IQS390 and IQS391 GUI User Guide

The user guide introduces the development tools available for the haptics product and guides the setup of certain key elements.

Contents

1 Introduction

This document provides an overview of the IQS390 and IQS391 ProxFusion® devices, the graphical user interface (GUI), and the IQS390 and IQS391 evaluation (EV) kits. It aims to equip users with the knowledge needed for configuring, debugging, data logging, and header file export using the GUI software to address their unique applications.

The firmware that runs on both IQS390EV02 and IQS391EV02 EV kits are very similar but differ in the way the haptics parameters are specifically in the settings available for vibration intensity and duration for each device. The differences between the two devices are shown in Table 1.1.

Table 1.1: Differences Between IQS390 and IQS391

Parameters	IQS390	IQS391
Haptics waveform	Multiple waveform can be selected and configured	Single waveform
Haptics patterns	Multiple patterns can be selected and configured	Single pattern
Haptics drive settings	Drive settings configured using multiple bytes	Drive settings configured using a single byte
Haptics drive stages	Up to five drive stages	Up to three drive stages

The IQS390EV02 and IQS391EV02 EV kits each consist of a single module showcasing the sensing technology that the IQS390 and IQS391 provide. See the IQS390EV02 and IQS391EV02 reference schematics in Section 5.

Figure 1.1: IQS390 and IQS391EV02 EV kit

For IC-specific information, operation, and memory map details, please refer to the IQS390 Datasheet and/or the IQS391 Datasheet.

2 Getting Started

This section describes the process of initial device set-up prior to application-specific tuning.

2.1 Step 1: GUI Software Installation

Download and install the Azoteq IQS390 or IQS391 GUI PC Software from the Azoteq website under the Software and Tools page. Extract the downloaded zip file and follow the installation wizard procedure.

2.2 Step 2: Launch GUI Software

Launch the IQS390 or IQS391 GUI software executable. The following window should appear:

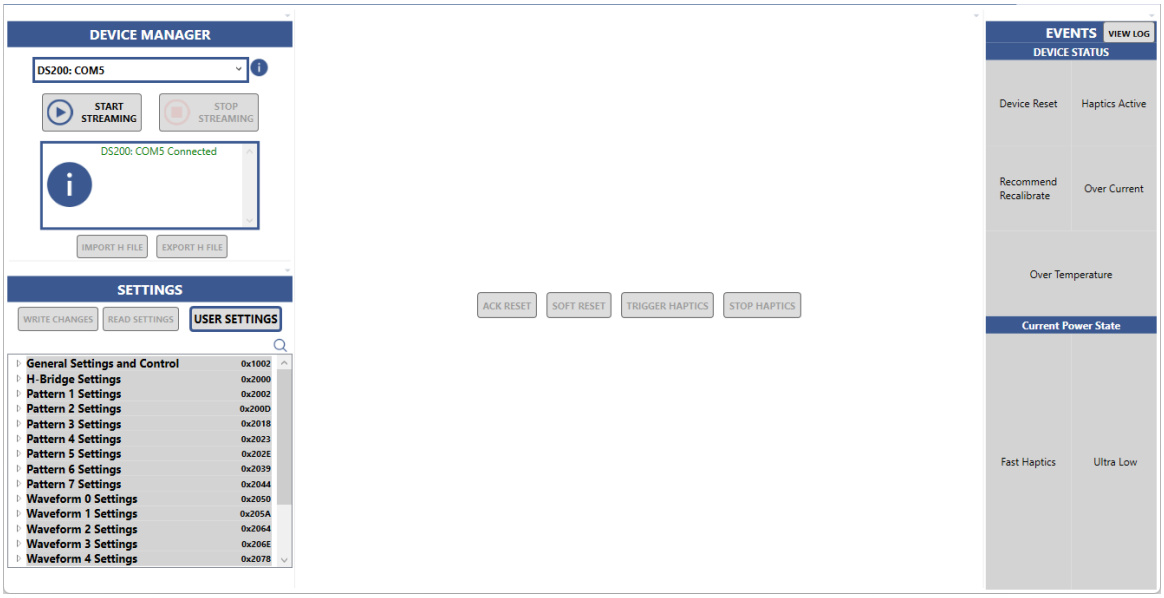

Figure 2.1: Main Window of the Azoteq IQS390 and IQS391 GUI

2.3 Step 3: Hardware Connections

Connect the DS200 to your PC using a standard Type-C cable. The device under test (DUT), being either an IQS390EV02 or IQS391EV02 EV kit or an application PCBA, can be interfaced with a suitable 10-to-10 pin ribbon cable connection (or application-specific connections), as shown in Figure 2.2 below.

Figure 2.2: CT210A Connection for Streaming and Testing

Note: The CT210A can be used instead of the DS200, along with a standard USB-micro data cable and a suitable 20-to-10 pin ribbon cable connection, as shown in Figure 2.3 below.

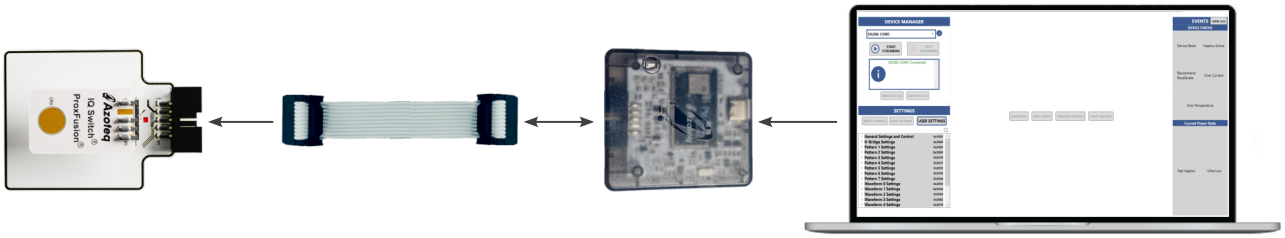

Figure 2.3: DS200 Connection for Streaming and Testing

If a custom cable or hardware is used, the required connections are shown in Table 2.1 and Figure 2.4 below.

Table 2.1: DS200 Pin-out

IQS Pins	DS200 Pins
GND	Pin 1
VDD	Pin 3
SDA	Pin 7
SCL	Pin 9
RDY	Pin 10

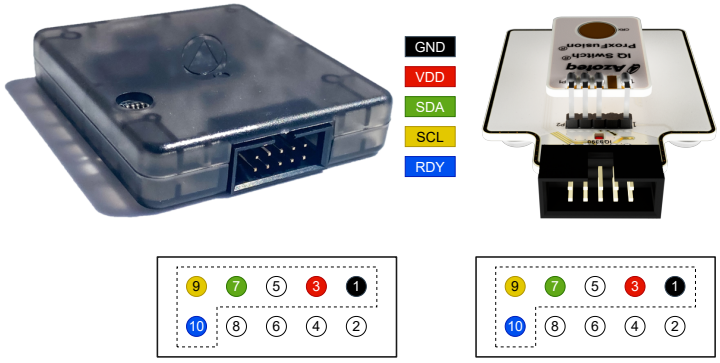

Figure 2.4: DS200 Power, I^2C and RDY Connections

2.4 Step 4: PC Connection Verification

After connecting the DS200 device to the computer, the GUI software will automatically install any necessary drivers. It will then verify its connection and firmware, displaying a 'Device Connected' message in the configuration tool manager section, as shown in the red block in Figure 2.5.

Figure 2.5: DS200 Recognition and Connection

Note: If the connected DS200 device firmware is out of date, an 'Update available' button should automatically appear next to the device enumeration. Click this button to launch the Azoteq firmware upgrade tool and update the firmware, as shown in Figure 2.6.

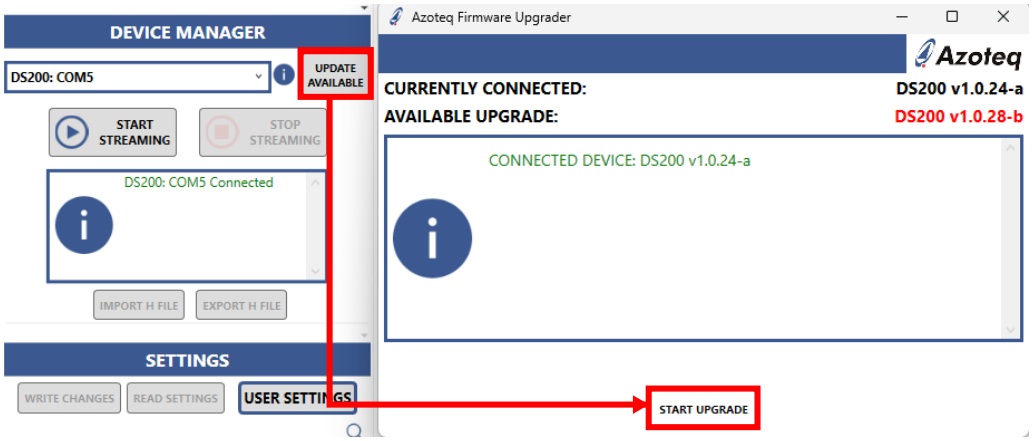

Figure 2.6: DS200 Firmware Upgrade

2.5 Step 5: Initiate IQS390 and IQS391 Communication (Streaming)

Click on 'START STREAMING' to initiate communications with the IQS390 and IQS391. Additional messages will appear and will provide the following information:

- Power status
- I^2C address
- Device version information
- Settings and streaming confirmations or errors, as applicable

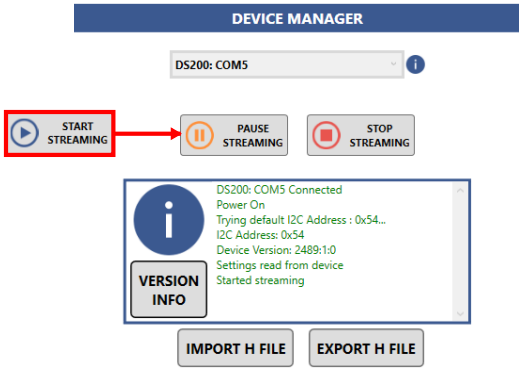

Figure 2.7: Message Dialogue Results from a Successful IQS390 and IQS391 Connection

If an error is displayed, please ensure that the device is properly connected and that the IQS390 and IQS391 product and version numbers were verified successfully.

2.6 Step 6: Acknowledge Reset and Streaming Mode

Click on the 'ACK RESET' button to clear the reset event flag.

Figure 2.8: ACK Reset Button

The IQS390 and IQS391in streaming mode, as shown in Figure 2.9. The default settings are *not* an appropriate baseline for a production application.

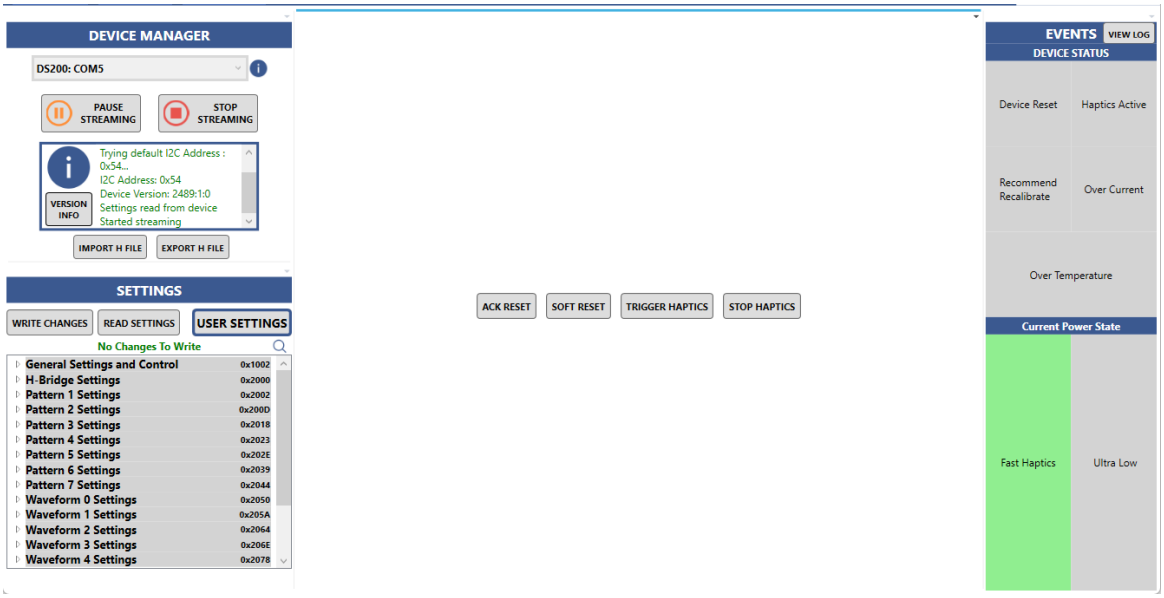

Figure 2.9: IQS390 and IQS391 Streaming

2.7 Step 7: Load Pre-Configured H-File (Demo Button)

When using the standard IQS390 and IQS391 EV kit hardware, the predefined configuration settings for the demo are applied automatically when the IQS390 and IQS391 are in streaming mode. Click

on the ‘USER SETTINGS’ button and navigate to the first tab named ‘General Settings and Control’. Refer to Figure 2.10.

The IQS390 and IQS391 device parameters may now be configured further by selecting the ‘USER SETTINGS’ button to open the pop-up window with settings organised in menu tabs.

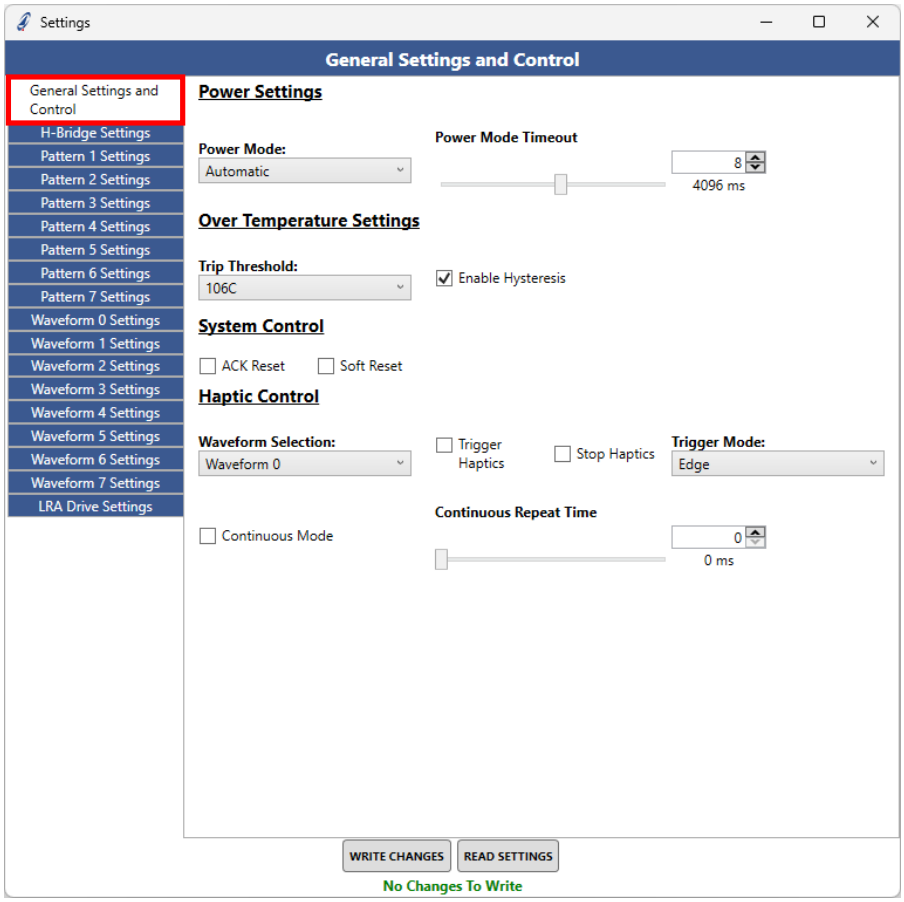

Figure 2.10: Importing the Predefined Demo Configuration

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3 IQS390 and IQS391 Debug and Display Software Overview

This section briefly explains the GUI elements such as the device events, and commands, as well as some additional core functionality such as exporting and importing of device settings.

3.1 Export Device Configuration to H-File

After configuring the IQS390 and IQS391, you can export the new settings for safekeeping, sharing, or future use on the same or another device. The settings are exported as a *.h*-header file using the 'EXPORT H FILE' button.

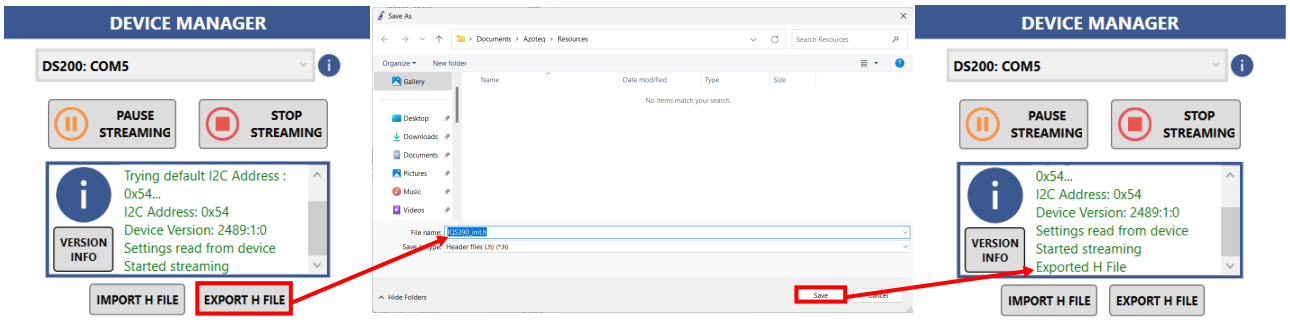

Figure 3.1: Exporting a Defined Configuration

3.2 Import Preconfigured H-File

If the device was previously configured and an associated .h file was exported from the GUI, the file may now be imported into the GUI using the 'IMPORT H FILE' button. Additional information will be provided to verify that the file was imported correctly:

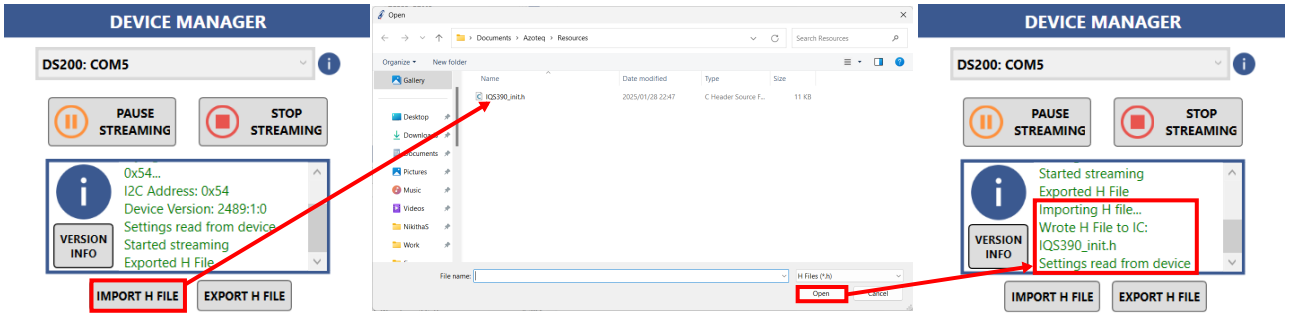

Figure 3.2: Importing a Predefined Configuration

3.3 Command Buttons

At the centre of the GUI is a row of buttons that execute commonly used commands.

Figure 3.3: Command Buttons

3.3.1 Acknowledge Reset

The “Ack Reset” button clears the IQS390 and IQS391’s reset flag by writing the **Acknowledge Reset** bit to the IC. This should be the first step after powering on any Azoteq IQS device. On start-up, the IC will set its reset flag to indicate that a reset event has occurred.

3.3.2 Soft Reset

The “Soft Reset” button issues a command to the IQS390 and IQS391 to perform a soft reset. This can be used to clear any configured settings back to their default values.

3.3.3 Trigger Haptics

The “Trigger Haptics” button issues a command to the IQS390 and IQS391 to run the haptics motor or linear resonant actuator (LRA). A trigger haptics command issued while the *Haptics Active* bit is set will be ignored.

3.3.4 Stop Haptics

The “Stop Haptics” button issues a command to the IQS390 and IQS391 to immediately stop the haptics waveform if it is active.

3.4 Events

The panel on the right-hand side of the GUI shows the current event flags that are set on the IC, as shown in Figure 3.4. These indicators are read from the IQS390 and IQS391's status registers.

The conditions for each event to trigger are described in the device datasheet.

3.4.1 System Status

The following events are read from the *System Status* register.

- **Device Reset**: A reset event has occurred, and all settings have been reset to defaults.
- **Haptics Active**: Haptics event is active and the haptics motor or LRA is running.
- **Recommend Recalibrate**: Haptics calibration error has occurred and recalibration is required.
- **Over Current**: The current drawn by the load connected to M+ and M- exceeds 200mA.
- **Over Temperature**: The temperature of the device exceeds the set over temperature threshold.
- **Current Power State:**
  - **Fast Haptics**: The digital core remains active. The haptics pulse generated as a result of the trigger haptics command begins significantly sooner compared to when the device is in ULP state.
  - **Ultra Low**: Lowest power consumption is achieved. The digital core and non-essential peripherals are powered off.

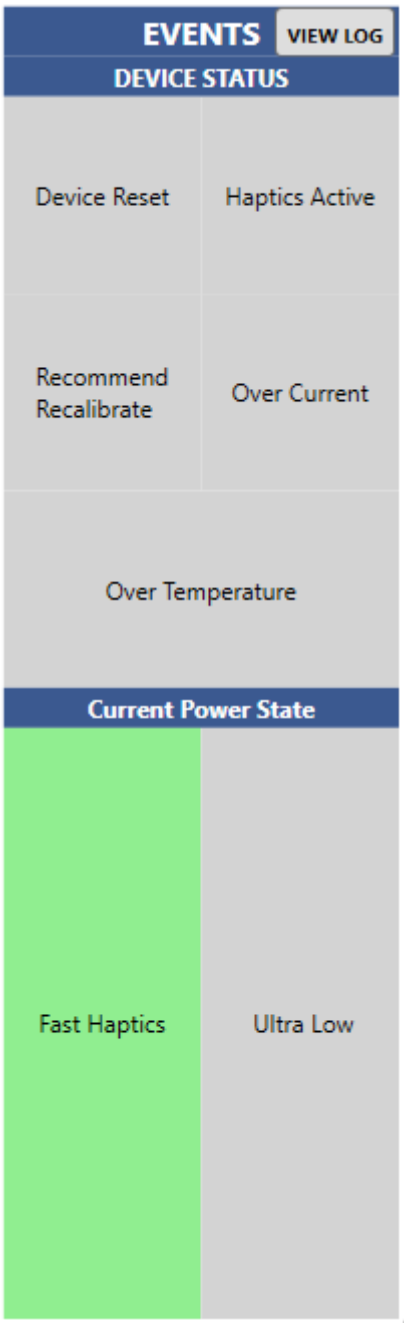

Figure 3.4: Events Panel

4 Device Setup

This section explains some of the basic system settings and commands that are specific to the haptics configuration of the IQS390 and IQS391. The settings described in Sections 4.1–4.4 can be accessed using the “User Settings” button shown in Figure 4.1 below.

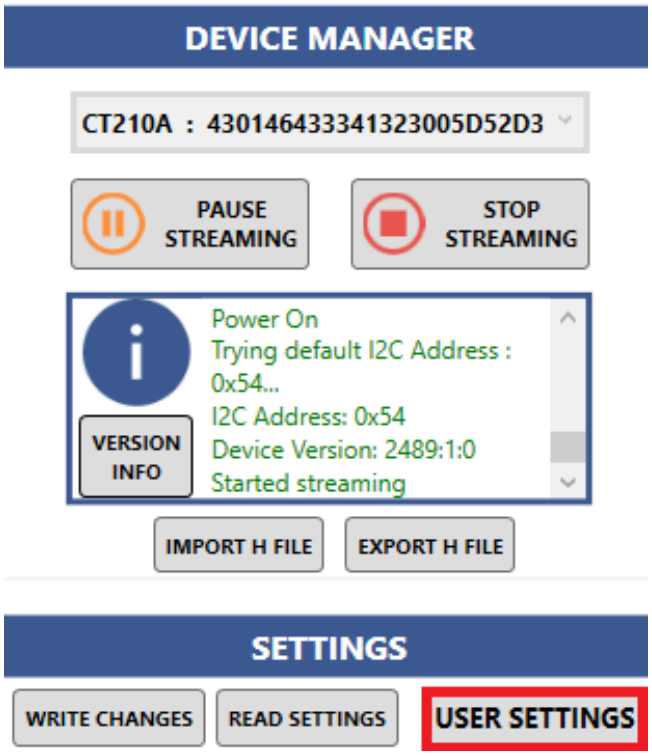

Figure 4.1: User Settings Button

When the “User Settings” button is clicked, a pop-up window will appear with multiple tabs. The tabs include general settings and control, h-bridge settings, pattern settings, waveform settings and LRA drive settings. The details of each of the tabs are provided in Sections 4.1–4.4, respectively.

4.1 General Settings and Control

The “General Settings and Control Settings” tab, shown in Figure 4.2 below, can be used to configure general settings, such as the power settings and over-temperature settings. The power settings include the power mode selection and power mode timeout, while the over-temperature settings include trip threshold and hysteresis.

Furthermore, the haptic control and system control settings can also be configured. The configurable system control settings include command bits for acknowledging a power-on reset and for performing a full system reset. The configurable haptic control settings include waveform selection, continuous repeat time and trigger mode selection. It also includes command bits to trigger, stop, and run haptics in continuous mode.

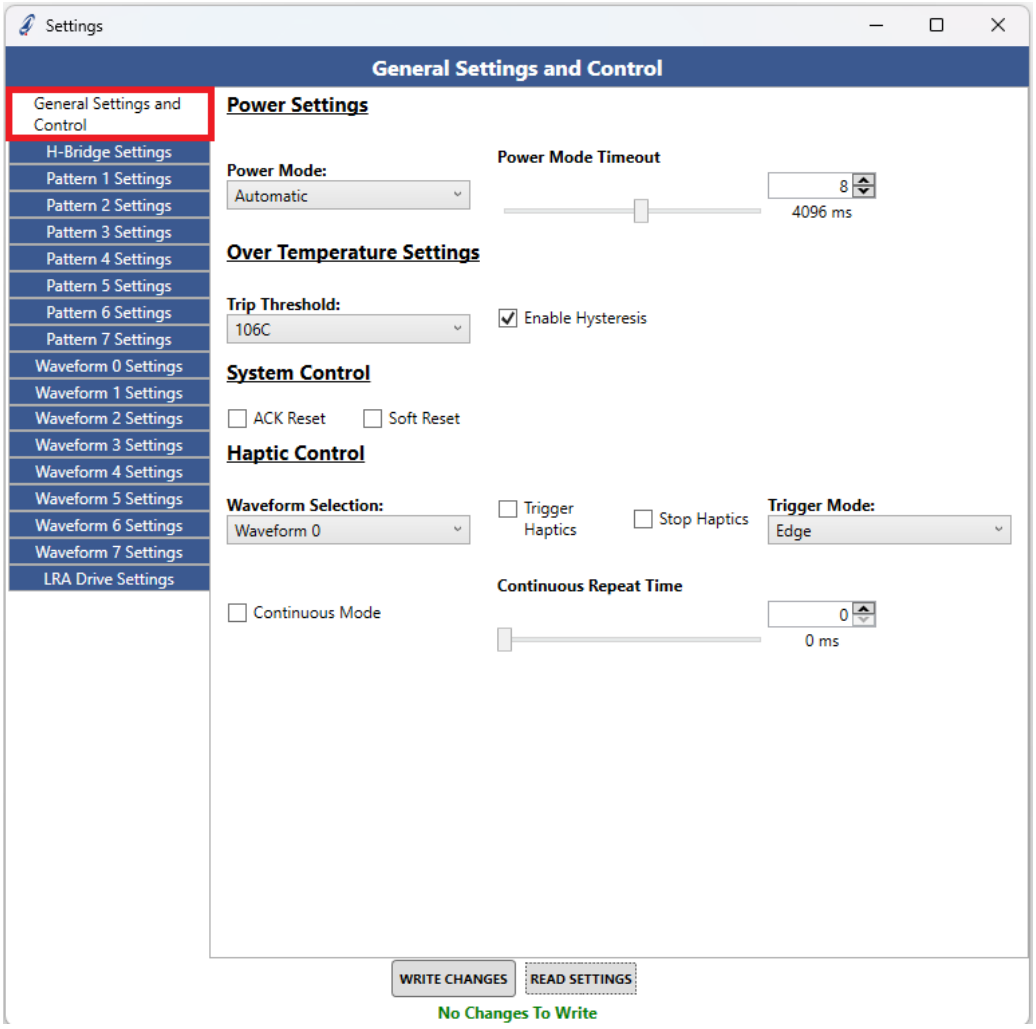

Figure 4.2: System Settings

4.2 H-Bridge Settings

The “H-Bridge Settings” tab, shown in Figure 4.3 below, can be used to configure the H-bridge protection settings, such as over temperature, over current, and shoot-through protection.

Furthermore, slew rate control settings and other general h-bridge settings can also be configured. The configurable general H-bridge settings include strict failure, ground inactive, external H-bridge and drive strength.

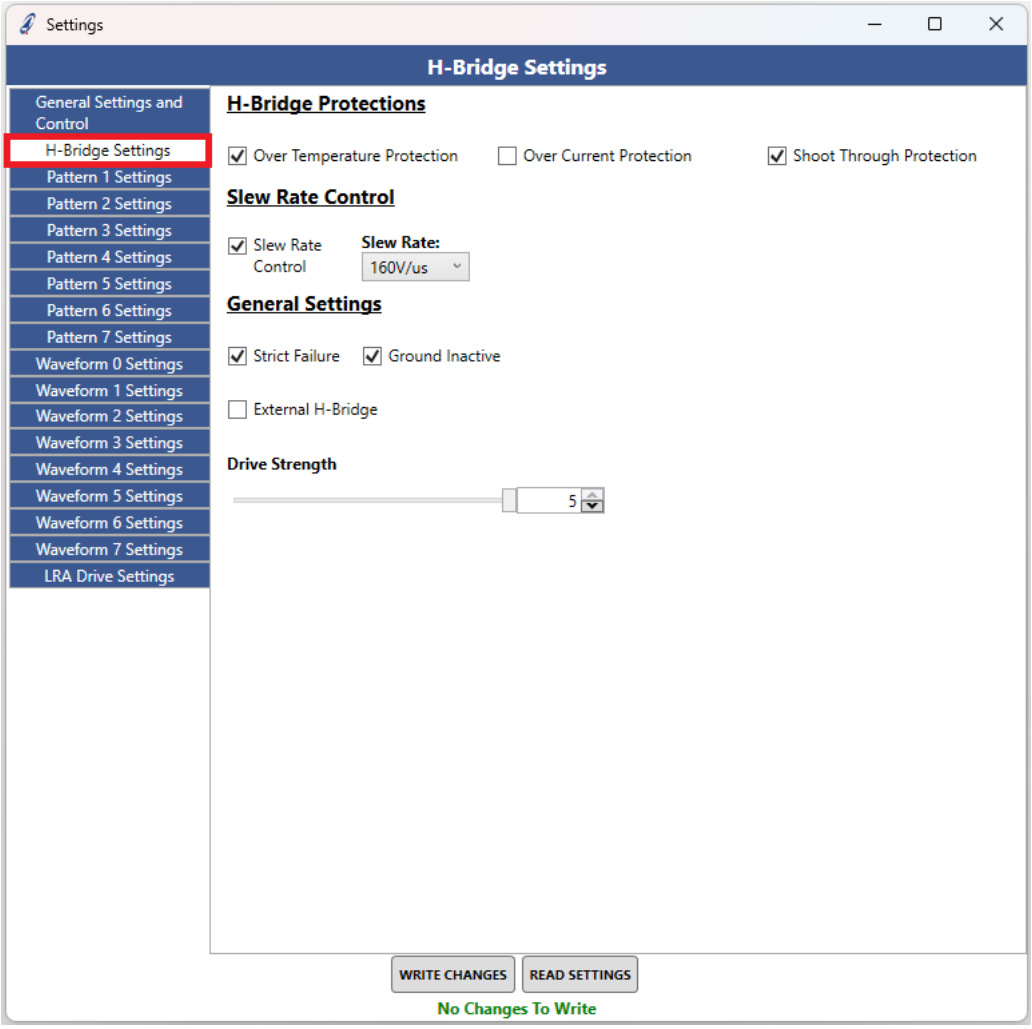

Figure 4.3: H-Bridge Settings

4.3 IQS390 Specific Haptic Settings

The differences between IQS390 and IQS391 are summarised in Table 1.1. The additional settings in the IQS390 that are not present in the IQS391 include multiple patterns and waveform settings. The IQS390 supports multiple patterns, as shown in Figure 4.4 and Figure 4.5. The pattern settings include autoresonance, pattern invert logic and number of segments as shown in Figure 4.4.

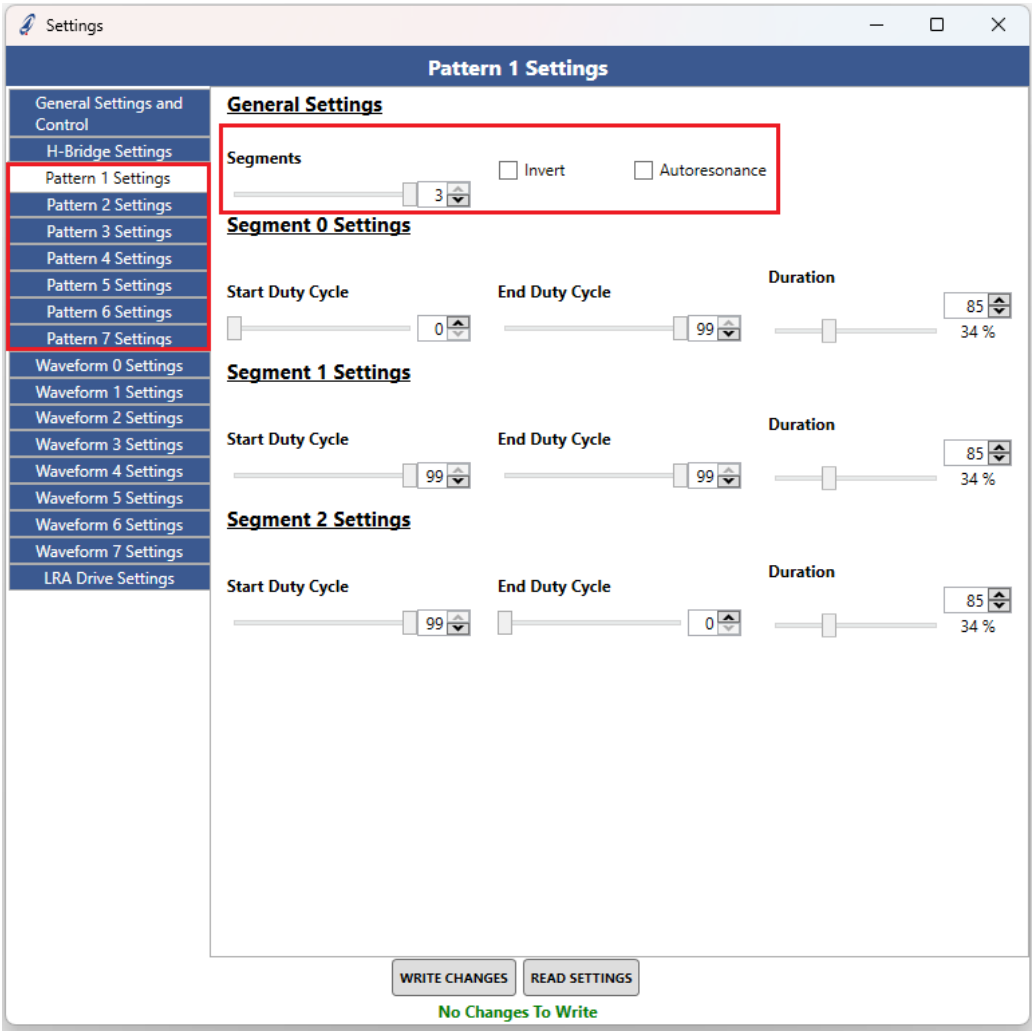

Figure 4.4: Haptic Pattern Settings 0

Other pattern settings include segment start duration, segment end duty cycle, and segment duration, as shown in Figure 4.5.

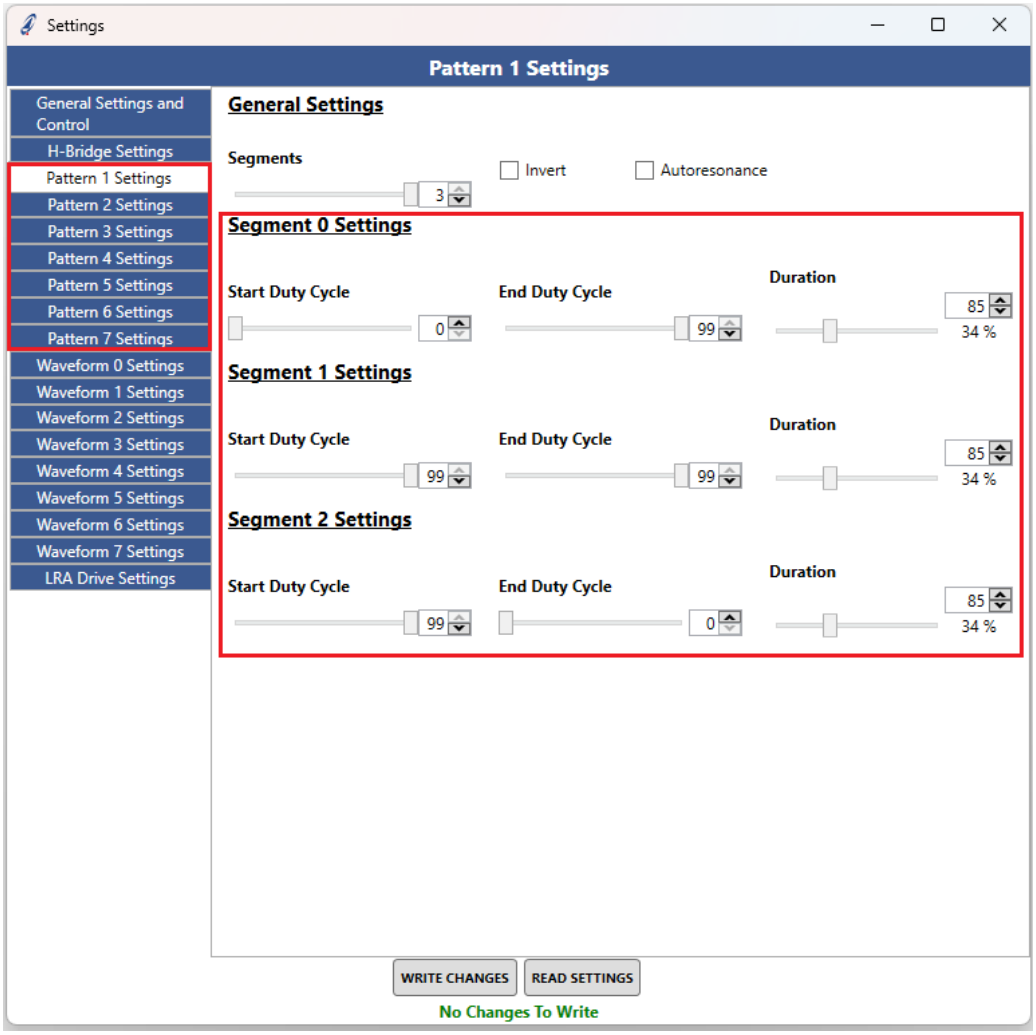

Figure 4.5: Haptic Pattern Settings 1

The IQS390 supports multiple waveforms as shown in Figure 4.6. The waveform settings include repeat count, repeat time, stage pattern selection, and stage half cycles.

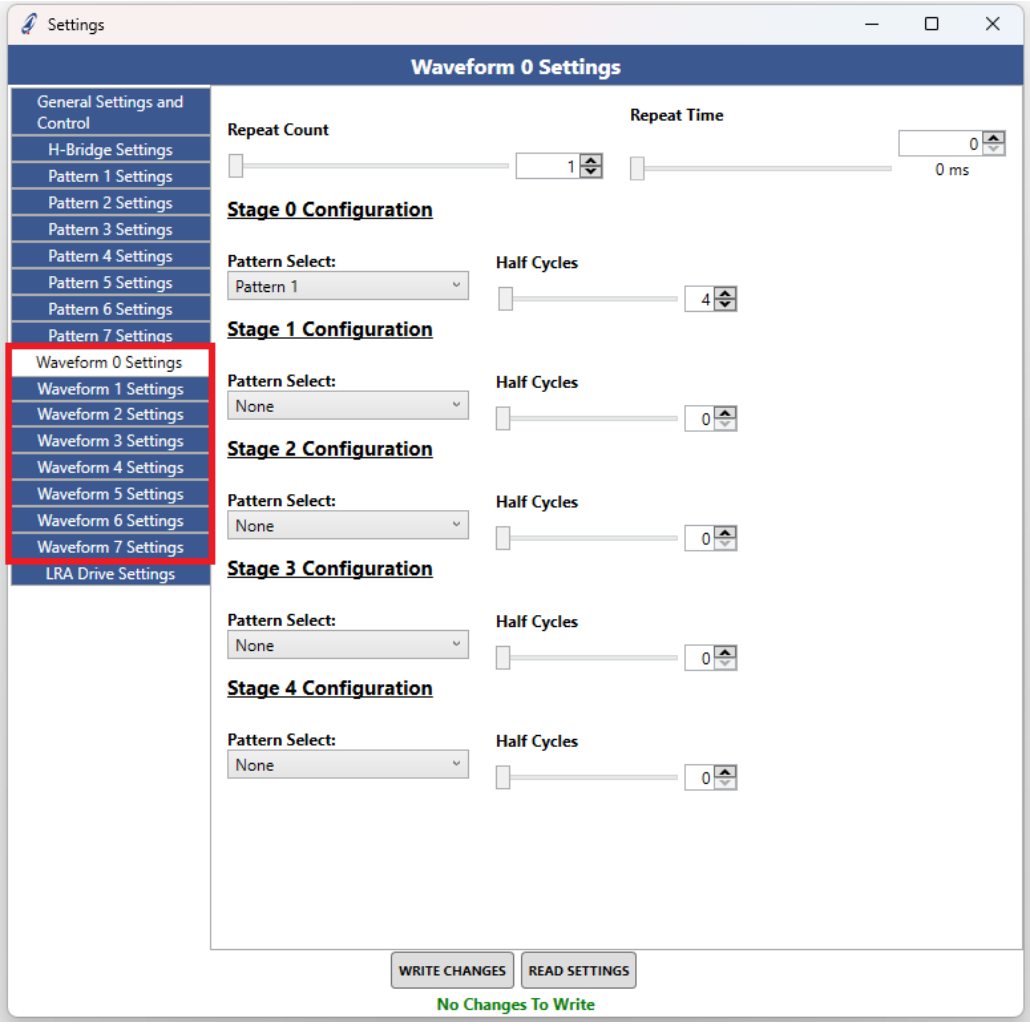

Figure 4.6: Haptic Waveform Settings

4.4 LRA Drive Settings

The “IQS390 and IQS391 LRA Drive Settings” tab shown in Figure 4.7 can be used to configure different LRA drive settings.

Configurable LRA drive settings include PWM frequency, LRA frequency, and autoresonance back-off. For more information about the haptic settings, see the IQS390 Datasheet and/or the IQS391 Datasheet.

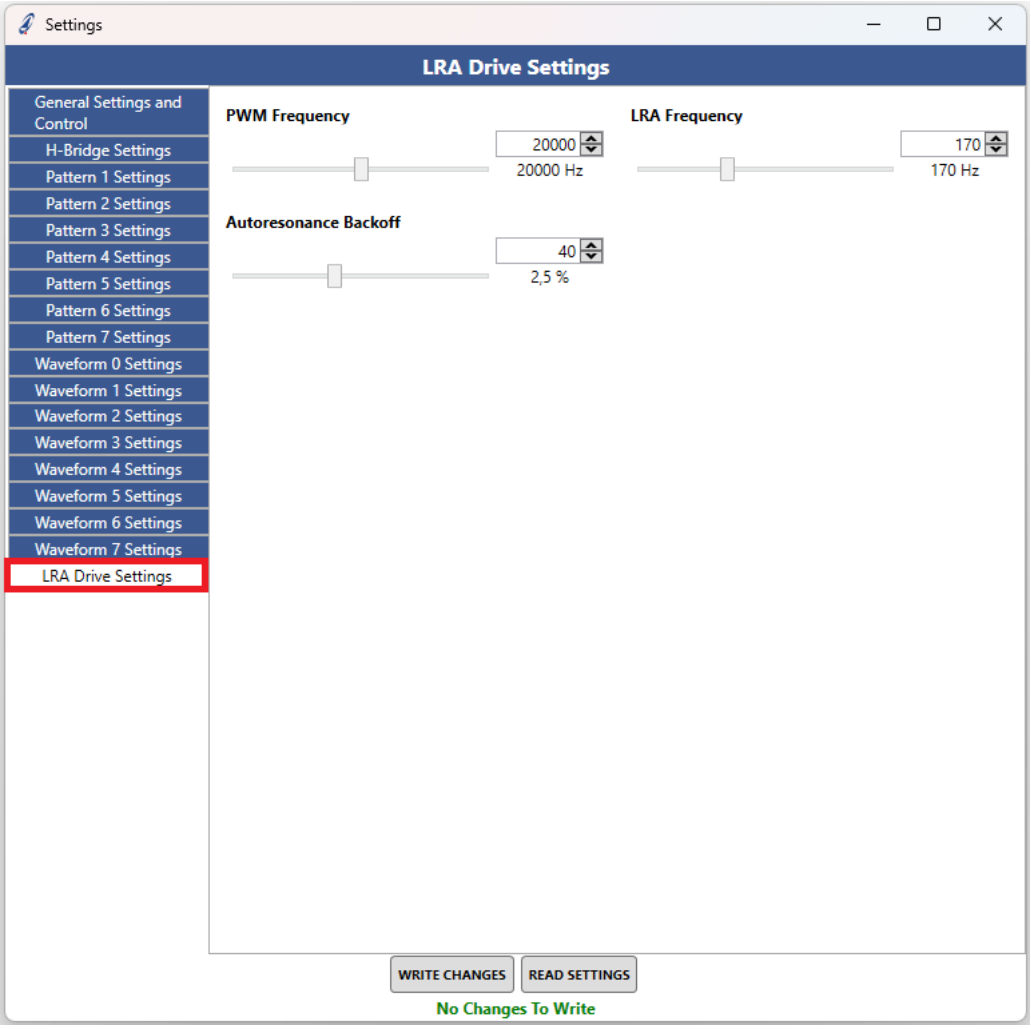

Figure 4.7: Haptics Settings

5 IQS390 and IQS391 Reference Design

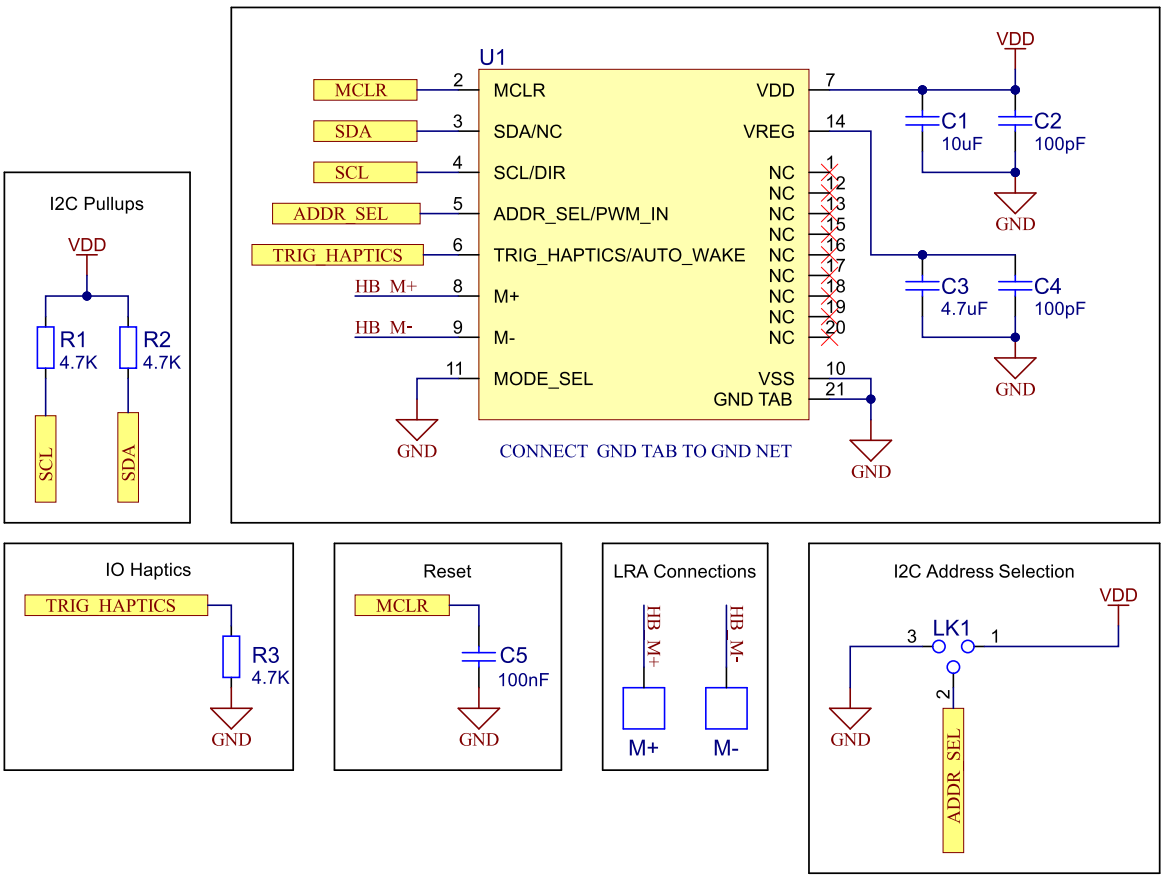

Figure 5.1: I²C Mode Reference Schematic

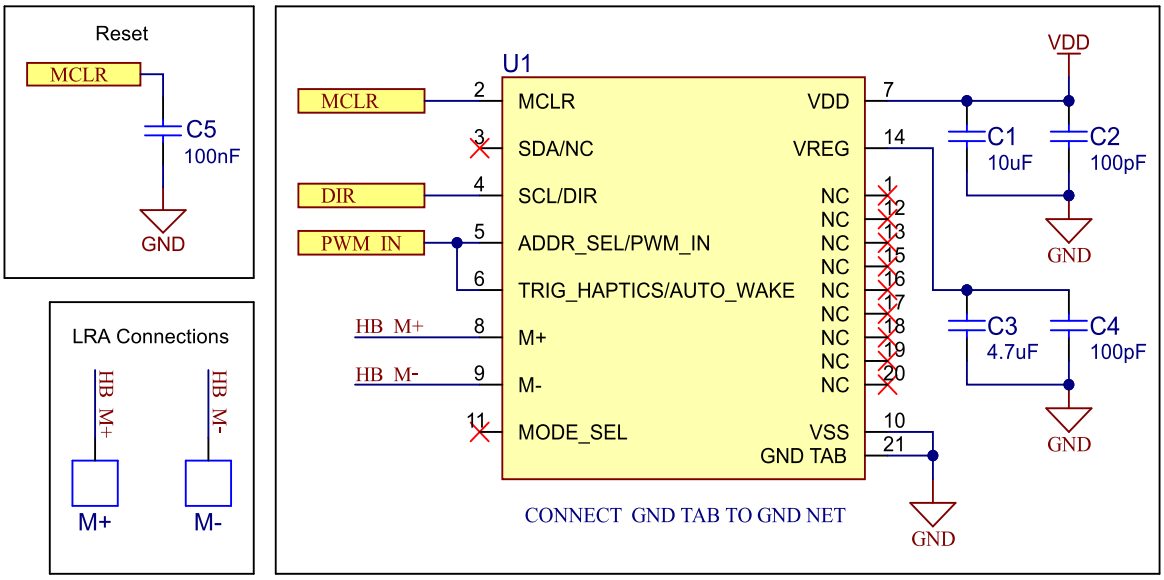

Figure 5.2: PWM Mode Reference Schematic

6 Revision History

Release	Date	Changes
v1.0	April 2026	Initial release

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