

## 56G PAM4 SerDes PHY

### Overview

The Samsung Foundry 56G PAM4 SerDes PHY IP is a hard-macro PHY for the IEEE and OIF protocols. I/O pads and ESD structures are included with extensive BIST features such as loopbacks decrease the test time. It offers a cost-effective and low-power solution. It builds on silicon-proven designs that are in network applications.

### General Features

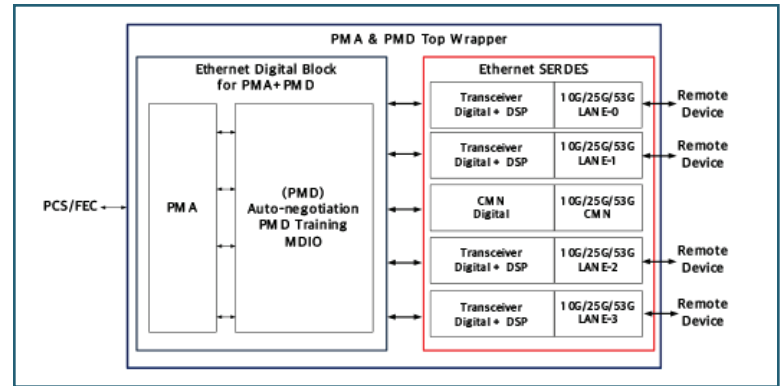
- Samsung Foundry 10 nm low-power CMOS device technology
- Supports a maximum LR channel loss of -35dB@14 GHz (ball-to-ball)
- Supports a maximum -50dB@14 GHz crosstalk
- Supports BIST feature capable of producing and checking PRBS7/13/31 random patterns

### Key Features

- High-performance DAC in TX side can express extremely fine voltage level
  - Fine resolution of 7-bit and wide SFDR of 49dBc
- Scalable power consumption according to channel-loss
  - Changeable via the number of FFE+DFE taps from 0 ~ 10
- Full adaptation and calibration to guarantee stable performance
  - IP fully calibrates gain, offset, and skew of analog blocks by itself
  - IP fully adapts to any channels and phase-locks in any situation

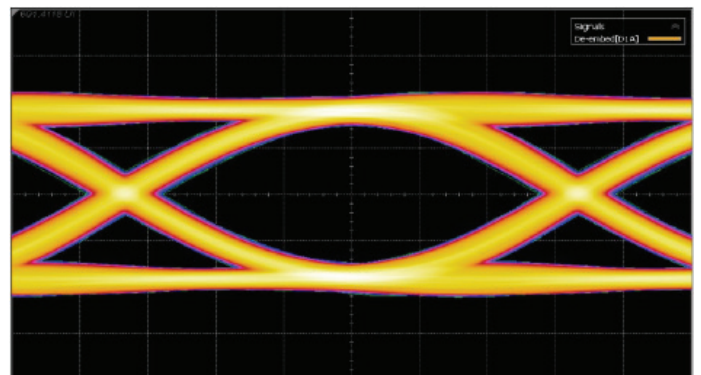
### Transmitter

The transmitter (TX) includes a voltage-mode driver, 7-bit DAC, and DSP w/ LUT. Due to the 7-bit DAC resolution, a TX can control the 4-tap FIR function and NRZ/PAM-4 signaling in a DSP. The figure shows the 56G SerDes TX silicon results with a superior jitter performance.



### Deliverables

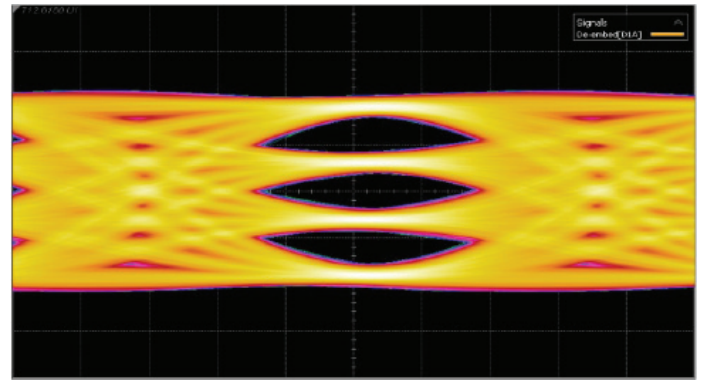
- Front-end DK: Timing LIB, Verilog model, and sample test bench
- Back-end DK: Physical view LEF, GDSII layout, DRC, and LVS
- Documentation: Datasheet and user guide



NRZ PRBS13 @ 25.78125Gbps

## Receiver

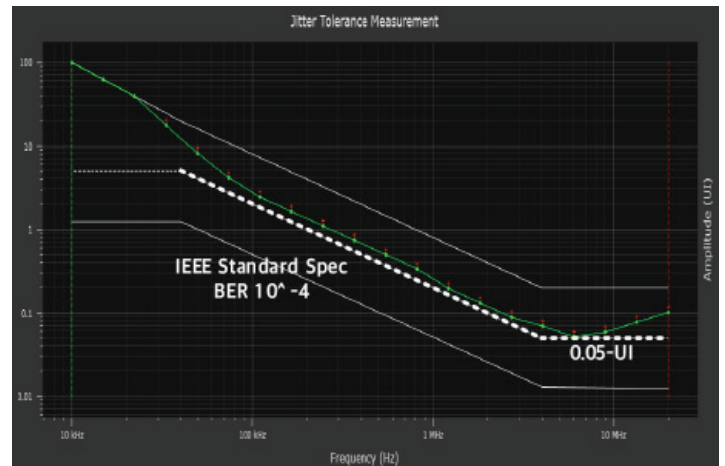
The receiver (RX) includes analog equalizers, a 7-bit ADC, and DSP w/ digital equalizers. A PEQ and CTLE boosts the high frequency signals by 15 dB and higher, and the ADC samples and converts the incoming data with 7-bit resolution. A DSP allows fully autonomous calibrations for skews, gains, and offsets. The 9-tap FFE and 1-tap DFE in a DSP allow the accurate equalization for any lossy channel.



PAM-4 PRBS13 @ 53.125Gbps

## Protocol

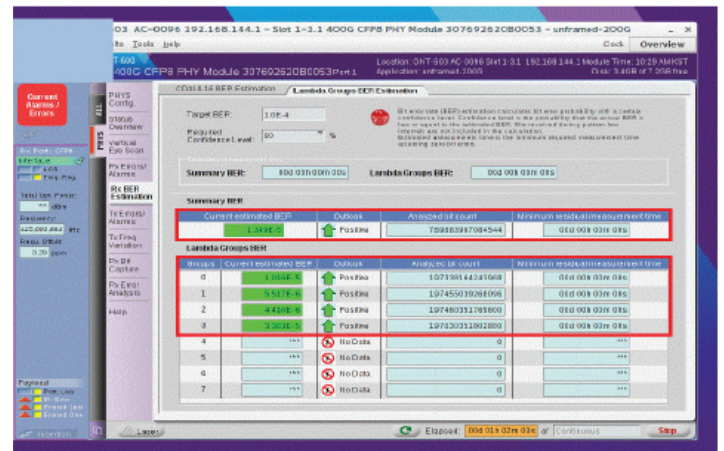
The Samsung Foundry 56G SerDes solution for network applications consists of a hard macro DB for SerDes and a soft-macro DB for protocol. The soft-macro DB can support PMA/PMD protocols of 200GBASE-KR4, 100GBASE-KR4/2, 40GBASE-KR4/1, and 25GBASE-KR. Also, the soft-macro DB can be replaced according to the required protocol. In tests using the network analyzer, the SF PMA/PMD adopting external PCS and FEC layers is compatible with 200GBASE-KR4 and 100GBASE-KR4 IEEE standards.



JTOL 53.125Gbps w/ IL -36dB@13.28GHz

## Low Power

The Samsung Foundry 56G SerDes solution consists of 4-lane transceivers including DSP and one common block. Power efficiency is under 8 mW/Gbps.



Protocol test w/ a Network Analyzer

# SAMSUNG Foundry

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