

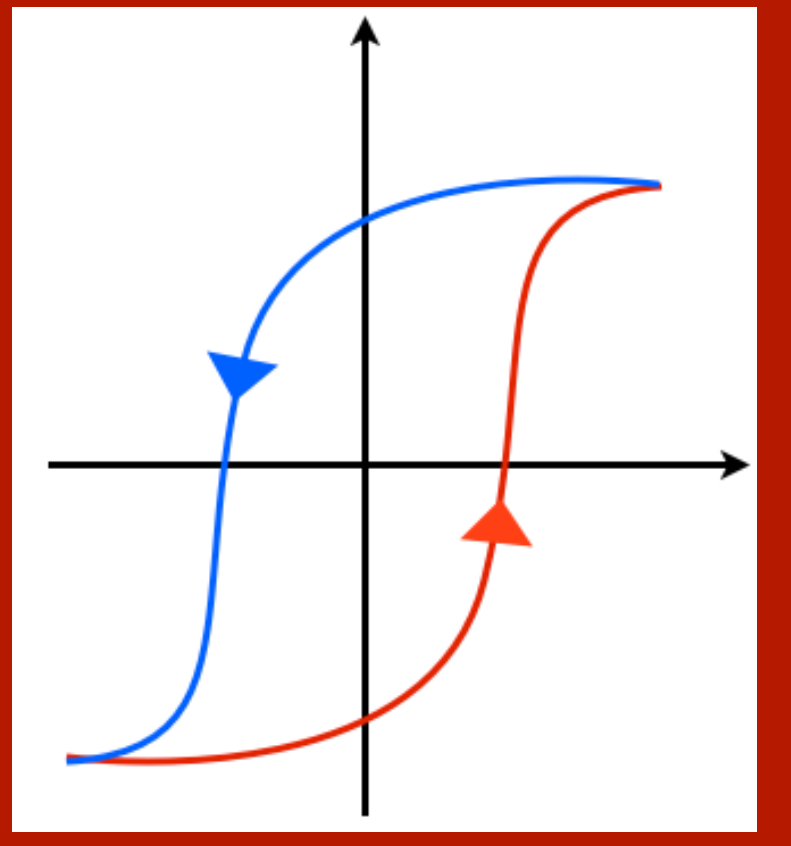
Single-Inductor Multi-Output DC-DC Converter Design With Hysteresis Control

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1. Introduce

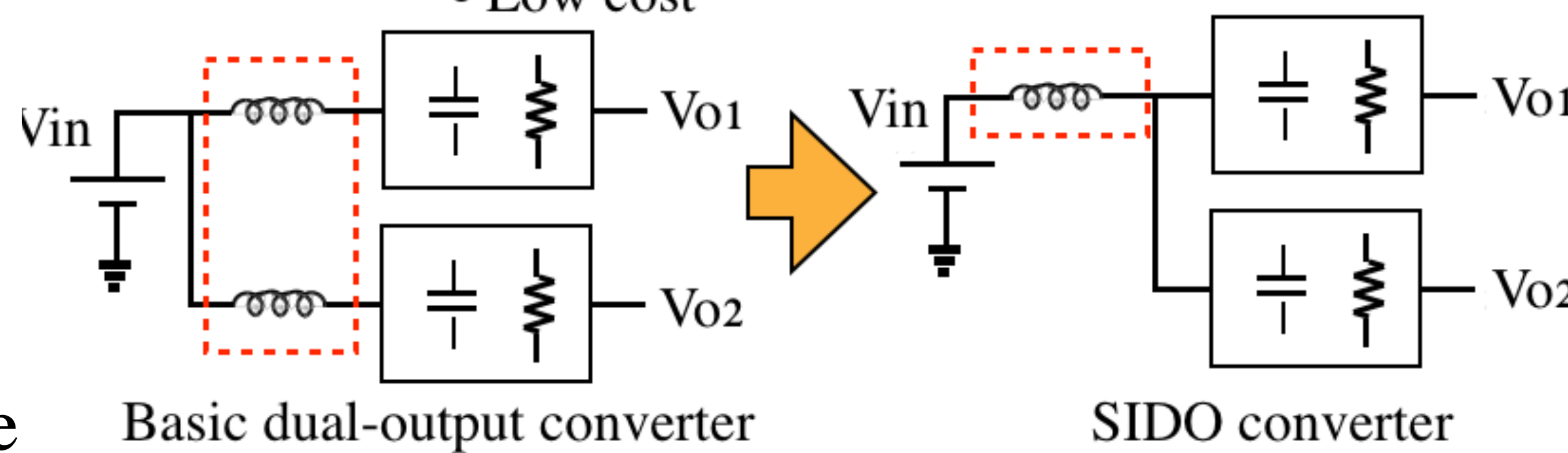
Objective

Apply hysteresis control to SIDO circuit

- Miniaturization of power supply circuit
- Fast response
- Good regulation performance

Merits of SIDO (Single-Inductor Dual-Output)

- Reduction of number of inductors
- Small size
- Low cost



Linear control
Voltage control
Current control

Nonlinear control
Hysteresis control (Ripple control)
Compact size

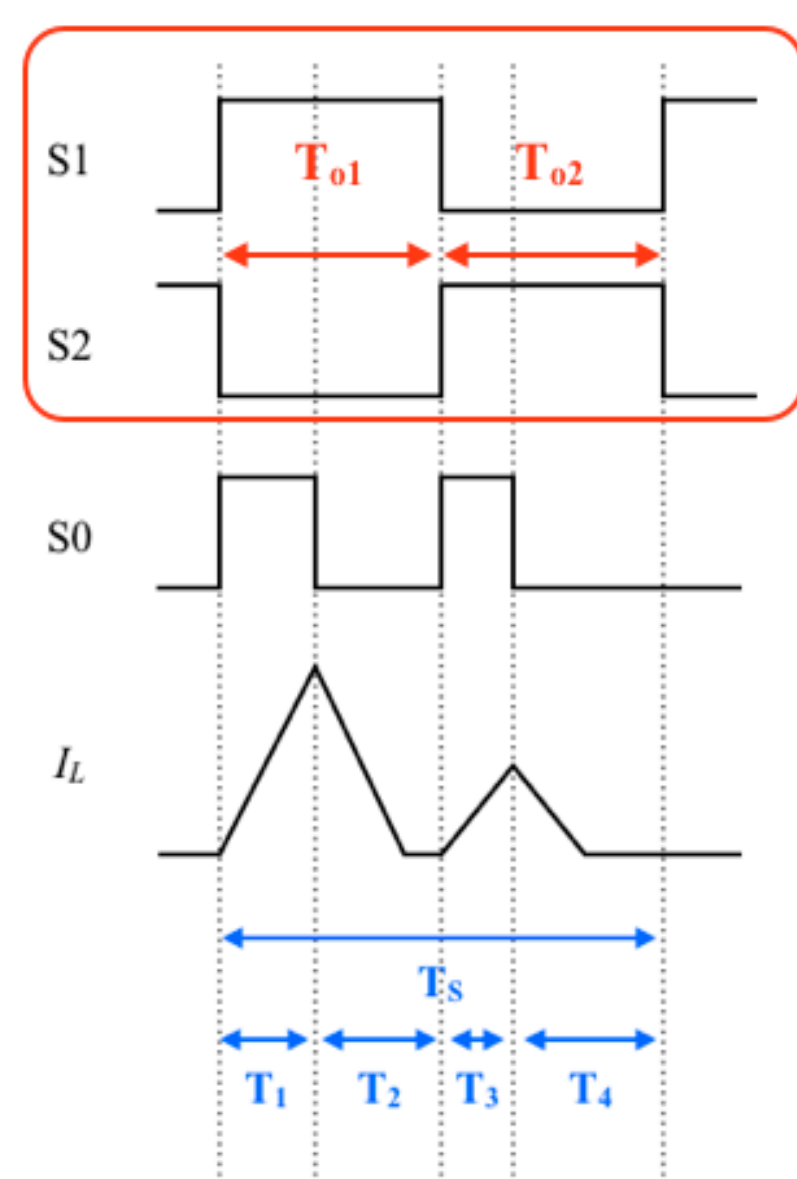
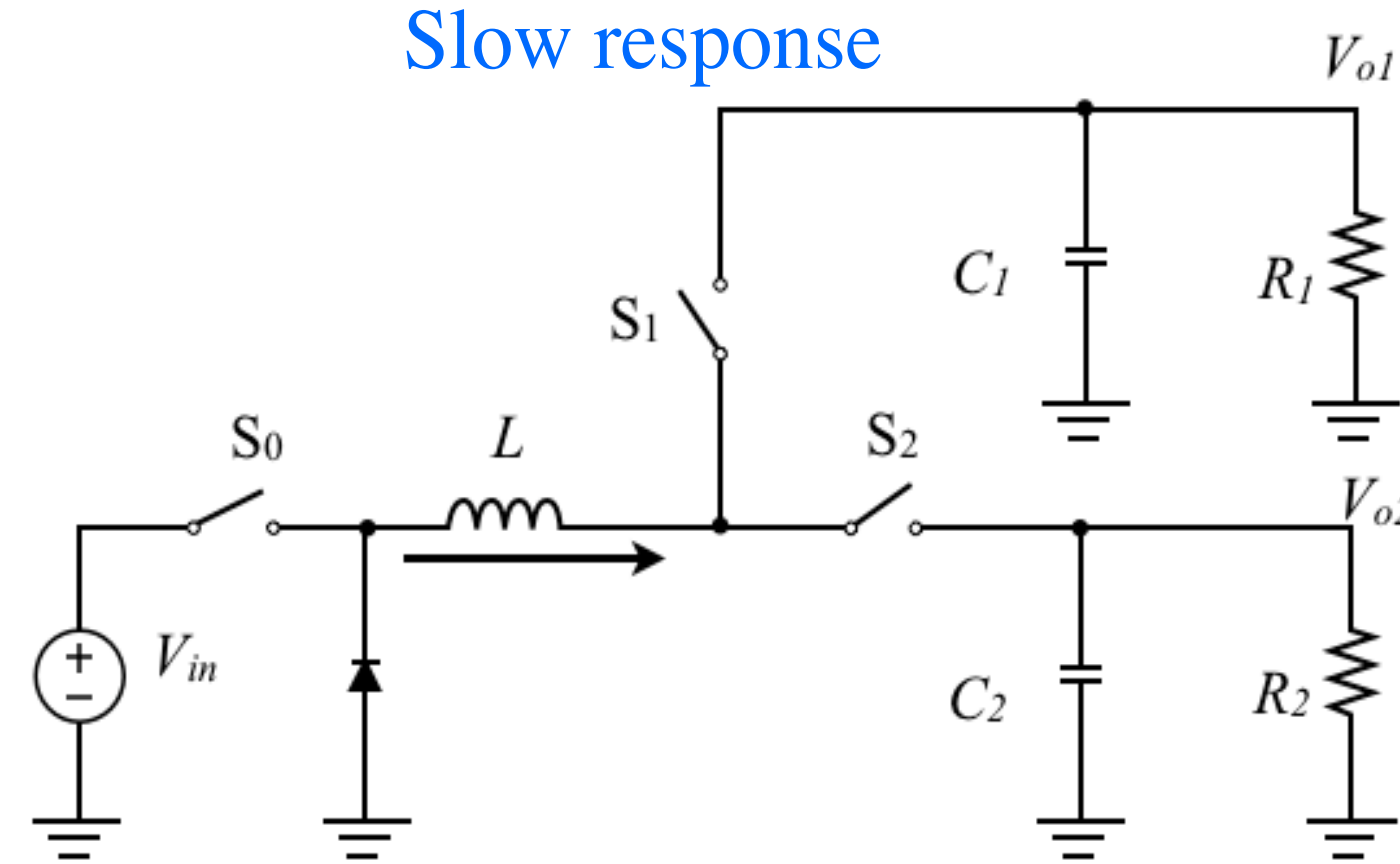
- Feature
- Compatible with high and low power
 - Fixed clock is necessary
 - Triangular wave is necessary
- Feature
- Fast response
 - Circuit is simple
 - Fixed clock is unnecessary
 - Triangular wave is unnecessary

2. Hysteresis SIDO Converter

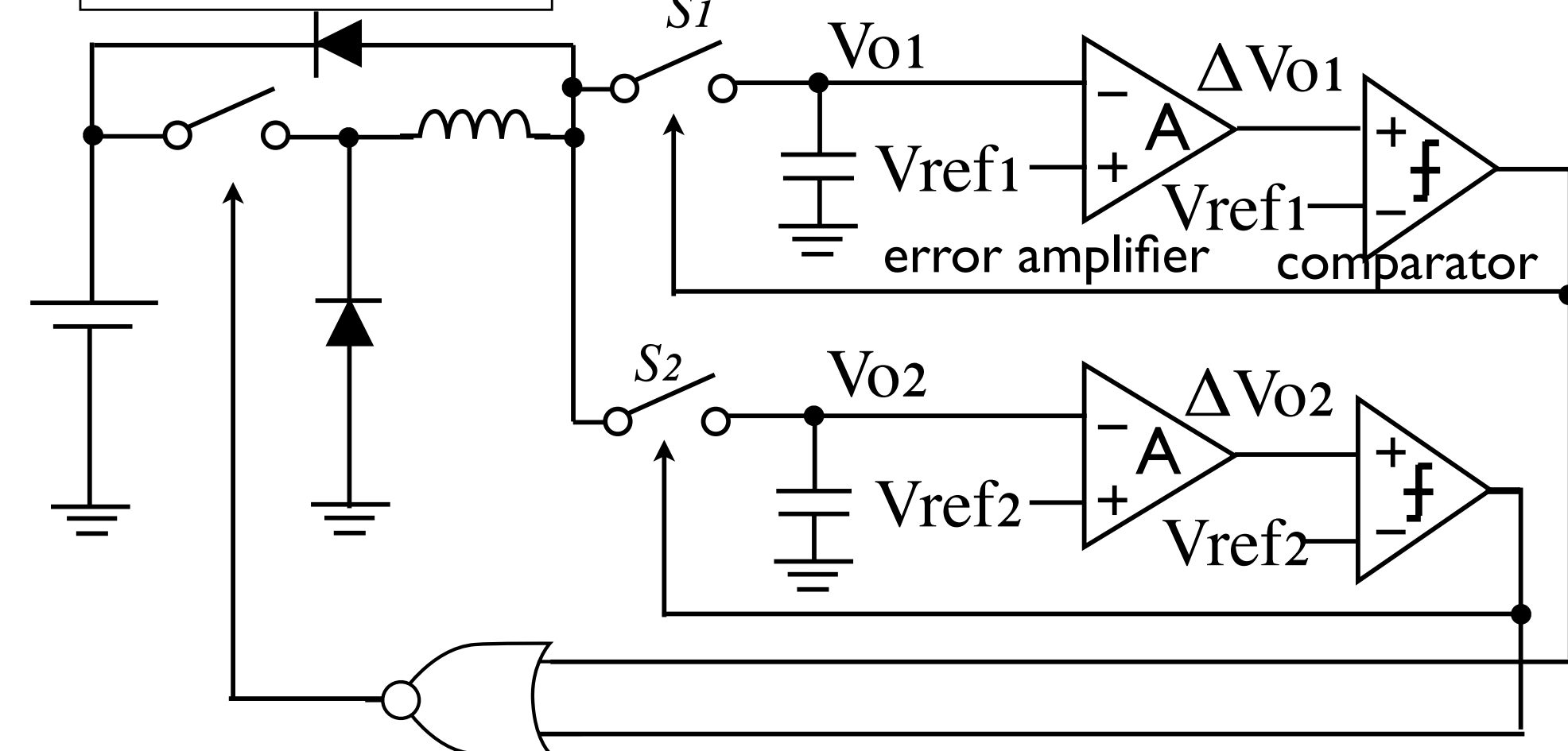
Problems of conventional circuit

Fixed operating frequency

Slow response

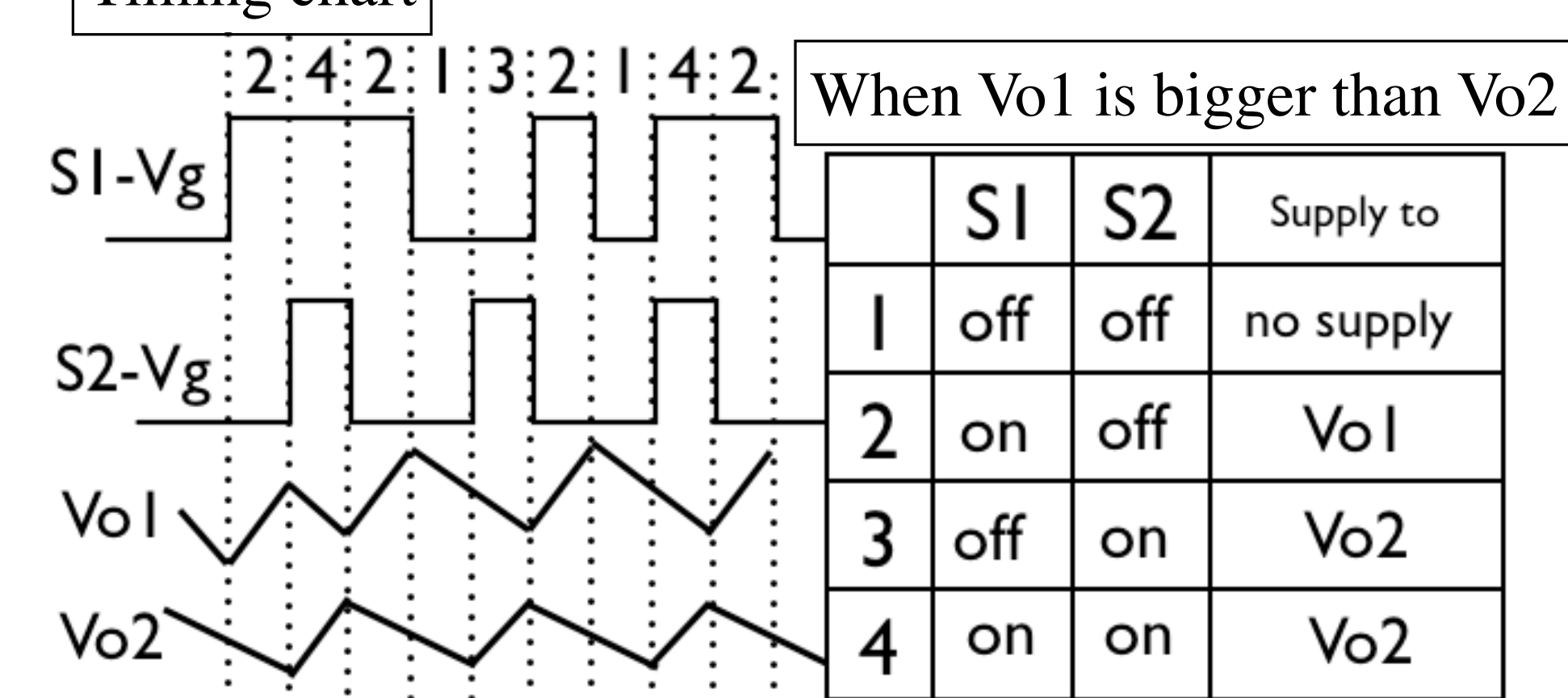


Proposed circuit



- Comparators directly control S1 and S2
- Variable operating frequency
- Quick response

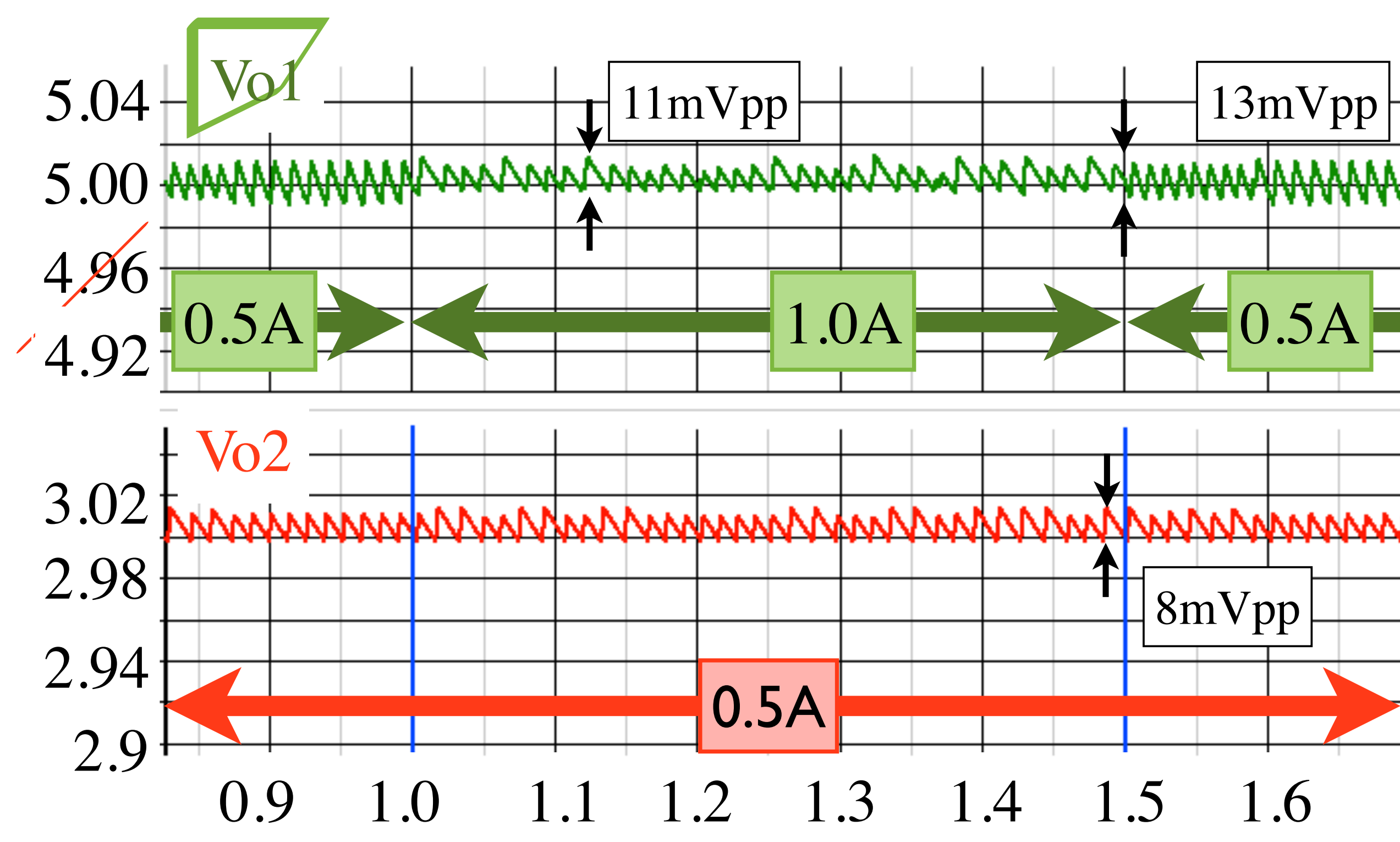
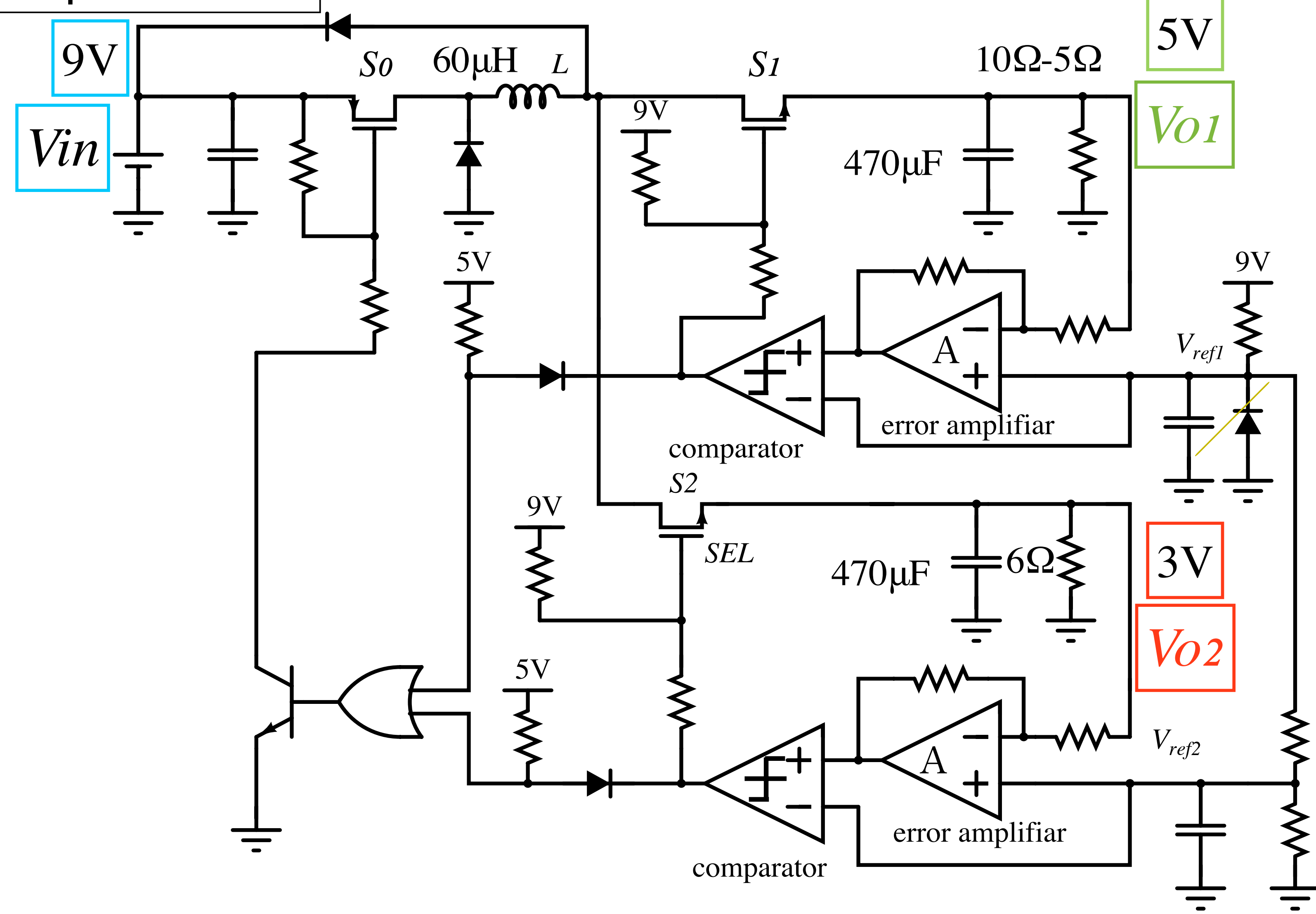
Timing chart



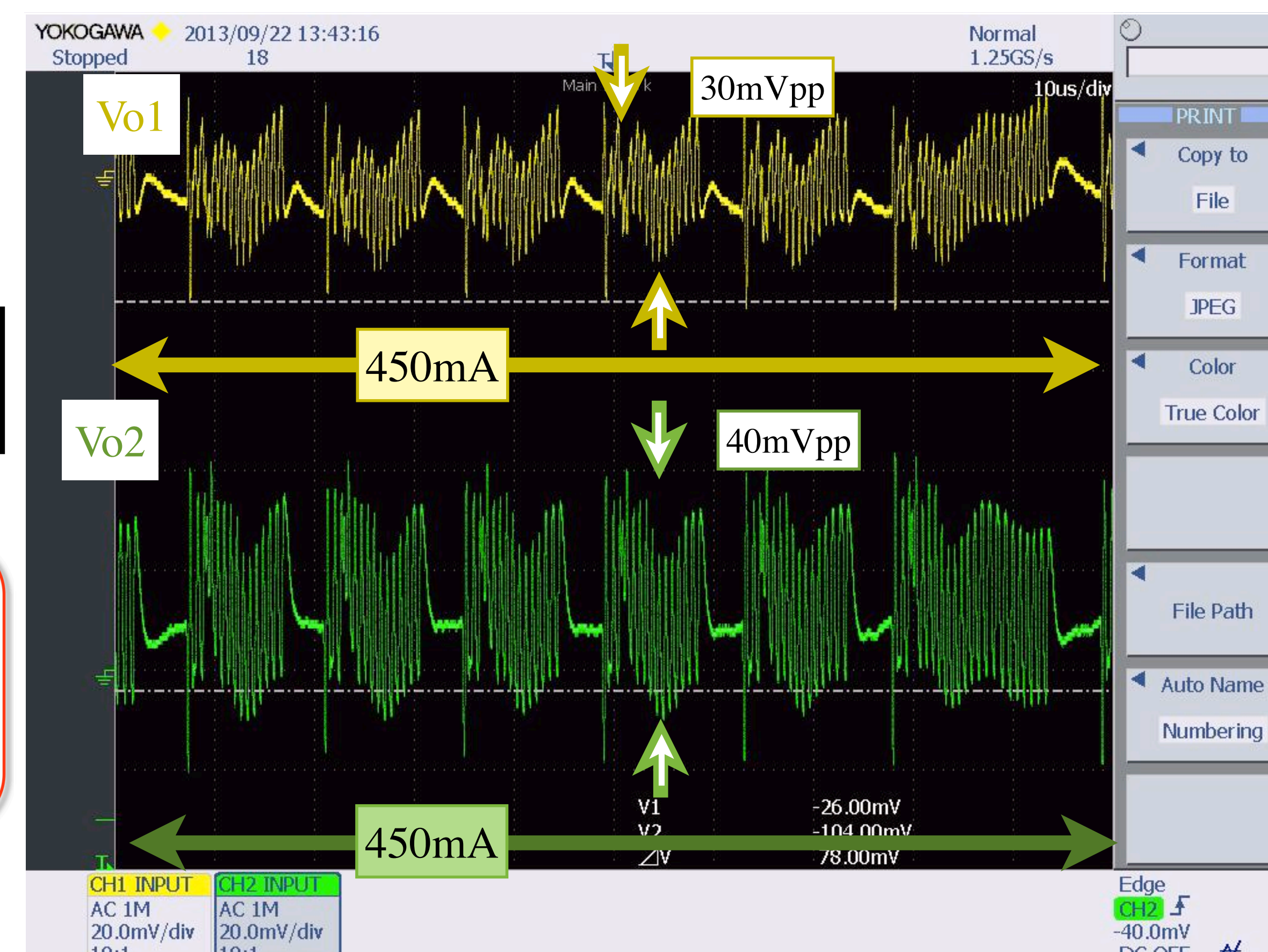
In mode 4 (S1, S2 are on), inductor current supplied to lower voltage terminal, Vo2.

3. Simulation Results

Proposed circuit



4. Experimental Results



5. Conclusion

Conclusion

Simulation result

- Output ripple of Vo1 and Vo2: less than 15mV.
- Self-regulation and cross regulation: 13mV, very good regulation performance.

Experimental result

- Output ripple of Vo1: 30mV.
- Output ripple of Vo2: 40mV.

Future work

- Noise reduction with printed-circuit board
- Application of this control to multi-output
- Control circuit development to supply additional current to the output terminal with larger error