*Project: RMC75E TEST BENCH*

*Module:* ExpModuleLED*.vhd*

*Author: Satchel Hamilton*

*Company: Delta Motion*

*Date: 7/26/2023*

*Last updated: July 26, 2023*

Contents

[High Level 1](#_Toc140670735)

[Low level: 3](#_Toc140670736)

[Simulation: 4](#_Toc140670737)

# High Level

The **ExpModuleLED** provides the interface for writing LED values to expansion boards in the RMC75E.

# Low level

The **ExpModuleLED** interface is designed to control the LEDs on expansion boards in the system.

**Input Ports:**

1. **Reset**: Asynchronous reset signal to initialize the module.
2. **H1\_CLKWR**, **SysClk**, **SynchedTick**: Clock signals used in the design.
3. **SlowEnable**: A control signal to enable slow clock operation.
4. **intDATA**: Input data to the module.
5. Various other input control signals for different LED writes and reads, as well as EEPROM access and discovery completion flags.

**Output Ports:**

1. **expLedDataOut**: Output for LED data to be displayed on the expansion boards.
2. Various control signals for LED data (e.g., **ExpLEDOE**, **ExpLEDLatch**, **ExpLEDClk**, **ExpLEDData**, **ExpLEDSelect**, etc.).
3. **ExpOldAP2**: Input signal representing the state of the old AP2 module.

**Internal Signals:**

1. Several internal signals (**ShiftRegister0**, **ShiftRegister1**, **ShiftRegister2**, **ShiftRegister3**, **Count**, **OutputClock**, **ShiftEnable**, **StartStateMachine**, **Exp0LED**, **Exp1LED**, **Exp2LED**, **Exp3LED**, **ClearExpLEDLatch**, **intExpLEDSelect**, **intExp0LED**, **intExp1LED**, **intExp2LED**, **intExp3LED**, **intExpLEDOE**, **EnableDelay**, **State**) are used for controlling LED writes and shifts.

**Functionality:**

* The interface is designed to work with an 8-bit shift register, where each bit corresponds to an LED.
* The **ShiftRegister0**, **ShiftRegister1**, **ShiftRegister2**, and **ShiftRegister3** signals are used to hold the LED data that will be shifted out to the LED drivers.
* The state machine controls the write sequence to the LED driver and is driven by the **SysClk** and **SynchedTick** signals.
* The **StartStateMachine** signal is used to initiate the state machine's operation when LED writes are requested and other conditions are met.
* The state machine goes through four states: **IdleState**, **ShiftState**, **ClearState**, and **EndState**. It controls the LED data shifting and latching process.
* The **ExpLEDSelect** signal selects which LED data should be written to the shift registers based on the LED write requests (**Exp0LEDWrite**, **Exp1LEDWrite**, etc.).
* The LED data is latched when the state machine enters the **EndState** state, and the **ExpLEDOE** signal is used to control the enable pin for the LED drivers.
* The state machine is reset when the **Reset** signal is asserted.

## Simulation