

Xilinx

Zynq FPGA

TI DSP MCU 기반의
프로그래밍 및 회로 설계 전문가

강사 이상훈

gcccompil3r@gmail.com



학생 김민호

minking12@naver.com



HAL Code Generator - - [TMS570LC4357ZWT]

File Edit View Tools Window Help

TMS570LC4357ZWT PINMUX RTI GIO ESM SCI1 SCI2 SCI3 SCI4 LIN1 LIN2 MIBSPI1 MIBSPI2 MIBSPI3 MIBSPI4

General Driver Enable R5-MPU-PMU Interrupts VIM Gen

Enable Driver Compilation

Click and mark the required modules for driver compilation from below:

☐ Enable RTI driver ☐ Mark/Unmark all drivers

☐ Enable GIO driver **

☒ Enable SCI drivers

☐ Enable SCI3 driver **

☐ Enable SCI4 driver **

☐ Enable LIN drivers

☐ Enable LIN1 driver ** / ☒ Enable SCI1 driver **

☐ Enable LIN2 driver ** / ☐ Enable SCI2 driver **

☒ Enable ETPWM driver

☒ Enable ECAP driver

☐ Enable EEE driver

TMS570LC4357ZWT PINMUX RTI GIO ESM SCI1 SCI2 SCI3 SCI4 LIN1 LIN2 MIBSPI1 MIBSPI2 MIBSPI3 MIBSPI4

Pin Muxing Input Pin Muxing Special Pin Muxing

N1 N2HET1[15] MIBSPI1NCS[4] NONE N2HET2[22] NONE ECAP1

TMS570LC4357ZWT PINMUX RTI GIO ESM SCI1 SCI2 SCI3 SCI4 LIN1 LIN2 MIBSPI1 MIBSPI2 MIBSPI3 MIBSPI4

Pin Muxing Input Pin Muxing Special Pin Muxing

B5 GIOA[5] NONE NONE EXTCLKIN NONE eTPWM1A

TMS570LC4357ZWT PINMUX RTI GIO ESM SCI1 SCI2 SCI3 SCI4 LIN1 LIN2 MIBSPI1 MIBSPI2 MIBSPI3 MIBSPI4

Input Pin Muxing Special Pin Muxing

_5, for disabling selected HET1 PWM outputs ☐ Enable EMIF_CLK output ☐ En

_2, for disabling selected HET2 PWM outputs ☐ EMIF Output enable ☐ En

ate ADC ' Trigger Option-A' Ethernet MII/ MII ☐ En

ate ADC ' Trigger Option-B' RMII select

PERR12 PERR12 PERR12

☐ Use HET1_LOOP_SYNC for time-base sync

☒ Enable TBCLK sync**

nTZ1 ASYNC

nTZ2 ASYNC

nTZ3 ASYNC

EPWM1SYNCI ASYNC

**Done in etpwmInit

eTPWM for AD

☒ Selecting

☒ Selecting

☒ Selecting

☒ Selecting

☒ Selecting

☒ Selecting

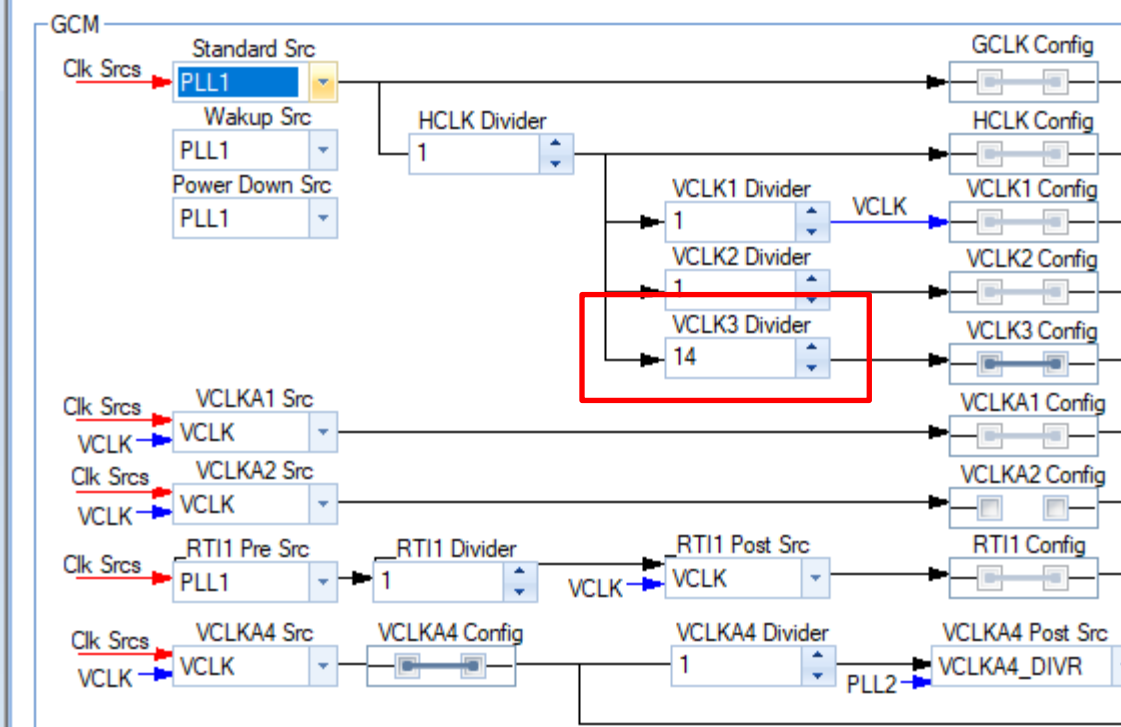
VIM RAM VIM Channel 0-31 VIM Channel 32-63 VIM Channel 64-95 VIM Channel 96-127 RAM

103 : eTPWM7 Trip Zone 103 → → → → → IRQ FIQ

104 : eCAP1 interrupt 104 → → → → → IRQ FIQ

105 : eCAP2 interrupt 105 → → → → → IRQ

Motor Control - eCAP



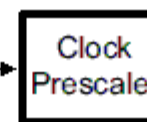
Enable ETPWM modules

☒ Enable ETPWM1☐ Enable ETPWM2☐ Enable ETPWM3☐ Enable ETPWM4☐ Enable ETPWM5

Clock Configuration

TB Clock (MHz): 110.000

VCLK3 (MHz): 10.000



Actual TB

1.250

HSPCLKDIV: 0

CLKDIV: 7 (highlighted with a red box)

Data Format

Baudrate (Hz): 9600 (highlighted with a red box)

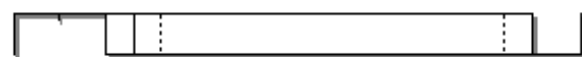
Prescale:

Actual Baudrate (Hz):

VCLK1 (MHz): 75.000

487

9606



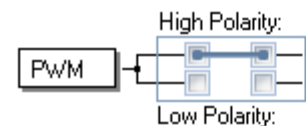
Stop Bits: 2

Length: 8

☐ Parity Enable☐ Even Parity

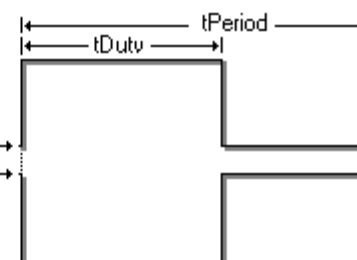
Motor Control - eCAP

PWM Configuration



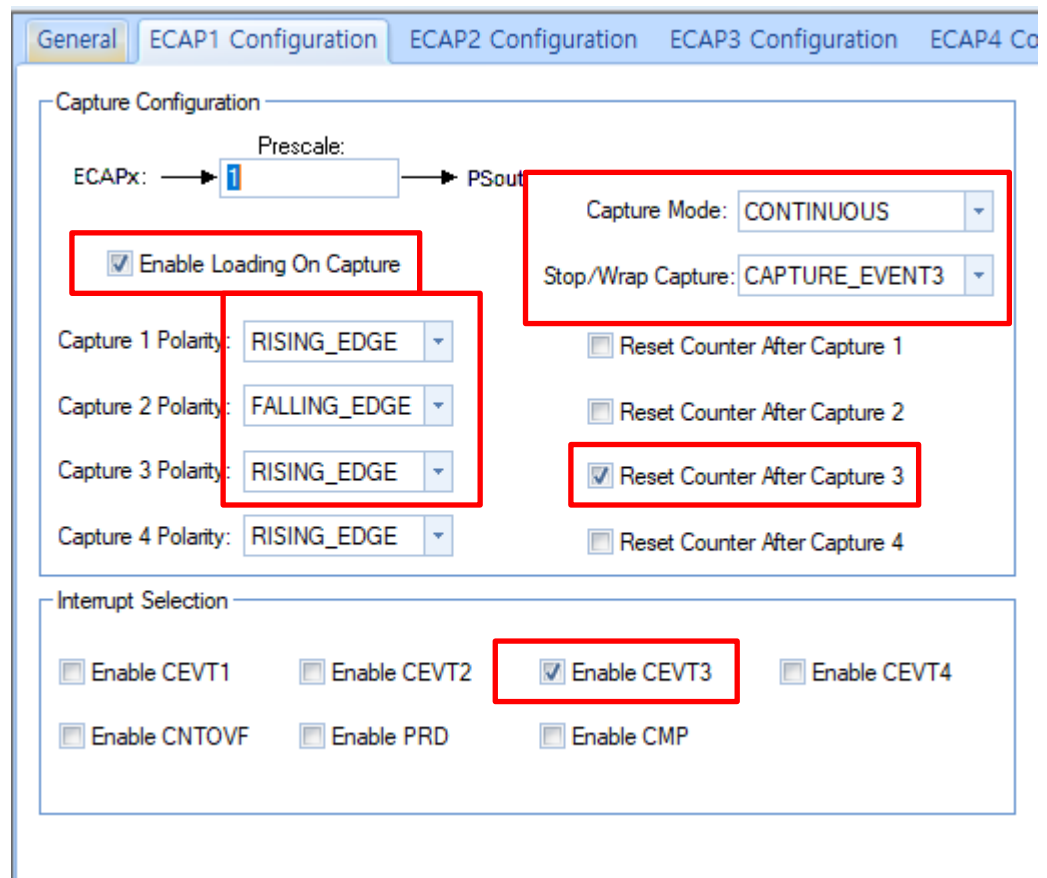
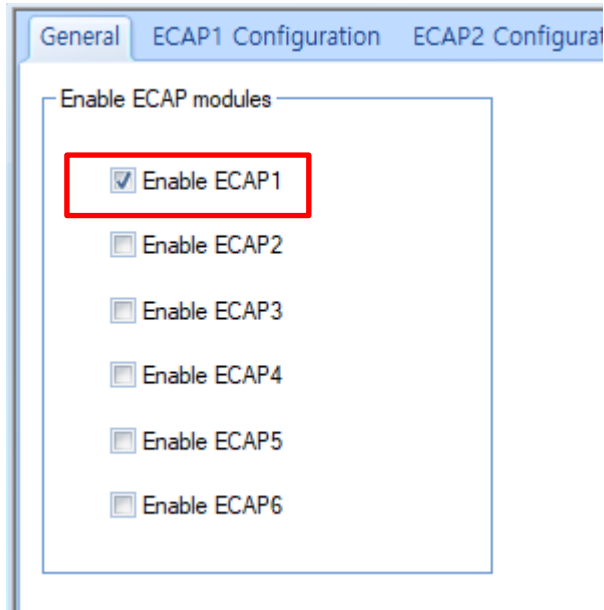
Duty[%]: 5 (highlighted with a red box)

Period[ns]: 20000000 (highlighted with a red box)



1000000.000

20000000.000



```

#include <HL_ecap.h>
#include <HL_etpwm.h>
#include <HL_hal_stdtypes.h>
#include <HL_reg_ecap.h>
#include <HL_reg_sci.h>
#include <HL_sci.h>
#include <HL_sys_core.h>
#include <HL_system.h>
#include <string.h>
#include "HL_system.h"
#include "stdio.h"
#include "math.h"

```

```
void send_data(sciBASE_t* sci, uint8* msg, int length);
```

```
int main(void)
```

```

{
    _enable_interrupt();
    sciInit();
    etpwmInit();
    ecapInit();

```

```
    etpwmStartTBCLK();
```

```
    while (1)
```

```

    {
    }
    return 0;

```

```
}
```

```
void send_data(sciBASE_t* sci, uint8* msg, int length)
```

```

{
    int i;
    for (i = 0; i < length; i++)
        sciSendByte(sci, msg[i]);
}

```

```
void ecapNotification(ecapBASE_t *ecap, uint16 flags)
```

```

{
    uint32 ecap1, ecap2, ecap3;
    float64 duty, period, w;
    float64 pi = 3.14;
    uint8 msg[128] = { 0, };
    uint8 T[64] = { 0, };

```

```
    ecap1 = ecapGetCAP1(ecapREG1);
```

```
    ecap2 = ecapGetCAP2(ecapREG1);
```

```
    ecap3 = ecapGetCAP3(ecapREG1);
```

```
    duty = (ecap2 - ecap1) * 1000 / VCLK3_FREQ;
```

```
    period = (ecap3 - ecap1) * 1000 / VCLK3_FREQ;
```

```
    w = ((2*pi)/(432*period))*pow(10,9);
```

```
    sprintf(msg, "duty = %.3lf, period = %.3lf, W = %.3lf\r\n", duty, period, w);
```

```
    send_data(sciREG1, msg, 128);
```

```
}
```

```

COM4 - PuTTY
duty = 135300.000, period = 268300.000, W = 54.182
duty = 136200.000, period = 269800.000, W = 53.881
duty = 132200.000, period = 262100.000, W = 55.464
duty = 138000.000, period = 273200.000, W = 53.210
duty = 134900.000, period = 267100.000, W = 54.425
duty = 135100.000, period = 268500.000, W = 54.142
duty = 134200.000, period = 266300.000, W = 54.589
duty = 137100.000, period = 271100.000, W = 53.622
duty = 134500.000, period = 266000.000, W = 54.651
duty = 132700.000, period = 264100.000, W = 55.044
duty = 133600.000, period = 265500.000, W = 54.753
duty = 135500.000, period = 268200.000, W = 54.202
duty = 135800.000, period = 269000.000, W = 54.041
duty = 134000.000, period = 265500.000, W = 54.753
duty = 137600.000, period = 273200.000, W = 53.210
duty = 135600.000, period = 267700.000, W = 54.303
duty = 135100.000, period = 268400.000, W = 54.162
duty = 132500.000, period = 262200.000, W = 55.443
duty = 137300.000, period = 272500.000, W = 53.347
duty = 134900.000, period = 267300.000, W = 54.385
duty = 135700.000, period = 268700.000, W = 54.101
duty = 134000.000, period = 265600.000, W = 54.733
duty = 137600.000, period = 271400.000, W = 53.563
duty = 134100.0

```

Motor Control – eCAP code