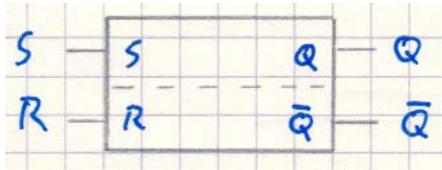


3. Ansteuerung der FF's

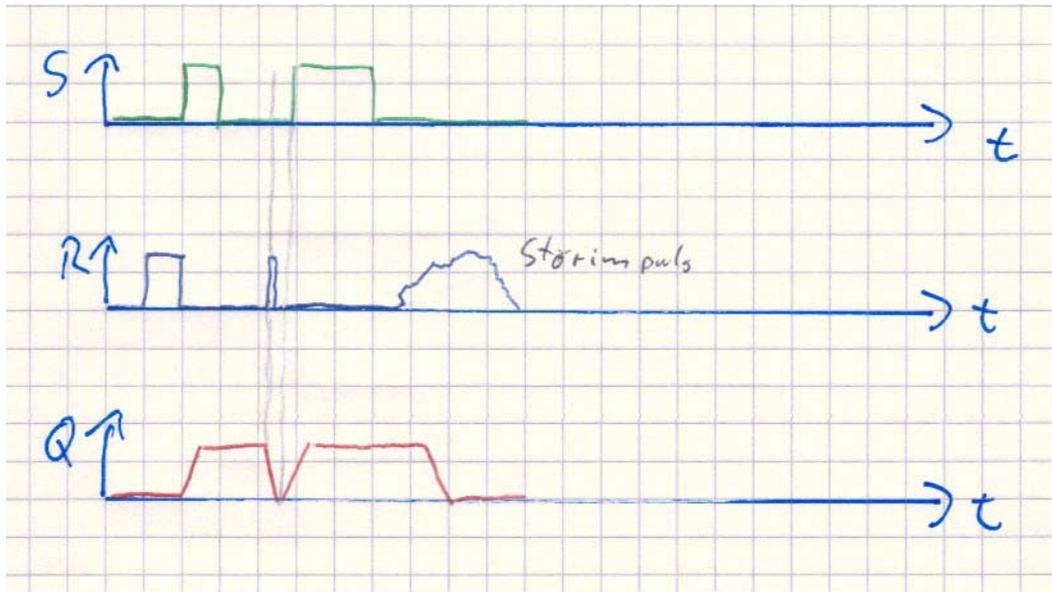
a) Zustandssteuerung



(Bild 3.01)

Die Erregungssignale (SR) erzwingen direkt eine Zustandsänderung

→ asynchrones FF



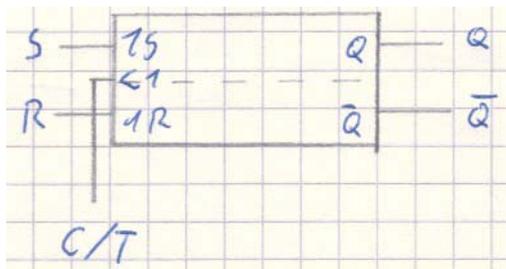
(Bild 3.02)

- hohe Anforderungen an die Steuersignale
- Störanfälligkeit durch Streupulse

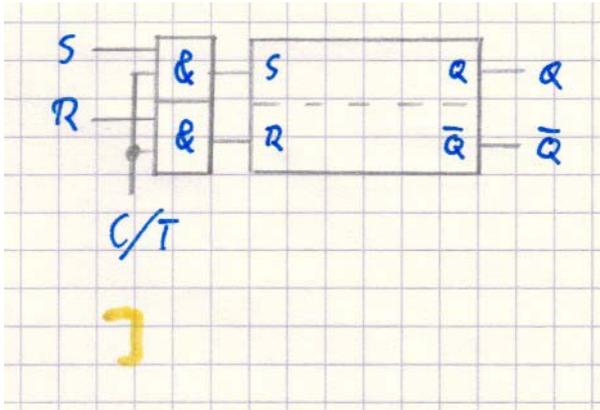
Informationen einlesen/auslesen in definierten Zeiten →

Taktsteuerung:

b) Taktzustandssteuerung



(Bild 3.03)

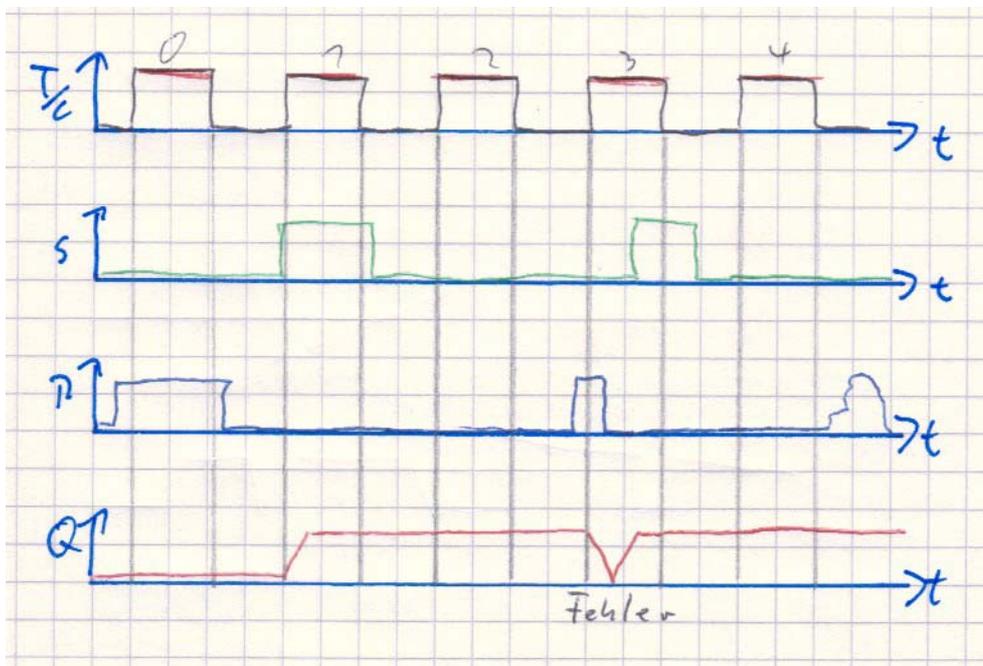


(Bild 3.04)

| c/t | Q | S | R | Q ^(k+1) |
|-----|---|---|---|--------------------|
| 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 1 | 0 | 0 |
| 0 | 1 | 0 | 1 | 1 |
| 0 | 1 | 1 | 1 | 1 |
| 1 | 0 | | | 0 / 1 |
| 1 | 0 | | | 0 / - |
| 1 | 1 | | | 1 / 1 |
| 1 | 1 | | | 0 / - |

$$Q^{(k+1)} = \bar{T} Q \bar{S} \bar{R} + \bar{T} Q S \bar{R} + \bar{T} Q S R + T \bar{Q} S \bar{R} + T Q \bar{S} \bar{R} + T Q S \bar{R}$$

$$= \bar{T} Q (\bar{S} \bar{R} + S \bar{R} + S R) + T (\bar{Q} S \bar{R} + Q (\bar{S} \bar{R} + S \bar{R}))$$

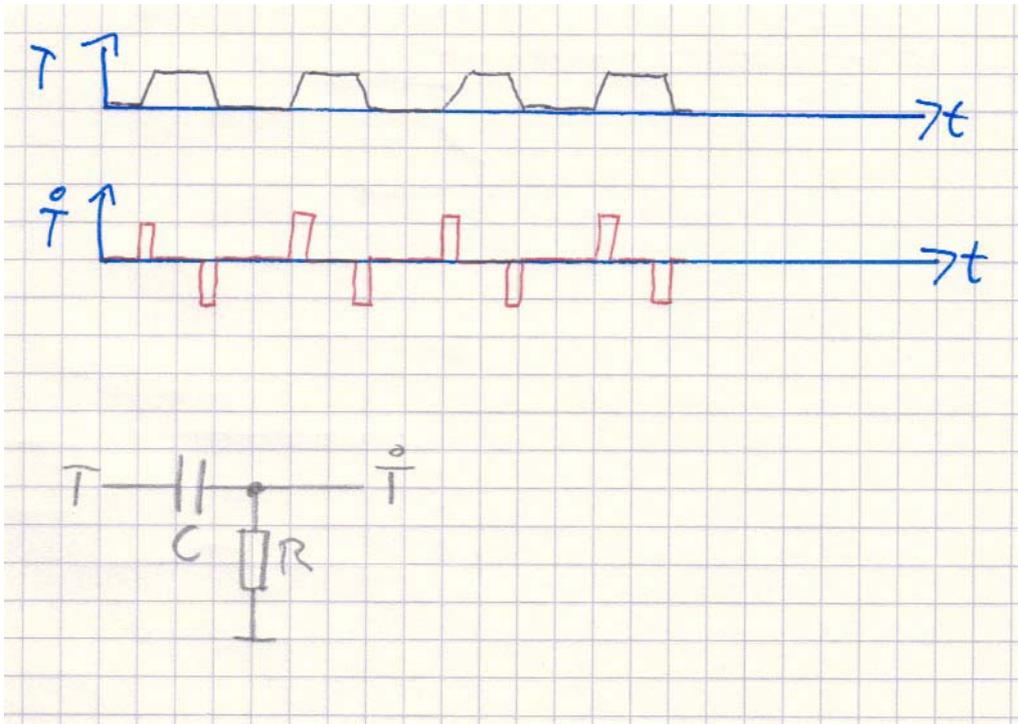


(Bild 3.05)

- Steuersignale müssen während Takthigh konstant stehen
- Maximale Taktfrequenz begrenzt, durch lange Takthigh-Zeichen
- Störanfälligkeit durch lange Takthigh

Nachteile vermeiden durch kurze Steuerpulse J

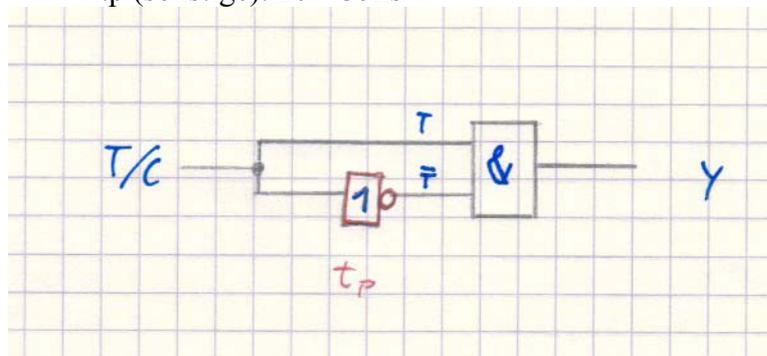
c) Taktflankensteuerung



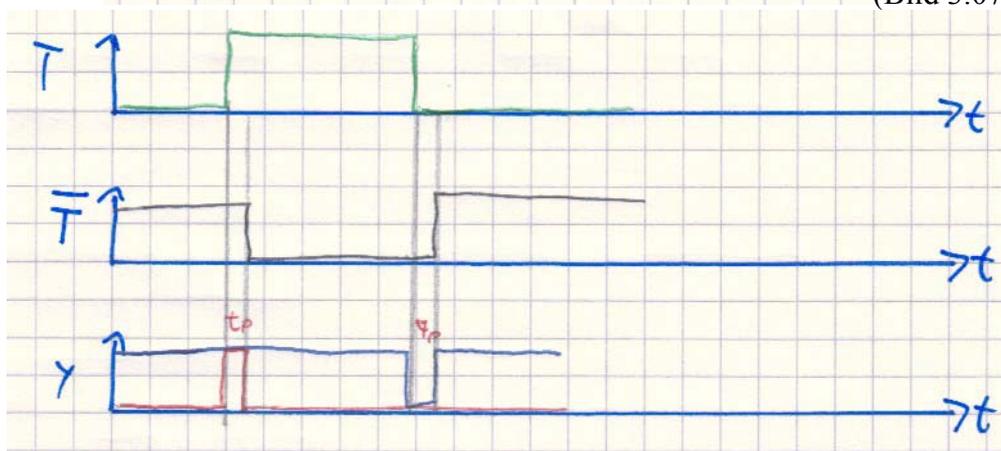
(Bild 3.06)

i) „Digitale Differentiation“

- t_p : PulsePropagationTime
- tp (Inverter): 5 – 10ns
- tp (sonstige): 20 – 35ns

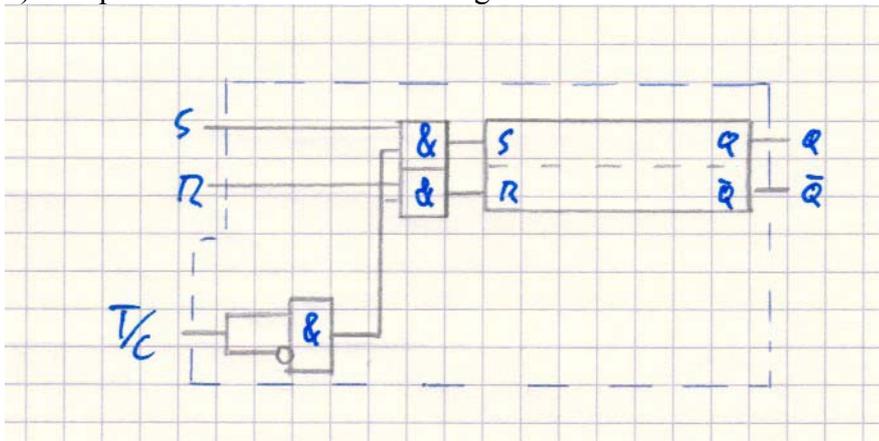


(Bild 3.07)

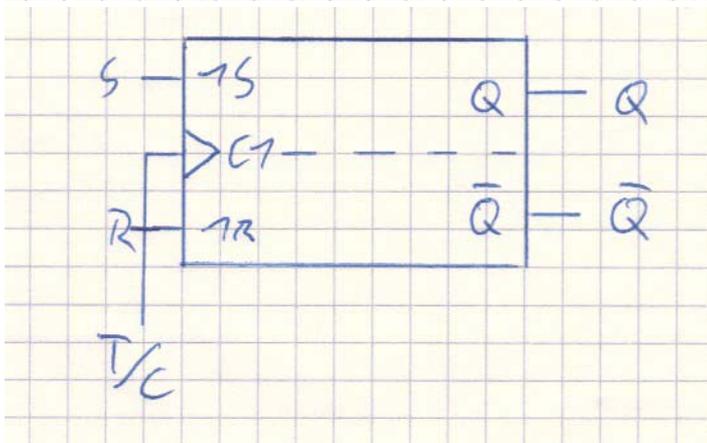


(Bild 3.08)

ii) positive Taktflankensteuerung

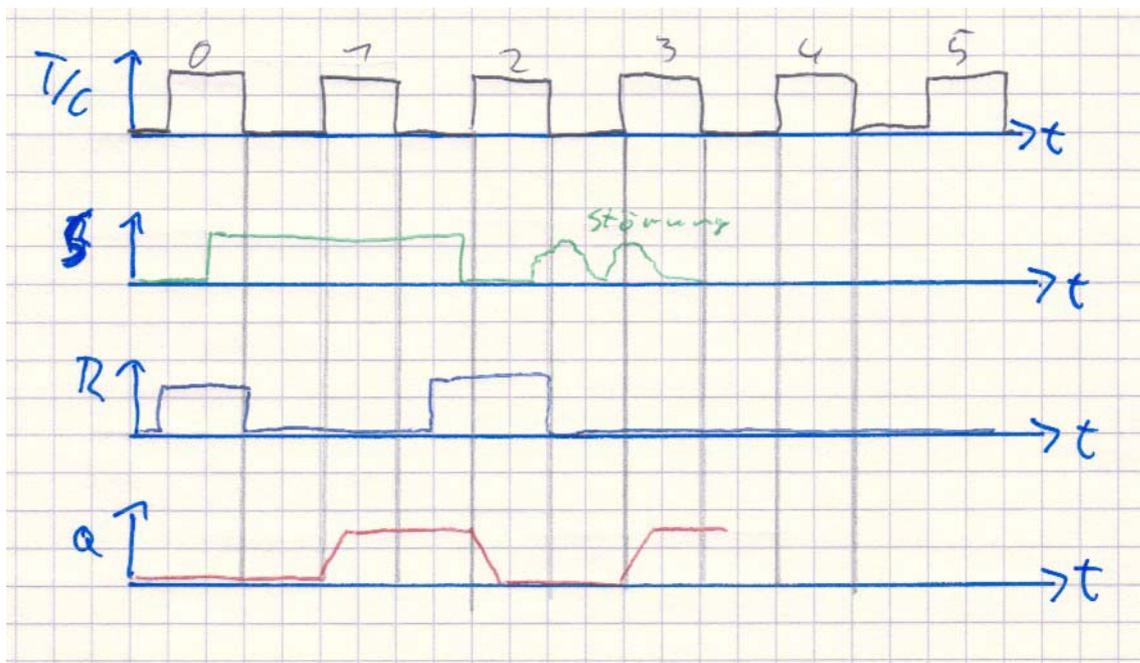


(Bild 3.09)



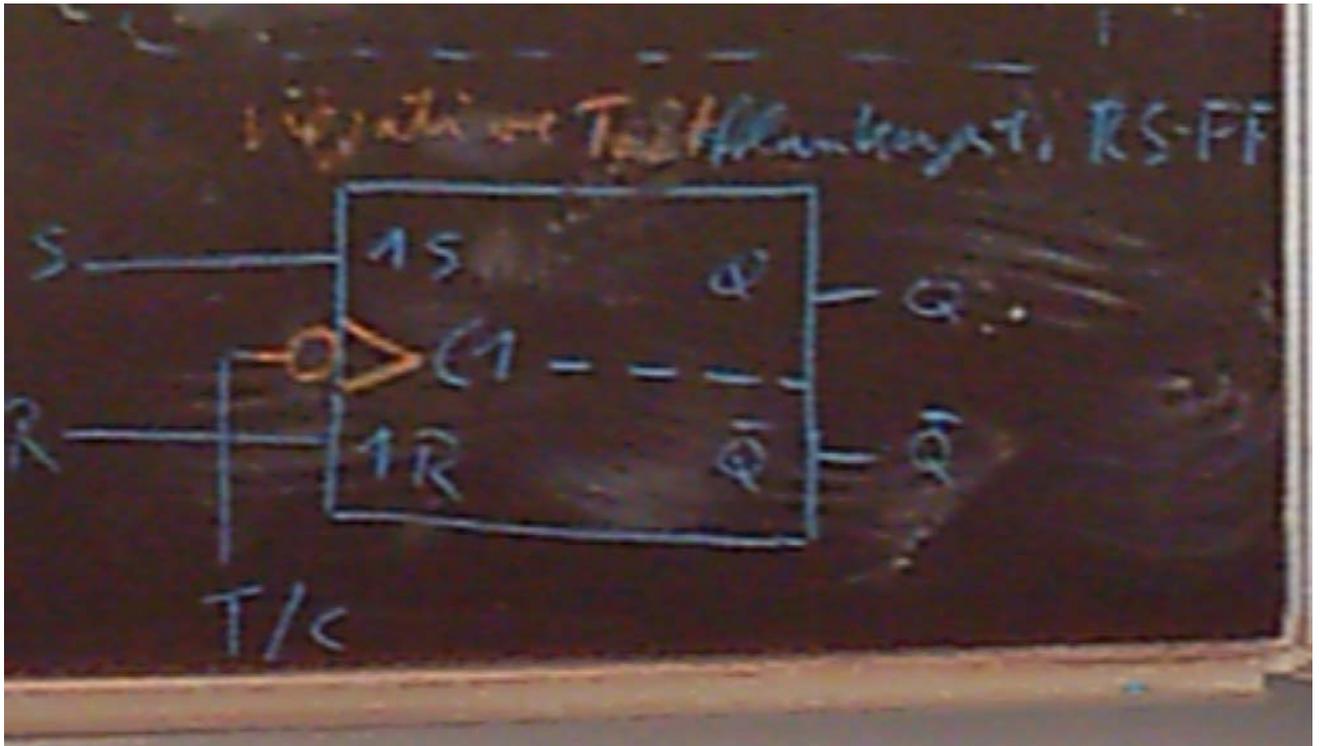
(Bild 3.10)

iii) positive Taktflanke



(Bild 3.11)

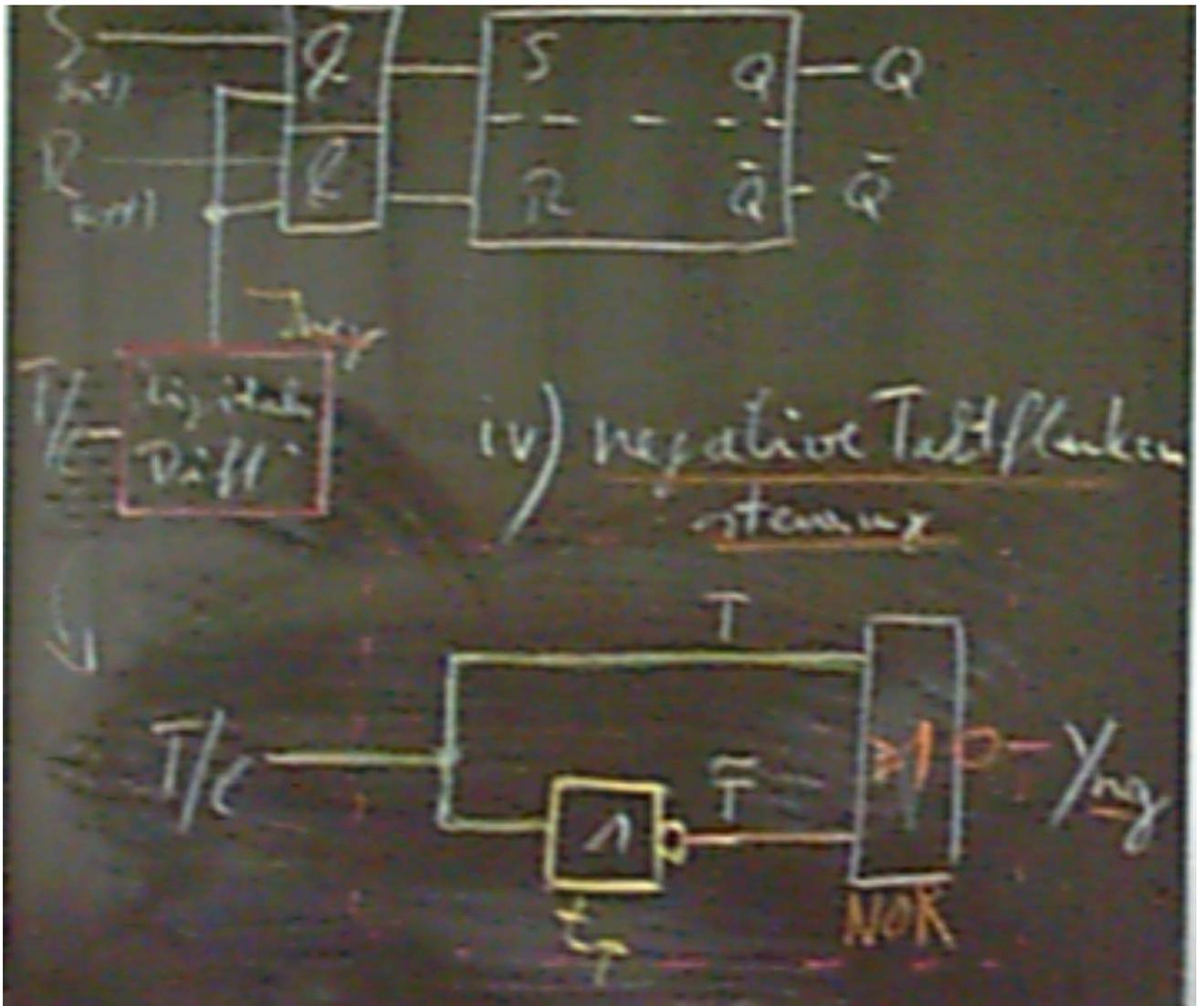
iv) negative Taktflankensteuerung



(Foto 001)



(Foto 002)



(Foto 003)