Ultra-low power Button Reset with GreenPAK
SLG46140V / SLG46811V / SLG46855V

Contents

1. References

For related documents and software, please visit:

GreenPAK™ Programmable Mixed-Signal Products | Renesas

Download our free Go Configure Software Hub [1] to open the .gp files [2] and view the proposed circuit design. Use the GreenPAK development tools [3] to freeze the design into your own customized IC in a matter of minutes. Find out more in a complete library of application notes [4] featuring design examples as well as explanations of features and blocks within the GreenPAK IC.

[1] Go Configure Software Hub, Software Download and User Guide
[2] AN-CM-376 Ultra-low Power Button Reset with GreenPAK.gp, GreenPAK Design File
[3] GreenPAK Development Tools, GreenPAK Development Tools Webpage
[4] GreenPAK Application Notes, GreenPAK Application Notes Webpage
[5] SLG46140V Datasheet
[6] SLG46811V Datasheet
[7] SLG46855V Datasheet

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2. Terms and Definitions

MF	Multi-Function Macrocell
I2C	Inter-integrated circuit (bus)

3. Introduction

This solution is very important for use in widely distributed digital devices such as smartwatches, smartphones, wireless headphones, tablet PCs, and other small devices that have high requirements for low power consumption and battery life.

The goal of this Application Note is to develop a design with an on/off button with GreenPAK, with an active current consumption close to 500 nA.

The operation of the design is founded on the low-frequency watchdog pulse generator, the button push detector, and a set of logic for generating a reset pulse with or without delay.

Also, the GreenPAK still has enough macrocells and configurable PINs to adapt the design to the specific needs of the customer.

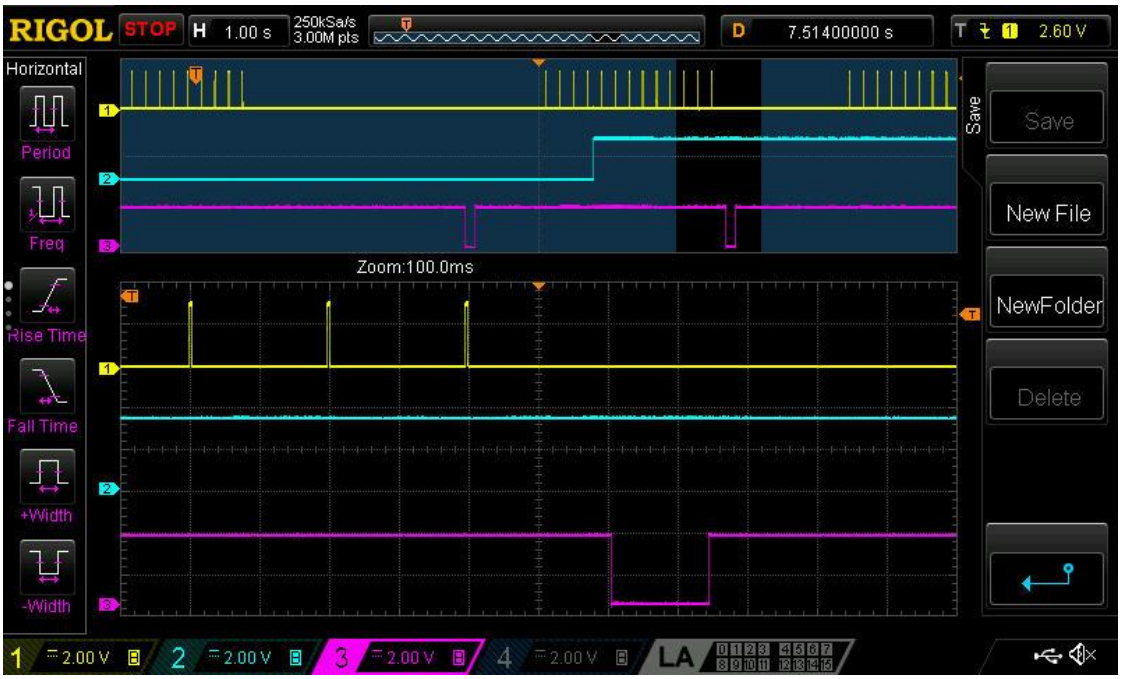
4. Operation of the Ultra-low power Button Reset with GreenPAK

In these Application Note three GreenPAK devices were selected to check and evaluate the level of current consumption: SLG46140, SLG46811, and SLG46855.

Since the main task of the device under development is a constant check of the condition of the external button (on/off) with minimal current consumption, for clock delay blocks and counter blocks in the design a low-frequency oscillator is used.

From the low-frequency watchdog pulse generator (WD) the low-frequency pulses, thru the 1M resistor, are applied to the "Button" input PIN. Also, the S1 button is connected to the "Button" PIN, which when pressed pulls down it to the GND. This allows to determine the condition of the button (on/off) using a frequency detector and generate a reset pulse to the RESET output PIN with delay time or without it (see Waveform 1. The main design functionality and the Figures 1-6).

Channel 1 (yellow/top line) –Button
Channel 2 (light blue/2nd line) –RES_DLY ON/OFF
Channel 3 (magenta/3rd line) –RESET



Waveform 1. The main design functionality

Figures 1,3,5 and Figures 2,4,6 show the circuits of the proposed application and the design block diagrams for each selected device.

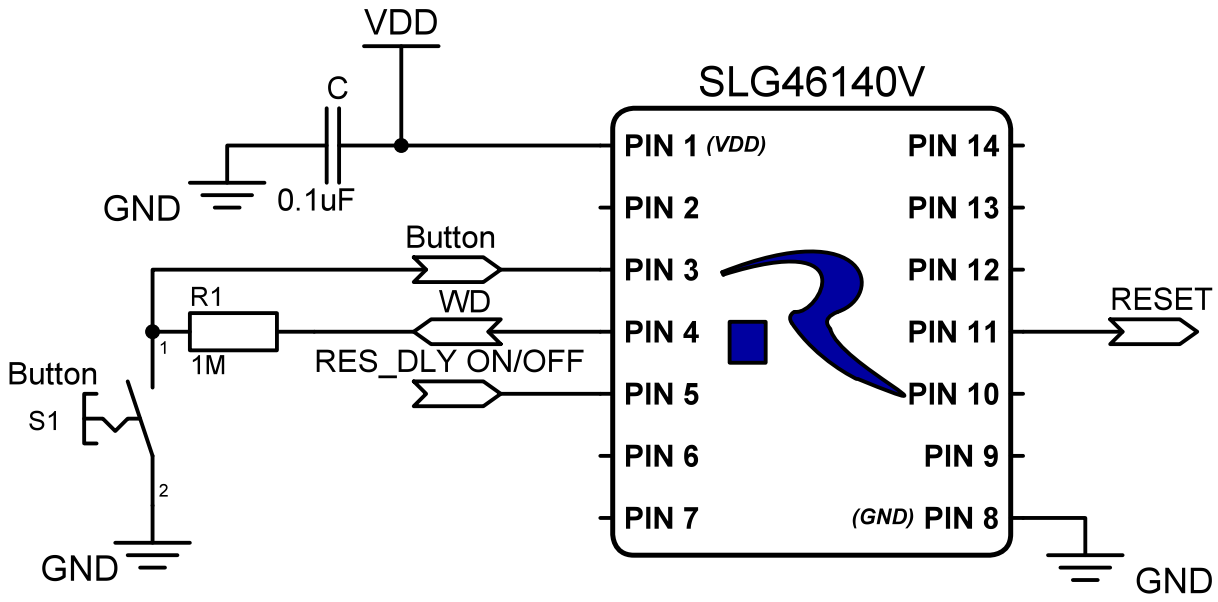


Figure 1: Application Circuit with SLG46140

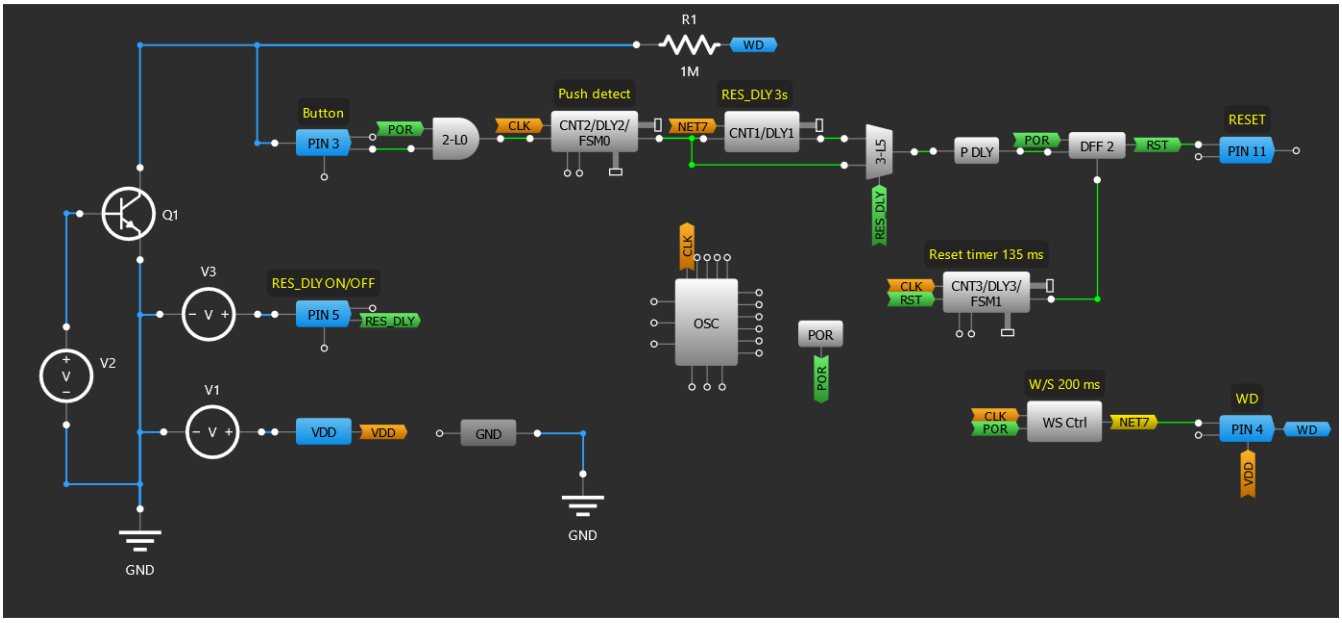


Figure 2. Block diagram of the design for SLG46140

Table 1. shows the current consumption values for the SLG46140 at different values of the period of the frequency of the low-frequency watchdog generator to determine its optimal settings.

Table 1. SLG46140 current consumption at the various values Tw/s

	Tw/s, ms	SW open	SW close
		Iq, uA	Ia, uA
VDD=3.0 V	90	~0.505	~0.467
	130	~0.475	~0.448
	200	~0.457	~0.439

As can be seen from the data given in Table 1, the lowest current consumption is at Tw/s = 200 ms, so the rest of the data will be taken at Tw/s = 200 ms. See the data in Table 2-4.

Table 2. SLG46140 current consumption at Tw/s = 200 ms

VDD, V	SW open	SW close
	Iq, uA	Ia, uA
1.71	~0.367	~0.367
2.1	~0.399	~0.396
3.0	~0.457	~0.439
3.3	~0.516	~0.489
3.7	~0.564	~0.525
4.2	~0.638	~0.577
5.5	~0.900	~0.766

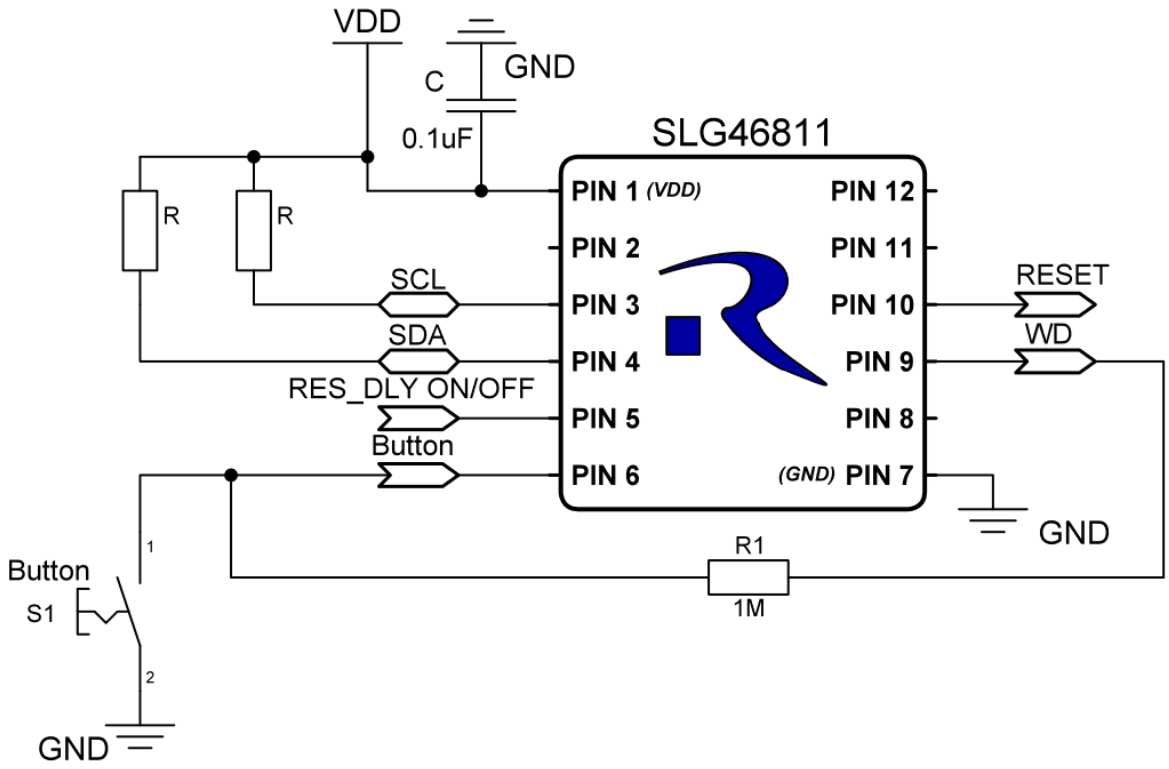


Figure 3: Application Circuit with SLG46811

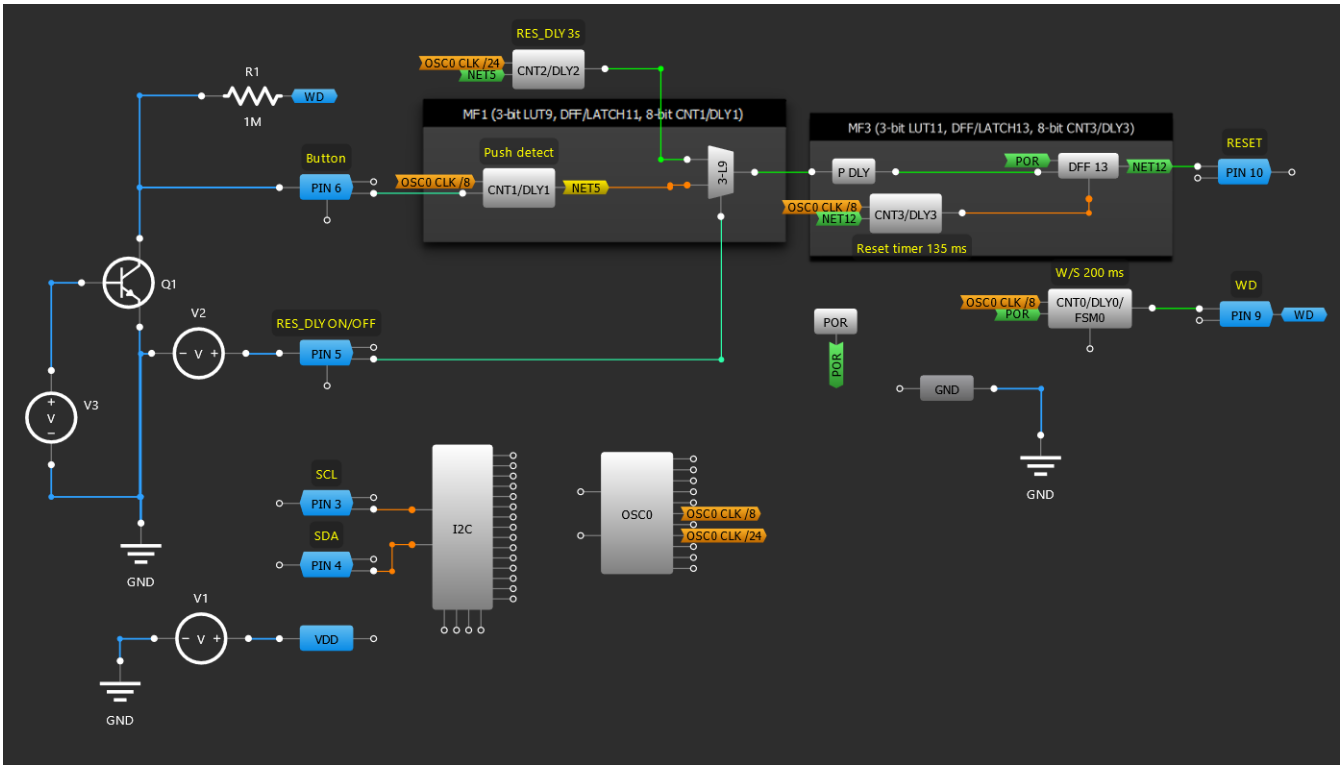


Figure 4. Block diagram of the design for SLG46811

Table 3. SLG46811current consumption at Tw/s = 200 ms

VDD, V	SW open	SW close
	Iq, uA	Ia, uA
2.3	~0.314	~0.354
3.0	~0.347	~0.399
3.3	~0.365	~0.419
3.7	~0.390	~0.446
4.2	~0.422	~0.481
5.5	~0.528	~0.576

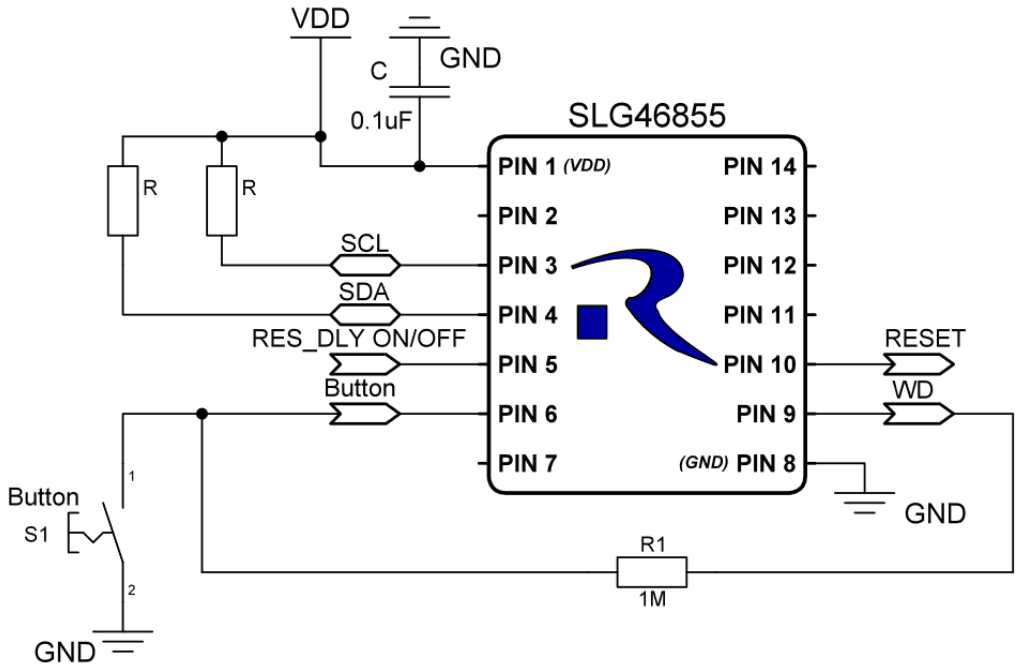


Figure 5: Application Circuit with SLG46855

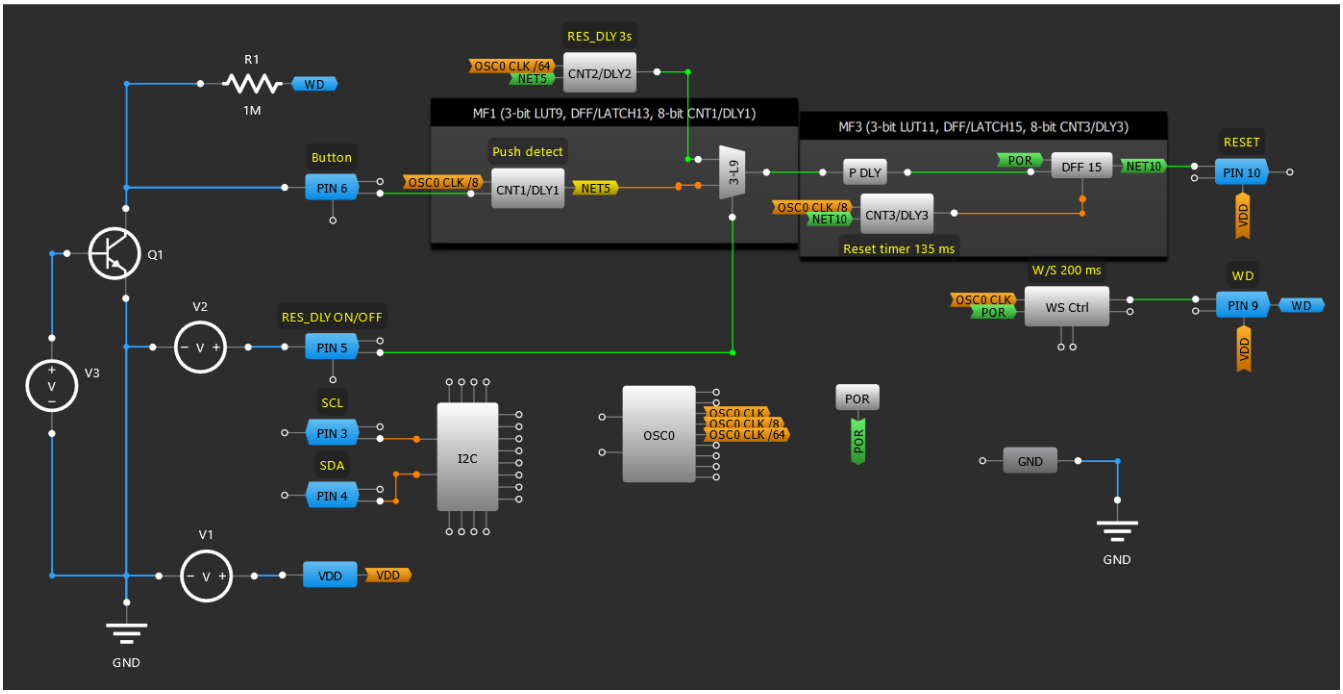


Figure 6. Block diagram of the design for SLG46855

Table 4. SLG46855 current consumption at Tw/s = 200 ms

VDD, V	SW open	SW close
	Iq, uA	Ia, uA
2.3	~0.304	~0.307
3.0	~0.340	~0.336
3.3	~0.358	~0.350
3.7	~0.382	~0.369
4.2	~0.416	~0.394
5.5	~0.525	~0.471

5. Conclusion

The current consumption values shown in Tables 1-4 are the average values of more than 200 measurements for each value, measured with a Digital Multimeter SIGLENT SDM3065X.

As we can see from the data given in Tables 2-4, the current consumption for SLG46140, SLG46811, and SLG46855 is close to 500nA but the lowest current consumption measured for SLG46855 is less than 500nA, so it can be considered that the goal has been achieved.

In addition, there are still many unused resources that can be additionally used for the needs of the customer.

6. Revision History

Revision	Date	Description
1.00	May 13, 2023	Initial release.

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