CX4 Receive Sensitivity Limits

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Agenda

- Objective
- Simulation
- Measurements
- Summary

Objective

- CX4 compliance channel has more attenuation than XAUI
- Either transmit level has to be increased, or receive sensitivity has to be reduced, or both
- XAUI input sensitivity specs were fairly easy to meet, so XAUI designers didn’t have to push the limits
- This presentation looks at practical limits on receive sensitivity for CX4

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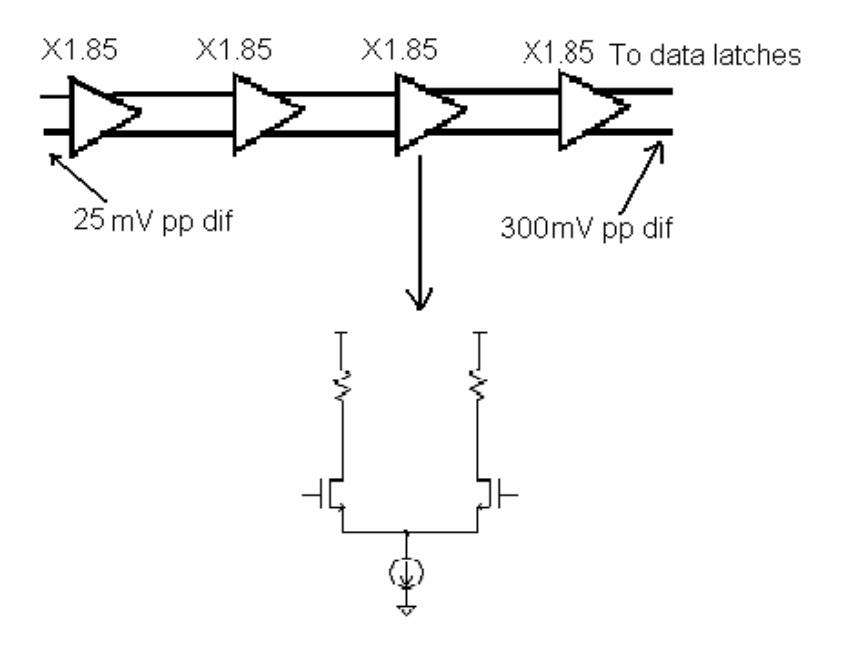
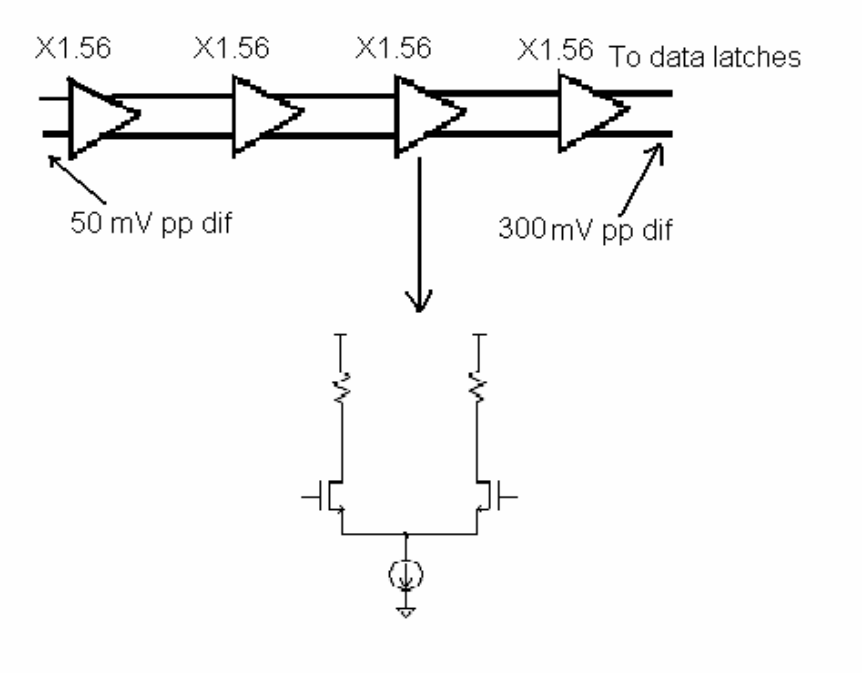
Standard Receiver Circuit



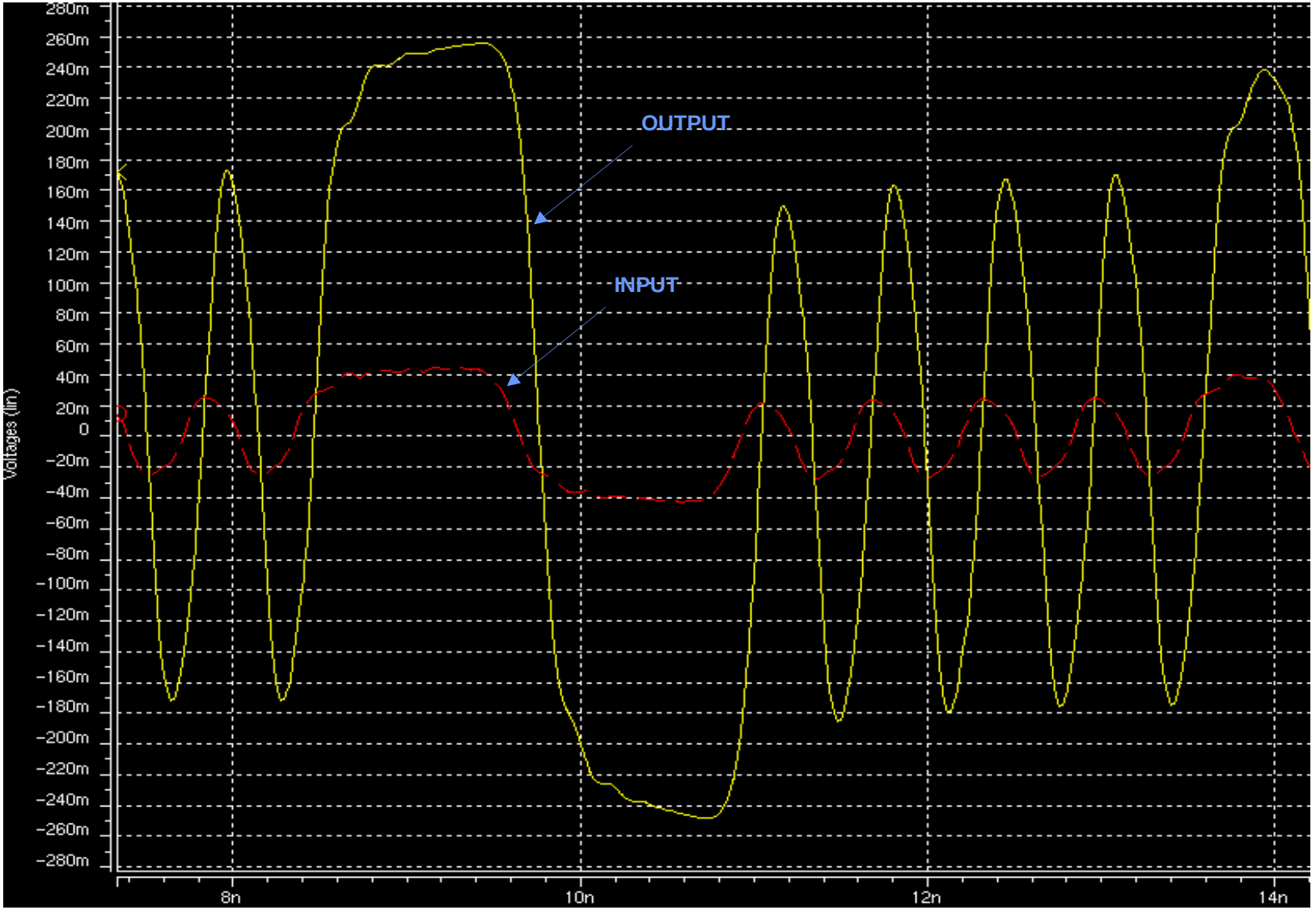
- Design simple, fairly standard, not pushing performance
- Only need 200mV pp dif output to trip CML latch, above has 300mV
- With modest gain, can achieve input sensitivity of 25mv pp dif typ → easy to achieve
- Works at VDD=1.2-3.3V

Worst Case Input Sensitivity Simulation on Previous Standard Receiver Circuit



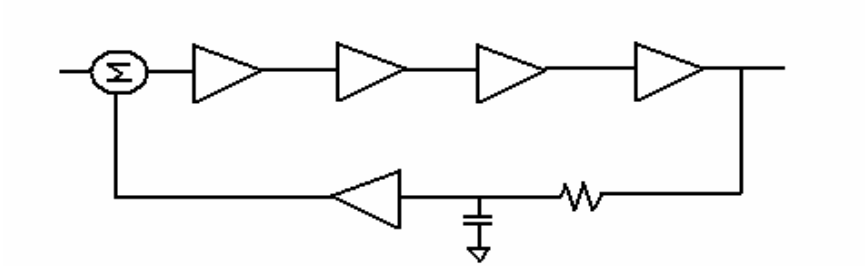
- Worst case: VDD=1.05V, 125 C, slow process
- Overall gain drop by factor of 2, but to achieve 300mV pp dif at latch, still only need 50mV pp dif at input
- Only need 200mV pp dif to trip latch, so lots of margin for offsets, drop across package, etc.

Worst Case Simulated Results on Previous Standard Receiver Circuit



What about Offsets?

- Two approaches
  - Size input transistors to keep input offset to ~10mV
    - This increases input xstor size, slows down circuit somewhat
    - It is doable, medium difficulty
  - Add offset cancellation circuit



- Fairly simple, not critical performance, low power
- Can reduce input offset to <5mV with little difficulty

Other Possible Improvements on Input Sensitivity

- Use inductor loads
  - Simulations show input sensitivity improved 1.5x
  - Larger area

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Measured Results

- Measured input sensitivity on 2 vendors XAUI parts in 3 different technologies
- Results

	Technology	Measured Receive Sensitivity @ 1.5G
Vendor A	0.18u	73 mv pp dif
Vendor A	0.13u	31 mv pp dif
Vendor B	?	38mV pp dif

- All 3 cases above achieved <75mV while shooting for 200mV spec $\rightarrow$ indicates tighter receive sensitivity is not difficult

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Conclusion

- 50mV receive input sensitivity is achievable
  - Simple
  - Small area
  - Low power
  - Compatible with wide range of supplies
  - Many XAUI designs already achieve this
- All simulations and results with single frequency waveforms, need to re-check with “stressed” eye