Block Diagram

16-MBit Flash
WiFi stack

SPI

TEXAS INSTRUMENTS
CC3120
IEEE 802.11b/g/n

MicroSD/ MMC socket

Expansion interfaces:

DC/DC & protections
5V and 3.3V

Power

SPI
IRQ
RST
SDIO

I2C
UART
PWM
GPIO
Analog

Analog & Digital MUX

5V / 3.3V switches

Grove

Grove

USB

Micro USB

- Mass storage
- Virtual UART
- SWD Flash/Debug

STM32F103
ST-LINK V2.1

RST
SWD
UART

STM32F413
1.5 MB FLASH
320 KB RAM

UART
I2C
SPI
GPIO
Analog

Analog & Digital MUX

ARDUINO

x1

LTR303-ALS
Ambient light sensor

IRQs

I2C

x2

UART
I2C
SPI
GPIO
Analog
PWM

mikroBUS 1

mikroBUS 2

BOSCH
Invented for life

BMA253
Accelerometer

BOSCH
Invented for life

Air Quality
Temperature
Humidity
Pressure
BME680

GPIOs

SPI
Control

x2 OUT

RGB LED and Button

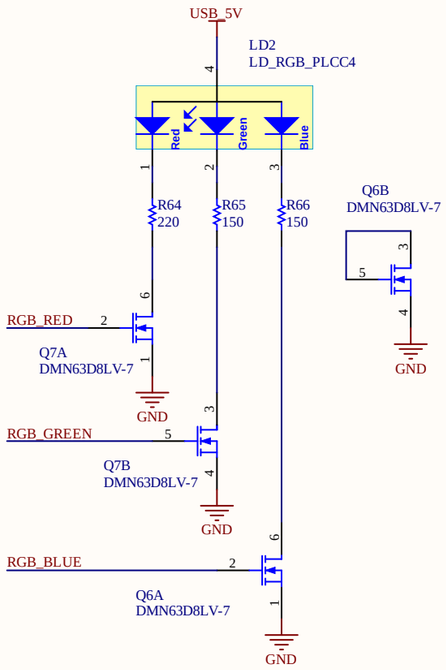
128x32 OLED Display
Controller: SSD1306

OUT 1: OFF, AIR QUALITY INDX = 143
OUT 2: ON, TEMP = 23.7, HUM = 46%

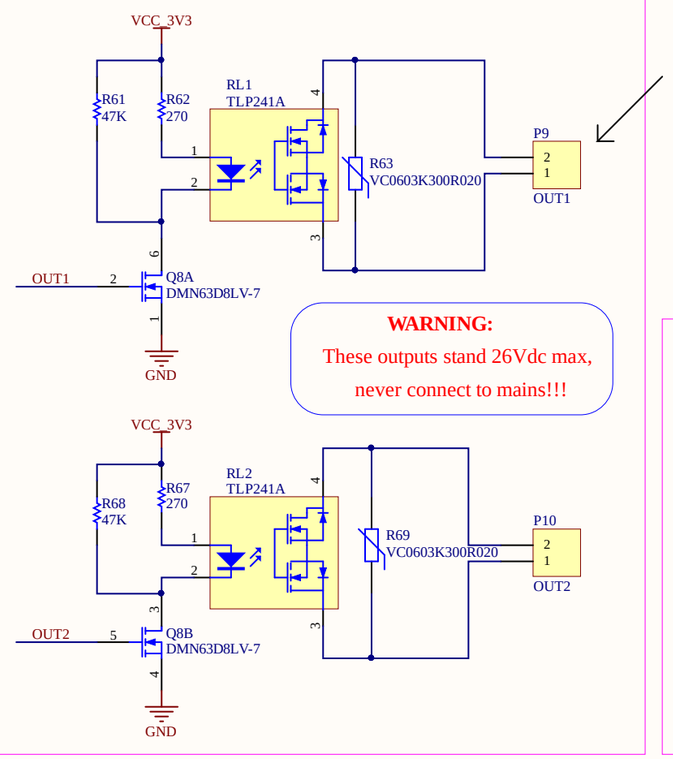
Opto Relays
TLP241A:
AC/DCMax 2A
26Vdc / 18Vac

Title: SensorIO Block diagram			Daniel Mancuso
Size: A4	Number:*	Revision: 2	*amancuso@ohmtech.io*
Date: 10/11/2018	Time: 19:02:37	Sheet 1 of 9	ohmtech.io
File: Z:\Documents\Conrad\SensorIO\SensorIO_PCB\0_BlockDiagram.SchDoc			

User RGB LED:



AC/DC optocoupled outputs:



WARNING:

These outputs stand 26Vdc max, never connect to mains!!!

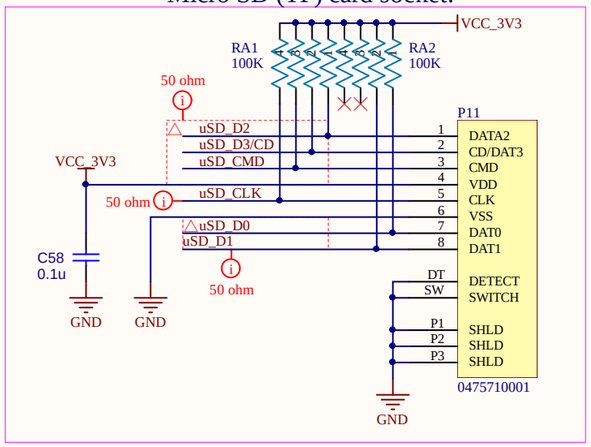
Outputs characteristics:

* ON-state current: 2.0 A max. continuous (6A pulsed)
* ON-state resistance: 150mOhm (continuous)
* Isolation Voltage: 5000 Vrms
* Maximum DC voltage: 26V
* Maximum AC voltage: 18Vrms

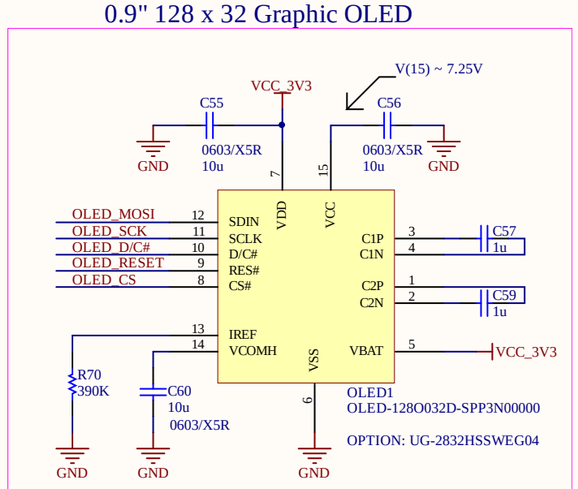
Recommended loads:

These outputs can be used to control small AC/DC motors, solenoids, bigger relay or contactors coils.
Care has to be taken regarding the inrush current, that with some loads can be 10x bigger than the nominal, therefore the recommended maximum nominal current for inductive loads is 600mA.

Micro SD (TF) card socket:



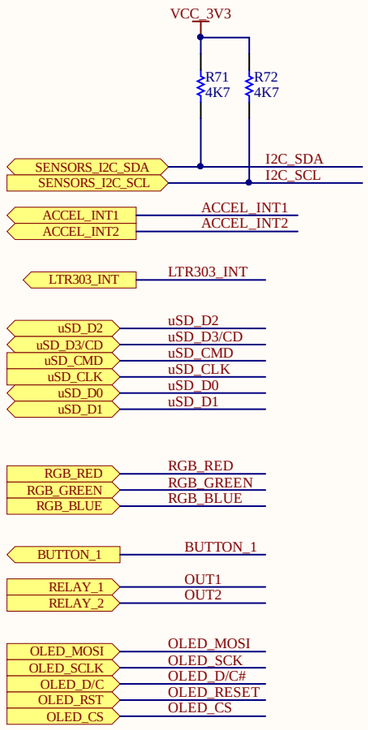
0.9" 128 x 32 Graphic OLED



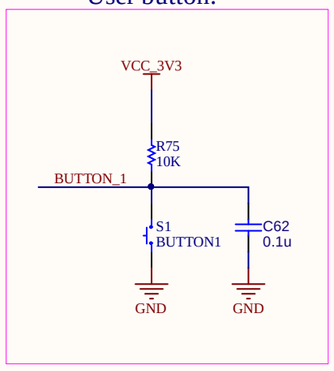
DISCLAIMER:

THERE IS NO WARRANTY FOR THIS DESIGN, TO THE EXTENT PERMITTED BY APPLICABLE LAW. EXCEPT WHEN OTHERWISE STATED IN WRITING THE COPYRIGHT HOLDERS AND/OR OTHER PARTIES PROVIDE THE DESIGN *AS IS* WITHOUT WARRANTY OF ANY KIND, EITHER EXPRESSED OR IMPLIED, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS A FOR A PARTICULAR PURPOSE. THE ENTIRE RISK AS TO THE QUALITY AND PERFORMANCE OF THE DESIGN IS WITH YOU. SHOULD THE DESIGN PROVE DEFECTIVE, YOU ASSUME THE COST OF ALL NECESSARY SERVICING, REPAIR OR CORRECTION.

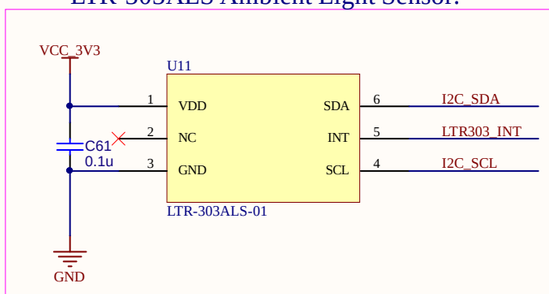
MCU Interfaces:



User button:

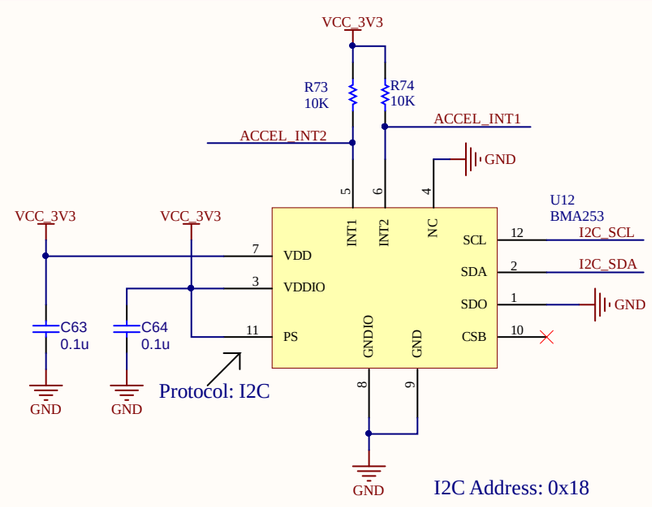


LTR-303ALS Ambient Light Sensor:



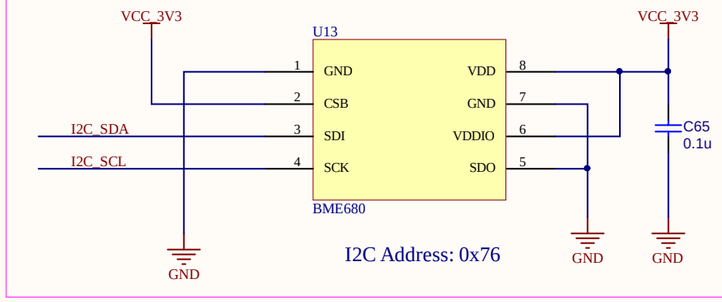
I2C Address: 0x29

Bosch Sensortec BMA253: 3-axis accelerometer



I2C Address: 0x18

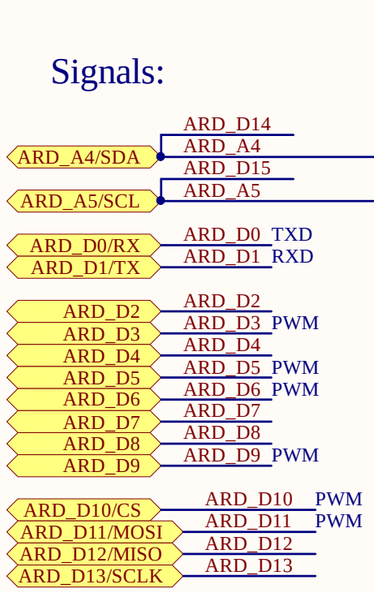
Bosch BME680: VOC gas, pressure, temperature & humidity



I2C Address: 0x76

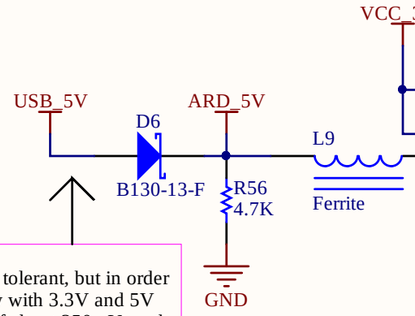
Title	***Peripherals***		Daniel Mancuso
Size: A3	Number:1	Revision: 2	dmancuso@ohmtech.io *
Date: 10/11/2018	Time: 19:02:37	Sheet 1 of 8	ohmtech.io
File: Z:\Documents\Conrad\SensorIO\SensorIO_PCB\1_Peripherals.SchDoc			

Signals:



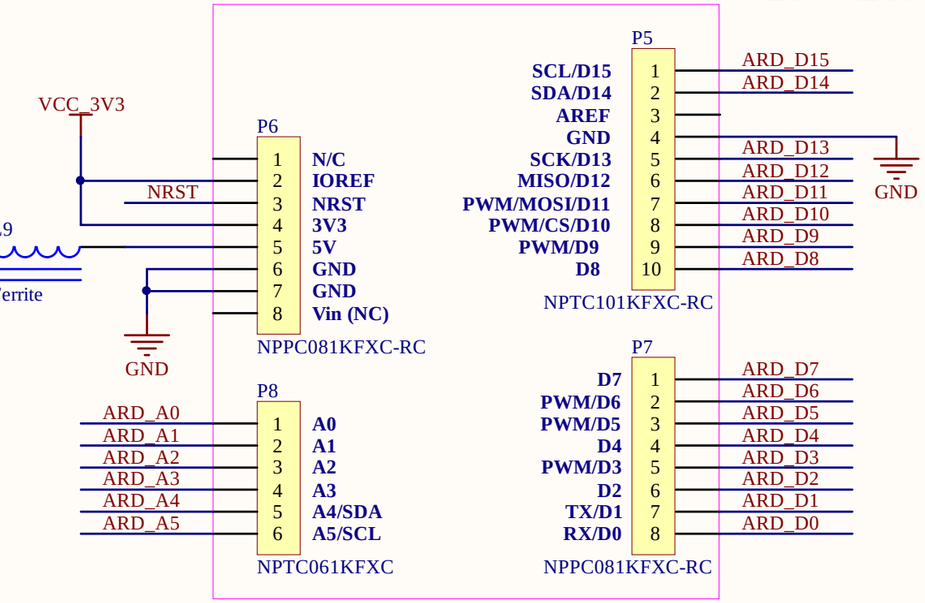
NOTE:

The MCU's GPIOs are 5V tolerant, but in order to ensure full compatibility with 3.3V and 5V shields, the voltage drop of about 350mV on the Schottky Diode will ensure that the output-high level of the MCU fall into the safe Input-High level for all the logic families present on the 5V-only shields.

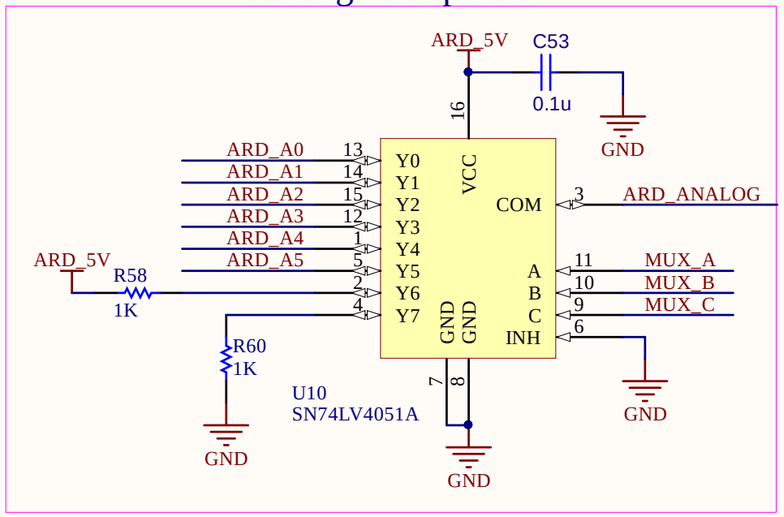


Arduino UNO R3 socket:

3.3V and 5V shields compatible



Analog Multiplexer



NOTE:

Pins A4 and A5 are internally connected to D14 and D15 in some shields, therefore, remember to configure D14 (PB4) and D15 (PA8) in high impedance mode (set as INPUT) to use these analog inputs

NOTE:

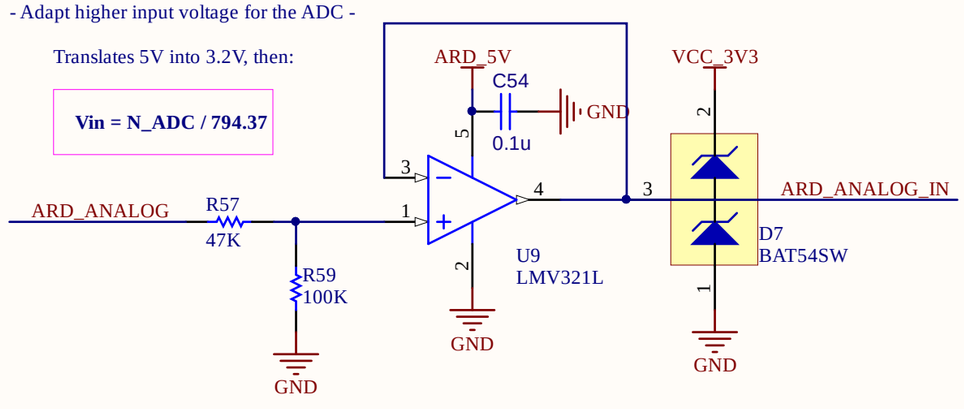
MUX values 6 and 7 can be used to calibrate the Analog Inputs to the Max and Min values respectively.

Analog Voltage adaptation and ADC protection

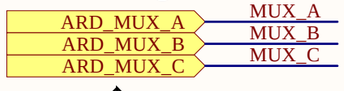
- Adapt higher input voltage for the ADC -

Translates 5V into 3.2V, then:

Vin = N_ADC / 794.37



Config:



Analog channel selection:

Control lines:			Channel Selected:
C	**B**	**A**	
0	0	0	A0
0	0	1	A1
0	1	0	A2
0	1	1	A3
1	0	0	A4 *
1	0	1	A5 *
1	1	0	CALIB_HIGH
1	1	1	CALIB_LOW

Title	***Arduino socket***		
Size: A4	Number: 2	Revision: 2	Daniel Mancuso * damancuso@ohmtech.io *
Date: 10/11/2018	Time: 19:02:38	Sheet 2 of 8	ohmtech.io
File: Z:\Documents\Conrad\SensorIO\SensorIO_PCB\2_Arduino_socket.SchDoc			

3.3V and 5V modules supported

Signals:

GROVE1_TXD
GROVE1_RXD
GROVE1_P1_PWM
GROVE1_P2_PWM
GROVE1_AI1
GROVE1_AI2
GROVE2_TXD
GROVE2_RXD
GROVE2_P1_PWM
GROVE2_P2_PWM
GROVE2_AI1
GROVE2_AI2
GROVE_SCL
GROVE_SDA

GROVE1_P2_TXD
GROVE1_P1_RXD
GROVE1_P1_PWM
GROVE1_P2_PWM
GROVE1_AI1
GROVE1_AI2
GROVE2_P2_TXD
GROVE2_P1_RXD
GROVE2_P1_PWM
GROVE2_P2_PWM
GROVE2_AI1
GROVE2_AI2
GROVE1_P1_SCL
GROVE2_P1_SCL
GROVE1_P2_SDA
GROVE2_P2_SDA

VCC_3V3
R38 4K7
R39 4K7

Config:

GROVE1_SW_3_5
GROVE2_SW_3_5
GROVE1_MUX_A
GROVE1_MUX_B
GROVE2_MUX_A
GROVE2_MUX_B

GROVE1_SW_5V
GROVE2_SW_5V
GROVE1_MUXA
GROVE1_MUXB
GROVE2_MUXA
GROVE2_MUXB

Grove 1/2 mode selection:

Control line:		
n_MUX_B	**n_MUX_A**	**Mode:**
0	0	PWM
0	1	UART
1	0	I2C
1	1	ANALOG_IN

Grove signal multiplexing and conditioning

- Adapt higher input voltage for the ADCs -

Translates 5V -> 3.2V, then:

Vin = N_ADC / 794.37

C40 0.1u
C41 0.1u
C42 0.1u

U7 SN74LV4052A
U8 SN74LV4052A

U6A LM324PT
U6B LM324PT
U6C LM324PT
U6D LM324PT

R36 47K
R37 100K
R40 47K
R41 100K
R45 47K
R46 100K
R49 47K
R51 100K

D2 BAT54SW
D3 BAT54SW
D4 BAT54SW
D5 BAT54SW

Grove 4-pin connectors

P3
P1 GROVE1_S1
P2 GROVE1_S2
VCC GROVE1_VCC
GND
Grove-1125R-SMT-4P

P4
P1 GROVE2_S1
P2 GROVE2_S2
VCC GROVE2_VCC
GND
Grove-1125R-SMT-4P

Grove Power control (3.3V / 5V)

Q2A DMG1023UV
Q2B DMG1023UV
Q3A DMN63D8LV-7
Q3B DMN63D8LV-7
Q4A DMG1023UV
Q4B DMG1023UV
Q5A DMN63D8LV-7
Q5B DMN63D8LV-7

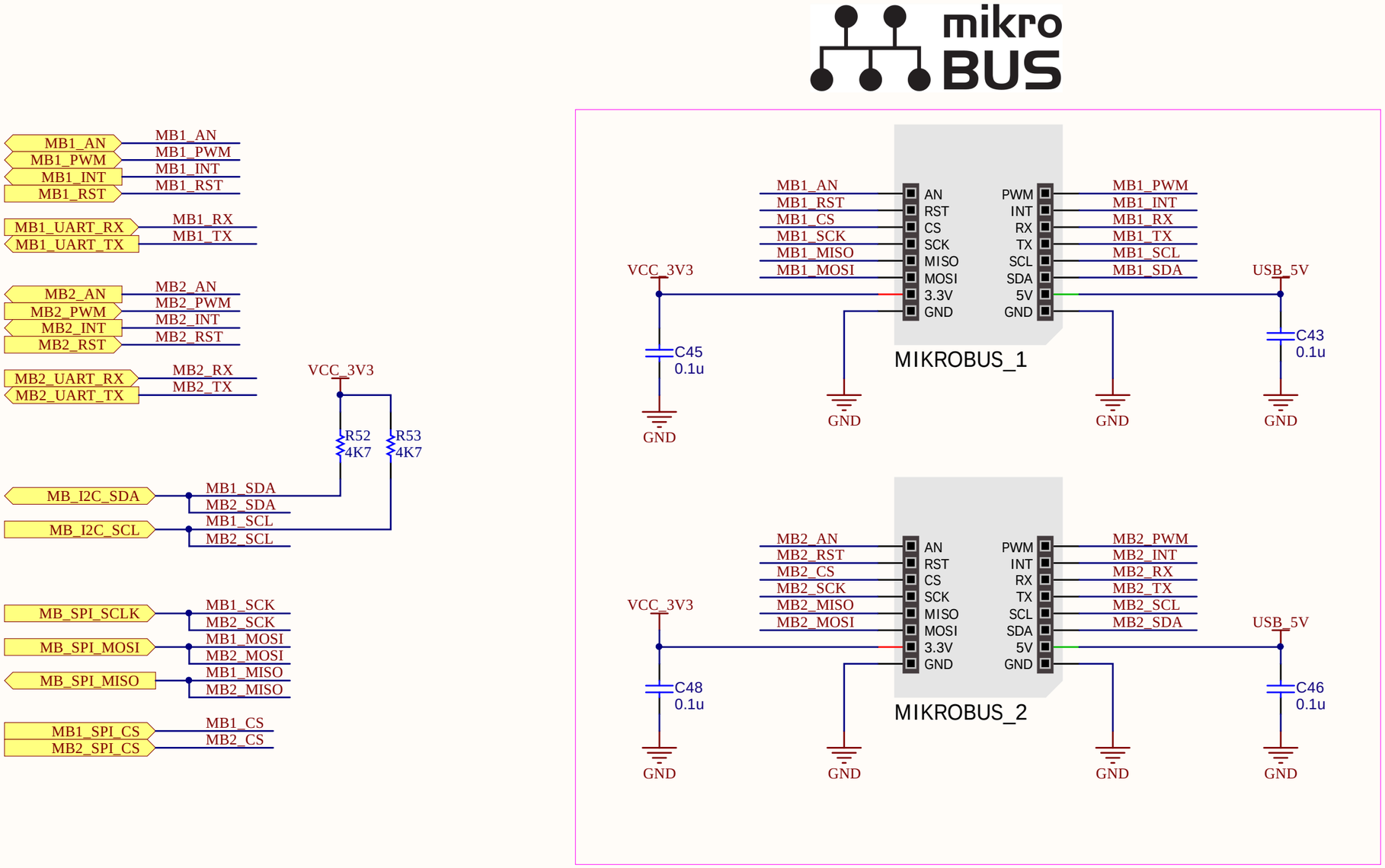
R42 4.7K
R43 10K
R44 10K
R47 4.7K
R48 10K
R50 10K

Grove VCC control:

0 (LOW) -> 3.3V (default)

1 (HIGH)-> 5V

Title	***Grove socket***		Daniel Mancuso
Size: A3	Number:3	Revision: 2	dmancuso@ohmtech.io
Date: 10/11/2018	Time: 19:02:38	Sheet 3 of 8	ohmtech.io
File: Z:\Documents\Conrad\SensorIO\SensorIO_PCB\3_Grove.SchDoc			



Title	***MikroBUS sockets***	
Size: A4	Number:4	Revision: 2
Date: 10/11/2018	Time: 19:02:38	Sheet4 of 8
File: Z:\Documents\Conrad\SensorIO\SensorIO_PCB\4_MikroBus.SchDoc		

Daniel Mancuso
damancuso@ohmtech.io
ohmtech.io

Main MCU: STM32F413ZHJ6

ARM Cortex-M4, 1.5MB Flash, 320KB RAM

MB1_UART_RX
MB1_UART_TX
MB2_UART_RX
MB2_UART_TX
ARD_D0/RX
ARD_D1/TX
GROVE_SCL
GROVE_SDA
SENSORS_I2C_SDA
SENSORS_I2C_SCL
ARD_D10/CS
ARD_D11/MOSI
ARD_D12/MISO
ARD_D13/SCK
MB1_SPI_CS
MB2_SPI_CS
MB_SPI_SCK
MB_SPI_MOSI
MB_SPI_MISO
OLED_MOSI
OLED_SCK
OLED_D/C#
OLED_RESET
OLED_CS
ARD_ANALOG_IN
MB1_AN
MB2_AN
GROVE1_AI1
GROVE1_AI2
GROVE2_AI1
GROVE2_AI2
CC_nRESET
CC_SPI_CLK
CC_SPI_CS
CC_SPI_MISO
CC_SPI_MOSI
CC_IRQ
uSD_D0
uSD_D1
uSD_D2
uSD_D3/CD
uSD_CMD
uSD_CLK

TP8
R76 10K
GND
VCC_3V3
BOOT0
S2 RESET
C68 0.1u
BOOT1
SWO
NRST

U14B
2 of 3
STM32F4x3ZHJ6

I2C2_SDA SENSORS_SDA C3
I2C2_SCL SENSORS_SCL C4
PF2 D4
TIM5_CH1 RGB_RED E2
TIM5_CH2 RGB_GREEN E3
TIM5_CH3 RGB_BLUE E4
UART7_RX MB1_UART_RX F3
UART7_TX MB1_UART_TX F2
G3
ARD_D2 G2
ARD_D4 G1
ARD_D7 M5
ARD_D8 L5
K5
I2CFMP1_SCL GROVE_SCL M6
I2CFMP1_SDA GROVE_SDA L6
PH1-OSC_OUT PH0-OSC_IN D1
C69 6.2pF
Y4 16 MHz
C70 6.2pF
PF0 PF1 PF2 PF3 PF4 PF5 PF6 PF7 PF8 PF9 PF10 PF11 PF12 PF13 PF14 PF15 PH0-OSC_IN
PE14 PE15 PG0 PG1 PG2 PG3 PG4 PG5 PG6 PG7 PG8 PG9 PG10 PG11 PG12 PG13 PG14 PG15
L8 MB_SPI_MOSI SPI5_MOSI
M8
K6 GROVE2_RXD UART9_RX
J6 GROVE2_TXD UART9_TX
J2 RELAY_1
J1 RELAY_2
J10 GROVE2_MUXA
H12 GROVE2_MUXB
H11 ARD_MUX_A
H10 ARD_MUX_B
G11 ARD_MUX_C
E8 GROVE1_SW_5V
D8 GROVE2_SW_5V
C8 UART10_RX
B8 UART10_TX
D7 LTR303_INT
C7 MB1_RST
B7 MB2_RST

U14A
1 of 3
STM32F4x3ZHJ6

BOOT0 BYPASS_REG PDR_ON NRST PB0 PB1 PB2 PB3 PB4 PB5 PB6 PB7 PB8 PB9 PB10 PB11 PB12 PB13 PB14 PB15 PD0 PD1 PD2 PD3 PD4 PD5 PD6 PD7 PD8 PD9 PD10 PD11 PD12 PD13 PD14 PD15
D5 H5 E5 F1 L4 M4 J5 A7 A6 B6 C6 D6 C5 B5 M9 M10 M11 M12 L11 L12 E10 D10 E9 D9 C9 B9 A8 A9 L9 K9 J9 K10 K11 K12
I2C3_SDA ARD_A4/SDA
I2C1_SCL MB_I2C_SCL
I2C1_SDA MB_I2C_SDA
PB8 PB9
TIM2_CH3 ARD_D6
TIM2_CH4 ARD_D9
UART5_RX MB2_UART_RX
UART5_TX MB2_UART_TX
TIM12_CH1 MB1_PWM
TIM12_CH2 MB2_PWM
MB1_INT
uSD_CMD
PD3
ACCEL_INT1
ACCEL_INT2
PD6
PD7
USART3_TX
USART3_RX
GROVE1_MUXA
GROVE1_MUXB
TIM4_CH1 GROVE2_P1_PWM
TIM4_CH2 GROVE2_P2_PWM
TIM4_CH3 GROVE1_P1_PWM
TIM4_CH4 GROVE1_P2_PWM

PC15-OSC32_OUT PH1-OSC_OUT
Y3 32.768kHz
C66 4.7pF
C67 4.7pF
PC14-OSC32_IN
PA0 PA1 PA2 PA3 PA4 PA5 PA6 PA7 PA8 PA9 PA10 PA11 PA12 PA13 PA14 PA15
C1 PC15-OSC32_OUT
E1 PH1-OSC_OUT
J2 ARD_D1/TX UART4_TX
K2 ARD_D0/RX UART4_RX
L2 ARD_D3 TIM9_CH1
M2 ARD_D5 TIM9_CH2
J3 CC_SPI_CS SPI1_NSS
K3 CC_SPI_CLK SPI1_SCK
L3 CC_SPI_MISO SPI1_MISO
M3 CC_SPI_MOSI SPI1_MOSI
E12 ARD_A5/SCL I2C3_SCL
D12 ARD_D13/SCK SPI2_SCK
D11 ARD_D11/MOSI SPI2_MOSI
C12 ARD_D10/CS SPI2_NSS
B12 ARD_D12/MISO SPI2_MISO
A12 SWDIO
A11 SWDCLK
A10 PA15
LTR303_INT
PC0 PC1 PC2 PC3 PC4 PC5 PC6 PC7 PC8 PC9 PC10 PC11 PC12 PC13 PC14-OSC32_IN
H1 ARD_ANALOG_IN
H2 MB1_AN
H3 MB2_AN
H4 GROVE1_AI1
I4 GROVE1_AI2 ADC1_IN14
K4 GROVE2_AI2 ADC1_IN15
G12 MB2_INT
F12
F11 uSD_D0
E11 uSD_D1
B11 uSD_D2
B10 uSD_D3/CD
C10 uSD_CLK
A1 BUTTON_1
B1 PC14-OSC32_IN
CC_RESTORE
CC_FACTORY_RESTORE
PE0 PE1 PE2 PE3 PE4 PE5 PE6 PE7 PE8 PE9 PE10 PE11 PE12 PE13
A5 GROVE1_RXD UART8_RX
A4 GROVE1_TXD UART8_TX
A3 OLED_SCK SPI4_SCK
A2 OLED_RESET
B2 OLED_CS SPI4_NSS
B3 OLED_D/C#
B4 OLED_MOSI SPI4_MOSI
M7 PE7
L7 CC_NRESET
K7 CC_IRQ
J7 CC_RESTORE
H8 MB2_SPI_CS
J8 MB_SPI_SCK SPI5_SCK
K8 MB_SPI_MISO SPI5_MISO

ARD_D2 ARD_D4 ARD_D7 ARD_D8
MB1_RST MB2_RST
BUTTON_1
ACCEL_INT1 ACCEL_INT2
MB1_INT MB2_INT
RELAY_1 RELAY_2
GROVE1_SW_5V GROVE2_SW_5V GROVE1_SW_3_5 GROVE2_SW_3_5
GROVE1_MUXA GROVE1_MUXB GROVE2_MUXA GROVE2_MUXB GROVE1_MUX_A GROVE1_MUX_B GROVE2_MUX_A GROVE2_MUX_B
ARD_MUX_A ARD_MUX_B ARD_MUX_C
ARD_D3 ARD_D5 ARD_D6 ARD_D9
MB1_PWM MB2_PWM
GROVE2_P1_PWM GROVE2_P2_PWM GROVE1_P1_PWM GROVE1_P2_PWM
RGB_RED RGB_GREEN RGB_BLUE
ARD_A4/SDA ARD_A5/SCL
MB_I2C_SDA MB_I2C_SCL
GROVE1_TXD GROVE1_RXD
GROVE2_TXD GROVE2_RXD

To ST-LINK/V2.1 interface

STLK_RX USART3_TX
STLK_TX USART3_RX
SWDCLK SWDIO NRST SWO

Cortex-M Debug SWD

VCC_3V3
SWD
Vref GND GND KEY GND
1 2 3 4 5 6 7 8 9 10
DIO CLK SWO NC nRESET
100 R77 100 R78 100 R79 100 R80
D8 ESDA6V1BC6

U14C
3 of 3
STM32F4x3ZHJ6

VBAT VCAP_1 VDD VSS VSSA VDDA VDDUSB VREF- VREF+
C2 H7 D3 F4 F5 F6 F7 F8 F9 G5 G6 G7 F10 M1 C11 K1 L1
D2 E6 E7 G4 G8 H6 G10 J1
C71 Cap0805, X5R 4u7
L10 Ferrite
AVCC
C86 0.1u
C87 Cap0603 10n
C88 1u

VCC_3V3
C72 22uF
C73 C74 C75 C76 C77 C78 C79 0.1µF

Daniel Mancuso
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*

Title	Main MCU		
Size: A3	Number:5	Revision: 2	
Date: 10/11/2018	Time: 19:02:38	Sheet5 of 8	
File: Z:\Documents\Conrad\SensorIO\SensorIO_PCB\5_MainMCU.SchDoc			

CC3120 SoC: WiFi Network Processor

Interface to MCU

CC_FACTORY_RESTORE
CC_nRESET
CC_SPI_CLK
CC_SPI_CS
CC_SPI_MISO
CC_SPI_MOSI
CC_IRQ

WiFi 2.4GHz

NOTE: Extemal antenna option
Move R5 to R4 position

FL1 DEA202450BT-1294C1-H
J1 Coax-w/switch
NOTE: Test-prove: MXHQ87WA3000
P2 UFL
ANT Inverted-F PCB antenna
Measured VSWR = 1.16:1, BW = 200 MHz

CC3120 UART Interface

U4 CC3120RNMARGKR

U3 MX25R1635FM1IL0

Restoring factory default configuration:
Hold high and release reset to recover factory image (10seconds)

Power pins:
- PA DCDC input (pin 39) maximum 1 A
– ANA DCDC input (pin 37) maximum 600 mA
– DIG DCDC input (pin 44) maximum 500 mA
– PA DCDC switching nodes (pin 40 and pin 41) maximum 1 A
– PA DCDC output node (pin 42) maximum 1 A
– ANA DCDC switching node (pin 38) maximum 600 mA
– DIG DCDC switching node (pin 43) maximum 500 mA
– PA supply (pin 33) maximum 500 mA

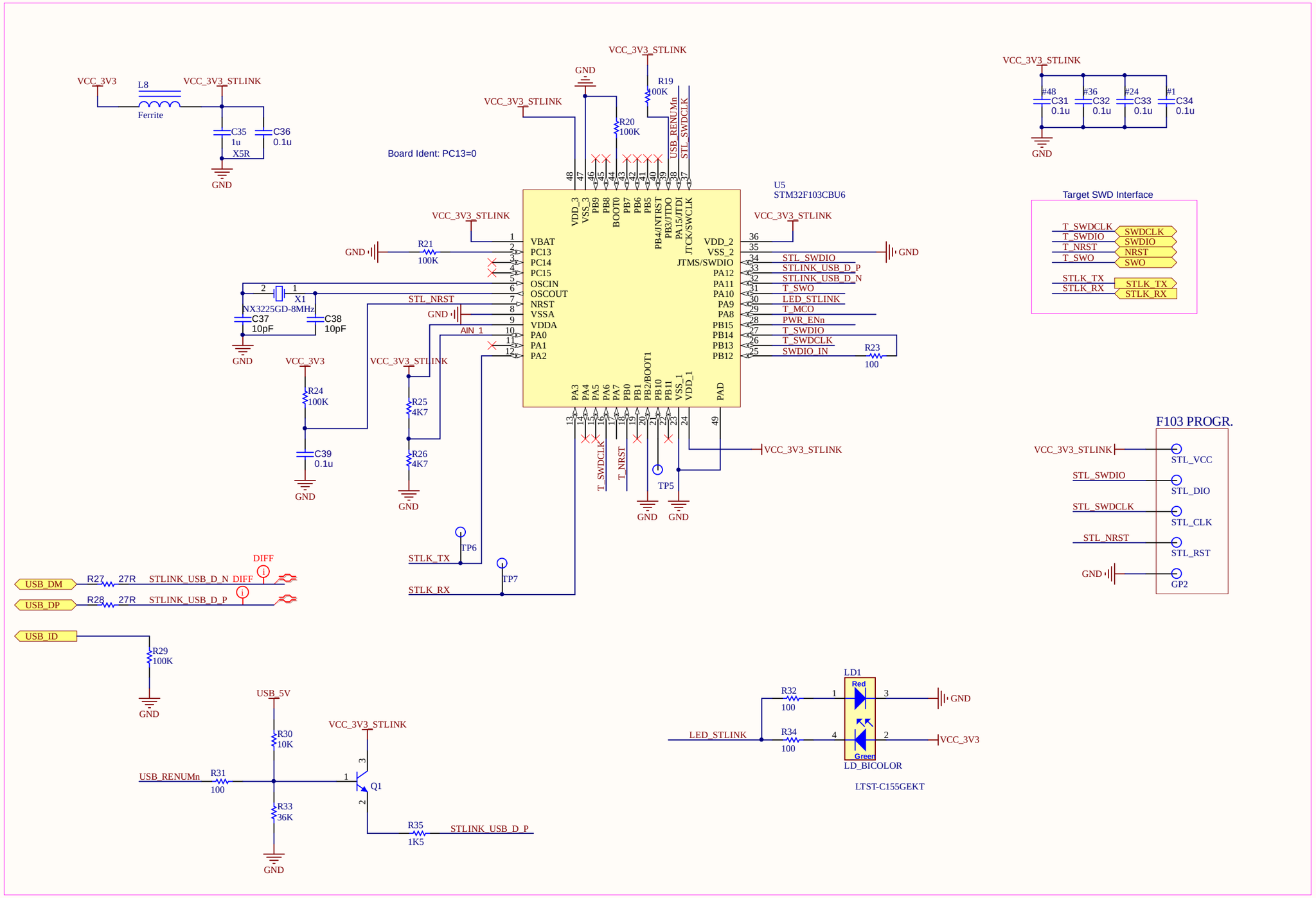
To ensure WLAN performance, ripple on the 2.1- to 3.3-V supply must be less than ±300 mV.

MAX TX Power = 272mA (mod: 1DSSS)

Peak calibration current: 450mA (17mJoules over 24ms)

Title: WiFi Network Processor			Daniel Mancuso dmancuso@ohmtech.io
Size: C	Number: 6	Revision: 2	ohmtech.io
Date: 10/11/2018	Time: 19:02:39	Sheet 6 of 8	
File: Z:\Documents\Conrad\SensorIO\SensorIO_PCB\6_WiFi.SchDoc			

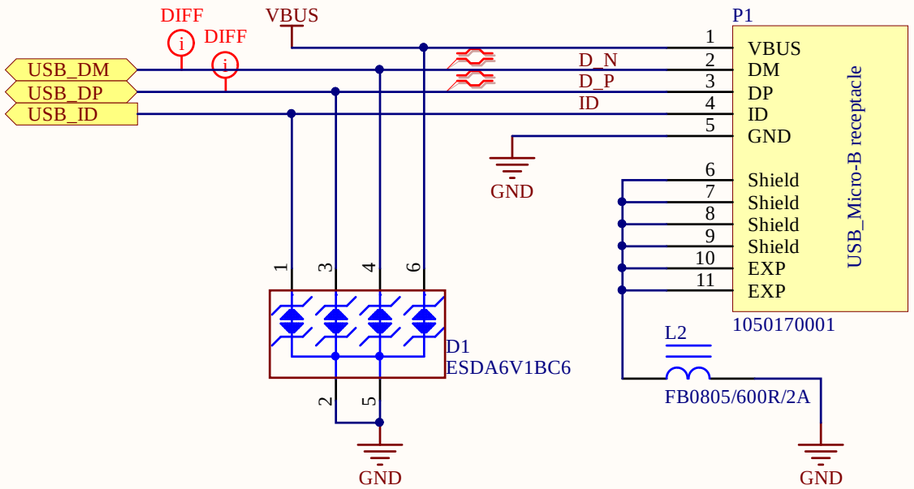
ST-Link-V2.1 programmer / debugger:



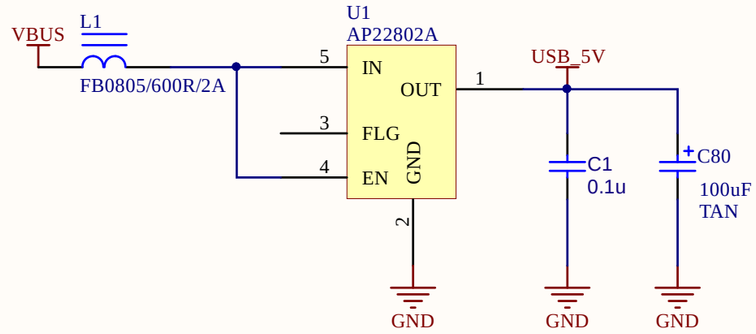
Title	***ST-Link/V2.1***		
Size: A3	Number:7	Revision: 2	Daniel Mancuso dmancuso@ohmtech.io
Date: 10/11/2018	Time: 19:02:39	Sheet 7 of 8	ohmtech.io
File: Z:\Documents\Conrad\SensorIO\SensorIO_PCB\7_ST_Link_V2_1.SchDoc			

Micro USB connector and protections

MicroUSB: ST-Link/V2.1 and Power input

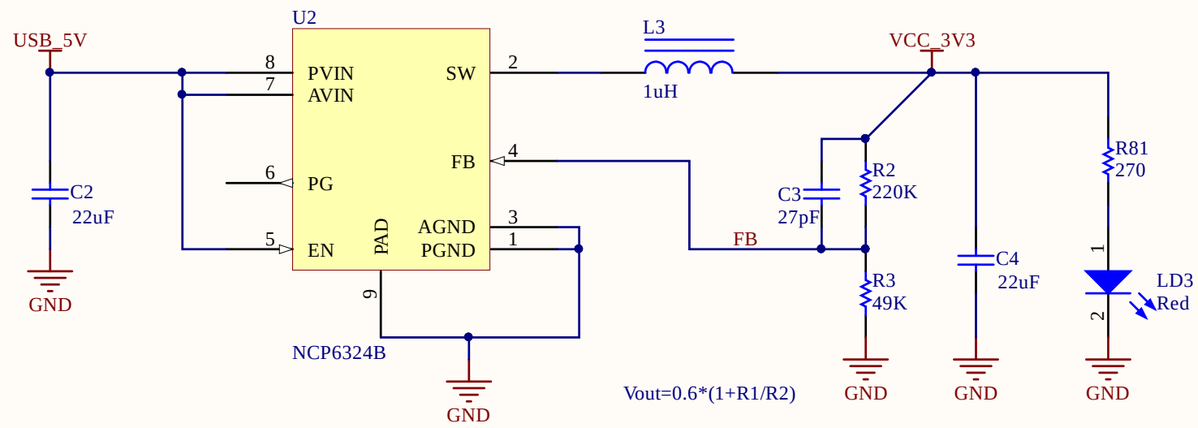


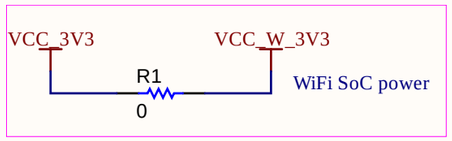
USB Power switch (2A short circuit protection)



DC to DC converter

3MHz, 2A syncrhonous buck converter (5V to 3.3V):





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MountingHole MountingHole MountingHole MountingHole

Title	***Power supply & USB connector***		
Size: A4	Number: 8	Revision: 2	
Date: 10/11/2018	Time: 19:02:40	Sheet 8 of 8	
File: Z:\Documents\Conrad\SensorIO\SensorIO_PCB\8_PowerSupply.SchDoc			

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damancuso@ohmtech.io

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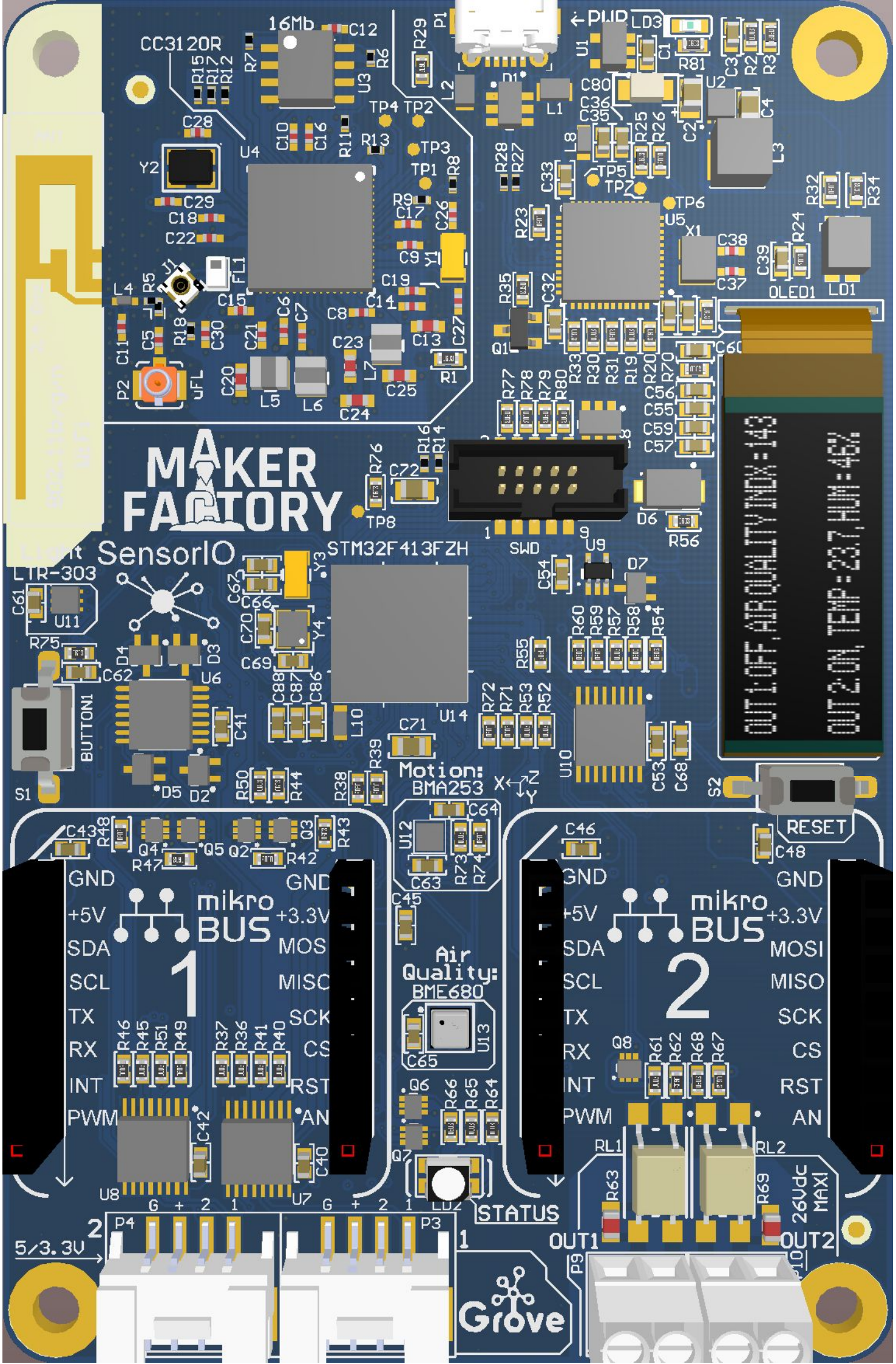
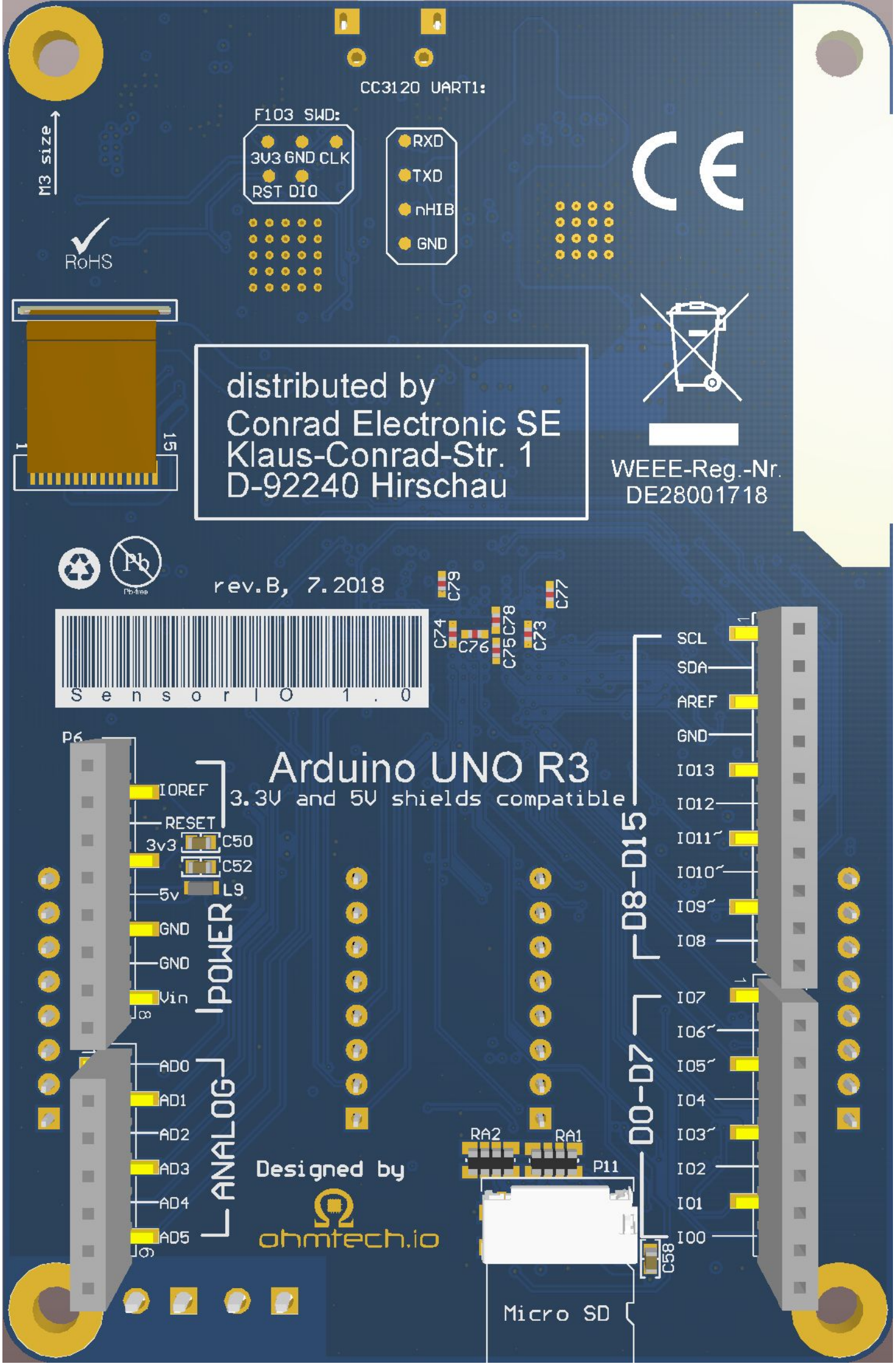

CC3120R
16Mb
←PWR
MAKER FACTORY
SensorIO
STM32F413FZH
LTR-303
Motion: BMA253
Air Quality: BME680
SWD
RESET
BUTTON1
OLED1
LD1
OUT1:OFF,AIR QUALITY INDEX=143
OUT2:ON, TEMP=23.7,HUM=46%
mikro BUS 1
mikro BUS 2
GND
+5V
SDA
SCL
TX
RX
INT
PWM
+3.3V
MOSI
MISO
SCK
CS
RST
AN
Grove
STATUS
OUT1
OUT2
26Vdc MAX!
5/3.3V


CC3120 UART1:
F103 SWD:
3V3 GND CLK
RST DIO
RXD
TXD
nHIB
GND
M3 size
RoHS
distributed by
Conrad Electronic SE
Klaus-Conrad-Str. 1
D-92240 Hirschau
WEEE-Reg.-Nr.
DE28001718
rev.B, 7.2018
SensorIO 1.0
Arduino UNO R3
3.3V and 5V shields compatible
POWER
ANALOG
D8-D15
D0-D7
IOREF
RESET
3v3
5v
GND
GND
Vin
AD0
AD1
AD2
AD3
AD4
AD5
SCL
SDA
AREF
GND
IO13
IO12
IO11~
IO10~
IO9~
IO8
IO7
IO6~
IO5~
IO4
IO3~
IO2
IO1
IO0
Designed by
ohmtech.io
Micro SD