle5jc.pdf

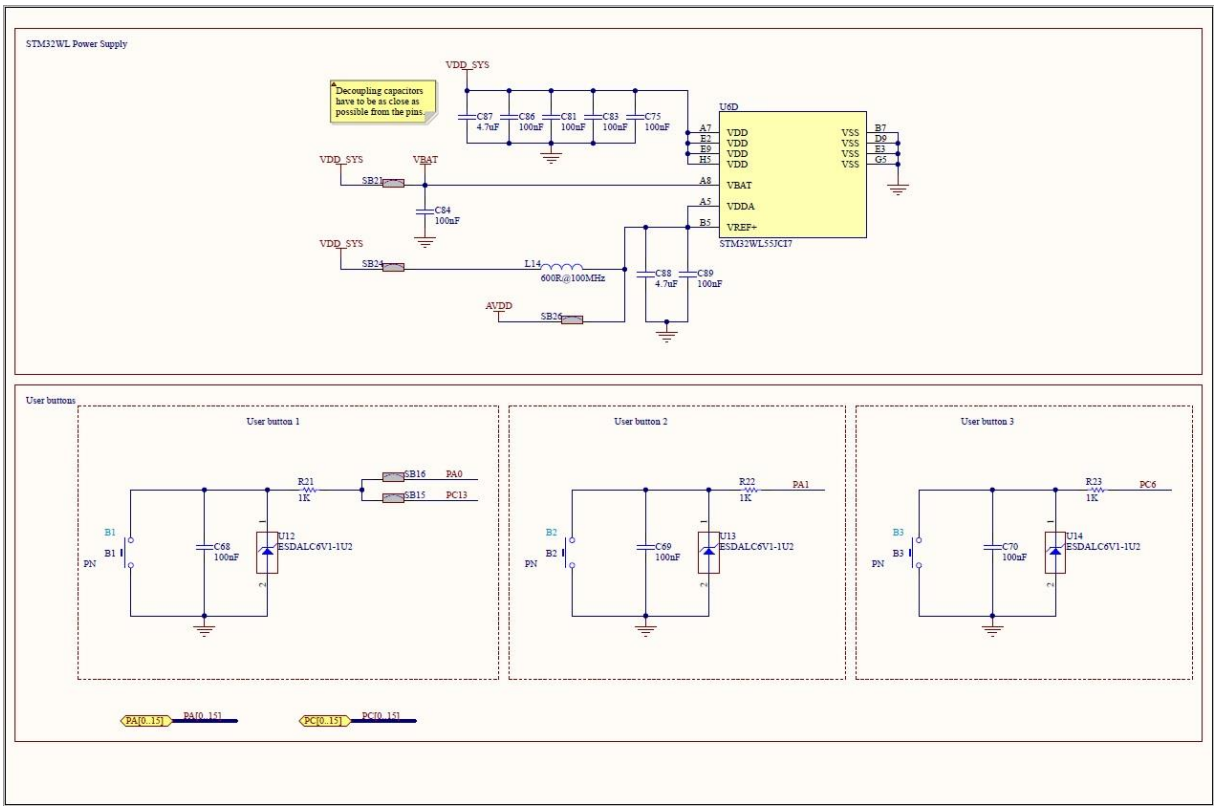
Radio parameters:

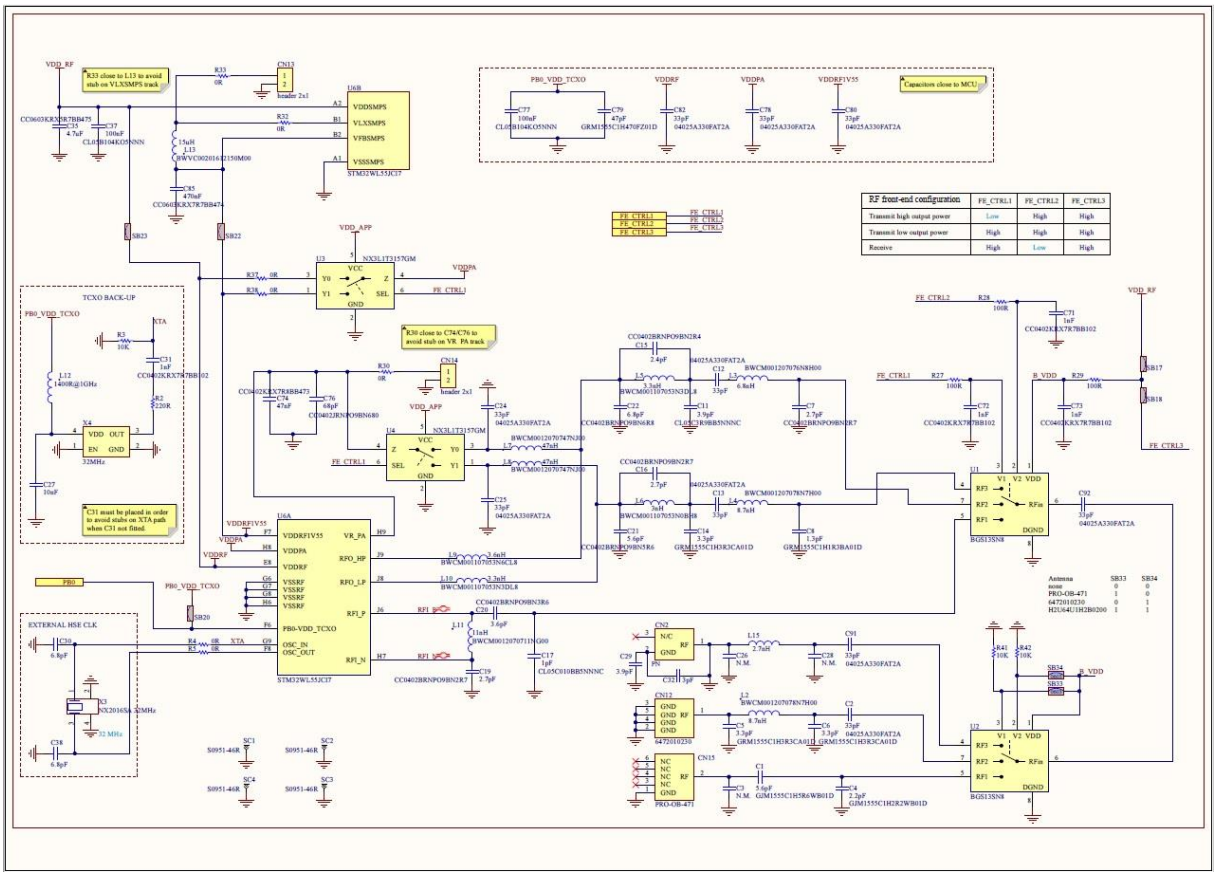
– Frequency range: 150MHz to 960MHz
– Modulation: LoRa, (G)FSK, (G)MSK and BPSK
– Transmitter high output power: up to +22 dBm
– Transmitter low output power: up to +15 dBm

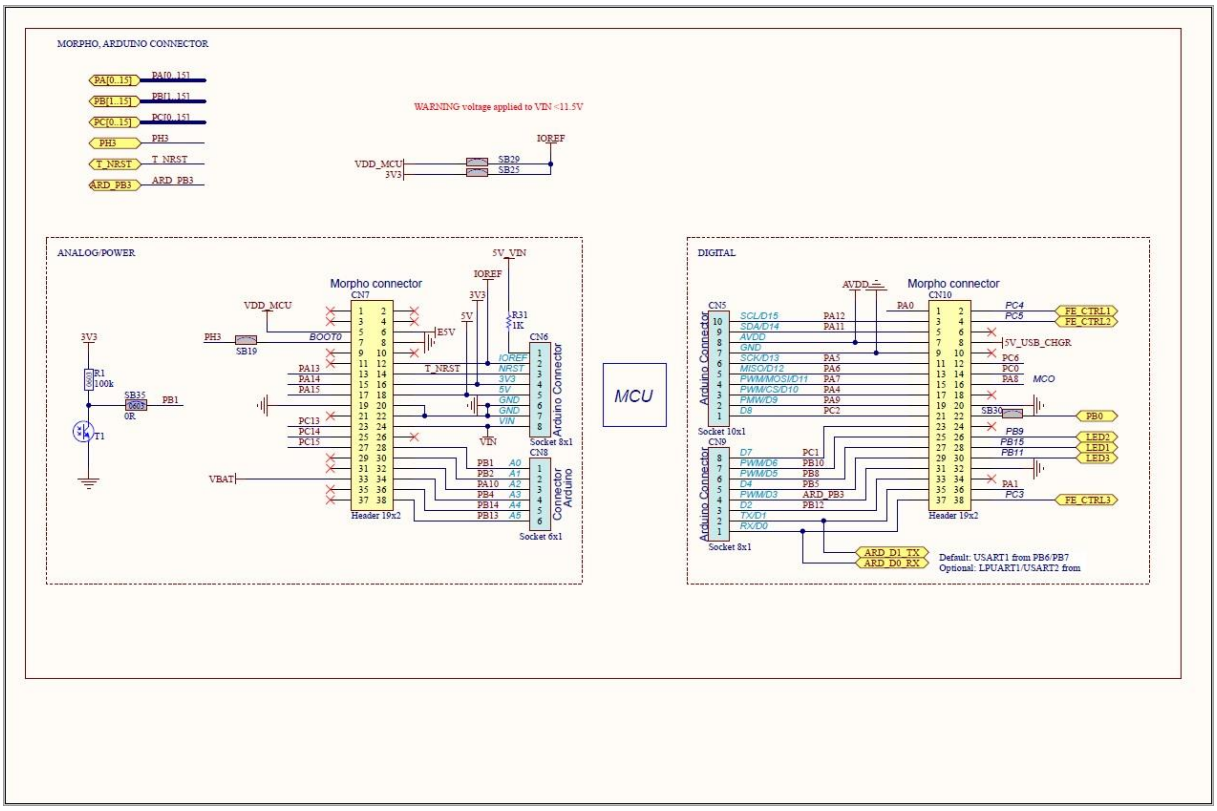
2. Schematic

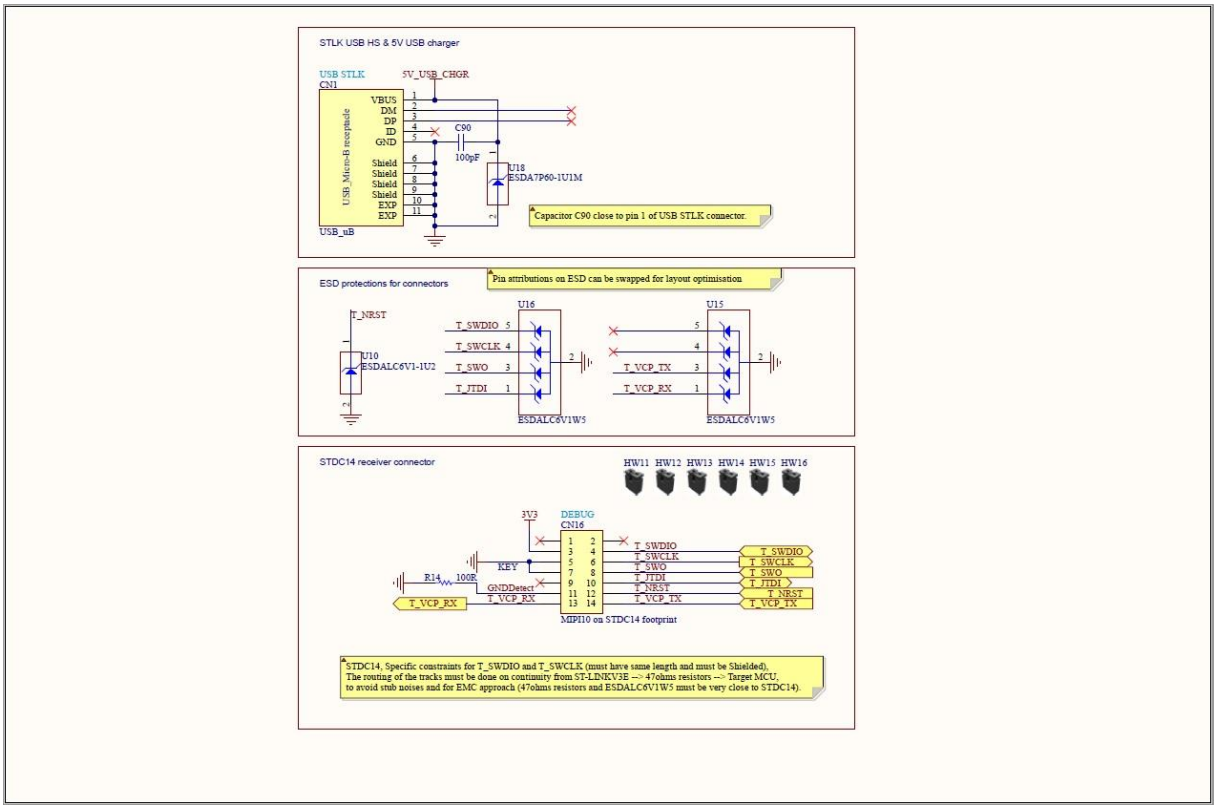

U_Arduino_extension_connectors
Arduino_extension_connectors.SchDoc
U_STM32_microcontroller_IOs
STM32_microcontroller_IOs.SchDoc
U_STLink_V3E_Module
STLink_V3E_Module.SchDoc
U_STLink_V3E_PWR
STLink_V3E_PWR.SchDoc
U_STM32_microcontroller_RF
STM32_microcontroller_RF.SchDoc
U_STM32_microcontroller_power
STM32_microcontroller_power.SchDoc
T_NRST
PA[0..15]
PB[1..15]
PC[0..15]
PH3
ARD_D0_RX
ARD_D1_TX
LED1
LED2
LED3
ARD_PB3
FE_CTRL1
FE_CTRL2
FE_CTRL3
T_VCP_TX
T_VCP_RX
T_SWCLK
T_SWDIO
T_SWO
T_JTDI
HW100
PCB
EVBRD C002 STM32WL
HW102
BOARD CPN
Board CPN
HW108
ES
ES

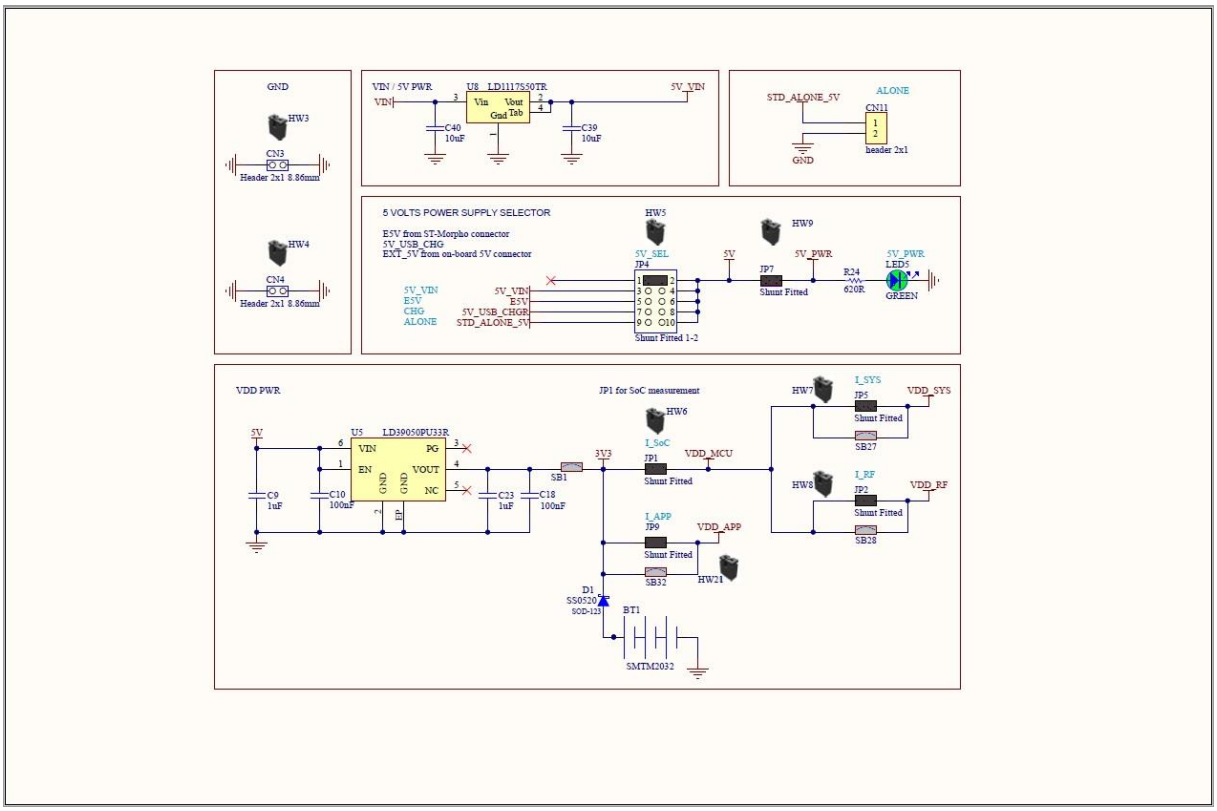

I/Os CONNECTIONS
U6E
STM32WL55JCI7
Parts above should be closed to MCU
U7
LEDS
EXTERNAL LSE CLK
U6C
HW20
BOOT0
RESET FUNCTION
ESDALC6V1-1U2
T_NRST
LED2
LED3
LED1
GREEN
RED
BLUE


STM32WL Power Supply
Decoupling capacitors have to be as close as possible from the pins
VDD_SYS
VBAT
AVDD
U6D
STM32WL55JCI7
User buttons
User button 1
User button 2
User button 3
ESDALC6V1-1U2
PA[0..15]
PC[0..15]

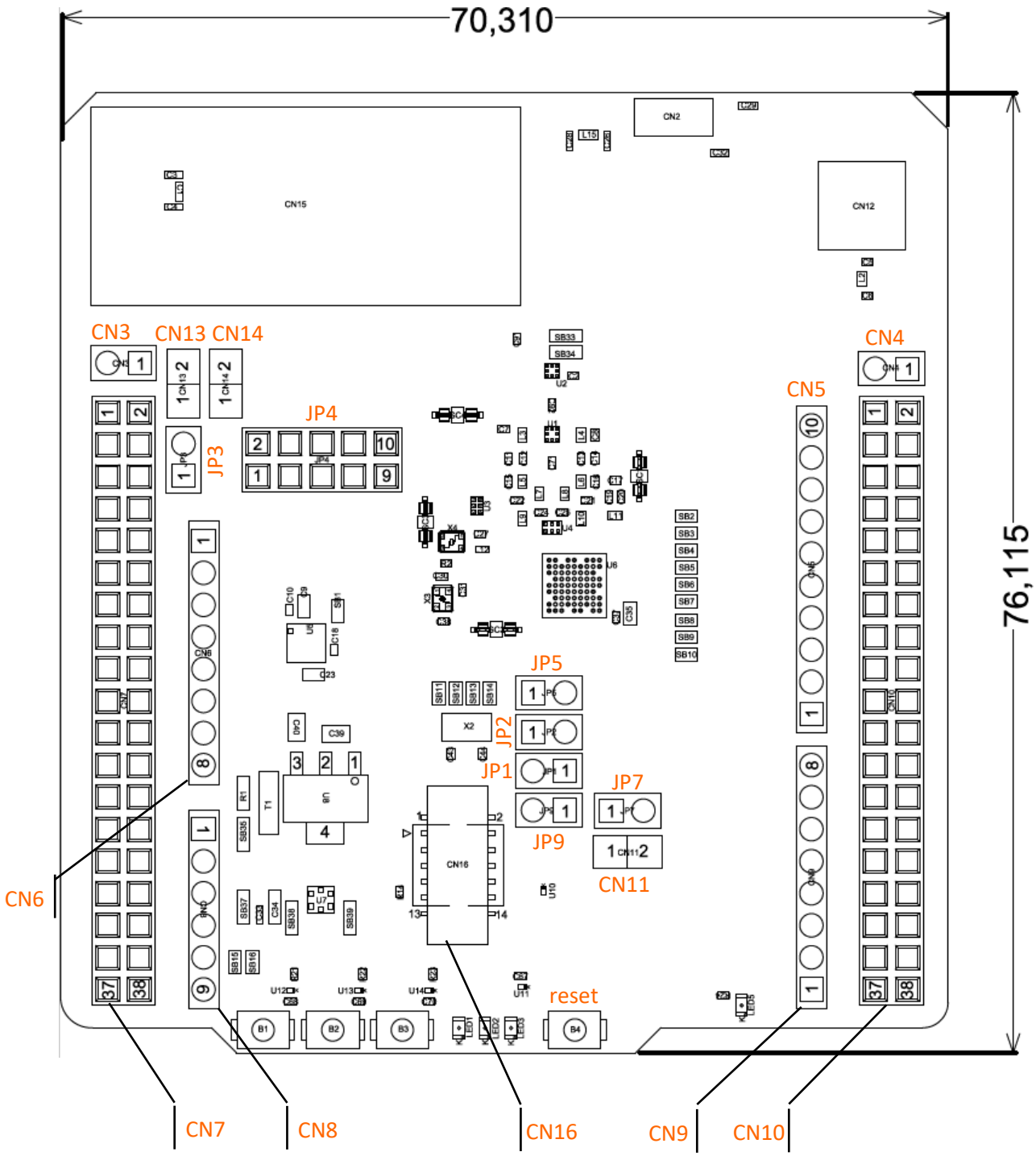

RF front-end configuration
Transmit high output power
Transmit low output power
Receive
TCXO BACK-UP
EXTERNAL HSE CLK
STM32WL55JCI7


MORPHO, ARDUINO CONNECTOR
WARNING voltage applied to VIN <11.5V
ANALOG/POWER
Morpho connector
Arduino Connector
MCU
DIGITAL
Morpho connector
Arduino Connector
Header 19x2
Socket 8x1
Socket 6x1
Socket 10x1
Default: USART1 from PB6/PB7
Optional: LPUART1/USART2 from


STLK USB HS & 5V USB charger
USB STLK
5V_USB_CHGR
Capacitor C90 close to pin 1 of USB STLK connector.
ESD protections for connectors
Pin attributions on ESD can be swapped for layout optimisation
ESDALC6V1W5
STDC14 receiver connector
DEBUG
MIPI10 on STDC14 footprint
STDC14, Specific constraints for T_SWDIO and T_SWCLK (must have same length and must be Shielded).
The routing of the tracks must be done on continuity from ST-LINKV3E --> 47ohms resistors --> Target MCU,
to avoid stub noises and for EMC approach (47ohms resistors and ESDALC6V1W5 must be very close to STDC14).


GND
HW3
CN3
Header 2x1 8.86mm
HW4
CN4
Header 2x1 8.86mm
VIN / 5V PWR
U8 LD1117S50TR
VIN
Vin
Vout
Gnd Tab
C40
10uF
C39
10uF
5V_VIN
STD_ALONE_5V
ALONE
CN11
header 2x1
GND
5 VOLTS POWER SUPPLY SELECTOR
E5V from ST-Morpho connector
5V_USB_CHG
EXT_5V from on-board 5V connector
HW5
HW9
5V_SEL
JP4
5V
JP7
Shunt Fitted
5V_PWR
R24
620R
LED5
GREEN
5V_VIN
E5V
CHG
ALONE
5V_USB_CHGR
STD_ALONE_5V
Shunt Fitted 1-2
VDD PWR
JP1 for SoC measurement
HW6
HW7
I_SYS
JP5
VDD_SYS
Shunt Fitted
SB27
5V
U5 LD39050PU33R
VIN
EN
GND
GND
EP
PG
VOUT
NC
C9
1uF
C10
100nF
C23
1uF
C18
100nF
SB1
3V3
I_SoC
JP1
VDD_MCU
Shunt Fitted
HW8
I_RF
JP2
VDD_RF
Shunt Fitted
SB28
I_APP
JP9
VDD_APP
Shunt Fitted
SB32
HW21
D1
SS0520
SOD-123
BT1
SMTM2032

3. Mechanical specification, pinout



Morpho Connectors

CN7 odd pins		CN7 even pins		CN10 odd pins		CN10 even pins	
Pin	Name	Name	Pin	Pin	Name	Name	Pin
1	-	-	2	1	PA0	PC4/FE_CTRL1	2
3	-	-	4	3	PA12	PC5/FE_CTRL2	4
5	VDD_MCU	E5V	6	5	PA11	-	6
7	PH3/BOOT0	GND	8	7	AVDD	5V_USB_CHGR	8
9	-	-	10	9	GND	-	10
11	-	IOREF	12	11	PA5	PC6	12
13	PA13	NRST	14	13	PA6	PC0	14
15	PA14	3V3	16	15	PA7	PA8	16
17	PA15	5V	18	17	PA4	-	18
19	GND	GND	20	19	PA9	GND	20
21	-	GND	22	21	PC2	PB0	22
23	PC13	VIN	24	23	PC1	-	24
25	PC14	-	26	25	PB10	PB9/LED2	26
27	PC15	PB1	28	27	PB8	PB15/LED1	28
29	-	PB2	30	29	PB5	PB11/LED3	30
31	-	PA10	32	31	ARD_PB3	GND	32
33	VBAT	PB4	34	33	PB12	-	34
35	-	PB14	36	35	ARD_D1_TX	PA1	36
37	-	PB13	38	37	ARD_D0_RX	PC3/FE_CTRL3	38

Arduino Connectors

Connector	Pin	Pin name	STM32 pin	Function
Left connectors				
CN6 power	1	-	-	5V_IN
	2	IOREF	-	3.3V REF
	3	NRST	NRST	RESET
	4	3V3	-	3.3V input/output
	5	5V	-	5V output
	6	GND	-	GND
	7	GND	-	GND
	8	VIN	-	power input
CN8 analog	1	A0	PB1	ADC_5
	2	A1	PB2	ADC_4
	3	A2	PA10	ADC_6
	4	A3	PB4	ADC_3
	5	A4	PB14	ADC_1
	6	A5	PB13	ADC_0
Right connectors				
CN5 digital	10	SCL/D15	PA12	I2C2_SCL
	9	SDA/D14	PA11	I2C2_SDA
	8	AVDD	-	AVDD
	7	GND	-	GND
	6	SCK/D13	PA5	SPI1_SCK
	5	MISO/D12	PA6	SPI1_MISO
	4	PWM/MOSI/D11	PA7	SPI1_MOSI/TIM17_CH1
	3	PWM/CS/D10	PA4	SPI1_NSS
	2	PWM/D9	PA9	TIM1_CH2
	1	D8	PC2	-
CN9 digital	8	D7	PC1	-
	7	PWM/D6	PB10	TIM2_CH3
	6	PWM/D5	PB8	TIM16_CH1
	5	D4	PB5	-
	4	PWM/D3	PB3	TIM2_CH2
	3	D2	PB12	-
	2	TX/D1	PA2	USART2_TX
	1	RX/D0	PA3	USART2_RX

Jumper Connectors

Connector	Pin	Description
JP4 power selector	1-2	NC
	3-4	5V_VIN
	5-6	E5V
	7-8	5V_USB_CHGR
	9-10	STD_ALONE_5V

Debug connector

Connector	Pin	STM32 pin	Function
CN16 debug	1	-	-
	2	-	-
	3	-	3.3V
	4	PA13	T_SWDIO
	5	-	GND
	6	PA14	T_SWCLK
	7	-	GND
	8	PB3	T_SWO
	9	-	-
	10	PA15	T_JTDI
	11	-	GNDDetect
	12	NRST	T_NRST
	13	PA3/PB7	T_VCP_RX
	14	PA2/PB6	T_VCP_TX

Buttons

Button	STM32 pin	Function
B1	PA0/PC13	User Button
B2	PA1	User Button
B3	PC6	User Button
B4	NRST	Reset

Other connectors

Connector	Pin	STM32 pin	Function
CN13 power	1	VLXSMPS	LDO/SMPS Output
	2	-	GND
CN14 RF	1	VR_PA	PA Voltage Regulator
	2	-	GND
CN11 power	1	-	STD_ALONE_5V
	2	-	GND
CN3	1	-	GND
	2	-	GND
CN4	1	-	GND
	2	-	GND

Connector	State	Description
JP3	jumper ON	PH3-BOOT0 pull-down
	jumper OFF	PH3-BOOT0 floating
JP1	jumper ON	3.3V power supply is connected to VDD_MCU
	jumper OFF	3.3V power supply is not connected to VDD_MCU
JP2	jumper ON	VDD_MCU is connected to VDD_RF
	jumper OFF	VDD_MCU is not connected to VDD_RF
JP5	jumper ON	VDD_MCU is connected to VDD_SYS
	jumper OFF	VDD_MCU is not connected to VDD_SYS
JP9	jumper ON	3.3V power supply is connected to VDD_APP
	jumper OFF	3.3V power supply is not connected to VDD_APP
JP7	jumper ON	5V power supply is connected to 5V_PWR
	jumper OFF	5V power supply is not connected to 5V_PWR

Solder Bridge

Bridge	State	Description
SB3, SB4	ON	PA2 and PA3 are connected to CN10 (ARD_D1_TX and ARD_D0_RX)
	OFF	PA2 and PA3 are not connected to CN10
SB2, SB5	ON	PA2 and PA3 are connected to CN16 (T_VCP_TX and T_VCP_RX)
	OFF	PA2 and PA3 are not connected to CN16
SB31	ON	PB3 is connected to CN10 (ARD_PB3)
	OFF	PB3 is not connected to CN10
SB8	ON	PB3 is connected to CN16 (T_SWO)
	OFF	PB3 is not connected to CN16
SB6, SB10	ON	PB6 and PB7 are connected to CN16 (T_VCP_TX and T_VCP_RX)
	OFF	PB6 and PB7 are not connected to CN16
SB7, SB9	ON	PB6 and PB7 are connected to CN10 (ARD_D1_TX and ARD_D0_RX)
	OFF	PB6 and PB7 are not connected to CN10
SB11, SB14	ON	PC14 and PC15 are connected to CN7
	OFF	PC14 and PC15 are not connected to CN7
SB12, SB13 (X2 crystal)	ON	X2, C43, C44 provide a clock 32.768kHz
	OFF	Clock 32.768kHz is not connected
SB37	ON	Voltage supply of U7 HTS221 is connected to 3V3
	OFF	Voltage supply of U7 HTS221 is not connected to 3V3
SB38	ON	PB13 is connected to SCL/SPC of U7
	OFF	PB13 is not connected to SCL/SPC of U7 HTS221
SB39	ON	PB14 is connected to SDA/SDI/SDO of U7 HTS221
	OFF	PB14 is not connected to SDA/SDI/SDO of U7 HTS221
SB21	ON	VBAT supplied by VDD_SYS
	OFF	VBAT supplied by VBAT
SB24	ON	VDD_SYS is connected to VDDA and VREF+
	OFF	VDD_SYS is not connected to VDDA and VREF+
SB26	ON	AVDD is connected to VDDA and VREF+
	OFF	AVDD is not connected to VDDA and VREF+
SB16	ON	B1 is connected to PA0
	OFF	B1 is not connected to PA0
SB15	ON	B1 is connected to PC13
	OFF	B1 is not connected to PC13
SB23	ON	VDD_RF is connected to VDDRF
	OFF	VDD_RF is not connected to VDDRF
SB22	ON	VDDRF1V55 is connected to VFBSMPS
	OFF	VDDRF1V55 is not connected to VFBSMPS
SB20 (X4 crystal)	ON	Supply of X4 crystal is connected to PB0_VDD_TCXO
	OFF	Supply of X4 crystal is not connected to PB0_VDD_TCXO
SB17	ON	Supply of RF switch U1 is connected to VDD_RF
	OFF	Supply of RF switch U1 is not connected to VDD_RF
SB18	ON	Supply of RF switch U1 is connected to PC3
	OFF	Supply of RF switch U1 is not connected to PC3

SB33	ON	V1 of RF Switch U2 BGS13SN8 is connected to B_VDD
	OFF	V1 of RF Switch U2 BGS13SN8 is not connected to B_VDD
SB34	ON	V2 of RF Switch U2 BGS13SN8 is connected to B_VDD
	OFF	V2 of RF Switch U2 BGS13SN8 is not connected to B_VDD
SB29	ON	IOREF is connected to VDD_MCU
	OFF	IOREF is not connected to VDD_MCU
SB25	ON	IOREF is connected to 3V3
	OFF	IOREF is not connected to 3V3
SB19	ON	PH3 is connected to CN7
	OFF	PH3 is not connected to CN7
SB30	ON	PB0 is connected to CN10
	OFF	PB0 is not connected to CN10
SB35	ON	PB1 is connected to T1 phototransistor
	OFF	PB1 is not connected to T1 phototransistor
SB1	ON	LD39050PU33R 3.3V power supply for the board
	OFF	3.3V power supply is not connected
SB32	ON	3.3V power supply is connected to VDD_APP
	OFF	3.3V power supply is not connected to VDD_APP
SB27	ON	3.3V power supply is connected to VDD_SYS
	OFF	3.3V power supply is not connected to VDD_SYS
SB28	ON	3.3V power supply is connected to VDD_RF
	OFF	3.3V power supply is not connected to VDD_RF

4. Default Settings

Solder Bridge Default Settings

Bridge	State
SB2	OFF
SB4	OFF
SB6	OFF
SB8	OFF
SB10	OFF
SB11	OFF
SB14	OFF
SB15	OFF
SB17	OFF
SB25	OFF
SB32	OFF

Note: Rest of the solder bridges should be mounted.

Additional Default Settings

The device is designed to use TCXO crystal oscillator by default. In order to use HSE crystal oscillator please refer to the following table.

Designator	State
R2	Not mounted
C31	Not mounted
L12	Not mounted
X4	Not mounted
C27	Not mounted
C30	Mounted
C38	Mounted
X3	Mounted

Default Antenna Settings

Bridge	State	Antenna
SB33	ON	Ceramic Antenna H2U64U1H2B0200
SB34	ON	

5. Power Supply

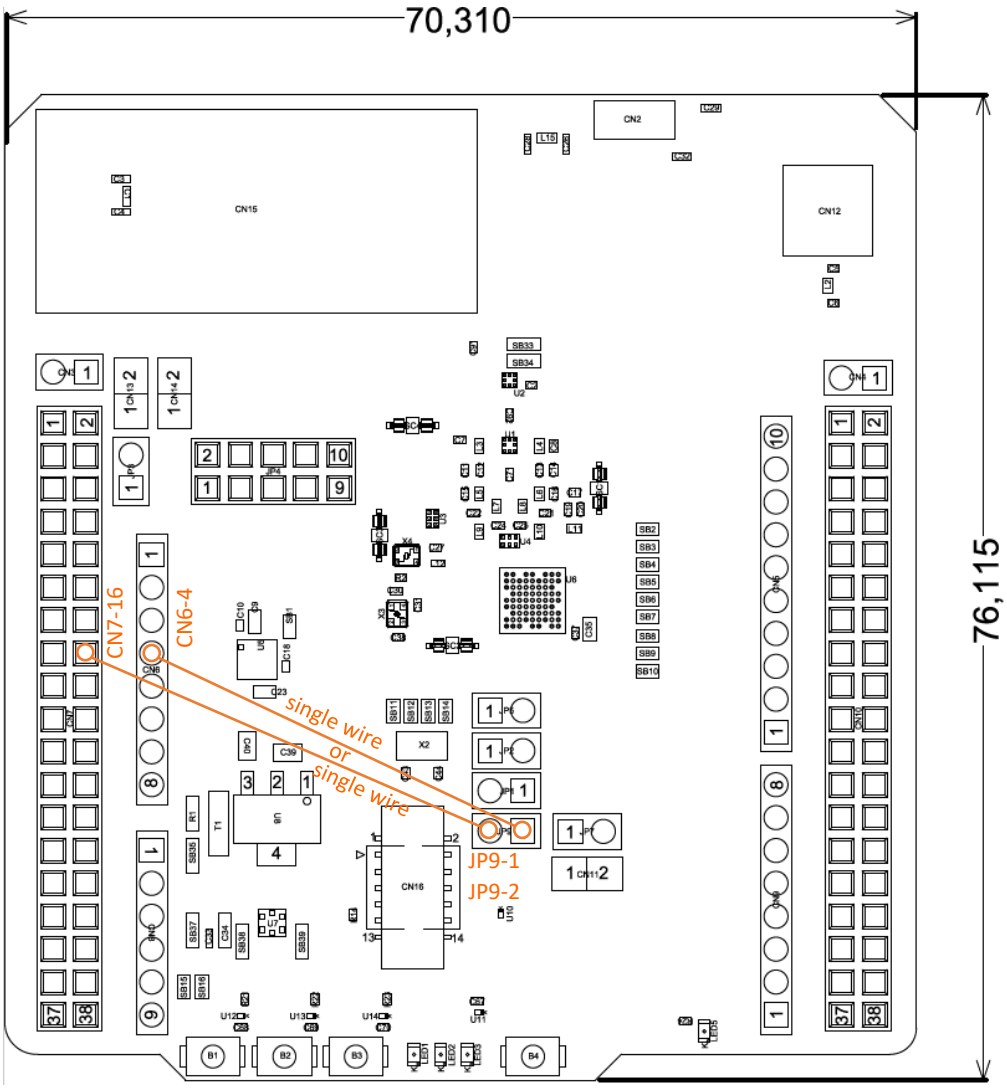
The board can be powered in two ways:

Using LDO

- Select the desired power source from the JP4 power selector connector
- Make sure that SB1 and SB32 are mounted
- Connect CN6-4 or CN7-16 to JP9-1 or JP9-2 using single wire
- Jumpers on connectors JP1, JP2 and JP5 should be ON

Using battery

- Make sure that SB1 is NOT mounted
- Make sure that SB32 IS mounted
- Connect CN6-4 or CN7-16 to JP9-1 or JP9-2 using single wire
- Jumpers on connectors JP1, JP2 and JP5 should be ON



6. Programmer connection

ST-Link V3

- Provide power supply to STM32WL - power selection on JP4 connector (default: CHG - USB-STLINK [CN1])
- Using the tape supplied to the programmer, connect ST-Link V3 to the CN16 (DEBUG) connector on the STM32WL board
- The programmer should be connected to the PC unit with a USB-A <-> USB-Micro-B cable

7. Antenna selector

Antenna selection is made by mounting or dismounting solder bridges SB33 and SB34. See the table below for the solder bridges mounting configurations to select the desired antenna. Mounted bridge is marked as '1' and dismounted as '0'.

SB33	SB34	Antenna
0	0	none
1	0	PRO-OB-471
0	1	6472010230
1	1	H2U64U1H2B0200

8. Software

Software:

Please contact Masters.

Due to the fact that the integrated circuit is still in a development phase we do not guarantee properties and reject liability for any damage caused by this device. During the development phase this device shall be used at your own risk.