

## Introduction

We will demonstrate how to make a 64-LED snowfall effect light using a single SLG46620V GreenPAK programmable mixed-signal ASIC. This IC provides a light line running function with a spatial intensity distribution, generating the dimming snowfall-effect (shown in figure 1). You can watch a video of the finished prototype in action here:

<https://www.youtube.com/watch?v=UdNEL6mWgZU>



**Figure 1. LED snowfall effect lights appearance**

## LED snowfall effect lights circuit design

The SLG46620V's 17 configurable GPIO's are not enough for each of the 64 LEDs to have a dedicated Output. To work around this limitation, we used dynamic indication. We divided the 64 LEDs into 8 groups, each group containing 8 LEDs which switch on one by one.

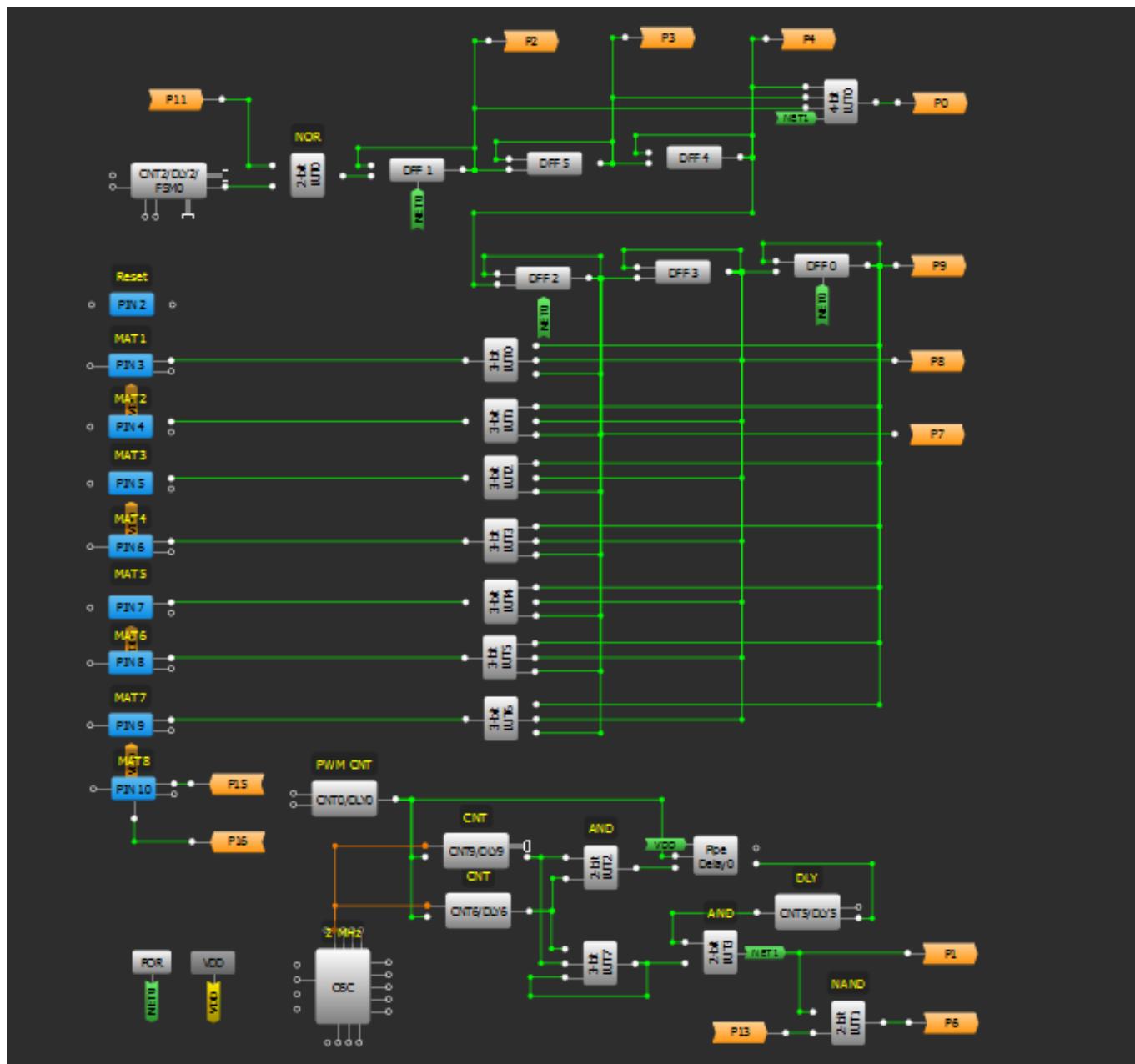
Refer to figures 2 & 3 below to see the schematic in GreenPAK software.

## LED snowfall effect lights circuit analysis

The design includes a 6-bit counter (made from 6 DFFs) which counts from 0 to 63. A system of 8 LUT's is used to connect the VDD to one of the groups depending on the combination of higher order 3 bits. Another system of LUT's monitor the state of the lower 3 bits and switch the appropriate LED cathodes to GND. This allows us to determine which LED will light (See figures 4, 5).

The system described above will switch on every LED one by one, giving us dynamic illumination of all LEDs in a row. Then if we switch the LEDs' cathodes to the PWM output instead of GND, we will be able to get a distribution of LED intensity along the moving line. It appears as a soft leading and trailing edge.

The PWM is made of two CNTs with counter data equal to 100 and 99. Reset for these CNTs (HIGH level reset) happens simultaneously, so these CNTs start operating synchronously. If we compare two CNTs' outputs, we will see that the distance between output pulses changes with time. Using a 3-bit LUT7 with a feedback it is possible to latch a HIGH on the pulse from the first CNT and to unlatch it on the pulse from the second one (see Figure 6).



**Figure 2. LED Snowfall Effect Lights circuit design (Matrix 0)**

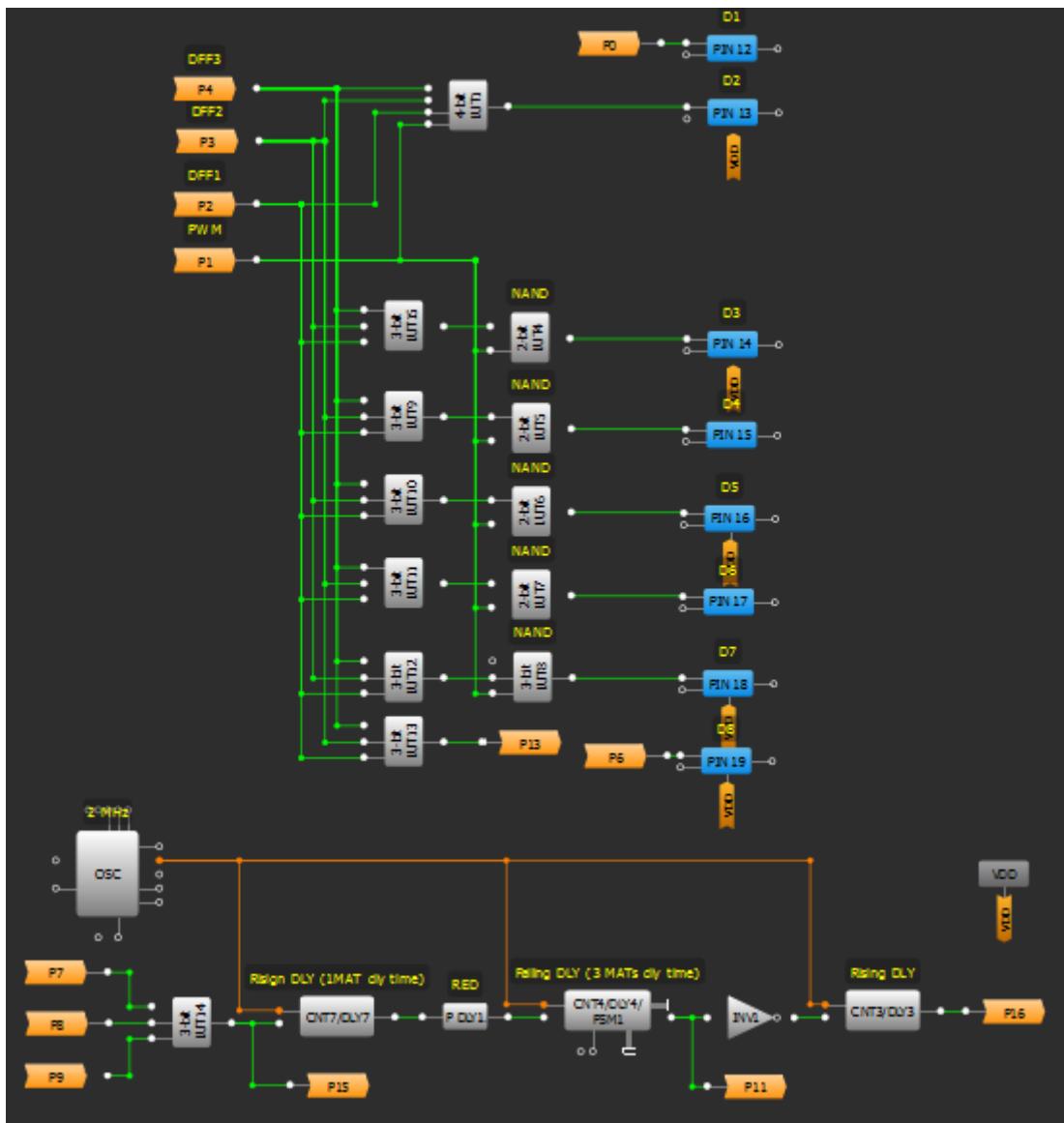
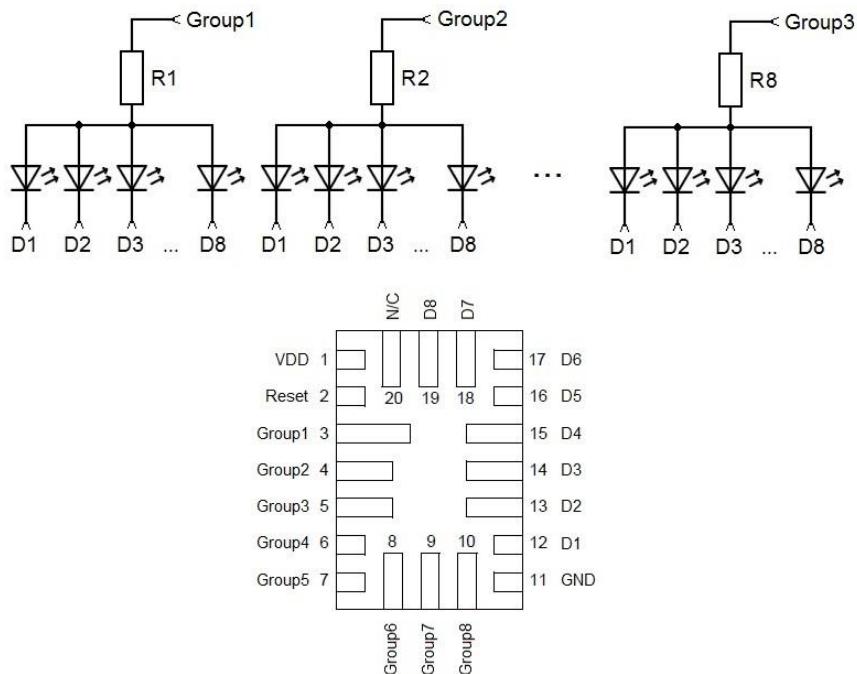
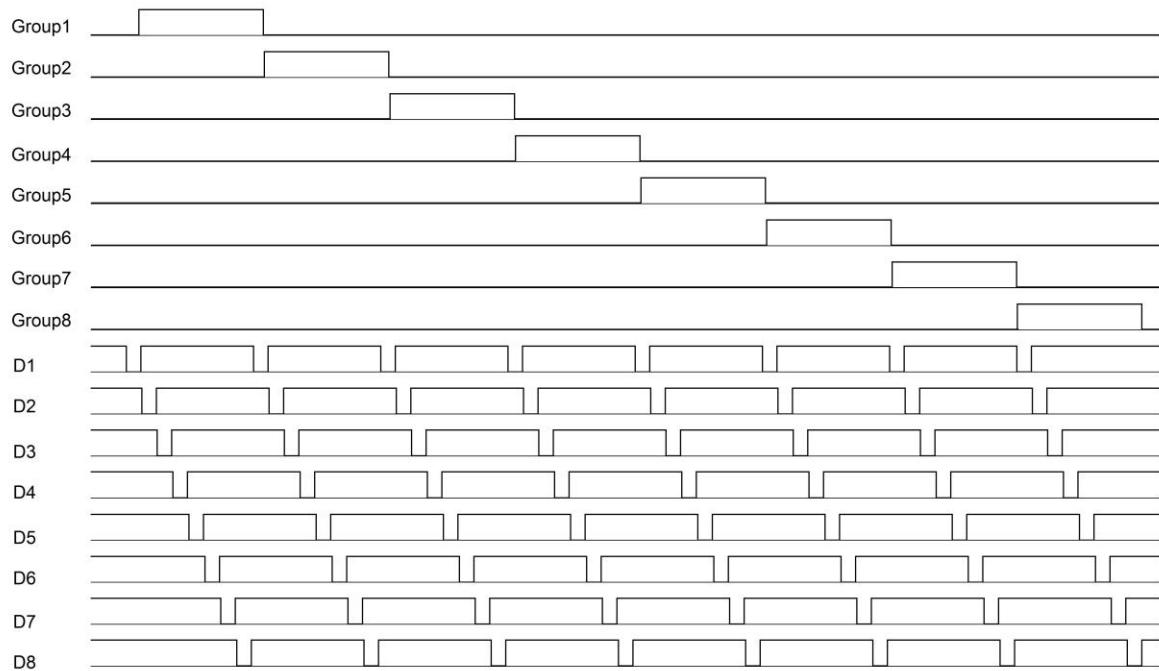


Figure 3. LED Snowfall Effect Lights circuit design (Matrix 1)



**Figure 4. LED Snowfall Effect Lights connections principle**



**Figure 5. LED Snowfall Effect Lights timing diagram**

That is how we get the PWM with its duty cycle changing dynamically in time. To have a travelling line 20-30% of the total 64 LED's, it is necessary to stop the PWM when we get the last pulse. For this a 2-bit LUT2 is used, configured as an AND gate. The signal from this AND gate output goes to the Pipe Delay (which operates as a simple DFF) CK input. The 2-bit LUT2 outputs HIGH at the end of the PWM signal or when the reset signal comes from CNT0. This is why the Pipe Delay's IN is connected to CNT0 output, so we get a logic HIGH on the Pipe Delay's output when it is PWM reset, and logic LOW when it is the end of PWM signal. That's how to stop outputting the PWM signal when it is necessary.

One more system in this design is used to start a new light line running only after the previous light line turns off. Tracking group#8 switching on moment and after three groups switching on time delay holding on a 6-bit counter made of 6 DFFs and switching off group#8. It is possible to realize this operation, which will add 3 imaginary groups to our system.

So we get  $8+3 = 11$  groups. CNT0 period should be configured with such counter data that matches the same time it takes to switch on 11 groups. But in this case the light line won't appear to run. To make it run, it is necessary to increase or decrease CNT0 counter data that will change the running speed and direction.

To realize reset function PIN#2 is used with enabled High level reset.

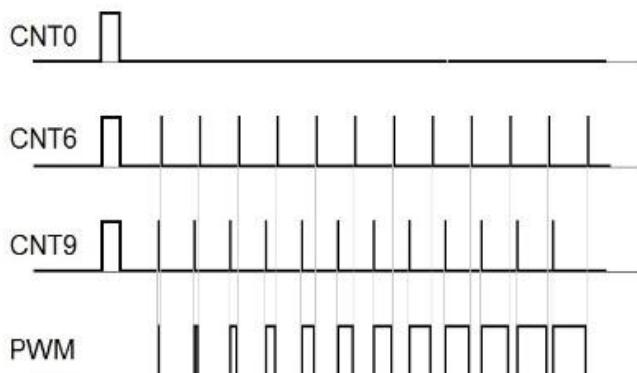


Figure 6. PWM functional diagram

## Conclusion

Using only one SLG46620V IC, we can create the LED Snowfall Effects Light, which can be used for lighting, decoration, direction indicators, and advertising displays.

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