Functional Test Record – SparkFun RedStick

Marshall Taylor
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HW version v01

Verifying Serial Pinout

Procedure:

(note: Products that have TTL: FTDI basics, serial 7 segment, pi wedge)

List SparkFun Products with TTL serial port:

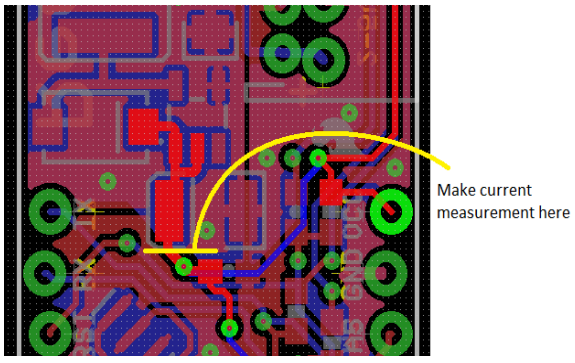
- FTDI basic
- Serial 7 segment
- Pi Wedge
- Serial LCD
- GPS modules

Criteria:

Do modern and useful serial ports line up properly more often then not? Discuss

No real standard exists. TX and RX are together on a lot, with various organizations of power and ground. The FTDI is the closest thing to standard but has extra pins. Going with any old 4 pin pattern really. This one allows reverse without shorting powers, but does let TXI drive ground.

Power Circuitry Tests



Low Load Test

Procedure:

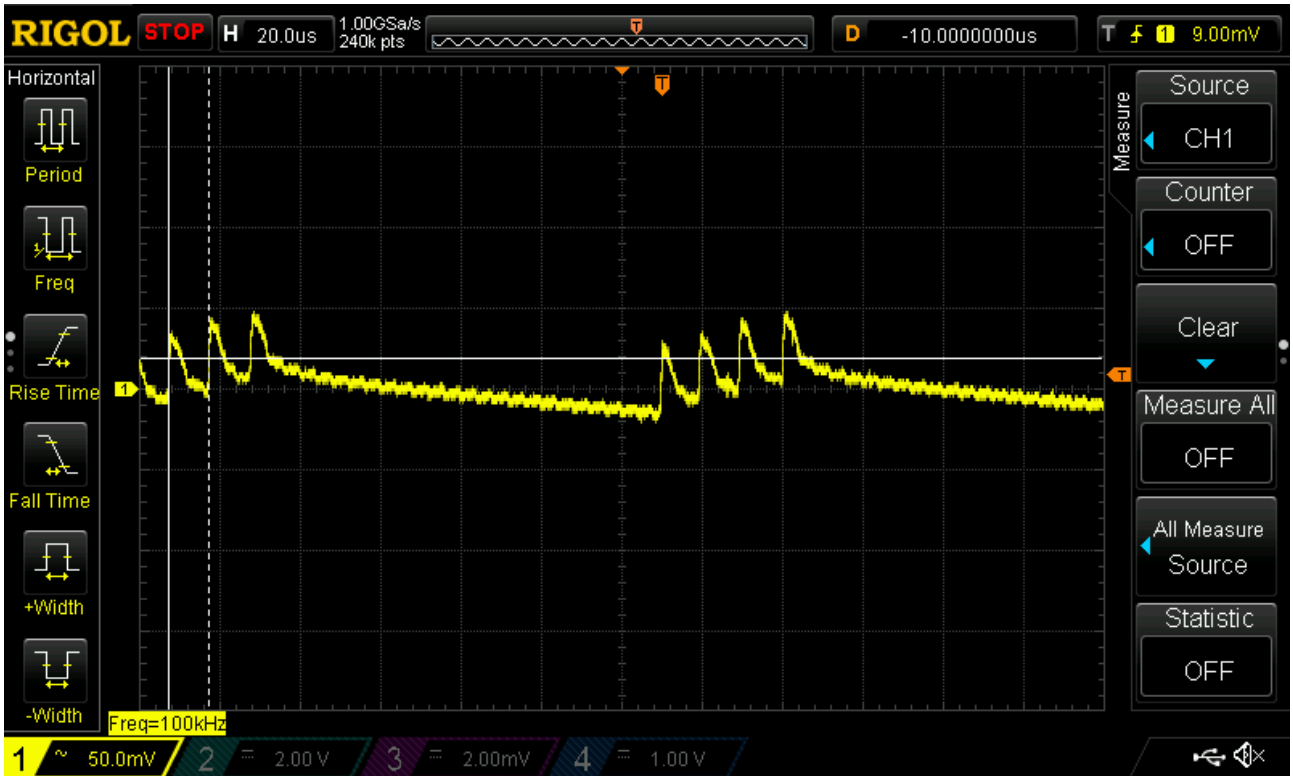
- Power from battery input with fine voltage supply.
- Increase input voltage from 1V to 6V. Measure Vin/Iin, Vout/Iout, ripple

Criteria:

- Does regulator provide clean output between 2.0 V and 5.0 V?

- Is efficiency above 80% in this range? **No**
- Is ripple below 10% in this range? **Yes**
- Mark the switching frequency: **About 5kHz**
- Data:

Input		Output	
Voltage	Current	Voltage	Current
1	0.019	3	0.0017
1.49	0.052	4.16	0.00975
1.95	0.057	4.98	0.0153
2.98	0.03	4.99	0.0153
4.01	0.022	4.99	0.0152
4.98	0.018	5.03	0.0156
5.48	0.016	5.18	0.0168
5.97	0.022	5.65	0.0213



Ripple generated at low load (Burpy)

100mA Load Test

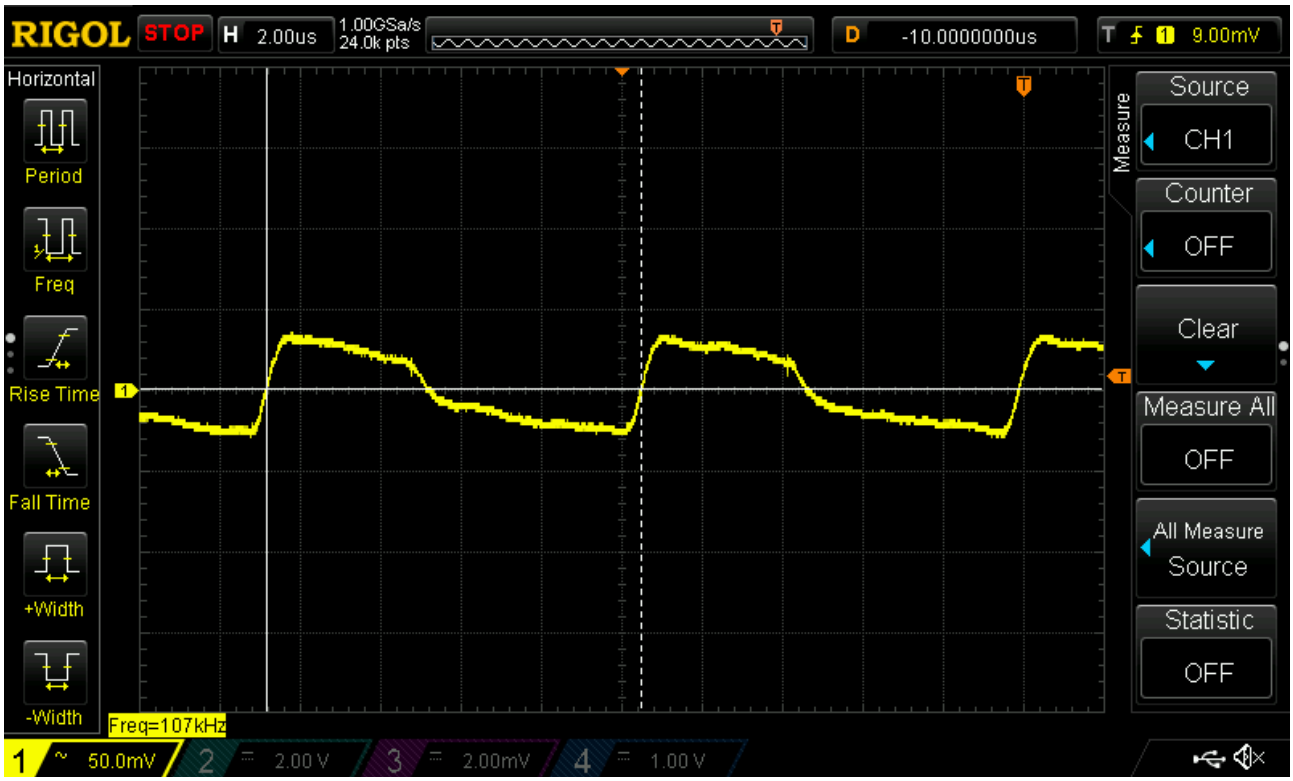
Procedure:

- Load 100mA total, add load to VCC pin
- Power from battery input with fine voltage supply.
- Increase input voltage from 1V to 6V. Measure Vin/Iin, Vout/Iout, ripple

Criteria:

- Does regulator provide clean output between 2.0 V and 5.0 V? **Yes**
- Is efficiency above 80% in this range? **No**
- Is ripple below 10% in this range? **Yes**
- Mark the switching frequency: **Various (See below)**
- Data:

Input		Output	
Voltage	Current	Voltage	Current
0.99	0.003	0.21	0.00366
1.58	0.023	0.87	0.0152
1.61	0.296	2.88	0.056
1.94	0.454	4.21	0.083
3	0.197	4.88	0.0996
4.05	0.144	4.89	0.1
5.02	0.116	4.93	0.1008
6.08	0.117	5.55	0.117



Ripple generated at 100mA

200mA Load Test

Procedure:

- Load 200mA total, add load to VCC pin
- Power from battery input with fine voltage supply.

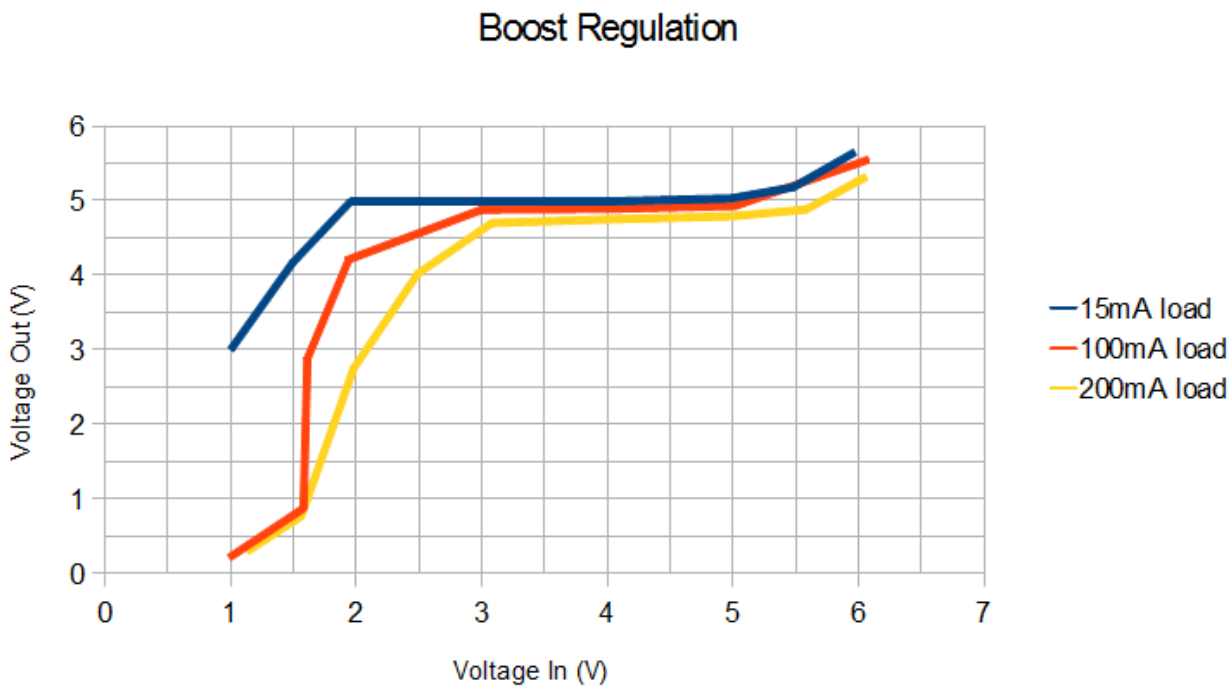
- Increase input voltage from 1V to 6V. Measure Vin/Iin, Vout/Iout, ripple

Criteria:

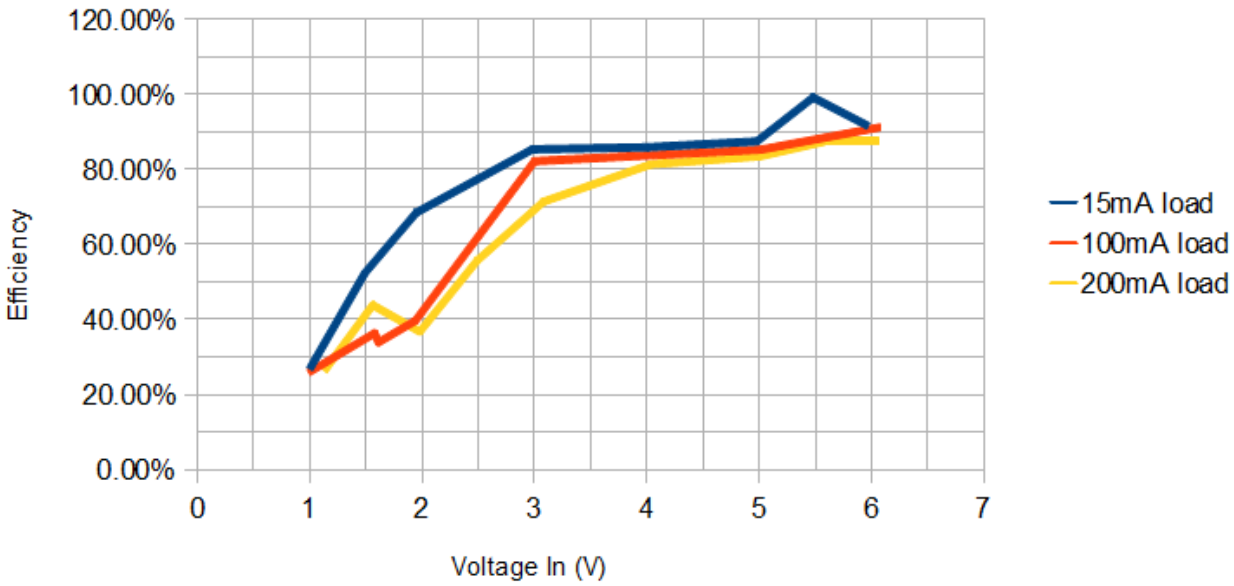
- Does regulator provide clean output between 2.0 V and 5.0 V? **Voltage sags below 3.0 V, 4.0 V output at 2.5 V input**
- Is efficiency above 80% in this range? **No**
- Is ripple below 10% in this range? **Yes**
- Mark the switching frequency: **Various (See below)**
- Data:

Input		Output	
Voltage	Current	Voltage	Current
1.13	0.011	0.29	0.01129
1.56	0.033	0.76	0.0297
1.98	0.426	2.75	0.1127
2.49	0.542	4.02	0.187
3.08	0.42	4.7	0.1966
4.03	0.288	4.75	0.1988
5	0.23	4.79	0.2005
5.58	0.204	4.88	0.204
6.06	0.225	5.32	0.225

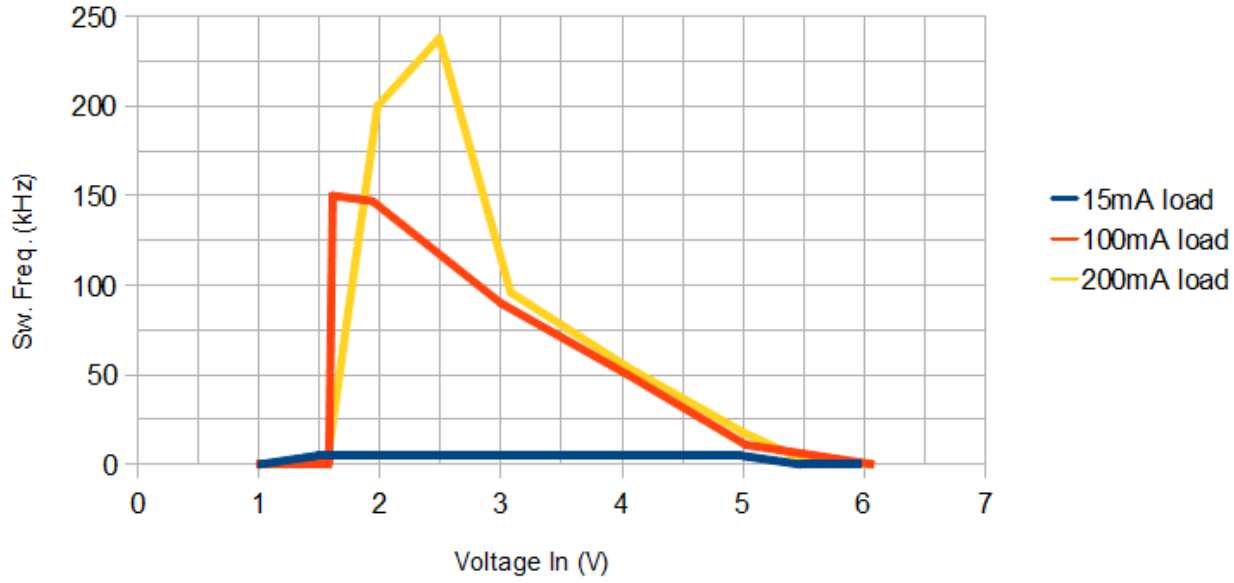
All Power Test Graphs

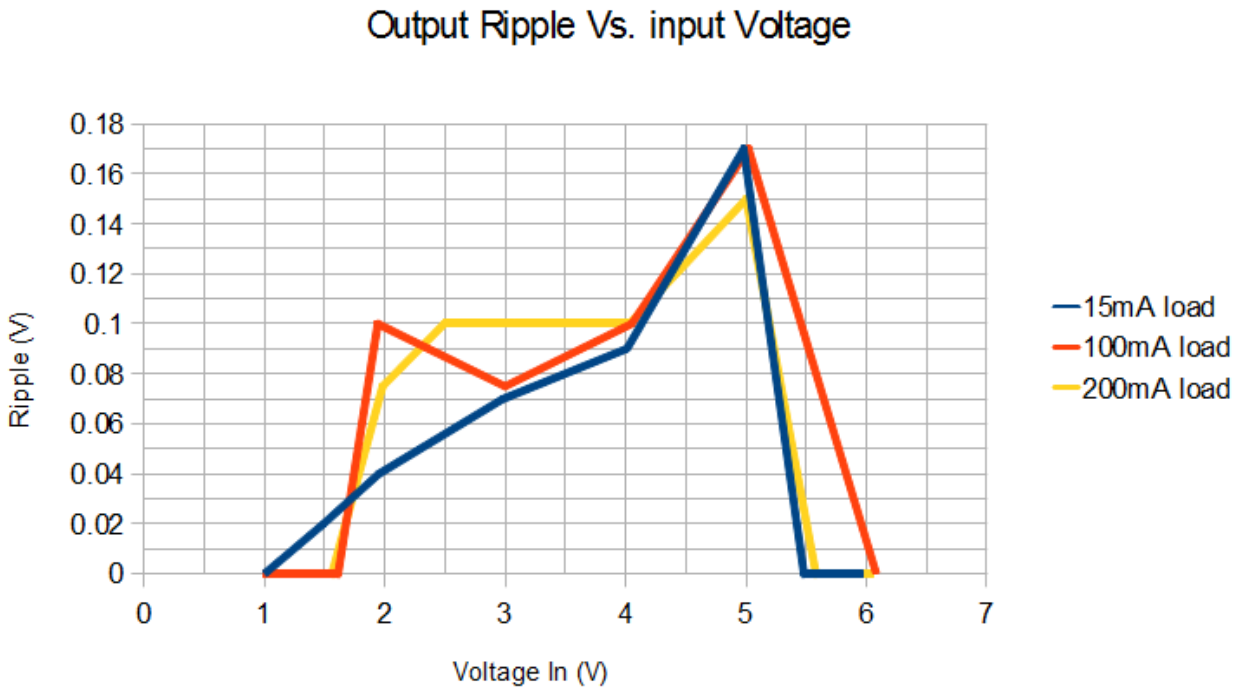


Efficiency Vs. input Voltage



Switching Frequency Vs. input Voltage





Test the regulator's reverse flow

Procedure:

- Apply 5.0 V to the serial VCC port
- Switch between shorting and opening the USB connection (simulate reverse plug-in)

Criteria:

- The total current input should match the no-load consumption of the MPU +/- 5% **Shorting the USB power lines had zero effect on current draw.**

Test the battery protection from rogue VCC input

Procedure:

- Attach a 3.0 V battery and current meter to the battery input.
- Apply 5.0 V to the serial VCC port.

Criteria:

- The battery must not accept current. **The battery consumed 0.00 A**

Test the battery protection from USB input

Procedure:

- Attach a 3.0 V battery and current meter to the battery input
- Apply 5.0 V to the USB VCC port

Criteria:

- The battery must not accept current. **The battery consumed 0.00 A**

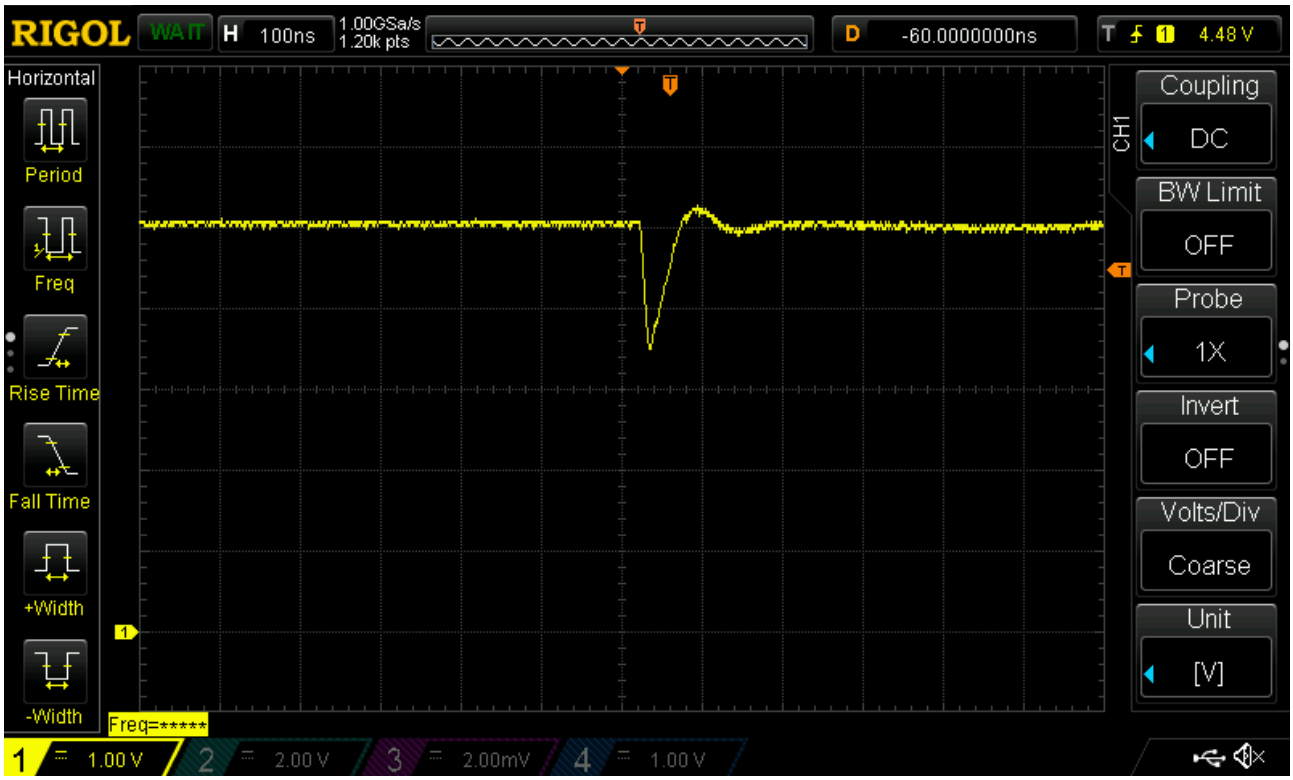
Extra test: Step loads

Procedure:

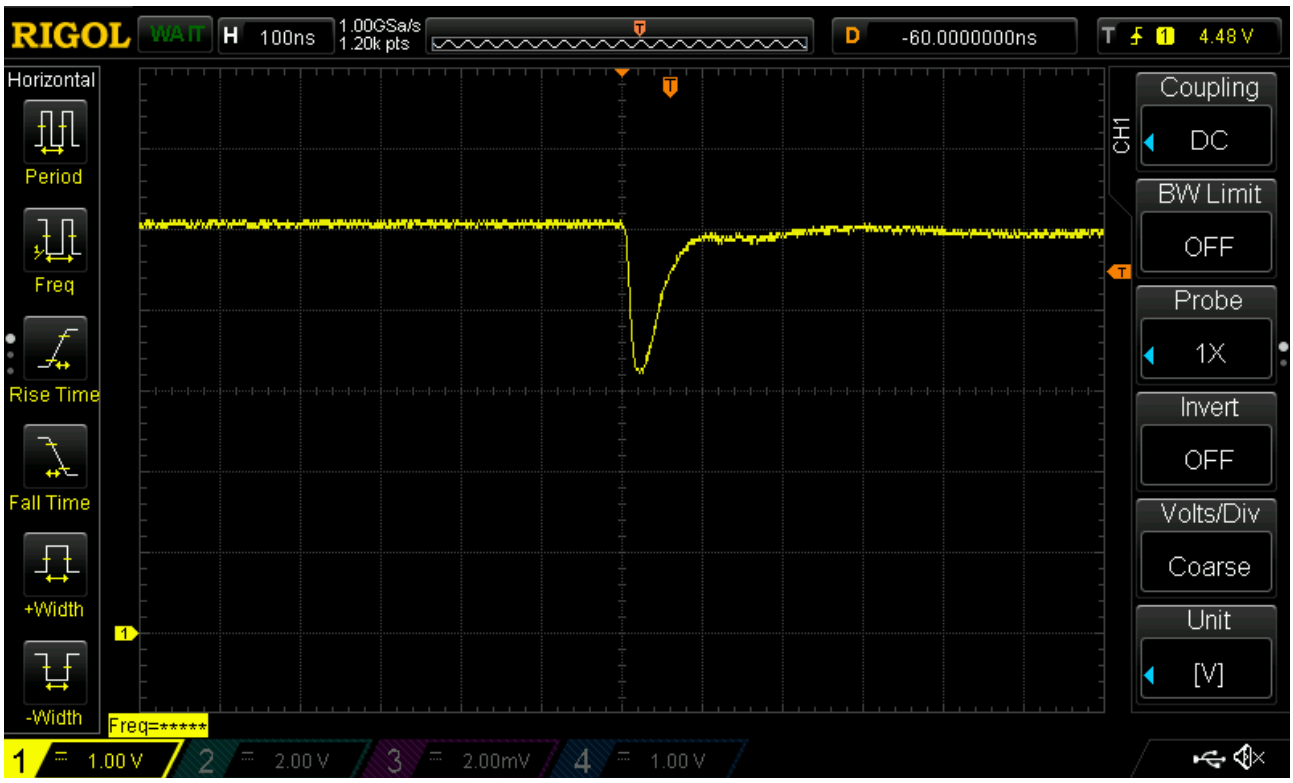
- Apply 2.5 V to the battery port
- Step loads between 0 and 100mA (total)

Criteria:

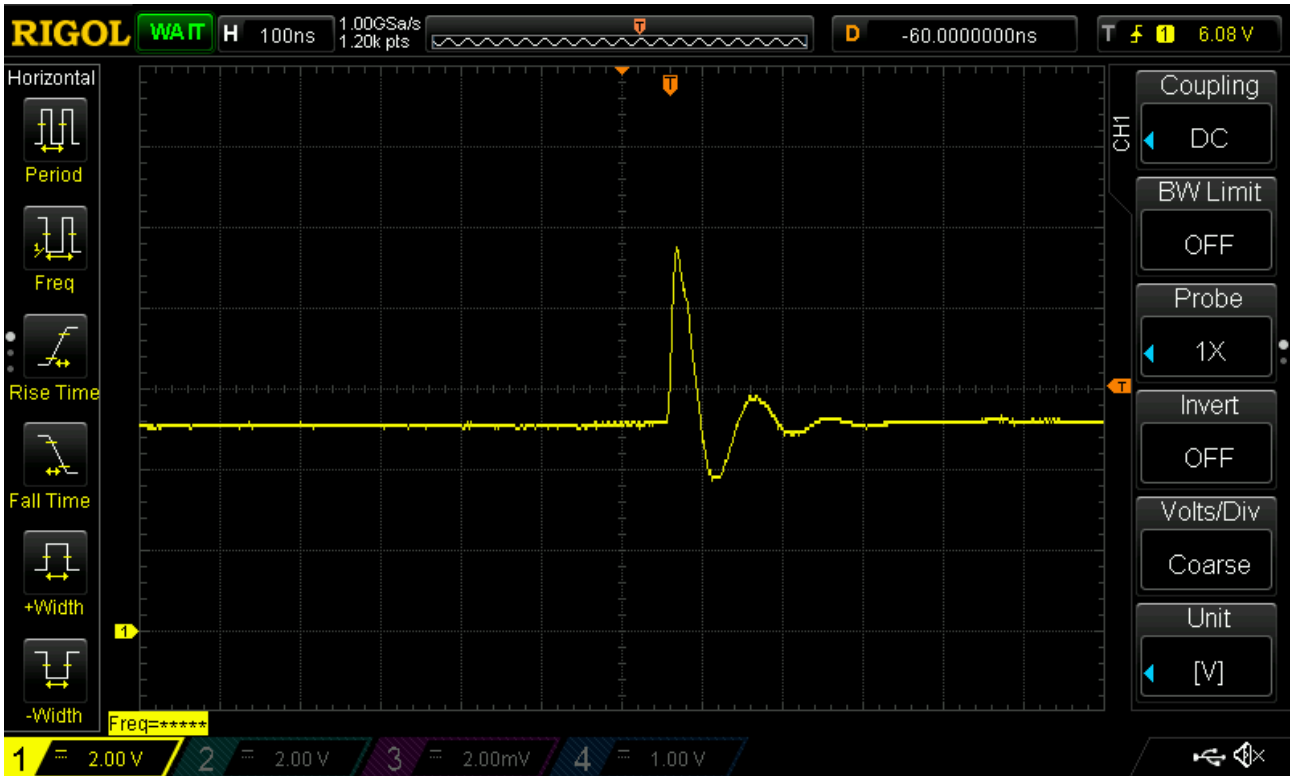
- Ringing should be minimal. **10 V for 40 ns**
- Attach labeled scope captures.



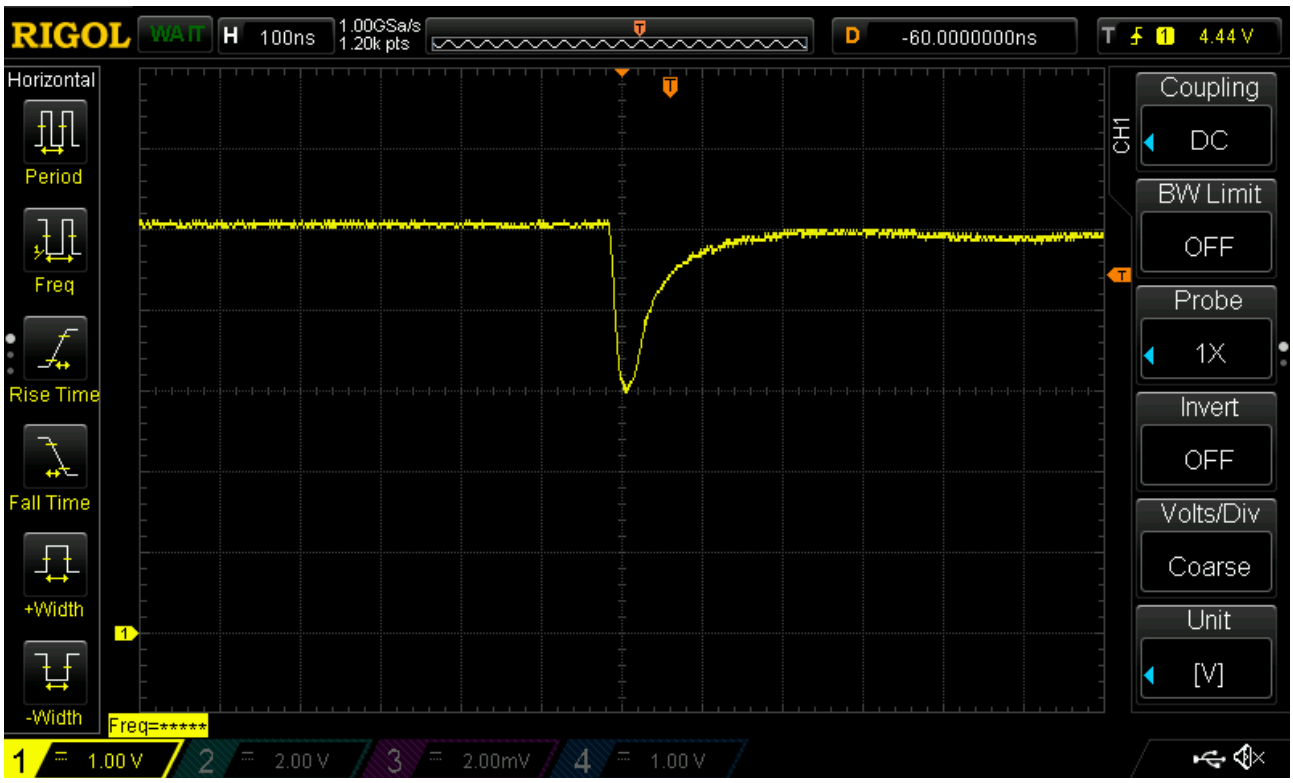
38mA load switching in



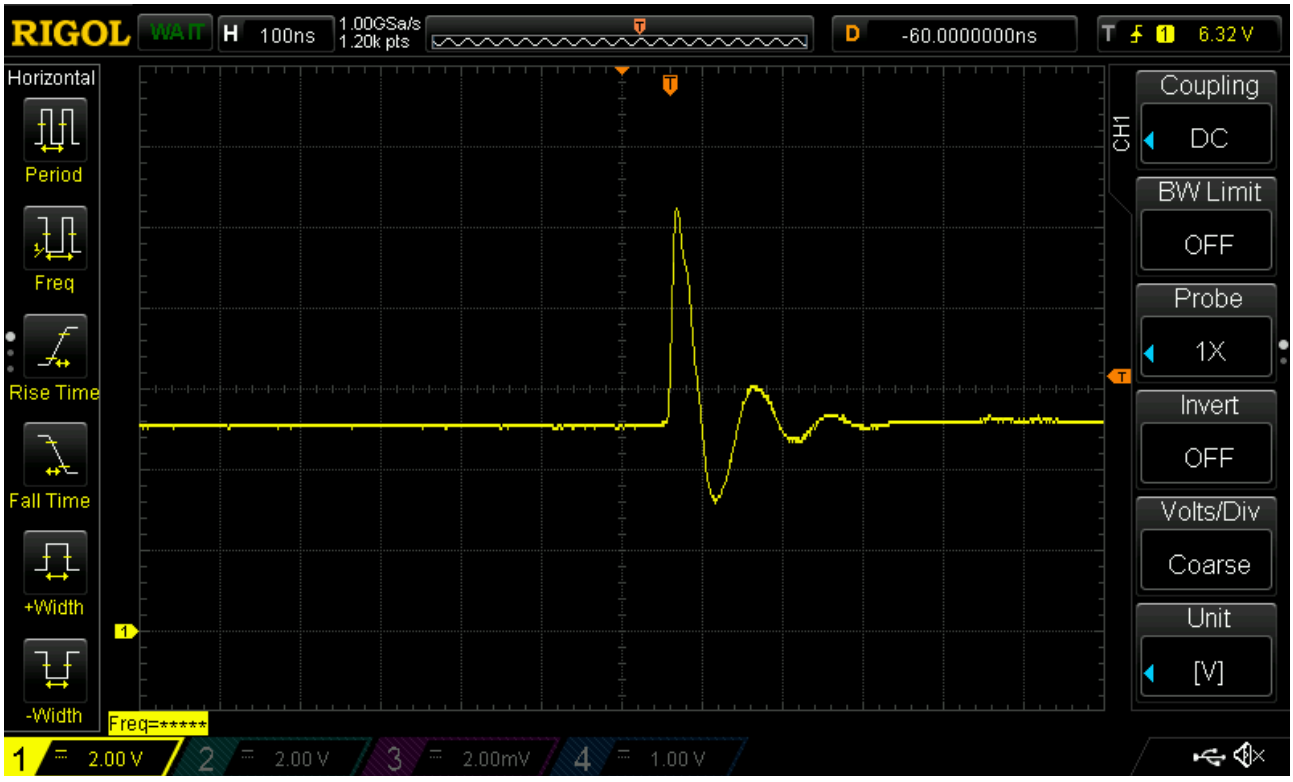
75mA load switching in



75mA load switching out



95mA load switching in



95mA load switching out

Extra test: Reverse battery voltage

Procedure:

- Apply reverse voltage to battery terminals

Criteria:

- Must not crater. **0.00 A was consumed from the reverse voltage. RedStick operated normally afterwards.**

Set LED bias

Procedure:

- Measure red current at Vin = 2.0 V. **0.34mA**
- Measure red current at Vin = 5.5 V. **0.36mA**
- Measure green current at Vin = 2.0 V. **8.73mA**
- Choose and set new resistors:
    - Red: Use 4.7kOhm
    - Green: Use 2.2kOhm for ~1.5mA of current

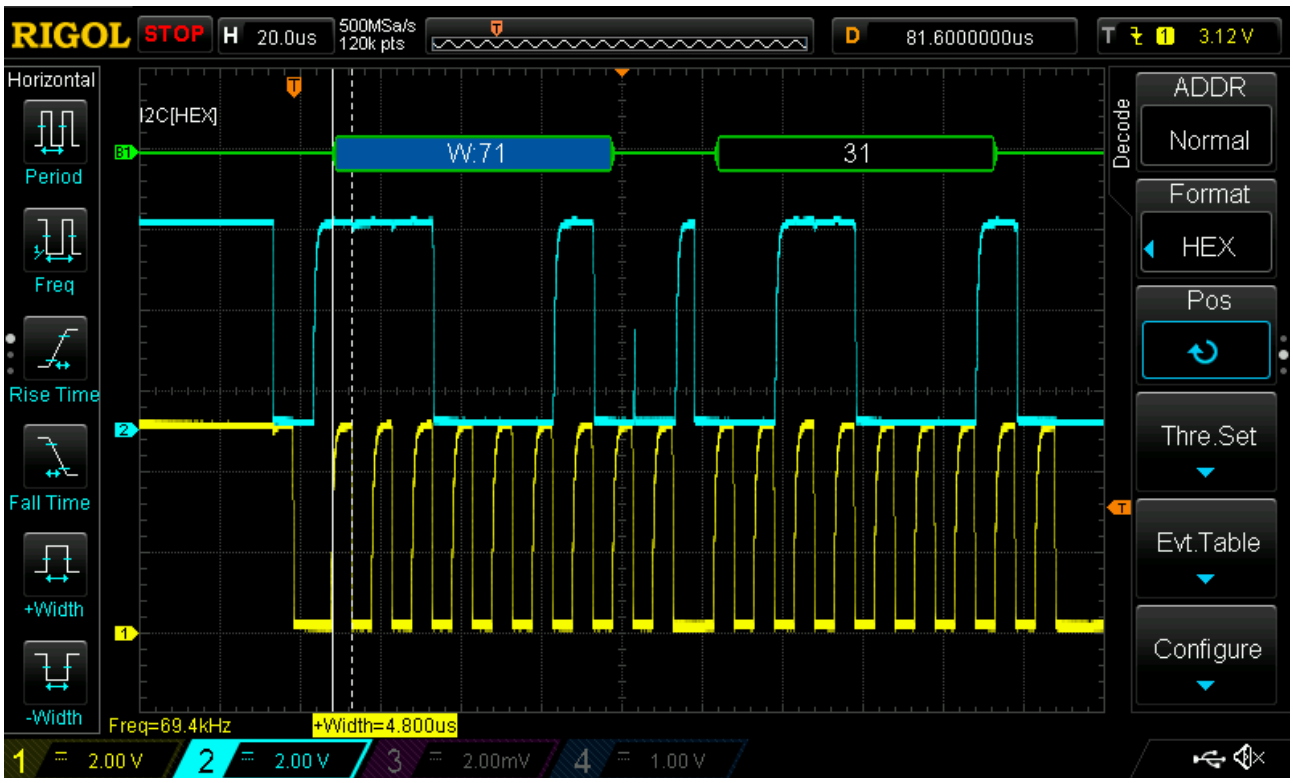
Test I2C signal integrity

Procedure:

- Attach a I2C device and start communication
- Capture signals with a scope.

Criteria:

- Mark test device (AUT): **7segment display with 4.7kOhm pullups**
- Are signals square and settled before clk edge?
- Clock should be clean
- Record scope capture



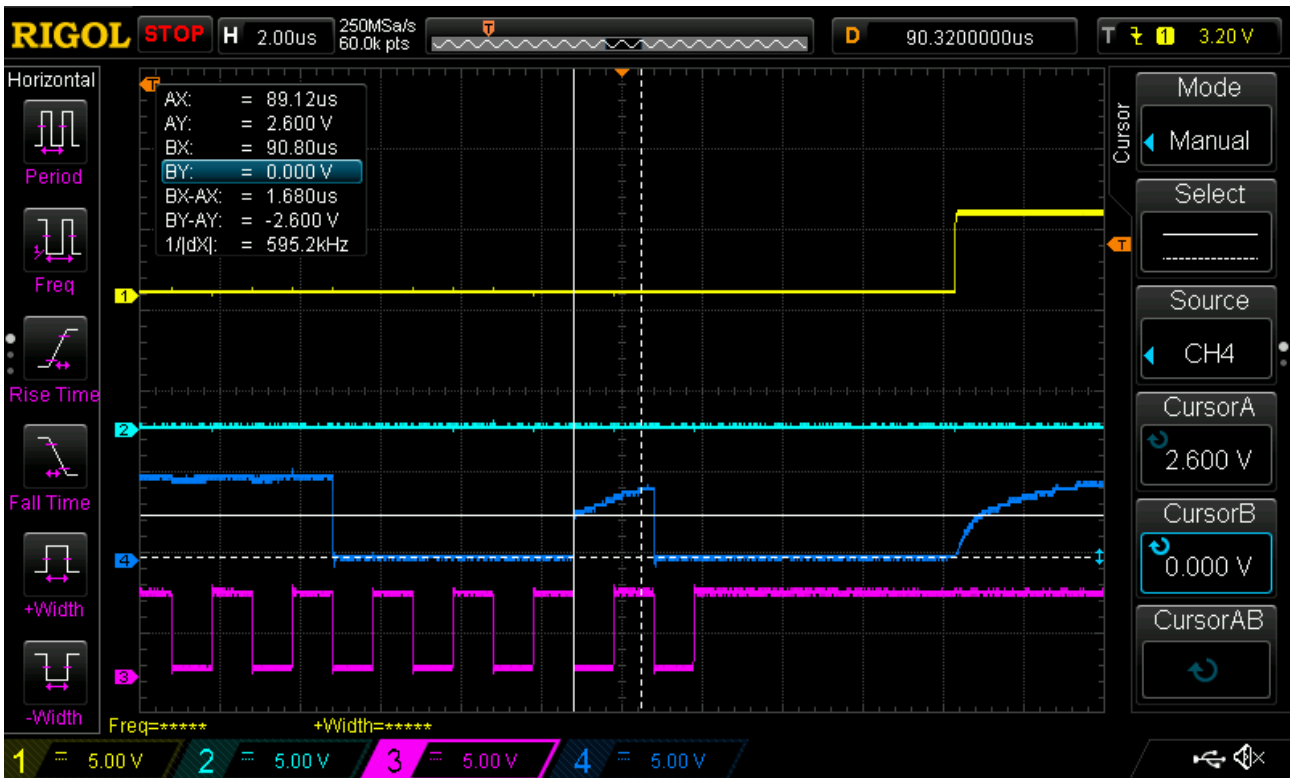
Test SPI signal integrity

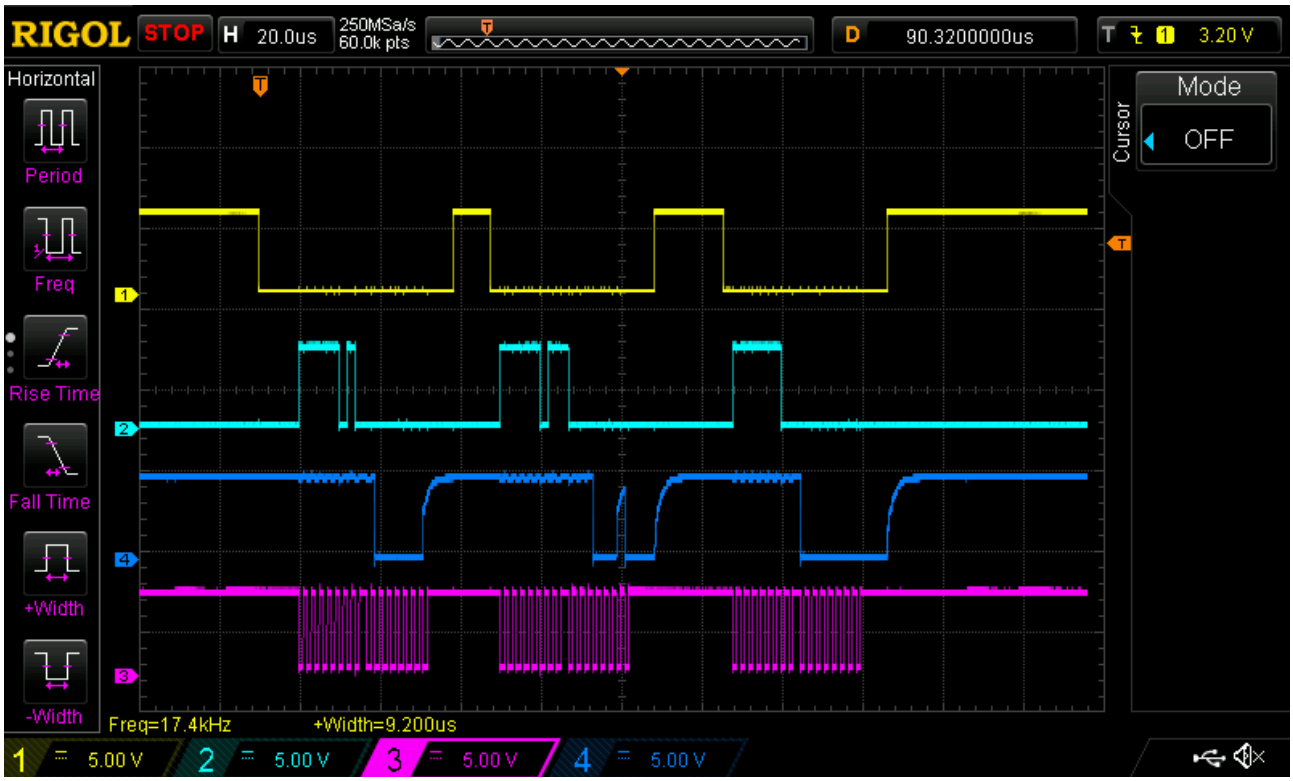
Procedure:

- Attach a SPI device through level shifter and start communication
- Capture signals with a scope between EUT and level shifter

Criteria:

- Mark test defice (AUT): **BME280 with level shifter**
- Are signals square and settled before clk edge?
- Clock should be clean
- Record scope capture





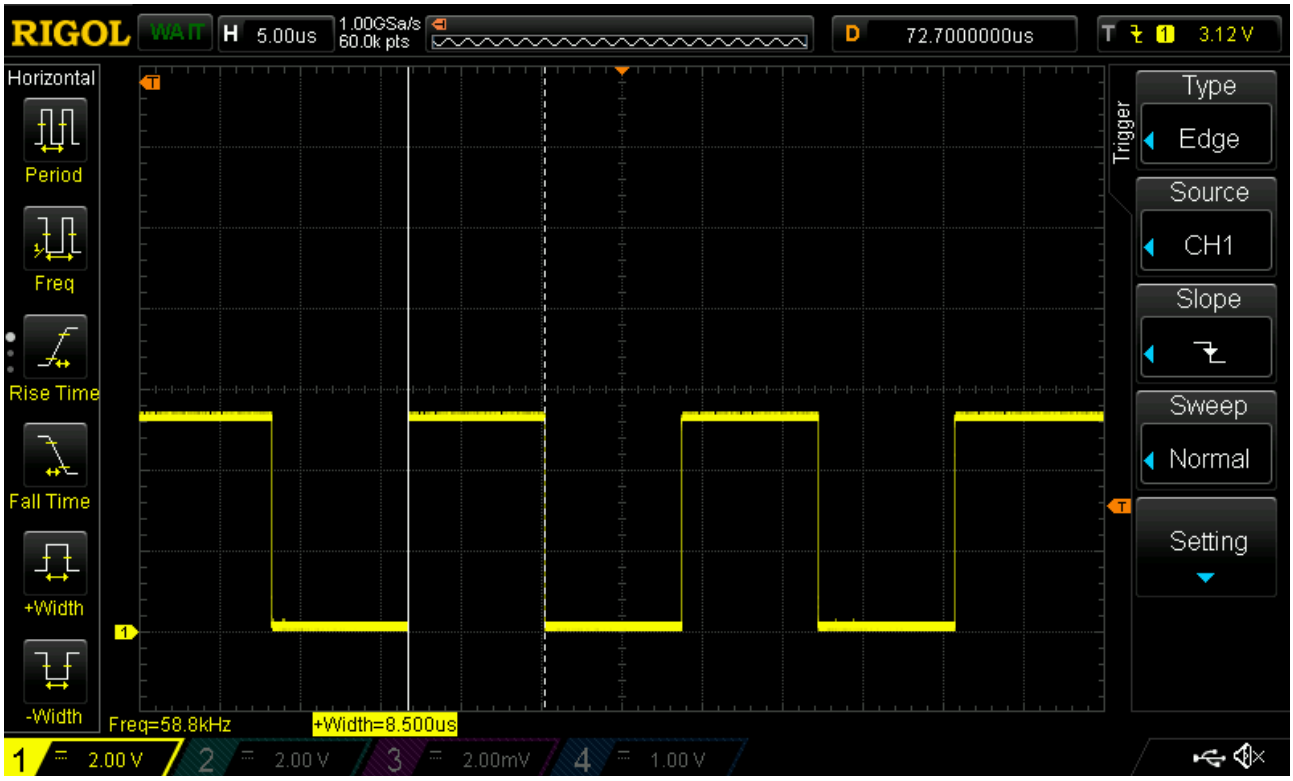
Test serial TTL signal integrity

Procedure:

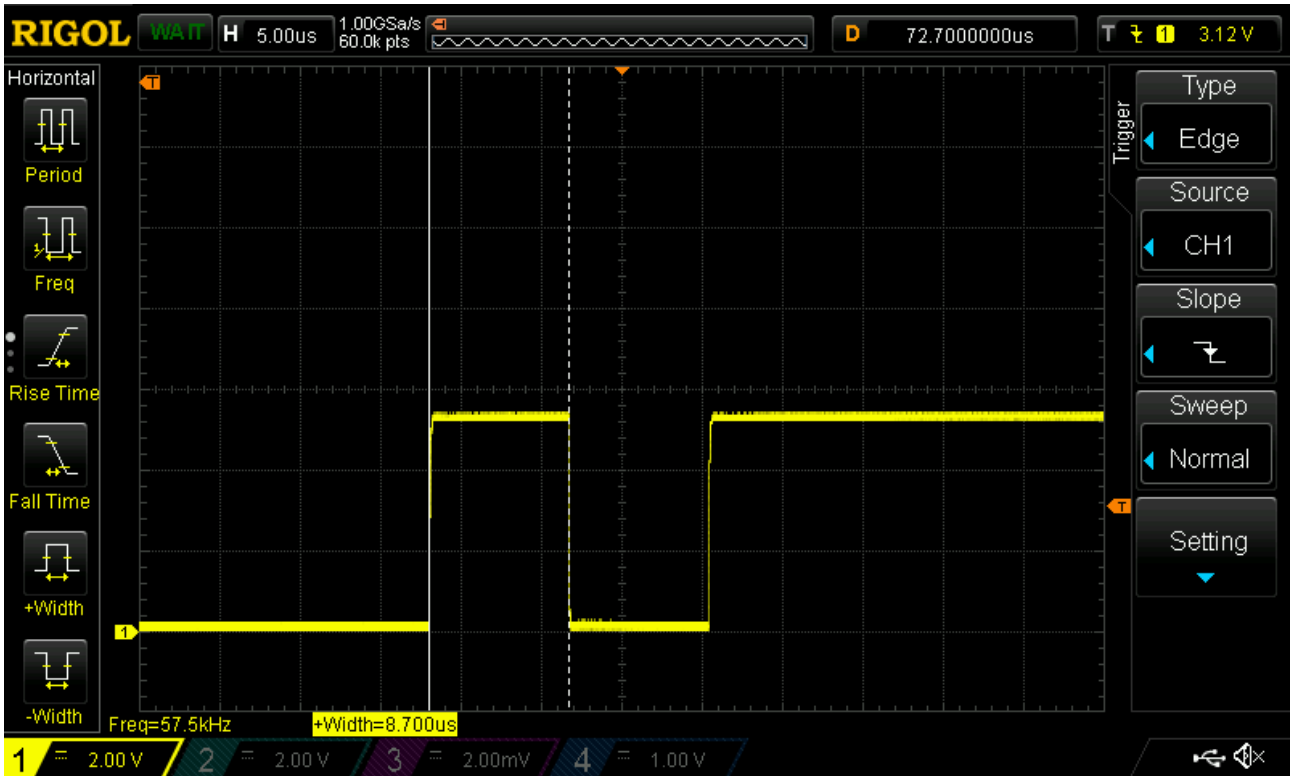
- Attach a serial device and start communication
- Capture signals with a scope.

Criteria:

- Mark test defice (AUT): **FTDI loop at 115200 baud**
- Are RX and TX typical?: **Yes**
- Record scope capture



TXO



RXI

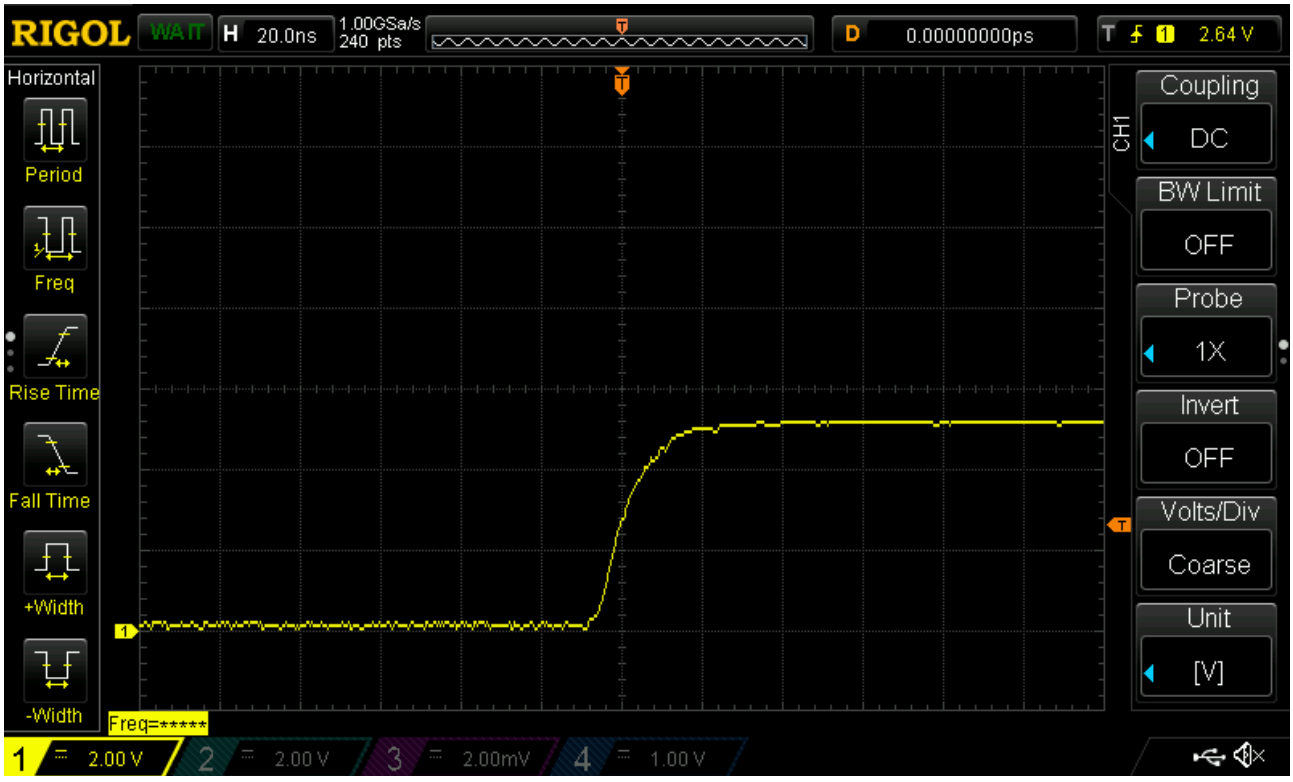
Test GPIO

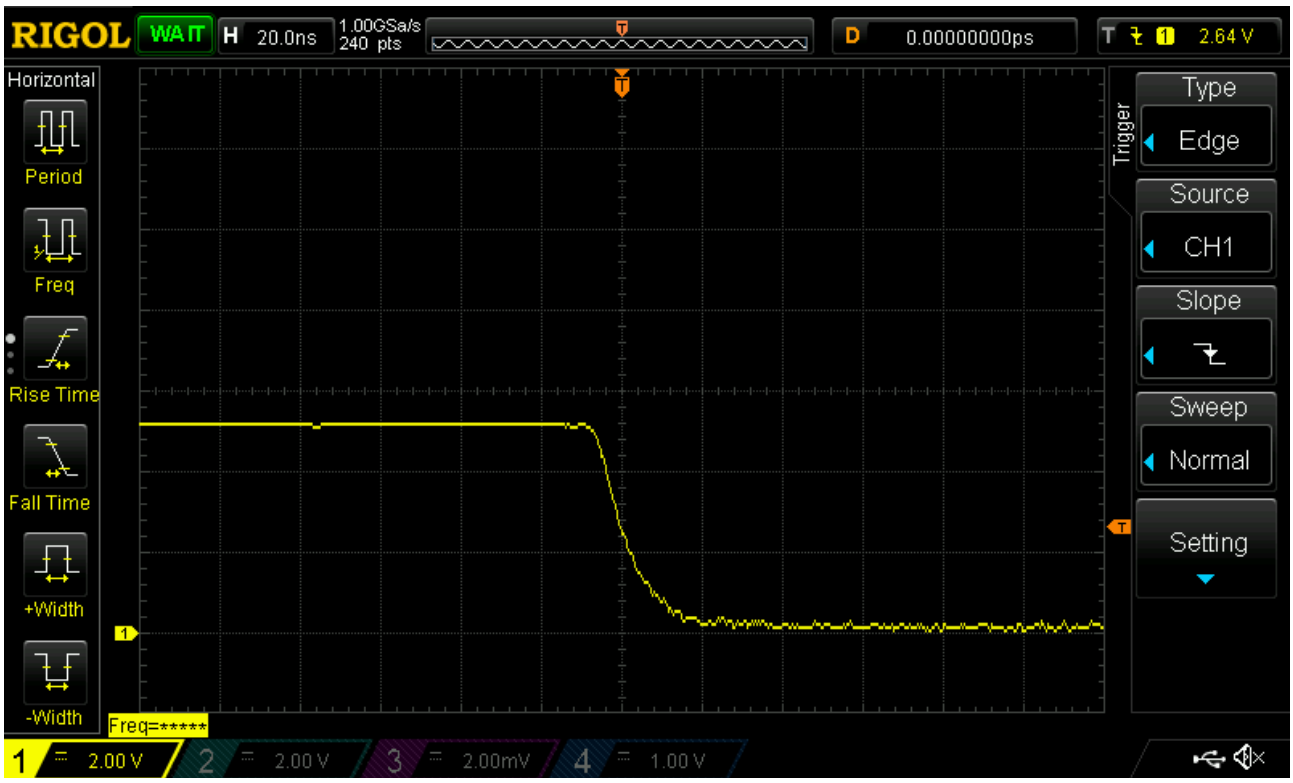
Procedure:

- Set code to pulse each pin sequentially
- Capture signals with a scope.
- Look for out of order pulses (> 1 pulse per pin13 cycle)
- Verify A0 – A7 by translating inputs to a PWM output and measuring

Criteria:

- Is each pin individually controllable? **Yes**
- Do any pins stick out as different from the others? **No**
- Do all analog inputs work and are stable? **Yes**
- Record scope capture of worst 2 pins. **All pretty much the same**




RIGOL
WAIT
H 20.0ns
1.00GSa/s
240 pts
D 0.00000000ps
T 2.64 V
Horizontal
Period
Freq
Rise Time
Fall Time
+Width
-Width
Freq=*****
Trigger
Type
Edge
Source
CH1
Slope
Sweep
Normal
Setting
1 2.00 V
2 2.00 V
3 2.00mV
4 1.00 V