

KTFRDMCD1020EVMUG

FRDMCD1020EVM Evaluation Board

Rev. 1 — 31 January 2018

User guide

1 FRDMCD1020EVM Evaluation Board

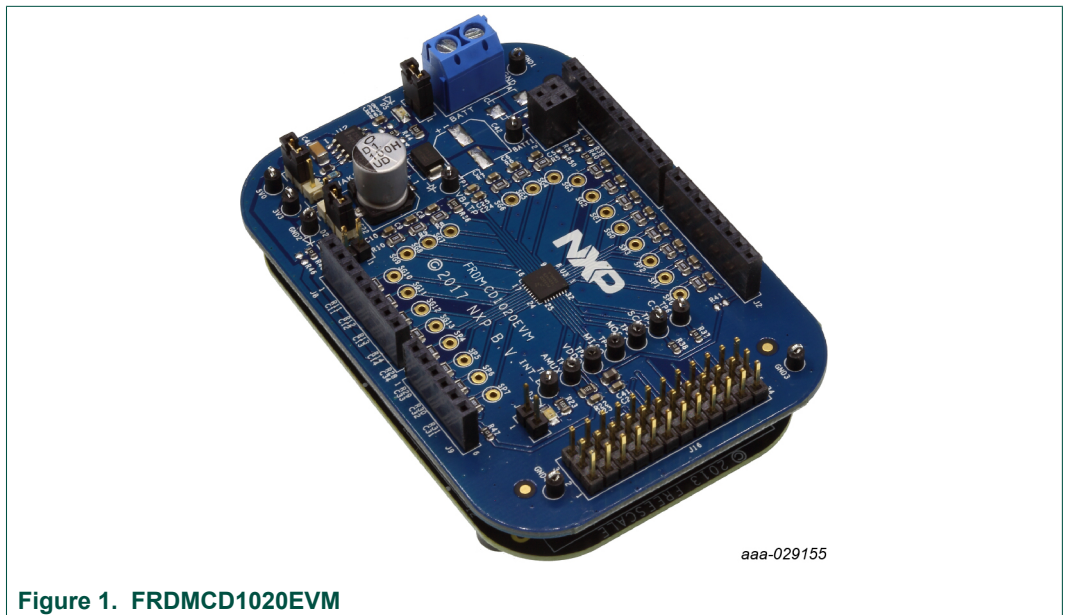


Figure 1. FRDMCD1020EVM



2 Important notice

NXP provides the enclosed product(s) under the following conditions:

This evaluation kit is intended for use of ENGINEERING DEVELOPMENT OR EVALUATION PURPOSES ONLY. It is provided as a sample IC pre-soldered to a printed circuit board to make it easier to access inputs, outputs, and supply terminals. This evaluation board may be used with any development system or other source of I/O signals by simply connecting it to the host MCU or computer board via off-the-shelf cables. This evaluation board is not a Reference Design and is not intended to represent a final design recommendation for any particular application. Final device in an application will be heavily dependent on proper printed circuit board layout and heat sinking design as well as attention to supply filtering, transient suppression, and I/O signal quality.

The goods provided may not be complete in terms of required design, marketing, and or manufacturing related protective considerations, including product safety measures typically found in the end product incorporating the goods. Due to the open construction of the product, it is the user's responsibility to take any and all appropriate precautions with regard to electrostatic discharge. In order to minimize risks associated with the customers applications, adequate design and operating safeguards must be provided by the customer to minimize inherent or procedural hazards. For any safety concerns, contact NXP sales and technical support services.

Should this evaluation kit not meet the specifications indicated in the kit, it may be returned within 30 days from the date of delivery and will be replaced by a new kit.

NXP reserves the right to make changes without further notice to any products herein. NXP makes no warranty, representation or guarantee regarding the suitability of its products for any particular purpose, nor does NXP assume any liability arising out of the application or use of any product or circuit, and specifically disclaims any and all liability, including without limitation consequential or incidental damages. Typical parameters can and do vary in different applications and actual performance may vary over time. All operating parameters, including Typical, must be validated for each customer application by customer's technical experts.

NXP does not convey any license under its patent rights nor the rights of others. NXP products are not designed, intended, or authorized for use as components in systems intended for surgical implant into the body, or other applications intended to support or sustain life, or for any other application in which the failure of the NXP product could create a situation where personal injury or death may occur.

Should the Buyer purchase or use NXP products for any such unintended or unauthorized application, the Buyer shall indemnify and hold NXP and its officers, employees, subsidiaries, affiliates, and distributors harmless against all claims, costs, damages, and expenses, and reasonable attorney fees arising out of, directly or indirectly, any claim of personal injury or death associated with such unintended or unauthorized use, even if such claim alleges NXP was negligent regarding the design or manufacture of the part.

NXP and the NXP logo are trademarks of NXP B.V. All other product or service names are the property of their respective owners. © NXP B.V. 2018.

3 Getting Started

The NXP analog product development boards provide an easy-to-use platform for evaluating NXP products. The boards support a range of analog, mixed-signal and power solutions. They incorporate monolithic integrated circuits and system-in-package devices that use proven high-volume technology. NXP products offer longer battery life, a smaller form factor, reduced component counts, lower cost and improved performance in powering state-of-the-art systems.

The tool summary page for FRDMCD1020EVM switch detection interface evaluation kit is located at www.nxp.com/FRDMCD1020EVM. The link provides access to overview information, documentation, software and tools for the FRDMCD1020EVM. The overview tab provides a device overview, list of device features, a description of the kit contents, links to any applicable supported devices and a **Get Started** section. The **Get Started** section provides links to everything needed to start using the device and contains the most relevant, current information applicable to the FRDMCD1020EVM evaluation kit.

1. Go to www.nxp.com/FRDMCD1020EVM
2. On the **Overview** tab, locate the **Jump To** navigation feature on the left side of the window.
3. Select the **Get Started** link or scroll in the main window of the **Overview** tab until the **Get Started** section is visible.
4. Review each entry in the **Get Started** section.
5. Download an entry by clicking on the linked title.

After reviewing the **Overview** tab, visit the other related tabs for additional information:

- **Documentation:** Download current documentation
- **Software & Tools:** Download current hardware and software tools
- **Buy/Parametrics:** Purchase the product and view the product parametrics.

After downloading files, review each file, including the user guide which includes setup instructions. If applicable, the bill of materials (BOM) and supporting schematics are also available for download in the **Get Started** section of the **Overview** tab.

3.1 Kit contents/packing list

The FRDMCD1020EVM development kit contents include:

- Assembled and tested FRDMCD1020EVM customer evaluation board/module and preprogrammed FRDM-KL25Z SPI Communication Board in an anti-static bag
- USB Male (standard) to USB Male (mini) cable
- Quick Start Guide

3.2 Required hardware and software

To use this kit, you need:

- Power supply 12 V with at least 1.0 A current capability
- KIT-SW33-EVB (optional) or any other type of ON-OFF switch to ground or switch to battery loads
- SPI Generator (SPIGen) software, version 7.1.8 or later, a Graphical User Interface (GUI)

3.3 System requirements

The kit requires the following to function properly with the software:

- Windows 10, Windows 8 or Window 7 compatible PC with an available USB port

4 Getting to know the hardware

4.1 Board overview

The FRDMCD1020EVM Evaluation Board (EVB) features the CD1020, a 22-channel switch detection interface with programmable wetting current. The kit is designed to detect the opening and closing of up to 22 switch contacts. The switch status, either open or closed, is transferred to the microprocessor unit (MCU) through a serial peripheral interface (SPI). The device also features a 22-to-1 analog multiplexer for reading the analog voltage at the inputs.

The analog input signal is buffered and provided on the AMUX output pin to be read by an external MCU. The CD1020 device has two modes of operation, Normal and Sleep. Normal mode allows programming of the device and supplies switch contacts with pull-up or pull-down current as it monitors switch change-of-state, while the sleep mode provides switch status detection with maximum power saving. The FRDMCD1020EVM can be controlled through a USB/SPI communication board (FRDM-KL25Z) connected to the PC's USB port. The NXP SPIGen (version 7.0 and above) program provides the user interface to the CD1020 SPI port and allows the user to program the configuration registers, send commands to the IC and receive status from the IC.

4.2 Board features

The board features include:

- CD1020 device with 22 channel switch detection and status report capability
- Single row interface connectors for the NXP FRDM-KL25Z pre-programmed communication board
- Status LEDs to report the status of the CD1020 Interrupt (INT) and Wake-up lines
- Single load connector with 36 pin, 100 MIL pin spacing for easy interface with external switch loads
- Direct connection to battery power with optional 3.3 V / 5.0 V LDO for VDDQ rail supply

4.3 Board description

[Figure 2](#) identifies important components on the FRDMCD1020EVM board and [Table 1](#) provides additional details on these components.

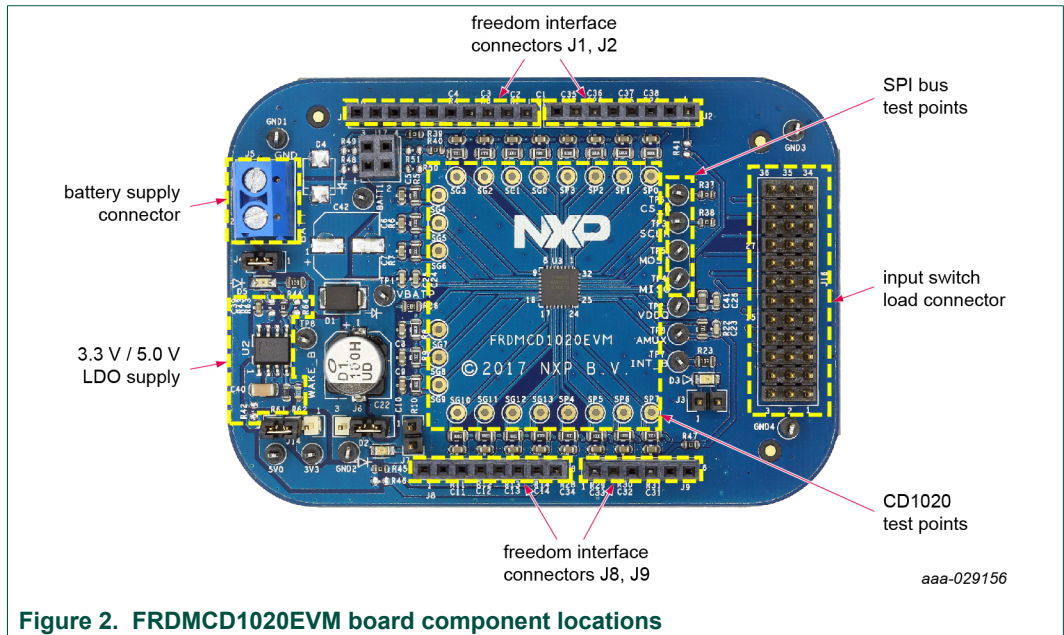


Figure 2. FRDMCD1020EVM board component locations

Table 1. Description of FRDMCD1020EVM board components

Name	Description
Battery supply connector	Provides direct connection to battery voltage and serves as the source for VBATP pin on the CD1020, which is protected against reverse voltage by the D1 Diode. Refer to Table 3 for details.
3.3 V/5.0 V LDO supply	The FRDMCD1020EVM provides an onboard LDO regulator to supply the VDDQ voltage during standalone applications. This LDO is optional, and can be disabled through jumper resistors for application where 3.3 V/5.0 V is supplied from the FRDM-KL25Z Board.
Input switch load connector	Provides access to the 22 SG/SP input pins as well as ground and battery voltage for direct interaction with the system loads. Refer to Table 3 for details.
Freedom interface connectors	J1, J2, J8 and J9 are single row connectors compatible with the Freedom/Arduino pin configuration. These provide access to the SPI communication pin, 3.3 V/5.0 V power supply from/to the Freedom board as well as access to I/Os in order to interface with the AMUX and INT_B on the CD1020. Refer to Table 3 for details.
SPI bus test points	The FRDMCD1020EVM provides easy access to the SPI signals in case external control is desired. SPI signals can be bypassed from the FRDM-KL25Z by changing the configuration of jumper resistors provided. Refer to Figure 5 and Table 4 for details.
CD1020 test points	The FRDMCD1020EVM provides access to all pins on the CD1020, including: VBATP, VDDQ, AMUX, WAKE_B, SPI pins and all SG/SP input pins. Refer to Figure 5 and Table 4 for details.

4.4 LED display

The FRDMCD1020EVM evaluation board contains three LEDs as visual indicators on the board. [Figure 3](#) identifies the location of the LEDs on the FRDMCD1020EVM board and [Table 2](#) describes the function of each LED.

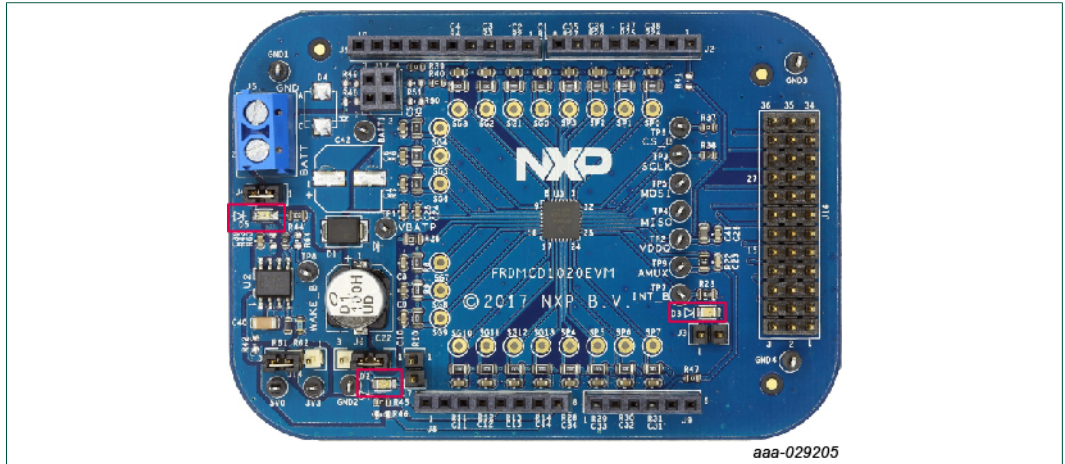


Figure 3. FRDMCD1020EVM board LED locations

Table 2. FRDMCD1020EVM board LED descriptions

Name	Description
D2 (WAKE_B LED)	When the external pull-up is selected on J6 while J7 is open, the LED light turns on when the device is in Normal mode.
D3 (INT_B LED)	The LED light turns on when an interrupt event has occurred. The LED light turns off when the INTflg is cleared.
D5 (BATTERY LED)	When J4 is shorted, LED D5 indicates the presence of battery voltage on connector J5.

4.5 Connectors

Figure 4 identifies connector locations on the FRDMCD1020EVM board which supply power, the ability to interface with programming logic or the ability to interface with the switch loads. Table 3 provides detail for each connector.

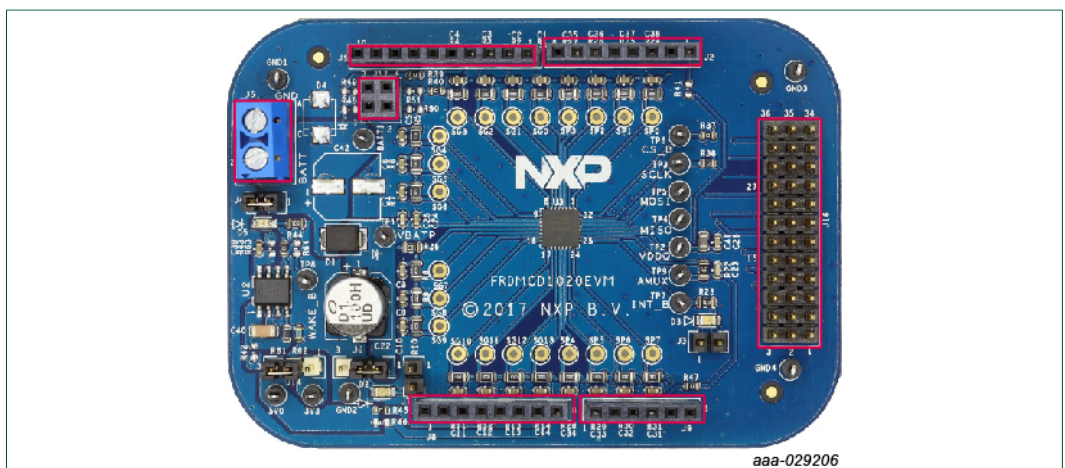


Figure 4. FRDMCD1020EVM board connector locations

Table 3. FRDMCD1020EVM board connector descriptions

Name	Type	Description										
J5	Supply	Battery supply connector (Operating voltage range from 4.5 V to 36 V)										
J16	Input switch connector	3 x 12 pin header for direct access to the 22 input channels. View the connector pinout on the KITCD1020EVM schematic in the Get Started section at http://www.nxp.com/CD1020 .										
J1, J2, J8, J9	Freedom interface connectors	Interface connector to FRDM-KL25Z board. Female top mount connector allows stacking up to 3 FRDMCD1020EVM evaluation boards for daisy chain configuration; long straight through male connector allows interfacing with the Freedom board on the bottom side. All NC pins are not used by the FRDMCD1020EVM evaluation board and may be used to interface other external signals on the system with the KL25Z MCU. Refer to the FRDM-KL25Z user guide on http://www.nxp.com/FRDM-KL25Z for more information of the signal allocation for the unused pins.										
J1	SPI communication interface to Freedom board	<table border="0"> <tr> <td>PIN 1 = NC^[1]</td> <td>PIN 6 = SCLK from MCU (bypass with R38)</td> </tr> <tr> <td>PIN 2 = NC</td> <td>PIN 7 = GND^[2]</td> </tr> <tr> <td>PIN 3 = CSB from MCU (bypass with R37)</td> <td>PIN 8 = NC</td> </tr> <tr> <td>PIN 4 = MOSI from MCU (bypass with R40)</td> <td>PIN 9 = NC</td> </tr> <tr> <td>PIN 5 = MISO to MCU (bypass with R39)</td> <td>PIN 10 = NC</td> </tr> </table>	PIN 1 = NC ^[1]	PIN 6 = SCLK from MCU (bypass with R38)	PIN 2 = NC	PIN 7 = GND ^[2]	PIN 3 = CSB from MCU (bypass with R37)	PIN 8 = NC	PIN 4 = MOSI from MCU (bypass with R40)	PIN 9 = NC	PIN 5 = MISO to MCU (bypass with R39)	PIN 10 = NC
PIN 1 = NC ^[1]	PIN 6 = SCLK from MCU (bypass with R38)											
PIN 2 = NC	PIN 7 = GND ^[2]											
PIN 3 = CSB from MCU (bypass with R37)	PIN 8 = NC											
PIN 4 = MOSI from MCU (bypass with R40)	PIN 9 = NC											
PIN 5 = MISO to MCU (bypass with R39)	PIN 10 = NC											
J2	INT_B interface	<table border="0"> <tr> <td>Pin 1 = INT_B to MCU</td> <td>Pin 5 = NC</td> </tr> <tr> <td>Pin 2 = NC</td> <td>Pin 6 = NC</td> </tr> <tr> <td>Pin 3 = NC</td> <td>Pin 7 = NC</td> </tr> <tr> <td>Pin 4 = NC</td> <td>Pin 8 = NC</td> </tr> </table>	Pin 1 = INT_B to MCU	Pin 5 = NC	Pin 2 = NC	Pin 6 = NC	Pin 3 = NC	Pin 7 = NC	Pin 4 = NC	Pin 8 = NC		
Pin 1 = INT_B to MCU	Pin 5 = NC											
Pin 2 = NC	Pin 6 = NC											
Pin 3 = NC	Pin 7 = NC											
Pin 4 = NC	Pin 8 = NC											
J8	Power lines	<table border="0"> <tr> <td>Pin 1 = NC</td> <td>Pin 5 = 5 V Supply from Freedom board</td> </tr> <tr> <td>Pin 2 = NC</td> <td>Pin 6 = GND</td> </tr> <tr> <td>Pin 3 = NC</td> <td>Pin 7 = GND</td> </tr> <tr> <td>Pin 4 = 3.3 V supply from Freedom board</td> <td>Pin 8 = 5 V supply to Freedom board</td> </tr> </table>	Pin 1 = NC	Pin 5 = 5 V Supply from Freedom board	Pin 2 = NC	Pin 6 = GND	Pin 3 = NC	Pin 7 = GND	Pin 4 = 3.3 V supply from Freedom board	Pin 8 = 5 V supply to Freedom board		
Pin 1 = NC	Pin 5 = 5 V Supply from Freedom board											
Pin 2 = NC	Pin 6 = GND											
Pin 3 = NC	Pin 7 = GND											
Pin 4 = 3.3 V supply from Freedom board	Pin 8 = 5 V supply to Freedom board											
J9	AMUX interface	<table border="0"> <tr> <td>Pin 1 = AMUX to MCU ADC</td> <td>Pin 4 = NC</td> </tr> <tr> <td>Pin 2 = NC</td> <td>Pin 5 = NC</td> </tr> <tr> <td>Pin 3 = NC</td> <td>Pin 6 = NC</td> </tr> </table>	Pin 1 = AMUX to MCU ADC	Pin 4 = NC	Pin 2 = NC	Pin 5 = NC	Pin 3 = NC	Pin 6 = NC				
Pin 1 = AMUX to MCU ADC	Pin 4 = NC											
Pin 2 = NC	Pin 5 = NC											
Pin 3 = NC	Pin 6 = NC											
J17	Daisy chain configuration	Provides an alternate configuration to stack up to three boards in a daisy chain configuration. Depending on the number of boards in the daisy chain, each board must use a different configuration of J17. Daisy chain up to three boards by connecting two or three boards, ensuring the J17 pins on the top board(s) mate into the J17 connectors of the lower boards. Complete a two-board configuration by shorting pins 1-2 in the J17 connector on the top board. Complete a three-board configuration by shorting pins 1-2 and pins 3-4 in the J17 connector on the top board.										

Name	Type	Description	
		<p>Two Board Daisy Chain</p> <p>Board #1</p> <ul style="list-style-type: none"> • MOSI_M - R40 - POP^[3] • MISO_M - R39 - DNP^[4] • R48 - POP • R49 - DNP • R50 - DNP • R51 - DNP <p>Board #2</p> <ul style="list-style-type: none"> • MOSI_M - R40 - DNP • MISO_M - R39 - POP • R48 - DNP • R49 - DNP • R50 - POP • R51 - DNP <p>J17 – 1-2 shorted on top board.</p>	<p>Three Board Daisy Chain</p> <p>Board #1</p> <ul style="list-style-type: none"> • MOSI_M - R40 - POP • MISO_M - R39 - DNP • R48 - POP • R49 - DNP • R50 - DNP • R51 - DNP <p>Board #2</p> <ul style="list-style-type: none"> • MOSI_M - R40 - DNP • MISO_M - R39 - DNP • R48 - DNP • R49 - POP • R50 - POP • R51 - DNP <p>Board #3</p> <ul style="list-style-type: none"> • MOSI_M - R40 - DNP • MISO_M - R39 - POP • R48 - DNP • R49 - DNP • R50 - DNP • R51 - POP <p>J17 – 1-2 and 3-4 shorted on top board</p>

- [1] NC - No Connect
- [2] GND - Ground
- [3] POP - Populate
- [4] DNP - Do not populate

4.6 Test point definitions

[Figure 5](#) identifies the test points on the FRDMCD1020EVM board. [Table 4](#) provides a description of the test point functionality.

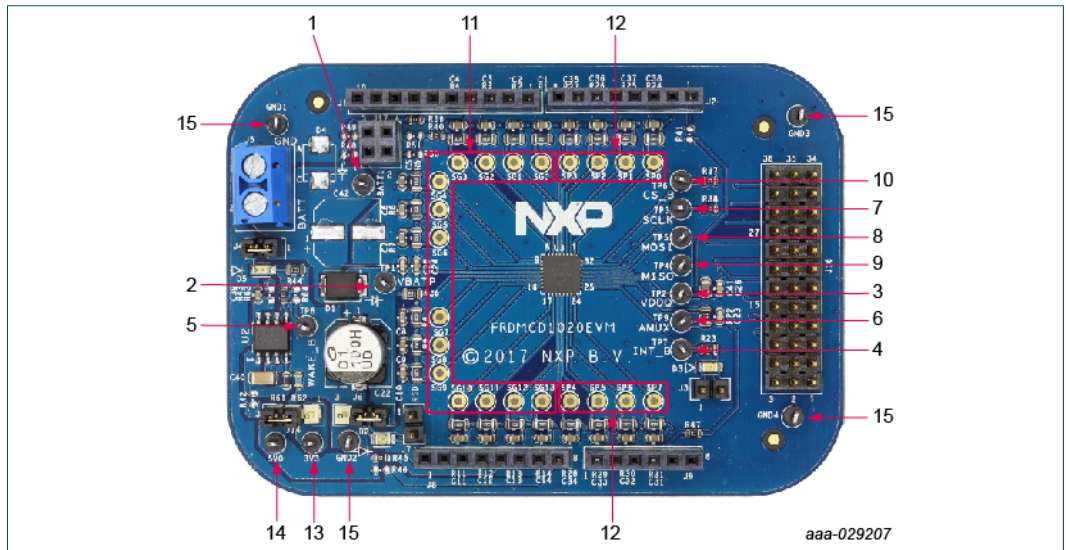


Figure 5. FRDMCD1020EVM board test point locations

Table 4. FRDMCD1020EVM board test point descriptions

ID	Schematic Label	Description
1	BATT1	Battery supply
2	VBATP	CD1020 input supply pin
3	VDDQ	Logic supply voltage
4	INT_B	I/O interrupt pin
5	WAKE_B	I/O wake-up pin
6	AMUX	Analog multiplexer output pin
7	SCLK	SPI serial clock
8	MOSI	SPI Master out - Slave in
9	MISO	SPI Master In - Slave Out
10	CS_B	SPI chip select
11	SGx	SG input pin test pad (connected directly to pin)
12	SPx	SP input pin test pad (connected directly to pin)
13	3V3	3.3 V supply from Freedom board
14	5V0	5.0 V supply from/to Freedom board
15	GNDx	Ground reference (4x)

4.7 Jumper definitions

[Figure 6](#) identifies jumper locations on the FRDMCD1020EVM evaluation board and [Table 5](#) describes their function.

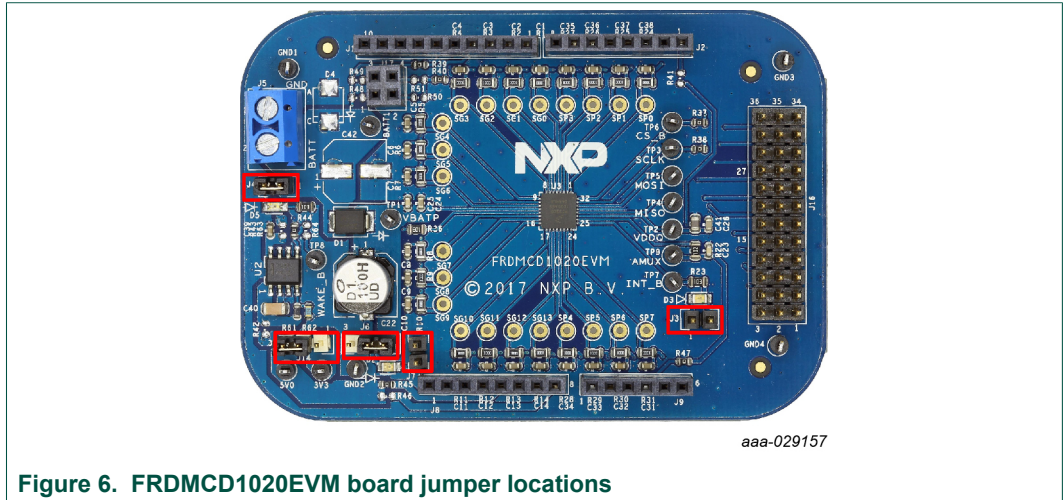


Figure 6. FRDMCD1020EVM board jumper locations

Table 5. FRDMCD1020EVM board jumper descriptions

Name	Default	Description
J3	Open	INT_B LED bypass jumper (short to bypass LED D5)
J4	Close	Battery voltage LED. Short to enable LED indicator when battery is connected on J5
J7	Open	WAKE_B LED bypass jumper. (short to bypass the LED D2)
J6	1-2	WAKE_B pull-up selector Short position 1-2 to select VBATP as pull-up voltage Short position 2-3 to select VDDQ as pull-up voltage
J14	2-3	VDDQ supply selector from FRDM-KL25Z communication board Short position 1-2 for 3.3 V VDDQ supply Short position 2-3 for 5.0 V VDDQ supply

4.8 Evaluation board schematic, board layout and bill of materials

The current evaluation board schematic, board layout and bill of materials are available at www.nxp.com/FRDMCD1020EVM on the **Overview** tab under **Get Started**.

5 Accessory boards

5.1 FRDM-KL25Z communication interface board

The FRDMCD1020EVM is designed to be used with the FRDM-KL25Z Freedom Board, which is pre-programmed to provide a USB-to-SPI communication interface. The main function of the FRDM-KL25Z is to provide serial communication from a PC environment (SPIGen) to control all features on the FRDMCD1020EVM Evaluation Board. However, the FRDM-KL25Z can also be used as system processor to create stand-alone applications interacting with the FRDMCD1020EVM.

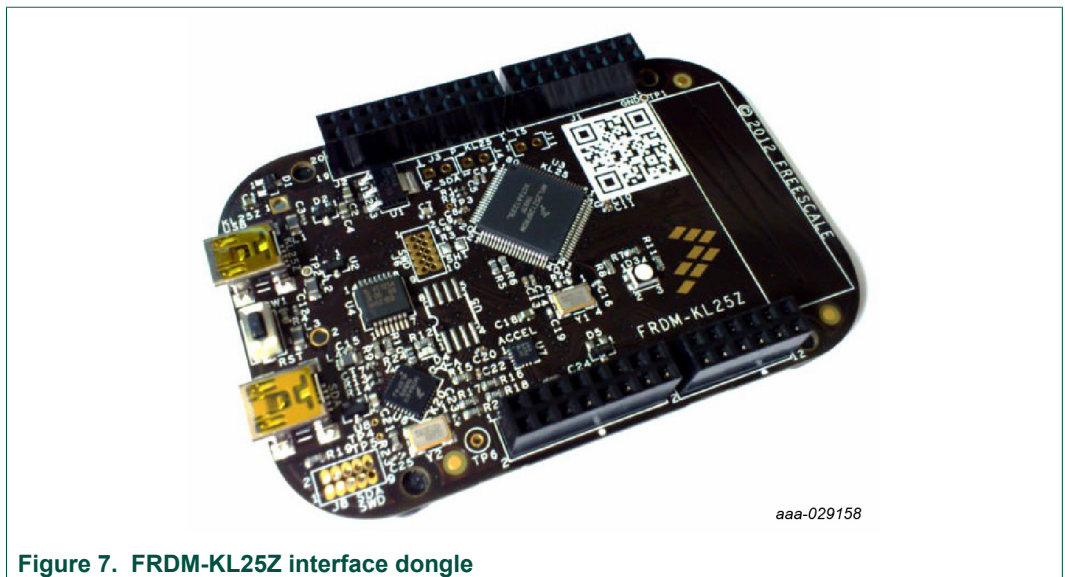


Figure 7. FRDM-KL25Z interface dongle

5.1.1 Connecting the FRDM-KL25Z communication interface board

A typical connection of the FRDM-KL25Z communication interface board to the FRDMCD1020EVM evaluation board is done by directly stacking the FRDMCD1020EVM on the Freedom/Arduino Interface connectors as shown in [Figure 8](#).

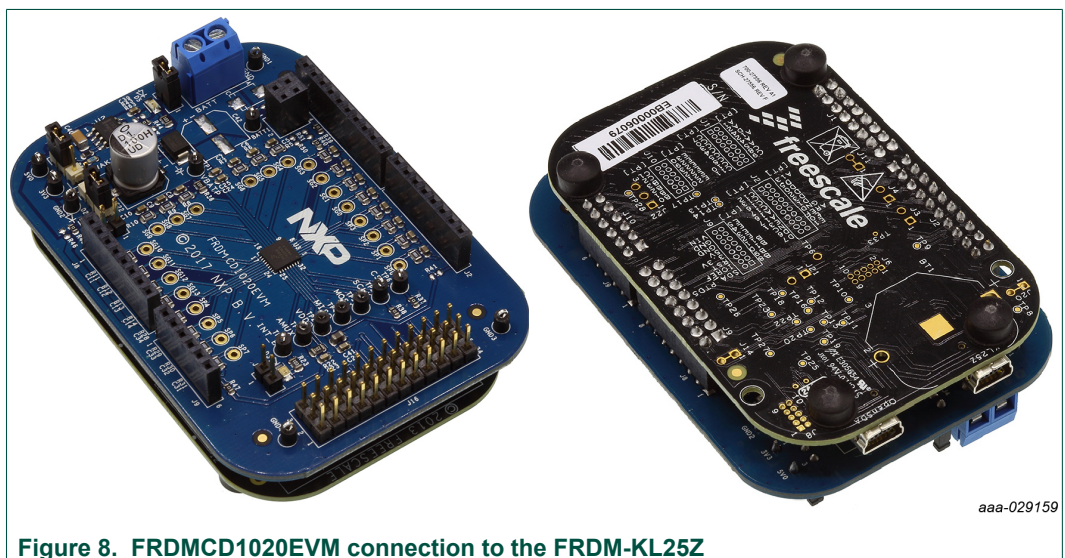


Figure 8. FRDMCD1020EVM connection to the FRDM-KL25Z

5.2 KIT-SW33-EVB switch board (optional)

The optional KIT-SW33-EVB switch board is a fully populated switch board with 33 dip switches to allow closure to GND or battery voltage on the input channels. The KIT-SW33-EVB switch board also provides a 36-pin interface connector to provide easy access to all 22 input channels, including the input protection R/C network on the FRDMCD1020EVM evaluation board. The KIT-SW33-EVB switch board connects to J16 on the FRDMCD1020EVM evaluation board as shown in [Figure 9](#).

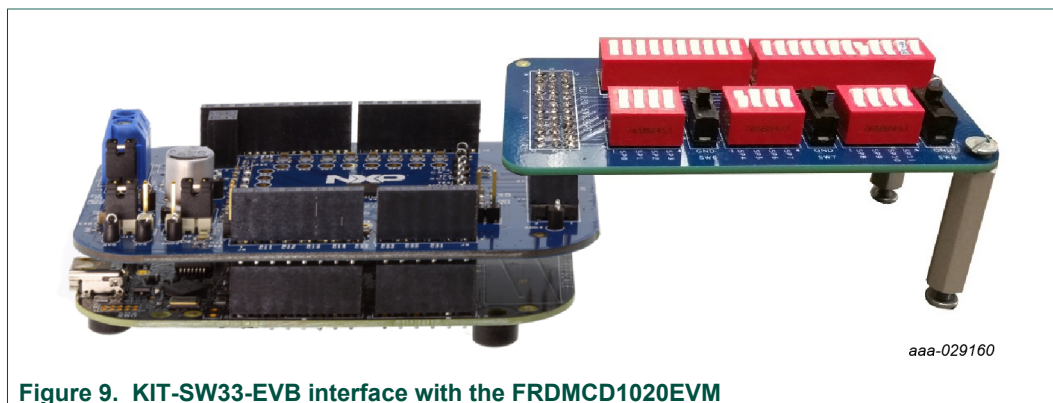


Figure 9. KIT-SW33-EVB interface with the FRDMCD1020EVM

Use switches SW1 and SW2 to connect or disconnect the SG pins to the FRDMCD1020EVM ground, or an external voltage level set on the SW_SG test point.

Switches SW3, SW4, and SW5, allow connection to FRDMCD1020EVM ground/battery and/or external voltage level applied to BATT_IN test point, as selected by J2. Ground or battery level selection on the SP channels is done in three independent banks of four channels each, controlled by SW6, SW7, and SW8 SPDT switches respectively.

The KIT-SW33-EVB switch board is compatible with other evaluation platforms. If the signals on KIT-SW33-EVB are not used by FRDMCD1020EVM, ignore the corresponding buttons. Refer to www.nxp.com/FRDMCD1020EVM on the **Overview** tab under **Get Started** for the FRDMCD1020EVM evaluation board schematic and the KIT-SW33-EVB adapter board schematic.

6 Configuring the hardware

Figure 10 presents an example hardware configuration incorporating a PC, power supply, the FRDMCD1020EVM evaluation kit boards and a KIT-SW33-EVB switch board. The SPI communication traffic travels through a male-to-male USB cable (not shown) between the PC and the FRDM-KL25Z communication board.

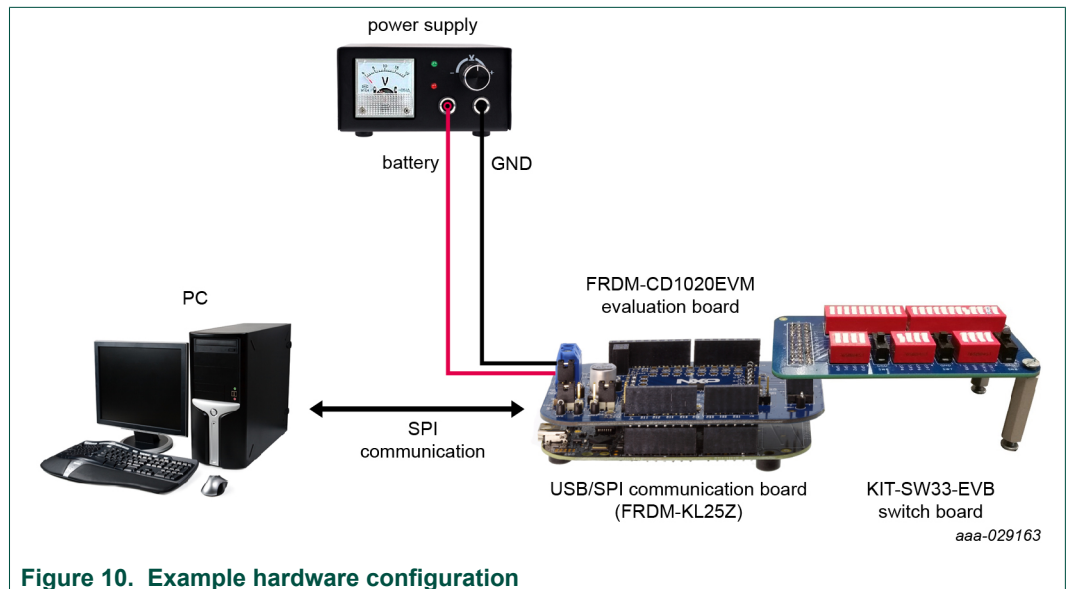


Figure 10. Example hardware configuration

6.1 Step-by-step hardware setup instructions to use SPIGen

To start working with the FRDMCD1020EVM, the following connections and setup must be performed:

1. Mount the FRDMCD1020EVM on top of the FRDM-KL25Z communication board.
2. (Optional) If using the optional KIT-SW33-EVB switch board, mount the KIT-SW33-EVB switch board to the J16 connector of the FRDMCD1020EVM evaluation board.
3. Plug the USB cable mini connector end into the FRDM-KL25Z communication board.
4. Plug the USB cable standard connector end into the computer.
5. With power turned off, attach a DC power supply to FRDMCD1020EVM.
6. Attach loads to the FRDMCD1020EVM board output terminals as desired.
7. Turn on the power supply. The LED labeled D5 lights up.

7 Software installation and setup

7.1 Installing SPIGen on your computer

The latest version of SPIGen is designed to run on any Windows 10, Windows 8 or Windows 7 operating system. To download and install the software:

1. Go to <http://www.nxp.com/SPIGEN>.
2. On the **Overview** tab, select the **Download** button or click on the **Downloads** tab to open the SPIGen **Downloads** page.
3. Select the software link for SPIGen 7.x.x or click the **Download** button next to the software version.
4. Read the NXP Semiconductor Software Licence Agreement and select either **I Accept** or **Decline**.
5. Click the **I Accept** button to open the SPIGen Software - Windows Application page. The software package immediately begins downloading. If the software package does not automatically download, click the **Download** button on this page.
6. Run the install program. The installation wizard guides the user through the rest of the process.

7.2 Launching the SPIGen GUI on your computer

The SPIGen GUI provides embedded support for some NXP devices, eliminating the need to load a configuration file to communicate with a specific device. CD1020 is supported in the latest version of the SPIGen software. To launch and start using the SPIGen software:

1. Locate the SPIGen program under Windows Start→Programs→SPIGen.
2. Click on the SPIGen icon. The SPI Generator GUI opens
3. Locate the CD1020 folder in the **Device View** window of the GUI.
4. Click to expand the CD1020 folder and view the CD1020 configuration registers.

7.3 SPIGen GUI interface overview

The SPIGen GUI is divided into three major sections:

- **SPI Words:** The **SPI Words** window provides the latest SPI word sent and received in RAW format (32-bit).
- **Device View:** The **Device View** window provides a list of devices supported by the SPIGen software.
- **Command View:** The **Command View** is the window area located to the right of **Device View**. The **Command View** provides access to all functions and commands for each CD1020 page in the **Device View**.

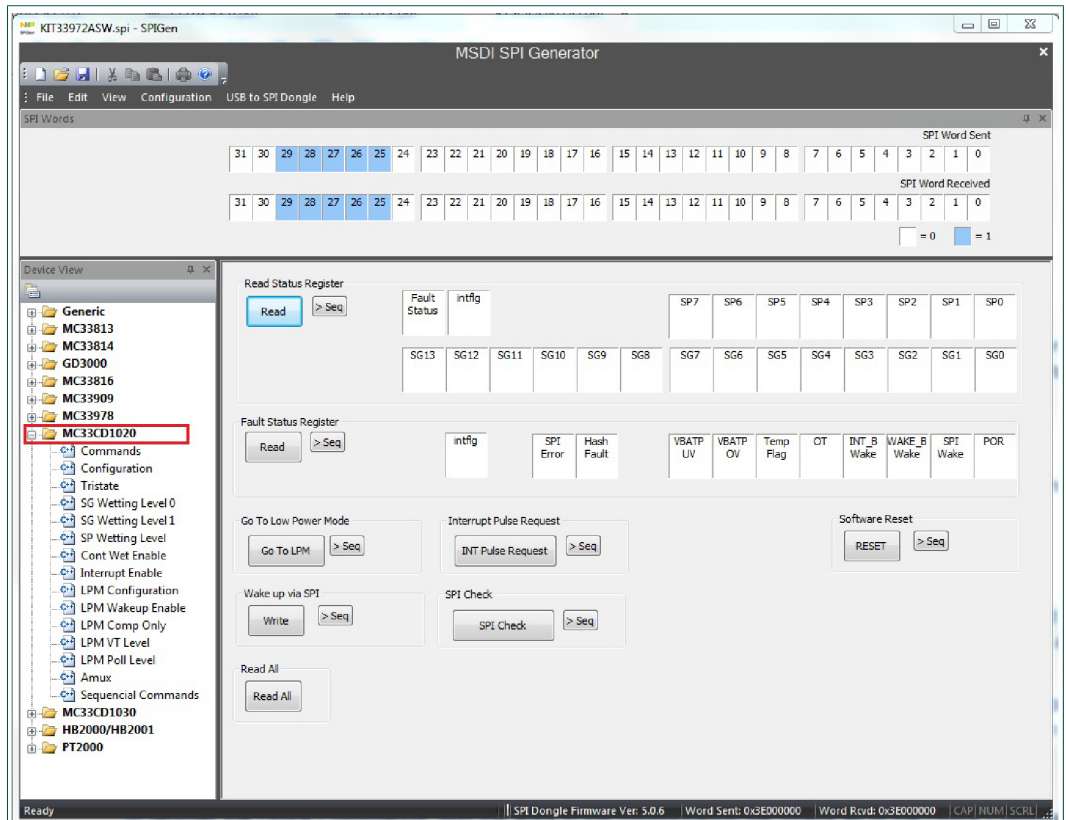


Figure 11. SPIGen GUI

7.4 Understanding the SPIGen GUI Interface

Before starting communication with the FRDMCD1020EVM, it is important to understand the full duplex nature of the SPI communication protocol.

During each SPI clock cycle, a full duplex data transmission occurs:

- the master sends a bit on the MOSI line; the slave reads it from that same line
- the slave sends a bit on the MISO line; the master reads it from that same line

Not all transmissions require all four of these operations to be meaningful, but they do happen. This means when the master sends a configuration command [A] through the MOSI pin, the actual data received on the MISO pin is the value for the transaction made in the previous SPI request. This in turns means the user sees the result to the command [A] on the MISO response of the next SPI transaction [B], as depicted in [Figure 12](#).

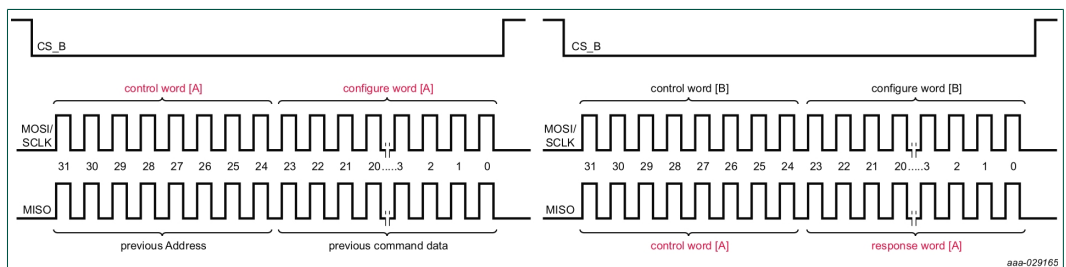


Figure 12. Full duplex SPI transaction example

Due to the full duplex nature of the protocol, when using the SPIGen GUI, the user should send the command twice in order to see the actual response to the request sent.

7.4.1 Reading/writing an SPI register

The CD1020 SPI register map is confirmed by 26 functional registers which can be read-only, write-only, or read and write. For more detail on the organization and register definition, refer to the CD1020 Data Sheet. The SPIGen GUI provides an easy way to configure and read each one of the registers. [Figure 13](#) presents the Device Configuration Register in the SPIGen GUI.

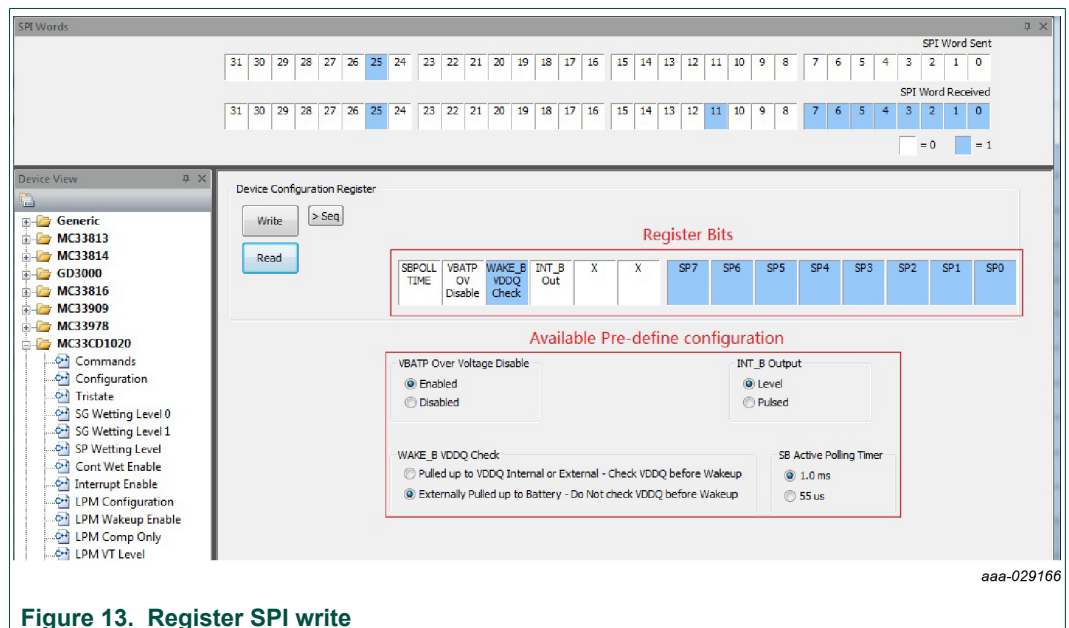


Figure 13. Register SPI write

To write a configuration register / command:

- Click on the corresponding command page
- Click to highlight and set the register bits to 1 or click to clear the highlight and set the register bit to 0. Users may also select any available, pre-defined configuration options.
- Click the **Write** button to send the SPI command

To read the value of a specific register:

- Click the **Read** button twice.

The current value is populated on the raw register bits. The SPIGen GUI writes or reads registers according to the register's properties. Therefore, if a register is read-only, SPIGen does not provide a predefined way to write to that register. [Figure 14](#) presents the Read Status register, an example of a read-only register on the CD1020. Notice that SPIGen displays only the **Read** button.



Figure 14. Read only register example

7.4.2 Creating sequential scripts

The SPIGen GUI provides a way to create, save and load scripts with a sequence of commands for quick configuration. To add commands to the **Sequential Script Command** page:

1. Select a device register from the **Device View** of the GUI.
2. In the **Command View**, set the configuration bits as desired.
3. In the **Command View**, click on the **>Seq** button

The configuration is added to the list of sequential commands in the **Sequential Script Command** window in the order each configuration was entered, see [Figure 15](#).

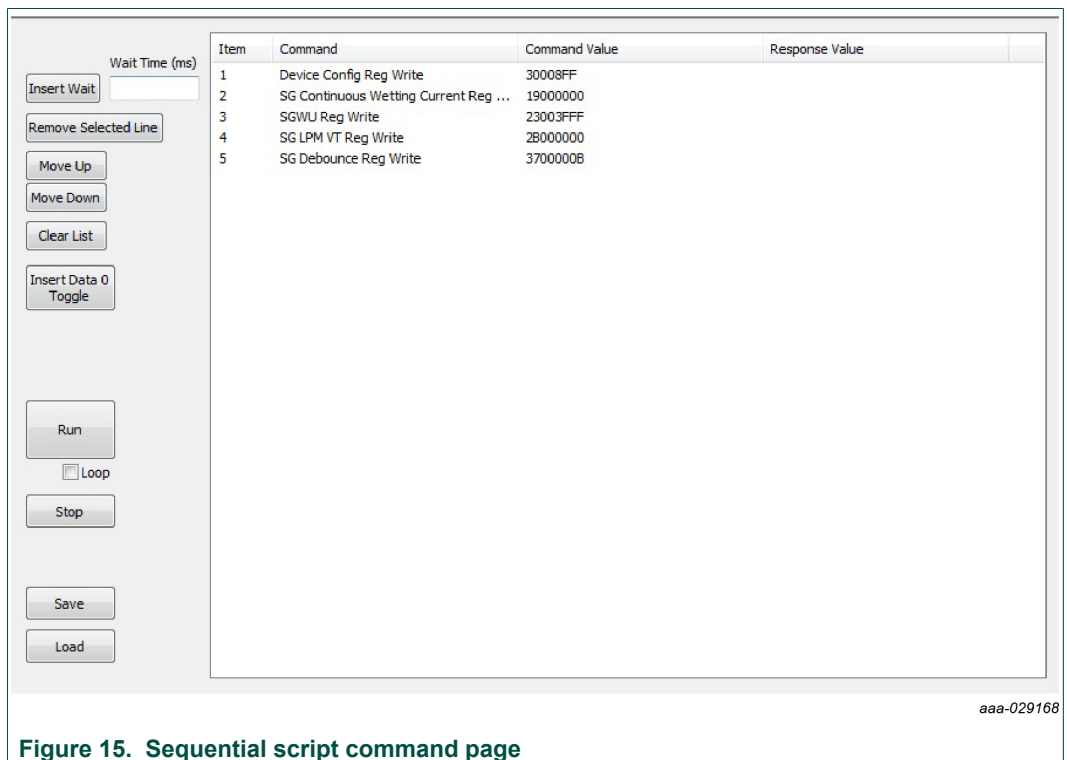


Figure 15. Sequential script command page

The sequential script command page organizes and creates various functions within the script by using the functionality of the following buttons.

- **Insert Wait:** Inserts a defined delay before the next command
- **Remove Selected line:** Deletes the selected line from the script
- **Move Up/Down:** Shift the selected command one place up or down
- **Clear List:** Deletes all lines from the script window
- **Insert Data 0 Toggle:** Not Used on FRDMCD1020EVM

- **Run:** Starts the script as a single or loop sequence
- **Loop:** Enables the looping sequence mode to repeat the script indefinitely
- **Stop:** Ends the script before it is over
- **Save:** Saves the current configuration into a .txt file
- **Load:** Loads a previous configuration from a file

7.4.3 Sending customized SPI commands

The SPIGen GUI sends customized 32-bit SPI words for debugging or any other special use with the CD1020.

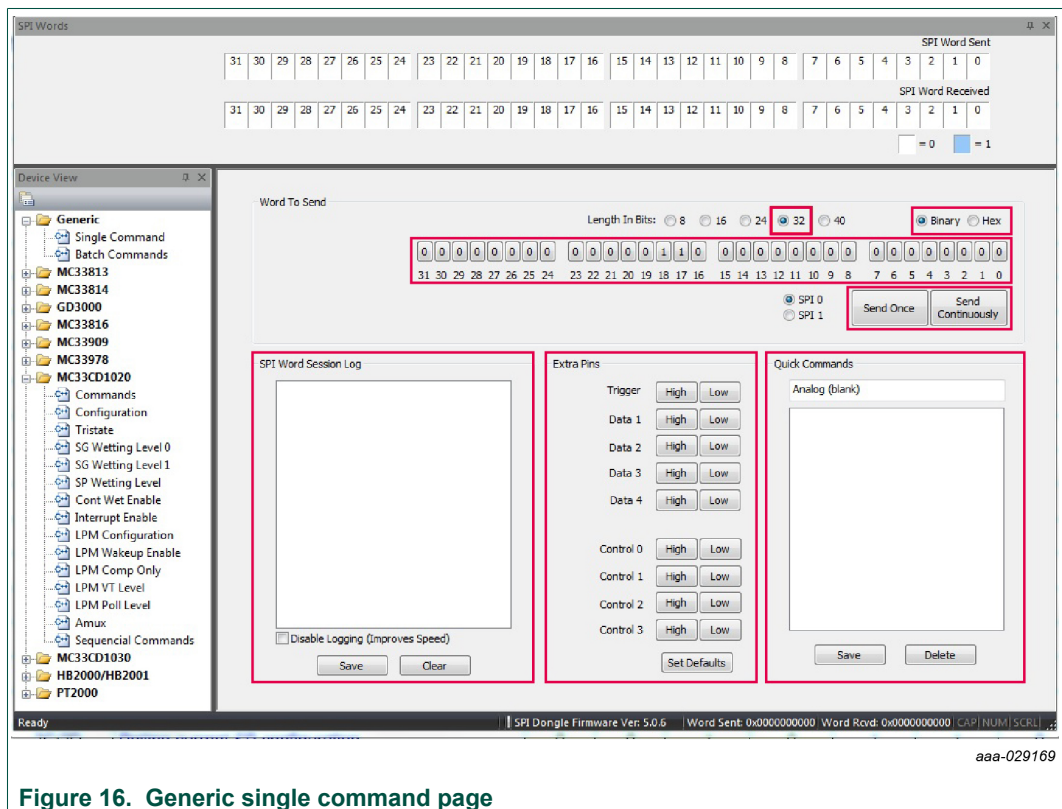


Figure 16. Generic single command page

- From the **Generic** folder in the **Device View**, select the **Single Command** page.
- In the **Command View**:
 - Using the **Length in Bits** radio buttons, choose the 32-bit length.
 - SPIGen supports binary or hexadecimal number systems. Choose the radio button for either **Binary** or **Hex** number system.
 - Set any of the 32 bits to high or low as desired.
 - Click the **Send Once** button or **Send Continuously** button to send the selected word through SPI.
- The **SPI Word Session Log** frame, shows the history of commands sent. The **SPI Word Session Log** has the following optional user specified choices:
 - Click the **Disable Logging** box to improve performance.
 - Click the **Save** button to save the session log to a file.
 - Use the **Clear** button to erase the session log.
- The **Extra pins** area sets the extra control/data I/Os to high or low, as provided by the FRDM-KL25Z I/O ports. Note that not all signals may be usable as input or output

with the FRDMCD1020EVM. Ensure your understanding of each pin function on the CD1020 before applying high or low to these pins.

- The **Quick Commands** frame allows for the creation of customized commands. The commands are saved for quick access during the current session. To save a quick command:
 1. Set the 32-bit word to be saved.
 2. Enter a name on the header frame.
 3. Click the **Save** button. Any new commands added are listed below the header frame.
 4. Use the **Delete** button to erase commands in the **Quick Commands** frame.

8 References

Information on related NXP products and application solutions may be found at:

Table 6. URLs for NXP product and application solutions support pages

NXP.com Support Pages	Description	URL
FRDMCD1020EVM	Tool overview page, Get Started section	www.nxp.com/ FRDMCD1020EVM
CD1020	Product overview page	www.nxp.com/CD1020
FRDM-KL25Z	Product overview page, Get Started section	www.nxp.com/FRDM-KL25Z
SPIGen	Software	www.nxp.com/SPIGEN

9 Revision history

Revision	Date	Description
v.1	20180131	Initial release

10 Legal information

10.1 Definitions

Draft — The document is a draft version only. The content is still under internal review and subject to formal approval, which may result in modifications or additions. NXP Semiconductors does not give any representations or warranties as to the accuracy or completeness of information included herein and shall have no liability for the consequences of use of such information.

10.2 Disclaimers

Limited warranty and liability — Information in this document is believed to be accurate and reliable. However, NXP Semiconductors does not give any representations or warranties, expressed or implied, as to the accuracy or completeness of such information and shall have no liability for the consequences of use of such information. NXP Semiconductors takes no responsibility for the content in this document if provided by an information source outside of NXP Semiconductors. In no event shall NXP Semiconductors be liable for any indirect, incidental, punitive, special or consequential damages (including - without limitation - lost profits, lost savings, business interruption, costs related to the removal or replacement of any products or rework charges) whether or not such damages are based on tort (including negligence), warranty, breach of contract or any other legal theory. Notwithstanding any damages that customer might incur for any reason whatsoever, NXP Semiconductors' aggregate and cumulative liability towards customer for the products described herein shall be limited in accordance with the Terms and conditions of commercial sale of NXP Semiconductors.

Right to make changes — NXP Semiconductors reserves the right to make changes to information published in this document, including without limitation specifications and product descriptions, at any time and without notice. This document supersedes and replaces all information supplied prior to the publication hereof.

Applications — Applications that are described herein for any of these products are for illustrative purposes only. NXP Semiconductors makes no representation or warranty that such applications will be suitable for the specified use without further testing or modification. Customers are responsible for the design and operation of their applications and products using NXP Semiconductors products, and NXP Semiconductors accepts no liability for any assistance with applications or customer product design. It is customer's sole responsibility to determine whether the NXP Semiconductors product is suitable and fit for the customer's applications and products planned, as well as for the planned application and use of customer's third party customer(s). Customers should provide appropriate design and operating safeguards to minimize the risks associated with their applications and products. NXP Semiconductors does not accept any liability related to any default, damage, costs or problem which is based on any weakness or default in the customer's applications or products, or the application or use by customer's third party customer(s). Customer is responsible for doing all necessary testing for the customer's applications

and products using NXP Semiconductors products in order to avoid a default of the applications and the products or of the application or use by customer's third party customer(s). NXP does not accept any liability in this respect.

Suitability for use in automotive applications — This NXP Semiconductors product has been qualified for use in automotive applications. Unless otherwise agreed in writing, the product is not designed, authorized or warranted to be suitable for use in life support, life-critical or safety-critical systems or equipment, nor in applications where failure or malfunction of an NXP Semiconductors product can reasonably be expected to result in personal injury, death or severe property or environmental damage. NXP Semiconductors and its suppliers accept no liability for inclusion and/or use of NXP Semiconductors products in such equipment or applications and therefore such inclusion and/or use is at the customer's own risk.

Export control — This document as well as the item(s) described herein may be subject to export control regulations. Export might require a prior authorization from competent authorities.

Evaluation products — This product is provided on an "as is" and "with all faults" basis for evaluation purposes only. NXP Semiconductors, its affiliates and their suppliers expressly disclaim all warranties, whether express, implied or statutory, including but not limited to the implied warranties of non-infringement, merchantability and fitness for a particular purpose. The entire risk as to the quality, or arising out of the use or performance, of this product remains with customer. In no event shall NXP Semiconductors, its affiliates or their suppliers be liable to customer for any special, indirect, consequential, punitive or incidental damages (including without limitation damages for loss of business, business interruption, loss of use, loss of data or information, and the like) arising out of the use of or inability to use the product, whether or not based on tort (including negligence), strict liability, breach of contract, breach of warranty or any other theory, even if advised of the possibility of such damages. Notwithstanding any damages that customer might incur for any reason whatsoever (including without limitation, all damages referenced above and all direct or general damages), the entire liability of NXP Semiconductors, its affiliates and their suppliers and customer's exclusive remedy for all of the foregoing shall be limited to actual damages incurred by customer based on reasonable reliance up to the greater of the amount actually paid by customer for the product or five dollars (US\$5.00). The foregoing limitations, exclusions and disclaimers shall apply to the maximum extent permitted by applicable law, even if any remedy fails of its essential purpose.

Translations — A non-English (translated) version of a document is for reference only. The English version shall prevail in case of any discrepancy between the translated and English versions.

10.3 Trademarks

Notice: All referenced brands, product names, service names and trademarks are the property of their respective owners.

Tables

Tab. 1.	Description of FRDMCD1020EVM board components	6	Tab. 4.	FRDMCD1020EVM board test point descriptions	10
Tab. 2.	FRDMCD1020EVM board LED descriptions	7	Tab. 5.	FRDMCD1020EVM board jumper descriptions	11
Tab. 3.	FRDMCD1020EVM board connector descriptions	8	Tab. 6.	URLs for NXP product and application solutions support pages	21

Figures

Fig. 1.	FRDMCD1020EVM	1	Fig. 8.	FRDMCD1020EVM connection to the	
Fig. 2.	FRDMCD1020EVM board component		FRDM-KL25Z		12
	locations	6	Fig. 9.	KIT-SW33-EVB interface with the	
Fig. 3.	FRDMCD1020EVM board LED locations	7	FRDMCD1020EVM		13
Fig. 4.	FRDMCD1020EVM board connector		Fig. 10.	Example hardware configuration	14
	locations	7	Fig. 11.	SPIGen GUI	16
Fig. 5.	FRDMCD1020EVM board test point		Fig. 12.	Full duplex SPI transaction example	16
	locations	10	Fig. 13.	Register SPI write	17
Fig. 6.	FRDMCD1020EVM board jumper locations	11	Fig. 14.	Read only register example	18
Fig. 7.	FRDM-KL25Z interface dongle	12	Fig. 15.	Sequential script command page	18
			Fig. 16.	Generic single command page	19