19-5509; Rev 0; 9/10

MAXIM

MAX11200/MAX11206/MAX11209/MAX11210/MAX11213 Evaluation Kits

Evaluate: MAX11200/11206/11209/11210/11213

General Description

The MAX11200, MAX11206, MAX11209, MAX11210, and MAX11213 evaluation kits (EV kits) consist of one MAX11200, MAX11206, MAX11209, MAX11210, or MAX11213 evaluation board and software. The EV kits are fully assembled and tested circuit boards that evaluate the MAX11200 family of ultra-low-power, high-resolution, serial output ADCs.

The EV kits include Windows XP®-, Windows Vista®-, and Windows® 7-compatible software that provides a graphical user interface (GUI) for exercising the features of the MAX11200 family of data converters. The EV kits are connected to a PC through a USB A-to-B cable.

Features

- **Windows XP-, Windows Vista-, and Windows 7-Compatible Software**
- **USB-PC Connection (Cable Included)**
- **USB Powered (No External Power Supply Required)**
- **On-Board Isolated Power Supplies Rejecting Power Line Noise**
- **On-Board Optocouplers Isolating ADC from Other Circuitry**
- **Real-Time Data Acquisition through USB**
- **Proven PCB Layout**

Selector Guide

PART	RESOLUTION	PROGRAMMABLE GAIN
MAX11200EEE+	24	N/A
MAX11206EEE+	20	1–128
MAX11209EEE+	18	1–128
MAX11210EEE+	24	1–16
MAX11213EEE+	16	1–128

Ordering Information

PART	TYPE
MAX11200EVKIT+	EV Kit
MAX11206EVKIT+	EV Kit
MAX11209EVKIT+	EV Kit
MAX11210EVKIT+	EV Kit
MAX11213EVKIT+	EV Kit

+Denotes lead(Pb)-free and RoHS compliant.

Component List

DESIGNATION	QTY	DESCRIPTION
C1	1	10µF ±20%, 6.3V X5R ceramic capacitor (0603) Murata GRM188R60J106M
C2	1	0.01µF ±10%, 16V X7R ceramic capacitor (0603) Murata GRM188R71C 103K
C3–C10, C13, C14, C15, C17, C18, C33	14	0.1µF ±10%, 25V X7R ceramic capacitors (0603) Murata GRM188R71E104K
C11, C12	2	1000pF ±10%, 50V X7R ceramic capacitors (0603) Murata GRM188R71H102K
C16, C19, C20, C29–C32	7	4.7µF ±10%, 10V X5R ceramic capacitors (0805) Murata GRM219R61A475K
C21, C24, C25, C28	4	1µF ±10%, 16V X7R ceramic capacitors (0603) Murata GRM188R71C105K
C22, C23, C26, C27	4	18pF ±5%, 50V C0G ceramic capacitors (0603) Murata GRM1885C1H180J
C34–C37	0	Not installed, ceramic capacitors (0805)
D1–D4	4	30V, 1A Schottky diodes (SOD123)
D5	1	15V zener diode (DO35)
D6	1	Green LED (0603)
D7	1	Red LED (0603)
FB1	1	120 at 100MHz, 200mA ferrite bead (0603) Murata BLM18RK121SN1

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For pricing, delivery, and ordering information, please contact Maxim Direct at 1-888-629-4642, or visit Maxim's website at www.maxim-ic.com.

MAX11200/MAX11206/MAX11209/MAX11210/ MAX11213 Evaluation Kits

Component List (continued)

DESIGNATION	QTY	DESCRIPTION
J1	1	12-position terminal block
J2	1	BNC PC-mount connector
J3	1	USB type-B right-angle receptacle
J4	0	Not installed, 10-pin (2 x 5) header
JU1	1	4-pin header
JU2–JU5	4	3-pin headers
JU6, JU7, JU10	3	2-pin headers
JU8, JU9	2	12-pin (2 x 6) headers
R1	1	100Ω ±5% resistor (0603)
R2, R3, R4	3	180Ω ±5% resistors (0603)
R5–R8	4	330Ω ±5% resistors (0603)
R9	1	47kΩ ±5% resistor (0603)
R10, R14	2	360Ω ±5% resistors (0603)
R11, R12	2	33.2Ω ±1% resistors (0603)
R13	1	10kΩ ±5% resistor (0603)
R15	1	10.5kΩ ±1% resistor (0603)
R16	1	6.49kΩ ±1% resistor (0603)
R17	1	100kΩ ±5% resistor (0603)
R18, R19	2	10kΩ ±1% resistors (0603)
R20–R23	4	0Ω ±5% resistors (0603)
T1	1	198µH, 3W, 1:1:2.6:2.6-turn 400kHz transformer HALO Electronics TGM-H281NF
TP1, TP3	2	Red multipurpose test points
TP2, TP4	2	Black multipurpose test points
TP5–TP13	9	Orange miniature test points
U1	1	See the *EV Kit-Specific Component List*
U2	1	4:1 analog multiplexer (16 TSSOP) Maxim MAX4782EUE+
U3	1	High-precision, low-noise voltage reference (8 µMAX®) Maxim MAX6126A30+
U4, U5, U6	3	High-speed optocouplers (8 DIP)
U7	1	H-bridge driver (8 SO-EP*) Maxim MAX256ASA+
U8	1	Linear regulator (8 SO) Maxim MAX1659ESA+
U9	1	Linear regulator (8 SO) Maxim MAX1658ESA+
U10	1	USB peripheral controller (24 TQFN-EP*) Maxim MAX3420EETG+
U11	1	Microcontroller (68 QFN-EP*) Maxim MAXQ2000-RAX+
U12	1	2.5V LDO regulator (5 SC70) Maxim MAX8511EXK25+
U13	1	Adjustable LDO regulator (6 SOT23) Maxim MAX8880EUT+
Y1	1	2.4576MHz clock oscillator Hong Kong X'tals C4L24576NSMI02601-0
Y2	1	2.048MHz clock oscillator Hong Kong X'tals C4L20480NSMI02601-0
Y3	1	12MHz crystal Hong Kong X'tals SSM12000N1HK188F0-0
Y4	1	20MHz crystal Hong Kong X'tals SSM20000NSMI02801-0
—	1	USB high-speed A-to-B cable
—	10	Shunts
—	1	PCB: MAX11200/11206/11209/11210/11213 EVALUATION KIT+

**EP = Exposed pad.*

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MAX11200/MAX11206/MAX11209/MAX11210/ MAX11213 Evaluation Kits

EV Kit-Specific Component List

PART	DESIGNATION	DESCRIPTION
MAX11200EVKIT+	U1	24-bit single-channel ADC (16 QSOP) Maxim MAX11200EEE+
MAX11206EVKIT+		20-bit single-channel ADC (16 QSOP) Maxim MAX11206EEE+
MAX11209EVKIT+		18-bit single-channel ADC (16 QSOP) Maxim MAX11209EEE+
MAX11210EVKIT+		24-bit single-channel ADC (16 QSOP) Maxim MAX11210EEE+
MAX11213EVKIT+		16-bit single-channel ADC (16 QSOP) Maxim MAX11213EEE+

Component Suppliers

SUPPLIER	PHONE	WEBSITE
HALO Electronics, Inc.	650-903-3800	www.haloelectronics.com
Hong Kong X'tals Ltd.	852-35112388	www.hongkongcrystal.com
Murata Electronics North America, Inc.	770-436-1300	www.murata-northamerica.com

Note: *Indicate that you are using the MAX11200, MAX11206, MAX11209, MAX11210, or MAX11213 when contacting these component suppliers.*

MAX11200/MAX11206/MAX11209/MAX11210/MAX11213 EV Kit Files

FILE	DESCRIPTION
INSTALL.EXE	Installs the EV kit files on your computer
11200_06_09_10_13.EXE	Application program
UNINST.INI	Uninstalls the EV kit software

Quick Start

Recommended Equipment

- MAX11200, MAX11206, MAX11209, MAX11210, or MAX11213 EV kit (USB A-to-B cable included)
- Windows XP, Windows Vista, or Windows 7 PC with a spare USB port
- High-precision digital voltmeter (DVM)

Refer to the MAX11200/MAX11210, MAX11203/MAX11213, MAX11206/MAX11207, and MAX11209/MAX11211 IC data sheets while using this EV kit for detailed descriptions of the device features.

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 underlined** refers to items from the Windows operating system.

Procedure

The EV kits are fully assembled and tested. Follow the steps below to verify board operation before exercising the full features of the MAX11200 family of data converters:

1) Verify that all the jumpers are set in their default positions (see Table 3).
2) Visit **www.maxim-ic.com/evkitsoftware** to download the latest version of the EV kit software, 11200_06_09_10_13Rxx.ZIP.
3) Install the evaluation software on your computer by running the INSTALL.EXE program. The program files are copied and icons are created in the Windows **Start | Programs** menu.
4) Connect the USB cable from the PC to the EV kit board.

5) Verify that green LED D6 on the EV kit board illuminates, indicating the isolated power supply is good.

6) Verify that red LED D7 on the EV kit board illuminates, indicating the microcontroller has successfully finished the board self-test.

7) Start the EV kit software by opening its icon in the Windows **Start | Programs** menu.

8) A **Device Select** window pops up. Select the device variant installed on the EV kit board and press the **OK** button (Figure 1).

9) The software automatically configures the device to perform a self-calibration and enables the use of the self-calibration offset and self-calibration gain values when computing the final offset and gain-corrected data value (set the CTRL3 register to 0x18).

10) The EV kit software main window appears (Figure 2). Verify that **Hardware: Connected** is displayed on the status bar at the bottom of the main window.

11) Press the **Start Conversion & Data Logging** button. The software switches to the **Data Analysis** tab (Figure 3), displaying the scope of the sampled data.

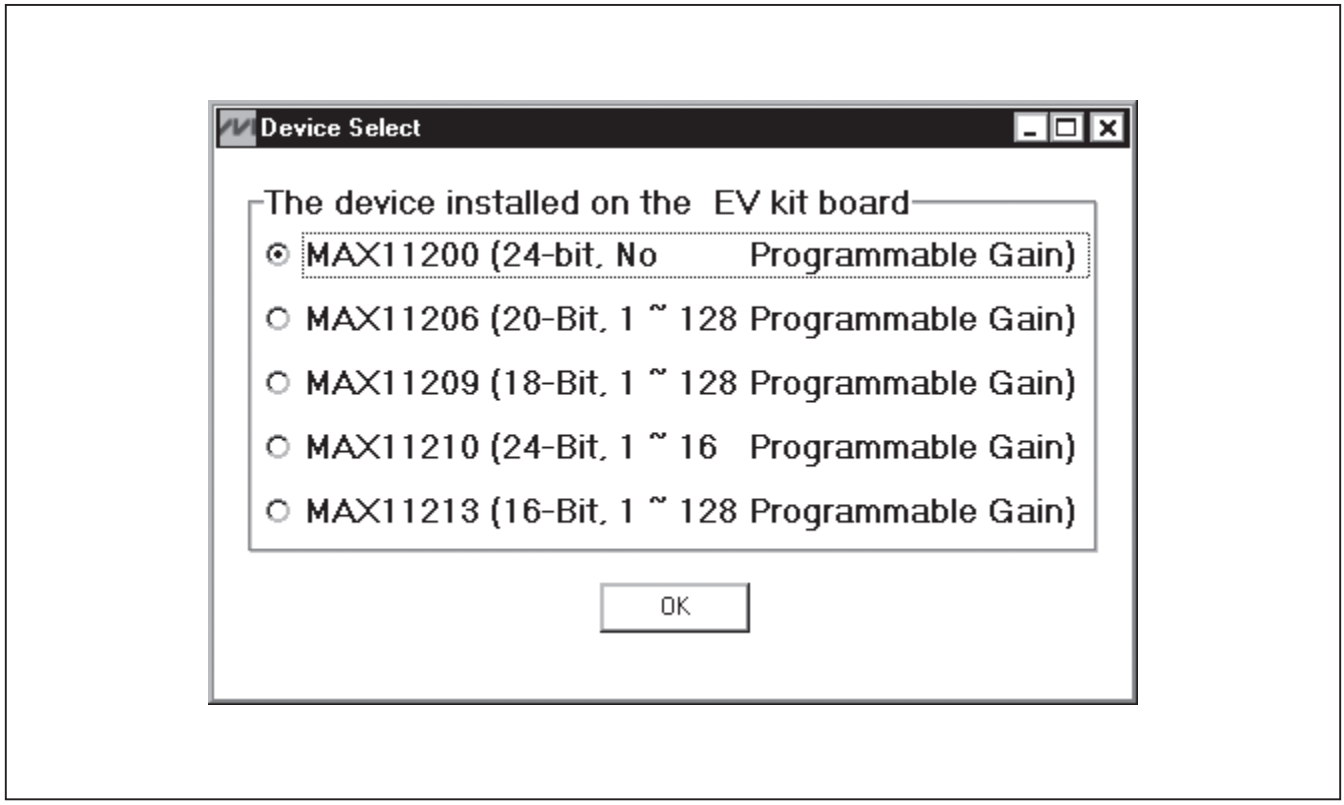


Figure 1. MAX11200/MAX11206/MAX11209/MAX11210/MAX11213 EV Kit Software (Device Select Window)

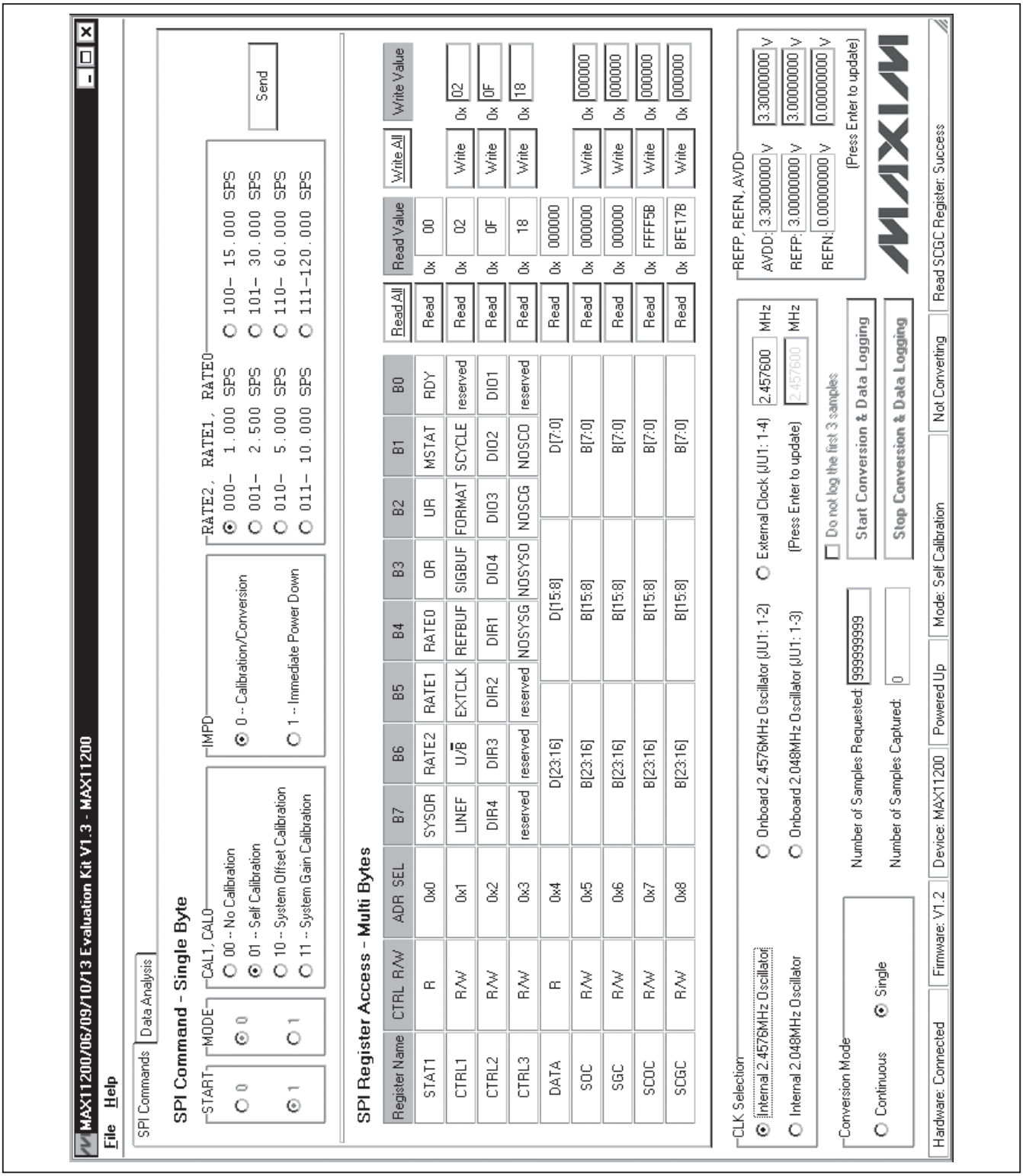


Figure 2. MAX11200/MAX11206/MAX11209/MAX11210/MAX11213 EV Kit Software (Main Window)

MAX11200/MAX11206/MAX11209/MAX11210/ MAX11213 Evaluation Kits

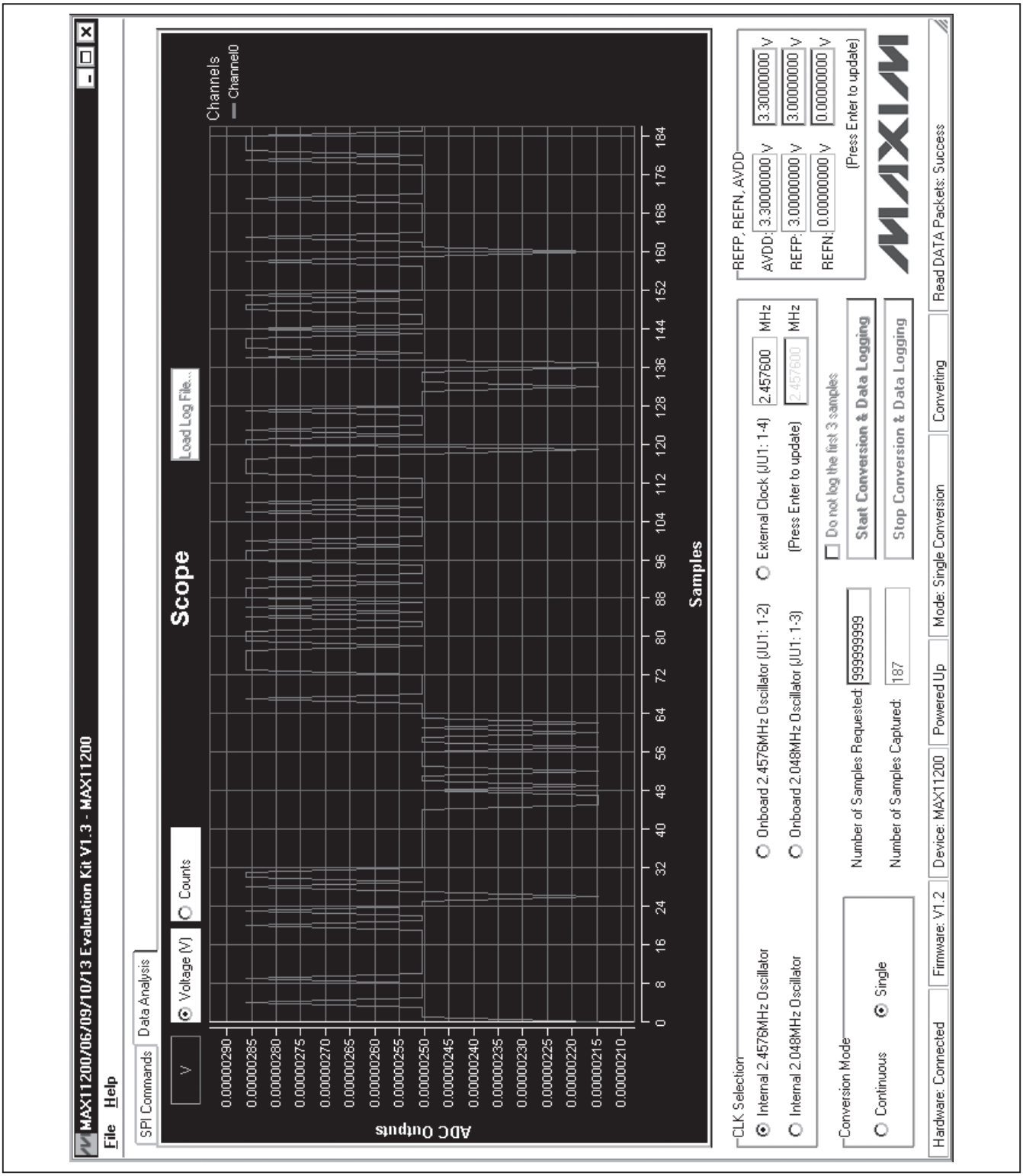


Figure 3. MAX11200/MAX11206/MAX11209/MAX11210/MAX11213 EV Kit Software (Data Analysis Tab)

Calibration Notes

The user **MUST** perform at least one calibration (either self-calibration and/or system calibration) before any measurement. Refer to the MAX11200/MAX11210, MAX11203/MAX11213, MAX11206/MAX11207, and MAX11209/MAX11211 IC data sheets for calibration details. The following calibration procedure details how to use all the calibration registers in a measurement.

1) To perform a self-calibration (both offset and gain):
   a. This is a conversion with internally shorted inputs, which is done by the internal state machine. No user manual action is required. That is, JU9 and JU8 shunt positions can be anywhere.
   b. In the **CAL1, CAL0** group box, select the **01 – Self Calibration** radio button.
   c. In the **IMPD** group box, select the **0 – Calibration/Conversion** radio button.
   d. Press the **Send** button. The device performs a self-calibration.
2) To perform a system calibration, a system offset calibration must be performed first:
   a. This is a conversion with the inputs held at system zero. For the EV kit, one option is to place the shunt on JU9 across pins 7-8 (AINP = GND) and place the shunt on JU8 across pins 7-8 (AINN = GND). In the case of a user system, the user should apply the target system zero to the AINN and AINP inputs.
   b. In the **CAL1, CAL0** group box, select the **10 – System Offset Calibration** radio button.
   c. In the **IMPD** group box, select the **0 – Calibration/Conversion** radio button.
   d. In the **CTRL3** register row, type 18 in the **Write Value** edit box to enable SCOC and SCGC registers. Press the **Write** button.
   e. Press the **Send** button. The device performs a system offset calibration with self-calibration registers enabled.
3) The second step of the system calibration is to perform a system gain calibration. The SOC register must be enabled before a system gain calibration is performed.
   a. This is a conversion with the inputs held at system full-scale reference. For the EV kit, one option is to place the shunt on JU9 across pins 1-2 (AINP = REFP = 3.0V) and place the shunt on JU8 across pins 3-4 (AINN = REFN = GND). In the case of a user system, the user should apply the target system full-scale reference to the AINP and AINN inputs.
   b. In the **CAL1, CAL0** group box, select the **11 – System Gain Calibration** radio button.
   c. In the **IMPD** group box, select the **0 – Calibration/Conversion** radio button.
   d. In the **CTRL3** register row, type 10 in the **Write Value** edit box to enable the system offset register and the self-calibration registers. Press the **Write** button.
   e. Press the **Send** button. The device performs a system gain calibration.
4) To enable the calibration coefficients:
   a. In the **CTRL3** register row, type 00 in the **Write Value** edit box. Press the **Write** button. All the self and system calibration gain and offset values are used in the calculation of the conversion result.
5) Continue to perform a measurement by connecting AINP and AINN to the measurement target.

Programmable Gain Register Bits

In the CTRL3 register of the MAX11206, MAX11209, MAX11210, and MAX11213 devices, there are 3 digital gain bits that control the input-referred gain. The user can change the gain by typing a new value in the **CTRL3**

Table 1. MAX11206/MAX11209/MAX11213 DGAIN[2:0] Decoding

GAIN	DGAIN2	DGAIN1	DGAIN0
1	0	0	0
2	0	0	1
4	0	1	0
8	0	1	1
16	1	0	0
32	1	0	1
64	1	1	0
128	1	1	1

Table 2. MAX11210 DGAIN[2:0] Decoding

GAIN	DGAIN2	DGAIN1	DGAIN0
1	0	0	0
2	0	0	1
4	0	1	0
8	0	1	1
16	1	0	0
16	1	0	1
16	1	1	0
16	1	1	1

register row's **Write Value** edit box and pressing the **Write** button. Decoding of programmable gain bits is listed in Tables 1 and 2.

Detailed Description of Software

Software Main Window

In the top section of the main window, an SPI™ command byte can be generated. Select the expected bit values and press the **Send** button to send the command to the ADC.

In the middle section of the main window, SPI register access commands can be generated. On each register row, the register bit names are listed. Press the **Read** button to read the register value. Type in a new value in the **Write Value** edit box, and press the **Write** button to write a new value to the register. Every write operation is automatically followed by a readback operation to verify that the write operation is successful. Press the **Read All** button to read all the register values. Press the **Write All** button to write all the new values in the edit boxes to the registers.

The **CLK Selection** group box lists the clock input options for the MAX11200 family of data converters.

The **Conversion Mode** group box is a duplicate for the SCYCLE register bit.

In the **REFP, REFN, AVDD** group box, the factory-set AVDD and reference voltages are listed. The user can apply user-supplied AVDD and reference voltages, type in the new values, and press Enter to update these values for conversion-result calculation.

In the **Number of Samples Requested** edit box, type in the number of samples expected.

Press the **Start Conversion & Data Logging** button to start a data-acquisition session. For continuous conversion mode, the user can discard the first 3 samples by checking the **Do not log the first 3 samples** checkbox.

Press the **Stop Conversion & Data Logging** button to stop the data-acquisition session before the requested number of samples is reached.

After a data-acquisition session is complete or stopped by the user, the software displays a popup window (Figure 4) asking if the user wants to save the data to a file. If the user presses the **Yes** button, the software displays a **Save As** window (Figure 5) to let the user input the file information for logged data.

In the bottom section of the main window, EV kit and device status are displayed.

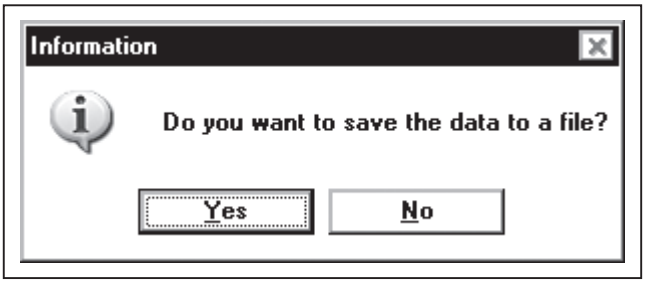


Figure 4. MAX11200/MAX11206/MAX11209/MAX11210/ MAX11213 EV Kit Software (Save Data Information Popup Window)

SPI is a trademark of Motorola, Inc.

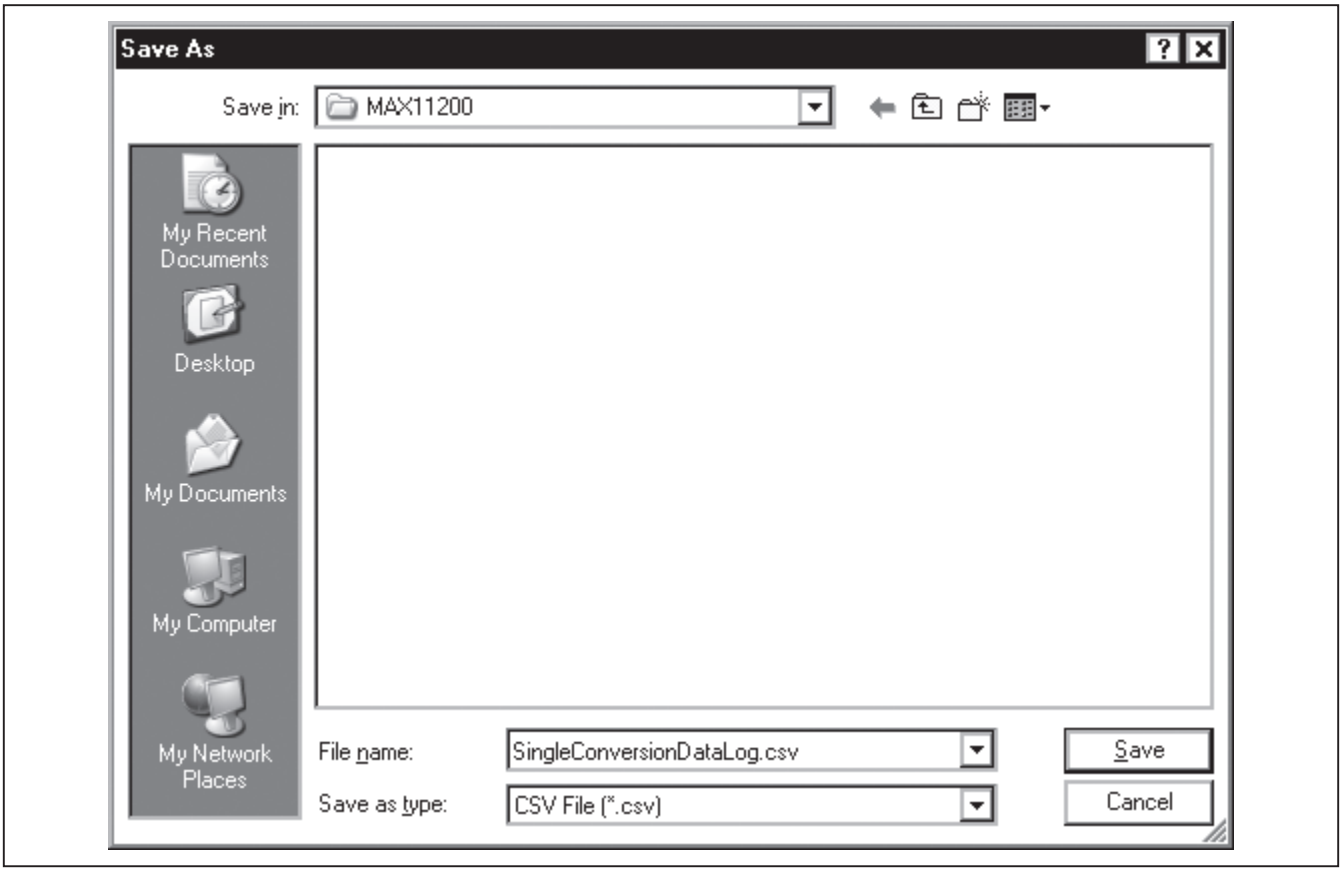


Figure 5. MAX11200/MAX11206/MAX11209/MAX11210/MAX11213 EV Kit Software (Save As Window)

Data Analysis Tab

The **Data Analysis** tab sheet (Figure 3) shows the waveform scope of the sampled signal. The user can load previous logged data to view the signal waveform by pressing the **Load Log File…** button. The user can zoom in and zoom out the scope. The user can also save and print the scope screenshot.

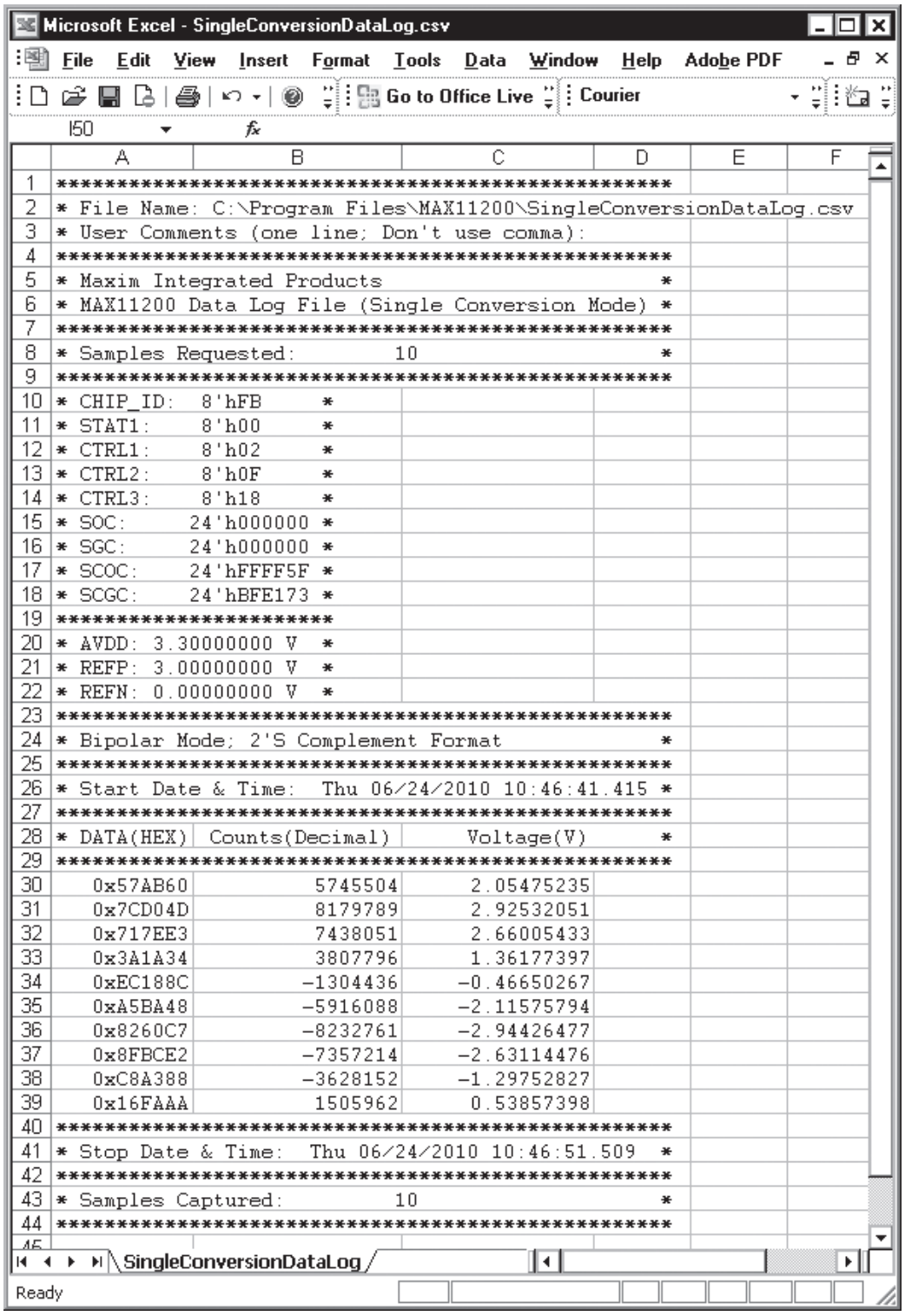
The user can select the Y axis of the scope to be the ADC conversion counts or the calculated voltage values.

When the device works in fast continuous-conversion mode, avoid frequently moving the mouse over the scope. Doing data analysis while data acquisition is in progress can cause data loss because the PC may not have enough processing power for multitasking.

Logged Data

Figure 6 shows a sample of logged data (*.csv) opened in the Microsoft Excel® spreadsheet. Figure 7 shows the same file opened in the Microsoft Notepad. Use monospaced fonts (such as Courier or Lucida Console) to open the file for clear alignment.

Excel is a registered trademark of Microsoft Corporation.



Microsoft Excel - SingleConversionDataLog.csv

File Edit View Insert Format Tools Data Window Help Adobe PDF

Go to Office Live | Courier

	A	B	C	D	E	F
1	**********					
2	* File Name: C:\Program Files\MAX11200\SingleConversionDataLog.csv					
3	* User Comments (one line; Don't use comma):					
4	**********					
5	* Maxim Integrated Products *					
6	* MAX11200 Data Log File (Single Conversion Mode) *					
7	**********					
8	* Samples Requested: 10 *					
9	**********					
10	* CHIP_ID: 8'hFB *					
11	* STAT1: 8'h00 *					
12	* CTRL1: 8'h02 *					
13	* CTRL2: 8'h0F *					
14	* CTRL3: 8'h18 *					
15	* SOC: 24'h000000 *					
16	* SGC: 24'h000000 *					
17	* SCOC: 24'hFFFF5F *					
18	* SCGC: 24'hBFE173 *					
19	**********					
20	* AVDD: 3.30000000 V *					
21	* REFP: 3.00000000 V *					
22	* REFN: 0.00000000 V *					
23	**********					
24	* Bipolar Mode; 2'S Complement Format *					
25	**********					
26	* Start Date & Time: Thu 06/24/2010 10:46:41.415 *					
27	**********					
28	* DATA(HEX)	Counts(Decimal)	Voltage(V) *			
29	**********					
30	0x57AB60	5745504	2.05475235			
31	0x7CD04D	8179789	2.92532051			
32	0x717EE3	7438051	2.66005433			
33	0x3A1A34	3807796	1.36177397			
34	0xEC188C	-1304436	-0.46650267			
35	0xA5BA48	-5916088	-2.11575794			
36	0x8260C7	-8232761	-2.94426477			
37	0x8FBCE2	-7357214	-2.63114476			
38	0xC8A388	-3628152	-1.29752827			
39	0x16FAAA	1505962	0.53857398			
40	**********					
41	* Stop Date & Time: Thu 06/24/2010 10:46:51.509 *					
42	**********					
43	* Samples Captured: 10 *					
44	**********					

SingleConversionDataLog

Ready

Figure 6. MAX11200/MAX11206/MAX11209/MAX11210/MAX11213 EV Kit Software (Logged Data Opened in Excel)

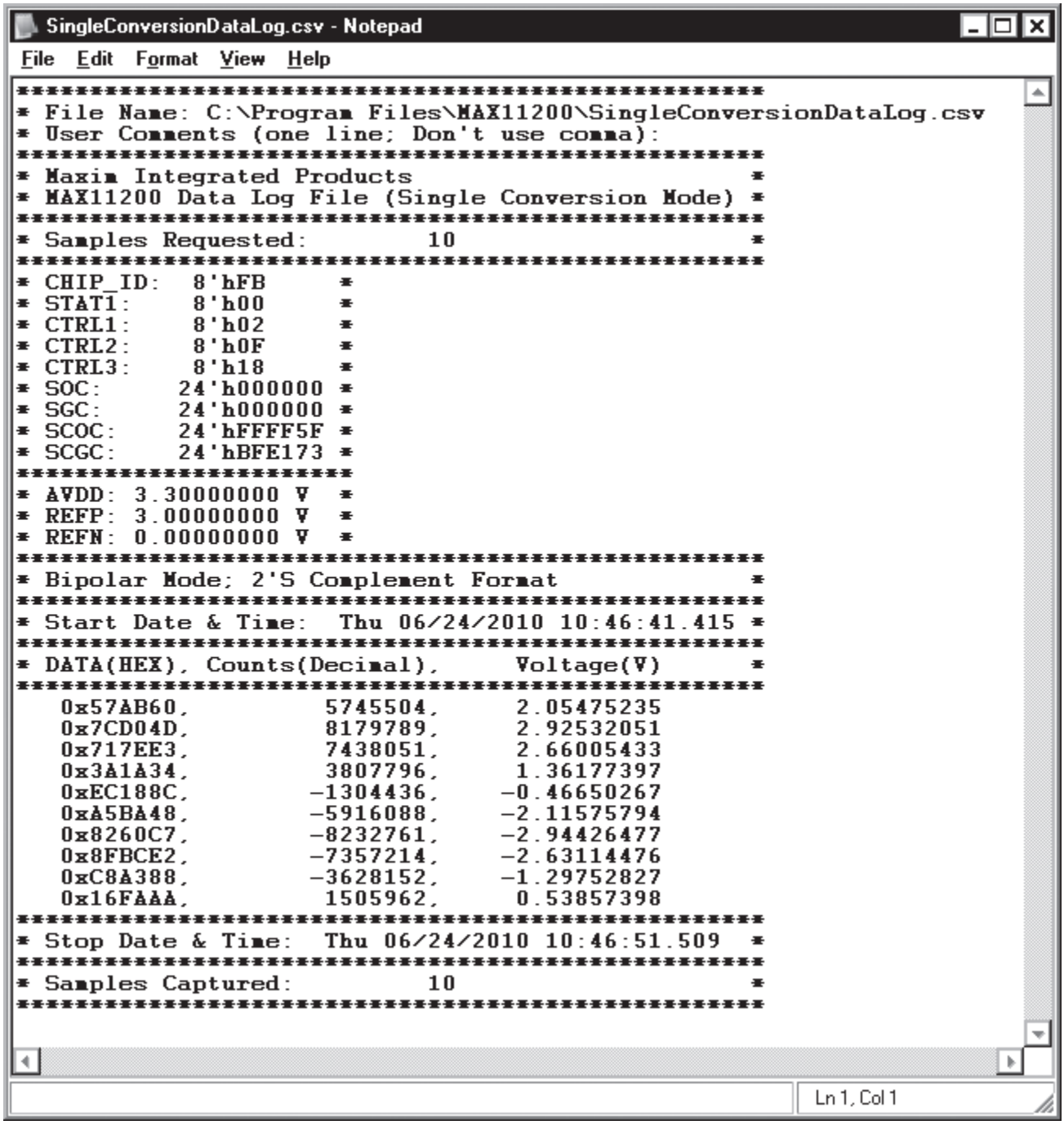


Figure 7. MAX11200/MAX11206/MAX11209/MAX11210/MAX11213 EV Kit Software (Logged Data Opened in Notepad)

_Detailed Description of Hardware

The MAX11200, MAX11206, MAX11209, MAX11210, and MAX11213 EV kits are complete evaluation systems for the MAX11200 family of data converters. The EV kits provide on-board isolated power supplies and optocouplers to reduce noise. The EV kits can do simple real-time data acquisition for the user to evaluate the performance of the devices.

See Table 3 for a description of all EV kit jumper configurations.

Signal Routing

When using an external reference, firmly connect the reference cables on pins 9 and 10 of the J1 connector.

The devices in the MAX11200 family are single-channel data converters. Normally, the inputs are applied on pins 11 and 12 of the J1 connector.

Using GPIO1, GPIO2, and GPIO3 to control the MAX4782 4-channel multiplexer, 4 channels of signals can be input to the MAX11200 family devices. See Table 4 for GPIO1, GPIO2, and GPIO3 functions.

Table 3. Jumper Descriptions (JU1–JU10)

JUMPER	SHUNT POSITON	DESCRIPTION
JU1	1-2*	ADC CLK connected to on-board 2.4576MHz clock
	1-3	ADC CLK connected to on-board 2.048MHz clock
	1-4	ADC CLK connected to a user-supplied clock
JU2	1-2*	ADC REFP connected to on-board 3.0V reference
	2-3	ADC REFP connected to user-supplied reference EXT_REFP
JU3	1-2*	ADC REFN connected to isolated GND
	2-3	ADC REFN connected to user-supplied reference EXT_REFN
JU4	1-2*	ADC DVDD connected to on-board 3.3V isolated power supply
	2-3	ADC DVDD connected to user-supplied power supply
JU5	1-2*	ADC AVDD connected to on-board 3.3V isolated power supply
	2-3	ADC AVDD connected to user-supplied power supply
JU6	Open*	Disable 2.4576MHz clock oscillator (reduce noise)
	1-2	Enable 2.4576MHz clock oscillator
JU7	Open*	Disable 2.048MHz clock oscillator (reduce noise)
	1-2	Enable 2.048MHz clock oscillator
JU8	1-2*	ADC AINN connected to REFP
	3-4	ADC AINN connected to REFN
	5-6	ADC AINN connected to (REFP+REFN)/2
	7-8	ADC AINN connected to isolated GND
	9-10	ADC AINN connected to EXT_AINN
	11-12	ADC AINN connected to MAX4782, pin Y
JU9	1-2*	ADC AINP connected to REFP
	3-4	ADC AINP connected to REFN
	5-6	ADC AINP connected to (REFP+REFN)/2
	7-8	ADC AINP connected to isolated GND
	9-10	ADC AINP connected to EXT_AINP
	11-12	ADC AINP connected to MAX4782, pin X
JU10	1-2*	ADC DVDD connected to on-board 3.3V isolated power supply
	Open	ADC DVDD disconnected from on-board 3.3V isolated power supply (for current measurement)

**Default position.*

Table 4. MAX4782 Switch Programming (GPIO1, GPIO2, GPIO3)

ENABLE INPUT (GPIO1)	SELECT INPUT		ON SWITCHES	CTRL2 REGISTER WRITE EXAMPLE
	B(GPIO2)	A(GPIO3)		
H	Don't care	Don't care	All switches open	0xF1
L	L	L	X-X0 Y-Y0	0xF0
L	L	H	X-X1 Y-Y1	0xF4
L	H	L	X-X2 Y-Y2	0xF2
L	H	H	X-X3 Y-Y3	0xF6

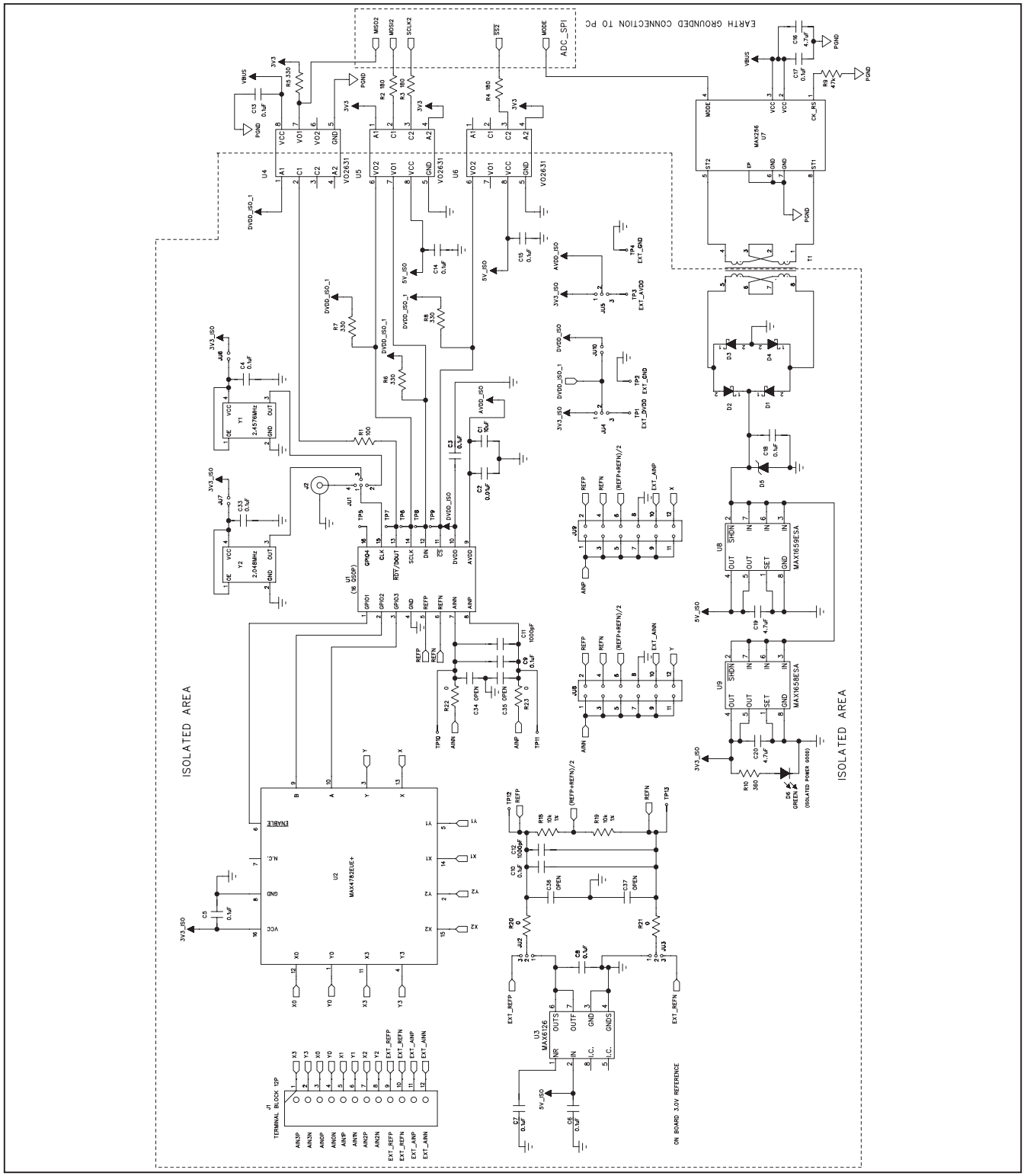


Figure 8a. MAX11200/MAX11206/MAX11209/MAX11210/MAX11213 EV Kit Schematic (Sheet 1 of 2)

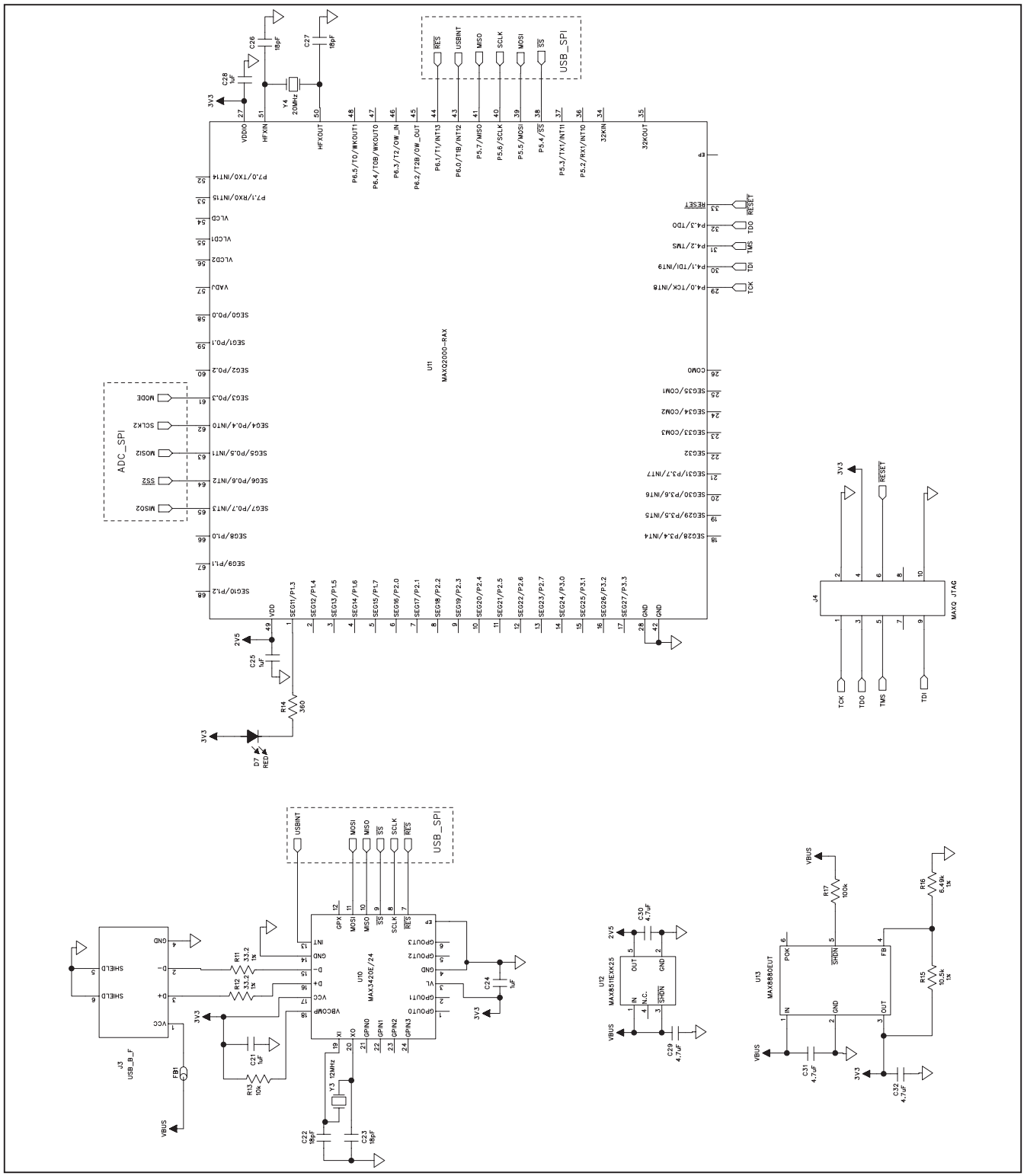


Figure 8b. MAX11200/MAX11206/MAX11209/MAX11210/MAX11213 EV Kit Schematic (Sheet 2 of 2)

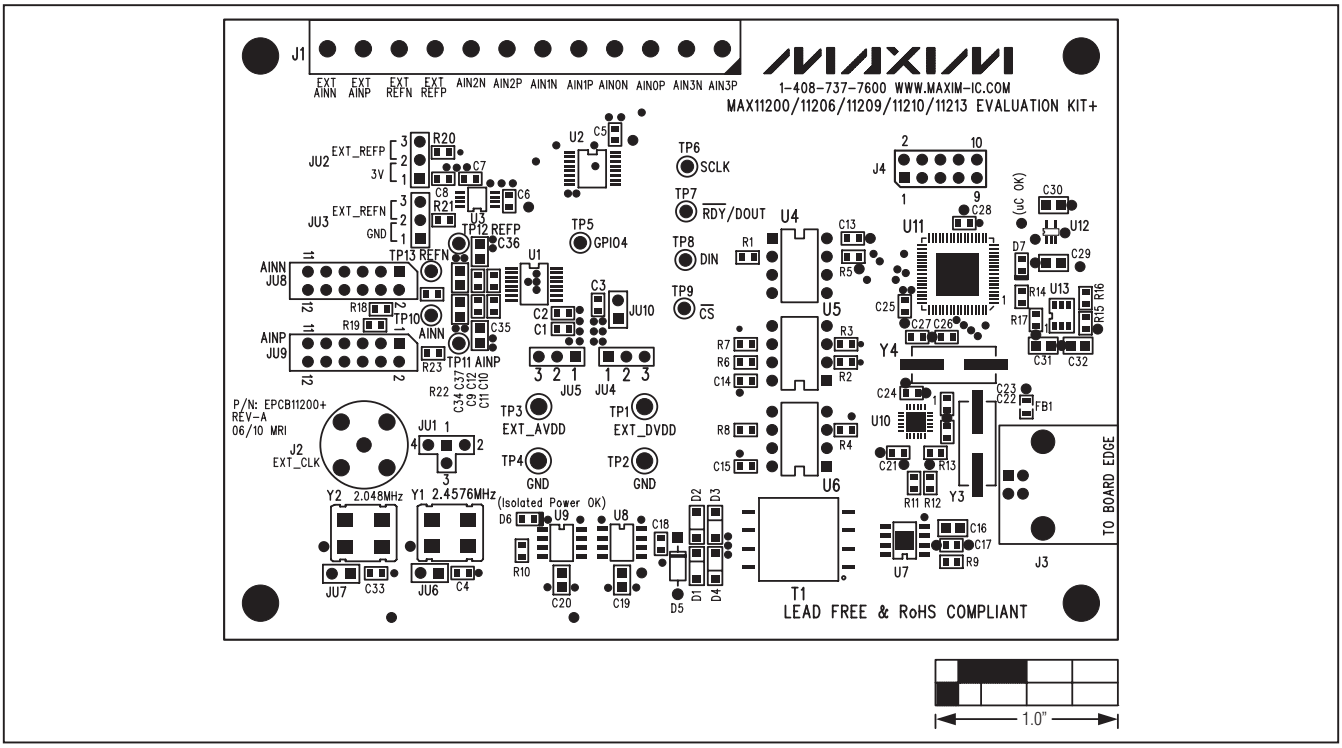


Figure 9. MAX11200/MAX11206/MAX11209/MAX11210/MAX11213 EV Kit Component Placement Guide—Component Side

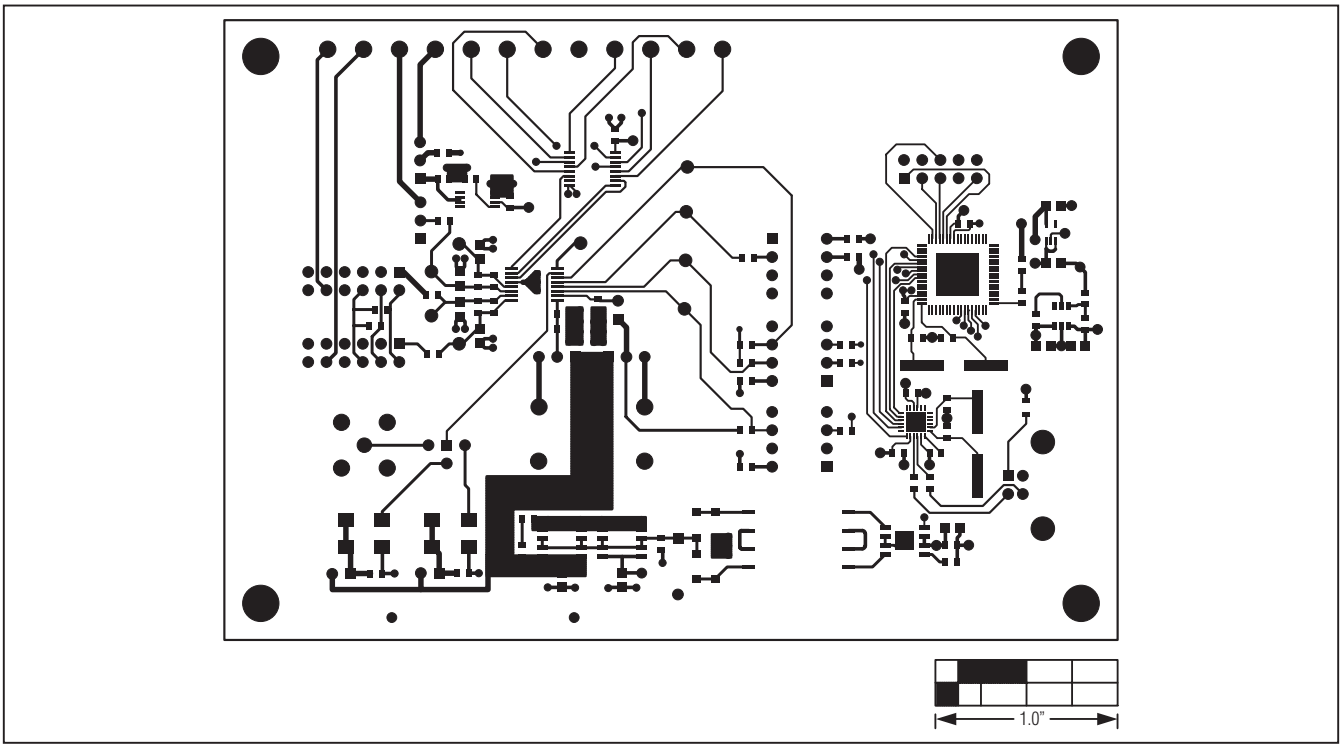


Figure 10. MAX11200/MAX11206/MAX11209/MAX11210/MAX11213 EV Kit PCB Layout—Component Side

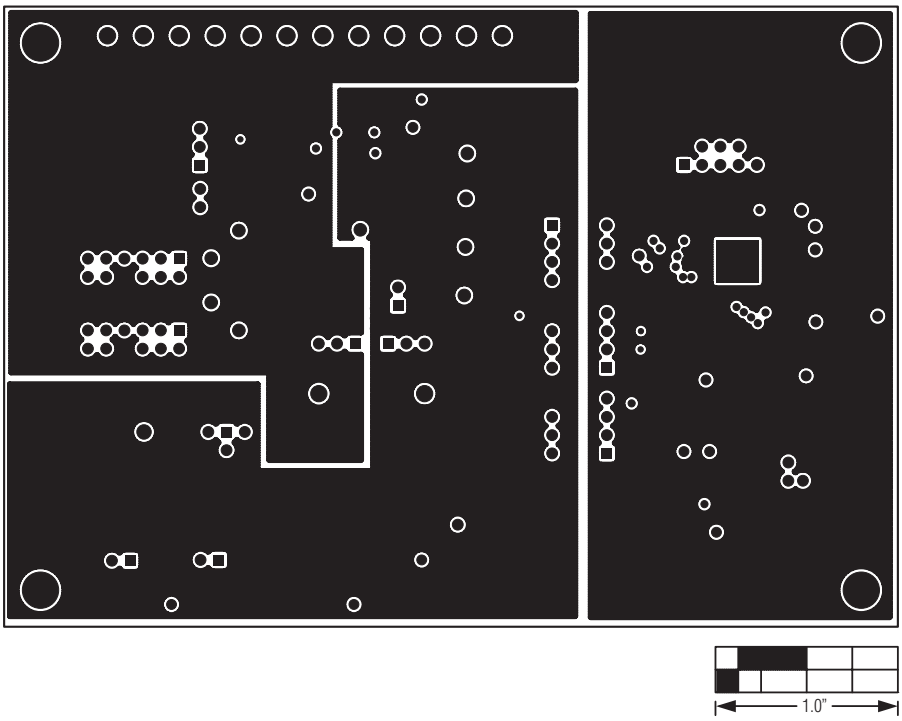


Figure 11. MAX11200/MAX11206/MAX11209/MAX11210/MAX11213 EV Kit PCB Layout—Inner Layer 2

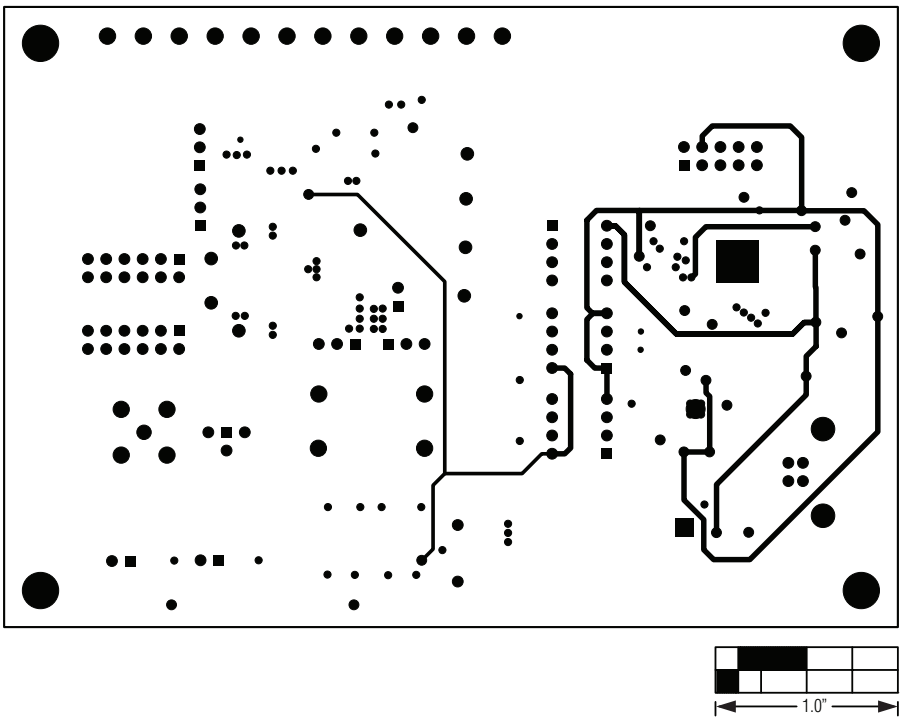


Figure 12. MAX11200/MAX11206/MAX11209/MAX11210/MAX11213 EV Kit PCB Layout—Inner Layer 3

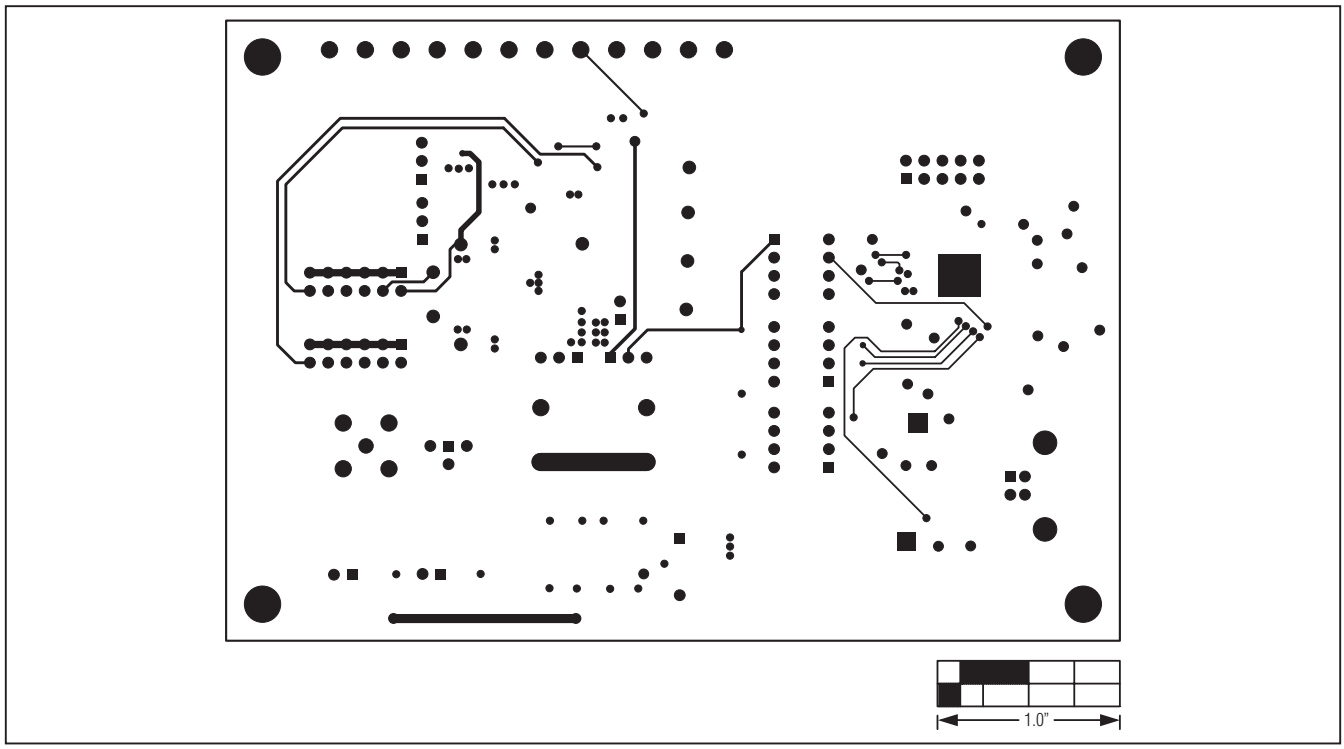


Figure 13. MAX11200/MAX11206/MAX11209/MAX11210/MAX11213 EV Kit PCB Layout—Solder Side

Revision History

REVISION NUMBER	REVISION DATE	DESCRIPTION	PAGES CHANGED
0	9/10	Initial release	—

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