

**FEATURES**
**Current Output Ranges: 4–20mA, 0–20mA,**
**0–24mA, ±20ma, ±24ma**
**Voltage Output Ranges: 0-5V, 0-10V, ±5V, ±10V,**
**20% over-range**
**Flexible Serial Digital Interface**
**On-Chip Output Fault Detection**
**Asynchronous CLEAR Function**
**Power Supply Range**
 $AV_{DD} : = +12V \text{ to } +20V$ 
 $AV_{SS} : = -12V \text{ to } -20V$ 
**Output Loop Compliance to  $AV_{DD} - 2.0V$** 
**Temperature Range: -40°C to +105°C**
**LFCSP Packages**
**APPLICATIONS**
**Process Control**
**Actuator Control**
**PLC**
**GENERAL DESCRIPTION**

The AD5750 is a single channel, low-cost, precision, voltage/current output driver with hardware or software

programmable output ranges. The software ranges are configured via an SPI/Microwire compatible serial interface.

The output current range is programmable across five current ranges - 4–20mA, 0–20mA or 0–24mA, ±20ma and ±24ma.

Voltage output is provided from a separate pin that can be configured to provide 0V to 5V, 0V to 10V, ±5V or ±10V output ranges. An over-range of 20% is available on the voltage ranges.

The input to the AD5750 is an analog input 0- 4.096v. Once the range is selected 0v will output the low end of the selected range and 4.096v will output the high end of the selected range. This evaluation board is configured to allow the AD5750 to be driven with an on-board DAC (AD5662 16 bit 0-4.096v output). Alternatively, the user can configure an external 0-4.096v input. The Evaluation board is designed to operate the AD5750 in software mode only.

The evaluation board is powered via terminal blocks.

**Note. The sense resistor used on this board (R38) is 15k ohm <15ppm/oc. There is no load resistor provided on this board.**

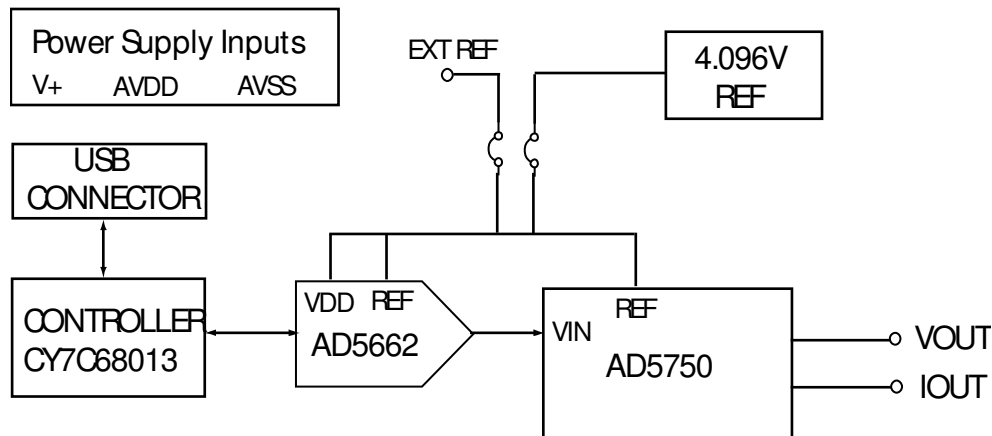
**EVALUATION BOARD BLOCK DIAGRAM**


Figure 1.

Rev. PrD

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**REVISION HISTORY**

PrD – Preliminary Version. June 28, 2012

## OPERATING THE AD5750 EVALUATION BOARD

### POWER SUPPLIES

The digital section of the AD5750 evaluation board can be powered from the USB port. This is the default setup. It can also be powered by an external supply using the J7 power connector. Both analog GND and DGND inputs are provided on the board. The analog GND and DGND planes are connected at one location close to the AD5750. Each supply is decoupled to the relevant ground plane with 10  $\mu$ F and 0.1  $\mu$ F capacitors. Each device supply pin is also decoupled with a 10  $\mu$ F and 0.1  $\mu$ F capacitor pair to the relevant ground plane.

The AVDD and AVSS pins may be operated from +/-12v to +/-20v respectively (connector J17). The supply for the on board reference can be supplied from AVDD or V+ (LK27). **Note - Maximum supply for this reference is 18V. If using AVDD to supply the ADR434 AVDD will need to be limited to +18V.** The external reference can be overdriven via connector J2.

### LINK OPTIONS

A number of link and switch options on the evaluation board should be set for the required operating setup before using the board. Table 1 lists the default link options. The functions of these link options are described in detail in Table 2. The default setup is for control by the PC via the USB port. The default setting also configures the on board reference and DAC to provide the analog input to the AD5750.

**Table 1. Link Options Default**

Link No.	Option (Default)
LK1	B
LK2	INSERTED
LK6	A
LK8	A
LK10	B
LK16	INSERTED
LK17	INSERTED
LK21	INSERTED
LK22	REMOVED
LK23	INSERTED
LK25	A
LK27	A

**Table 2. Link Options**

Link No.	Function
LK1	Used to Select whether on board DAC or external analog input used for 0-4.096v input. <ul style="list-style-type: none"> <li>• Position A: External source used.</li> <li>• Position B: On Board DAC used.</li> </ul>
LK2	Used to disconnect on board DAC if user wants to connect an external analog input.
LK6	This link selects the Power Supply source for the ADP3303. <ul style="list-style-type: none"> <li>• Position B: J7 is the power supply source for the ADP3303.</li> <li>• Position A: The USB 5 V power supply source is the power supply source for the ADP3303.</li> </ul>
LK8	This link selects the Power Supply source for the digital circuitry DVCC. <ul style="list-style-type: none"> <li>• Position B: ADP3303 output is used to supply the digital circuitry.</li> <li>• Position A: The USB 5 V power supply source or J7 is the power supply source for the DVCC</li> </ul>
LK10	This link selects what the VSS pin is connected to. <ul style="list-style-type: none"> <li>• Position B: VSS pin tied to GND</li> <li>• Position A: VSS pin tied to J14 connector.</li> </ul>
LK16	Used to connect voltage output to positive sense feedback.
LK17	Used to connect voltage output to negative sense feedback.

LK21	Used to connect AVDD supply to AVDD pin on AD5750. Should be left inserted.
LK22	This link selects an external reference source to be used as reference/supply to the AD5662 and reference for the AD5750.
LK23	This link selects the on board ADR434 reference to be used as reference/supply to the AD5662 and reference for the AD5750.
LK25	Used to determine the connection to Pin 32. <ul style="list-style-type: none"><li>• Position A: Pin 32 tied to GND (selected in Software Mode)</li><li>• Position B: Pin 32 tied to pull up resistor (can be used in hardware mode)</li></ul>
LK27	Used to determine the Supply to the on board reference. Note. Maximum supply for this reference is 18V. If using AVDD to supply the ADR434 AVDD will need to be limited to +18V. <ul style="list-style-type: none"><li>• Position A: Reference is tied to AVDD</li><li>• Position B: Reference is tied to V+</li></ul>

## EVALUATION BOARD SOFTWARE

### SOFTWARE INSTALLATION

The AD5750EBZ evaluation kit includes self-installing software on CD-ROM. The software is compatible with Windows® 2000 and Windows® XP. If the setup file does not run automatically when you insert the CD, run the **setup.exe** file directly from the CD.

Install the software before connecting the evaluation board to the USB port to ensure that the evaluation board is correctly recognized when connected to the PC.

1. After the installation from the CD-ROM has completed, connect the AD5750 evaluation board to the USB port using the cable supplied.
2. The software detects the evaluation board. Follow the instructions on the dialog boxes that appear to complete the installation.

### SOFTWARE OPERATION

1. From the Analog Devices menu, select Start > All Programs > Analog Devices > AD5750 > AD5750 Evaluation Software. The following screen should appear.

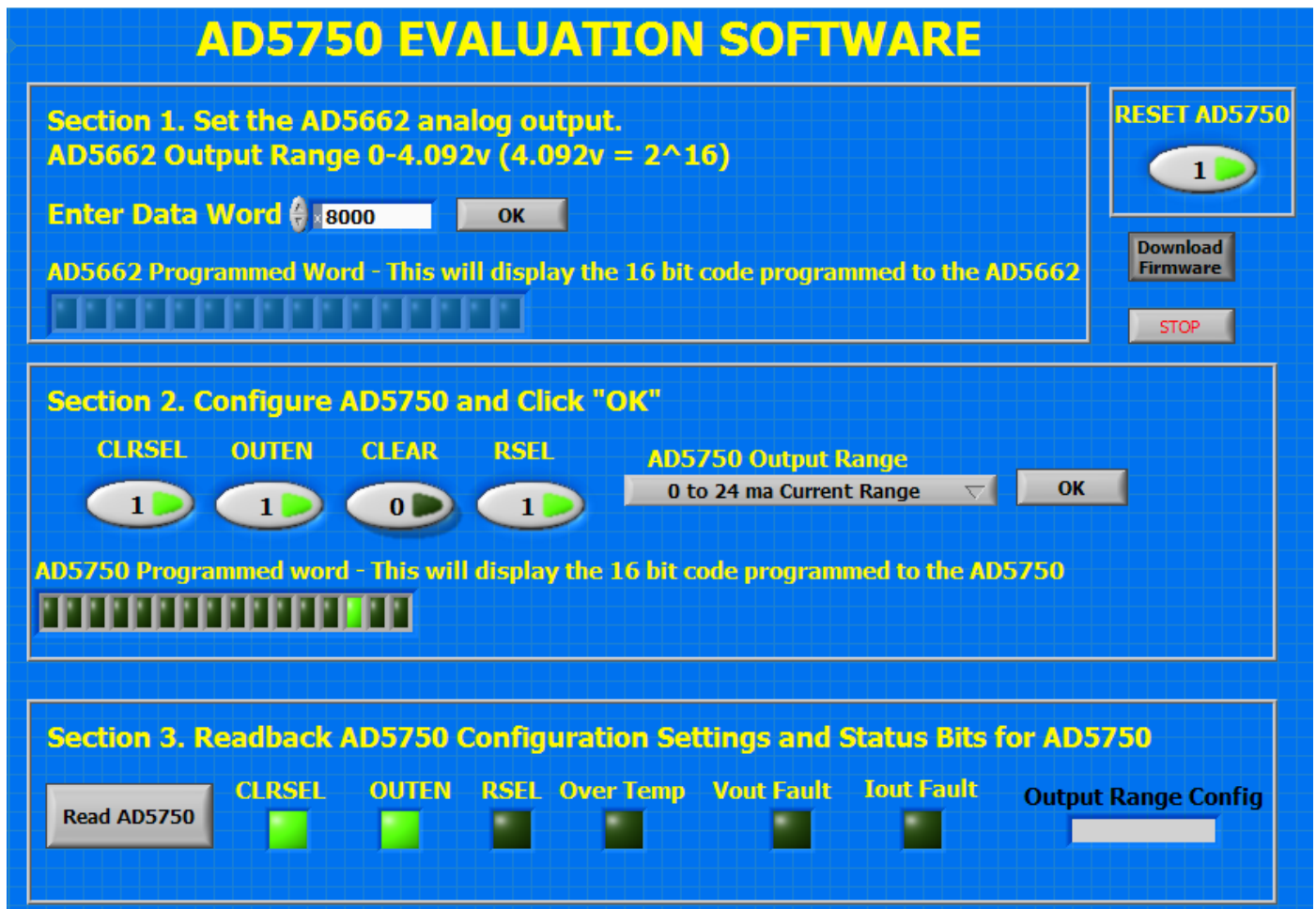


Figure 2. Main Window

2. Programming the AD5750 Analog Input.

This applies to SECTION 1 of the eval board software. The analog input to the AD5750 is provided from the on board AD5662 16 bit DAC. The AD5662 is a 16 bit 5v DAC. Both the power supply and the reference to the DAC are supplied from an on board reference ADR434 (4.096v). This reference can be overdriven and an external reference supply can be connected via connector J2. To program the AD5662 DAC, type the data word in the HEX field of the 'Enter Data Word' section. Then click OK to program the DAC. The 'AD5662

programmed word' will display the programmed word to the DAC. If the user is using an external DAC there is no need to program the on board DAC.

### 3. Configuring the AD5750 Range and Settings:

This applies to SECTION 2 of the evaluation board software. Using the Eval board, the AD5750 can be configured for the following functions: OUTPUT RANGE, CLRSEL, CLEAR, OUTEN.

**SELECT OUTPUT RANGE:** The AD5750 output range is selected using a combination of the pull down menu (AD5750 output Range) and the RSEL bit. The RSEL nominally selects whether the internal or external sense resistor is enabled but is also used as a decode bit to allow for extra ranges (for example current mode over ranges and an extra voltage range). Table 3 shows the implementation and settings for choosing all the available ranges.

Choose the output range required in the left hand column of the Table below.

Set the RSEL bit and 'Output Range' pull down menu accordingly to select the desired range.

**Table 3. Choosing Output Range Configuration: 1) Choose the required range from the 1<sup>st</sup> column. 2) Set RSEL and the output range on the evaluation to configure the AD5750 for this range.**

Output Range Required	RSEL	Output Range Pull Down Menu
4-20ma output using External Current Sense Resistor Option	0	4 to 20ma Current Range
0-20ma output using External Current Sense Resistor Option	0	0 to 20ma Current Range
0-24ma output using External Current Sense Resistor Option	0	0 to 24ma Current Range
+/- 20ma output using External Current Sense Resistor Option	0	+/- 20ma Current Range
+/- 24ma output using External Current Sense Resistor Option	0	+/- 24ma Current Range
0-5v Voltage Range	0 or 1	0-5v Voltage Range
0-10v Voltage Range	0 or 1	0-10v Voltage Range
+/-5v Voltage Range	0 or 1	+/-5v Voltage Range
+/-10v Voltage Range	0 or 1	+/-10v Voltage Range
0-6v Voltage Range	0 or 1	0-6v Voltage Range
0-12v Voltage Range	0 or 1	0-12v Voltage Range
+/-6v Voltage Range	0 or 1	+/-6v Voltage Range
+/-12v Voltage Range	0 or 1	+/-12v Voltage Range
+/-2.5v Voltage Range	0	Range 1101
0V	0	Range 1110
0V	0	Range 1111
4-20ma output using Internal Current Sense Resistor Option	1	4 to 20ma Current Range
0-20ma output using Internal Current Sense Resistor Option	1	0 to 20ma Current Range
0-24ma output using Internal Current Sense Resistor Option	1	0 to 24ma Current Range
+/- 20ma output using Internal Current Sense Resistor Option	1	+/- 20ma Current Range
+/- 24ma output using Internal Current Sense Resistor Option	1	+/- 24ma Current Range
3.92-20.4ma using Internal Current Sense Resistor Option.	1	Range 1101
0ma -20.4ma using Internal Current Sense Resistor Option.	1	Range 1110
0ma - 24.5ma using Internal Current Sense Resistor Option.	1	Range 1111

**CLRSEL:** Selects the CLEAR condition, either Zero Scale or Full Scale of the selected Range. CLRSEL = 1 selects mid-scale of the selected range, CLRSEL = 0 selects full-scale of the selected range.

**CLEAR:** Implements a Clear Condition. CLEAR =1 sets the CLEAR bit in the register and clears the output. CLEAR=0 enables the output with the last code programmed.

**OUTEN:** Enables/ Disables the output. OUTEN=1 enables the output. OUTEN=0 disables the output

### READBACk FROM THE AD5750:

This applies to SECTION 3 in the evaluation board software. Click 'READ AD5750' button to read back from the AD5750. The following information is available:

**CLRSEL:** Display the condition of the CLRSEL bit in the control register. CLRSEL = 1 means mid-scale of range selected, CLRSEL = 0 means full-scale of range selected.

**OUTEN:** Displays whether the output is or is enabled/disabled. OUTEN=1 means the output is enabled. OUTEN=0 means the output is disabled.

**RSEL:** Displays the condition of the RSEL bit internally. RSEL= 0 means external sense resistor selected. RSEL=1 means internal sense resistor selected.

**OverTemp:** This bit will get set if the core temp exceeds 150 oc.

**Iout Fault:** This bit will get set if there is an open circuit condition on the current output channel.

**Vout Fault:** This bit will set is there is a short circuit condition on the voltage output channel.

**Output Range Config:** This will show the selected output range configuration.

### **RESETTING THE AD5750:**

Click 'RESET AD5750' to reset the AD5750. Reset=1 resets the part. Reset=0 puts the part back in normal mode.

### **TESTING THE OUTPUTS:**

**Voltage Output.** The voltage output is available on the Vout channel. Connect this channel to a DVM to see the output voltage.

**Current Output.** The Current output is available on the Iout channel. On the AD5750 evaluation board the Iout output is terminated with a +/-2.0 ppm/oC 250 ohm load resistor. This resistor is rated at 0.6W. The maximum output in current mode from the AD5750 is 24.5ma, therefore the maximum power dissipation using this resistor is 0.15W. Using the set-up provided, you can connect the Iout channel to a DVM to monitor the output voltage and calculate output current.

EVALUATION BOARD SCHEMATICS AND ARTWORK

C39, C49, C41, C48, C46, C47, C62, C63 must be rated over 60V  
 C40, C50, C42, C51 must be rated over 30V  
 The following components are not to be populated:  
 C54, C56, C59, C61, C60, C1, R1, R2

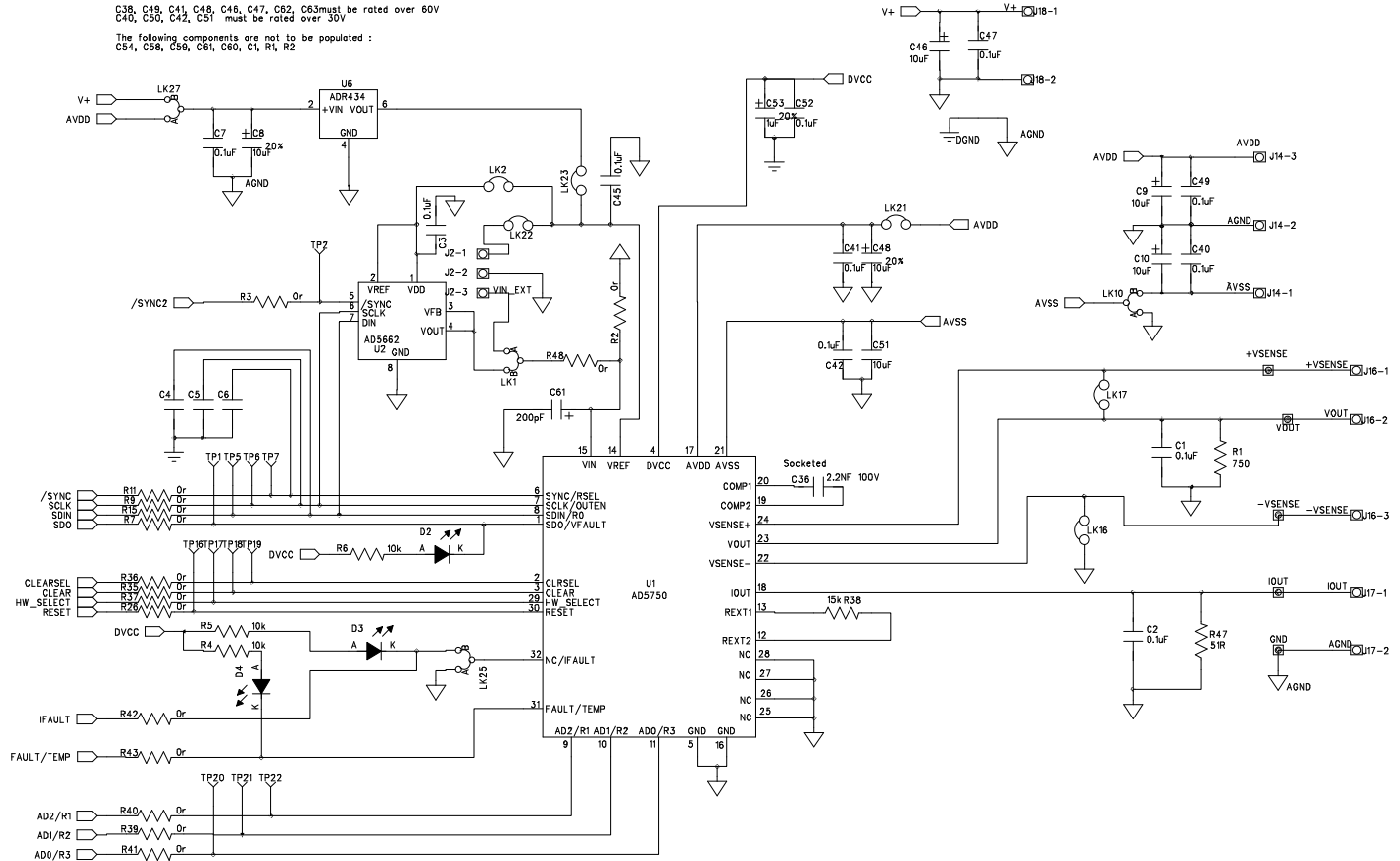


Figure 3. Main Device Circuitry

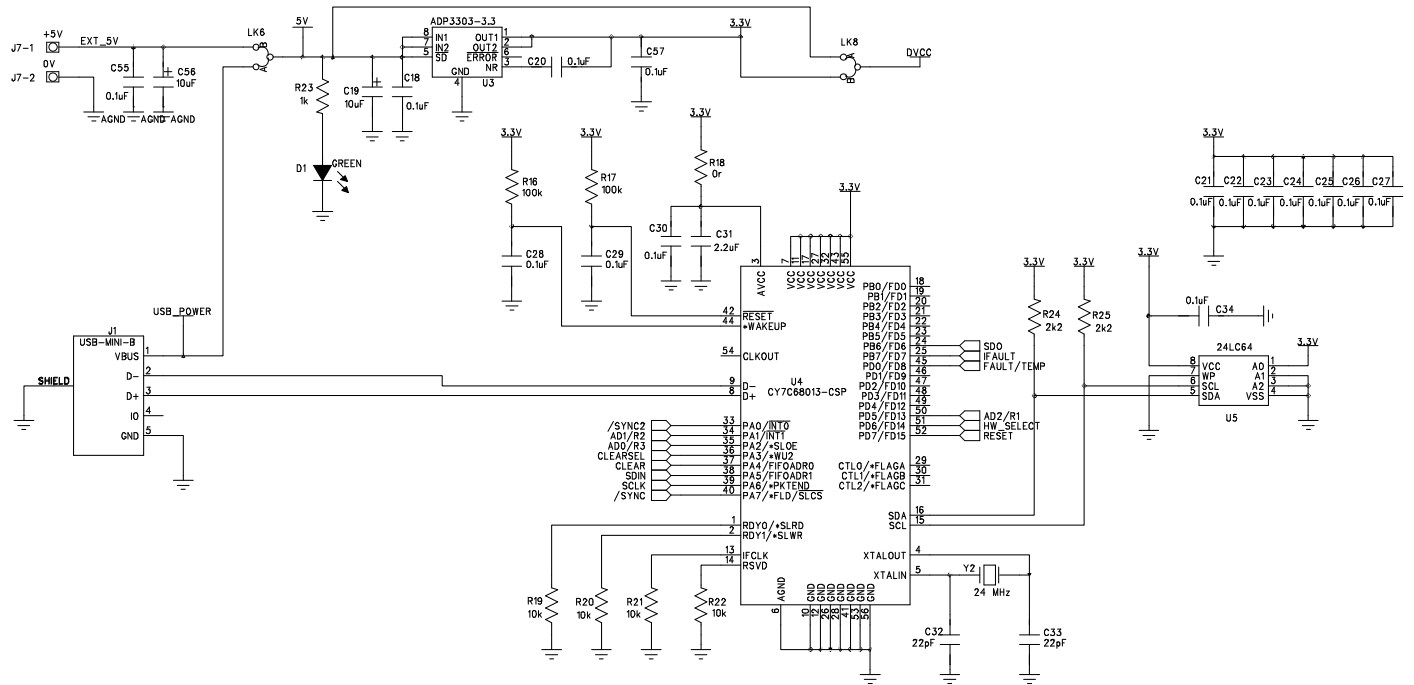


Figure 4. USB controller Circuitry



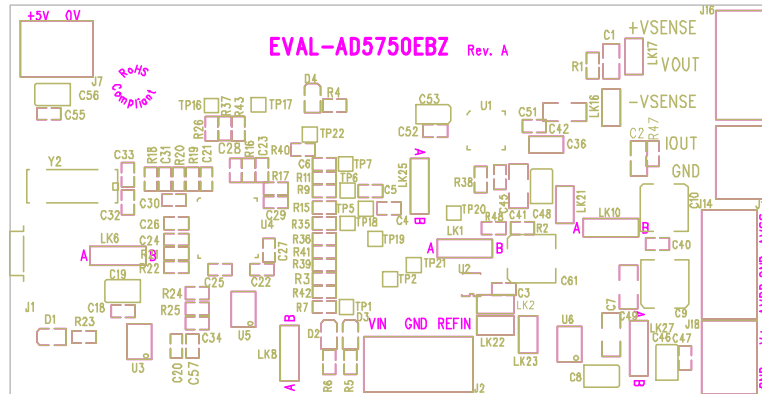


Figure 5. Component Placement

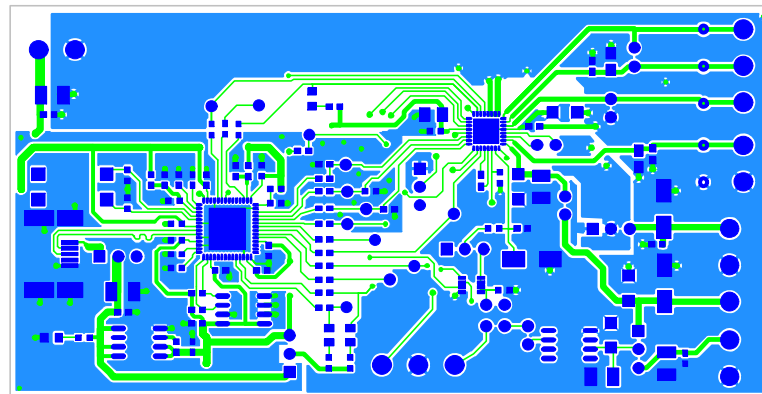


Figure 6. Top PCB Layer

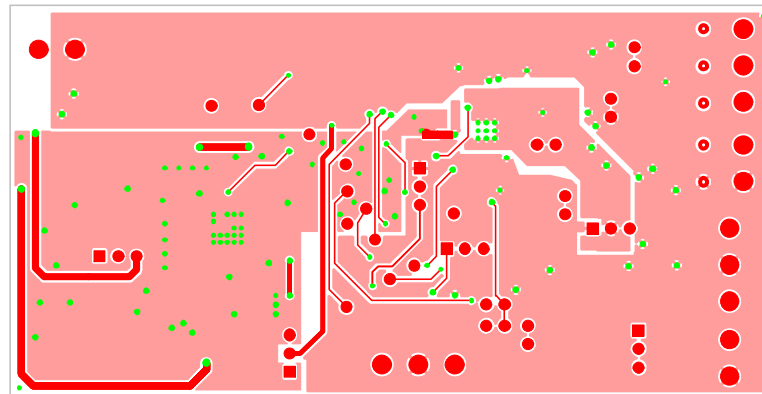


Figure 7. Bottom PCB Layer

## BILL OF MATERIALS

Table 3.

Name	Part Description	Part Number	Stock Code
C1, C3, C18, C20, C21, C22, C23, C24, C25, C26, C27, C28, C29, C30, C34, C45, C47, C52, C55, C57 C2, C4, C5, C6, C61 C7, C40, C41, C42, C49 C8, C19, C46, C56 C9, C10, C48 C31 C32, C33	0.1uF 16V X7R Ceramic Capacitor	CM105X7R104K16AT	FEC 1216538 DNP
C51 C53 D1, D2, D3, D4 J1 J2, J7, J14, J16, J17, J18 LK1, LK2, LK6, LK8, LK10, LK16, LK17, LK21, LK22, LK23, LK25, LK27 R1, R2, R47 R3, R7, R9, R11, R15, R18, R26, R35, R36, R37, R39, R40, R41, R42, R43, R48 R4, R5, R6, R19, R20, R21, R22 R16, R17 R23 R24, R25 R38 U1	0.1uF 100V Ceramic Capacitor 10uF 10V SMD Tantalum Capacitor 10uF 63V Electrolytic Capacitor 2.2uF 10V Y5V Ceramic Capacitor 22Pf 50V NPO Ceramic Capacitor	C1206F104K1RAC MCCTB106M010 EEEFK1J100P 9402098 2238 867 15229	FEC 1288275 FEC 1190113 FEC 9696008 FEC 9402098 FEC 722005 Digikey 587-1352-1-ND
	10uF 35V Y5V Ceramic Capacitor	GMK316F106ZL-T	FEC 197099
	1uF 10V SMD Tantalum Capacitor	TAJR105K010R	FEC 5790840
	Red SMD LED	HSMH-C170	FEC 9786490
	USB Mini-B Connector (usb-otg)	565790576	FEC 151790
	3 Pin Terminal Block (5mm Pitch)	CTB5000/3	FEC 1022249 & 150-411 DNP
	3 Pin (0.1" Pitch) Header & Shorting Shunt	M20-9990246	
	0Ω, SMD Resistor	MC 0.063W 0603	FEC 9331662
	10kΩ, SMD Resistor	MC 0.063W 0603	FEC 9330399
	100kΩ, SMD Resistor	MC 0.063W 0603	FEC 9330402
	1kΩ, SMD Resistor	MC 0.063W 0603	FEC 9330380
	2.2kΩ, SMD Resistor	MC 0.063W 0603	FEC 9330810
	15kΩ, precision SMD Resistor	RN73C2A15KBTG	FEC 1140932
	8 X 12 Analog Switch Array	AD5750YCPZ	AD5750YCPZ AD5662BRJZ-2500RL7
U2	16-Bit nanoDAC with Reference	AD5662BRJZ-2500RL7	
U3	Precision Low Dropout Voltage Regulator	ADP3303ARZ-3.3	ADP3303ARZ-3.3 CY7C68013-56LFC Digikey 24LC64-I/SN-ND
U4	USB Microcontroller	CY7C68013-56LFC	
U5	64K EEPROM	24LC64-I/SN	
U6	Reference	ADR434ARMZ	ADR434ARZ/ADR434BRZ
Y2	24 MHz , Plastic SMD Crystal	X24M000000S244	FEC 9509658