

Switching and Signal Conditioning Solutions with Amplif-Eye™

Advancing from PCI Express Gen 2 to Gen 3 can bring significant challenges to system designs related to physical interconnect. The increase in data rate from 5.0 Gbps to 8.0 Gbps creates additional inter-symbol interference as the result of increased insertion loss. Additionally, increased edge rates reduce isolation between channels thereby increasing crosstalk.

Amplif-EYE™ technology from Mindspeed provides robust signal path solutions for PCIe Gen 2 and 3 in **Three Different Product Types**. Mindspeed’s high-bandwidth **Passive Switches** enable switching of 8.0 Gbps data while preserving signal fidelity. **Redriving Signal Conditioners** are equipped with both receive and transmit equalization that minimize deterministic jitter caused by insertion loss. **Retiming Signal Conditioners** include a clock data recovery circuit (CDR) along with Rx and Tx equalization. The CDR is used to reduce jitter that cannot be managed with an equalizer such as that caused by impedance mismatches, stubs, and crosstalk. Mindspeed devices include PCIe specific features such as electrical idle transparency (EI) and Rx detectable receiver termination. All devices are backward compatible with lower PCIe data rates and provided in small RoHS packages.

PASSIVE SWITCH | Switching PCI Express lanes

Mindspeed passive switches are designed to provide high bandwidth switch paths with minimal power and PCB space expenditure. M20000 and M20001 provide up to 7 GHz of bandwidth, through a pair differential passive switches that are offered in 3 x 3 mm QFN package.

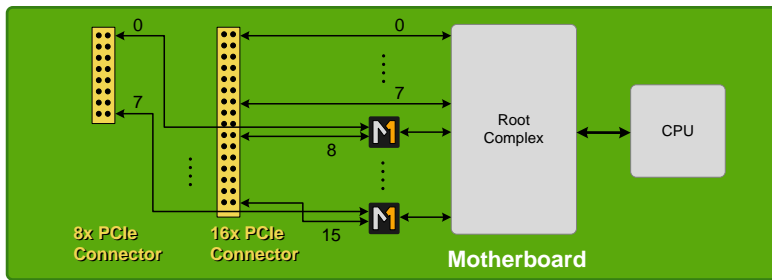


Figure 1 – Mindspeed Passive Switch Application Diagram

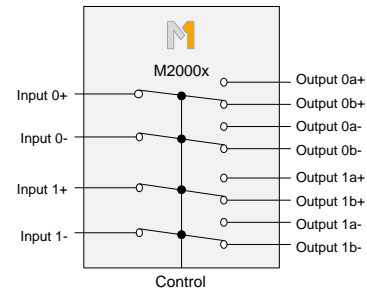


Figure 2 – Passive Switch Device Architecture

REDRIVING SIGNAL CONDITIONER | Managing signal integrity over longer channels

Insertion loss increases with higher frequencies and longer channel lengths. Channels of 15” or more are typical in blade servers and high-end RAID systems. Mindspeed redriving signal conditioners provide transmit and receive equalization at frequencies up to 4.00 GHz (for 8.0 Gbps signaling) to generate a flat channel response by providing great equalization at high frequencies. Mindspeed is the market leader in adaptive equalizers that self-optimize without the need for user programming.

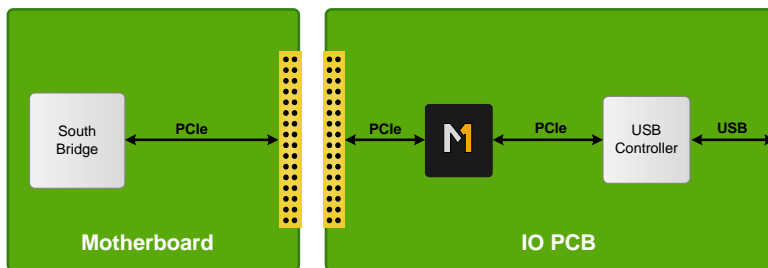


Figure 3 – Mindspeed Redriver Application Diagram

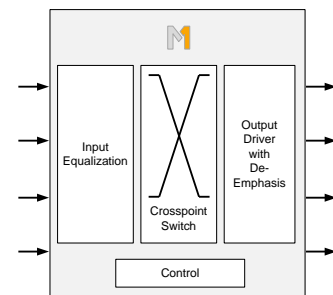
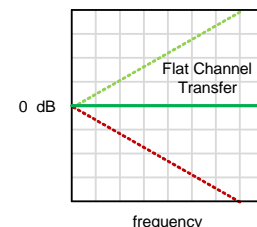
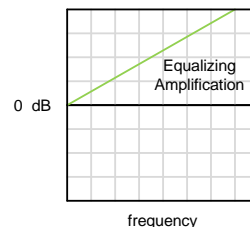
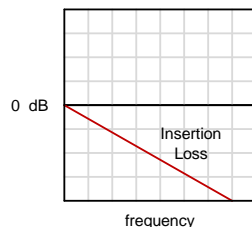


Figure 4 – Redriving SC Device Architecture

Attenuation due to insertion loss is remedied by Mindspeed equalizers to yield a flat transfer function for the channel thereby minimizing deterministic jitter.



RETIMING SIGNAL CONDITIONER | Managing signal integrity over the most challenging channels

Systems with higher densities, multiple hops, varying materials from PCB to PCB, and multiple vias present further signal integrity challenges in addition to insertion loss. These systems will experience increase jitter due to crosstalk and reflection. This type of jitter is non-deterministic and therefore cannot be managed with equalizers alone. Mindspeed retiming signal conditioners incorporate a clock data recovery (CDR) circuit that can be used to address non-equalizable jitter. The CDR retimes data effectively resetting the jitter budget.

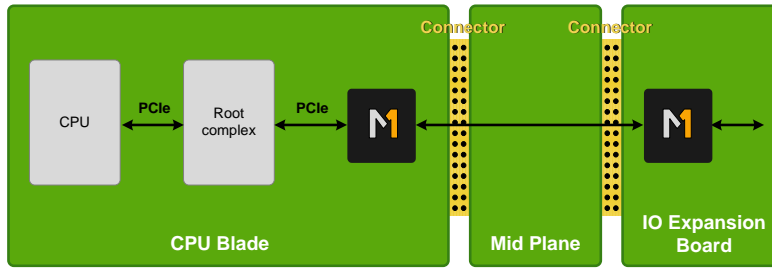


Figure 5 – Mindspeed Retimer Application Diagram

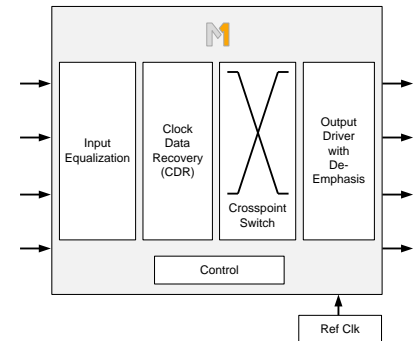
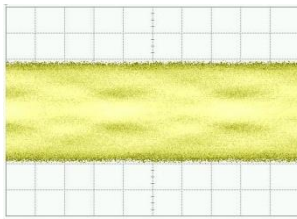
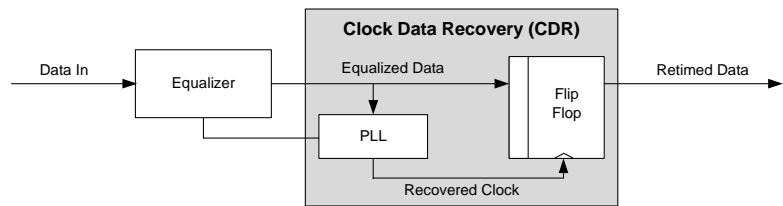
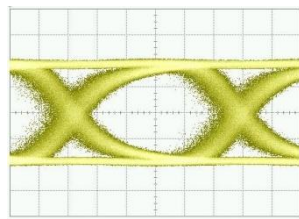


Figure 6 – Retiming SC Device Architecture

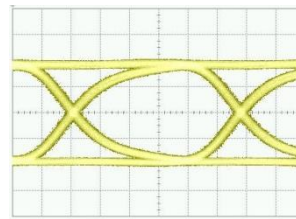
CDR circuits are designed to extract a clock from multi-gigabit speed NRZ-coded input data signals. This clock is then used to retime data effectively regenerating the digital stream and greatly reducing jitter.



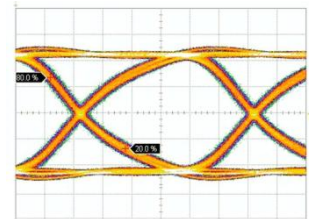
Output Signal at 5.0Gbps (PCIe 2.0) over 30" Trace



Redriver Output at 5.0Gbps (PCIe 2.0) over 30" Trace



Retimer Output at 5.0Gbps (PCIe 2.0) over 30" Trace



Retimer Output at 8.0Gbps (PCIe 3.0) over 40" Trace

Device Type	PCIe Gen 2	PCIe Gen 3	PART #	PCIe Lane - Tx/Rx	Package (mm)	Device Status
Retimer	•	•	M21431	6 lane (12 channel)	19x19 324 BGA	Sampling
Redriver	•		M21453	6 lane (12 channel)	12x12 88 QFN	Production
Retimer	•		M21363	6 lane (12 channel)	12x12 88 QFN	Production
Retimer	•	•	M21430	4 lane (8 channel)	12x12 88 QFN	Sampling
Redriver	•		M21452	4 lane (8 channel)	10x10 72 QFN	Production
Retimer	•		M21362	4 lane (8 channel)	10x10 72 QFN	Production
Retimer	•	•	M21432	2 lane (4 channel)	12x12 88 QFN	Sampling
Redriver	•		M21030	2 lane (4 channel)	6x6 40 QFN	Production
Redriver	•		M21451	2 lane (4 channel)	6x6 40 QFN	Production
Redriver	•	•	M21401	1 lane (2 channel)	5x5 32 QFN	Production
Redriver	•		M21450	1 lane (2 channel)	6x6 40 QFN	Production
Redriver	•		M21400	1 lane (2 channel)	5x5 32 QFN	Coming soon
Passive Switch	•	•	M21000	1 lane (2:1 mux/demux)	3x3 16 QFN	Coming soon
Passive Switch	•		M21001	1 lane (2:1 mux/demux)	3x3 16 QFN	Coming soon