TMS570_CPU

File: tms570_cpu.kicad_sch

BUS_IO_Interface

File: BUS_IO_Interface.kicad_sch

Memory

File: memorg.kicad_sch

Need to verify the MISO on MRAM
is a Tri State output or open collector.
Data Sheet just says output.

Power

File: power.kicad_sch

RF_Power_AMP

File: Power_Amp.kicad_sch

TX_ax5043

File: TX_ax5043.kicad_sch

RX_1_ax5044

File: RX_1_ax5043.kicad_sch

RX_2_ax5045

File: RX_2_ax5043.kicad_sch

RX_3_ax5045

File: RX_3_ax5043.kicad_sch

RX_4_ax5045

File: RX_4_ax5043.kicad_sch

Need to verify the MISO on AX5042
is a Tri State output or open collector.
Data Sheet just says output.

Rx_Power_Divider

File: Power_Divider.kicad_sch

Clocks

File: Clocks.kicad_sch

SPI_CTL

File: SPI_CTL.kicad_sch

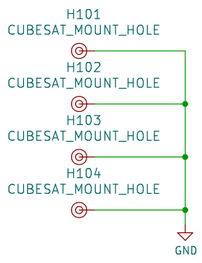
BUS_IO

File: bus_io_conn.kicad_sch

PC104_IO

File: PC104_io_conn.kicad_sch

TODO: ANALOG SIGNAL CONDITIONING ON ALL I/O
Check clock generaators
Assign clock frequencies
develope frequency plan
check settings for PSK modulation
Check Power supplies

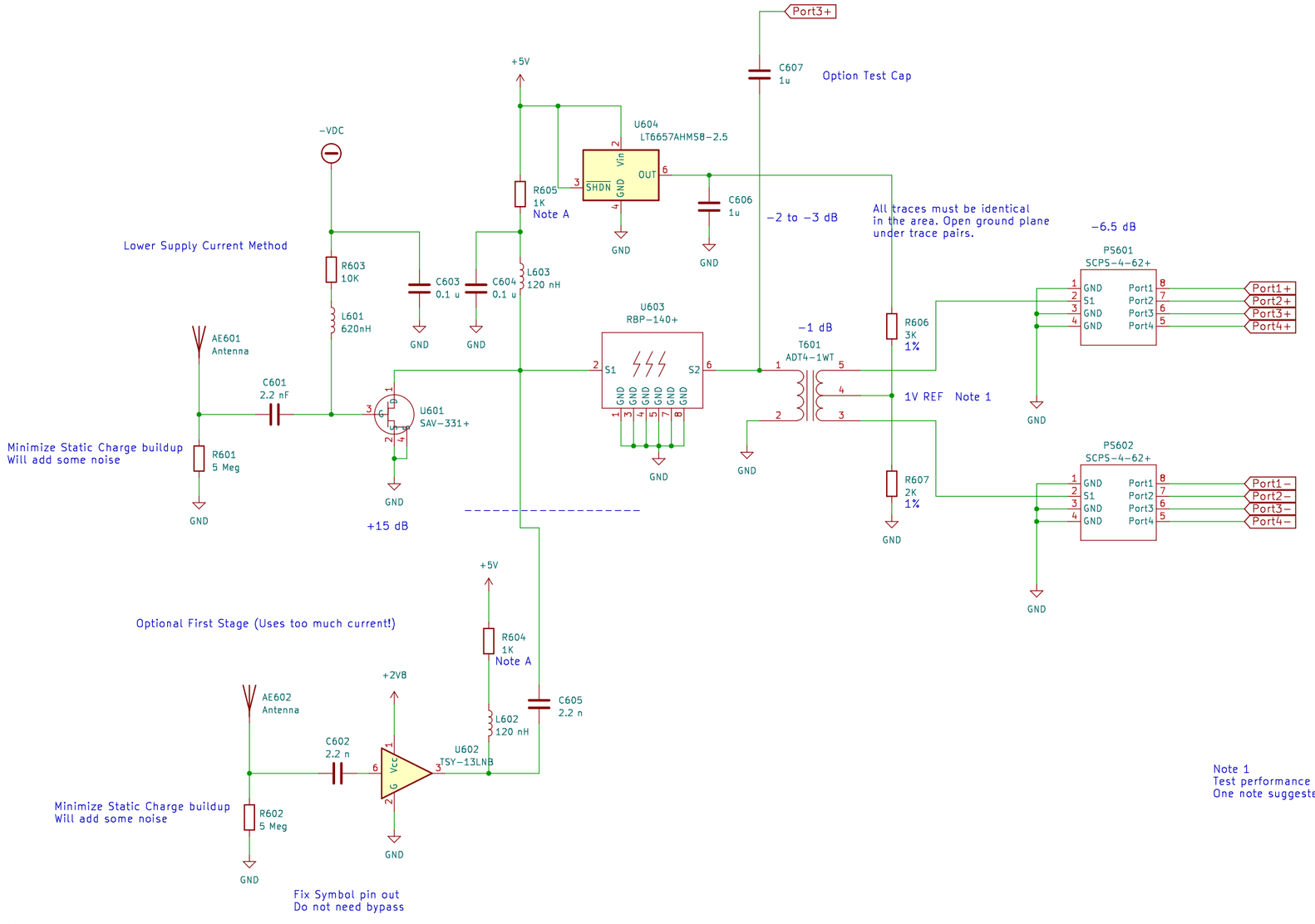


N5BRG
AMSAT-NA

Sheet:
File: PACSAT_DEV_REVB.kicad_sch

Title: Radiation Tolerant Internal Housekeeping Unit (IHU)

Size: USLedger	Date: 2022-12-27	**Rev: 1.2**
KiCad E.D.A. kicad 7.0.0-da2b9df05c-171-ubuntu22.04.1		Id: 1/17



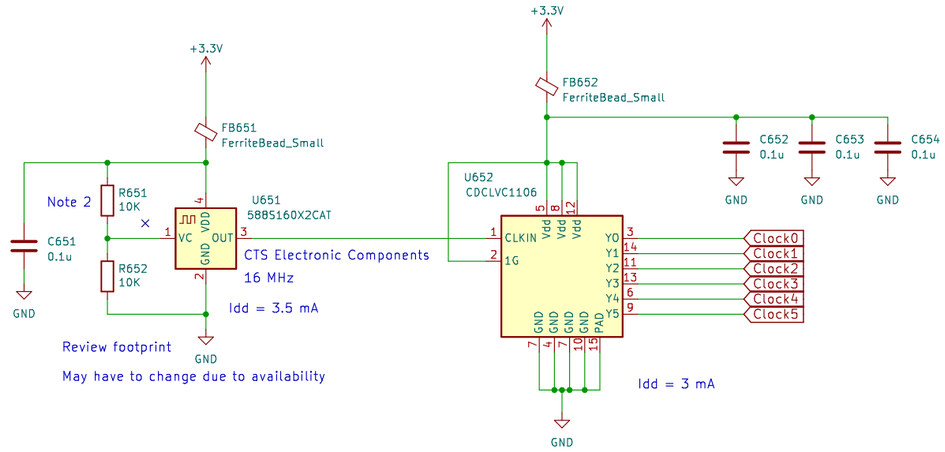
N5BRG
AMSAT-NA

Sheet:
File: Power_Divider.kicad_sch

Title: Radiation Tolerant Internal Housekeeping Unit (IHU)

Size: USLedger	Date: 2023-02-16	**Rev: A**
KiCad E.D.A. kicad 7.0.0-da2b9df05c-171-ubuntu22.04.1		Id: 2/17

U101
U102
U103
U104
GND
Alternate Coupling
U106
SMA
Look at matching circuits may be overkill
7.4 dB
C106
2200p
OUTPUT FILTER
PER AX5043 DS
AX5043_ANTP1
C102 4p3
L102 43n
C104 4p3
U105 4n7
L104 1n2
L101 100n
C103 5p6
C105 NS
L103 18n
JPS-2-1W+
U107
P1
P3
P2
NC
NC
GND
7.4 dB
Splitter
PCB layout must
be symetic in this area
SSPA_VCC
1u C108
1k5 R104
330R R102
L110 12n
FB102
FerriteBead
C114 1u
FB104
FerriteBead
3n9
L112
C118 4u7
C116 3p9
MMZ09312BT1
VBA1
VBIAS
RFIN
VBA2
VCC1
GND
VCC2
RFOUT
RFOUT
GND
GND
PDET
U109
L108 1n2
L106 18n
C110 100p
GNDGND
C112 470p
0R
R106
SSPA_PDET_1
L114 12n
C120 10p
RF AMPLIFIER
INPUT MATCH
28 dB
Locate the best filter:
Temwell TDW2896A-425M
MiniCircuits SXBP-425+ 3dB SMD
JPS-2-1W+
U110
Combiner
33 dB
2 W
U111
SXBP-425+
IN
OUT
U112
SMA
28 dB
SSPA_VCC
1u C107
1k5 R103
330R R101
L109 12n
FB101
FerriteBead
C113 1u
FB103
FerriteBead
3n9
L111
C117 4u7
C115 3p9
MMZ09312BT1
U108
L107 1n2
L105 18n
C109 100p
GNDGND
C111 470p
0R
R105
SSPA_PDET_2
L113 12n
C119 10p
RF Shield over these parts.
MMZ09312BT1:
Class AB InGaP HBT amplifier
Capacitivily Couple internal on output
Will AX5043 suppot Digital Predistortion?
74 mA % 5V Typ
Pin 14 dB max
Use Hi Q Caps in all matching circuits (Ultra low ESR at 435 MHz)
Symbol Numbers 100 up
N5BRG
AMSAT-NA
Sheet:
File: Power_Amp.kicad_sch
Title: Radiation Tolerant Internal Housekeeping Unit (IHU)
Size: USLedger
Date: 2023-02-16
Rev: A
KiCad E.D.A. kicad 7.0.0-da2b9df05c-171-ubuntu22.04.1
Id: 3/17



Note:

1. Review FILT voltage node and adjust current if needed per ap note AND9315-D.PDF

2. Seletec best resitor values after assembly and use one percent resistors to put frequeny at 16 MHz.

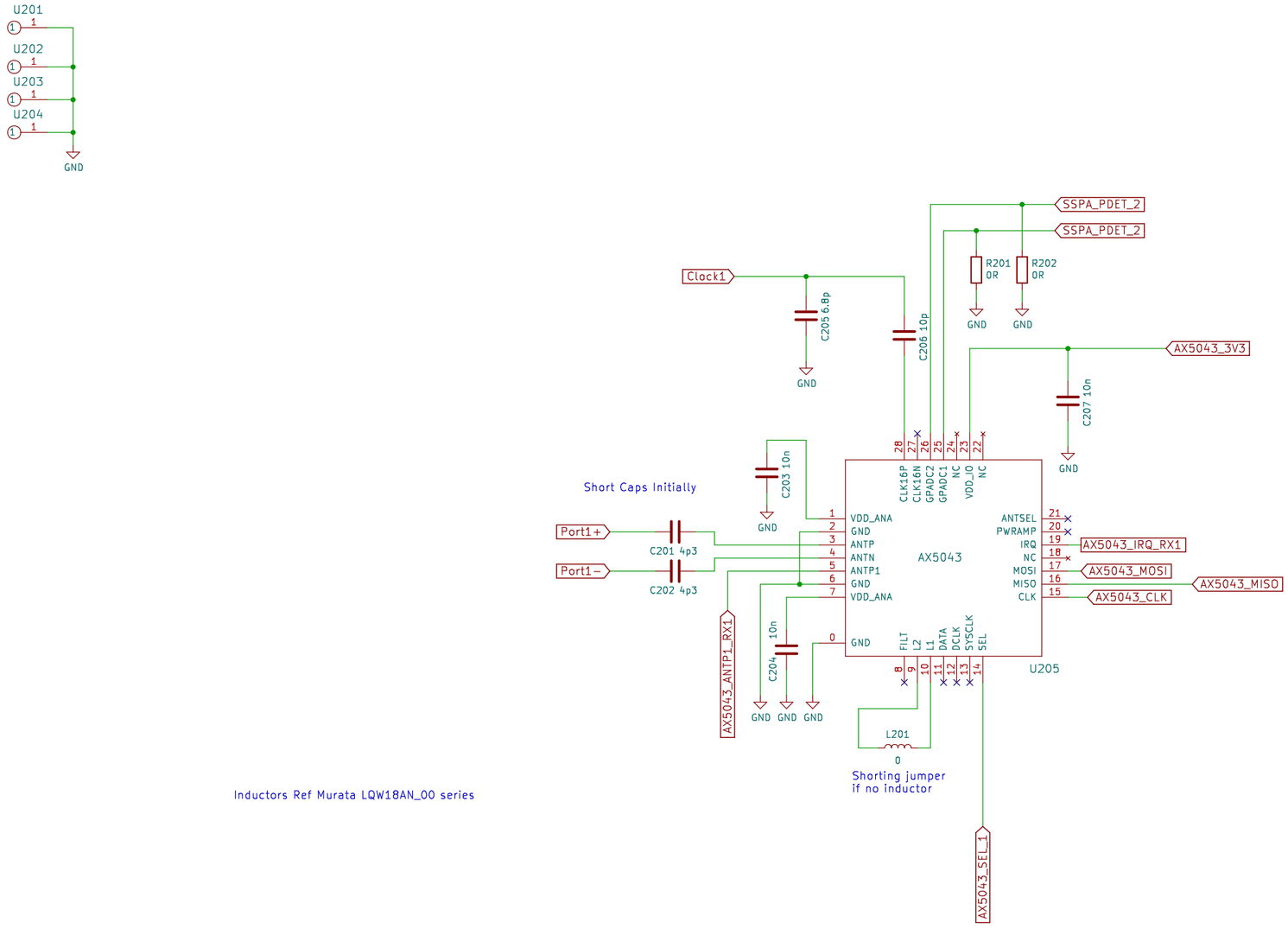
Symbol Numbers 650 up

N5BRG
AMSAT-NA

Sheet:
File: Clocks.kicad_sch

Title: Radiation Tolerant Internal Housekeeping Unit (IHU)

Size: USLedger	Date: 2023-02-16	**Rev: A**
KiCad E.D.A. kicad 7.0.0-da2b9df05c-171-ubuntu22.04.1		Id: 4/17



RECEIVER 1

N5BRG
AMSAT-NA

Sheet:
File: RX_1_ax5043.kicad_sch

Title: Radiation Tolerant Internal Housekeeping Unit (IHU)

Size: USLedger	Date: 2023-02-16	**Rev: A**
KiCad E.D.A. kicad 7.0.0-da2b9df05c-171-ubuntu22.04.1		Id: 5/17

U151
U152
U153
U154
GND

16 dB Max Power Out @ 430 MHz

While radio transceivers using power amplifiers with topologies such as class−A or class−B may have integrated amplifiers, AX5043 utilizes a class−E amplifier. Because of this, high efficiency power output can be achieved, though external components are required.

AX5043 pins ANTP, ANTN, and ANTP1 are not the PA outputj; rather, they are the transition between the internal switching transistor and the external resonant components. In the various AX5043 reference designs, LC, CC, CT, LT, and CM actually form the amplifier. For this reason, the output impedance of the ANT pins is not relevant to antenna matching. When the class−E power amplifier has been properly designed, the output impedance will be found at the balun (LB, CB) components, and will be 100 ohms differential, and 50 ohms after the balun. Between the balun and the antenna (or SMA port), filtering and Antenna matching networks can be inserted in series with the RF path.

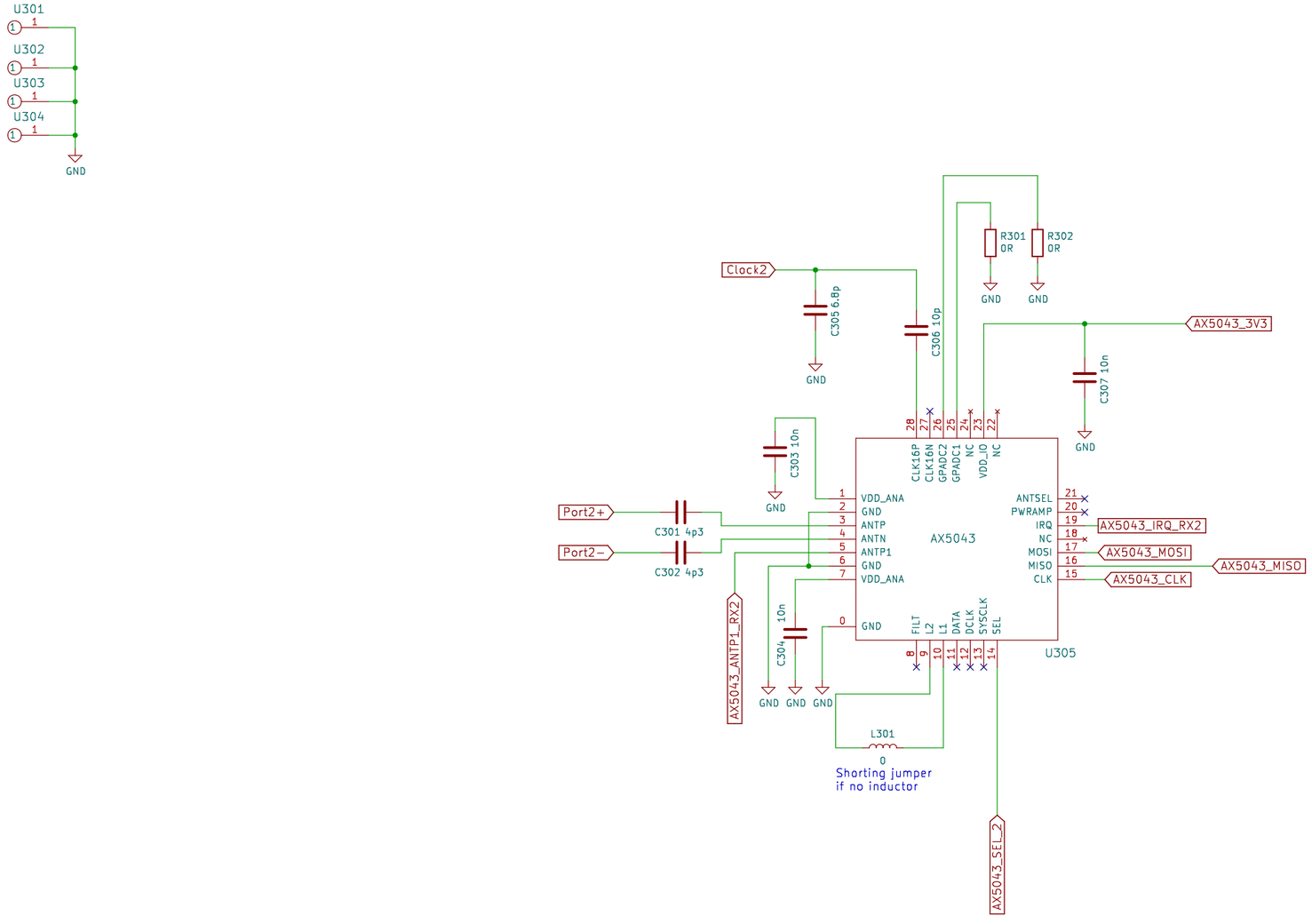
Another important point is that the output impedance of the internal PA transistor also depends on the output power setting.

Symbol Numbers 150 up

Shorting jumper if no inductor

TRANSMITTER	
N5BRG	
AMSAT−NA	
Sheet:	
File: TX_ax5043.kicad_sch	
Title: Radiation Tolerant Internal Housekeeping Unit (IHU)	
Size: USLedger	Date: 2023−02−16
KiCad E.D.A. kicad 7.0.0−da2b9df05c−171−ubuntu22.04.1	Id: 6/17

Rev: A



Inductors Ref Murata LQW18AN_00 series

Symbol Numbers 300 up

RECEIVER 2

N5BRG
AMSAT-NA

Sheet:
File: RX_2_ax5043.kicad_sch

Title: Radiation Tolerant Internal Housekeeping Unit (IHU)

Size: USLedger	Date: 2023-02-16	**Rev: A**
KiCad E.D.A. kicad 7.0.0-da2b9df05c-171-ubuntu22.04.1		Id: 7/17

ToDo: Add a negative Power generator for FET bias

SH86
SH87
SH88
SH89

U86
TPS7A21-Q1
L86
3u3
VSYS
REG_5.0V
REG_5V_EN
C90
10u
C93
22u
GND

-VDC
+5V
+2V8
+1V2
PWR_FLAG

U87
MAX1556A
VSYS
REG_3V3
R86
0R
C86
470n
C88
1000p
C91
10u
L87
3u3
C94
22u
HW_POWER_OFF_N

U88
MAX1556A
VSYS
REG_1V2
R87
0R
C87
470n
C89
1000p
C92
10u
L88
3u3
C95
22u
HW_POWER_OFF_N

U90
MAX4995
+1V2
REG_1V2
R97
10K
Current Fault_1V2
WDO_N
R99
0R
C96
1u
C101
1u
R90
45k8 1%
= 602mA limit
FIXME: DETERMINE REAL-WORLD LOAD AND MARGIN

U91
MAX4995
+3.3V
REG_3V3
R98
10K
Current Fault_3V3
WDO_N
R100
0R
C97
1u
C121
1u
R91
45k8 1%
= 602mA limit
FIXME: DETERMINE REAL-WORLD LOAD AND MARGIN

U92
MAX4995
AX5043_3V3
REG_3V3
R94
10K
PWR_FLAG_AX5043
PWR_SW_AX5043
R95
4.7k
C98
1u
C122
1u
R92
143k 1%
= 200mA limit

U93
MAX4995
SSPA_VCC
R107
10K
PWR_FLAG_SSPA
PWR_SW_SSPA
REG_5.0V
R96
4.7k
C99
1u
C100
1u
R93
45k8 1%
= 602mA limit

NOTE: LOAD SWITCHES ARE MAX +5.5V (ABS MAX +6)

HARDWARE WATCHDOG

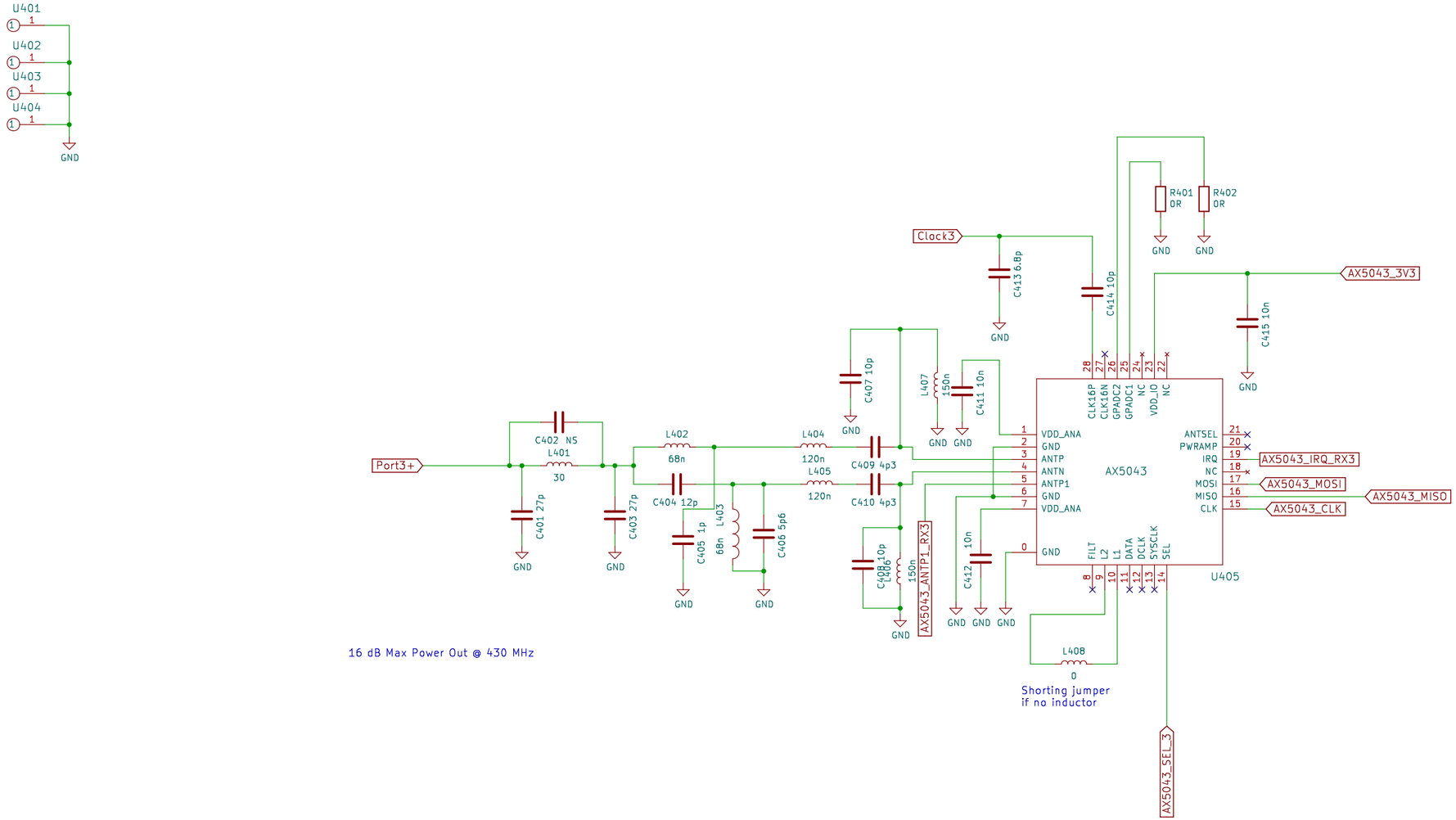
U89
STWD100NYWY3F
R89
10k
WDO_N
REG_3V3
JP86
Disable Watchdog
R88
10k
FEED_WATCHDOG

Must review this to be sure we have enough power for the board.

We are assuming battery voltage in and regulators for all voltages are included.

Start with 85

N5BRG
AMSAT-NA
Sheet:
File: power.kicad_sch
Title: Radiation Tolerant Internal Housekeeping Unit (IHU)
Size: USLedger | Date: 2023-02-16 | **Rev: A**
KiCad E.D.A. kicad 7.0.0-da2b9df05c-171-ubuntu22.04.1 | Id: 8/17



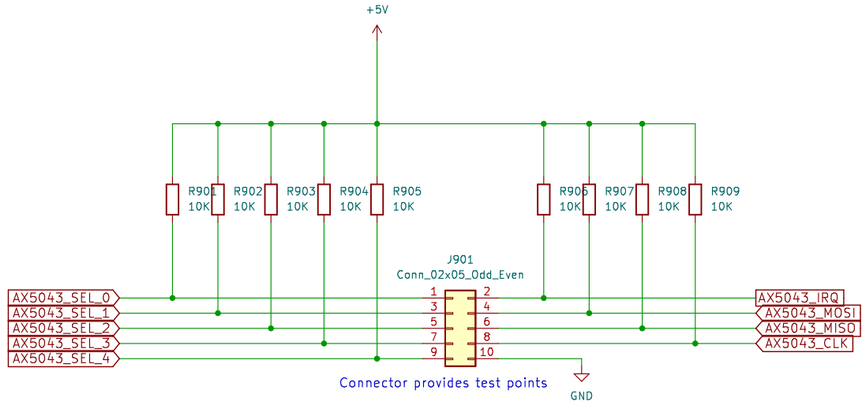
RECEIVER 3

N5BRG
AMSAT-NA

Sheet:
File: RX_3_ax5043.kicad_sch

Title: Radiation Tolerant Internal Housekeeping Unit (IHU)

Size: USLedger	Date: 2023-02-16	**Rev: A**
KiCad E.D.A. kicad 7.0.0-da2b9df05c-171-ubuntu22.04.1		Id: 9/17

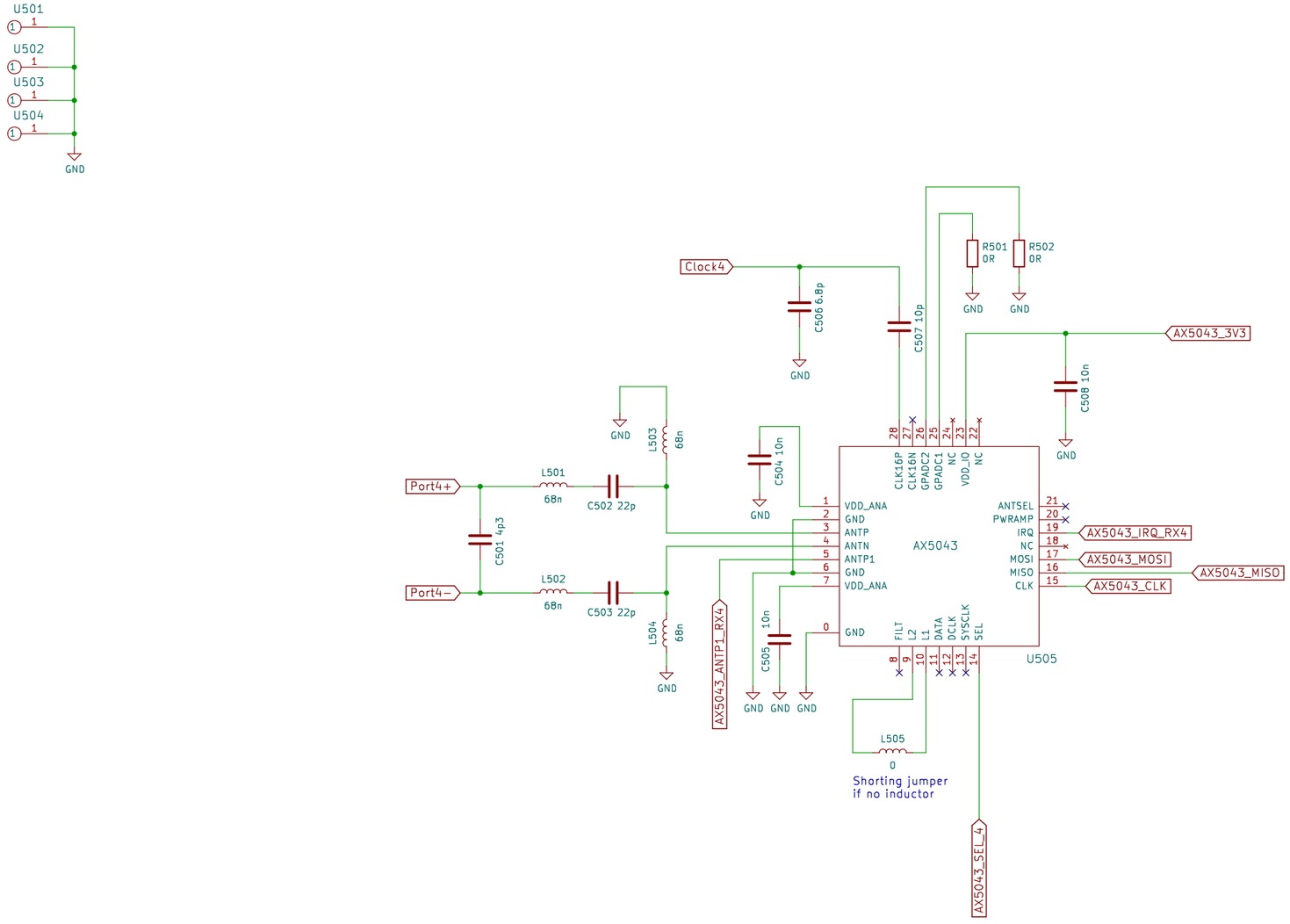


Symbol Numbers B00 up

N5BRG
AMSAT-NA
Sheet:
File: SPI_CTL.kicad_sch

Title: Radiation Tolerant Internal Housekeeping Unit (IHU)

Size: USLedger	Date: 2023-02-16	**Rev: A**
KiCad E.D.A. kicad 7.0.0-da2b9df05c-171-ubuntu22.04.1		Id: 10/17



Inductors Ref Murata LQW18AN_00 series

Symbol Numbers 500 up

RECEIVER 4

N5BRG
AMSAT-NA

Sheet:
File: RX_4_ax5043.kicad_sch

Title: Radiation Tolerant Internal Housekeeping Unit (IHU)

Size: USLedger	Date: 2023-02-16	**Rev: A**
KiCad E.D.A. kicad 7.0.0-da2b9df05c-171-ubuntu22.04.1		Id: 11/17

TMS570LS0914PGE

U2

JTAG

J2
CONN_02X05

HARDWARE REV
0 0 0 1

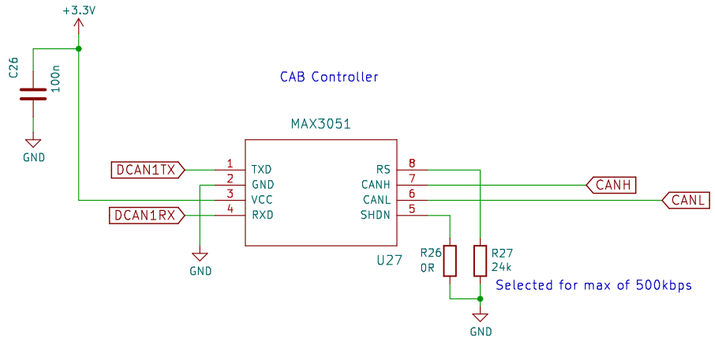
Must add USB interface

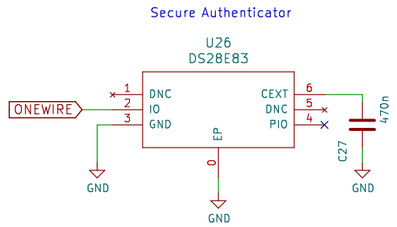
Need to review and remove things not used on this design.

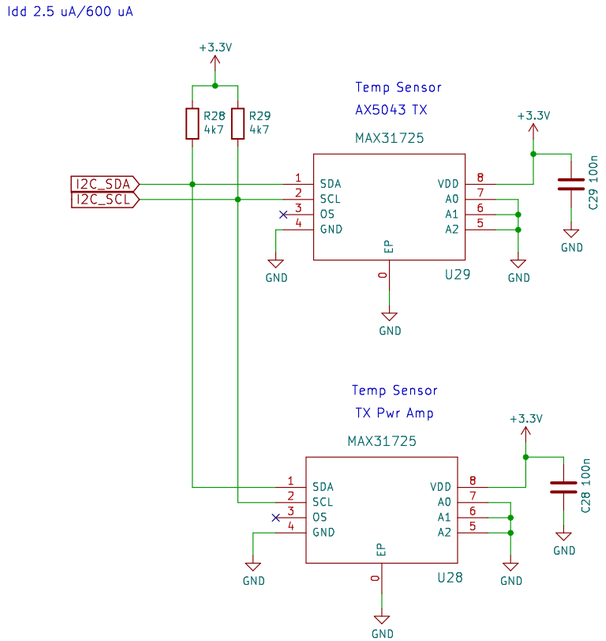
Start with 1

Z. Metzinger	
AMSAT-NA	
Sheet:	
File: tms570_cpu.kicad_sch	
Title: Radiation Tolerant Internal Housekeeping Unit (IHU)	
Size: USLedger	Date: 2019-12-23
KiCad E.D.A. kicad 7.0.0-da2b9df05c-171-ubuntu22.04.1	Id: 12/17

Rev: 1.1







N5BRG
AMSAT-NA

Sheet:
File: BUS_IO_Interface.kicad_sch

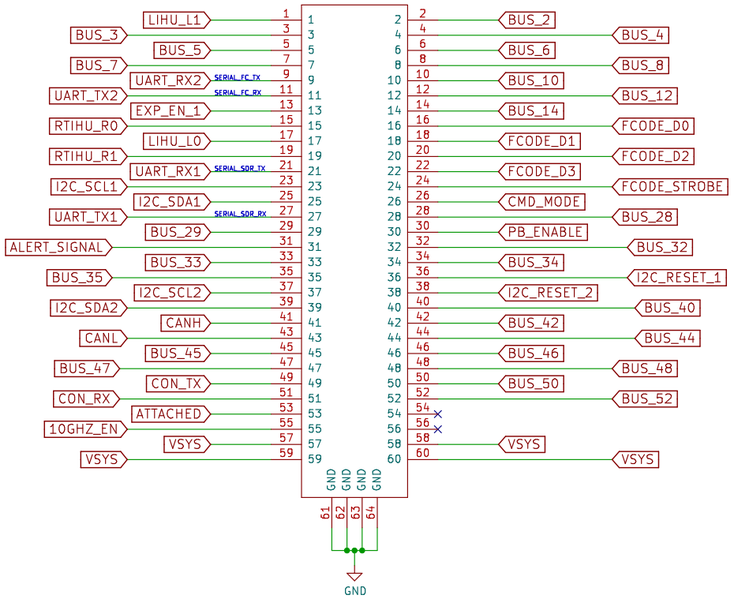
Title: Radiation Tolerant Internal Housekeeping Unit (IHU)

Size: USLedger	Date: 2023-02-20	**Rev: 1.1**
KiCad E.D.A. kicad 7.0.0-da2b9df05c-171-ubuntu22.04.1		Id: 13/17

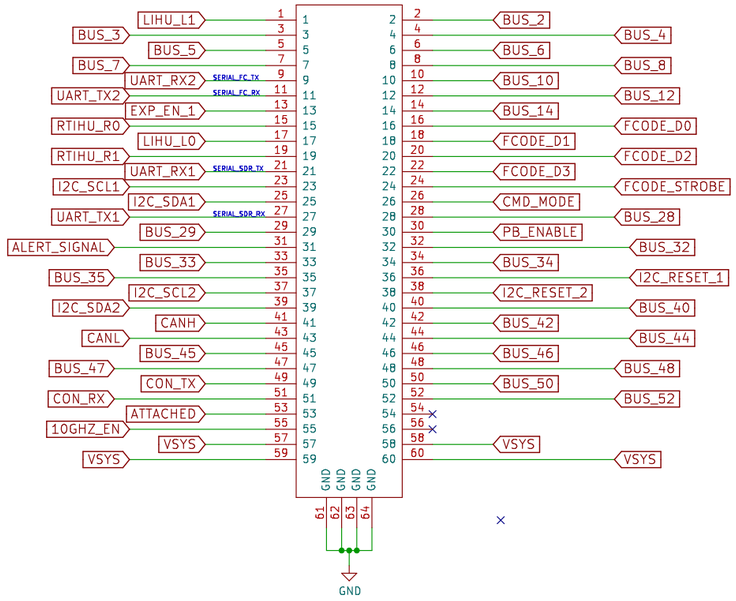
TODO: ANALOG SIGNAL CONDITIONING ON ALL I/O

These connectors may go away!

J991
QSH-030-01-L-D-A



J992
QTH-030-02-L-D-A



Samtec Q Series Connectors
QSS mates with QTS
This cinnector accomidates stacking PCBs

This connector may go away.

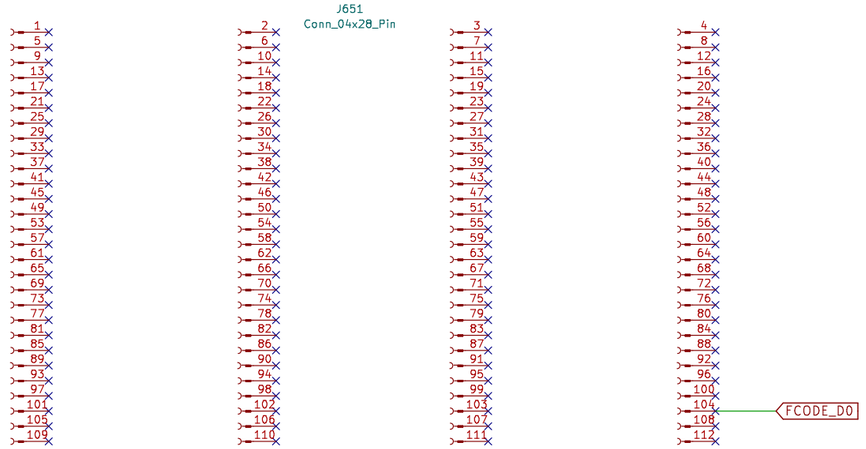
Symbol Numbers 900 up

N5BRG
AMSAT-NA

Sheet:
File: bus_io_conn.kicad_sch

Title: Radiation Tolerant Internal Housekeeping Unit (IHU)

Size: USLedger	Date: 2023-02-16	**Rev: A**
KiCad E.D.A. kicad 7.0.0-da2b9df05c-171-ubuntu22.04.1		Id: 14/17



Needs a lot of work to define all IO and put the connections on proper pins.

Samtec Q Series Connectors
QSS mates with QTS
This cinnector accomidates stacking PCBs

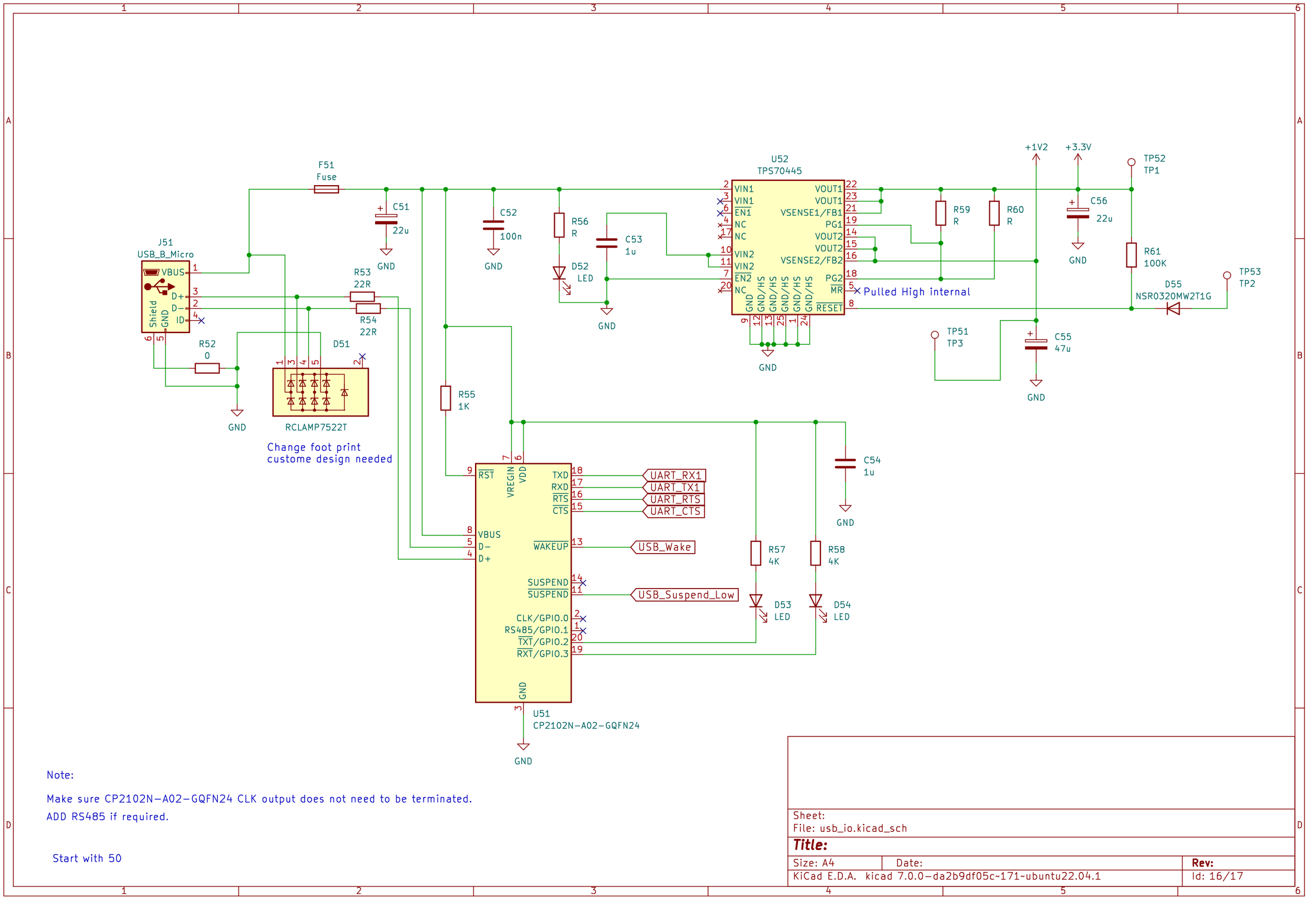
Symbol Numbers 925 up

N5BRG
AMSAT-NA

Sheet:
File: PC104_io_conn.kicad_sch

Title: Radiation Tolerant Internal Housekeeping Unit (IHU)

Size: USLedger	Date: 2023-02-16	**Rev: A**
KiCad E.D.A. kicad 7.0.0-da2b9df05c-171-ubuntu22.04.1		Id: 15/17



Note:

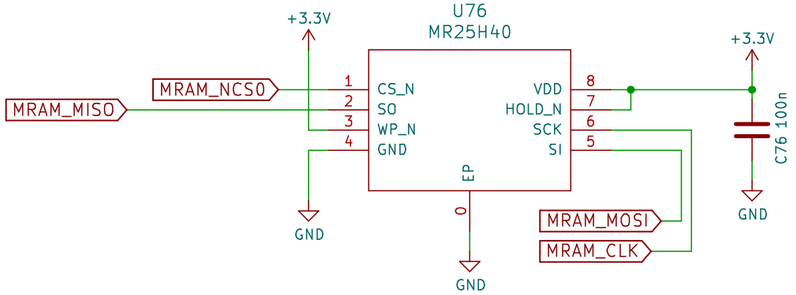
Make sure CP2102N−A02−GQFN24 CLK output does not need to be terminated.

ADD RS485 if required.

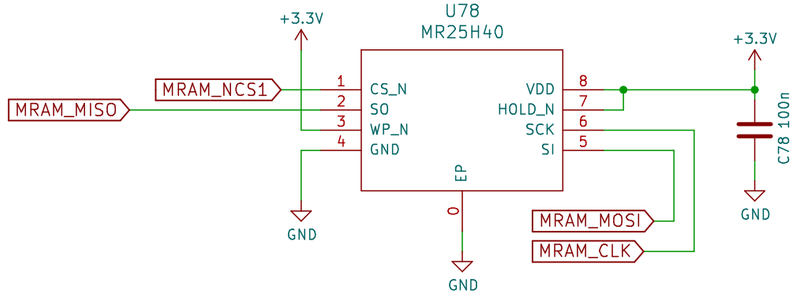
Start with 50

Sheet:		
File: usb_io.kicad_sch		
Title:		
Size: A4	Date:	**Rev:**
KiCad E.D.A. kicad 7.0.0−da2b9df05c~171~ubuntu22.04.1		Id: 16/17

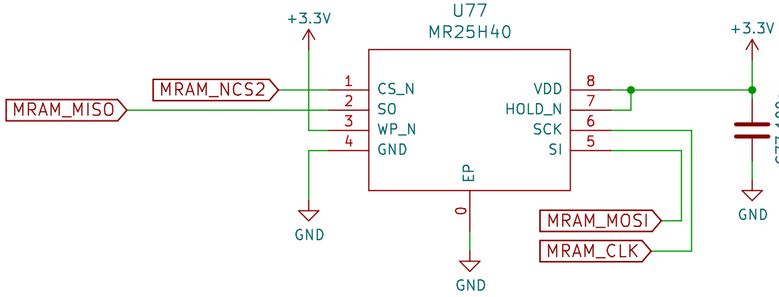
MRAM 4 Mb 512KX8



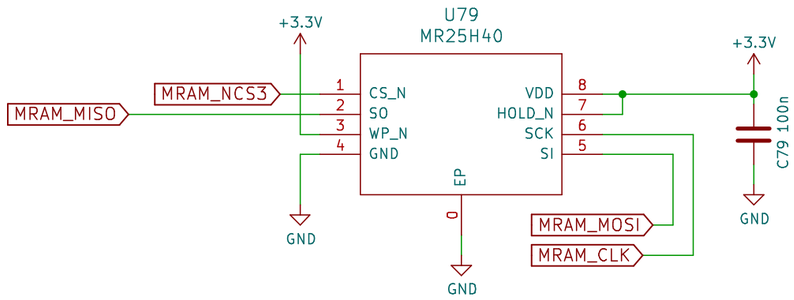
MRAM 4 Mb 512KX8



MRAM 4 Mb 512KX8



MRAM 4 Mb 512KX8



Memory Chips
400 uA standby
11 to 18.5 mA active

Start with 75

Sheet: File: memorg.kicad_sch		
Title:		
Size: A4	Date:	**Rev:**
KiCad E.D.A. kicad 7.0.0-da2b9df05c~171~ubuntu22.04.1		Id: 17/17