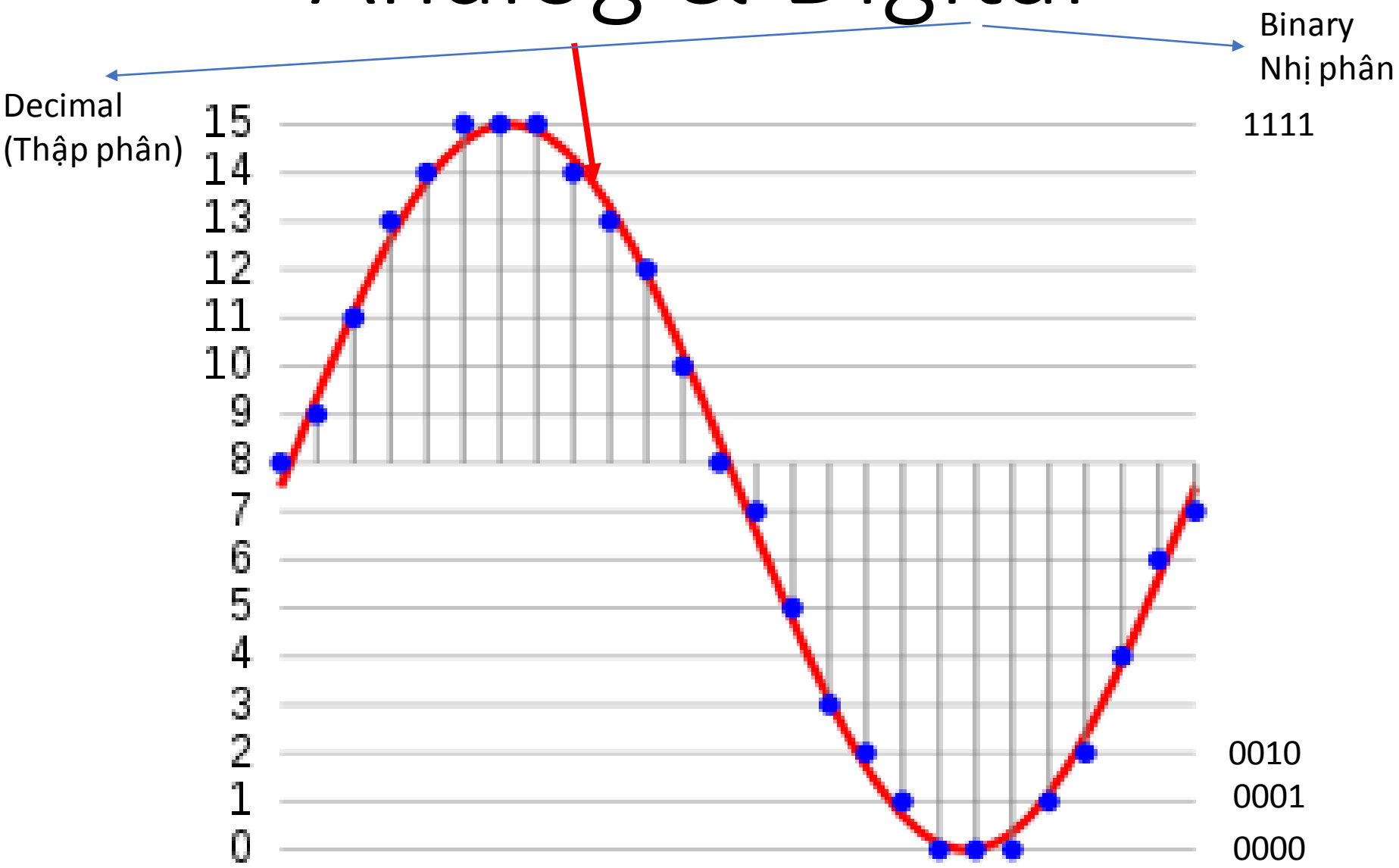
Digital Electronics

- What
- Why
- How

Analog & Digital

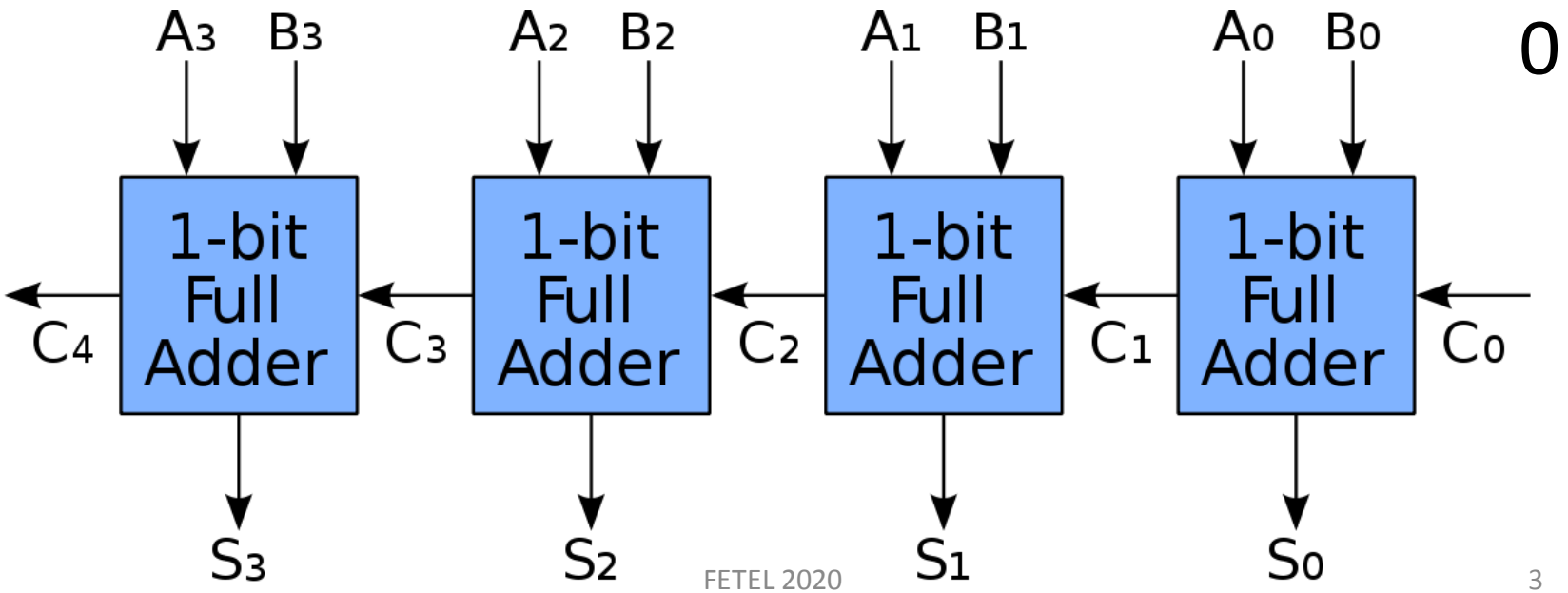


4 Bit Binary Adder

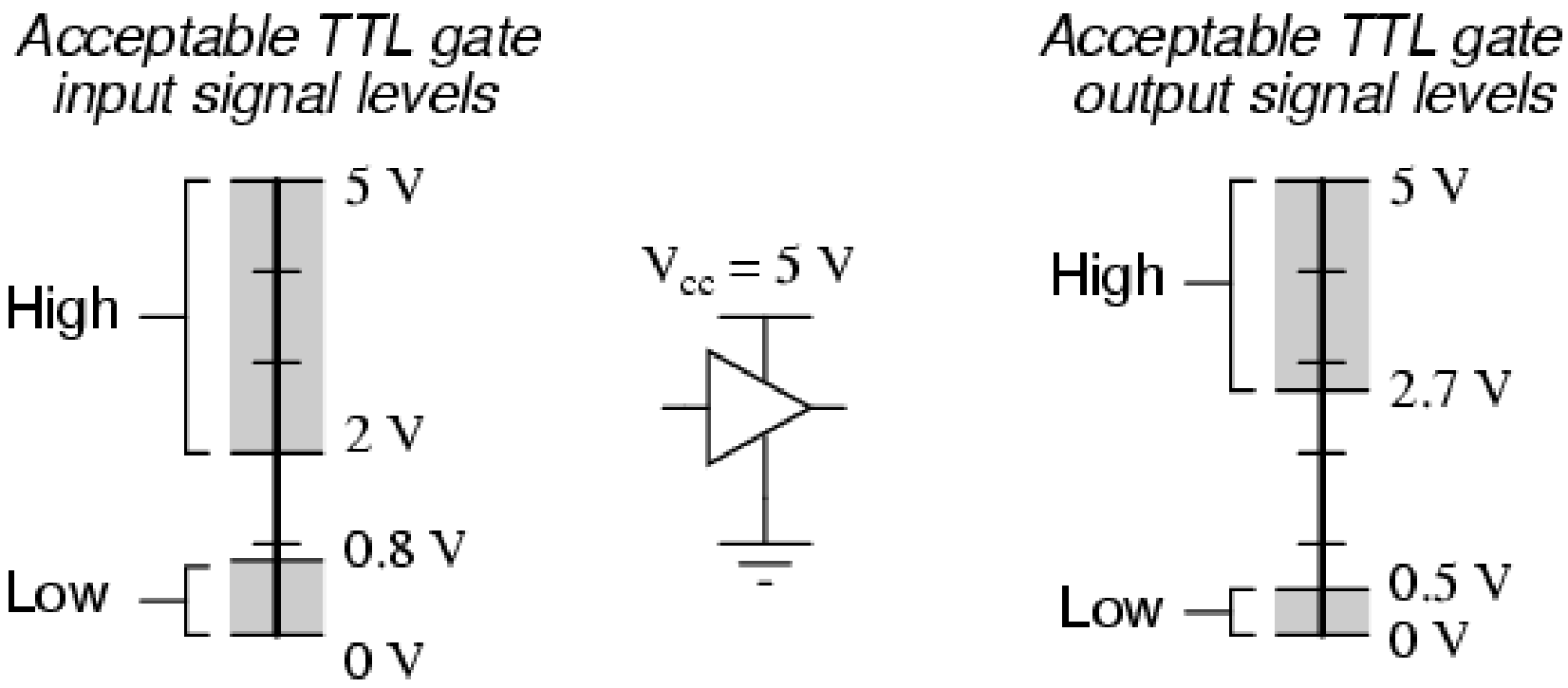
Ex: 0110

\+

0101

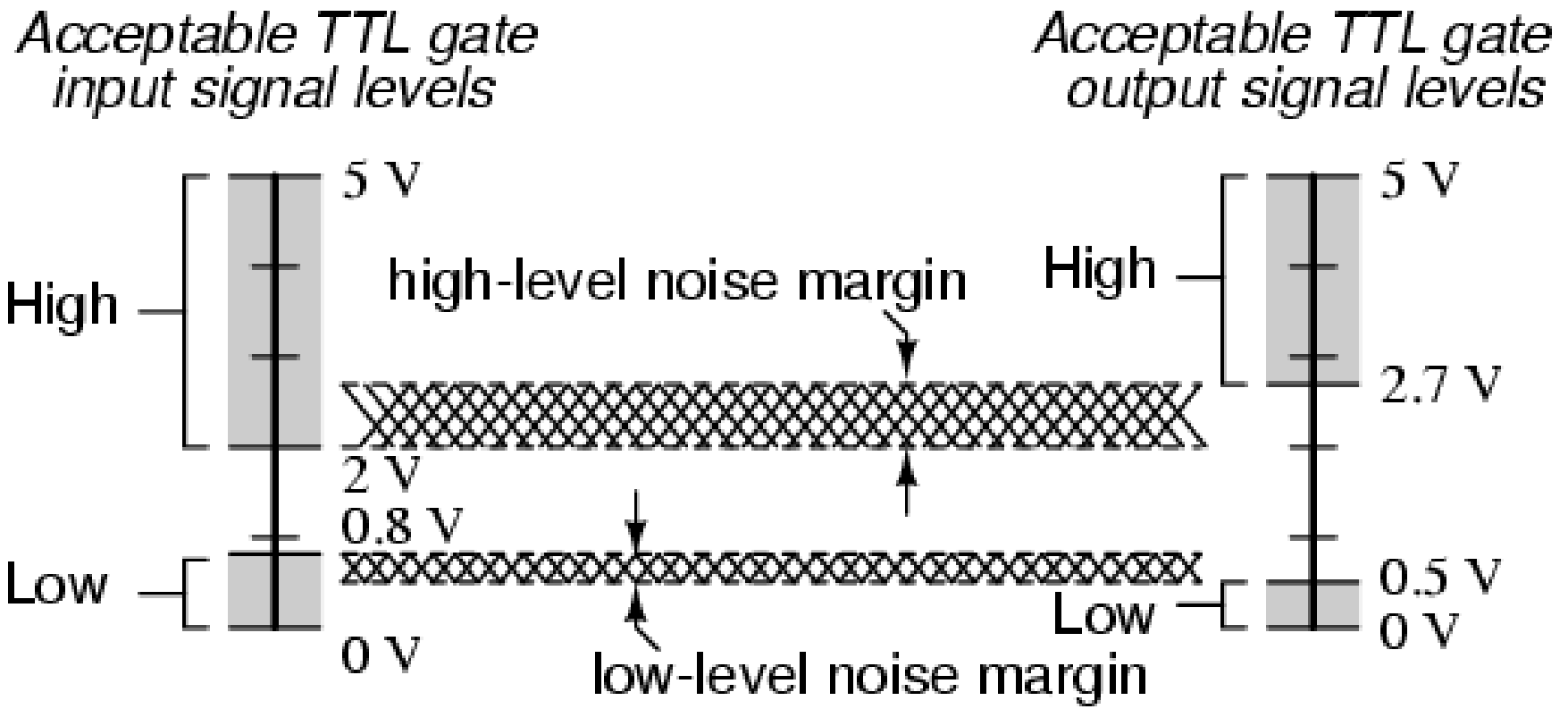


Logic 0 and Logic 1

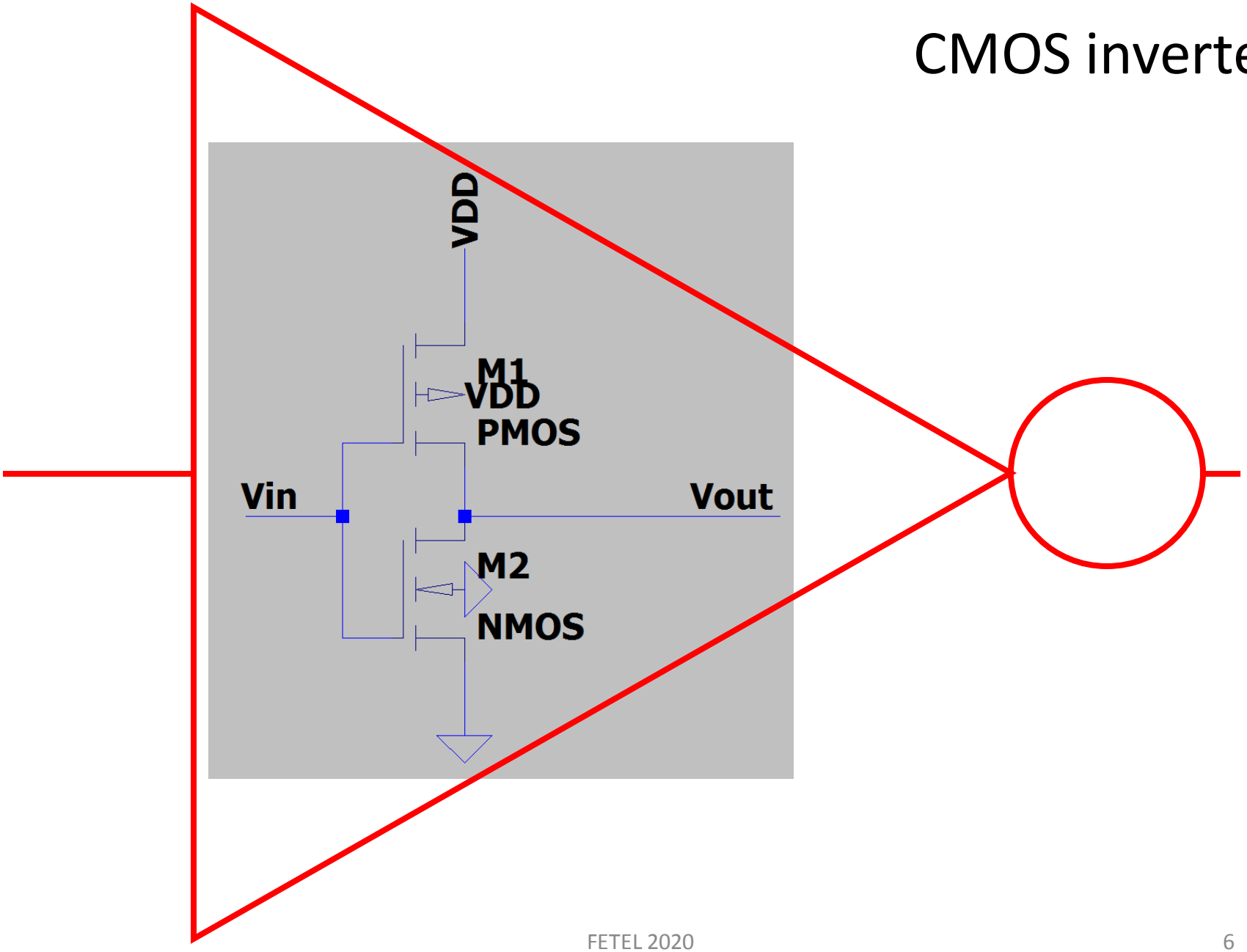


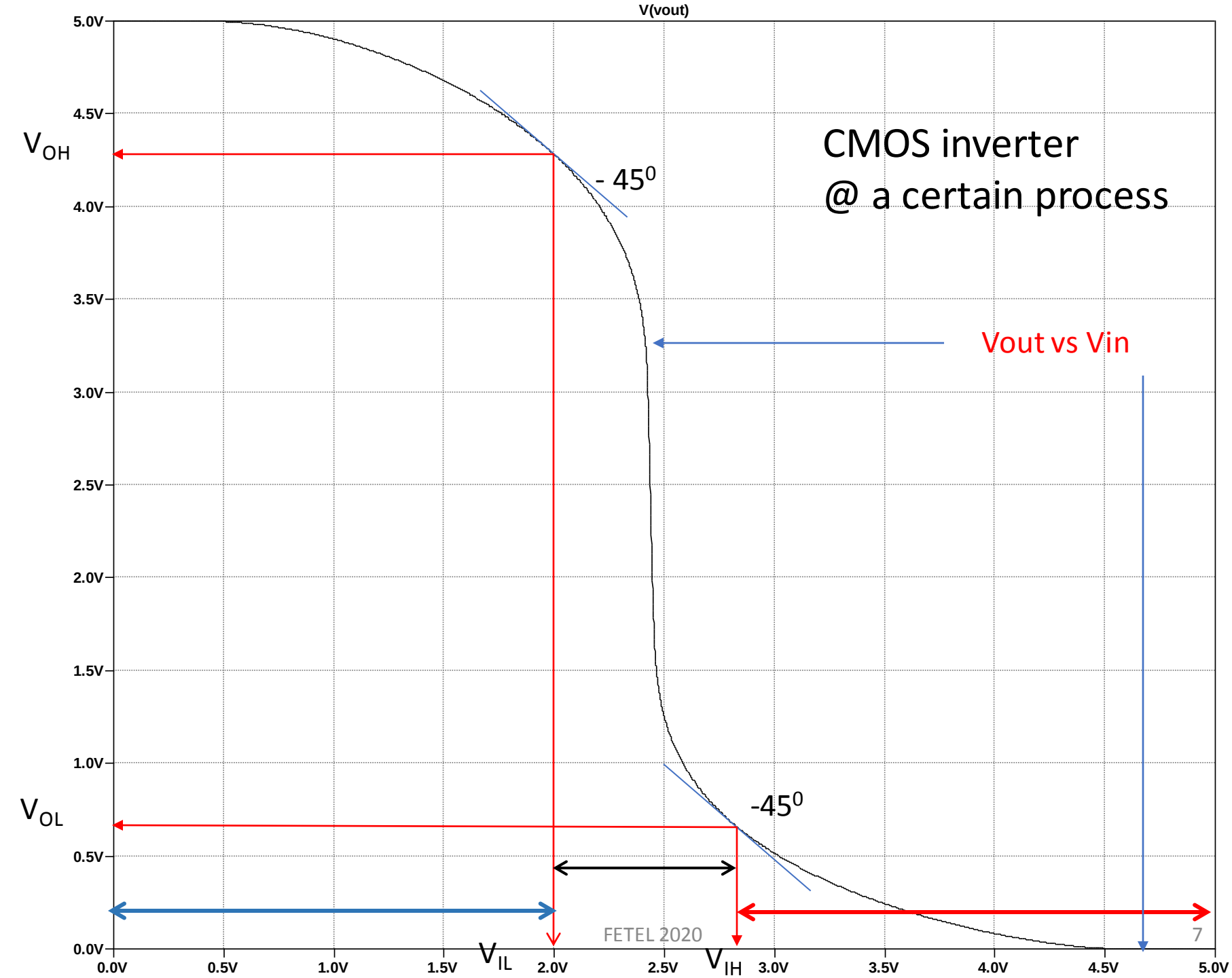
In this example, the range of input voltage (V_{IH}) can represent a HIGH (logic 1) is from 2 V to 5 V for the 5 V logic…..

Noise Margin



CMOS inverter




V(vout)
5.0V
4.5V
4.0V
3.5V
3.0V
2.5V
2.0V
1.5V
1.0V
0.5V
0.0V
V_{OH}
V_{OL}
- 45^0
-45^0
CMOS inverter
@ a certain process
Vout vs Vin
V_{IL}
V_{IH}
0.0V
0.5V
1.0V
1.5V
2.0V
2.5V
3.0V
3.5V
4.0V
4.5V
5.0V

How to find V_{IH}, V_{IL}, V_{OH}, V_{OL}

➔ Datasheet

SN5404, SN54LS04, SN54S04, SN7404, SN74LS04, SN74S04
HEX INVERTERS

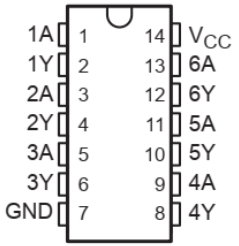
SDLS029C – DECEMBER 1983 – REVISED JANUARY 2004

- **Dependable Texas Instruments Quality and Reliability**

description/ordering information

These devices contain six independent inverters.

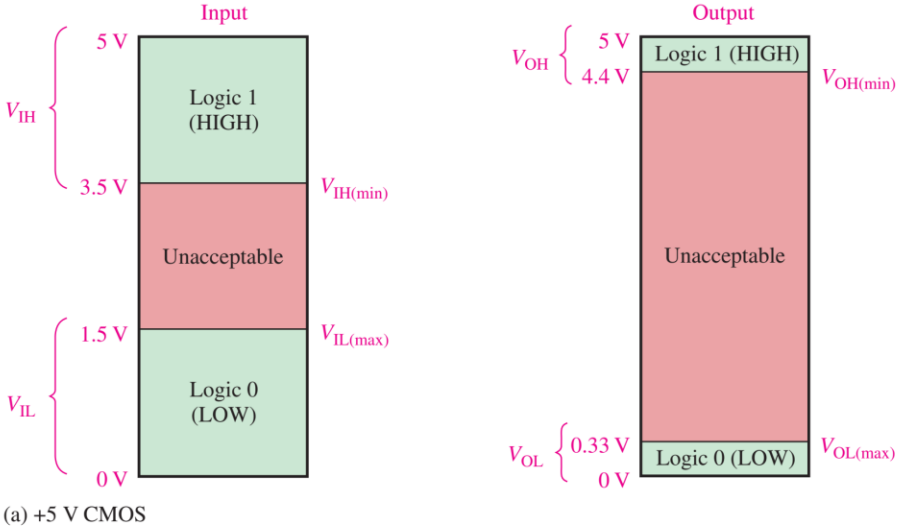
SN5404 . . . J PACKAGE
SN54LS04, SN54S04 . . . J OR W PACKAGE
SN7404, SN74S04 . . . D, N, OR NS PACKAGE
SN74LS04 . . . D, DB, N, OR NS PACKAGE
(TOP VIEW)



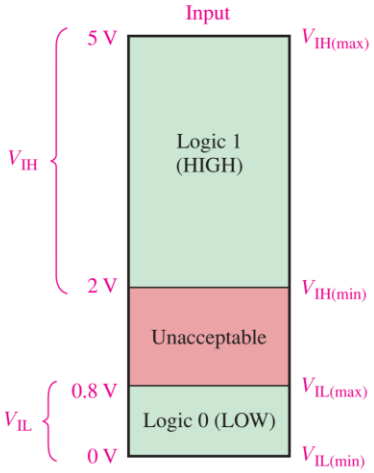
		SN54LS04			SN74LS04			UNIT
		MIN	NOM	MAX	MIN	NOM	MAX	
V_{CC}	Supply voltage	4.5	5	5.5	4.75	5	5.25	V
V_{IH}	High-level input voltage	2			2			V
V_{IL}	Low-level input voltage			0.7			0.8	V

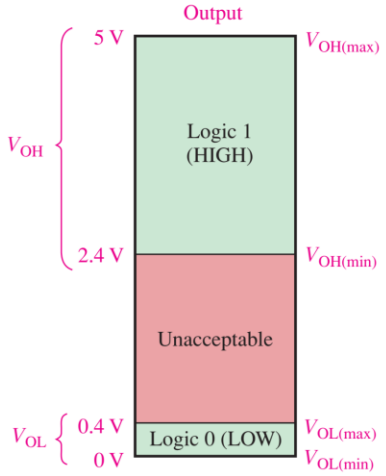
PARAMETER	TEST CONDITIONS†			SN54LS04			SN74LS04			UNIT
				MIN	TYP‡	MAX	MIN	TYP‡	MAX	
V_{IK}	V_{CC} = MIN,	I_I = −18 mA				−1.5			−1.5	V
V_{OH}	V_{CC} = MIN,	V_{IL} = MAX,	I_{OH} = −0.4 mA	2.5	3.4		2.7	3.4		V
V_{OL}	V_{CC} = MIN,	V_{IH} = 2 V	I_{OL} = 4 mA		0.25	0.4			0.4	V
			I_{OL} = 8 mA					0.25	0.5	

V_{IH} ,V_{IL}, V_{OH} ,V_{OL} of some technologies

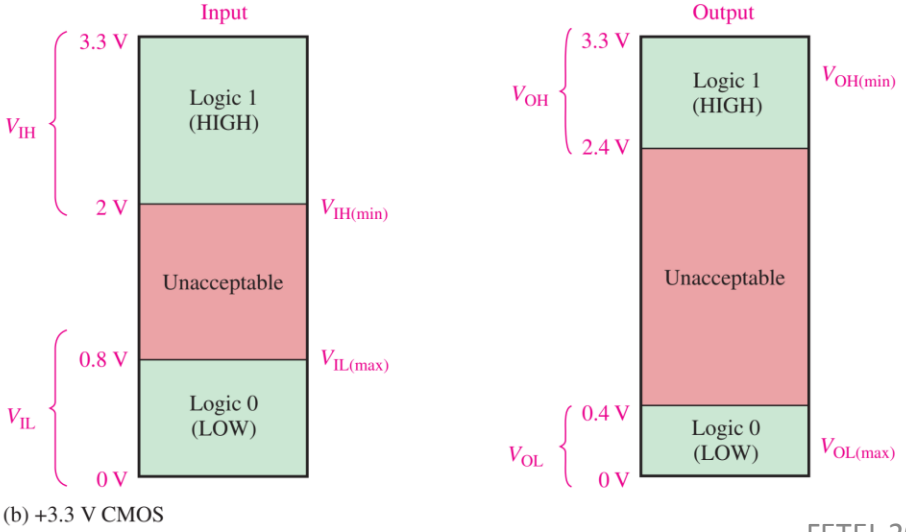


(a) +5 V CMOS





Input and output logic levels for TTL

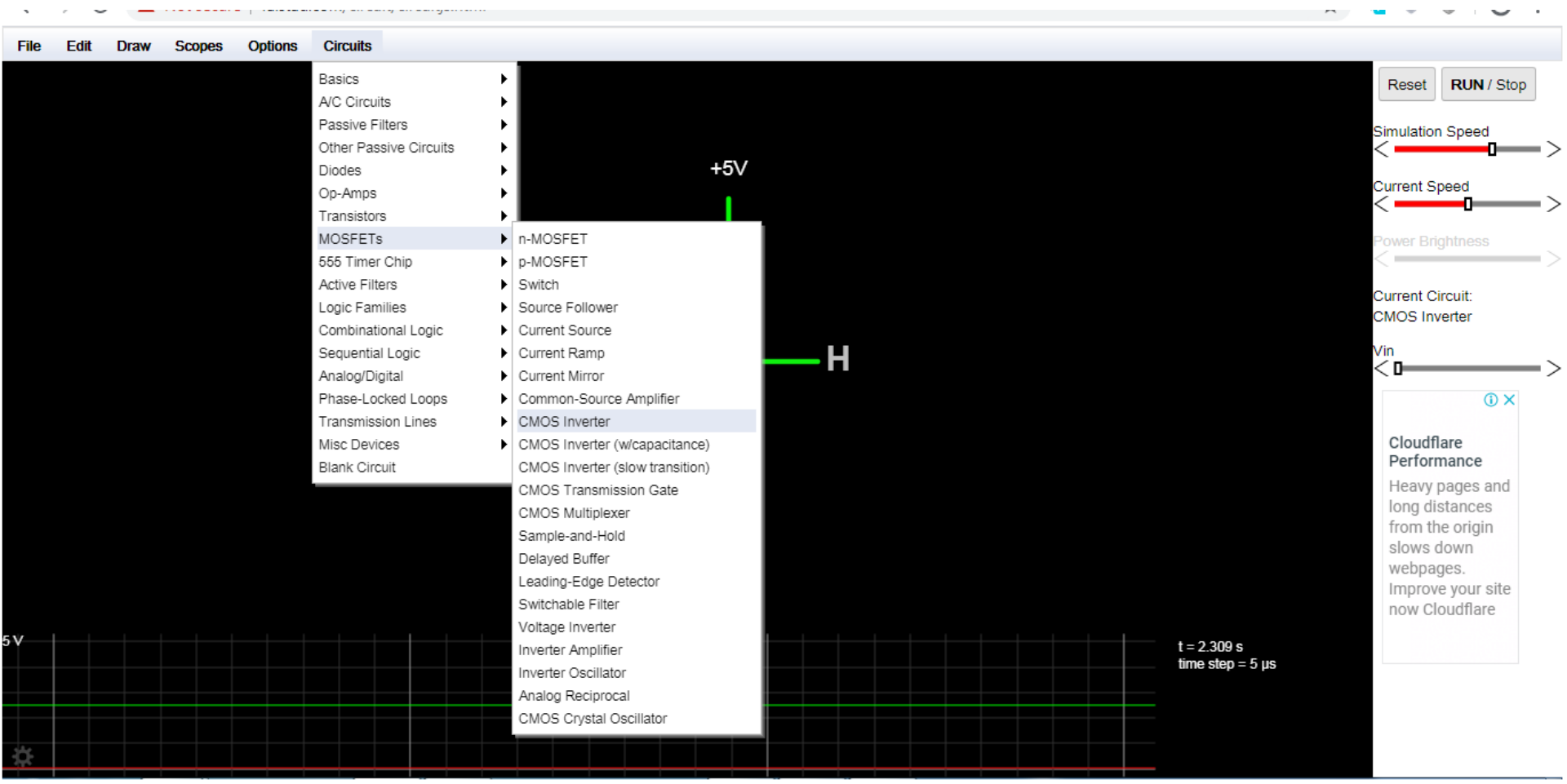


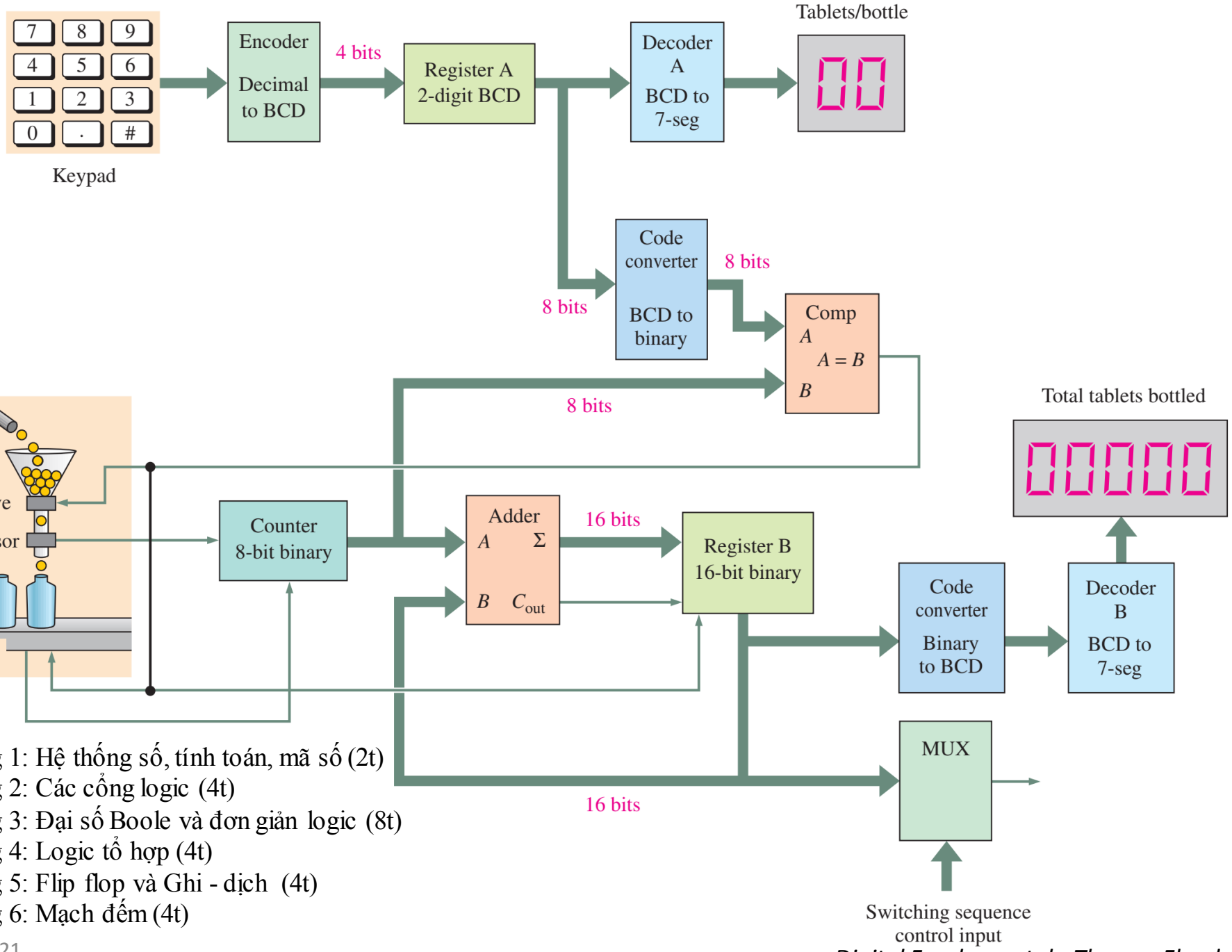
(b) +3.3 V CMOS

Input and output logic levels for CMOS

Demo

- http://www.falstad.com/circuit/circuitjs.html





Chương 1: Hệ thống số, tính toán, mã số (2t)
Chương 2: Các cổng logic (4t)
Chương 3: Đại số Boole và đơn giản logic (8t)
Chương 4: Logic tổ hợp (4t)
Chương 5: Flip flop và Ghi - dịch (4t)
Chương 6: Mạch đếm (4t)

Digital Fundamentals, Thomas Floyd