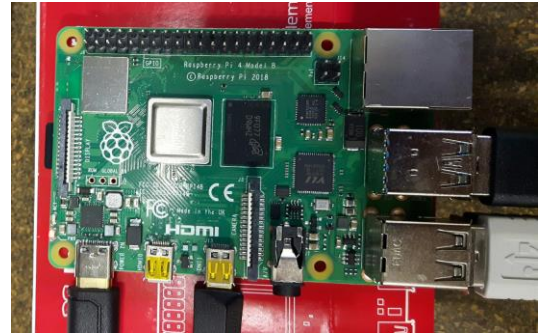


Master Thesis

Robustness of USB 3.x and 4.x against noise: Using Consumer ICs in Automotive and Industrial Application



Motivation

USB is widely used in all its different flavors. Data rates range from hardly anything in a USB 1.0 mouse to 10 Gbit/sec or more. USB traffic can easily be disturbed by noise that couples into the cabling, connectors or the ICs. Different noise sources are likely, electrostatic discharge is the most prevailing noise source. Each implementation of USB will show somewhat different reactions to noise. The reaction ranges from a very brief drop in data rate to destruction. Besides destruction latent failures, such as reduced output voltage swing, changes in the termination impedance etc. have been observed. USB is often implemented in consumer electronic style IC fabrication. These processes offer a very high integration density at low cost. However, if consumer grade ICs are used in demanding automotive or industrial applications they will be subjected to much larger noise levels in a wide frequency range having decade long life expectancies. Can that be achieved?

Research Questions

The project will try to answer the following questions:

- 1) How do selected consumer electronic USB links react to different types of noise?
 - a. What types of disturbance is observed?
 - b. Are they self curing or do they need user intervention?
 - c. Will data rate drops from 3.x speed to 2.0 speed recover?
 - d. How do pulse shape, length, rise time, repetition rate influence the responses?
- 2) Will physical damage occur that reduces life span but allows to system to continue to function?
- 3) How does temperature effect the robustness?

Methodology

- Different USB links will be created using consumer electronic devices, e.g., using Raspberry Pi4
- The link will be analyzed by its data rate and using protocol analysis tools
- Noise will be introduced and upset style errors will be analyzed
- Noise will be introduced observing for physical damage

Organization

- Can start right now
- At the IFE

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