Document Number: KT33816UG
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KIT33816AEEVM Evaluation Board

Featuring the MC33816 SD6 Programmable Solenoid Controller for Precision Automotive Solenoid Control Applications

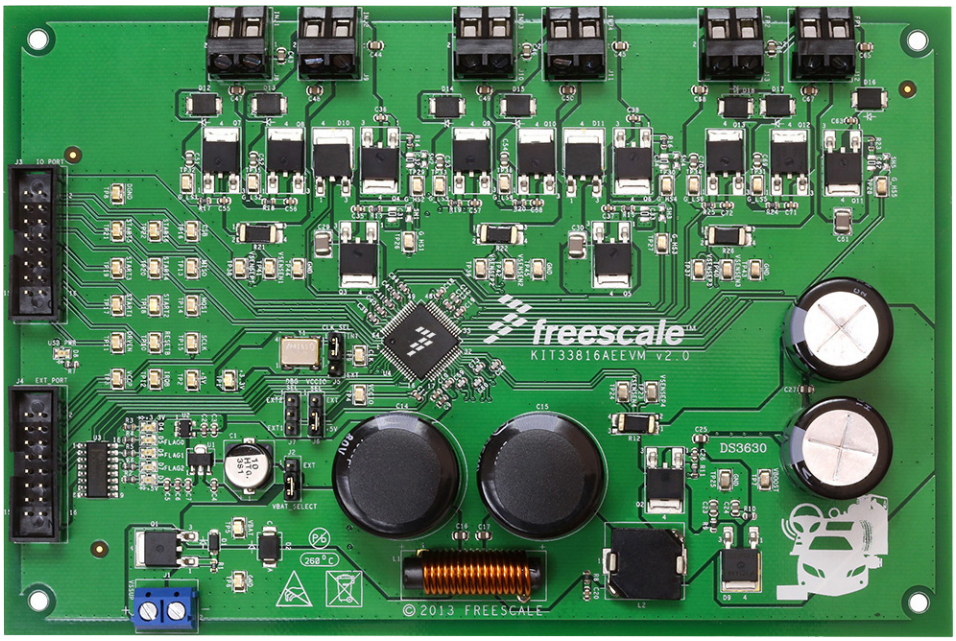

Figure 1. KIT33816AEEVM Evaluation Board

Table of Contents

1 Kit Contents / Packing List

- Assembled and tested evaluation board/module in anti-static bag.
- Warranty card

2 Jump Start

- Go to www.freescale.com/analogtools
- Locate your kit
- Review your Tool Summary Page
- Look for

- Download documents, software and other information

Archive Information

3 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.

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4 Introduction

The KIT33816AEEVM Evaluation Board (EVB) is an easy-to-use circuit board that allows the user to exercise all the functions of the MC33816 Smart Pre-driver circuit. A PC communicates to the EVB through a USB/SPI dongle (KITUSBSPIDGLEVME) connected to the PC's USB port. The Freescale SPIGen (version 7.0 and above) program provides the user interface to the MC33816 SPI port and allows the user to program the Code RAM and Data Registers, send commands to the IC and receive status from the IC.

5 KIT33816AEEVM Features

This EVB consists of the following:

- A MC33816 Smart Pre-driver Integrated Circuit
- A USB-to-SPI dongle interface
- Power-conditioning circuitry
- External MOSFETs
- A +3.3 V regulator supplies all +3.3 Volt power required by the EVB
- A +5.0 Volt regulator supplies all +5.0 Volt power required by the EVB
- A +12 V V_{SUPP} supply provides the power to the MC33816 and the loads.

6 MC33816 Device Features

- Battery voltage range, 5.5 V < V_{BATT} < 32 V (1)
- Pre-drive operating voltage up to 72 V
- High-side/ low-side pre-drive PWM capability up to 100 kHz
- All pre-drivers with four selectable slew rates
- Eight selectable, pre-defined VDS monitoring thresholds
- Encryption for microcode protection
- Integrated 1.0 MHz back-up clock

Freescale analog ICs are manufactured using the SMARTMOS process, a combinational BiCMOS manufacturing flow that integrates precision analog, power functions and dense CMOS logic together on a single cost-effective die.

Notes

1. In case V_{SUPP} > 16 V, it is highly recommended to disable the internal V_{CCP} regulator and externally supply V_{CCP}.

7 Equipment Required

Minimum equipment required:

- Power supply 12 V with current limit set initially to 4.0 A
- Oscilloscope (four-channel preferably) with current probe
- Multimeter
- PC with Windows XP or above
- SPIGen 7.0 or greater and USB/SPI dongle (KITUSBSPIDGLEVME)

8 Evaluation Board Configuration

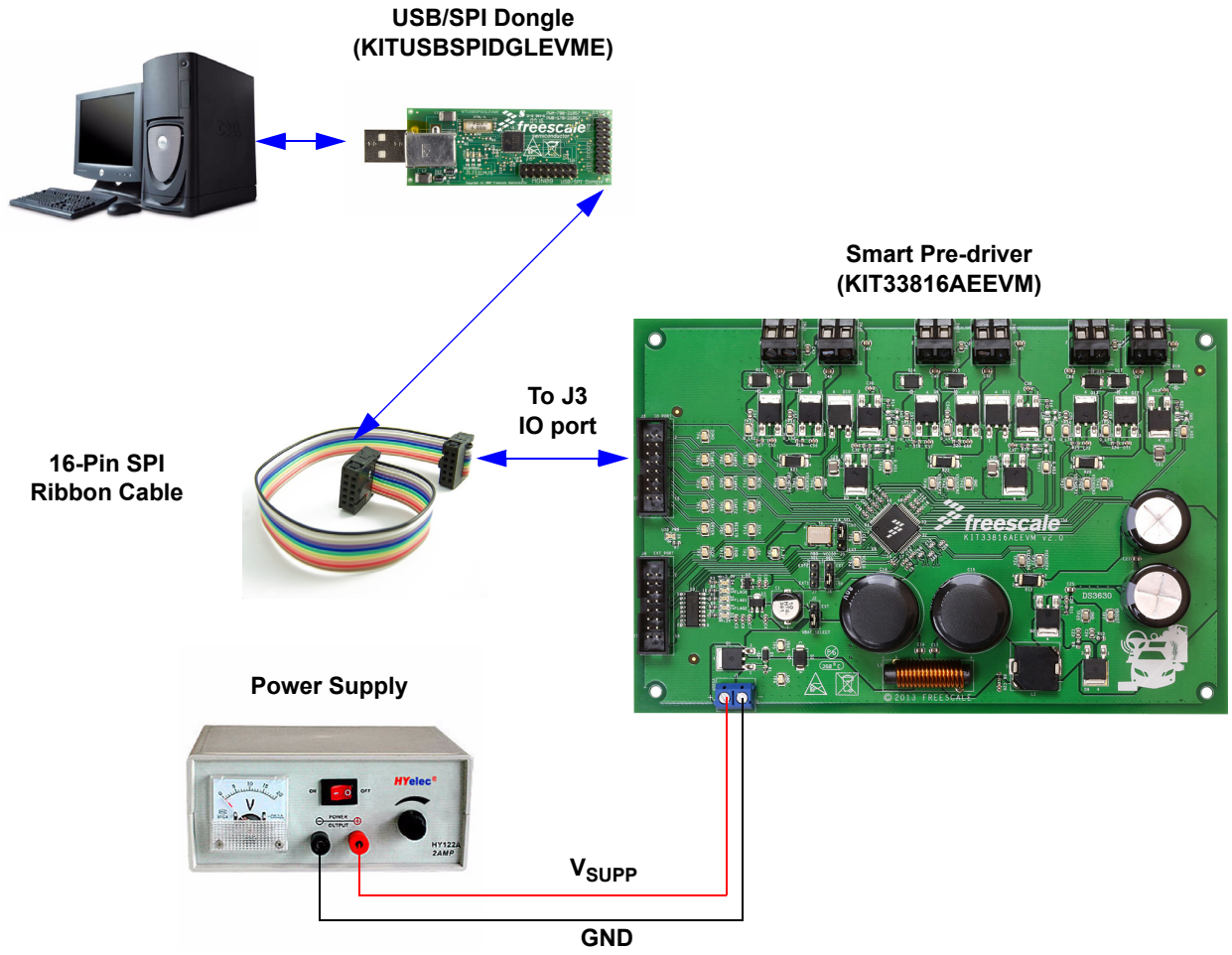


Figure 2. Evaluation Board Setup

9 Installing SPIGen Freeware on your Computer

The latest version of SPIGen is designed to run on any Windows 8, Windows 7, Vista or XP-based operating system. To install the software, go to www.freescale.com/analogtools and select your kit. Click on that link to open the corresponding Tool Summary Page. Look for “Jump Start Your Design”. Download to your computer desktop the SPIGen software as well as the associated configuration file.

Run the install program from the desktop. The Installation Wizard will guide you through the rest of the process.

To use SPIGen, go to the Windows Start menu, then Programs, then SPIGen, and click on the SPIGen icon. The SPIGen Graphic User Interface (GUI) will appear. Go to the file menu in the upper left hand corner of the GUI, and select “Open”. In the file selection window that appears, set the “Files of type: ” drop-down menu to “SPIGen Files (*.spi)”. (As an exceptional case, the file name may have a .txt extension, in which

case you should set the menu to “All Files (*.*)”.) Next, browse for the configuration file you saved on your desktop earlier and select it. Click “Open”, and SPIGen will create a specially configured SPI command generator for your evaluation board.

The GUI is shown in Figure 3. The text at the top is the name of the configuration file loaded. The left side panel displays folders that group user interfaces. The interfaces in the pre-installed MC33816 folder pertain specifically to the board under discussion.The process of loading the configuration file has assigned a list of “Extra Pins” as well as a list “Quick Commands”, all of which are board-specific.

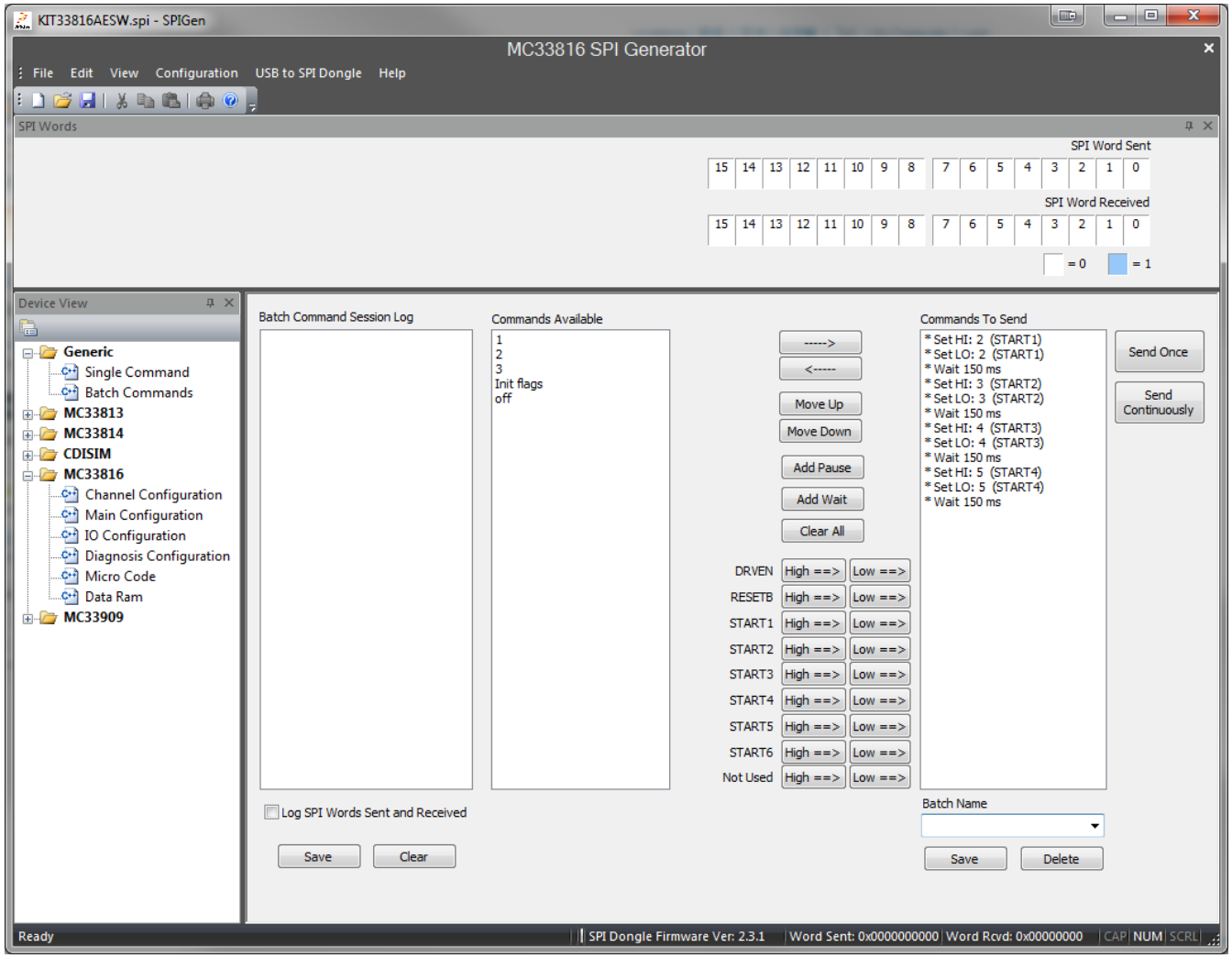


Figure 3. SPI Generator GUI

10 Setup and Using the Hardware

To perform the examples included in the software bundle, the following connections and setup must be performed:

1. Make sure the SPIGen 7.0 or higher 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 MC33816 EVB via a 16 conductor ribbon cable. Make sure to orient the cable connectors so that pin1 on both the USB/SPI dongle and the MC33816 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_PWR LED on the MC33816 EVB should both be illuminated. Reprogram the USB/SPI dongle with the MC33816 USB/SPI dongle image. The image is version 2.3.1, and is available in the Downloads section of the KIT33816AEEVM web page. See the SPIGen User's Guide for instructions on how to reprogram the USB/SPI dongle.
4. Attach the +12 VDC supply (do not turn on power yet) to the VSUPP input connector on the MC33816 EVB, making sure to observe the GND and +12 V terminals. The current capability of the +12 V supply should exceed the maximum total current that the number of simultaneously ON loads will require.
5. Attach loads (Injectors) to the INJ1, INJ2, INJ3, and INJ4 output terminals (and optionally FP1 and FP2), as desired
6. Turn on the +12 volt supply. Verify that all is working correctly by observing the +3.3 V and +5.0 V LEDs, which should be illuminated.

10.1 Running an example program

1. Launch the SPIGen program.
2. Load the config file, by clicking on "File" then "Open" and browsing to the KIT33816AESW.spi file located inside the "**Injector Demo Files**" directory.
3. Go to the "**Single Command**" page in SPIGen and set the RESETB pin high.
4. Go to the "**Micro code**" page under "**MC33816**" and click on the folder icon on the right side of the "**Code Ram 1**" edit box. Browse to the location of the **MC33816_ch1.cip.bin** file, select it, and click on the "**Open**" button.
5. Click on the folder icon on the right side of the "**Code Ram 2**" edit box. Browse to the location of the **MC33816_ch2.cip.bin** file, select it, and click on the "**Open**" button.
6. Continue by selecting the **Data Ram** and **Register** files located inside the same directory as the microcode files. The file names should be self explanatory. After selecting all the files click "**Download All**" and wait for a confirmation message. Click on the "**Save Filenames**" button to save the code and register file configuration.
7. Click the "**Enable Flash on CH1 and Ch2**" button to run the code. At this point both channels should be operational.
8. Go to the "**Single command**" page and set the **DRVEN** pin high. This will enable all of the pre-drivers and the DC-DC boost converter should also start regulating. Approximately 40 V should be measured on the VBOOST output pin.

10.2 Running the example batch files

1. Go to the "**Batch commands**" page and select the batch file you want to run. There are 5 choices. "**Start1**" through "**Start4**" pulse only one injector (1, 2, 3, or 4). The "**Start1-4**" batch command pulses all four injectors in sequence.
2. Click on the "**Send Continuously**" button and observe that the four loads attached to the MC33816 EVB board are turning on and then off in succession.

There are other demo batch examples that can be run and examined for learning how to use the EVB.

11 Evaluation Board Hardware Description

This EVB consists of a MC33816 Smart Pre-driver Integrated Circuit, a USB to SPI dongle interface, power conditioning circuitry, and external MOSFETs. The +12 V V_{SUPP} supply provides the power to the device, the loads, and the +5.0 V and +3.3 V EVB regulators. The hardware block diagram is shown below:

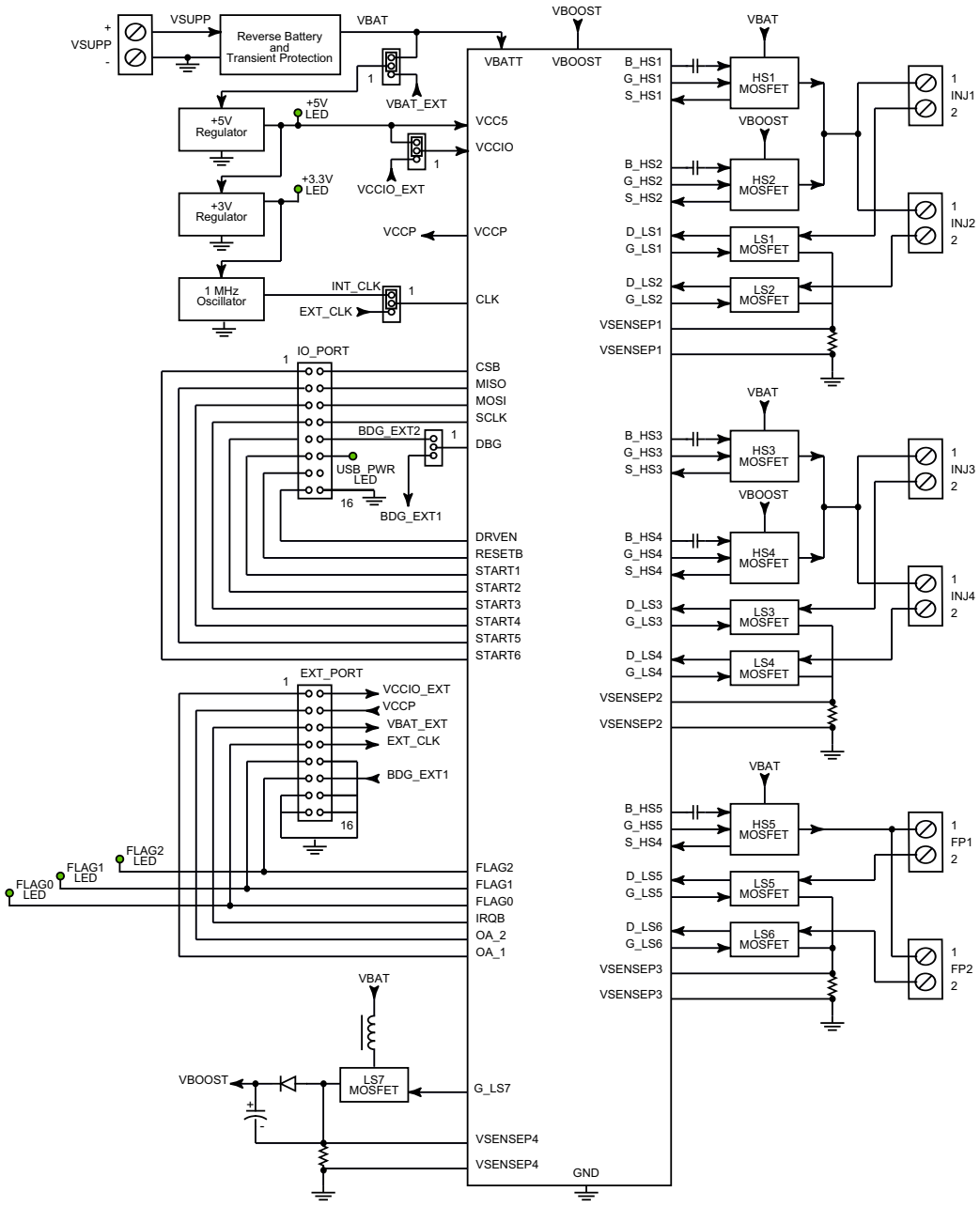


Figure 4. MC33816 Smart Pre-driver EVB Block Diagram

11.1 LED Display

Five LED's are provided as visual output devices for the MC33816 EVB. A list of the LED devices is shown by the following:

1. **+3.3 V LED** - Indicates that the +3.3 volt regulator is running.
2. **FLAG0 LED** - Indicates that the digital FLAG 0 output is a logic 1.
3. **FLAG1 LED** - Indicates that the digital FLAG 1 output is a logic 1.
4. **FLAG2 LED** - Indicates that the digital FLAG 2 output is a logic 1.
5. **+5.0 V LED** - Indicates that the +5.0 volt regulator is running.
6. **USB_PWR LED** - Indicates that the USB SPI dongle is connected properly and is attached to an active USB port on a PC.

11.2 Test Point Definitions

The EVB contains forty-six (46) test points that provide access to certain signals in the MC33816 as follows:

1. **+3.3 V** - +3.3 Volt regulator output
2. **+5.0 V** - +5.0 Volt regulator output
3. **VCCP** - VCCP device pin
4. **VCCIO** - VCCIO device pin
5. **VBAT** - VBAT device pin
6. **PGND** - power ground
7. **VBOOST** - DC-DC convertor output, 0 to 72 V
8. **DGND** - digital ground
9. **CLK** - CLK device pin for external clocking
10. **RESETB** - RESETB device pin for reset
11. **DRVEN** - DRVEN device pin for enabling the pre-drivers
12. **IRQB** - IRQB device pin, output for MCU hardware interrupt
13. **MISO** - MISO device pin for SPI for data out
14. **MOSI** - MOSI device pin for SPI for data in
15. **SCLK** - SCLK device pin for SPI clock
16. **CSB** - CSB device pin for SPI chip select
17. **START1** - START1 device pin for injector 1 (INJ1) output control
18. **START2** - START2 device pin for injector 2 (INJ2) output control
19. **START3** - START3 device pin for injector 3 (INJ3) output control
20. **START4** - START4 device pin for injector 4 (INJ4) output control

21. **START5** - START5 device pin for fuel pump 1 (FP1) output control
22. **START6** - START6 device pin for fuel pump 2 (FP2) output control
23. **VSENSEP4** - VSENSEP4 device pin, voltage across R12 current sense resistor for the DC-DC converter
24. **VSENSEN4** - VSENSEN4 device pin, voltage across R12 current sense resistor for the DC-DC converter
25. **PGND** - power ground
26. **G_HS1** - G_HS1 device pin for HS1 driver control
27. **G_HS3** - G_HS3 device pin for HS3 driver control
28. **G_HS5** - G_HS5 device pin for HS5 driver control
29. **G_HS2** - G_HS2 device pin for HS2 driver control
30. **G_HS4** - G_HS4 device pin for HS4 driver control
31. **G_LS5** - G_LS5 device pin for LS5 driver control
32. **G_LS1** - G_LS1 device pin for LS1 driver control
33. **G_LS3** - G_LS3 device pin for LS3 driver control
34. **G_LS6** - G_LS6 device pin for LS6 driver control
35. **G_LS2** - G_LS2 device pin for LS2 driver control
36. **G_LS4** - G_LS4 device pin for LS4 driver control
37. **VSENSEP3** - VSENSEP3 device pin, voltage across R26 current sense resistor for the fuel pump bank
38. **VSENSEP1** - VSENSEP1 device pin, voltage across R21 current sense resistor for the injector bank 1
39. **VSENSEP2** - VSENSEP2 device pin, voltage across R22 current sense resistor for the injector bank 2
40. **VSENSEN3** - VSENSEN3 device pin, voltage across R26 current sense resistor for the fuel pump bank
41. **VSENSEN1** - VSENSEN1 device pin, voltage across R21 current sense resistor for the injector bank 1
42. **VSENSEN2** - VSENSEN2 device pin, voltage across R22 current sense resistor for the injector bank 2
43. **PGND** - power ground
44. **PGND** - power ground
45. **PGND** - power ground
46. **G_LS7** - G_LS7 device pin for LS7 driver control

11.3 Input Signal Definitions

The MC33816 EVB has nine logic level input signals used to control certain outputs or functions inside the circuit. These 9 signals are:

1. **DRVEN** - Controls the state of the all the pre-driver outputs
2. **RESETB** - When the RESETB line is held low, the MC33816 is reset
3. **START1** - Provides start signal for Injector 1
4. **START2** - Provides start signal for Injector 2

5. **START3** - Provides start signal for Injector 3
6. **START4** - Provides start signal for Injector 4
7. **START5** - Provides start signal for Fuel Pump 1
8. **START6** - Provides start signal for Fuel Pump 2
9. **DBG** - Provides the trace signal if activated

These nine signals are provided by the nine parallel outputs from the USB/SPI interface, as described by the following:

1. **DRVEN** - Connected to the DATA0 signal
2. **RESETB** - Connected to the DATA1 signal
3. **START1** - Connected to the DATA2 signal
4. **START2** - Connected to the DATA3 signal
5. **START3** - Connected to the DATA4 signal
6. **START4** - Connected to the CNTL0 signal
7. **START5** - Connected to the CNTL1 signal
8. **START6** - Connected to the CNTL2 signal
9. **DBG_EXT2** - Connected to the CNTL3 signal

DATA0 - DATA4 and CNTL0 - CNTL3 signals are logic level outputs from the USB/SPI dongle that can be controlled directly from the SPIGen program. An example SPIGEN configuration file called KIT33816SW.spi is provided in the software bundle, which contains several batch file examples.

If the user prefers to supply the various MC33816 input signals externally, other than from the USB-SPI interface, the connections are available on the connector listed by the following.

11.4 USB/SPI Dongle Connector

The USB/SPI dongle connector is a 16 pin, 0.1” 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.

Table 1. USB/SPI Dongle Pin Description

Pin Number	Name	Description
1	CNTL2	CNTL2 connected to START6
2	CSB	SPI signal, Chip Select Bar
3	CNTL1	CNTL1 connected to START5
4	SO	SPI signal, Slave Out
5	CNTL0	CNTL0 connected to START4
6	SI	SPI signal, Slave In
7	DATA4	DATA4 connected to START3
8	SCLK	SPI signal, Serial Clock
9	DATA3	DATA3 connected to START2
10	CNTL3	CNTL3 connected to DBUG_EXT2

Table 1. USB/SPI Dongle Pin Description

Pin Number	Name	Description
11	DATA2	DATA2 connected to START1
12	VDD	+5.0 Volt from USB
13	DATA1	DATA1 connected to RESETB
14	+3.3 V	+3.3 V from USB (Not Used)(2)
15	DATA0	DATA0 connected to DRVEN
16	GND	Signal Ground connected to DGND

Notes
2. This connection is unused in this EVB.

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

11.5 Screw Terminal Connections

The MC33816 EVB contains four injector outputs, two fuel pump outputs, and one VSUPP input screw terminal connection.

Figure 5 shows the locations of the screw terminals and their functional definitions:

11.6 Pin Jumpers

There are four 3-pin jumper headers on the MC33816 EVB.

1. **VBAT_SELECT** - This is a header to supply the +5.0 V and +3.3 V linear regulator from VSUPP (position 2-3) or from the VBAT_EXT pin of the EXT_PORT connector (position 1-2).
2. **VCCIO_SEL** - This is a header to Supply VCCIO from the +5.0 V regulator (position 2-3) or from the VCCIO_EXT pin for the EXT_PORT connector (position 1-2).
3. **DBG_SEL** - This is a header to connect the device DBG pin to the DBG_EXT1 pin of the EXT_PORT connector (position 2-3) or to the DBG_EXT2 pin of the IO_PORT connector (position 1-2).
4. **CLK_SEL** - This is a header to select the EVB oscillator (position 1-2) or an external clock pin (position 2-3) applied on the EXT_CLK PIN of the EXT_PORT connector as device clock.

11.7 MC33816 EVB Connectors

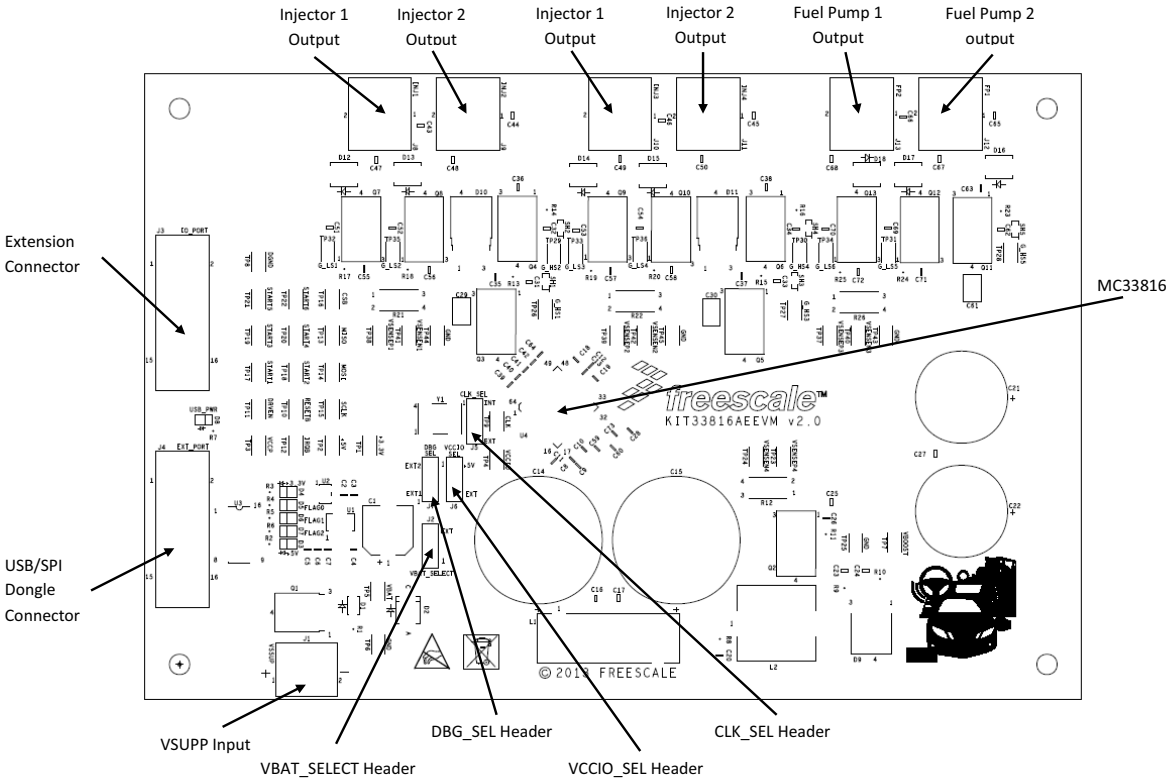


Figure 5. KIT33816AEEVM Evaluation Board Diagram

11.7.1 Input Connector

There is one input connector used to connect the EVB to +12 V.

1. (VSUPP) +12 VOLT POWER SUPPLY INPUT -
   Screw Terminal 1 (+) +12 V
   Screw Terminal 2 (-) GND

11.7.2 Output Connectors

There are six output connectors that provide the four injector and two fuel pump output signals:

1) (INJ1) INJECTOR OUTPUT 1 -
   Screw Terminal 1 - High-side drive
   Screw Terminal 2 - Low-side drive

2. (INJ2) INJECTOR OUTPUT 2 -
   Screw Terminal 1 - High-side drive
   Screw Terminal 2 - Low-side drive

3. (INJ3) INJECTOR OUTPUT 3 -
   Screw Terminal 1 - High-side drive
   Screw Terminal 2 - Low-side drive

4. (INJ4) INJECTOR OUTPUT 4 -
   Screw Terminal 1 - High-side drive
   Screw Terminal 2 - Low-side drive

5. (FP1) FUEL PUMP OUTPUT 1 -
   Screw Terminal 1 - Low-side drive
   Screw Terminal 2 - High-side drive

6. (FP2) FUEL PUMP OUTPUT 2 -
   Screw Terminal 1 - Low-side drive
   Screw Terminal 2 - High-side drive

11.8 Accessory Boards

The KITUSBSPIDGLEVME Evaluation board (shown below) provides a USB to SPI interface that features the MC68HC908JW32 with dongle. It is a working hardware/software example that allows a user to become familiar with the MC68HC908JW32 microcontroller by means of an actual useful application, a USB to SPI and USB to parallel converter. The main function provided by this kit is to allow a PC, that may not have a parallel port, to communicate with other Freescale Evaluation Kits, via a USB port. The USB port is a standard feature on almost every new PC. This kit makes use of the MC68HC908JW32's built-in USB, SPI and parallel ports.

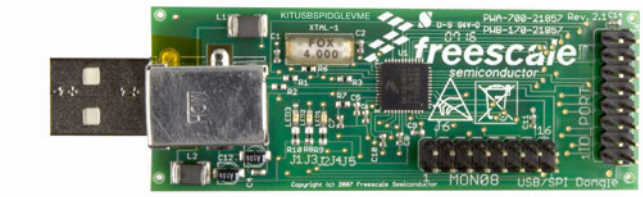


Figure 6. KITUSBSPIDGLEVME Evaluation Kit

12 Schematic

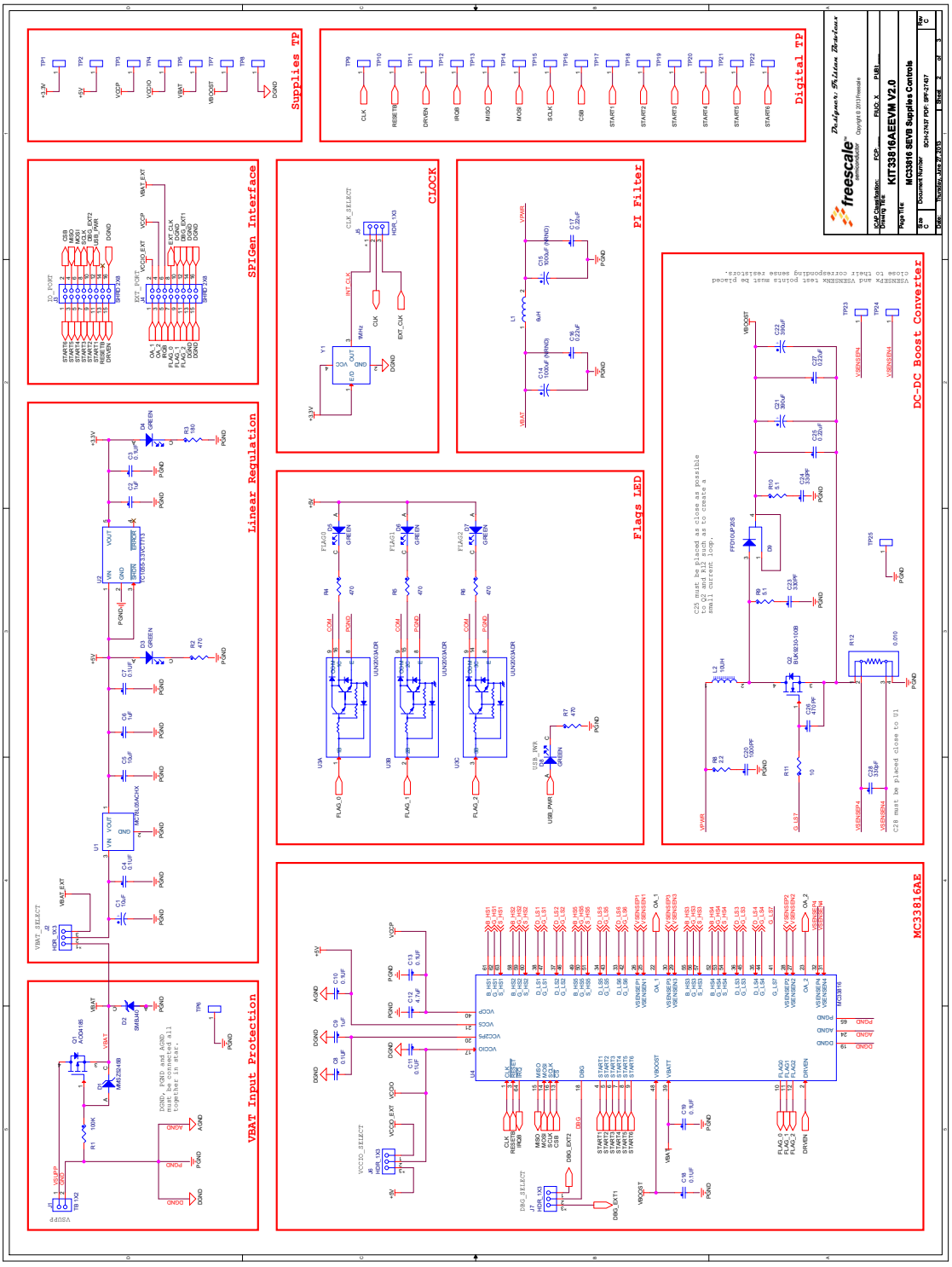


Figure 7. KIT33816AEEVM Evaluation Board Schematic

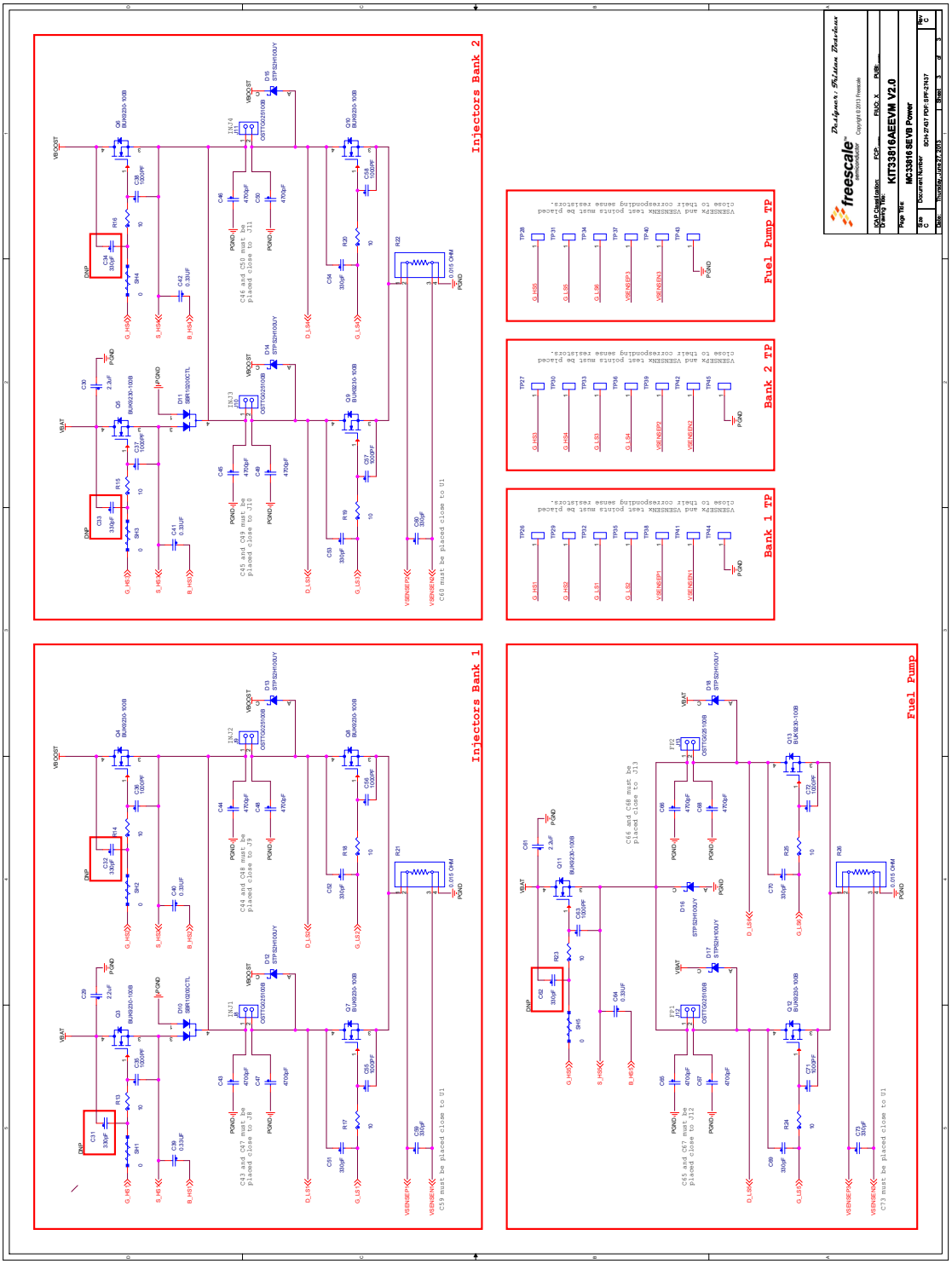
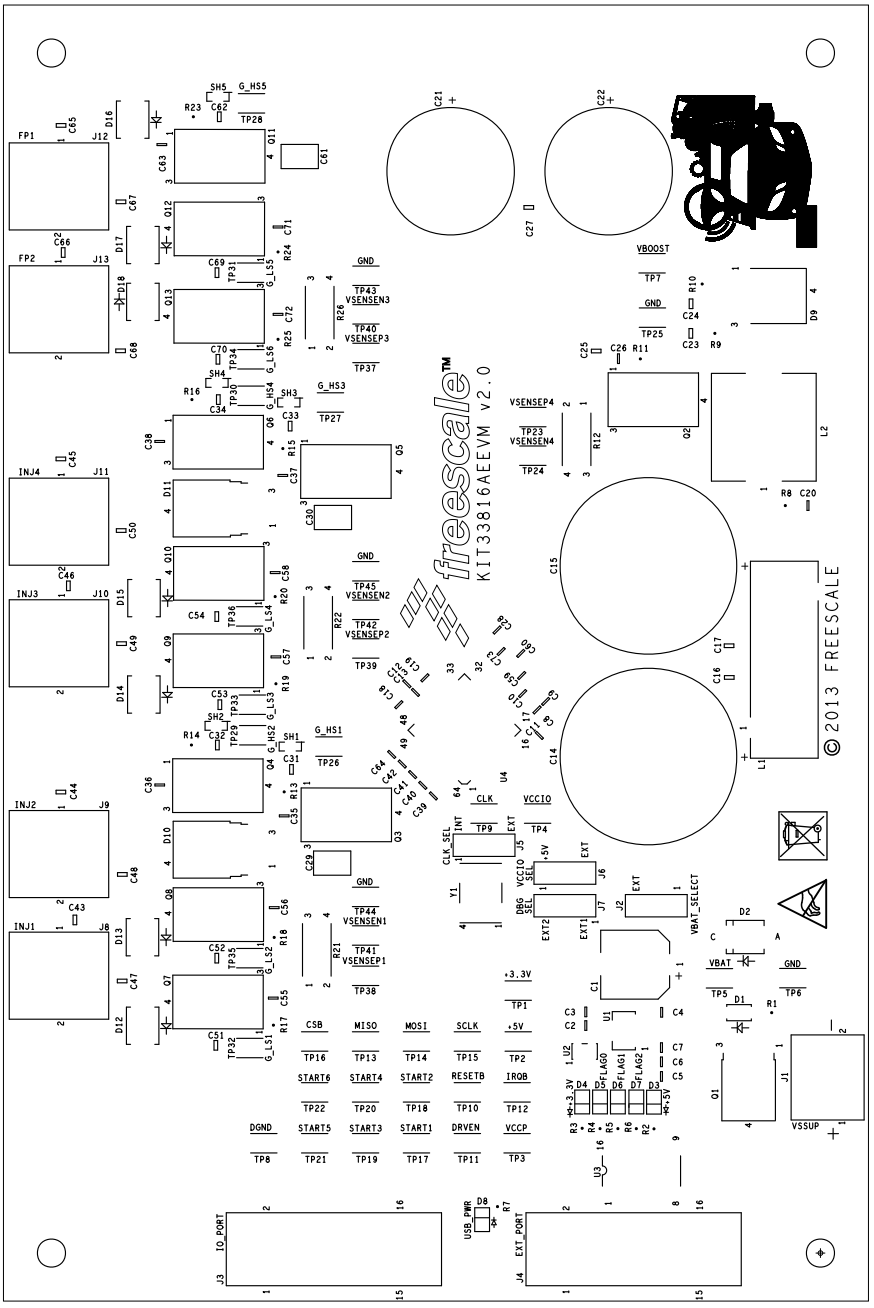


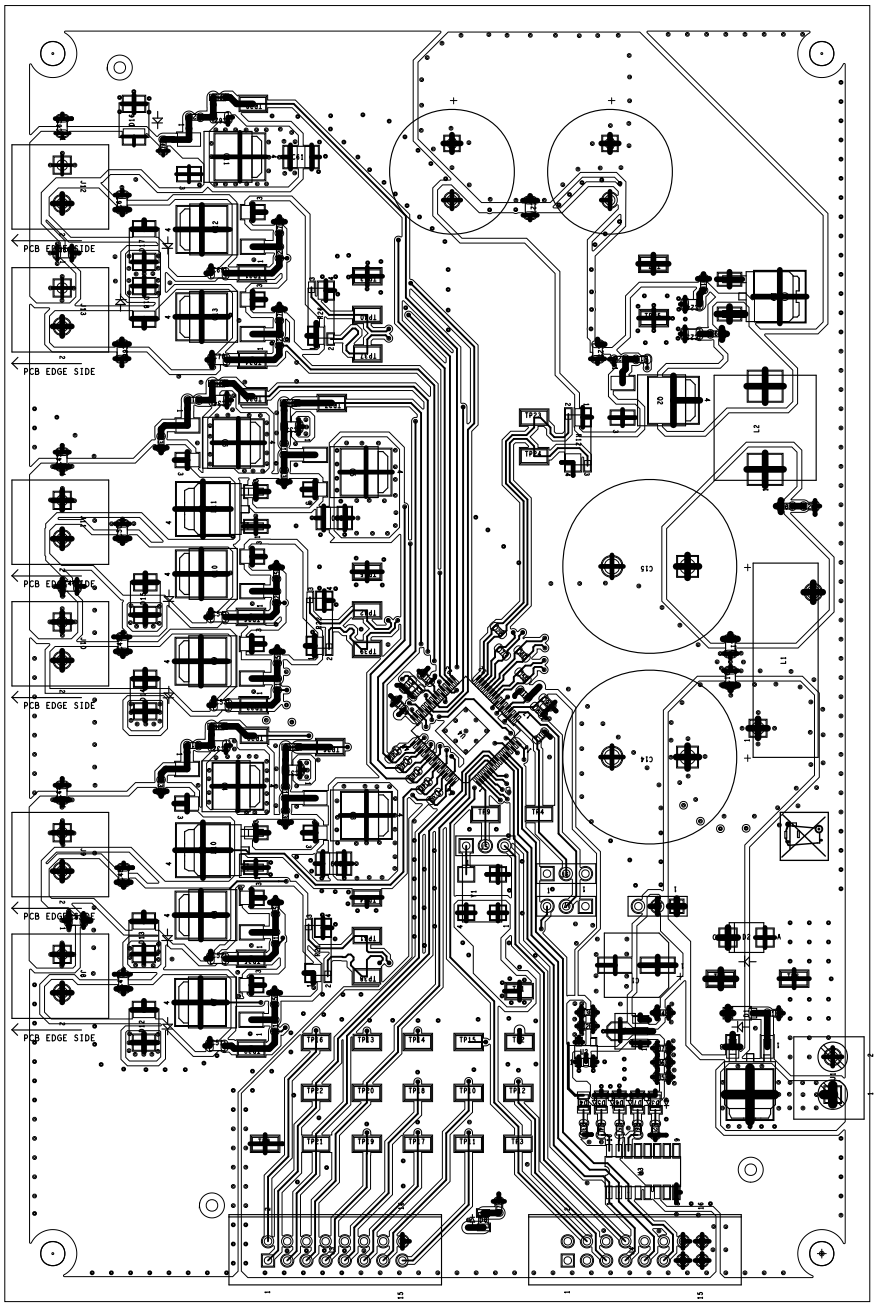
Figure 8. KIT33816AEEVM Evaluation Board Schematic

13 Board Layout

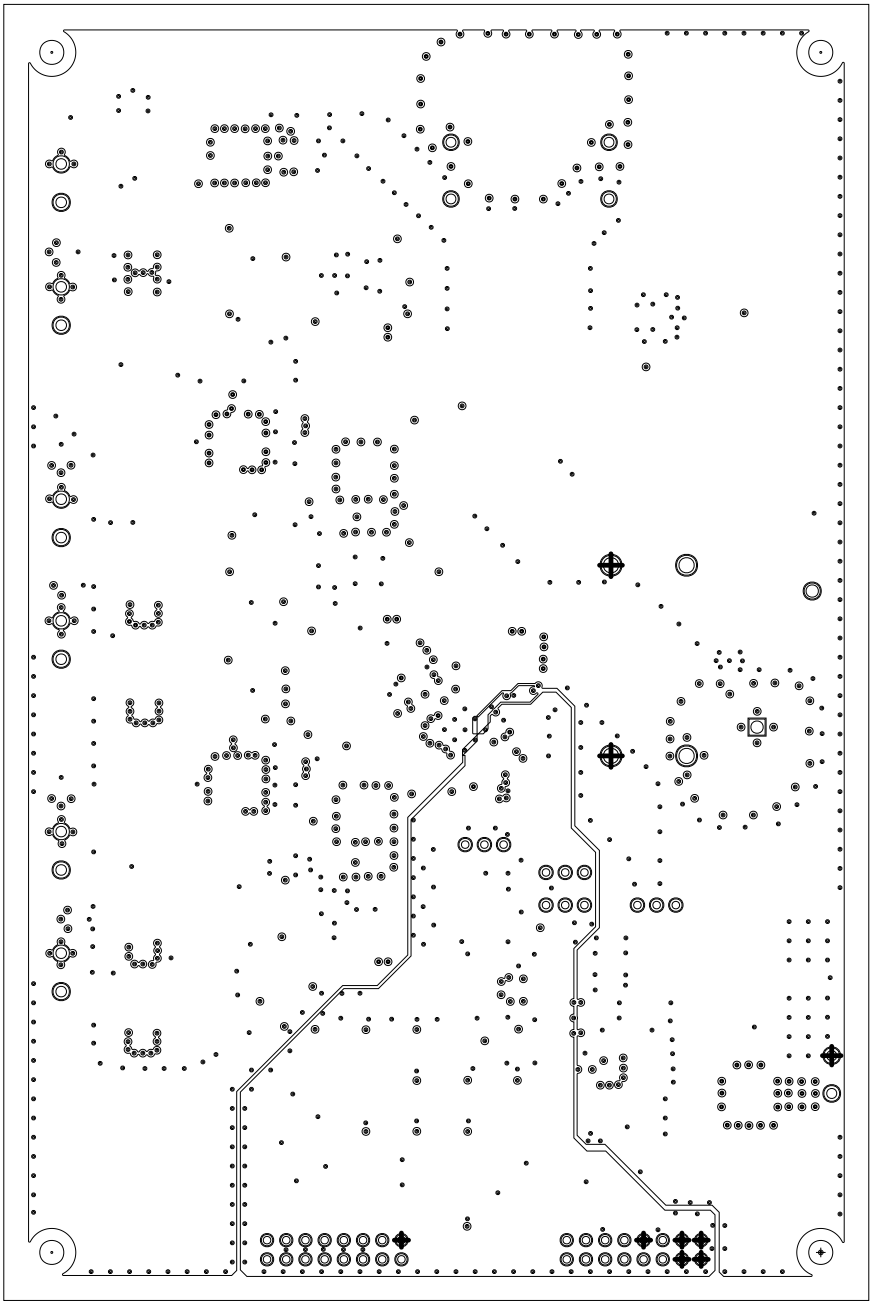
13.1 Assembly Layer Top



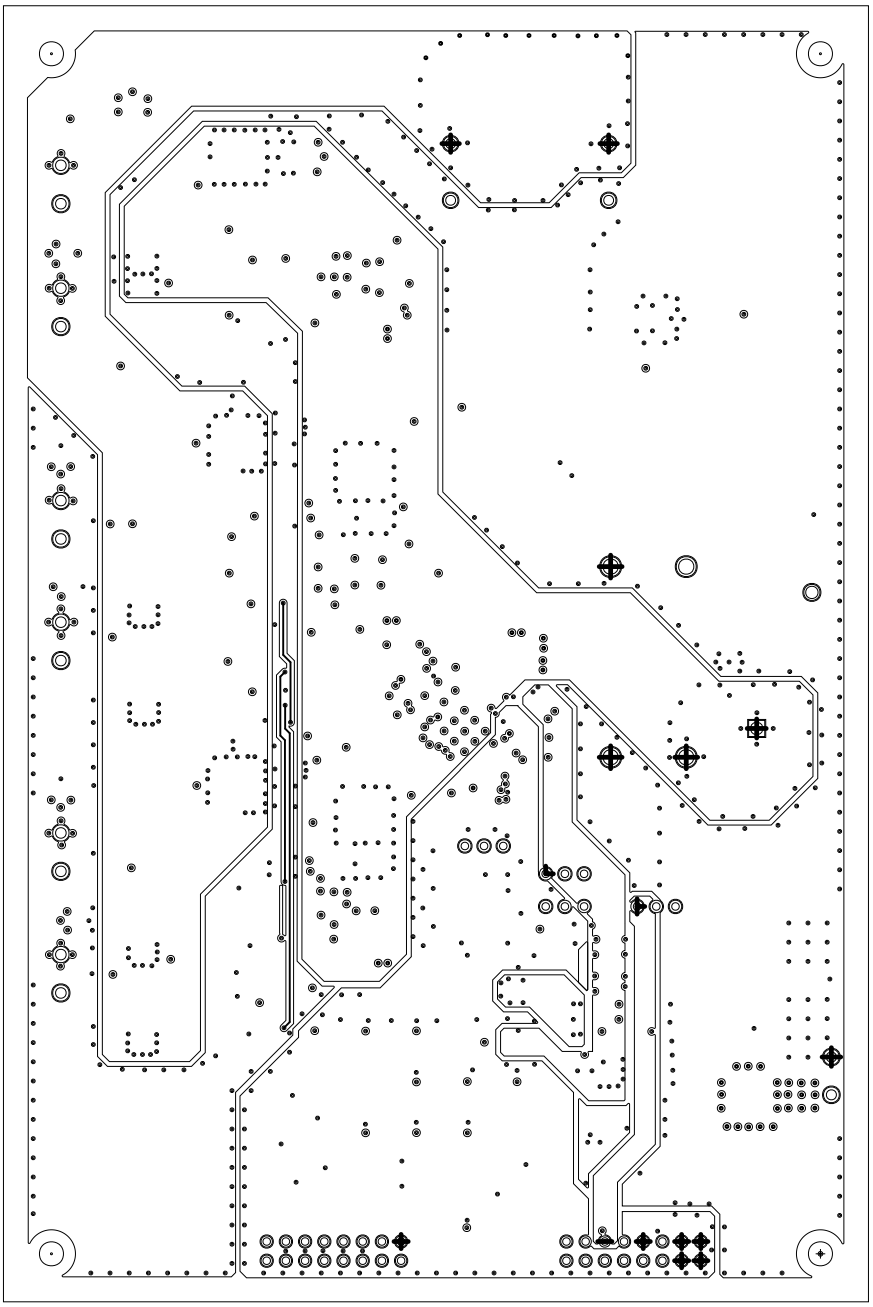
13.2 Top Layer Routing



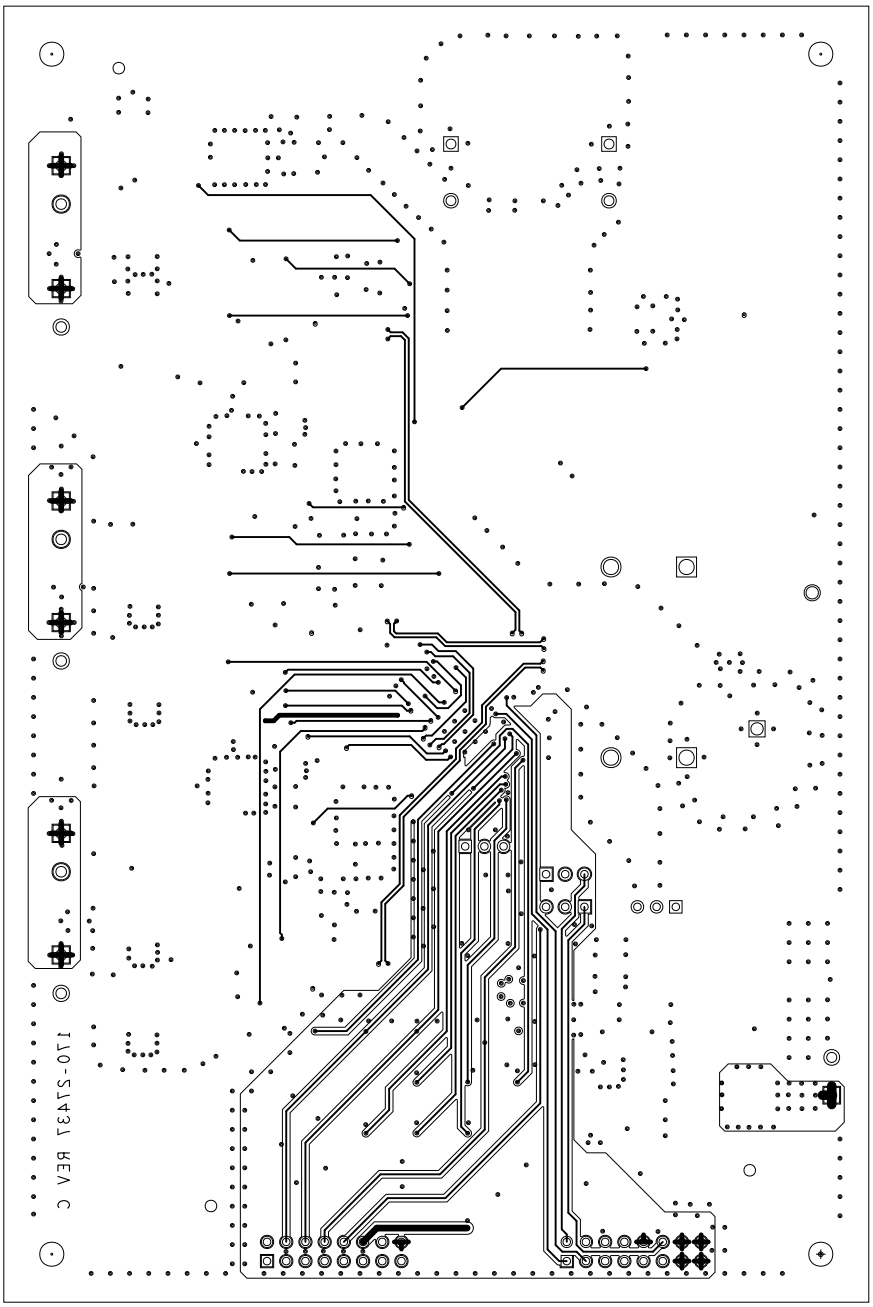
13.3 Inner Layer 1 Routing



13.4 Inner Layer 2 Routing



13.5 Bottom Layer Routing



14 Bill of Material

Quantity	Schematic Label	Value	Description and Values	Manufacturer Name	Part Number	PCB Footprint
Capacitors						
1	C1	10 µF	CAP ALEL 10uF 50V 20% -- SMD	Panasonic	EEETG1H100P	E CASE
3	C2, C6, C9	1.0 µF	CAP CER 1UF 25V 10% X7R 0'0603	Capax Technologies INC	0'0603X105K250SNT	0603
9	C3, C4, C7, C8, C10, C11, C13, C18, C19	0.1 µF	CAP CER 0.1UF 50V 10% X7R 0'0603	Murata	GRM188R71H104KA93D	0603
1	C5	10 µF	CAP CER 10UF 10V 20% X5R 0'0603	Taiyo Yuden	LMK107BJ106MALTD	0603
1	C12	4.7 µF	CAP CER 4.7UF 10V 10% X5R 0'0603	Taiyo Yuden	LMK107BJ475KA-T	0603
2	C14, C15	1000 µF (NRND)	CAP ALEL 1000uF 80V 20% -- RADIAL (NRND)	Panasonic	ECOS1KP102BA	Radial
4	C16, C17, C25, C27	0.22 µF	CAP CER 0.22UF 100V 20% X7S 0'0805	TDK	C2012X7S2A224M/SOFT	0805
12	C20, C35-C38, C55-C58, C63, C71, C72	1000 PF	CAP CER 1000PF 100V 10% X7R 0'0603	Kemet	C0'0603C102K1RACTU	0603
2	C21, C22	390 µF	CAP ALEL 390uF 100V 20% -- RADIAL	Nichicon	UHE2A391MHD	Radial
2	C23, C24	330 pF	CAP CER 330PF 100V 5% C0G 0'0805	AVX	0'08051A331JAT2A	0805
1	C26	470 pF	CAP CER 470PF 100V 5% C0G 0'0603	Fenghua	0'0603CG471J101NT	0603
4	C28, C59, C60, C73	330 pF	CAP CER 330PF 25V 1% C0G 0'0603	AVX	0'06033A331FAT2A	0603
3	C29, C30, C61	2.2 µF	CAP CER 2.2UF 100V 10% X7R 1210	murata	GRM32ER72A225KA35L	1210
5	C39-C42, C64	0.33 µF	CAP CER 0.33UF 25V 10% X7R 0'0603	Multicomp	MCCA001173	0603
12	C43-C50, C65-C68	4700 pF	CAP CER 4700pF 100V 5% C0G 0'0805	Kemet	C0'0805C472J1GACTU	0805
Diodes						
1	D1	MMSZ5245B	DIODE ZNR -- 15V 0.5W SOD123	ON Semiconductor	MMSZ5245BT1G	SOD123
1	D2	SMBJ40	DIODE TVS 9.3A 40V SMB SMT	Bourns	SMBJ40A	DO214A
6	D3-D8	GREEN	LED GRN SGL 30MA SMT 0'0805	Lite ON	LTST-C171KGKT	0'0805
1	D9	FFD10UP20S	DIODE SW UF 10A 200V TO252	Fairchild	FFD10UP20S	TO252
2	D10, D11	SBR10200CTL	DIODE DUAL CC RECT SW 10A 200V DPAK	Diodes INC	SBR10200CTL-13	DPAK
7	D12-D18	STPS2H100UY	DIODE SCH RECT 2A 100V AEC-Q101 SMB	ST Microelectronics	STPS2H100UY	SMB
Connectors and Jumpers						
1	J1	TB 1X2	CON 1X2 TB TH 5MM 12.9MM SN 150L	ON-Shore Technology	OSTTA020161	Connector 1X2

Quantity	Schematic Label	Value	Description and Values	Manufacturer Name	Part Number	PCB Footprint
4	J2, J5-J7	HDR_1X3	HDR 1X3 TH 100MIL SP 319H AU 130L	3M	961103-6404-AR	Header 1X3
2	J3, J4	SHRD 2X8	CON 2X8 SHRD TH 100MIL CTR 366H AU 118L	Sullins Electronics Corp	SBH11-PBPC-D08-ST-BK	CONNECTOR 2X8
6	J8-J13	OSTTG025100B	CON 1X2 TB TH 5.08MM 504H -- 177L	ON-Shore Technology	OSTTG025100B	Connector 1X2
Inductors						
1	L1	6.0 µH	IND ROD CHK 6uH@10KHZ 10A 25% TH	Wurth Elektronik Eisos Gmbh & Co. Kg	744710610	
1	L2	10 µH	IND PWR 10UH@100KHZ 16A 20% SMT	Bourns	SRP1250-100M	SMT
Transistors						
1	Q1	AOD4185	TRAN PMOS PWR 40A 40V TO252	Alpha and Omega Semiconductor	AOD4185	TO252AA
12	Q2-Q13	BUK9230-100B	TRAN NMOS PWR SW 47A 100V DPAK	NXP Semiconductors	BUK9230-100B,118	DPAK
Resistors						
1	R1	100 K	RES MF 100K 1/10W 5% 0'0603	Bourns	CR0'0603-JW-104ELF	0603
5	R2, R4-R7	470	RES MF 470 OHM 1/10W 5% 0'0603	Venkel Company	CR0'0603-10W-471JT	0603
1	R3	180	RES MF 180 OHM 1/10W 5% 0'0603	KOA Speer	RK73B1JTTD181J	0603
1	R8	2.2	RES MF 2.2 OHM 1/10W 5% 0'0603	Panasonic	ERJ3GEYJ2R2V	0603
2	R9, R10	5.1	RES MF 5.1 OHM 1/10W 5% 0'0603	KOA Speer	RK73B1JTTD5R1J	0603
12	R11, R13-R20, R23-R25	10	RES MF 10 OHM 1/10W 5% AEC-Q200 0'0603	Vishay Intertechnology	CRCW0'060310R0JNEA	0603
1	R12	0.010	RES METAL STRIP 0.01 OHM 1W 1% 2512	Vishay Intertechnology	WSK2512R0100FEA	2512_4P
3	R21, R22, R26	0.015	RES MF 0.015 OHM 1W 1% AEC-Q200 2512	Vishay Intertechnology	WSK2512R0150FEA	2512_4P
Test points						
46	TP1-TP45	3.65x2.05 MM	TEST POINT 3.65x2.05MM SMT	Harwin INC	S1751-46R	
Integrated Circuits						
1	U1	MC78L05ACHX	IC VREG 5V 100MA 30V SOT-89	Fairchild	MC78L05ACHX	SOT89
1	U2	TC1055-3.3 VCT713	IC VREG LDO 3.3V 100MA 2.7-6V SOT23-5	Microchip Technology INC	TC1055-3.3VCT713	SOT23-5

Quantity	Schematic Label	Value	Description and Values	Manufacturer Name	Part Number	PCB Footprint
1	U3	ULN2003 ADR	IC TRAN ARRAY NPN DARL SEVEN 50V 0.5A SOIC16	Texas Instruments	ULN2003ADR	SOIC16
1	U4	MC33816	IC CTLER AUTOMOTIVE ENGINE/SMART GATE 5.5-72V LQFP64	Freescale Semiconductor	MC33816AE	LQFP64_EP

Note: 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.

15 References

The following table contains URLs where you can obtain information on KIT33816AEEVM and other Freescale products and product solutions:

Freescale.com Support Pages	URL
MC33816 Product Summary Page	http://www.freescale.com/webapp/sps/site/prod_summary.jsp?code=MC33816
KITUSBSPIDGLEVME Tool Summary Page	http://www.freescale.com/webapp/sps/site/ prod_summary.jsp?code=KITUSBSPIDGLEVME
SPIGen Reference Tool Summary Page	http://www.freescale.com/files/soft_dev_tools/software/device_drivers/ SPIGen.html?fsrch=1&sr=11
Analog Home Page	www.freescale.com/analog
Automotive Home Page	www.freescale.com/automotive

15.1 Support

Visit Freescale.com/support for a list of phone numbers within your region.

15.2 Warranty

Visit Freescale.com/warranty for a list of phone numbers within your region.

16 Revision History

Revision	Date	Description of Changes
1.0	2/2013	•Initial Release
2.0	4/2013	•Add Jump Start link for downloading software and/or documents. •Update SPIGen section to match latest template
3.0	1/2014	•Added new KIT33816AEEVM evaluation board. •Update all information to match the new board configuration.

How to Reach Us:

Home Page:
freescale.com

Web Support:
freescale.com/support

Document Number: KT33816UG
Rev. 3.0
1/2014