

B31DG Assignment 1 Report

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1. Contact Details

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2. Revision History

Version Number	Date	Author Name	Notes
1.0	24/01/25	Ewan Wills	Initial Version
2.0	30/01/25	Ewan Wills	Added oscilloscope section and formatting

3. Calculation of Application Parameters

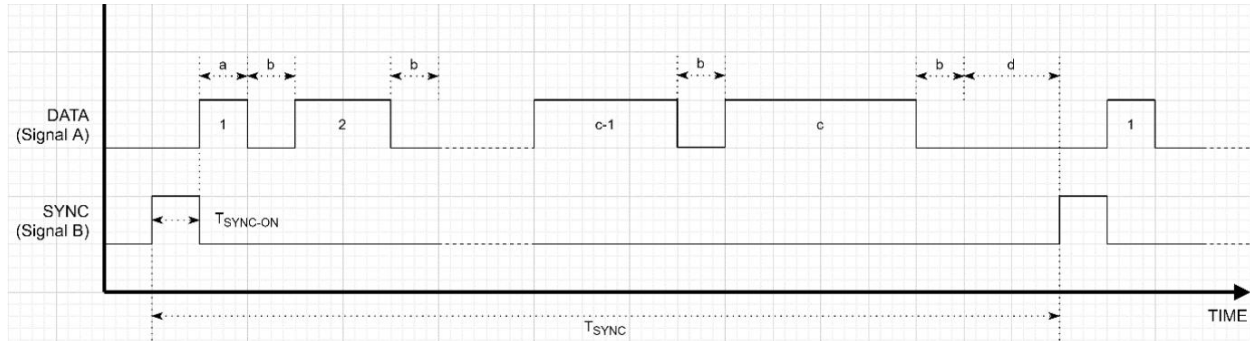


Figure 1 – Output Timing Diagram

With reference to the diagram provided (Figure 1), all of the timing parameters are assigned to either a, b, c, d or $T_{\text{SYNC-ON}}$.

Values for a, b, c, and d are determined by the alphanumeric mapping of the students surname. For WILLS: W=4, I=9, L=12, L=12, S=8.

$$W = 4 \therefore a = 4 * 100\mu S = 400\mu S$$

$$I = 9 \therefore b = 9 * 100\mu S = 900\mu S$$

$$L = 12 \therefore c = 12 + 4 = 16 \text{ (pulses)}$$

$$L = 12 \therefore d = 12 * 500\mu S = 6000\mu S$$

The alphanumeric value for S is used for determine the alternative output behaviour of the DATA line.

$$S = 8 \therefore \text{Option} = 8\%4 + 1 = 1$$

For normal data output, the pulses 1, 2, ..., c (16) increase by a set amount given by the calculation:

$$T_{ON(n)} = a + ((n - 1) * 50\mu S), \quad \text{for } n > 0$$

This is implemented in code using a **for** loop. This is for PRODUCTION mode. In DEBUG mode DataPeriodOn1 will be multiplied by 1000 prior to the calculations, therefore

$$\text{DataPeriodOn}[n] = \text{DataPeriodOn1} + ((n - 1) * 50 * 10^{-3})$$

```

//calculate all DataPeriodOn's for NumPulses for PRODUCTION
for (int n=1; n<NumPulses; n++){
    DataPeriodOn[n] = DataPeriodOn1 + (n-1)*(50*(10^-6));
}

```

Figure 2 - DataPeriodOn(n) loop

Figure 3 shows the initialisation of NumPulses (C) and the DataPeriodOn list. PRODUCTION is a Boolean value to implement a conditional code-compile.

```

//define if program will compile in production or debug
#define PRODUCTION false

const int NumPulses = 16;

int DataPeriodOn[NumPulses+1];

```

Figure 3 – Application parameters A

Figure 4 shows the assignment of values for PRODUCTION and DEBUG mode. All values are in microseconds so that they can all be integers.

```

//all values in microseconds
if (PRODUCTION){
    DataPeriodOff = 900; //900uS
    DataPeriodOffFinal = 6000; //6mS
    DataPeriodOn1 = 400; //400uS
    SyncPeriodOn = 50; //50uS
    //calculate all DataPeriodOn's for NumPulses for PRODUCTION
    for (int n=1; n<=NumPulses; n++){
        DataPeriodOn[n] = DataPeriodOn1 + (n-1)*(50);
    }
}
else{
    DataPeriodOff = 900*1000; //900mS - b
    DataPeriodOffFinal = 6000*1000; //6S - d
    DataPeriodOn1 = 400*1000; //400mS - a
    SyncPeriodOn = 50*1000; //50mS
    //calculate all DataPeriodOn's for NumPulses *1000 for DEBUG
    for (int n=1; n<=NumPulses; n++){
        DataPeriodOn[n] = DataPeriodOn1 + (n-1)*(50*(1000));
    }
}
}

```

Figure 4 – Application parameters B

4. Oscilloscope Screen Captures

a. Oscilloscope Images

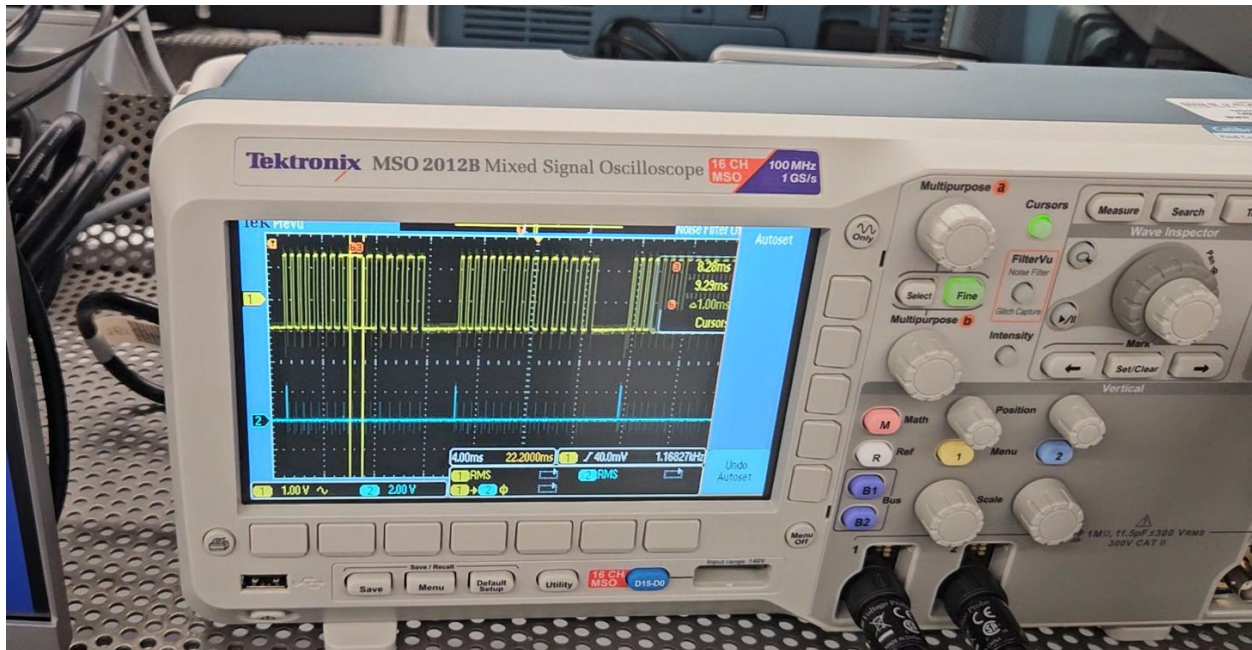


Figure 5 - Oscilloscope capture 1

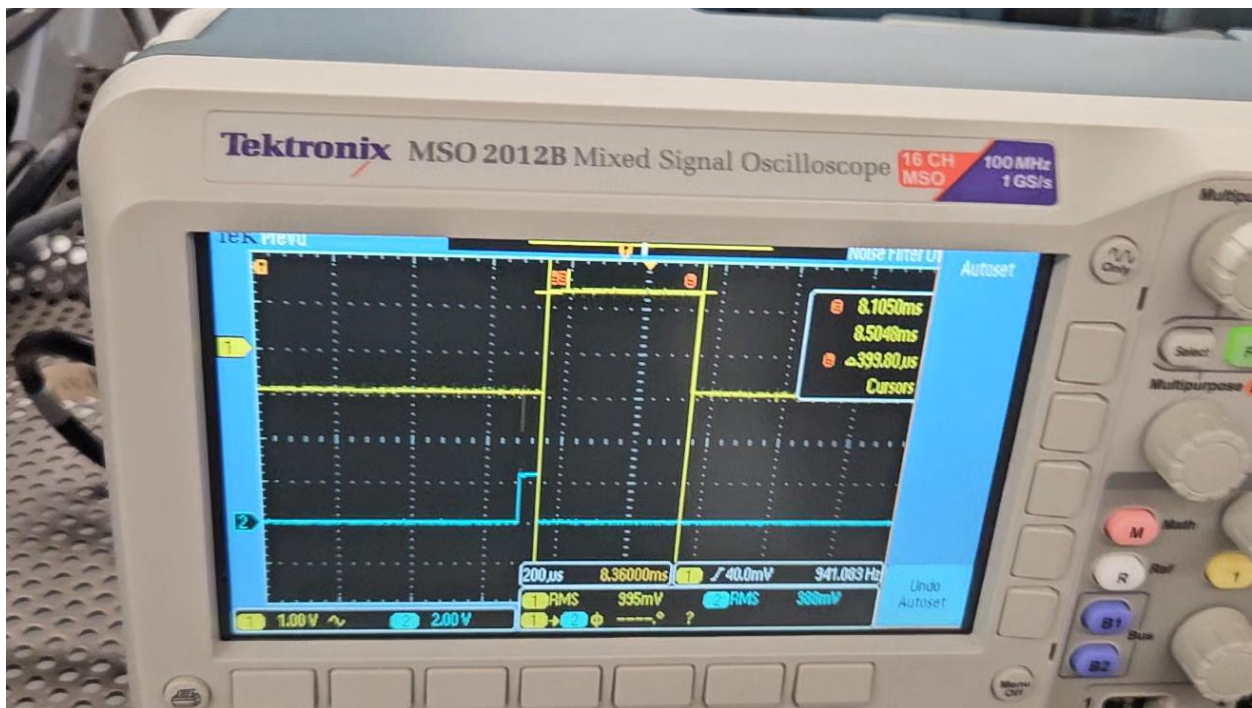


Figure 6 - Oscilloscope capture 2

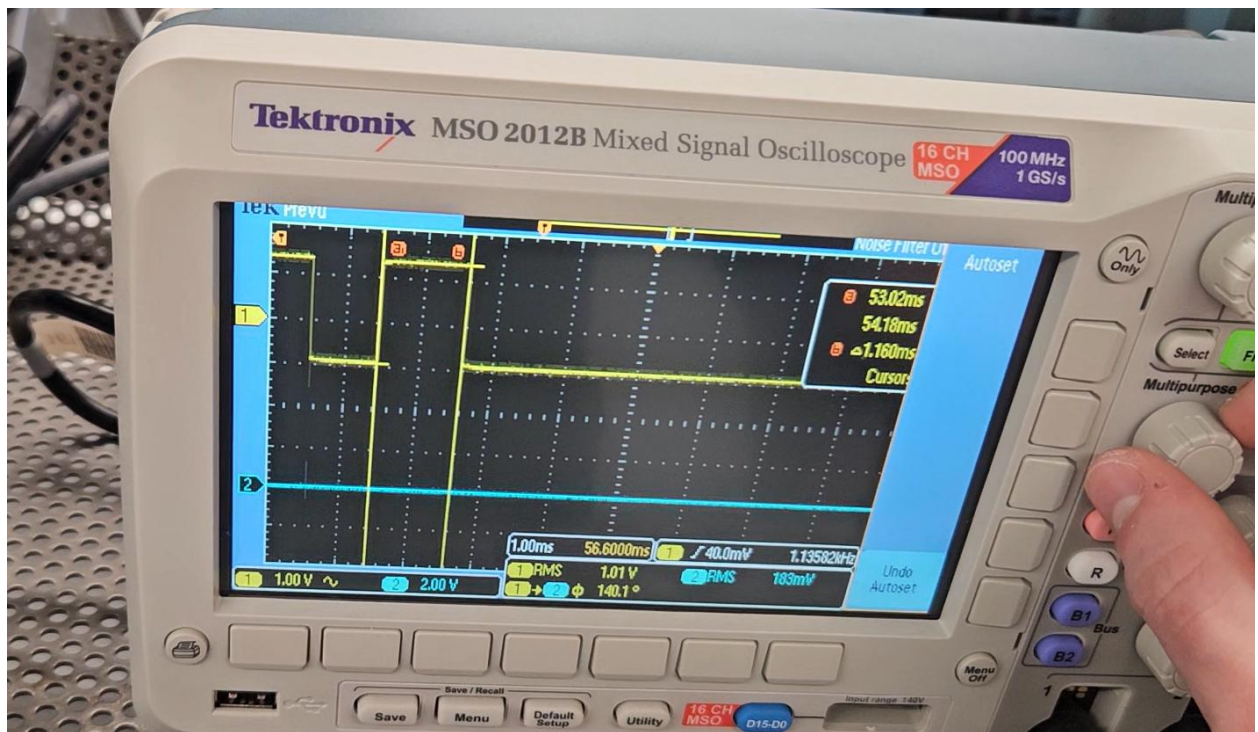


Figure 7 - Oscilloscope capture 3

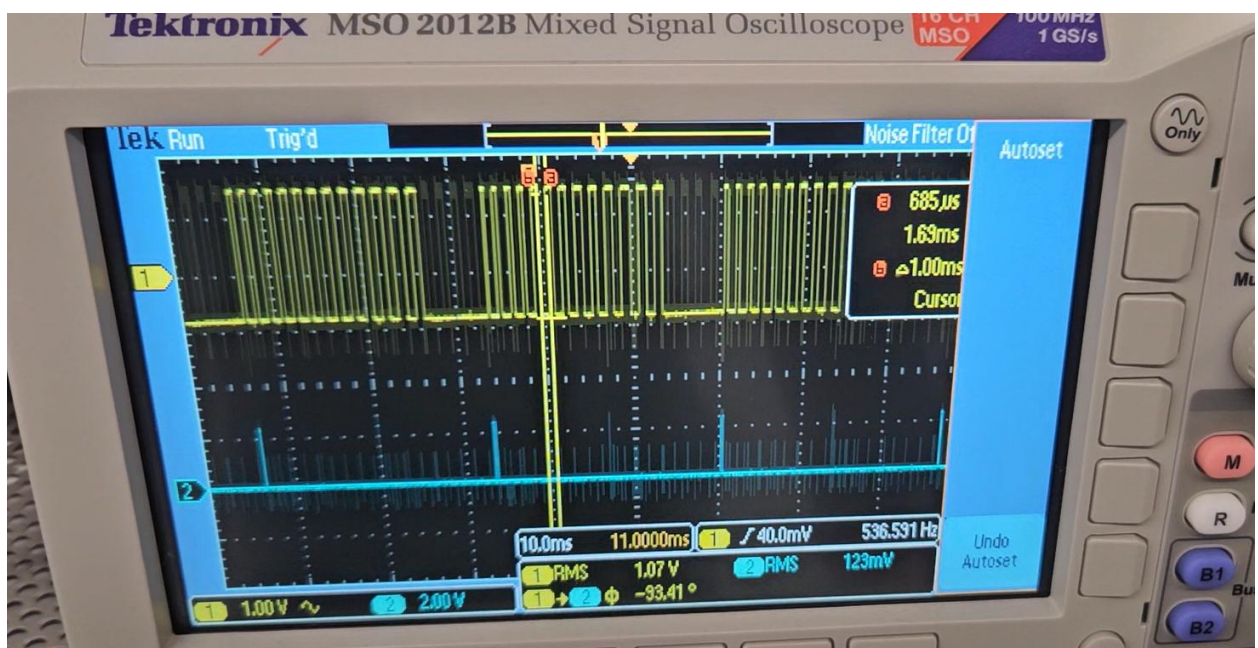


Figure 8 - Oscilloscope capture 4

5. Hardware Circuit

a. Hardware Images

No resistors are required due to pullup resistors within esp32. The pullup resistors can be used when setting the pin modes during setup.

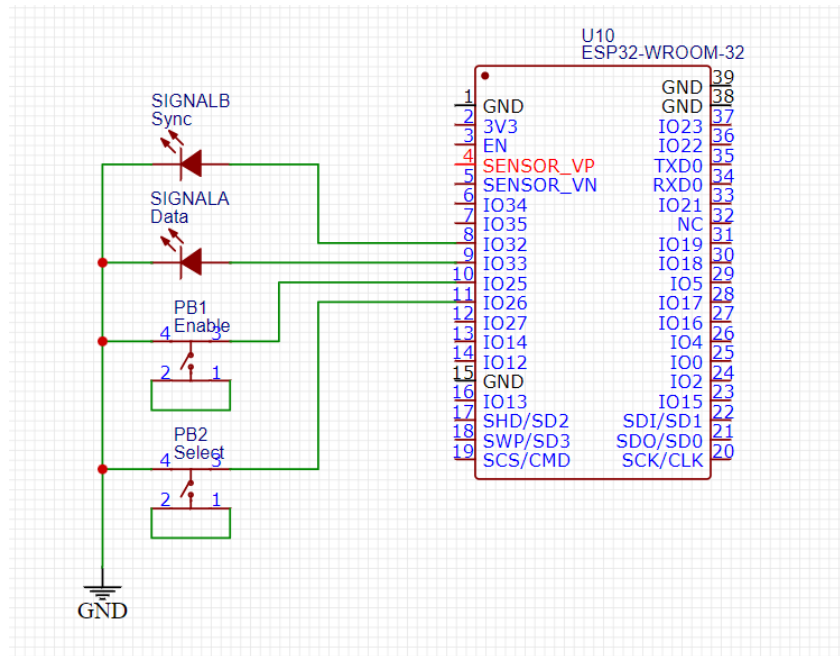


Figure 10 - Hardware Schematic

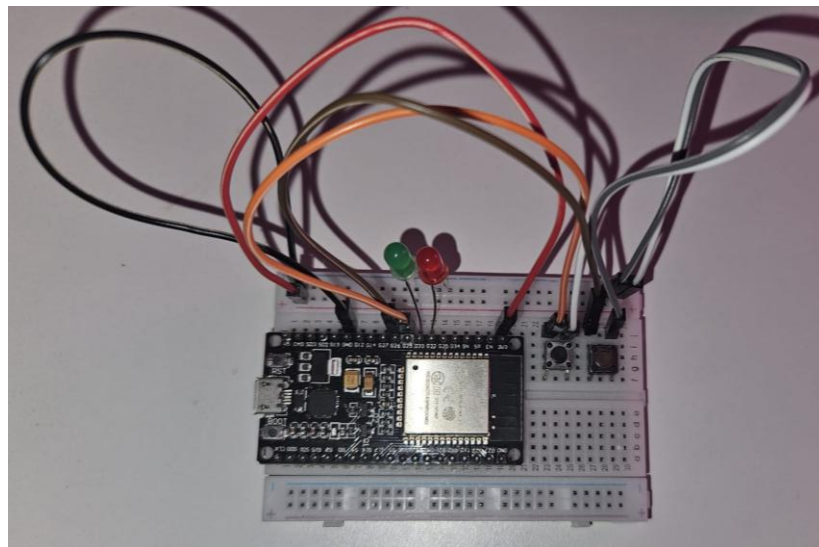


Figure 11 - Physical Hardware Circuit

b. Hardware Demo Video

Video showing operation in DEMO mode is uploaded unlisted on YouTube at:

<https://youtu.be/NMU1bU0y8ls>

6. Flowchart

a. Flowchart

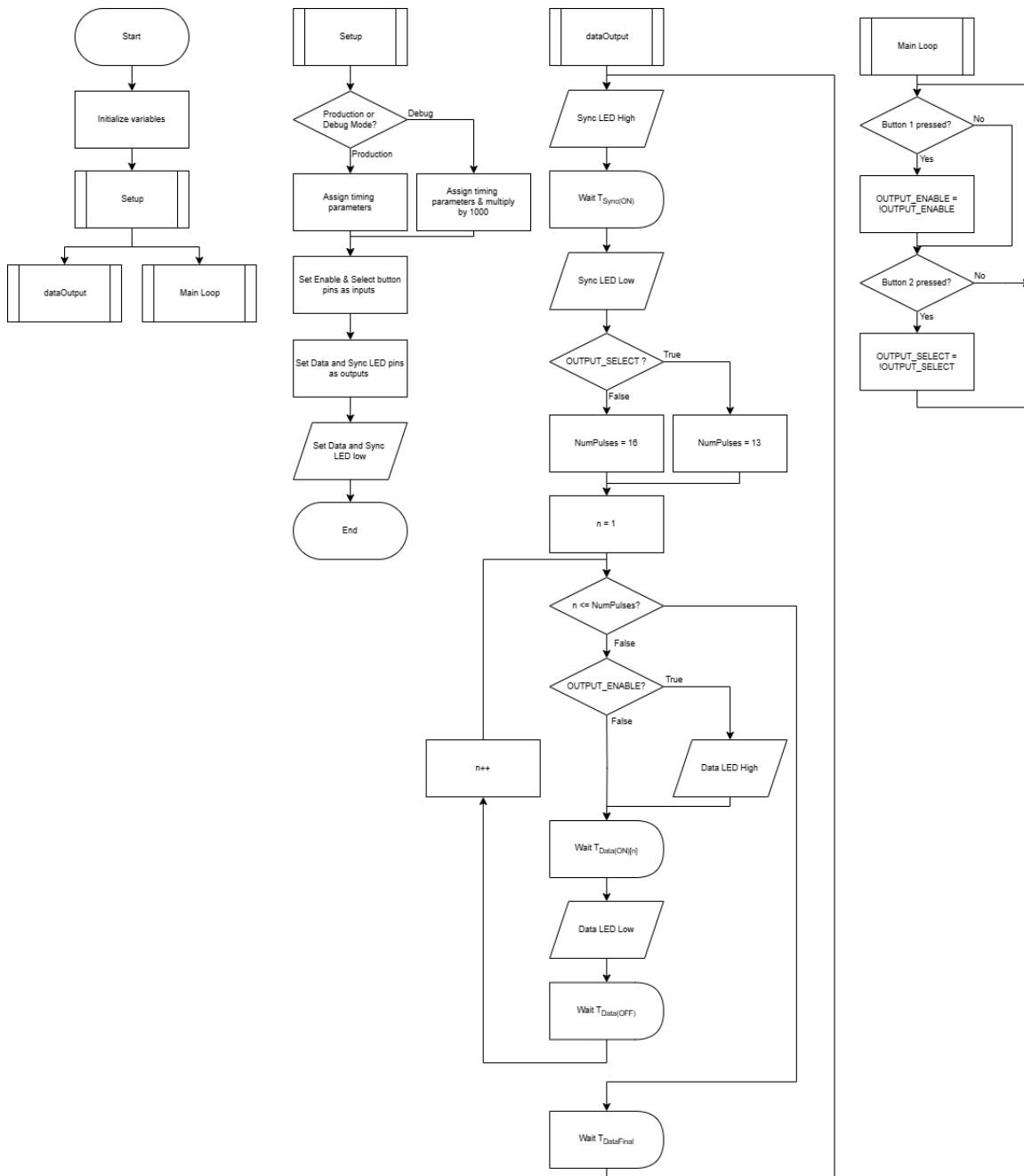


Figure 12 - Application Control Flow Flowchart

b. Nassi Shneiderman diagram

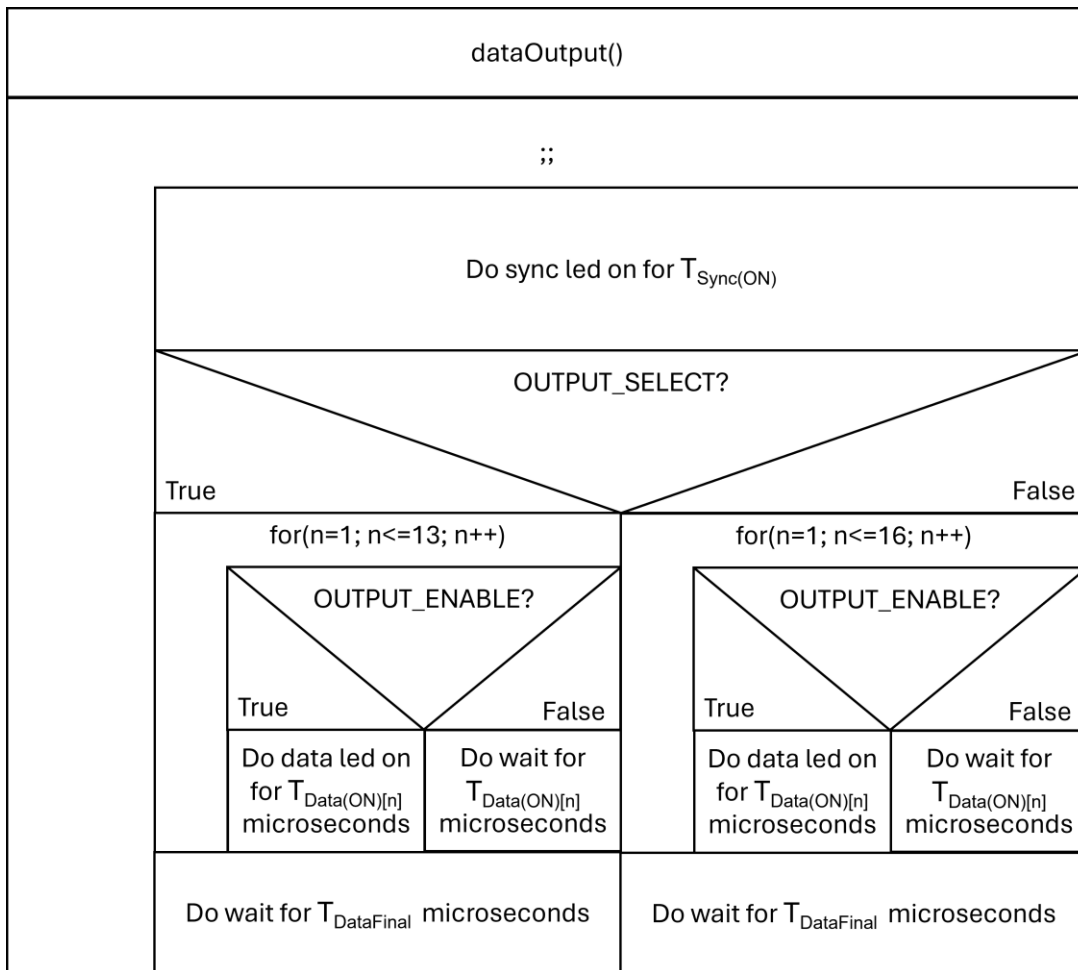


Figure 13 - Nassi Shneiderman diagram

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