

Design (E) 314

Preliminary Report

PV System Efficiency Monitor

Author: Student Number:

Dgibrilly M. Mutabazi 23765518

[01/04/2024)]

**Plagiaatverklaring / Plagiarism Declaration**

1. Plagiaat is die oorneem en gebruik van die idees, materiaal en ander intellektuele eiendom van ander persone asof dit jou eie werk is.

*Plagiarism is the use of ideas, material and other intellectual property of another’s work and to present is as my own.*

1. Ek erken dat die pleeg van plagiaat ’n strafbare oortreding is aangesien dit ’n vorm van diefstal is.

*I agree that plagiarism is a punishable offence because it constitutes theft.*

1. Ek verstaan ook dat direkte vertalings plagiaat is.

*I also understand that direct translations are plagiarism.*

1. Dienooreenkomstig is alle aanhalings en bydraes vanuit enige bron (ingesluit die internet) volledig verwys (erken). Ek erken dat die woordelikse aanhaal van teks sonder aanhalingstekens (selfs al word die bron volledig erken) plagiaat is.

*Accordingly all quotations and contributions from any source whatsoever (including the internet) have been cited fully. I understand that the reproduction of text without quotation marks (even when the source is cited) is plagiarism.*

1. Ek verklaar dat die werk in hierdie skryfstuk vervat, behalwe waar anders aangedui, my eie oorspronklike werk is en dat ek dit nie vantevore in die geheel of gedeeltelik ingehandig het vir bepunting in hierdie module/werkstuk of ’n ander module/werkstuk nie.

*I declare that the work contained in this assignment, except where otherwise stated, is my original work and that I have not previously (in its entirety or in part) submitted it for grading in this module/assignment or another module/assignment.*

|  |  |  |
| --- | --- | --- |
|  |  | 23765518 |
| Handtekening / *Signature* |  | Studentenommer / *Student number* |
| D.M Mutabazi |  | 01/04/2024 |
| Voorletters en van / *Initials and surname* |  | Datum / *Date* |

**Table of contents**

**Task 1: Hardware Design Details**

//Introduction to hardware elements

**LMT01 Sensor**

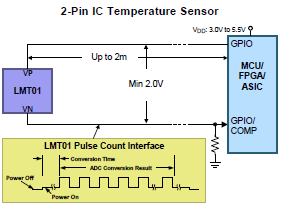
//what

The LMT01 device is a high-accuracy, 2 pin, temperature sensor with an easy-to-use pulse count current loop interface. The LMT01 has the pulse count interface which is used to determine the temperature. Where the number of output pulses is proportional to the temperature.

//how

The LMT01 temperature output is transmited over a single wire, using a train of current pulses that change from 34uA to 125uA. A simple resistor is then used to convert the current pulses to a voltage. When the temperature is determined the current level will remain below 34uA for at most 54ms while the LMT01 is determining the temperature. When the temperature is determined, the pulse train begins. Where the pulse train toggles from the low current 34uA to a high current level of 125uA. The pulse train maximum interval is 50ms. After the pulse count has been transmitted the current level will remain low for the remainder of the 50ms. The individual pulse frequency is 88khz. The LMT01 will continuously convert and transmit data when the power is supplied every 104ms.

//schematic

**Figure 1: LMT01 micro-controller connection Figure 2: LMT01 top view and pin**

// resistor values and input voltage

The LMT01 takes as input 5V source, with the minimum voltage across the sensor to be 5V. To be able to detect the output voltage from the pulses, we calculate an appropriate resistance value. This is determined by the equation:

The micro-controller detects as input a low signal that is less than 0.3VDD and an input high voltage (VIH) that is a minimum of 0.7VDD (*stm32f411re.pdf pg 98*). VDD falls in the range of [1.7V, 3.6V] (*stm32f411re.pdf*). The ranged designed for was [3.3 – 3.6] V. Thus to determining the low voltage for 34uA current source: **Explain how resistor value determined**

The high signal using a 22k resistor:

Using a resistor value of 22k ohms, allows the current pulses to be converted to valid voltage logic level for the micro-controller to be able to detect the input.

**Top push button**

//why

The top button purpose is to initiate a measurement command across the LMT01 sensor discussed above and the LM235 analog sensor (not to be discussed). Upon pressing the top button one, it is to begin the measurement sequence, after which when the button is pressed again, the system stops measuring and returns the measured values.

//how (connections)

The button is configured in an active low configuration. Where on a button press the signal is to be driven low, upon which the system detects the button the button press.

//schematic

**Insert schematic**

//resistor

To achieve the active low setup, an internal pull-up resistor is used, where the typical resistor value is .

**LED circuit**

**//** why

The LED circuit serve to UI to indicate to the user the current state of the system. The LEDs are labeled, D2, D3, D4, and D5, connected to pins PB10, PB4, PB5 and PA10 respectively. The LEDS can be in one of two states:

1. Flashing ON and OFF at a specific rate
2. Remain on

The system flashes LEDS D2, D3, D4 and D5 at a rate of 100ms, 50ms, 200ms, 100ms respectively.

The system flashes the LED when a measurement is in progress. Once a measurement stops, the LED corresponding to the device performing the measurement is to stop is stop flashing, and remain on.

// how, resistor value

The LED has a forward current (*If*) of and a forward voltage(*Vf*) of .The voltage supplied from the PINS to the LED circuit is 3.3V (*stm32f411re.pdf*). From this an appropriate resistance value is calculate using:

**(Mention something about MCU sinking/sourcing 8mA)**

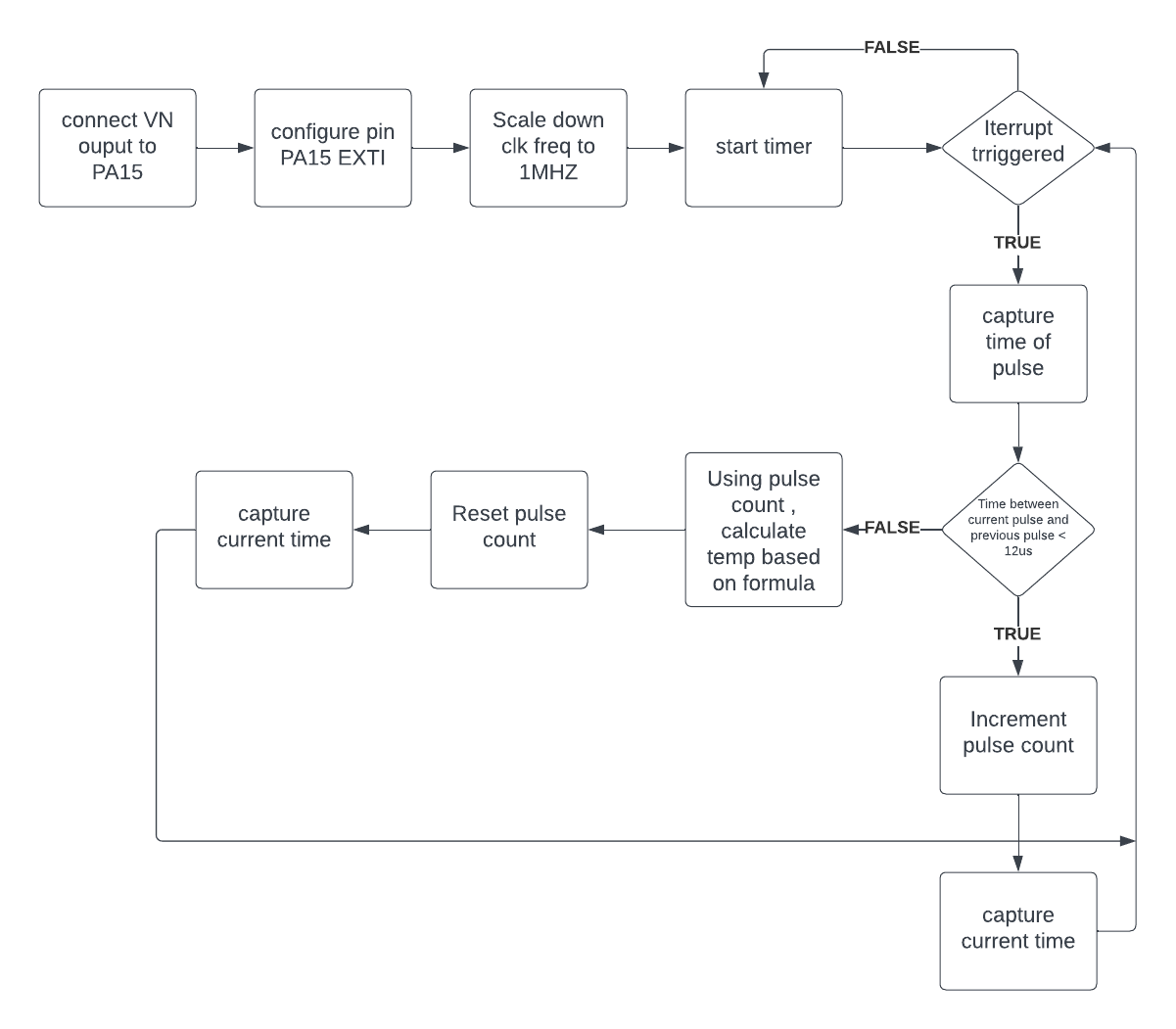
Thus an appropriate resistance value for the LED circuit is 55Ω. Below please find the schematic for the LED circuit.

//schematic

**Insert schematic**

**Task 2: Software Design Details**

**//LMT01**



**Task 3: Testing of system to verify performance/functionality**