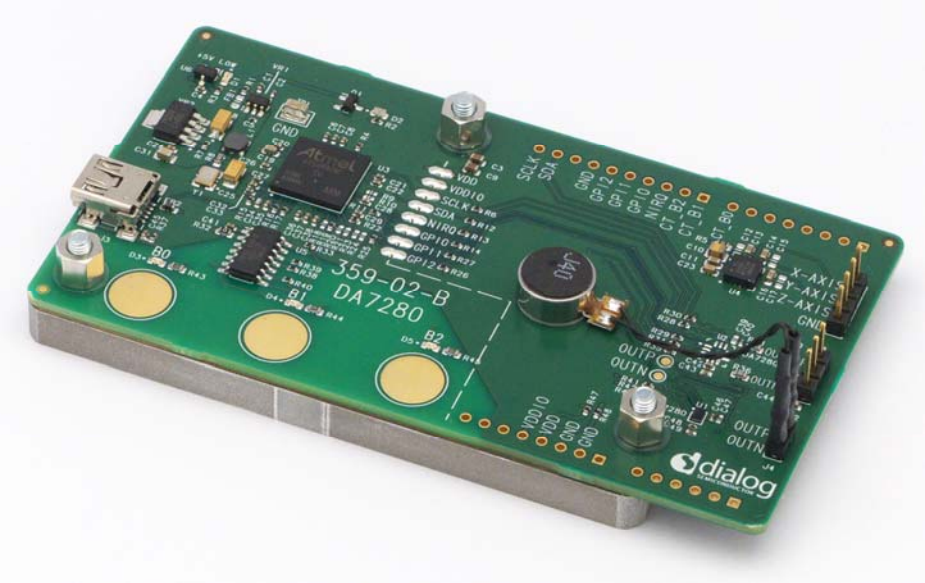
User Manual

DA7280 Performance Board

UM-AU-011



Abstract

This document is the User Manual for the DA7280 Performance Board, 359-02-B.

Contents

Figures

Tables

1 Terms and Definitions

359-02-B	Performance Board PCB containing DUT, LRA and accelerometer circuitry
DA7280	Dialog Semiconductor's Haptic Driver I.C
DRO	Direct Register Override
DUT	Device Under Test
ERM	Eccentric Rotating Mass
ETWM	Edge Triggered Waveform Memory
GUI	Graphical User Interface, see SmartCanvas definition below.
I^2C	Inter-Integrated Circuit communication standard
LRA	Linear Resonant Actuator
PCB	Printed Circuit Board
PWL	Piecewise-Linear time and amplitude pairs for defining snippets in waveform memory
PWM	Pulse Width Modulation
RTWM	Register Triggered Waveform Memory
SmartCanvas	Dialog Semiconductor's (GUI) software tool for controlling DA7280 over USB
SAM3U	Dialog Semiconductor's USB Module for I^2C communication over USB
USB	Universal Serial Bus
WLCSP	Wafer Level Chip Scale Package

2 References

[1] DA7280, Datasheet, Dialog Semiconductor

[2] 359-02-B_SCH.pdf, Performance Board Schematic

3 Introduction

This is the DA7280 Performance Board user manual. It describes how to use the 359-02-B to experience the haptic capabilities of DA7280 with the supplied LRA. DA7280 is configured and controlled by Dialog Semiconductor's SmartCanvas™ graphical user interface (GUI) over USB. DA7280 is capable of driving either LRA or ERM type motors, but this User Manual will focus on usage with the supplied LRA.

4 Quick Start Setup

1. Install the GUI.
2. Connect the USB cable from the computer to the Performance Board, if this is the first-time connecting Windows will automatically install Dialog's USB Drivers.
3. Check that the LRA is connected to header J4.
4. Isolate the Performance Board from hard surfaces as this can dampen the haptic feedback. For example, the foam inserts shipped with the Performance Board is ideal.
5. Open the **GUI**.
6. In the popup window press **Download Default Setup Scripts**, this enables DA7280 to work with the cap sense buttons on the PCB.
7. Pressing B0, B1 or B2 cap sense buttons on the PCB will trigger haptic sequences.

5 Hardware and Software Prerequisites

The GUI **must** be installed before plugging in the DA7280 Performance board hardware on a Windows® 7 or Windows® 10 operating system. The DA7280 GUI installation file is included with the Performance Board kit. Run the .exe file to start the installation.

The latest version of the GUI can be found at https://support.dialog-semiconductor.com/ under the **PMIC & Audio & Haptics** section.

5.1 SmartCanvas GUI Setup

Follow the steps in the Setup Wizard:

1. Click the - **I accept the agreement** option button.

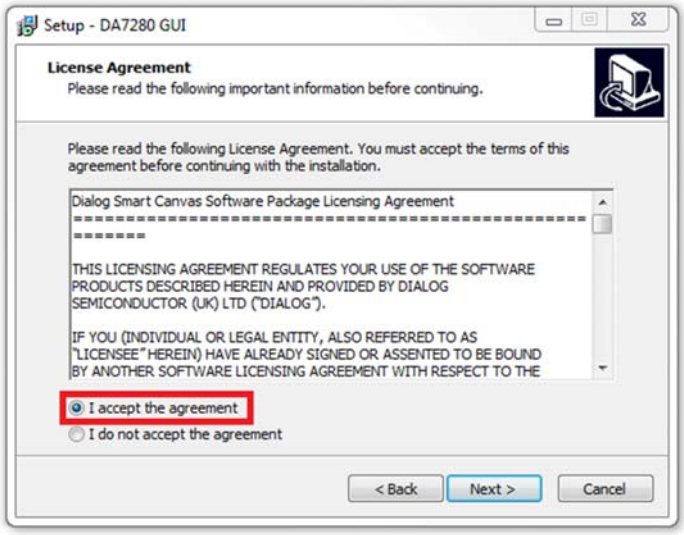


Figure 1: License Agreement

2. Click **Next**.

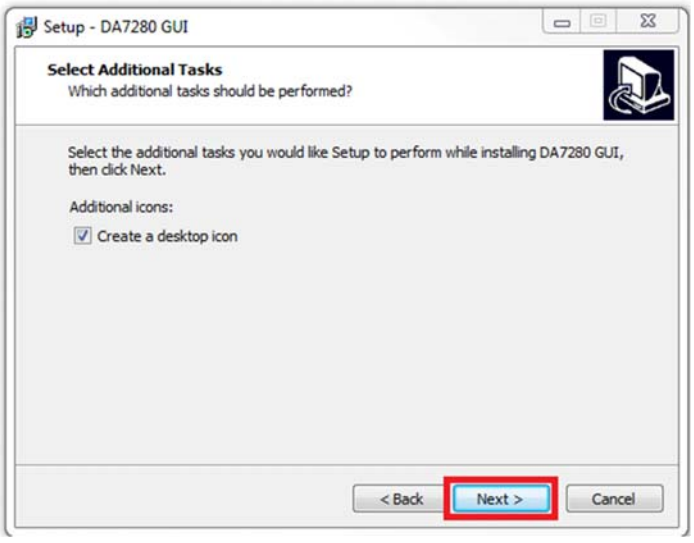


Figure 2: Create a Desktop Item

3. Click **Install**.

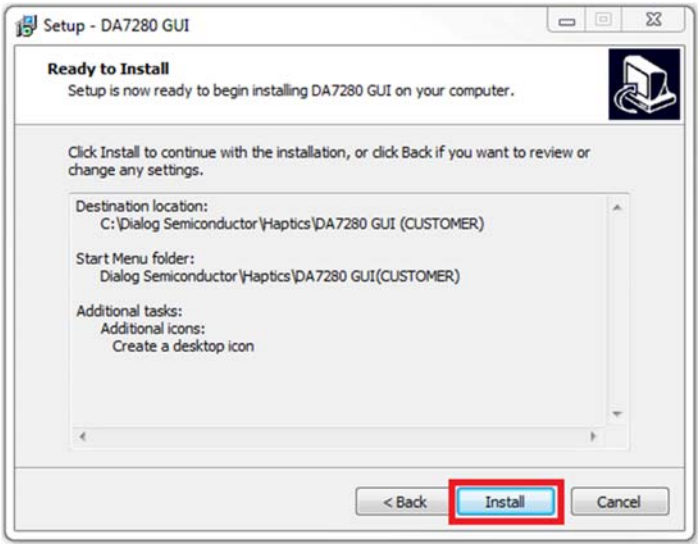


Figure 3: Install the GUI

4. Clear the **Launch DA7280 GUI** check box and click **Finish**.

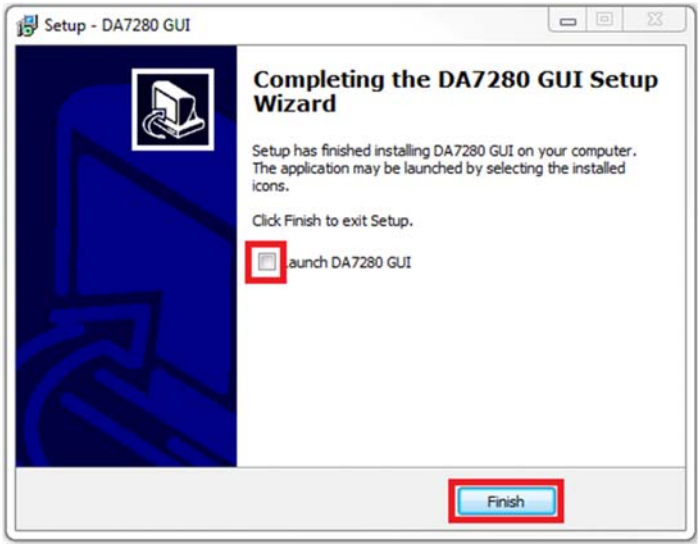


Figure 4: Finish Setup

5. Connect the universal serial bus (USB) cable from the Performance Board printed circuit board (PCB) to the computer.

Windows will now install the required drivers.

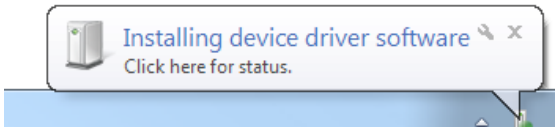


Figure 5: Installing Driver Windows Notification

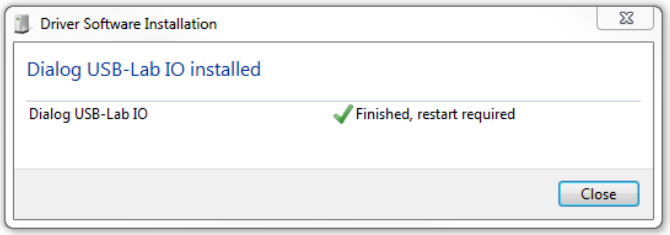


Figure 6: Installation Complete

6. Click the desktop icon to run the **DA7280 GUI**

Figure 7: Desktop Icon

6 Hardware Overview

The board is powered and controlled from the onboard USB circuitry. The device-under-test (DUT) side can be completely isolated from the USB controller side both in terms of power and I²C, or general purpose interface (GPI) signals, by de-soldering the solder bumps connections.

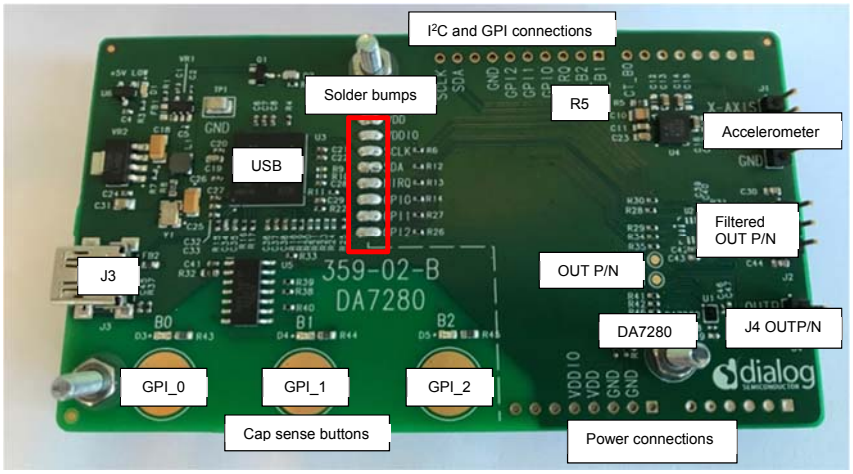


Figure 8: Performance Board Functionality

6.1 Power

The board and DA7280 are powered from the 5 V USB power supply (J3), additional external power supplies are not required. VDDIO is powered from an onboard, regulated 1.8 V supply. DA7280 is capable of driving 250 mA into the linear resonant actuator (LRA) load, so the USB power is adequate for most applications. When driving with Double Output Current Range enabled and driving 500 mA, supply VDD from an external supply.

To externally power the board and take accurate current measurements, de-solder the VDD and VDDIO solder bumps and connect the supplies via the labeled through-hole connections, see **Power connections** in Figure 8.When taking current measurements on the board, remove resistor R5 this powers down the accelerometer.

6.2 I²C Communications

The GUI communicates to the DA7280 through Dialog's USB to I²C interface. DA7280 slave address is 0x4A, when adding the R/W bit the I²C read = 0x94 and the I²C write = 0x95.

To use external I²C communication, de-solder the SDA and SCLK solder bumps and connect the external I²C wires into the through-hole connections, labeled SCLK and SDA, see **I²C and GPI connections** in Figure 8.

If external I²C signaling is used, the VDDIO voltage level should be set to the external I²C signal voltage level.

6.3 DA7280

DA7280 is located in either position U1 (QFN) or U2 (WLCSP), see Figure 8, depending on the supplied package variant on the board. The silicon in both package variants is identical.

After power-on reset, download the setup script see 7.1.1 for the supplied LRA. This ensures the correct DC parameters are driving the LRA according to the LRA's datasheet. If a different LRA is used, the settings should be adjusted according to that specific LRA's electrical parameters.

To drive the LRA DA7280 outputs PWM differential signals to two locations on the board:

a. Solder pads labeled OUTP and OUTN
b. J4 header pins labeled OUTP and OUTN.

Connect the LRA to only one of these positions.

Filtered OUT_P and OUT_N signals from DA7280 are accessed from the OUTP_F and OUTN_F pins (J2). Connect J2 to an oscilloscope for signal monitoring and tuning purposes, see Section 8.

6.4 Accelerometer

A high-precision accelerometer (U4) is fitted to capture the acceleration profile of the LRA see Figure 8. This is used to evaluate and tune the LRA's performance. See Section 8.

6.5 Metal Mass Connection

To create a reference 100-gram mass, tightly screw the metal mass to the PCB, see Figure 9. This is useful for evaluating LRA performance with respect to the amount of acceleration (g) the LRA produces attached to this reference weight.

If fly wiring power or control signals, ensure that these connections do not electrically short to the metal mass. A thin piece of card is placed between the mass and the PCB; also electrical insulating tape could be used.

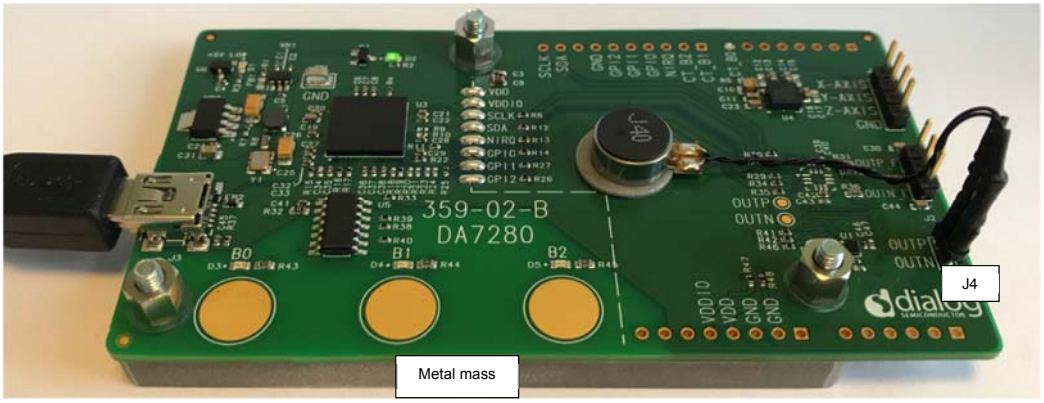


Figure 9: PCB with Metal Mass

6.6 LRA Connection

Fix the LRA to the top of the PCB, glue or double sided sticky pads can be used. Ensure the LRA is firmly connected and has no movement when been driven to reduce damping. If using glue to connect the LRA to the PCB, ensure the glue does not enter the LRA housing through any relief openings on the LRA.

Connect the LRA terminals to the OUT_P and OUT_N header (J4), see Figure 9. The orientation of LRA terminals to the header pins is not important.

7 Software Control

After starting the GUI this popup setup window is presented to the user, pressing **Download Default Startup Scripts** button will set DA7280 in Edge Triggered Mode so the cap sense buttons trigger haptic sequences. Close Window will close the window while not setting up DA7280 in any mode.

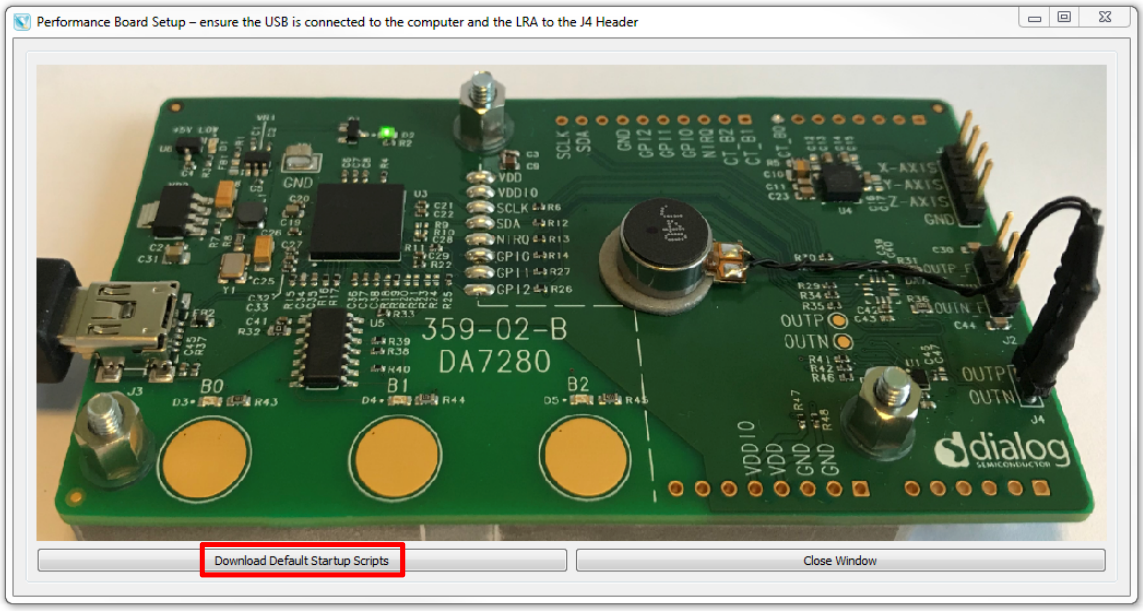


Figure 10: Performance Board Setup

The main window of the GUI looks like this, check the status of the following connections:

a. **Bus** and **USB** communication LEDs are green.

b. **Enable/Disable Polling** button is green and states **Enabled**.

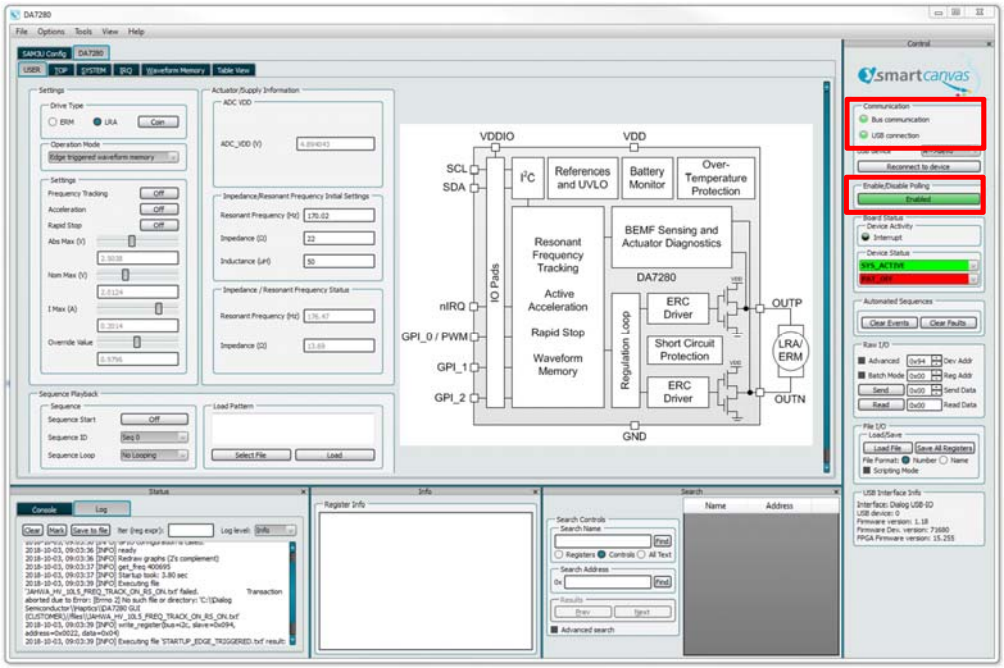


Figure 11: Main GUI Window

7.1 LRA Setup Scripts

There are three setup scripts bundled with the GUI for the supplied Jahwa 1040 LRA. These scripts include specific LRA configuration parameters, DA7280 feature configuration parameters, and waveform memory data; these are described in section 7.1.3.

7.1.1 Load LRA Setup Scripts

To download the scripts:

1. In the **File I/O window**, click on the **Load File** button, see Figure 12.

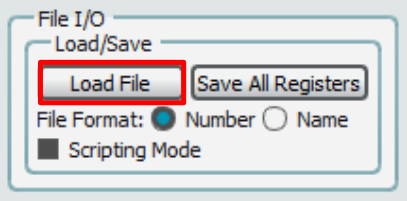


Figure 12: File I/O

2. Select the required .txt download script for the Jahwa LRA from the **Load Register Dump** popup window, see Figure 13. For the supplied LRA only download scripts with 'JAHWA_1040' prefix.

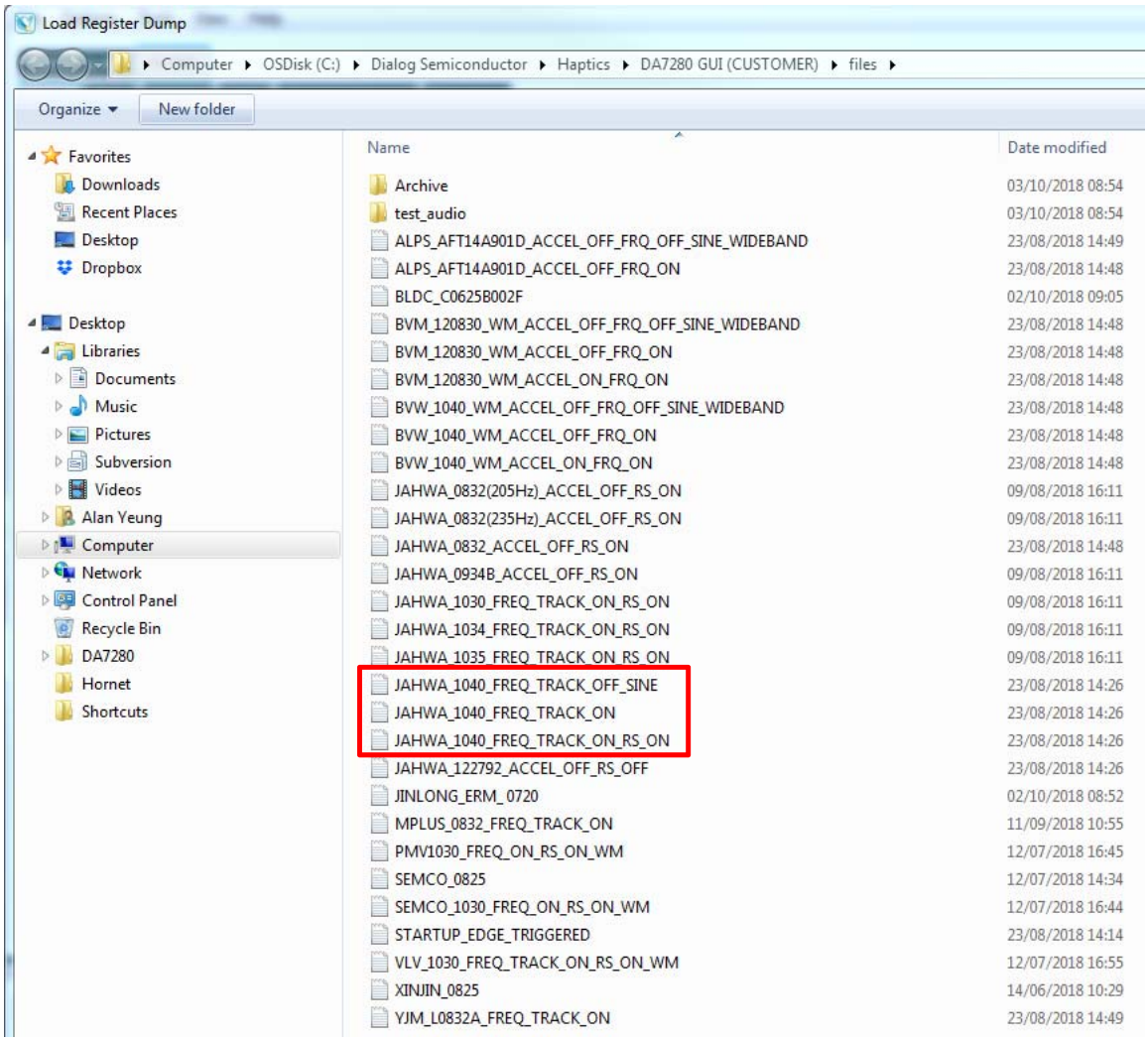


Figure 13: Load Register Dump

7.1.2 Save All Registers

To save the current status of DA7280 registers:

1. In the **File I/O window**, click on **Save All Registers**, see Figure 14.

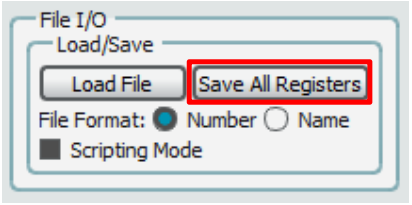


Figure 14: File I/O

2. In the **Save All Registers** dialog box, in the **File name** field, type in the file name.
3. In the **Save All Registers** dialog box, in the **Save as type** field, select the file format using the drop-down menu.

Note:

a. Normally **.txt** is used however **.csv** format also saves the IRQ status registers. The **.csv** format is useful for debugging, see Figure 15.

b. The **File Format** options **Number** or **Name** will save the registers either by register number or by register name.

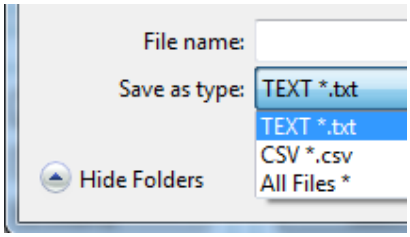


Figure 15: Save All Registers Dialog Box

7.1.3 Setup Scripts for Supplied LRA

The JAHWA_1040 LRA setup scripts include specific Jahwa configuration parameters, DA7280 feature configuration parameters, and waveform memory data. This LRA is also known as the 1040 model. This LRA has fast rise time and the Acceleration feature of DA7280 does not need to be enabled.

This LRA has the following specifications.

- Rated Voltage = 2.5 V*(rms)*
- Frequency = 170 Hz ± 10 Hz
- Vibration = 2.0 G
- Rated current = 170 mA
- Noise = 35 dB (max)
- Rise time (50 %) = max 10 ms
- Fall time (50 %) = max 50 ms
- *Measured impedance = 13 Ω*
- *Measured inductance = 353 µH*

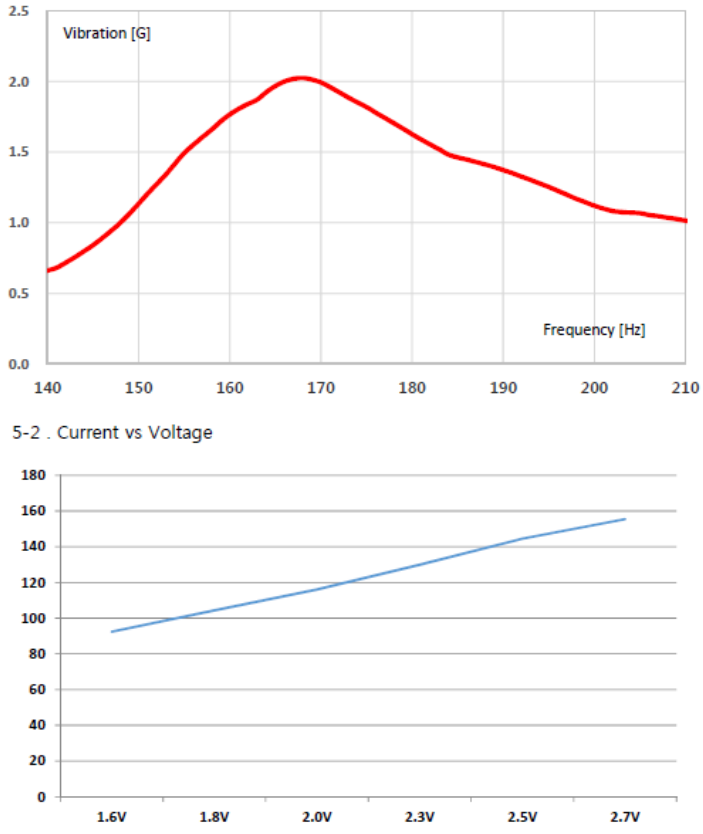


Figure 16: LRA Characteristics Graph

The following 3 setup scripts are provided with the GUI for the supplied LRA. To Load these scripts see section 7.1.1

7.1.3.1 JAHWA_1040_FREQ_TRACK_ON

The **JAHWA_1040_FREQ_TRACK_ON.txt** script sets up the DA7280 to enable the features shown in Table 1.

Table 1: JAHWA_1040_FREQ_TRACK_ON script features:

Feature	Status
Frequency tracking	ON
Acceleration	OFF
Rapid stop	OFF

After the scripts have loaded, the GUI shows the parameter settings as applied by the setup script.

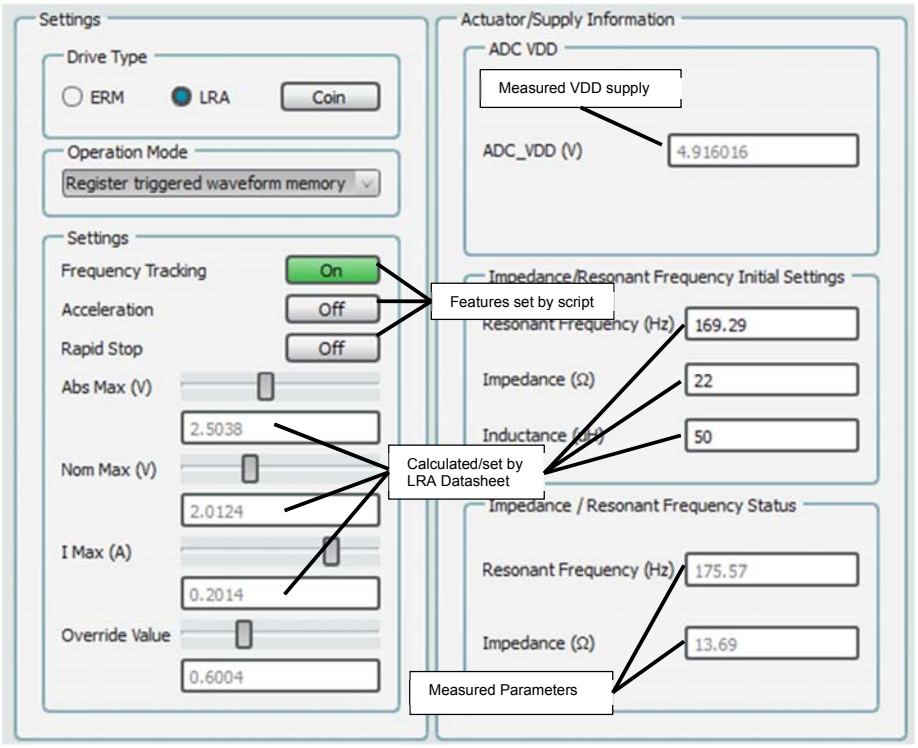


Figure 17: JAHWA_1040_FREQ_TRACK_ON Parameters

The measured resonant frequency and impedance of the supplied LRA are shown in the GUI, see Figure 17.

The Abs Max and Nom Max voltages for the LRA are calculated and set in the GUI by the script as follows:

- Abs Max = (I_{MAX} * 1.1) * measured impedance = 2.51 V
- Nom Max = (measured impedance * I_{MAX}) * 0.707 = 2 V

Notes:

1. These are conservative settings following LRA manufacturer's recommendations.
2. The Impedance and Inductance values after downloading setup scripts are not updated, but the underlying registers in DA7280 are set correct for the LRA.

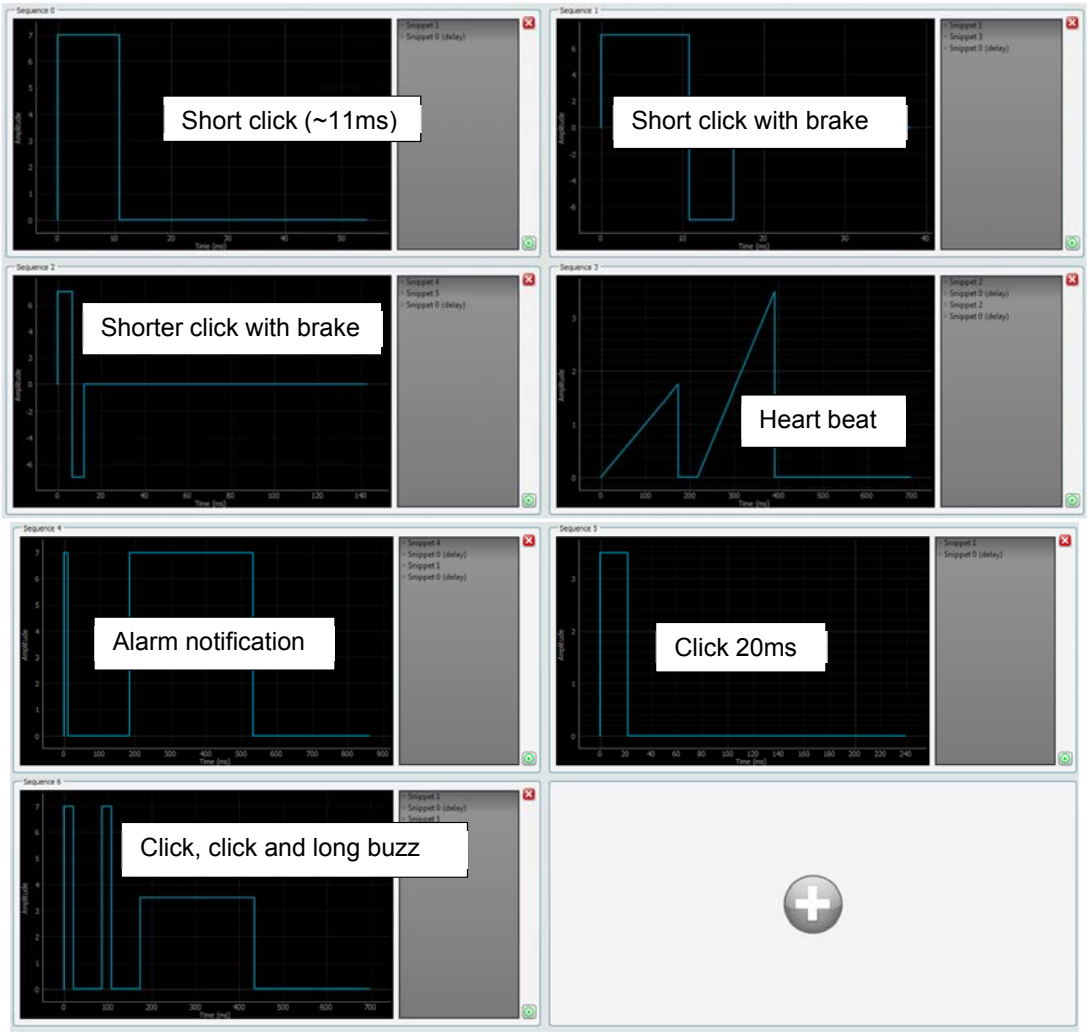


Figure 18: JAHWA_1040_FREQ_TRACK_ON Sequences

The haptic sequences loaded from the setup scripts are displayed in the GUI, see Section 7.3. For the JAHWA_1040_FREQ_TRACK_ON script, the sequences are shown in Figure 18.

7.1.3.2 JAHWA_1040_FREQ_TRACK_ON_RS_ON

The **JAHWA_1040_FREQ_TRACK_ON_RS_ON.txt** script sets up the DA7280 to enable the features shown in Table 2.

Table 2: JAHWA_1040_FREQ_TRACK_ON_RS_ON script features:

Feature	Status
Frequency tracking	ON
Acceleration	OFF
Rapid stop	ON

After the scripts have loaded, the GUI shows the parameter settings as applied by the setup script. See Figure 19

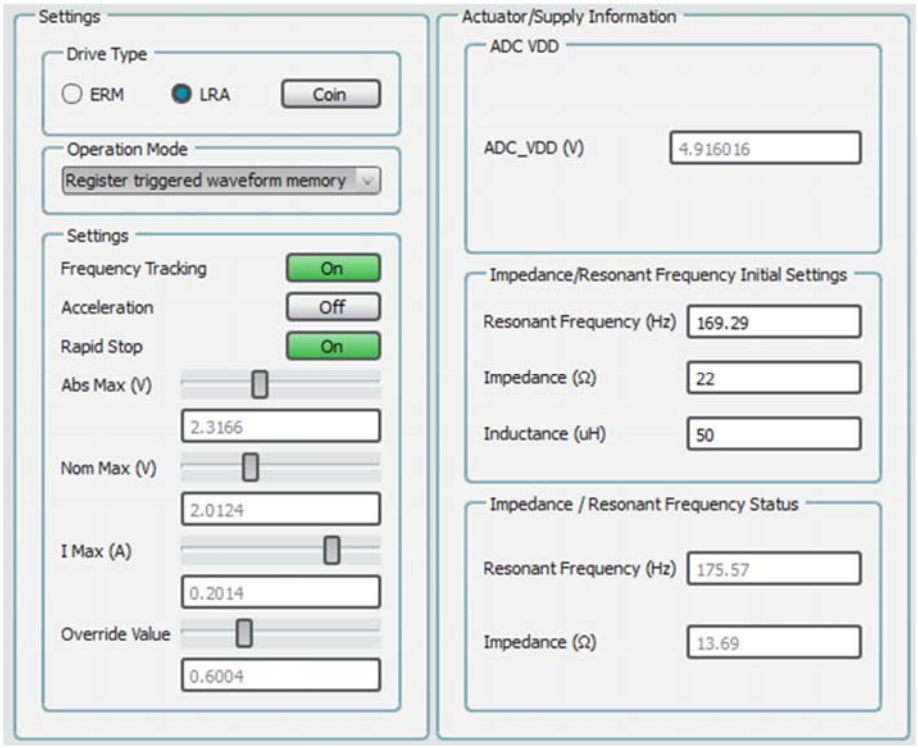


Figure 19: JAHWA_1040_FREQ_TRACK_ON_RS_ON Parameters

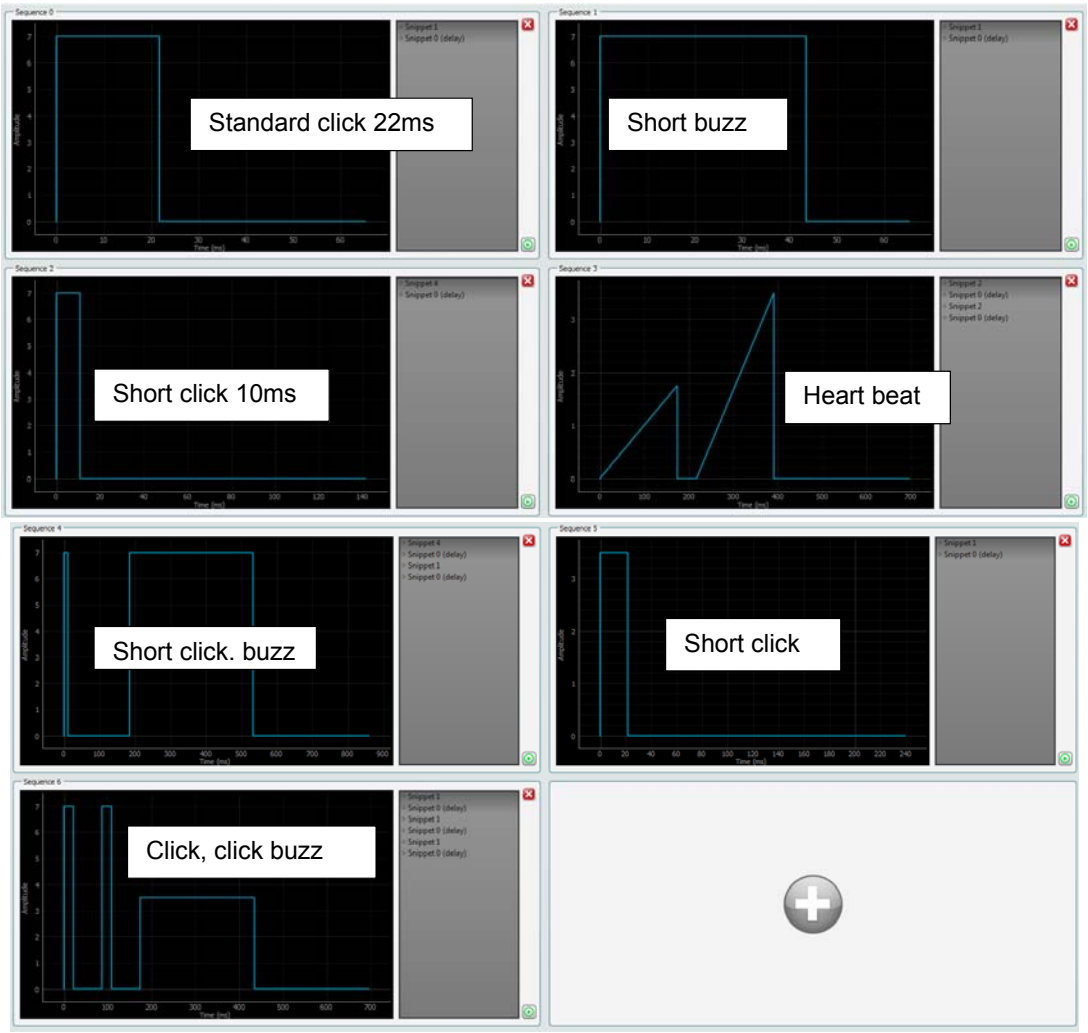


Figure 20: JAHWA_1040_FREQ_TRACK_ON_RS_ON Sequences

The haptic sequences loaded from the setup scripts are displayed in the GUI, see Section 7.3. For the JAHWA_1040_FREQ_TRACK_ON_RS_ON script, the sequences are shown in Figure 20 .

7.1.3.3 JAHWA_1040_FREQ_TRACK_OFF_SINE

This script drives the output in sinewave mode. This mode reduces the LRA's audibility by driving a sine wave rather than square waves.

Frequency tracking is off; see Table 3, and the Waveform Memory sequences specify the drive frequency to allow wideband haptic effects.

Table 3: JAHWA_1040_FREQ_TRACK_OFF_SINE script features:

Feature	Status
Frequency tracking	OFF
Acceleration	OFF
Rapid stop	OFF

After the scripts have loaded, the GUI shows the parameter settings as applied by the setup script see Figure 21.

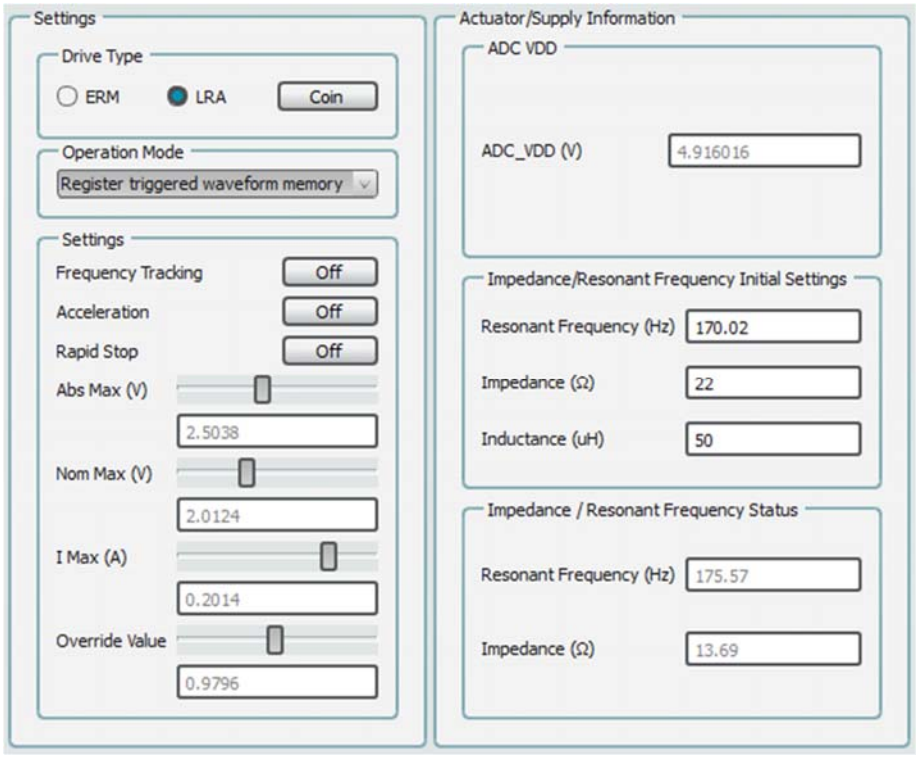


Figure 21: JAHWA_1040_FREQ_TRACK_OFF_SINE Parameters

Figure 22: JAHWA_1040_FREQ_TRACK_OFF_SINE Sequences

The haptic sequences loaded from the setup scripts are displayed in the GUI, see Section 7.3. For the JAHWA_1040_FREQ_TRACK_ON_RS_ON script, the sequences are shown in Figure 22.

7.2 Operating Modes

To select different modes for driving the LRA:

1. In **Drive Type**, select **LRA**, see Figure 23.
2. Use the drop-down menu in **Operation Mode** to select the required mode, see Figure 24. Each Operation Mode is described in detail in the following sub-sections.

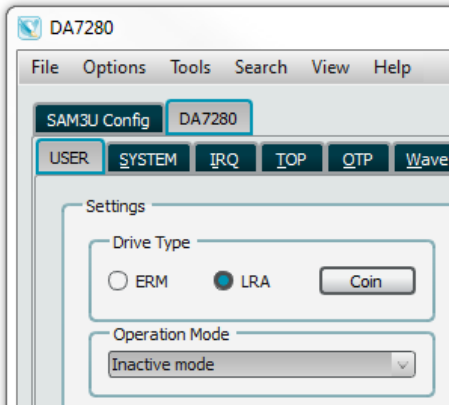


Figure 23: Drive Type

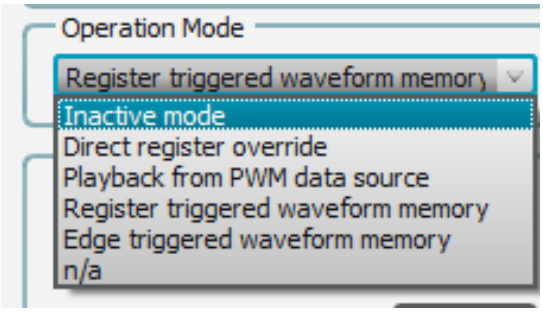


Figure 24: Operation Mode

7.2.1 Direct Register Override Mode (DRO)

In DRO mode haptic sequences are streamed to DA7280 via I2C input. The drive level of the output is set via Override value.

To use direct register override (DRO) mode:

1. In **Drive Type**, select **LRA**, see Figure 25.
2. Set the **Override** value.
3. Use the drop-down menu in **Operation Mode** to select **Direct register override**.

Setting the **Override** value and then setting the operating mode to **Direct register override** ensures optimal latency.

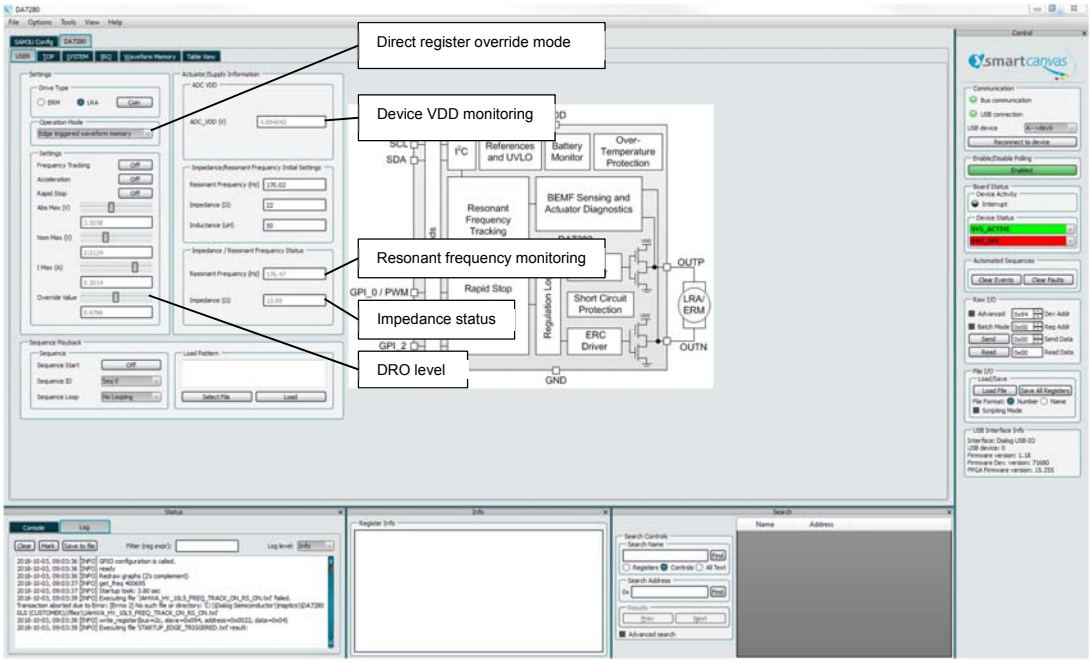


Figure 25: GUI in DRO Mode

7.2.2 Register Triggered Waveform Memory (RTWM)

This mode allows the user to trigger haptic sequences stored in the Waveform Memory by using I²C writes to DA7280.

1. In **Drive Type**, select **LRA**, see Figure 26.
2. Use the drop-down menu in **Operation Mode** to select **Register triggered waveform memory**.
3. In the **Pattern** window, use the drop-down menu in **Sequence ID** to select a sequence.
4. Click the **Sequence Start** button to trigger the chosen sequence.

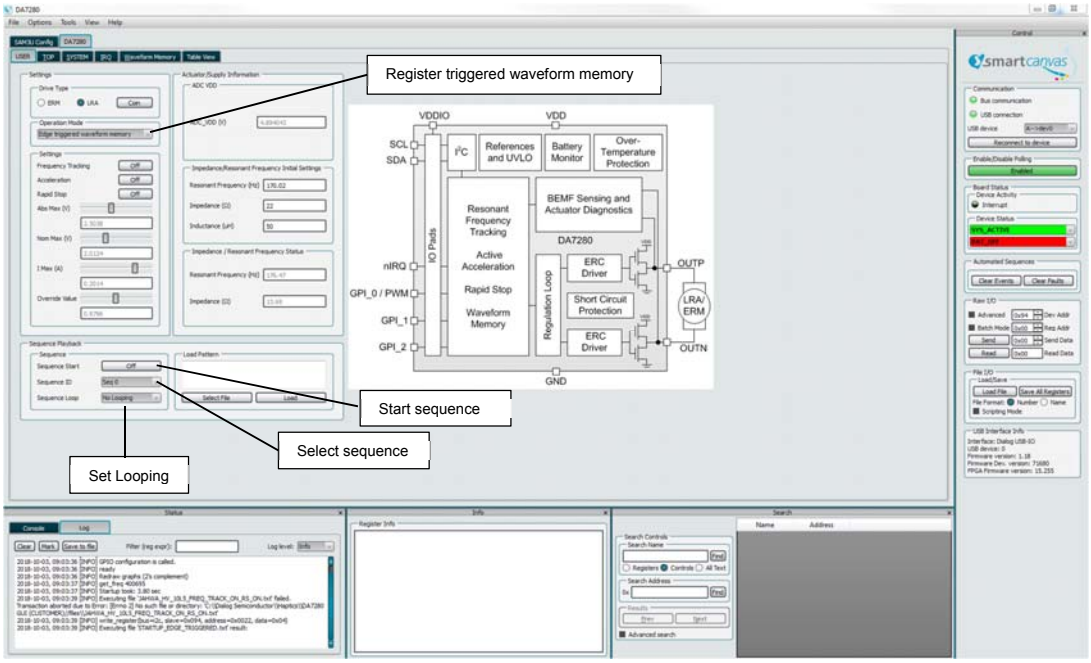


Figure 26: GUI in RTWM Mode

The haptic sequences in the Waveform Memory can be edited, created, and triggered from the Waveform memory editor, see Section 7.3.

7.2.3 Pulse Width Modulation Mode (PWM)

PWM mode is used to stream haptic sequences to DA7280 via the GPI_0/PWM input pin where the output drive level is determined by the duty cycle of the PWM signal. The PWM signal contains envelope information only and the input PWM frequency is unrelated to the output PWM frequency or the resonant frequency setting. The duty cycle is interpreted differently defending if the **Acceleration** is enabled or disabled - see datasheet sections **Pulse Width Modulation Mode** and **General Data Format** for more details.

To drive the LRA in PWM mode:

1. Set the input PWM frequency to the lower end of the allowable range, 10 kHz to 250 kHz.
2. Actively drive the PWM signal via the GPI_0/PWM pin.
3. In the **Impedance/Resonant Frequency Initial Settings** window of the GUI, set the resonant frequency and impedance of the LRA.

Note: Before selecting this mode, the PWM signal must be actively driving the GPI_0/PWM pin otherwise DA7280 will generate an IRQ, which must be cleared manually.

7.2.4 Edge Triggered Waveform Memory (ETWM)

In edge triggered waveform memory (ETWM) mode rising or falling edges, or both rising and falling edges, on GPI_0/PWM, GPI_1, and GPI_2 pins trigger sequences from Waveform Memory, see Section 7.3. Set the registers shown in Figure 27 as required. See also section 7.6.

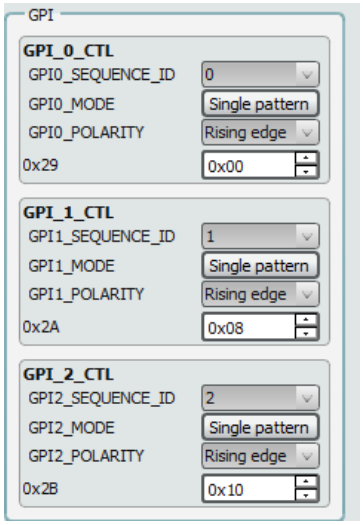


Figure 27: GPI Registers

7.3 Waveform Memory Editor

The Waveform Memory editor is a powerful and intuitive tool for creating haptic effects stored in memory. Haptic effects in Waveform Memory are modified and viewed by selecting **Tools -> Waveform Memory Editor**, see Figure 28.

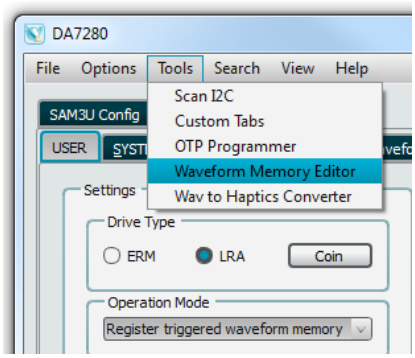


Figure 28: Enabling the Waveform Memory Editor

Note: Before proceeding, select **Register Sync** -> **Read from Device** to read back the Waveform Memory from DA7280.

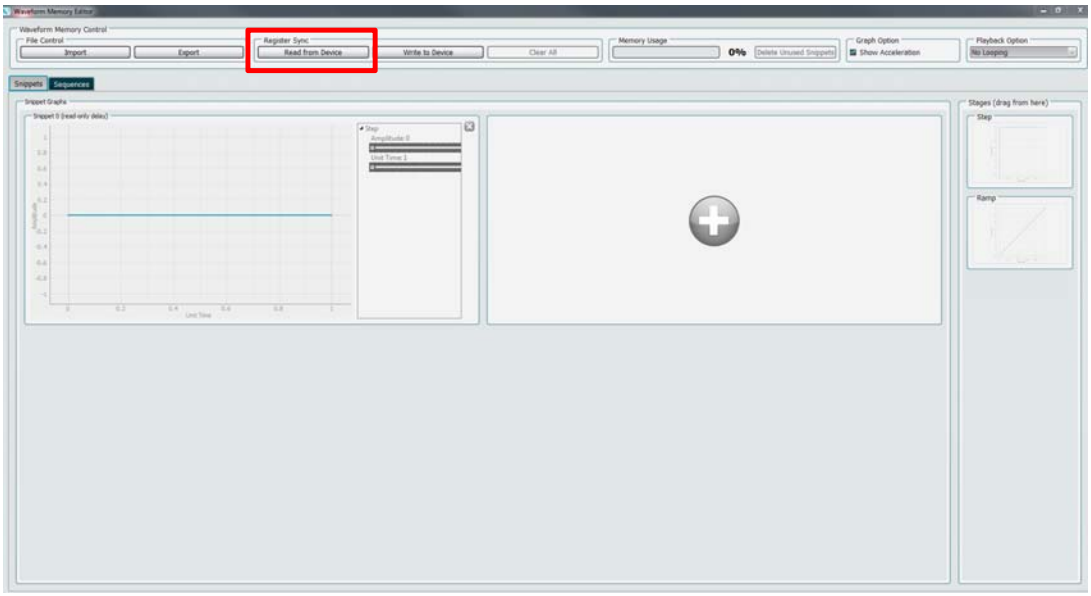


Figure 29: Register Syncing from DA7280 Memory

7.3.1 Setting Operation Mode

To trigger haptic sequences:

1. Select the **USER** tab
2. Use the drop-down menu in **Operation Mode** to select **Register triggered waveform memory**.

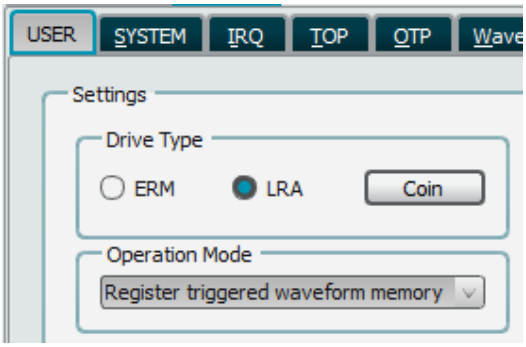


Figure 30: Set RTWM Mode in Operation Mode

7.3.2 Snippets Tab

In the Snippets tab, delete, create, and modify snippets by dragging and dropping the basic ***Step*** and ***Ramp*** piecewise-linear (PWL) snippets from the **Stages** window into the **Snippets** window. The time and amplitude parameters of each snippet can then be changed in the GUI.

Note: Snippets cannot be played directly the haptic effects can only be triggered once the snippet is added to the sequence memory.

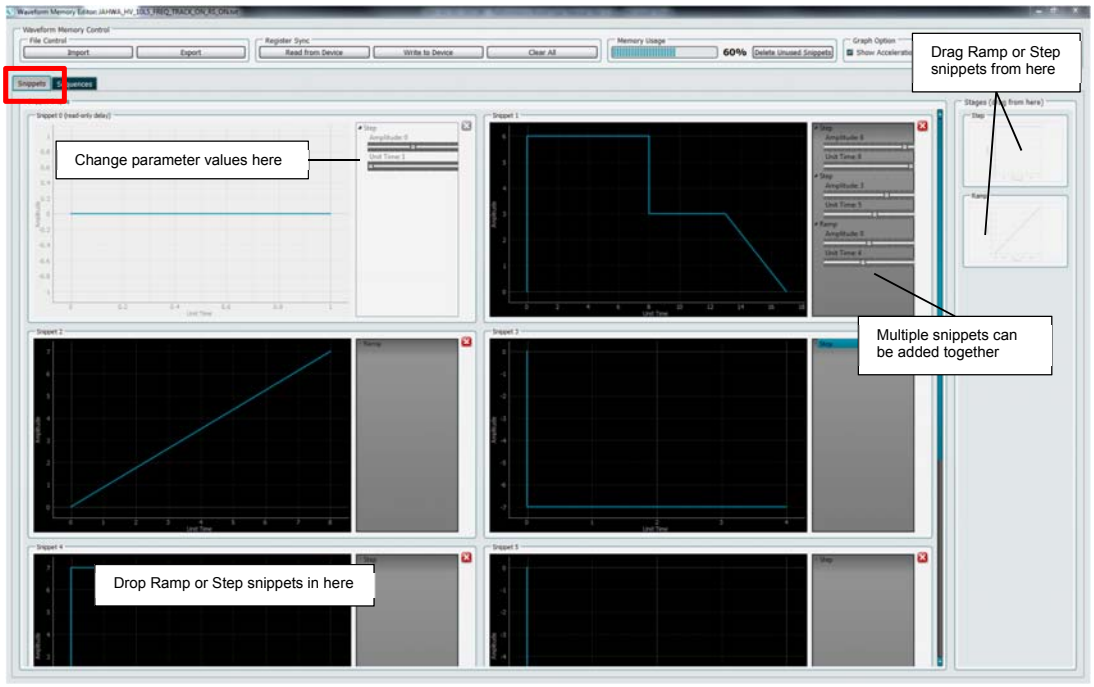


Figure 31: Waveform Memory Editor Snippets Tab

7.3.3 Sequences Tab

After dragging and dropping snippets to create haptic sequences, the haptic sequences are played by clicking the green play buttons in the **Sequences** tab, see Figure 32. The played sequence can be looped by changing using the drop-down menu in **Playback Option**. To change the sequence name, click on the sequence identifier.

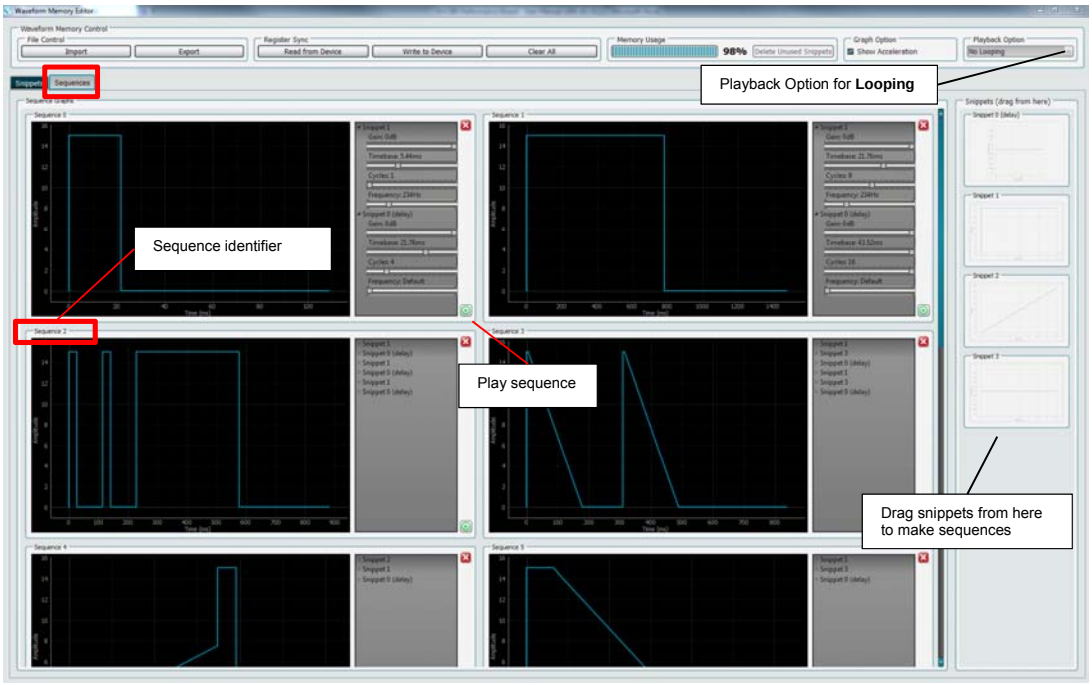


Figure 32: Waveform Memory Editor Sequences Tab

7.3.3.1 Changing Snippet Parameter Values

When the snippet is added to the sequence the user can control four snippet parameters:

- **Gain**: The gains that can be applied to the snippets are 0 db, -6 dB, -12 dB and -18 dB.
- **Timebase**: The unit time of the snippet depends on the FREQ_WAVEFORM_TIMEBASE bit of register SEQ_CTL1. It can be (5.44, 21.76, 43.52, 87.04) ms or (1.36, 5.44, 21.76, 43.52) ms.
- **Cycles**: The snippet can be 1 cycle to 16 cycles.
- **Frequency Default**: From 26 Hz to 1024 Hz; If set to **Default**, the current frequency setting is used. Note that if using this for wideband patterns, frequency tracking should be switched off.

Note: The overall time of each sequence = Unit Time * Cycles * Timebase.

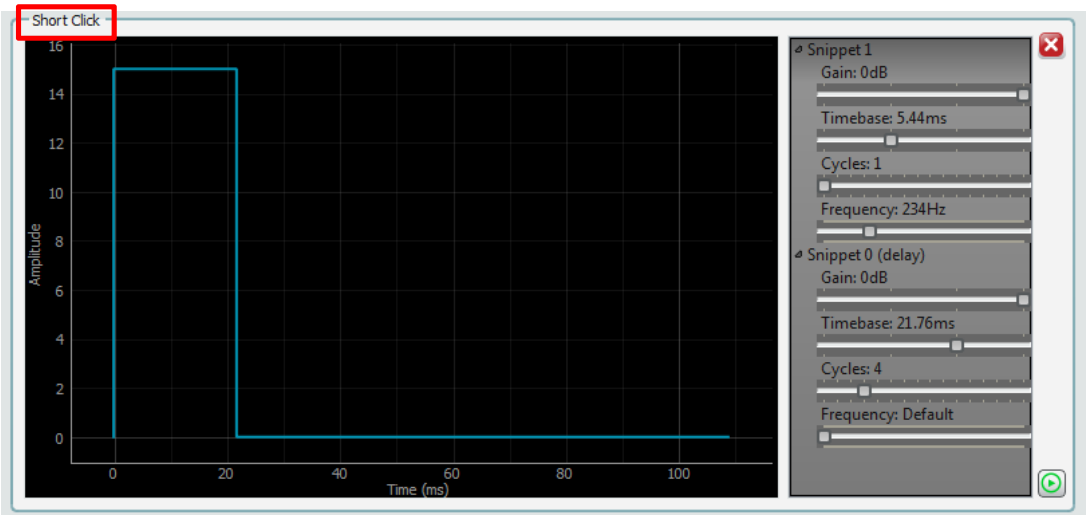


Figure 33: Two Snippet Sequence Example

Sequence Short Click, see Figure 33, is made up of Snippet 1 and Snippet 0, see Figure 34.

- Snippet 1 has an amplitude of 15 and a unit time of 4 ms. The overall time is:

$$4 * 5.44\ \text{ms} * 1 = 21.76\ \text{ms}$$

- Snippet 0 has an amplitude of 0 and a unit time of 1. This is silence for an overall time of:

$$1 * 21.76\ \text{ms} * 4 = 87.04\ \text{ms}$$

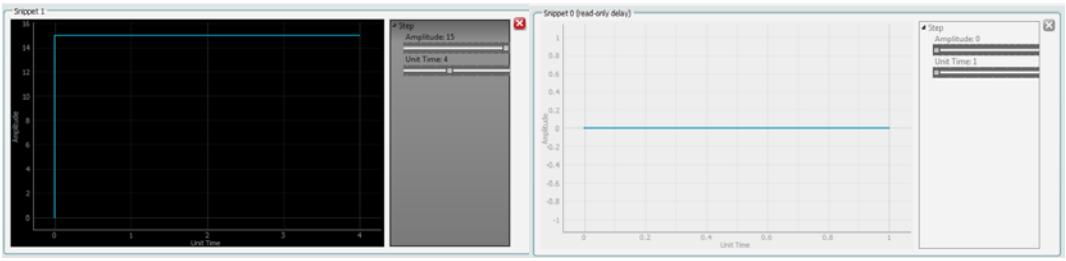


Figure 34: Snippets for the Two Snippet Sequence Example

7.4 Wav to Haptics Converter

The Wav to Haptics converter allows .wav files to be converted to haptic patterns and the audio and haptic effect can be played back simultaneously.

Select **Wav to Haptics Converter** from the **Tools** menu and the press the **Load File** button.

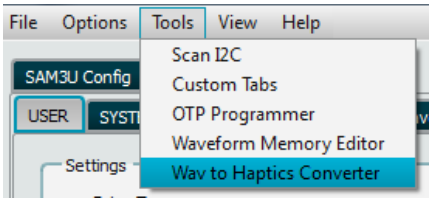


Figure 35: Launching Wav to Haptics Converter

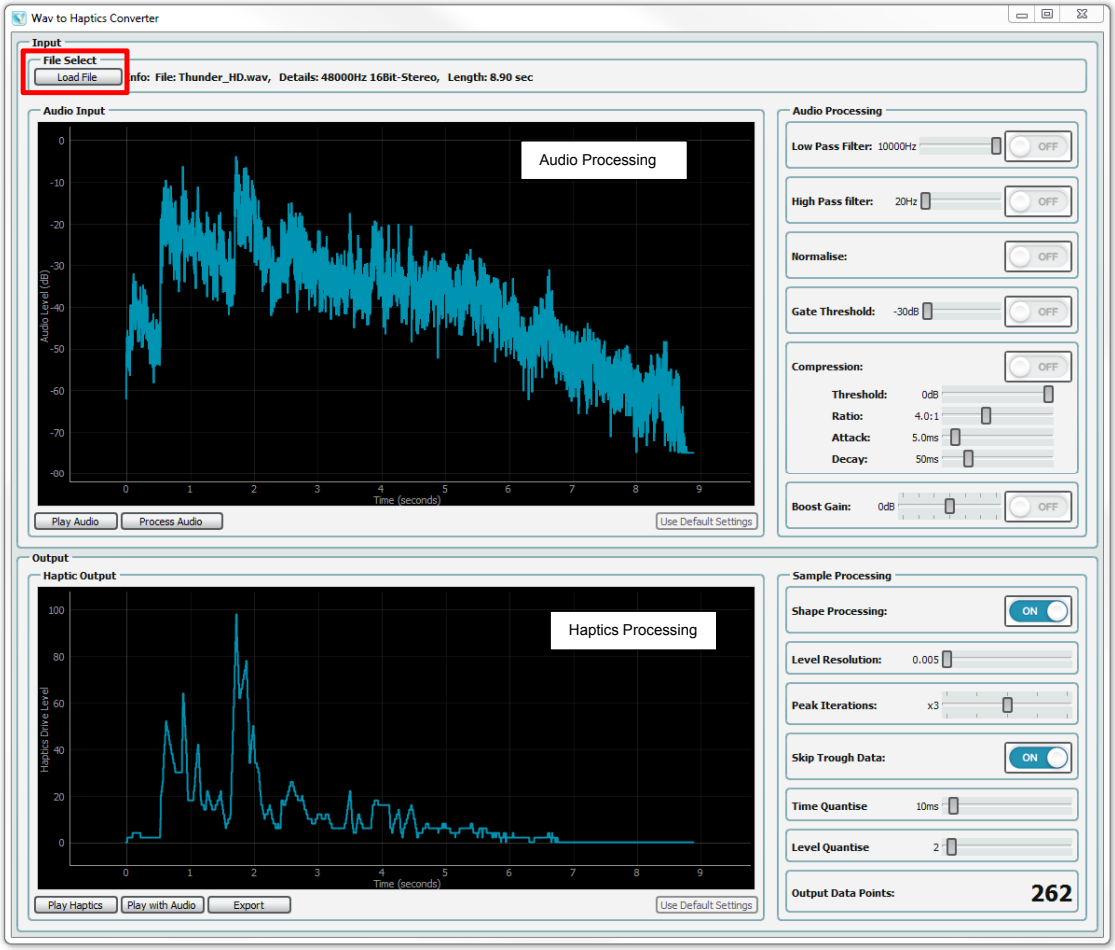


Figure 36: Wav To Haptics Converter Plugin

- Load File
  - The GUI will navigate to the ***test_audio*** folder bundled with the GUI. A number of sound effects .wav file are included for demonstration purposes.

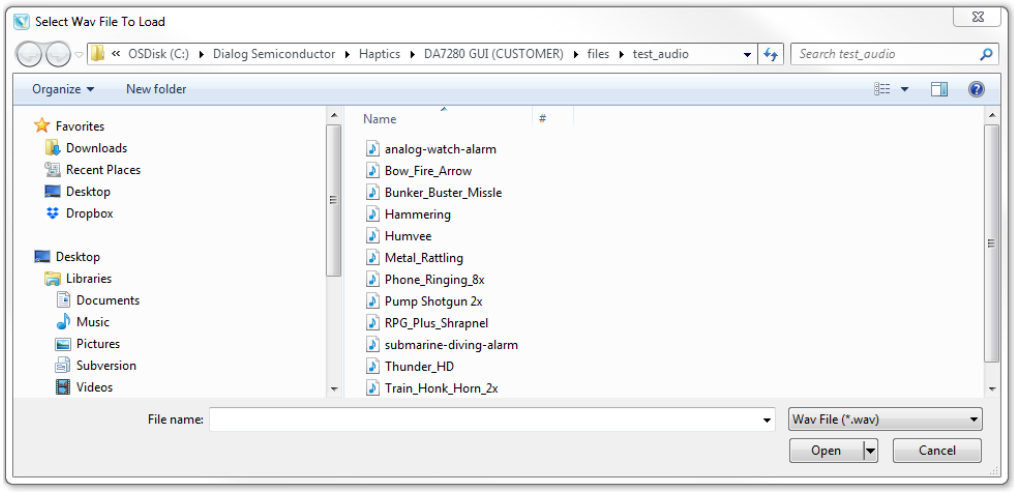


Figure 37: Included Sound Effect Files

- Play Audio
  - Plays the audio track through the computers soundcard.
- Process Audio
  - The audio can be processed with the plug-ins basic filters these include low-pass filter, high-pass filter, Normalise, Gate Threshold, Compression and Boost Gain.
- Play Haptics
  - Plays the haptic sequence.
- Play with Audio
  - Plays haptic sequence and audio simultaneously.
- Export
  - Exports the haptic sequence as .txt, .csv or .bin file.

Note: Hoovering the mouse cursor over the GUI's sliders shows detailed description of each control.

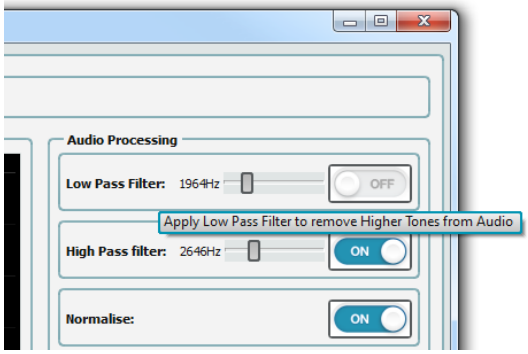


Figure 38: Detailed Descriptions of Controls

7.5 IRQ

Interrupt requests in the form of events and warnings can occur in normal operation. To continue driving the LRA, these must be cleared in the GUI.

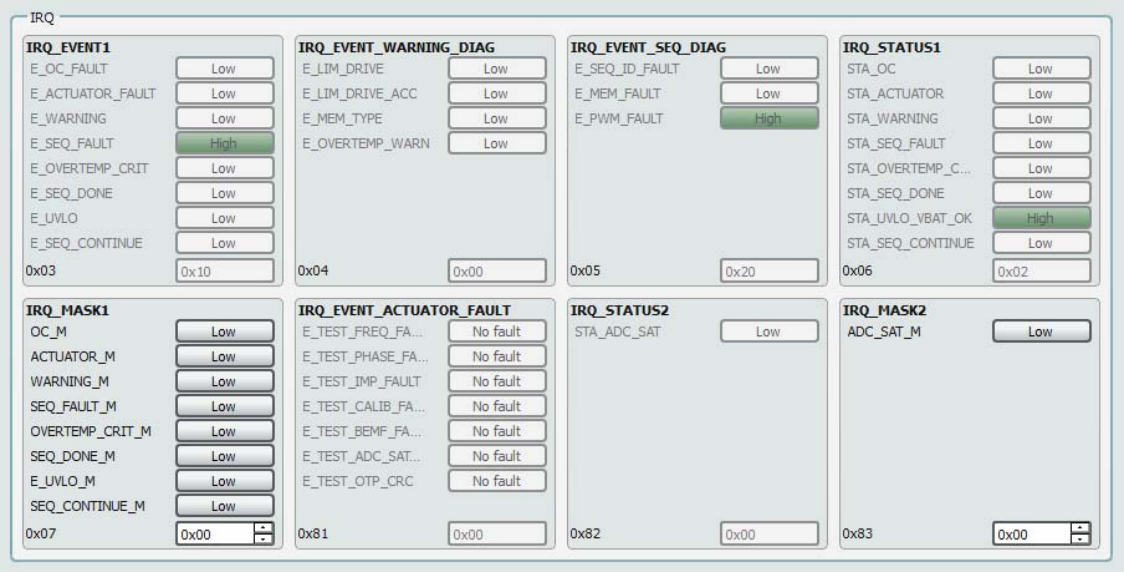


Figure 39: IRQ Tab

To clear IRQ faults events click on buttons **Clear Events** and **Clear Faults**, see Figure 40.

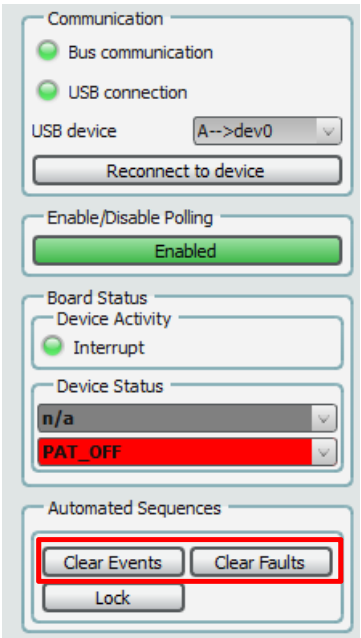


Figure 40: Clear IRQ Events and Faults

Note: In Embedded Mode operation, see Figure 41, the IRQs will self-clear when the playback ends. This is useful for systems with minimum interaction between the host and DA7280.

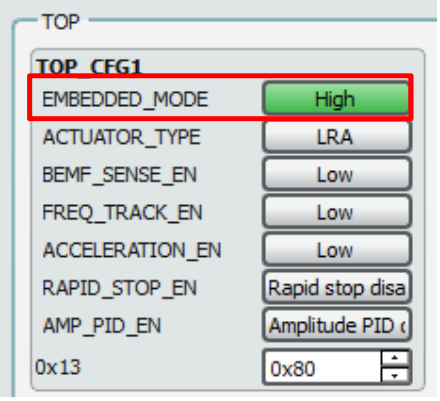


Figure 41: Embedded Mode

7.6 Cap Sense Setup

The USB to I2C controller can be configured to ensure the USB does not interfere with the cap sense buttons. Set the IO Mode to **Input: High-Z** in the **Sam3U Config** tab, see Figure 42.

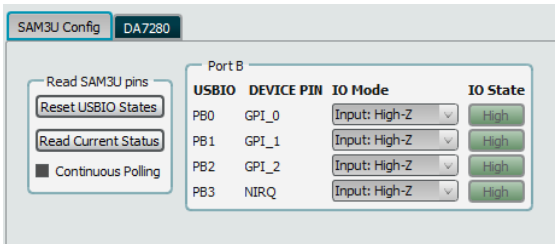


Figure 42: SAM3U Configuration

Now set the operation mode to **ETWM** mode, see Figure 43.

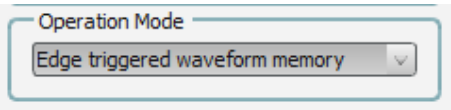


Figure 43: ETWM Mode

Set the GPI controls as required for user defined operation. In this case **GPI0_POLARITY** is set to **Falling edge** triggered, and **GPI0_SEQUENCE_ID** is set to **0**, see Figure 44. On receiving a falling edge on **GPI_0** pin the first haptic sequence in the Waveform Memory will be triggered.

Note: The cap sense buttons voltage levels are high by default; pressing cap sense button pulls the line to ground triggering GPI 0 on the falling edge. Triggering on the rising edge would mean that on releasing the cap sense button the sequence would be triggered. A third option is to trigger on either rising or falling edges.

In **Multi sequence** mode, the rising edge will trigger the sequence denoted by **SEQUENCE_ID**, while the falling edge will trigger the sequence located at SEQUENCE_ID + 1.

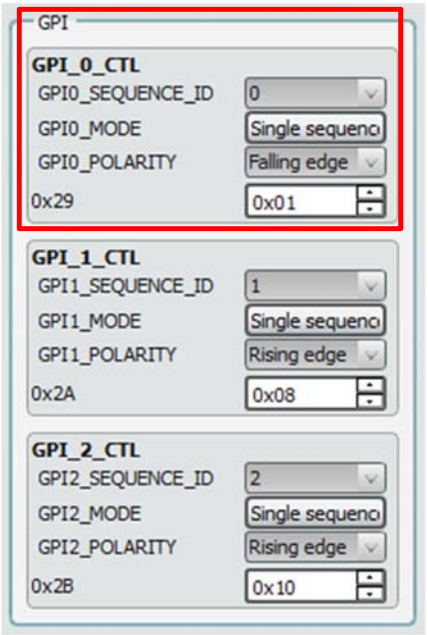


Figure 44: GPI_0_CTL Settings

7.7 GPI Triggering from GUI

The GPIs can be controlled from the GUI's **SAM3U Config** tab by setting the **IO Mode** to **Output** and pressing the **IO State** button, see Figure 45.

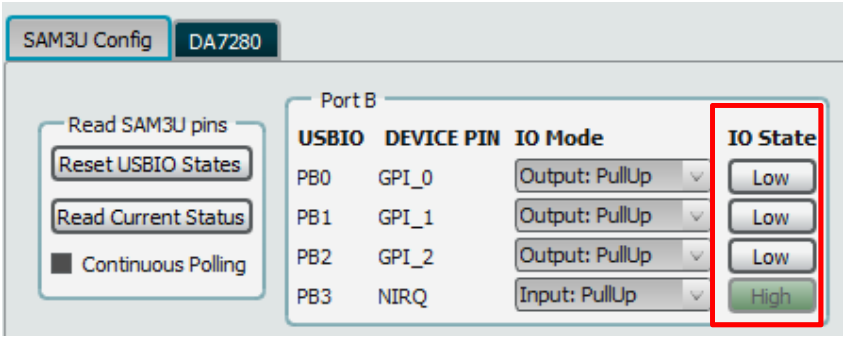


Figure 45: Controlling GPIs from GUI

8 Monitoring Drive Signals and Measuring Acceleration

When evaluating the system performance of the haptic driver and the LRA and for general tuning purposes, it is useful to go through the following procedure:

1. Place the DA7280 Performance Board on foam to isolate it from hard surfaces. This reduces damping of the LRA's motion.
2. Connect the oscilloscope channels 1 and 2 (yellow and green trace) to header J2 to monitor the filtered OUTP and OUTN signals. The filter cut-off is set at ~3.3 kHz.
3. The unfiltered OUTP and OUTN signals (header J4) are PWM signals at 187.5 kHz so looking at these makes little sense for analysis purposes.
4. Connect oscilloscope channels 3 (blue trace) to the header J1 and chose a suitable accelerometer axis which is depending on type of actuator, in this case the Z-AXIS.
5. Set the oscilloscopes trigger channel to trigger on the rising edge of channel 1. Now drive haptic patterns and observe the acceleration while also feeling the movement of the LRA with your hand.
6. The default 100nF caps (C13, C14, and C16) on the output accelerometer circuit set the bandwidth to be 50Hz. With VDD=1.8V, 1 g peak of acceleration is ~50 mV (peak).
    a. For higher resolution measurements for this accelerometer changing these caps to 10nF is advisable. 1g of peak acceleration would then be ~150mV at 1.8V VDDIO.

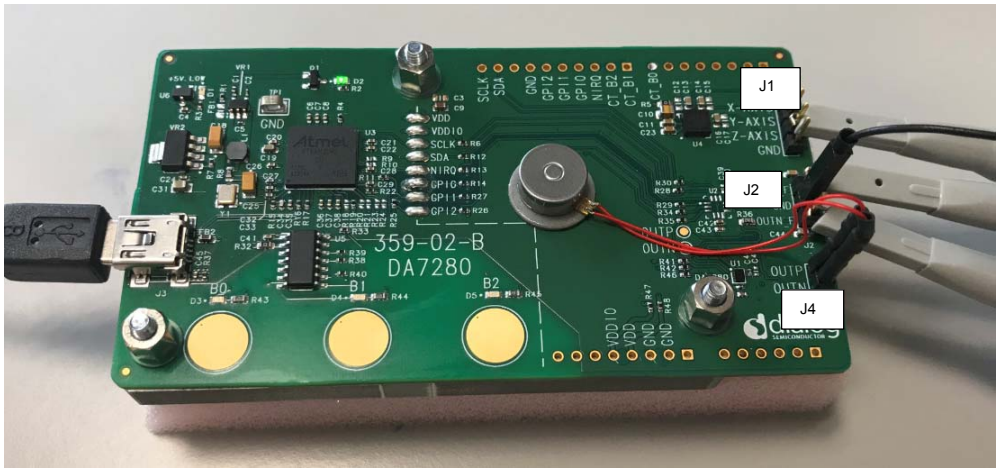


Figure 46: Monitoring Signals

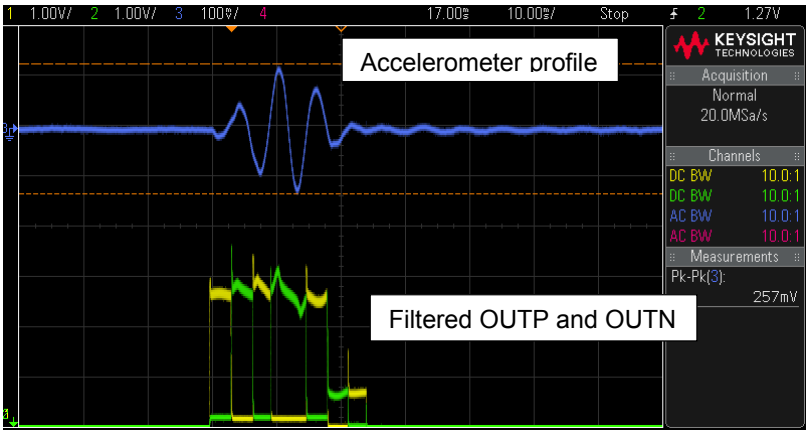


Figure 47: Measured Output Signals and Acceleration Profile

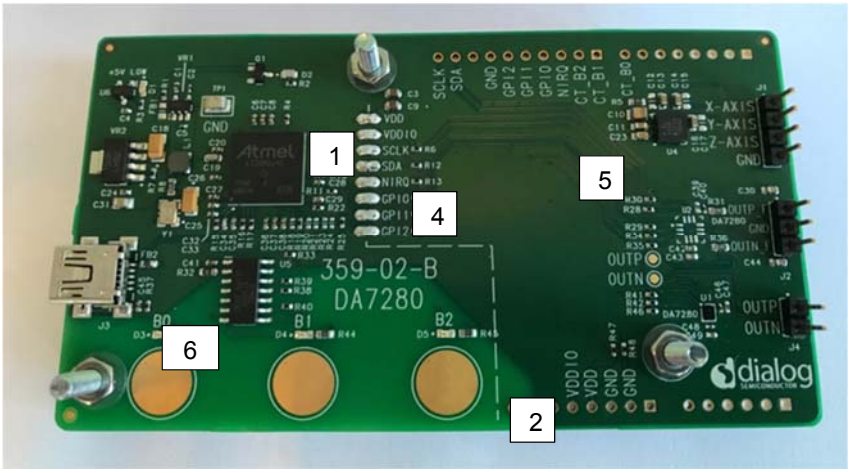
9 Measuring current

To measure the current taken by the VDD supply the following hardware modifications should be made to the Performance Board - see Figure 48: Measuring current board modifications

1. Unsolder VDD solder bump, this isolates the DA7280 VDD Power supply from the USB supply.
2. Externally supply VDD at 3.7 Volts and GND to the Power Connections header.
3. If the GUI is connected to DA7280 ensure Polling Enabled/Disabled button is disabled.

To measure VDDIO supply, the following modifications should be made.

4. Unsolder the following solder bumps to isolate VDDIO supply – VDDIO, SCLK, SDA, NIRQ, GPI0, GPI1, and GPI2.
5. Remove R5, powers down accelerometer.
6. Remove R32, powers down Cap Sense circuitry.
7. If the GUI is connected to DA7280 ensure Polling Enabled/Disabled button is disabled.



Revision History

Revision	Date	Description
1.0	26-Mar-2018	Initial version
1.1	18-April-2018	Updated scripts section.
1.2	14-August-2018	Updated sections 8 and 9.
1.3	03-October-2018	Changed Jahwa script names to 1040. DA7280 GUI UI updated.

Status Definitions

Status	Definition
DRAFT	The content of this document is under review and subject to formal approval, which may result in modifications or additions.
APPROVED or unmarked	The content of this document has been approved for publication.

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