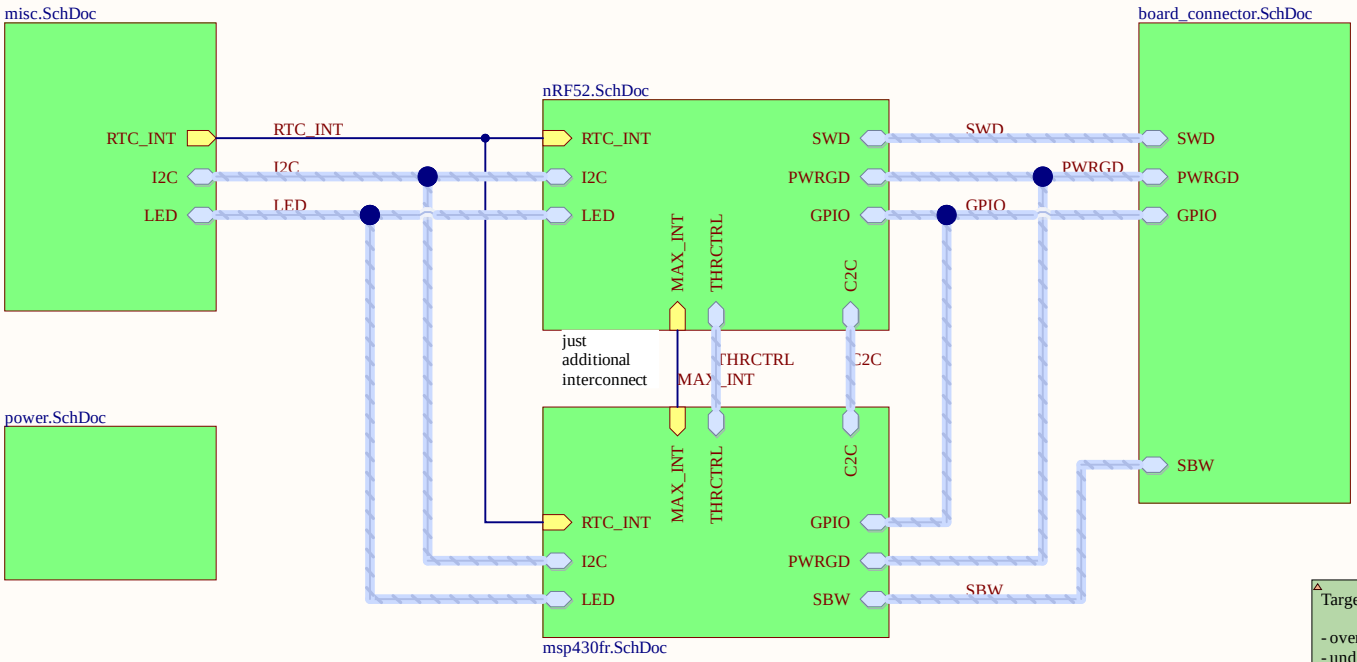


GPIO Current Protection

nRF52
High Drive (>= 2.7 V) -> 6-15 mA sink & drive
Std Drive (>=1.7 V) -> 1-4 mA sink & drive

MSP430FR59x
diode current @ pin max +- 2mA
I_OHmax = -6 mA @ 3V
I_OLmax = 6 mA @ 3V
"8.12.5.3 Typical Characteristics, Digital Outputs" show 0.5 V drop / increase @ 10 mA

74LVC2T45GT
has +- 24 mA drive & sink current

consequence -> limit to 8-10 mA @ 4V with 470 R or 2x 220 R

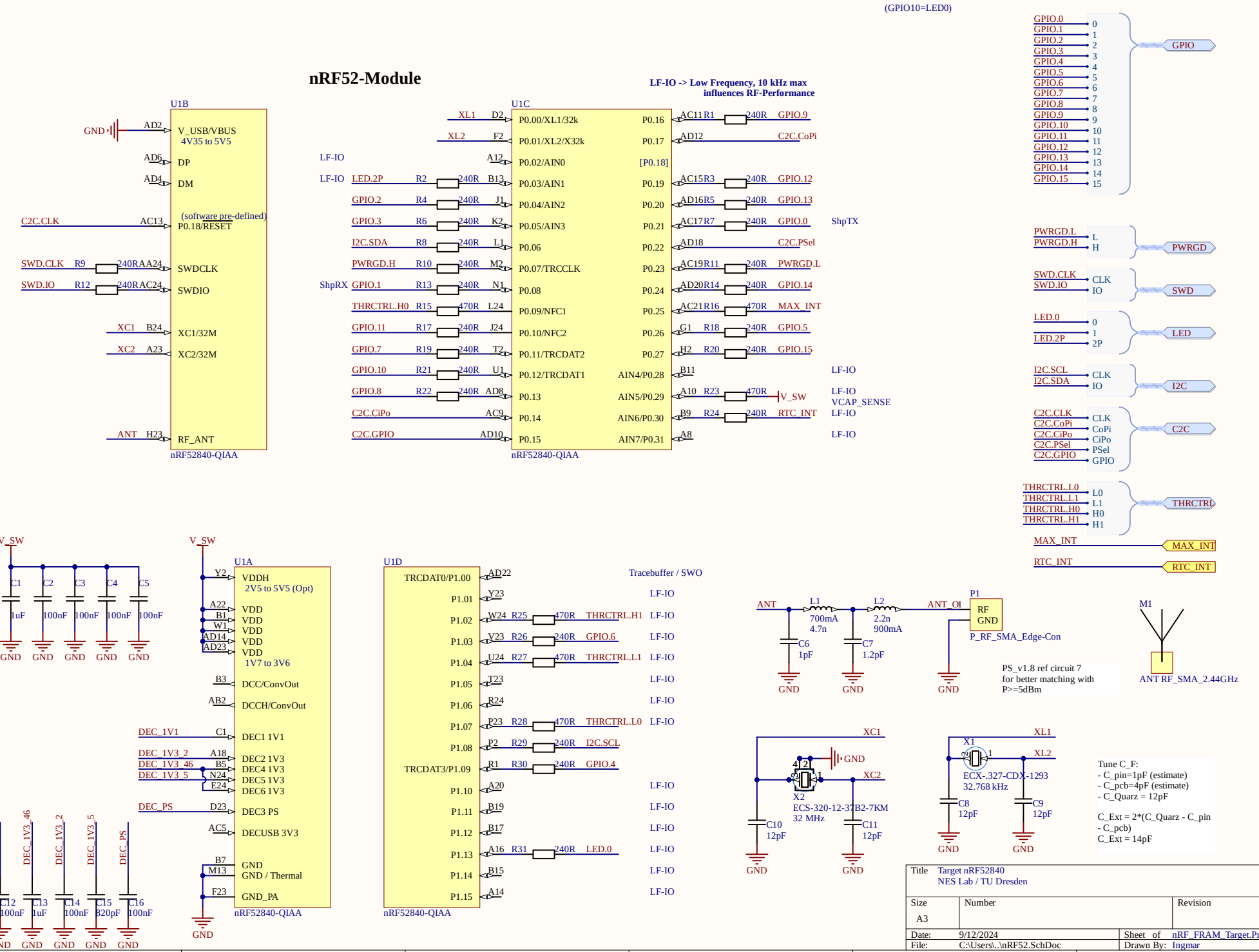
Target-Features

- over-voltage protection for V_LV (max 3.9V)
- under-voltage protection with hysteresis for nRF
- one debug LEDs with separate supply for minimal impact on pwr-budget
- one self-powered LED to "burn" energy
- io pins not interferring with RF (nRF PS v1.6 page 578)
- LEDs / UART similar to Riotee
- 16x GPIO shared to host, current-limited with 240R star-configuration (every participant has that resistor on its port to also keep data rates >10 MHz)
- high & low power-good-signal (similar to riotee)
- SMA-port for external antenna

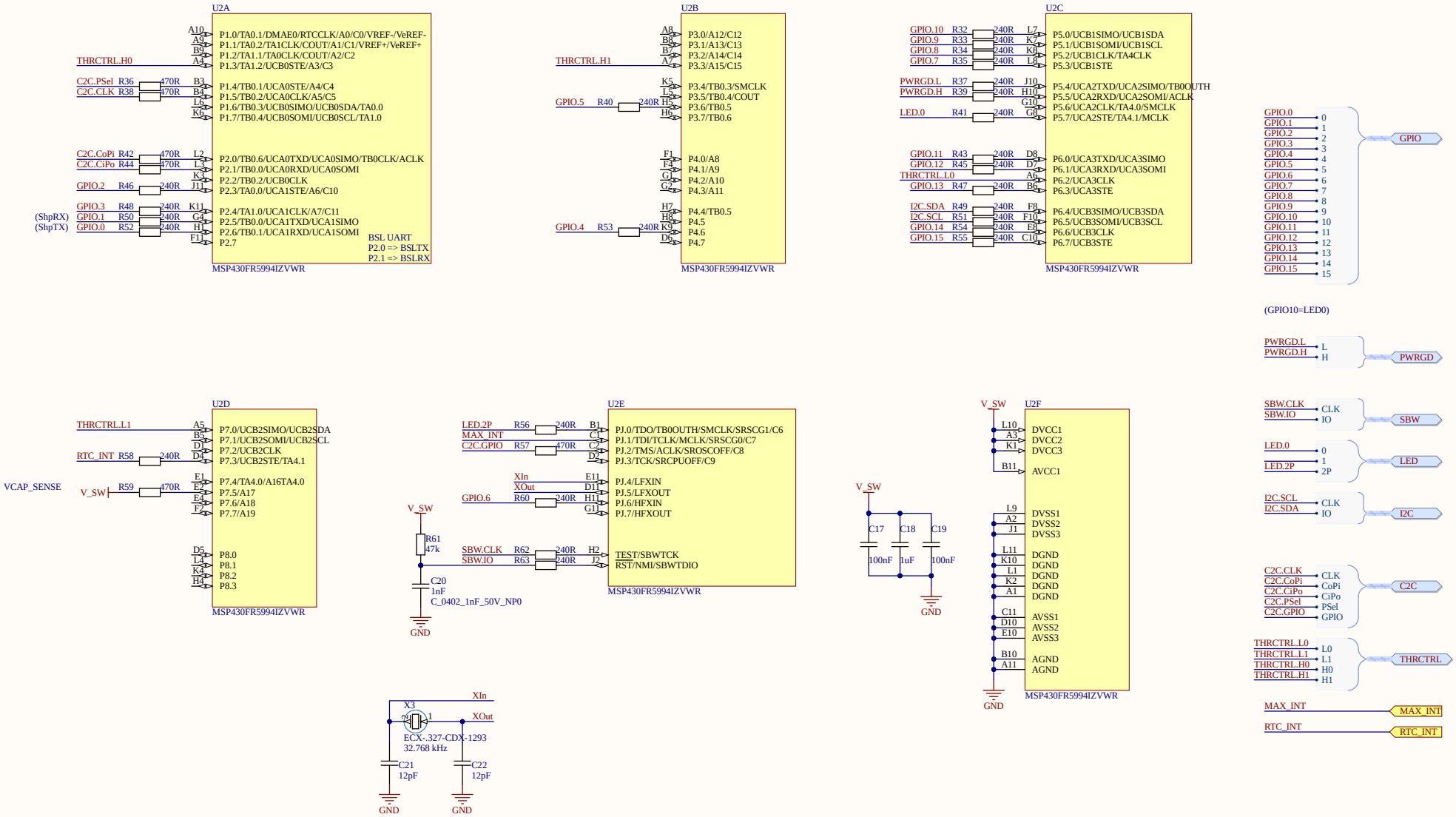
- nRF uses low voltage mode (PSv1.1 page 61)
- 3rd possible way for reset (external), beside jtag and pwr-cycle

Title	Target-Board Overview NES Lab / TU Dresden		
Size A4	Number		Revision
Date:	9/12/2024	Sheet of	nRF_FRAM_Target.PrjPcb
File:	C:\Users\..\overview.SchDoc	Drawn By:	Ingmar

nRF52-Module

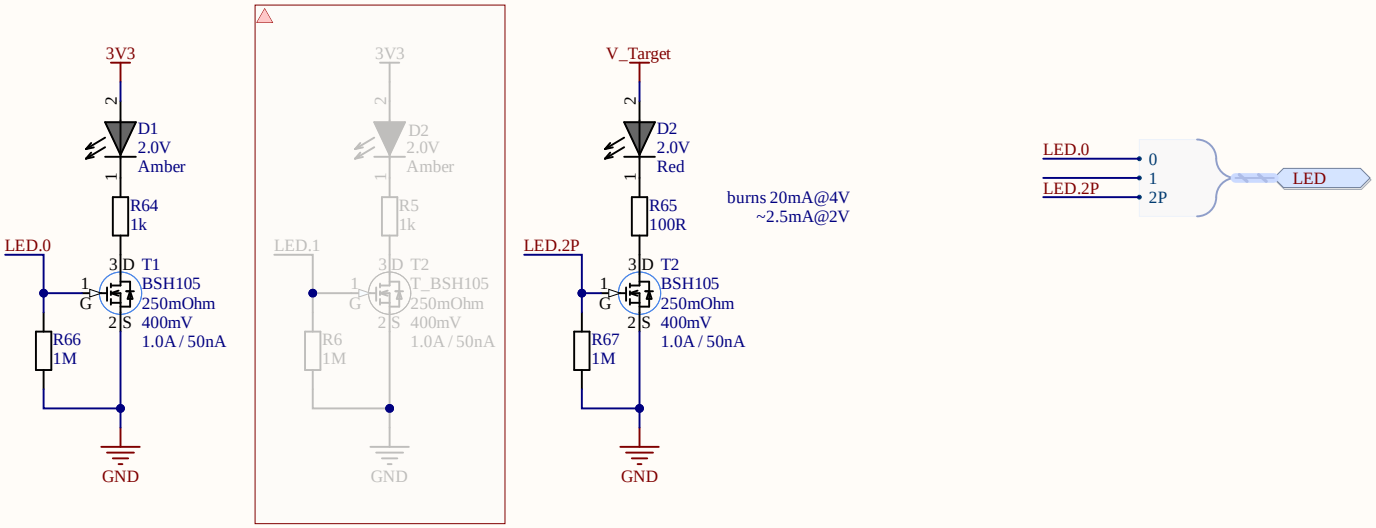


Title	Target nRF52840 NES Lab / TU Dresden	
Size A3	Number	Revision
Date: 9/12/2024		Sheet of nRF_FRAM_Target.PrjPcb
File: C:\Users\..\nRF52.SchDoc		Drawn By: Ingmar

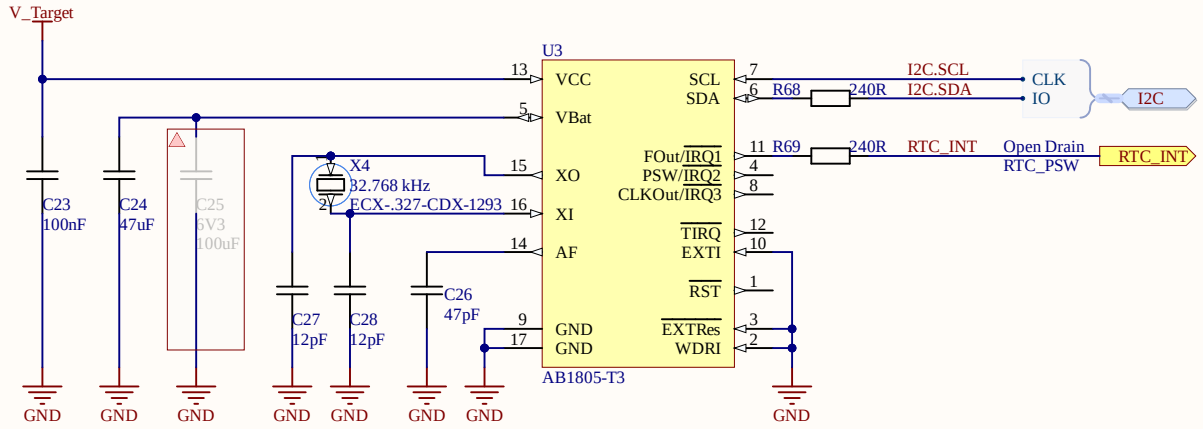


Title	Target MSP430FR NES Lab / TU Dresden	
Size A3	Number	Revision
Date: 9/12/2024	Sheet of	nRF_FRAM_Target.PrjPcb
File: C:\Users\..\msp430fr.SchDoc	Drawn By:	Ingmar

Debug-LEDs



RTC & Watchdog

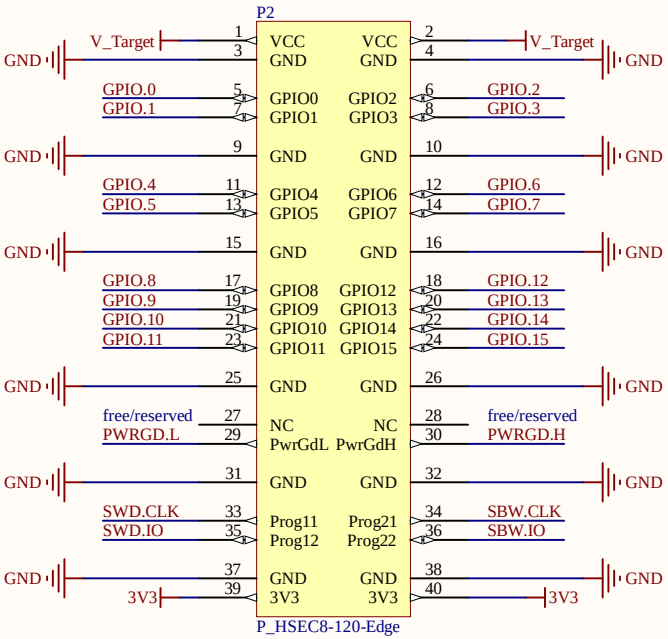


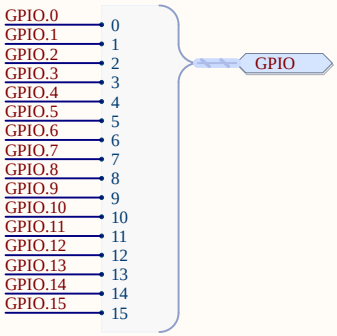
Title	RTC & LEDs NES Lab / TU Dresden		
Size A4	Number	Revision	
Date:	9/12/2024	Sheet of	nRF_FRAM_Target.PrjPcb
File:	C:\Users\..\misc.SchDoc	Drawn By:	Ingmar

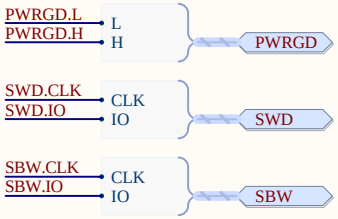
Cape-Port

signal-direction is from Host point of view (Target is Guest)

Switchable Directions:
Group A = TBD
Group B = TBD
Group C = TBD







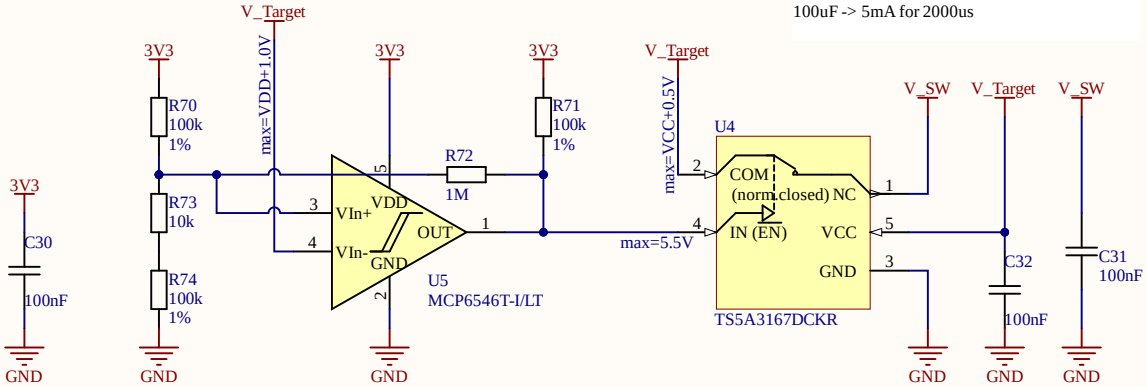
Title	Board-Connector NES Lab / TU Dresden	
Size: A4	Number	Revision
Date: 9/12/2024	Sheet of	nRF_FRAM_Target.PrjPcb
File: C:\Users\..\board_connector.SchDoc	Drawn By:	Ingmar

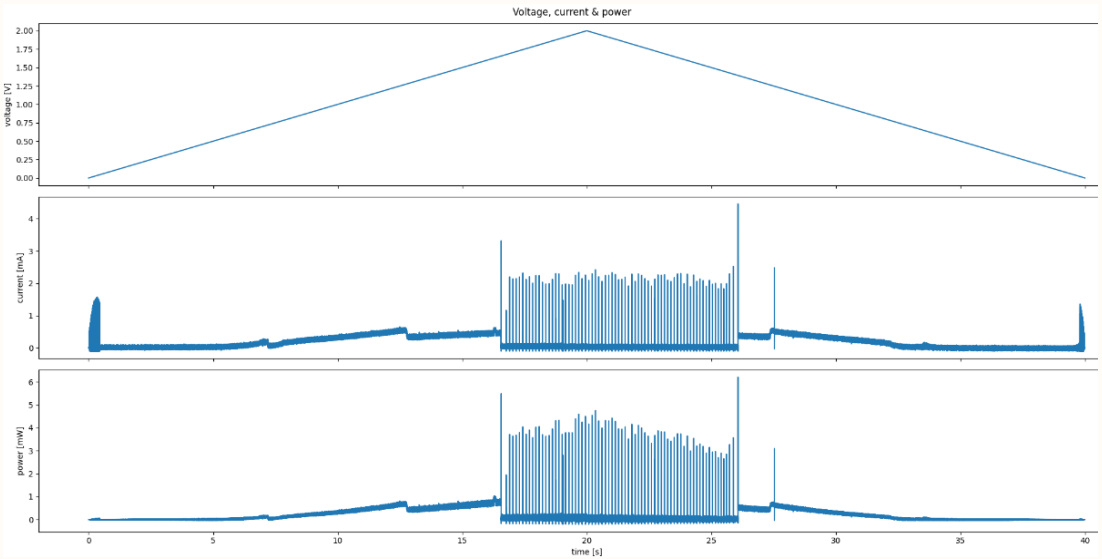
Analog Switch controlled by Comparator

nRF consumes ~.5mA below 1.7V in deep-sleep
- consumption drops when going above 1.69 V
- rise when going below 1.58 V
- tested 13 nodes range from
  ON [1.63, 1.69] V
  OFF [1.58, 1.60] V

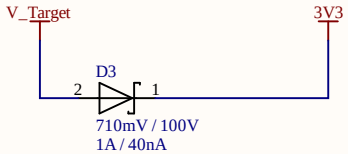
Analog Switch controlled by comparator with small hysteresis.
VON: 1.729 V
VOFF: 1.652 V (according to datasheet)
Own Calculations say: 1.642 & 1.797 V
-> measurements confirm own calc!

Calculate PDraw for 100mV-Drop when enabling
10uF -> 5mA for 200us
10uF -> 1mA for 1000ms
47uF -> 5mA for 940us
100uF -> 5mA for 2000us





Over-Voltage-Protection

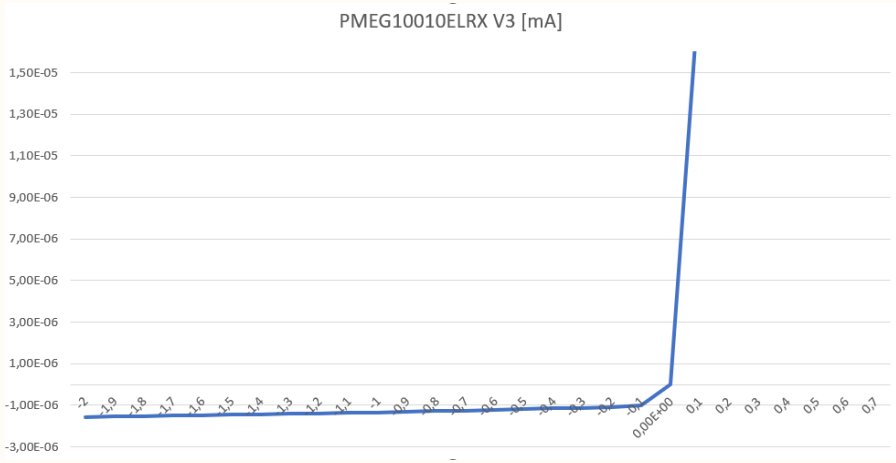


505-565mV @ 100mA

Abs Max Ratings:

nRF52	3.9 V
RTC	3.8 V
MSP430	4.1 V

One Diode:
+ 0.0 V -> 6 pA (noise)
+ 0.1 V -> 47 nA
+ 0.2 V -> 2.3 uA
+ 0.3 V -> 120 uA
+ 0.4 V -> 4.83 mA



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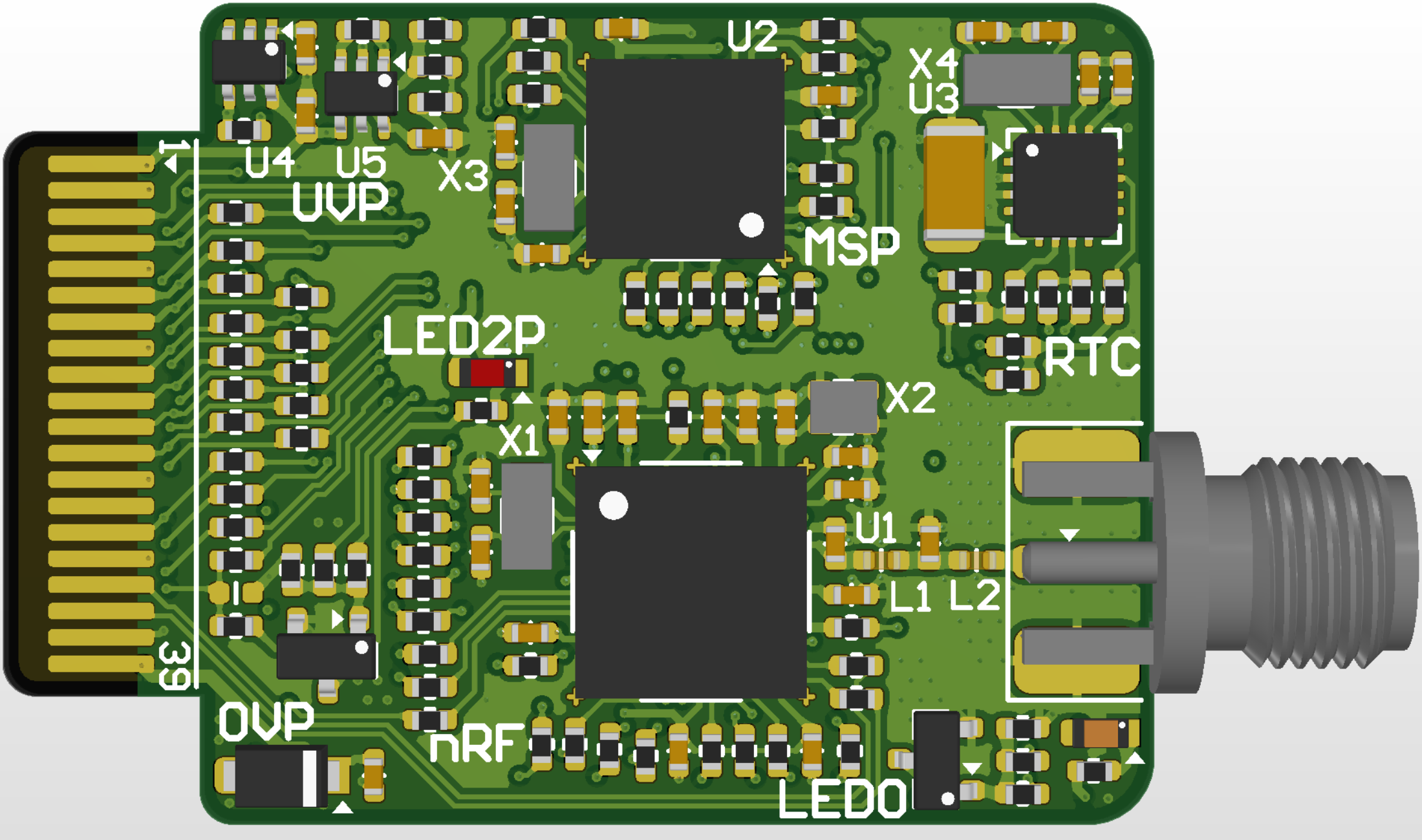
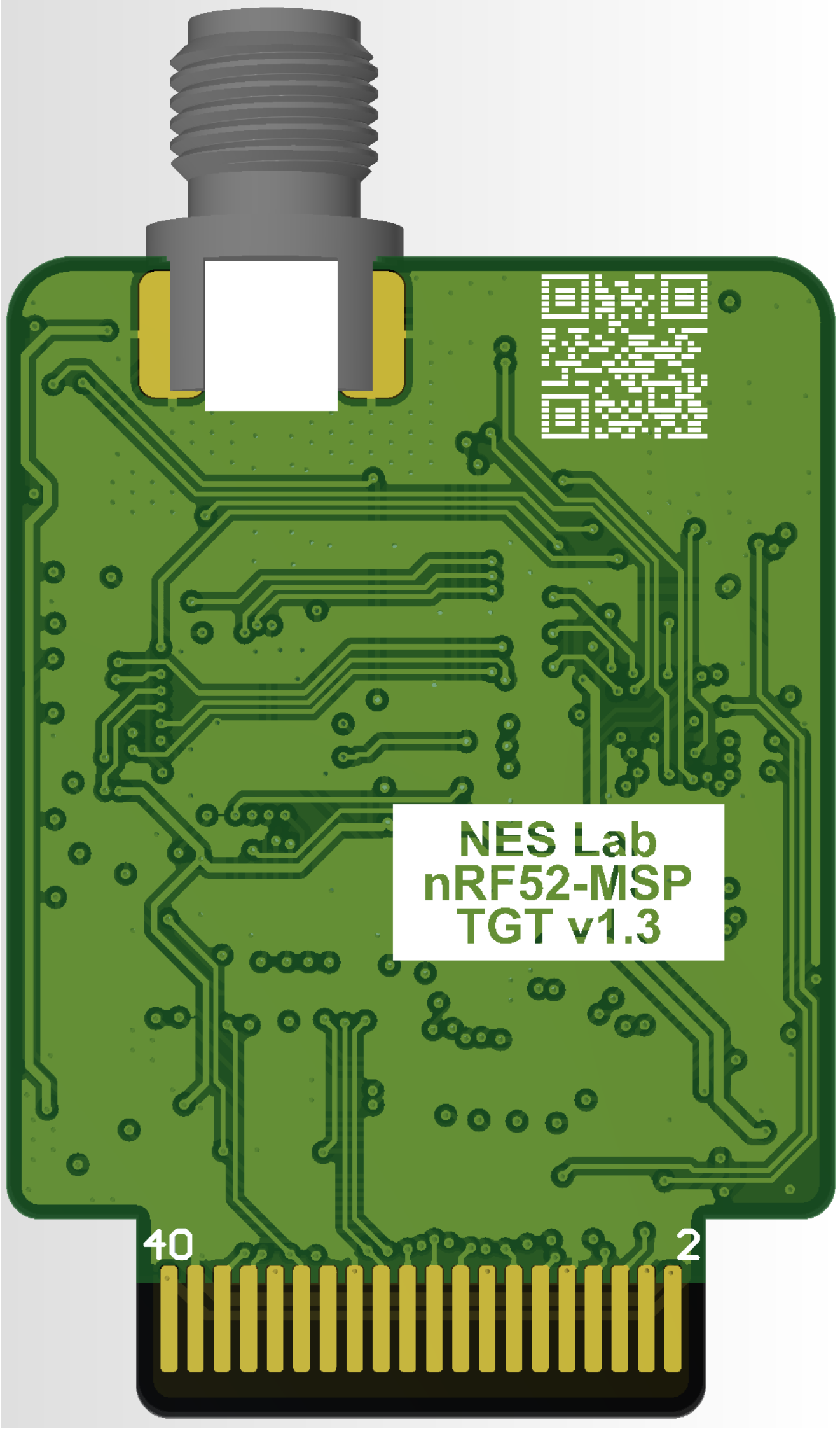
Size A4	Number	Revision
Date: 9/12/2024		Sheet of
File: C:\Users\..\power.SchDoc		Drawn By:


U2
X4
U3
X3
U4
U5
UVP
MSP
LED2P
RTC
X2
X1
U1
L1
L2
1
39
OVP
nRF
LED0


NES Lab
nRF52-MSP
TGT v1.3
40
2