

# KIT33932VWEVBE Evaluation Board

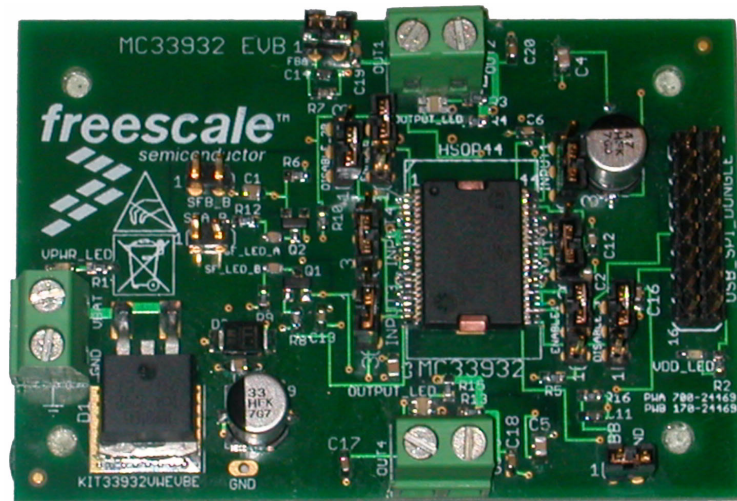


Figure 1. Evaluation Board

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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

## 2 Important Notice

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### 3 Kit Introduction

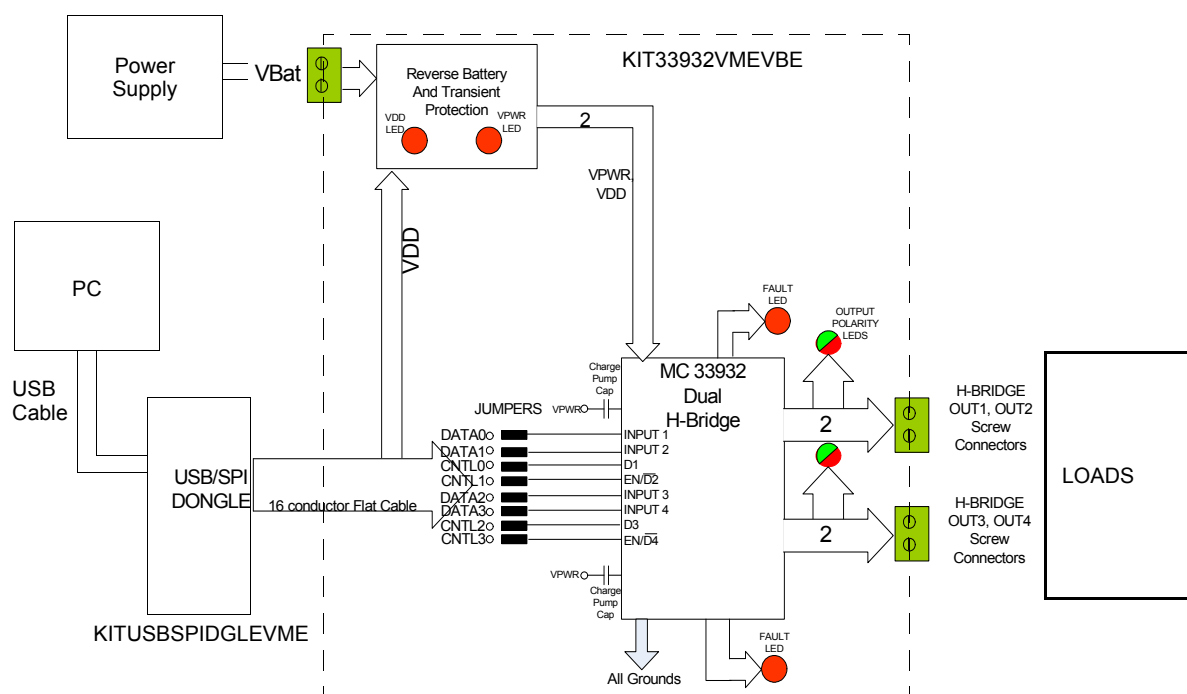
- The **KIT33932VWEVBE** Evaluation Board (EVB) is an easy-to-use circuit board that allows the user to exercise all the functions of the MC33932 H-Bridge circuit. The EVB parallel input can be easily controlled through a USB/SPI Dongle connected to a PC's USB port. The Freescale SPIGen program provides 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	1-2/2-3	<b>GND/DATA0</b>
INPUT 2	1-2/2-3	<b>GND/DATA1</b>
INPUT3	1-2/2-3	<b>GND/DATA2</b>
INPUT4	1-2/2-3	<b>GND/DATA3</b>
ENABLE/DISABLE 2	1-2/2-3	<b>PullUp/CNTL1</b>
ENABLE/DISABLE 4	1-2/2-3	<b>PullUp/CNTL3</b>
DISABLE 1	1-2/2-3	CNTL0/ <b>GND</b>
DISABLE_2B	1-2/2-3	<b>GND/CNTL2</b>

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 (KITUSBSPIDGLEVME).

## 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:

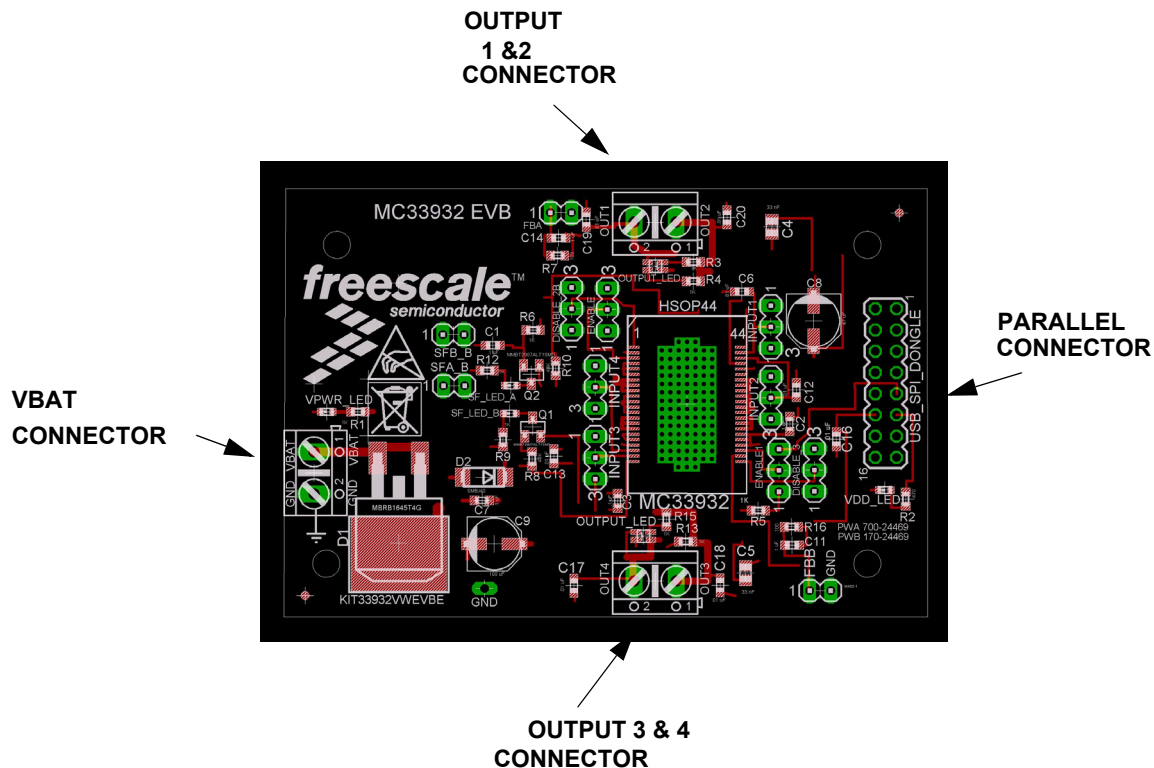


Figure 3. Screw Terminals with Definitions

## 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

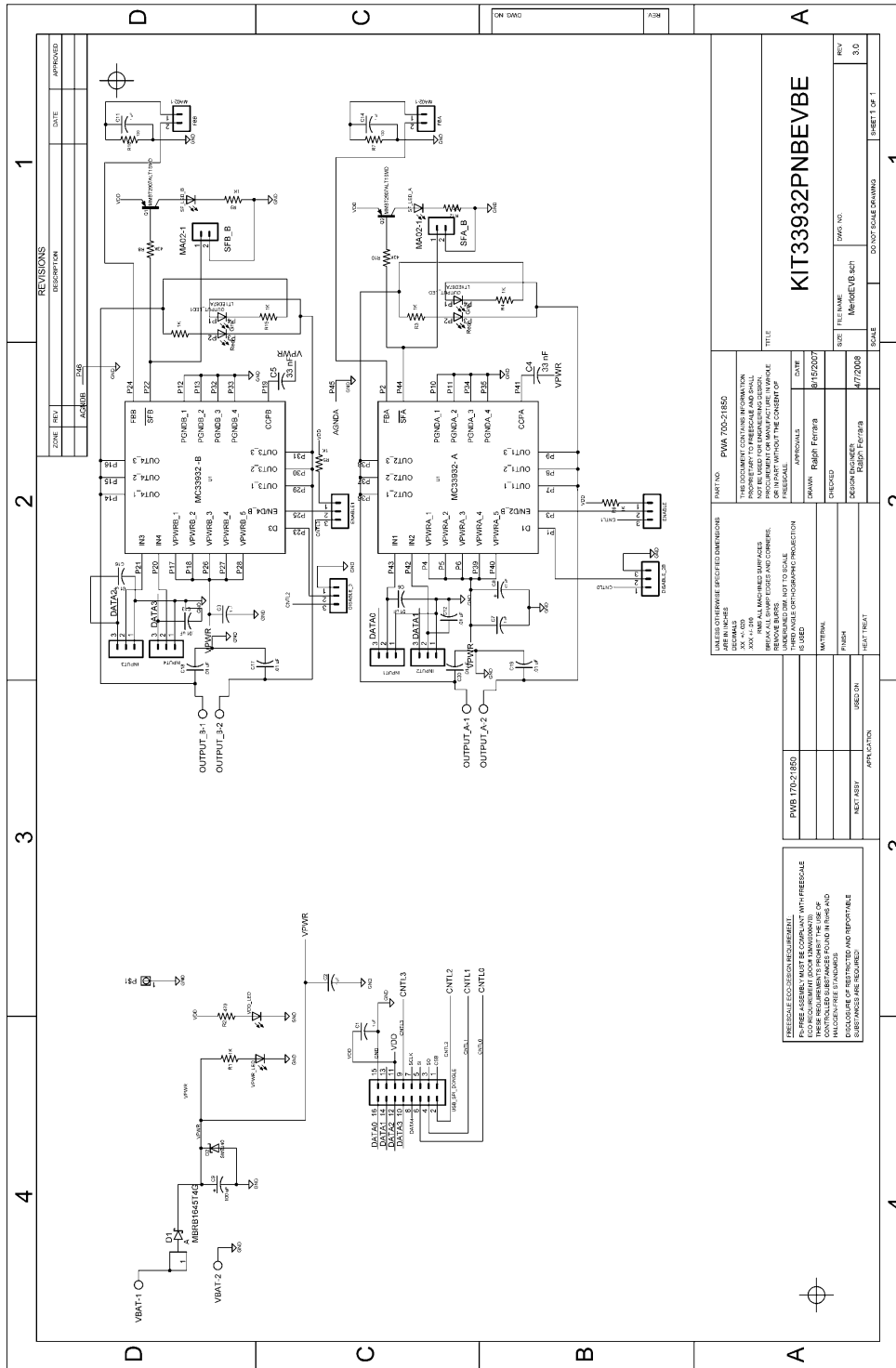


Figure 4. EVB Schematic

## 7 Board Layout

### 7.1 Assembly Layer Top

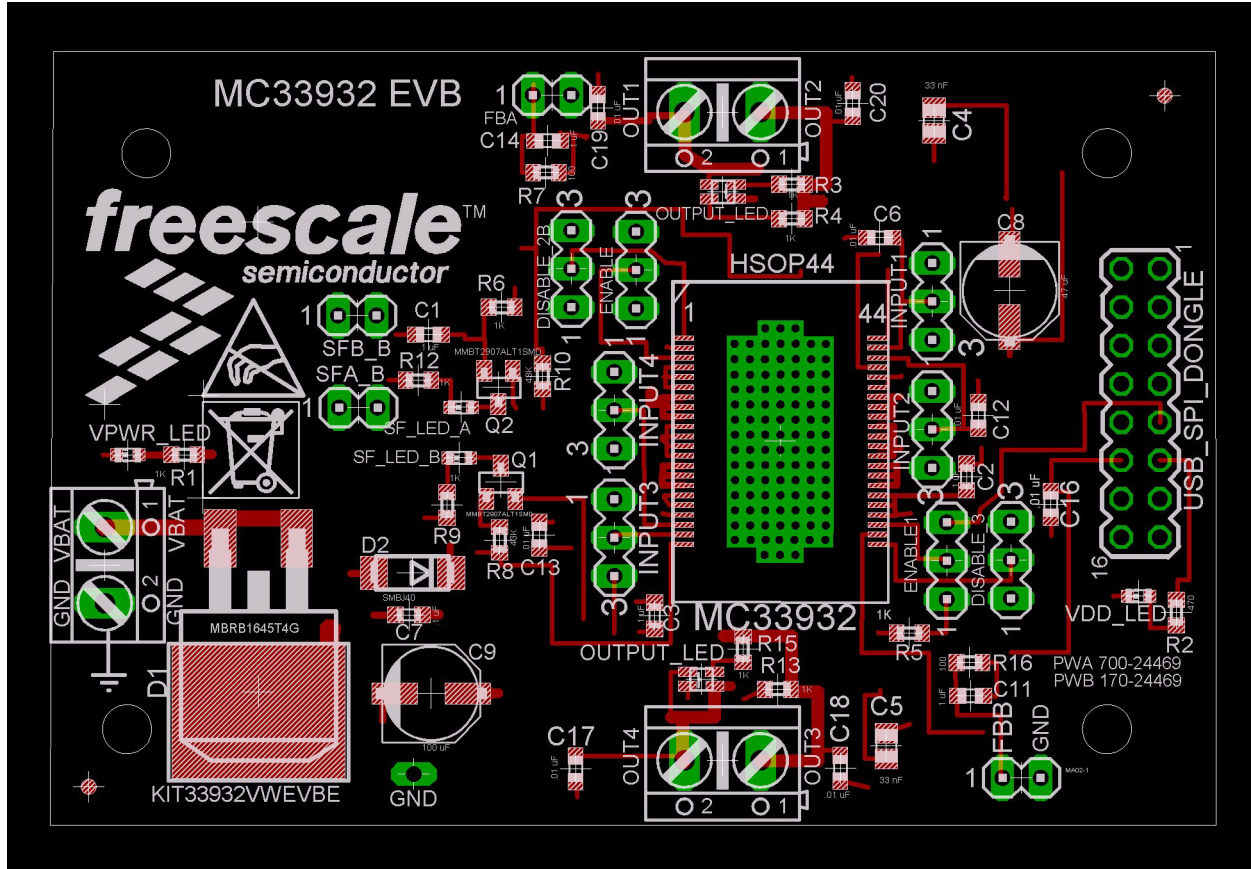


Figure 5. Assembly Layer Top

## 7.2 Assembly Layer Bottom

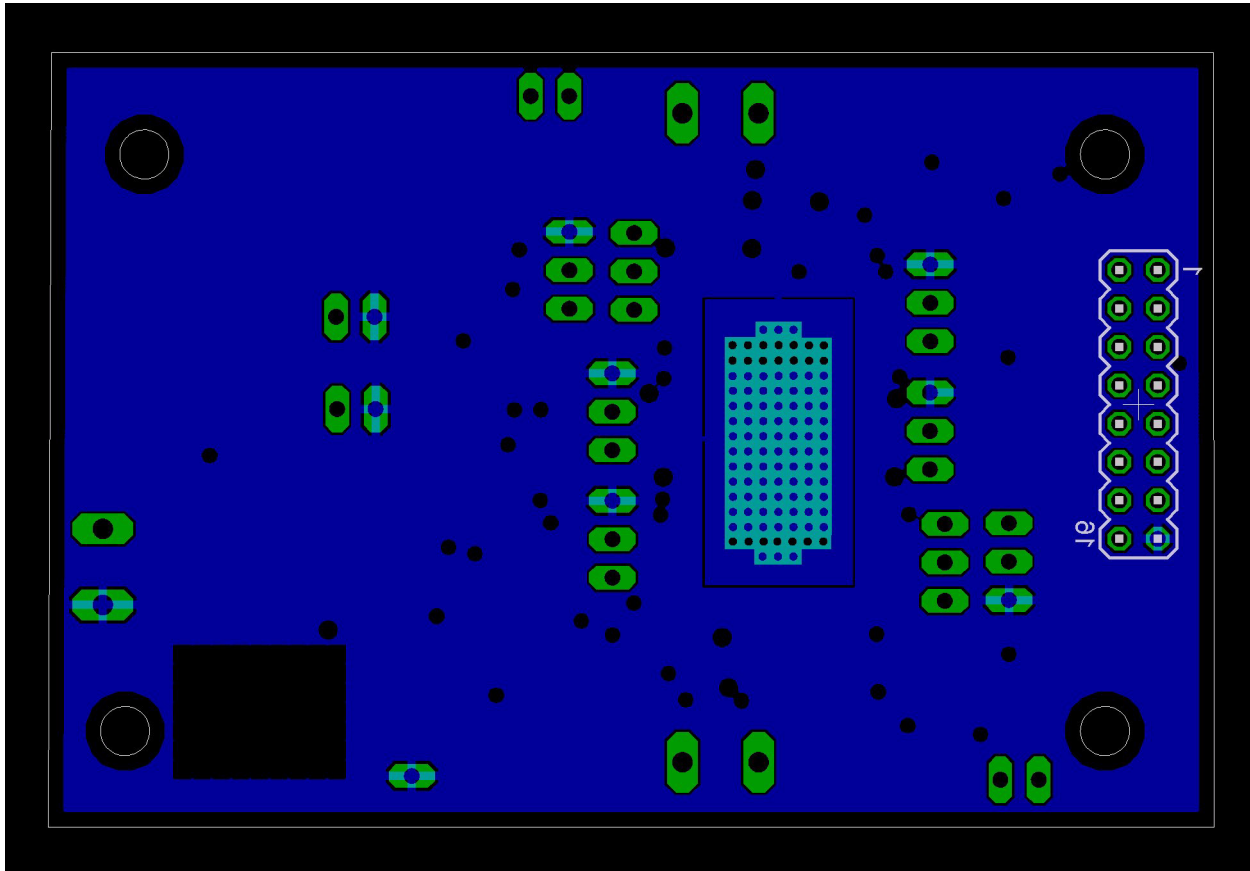


Figure 6. Assembly Layer Bottom

## 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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Freescale Semiconductor Japan Ltd.  
Headquarters  
ARCO Tower 15F  
1-8-1, Shimo-Meguro, Meguro-ku,  
Tokyo 153-0064  
Japan  
0120 191014 or +81 3 5437 9125  
[support.japan@freescale.com](mailto:support.japan@freescale.com)

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Freescale Semiconductor China Ltd.  
Exchange Building 23F  
No. 118 Jianguo Road  
Chaoyang District  
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