"A brief Introduction"

- Introduction – *"Is there a limit?"*
- Transistors – *"CMOS building blocks"*
- Parasitics I – *"The [un]desirables"*
- Parasitics II – *"Building a full MOS model"*
- The CMOS inverter – *"A masterpiece"*
- Technology scaling – *"Smaller, Faster and Cooler"*
- Technology – *"Building an inverter"*
- Gates I – *"Just like LEGO"*
- The pass gate – *"An useful complement"*
- Gates II – "A portfolio"
- Sequential circuits – *"Time also counts!"*
- DLLs and PLLs – " A brief introduction"
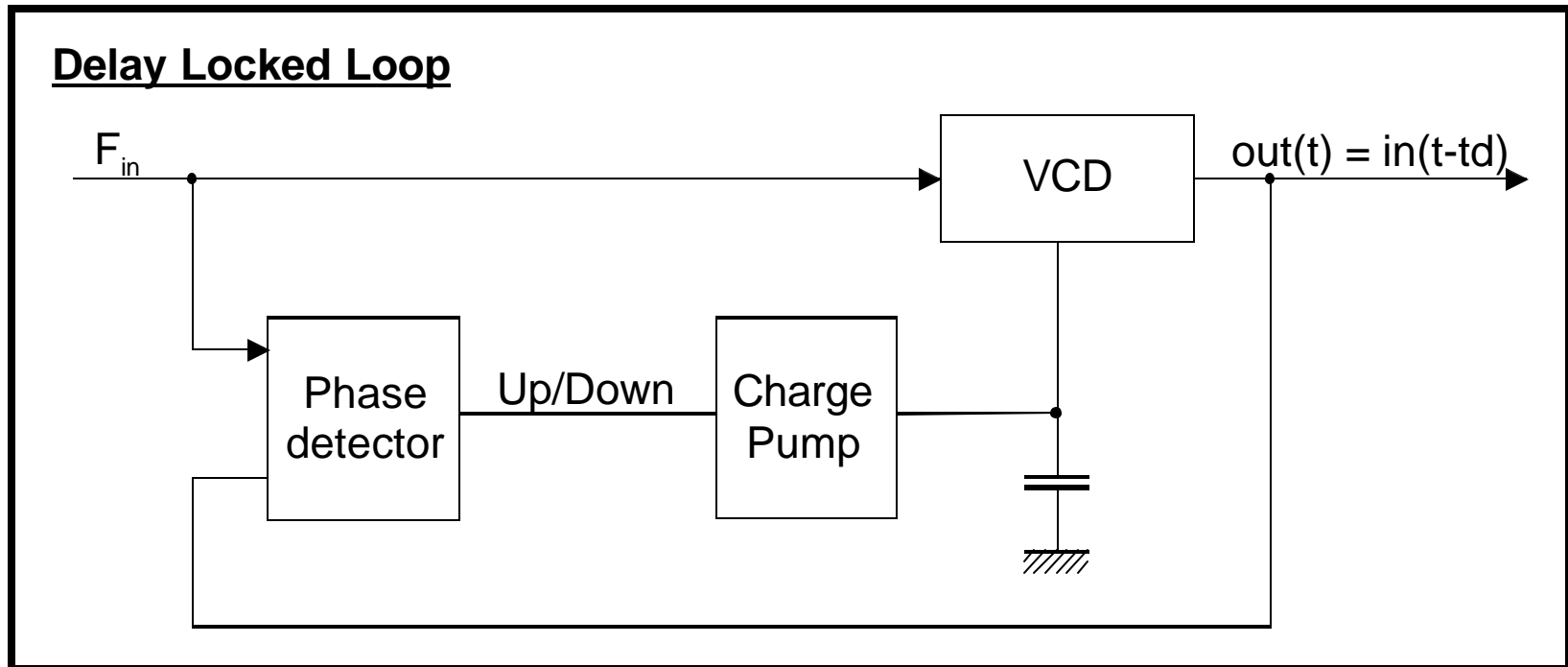- Storage elements – *"A bit in memory"*

"A brief introduction"

- Delay-Locked Loop (DLL)
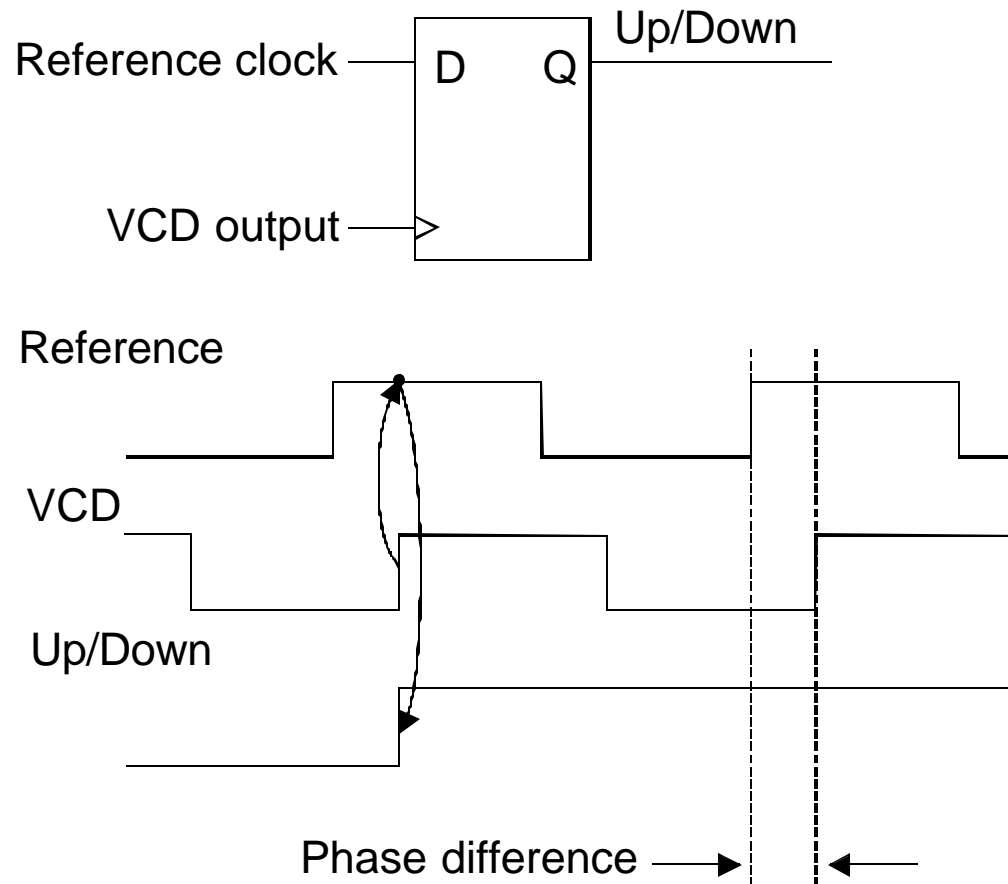- Phase-Locked Loop (PLL)
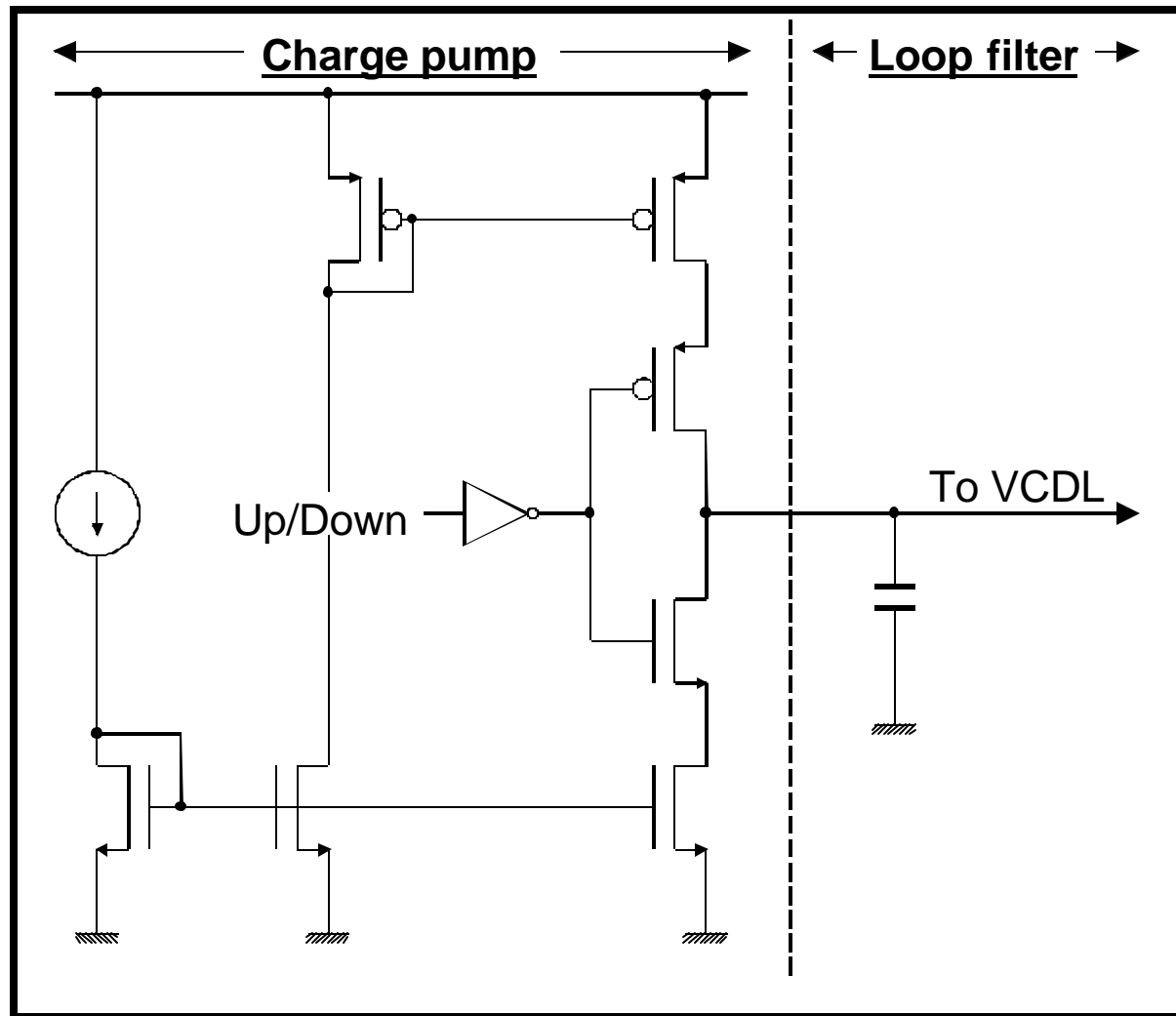
Delay locked loops

Delay locked loops

Delay Locked Loop

F_{in} →
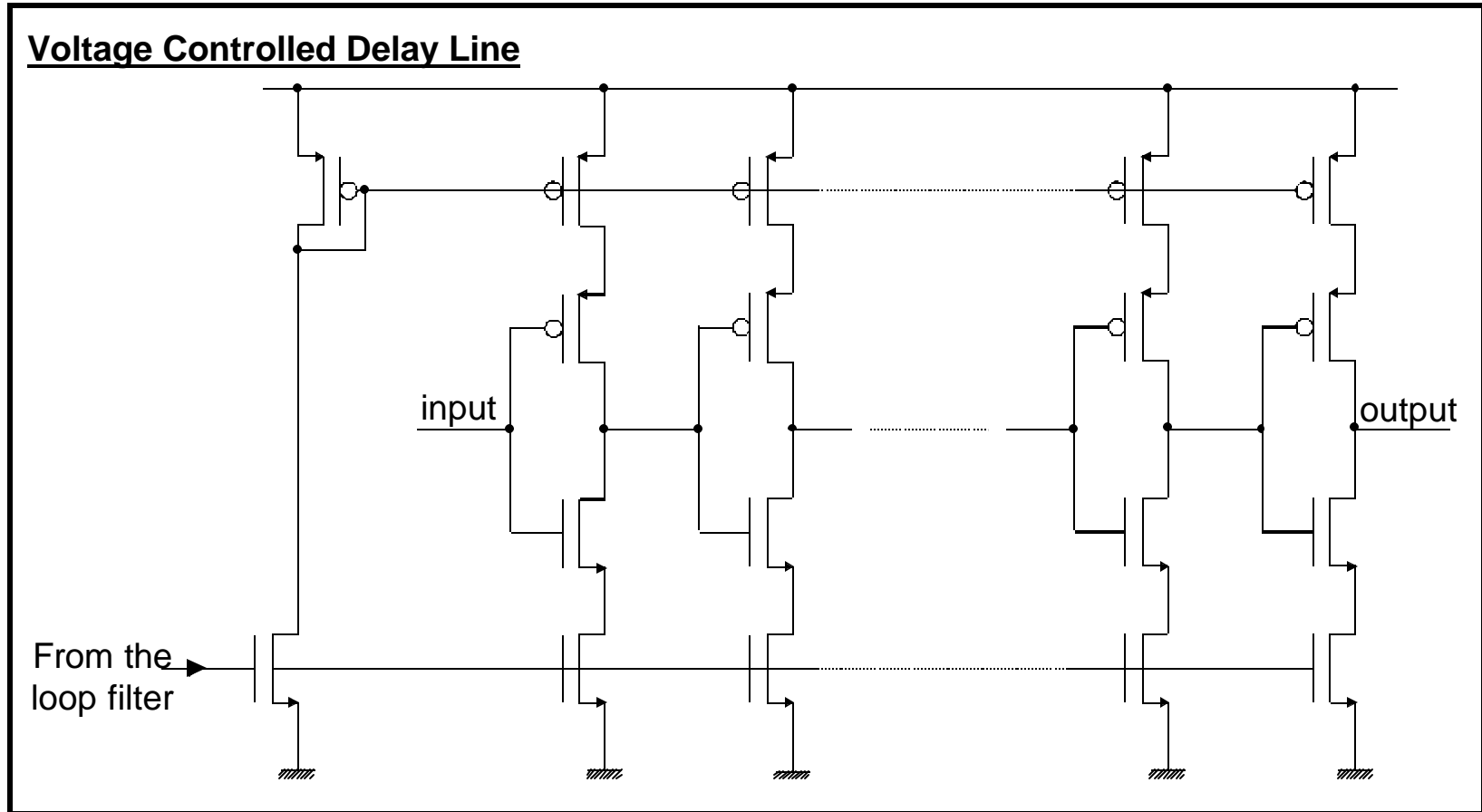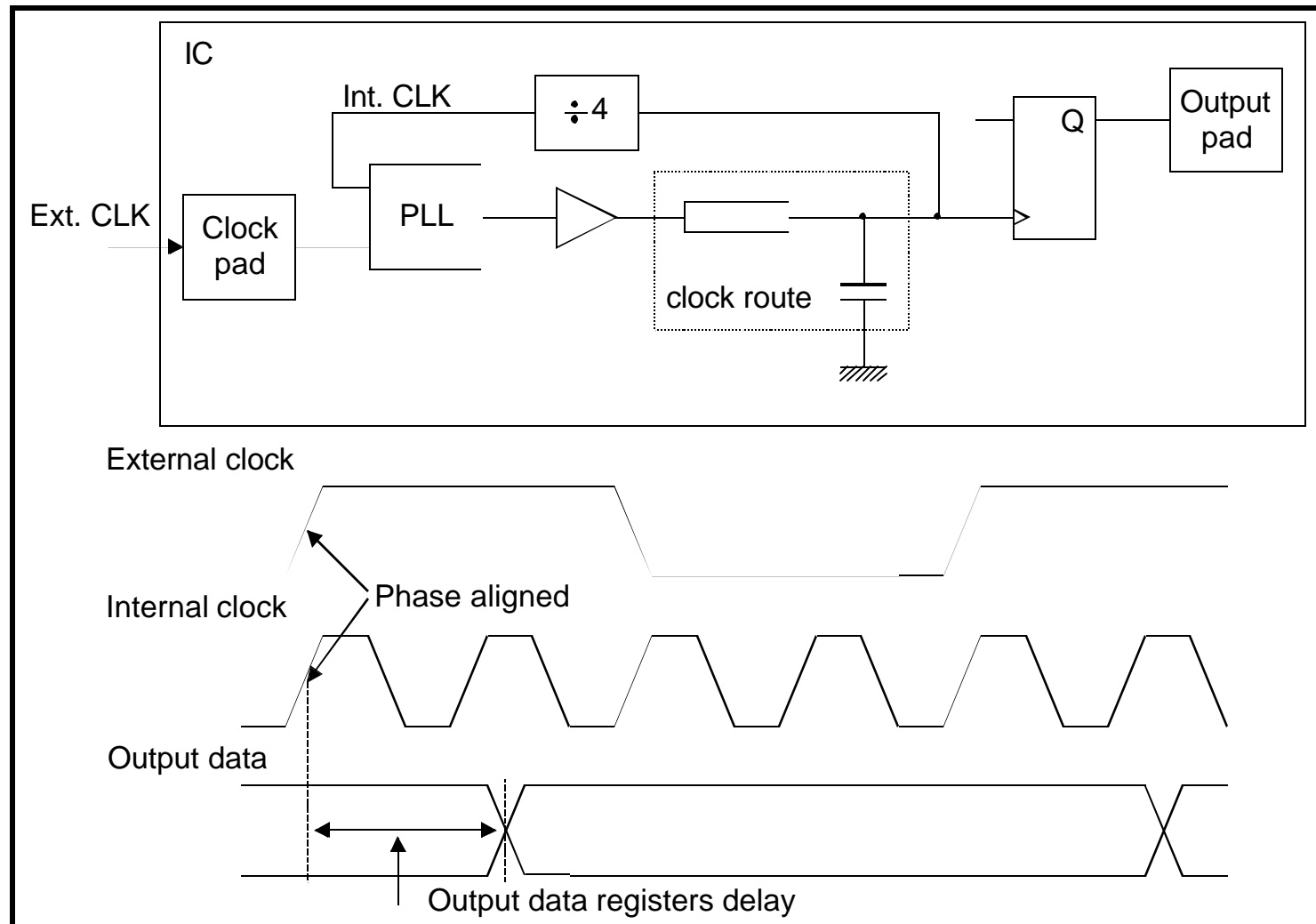
VCD

out(t) = in(t-td)

Phase detector — Up/Down — Charge Pump
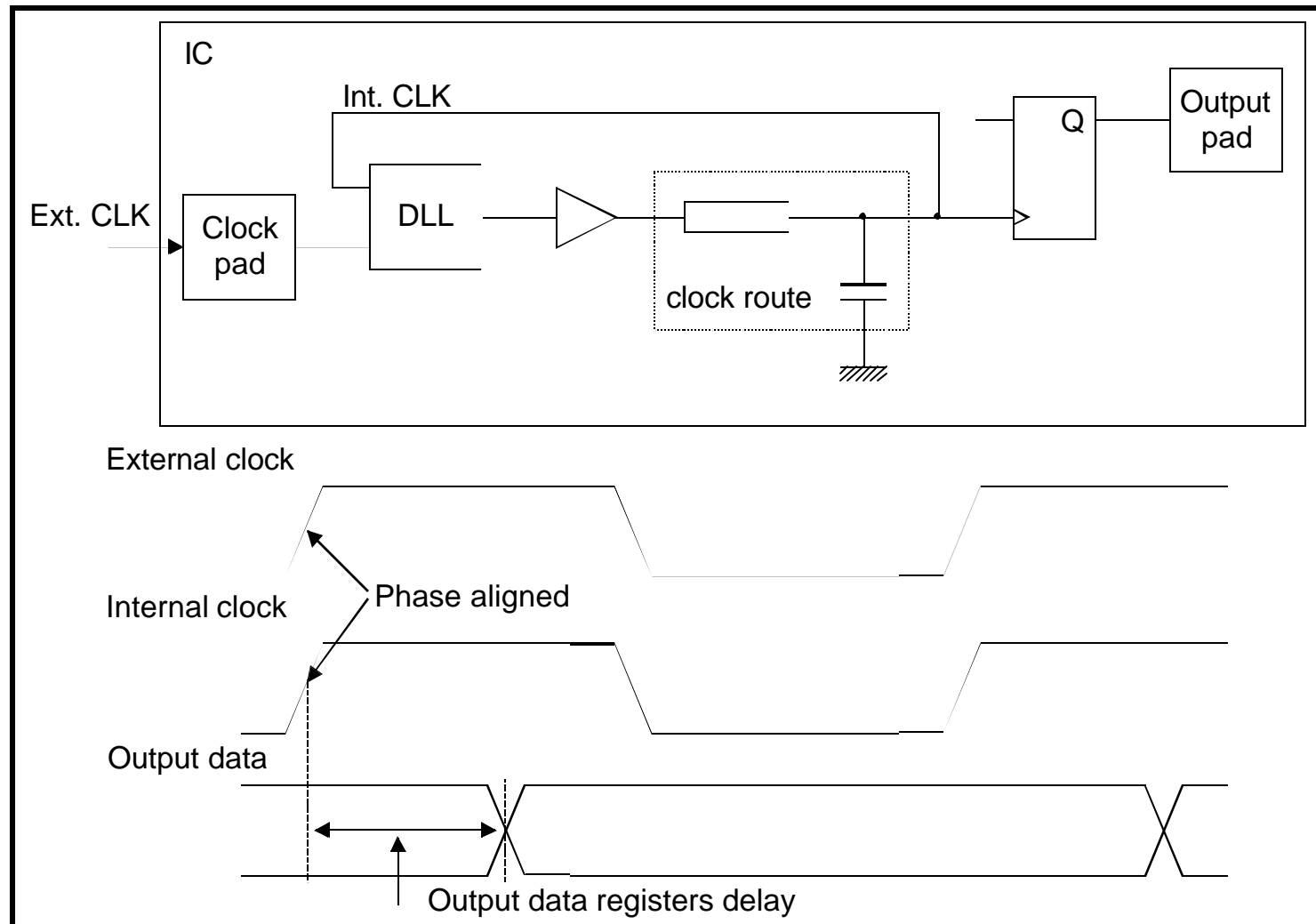
Delay locked loops

Phase detector
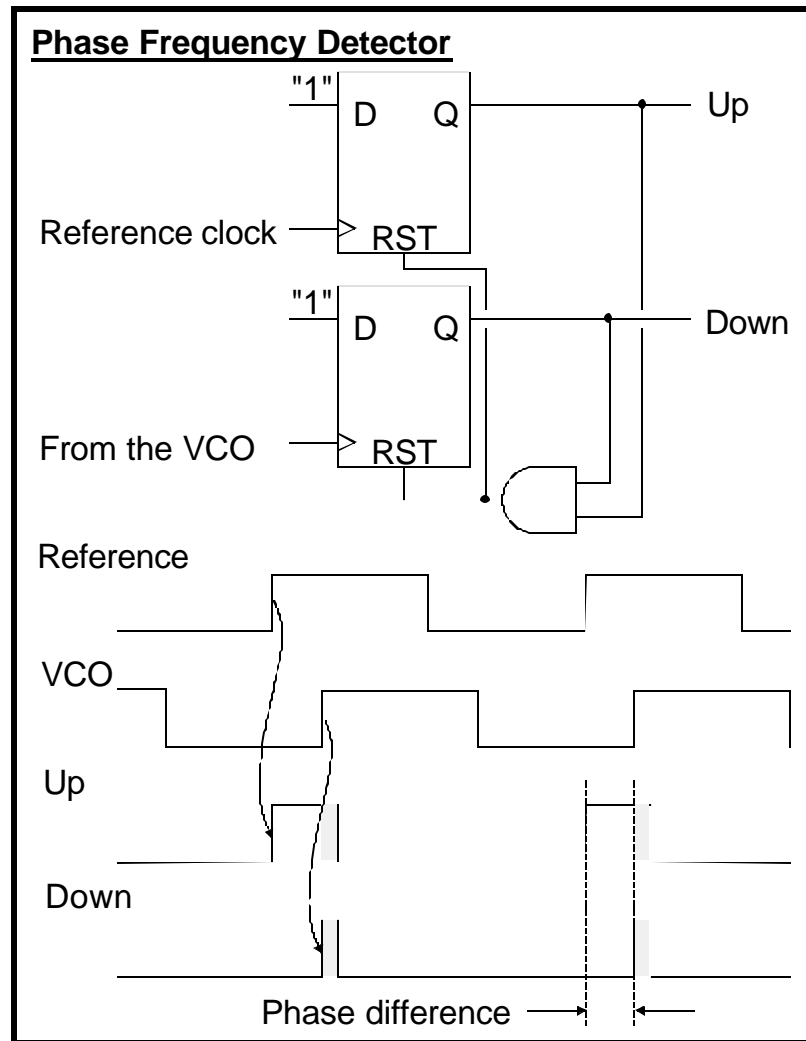
Delay locked loops

Delay locked loops

Voltage Controlled Delay Line

input

output

From the
loop filter

Phase Locked Loops

Phase locked loops

Phase Locked Loop

F_{in} → Phase detector

Phase detector — Up → Charge Pump

Phase detector — Down → Charge Pump

Charge Pump → VCO → $F_{out} = N \times F_{in}$

÷N

Phase locked loops

Phase locked loops

Phase locked loops

Voltage Controlled Oscillator

From the loop filter

output