

MC13892 Evaluation Board

Supports KIT13892VKEVBEJ and KIT13892VLEVBEJ

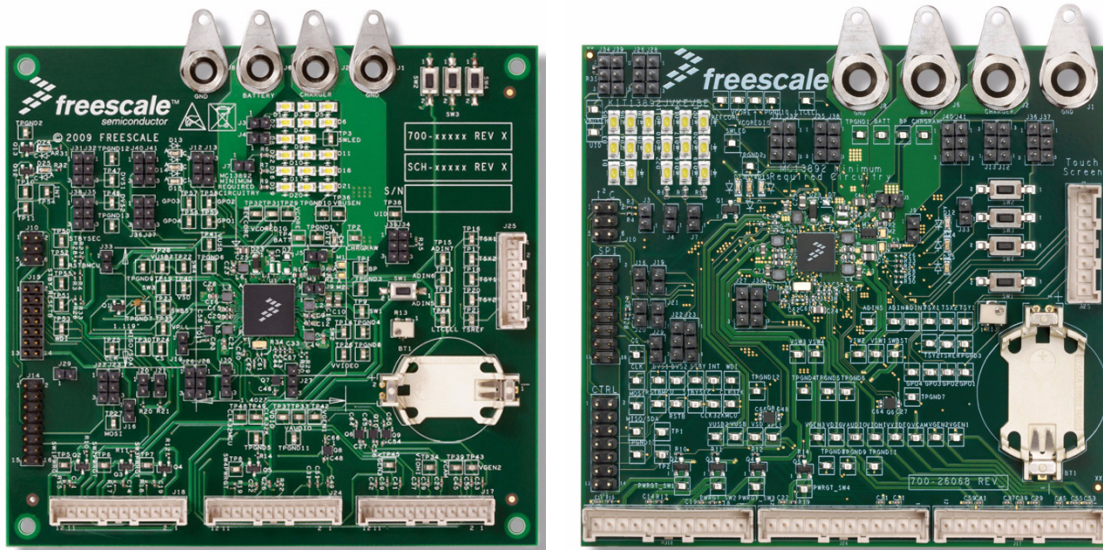


Figure 1. MC13892 Evaluation Boards

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1 Kit Contents / Packing List

- KIT13892VxEVBEJ
- Kit KITUSBCOMDGLVME
- Cables (8):
 - 7x2 Flat Ribbon Cable (GPIO)
 - 8x2 Flat Ribbon Cable (SPI)
 - 3x2 Flat Ribbon Cable (I²C)
 - 1x12 Flat Ribbon Cable (3 each) (Application Peripherals)
 - 1x8 Flat Ribbon Cable (Touch Screen)
 - USB extension cable

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.

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3 Introduction

KIT13892VXEVB EJ

This EVB shows the functionality of the MC13892JVxx device set up under specific operation parameters.

The MC13892 is a SMARTMOS Power Management Integrated Circuit (PMIC) component for Freescale's i.MX51, i.MX37, i.MX35, and i.MX27 application processors, targeting netbooks, ebooks, mobile internet devices, smart phones, personal media players, and personal navigation devices. For evaluation purposes this KIT13892KVXXEVB E comes with the KITUSBCOMDGLVME board for communication and control purposes.

KITUSBCOMDGLVME

This KIT is a USB communication dongle that uses the MC9S08JM8CLC MCU to enable communication between a PC/laptop with a USB port, and the KIT13892VXEVB EJ, through SPI or I²C terminals.

Beside communication, this board also provides two pins for quick “plug in” identification as well as three GPIO, four PWM signals, and two ADC. All of these pins can be configured and used as general purpose I/O pins, getting 11 GPIOs in total, if needed.

These communication signals and GPIOs can be level shifted to 5.0 V, 3.3 V, and 1.8 V, in order to cover most of the application voltage requirements.

3.1 KIT13892VXEVB EJ Functional Blocks

- **Charger:** The charge path can be configured for single or serial path using jumpers J5 and J9 to enable/disable the M3 transistor. CHRGSE1B pin is driven by the USB dongle MCU through a FET. This saves the need to specify if the charger connected is a wall or USB charger through hardware.
- **LED Backlighting:** RGB and backlighting LEDs are provided on the board to test these features. Jumpers (J4, J7, and J3) have been placed to connect or disconnect the backlighting LEDs to their respective channel.
- **Power:** All the regulators and regulators signals have been connected to J17, J18, and J24 so they can be loaded and tested from there. They also have their respective test point on the board. Regulators have a 0 Ω resistor that allows the output to be connected to the feedback signal on the board. The feedback signals are also available on the load connectors, so the feedback point can be connected directly to the load by removing these resistors. These resistors are populated by default. The DVS feature of the regulators can be controlled by means of J31/32 and J35/38 jumpers. LDOs that can be used with either internal or external pass devices (VCAM and VGEN3) can be set for either one of both configurations by changing the J27 and J30 jumpers positions.
- **Programmability and Control:** The MC13892 can be configured to be controlled by I²C or SPI communication. In I²C mode, J19 ties the CS pin to V_{CORE}, J20 and J21 connect the pull-up resistors on MISO and CLK respectively, and J22/23 are intended to set the A0 address at the MOSI pin. The following pins are connected to the KITUSBCOMDGLVME, so they can be controlled/monitored through the GUI: CS, CLK, MISO, MOSI, WDI, INT, RESETB, RESETBMCU, STANDBY, STANDBYSEC, and PWRON1. The SPIVCC pin can be supplied by SW4 of the MC13892, by placing the J16 jumper, or by the LDO on the KITUSBCOMDGLVME through the SPIVCC signals on the J10, J14, and J15 connectors. PUMS and MODE pins can be configured through the J36/37, J40/41, and J12/13 jumpers on the board.
- **LICELL:** The coin cell holder offers the possibility to keep the RTC running and save the contents of some registers, even if the device is in Off mode.
- **USB:** The VBUSEN and UID pins can be configured through the J26/28 and J34/39 jumpers. The VBUS of the KITUSBCOMDGLVME can be connected to the UVBUS pin of the, by means of the J29 jumper. The UVBUS pin is also available at J2 for OTG mode.
- **ADC:** The ADC block can be triggered by hardware by using the SW1 push button. The J25 connector contains all the necessary signals to connect a touch screen panel. The R13 potentiometer is provided in order to test the ADIN5 input, as well as giving the possibility to bias a battery thermistor connected there. ADIN6 and ADIN7 have their respective test point in order to connect a specific voltage there and test these inputs.

3.2 KITUSBCOMDGLVME Functional Blocks

Table 1. SPI Interface.- Pin Header Configuration for SPI Interface at J9

PIN NUMBER	DESCRIPTION	PIN NUMBER	DESCRIPTION
1	GND - Ground	9	SPSCK - SPI Serial Clock
2	ADC1 - Analog-to-Digital Regulator	10	PWM3 - Pulse Width Modulation Signal
3	COMM_V - Communication Voltage	11	MOSI - SPI Master Output Slave Input
4	ADC0 - Analog-to-Digital Regulator	12	PWMSYNC - PWM Synchronization Signal
5	5.0 V - Voltage from USB Port	13	MISO - SPI MAsTer Input Slave Output
6	PWM0 - Pulse Width Modulation Signal	14	ID1 - Board Identifier 1
7	PWM2 - Pulse Width Modulation Signal	15	SS - Slave Select
8	PWM1 - Pulse Width Modulation Signal	16	ID0 - Board Identifier 0

Table 2. I²C Interface.- Pin Header Configuration for I²C Interface at J7

PIN NUMBER	DESCRIPTION	PIN NUMBER	DESCRIPTION
1	ID0 - Board Identifier 0	4	GND - Ground
2	ID0 - Board Identifier 1	5	SCL - I ² C Serial Clock
3	SDA - I ² C Serial Data	6	COMM_V - Communication Voltage

Table 3. UART Interface.- Pin Header Configuration for UART Interface at J6

PIN NUMBER	DESCRIPTION	PIN NUMBER	DESCRIPTION
1	ID0 - Board Identifier 0	4	GND - Ground
2	ID0 - Board Identifier 1	5	RXD - Receive Data
3	TXD - Transmit Data	6	GND - Ground

Table 4. GPIO Interface.- Pin Header Configuration for GPIOs Interface at J8

PIN NUMBER	DESCRIPTION	PIN NUMBER	DESCRIPTION
1	ID0 - Board Identifier 0	8	PWM2 - Pulse Width Modulation Signal
2	ID0 - Board Identifier 1	9	PWM1 - Pulse Width Modulation Signal
3	GPIO2 - General Purpose I/O	10	PWM0 - Pulse Width Modulation Signal
4	GPIO1 - General Purpose I/O	11	ADC0 - Analog-to-Digital Regulator
5	GPIO0 - General Purpose I/O	12	ADC1 - Analog-to-Digital Regulator
6	PWMSYNC - PWM Synchronization Signal	13	GND - Ground
7	PWM3 - Pulse Width Modulation Signal	14	COMM_V - Communication Voltage

Communication voltage selection - This communication board allows the user to select one of the following three communication voltages through hardware, which are very common on most of the applications:

- 5.0 V - This voltage comes directly from the USB port and can be selected by connecting J3(1-2). This selection ignores the voltage coming from the LDO, and sets the USB voltage as the maximum level for communication.
- 3.3 V - This voltage can be selected by connecting J5(1-2) and J3(2-3). This selection configures the LDO to supply 3.3 V, and set the voltage as the maximum voltage reference of communication.
- 1.8 V - This communication voltage is selected by connecting J5(2-3) and J3(2-3). By connecting these two jumpers, the LDO supplies 1.8 V, and set this voltage level as the maximum voltage reference of communication.

3.3 EVBs Operating Parameters

KIT13892VXEVBEBJ Board

- Input voltages:
 - Battery: 3.7 V
 - USB/Wall charger: 5.0 V
 - Power supply for backlighting: 9.0 V
- Default output voltages:
 - Regulators: SW1 = 1.05 V; SW2 = 1.22 V; SW3 = 1.2 V; SW4 = 1.8 V; SWBST = 5.0 V (when a charger is attached, otherwise 0 V).
 - Linear regulators: VUSB = 3.3 V; VUSB2 = 2.6 V; VPLL = 1.8 V; VDIG = 1.25 V; VIOHI = 2.775 V; VGEN1 = 0 V; VGEN2 = 3.15 V; VGEN3 = 0 V; VSD = 0 V; VVIDEO = 0 V; VAUDIO = 0 V; VCAM = 0 V.
 - Switching frequency in regulators: 3.1457 MHz (SWBST operates at 2.0 MHz).
- Communication interfaces:
 - SPI - Frequency up to 26 MHz
 - I²C - Frequency at 400 kHz
- Power control signals - RESETB, RESETBMCU, WDI, INT, STANDBY, STANDBYSEC, CHRGSE1B, and CS

KITUSBCOMDGLVME Board

- Power supply = 5.0 V (supplied by computer USB port)
- Communication Interfaces:
 - I²C - Frequency up to 3.5 MHz (100 kHz, 400 kHz or 3.5 MHz); Voltage Level = Selectable (5.0 V, 3.3 V, or 1.8 V)
 - SPI - Frequency up to 4.0 MHz; Voltage Level = Selectable (5.0 V, 3.3 V, or 1.8 V)
 - UART - Frequency from 2400 bps to 115200 bps; Voltage Level = 12 V (Typ.)
 - USB - Frequency fixed at 12 Mbps; Voltage Level = 5.0 V (Typ.)
- Other Signals:
 - Four PWM signals (Adjustable frequency up to 4.0 MHz)
 - Open Drain signals with selectable voltage Level (5.0 V, 3.3 V or 1.8 V)
 - Three GPIOs (General Purpose I/O pins) Open Drain signals with selectable voltage Level (5.0 V, 3.3 V, or 1.8 V)
 - Two ADCs (10 bits)
 - Identifiers - Two ADC signals pulled up to 5.0 V thru 10 kohm resistors. These inputs are designated to identify the Slave device and automatically OPEN its corresponding Graphical User Interface (GUI). This feature only applies if a slave board was designed for it.

3.4 EVBs Features

KIT13892KVxEVBEJ Board

- Four Layer Board
- Low Noise Design
- Top and bottom Layer component placement
- Three 12 pin connectors (J17, J18, and J24) for regulators, linear regulators, and NMOS power gate switches accessibility. Review [Figures 9](#) and [10](#) schematics for connections
- Banana jack connectors (J6-J8 and J1-J2) for battery and charger attachments
- Battery holder for a CR2477 Li-Ion/Li-Pol coin cell
- Several jumper configurations for PMIC mode of operation
- Scattered test points for different measurements
- I²C and SPI communication interface connectors (J10 and J14)
- Power control interface connector (J15)
- Three RGB LEDs for color mixing or general purpose signaling
- 17 white LEDs for backlighting applications. Note that an external Boost regulator voltage needs to be attached at TP SWLED
- Two green LEDs for RESETB and RESETBMCU signaling
- One red LED for charger attachment signaling
- Four-wire resistive touch screen interface connector (J25)

KITUSBCOMDGLVME Board

- Four Layer Board
- Low Noise Design
- Top Layer Placement
- UART, I²C, and SPI communication interface connectors (J6, J7, and J9)
- USB type A connector
- Communication Voltage Level Shifting configuration (J3 and J5)
- BDM connector for MCU programming (J2)
- Pull-up resistors for I²C and SPI line communication voltage jumper configurations (J4)

3.5 MC13892 Device Description/Features

- Battery charger system for wall charging and USB charging
- 10 bit ADC for monitoring battery and other inputs, plus a coulomb counter support module
- Four adjustable output buck regulators for direct supply of the processor core and memory
- 12 adjustable output LDOs with internal and external pass devices
- Boost regulator for supplying RGB LEDs
- Serial backlight drivers for displays and keypad, plus RGB LED drivers
- Power control logic with processor interface and event detection
- Real time clock and crystal oscillator circuitry, with coin cell backup and support for external secure real time clock, on a companion system processor IC
- Touch screen interface
- SPI/I²C bus interface for control and register access

4 Required Equipment

- 3.7 V Li-Ion battery to be connected at J6-J8
- 9.0 V, 500 mA power supply to be connected at test point SWLED.
- 5.0 V, 5.0 A, Adjustable Power Source to be connected at J1-J2
- Computer Central Processing Unit (CPU) System Requirements:
 - Windows eXperience (XP)
 (Note: The USB drivers for the KITUSBCOMDGLVME MCU were developed under Windows XP operating system)
- 1.0 Gigabyte Random Access Memory
- 100 Megabyte Hard Disc Drive Available Memory

5 Setup Configuration

Please refer to the following figures for setting up the connections between the USBCOMDGL, and either the KIT13892VKEVBEJ or the KIT13892VLEVBEJ, by I²C or SPI communication.

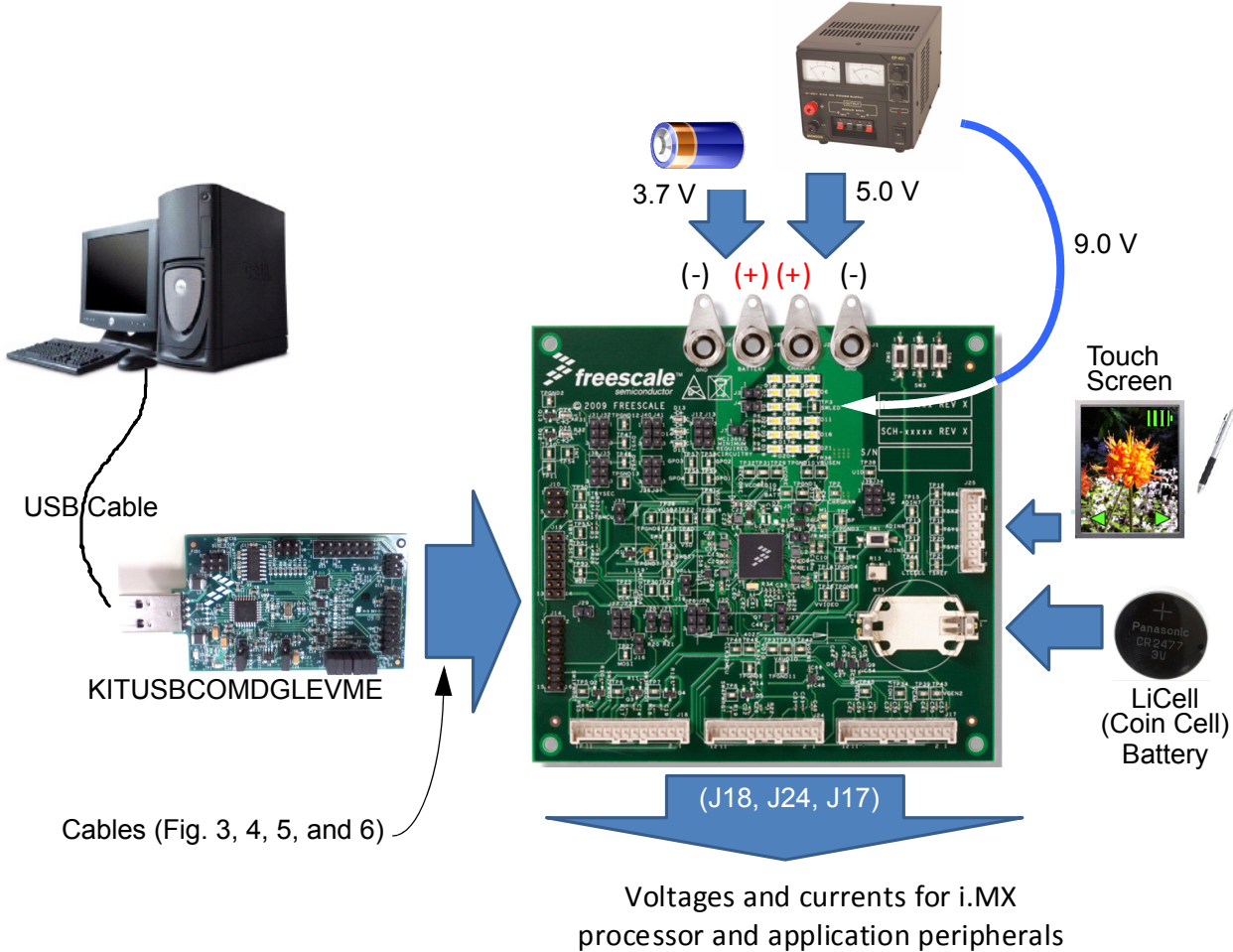


Figure 1. MC13892 Basic Hardware Setup

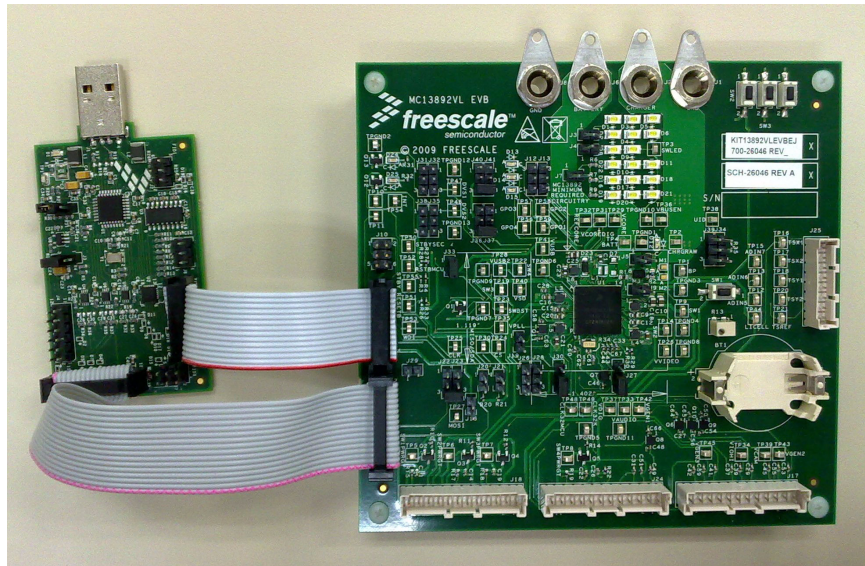


Figure 2. SPI Configuration for the MC13892JVL Board alongside the USB Dongle

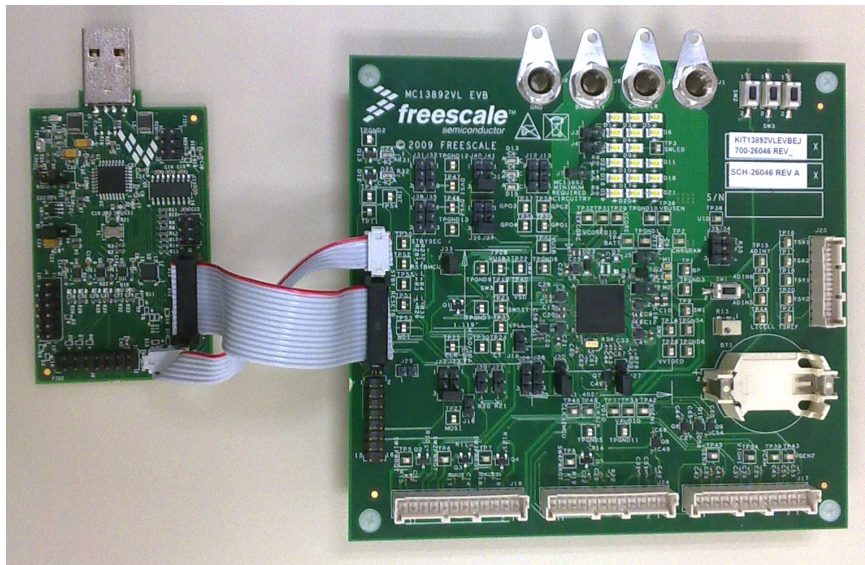


Figure 3. I²C Configuration for the MC13892JVL Board alongside the USB Dongle

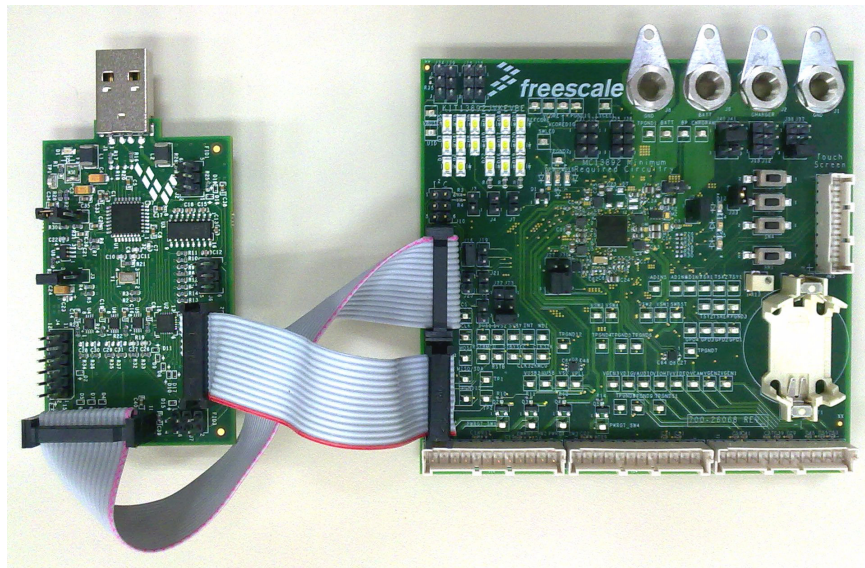


Figure 4. SPI Configuration for the MC13892JVK Board alongside the USB Dongle

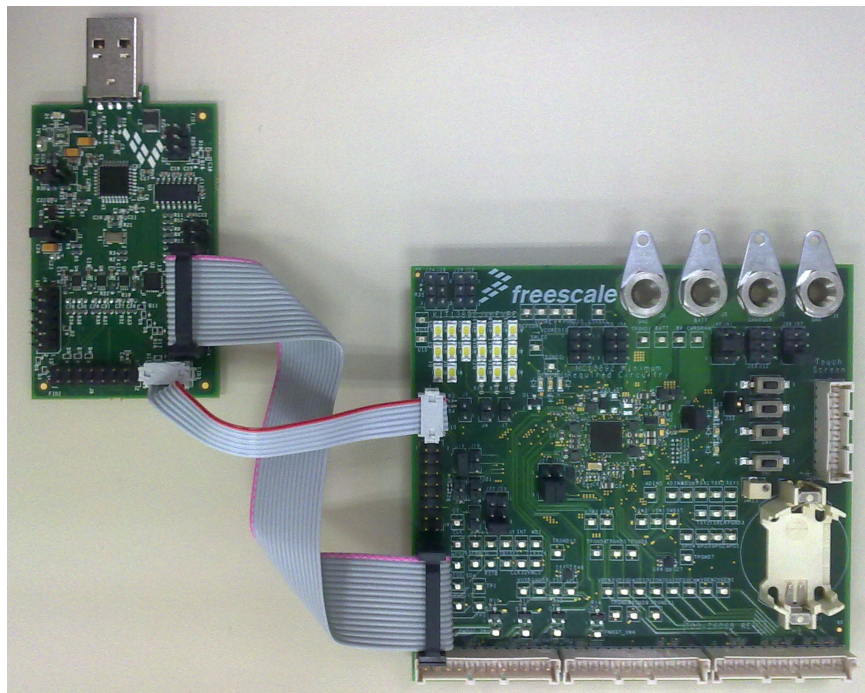


Figure 5. I²C Configuration for the MC13892JVK Board alongside the USB Dongle

5.1 KIT13892VxEVBEJ Jumper Location and Configuration

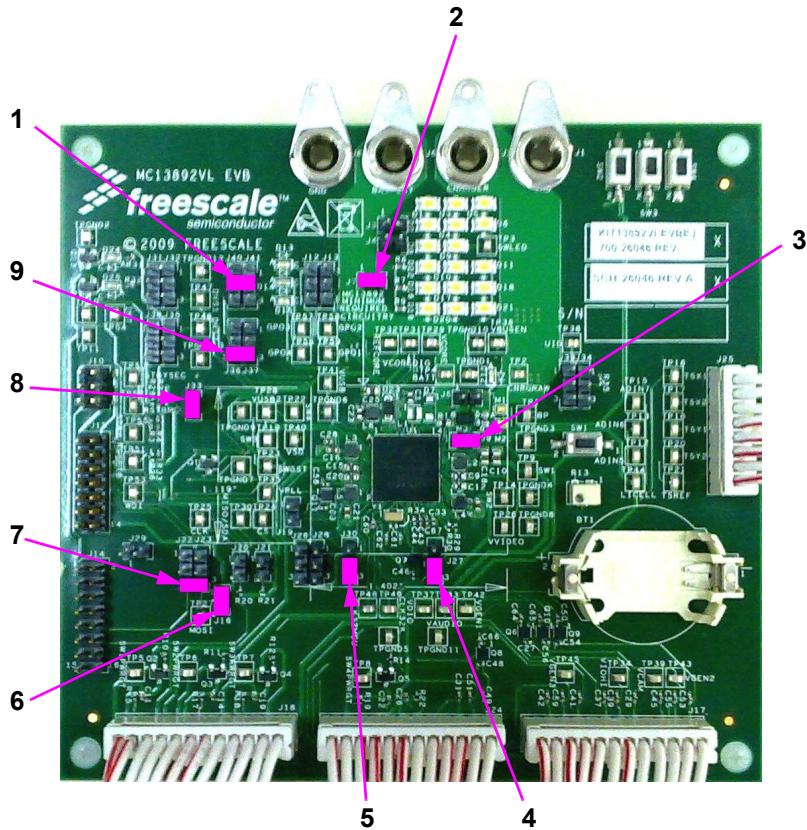


Figure 6. KIT13892VLEVBEJ Default Jumper Location and Configuration

Location	Jumper Reference	Position
1	J40-41	2
2	J7	Shorted
3	J9	Shorted
4	J27	2-3
5	J30	2-3
6	J16	Shorted
7	J22-23	3
8	J33	Shorted
9	J36-37	3

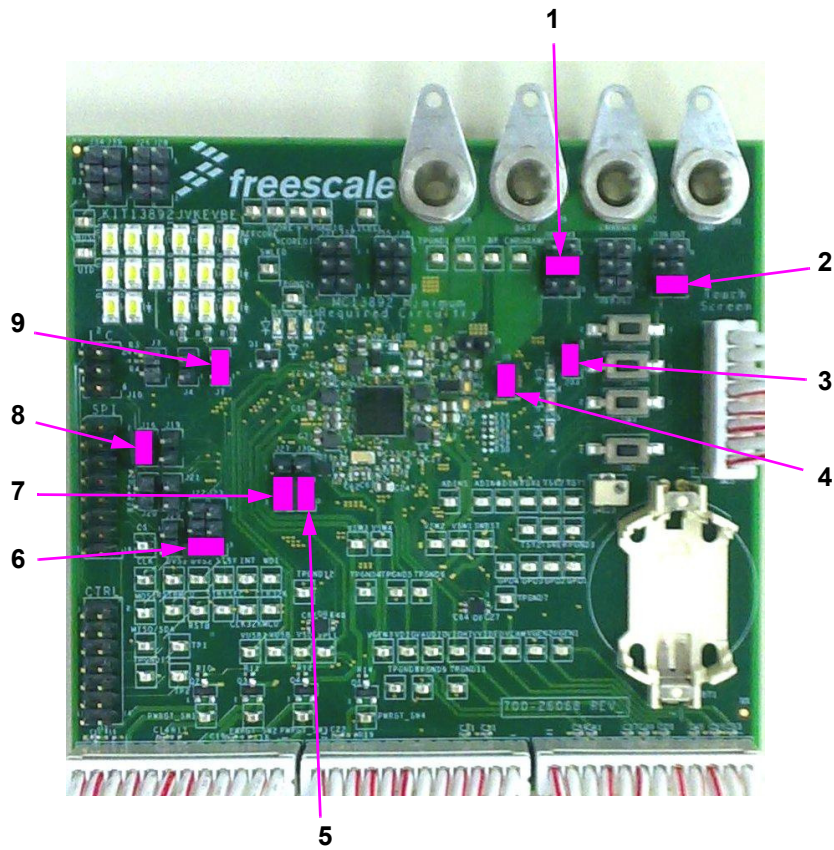


Figure 7. KIT13892VKEVBEJ Default Jumper Location and Configuration

Location	Jumper Reference	Position
1	J40-41	2
2	J36-37	3
3	J33	Shorted
4	J9	Shorted
5	J30	2-3
6	J22-23	3
7	J27	2-3
8	J16	Shorted
9	J7	Shorted

Jumper Reference	General Description	Position	Function
J34-J39	USB ID Connection	Open (default)	B type plug (USB Host, OTG default master or no device) is attached
		1	Grounded: A type plug (USB default slave) is attached
		2	Resistor to ground: Non-USB accessory is attached
		3	Tied to SWBST: Factory mode
J26-J28	Control VBUSEN pin	Open (default)	VBUSEN feature not used
		1	Grounded: VBUS supplied from USB cable
		2	For future usage
		3	Tied to SW4: VBUS supplied from SWBST if VUSBIN and OTGSWBSTEN bits = 1 (OTG mode), or VUSB supplied from VBUS if VUSBIN = 0 and a valid VBUS is present
J31-J32	DVS1 Control	Open (default)	Dynamic Voltage Scaling feature disabled for SW1
		1	Tied to SW4: DVS feature activated. The regulator output voltage will transition to the set point indicated in the SW1DVS bits on programmed steps
		2	For future usage
		3	Grounded: DVS feature deactivated and the regulator will be working on the set point indicated by the SW1 bits
J35-J38	DVS2 Control	Open (default)	Dynamic Voltage Scaling feature disabled for SW2
		1	Tied to SW4: DVS feature activated. The regulator output voltage will transition to the set point indicated in the SW2DVS bits on programmed steps
		2	For future usage
		3	Grounded: DVS feature deactivated and the regulator will be working on the set point indicated by the SW2 bits
J40-J41	PUMS1 Control (Controls the power up default values of the regulators)	Open	Open (Check MC13892 Data Sheet for further reference on the default values)
		1	Tied to VCORE (Check MC13892 Data Sheet for further reference on the default values)
		2 (default)	Tied to VCOREDIG (Check MC13892 Data Sheet for further reference on the default values)
		3	Grounded (Check MC13892 Data Sheet for further reference on the default values)
J13-J12	PUMS2 Control (Controls the power up default values and sequence of the regulators)	Open (default)	Open (Check MC13892 Data Sheet for further reference on the default values)
		1	Tied to VCORE: No usage on version 2.0 A of the device. For future usage
		2	Tied to VCOREDIG: No usage on version 2.0 A of the device. For future usage
		3	Grounded (Check MC13892 Data Sheet for further reference on the default values)
J36-J37	Control MODE pin	Open	No mode selected, the device will not work
		1	Tied to VCORE: Test mode
		2	Tied to VCOREDIG: Low Power Boot allowed
		3 (default)	Grounded: Normal operation
J3	LEDMD String Control	Open (default)	LEDMD string open. LEDMD pin unconnected
		Shorted	LEDMD string enabled and connected to LEDMD pin
J4	LEDAD String Control	Open (default)	LEDAD string open. LEDAD pin unconnected
		Shorted	LEDAD string enabled and connected to LEDAD pin
J7	LEDKP String Control	Open	LEDKP string open. LEDKP pin unconnected
		Shorted (default)	LEDKP string enabled and connected to LEDKP pin

Jumper Reference	General Description	Position	Function
J16	SPIVCC Supply	Open	SPIVCC pin allowed to be supplied through connectors J10, J15, or J14
		Shorted (default)	SPIVCC supplied by SW4 ⁽¹⁾
J19	CS pin Control	Open (default)	CS pin allowed to be controlled by connector J15. If it is grounded or left open at startup, the device will be configured on SPI mode.
		Shorted	Tied to VCORE: If this pin is tied to VCORE at startup, the device will be configured for I ² C mode.
J20	MISO Pull-up	Open (default)	Pull-up resistor on MISO pin disabled for SPI communication
		Shorted	Pull-up resistor on MISO pin enabled for I ² C communication
J21	CLK Pull-up	Open (default)	Pull-up resistor on CLK pin disabled for SPI communication
		Shorted	Pull-up resistor on CLK pin enabled for I ² C communication
J29	UVBUS Supply	Open (default)	UVBUS pin disconnected from J14
		Shorted	UVBUS pin connected to J14 connector for it to be supplied from the USB cable connected to the MCU board, or to supply a USB cable in OTG mode
J27	VCAMDRV	Open	VCAM regulator not used
		1-2	VCAM regulator configured with external pass device (VCAMCONFIG bit needs to be set to 1)
		2-3 (default)	VCAM regulator configured with internal pass device (VCAMCONFIG bit needs to be cleared)
J30	VGEN3DRV	Open	VGEN3 regulator not used
		1-2	VGEN3 regulator configured with external pass device (VGEN3CONFIG bit needs to be set to 1)
		2-3 (default)	VGEN3 regulator configured with internal pass device (VGEN3CONFIG bit needs to be cleared)
J5	M3 FET Control 1	Open (default)	Charge path configured as Serial Path (J9 needs to be shorted)
		Shorted	Charge path configured as Single Path (J9 needs to be open)
J9	M3 FET Control 2	Open	M3 FET not controlled. Charge path configured as Single Path
		Shorted (default)	M3 FET controlled by BATTFET pin. Charge path configured as Serial Path
J33	PWRON1 pin Control	Open	PWRON1 pin can only be controlled through Switch 2
		Shorted (default)	PWRON1 pin can be controlled by either Switch 2 or an MCU board connected to J15 connector
J22-J23	MOSI Control	Open	MOSI pin not connected. Not recommended
		1	Grounded: A0 address = 0 on I ² C communication
		2	Tied to VCORE: A0 address = 1 on I ² C communication
		3 (default)	MOSI pin tied to J14 connector for SPI communication

Notes:

1. Due to the effect the level shifter of the KITUSBCOMDGLVME produces on SW4, the latter will need a minimum extra load of 10 kOhm to work properly when it is supplying SPIVCC.

5.2 KITUSBCOMDGLVME Jumper Location and Configuration

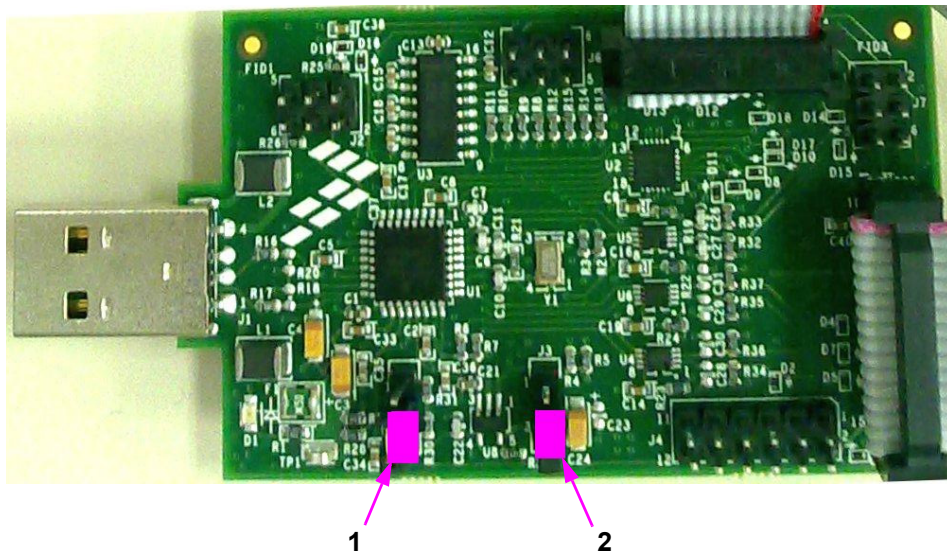


Figure 8. KITUSBCOMDGLVME Default Jumper Location and Configuration

Location	Jumper Reference	Position
1	J5	2-3
2	J3	2-3

Jumper Reference	General description	Position	Function
J5	Level shifted Communication voltage	1 - 2	Adjust LDO voltage to 3.3 V
		2 - 3 (Default)	Adjust LDO voltage to 1.8 V
J3	Level shifting Communication voltage enablement	1 - 2	Set communication voltage to 5.0 V
		2 - 3 (Default)	Set communication voltage to LDO voltage
J4	Pull up resistor enablement for low voltage side	1 - 2	SDA pull-up resistor enable
		3 - 4	SCL pull-up resistor enable
		5 - 6	MISO pull-up resistor enable
		7 - 8	SS pull-up resistor enable
		9 - 10	SPSCK pull-up resistor enable
		11 - 12	MOSI pull-up resistor enable

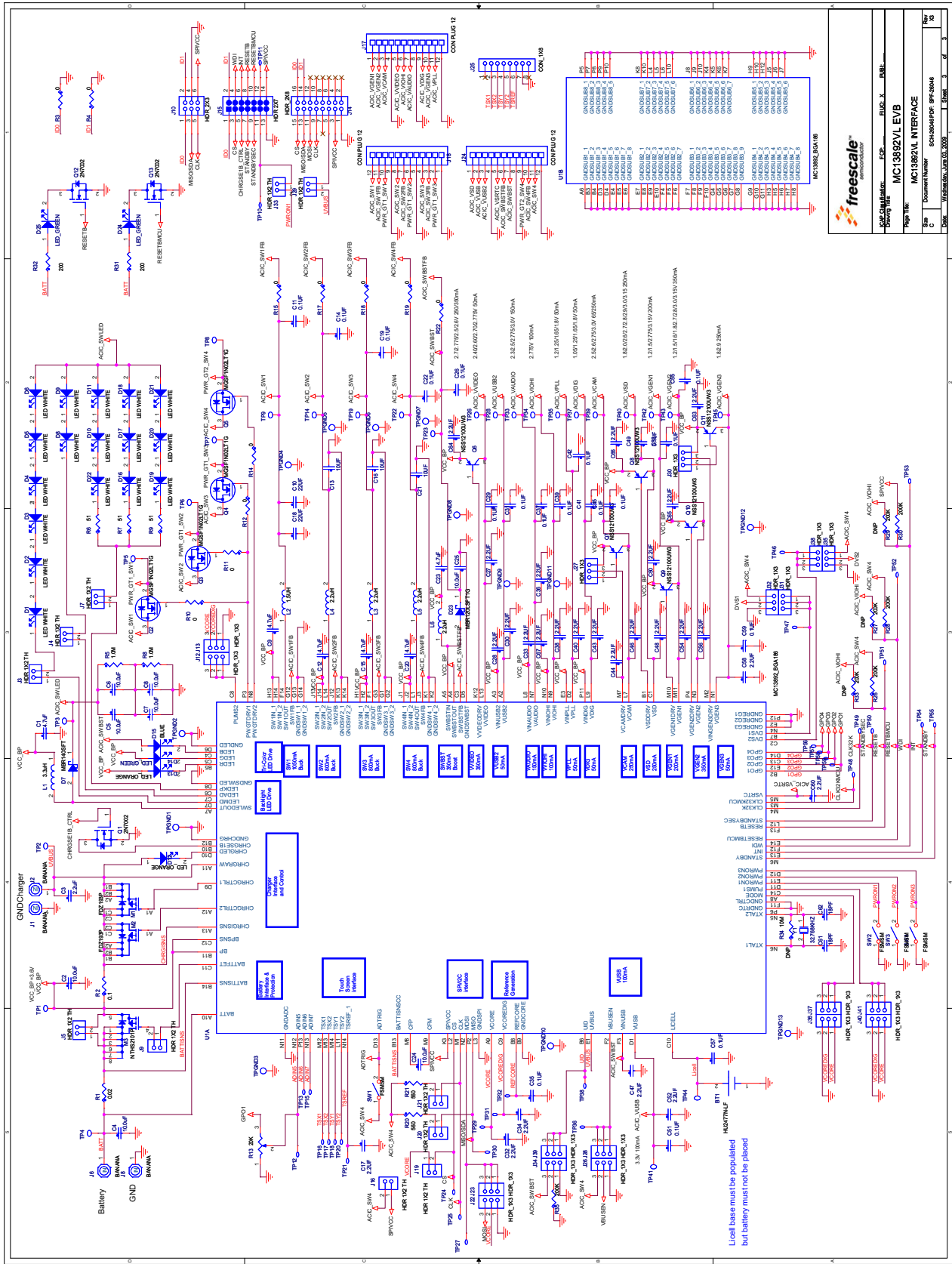


Figure 10. KIT13892VLEVB Schematic (12x12)

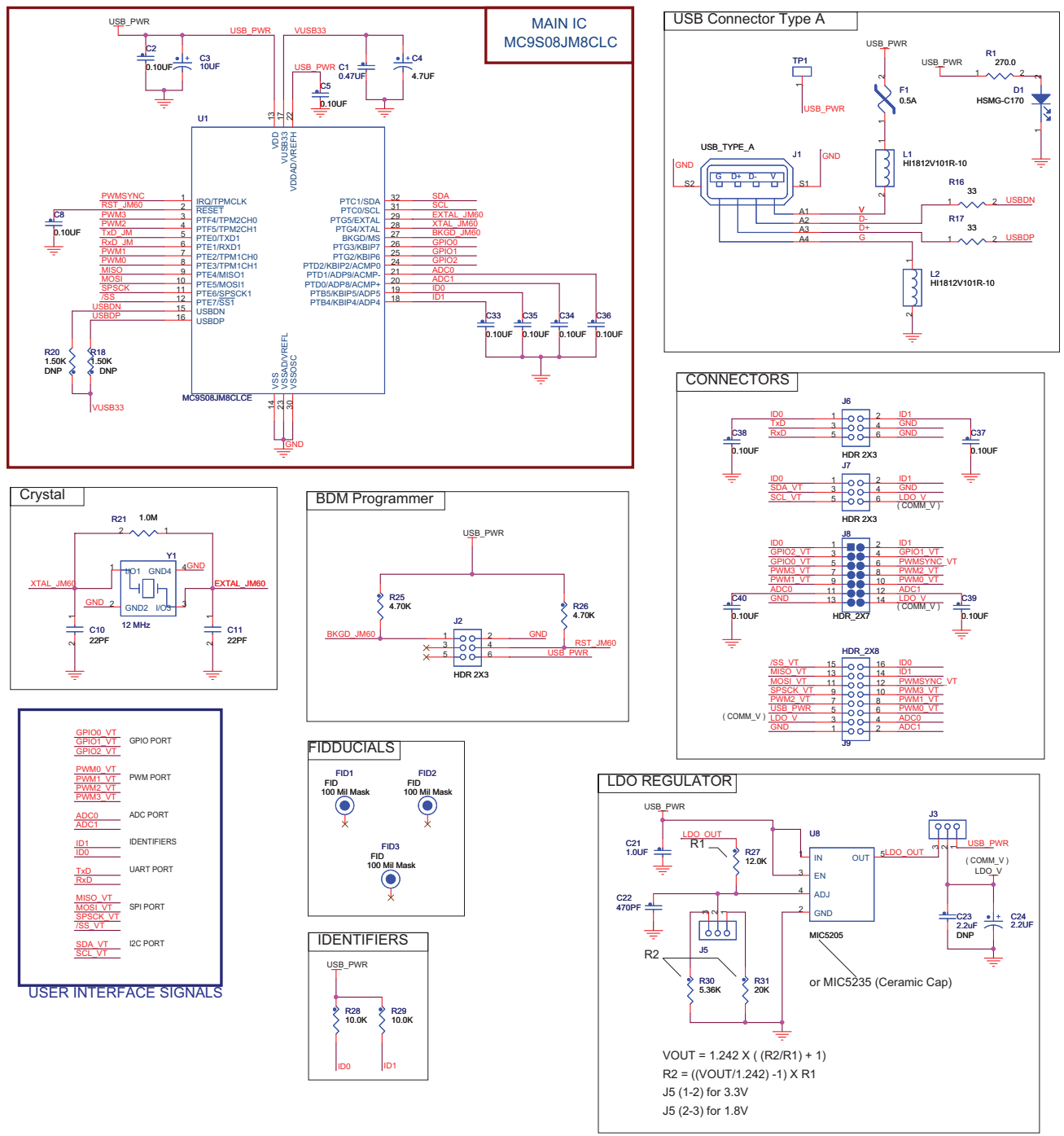


Figure 11. KITUSBCOMDGL Schematic

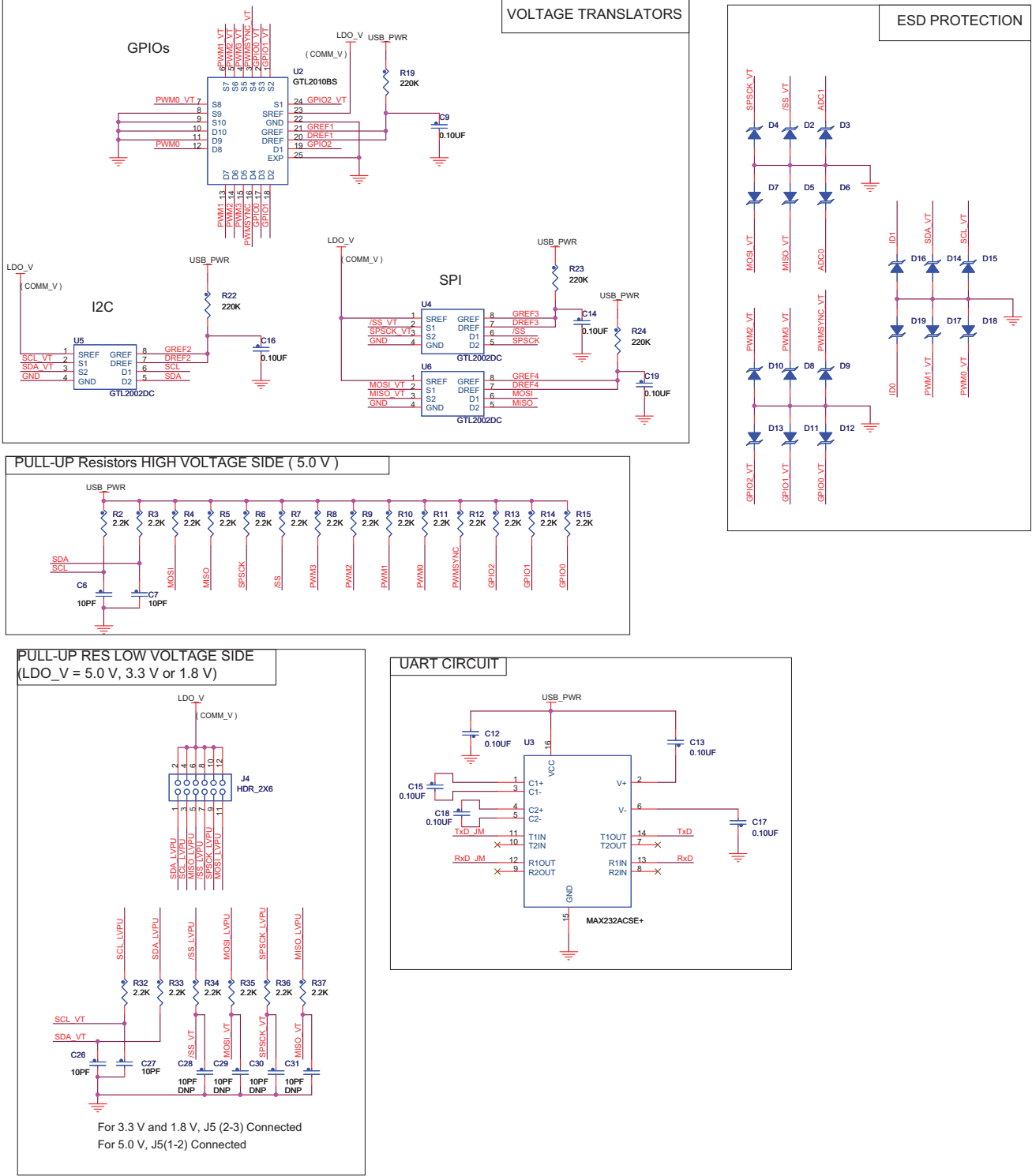


Figure 12. KITUSB COMDGL Schematic

7 Software

7.1 Installing the MC13892 GUI.

The Setup installer will be provided as the **MC13892 Installer.exe** file.

1. Double-Click to the executable file. The installer shall run immediately and will look like as depicted in [Figure 13](#).

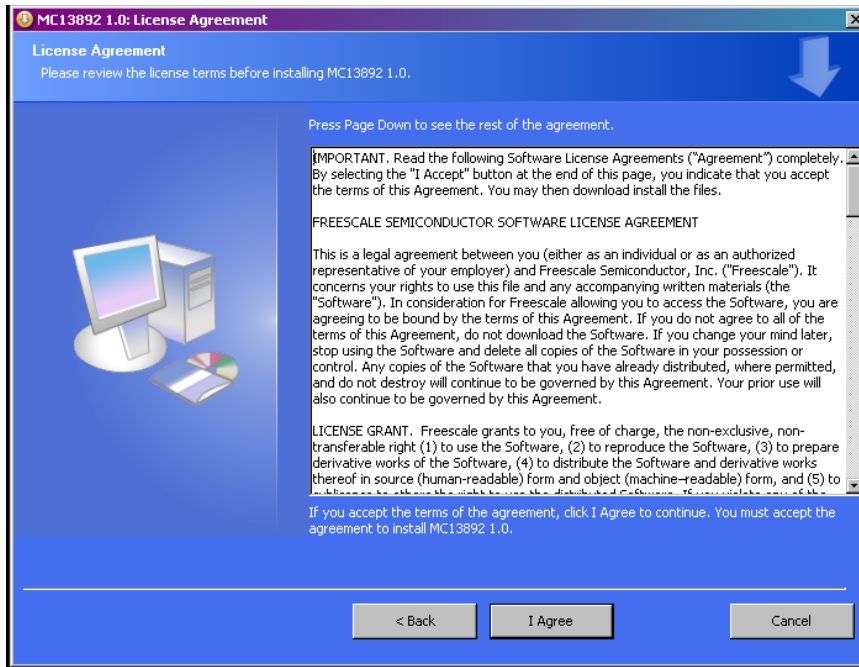


Figure 13. License Agreement

2. Press the "I Agree" button to continue with the installation process.
3. [Figure 14](#) shows the application components and the device drivers for the USB Dongle. There is no reason for users to uncheck the options to install the files.
4. All these files need to be installed for the proper run of the **MC13892 Installer.exe** application.

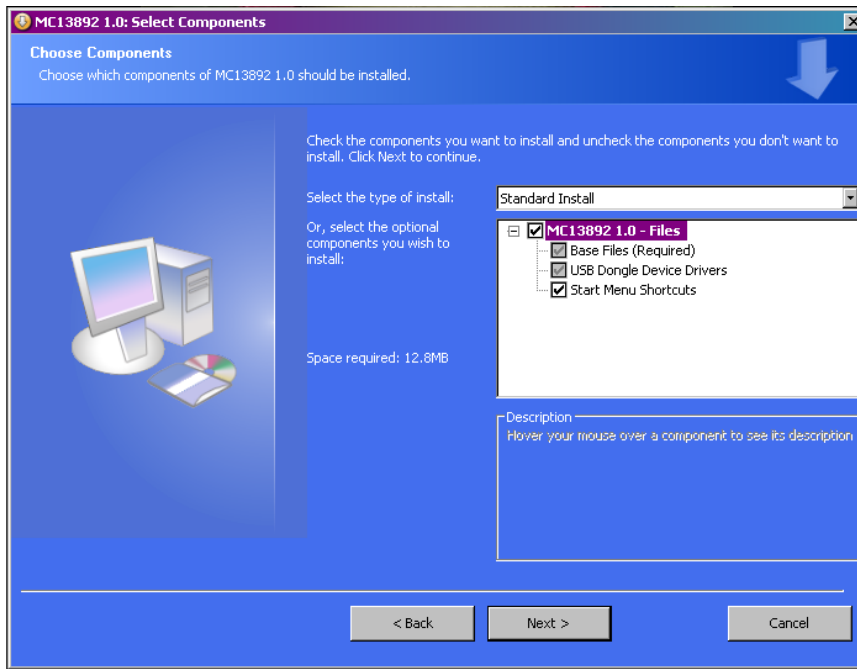


Figure 14. Choose Component Window

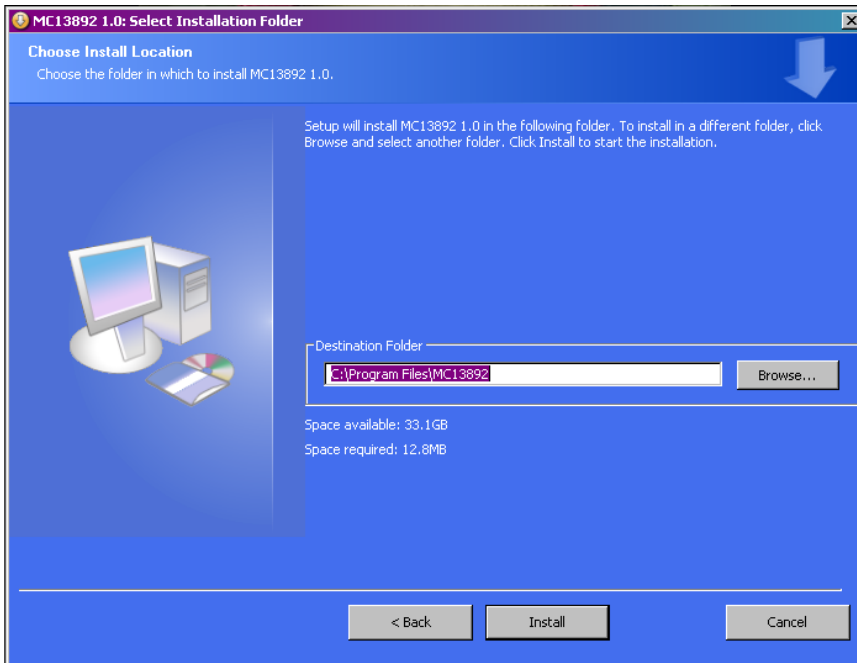


Figure 15. Choose Install Location

5. Before the installer runs, all needed files are stored in the C:/Program Files/MC13892 folder.
6. Once the destination folder is selected, click "Install". The installation of the necessary drivers begins ([Figure 16](#)).

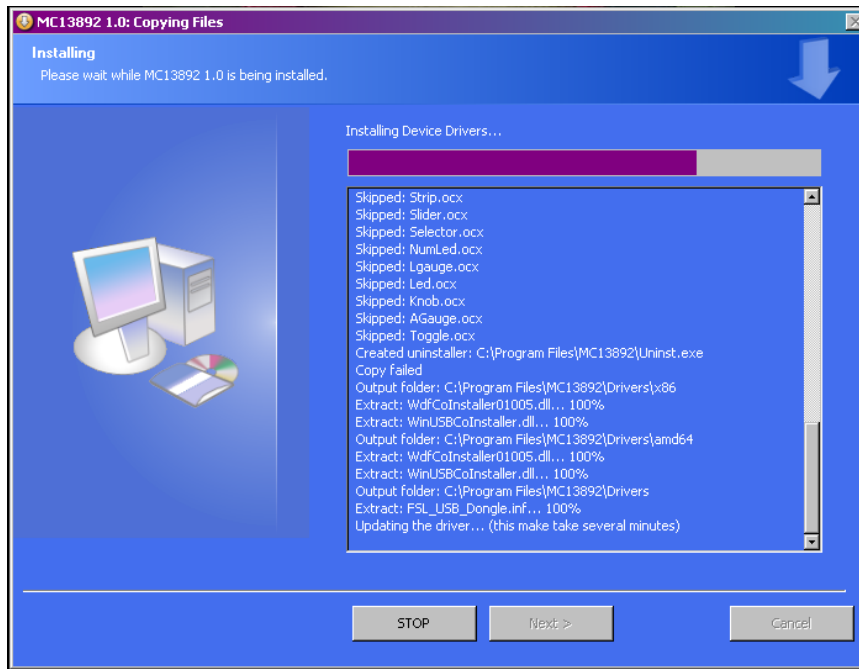


Figure 16. Software Install Window

- Following the correct installation of the GUI and device drivers, the **KIT13892VxEVBEJ** board is ready to receive and send commands to the **MC13892 Installer.exe** application thru the **KITUSBCOMDGLVME** board. To finish the installation process, select the “Close” button ([Figure 17](#)).

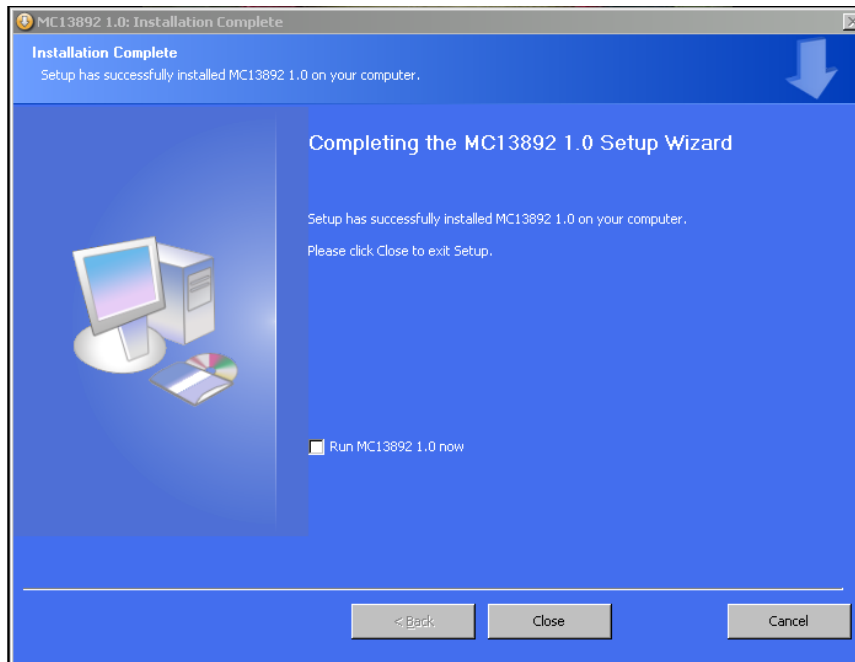


Figure 17. Installation Complete Window

7.2 Controlling the Hardware from the Graphical User interface

To interface the KITUSBCOMDGLVME with KIT13892VxEVBEJ, the following connections should be made:

KITUSBCOMDGLVME Connector	KIT13892Vx EVBEJ Connector	Function
J8	J15	For Control signals: WDI, INT, RESETB, RESETBMCU, STANDBY, STANDBYSEC, CHRGSE1B, CS, and PWRON1.
J9	J14	If SPI communication is desired.
J7	J10	If I ² C communication is desired.

After plugging the KITUSBCOMDGLVME to the USB port of the PC/Laptop, open the MC13892 Graphical User Interface program and click “Open USB Communications” on the main window (See [Figure 18](#)).



Figure 18. Main Screen of the MC13892 Graphical User Interface Program

A window will appear on which the desired type of communication must be chosen (See [Figure 19](#)).

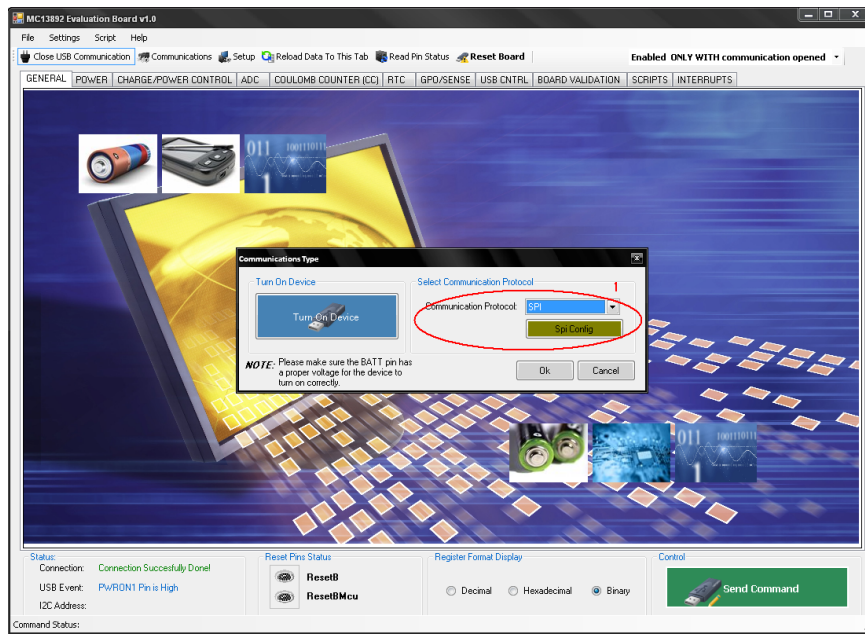


Figure 19. Communication Type Selection Window for the SPI

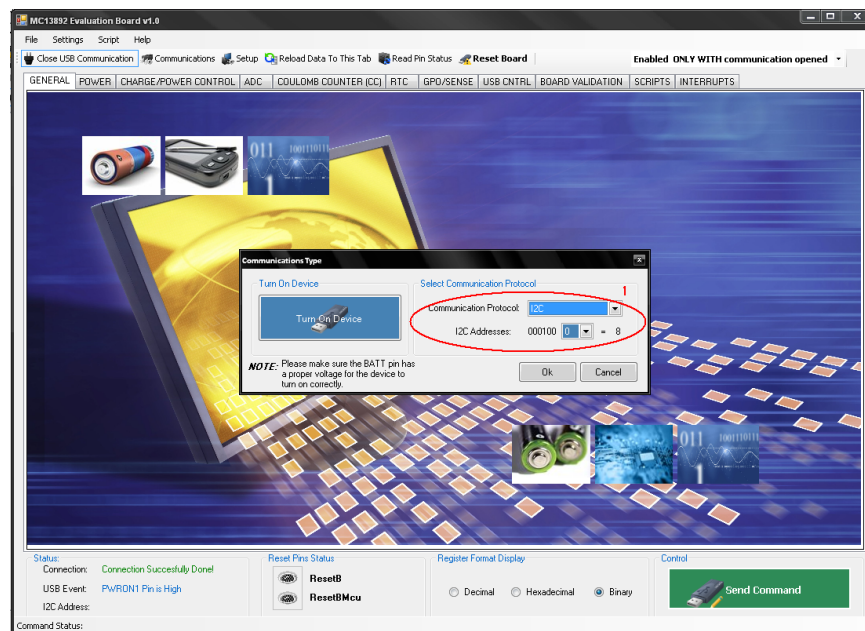


Figure 20. Communication Type Selection Window for SCI

After selecting the communication type, go to the “Board Validation” tab (reference [Figure 31](#) {5}) and set the WDI pin high, toggle the PWRON1 button to ON, and the MC13892 will turn on. If the I²C mode is selected ([Figure 20](#)), the user must select the I²C address to operate the MC13892 device, depending on the status of the A0 (MOSI) pin. At this point the user can start configuring the rest of the tabs to test all the MC13892 features.

The structure of the GUI is divided in different tabs, which control different blocks of the MC13892. Each one of these tabs controls a specific register and block of the device. From this point forward, this document will refer to specific parts of the figures with a number in parenthesis, i.e. (1). Refer to the figure following each paragraph, to locate the referred section.

On the example (Figure 22), the “Power” tab has been selected (1); this tab controls the registers for the Linear Regulators, Backlight, and RGB LED blocks. On the Buck Regulators 1 and 2/PLL sub tab (2), all the functions of these two regulators and the PLL frequency can be changed.

The window shows the value of the register and how it changes, depending on command (3). Remember that a SPI command consists of a Read/Write bit, six Address bits, and 24 Data bits (Figure 21).



Figure 21. Register Value Changes with Commands

After the registers have been configured on the selected tab, the “Send Command” button (4) must be selected for the information to be sent and the registers to be written*. The button will send commands only when an open USB communication has being established. In the current operation mode proposed earlier (Enabled Without communication opened), these bytes will not be sent to the board. When the command has been sent, the “Command Status” bar (5) will read “Done!”. At this point, the next command can be assembled.

When a USB communication has being established, every time a tab is being selected, the GUI will request data from the MC13892 device and update the current tab with the received data from the board.

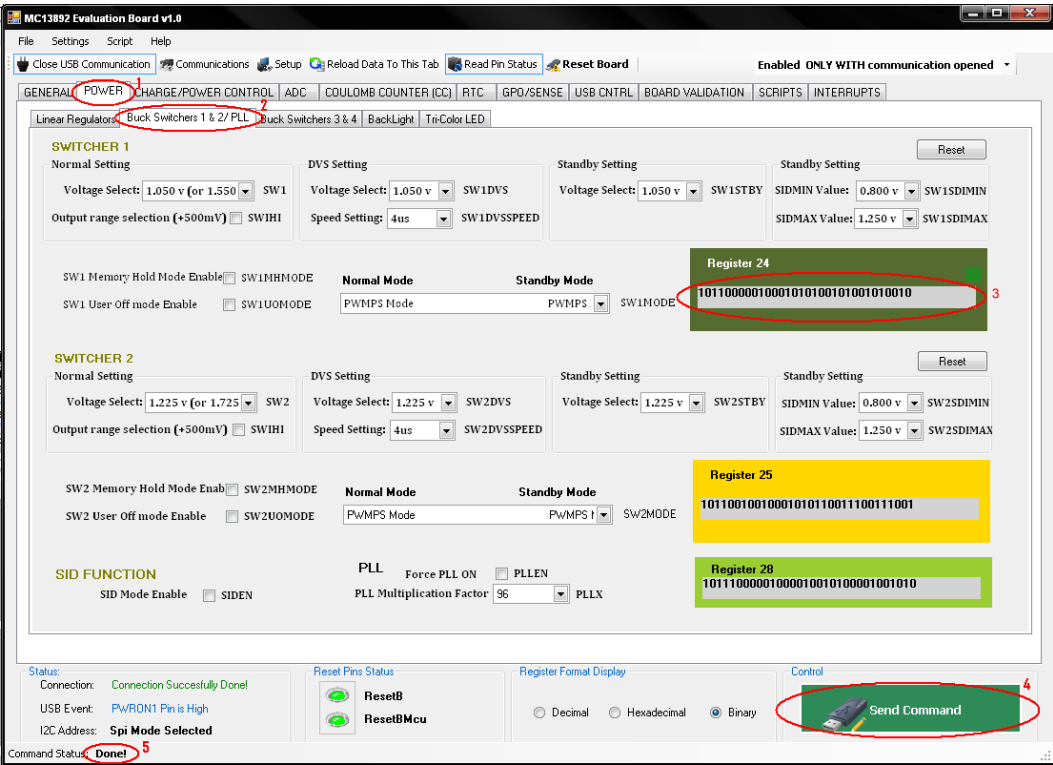


Figure 22. Writing and Reading Commands thru the Software Program

7.3 Power Tab

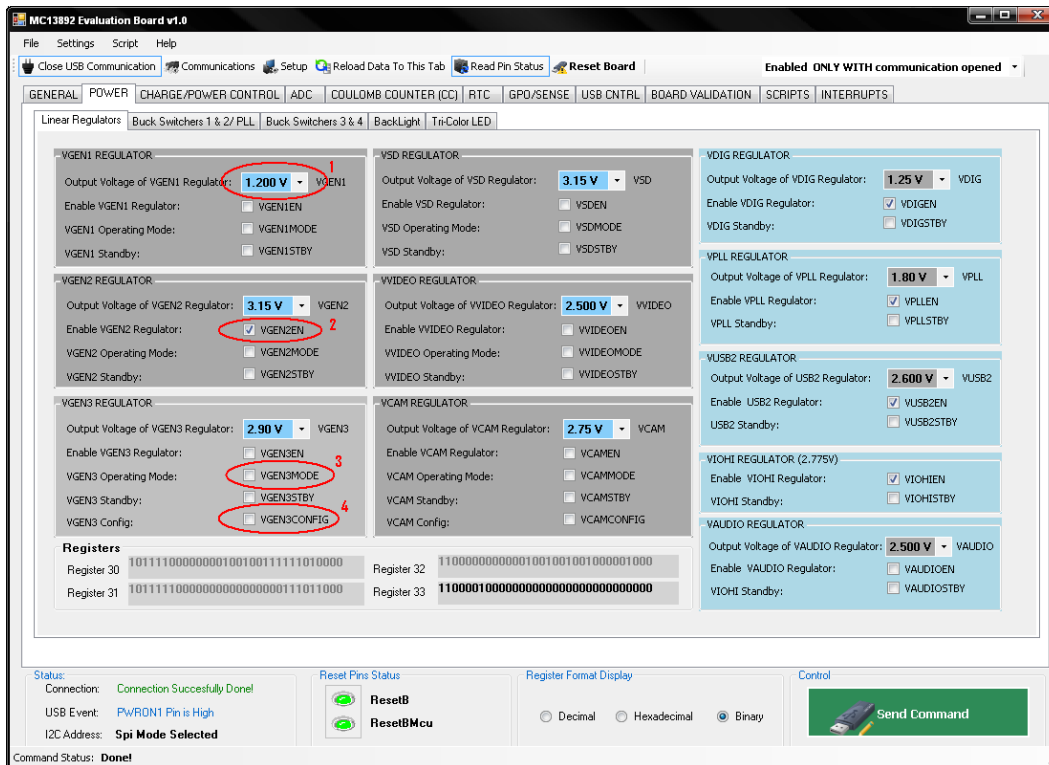


Figure 23. Linear Regulator Configuration Screen

The POWER tab includes all the controls to configure the set point of all the LDOs and regulators (1), as well as enable/disable them (2), configure the operation mode (3), and in the case of VGEN3 and VCAM, configure them to work with their internal or external pass device (4).

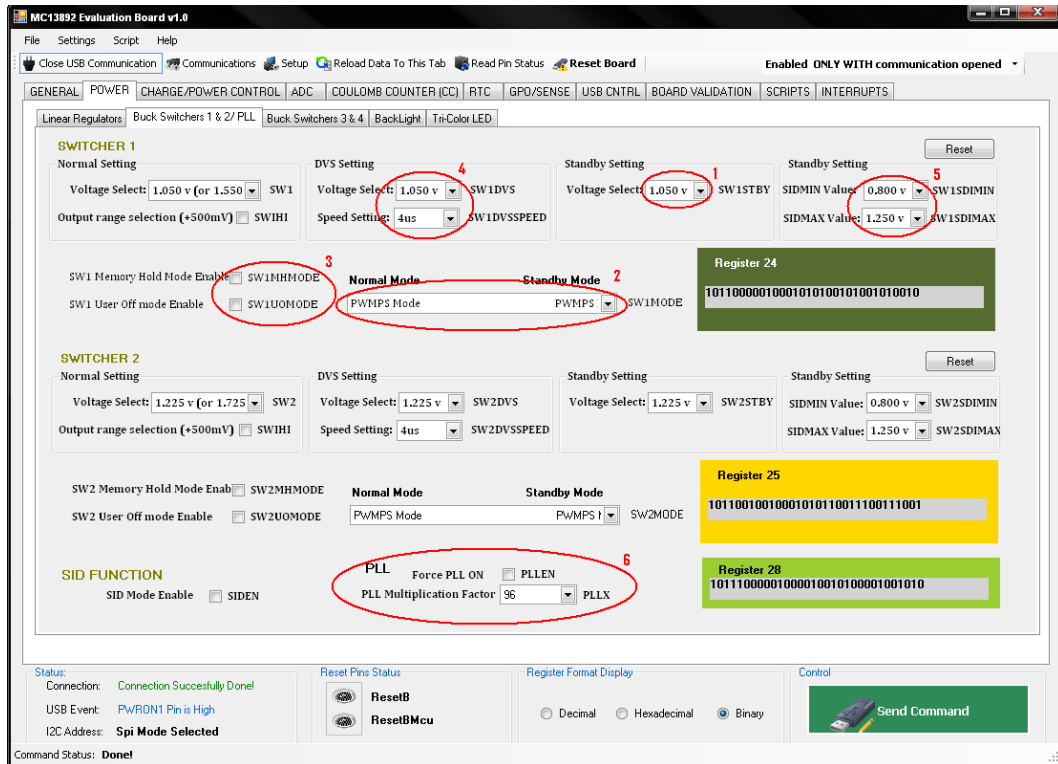


Figure 24. Regulators Configuration Tab Screen

In the case of the regulators, the configuration features include for example, other than the normal mode set point, the standby set point (1), the operating mode in normal and standby modes (2), whether they will be enabled or disabled in Memory Hold and User Off modes (3), and in the case of regulators 1 and 2, the Dynamic Voltage Scaling (DVS settings) and the Regulator Increment/Decrement set point (SIDMIN, SIDMAX) (4 and 5 respectively).

The PLL frequency can also be configured on this tab (6).

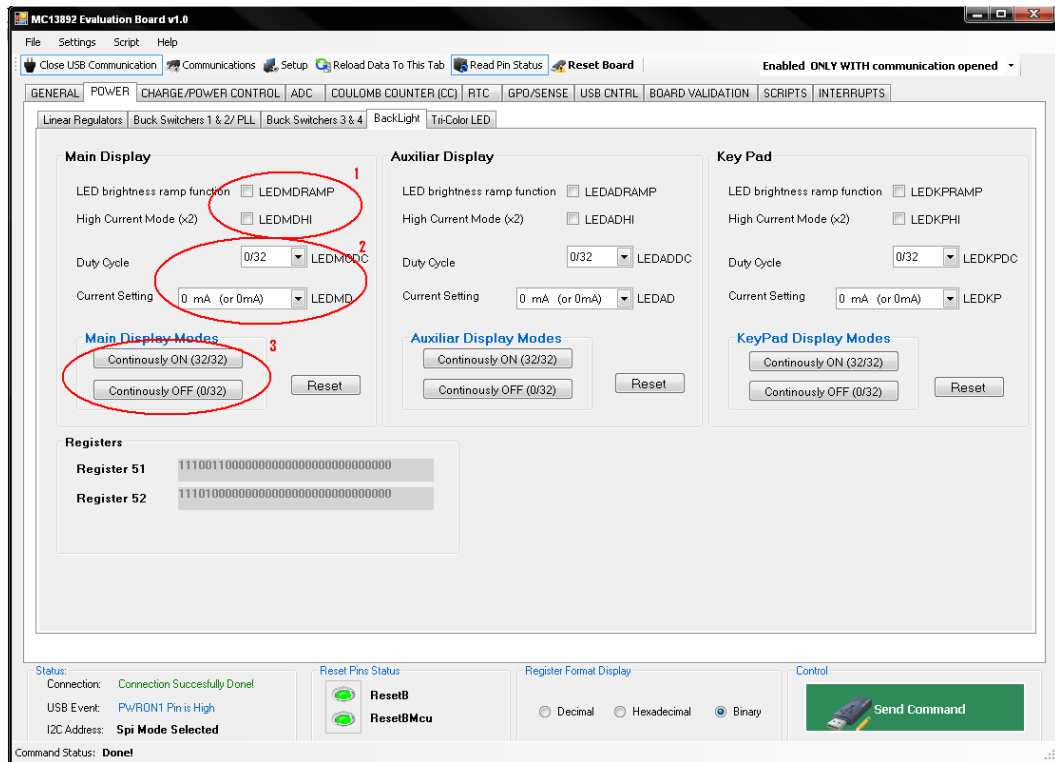


Figure 25. White LED Backlighting Configuration Tab Screen

The Backlight and Tri-color LED sub-tabs include the controls to configure the Ramp and High Current Mode of the LED drivers (1), and combo boxes to set the duty cycle and current setting of the PWM drivers (2). The Continuously On/Off buttons (3) set the duty cycle of the corresponding PWM controller to 32/32 or 0/32 respectively.

7.4 Charger/Power Control Tab

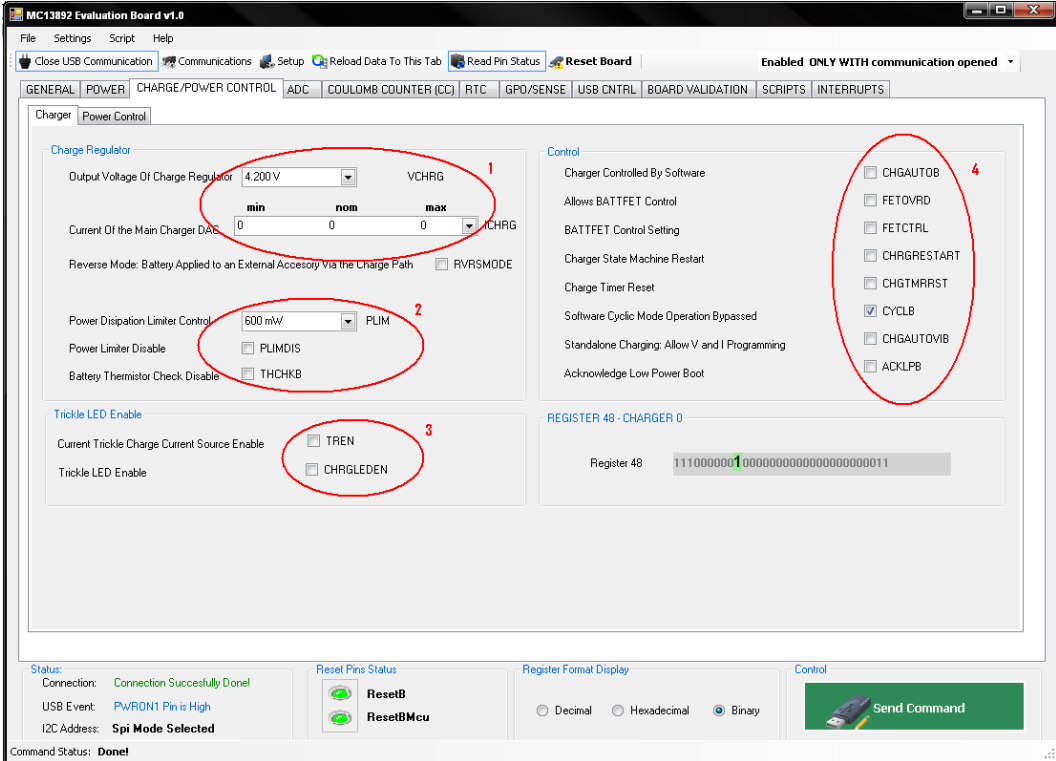


Figure 26. Battery Charger Configuration Tab Screen

The charger settings can be configured on the Charger sub-tab: The charger Voltage and Current (1), Power Limiter settings (2), Trickle LED (3), and bits for Software Controlled Charging configuration (4).

7.5 ADC and Coulomb Counter Tabs

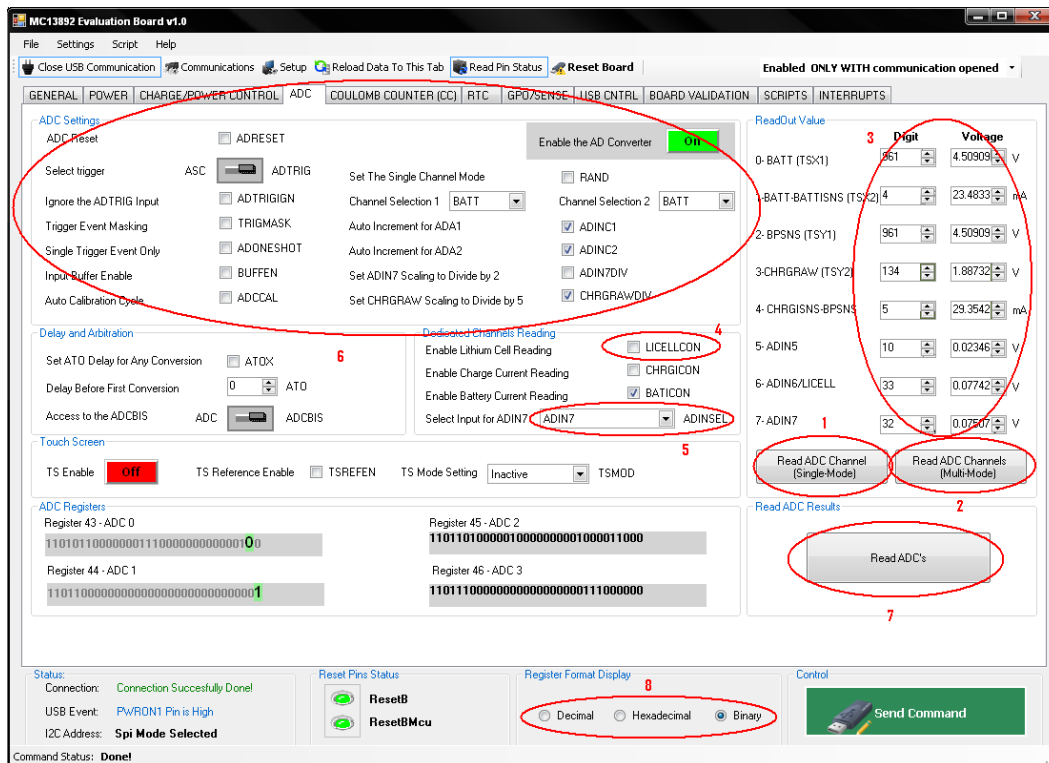


Figure 27. ADC Configuration Tab Screen

The MC13892 Graphical User Interface can control the ADC module in an automatic or manual method. For automatic mode, the ADC tab has two special buttons:

- Read ADC Channel (Single Mode) (1)
- Read ADC Channels (Multi Mode) (2)

Both buttons enable and trigger the ADC before starting the conversions.

The Single mode performs eight readings of the same channel [the channel has to be selected on the Channel Selection 1 combo box (6)], and shows the results on the Read Out Value text boxes (3).

The Multi mode performs one reading of each one of the eight ADC channels, and returns eight different results shown on the text boxes. This ADC mode automatically sets and clears specific ADC register bits to complete the readings of all channels.

In the case of channels 6 and 7, which can be configured to read different parameters, the returned results will depend on the LICELLCON (4) and ADIN7SEL bits (5) configuration.

The tab also includes all the necessary bit controls to manually use the ADC module (6). As an example, follow these steps. Remember to select the “Send Command” button after each step to execute the command:

- Set the “Enable the AD Regulator” button to ON
- Set the ADCCAL bit to calibrate the ADC
- Select the channels to be read with the Channel Selection 1 and 2 combo boxes, then set the RAND bit, if a single channel is to be read, or clear it if a multiple channel read is desired
- Move the “Select Trigger” switch to the ASC position and click the “Send Command” button
- The result of the conversions will be available on the ADC2 register (6), which can be read by clicking the “Read ADCs” button (7). The format of the reading can be changed with the “Register Format Display” controls (8)

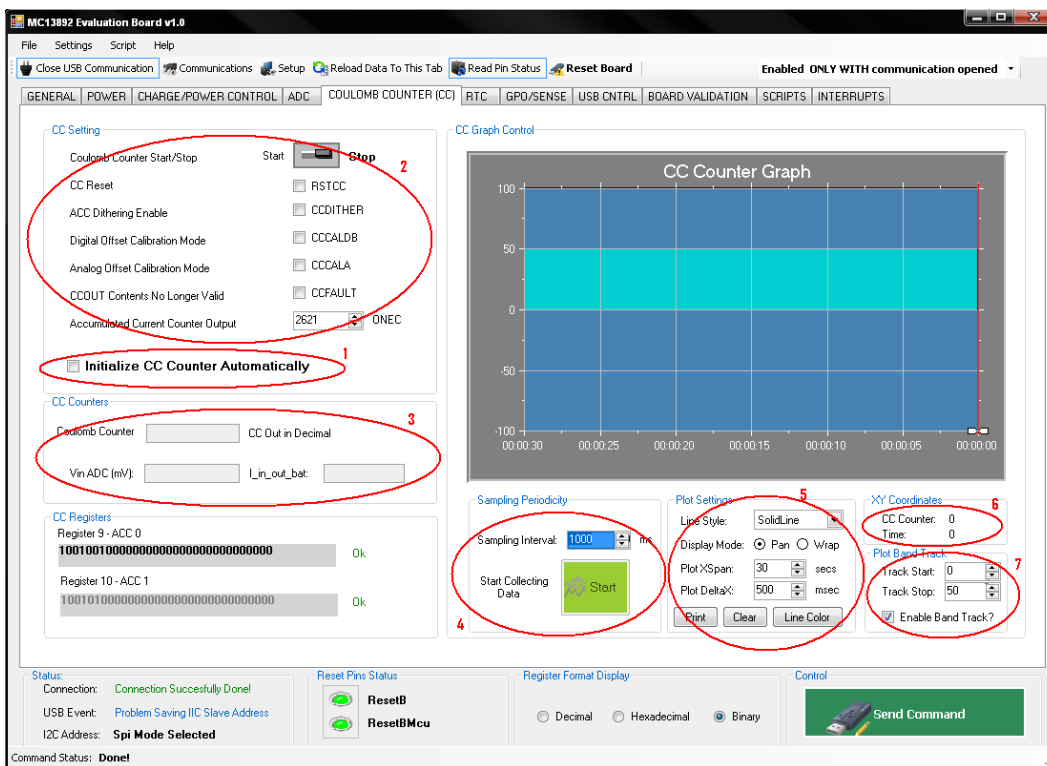


Figure 28. Coulomb Counter Configuration Tab Screen

On the Coulomb Counter tab, a function called “Initialize CC Counter Automatically” (1) performs the following sequence of commands:

- Start the Coulomb Counter
- Reset the Coulomb Counter
- Set the CCDITHER bit, which applies a dithering to the A to D regulator to avoid any error in the measurement, due to repetitive events
- Set the CCCALA bit, which calibrates the Coulomb Counter
- Set ONEC Value for Coulomb Counter accuracy
- Clear CCCALA bit

This module can also be manually controlled through the CC Setting section bits (2).

The CC Counter section (3) displays the value in decimal of the module counter in the MC13892 device. Every time user reads the counter value, this section will display the current value in the MC13892 register.

7.5.1 Sampling Periodicity (4)

The sampling periodicity section in the coulomb counter tab allows the user to retrieve the CC counter value from MC13892 device at certain rate. The field called “Sampling Interval” lets the user request data from the Coulomb Counter in milliseconds.

Once the “Start” button is pressed, the application automatically starts collecting data from the CC Counter and displays it in the graph section.

7.5.2 Plot Settings (5)

The plot setting section manages the general settings of the graphical section in the CC Counter tab. The “Line Style” option tells the graph to display data using different painting styles such as solid, dash, and dot type lines.

The “Display Mode” has two different options indicating how data will be displayed and saved into the graph tool. The “Pan” mode will scroll the data continuously across the screen like a standard Strip Chart. The “Wrap mode” allows the data to remain static on the screen, while a line moves across the plot area, and everything behind the line is repainted with the new data.

The “Plot XSpan” option sets the viewable extents of the X-Axis. When you are using the X-Axis to display Time, setting XSpan = 1 is equivalent to setting it to 24 hours. For instance, if you want to display five seconds of data on the viewable area, you would set XSpan = 0.00005787037037037 (1/24/60/60*5).

The button called “Line Color” lets the user change the color of the printing line in the graph. In the same row, the button called “Print”, allows the user to print the currently displayed data in the graph.

7.5.3 XY Coordinates (6)

This section shows the exact position of the cursor in the graph area. The user is able to select any point in the graph, and the XY Coordinates box will display the coordinates of the selected point.

7.5.4 Plot Band Track (7)

This option lets the user create a bound area between the delimited low and high sections in the graph. For instance, if the user needs to check a specific area in the graph between 0 and 50 (shown in [Figure 28](#)), they need to set the boundaries in the “Track Start” and “Track Stop” components accordingly, to create a delimited band.

7.6 RTC Tab

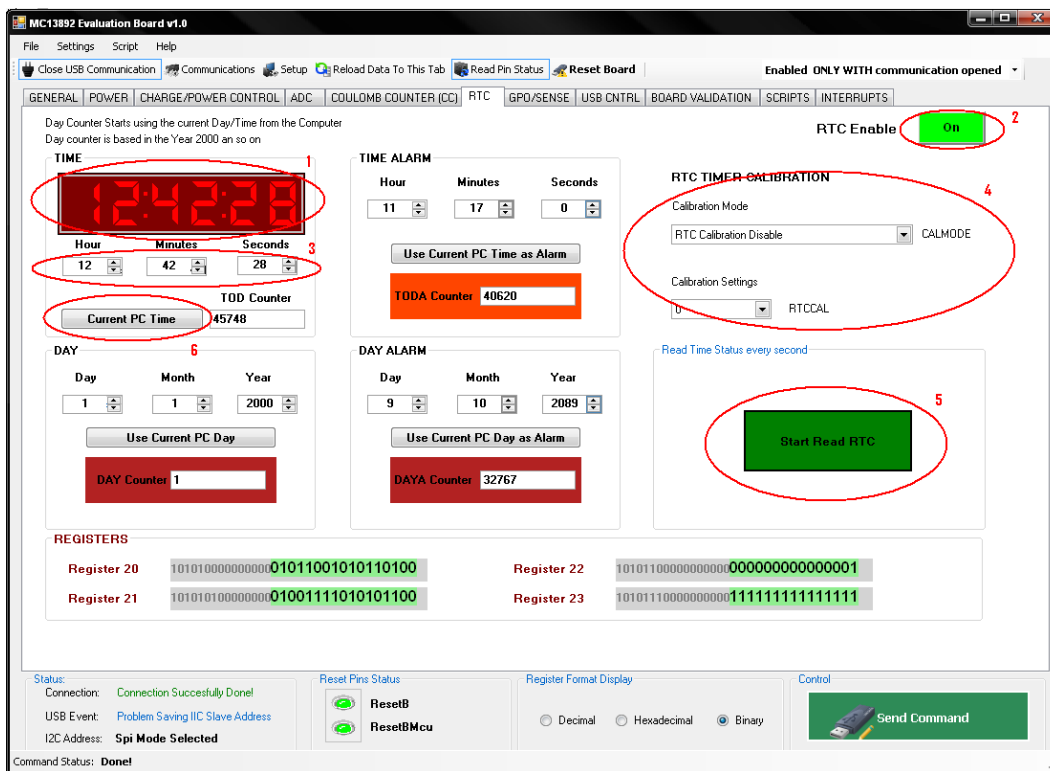


Figure 29. Real Time Clock Configuration Screen

The digital clock control (1) shows the current time of the RTC register of the MC13892. It is important to enable the RTC (2) and click on the “Send Command” button for it to begin. The time can be changed at any moment using the control text boxes (3). This tab also includes the RTC calibration controls (4).

If the “Start Read RTC” button (5) is enabled, the RTC will automatically refresh each second. This way its accuracy can be corroborated. It is important to mention that while the RTC is being automatically refreshed, the rest of the commands will be disabled.

As a special feature, a “Current PC Time” button (6) is available. This button reads the value of the computer clock, which can be sent later to the RTC time register by clicking the “Send Command” button. The “Use Current PC Day”, “Use current PC Time as Alarm”, and “Use current PC Day as Alarm” buttons will similarly set the corresponding time or day on their respective blocks.

7.7 GPO/Sense and USB Control Tabs

The GPO/Sense tab contains the controls for the GPO pins, and allows them to turn on and off, and configure their standby mode setting, as well as the ADC input control for GPO4. This tab also controls the Power Gating feature of the MC13892, and senses the state of the PUMS, MODE, CHRGSE1B pins, and whether the charger is configured in Single or Serial mode.

The USB Control tab, as its name indicates, contains all the controls of the bits that configure the USB block of the MC13892, including the enable bit of the VUSB regulator and the bits for OTG mode control.

7.8 Interrupts Tab

This tab contains a list of all the interrupt bits of the MC13892, their masks, and sense bits. For an interrupt bit to be reflected on the INT pin, its corresponding mask must be set to Off, and the “Send Command” button must be selected. The INT pin status can be read in the bottom right section of the Board Validation tab. Its status can be refreshed by clicking on the “Read Pin Status” button on top of the window. Note that the Interrupts tab indicates if the bits contained in each column are Read or Read/Write (1), signaling that the read only bits cannot be modified through the interrupt status tab.

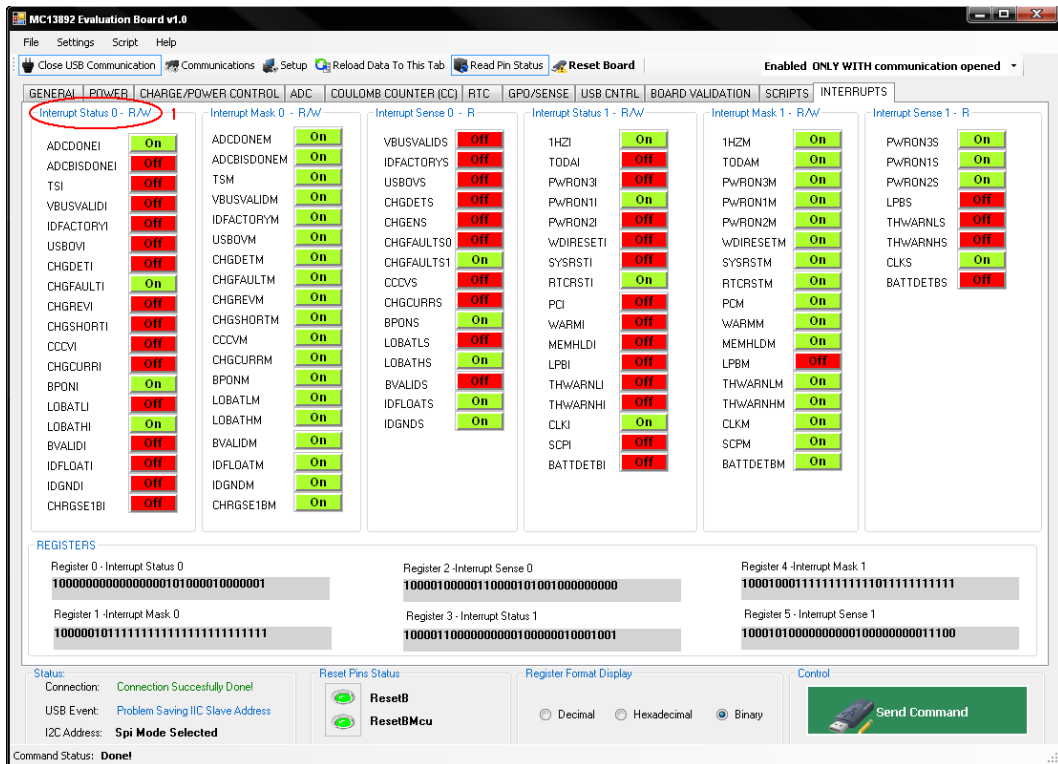


Figure 30. Interrupts Status Tab Screen

7.9 Board Validation and Scripts Tabs

These are two special tabs that control the overall functionality of the device, instead of a specific block like the rest of the tabs.

The “Register” combo box (1) contains a list of all the MC13892 registers, in which contents will be shown on the “Bytes” buttons (2) when they are selected in the combo box. The user can manually modify the contents of the registers by clicking on the buttons and sending the command with the “Send Command” button. The command to be sent will be shown in the “Command Assembled” text box (3).

A specific register can be read in the “Auxiliary Read Bytes” section (4) using the “Register” combo box placed there. The value of the register to be read will be shown in the “Bytes” text boxed on that section. This way, the user can (for example) check the result of an ADC conversion on the ADC2 register. They configure and trigger the ADC on the rest of the ADC registers using sections (1) and (2). The main purpose of the Auxiliary Read Bytes section is to read the contents from the MC13892, but not to write the registers.

In section (5), the CS, CHRGSE1B, STANDBY, STANDBYSEC, WDI, and PWRON1 pins can be controlled by clicking their respective buttons.

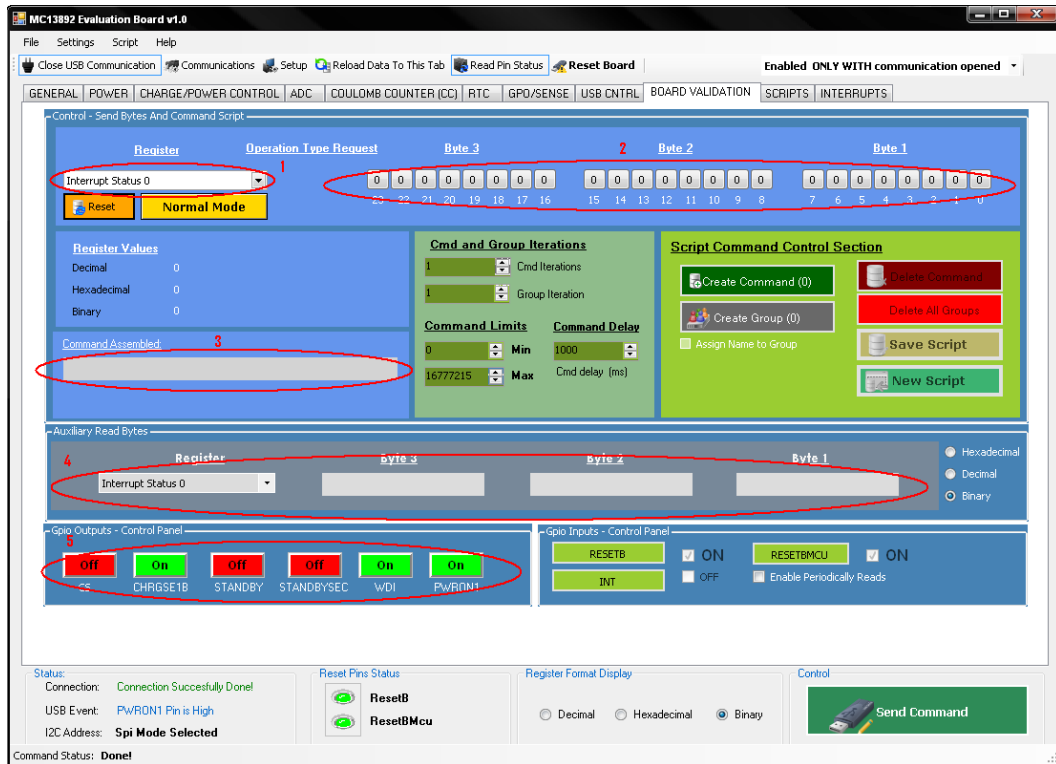


Figure 31. Board Validation Configuration Screen

7.9.1 Writing and Running a Script



Figure 32. Script Writing Configuration Command Section

A complete list of commands can be saved in a file to be run in series as a script. This is done with the “Board Validation” and “Scripts” tabs. To accomplish this, first click on the “Normal Mode” button (1) in [Figure 31](#). After clicking it, it will show that the tab is working in “Script Mode”, in which the “Send Command” button is disabled and the commands assembled are only intended to be saved into a file. A Read/Write button will appear (2). This button is to indicate if the assembled command is to read or write to a specific register.

Script writing steps to write a script are listed by the following:

1. Click the “Normal Mode” button (1) to go into Script Mode
2. Select the register to be read/written in the “Register” combo box right above the “Normal Mode” button
3. Specify if it will be a Read or Write command with the Read/Write button
4. Configure the data bits using the “Bytes” buttons on the right of the Read/Write button
5. Select the Command Iterations, Limits and Delay in section (3) of the window
 - Command Iterations indicate the number of times the command will be repeated
 - Command Limits is for Read commands. The user can set the limits that indicate if the read of a register is valid or not (as a decimal number). When the script runs, a write command will compare the read value with these limits and show if the command passed or failed. This is useful for example for ADC readings
 - The Command Delay box is to specify a determined delay after the command is executed. It is given in milliseconds
6. Click on the “Create Command” button on section (4) of the window. The command will be saved with the characteristics specified on section (3)
7. The software gives the possibility to iterate a bunch of commands that are saved in a group. To do this, after creating a bunch of commands and selecting the number of group iterations, click on the “Create Group” button, and all the commands will be saved under that specific group. After saving the commands into a group, they will be removed from the command list and a new group will begin. A specific name can be assigned to a group with the “Assign Name to Group” check box. All scripts must have at least one group in order to save them and all the commands must belong to a group, even if the group consists of a single command.
8. After all the commands and groups have been created and saved, click on the “Save Script” button to save the file

The “Delete Command” button shows a list of all the created commands. The user can select a specific one and delete it.

The “Delete All Groups” button deletes all the created groups from the RAM memory.

The “New Script” button removes all the commands and groups from the RAM memory after they have been saved to disk, to start a new script file.

7.9.2 Special RTC Commands and GPIO Commands

When running in Script Mode, special commands are added at the end of the list in the “Register” combo box. These commands are:

RTC Set Time of Computer Clock: Takes the value of the computer clock and writes it in the RTC time register.

RTC Time Compare Between Computer Clock and MC13892: Compares the value of the MC13892 RTC with the time of the computer clock.

GPIO “x” Write High/Low State: Where “x” represents CS, CHRGSE1B, STANDBY, STANDBYSEC, WDI, and PWRON1. These commands simply configure the state of the listed pins.

GPIO “x” Read State: Where “x” represents CS, CHRGSE1B, STANDBY, WDI, STANDBYSEC, PWRON1, RESETB, RESETBMCU, and INT. These commands read the state of the listed pins.

7.10 Running a Script

Once the script has been saved, the “Scripts” tab has all the controls to run it. In the “Control Panel” section (1), click on the “Read Script File” button and load the script. A list of all the commands of the loaded script will appear in the “Command” window (2). A summarized view of the script can be selected with the “Collapse Command Nodes” option on the Control Panel. After the script has been loaded, click on the “Start” button on the Control Panel, and all the commands will be executed.

The “Input and Output Monitor Terminal” (3) will show a detailed list of all the commands sent and received, and whether they passed or failed, according to the limits set when created. The log on this window can be saved after the script has finished by going to the Script – Save Log Into RTF File menu at the top of the screen.

The “Compare Read Values” (4) also shows if the command currently being executed passes or fails a comparison to the limits.

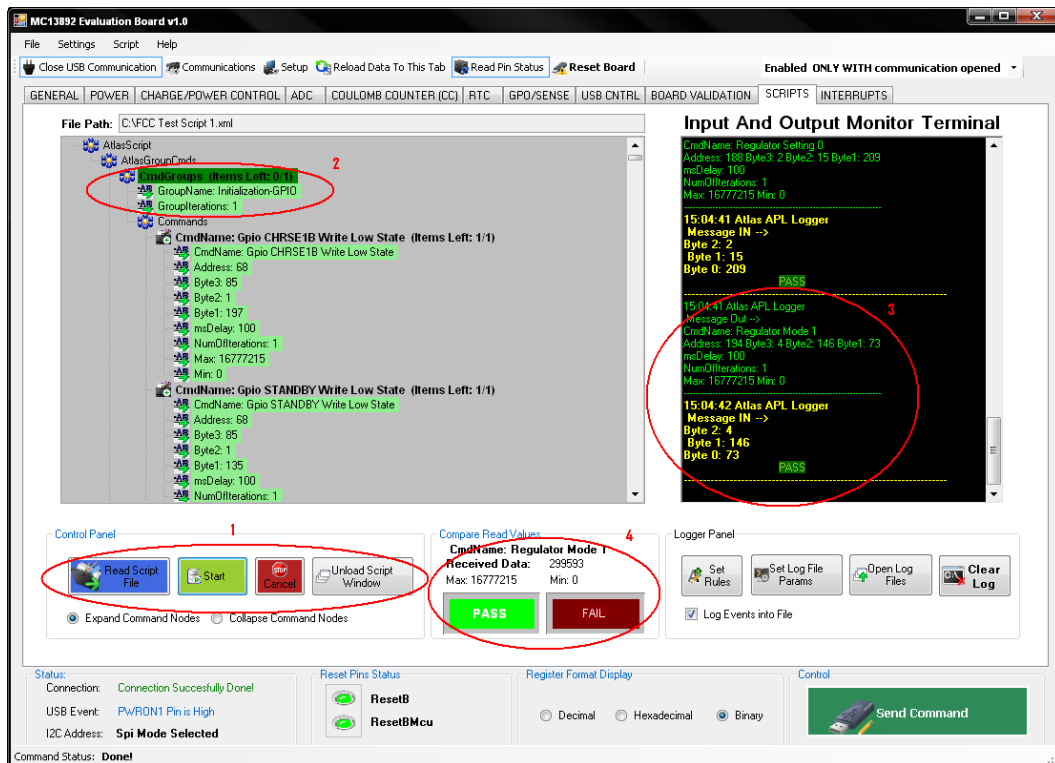


Figure 33. Script Configuration Tab Screen

7.11 Brief Example: Writing a Quick Script

The following example shows the steps to follow to write a script that will turn on and off the RGB LEDs:

1. Go to the “Board Validation” tab and click on the “Normal Mode” button to select Script Mode
2. In the “Registers” combo box select the “GPIO WDI Write High State” command
3. Set a command delay of 100 ms. The command iterations and limits can be left with the default values
4. Click on the “Create Command” button
5. In the “Registers” combo box select the “GPIO PWRON1 Write High State” command
6. Set a command delay of 100 ms. The command iterations and limits can be left with the default values
7. Click on the “Create Command” button
8. In the “Registers” combo box select the “GPIO PWRON1 Write High State” command
9. Set a command delay of 100 ms. The command iterations and limits can be left with the default values

10. Click on the “Create Command” button
11. Select the “Assign Name to Group” option, and write “Turn on Sequence” in the group name text box
12. Click on the “Create Group” button
13. In the “Registers” combo box, select the “LED Control 2” register, and with the “Bytes” buttons set the following value: 10010000 00001001 00000000. This will turn on the red and green LEDs
14. Set a command delay of 100 ms. The command iterations and limits can be left with the default values
15. Click on the “Create Command” button
16. In the “Registers” combo box, select the “LED Control 3” register, and with the “Bytes” buttons set the following value: 00000000 00011001 00000000. This will turn on the blue LED and the SWBST for supplying the LEDs
17. Set a command delay of 1000 ms. The command iterations and limits can be left with the default values
18. Click on the “Create Command” button
19. In the “Registers” combo box, select the “LED Control 2” register, and with the “Bytes” buttons set the following value: 00000000 00000000 00000000. This will turn off the red and green LEDs
20. Set a command delay of 100 ms. The command iterations and limits can be left with the default values
21. Click on the “Create Command” button
22. In the “Registers” combo box, select the “LED Control 3” register, and with the “Bytes” buttons set the following value: 00000000 00000000 00000000. This will turn off the blue LED and the SWBST for supplying the LEDs
23. Set a command delay of 1000 ms. The command iterations and limits can be left with the default values
24. Click on the “Create Command” button
25. Select the “Assign Name to Group” option, and write “Loop” on the group name text box
26. Set a group iterations value of 3
27. Click on the “Create Group” button
28. Click on the “Save Script” button and select a location and a name for the script
29. Load the script in the “Scripts” tab using the “Read Script File” button
30. Verify the connections of the KITUSBCOMDGLVME and the KIT13892VxEVBEJ.
31. Click on the “Start” button of the “Scripts” tab to run the script

The following example shows a script that will read, and compare the battery voltage and the RTC time. This is a more complex script with which the user will start getting acquainted with the read value comparator:

1. Go to the “Board Validation” tab and click on the “Normal Mode” button to select Script Mode
2. In the “Registers” combo box, select the “GPIO WDI Write High State” command
3. Set a command delay of 100 ms. The command iterations and limits can be left with the default values
4. Click on the “Create Command” button
5. In the “Registers” combo box, select the “GPIO PWRON1 Write High State” command
6. Set a command delay of 100 ms. The command iterations and limits can be left with the default values
7. Click on the “Create Command” button
8. In the “Registers” combo box, select the “GPIO PWRON1 Write High State” command
9. Set a command delay of 100 ms. The command iterations and limits can be left with the default values
10. Click on the “Create Command” button
11. Select the “Assign Name to Group” option and write “Turn on Sequence” on the group name text box
12. Click on the “Create Group” button
13. In the “Registers” combo box, select the “RTC Set Time From Computer Clock” command
14. Set a command delay of 100 ms. The command iterations and limits can be left with the default values
15. Click on the “Create Command” button
16. In the “Registers” combo box, select the “ADC 1” register, and with the “Bytes” buttons set the following value: 00000000 00000000 00000001. This will set the ADEN bit to enable the ADC

17. Ensure the Read/Write button says “Write” and set a command delay of 100 ms. The command iterations and limits can be left with the default values
18. Click on the “Create Command” button
19. In the “Registers” combo box, select the “ADC 1” register, and with the “Bytes” buttons set the following value: 00000000 00000000 00000111. This will set the ADCCAL bit to calibrate the ADC, set the RAND bit in order to make a single channel conversion, and configure the ADAx bits to 000 (channel 0 – Battery Voltage)
20. Set a command delay of 100 ms. The command iterations and limits can be left with the default values
21. Click on the “Create Command” button
22. Select the “Assign Name to Group” option and write “Initialization” on the group name text box
23. Click on the “Create Group” button
24. In the “Registers” combo box, select the “ADC 1” register, and with the “Bytes” buttons set the following value: 00010000 00000000 00000011. This will trigger the ADC to start a conversion
25. Set a command delay of 1000 ms. The command iterations and limits can be left with the default values
26. Click on the “Create Command” button
27. In the “Registers” combo box, select the “ADC 2” register. Ensure the Read/Write button says “Read”. The GUI will disregard the value contained on the “Bytes” buttons since this is a read command, so they can be left as zeroes
28. Set a command delay of 100 ms. Set the commands limits as min = 10488320 and max = 12585984 (equivalent to a min of 3.0 V and a max of 3.3 V on the battery voltage)
29. Click on the “Create Command” button
30. In the “Registers” combo box, select the “RTC Time Compare Between Computer Clock and MC13892” command. This command will ignore the Read/Write button and the values contained on the “Bytes” buttons
31. Click on the “Create Command” button
32. Select the “Assign Name to Group” option and write “Loop” on the group name text box
33. Set a group iterations value of 3
34. Click on the “Create Group” button
35. Click on the “Save Script” button and select a location and a name for the script
36. Load the script on the “Scripts” tab using the “Read Script File” button
37. Verify the connections of the KITUSBCOMDGLVME and the KIT13892VxEVBEJ.
38. Ensure the MC13892 has 3.3 V on the BATT pin
39. Click on the “Start” button of the “Scripts” tab in order to run the script

8 KIT13892VKEVBEJ Board Layout

8.1 Assembly Top

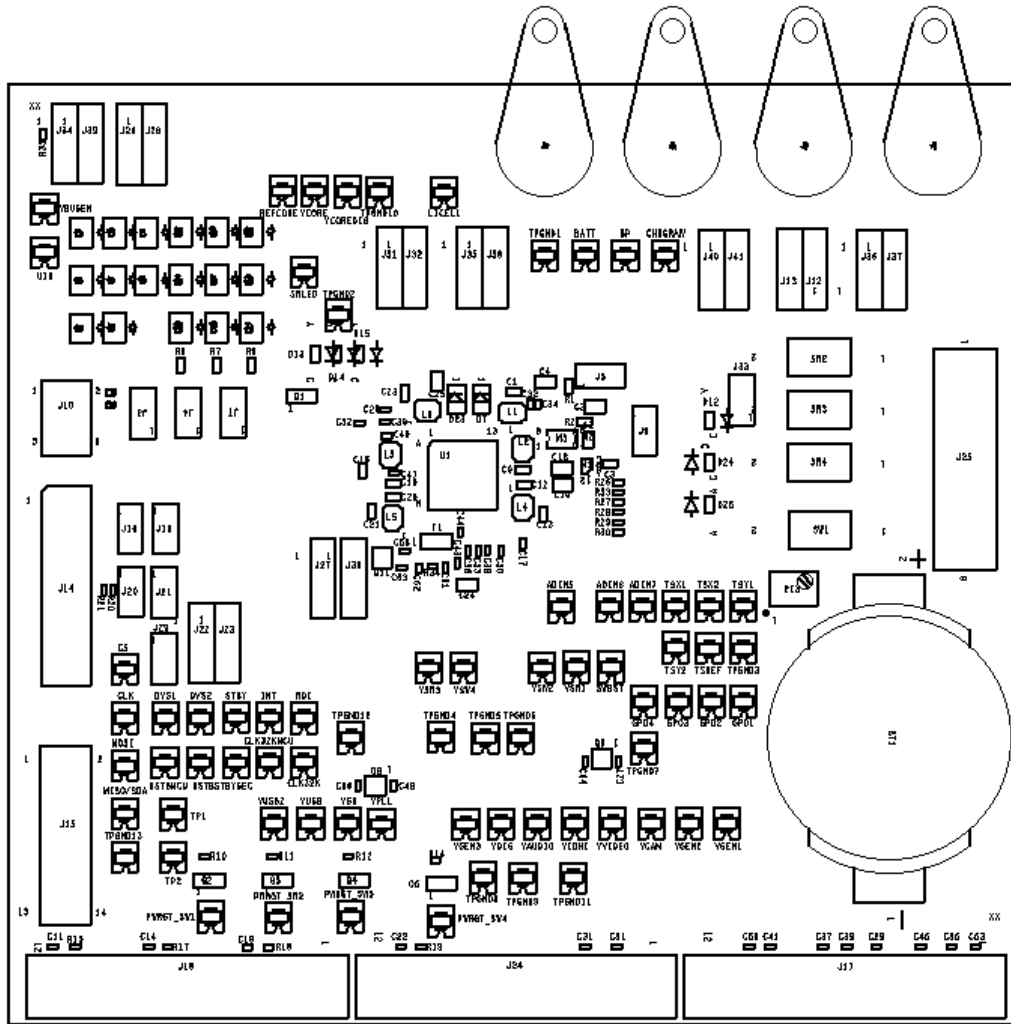


Figure 34. 13892VK Top Assembly Layer

8.2 Top Layout

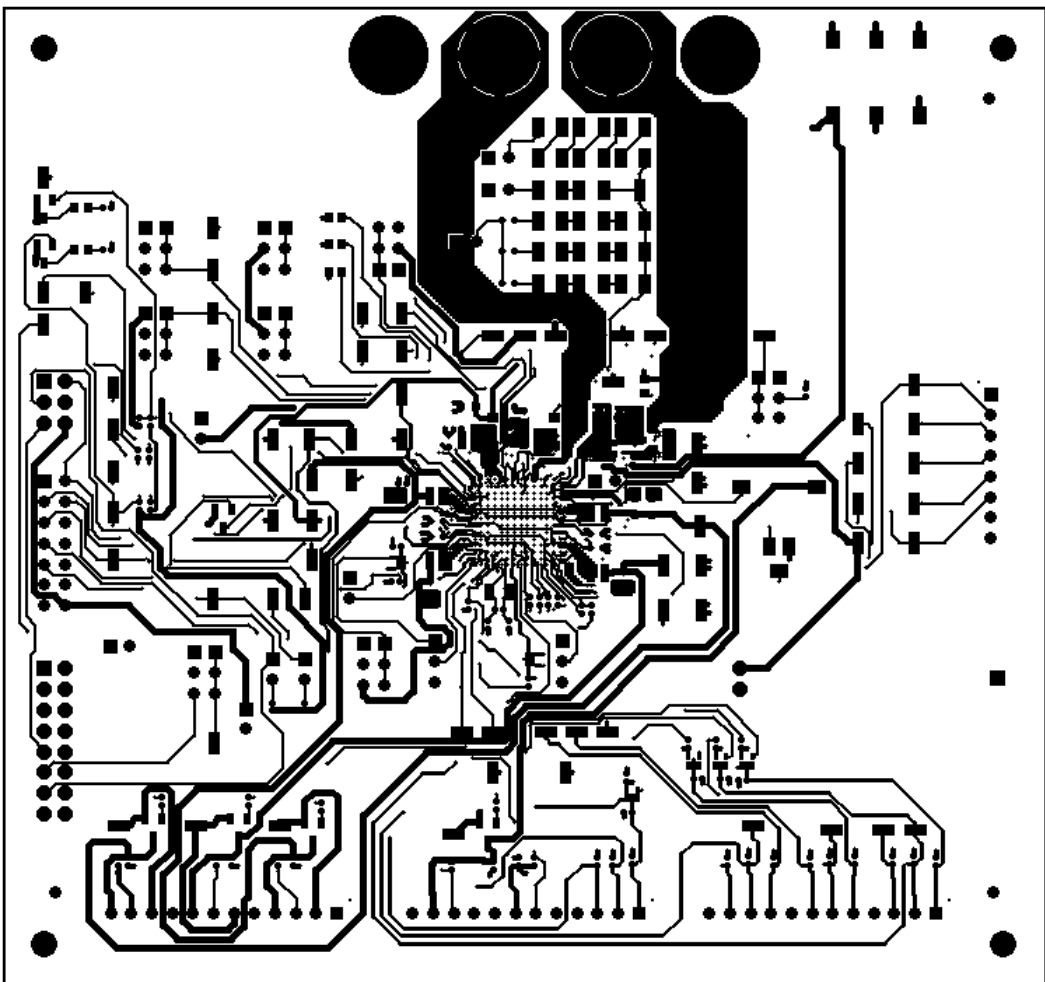


Figure 35. 13892VK Top Layout Layer

8.3 Bottom Layout

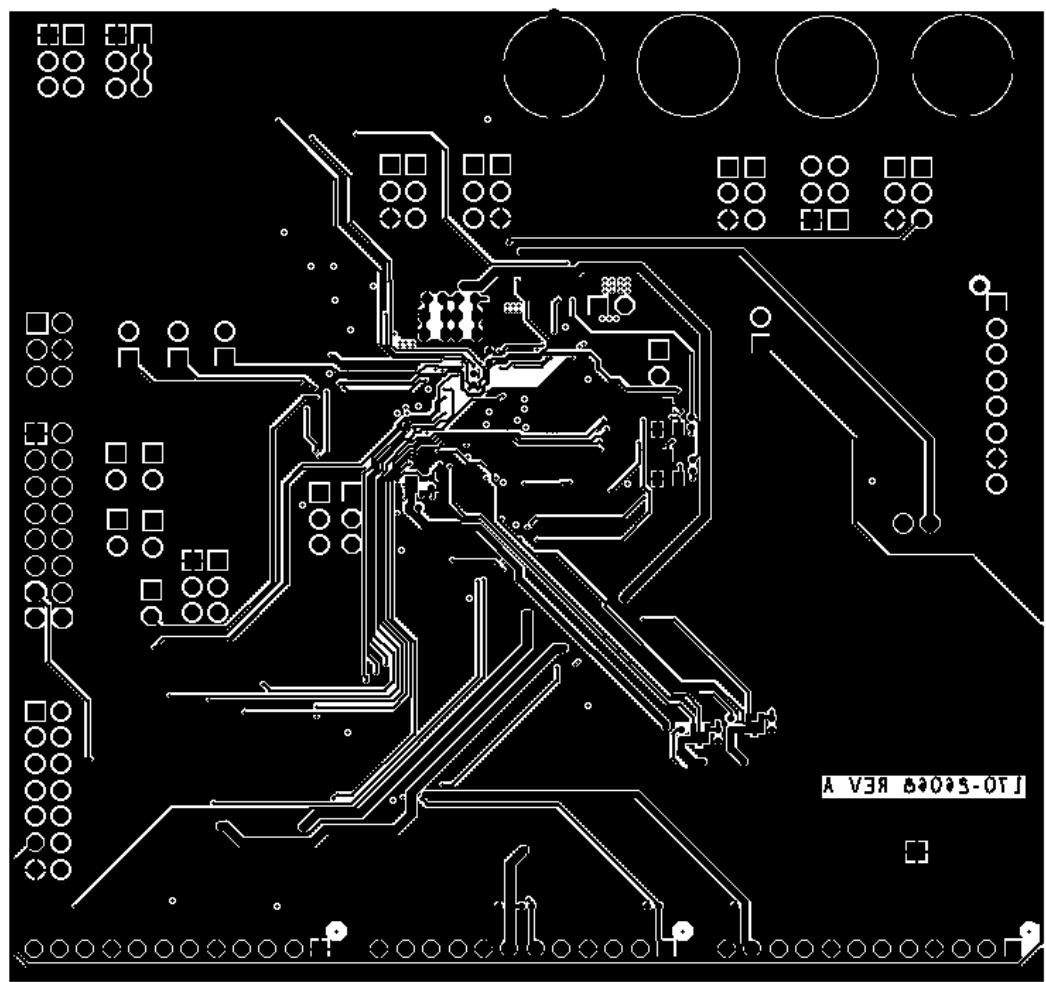


Figure 36. 13892VK Bottom Layout Layer

8.4 Bottom Assembly and Silk Screen

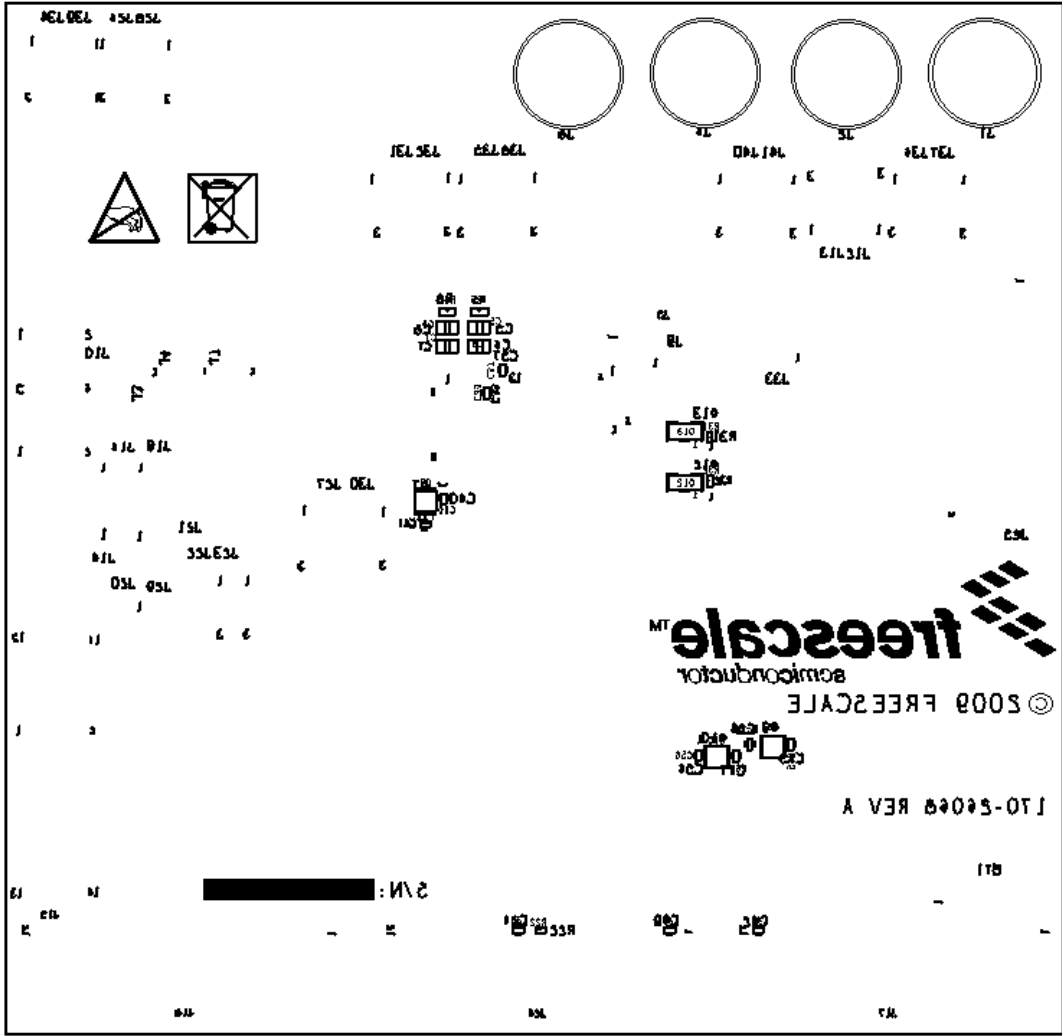
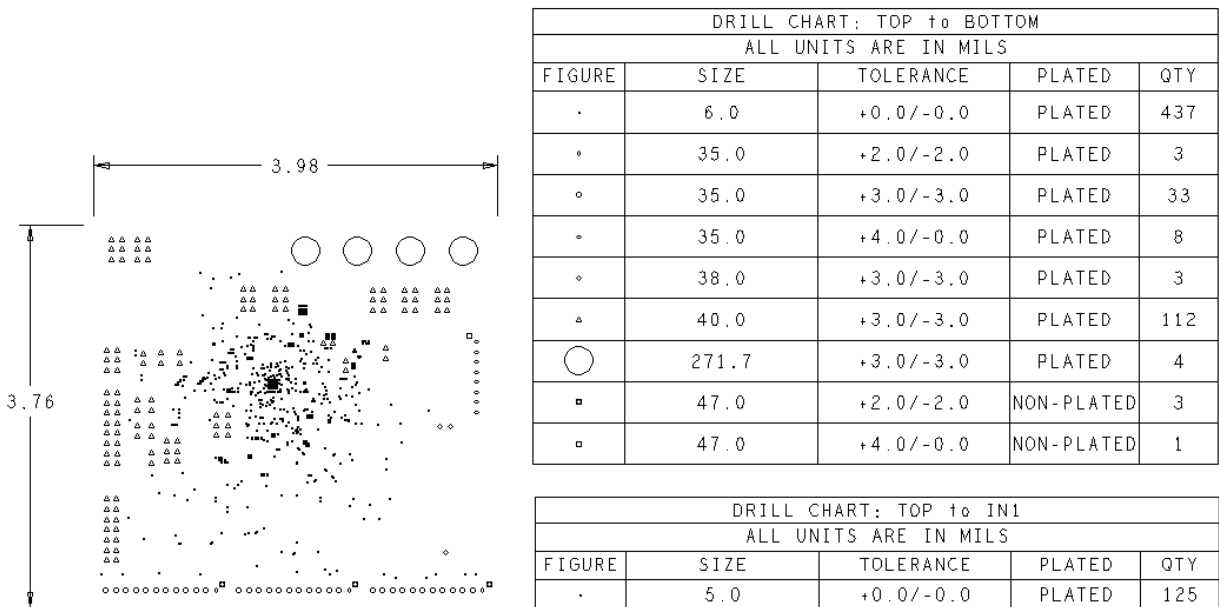


Figure 37. 13892VJ bottom assembly and silk screen layer

8.5 Fabrication Drawing



- THIS DRAWING SPECIFIES THE REQUIREMENTS FOR A MULTILAYER PRINTED WIRING BOARD IN ACCORDANCE WITH SPECIFICATION IPC-A-600 (LATEST REVISION).
- BASIC GRID INCREMENT AT 1:1 IS .0001.
- BASE MATERIAL - HIGH GRADE FR4
- COPPER FOIL WEIGHT - FINISH AT 0.5OZ REQUIRED ON TOP LAYER AND 1OZ FOR THE REST OF THE LAYERS
- SUPPLIER MARKINGS - ON SOLDER SIDE ONLY, WHERE SHOWN.
- PLATING FINISH - BOTH SIDES IMMERSION GOLD:
 - 75.2-203.2 MILLIMICRON (3-8 MICROINCH) OF GOLD OVER
 - 2,540-5,080 MILLIMICRON (100-200 MICROINCH) MINIMUM NICKEL.
- ALL THROUGH HOLE VIAS MUST COVER WITH SOLDERMASK.
- SOLDERMASK - GREEN TAIYO, BOTH SIDES
- SILK SCREEN - WHITE EPOXY INK, BOTH SIDES. NO SILK ON PADS.
- ELECTRICAL TEST - 100% IPCD356
- PRINTED WIRING BOARD IS TO BE INDIVIDUALLY BAGGED.
- DRC'S MUST BE RUN ON THE GERBER BEFORE BUILDING BOARDS UNLESS PRIOR APPROVAL IS GIVEN IN WRITING BY FREESCALE.
- ADD TEARDROPS TO ALL SIGNAL LAYERS.
- SOLDER SAMPLES TO BE PROVIDED.

Figure 38. 13892VK Fabrication Drawing

9 KIT13892VLEVBEJ Board Layout

9.1 Assembly Top

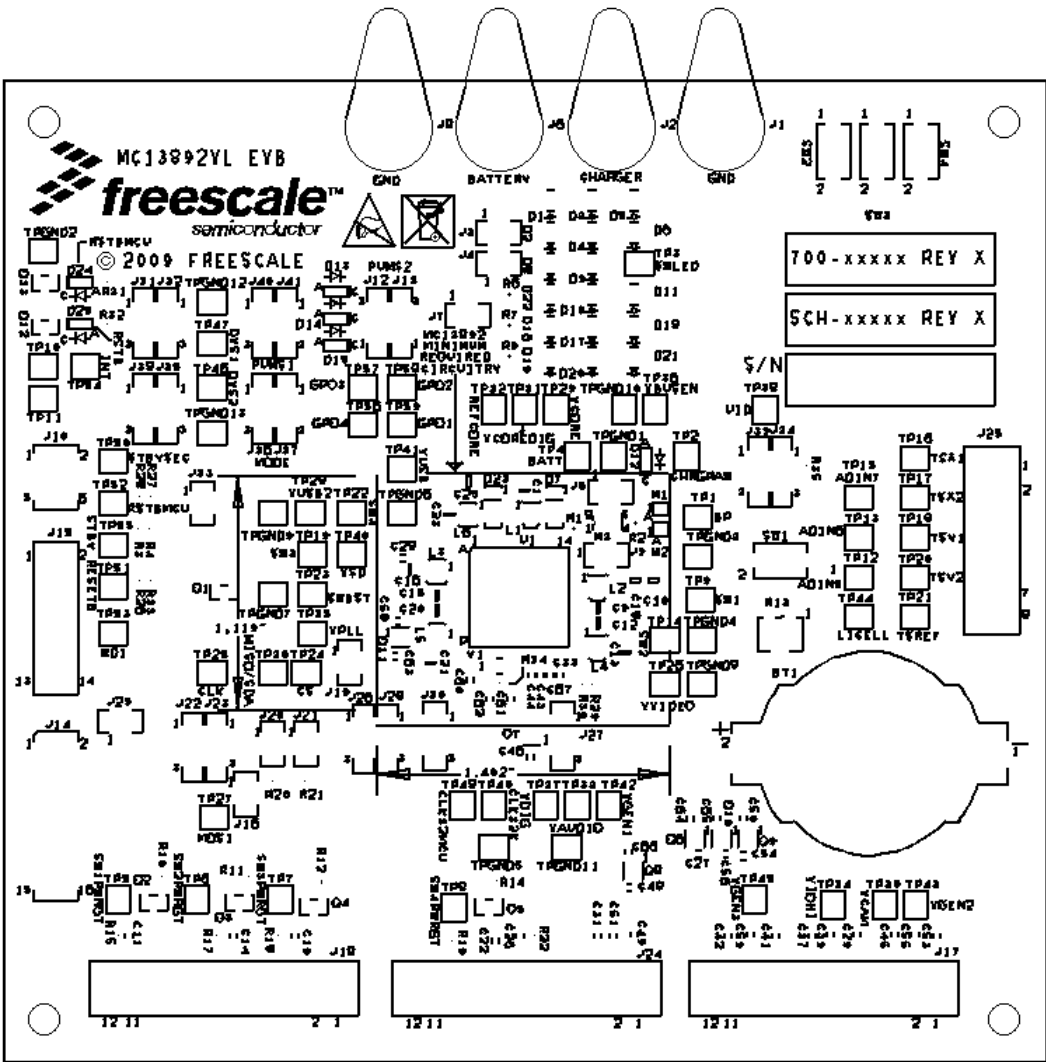


Figure 39. 13892VL Top Assembly and Silk Screen Layer

9.2 Top Layout

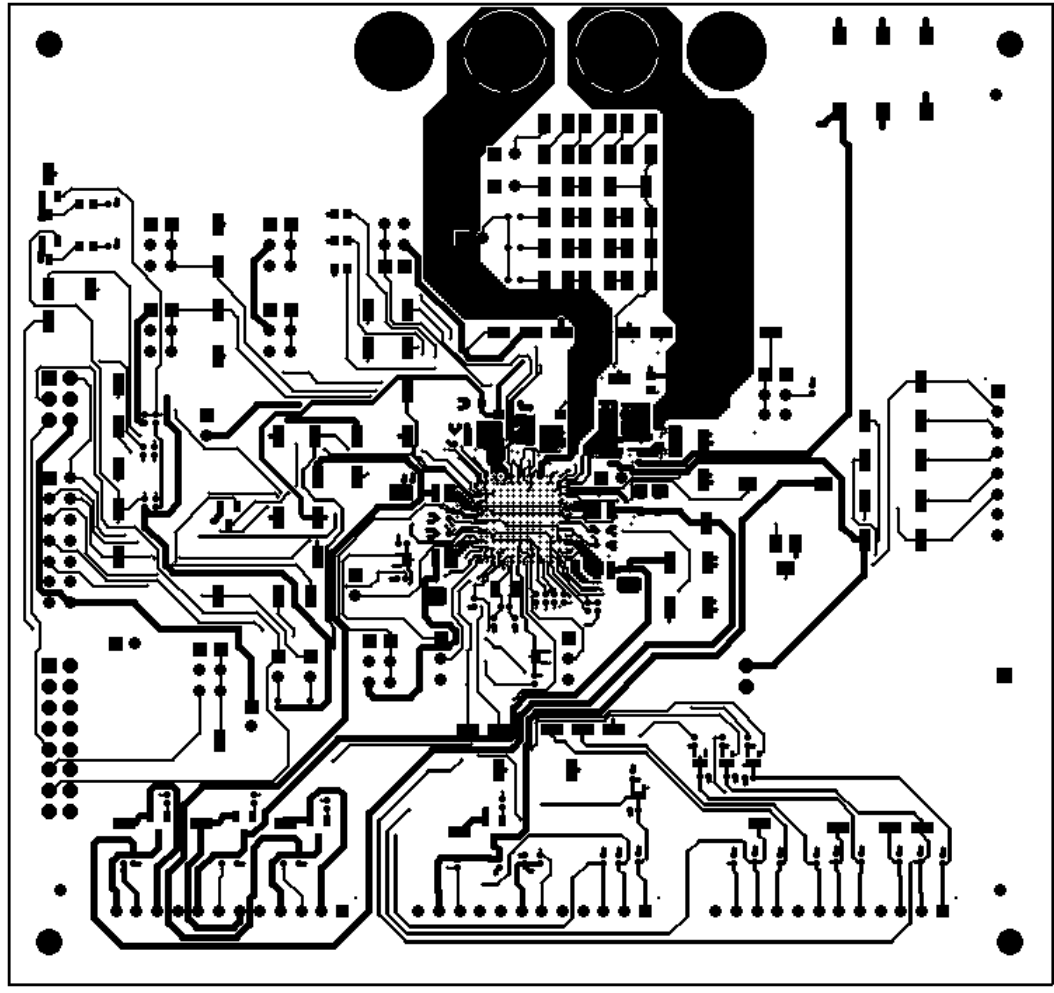


Figure 40. 13892VL Top Layout Layer

9.3 Bottom Layout

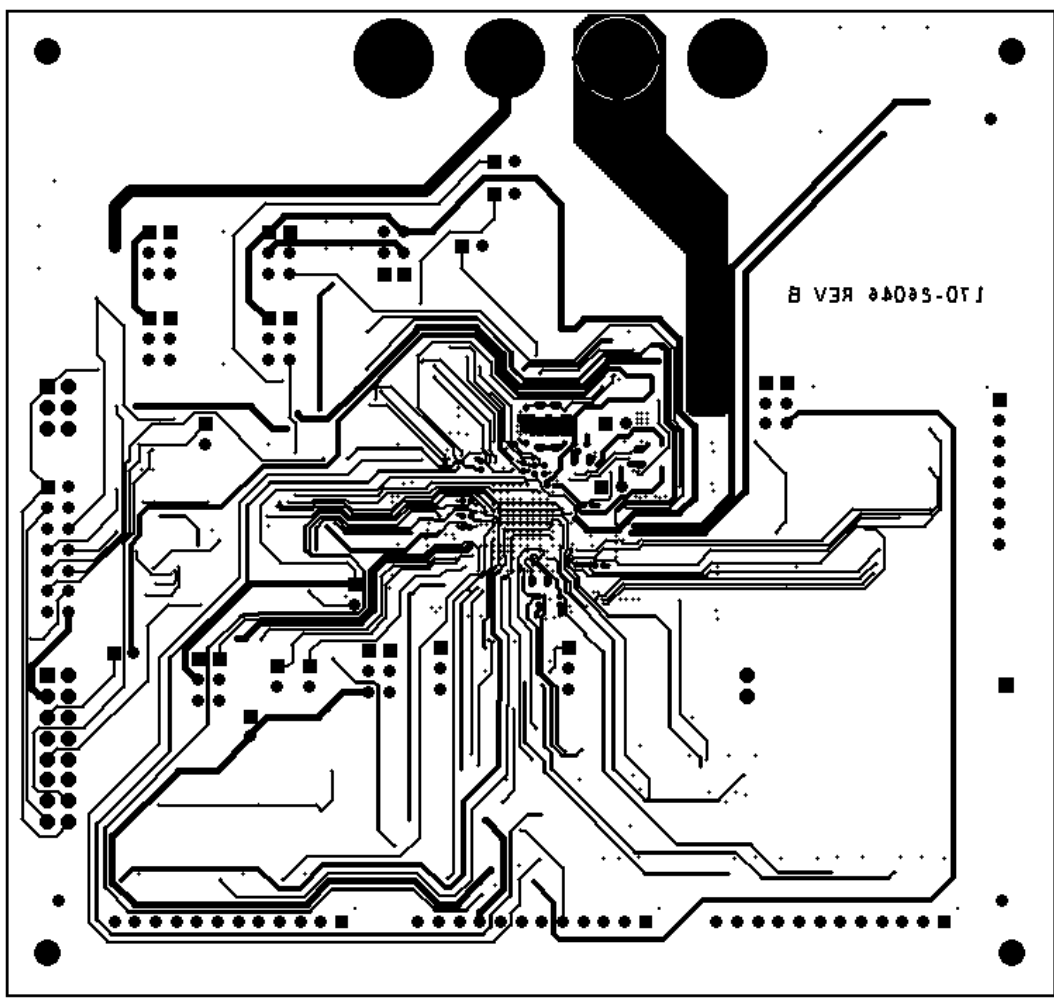


Figure 41. 13892VL Bottom Layout Layer

9.4 Bottom Assembly and Silk Screen

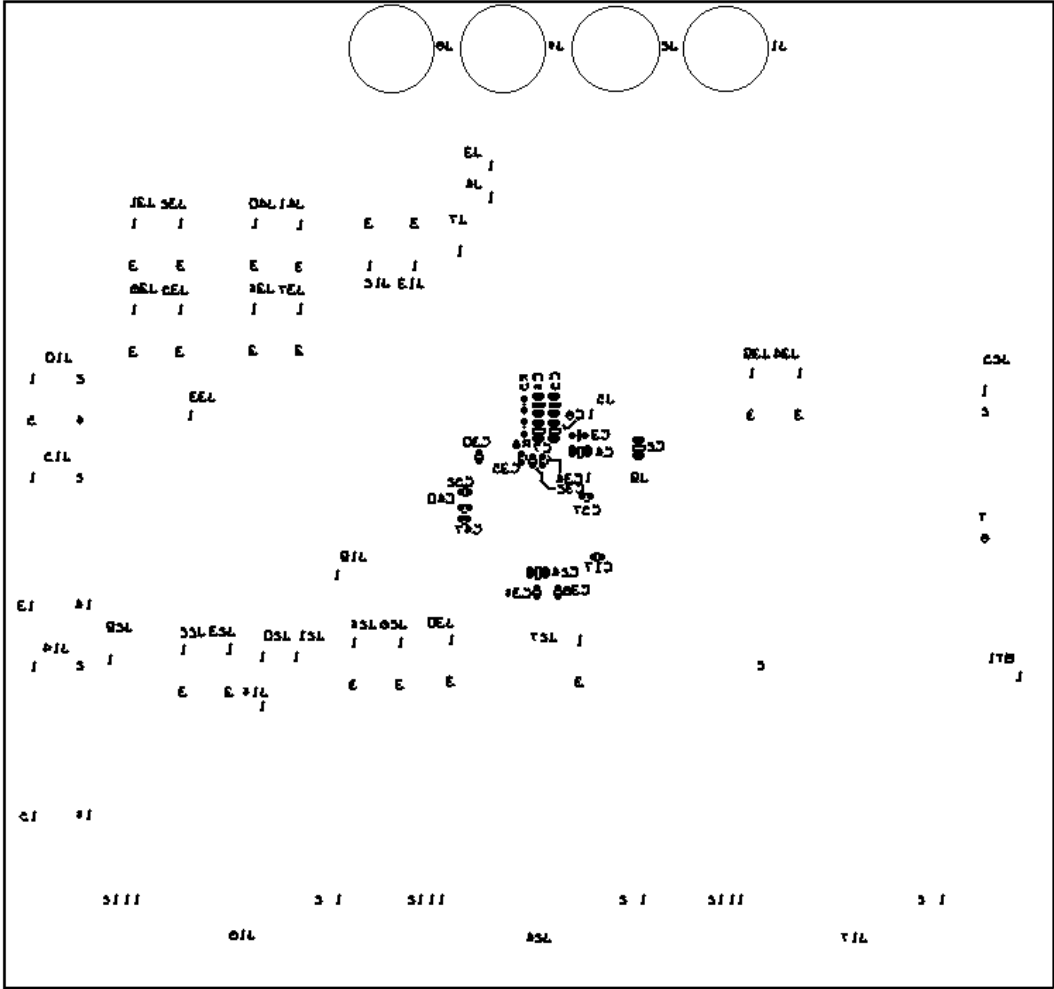
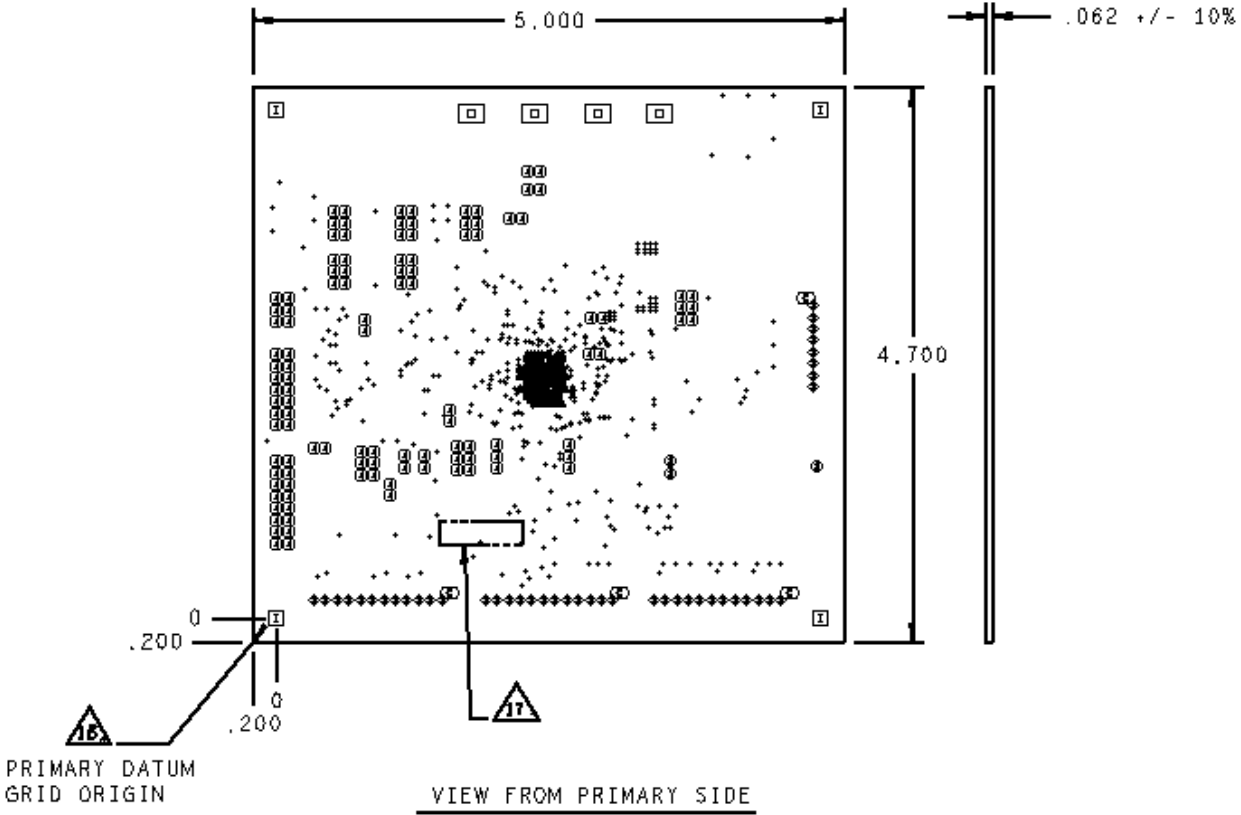


Figure 42. 13892 Bottom Assembly and Silk Screen Layer

9.5 Fabrication Drawing



DRILL CHART: TOP to BOTTOM
ALL UNITS ARE IN MILS

FIGURE	SIZE	TOLERANCE	PLATED	QTY
•	6.0	+0.0/-6.0	PLATED	378
▲	6.1	+0.0/-6.0	PLATED	118
◆	35.0	+3.0/-3.0	PLATED	44
⊙	38.0	+3.0/-3.0	PLATED	3
⊘	40.0	+3.0/-3.0	PLATED	112
□	271.65	+3.0/-3.0	PLATED	4
⊞	47.0	+3.0/-3.0	NON-PLATED	4
⊠	125.0	+4.0/-4.0	NON-PLATED	4

Figure 43. 13892VL Fabrication Drawing

10 KITUSBCOMDGL Board Layout

10.1 Assembly Top

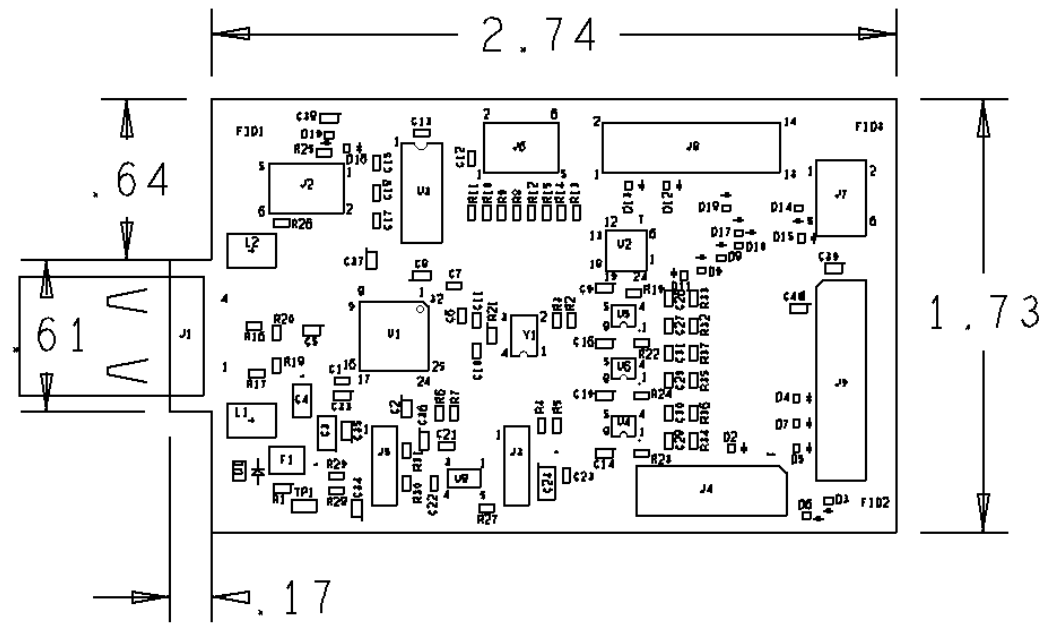


Figure 44. USBCONDG Top Assembly Layer

10.2 Bottom Layout

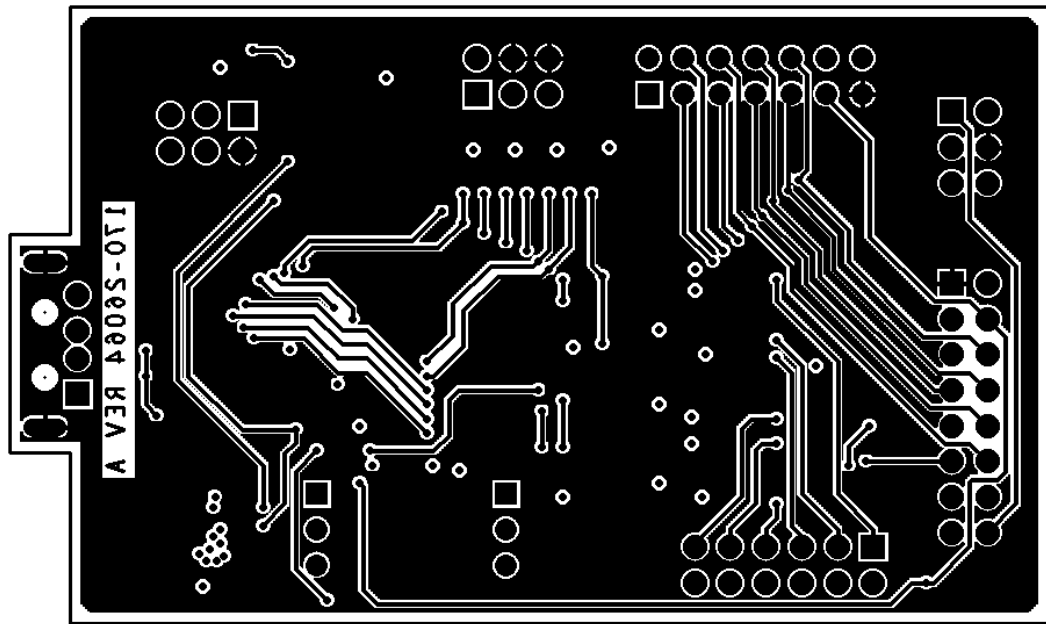


Figure 45. USBCOMDGL Bottom Layout Layer

10.3 Top Layout

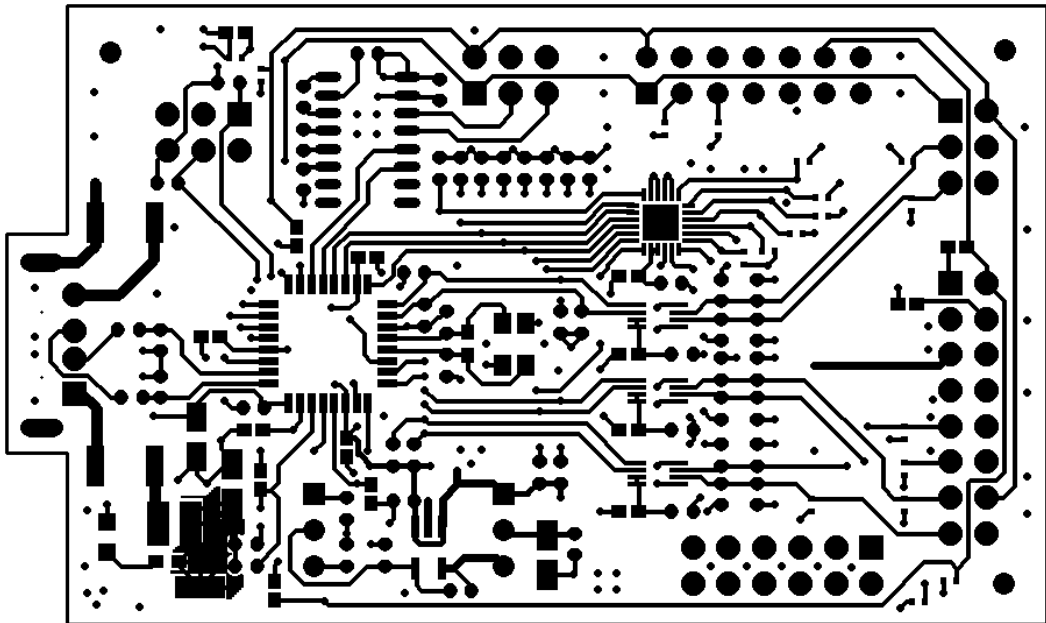
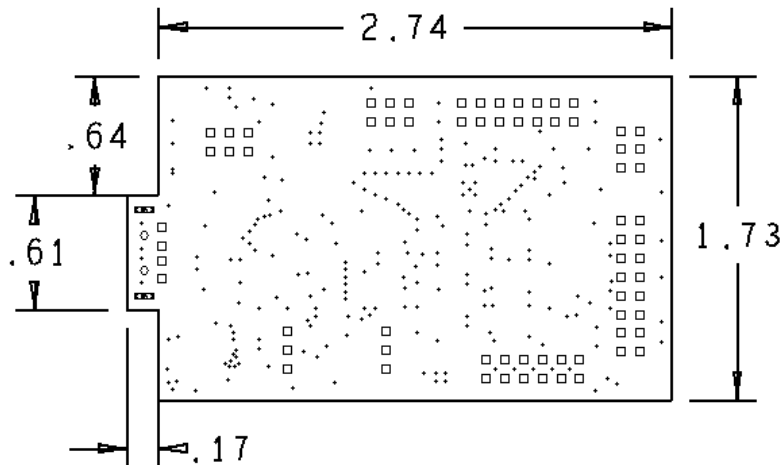


Figure 46. USBCOMDG Top Layout Layer

10.4 Fabrication Drawing



DRILL CHART: TOP to BOTTOM				
ALL UNITS ARE IN MILS				
FIGURE	SIZE	TOLERANCE	PLATED	QTY
.	13.0	+3.0 / -3.0	PLATED	237
□	40.0	+3.0 / -3.0	PLATED	70
◦	43.0	+3.0 / -3.0	NON-PLATED	2
▢	98.0x28.0	+3.0 / -3.0	PLATED	2

Figure 47. USBCOMDG Fabrication Drawing

11 KIT13892VxEVBEJ Bill of Material

Qty	Reference	Value	Description	Manufacturer	Part Number
1	BT1	HU2477N-LF	Battery Holder CR2477 Top Load Horizontal TH	Renata Batteries	HU2477N-LF
6	C1, C9, C12, C15, C20, C23	4.7µF	CAP CER 4.7µF 10V 10% X5R 0603	Taiyo Yuden	LMK107BJ475KA-T
8	C2, C4, C5 ⁽²⁾ , C6 ⁽²⁾ , C7 ⁽²⁾ , C8 ⁽²⁾ , C24, C25	10.0µF	CAP CER 10µF 16V 10% X7R 0805	Capax Technologies Inc.	0805X106K160SNT
1	C3	2.2µF	CAP CER 2.2µF 16V 10% X5R 0603	Murata	GRM188R61C225KE15D
2	C10,C18	22µF	CAP CER 22µF 10V 20% X5R 0805	Taiyo Yuden	LMK212BJ226MG-T
17	C11,C14,C19,C22,C26, C29,C31,C37,C39,C41, C42,C45,C49,C51,C53, C55,C59	0.1µF	CAP CER 0.1µF 10V 10% X5R 0402	Kemet	C0402C104K8PAC
3	C13,C16,C21	10µF	CAP CER 10µF 6.3V 20% X5R 0603	Panasonic	ECJ1VB0J106M
26	C17,C27,C28,C30,C32, C33,C34,C36,C38,C40, C43,C44,C46,C47,C48, C50,C52,C54,C56,C58, C60,C63,C64, C65,C66, C67	2.2µF	CAP CER 2.2µF 6.3V 20% X5R 0402	Murata	GRM155R60J225ME15D
2	C35,C57	0.1µF	CAP CER 0.1µF 16V 10% X7R 0402	Venkel Company	C0402X7R160-104KNE
2	C61,C62	18PF	CAP CER 18PF 50V 1% C0G 0402	Capax Technologies Inc.	0402G180F500SNT
19	D1,D2,D3,D4,D5,D6,D8, D9,D10,D11,D16,D17, D18,D19,D20,D21,D22	LED WHITE	LED White SGL 35MA SMT	Nichia	NSSW100CT
1	D7 ⁽²⁾	MBR140SFT	Diode SCH PWR RECT 1A 40V SOD123	ON Semiconductor	MBR140SFT1G
2	D12,D13	LED_RED	LED Super Bright Red SMD 0603	Kingbright	AP1608SRC
3	D14,D24,D25	LED_GREEN	LED GRN SGL 30MA SMT 0603	Kingbright	AP1608MGC
1	D15	BLUE	LED BL SGL 30MA SMT 0603	Kingbright	APT1608QBC/D
1	D23	MBR120LSFT1G	Diode SCH PWR RECT 1A 20V SMT	ON Semiconductor	MBR120LSFT1G
4	J1,J2,J6,J8	BANANA	CON 1 Banana Uninsulated TH -- 531H NI	Johnson Components Inc.	108-0740-001
11	J3,J4,J5,J7,J9,J16,J19, J20,J21,J29,J33	HDR 1X2 TH	HDR 1X2 TH 100MIL SP 330H AU 100L	3M	929647-01-02-EU
18	J12,J13,J22,J23,J26,J27, J28,J30,J31,J32,J34,J35, J36,J37,J38,J39,J40,J41	HDR_1X3	HDR 1X3 TH 100MIL SP 330H SN 95L	Framatome Connectors International	68001-403HLF
1	J10	HDR_2x3	HDR 2X3 TH 100MIL CTR 330H SN 115L	Samtec	TSW-103-23-T-D
1	J14	HDR_2X8	HDR 2X8 TH 100MIL CTR 330H AU	Samtec	TSW-108-07-G-D
1	J15	HDR_2X7	HDR 2X7 TH 100MIL CTR 330H AU	Samtec	TSW-107-23-T-D
3	J17,J18,J24	CON PLUG 12	CON 1X12 PLUG SHRD TH 2.5MM SP 346H SN 110L	JST MFG. CO	B12B-XASK-1N-A
1	J25	CON_1X8	CON 1X8 PLUG SHRD TH 2.5MM SP 346H SN	JST MFG. CO	B08B-XASK-1-A(LF)(SN)
1	L1 ⁽²⁾	3.3µH	IND PWR 3.3µH@100KHZ 1.4A 20% SMT	TDK	VLS252012T-3R3MR99
1	L2	1.5µH	IND PWR 1.5µH@1MHZ 2A 30% SMT	TDK	VLS252012T-1R5N1R4
4	L3,L4,L5,L6	2.2µH	IND PWR 2.2µH@1MHZ 1.8A 20% SMT	TDK	VLS252012T-2R2M1R3
2	M1,M2	FDZ193P	TRAN PMOS PWR 20V 3A BGA6	Fairchild	FDZ193P

Qty	Reference	Value	Description	Manufacturer	Part Number
1	M3	NTHS2101P	TRAN MOSFET PWR SGL P-CHANNEL 8V 7.5A CHIPFET	ON Semiconductor	NTHS2101PT1G
3	Q1,Q12,Q13	2N7002	TRAN NMOS 60V 115MA SOT23	ON Semiconductor	2N7002LT1G
4	Q2,Q3,Q4,Q5	MGSF1N02LT1G	TRAN NMOS PWR 20V 750MA	ON Semiconductor	MGSF1N02LT1G
6	Q6,Q7,Q8,Q9,Q10,Q11	NSS12100UW3	TRAN PNP PWR 1A 12V WDFN3	ON Semiconductor	NSS12100UW3TCG
1	R1	0.02	RES MF 0.02 OHM 1/5W 1% 0603	Vishay Intertechnology	CRCW0603R020FKEAEL
1	R2	0.1	RES MF 0.10 OHM 1/8W 5% 0603	Venkel Company	LCR0603-R100JT
11	R3,R4,R10,R11,R12,R14,R15,R17,R18,R19,R22	0	RES MF ZERO OHM 1/16W 5% 0402	ROHM	MCR01MZPJ000
2	R5 ⁽²⁾ ,R8 ⁽²⁾	1.0M	RES MF 1.0M 1/10W 1% 0603	KOA Speer	RK73H1JTDD1004F
3	R6,R7,R9	51	RES MF 51 OHM 1/10W 5% 0603	KOA Speer	RK73B1JTDD510J
1	R13	20K	RES POT 20K 1/4W 10% SMT	Bourns	3224W-1-203E
2	R20,R21	560	RES MF 560 OHM 1/16W 5% 0402	Venkel Company	CR0402-16W561JT
7	R26 ⁽²⁾ , R27, R28 ⁽²⁾ , R29, R30 ⁽²⁾ , R33, R35	200K	RES MF 200K 1/16W 5% 0402	Yageo America	RC0402JR-07200KL
2	R31,R32	200	RES MF 200 OHM 1/16W 0.1% 0402	Vishay Intertechnology	MCS04020D2000BE100
4	SW1,SW2,SW3,SW4	FSMSM	SW SPST PB 12V 50MA SMT	Tyco Electronics	1437566-4
13	TPGND1,TPGND2,TPGND3,TPGND4,TPGND5,TPGND6,TPGND7,TPGND8,TPGND9,TPGND10,TPGND11,TPGND12,TPGND13	BLACK	Test Point Pad Size 3.4MM X 1.8MM SMT	Keystone Electronics	5015
26	TP1,TP2,TP3,TP4,TP5,TP6,TP7,TP8,TP9,TP14,TP19,TP22,TP23,TP26,TP28,TP33,TP34,TP35,TP37,TP39,TP40,TP41,TP42,TP43,TP44,TP45				
33	TP10,TP11,TP12,TP13,TP15,TP16,TP17,TP18,TP20,TP21,TP24,TP25,TP27,TP29,TP30,TP31,TP32,TP36,TP38,TP46,TP47,TP48,TP49,TP50,TP51,TP52,TP53,TP54,TP55,TP56,TP57,TP58,TP59				
1	U1	MC13892 MC13892	IC MCU PWR Management BGA 186 (12X12MM) IC MCU PWR Management BGA139(7X7MM)	Freescale Semiconductor	MC13892VL MC13892VK
1	Y1	32.768KHZ	XTAL 32.768KHZ RSN -- SMT	Micro Crystal	CC7V-T1A 32.768KHZ 9PF+/-30PPM
9	Extra	Jumper	Shorting Jumper Unplated BLK	3M	929950-00
3	Extra	Cable	1x12	Custom	600-76735
1	Extra	Cable	1x8	Custom	600-76838

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

12 KITUSBCOMDGLVME Bill of Material

Reference	Value	Description	Manufacturer	Part Number
U1	MC9S08JM8CLCE	IC MCU 8BIT 8K FLASH 1K RAM 48MHZ 2.7-5.5 LQFP32	Freescale Semiconductor	MC9S08JM8CLCE
C1	0.47 μ F	CAP CER 0.47 μ F 16V 10% X7R 0603	Kemet	C0603C474K4RAC
C2, C5, C8, C9, C14, C16, C19, C33, C34, C35, C36, C37, C38, C39, C40	0.10 μ F	CAP CER 0.10 μ F 16V 5% X7R 0603	AVX	0603YC104JAT2A
C3	10 μ F	CAP CER 10 μ F 16V 5% X7R 0603	AVX	TAJA106K016R
C4	4.7 μ F	CAP TANT 4.7 μ F 10V 10% -3216-18	AVX	TAJA475K010R
C6, C7, C26, C27	10PF	CAP CER 10PF 50V 1% COG0603	Kemet	C0603C100F5GAC
C10, C11	22PF	CAP CER 22PF 16V 1% COG0603	Kemet	C0603C22F4GAC
C12, C13, C15, C17, C18	0.10 μ F	CAP CER 0.10 μ F 16V 5% X7R 0603	AVX	0603YC104JAT2A
C21	1.0 μ F	CAP CER 1.0 μ F 16V 10% X5R 0603	TDK	C1608X5R1C105K
C22	470PF	CAP CER 470PF 50V 5% COG 0603	Panasonic	ECJ1VC1H471J
C23	2.2 μ F	CAP CER 2.2 μ F 16V 10% X5R 0603	Murata	GRM188R61C225KE15D
C24	2.2 μ F	CAP TANT ESR = 1.800 OHMS 2.2 μ F 10V 10% 3216-18	AVX	TPSA225K010R1800
C28, C29, C30, C31	10PF	CAP CER 10PF 50V 1% COG 0603	Kemet	C0603C100F5GAC
D1	HSMG-C170	LED Green SGL 2.2V 20MA 0805	Avago Technologies	HSMG-C170
D2-D19	ESD9L5.0ST5G	Diode TVS ESD PROT ULT LOW CAP 5-5.4V SOD-923	ON Semiconductor	ESD9L5.0ST5G
FID1, FID2, FID3	FID	FIDUCIAL	Generic	FID-040
F1	0.5A	FUSE PLYSW 0.5A 13.2V SMT	Raychem	MICROSMD050F-2
J1	USB_TYPE_A	CON 1X4 USB TYPE A MALE RA TH 178h AU	Samtec	USB-AM-S-S-B-TH
J2, J6, J7	HDR 2X3	HDR 2X3 TH 100MIL CTR 335H AU	Samtec	TSW-103-07-S-D
J3, J5	HDR 1X3	HDR 1X3 TH 100MIL SP 330H AU	Samtec	HTSW-103-07-S-S
J4, J8	HDR 2X6	HDR 2X6 TH 100MIL CTR 330H AU	Samtec	TSW-106-07-S-D
J9	HDR 2X8	HDR 2X8 TH 100MIL CTR 330H AU	Samtec	TSW-106-07-G-D
L1	H1812V101R-10	IND FER 100 OHM@100MHZ 8A 25% SMD/1812	Laird Technologies	H1812V101R-10
L2	H1812V101R-10	IND FER 100 OHM@100MHZ 8A 25% SMD/1812	Laird Technologies	H1812V101R-10
R1	270	RES MF 270.0 OHM 1/10W 1% 0603	KOA Speer	RK73H1JTTD2700F
R2-R15, R32-R37	2.2K	RES TF 2.20K 1/10W 1% RC0503	Bourns	CRO603FX2201E
R16, R17	33	RES MF 33.0 OHM 1/10W 1% 0603	KOA Speer	RK73H1JTTD33R0F
R18, R20	1.50K	RES MF 1.50K 1/10W 1% 0603	KOA Speer	RK73H1JTTD1501F
R19, R22, R23, R24	220K	RES MF 220K 1/10W 5% 0603	Venkel Company	CR0603-10W-224JT
R21	1.0M	RES MF 1.0M 1/10W 1% 0603	KOA Speer	RK73H1JTTD1004F
R25, R26	4.70K	RES MF 4.70K 1/10W 1% 0603	KOA Speer	RK73H1JTTD4701F
R27	12.0K	RES MF 12.0K 1/10W 1% 0603	KOA Speer	RK73H1JTTD1202F

Reference	Value	Description	Manufacturer	Part Number
R28, R29	10.0K	RES MF 10.0K 1/10W 1% 0603	KOA Speer	RK73H1JTDD1002F
R30	5.36K	RES MF 5.36K 1/10W 1% 0603	KOA Speer	RK73H1JTDD5361F
R31	20K	RES MF 20K 1/10W 5% 0603	Bourns	CR0603-JW-203ELF
TP1	TEST POINT	Test Point Pin.138X.059 SMT	Nicomatic	C12000B
U2	GTL2010BS	IC VXLTR BIDIR 10BIT GTL-TVC 1.0-5.0V HVQFN24	NXP Semiconductors	GTL2010BS
U3	MAX232A	IC,L,MAX232A,RS232 SO16	Maxim	MAX232ACSE
U4, U5, U6	GTL2002DC	IC VXLTR BIDIR 2BIT GTL-TVC 1.0-5.0V VSSOP8	NXP Semiconductors	GTL2002DC
U8	MIC5205	IC LIN VREG LDO 1.5-15V 150MA 2-5-16V SOT23-5	Micrel	MIC5205YM5
Qty. 2	Jumper	Shorting Jumper Unplated BLK	3M	929950-00
Y1	12 MHZ	XTAL 12MHZ SER 9PF SMT	ECS INC. International	ECS-120-9-42X-CKM-TR

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.

13 References

The following list contains 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/
Freescale's Analog Web Site	www.freescale.com/analog
Data Sheet MC13892	http://www.freescale.com/files/analog/doc/data_sheet/MC13892.pdf
Freescale Power Management Web Site	http://www.freescale.com/webapp/sps/site/taxonomy.jsp?nodeId=01435979961182

14 Revision History

Revision	Date	Description of Changes
4.0	8/2014	<ul style="list-style-type: none">• Updated kit contents/packing list• Added revision history page• Updated back page

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