2015 CONTROLA Day four

Lab. For Navigation, Control, and Applications

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Ubuntu 기반 ARM 개발환경 구축 & Controla-9DOF 회로도 설계

Contents

What is Ubuntu?

하나. 무료이다.

둘. 공개운영체제이다.

셋. 프로그래밍 용으로는 적합하다.

넷. 다중작업이 가능하다.

다섯. 업데이트가 빠르다.

Build a development environment

- **Tool Chain 설치**
- **보드 Firmware 다운**
- **ST-link 유틸리티 설치**
- **Sample code 다운**
- **Compile**
- **보드에 다운로드**

Tool Chain 설치

Tool Chain이란?

Embedded system에서 자주 사용되는 말이며, Target 시스템의 Software 개발을 진행하기 위해 필요한 Host system의 Cross Compile 환경이다.

Toolchain은 컴파일러만을 의미하지 않는다. Source code를 Compile하고 Build실행 파일을 생성하는데 필요한 각종 Utility 및 Library의 모음이라고 생각하면 되고, 기본적으로는 Assembler, Linker, C Compiler, C library 등으로 구성되어 있다.

Tool Chain 설치

Cross 란?

현재 우리가 사용하고 있는 PC의 CPU와 Atmega, Mango에서 사용하는 CPU는 다르다. 이와 같이 개발하는 곳의 환경과 실제 개발된 코드가 동작될 환경이 다를 경우 Cross라고 부른다.

Tool Chain 설치

```
yyy@controla:~$ sudo add-apt-repository ppa:terry.guo/gcc-arm-embedded
yyy@controla:~$ sudo apt-get update
yyy@controla:~$ sudo apt-get install gcc-arm-none-eabi
yyy@controla:~$ arm-none-eabi-gcc –version
```

보드 Firmware 패키지 및 예제 다운로드

http://www.st.com/web/en/catalog/tools/PF257904 에서 보드 Firmware 다운

Sample & Buy

Top

Part Number	Version	Marketing Status	
STSW-STM32068	1.1.0	Active	Download

보드 Firmware 패키지 및 예제 다운로드

```
yyy@controla:~$ unzip stsw-stm32068.zip
yyy@controla:~$ sudo mv STM32F4-Discovery_FW_V1.1.0/ /opt/
```

예제코드 위치

```
yyy@controla:~$ ls /opt/STM32F4-Discovery_FW_V1.1.0/Project/Peripheral_Examples/
```

ST-link 유틸리티 설치

```
yyy@controla:~$ git clone https://github.com/texane/stlink.git
yyy@controla:~$ cd stlink
yyy@controla:~/stlink$ sudo apt-get install autoconf
yyy@controla:~/stlink$ ./autogen.sh
yyy@controla:~/stlink$ ./configure
yyy@controla:~/stlink$ make
yyy@controla:~/stlink$ sudo make install
```

Sample code 다운

```
yyy@controla:~/stlink$ git clone https://github.com/Malkavian/tuts.git
yyy@controla:~/stlink$ cd tuts/stm/blinky
yyy@controla:~/stlink/tuts/stm/blinky$ ls –l

합계 56
-rwxrwxr-x 1 webnautes webnautes 3816 1월 11 17:37 Makefile
-rw-rw-r-- 1 webnautes webnautes 7700 1월 11 17:37 Readme.md
-rw-rw-r-- 1 webnautes webnautes 5490 1월 11 17:37 main.c
-rwxrwxr-x 1 webnautes webnautes 4823 1월 11 17:37 stm32_flash.ld
-rwxrwxr-x 1 webnautes webnautes 3870 1월 11 17:37 stm32f4xx_conf.h
-rwxrwxr-x 1 webnautes webnautes 21726 1월 11 17:37 system_stm32f4xx.c
```

Sample code 다운

Makefile 에서 보드 Firmware 복사해둔 위치로 수정

```
# This is the directory containing the firmware package,
# the unzipped folder downloaded from here:
# http://www.st.com/web/en/catalog/tools/PF257904
STM_DIR=/opt/STM32F4-Discovery_FW_V1.1.0
```

Makefile 에서 Toolchain설정 부분 수정

```
# The tool we use
CC      = arm-none-eabi-gcc
OBJCOPY = arm-none-eabi-objcopy
GDB     = arm-none-eabi-gdb
```

Compile

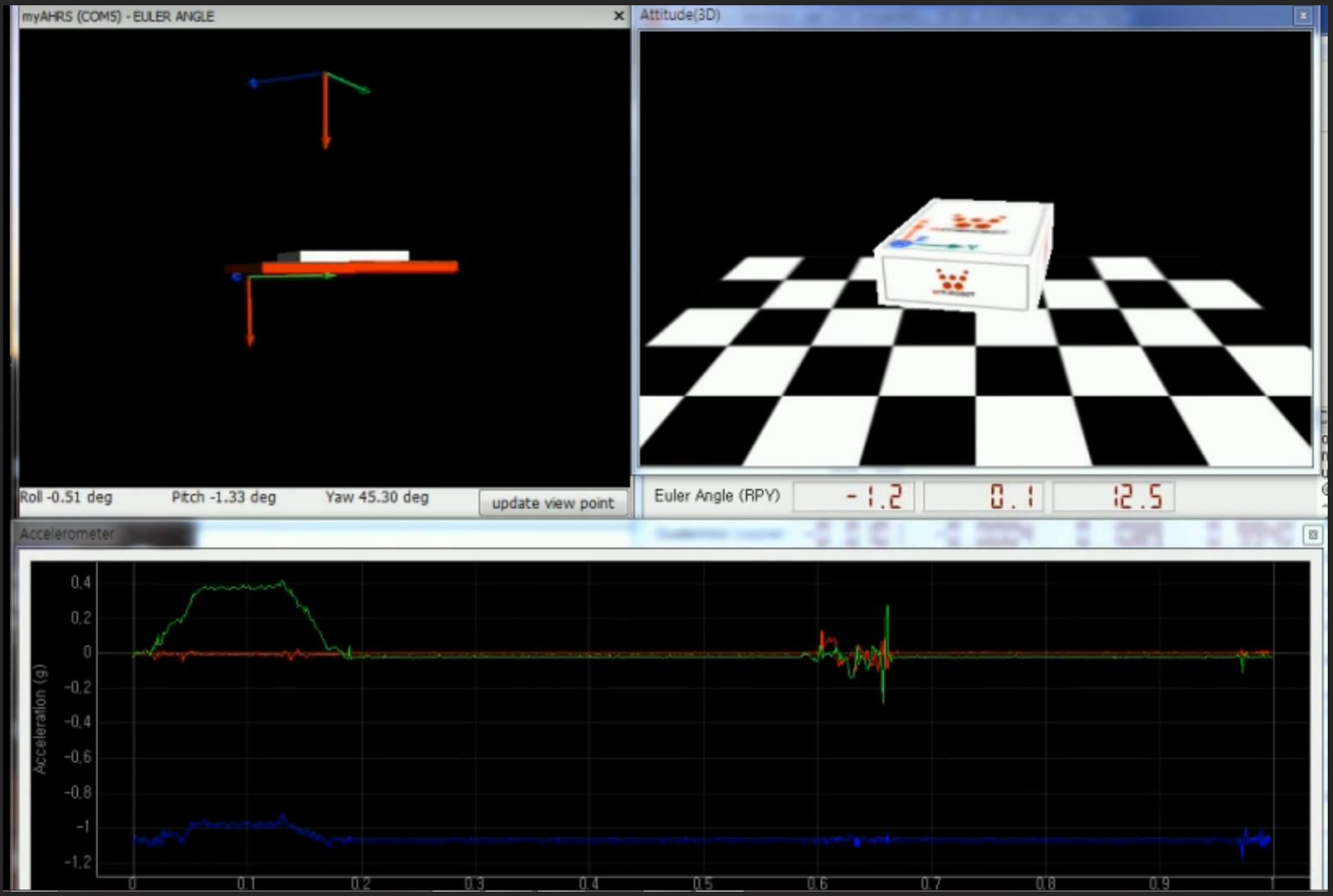
```
yyy@controla:~/stlink/tuts/stm/blinky$ make

arm-none-eabi-gcc -I/opt/STM32F4-Discovery_FW_V1.1.0/Utilities/STM32F4-Discovery -I/opt/STM32F4-Discovery_FW_V1.1.0/Libraries/CMSIS/Include -I/opt/STM32F4-Discovery_FW_V1.1.0/Libraries/CMSIS/ST/STM32F4xx/Include -I/opt/STM32F4-Discovery_FW_V1.1.0/Libraries/STM32F4xx_StdPeriph_Driver/inc -I. -DUSE_STDPERIPH_DRIVER -ggdb -O0 -Wall -Wextra -Warray-bounds -mlittle-endian -mthumb -mcpu=cortex-m4 -mthumb-interwork -mfloat-abi=hard -mfpu=fpv4-sp-d16 -Tstm32_flash.ld main.c system_stm32f4xx.c /opt/STM32F4-Discovery_FW_V1.1.0/Libraries/STM32F4xx_StdPeriph_Driver/src/stm32f4xx_rcc.c /opt/STM32F4-Discovery_FW_V1.1.0/Libraries/STM32F4xx_StdPeriph_Driver/src/stm32f4xx_gpio.c /opt/STM32F4-Discovery_FW_V1.1.0/Libraries/CMSIS/ST/STM32F4xx/Source/Templates/TrueSTUDIO/startup_stm32f4xx.s -o blinky.elf

arm-none-eabi-objcopy -O ihex blinky.elf blinky.hex
arm-none-eabi-objcopy -O binary blinky.elf blinky.bin
```

보드에 다운로드

```
yyy@controla:~/stlink/tuts/stm/blinky$ sudo make flash
```

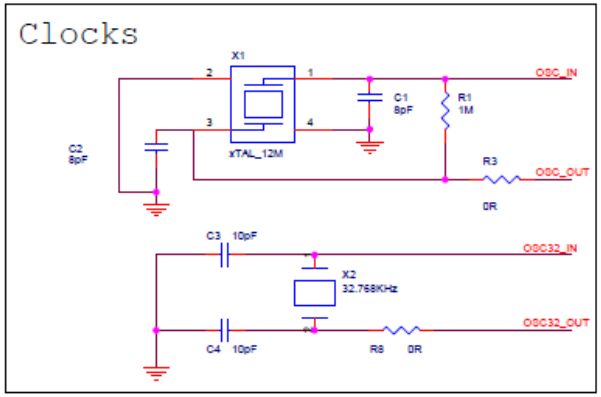
Contents

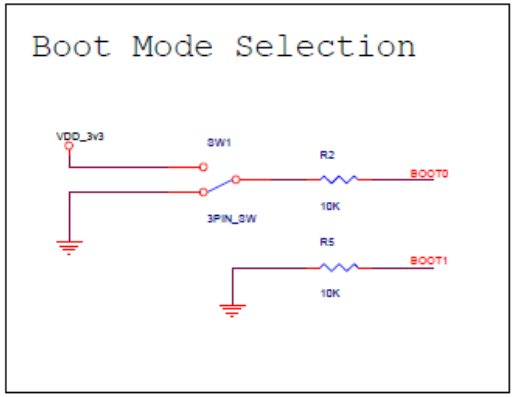
Competition

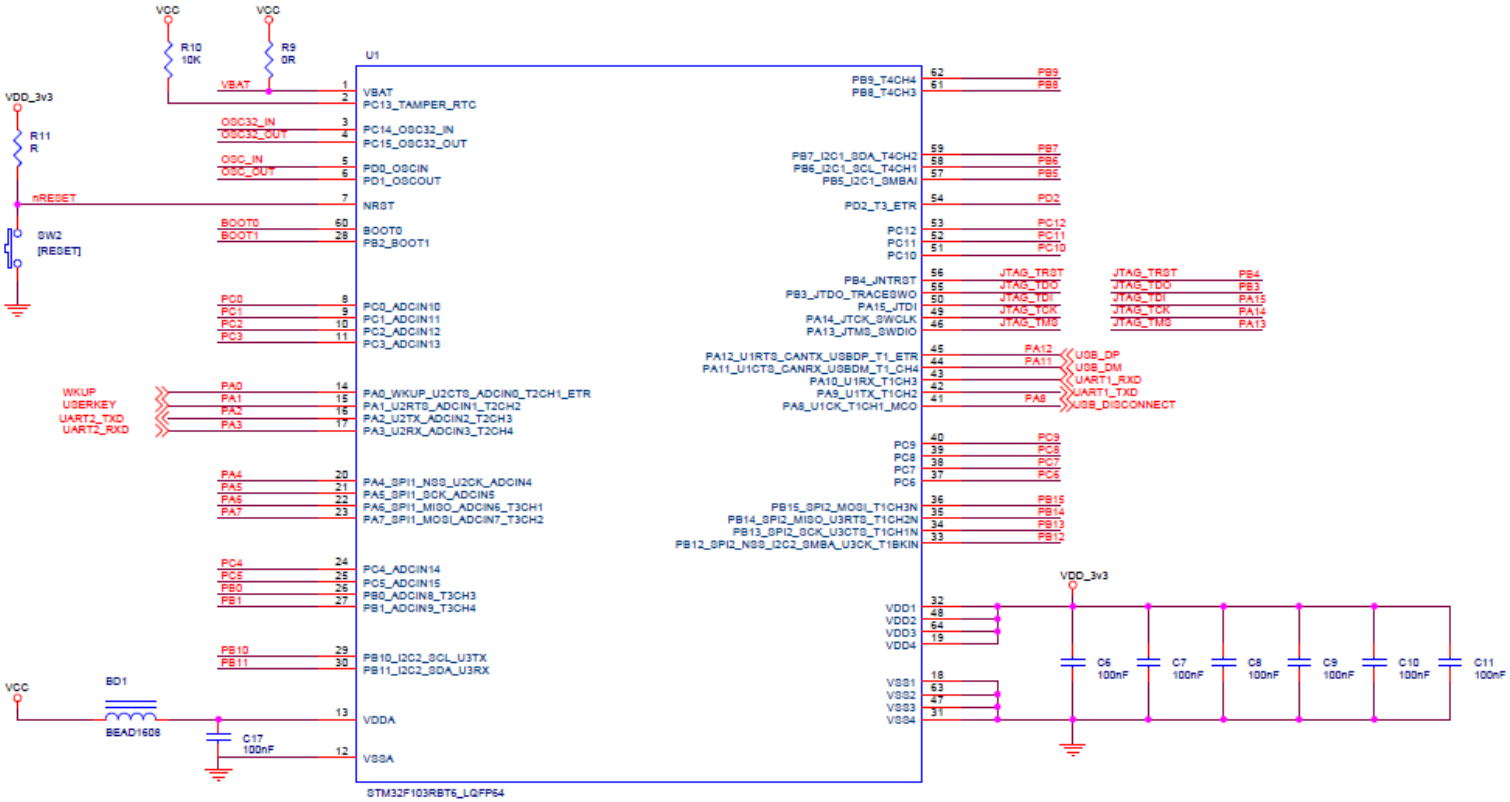

myAHRS (COM5) - EULER ANGLE
Roll -0.51 deg
Pitch -1.33 deg
Yaw 45.30 deg
update view point
Attitude(3D)
Euler Angle (RPY)
-1.2
0.1
12.5
Accelerometer
Acceleration (g)
0.4
0.2
0
-0.2
-0.4
-0.6
-0.8
-1
-1.2
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1

Competition (2/2)

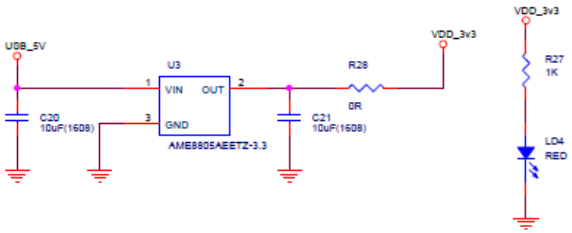
Controla-9DOF
Schematic Description


Clocks
X1
xTAL_12M
C1
8pF
R1
1M
C2
8pF
OSC_IN
R3
0R
OSC_OUT
C3 10pF
OSC32_IN
X2
32.768KHz
OSC32_OUT
C4 10pF
R8 0R

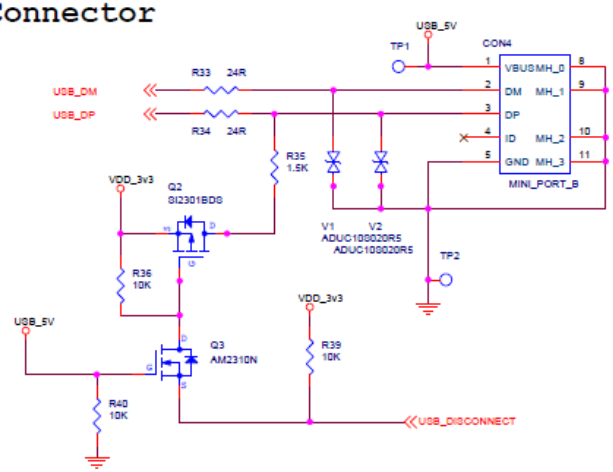

Boot Mode Selection
VDD_3v3
SW1
3PIN_SW
R2
10K
BOOT0
R5
10K
BOOT1


VCC
R10
10K
R9
0R
U1
VDD_3v3
R11
R
nRESET
SW2
[RESET]
VBAT
PC13_TAMPER_RTC
PC14_OSC32_IN
PC15_OSC32_OUT
PD0_OSCIN
PD1_OSCOUT
NRST
BOOT0
PB2_BOOT1
PC0_ADCIN10
PC1_ADCIN11
PC2_ADCIN12
PC3_ADCIN13
WKUP
USERKEY
UART2_TXD
UART2_RXD
PA0_WKUP_U2CTS_ADCIN0_T2CH1_ETR
PA1_U2RTS_ADCIN1_T2CH2
PA2_U2TX_ADCIN2_T2CH3
PA3_U2RX_ADCIN3_T2CH4
PA4_SPI1_NSS_U2CK_ADCIN4
PA5_SPI1_SCK_ADCIN5
PA6_SPI1_MISO_ADCIN6_T3CH1
PA7_SPI1_MOSI_ADCIN7_T3CH2
PC4_ADCIN14
PC5_ADCIN15
PB0_ADCIN8_T3CH3
PB1_ADCIN9_T3CH4
PB10_I2C2_SCL_U3TX
PB11_I2C2_SDA_U3RX
VDDA
VSSA
BD1
BEAD1608
C17
100nF
STM32F103RBT6_LQFP64
PB9_T4CH4
PB8_T4CH3
PB7_I2C1_SDA_T4CH2
PB6_I2C1_SCL_T4CH1
PB5_I2C1_SMBAI
PD2_T3_ETR
PC12
PC11
PC10
PB4_JNTRST
PB3_JTDO_TRACESWO
PA15_JTDI
PA14_JTCK_SWCLK
PA13_JTMS_SWDIO
JTAG_TRST
JTAG_TDO
JTAG_TDI
JTAG_TCK
JTAG_TMS
PA12_U1RTS_CANTX_USBDP_T1_ETR
PA11_U1CTS_CANRX_USBDM_T1_CH4
PA10_U1RX_T1CH3
PA9_U1TX_T1CH2
PA8_U1CK_T1CH1_MCO
USB_DP
USB_DM
UART1_RXD
UART1_TXD
USB_DISCONNECT
PC9
PC8
PC7
PC6
PB15_SPI2_MOSI_T1CH3N
PB14_SPI2_MISO_U3RTS_T1CH2N
PB13_SPI2_SCK_U3CTS_T1CH1N
PB12_SPI2_NSS_I2C2_SMBA_U3CK_T1BKIN
VDD1
VDD2
VDD3
VDD4
VSS1
VSS2
VSS3
VSS4
C6
100nF
C7
100nF
C8
100nF
C9
100nF
C10
100nF
C11
100nF

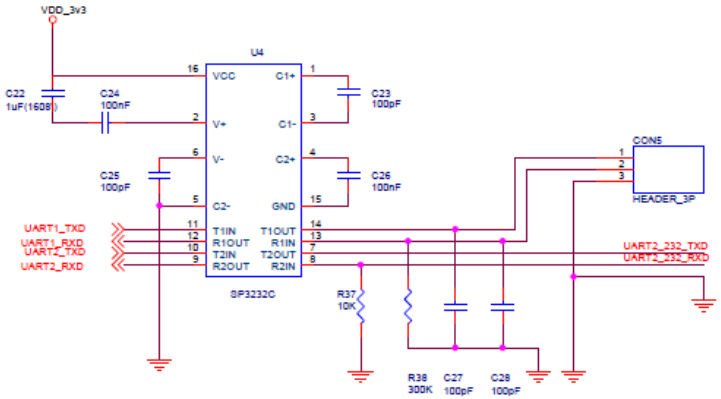
Main Power



USE Connector

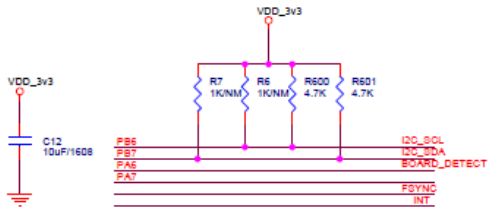


RS-232C

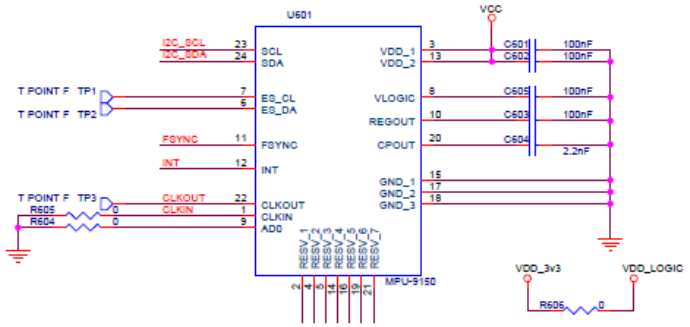


2.2 Controla-9DOF Schematic Description (3/3)

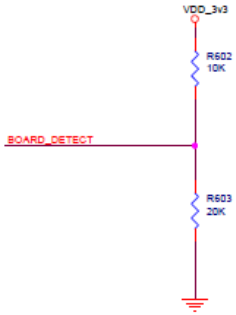
Connecter



Sensor



Board Detect



THANKS.