B31DG - Assignment 1

Fraser Holman

H00368728

[fjah2000@hw.ac.uk](mailto:fjah2000@hw.ac.uk)

Due: 2nd March 2025

Revision History:

|  |  |  |  |
| --- | --- | --- | --- |
| **Version Number** | **Date** | **Author** | **Notes** |
| 0.0 | 24/02 | Fraser Holman | Initial Report Layout |
| 1.0 | 25/02 | Fraser Holman | Calculated Parameters |
| 1.1 | 26/2 | Fraser Holman | Oscilloscope Screenshots |

Table of Contents

[Calculated Parameters 2](#_Toc191401446)

[LED Resistor Values 2](#_Toc191401447)

[Application Parameters 2](#_Toc191401448)

[References 3](#_Toc191401449)

# Calculated Parameters

## LED Resistor Values

Equation 1 can be used to calculate the corresponding resistor values for the LEDs used in this system. Vs represents the supply voltage which for all LED’s is 3.3V as this is the voltage level of the ESP’s digital logic. Vf represents the forward voltage for each LED which can be found in the appropriate datasheet alongside If the forward current. And R represents the desired resistor value for the corresponding resistor to each LED.

Equation 1 - Corresponding LED Calculation

Using Equation 1 the following desired resistor values were calculated as shown in Table 1.

Table 1 - LED Desired Resistors

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **LED Colour** | **Supply Voltage Vs (V)** | **Typical Forward Voltage Vf (V)** | **Forward Current If (mA)** | **Desired Resistor Value (Ω)** |
| Red | 3.3 | 2 | 20 | 65 |
| Orange | 3.3 | 2 | 20 | 65 |
| Green | 3.3 | 3.2 | 20 | 5 |

## Application Parameters

To calculate the application parameters used within this system the surname ‘HOLMAN’ was used. Table 2 demonstrates the final calculations for each parameter used for the signal. The alternate behaviour was calculated as option 2 – this is the reversed data waveform starting at the largest pulse rather than the shortest.

Table 2 - Application Parameters Calculations

|  |  |  |
| --- | --- | --- |
| **Parameter** | **Numerical Mapping** | **Calculation** |
| a | ‘H’ maps to 8 | 8 x 100us = 800us |
| b | ‘O’ maps to 12 | 12 x 100us = 1200us |
| c | ‘L’ maps to 12 | 12 + 4 = 16 |
| d | ‘M’ maps to 13 | 13 x 500us = 6500 |
| Alternative Behaviour | ‘A’ maps to 1 | (1 % 4) + 1 = 2 |
| TON(n) | N/A | 800 + ((n-1) x 50us) for 2 ≤ n |

# Oscilloscope

Figure 1 represents the data waveform output displayed on an oscilloscope. The oscilloscope was setup to be triggered on the rising edge of the sync pulse (in blue). Figure 2 shows the alternate behaviour waveform, similarly triggered on the rising edge of the sync pulse. As stated previously the alternative behaviour was a reverse of the original data waveform, rather than the pulse width increasing the data signal (in yellow) starts at the widest pulse and decreases.

A screenshot of a computer

AI-generated content may be incorrect.

Figure 1 - Data Waveform Output

A screen shot of a device

AI-generated content may be incorrect.

Figure 2 - Alternative Data Waveform Output

# Hardware Circuit

# Flowchart

# References

Red LED:

<https://www.farnell.com/datasheets/1498852.pdf>

Orange LED:

<https://www.farnell.com/datasheets/2861537.pdf>

Green LED:

<https://www.farnell.com/datasheets/2724776.pdf>

Resistance Value Calculation:  
<https://uk.rs-online.com/web/content/discovery/tools-and-calculators/led-resistor-calculator>