Evaluation Board for ADF7012 ISM Band Transmitter

Preliminary Technical Data

EVAL-ADF7012EB5

FEATURES

Part-Featured Evaluation Board for the ADF7012
Board requires all matching, loop filter components, crystal and Inductor to set frequency range.
Easy to use PC Software for Register Programming

INTRODUCTION

This Technical Note describes the operation and functionality of the ADF7012EB5 Evaluation Boards. The evaluation board allows the functionality and performance of the ADF7012 to be easily evaluated. Access to the control registers of the ADF7012 is made easier by using the PC software provided which can be used to program the control registers via the printer port of the PC.

OPERATING THE ADF7012EB5 EVALUATION BOARD

Power Supplies

The evaluation board requires a supply between 2.1V and 3.6V. The voltage is connected at the white terminal block. The I-out and I-In lines can be connected via an ammeter so that the Idd can easily be monitored. When there is no ammeter these pins should be linked with a piece of short wire. The supplies are decoupled with 2.2uF and 100pF capacitors, and the 2 on-chip regulators are stabilized with 2 x 2.2uF capacitors.

The chip is enabled by placing the CE header join between H (high), and the centre pin.

(Continued on Page 3)

FUNCTIONAL BLOCK DIAGRAM

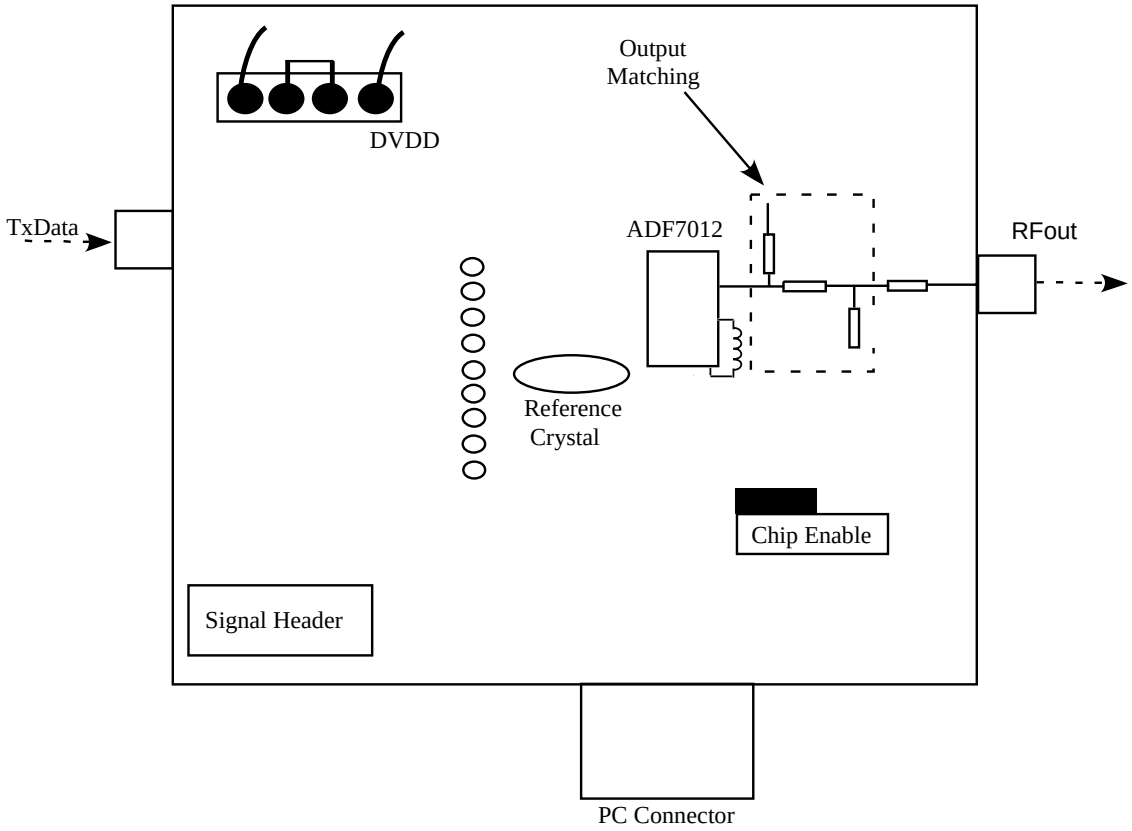

Figure 1. Functional Block Diagram

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TABLE OF CONTENTS

REVISION HISTORY

HARDWARE DESCRIPTION

The evaluation board contains an ADF7012 Transmitter IC, loop filter, matching components, crystal, and external inductor in 0603 to set the frequency of operation for the VCO. A parallel cable is provided to link the PC running the evaluation software to the eval board.

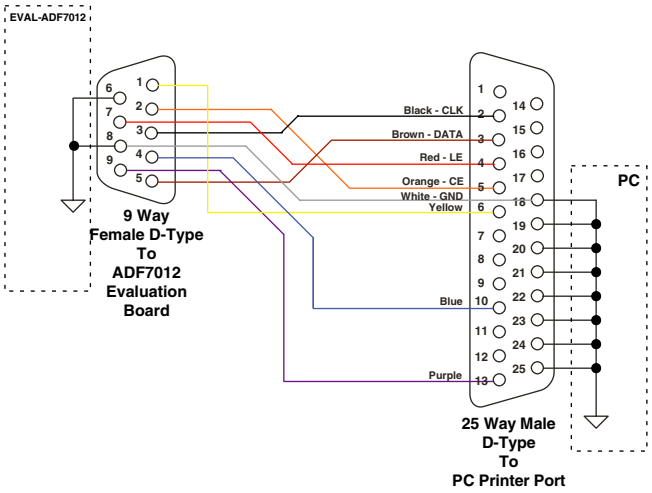
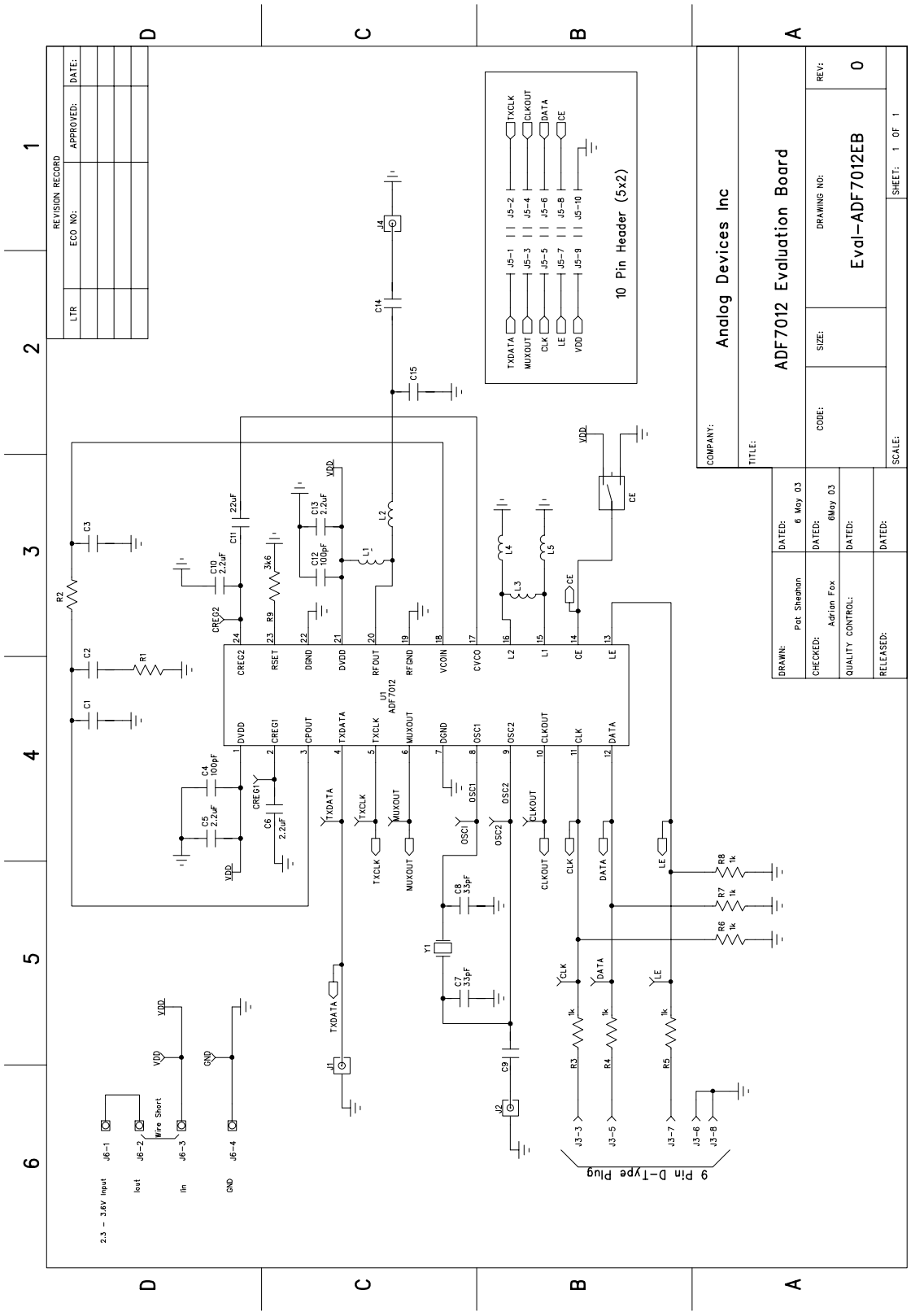


Figure 1 – Parallel Port Connections

The levels from the parallel port are 5V, so there is a voltage divider to reduce the voltage levels to levels, which do not exceed the threshold of the ESD protection diodes on the inputs.

The crystal supplies a reference to the circuit, and the crystal frequency or a divided down version are multiplied by the N-divider programmed into the part to generate a stable output frequency. The range of the internal VCO is determined by the value of the external inductor L3. By the reducing the value of this inductor the centre frequency of operation is increased.
A matching network should be provided to ensure maximum power transfer from the PA output to the SMA output – terminated in 50Ohms.
The loop filter is used to ensure stability and is designed using the ADIsimPLL software which is available free of charge from the ADI website. An example design is included with the ADF7012 evaluation package. The loop filter integrates the current pulses provided by the charge pump and alters the voltage to the input of the VCO, and hence the output frequency.

EVALUATION BOARD SCHEMATICS



BOARD-SPECIFIC COMPONENTS

This application note does not cover any particular frequency range but the values below give an indication as to how to match and design loop filter for some common frequency configurations. (VCO inductor, PA Matching, Loop Filter, Crystal)

Frequency of Operation (MHz)	315MHz	433MHz	868MHz	915MHz
Crystal Frequency	3.6864MHz	4MHz	12MHz	10MHz

Table 1 : Crystal Frequencies for Different Boards

Frequency of Operation (MHz)	315MHz	433MHz	868MHz	915MHz
VCO Inductor – L3	36nH	19nH	1.9nH	1.6nH

Table 2 : L3 Inductor Value for Different Boards

Frequency of Operation (MHz)	315MHz	433MHz	868MHz	915MHz
L1	56nH	22nH	27nH	27nH
L2	1nF -cap	10pF	6.2nH	6.2nH
C15 (to GND)	OPEN	OPEN	OPEN	OPEN
C14 (to Rfout)	SHORT	SHORT	470pF	470pF

Table 3 : Matching Component Values

Frequency of Operation (MHz)	315MHz	433MHz	868MHz	915MHz
C1	330pF	100pF	1.2nF	470pF
C2	8.2nF	2.2nF	22nF	12nF
C3	82pF	22pF	470pF	120pF
R1	750R	2.5k	470	470
R2	3k	10k	1.3k	1.8k

Table 4 : Loop Filter Component Values (LBW = 100kHz, 868MHz, 800kHz all others.)

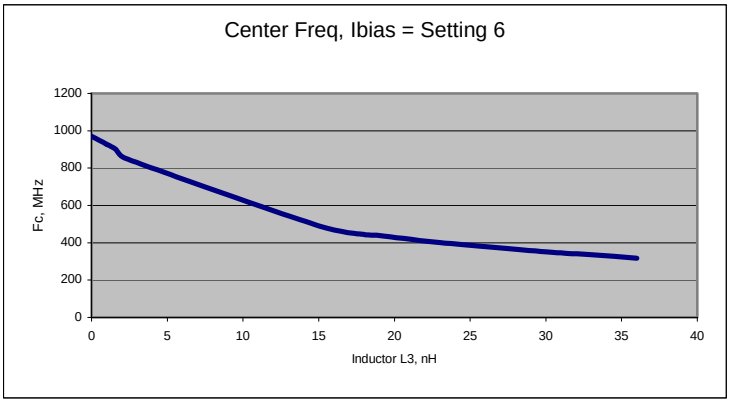


Figure 3 – Graph of VCO Center Frequency vs. L3

Software

The Evaluation Board comes with PC compatible software that allows the user easy access to the control registers of the ADF7012. The software uses the parallel printer port and is compatible with Windows 9x/2000/NT/XP. A centronics printer port cable is required to connect the evaluation board to the PC.

Installing the Software

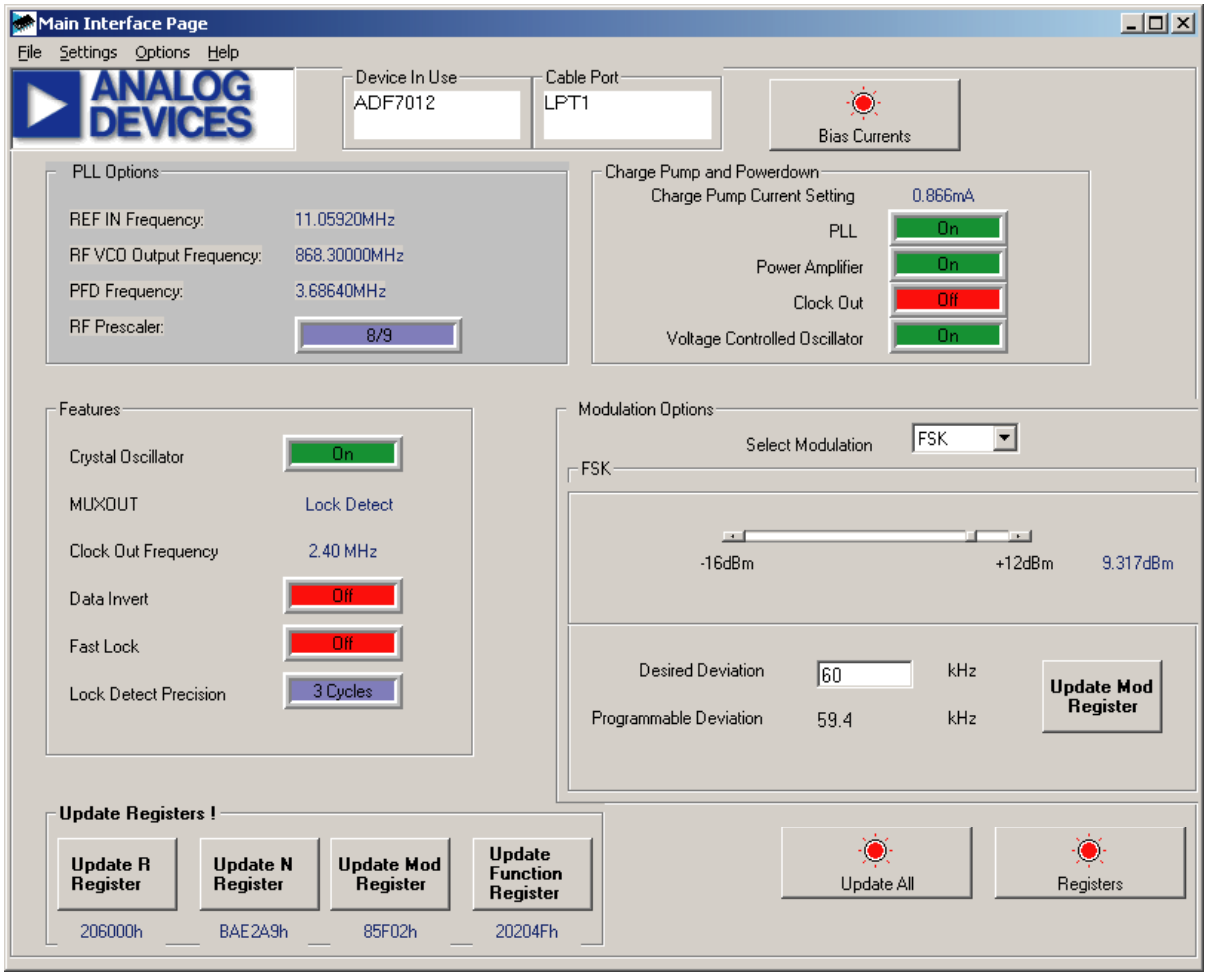
The software is supplied on a CD. Inserting the CD in the CD drive should automatically start the installation procedure. If the CD drive is not setup to do this the user should double-click on the "SETUP.EXE" file in the root directory of the CD to begin installation. Running the Software

The software can be started via the shortcuts added to the Start Menu. The application file has a shortcut located in Program Files/Analog Devices/ADF7xxx/ADF7012Rev2_1. When the software initializes it checks to see what operating system is present.

The software gives the user access to the internal registers of the ADF7012. The software allows graphical controls to setup the part. On the next version the ability to program the registers directly will be available by clicking the registers button in the bottom right hand corner of the main panel. Once the user changes the settings on the software and hit the update button, the hex value written to the part will appear beside the relevant update button. The user can take note of these and use these in their microcontroller code.

The front panel as it will appear is shown below. To change the frequency of the PLL, the user should click on the blue text indicating the current PLL frequency. To access the sub menus for MUXout, CLKout and Charge Pump current, the user should click on the text (blue) representing the present value.

On power up – The crystal, PFD, and output frequency values should be updated to represent the actual settings on the relevant eval board. The update all button will write to all 4 registers.



GETTING STARTED WITH THE ADF7012 EVALUATION BOARD

The evaluation performed by each customer is specific to each application, but the notes in this section will help the user become familiar with the operation of the part and the software.

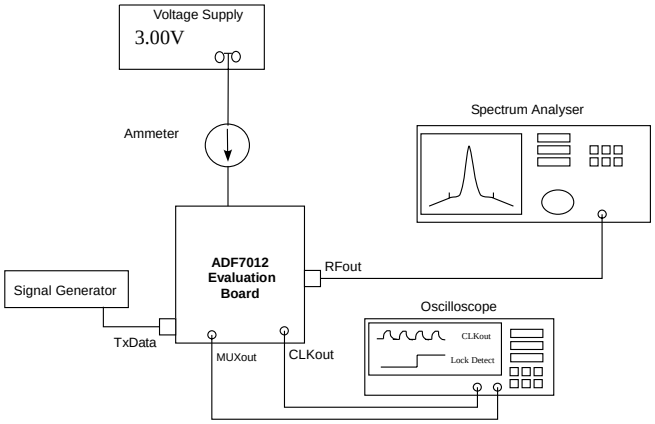


Figure 5- Evaluation Test Setup

1) Set the frequency of operation, the crystal frequency and the PFD frequency to the correct value. This is done by clicking the 868MHz text on the front panel, which opens a submenu where these items can be adjusted.

2) Select the modulation required. If FSK enter the deviation frequency.

3) In the MUXout menu, select the Logic low/logic High signals and monitor using the scope. This confirms operation of the parallel port on your PC and correct installation of the software.

4) Monitor the Creg1 and Creg2 pins. These should be close to 2.2V. The regulator outputs are used internally, but there are applications where you may use these voltages for powering low current devices.

5) Pull TxData low, turn the PA on, and look at the output signal on the Spectrum Analyzer. Set the data invert bit to invert and see that the signal moves by 2 x deviation to the 1 frequency.

6) The absolute power values are not correct and the ideal output power is obtained by tweaking the level on the scroll bar.

7) The battery voltage can be monitored using the MuxOut pin., by selecting the battery monitoring options in the MUXout sub-menu.

8) Apply Modulation to the TxData pin and examine the modulated spectrum on the Spectrum Analyzer. For operation in the US, usually the –20dB points of the spectrum usually denote the effective occupied BW. In Europe, the BW is the frequency limit where the power level is –36dBm. (Please review the relevant standards for measurement conditions).

BILL OF MATERIALS EB5 –

Name	Part Type	Value	Tolerance	PCB Decal	Part Description	Stock Code	SMD	Layer Name
C1	CAP	???		0805	User Defined - Not inserted		Yes	Bottom
C2	CAP	???		0805	User Defined - Not inserted		Yes	Bottom
C3	CAP	???		0805	User Defined - Not inserted		Yes	Bottom
C4	CAP	100pF	+/-5%	0402	50V Ceramic NPO Capacitor	Digikey 311-1024-1-ND	Yes	Top
C5	CAP	2.2uF	+80/-20	0603	10V Ceramic F Capacitor	Digikey PCC2229CT-ND	Yes	Top
C6	CAP	2.2uF	+80/-20	0603	10V Ceramic F Capacitor	Digikey PCC2229CT-ND	Yes	Top
C7	CAP	33pF	+/-5%	0603	50V Ceramic NPO Capacitor	Digikey BC1231CT-ND	Yes	Bottom
C8	CAP	33pF	+/-5%	0603	50V Ceramic NPO Capacitor	Digikey BC1231CT-ND	Yes	Bottom
C9	CAP	???		0805	User Defined - Not inserted		Yes	Top
C10	CAP	2.2uF	+80/-20	0603	10V Ceramic F Capacitor	Digikey PCC2229CT-ND	Yes	Top
C11	CAP	.22uF	+80/-20	0603	16V Ceramic Y5V Capacitor	Digikey PCC1790CT-ND	Yes	Bottom
C12	CAP	100pF	+/-5%	0402	50V Ceramic NPO Capacitor	Digikey 311-1024-1-ND	Yes	Top
C13	CAP	2.2uF	+80/-20	0603	10V Ceramic F Capacitor	Digikey PCC2229CT-ND	Yes	Top
C14	CAP	???		0603	User Defined - Not inserted		Yes	Top
C15	CAP	???		0603	User Defined - Not inserted		Yes	Top
J1	SMA			SMA_90DEG	Right Angle SMA Socket	Pasternack PE4118	No	Top
J2	SMA			SMA_90DEG	Not inserted		No	Top
J3	CON\DB9HM			DB9-HM	9 Pin Dtype PCB Mount Plug	FEC 150-750	No	Top
J4	SMA			SMA	Straight SMA Socket	Pasternack PE4117	No	Top
J5	HEADER10			HEADER10	10 Pin 0.1" Header (5x2)	FEC 511-808	No	Top
J6	CON\POWER4			CON\POWER4	4 Pin Terminal Block	FEC 151-787	No	Top
L1	IND	???		0603	User Defined - Not inserted		Yes	Top
L2	IND	???		0603	User Defined - Not inserted		Yes	Top
L3	IND	???		0603	User Defined - Not inserted		Yes	Top
L4	IND	???		0603	User Defined - Not inserted		Yes	Top
L5	IND	???		0603	User Defined - Not inserted		Yes	Top
R1	RES	???		0805	User Defined - Not inserted		Yes	Bottom
R2	RES	???		0805	User Defined - Not inserted		Yes	Bottom
R3	RES	1k	1%	0603	0.063W Resistor	FEC 911-239	Yes	Top
R4	RES	1k	1%	0603	0.063W Resistor	FEC 911-239	Yes	Top
R5	RES	1k	1%	0603	0.063W Resistor	FEC 911-239	Yes	Top
R6	RES	1k	1%	0603	0.063W Resistor	FEC 911-239	Yes	Top
R7	RES	1k	1%	0603	0.063W Resistor	FEC 911-239	Yes	Top
R8	RES	1k	1%	0603	0.063W Resistor	FEC 911-239	Yes	Top
R9	RES	3k6	1%	0603	0.063W Resistor	Digikey RR08P3.6KDCT-ND	Yes	Top
CE	JUM_CHANGE_1			JUMP_CHANGE_1		FEC 512-047 & FEC 150-410	No	Top
TXDATA	TESTPOINT			TESTPOINT	Testpoint	FEC-240-345	No	Top
TXCLK	TESTPOINT			TESTPOINT	Testpoint	FEC-240-345	No	Top
MUXOUT	TESTPOINT			TESTPOINT	Testpoint	FEC-240-345	No	Top
OSC1	TESTPOINT			TESTPOINT	Testpoint	FEC-240-345	No	Top
OSC2	TESTPOINT			TESTPOINT	Testpoint	FEC-240-345	No	Top
CLKOUT	TESTPOINT			TESTPOINT	Testpoint	FEC-240-345	No	Top
CLK	TESTPOINT			TESTPOINT	Testpoint	FEC-240-345	No	Top
DATA	TESTPOINT			TESTPOINT	Testpoint	FEC-240-345	No	Top
LE	TESTPOINT			TESTPOINT	Testpoint	FEC-240-345	No	Top
CREG1	TESTPOINT			TESTPOINT	Testpoint	FEC-240-345	No	Top
CREG2	TESTPOINT			TESTPOINT	Testpoint	FEC-240-345	No	Top
VDD	TESTPOINT			TESTPOINT	Testpoint	FEC-240-345	No	Top
GND	TESTPOINT			TESTPOINT	Testpoint	FEC-240-345	No	Top
U1	ADF7012			TSSOP24		ADF7012BRU	Yes	Top
Y1	XTAL1	???		HC49	User Defined - Not inserted		No	Top
J6	Short Wire Link between screw terminals J6-IOUT and J6-IIN							
Corners	Rubber Stick-On Feet x4					FEC 148-922		
	Bare PCB					Eval-ADF7012EB		
	RF Eval Board Cable					Requires assembly/test		
	CD & Sleeve					ADI Issue		
	Barcode Label					Eval-ADF7012EB		

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