

## Overcome Signal Attenuation and Noise & Jitter Interference Challenges in USB 3.0 System Design

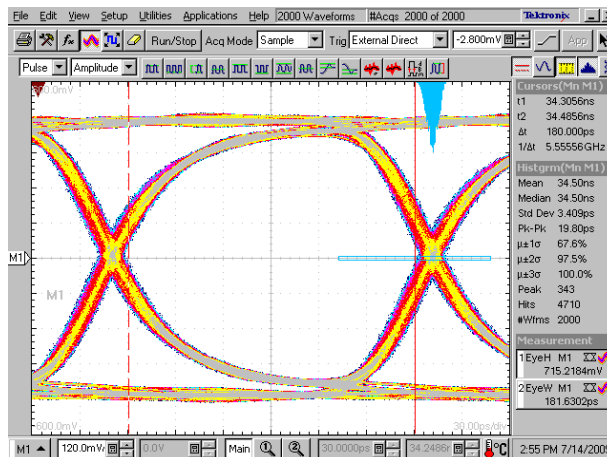
By Joseph Juan

The highly anticipated USB 3.0 is now seeing wide spread adoption in PC, Notebook, Server and Portable Devices. USB 3.0 delivers an unprecedented bandwidth, 10 times that of USB 2.0. USB 3.0 supports full-duplex communication, or the ability to send and receive data simultaneously. It also improves QoS (Quality of Service) thanks to advance data error checking, while saving power with the USB 3.0 link power management. Most importantly, it is 100% backward compatible with USB 2.0 devices. However, with all these added benefits, the high-speed differential signal of USB 3.0 also introduces uncontrollable noise, or signal attenuation, causing USB 3.0 signal voltage swing to overshoot or undershoot the “optimal eye opening”. This distorts the quality of USB 3.0 signal eye during high-speed signal switching. USB 3.0 signal quality is gravely impacted when random or deterministic noise degrades the signal quality with crosstalk during transmitting and receiving of packet transfers between USB 3.0 hosts and peripheral devices.

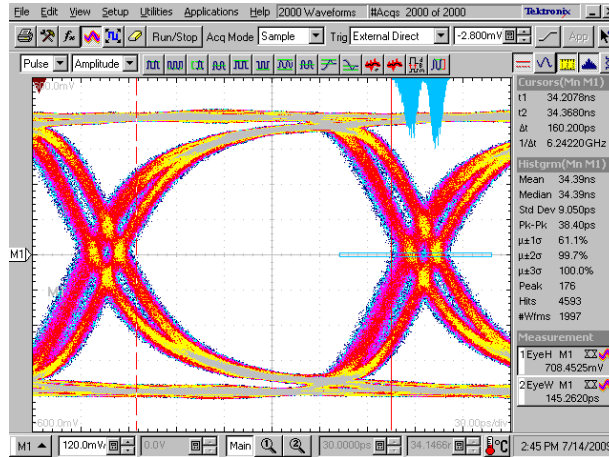
To offset the signal quality degradation, Pericom offers a broad array of USB 3.0 ReDrivers for maintaining a high level of SI (Signal Integrity) during Tx and Rx of USB 3.0 high-speed signals. Pericom USB 3.0 ReDriver enables USB 3.0 system designers to overcome USB 3.0 signal layout constraints, routing high-speed signals through multi-layer PCBs, extensive VIAs & connectors or across extensive cable lengths. Pericom USB 3.0 ReDriver allows designers to achieve overall cost saving in PCB and trace materials with standard micro strip or stripline trace on FR4 PCB materials. The programmable emphasis and equalization settings of Pericom’s USB 3.0 ReDriver devices compensate for the incurred Insertion loss of USB 3.0 signal while maintaining optimal opening of USB 3.0 signal eye with a sizable margin to spare.

The eye pattern scopes below show the captured Insertion loss at 6” and 48” USB 3.0 signal trace. The signal insertion loss due to USB 3.0 signal attenuation and noise occurrence can be effectively neutralized thru the implementation of Pericom USB 3.0 ReDriver in between USB 3.0 host and devices.

6in trace (1.776dB loss)

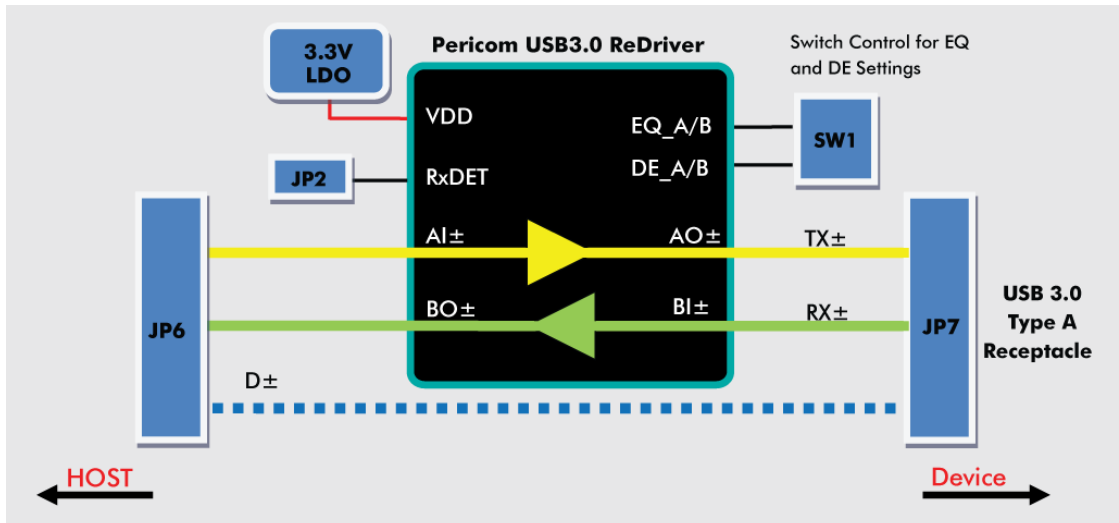


48in trace (14.2dB loss)



Faced with complex PCB layout challenges, USB 3.0 system designers see significant benefits from ReDrivers in transmitting and receiving reliable USB 3.0 signals with adequate output swing, effective jitter removal, flexible transmit emphasis and receiver equalization. System designers don't always have full control in how USB 3.0 end-point devices, like external HDDs, digital cameras, handhelds, or tablets, are connected between host and end point. When the signal travels thru extensive traces, multi-layer vias, connectors before exiting to the USB 3.0 ports or cables, the transmit eye of USB 3.0 host or device may show significant degradation from jitter, attenuation or insertion loss. As result, the USB 3.0 Link may likely suffer greater BER and link recovery during USB 3.0 cable plug and un-plug processes. Faced with USB 3.0 signal degradation, USB 3.0 system designers need to take greater measures to ensure strong SI during USB 3.0 Tx and Rx signal transmission. Pericom's USB 3.0 ReDriver devices offer just this sort of control: the USB 3.0 eye is fully optimized to maintain consistent level of SI when routing to extensive long traces across connectors and vias.

With Pericom's USB 3.0 ReDrivers, system designers are given greater flexibility to design and route High-speed USB 3.0 signals in a challenging environment while maintaining consistent level of signal quality. Pericom USB 3.0 ReDriver devices provide programmable equalization (EQ) and de-emphasis (DE) settings to optimize signal Tx and Rx performance over a variety of physical mediums.



Pericom's ReDriver keeps signals clear from host to end point.

ReDrivers provide adjustable EQ and de-emphasis (DE) settings to optimize USB 3.0 signal Tx and Rx performance over a variety of physical signal mediums on PCB or across cable.

Adjustable DE and EQ settings of Pericom USB3.0 ReDriver:

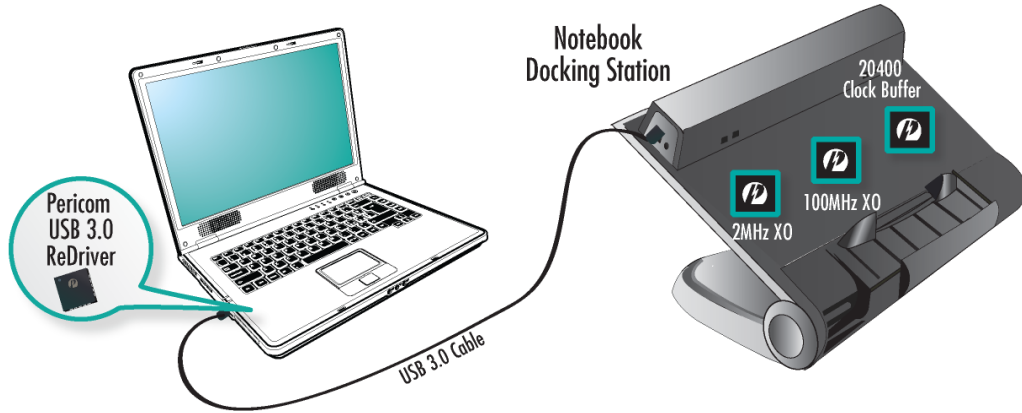
Function Pins	Switch Status	Pin Descriptions
RxDet	Open	Enable Receive detect function
EN_A#	Open	Channel A enable
EN_B#	Open	Channel B enable
VTH*	Open	Pull HIGH for normal operation
VDD	Short	Use internal power from PC USB port
DE_A	SW1 – 1 = ON SW1 – 2 = OFF	De-emphasis setting on channel A = 0dB
EQ_A	SW1 – 3 = ON SW1 – 4 = OFF	Equalizer setting on channel A = 3dB
DE_B	SW1 – 5 = ON SW1 – 6 = OFF	De-emphasis setting on channel B = 0dB
EQ_B	SW1 – 7 = ON SW1 – 8 = OFF	Equalizer setting on channel B = 3dB

Pre-configured to the specific DQ and EQ settings, Pericom USB 3.0 ReDriver effectively minimizes the risk of Inter-symbol Interference (ISI) and maintains optimal eye opening during high-speed signal transmission. To identify best EQ and DE settings on a real-time environment, Pericom offers a USB 3.0 ReDriver Reference Design Kit to conduct real-time inter-op testing against Intel, NEC and Fresco USB 3.0 host controllers. These kits are useful in real-time USB 3.0 system inter-op testing and allow system designers to verify and fine tune DE and EQ settings with respect to the USB3.0 trace layout architecture.

For further enquiries of USB 3.0 ReDriver Reference Design Kits, please contact your Pericom Distributor.

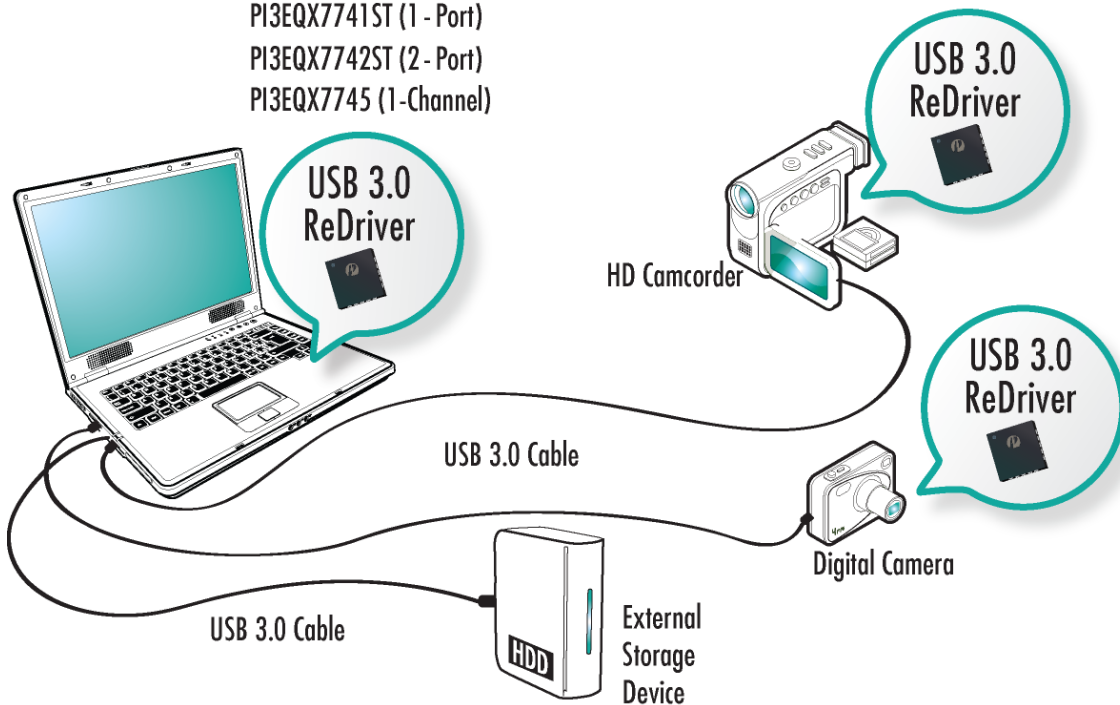
Below are reference USB 3.0 applications and platforms that would greatly benefit from Pericom USB 3.0 ReDriver for maintaining consistent level of SI standard.

**Notebook / Docking:**



**Peripheral Interconnect to USB3.0 Devices:**

- PI3EQX7741ST (1 - Port)
- PI3EQX7742ST (2 - Port)
- PI3EQX7745 (1-Channel)



Front Panel USB3.0 Ports of Server/Workstation MBs:

