



Departamento de
Engenharia Elétrica e
de Computação

SEL 414 - Sistemas Digitais

REGISTRADOR DE DESLOCAMENTO

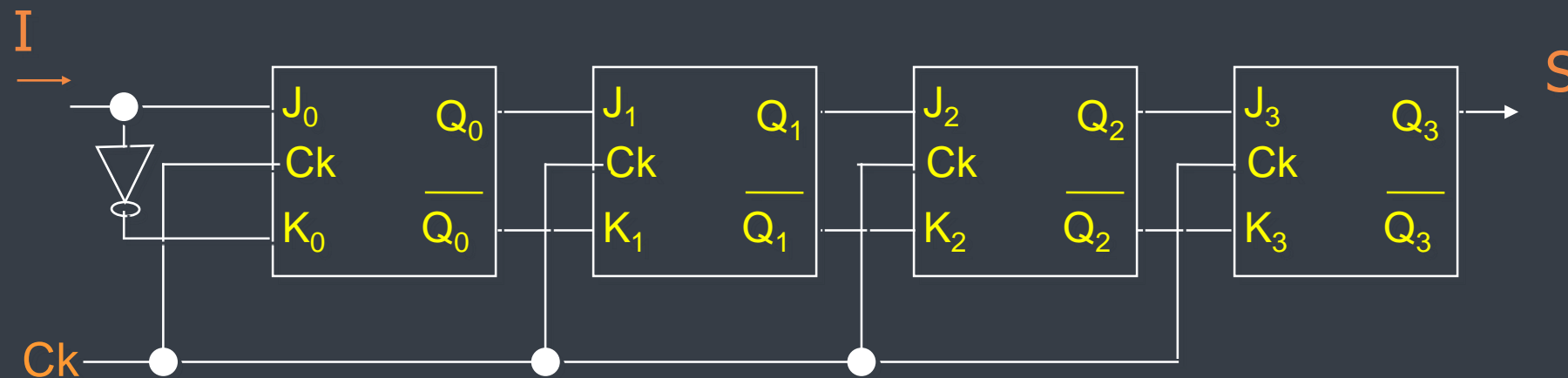
Prof. Homero Schiabel



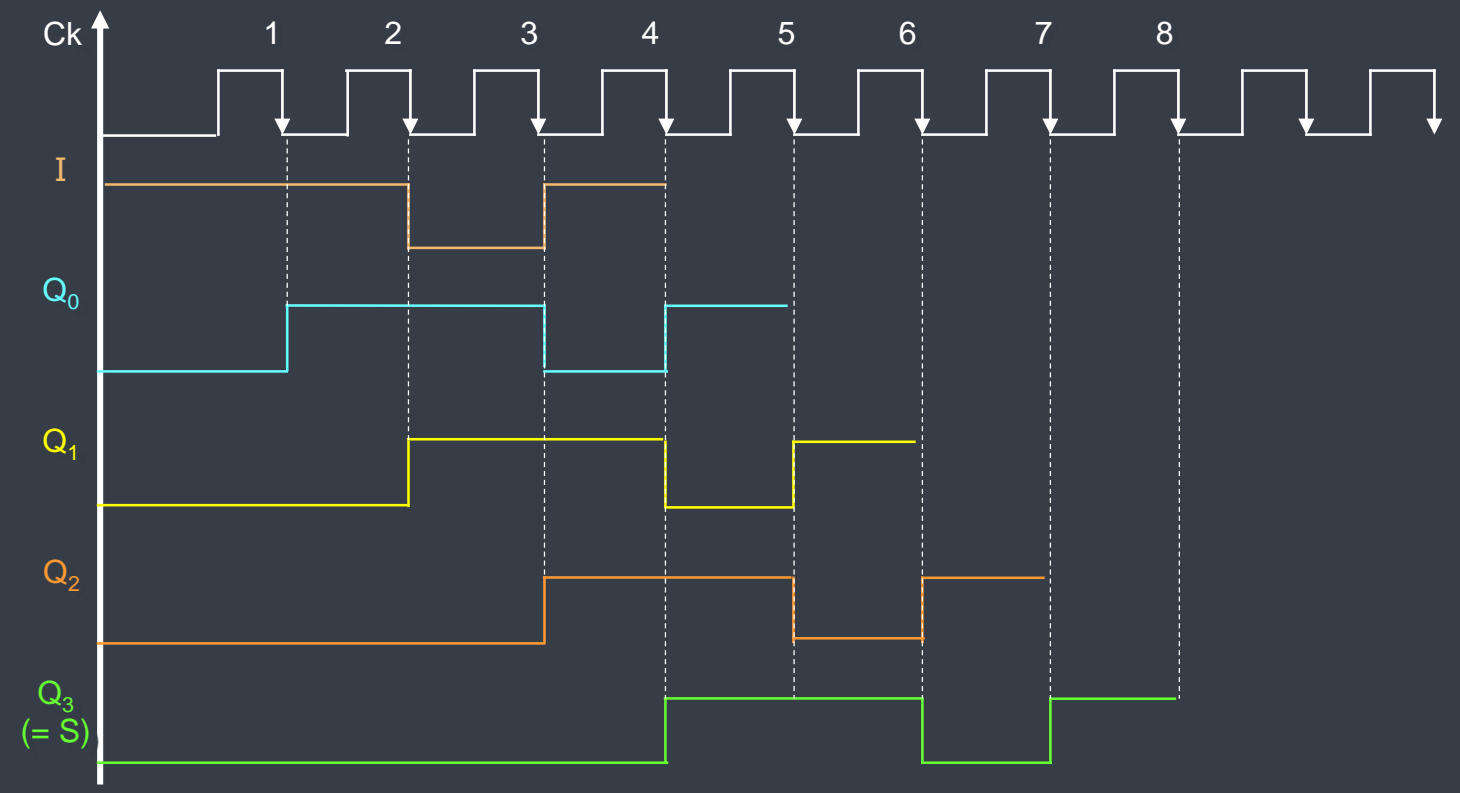
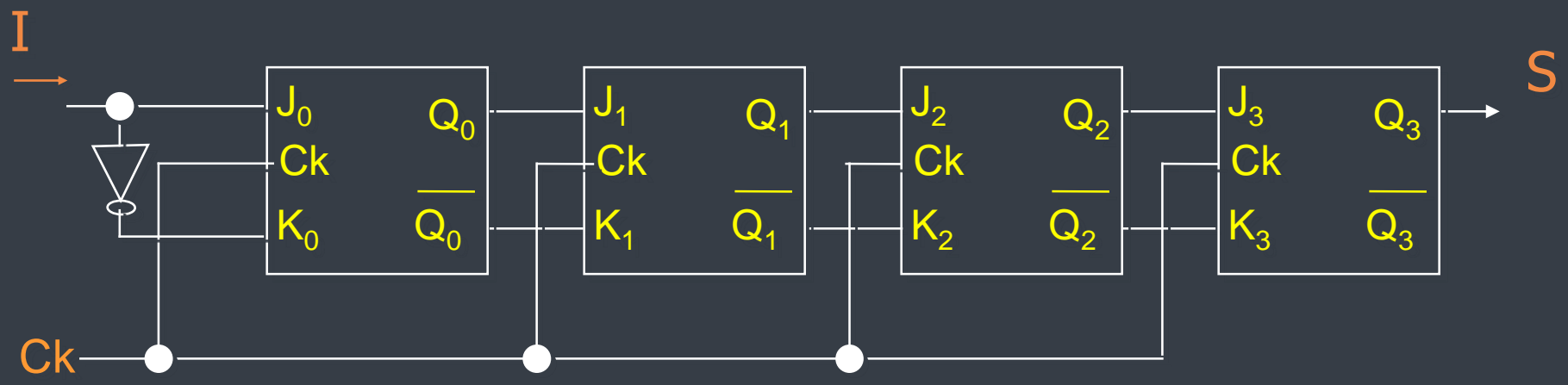
UTILIZAÇÃO:

1. Armazenamento de informações com mais de 1 bit (tipo mais simples de MEMÓRIA)
2. Aplicação em:
 - ✓ Conversores (série/paralelo, paralelo/série...)
 - ✓ Contadores
 - ✓ Multiplicadores binários
 - ✓ Memórias...

1. Conversor Série/Série



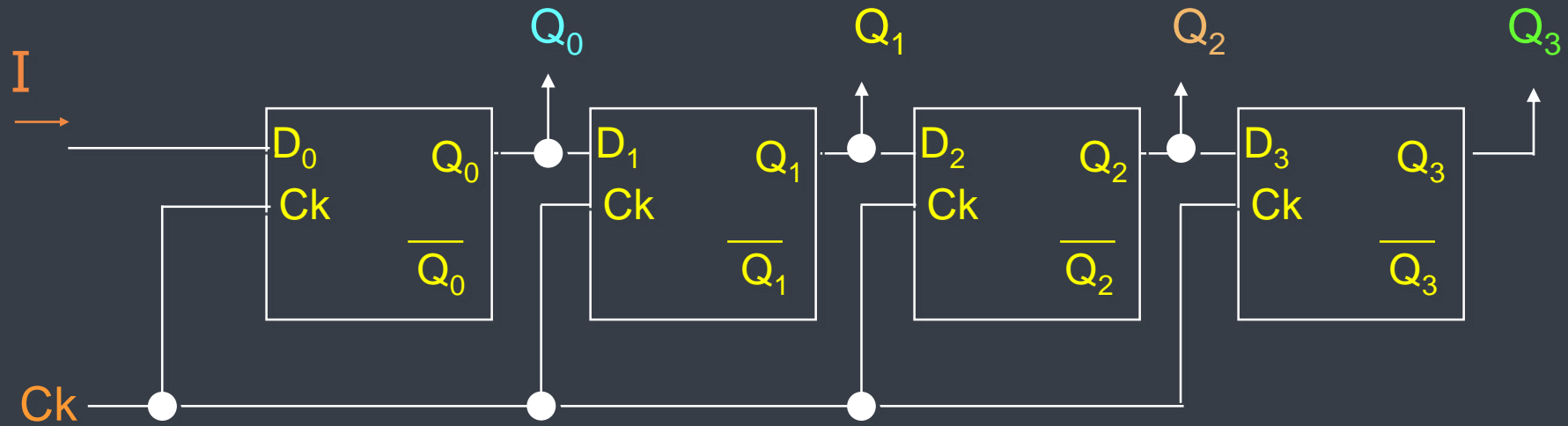
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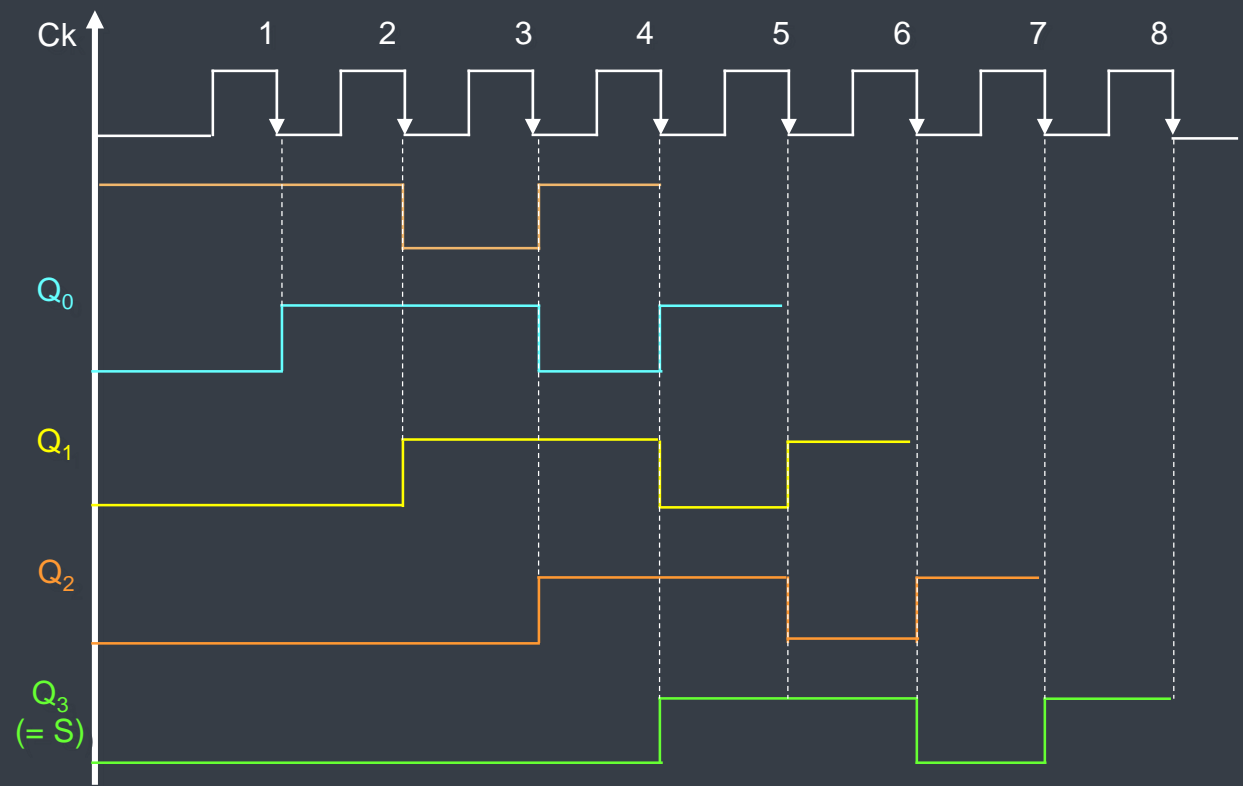
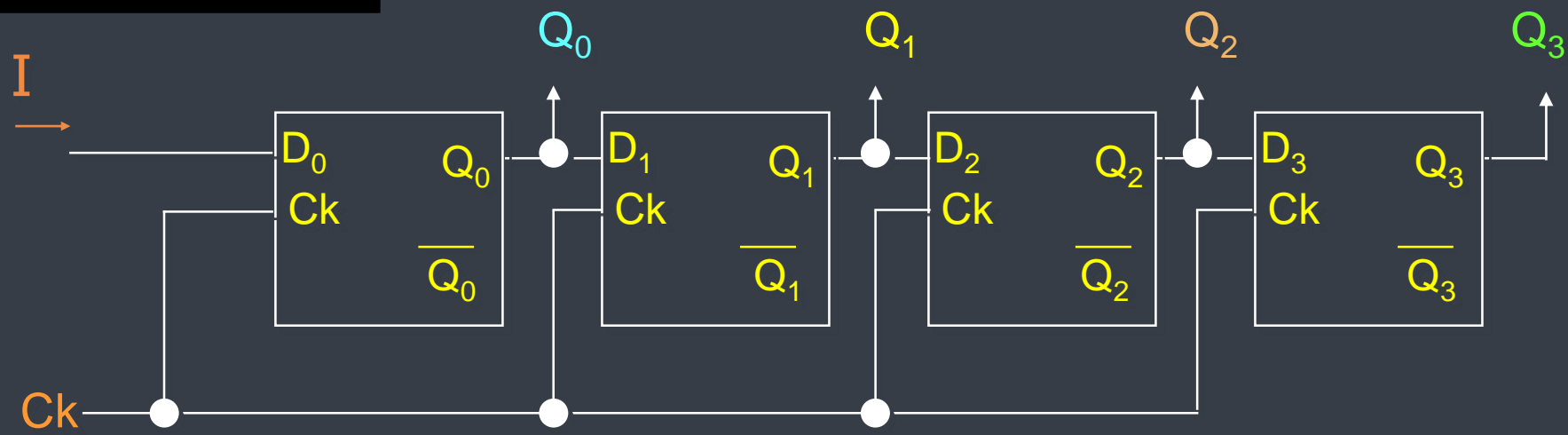
Sequência de entrada	Q ₀	Q ₁	Q ₂	Q ₃	Bordas do CK
1 1 0 1 →	0	0	0	0	1
	1	0	0	0	2
	1	1	0	0	3
	0	1	1	0	4
	1	0	1	1	5
		1	0	1	6
			1	0	7
				1	

Saída serial

2. Conversor Série/Paralelo



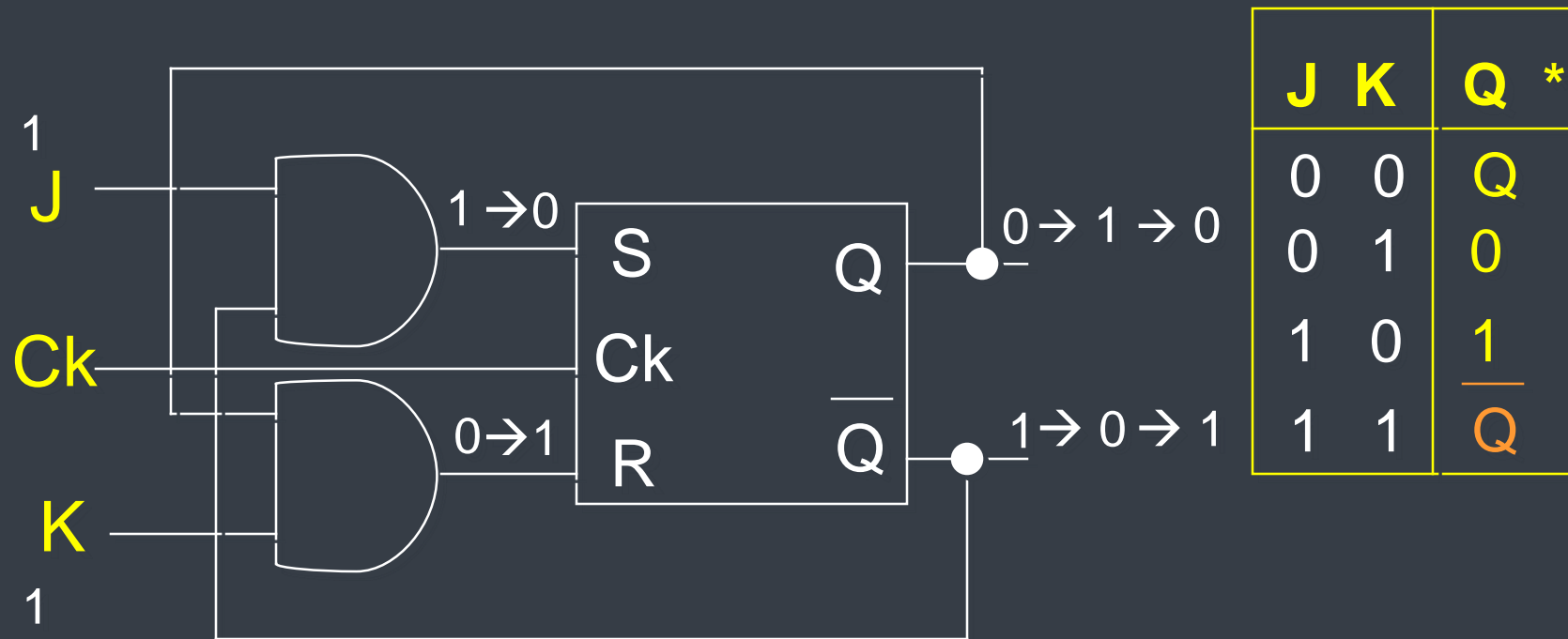
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I	Q ₀	Q ₁	Q ₂	Q ₃	Ck
1	0	0	0	0	1
1	1	0	0	0	2
0	1	1	0	0	3
1	0	1	1	0	4
	1	0	1	1	

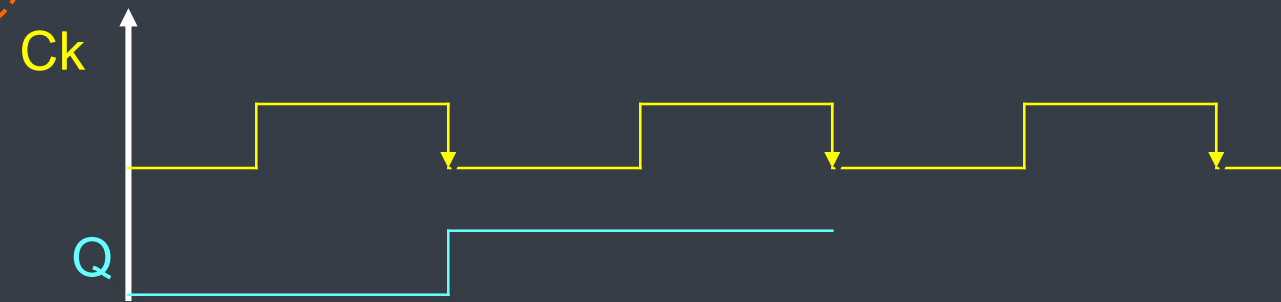
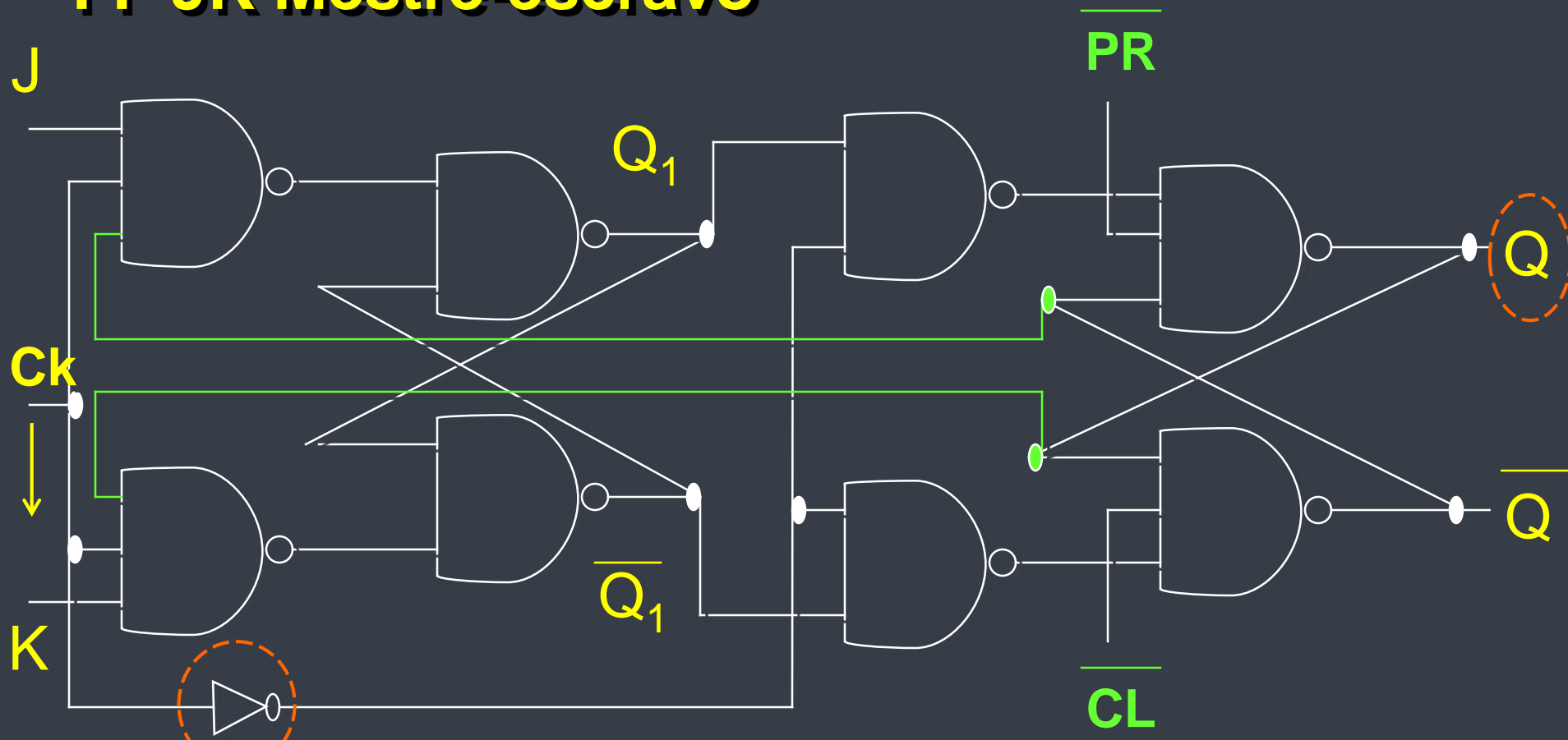
1 1 0 1
 MSB = Q₃ LSB = Q₀

SENSIBILIDADE DE UM FLIP-FLOP AO SINAL DE CK

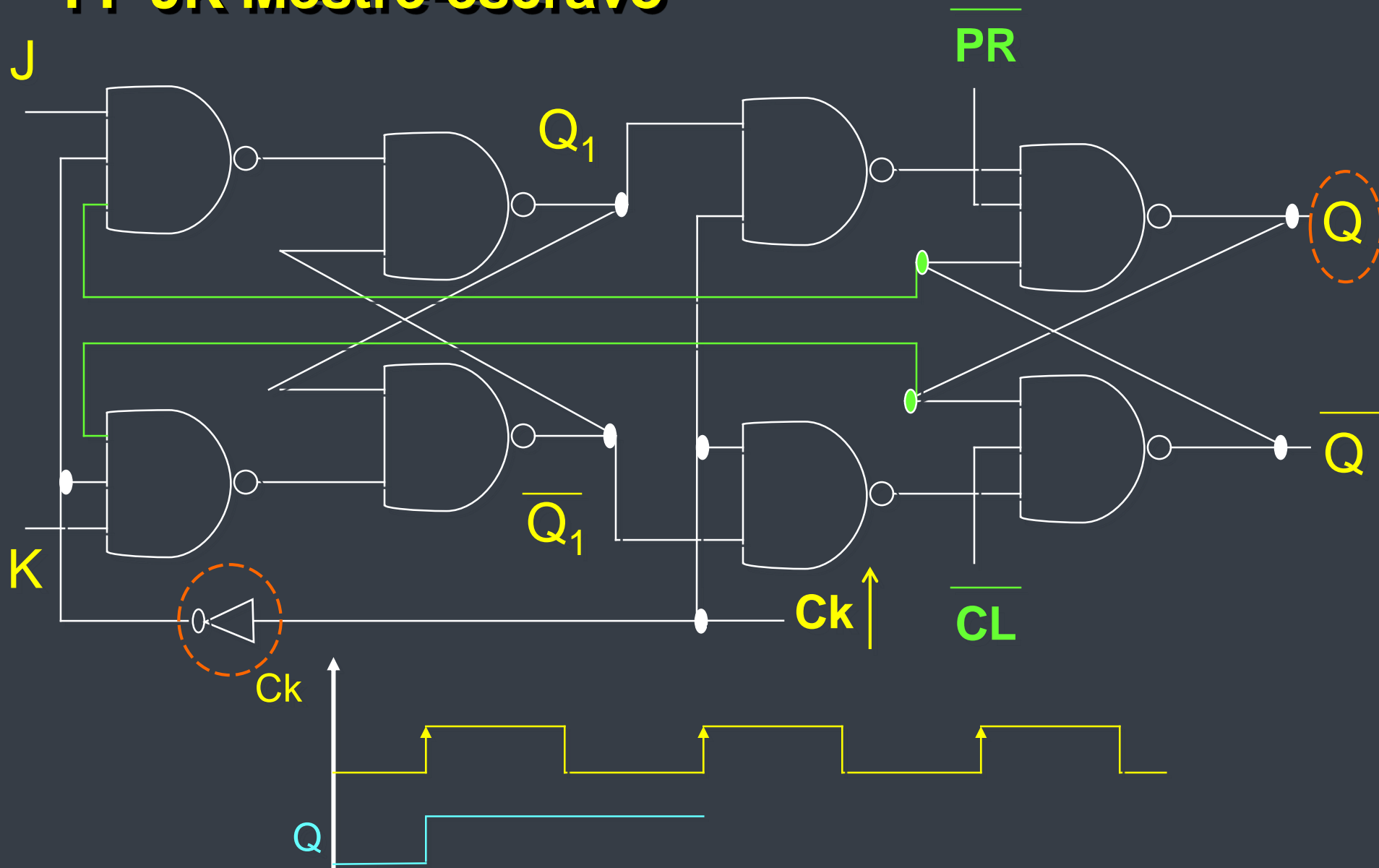


* Após o pulso do Ck

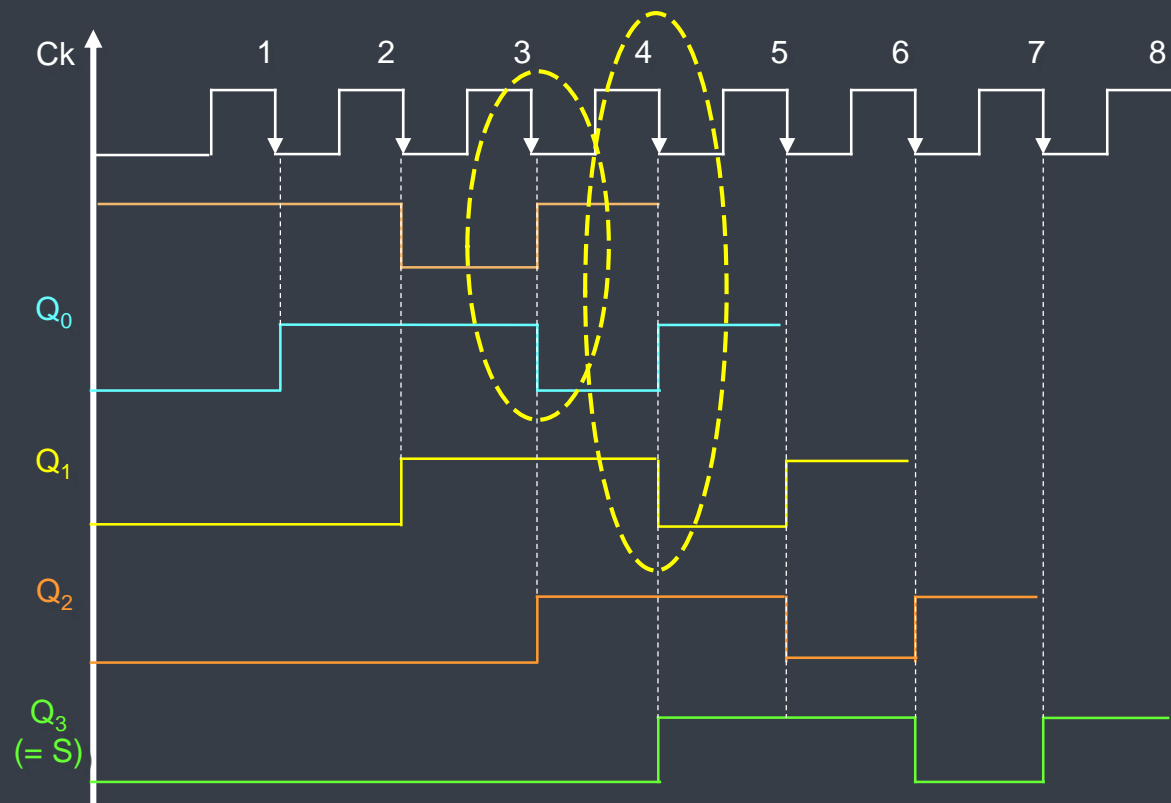
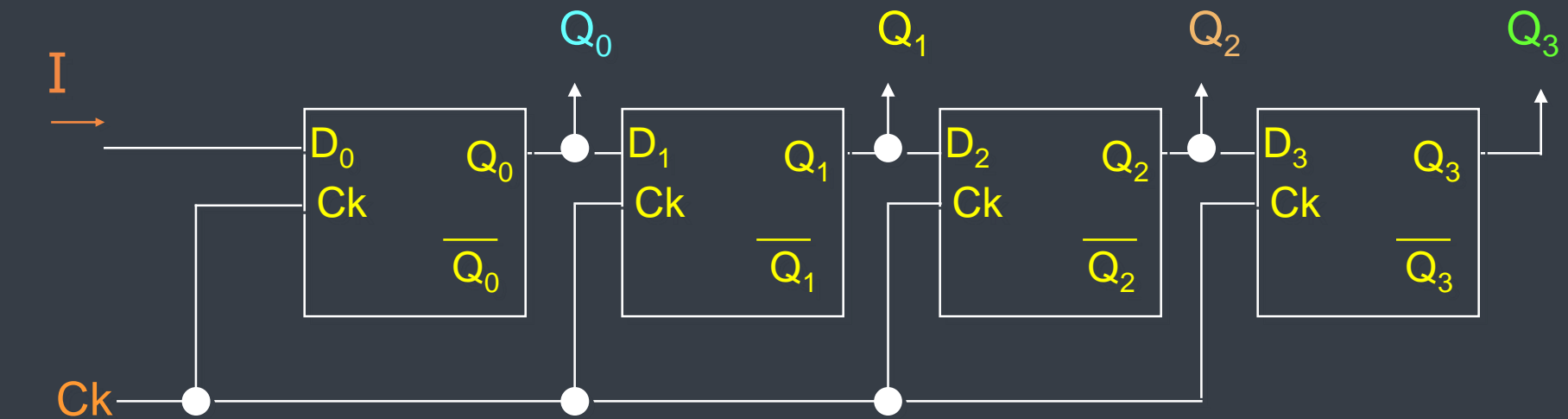
FF JK Mestre-escravo



FF JK Mestre-escravo



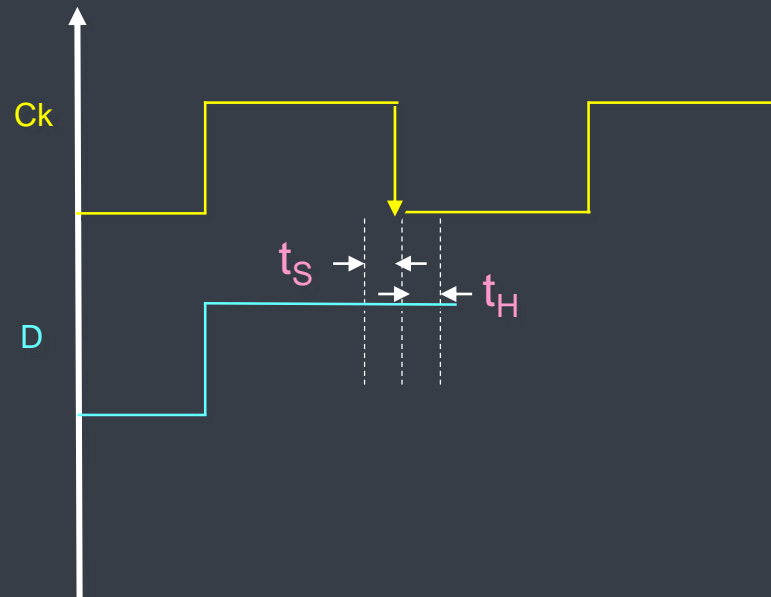
Registrador de Deslocamento



Set up time – t_S

Hold time – t_H

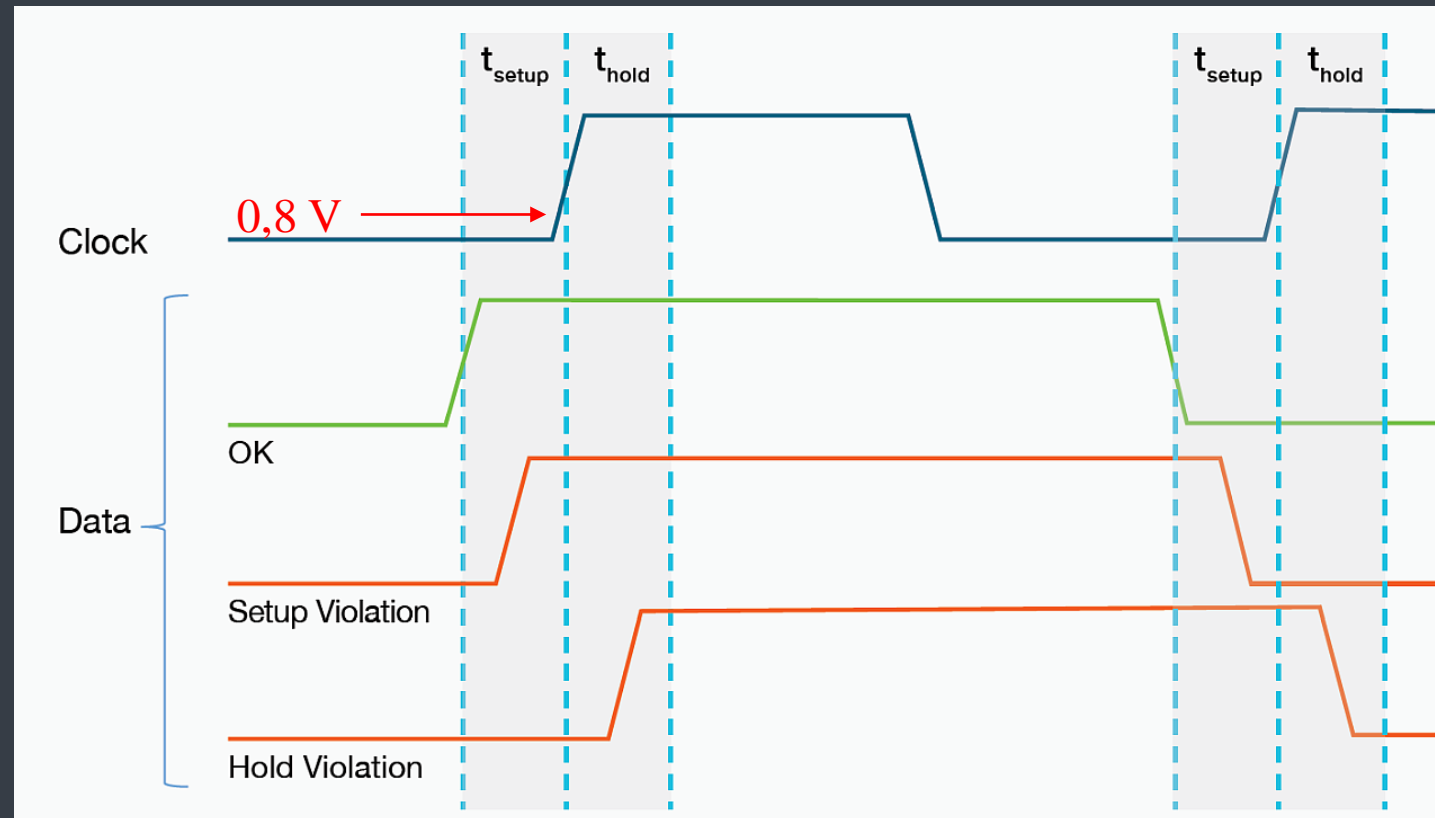
Tempo necessário de estabilidade do sinal de entrada **ANTES** e **DEPOIS** da transição do CK para armazenamento do dado



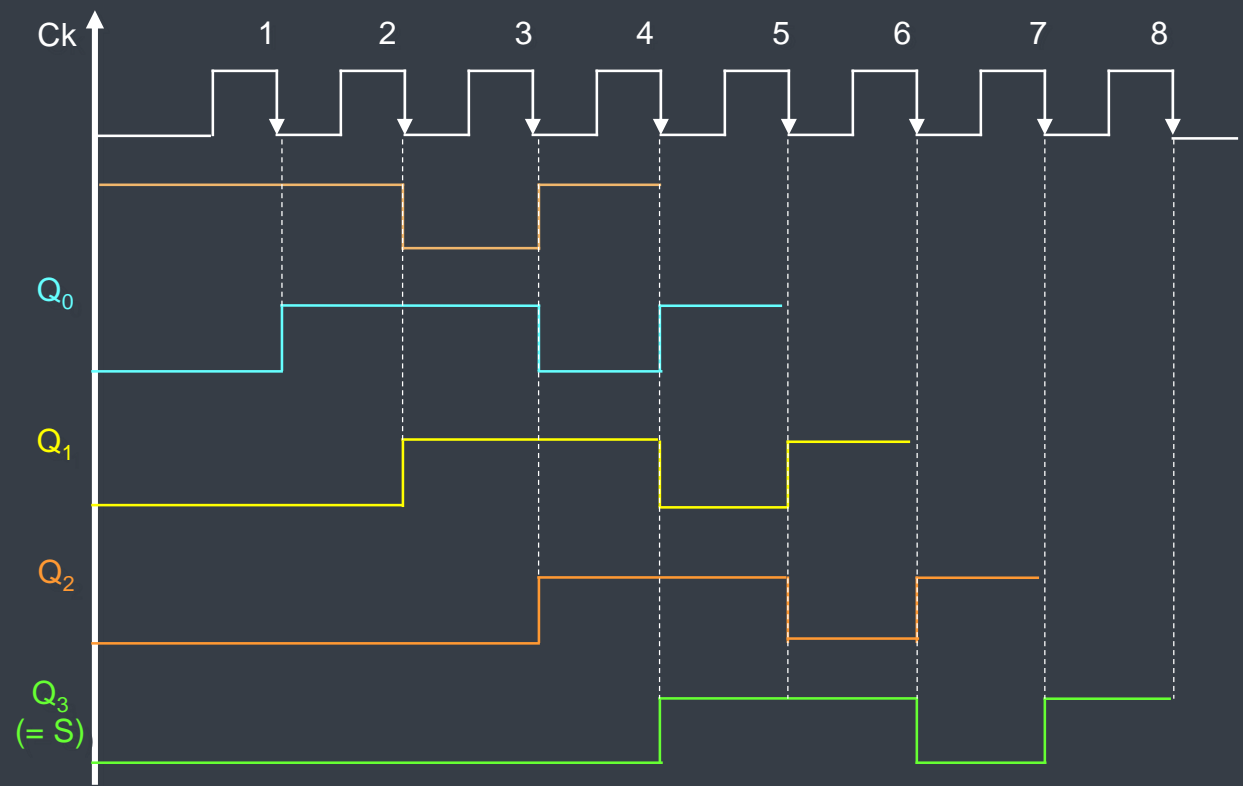
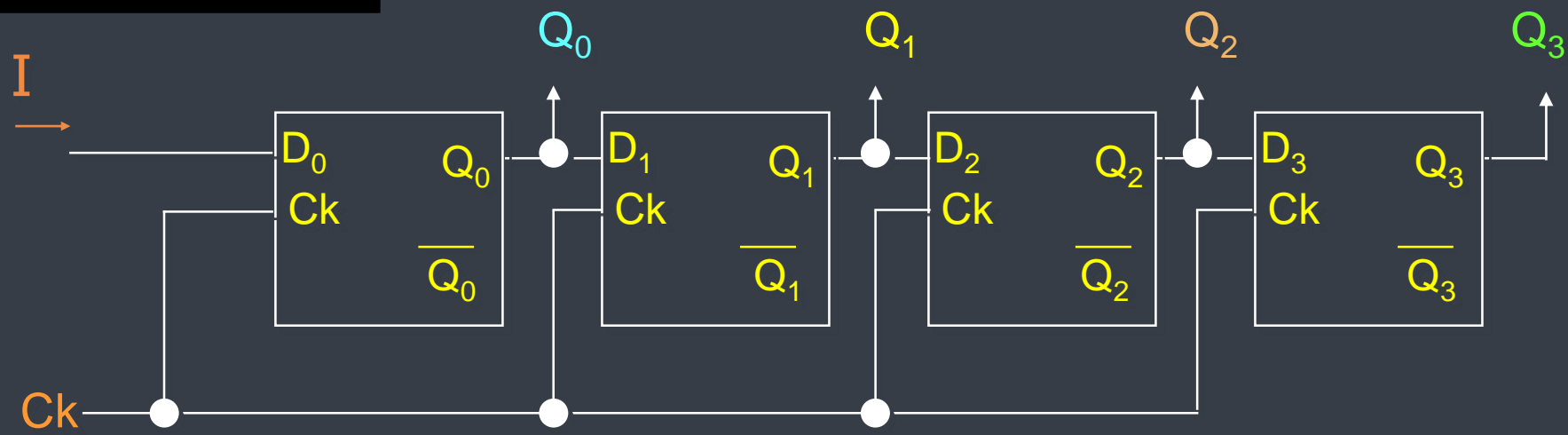
Set up time – t_s

Hold time – t_H

Tempo necessário de estabilidade do sinal de entrada **ANTES** e **DEPOIS** da transição do CK para armazenamento do dado



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I	Q ₀	Q ₁	Q ₂	Q ₃	Ck
1	0	0	0	0	1 2 3 4
1	1	0	0	0	
0	1	1	0	0	
1	0	1	1	0	
	1	0	1	1	

1 1 0 1
 MSB = Q₃ LSB = Q₀

Somador Serial

