Click here to ask about the production status of specific part numbers.

MAX11410 Evaluation Kit

Evaluates: MAX11410/MAX11410A

General Description

The MAX11410 evaluation kit (EV kit) demonstrates the 24-bit multi-channel low-power delta-sigma ADC. The EV kit includes a graphical user interface (GUI) that provides communication from the target device to the PC. The GUI allows the user to configure all the registers and includes graphing software to display captured data and calculate the histogram and FFT.

EV Kit Contents

- MAX11410 EV kit
- Micro-USB cable

MAX11410 EV Kit Files

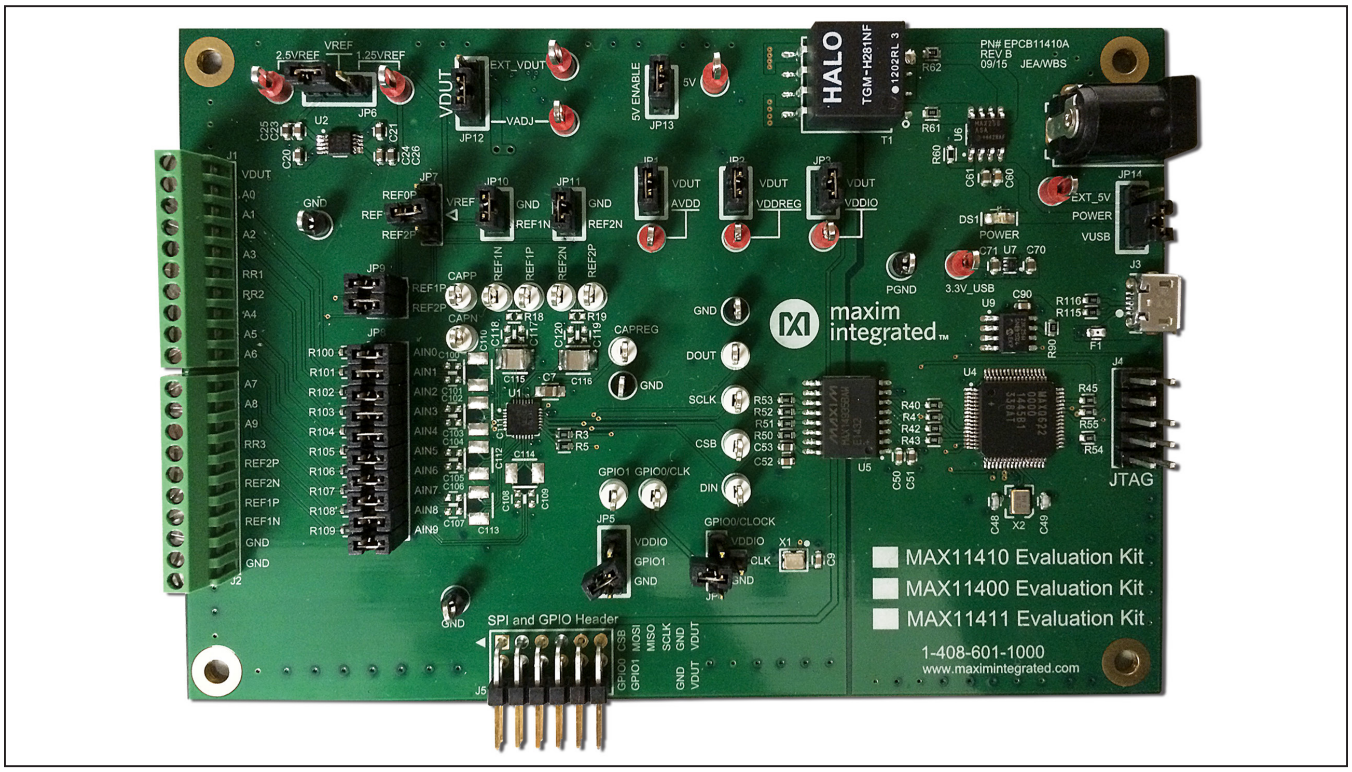
FILE	DESCRIPTION
MAX11410EVKitSetup.exe	Application Program

Features

- Easy Evaluation of MAX11410/MAX11410A
- USB Powered
- Selectable On-Board Voltage Reference (2.5V, 1.25V)
- Optional External Clock (2.4576MHz)
- Isolated Power and Digital Communication
- Various Sample Rates and Sample Sizes
- Time Domain, Frequency Domain, and Histogram Plotting
- Savable Plots and Register Configurations
- Windows XP®, Windows® 7, Windows 8.1-Compatable Software
- Fully Assembled and Tested

***Ordering Information* appears at end of data sheet.**

MAX11410 EV Kit Photo



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Quick Start

Required Equipment

- MAX11410 EV kit
- Windows XP, Windows 7, or Windows 8.1 PC
- Micro-USB cable
- Screwdriver
- Wires

Note: In the following sections, software-related items are identified by bolding. Text in **bold** refers to items directly from the EV kit software. Text in **bold and underline** refers to items from the Windows operating system.

Procedure

The EV kit is fully assembled and tested. Follow the steps below to verify board operation:

1) Ensure that the jumpers/shunts are in their default locations. Refer to Table 2.
2) Prior to starting the GUI, connect the EV kit hardware to a PC using the supplied micro-USB cable. The Power LED (DS1) should be green.
3) The EV kit hardware is configured as a HID device so Windows should automatically begin installing the necessary drivers. Once the driver installation is complete, a Windows message appears near the **System Icon** menu indicating the hardware is ready to use. If the GUI was started before this message appears then restart the GUI.
4) Visit **www.maximintegrated.com/evkitsoftware** to download the latest version of the EV kit software, MAX11410EVKitSetup.ZIP.
5) Save the EV kit software to a temporary folder. Unzip the .ZIP file and double-click the .EXE file to run the installer. A message box asking **Do you want to allow the following program to make changes to this computer?** may appear. If so, click **Yes**.
6) Follow the instructions on the installer and once complete, click **Finish**. The default location of the software is in the program files directory.
7) Launch the GUI and when it appears it should automatically connect to the hardware. The GUI should display **EV Kit Hardware Connected** in the lower right hand corner.
8) Connect a signal to the desired inputs (A0–A9) on the screw connector (J1–J2) using a wire and a screwdriver. For example, connect the $1.25V_{REF}$ testpoint to A2.
9) In the GUI on the **ADC Config** tab, select **AINP** to AIN2 and **AINN** to GND for the **Channel MUX**.
10) Click **Convert** and then **Click Read Data and Status** to see the converted data.

Detailed Description

Software Startup

When the software is started, it searches for the EV kit hardware and connects to it if found. If connection to the EV kit is successful, the GUI displays **EV Kit Hardware Connected** in the status bar's lower-right corner. Then it writes default registers settings shown in Table 1 and reads all the registers to display on the GUI.

Status Log

The **Status Log** group box below the tabs displays all the actions the GUI performs. When an action is requested, the log confirms the action or shows an error message. The log can be cleared by pressing the **Clear Log** button.

Table 1. Startup GUI Registers Settings

SETTING	VALUE
Digital Filter	60Hz SINC4
Sample Rate	59.8sps
MUX - AINP	AIN2
MUX_AINN	GND
Channel	0
Conversion Mode	Continuous

ADC Config Tab

The **ADC Config** tab provides an interface for configuring the IC from a functional perspective. The **Block** tab (Figure 1) provides for configuration of the input MUX, input path, data format, filtering, calibration, reference current sources, V_{BIAS}, and power. To read all the configuration settings, click the **Read All** button in the **Serial Interface** block. When a setting is changed, the register associated with that setting is automatically written. The **Status Log** at the bottom of the GUI shows the value and register that was changed. Once the configurations are completed, start conversions by clicking **Convert** in the **Serial Interface** block. To read the data and status, click **Read Data and Status** on the lower-right of the GUI. This, first, reads the status register and then the data registers for the channel selected, displaying the value in volts and hex. For the data in volts to be calculated correctly, the **Reference Voltage** numeric box on the left should match the reference applied on the hardware. Note: All voltage values are input referred.

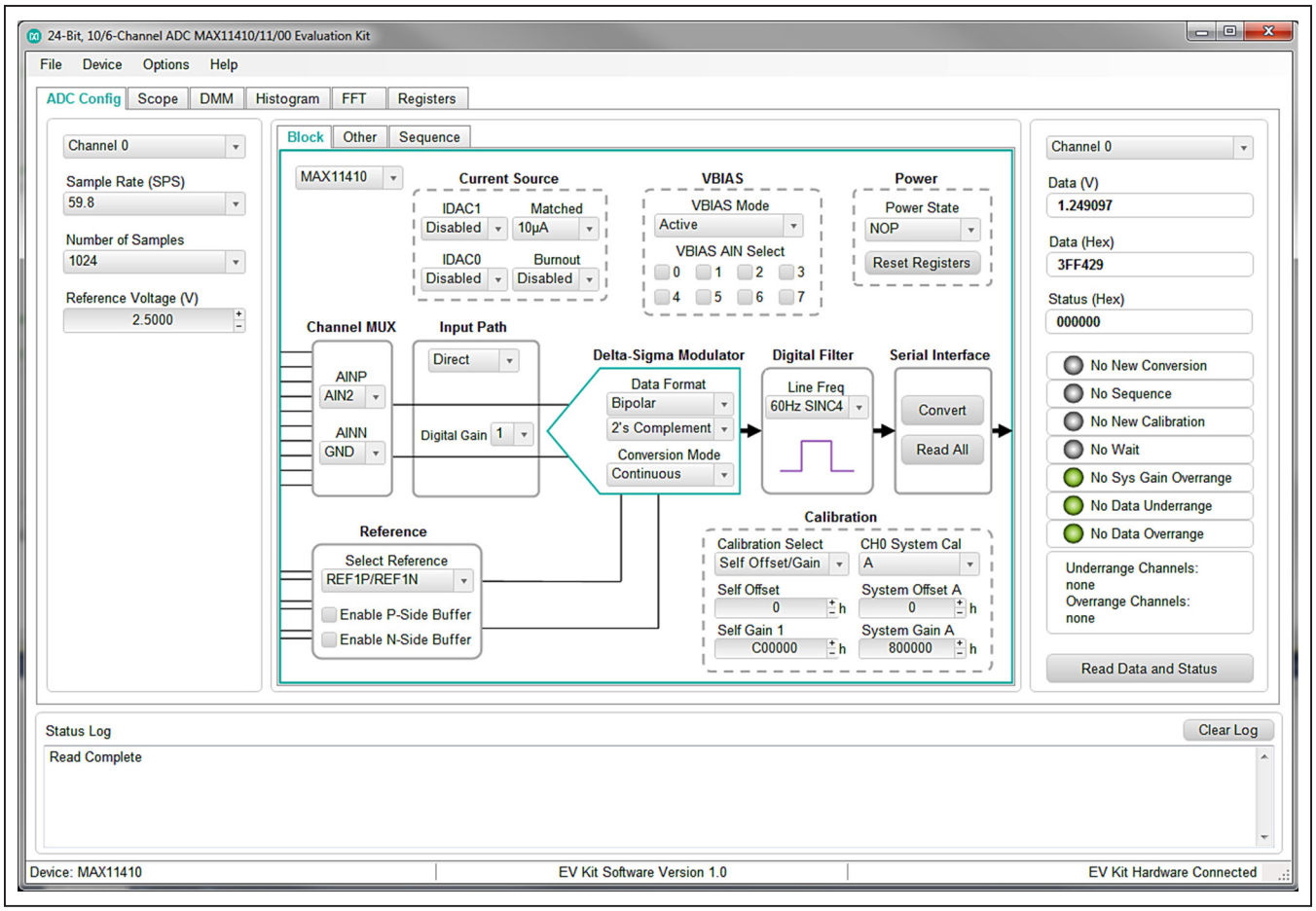


Figure 1. Quick-Start Connection Diagram

Other Tab

The **Other** tab sheet (Figure 2) displays the thresholds, wait, GPIO, clock, and INT options. To read all the values on the tab, click **Read All** on the bottom right. The **Channel Thresholds** table allows reads/writes to the upper and lower threshold. The display unit can be changed to LSB, V, mV, or uV using the **Threshold Units** drop-down list. The **TUR INT** and **TOR INT** bits for the under and over range interrupts can be enabled by checking the checkbox for the channels desired.

To start a wait time, enter the desired decimal value in the **Wait** and **Wait Extension** numeric boxes. Note: Entering a value in the **Wait** numeric box does not perform a write to the part. Click **Calculate Wait Time** to see the equivalent wait time of these decimal values based on a 2.4576MHz clock. Click **Start Wait Time** to write the value in the **Wait** numeric box and begin the wait time.

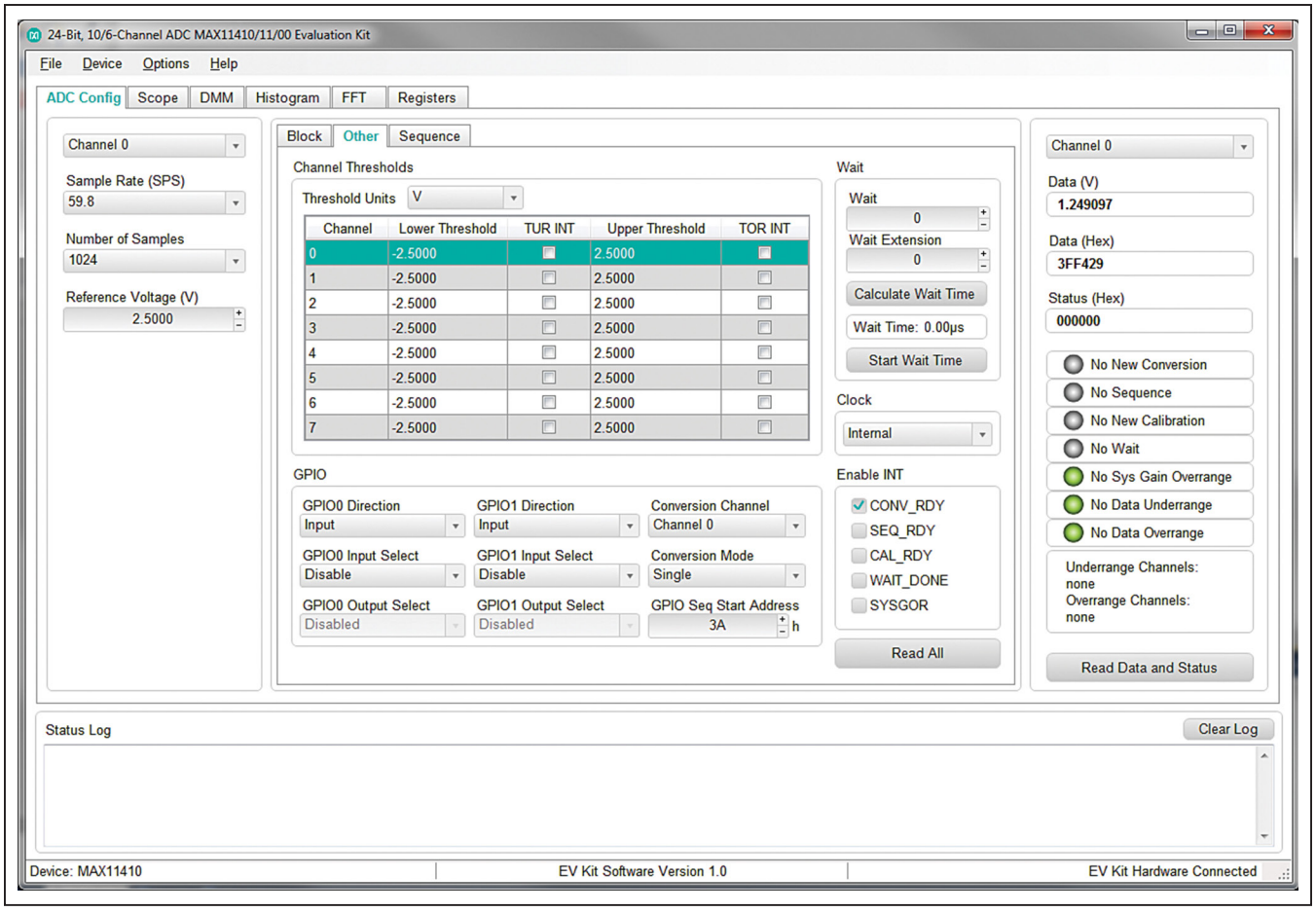


Figure 2. EV Kit Software (ADC Config Tab > Other)

Sequence Tab

The **Sequence** tab sheet (Figure 3) allows read/writes to the microcode registers (uC0-uC52). Click **Read All** to read all microcode registers. To write a register first select the hex value in the **Value (Hex)** column then type the desired hex value and press Enter on the keyboard. To start the sequence, enter the hex address of the microcode to start at in the **Sequence Start Address** and then click **Start Sequence**. During a sequence, the current address of the executing microcode can be read by clicking **Read Current Address**.

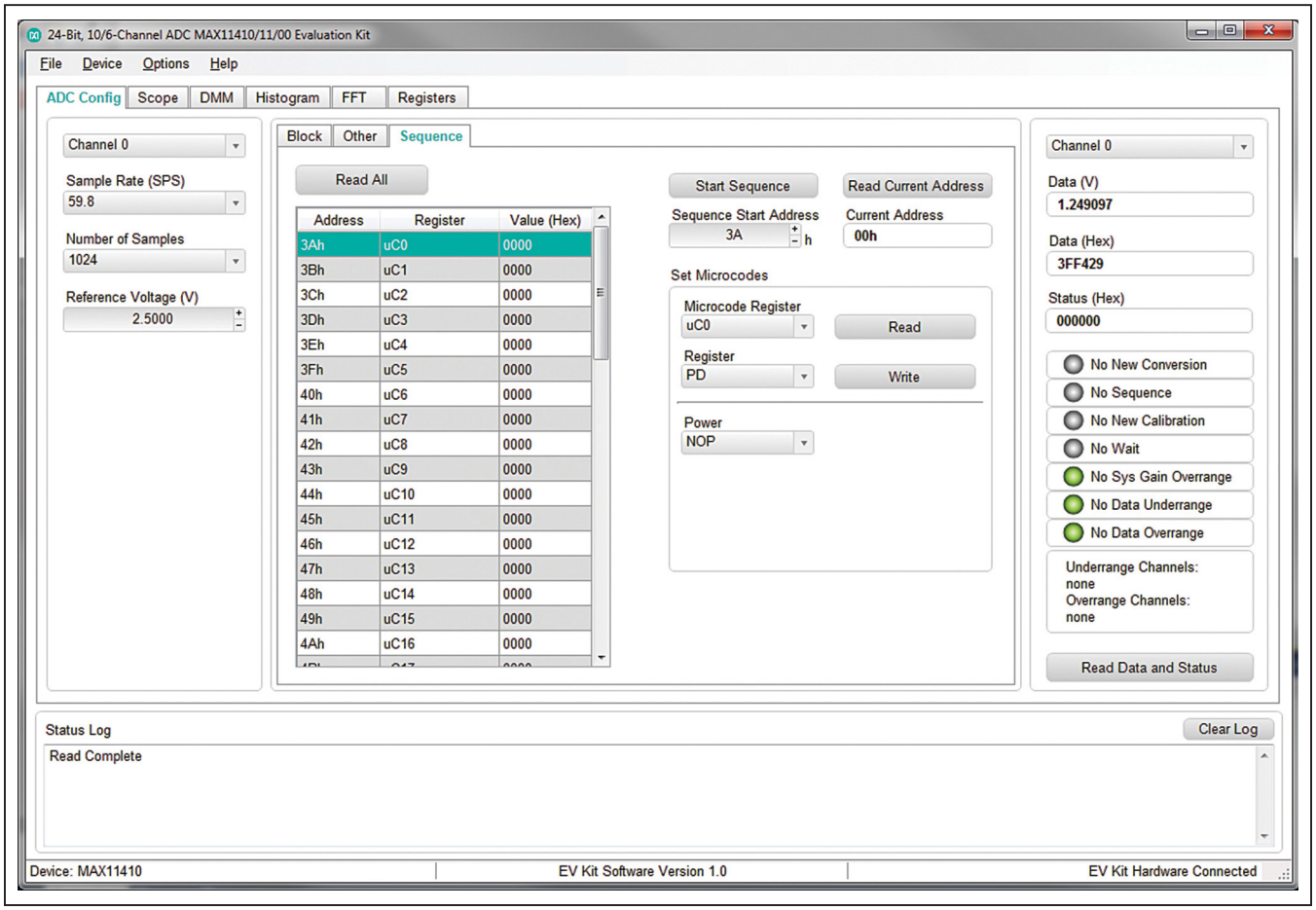


Figure 3. EV Kit Software (ADC Config Tab > Sequence)

Save/Load ADC Configuration

In the File menu, there are options to save or load a configuration file. **Save ADC Config As..** and **Save ADC Config** read the registers from the connected MAX11410 EV kit and saves these values to an XML file. This includes the microcode registers as well. **Load ADC Config** gets register values from an XML file and writes them to the MA11410 EV kit.

Scope Tab

The **Scope** tab sheet (Figure 4) is used to capture data and display it in the time domain. Sample rate and number of samples can also be set in this tab if they were not appropriately adjusted in other tabs. The **Display Unit** drop-down list allows LSB and voltages. Once the desired configuration is set, click on the **Capture** button. The right side of the tab sheet displays details of the waveform, such as average, standard deviation, maximum, minimum, and fundamental frequency. To save the captured data to a file, go to **Options > Save Graph > Scope**. This saves the setting on the left and the data captured to a csv file.

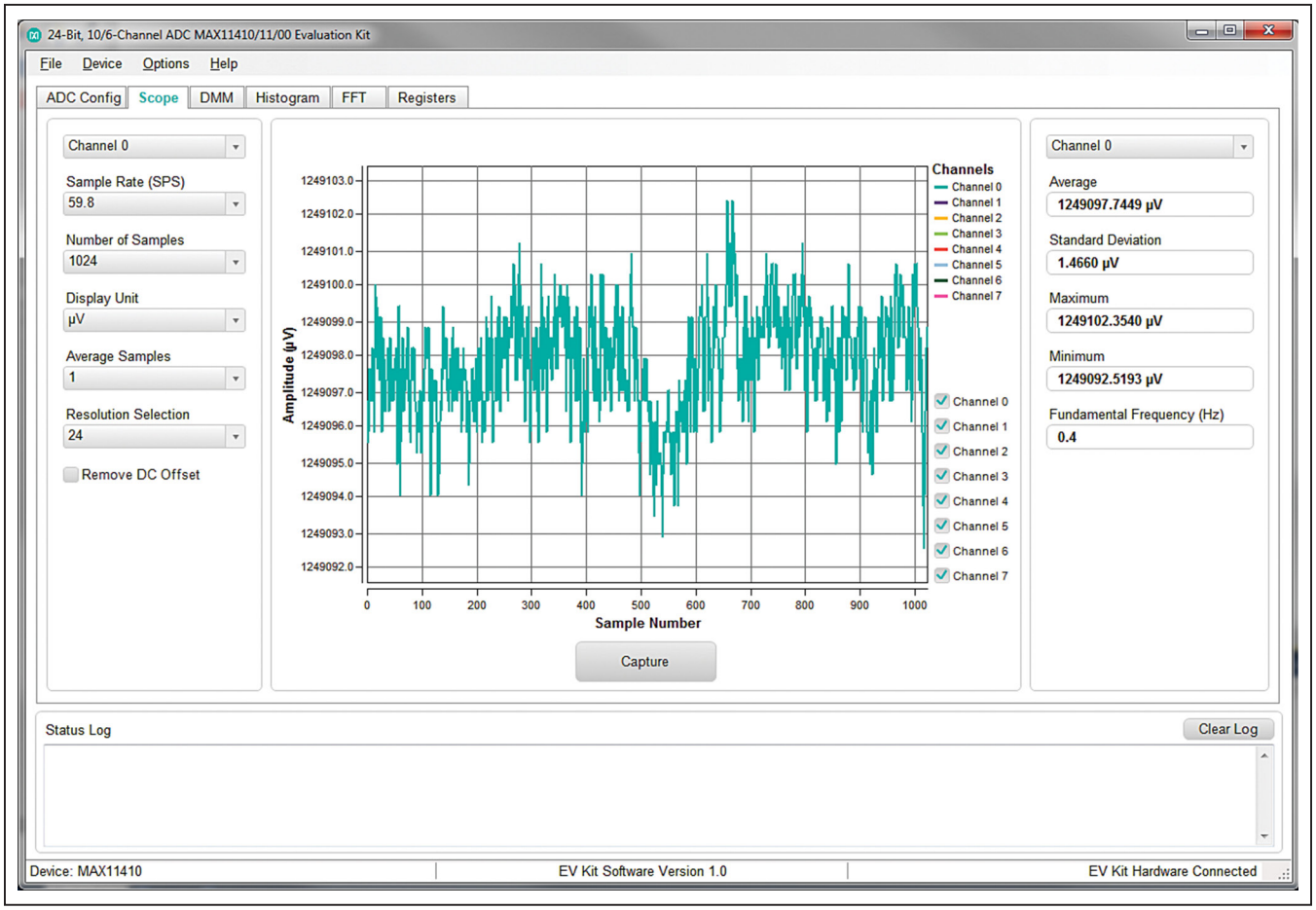


Figure 4. EV Kit Software (Scope Tab)

DMM

The **DMM** tab sheet (Figure 5) provides captured data as a digital multimeter. Once the desired configuration is set, click the **Capture** button.

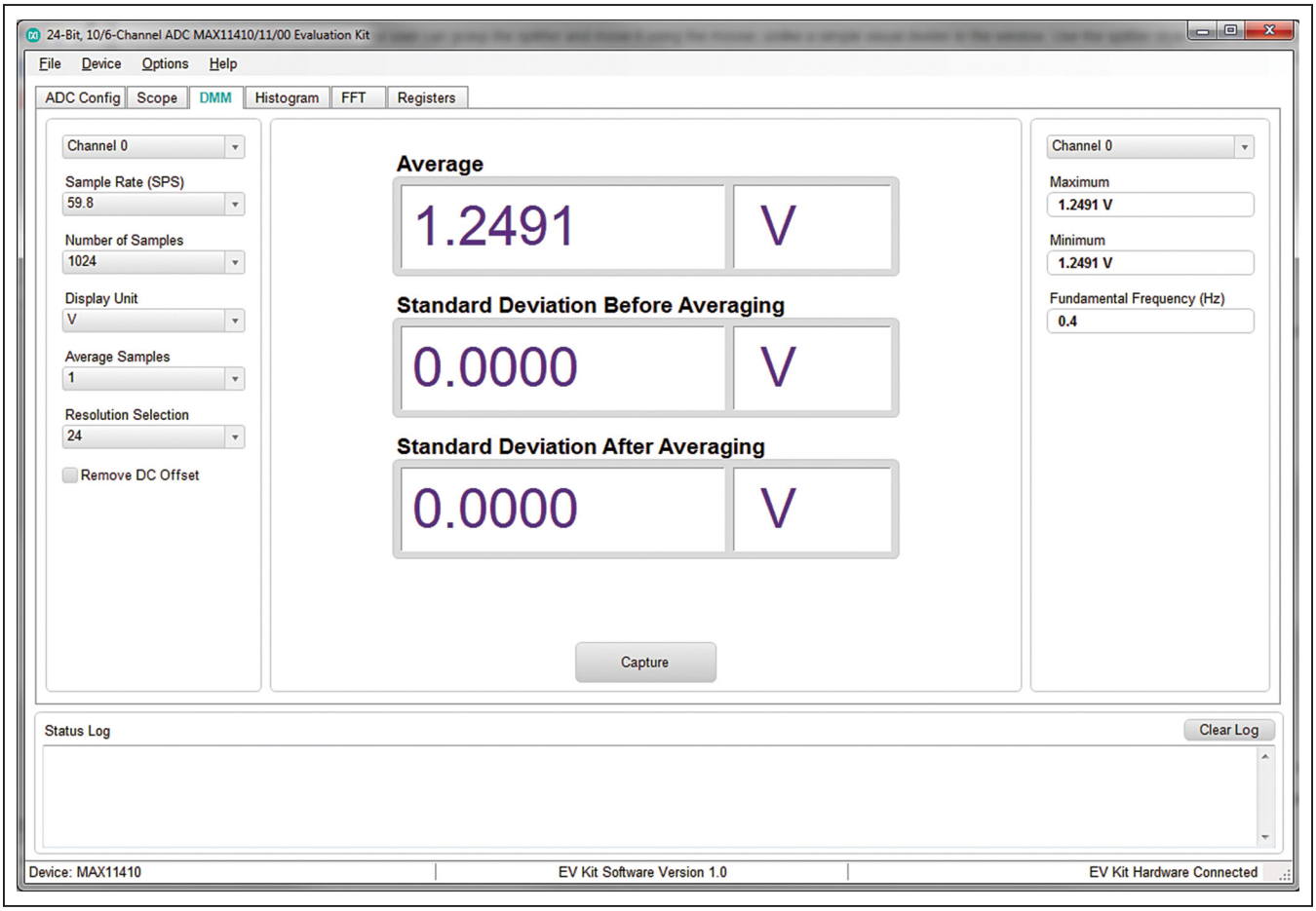


Figure 5. EV Kit Software (DMM Tab)

Histogram

The **Histogram** tab sheet (Figure 6) is used to display a histogram of the captured data. Sampling rate and number of samples can also be set in this tab if they were not appropriately adjusted in other tabs. Once the desired configuration is set, click on the **Capture** button. The right side of the tab sheet displays details of the histogram such as average, standard deviation, maximum, minimum, peak-to-peak noise, effective resolution, and noise-free resolution. To use this histogram feature, uncheck the **Disable Histogram** checkbox. To save the histogram data to a file, go to **Options > Save Graph > Histogram**. This saves the setting on the left and the histogram data captured to a csv file.

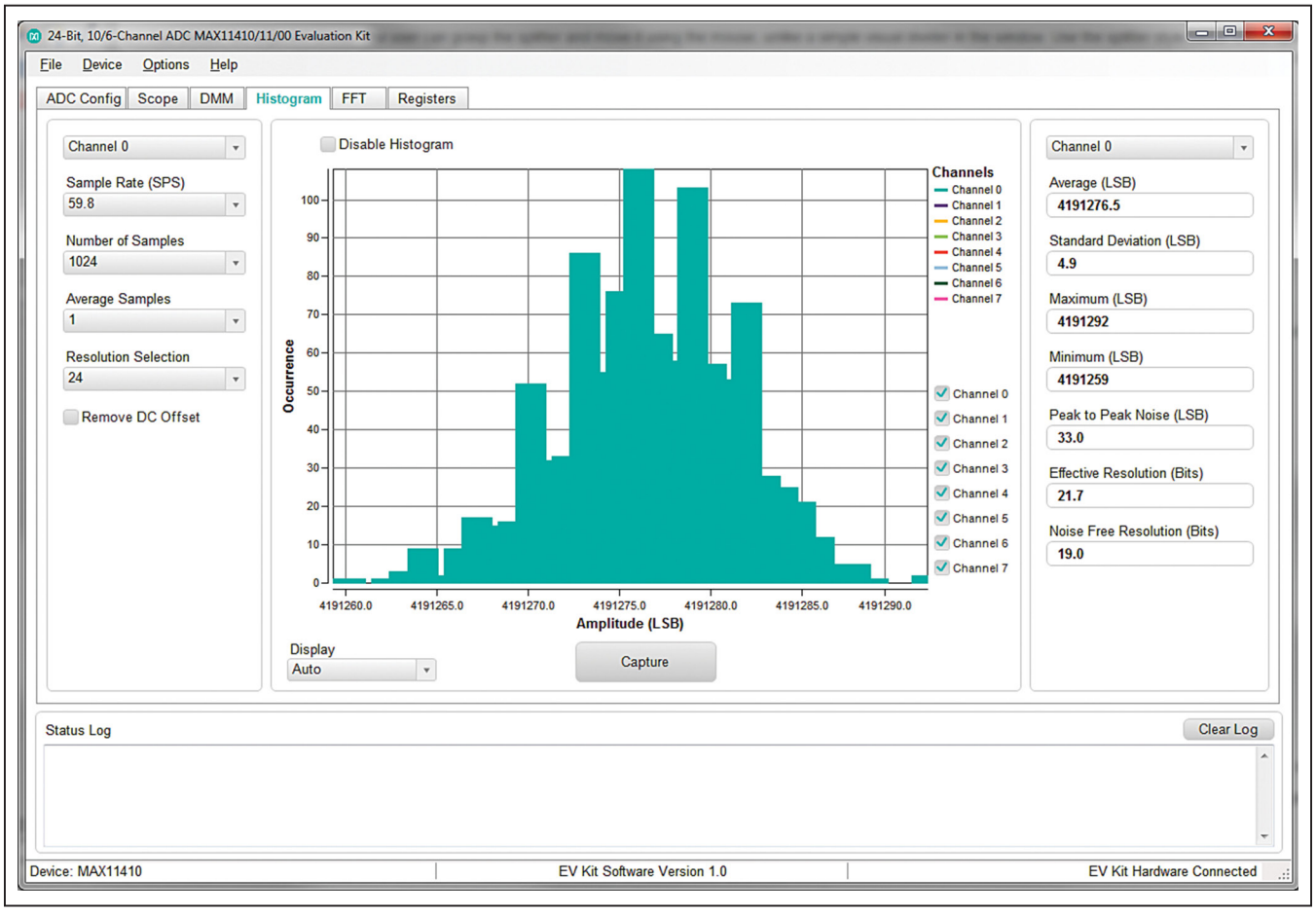


Figure 6. EV Kit Software (Histogram Tab)

FFT

The **FFT** tab sheet (Figure 7) is used to display the frequency domain FFT of the captured data. Sample rate and number of samples can also be set in this tab if they were not appropriately adjusted in other tabs. Once the desired configuration is set, click on the **Capture** button. The right side of the tab displays the performance based on the FFT, such as fundamental frequency, THD, SNR, SINAD, SFDR, ENOB, and noise floor. To save the FFT data to a file, go to **Options > Save Graph > FFT**. This saves the setting on the left and the FFT data captured to a csv file.

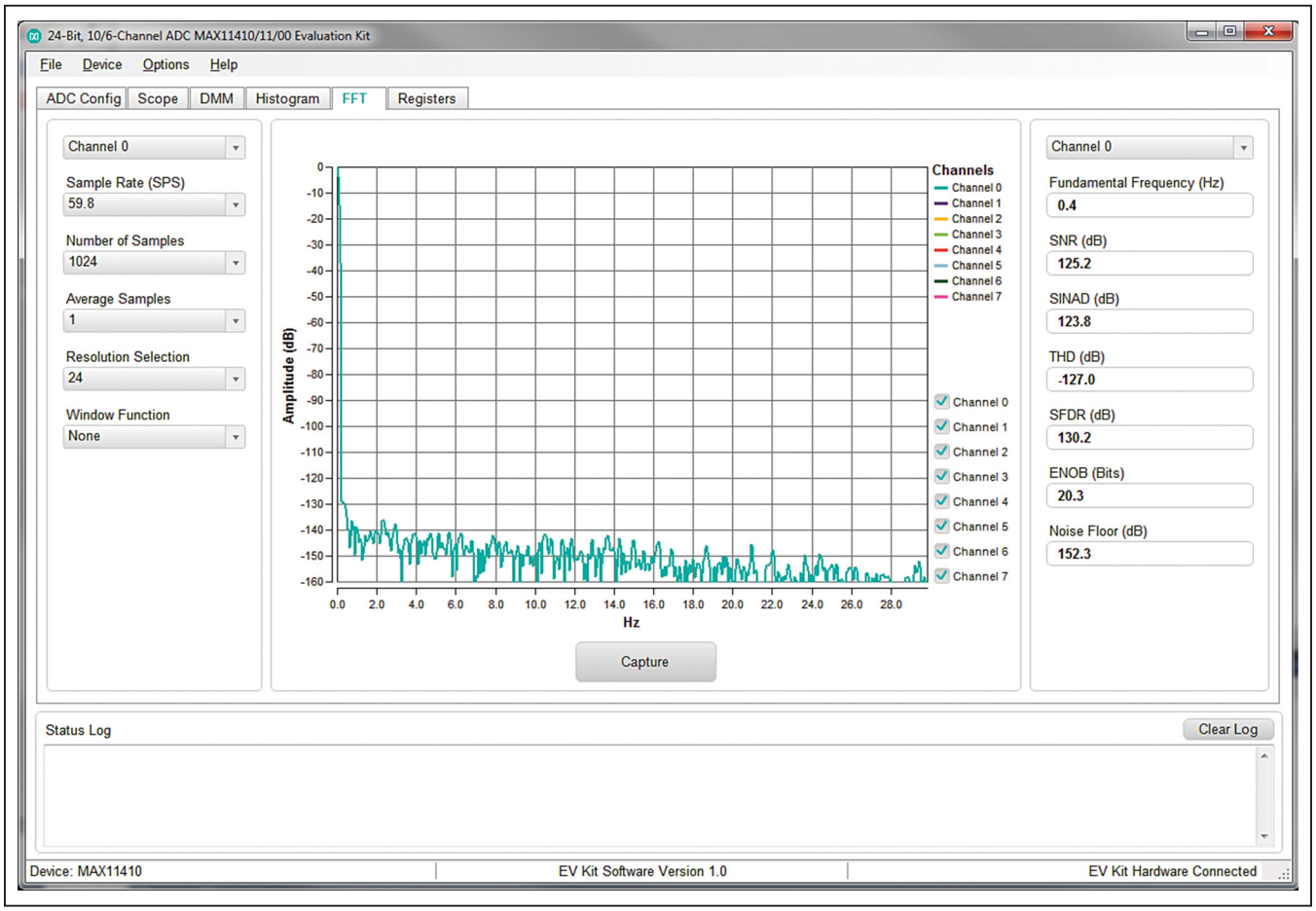


Figure 7. EV Kit Software (FFT Tab)

Registers

The **Registers** tab sheet (Figure 8) allows the user to read/write to the ADC registers in hex format. Click **Read All** to read all registers and refresh the window with the register settings. To write a register first select the hex value in the **Value (Hex)** column then type the desired hex value and press Enter on the keyboard. The **Bit Description** section shows the format of the register selected in the **Registers** table.

Detailed Description of Hardware

The EV kit hardware includes the MAX11410 ADC, external reference (MAX6072), digital isolator (MAX14935), microcontroller (MAXQ622), isolated power, and jumpers to customize the configuration. See the links at the end of this data sheet for component information, PCB layout diagrams, and schematic.

Reference Voltage

The ADC has three pairs of REFP/REFN pins to select as reference pins. In the GUI, go to the **Block** tab on the **ADC Config** tab and select the desired reference pins in the **Reference** block. When using the on-board voltage reference, move JP7 to the same REFXP selected in the GUI. If using REF0N, connect A1 on the screw terminal to GND or remove the AIN1 jumper on JP8 and connect AIN1 to GND. The default reference value is set to 2.5V. The EV kit also provides a reference of 1.25V by moving JP6 to 1.25V_{REF} and changing the **Reference Voltage** to 1.25V on the **ADC Config** tab.

If using a user-supplied voltage reference, remove all jumpers on JP7, JP10, and JP11 and supply the reference on the REFXP and REFXN testpoints. If using REF0P/REF0N connect the reference to A0/A1 on the screw terminal or remove the AIN0/AIN1 jumpers on JP8 and supplied the voltage on AIN0/AIN1 pins. In the GUI, change the **Reference Voltage** on the **ADC Config** tab to the user-supplied voltage.

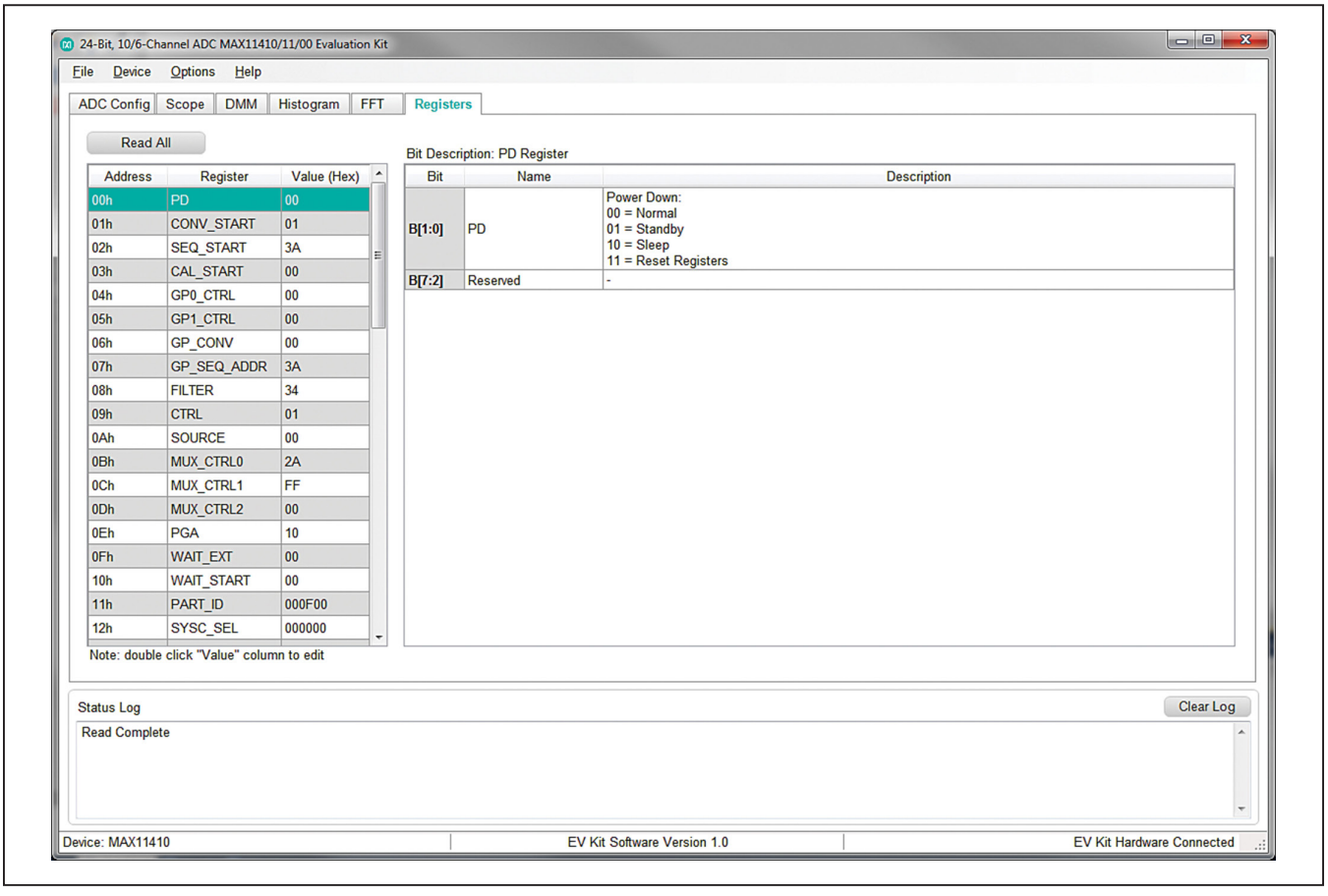


Figure 8. EV Kit Software (Registers Tab)

ADC Inputs

The ADC inputs at the screw terminal (J1, J2) have series 1kΩ input protection resistors. To bypass these resistors, remove the jumpers on JP8 and connect to the AINX pin on the right.

External Clock

The ADC can be configured to use an external clock. In the GUI, go to the **Other** tab on the **ADC Config** tab and change the clock to **External** using the **Clock** drop-down list. To use the on-board oscillator, move a jumper to the CLK position on JP4. To connect a user-supplied clock, remove any jumper on JP4 and connect the signal to the GPIO0/CLK testpoint.

GPIO

Testpoints and jumpers are provided for the two GPIO signals. To set the input/output modes of the GPIO go to the **Other** tab on the **ADC Config** tab. If the GPIOs are set as inputs the jumpers JP5 and JP4 can be used to set the inputs high or low. See Table 2. Each GPIO has a 100kΩ resistor to GND on the EV kit. GPIO0 has an added option be being set to an external clock. See the External Clock section.

User-Supplied SPI

To evaluate the ADC on this EV kit with a user-supplied SPI bus, disconnect digital signals from the isolator by removed resistors R50–R53. Apply the user-supplied SPI signals to CSB, MOSI, MISO, and SCLK at the SPI and GPIO Header (J5). Make sure the return ground is connected to GND on the EV kit.

EV Kit Power

By default the EV kit is configured to power from the USB 5V. To power the board externally, first disconnect the USB. Then move JP14 to EXT_5V and connect 5V to the EXT_5V testpoint or to the power jack J6. Connect the USB for communication with the GUI.

V_{DUT} Power

V_{DUT} powers the ADC and one side of the digital isolator. By default V_{DUT} is connected to V_{ADJ}, which is the output of an adjustable LDO (MAX8842) set to 3.3V. To adjust V_{ADJ}, change resistors R80 and R81 according to the equation below for the desired output. Ensure V_{ADJ} is within the range 3.6V to 2.8V as the minimum voltage for the MAX6072 is 2.8V and the maximum voltage for the MAX11410 is 3.6V.

$$V_{ADJ} = 1.225V \times (R80/R81 + 1)$$

V_{DUT} can also be power externally with EXT_VDUT test point. To power externally, move JP12 to EXT_DUT and provide a voltage (3.6V to 2.7V) on the test point.

Table 2. Description of Jumpers

JUMPER	JUMPER NAME	JUMPER POSITION	DESCRIPTION
JP1	AV_{DD}	Short*	Connects on-board V_{DUT} to AV_{DD}
JP2	V_{DDREG}	Short*	Connects on-board V_{DUT} to V_{DDREG}
JP3	V_{DDIO}	Short*	Connects on-board V_{DUT} to V_{DDIO}
JP4	GPIO0/CLK	V_{DDIO}	Sets GPIO0 high (V_{DDIO}) Note 1
		CLK	Provides an external clock to GPIO0/CLK
		GND	Sets GPIO0 low (GND)
JP5	GPIO1	V_{DDIO}	Sets GPIO1 high (V_{DDIO}) Note 1
		GND	Sets GPIO1 low (GND)
JP6	V_{REF}	$2.5V_{REF}$*	Sets V_{REF} to 2.5V
		$1.25V_{REF}$	Sets V_{REF} to 1.25V

Table 2. Description of Jumpers (continued)

JUMPER	JUMPER NAME	JUMPER POSITION	DESCRIPTION
JP7	REFP	REF0P	Sets REF0P(AIN0) to V_{REF}
		REF1P*	Sets REF1P to V_{REF}
		REF2P	Sets REF2P to V_{REF}
JP8	AINX	Short*	Connects AINX input to screw terminal through 1kΩ resistor
JP9	REFXP	Short*	Connects REFXP input to screw terminal through 1kΩ resistor
JP10	REF1N	Short*	Sets REF1N to GND
JP11	REF2N	Short*	Sets REF2N to GND
JP12	V_{DUT}	EXT_VDUT	V_{DUT} is powered from external EXT_VDUT test point
		V_{ADJ}*	V_{DUT} is powered from on-board V_{ADJ}
JP13	5V ENABLE	Short*	Enabled 5V from transformer T1
JP14	POWER	EXT_5V	Board is powered from external EXT_5V test point or J6 power jack
		V_{USB}*	Board is powered from USB 5V

Ordering Information

PART	TYPE
MAX11410EVKIT#	EV Kit

#Denotes RoHS compliant.

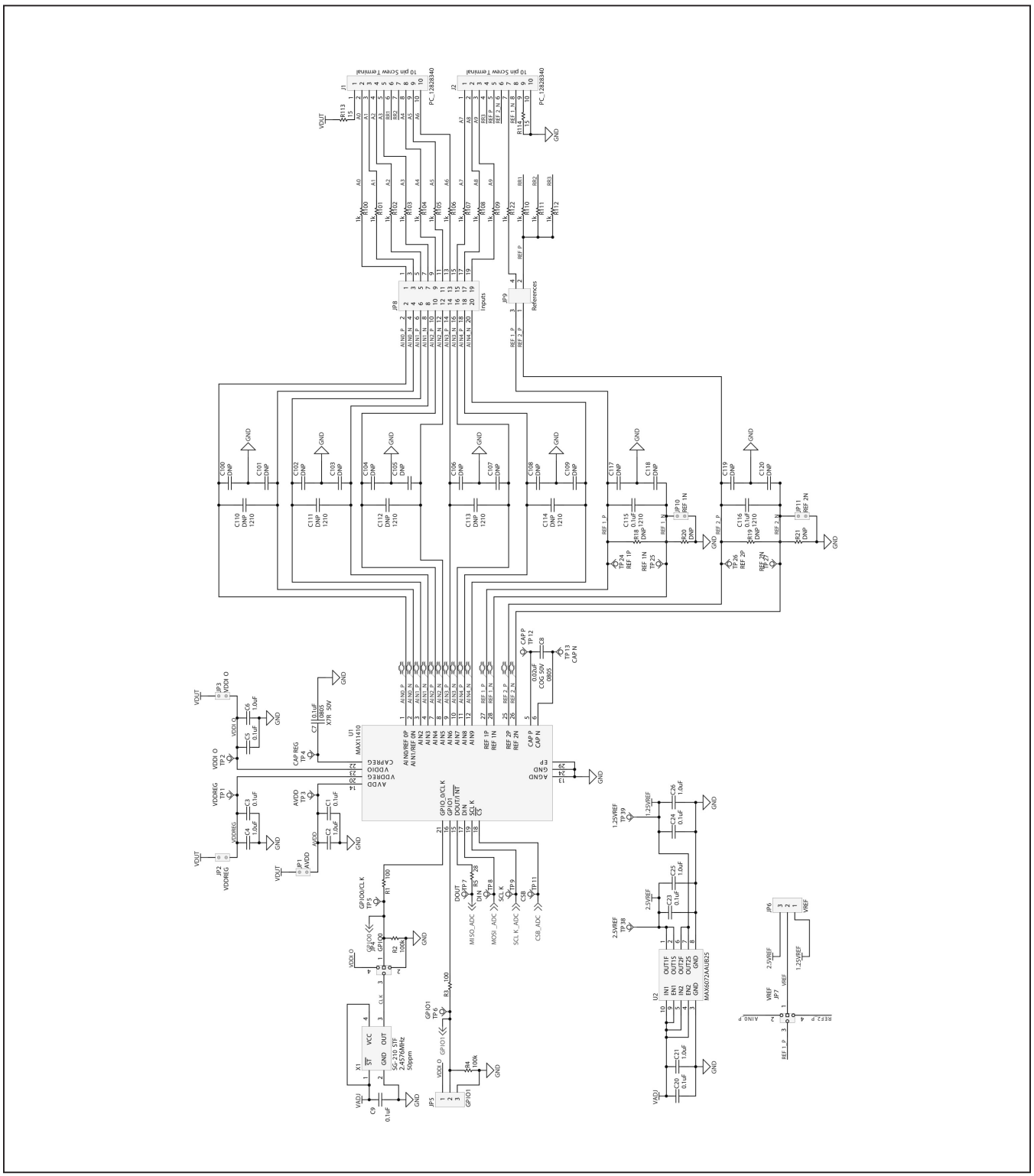
MAX11410 EV Kit Bill of Materials

Designator	Quantity	Description	Manufacturer	Manufacturer Part Number
C1, C3, C5, C9, C20, C23, C24, C40, C42, C44, C45, C50, C52, C60, C62, C63, C65, C90,	25	0.1uF 10%, 25V, X7R ceramic capacitor (0603)	TDK	C1608X7R1E104K080AA
C2, C4, C6, C21, C25, C26, C41, C43, C46, C47, C51, C53, C70, C71, C80, C81	16	1.0uF 10%, 16V, X7R ceramic capacitor (0603)	Murata	GRM188R71C105KA12D
C7	1	0.1uF, 10%, 50V, X7R ceramic capacitor (0805)	Kemet	C0805C104K5RACTU
C8	1	0.02uF,5%, 50V, COG ceramic capacitor (0805)	Murata	GRM21B5C1H203JA01L
C48, C49	2	18pF, 5%, 50V, COG ceramic capacitor (0603)	Vishay	VJ0603A180JXACW1BC
C61	1	4.7uF, 10%, 10V, X5R ceramic capacitor (0603)	TDK	CGB3B1X5R1A475K055AC
C64	1	10uF, 10%, 10V, X5R ceramic capacitor (0603)	TDK	C1608X5R1A106K080AC
C100, C101, C102, C103, C104, C105, C106, C107, C108, C109, C117, C118, C119, C120	0	100pF, 2%, 16V, PPS capacitor (0603)	Panasonic	ECH-U1C101GX5
C110, C111, C112, C113, C114	0	0.1uF, 2%, 16V, PPS capacitor (1210)	Panasonic	ECH-U1C104GX5
C115, C116	2	0.1uF, 2%, 16V, PPS capacitor (1210)	Panasonic	ECH-U1C104GX5
D1	1	Diode Array (SOT143-4)	Infineon	BAS 4002A RPP E6327
D2	1	5.6V Zener Diode (SOT-123)	Fairchild Semiconductor	MMSZ5232B
DS1	1	Green LED (0805)	Kingbright	APT2012SGC
F1	1	Resettable Fuse, 750mA Trip	Bourns	MF-FSMF035X-2
J1, J2	2	10 pin Screw Connector, 2.54mm pitch	TE Connectivity	1-282834-0
J3	1	USB Micro-B Receptical	Molex	105017-0001
J4	1	10-pin (2x5) Header, 2.54mm pitch	TE Connectivity	5-146258-5
J5	1	12-pin (2x6) Right Angle Header, 2.54mm pitch	FCI	68021-412HLF
J6	1	DC Power Jack	Kycon	KLDX-0202-B
JP1, JP2, JP3, JP10, JP11, JP13	6	2-pin Header, 2.54mm pitch	TE Connectivity	826936-2
JP4, JP7	2	4-pin T-Header, 2.54mm pitch	TE Connectivity	826936-4
JP5, JP6, JP12, JP14	4	3 Pin Single Row Header	3M	961103-6404-AR
JP8	1	20-pin (2x10) Header, 2.54mm pitch	FCI	67996-420HLF
JP9	1	4-pin (2x2) Header, 2.54mm pitch	TE Connectivity	5-146258-2
R1, R3	2	100Ω, 1%, 1/10W resistor (0603)	Vishay	CRCW0603100RFKEA
R2, R4, R81	3	100kΩ, 1%, 1/10W resistor (0603)	Vishay	CRCW0603100KFKEA
R5, R40, R41, R42, R43, R45, R50, R51, R52, R53, R54, R55	12	28Ω, 1%, 1/10W resistor (0603)	Vishay	CRCW060328R0FKEA

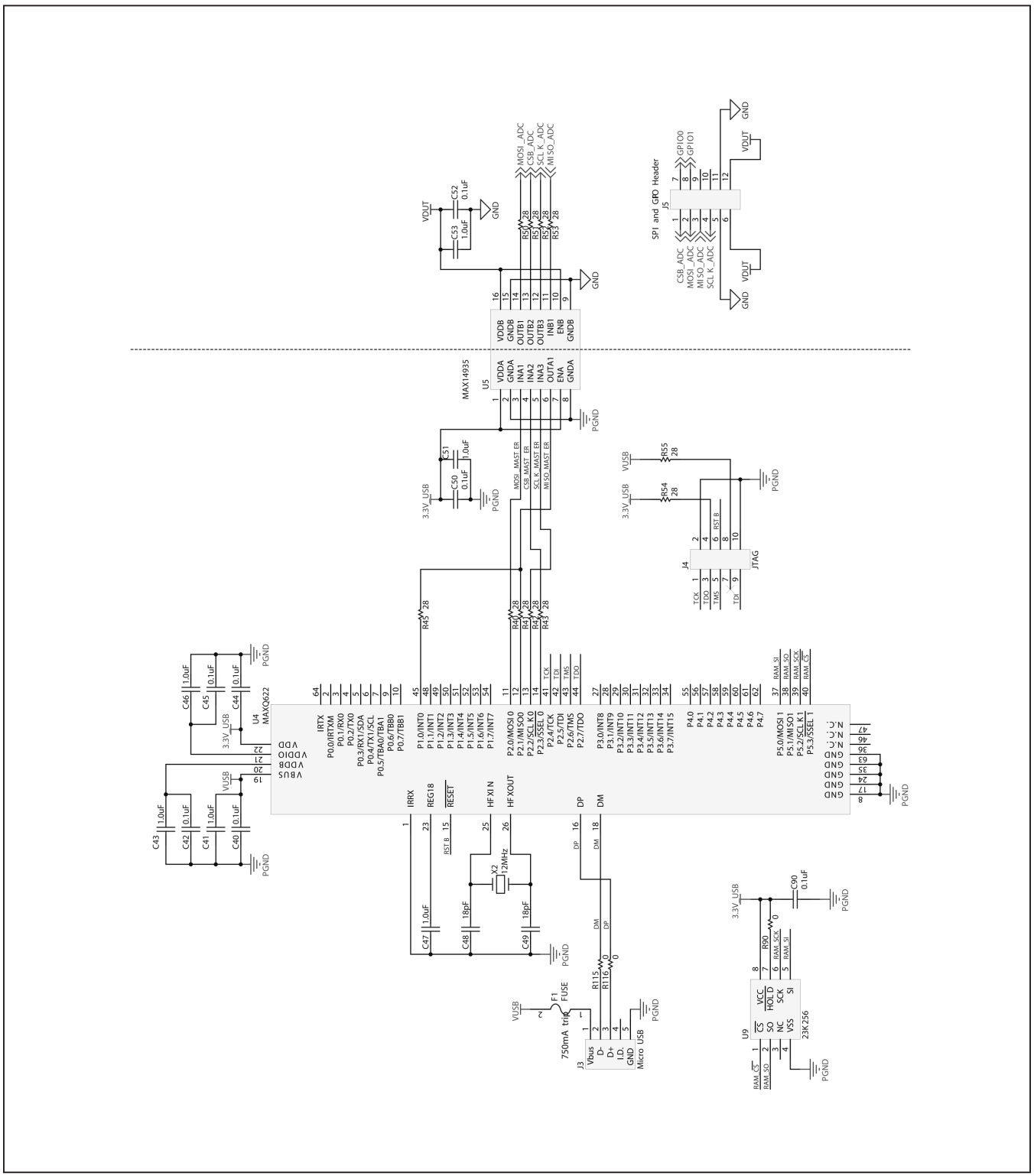
MAX11410 EV Kit Bill of Materials (continued)

R18, R19, R20, R21	0	DNP (0603)		
R60	1	47kΩ, 1%, 1/10W resistor (0603)	Vishay	CRCW060347K0FKEA
R61, R62, R90, R115, R116	5	0Ω, 1%, 1/10W resistor (0603)	Vishay	CRCW06030000Z0EB
R63	1	10Ω, 1%, 1/2W resistor (0805)	Panasonic	ERJ-P06F10R0V
R80	1	169kΩ, 1%, 1/10W resistor (0603)	Vishay	CRCW0603169KFKEA
R100, R101, R102, R103, R104, R105, R106, R107, R108, R109, R110, R111, R112, R122	14	1kΩ, 1%, 1/10W resistor (0603)	Vishay	CRCW06031K00FKEA
R113, R114	2	15Ω, 1%, 1/10W resistor (0603)	Vishay	CRCW060315R0FKEB
R117	1	499Ω, 1%, 1/10W resistor (0603)	Vishay	CRCW0603499RFKEA
T1	1	1:2.6 Transformer	Halo	TGM-H281NFRL
TP1(VDDREG), TP2 (VDDIO), TP3 (AVDD), TP28 (EXT_5V), TP30 (3.3V_USB), TP31 (5V), TP32 (VADJ), TP33 (EXT_VDUT), TP38 (2.5VREF), TP39 (1.25VREF)	10	Red Test Point	Keystone	5010
TP4 (CAPREG), TP5 (GPIO0/CLK), TP6 (GPIO1). TP7 (DOUT), TP8 (DIN), TP9 (SCLK), TP11 (CSB), TP12 (CAPP) TP13 (CAPN) , TP24 (REF1P), TP25 (REF1N), TP26 (REF2P), TP27(REF2N)	13	White Test Point	Keystone	5012
'TP29 (PGND), TP34 (GND), TP35 (GND), TP36 (GND), TP37 (GND)	5	Black Test Point	Keystone	5011
U1	1	ADC(TQFN -28)	Maxim	MAX11410
U2	1	Voltage Reference (uMAX)	Maxim	MAX6072AAUB25
U4	1	Microcontroller (LQFP)	Maxim	MAXQ622G-0000+
U5	1	Isolator (SOIC)	Maxim	MAX14935BAWE+
U6	1	H-Bridge Driver (SOIC)	Maxim	MAX256ASA+
U7	1	3.3V LDO(QFN)	Maxim	MAX8841ELT33+
U8	1	Adjustable LDO (QFN)	Maxim	MAX8842ELT+
U9	1	256KBit SRAM (SOIC-8)	Microchip	23K256
X1	1	2.4576MHz Oscillator	EPSON	SG-210 STF
X2	1	12MHz Oscillator (3.2 x 2.5mm)	CTS	403C35D12M00000
	24	Jumpers open wire		

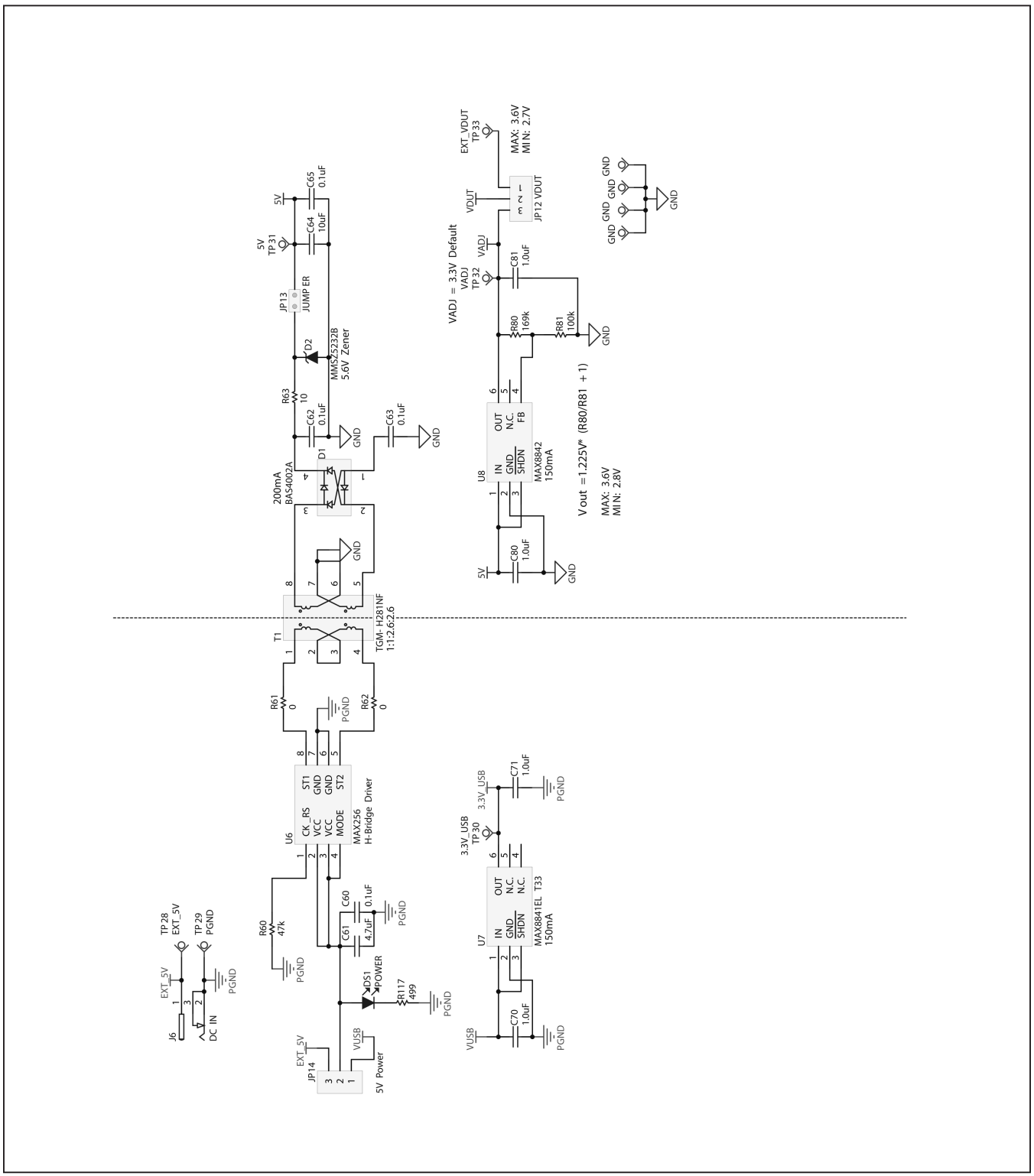
MAX11410 EV Kit Schematics



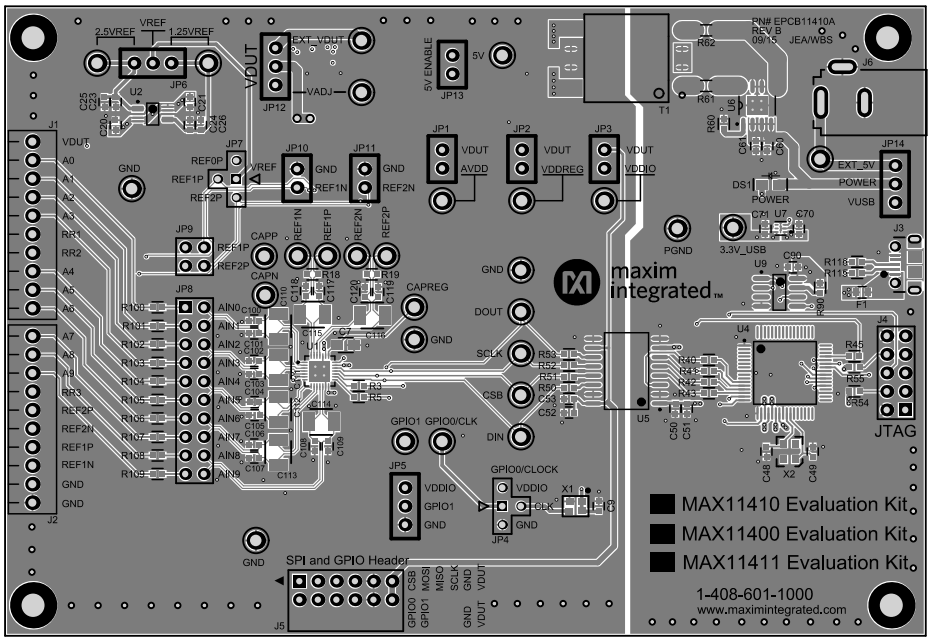
MAX11410 EV Kit Schematics (continued)

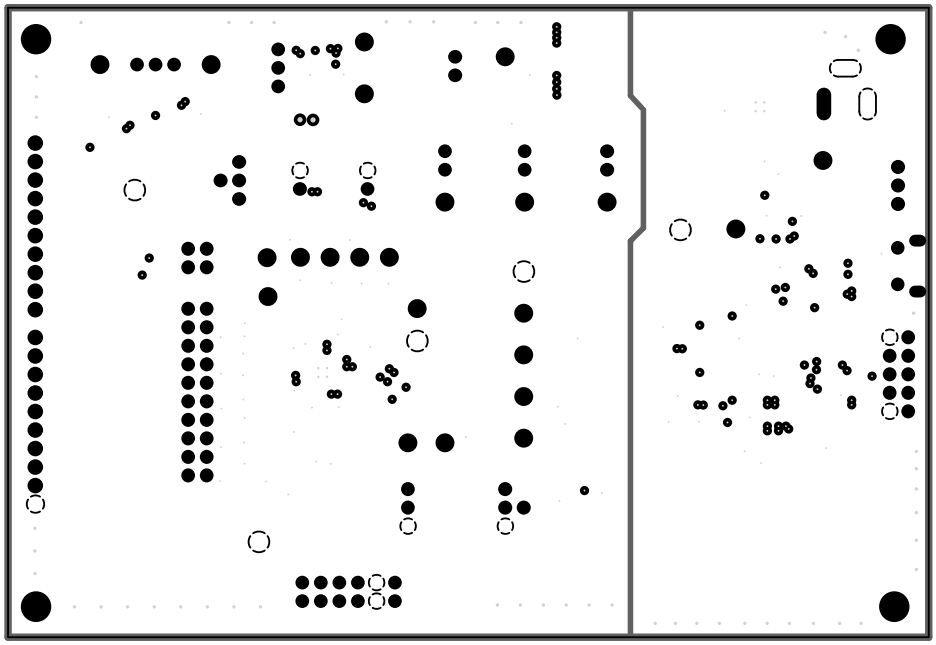


MAX11410 EV Kit Schematics (continued)

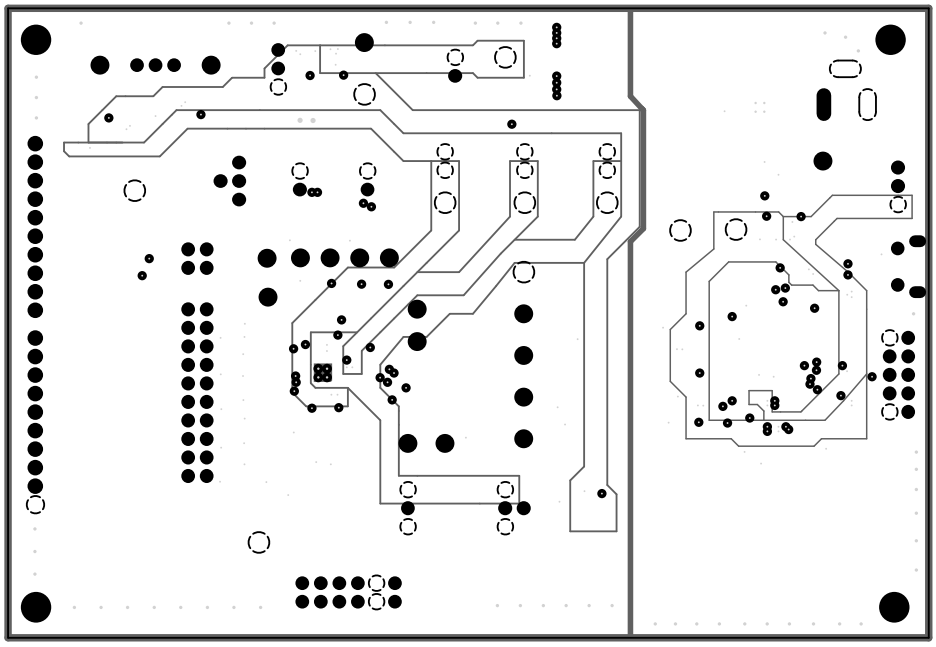


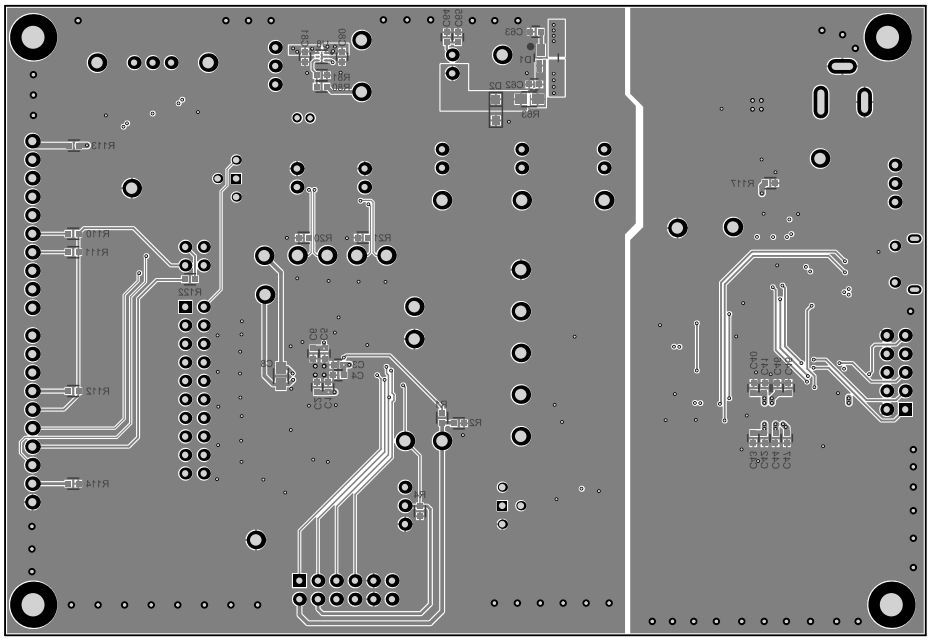
MAX11410 EV Kit PCB Layouts





MAX11410 EV Kit PCB Layouts (continued)





Revision History

REVISION NUMBER	REVISION DATE	DESCRIPTION	PAGES CHANGED
0	3/16	Initial release	—
1	1/21	Added part numer MAX11410A to the title and *Feature* section	1–20

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