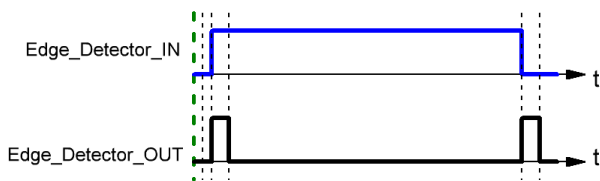


## Introduction

Digital Edge Detectors are the devices which with the appearance of the defined edge on the input produce a short pulse on their output. This simple unit consists of one input, and output, main part of which is a LUT (Look-up table) cell with some passing unit on its input that defines the width of output pulse see Figure 1.

## Digital Edge Detector Circuit Design

As you can see on Figure 6, Digital Edge Detector can be implemented using 2-bit LUT4 with connected to its input Edge\_Detector\_IN (PIN3), programmable delay and Edge\_Detector\_OUT (PIN19) connected to its output. This output PIN has an Output Enable node connected to VDD as it is configured as Push-Pull.



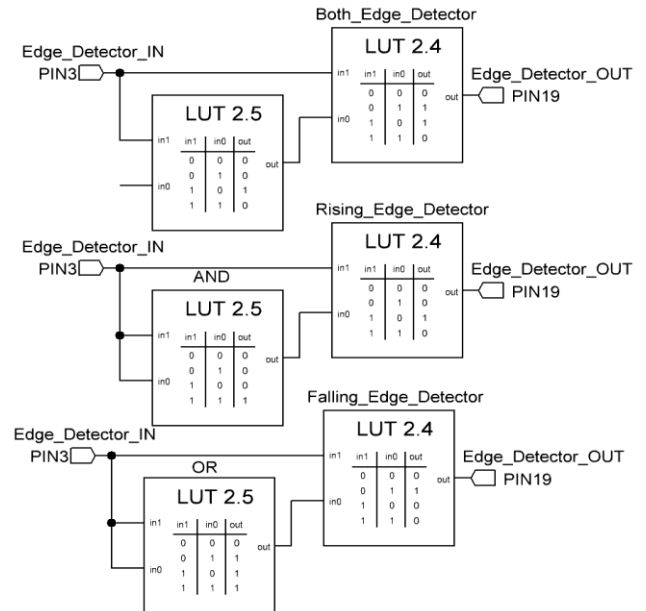
**Figure 1. Digital Both Edge Detector Timing Diagrams**

## Digital Edge Detector Circuit Analysis

When input signal that comes to an Edge\_Detector\_IN (PIN3) it produces a HIGH state on 2-bit LUT4 output until HIGH level comes on IN0 from 2-bit LUT5 cell output. In such way we get a pulse width of several nanoseconds, depending on VDD level and passing unit type.

Please note, that except of Look-up table, such cells as FILTER, PDLY, LATCH can also be used as a passing units for Edge Detector circuit.

Now, if Edge\_Detector\_IN (PIN3) switches LOW the HIGH pulse on Edge\_Detector\_OUT (PIN19) will appear again until LOW level on IN0 will appear, because 2-bit LUT5 itself delays both edges of input signal (see Figure 2).



**Figure 2 Digital Edge Detector Truth Tables**

Please use Look-up table configured as AND gate for Rising Edge Detector configuration and as OR gate for Falling Edge Detector configuration, for bigger pulse duration on Edge Detector output (see Figure 3). Different propagation times of these Look-up tables cells depending on configurations can be seen on Figure 4.

Functionality waveform of real Digital Edge Detector circuit created in GreenPAK3 Designer is shown on Figure 5, where Channel1 (yellow/top line) — PIN3 (Edge\_Detector\_IN), Channel2 (light blue/bottom line) — PIN19 (Edge\_Detector\_OUT). As can be seen from Figure 4 the real waveforms coincide with the theoretical shown on Figure 1.

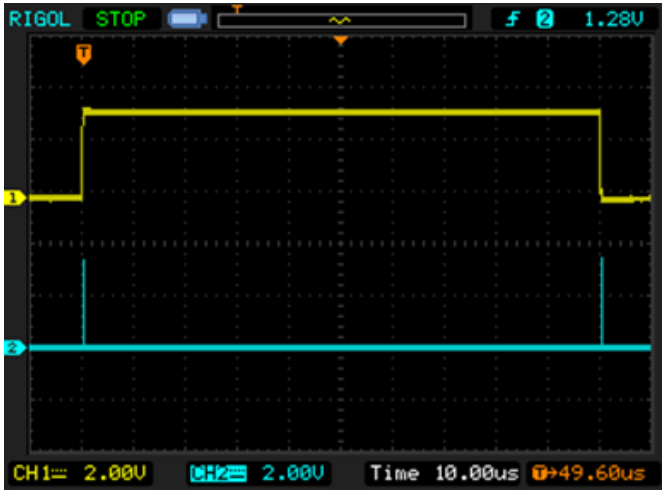


Figure 3. Digital Both Edge Detector Functionality Waveforms

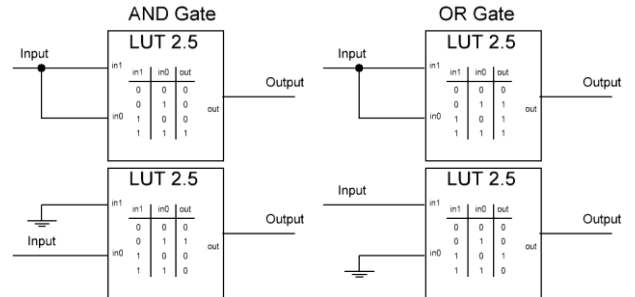


Figure 5. Different Look-up Tables Configurations

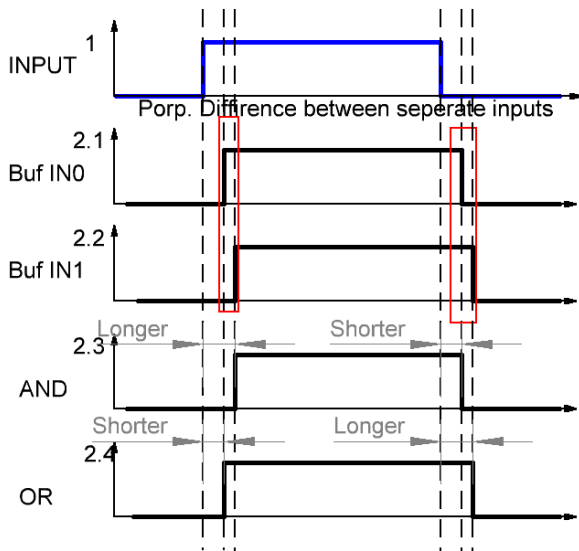


Figure 4. Different Look-up cell propagation time

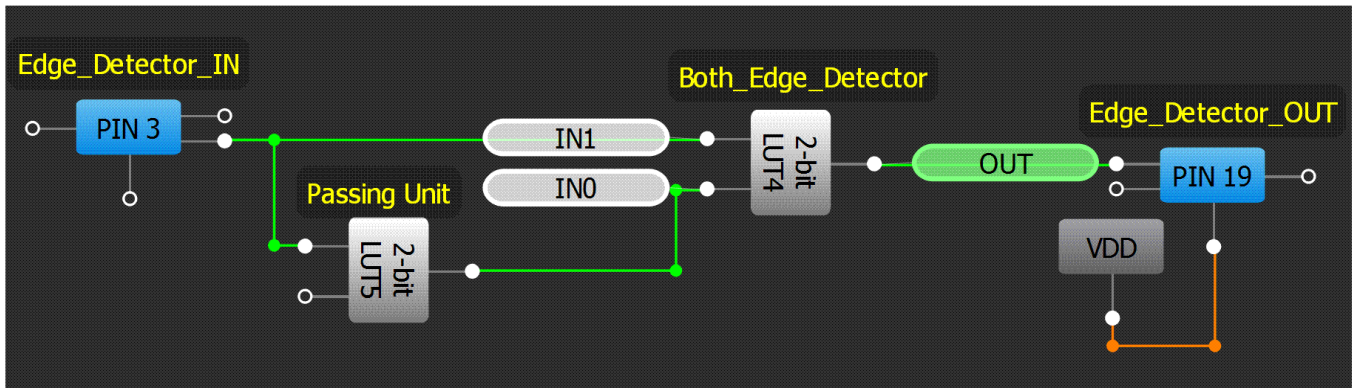
### Related Files

Programming code for **GreenPAK Designer**.

### Conclusions

Digital Edge Detector is a simple but useful circuit that can be used to produce trigger signals for other blocks and systems.

*Note: for proper operation of circuit don't forget to configure input and output pins correctly. In case of schematic you see on Figure 6 input is configured as Digital Input with Schmitt trigger, and output as Push-Pull.*



**Figure 6. Digital Edge Detector Circuit in GreenPAK3 Designer**



### About the Author

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### Document History

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Revision	Orig. of Change	Submission Date	Description of Change
A	Volodymyr Batig	03/25/2014	New application note
B	Volodymyr Batig	04/07/2014	Expanded and updated with programming file for GreenPAK3 chip

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