Ge/Si APD for PAM4 application

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SiFotonics

SiFotonics Contributors

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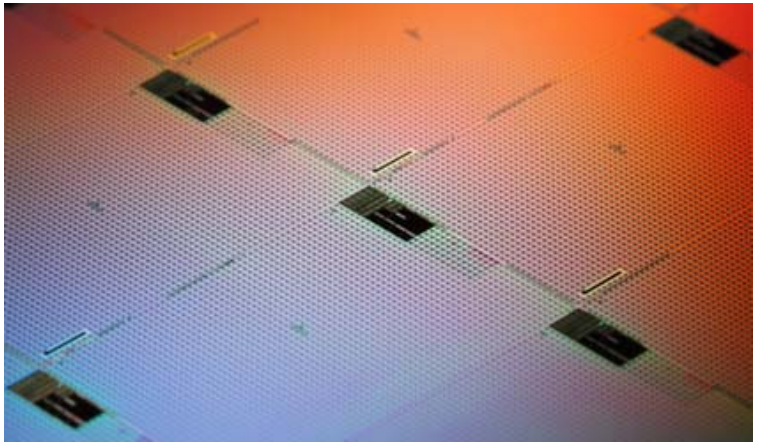
New Platform of Ge/Si for photonic devices

Ge/Si devices are manufactured by standard CMOS commercial foundry (130nm node), and the process of Ge growth on Si is completed on 8-inch CVD

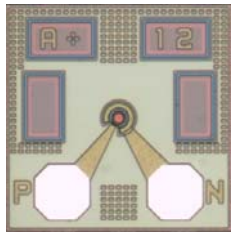
SiFotonics's CVD tool in Commercial CMOS foundry



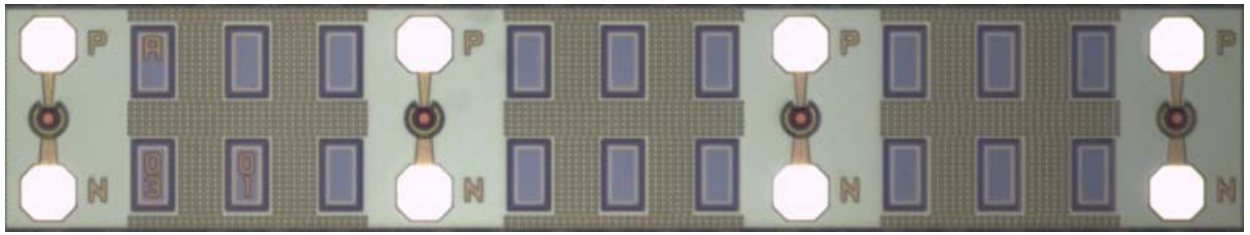
SiFotonics's 200nm SOI wafer

Ge/Si APD advantage

- Ge/Si APDs cover both 1310nm and 850nm applications;
- Ge/Si APDs can provide 5~6dB more link budget than PIN solution, which can reduce power of Tx output power or provide more Rx sensitivity margin;
- Ge/Si APDs are using silicon photonics technologies and are fabricated at CMOS foundry;
- Both single 25G Ge/Si APD and 4x25G Ge/Si APD array are ready for mass production;



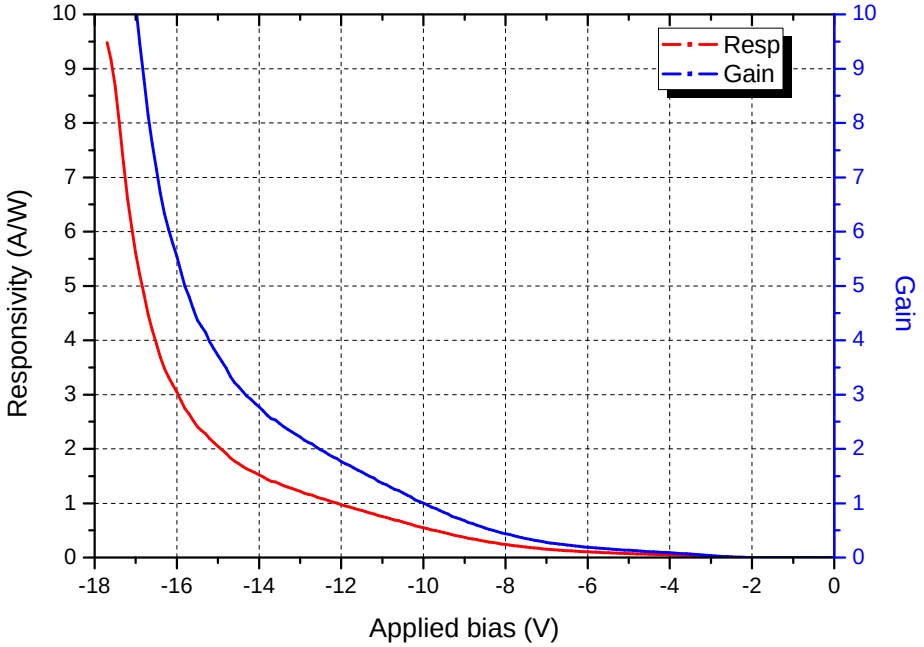
OM image of Ge/Si APD



OM image of Ge/Si APD array

Ge/Si APD device DC & RF performance

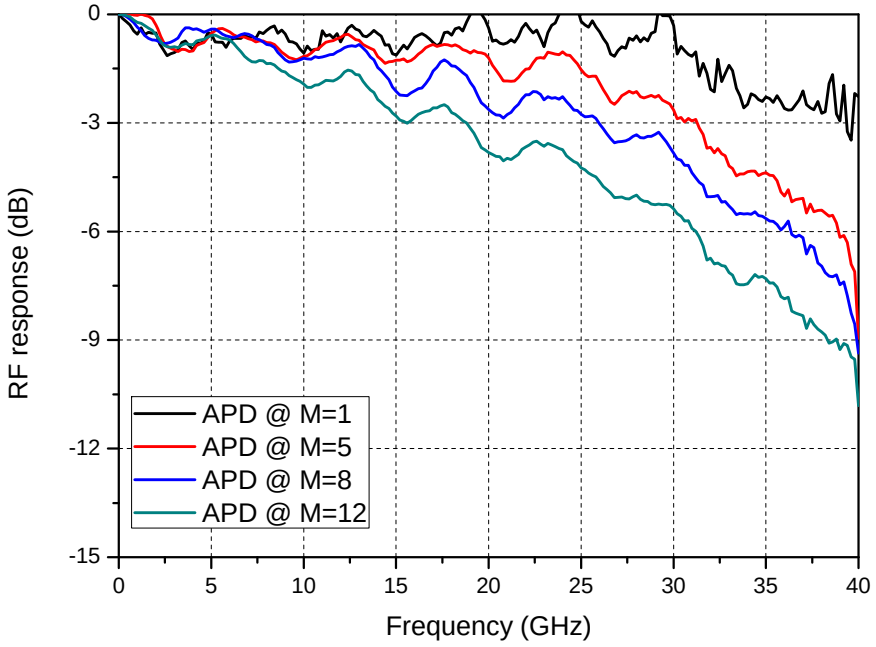
1310nm Responsivity & gain curves



Test equipment: Agilent 4145B semiconductor parameter analyzer

Test conditions: room temperature, 1310nm, input optical power =-13dBm

S21 curve at different APD gains



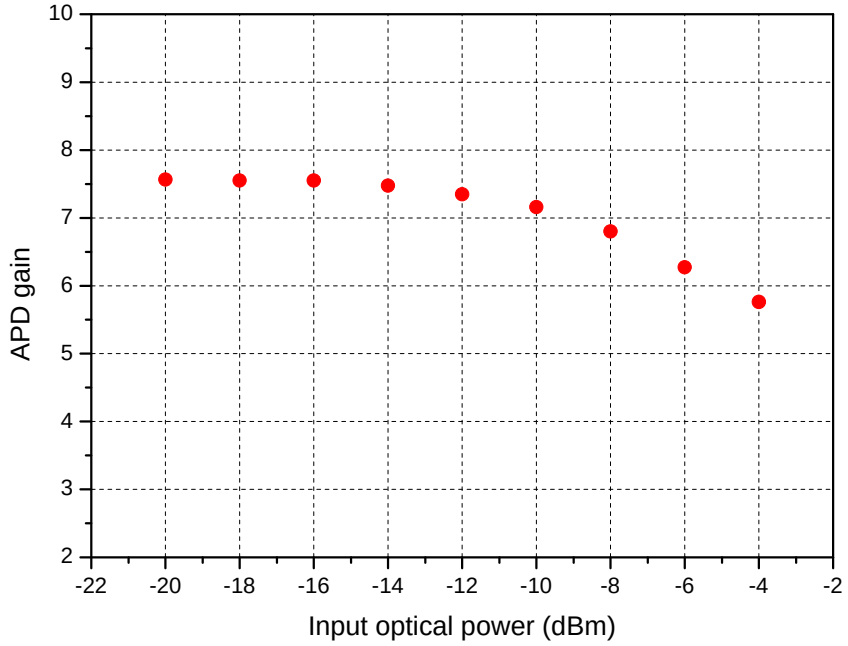
Test equipment: Anristu MS46122A Network Analyzer

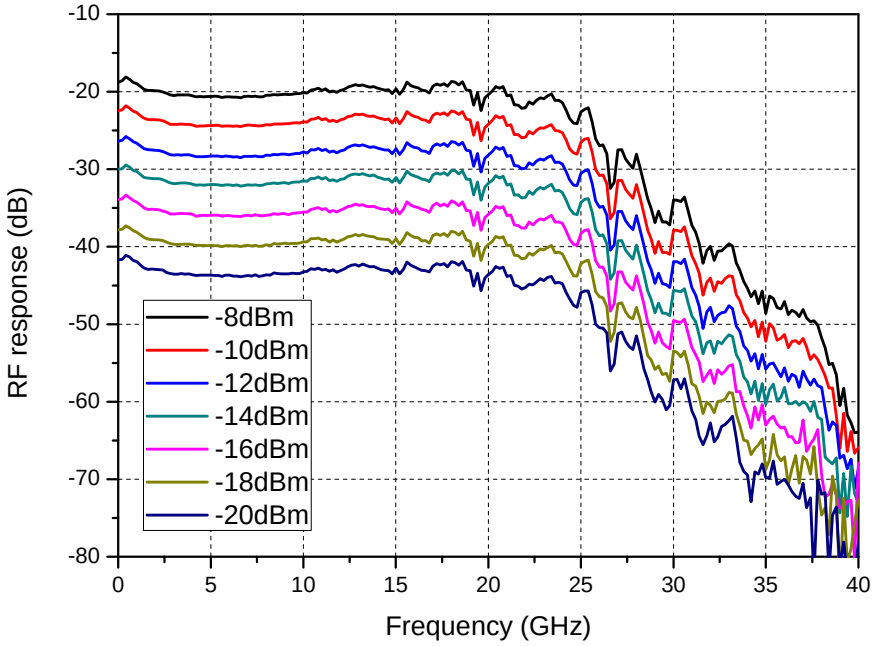
Test conditions: laser + external LiNbO3 modulator;

input optical power=-13dBm, room temperature

High linear Ge/Si APD based receiver performance

This linear receiver is composed by a Ge/Si APD and a 32G linear TIA.

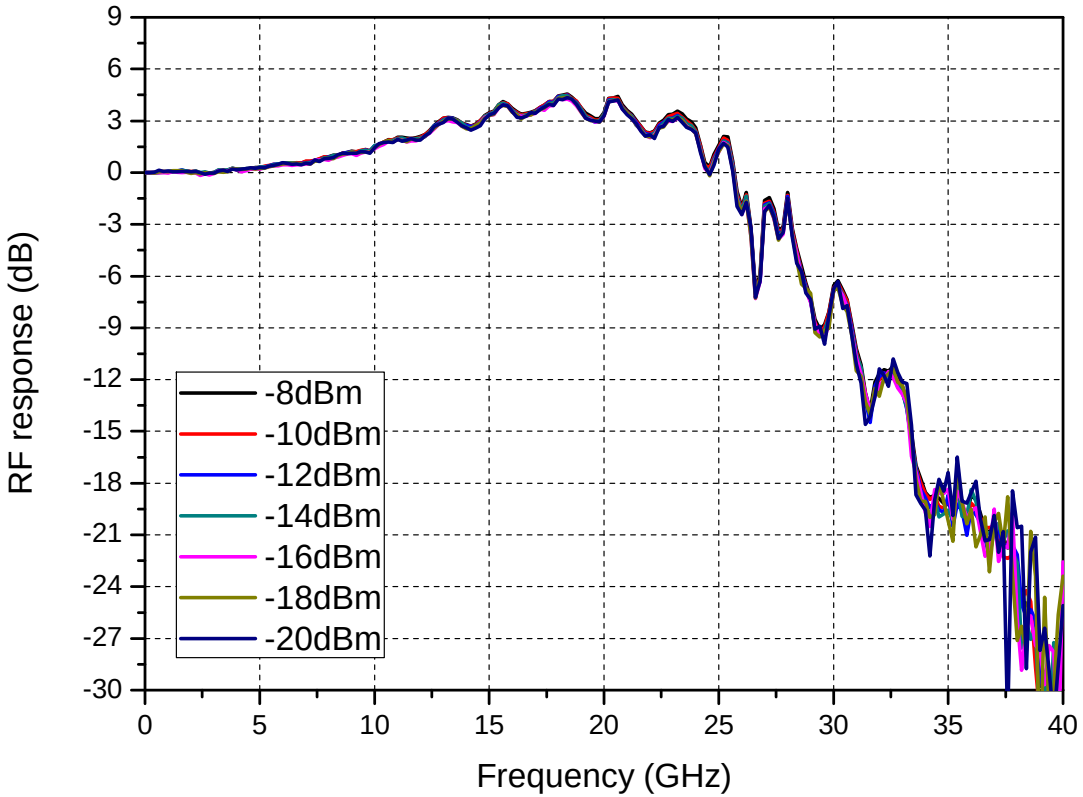




Test conditions: 1310nm, APD bias at Vbr-1.5, room temperature

Under a large optical power range (-20~-8dBm) and APD is biased at operation condition (Vbr-1.5), the receiver's gain and S21 curves are almost unchanged, which demonstrate great linearity of this Ge/Si APD based receiver.

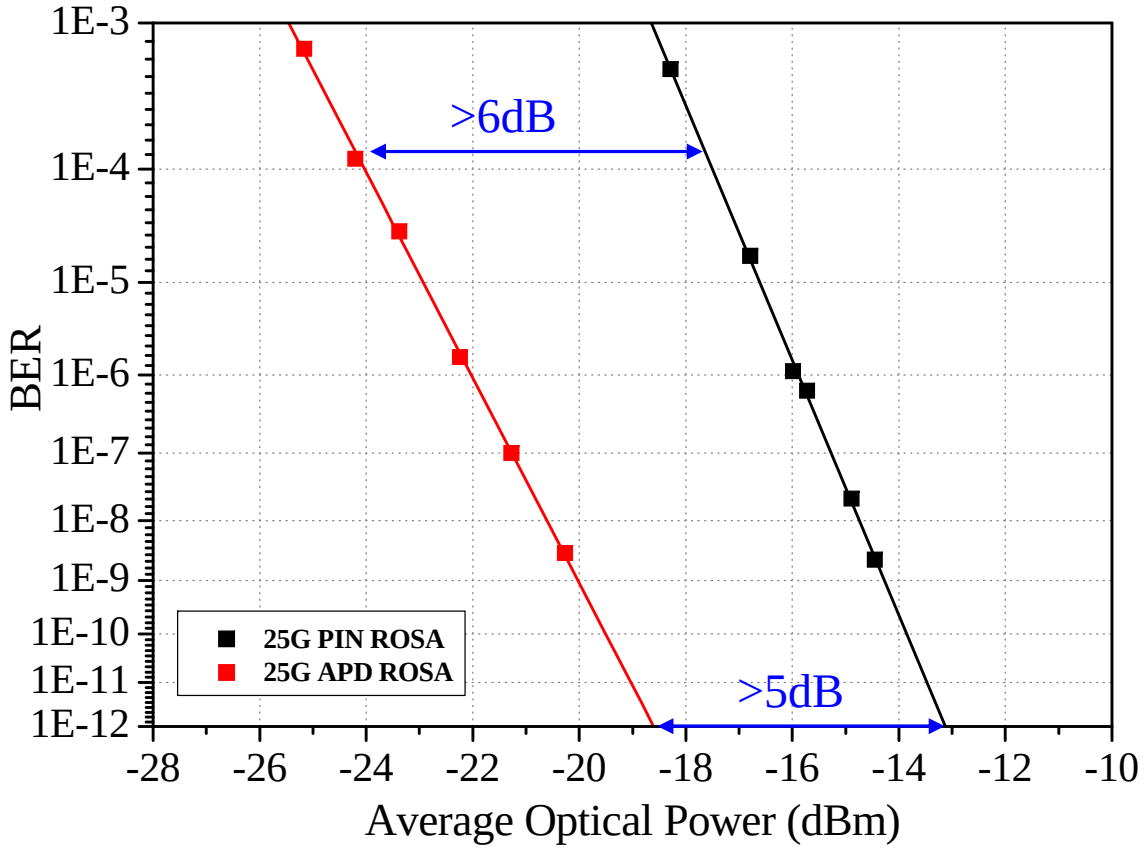
Linear receiver S21 curves (normalized)



Test conditions: 1310nm, APD bias at Vbr-1.5, APD gain=7.5 (@-20dBm), room temperature

Normalized 3-dB bandwidth of this receiver is close to 28GHz, this value could be further improved to >30GHz by optimized bonding scheme.

APD & PIN ROSA sensitivity comparison (using 25G limiting TIA)



Test conditions: 25.78Gb/s,1310nm, ER=7dB, PRBS=2^31-1, NRZ, room temperature