

### FEATURES

**Full-featured evaluation board for the AD7764/AD7765  
Blackfin® ADSP-BF537 EZ-KIT Lite® compatible  
On-board 4.096 V reference  
Crystal clock oscillator MCLK source  
PC software for control and data analysis for  
use with Blackfin EZ-KIT Lite**

### EVALUATION BOARD DESCRIPTION

This data sheet describes the evaluation board for the AD7764/AD7765  $\Sigma$ - $\Delta$  ADCs. The AD7764 is a 24-bit ADC that combines wide input bandwidth and high speed with the benefits of  $\Sigma$ - $\Delta$  conversion with a performance of 105 dB SNR at 312 kSPS, making it ideal for high speed data acquisition.

The AD7765 uses a serial interface version also, offering two different decimation rates, decimate  $\times$  128, and decimate  $\times$  256, or in output data rate terms, 156kSPs, and 78kSPs..

Complete specifications for the AD7764/AD7765 devices are available in the AD7764/AD7765 data sheets available from Analog Devices, Inc., and should be consulted in conjunction with this data sheet when using the evaluation board.

The EVAL-AD7764/AD7765EBZ includes a 40 MHz crystal oscillator that provides the MCLK for the AD7764/AD7765 device. The user can also choose, if required,

to drive the AD7764/AD7765 with a different clock oscillator, or to insert the 0  $\Omega$  link so that the MCLK signal is driven using an external clock source via the SMB connector marked MCLK.

The AD7764/AD7765 evaluation board, comes with an on-board FPGA device which is used to interface with the Blackfin EZ-KIT Lite board. The combination of both the FPGA and the Blackfin board allied with the EVAL-AD7764/AD7765/EBZ software allows the user to upload samples taken by the AD7764/AD7765 device onto a PC showing the waveform being sampled, as well as allowing the data to be shown in histogram or FFT format. The EVAL-AD7764/AD7765/EBZ can also be used on a standalone basis (without the FPGA and EZ-KIT Lite); however, in this case the user must provide the required interface signals.

### CONTENTS OF EVALUATION KIT

- Blackfin board (ADDS-BF537 EZ-KIT Lite with USB mezzanine board attached underneath).
- Power supply for Blackfin board.
- Black USB cable (Type A/Mini B)
- AD7764/AD7765 evaluation board (EVAL-AD7764/AD7765EBZ)
- EVAL-AD7764/AD7765EBZ evaluation software autoplay CD—software and drivers

### EVALUATION BOARD BLOCK DIAGRAM

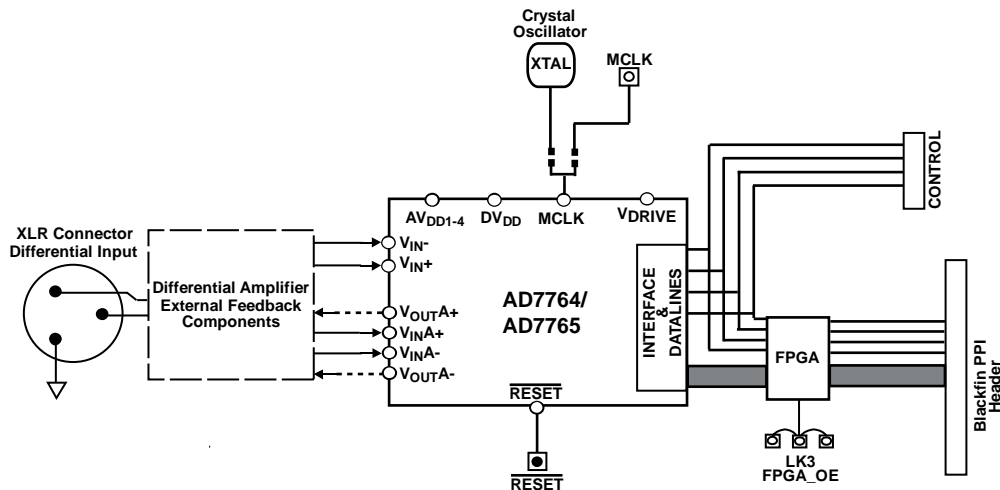


Figure 1.

Rev. PrB

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REVISION HISTORY

02/07—Revision Pr.A

## HARDWARE DESCRIPTION

### POWER SUPPLIES

The EVAL-AD776xEB must be powered using a power supply that applies a 7.5 V between the V+ and GND terminals of Connector J2.

This 7.5 V supply is then regulated on board using ADP3330 devices (U3 and U5) to provide the 2.5 V and 5 V signals required by the AD7764/AD7765 device. Supplies  $AV_{DD2}$ ,  $AV_{DD3}$ , and  $AV_{DD4}$  are the 5 V supplies to the AD7764/AD7765 device. The AD7764/AD7765 pins  $AV_{DD1}$ ,  $V_{DRIVE}$ , and  $DV_{DD}$  are supplied by a voltage of 2.5 V.

Setting LK7 to A means that the MCLK buffer is powered by 5V, enabling the AD7764/AD7765 device to be operated using an MCLK signal with an amplitude of 5 V.

### DIFFERENTIAL INPUT

The differential input to the AD7764/AD7765 device is applied through the connector marked J1. This is an XLR audio standard connector. The differential inputs are routed through the AD7764/AD7765 on-board differential amplifier using the external circuit components as detailed in the AD7764/AD7765 data sheets.

### STANDALONE OPERATION

The EVAL-AD7764/AD7765EBZ can be used in a standalone manner (that is, without using the Blackfin EZ-KIT Lite). In this

case, however, the user must provide all the required interface communications and be able to provide a means to acquire the output data from the board. In the case where this is desirable, the FPGA can be disabled to allow the data from the AD7764/AD7765 device to be taken from Header J5 (marked “CONTROL” or the associated SMB connectors J9 to J16). The FPGA outputs can be set to three-state by putting LK3 in Position B. This means that the output data is routed through the ADG3308 U10 and is available at Header J5. The enable mechanism for U10 is set by LK6 which is set to position A. See the Link Options section for details.

The output voltage of Buffer U10 can be set by inputting the desired voltage to Connector J6 (marked “External IO Voltage 2.5V to 5V”). Note that the ADG3308 is a bidirectional level shifter, which will level shift both controls input by the user and outputs from the AD7764/AD7765 device.

### DECOUPLING AND LAYOUT

The EVAL-AD7764/AD7765EBZ is a 4-layer board. One of these layers is a dedicated ground plane. All supplies to devices on the EVAL-AD7764/AD7765EBZ are decoupled to this ground plane. In addition to the PCB's top and bottom layers, there is also a layer for routing power signals..

## LINK OPTIONS

The link options on the evaluation board should be set for the required operating setup before using the board. The functions of these links are described in Table 1.

**Table 1. Link Options**

Link No.	Function	Position Descriptions	Default
LK3	FPGA enable.	Position A connects Pin 43 of the FPGA to GND. This sends all the pins of the FPGA device to three-state so that the FPGA is bypassed. Position B connects Pin 43 of the FPGA to logic high 2.5 V. The FPGA is now fully operational. This link must be in Position B for the evaluation board to function with the EZ-KIT Lite.	Position B
LK4	Selects the voltage supply to power the FPGA outputs.	Position A digital drive voltage for the FPGA is taken from the Blackfin PPI connector. Position B digital drive voltage for the FPGA is taken from the EVAL-AD776xEB DVDD supply.	Position B
LK5	Selects the input/output voltage for Data Buffer.	Position A selects DVDD supply from the EVAL-AD776xEB. Position B selects External Voltage Connector J6 to provide this voltage.	Position A
LK6	Output enable for Data Buffer U10	Position A selects the DVDD supply: outputs permanently enabled. Position B Selects GND, outputs disabled.	Position A
LK7	Selects the $V_{DD}$ voltage for Clock Buffers U11 and U12.	Position A selects $V_{DD} = 5\text{ V}$ . Position B selects $V_{DD} = 2.5\text{ V}$	Position A
R27, R28, R29, R30.	A $0\ \Omega$ link must be placed in either pair of resistors, R27 & R29, or R28 & R30 to select the MCLK source for the AD7764/AD7765 device.	R27 & R29 routes the buffered 40 MHz on-board crystal oscillator to the MCLK pin of the AD7764/AD7765 device. R28 & R30 allows the user to input an external MCLK signal through the MCLK SMB connector (J7), which is buffered (by U12) and routed to the MCLK pin of the AD7764/AD7765 device.	R27 & R29

## SOFTWARE INSTRUCTIONS FOR FIRST-TIME USE

These instructions are for the first-time installation of the EVAL-AD7764/AD7765EBZ evaluation software. The figures shown in this section are an example of the install screens for the AD7764 device. The same instruction set is valid in the case of the AD7765 device.

1. Insert the CD into the appropriate computer drive.
2. The dialog box shown in Figure 2 appears. Click **Next**.

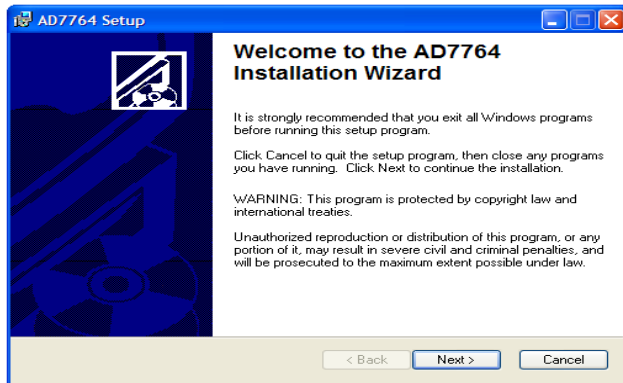


Figure 2. AD7764 Setup Dialog Box, Initial Software Install Screen

3. The installation wizard allows the user to choose where the installation should be located (see Figure 3). If a different location than the default is preferred, click **Browse** and select the desired location. When ready, click **Next**.

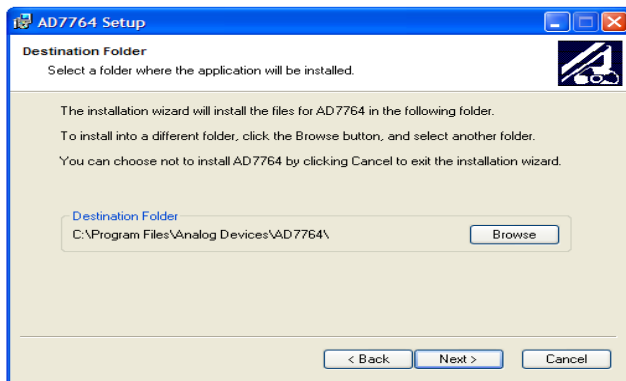


Figure 3 Choose the Destination of the AD7764/AD7765 Software

4. Click **Next**, as shown in Figure 4, unless there's a need to go back to the previous dialog box to change the installation location.

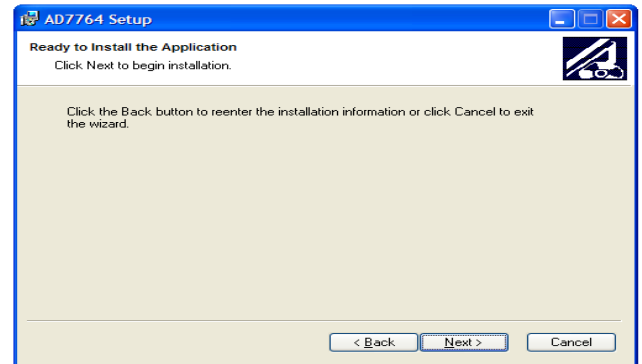


Figure 4. Install the Software

5. The installation begins and when finished, the dialog box shown in Figure 5 appears. Click **Finish** to complete the installation.

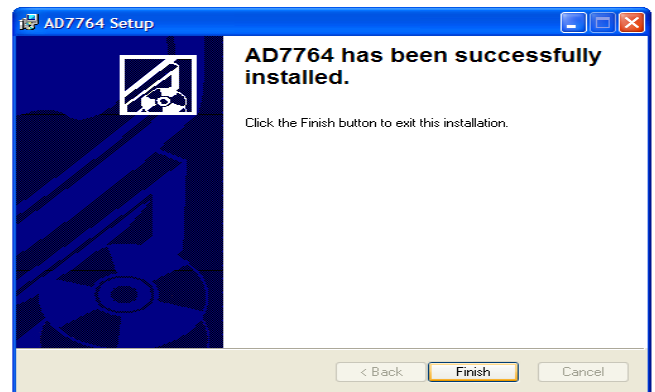


Figure 5. Software Install Completed

6. The software can now be located by following the path that was chosen during installation. If the default location was chosen, the location of the software in the case of the AD7764 is **Start > All Programs > Analog Devices > AD7764 > AD7764**

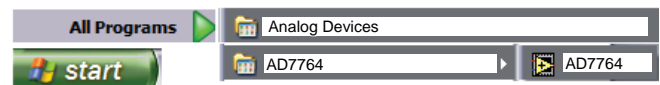


Figure 6. Default Location of AD7764/AD7765 Software

Now that the software installation is complete, install the hardware fully before attempting to use the application software.

## HARDWARE INSTRUCTIONS FOR FIRST-TIME USE

These instructions should be followed for first-time installation of the hardware (that is, if the EVAL-AD7764/AD7765 evaluation kit has never been used on a particular PC).

1. Power up the Blackfin board.
2. Ensure that the EVAL-AD7764/AD7765EBZ evaluation kit CD is in the appropriate computer drive.
3. Connect the black USB cable Type A/Mini B from USB mezzanine board (located underneath the EZ-KIT Lite board) to the USB port of the PC.
4. The **Found New Hardware Wizard** dialog box shown in Figure 7 appears. Select **Install the software automatically** and then click **Next**.



Figure 7. Found New Hardware Wizard Dialog Box

5. The **Files Needed** dialog box in Figure 8 appears. To find the required file, bulkadi.sys, click **Browse**.

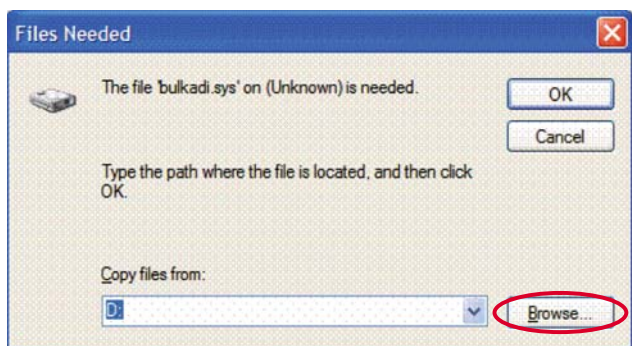


Figure 8. Select Location of bulkadi.sys File

6. Locate the CD drive of the computer, select the file bulkadi.sys and then click **Open**, as shown in Figure 9.

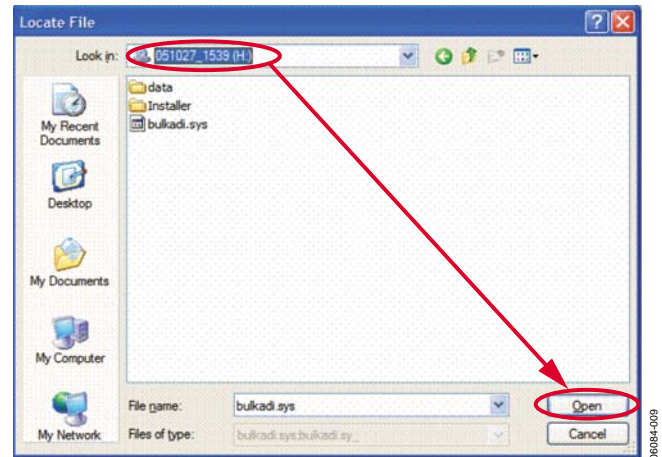


Figure 9. Find the bulkadi.sys File on the EVAL-AD7764/AD7765EBZ Software CD

7. When the driver has been found, the dialog box shown in Figure 10 appears. Click **Finish** to complete the hardware wizard.

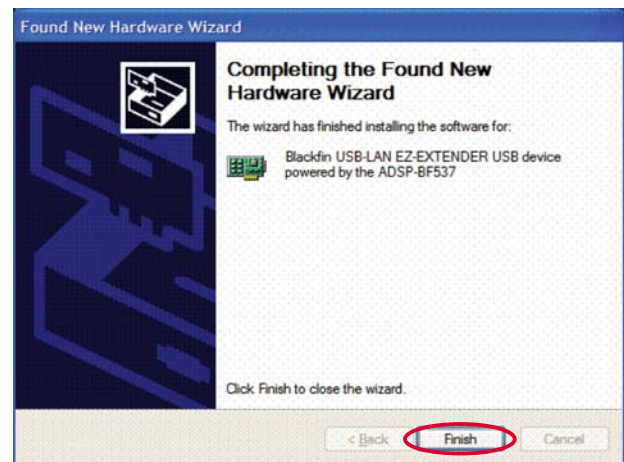


Figure 10. Install of Hardware Completed

8. After the dialog box closes, power down the Blackfin EZ-KIT Lite board. Instructions for normal use can now be followed.



## HARDWARE INSTRUCTIONS FOR NORMAL USE

When the initial hardware installation has been completed, the user should follow these instructions each subsequent time the system is set up.

1. Ensure that all the link positions are as per the the link options shown in Table 1.
2. Power up the Blackfin board by inserting the power cable into the receiver as shown in Figure 11.

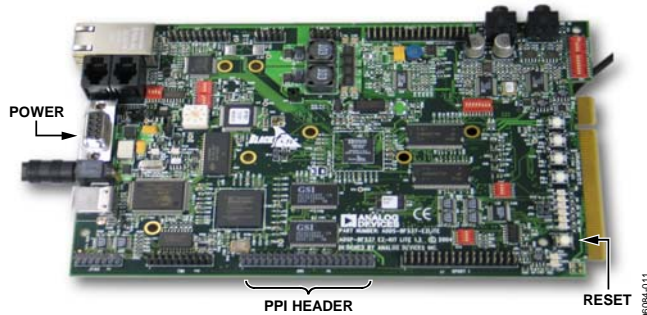


Figure 11. Powering Up the Blackfin EZ-KIT Lite Board

3. Using the black mini USB cable included in the AD7764/AD7765 evaluation kit, connect the Blackfin board (via the USB mezzanine board underneath the Blackfin board shown in Figure 12) to one of the PC's USB sockets.

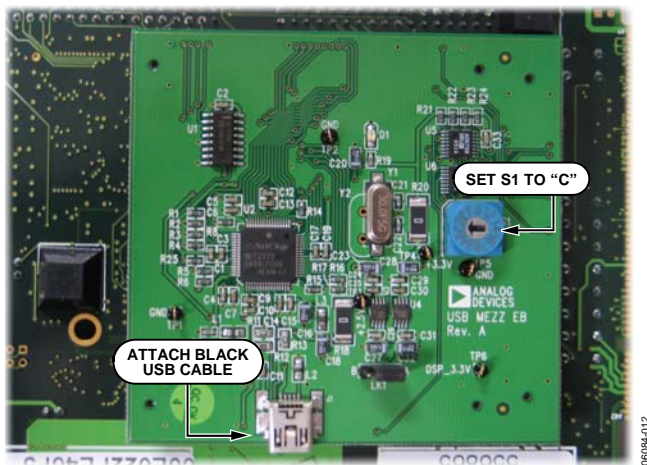


Figure 12. USB Mezzanine Board (Attached Underneath Blackfin EZ-KIT Lit)

4. Also ensure that the hexadecimal switch (S1) is set to C and that Link L1 is set to A on the USB mezzanine board (see Figure 12).
5. Reset the Blackfin board (use the RESET push button as indicated in Figure 11 ).
6. Power up the EVAL-AD7764/AD7765EBZ evaluation board through Connector J2. Connect a wire from the V+ labeled connector to 7.5 V of an external power supply. Also ensure that there is a GND connection between the GND of J2 and the power supply GND connection.
7. The differential input to the AD7764/AD7765 device should be connected to the black connector XLR connector (J1) marked "Differential Input." This differential input is routed to the inputs of the AD7764/AD7765's on-board differential amplifier.
8. Connect the female connector (J4, marked "Blackfin PPI"), which is on the under side of the EVAL-AD7764/AD7765EBZ evaluation board to the PPI header of the Blackfin board. The PPI port is highlighted in Figure 11.
9. The hardware system is now set up. Figure 13 shows the entire powered-up AD7764/AD7765 evaluation kit. The EVAL-AD7764/AD7765EBZ software can now be opened.



Figure 13. Powered Up AD7764/AD7765 Evaluation Kit

## SOFTWARE INSTRUCTIONS FOR NORMAL USE

Once the initial software installation has been completed, follow these instructions for the general setup of the evaluation software each subsequent time the system is used.

Note that the hardware must be powered up as per the Hardware Instructions for Normal Use section before attempting the following steps.

1. The download default location for the EVAL-AD7764/AD7765EBZ evaluation software can be found by clicking **Start > All Programs > Analog Devices > AD776x > AD776x**. These steps are illustrated for the case of the AD7764 in Figure 14. If a location other than the default was used, follow the path that was entered during setup.

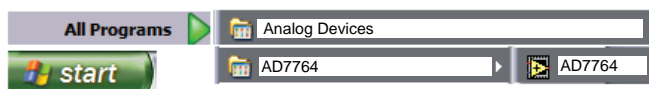


Figure 14. Default EVAL-AD7764/AD7765 Evaluation Software Location

2. The evaluation software GUI appears.
3. The user can specify the decimation rate, and number of samples to be acquired by using the drop-down menus on the software front panel circled in red in Figure 15. The software allows the number of samples specified by the user samples to be viewed as a waveform, histogram, or FFT.

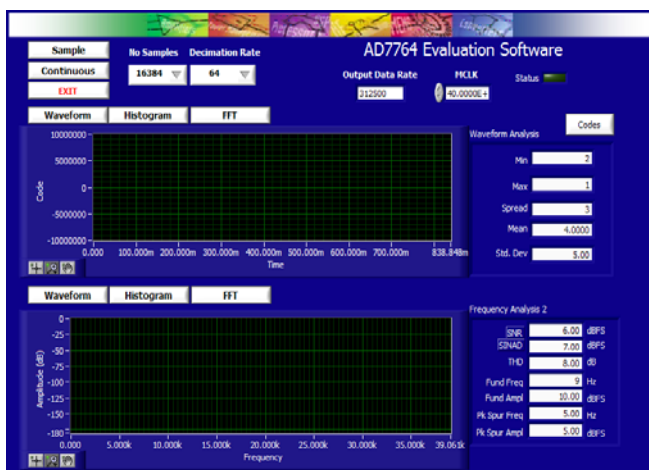


Figure 15. EVAL-AD7764/AD7765EBZ Evaluation Software Front Panel Features

the front panel of the AD776x Evaluation Software dialog box. This is the default decimation rate of the AD7764/AD7765 parts on reset and power-up of the evaluation board.

5. Press the **RESET** push button (S1) on the EVAL-AD7764/AD7765EBZ evaluation board.
6. To show samples output by the EVAL-AD7764/AD7765EBZ evaluation board Click **Sample** or **Continuous**. Clicking **Sample** gives one set of samples, the length of which is determined by the **No. Samples** selection on the software front panel. Clicking **Continuous** shows continuously updated samples of the analog input to the device.

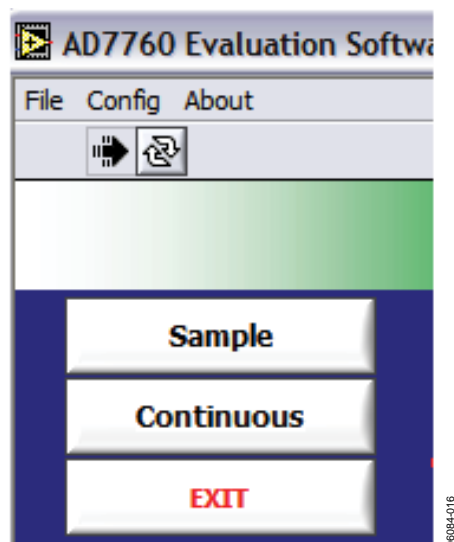


Figure 16. **Sample** and **Continuous** Front Panel Buttons

7. It is important to ensure that the frequency of the  $\overline{\text{FSO}}$  pulse on an oscilloscope (at the SMB connector marked J14) is checked so that it matches the frequency shown in the **Output Data Rate** text box on the software front panel.
8. If at any stage these do not match, reset the AD7764/AD7765 evaluation board by pressing the **RESET** push button on the evaluation board. Then set the software front panel decimation rate to the correct default value: 256 for the AD7764/AD7765.

4. For the initial operation of the AD7764 and AD7765 versions of the evaluation board, set the **Decimation Rate** to 256 in



## HARDWARE CONFIGURATION FOR Blackfin BOARD

The jumpers on the shipped Blackfin board are in the correct position for operation in the evaluation setup. Note that these are different than the default positions listed in the [ADSP-BF537 EZ-KIT Lite Evaluation System Manual](#), which should be ignored. Figure 17 shows how each of the switches (SW1 to SW8) should be configured for operation in the AD7764/AD7765 evaluation kit setup. The shaded boxes demonstrate where the slider switches should be in relation to the numbers on the switches. Note that the [ADSP-BF537 EZ-KIT Lite Evaluation System Manual](#) is not required for the evaluation of the AD7764/AD7765 devices.

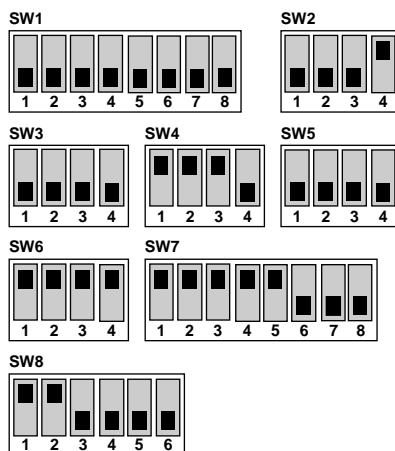


Figure 17. Settings for Switches SW1 to SW8 on the Blackfin EZ-KIT Lite Board

06084-017

Resistors (R1-R6) must be 0.1% or better

C1 & C2 - Optional Capacitor Locations (Not Populated).

Differential Input

AD7764

1 VIN- 2 VOUTA+ 3 VINA+ 4 VOUTA- 5 VIN- 6 VIN+ 7 VREF+ 8 REF GND 9 REBIAS 10 AVDD2 11 AVDD2 12 AVDD3 13 AVDD3 14 AVDD4 15 AVDD4 16 DVDD 17 DVDD 18 DVDD 19 DVDD 20 DVDD 21 DVDD 22 DVDD 23 DVDD 24 DVDD 25 DVDD 26 DVDD 27 DVDD

COMPANY: Analog Devices Inc

COMPANY: Analog Devices Inc.		TITLE: AD7764/65 Evaluation Board (Analog Section)		REV: A	
		DRAWING NO:		Eval-AD7764/65EBZ	
SIZE:					
SHEET: 1		OF 4			

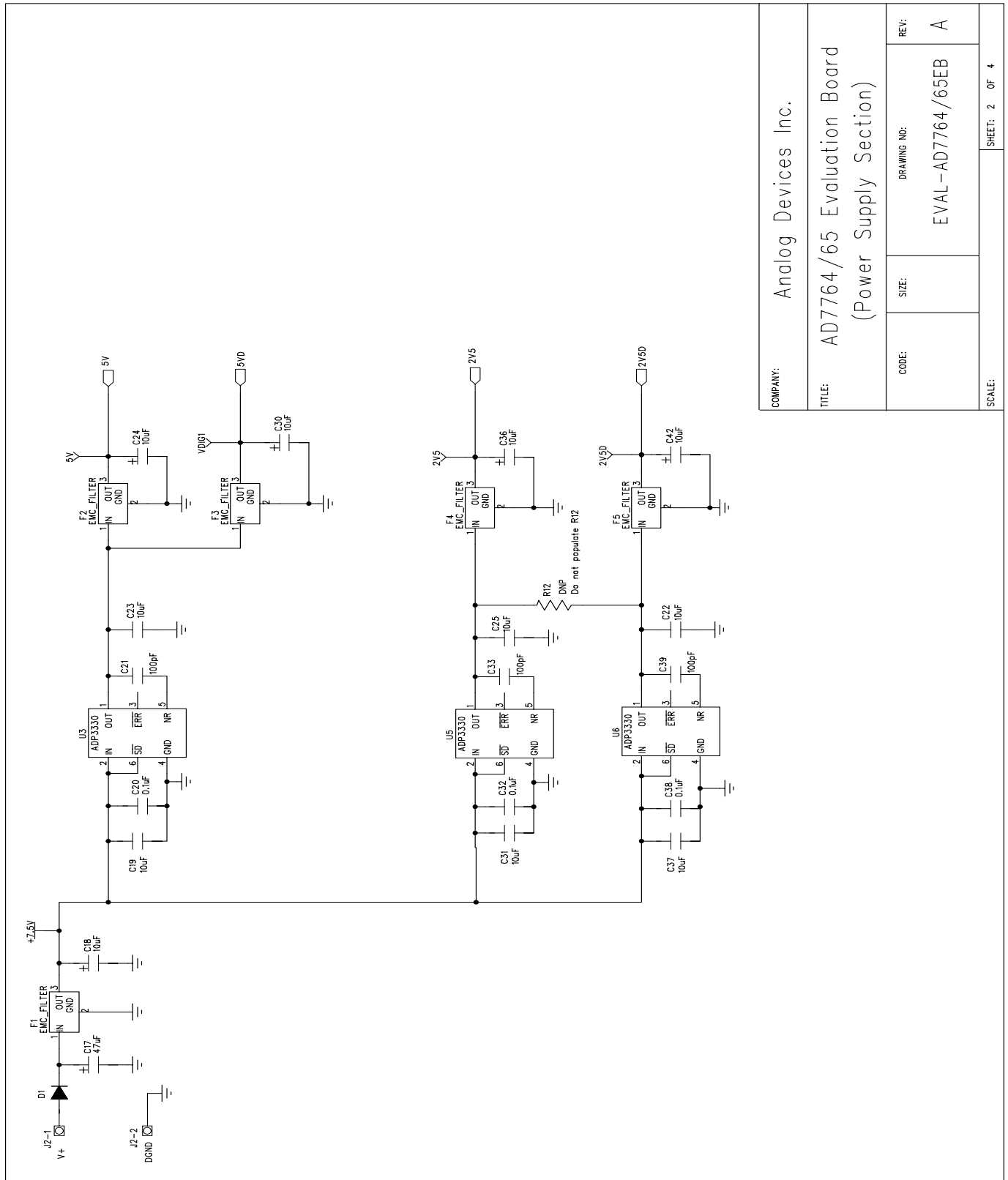


Figure 19. EVAL-AD7764/AD7765EBZ Schematic (Power Supply Section) Page 2 of 4

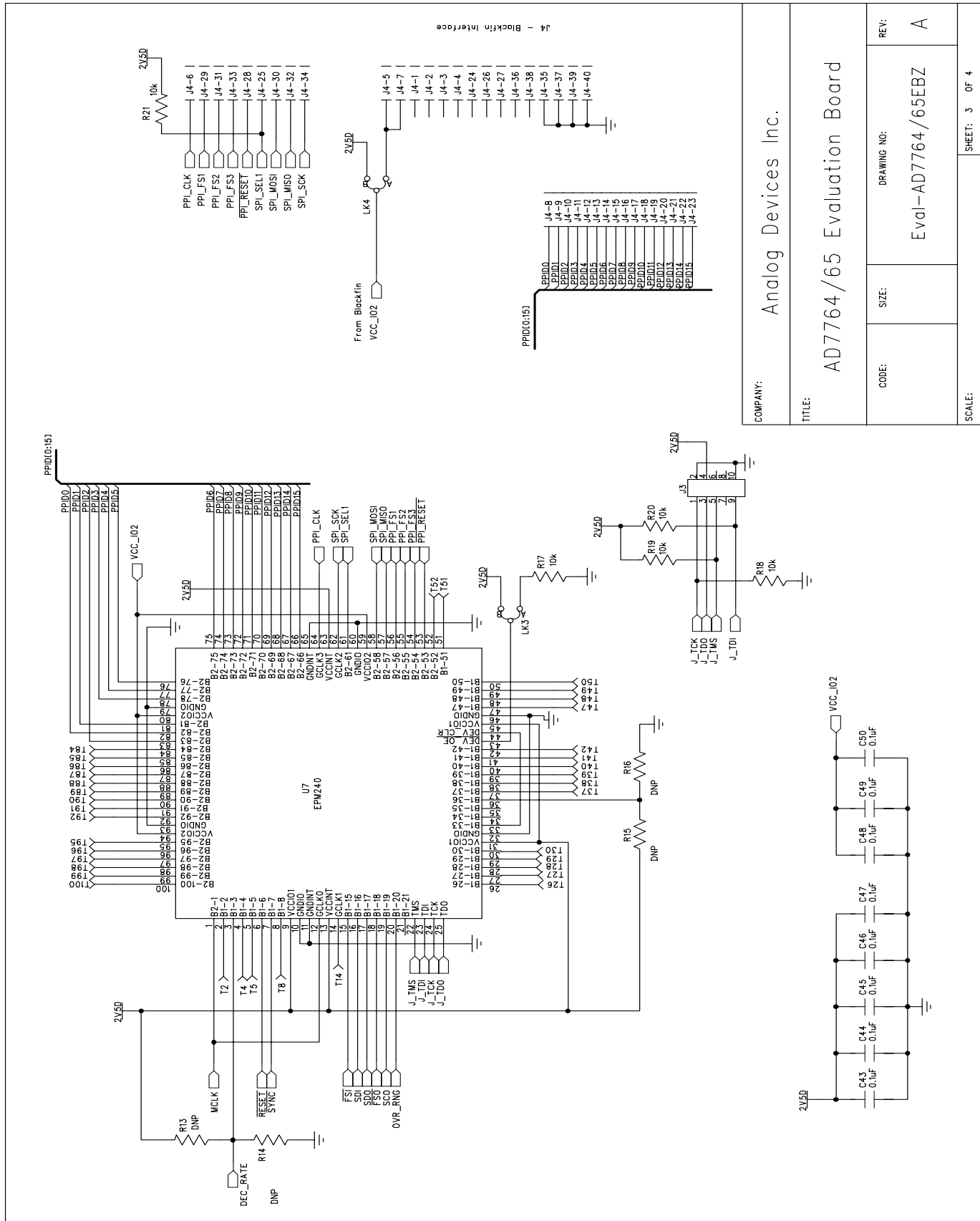
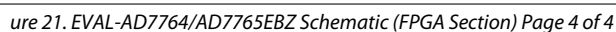


Figure 20. EVAL-AD7764/AD7765EBZ Schematic (Digital Section) Page 3 of 4



## ORDERING INFORMATION

### ORDERING GUIDE

Model	Description
EVAL-AD7764EBZ	Evaluation Kit
EVAL-AD7765EBZ	Evaluation Kit

### ESD CAUTION

ESD (electrostatic discharge) sensitive device. Electrostatic charges as high as 4000 V readily accumulate on the human body and test equipment and can discharge without detection. Although this product features proprietary ESD protection circuitry, permanent damage may occur on devices subjected to high energy electrostatic discharges. Therefore, proper ESD precautions are recommended to avoid performance degradation or loss of functionality.





## NOTES