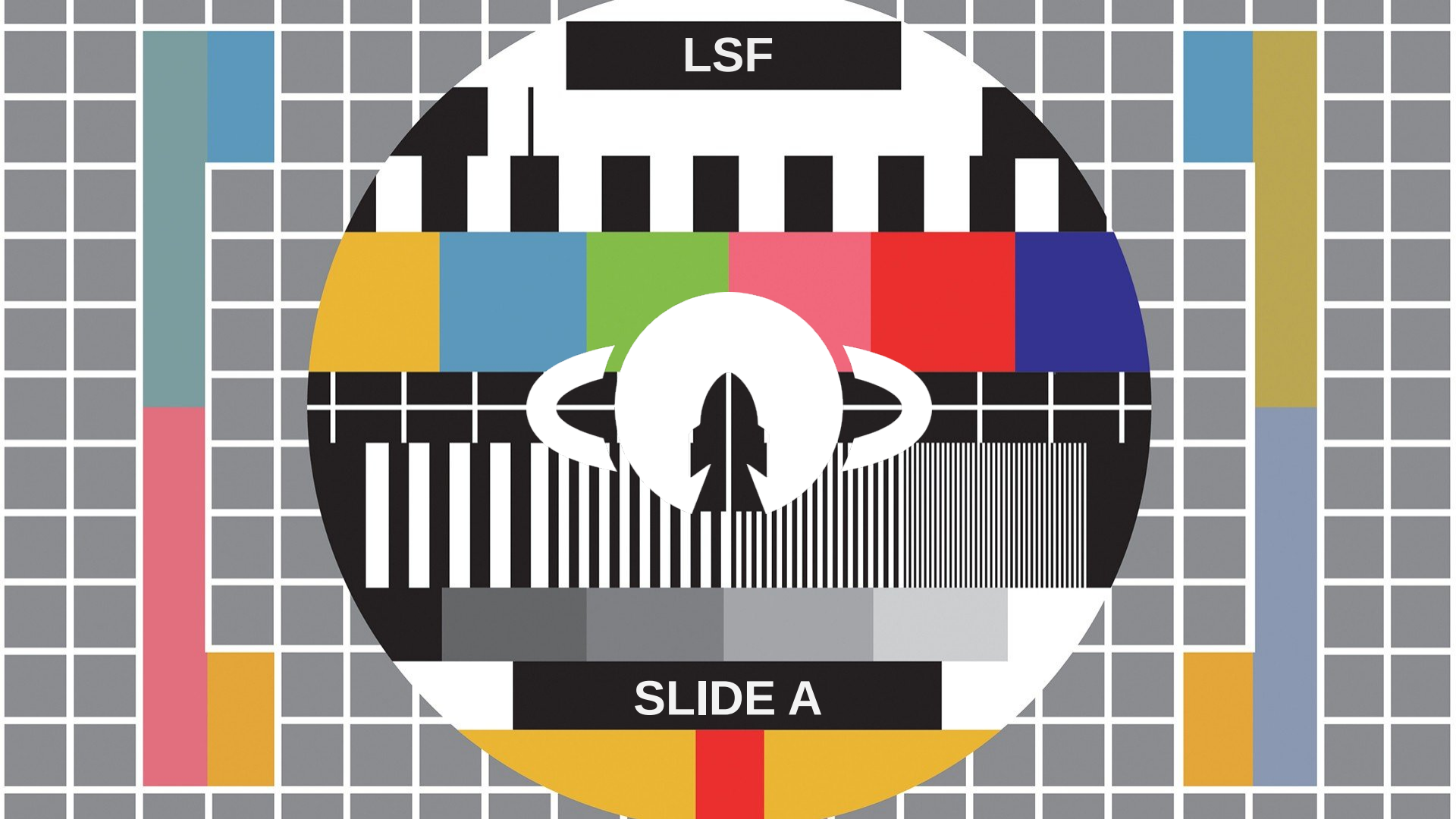
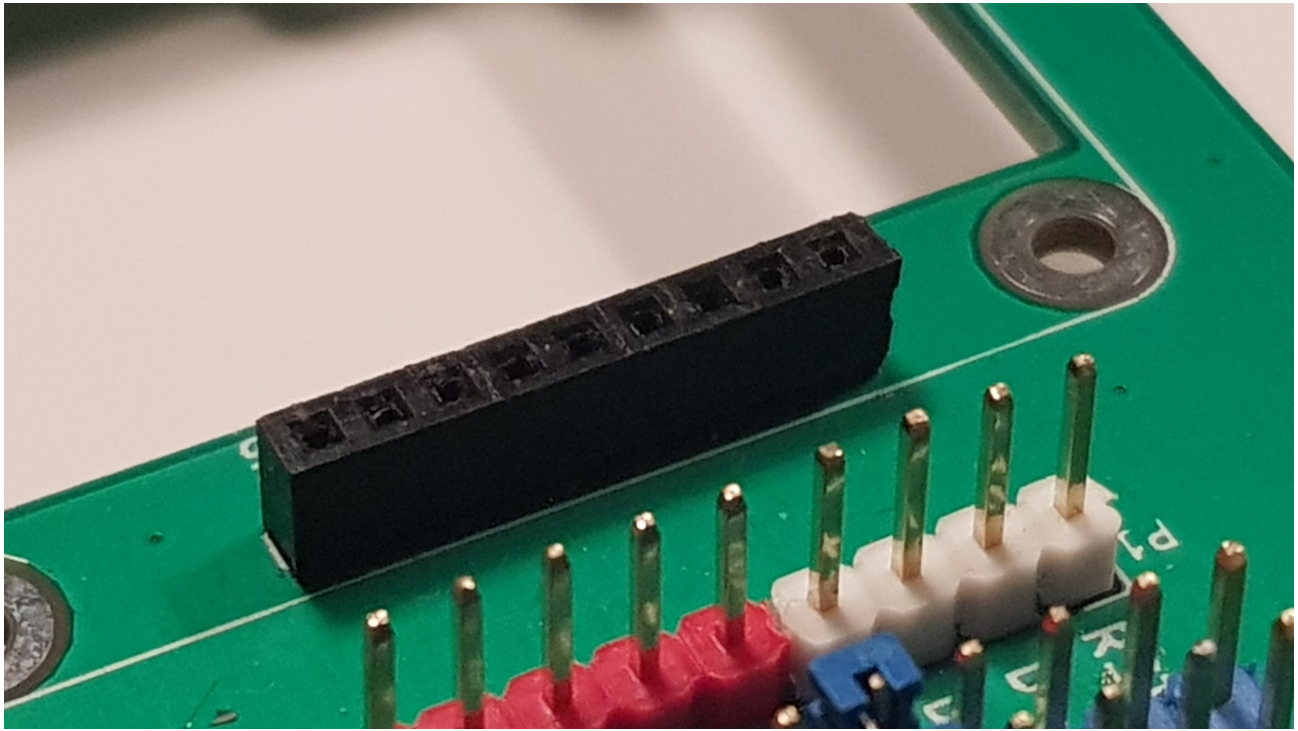
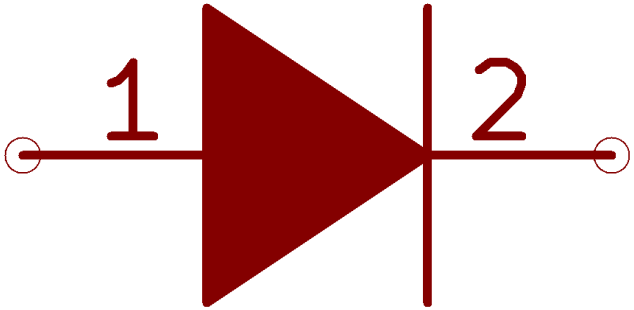
LSF
SLIDE 1


LSF
SLIDE A

Open source hardware and software PocketQube family of satellite modules

Ilias Daradimos - Lead Systems Engineer
Libre Space Foundation




1
2

CAN

UPSat

The first open source satellite

EPS, OBC, COMMS, ADCS and Structure

Deployed on May 2017 from ISS

Part of the QB50 flock

Currently in orbit

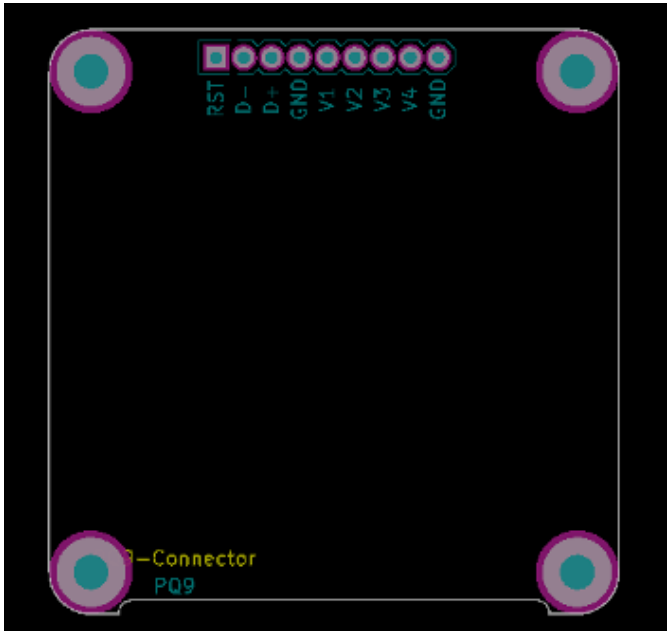
Intermittent operation due to power-safe mode

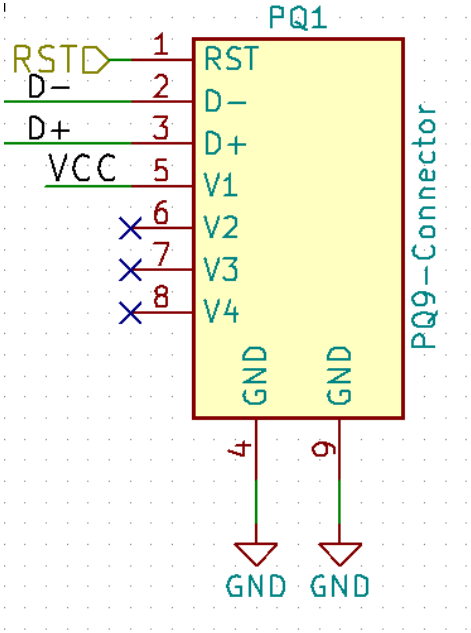
PocketQube

Let’s bring open source in PQ Ecosystem

PQ9

PQ9





https://gitlab.com/librespacefoundation/lsf-kicad-lib

PQ9

PQ9-ish

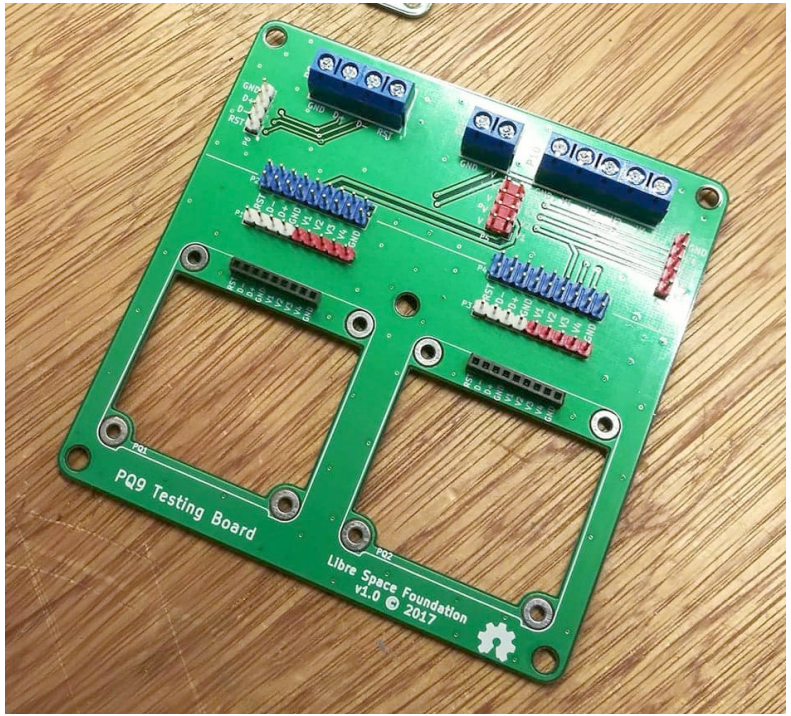
Because we CAN ;)

Dev Board

Two PQ9 board stacks

Configurable power source

Coupling among board stacks



https://gitlab.com/librespacefoundation/pq9ish/

PocketQube COMMS

Combined COMMS/OBC module

SD Data logging

UHF Transceiver GFSK 9600 Reconfigurable with PA

RTC

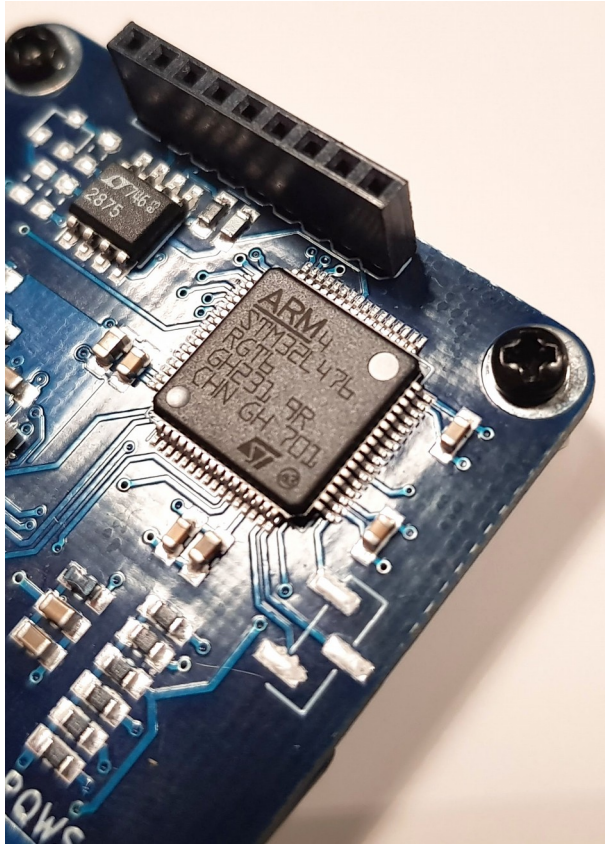
Designed around STM32L476RGT

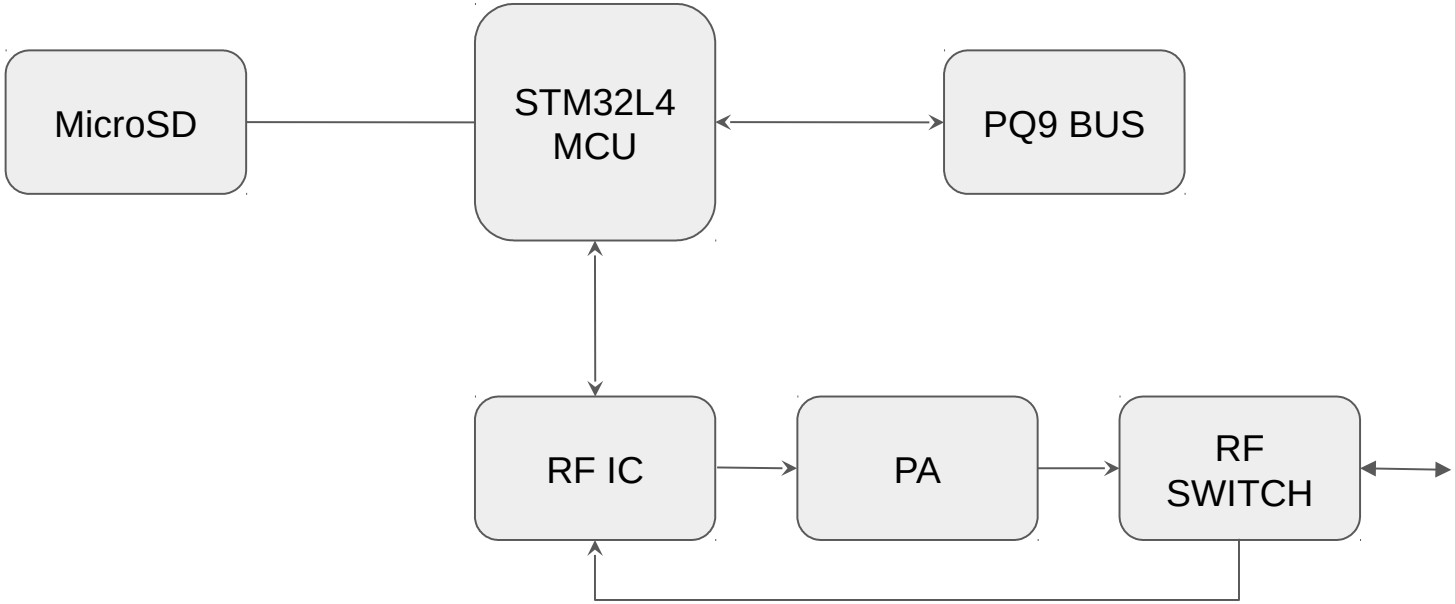
STM32 proven in space (UPSat and various other missions)

CAN bus:

- 3 transmit mailboxes
- 2 receive FIFOs with 3 stages
- 14 scalable filter banks

FreeRTOS + HAL

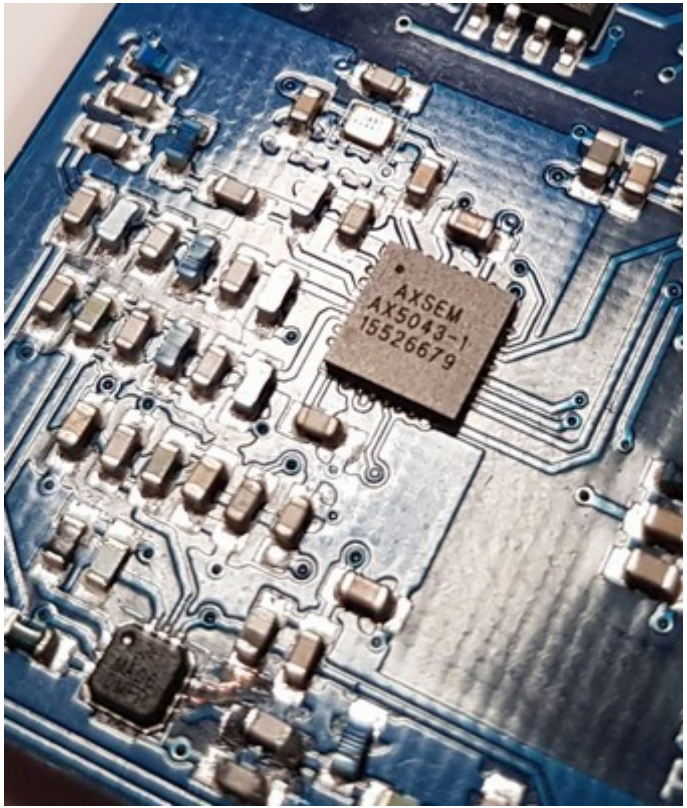




System Blocks

AX5043 Transceiver

- 27 MHz −1050 MHz Bands
- FSK, 4−FSK, GFSK
- MSK, GMSK
- ASK
- AFSK
- FM
- PSK
- Data Rates from 0.1 kbps to 125 kbps
- Optional Forward Error Correction (FEC)
- 16 dBm Power Level in 0.5 dB Steps



CAN bus

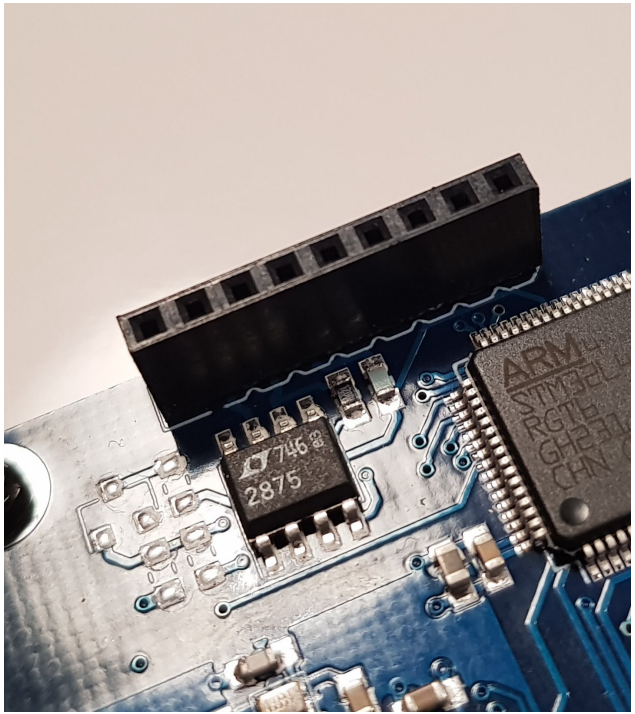
Added both options for testing

Single line CAN bus allows dual CAN bus operation

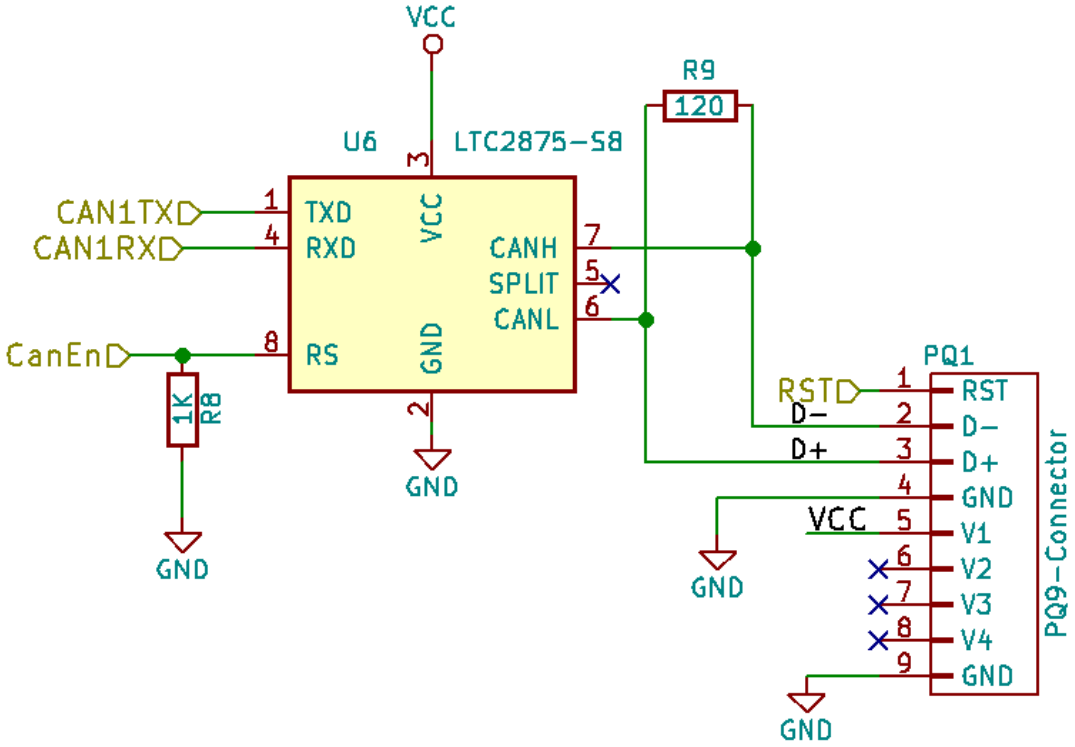
Bus speed up to 1Mbps (UART 204kbps)

Multiple application layer options

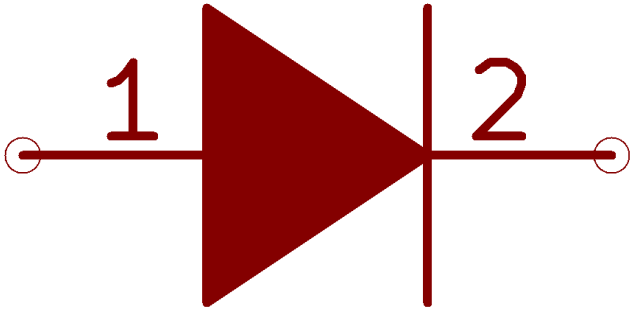
- UAVCAN best candidate due to developed ecosystem
- Open libraries using STM32 HAL



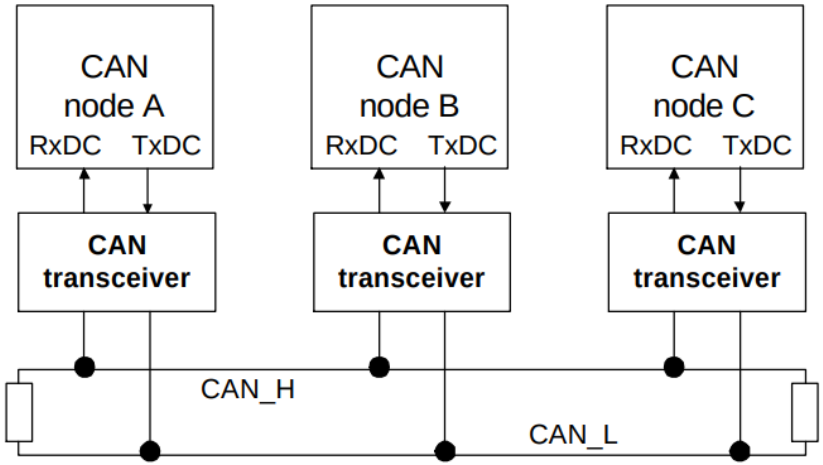
CAN bus connection

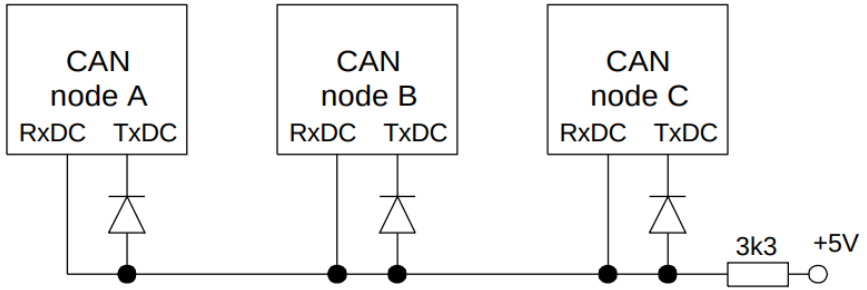


Transceiverless CAN



Transceiverless CAN

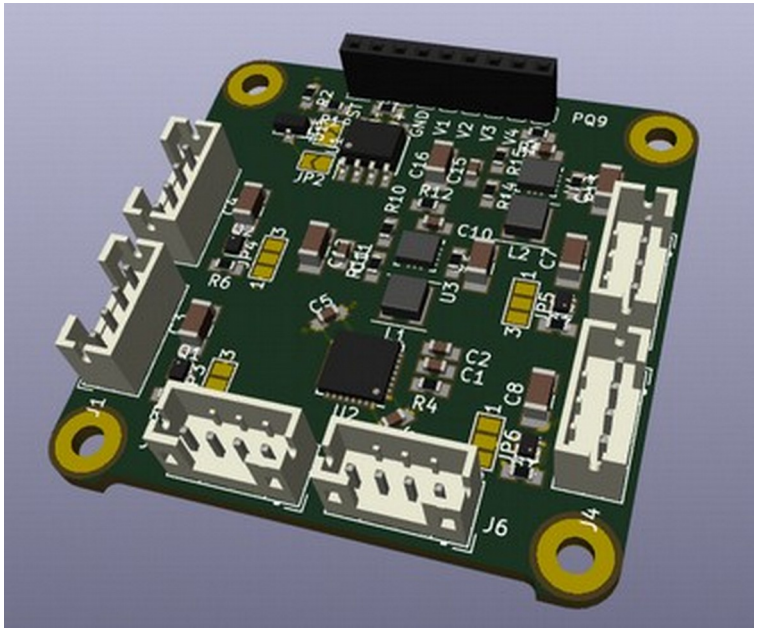




Siemens AP2921
Author : Dr. Jens Barrenscheen

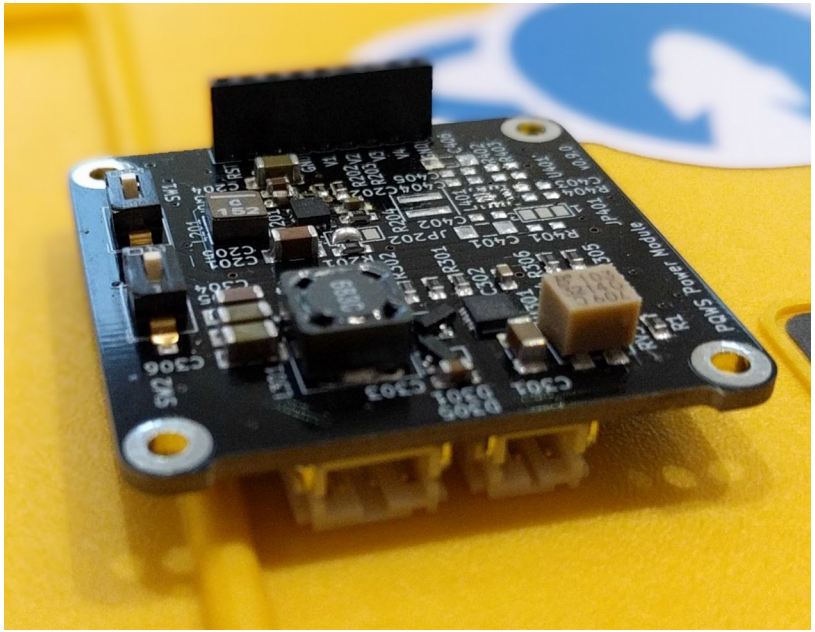
Generic sensor module

- I2C
- UART
- 2 Controlable Power lines
- 2 PWM power lines
- 8 (4 differential) ADC channels
- 3.3V Buck/Boost DC/DC converter
- Secondary Buck/Boost DC/DC converter



DummyPS

- Testing PQ9ISH modules
- No Logic or MCU
- Solar MPPT batery charger
- 2 DC/DC buck/boost converters
- Powers V1 & V4 from DC/DC or VBat/VSolar



pqws-main-sw

PQWS - PocketQube format COMMS/OBC Software

SSH | git@gitlab.com:librespacefounda

GPL Free Software

Free as in Freedom

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pqws-main-hw

PQWS - PocketQube format COMMS/OBC Hardware

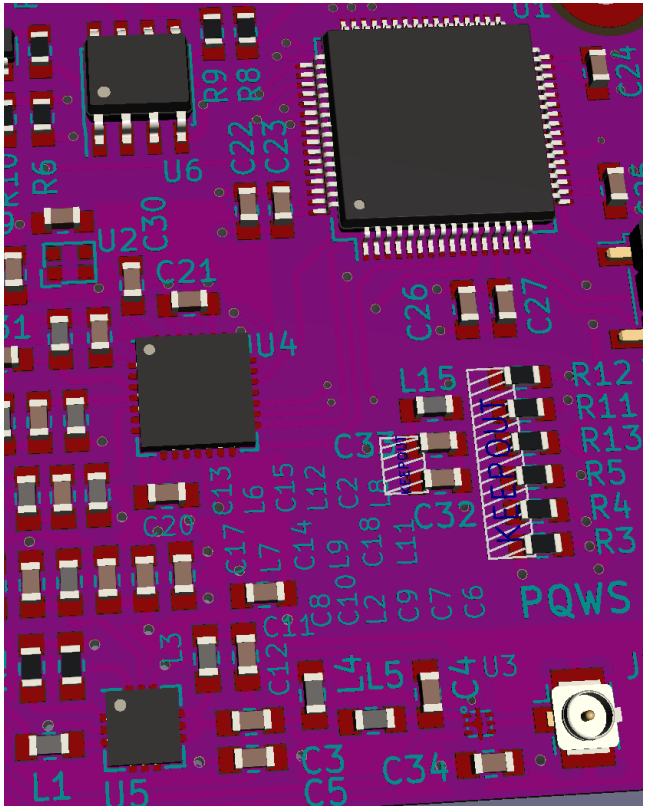
SSH | git@gitlab.com:librespacefounda

open source hardware

CERN Open Hardware License

What’s next

- Move to COMMS version 1.0
  - Expose more STM32 connectivity
  - Reduce RF components
  - Add RF shield
- Verify and Test
  - Vacuum and thermal testing
  - High-altitude balloon and rocket flights
  - Fly to space on a mission



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