EMBEDDED SYSTEMS DESIGN

LAB 1 : INTRODUCTION TO TM4C123GH6PM AND BLINKING LED

GROUP No. : 01

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AIM :

To write a program and flash it to ***TM4C123GH6PM*** to blink the led such that the resultingoutput waveform is a square wave of frequency 1KHz.

MATERIALS REQUIRED:

1. EK-TM4C123GH6PM Board
2. Code Compiler Studio
3. Oscilloscope
4. Datasheet

PROCEDURE

1. Go through the Board Schematic and identity the port and pin to which the LED is connected
2. In the datasheet of the IC open GPIO section
    a. Enable Clock for the corresponding pins/port.
    b. Set the pins to Digital GPIO mode.
    c. Set the direction as output of the LED pins.
3. Send 1 to the pin to which the led is connected to turn it on and 0 to turn it off.
4. Write a function to keep the led on for 0.5 ms and off for 0.5 ms i.e. the resulting signal Generated should be a square wave of frequency 1KHz.

DEVICE SPECIFICATIONS

1. The default system clock s 16Hz for TM4C123GH6PM MHz. It can be increased to 80MHz

CALCULATION

1. To generate a delay we need to first calculate the time it takes for the IC for 1 clockcycle.
2. The clock frequency is 16Mhz and we need a square wave of width 0.5 ms on and off.
3. Time taken for 1 clock cycle is 1/Fosc = 62.5ns.
4. Delay required is 0.5ms , hence 62.5ns x N = 0.5 ms .
5. Solving for N we get N = 8000 , hence we need 8000 instruction/clock cycles to get a delay 0f 0.5ms.
6. After we referring to the disassembly we get to know that in ‘for loop’ in the code, for introducing a delay, it takes 10 instruction for every loop. So for 8000 cycles we need 8000/10= 800 counts in the for loop.

Code

```
#include <stdint.h>
#include <stdbool.h>
#include "tm4c123gh6pm.h"

int main(void)
{
    SYSCTL_RCGC2_R |= 0x00000020;         /* enable clock to GPIOF */
    GPIO_PORTF_LOCK_R = 0x4C4F434B;     /* unlock commit register */
    GPIO_PORTF_CR_R = 0x1F;              /* make PORTF0 configurable */
    GPIO_PORTF_DEN_R = 0x0E;            /* set PORTF pins 4-3-2-1-0 as digital
pins */
    GPIO_PORTF_DIR_R = 0x0E;            /* set PORTF3+PORTF2+PORTF1 pin as
output (LED) pin */

    int i=0;

    while(1){
     GPIO_PORTF_DATA_R = 0X04;          /* White */

     for(i=0; i<800; i++)               /*delay of 0.5ms*/
     {}

     GPIO_PORTF_DATA_R = 0X00;          /* Dark */

     for(i=0; i<800; i++)               /*delay of 0.5ms*/
     {}
    }
return 0;
}
```

Results :

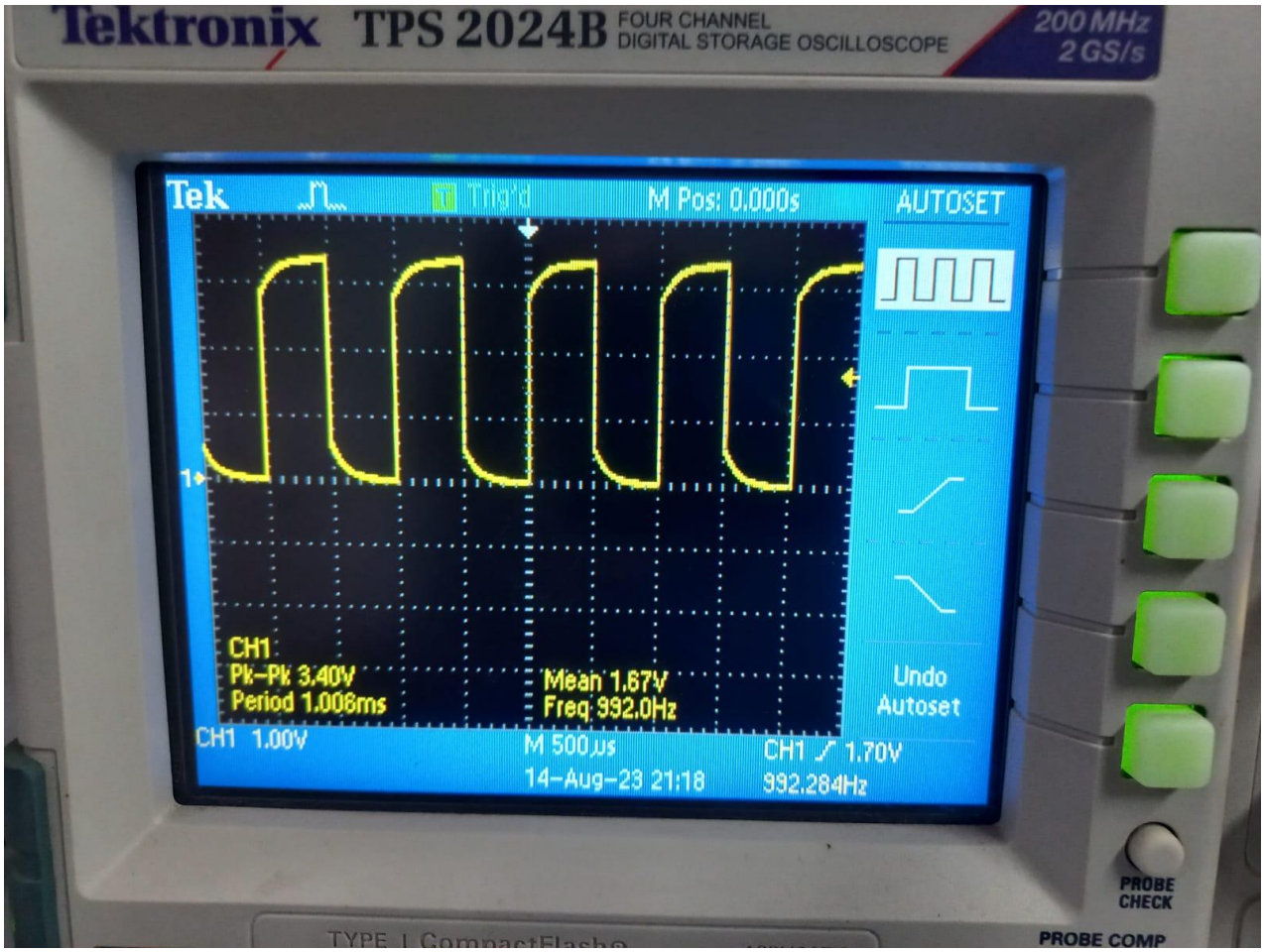

Fig 1: Waveform on the Oscilloscope
A square wave of pulse width 1ms generated.

References :

1. TM4C123GH6PM microcontroller datasheet.
2. Cortex-M4 Technical Reference Manual.