

KT33811EGEVBE Evaluation Board

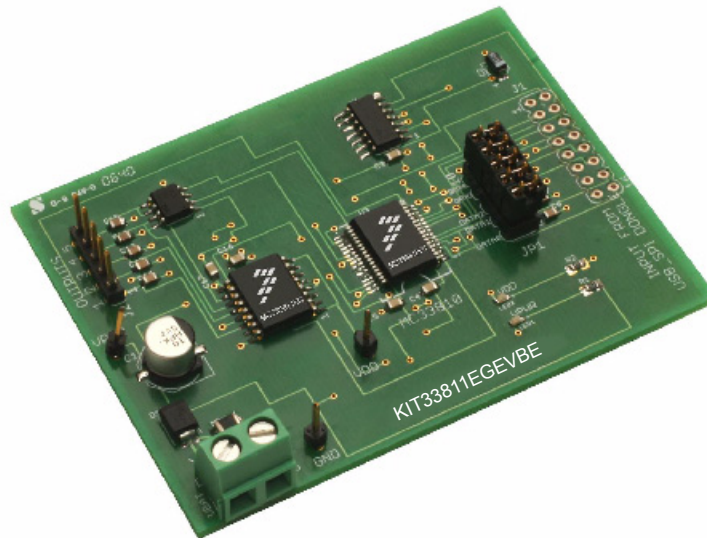


Figure 1. MC33811 EVB

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1 Kit Contents / Packing List

- CDROM - Kit Documentation
- KIT33811EGEVBE PWB, Evaluation Board, PWA 700-21858 Rev B
- FLAT RIBBON CABLE 16 PIN (DIGIKEY P/N M3AAA-1636J-ND)
- 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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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.

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3 Introduction

The **KIT33811EGEVBE** Evaluation Board is a simple circuit for exercising the 33811 IC.

The 33811 is a 5 channel Solenoid Monitor IC that is used to verify proper electrical and mechanical solenoid operation. The IC contains five solenoid driver voltage monitoring stages and a serial peripheral interface (SPI) for fault communication and setup. The IC has the ability to determine the correct movement of solenoid armatures by analyzing the variation in the voltage profile, across the solenoid driver MOSFET, which represents the actual solenoid current profile.

4 EVB Description/Features

- Unique solenoid current profile detection circuitry
- Interfaces directly to MCU using 3.3 - 5.5 V SPI protocol
- Internal voltage regulator
- Internal oscillator

5 Hardware Description

The Block Diagram for the 33811 Evaluation Board is shown below:

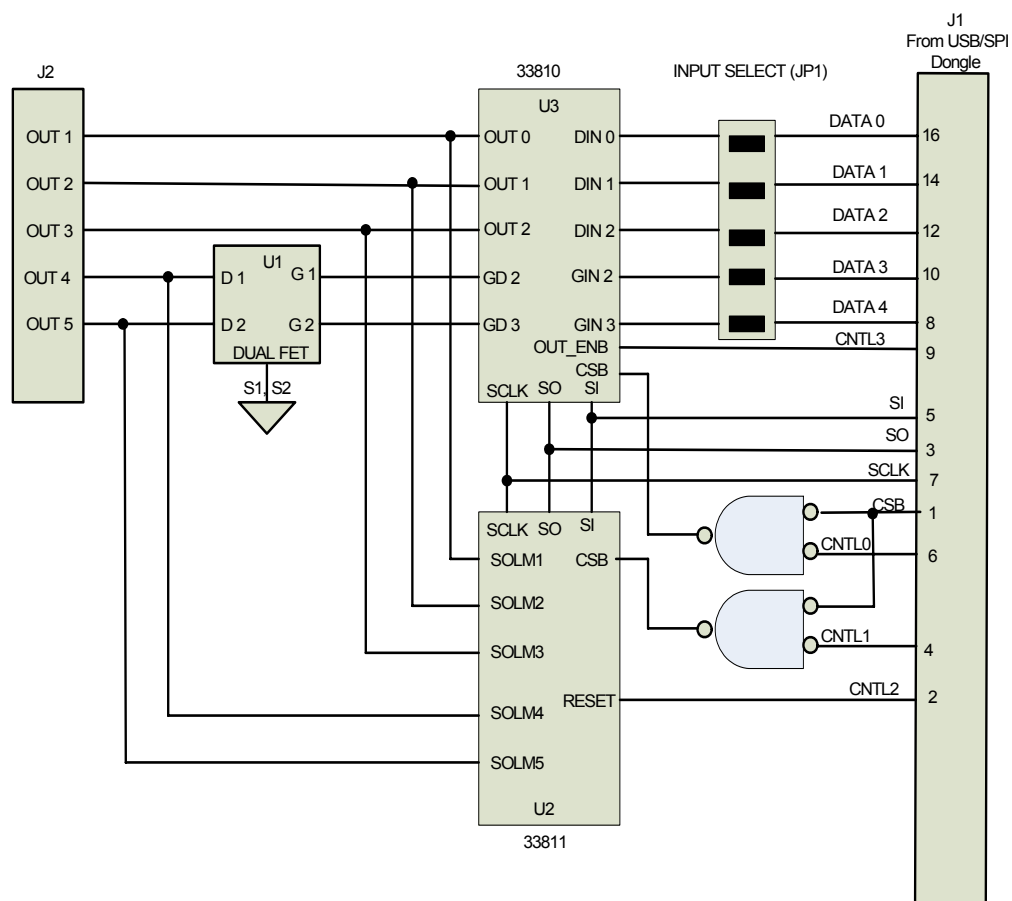


Figure 1. 33811 EVB Block Diagram

The 33811 EVB consists of a 33811 Solenoid Monitor Circuit, a 33810 Injector/Ignition Driver circuit, and a SPI and parallel interface.

Five outputs are provided, three injector outputs from the 33810 and two gate driver outputs driving an IRF73410 dual MOSFET. The five outputs are monitored by the 33811 and fault messages are provided by the SPI interface. It is intended to be used

together with the USB/SPI Dongle (KITUSBSPIDGLEVME) that provides a SPI interface plus 9 parallel logic level outputs, CNTL0-3 and DATA0-4. The CNTL outputs are used to control the Output_Enable on the 33810, the RESET on the 33811 and to steer the \overline{CS} on the 33810 and 33811 to allow the SPI port to be shared between the 33810 and the 33811. If the USB/SPI Dongle is not used, the 16 pin I/O port can be connected to another microcomputer board or other external circuitry. The five outputs are low side drivers, which will energize solenoids which are connected to VPWR. The 33811 will monitor the operation of the solenoids and indicate a fault if any of the solenoids fail to pull-in. A detailed schematic is included on the accompanying CD.

5.1 LED Display

There are two LED's, not shown in the block diagram, which indicate that VDD and VPWR are present. VDD (5 volts) is provided by the 16 pin I/O connector (from the USB port if the USB/SPI Dongle is used) and VPWR is provided externally through connector X1.

5.2 16 Pin I/O Port Header Pin Definitions

The SPI Port and 9 parallel lines from the USB/SPI Dongle that control signals on the 33811 EVB are listed below. These signals are all available on the I/O Port Header (J1):

Pin Number	USB/SPI Dongle Name	Description
1	\overline{CS}	SPI port Chip Select Bar
2	CNTL2	RESET signal for 33811
3	SO	SPI port Serial Output
4	CNTL1	Steers \overline{CS} to 33811
5	SI	SPI port Serial Input
6	CNTL0	Steers \overline{CS} to 338110
7	SCLK	SPI port Serial Clock
8	DATA4	Input signal for OUTPUT5
9	CNTL3	<u>OUTPUT_ENABLE</u> for 33810
10	DATA3	Input signal for OUTPUT4
11	+5V	Supplies VDD to 33810, 33811
12	DATA2	Input signal for OUTPUT3
13	+3.3 V	Unused in 33811 EVB
14	DATA1	Input signal for OUTPUT2
15	GROUND	VSS for all circuits (GND)
16	DATA0	Input signal for OUTPUT1

6 Circuit Description and Operation

The 33811 EVB provides the user with a means to evaluate the operation of the 33811 Solenoid Monitor Circuit. The 33810 Injector/Ignition Driver circuit provides the solenoid drivers that serve as the host for the 33811 circuit. The inputs to the 33810 circuit are jumpered via JP1 to the 16 pin I/O connector. If the user wishes to provide the 5 input signals externally, then the jumpers in JP1 can be removed and the input signals can be connected to pins 1,3,5,7, and 9 of JP1. Please see the schematic diagram for further details. If the user wishes to use the USB/SPI Dongle and SPIGen program to provide the inputs to the 33811 EVB inputs, then Jumpers 1 - 5, on JP1, should be left connected. The OUTPUTs 1 - 5 can be connected to external solenoids. The solenoids' second connection is to VPWR. Three outputs (OUT 1, 2, and 3) are provided by the 33810 injector drivers directly. For information on these outputs, please refer to the 33810 Data Sheet, included on the accompanying CD. The remaining two outputs, (OUT 4, 5) are provided by a dual MOSFET, IR7341, which are driven by the 33810 GPGD circuits. For information of these outputs please refer to IR's web site: <http://www.irf.com/> for the data sheet on this device and the data sheet for 33810.

The SPI port, SO, SI SCLK and \overline{CS} are shared between the 33810 and 33811 circuit. The means for sharing the SPI port is by multiplexing the \overline{CS} line, using CNTL0 and CNTL1. When CNTL0 is low (logic 0) and CNTL1 is high (logic 1) \overline{CS} is routed to the 33810 circuit. When CNTL0 high (logic 1) and CNTL1 is low (logic 0), \overline{CS} is routed to the 33811 circuit. The conditions with both CNTL0 and CNTL1 high or both low should not be allowed to occur. See the truth table below for more information:

Truth Table for CNTL0 and CNTL1			
CNTL0	CNTL1	SPI Port Connection	Comments
0	0	Invalid	SPI drives both 33810 and 33811 SO conflict
0	1	33810	
1	0	33811	
1	1	Invalid	SPI not connected to either 33810 or 33811

The remaining CNTL lines, CNTL2 and CNTL3 are used to control the 33811 RESET line and 33810 OUTPUT_ENABLE line, respectively. For information about the operation of the RESET and OUTPUT_ENABLE lines, please refer to the 33811 and 33810 data sheets, included on the accompanying CD.

7 Power Supply Considerations

The 33811 EVB is intended to be run with VDD= 5.0 Volts and with VPWR = 12.0 Volts. The VDD is supplied via pin 11 of J1 and VPWR is supplied via connector X1. When both supplies are connected correctly, LEDs 1 and 2 should be illuminated. Please refer to the data sheets for the maximum voltage and power ratings for the devices in the EVB.

8 SPI Configuration File

Included on the CD is a SPI configuration file called “MC33811_EVB_CONFIGURATION_FILE.spi” that can be loaded into SPIGen to perform some basic functions for the EVB. The configuration file has a few “batch” files that perform the initialization of the board and the SPI communications. A typical running batch file is also included. For an explanation of the SPIGen program, the user is referred to the documentation that comes with the disk for that program.

9 Board Layout

9.1 Assembly Drawing

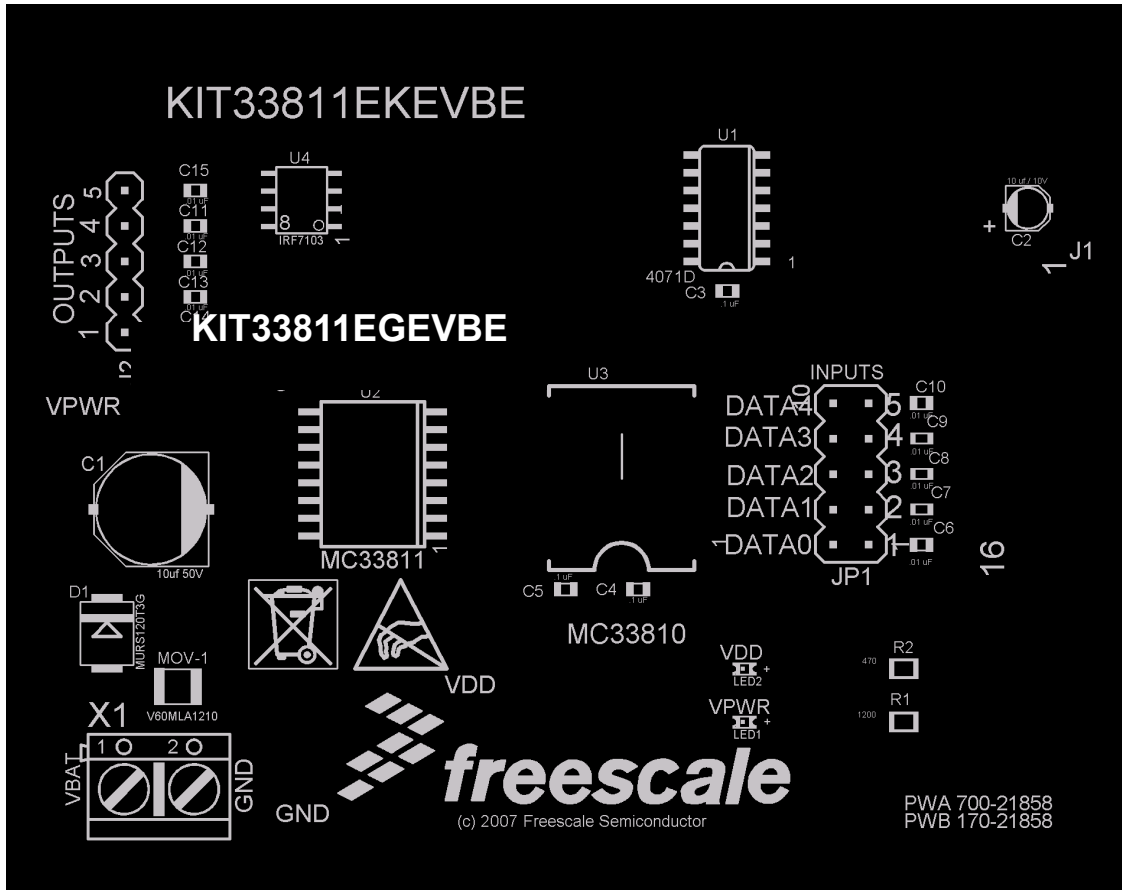


Figure 2. Assembly Drawing

9.2 PCB Bottom

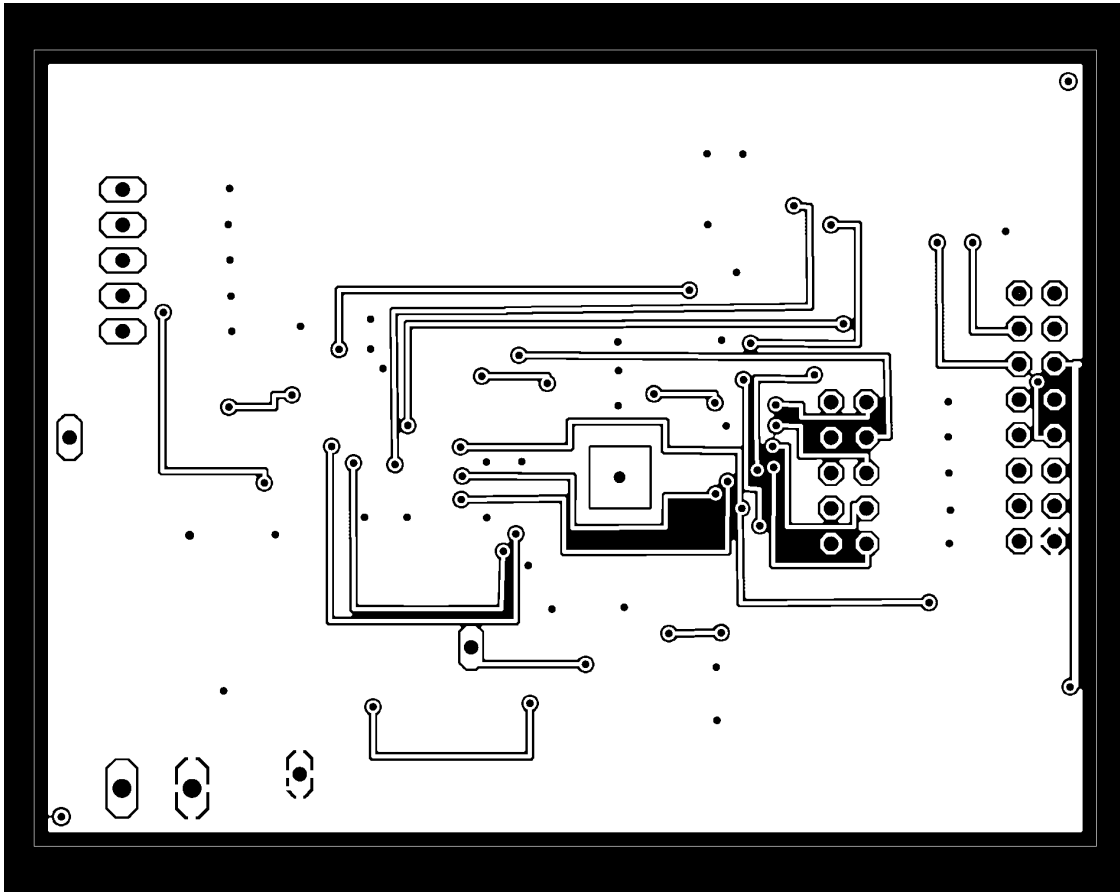


Figure 3. Bottom Copper Layer (As Seen Thru Board Looking From The Top)

9.3 PCB Top

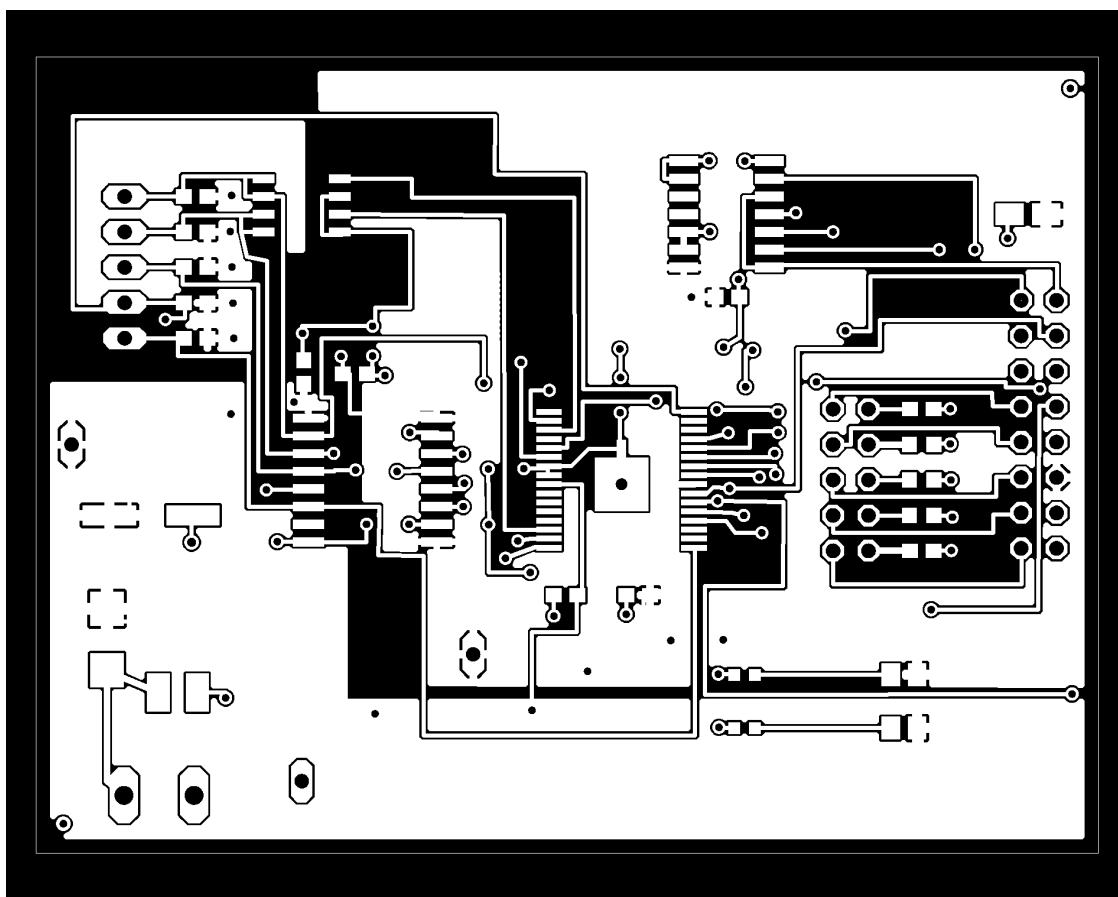


Figure 4. Top Copper Layer

10 Schematic

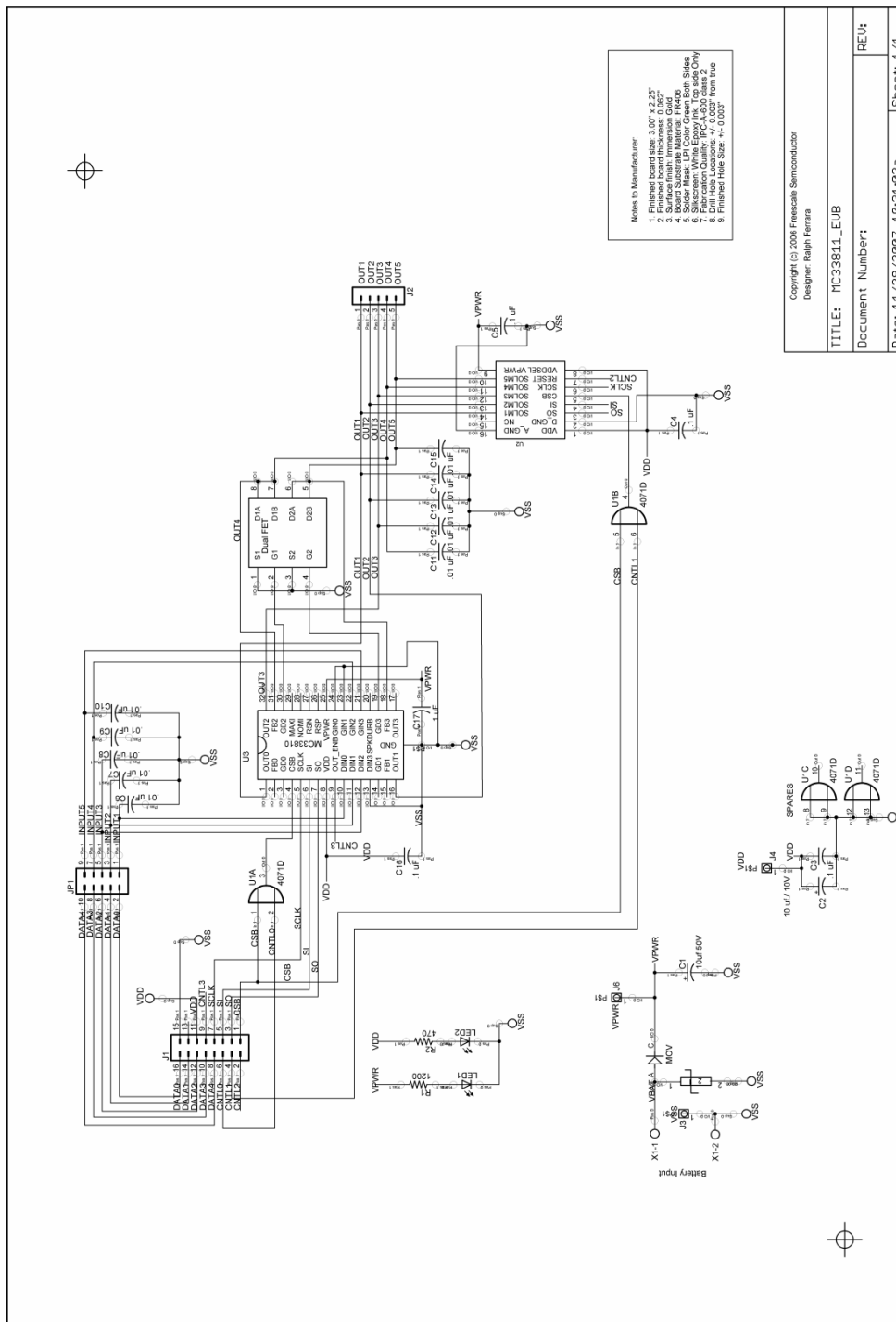


Figure 5. Schematic Drawing

11 Bill of Material

Reference Designation	Device or Signal Name	Type	Description	Mfr	PN
Freescale Components					
U2	MCZ33811EG	330-21858	SOLENOID MONITOR CIRCUIT	Freescale Semiconductor	MCZ33811EG
U3	MCZ33810EK	330-21848	QUAD IGNITION/INJECTOR CIRCUIT	Freescale Semiconductor	MCZ33810EK
Capacitors					
C1	VPWR	EEE1HA100SP	CAP ALEL 10 μ F 50 V 20% -- CCE63X54 (CASE D)	Panasonic	EEE1HA100SP
C2	VDD	150-30020	CAP TANT 10 μ F 10 V 10% Panasonic_A	Vishay Intertechnology	293D106X9010A2TE3
C3	VDD	150-75142	CAP CER 0.1 μ F 50V 10% X7R CC0603	Venkel Co.	C0603X7R500104KNE
C4	VDD	150-75142	CAP CER 0.1 μ F 50 V 10% X7R CC0603	Venkel Co.	C0603X7R500104KNE
C5	VPWR	150-75142	CAP CER 0.1 μ F 50 V 10% X7R CC0603	Venkel Co.	C0603X7R500104KNE
C6	INPUT 1	150-75009	CAP CER 0.01 μ F 50 V 10% X7R CC0603	Venkel Co.	C0603X7R500103KNE
C7	INPUT 2	150-75009	CAP CER 0.01 μ F 50 V 10% X7R CC0603	Venkel Co.	C0603X7R500103KNE
C8	INPUT 3	150-75009	CAP CER 0.01 μ F 50 V 10% X7R CC0603	Venkel Co.	C0603X7R500103KNE
C9	INPUT 4	150-75009	CAP CER 0.01 μ F 50 V 10% X7R CC0603	Venkel Co.	C0603X7R500103KNE
C10	INPUT 5	150-75009	CAP CER 0.01 μ F 50 V 10% X7R CC0603	Venkel Co.	C0603X7R500103KNE
C11	OUT 4	150-75009	CAP CER 0.01 μ F 50 V 10% X7R CC0603	Venkel Co.	C0603X7R500103KNE
C12	OUT 3	150-75009	CAP CER 0.01 μ F 50 V 10% X7R CC0603	Venkel Co.	C0603X7R500103KNE
C13	OUT 2	150-75009	CAP CER 0.01 μ F 50 V 10% X7R CC0603	Venkel Co.	C0603X7R500103KNE
C14	OUT 1	150-75009	CAP CER 0.01 μ F 50 V 10% X7R CC0603	Venkel Co.	C0603X7R500103KNE
C15	OUT 5	150-75009	CAP CER 0.01 μ F 50 V 10% X7R CC0603	Venkel Co.	C0603X7R500103KNE
C16	VDD	150-75142	CAP CER 0.1 μ F 50 V 10% X7R CC0603	Venkel Co.	C0603X7R500104KNE
C17	VDD	150-75142	CAP CER 0.1 μ F 50 V 10% X7R CC0603	Venkel Co.	C0603X7R500104KNE

Reference Designation	Device or Signal Name	Type	Description	Mfr	PN
Resistors					
R1	LED1	N/A	RES 1200 OHM 1/10 W 5% 0603 SMD	Yageo Corp.	RC0603JR-071K2RL
R2	LED2	N/A	RES 470 OHM 1/10 W 5% 0603 SMD	Yageo Corp.	RC0603JR-07470RL
Diodes					
D1	DIODE	480-75183	DIODE PWR RECT 1.0 A 200 V--RECOVERY SMB	On Semiconductor	MURS120T3G
Connectors					
J1	INPUT	N/A	16 pin HDR 2X8 100 MIL CTR LOW PROFILE BRKWY	TYCO Electronics	87215-5
J2	OUTPUT	N/A	5 pin HDR 1X5 100 MIL CTR LOW PROFILE BRKWY	TYCO Electronics	87220-5
J3	VSS	N/A	1 pin HDR 1X1 100 MIL CTR LOW PROFILE BRKWY	TYCO Electronics	87220-1
J5	VDD	N/A	1 pin HDR 1X1 100 MIL CTR LOW PROFILE BRKWY	TYCO Electronics	87220-1
J6	VPWR	N/A	1 pin HDR 1X1 100 MIL CTR LOW PROFILE BRKWY	TYCO Electronics	87220-1
JP1	INPUT SELECT	N/A	10 pin HDR 2X5 100 MIL CTR LOW PROFILE BRKWY	TYCO Electronics	87215-2
Misc.					
LED1	LED1	N/A	LED 660 NM RED DIFF 0603 SMD	AVAGO Technologies	HSMH-C190
LED2	LED2	N/A	LED 660 NM RED DIFF 0603 SMD	AVAGO Technologies	HSMH-C190
MOV-1	SURGE PROTECTOR	N/A	MOV 50 VDC	Littlefuse	V60MLA1210
U1	CD4071D	N/A	QUAD 2 INPUT OR GATE	Texas Instruments	CD4071BNSR
U4	DUAL MOSFET	N/A	IRF7103TRPBF Dual N Channel MOSFET	International Rectifier	IRF7103TRPBF
X1	VBAT	N/A	MKDS 3 CONN TERM BLOCK 2POS 5 MM PCB	Phoenix Contact	1711026

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.

12 References

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

Description	URL
Reference Web Sites	Reference URL Locations
Freescale Web Site	http://www.freescale.com/
MC33811 Product Summary Page	http://www.freescale.com/webapp/sps/site/prod_summary.jsp?code=MC33811
MC33811 Datasheet	http://www.freescale.com/files/analog/doc/data_sheet/MC33811.pdf
MC33810 Product Summary Page	http://www.freescale.com/webapp/sps/site/prod_summary.jsp?code=MC33810
MC33810 Datasheet	http://www.freescale.com/files/analog/doc/data_sheet/MC33810.pdf
KITUSBSPIDNGLEVME Summary Page	http://www.freescale.com/webapp/sps/site/prod_summary.jsp?code=KITUSBSPIDGLEVME

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