Main Circuit Documentation

Functionality

The **main circuit** integrates the traffic light signal producer and controls the traffic lights for **four streets**. It uses **LEDs** to represent the traffic light states (Red, Yellow, Green) for each street.

Components

- **LEDs**: Represent traffic light states (Red, Yellow, Green).
- **Clock**: Provides timing signals for synchronization.
- **Wires**: Connect components and propagate signals.

Logic Diagram

Main Circuit Logic Diagram
Insert your logic diagram here.

Truth Tables

LED States

Street	Red	Yellow	Green	Description
Street1	1	0	0	Red light on
Street1	0	1	0	Yellow light on
Street1	0	0	1	Green light on
Street2	1	0	0	Red light on
Street2	0	1	0	Yellow light on
Street2	0	0	1	Green light on
Street3	1	0	0	Red light on
Street3	0	1	0	Yellow light on
Street3	0	0	1	Green light on
Street4	1	0	0	Red light on
Street4	0	1	0	Yellow light on
Street4	0	0	1	Green light on

Traffic Light Signal Producer Documentation

Functionality

The **traffic light signal producer** generates control signals for the traffic lights based on the clock input. It uses **T Flip-Flops** and **logic gates** to manage the state transitions (Red → Green → Yellow → Red).

Components

- **T Flip-Flops**: Store the current state of the traffic light.
- **AND Gates**: Combine signals to control light transitions.
- **OR Gates**: Manage multiple input conditions.
- **NOT Gates**: Invert signals for state management.

Logic Diagram

Traffic Light Signal Producer Logic Diagram
Insert your logic diagram here.

Truth Tables

T Flip-Flop

Clock (Clk)	T	Q (Next State)
↑ (Rising)	0	Q (Hold)
↑ (Rising)	1	Q' (Toggle)

AND Gate

A	B	Output
0	0	0
0	1	0
1	0	0
1	1	1

OR Gate

A	B	Output
0	0	0
0	1	1
1	0	1
1	1	1

NOT Gate

A	Output
0	1
1	0

Components and Truth Tables Documentation

Clock

The **clock** generates periodic signals to synchronize the traffic light transitions.

Clock State	Description
High (1)	Active state
Low (0)	Inactive state

LEDs

The **LEDs** represent the traffic light states for each street.

LED Color	State	Description
Red	1	Stop
Yellow	1	Prepare to stop/go
Green	1	Go

Timing Diagram Documentation

Timing Diagram

The **timing diagram** illustrates the behavior of the traffic light system over time. It shows the transitions between Red, Yellow, and Green states for all four streets.

Example Timing Diagram

"'plaintext Time: 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 Street1: R R R R G G G G Y Y Y Y R R R R Street2: G G G G Y Y Y Y R R R R G G G G Street3: R R R R G G G G Y Y Y Y R R R R Street4: G G G G Y Y Y Y R R R R G G G G Key: R: Red light on

Y: Yellow light on

G: Green light on

Explanation: Street1 and Street3 start with a Red light, while Street2 and Street4 start with a Green light.

After 4 clock cycles, Street1 and Street3 transition to Green, and Street2 and Street4 transition to Yellow.

After another 4 clock cycles, Street1 and Street3 transition to Yellow, and Street2 and Street4 transition to Red.

The cycle repeats every 12 clock cycles.

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5. State Table for T Counter Documentation (`state_table.md`)

"'markdown # State Table for T Counter Documentation

State Table

The **T counter** is a 4-bit counter that counts from 0 to 15. It controls the state transitions of the traffic lights.

Clock Cycle	T3	T2	T1	T0	Decimal Value
0	0	0	0	0	0
1	0	0	0	1	1
2	0	0	1	0	2
3	0	0	1	1	3
4	0	1	0	0	4
5	0	1	0	1	5
6	0	1	1	0	6
7	0	1	1	1	7
8	1	0	0	0	8
9	1	0	0	1	9
10	1	0	1	0	10
11	1	0	1	1	11
12	1	1	0	0	12
13	1	1	0	1	13
14	1	1	1	0	14
15	1	1	1	1	15

Explanation:

- The **T counter** increments on every clock cycle.
- It resets to 0 after reaching 15, creating a continuous loop. # Data Sheets Documentation

Main Circuit

Component	Description	Inputs	Outputs
LED	Traffic light indicator	Control signal	Visual output
Clock	Timing signal	-	Clock signal

Component	Description	Inputs	Outputs
Wire	Signal propagation	Input signal	Output signal

Traffic Light Signal Producer

Component	Description	Inputs	Outputs
T Flip-Flop	State storage	Clock, T	Q, Q'
AND Gate	Logical AND operation	2 inputs	1 output
OR Gate	Logical OR operation	2 inputs	1 output
NOT Gate	Logical NOT operation	1 input	1 output

Considerations Documentation

1. **Timing**: Ensure the clock signal is correctly configured to synchronize traffic light transitions.
2. **State Transitions**: Verify that the traffic light states transition correctly (Red → Green → Yellow → Red).
3. **Fault Tolerance**: Test the system for edge cases, such as simultaneous inputs or clock glitches.
4. **Scalability**: Ensure the system can be extended to support additional streets or traffic lights. # Conclusion Documentation

This documentation provides a detailed analysis of the `TrafficLight.XML` file, including truth tables, timing diagrams, state tables, data sheets, and considerations. You can now insert the logic diagrams for each subcircuit and add any additional notes or modifications. Let me know if you need further assistance!