

Timing Simplified

Silicon Labs offers a broad portfolio of frequency flexible timing products that enable hardware designers to simplify clock generation, distribution, and jitter attenuation. The portfolio includes:

- Network synchronizers
- Jitter attenuating clocks
- Clock generators
- Clock buffers
- PCIe clocks and buffers
- Oscillators (XO/VCXO)

Silicon Labs clocks use proprietary DSPLL and MultiSynth technologies to generate any combination of frequencies with ultra-low jitter, enabling best-in-class clock tree integration. Clock buffers provide low-jitter, low-skew clock distribution with integrated format/voltage level translation. PCIe clocks/buffers combine Gen 1/2/3/4/5 compliance with on-chip series termination, simplifying design. XO/VCXOs are factory-customizable to any frequency, with samples available in one to two weeks.



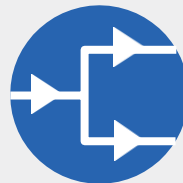
Oscillators

- Any frequency up to 3 GHz
- Ultra-low jitter: 80 fs RMS
- Short lead times: 1-2 weeks (samples)



Clock Generators

- Any-frequency, any-output
- Ultra-low jitter: 69 fs RMS
- Clock tree on a chip replaces clocks and XOs



Clock Buffers

- Integrated format/level translation
- Ultra-low additive jitter: 50 fs RMS
- PCI Express Gen 1/2/3/4/5 compliant



Jitter Attenuating Clocks/Network Sync

- Any frequency, any output
- Ultra-low jitter: 69 fs RMS
- Clock tree on a chip replaces clocks, XOs, VCXOs

Recommended Timing Solutions for Xilinx



*Yes, but without spread spectrum

Note 1: Jitter integration band defined by jitter tolerance mask (receiver CDR) and XCVR PLL multiplying BW (20MHz default)

Note 2: Jitter defined by standard or as budgeted fraction of transmitter eye closure

Industry Standard Interface			Xilinx										Silicon Labs												
			Versal		Kintex			Artix	Zynq	Virtex				XO/VCXO				Buffer		Clock Gen				Jitter Atten. Clock	
			AI Core & Prime	Premium	Ultra Scale+	Ultra Scale	7	7	Ultra Scale+	Ultra Scale+	Ultra Scale	7	Si51x	Si59x	Si54x	Si56x	Si533xx	Si532xx	Si522xx	Si5332	Si5341	Si5391	Si534x/Bx	Si539x	
Jitter Band ¹ (MHz)	Max Jitter ² (fs rms)																								
OIF	CEI-6G-SR/LR	4-20	630	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓			✓	✓	✓	✓	✓	✓		
	CEI-11G-SR	8-20	380	✓	✓	✓	✓		✓	✓	✓	✓		✓	✓	✓		✓	✓	✓	✓	✓	✓		
	CEI-28G-VSR	16-20	150	✓	✓	✓	✓		✓	✓	✓	✓		✓	✓				✓	✓	✓	✓	✓		
	CEI-56G-PAM4-MR/LR	4-20	350	✓	✓					✓				✓	✓	✓		✓	✓	✓	✓	✓	✓		
	CEI-56G-PAM4-VSR	4-20	240	✓	✓					✓				✓	✓			✓	✓	✓	✓	✓	✓		
	CEI-112G-PAM4-VSR	4-20	120 ⁽⁹⁾		✓									✓	✓					✓			✓		
	SFI-5.1	4-20	1300	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓			✓	✓	✓	✓	✓	✓	
	SFI-5.2	4-20	380	✓	✓	✓	✓		✓	✓	✓	✓		✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	
IEEE 802.3	1000BASE-X (GbE)	0.6-10	3000	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓			✓	✓	✓	✓	✓	✓		
	10GBASE-R	0.6-20	430	✓	✓	✓	✓	✓	✓	✓	✓			✓	✓	✓		✓	✓	✓		✓	✓		
	10GBASE-KR	0.6-20	430	✓	✓	✓	✓	✓	✓	✓	✓			✓	✓	✓		✓	✓	✓	✓	✓	✓		
	400GAUI-8 C2C	4-20	380	✓	✓					✓				✓	✓	✓			✓	✓	✓	✓	✓		
	400GAUI-8 C2M	4-20	275	✓	✓					✓				✓	✓	✓			✓	✓	✓	✓	✓		
	CDAUI-16 (400GbE)	4-20	480	✓	✓				✓	✓				✓	✓	✓			✓	✓	✓	✓	✓		
	CDAUI-8 (400GbE)	4-20	240	✓	✓					✓				✓	✓				✓	✓	✓	✓	✓		
	CAUI-4	1.9-10	280	✓	✓	✓	✓	✓	✓	✓	✓	✓			✓	✓	✓		✓	✓	✓	✓	✓	✓	
	CAUI-10	1.9-4	460	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	
	XAUI 10GBASE-X	0.6-20	430	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓		✓	✓	✓	✓	✓	✓	
	XLAUI (40GbE)	0.6-20	430	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓		✓	✓	✓	✓	✓	✓	
	OTN (OTU/EPON)	0.6-20	430	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓		✓	✓	✓	✓	✓	✓	
	SGMII/QSGMII	4-20	1400	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	
Proprietary	RXAUI/DXAUI	1.9-20	950	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓		

*Yes, but without spread spectrum Note 1: Jitter integration band defined by jitter tolerance mask (receiver CDR) and XCVR PLL multiplying BW (20MHz default) Note 2: Jitter defined by standard or as budgeted fraction of transmitter eye closure				Xilinx										Silicon Labs											
				Versal		Kintex			Artix	Zynq	Virtex			XO/VCXO				Buffer		Clock Gen				Jitter Atten. Clock	
				AI Core & Prime	Premium	Ultra Scale+	Ultra Scale	7	7	Ultra Scale+	Ultra Scale+	Ultra Scale	7	Si51x	Si59x	Si54x	Si56x	Si533xx	Si532xx	Si522xx	Si5332	Si5341	Si5391	Si534x/8x	Si539x
Industry Standard Interface	Jitter Band ¹ (MHz)	Max Jitter ² (fs rms)																							
ITU	GPON	0.6-10	1500	✓	✓		✓	✓			✓	✓	✓	✓	✓	✓			✓	✓	✓	✓	✓		
CPRI	CPRI 10G	various	Various 10G+	✓	✓		✓	✓	✓		✓	✓	✓			✓	✓		✓	✓	✓	✓	✓		
	CPRI 12G	various	Various 12G+	✓	✓		✓	✓	✓		✓	✓	✓			✓	✓		✓	✓	✓	✓	✓		
	CPRI 24G	various	Various 24G+	✓	✓		✓	✓	✓		✓	✓	✓			✓	✓		✓	✓	✓	✓	✓		
ANSI	Fibre Ch – 8G, 16G	0.6-10	240	✓	✓		✓	✓	✓		✓	✓	✓			✓	✓		✓	✓	✓	✓	✓		
	Fibre Ch – 32G	0.6-10	130	✓	✓		✓	✓	✓		✓	✓	✓			✓	✓		✓	✓	✓	✓	✓		
JEDEC	JESD204B	various	Per DAC/ADC	✓	✓		✓	✓	✓		✓	✓	✓						✓	✓	✓	✓	✓		
Intel	Interlaken – 6G	4-20	630	✓	✓		✓	✓			✓	✓	✓	✓	✓	✓			✓	✓	✓	✓	✓		
	Interlaken – 10G	4-20	380	✓	✓		✓	✓			✓	✓	✓	✓	✓	✓			✓	✓	✓	✓	✓		
	QPI	Intel	200	✓	✓		✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		
PCI-SIG	PCI Express Gen3	various	1000	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	*	*	*	*	✓	✓	✓	✓	*	*	*	
	PCI Express Gen4	various	500	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	*	*	*	*	✓	✓	✓	✓	*	*	*	
	PCI Express Gen5	various	150	✓	✓									*	*	*	*	✓	✓	✓	✓	*	*	*	
CCIX	CCIX-25G	various	350	✓	✓									*	*	*	*	✓	✓		✓	*	*	*	
SATA-IO	SAS/SATA 6G	2.6-15	780	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓			✓	✓	✓	✓	✓	
	SAS/SATA 12G	2.6-15	390	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓			✓	✓	✓	✓	✓	
SMPTE	SDI 3G, 6G	0.1-F/2	800	✓	✓		✓	✓	✓		✓	✓	✓		✓	✓	✓			✓	✓	✓	✓	✓	
	SDI 12G	0.1-F/2	400	✓	✓		✓	✓	✓		✓	✓	✓		✓	✓	✓			✓	✓	✓	✓	✓	
	SDI 24G	0.1-F/2	200	✓	✓						✓					✓				✓	✓	✓	✓	✓	
RapidIO	RapidIO-1, -2, -3	4-20	410	✓	✓		✓	✓	✓		✓	✓	✓	✓	✓	✓			✓	✓	✓	✓	✓	✓	
	RapidIO-4	1.9-10	290	✓	✓		✓	✓	✓		✓	✓	✓		✓	✓	✓			✓	✓	✓	✓	✓	
ITU ANSI	SONET/SDH OC-48	1-20	1000	✓	✓		✓	✓			✓	✓	✓	✓		✓	✓			✓	✓	✓	✓	✓	
	SONET/SDH OC-192	4-20	240	✓	✓		✓	✓			✓	✓	✓		✓	✓	✓			✓	✓	✓	✓	✓	
	SONET/SDH OC-768	16-20	80	✓	✓										✓					✓			✓	✓	

Xilinx UltraScale+ Phase Noise Mask Requirements



Xilinx Virtex, Kintex UltraScale+ GTH Transceiver		XO			VCXO		Clock Buffer	Clock Generator			Jitter Attenuating Clock		Network Synchronizers (SyncE/1588)
Offset (dBc/Hz)	QPLL PN 156.25 MHz	Si545	Si540	Si570/Si53x	Si56x	Si55x	Si5330x Universal Buffers	Si5391	Si5341 Si5340	Si5332	Si5347/6/5/4/2	Si5392/5	Si5383/48
10 Hz	-111	-140	-132	-129	-130	-128	-140	-136	-136	-125	-136	-136	-137
100 kHz	-130	-145	-139	-134	-142	-133	-150	-146	-141	-132	-141	-145	-145
1 MHz	-136	-152	-151	-145	-150	-144	-154	-150	-150	-145	-150	-150	-150

Xilinx Zync Ultrascale+ GTH Transceiver		XO			VCXO		Clock Buffer	Clock Generator			Jitter Attenuating Clock		Network Synchronizers (SyncE/1588)
Offset (dBc/Hz)	QPLL PN 156.25 MHz	Si545	Si540	Si570/Si53x	Si56x	Si55x	Si5330x Universal Buffers	Si5391	Si5341 Si5340	Si5332	Si5347/6/5/4/2	Si5392/5	Si5383/48
10 kHz	-111	-140	-132	-129	-130	-132	-140	-136	-136	-125	-136	-136	-137
100 kHz	-130	-145	-139	-134	-142	-142	-150	-146	-141	-132	-141	-145	-145
1 MHz	-136	-152	-151	-145	-150	-148	-154	-150	-150	-145	-150	-150	-150

Xilinx UltraScale Phase Noise Mask Requirements



Xilinx Virtex, Kintex UltraScale+ GTY Transceiver		XO			VCXO		Clock Buffer	Clock Generator			Jitter Attenuating Clock		Network Synchronizers (SyncE/1588)
Offset (dBc/Hz)	QPLL PN 156.25 MHz	Si545	Si540	Si570/Si53x	Si56x	Si55x	Si5330x Universal Buffers	Si5391	Si5341 Si5340	Si5332	Si5347/6/5/4/2	Si5392/5	Si5383/48
10 Hz	-112	-140	-132	-129	-130	-128	-140	-136	-136	-125	-136	-136	-137
100 kHz	-128	-145	-139	-134	-142	-133	-150	-146	-141	-132	-141	-145	-145
1 MHz	-145	-152	-151	-145	-150	-144	-154	-150	-150	-145	-150	-150	-150

Xilinx Zync Ultrascale+ GTY Transceiver		XO			VCXO		Clock Buffer	Clock Generator			Jitter Attenuating Clock		Network Synchronizers (SyncE/1588)
Offset (dBc/Hz)	QPLL PN 156.25 MHz	Si545	Si540	Si570/Si53x	Si56x	Si55x	Si5330x Universal Buffers	Si5391	Si5341 Si5340	Si5332	Si5347/6/5/4/2	Si5392/5	Si5383/48
10 kHz	-112	-140	-132	-129	-130	-132	-140	-136	-136	-125	-136	-136	-137
100 kHz	-128	-145	-139	-134	-142	-142	-150	-146	-141	-132	-141	-145	-145
1 MHz	-145	-152	-151	-145	-150	-148	-154	-150	-150	-145	-150	-150	-150

Xilinx UltraScale Phase Noise Mask Requirements



Xilinx Virtex, Kintex UltraScale+ GTM Transceiver		XO			VCXO		Clock Buffer	Clock Generator			Jitter Attenuating Clock		Network Synchronizers (SyncE/1588)
Offset (dBc/Hz)	QPLL PN 156.25 MHz	Si545	Si540	Si570/ Si53x	Si56x	Si55x	Si5330x Universal Buffers	Si5391	Si5341 Si5340	Si5332	Si5347/6/5/4/2	Si5392/5	Si5383/48
10 Hz	-112	-140	-132	-129	-130	-128	-140	-136	-136	-125	-136	-136	-137
100 kHz	-130	-145	-139	-134	-142	-133	-150	-146	-141	-132	-141	-145	-145
1 MHz	-145	-152	-151	-145	-150	-144	-154	-149	-149	-145	-150	-150	-150

Xilinx Zync Ultrascale+ GTM Transceiver		XO			VCXO		Clock Buffer	Clock Generator			Jitter Attenuating Clock		Network Synchronizers (SyncE/1588)
Offset (dBc/Hz)	QPLL PN 156.25 MHz	Si545	Si540	Si570/ Si53x	Si56x	Si55x	Si5330x Universal Buffers	Si5391	Si5341 Si5340	Si5332	Si5347/6/5/4/2	Si5392/5	Si5383/48
10 kHz	-111	-140	-132	-129	-130	-132	-140	-136	-136	-125	-136	-136	-137
100 kHz	-130	-145	-139	-134	-142	-142	-150	-146	-141	-132	-141	-145	-145
1 MHz	-136	-152	-151	-145	-150	-148	-154	-149	-149	-145	-150	-150	-150

Xilinx UltraScale Phase Noise Mask Requirements



Xilinx Virtex, Kintex Ultrascale GTH Transceiver		XO			VCXO		Clock Buffer	Clock Generator			Jitter Attenuating Clock		Network Synchronizers (SyncE/1588)
Offset (dBc/Hz)	QPLL PN 156.25 MHz	Si545	Si540	Si570/ Si53x	Si56x	Si55x	Si5330x Universal Buffers	Si5391	Si5341 Si5340	Si5332	Si5347/6/5/4/2	Si5392/5	Si5383/48
10 kHz	-111	-140	-132	-129	-130	-132	-140	-136	-136	-125	-136	-136	-137
100 kHz	-130	-145	-139	-134	-142	-142	-150	-146	-141	-132	-141	-145	-145
1 MHz	-136	-152	-151	-145	-150	-148	-154	-150	-150	-145	-150	-150	-150

Xilinx Virtex, Kintex Ultrascale GTY Transceiver		XO			VCXO		Clock Buffer	Clock Generator			Jitter Attenuating Clock		Network Synchronizers (SyncE/1588)
Offset (dBc/Hz)	QPLL PN 156.25 MHz	Si545	Si540	Si570/ Si53x	Si56x	Si55x	Si5330x Universal Buffers	Si5391	Si5341 Si5340	Si5332	Si5347/6/5/4/2	Si5392/5	Si5383/48
10 kHz	-112	-140	-132	-129	-130	-132	-140	-136	-136	-125	-136	-136	-137
100 kHz	-128	-145	-139	-134	-142	-142	-150	-146	-141	-132	-141	-145	-145
1 MHz	-145	-152	-151	-145	-150	-148	-154	-150	-150	-145	-150	-150	-150