DESCRIPTION

Demonstration circuit 1907A is an isoSPI™ analyzer board.

isoSPI is a bi-direction 2-wire serial interface with high noise immunity and the ability to communicate over long cables. Because isoSPI is a proprietary serial interface with unique signaling, the DC1907 board is available to help users develop systems using the isoSPI serial link. The DC1907 can be connected across the two wires of an isoSPI link to decode the isoSPI communication and convert the signals to standard 4-wire SPI. The DC1907 is also capable of displaying the isoSPI link data on a PC for analysis or troubleshooting.

Design files for this circuit board are available at http://www.linear.com/demo

LT, LT, LTC, LTM, Linear Technology and the Linear logo are registered trademarks and isoSPI is a trademark of Linear Technology Corporation. All other trademarks are the property of their respective owners.

OPERATION DESCRIPTION

The DC1907 implements an isoSPI receiver that can connect across a 2-wire isoSPI data link. The DC1907 does not terminate the isoSPI lines and should represent a minimal load to an operating isoSPI serial link. The DC1907 decodes the isoSPI data using comparators to check for minus 1 and plus 1 signals and an FPGA to check pulse timing. After pulses have been decoded the FPGA outputs the serial data in a standard SPI format onto the logic analyzer header JP13 for analysis with an oscilloscope or logic analyzer. The FPGA also sends the detected isoSPI data to an onboard microcontroller(MCU) that formats the data and transmits it to a PC. The MCU connects to the PC over a USB link. Software is available that can decode the data sent from the DC1907 to the PC. The software is capable of displaying data and data logging. For LTC®6804 battery management applications the software is capable of decoding unique device commands and checking the command packet error codes(PEC) to aid program development.

PERFORMANCE SUMMARY Specifications are at $T_A = 25°C$

SYMBOL	PARAMETER	CONDITIONS	MIN	TYP	MAX	UNITS
V_S	Supply Range		4.5		5.5	V
I_{SUPPLY}	Supply Current			150		mA
V_{LOGIC}	Logic Analyzer Voltage Output Level			3.3		V

BOARD PHOTO
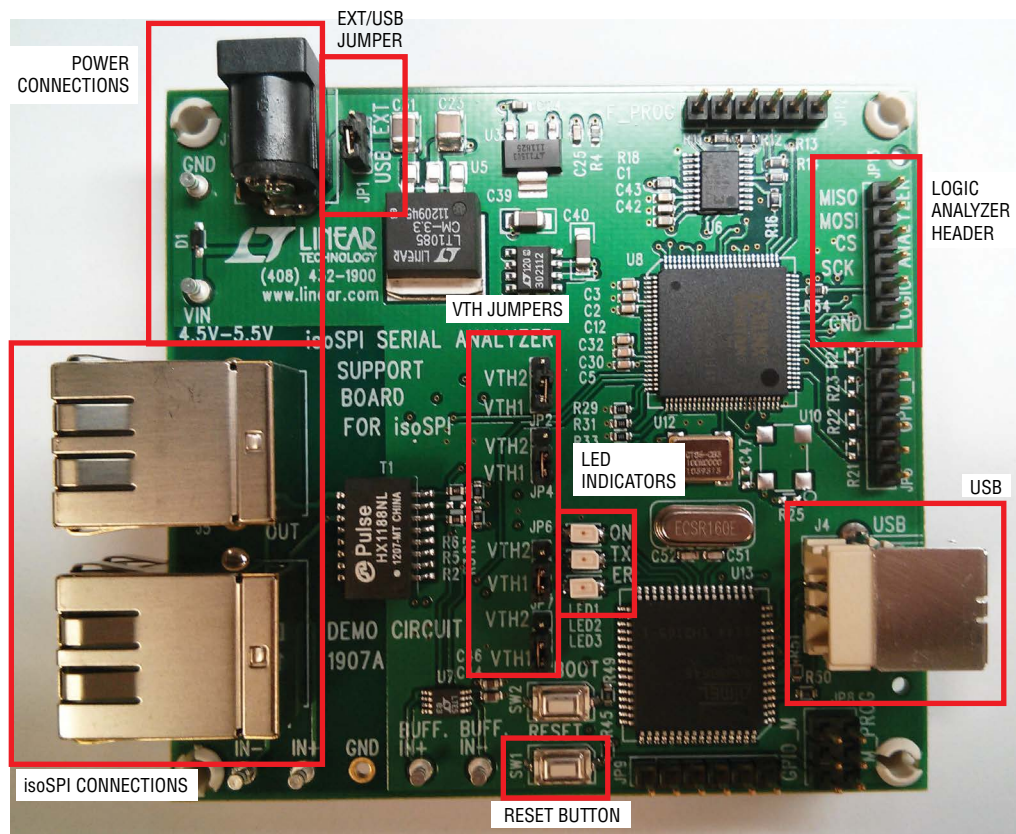
CONNECTION SUMMARY

Turrets

- V_{IN}: Power supply input, 4.5V to 5.5V up to 200mA

- GND: Power supply ground connection

- IN$^+$: Isolated IP turret. This turret connects to the IP line of an isoSPI network

- IN$^-$: Isolated IM turret. This turret connects to the IM line of an isoSPI network

- Buff IN$^+$: A buffered version of the isoSPI IP signal

- Buff IN$^-$: A buffered version of the isoSPI IM signal

Logic Analyzer Header

- MOSI: The decoded master out slave in signal

- MISO: The decoded master in slave out signal

- CS: The decoded chip select

- SCK: The decoded clock signal

Connections

- J1 Power Jack

- RJ45 IN

- RJ45 OUT

- USB

JUMPER SUMMARY

JP1 V_IN - EXT/USB

- Ext: Set to EXT to power the board from an external 5V supply.

- USB(default): Set to USB to power the board from a PC's USB port (no external supply required).

JP 2, 4, 6, 7 - VTH Jumpers

Note that all four of these jumpers must be connected the same (i.e. connected to VTH1 or VTH2).

- VTH1: Use this setting for an isoSPI link with Ibias between 160µA and 1mA (default setting).

- VTH2: Use this setting for an isoSPI link with Ibias between 100µA and 160µA.

LED SUMMARY

ON: Indicates the state of the connection between the PC and the DC1907 MCU. If the LED is blinking, the MCU is waiting for the PC to connect. If the LED is solid this means the MCU is connected to the PC.

TX: Indicates when data is being sent from the MCU to the PC. The LED turns on when the MCU is communicating with the PC.

ER: Indicates a full transmit buffer. If this LED is ON the PC will most likely have lost some of the isoSPI transmitted data.

BUTTON SUMMARY

Reset: Can be used to reset the MCU. This button is useful if the MCU appears to be non responsive and data is not being received by the PC.

Boot: This button is used to program the MCU. Do not use.

SOFTWARE INSTALLATION

- Unzip isoSPI_Software.zip

- Double click setup.exe and go through setup instructions

- Software will install into a Start Menu → Programs folder called Linear Technology

DRIVER INSTALLATION

Windows XP

- Connect the DC1907 to a USB port and wait for new hardware installer to open.

- Do not allow windows to search for the driver automatically. Select the *install from a list or specific location* option, then navigate to the folder where the DC1907 software was installed. This will default to either C:\Program Files\LTC\DC1907_Generic or C:\Program Files\LTC\DC1907_LTC6804 depending on which version of the software was installed. If both versions are installed, the driver can be found in either location.

- Windows should now find the DC1907.inf file and install the drivers.

Windows 7/XP

- Connect the DC1907 to a USB port and Windows will automatically begin it's driver installation process. It will fail after a short time.

- From the Start Menu, open the Control Panel.

- In the Control Panel, navigate to System and Security. Then, click on System and in the System window open the Device Manager.

- Look under Ports (COM & LPT). There should be an open port named DC1907_isoSPI_Analyzer (COMxx)

- Right click on the DC1907_isoSPI_Analyzer (COMxx) port and choose the Update Driver Software option.

- Next, choose the *Browse my computer for Driver software* option.

- Navigate to and select the DC1907's driver file, named **DC1907.inf**, located in the folder that the DC1907 software was installed into. This will default to either C:\Program Files(x86)\LTC\DC1907_Generic or C:\Program Files(x86)\LTC\DC1907_LTC6804 depending on which version of the software was installed.

- Windows will finish up the driver installation from there.

HARDWARE CONNECTIONS

4-Wire SPI Decode Connection

Figure 1 shows how to connect the DC1907 to two DC1941(LTC6820) isoSPI demo boards.

1) Set JP1 to USB if you want the DC1907 to be powered from the computer USB port. Make sure threshold jumpers are set to VTH1.

2) Connect the DC1907 to a PC through a USB port.

3) Connect both DC1941 J1 RJ45 connectors to the DC1907 with two CAT5 patch cables.
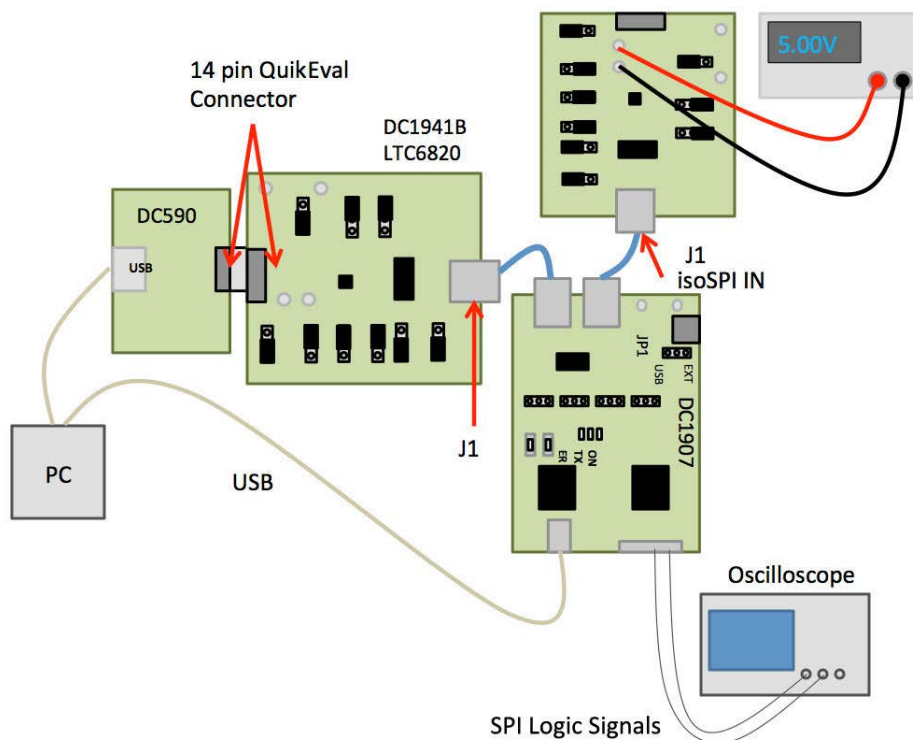

Figure 1. isoSPI Demo Board Setup

HARDWARE CONNECTIONS

Figure 2 shows how to connect the DC1907 to any isoSPI network.

1) The DC1907 must be connected on the cable side of the isoSPI network. Connect the IN+ turret to the isolated IP signal. Connect the IN− turret to the isolated IM signal. The IN+ → IP and IN− →IM connect can be made on test points, in the cable or even on the pads of the transformer.

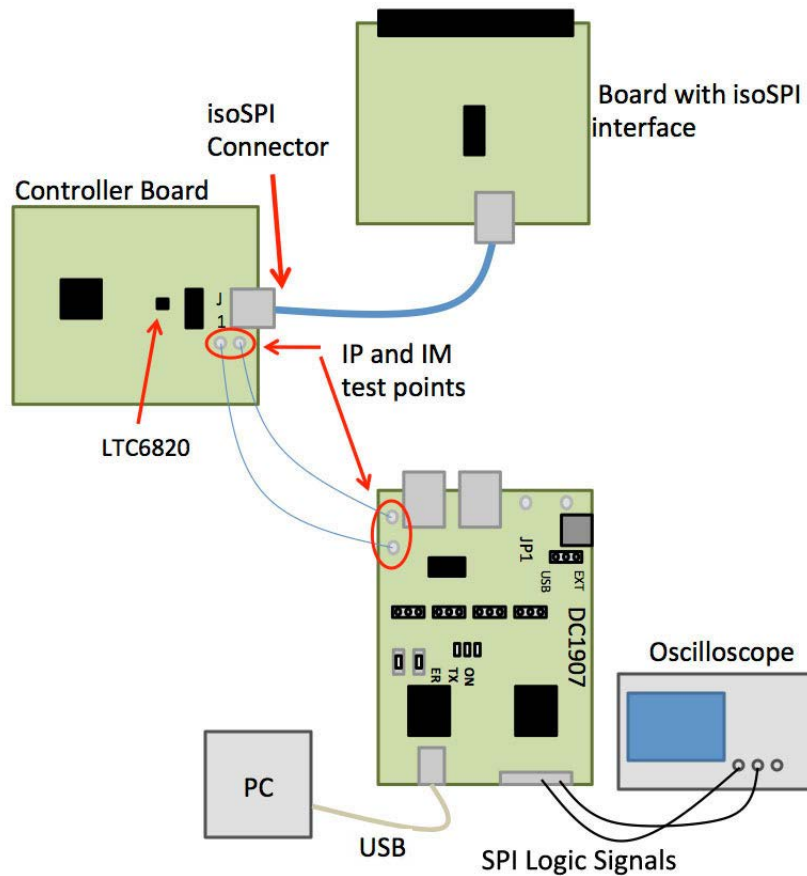2) Set JP1 to USB to have the board powered from the computer's USB port.

3) Connect the DC1907 to the PC through a USB port.

Figure 2. General isoSPI Connection Setup

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LTC6804 SOFTWARE OPERATION

The DC1907 isoSPI monitoring software is easy to use. When you open the software you will see the window shown in Figure 3.

The software will automatically try to connect to the attached DC1907. Once the board connects, the status box will become green and indicate connected. The ON LED on the DC1907 should be blinking while the software is trying to connect. Once the software has connected, the LED will turn solid. If the board does not connect, make sure that the ON LED is blinking. If it is not blinking press the reset button located on the DC1907 demo board. Once the LED is blinking, manually select the comm. port in the software and click the connect button. Generally, if there is more than one port listed the DC1907 will most likely be the highest numbered port. The connection status is also indicated on the DC1907 board by the ON LED.

Once the software has connected (Figure 4) it will begin to display data decoded by the DC1907. The software displays LTC6804 data separated into IC data and command data. The IC data is made up of the master out slave in (MOSI) row and the master in slave out (MISO) row. Data is displayed in hex format. The LTC6804 command data is decoded and the software will check to make sure the transmitted command PEC matches a calculated PEC.
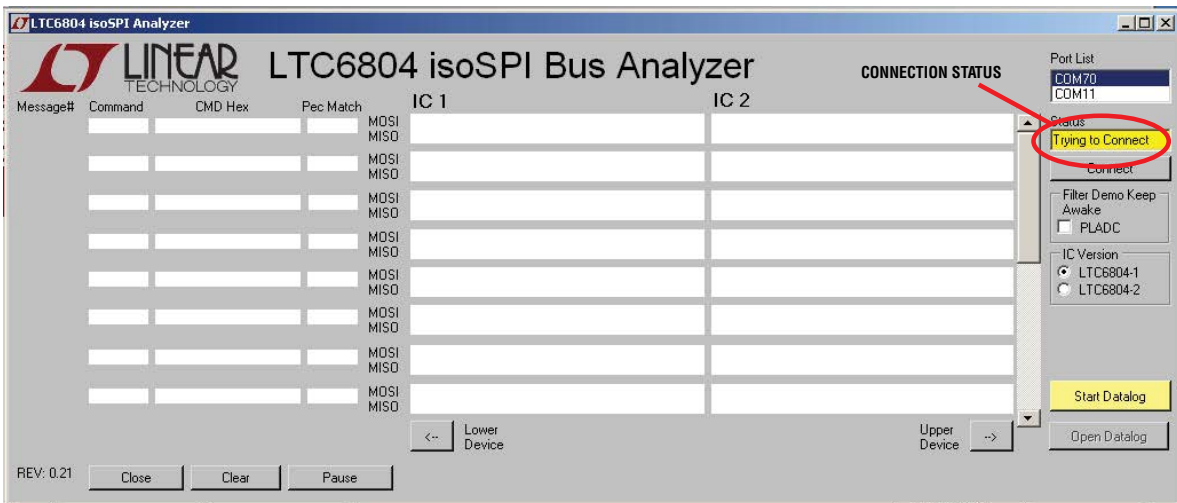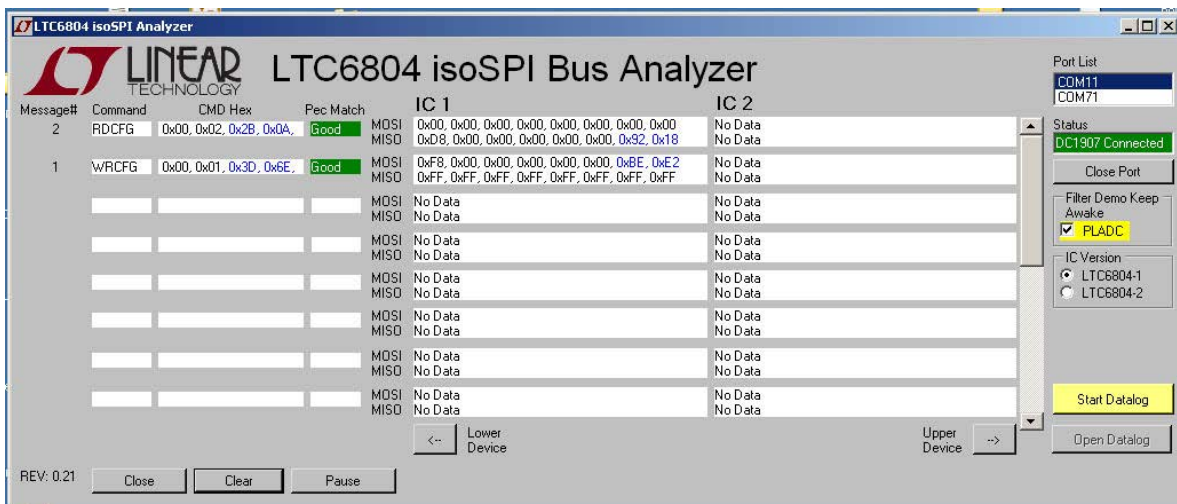

Figure 3. isoSPI Analyzer Start Screen

Figure 4.

LTC6804 SOFTWARE OPERATION

If desired, the decoded isoSPI hex data can be saved into a .csv file by clicking the Start Datalog button. A dialog box will open as is shown in Figure 5. A custom file name and save location can be entered along with notes to append to the data log. To start the datalog click the green Start Datalog button.

When using the DC1907 with the LTC6804-2, the IC version should be changed from LTC6804-1 (default) to LTC6804-2. When the LTC6804-2 is selected, the display will reformat as shown in Figure 6. In this mode the software will read the address of each command and display it next to the data.

Additional Software Controls

- Pause/Resume: Pauses the screen from updating and can be used to pause the programs datalog. The software will continue to decode the isoSPI traffic in the background.

- Clear: Clears the screen buffer and message counter.

- Open Datalog: Opens the last completed datalog file in Windows Notepad to be viewed.

- Close: Closes the program and disconnects the DC1907.

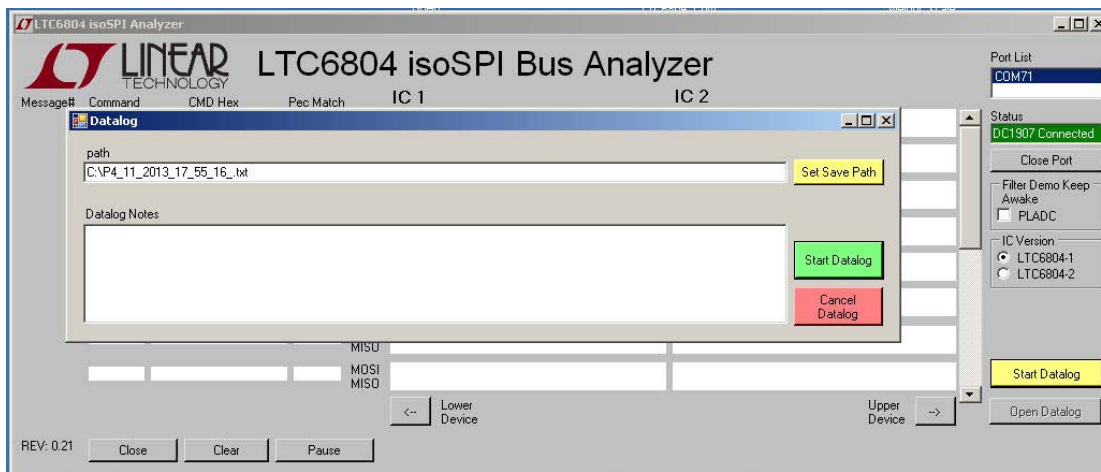- Close Port: Disconnects the DC1907 and stops data decode.

Figure 5. Datalog Dialog
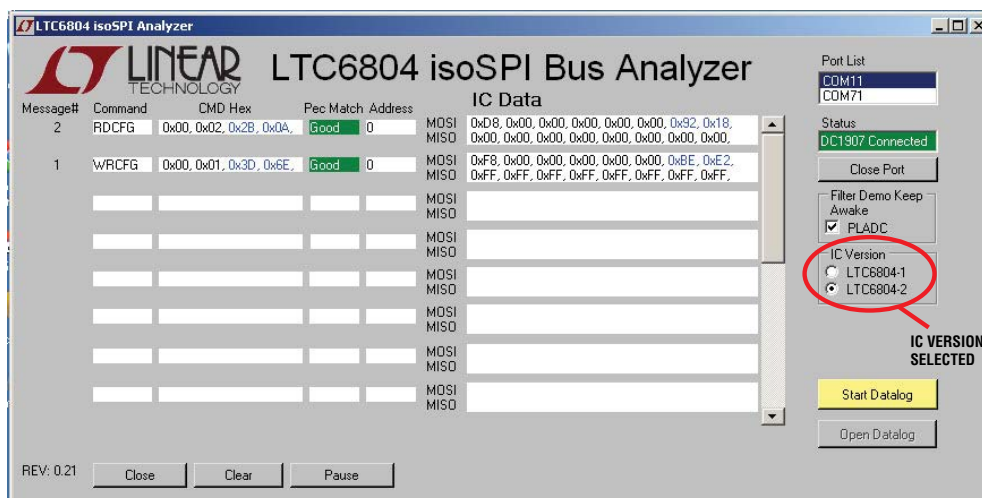

Figure 6. isoPSI Analyzer in LTC6804-2 Mode

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GENERIC SOFTWARE OPERATION

The Generic DC1907 isoSPI monitoring software can be used to monitor any isoSPI traffic. When you open the software you will see the window in Figure 7.

The software will automatically try to connect to the attached DC1907. Once the board connects the status box will become green and indicate connected. The ON LED on the DC1907 should be blinking while the software is trying to connect. Once the software has connected the LED will turn solid. If the board does not connect, first make sure that the ON LED is blinking. If it is not blinking press the reset button located on the DC1907 demo board. Once the LED is blinking, manually select the com. port in the software and click the connect button. Generally if there is more than one port listed the DC1907 will most likely be the highest numbered port. The connection status is also indicated on the DC1907 board by the ON LED.
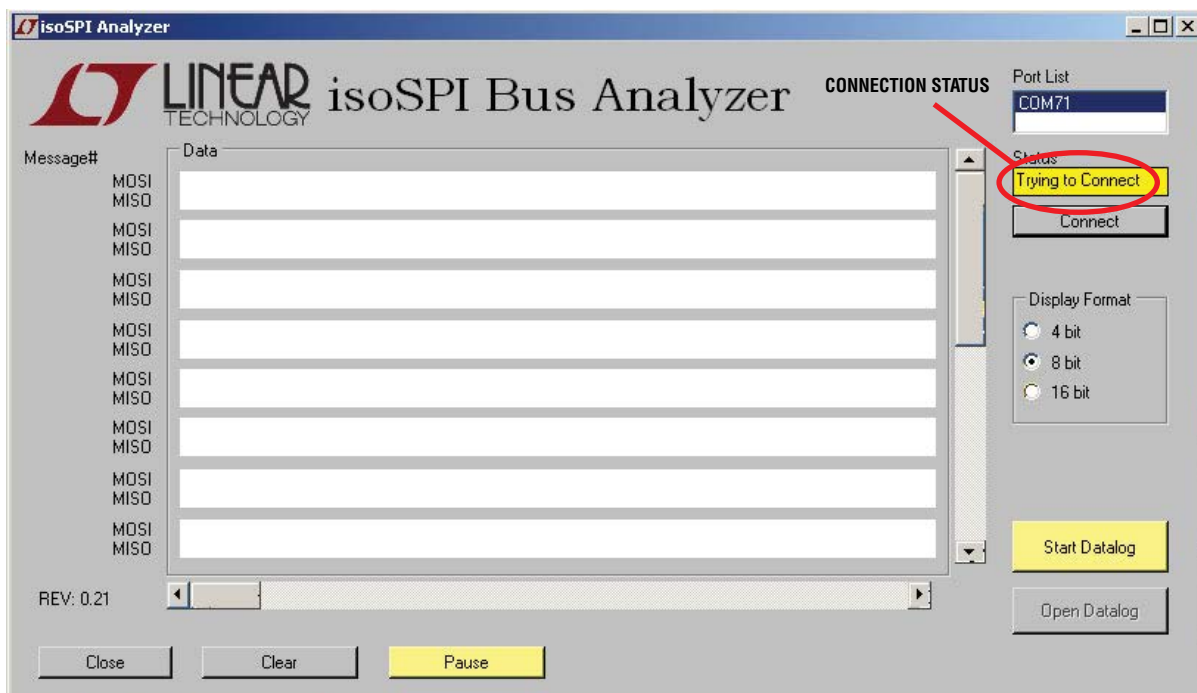

Figure 7. Generic isoSPI Analyzer GUI

GENERIC SOFTWARE OPERATION

Once the software has connected to the DC1907 it will begin to display data seen by the DC1907 shown in Figure 8. The software displays the master out slave in (MOSI) data and the master in slave out (MISO) data on separate lines and the data is displayed in hex format. By default the software displays data divided into bytes; this can be changed so that data is grouped into bytes, nibbles or 16 bit words. If desired, the decoded isoSPI hex data can be saved into a .csv file by clicking the Start Datalog button. A dialog will open, a custom file name and save location can be entered along with notes to append to the data log. To start the datalog, click the green Start Datalog button.

Additional Software Controls

• Pause/Resume: Pauses the screen from updating and can be used to pause the programs datalog. The software will continue to decode the isoSPI traffic in the background.

• Clear: Clears the screen buffer and message counter.

• Open Datalog: Opens the last completed datalog file in Windows Notepad to be viewed.

• Close: Closes the program and disconnects the DC1907

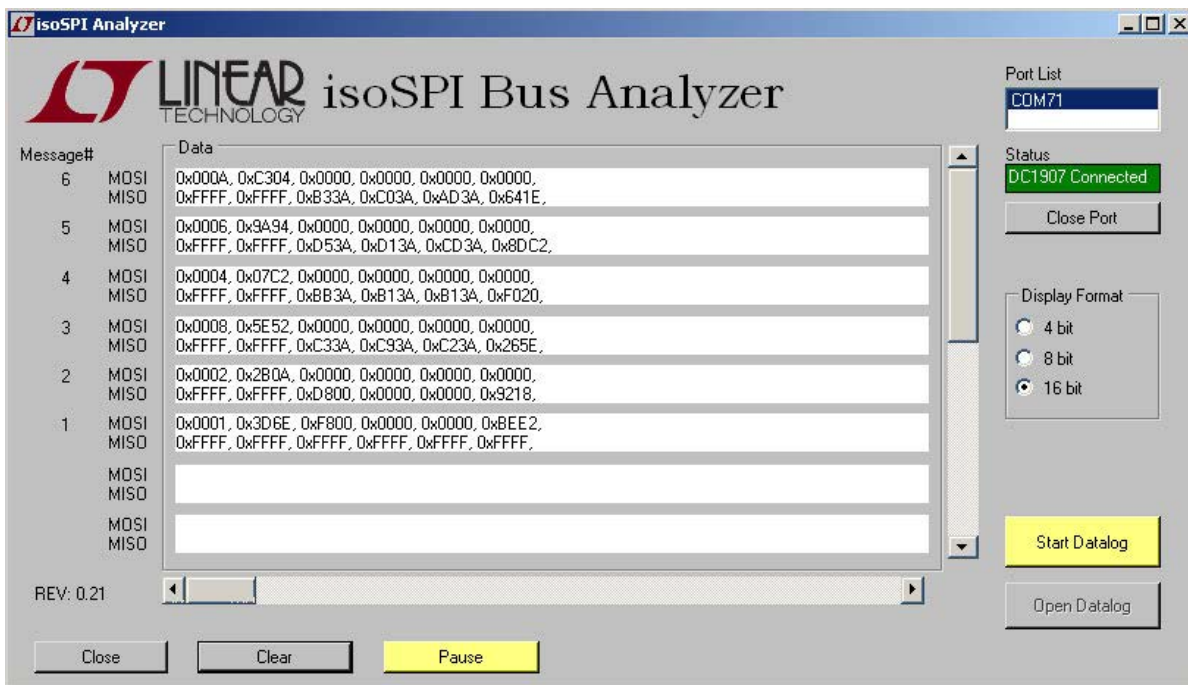• Close Port: Disconnects the DC1907 and stops data decode.
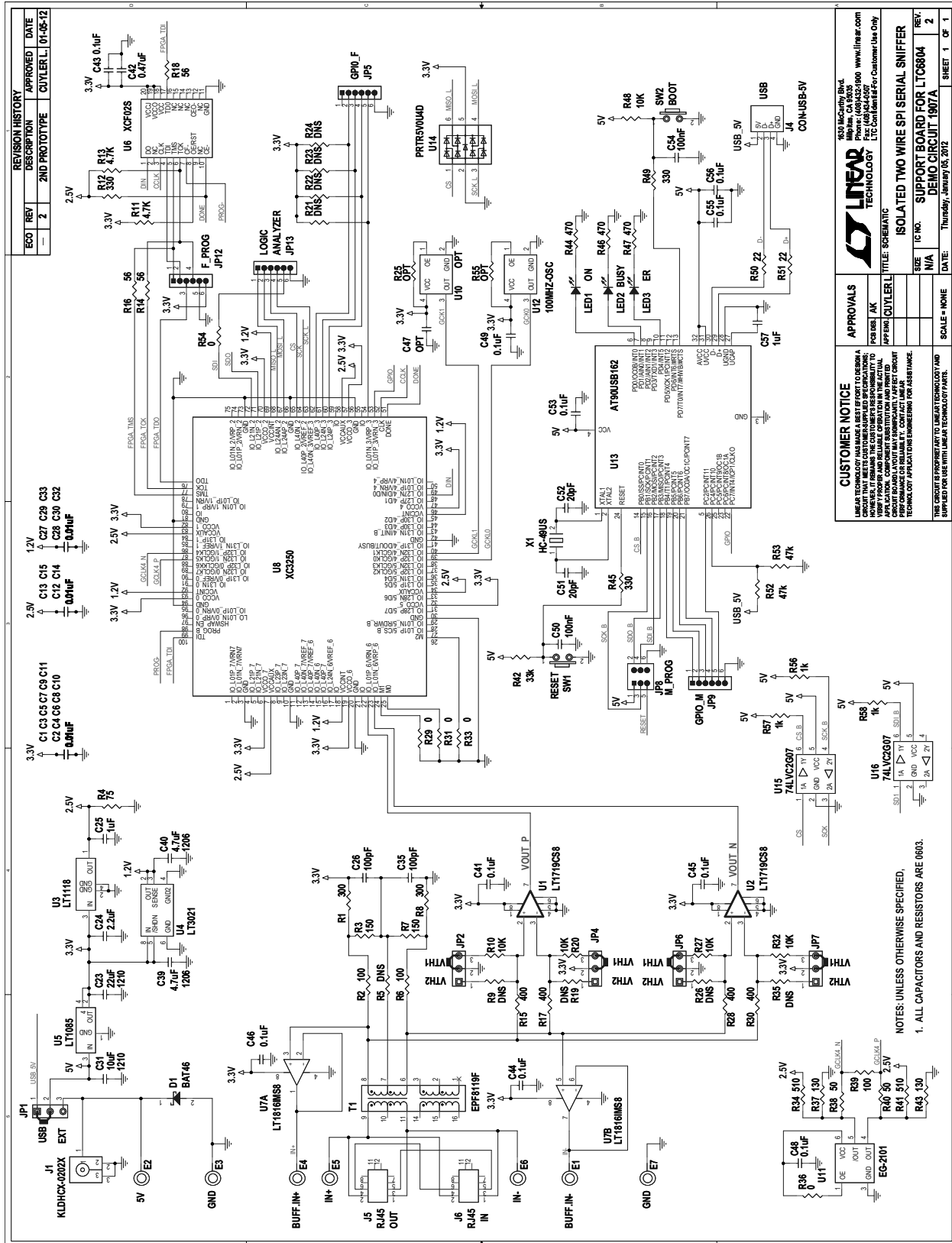

Figure 8.

PARTS LIST

ITEM	QTY	REFERENCE	PART DESCRIPTION	MANUFACTURER/PART NUMBER
Required Circuit Components				
1	21	C1, C2, C3, C4, C5, C6, C7, C8, C9, C10, C11, C12, C13, C14, C15, C27, C28, C29, C30, C32, C33	CAP, 0.01µF 10% 25V X7R, 0603	AVX, 06033C103KAT
2	1	C23	CAP, 22µF 20%, 16V X7R,1210	AVX,1210YC226KAT2A
3	1	C24	CAP, 2.2µF 10% 16V X5R, 0603	TAIYO YUDEN, EMK107BJ225KA-T
4	2	C25, C57	CAP, 1µF 10% 16V X5R, 0603	AVX, 0603YD105KAT2A
5	2	C26, C35	CAP, 100pF 10% 25V X5R, 0603	AVX, 06033C101KAT2A
6	1	C31	CAP, 10µF 20%, 16V X7R,1210	AVX, 1210YC106KAT2A
7	2	C39, C40	CAP, 4.7µF 20% 16V X5R, 1206	TAIYO YUDEN, EMK316BJ475KL-T
8	9	C41, C43, C44, C45, C46 C49, C53, C55, C56	CAP, 0.1µF 20% 10V X5R, 0603	TAIYO YUDEN, LMK107BJ104MV-F
9	1	C42	CAP, 0.47µF 20% 16V X5R, 0603	AVX, 0603YD474KAT2A
10	0	C47, C48	OPT, 0603	
11	2	C50, C54	CAP, 100nF 20% 25V X7R, 0603	AVX, 06033C104MAT2A
12	2	C51, C52	CAP, 20pF 10% 25V COG, 0603	AVX, 06033A220KAT2A
13	1	D1	SMALL SIGNAL SCHOTTKY DIODE, SOD-323	ST, BAT46JFILM
14	6	E1, E2, E3, E4, E5, E6	TESTPOINT, TURRET, 0.060"	MILL-MAX, 2308-2-00-80-00-00-07-0
15	5	JP1, JP2, JP4, JP6, JP7	HEADER, 3PIN, 2MM	SAMTEC TMM-103-02-L-S
16	5	XJP1 TO XJP7	SHUNT, 0.079" CENTER	SAMTEC, 2SN-BK-G
17	4	JP5, JP9, JP12, JP13	HEADER, 6 PIN, 0.100"	SAMTEC TSW-106-02-L-S
18	1	JP8	HEADER, 2X3 PIN, 0.100"	SAMTEC TSW-103-02-L-D
19	1	J1	POWER JACK, KLDHCX-0202-AC	KYCON, KLDHCX-0202-AC
20			DELETE BANANA JACKS	
21	1	J4	CONNECTOR, USB	TE CONNECTIVITY, 292304-2
22	2	J5, J6	CONNECTOR RJ45, CACE CODE 00779	TE CONNECTIVITY, 5406298-1-ND
23	3	LED1, LED2, LED3	RED1206 LED	PANASONIC/LN1251C
24	2	R1, R8	RESISTOR, 300Ω 1% 0603	VISHAY, CRCW0603300RFKEA
25	2	R2, R6	RESISTOR, 100Ω 1% 0603	VISHAY, CRCW0603100RFKEA
26	2	R3, R7	RESISTOR, 150Ω 1% 0603	VISHAY, CRCW0603150RFKEA
27	1	R4	RESISTOR, 75Ω 1% 0603	VISHAY, CRCW060375R0FKEA
28	0	R5, R21, R22, R23, R24, R25, R35, R55	OPT, 0603	
29	4	R9, R19, R26, R35	RESISTOR, 40.2kΩ 1% 0603	VISHAY, CRCW060340K2FKEA
30	5	R10, R20, R27, R32, R48	RESISTOR, 10kΩ 1% 0603	VISHAY, CRCW060310K0FKEA
31	2	R11, R13	RESISTOR, 4.7kΩ 1% 0603	VISHAY, CRCW06034K70FKEA
32	3	R12, R45, R49	RESISTOR, 330Ω 1% 0603	VISHAY, CRCW0603330RFKEA
33	3	R14, R16, R18	RESISTOR, 56Ω 1% 0603	VISHAY, CRCW060356R0FKEA
34	4	R15, R17, R28, R30	RESISTOR, 402Ω 1% 0603	VISHAY, CRCW0603402RFKEA
35	4	R29, R31, R33, R54	RESISTOR, 0Ω 1% 0603	VISHAY, CRCW06030000Z0EA

PARTS LIST

ITEM	QTY	REFERENCE	PART DESCRIPTION	MANUFACTURER/PART NUMBER
36	0	R34, R36, R37, R38, R39, R40, R41, R43	OPT	
37	1	R42	RESISTOR, 33kΩ 1% 0603	VISHAY, CRCW060333K0FKEA
38	3	R44, R46, R47	RESISTOR, 470Ω 1% 0603	VISHAY, CRCW0603470RFKEA
39	2	R50, R51	RESISTOR, 22Ω 1% 0603	VISHAY, CRCW060322R0FKEA
40	3	R56, R57, R58	RESISTOR, 1kΩ 1% 0603	VISHAY, CRCW06031K00FKEA
41	2	SW1, SW2	SWITCH, PUSH BUTTON	PANASONIC/EVQPPDA25
42	1	T1	TRANSFORMER, HX1188NL	PULSE, HX1188NL
43	2	U1, U2	IC, LT1719CS8	LINEAR TECHNOLOGY, LT1719CS8
44	1	U3	IC, LT1118	LINEAR TECHNOLOGY, LT1118
45	1	U4	IC, LT3021	LINEAR TECHNOLOGY, LT3021
46	1	U5	IC, LT1085	LINEAR TECHNOLOGY, LT1085
47	1	U6	IC, XCF02SVOG20C	XILINX, XCF02SVOG20C
48	1	U7	IC, LT1819IMS8	LINEAR TECHNOLOGY, LT1819IMS8
49	1	U8	IC, XC3S50-5VQG100C	XILINX, XC3S50-5VQG100C
50	0	U10	20MHZ-OSC, OPT	
51	0	U11	CRISTAL OSCILL, OPT	
52	1	U12	CRISTAL, 100MHz 4-SMB DFN,LCC	CTS-FREQUENCY CONTROLS, CB3LV-3I-100M0000
53	1	U13	8-BIT MICROCONTROLLER, TQFP64	ATMEL, AT90USB646-AU, PACKAGE MD
54	1	U14	PRTR5V0U4D, SOT457-TSOP6	NXP SEMI, PRTR5V0U4D
55	2	U15, U16	BUFFER WITH OPEN-DRAIN OUTPUTS, SOT363	NXP SEMI, 74LVC2G07GW
56	1	X1	QUARTZ CRYSTAL	ECS INC, ECS-160-20-4-DN
57	4	MH1 TO MH4	STAND-OFF, NYLON 0.5" TALL	KEYSTONE, 8833(SNAP ON)

dc1907af

SCHEMATIC DIAGRAM

Information furnished by Linear Technology Corporation is believed to be accurate and reliable. However, no responsibility is assumed for its use. Linear Technology Corporation makes no representation that the interconnection of its circuits as described herein will not infringe on existing patent rights.

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DEMO MANUAL DC1907A

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