

KIT33972AEWEVBE Evaluation Board

Featuring the MC33972A Multiple Switch Detection Interface IC

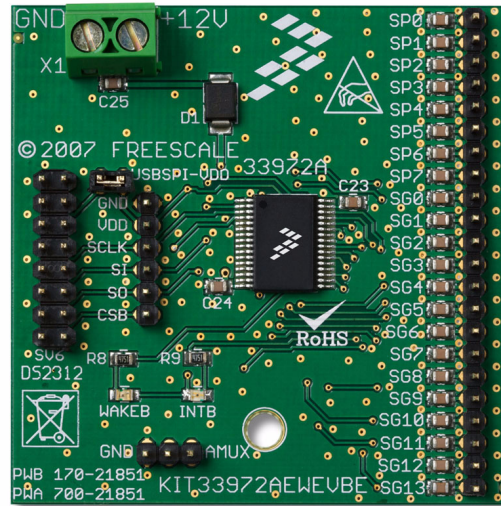


Figure 1. KIT33972AEWEVBE Evaluation Board

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1 Kit Contents/Packing List

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

2 Jump Start

- Go to www.freescale.com/analogtools
- Locate your kit
- Review your Tool Summary Page
- Look for



Jump Start Your Design

- Download documents, software and other information

3 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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4 Introduction

This evaluation kit features the MC33972A Multiple Switch Detection Interface with suppressed wake-up. The kit is designed to detect the closing and opening 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 inputs as analog. The analog input signal is buffered and provided on the AMUX output pin for the MCU to read. The MC33972A 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. The Sleep Mode provides low quiescent current, which makes the MC33972A ideal for automotive and industrial products requiring low sleep-state currents.

5 Evaluation Board Features

The board has the following capabilities:

- The MC33972A device can monitor as many as twenty-two switches and provide their states as information to a PC for evaluation.
- An onboard 16-pin USB port connects to the PC through the Freescale SPI-to-USB Interface Dongle (KITUSBSPIDGLEVME). See [Accessory Interface Board](#).
- The MC33972A device can be programmed using the SPIGen utility running on the PC. See [“Installing SPIGen Freeware on your Computer”](#).
- LEDs report the status of the MC33972A Interrupt (INT) and Wake-Up lines.

6 MC33972A Device Features

The MC33972A device supports the following functions:

- Designed to operate $5.5\text{ V} \leq V_{PWR} \leq 26\text{ V}$
- Switch input voltage range -14 V to V_{PWR} , 40 V Max
- Interfaces directly to MPU using 3.3 V/5.0 V SPI protocol
- Selectable wake-up on change of state
- Selectable wetting current (16 or 2.0 mA)
- 8 programmable inputs (switches to battery or ground)
- 14 switch-to-ground inputs
- Typical standby current: $V_{PWR} = 100\ \mu\text{A}$ and $V_{DD} = 20\ \mu\text{A}$
- Active interrupt (INT) on change-of-switch state

Freescale analog ICs are manufactured using the SMARTMOS process, a combinational BiCMOS manufacturing flow that integrates precision analog, power functions and dense CMOS logic together on a single cost-effective die.

7 Accessory Interface Board

The KIT33972AEWEVBE board may be used with the KITUSBSPIDGLEVME interface dongle (shown below), which provides a USB-to-SPI interface. This small board makes use of the USB and SPI ports built into Freescale's MC68HC908JW32 microcontroller. The main function provided by this dongle is to allow Freescale evaluation boards that have an SPI port to communicate with a PC through its USB port.

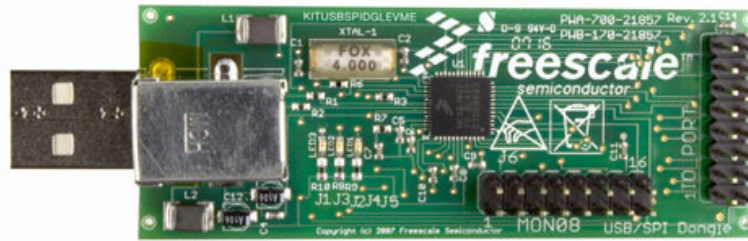


Figure 2. KITUSBSPIDGLEVME Interface Dongle

8 Required Equipment

Minimum equipment required:

- DC power supply
- USB-enabled PC with Windows XP or higher
- KITUSBSPIDGLEVME Interface Dongle

9 Evaluation Board Configuration

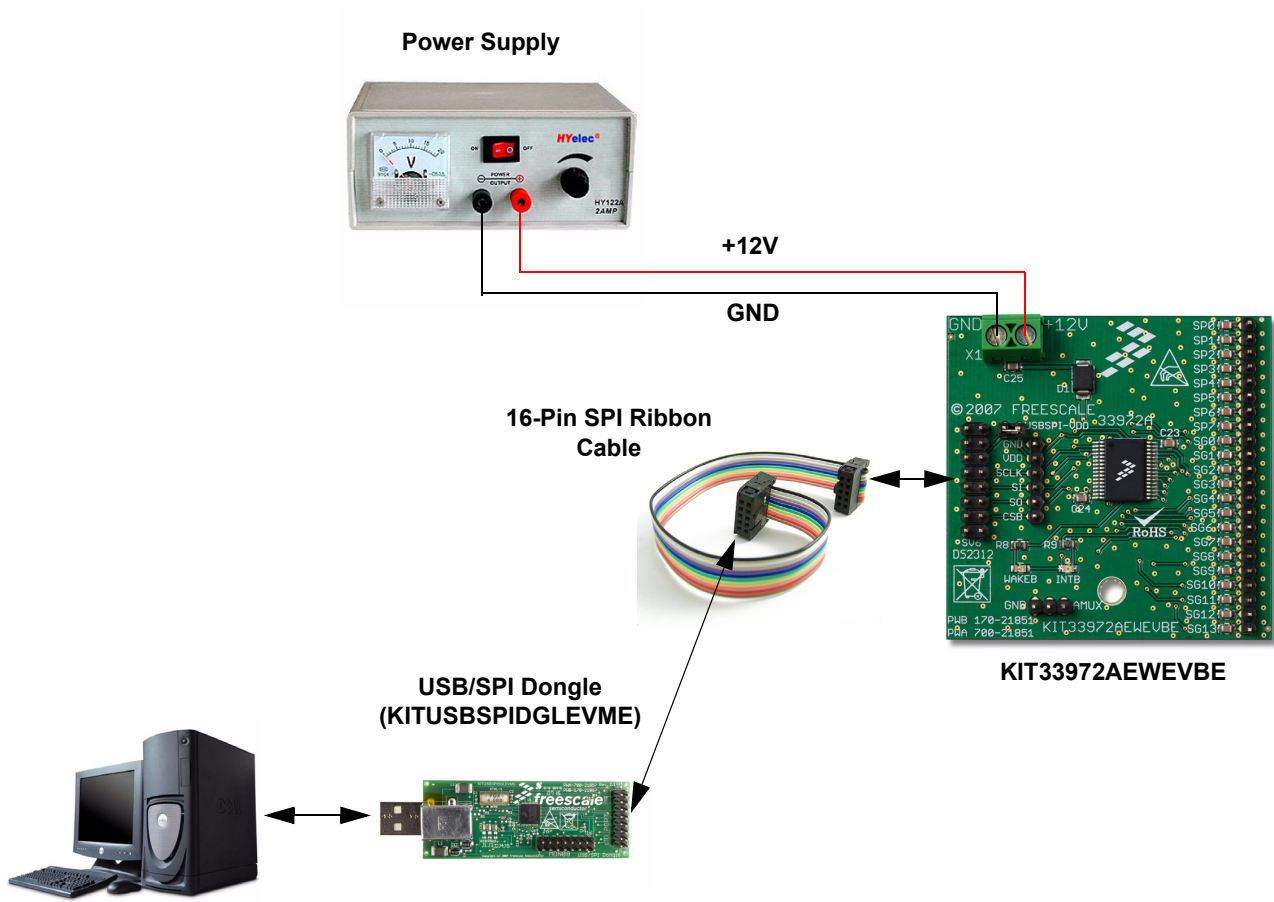


Figure 3. KIT33972AEWEVBE plus KITUSBSPIDGLEVME Board Setup

10 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, go to www.freescale.com/analogtools and select your kit. Click on that link to open the corresponding Tool Summary Page. Look for “Jump Start Your Design”. Download to your computer desktop the SPIGen software as well as the associated configuration file.

Run the install program from the desktop. The Installation Wizard will guide you through the rest of the process.

To use SPIGen, go to the Windows Start menu, then Programs, then SPIGen, and click on the SPIGen icon. The SPIGen Graphic User Interface (GUI) will appear. Go to the file menu in the upper left hand corner of the GUI, and select “Open”. In the file selection window that appears, set the “Files of type:” drop-down menu to “SPIGen Files (*.spi)”. (As an exceptional case, the file name may have a .txt extension, in which case you should set the menu to “All Files (*.*)”.) Next, browse for the configuration file you saved on your desktop earlier and select it. Click “Open”, and SPIGen will create a specially configured SPI command generator for your evaluation board.

The GUI is shown in **Figure 4**. The text at the top is the name of the configuration file loaded. The left side panel displays folders that group user interfaces. The process of loading the configuration file has assigned a list of “Extra Pins” as well as a list “Quick Commands”, all of which are board-specific.

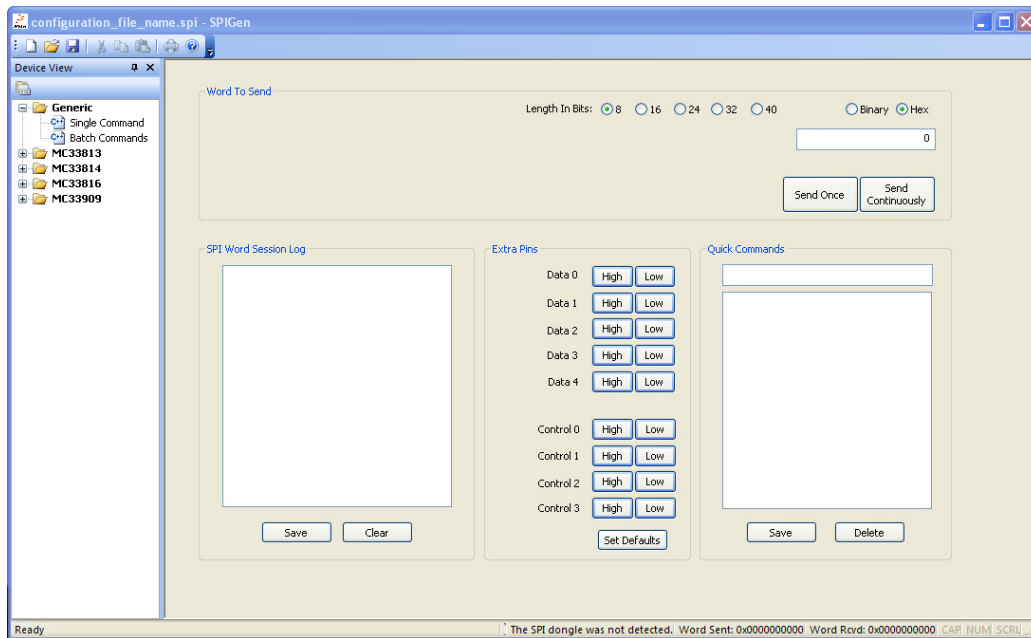


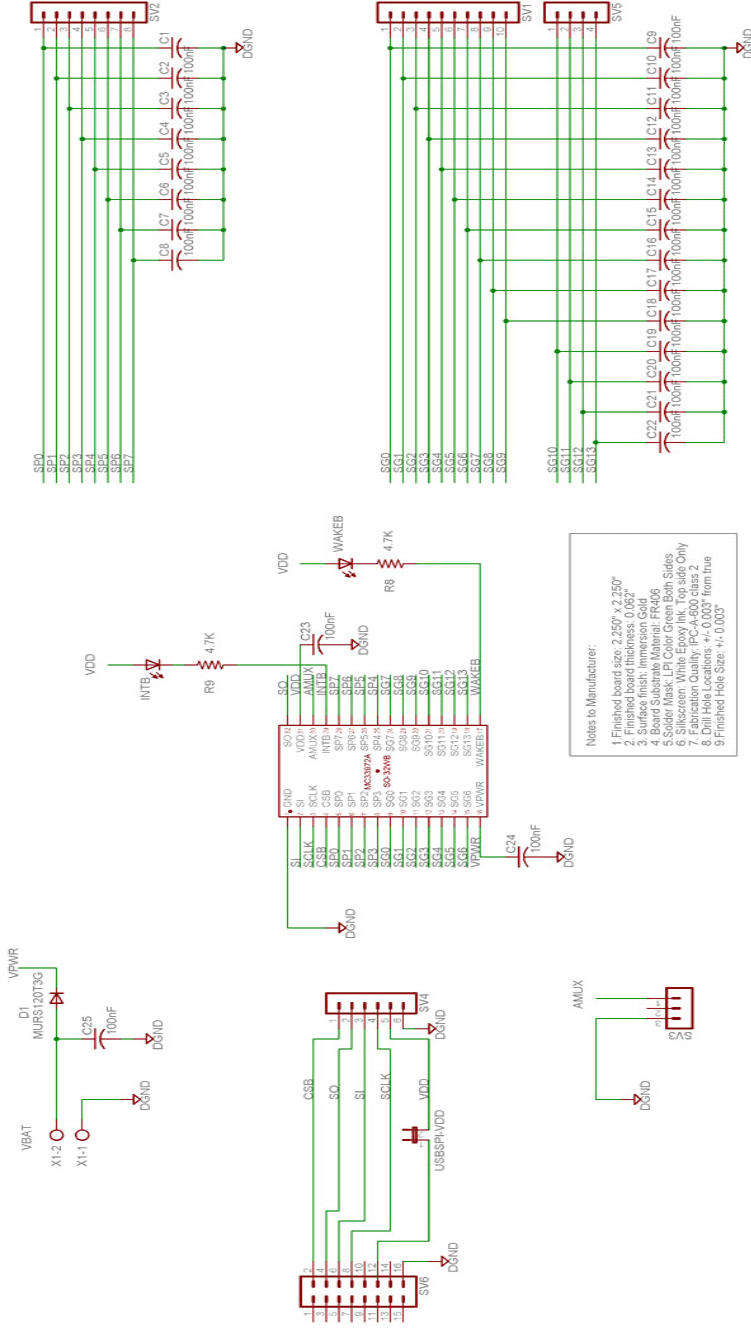
Figure 4. SPIGen GUI

11 Setup and Using the Hardware

In order to perform the demonstration examples, first set up the evaluation board hardware and software as follows:

1. The KIT33972AEWEVBE evaluation board allows the customer to quickly evaluate features of the device with a simple bench top setup. All switch inputs may be evaluated using the onboard switch banks or actual system switches connected to the switch input edge connector.
2. Using a standard USB cable, the USB to SPI dongle board and the enclosed SPIGen SPI Driver software, you can use a personal computer to provide the Serial Peripheral Interface (SPI) communication with this EVB. (See [Evaluation Board Configuration](#).)
3. Connect power supply to the +12 V and GND terminals on the EVB's power terminal block. Make sure the voltages provided are in accordance with the device data sheet and that the supply currents are sufficient to supply the switch contact wetting current.
4. With power applied to the KIT33972AEWEVBE Evaluation board, the 33972A device will be in NORMAL mode with both LEDs illuminated. The 33972A device is now ready to receive SPI commands and be configured via SPI to read the switch inputs. External switches may be used to evaluate the device.
5. To use SPIGen, go to the Windows Start menu, then Programs, then SPIGen, and click on the SPIGen icon. The SPIGen GUI will appear. Loading of the configuration file specific to the KIT33972AEWEVBE board is described in section "[Installing SPIGen Freeware on your Computer](#)". Once having loaded the configuration file, SPIGen will open a specifically configured SPI command generator for the evaluation board. The configuration file will set all parameters for SPI signals from the PC and provide a list of commands that may be sent to the EVB.
6. To initialize the MCZ33972AEW device to read switch inputs, the user may use batch commands. To do this, select the "Batch Commands" option inside the "Generic" folder on the left-hand panel. In the window that appears, select "Full Initialize" from the "Batch Name" drop-down menu. To send this batch of commands to the evaluation board, click the "Send Once" tab.
7. To quickly evaluate the board as well as the MCZ33972AEW device, simply select the "Single Command" option inside the "Generic" folder on the left-hand panel. In the window that appears, select the "Switch Status" command from the "Quick Commands" list, then click the "Send Continuously" button. The opening and closing of switches may now be seen in the "Word Rcvd" field located at the bottom of the SPIGen GUI. Refer to the MCZ33972AEW data sheet for detailed information on I/O communication and device operation.

12 Schematic



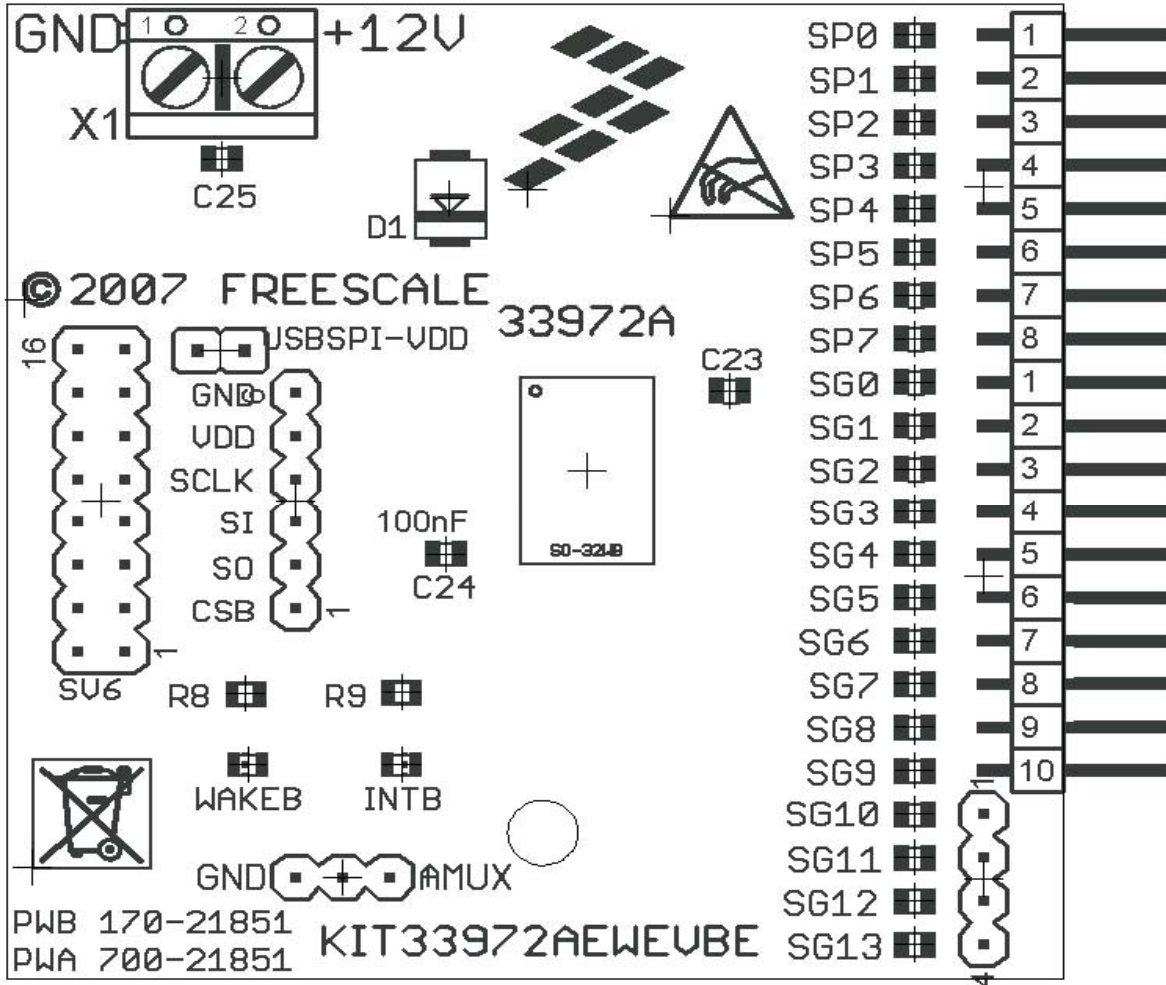
Notes to Manufacturer:

- 1 Finished board size: 2.250" x 2.250"
- 2 Finished board thickness: 0.062"
- 3 Surface finish: Immersion Gold
- 4 Solder Mask: Color Green
- 5 Solder Mask: LPI Color Green Both Sides
- 6 Silkscreen: White Epoxy Ink, Top side Only
- 7 Fabrication Quality: IPC-A800 class 2
- 8 Drill Hole Locations: +/- 0.003" from true
- 9 Finished Hole Size: +/- 0.003"

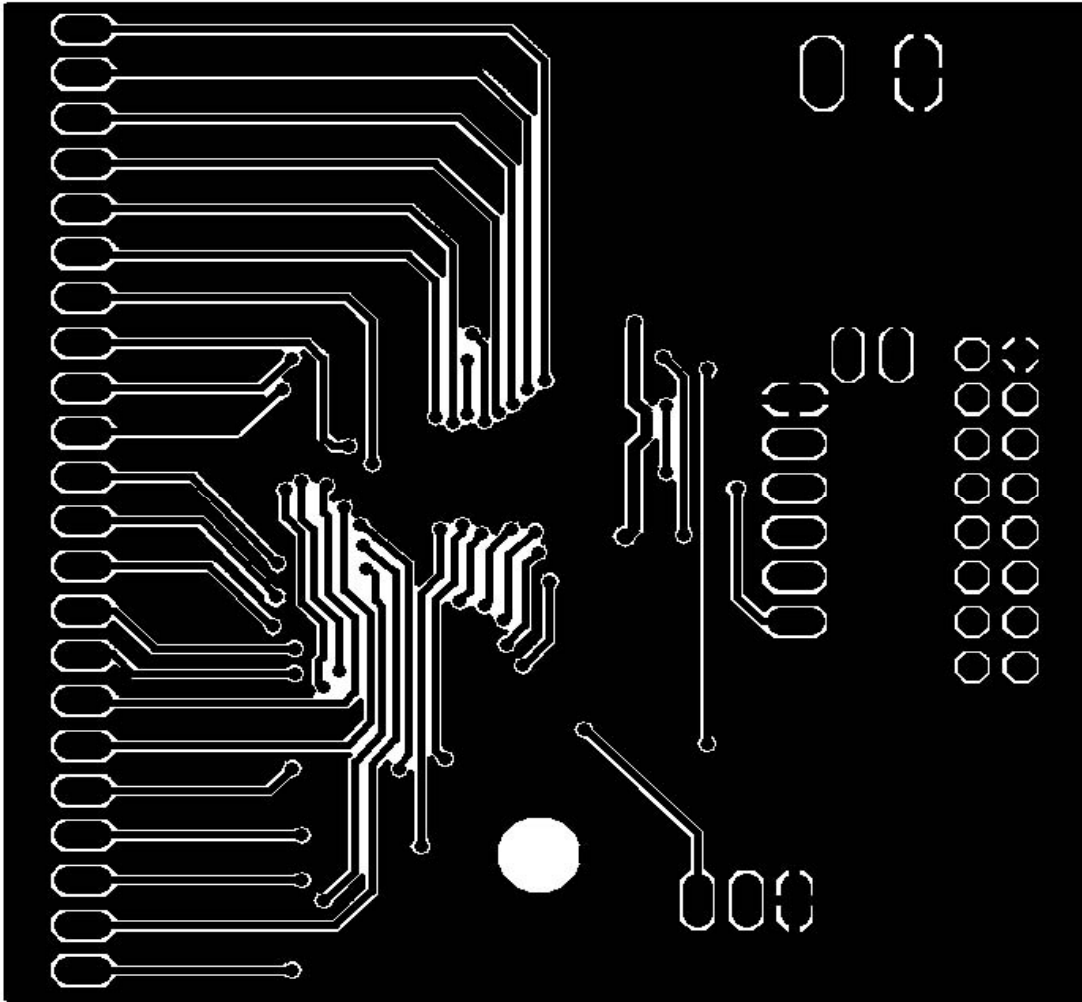
Figure 5. Evaluation Board Schematic

13 Board Layout

13.1 Assembly Layer Top



13.2 Bottom Layer Routing



Note: This image is an exception to the standard top-view mode of representation used in this document. It has been flipped to show a bottom view.

14 Bill of Material

Qty	Schematic Label	Value	Description	Package
Integrated Circuits				
1	MC33972AEW		Freescale MC339972AEW	SO-32WB
Diodes				
1	D1	1.0 amp	Schottky Diode MURS120T3G	SMB
LEDs				
1	WAKEB		Green Through Hole LED	2.5 mm LED
1	INTB		Red Through Hole LED	2.5 mm LED
Capacitors				
25	C1-C25	100 nF	50V X7R CAP	C0805
Resistors				
2	R8, R9	1.0 K	5% Resistor	R0805
Switches, Connectors, and Board				
1	JP1		1 x 2 Pin Header Straight	
1	SV3,JP1		1 x 3 Pin Header Straight	
1	SV4,JP1		1 x 6 Pin Header Straight	
1	SV6		2 x 8 Pin Header Straight	
1	SV1,SV2 SV5		1 x 22 Pin Header 90 Degree	
1	X1		AK500/2 2-Terminal Power Connector	
1		2.3" X 3.0" X 0.062"	EVB Circuit Board 1 oz. Copper	

Note: Freescale does not assume liability, endorse, or warrant components from external manufacturers that 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.

15 References

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

Freescale.com Support Pages	URL
MC33972A Product Summary Page	http://www.freescale.com/webapp/sps/site/prod_summary.jsp?code=MC33972A
KIT33972AEWEVBE Tool Summary Page	http://www.freescale.com/webapp/sps/site/prod_summary.jsp?code=KIT33972AEWEVBE
KITUSBSPIDGLEVME Tool Summary Page	http://www.freescale.com/webapp/sps/site/prod_summary.jsp?code=KITUSBSPIDGLEVME
SPIGen Tool Summary Page	http://www.freescale.com/files/soft_dev_tools/software/device_drivers/SPIGen.html
Analog Home Page	http://www.freescale.com/analog
Automotive Home Page	http://www.freescale.com/automotive

15.1 Support

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

15.2 Warranty

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

16 Revision History

Revision	Date	Description of Changes
1.0	7/2013	• Initial Release



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