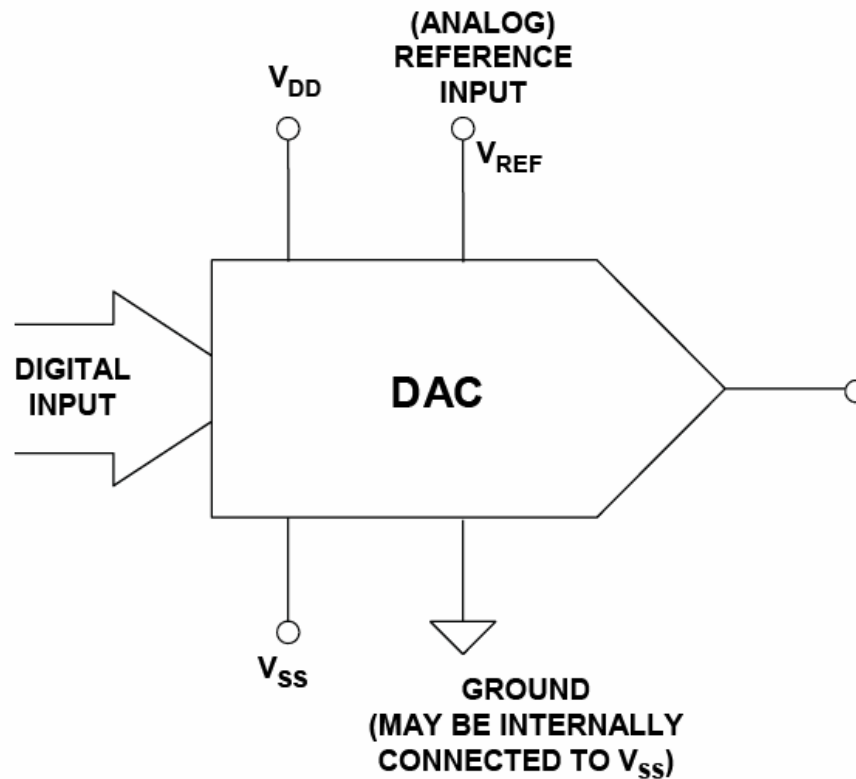


Digital to Analog Converters

Lecturer: Krébesz, Tamás

Digital to analog converter (DAC)

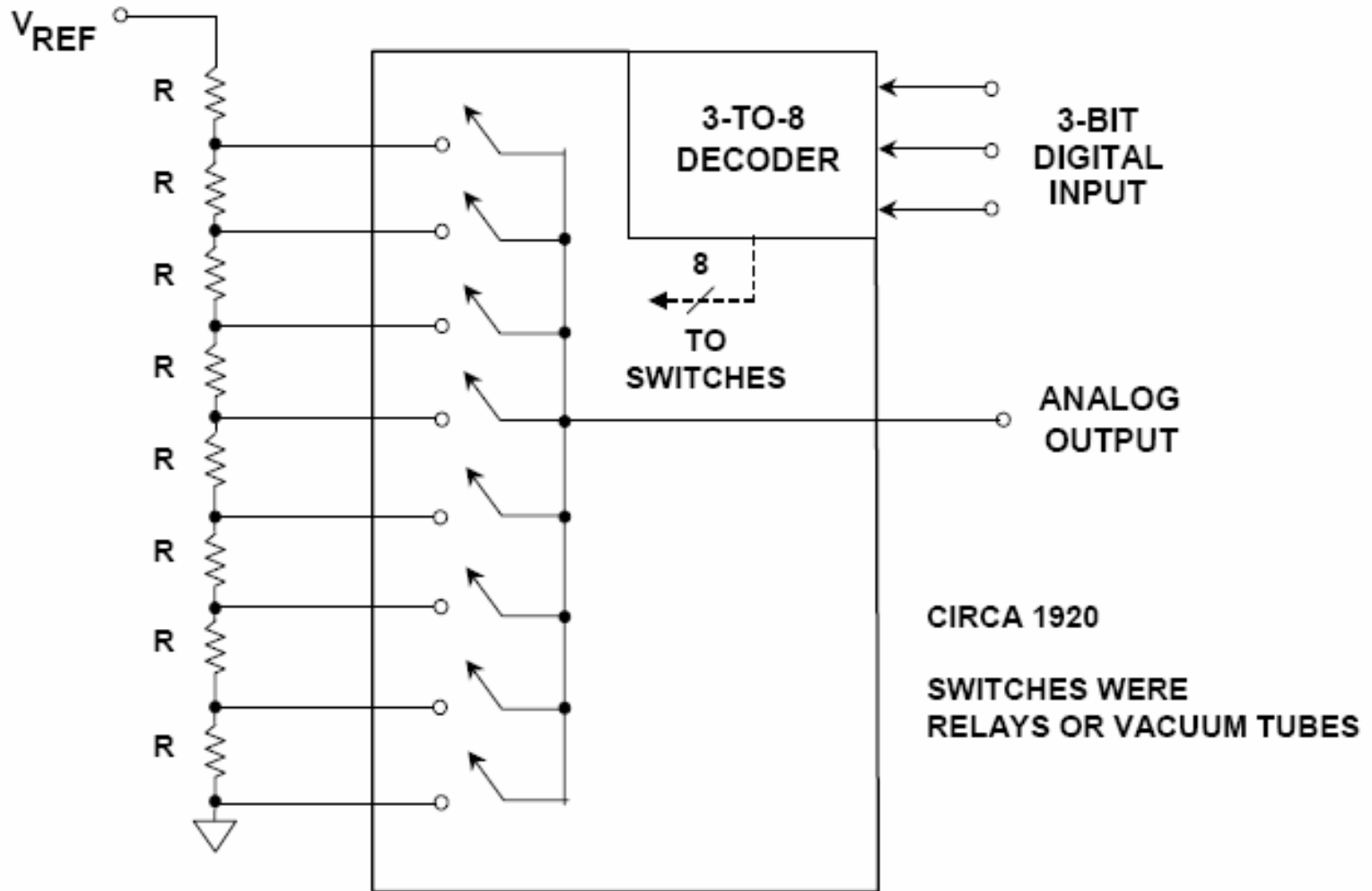
- Idea



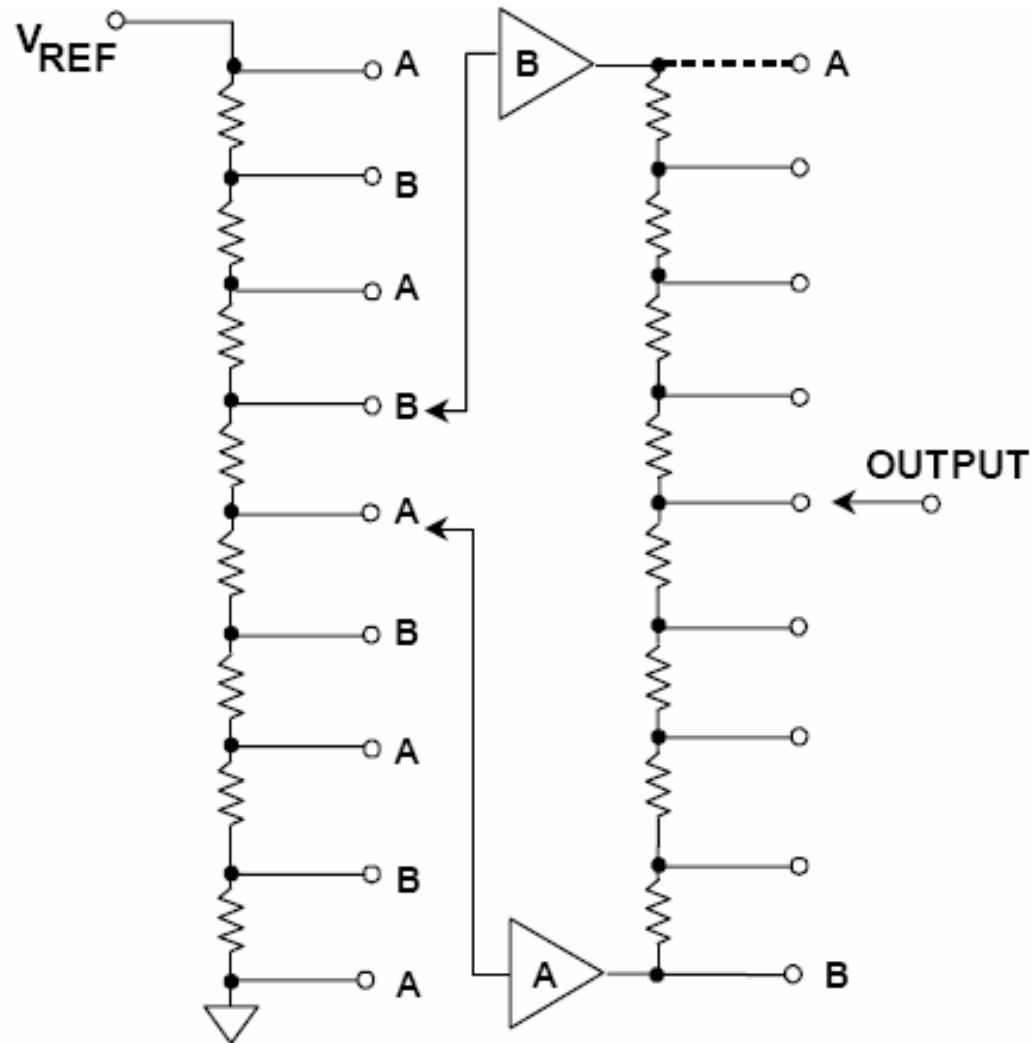
Kelvin divider (string DAC)

- Simplest voltage output DAC
 - Number of resistances: 2^N
 - Number of switches: 2^N
 - Output impedance is code dependent
 - Monoton
 - Small code change transient (glitch)

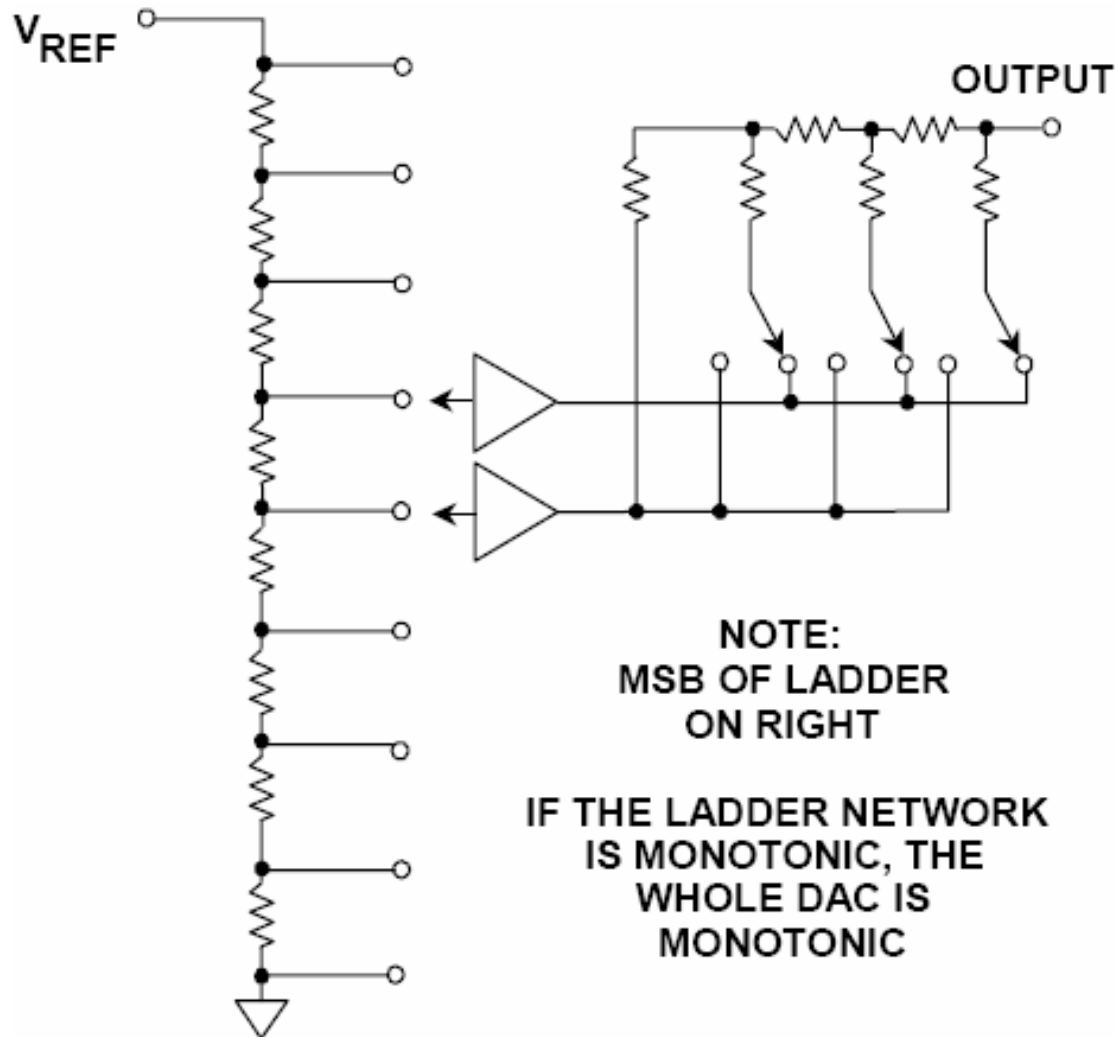
- Block diagram of Kelvin divider



- Segmented Kelvin divider

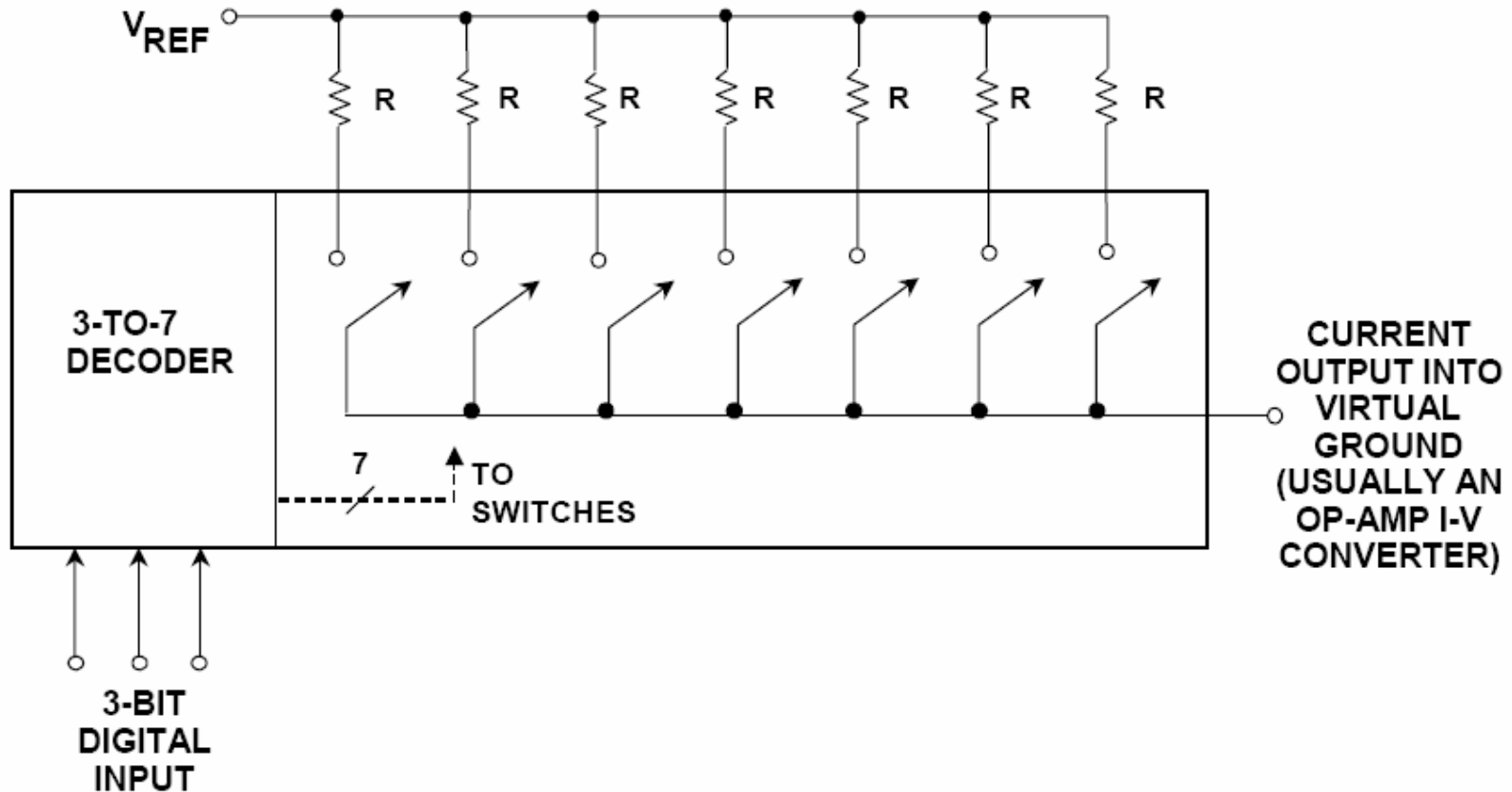


- Kelvin divider and R-2R ladder network

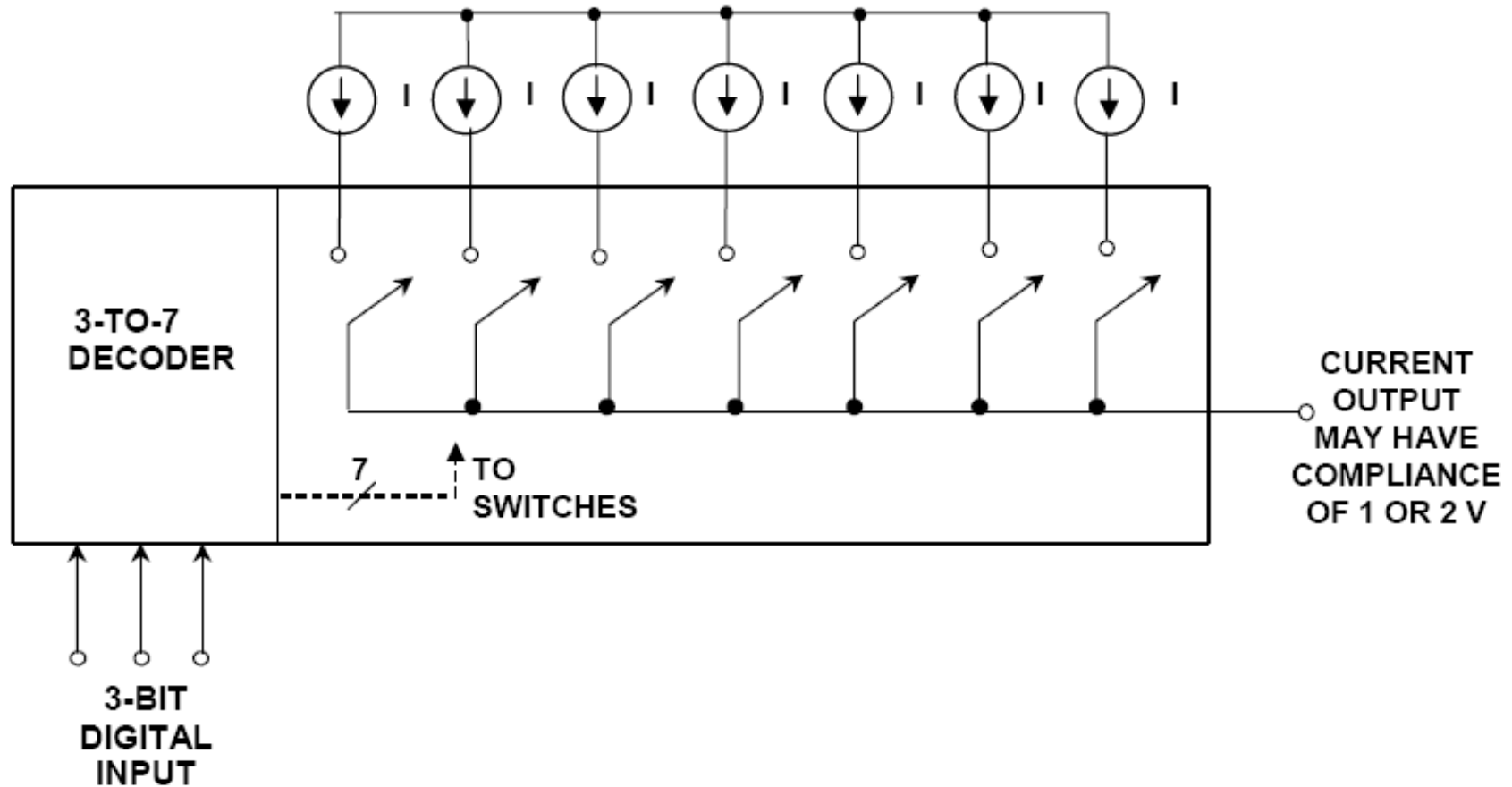


Current output DAC

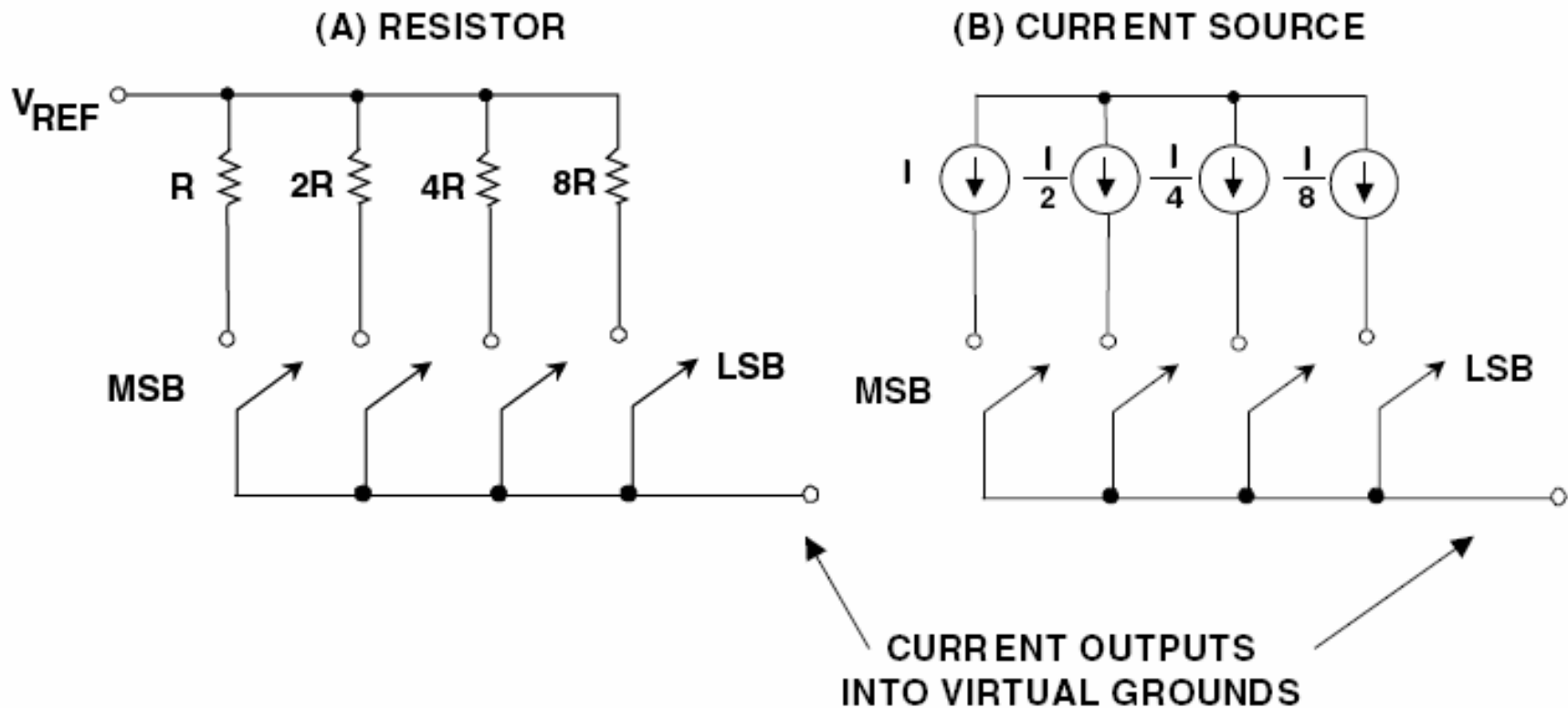
- Simplest case:



- Current output DAC with current sources

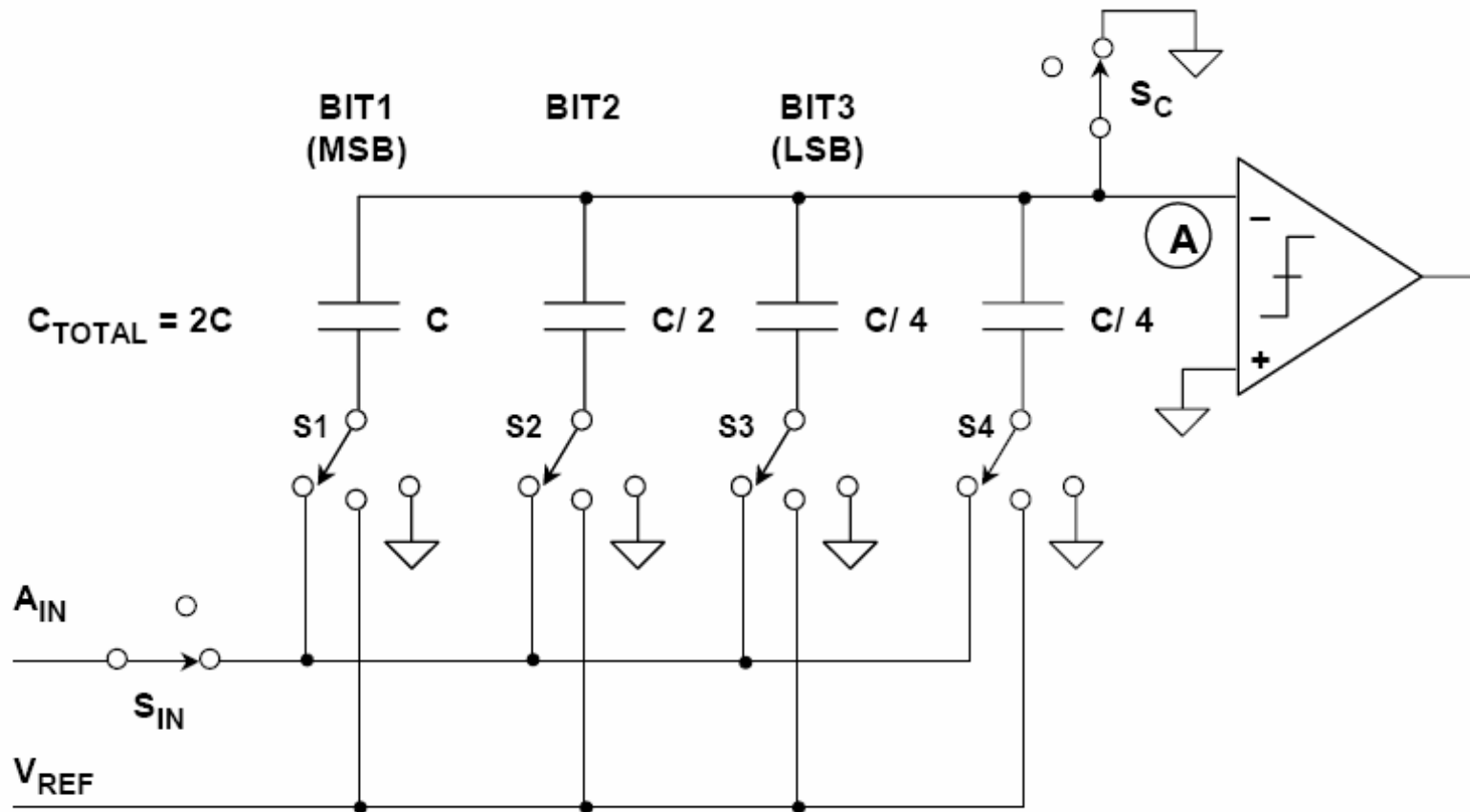


- Binary weighted current output DAC



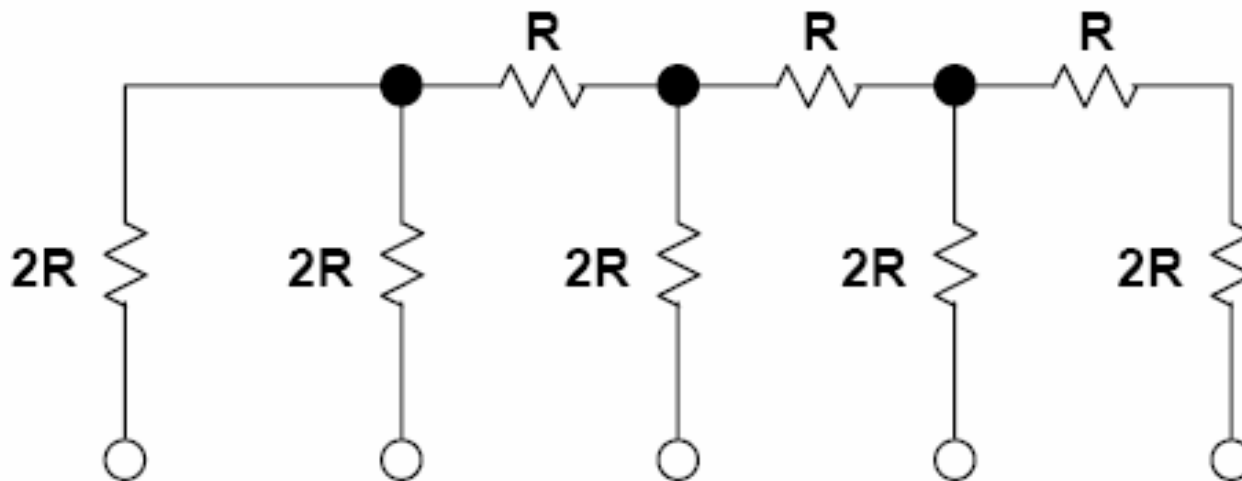
- Note:
difficult to fabricate on IC due to large resistors or current ratios for high resolutions

- Remember:

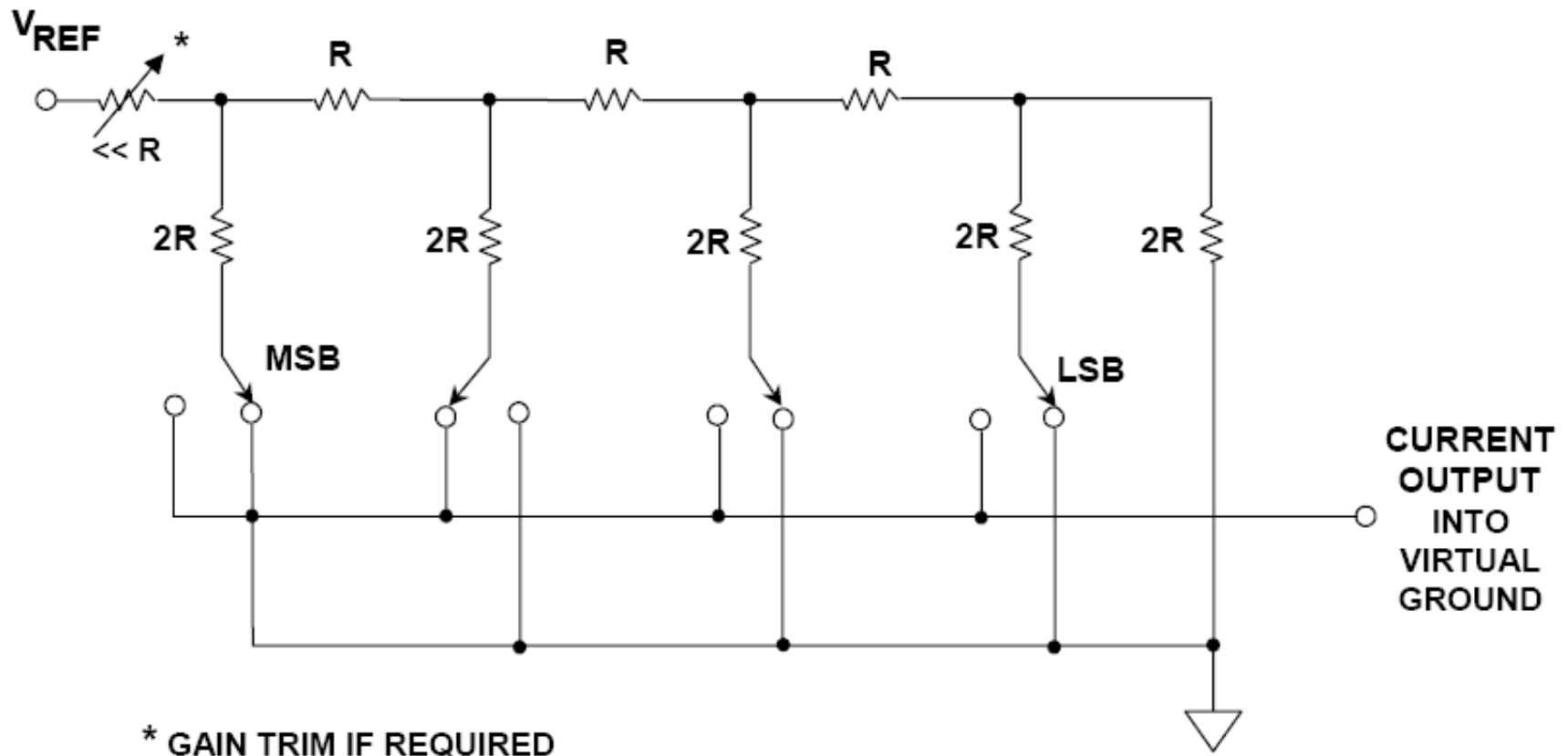


R-2R ladder network

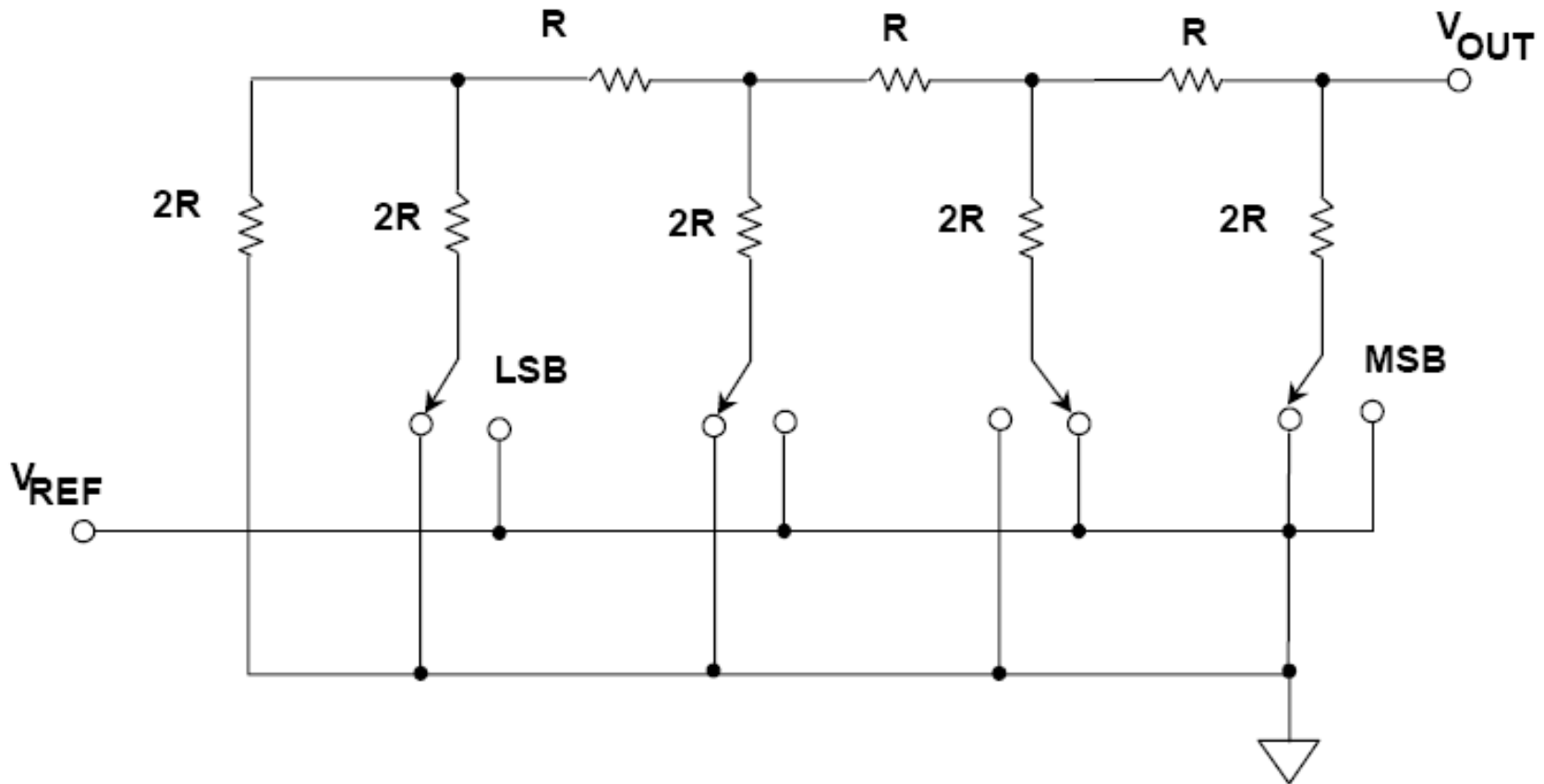
- One of the most common DAC building-block structure



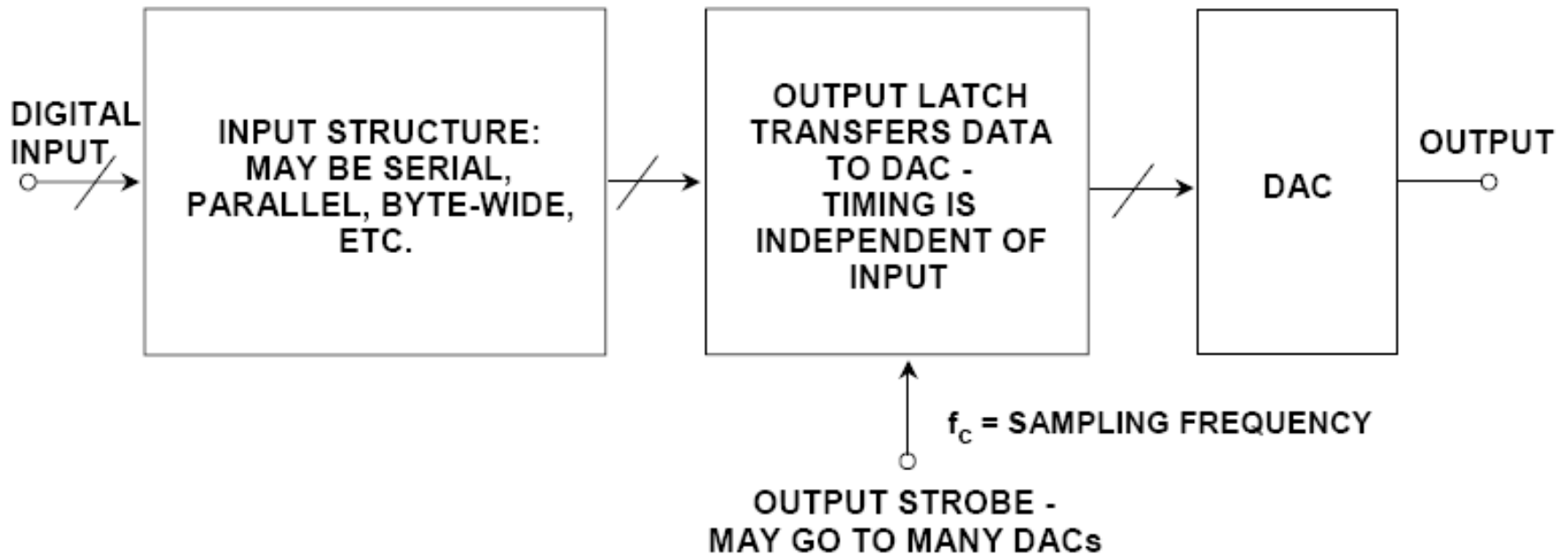
- Current output



- Voltage output



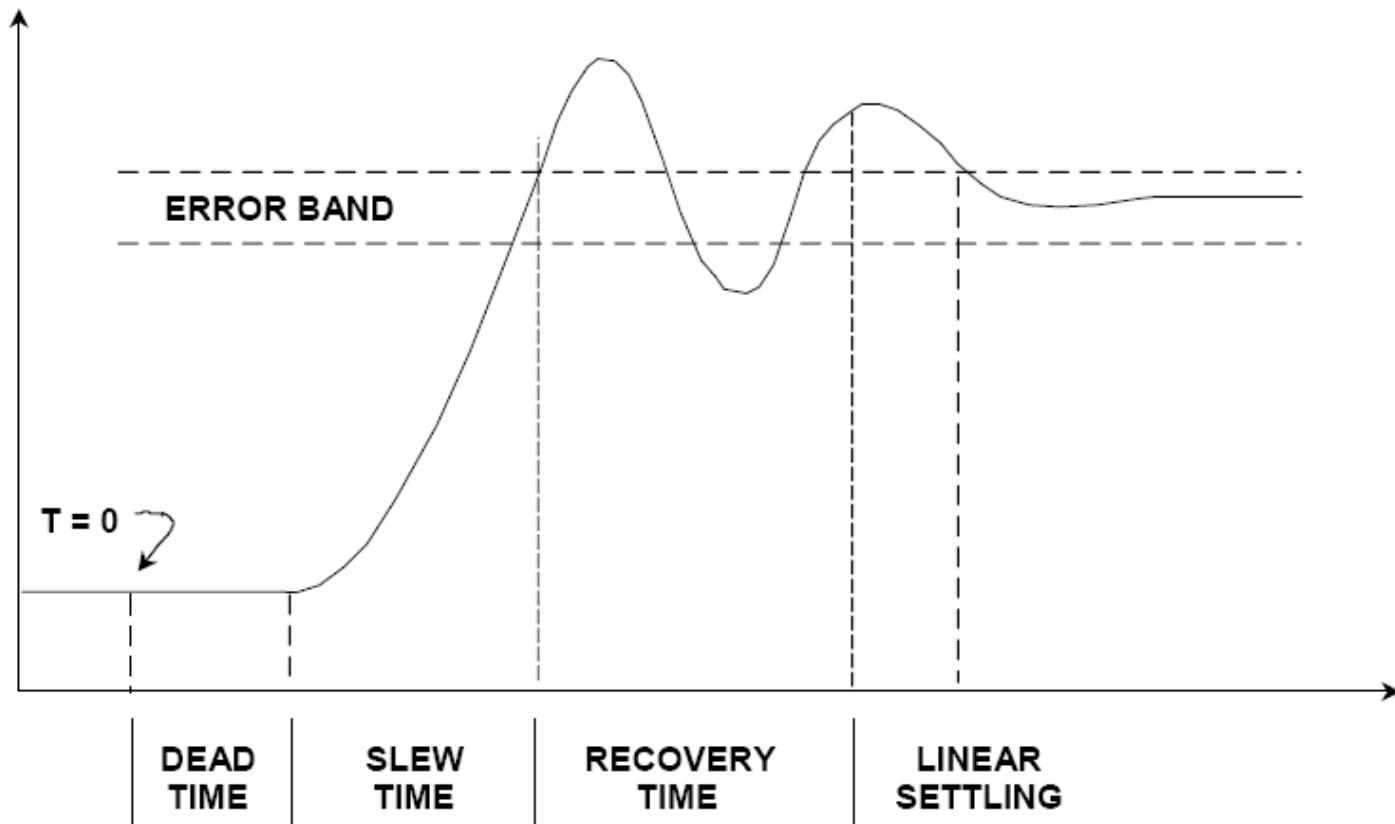
Double buffering in DAC



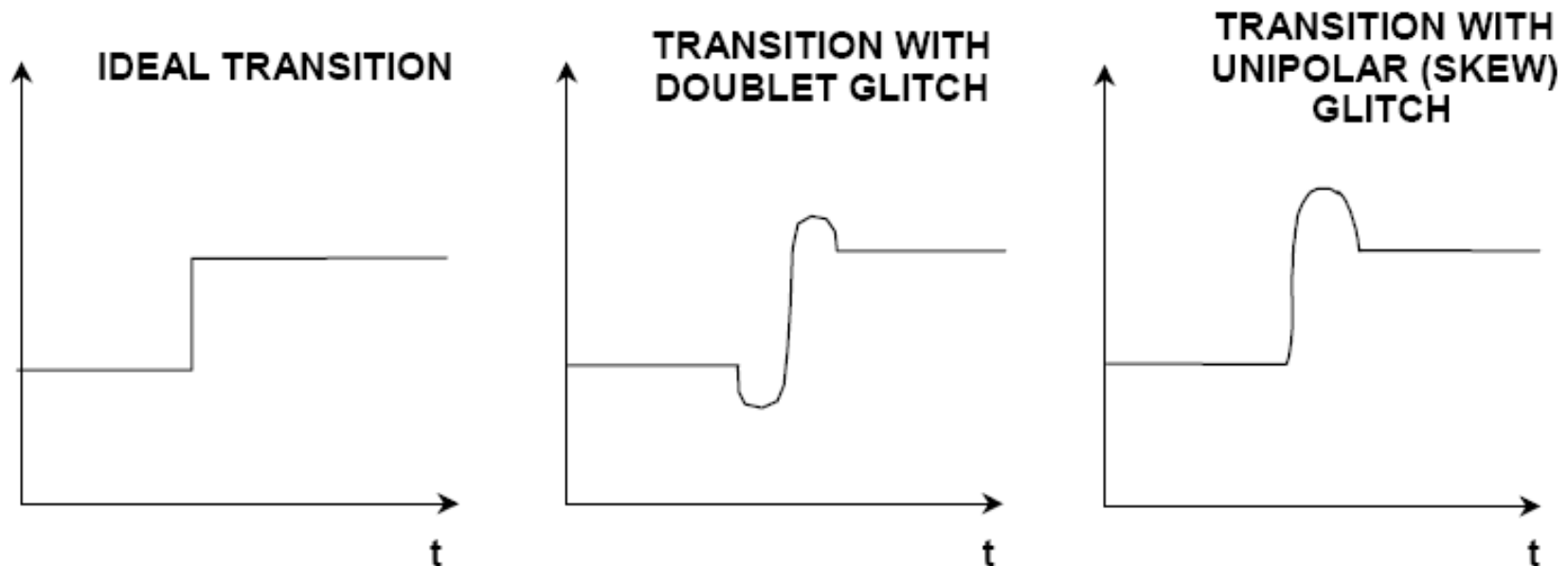
- Input representation is arbitrary
- Input can be asynchronous while output buffer works at constant frequency

DAC dynamic performance

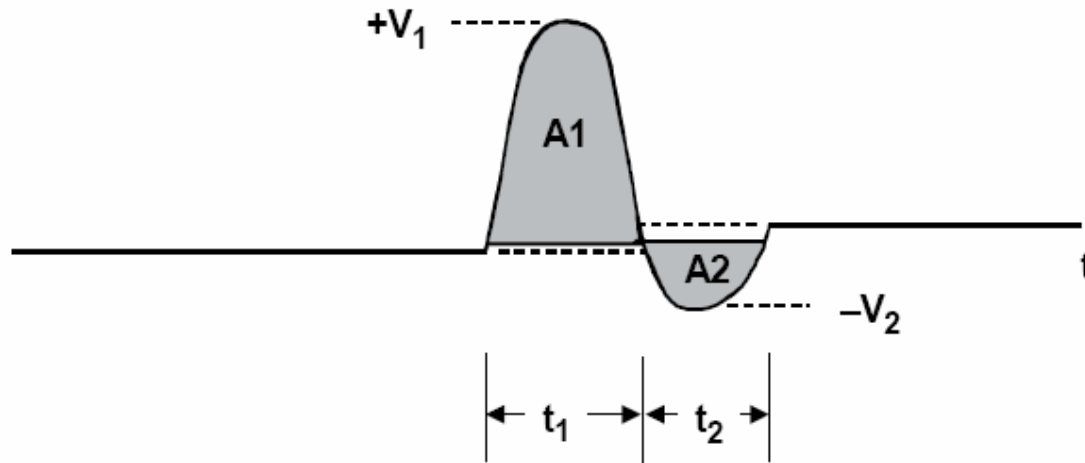
- Settling time



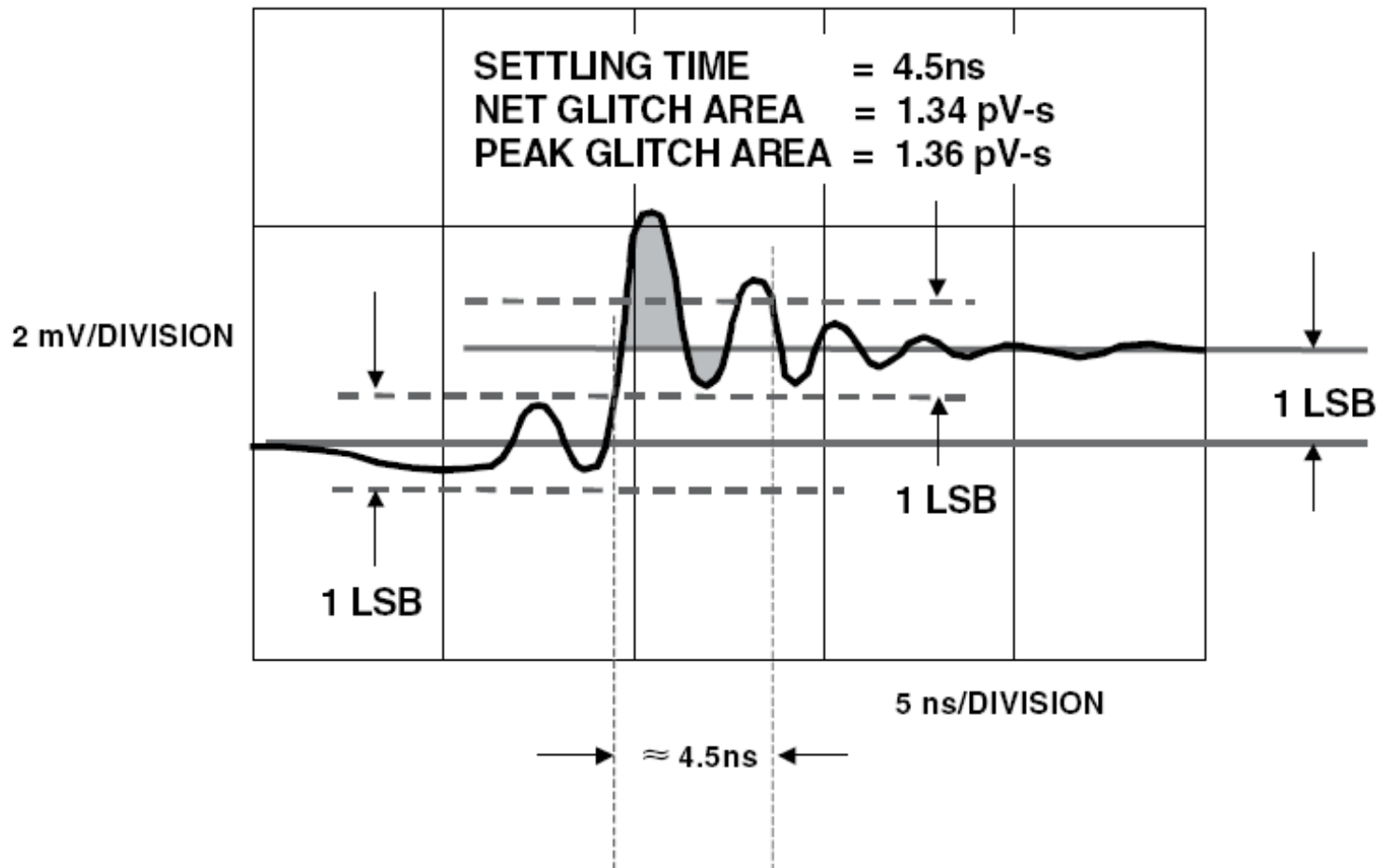
- Glitch: code change transient



- Characterized by Glitch pulse area

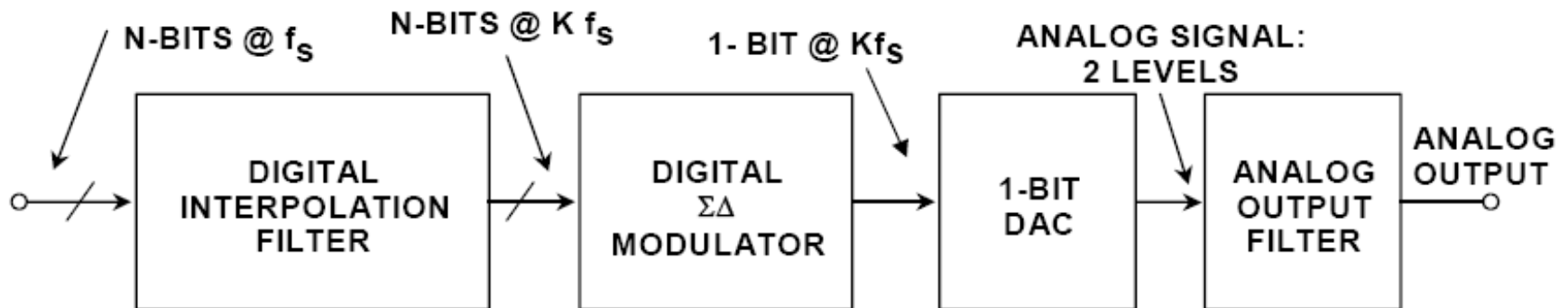


- Example of measuring dynamic features



Sigma-Delta DAC

- Single bit



- Multi bit

