Mark & Hold feasibility study 2.

MIKLOS LUKACS, SEPTEMBER 2017

PD disconnect is reliably detectable in the Classification Mark state

Laboratory measurements

Goal: prove that the measured current by the PSE in a noisy environment in the Classification Mark state is less than the PD lower current limit, when the PD is not connected

(PD Mark event current: 0.25mA < IMark < 4mA)

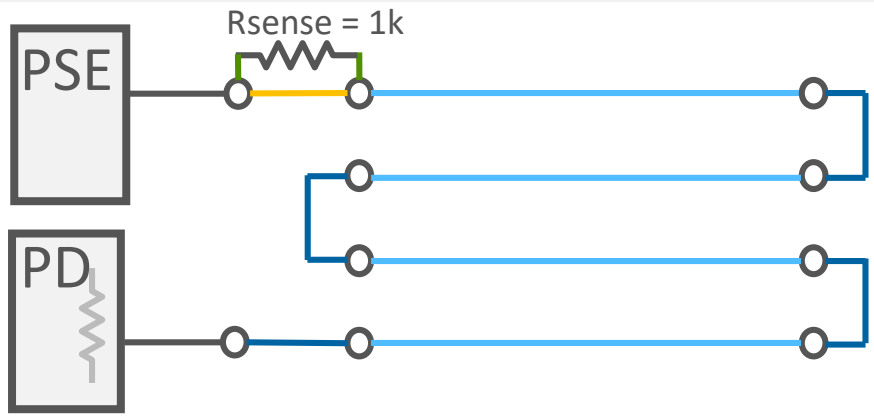
Agenda:

- Test setup
- Measurement methods
- Measurement results

Measurement setup

1.

- Standard office environment
- PD side: resistive load, R = 37kOhm
- PSE side: Cisco 24-port PoE switch
  - Port 4 is used for the mark current measurement:
    - PI voltage is set to 7.2V (V_{PWR} = 50V, V_{Drain} = 42,8V)
    - Calculated current: 195uA
    - Mark current is measured by the Si3458
      - The port was controlled by python (through I2C) to set the voltage and measure the current
    - Port voltage and current were monitored on oscilloscope also, using differential probes and 1K sense resistor
    - ‚PD' current also measured with a DMM
    - ‚PD' is connected using 4pcs of Cat5 cables, running parallel and connected serially
      - mixed with other cable types (power)
      - Each cable is ~30m in length; total: ~120m

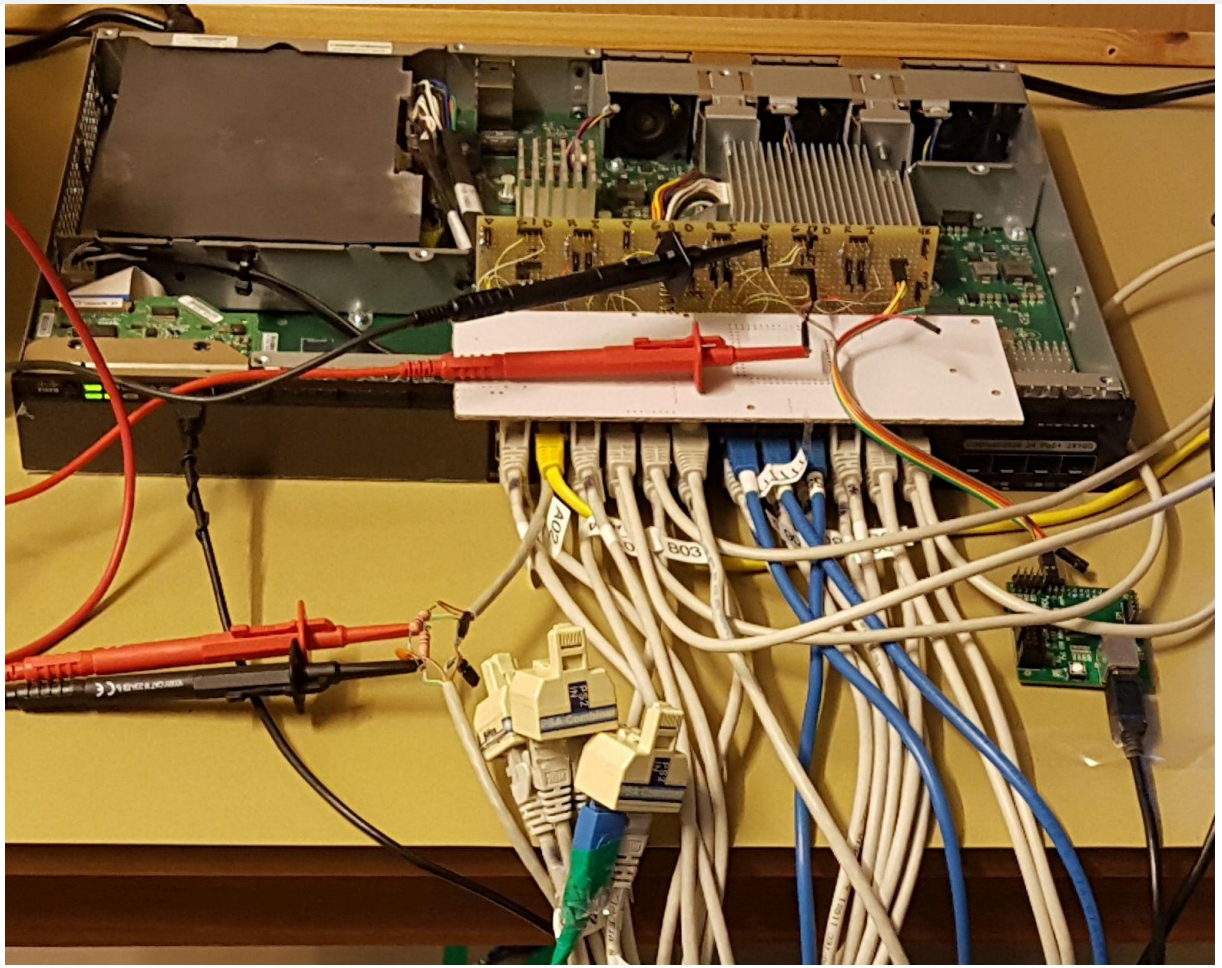


Measurement setup 2.

- PSE side: Continued
  - Connected to other ports:
    - 12 port were connected to Sifos PSA-1200 which emulated a PD on each port and disconnected periodically
    - 7pcs laptop which produced Ethernet data communication
    - 2 pcs Cisco wireless access points (no data, just PoE load)
    - 1 pc Cisco IP phone, both PoE and data (pinged with 1500bytes endlessly from one of the laptops)
- Noise generator:
  - Drilling machine; the mains cable was twisted in ~10m length around the Cat5 cables used for current measurement

Measurement setup

3.

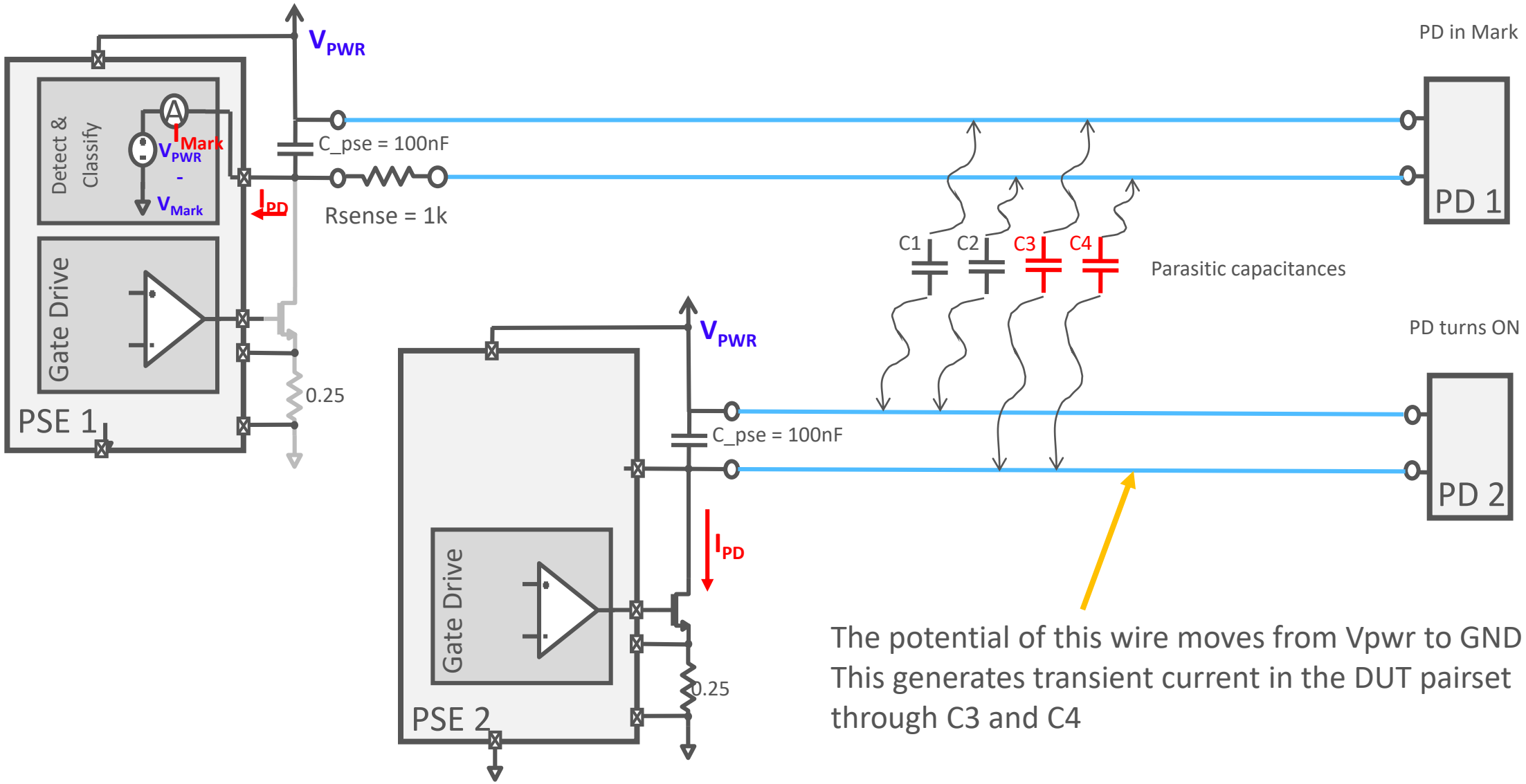


More pictures available upon request

Noise sources

- Ethernet data communication: - no detectable impact on noise
- Common mode disturbers:
  - PoE related activity (Classify, Turn On) on other ports
    - Not fully common mode due to the different impedances to Vpwr and GND
    - Generates differential voltage in the pairset
    - Noticeable transient can be observed on the external sense resistor
    - The impact on the internal sense resistor is significantly reduced by the PSE input impedance
  - Mains operated equipment – significant noise can be observed when a drilling machine turned on
    - Trully common mode signal
    - Appears on both pairs at the same time – does not generate current flow
    - no impact

Simplified modell of PoE related activity on other ports

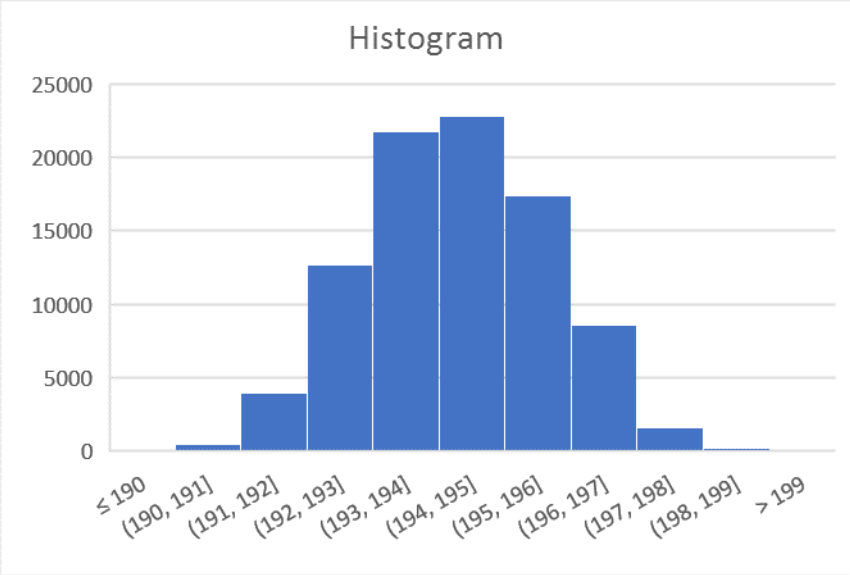


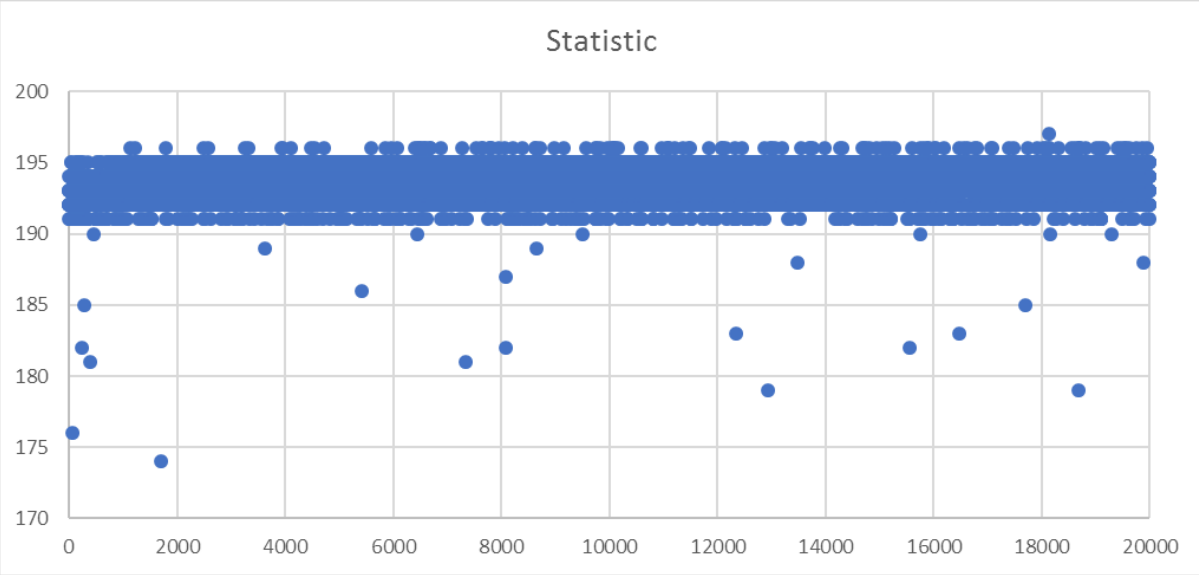
Measurement methods

1. Active state current monitoring
2. Disconnected state current monitoring

Active state current monitoring measurement results

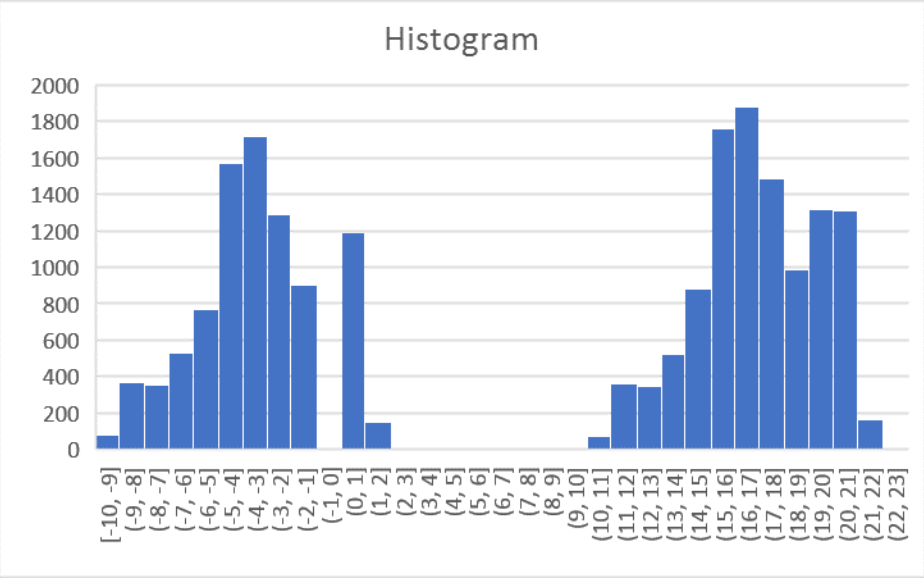
- Maximum current measured: 197uA
- Minimum current measured: 174uA
- Standard deviation: 1.03uA

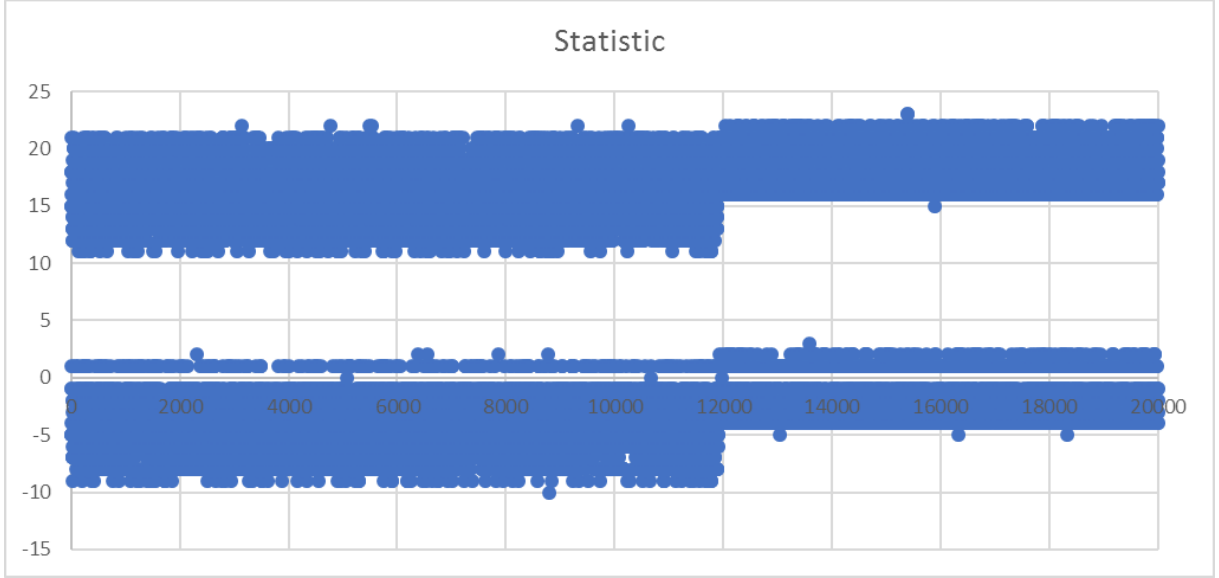




Disconnected state current monitoring measurement results

- Maximum current measured: 23uA
- Standard deviation: 10.44uA





Summary

- Two methods were used to prove that both the PD existence and removal during Mark&Hold can be safely detected
- The measured current in the Classification Mark state - when the PD is not connected - is well below the 250uA threshold (PD Mark event current: 0.25mA < I_{Mark} < 4mA)

Appendix 1

OSCILLOSCOPE SCREENSHOTS

Common mode noise generated by other port turn on 1.

Note: The DUT (PD) Current waveform is recorded using external sense resistor -> current can also be negative

„Other" port voltage;

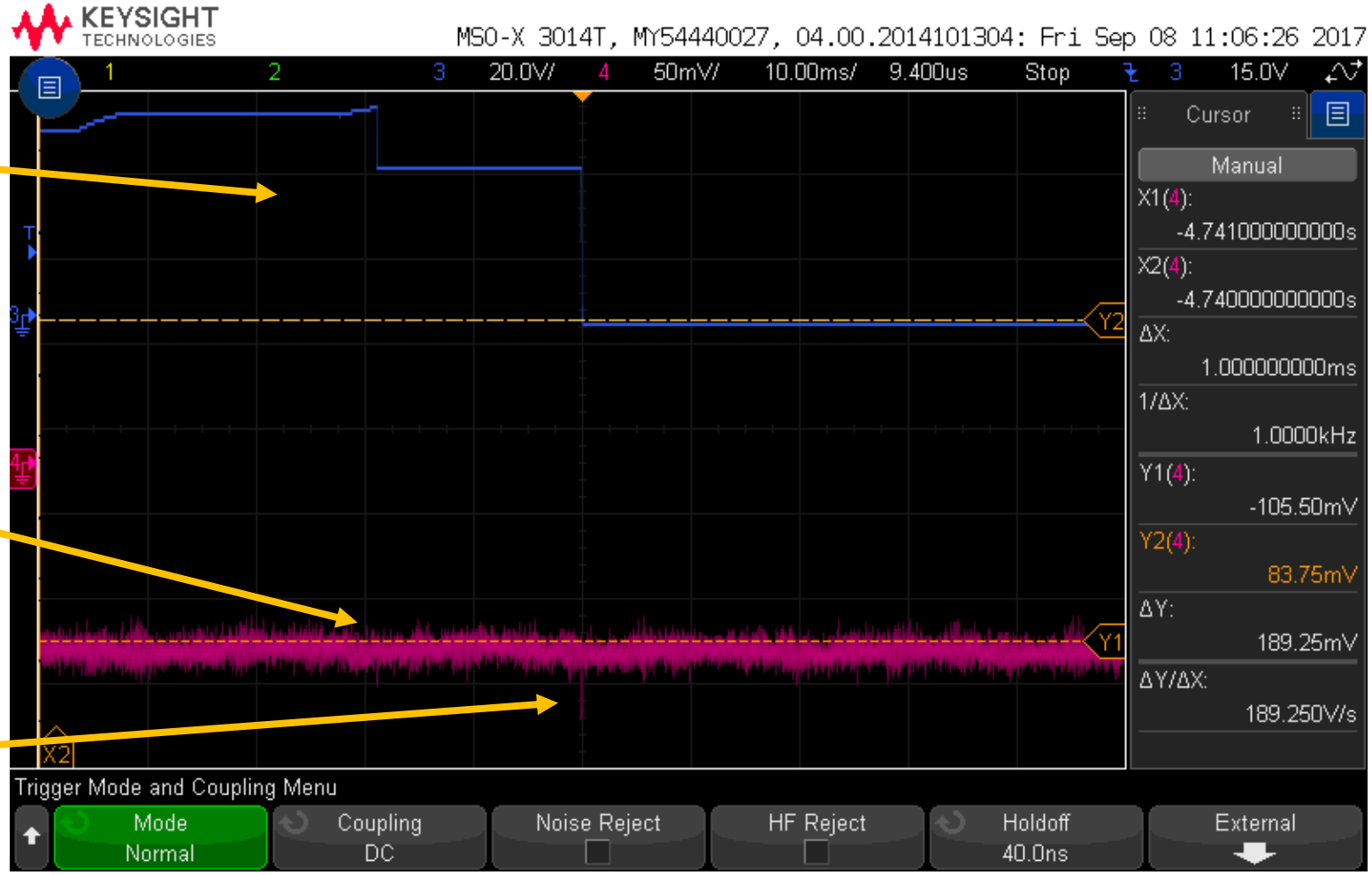
Class. and Turn On

DUT (PD) current;

Generated transient by

- Classification

- Turn on



Common mode noise generated by „other” port turn on 2.

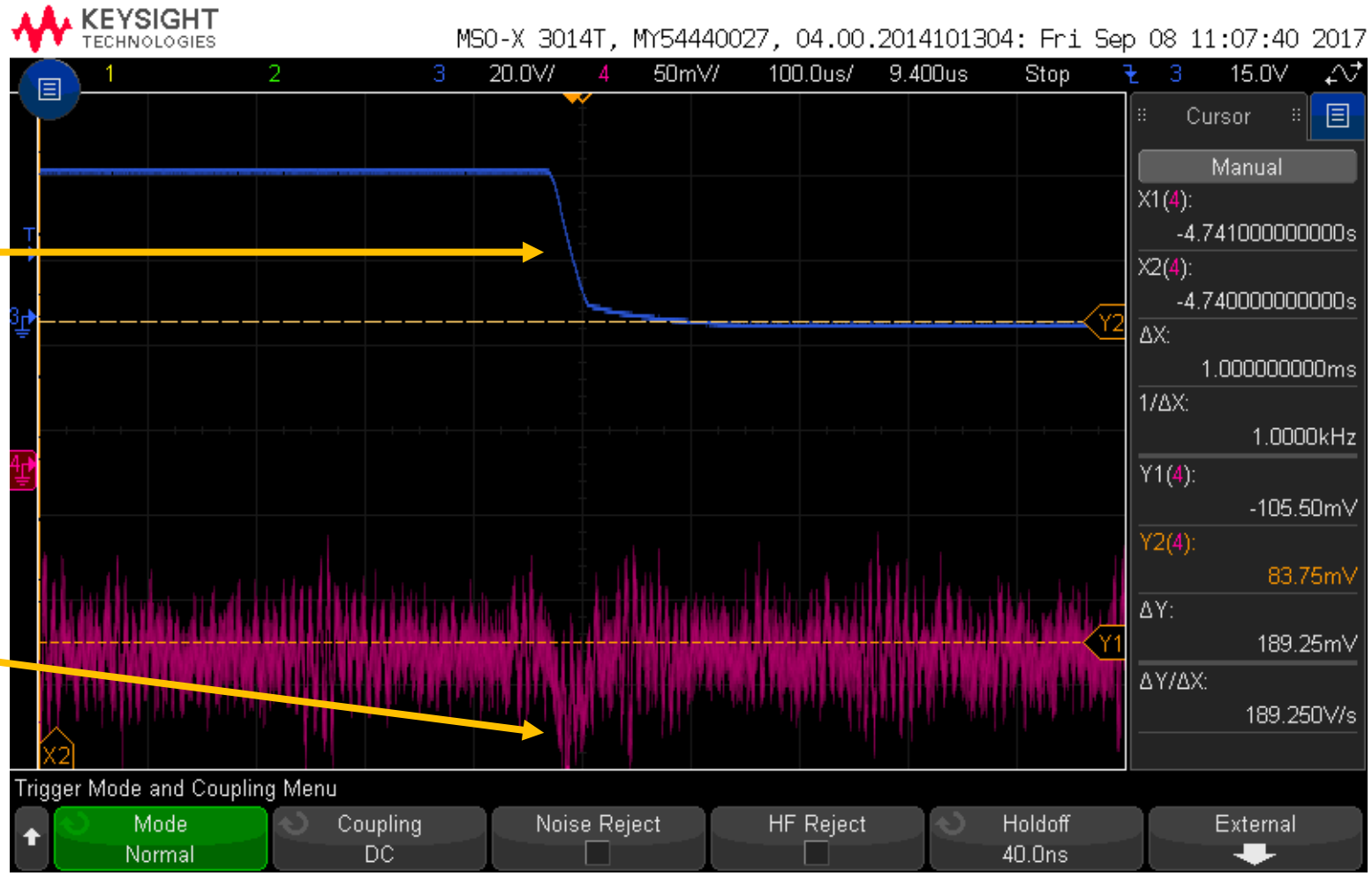
Note: The DUT (PD) Current wavform is recorded using external sense resistor -> current can also be negative

„Other” port voltage;

Turn on

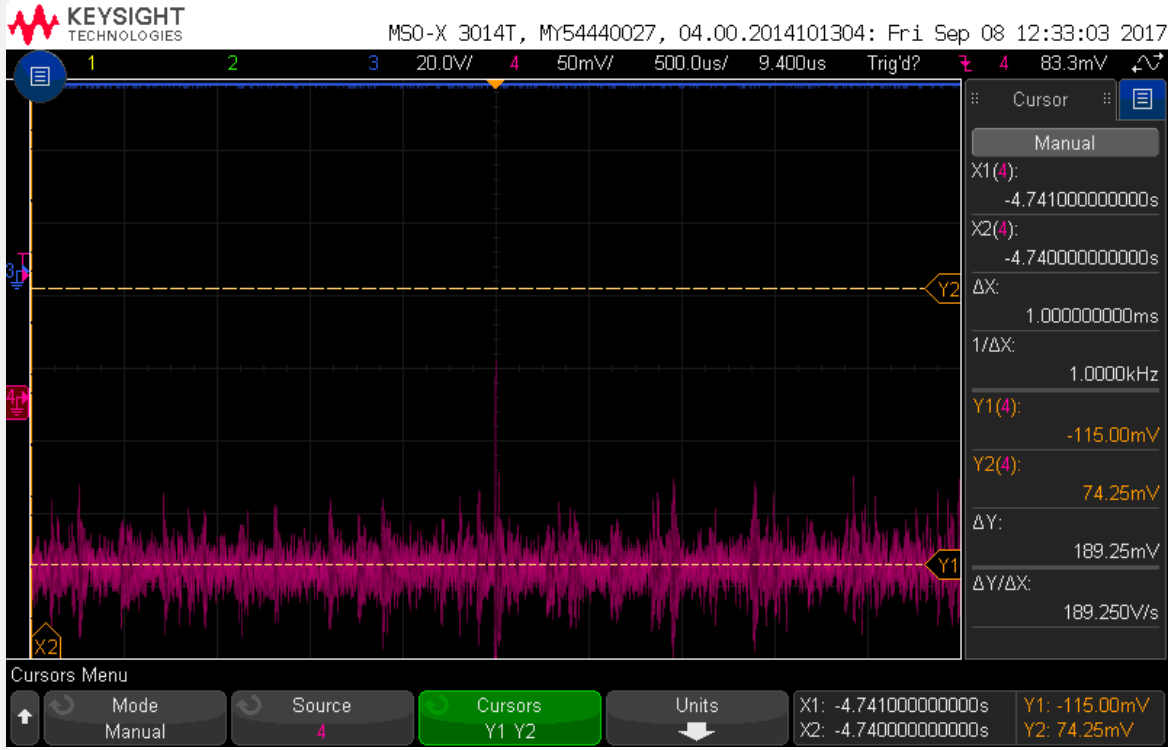
DUT (PD) current zoomed;

Generated transient

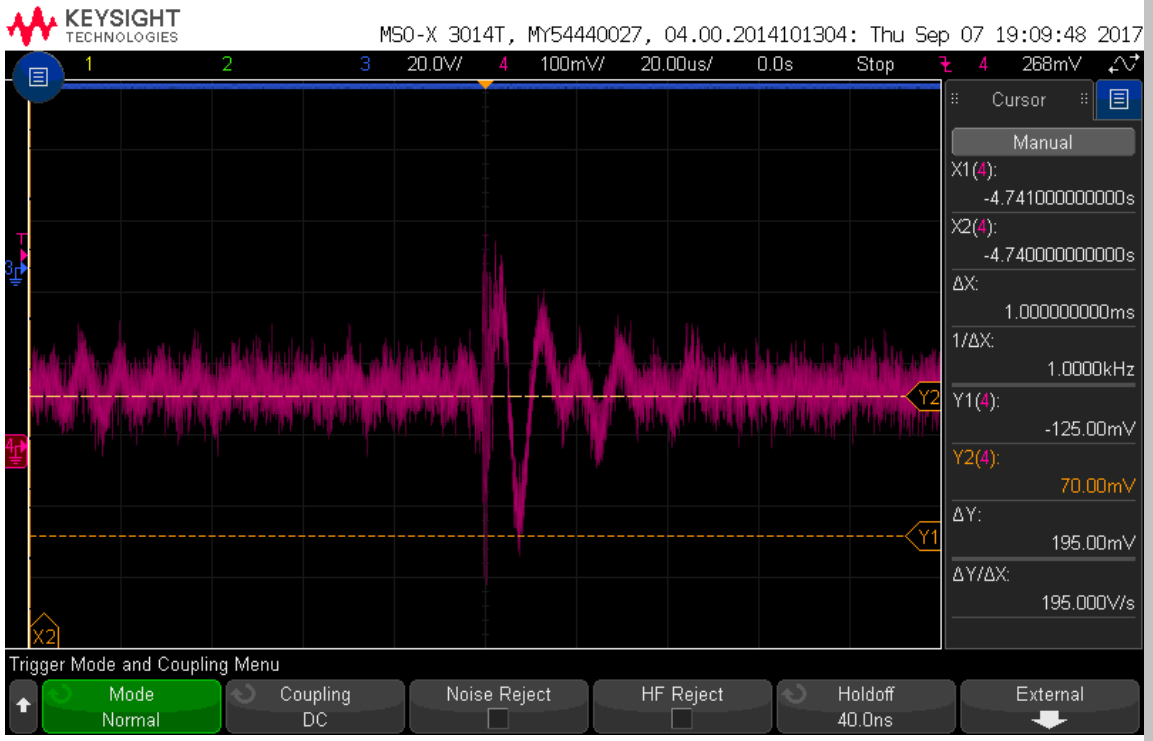


Common mode noise generated by drilling machine

500us/Div



30us/Div



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