

KIT33812EKEVBE Evaluation Board

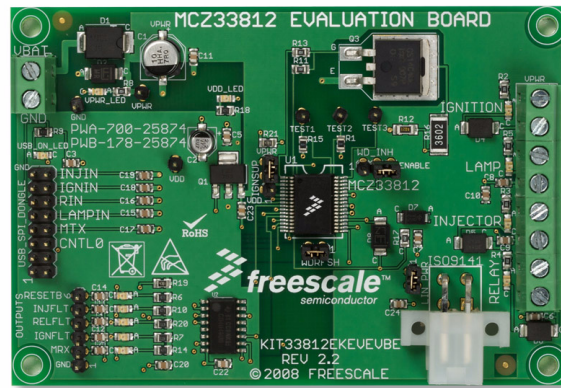


Figure 1. KIT33812EKEVBE Evaluation Board

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1 Kit Contents / Packing List

- KIT33812EKEVBE Evaluation Board
- CD33812

2 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 EVB 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 EVB 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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3 Kit Introduction

KIT33812EKEVBE Evaluation Board (EVB) is an easy-to-use circuit board used to exercise all the functions of the MC33812 Multifunctional Ignition and Injector Driver. A Personal Computer (PC) communicates to the EVB through a USB/SPI Dongle (KITUSBSPIIDGLEVME) connected to the PC's USB port. The Freescale SPIGen program provides the user Interface to the MC33812 EVB's SPI port and is used to send commands to the IC.

3.1 EVB Features

- Designed to operate over the range of $\sim 4.7V \leq V_{PWR} \leq 36V$
- Fuel Injector driver - Current Limit - 4.0A Typical
- Ignition pre-driver can drive IGBT or Darlington bipolar junction transistor
- Ignition pre-driver has independent high and low side outputs
- Relay driver - Current Limit - 4.0A Typical
- Lamp driver- Current Limit - 1.5A Typical
- All external outputs protected against short to battery, over-current
- Ignition and other drivers protected against over-temperature
- Interfaces directly to MCU Using 5.0V parallel interface
- VCC voltage pre-regulator provides +5.0V power for MCU
- MCU Power On $\overline{\text{RESET}}$ generator
- MCU watchdog timer circuit with parallel refresh/time setting line
- Independent fault annunciation outputs for ignition and injection
- ISO-9141 K-Line transceiver for communicating diagnostic messages
- Pb-free packaging designated by suffix code EK

4 Required Equipment

Minimum required equipment:

- Power supply: 5.5 to 18V
- USB-SPI Dongle
- USB Cable
- 16-wire ribbon cable with 16 pins ribbon cable connectors on both sides
- USB enabled computer with Windows XP
- SPIGen software (Setup.exe)

5 EVB Block Diagram

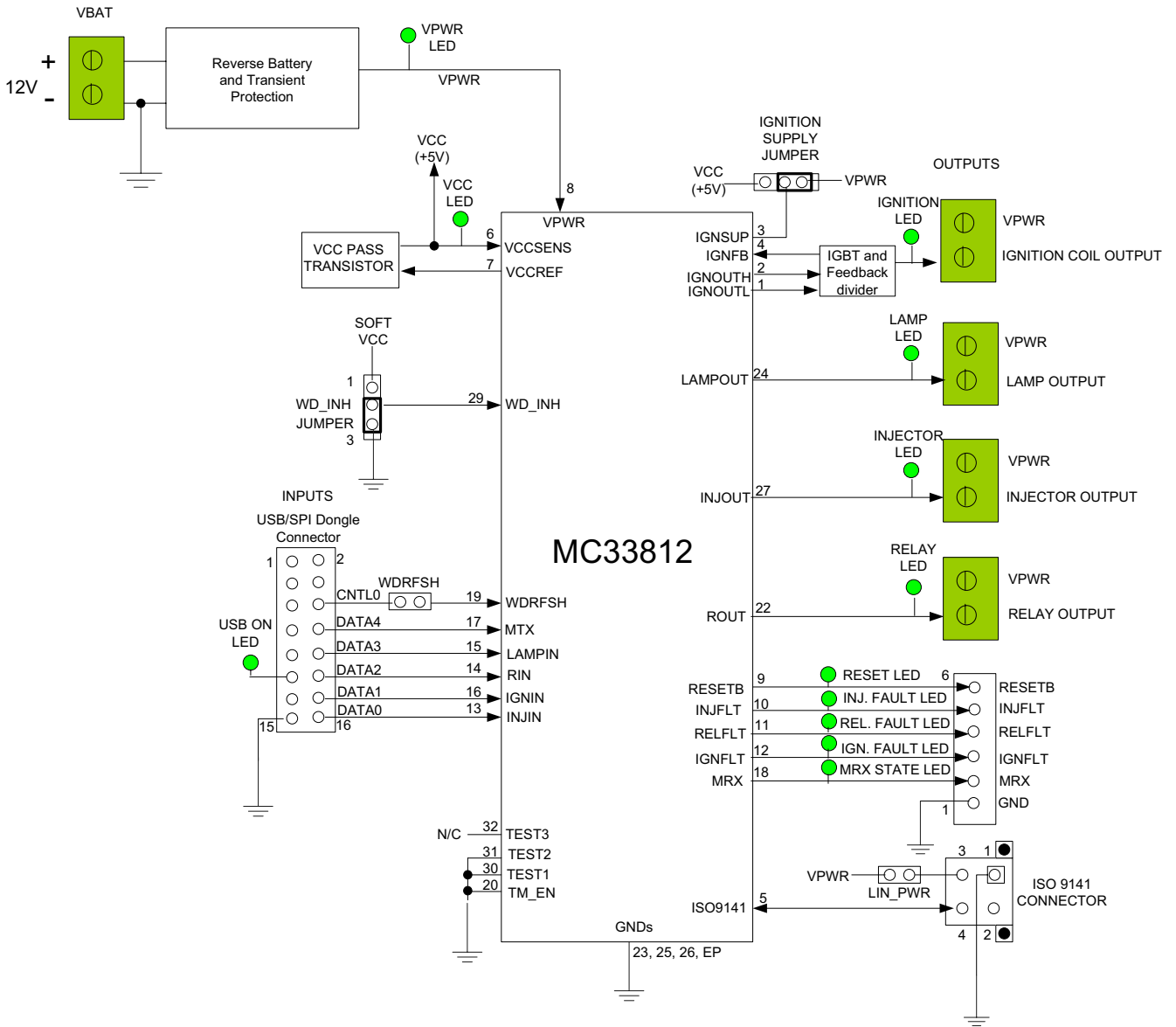


Figure 1. EVB Block Diagram

6 Using Hardware

This EVB consists of a MC33812 Small Engine Control Circuit, a USB to SPI Dongle interface, power conditioning circuitry, and a set of Input Select Jumpers. All +5 volt VCC power required by the EVB is obtained from the MC33812 built-in power regulator.

6.1 LED Display

Twelve LED's are provided as visual output devices for the MC33812 EVB board. A list of the LED devices is shown below:

1. VPWR LED - Indicates when +12V supply is connected to the EVB.
2. VCC LED - Indicates that the MC33812 internal +5V regulator is running and providing the +5V VCC voltage supply
3. IGNITION LED - Indicates that the Ignition Input, IGNIN, is active and the Ignition Output driver is turned on.
4. LAMP LED - Indicates that the Lamp Input, LAMPIN, is active and the Lamp Output is pulled low.
5. INJECTOR LED - Indicates that the Injector Input, INJIN, is active and the Injector Output is pulled low.
6. RELAY LED - Indicates that the Relay Input, RIN, is active and the Relay Output is pulled low.
7. RESET LED - Indicates that the RESETB output logic level is active (low).
8. INJECTOR FAULT LED - Indicates that there is either a short to Battery, Open Load or other fault on the Injector output.
9. RELAY FAULT LED - Indicates that there is either a short to Battery, Open Load or other fault on the Relay output.
10. IGNITION FAULT LED - Indicates that there is either a short to Battery, Open Load or other fault on the Ignition IGBT output.
11. MRX STATE LED - Indicates the state of the MRX line as a result of the data on the ISO9141 line.
12. USB ON LED - Indicates that the USB SPI dongle is connected properly and is attached to an active USB port on a PC.

6.2 Selection Jumper Definitions

The EVB contains four jumpers that provide certain selections for the MC33812 as follows (**Bold** = default factory setting):

<u>JUMPER NAME</u>	<u>JUMPER POSITION</u>	<u>/ CONNECTION</u>
WD_INH	1-2 / 2-3	+5V PU/GND
WDRFSH	OFF/ON	OPEN/CNTL0
LIN_PWR	OFF/ON	FLOAT/VPWR
IGNITION SUPPLY	1 -2 /2 - 3	VCC/VPWR

6.2.1 WD_INH Jumper

The WD_INH is the Watch Dog Inhibit enable/disable setting jumper. With a shorting jumper between pins 1 and 2, the WD_INH pin on the MC33812 is pulled high through a 4.7K resistor to +5 V, causing the Watch Dog circuit to be disabled. With the shorting jumper between pins 2 and 3, or left off, the WD_INH pin on the MC33812 is pulled to GND, enabling the Watch Dog circuit.

6.2.2 WDRFSH Jumper

The WDRFSH jumper provides a connection from the MC33812's WDRFSH line to the CNTL0 output from the USB/SPI Dongle interface. The WDRFSH line is the logic input that "Pets" the Watch Dog timer circuit, preventing it from issuing a RESET signal when the Watch Dog times out. Placing a shorting jumper between pins 1 and 2 connects the CNTL0 signal from the USB/SPI interface to this WDRFSH pin on the MC33812 circuit. Removing the jumper provides access to the WHDRFSH pin on the MC33812 circuit (on jumper pin 1) to allow other external pulse generators or logic outputs to drive this Watch Dog reloading input.

6.2.3 LIN_PWR Jumper

The LIN_PWR jumper allows the user to place VPWR on pin 3 of the ISO9141 connector. With a shorting jumper in place the VPWR supply is connected to pin 3 of the ISO9141 connector. With the jumper removed, pin 3 of the ISO9141 connector is left floating.

6.2.4 IGNITION SUPPLY Jumper

The MC33812 Ignition Outputs (IGNOUTL and IGNOUTH) are capable of driving either an IGBT transistor or a Darlington transistor to control a spark coil. The IGNITION SUPPLY selector jumper connects either the VCC supply or the VPWR supply to the MC33812's IGNSUP pin to provide the proper voltage for driving the chosen output transistor type. When a Darlington transistor is being used to drive the spark coil, the IGNITION SUPPLY Jumper should be placed on pins 1 and 2 to select VCC as the Ignition Supply, IGNSUP. When an IGBT is the transistor of choice, to drive the spark coil, the IGNITION SUPPLY Jumper should be placed on pins 2 and 3 (the factory default setting) to select VPWR as the Ignition Supply Voltage, IGNSUP, to be able to fully enhance the IGBT's gate.

The factory supplied IGBT can be replaced with a darlington transistor, if desired, however resistors R11 and R13 will need to be changed to provide the additional drive current required by the darlington transistor.

6.2.5 Input Signal Definitions

The MC33812 has six logic level input signals that are used to control certain outputs or functions inside the circuit. These six signals are:

1. WDRFSH - Reloads the Watch Dog to prevent issuing a RESET
2. MTX - Provides the transmit data to the ISO9141 line
3. LAMPIN - Controls the state of the LAMPOUT output
4. RIN - Controls the state of the ROUT output
5. IGNIN - Controls the state of the IGNOUTH and IGNOUTL outputs
6. INJIN - Controls the state of the INJOUT output

These six signals are provided by six of the parallel outputs from the USB/SPI interface as described below:

1. WDRFSH - Connected to the CNTL0 signal

2. MTX - Connected to the DATA4 signal
3. LAMPIN - Connected to the DATA3 signal
4. IN - Connected to the DATA2 signal
5. IGNIN - Connected to the DATA1 signal
6. INJIN - Connected to the DATA0 signal

DATA0 -DATA4 and CNTL0 signals are parallel outputs from the USB/SPI Dongle that can be controlled directly from the SPIGen program. An example config file called “MCZ33812_EVB_CONFIGURATION_FILE.spi”

is provided on the CD which contains several batch file examples.

If the user prefers to supply the various MC33812 input signals externally, other than from the USB-SPI Interface, the connections are available on the connector listed below.

6.2.6 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 –

Pin Number	Name	Description
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*	+3.3V	+3.3 V from USB
14	DATA1	Parallel port signal DATA1
15	GND	Signal Ground
16	DATA0	Parallel port signal DATA0

Notes: * These connections are unused in this EVB.

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

6.2.7 Screw Terminal Connections

The MC33812 board contains four output and one input screw terminal connections to allow easy access to the MC33812's circuits.

The diagram below shows the locations of the screw terminals and their functional definitions:

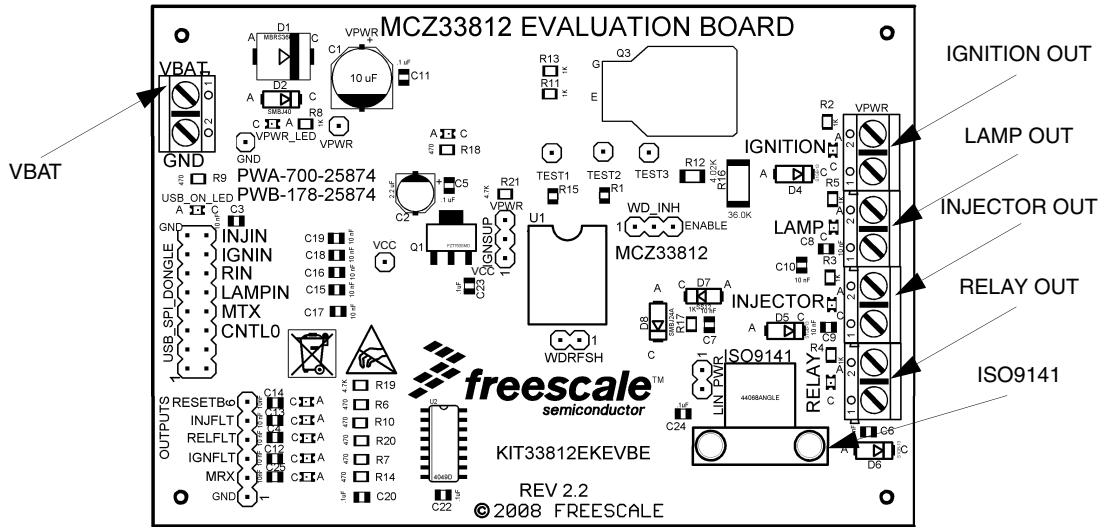


Figure 2. MC33812 EVB Screw Connectors

6.2.8 VBAT Input 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”.

6.2.9 ISO 9141 Connector

The ISO9141 connector is a four pin Input/Output connector that provides power, ground and the ISO9141 bidirectional signal.

6.2.10 Output Connectors

There are four Output Connectors which are 2 position screw terminals that provides the following signals:

1. 1) IGNITION OUT
 - Screw Terminal 1 - Low side drive, IGNOUT
 - Screw Terminal 2 - VPWR
2. 2) LAMP OUT
 - Screw Terminal 1 - Low Side LAMP OUT
 - Screw Terminal 2 - VPWR

3. 3) INJECTOR OUT
 - Screw Terminal 1 - Low side INJOUT
 - Screw Terminal 2 - VPWR
4. 4) RELAY OUT
 - Screw Terminal 1 - LOW side ROUT
 - Screw Terminal 2 - VPWR

6.2.11 MC33812 EVB 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 MC33812 EVB via a 16 pin ribbon cable. Make sure to orient the cable so that pin1 on both the USB/SPI Dongle and the MC33812 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 USB ON LED on the MC33812 board should both be illuminated.
4. Attach a +12 VDC supply (do not turn on power yet) to the VBAT connector on the MC33812 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 IGNITION OUT, LAMP OUT, INJECTOR OUT and RELAY OUT and ISO9141 terminals as appropriate.
6. Launch SPIGen and from the "File" menu, select "Open" and browse to the CD containing the "MCZ33812_EVB_CONFIGURATION_FILE.spi" file. The title on the SPIGen screen should change from "Generic SPI Generator" to "MC33812 SPI Generator".
7. Turn on the +12 Volt Supply. Verify that all is working correctly by observing the VPWR and VCC LEDs which should be illuminated. Click on the "Extra Pins" button in the SPIGen main screen and then click on the following buttons:
8. Click on the Data 0 "**High**" button. The INJECTOR load and LED should turn on. Clicking on the DATA 0 "**Low**" button should turn off the load and LED.
9. Click on the Data 1 "**High**" button. The IGNITION load and LED should turn on. Clicking on the DATA 1 "**Low**" button should turn off the IGNITION load and LED.
10. Click on the Data 2 "**High**" button. The RELAY load and LED should turn on. Clicking on the DATA 2 "**Low**" button should turn off the RELAY load and LED.
11. Click on the Data 3 "**High**" button. The LAMP load and LED should turn on. Clicking on the DATA 3 "**Low**" button should turn off the LAMP load and LED.
12. Click on the Data 4 "**High**" button. The ISO9141 load should turn on. Clicking on the DATA 3 "**Low**" button should turn off the ISO9141 load.

If everything described so far occurs then you are ready to proceed with the remaining examples.

7 EVb Schematic

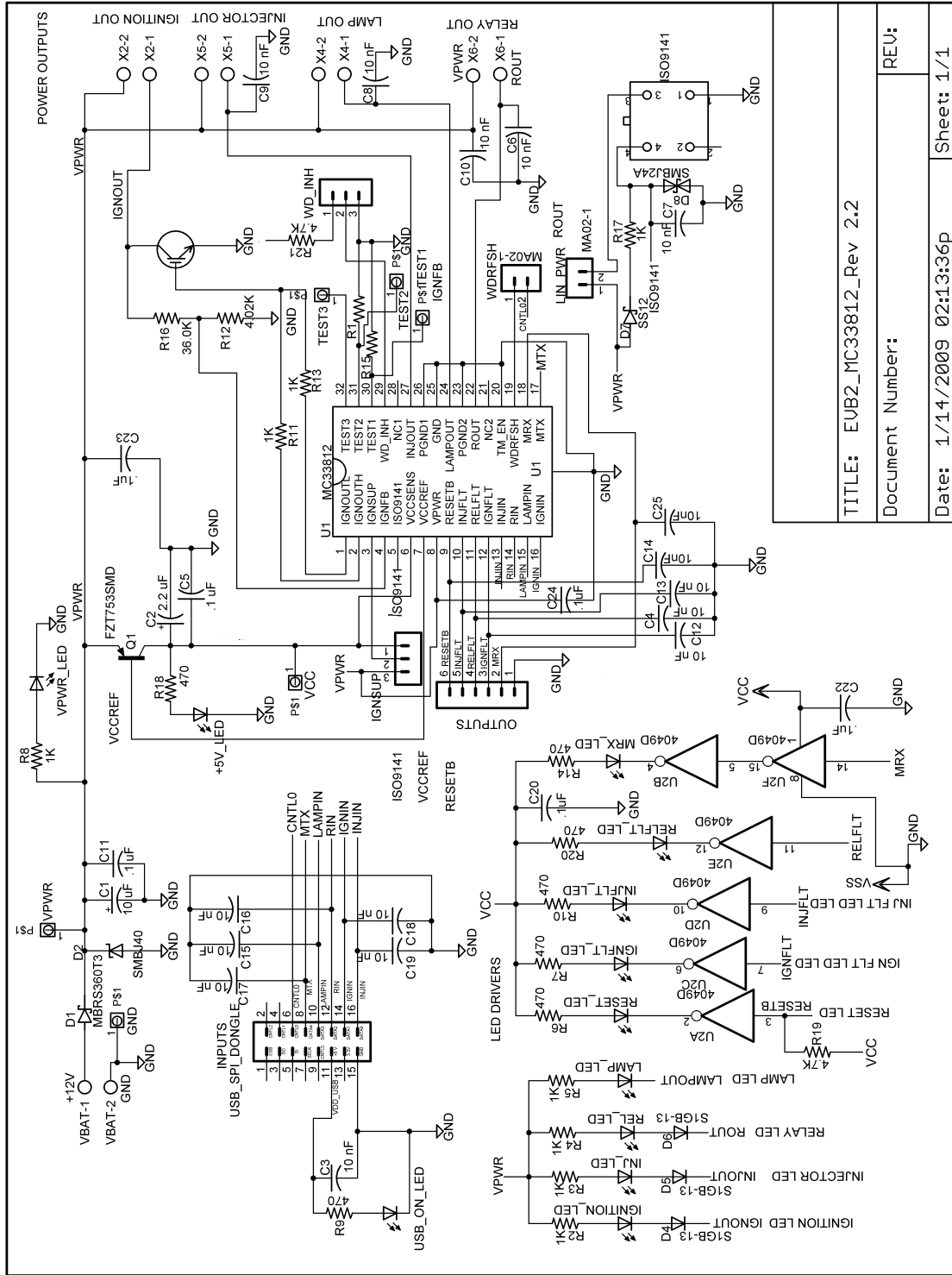


Figure 3. EVb Schematic

8 Board Layout

8.1 Assembly Drawing

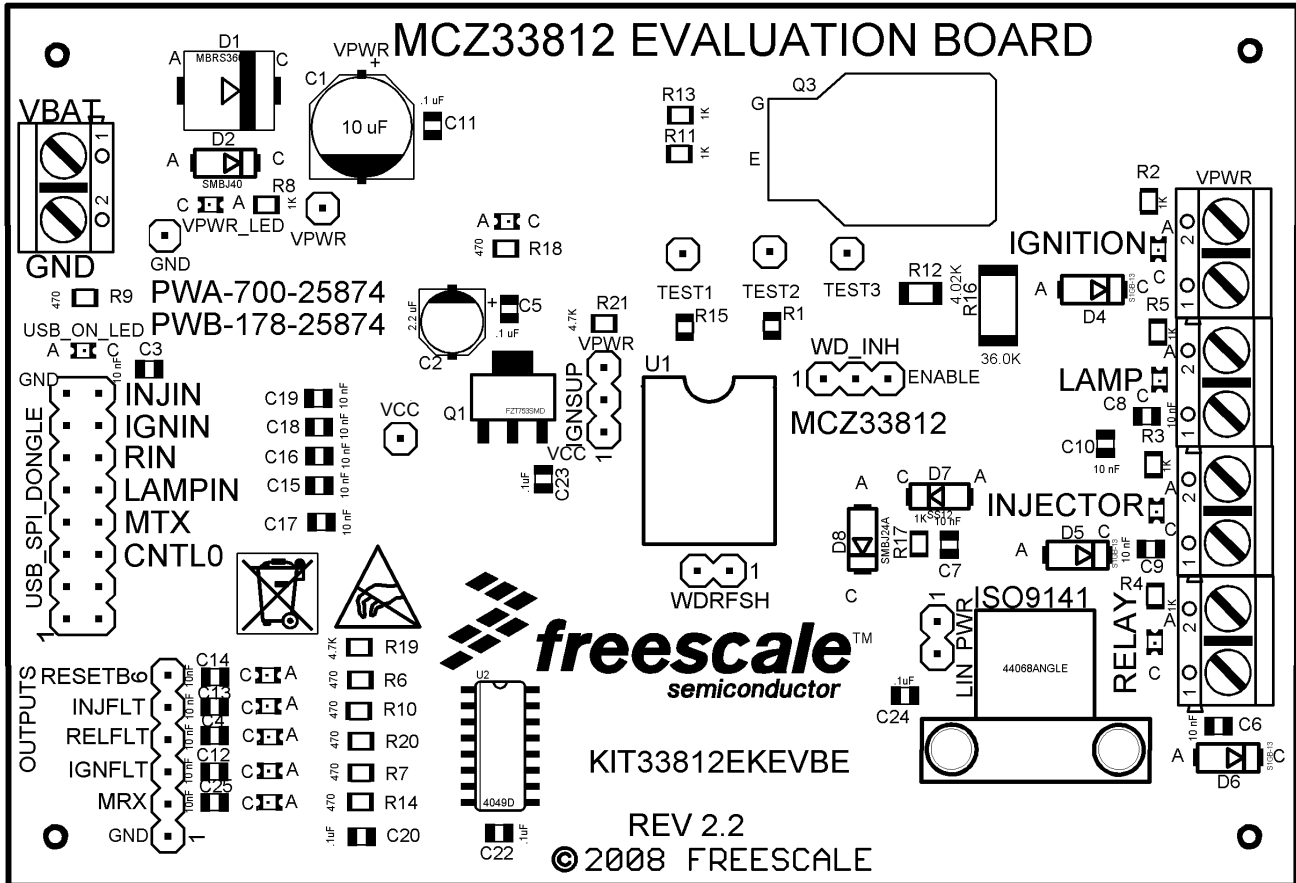


Figure 4. Assembly Drawing

8.2 PCB Top Layer

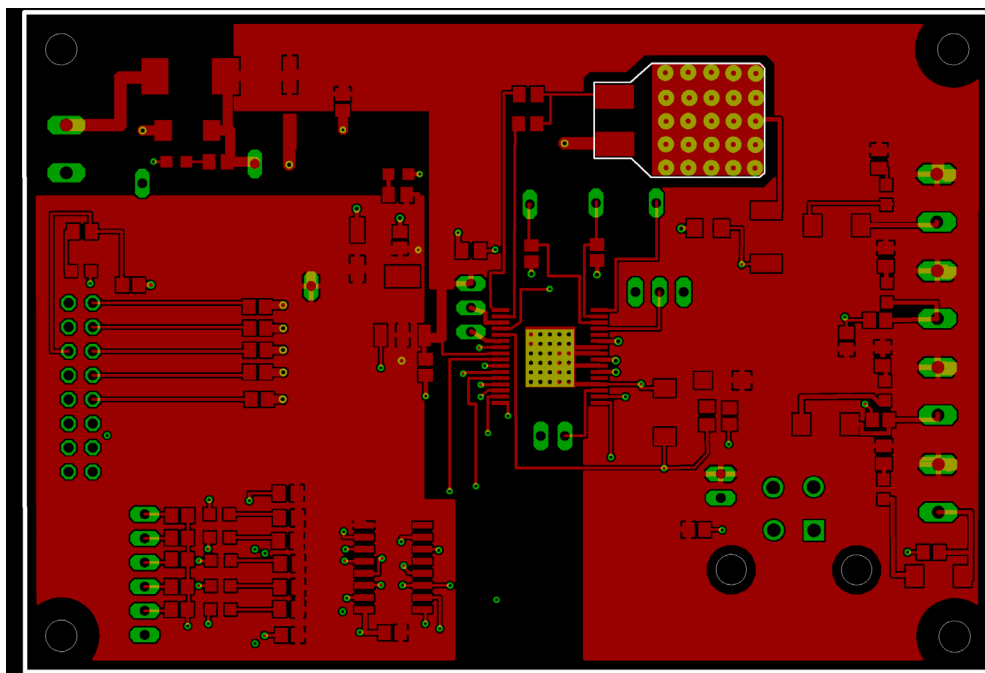


Figure 5. PCB Top Layer

8.3 PCB Bottom Layer

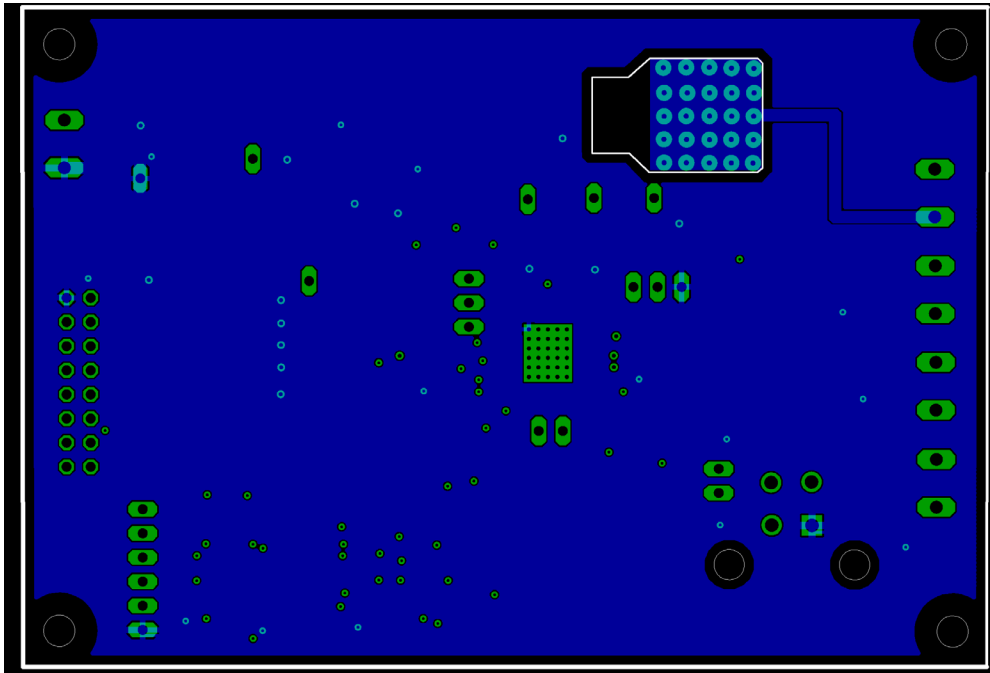


Figure 6. PCB Bottom Layer

9 KIT33812EKEVBE Bill of Material

Part Name	Value	Package	Mfr.	Mfr. Part #	Digi-Key Part #	Location	Orientation	Qty
Capacitors								
C1	10 uF/ 50V	PANASONIC_E	Panasonic	EEE-HA1H100P	PCE4209CT-ND	(1097.244 2355.906	R90	1
C2	2.2 uF/35V	PANASONIC_C	Panasonic	EEE-FC1V2R2R	PCE4027CT-ND	(1377.988 1750.504	R270	1
C3	10 nF	C0805	Murata Electronics NA	GCM2195C1H103JA16D	490-4783-1-ND	(437.319 1603.524	R0	16
C4	10 nF	C0805	Murata Electronics NA	GCM2195C1H103JA16D	490-4783-1-ND	(640.445 465.862)	R0	6
C5	0.1 uF	C0805	Murata Electronics NA	GCM21BR72A104KA37L	490-4789-1-ND	(1555.177 1790.657)	R90	
C6	10 nF	C0805	Murata Electronics NA	GCM2195C1H103JA16D	490-4783-1-ND	(3758.815 495.823)	R180	
C7	10 nF	C0805	Murata Electronics NA	GCM2195C1H103JA16D	490-4783-1-ND	(2922.146 1059.469)	R270	
C8	10 nF	C0805	Murata Electronics NA	GCM2195C1H103JA16D	490-4783-1-ND	(3536.098 1457.717)	R180	
C9	10 nF	C0805	Murata Electronics NA	GCM2195C1H103JA16D	490-4783-1-ND	(3548.012 1044.921)	R180	
C10	10 nF	C0805	Murata Electronics NA	GCM2195C1H103JA16D	490-4783-1-ND	(3407.654 1371.933)	R90	
C11	0.1 uF	C0805	Murata Electronics NA	GCM21BR72A104KA37L	490-4789-1-ND	(1317.173 2360.283)	R270	
C12	10 nF	C0805	Murata Electronics NA	GCM2195C1H103JA16D	490-4783-1-ND	(639.197 353.756)	R0	
C13	10 nF	C0805	Murata Electronics NA	GCM2195C1H103JA16D	490-4783-1-ND	(640.256 555.61)	R0	
C14	10 nF	C0805	Murata Electronics NA	GCM2195C1H103JA16D	490-4783-1-ND	(641.079 647.634)	R0	
C15	10 nF	C0805	Murata Electronics NA	GCM2195C1H103JA16D	490-4783-1-ND	(964.902 1242.331)	R0	
C16	10 nF	C0805	Murata Electronics NA	GCM2195C1H103JA16D	490-4783-1-ND	(965.346 1333.961)	R0	
C17	10 nF	C0805	Murata Electronics NA	GCM2195C1H103JA16D	490-4783-1-ND	(971.398 1129.232)	R0	
C18	10 nF	C0805	Murata Electronics NA	GCM2195C1H103JA16D	490-4783-1-ND	(964.386 1424.031)	R0	
C19	10 nF	C0805	Murata Electronics NA	GCM2195C1H103JA16D	490-4783-1-ND	(962.583 1513.295)	R0	
C20	.1uF	C0805	Murata Electronics NA	GCM21BR72A104KA37L	490-4789-1-ND	(1096.748 152.161)	R180	
C22	.1uF	C0805	Murata Electronics NA	GCM21BR72A104KA37L	490-4789-1-ND	(1524.047 162.972)	R180	
C23	.1uF	C0805	Murata Electronics NA	GCM21BR72A104KA37L	490-4789-1-ND	(1661.445 1263.165)	R270	
C24	.1uF	C0805	Murata Electronics NA	GCM21BR72A104KA37L	490-4789-1-ND	(2784.752 589.614)	R0	
C25	10nF	C0805	Murata Electronics NA	GCM2195C1H103JA16D	490-4783-1-ND	(639.492 258.76)	R0	

Part Name	Value	Package	Mfr.	Mfr. Part #	Digi-Key Part #	Location	Orientation	Qty
Diodes								
D1	MBRS360T3	SMC	ON Semiconductor	MBRS360T3G	MBRS360T3GOSCT-ND	(684.646 2468.898)	R180	1
D2	SMBJ40	DO214AA	Little Fuse	SMBJ40A	SMBJ40ALFCT-ND	(673.228 2243.622)	R180	1
D4	S1GB-13	DO214AA	Diodes, Inc.	S1GB-13-F	S1GB-FDICT-ND	(3366.72 1850.402)	R180	3
D5	S1GB-13	DO214AA	Diodes, Inc.	S1GB-13-F	S1GB-FDICT-ND	(3320.437 1026.295)	R180	
D6	S1GB-13	DO214AA	Diodes, Inc.	S1GB-13-F	S1GB-FDICT-ND	(3788.433 396.815)	R180	
D7	SS12	DO214AC	Vishay/General Semi.	SS12-E3/51T	SS12-E3/51TGI-ND	(2892.591 1208.165)	R0	1
D8	SMBJ24A	DO214AA	Little Fuse	SMBJ24A	SMBJ24ALFCT-ND	(2652.594 1075.378)	R90	1
+5V_LED	Green LED	CHIPLED_0805	Panasonic	LNJ306G5PRX	P11493CT-ND	(1548.839 2062.543)	R270	12
IGNFLT_LED	Green LED	CHIPLED_0805	Panasonic	LNJ306G5PRX	P11493CT-ND	(811.244 356.508)	R90	
IGNITION_LED	Green LED	CHIPLED_0805	Panasonic	LNJ306G5PRX	P11493CT-ND	(3571.504 1976.976)	R180	
USB_ON_LED	Green LED	CHIPLED_0805	Panasonic	LNJ306G5PRX	P11493CT-ND	(232.22 1661.366)	R270	
INJFLT_LED	Green LED	CHIPLED_0805	Panasonic	LNJ306G5PRX	P11493CT-ND	(807.516 557.181)	R90	
INJ_LED	Green LED	CHIPLED_0805	Panasonic	LNJ306G5PRX	P11493CT-ND	(3566.118 1164.677)	R180	
RELFLT_LED	Green LED	CHIPLED_0805	Panasonic	LNJ306G5PRX	P11493CT-ND	(812.126 461.988)	R90	
LAMP_LED	Green LED	CHIPLED_0805	Panasonic	LNJ306G5PRX	P11493CT-ND	(3575.409 1571.547)	R180	
REL_LED	Green LED	CHIPLED_0805	Panasonic	LNJ306G5PRX	P11493CT-ND	(3560.366 756.697)	R180	
RESET_LED	Green LED	CHIPLED_0805	Panasonic	LNJ306G5PRX	P11493CT-ND	(806.331 653.417)	R90	
MRX_LED	Green LED	CHIPLED_0805	Panasonic	LNJ306G5PRX	P11493CT-ND	(810.327 258.681)	R90	
VPWR_LED	Green LED	CHIPLED_0805	Panasonic	LNJ306G5PRX	P11493CT-ND	(627.709 2114.701)	R90	
Transistors								
Q1	FZT753SMD	SOT223	Zetex, Inc.	FZT753TA	FZT753CT-ND	(1566.016 1517.457)	R0	1
Q3	IRGS14C40LPBF	T0263N	International Rectifier	IRGS14C40LPBF	IRGS14C40LPBF-ND	(2847.083 2282.74)	R270	1
Integrated Circuits								
U1	MC33812	32SOICEP_FINAL	Freescale Semiconductor	PCZ33812	N/A	(2176.756 1320.075)	R0	1
U2	4049D	SOP16	Texas Instruments	CD4049UBNSR	296-14112-1-ND	(1527.165 433.114)	R270	1
Resistors								
R1	0	R0805	Panasonic ECG	ERJ-6GEY0R00V	P0.0ACT-ND	(2371.787 1738.146)	R270	2
R2	1K	M0805	Panasonic ECG	ERJ-6GEYJ102V	P1.0KACT-ND	(3542.252 2125.283)	R90	8
R3	1K	M0805	Panasonic ECG	ERJ-6GEYJ102V	P1.0KACT-ND	(3556.307 1307.303)	R90	
R4	1K	M0805	Panasonic ECG	ERJ-6GEYJ102V	P1.0KACT-ND	(3562.244 899.949)	R90	
R5	1K	M0805	Panasonic ECG	ERJ-6GEYJ102V	P1.0KACT-ND	(3570.165 1719.039)	R90	
R6	470	M0805	Panasonic ECG	ERJ-6GEYJ471V	P470ACT-ND	(1092.555 638.331)	R0	6
R7	470	M0805	Panasonic ECG	ERJ-6GEYJ471V	P470ACT-ND	(1094.189 350.961)	R0	
R8	1K	M0805	Panasonic ECG	ERJ-6GEYJ102V	P1.0KACT-ND	(800.634 2114.559)	R0	
R9	470	M0805	Panasonic ECG	ERJ-6GEYJ471V	P470ACT-ND	(237.594 1825.079)	R0	2
R10	470	M0805	Panasonic ECG	ERJ-6GEYJ471V	P470ACT-ND	(1088.65 542.626)	R0	
R11	1K	M0805	Panasonic ECG	ERJ-6GEYJ102V	P1.0KACT-ND	(2084 2272.008)	R0	
R12	4.02K	R1206	Panasonic ECG	ERJ-8ENF4021V	P4.02KFCT-ND	(2833.26 1838.929)	R0	1
R13	1K	M0805	Panasonic ECG	ERJ-6GEYJ102V	P1.0KACT-ND	(2086.646 2392.969)	R0	
R14	470	M0805	Panasonic ECG	ERJ-6GEYJ471V	P470ACT-ND	(1093.539 260)	R0	

KIT33812EKEVBE Bill of Material

Part Name	Value	Package	Mfr.	Mfr. Part #	Digi-Key Part #	Location	Orienta tion	Qty
Resistors (Continued)								
R15	0	R0805	Panasonic ECG	ERJ-6GEY0R00V	P0.0ACT-ND	(2100.657 1733.843)	R270	
R16	36.0K	R2512	Vishay/Dale	CRCW251236K0JNEG	541-36KXCT-ND	(3073.795 1802.346)	R270	1
R17	1K	M0805	Panasonic ECG	ERJ-6GEYJ102V	P1.0KACT-ND	(2827.925 1061.657)	R270	
R18	470	M0805	Panasonic ECG	ERJ-6GEYJ471V	P470ACT-ND	(1544.917 1978.461)	R180	
R19	4.7K	M0805	Panasonic ECG	ERJ-6GEYJ472V	P4.7KACT-ND	(1090 740)	R0	
R20	470	M0805	Panasonic ECG	ERJ-6GEYJ471V	P470ACT-ND	(1094.98 448.803)	R0	
R21	4.7K	M0805	Panasonic ECG	ERJ-6GEYJ472V	P4.7KACT-ND	(1849.992 1745.831)	R180	
Headers & Jumpers								
OUTPUTS	MA06-1	MA06-1	Tyco Electronics Amp	87224-6	A26551-ND	(496.043 403.72)	R90	1
LIN_PWR	MA02-1	MA02-1	Tyco Electronics Amp	87224-2	A26543-ND	(2885.441 771.134)	R270	2
TEST1	MA01-1	MA01-1	Tyco Electronics Amp	87224-1	A26541-ND	(2367.618 1943.13)	R0	6
TEST2	MA01-1	MA01-1	Tyco Electronics Amp	87224-1	A26541-ND	(2093.524 1937.445)	R0	
TEST3	MA01-1	MA01-1	Tyco Electronics Amp	87224-1	A26541-ND	(2617.248 1943.228)	R180	
GND	MA01-1	MA01-1	Tyco Electronics Amp	87224-1	A26541-ND	(486.169 2024.677)	R0	
USB_SPI_DONGL E	MA08-2	MA08-2	Tyco Electronics Amp	9-146261-0-04	A34268-04-ND	(230.394 1179.28)	R90	1
VCC	MA01-1	MA01-1	Tyco Electronics Amp	87224-1	A26541-ND	(1186.402 1599.343)	R180	
VPWR	MA01-1	MA01-1	Tyco Electronics Amp	87224-1	A26541-ND	(952.776 2105.823)	R180	
IGNSUP	MA03-1	MA03-1	Tyco Electronics Amp	87224-3	A26545-ND	(1849.13 1509.134)	R90	2
WDRFSH	MA02-1	MA02-1	Tyco Electronics Amp	87224-2	A26543-ND	(2188.618 977.976)	R180	
WD_INH	MA03-1	MA03-1	Tyco Electronics Amp	87224-3	A26545-ND	(2631.469 1574.665)	R0	
Connectors								
IGNITION OUT	X2	AK500/2	Phoenix Contact	1729128	277-1247-ND	(3781.425 1963.713)	R90	5
LAMP OUT	X4	AK500/2	Phoenix Contact	1729128	277-1247-ND	(3783.579 1563.244)	R90	
INJECTOR OUT	X5	AK500/2	Phoenix Contact	1729128	277-1247-ND	(3786.181 1163.307)	R90	
RELAY OUT	X6	AK500/2	Phoenix Contact	1729128	277-1247-ND	(3788.016 761.063)	R90	
VBAT	VBAT	AK500/2	Phoenix Contact	1729128	277-1247-ND	(170.945 2167.244)	R270	
ISO9141	44068ANGLE	5566-4A	Molex Waldom Elec.	39-29-1048	WM3901-ND	(3189.016 677.563)	R0	1

Notes: 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.

10 References

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

Products	Links
Data Sheet MC33812	www.freescale.com/files/analog/doc/data_sheet/MC33812.pdf
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Freescale's Powertrain an Engine Control	www.freescale.com/powertrain_and_engine_control
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11 Revision History

REVISION	DATE	DESCRIPTION OF CHANGES
2.0	7/2009	• Initial Release

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KT33812UG
Rev. 2.0
7/2009