## Introduction

With so many advances in phones and apps, the cellphone is often used more for mobile entertainment than for making calls.

So it makes sense to free up an entire cellphone if a popular game can be implemented in simple hardware. The Silego Dino Game does just that, based on the Android OS – Google Chrome offline game: **http://www.omgchrome.com/chrome-dinosaur-game-pterodactyl-upgrade/**

The main task of the game is to make a dinosaur (red LED) jump over all cactuses (green LEDs). Cactuses' height may vary from 1 to 3. There are 3 levels in the game, and passing each level sounds a victory signal. Each time you hit the cactus, you lose 1 life (3 lives total). If there are no lives, then the dinosaur dies. Then you start from the beginning (See Figure 1).

The PCB was designed having 2 buttons, which is the perfect solution for left and right -handed people.
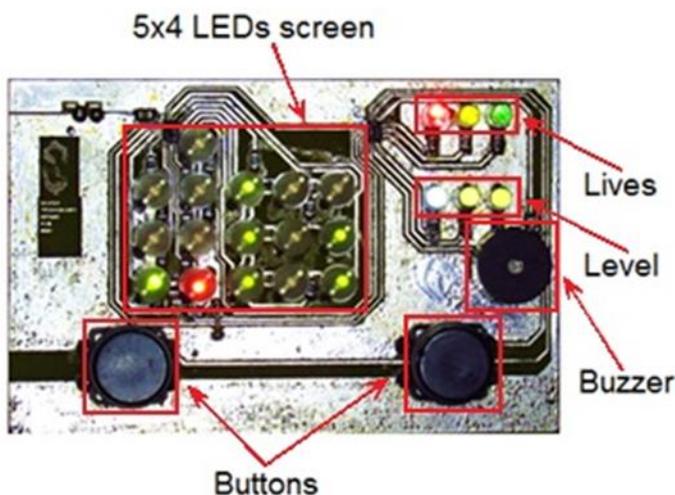
Figure 1. Dino Game hardware

Dino Game circuit design

It takes only 2 CMIC's (SLG46620 and SLG46722) to realize this game having 3 lives, 3 levels with different speeds and sound effects as well.

To find a compromise between internal circuit resource usage and a number of PIN outputs, a combination of static (for D11..D13 and D21..D23 and D21*..D24* LEDs) and dynamic (all other LEDs) indication was used (see Figure 2). Moreover, for a static indication it is easier to detect the cactus – dinosaur collision instance.

There is a 16-pixel LED display with 2-colors of LEDs: green and red.

A simple sequencer is used to simulate a dinosaur jump function, which switches red LEDs one by one with different delays. Delay time is long enough to be able to jump over the cactus on the one hand and short enough to fall down before the next cactus comes.

There are two buttons (active High), connected with a logic OR gate, so you may press any button you want. Dinosaur's position won't be held high when you press and hold the button because of edge detectors usage. It is not allowed to jump again before the dinosaur reaches the lowest position as well.

PGEN element is used to generate an incoming cactuses pattern. With a combination of counter built using DFFs we can define different cactus heights.

Pipe Delay and DFFs are used to shift the pattern right.
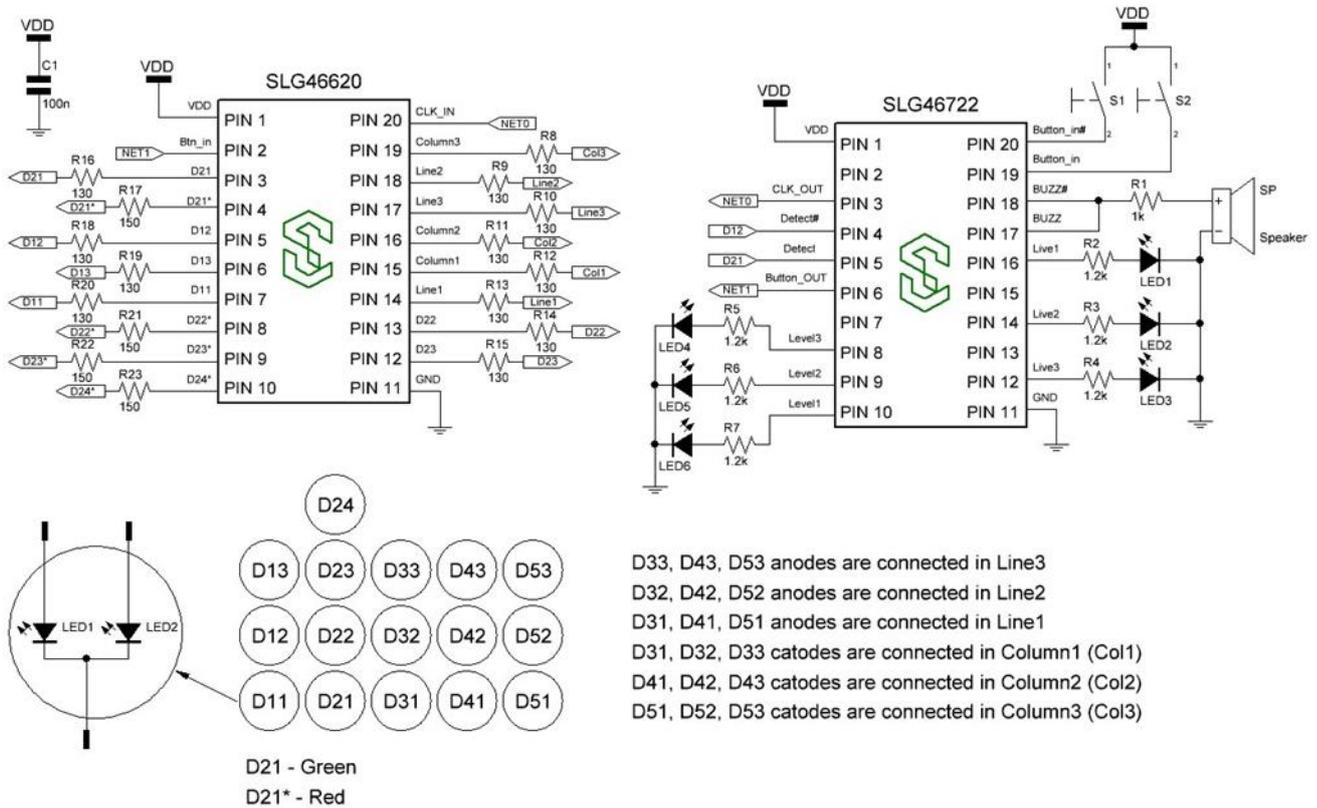
Figure 2. Dino Game circuit

LUTs with deglitch delays (not to detect short pulses between LEDs columns switching and not to detect 2 or more hits) are used to detect if a simultaneous signal comes to (D21 and D21*) or (D22 and D22*) or (D23 and D23*), which means dinosaur has hit the cactus.

Because there are no free PINs to use as an output, we need to choose a different way of outputting "collision moment". Because there aren't two cactuses in a row from the PGEN pattern, we may output a short pulse on the two neighboring LEDs, which can be detected by the two inputs of SLG46722.

All elements in SLG46620 are using external clock source signal, which comes from SLG46722. Changing its frequency we can easily change the game speed to the desired level using MUX, which takes signals directly from 25kHz internal OSC or via dividers.

There is a buzzer, which generates a short beep when you loose one life, long beep, when the game is over and periodical beep in case you win.

Simple DFF counters are used to change the number of level and lives, which can be decoded by LUTs and output to the indicator LEDs.
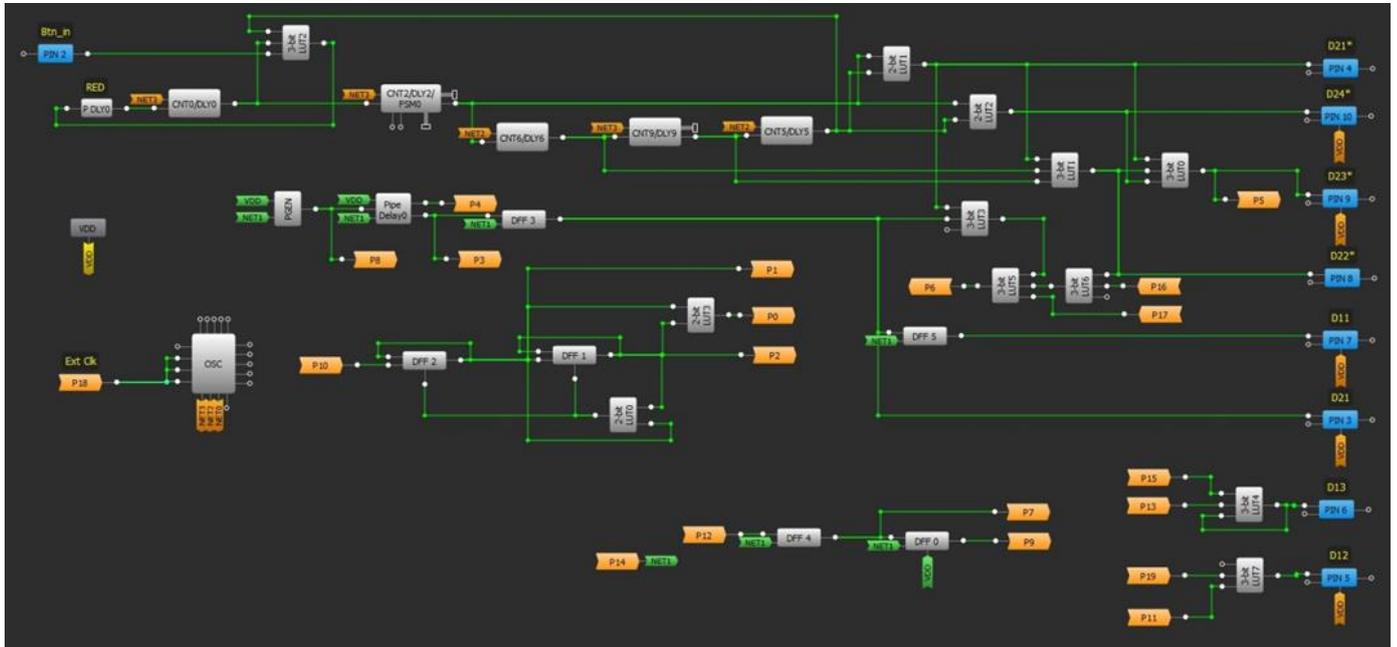

Figure 3. Dino Game design (SLG46620, Matrix 0)
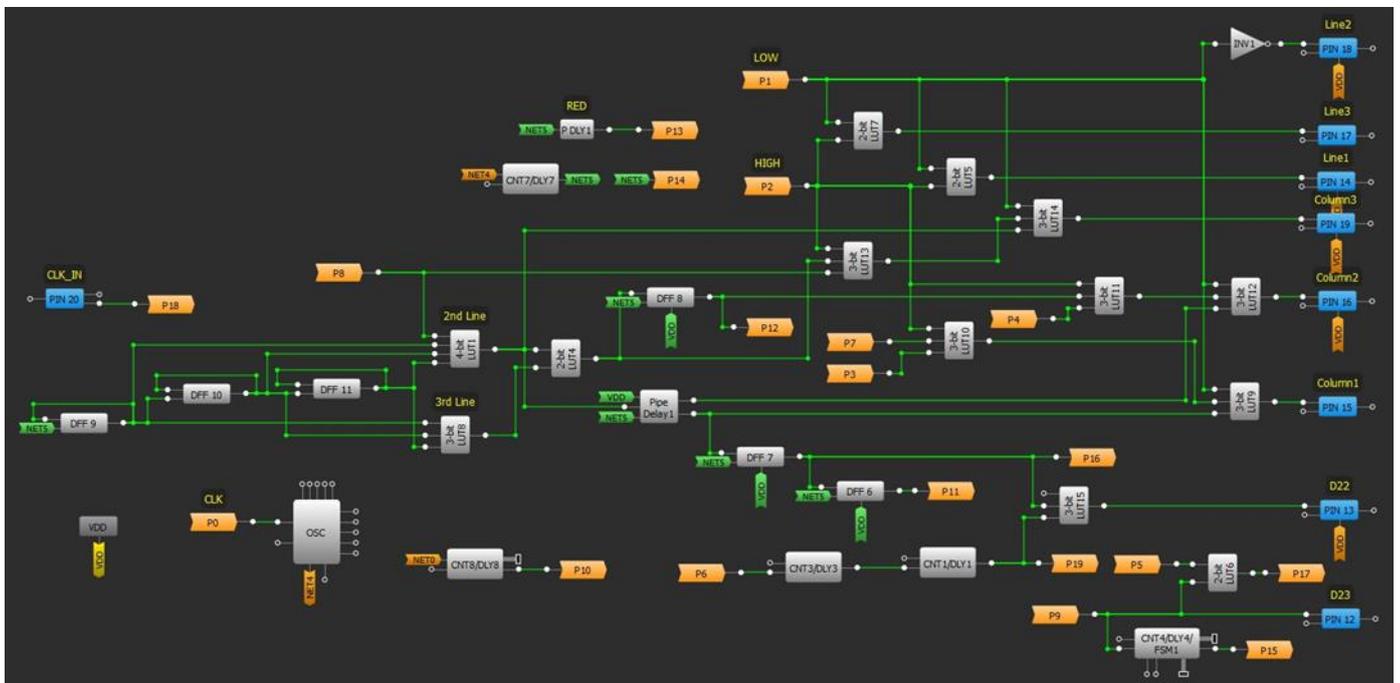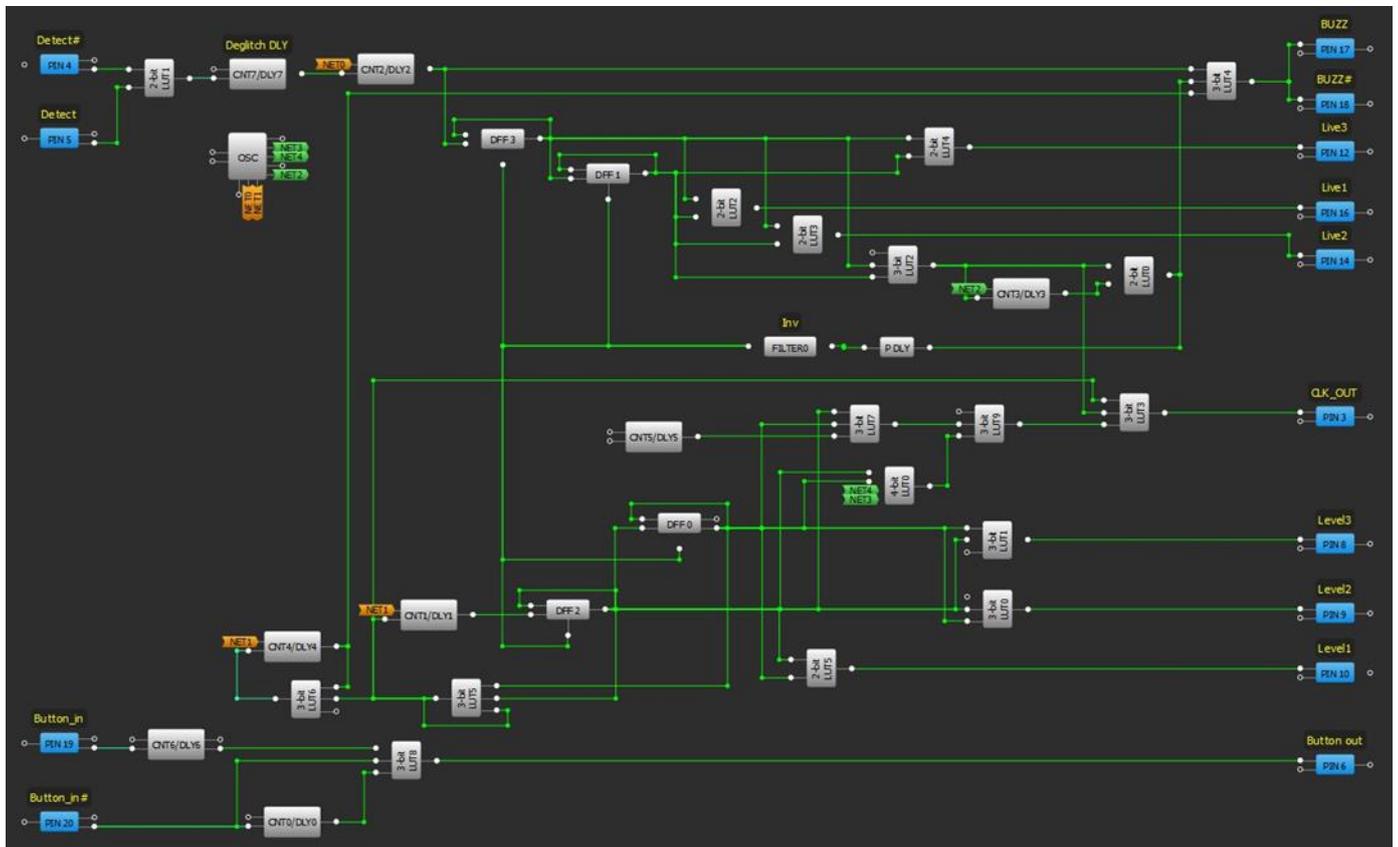

Figure 4. Dino Game design (SLG46620, Matrix 1)

Figure 5. Dino Game design (SLG46722)

PCB layout is displayed in Figure 6. List of recommended components to use is:

1) Buttons (2 pcs);
2) Buzzer KLS3-MWC-12*7.5-A2;
3) LEDs:
   a) 5mm 2-colors LEDs L-59EGC (16 pcs);
   b) 3mm white-color LEDs LTW-42NC5 (3 pcs);
   c) 3mm red-color LEDs RL3-R4545 (3 pcs);

4) Capacitor 0.1uF;
5) Resistors:
   a) 1.2k (6 pcs);
   b) 1k;
   c) 130 Ohm (12 pcs);
   d) 150 Ohm (4 pcs);
6) Silego chips:
   a) SLG46620;
   b) SLG46722;
7) 3.3V – 5.5V supply.
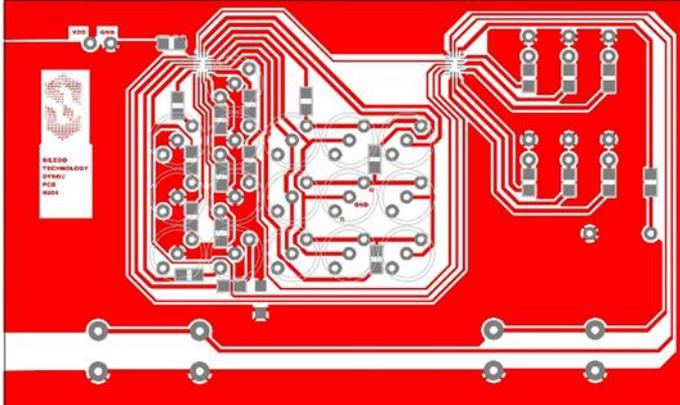
Figure 6. Dino Game PCB layout

Conclusion

Using two Silego CMIC's: SLG46620 and SLG46722, a complete mobile gaming device can be created, and demonstrates the versatility of GreenPAK CMIC designs.

About the Author

Name:	Yurii Shchebel
Background:	Yurii Shchebel graduated from Ivan Franko Lviv National University in 2015, studying at the Department Electronics. Presently he is working with Configurable Mixed Signal ICs (CMICs), He has additional interests designing audiophile grade amplifiers.
Contact:	**appnotes@silego.com**

Document History

Document Title: Mobile Dino Game

Document Number: AN-1094

Revision	Orig. of Change	Submission Date	Description of Change
A	Yurii Shchebel	12/30/2015	New application note

Worldwide Sales and Design Support

Silego Technology maintains a worldwide network of offices, solution centers, manufacturer's representatives, and distributors. To find the sales person closest to you, visit us at **Sales Representatives and Distributors.**

About Silego Technology

Silego Technology, Inc. is a fabless semiconductor company headquartered in Santa Clara, California, with operations in Taiwan, and additional design/technology centers in China, Korea and Ukraine.

Silego Technology Inc.
1515 Wyatt Drive
Santa Clara, CA 95054

Phone: 408-327-8800
Fax: 408-988-3800
Website: www.silego.com