

# KIT eXtreme Switch Evaluation Board

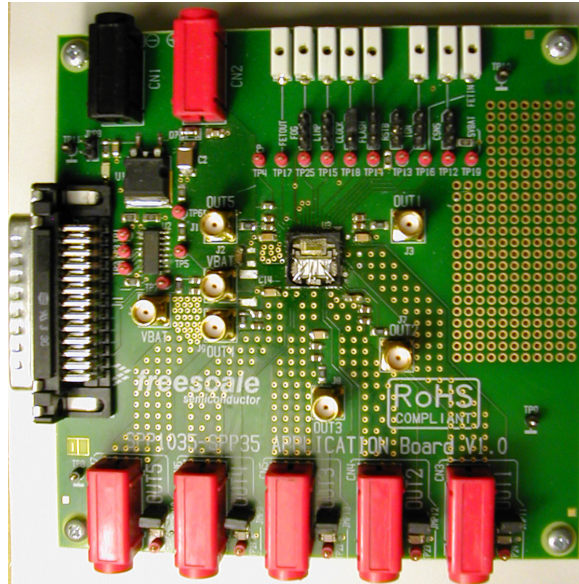


Figure 1. Extreme Switch Evaluation Board (EVB)

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# 1 Kit Contents / Packing List

- Assembled and tested evaluation board/module in anti-static bag.
- CD-ROM containing:
  - Supporting documentation for featured device (including data sheet and user's guide)
  - SPIGen software
- Warranty card

## 2 Important Notice

Freescale provides the enclosed product(s) under the following conditions:

This evaluation kit is intended for use of ENGINEERING DEVELOPMENT OR EVALUATION PURPOSES ONLY. It is provided as a sample IC pre-soldered to a printed circuit board to make it easier to access inputs, outputs, and supply terminals. This EVB may be used with any development system or other source of I/O signals by simply connecting it to the host MCU or computer board via off-the-shelf cables. This EVB is not a Reference Design and is not intended to represent a final design recommendation for any particular application. Final device in an application will be heavily dependent on proper printed circuit board layout and heat sinking design as well as attention to supply filtering, transient suppression, and I/O signal quality.

The goods provided may not be complete in terms of required design, marketing, and or manufacturing related protective considerations, including product safety measures typically found in the end product incorporating the goods. Due to the open construction of the product, it is the user's responsibility to take any and all appropriate precautions with regard to electrostatic discharge. In order to minimize risks associated with the customers applications, adequate design and operating safeguards must be provided by the customer to minimize inherent or procedural hazards. For any safety concerns, contact Freescale sales and technical support services.

Should this evaluation kit not meet the specifications indicated in the kit, it may be returned within 30 days from the date of delivery and will be replaced by a new kit.

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## 3 Introduction

### 3.1 EVB Features

This family of devices is designed for low-voltage automotive lighting applications. Its five low RDS(ON) MOSFETs can control:

- Five separate 55W / 28W bulbs
- Five separate Xenon modules
- Five separate LEDs
- Five separate Other type of loads

In addition, this family of devices has the following features:

- Programming, control, and diagnostics are accomplished using a 16-bit SPI interface.
- Its output with selectable slew-rate allows to satisfy electromagnetic compatibility (EMC) requirements.
- Each output can be controlled with an internal PWM modulated clock signal.

### 3.2 Device Description/Features

The 10XS3535 or 35XS3500 is designed for low-voltage automotive and industrial lighting applications. Its five low RDS(ON) MOSFETs can control the high sides of five separate resistive loads (bulbs, Xenon-HID modules and LEDs).

Programming, control, and diagnostics are accomplished using a 16-bit SPI interface (3.3V or 5.0V). Each output has its own PWM control via the SPI. The 10XS3535 and 35XS3500 have highly sophisticated failure mode handling to provide high availability of the outputs. Its multi-phase control and output edge shaping improves electromagnetic compatibility (EMC) behavior.

#### Features

- Penta high side switches
- 16-bit SPI communication interface with daisy chain capability
- Current sense output with SPI-programmable multiplex switch and Board Temperature Feedback
- Digital diagnosis feature
- PWM module with multi-phase feature including prescaler
- LEDs control including accurate current sensing and low duty-cycle capability
- Fully-protected switches
- Over-current shutdown detection
- Power net and reverse polarity protection
- Low-power mode
- Fail mode functions including auto restart feature
- External smart power switch control including current recopy

### 3.3 KITUSBSPIEVME USB-to-Parallel Converter Board

The KITUSBSPIEVME board converts from USB to SPI and from USB to parallel data transmission. The main function provided by this board is to allow a PC that may not have a parallel port to communicate with other Freescale Evaluation Boards via a USB port.

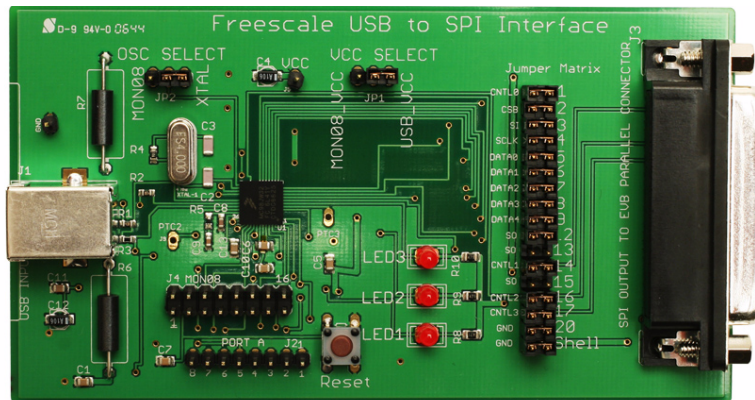


Figure 2. KITUSBSPIEVME Converter Board

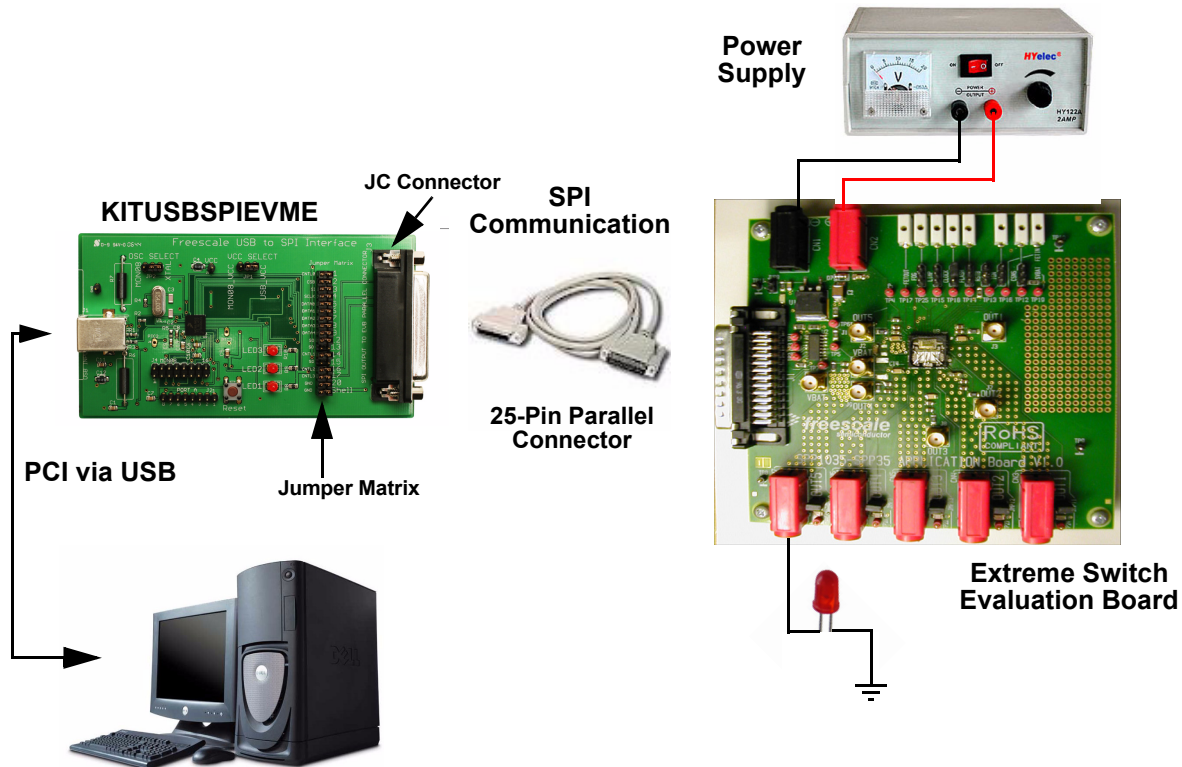
## 4 Required Equipment

Minimum required equipment:

- Power DC supply 40A/20V
- 5.0 V power supply, 1.0 A current capability
- Computer with an available USB port, running Windows XP or higher
- KITUSBSPIEVME board for converting from USB to SPI
- SPIGen software, which is available from the Freescale SPIGen website (also from the evaluation kit's CD-ROM)
- Typical load (lamps,...)

## 5 EVB Setup

The typical evaluation board (EVB) shown below utilizes the KITUSBSPIEVME as an alternate communication interface to a PC, instead of a 25 pin parallel I/O connector/cable. These EVBs have been designed to use SPIGen software in order to communicate and control the device functions on the evaluation board. The figure below illustrates a typical EVB and how you would configure it to work with a KITUSBSPIEVME interface board, for a USB connection to a PC.



**Figure 3. Evaluation Board Setup**

Verify that the SI signal (Slave Input of the Serial Peripheral Input bus) on the EVB connects to the 25-pin parallel connector on pin 3. If instead it is on pin 6, then the jumper matrix of the KITUSBSPIEVME ([Figure 4](#)) will have to be configured in the following way:

1. Remove the jumper between pins SI and 3.
2. Remove the jumper between pins Data1 and 6.
3. Connect a jumper between pin SI and pin 6

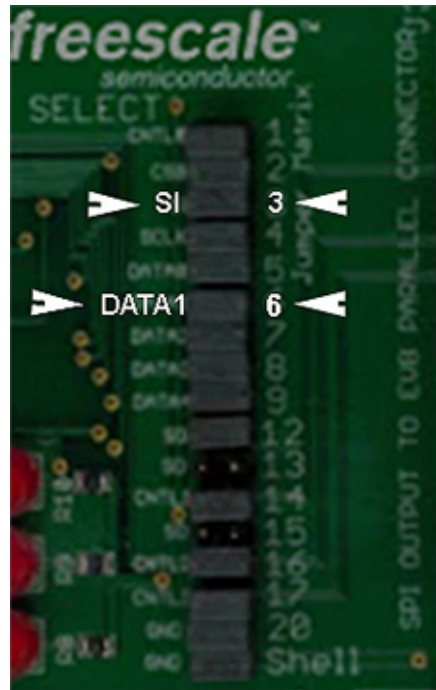


Figure 4. Jumper Matrix on KITUSBSPIEVME Converter Board

## 6 Installing SPIGen Freeware on your Computer

The latest version of SPIGen can be downloaded from the SPIGen web page at [www.freescale.com](http://www.freescale.com) (see the [References](#) section) and is designed to run on any Windows 7, Vista or XP-based operating system. SPIGen is also included on the CD-ROM supplied with the board, though this version may not be as up-to-date as that available from the SPIGen web page.

Before you install the program, refer to the SPIGen README.txt file to check the compatibility of the installation program and your computer operating system. For each operating system, README.txt describes where the software should be installed.

For computers running Windows 7, Vista, or Windows XP, download the SPIGen 7 install program from the SPIGen website. When the download is complete, run the install program. Several temporary files will be copied to your computer, and then the Installation Wizard will guide you through the rest of the process.

To install the software from the CD-ROM, insert the CD-ROM into your CD drive. Click the Start button, and then click “Run...”.

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 “All Files (\*.\*)”. Next, browse the evaluation kit CD-ROM and select the file called “SPIGen Config File.txt”. Click Open, and SPIGen will create a specifically configured SPI command generator for your EVB.

The GUI is shown in [Figure 5](#). The text at the top is the name of the configuration file loaded. (As an exceptional case, the file name has a .txt extension for the boards covered by this user’s guide. In other cases, the standard .spi extension will be evident.) The left side panel displays folders that group user interfaces. The boards associated with this guide will all make use of the Generic user interfaces. (The other pre-installed folders contain interfaces for boards unrelated to this document.) The process of loading the configuration files has assigned a list of “Extra Pins” as well as a list “Quick Commands”, all of which are specific to the board in use.



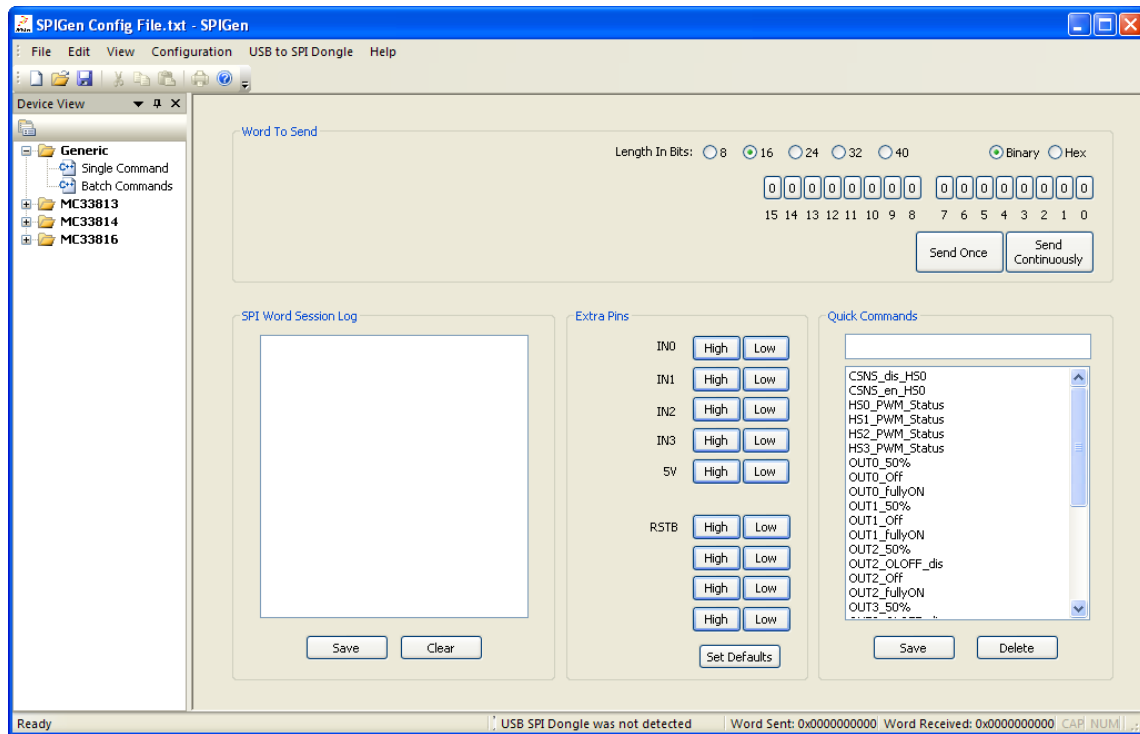


Figure 5. SPIGen GUI

## 7 Setup and Using the Hardware

**Warning:** Always wear Safety Glasses when working around electronic modules and when soldering.

1. The EVB allows the customer to quickly evaluate features of the device with a simple bench top setup. All switch inputs may be evaluated using the onboard switch banks or actual system switches connected to the switch input edge connector.
2. Using a standard 25 pin Sub-D parallel port cable to provide the Serial Peripheral Interface (SPI) communication with this EVB (see SETUP\_EVB).
3. Connect power supply to the VPWR and GND terminals on the EVB. Make sure the voltages provided are in accordance with the device data sheet and that the supply currents are sufficient to supply the switch contact wetting current
4. Connect desired external load between one of the output (OUT1 - OUT5) and power supply ground.
5. For direct control of the outputs apply +5V on connectors IGN, FLASH and FOG. Corresponding HS output turns-on. Each IN input wakes the device.

## 8 Hardware Description

### 8.1 Jumper Connections

**JMP1 Allows connecting current sensing resistor**

1-2 selection: CSNS terminal connected to JP1 connector

2-3 selection: CSNS terminal connected through 1k Ohm resistor to ground

**JMP2 Allows connecting ignition signal**

1-2 selection: IGN terminal connected to JP2 connector

2-3 selection: 5V applied directly to IGN terminal

**JMP3 Allows connecting flasher signal**

1-2 selection: FLASHER terminal connected to JP3 connector

2-3 selection: 5V applied directly to FLASHER terminal

**JMP4 Allows connecting limp home signal**

1-2 selection: LIMP terminal connected to JP4 connector

2-3 selection: 5V applied directly to LIMP terminal

**JMP5 Allows connecting PWM clock signal**

1-2 selection: CLOCK terminal connected to JP7 connector

2-3 selection: CLOCK terminal connected to DB25 connector

**JMP6 Allows connecting reset signal**

1-2 selection: RSTB terminal connected to DB25 connector

2-3 selection: 5V applied directly to RSTB terminal

**JMP7 Allows connecting fog signal**

1-2 selection: FOG terminal connected to JP8 connector

2-3 selection: 5V applied directly to FOG terminal

**JMP8 Allows disconnecting 5V reference voltage**

**JMP9 to JMP13 Allows disconnecting the LED on the corresponding output OUT1-5**

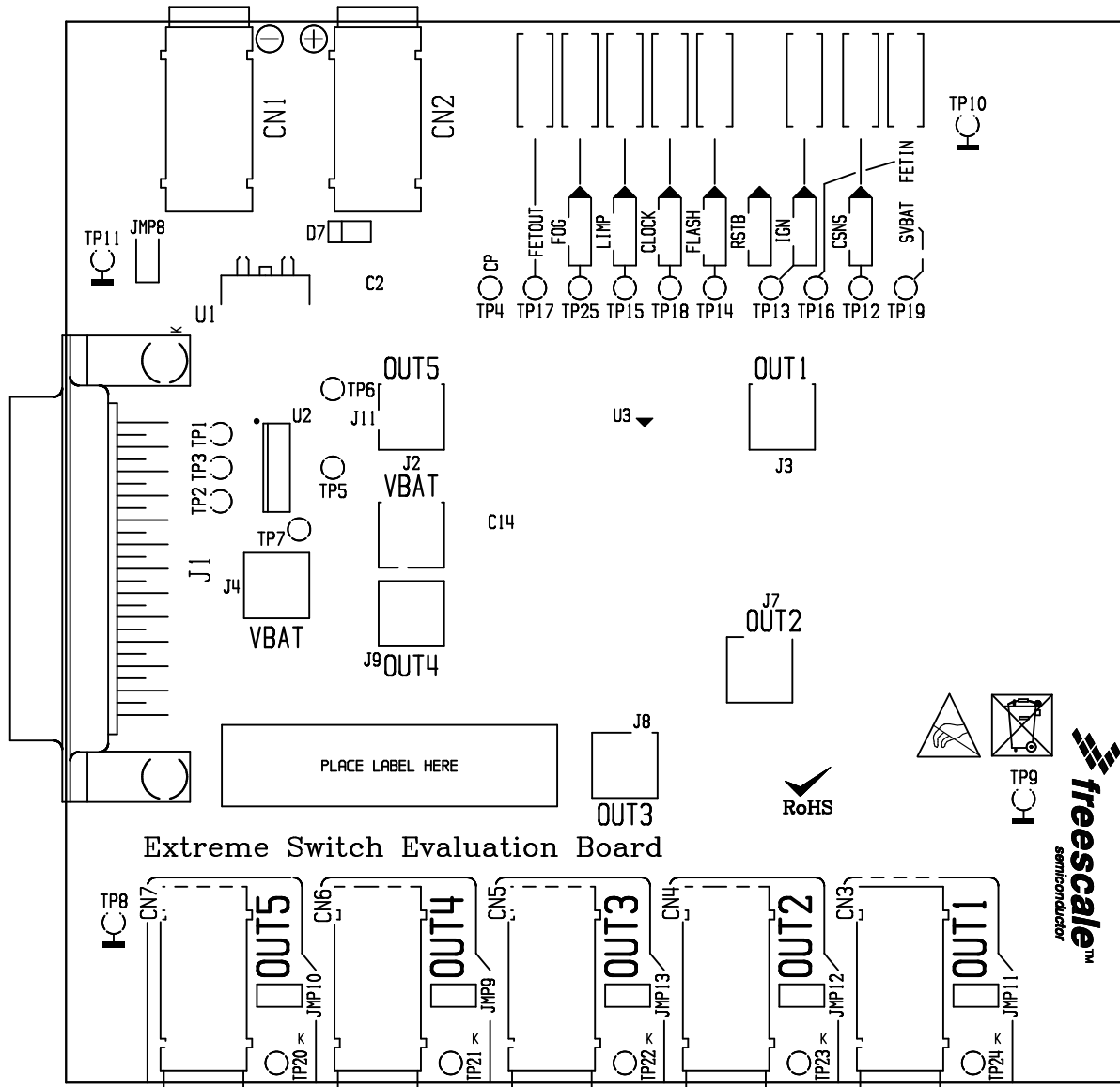
**TEST POINTS**

Several test points are presented on the evaluation board to check some signals using oscilloscope if necessary.

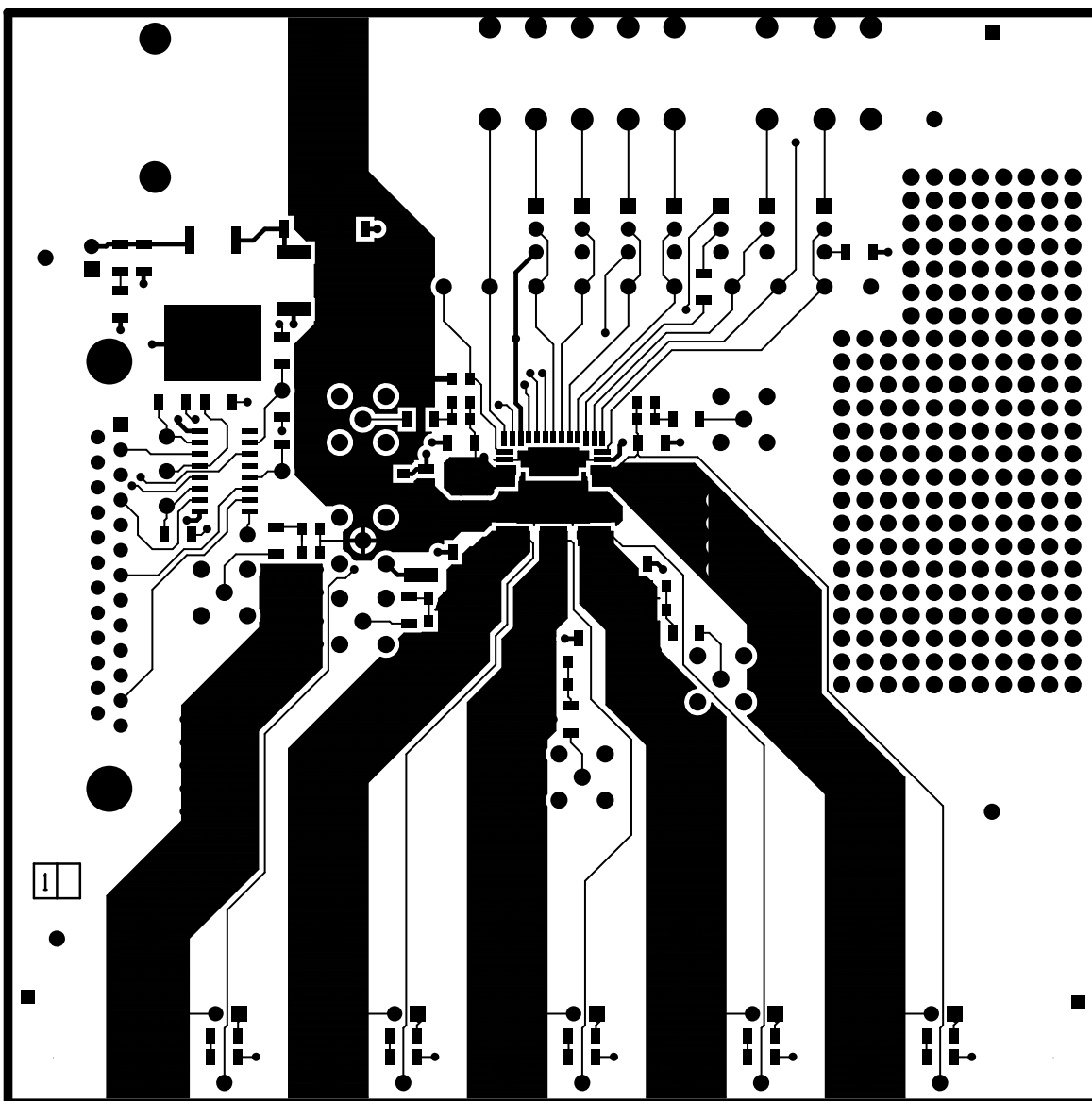


# 10 Board Layout

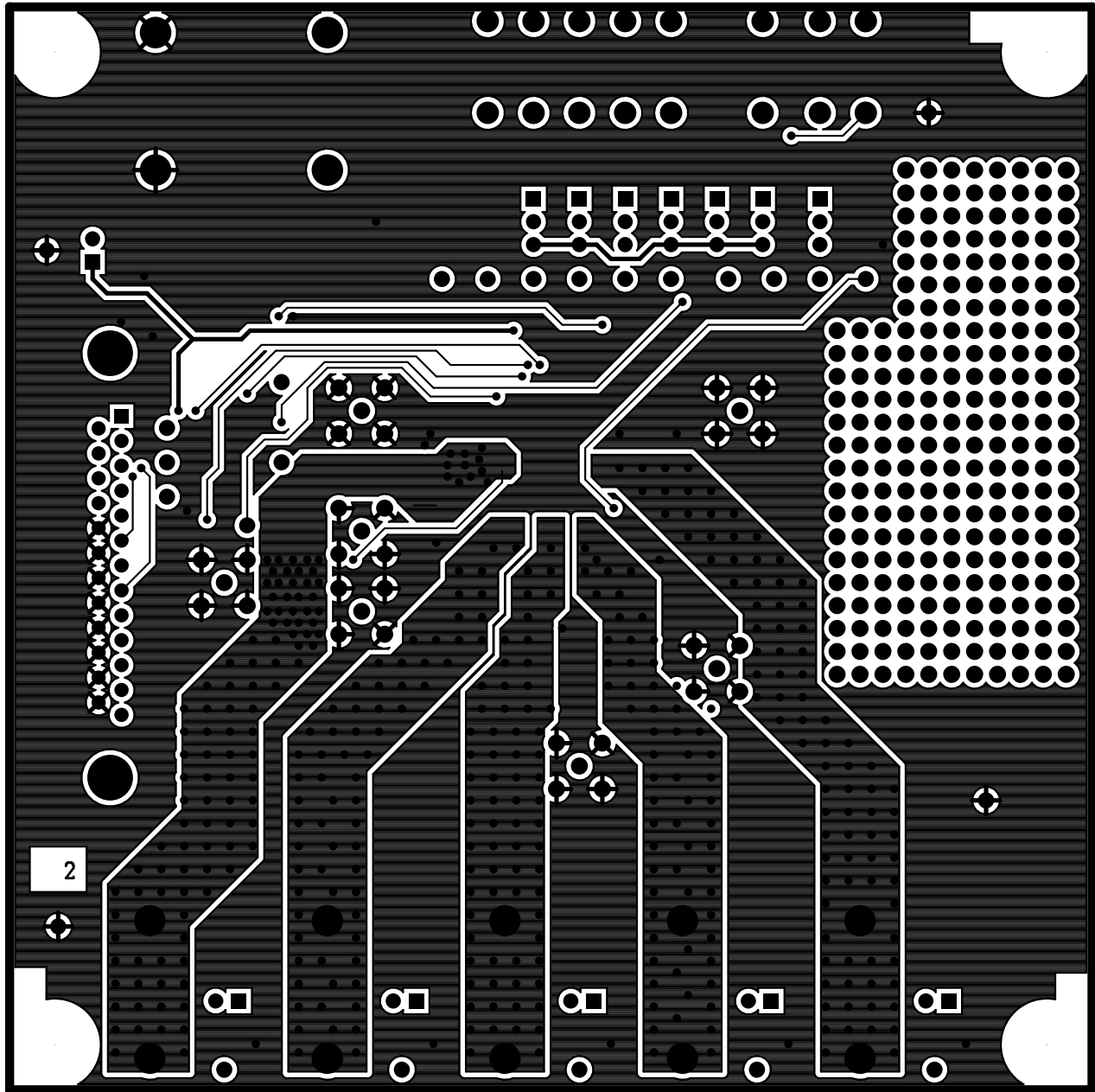
## 10.1 Assembly Layer Top



## 10.2 Top Layer Routing



### 10.3 Bottom Layer Routing



## 10.4 Drill Location

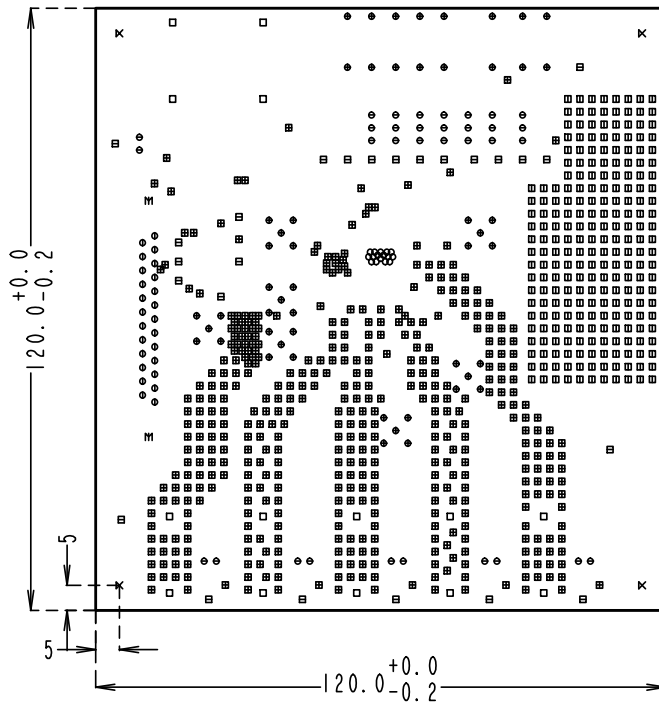


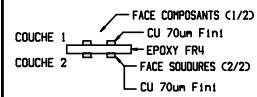
TABLEAU DES Ø DE PERÇAGE, METALLISATION FINIE.

SYMBOLE	DIA.	QUANT.	METAL.	TOL.
○	0.25	16	OUI	---
⊞	0.50	445	OUI	---
⊕	0.90	25	OUI	---
⊞	1.00	25	OUI	---
⊖	1.10	33	OUI	---
⊞	1.20	232	OUI	---
⊕	1.30	51	OUI	---
□	2.20	14	OUI	---
Ⓜ	3.20	2	OUI	---
κ	3.20	4	NON	---

### FABRICATION CLASSE 4

TOL. USIN.: UTE C 93703 § 6.7  
 FLECHE MAX.: 0.1 %  
 MASQUE: VERNIS PHOTO-IMAGEABLE VERT  
 MARQUAGE: ENCRE BLANCHE THERMODURCISSABLE  
 PROTECTION: Ni/Au Chimique

### STRATIFICATION



EPAISSEUR TOTALE: 1.6 mm +/- 0.1

# 11 Bill of Material

Part	Footprint	Qty	Ref
<b>Freescale MC10XS3535PNA or MC35XS3500PNA</b>	<b>PQFN24</b>	<b>1</b>	<b>U3</b>
BANANA RED		6	CN2 CN3 CN4 CN5 CN6 CN7
BANANA BLACK		1	CN1
Capacitor 22uF 16V 10%	1812	1	C14
DB25	SUBD_25_MC	1	J1
NXP SCHOTTKY Diode PRL5819 40V 1A	SOD87	1	D7
LED Green	LED1206	6	D1 D2 D3 D4 D5 D6
Capacitor C0805 100nF 50V 10%	C0805	2	C8 C16
Capacitor C1206 1uF 50V 10%	C1206	2	C3 C15
Capacitor 1812 47uF 10V 10%	1812	1	C2
Capacitor 1206 100nF 50V 10%	C1206	1	C1
Capacitor C1206 22nF DNP 50V 10%	C1206 DNP	5	C5 C7 C9 C11 C13
Capacitor C0805 1nF 50V 5%	C0805	6	C6 C22 C23 C24 C25 C26
Capacitor C0805 10nF 50V 10%	C0805	6	C4 C17 C18 C19 C20 C21
Test Point	5001	4	TP8 TP9 TP10 TP11
Test Point	5000	21	TP1 TP2 TP3 TP4 TP5 TP6 TP7 TP12 TP13 TP14 TP15 TP16 TP17 TP18 TP19 TP20 TP21 TP22 TP23 TP24 TP25
10k Resistor +/-1%	R1206	5	R12 R13 R14 R15 R16
NXP MC74HC4050	SO16	1	U2
STM I7805CD2T	D2PAK	1	U1
1k Resistor +/-1%	R1206	7	R3 R4 R5 R6 R7 R22 R23
Jumper	CON_2_2,54	6	JMP8 JMP9 JMP10 JMP11 JMP12 JMP13
Jumper	CON_3_2,54	7	JMP1 JMP2 JMP3 JMP4 JMP5 JMP6 JMP7
SMA Connector	SMA	7	J2 J3 J4 J7 J8 J9 J11 (Not Populated)
Resistor 10 +/-1%	R1206	6	R2 R17 R18 R19 R20 R21
Resistor 470 +/-1%	R1206	1	R1



## 12 References

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

Document Number	Description	URL
MC10XS3535	Data Sheet	<a href="http://www.freescale.com/files/analog/doc/data_sheet/MC10XS3535.pdf">www.freescale.com/files/analog/doc/data_sheet/MC10XS3535.pdf</a>
MC35XS3500	Data Sheet	<a href="http://www.freescale.com/files/analog/doc/data_sheet/MC35XS3500.pdf">www.freescale.com/files/analog/doc/data_sheet/MC35XS3500.pdf</a>
	KITUSBSPIEVME Tool Summary Page	<a href="http://www.freescale.com/webapp/sps/site/prod_summary.jsp?code=KITUSBSPIEVME">http://www.freescale.com/webapp/sps/site/prod_summary.jsp?code=KITUSBSPIEVME</a>
	SPIGen Reference Tool Summary Page	<a href="http://www.freescale.com/files/soft_dev_tools/software/device_drivers/SPIGen.html?fsrch=1&amp;sr=11">http://www.freescale.com/files/soft_dev_tools/software/device_drivers/SPIGen.html?fsrch=1&amp;sr=11</a>
	Analog Home Page	<a href="http://www.freescale.com/analog">www.freescale.com/analog</a>
	Automotive Home Page	<a href="http://www.freescale.com/automotive">www.freescale.com/automotive</a>

## 13 Revision History

Revision	Date	Description of Changes
1.0	6/2010	Initial Release
2.0	2/2013	<ul style="list-style-type: none"><li>• Provide information on the use of the KITUSBSPiEVME Converter Board for USB connections.</li><li>• Updated Evaluation Board Setup diagram, SPIGen GUI image and PCB layer images.</li></ul>



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2/2013

