

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.

Freescale reserves the right to make changes without further notice to any products herein. Freescale makes no warranty, representation or guarantee regarding the suitability of its products for any particular purpose, nor does Freescale assume any liability arising out of the application or use of any product or circuit, and specifically disclaims any and all liability, including without limitation consequential or incidental damages. "Typical" parameters can and do vary in different applications and actual performance may vary over time. All operating parameters, including "Typical", must be validated for each customer application by customer's technical experts.

Freescale does not convey any license under its patent rights nor the rights of others. Freescale products are not designed, intended, or authorized for use as components in systems intended for surgical implant into the body, or other applications intended to support or sustain life, or for any other application in which the failure of the Freescale product could create a situation where personal injury or death may occur.

Should Buyer purchase or use Freescale products for any such unintended or unauthorized application, Buyer shall indemnify and hold Freescale and its officers, employees, subsidiaries, affiliates, and distributors harmless against all claims, costs, damages, and expenses, and reasonable attorney fees arising out of, directly or indirectly, any claim of personal injury or death associated with such unintended or unauthorized use, even if such claim alleges that Freescale was negligent regarding the design or manufacture of the part. Freescale™ and the Freescale logo are trademarks of Freescale Semiconductor, Inc. All other product or service names are the property of their respective owners. © Freescale Semiconductor, Inc., 2009. All rights reserved.

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{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

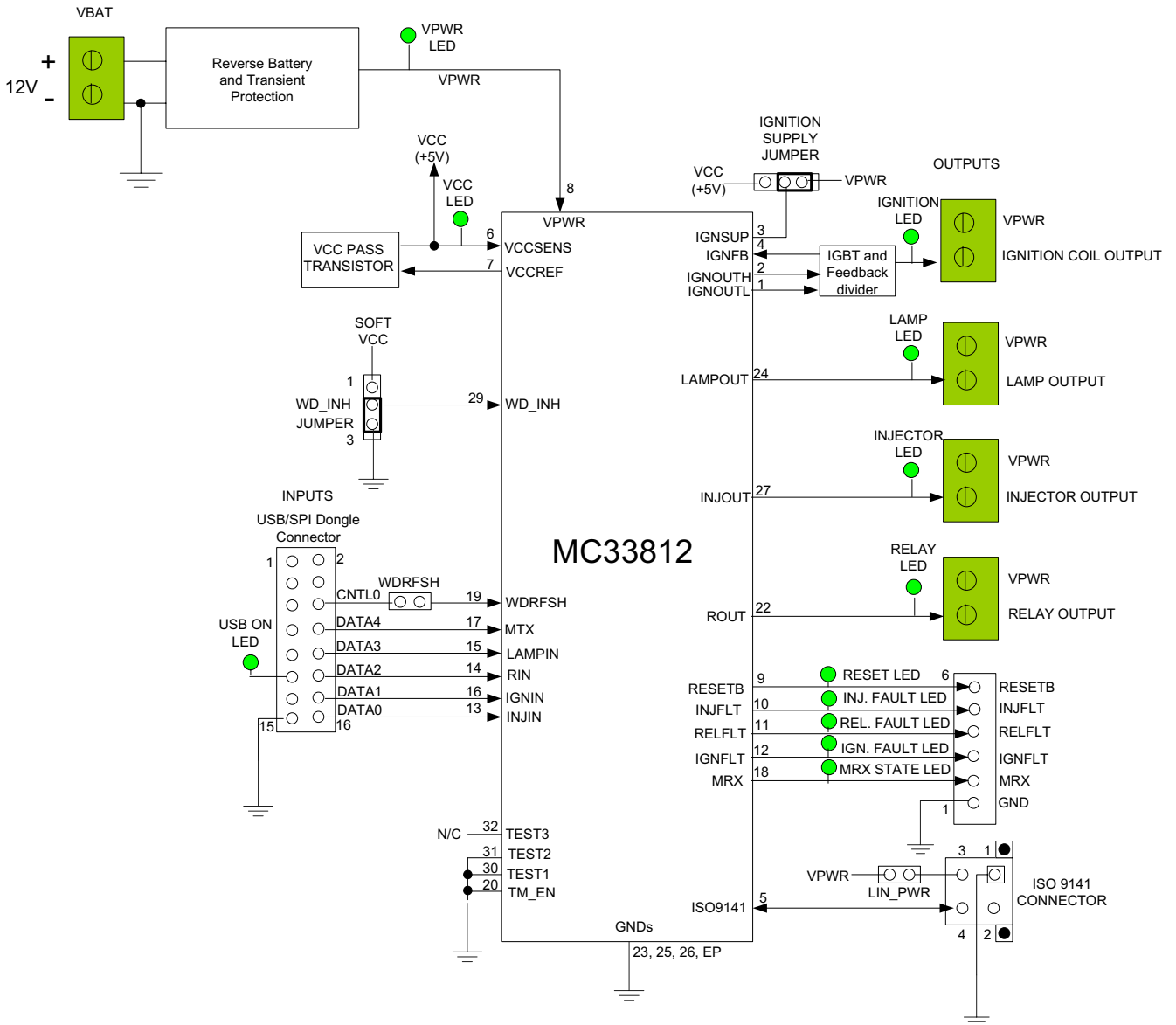


Figure 1. EVB Block Diagram

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:

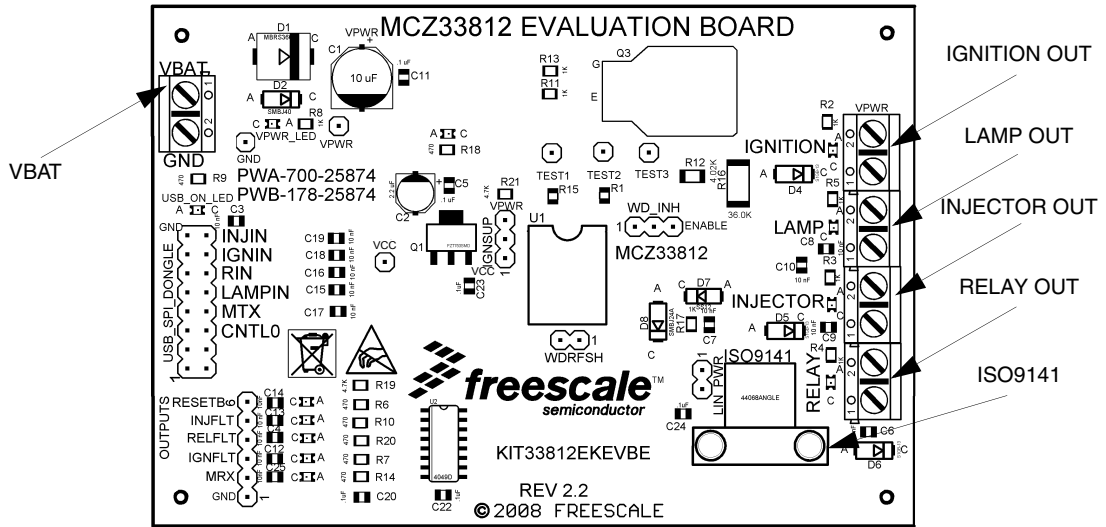


Figure 2. MC33812 EVB Screw Connectors

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

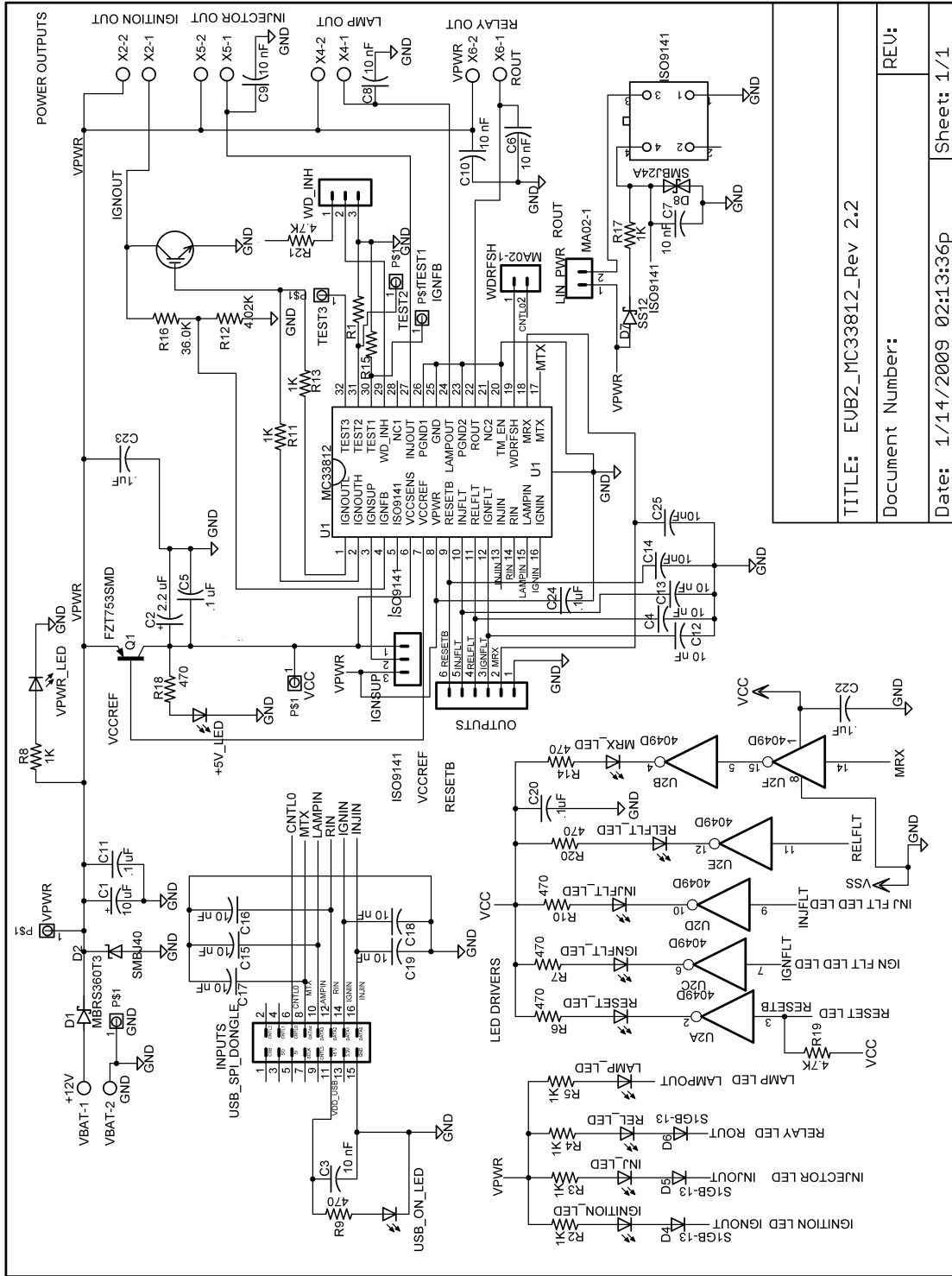


Figure 3. EVb Schematic

8 Board Layout

8.1 Assembly Drawing

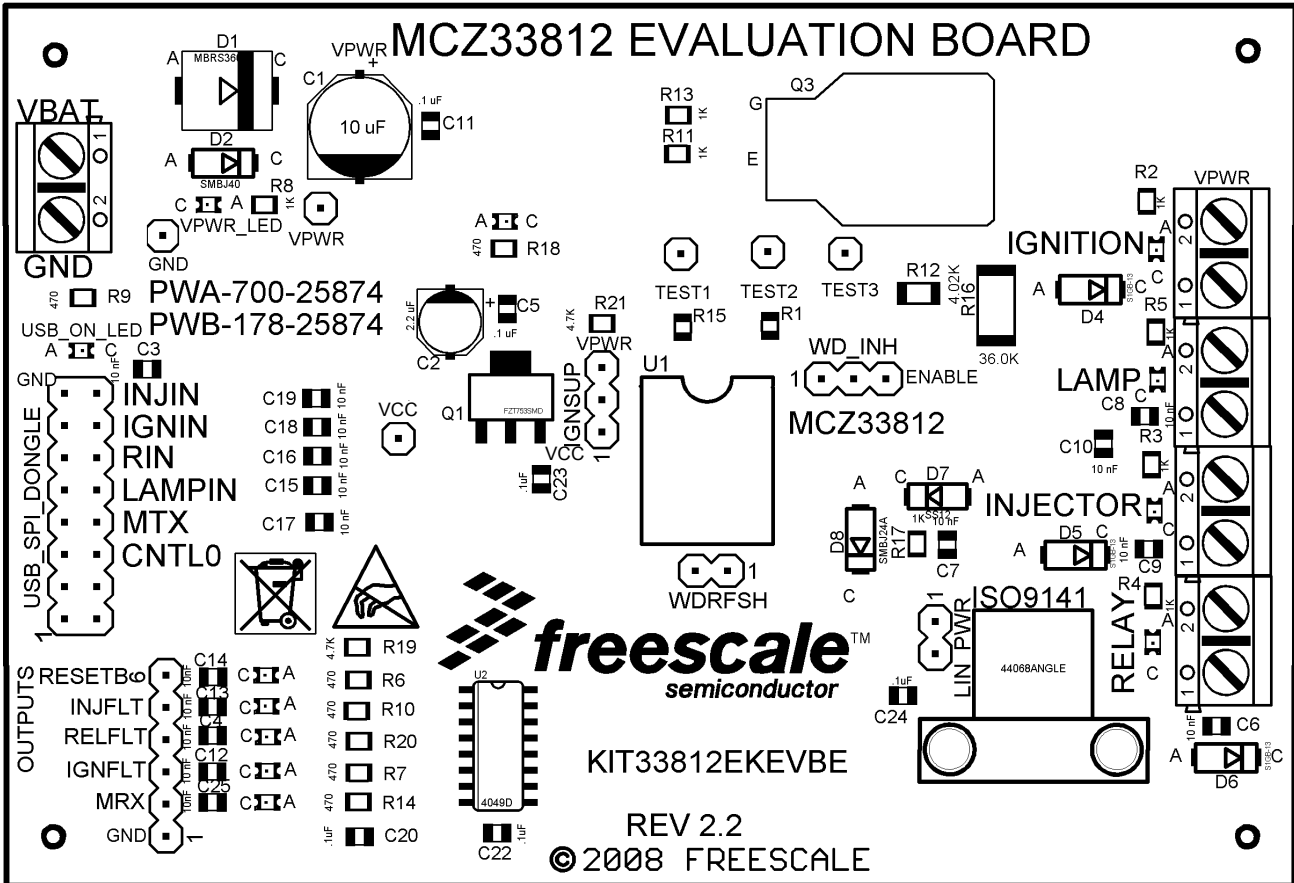


Figure 4. Assembly Drawing

8.2 PCB Top Layer

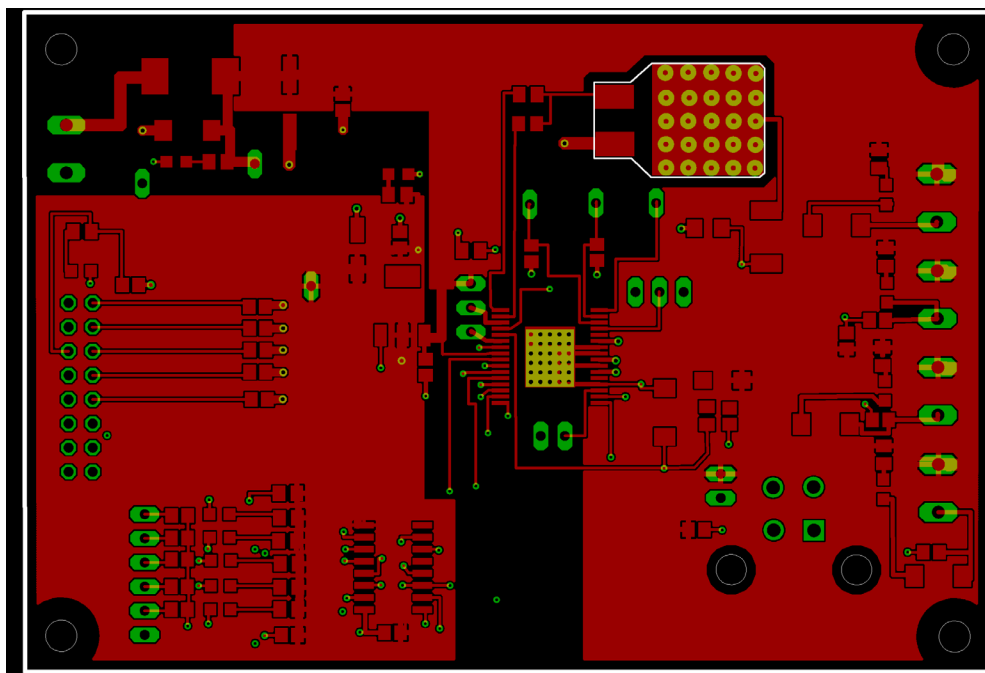


Figure 5. PCB Top Layer

8.3 PCB Bottom Layer

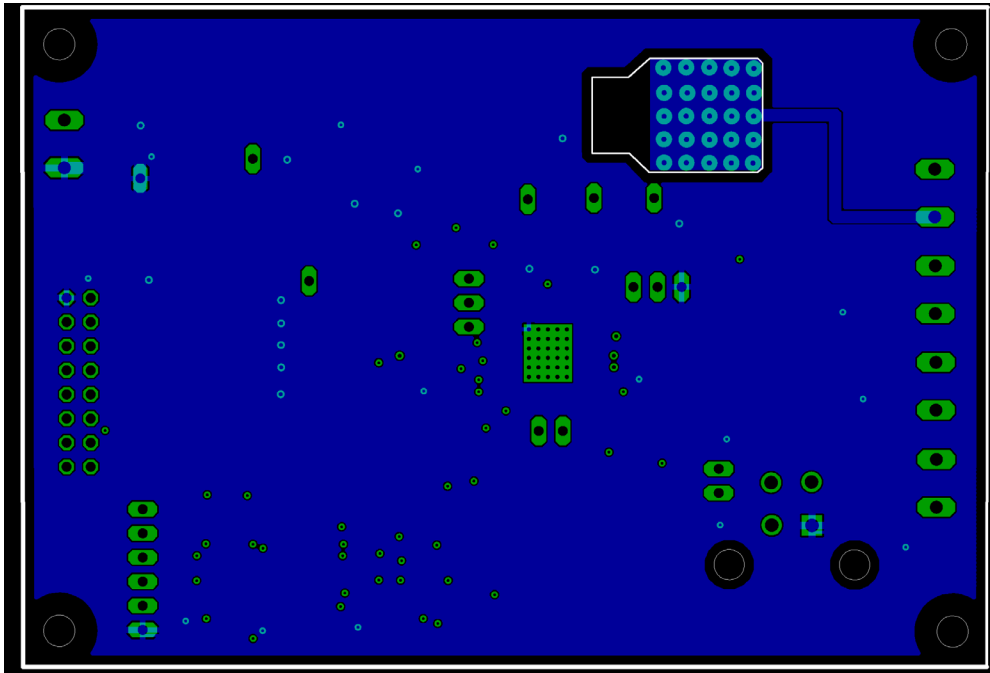


Figure 6. PCB Bottom Layer

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 |
| Freescale's Web Site | www.freescale.com |
| Freescale's Analog Web Site | www.freescale.com/analog |
| Freescale's Powertrain and Engine Control | www.freescale.com/powertrain_and_engine_control |
| Freescale's Automotive Applications | www.freescale.com/automotive |

11 Revision History

| REVISION | DATE | DESCRIPTION OF CHANGES |
|----------|--------|---|
| 2.0 | 7/2009 | <ul style="list-style-type: none">Initial Release |

How to Reach Us:

Home Page:

www.freescale.com

Web Support:

<http://www.freescale.com/support>

USA/Europe or Locations Not Listed:

Freescale Semiconductor, Inc.
Technical Information Center, EL516
2100 East Elliot Road
Tempe, Arizona 85284
1-800-521-6274 or +1-480-768-2130
www.freescale.com/support

Europe, Middle East, and Africa:

Freescale Halbleiter Deutschland GmbH
Technical Information Center
Schatzbogen 7
81829 Muenchen, Germany
+44 1296 380 456 (English)
+46 8 52200080 (English)
+49 89 92103 559 (German)
+33 1 69 35 48 48 (French)
www.freescale.com/support

Japan:

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

Asia/Pacific:

Freescale Semiconductor China Ltd.
Exchange Building 23F
No. 118 Jianguo Road
Chaoyang District
Beijing 100022
China
+86 10 5879 8000
support.asia@freescale.com

For Literature Requests Only:

Freescale Semiconductor Literature Distribution Center
P.O. Box 5405
Denver, Colorado 80217
1-800-441-2447 or +1-303-675-2140
Fax: +1-303-675-2150
LDCForFreescaleSemiconductor@hibbertgroup.com

Information in this document is provided solely to enable system and software implementers to use Freescale Semiconductor products. There are no express or implied copyright licenses granted hereunder to design or fabricate any integrated circuits or integrated circuits based on the information in this document.

Freescale Semiconductor reserves the right to make changes without further notice to any products herein. Freescale Semiconductor makes no warranty, representation or guarantee regarding the suitability of its products for any particular purpose, nor does Freescale Semiconductor assume any liability arising out of the application or use of any product or circuit, and specifically disclaims any and all liability, including without limitation consequential or incidental damages. "Typical" parameters that may be provided in Freescale Semiconductor data sheets and/or specifications can and do vary in different applications and actual performance may vary over time. All operating parameters, including "Typicals", must be validated for each customer application by customer's technical experts. Freescale Semiconductor does not convey any license under its patent rights nor the rights of others. Freescale Semiconductor products are not designed, intended, or authorized for use as components in systems intended for surgical implant into the body, or other applications intended to support or sustain life, or for any other application in which the failure of the Freescale Semiconductor product could create a situation where personal injury or death may occur. Should Buyer purchase or use Freescale Semiconductor products for any such unintended or unauthorized application, Buyer shall indemnify and hold Freescale Semiconductor and its officers, employees, subsidiaries, affiliates, and distributors harmless against all claims, costs, damages, and expenses, and reasonable attorney fees arising out of, directly or indirectly, any claim of personal injury or death associated with such unintended or unauthorized use, even if such claim alleges that Freescale Semiconductor was negligent regarding the design or manufacture of the part.



Freescale™ and the Freescale logo are trademarks of Freescale Semiconductor, Inc. All other product or service names are the property of their respective owners.

© Freescale Semiconductor, Inc. 2009. All rights reserved.

KT33812UG
Rev. 2.0
7/2009