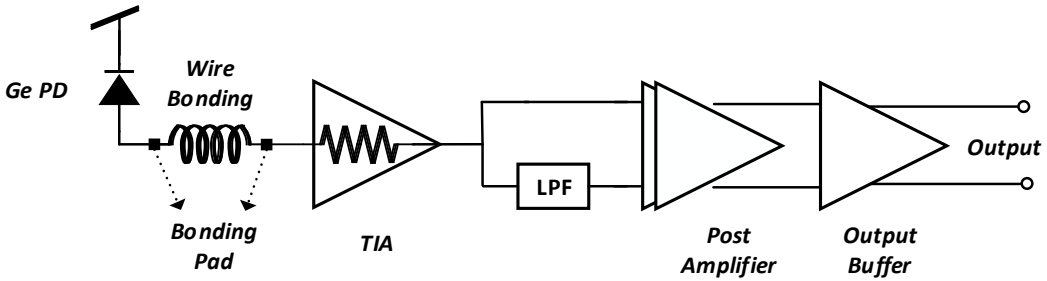
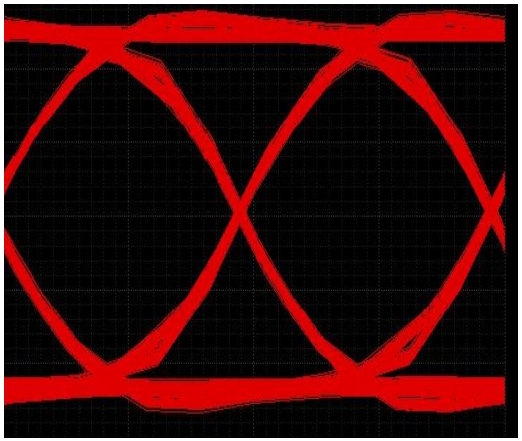
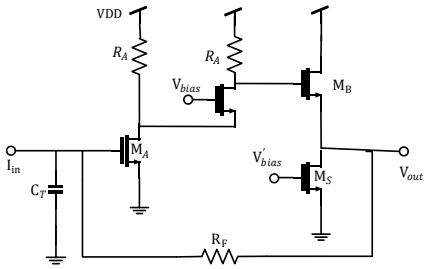
Low-noise optical receiver front-end

- 25 Gb/s Low-noise ORx front-end

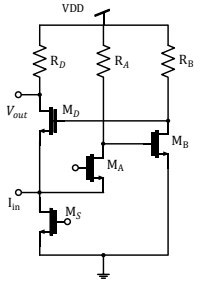




<25 Gb/s Eye Simulation @ Shunt feedback TIA>



[Shunt Feedback]



[RGC]

1. Input referral function for M_A and other Two Resistor

$$\frac{I_{n,in}}{I_{n,A}} = -\frac{1}{g_{m,A}R_F}\cdot\frac{(sC_TR_F+1)(s\frac{C_TR_E}{A_0}+1)(sC_BR_A+1)}{s\left(\frac{C_T\left(R_F+\frac{1}{g_{m,B}}\right)}{g_{m,A}(R_A||C_B)}\right)+1}$$

2. Input referral function for M_B

$$\frac{I_{n,in}}{I_{n,D,B}} = \frac{1}{g_{m,A}g_{m,B}R_AR_F}\cdot\frac{(sC_TR_F+1)(s\frac{C_TR_E}{A_0}+1)(sC_BR_A+1)}{s\left(\frac{C_T\left(R_F+\frac{1}{g_{m,B}}\right)}{g_{m,A}(R_A||C_B)}\right)+1}$$

3. Input referral function for M_S

$$\frac{I_{n,in}}{I_{n,D,S}} = \frac{1}{g_{m,A}g_{m,B}R_AR_F}\cdot\frac{\left\{(sC_TR_F+1)\left(s\frac{C_TR_E}{A_0}+1\right)(sC_BR_A+1)\right\}}{s\left(\frac{C_TR_F}{g_{m,A}(R_A||C_B)}\right)+1}$$

4. Input referral function for M_C

$$\frac{I_{n,in}}{I_{n,D,C}} = \frac{1}{g_{m,A}R_F(1+g_{m,C}R_A)}\cdot\frac{(sC_TR_F+1)\left(s\frac{C_TR_E}{A_0}+1\right)}{s\left(\frac{C_T\left(R_F+\frac{1}{g_{m,B}}\right)}{g_{m,A}(R_A||C_B)}\right)+1}$$

Performance	RGC TIA		SF TIA	
	Pre	Post	Pre	Post
Gain[dB]	51.9	51.6	52.7	52.6
Bandwidth[GHz]	17.1	13.9	16.6	16.5
Input RMS noise current[μArms]	2.52	2.7	2.1	1.96

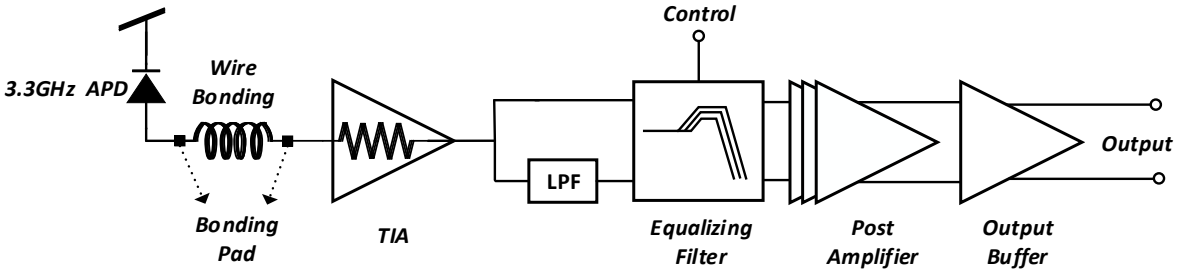
<Compare of noise by TIA type>

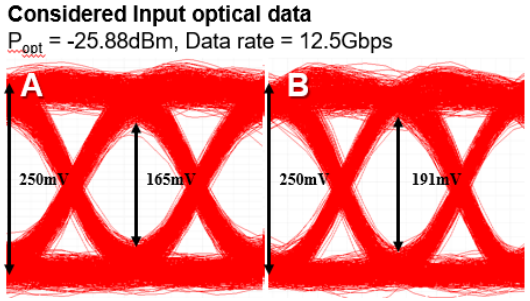
<Input referral function for noise optimizing>

<Performance comparison>

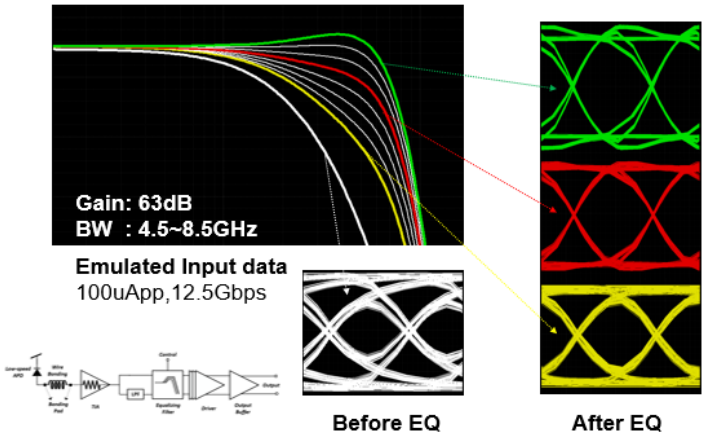
Optical receiver with low speed APD

- 12.5Gb/s optical receiver with low speed APD

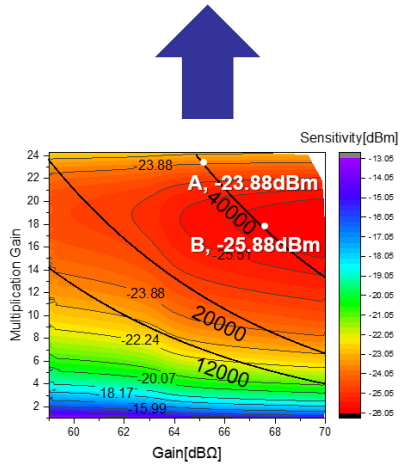




<Eye Simulation >



<Equalizer verification >



<Sensitivity optimizing>