



# ClockBuilder Pro Overview

JANUARY 2020

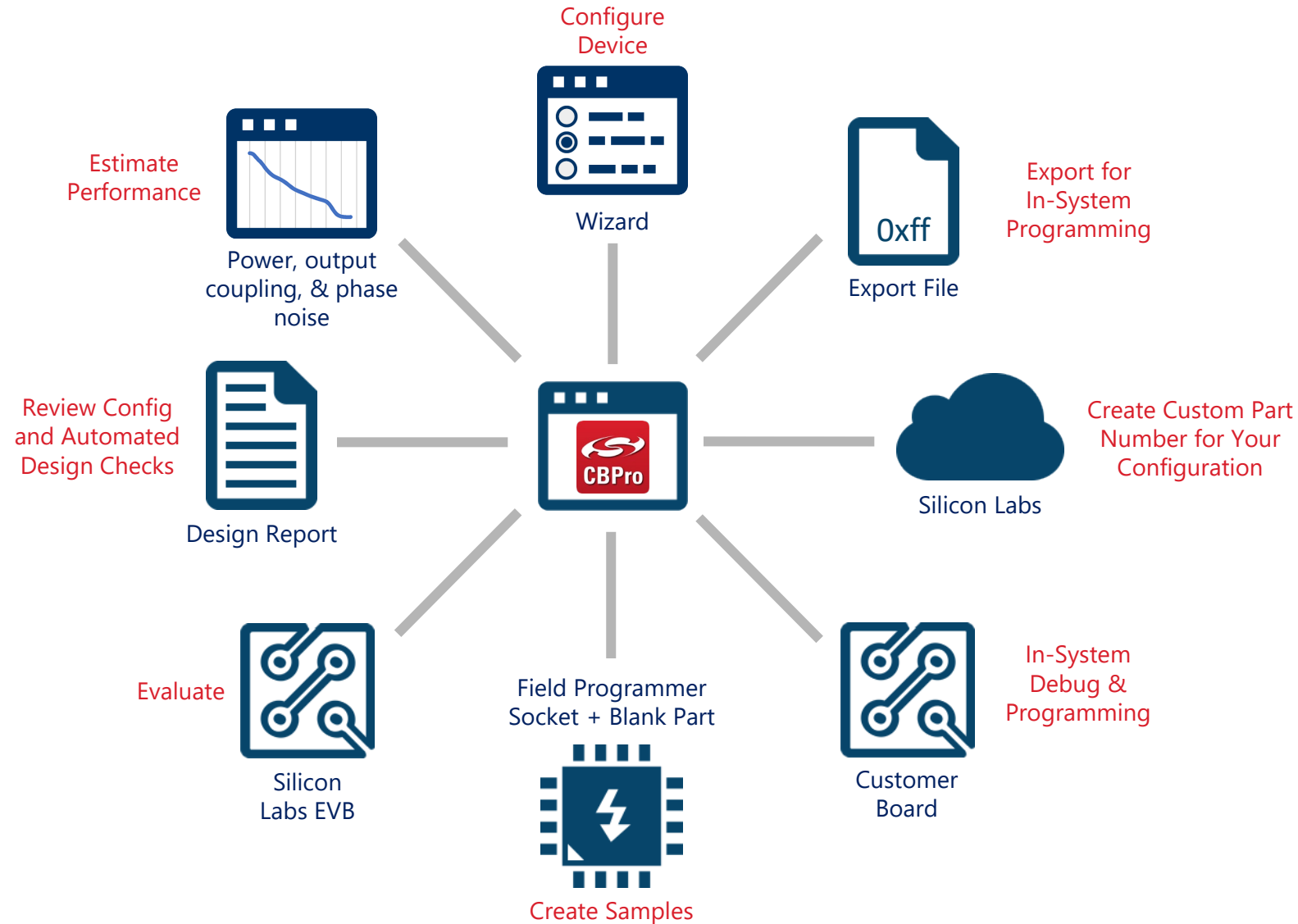




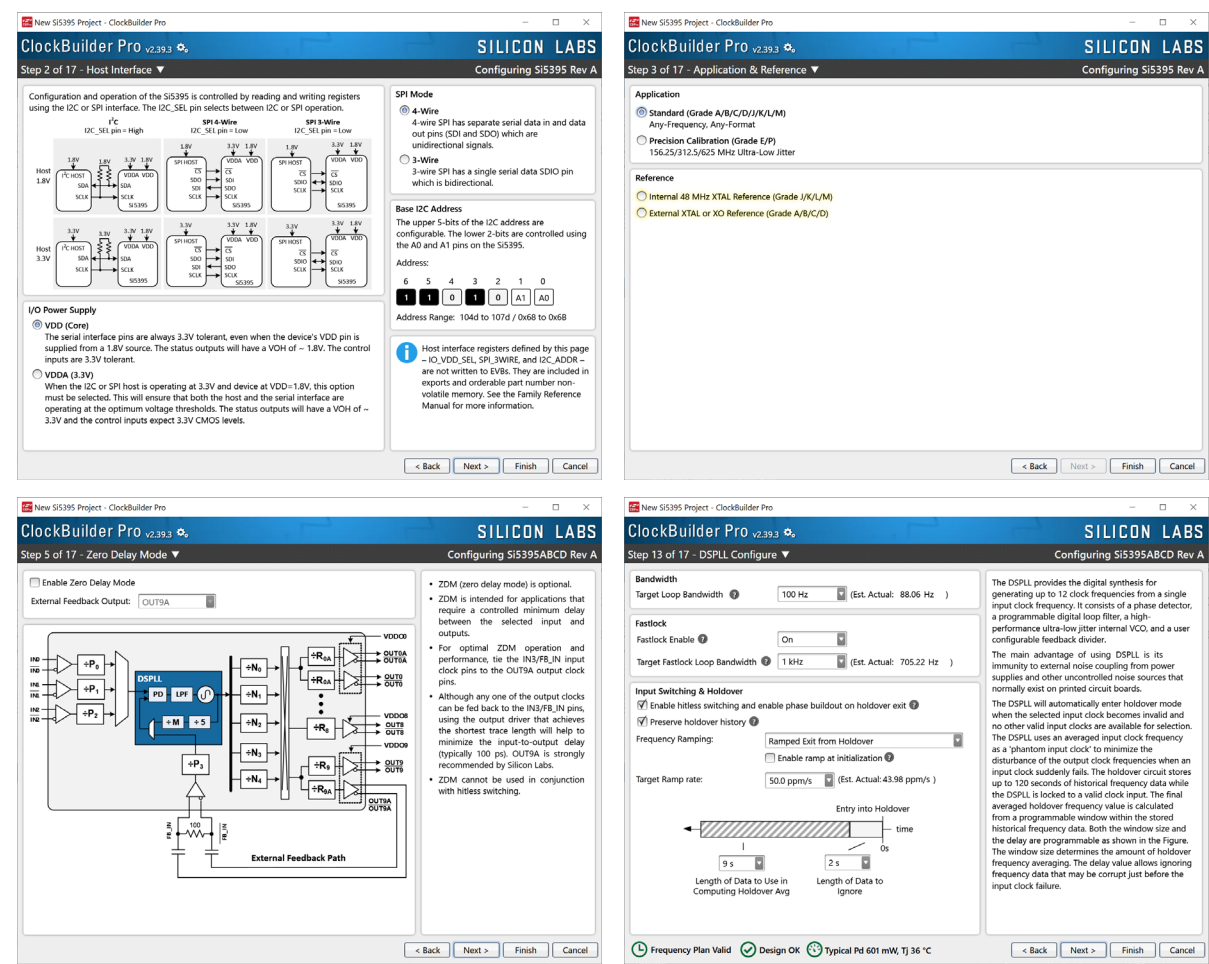
A walk through of the  
**top 14**  
**CBPro features** that will  
help you get your design to  
market easier and *faster*

Note: feature availability varies by device

# #1 - A Single Tool that Supports All Stages of Your Timing Design




# #2 - Device Configuration Wizard



- The CBPro wizard breaks configuration into related and manageable chunks
- Ensures configuration is done in logical order
- Hides features not applicable based on earlier selections

# #3 - Expression-Based Frequency Entry

174.7030... MHz [ 174 + 798/1135 MHz ] Auto 

OUT2: 255\*9953.28/(16\*4\*227)M

174.703083700440... MHz [ 174 + 798/1135 MHz ]  
Frequency Range: 100 Hz to 720 MHz, 733.334 MHz to 800 MHz, 825 MHz to 1.028 GHz

Frequency entry examples:

- 19.2M
- 19.2 MHz
- 2\*IN0
- OUT5
- OUT5 + 5 ppb
- 10e9\*4\*255 / (236\*64)
- 5 MHz + 25 ppm

- Frequencies can be entered using human readable expressions like "10e9\*4\*255 / (236\*64)" and "OUT5 + 5 ppb"
- Leads to quick, error free data entry and precise frequency output

# #4 - Automatic Optimal Device Configuration

Input Clock	- Assert & De-Assert Thresholds -			
	For Max Period	For Min Period	Validation Time	
IN0	<input type="text" value="2.000"/>	<input type="text" value="0.031"/>	<input type="text" value="10 msec"/>	<input checked="" type="checkbox"/> Set for me
IN1	<input type="text" value="2.000"/>	<input type="text" value="0.031"/>	<input type="text" value="10 msec"/>	<input checked="" type="checkbox"/> Set for me
IN2	<input type="text" value="2.000"/>	<input type="text" value="0.031"/>	<input type="text" value="10 msec"/>	<input checked="" type="checkbox"/> Set for me
IN3	<input type="text" value="2.000"/>	<input type="text" value="0.031"/>	<input type="text" value="10 msec"/>	<input checked="" type="checkbox"/> Set for me

Externally Switched Inputs? ☒ Yes ☐ No

Use HSW Assistant? ☒ Yes ☐ No

Communication Standards

Select GR-253/GR-1244 ST-3/3E

Dimmed items are set automatically

Fastlock

Fastlock Enable  ☐

Target Fastlock Loop Bandwidth  (Est. Actual: 1.11 kHz)

Input Switching & Holdover

☒ Enable hitless switching and enable phase buildout on holdover exit




☐ Preserve holdover history


Frequency Ramping:

☒ Enable ramp at initialization

- Many features have "set for me" options to auto select configuration options based on overall design and other user input
- Frequency planner automatically selects dividers that yield best performance

# #5 - Design Rule Checks (DRCs)

 **Frequency Plan Valid**  **3 Issues**  **Typical Pd 1.13 W, Tj 45 °C**



Si5395 Design Check Results

Design check results are shown below. You can check the box next to a warning or note to exclude it from the design check widget count in the ClockBuilder Pro wizard. Warnings and notes will always be included in design reports, however.

Ignore?	Category	Message	Note
<input type="checkbox"/>	Warning	OUT2 [174.703083... MHz] and OUT3 [174.703957... MHz] may have coupling	[1]
<input type="checkbox"/>	Note	DSPLL: selecting the highest bandwidth allowed by the application is recommended to minimize phase deviation on input switch	[2]
<input type="checkbox"/>	Note	DSPLL: to optimize switching performance, the Hitless Switching Assistant has disabled the Fastlock feature, extending PLL lock time. In cases where this is not acceptable, the assistant may be disabled and Fastlock selected by the user.	

Footnotes:  
[1] To avoid coupling in outputs, Silicon Labs recommends the following:  

- Avoid adjacent frequency values that are close. CBPro uses an output's integration bandwidth (IBW) to determine whether two adjacent frequencies are too close. An IBW of 20 MHz is used for frequencies 80 MHz and larger. Lower frequencies will use IBW of OUT/4. CBPro will flag fundamental coupling and coupling up to the fourth harmonic, where coupling frequency =  $\text{Absolute}(\text{OUTa} \times x - \text{OUTb} \times y)$  for all combinations of x and y 1 through 4. If any one of these values is less than or equal to the IBW, the output is flagged as having possible coupling.
- Adjacent frequency values that are integer multiples of one another are okay and these outputs should be grouped accordingly. For example, a 155.52 MHz and 622.08 MHz ( $155.52 \times 4$ ) can be adjacent.
- Unused outputs can be used to separate clock outputs that might otherwise interfere with one another.

Silicon Labs recommends you validate your design's jitter performance using an Evaluation Board. You can request a custom phase noise report for your design from CBPro's design dashboard.

[2] Recommendation is based on the frequency plan and selections in the hitless input switching assistant. Loop bandwidth is configured on the "DSPLL Configure" page of the CBPro wizard.

Copy Design Check to Clipboard

OK

- CBPro checks your configuration for errors and potential issues (warnings) in real-time
- Always visible DRC widget provides centralized clearing house for errors and warnings, making it easy to track whether your design is issue free
- Also included in design report
- You must review and approve if custom part number is created



# #6 - Configuration Performance Analysis



Typical Pd 1.13 W, Tj 45 °C

Total Power: 1.130 W, On Chip Power: 1.082 W, Tj: 45 °C

	Frequency	Format	Voltage	Current	Power
VDD			1.8 V	225.7 mA	406 mW
VDDA			3.3 V	122.4 mA	404 mW
VDDO0A	161.132812... MHz	LVDS	2.5 V	15.7 mA	39 mW
VDDO0	161.132812... MHz	LVDS	2.5 V	15.7 mA	39 mW
VDDO1	Unused				
VDDO2	174.703083... MHz	LVDS	2.5 V	15.8 mA	39 mW
VDDO3	174.703957... MHz	LVDS	2.5 V	15.8 mA	39 mW
VDDO4	Unused				
VDDO5	Unused				
VDDO6	155.52 MHz	LVDS	2.5 V	15.7 mA	39 mW
VDDO7	Unused				
VDDO8	625 MHz	LVDS	2.5 V	17.8 mA	44 mW
VDDO9	156.25 MHz	LVDS	2.5 V	15.7 mA	39 mW
VDDO9A	156.25 MHz	LVDS	2.5 V	15.7 mA	39 mW
Total				476.1 mA	1.130 W

- Review estimated power and junction temperature
- Si5332, Si534x/7x/8x/9x, Si5121x

174.7030... MHz [ 17. ] !

174.7039... MHz [ 17. ] !

N/A

N/A

155.52 MHz

OUT3 may have coupling from OUT2.

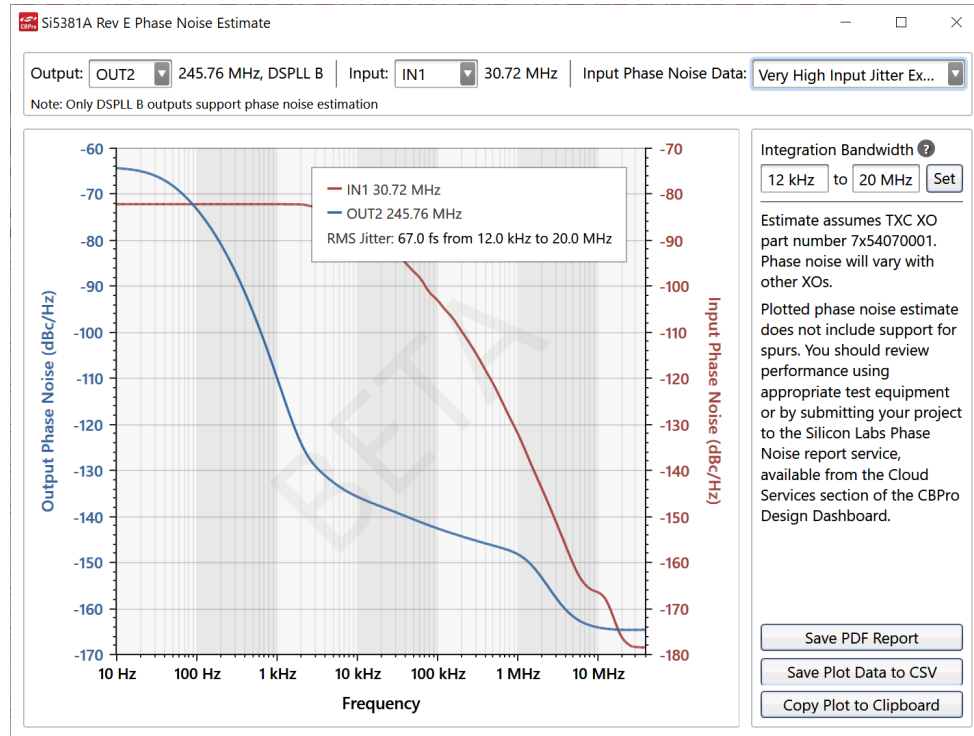
Integration Bandwidth: 20 MHz

Click the 'Clock Placement Wizard' button below for help in addressing this issue.

- Check for potential output coupling issues, with option to auto place frequencies for optimum performance
- Si534x/7x/8x/9x, Si535x (warnings only)



# #6 - Configuration Performance Analysis



- Si5380/1/2/6: estimate phase noise for wireless PLL

- All devices: request phase noise plots from Silicon Labs with a few clicks

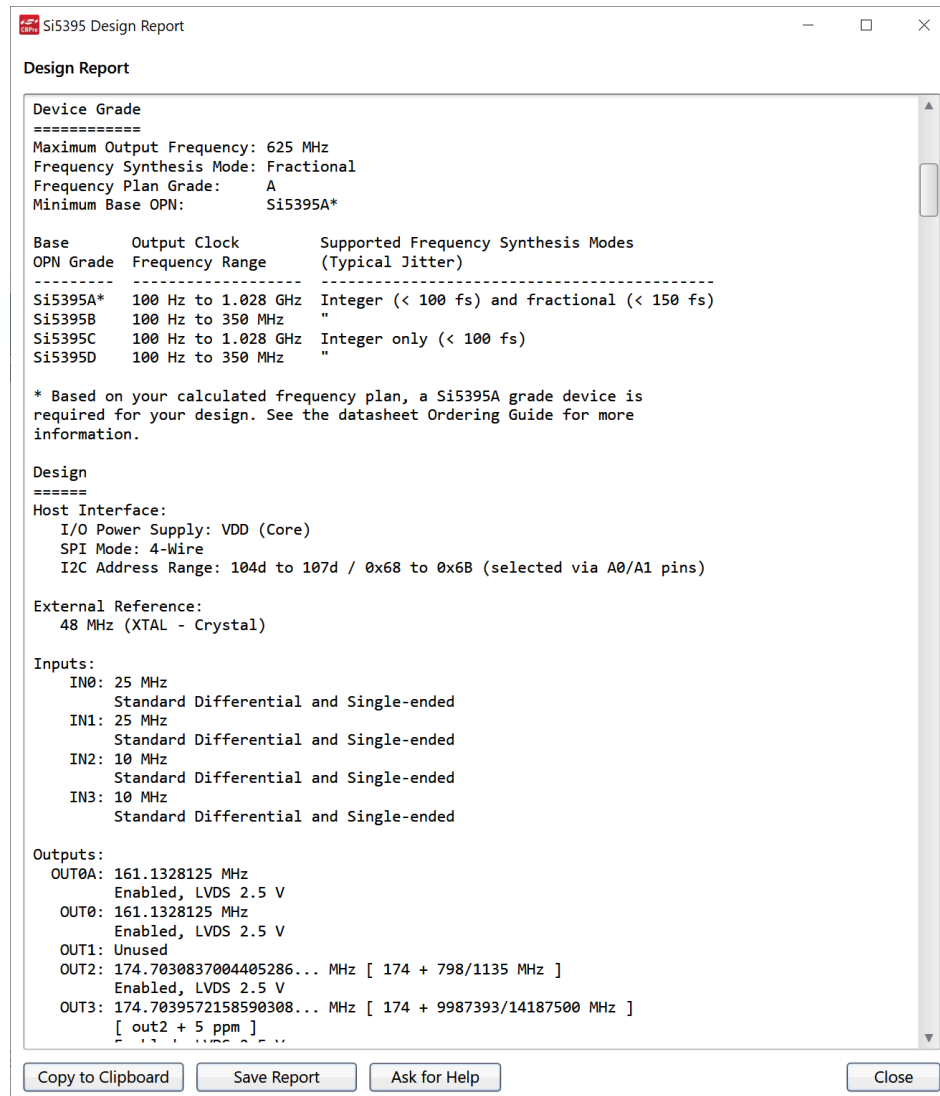


## Silicon Labs Cloud Services

You can [create a custom part number](#) for your design, which can be used to order factory pre-programmed devices. Or [request a phase noise report](#) for this design.



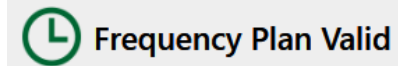
# #7 - Design Report



- CBPro's design report summarizes key design inputs and resulting frequency plan, design rule check results, estimated power consumption, and register breakdown/values

- Provides detailed record/snapshot of CBPro project

- Available from widget area:




- Or dashboard:



## Design Report & Datasheet Addendum

You can view a [design report \(text\)](#) or create a [draft datasheet addendum \(PDF\)](#) for your design.

# #8 – Evaluation Support

 **Evaluation Board Detected**  
SI5391P Rev A EVB

Write Design to EVB

Open EVB GUI

	Inputs	Other
Non-Sticky	LOSIN[0]	SYSINCAL
	LOSIN[1]	LOL
	LOSIN[2]	SMBUS_TIMEOUT
	LOSREF	
	LOSAXB	
Sticky	LOSIN_FLG[0]	SYSINCAL_FLG
	LOSIN_FLG[1]	LOL_FLG
	LOSIN_FLG[2]	SMBUS_TIMEOUT_FLG
	LOSREF_FLG	
	LOSAXB_FLG	

Name	MCU Pin	Ribbon Pin	Type ?	State
SCLK	6	0	Output	<input type="checkbox"/> 0 <input type="button" value="Read"/>
A1/SDO	5	0	Input	<input type="checkbox"/> 0 <input type="button" value="Read"/>
SDA/SDIO	4	0	Output	<input type="checkbox"/> 0 <input type="button" value="Read"/>
A0/CS	3	0	Input/Output	<input type="checkbox"/> 0 <input type="button" value="Read"/>
FDEC	38	0	Output	<input type="checkbox"/> 0 <input type="button" value="Read"/>
LOL	35	0	Input	<input type="checkbox"/> 0 <input type="button" value="Read"/>
RST	34	0	Output	<input type="checkbox"/> 0 <input type="button" value="Read"/>
I2C_SEL	33	0	Output	<input type="checkbox"/> 0 <input type="button" value="Read"/>
INTR	32	0	Input	<input type="checkbox"/> 0 <input type="button" value="Read"/>
SYNC	31	0	Output	<input type="checkbox"/> 0 <input type="button" value="Read"/>
OE	30	0	Output	<input type="checkbox"/> 0 <input type="button" value="Read"/>
IN_SEL0	29	0	Output	<input type="checkbox"/> 0 <input type="button" value="Read"/>
IN_SEL1	28	0	Output	<input type="checkbox"/> 0 <input type="button" value="Read"/>
FINC	27	0	Output	<input type="checkbox"/> 0 <input type="button" value="Read"/>

	Voltage	Current	Power	
VDD	1.80V <input type="button" value="On"/>	1.778 V	241 mA	428 mW <input type="button" value="Read"/>
VDDA	3.30V <input type="button" value="On"/>	3.301 V	124 mA	409 mW <input type="button" value="Read"/>
VDD00	2.50V <input type="button" value="On"/>	2.491 V	43 mA	107 mW <input type="button" value="Read"/>
VDD01	2.50V <input type="button" value="On"/>	2.501 V	22 mA	55 mW <input type="button" value="Read"/>
VDD02	2.50V <input type="button" value="On"/>	2.499 V	22 mA	55 mW <input type="button" value="Read"/>
VDD03	1.80V <input type="button" value="On"/>	1.798 V	14 mA	25 mW <input type="button" value="Read"/>
VDD04	1.80V <input type="button" value="On"/>	1.796 V	14 mA	25 mW <input type="button" value="Read"/>
VDD05	2.50V <input type="button" value="On"/>	2.497 V	15 mA	37 mW <input type="button" value="Read"/>
VDD06	2.50V <input type="button" value="On"/>	2.502 V	15 mA	38 mW <input type="button" value="Read"/>
VDD07	2.50V <input type="button" value="On"/>	2.497 V	15 mA	37 mW <input type="button" value="Read"/>
VDD08	2.50V <input type="button" value="On"/>	2.499 V	15 mA	37 mW <input type="button" value="Read"/>
VDD09	2.50V <input type="button" value="On"/>	2.499 V	30 mA	75 mW <input type="button" value="Read"/>
Total		570 mA	1.328 W	<input type="button" value="Read All"/>

All Output Supplies

Select Voltage ...

Power On Power Off

Compare Design Estimates to Measurements

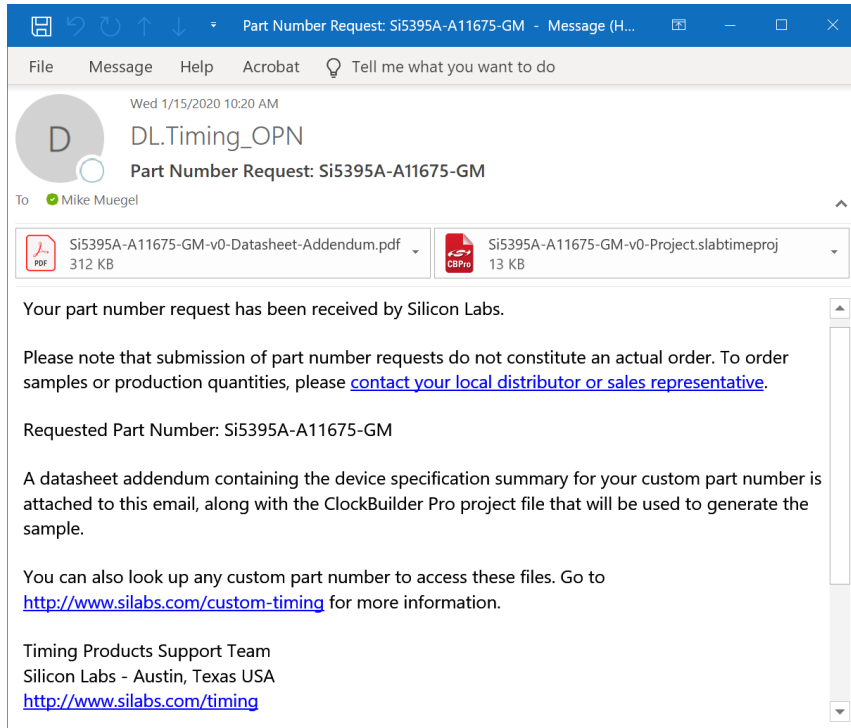
- Your configuration can be written to EVB with a single button press
- EVBs support most configurable features
- Telemetry such as status registers can be read from the device and inspected via GUI or CLI
- Measure power draw and compare to estimate

# #9 - Custom Part Number Generation



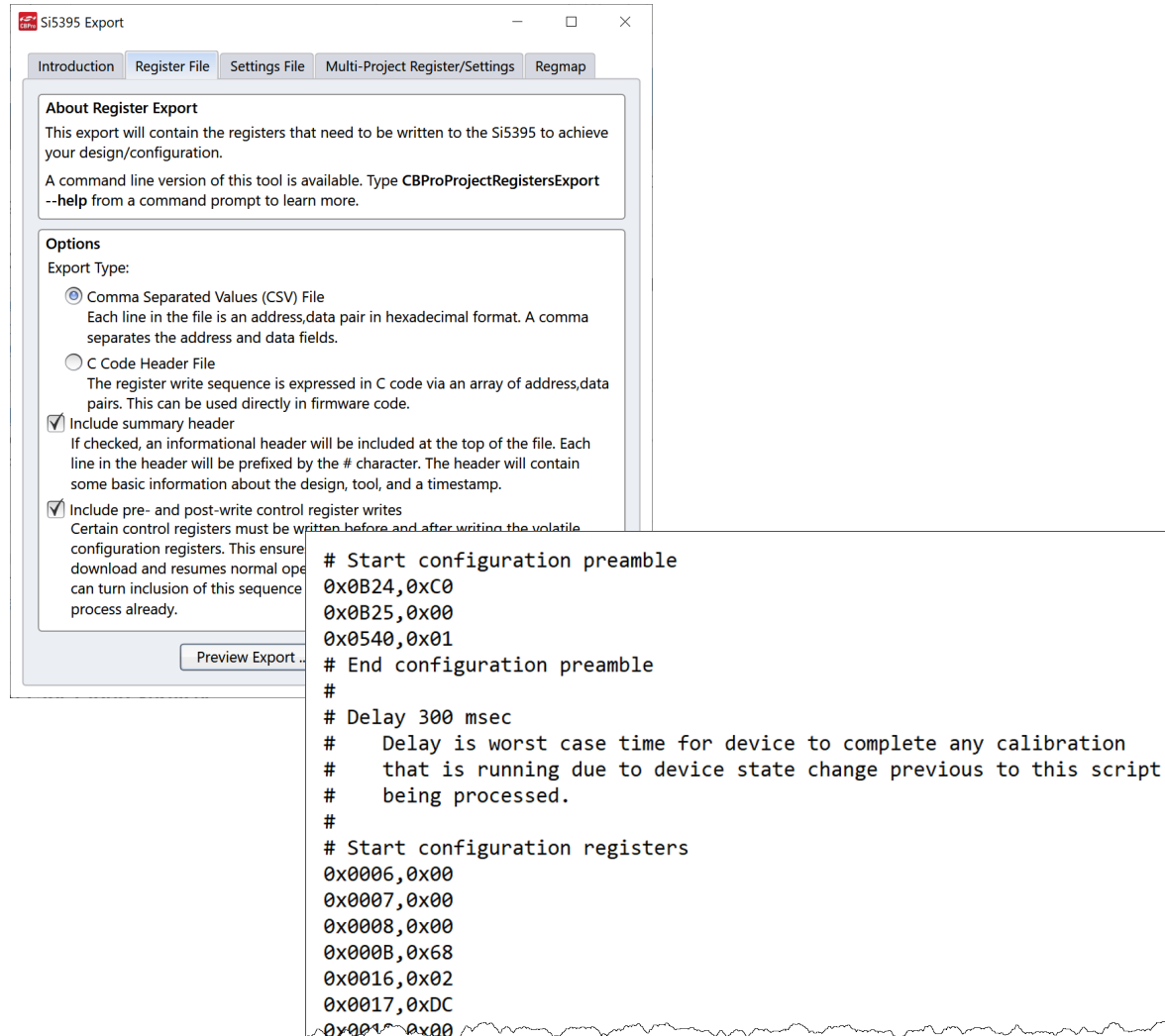
## Silicon Labs Cloud Services

You can [create a custom part number](#) for your design, which can be used to order factory pre-programmed devices. Or [request a phase noise report](#) for this design.



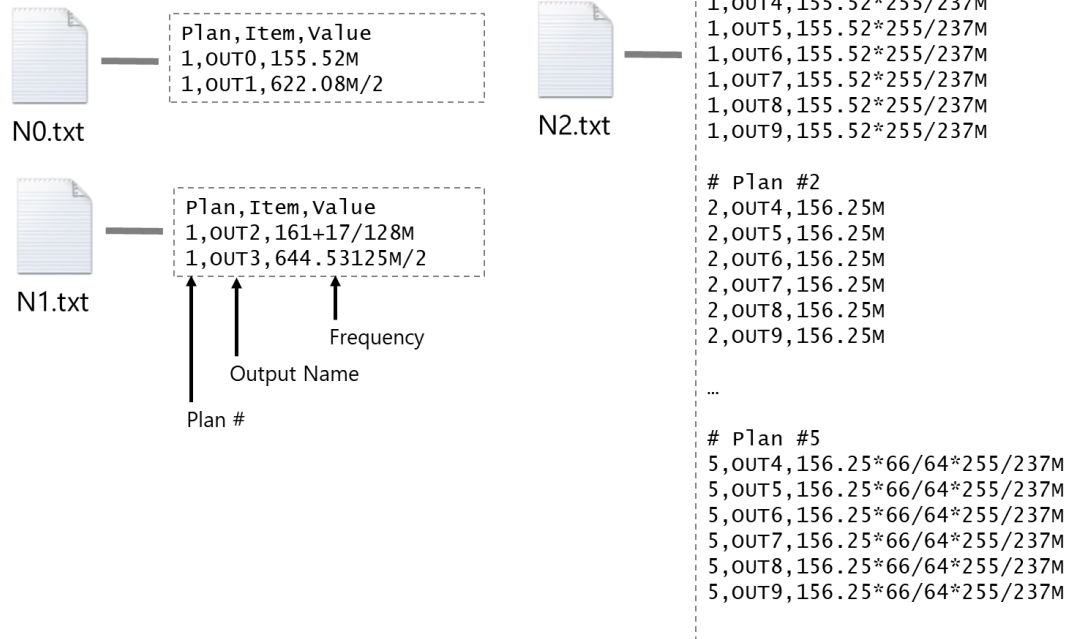
- With a few clicks, create part number such as Si5395A-A11675-GM that will have CBPro configuration burned into the part
- Saves cost and effort to program in-house or using third party
- You will receive an e-mail acknowledgement containing the part number, project file, and PDF datasheet addendum that includes the project's design report
- Option still available to program in-system should configuration need to be changed once device has been soldered down

# #10 - In-system Programming Assistance



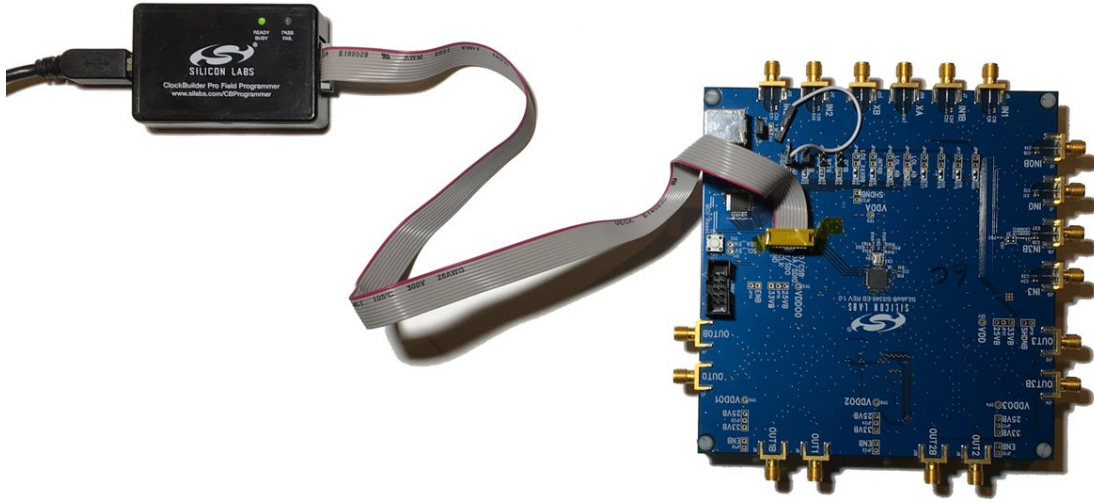
- Export tools support creating simple "script" files that can be written to device by micro-controller to fully **reconfigure** a device
- End-customer software engineer needs to know very little about Silicon Labs device other than how to read/write a register via serial interface: the script handles all programming setup and finalization tasks

# #10 - In-system Programming Assistance



- On select Si534x/7x/8x/9x devices, supports **frequency-on-the-fly** scenarios where subset of outputs is modified, leaving other outputs undisturbed
- Simple text files define alternate per-MultiSynth or per-PLL plans
- FOTF tool creates optimized scripts to switch between plans
- Advanced scenarios such as discrete PLL reconfiguration also supported

# #11 - In System Bring-up and Debug Support



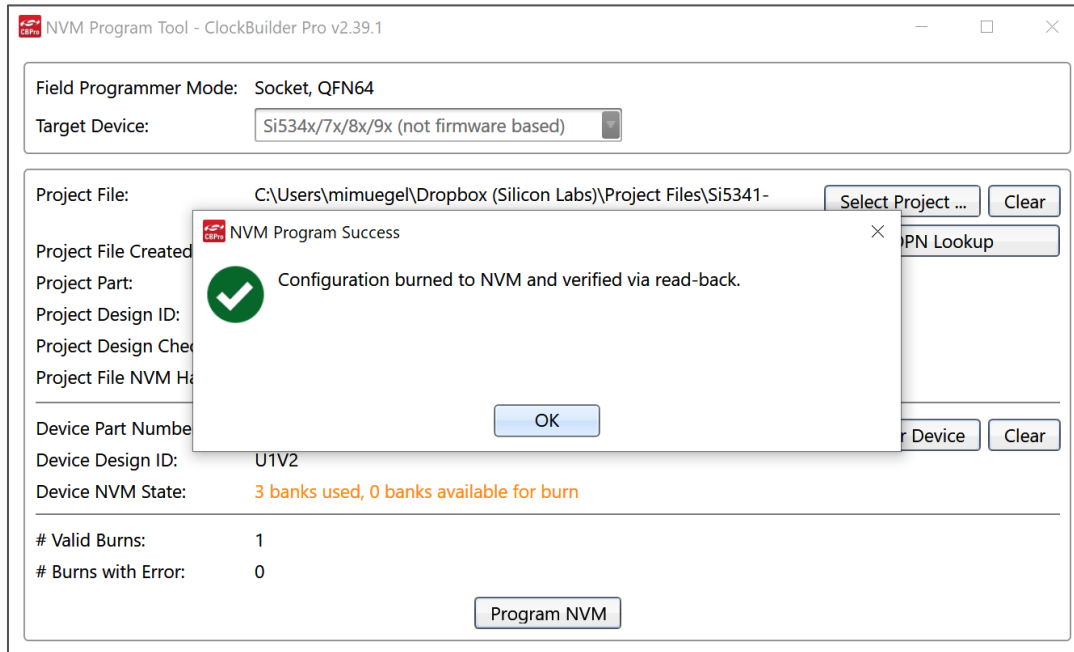
- Using the ClockBuilder Pro Field Programmer, CBPro can communicate with customer board using I2C or SPI and:
  - Read/write settings and registers
  - Write a CBPro project file
  - Flash firmware and configuration
- GUI and Command Line interfaces



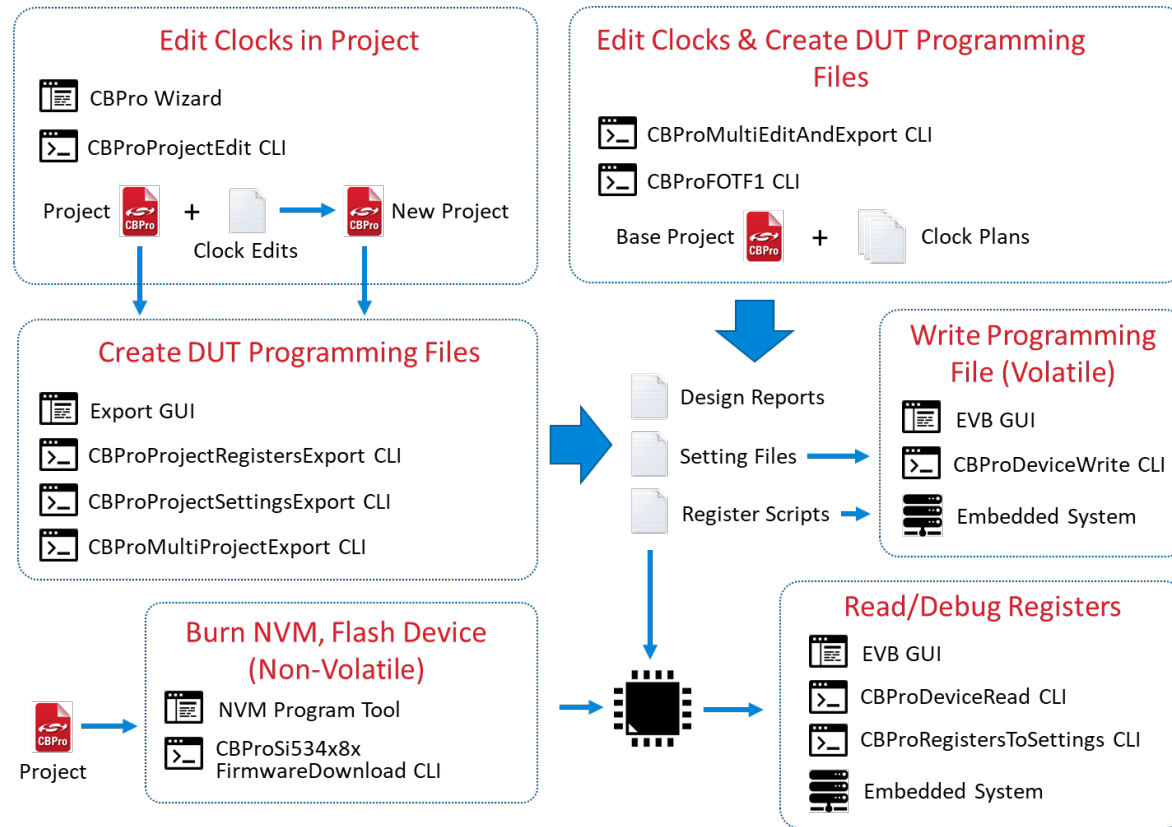
# #12 - Program Non-Volatile Memory of Loose or Soldered Down Parts



- Using the ClockBuilder Pro Field Programmer, device NVM can be written based on CBPro project file:
  - Wired to system board via serial interface, program NVM of soldered part
  - Using appropriate field programmer socket, program NVM of loose sample
- Supports rapid prototyping where in-system programming  $\mu$ c support is not available and custom part number (OPN) turn around would be too long
- Sockets for Si5332, Si534x, Si537x, Si538x, and Si539x



# #13 - Automate Common Activities




- There are command line interfaces (CLI) to all CBPro export and device read/write activities.
- These can be used to automate and streamline:
  - In-system programming file generation
  - EVB and system board programming and test

# #14 - Convert a Design Between Part Families

## [Convert Existing Project/NVM File](#)

Convert Project/NVM - ClockBuilder Pro

**ClockBuilder Pro** v2.39.3  **SILICON LABS**

Convert Project/NVM - Select Destination Part

For select devices, ClockBuilder Pro (CBPro) can create a new project based on an existing CBPro project file or a ClockBuilder Desktop (CBD) NVM file. Select the device you want to create below (To column). Only devices that support conversion are shown.

From	To	Num PLLs	Num Inputs	Num Outputs	Input Frequency	Output Frequency	Package
Si5338 CBDDesktop NVM File	→ Si5338 Project	1	2	4	5 MHz to 710 MHz	160 kHz to 710 MHz	4x4 mm 24-QFN
Si5342H CBPro Project	→ Si5371 Project	1	4	2	8 kHz to 750 MHz	100 Hz to 2.75 GHz	7x7 mm 44-QFN, 7x7 mm 44-LGA
Si5344H CBPro Project	→ Si5372 Project	1	4	4	8 kHz to 750 MHz	100 Hz to 2.75 GHz	7x7 mm 44-QFN, 7x7 mm 44-LGA
Si5341 CBPro Project	→ Si5391 Project	1	3	12	10 MHz to 750 MHz	100 Hz to 720 MHz, 733.334 MHz to 800 MHz, 825 MHz to 1.028 GHz	9x9 mm 64-QFN
Si5342 CBPro Project	→ Si5392 Project	1	4	2	8 kHz to 750 MHz	100 Hz to 720 MHz, 733.334 MHz to 800 MHz, 825 MHz to 1.028 GHz	7x7 mm 44-QFN
Si5344 CBPro Project	→ Si5394 Project	1	4	4	8 kHz to 750 MHz	100 Hz to 720 MHz, 733.334 MHz to 800 MHz, 825 MHz to 1.028 GHz	7x7 mm 44-QFN
Si5345 CBPro Project	→ Si5395 Project	1	4	12	8 kHz to 750 MHz	100 Hz to 720 MHz, 733.334 MHz to 800 MHz, 825 MHz to 1.028 GHz	9x9 mm 64-QFN
Si5346 CBPro Project	→ Si5396 Project	2	4	4	8 kHz to 750 MHz	100 Hz to 720 MHz	7x7 mm 44-QFN

< Back Next > Finish Cancel

- Support conversion between select product families, such as converting an Si5341 project to Si5391
- Convert Si5338 CBDDesktop NVM file to CBPro project

# Learn More

- [CBPro Tools & Support for In-System Programming](#)
- [CLI User's Guide](#)
- Both are bundled with CBPro and available from the welcome screen or links above
- [ClockBuilder Pro Field Programmer](#) product page

## ClockBuilder Pro Documentation

[CBPro Overview](#)

[CBPro Tools & Support for In-System Programming](#)

Includes walkthroughs of frequency-on-the-fly, full configuration, and partial configuration programming scenarios.

[CLI User's Guide](#)

[Release Notes](#) • [Knowledge Base](#)

Thank you!

[silabs.com](http://silabs.com)

