RTL_EXERCISE_1 BOUND FLASHER

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Contents

1. Interface

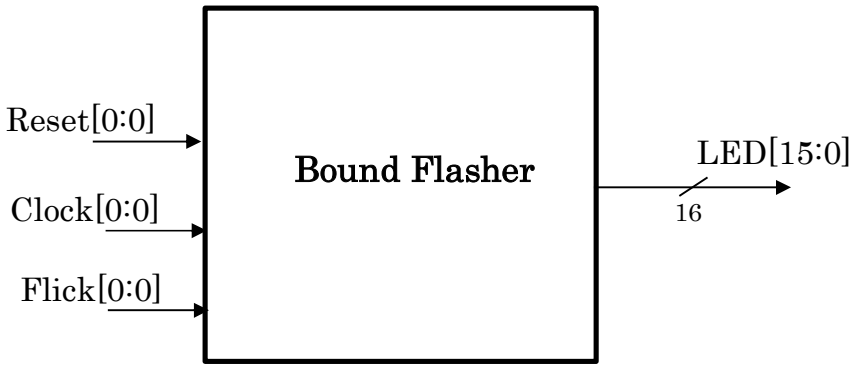


Figure 1: the figure of Bound Flasher System

Signal	Width	In/Out	Description
Reset	1	In	Low-active synchronous reset signal
Clock	1	In	Clock provided by system
Flick	1	In	Special input for controlling the state transfer
LED	16	Out	System LEDs

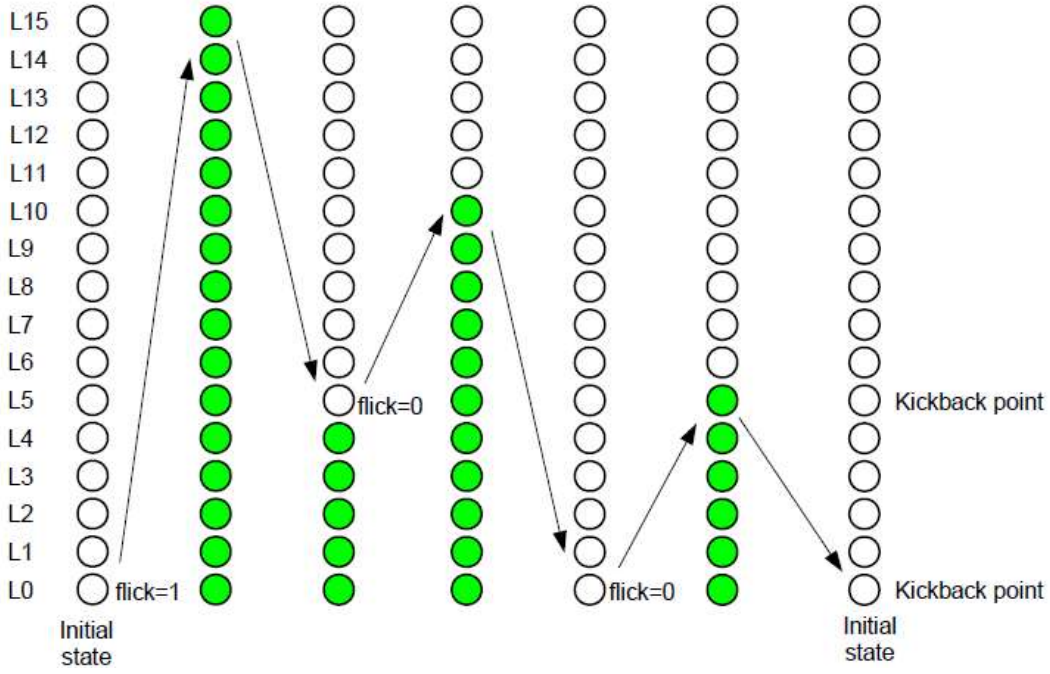
Table 1: Description of signals in Bound Flasher

2. Functional implementation.

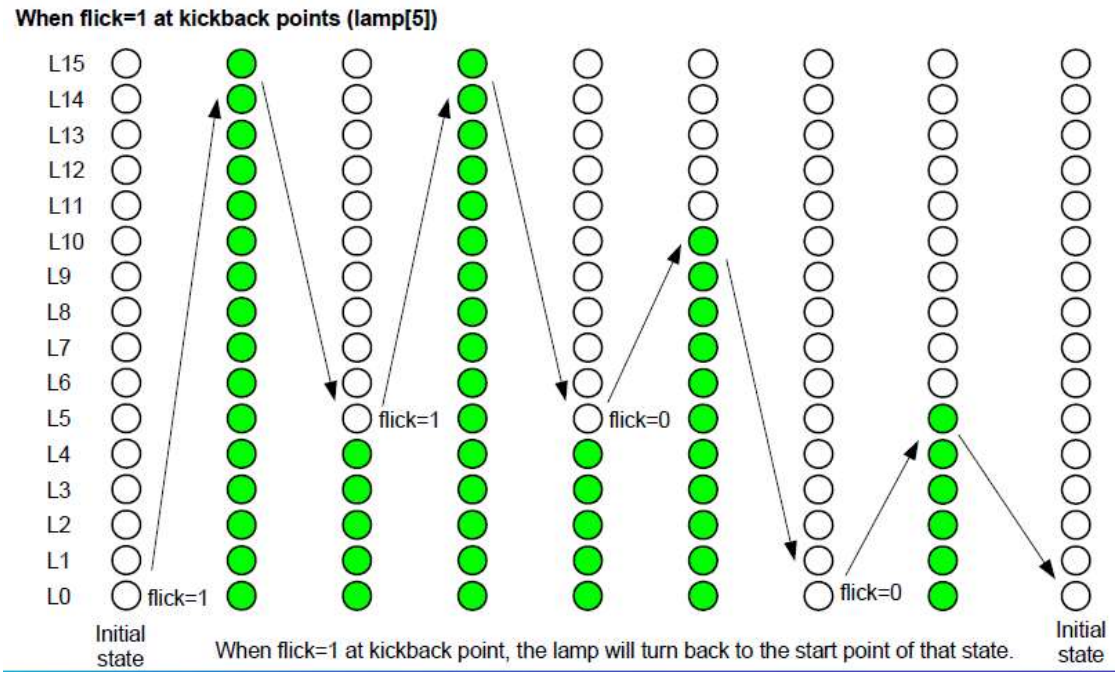
- Implement a 16-bits LEDs system
- System's Operation base on three input signal
  - Reset
  - Clock
  - Flick
- The system specification
  - Clock signal is provided for system inspire of function status. The function operate state's transition at positive edge of the clock signal.
  - Reset signal:
    - LOW-ACTIVE Reset = 0: System is restarted to Initial State.
    - HIGH-ACTIVE Reset = 1: System is started with initial state.
- Flick signal: special input for controlling state transfer.
- At the initial state, all lamps are OFF. If flick signal is ACTIVE, the flasher start operating:
  - The lamps are turned ON gradually from LEDs [0] to LEDs [15].
  - The LEDSs are turned OFF gradually from LEDs [15] to LEDs [5].
  - The LEDSs are turned ON gradually from LEDs [5] to LEDs [10].
  - The LEDSs are turned OFF gradually from LEDs [10] to LEDs [0].
  - The LEDSs are turned ON gradually from LEDs [0] to LEDs [5].
  - Finally, the LEDs s are turned OFF gradually from LEDSs [5] to LEDSs [0], return to initial state.
- Additional condition: At each kickback point (LEDs [5] and LEDs [0]), if flick signal is ACTIVE, the LEDs will go back and repeat that STATE. For simple, kickback point is considered only when the LEDs s are turned OFF gradually, except final state.

– Some insulations:

- When flick = 0 at kickback points



- When flick = 1 at kickback points (lamp[5])



3. Internal implementation.

3.1. Overall.

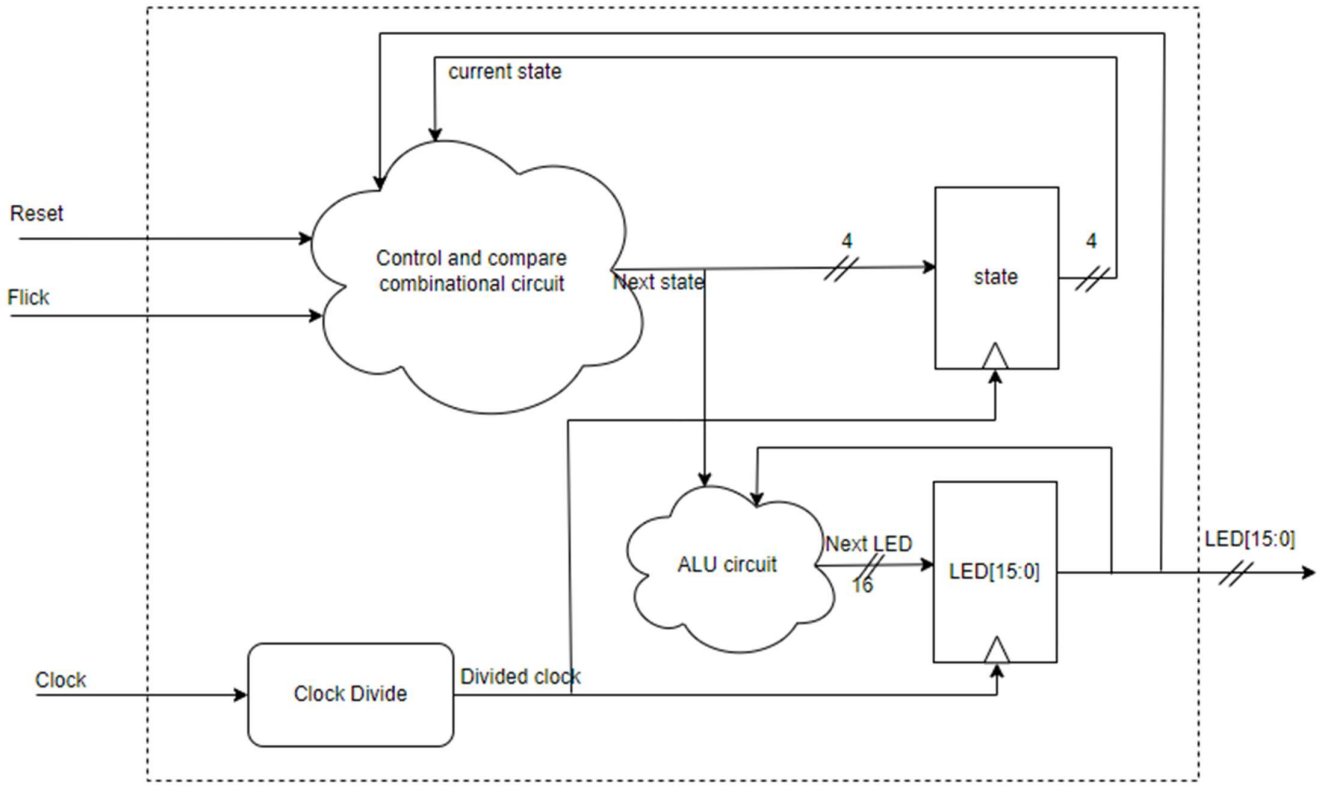


Figure 3.1: Block diagram of Bound Flasher

Block Name	Description
Control and compare combinational circuit	The combinational circuit that determines next state and next value of LEDs based on current state, flick and reset
State	Holds state of the circuit
LED	The system LEDs
ALU circuit	The arithmetic circuit that evaluate the next value of LEDs of the next state
Clock divide	A circuit that creates lower frequency clock

Table 3.1: Block diagram of Bound Flasher Description

3.2. State Machine

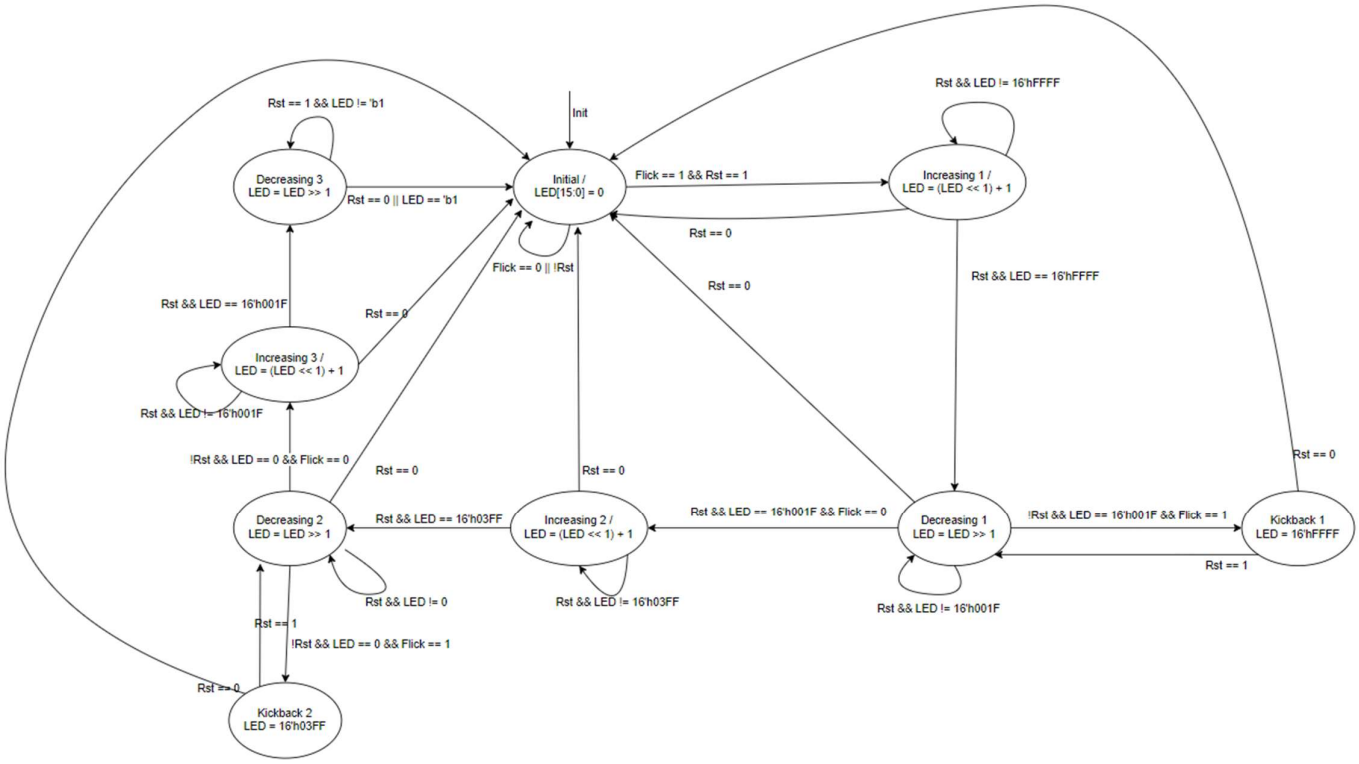


Figure 3.2: State Machine of Bound Flasher

Variable Name	Description
Rst	1-bit input Reset signal
Flick	1-bit input Flick signal
LED	16-bit LEDs system

Table 3.2: variable name of State machine

State Name	Description
Initial	Initial state in which all LEDs are turned off
Increasing 1	State in which LEDs are turned on from LED[0] to LED[15]
Decreasing 1	State in which LEDs are turned off from LED[15] to LED[5]

Kickback 1	Kickback point where Flick is asserted and all LEDs are turned on
Increasing 2	State in which LEDs are turned on from LED[5] to LED[10]
Decreasing 2	State in which LEDs are turned off from LED[10] to LED[0]
Kickback 2	Kickback point where Flick is asserted and LEDs are turned on from LED[0] to LED[10]
Increasing 3	State in which LEDs are turned on from LED[0] to LED[5]
Decreasing 3	State in which LEDs are turned off from LED[5] to LED[0] and then return to Initial state

Table 3.3: state name of State machine

4. History

Date	Author	Modified part	Description
2017/03/28		All	New creation