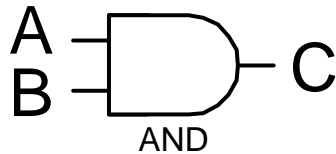


Digital Logic Topics

Brief notes to preface the laboratory exercise

Truth Tables

- Consider the following and gate

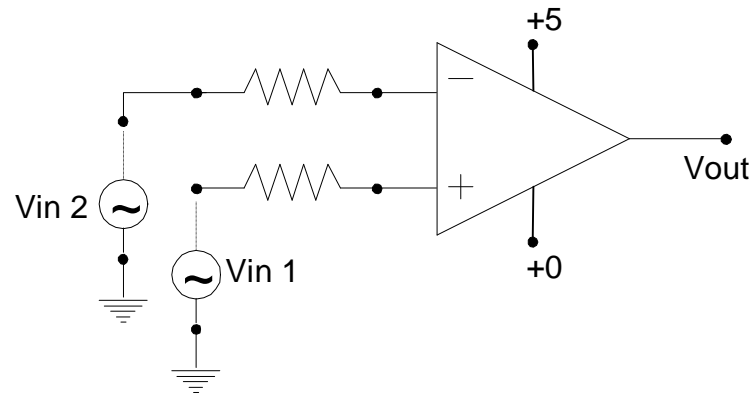


- A truth table “enumerates” the output state for every possible input state. See Example:

Input		Output
A	B	C
0	0	0
1	0	0
0	1	0
1	1	1

OpAmp Gate Model

- ● Comparator



- $V_{out} = +5$ if $V_{in 1} > V_{in 2}$ else $V_{out} = 0$
- Devices are available designed for the comparison purpose. They are in general faster and better suited for this purpose than a conventional op-amp.
- Devices actually used in digital logic are much simpler internally than an Op Amp

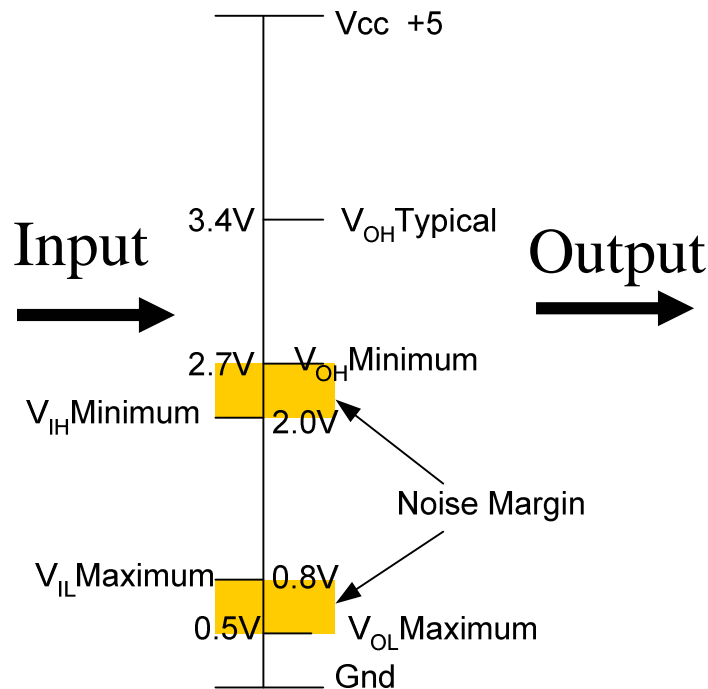
Digital Logic Devices

- Logic Function
 - Electronic elements for processing digital (numeric) information
 - Normally bi-state, 1 or 0 digital values represented by two discrete electrical signals
 - Our concern is primarily interfacing with logic inputs and outputs
- Important terms/issues
 - Fan-out - the amount of output drive capacity compared to input drive requirement
 - Open collector - an output that is configured as a switch to reference voltage rather than a voltage level signal
 - Propagation delay - the amount of time between a change in input state and a change in output state.
 - Power - Quiescent and active power consumption

Input and Output Voltage Levels

- TTL

- Transistor-Transistor Logic
 - Classically has 0 and 5 V nominal logic levels. 3V logic is evolving
- Signal levels



- Logic voltage level comparison

	5VTTL	5V CMOS	3.3 LVTTTL	2.5V CMOS	4000 CMOS
V_{CC}	5	5	3.3	2.5	*10
V_{OH}	2.4	4.44	2.4	2.3	9.95
V_{IH}	2	3.5	2	1.7	7
V_T	1.5	2.5	1.5	1.2	5
V_{IL}	0.8	1.5	0.8	0.7	3
V_{OL}	0.4	0.5	0.4	0.2	0.05
GND	0	0	0	0	0

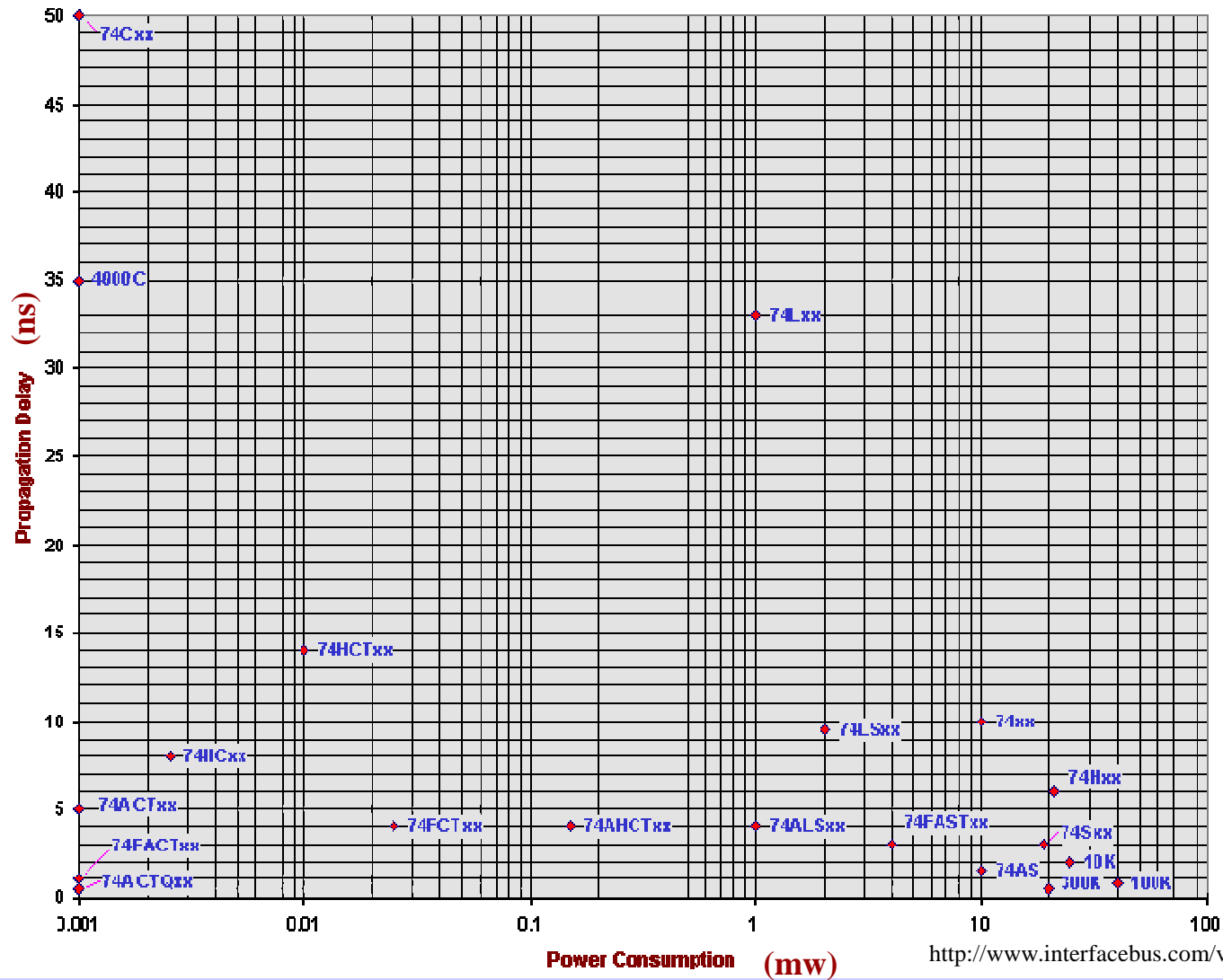
*3-18V

Device Families

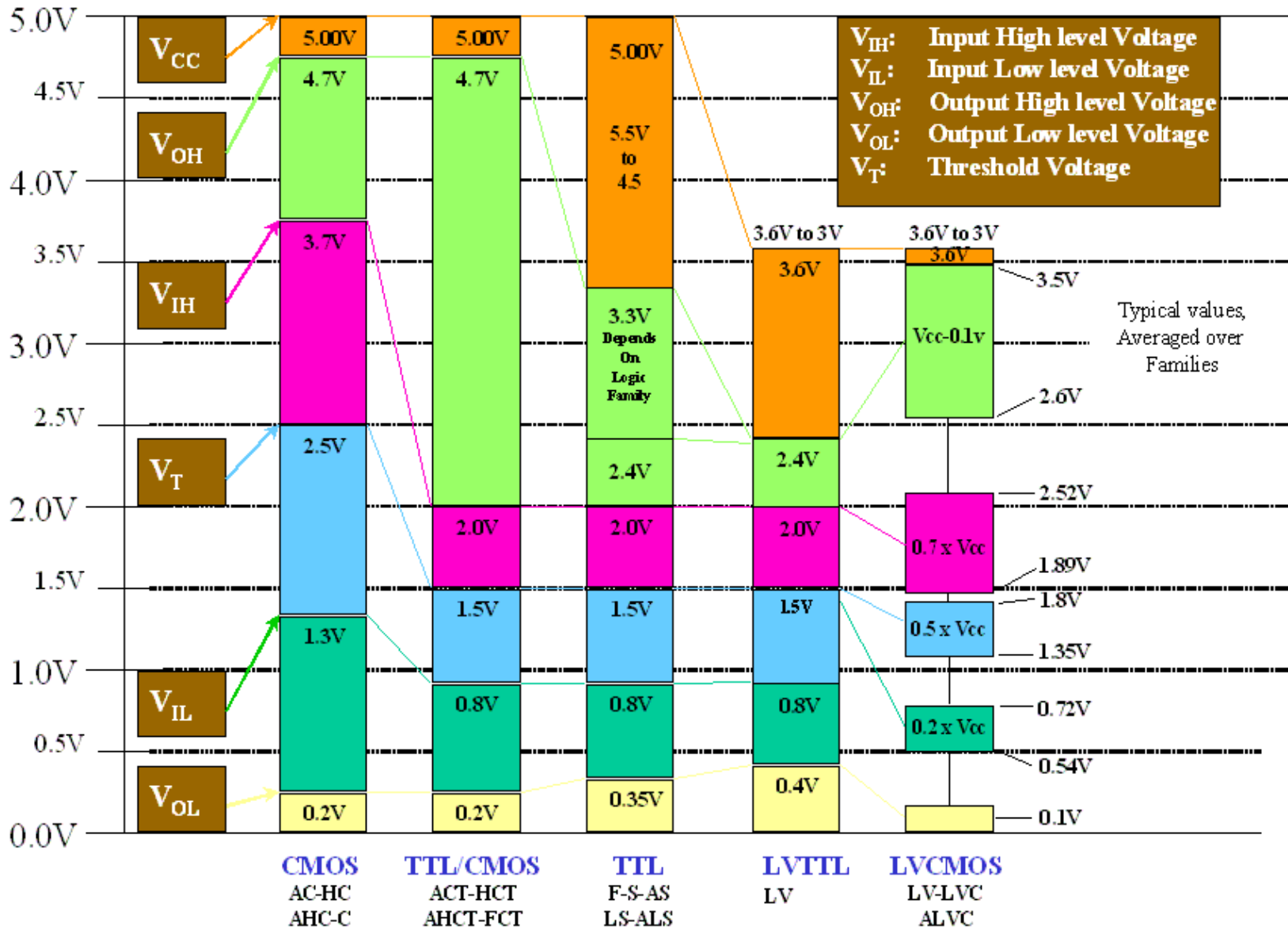
TTL (74xx)	True TTL
74L	Low power
74S	Schottky
74H	High speed
74LS	Low power - Schottky
74AS	Advanced - Schottky
74ALS	Advanced - Low power - Schottky
74F(AST)	Fast - (Advanced - Schottky)
74C	CMOS
74HC (U)	High speed - CMOS (Unbuffered output)
74HCT	High speed - CMOS - TTL inputs
74AHC	Advanced - High speed - CMOS
74AHCT	Advanced - High speed - CMOS - TTL inputs
74FCT (-A)	Fast - CMOS - TTL inputs (speed variations)
74FCT (-T, -AT)	Fast - CMOS - TTL inputs (speed variations)
74AC	Advanced - CMOS
74ACT	Advanced - CMOS - TTL inputs
74FACT	AC, ACT (Q) series
74ACQ	Advanced - CMOS - Quiet outputs
74ACTQ	Advanced - CMOS - TTL inputs - Quiet outputs

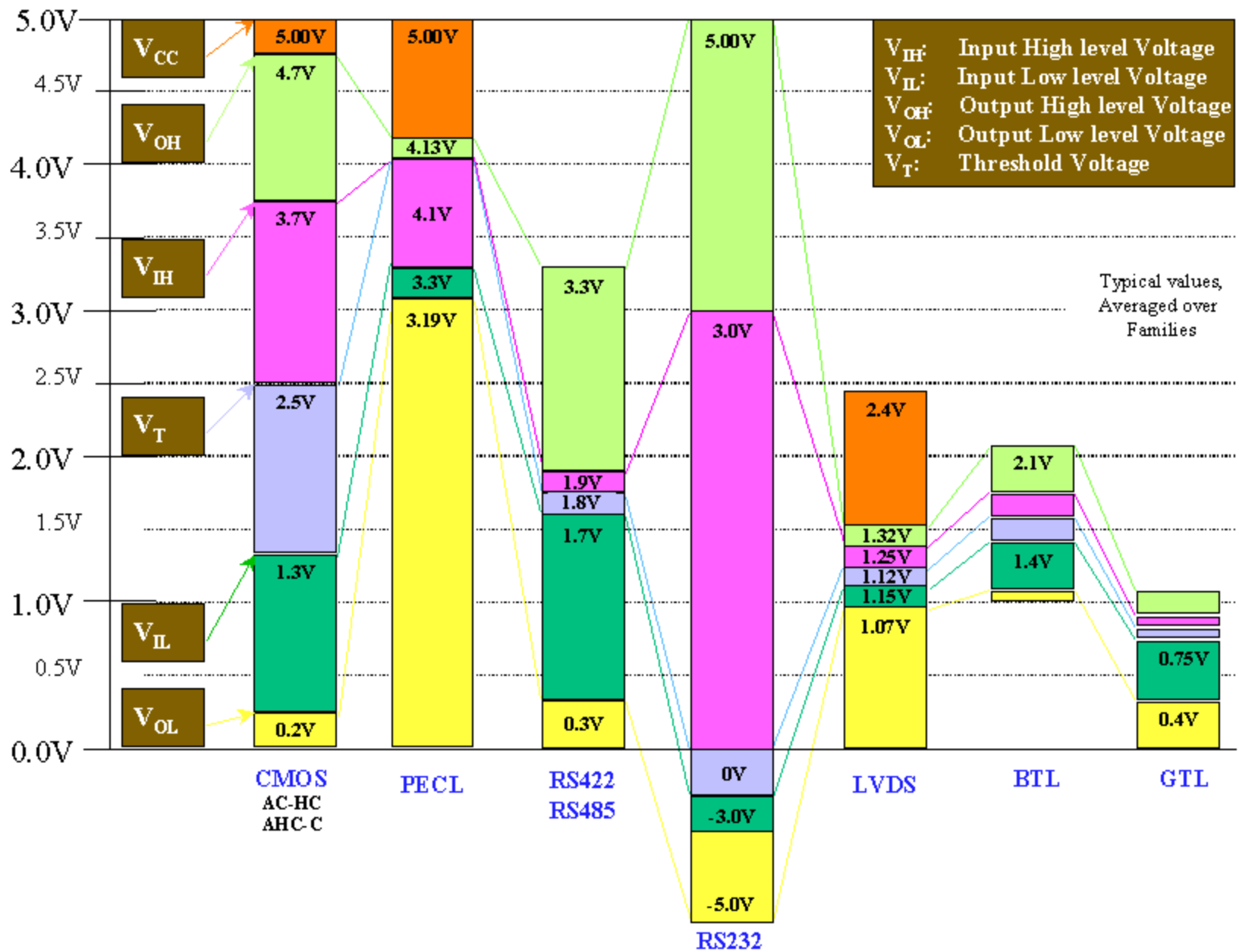
http://www.interfacebus.com/voltage_threshold.html

LOGIC Power vs. Speed



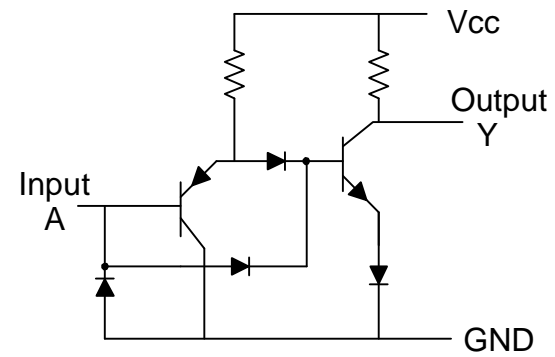
http://www.interfacebus.com/voltage_threshold.html



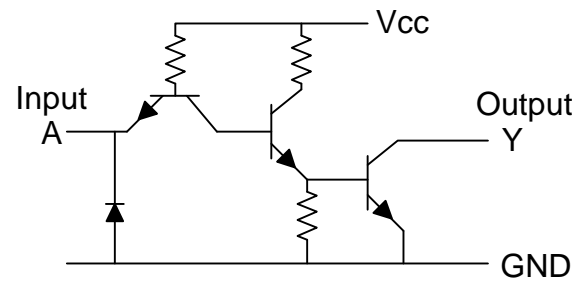


TTL

- Gate Electronic structure



Conventional Bipolar Gate



Open Collector Gate

CMOS Logic

- CMOS - Logic
 - Low power
 - 3 - 18 V logic levels
 - Static Sensitive
 - Gate electronic struct

