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Ultrafast electronics for next generation oscilloscopes

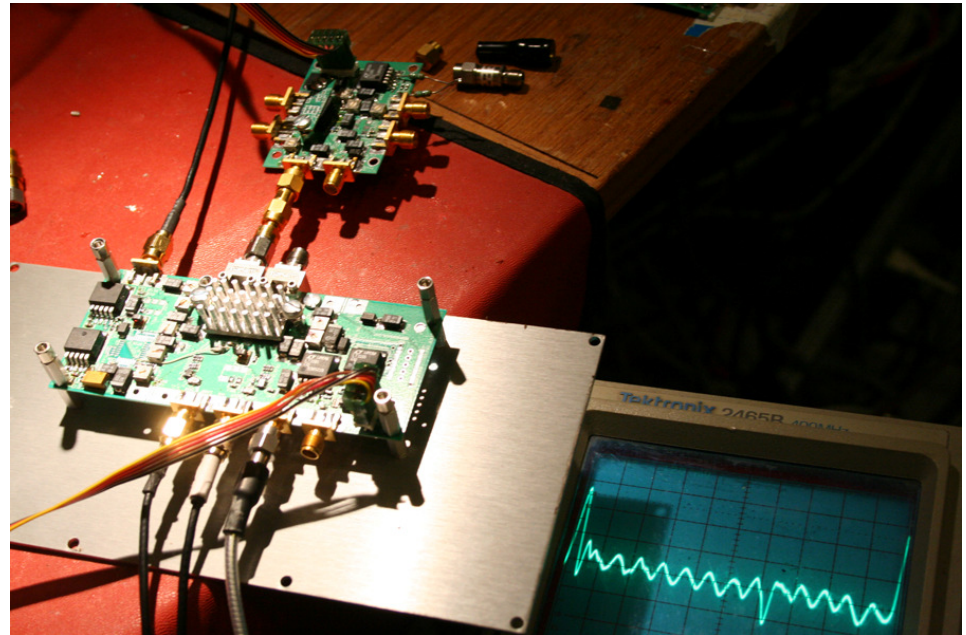
Proposals

- Next Generation 100 GHz Monolithic TDR/Sampling Scope IC
- “No-Load” TDR/Sampler IC for in-line PCIe, 10GE PHY measurement
- Microwave Arbitrary Waveform Generator for UWB Pulse Generation

The samplers and pulsers enabling this technology are covered by US patents #6,433,720 and #6,642,878 issued to Furaxa, Inc.

Next Generation 100 GHz Monolithic TDR/Sampling Scope IC

- Lower cost, size, power and jitter for 100 GHz TDR/sampling scope. Eliminates SRDs and NLTLS.
- Multiple samplers and TDR pulsers on single IC. Octal monolithic sampler IC could enable 50 GSPS real-time sampling with 25 GHz BW.
- Impulse-based TDR/TDT generates up to 5 billion UWB pulses/sec.
- Existing monolithic InP ICs achieve 50 GHz BW, 10ps incident impulse, 2GSPS sampler/pulser rep rate.
- SiGe IBM8HP IC in fab, simulated to 5ps, Vitess InP IC simulated to 3ps.



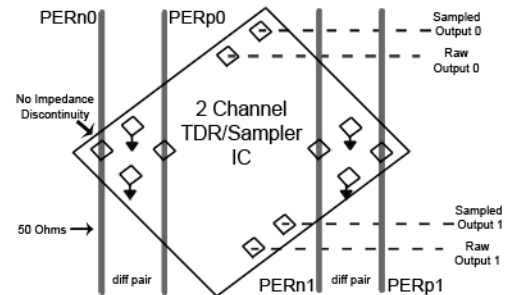
50 GHz, 1 GSPS Furaxa InP sampling scope front end IC with on-chip .999 GPPS TDR pulser, simultaneously measuring VCO output impedance and 14GHz output, injection locked to TDR pulser.

“No-Load” TDR/Sampler IC for in-line PCIe, 10GE PHY measurement

Enabling Next Generation Minimally Invasive Real-Time Link Analysis

- IC provides Hi-Z TDR / Eye-pattern measurement of PCIe or 10GE lanes.
- Coherent TDR has little affect on the bit error rate of the active link.
- IC provides downsampled output and raw output.
- Allows for continuous link characterization using low bandwidth oscilloscope or ADC.

Integrated in-line PCIe or 10Gb Ethernet TDR / Sampler

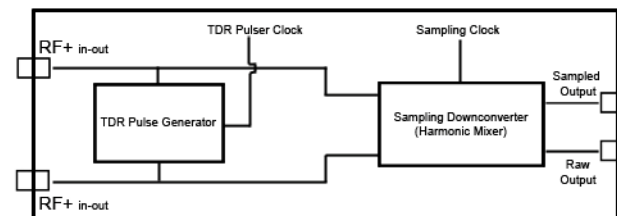


TDR
50 Ohms
(Terminated)



TDR
(shorted)

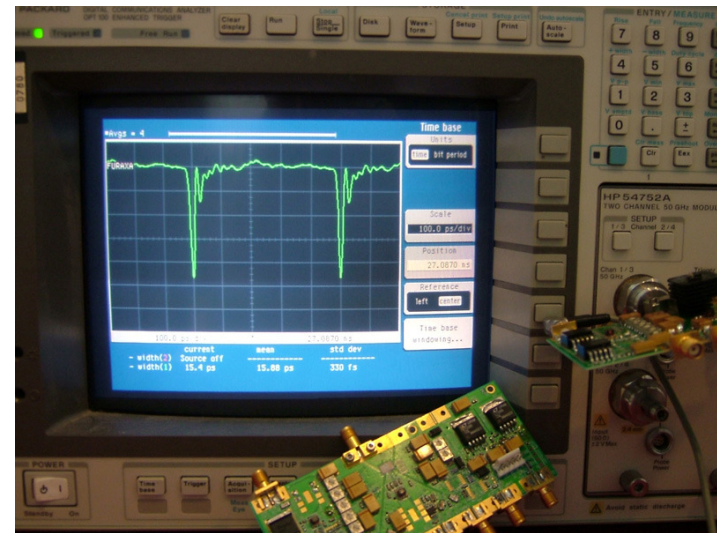
No-Load 50+ GHz TDR / Sampling Scope IC Sub-block



IC shown monitors high-speed serial link when mounted on simple pass through extender. TDR plots shown were generated using Furaxa InP sampler/pulsar IC. Reflected pulse widths are approximately 15 ps.

Microwave Arbitrary Waveform Generator for UWB Pulse Generation

- Dynamic pulse amplitude modulation and pulse position modulation allow for generation of UWB waveforms.
- Combining multiple pulsers and multi-phased VCO in single IC would allow generation of short arbitrary wave shapes.
- See video of dynamically modulated UWB pulsed based waveforms generated at 8 GSPS per second:
<http://www.furaxa.com/Documents/8PulsedArrayOutput.wmv>



Furaxa InP pulser IC generating 2 billion 15 ps pulses per second.

Enabling Next Generation of Ultrafast Instrumentation

- **Low cost high impedance sampling head / TDR pulser can be located right at signal source, enabling non-invasive in line instrumentation.**
- **Monolithic sampler and pulser construction allow multiple samplers / pulsers on a single IC for scalable sampling rates and generation of arbitrary microwave/UWB waveforms.**
- **Presently achieves 50 GHz / 10 ps pulses and sampling apertures in InP, and 15 GHz / 30 ps pulses and apertures in CMOS.**
- **Simulations in newer InP processes show 150 GHz / sub 3 ps pulses and apertures. Simulations in 8HP SiGe show 80 GHz / 7 ps.**
- **This scalable technology is ideally suited for low voltage IC processes of the future.**