Evaluation Board User Guide

MAX22215-EVKIT

Motor Brake Driver with Current-Sense Amplifier and Advanced Diagnostics

General Description

The MAX22215-EVAL allows evaluation of the MAX22215 in combination with the TRINAMIC evaluation board system or as a standalone board. It uses the standard schematic and offers several options to test different modes of operation. The MAX22215 is a 3A motor brake driver with a current-sense amplifier and advanced diagnostics.

Features

- One Half-Bridge Driver
- One 65V Rated LS FET
- Embedded Demagnetization Circuitry
- Integrated Current-Sense Amplifier
- Supply Voltage 8V to 36V
- Up to 3A Drive Current
- 1MHz I^2C Serial Interface
- Full Set of Protections

Applications

- Industrial Motor Brake Release
- Robotics Motor Brake Release

MAX22215-EVKIT Contents

FILE	DESCRIPTION
MAX22215-EVAL	MAX22215 Evaluation Board
Landungsbruecke	PC Interface Board
Eselsbruecke	Bridge Connection Board

Documents Needed

- MAX22215 data sheet

Software Needed

- *TMCL-IDE Evaluation Software*

Ordering Information ***appears at end of data sheet.***

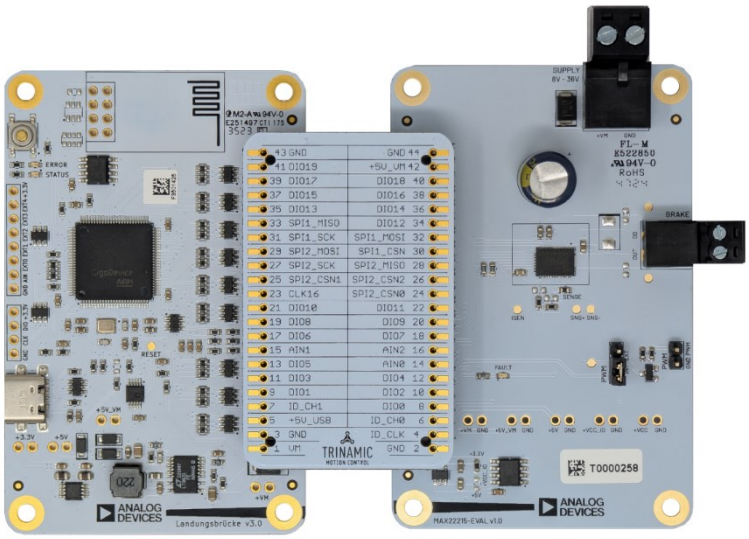


Figure 1. Assembled MAX22215-EVKIT

Getting Started

Required Equipment

- MAX22215-EVAL (included)
- Landungsbruecke board (included)
- Eselsbruecke bridge board (included)
- A compatible load (electromechanical motor brake or solenoid)
- Power supply
- Cables to interface the load and power supply
- Latest *TMCL-IDE*
- Latest firmware for *TMC-EvalSystem*

Precautions

- ENSURE THE POWER SUPPLY IS OFF.
- Do not mix up connections or short-circuit pins.
- Avoid bundling I/O wires with load wires.
- Do not exceed the maximum rated supply voltage!
- Do not connect or disconnect the load while powered!

Connecting the Peripherals

1. Connect the MAX22215-EVAL to the Landungsbruecke board through the Eselsbruecke bridge board as shown in *Figure 1*. While connecting the boards together, both the Landungsbruecke board and the MAX22215-EVAL must not be powered. Make sure that every pin in the connector is connected to its corresponding header. The working area is nonconductive to prevent the shorting of pins on the backsides of the boards.
2. Plug the selected load to connector J203, which is labelled as **BRAKE** on the board's silkscreen.
3. Connect the Landungsbruecke board to the computer through a USB cable.
4. Plug the power supply cable to connector J202, which is labelled as **SUPPLY** on the board's silkscreen. Make sure the power supply is off before connecting it to the board and the polarity is correct.

The board is now ready for the next steps. Continue with the following section, but do not turn on the power supply yet.

First Start-Up

1. Make sure that the latest version of the TMCL-IDE is installed. TMCL-IDE can be downloaded from *www.analog.com TMCL-IDE*.
2. Open TMCL-IDE and connect the Landungsbruecke board with the attached MAX22215-EVAL by USB to the computer. For Windows® 8 and higher, no driver is needed. For Windows 7, TMCL-IDE installs the driver automatically.
3. Verify that the Landungsbruecke board is using the latest firmware version. The firmware version is shown in the connected device tree. The latest firmware can be downloaded from *https://www.analog.com Landungsbruecke*.
4. TMCL-IDE needs space to display all-important information and to provide a good overview. Therefore, arrange the main window as needed. Using full-screen mode is recommended. For evaluation boards, it is essential to have access to the registers. Therefore, open the register browser from the device tree on the left side. For a better view, click the top right normal icon to maximize the register browser window.
5. TMCL-IDE includes a dialog box for diagnostic tasks. The dialog box provides an overview of the connected motion controller and driver chips. A window pops up immediately after connecting the Landungsbruecke board for the first time. The **Board Assignment** tab shows the actual status of the connections. The **Settings** tab allows to choose basic settings or to reset the module to the factory default settings.
6. The last hardware setup step is to plug in a power supply by using provided power connector. The +VM input range is +8V to +36V. Check the power supply by looking at the top left corner of the TMCL-IDE, where there is a VM monitor (with VM measurements done by the Landungsbruecke board).
7. Now the MAX22215 evaluation board can be controlled using the TMCL-IDE by setting up the MAX22215 using the GUI tools or directly accessing to the registers through the **Register Browser** tool.

8. **Settings and Status MAX22215 settings (*Figure 2*):** Upon initial power-up, the MAX22215 indicates a fault condition, which is signaled by a red LED on the board. To enable normal operation, first clear the fault by setting the reset bit. Next, activate the device by setting the NSLEEP bit. Set the SW_HW bit to enable communication. Once these steps are completed, the MAX22215 is ready for use. To verify if it ready for use, set the RLS_BRK bit, which changes the state of the solenoid or electromechanical brake connected to the output connector. To continuously read the status of the IC, check the **Enable Status Read** box.

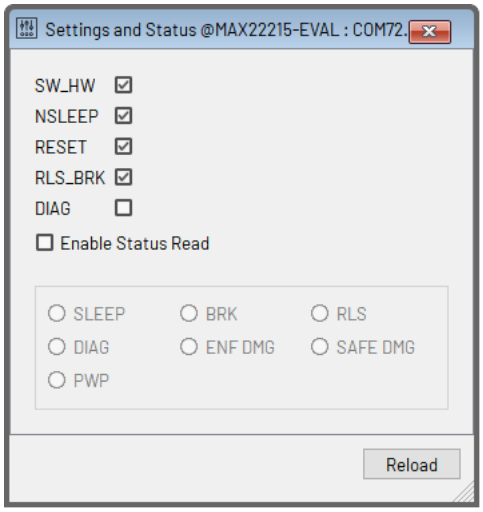


Figure 2. Settings and Status Window for the MAX22215

9. **EvalBoard Flags (*Figure 3*):** Another step for using the MAX22215 is to check the faults. At startup, the **EvalBoard Flags** window shows the **UVLO** flag, as the MAX22215 went through a power cycle. The flags can be cleared by pressing **Reset** button. It is also recommended to have **Auto Reload** active by checking its box, so real-time updates of the MAX22215 faults can be seen.

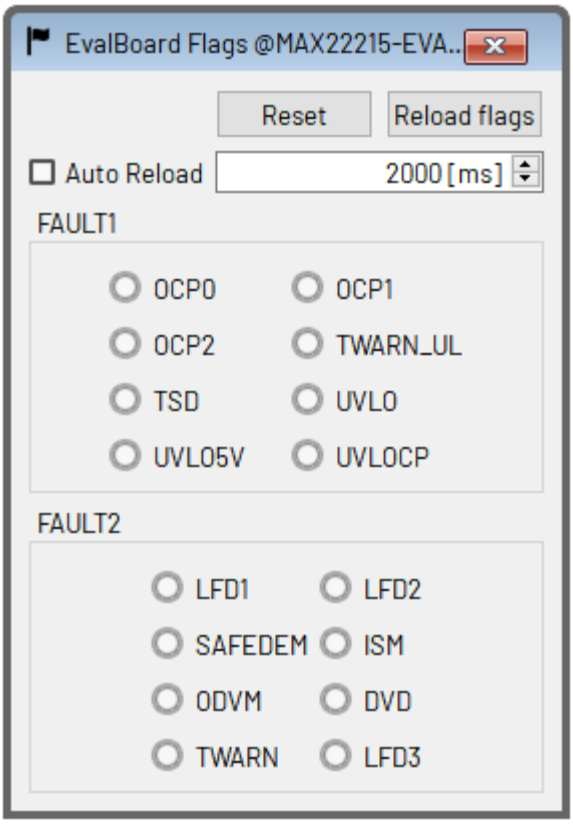


Figure 3. MAX22215 EvalBoard Flags

10. **PWM Settings tool (*Figure 4*):** This tool is designed for real-time current measurement (ISEN pin) by setting the PWM frequency and duty cycle. The PWM tool offers recording of the current measurement and exporting the data to a CSV file. Use the following steps to operate the tool:
    a. Click **Reset** to reset fault flags.
    b. Check the **Enable the chip** box.
    c. Set **Record Duration (ms):** 1000ms–5000ms.
    d. Set **Sampling Interval (ms):** 1, 10, 100.
    e. Click **Record Current** to begin recording.
    f. Generate a CSV file by clicking **Export to CSV**.

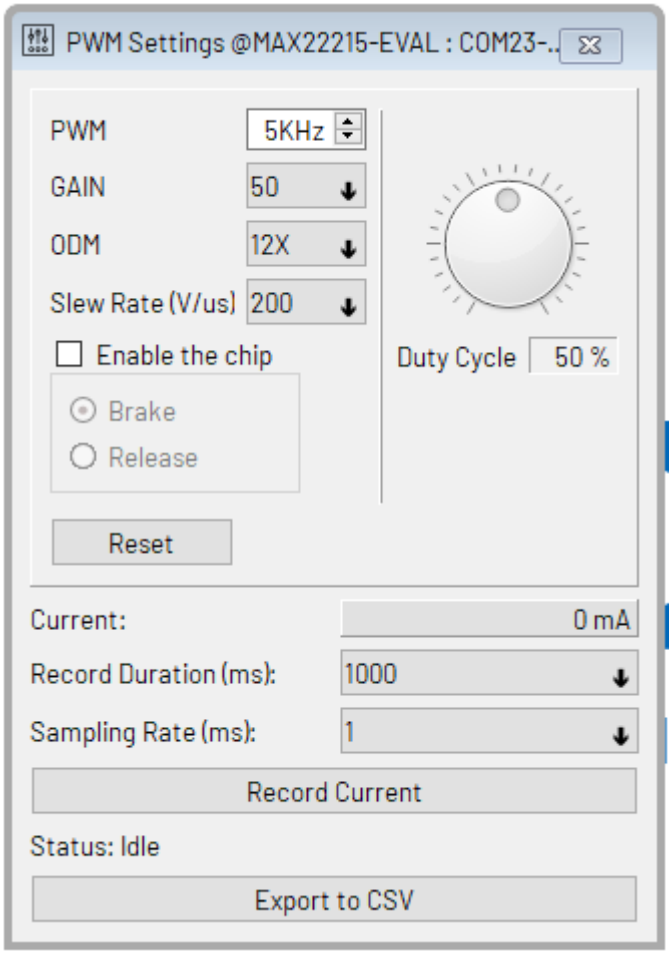


Figure 4. MAX22215 PWM Settings Window

11. Solenoid **Sequencer (***Figure 5***):** This tool can set the release hit duty cycle, release hold duty cycle, release hit time, and brake duty cycle. Use the following steps to operate this tool:
    a. Set **RLS_HIT_DC** (release hit duty cycle) by percentage: 0–100.
    b. Set **Hit Duration (ms)** (release hit time): 1–5000.
    c. Set **RLS_HOLD_DC** (release hold duty cycle) by percentage: 0–100.
    d. Set **BRAKE_DC** (brake duty cycle) by percentage: 0–100.
    e. Click **RELEASE**. After hit time, the release hold duty cycle is applied.
    f. Click **BRAKE**.

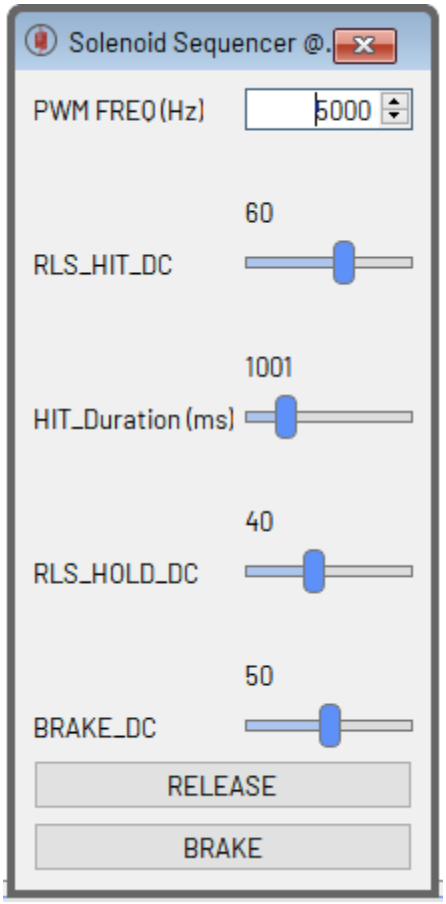


Figure 5. MAX22215 Solenoid Sequencer Window

Detailed Description of Hardware

Component Placement Drawing

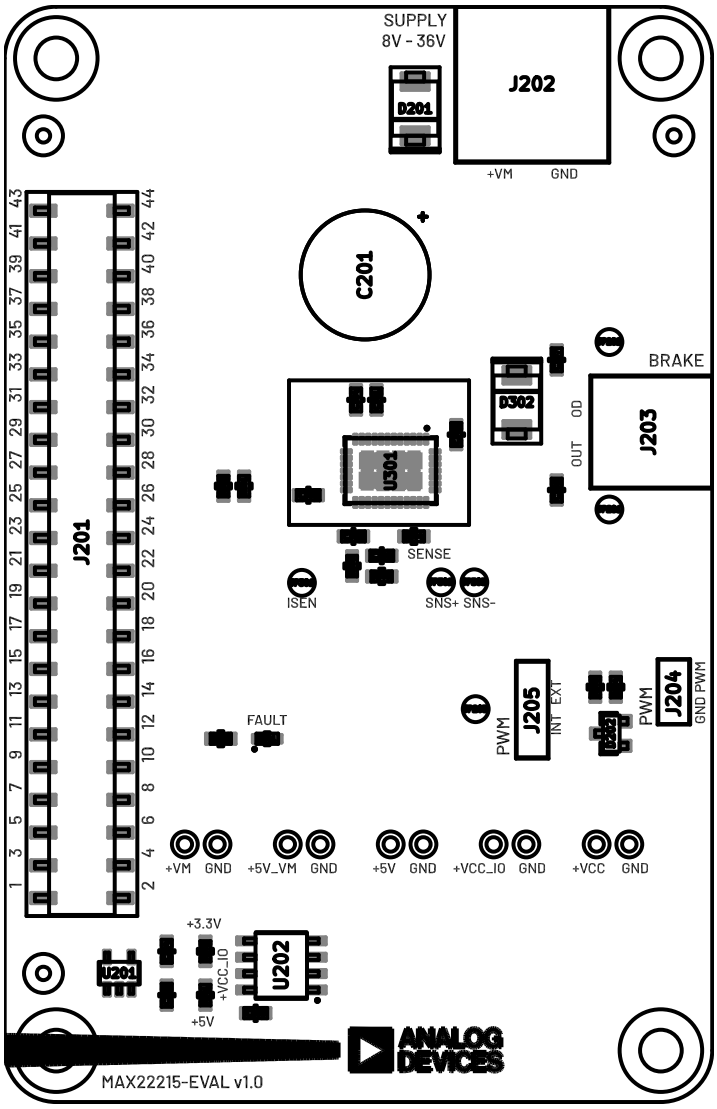


Figure 6. MAX22215-EVAL Component Placement and Silkscreen

Onboard Jumpers

In case the MAX22215 V_{IO} is used with +5V instead of +3.3V, there is a solder selection near the EEPROM. This selection needs to be changed if an external electronic component with 5V levels is connected. When using the MAX22215-EVAL board with the Landungsbruecke board, the V_{CC_IO} must be set to +3.3V (default).

Do not bridge both selections simultaneously. Doing so may disturb the onboard voltage regulator. Leave at +3.3V (default) in combination with the Landungsbruecke board.

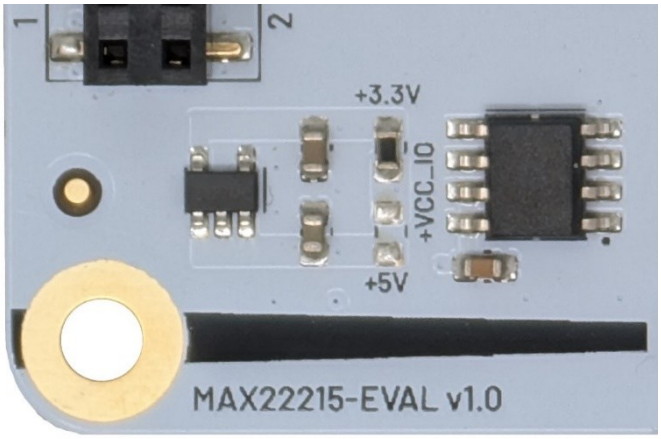


Figure 7. $+V_{cc\_IO}$ Selection Near the EEPROM

Onboard Connectors

Table 1 contains information on the connector type and mating plugs. The supply and output connectors pinouts are printed on the board. For the interface connector pinout refer to *Figure 8*. The entire schematic drawing is available on the Modular Evaluation System page of the ADI website.

Table 1. MAX22215-EVAL Connectors

#	CONNECTOR	CONNECTOR/PLUG	DESCRIPTION
1	Power Supply	MOLEX 395221002/MOLEX 395200002	Connects a battery or power supply to the evaluation board and the Landungsbruecke board.
2	Output	MOLEX 395021002/MOLEX 395000002	Connects the loads to the MAX22215 outputs.
3	PWM Imput	2-pin header	Connects the PWM control signal to the MAX22215 imput.
4	Interface	46-3492-44-3-00-10-PPTR from W+P Series 3492	Connects to the Landungsbruecke board through the Eselsbruecke board.

Landungsbruecke Connector

Most signals are connected to the MAX22215 directly without any additional protection. Refer to the MAX22215 data sheet for electrical ratings.

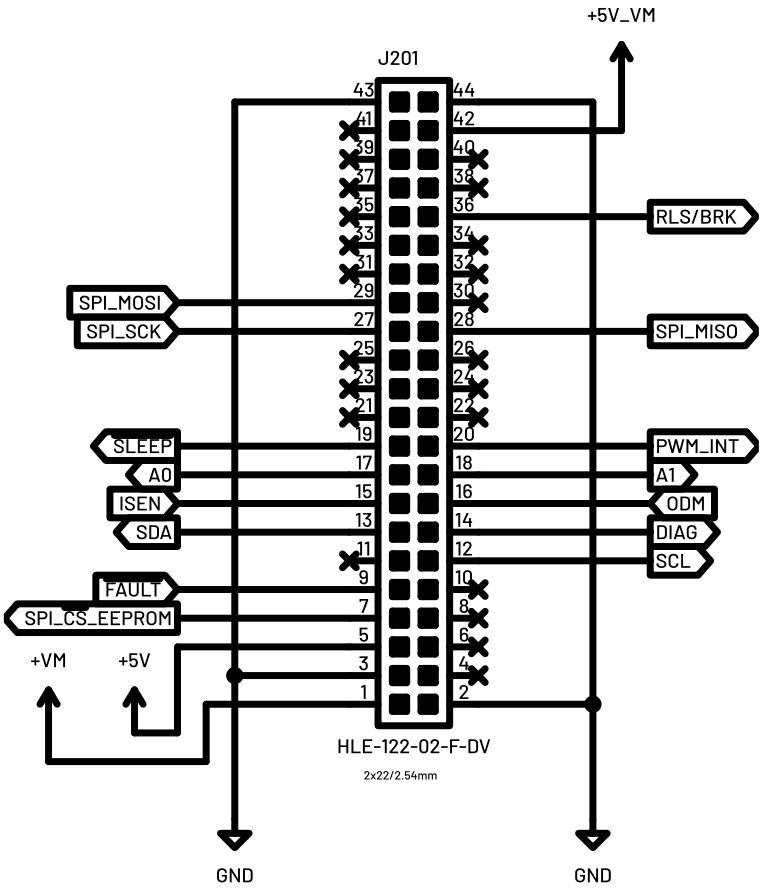


Figure 8. Pin Assignment on Landungsbruecke Connector

LED

The MAX22215-EVAL includes a status LED that is connected to the the MAX22215 FAULT pin. Refer to the MAX22215 datasheet for a detailed description of the diagnostic features and settings.

Test Pads

The MAX22215-EVAL employs the OUT, OD, PWM, ISEN signals and sense resistor pins as test points to provide a convenient way to monitor the signals during operation. The OUT, OD, and PWM test pads are located next to their respective connectors.

Software

This evaluation board is designed to be used with the TMCL-IDE software. The software provides tools for easy evaluation of MAX22215 the board's features and settings.The Register Browser provides full access to all registers.

To achieve optimal settings, refer to the descriptions and flowcharts in the MAX22215 data sheet. The register browser of the TMCL-IDE V4.0 provides helpful information about any currently selected parameter. Additionally, the data sheet explains concepts and ideas that are essential for understanding how the registers are linked together, and which settings are suitable for the application.

This MAX22215-EVAL supports the following tools:

- **Register Browser** to read and write all registers
- **PWM Settings** to set the PWM frequency and the PWM mode
- **Solenoid Sequencer** for basic solenoid control
- **EvalBoard Flags** to read the flags of the evaluation board
- **Settings and Status** for additional settings and status information

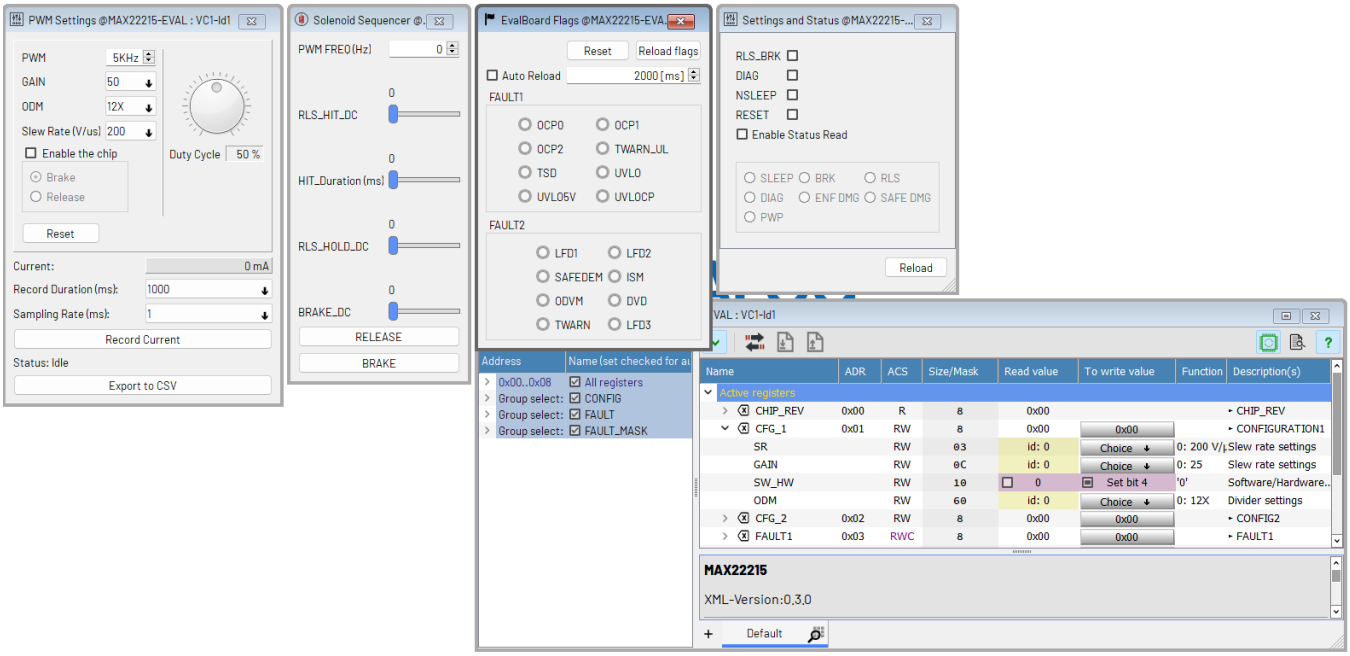


Figure 9. TMCL-IDE Evaluation Features Overview

Ordering Information

PART	TYPE
MAX22215-EVKIT	Evaluation Kit for MAX22215 EM Break and Solenoid Driver

MAX22215-EVKIT Bill of Materials

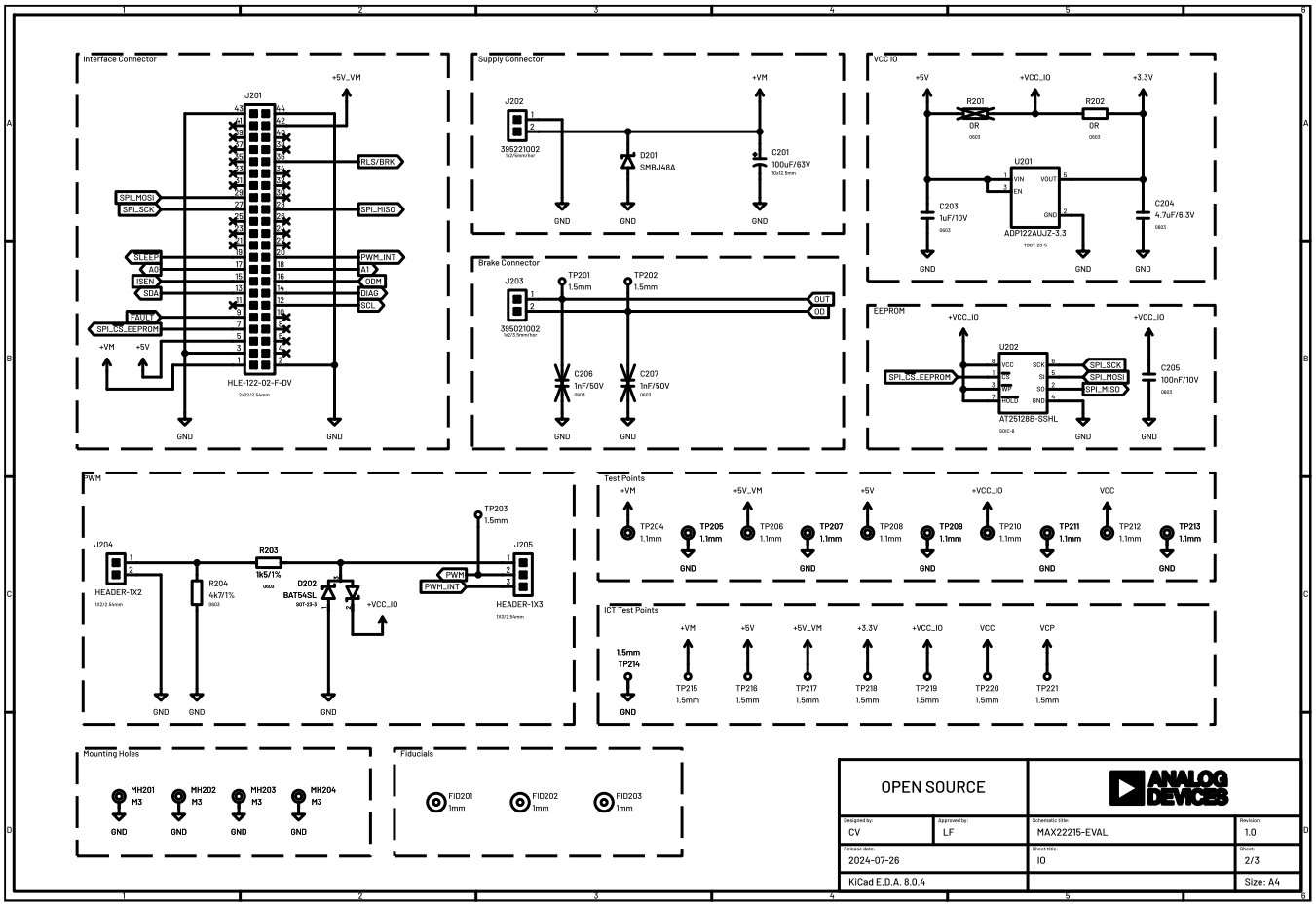
The Bill of Materials reflects the MAX22215-EVAL only.

PART	QTY	PACKAGE	MANUFACTURER	MANUFACTURER PN
C201	1	10mm × 12.5mm	PANASONIC CORP	EEU-FC1J101
C203	1	0603	AVX Corporation	0603ZD105KAT2A
C204	1	0603	SAMSUNG GROUP	CL10B475KQ8NQNC
C205	1	0603	KEMET CORPORATION	C0603C104K8RACAUTO
C301, C304	2	0603	KEMET CORPORATION	C0603C105K4RAC7867
C302	1	0603	YAGEO CORPORATION	CC0603KRX7R9BB105
C303	1	0603	AVX Corporation	0603YC104K4Z2A
D201	2	DO-214AA (SMB)	TAIWAN SEMICONDUCTOR CO LTD	SMBJ48A
D202	1	SOT-23 3L	ON SEMICONDUCTOR CORPORATION	BAT54S
D301	1	0603	KINGBRIGHT	KPT-1608EC
J201	1	2×22/2.54mm	W+P PRODUCTS GMBH	3492-44-3-00-10-PPTR
J202	1	1×2/5mm/hor	MOLEX LLC	395221002
J203	1	1×2/3.5mm/hor	MOLEX LLC	395021002
J204	1	1×2/2.54mm	WURTH ELECTRONIK GROUP	61300211121
J205	1	1×3/2.54mm	WURTH ELECTRONIK GROUP	61300311121
R202, R305, R306	3	0603	ASJ COMPONENTS	CR16-000-ZL
R203	1	0603	PANASONIC CORP	ERJ-3EKF1501V
R204	1	0603	PANASONIC CORP	ERJ-3EKF4701V
R301, R302, R303	3	0603	TT ELECTRONICS PLC	ASC0603-1K0FT5
R304	1	0603	PANASONIC CORP	ERJ3LWFR010V
U201	1	TSOT-23-5	ANALOG DEVICES INC.	ADP122AUJZ-3.3-R7
U202	1	SOIC-8	MICROCHIP TECHNOLOGY INC.	AT25128B-SSHL-B
U301	1	TOFN-38-EP	ANALOG DEVICES INC.	MAX22215ATU+
J202 plug	1		MOLEX	395200002
J203 plug	1		MOLEX	395000002
J205 jumper	1		METZ CONNECT	09200-71-BBGB00

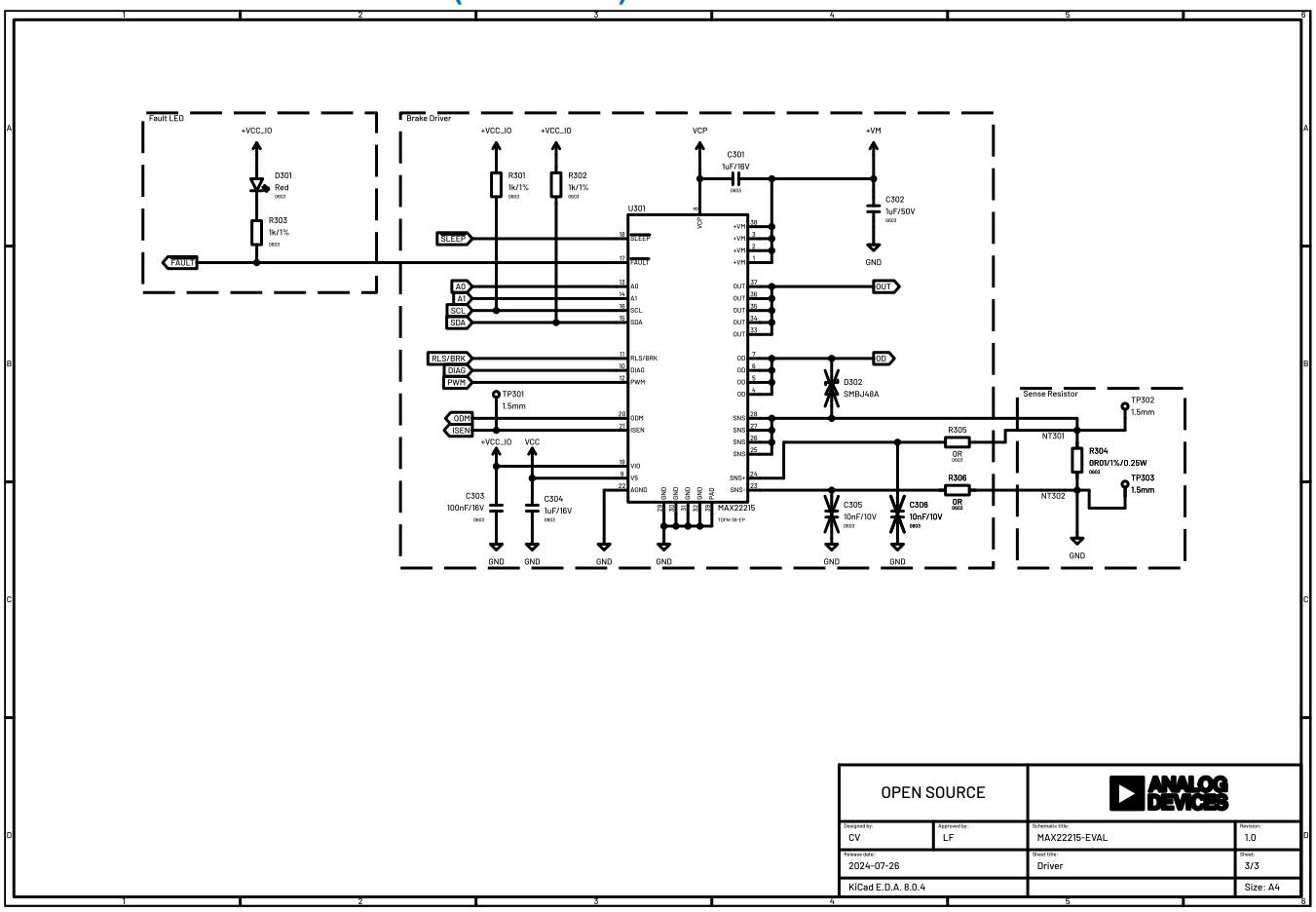
The following parts are not mounted on the board.

PART	QTY	PACKAGE	MANUFACTURER	MANUFACTURER PN
C206, C207	2	0603	YAGEO CORPORATION	CC0603KRX7R9BB102
C305, C306	2	0603	WURTH ELECTRONIK GROUP	885012206014
D302	2	DO-214AA (SMB)	TAIWAN SEMICONDUCTOR CO LTD	SMBJ48A
R201	1	0603	ASJ COMPONENTS	CR16-000-ZL

MAX22215-EVKIT Schematic



MAX22215-EVKIT Schematic (continued)



MAX22215-EVKIT PCB Layout

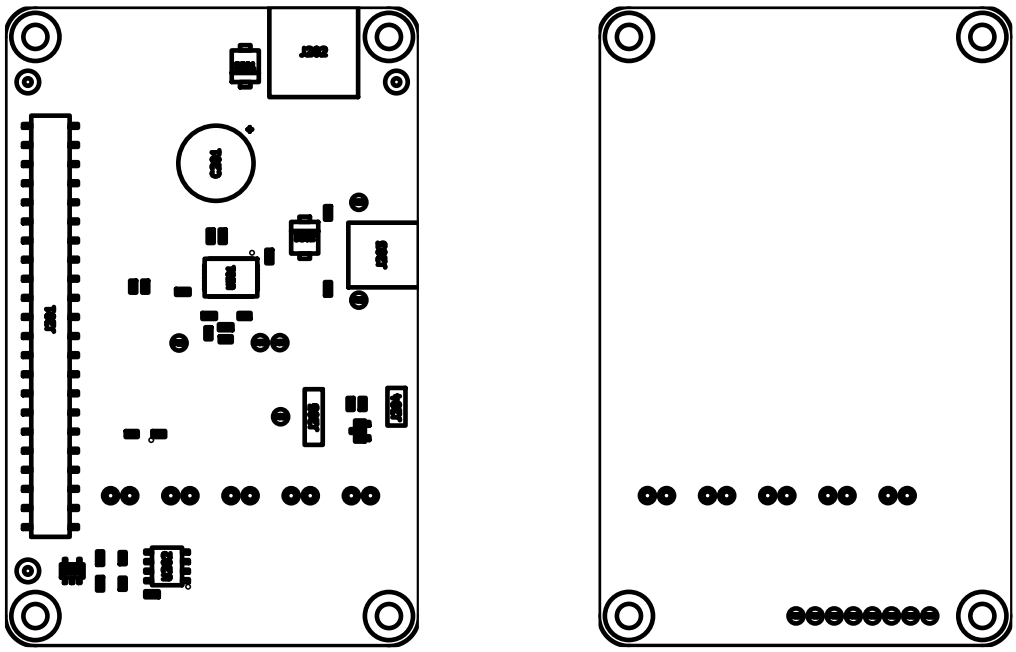


Figure 10. MAX22215-EVKIT Component Placement Guide—Top Silkscreen (left) and Bottom Silkscreen (right)

Revision History

REVISION NUMBER	REVISION DATE	DESCRIPTION	PAGES CHANGED
0	12/25	Initial release	—

Notes