ARM HW3

2019. 03. 29.

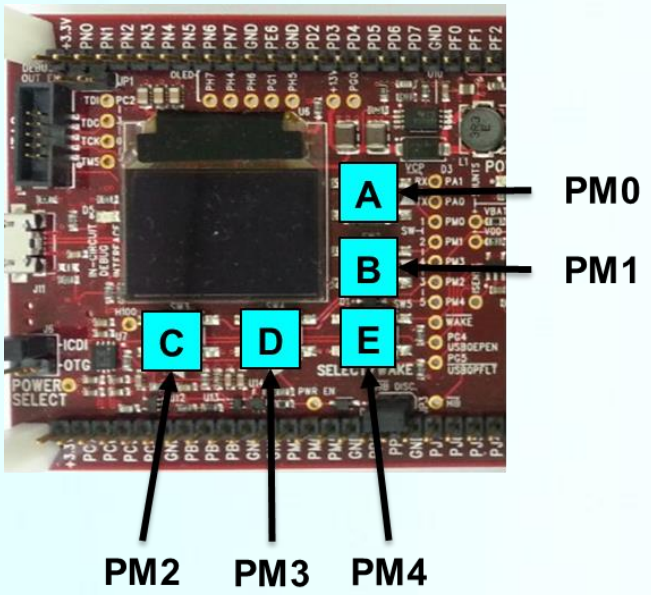
Embedded System LAB
SKKU

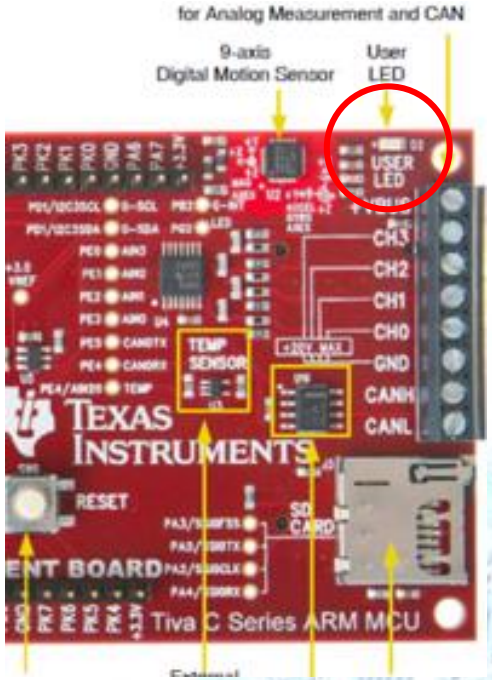
Implementation Topic

- Using switch
  - LED ON and OFF
  - LED Blink Speed
  - UART Communication

Implementation Condition

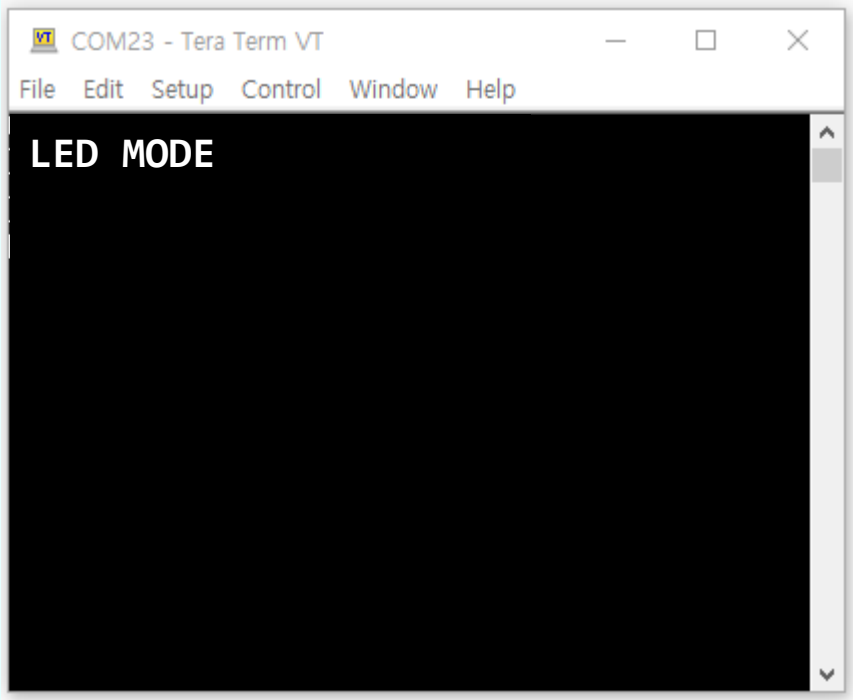
- Using switch
  - A : LED ON, Print “-SW A”
  - B : LED OFF, Print “-SW B”
  - C : LED Blink 5 times Slow, Print “-SW C”
  - D : LED Blink 5 times Fast, Print “-SW D”



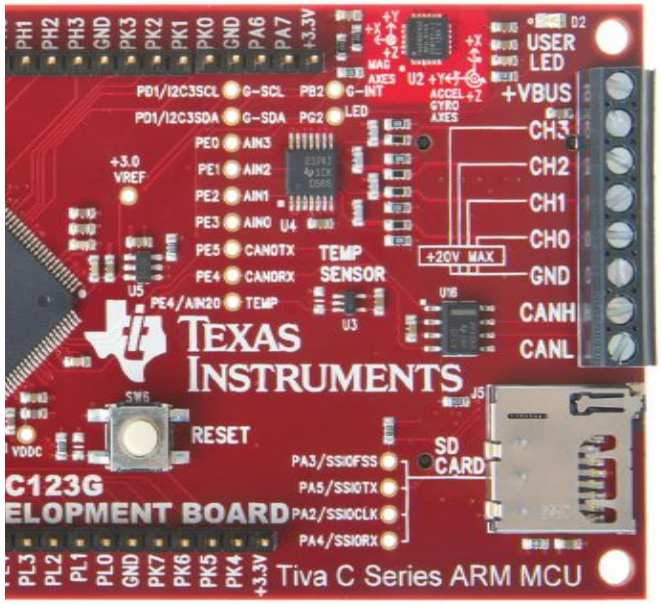


Implementation Condition

- **Initial Display in Tera Term**

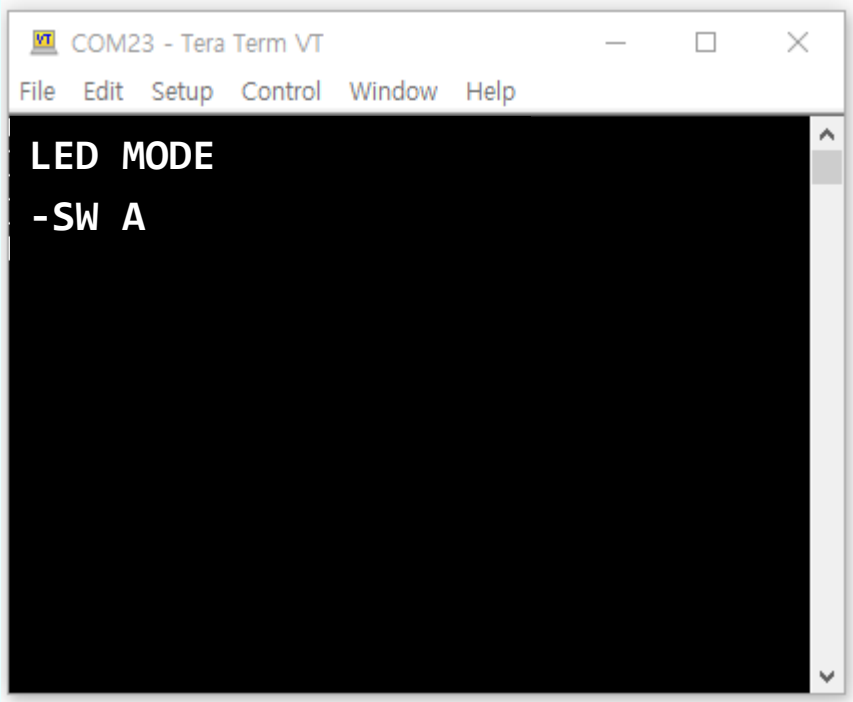


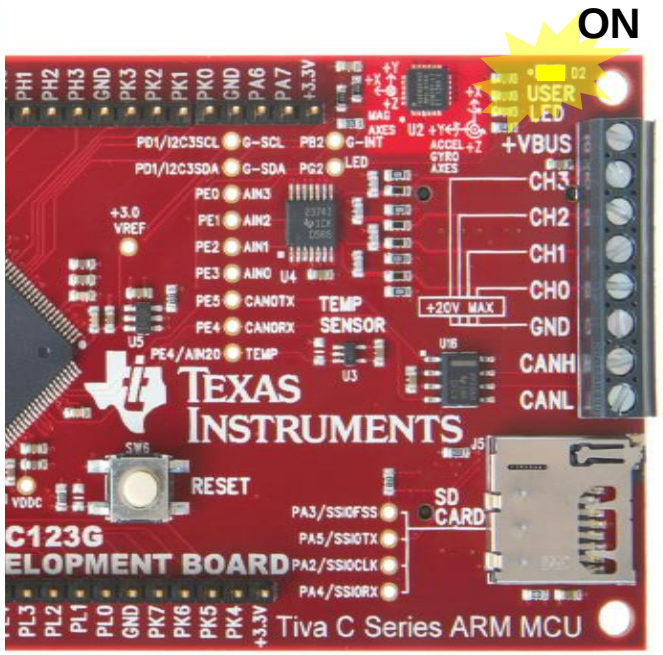
OFF



Implementation Condition

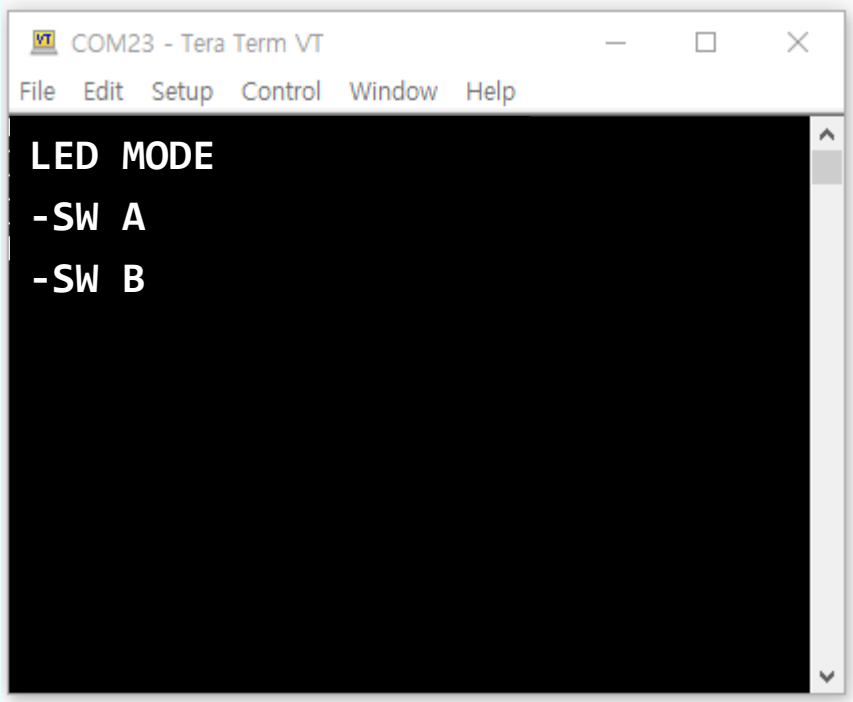
- A Button Push
  - LED ON / Print “-SW A”



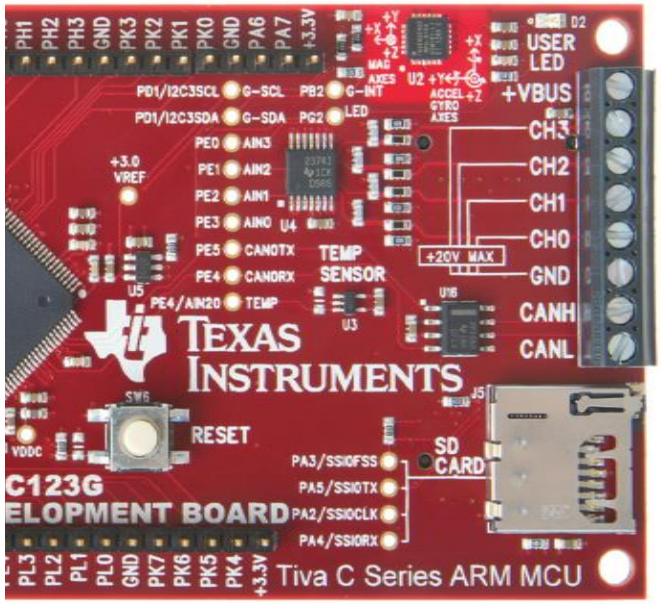


Implementation Condition

- **B Button Push**
  - **LED OFF / Print “-SW B”**

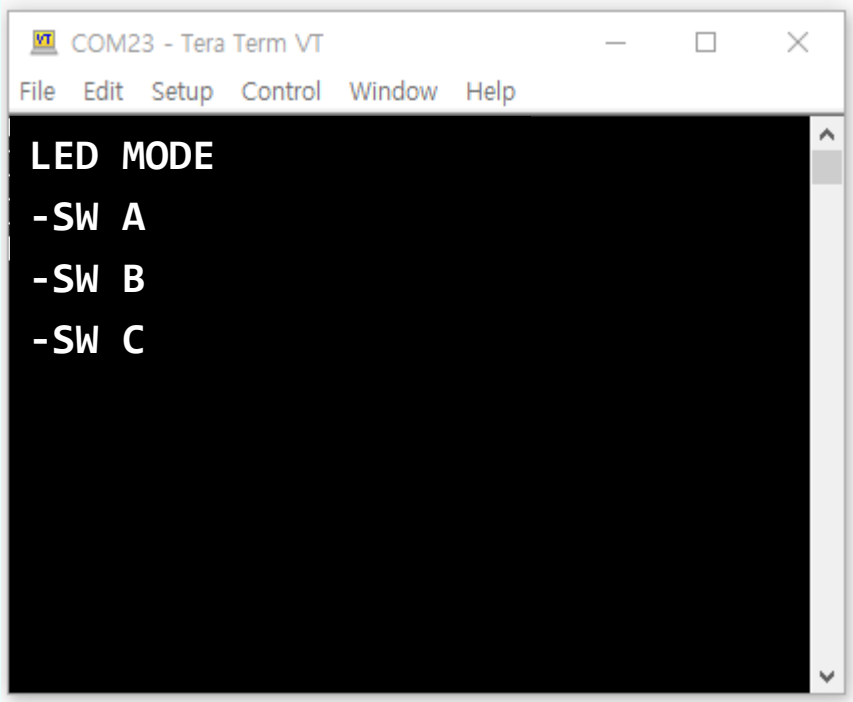


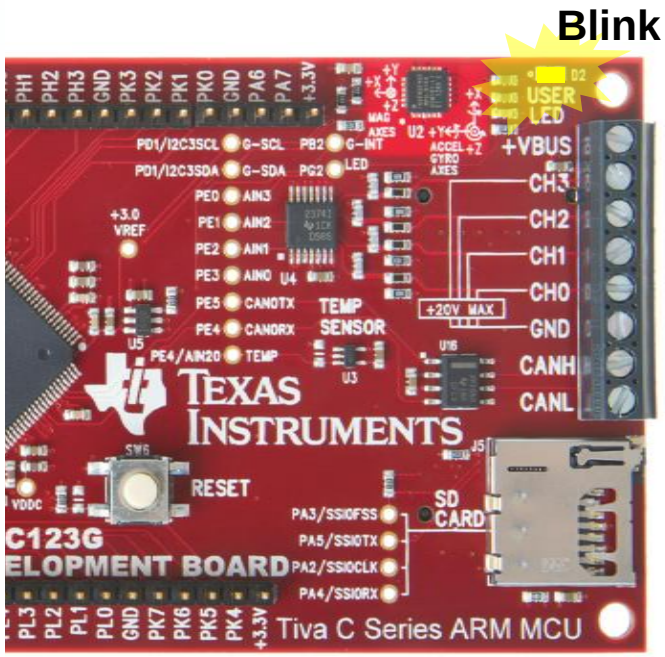
OFF



Implementation Condition

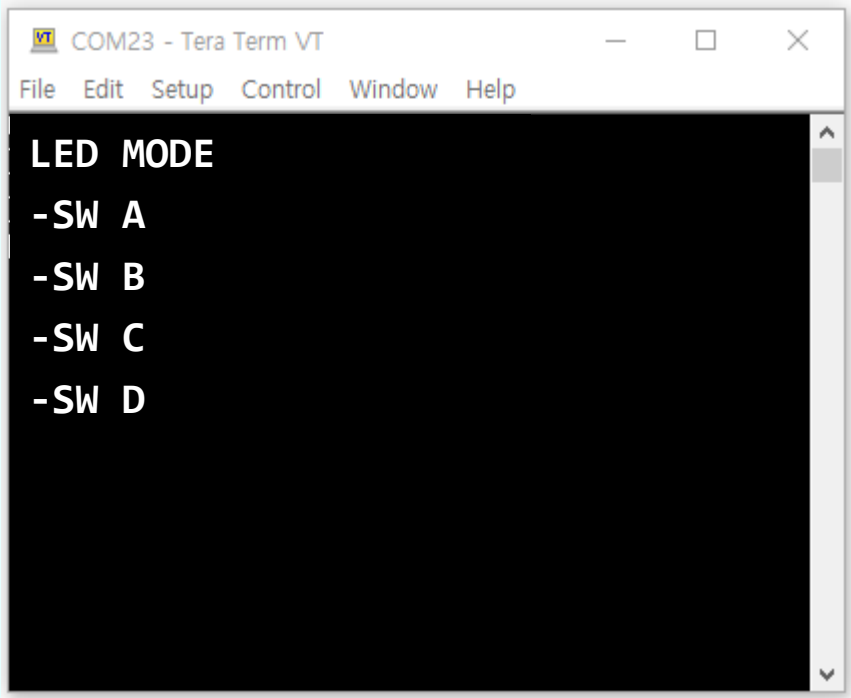
- C Button Push
  - LED Blink 5 times Slow / Print “-SW C”

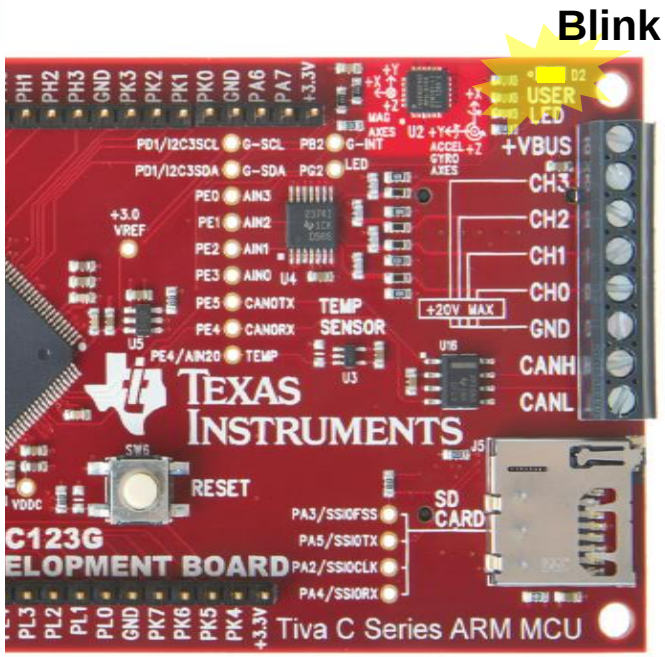




Implementation Condition

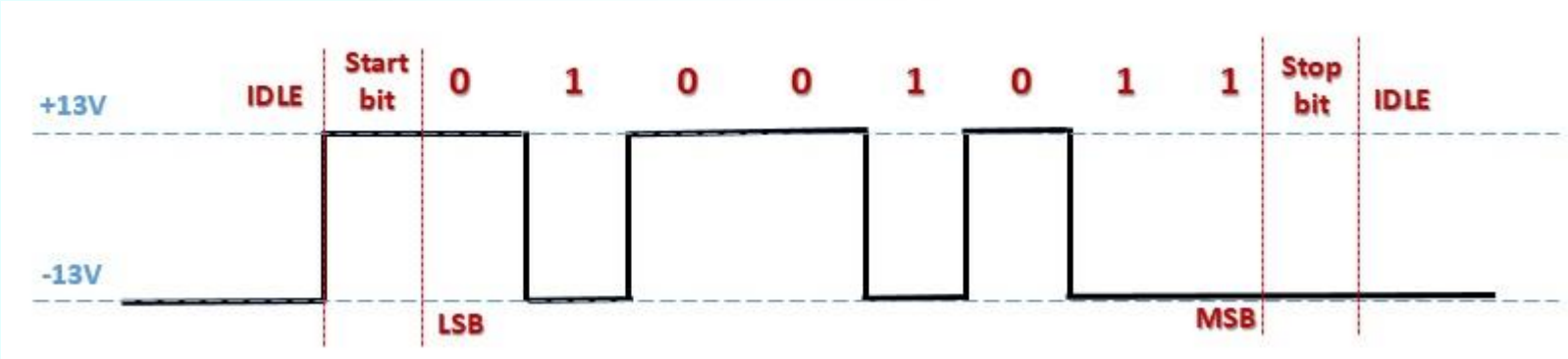
- D Button Push
  - LED Blink 5 times Fast / Print “-SW D”





UART Communication

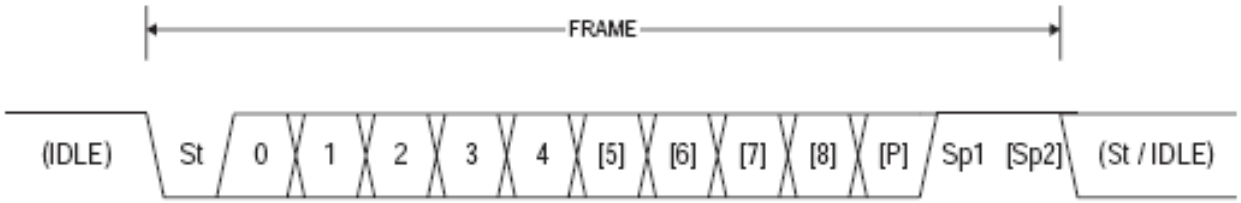
- **Serial Communication**
  - **Communication that transmits data bit by bit between devices**



  - **Serial Communication Protocol**
    - **I2C(Inter-Integrated Circuit)**
    - **SPI(Serial Peripheral Interface)**
    - **UART(Universal Asynchronous Receive-Transmit)**

UART Communication

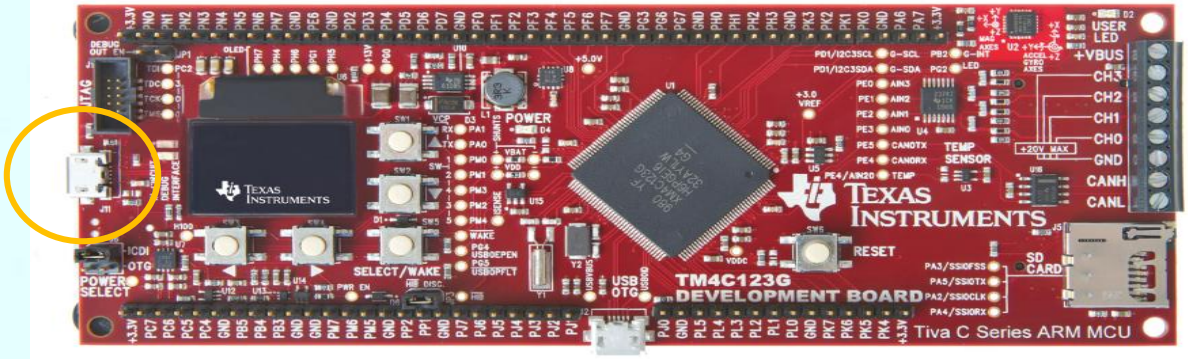
- **UART (Universal Asynchronous Receive-Transmit)**
  - **Asynchronous serial communication**
    - **Not use a clock to validate data**
  - **Serial data is transferred one bit at time**

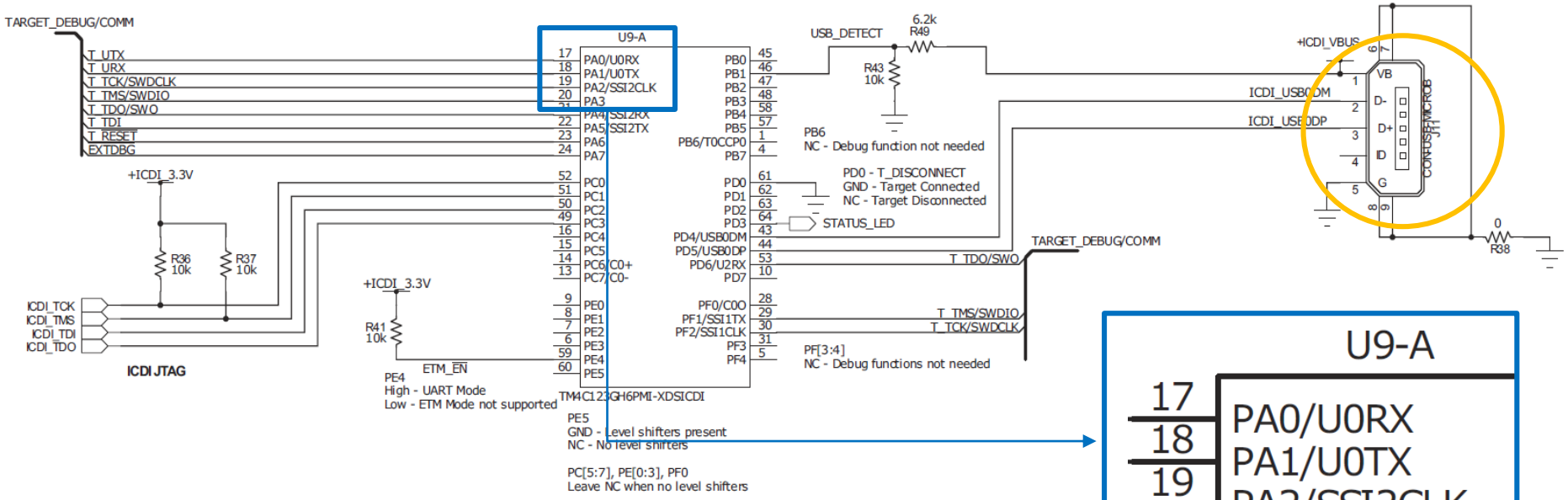


St	Start bit, always low.
(n)	Data bits (0 to 8).
P	Parity bit. Can be odd or even.
Sp	Stop bit, always high.
IDLE	No transfers on the communication line (RxD or TxD). An IDLE line must be high.

How to use UART

ICDI Debug USB Port

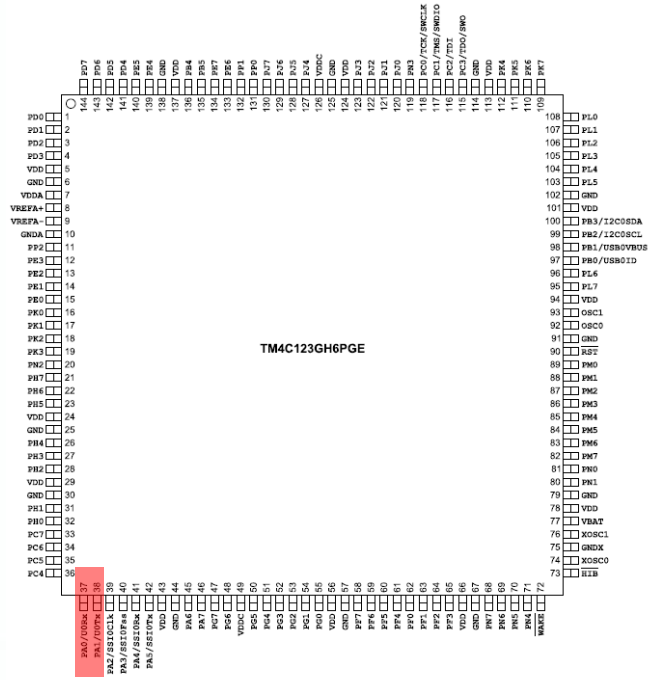




How to use UART

- **Signals by Pin Number (page 1357)**

37	PA0	I/O	TTL	GPIO port A bit 0.
	CAN1Rx	I	TTL	CAN module 1 receive.
	U0Rx	I	TTL	UART module 0 receive.
38	PA1	I/O	TTL	GPIO port A bit 1.
	CAN1Tx	O	TTL	CAN module 1 transmit.
	U0Tx	O	TTL	UART module 0 transmit.



How to use UART

- System Control
  - RCGCUART → Enable
  - RCGCGPIO → Enable
- UART
  - UARTCTL
  - UARTIBRD
  - UARTFBRD
  - UARTLCRH
  - UARTFR
  - UARTDR
- To enable and initialize the UART, some steps are necessary

How to use UART

- UART
  - Initialization and Configuration (page 928)
    - Step 1 : UARTCTL → Disable UART
    - Step 2 : UARTIBRD / UARTFBRD → Setting to the correct value
      - UARTSys CLK : 16MHz (ClkDiv is 16)
      - UART Baud Rate : 115200 baud rate
    - Step 3 : UARTLCRH → 8-bit / no parity / 1-stop bit
    - Step 4 : UARTCTL → Enable UART/Enable transmit & receive section
- General-Purpose Input/Outputs
  - GPIOAFSEL → Peripheral signal
  - GPIOPCTL → use U0Rx, U0Tx (refer to page 1396, Table 23-5)
  - GPIODEN → Enable
  - GPIOAMSEL → Disable
- Use GPIO Port A (APB) base address.

How to use UART

- **Send ‘A’ by UART in C**
  - **void Print_Char (void)**

```
{
    while(UARTFR & (1<<5) != 0);     // TXFF bit
    UARTDR = ‘A’;
}
```

  - **We recommend creating a printf function using a branch**

How to use UART

```
MOV r0, #0x01
MOV r1, #0x01
SUBS r1, r1, r0
MVN r1, r0, LSL #3
BL  func1
mov r0, #0x05
mov r1, #0x01
mov r2, #0x01
CMP.W r1, r2
IT NE
SUBNE r0, r1, r2
B  halt
func1:STMFD sp!, {r1-r3, lr}
mov r0, #0x01
mov r1, #0x04
mov r2, #0x03
mov r3, #0x02
BL func2
cmp r0, r1
ITTE NE
ANDNEr0, r0, r1
ADDSNEr2, r2, #1
MOVEQr3, r1
LDMFDsp!, {r1-r3, pc}
func2:mov r1, #3
mov r0, #5
cmp r1, r0
mov pc, lr
mov r1, #5
```

PC = 0x00000004 SP = 0x20001000 LR = 0xFFFFFFFF

PC = 0x0000000E SP = 0x20001000 LR = 0xFFFFFFFF

PC = 0x00000028 SP = 0x20001000 LR = 0x00000013

PC = 0x00000016 SP = 0x20001000 LR = 0x00000041

① ①

PC = 0x0000002C SP = 0x20000FF0 LR = 0x00000013

R1	0xFFFFFFF7
R2	0x00000000
R3	0x00000000

④ ④

PC = 0x0000003C SP = 0x20000FF0 LR = 0x00000013

PC = 0x00000050 SP = 0x20000FF0 LR = 0x00000041

PC = 0x00000042 SP = 0x20000FF0 LR = 0x00000041

② ②

PC = 0x0000004C SP = 0x20000FF0 LR = 0x00000041

R1	0xFFFFFFF7
R2	0x00000000
R3	0x00000000

PC = 0x00000012 SP = 0x20001000 LR = 0x00000041

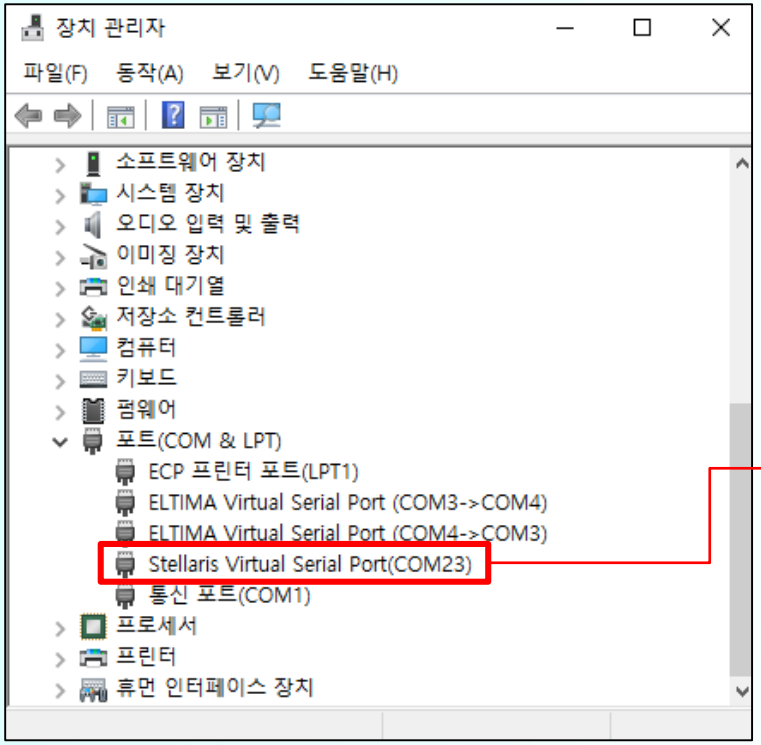
③ ③

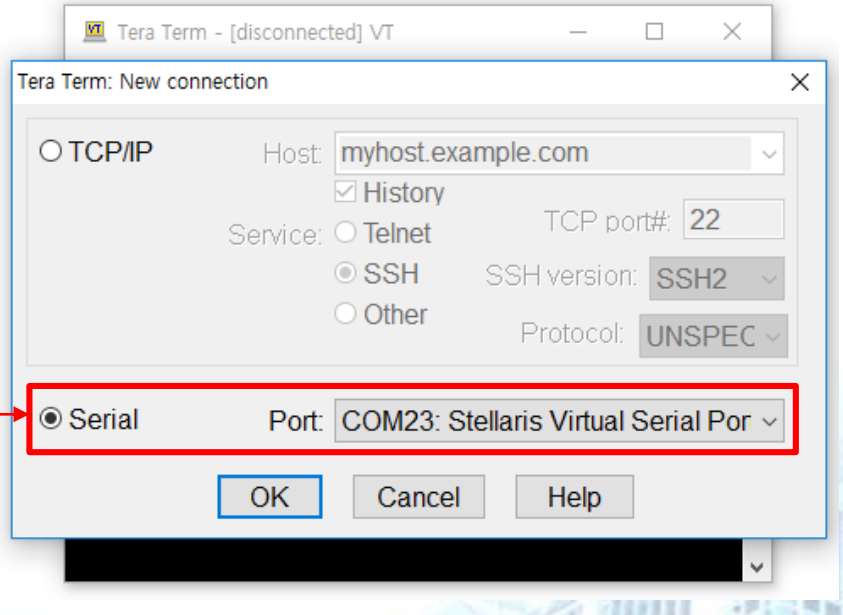
PC = 0x00000054 SP = 0x20000FF0 LR = 0x00000041

PC = 0x00000040 SP = 0x20000FF0 LR = 0x00000041

How to use UART

- **Tera Term**
  - **Serial terminal emulation programs**
  - **Download Link : https://osdn.net/projects/ttssh2/releases/**

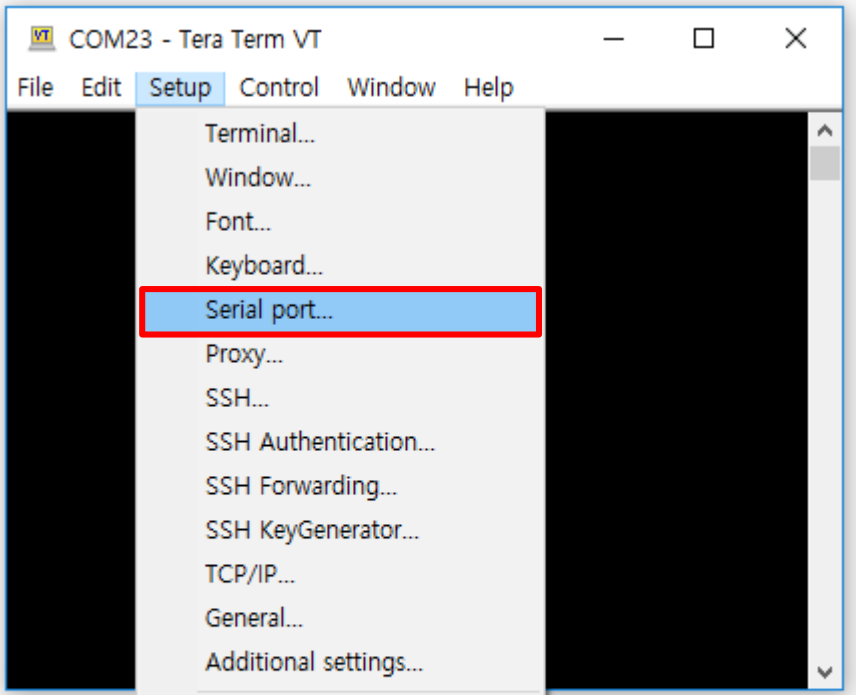


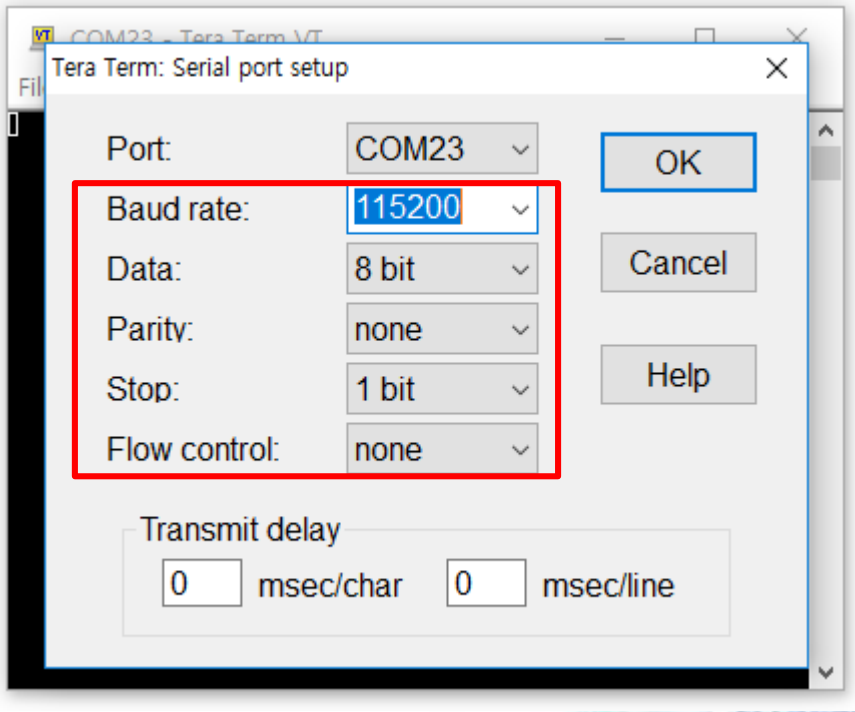


How to use UART

Tera Term

Setting Serial Port

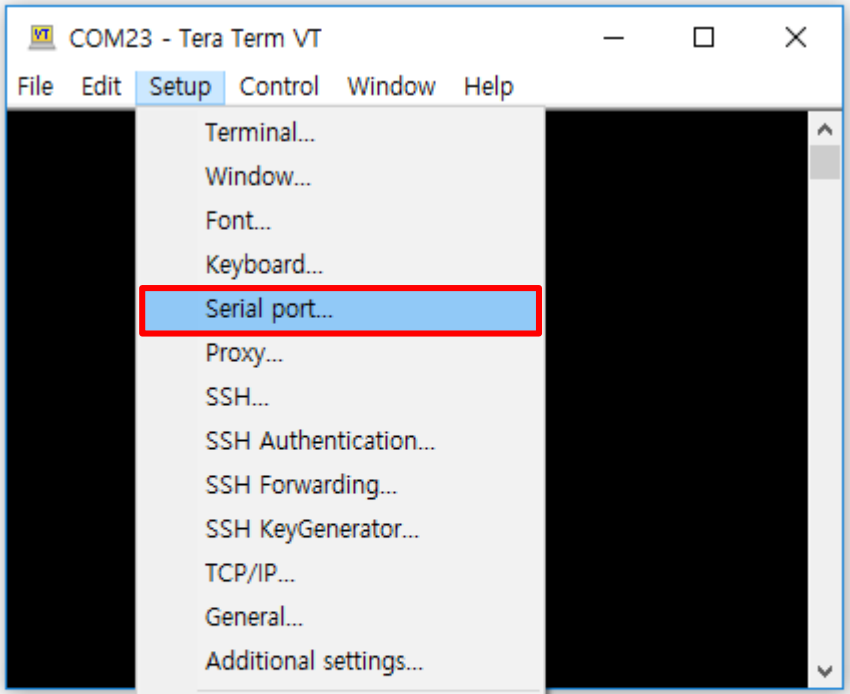


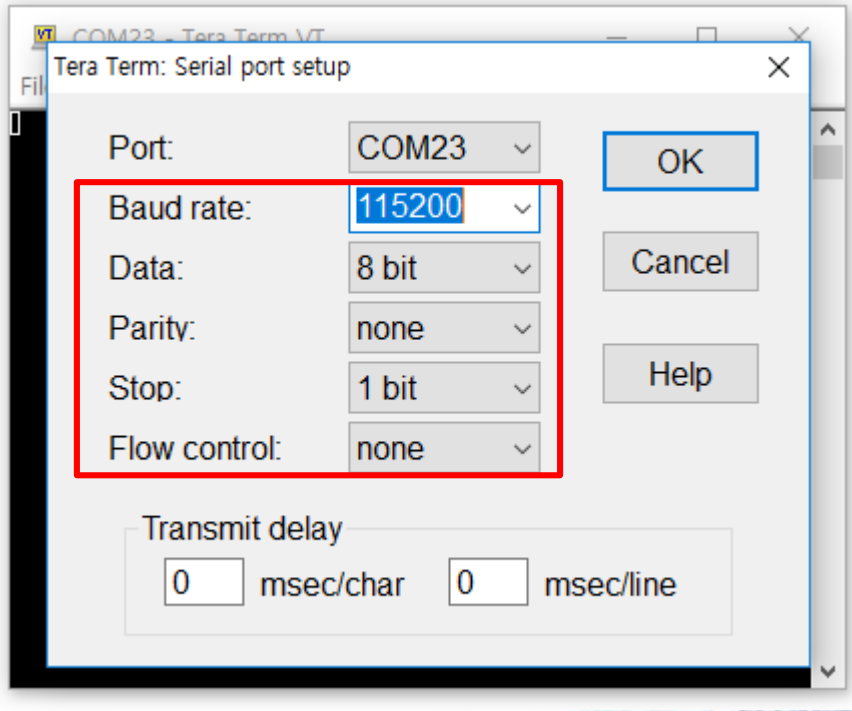


How to use UART

Tera Term

Setting Serial Port





ARM HW3 check

- Time & Place
  - April 5th(Fri) 19:00
  - Semi-conductor building 2 floor workstation room
    - 400202, 400212
- How to submit
  - I-campus, until April 5th 18:59
    - format
      - 2012310000_HW3.asm