

# KIT33932VWEVBE Evaluation Board



Figure 1. Evaluation Board

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# 1 Kit Contents / Packing List

- Evaluation Board - KIT33932VWEVBE
- Hardware Document CD, CD33932
- Warranty Card, Freescale, 920-75133, Rev. A
- Technical Information Center Freescale Semiconductor, Inc. BR1530
- FCC Disclaimer, Freescale, 926-75760, Rev A

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### 3 Kit Introduction

- The **KIT33932VWEVBE** Evaluation Board (EVB) is an easy-to-use circuit board that allows the user to exercise all the functions of the MC33932 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.

## 4 Hardware Description

### 4.1 Recommended Equipment

- PC Computer running Windows XP
- 5-40V Power Supply
- USB Cable
- KITUSBSPIDGLEVME

The Hardware Block Diagram is shown below:

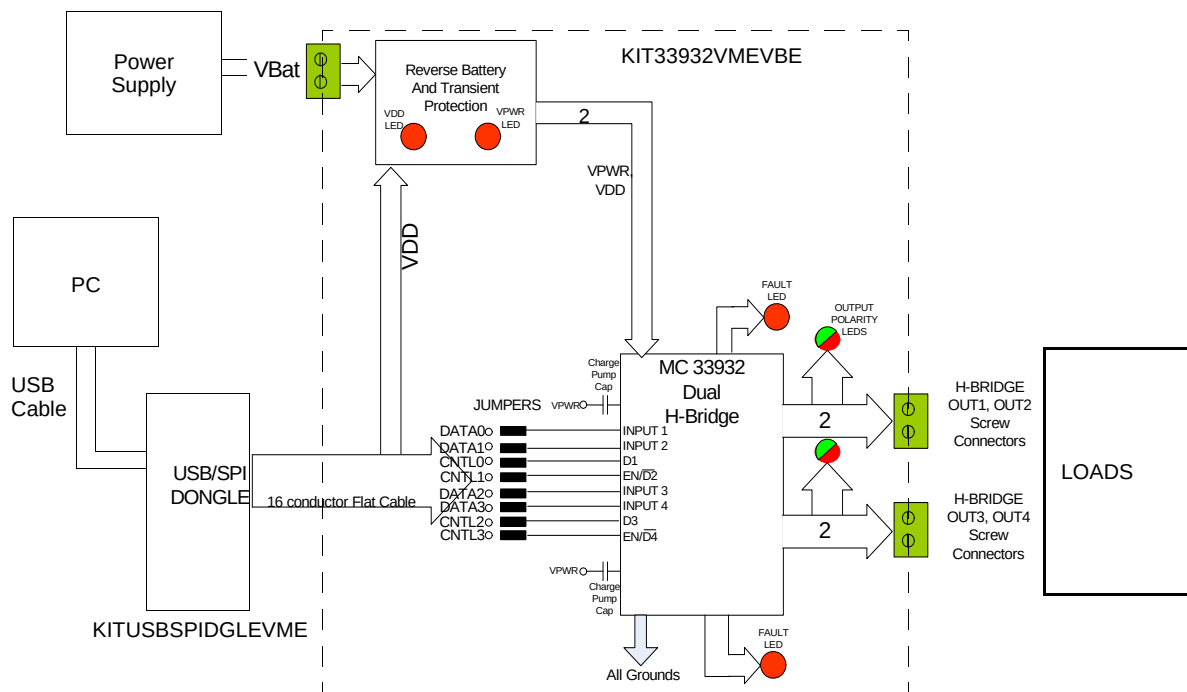


Figure 2. Block Diagram

This EVB consists of a Dual H-Bridge, a parallel interface, power conditioning circuitry, and a set of 8 Input Select Jumpers. All +5 volt VDD power required by the EVB is obtained via the parallel interface.

### 4.2 LED Display

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.

## 4.3 I/O Jumper Definitions (J3)

The EVB contains seven jumpers that connect the inputs of the 33932 as follows (**Bold** = factory setting):

| <u>JUMPER NAME</u> | <u>JUMPER POSITION</u> | <u>CONNECTION</u>    |
|--------------------|------------------------|----------------------|
| INPUT 1            | 1-2/ <b>2-3</b>        | GND/ <b>DATA0</b>    |
| INPUT 2            | 1-2/ <b>2-3</b>        | GND/ <b>DATA1</b>    |
| INPUT3             | 1-2/ <b>2-3</b>        | GND/ <b>DATA2</b>    |
| INPUT4             | 1-2/ <b>2-3</b>        | GND/ <b>DATA3</b>    |
| ENABLE/DISABLE 2   | 1-2/ <b>2-3</b>        | <b>PullUp</b> /CNTL1 |
| ENABLE/DISABLE 4   | 1-2/ <b>2-3</b>        | <b>PullUp</b> /CNTL3 |
| DISABLE 1          | 1-2/ <b>2-3</b>        | CNTL0/ <b>GND</b>    |
| DISABLE_2B         | 1-2/ <b>2-3</b>        | <b>GND</b> /CNTL2    |

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 config file called "MC33932\_EVB\_CONFIGURATION\_FILE spi" is provided on the CD which contains a batch file example.

If the user prefers to supply the various MC33932 input signals externally, other than from the USB-SPI Interface, the jumpers can be removed and connections can be made to the open pin number 2' s.

## 4.4 USB/SPI Dongle Connector

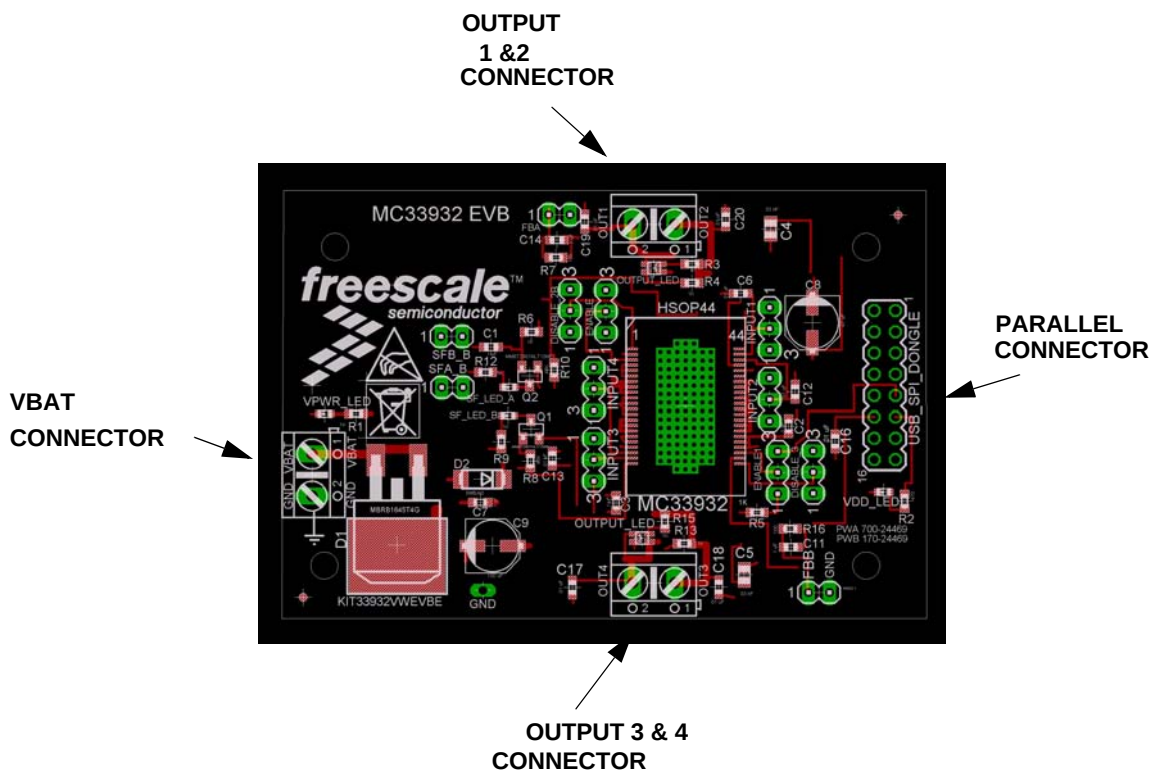
The USB/SPI dongle connector is a 16 pin,.1" center, dual-row connector that is designed to interface directly to the USB/SPI Dongle unit. The USB/SPI dongle connector consists of the following 16 pins –

| <u>Pin Number</u> | <u>Name</u> | <u>Description</u>          |
|-------------------|-------------|-----------------------------|
| 1                 | CSB         | SPI signal, Chip Select Bar |
| 2                 | CNTL2       | Parallel port signal CNTL2  |
| 3                 | SO          | SPI signal, Serial Out      |
| 4                 | CNTL1       | Parallel port signal CNTL1  |
| 5                 | SI          | SPI signal, Serial In       |
| 6                 | CNTL0       | Parallel port signal CNTL0  |
| 7                 | SCLK        | SPI signal, Serial Clock    |
| 8                 | DATA4       | Parallel port signal DATA4  |
| 9                 | CNTL3       | Parallel port signal CNTL3  |
| 10                | DATA3       | Parallel port signal DATA3  |
| 11                | VDD         | +5 Volt VDD from USB        |
| 12                | DATA2       | Parallel port signal DATA2  |
| 13                | NC          | Unused                      |
| 14                | DATA1       | Parallel port signal DATA1  |
| 15                | GND         | Signal Ground               |
| 16                | DATA0       | Parallel port signal DATA0  |

This connector mates with the 16 conductor flat cable that connects to the USB/SPI Dongle (KITUSBSPIIDGLEVME).

## 4.5 Screw Terminal Connections

The EVB contains input and output screw terminal connections to allow easy access to the MC33932's drive circuits. The diagram below shows the locations of the screw terminals and their functional definitions:



### Figure 3. Screw Terminals with Definitions

## 4.6 VBAT Connector

The VBAT Connector is a 2 position screw terminal that provides +12 Volt and Ground Terminals. The Ground terminal is marked “**GND**” and the +12 Volt Terminal is marked “**VBAT**”.

## 4.7 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**”

## 5 Setup and Example Demonstrations

To perform the examples included in the CD the following connections and setup must be performed:

1. Make sure the SPIGen 5.0X program is installed on the PC and 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 browse to the CD containing the "MC33932\_EVB\_CONFIGURATION\_FILE.spi" file. The title on the SPIGen screen should change from "Generic SPI Generator" to "MC33932 SPI Generator".
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 and then click on the following buttons to set the 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.  
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.
9. 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.
10. 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.

### EXAMPLE 1. RUNNING THE TEST BOTH H-BRIDGES BATCH FILE

1. Click on the "Send a Batch of Commands" Tab in the SPIGen main screen.
2. In the box below the "Commands to Send:" column is a pull-down menu box containing several batch file names. One of these example batch files is labeled **"Test Both H-Bridges"**.
3. Click on this label to load it. You should see a list of commands in the "Command to Send" box.
4. Click on the **"Continuous"** 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 can be run and examined for learning how to use the EVB.



# 6 EVB Schematic

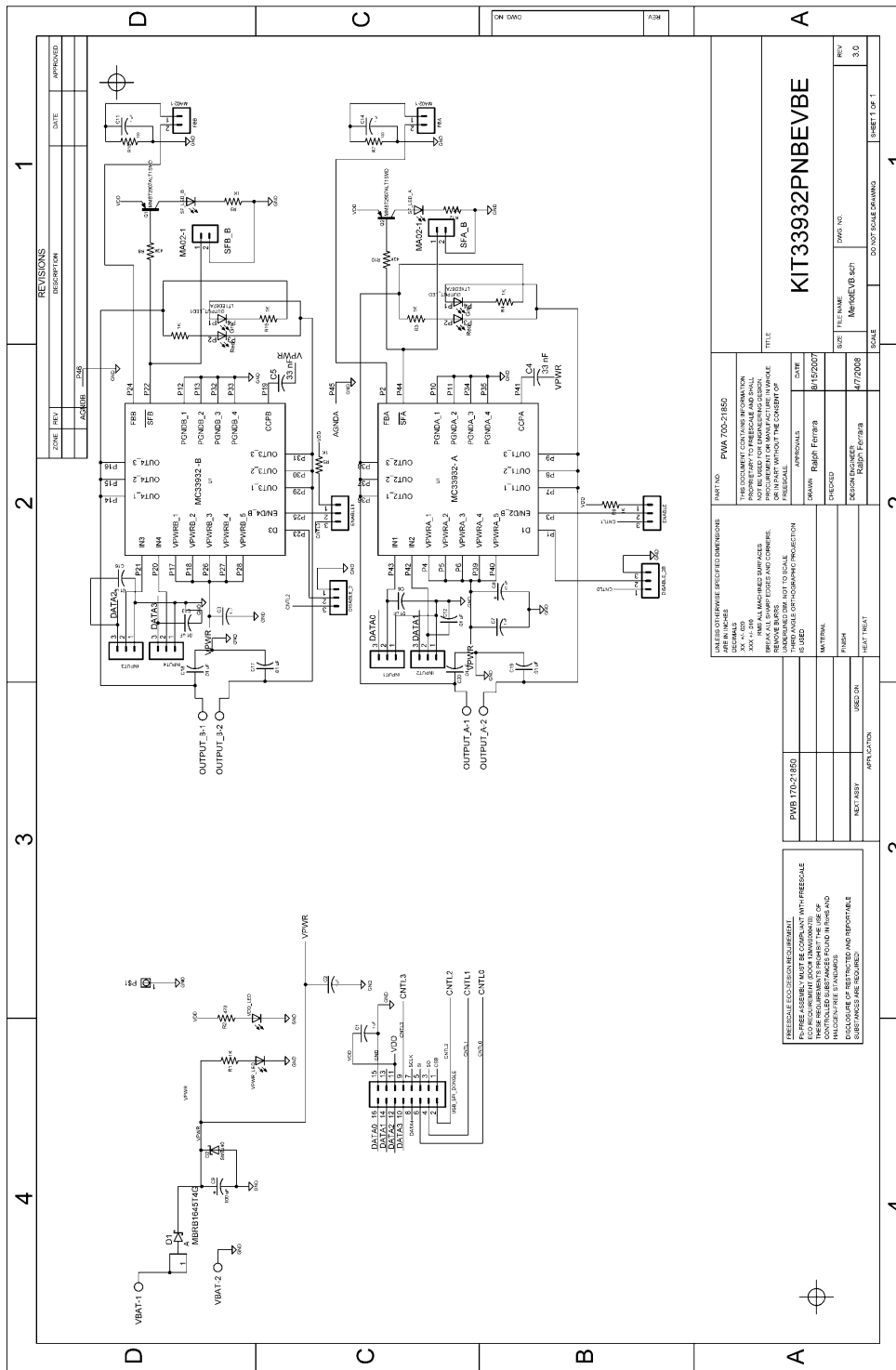


Figure 4. EVB Schematic

# 7 Board Layout

## 7.1 Assembly Layer Top

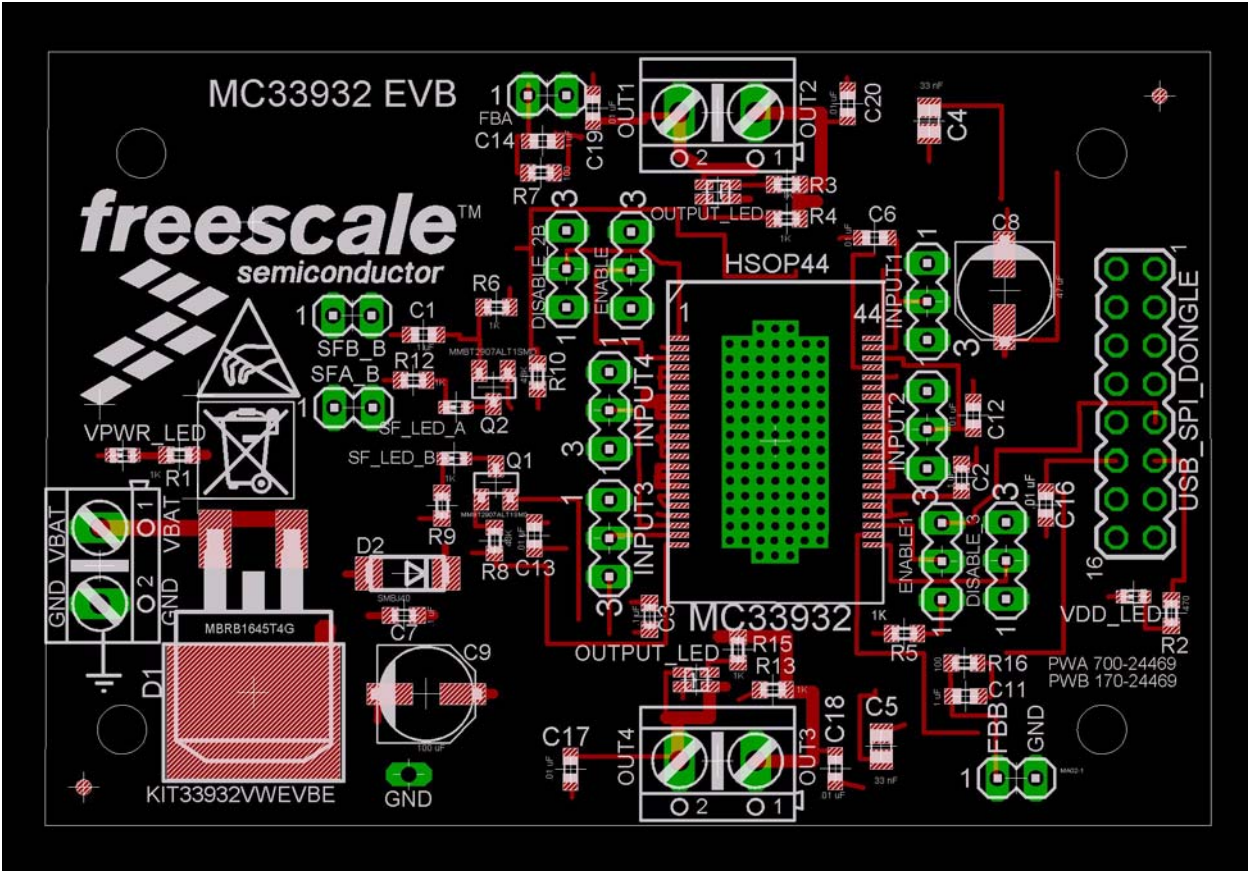


Figure 5. Assembly Layer Top

# 7.2 Assembly Layer Bottom

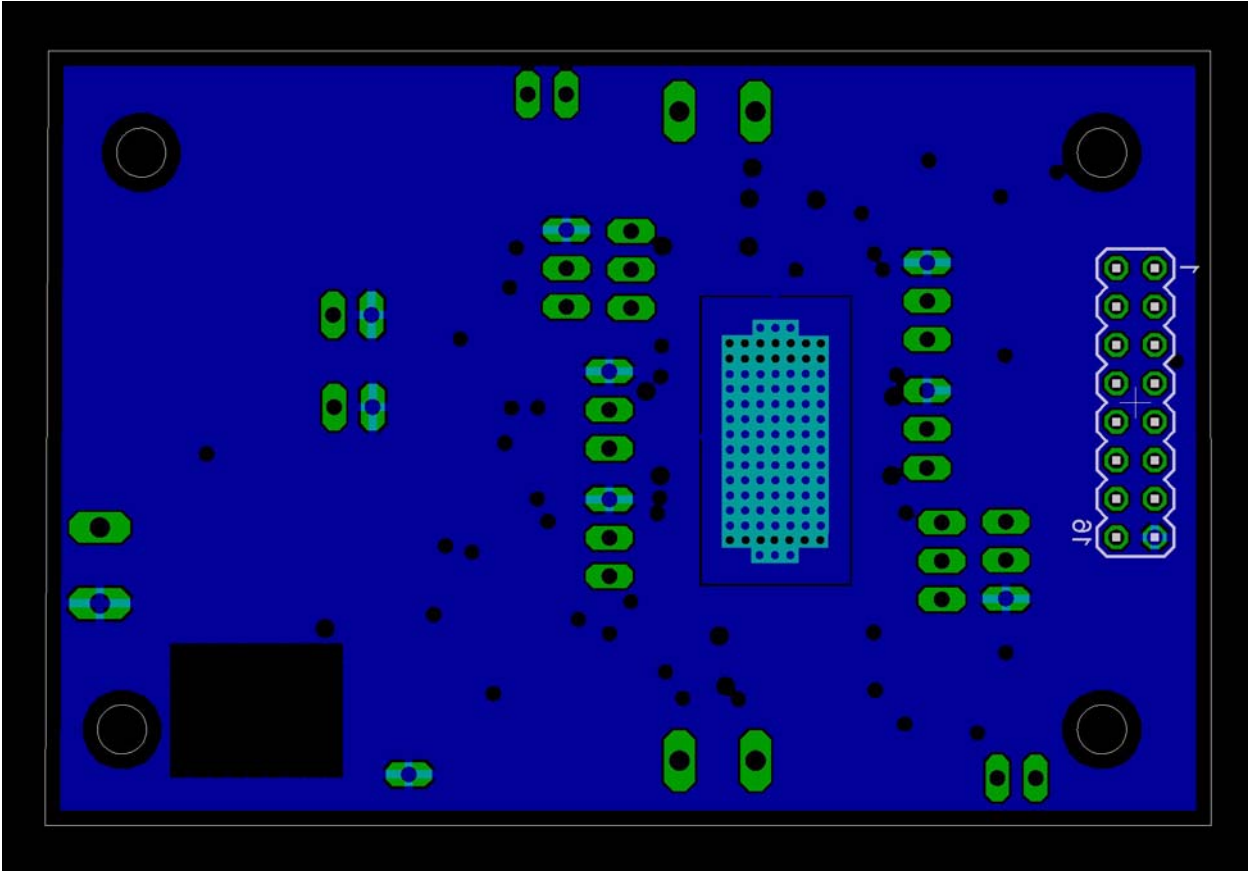


Figure 6. Assembly Layer Bottom

# 8 Bill of Material

| Reference Designation       | Value   | Package     | Description                              | Mfr       | PN            |
|-----------------------------|---------|-------------|------------------------------------------|-----------|---------------|
| <b>Freescale Components</b> |         |             |                                          |           |               |
| U7                          | MC33932 | HSOP44      | Freescale 5.0A Throttle Control H-Bridge | Freescale | MC34700EP     |
| <b>Capacitors</b>           |         |             |                                          |           |               |
| C1                          | .1 uF   | C0603       | CAP 0.1UF 25V CERAMIC X7R 0603           |           | 399-1281-1-ND |
| C2                          | .1 uF   | C0603       | CAP 0.1UF 25V CERAMIC X7R 0603           |           | 399-1281-1-ND |
| C3                          | .1 uF   | C0603       | CAP 0.1UF 25V CERAMIC X7R 0603           |           | 399-1281-1-ND |
| C4                          | 33 nF   | C0805       | CAP 33000PF 50V CERM X7R 0805            |           | PCC1834CT-ND  |
| C5                          | 33 nF   | C0805       | CAP 33000PF 50V CERM X7R 0805            |           | PCC1834CT-ND  |
| C6                          | .01 uF  | C0603       |                                          |           |               |
| C7                          | .1 uF   | C0603       |                                          |           |               |
| C8                          | 47 uF   | PANASONIC_D |                                          |           |               |
| C9                          | 100 uF  | PANASONIC_D |                                          |           |               |
| C11                         | 1 uF    | C0603       |                                          |           |               |
| C12                         | .01 uF  | C0603       |                                          |           |               |
| C13                         | .01 uF  | C0603       |                                          |           |               |
| C14                         | 1 uF    | C0603       |                                          |           |               |
| C16                         | .01 uF  | C0603       |                                          |           |               |
| C17                         | .01 uF  | C0603       |                                          |           |               |
| C18                         | .01 uF  | C0603       |                                          |           |               |
| C19                         | .01 uF  | C0603       |                                          |           |               |
| C20                         | .01 uF  | C0603       |                                          |           |               |
| <b>Resistors</b>            |         |             |                                          |           |               |
| R1                          | 1K      | R0603       |                                          |           |               |
| R2                          | 470     | R0603       |                                          |           |               |
| R3                          | 1K      | R0603       |                                          |           |               |
| R4                          | 1K      | R0603       |                                          |           |               |
| R5                          | 1K      | R0603       |                                          |           |               |
| R6                          | 1K      | R0603       |                                          |           |               |
| R7                          | 100     | R0603       |                                          |           |               |
| R8                          | 43K     | R0603       |                                          |           |               |
| R9                          | 1K      | R0603       |                                          |           |               |
| R10                         | 43K     | R0603       |                                          |           |               |
| R12                         | 1K      | R0603       |                                          |           |               |
| R13                         | 1K      | R0603       |                                          |           |               |
| R15                         | 1K      | R0603       |                                          |           |               |
| R16                         | 100     | R0603       |                                          |           |               |

| Reference Designation | Value            | Package      | Description | Mfr | PN |
|-----------------------|------------------|--------------|-------------|-----|----|
| <b>Diodes</b>         |                  |              |             |     |    |
| D1                    | MBRB1645T4G      | D2PAK        |             |     |    |
| D2                    | SMBJ40           | DO214AA      |             |     |    |
| <b>Other</b>          |                  |              |             |     |    |
| DISABLE_2B            | MA03-1           | MA03-1       |             |     |    |
| DISABLE_3             | MA03-1           | MA03-1       |             |     |    |
| ENABLE                | MA03-1           | MA03-1       |             |     |    |
| ENABLE_1              | MA03-1           | MA03-1       |             |     |    |
| FBA                   | MA02-1           | MA02-1       |             |     |    |
| FBB                   | MA02-1           | MA02-1       |             |     |    |
| GND                   | MA01-1           | MA01-1       |             |     |    |
| INPUT1                | MA03-1           | MA03-1       |             |     |    |
| INPUT2                | MA03-1           | MA03-1       |             |     |    |
| INPUT3                | MA03-1           | MA03-1       |             |     |    |
| INPUT4                | MA03-1           | MA03-1       |             |     |    |
| OUTPUT_A              |                  | AK500/2      |             |     |    |
| OUTPUT_B              |                  | AK500/2      |             |     |    |
| OUTPUT_LED            | LT1ED67A         | 1.6X1.6      |             |     |    |
| OUTPUT_LED1           | LT1ED67A         | 1.6X1.6      |             |     |    |
| Q1                    | MMBT2907ALT 1SMD | SOT23-BEC    |             |     |    |
| Q2                    | MMBT2907ALT 1SMD | SOT23-BEC    |             |     |    |
| SFA_B                 | MA02-1           | MA02-1       |             |     |    |
| SFB_B                 | MA02-1           | MA02-1       |             |     |    |
| SF_LED_A              |                  | CHIP-LED0603 |             |     |    |
| SF_LED_B              |                  | CHIP-LED0603 |             |     |    |
| USB_SPI_DONGLE        | MA08-2           | MA08-2       |             |     |    |
| VBAT                  |                  | AK500/2      |             |     |    |
| VDD_LED               |                  | CHIP-LED0603 |             |     |    |
| VPWR_LED              |                  | CHIP-LED0603 |             |     |    |

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

# 9    References

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

| Description                 | URL                                                                                                                                      |
|-----------------------------|------------------------------------------------------------------------------------------------------------------------------------------|
| Data Sheet - MC34932        | <a href="http://www.freescale.com/files/analog/doc/data_sheet/MC33932.pdf">www.freescale.com/files/analog/doc/data_sheet/MC33932.pdf</a> |
| Freescale's Web Site        | <a href="http://www.freescale.com">www.freescale.com</a>                                                                                 |
| Freescale's Analog Web Site | <a href="http://www.freescale.com/analog">www.freescale.com/analog</a>                                                                   |

# 10 Revision History

| REVISION | DATE   | DESCRIPTION OF CHANGES                                                                                                                                            |
|----------|--------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1.0      | 7/2008 | <ul style="list-style-type: none"> <li>Initial Release</li> </ul>                                                                                                 |
| 2.0      | 4/2011 | <ul style="list-style-type: none"> <li>Added <a href="#">Kit Contents / Packing List on page 2</a> and Revised <a href="#">Block Diagram on page 5</a></li> </ul> |

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