TMS570_CPU

1

File: tms570_cpu.kicad_sch

BUS_IO_Interface

25

File: BUS_IO_Interface.kicad_sch

Memory

75

File: memorg.kicad_sch

Need to verify the MISO on MRAM
is a Tri State output or open collector.
Data Sheet just says output. If it is not
we need to add IPO buffers for each memory
chip.

Power

85

File: power.kicad_sch

RF_Power_AMP

100

File: Power_Amp.kicad_sch

TX_ax5043

150

File: TX_ax5043.kicad_sch

RX_1_ax5044

200

File: RX_1_ax5043.kicad_sch

RX_2_ax5045

300

File: RX_2_ax5043.kicad_sch

RX_3_ax5045

400

File: RX_3_ax5043.kicad_sch

RX_4_ax5045

500

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

600

File: Power_Divider.kicad_sch

Clocks

650

File: Clocks.kicad_sch

SPI_CTL

800

File: SPI_CTL.kicad_sch

BUS_IO

900

File: bus_io_conn.kicad_sch

PC104_IO

925

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

H101
CUBESAT_MOUNT_HOLE

H102
CUBESAT_MOUNT_HOLE

H103
CUBESAT_MOUNT_HOLE

H104
CUBESAT_MOUNT_HOLE

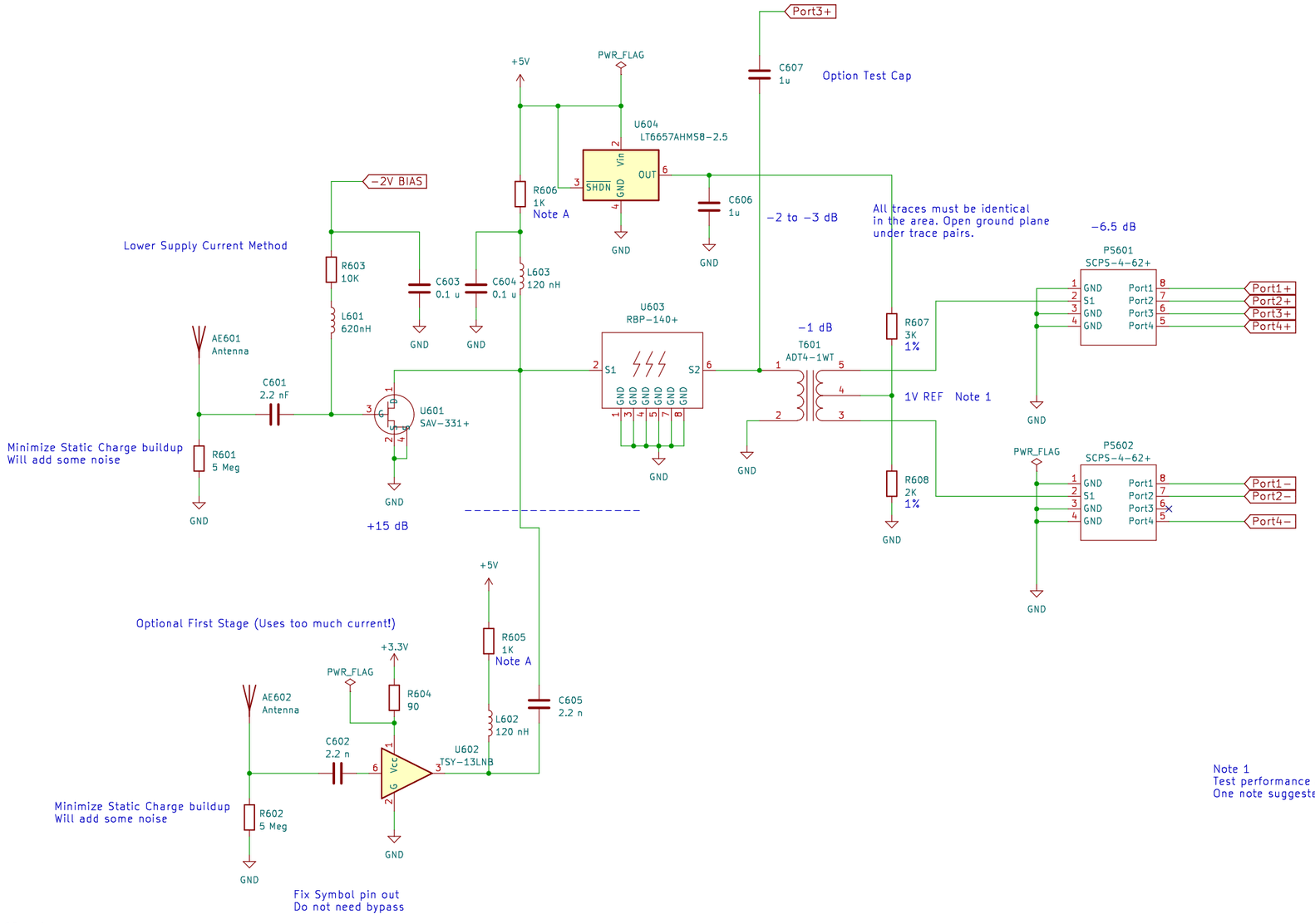
GND

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
GND
C106
2200p

Look at matching circuits may be overkill
7.4 dB

OUTPUT FILTER
PER AX5043 DS
AX5043_ANTP1
C102 4p3
100n L101
L102 43n
C103 5p6
C104 4p3
L105 4n7
C105 NS
18n L103
L104 1n2
GND

JPS-2-1W+
U107
P1
P3
P2
NC NC GND
7.4 dB
Splitter

PCB layout must
be symetic in this area

SSPA_VCC
PWR_FLAG
FB102
FerriteBead
12n
L110
1k5 R104
C114 1u
GND
FB104
FerriteBead
L112
3n9
C118 4u7
PWR_FLAG
C116 3p9
1u C108
330RR102
MMZ09312BT1
VBA1
VBIAS
RFIN
VBA2
VCC1
GND
VCC2
RFOUT
RFOUT
GND
GND
PDET
U109
1n2
L108
18n L106
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
Combine
33 dB
2 W
U111
SXBP-425+
IN
OUT
GND
U112
SMA

28 dB

SSPA_VCC
PWR_FLAG
FB101
FerriteBead
12n
L109
1k5 R103
C113 1u
PWR_FLAG
3n9
L111
FB103
FerriteBead
C117 4u7
1u C107
330RR101
MMZ09312BT1
U108
1n2
L107
18n L105
C109 100p
GNDGND
C111 470p
0R R105
SSPA_PDET_2
L113 12n
C119 10p
RF AMPLIFIER
INPUT MATCH

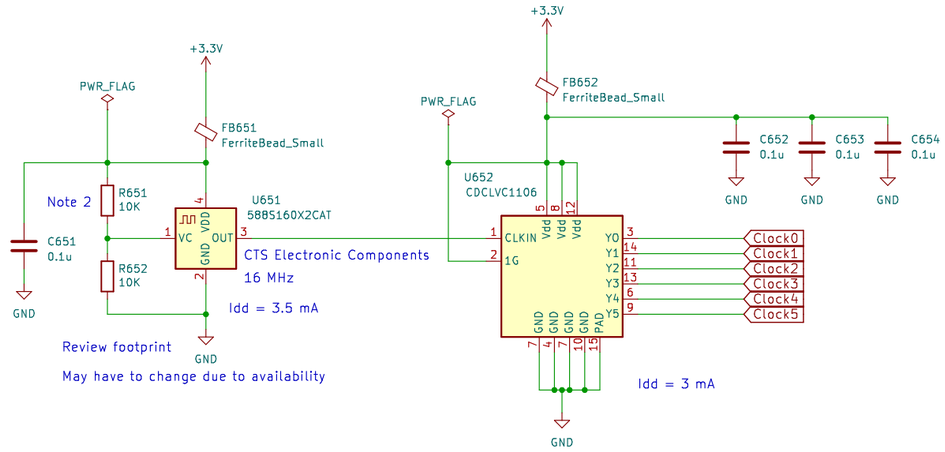
RF Shield over these parts.

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.

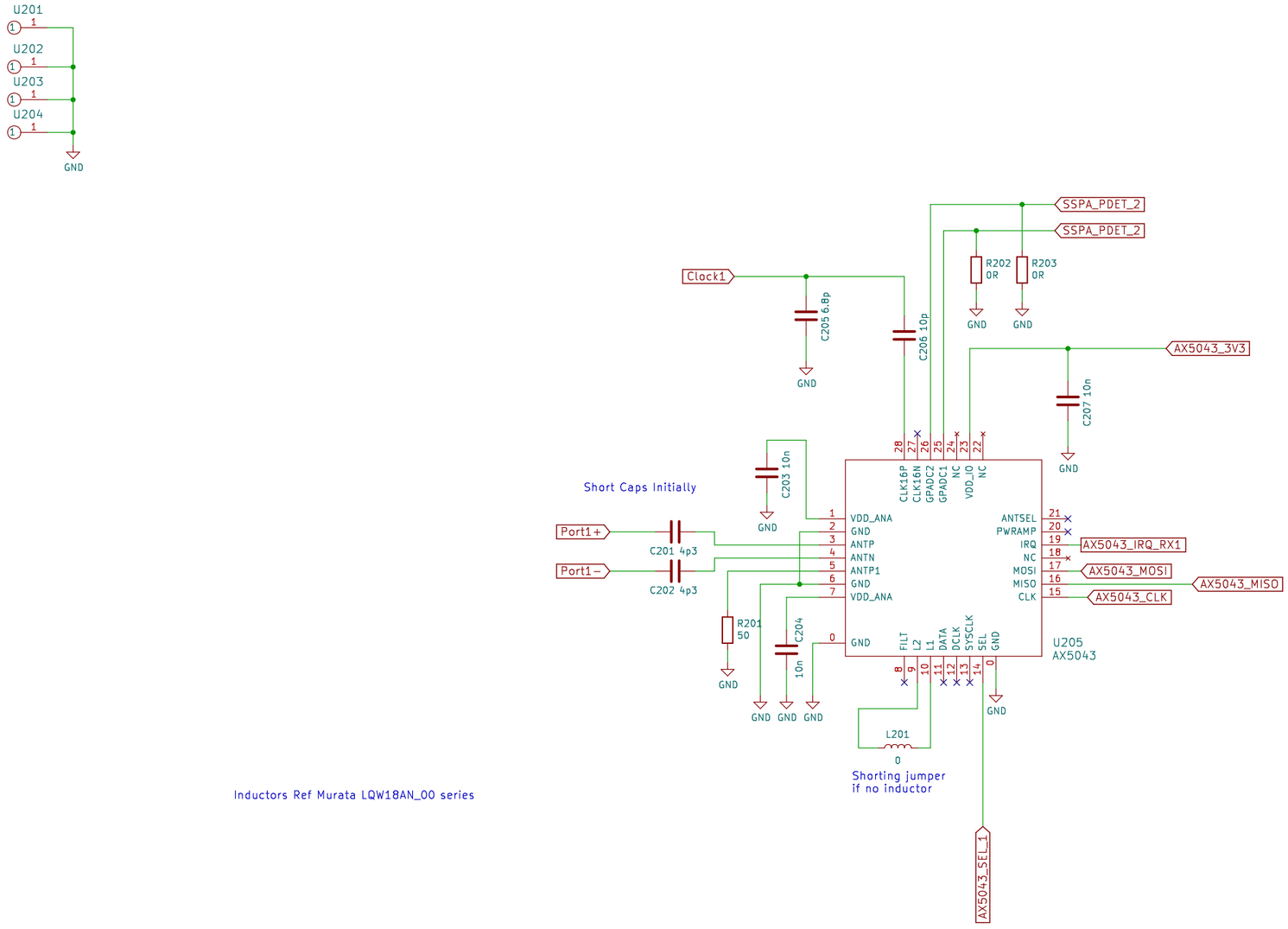
Symbol Numbers 650 up

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



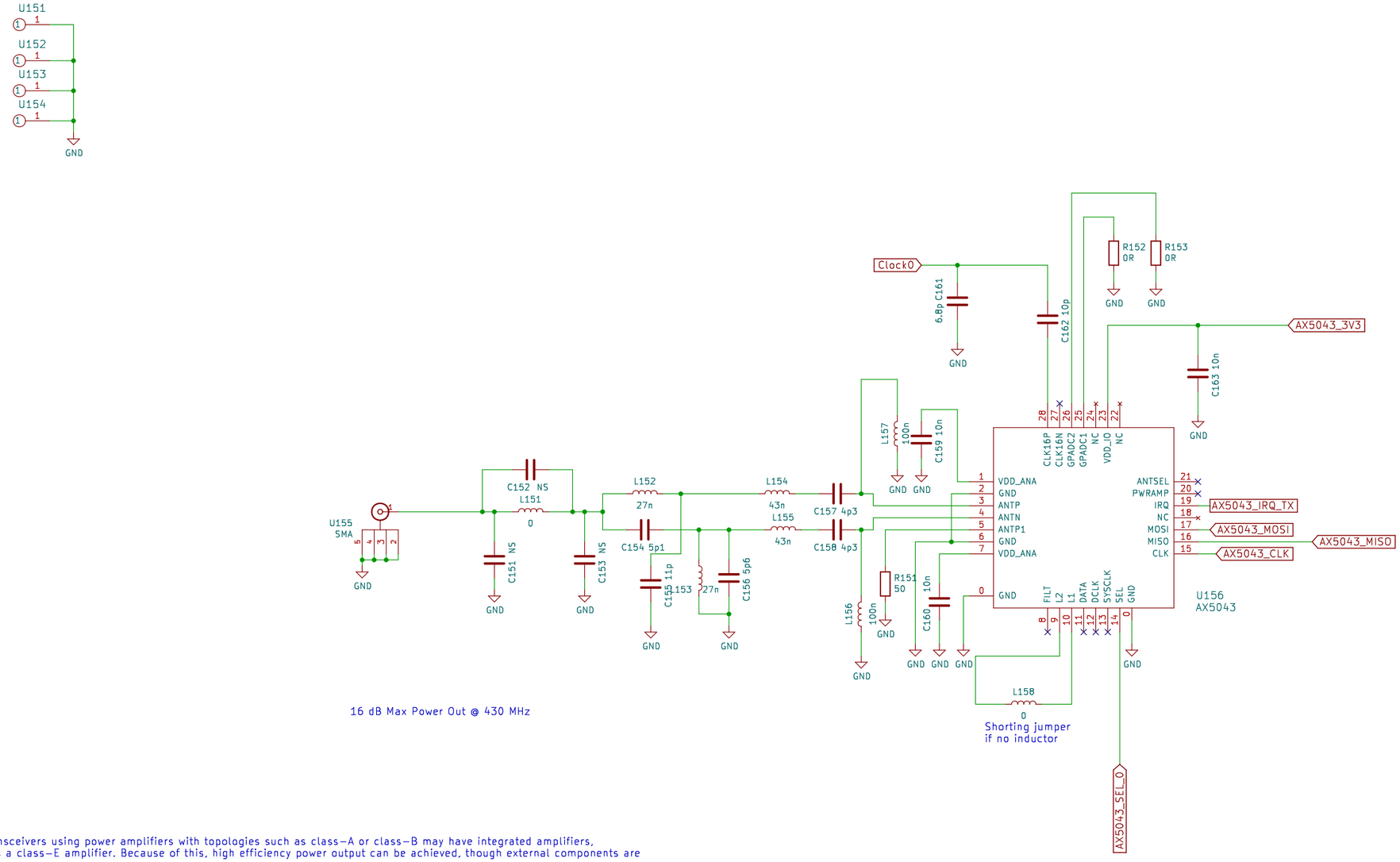
RECEIVER 1

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



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

TRANSMITTER

N5BRG

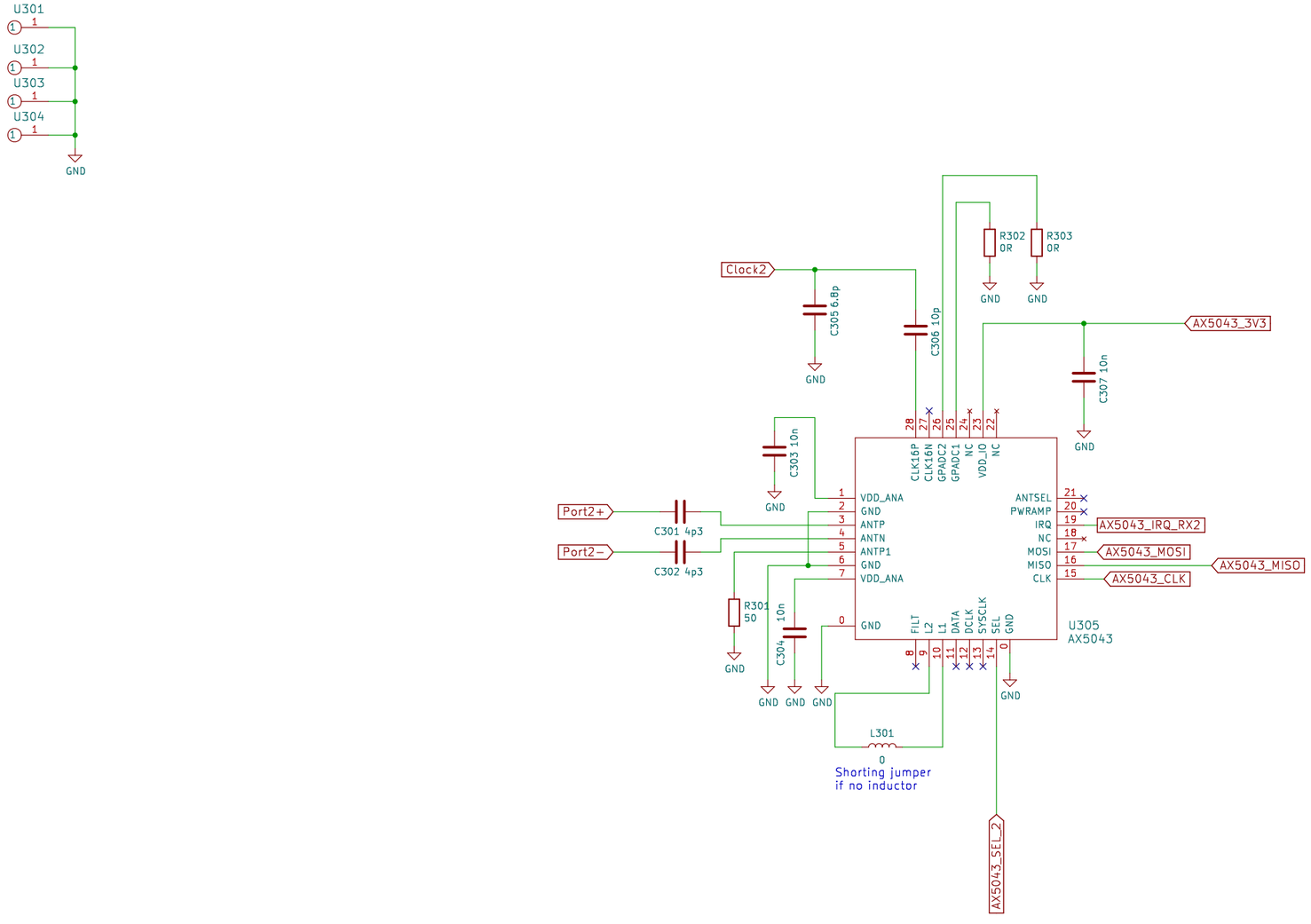
AMSAT−NA

Sheet:

File: TX_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: 6/17



Inductors Ref Murata LQW18AN_00 series

Symbol Numbers 300 up

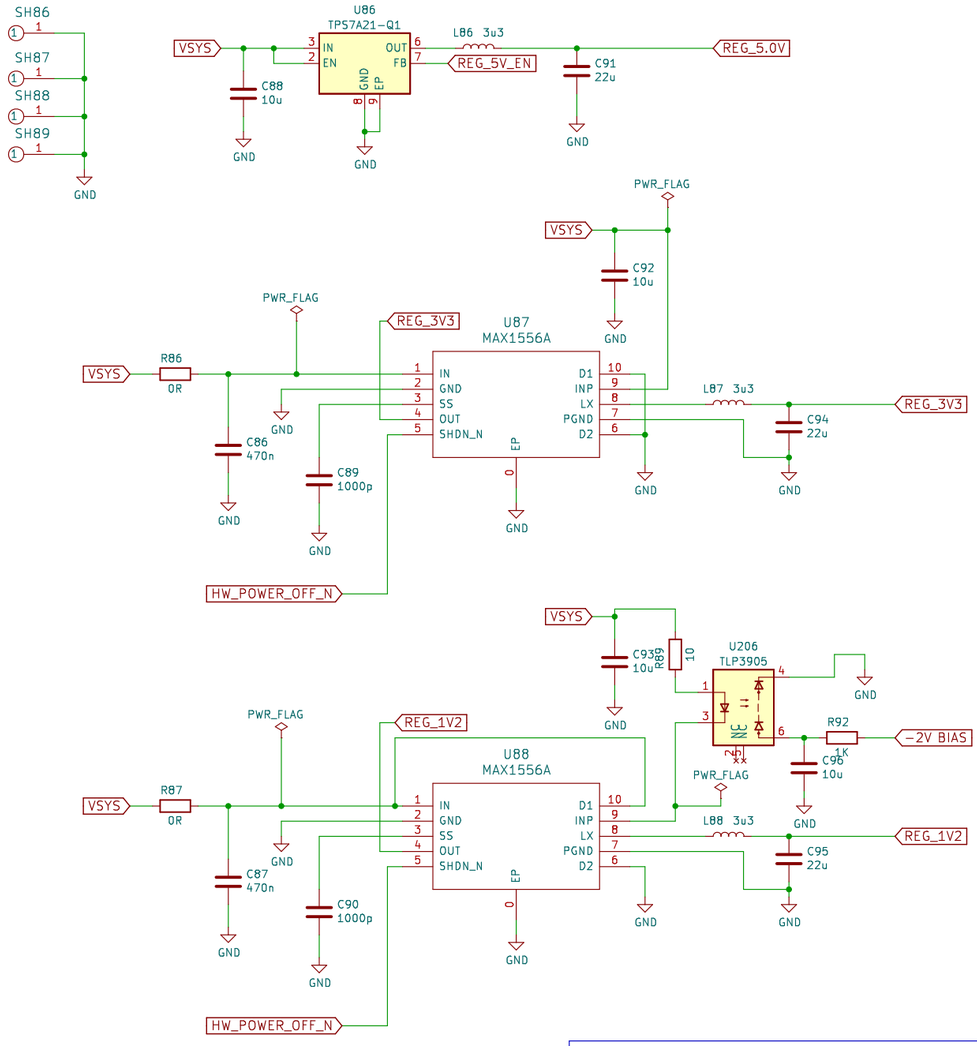
RECEIVER 2

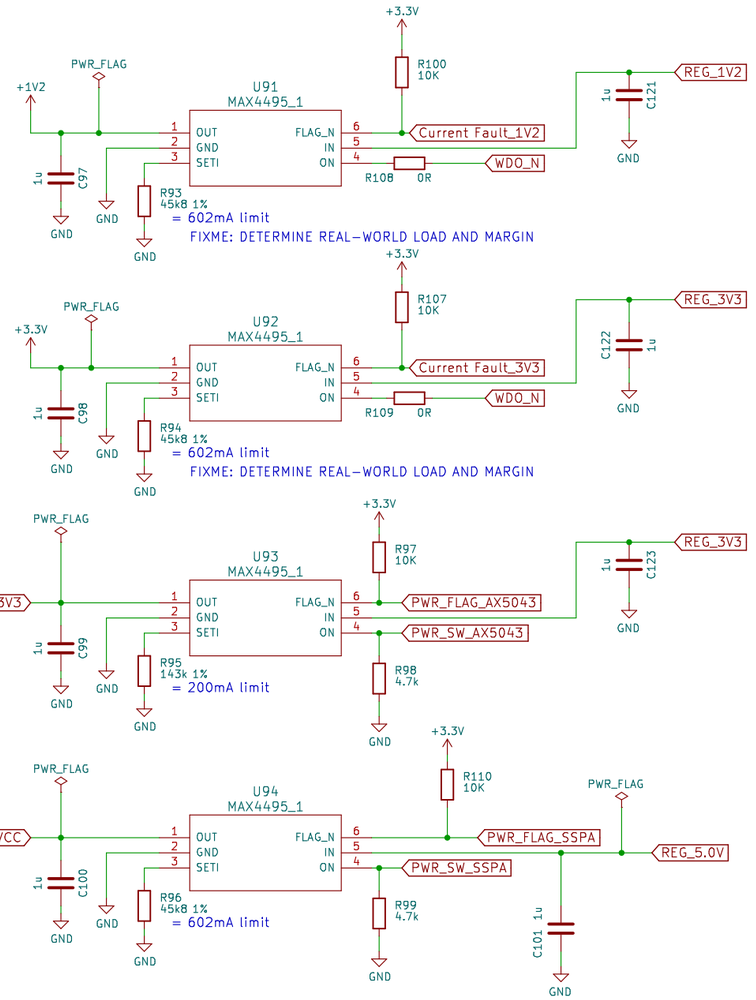
N5BRG
AMSAT-NA

Sheet:
File: RX_2_ax5043.kicad_sch

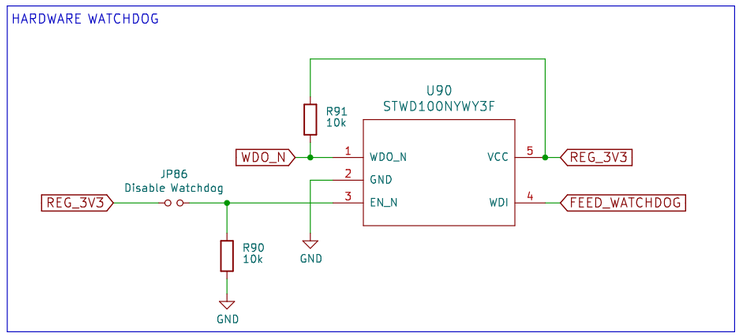
Title: Radiation Tolerant Internal Housekeeping Unit (IHU)

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





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



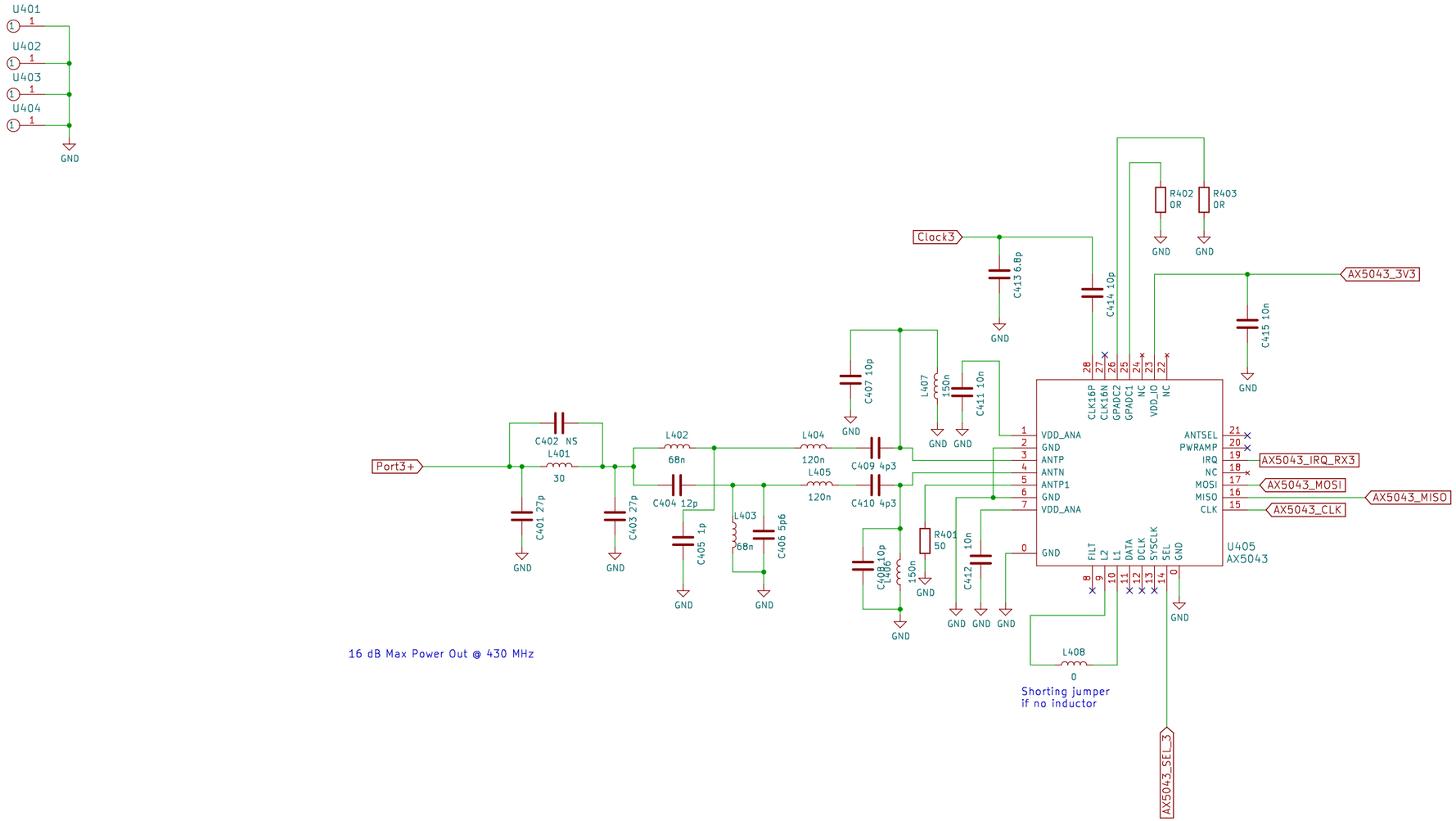
Must review this to be sure we have enough power for the board.

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
KiCad E.D.A. kicad 7.0.0−da2b9df05c−171−ubuntu22.04.1	**Rev: A**
	Id: 8/17



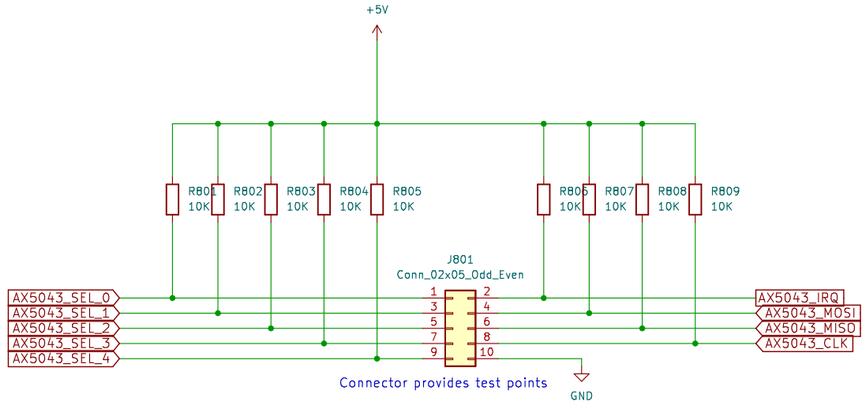
RECEIVER 3

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

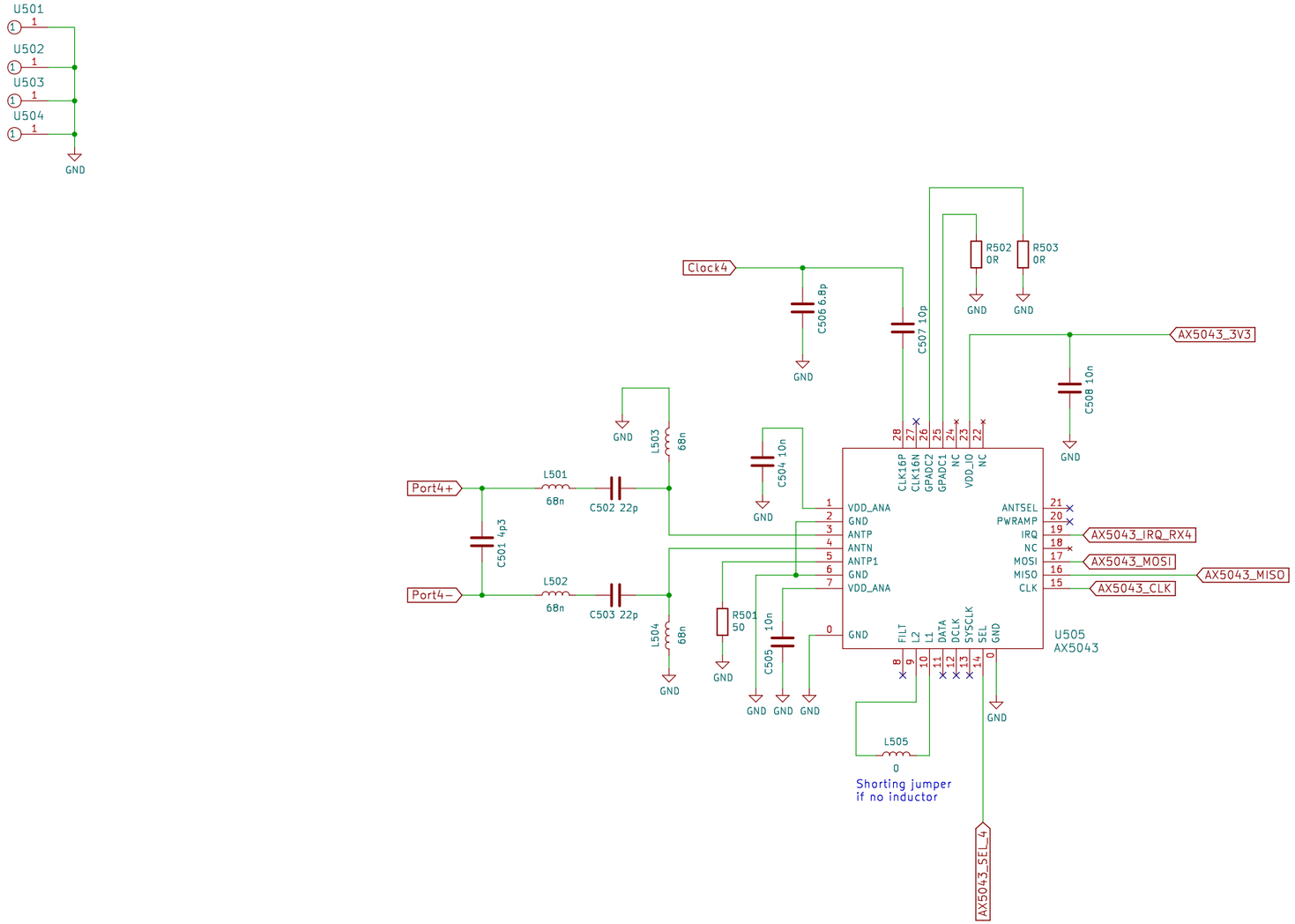


Symbol Numbers B00 up

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



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

PacSatDev_samtec:FTSH-105-01-L-DV-K

JTAG

J2
CONN_02X05

TMS570LS0914PGE

U2

HARDWARE REV
0 0 0 1

Must add USB interface

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

Start with 1

USB_Development_IO

File: usb_development_io.kicad_sch

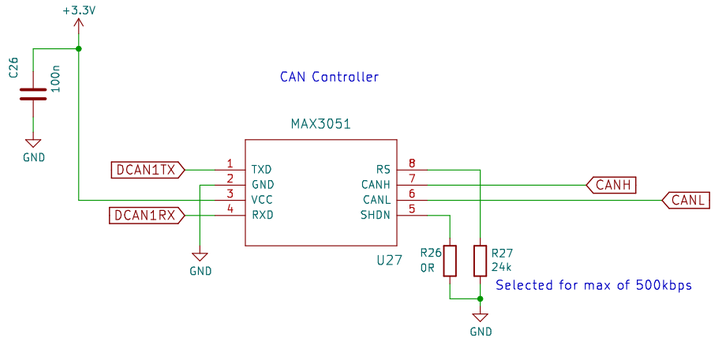
KELVIN GND
Address in
Layout

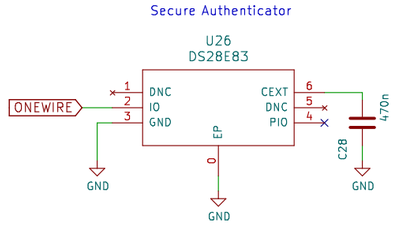
Consider Using this OSC out.

Z. Metzinger
AMSAT-NA
Sheet:
File: tms570_cpu.kicad_sch

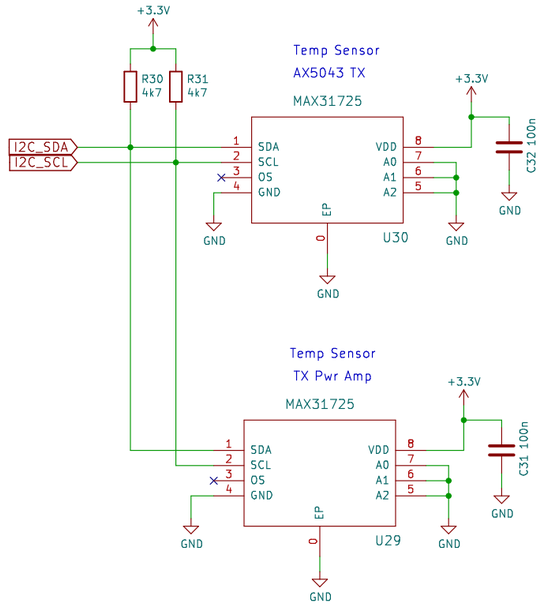
Title: Radiation Tolerant Internal Housekeeping Unit (IHU)

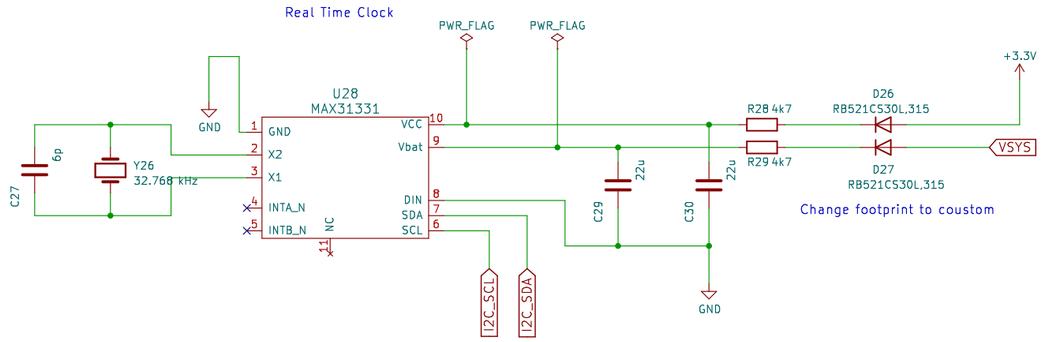
Size: USLedger	Date: 2019-12-23	**Rev: 1.1**
KiCad E.D.A. kicad 7.0.0-da2b9df05c-171-ubuntu22.04.1		Id: 12/17





Idd 2.5 uA/600 uA





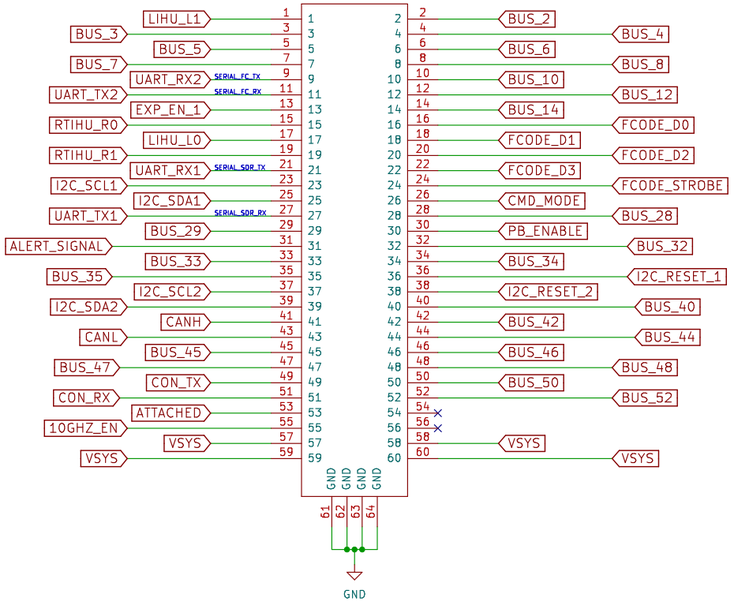
Start with 25

N5BRG	
AMSAT-NA	
Sheet:	
File: BUS_IO_Interface.kicad_sch	
Title: Radiation Tolerant Internal Housekeeping Unit (IHU)	
Size: USLedger	Date: 2023-02-20
KiCad E.D.A. kicad 7.0.0-da2b9df05c-171-ubuntu22.04.1	Id: 13/17

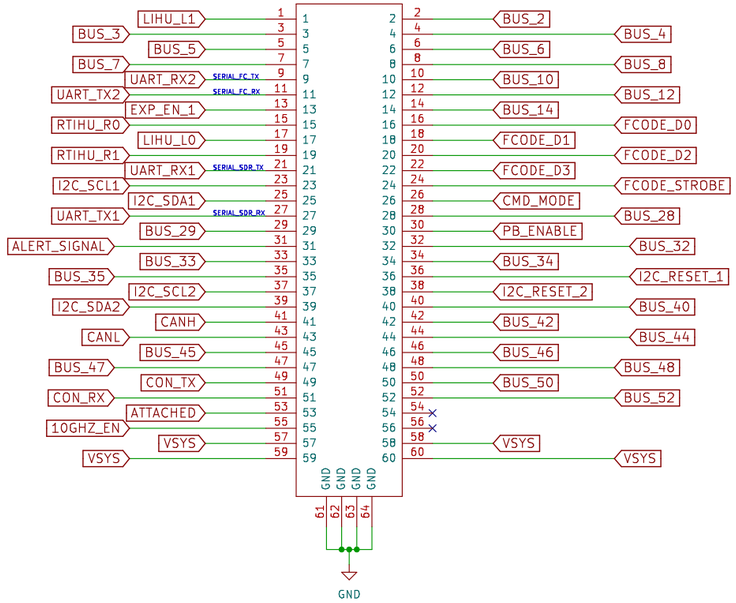
TODO: ANALOG SIGNAL CONDITIONING ON ALL I/O

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.

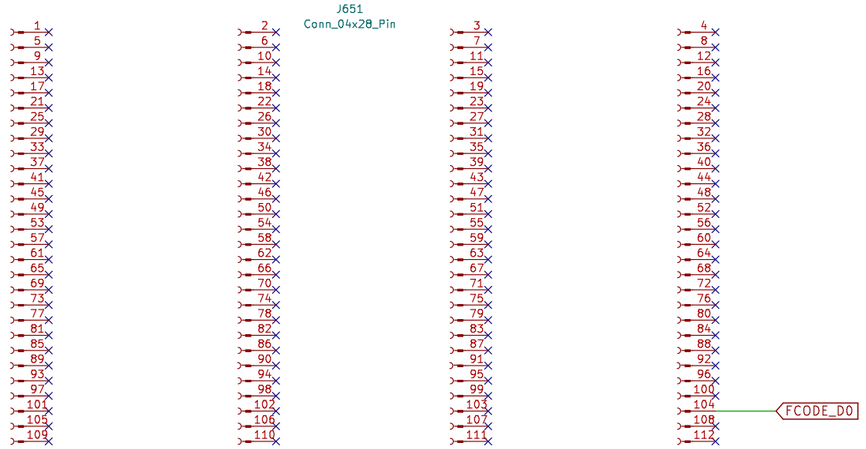
Symbol Numbers 900 up

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

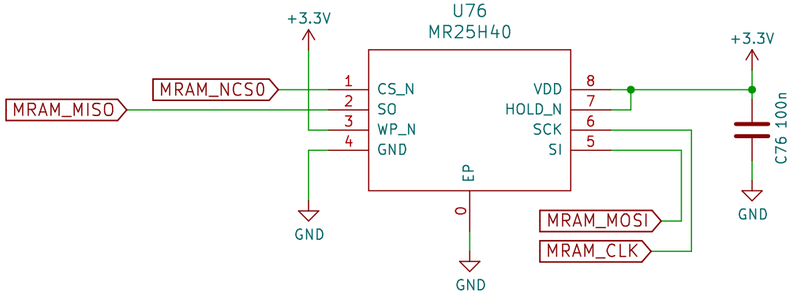
N5BRG
AMSAT-NA

Sheet:
File: PC104_io_conn.kicad_sch

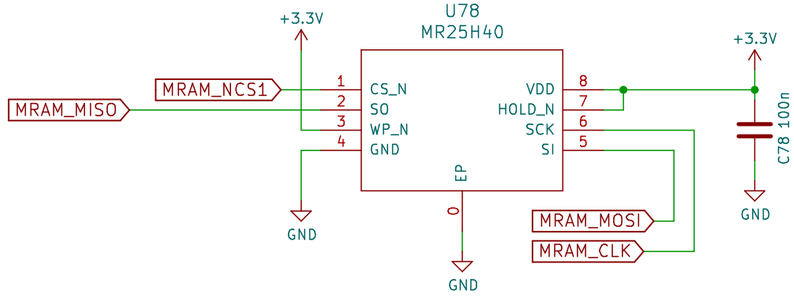
Title: Radiation Tolerant Internal Housekeeping Unit (IHU)

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

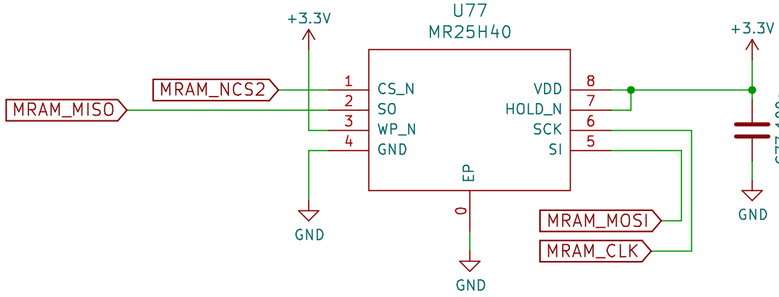
MRAM 4 Mb 512KX8



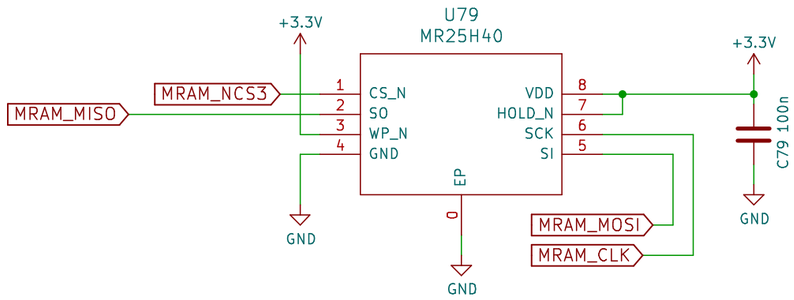
MRAM 4 Mb 512KX8



MRAM 4 Mb 512KX8



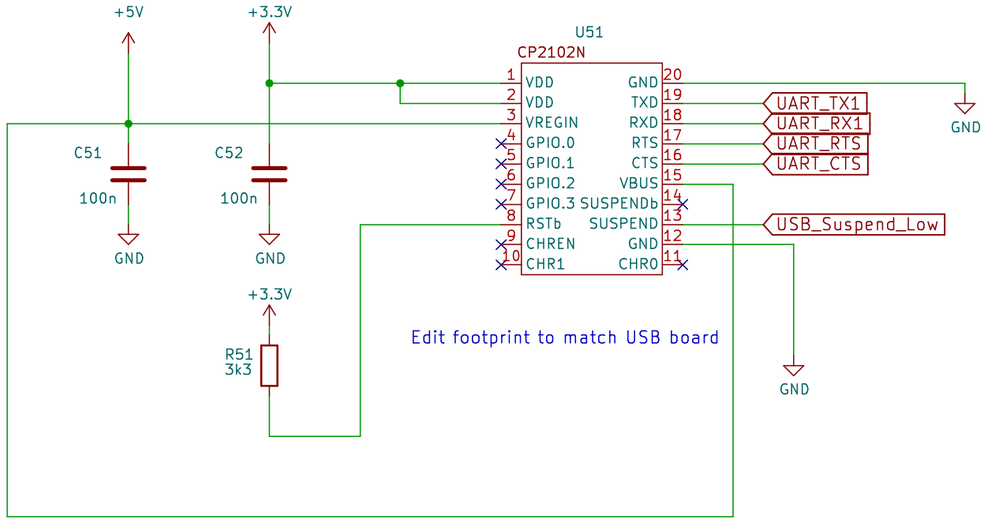
MRAM 4 Mb 512KX8



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



No Battey Charging Implimented

No remote USB wake implimented

Start with 50

Sheet: File: usb_development_io.kicad_sch		
Title:		
Size: A4	Date:	**Rev:**
KiCad E.D.A. kicad 7.0.0-da2b9df05c~171~ubuntu22.04.1		Id: 18/17