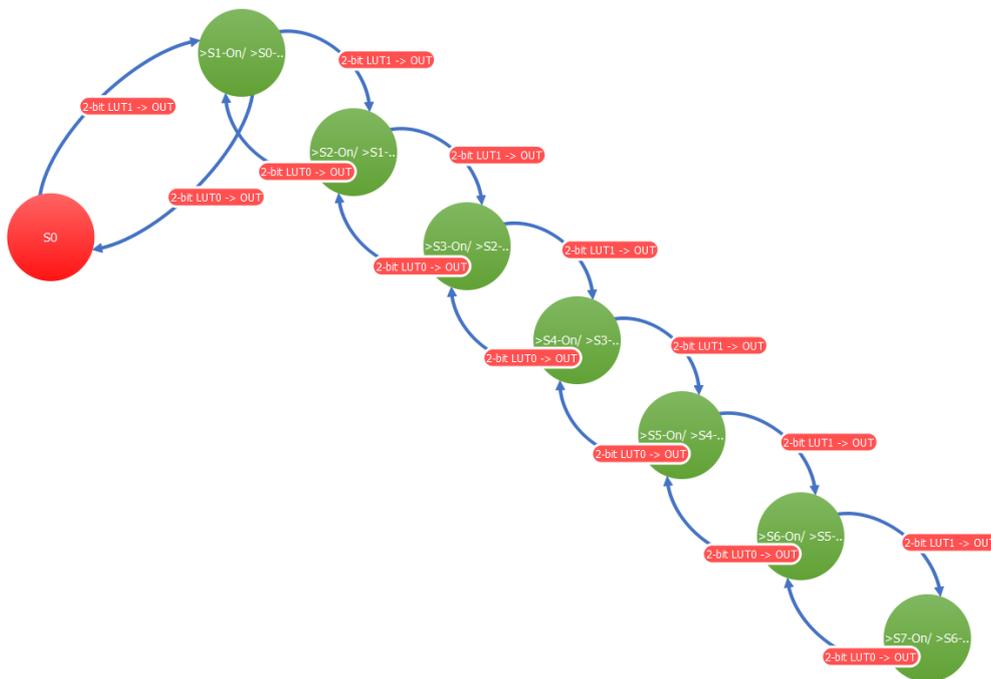


Introduction

This application note demonstrates how to implement a Linear Sequencer using the Asynchronous State Machine in the SLG46531 GreenPAK IC. The sequencer can control up to 7 lines with a constant delay of switching.

Structure of a State Machine

Figure 1 shows the ASM editor window. The initial state is State0. The value of outputs in each state are shown in the RAM window. When transitioning from state to state (like S0>S1>S2>S3>S4>S5>S6>S7), every incrementing state output switches HIGH. Conversely, when decrementing through the states they switch to LOW (like S7>S6>S5>S4>S3>S2>S1>S0). Incrementing from S0 to S7 occurs when the input ENABLE signal goes HIGH, and decrements when it goes LOW.



| State name | Connection Matrix Output RAM | | | | | | | |
|-----------------|------------------------------|------|------|------|------|------|------|------|
| | OUT7 | OUT6 | OUT5 | OUT4 | OUT3 | OUT2 | OUT1 | OUT0 |
| S0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| >S1-On/ >S0-Off | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| >S2-On/ >S1-Off | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 |
| >S3-On/ >S2-Off | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 |
| >S4-On/ >S3-Off | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 |
| >S5-On/ >S4-Off | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 |
| >S6-On/ >S5-Off | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 |
| >S7-On/ >S6-Off | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |

Bulk operations: All to 0 [Set]

States

- State 0 (S0)
- State 1 (>S1-On/ >S0-Off)
- State 2 (>S2-On/ >S1-Off)
- State 3 (>S3-On/ >S2-Off)
- State 4 (>S4-On/ >S3-Off)
- State 5 (>S5-On/ >S4-Off)
- State 6 (>S6-On/ >S5-Off)
- State 7 (>S7-On/ >S6-Off)

Figure 1. ASM Editor Window

Lines Sequencer Control

Control of switch direction between states is done by 2-bit LUT1 and 2-bit LUT0. They pass the pulses of CLK GENERATOR, as shown in Figure 2. Each subsequent clock pulse makes the transition from one state to another with a delay of 100ms. ENABLE signal input level sets the direction of the Sequencer.

To turn the generator ON and OFF 3-bit LUT1 is used. This reduces current consumption. ENABLE, Line1 and Line2 signals are fed into IN2, IN1 and IN0 3-bit LUT1 inputs respectively. When all inputs are High or Low, then the output is LOW and the generator turned OFF. In all other cases it is turned ON.

Also for the correct operation of CLK GENERATOR, 3-bit LUT0 is used. When the rising or the falling are edge signal ENABLE, then the PDLY logic cells output will be High. This pulse will reset the generator, and that provides the proper delay.

Blocks configuration is presented in Figure 3.

Lines Sequencer functionality signals is shown in Figure 4.

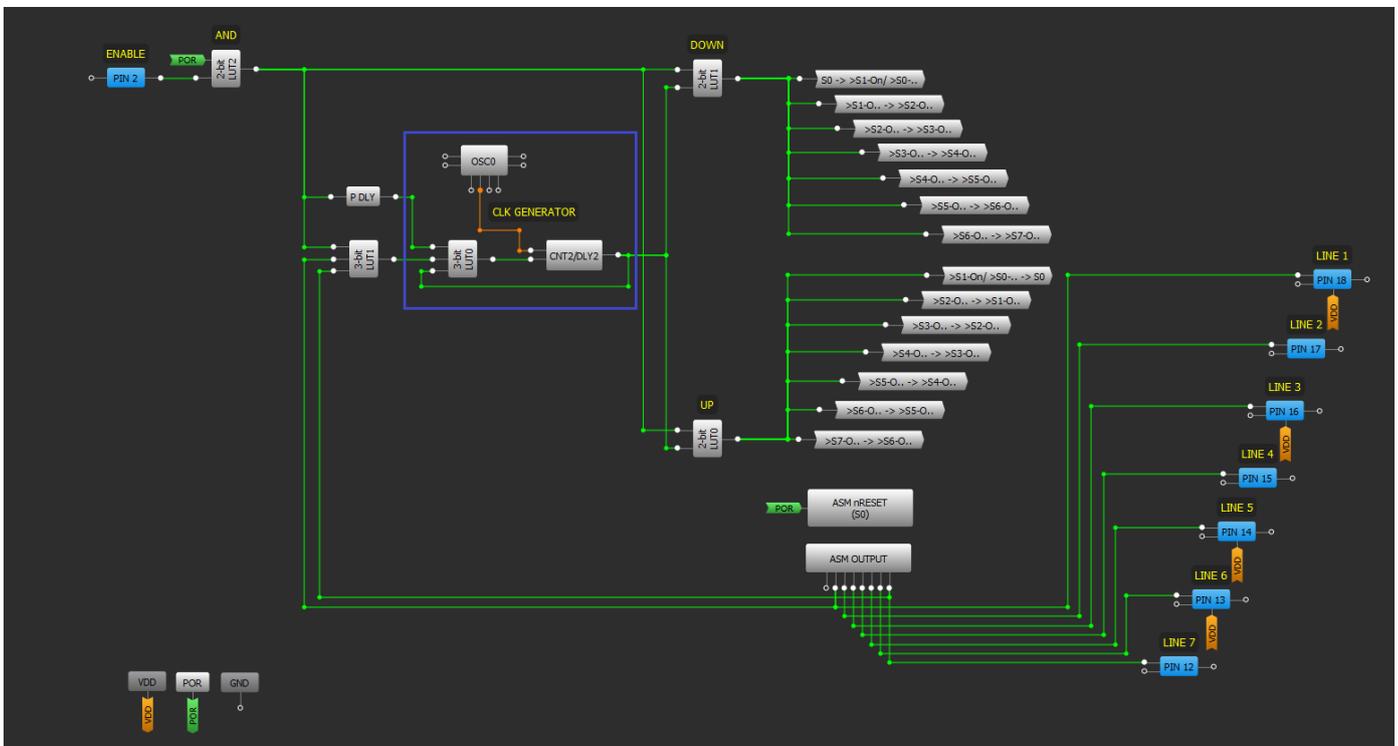


Figure 2. Linear Sequencer Schematic

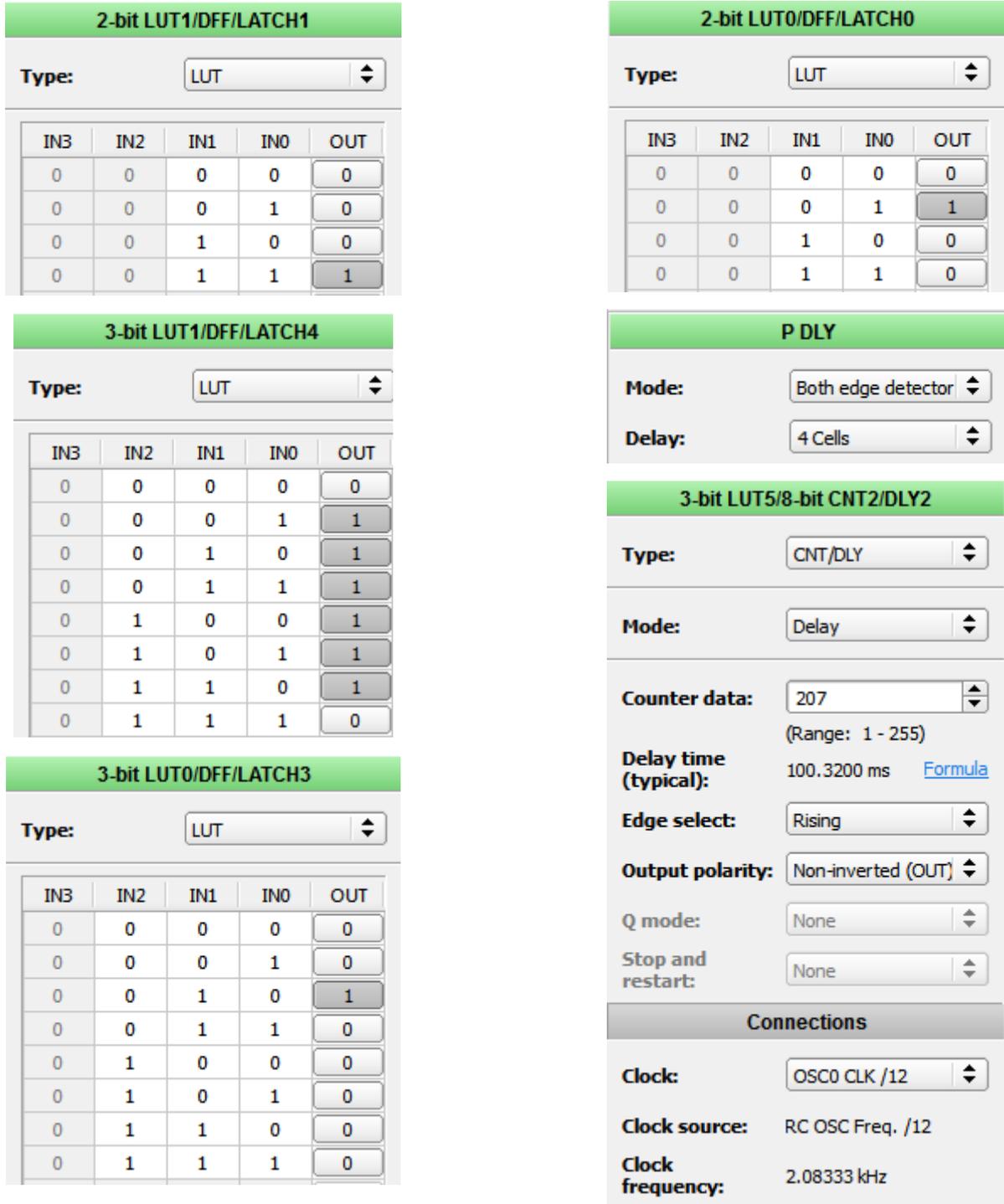


Figure 3. Blocks Configurations

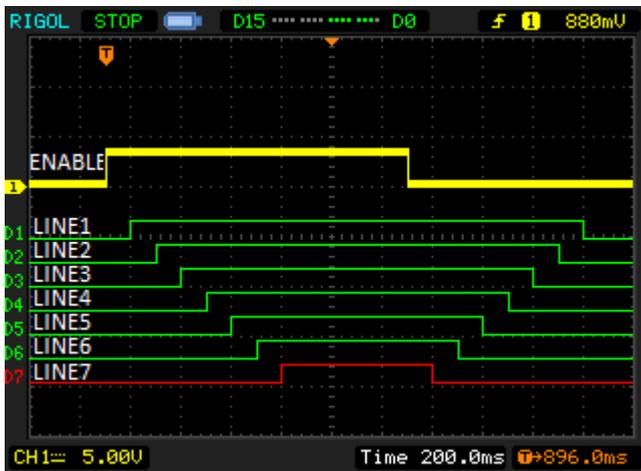


Figure 4. Linear Sequencer Functionality Waveform

Conclusion

Using the Asynchronous State Machine in the SLG46531 GreenPAK IC, we can make a 7-Line Sequencer. It was shown that using the ASM simplifies the design task nicely.

IMPORTANT NOTICE AND DISCLAIMER

RENESAS ELECTRONICS CORPORATION AND ITS SUBSIDIARIES (“RENESAS”) PROVIDES TECHNICAL SPECIFICATIONS AND RELIABILITY DATA (INCLUDING DATASHEETS), DESIGN RESOURCES (INCLUDING REFERENCE DESIGNS), APPLICATION OR OTHER DESIGN ADVICE, WEB TOOLS, SAFETY INFORMATION, AND OTHER RESOURCES “AS IS” AND WITH ALL FAULTS, AND DISCLAIMS ALL WARRANTIES, EXPRESS OR IMPLIED, INCLUDING, WITHOUT LIMITATION, ANY IMPLIED WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE, OR NON-INFRINGEMENT OF THIRD-PARTY INTELLECTUAL PROPERTY RIGHTS.

These resources are intended for developers who are designing with Renesas products. You are solely responsible for (1) selecting the appropriate products for your application, (2) designing, validating, and testing your application, and (3) ensuring your application meets applicable standards, and any other safety, security, or other requirements. These resources are subject to change without notice. Renesas grants you permission to use these resources only to develop an application that uses Renesas products. Other reproduction or use of these resources is strictly prohibited. No license is granted to any other Renesas intellectual property or to any third-party intellectual property. Renesas disclaims responsibility for, and you will fully indemnify Renesas and its representatives against, any claims, damages, costs, losses, or liabilities arising from your use of these resources. Renesas' products are provided only subject to Renesas' Terms and Conditions of Sale or other applicable terms agreed to in writing. No use of any Renesas resources expands or otherwise alters any applicable warranties or warranty disclaimers for these products.

(Disclaimer Rev.1.01 Jan 2024)

Corporate Headquarters

TOYOSU FORESIA, 3-2-24 Toyosu,
Koto-ku, Tokyo 135-0061, Japan
www.renesas.com

Trademarks

Renesas and the Renesas logo are trademarks of Renesas Electronics Corporation. All trademarks and registered trademarks are the property of their respective owners.

Contact Information

For further information on a product, technology, the most up-to-date version of a document, or your nearest sales office, please visit www.renesas.com/contact-us/.