CDB5463U

CDB5463U Engineering Board and GUI Software

Features

❑ Voltage and Current Interface

❑ USB Communication with PC

❑ On-board C8051F320 Microcontroller

❑ On-board Voltage Reference

❑ LabWindows®/CVI® GUI Software

– Register Setup & Chip Control

– FFT Analysis

– Time Domain Analysis

– Noise Histogram Analysis

❑ "Auto-boot" Demo with Serial EEPROM

General Description

The CDB5463U is an inexpensive tool designed to evaluate the functionality and performance of the CS5463 analog-to-digital converter (ADC). The evaluation board includes an LT1019 voltage reference, a C8051F320 microcontroller with a USB interface, and firmware. The microcontroller controls the serial communication between the evaluation board and the PC via the firmware, enabling quick and easy access to all of the CS5463's registers and functions.

The CDB5463U includes software for data capture, time domain analysis, histogram analysis, and frequency domain analysis.

Schematics in PADS™ PowerLogic™ format are available for download at www.cirrus.com/IndustrialSoftware.

ORDERING INFORMATION
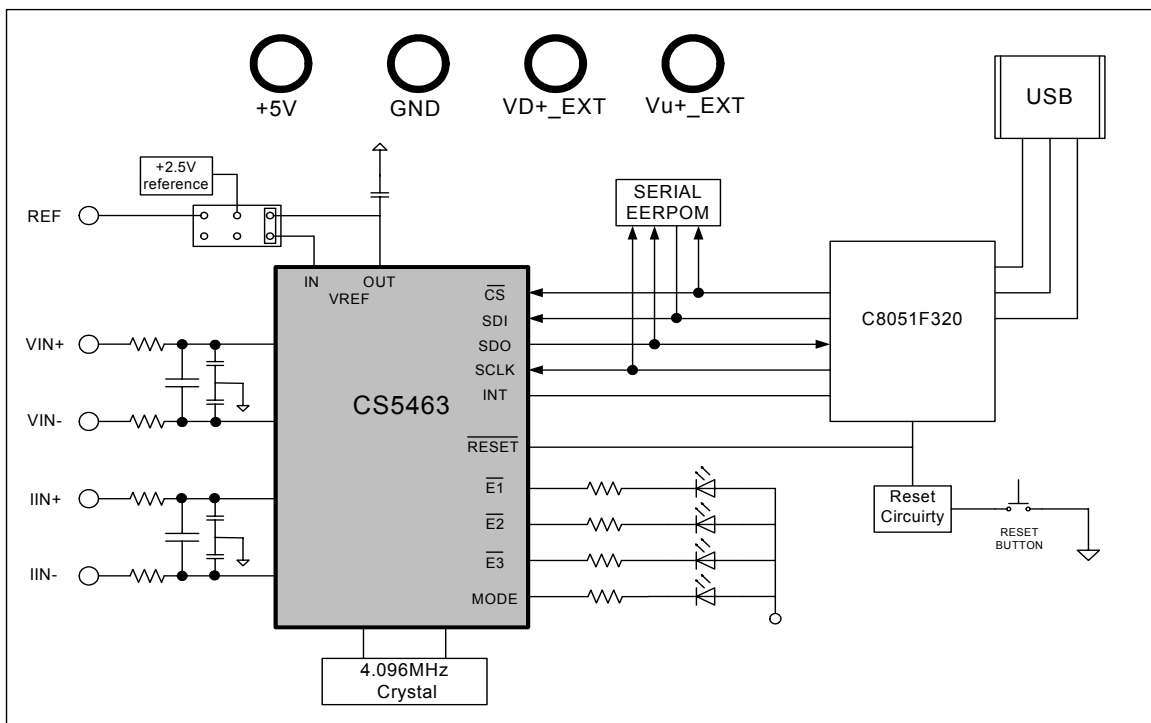CDB5463U   Evaluation Board

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DS805DB2

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1. HARDWARE

1.1 Introduction

The CDB5463U evaluation board provides a convenient means of evaluating the CS5463 power measurement IC. The CDB5463U evaluation board operates from a single +5V power supply. The evaluation board interfaces the CS5463 to a PC via a USB cable. To accomplish this, the board comes equipped with a C8051F320 microcontroller and a USB interface. Additionally, the CDB5463U GUI software provides easy access to the internal registers of the CS5463. The software also provides a means to display the performance in the time domain or frequency domain.

1.2 Evaluation Board Overview

The board is partitioned into two main sections: analog and digital. The analog section consists of the CS5463 and a precision voltage reference. The digital section consists of the C8051F320 microcontroller, EEPROM, the hardware test switches, the reset circuitry, and the USB interface. The board also has a user friendly power supply connection.
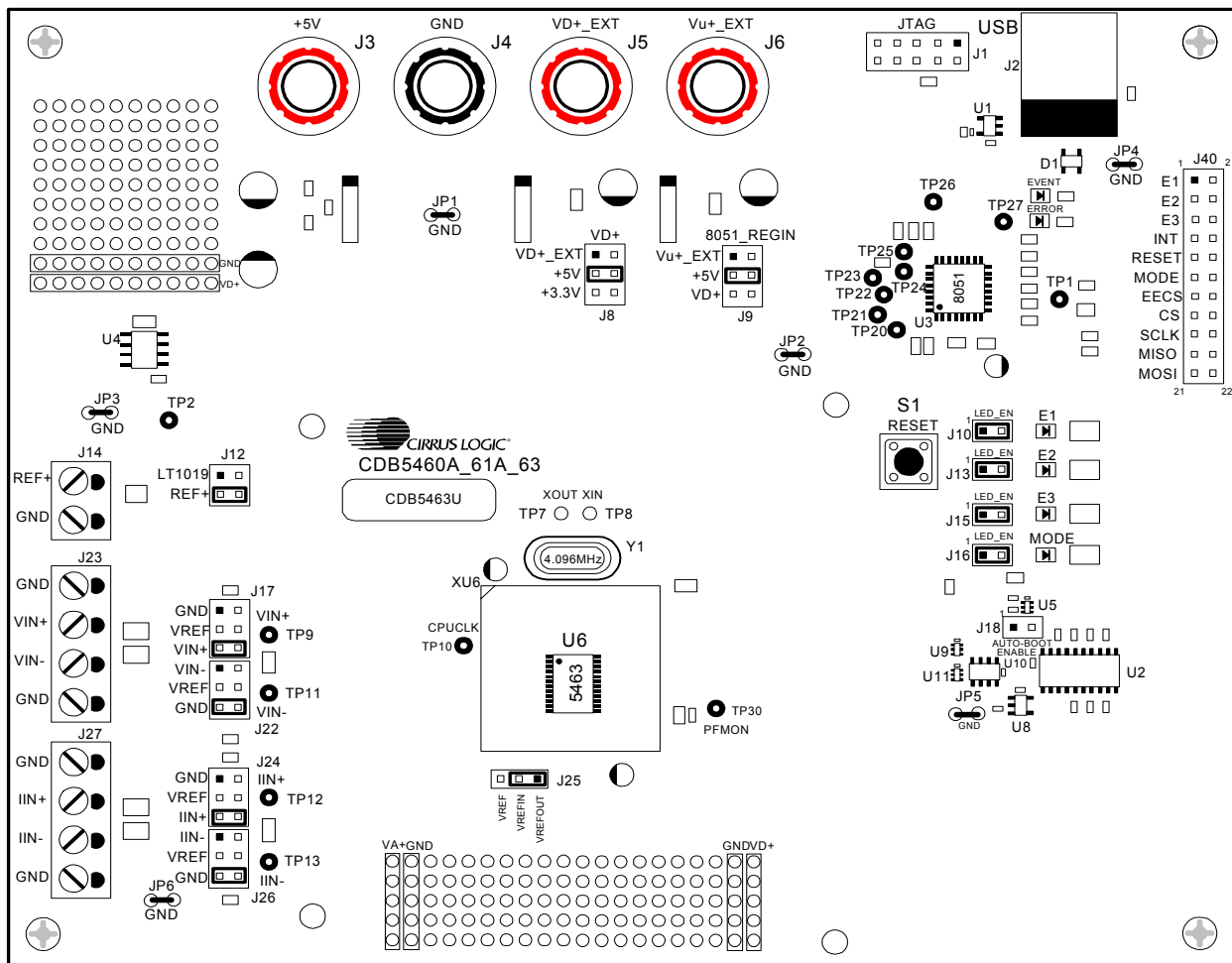

Figure 1. CDB5463U Assembly Drawing

1.3   Analog Section

The CDB5463U evaluation board provides screw-type terminals (J23, J27) to connect input signals to the voltage and current channels. The screw terminals are labels as VIN+, VIN1-, IIN+, and IIN-. A simple R-C network at each channel input provides a simple anti-alias filter.

The evaluation board provides three voltage reference options for VREFIN to the CS5463. The three voltage reference options include: VREFOUT from CS5463, the on-board +2.5V reference, and external REF+ (screw terminal J14). Table 1 and Table 2 illustrate the options available for VREFIN. With a jumper on J25 in the position labeled VREFOUT, the reference is supplied by the on-chip voltage reference. With a jumper on J25 in the position labeled VREF, the reference is supplied by an off-chip voltage reference.

Reference	Description	J25
VREFOUT	Selects On-chip Reference (25 ppm/°C)	VREF O VREFIN ◐ VREFOUT ■ *(Default)*
VREF	Selects External or LT1019 Reference(J12)	VREF ◐ VREFIN ◐ VREFOUT □

Table 1. Internal Voltage Reference Selection for VREF

Table 2 illustrates the options available for VREF. With a jumper on J12 in position *LT1019*, the LT1019 provides a +2.5V reference (the LT1019 was chosen for its low drift - typically 5 ppm/°C). By setting the jumper on J12 to position *REF+*, an external voltage reference is supplied via screw terminal J14's *REF+* input.

Reference	Description	J12
LT1019	Selects On-board LT1019 Reference (5 ppm/°C)	LT1019 ■━◐ VREF REF+ O O VREF
REF+	Selects External Reference Source (J14)	LT1019 □ O VREF REF+ ◐━━◐ VREF *(Default)*

Table 2. External Voltage Reference Selection for VREF

The three input signal options for the voltage (VIN±) and current (IIN±) channel input include: an external signal (screw terminals J23 and J27), GND, or VREF. Table3 illustrates the options available. By installing jumpers on J17 to position *VIN+*, J22 to position *VIN-*, J24 to position *IIN+*, and J26 to position *IIN-*, the input voltage signal is supplied from the screw terminals J23 and J27. With a jumper on J17, J22, J24 and

J26 in the *GND* position, the inputs are connected to analog ground (AGND). With a jumper on J17, J22, J24 and J26 in position *VREF*, the inputs are connected to the reference voltage selected on J12.

INPUT	Description	J17	J22	J24	J26
VIN± or IIN±	Selects External Signal	GND □ O VIN+ VREF O O VIN+ VIN+ ●—● VIN+ *(Default)*	VIN- □ O VIN- VREF O O VIN- GND ●—● VIN- *(Default)*	GND □ O IIN+ VREF O O IIN+ IIN+ ●—● IIN+ *(Default)*	IIN- □ O IIN- VREF O O IIN- GND ●—● IIN- *(Default)*
VIN± or IIN±	Selects External Signal	GND □ O VIN+ VREF O O VIN+ VIN+ ●—● VIN+	VIN- ●—● VIN- VREF O O VIN- GND O O VIN-	GND □ O IIN+ VREF O O IIN+ IIN+ ●—● IIN+	IIN- ●—● IIN- VREF O O IIN- GND O O IIN-
GND	Selects Grounding the Input	GND ●—● VIN+ VREF O O VIN+ VIN+ O O VIN+	VIN- □ O VIN- VREF O O VIN- GND ●—● VIN-	GND ●—● IIN+ VREF O O IIN+ IIN+ O O IIN+	IIN- □ O IIN- VREF O O IIN- GND ●—● IIN-
VREFIN	Selects Reference Source	GND □ O VIN+ VREF ●—● VIN+ VIN+ O O VIN+	VIN- □ O VIN- VREF ●—● VIN- GND O O VIN-	GND □ O IIN+ VREF ●—● IIN+ IIN+ O O IIN+	IIN- □ O IIN- VREF ●—● IIN- GND O O IIN-

Table 3. Voltage and Current Channel Input Signal Selection

1.4 Digital Section

The digital section contains the microcontroller, USB interface, JTAG header, reset circuitry, and an external interface header (J40). The microcontroller interfaces the SPI of CS5463 with the USB connection to the PC, enabling the GUI software to access all the CS5463 registers and functions. Interface header, J40, is provided to allow the CDB5463U to be connected to an external energy registration device or an external microcontroller. To connect the CS5463 to an external microcontroller, R57, R58, R59, R60, R61, and R62 must be removed from the board. The energy output pins E1, E2, and E3 are routed to LEDs which provide a simple visual check of the energy output pulses. The MODE pin is also routed to a LED to indicate whether the CS5463 is operating in auto-boot mode. Jumpers J10, J13, J15, and J16 are equipped at the factory with jumpers to enable the LEDs.

1.5 Power Supply Section

Table 4 illustrates the power supply connections to the evaluation board. The *+5V* binding post (J3) supplies the positive analog (VA+) for the CS5463 and the +2.5V reference. The *VD+_EXT* binding post (J5) supplies the digital section of the CS5463 (VD+) and level shifters. Jumper J8 allows the VD+ supply to be sourced from the *VD+_EXT* binding post (J5), the *+5V* binding post (J3), or the regulated 3.3V supply derived from the microcontroller. The *Vu+_EXT* (J6) binding post supplies the positive supply for the 8051

microcontroller (*8051_REGIN*). Jumper J9 allows the *8051_REGIN* supply to be sourced from either the *Vu+_EXT* binding post (J6), *+5V* binding post (J3) or *VD+_EXT* binding post (J5).

Power Supplies			Power Post Connections				VD+	8051-REGIN
Analog (VA+)	Digital (VD+)	8051 (Vu+)	+5V	GND	VD+EXT	VU+EXT	J8	J9
+5	+5	+5	+5	0	NC	NC	VD+_EXT □ O VD+ / +5 ●━● VD+ / +3.3 O O VD+ *(Default)*	Vu+_EXT □ O 8051 / +5 ●━● 8051 / VD+ O O 8051 *(Default)*
						+5	VD+_EXT □ O VD+ / +5 ●━● VD+ / +3.3 O O VD+	Vu+_EXT ■━● 8051 / +5 O O 8051 / VD+ O O 8051
						NC	VD+_EXT □ O VD+ / +5 ●━● VD+ / +3.3 O O VD+	Vu+_EXT □ O 8051 / +5 O O 8051 / VD+ ●━● 8051
					+5	NC	VD+_EXT ■━● VD+ / +5 O O VD+ / +3.3 O O VD+	Vu+_EXT □ O 8051 / +5 ●━● 8051 / VD+ O O 8051
						+5	VD+_EXT ■━● VD+ / +5 O O VD+ / +3.3 O O VD+	Vu+_EXT ■━● 8051 / +5 O O 8051 / VD+ O O 8051
						NC	VD+_EXT □ O VD+ / +5 ●━● VD+ / +3.3 O O VD+	Vu+_EXT ■━● 8051 / +5 O O 8051 / VD+ O O 8051
+5	+3.3	+5	+5	0	NC	NC	VD+_EXT □ O VD+ / +5 O O VD+ / +3.3 ●━● VD+	Vu+_EXT □ O 8051 / +5 ●━● 8051 / VD+ O O 8051
						+5	VD+_EXT □ O VD+ / +5 O O VD+ / +3.3 ●━● VD+	Vu+_EXT ■━● 8051 / +5 O O 8051 / VD+ O O 8051
					+3.3	NC	VD+_EXT ■━● VD+ / +5 O O VD+ / +3.3 O O VD+	Vu+_EXT □ O 8051 / +5 ●━● 8051 / VD+ O O 8051
						+5	VD+_EXT ■━● VD+ / +5 O O VD+ / +3.3 O O VD+	Vu+_EXT ■━● 8051 / +5 O O 8051 / VD+ O O 8051

Table 4. Power Supply Connections

1.6   Auto-boot Mode

With a jumper connection on J18 (*AUTO-BOOT ENABLE*), the CS5463 operates in auto-boot mode and the CDB5463U board operates as a stand-alone system without attaching it up to a PC. When in auto-boot mode, a hardware reset (press on S1) will cause the CS5463 to boot up using the serial data from the serial EEPROM on the board (U10). When the CS5463 is in auto-boot mode, the SPI connections

between the microcontroller and the CS5463 are removed and the GUI software can not access the CS5463 registers and functions.

The EEPROM must be programmed prior to the auto-boot sequence. When the CDB5463U Evaluation Board is sent from the factory, the EEPROM is programmed with the following CS5463 command/data sequence:

1. Write Mode register, turn high-pass filters on:

   0x64 0x00 0x00 0x60

2. Unmask bit #2 (LSD) in the Mask register:

   0x74 0x00 0x00 0x04

3. Start continuous conversion:

   0xE8

4. Write STOP bit to Control register, to terminate auto-boot sequence:

   0x78 0x00 0x01 0x00

This sequence programs the CS5463 for continuous conversion mode. If voltage and current signals are applied to the inputs, the CS5463 will issue pulses on the $\overline{E1}$ pin. See the CS5463 data sheet for more details on auto-boot.

2. SOFTWARE

The evaluation board comes with software and an USB cable to link the evaluation board to the PC. The evaluation software was developed with LabWindows®/CVI®, a software development package from national Instruments. The evaluation software is available for download on the Cirrus Logic web site at http://www.cirrus.com/industrialsoftware and was designed to run under Windows® 2000 or Windows XP®.

2.1 Installation

To install the software, go to the Cirrus Logic web site at http://www.cirrus.com/industrialsoftware and refer to application note AN278.

2.2 Using the Software

Before launching the software, check all jumper settings on the CDB5463U evaluation board as described in Section 1, and connect the board to an open USB port on the PC using the provided cable. Once the board is powered on, the software program can be launched.

2.3 Start-up Window

When the software is launched, the start-up window will appear. This window contains information concerning the software's title, revision number, copyright date, etc. See Figure 2.

Figure 2. GUI Start-up Window

At the top of the screen is a menu bar which displays user options. The menu bar has three items: *Menu*, *Setup*, and *Quit*. Initially *Menu* is disabled. After establishing a link to a data source, the *Menu* item will become available.

2.3.1   Setup Menu

Setup allows user to establish a USB communication connection with CDB5463U board or select a previously saved data file for further analysis.

If the *USB* item in the *Setup* menu is selected, the evaluation software will poll the CDB5463U, verifying the serial communication link is ready. At this point, the *USB* menu item is checked indicating that the PC has successfully communicated with CDB5463U evaluation board, and device and micro-code version information are read from the board and displayed on the screen. See Figure 3. Due to improvements to the software or new features being added, the version displayed may be different than the image shown here.
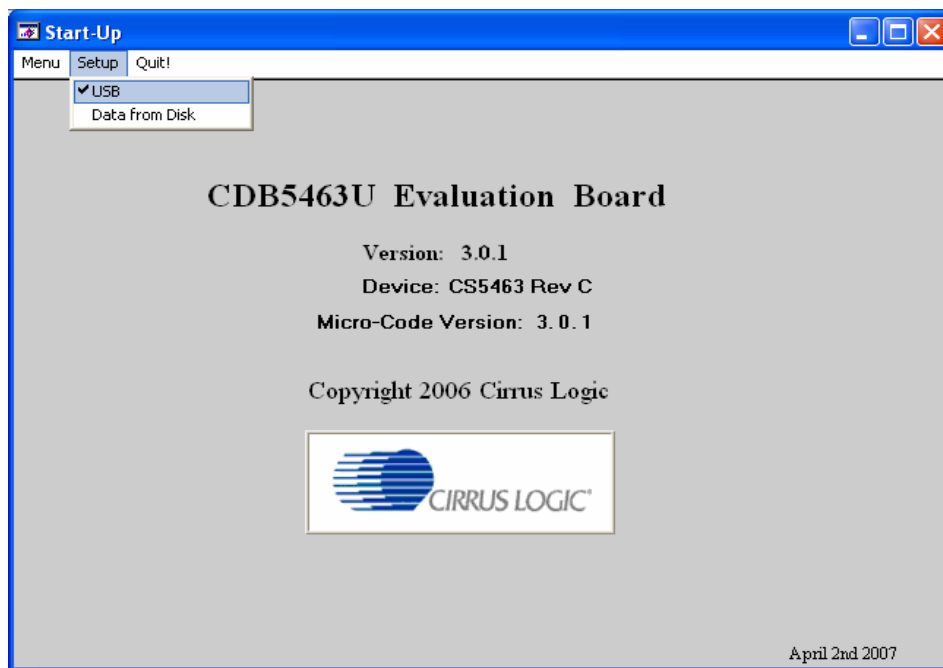
Figure 3. *Setup* Menu Showing Successful USB Connection

If the evaluation software is unable to establish a communication link with the CDB5463U board, a message will appear, indicating that the initial communication has failed. See Figure 4.
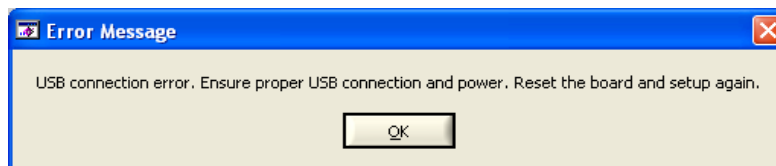
Figure 4. USB Error Message

Check to verify that the USB cable is connected properly and the power supply is on and connected properly to the CDB5463U. Reset the board (press the *RESET* button on the board) and try to setup the USB connection again.

If the *Data from Disk* item in the *Setup* menu is selected, a file selection window will appear as shown in Figure 5. User can select a pre-saved data file for further analysis using time domain, FFT, and histogram plots in Data Collection Window of the software.
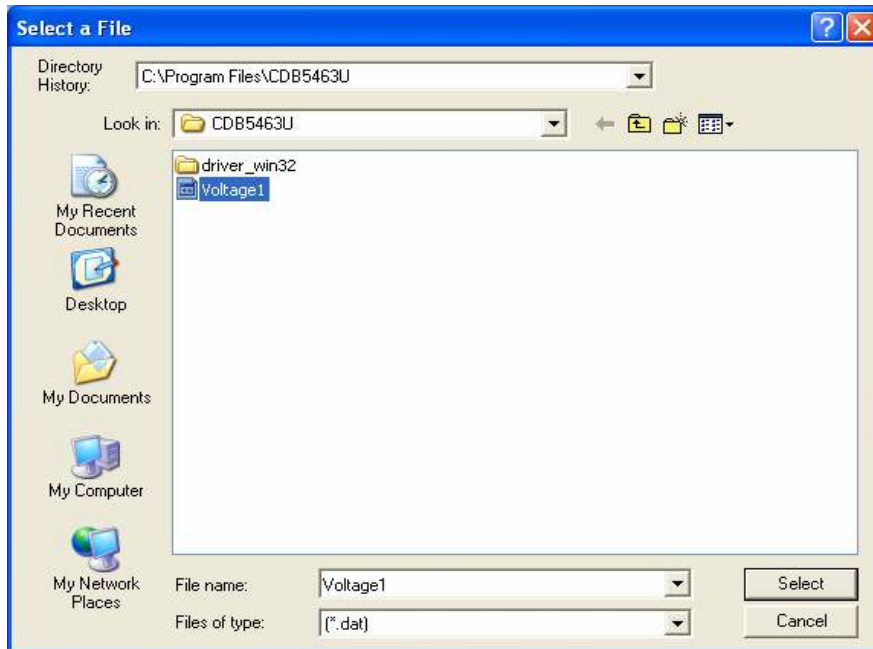
Figure 5. *Data from Disc* File Selection Window

2.3.2   *Menu Menu*

Excluding the *Start-Up* window, the *Menu* menu provides 7 options: *Setup Window*, *Calibration Window*, *Conversion Window*, *Pulse Rate Window*, *Data Collection Window*, *EEPROM Window*, and *Debug Win-*

dow. Each window provides a means to evaluate the different functions and performance of the CS5463. Each option has an associated function key (<F1>, <F2>, etc.). See Figure 6.
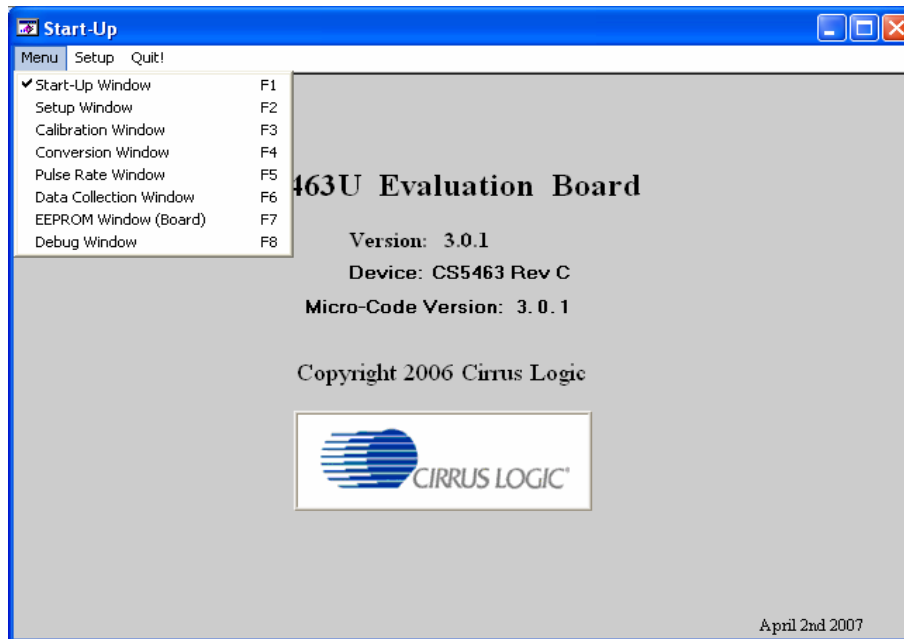
Figure 6. *Menu* Pull-down Options

2.3.3   *Quit Menu*

The *Quit* menu allows the user to exit the evaluation software. Upon selecting *Quit*, a message window appears and queries if exiting the evaluation software is desired. See Figure 7.
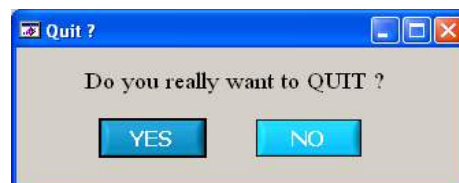
Figure 7. *Quit* Dialog

2.4   *Setup* Window

The evaluation software provides access to the CS5463's internal registers through the *Setup* window. See Figure 8. The user can enter the *Setup* window by pulling down the *Menu* menu and selecting *Setup Window*, or by pressing <F2> on the keyboard.

In the *Setup* window, all of the CS5463's registers are displayed in hexadecimal notation and are decoded to provide easier readability. Refer to the CS5463 data sheet for information on register functionality and definitions. See Figure 8.
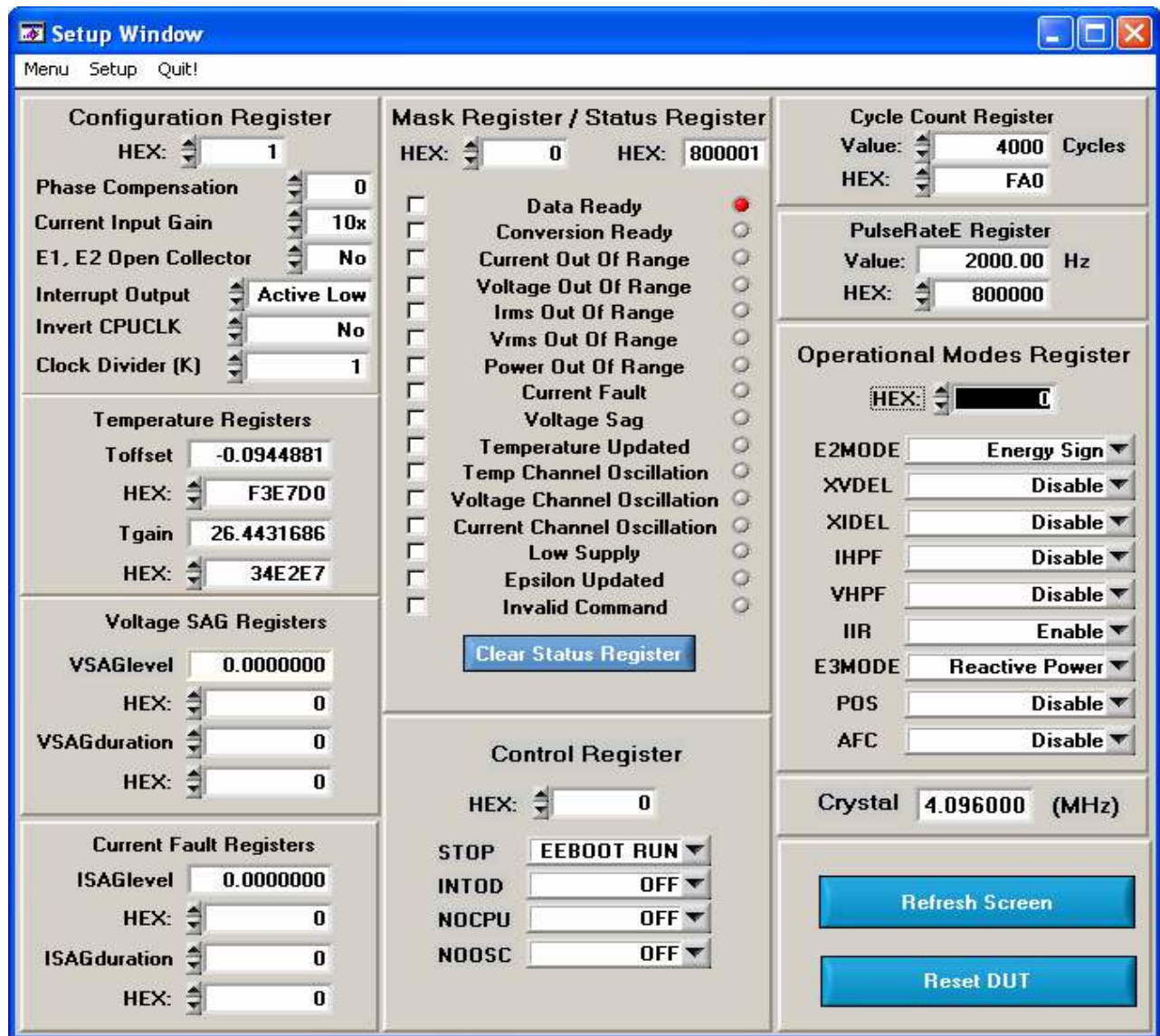
Figure 8. *Setup* Window

2.4.1   Refresh Screen Button

The *Refresh Screen* button will update the contents of the screen by reading all the register values from the CS5463. It is a good idea to press the *Refresh Screen* button when entering the *Setup* window, or after modifying any registers, to reflect the current status of the CS5463.

2.4.2   Reset DUT Button

The *Reset DUT* button will hardware reset the CS5463. The CS5463 will perform a reset as discussed in the CS5463 data sheet. After the hardware reset to the CS5463 device, the screen contents will be automatically refreshed with the updated status of the CS5463.

2.4.3   CS5463 Crystal Frequency

The CS5463 accepts a wide range of crystal input frequencies, and can therefore run at many different sample rates. The crystal frequency being used on the CS5463 should be entered in this field to provide accurate frequency calculation in the *FFT* window. This will also help the software decide which functions the evaluation system can perform reliably.

2.4.4   Configuration Register

In the *Configuration Register* box, the contents of the Config register can be modified by typing a hexadecimal value in the *HEX:* field, or by changing any of the values below the *HEX:* field to the desired settings. Although the CDB5463U software allows the user to modify any of the bits in the Config register, changing certain bits may cause the software and board to behave erratically. For the evaluation system to function properly, the *Interrupt Output* field should be set to the default *Active Low*. This applies only to the CDB5463U evaluation system, and not to the CS5463 chip itself.

2.4.5   Temperature, Voltage SAG, Current Fault Registers

These fields display the values of the corresponding registers in both hexadecimal and decimal format. Each register can be modified by typing a value in the corresponding offset, level, duration, or gain value field (decimal) or *HEX:* field (hexadecimal).

2.4.6   Mask Register / Status Register

The *Mask Register / Status Register* box displays the values for these registers in hexadecimal and decodes them to indicate each bit's function. The Mask register can be modified by typing a value in the *HEX:* field, or by checking the appropriate check boxes for the bits that are to be masked. The Status register cannot be directly modified. It can only be reset by pressing the *Clear Status Register* button. The *HEX:* field for this register and the lamps are indicators only. A lamp which is on means that the corresponding bit in the Status register is set (except the Invalid Command bit, which is inverted). The value present in the Mask register may be changed by the software during certain operations to provide correct functionality of the CDB5463U board.

2.4.7   Cycle Count / PulseRateE Register

These fields display the values of the corresponding registers in both hexadecimal and decimal format. Each register can be modified by typing a value in the corresponding *Value:* or *HEX:* field.

2.4.8 Control Register

The *Control Register* box contains various bits used to activate or terminate various features of the CS5463. Refer to the CS5463 data sheet for descriptions of the bits. The user is able to turn each bit on or off individually. The value of the Ctrl register is displayed in the *HEX:* field. Most of the Ctrl register bits are reserved or unused. Only the usable bits are displayed in the *Setup* window.

2.4.9 Operational Modes Register

The *Operational Modes Register* box contains various bits used to set different operation modes for the CS5463 functions. Refer to the CS5463 data sheet for descriptions of the bits. The value of the Mode register is displayed in the *HEX:* field. Many of the Mode register bits are reserved or unused. Only the usable bits are displayed in the *Setup* window.

2.5 Calibration Windows

The *Calibration* window is used to display and write to the CS5463 offset and gain calibration registers. The user is also able to initiate the CS5463's calibration sequences that are used to set the calibration values. Both AC and DC calibrations can be performed for offset and gain, for either the voltage channel or the current channel, or both simultaneously. The user should refer to the CS5463 data sheet for more details on calibration.

The *Refresh Screen* button will update the contents of the screen by reading all the register values from the CS5463. It is a good idea to press the *Refresh Screen* button when entering the *Calibration* window, or after modifying any registers to reflect the current status of the CS5463.
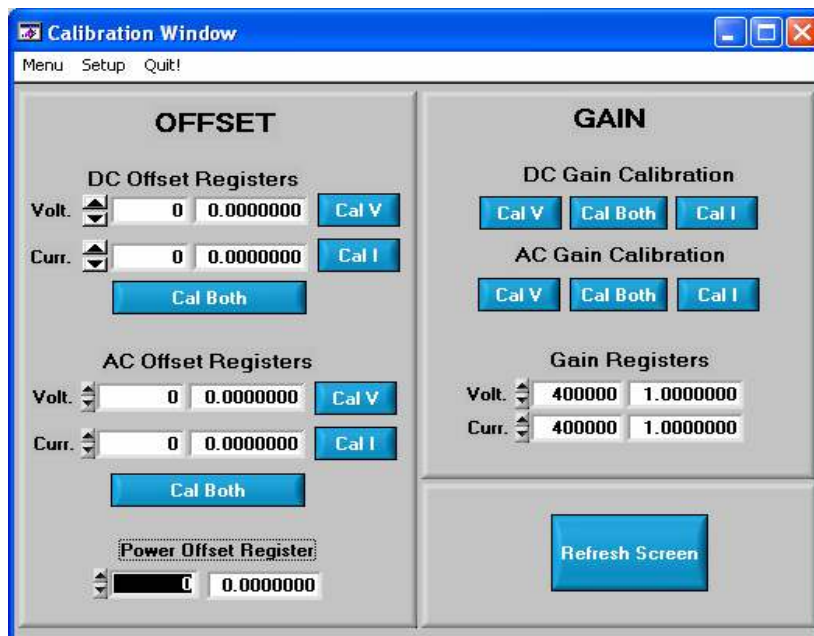
Figure 9. Calibration Window

2.5.1 Offset / Gain Register

In the *Offset* & *Gain* fields, the offset and gain registers for both channels are displayed in hexadecimal and decimal formats. These registers can be modified directly by typing the desired value in the hexadecimal display fields. There are two types of offset registers: DC offset and AC offset. The AC Offset register only affects the RMS register values. The DC & AC offset registers are two's complement numbers whose values ranges from -1 to +1. The gain register value ranges from 0 to 4.

2.5.2 Performing Calibrations

Offset and gain calibrations can be performed on both the voltage and current channels of the CS5463. Because the initial values in the calibration registers will affect the results of the calibrations, it is generally a good idea to software reset the CS5463 before running calibrations. A software reset will reset these registers back to the default values of zero offset and unity gain. Offset calibration should be performed before gain calibration to ensure accurate results.

2.5.2.1 Offset Calibrations

1. Ground the channel(s) you want to calibrate directly at the channel header(s) J17 and J22 for the voltage channel, and J24 and J26 for the current channel. The channel(s) could also be grounded directly at the screw terminals.

2. Press the corresponding AC or DC offset calibrate button (*Cal V*, *Cal I*, or *Cal Both*) beside or below the corresponding offset registers fields.

The calibration value(s) will automatically update when the calibration is completed.

2.5.2.2 Gain Calibrations

1. Attach an DC or AC calibration signal to the screw terminals, and make sure the corresponding channel headers (J17, J22, J24, and J26) are set to the input position.

2. Press the corresponding AC or DC gain calibrate button (*Cal V*, *Cal I*, or *Cal Both*) beside or below the *Gain Registers* fields.

The calibration value(s) will automatically update when the calibration is completed.

The *Calibration Window* also contains the *Power Offset Register* display and adjustment. The user can read and write the value in the power offset (Poff) register.

2.6 Conversion Window

The *Conversion Window* allows the user to see the results of single and continuous conversions, perform data averaging, and utilize the power-saving modes of the CS5463. See Figure 10. The Conversion Window can be accessed by pulling down the Menu option, and selecting Conversion Window, or by pressing F4.
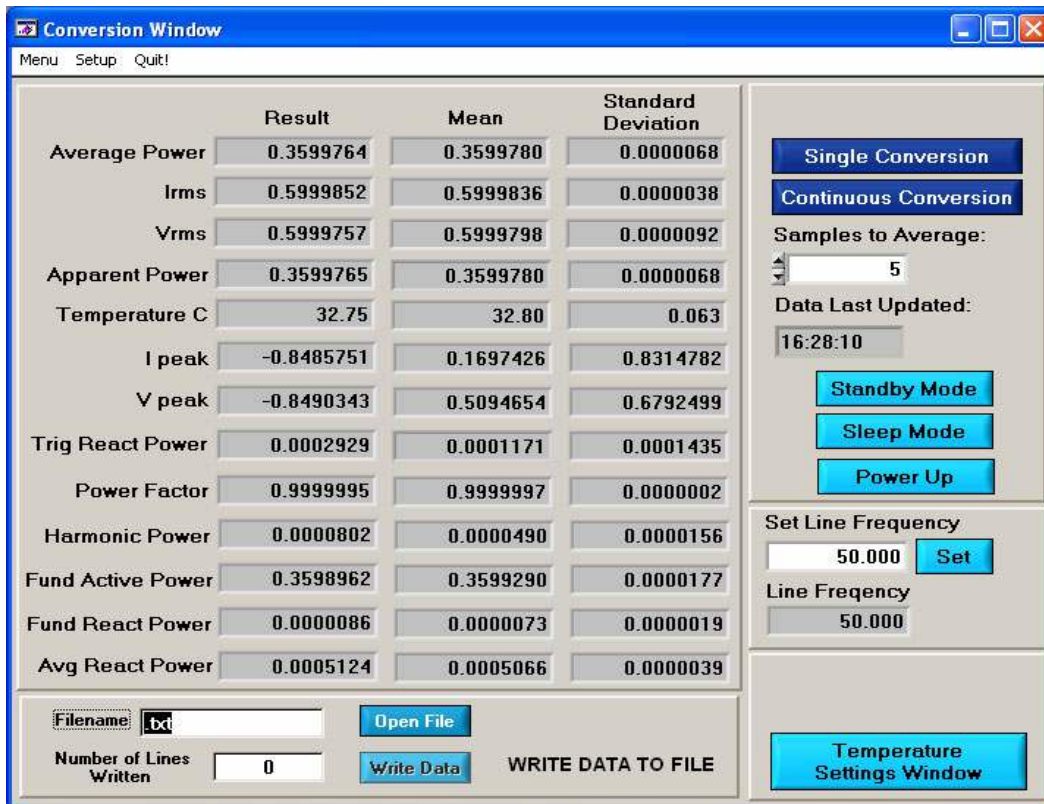
Figure 10. *Conversion Window*

2.6.1 Single Conversion Button

Pressing this button will cause a single conversion to be performed. After a single conversion is complete, the *Result* column will be updated with the values present in each data register.

2.6.2 Continuous Conversion Button

Pressing this button will cause continuous conversions to be performed until the user presses the *Stop* button. After each conversion is complete, the *Result* column will be updated with the values present in each data register. The *Mean* and *Standard Deviation* columns will be updated every N cycles, where N is the number in the *Samples to Average* field. If the *Samples to Average* is set to a large number, it may take many collection cycles after pressing the *Stop* button before the data actually stops being collected.

2.6.3 Standby / Sleep Mode Buttons

When these buttons are pressed, the CS5463 will enter either standby or sleep power saving modes. To return to normal mode, press the *Power Up* button.

2.6.4 Power Up Button

This button is used to send the *Power Up/Halt* command to the CS5463. The part will return to normal operating mode and halt any conversions that are being done at this time.

2.6.5 Temperature Settings Window

The *Temperature Settings Window* is used to adjust the temperature offset register (Toffset) and temperature gain register (Tgain) to convert the temperature register (T) from a Celsius scale (°C) to a Fahrenheit scale (°F) or vice versa and to improve temperature measurement accuracy. Refer to the CS5463 data sheet for the details of the on-chip temperature sensor.

2.6.6 Write Data to File Window

This window provides a means to write the conversion result data to a .txt text file for later analysis or print out. The file path and name will be shown in *Filename* field. The *Open File* button is used to open a new or existing .txt text file for data writing. Each time the *Write Data* button is pressed, the result data is written into the file and the *Number of Lines Written* field value will be increased by 1.

2.7 Pulse Rate Window

The CS5463 features a pulse-rate energy output. The CDB5463U has the capability to demonstrate the functionality of this output in the *Pulse Rate Output Window.* See Figure 11. The *Pulse Rate Output Window* can be accessed by pressing <F5>, or by pulling down the *Menu* menu, and selecting the *Pulse Rate Window* item.
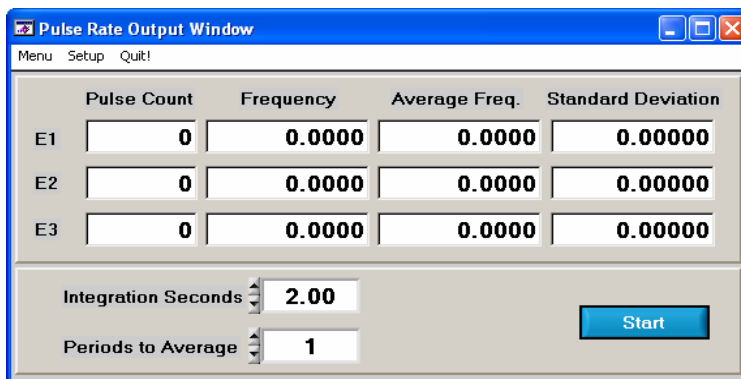
Figure 11. Pulse Rate Output Window

2.7.1 Integration Seconds

This field allows the user to select the length of time over which pulses will be collected. Because there is a time delay (2x N / OWR) from start conversion to pulse output, the *Integration Seconds* field is normally set to a delay longer than the actual pulsing period.

2.7.2 Periods To Average

This field allows the user to average a number of integration periods.

2.7.3 Start Button

When the *Start* button is pressed, the CDB5463U will capture pulse rate data according to the values in the *Integration Seconds* and *Periods to Average* fields. After each integration period, the *Pulse Count* and *Frequency* columns will be updated. The *Average Frequency* and *Standard Deviation* columns will only be updated after all the integrations have been collected. The software stops collecting data when the user presses the *Stop* button, or when the data collection is finished. Due to speed limitations of the on-board microcontroller, some higher pulse rates cannot be accurately collected.

2.8 Data Collection Window

The *Data Collection Window* (Figure 12) allows the user to collect sample sets of data from the CS5463 and analyze them using time domain, FFT, and histogram plots. The *Data collection Window* can be accessed by pulling down the *Menu* menu, and selecting the *Data Collection Window* item, or by pressing <F6>.
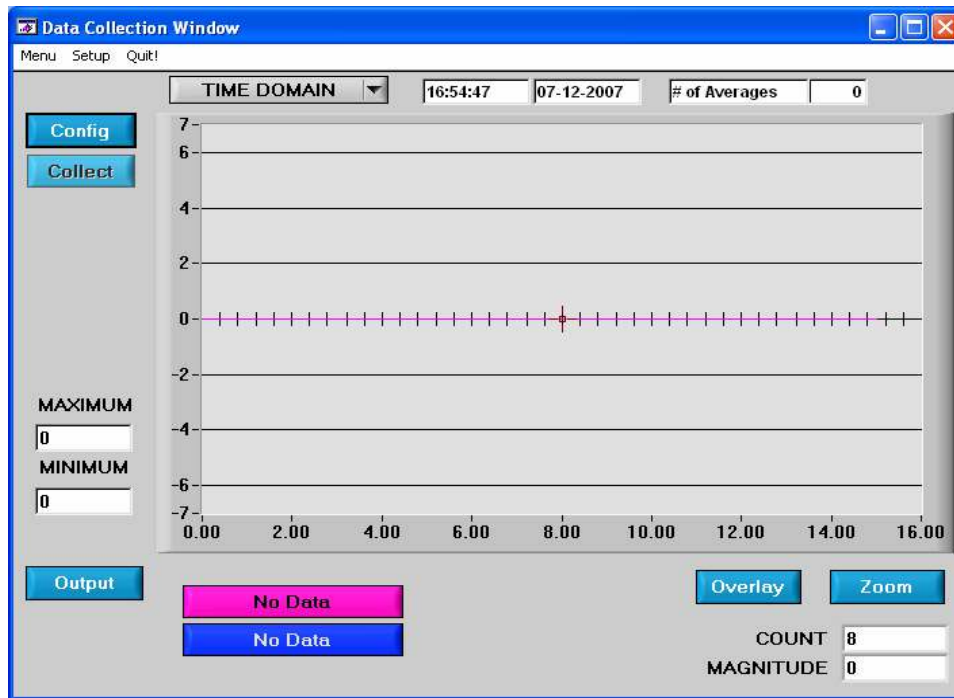
Figure 12. Data Collection Window

2.8.1 Time Domain / FFT/ Histogram Selector

This menu selects the type of data processing to perform on the collected data and display in the plot area. Refer to the Analyzing Data section for more information.

2.8.2 Config Button

This button will bring up the *Configuration* window, in which the user can modify the data collection specifications. Refer to the Configuration Window section in this document for more information.

2.8.3 Collect Button

This button will collect data from the part, to be analyzed in the plot area. See the Collecting Data Sets section for more information.

2.8.4 Output Button

This button will bring up a window in which the user can output the data to a file for later use, print out a plot, or print out the entire screen. When saving data, only the data channel being displayed on the plot will be saved to a file.

2.8.5 Zoom Button

This button allows the user to zoom in on the plot by selecting two points in the plot area. Press the *Restore* button to return to the normal data plot, or press the *Zoom* button again to zoom in even further.

2.8.6 Channel Select Button

After data collection, the two buttons labeled as "No Data" will be replaced with *Current* and *Voltage* buttons, allowing the user to choose the appropriate channel for display. In the time domain mode, an additional *Overlay* button will be present which allows the user to display all the channels on the same plot.

2.8.7 Configuration Window

The *Configuration* window allows the user to set up the data collection and analysis parameters.
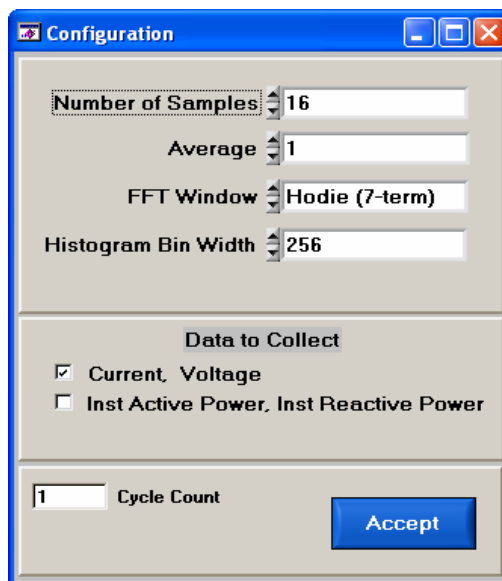
Figure 13. Configuration Window

2.8.7.1 Number of Samples

This field allows the user to select the number of samples to collect, between 16 and 32768.

2.8.7.2 Average

When performing FFT analyses, this field determines the number of FFTs to average. FFTs will be collected and averaged when the *Collect* button is pressed.

2.8.7.3 FFT Window

This field allows the user to select the type of windowing algorithm for FFT processing. Windowing algorithms include the *Blackman*, *Blackman-Harris*, *Hanning*, *5-term Hodie*, and *7-term Hodie*. The 5-term Hodie and 7-term Hodie are windowing algorithms developed at Crystal Semiconductor.

2.8.7.4   Histogram Bin Width

This field determines the "bin width" when plotting histograms of the collected data. Each vertical bar in the histogram plot will contain the number of output codes entered in this field. Increasing this number may allow the user to view histograms with larger input ranges.

2.8.7.5   Data to Collect

These two check boxes allow the user to select the data types that will be collected and returned to the PC for processing.

2.8.7.6   Cycle Count

The value in the *Cycle Count* field will be written to the Cycle Count register in the CS5463. The Cycle Count register determines the length of one computation cycle. The Cycle Count value should be selected appropriately according to the *Data to Collect* setting. For example, if the *Data to Collect* is instantaneous current, voltage, or power it is better to set *Cycle Count* to 1.

2.8.7.7   Accept Button

When this button is pressed, the current settings will be saved, and the user will return to the *Data Collection Window*.

2.8.8   Collecting Data Sets

To collect a sample data set:

1. In the *Data Collection Window*, press the *Config* button to bring up the *Configuration* window and view the current settings.

2. Select the appropriate settings from the available options (see the Configuration Window section) and press the *Accept* button.

3. The *Data Collection Window* should still be visible. Press the *Collect* button to begin collecting data.

4. Once the data has been collected, it can be analyzed, printed, or saved to disk.

2.8.9   Retrieving Saved Data From a File

The CDB5463U software allows the user to save data to a file, and retrieve it later when needed. To load a previously saved file:

1. Pull down the *Setup* menu and select the *Disk* menu item. A file menu will appear.

2. Find the data file in the list and select it. Press the *Select* button to return.

3. Go to the *Data Collection Window*, and press the *Collect* button.

4. The data from the file should appear on the screen. To select a different file, repeat the procedure.

2.8.10   Analyzing Data

The evaluation software provides three types of analysis tests: *Time Domain*, *Frequency Domain*, and *Histogram*. The time domain analysis processes acquired conversions to produce a plot of magnitude versus conversion sample number. The frequency domain analysis processes acquired conversions to produce a plot of magnitude versus frequency using the Fast-Fourier transform (results up to Fs/2 are calculated and plotted). Also statistical noise calculations are calculated and displayed. The histogram

analysis processes acquired conversions to produce a histogram plot. Statistical noise calculations are also calculated and displayed.

2.8.11 Histogram Information

The following is a description of the indicators associated with histogram analysis. Histograms can be plotted in the *Data Collection Window* by setting the analysis type pull-down menu to *Histogram*.
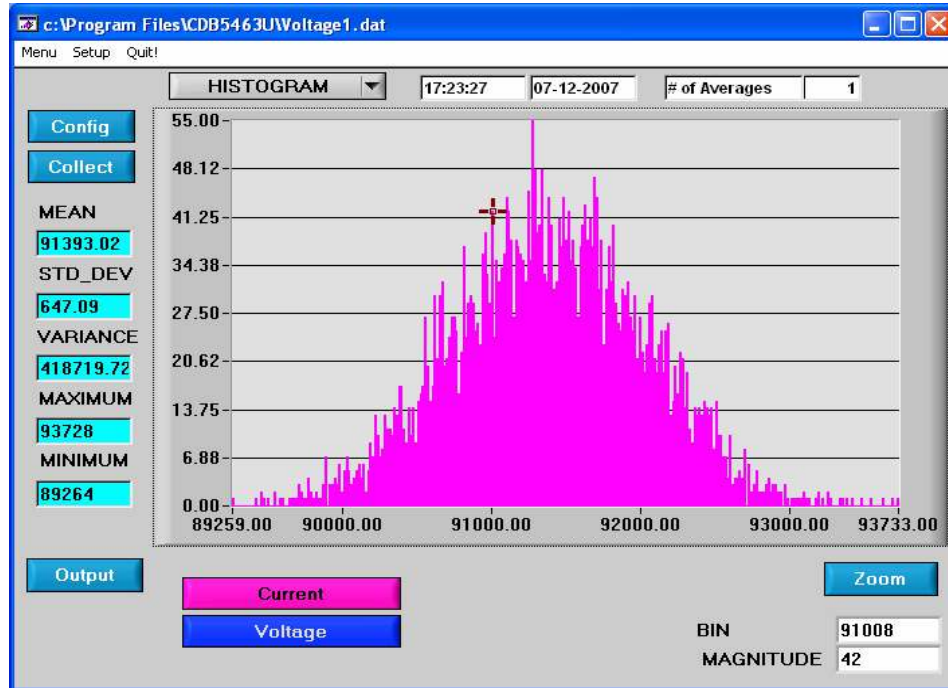
Figure 14. Histogram Analysis

2.8.11.1 BIN

Displays the x-axis value of the cursor on the histogram.

2.8.11.2 MAGNITUDE

Displays the y-axis value of the cursor on the histogram.

2.8.11.3 MEAN

Indicates the mean of the data sample set. The mean is calculated using the following formula:

$$\text{Mean} = \frac{\sum_{i=0}^{n-1} Xi}{n}$$

2.8.11.4 STD_DEV

Indicates the standard deviation of the collected data set. The standard deviation is calculated using the following formula:

$$STDDEV = \sqrt{\frac{\sum\limits_{i=0}^{n-1}(Xi - MEAN)^2}{n}}$$

2.8.11.5 VARIANCE

Indicates for the variance of the current data set. The variance is calculated using the following formula:

$$VARIANCE = \frac{\sum\limits_{i=0}^{n-1}(Xi - MEAN)^2}{n}$$

2.8.11.6 MAXIMUM

Indicates the maximum value of the collected data set.

2.8.11.7 MINIMUM

Indicates the minimum value of the collected data set.

2.8.12 Frequency Domain Information

The following describe the indicators associated with FFT (Fast Fourier Transform) analysis. FFT data can be plotted in the *Data Collection Window* by setting the analysis type selector to *FFT* (Figure 15).
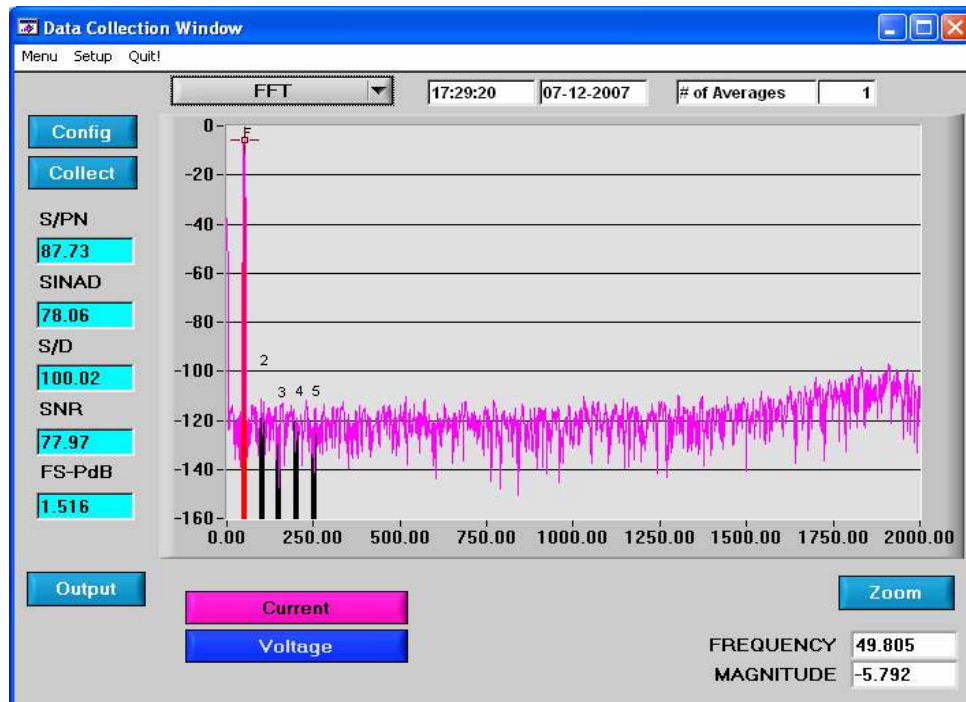
Figure 15. FFT Analysis

2.8.12.1 FREQUENCY

Displays the x-axis value of the cursor on the FFT display.

2.8.12.2 MAGNITUDE

Displays the y-axis value of the cursor on the FFT display.

2.8.12.3 S/PN

Indicates the signal-to-peak noise ratio (decibels).

2.8.12.4 SINAD

Indicates for the signal-plus-noise-plus-distortion to noise-plus-distortion ratio (decibels).

2.8.12.5 S/D

Indicates for the signal-to-distortion ratio, 4 harmonics are used in the calculations (decibels).

2.8.12.6 SNR

Indicates for the signal-to-noise ratio, first 4 harmonics are not included (decibels).

2.8.12.7 FS-Pdb

Indicates for the full-scale to signal Ratio (decibels).

2.8.12.8 Time Domain Information

The following controls and indicators are associated with time domain analysis. Time domain data can be plotted in the *Data Collection Window* by setting the analysis type selector to *Time Domain* (Figure 16).
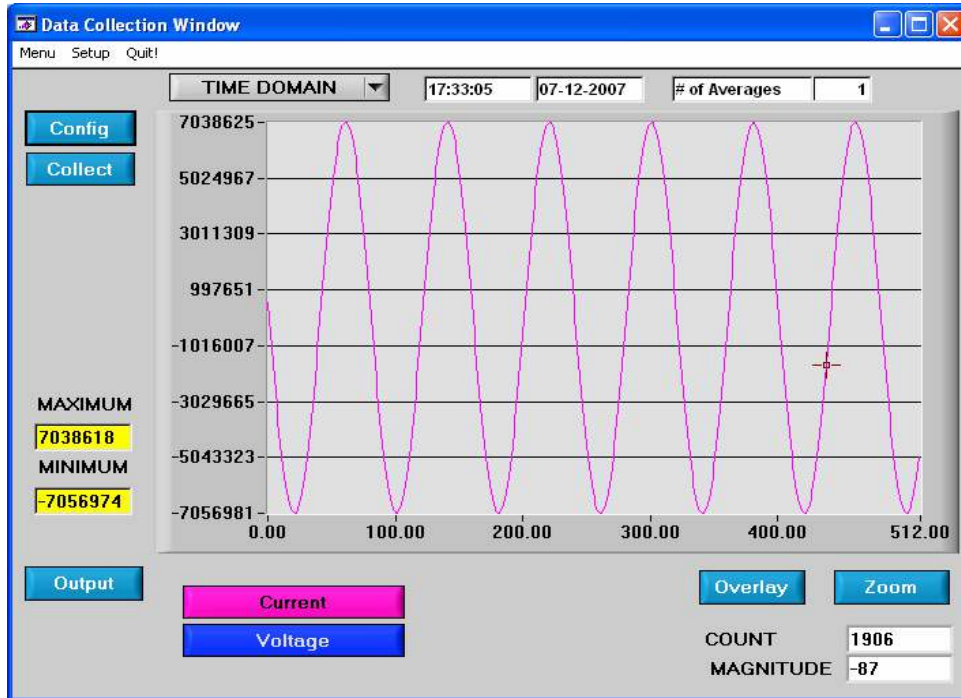
Figure 16. Time Domain Analysis

2.8.12.9 COUNT

Displays current x-position of the cursor on the time domain display.

2.8.12.10 MAGNITUDE

Displays current y-position of the cursor on the time domain display.

2.8.12.11 MAXIMUM

Indicates for the maximum value of the collected data set.

2.8.12.12 MINIMUM

Indicates for the minimum value of the collected data set.

2.9   EEPROM Window

CDB5463U has an "Auto-Boot" demo feature that uses the on-board serial EEPROM, so that the CDB5463U can operate independently without being connected to a PC. CDB5463U GUI software also provides an EEPROM Window for reading & writing the serial EEPROM (Figure 17).
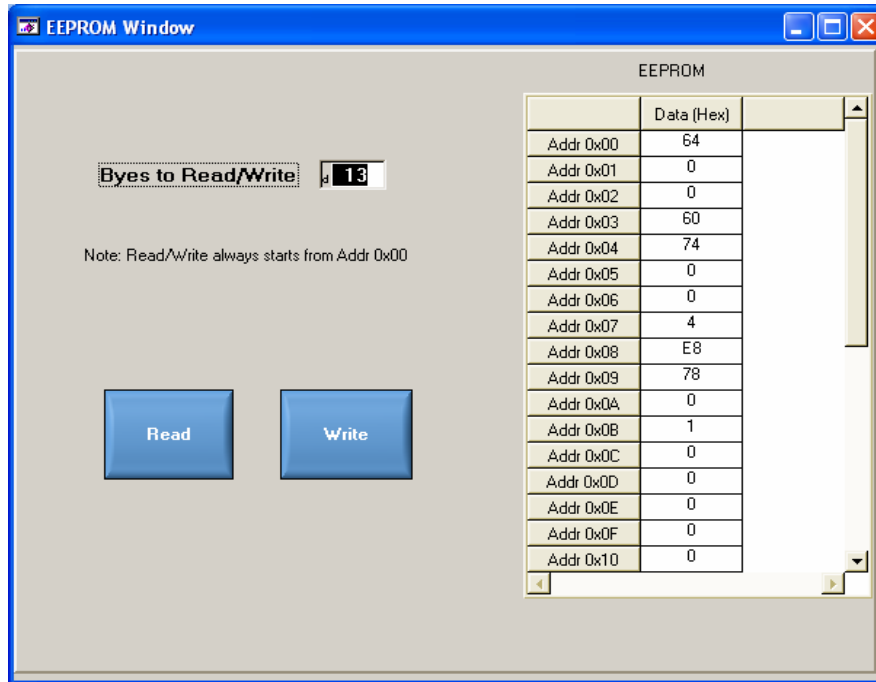
Figure 17.   EEPROM Window

2.9.1   *Bytes to Read/Write*

The *Bytes to Read/Write* field allows the user to define the number of bytes to read or write.

2.9.2   *Read EEPROM*

First input the number of bytes to read in the *Bytes to Read/Write* field. After pressing the *Read* button, that number of bytes starting from the address 0x00 will be read from EEPROM and displayed in the *EEPROM* table in hexadecimal format.

2.9.3   *Write EEPROM*

Input the number of bytes to write in the *Bytes to Read/Write* field and input the hexadecimal byte values in the EEPROM table starting from address 0x00. After pressing the *Write* button, the bytes in the *EEPROM* table will be written to the EEPROM.

2.10 Debug Panel

The *Debug* panel provides the user a way to access CS5463 registers and send commands to CS5463 directly (Figure 18). Remember that the correct register page must be selected before accessing a register location. Refer to 5.15 in CS5463 data sheet for more details.

Figure 18. Debug Panel

APPENDIX A. BILL OF MATERIALS

CIRRUS LOGIC
CDB5463U_Rev_B.bom

BILL OF MATERIAL (Page 1 of 2)

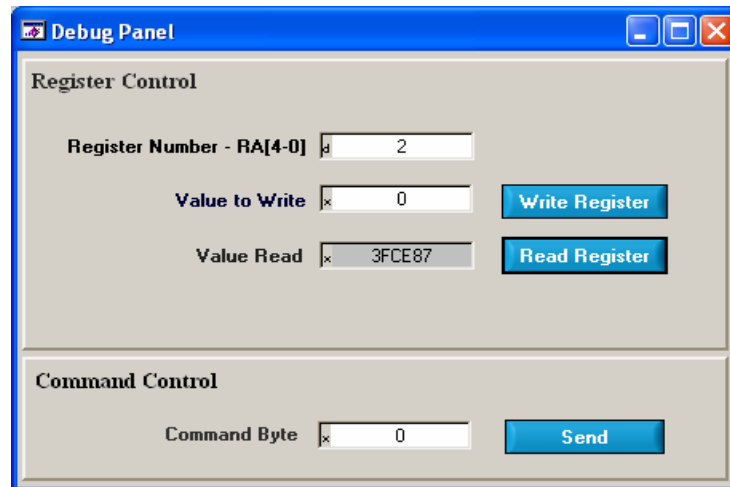| Item	Cirrus P/N	Rev	Description	Qty	Reference Designator	MFG	MFG P/N	Notes
1	001-06872-Z1	A	CAP 0.1uF ±10% 50V NPb X7R 1206	6	C1 C18 C19 C21 C29 C30	KEMET	C1206C104K5RAC	
2	001-02779-01	A	CAP 22pF ±5% 50V C0G 0805	1	C2	KEMET	C0805C220J5GAC	
3	001-02189-Z1	A	CAP 0.1uF ±10% 16V X7R NPb 0603	5	C3 C4 C26 C32 C33	KEMET	C0603C104K4RAC	
4	012-00010-Z1	A	CAP 47uF ±20% 16V NPb ELEC CASE C	4	C5 C8 C28 C31	PANASONIC	EEE1CA470WR	
5	001-04344-01	A	CAP 0.1uF ±5% 50V X7R 0805	7	C6 C7 C10 C11 C12 C15 C25	KEMET	C0805C104J5RAC	
6	001-03266-01	A	CAP 220pF ±10% 50V X7R 0805	4	C9 C17 C20 C24	KEMET	C0805C221K5RAC	
7	001-06685-01	A	CAP 0.018uF ±10% 50V X7R 1206	2	C13 C23	KEMET	C1206C183K5RAC	
8	012-00012-01	A	CAP 10uF ±20% 16V ELEC CASE A	3	C14 C22 C1000	PANASONIC	ECEV1CS100SR	
9	001-07078-01	A	CAP 1uF ±10% 25V X7R 1206	1	C16	KEMET	C1206C105K3RAC	
10	070-00055-01	A	DIODE ARRAY 5V (TVS) ESD SOT143	1	D1	LITTLE FUSE	SP0503BAHT	
11	165-00004-01	A	LED CLR SUP RED 1.7V 1mA 1.6MCD SMD	6	D2 D3 D4 D5 D6 D7	CHICAGO MINIATURE	CMD28-21SRC/TR8/T1	
12	115-00003-01	A	HDR 5x2 MLE .1"CTR S GLD	1	J1	SAMTEC	TSW-105-07-G-D	
13	110-00041-01	A	CON RA USB BLK	1	J2	AMP	787780-1	
14	110-00010-01	A	CON BPOST 2" SILV NYLON INS RED	3	J3 J5 J6	JOHNSON COMPONENTS	111-0102-001	REQUIRES WIRE, 1.5L X 0.25T X 0.25T TYPE E 24/19 BLU SQUIRES ELEC. INC.
15	110-00008-01	A	CON BPOST 2" SILV NYLON INS BLK	1	J4	JOHNSON COMPONENTS	111-0103-001	REQUIRES WIRE, 1.5L X 0.25T X 0.25T TYPE E 24/19 BLU SQUIRES ELEC. INC.
16	115-00016-01	A	HDR 3x2 MLE .1"CTR .062BD S GLD	6	J8 J9 J17 J22 J24 J26	SAMTEC	TSW-103-07-G-D	
17	115-00014-01	A	HDR 2x1 ML .1"CTR .062BD ST GLD TH	5	J10 J13 J15 J16 J18	SAMTEC	TSW-102-07-G-S	
18	115-00013-01	A	HDR 2x2 MLE .1"CTR .062BD S GLD	1	J12	SAMTEC	TSW-102-07-G-D	
19	110-00056-01	A	CON TERM BLOCK 2 POS 5mm C/C BLUE	1	J14	ON-SHORE TECHNOLOGY	ED 100/2DS	
20	110-00055-01	A	CON TERM BLOCK 4 POS 5mm C/C BLUE	2	J23 J27	OST	ED 100/4DS	
21	115-00009-01	A	HDR 3x1 ML .1"CTR .062BD ST GLD TH	1	J25	SAMTEC	TSW-103-07-G-S	
22	115-00031-01	A	HDR 11x2 MLE .1"CTR S GLD	1	J40	SAMTEC	TSW-111-07-G-D	
23	080-00004-01	A	WIRE, JUMPER 2P, 0.1"CTR, BRASS	6	JP1 JP2 JP3 JP4 JP5 JP6	COMPONENTS CORPORATION	TP-101-10	
24	304-00001-01	A	SPCR, STANDOFF 4-40 THR, 0.875"L	4	MH1 MH2 MH3 MH4	KEYSTONE	1809	REQUIRES 4-40- PAN HEAD SCREW
25	020-01848-01	A	RES 2k OHM 1/8W ±1% 0805 FILM	12	R2 R3 R6 R7 R8 R14 R15 R16 R17 R29 R36 R38	DALE	CRCW08052001F	
26	020-01588-01	A	RES 10 OHM 1/8W ±1% 0805 FILM	1	R4	DALE	CRCW080510R0F	
27	020-01816-01	A	RES 1k OHM 1/8W ±1% 0805 FILM	5	R5 R11 R12 R13 R18	DALE	CRCW08051001F	
28	020-01930-01	A	RES 10k OHM 1/8W ±1% 0805 FILM	0	R19	DALE	CRCW08051002F	DO NOT POPULATE
29	035-00005-01	A	RES POT, 5k ±10%, 25 TURN TRIMMING	0	R20	BOURNS	3296W-1-502	DO NOT POPULATE
30	020-01667-01	A	RES 49.9 OHM 1/8W ±1% 0805 FILM	1	R21	DALE	CRCW080549R9F	
31	020-01905-01	A	RES 6.04k OHM 1/8W ±1% 0805 FILM	0	R22	DALE	CRCW080560 41F	DO NOT POPULATE
32	021-00759-01	A	RES 1k OHM 1/3W ±5% 1210 FILM	4	R23 R24 R26 R28	DALE	CRCW1210102J	

CIRRUS LOGIC
CDB5463U_Rev_B.bom

BILL OF MATERIAL (Page 2 of 2)

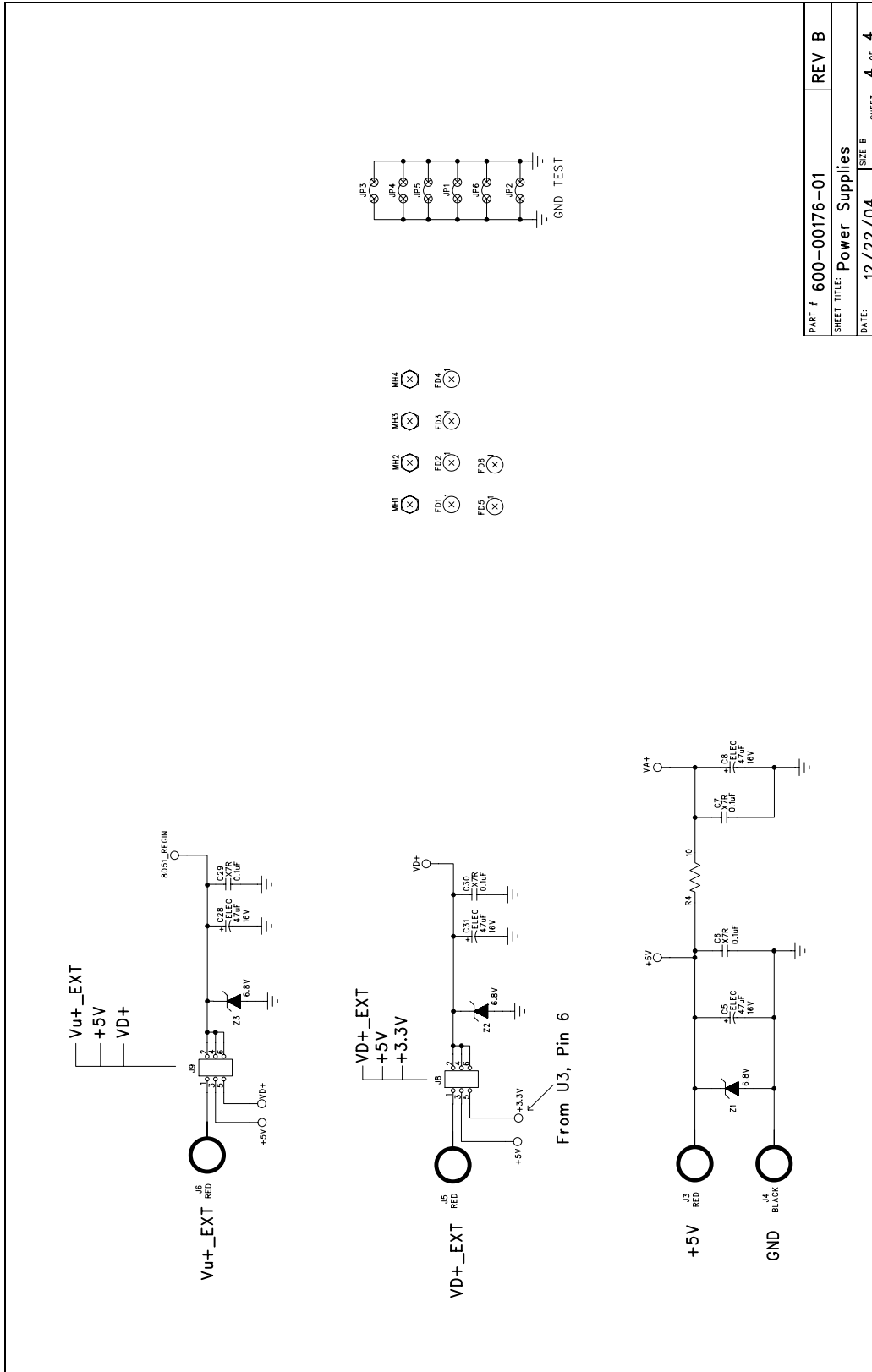| Item	Cirrus P/N	Rev	Description	Qty	Reference Designator	MFG	MFG P/N	Notes
33	020-03355-01	A	RES 301 OHM 1/3W ±1% 1210 FILM	1	R25	DALE	CRCW12103010F	
34	020-03378-01	A	RES 470 OHM 1/3W ±1% 1210 FILM	4	R30 R31 R32 R33	DALE	CRCW12104700F	
35	020-03539-01	A	RES 12.1k OHM 1/3W ±1% 1210 FILM	1	R35	DALE	CRCW12101212F	
36	020-02748-01	A	RES 15k OHM 1/8W ±1% 1206 FILM	1	R37	DALE	CRCW12061502F	
37	020-01473-01	A	RES 0 OHM 1/18W ±1% 0805 FILM	12	R51 R52 R53 R54 R55 R56 R57 R58 R59 R60 R61 R62	DALE	CRCW08050000Z	
38	020-02273-Z1	A	RES 0 OHM 1/4W NPb 1206 FILM	1	R64	DALE	CRCW12060000Z0EA	
39	120-00002-01	A	SWT 0/1 TACT W/ESD	1	S1	C&K	PTS645TL50	
40	110-00045-01	A	CON TEST PT .1"CTR TIN PLATE BLK	16	TP1 TP2 TP9 TP10 TP11 TP12 TP13 TP20 TP21 TP22 TP23 TP24 TP25 TP26 TP27 TP30	KEYSTONE	5001	INSTALL AFTER WASH PROCESS
41	062-00124-01	A	IC PGM 128 BIT SER EEPROM SOT23-5	1	U1	MICROCHIP	24LC00-I/OT	NOT PROGRAMMED BEFORE ASSEMBLED
42	061-00250-01	A	IC DIG LOW V BUF/LDRV 5V OPEN DRAIN	1	U2	FAIRCHILD SEMICONDUCTOR	74LCX760WM	
43	062-00079-01	A	IC PGM USB 16kB FLASH MCU LQFP32	1	U3	CYGNAL	C8051F320	NOT PROGRAMMED BEFORE ASSEMBLED
44	060-00061-01	A	IC LNR PRECISION V REF 2.5V SO8	1	U4	LINEAR TECH	LT1019CS8-2.5	
45	061-00190-01	A	IC LOG, UHS TINY, DUAL BUF, SC70-6	1	U5	FAIRCHILD SEMICONDUCTOR	NC7WZ07P6X	
46	065-00162-Z3	C	IC CRUS PWR/ENERGY MON NPb SSOP24	1	U6	CIRRUS LOGIC	CS5463-ISZ/C	
47	061-00002-01	A	IC LOG INV 5P UHS TINY SOT23	1	U8	FAIRCHILD SEMICONDUCTOR	NC7SZ04M5X	
48	061-00219-01	A	IC LOG UHS TINY ANALOG SWT 6P SC70	2	U9 U11	FAIRCHILD SEMICONDUCTOR	NC7SB3157P6X	
49	062-00122-01	A	IC PGM EEPROM 512x8 4K SPI SOIC8	1	U10	ATMEL	AT25040AN-10SI-2.7	NOT PROGRAMMED BEFORE ASSEMBLED
50	080-00003-01	A	WIRE BPOST 1.5X.25" 24/19 GA BLU	4	XJ3XJ4 XJ5 XJ6	SQUIRES	L-1.5X.25TX.25T_TYPE_E_	WIRES FOR BINDING POSTS
51	300-00001-01	A	SCREW 4-40X5/16" PH STEEL	4	XMH1 XMH2 XMH3 XMH4	BUILDING FASTENERS	PMS 440 0031 PH	SCREWS FOR STANDOFFS
52	135-00013-01	A	SKT PINCH CONTACT FOR SSOP24	0	XU6	ENPLAS	OTS-2434-0.65-01	DO NOT POPULATE
53	312-00008-01	A	INSULATOR .312 x .145 FOR HC49U/US	1	XY1	ECS	700-9001	INSULATOR FOR Y1
54	100-00049-01	A	XTL OSC 4.0960MHZ HC49S 50ppm 50pF	1	Y1	CAL CRYSTAL	CCL-6S-4.0960C14F	REQUIRES INSULATOR XY1
55	070-00006-01	A	DIODE TR 6.8V 600W AXL	3	Z1 Z2 Z3	LITTLE FUSE	P6KE6.8	
56	110-00013-Z1	D	CON SHUNT 2P .1"CTR BLK NPb	12		MOLEX	15-29-1025	INSTALL SHUNTS PER ASSY DWG 603-00176-01
57	422-00037-01	A1	LBL SUBASSY PRODUCT NUMBER	1		CIRRUS LOGIC	422-00037-01	PLACE PRODUCT NUMBER LABEL PER ASSY DWG 603-00176-01
58	240-00176-Z1	B	PCB CDB5460A_61A_63	1		CIRRUS LOGIC	240-00176-Z1	
59	603-00176-01	B	ASSY DWG PWA CDB5460A_61A_63	REF		CIRRUS LOGIC	603-00176-01	
60	600-00176-01	B	SCHEM CDB5460A_61A_63	REF		CIRRUS LOGIC	600-00176-01	
61	020-01473-01	A	RES 0 OHM 1/18W ±1% 0805 FILM	0	R34	DALE	CRCW08050000Z	DO NOT POPULATE
62	110-00045-01	A	CON TEST PT .1"CTR TIN PLATE BLK	0	TP7 TP8	KEYSTONE	5001	DO NOT POPULATE

APPENDIX B. SCHEMATICS
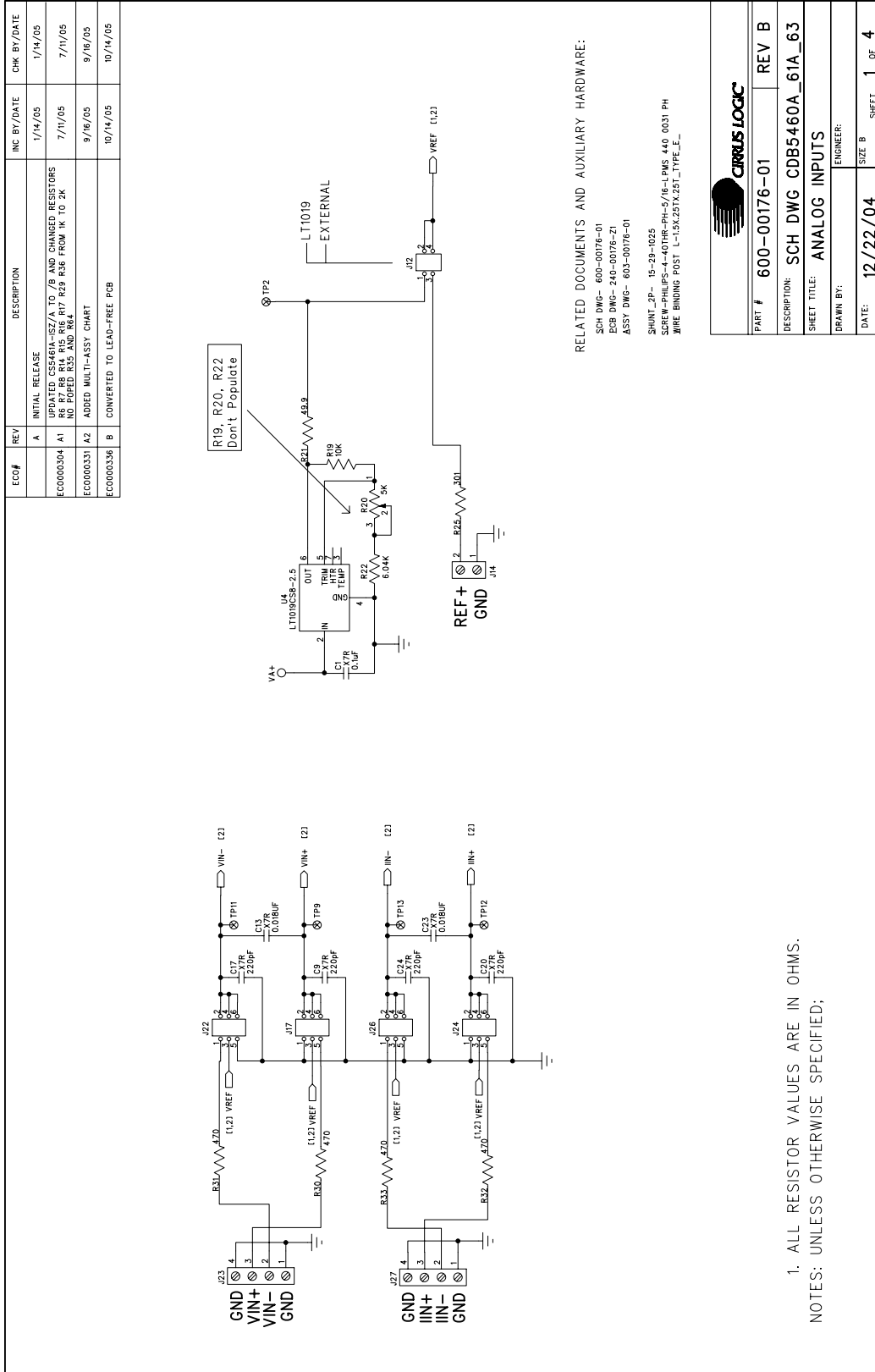
Figure 19. Schematic - Analog Inputs

Figure 20. Schematic - CS5463 & Socket

Figure 21. Schematic - Microcontroller & USB Interface

Figure 22. Schematic - Power Supplies

GND TEST

JP3 JP4 JP5 JP1 JP6 JP2

MH4 FD4
MH3 FD3
MH2 FD2 FD6
MH1 FD1 FD5

8051_REGN

C29 X7R 0.1uF
C28 ELEC 47uF 16V
Z3 6.8V

Vu+_EXT
+5V
VD+

J9
+5V
VD+

Vu+_EXT
J6 RED

VD+

C30 X7R 0.1uF
C31 ELEC 47uF 16V
Z2 6.8V

VD+_EXT
+5V
+3.3V

J8
+5V
+3.3V

From U3, Pin 6

VD+_EXT
J5 RED

VA+
C8 ELEC 47uF 16V
C7 X7R 0.1uF

R4 10

+5V
C6 X7R 0.1uF
C5 ELEC 47uF 16V
Z1 6.8V

+5V
J3 RED

GND
J4 BLACK

PART # 600-00176-01
REV B
SHEET TITLE: Power Supplies
DATE: 12/22/04
SIZE B
SHEET 4 OF 4

APPENDIX C. LAYER PLOTS

Figure 23. Top Silkscreen
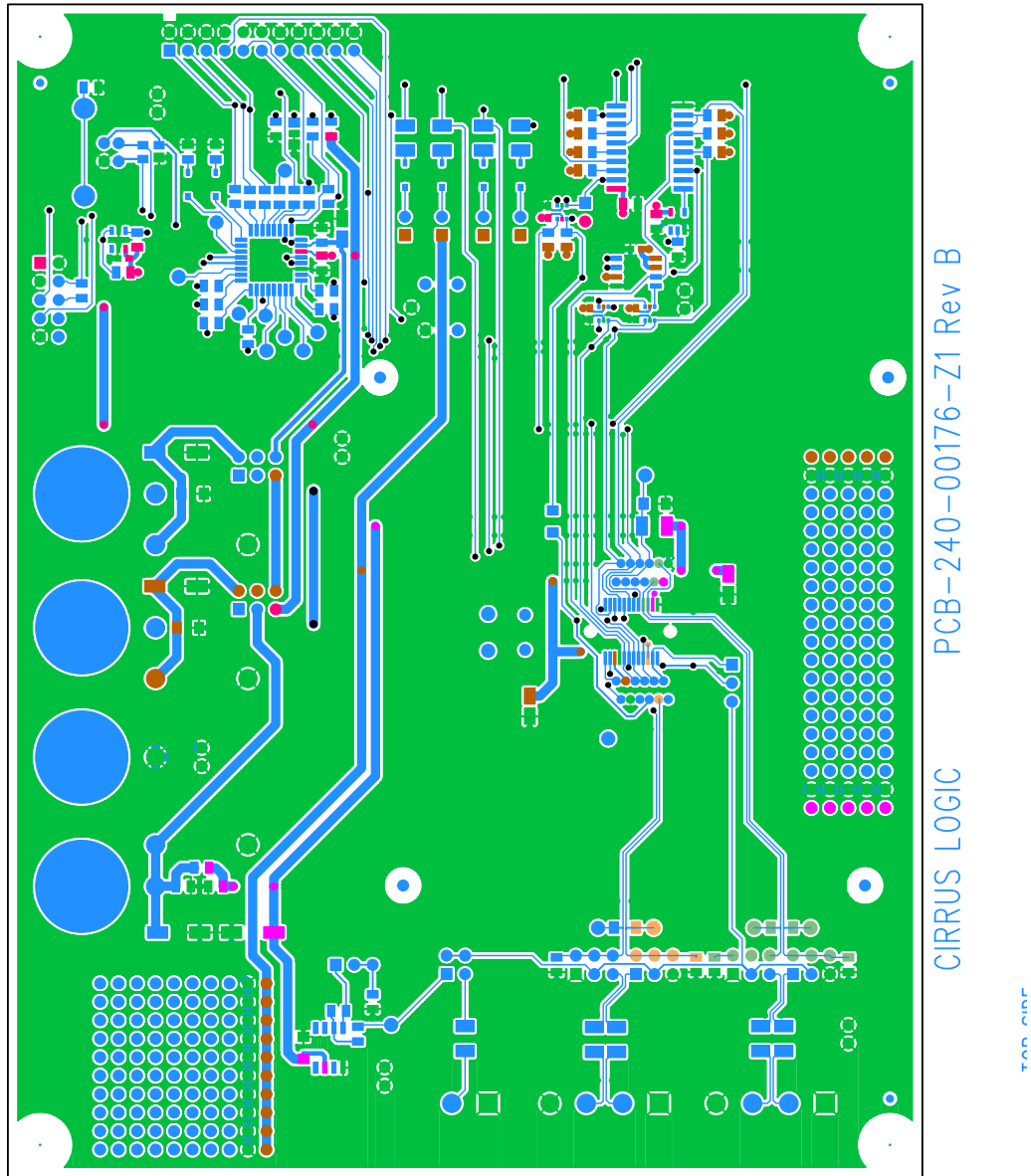
Figure 24. Top Routing
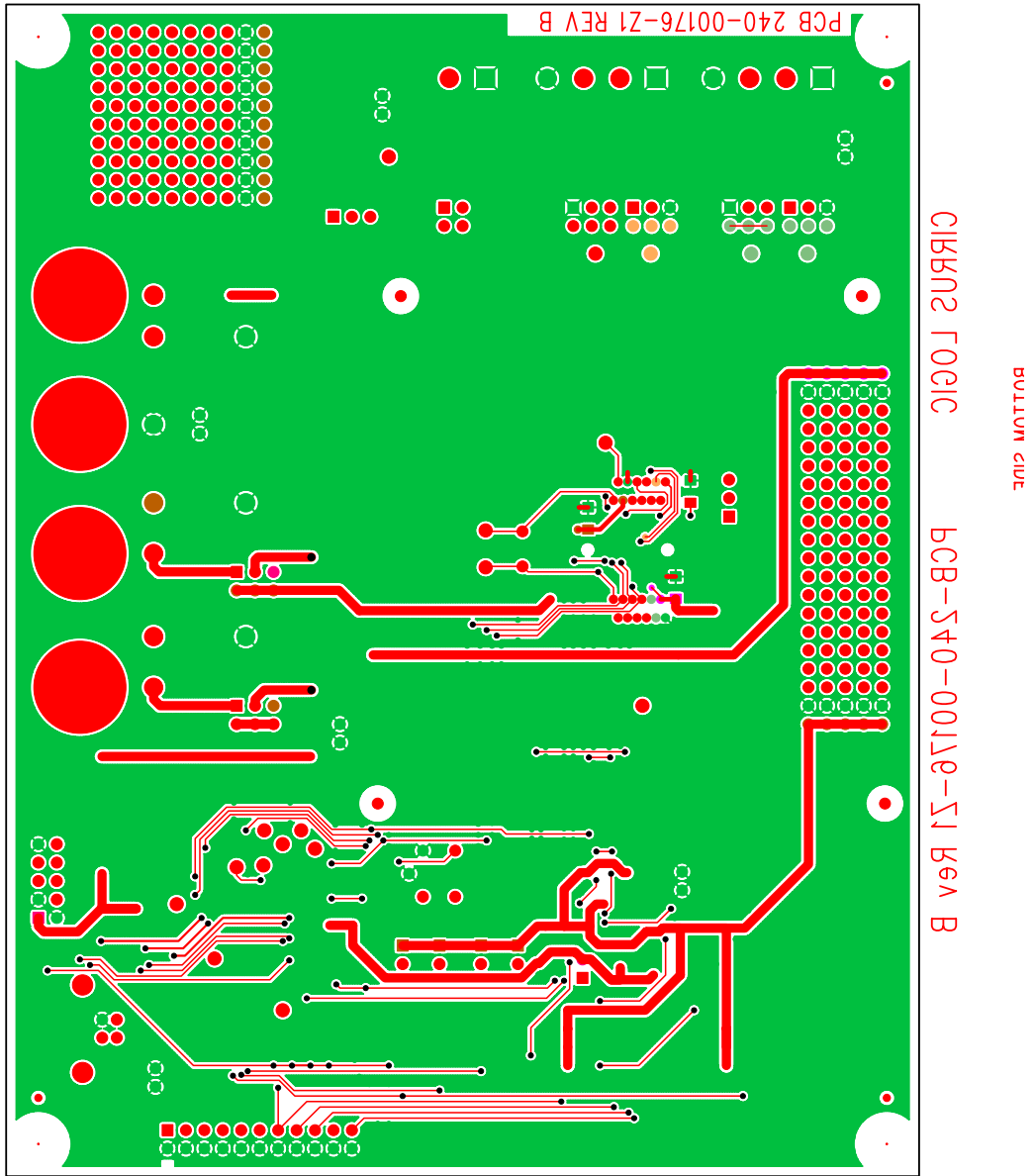
Figure 25. Bottom Routing
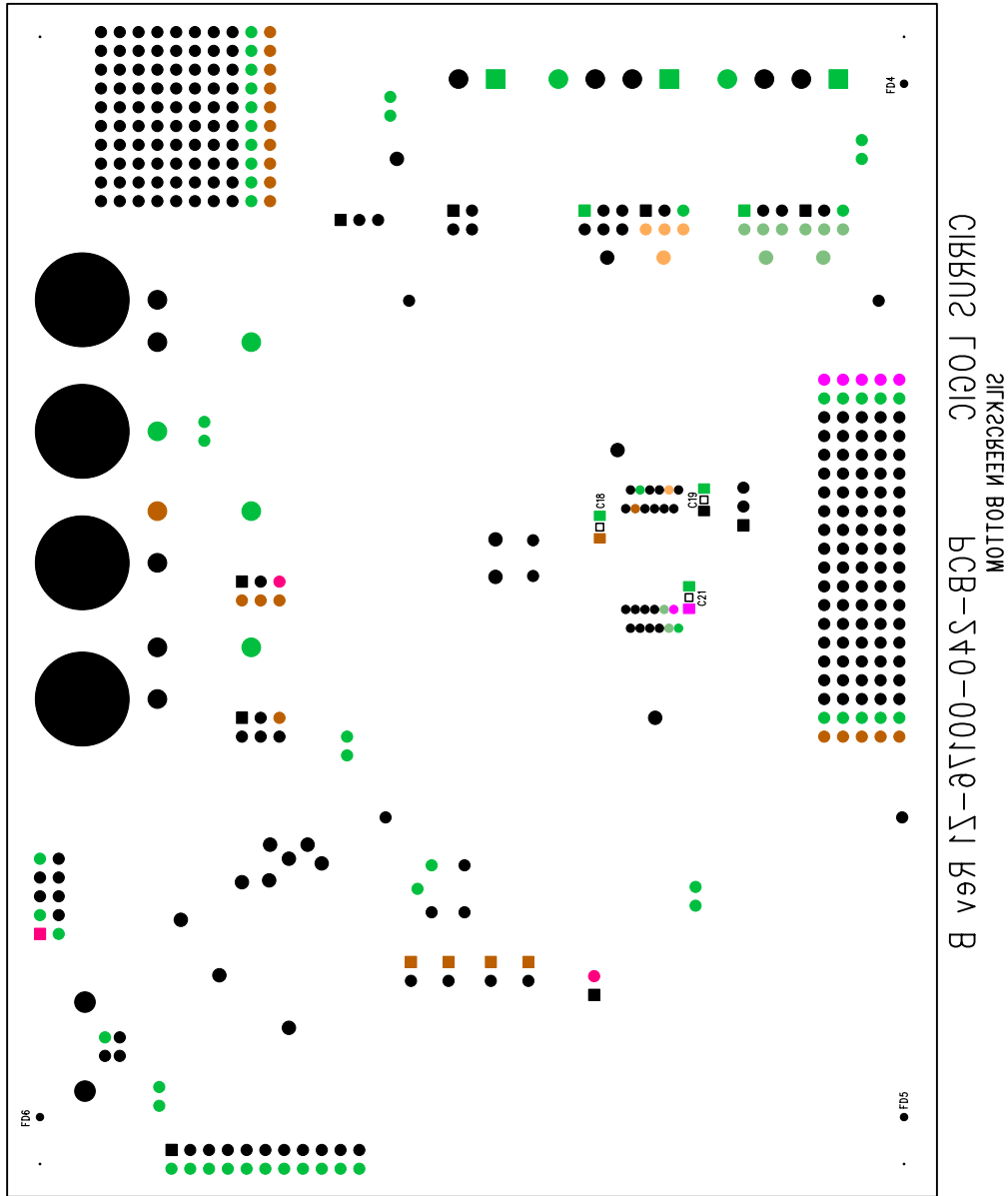
Figure 26. Bottom Silkscreen

REVISION HISTORY

Revision	Date	Changes
DB1	SEP 2007	Initial Release.
DB2	OCT 2007	Minor correction to List of Figures.

Contacting Cirrus Logic Support

For all product questions and inquiries contact a Cirrus Logic Sales Representative. To find the one nearest to you go to www.cirrus.com

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