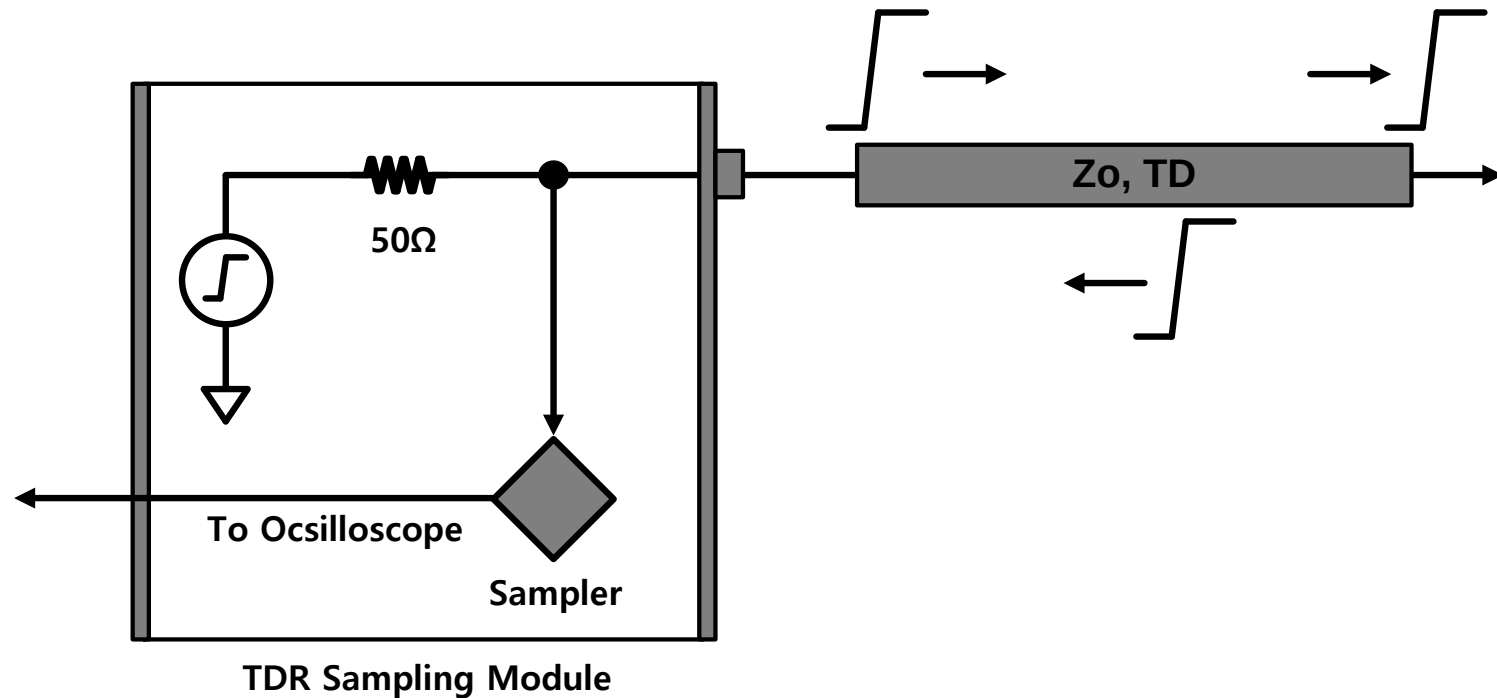


High-Speed Serial Interface Circuits and Systems

Design Exercise 7 – Time-Domain Reflectometer

TDR (Time-Domain Reflectometer)



- Pulse generator produces step input with very large period.
- Scope measures the pulse shape.
- Analysis of transmission line characteristic.

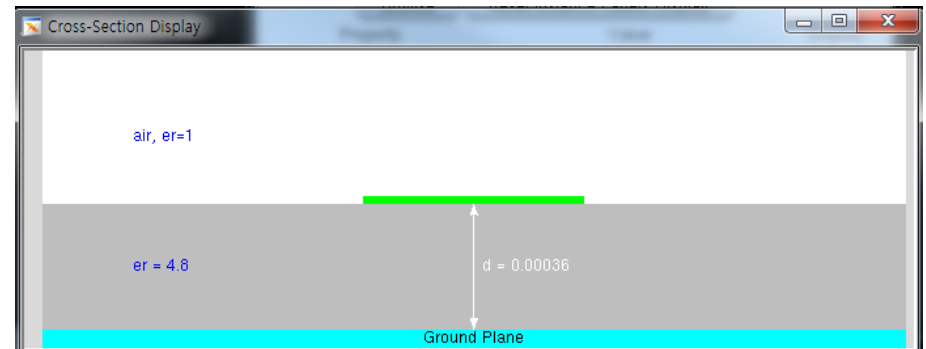
mtline Setting

● mtline setting

– Micro-stripe transmission line type

Num of lines (excluding ref.)	1	off
Model name		off
Physical length	150m M	off
Multiplicity factor	1	off
Max signal frequency		off
Type of Input	FieldSolver	off
Generate noise?	no	off
Transmission line type	microstrip	off
Model type	wideband	off
Rel dielectric const of layers(er)	4.8	off
Dielectric layer thickness (d)	360u	off
Signal line width	625u	off
Signal line thickness	17.78u	off

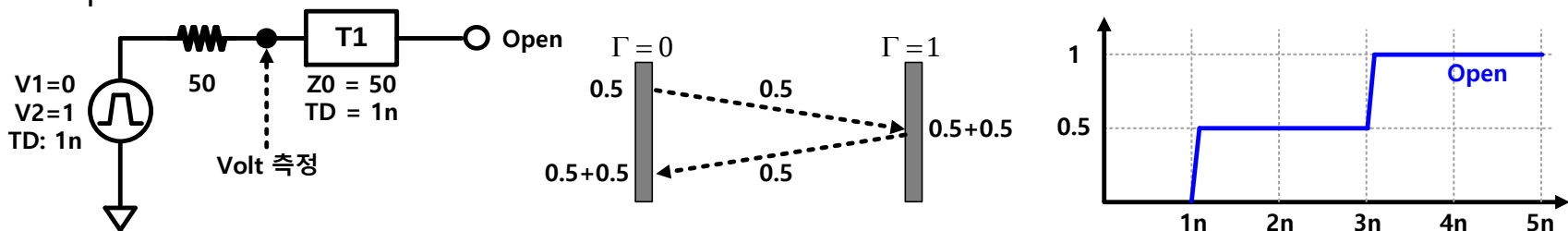
- Physical length: 0.15m → ~1n delay
- Type of Input : FieldSolver
- Transmission line type : microstrip
- Model type : wideband
- Real dielectric const of layers : 4.8 (FR4)
- Dielectric layer thickness : 360u (H)
- Signal line width : 625u (W)
- Signal line thickness : 17.78u (T)
- Display Cross-section



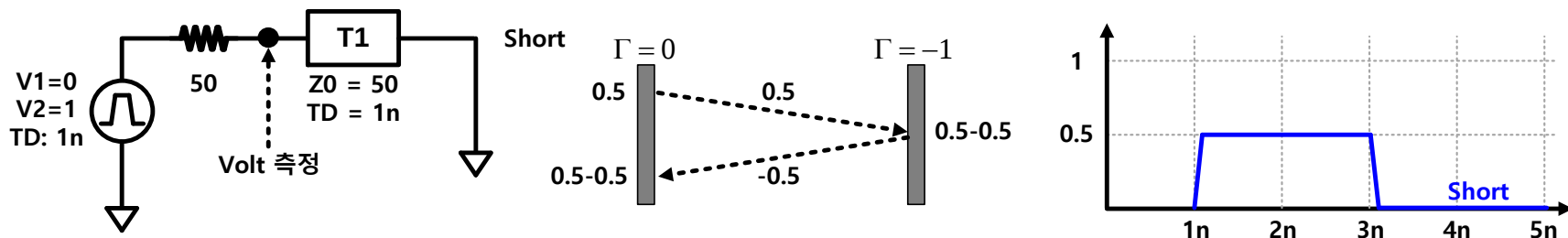
TDR Load Condition 1

- TDR application : resistor load

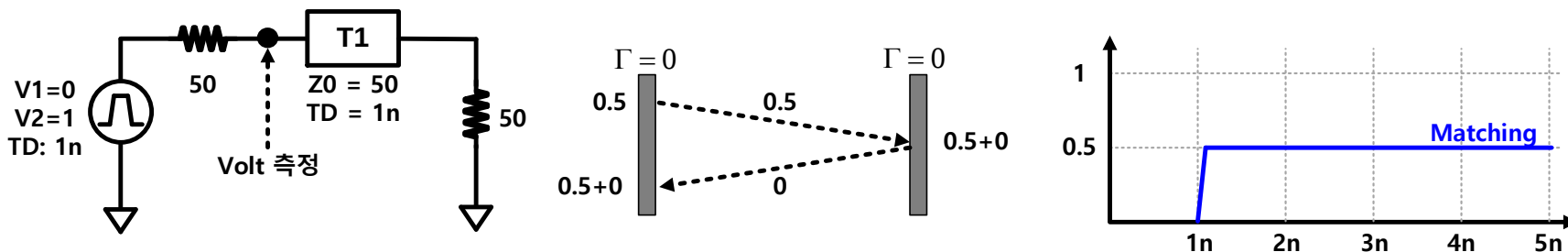
- Open



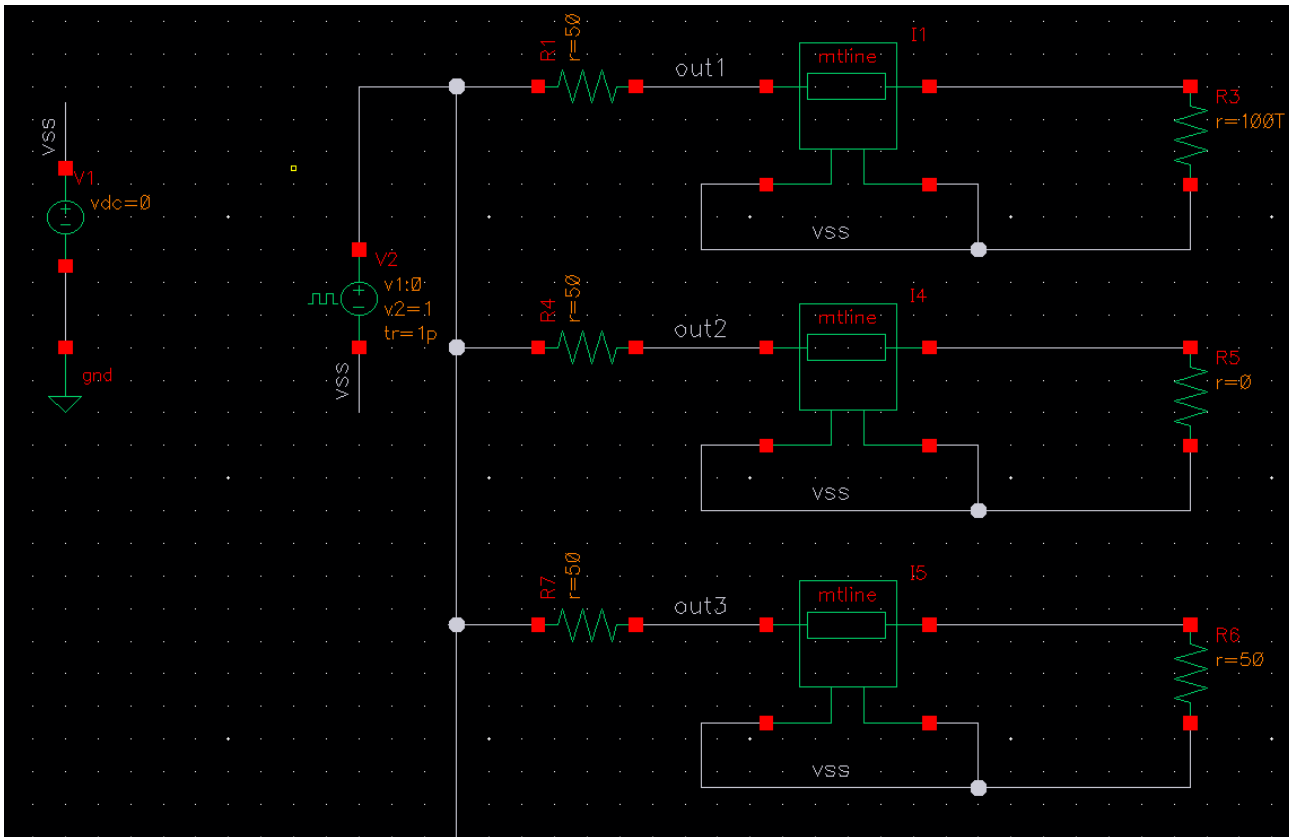
- Short



- Matching



TDR Load Condition 1



- V-pulse setting
 - Voltage1 : 0V
 - Voltage2 : 1V
 - Period : 10n
 - Delay: 1n
 - Rise time : 1p
 - Fall time : 1p
 - Pulse width : 5n

Voltage 1	0 V
Voltage 2	1 V
Period	10n s
Delay time	1n s
Rise time	1.0p s
Fall time	1.0p s
Pulse width	5n s

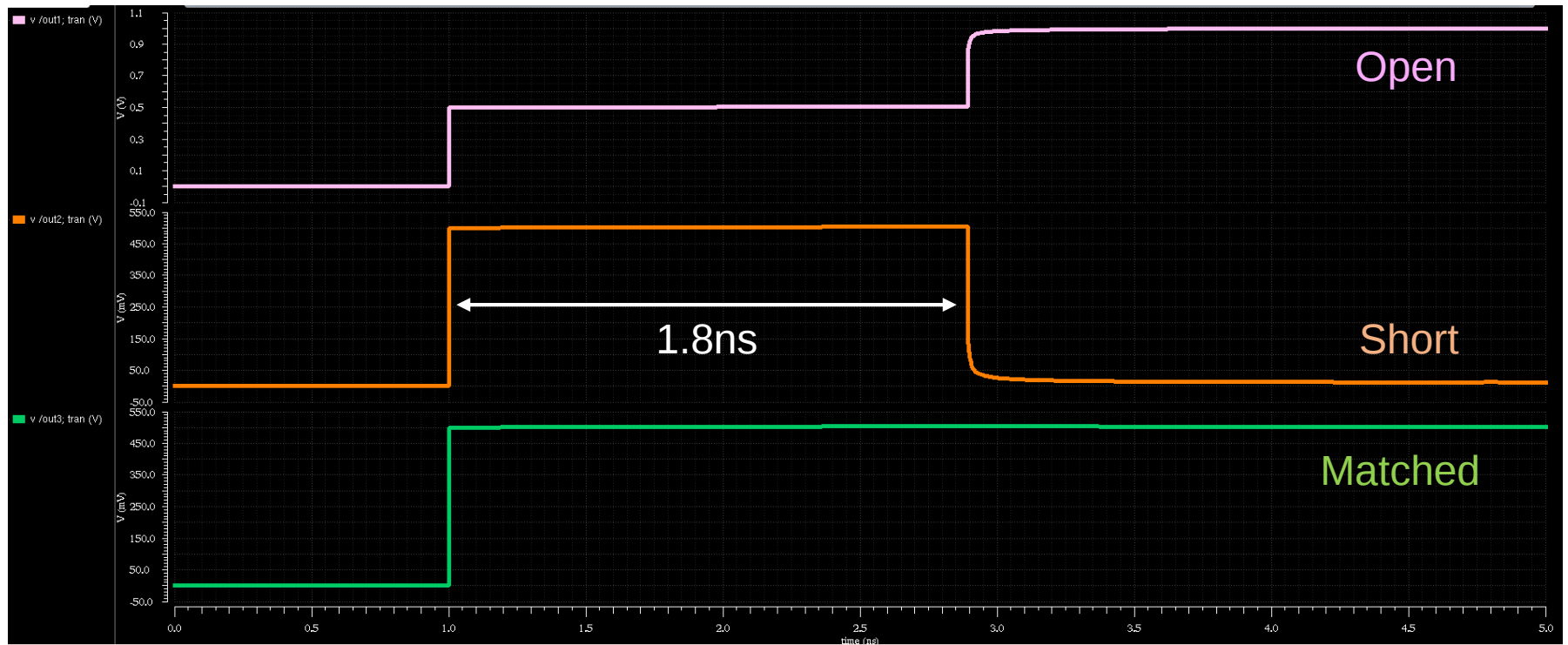
- Simulation setting

- Trans
- 5n

Analyses		
Type	Enable	Arguments
1 tran	☒	0 5n

TDR Load Condition 1

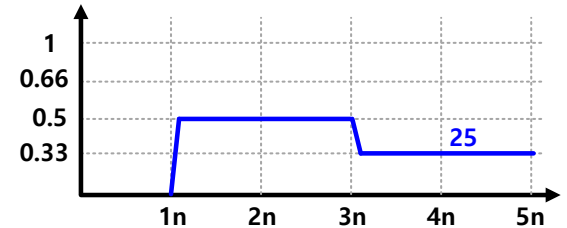
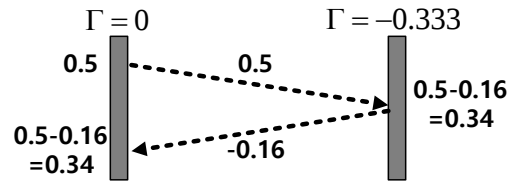
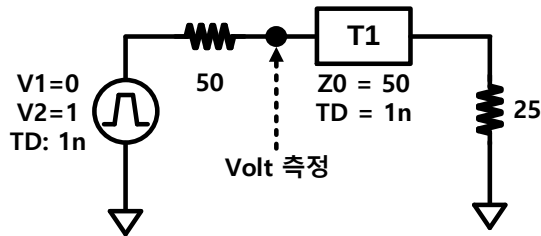
Simulation result



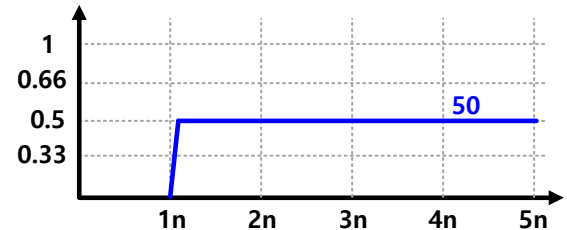
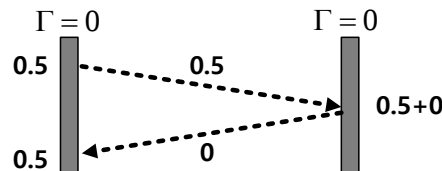
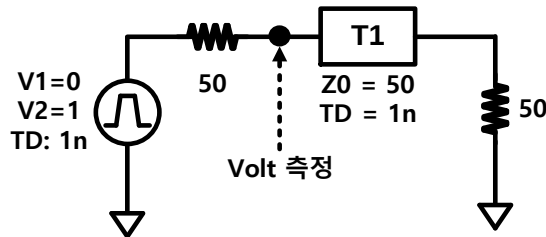
TDR Load Condition 2

TDR application : resistor load

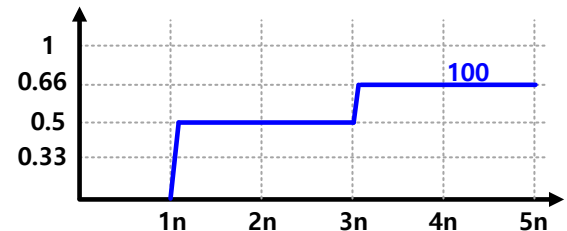
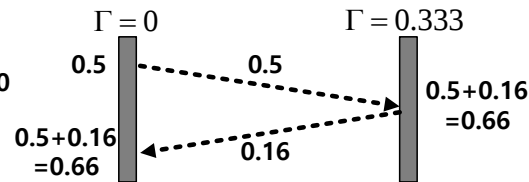
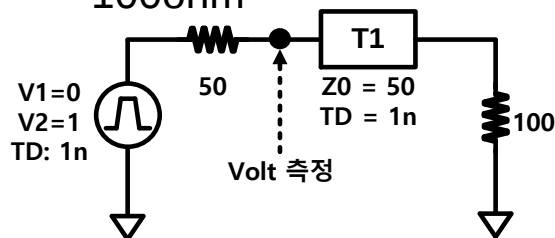
– 25ohm



– 50ohm



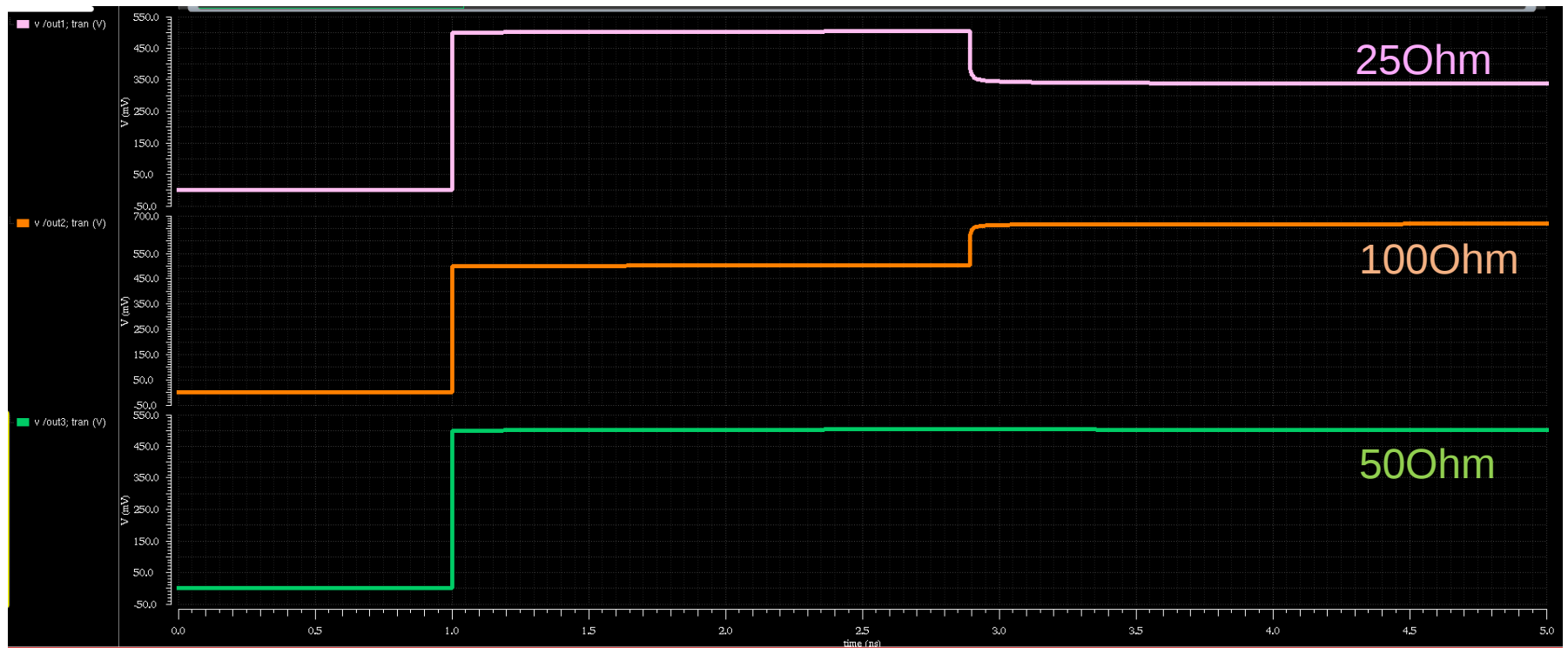
– 100ohm



TDR Load Condition 2



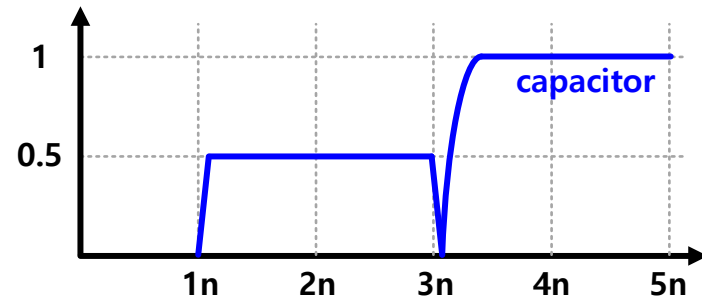
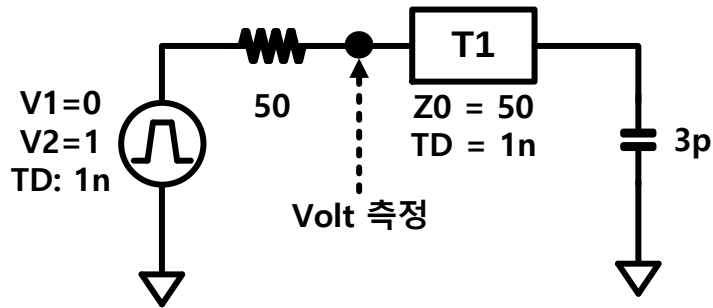
Simulation result



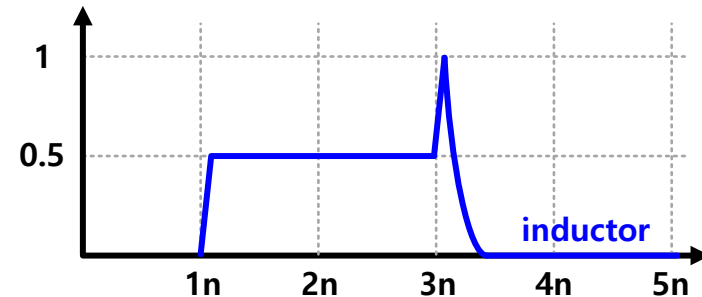
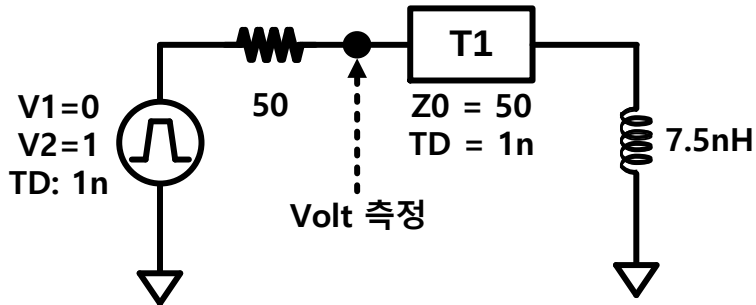
TDR Load Condition 3

● TDR application : capacitive & inductive load

– Capacitive load



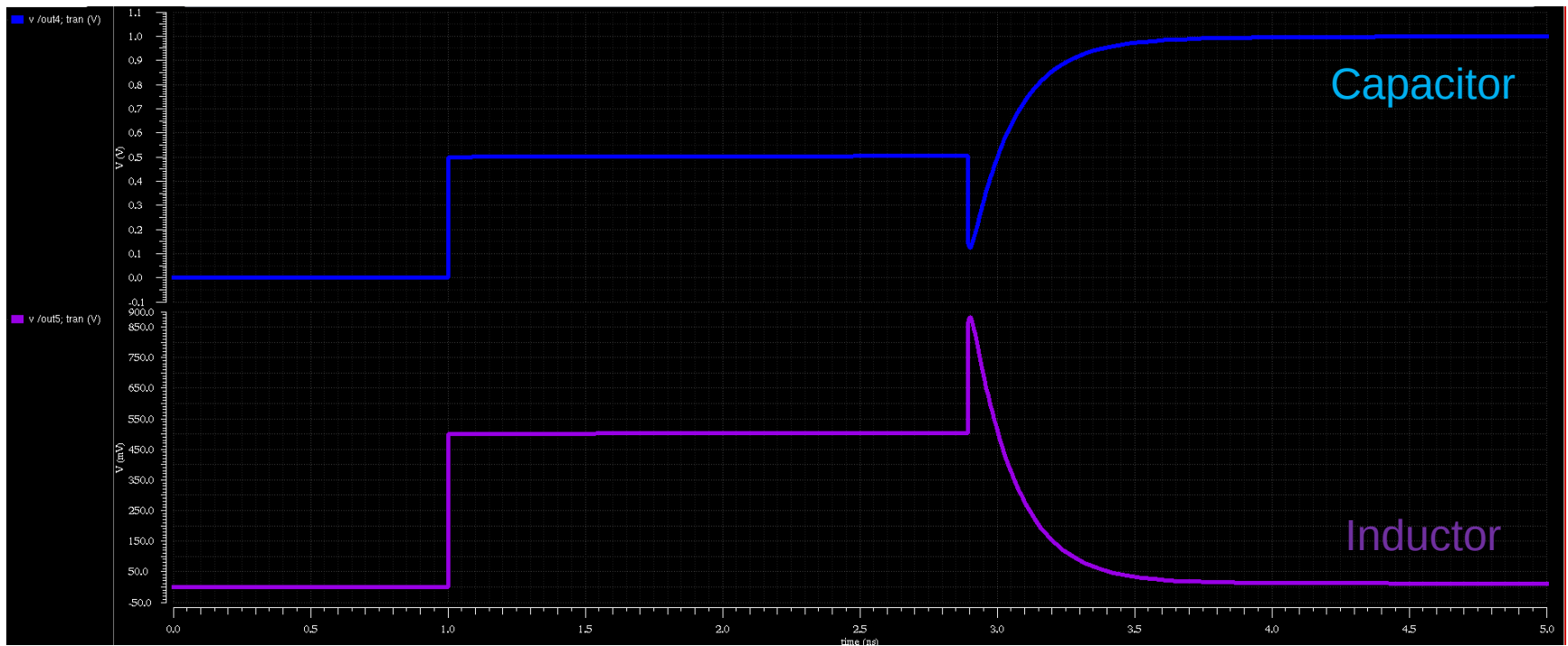
– Inductive load



TDR Load Condition 3



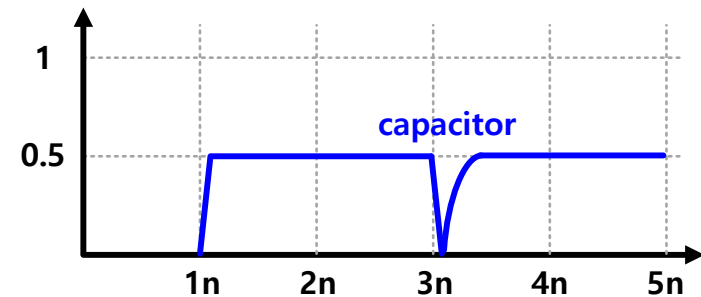
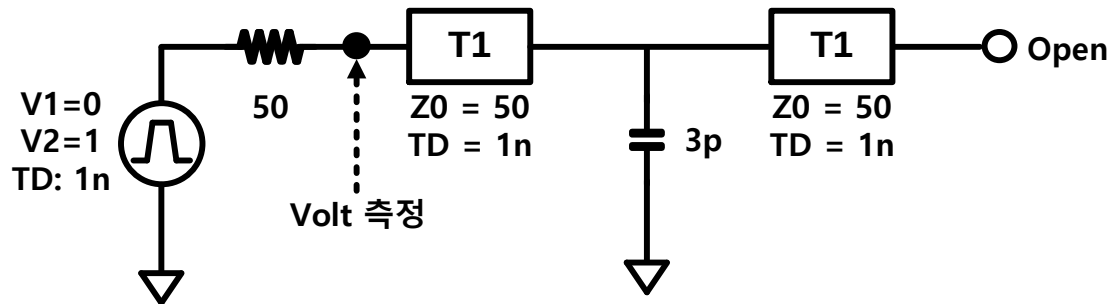
Simulation result



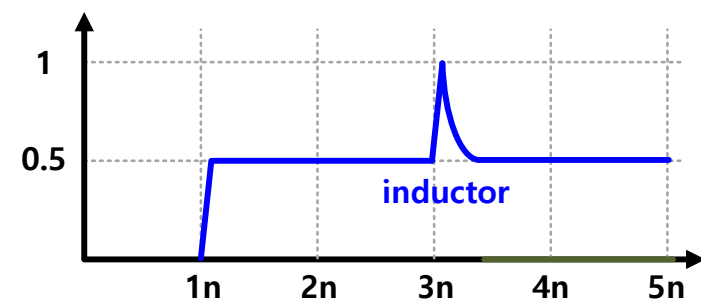
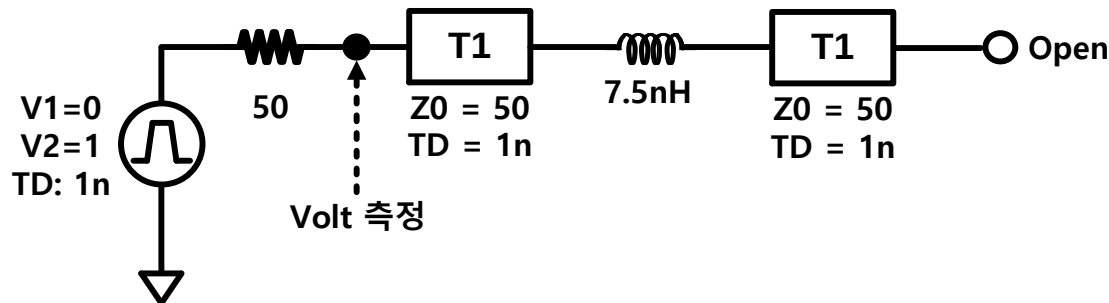
TDR Discontinuity

TDR application : capacitive & inductive discontinuity

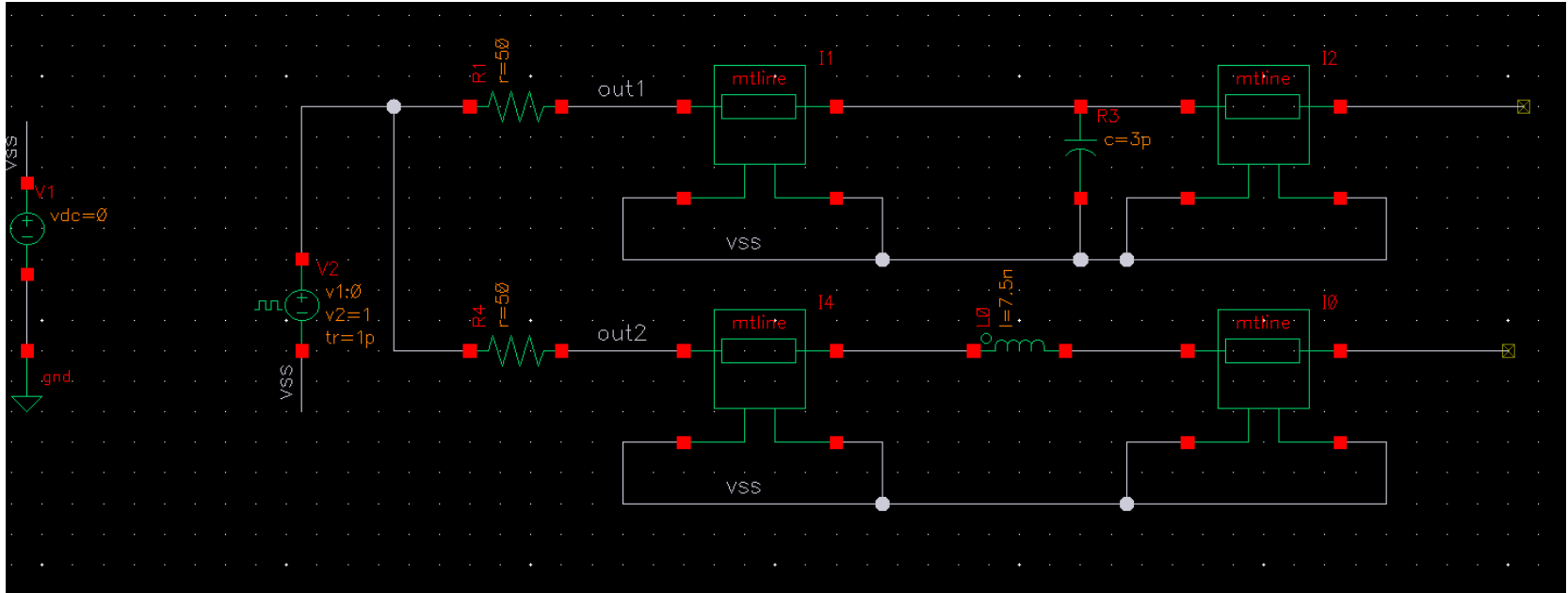
– Capacitive discontinuity



– Inductive discontinuity



TDR Discontinuity

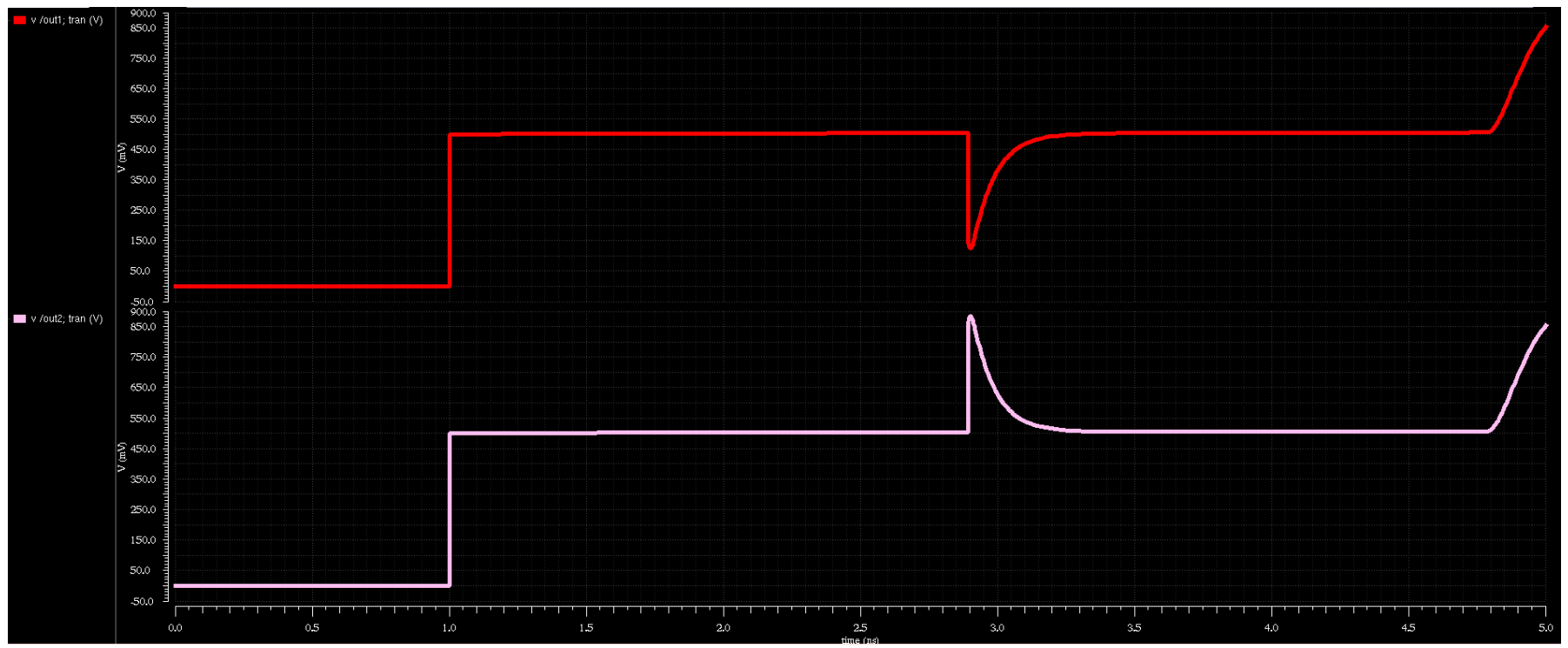


- V-pulse setting
 - Voltage1 : 0V
 - Voltage2 : 1V
 - Delay: 1n
 - Period : 10n
 - Rise time : 1p
 - Fall time : 1p
 - Pulse width : 5n
- Simulation setting
 - Trans
 - 5n
 - Conservative

TDR Discontinuity

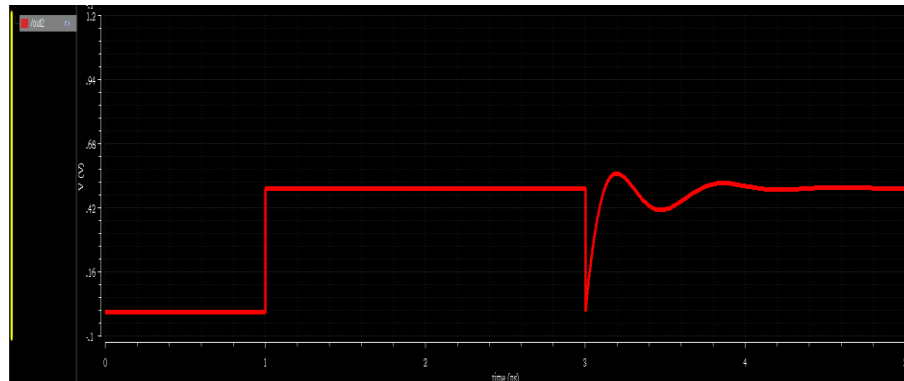
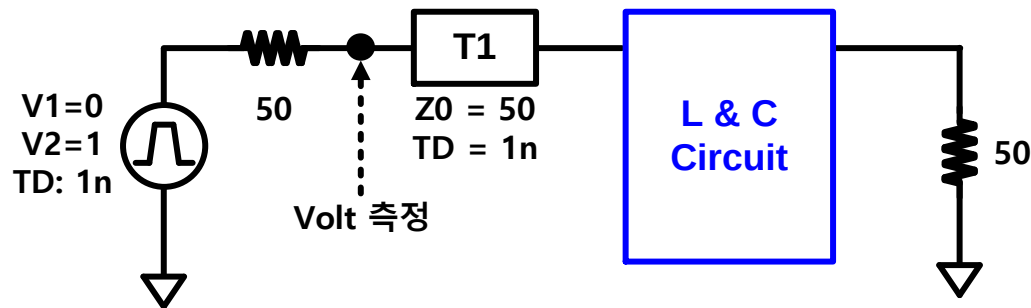


Simulation result



Homework 1

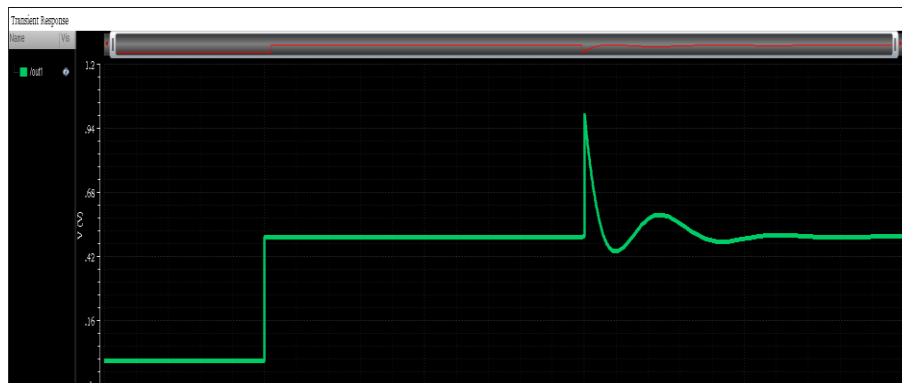
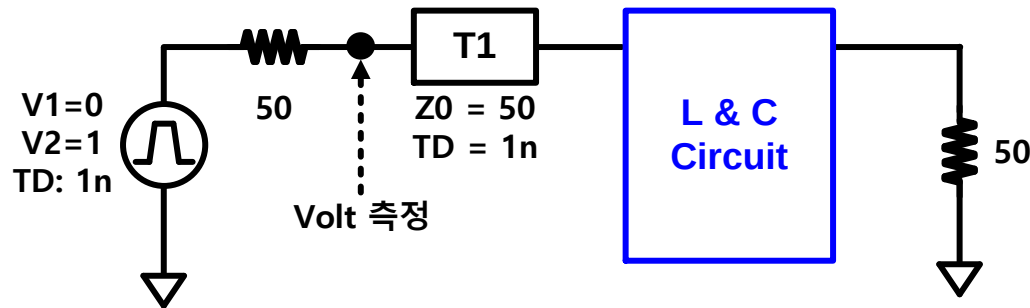
- TDR application : discontinuity
 - Derive L and C circuit from the given waveforms.



< TDR >

Homework 2

- TDR application : discontinuity
 - Derive L and C circuit from the given waveforms.



< TDR >