

Challenges in Designing 10 GB/S Backplanes

IEEE 802.3ae Task Force

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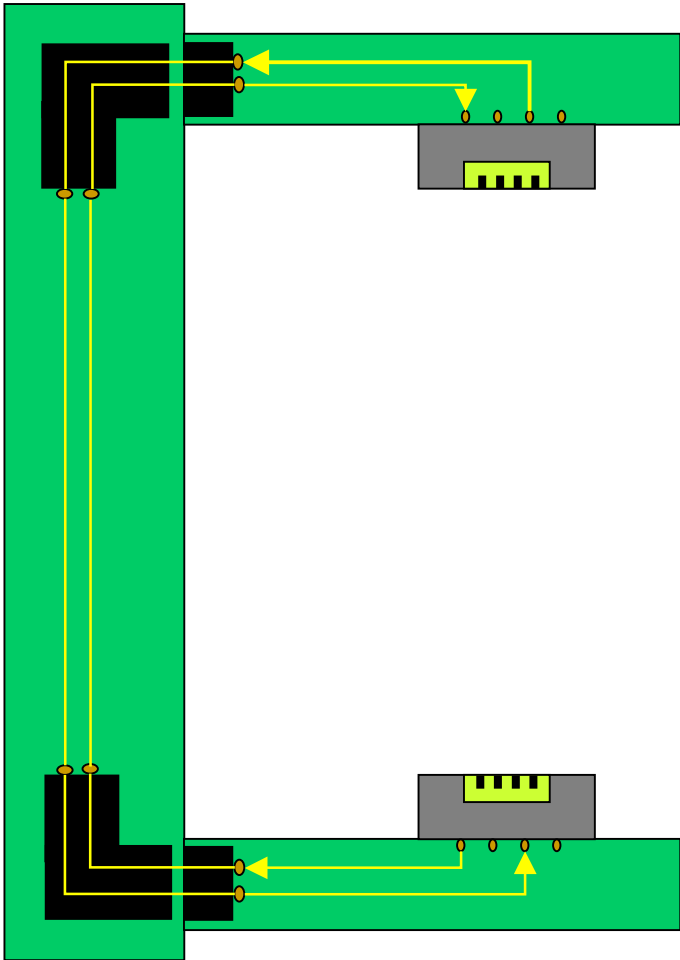
San Diego, Ca

JIM_TAVACOLI@ACCELERANT.NET

Goal

- Share information on design issues in 10 GB/S backplane interconnects
- Make recommendations
- Provide an implementation perspective

Backplane Communication System

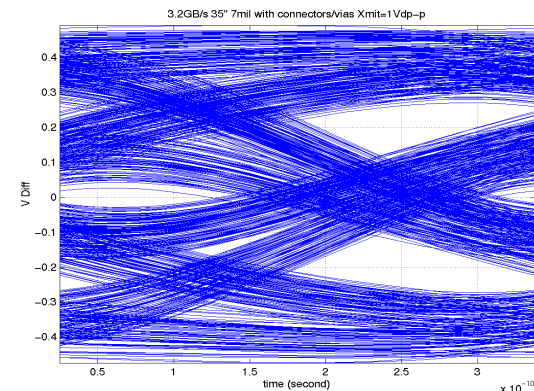
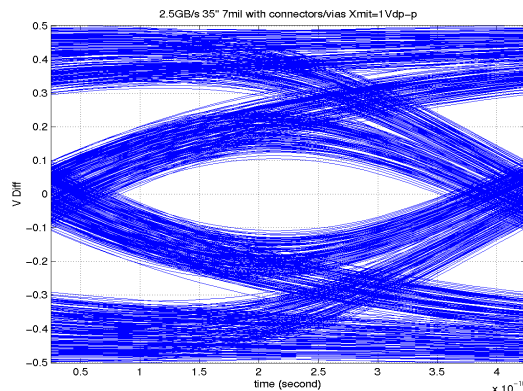


Parameters

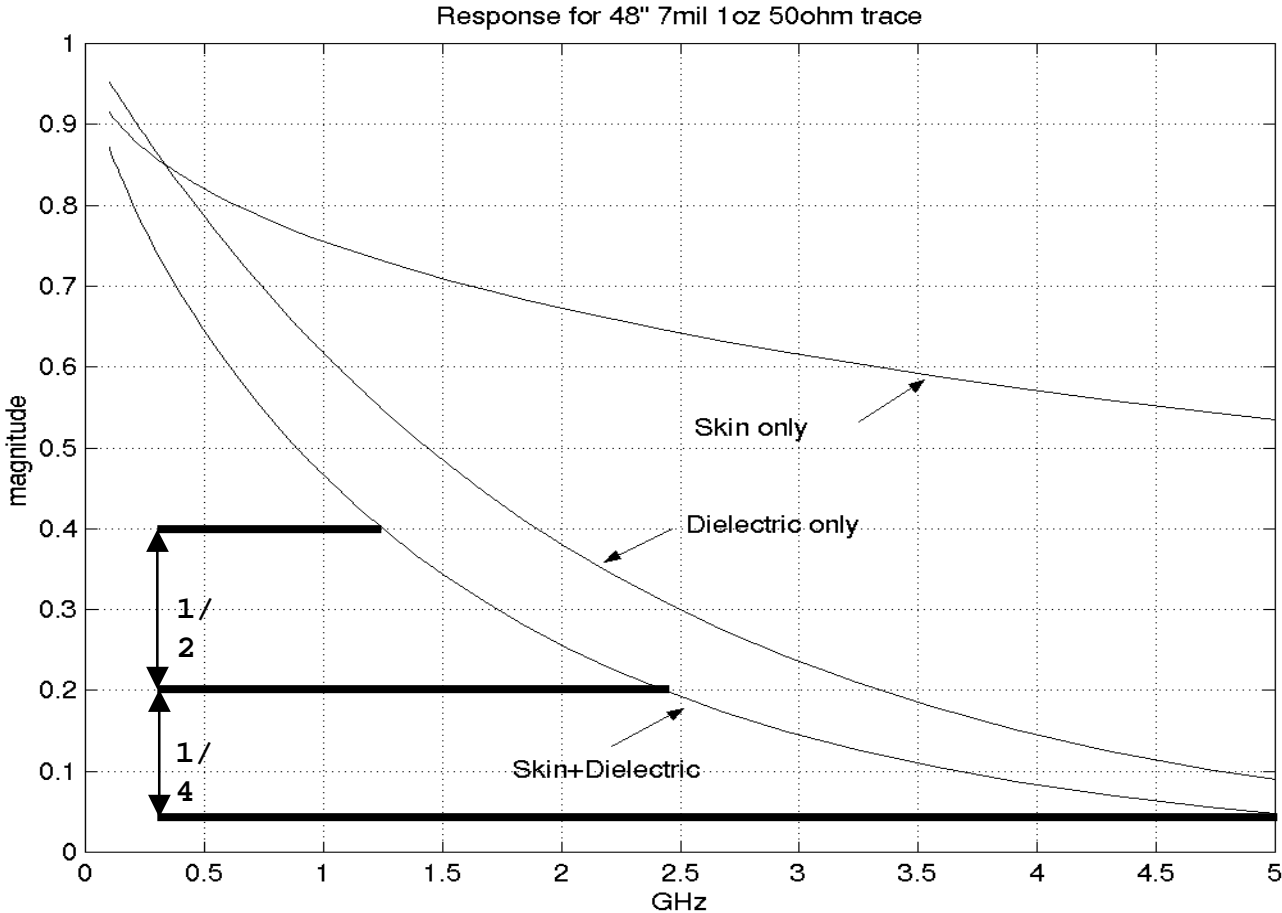
- Aggregate Reflection due to Vias, Connectors, Terminations
- Crosstalk
 - Due to vias, Connectors
 - Capacitive and inductive mismatches between differential signals
- High Frequency Loss
 - Differential trace impedance
 - Loss may be a good thing (when alleviating short run reflections)
- EMI
 - Trace configuration will not stop radiation
- Density
 - How close can the traces be packed determines cost, aggregate bandwidth

Problem

- As symbol rates increase,
 - Amplitude decreases, crosstalk increases
- Better PCB material solve one problem, create another
- Variations in dispersion cause a myriad of channel conditions
- How to define, identify and compensate for weakest link



From 1.25GB/S to 5GB/S



Possible Solutions

- **New strategies for system design offer incremental improvements**
 - Utilize new PCB material, connectors
 - Challenge the via culprit
 - Optimize trace structures
- **New 2.5G or 3.125G SERDES**
 - Offering pre-emphasis, post-emphasis
 - Effectiveness in backplanes remains to be seen
 - SERDES are getting better than ever
- **Optical backplanes**
 - Flexible, high performance but
 - Cost issues are limiting deployment

Recommendation

- View Backplane channel as a **communication system**
- Exploit the transmission media with **targeted solutions**
- Robust backplane design requires a targeted solution
- Lower line rate and increase # bits per symbol
 - Reduce number of pins per GB/S
 - Reduce signal integrity problems
 - Increase reach

A Targeted Solution

- A targeted backplane transceiver should:
 - Optimize for performance & density within any backplane construct
 - Work on standard FR4 PCB material and connectors
 - Adapt to most existing serial backplanes
 - Alleviate Signal integrity problems: Crosstalk, Reflections, Dispersion
 - Complement enhancements made to PCB, vias & connectors

Problems and Solutions



- Reflection
- Crosstalk
- Dispersion
- EMI
- Density
- Adaptive equalization
- Adaptive transmit levels
- Lower line rate
- Scrambler
- Adaptive transmit levels