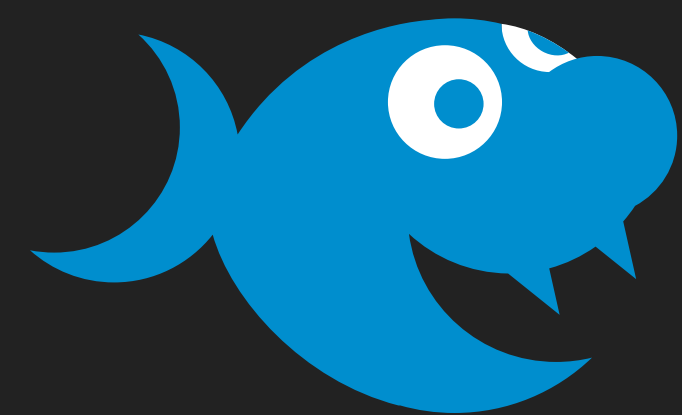
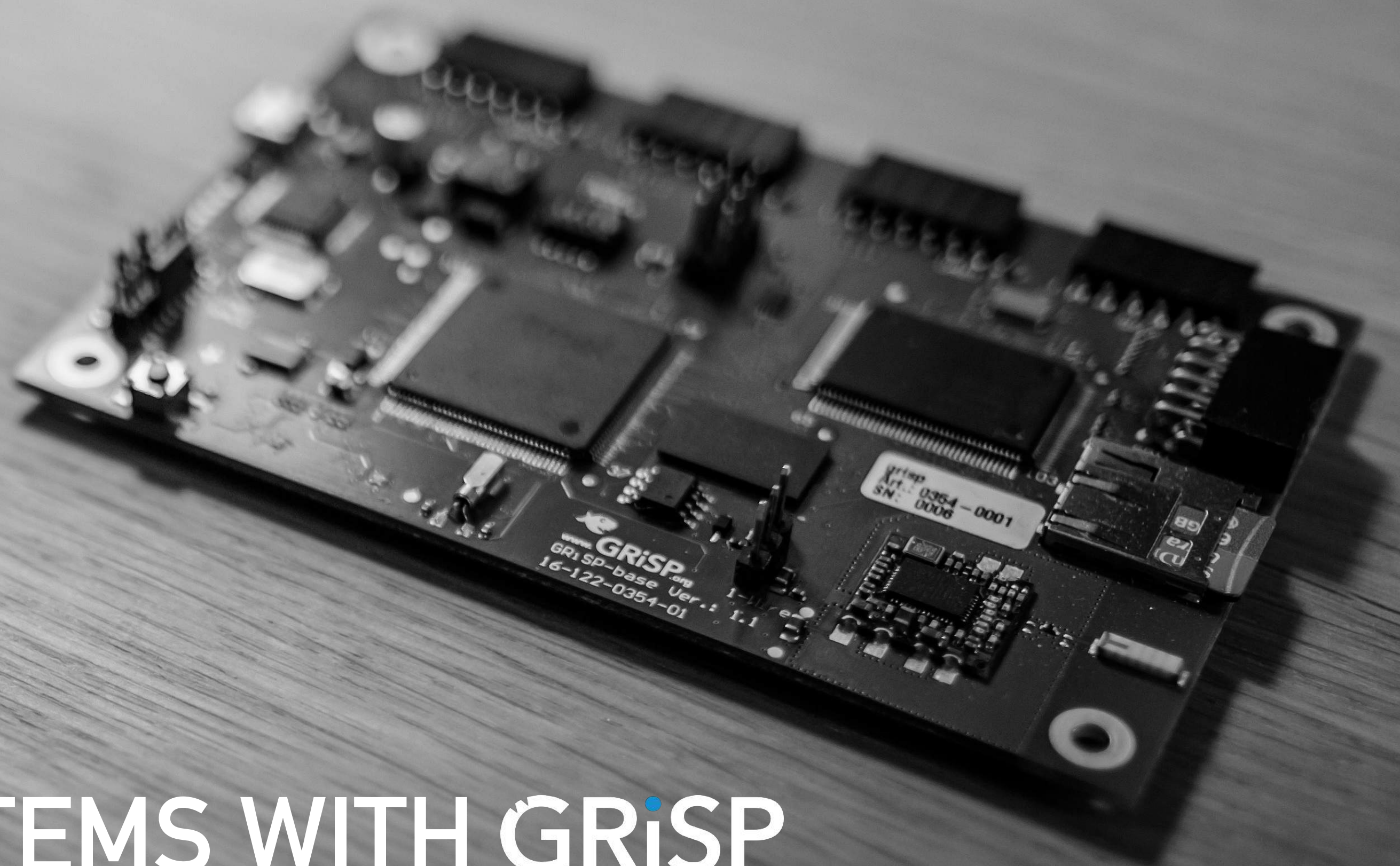
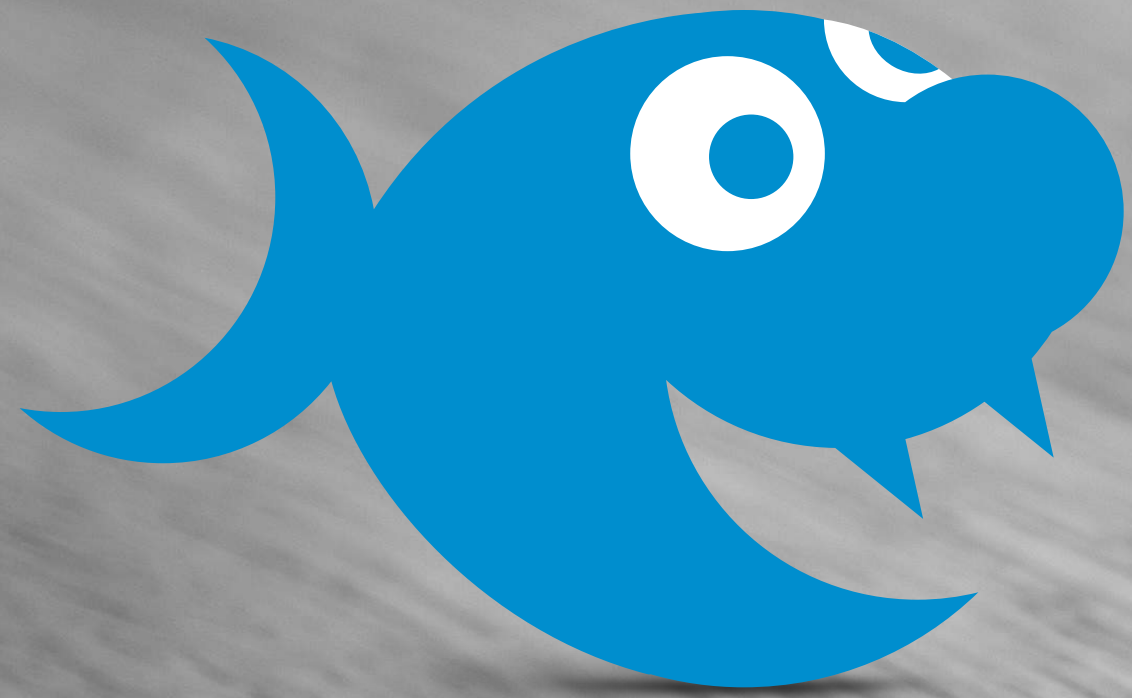




GRiSP



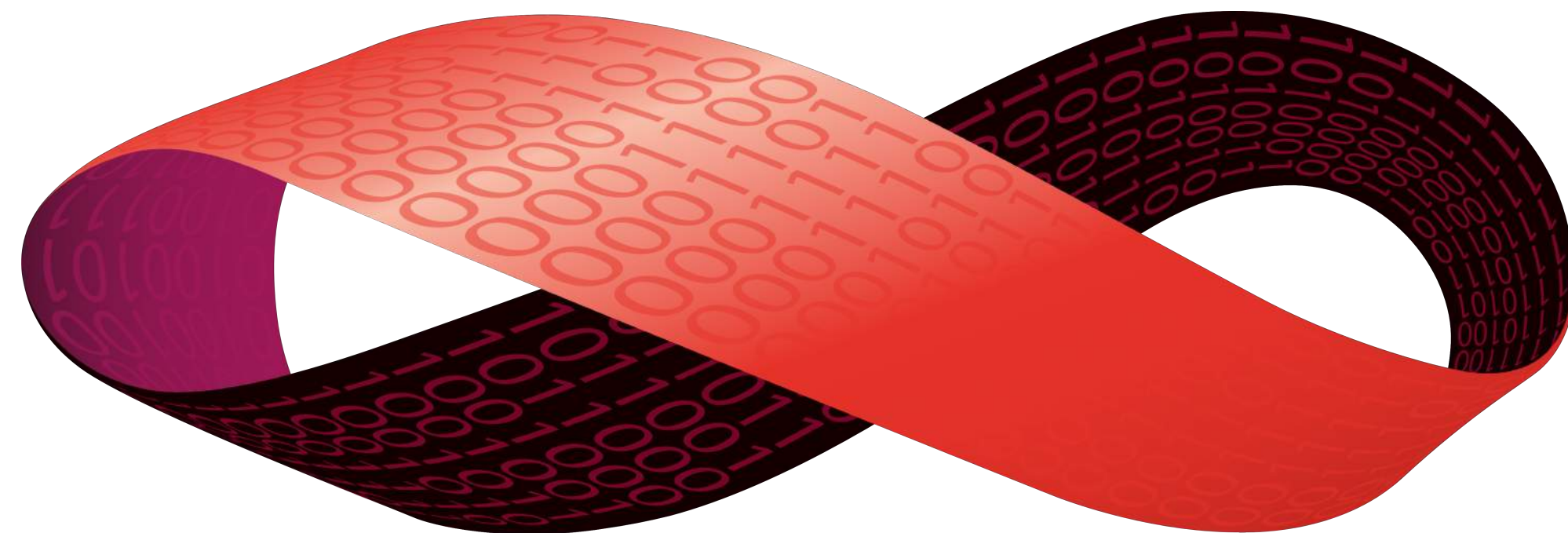
EMBEDDED SYSTEMS WITH GRiSP

ROBOTICS AND SENSORS
USING ERLANG



Peer Stritzinger

Slides also by
Adam Lindberg
github.com/eproxis



DIPL. PHYS.

PEER STRITZINGER GMBH



**Mainboard
Mini ITX
Intel Atom
FreeBSD, Erlang**

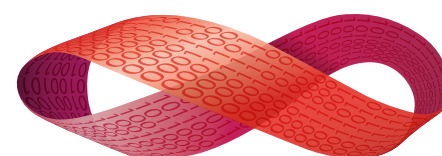
**Gateways
custom
Freescale
MPC5517
RTEMS**

Ethernet

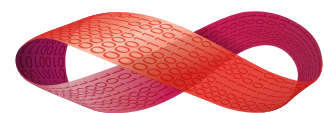
USB

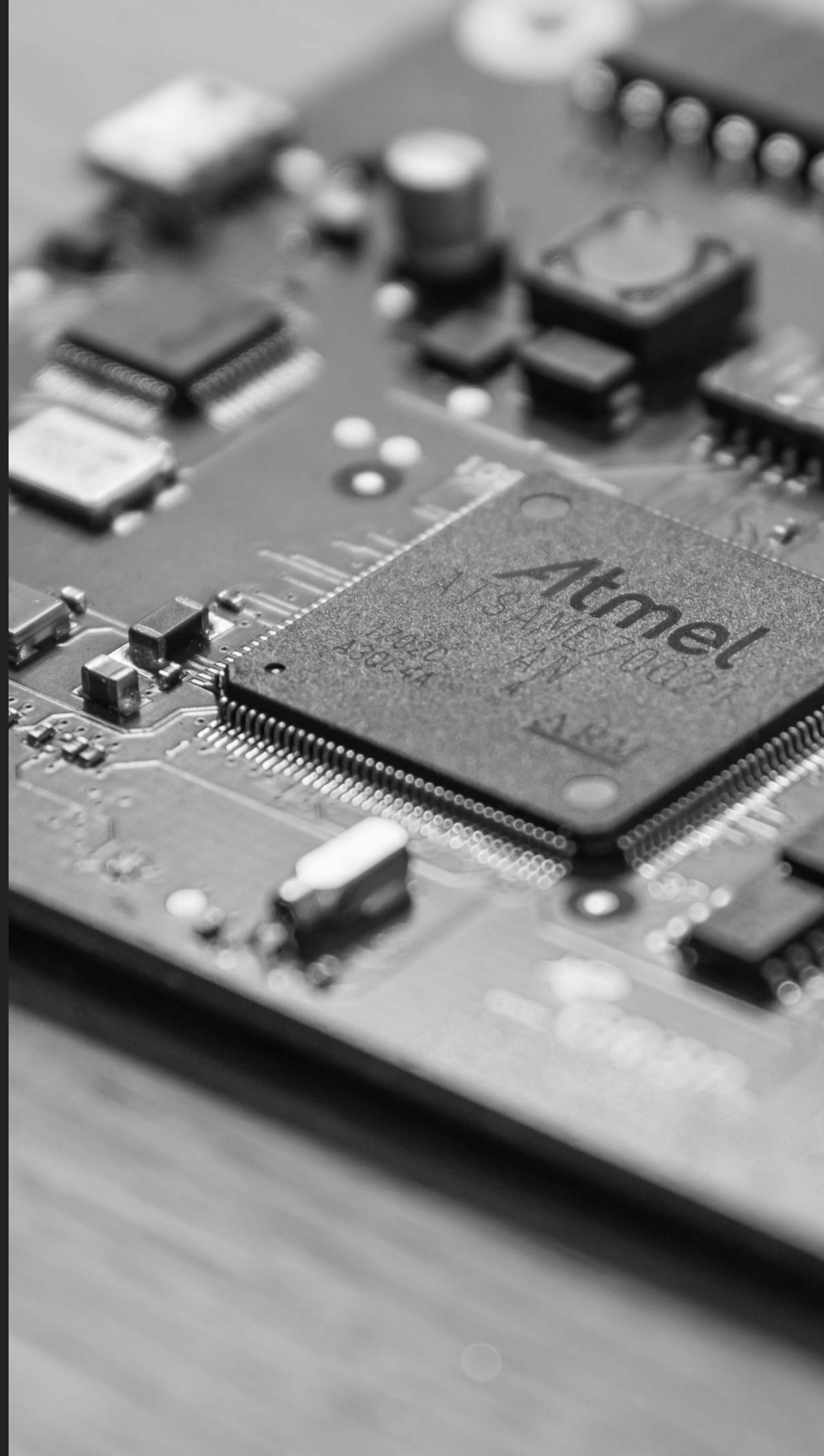
USB

Ethernet Switch / USB Hub



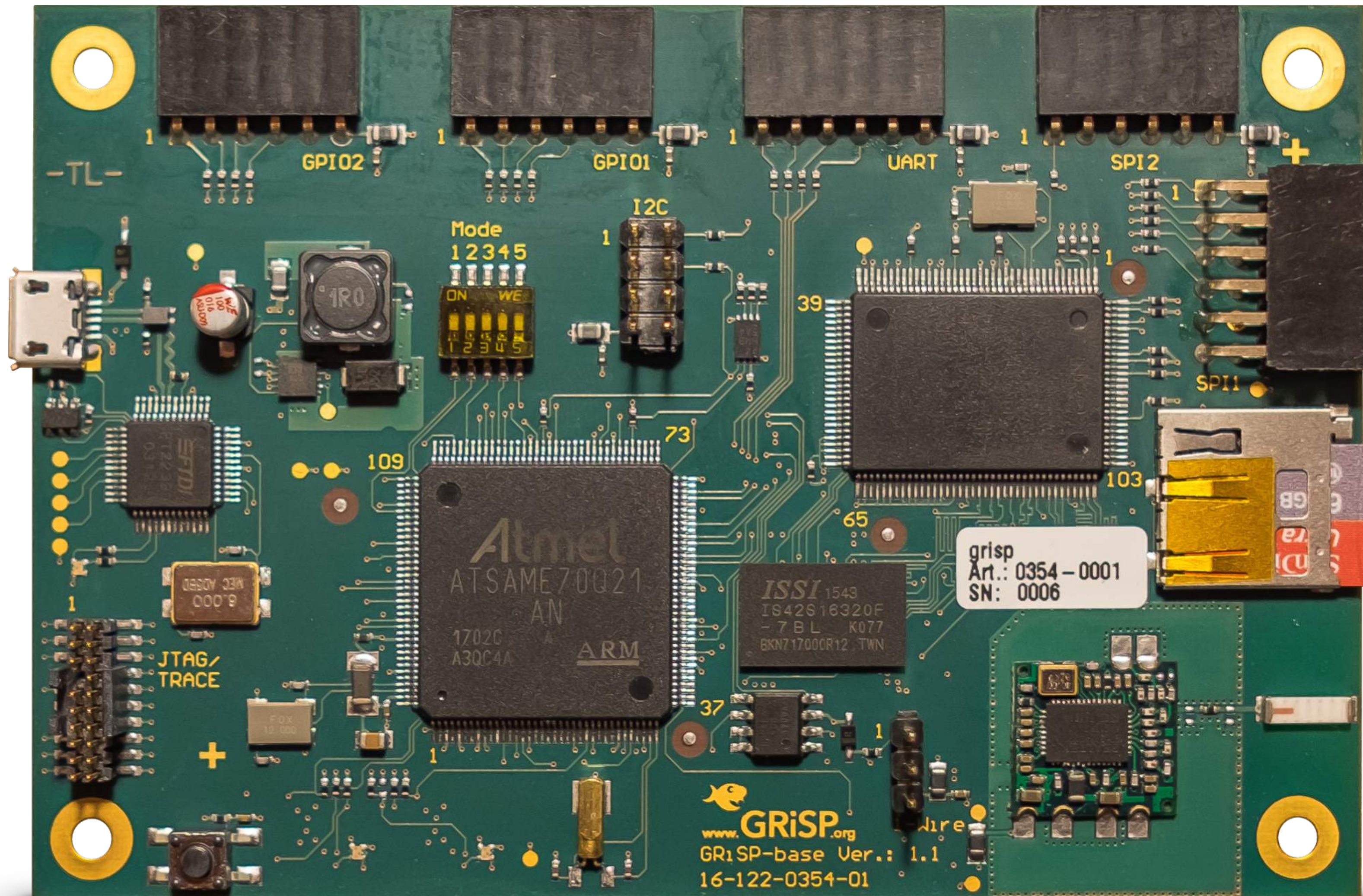
**HARDWARE
COMPONENTS
SOFTWARE
FUTURE**





THE GRISP BOARD

SPECS

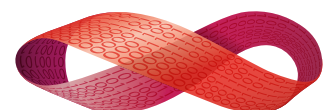


EMBEDDED WIRELESS DEVICE

REAL ERLANG

ON

REAL BARE METAL



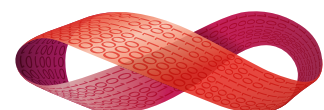
CONNECTORS FOR SENSORS & ACTUATORS

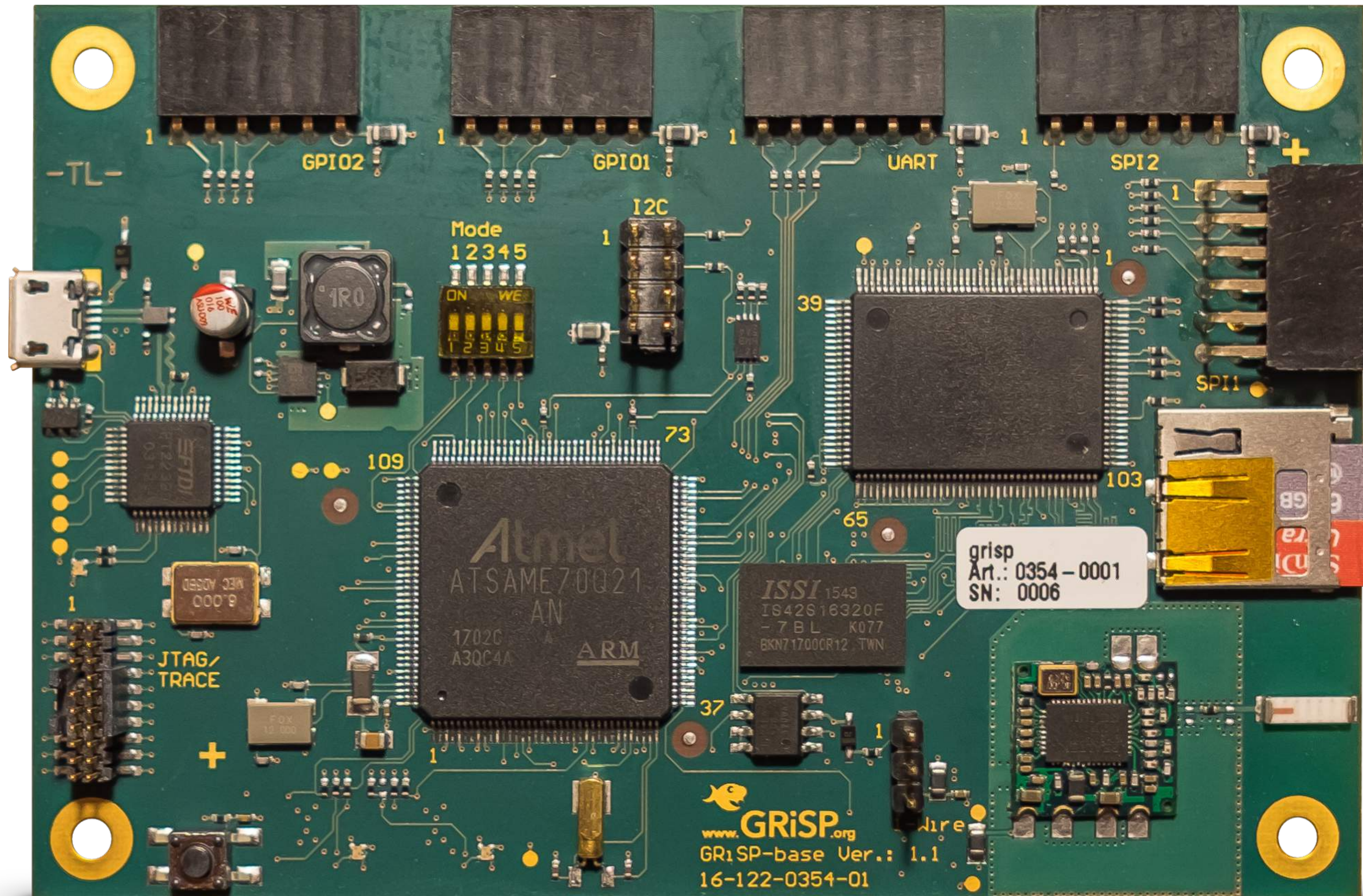
300 MHZ

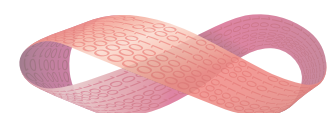
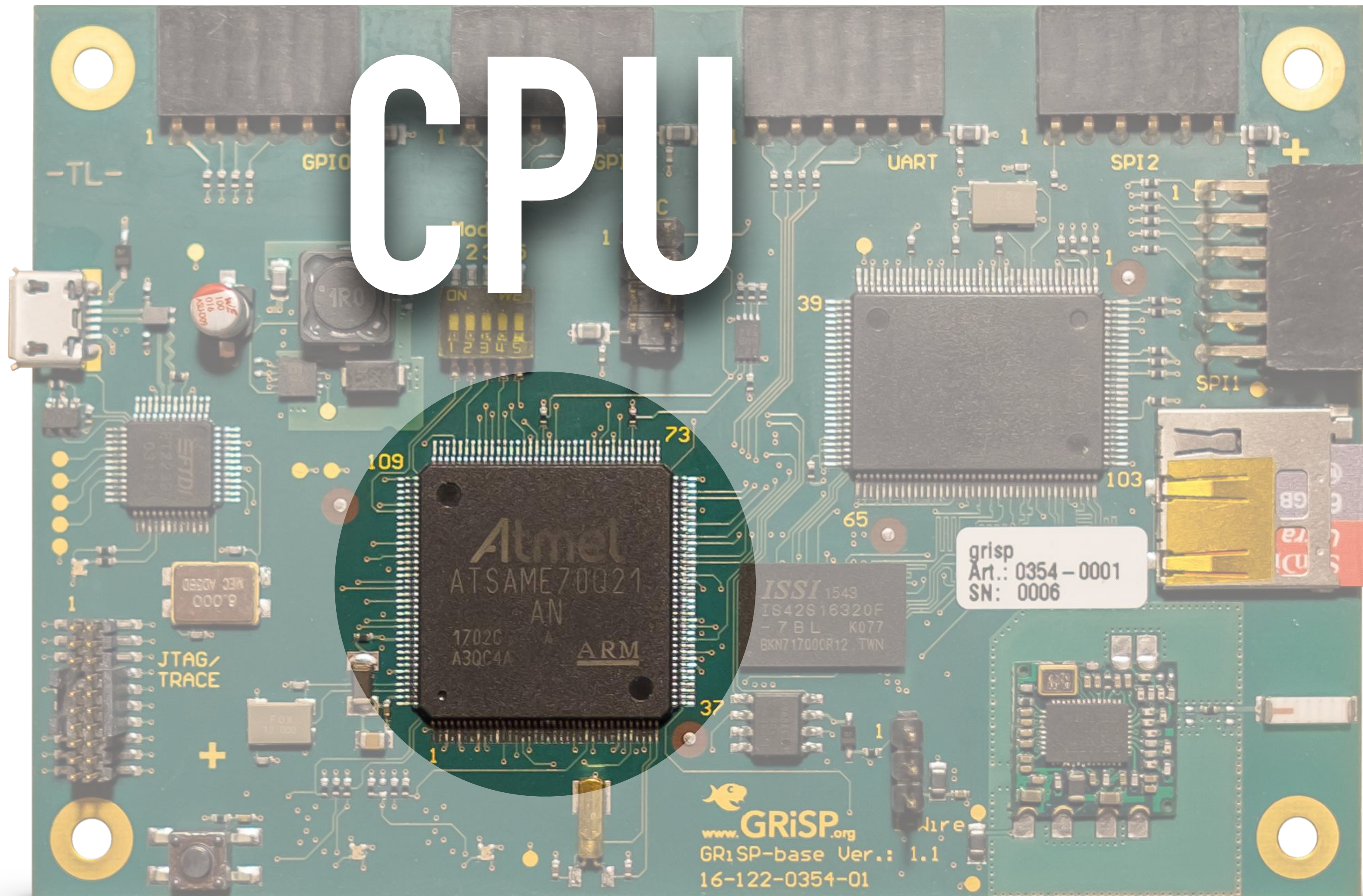
64 MiB RAM

WIFI

MICROSD







ARM CORTEX M7

ATMEL SAM V71

UP TO 300MHZ

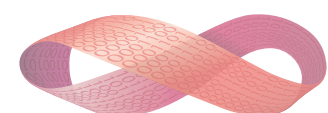
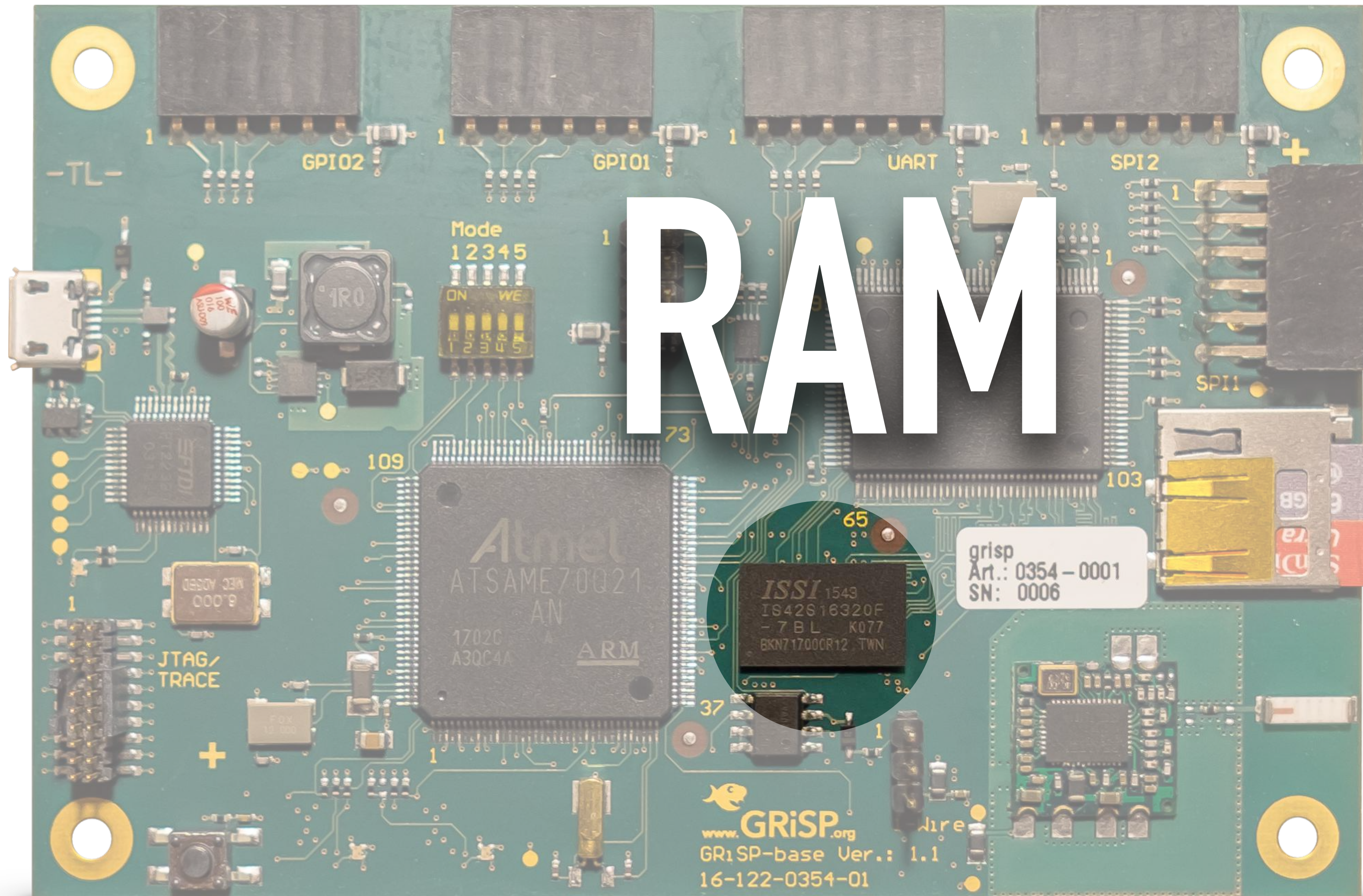
FPU & DSP EXT.

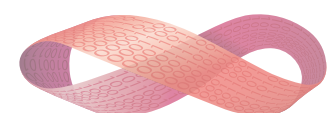
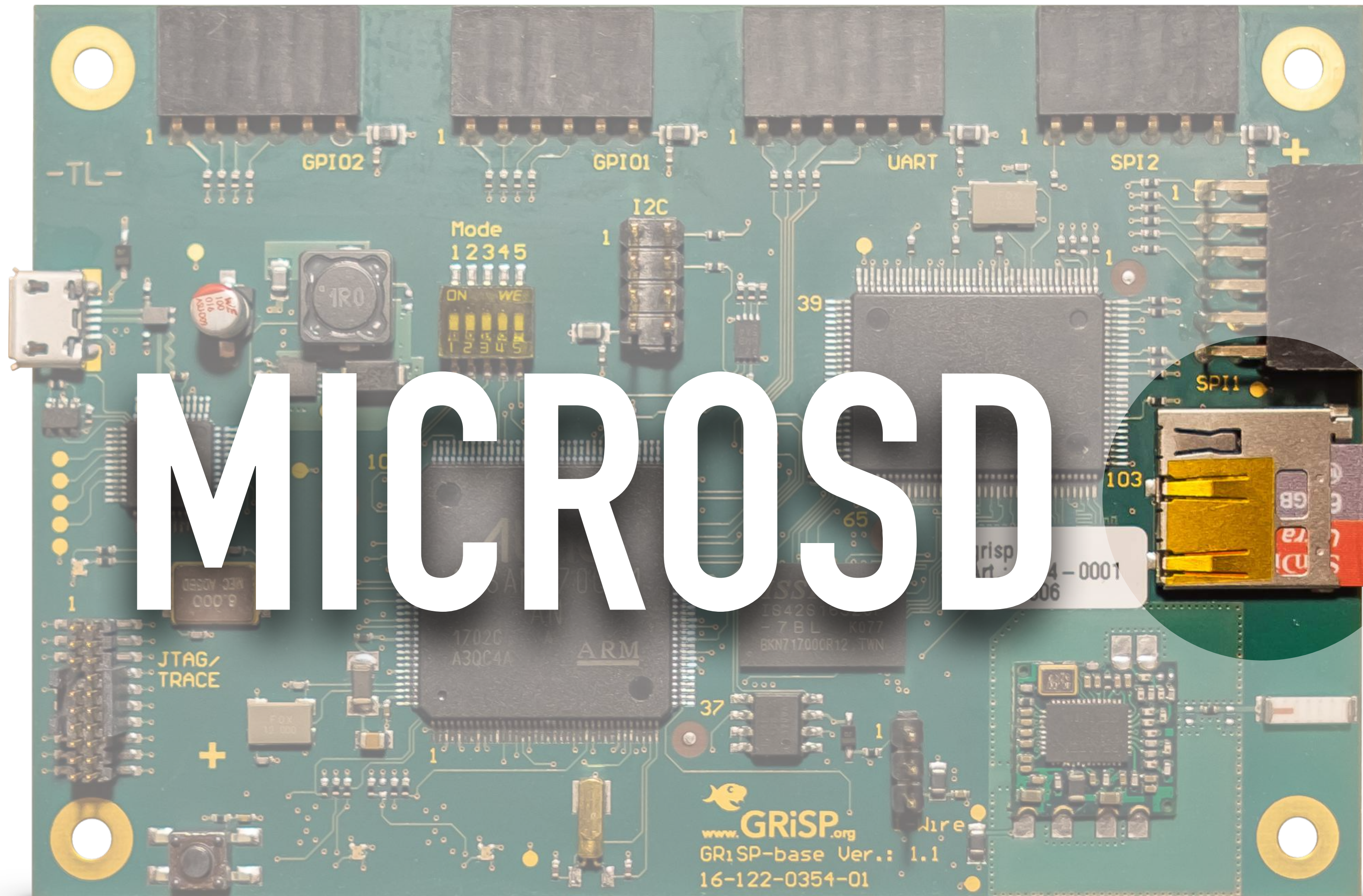


INTERNAL

2048 KiB FLASH

384 KiB SRAM





EXTERNAL

64 MiB SDRAM

2 KiB EEPROM

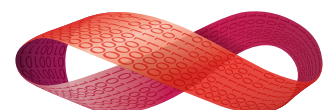
MICROSD

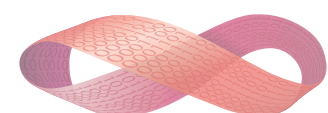
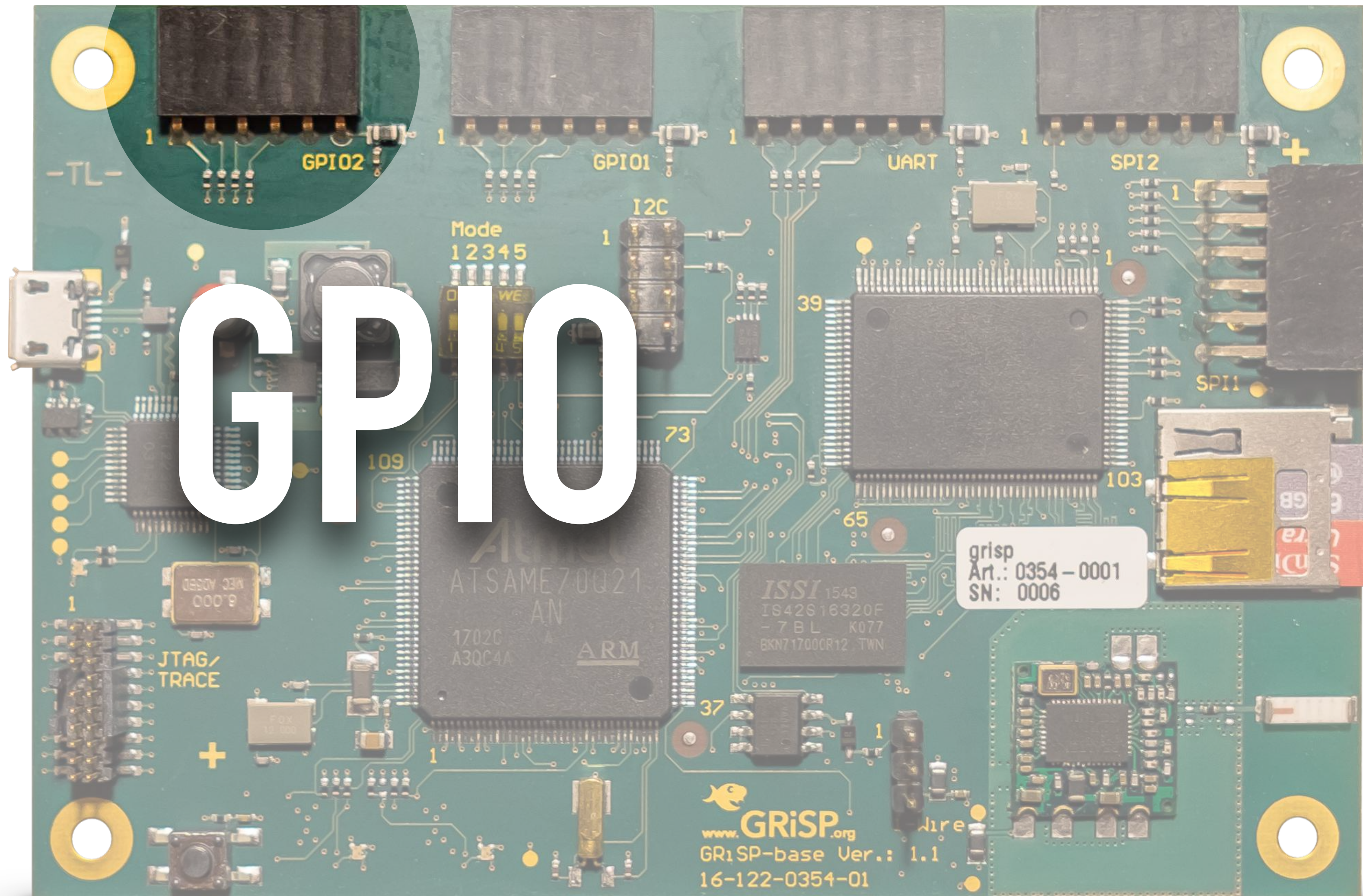


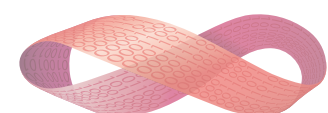
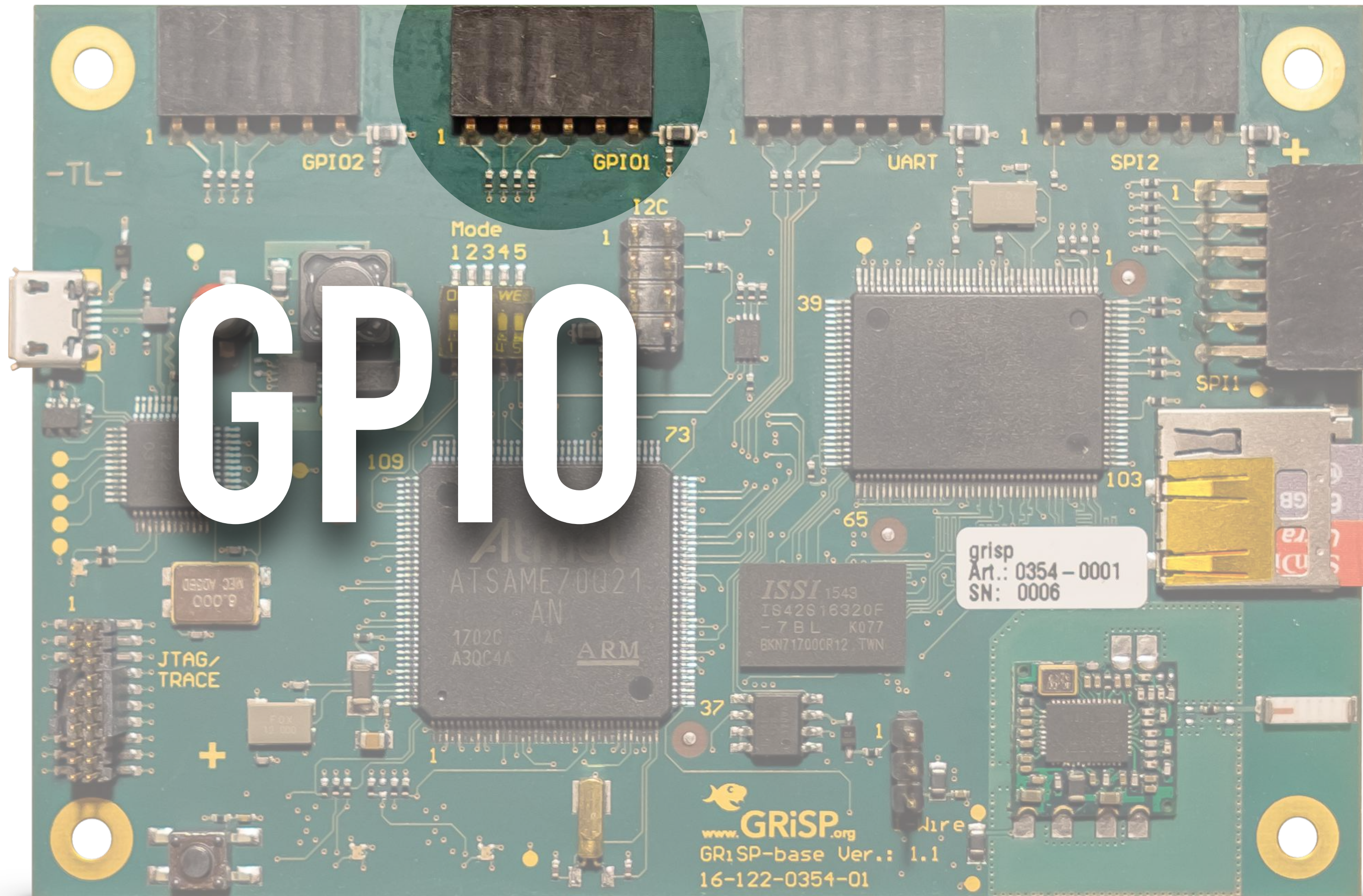
802.11N 2.4 GHZ

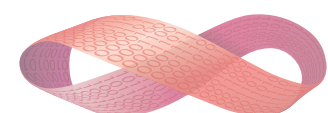
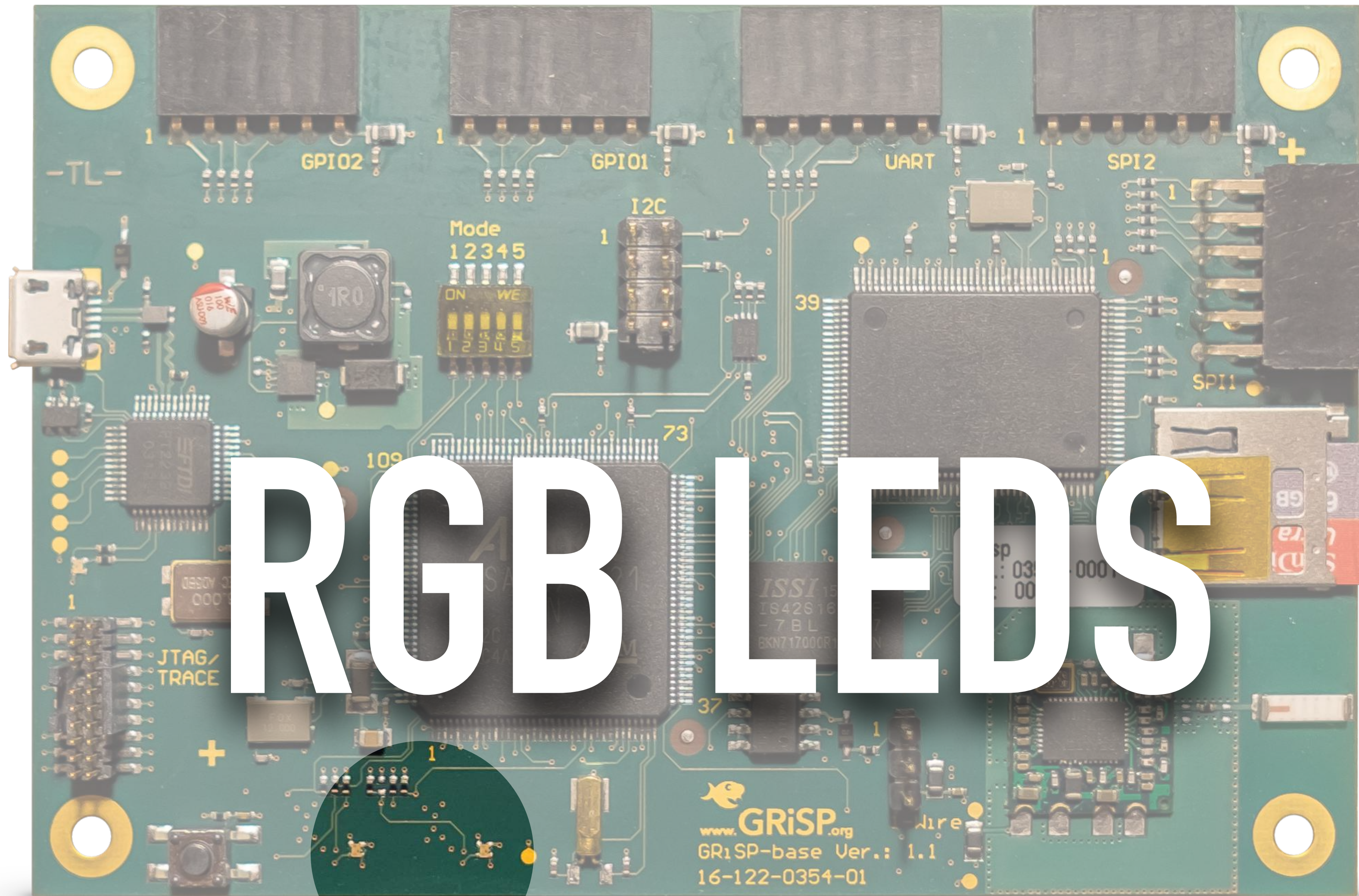
UP TO 150 MBPS

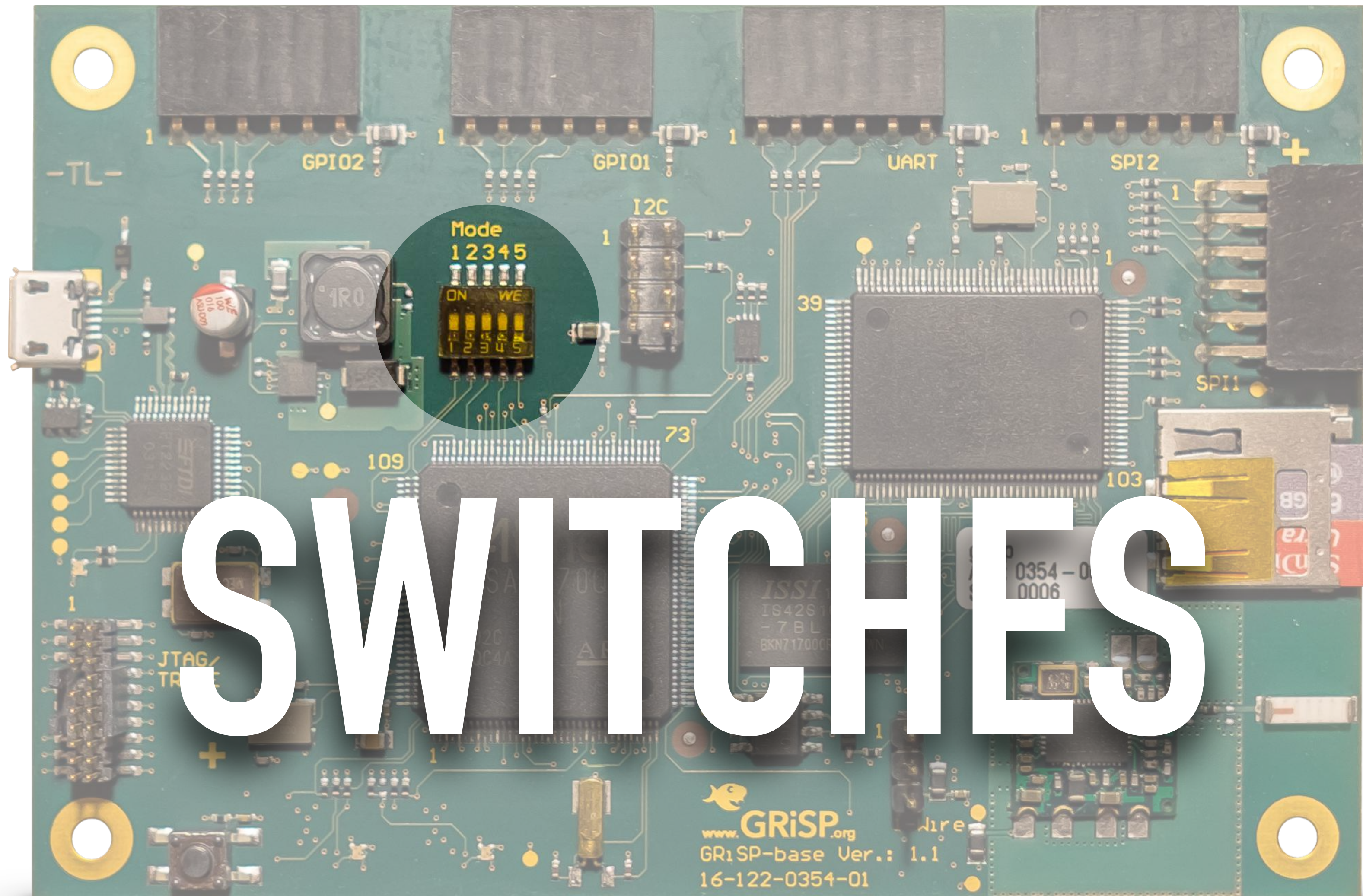
POWER SAVING

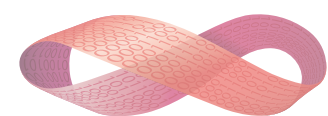
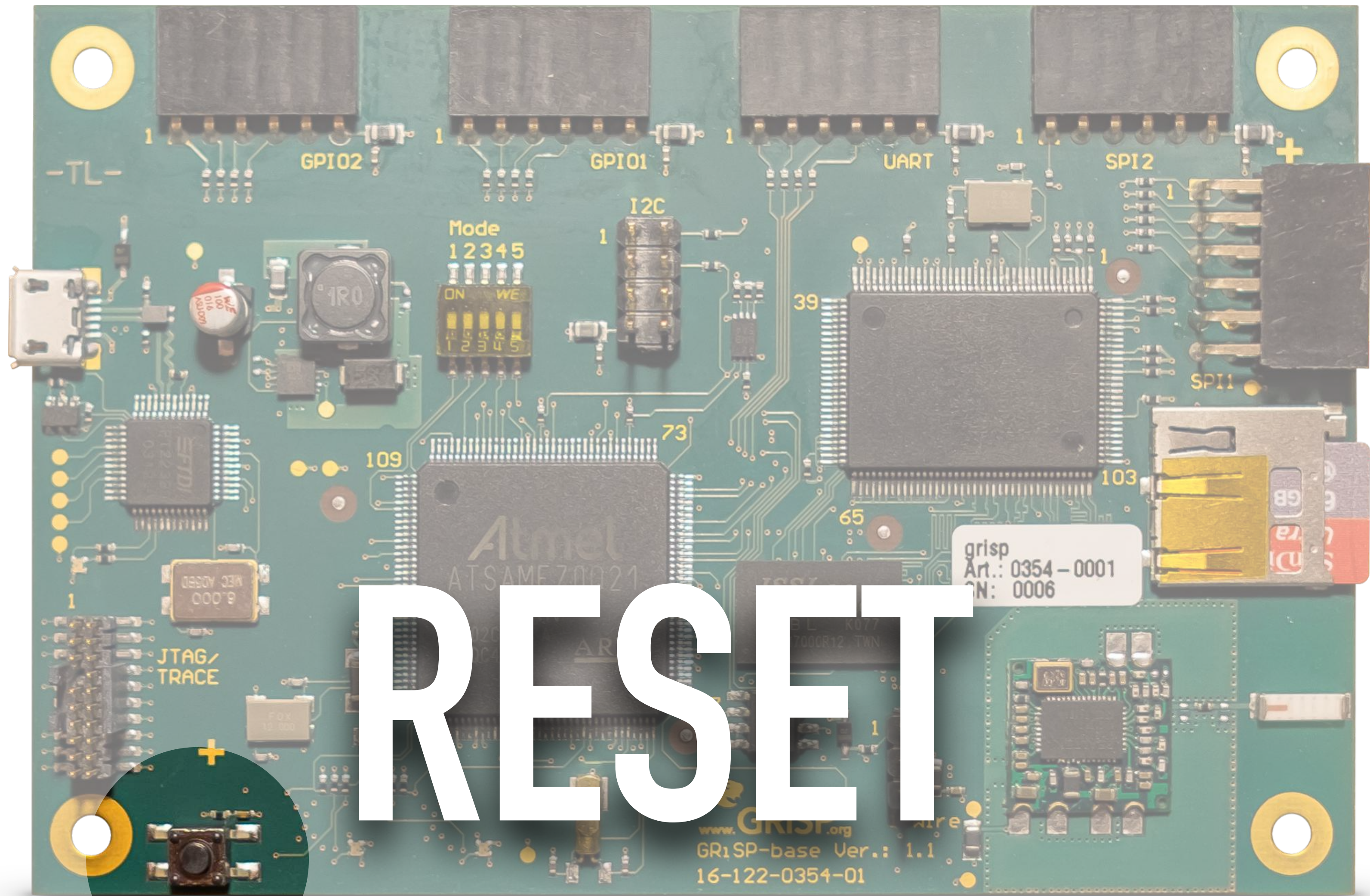








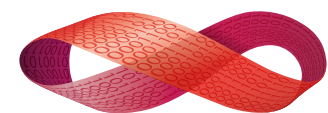


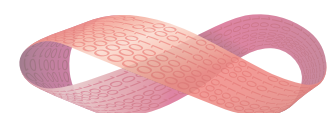
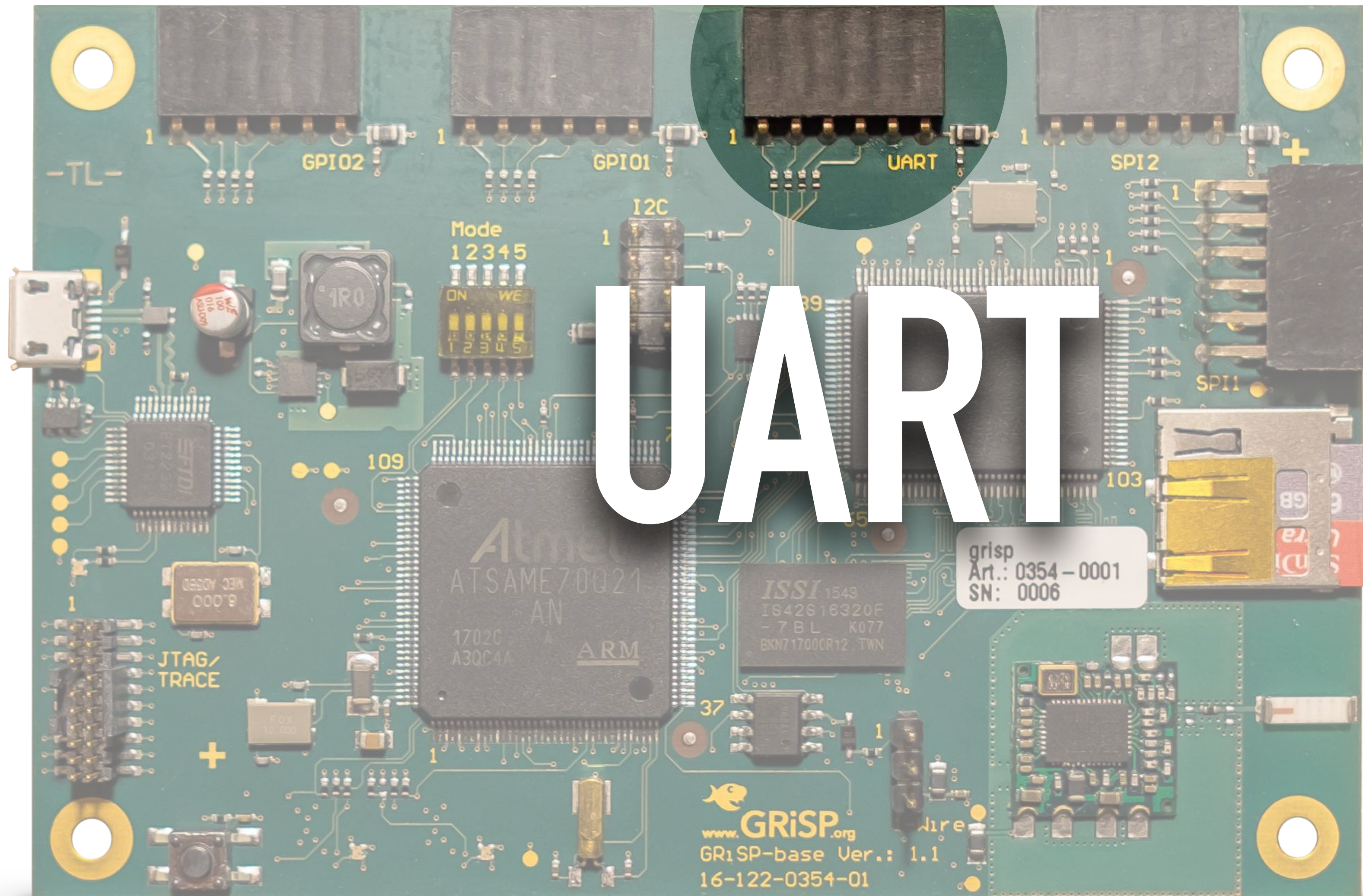


GENERAL PURPOSE

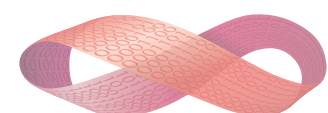
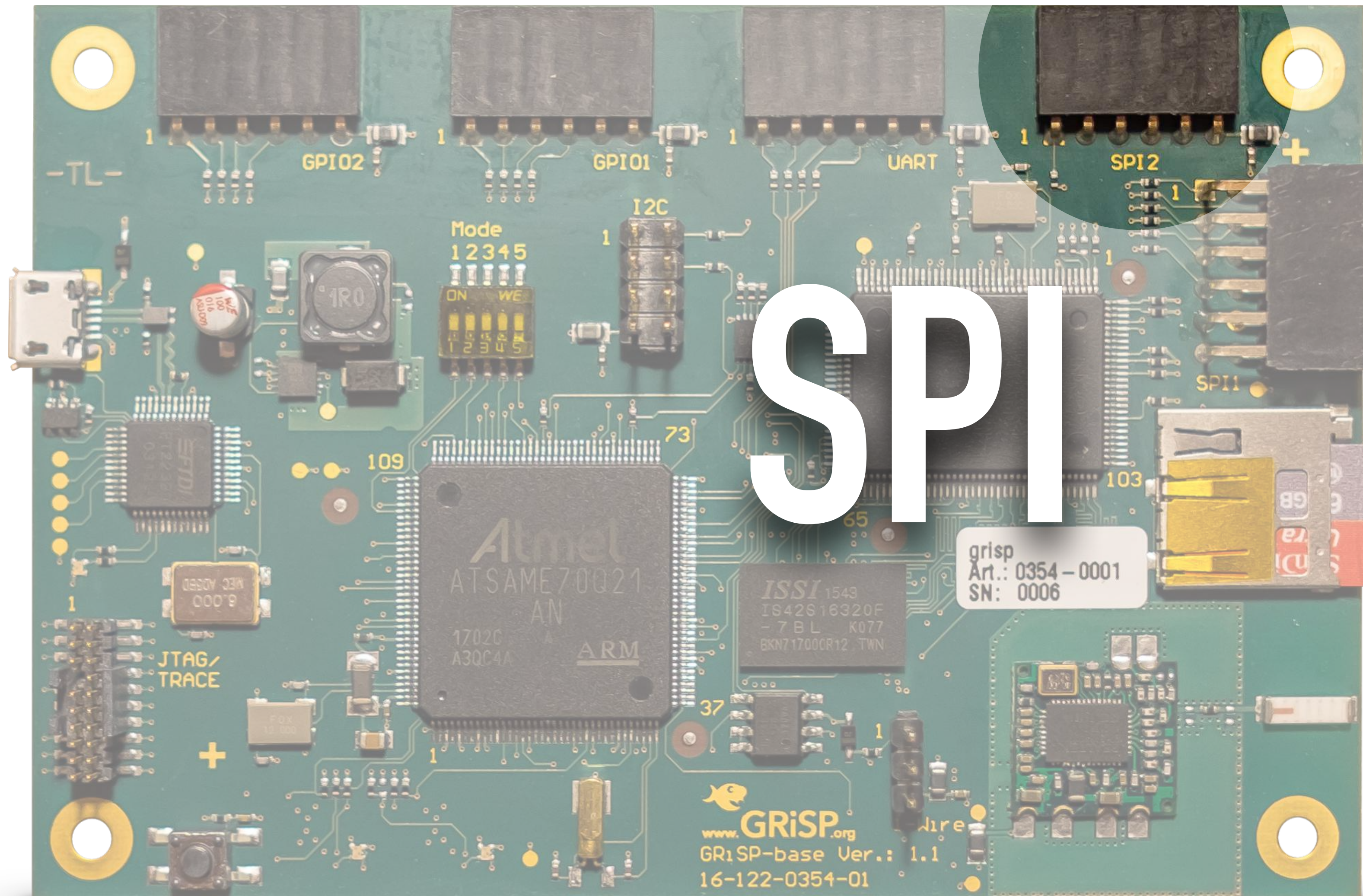
INPUT/OUTPUT

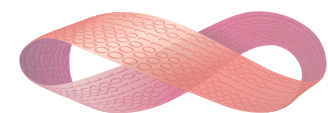
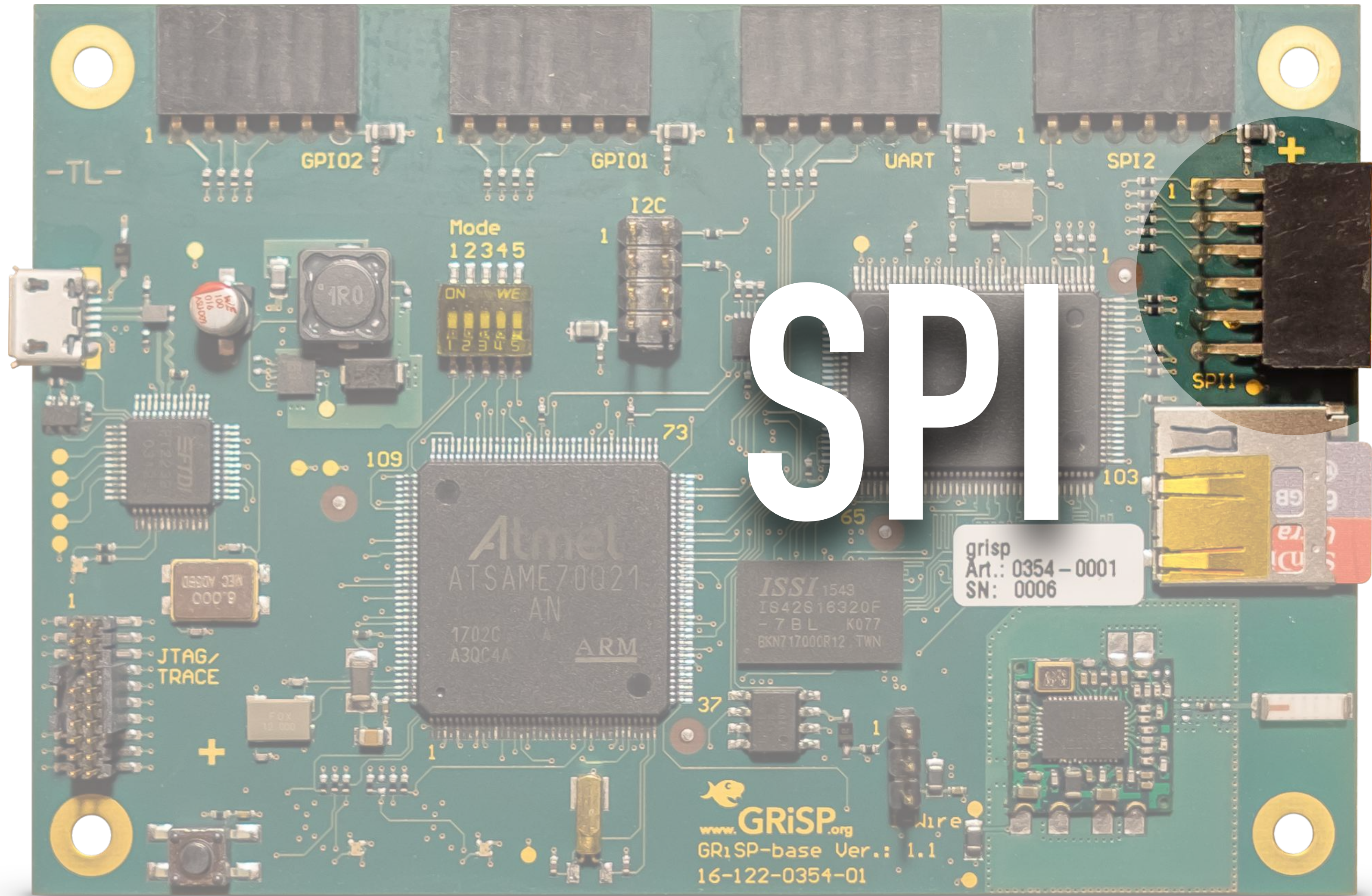
SUPPORTS PWM





ASYNCHRONOUS SERIAL COMMUNICATION BIT STREAMS CONFIGURABLE





**SYNCHRONOUS
SERIAL COMMUNICATION
BROAD CHIP SUPPORT
UP TO 20 MBIT/S**

MASTER SLAVE PROTOCOL

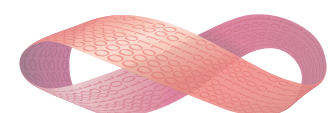
2 LINES IO

1 CLOCK LINE

1 SLAVE SELECT

POWER & GROUND





MASTER SLAVE PROTOCOL

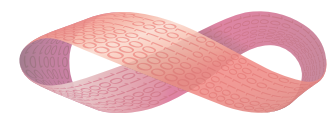
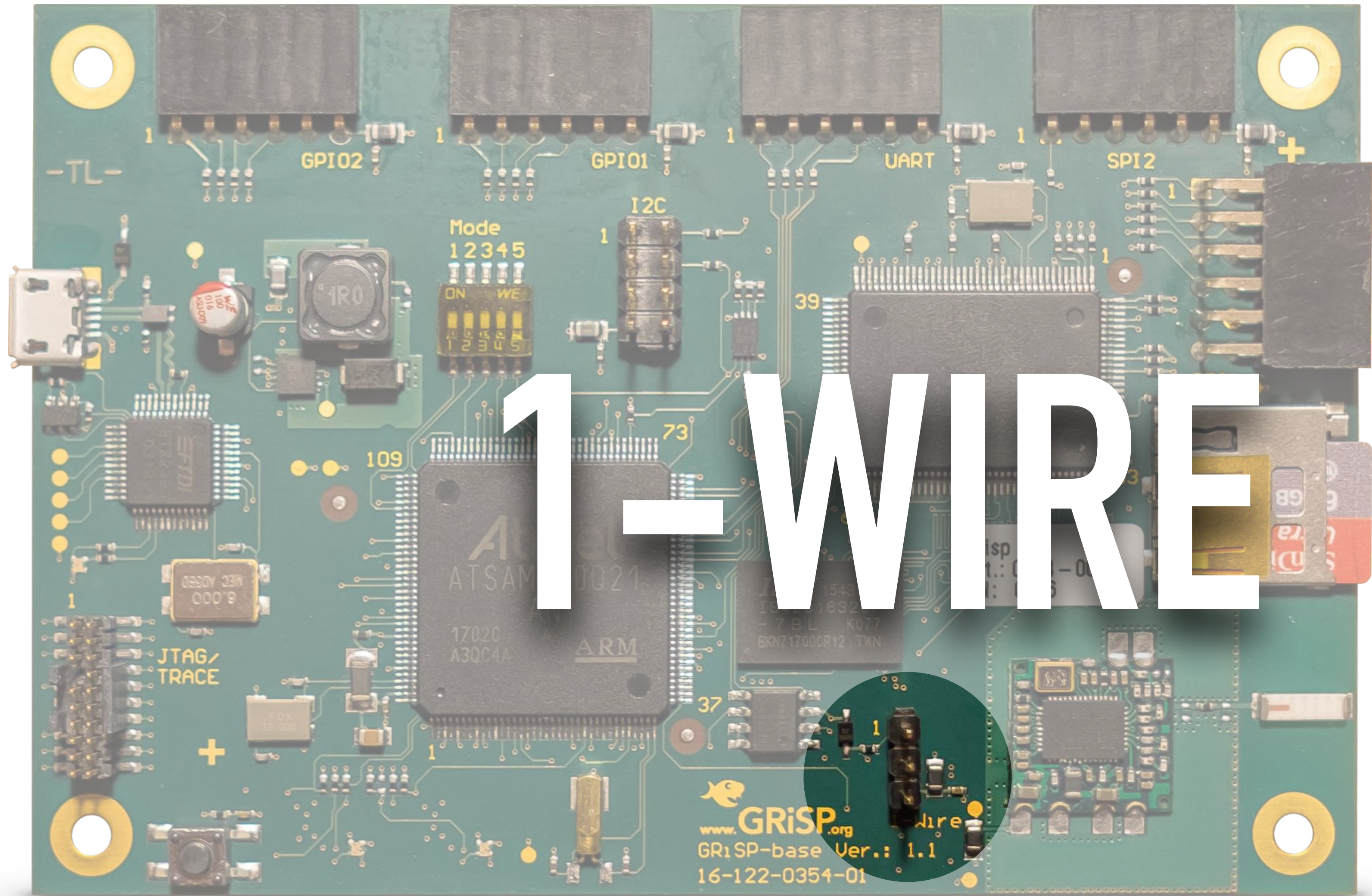
1 DATA LINE

1 CLOCK LINE

POWER & GROUND

ADDRESSABLE



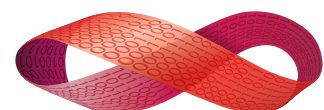


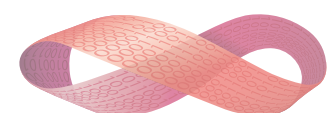
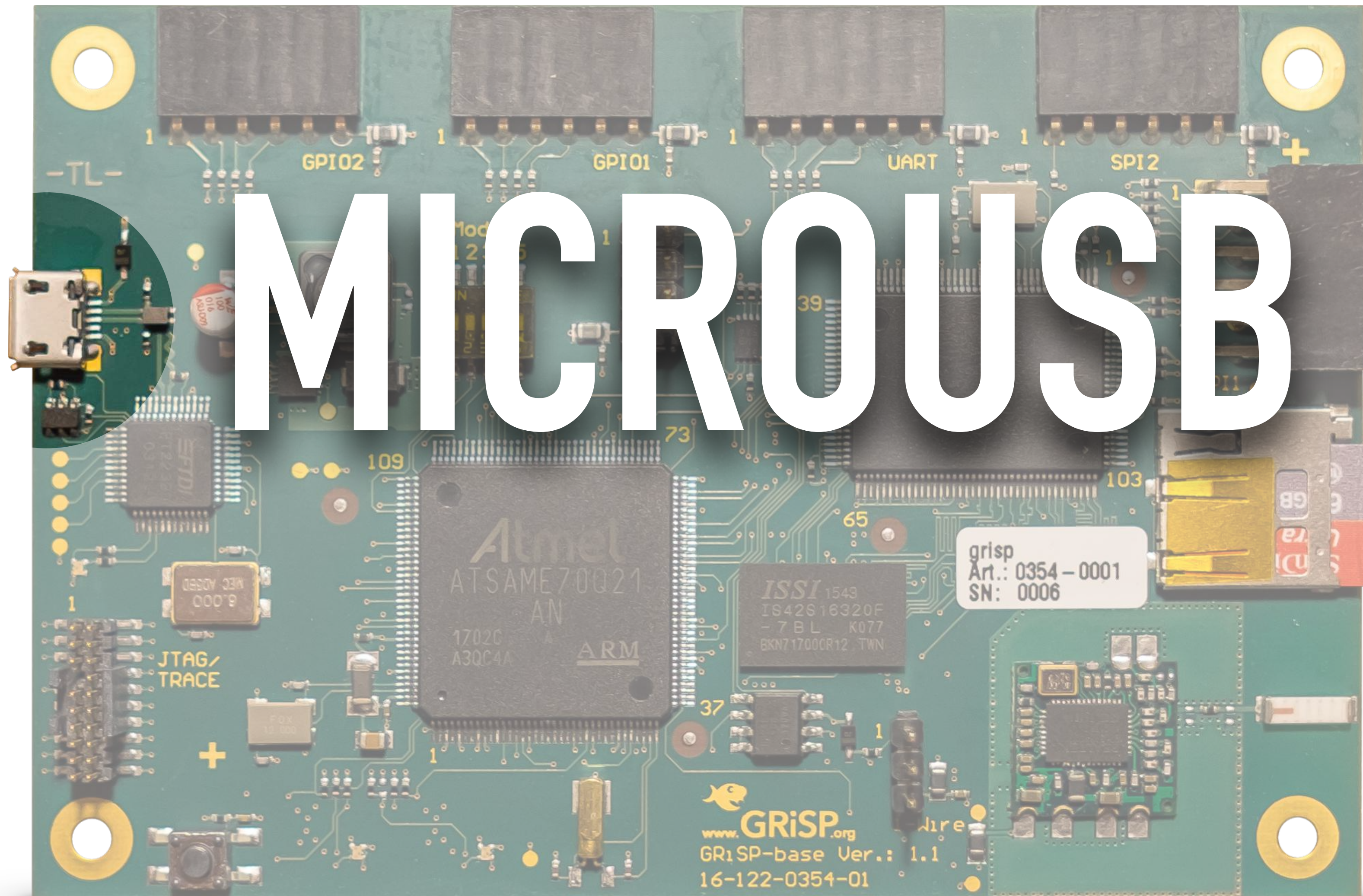
DALLAS 1-WIRE

1 DATA + POWER LINE

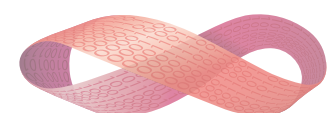
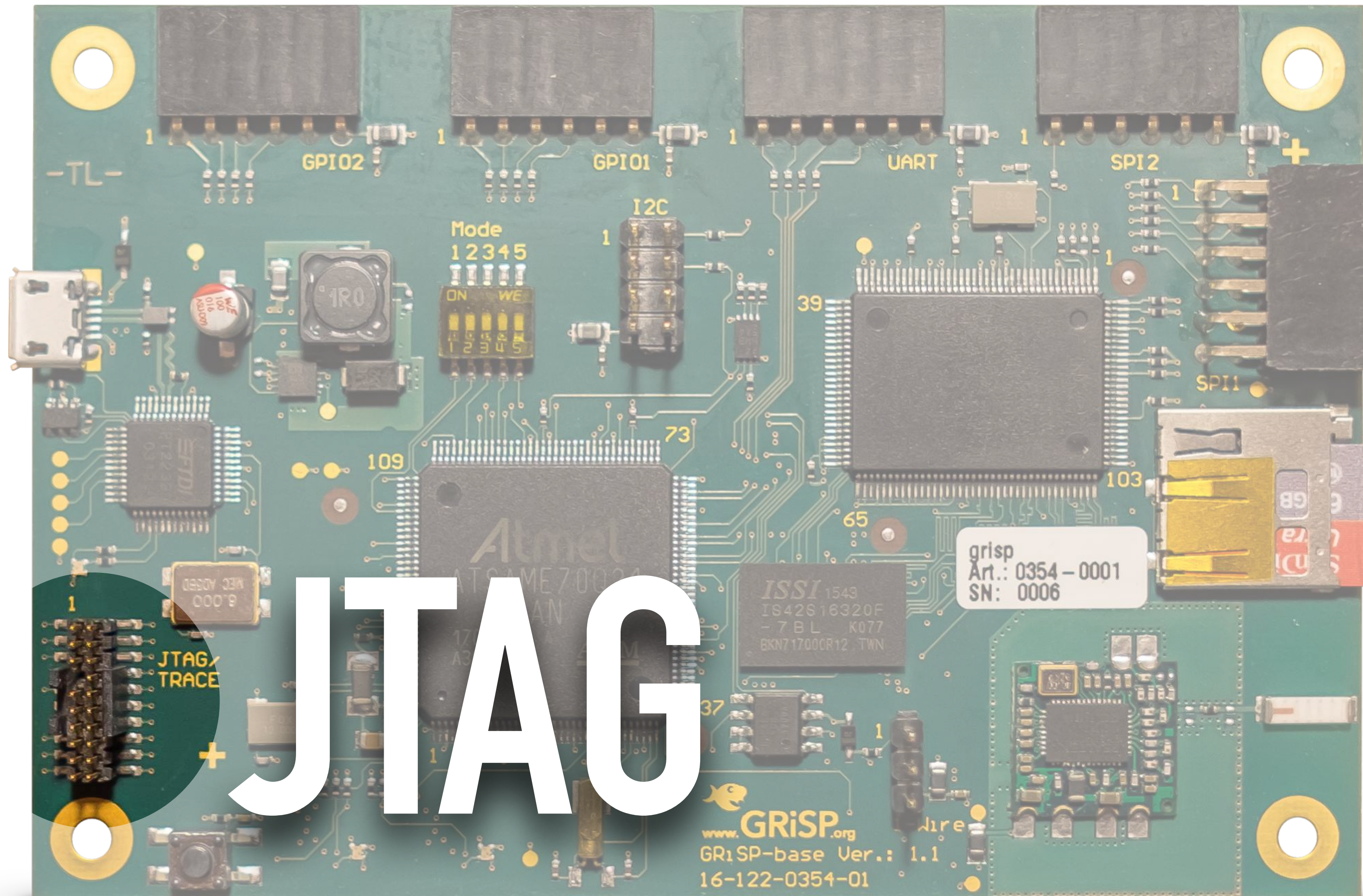
GROUND

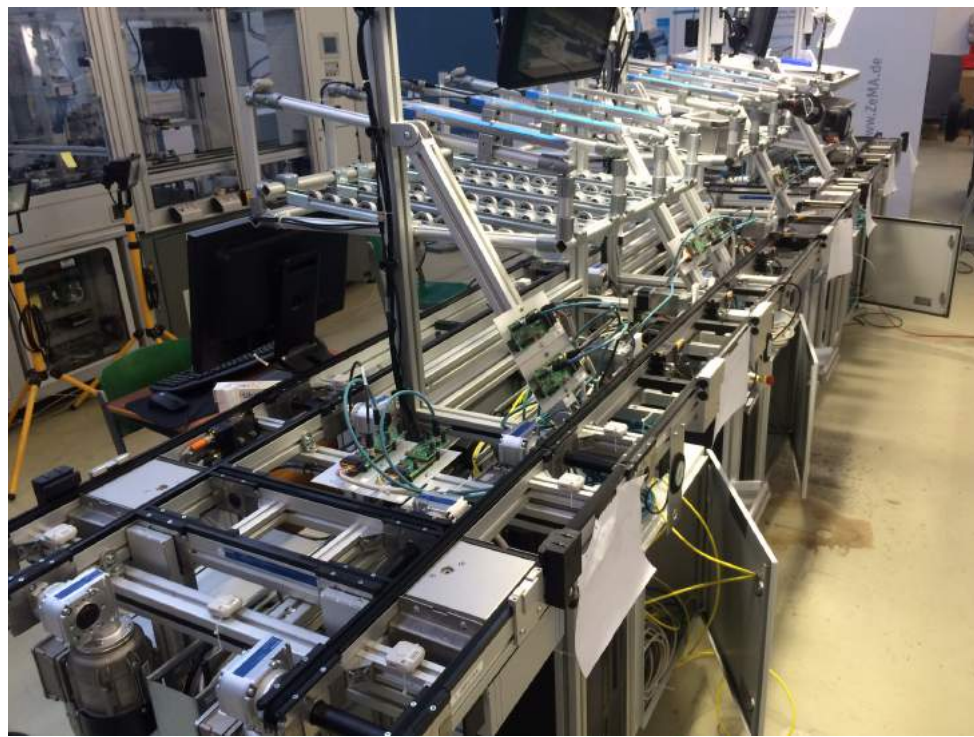
ADDRESSABLE MICROLAN

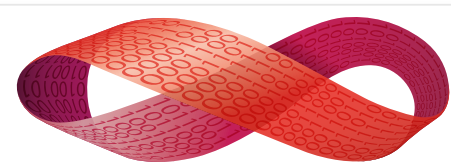




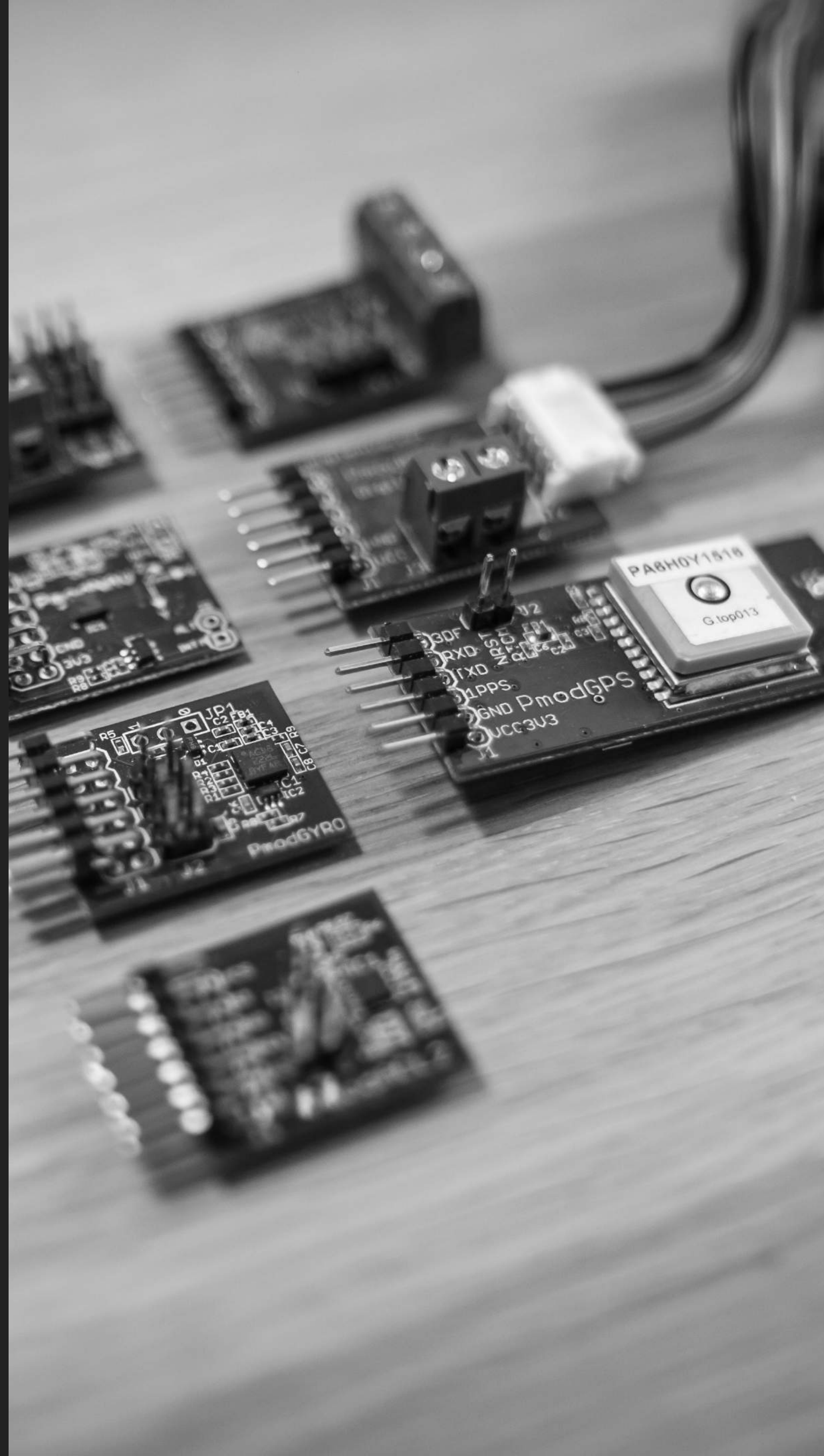
MICROUSB FOR POWER & SERIAL CONSOLE JTAG DEBUGGER





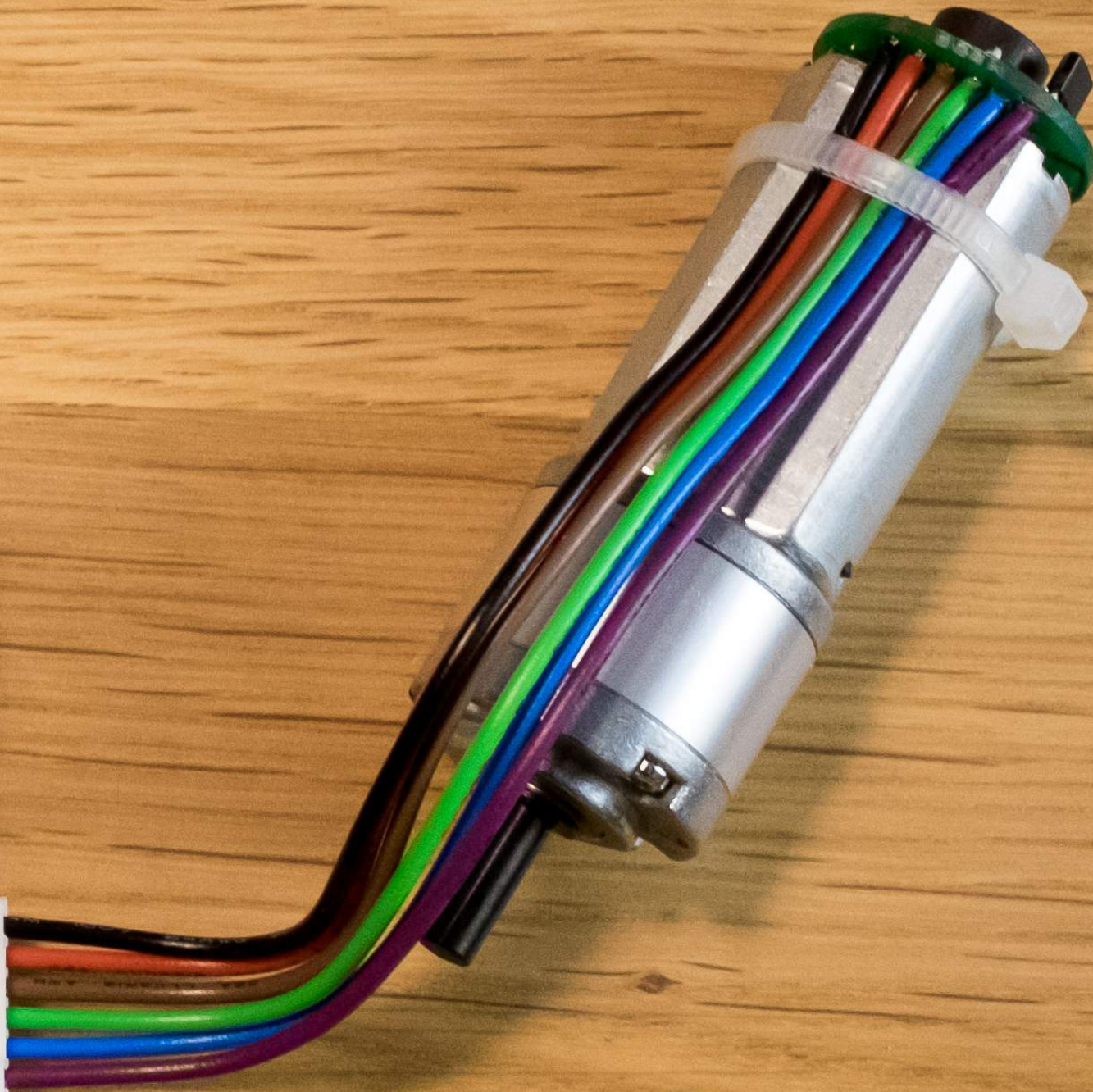
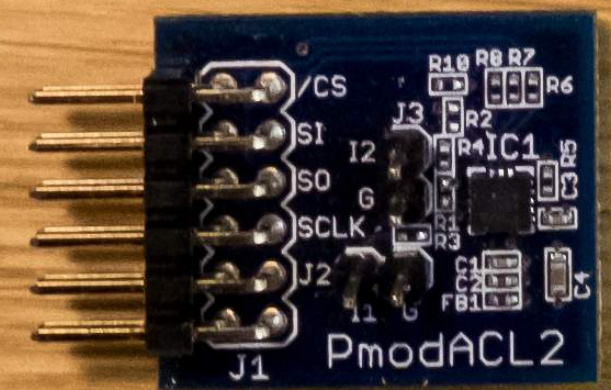
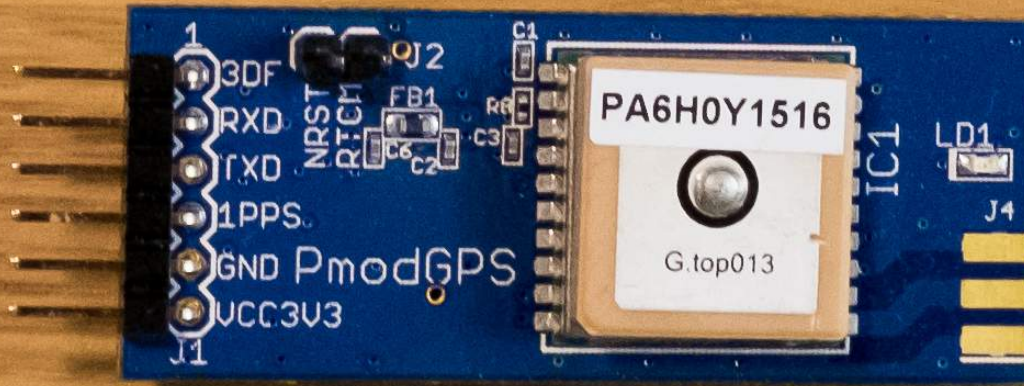
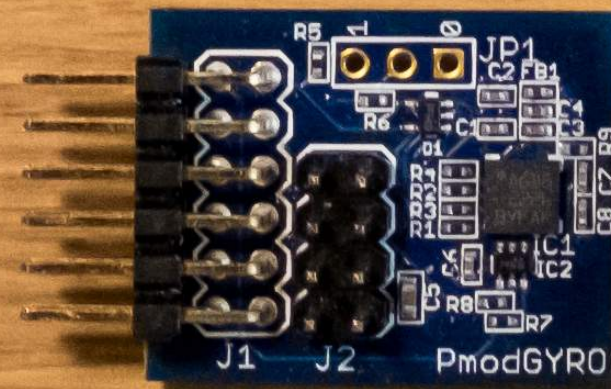
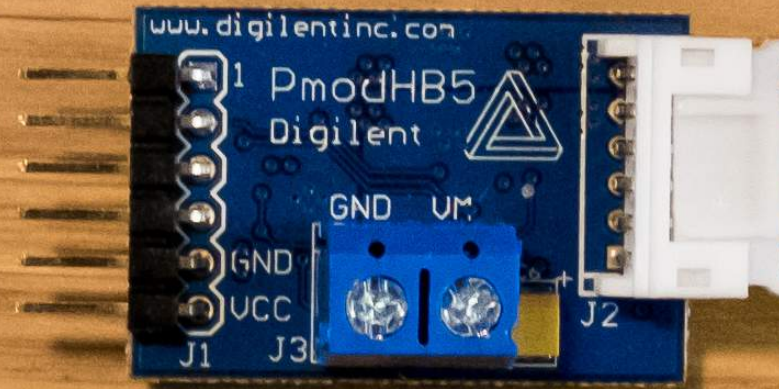
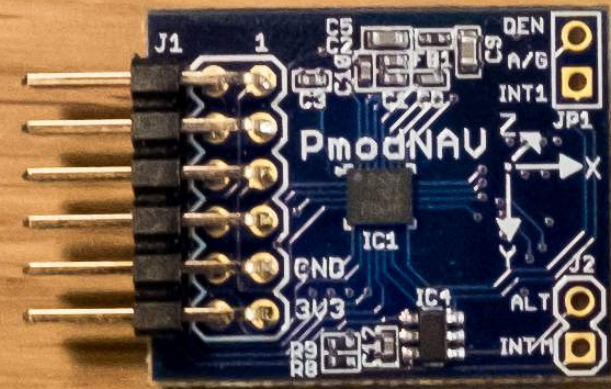
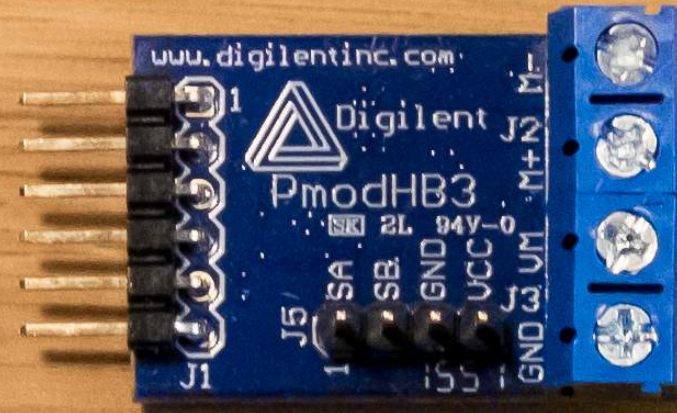
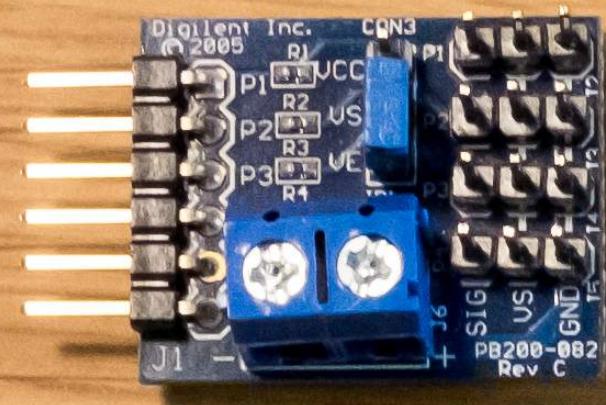


DIPL. PHYS. PEER STRITZINGER GMBH

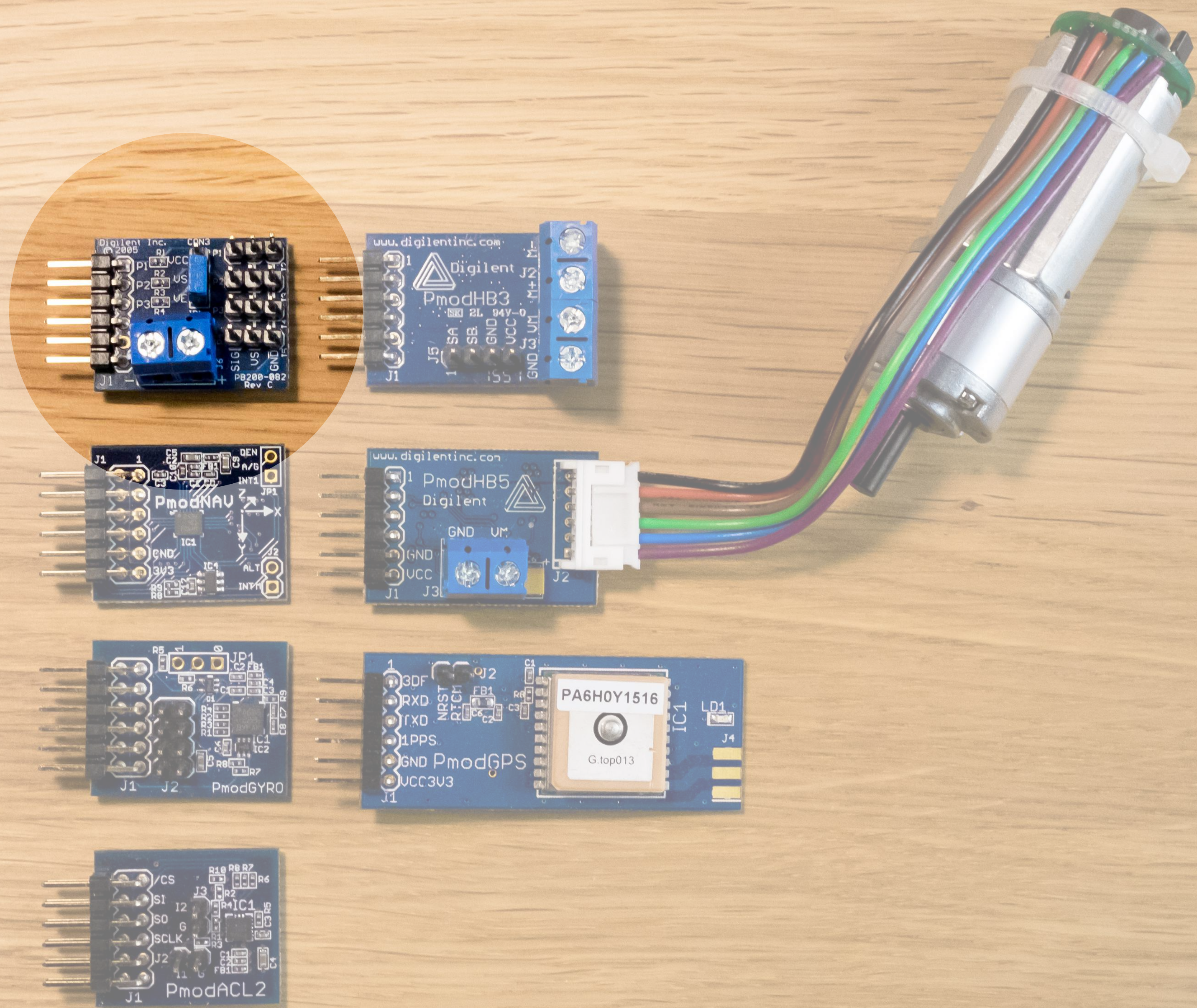


ACCESSORIES

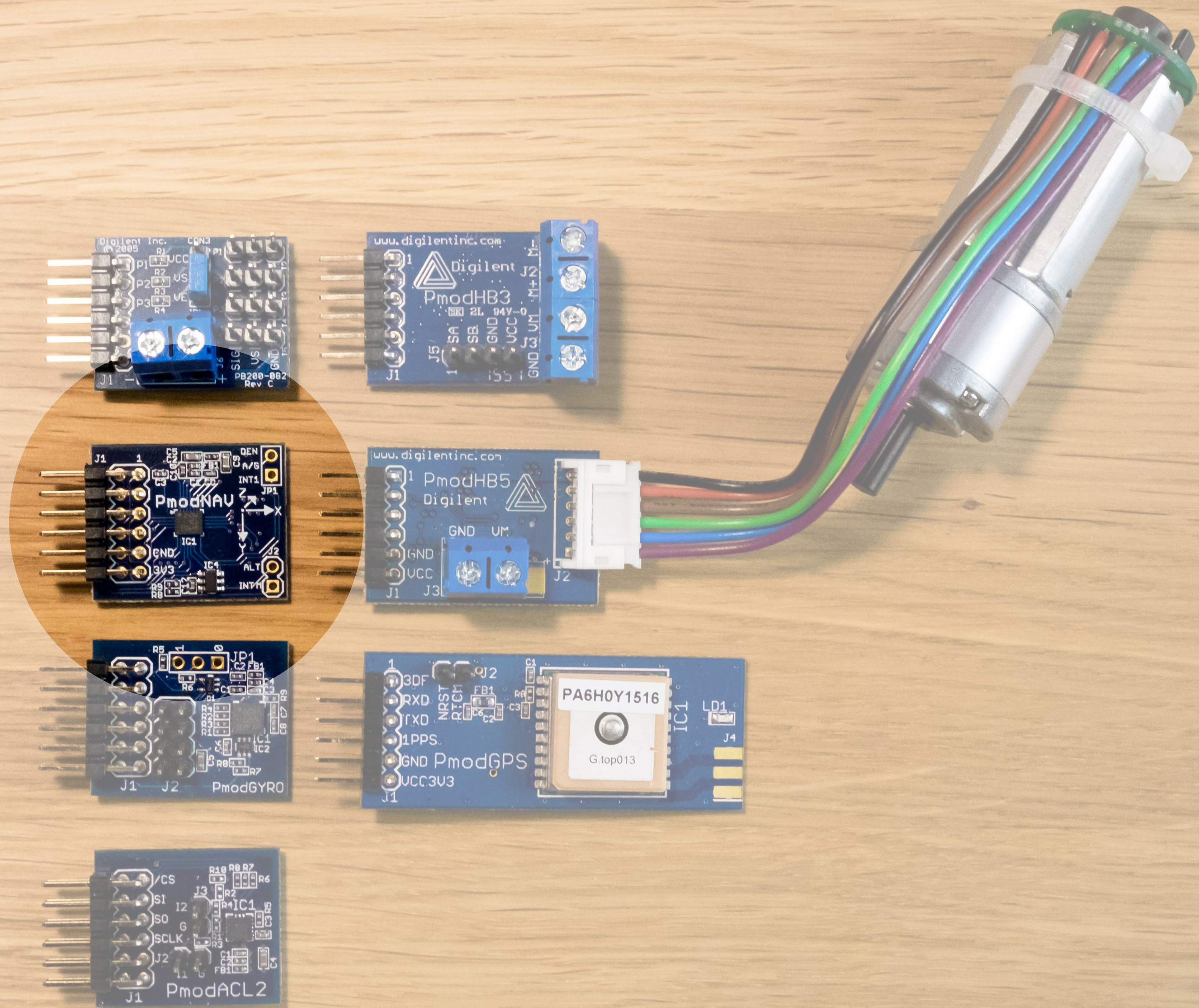
PMODS



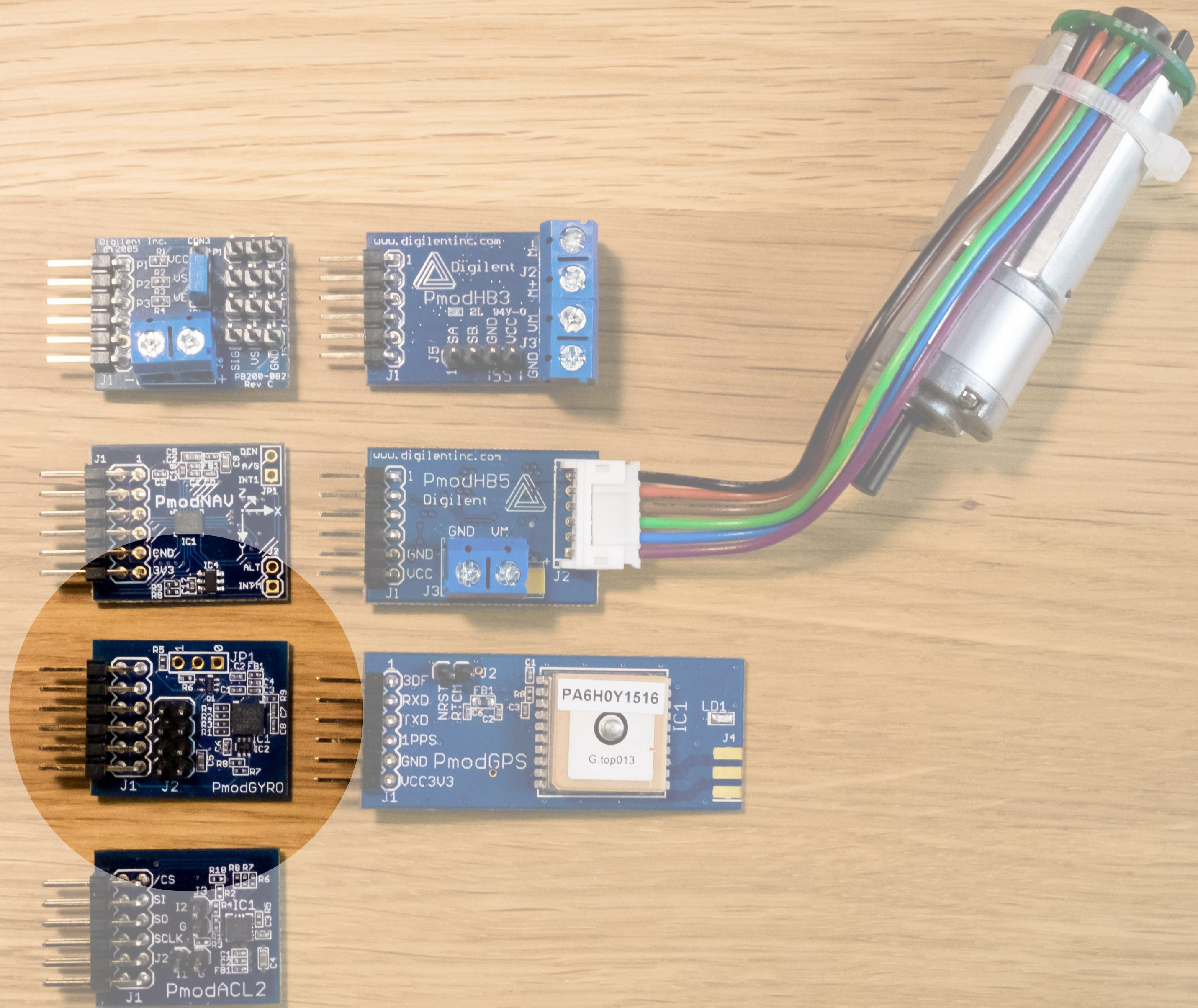
CON3



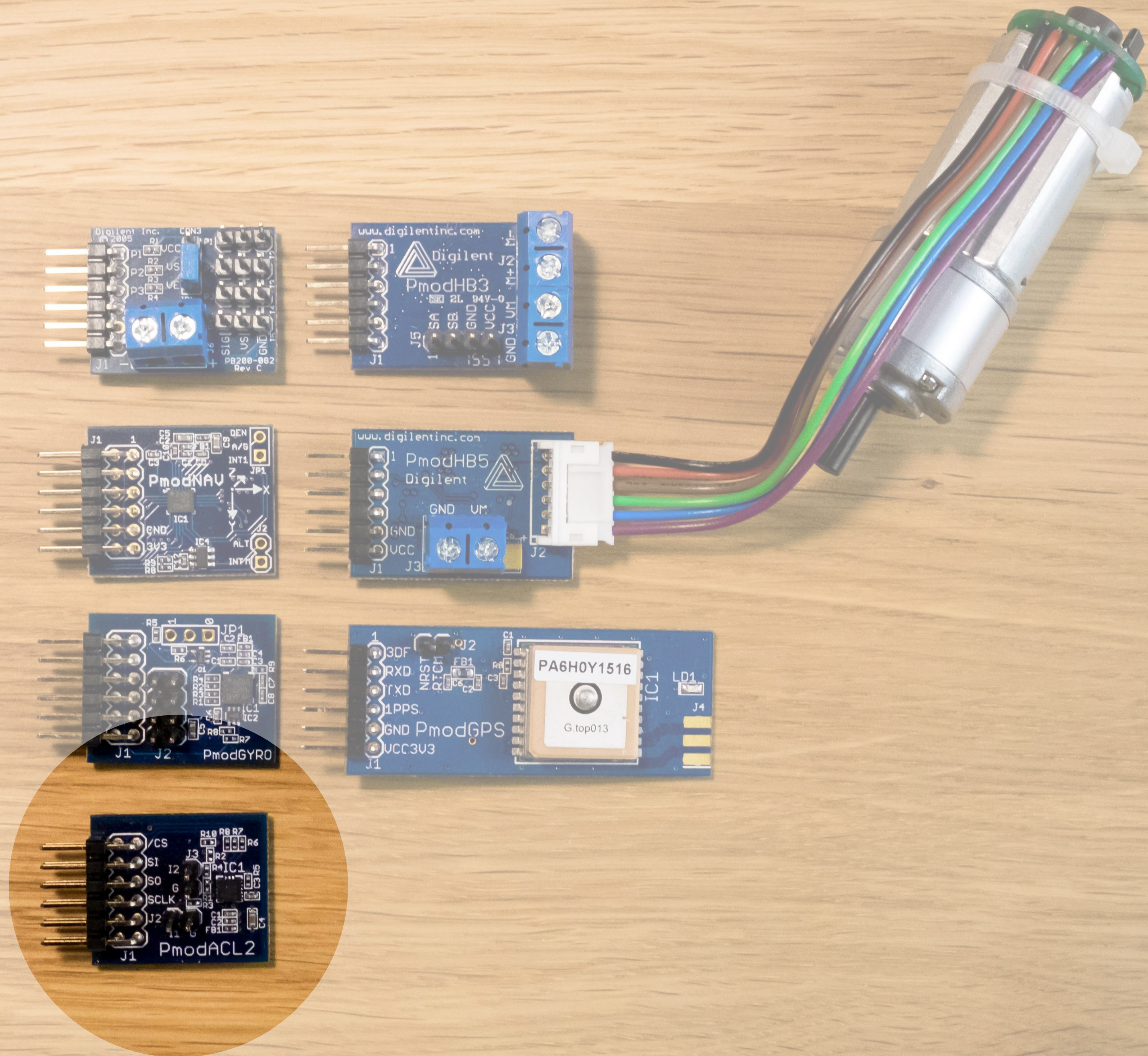
NAV



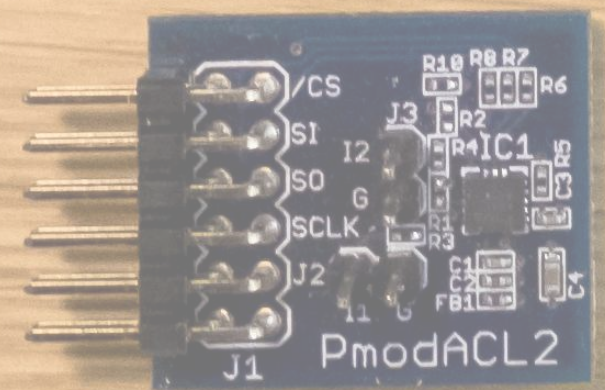
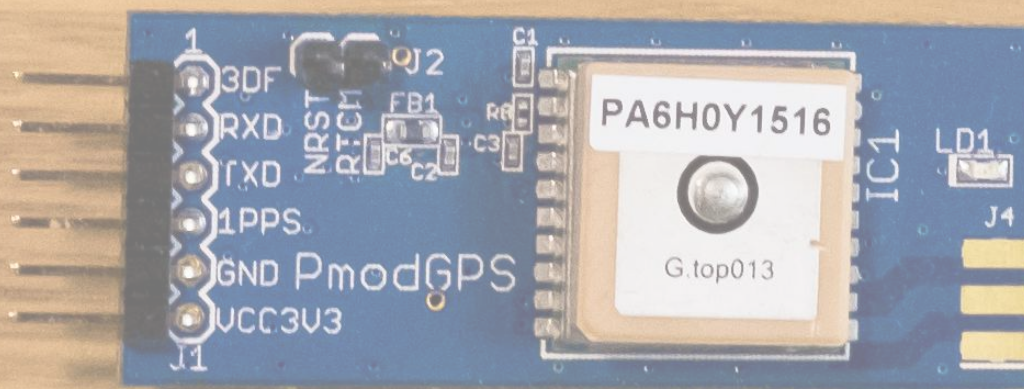
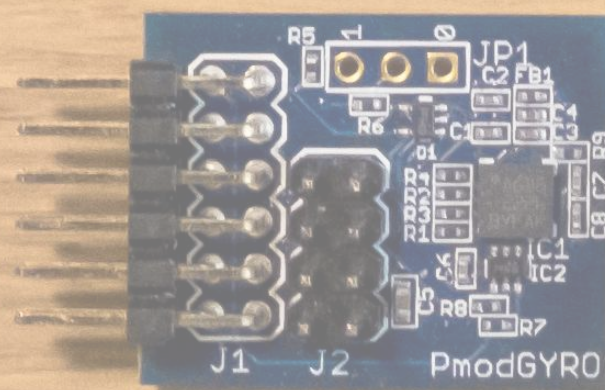
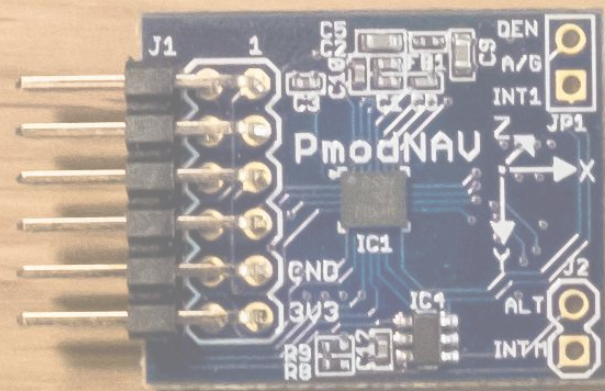
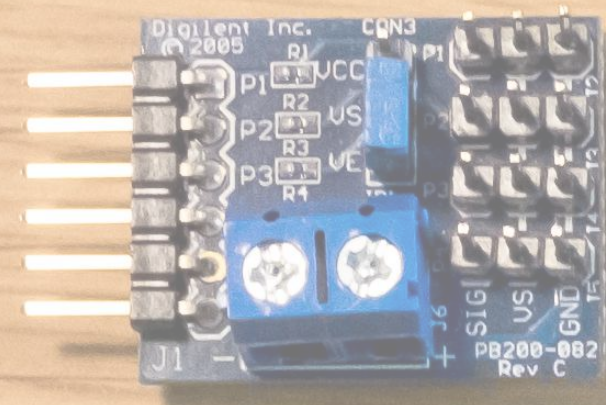
GYRO

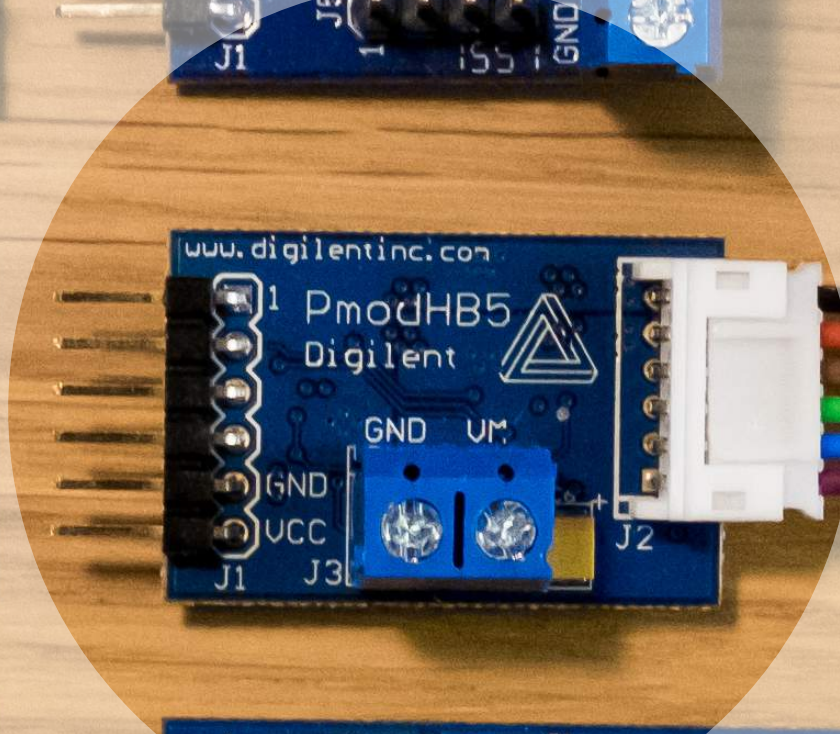


ACL2

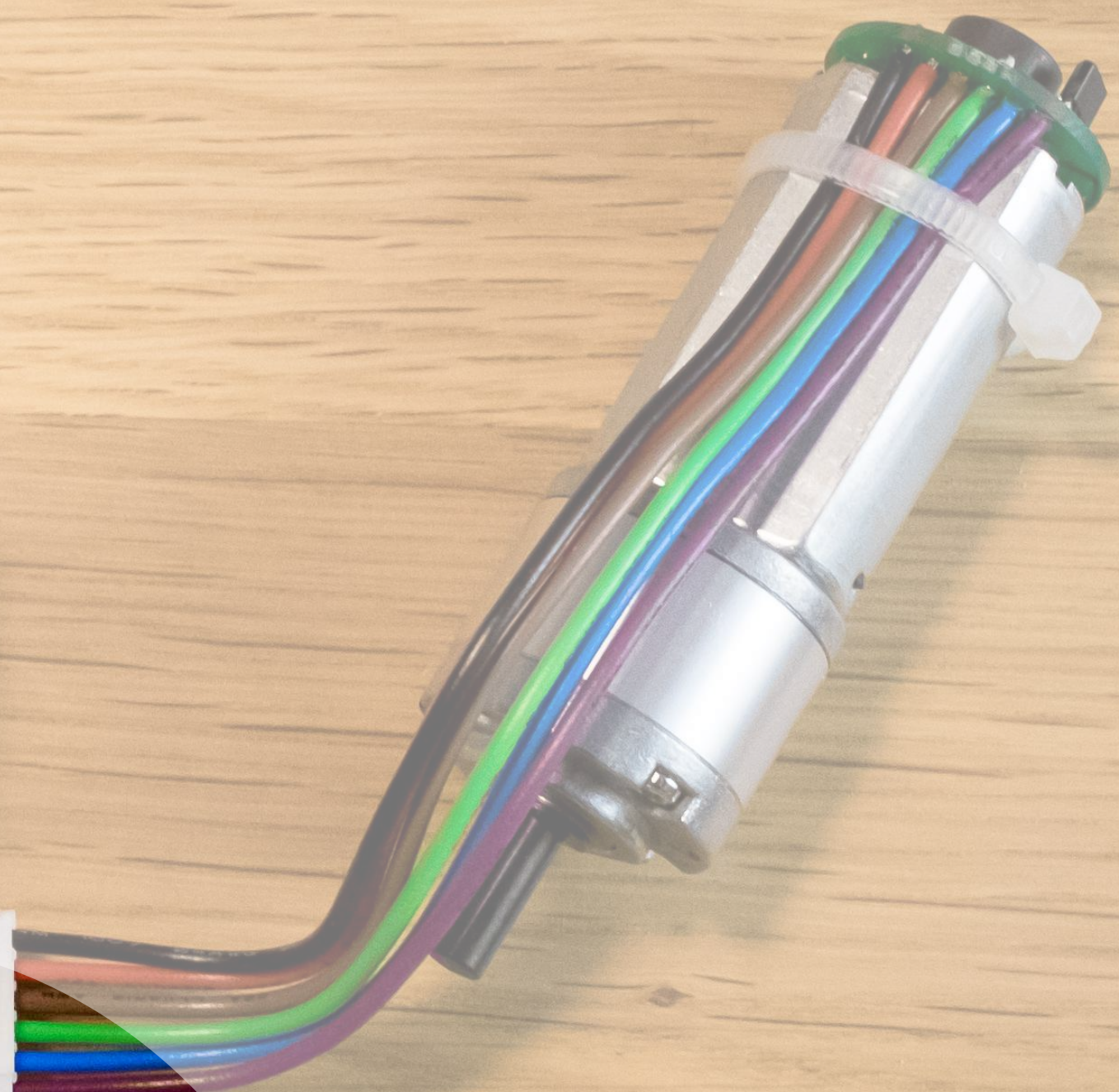
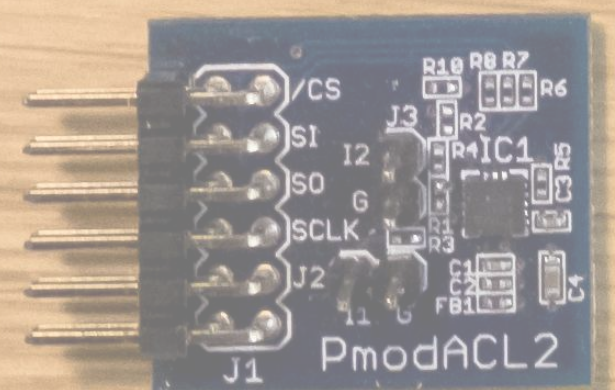
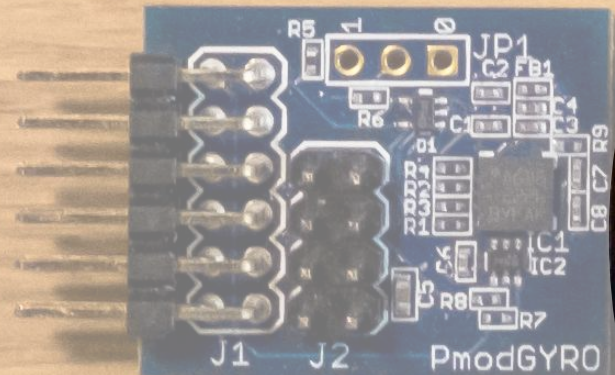
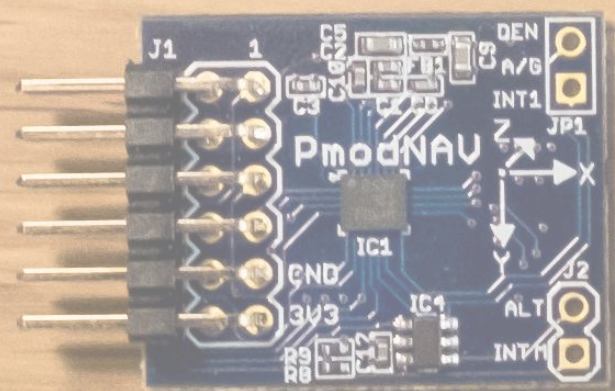
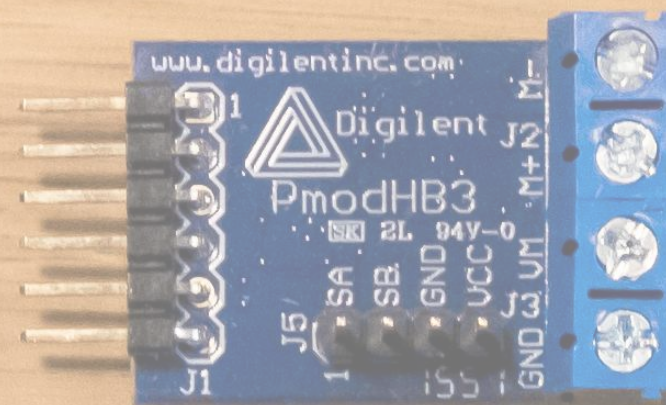
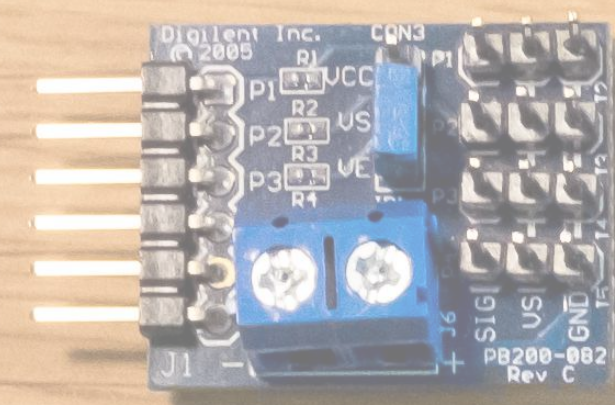


HB3





HB5



GPS

DEMO



GRiSP

www.grisp.org



DIPL. PHYS.
PEER STRITZINGER GMBH



TOOLCHAIN,
OS
& RUNTIME

SOFTWARE

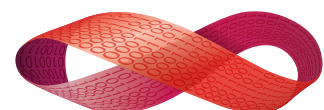
RTEMS

RTOS

“OS-AS-A-LIBRARY”

AKA UNIKERNEL NOWADAYS

POSIX

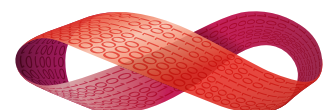


PERFORMANT

SMP

PROCESSES VIA THREADS

FREEBSD NETWORKING



BEAM COMPILED WITH
RTEMS

STARTS FROM BOOTLOADER

OS APIS PROVIDED BY
RTEMS



BEAM

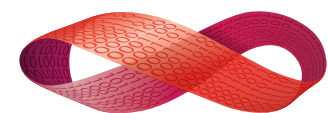
APPLICATION

OTP

GRiSP RUNTIME

RTEMS

HARDWARE



GRiSP RUNTIME

HARDWARE ABSTRACTION

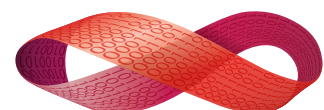
LOW LEVEL DRIVERS

HIGH LEVEL DRIVERS



CONFIGURING DRIVERS

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[
    {grisp, [
        {devices, [
            {spi1, pmod_nav, #{debug => true}},
            {uart, pmod_maxsonar}
        ]}
    ]}
].
```





BUILD&DEPLOY

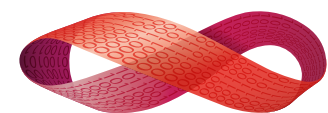
TOOLING

REBAR3 PLUGIN

rebar3 new grispapp

rebar3 grisp build

rebar3 grisp deploy



COMPILED WITH RTEMS
STARTS FROM BOOTLOADER
OS APIS PROVIDED BY
RTEMS

DEMO

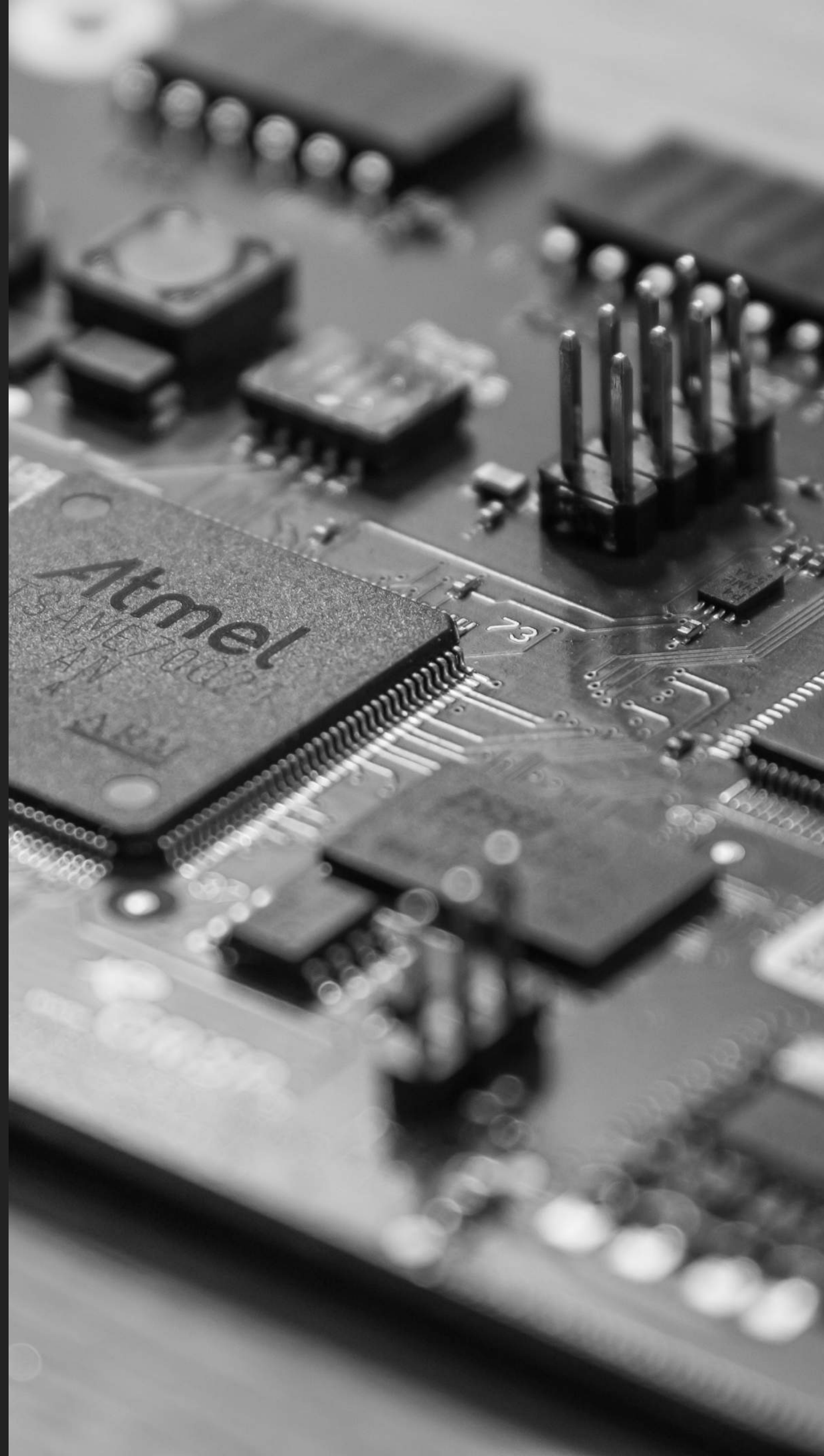


GRiSP

www.grisp.org



DIPL. PHYS.
PEER STRITZINGER GMBH



WHAT WE'RE
WORKING ON

THE FUTURE

NOVEMBER 2017

HARDWARE SHIPS

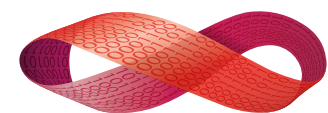
SOFTWARE 1.0



WIFI WPA2

ERLANG 19.3

ALL BASIC DRIVERS





Lightweight computation for networks at the edge



Funded by the Horizon 2020
Framework Programme of the
European Union

IOT

**SYNCHRONIZATION-FREE
PROGRAMMING**

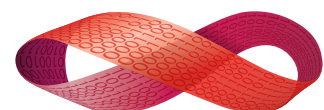
HYBRID GOSSIP PROTOCOLS

ROADMAP

ERLANG 20

MORE DRIVERS

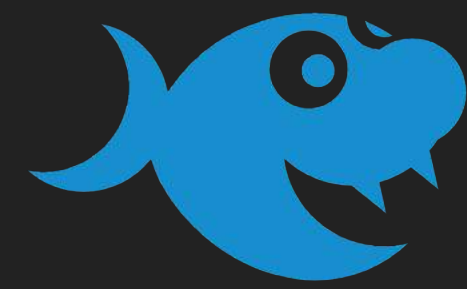
HARD REALTIME ERLANG



RAFFLES!

GET ON MAILING LIST
BETWEEN NOV 7TH – 12TH 2017
WIN ONE OF 3 BOARDS!

EVERY BOARD ORDERED UNTIL
DEC 6TH 2017 ENTERS DRAWING OF
10 PMOD NAV AND 1 ROBOT KIT!



GRiSP

grisp.org

github.com/grisp

stritzinger.com

THANK YOU!

QUESTIONS?