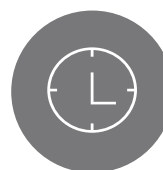




# Timing Solutions

PRODUCT SELECTOR GUIDE



## Timing

The industry's broadest portfolio of oscillators, clock buffers, clock generators, PCI Express (PCIe) clocks, jitter attenuators and SyncE/IEEE 1588 clocks.

# Timing Solutions

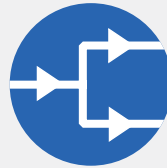
Silicon Labs offers a broad portfolio of timing products that enable hardware designers to simplify clock generation, clock distribution, jitter attenuation and network synchronization. These products combine best-in-class jitter performance and frequency flexibility, enabling customers to easily architect optimized clock tree solutions. Custom samples are available in 1-2 weeks, easing design and reducing time-to-market.

## Products:



### Oscillators

- Any frequency up to 1.5 GHz
- Ultra-low jitter: 80 fs RMS
- Short lead times: 1-2 weeks (samples)



### Clock Buffers

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



### Clock Generators

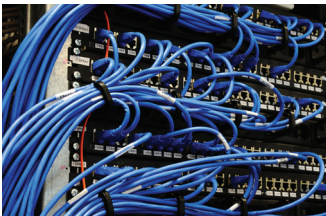
- Any-frequency, any-output
- Ultra-low jitter: 90 fs RMS
- Clock tree on a chip replaces clocks and XOs



### Jitter Attenuating Clocks/ Network Synchronizers

- Any frequency, any output
- Ultra-low jitter: 90 fs RMS
- Clock tree on a chip replaces clocks, XOs, VCXOs

## Applications:



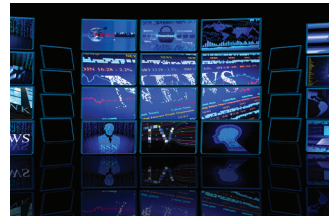
- Enterprise Routers
- Cable/DSL
- PON



- Base stations
- Small cells/DAS
- Backhaul/Fronthaul



- Switches/servers
- Storage/security
- Search Acceleration
- Machine Learning



- Audio/video
- Test/measurement
- Mil/aero



- Optical Transport (OTN)
- WDM
- Carrier Ethernet

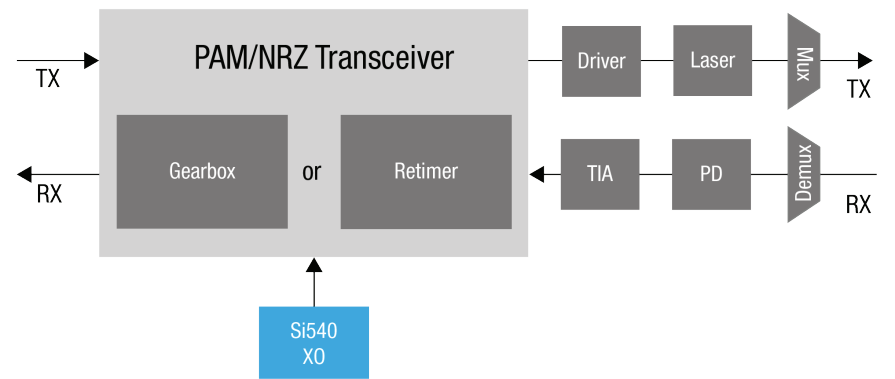
# Crystal Oscillators (XO)

Silicon Labs offers the industry’s broadest portfolio of high performance, low jitter XOs and VCXOs. Silicon Labs’ new Si54x Ultra Series™ family of high performance XOs delivers best-in-class jitter performance and frequency flexibility. All devices are highly customizable, with samples of any XO available with 1-2 week lead times.

## PORTFOLIO KEY FEATURES

- Industry’s lowest jitter any frequency XOs
- Jitter as low as 80 fs RMS typ
- Any frequency up to 1.5 GHz
- Single, dual, quad and I2C prog. options
- LVPECL, LVDS, HCSL, CML, LVCMOS
- Superior stability vs. SAW oscillators
- Best-in-class power supply noise rejection
- Single device supports 1.8 – 3.3 V operation
- -40 to +85 C operation
- Samples in 1-2 weeks

## EXAMPLE APPLICATION: 100G/200G OPTICAL MODULE



## FEATURED PRODUCTS

| PERFORMANCE OPTION | PART NUMBER | NUMBER OF FREQUENCIES | FREQUENCY RANGE    | TYP JITTER (fs RMS) | TOTAL STABILITY (±PPM) | LVPECL | LVDS | HCSL | CML | LVCMOS | DUAL LVCMOS | VOLTAGE (V)   | PACKAGE SIZE (MM) |
|--------------------|-------------|-----------------------|--------------------|---------------------|------------------------|--------|------|------|-----|--------|-------------|---------------|-------------------|
| ULTRA LOW JITTER   | Si545       | SINGLE                | 200 kHz to 1.5 GHz | 80                  | 50                     | ✓      | ✓    | ✓    | ✓   | ✓      | ✓           | 1.8 - 3.3     | 3.2 x 5           |
|                    | Si546       | DUAL                  |                    |                     |                        |        |      |      |     |        |             |               |                   |
|                    | Si547       | QUAD                  |                    |                     |                        |        |      |      |     |        |             |               |                   |
|                    | Si540       | SINGLE                | 200 kHz to 1.5 GHz | 125                 | 50                     | ✓      | ✓    | ✓    | ✓   | ✓      | ✓           | 1.8 - 3.      | 3.2 x 5           |
|                    | Si541       | DUAL                  |                    |                     |                        |        |      |      |     |        |             |               |                   |
|                    | Si542       | QUAD                  |                    |                     |                        |        |      |      |     |        |             |               |                   |
| LOW JITTER         | Si530/1     | SINGLE                | 10 MHz to 1.4 GHz  | 300                 | 20, 31.5, 61.5         | ✓      | ✓    |      | ✓   | ✓      |             | 1.8, 2.5, 3.3 | 5 x 7             |
|                    | Si532/3     | DUAL                  |                    |                     |                        |        |      |      |     |        |             |               |                   |
|                    | Si534       | QUAD                  |                    |                     |                        |        |      |      |     |        |             |               |                   |
|                    | Si570       | ANY (I2C)             |                    |                     |                        |        |      |      |     |        |             |               |                   |
| GENERAL PURPOSE    | Si590/1     | SINGLE                | 10 MHz to 810 MHz  | 500                 | 20, 30, 50, 100        | ✓      | ✓    |      |     | ✓      |             | 1.8, 2.5, 3.3 | 5 x 7             |
|                    | Si598       | ANY (I2C)             |                    |                     |                        |        |      |      |     |        |             |               |                   |
|                    | Si510/1     | SINGLE                | 100 kHz to 250 MHz | 800                 | 30, 50, 100            | ✓      | ✓    | ✓    |     | ✓      | ✓           | 1.8, 2.5, 3.3 | 3.2 x 5           |
|                    | Si512/3     | DUAL                  |                    |                     |                        |        |      |      |     |        |             |               |                   |
|                    | Si514       | ANY (I2C)             |                    |                     |                        |        |      |      |     |        |             |               |                   |

XO

XO Software Tools

XO Development Tools

Reference Designs

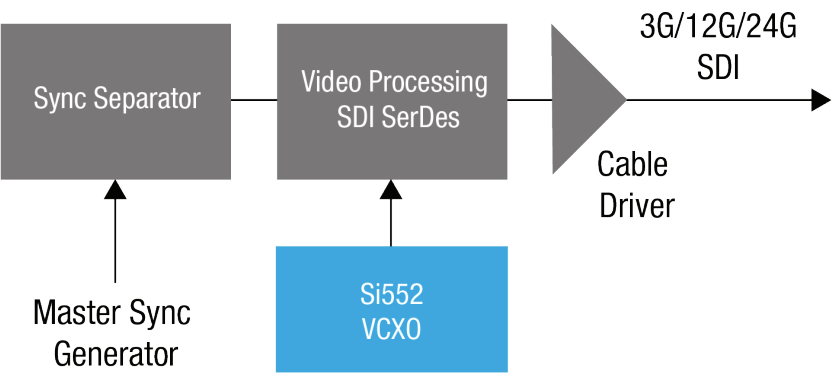
# Voltage-Controlled Crystal Oscillators (VCXO)

Silicon Labs offers the industry’s broadest portfolio of high performance, low jitter XOs and VCXOs. Silicon Labs’ VCXOs deliver exceptional jitter performance and best-in-class control voltage linearity and power supply noise rejection. All devices are highly customizable, with samples of any VCXO available with 1-2 week lead times.

## PORTFOLIO KEY FEATURES

- Jitter: 500 fs RMS typ (12 kHz – 20 MHz)
- Any frequency up to 1.4 GHz
- Single, dual, quad and I2C prog. options
- LVPECL, LVDS, HCSL, CML, LVCMOS
- Superior linearity vs. traditional VCXO/VCXOs
- Best-in-class power supply noise rejection
- 1.8, 2.5 or 3.3 V
- 5x7 mm, 3.2x5 mm
- -40 to +85 C operation
- Samples in 1–2 weeks

## EXAMPLE APPLICATION: VIDEO FORMAT CONVERTER



## FEATURED VOLTAGE-CONTROLLED CRYSTAL OSCILLATORS (VCXO)

| PERFORMANCE OPTION | PART NUMBER | NUMBER OF FREQUENCIES | FREQUENCY RANGE    | TYP JITTER (fs RMS) | MIN APR (±PPM) | LVPECL | LVDS | HCSL | CML | LVCMOS | DUAL LVCMOS | VOLTAGE (V)   | PACKAGE (MM) |
|--------------------|-------------|-----------------------|--------------------|---------------------|----------------|--------|------|------|-----|--------|-------------|---------------|--------------|
| Low Jitter         | SI550       | SINGLE                |                    |                     |                |        |      |      |     |        |             |               |              |
|                    | SI552       | DUAL                  | 10 MHz to 1.4 GHz  | 500                 | 12 - 375       | ✓      | ✓    |      | ✓   | ✓      |             | 1.8, 2.5, 3.3 | 5x7          |
|                    | SI554       | QUAD                  |                    |                     |                |        |      |      |     |        |             |               |              |
|                    | SI571       | ANY (I2C)             |                    |                     |                |        |      |      |     |        |             |               |              |
| General Purpose    | SI595       | SINGLE                |                    |                     |                |        |      |      |     |        |             |               |              |
|                    | SI596       | DUAL                  |                    |                     |                |        |      |      |     |        |             |               |              |
|                    | SI597       | QUAD                  | 10 MHz to 810 MHz  | 700                 | 10 - 370       | ✓      | ✓    |      | ✓   | ✓      |             | 1.8, 2.5, 3.3 | 5x7          |
|                    | SI598       | ANY (I2C)             |                    |                     |                |        |      |      |     |        |             |               |              |
|                    | SI515       | SINGLE                | 100 kHz to 250 MHz | 1000                | 30, 50, 100    | ✓      | ✓    | ✓    |     | ✓      | ✓           | 1.8, 2.5, 3.3 | 5x7          |
|                    | SI516       | DUAL                  |                    |                     |                |        |      |      |     |        |             |               | 3.2x5        |

VCXO

VCXO Software Tools

VCXO Development Tools

Reference Designs

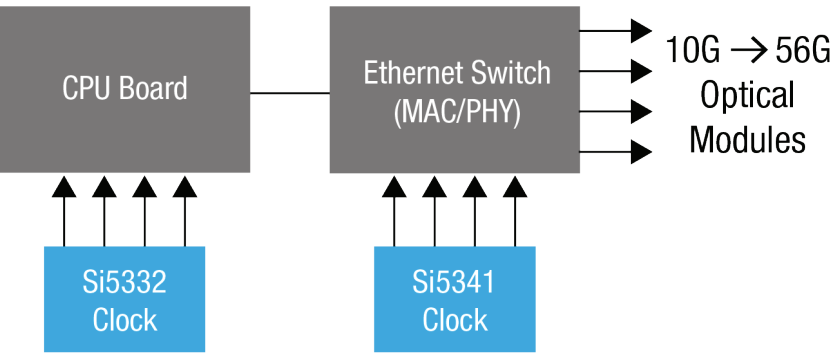
# Clock Generators

Silicon Labs offers the industry’s lowest jitter, most frequency flexible, most highly integrated clock generators. Leveraging Silicon Labs’ proven MultiSynth technology, a single clock generator can replace an entire clock tree of multiple oscillators, buffers, clock generators, and muxes, simplifying design and accelerating time to market. Silicon Labs’ comprehensive clock generator portfolio offers optimized solutions for communications, data center, industrial and consumer applications.

## PORTFOLIO KEY FEATURES

- Ultra-low jitter as low as 100 fs RMS
- Generate any combination of frequencies
- Lowest jitter fractional clock synthesis
- Programmable format per output
- LVPECL, LVDS, HCSL, CML, LVCMOS
- Programmable VDDO per output
- Best-in-class power supply noise rejection
- PCIe Gen 1/2/3/4 compliant
- Custom samples in 2 weeks
- ClockBuilder Pro support

## APPLICATION EXAMPLE: DATA CENTER ETHERNET SWITCH



## FEATURED CLOCK GENERATORS

| APPLICATION    | PART NUMBER     | PCI EXPRESS | CLOCK INPUTS | CLOCK OUTPUTS | MAX OUTPUT FREQUENCY | TYP JITTER (fs RMS) | LVPECL | LVDS | HCSL | CML | LVCMOS | VOLTAGE (V)   | PACKAGE           |
|----------------|-----------------|-------------|--------------|---------------|----------------------|---------------------|--------|------|------|-----|--------|---------------|-------------------|
| COMMUNICATIONS | Si5341          |             | 4            | 10            | 1.028 GHz            | 100                 |        |      |      |     |        | 1.8, 3.3      | QFN64 QFN44       |
|                | Si5340          |             | 4            | 4             | 1.028 GHz            | 100                 | ✓      | ✓    | ✓    | ✓   | ✓      | 1.8, 3.3      | QFN64 QFN44       |
| DATA CENTER    | Si5332          | ✓           | 2            | 6, 8, 12      | 312.5 MHz            | 230                 | ✓      | ✓    | ✓    |     | ✓      | 1.8, 2.5, 3.3 | QFN48 QFN40 QFN32 |
|                | Si52208/12      | ✓           | 1            | 8, 12         | 133 MHz              | -                   |        |      | ✓    |     | ✓      | 1.5, 1.8      | QFN64 QFN48       |
|                | Si5338/35/34    | ✓           | 1            | 4             | 710 MHz              | 700                 |        |      | ✓    |     |        | 1.8, 2.5, 3.3 | QFN24             |
| INDUSTRIAL     | Si52142/3/4/6/7 | ✓           | 1            | 2, 4, 6, 9    | 100 MHz              | -                   |        |      | ✓    |     |        | 3.3           | QFN48 QFN32 QFN24 |
|                | Si52111/2       | ✓           | 1            | 1, 2          | 100 MHz              | -                   |        |      | ✓    |     |        | 3.3           | TDFN10            |
| CONSUMER       | Si52202/4       | ✓           | 1            | 2, 4          | 133 MHz              | -                   |        |      | ✓    |     | ✓      | 1.5, 1.8      | QFN32 QFN20       |
|                | Si5350/51       |             | 1            | 3, 8          | 200 MHz              | -                   |        |      | ✓    |     | ✓      | 1.8, 2.5, 3.3 | MSOP10 QFN20      |
|                | Si51210/1/4/8   |             | 1            | 2, 3          | 170 MHz              | -                   |        |      |      |     | ✓      | 1.8, 2.5, 3.3 | TDFN6 TDFN8       |

Clk Gens

Clk Gen Software Tools

Clk Gen Development Tools

Reference Designs

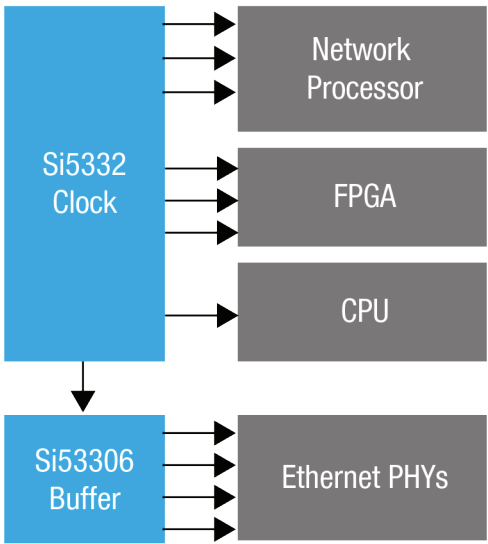
# Clock Buffers

Silicon Labs offers a comprehensive portfolio of clock buffers. In addition to universal buffers that support any in/out signal format translation, we offer a wide range of differential and single-ended buffers that provide ultra-low additive jitter and low skew clock distribution. Silicon Labs also offers a broad range of low-power PCIe buffers that integrate all termination components while providing compliance with PCIe Gen 1/2/3/4 standards.

## PORTFOLIO KEY FEATURES

- Ultra-low additive jitter as low as 50 fs RMS
- Clock distribution up to 1.25 GHz
- LVPECL, LVDS, HCSL, CML, LVCMOS
- Pin-selectable signal format
- Individual clock output OE control
- Synchronous, glitchless OE control
- Best-in-class power supply noise rejection
- PCIe: push-pull HCSL drivers
- PCIe: integrated termination resistors
- PCIe: Gen 1/2/3/4 compliant
- PCIe: Intel-qualified solutions

## APPLICATION EXAMPLE: SWITCH/ROUTER



## FEATURED CLOCK BUFFERS

| PRODUCT FAMILY                 | PART NUMBER | CLOCK INPUTS | CLOCK OUTPUTS    | MAX OUTPUT FREQUENCY | TYP JITTER (fs RMS) | LVPECL | LVDS | HCSL | CML | LVCMOS | VOLTAGE (V)   | PACKAGE                          |
|--------------------------------|-------------|--------------|------------------|----------------------|---------------------|--------|------|------|-----|--------|---------------|----------------------------------|
| ANY FORMAT                     | Si5331x     | 2            | 6, 10            | 1250 MHz             | 50                  | ✓      | ✓    | ✓    | ✓   | ✓      | 1.8, 2.5, 3.3 | 32QFN                            |
|                                | Si5330x     | 1, 2         | 2, 4, 6, 10      | 725 MHz              | 50                  | ✓      | ✓    | ✓    | ✓   | ✓      | 1.8, 2.5, 3.3 | 16QFN<br>32QFN<br>44QFN          |
| LVPECL                         | Si5332x     | 1, 2         | 2, 4, 5, 6, 10   | 1250 MHz             | 50                  | ✓      |      |      |     |        | 2.5, 3.3      | QFN16<br>QFN24<br>QFN32          |
| LVDS                           | Si5334x     | 2            | 4, 6, 8, 10      | 1250 MHz             | 50                  |        | ✓    |      |     |        | 1.8, 2.5, 3.3 | QFN16<br>QFN24<br>QFN32          |
| LVC MOS                        | Si5336x     | 1, 2         | 8, 12            | 200 MHz              | 100                 |        |      |      |     | ✓      | 1.8, 2.5, 3.3 | 16QFN<br>24QFN<br>16TSSOP        |
| PCI EXPRESS                    | Si5315x     | 1            | 2, 4, 6, 9       | 210 MHz              | 100                 |        |      | ✓    |     |        | 3.3           | 24QFN<br>32QFN<br>48QFN          |
|                                | Si53102-Ax  | 1            | 2                | 175 MHz              | 200                 |        |      | ✓    |     |        | 2.5, 3.3      | 8TDFN                            |
| PCI EXPRESS ZERO DELAY BUFFERS | Si5311x     | 1            | 6, 8, 12, 15, 19 | 133 MHz              | 80                  |        |      | ✓    |     |        | 3.3           | 40QFN<br>48QFN<br>64QFN<br>72QFN |
| TCX0 BUFFERS                   | SL18860/1   | 1            | 3                | 52 MHz               | -                   |        |      |      |     | ✓      | 1.8           | TDFN10                           |

Buffers

PCIe Clock Jitter Tool

Buffer Development Tools

Reference Designs

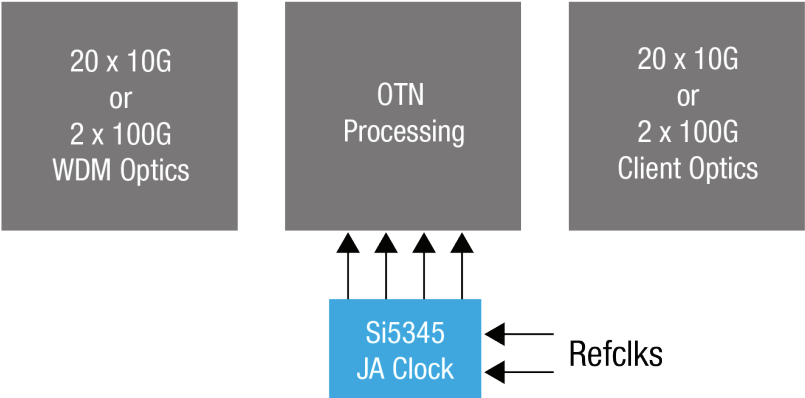
# Jitter Attenuating Clocks

Silicon Labs offers the industry’s lowest jitter, most frequency flexible, most highly integrated jitter attenuating clock generators. Leveraging Silicon Labs’ proven DSPLL and MultiSynth technology, a single jitter attenuating clock can synchronize to a wide range of different clocks, filter jitter, and provide any combination of output frequencies. Silicon Labs offers an extensive range of jitter attenuating clocks to solve the most complex timing challenges in 100G+ packet optical transport designs.

## PORTFOLIO KEY FEATURES

- Ultra-low jitter as low as 90 fs RMS
- Programmable loop bandwidth down to 0.1 Hz
- Generate any combination of frequencies
- Lowest jitter fractional clock synthesis
- Programmable format per output
- LVPECL, LVDS, HCSL, CML, LVCMOS
- Programmable VDDO per output
- Best-in-class power supply noise rejection
- Custom samples in 2 weeks
- ClockBuilder Pro support

## APPLICATION EXAMPLE: 200G OTN MUXPONDER



## FEATURED JITTER ATTENUATING CLOCKS

| APPLICATION                  | PART NUMBER   | # DSPLL | # MULTISYNTH | CLOCK INPUTS | OUTPUT FREQUENCY (MHz) | MAX OUTPUT FREQUENCY | TYP JITTER (fs RMS) | LVPECL | LVDS | HCSL | CML | LVCMOS | VOLTAGE (V)   | PACKAGE |
|------------------------------|---------------|---------|--------------|--------------|------------------------|----------------------|---------------------|--------|------|------|-----|--------|---------------|---------|
| Optical Networking Broadband | Si5345        | 1       | 5            | 4            | 10                     |                      |                     |        |      |      |     |        |               | QFN64   |
|                              | Si5344        | 1       | 4            | 4            | 4                      | 1.028 GHz            |                     |        |      |      |     |        |               | QFN44   |
|                              | Si5342        | 1       | 2            | 4            | 2                      |                      | 90                  | ✓      | ✓    | ✓    | ✓   | ✓      | 1.8, 3.3      | QFN44   |
|                              | Si5347        | 4       | 0            | 4            | 4, 8                   | 720 MHz              |                     |        |      |      |     |        |               | QFN64   |
|                              | Si5346        | 2       | 0            | 4            | 4                      |                      |                     |        |      |      |     |        |               | QFN44   |
| Coherent Optics              | Si5342H / 44H | 1       | 1, 2         | 2            | 2, 4                   | 2.75 GHz             | 50                  | ✓      | ✓    | ✓    | ✓   | ✓      | 1.8, 2.5, 3.3 | QFN44   |

Jitter Attenuators

JA Software Tools

JA Development Tools

Reference Designs

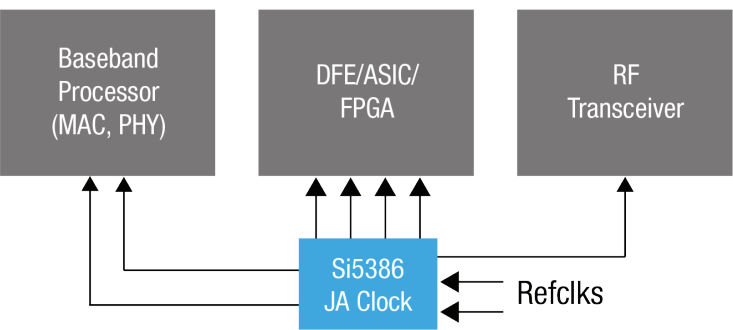
# Wireless Clocks

Silicon Labs offers the industry’s most highly integrated clocking solutions for radio access networks. Leveraging Silicon Labs’ proven DSPLL and MultiSynth technology, a single jitter attenuating clock can synchronize to a wide range of different clocks, filter jitter, and generate LTE, Ethernet and general-purpose clocks from a single device. All PLL components are integrated on-chip, eliminating the need for discrete VCXOs, XO’s and loop filters in the design.

## PORTFOLIO KEY FEATURES

- Ultra-low phase noise
- Replaces multiple clock IC’s and VCXO’s
- Generates LTE & Ethernet clocks from single IC
- No external loop filter
- Integrated crystal
- Noise floor: -165 dBc/Hz
- Best-in-class power supply noise rejection
- Custom samples in 2 weeks
- ClockBuilder Pro support

## APPLICATION EXAMPLE: SMALL CELL / DAS



## FEATURED WIRELESS CLOCK

| APPLICATION            | PART NUMBER | # DSPLL | # MULTISYNTH | CLOCK INPUTS | CLOCK OUTPUTS | MAX OUTPUT FREQUENCY | TYP JITTER (fs RMS) | LVPECL | LVDS | HCSL | CML | LVC MOS | VOLTAGE (V) | PACKAGE |
|------------------------|-------------|---------|--------------|--------------|---------------|----------------------|---------------------|--------|------|------|-----|---------|-------------|---------|
| C-RAN Small cells DAS  | Si5386      | 1       | 5            | 4            | 12            | 2.94912 GHz          | 80                  | ✓      | ✓    | ✓    | ✓   | ✓       | 1.8, 3.3    | LGA64   |
| Macro RRH              | Si5380      | 1       | 0            | 4            | 12            | 1.475 GHz            | 65                  | ✓      | ✓    | ✓    | ✓   | ✓       | 1.8, 3.3    | QFN64   |
| Backhaul Fronthaul BBU | Si5381      | 4       | 0            | 4            | 12            | 2.94912 GHz          | 80                  | ✓      | ✓    | ✓    | ✓   | ✓       | 1.8, 3.3    | LGA64   |
|                        | Si5382      | 2       | 0            | 4            | 12            | 2.94912 GHz          | 80                  | ✓      | ✓    | ✓    | ✓   | ✓       | 1.8, 3.3    | LGA64   |

Wireless Clks

Wireless Clk Software Tools

Wireless Clk Dev Tools

Ref Designs

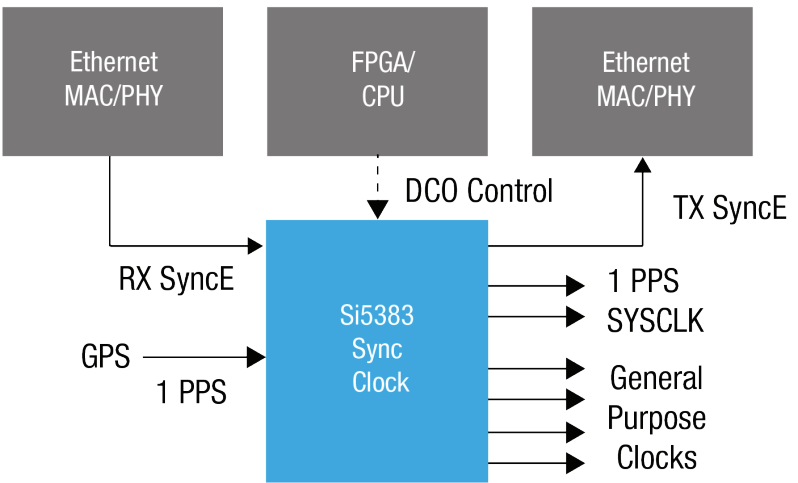
# Network Synchronizers (Synchronous Ethernet / IEEE 1588)

Silicon Labs offers standards-compliant synchronization clocks that lead the industry in terms of jitter performance and power consumption. These products combine network synchronization and jitter attenuation functions in a single device, enabling single-IC designs for pizza box Carrier Ethernet switches/routers and BBU control card applications.

## PORTFOLIO KEY FEATURES

- Ultra-low jitter as low as 100 fs RMS
- Programmable loop bandwidth down to 1mHz
- Each DSPLL generates any output frequency
- Support for 1PPS/1Hz input and output
- Synchronous, free-run, holdover modes
- Automatic/manual hitless switching
- Pin or SW-controlled 1588 DCO (1 ppt/step)
- Meets G.8262 (SyncE), G.812, G.813
- Suitable for ITU-T G.8273.1 T-GM, G.8273.2 T-BC, T-TSC
- ClockBuilder Pro support

## APPLICATION EXAMPLE: TELECOM BOUNDARY CLOCK



## FEATURED NETWORK SYNCHRONIZERS

| APPLICATION                                 | PART NUMBER | # DSPLL | GPS SYNC<br>(1 PPS INPUT) | MIN LOOP<br>BANDWIDTH | CLOCK<br>INPUTS | CLOCK<br>OUTPUTS | MAX OUTPUT<br>FREQUENCY | TYP JITTER<br>(fs RMS) | LVPECL | LVDS | HCSL | CML | LVC MOS | VOLTAGE<br>(V) | PACKAGE |
|---------------------------------------------|-------------|---------|---------------------------|-----------------------|-----------------|------------------|-------------------------|------------------------|--------|------|------|-----|---------|----------------|---------|
| Optical Networking<br>Broadband<br>Wireless | Si5383      | 3       | ✓                         | 1 mHz                 | 5               | 7                |                         |                        | ✓      | ✓    | ✓    | ✓   | ✓       |                | LGA56   |
|                                             | Si5384      | 1       | ✓                         | 1 mHz                 | 5               | 7                | 718.5 MHz               | 150                    | ✓      | ✓    | ✓    | ✓   | ✓       | 1.8, 3.3       | LGA56   |
|                                             | Si5348      | 3       |                           | 1 mHz                 | 5               | 7                |                         |                        | ✓      | ✓    | ✓    | ✓   | ✓       |                | QFN64   |

Net Sync

Net Sync Software Tools

Net Sync Dev Tools

Reference Designs



**SILICON LABS**

Smart. Connected. Energy-Friendly.