Evaluating the ADMV4630 14.0 GHz to 14.5 GHz, SATCOM, Ku-Band Upconverter

FEATURES

- Fully featured evaluation board for the ADMV4630
- On-board SDP-S connector for SPI control
- Simplified power-up with on-board LDO regulators
- 5 V operation
- ACE software interface for SPI control

EVALUATION KIT CONTENTS

- EVAL-ADMV4630Z evaluation board
- Mini USB to USB cable
- SDP-S controller board

EQUIPMENT NEEDED

- 5 V dc power supply
- DC clips
- RF signal generator
- Spectrum analyzer
- Power supply cables, 2.92 mm coaxial cables
- PC for ACE software

DOCUMENTS NEEDED

- ADMV4630 data sheet

SOFTWARE NEEDED

- ACE software
- ADMV4630 plugins

GENERAL DESCRIPTION

The evaluation board incorporates the ADMV4630, low dropout (LDO) regulators, and the EVAL-SDP-CS1Z (SDP-S) controller board to allow simplified, efficient evaluation of the ADMV4630. The SDP-S controller board allows the configuration of the ADMV4630 register map through the Analysis, Control, Evaluation (ACE) software. The LDO regulators allow the EVAL-ADMV4630Z to be powered by a 5 V single supply.

The ADMV4630 is a Ku-band upconverter optimized for various satellite communication (SATCOM) user terminals operating in the 14.0 GHz to 14.5 GHz frequency range. The ADMV4630 upconverter comes in a compact, thermally enhanced, 6 mm × 6 mm, 40-lead frame chip scale package (LFCSP). The ADMV4630 operates over the −40°C to +85°C case temperature range.

For full details on the ADMV4630, see the ADMV4630 data sheet, which must be consulted in conjunction with this user guide when using the EVAL-ADMV4630Z.

EVALUATION BOARD PHOTOGRAPH

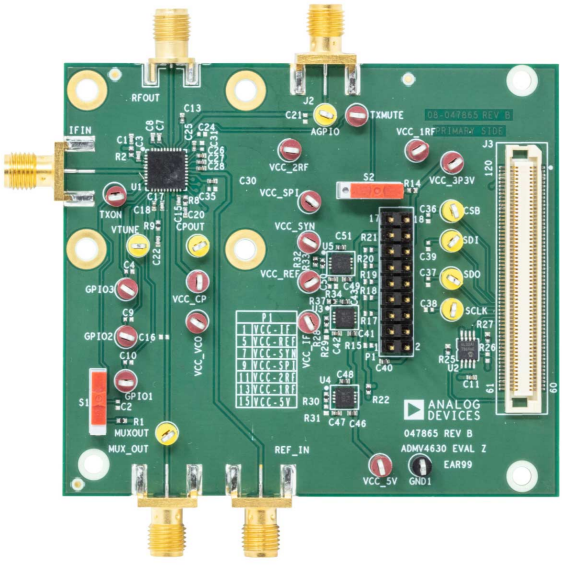

Figure 1.

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REVISION HISTORY

7/2022—Revision A: Initial Version

EVALUATION BOARD HARDWARE

The EVAL-ADMV4630Z comes with an on-board ADMV4630 chip. When evaluating the ADMV4630 device, connect the IF input to an RF signal generator. The EVAL-ADMV4630Z runs on a 5 V dc supply. Connect the 5 V dc supply to the VCC_5V test point and the ground to the GND1 test point.

Figure 2 shows the block diagram of the EVAL-ADMV4630Z lab bench setup.

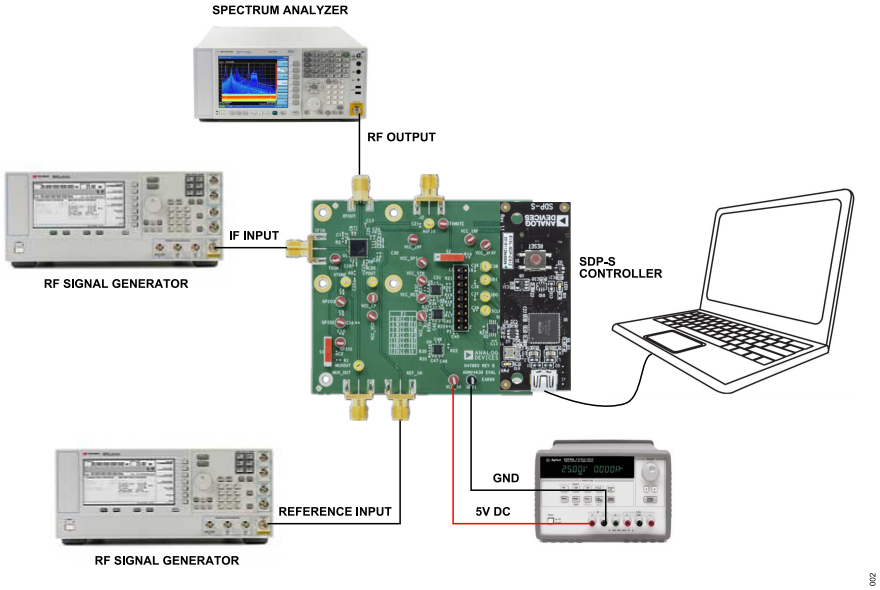

Figure 2. Lab Bench Setup

EVALUATION BOARD SOFTWARE QUICK START PROCEDURES

INSTALLING THE ACE SOFTWARE AND ADMV4630 PLUGINS AND DRIVERS

The EVAL-ADMV4630Z software uses the Analog Devices, Inc., ACE software. Ensure that the ACE software is installed before setting up or using the EVAL-ADMV4630Z. For instructions on how to install and use the ACE software, go to www.analog.com/ACE.

If the ACE software has already been installed on the PC, ensure that it is the latest version that is shown on the www.analog.com/ACE page.

1. Install the latest version of ACE software. In the **ACE Setup** window, ensure that the **SDP Drivers**, **LRF Drivers**, and **.NET 4.8** driver installations are selected as well (see Figure 3), then click **Install**.

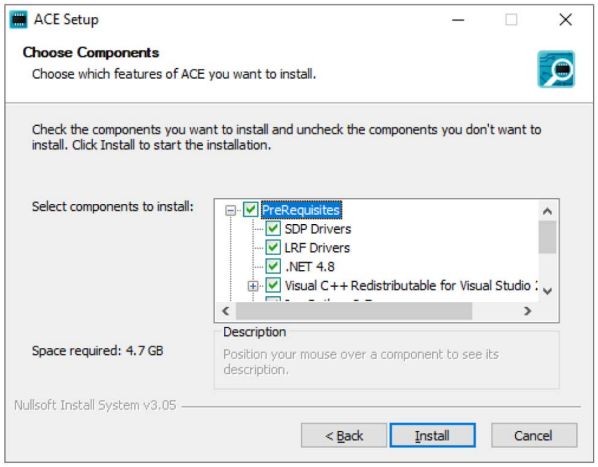

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Figure 3. Drivers to Install with ACE Software

2. The EVAL-ADMV4630Z plugin can be downloaded and installed from the ACE plugin manager.
3. When the software and driver installations are finished, open the ACE software and the EVAL-ADMV4630Z plugin appears (see Figure 4).

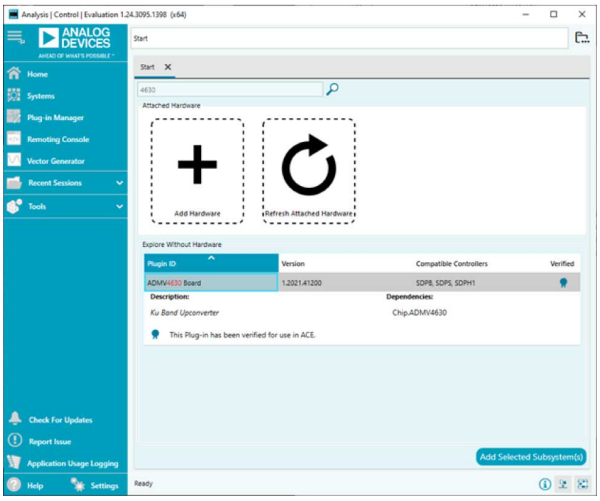

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Figure 4. EVAL-ADMV4630Z Plugin Window

CONFIGURING THE BOARD

To set up the EVAL-ADMV4630Z, take the following steps:

1. Connect the SDP controller board to the J3 connectors on the EVAL-ADMV4630Z.
2. Connect the USB cable to the PC and then to the SDP-S controller board.
3. Connect the 5 V clip lead on the power supply to the red VCC_5V test point on the EVAL-ADMV4630Z, and connect the GND clip lead on the power supply to the black GND1 test point. The power supply current limiting must be set to approximately 600 mA.
4. Open the ACE software. The **ADMV4630 Board** plugin appears in the **Attached Hardware** section. Double-click the EVAL-ADMV4630Z plugin. The **ADMV4630 Board** tab opens (see Figure 5).
5. Click off the **Poll Device** button and double-click the **ADMV4630** button (see Figure 5).

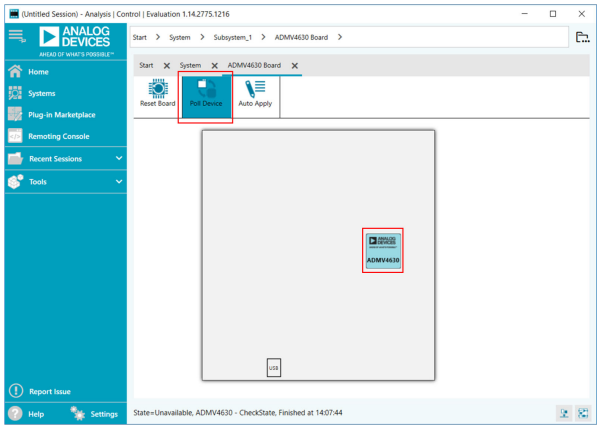

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Figure 5. ADMV4630 Board Tab

6. The **ADMV4630** block diagram appears (see Figure 6).

EVALUATION BOARD SOFTWARE QUICK START PROCEDURES

7. Click the **Initialization & Optimization** button in the **ADMV4630** block diagram to initialize the device before operation.

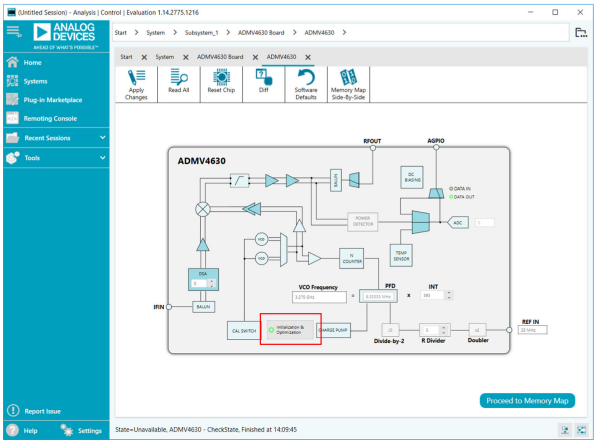

Figure 6. ADMV4630 Block Diagram in the ACE Software

8. To set up the RF, use the following settings and measure the output at the EVAL-ADMV4630Z RFOUT port:
   - REF_IN port: reference frequency = 25 MHz, 4 dBm, and dc block is needed.
   - IF input: IF frequency = 4.1 GHz, −30 dBm.
   - The gain is at minimum attenuation. Note that the chip temperature is higher than 25°C for the reference frequency and IF frequency conditions and there is part to part variation. The gain may be lower than the typical specifications in the ADMV4630 data sheet.

ADMV4630 BLOCK DIAGRAM AND FUNCTIONS

The ADMV4630 block diagram user interface with labels is shown in Figure 7, and Table 1 describes the functionality of each block.

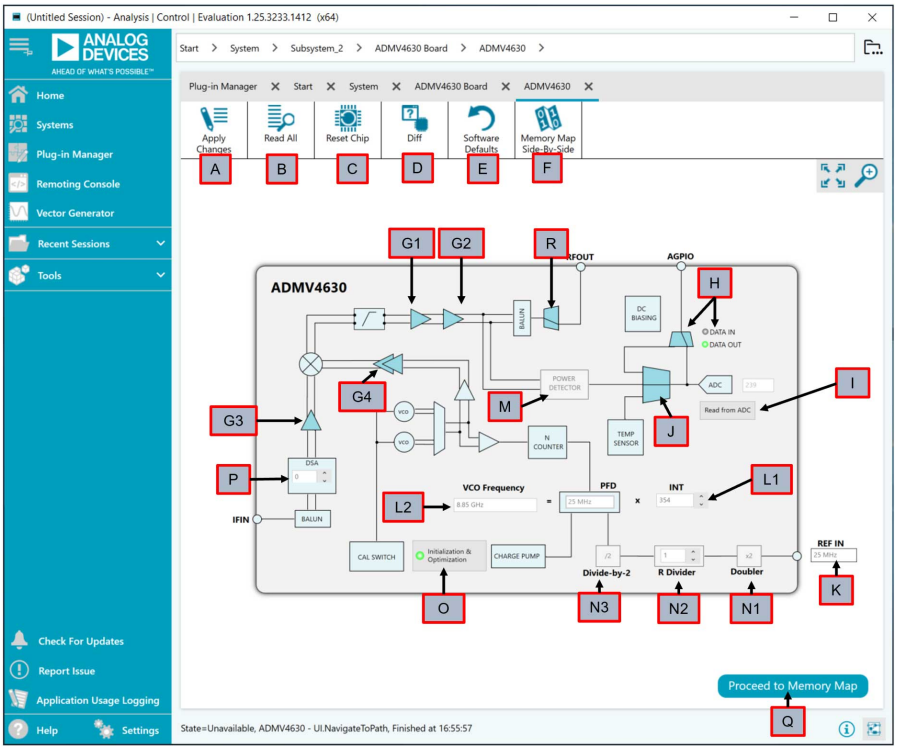

Figure 7. ADMV4630 Block Diagram with Labels

Table 1. ADMV4630 Block Diagram Label Functions (See Figure 7)

Label	Function
A	Click **Apply Changes** to apply all register values to the device. If **Auto Apply** is highlighted in the **ADMV4630 Board** tab, then the **Apply Changes** feature continuously runs every few seconds, and does not need to be clicked to apply or read back the block diagram settings.
B	Click **Read All** to read back all serial peripheral interface (SPI) registers of the device.
C	Click **Reset Chip** to reset the ADMV4630 chip.
D	Click **Diff** to show registers that are different on the device.
E	Click **Software Defaults** to load the software defaults on to the device, and then click **Apply Changes**.
F	Click **Memory Map Side-By-Side** to open the memory map.
G1	Click the **RF Driver Preamp Enable** switch (represented by Label G1) to set the AMPRFPREDRIVER_BIAS_CONTROL bit (Bit 2, Register 0x100). When **RF Driver Preamp Enable** is highlighted, the AMPRFPREDRIVER_BIAS_CONTROL bit is enabled. When **RF Driver Preamp Enable** is not highlighted, the AMPRFPREDRIVER_BIAS_CONTROL bit is disabled.
G2	Click the **RF Output Driver Amp Enable** switch (represented by Label G2) to set the AMPRFDRIVER_BIAS_CONTROL bit (Bit 3, Register 0x100). When **RF Output Driver Amp Enable** is highlighted, the AMPRFDRIVER_BIAS_CONTROL bit is enabled. When **RF Output Driver Amp Enable** is not highlighted, the AMPRFDRIVER_BIAS_CONTROL bit is disabled.
G3	Click the **IF Amp Enable** switch (represented by Label G3) to set the AMPIF_BIAS_CONTROL bit (Bit 0, Register 0x100). When **IF Amp Enable** is highlighted, the AMPIF_BIAS_CONTROL bit is enabled. When **IF Amp Enable** is not highlighted, the AMPIF_BIAS_CONTROL bit is disabled.
G4	Click the **LO Amp Enable** switch (represented by Label G4) to set the AMPLO_BIAS_CONTROL bit (Bit 1, Register 0x100). When **LO Amp Enable** is highlighted, the AMPLO_BIAS_CONTROL bit is enabled. When **LO Amp Enable** is not highlighted, the AMPLO_BIAS_CONTROL bit is disabled.
R	Click the **TX Output** switch (represented by Label R) to set the TXOUTPUT_SWITCH bit (Bit 4, Register 0x100). When the **TX Output** switch is set toward the RFOUT output, the TXOUTPUT_SWITCH bit is enabled. Otherwise, the TXOUTPUT_SWITCH bit is disabled.

ADMV4630 BLOCK DIAGRAM AND FUNCTIONS

Table 1. ADMV4630 Block Diagram Label Functions (See Figure 7)

Label	Function
H	Click the **AGPIO** switch (represented by Label H) to set the SEL_AGPIO bit (Bit 3, Register 0x301). When the **AGPIO** switch is set to the right, the SEL_AGPIO bit is disabled and the AGPIO pin is used as data output. When the **AGPIO** switch is set to the left, the SEL_AGPIO bit is enabled and the AGPIO pin is used as external data input. See the ADMV4630 data sheet for further details.
I	ADC blocks. Click **Read from ADC** to read back ADC values. See the ADMV4630 data sheet for further details.
J	Click the **AMUX** switch (represented by Label J) to set the SEL_AMUX bit (Bit[2:0], Register 0x301). There are three options for the AMUX, AGPIO, and power detector and temperature sensor (PTAT). See the ADMV4630 data sheet for further details.
K	Enter a value in the **REF IN** text box to set the reference frequency.
L1	Use the **INT** scroll to choose a value, or enter a value in the text box to set the 16-bit integer value (Register 0x200, Register 0x201) of the synthesizer. The **VCO Frequency** (Label L2) value is calculated based on the **INT** value. Alternatively, change the **VCO Frequency** to calculate the **INT** value.
L2	Enter a value in the **VCO Frequency** text box to set the VCO frequency. The **INT** value is calculated based on the **VCO Frequency** value. Alternatively, change the **INT** value to calculate the **VCO Frequency** value.
M	Click **POWER DETECTOR** to set the DET_BIAS_CONTROL bit (Bit 5, Register 0x100). When **POWER DETECTOR** is highlighted, the DET_BIAS_CONTROL bit is enabled. When **POWER DETECTOR** is not highlighted, the DET_BIAS_CONTROL bit is disabled.
N1	Click the **Doubler** switch to set the DOUBLER_EN bit (Bit 3, Register 0x20E). When the **Doubler Enable** switch is highlighted, the DOUBLER_EN bit is enabled. When the **Doubler Enable** switch is not highlighted, the DOUBLER_EN bit is disabled.
N2	Use the **R Divider** scroll to choose a value, or enter a value in the text box to change the reference divider value (Bit[4:0], Register 0x20C).
N3	Click **Divide-by-2** to set the RDIV2_EN bit (Bit 0, Register 0x20E). When **Divide-by-2** is highlighted, the RDIV2_EN bit is enabled. When **Divide-by-2** is not highlighted, the RDIV2_EN bit is disabled.
O	Click **Initialization & Optimization** to initialize and lock the PLL.
P	Use the **DSA** scroll to choose a value, or enter a value to set the SEL_DSA_ATTEN bit (Bit[4:0], Register 0x300).
Q	Click **Proceed to Memory Map** to open the ADMV4630 memory map (see Figure 8).

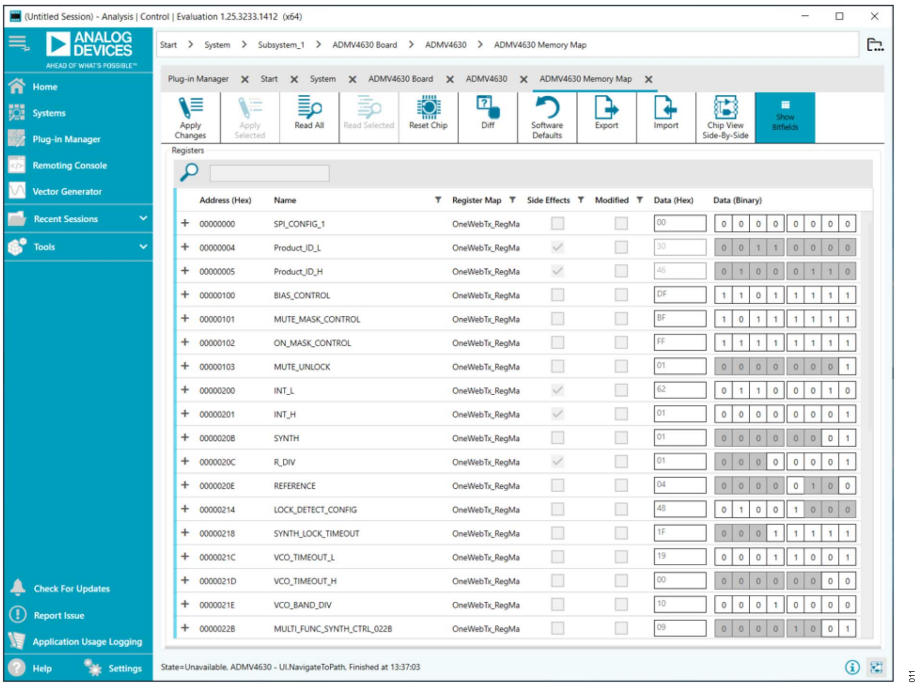

Figure 8. ADMV4630 Memory Map in the ACE Software

EVALUATION BOARD SCHEMATICS

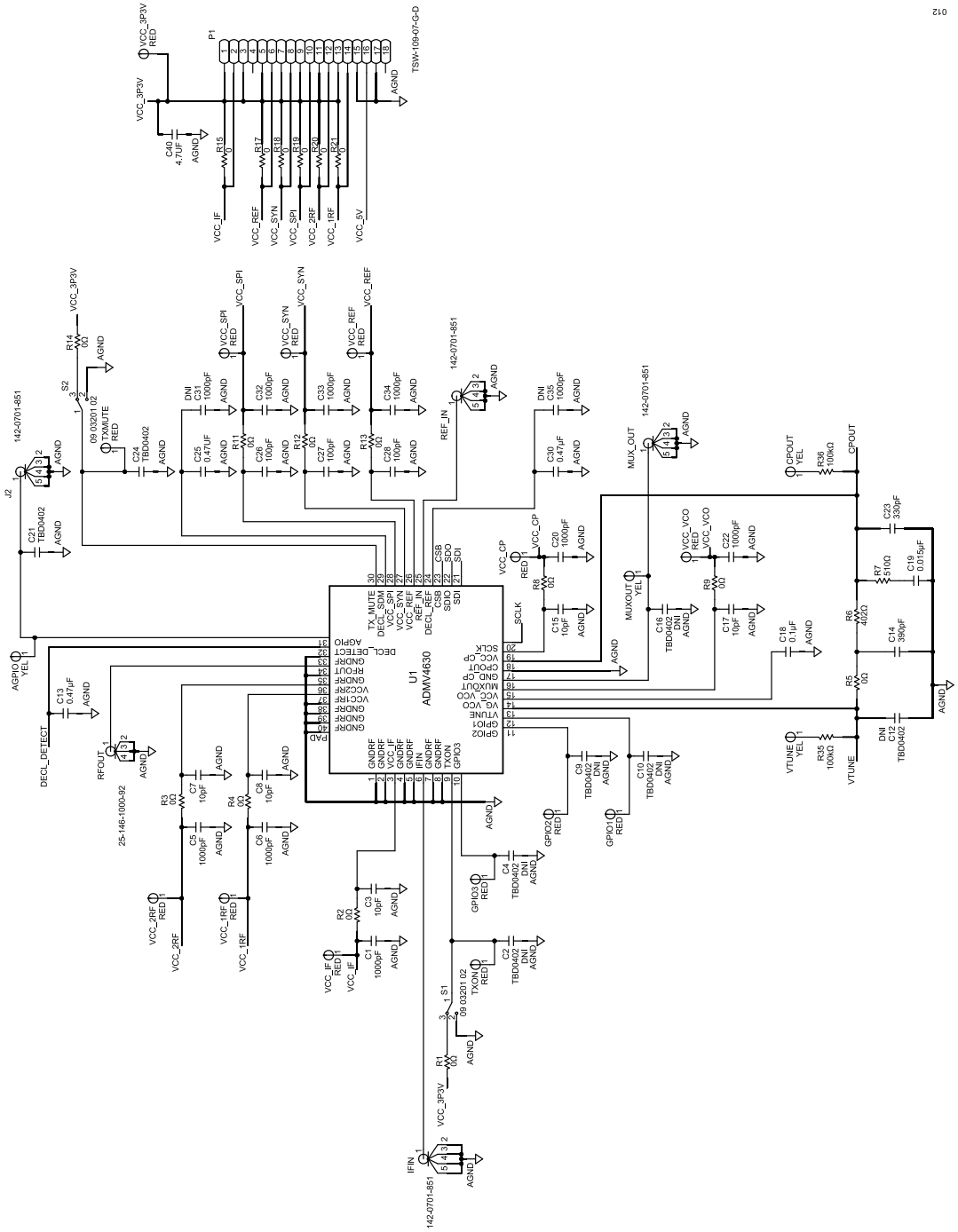

Figure 9. EVAL-ADMV4630Z Schematic, Page 1

EVALUATION BOARD SCHEMATICS

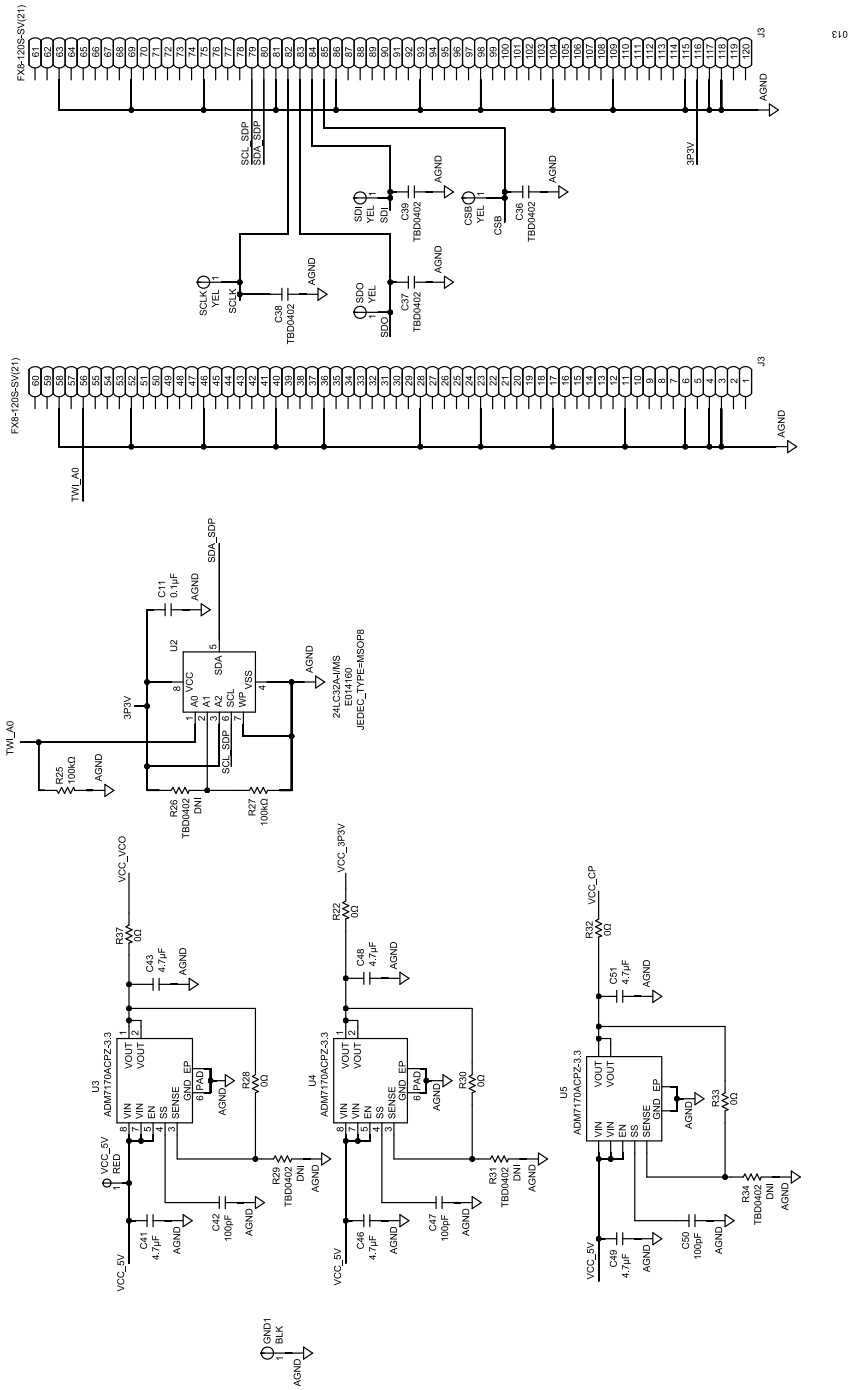

Figure 10. EVAL-ADMV4630Z Schematic, Page 2

ORDERING INFORMATION

BILL OF MATERIALS

Table 2.

Qty	Reference Designators	Description	Manufacturer	Part Number
8	AGPIO, CPOUT, CSB, MUXOUT, SCLK, SDI, SDO, VTUNE	Test points, yellow	Components Corporation	TP-104-01-04
8	C1, C5, C6, C20, C22, C32 to C34	1000 pF ceramic capacitors	Murata	GRM1555C1H102JA01
2	C11, C18	0.1 µF ceramic capacitors	American Technical Ceramics	530L104KT16T
3	C13, C25, C30	0.47 µF ceramic capacitors	Taiyo Yuden	UMK105ABJ474KV-F
1	C14	390 pF ceramic capacitor	Murata	GCM1555C1H391JA16D
5	C3, C7, C8, C15, C17	10 pF ceramic capacitors	Yageo	CC0402JRNP09BN100
1	C19	0.015 µF ceramic capacitor	Murata	GCM155R71H153JA55D
14	C4, C9, C10, C12, C16, C21, C24, C36 to C39	Do not install	TBD0402	TBD0402
1	C23	330 pF ceramic capacitor	Murata	GCM1555C1H331JA16D
6	C26 to C28, C42, C47, C50	100 pF ceramic capacitors	TDK	C1005NP01H101J050BA
7	C40, C41, C43, C46, C48, C49, C51	4.7 µF ceramic capacitors	Murata	GRM155R60J475ME87D
1	GND1	Test point, black	Components Corporation	TP-104-01-00
15	GPIO1, GPIO2, GPIO3, TXMUTE, TXON, VCC_1RF, VCC_2RF, VCC_3P3V, VCC_5V, VCC_CP, VCC_IF, VCC_REF, VCC_SPI, VCC_SYN, VCC_VCO	Test points, red	Components Corporation	TP-104-01-02
4	IFIN, J2, MUX_OUT, REF_IN	SMA connectors	Johnson	142-0701-851
1	J3	120-pin connector	Hirose Electric	FX8-120S-SV(21)
1	P1	18-pin connector	Samtec Inc.	TSW-109-07-G-D
23	R1 to R5, R8, R9, R11 to R15, R17 to R22, R28, R30, R32, R33, R37	0 Ω chip resistors	Panasonic	ERJ-2GE0R00X
2	R25, R27	100 kΩ chip resistors	Panasonic	ERJ-2RKF1003X
4	R26, R29, R31, R34	Do not install	TBD0402	TBD0402
2	R35, R36	100 kΩ chip resistors	Vishay	CRCW0402100KJNED
1	R6	402 Ω chip resistor	Panasonic	ERJ-2RKF4020X
1	R7	510 Ω chip resistor	Yageo	RC0402FR-07510RL
1	RFOUT	2.92 mm RF connector	SRI Connector Gage Company	25-146-1000-92
2	S1, S2	Switches	EAO	09-03-201-02
1	U1	ADMV4630	Analog Devices	ADMV4630BCPZN
1	U2	EEPROM	Microchip Technology	24LC32A-I/MS
3	U3, U4, U5	LDO regulators	Analog Devices	ADM7170ACPZ-3.3-R7

ORDERING INFORMATION

NOTES

ESD Caution
ESD (electrostatic discharge) sensitive device. Charged devices and circuit boards can discharge without detection. Although this product features patented or proprietary protection circuitry, damage may occur on devices subjected to high energy ESD. Therefore, proper ESD precautions should be taken to avoid performance degradation or loss of functionality.