A Programmable Pulse Predistortion Technique for an 8×25Gb/s NRZ Microring Modulator Transmitter

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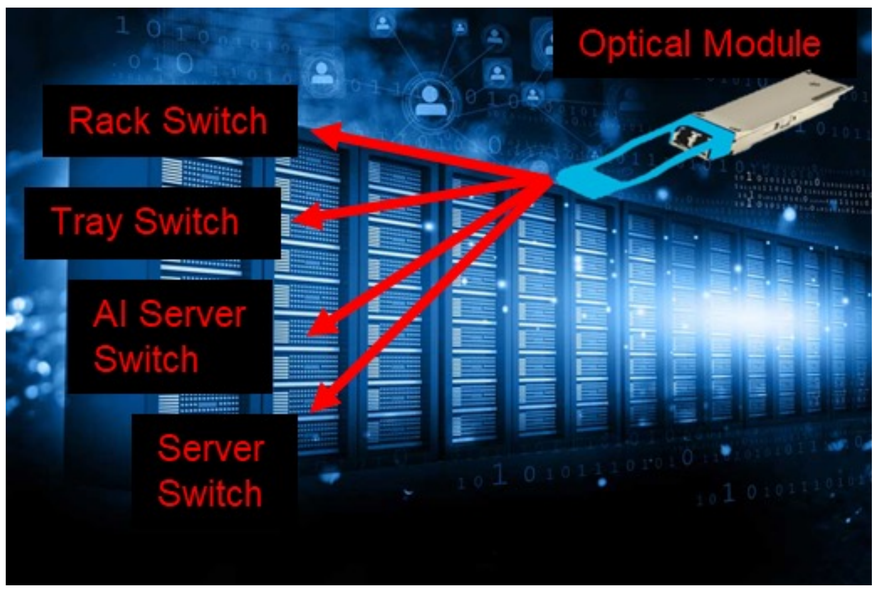
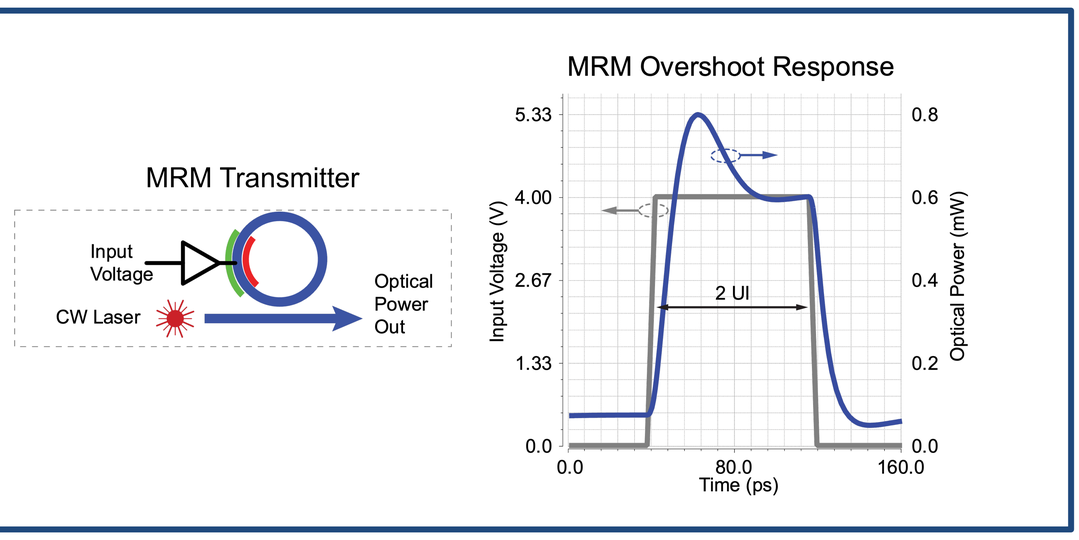
Motivation

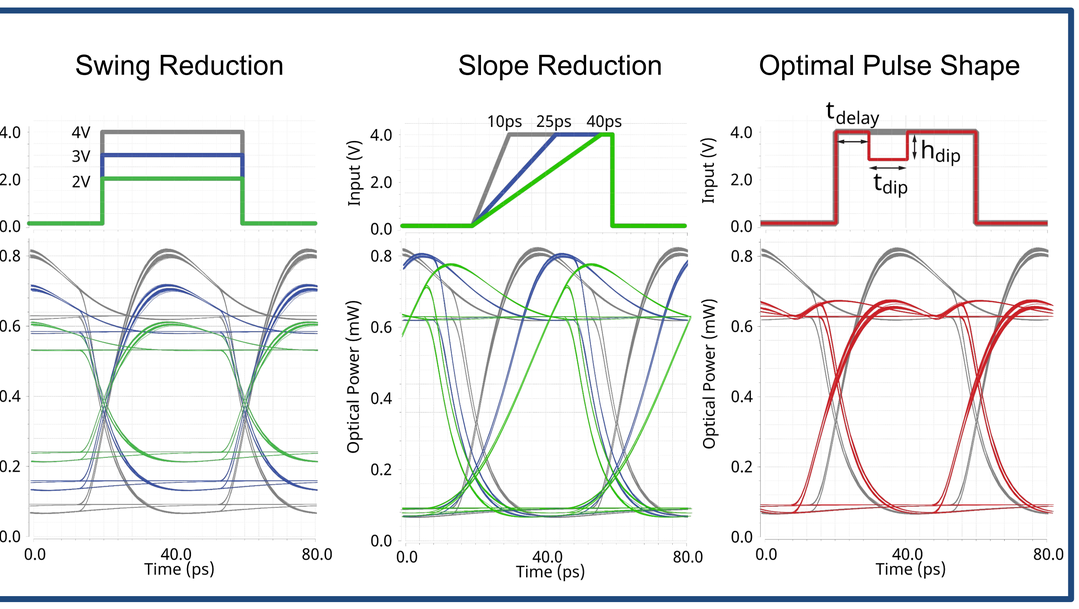


- Rising demand for high network bandwidth due to AI
- Co-packaged optics is an attractive solution
- Microring modulators (MRM) are good candidates for electro-optic devices

Background



- MRMs have compact footprint and inherent WDM compatibility
- However, rise time of optical signal exhibits overshoot and damping
- This effect occurs when the rise time of the signal and the photon lifetime are comparable

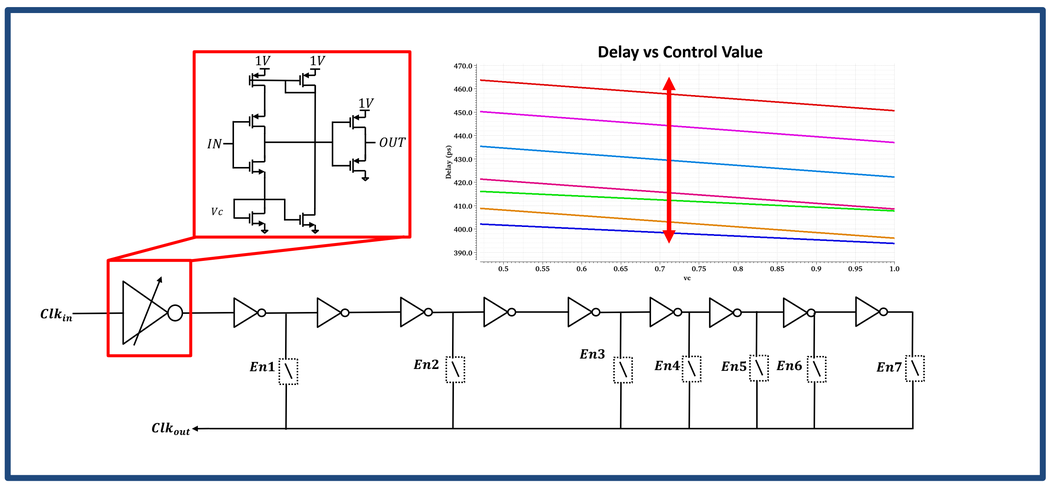


- Decreasing the electrical voltage swing applied to the ring results in optical eye-opening degradation.
- Reducing the slope of the rising edge results in decreased eye width and quality
- Optimal pulse shape shown above where a dip is embedded within the pulse results in highest eye quality

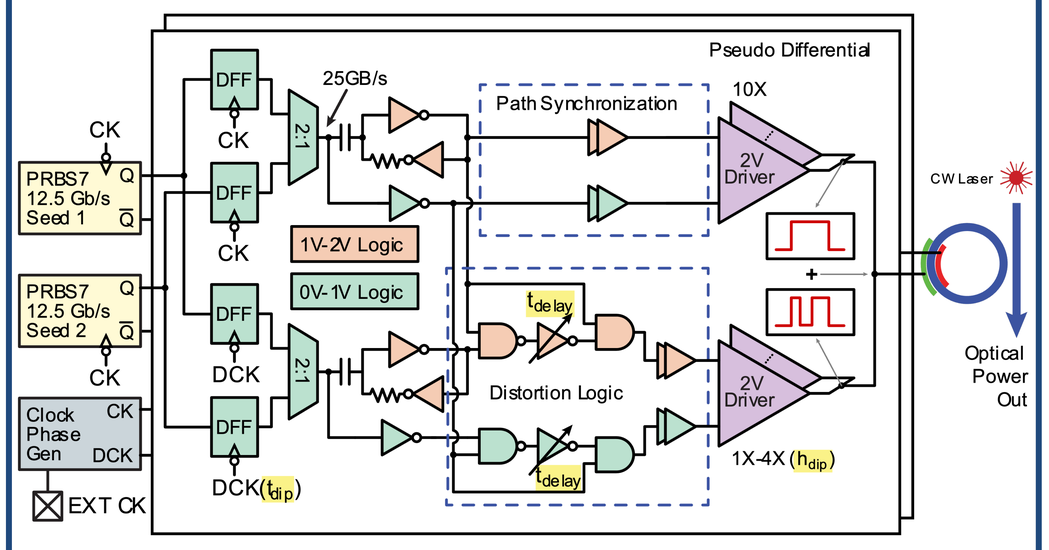
Circuit Design

Key Components of the Design:

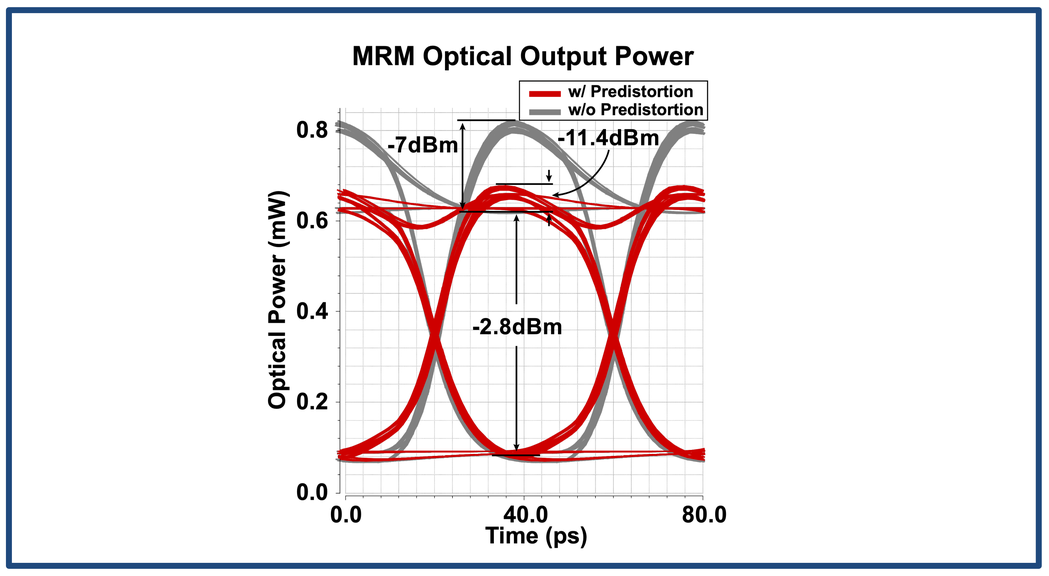
- Half rate design to reduce power
- 8XMRM for WDM
- CMOS logic to create 3 degrees of freedom for pulse pre-distortion
- Cascode voltage mode drivers
- High Resolution Delay Cell (control voltage has 12 bits of resolution)



System Diagram



Simulation Results



- Simulated using global foundries technology GF45SPCLO
- Validated with and without pre-distortion enabled
- Reduces the spread of the ”1” level from -7dBm to -11.4dBm
- Maintains the same optical eye opening of -2.8dBm
- 0.96pJ/bit power efficiency

Conclusion

- Demonstrated a method to compensate for rising edge overshoot
- Improves eye quality and achieves ultra low power
- Future work could adapt method to PAM4