

Programming Options for Si5332

The Si5332 is a part with three multisynth (fractional dividers) as seen in the block diagram below. This application note outlines the ways in which these dividers can be programmed.

- KEY FEATURES OR KEY POINTS**
- NVM programming
 - Volatile memory programming
 - Frequency-on-the-fly programming for ADPLL applications

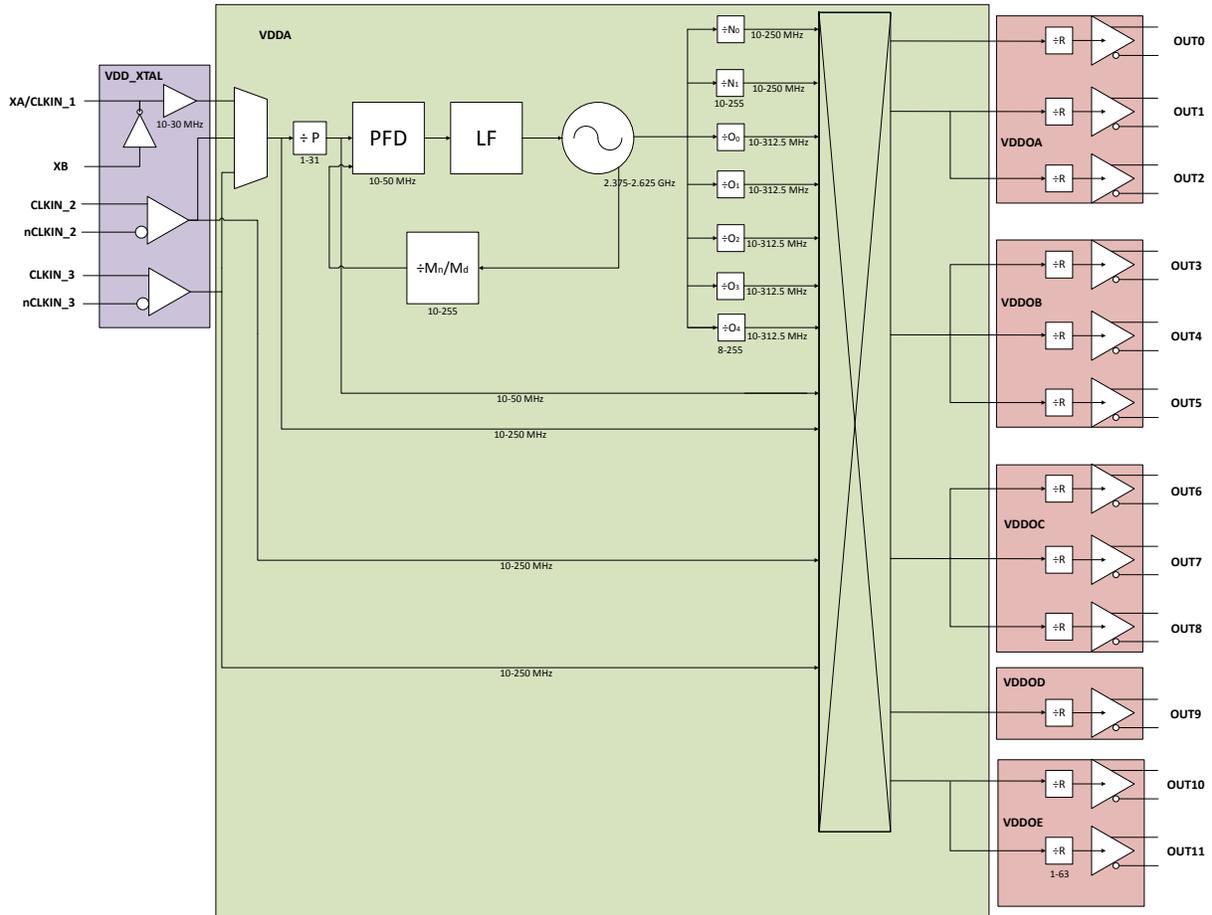


Figure .1. Si5332 PLL Block Diagram

1. Overview

Broadly speaking, there are three different methods to program the Si5332:

1. Frequency plan Non-volatile Memory (NVM) program: A configuration (i.e., a set of output frequencies) are required on power up.
2. Frequency plan volatile memory program: Si5332 powers up with a configuration A that needs to be modified to another configuration B.
3. Frequency on the fly program: Si5332 powers up with a configuration A and needs only a selected output (or outputs) to change while the other outputs retain their frequency and function.

Each method has its use case and all of them sometimes mean “re-programming” the Si5332 PLL. Hence, it is useful for the user to review the differences between each method and choose the initial configuration. As will be shown, the choice of the initial configuration determines the feasibility of methods 2 and 3 in the above list.

2. Frequency Plan NVM Program

The Si5332 Non-Volatile-Memory (NVM) is a sophisticated architecture. There are about 600 bytes of NVM memory available for about 250 bytes of register fields (the register fields that define a user's configuration completely). Hence, a user has the following options:

1. Configure an initial plan and order an NVM-programmed part from Silicon Labs.
2. "Re-configure" the NVM as many times as possible (the accounting of NVM already used and now available for NVM reprogram is managed by CBPro when the device is connected to CBPro through the CBPro dongle).

A register that is already programmed using an initial NVM can be selectively changed without affecting any other register and thereby saves memory space and re-programming capability for future needs. This memory management (available in Si5332) allows flexibility to users. The flow chart in the figure below illustrates the options available for NVM programming.

The following characteristics need to be noted when changing NVM programming:

1. An NVM program (or re-program) takes effect only after a power cycle.
2. The power cycle needed means that "all output" clocks will be temporarily out due to the power cycle.
3. Hence, using NVM re-program when a dynamic frequency change is needed is not advisable

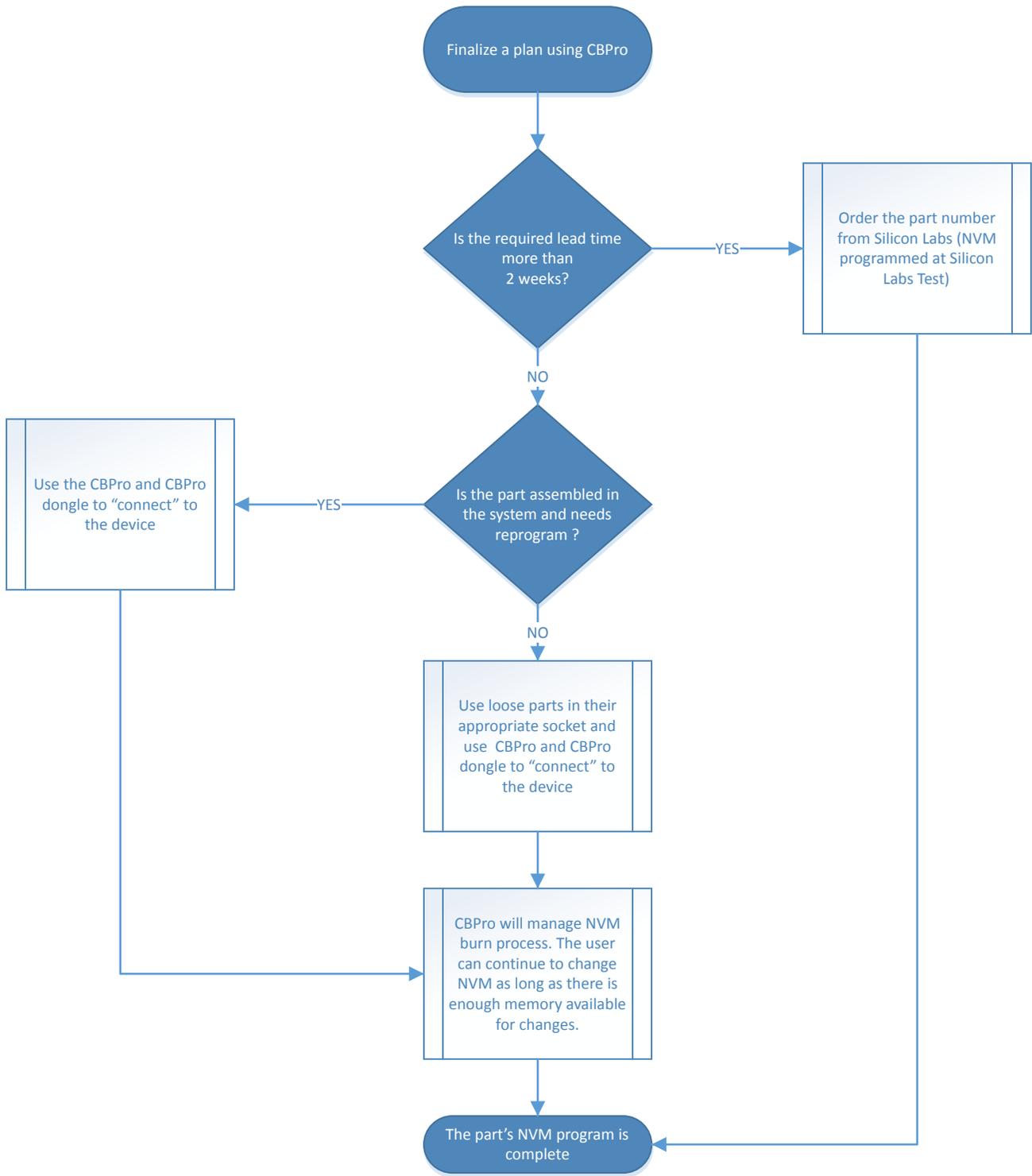


Figure 2.1. Si5332 NVM Programming

3. Frequency Plan Volatile Memory Program

The Si5332 registers needed to implement a configuration change must be determined by the user. There are two methods available to the user:

1. Use CBPro to create a new project file, export the register map, and list a difference (using CBPro diff tools for multiple projects or otherwise) in the registers that need reprogramming for the new configuration.
2. Use methods similar to the suggested method in the [Si5332 Family Reference Manual](#) to calculate all the register fields needed to implement the configuration.

When a comprehensive list of registers is generated, the user must identify the mode of the device that needs to be used for the re-program.

The Si5332 has two modes of operation:

1. **READY mode:** The mode in which the Si5332 digital system is ready to implement changes to any register. However, in this mode, output clocks are disabled.
2. **ACTIVE mode:** The mode in which only a select few registers can be programmed (as listed in the register map in the [Si5332 Family Reference Manual](#)). The outputs remain enabled in this mode but only a few registers can be reprogrammed.

In ACTIVE mode: The following register writes are needed for re-programming:

1. Write all the relevant registers as calculated from the steps above.

In READY mode: The following pre-amble and post-amble register writes are needed for re-programming:

1. Write 0x01h to register 0x06h and put the Si5332 into the READY state.
2. Write all the relevant registers as calculated from the steps above.
3. Ensure that the valid input clocks are available for the Si5332 to attempt a PLL lock.
4. Write 0x02h to register 0x06h and put the Si5332 into the ACTIVE state.

The volatile memory program (or re-program) is suitable for the following user applications:

1. Complete volatile memory program control: When the system designer needs complete independence in setting the output clock frequencies and/or output formats to suit varying system needs.
2. Minor modifications for system diagnostics: When the system designer needs to make minor modifications such as enabling or disabling an output or control presence of absence of spread spectrum clock, etc.

Note: Volatile memory program cannot guarantee presence of output clocks while register programming is underway.

4. Frequency-on-the-fly Updates to Output Frequencies

A frequency-on-the-fly (FOTF) update for an output frequency is depicted in the figure below. The characteristics of FOTF updates are:

- The frequency change is glitchless as shown in the figure below.
- When a certain output is being updated, other outputs remain unchanged.

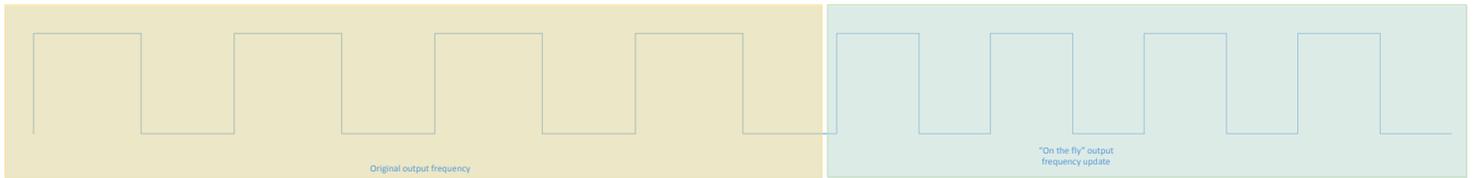


Figure 4.1. Illustration of an FOTF Update

[Figure 4.2 Output Crossbar Associating Output Dividers with Outputs on page 7](#) below shows the “output” crossbar that connects the output dividers to various outputs. As described in the [Si5332 Family Reference Manual](#), any output is derived as the ratio of the VCO frequency and the product of the output divider and R-divider associated with that output.

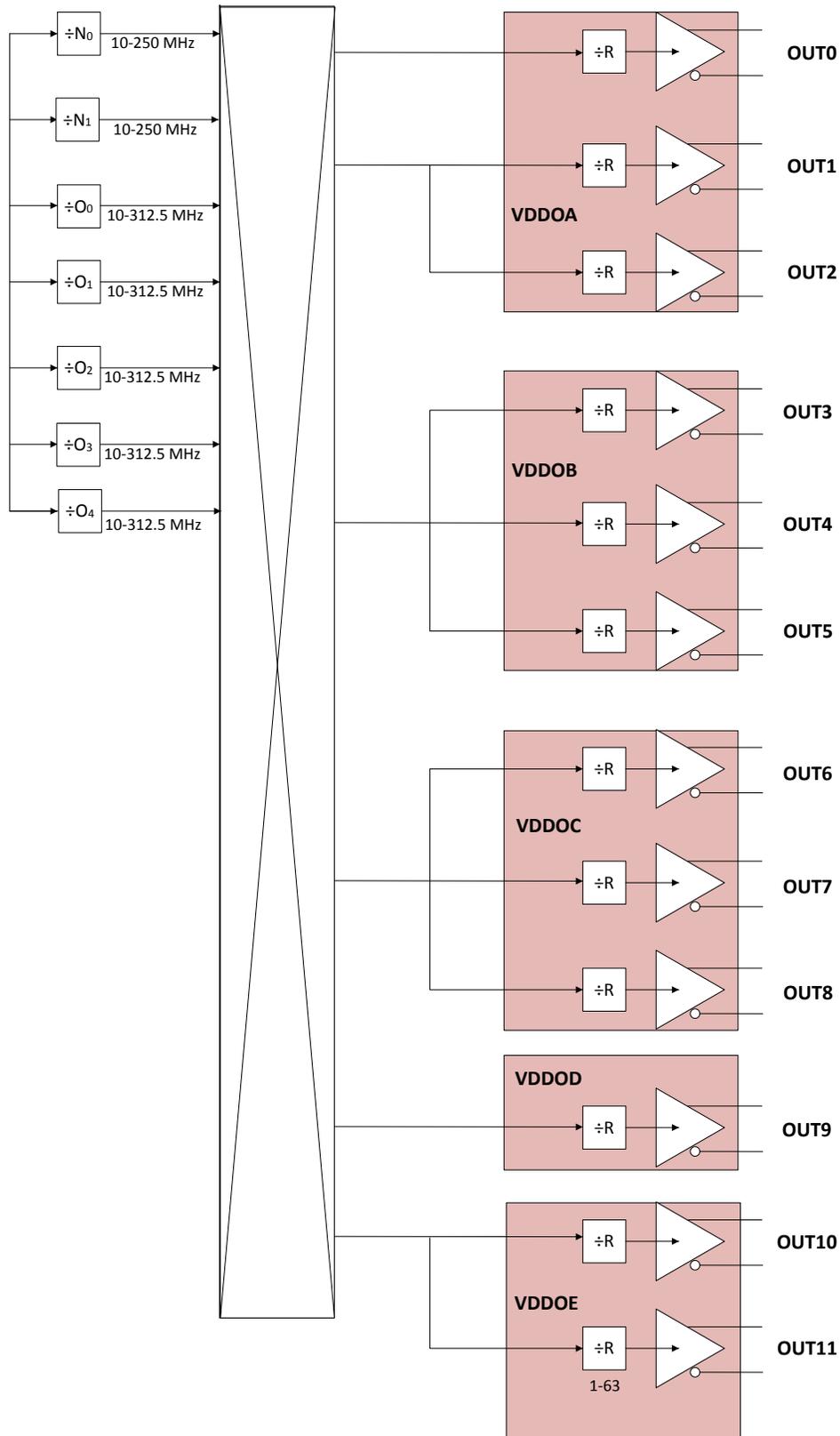


Figure 4.2. Output Crossbar Associating Output Dividers with Outputs

5. Conclusion

The Si5332 is a versatile clock generator that can support various levels of programming including frequency on the fly applications. It can be used for frequency margining for both coarse and fine frequency adjustments and also be re-programmed (NVM and/or volatile memory re-program) to match system design changes. The table shows the cases when each of the three different programming options can apply. A single IC can be used for any (or all) of these needs in a system and can be used to reduce system board BOM, power, and area with increased functionality. The Si5332 can be used not just as a clock tree in chip solution, but also as the most flexible clock solution in the system.

Table 5.1. Summary of Programming Methods vs System Needs

System Need	VM	NVM	FOTF
System board re-designs/upgrades	Suitable	Suitable	Not suitable
System board modifications	Not suitable	Suitable	Not suitable
System clock speed test	Suitable	Not suitable	Suitable
Servo PLLs	Not suitable	Not suitable	Suitable



SKYWORKS®

ClockBuilder Pro

Customize Skyworks clock generators, jitter attenuators and network synchronizers with a single tool. With CBPro you can control evaluation boards, access documentation, request a custom part number, export for in-system programming and more!

www.skyworksinc.com/CBPro



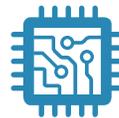
Portfolio

www.skyworksinc.com/ia/timing



SW/HW

www.skyworksinc.com/CBPro



Quality

www.skyworksinc.com/quality



Support & Resources

www.skyworksinc.com/support

Copyright © 2021 Skyworks Solutions, Inc. All Rights Reserved.

Information in this document is provided in connection with Skyworks Solutions, Inc. ("Skyworks") products or services. These materials, including the information contained herein, are provided by Skyworks as a service to its customers and may be used for informational purposes only by the customer. Skyworks assumes no responsibility for errors or omissions in these materials or the information contained herein. Skyworks may change its documentation, products, services, specifications or product descriptions at any time, without notice. Skyworks makes no commitment to update the materials or information and shall have no responsibility whatsoever for conflicts, incompatibilities, or other difficulties arising from any future changes.

No license, whether express, implied, by estoppel or otherwise, is granted to any intellectual property rights by this document. Skyworks assumes no liability for any materials, products or information provided hereunder, including the sale, distribution, reproduction or use of Skyworks products, information or materials, except as may be provided in Skyworks' Terms and Conditions of Sale.

THE MATERIALS, PRODUCTS AND INFORMATION ARE PROVIDED "AS IS" WITHOUT WARRANTY OF ANY KIND, WHETHER EXPRESS, IMPLIED, STATUTORY, OR OTHERWISE, INCLUDING FITNESS FOR A PARTICULAR PURPOSE OR USE, MERCHANTABILITY, PERFORMANCE, QUALITY OR NON-INFRINGEMENT OF ANY INTELLECTUAL PROPERTY RIGHT; ALL SUCH WARRANTIES ARE HEREBY EXPRESSLY DISCLAIMED. SKYWORKS DOES NOT WARRANT THE ACCURACY OR COMPLETENESS OF THE INFORMATION, TEXT, GRAPHICS OR OTHER ITEMS CONTAINED WITHIN THESE MATERIALS. SKYWORKS SHALL NOT BE LIABLE FOR ANY DAMAGES, INCLUDING BUT NOT LIMITED TO ANY SPECIAL, INDIRECT, INCIDENTAL, STATUTORY, OR CONSEQUENTIAL DAMAGES, INCLUDING WITHOUT LIMITATION, LOST REVENUES OR LOST PROFITS THAT MAY RESULT FROM THE USE OF THE MATERIALS OR INFORMATION, WHETHER OR NOT THE RECIPIENT OF MATERIALS HAS BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGE.

Skyworks products are not intended for use in medical, lifesaving or life-sustaining applications, or other equipment in which the failure of the Skyworks products could lead to personal injury, death, physical or environmental damage. Skyworks customers using or selling Skyworks products for use in such applications do so at their own risk and agree to fully indemnify Skyworks for any damages resulting from such improper use or sale.

Customers are responsible for their products and applications using Skyworks products, which may deviate from published specifications as a result of design defects, errors, or operation of products outside of published parameters or design specifications. Customers should include design and operating safeguards to minimize these and other risks. Skyworks assumes no liability for applications assistance, customer product design, or damage to any equipment resulting from the use of Skyworks products outside of Skyworks' published specifications or parameters.

Skyworks, the Skyworks symbol, Sky5®, SkyOne®, SkyBlue™, Skyworks Green™, Clockbuilder®, DSPLL®, ISOModem®, ProSLIC®, and SiPHY® are trademarks or registered trademarks of Skyworks Solutions, Inc. or its subsidiaries in the United States and other countries. Third-party brands and names are for identification purposes only and are the property of their respective owners. Additional information, including relevant terms and conditions, posted at www.skyworksinc.com, are incorporated by reference.