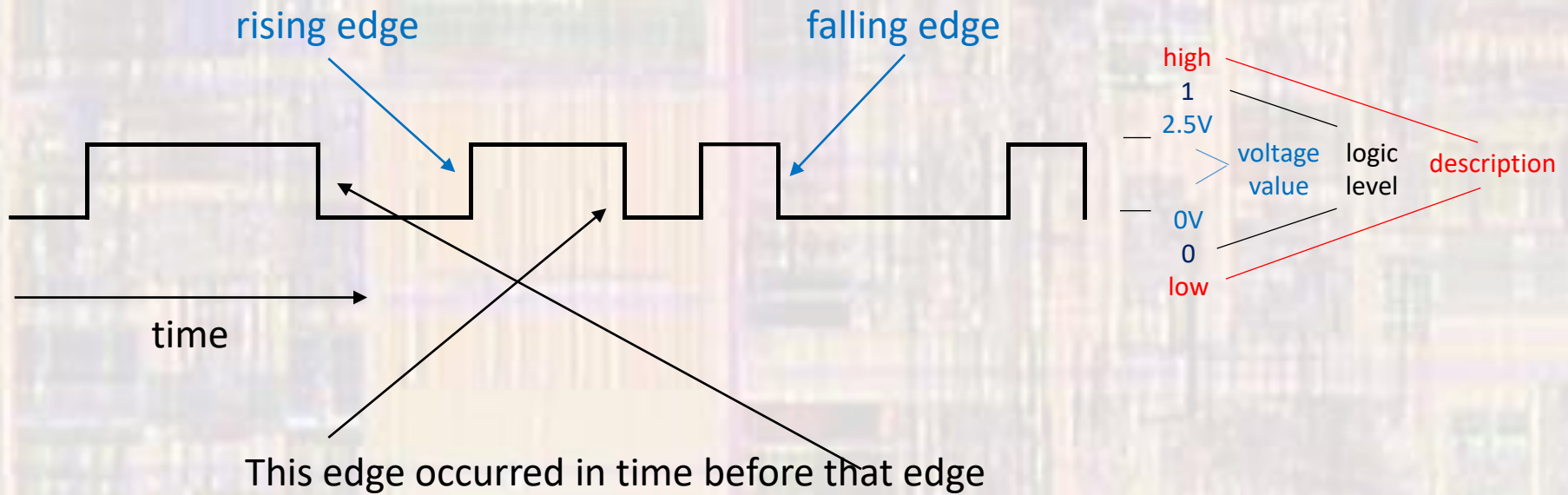


# Signals

Last updated 1/11/21

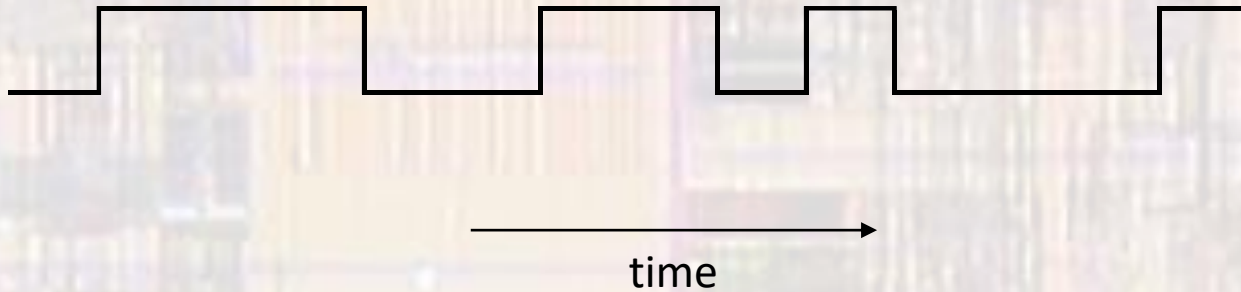
# Signals

- Digital signals
  - 2 values



# Signals

- Digital signals
  - Aperiodic
    - No fixed repetition
    - e.g. Intermittent logic signals



# Signals

- Engineering Notation

- Special version of Scientific Notation

- Scientific Notation

- $234.567 \rightarrow 2.3456 \times 10^2$       2.3456E2
- $0.009876 \rightarrow 9.86 \times 10^{-3}$       9.86E-3

- Engineering Notation

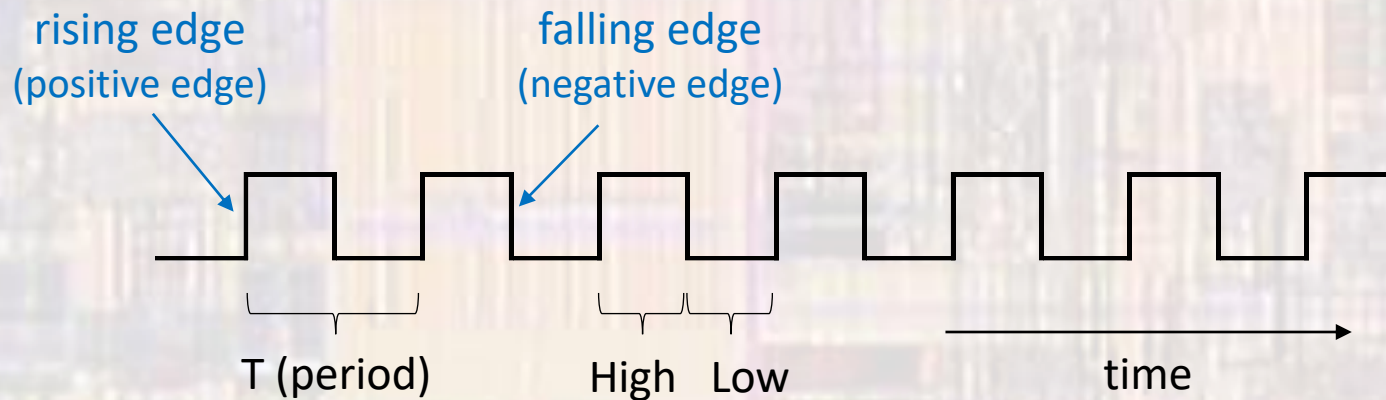
- Exponents are factors of 3 to match to the magnitude abbreviations

•	f	p	n	u	m		K	M	G	T
•	-15	-12	-9	-6	-3		3	6	9	12
•	femto	pico	nano	micro	milli		Kilo	Mega	Giga	Tera

- $2365.54 \rightarrow 2.36554 \times 10^3$       2.36554K
- $.0000000234 \rightarrow 23.4 \times 10^{-9}$       23.4p
- $1.234 \times 10^7 \rightarrow 12.34 \times 10^6$       12.34M
- $23.654 \rightarrow 23.654$       23.654
- $1.234 \times 10^7 \rightarrow$  ~~$.01234 \times 10^9$~~  $\rightarrow 12.34 \times 10^6$       12.34M

# Signals

- Digital signals
  - Periodic
    - Fixed repetition cycle
    - e.g. Clock signals



$$F \text{ (frequency)} = 1/T$$

$$50\text{MHz} \leftrightarrow 20\text{ns}$$

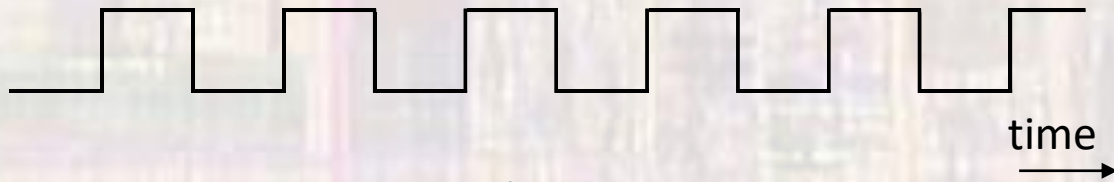
$$\text{Duty Cycle} = (\text{High} / T) \%$$

$$50\% \rightarrow \text{High} = 10\text{ns}, \text{Low} = 10\text{ns}$$

# Signals

- Clock Systems

50MHz Clk



F = \_\_\_\_\_

T = \_\_\_\_\_

Duty Cycle = \_\_\_\_\_

$t_{\text{HIGH}} = 25\text{ns}$

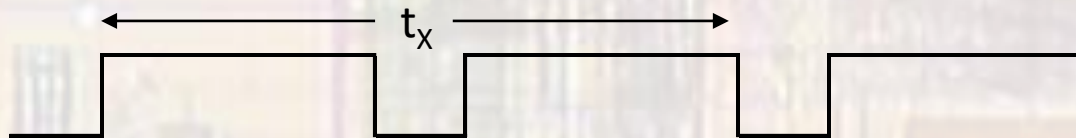


F = \_\_\_\_\_

T = \_\_\_\_\_

Duty Cycle = \_\_\_\_\_

$t_x = 875\text{ns}$



F = \_\_\_\_\_

T = \_\_\_\_\_

Duty Cycle = \_\_\_\_\_

# Signals

- Clock Systems – quick calculations

- No calculator

F                      T  
1MHz    → \_\_\_\_\_ s

10MHz   → \_\_\_\_\_ s

1GHz     → \_\_\_\_\_ s

300MHz → \_\_\_\_\_ s

20KHz   → \_\_\_\_\_ s

48MHz   → \_\_\_\_\_ s

T                      F  
10ms    → \_\_\_\_\_ Hz

100us   → \_\_\_\_\_ Hz

50ns     → \_\_\_\_\_ Hz

125ps   → \_\_\_\_\_ Hz

33.33us → \_\_\_\_\_ Hz

25s      → \_\_\_\_\_ Hz

# Signals

- Clock Systems
  - 3 – phase, non-overlapping clock

