



RD3803MMA7660FC Evaluation Kit User's Guide

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ACRONYMS

GUI: Graphical User Interface

USB: Universal Serial Bus

INTRODUCTION

The RD3803MMA7660FC Evaluation kit is a complete out of the box experience tool to evaluate the MMA7660FC, a low power, 3-linear smart accelerometer with I²C digital output. The accelerometer contains both a communication board and a DIP board that has the sensor that plugs into the communication board (Figure 1). Providing the DIP as a separate component allows the capability to evaluate the sensor using the communication board and/or on the target customer application. This application note is an in-depth document explaining the setup and installation of the board and GUI and a thorough description of the demos included in the GUI.

The kit includes:

- Communication board containing a Freescale Microcontroller MC9S08Q68 and USB interface which enables communication with the PC (Figure 1).
- DIP board with the MMA7660FC accelerometer (Figure 2).
- GUI for demonstrating all integrated accelerometer features as well as demonstrations for specific mobile applications using the sensor.
- USB to mini USB connector.
- Sensor CD containing documentation, GUI, and pertinent web link.

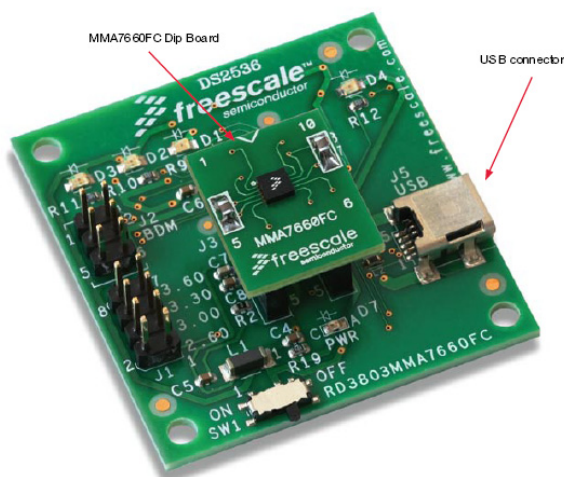


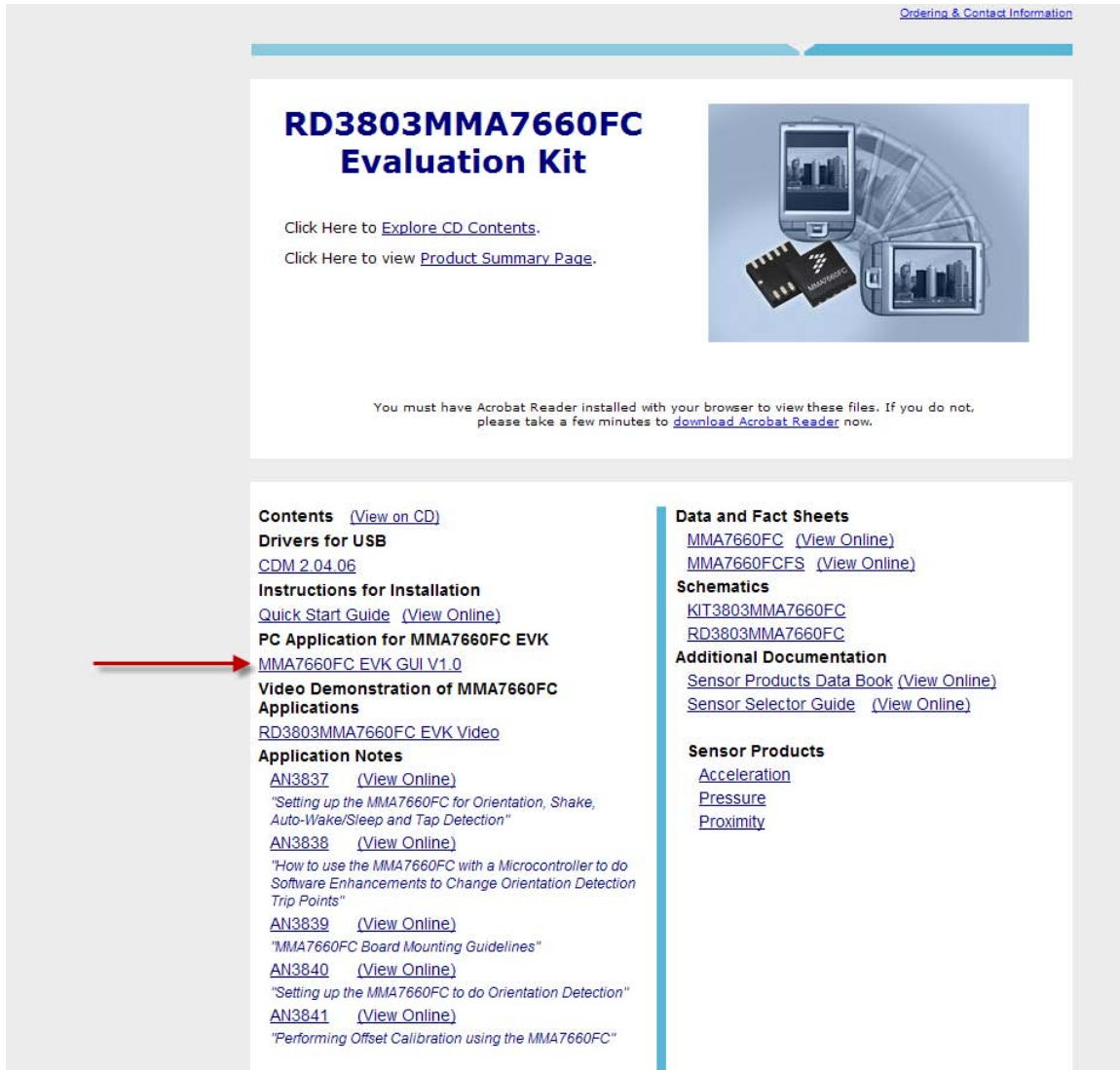
Figure 1. RD3803MMA7660FC Evaluation Kit Board



Figure 2. MMA7660FC Dip Board

INSTALLATION OF THE GUI

1. Insert the RD3803MMA7660FC Evaluation Kit CD into the PC.
2. Select and download the link "MMA7660FC EVK GUI V 1.0" as shown in Figure 3.
3. Save the file to a known location and unzip.




Ordering & Contact Information

RD3803MMA7660FC Evaluation Kit

Click Here to [Explore CD Contents](#).

Click Here to view [Product Summary Page](#).



You must have Acrobat Reader installed with your browser to view these files. If you do not, please take a few minutes to [download Acrobat Reader](#) now.

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[AN3837 \(View Online\)](#)
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Additional Documentation
[Sensor Products Data Book \(View Online\)](#)
[Sensor Selector Guide \(View Online\)](#)

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Figure 3. RD3803MMA7660FC Evaluation Kit CD Start Page

4. Navigate to the file location and open RD3803MMA7660FC Evaluation Kit GUI Installer. Run Setup.exe. (Figure 4)
5. Use the RD3803MMA7660FC Evaluation Kit Setup Wizard to tailor the installation to desired computer configurations

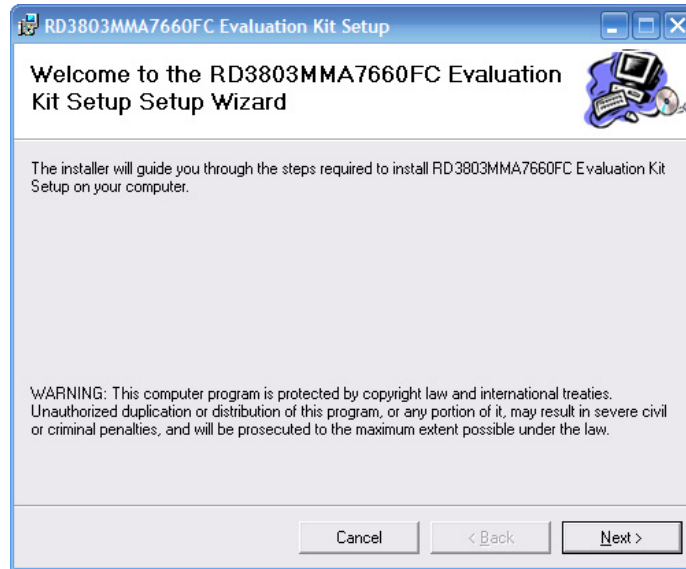


Figure 4. Step 1 in the RD3803MMA7660FC Setup Wizard

INSTALLING HARDWARE DRIVER AND COMPONENTS

1. Connect the mini USB cable end to the RD3803MMA7660FC Evaluation Kit. (Figure 1)
2. Connect the USB cable to the PC.
3. The “Found New Hardware Wizard” screen will appear (Figure 5). Select to “Install from a list or specific location (Advanced)” option under “What do you want the wizard to do?”.



Figure 5. Found New Hardware Wizard

4. In the “Hardware Update Wizard” screen, select “Include this location in the search”. Include the folder location where the application was installed in, i.e. C:\Program Files\Freescale\RD3803MMA7660FC Evaluation Kit Setup (Figure 6) Select “Next” and the drivers will install.

NOTE 1: If the default location for the GUI installer is used the location of the files are in C:\Program Files\Freescale\RD3803MMA7660FC Evaluation Kit Setup

NOTE 2: If the drivers are not found, they are also located in the CD under Drivers for USB.

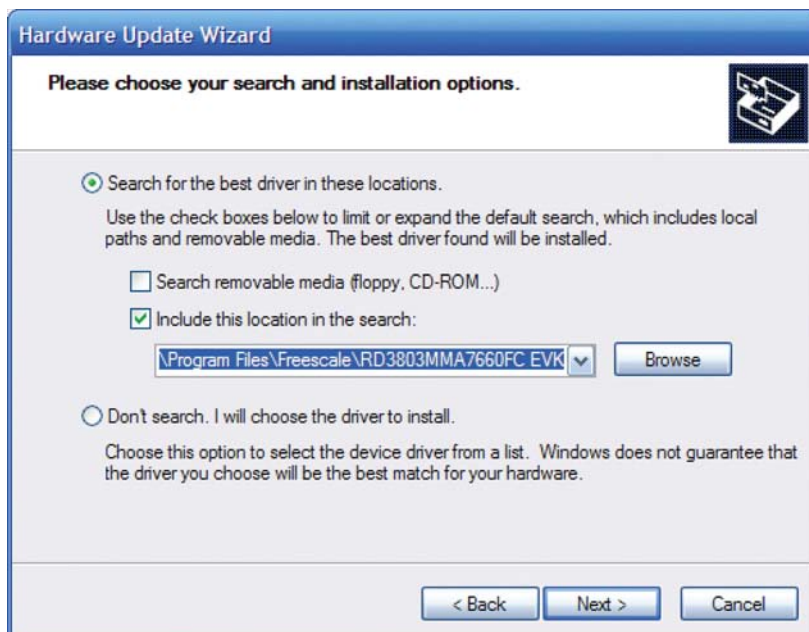


Figure 6. Hardware Update Wizard

START UP OF RD3803MMA7660FC EVALUATION KIT GUI

1. Turn board On.
2. Select Start > Programs > RD3803MMA7660FC Evaluation Kit or select the icon from the Desktop screen. The COM port selection screen will appear. The application performs an Auto – COM port algorithm which finds the port being used by RD3803MMA7660FC, by handshaking with each available port and selecting the one that answers with the correct handshake command (Figure 7). Select “OK”.

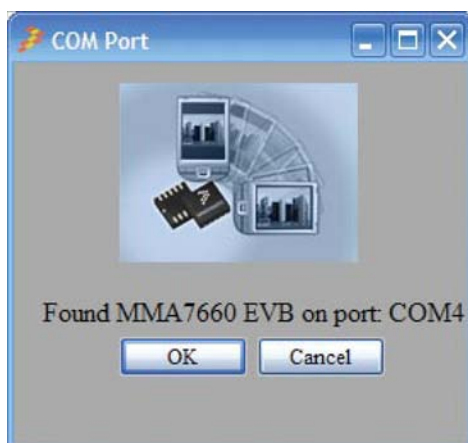


Figure 7. Com Port Selection Screen

“If the Device not found, please check settings” message appears select “Cancel”. Go to Control Panel > System > Hardware Tab > Device Manager. Verify that the port is there under Ports (Figure 8).

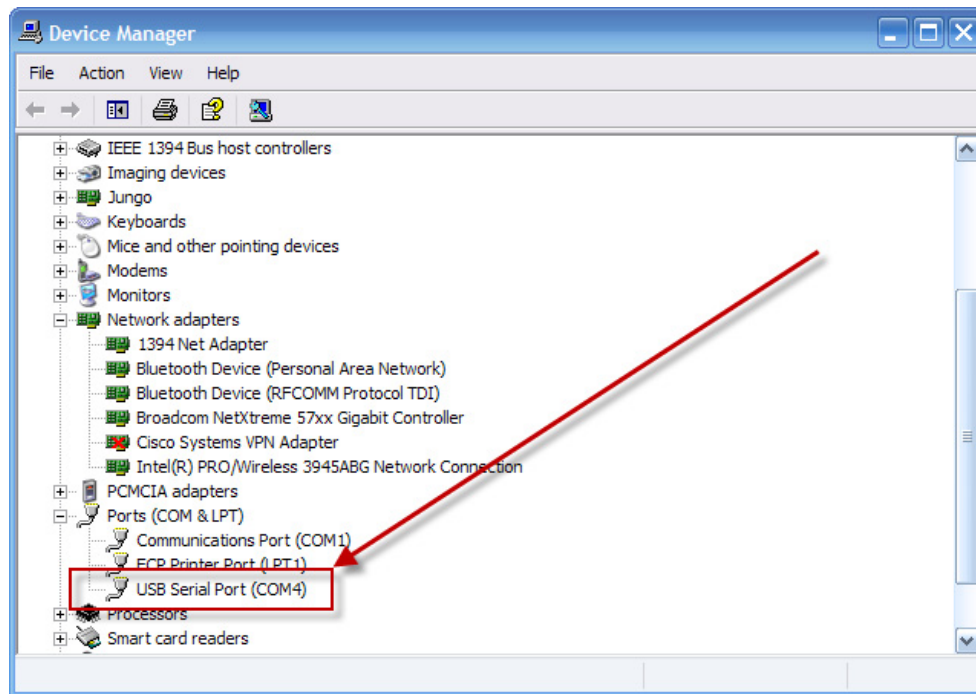


Figure 8. Device Manager

NOTE: If a blue tooth module is installed on the PC, this may cause intermittent behavior due to the driver. Please uninstall blue tooth device and then run GUI.

3. The “Demos for RD3803MMA7660FC” screen will appear (Figure 9). The following section will describe in detail all the demos available on the GUI.

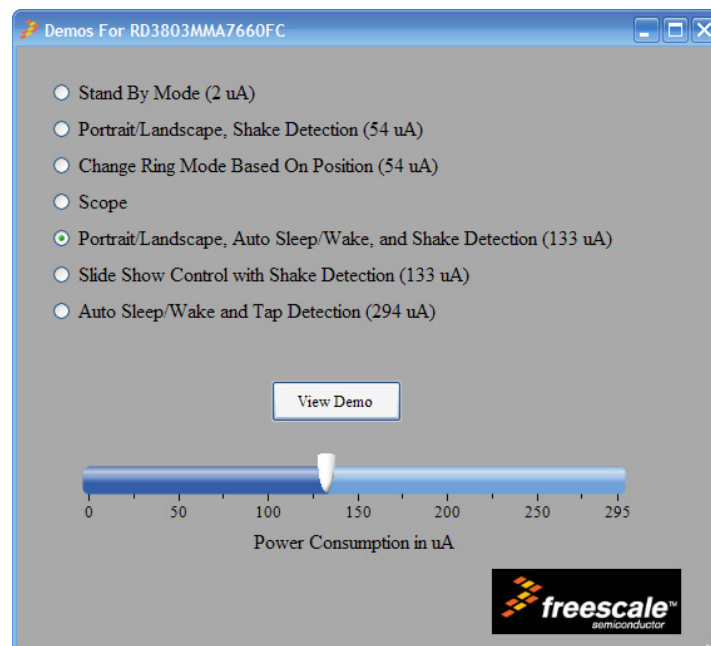


Figure 9. Demos for RD3803MMA7660FC

DEMOS FOR RD3803MMA7660FC EVALUATION KIT GUI

There are a number of different demos that are included in the application. The demos showcase the built in intelligence of the sensor, for example: orientation detection (back, front, up, down, left, and right), shake detection, tap detection, and auto-wake/sleep features. It also includes a couple of demos showcasing applications that could be built using the MMA7660FC sensor in a mobile phone such as slide show control with shake detection and changing the ringer mode based on the orientation of the device. This section will describe the demos in depth and explain how to use them.

NOTE: For more information on configuring the MMA7660FC sensor to perform built in functionality, please refer to AN3837 titled, "Setting up the MMA7660FC for Orientation, Shake, Auto-Wake/Sleep and Tap Detection". For register configurations, please refer to the MMA7660FC Data Sheet.

Portrait/Landscape, Shake Detection (54 μ A)

This demo uses the built in features of both shake detection and orientation detection. The device is running at a sampling rate of 4 SPS and the debounce filter for orientation detection is set to 8 consecutive samples.

1. As the device is rotated the graphic will change and wording on the right will change based on the orientation the board is held. For example, Front and Down (Figure 10).

NOTE: Back/Front (Based on Z-axis only) can occur at the same time that Left/Right/Up/Down (Based on X, Y, and Z) orientation positions can occur.



Figure 10. Portrait/Landscape and Shake Detection

2. Move the device in the 6 different positions: Back, Front, Left, Down, Right, and Up (Figure 11) and watch as the graphic and wording changes based on the position that the board is being held. The graphic directly shows the position the board is being held.

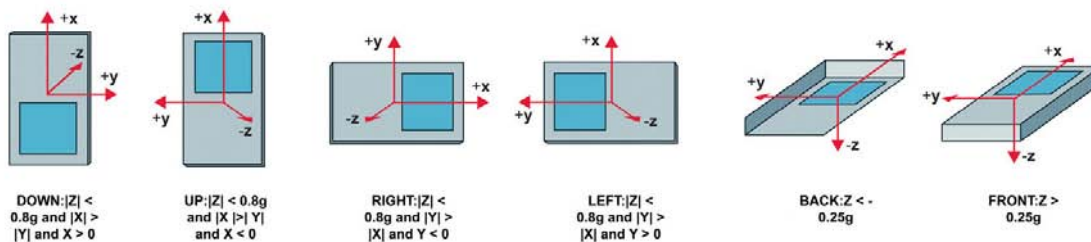


Figure 11. Orientation of 6 Positions on the Device.

3. There is an LED on the top left corner for shake detection. Shake detection is defined as an acceleration surpassing the $\pm 1.3g$. When this occurs the LED will light and Shake will appear in the Shake box (Figure 12).



Figure 12. Portrait/Landscape and Shake Detection (Shake Detect Occurring)

NOTE: When shaking the board, hold the board in your hand. Do NOT shake from the USB cable. This can cause the USB cable to disconnect, ceasing communication the PC.

Change Ring Mode Based On Position

This demo is an example of a mobile application that could be done with the MMA7660FC sensor. This demo uses orientation detection output to change the graphic on the left from Portrait to Landscape and Landscape to Portrait. The demo also displays the Position read from the TILT register (0x03). The Ring Mode is decided based on the front back position. If the device is Front, the ring mode is Normal. If the device is placed on its Back, the ring mode would be set to Silent. This example could be used during a meeting to change your ring mode to silent by just placing the phone upside down. Then when the meeting is over, pick it up and it would go to normal ring mode (Figure 13).



Figure 13. Change Ring Mode Screen Shot

Portrait/Landscape Graphic and Position Instructions

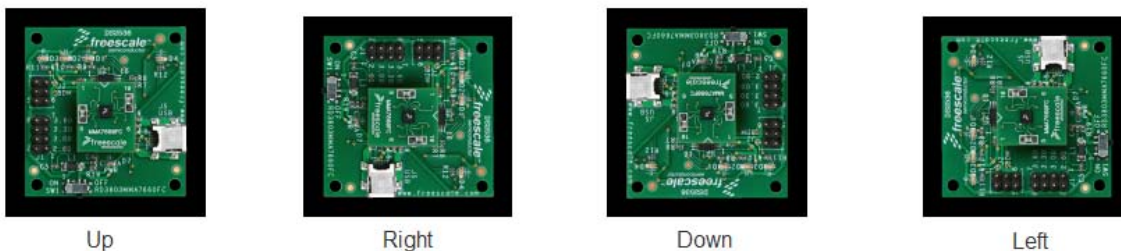


Figure 14. Board Orientations for Up, Down, Left, and Right

NOTE: The Portrait/Landscape will only change when the device is in the Front Position.

1. Hold the board in the Up position and rotate until in the Right position (Figure 14). The graphic on the right will change from Landscape to Portrait.
2. Hold the device in the Right position and transition to the Down position (Figure 14). The graphic on the right will change from Portrait to Landscape.
3. Continue moving the board in clockwise manner and observe the position and graphic change.
4. Take the board and move it in a counter-clockwise direction and again observe the position and graphic change.

Ring Mode Instructions

1. Hold the board so the position is in the Front position (Figure 11). The DIP board is facing front. Observe that the ring mode is Normal.
2. Rotate the board so that it is in the Back position (Figure 11). The board is upside down. Observe the ring mode change to Silent.

Scope

This demo shows the XYZ raw output, using the GINT interrupt functionality, at a sample rate of 32 SPS. This demo allows the user to understand how the XYZ data correlates to the built-in functionality of the sensor.

Calibration Instructions

Offset calibration is very important for applications such as tilt for gaming and hand gesturing on mobile phones/PMP/PDA devices. There are a number of proponents when it comes to offset errors such as trim errors, mechanical stresses due to package and mounting, shifts due to temperature and aging. The calibration is performed with the Scope application, since the application is using the raw XYZ data.

NOTE: The built in functionality of the sensor does not require calibration.

1. Place the board flat on the table (Figure 15).
2. Select the “Calibrate” button.
3. Once the calibration has occurred the Scope demo screen will appear (Figure 16).

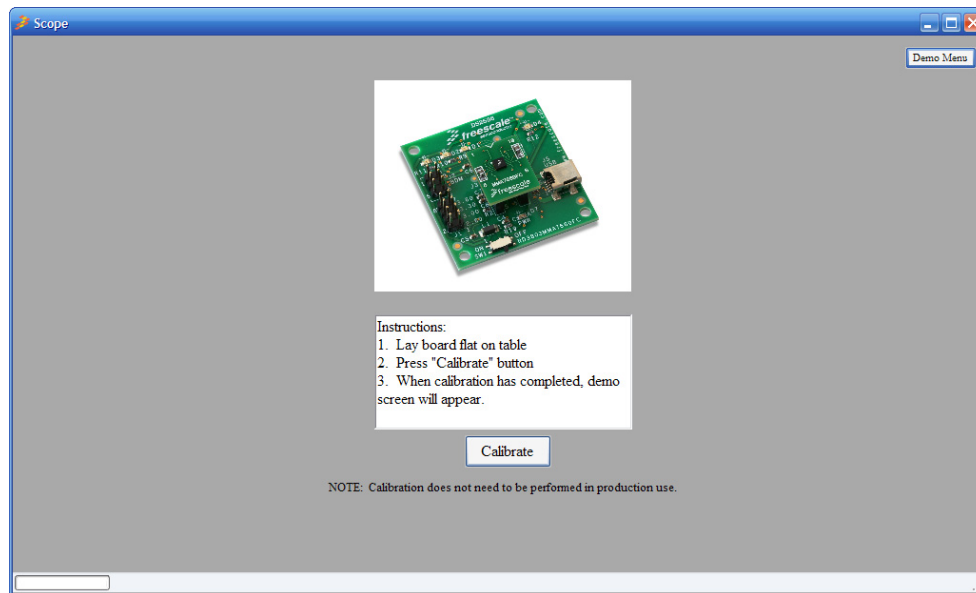


Figure 15. Calibrate Board for Scope Demo

Scope Demo

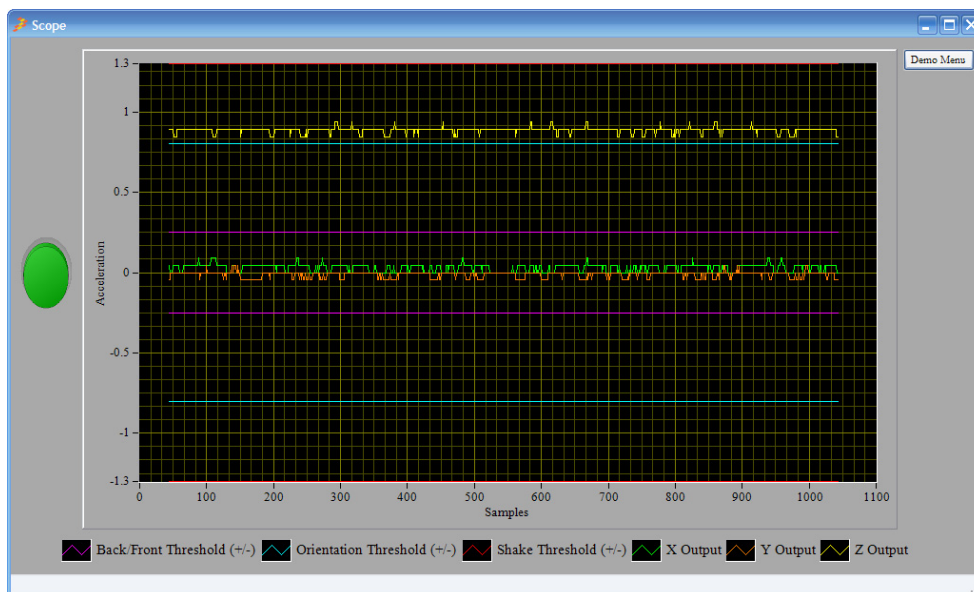


Figure 16. Scope Demo Screen Shot

Table 1. Color Key for Scope Demo Screen

Color	Definition
Pink	Back/ Front Threshold at $\pm .25g$
Teal	Orientation Threshold at $\pm .8g$
Red	Shake Threshold at $\pm 1.3g$
Green	X Output
Orange	Y Output
Yellow	Z Output

Back/Front Threshold

Back is defined as $Z < -.25g$. Front is defined as $Z > .25g$. Rotate the Z-axis to transition between back/front to understand the functionality (Figure 11).

Orientation Threshold

The orientation threshold shows that $|Z| < .8g$. Rotate the board to move the X, Y, and Z-axis to transition the Up, Down, Left, Right positions (Figure 11). In the condition where $|Z| > .8g$, the device is in a flat position and it does not output new orientation positions.

NOTE: There is a green button on the left side of the demo (Figure 16). This button plays/pauses the scope. The user can use this to observe the output and pause where needed.

Shake Threshold

Shake is defined as an acceleration on any axis that is greater than $\pm 1.3g$. The red lines indicate the 1.3g threshold. Shake the board and observe as the output surpasses $\pm 1.3g$. When this occurs a shake interrupt would occur. The device can be configured to monitor a shake on X and/or Y and/or Z.

NOTE: When shaking the board, hold the board in your hand. Do NOT shake from the USB cable. This can cause the USB cable to disconnect, ceasing communication the PC.

Portrait/Landscape, Auto-Sleep/Wake, and Shake Detection

This demo shows many of the built-in features of the sensor, such as shake detection, orientation detection, and auto-wake/sleep mode. The device is running at 32 SPS during the wake mode and 8 SPS during the sleep mode. The debounce filter being used for orientation detection is 8 consecutive readings (Figure 17).

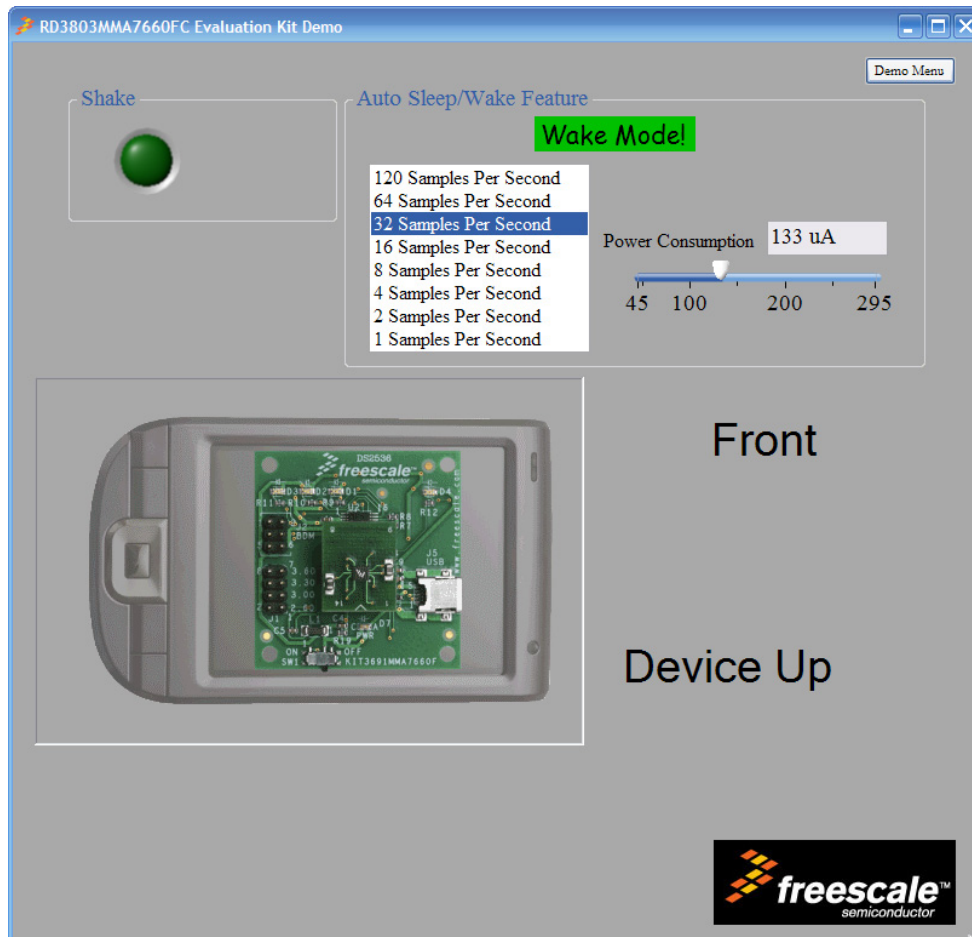


Figure 17. Portrait/Landscape, Auto-Sleep/Wake, and Shake Detection Screen Shot

Portrait/Landscape Instructions

Move the device in the 6 different positions: Back, Front, Left, Down, Right, and Up (Figure 11) and watch as the graphic and wording changes based on the position that the board is being held. The graphic directly shows the position the board is being held.

Shake Detection Instructions

There is an LED on the top left corner for shake detection. Shake detection is defined as an acceleration surpassing the $\pm 1.3g$. When this occurs the LED will light and Shake will appear in the Shake box.

NOTE: When shaking the board, hold the board in your hand. Do NOT shake from the USB cable. This can cause the USB cable to disconnect, ceasing communication the PC.

Auto-Sleep/Wake

The MMA7660FC has the Auto-Wake/Sleep feature that can be enabled for power saving. In the Auto-Wake (Sleep Mode) function, the device is put into a user specified low samples per second rate (32 SPS, 16 SPS, 8 SPS, or 1 SPS) in order to minimize power consumption. In the Auto-Sleep (Wake Mode) function, the device is put into any of the following user specified samples per second rate (120 SPS, 64 SPS, 32 SPS, 16 SPS, 8 SPS, 4 SPS, 2 SPS, and 1 SPS). In this particular demo, the wake state is running at 32 SPS and the sleep state is running at 8 SPS.

Wake Mode

The device is running at 32 SPS. The sensor will trigger interrupts when an orientation detection occurs or a shake detection occurs. The sleep counter is set to approximately about 4 seconds, therefore no activity has to occur for about 4 seconds before entering Sleep Mode.

Sleep Mode

The device is running at 8 SPS. The sensor will not trigger any interrupts. It will stay in the data rate until it detects either a shake, orientation change, or a change in acceleration (based on the interrupts enabled in this demo).

NOTE: For further information on Auto-Wake/Sleep capability please refer to either the MMA7660FC Data Sheet or AN3837.

Slide Show Control with Shake

This demo is an example of a mobile application that could be done with the MMA7660FC sensor. It could be implemented to use as a control to scroll through a photo album. This demo uses the built in shake detection and orientation detection feature to scroll through a series of pictures and to display the pictures with the Portrait/Landscape capability depending on how the device is held.



Figure 18. Slide Show Control with Shake

Shake Detection Instructions

There is an LED on the top left corner for shake detection. Shake detection is defined as an acceleration surpassing the $\pm 1.3g$. When this occurs the LED will light and Shake will appear in the Shake box and the image will change to the next image in the album. If the board is held in an Up/Down direction, the picture will be displayed in Landscape format, as where its held Left/Right orientation, then Portrait format will be displayed. (Figure 14)

NOTE: When shaking the board, hold the board in your hand. Do NOT shake from the USB cable. This can cause the USB cable to disconnect, ceasing communication the PC.

Auto-Sleep/Wake and Tap Detection

This demo shows the built in capability of tap detection and Auto-Wake/Sleep Feature. The Wake Mode is sampling at a rate of 120 SPS, tap detection can only be enabled at this sample rate. The Sleep mode is sampling at a rate of 8 SPS.

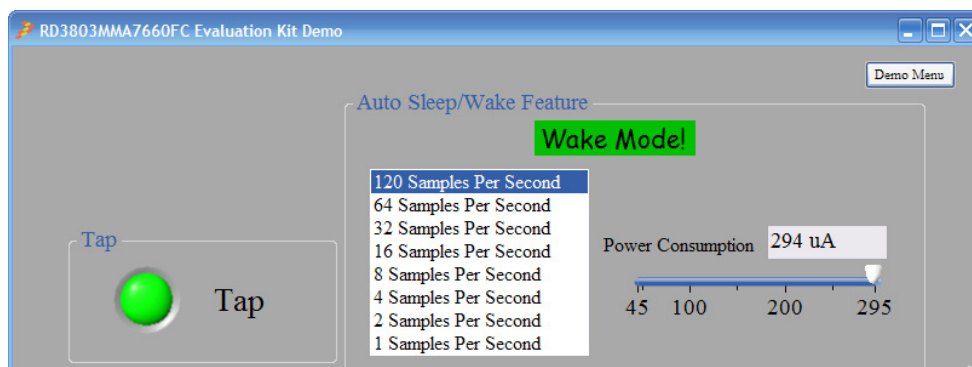


Figure 19. Wake Mode!

Auto-Wake/Sleep

The MMA7660FC has the Auto-Wake/Sleep feature that can be enabled for power saving. In the Auto-Wake (Sleep Mode) function, the device is put into a user specified low samples per second rate (32 SPS, 16 SPS, 8 SPS, or 1 SPS) in order to minimize power consumption. In the Auto-Sleep (Wake Mode) function, the device is put into any of the following user specified samples per second rate (120 SPS, 64 SPS, 32 SPS, 16 SPS, 8 SPS, 4 SPS, 2 SPS, and 1 SPS). In this particular demo, the wake state is running at 32 SPS and the sleep state is running at 8 SPS.

Wake Mode

The device is running at 120 SPS. The sensor will trigger interrupts when an orientation detection occurs or a shake detection occurs, therefore no activity has to occur for about 4 seconds before entering Sleep Mode.

Sleep Mode

The device is running at 8 SPS. The sensor will not trigger any interrupts. It will stay in the data rate until it detects either a tap, orientation change, shake or a change in acceleration.

Tap Detection Instructions

This demo shows the MMA7660FC built in capability of tap detection. This feature can be used to do a number of different customer application such as button replacement or zoom in to a window.

NOTE: When tapping the board, hold the board in your hand. Do NOT tap from the USB cable. This can cause the USB cable to disconnect, ceasing communication the PC.

1. Hold the board in your hand.
2. Tap the top of the sensor.
3. Observe as the LED in the left hand side of the screen and the Tap detect label appears.

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