DB3672B Demo Board User Guide

MEMSIC Semiconductor (Tianjin) Co., Ltd.

INTRODUCTION

The DB3672B Demo Board is a standalone accelerometer demonstration platform that enables firsthand user experience of the IoMT (Internet of Moving Things) functionality for the latest MEMSIC motion sensors. It highlights either the MC3672 (1.1 x 1.3 mm CSP) and MC3635 (1.6 x 1.6 mm LGA) ultra-low power, 3-axis accelerometers by providing g-force data to 32-bit ARM Cortex-M4. Motion sensing algorithms are performed in firmware on the MCU to demonstrate popular accelerometer use cases. These include a variety activity tracking, user interface and power management functions. Results and status are displayed live on the on-board OLED display. The board is also equipped with an USB/UART interface for easy firmware upgrades and external power.

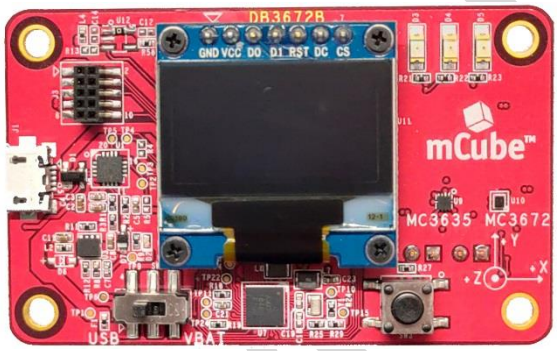

Figure 1: Top View

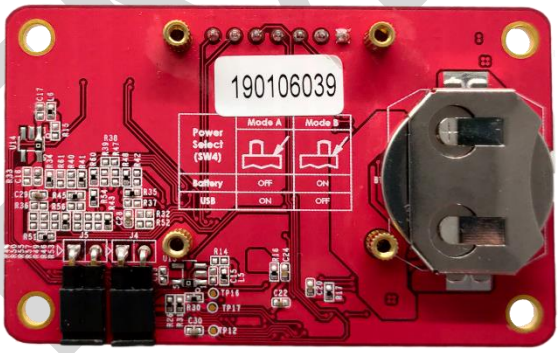

Figure 2: Bottom View

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FEATURES

The DB3672B (demo) board offers the following features:

1. MEMSIC 3-axis Accelerometer MC3635 (U9) in 1.6 x 1.6mm LGA package
2. MEMSIC 3-axis Accelerometer MC3672 (U10) in 1.3 x 1.1 mm WLCSP package
3. Ambiq 32-bit ARM Cortex-M4F Apollo2 MCU (U7) with 48 MHz clock frequency, 1 MB flash storage and 256 KB SRAM
4. 0.96" 128x64 monochrome OLED (U11) using ssd1306 controller
5. CP210x USB-to-UART interface(J1) chip for connection to PC
6. Four LEDs:
    1. Application controllable Red(D3), Green(D4), Yellow(D5)
    2. Power(D2)
7. Push-button (SW3)
8. Power-on slide switch (SW4)
9. Pre-programmed bootloader
10. Coin-cell battery CR2032 (BT1) powered for standalone use
11. Demo application with various motion algorithms

COMPONENT LAYOUT

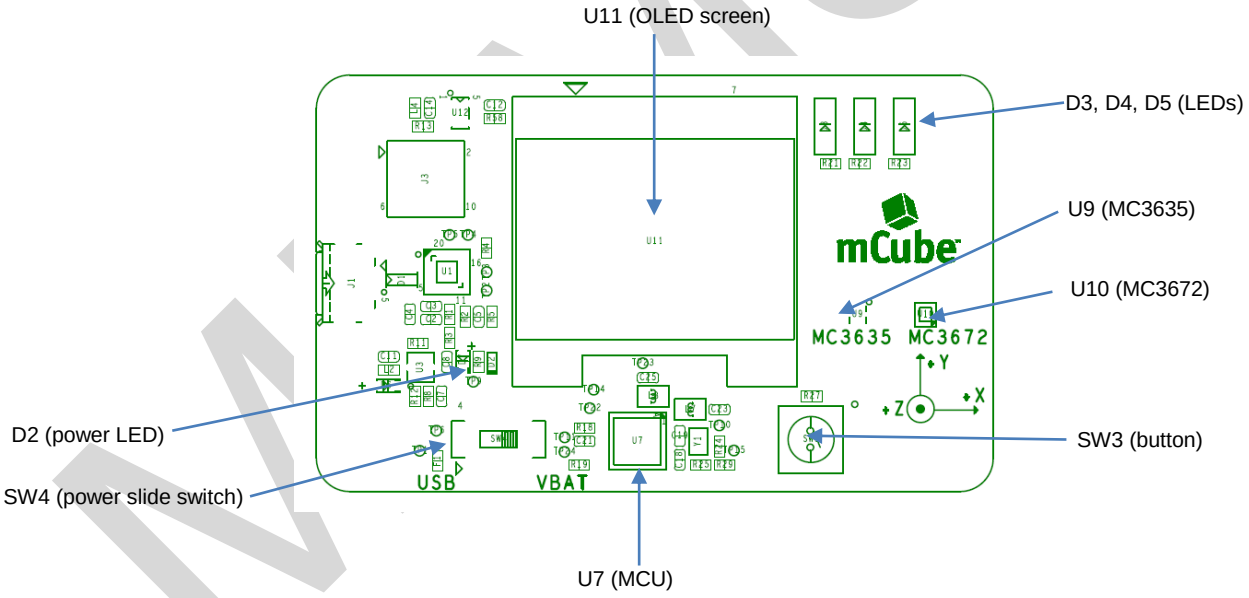


Figure 3 Components (front view)

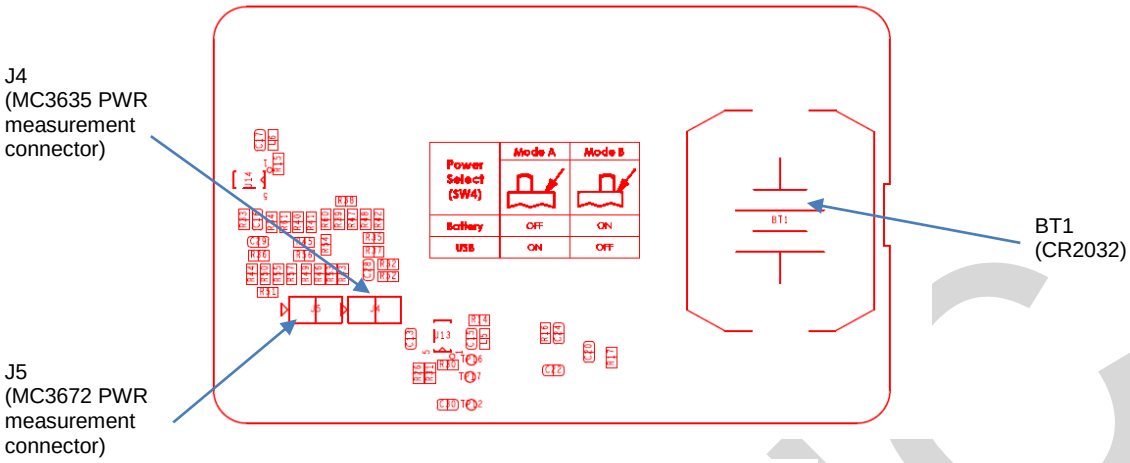


Figure 4 Components (bottom view)

DEMO APPLICATIONS

DB3672B illustrates with a few common IoT gestures of accelerometer. All results are shown on screen with LEDs to assist demonstration, which consists of following features:

Feature	KPI	Memory (KB)	DMIPS	Version	Comments
Data Readout	N/A	N/A	N/A	v1.0.0	Raw data
Tap	90%	2.7	0.32	v1.0.0	Single Tap
	95%				Double Tap
	90%				Triple Tap
Shake	95%	1.3	0.23	v1.0.0	2 (or more) back-and-forth shakes
Freefall	99%	0.6	0.16	v1.0.0	> 2 cm drop
Tilt Angle	N/A	3.6	6.73	v1.0.0	Pitch/Roll
Face Side	N/A	N/A	N/A	v1.0.0	Dominant side
Jump Rope	90%	1.7	0.03	v1.0.0	Jump rope
Activity	95%	3.5	1.64	v1.0.0	Steps/State
Sniff	N/A	N/A	N/A	v1.0.0	Power switch

APPLICATION FLOW

The board can be turned-on by sliding the power slide switch (SW4) to the right. When powered ON, it will show a splash screen containing logo with FW version.

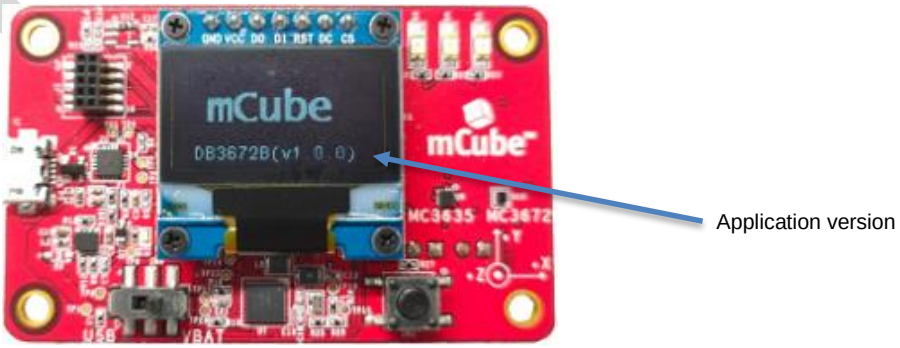


Figure 5 splash screen

Splash screen is followed by 1st feature on sensor data output. Long press (SW3) to toggle sensor MC3672 and MC3635. Default accelerometer is MC3672 (U10). See Image below for

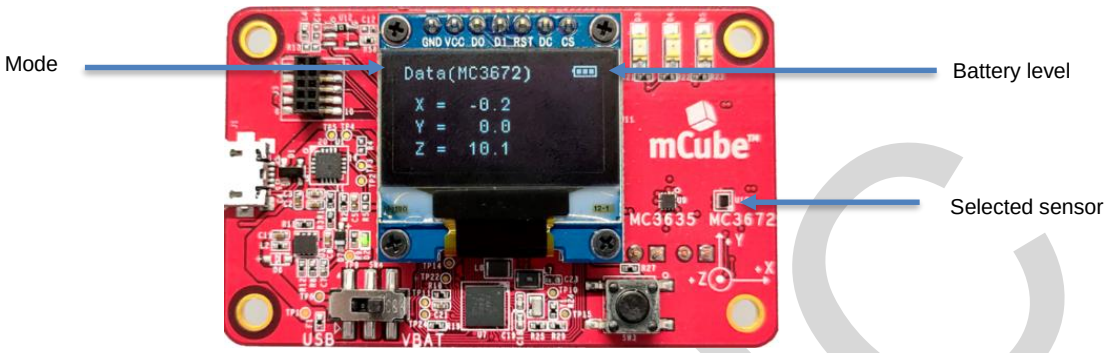


Figure 6 Data mode

Tap Mode: On pressing button (SW3), subsequent feature is shown. This button is used to toggle between different demo modes. First feature is Tap mode.

Tap window: waiting for tapping on the screen	
When screen is tapped once, Single Tapped is shown and Red LED (D3) is ON for 2 seconds	
When screen is tapped twice within 0.3 secs, Double Tapped is shown and Yellow LED (D4) is ON for 2 seconds.	
When screen is tapped three times with 0.7secs, Triple Tapped is shown and Green LED (D5) is ON for 2 seconds.	

Figure 7 Tap Mode

Shake Mode:

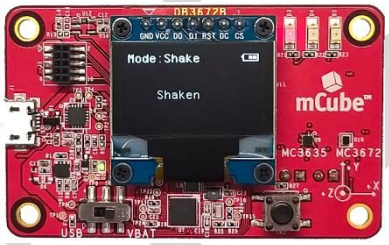
Shake mode window: waiting for shake event	
When device is shaken two to-and-fro movement, Shaken is shown and **Red** LED (D3) is ON for 2 seconds.	

Figure 8 Shake Mode

Freefall Mode:

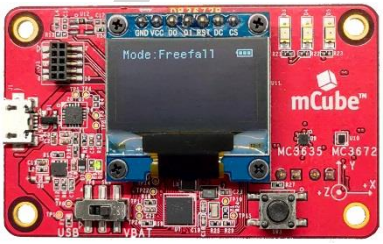
Freefall mode window: waiting for freefall event	
When device dropped over 10 cm height, freefall event is shown on screen and Green LED (D5) is ON for 2 seconds.	

Figure 9 Freefall Mode

Tilt Mode:

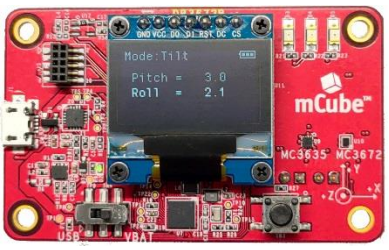
Tilt mode: Shows Roll and Pitch angle when board is rotated along X and Y axis. Pitch > abs(30º), Green LED is ON Roll > abs((30º), **Yellow** LED is ON Both Green and **Yellow** are ON when Pitch and Roll > abs(30º).	

Figure 10 Tilt Mode

Face Side Mode:

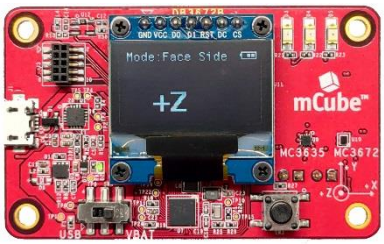
Dominant side displayed on screen, +Z when board is parallel to the plane of the horizon.	

Figure 11 Face Side Mode

Jump Rope Mode:

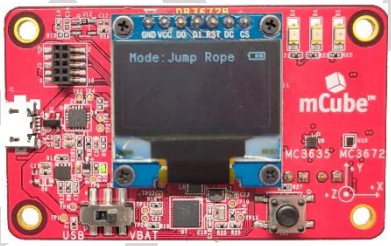
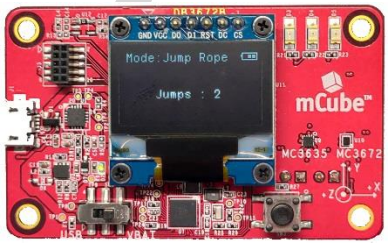
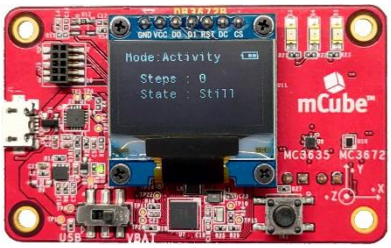
Jump mode: waiting for Jump	
Jump Rope mode: track number of Jumps	

Figure 12 Jump Rope Mode

Activity Mode: In this mode DB3672B acts like a pedometer, which measures number of steps taken and current state: still, walking or running. At least 10 steps required to transit from Still to “Walking” or “Running” for every single trial.

Activity mode: no activity Steps: 0 State: Still	

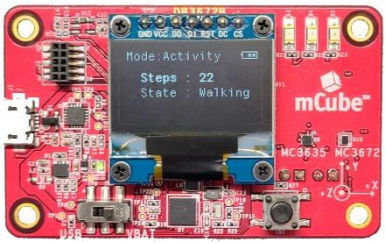
Activity mode: Walking Steps: number of step count State: Walking	
Activity mode: Running Steps: number of step count State: Running	

Figure 13 Activity Mode

Sniff Mode: Sniff mode is a unique feature in MC3672/MC3635 to have sensor enter an ultra-low power state (0.4uA) and can be activated when significant motion is detected.

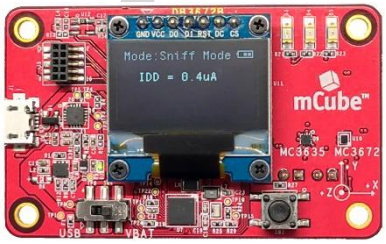
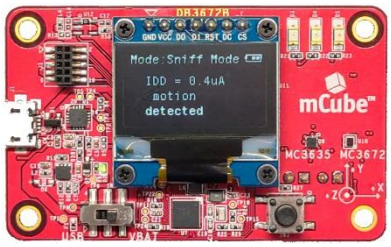
Sniff mode: waiting for motion detection	
Sniff mode: motion detected event displayed on screen for 2 seconds	

Figure 14 Activity Mode

After Sniff page, subsequent screen shows QR code followed by Data page again in loop.

QR Code	

Figure 15 QR code Mode

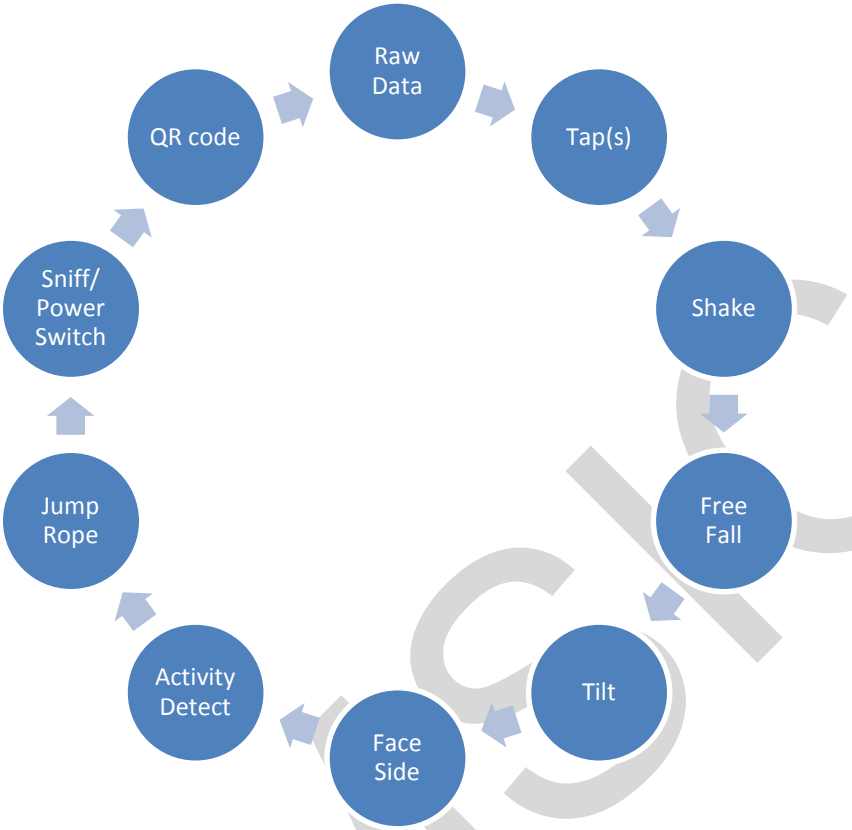


Figure 16 Demo application flow

FIRMWARE UPDATE TOOL

Get the tools from MEMSIC

STEPS to update firmware:

1. Install CP2102 driver on your PC/laptop from link below: *https://www.silabs.com/products/development-tools/software/usb-to-uart-bridge-vcp-drivers*

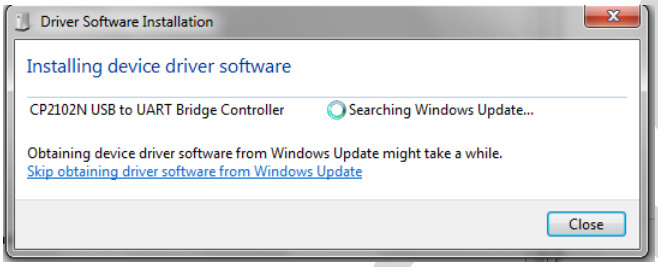
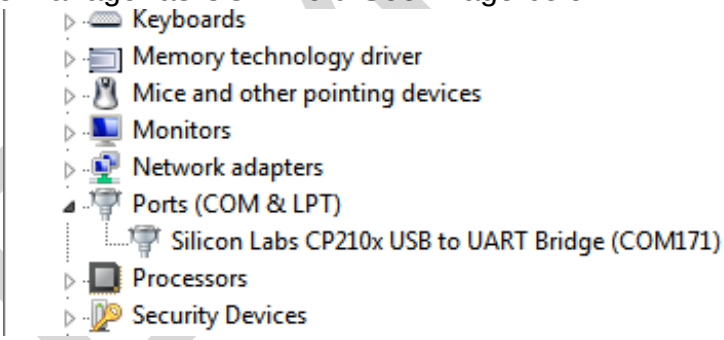


Figure 17 Installing USB-to-UART Driver

2. While pressing button (SW3) on sensor board, connect board to computer by micro USB cable
3. Now, on connecting sensor board to Windows PC will automatically install driver. Will show up in Device Manager as COM Port. See Image below.



4. Unzip “MEMSIC_DB3672B_tools v1.0.0.zip file
5. Click to open “DB3672_flash_tool.exe” application from package. (Do NOT copy it outside of the folder).
6. Press “Load” button and choose firmware binary file “MEMSIC_DB3672B_v1.0.0.bin”
7. Select your COM port from “SerialPort” drop-down list menu. Should match to the one found in device manager. Press “Reload” button in case this does not work
8. Now press “Program” button to flash firmware.
9. If you don’t see the Serial Port on the flash tool, which indicates that you may haven’t installed the USB-to-UART device driver successfully. Try to reinstall it again, then you will see the com port on the flash tool when USB plug-in.

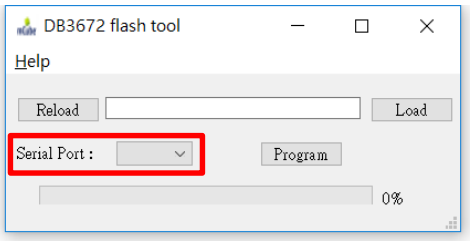


Figure 18 Serial Port Not Detected

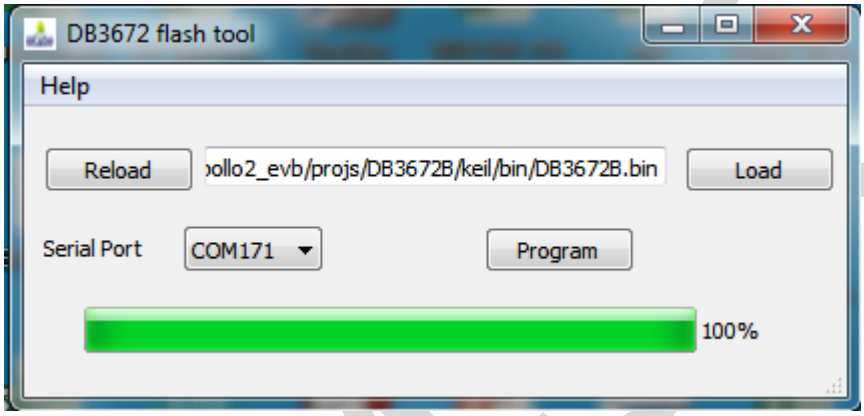


Figure 19 DB3672 FW flash tool

CURRENT MEASUREMENT

DB3672B board has a pair of jumpers for measuring current consumption on MEMSIC accelerometers (U9 & U10).

J4 (MC3635) and J5(MC3672) jumper can be used to measure current on sensor, depicted ultra-low power at 0.4uA in Sniff mode.

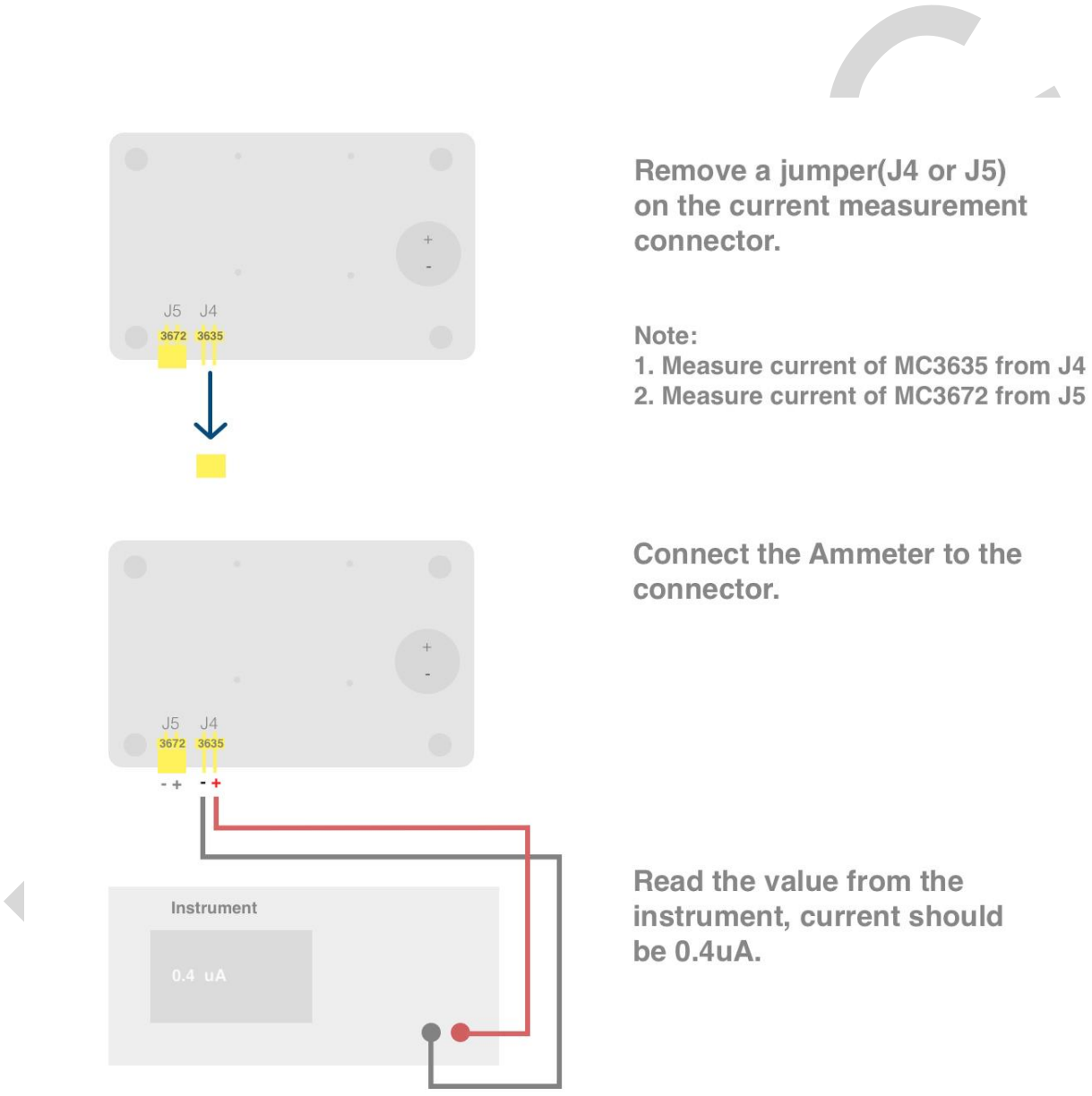


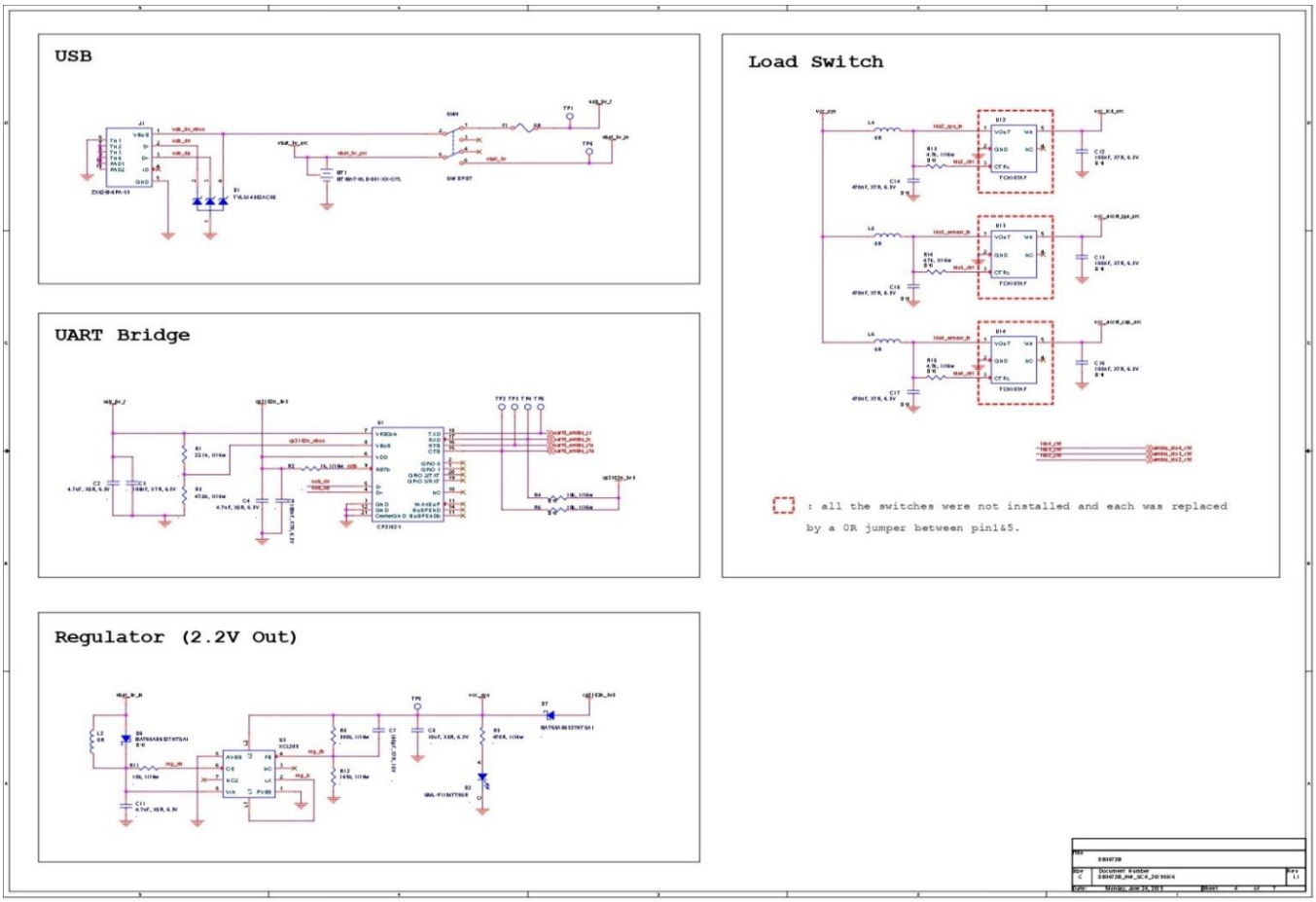
Figure 20 Current measurement by jumper J4, J5

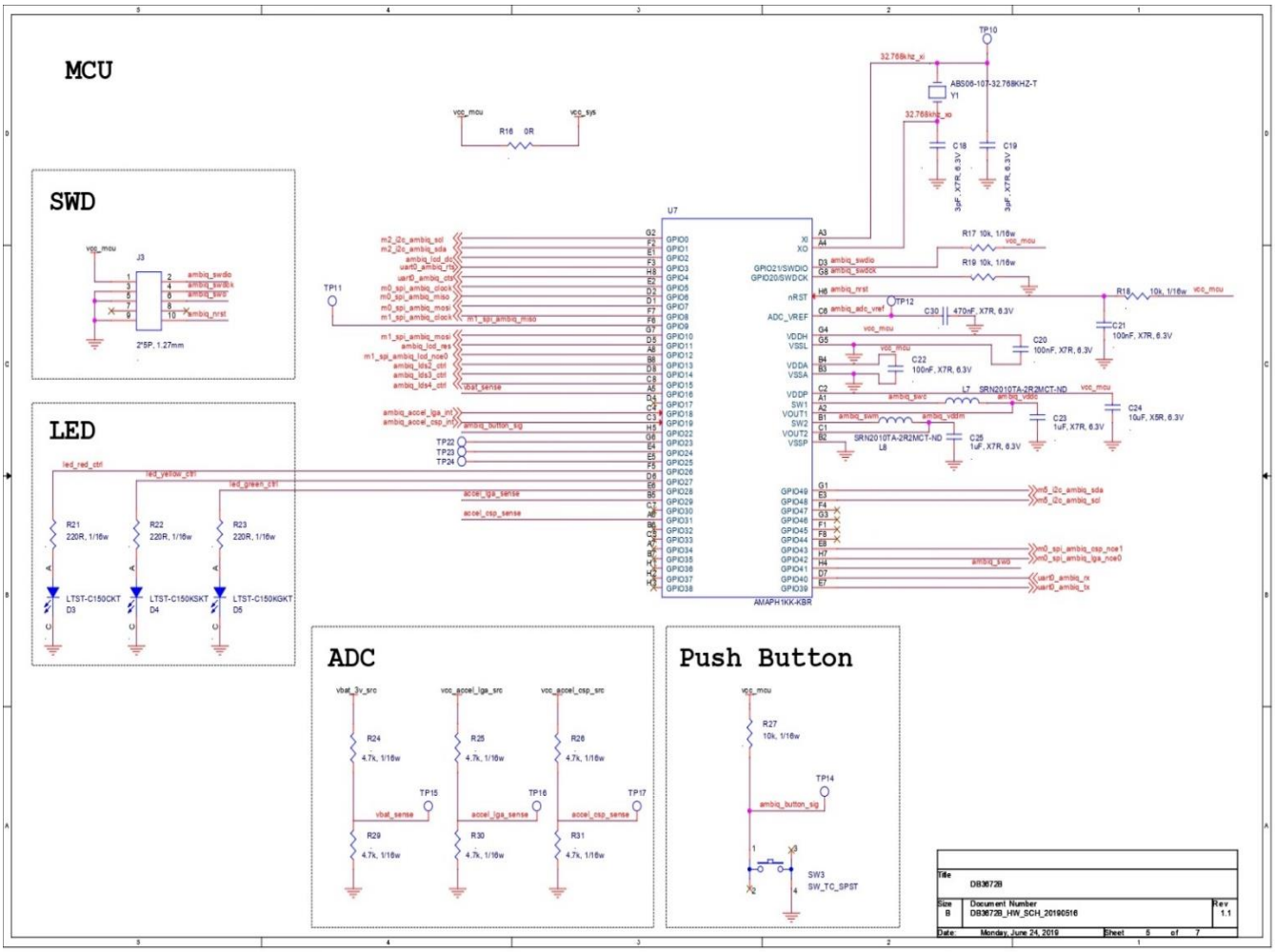
Figure 21 Sniff current at 6Hz

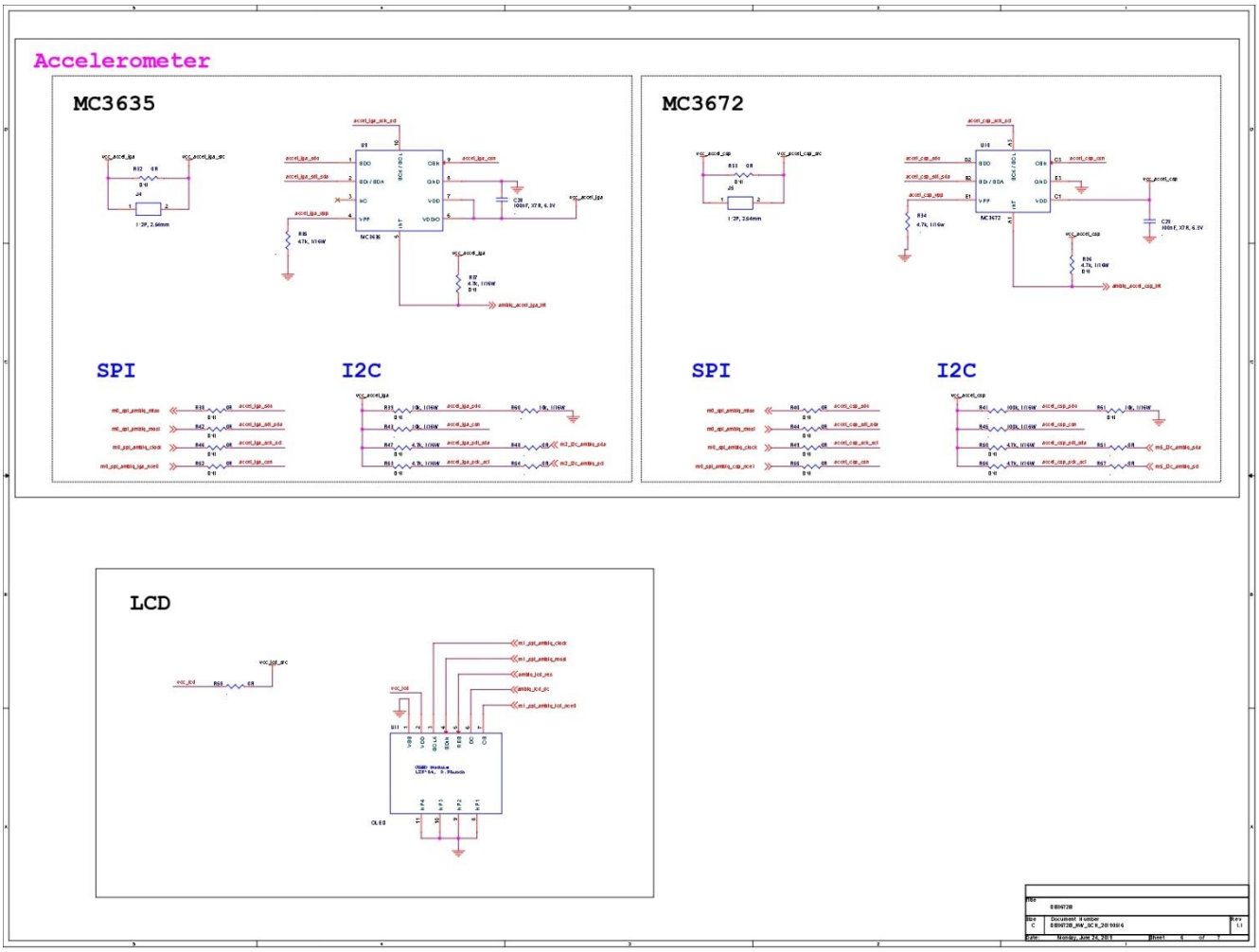
Figure 22 Wake supply current @ ultra-low power, 25Hz

Sensor Category	Sniff Current @ 6Hz	Wake Current @ ULP, 25Hz
MC3672	0.4 uA	0.9 uA
MC3635	0.4 uA	0.9 uA

SCHEMATICS




MCU
SWD
LED
ADC
Push Button
U7
AMAPH1KK-KBR
Y1
ABS06-107-32.768KHZ-T
SRN2010TA-2R2MCT-ND
LTST-C150CKT
LTST-C150KSKT
LTST-C150KGKT
SW3
SW_TC_SPST
Title
DB3672B
Document Number
DB3672B_HW_SCH_20190516
Rev
1.1
Monday, June 24, 2019
Sheet 6 of 7



EV3672/EV3635 EVAL BOARDS INSTALL

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EV3672A

mCube

Enlarge

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See Product Specifications

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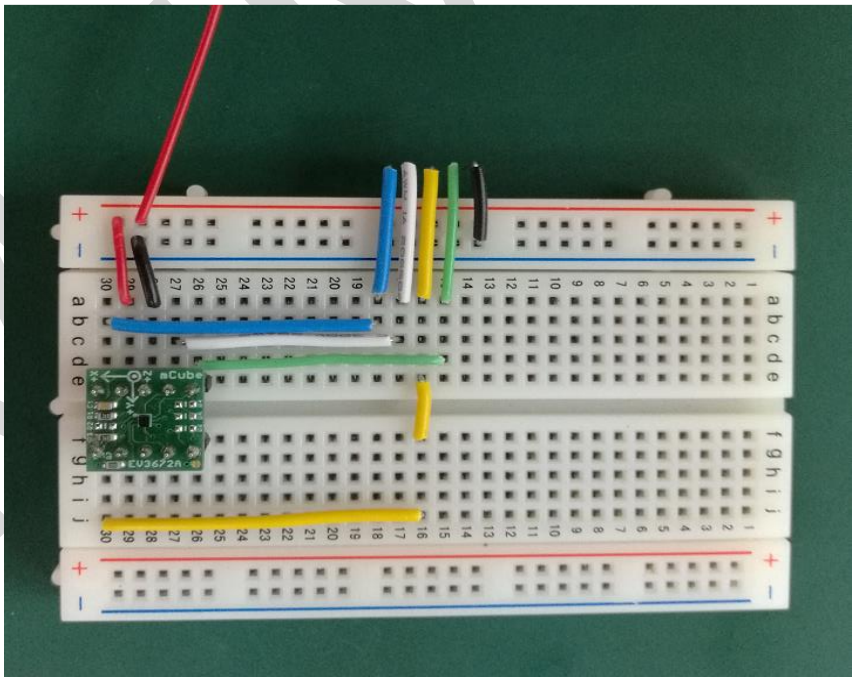
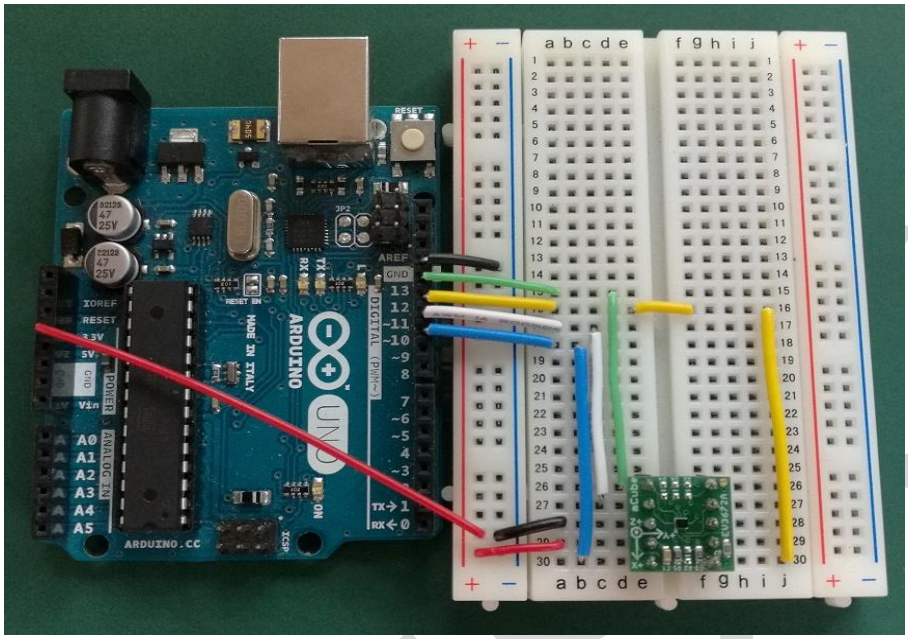
Mouser #:	498-EV3672A
Mfr. #:	EV3672A
Mfr.:	mCube
Customer #:	Customer #
Description:	Acceleration Sensor Development Tools DIP Evaluation Board For MC3672
Datasheet:	EV3672A Datasheet
More Information:	Learn more about mCube EV3672A

GET QUICK START GUIDE FROM MEMSIC

PLUG EV36XXA INTO A BREADBOARD

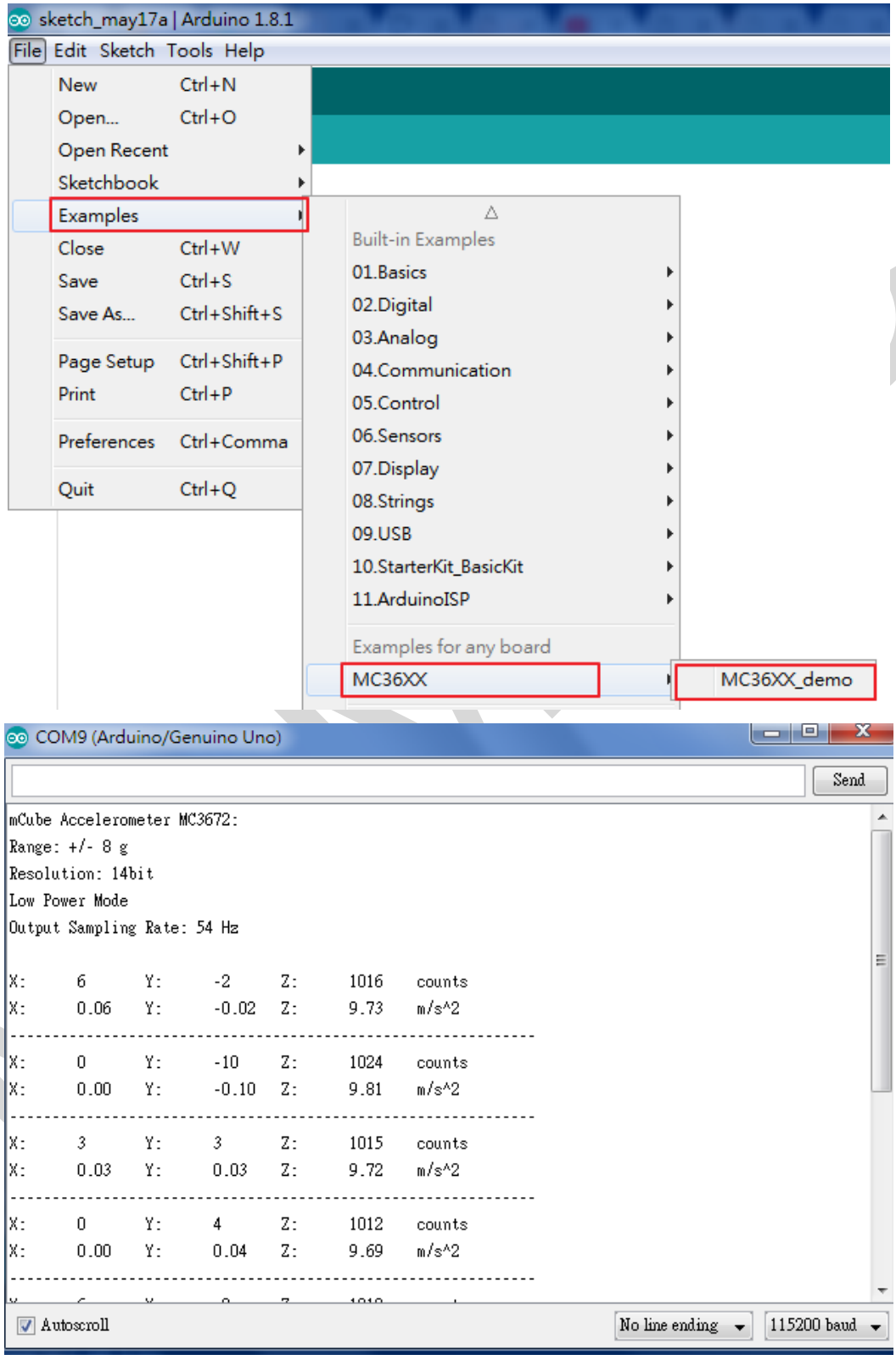


CONNECT TO PROCESSOR(ARDUINO) VIA SPI OR I2C



GET DRIVERS FROM MEMSIC

LOAD AND RUN MC36XX DEMO



REVISION HISTORY

Date	Revision	Description
2019-06-18	APS-045-0031v1.0	First release.
2020-08-17	APS-045-0031v1.1	Change to MEMSIC format based on the License Agreement with mCube.