Freescale Semiconductor
User's Guide

Document Number: KT33810UG1
Rev. 1.0, 12/2014

KIT33810EKEVB Evaluation Board

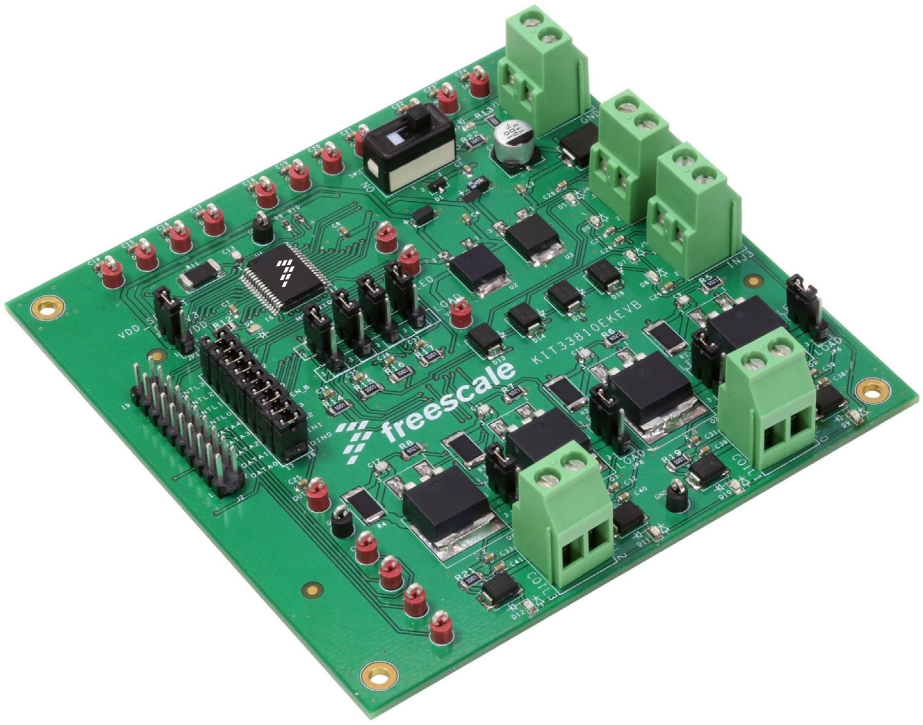


Figure 1. KIT33810EKEVB

Table of Contents

1 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 evaluation kit 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. 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 the Buyer purchase or use Freescale products for any such unintended or unauthorized application, the 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.

2 Getting Started

2.1 Kit Contents/Packing List

The KIT33810EKEVB contents include:

- Assembled and tested evaluation board/module in an anti-static bag
- Quick Start Guide, Analog Tools
- One 20-pin ribbon cable
- Warranty card

2.2 Jump Start

Freescale's analog product development boards help to easily evaluate Freescale products. These tools support analog mixed signal and power solutions including monolithic ICs using proven high-volume SMARTMOS mixed signal technology, and system-in-package devices utilizing power, SMARTMOS and MCU dies. Freescale products enable longer battery life, smaller form factor, component count reduction, ease of design, lower system cost and improved performance in powering state of the art systems.

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

- Download documents, software, and other information

Once the files are downloaded, review the user guide in the bundle. The user guide includes setup instructions, BOM and schematics. Jump start bundles are available on each tool summary page with the most relevant and current information. The information includes everything needed for design.

2.3 Required Equipment and Software

To use this kit, you need:

- Power supply (a second power supply is optional if used externally for the injectors and coils/spark plugs)
- Oscilloscope (preferably 4-channel) with current probe(s) (500 MHz)
- Digital multimeter
- FRDM-KL25Z Freedom Development Platform
- Typical loads (four port injectors, four coils and spark plugs)

2.4 System Requirements

The kit requires the following:

- USB-enabled PC with Windows® XP or higher

3 Getting to Know the Hardware

3.1 Board Overview

The KIT33810EKEVB evaluation board is an easy-to-use circuit board that allows the user to exercise all the functions of the MC33810 Automotive Engine Control IC.

There are two ways to communicate with the evaluation board:

1. A PC communicates with the evaluation board through a Freedom SPI dongle (FSD), connected to the PC's USB port or
2. the microcontroller on the FRDM-KL25Z communicates with the evaluation board via microcontroller code.

The Freescale SPIGen (version 7.0.1 or higher) program provides the user interface to the MC33810 SPI port and allows the user to send commands to the IC and receive statuses from the IC.

3.2 Board Features

This board features the MC33810 Automotive Engine Control IC, which is an eight channel output driver IC intended for automotive engine control applications. The IC consists of four integrated low-side drivers and four low-side gate pre-drivers. The low-side drivers are suitable for driving fuel injectors, solenoids, lamps, and relays. The four gate pre-drivers can function either as ignition IGBT gate pre-drivers or as general purpose MOSFET gate pre-drivers. The PCB contains a board to FRDM-KL25Z connector, which allows the FRDM-KL25Z to act as either a FSD or simply as an access to the KL25Z microcontroller. The board features are as follows:

- Output terminals for injector and coil loads
- Test points for various inputs, outputs, and SPI signals
- FSD connector
- Signal jumpers for maximum flexibility in signal routing

3.3 FRDM-KL25Z Features

The FRDM-KL25Z board features are as follows:

- MKL25Z128VLK4 MCU - 48 MHz, 128 KB Flash, 16 KB SRAM, USB OTG (FS), 80 LQFP
- Capacitive touch slider, MMA8451Q accelerometer, Tri-color LED
- Flexible power supply options - USB, coin cell battery, external source
- Easy access to MCU I/O
- Battery-ready, power-measurement access points
- Form factor compatible with Arduino™ R3 pin layout
- New, OpenSDA debug interface
- Mass storage device flash programming interface (default) - no tool installation required to evaluate demonstration applications
- P&E Debug interface provides run-control debugging and compatibility with IDE tools
- CMSIS-DAP interface: new ARM standard for embedded debug interface

Additional reference documents are available on freescale.com/FRDM-KL25Z.

3.4 Block Diagram

This evaluation board consists of an MC33810 Automotive Engine Control IC. This high level system block diagram (Figure 2) outlines the way Freescale standard products are used to implement injectors and coils.

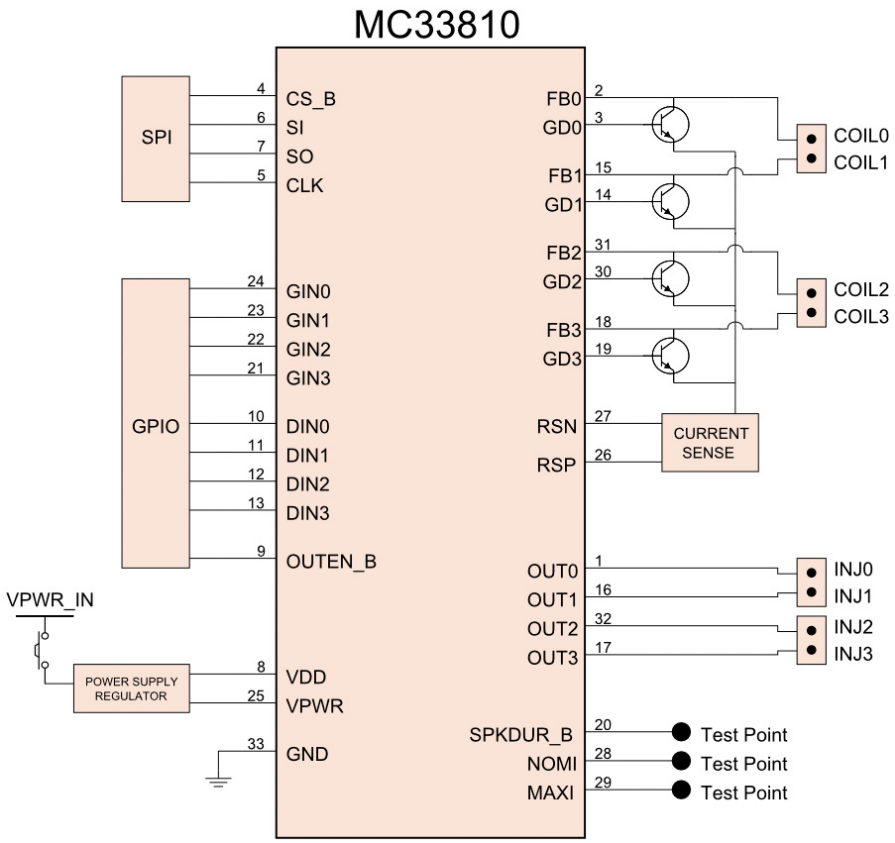


Figure 2. Block Diagram

3.4.1 Device Features

This evaluation board features the following Freescale product:

Table 1. MC33810 Device Features

Device	Description	Features
MC33810	8 channel output driver IC	• Designed to operate over the range of 4.5 V ≤ VPWR ≤ 36 V • Quad Ignition IGBT or MOSFET gate pre-driver with Parallel/SPI and/or PWM Control • Quad Injector Driver with Parallel/SPI Control • Interfaces Directly to MCU Using 3.3 V/5.0 V SPI Protocol • Injector Driver Current Limit - 4.5 A Typical • Independent Fault Protection and Diagnostics • VPWR Standby Current 10 µA Typical

3.5 Board Description

The analog part consists of the MC33810 chip controlling external drivers. The digital part consists of the KL25Z controlling the MC33810 by SPI and I/Os.

This evaluation board is meant to demonstrate how the MC33810 can control four injectors and four coils.

Power is provided to the board via a VPWR/GND screw terminal (J1). Power can be disconnected from the board via an onboard switch (SW1). The VDD input of the device can accept either 3.3 V or 5.0 V. This can be selected via a jumper (JP1). Note the KL25Z FSD uses a 3.3 V microcontroller, so when the KL25Z FSD is being used, JP1 needs to be set to the 3.3 V selection.

The evaluation board provides a 20-pin connector (J2) to be used with the FRDM board. The connector J2 on the FRDM board connects to J2 on the evaluation board. A bank of jumpers (J3) is provided to allow signals to be disconnected or controlled by some other external source.

The injector control signals are routed straight to the injector screw terminals (J4 and J5). The coil pre-driver signals are routed to IGBTs that in turn are routed to coil screw terminals (J6 and J7). The evaluation board also provides visual indication that the injector and coil outputs of the device are functioning. These LEDs can be selected via jumpers (JP2 through JP9). The LEDs and screw terminal outputs cannot be selected at the same time. The load side of jumpers JP2 through JP9 selects the screw terminal outputs, as opposed to the LEDs.

The evaluation board also includes several test points. Eight of these test points allow the input signals to the device to be monitored (DIN0 through DIN3 and GIN0 through GIN3). Four of them provide access to extra outputs of the device (MAXI, NOMI, SPKDUR, and OUTEN_B). Another four are the SPI signals (CLK, SO, SI, and CS). There are also three ground test points (GND1 through GND3) and three power test points (3V3, 5V, and VPWR).

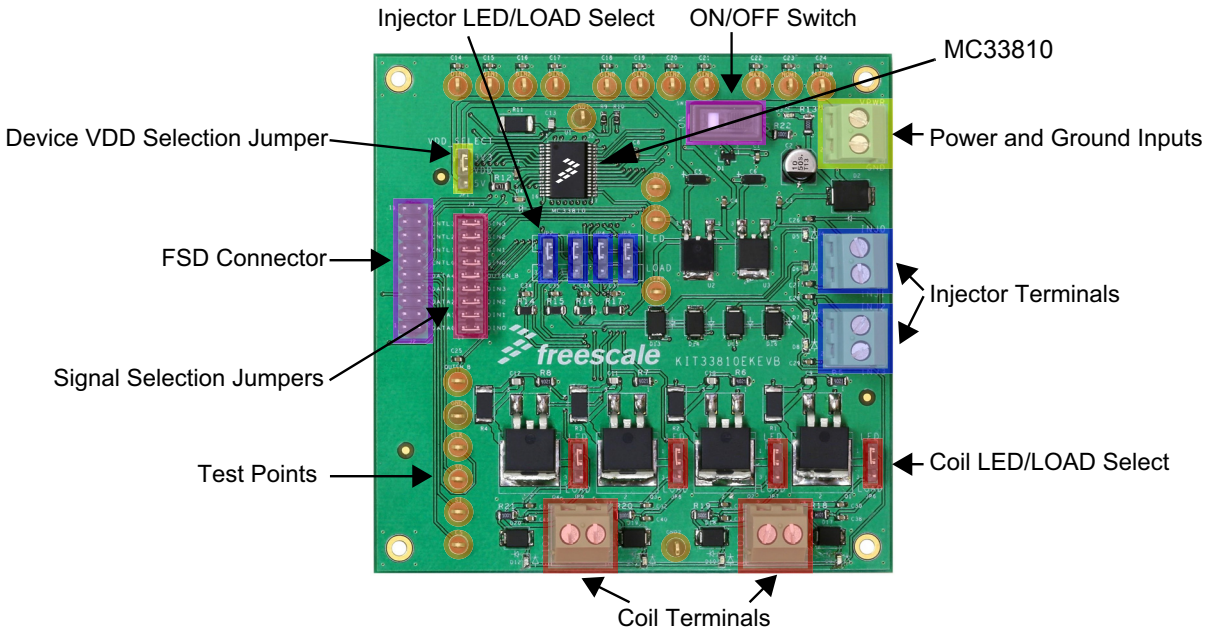


Figure 3. Board Description

Table 2. Board Description

Name	Description
ON/OFF Switch	• Allows the board to be disconnected from power easily
Injector LED/LOAD Select	• Selects where the INJ signals are routed; either to the LEDs or the injector terminals
Device VDD Selection Jumper	• Selects either 3.3 V or 5.0 V to be routed to the MC33810 to determine logic levels
FSD Connector	• Allows a FSD to be connected to the evaluation board via a 20-pin ribbon cable
Signal Selection Jumpers	• Routes the signals from the FSD connector to the MC33810. These can be removed and connected to external sources if other signals are to be used

Table 2. Board Description (continued)

Name	Description
Test Points	• Provides test points for various signals (see Section 3.7 for more information)
Coil Terminals	• Provides connection points for coils and spark plugs
Coil LED/LOAD Select	• Selects where the COIL signals are routed; either to the LEDs or to the coil terminals
Injector Terminals	• Provides connection points for injectors
Power and Ground Inputs	• Provides connection points for power and ground
MC33810	• Automotive engine control IC

3.6 LED Display

The following LEDs are provided as visual output devices for the KIT33810EKEVB evaluation board:

1. LED D3 indicates when VPWR is present.
2. LED D4 indicates when 5.0 V/3.3 V is present.
3. LED D5 indicates when injector 0 is on. In order for the LEDs to light up, the corresponding jumper must be set to LED, not LOAD.
4. LED D6 indicates when injector 1 is on. In order for the LEDs to light up, the corresponding jumper must be set to LED, not LOAD.
5. LED D7 indicates when injector 2 is on. In order for the LEDs to light up, the corresponding jumper must be set to LED, not LOAD.
6. LED D8 indicates when injector 3 is on. In order for the LEDs to light up, the corresponding jumper must be set to LED, not LOAD.
7. LED D9 indicates when coil 0 is on. In order for the LEDs to light up, the corresponding jumper must be set to LED, not LOAD.
8. LED D10 indicates when coil 1 is on. In order for the LEDs to light up, the corresponding jumper must be set to LED, not LOAD.
9. LED D11 indicates when coil 2 is on. In order for the LEDs to light up, the corresponding jumper must be set to LED, not LOAD.
10. LED D12 indicates when coil 3 is on. In order for the LEDs to light up, the corresponding jumper must be set to LED, not LOAD.

3.7 Test Point Definitions

The following test points provide access to signals on the MC33810 IC:

Table 3. Test Point Definitions

Schematic Label	Name	Description
OUTEN_B	Output Enable	Active low enable
DIN0	Driver Input 0	Injector IN signal 0 coming from the microcontroller/SPI dongle
DIN1	Driver Input 1	Injector IN signal 1 coming from the microcontroller/SPI dongle
DIN2	Driver Input 2	Injector IN signal 2 coming from the microcontroller/SPI dongle
DIN3	Driver Input 3	Injector IN signal 3 coming from the microcontroller/SPI dongle
GIN0	Gate Driver Input 0	Coil IN signal 0 coming from the microcontroller/SPI dongle
GIN1	Gate Driver Input 1	Coil IN signal 1 coming from the microcontroller/SPI dongle
GIN2	Gate Driver Input 2	Coil IN signal 2 coming from the microcontroller/SPI dongle
GIN3	Gate Driver Input 3	Coil IN signal 3 coming from the microcontroller/SPI dongle
MAXI	Maximum Ignition Coil Current	MAXI signal coming from the MC33810 IC
NOMI	Nominal Ignition Coil Current	NOMI signal coming from the MC33810 IC
SPKDUR	Spark Duration Output	SPKDUR signal coming from the MC33810 IC
VPWR	Analog Supply Voltage	External power coming into the evaluation board

Table 3. Test Point Definitions (continued)

Schematic Label	Name	Description
3V3	3.3 V	3.3 V converted from VPWR
5V	5.0 V	5.0 V converted from VPWR
CLK	Serial Clock Input	SPI clock
SO	Serial Output Data	SPI MISO (Master Input, Slave Output)
SI	Serial Input Data	SPI MOSI (Master Output, Slave Input)
CS	Chip Select	SPI chip select
GND1	Ground	Ground near injector and coil signals from microcontroller/SPI dongle
GND2	Ground	Ground near coil outputs
GND3	Ground	Ground near SPI signals

3.8 Input Signal Definitions

The MC33810 IC has fifteen input signals that are used to control certain outputs or functions inside the circuit. These signals are:

Table 4. Input Signal Definitions

Schematic Label	Name	Description
DIN0	Driver Input 0	Controls OUT0
DIN1	Driver Input 1	Controls OUT1
DIN2	Driver Input 2	Controls OUT2
DIN3	Driver Input 3	Controls OUT3
GIN0	Gate Driver Input 0	Controls GD0
GIN1	Gate Driver Input 1	Controls GD1
GIN2	Gate Driver Input 2	Controls GD2
GIN3	Gate Driver Input 3	Controls GD3
OUTEN_B	Output Enable	Controls on/off state of the MC33810
FB0	Feedback Voltage Sense 0	Provides feedback from the IGBT connected to COIL0
FB1	Feedback Voltage Sense 1	Provides feedback from the IGBT connected to COIL1
FB2	Feedback Voltage Sense 2	Provides feedback from the IGBT connected to COIL2
FB3	Feedback Voltage Sense 3	Provides feedback from the IGBT connected to COIL3
RSN	Resistor Sense Negative	Monitors current from IGBTs
RSP	Resistor Sense Positive	Monitors current from IGBTs

3.9 Output Signal Definitions

The MC33810 IC has eleven output signals that are used to control various devices and outputs on the evaluation board. These signals are:

Table 5. Output Signal Definitions

Schematic Label	Name	Description
OUT0	Low-side Injector Driver Output 0	Controls INJ0
OUT1	Low-side Injector Driver Output 1	Controls INJ1
OUT2	Low-side Injector Driver Output 2	Controls INJ2
OUT3	Low-side Injector Driver Output 3	Controls INJ3
GD0	Gate Driver Output 0	Controls the IGBT connected to COIL0
GD1	Gate Driver Output 1	Controls the IGBT connected to COIL1
GD2	Gate Driver Output 2	Controls the IGBT connected to COIL2
GD3	Gate Driver Output 3	Controls the IGBT connected to COIL3
MAXI	Maximum Ignition Coil Current	Output to test point only (nominal ignition coil current output flag)
NOMI	Nominal Ignition Coil Current	Output to test point only (maximum ignition coil current output flag)
SPKDUR	Spark Duration Output	Output to test point only (spark duration output)

3.10 USB/SPI Dongle Connector

This is a 20-pin, 0.1" center, dual-row connector that is designed to interface directly to the FSD unit via a 20-pin ribbon cable. The FRDM-KL25Z SPI dongle connector consists of the following 20 pins (J2 on both the FRDM-KL25Z and the KIT33810EKEVB).

Table 6: USB/SPI Dongle Pin Description

Pin Number	FSD Name	EVB Name	Description
1	DATA0	DATA0	Connected to DIN0 of MC33810
2	SPI1-CSB	<NC>	<unused>
3	DATA1	DATA1	Connected to DIN1 of MC33810
4	SPI1-CLK	<NC>	<unused>
5	DATA2	DATA2	Connected to DIN2 of MC33810
6	SPI0-CSB	SPI0_CSB	SPI0 signal – Chip Select Bar of MC33810
7	DATA3	DATA3	Connected to DIN3 of MC33810
8	SPI0-MOSI	SPI0_MOSI	SPI0 signal – Serial In of MC33810
9	DATA4	DATA4	Connected to OUTEN_B of MC33810
10	SPI0-MISO	SPI0_MISO	SPI0 signal – Serial Out of MC33810
11	CTRL0	CNTL0	Connected to GIN0 of MC33810
12	SPI0-CLK	SPI0_CLK	SPI0 signal – Serial Clock of MC33810
13	CTRL1	CNTL1	Connected to GIN1 of MC33810
14	GND	GROUND	Ground Signal
15	<NC>	<NC>	<unused>
16	VREFH	<NC>	<unused>
17	SPI1-MISO	<NC>	<unused>
18	CTRL3	CNTL3	Connected to GIN3 of MC33810
19	CTRL2	CNTL2	Connected to GIN2 of MC33810
20	SPI1-MOSI	<NC>	<unused>

3.11 Screw Terminal Connections

The KIT33810EKEVB board features screw terminal connections to allow easy access to the MC33810 signals and supply rails. Figure 4 shows the board locations and names of the screw terminals.

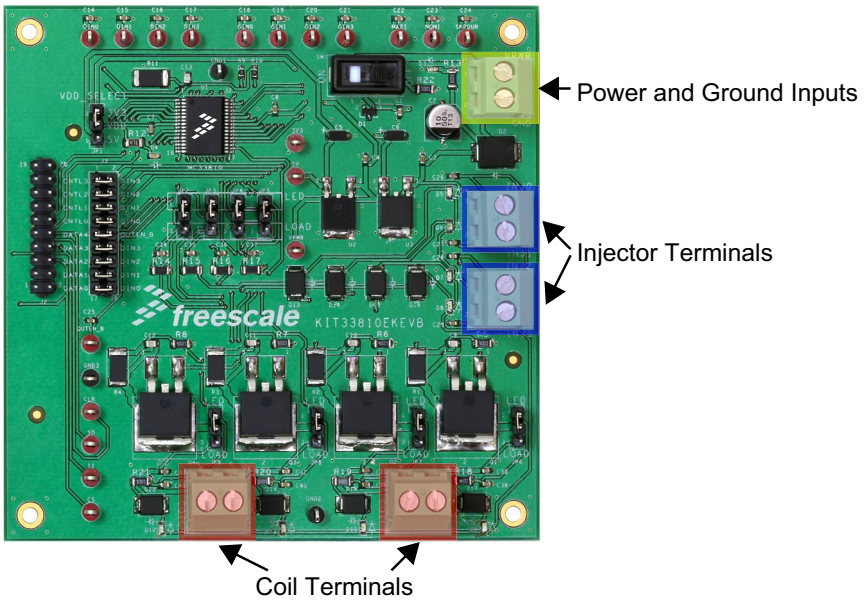


Figure 4. Connector Designations

3.12 Input and Output Evaluation Connectors

There is one input connector which provides the following signals:

Table 7. Input Connectors

Pin	Schematic	Signal
1	J1	VPWR
2		GND

There are four output connectors which provide the following signals:

Table 8. Output Connectors

Pin	Schematic	Signal
1	J4	OUT0
2		OUT1
1	J5	OUT2
2		OUT3
1	J6	COIL0
2		COIL1
1	J7	COIL2
2		COIL3

3.13 Jumper Definitions

The following table defines the evaluation board jumper positions and explains their functions.

Table 9. Jumper Table

Jumper	Description	Default Setting	Setting	Connection
J3	Determines which voltage is supplied to the VDD input of the MC33810	1-2		CNTL3 to GIN3 (remove to disconnect from J2)
		3-4		CNTL2 to GIN2 (remove to disconnect from J2)
		5-6		CNTL1 to GIN1 (remove to disconnect from J2)
		7-8		CNTL0 to GIN0 (remove to disconnect from J2)
		9-10		DATA4 to OUTEN_B (remove to disconnect from J2)
		11-12		DATA3 to DIN3 (remove to disconnect from J2)
		13-14		DATA2 to DIN2 (remove to disconnect from J2)
		15-16		DATA1 to DIN1 (remove to disconnect from J2)
		17-18		DATA0 to DIN0 (remove to disconnect from J2)
JP1	Determines which voltage is supplied to the VDD input of the MC33810		1-2	5.0 V is supplied to the VDD input of the MC33810
		2-3		3.3 V is supplied to the VDD input of the MC33810
JP2	Determines if the signal from OUT0 goes to an LED or to the terminal	1-2		The output of OUT0 is routed to an LED
			2-3	The output of OUT0 is routed to the terminal
JP3	Determines if the signal from OUT1 goes to an LED or to the terminal	1-2		The output of OUT1 is routed to an LED
			2-3	The output of OUT1 is routed to the terminal
JP4	Determines if the signal from OUT2 goes to an LED or to the terminal	1-2		The output of OUT2 is routed to an LED
			2-3	The output of OUT2 is routed to the terminal
JP5	Determines if the signal from OUT3 goes to an LED or to the terminal	1-2		The output of OUT3 is routed to an LED
			2-3	The output of OUT3 is routed to the terminal
JP6	Determines if the signal from COIL0 goes to an LED or to the terminal	1-2		The output of COIL0 is routed to an LED
			2-3	The output of COIL0 is routed to the terminal

Table 9. Jumper Table (continued)

JP7	Determines if the signal from COIL1 goes to an LED or to the terminal	1-2		The output of COIL1 is routed to an LED
			2-3	The output of COIL1 is routed to the terminal
JP8	Determines if the signal from COIL2 goes to an LED or to the terminal	1-2		The output of COIL2 is routed to an LED
			2-3	The output of COIL2 is routed to the terminal
JP9	Determines if the signal from COIL3 goes to an LED or to the terminal	1-2		The output of COIL3 is routed to an LED
			2-3	The output of COIL3 is routed to the terminal

4 FRDM-KL25Z Freedom Development Platform

The KIT33810EKEVB kit may be used with the FRDM SPI Dongle (FSD), (see Figure 5), which provides a USB-to-SPI interface. This small board makes use of the USB, SPI and parallel ports built into Freescale's KL25Z microcontroller. The main function provided by this dongle is to allow Freescale evaluation kits that have a parallel port to communicate via a USB port to a PC. It can also be used as a regular microcontroller board if not configured as a SPI dongle.

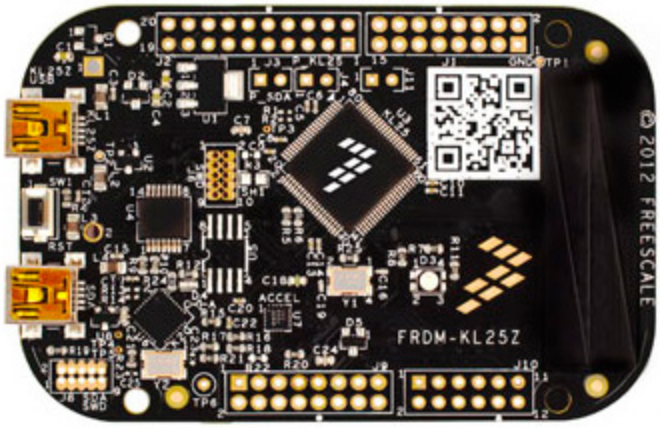


Figure 5. FRDM-KL25Z Interface Dongle

4.1 Using the FRDM-KL25Z as a FSD

First, the MSD-DEBUG-FRDM-KL25Z_Pemicro_v114.SDA file must be loaded to the FRDM-KL25Z board. This is accomplished by plugging the mini-USB cable into the SDA USB port on the FRDM-KL25Z while holding down the reset button. The green LED should be flashing. The MSD-DEBUG-FRDM-KL25Z_Pemicro_v114.SDA file must then be drag and dropped onto the BOOTLOADER drive in Windows Explorer. The FRDM-KL25Z should be unplugged after the file has been transferred. The mini-USB cable must then be plugged back into the SDA USB port on the FRDM-KL25Z. The FSD srec file found on the SPIGen website can then be drag and dropped onto the FRDM-KL25Z drive in Windows Explorer. To use the FRDM-KL25Z as a FSD, the mini-USB cable must be plugged into the KL25Z USB port.

4.2 Using the FRDM-KL25Z as a Microcontroller Board

4.2.1 Using the FRDM-KL25Z Sample Code Drag/Drop File

First, the MSD-DEBUG-FRDM-KL25Z_Pemicro_v114.SDA file must be loaded to the FRDM-KL25Z board. This is accomplished by plugging the mini-USB cable into the SDA USB port on the FRDM-KL25Z while holding down the reset button. The green LED should be flashing. The MSD-DEBUG-FRDM-KL25Z_Pemicro_v114.SDA file must then be drag and dropped onto the BOOTLOADER drive in Windows Explorer. The FRDM-KL25Z should be unplugged after the file has been transferred. The mini-USB cable must then be plugged back into the SDA USB port on the FRDM-KL25Z. The sample code srec file found in this kit's jumpstart package can then be drag and dropped onto the FRDM-KL25Z drive in Windows Explorer. To use the FRDM-KL25Z with this sample code, the mini-USB cable must be plugged into the KL25Z USB port.

4.2.2 Using the FRDM-KL25Z with Custom CodeWarrior Code

First, the MSD-DEBUG-FRDM-KL25Z_Pemicro_v114.SDA file must be loaded to the FRDM-KL25Z board. This is accomplished by plugging the mini-USB cable into the SDA USB port on the FRDM-KL25Z while holding down the reset button. The green LED should be flashing. The MSD-DEBUG-FRDM-KL25Z_Pemicro_v114.SDA file must then be drag and dropped onto the BOOTLOADER drive in Windows Explorer. The FRDM-KL25Z should be unplugged after the file has been transferred. To use the FRDM-KL25Z as a programmable microcontroller with CodeWarrior, the mini-USB cable must be plugged into the SDA USB port. Sample code for this kit is available at the kit’s website.

5 Installing the Software and Setting up the Hardware

5.1 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 guides 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) appears. 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 creates a specially configured SPI command generator for your evaluation board.

The GUI is shown in Figure 6. The text at the top is the name of the configuration file loaded. The left side panel displays folders that group user interfaces. The process of loading the configuration file has assigned a list of “Extra Pins” as well as a list of “Quick Commands”, all of which are board-specific.

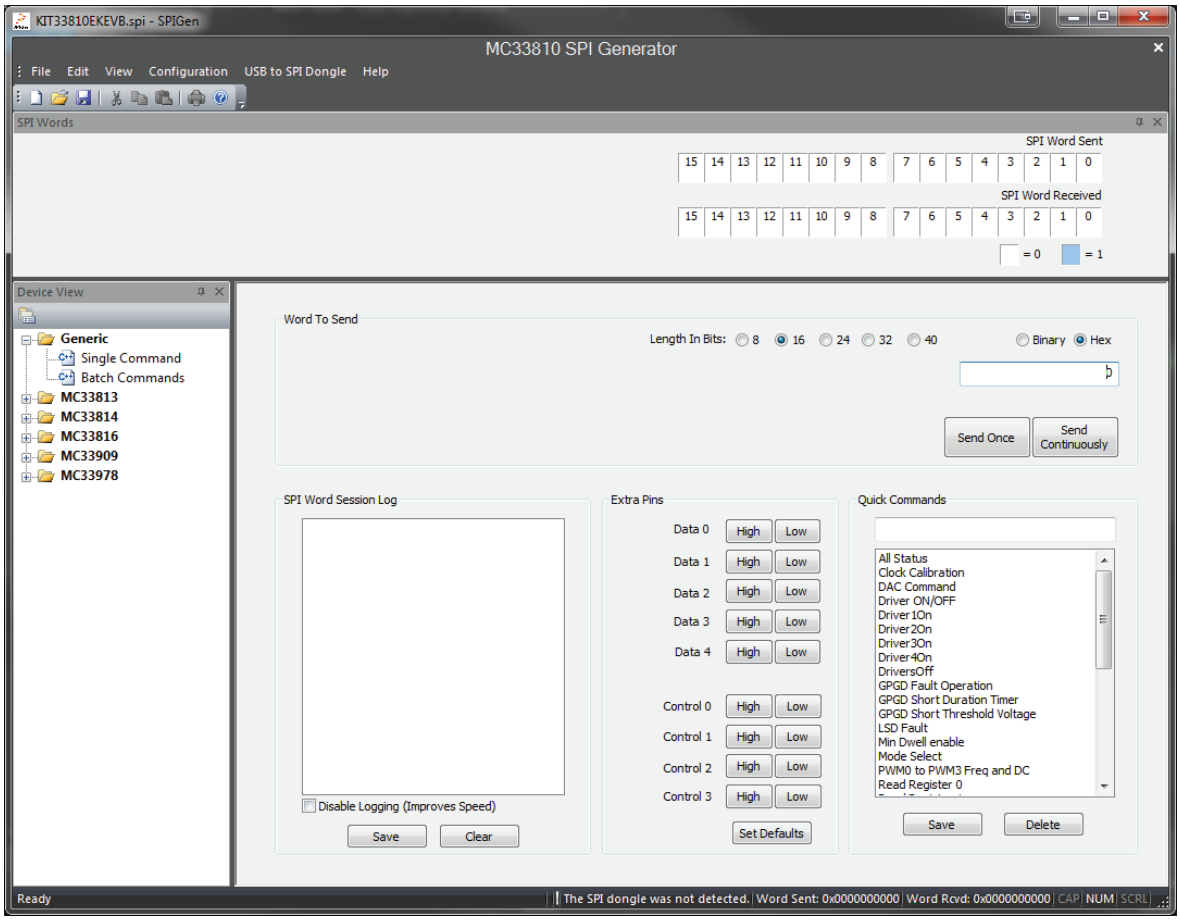


Figure 6. SPIGen GUI

5.2 Installing CodeWarrior on your Computer

This procedure explains how to obtain and install the latest version of CodeWarrior 10.5 or greater.

Notes: The sample software in this kit requires CodeWarrior 10.5 or greater. If CodeWarrior 10.5 or greater is already on your system, the steps in this section can be skipped.

1. Obtain the latest CodeWarrior 10.5 (or greater) installer file from freescale.com/codewarrior.
2. Run the executable file and follow the instructions.

During the installation, there is a request to select components to install. This kit requires Kinetis which also must be installed. User must install at least the Kinetis component. Select Kinetis and click on "Next" to complete the installation.

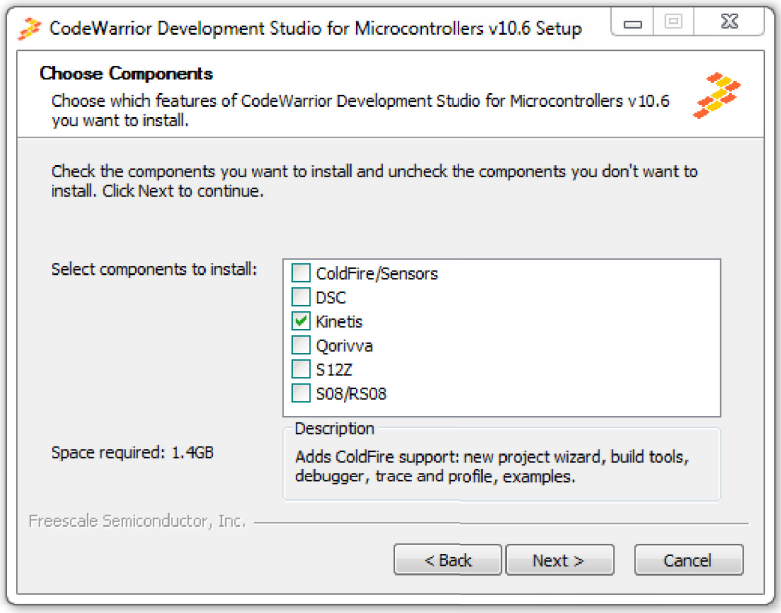


Figure 7. Choose Components GUI

5.3 Configuring the Hardware

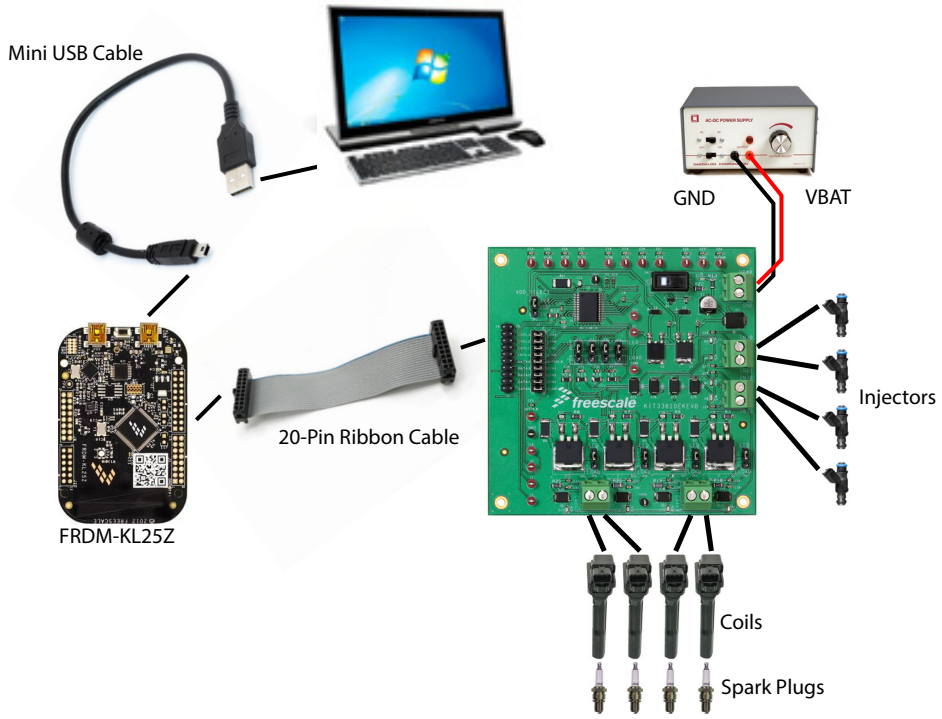


Figure 8. KIT33810EKEVB plus FRDM-KL25Z Board Setup

5.3.1 Step-by-step Instructions for Setting up the Hardware using SPIGen

In order to perform the demonstration examples, first set up the evaluation board hardware and software as follows:

1. Ready the computer, install the SPIGen software. Make sure the FRDM board has been flashed with the correct SPIGen srec file.
2. Connect the FRDM-KL25Z board to the KIT33810EKEVB evaluation board via the 20-pin ribbon cable. The FRDM-KL25Z board must have a 20-pin male header soldered onto the top of the FRDM-KL25Z board in J2.
3. Connect the mini USB cable between the FRDM-KL25Z board and the PC (use the KL25Z port, not the SDA port).
4. Attach the DC power supply (without turning on the power) to the VPWR/GND terminal (J1).
5. If desired, attach injector loads to the injector output terminals on the board (J4, J5), and move the injector jumpers (JP2-JP5) to select LOAD. Otherwise, move the injector jumpers to select LED.
6. If desired, attach coil loads to the coil output terminals on the board (J6, J7), and move the coil jumpers (JP6-JP9) to select LOAD. Otherwise, move the coil jumpers to select LED.
7. Launch SPIGen and load the .spi configuration file from the kit's website and open it in SPIGen.
8. Turn on the power supply and switch SW1 to the ON position.
9. Send various commands via SPIGen using the predefined sequences available.

Notes: LEDs D9-D12 are dim and will flash brighter when they are triggered.

5.3.2 Step-by-step Instructions for Setting up the Hardware using Sample Flash File

1. Ready the computer. Only a USB port to provide power is required. (Make sure the FRDM board has been flashed with the correct srec file).
2. Connect the FRDM-KL25Z board to the KIT33810EKEVB evaluation board via the 20-pin ribbon cable. The FRDM-KL25Z board must have a 20-pin male header soldered onto the top of the FRDM-KL25Z board in J2.
3. Connect the mini USB cable between the FRDM-KL25Z board and the PC (use the KL25Z port, not the SDA port).
4. Attach the DC power supply (without turning on the power) to the VPWR/GND terminal (J1).
5. If desired, attach injector loads to the injector output terminals on the board (J4, J5), and move the injector jumpers (JP2-JP5) to select LOAD. Otherwise, move the injector jumpers to select LED.
6. If desired, attach coil loads to the coil output terminals on the board (J6, J7), and move the coil jumpers (JP6-JP9) to select LOAD. Otherwise, move the coil jumpers to select LED.
7. Turn on the power supply and switch SW1 to the ON position.
8. The flashed program will run automatically.

Notes: LEDs D9-D12 are dim and will flash brighter when they are triggered.

5.3.3 Step-by-step Instructions for Setting up the Hardware using CodeWarrior

1. Ready the computer, install the CodeWarrior software.
2. Connect the FRDM-KL25Z board to the KIT33810EKEVB evaluation board via the 20-pin ribbon cable. The FRDM-KL25Z board must have a 20-pin male header soldered onto the top of the FRDM-KL25Z board in J2.
3. Connect the mini USB cable between the FRDM-KL25Z board and the PC (use the SDA port, not the KL25Z port).
4. Attach the DC power supply (without turning on the power) to the VPWR/GND terminal (J1).
5. If desired, attach injector loads to the injector output terminals on the board (J4, J5), and move the injector jumpers (JP2-JP5) to select LOAD. Otherwise, move the injector jumpers to select LED.
6. If desired, attach coil loads to the coil output terminals on the board (J6, J7), and move the coil jumpers (JP6-JP9) to select LOAD. Otherwise, move the coil jumpers to select LED.
7. Launch CodeWarrior and either load the sample project or create your own bareboard project.
8. Turn on the power supply and switch SW 1 to the ON position.
9. You can now program the board and debug your code.

6 Schematic

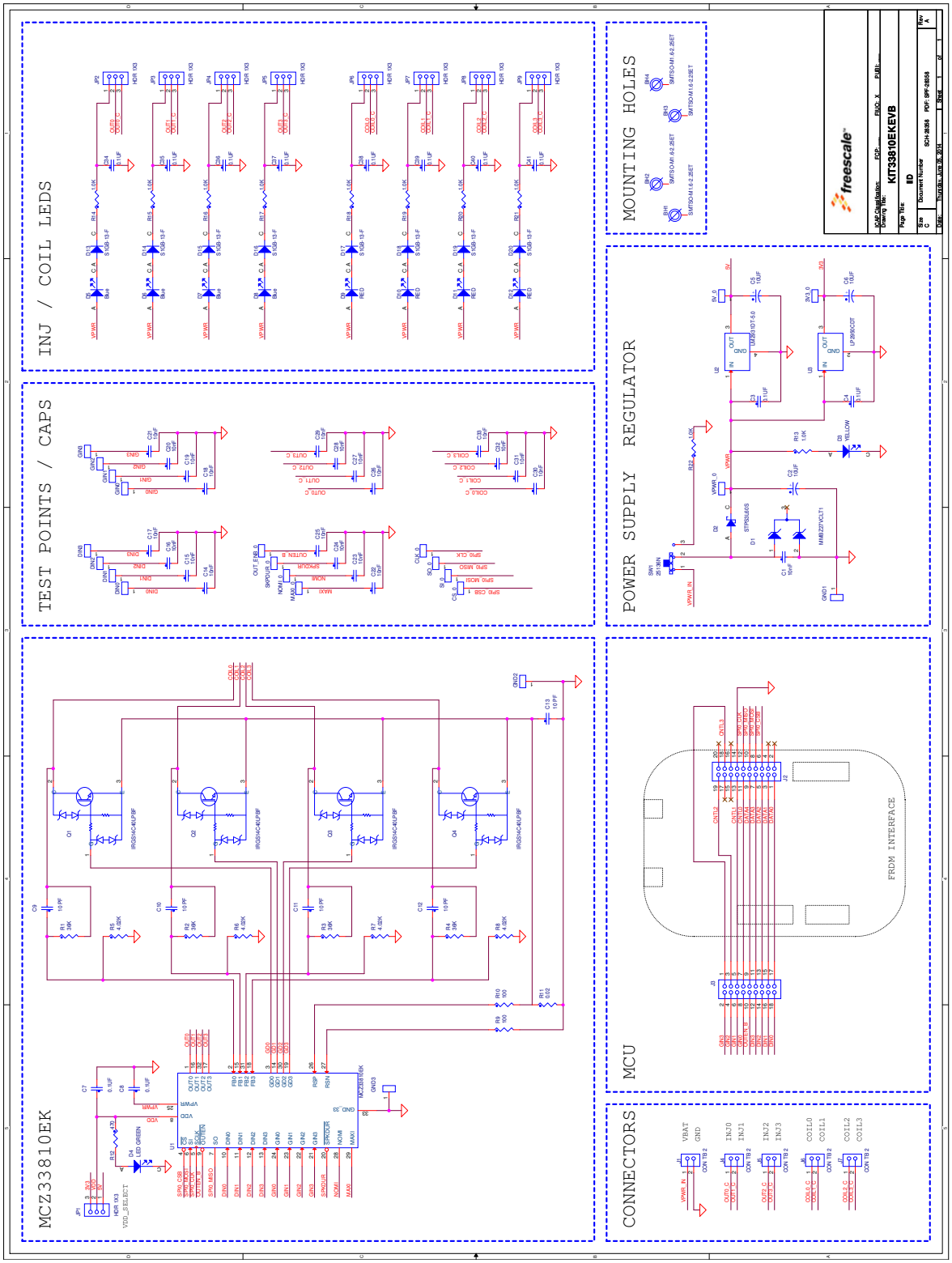
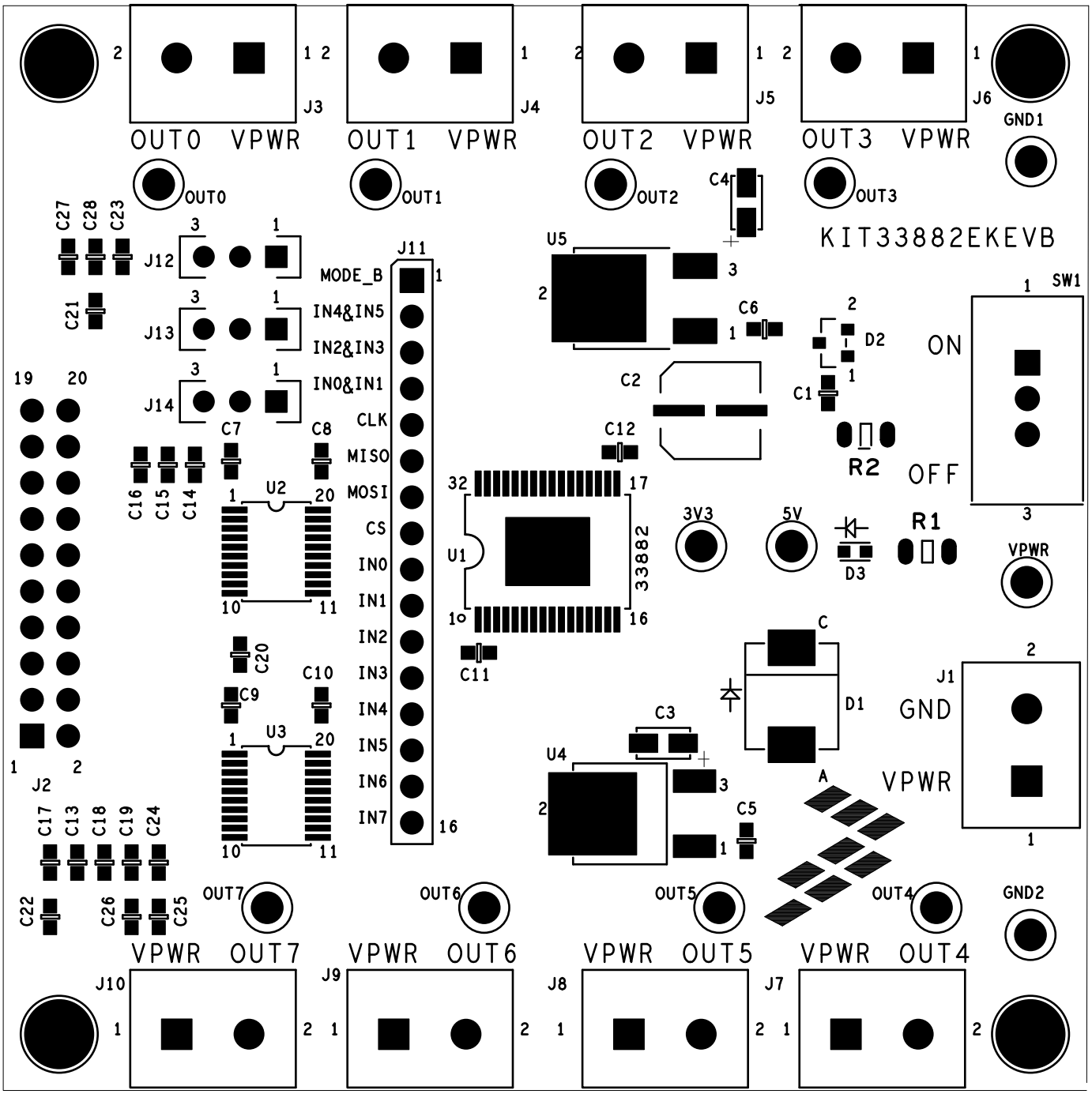


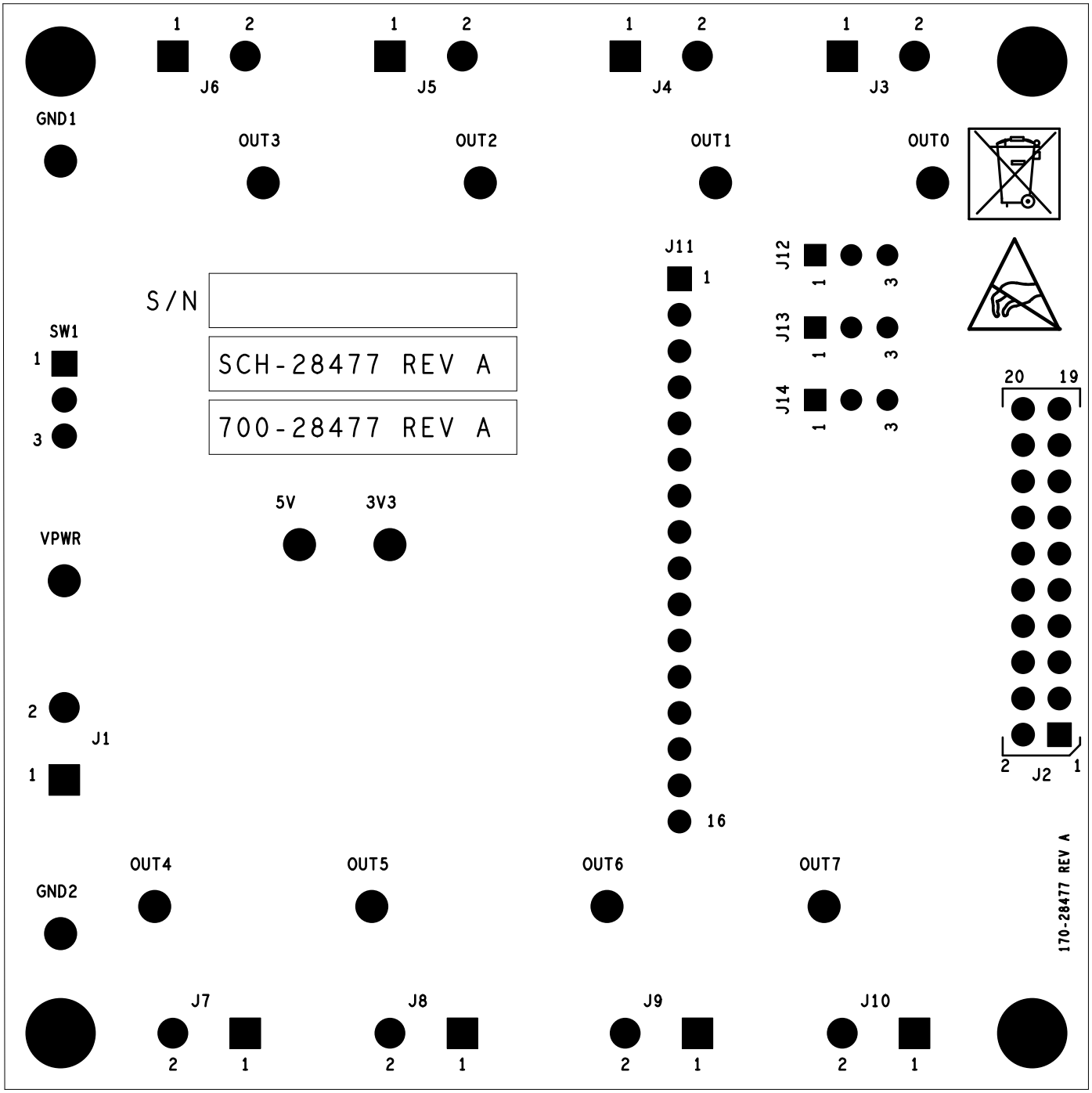
Figure 9. Schematic

7 Silkscreens

7.1 Silkscreen Top



7.2 Silkscreen Bottom



Notes: This image is an exception to the standard top-view mode of representation used in this document. It has been flipped to show a bottom view.

8 Bill of Materials

Table 10. Bill of Materials [(1)]

Item	Qty	Schematic Label	Value	Description	Part Number	Assy Opt
Active Components						
1	1	U1		IC AUTOMOTIVE ENGINE CONTROL SOICW-EP32	MCZ33810EK	[(3)]
2	1	U2		IC VREG LDO 5 V 100 MA 5.0 V- 40 V DPACK	LM2931DT-5.0G	
3	1	U3		IC VREG LDO 3.3 V 100 MA 30 V TO-252	LP2950CDT-3.3/NOPB	
Other Components						
4	19	GIN1,DIN1,GIN2,DIN2,GIN3,DIN3, 5V_0,3V3_0,VPWR_0,SO_0,SKPD UR_0,SI_0,OUTEN_B_0,NOMI_0, MAXI_0,GIN0,DIN0,CS_0,CLK_0		TEST POINT RED 70X220 MIL TH	5005	
Capacitors						
5	21	C1,C14,C15,C16,C17,C18,C19,C2 0,C21,C22,C23,C24,C25,C26,C27, C28,C29,C30,C31,C32,C33	0.01 µF	CAP CER 0.01 µF 50 V 5% X7R 0603	06035C103JAT2A	
6	1	C2	10 µF	CAP ALEL 10 µF 50 V 20% SMT (CASE D)	EEE1HA100SP	
7	12	C3,C4,C7,C8,C34,C35,C36,C37,C3 8,C39,C40,C41	0.1µF	CAP CER 0.1µF 50 V 10% X7R 0603	GRM188R71H104KA93D	
8	2	C5,C6	10 µF	CAP TANT 10 µF 10 V 10% -- 3216-18	293D106X9010A2TE3	
9	5	C9,C10,C11,C12,C13	10 pF	CAP CER 10 pF 50 V 5% C0G 0805	C0805C100J5GAC	
Diodes						
10	1	D1		DIODE ZNR TVS -- 27 V/40 W SOT23	MMBZ27VCLT1G	
11	1	D2		DIODE SCH RECT 3 A 60 V SMC	STPS3L60S	
12	1	D3		LED YEL SGL 25 MA SMT 0603	LY Q976-P1S2-36-0-20-R18	
13	1	D4		LED GRN SGL 20 MA 0603	LG L29K-G2J1-24-Z	
14	4	D5,D6,D7,D8		LED BL SGL 30 MA 0603	QTLP600CBTR	
15	4	D9,D10,D11,D12		LED SM RED 0603 ROHS COMPLIANT	QTLP600CRTR	
16	8	D13,D14,D15,D16,D17,D18,D19,D 20		DIODE RECT 1 A 400 V SMB	S1GB-13-F	
Switches, Connectors, Jumpers and Test Points						
17	3	GND1,GND2,GND3		TEST POINT BLK 70X220 MIL TH	5006	
18	9	JP1,JP2,JP3,JP4,JP5,JP6,JP7,JP8, JP9		HDR 1x3 TH 100 MIL SP 343 H SN 100 L	TSW-103-07-T-S	
19	5	J1,J4,J5,J6,J7		CON 1X2 TB TH 200MIL SP 709 H - 197 L	1711725	
20	1	J2		HDR 2X10 TH 100 MIL CTR 343 H SN 100 L	TSW-110-07-T-D	
21	1	J3		HDR 2X9 TH 100 MIL CTR 330 H AU	TSW-109-07-S-D	
22	4	Q1,Q2,Q3,Q4		TRAN IGBT IGNITION 430 V 20 A D2PAK	IRGS14C40LPBF	
23	4	R1,R2,R3,R4	36 KΩ	RES MF 36 K 1 W 5% 2512	CRCW251236K0JNEG	

Table 10. Bill of Materials [1] (continued)

24	4	R5,R6,R7,R8	4.02 KΩ	RES MF 4.02 K 1/4 W 1% 1206	CRCW12064K02FKEA	
25	2	R9,R10	100 Ω	RES MF 100 Ω 1/10 W 5% 0603	CR0603-JW-101ELF	
26	1	R11	0.02 Ω	RES TF 0.02 Ω 1W 1% 2512	ERJM1WSF20MU	
27	1	R12	470 Ω	RES MF 470 Ω 1/4 W 5% 1206	CR1206-JW-471ELF	
28	10	R13,R14,R15,R16,R17,R18,R19, R20,R21,R22	1.0 KΩ	RES MF 1.0 K 1/4 W 1% 1206	CRCW12061K00FKEA	
29	1	SW1		SW SPDT SLD 125 V 4 A TH	25136NAH	
30	18	JUMPER		SHUNT JUMPER .1" BLACK GOLD	969102-0000-DA	

Notes:

1. 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.
2. Do not populate.
3. **Critical components.** For critical components, it is vital to use the manufacturer listed.

9 References

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

Freescale.com Support Pages	Description	URL
KIT33810EKEVB	Tool Summary Page	http://www.freescale.com/webapp/sps/site/prod_summary.jsp?code=KIT33810EKEVB
MC33810	Product Summary Page	http://www.freescale.com/webapp/sps/site/prod_summary.jsp?code=MC33810
FRDM-KL25Z	Freescale Development Platform	http://www.freescale.com/webapp/sps/site/prod_summary.jsp?code=FRDM-KL25Z
SPIGen	Software	http://www.freescale.com/files/soft_dev_tools/software/device_drivers/SPIGen.html
CodeWarrior	Software	http://www.freescale.com/webapp/sps/site/homepage.jsp?code=CW_HOME&tid=vanCODEWARRIOR

9.1 Support

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

9.2 Warranty

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

10 Revision History

Revision	Date	Description of Changes
1.0	12/2014	• Initial Release

How to Reach Us:

Home Page:
freescale.com

Web Support:
freescale.com/support

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

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 that may be provided in Freescale 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 does not convey any license under its patent rights nor the rights of others. Freescale sells products pursuant to standard terms and conditions of sale, which can be found at the following address: freescale.com/SalesTermsandConditions.

Document Number: KT33810UG1
Rev. 1.0
12/2014