

FORMULA SHEET – DIGITAL**1 Operational amplifier****1.1 Gain:**

$$A_v = \frac{V_{out}}{V_{in}} \quad A_v = -\left(\frac{R_f}{R_{in}}\right) \quad A_v = \left(1 + \frac{R_f}{R_{in}}\right)$$

1.2 Voltage:

$$V_{out} = V_{in} \times \left(1 + \frac{R_f}{R_{in}}\right) \quad V_{out} = V_{in} \times \left(-\frac{R_f}{R_{in}}\right) \quad V_{out} = -(V_i - V_x) A_v$$

$$V_{out} = -(V_1 + V_2 + V_3) \quad V_{out} = -V_i \times A_v \quad V_{ref} = V_{cc} \left(\frac{R_1}{R_1 + R_2}\right)$$

$$V_o = -V_i \left(\frac{1}{j2\pi fRC}\right) \quad V_o = -R_f C \left(\frac{\Delta V_i}{\Delta t}\right) \quad V_{out} = -\left(V_{i1} \frac{R_f}{R_1} + V_{i2} \frac{R_f}{R_2} + V_{i3} \frac{R_f}{R_3} \dots\right)$$

1.3 Time:

$$T_1 = 0,693(R_2 + R_1)C \quad T = RC \quad T = R_f C$$

$$T_1 = 0,693 \times R_2 C \quad T = 0,693RC \quad T = 1,1R_2 C$$

1.4 Frequency:

$$f = \frac{1}{2R_f C} \quad f = \frac{1,44}{(R_1 + 2R_2)C}$$

1.5 Duty cycle:

$$\text{Duty cycle} = \frac{R_1 + R_2}{(R_1 + 2R_2)} \times 100\%$$

2 Logic

$$\text{MOD } X = 2^N \quad \text{Counting steps} = 2^N - 1 \quad N = \sqrt{\text{MOD } X}$$