Document Number: KT34932UG
Rev. 1.0, 6/2015

KIT34932SEKEVB Evaluation Board

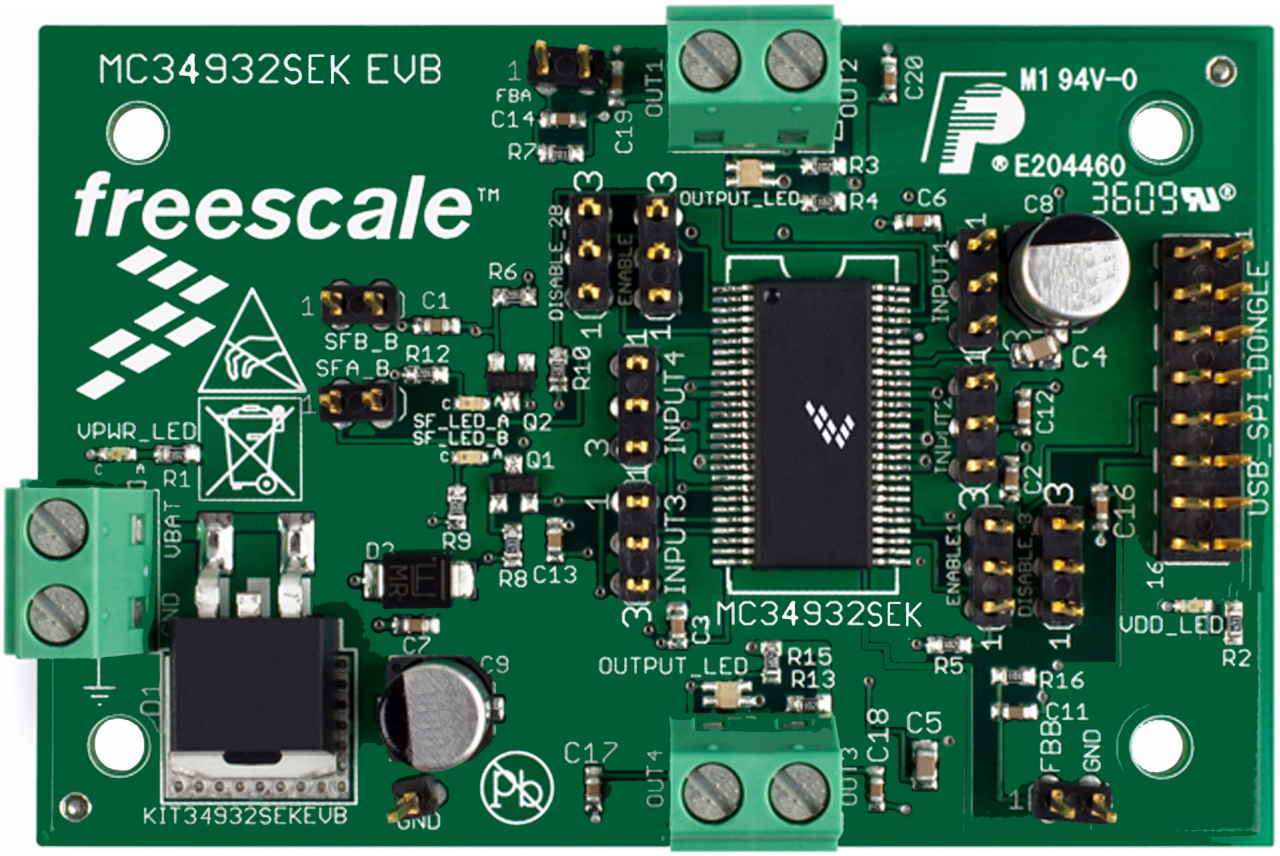


Figure 1. KIT34932SEKEVB Evaluation Board

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1 Important Notice

Freescale 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 Freescale 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.

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2 Getting Started

2.1 Kit Contents/Packing List

The KIT34932SEKEVB contents include:

- Assembled and tested evaluation board/module in anti-static bag.
- Warranty card

2.2 Jump Start

Freescale's analog product development boards help to easily evaluate Freescale products. These tools support analog mixed signal and power solutions including monolithic ICs using proven high-volume SMARTMOS mixed signal technology, and system-in-package devices utilizing power, SMARTMOS and MCU dies. Freescale products enable longer battery life, smaller form factor, component count reduction, ease of design, lower system cost and improved performance in powering state of the art systems.

- Go to www.freescale.com/KIT34932SEKEVB
- Review your Tool Summary Page
- Look for



- Download documents, software and other information

Once the files are downloaded, review the user guide in the bundle. The user guide includes setup instructions, BOM and schematics. Jump start bundles are available on each tool summary page with the most relevant and current information. The information includes everything needed for design.

2.3 Required Equipment and Software

To use this kit, you need:

- DC Power supply: 5.0 V to 36 V
- USB Standard-A to Standard A Cable
- 16-bit ribbon cable, female-to-female
- SPIGen Software with KITUSBSPIDGLVME: http://www.freescale.com/spigen

2.4 System Requirements

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

- Windows® XP, Windows 7, or Vista in 32-bit and 64-bit versions

3 Getting to Know the Hardware

3.1 Board Overview

The KIT34932SEKEVB Evaluation Board (EVB) is an easy-to-use circuit board allowing the user to exercise all the functions of the MC34932 H-Bridge circuit. The EVB parallel input can be easily controlled through a USB/SPI Dongle connected to a PC's USB port. The Freescale SPIGen program provides the User Interface to the USB/SPI Dongle and allows the user to send commands to the IC.

3.2 Board Features

KIT34932SEKEVB board provides a means of evaluating all of the functions available in Freescale's MC34932SEK device. The board features the following.

- Compatibility with Freescale's SPI Dongle, KITUSBSPIDGLEVME
- Built in reverse battery protection.
- Jumpers to configure the device and use all the features.
- LEDs to indicate the supply status, motor direction and fault.
- A transient voltage suppressor to handle system level voltage transients.

3.3 Device Features

This evaluation board features the following Freescale product:

Table 1. Features

Device	Description	Features
MC34932	Dual 5.0 A H-Bridge	• 5.0 V to 36 V continuous with 24 V nominal operating voltage (transient operation from 5.0 V to 40 V) • 235 mΩ maximum $R_{DS(on)}$ at T_J = 150 °C (each H-Bridge MOSFET) • 3.0 V and 5.0 V TTL/CMOS logic compatible inputs • Output short-circuit protection (short to VPWR or GND) • Overcurrent limiting (regulation) via internal constant-off-time PWM • Temperature dependant current limit threshold reduction to allow for continuous operation without shut-down • All inputs have an internal source/sink to define the default (floating input) states • Sleep mode with current draw < 20 µA (each half with inputs floating or set to match default logic states)

3.4 Board Description

This EVB consists of a Dual H-Bridge, a parallel interface, power conditioning circuitry, and a set of 8 Input Select Jumpers. All +5.0 volt V_{DD} power required by the EVB is obtained via the parallel interface.

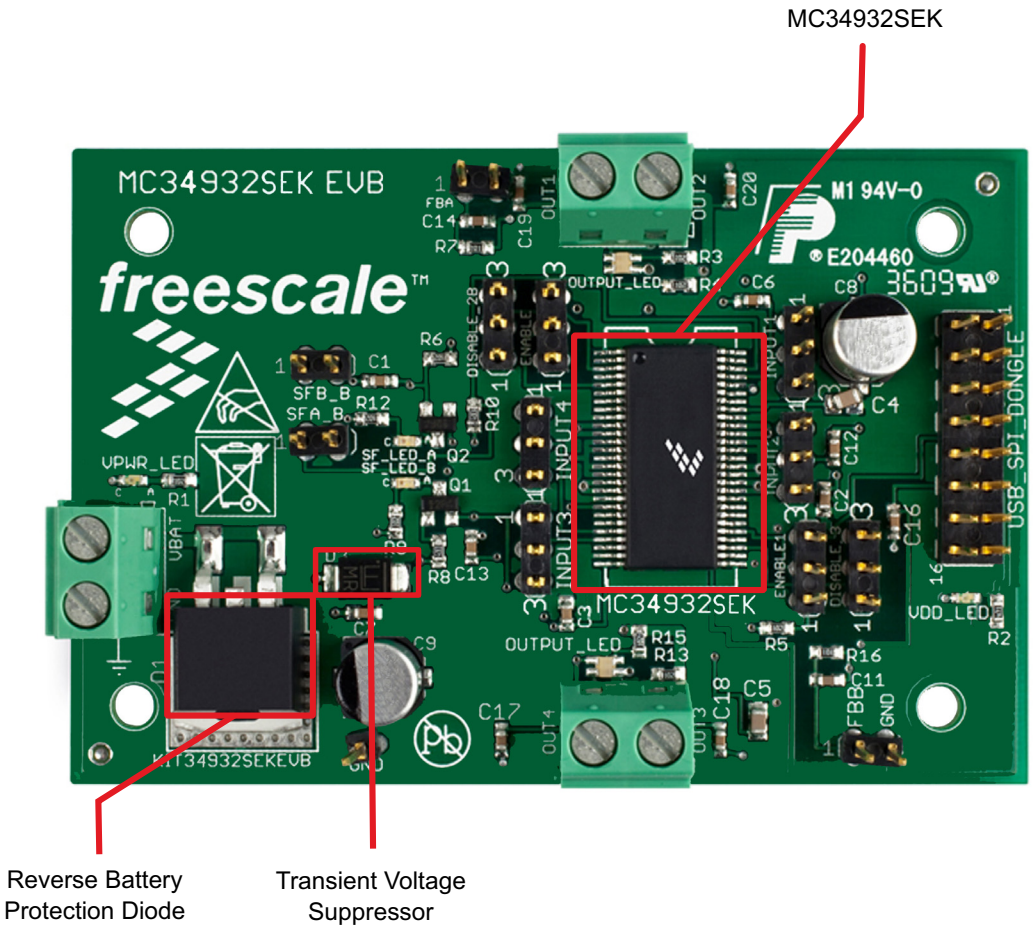


Figure 2. KIT34932SEKEVB

Table 2. Board Description

Name	Description
MC34932	Monolithic dual H-Bridge Power IC in a robust thermally enhanced 54 lead SOIC-EP package
Reverse Battery Protection Diode	Diode for protecting MC34932 in reverse battery condition
Transient voltage suppressor (TVS)	TVS diode to protect the part against system voltage transients.

3.5 LED Display

The following LEDs are provided as visual output devices for the KIT34932SEKEVB:

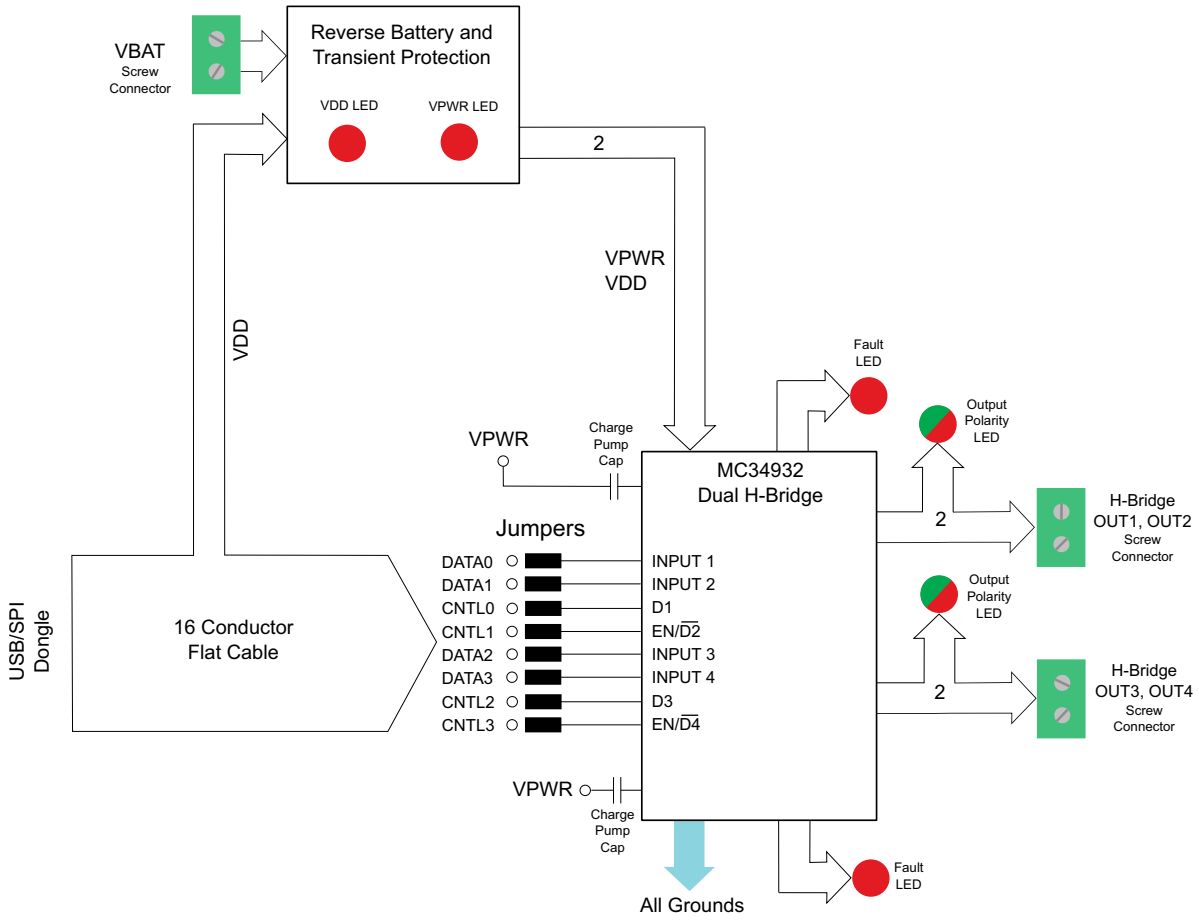


Figure 3. LED Locations on the KIT34932SEKEVB

Several LED's are provided as visual output devices for the EVB. A list of the LED devices is shown below:

1. VDD LED - Indicates when +5 Volt supply is connected
2. VPWR LED - Indicates when +12 Volt supply is connected
3. Fault LEDs - Illuminates when one of the H-Bridges detects a fault
4. Output LEDs - Red/Green LED, for each H-Bridge, that indicates which direction the current is flowing in the legs of the H-Bridge.

3.6 Connectors

The EVB contains three screw terminal connections and one parallel port. Figure 4 shows the locations of the connectors

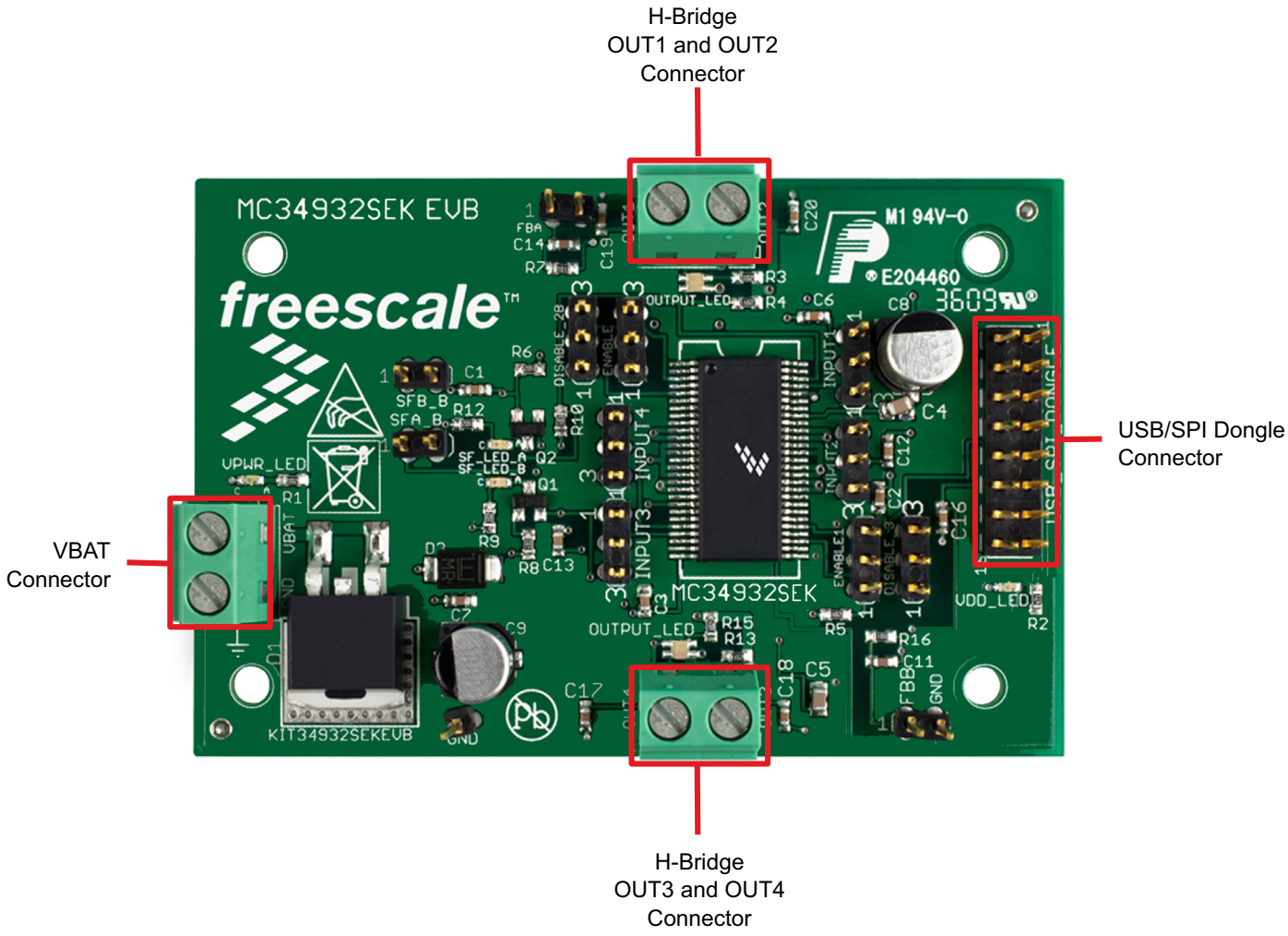


Figure 4. Screw Terminal Locations on the KIT34932SEKEVB

3.6.1 Screw Terminal Connectors

The three input and output screw terminal connectors allow easy access to the MC34932's drive circuits. Their function is described below

3.6.1.1 VBAT Connector

The VBAT Connector is a 2 position screw terminal providing +12 Volt and Ground Terminals. The Ground terminal is marked "**GND**" and the +12 Volt Terminal is marked "**VBAT**".

3.6.1.2 H-Bridge Output Connectors

The H-Bridge Output Connectors are 2 position screw terminals that provides the following two connections:
1) Output 1/2 of the H-Bridge
2) Output 3/4 of the H-Bridge
For H-Bridge A the output 1 connector is labeled "**OUT1**"
For H-Bridge A the output 2 connector is labeled "**OUT2**"
For H-Bridge B the output 3 connector is labeled "**OUT3**"
For H-Bridge B the output 4 connector is labeled "**OUT4**"

3.6.2 USB/SPI Dongle Connector

The USB/SPI dongle connector is a 16 pin,.1” center, dual-row connector that is designed to connect directly to the USB/SPI Dongle unit. The USB/SPI dongle connector consists of the following 16 pins:

Table 3. USB/SPI Dongle Connector Pinouts

Pin Number	Name	Description
1	CSB	SPI signal, Chip Select Bar
2	CNTL2	CNTL2 connected to TXD_C0
3	SO	SPI signal, Serial Out
4	CNTL1	CNTL1 connected to TXD_C1
5	SI	SPI signal, Serial In
6	CNTL0	CNTL0 connected to IWAKE
7	SCLK	SPI signal, Serial Clock
8	DATA4	DATA4 connected to RESETB
9	CNTL3	CNTL3 connected to INTB
10	DATA3	DATA3 Connected to TXD_L0
11	VDD	+5.0 V VDD from USB
12	DATA2	DATA2 connected to TXD_L2
13	+3.3V	+3.3 V from USB (Not Used)
14	DATA1	DATA1 Connected to TXD_L2
15	GND	Signal Ground
16	DATA0	DATA0 connected to TXD_L3

3.7 Jumper Definitions

The following table defines the evaluation board jumper positions and explains their functions. (The default settings are shown in bold.)

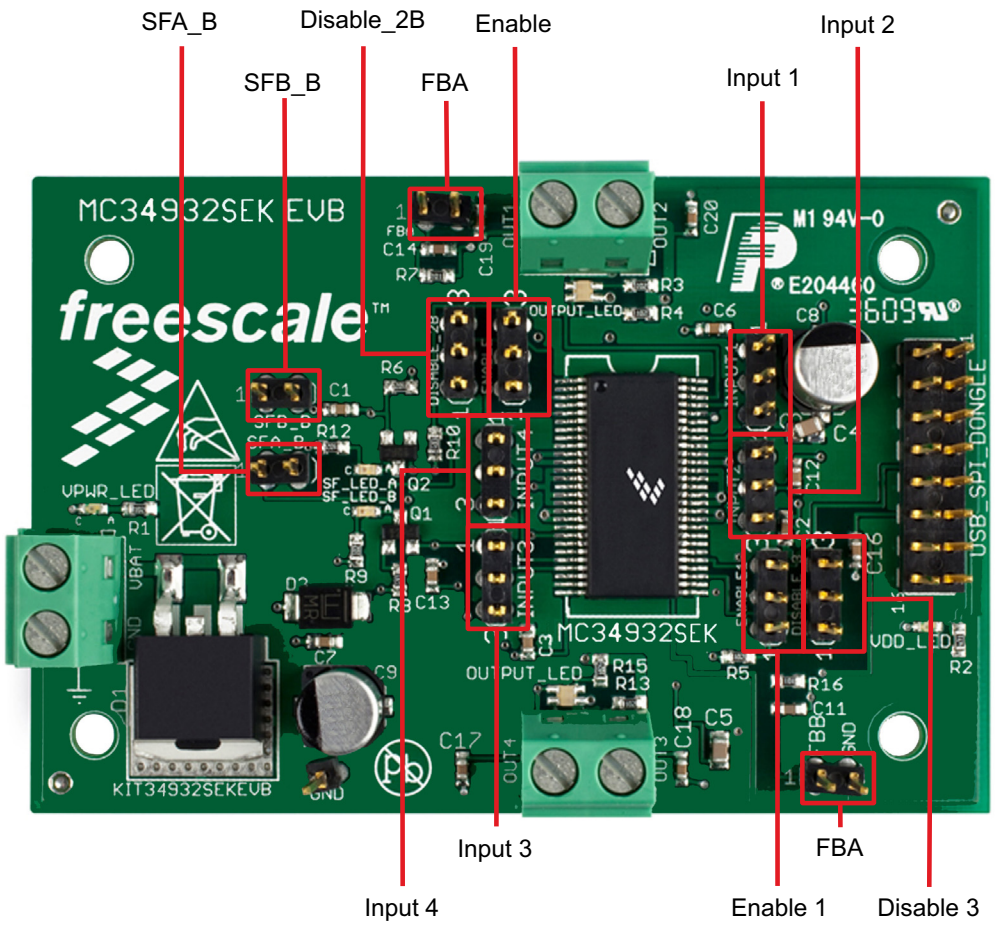


Figure 5. Jumper locations on the KIT34932SEKEVB

Table 4. KIT34932SEKEVB Jumper Definitions

Jumper	Description	Setting	Connection
Input 1	Controls IN1 in MC34932SEK	1-2	GND
		2-3	**DATA0**
Input 2	Controls IN2 in MC34932SEK	1-2	GND
		2-3	**DATA1**
Input 3	Controls IN3 in MC34932SEK	1-2	GND
		2-3	**DATA2**
Input 4	Controls IN4 in MC34932SEK	1-2	GND
		2-3	**DATA3**
Enable	Controls EN/D2_B in MC34932SEK	**1-2**	**Pull-up**
		2-3	CNTL1

Table 4. KIT34932SEKEVB Jumper Definitions (continued)

Jumper	Description	Setting	Connection
Enable1	Controls EN/D4_B in MC34932SEK	**1-2**	**Pull-up**
		2-3	CNTL3
Disable_2B	Controls D1 in MC34932SEK	1-2	CNTL0
		2-3	**GND**
Disable 3	Controls D3 in MC34932SEK	**1-2**	**GND**
		2-3	CNTL2
SFA_B	Reports status fault for Channel A	**Closed**	**$\overline{\text{SFA}}$**
SFB_B	Reports status fault for Channel B	**Closed**	**$\overline{\text{SFB}}$**
FBA	FBA (Channel A current feedback)	**Closed**	**FBA**
FBB	FBB (Channel B current feedback)	**Closed**	**FBB**

The DATA0 -DATA3 and CNTL0 - CNTL3 signals are parallel outputs from the USB/SPI Dongle that can be controlled directly from the SPIGen program. An example configuration file called KIT34932EKSW.spi which contains a batch file example has been provided. (See Section 5.1, Installing SPIGen Freeware on your Computer.)

4 Accessory Interface Board

The KIT34932SEKEVB kit may be used with the KITUSBSPIDGLEVME interface dongle (shown in Figure 6), which serves as a USB-to-SPI conversion interface. The board makes use of the USB, SPI, and parallel ports built into Freescale's MC68HC908JW32 microcontroller. The dongle's primary function is to provide Freescale evaluation kits with a parallel port that communicates via a USB port to a PC.



Figure 6. KITUSBSPIDGLEVME Interface Dongle

4.1 Connecting the KITUSBSPIDGLEVME Interface Dongle

To connect the KITUSBSPIDGLEVME Interface Dongle to the KIT34932SEKEVB evaluation board, attach a 16-bit ribbon cable from the IO PORT connector on the dongle to the USB_SPI_DONGLE connector on the evaluation board (see Figure 7). You can use SPIGen to communicate with the parallel inputs of the part and drive the outputs using the KITUSBSPIDGLEVME interface.

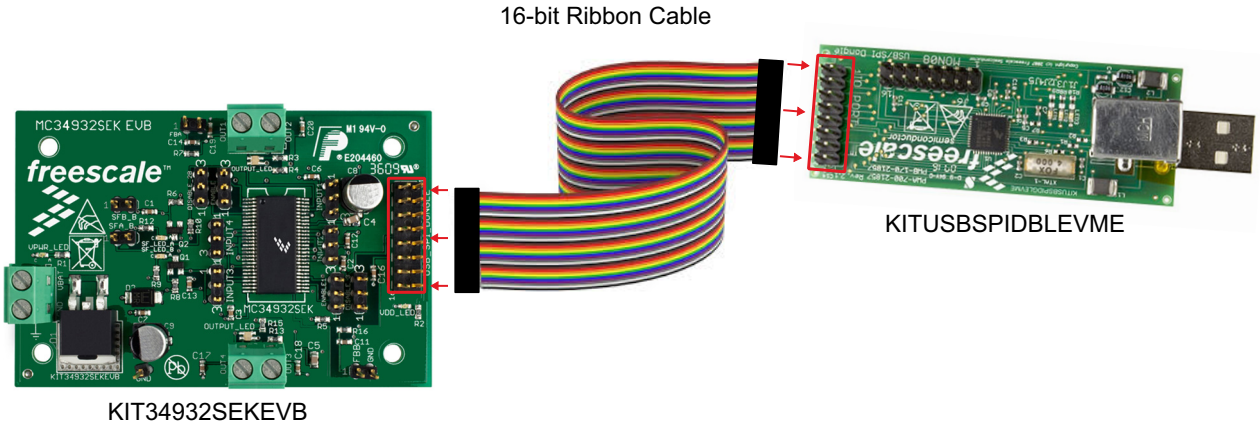


Figure 7. Connecting KITUSBSPIDGLEVME to the Evaluation Board

5 Installing the Software and Setting up the Hardware

5.1 Installing SPIGen Freeware on your Computer

The latest version of SPIGen is designed to run on any Windows 8, Windows 7, Vista, or XP-based operating system. To install the software, do the following:

1. Download and install SPIGen
   a) Go to www.freescale.com/analogtools and find your kit.
   b) Click on the kit name to open the corresponding Tool Summary Page
   c) On the tool summary page, look for “Jump Start Your Design.” Click on ‘Get Started with the KIT34932SEKEVB” link.
   d) From the list of items that appear, click on “SPI Generator (SPIGen) Software” and follow the sequence of instructions to begin the download process.
   e) After you click the appropriate download button, a large downward arrow appears momentarily at the bottom left corner of your screen, indicating that the download has begun.
   f) When the download completes, an SPIGEN.exe button appears at the bottom left corner of your screen. Click on the button and select “Run.” A wizard guides you through the installation process.
   g) If you instructed the SPIGen wizard to create a short-cut, an SPIGen icon appears on you desktop. If you elected not to create a short-cut, the SPIGen executable is installed by default at C:Program Files\SPIGen
2. Download the configuration file
   a) Go to www.freescale.com/analogtools and find your kit.
   b) Click on the kit name to open the corresponding Tool Summary Page
   c) On the tool summary page, look for “Jump Start Your Design.” Click on ‘Get Started with the KIT34932SEKEVB.”
   d) From the list of items that appear, click on “KIT34932SEK.spi”
   e) A large downward arrow appears momentarily at the bottom left corner of your screen, indicating that the download has begun.
   f) When the download completes, an KIT34932SEK.spi button appears at the bottom left corner of your screen, indicating that the configuration file has been downloaded to your system download folder (C:\Users*xxxx*\Downloads).

5.2 Running SPIGen

To run SPIGen, do the following:

1. Click on the SPIGen icon. This icon appears on your desktop if you elected to create a short-cut during the installation process. Otherwise, the icon resides in the folder C:Program Files\SPIGen. The generic SPIGen start-up screen appears.
2. From the SPIGen menu bar, click on FILE>Open and select the configuration file “KIT34932EKSW.spi” (previously downloaded in Section 5.1.) Figure 8 shows SPIGen screen with the configuration file installed.

Refer to the SPIGen User Guide at http://www.freescale.com/files/soft_dev_tools/software/device_drivers/SPIGen.html for additional usage information.

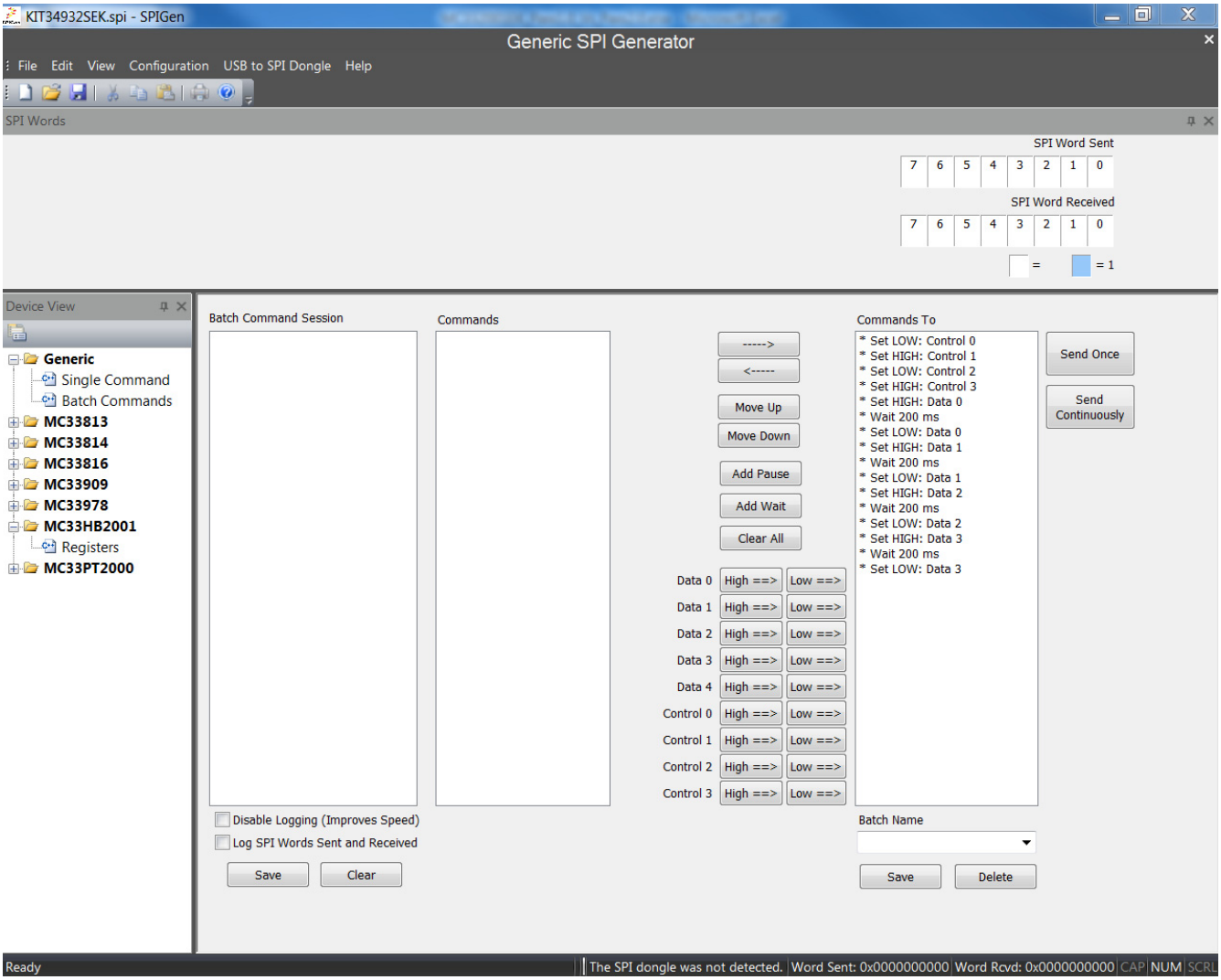


Figure 8. SPIGen GUI

5.3 Configuring the Hardware

Figure 9 shows the setup required to use the KIT34932SEKEVB Evaluation Board

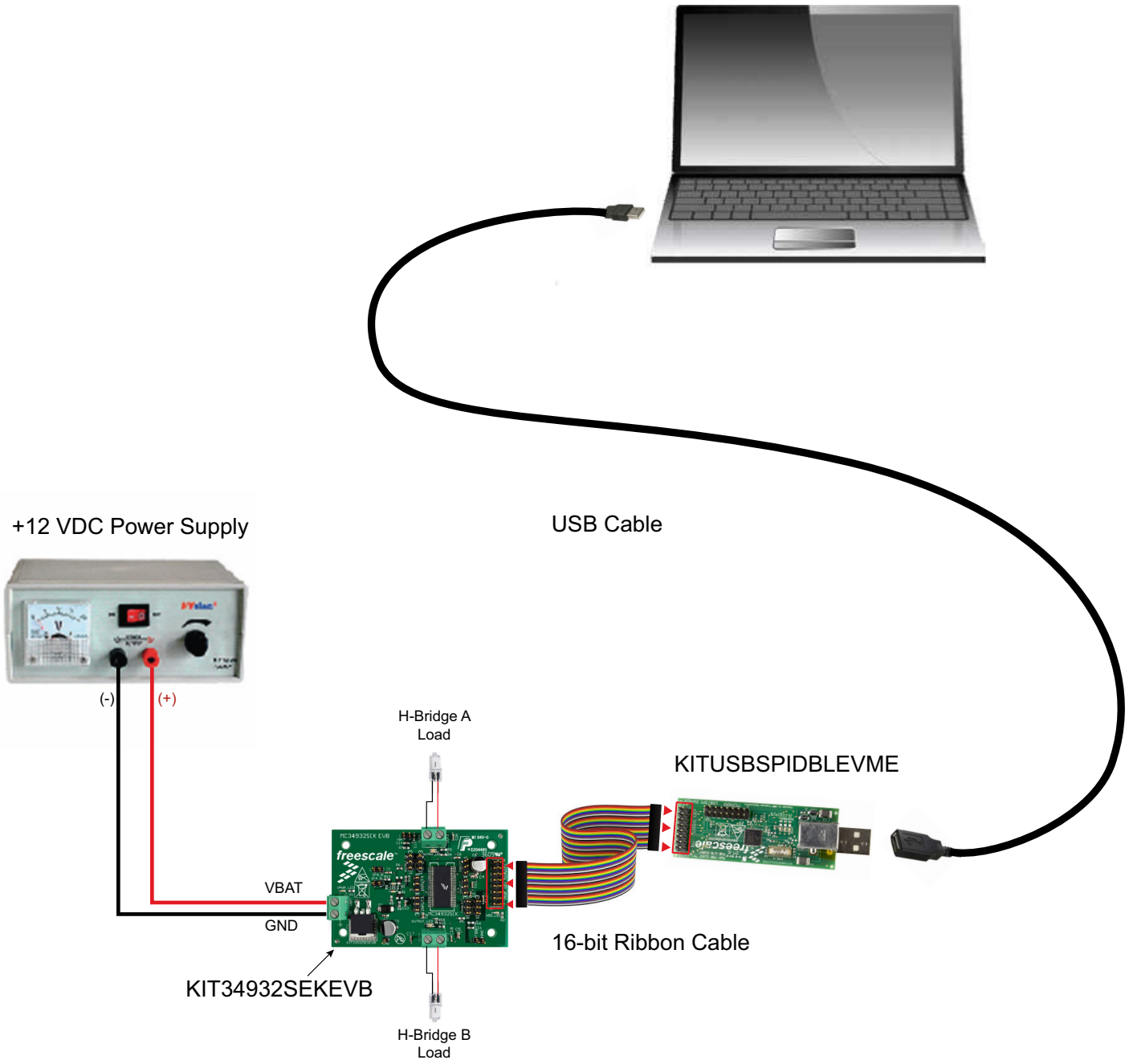


Figure 9. KIT34932SEKEVB Board Setup

5.3.1 Step-by-step Instructions for Setting Up the Hardware

The examples in this section demonstrate the basic functions of the KIT34932SEKEVB when used in conjunction with the USB/SPI Dongle and the SPIGen GUI software. To perform the examples, the following connections and setup must be performed:

1. Make sure the SPIGen 5.0X or latest version of SPIGen is installed on the PC and that it can communicate with the USB/SPI Dongle as described in that kit's documentation.
2. Connect the USB/SPI Dongle to the EVB via a 16 pin ribbon cable. Make sure to orient the cable so that pin1 on both the USB/SPI Dongle and the EVB are connected correctly, pin 1 to pin 1.
3. Connect the USB/SPI Dongle to a PC, LED 2 on the USB/SPI Dongle and the VDD LED on the board should both be illuminated.
4. Attach a +12 VDC supply (do not turn on power yet) to the power connector on the EVB, making sure to observe the GND and +12V terminals. The current capability of the +12V supply should exceed the maximum total current that the number of simultaneously ON loads will require.
5. Attach loads to the OUT1/2 and OUT3/4 terminals. One possible demo load is a 10w halogen G4 Base T3 bulb (used in landscape lighting applications). This load will draw approximately 850 mA and fits nicely into the screw terminals.
6. Launch SPIGen and from the "**File**" menu, select "**Open**" and find the "KIT34932EKSW.spi" file. (Previously downloaded as shown in Section 5.1, Installing SPIGen Freeware on your Computer.)
7. Turn on the +12 Volt Supply. Verify that all is working correctly by clicking on the "Extra Pins" button in the SPIGen main screen. Then click on the following buttons to set up the proper conditions:
   A) Control 0 "**Low**"
   B) Control 1 "**High**"
   C) Control 2 "**Low**"
   D) Control 3 "**High**"
8. Next, click on the Data 0 "**High**" button. The OUT1/2 load or bulb should turn on. The OUT 1/2 LED should be glowing green. Clicking on the DATA 0 "**Low**" button should turn off the load or bulb and the OUT 1/2 LED.
9. Next, click on the Data 1 "**High**" button. The OUT1/2 load or bulb should turn on. The OUT 1/2 LED should be glowing red. Clicking on the DATA 1 "**Low**" button should turn off the load or bulb and the OUT 1/2 LED.
10. Next, click on the Data 2 "**High**" button. The OUT3/4 load or bulb should turn on. The OUT 3/4 LED should be glowing green. Clicking on the DATA 2 "**Low**" button should turn off the load or bulb and the OUT 3/4 LED.
11. Next, click on the Data 3 "**High**" button. The OUT3/4 load or bulb should turn on. The OUT 3/4 LED should be glowing red. Clicking on the DATA 3 "**Low**" button should turn off the load or bulb and the OUT 3/4 LED. If everything described so far occurs then you are ready to proceed with the remaining examples.

5.3.2 Example 1. Running the Test Both H-Bridges Batch File

1. From the SPIGen main screen, click on the "Batch Commands" Tab in the Device View panel.
2. In the box below the "Commands To Send:" column, click on the a pull-down menu box labelled Batch Name.
3. Click on the "**Basic Test both bridges**" label to load to load the example. You should see a list of commands in the "Command To" box.
4. Click on the "**Send Continuously**" button and observe that the loads or bulbs you have attached to the EVB board are blinking twice and then going out in succession.

There are other demo batch examples that appear in the Batch Name menu box. You may wish to also run them as a learning exercise.

6 Schematic

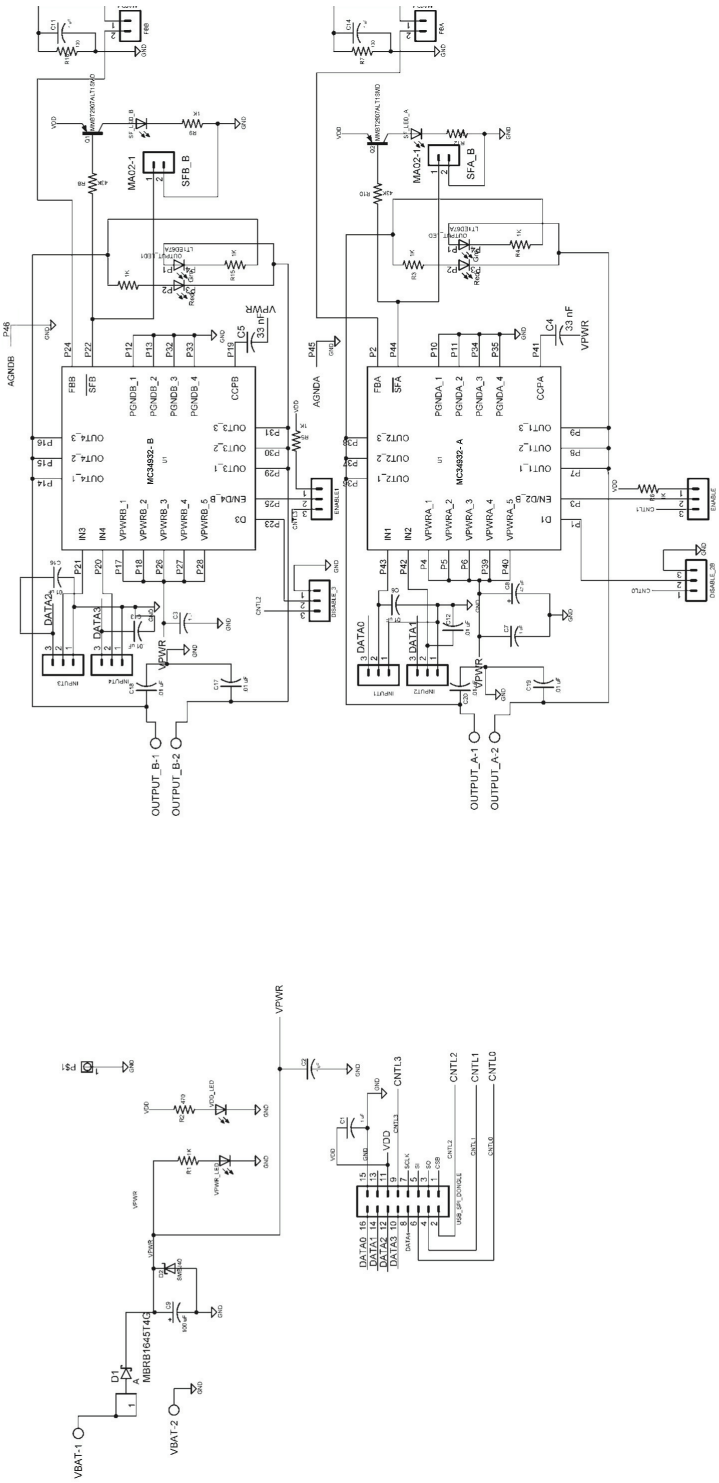


Figure 10. KIT34932SEKEVB Schematic

7 Board Layout

7.1 Assembly Top Layer

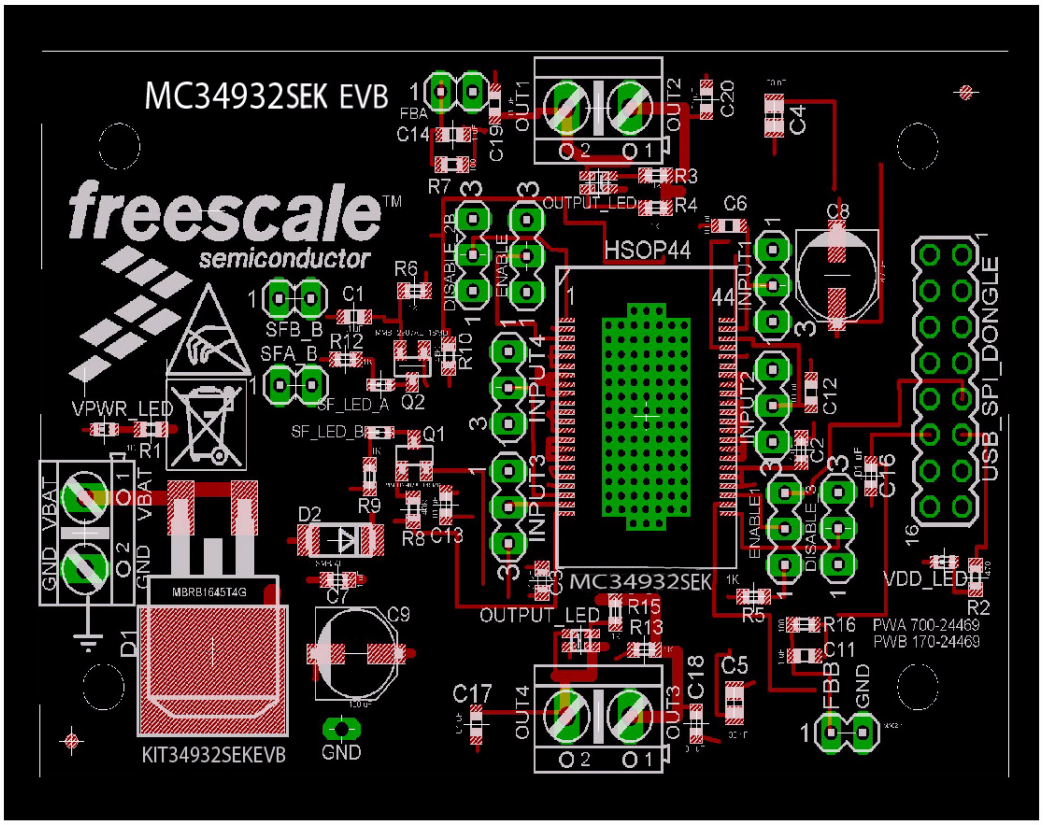


Figure 11. KIT34932SEKEVB Top Layer

8 KIT34932SEKEVB Bill of Materials

Table 5. KIT34932SEKEVB Bill of Materials (1)

Item	Qty	Schematic Label	Value	Description	Part Number	Assy. Option
Freescale Components						
1	1	U1		DUAL 5A H-BRIDGE	MC34932SEK	(2)
Capacitors						
2	4	C1, C2, C3, C7	0.1 µF	CAP CER 0.1 UF 25V 10% X7R 0603	0603 (1608 Metric)	
3	2	C11, C14	1.0 µF	CAP CER 1 UF 35V 10% X5R 0603	0603 (1608 Metric)	
4	2	C4,C5	0.033 µF	CAP CER 0.033 UF 50V 10% X7R 0805	0805 (2012 Metric)	
5	8	C6, C12, C13, C16, C17, C18, C19, C20	10000 pF	CAP CER 10000 PF 50V 10% X7R 0603	0603 (1608 Metric)	
6	1	C8	47 µF	CAP ALUM 47UF 50 V 20% SMD	Radial, Can - SMD	
7	1	C9	100 µF	CAP ALUM 100UF 50 V 20% SMD	Radial, Can - SMD	
Resistors						
8	9	R1, R3, R4, R5, R6, R9, R12, R13, R15	1 KΩ	RES 1.0K OHM 1/10W 5% 0603 SMD	0603 (1608 Metric)	
9	1	R2	470 Ω	RES 470 OHM 1/10W 5% 0603 SMD	0603 (1608 Metric)	
10	2	R7, R16	100 Ω	RES 100 OHM 1/10W 5% 0603 SMD	0603 (1608 Metric)	
11	2	R8, R10	43 KΩ	RES 43K OHM 1/10W 5% 0603 SMD	0603 (1608 Metric)	
Diodes						
12	1	D1	SCHOTTKY	DIODE SCHOTTKY 45 V 16 A D2PAK	D2PAK, TO-263	
13	1	D2	40 V	DIODE TVS 40 V 600 W UNIDIR 5% SMB	DO-214AA, SMB	
Transistors						
14	2	Q1, Q2	PNP	TRANSISTOR SWITCHING PNP SOT-23	TO-236-3, SC-59, SOT	
Switches, Connectors, Jumpers and Test Points						
15	8	DISABLE_2B, DISABLE_3, NABLE, ENABLE1, INPUT1, INPUT2, INPUT3, INPUT4	MA03-2	CONN HEADER VERT .100 3 POS 15 AU		
16	4	FBA, FBB, SFA_B, SFB_B	MA02-1	CONN HEADER VERT .100 2 POS 15 AU		
17	1	GND TP	MA01-1	CONN HEADER VERT .100 1 POS 15 AU		
18	3	OUTPUT_A, OUTPUT_B, VBAT	2 POS	CONN TERM BLOCK 2 POS 5.08 MM PCB	Term Block	
19	2	OUTPUT_LED, OUTPUT_LED1		LED YELGRN/RED 565/635 DIFF 1616	0606 (1616 Metric)	
20	2	SF_LED_A, SF_LED_B	RED	LED RED HI BRT SS TYPE LO CUR SM	0603 (1608 Metric)	
21	2	VDD_LED, VPWR_LED	GREEN	LED GREEN USS TYPE 0603	0603 (1608 Metric)	
22	1	USB_SPI_DONGLE	MA08-2	CONN HDR BRKWAY .100 08 POS VERT		

Notes
1. Freescale does not assume liability, endorse, or warrant components from external manufacturers are referenced in circuit drawings or tables. While Freescale offers component recommendations in this configuration, it is the customer's responsibility to validate their application.
2. **Critical components.** For critical components, it is vital to use the manufacturer listed.

9 Accessory Item Bill of Materials

Table 6. Bill of Materials [3]

Item	Qty	Part Number	Description
1	1	KITUSBSPIDGLEVME	SPIGen USB to EVB interface board

Notes

3. Freescale does not assume liability, endorse, or warrant components from external manufacturers are referenced in circuit drawings or tables. While Freescale offers component recommendations in this configuration, it is the customer's responsibility to validate their application.

10 References

Following are URLs where you can obtain information on related Freescale products and application solutions:

Freescale.com Support Pages	Description	URL
KIT34932SEKEVB	Tool Summary Page	http://www.freescale.com/webapp/sps/site/prod_summary.jsp?code=KIT34932SEKEVB
MC34932	Product Summary Page	http://www.freescale.com/webapp/sps/site/prod_summary.jsp?code=MC34932
SPIGen	Software	http://www.freescale.com/files/soft_dev_tools/software/device_drivers/SPIGen.html
KITUSBSPIDGLEVME	Tool Summary Page	http://www.freescale.com/webapp/sps/site/prod_summary.jsp?code=KITUSBSPIDGLEVME

10.1 Support

Visit www.freescale.com/support for a list of phone numbers within your region.

10.2 Warranty

Visit www.freescale.com/warranty for a list of phone numbers within your region.

11 Revision History

Revision	Date	Description of Changes
1.0	6/2015	Initial Release

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freescale.com

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