

# INSTRUCTION MANUAL

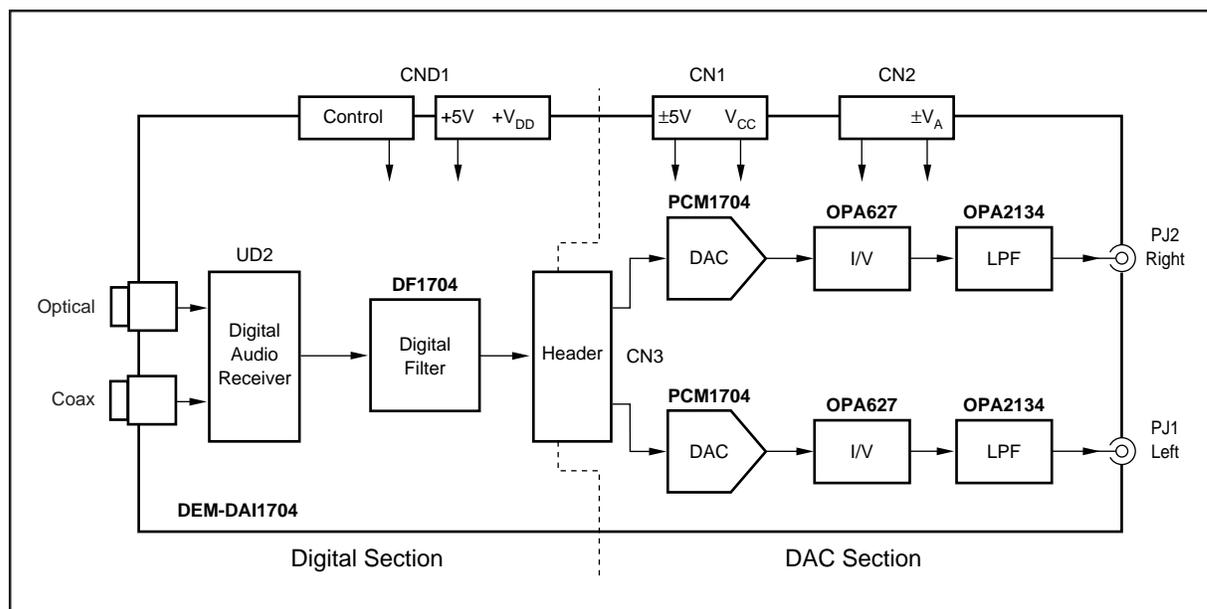
## FEATURES

- INCLUDES TWO PCM1704 DACs, ONE DF1704 8x INTERPOLATION FILTER, TWO OPA627 OP AMPS (utilized as I/V converters), ONE OPA2134 (provides DAC low-pass filters)
- ON-BOARD DIGITAL AUDIO RECEIVER ACCEPTS S/PDIF DATA INPUT UP TO 96kHz (RCA and optical input connectors provided)
- DEMONSTRATION SOFTWARE FOR PROGRAMMING DF1704 CONTROL REGISTERS (requires Intel-standard PC with Microsoft Windows 3.1, 95, or 98)
- INTERFACE CABLE FOR CONNECTION TO PC PRINTER PORT (required for the demonstration software)
- POWER SUPPLY REQUIREMENTS:
  - ±5V for PCM1704 DACs
  - ±15V for Op Amps
  - +5V for Digital Audio Receiver and DF1704 Digital Filter

## DESCRIPTION

The DEM-DAI1704 is a complete evaluation fixture for the PCM1704 (24-bit, sign-magnitude digital-to-analog converter) and the DF1704 digital interpolation filter. The demonstration board includes all the necessary power supply and interface connectors, as well as analog signal conditioning circuitry for the DAC outputs. An on-board S/PDIF receiver provides an industry-standard interface to audio measurement systems and commercial audio equipment.

## BLOCK DIAGRAM



# DEMONSTRATION BOARD HARDWARE

## ANALOG SECTION

The analog section of the demonstration board includes two PCM1704 D/A converters, two OPA627s utilized as current-to-voltage (I/V) converters, and an OPA2134 dual op amp providing second-order low-pass filters for the Right and Left audio channels. The D/A converters and op amps are socketed for easy replacement.

### Connectors

Connector CN1 provides power for the PCM1704 DACs.

+V<sub>CC</sub> should be set for +5VDC, while -V<sub>CC</sub> should be set for -5VDC.

Connector CN2 provides power for the OPA627 and OPA2134 op amps.

+V<sub>A</sub> is typically set for +15VDC (maximum is +18VDC), while -V<sub>A</sub> is typically set to -15VDC (minimum is -18VDC).

The GND pins on connectors CN1 and CN2 are connected to the analog ground plane of the DAC Section.

CN3 is used to connect the audio interface of the Digital Section to the audio inputs of the PCM1704 D/A converters. Normally, jumpers should be installed for BCK, WDCK, DOL, DOR, and GND. However, if the user desires to bypass the circuitry of the Digital Section and drive the DACs directly from another digital signal source, this can be accomplished through connector CN3.

RCA jacks PJ1 and PJ2 are the Left and Right audio outputs. They provide direct connection to measurement and commercial audio equipment.

### Switches

DIP switch SW0 is used to set the data word length and output polarity for the two PCM1704 DACs.

Table I shows the function of the DIP switch settings.

SW0	FUNCTION	SETTINGS
20BIT	Selects Data Word Length for both DACs	H = 24 Bits L = 20 Bits
INVL	Selects Phase for Left Channel DAC	H = Normal L = Inverted
INVR	Selects Phase for Right Channel DAC	H = Normal L = Inverted

TABLE I. DAC Data Format Configuration.

## DIGITAL SECTION

The digital section includes the DF1704 digital interpolation filter (UD1), which 8x over samples the data from the on-board digital audio receiver (UD2) or an external source at connector CND2. DIP switches are provided to configure the DF1704 filter settings. The DF1704 is socketed for easy replacement.

### Connectors

Connector CND1 provides two functions. First, it is used to provide the +5V digital power supply connections. The supplied PC interface cable includes two banana plugs; the Red plug is connected to a +5V power supply, while the Black plug is connected to the power supply's ground.

CND1 is also used in conjunction with the supplied demonstration software and PC interface cable to provide a means to control the DF1704's MC, ML, MD, and RST lines when the DF1704 is set to Software mode (see Table II). The demonstration software utilizes a PC printer port to program the DF1704's internal control registers via CND1.

Connector CND2 provides the interface between the digital audio source and the DF1704 digital interpolation filter. The digital source will usually be the on-board digital audio receiver (UD2). In this case, BCK, LRCK, DATA, XTI, and GND must have jumpers installed to connect the digital audio receiver outputs to the DF1704 clock and data inputs. Alternatively, an external digital audio source may be connected to the demo board via CND2.

Connector PJ1 provides the electrical input for the digital audio receiver, UD2.

Connector UD5 provides the optical input for the digital audio receiver, UD2.

### Switches

DIP switches SW1 and SW2 are used to set the configuration of the DF1704 digital filter. The DF1704 can be controlled using Hardware or Software modes, which is determined by the logic state of the MODE switch. Table II shows the operation of DIP switch SW1. Table III shows the operation of DIP switch SW2 in Hardware Mode. SW2 settings are ignored in Software Mode.

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SW1	FUNCTION	SETTINGS
MODE	Mode Control	MODE = H = Software Mode MODE = L = Hardware Mode
ML/RESV	Software Mode: Control Port Word Clock  Hardware Mode: Reserved, Not used	Set to H  Set to H
MC/LRIP	Software Mode: Control Port Bit Clock  Hardware Mode: LRCIN Polarity	Set to H  LRIP = L = Normal LRCIN Polarity LRIP = H = Inverted LRCIN Polarity
MD/CKO	Software Mode: Control Port Data  Hardware Mode: CLKO Output Frequency	Set to H  CKO = L : $f_{CLKO} = f_{XTI}$ CKO = H : $f_{CLKO} = f_{XTI}/2$
RST	Reset	RST = L = Reset Mode RST = H = Normal Operation
MUTE	Software Mode: Ignored  Hardware Mode: Soft Mute Enable	Set to H  MUTE = L = Mute Enabled MUTE = H = Mute Disabled

TABLE II. SW1 Operation.

SW2	DESCRIPTION			
I <sup>2</sup> S IWO IW1	Input Data Format Controls			
	<b>I<sup>2</sup>S</b>	<b>IW1</b>	<b>IWO</b>	<b>Input Format</b>
	L	L	L	16-Bit, Standard, MSB-First, Right-Justified
	L	L	H	20-Bit, Standard, MSB-First, Right-Justified
	L	H	L	24-Bit, Standard, MSB-First, Right-Justified
	L	H	H	24-Bit, MSB-First, Left-Justified
	H	L	L	16-Bit, I <sup>2</sup> S
	H	L	H	24-Bit, I <sup>2</sup> S
SRO	Digital Filter Roll-Off SRO = H = Slow Roll-Off SRO = L = Sharp Roll-Off			
OW0 OW1	Output Data Format Controls			
	<b>OW1</b>	<b>OW0</b>	<b>Output Format</b>	
	L	L	16-Bit, MSB-First	
	L	H	18-Bit, MSB-First	
	H	L	20-Bit, MSB-First	
	H	H	24-Bit, MSB-First	
SF0 SF1	Sample Rate Selection for De-Emphasis Control			
	<b>SF1</b>	<b>SF0</b>	<b>Sampling Rate</b>	
	L	L	44.1kHz	
	L	H	Not Used	
	H	L	48kHz	
	H	H	32kHz	
DEM	<b>Digital De-Emphasis</b> DEM = H = De-Emphasis On DEM = L = De-Emphasis Off			

TABLE III. SW2 Operation (hardware mode only).

SW4	SW5	SW6	OUTPUT FORMAT
L	L	L	16- to 24-Bit, Left-Justified, MSB-First <sup>(1)</sup>
L	H	L	16- to 24-Bit, I <sup>2</sup> S <sup>(2)</sup>
H	L	H	16-Bit, Standard <sup>(2)</sup>
H	H	L	18-Bit, Standard, Right-Justified, MSB-First <sup>(2)</sup>

NOTES: (1) Jumper JP1 must be set in the INV position for this format.  
(2) Jumper JP1 must be set in the NML position for this format.

TABLE IV. Setting the Digital Audio Receiver Data Format.

Switch SW3 is used to reset the digital audio receiver when necessary. It is a normally open push-button switch. Press and release to perform a reset.

Switches SW4 through SW6 are used to select the output data format for the digital audio receiver.

Table IV shows the format selection for use with the DF1704 digital filter.

## SCHEMATICS

Figure 1 shows the circuit connections for the Digital Section of the demo board.

Figure 2 shows the circuit diagram for the DAC Section of the demo board.

## PCB PLOTS

Figures 3 through 5 show the silk screen, as well as the top and bottom layer plots of the DEM-DAI1704.

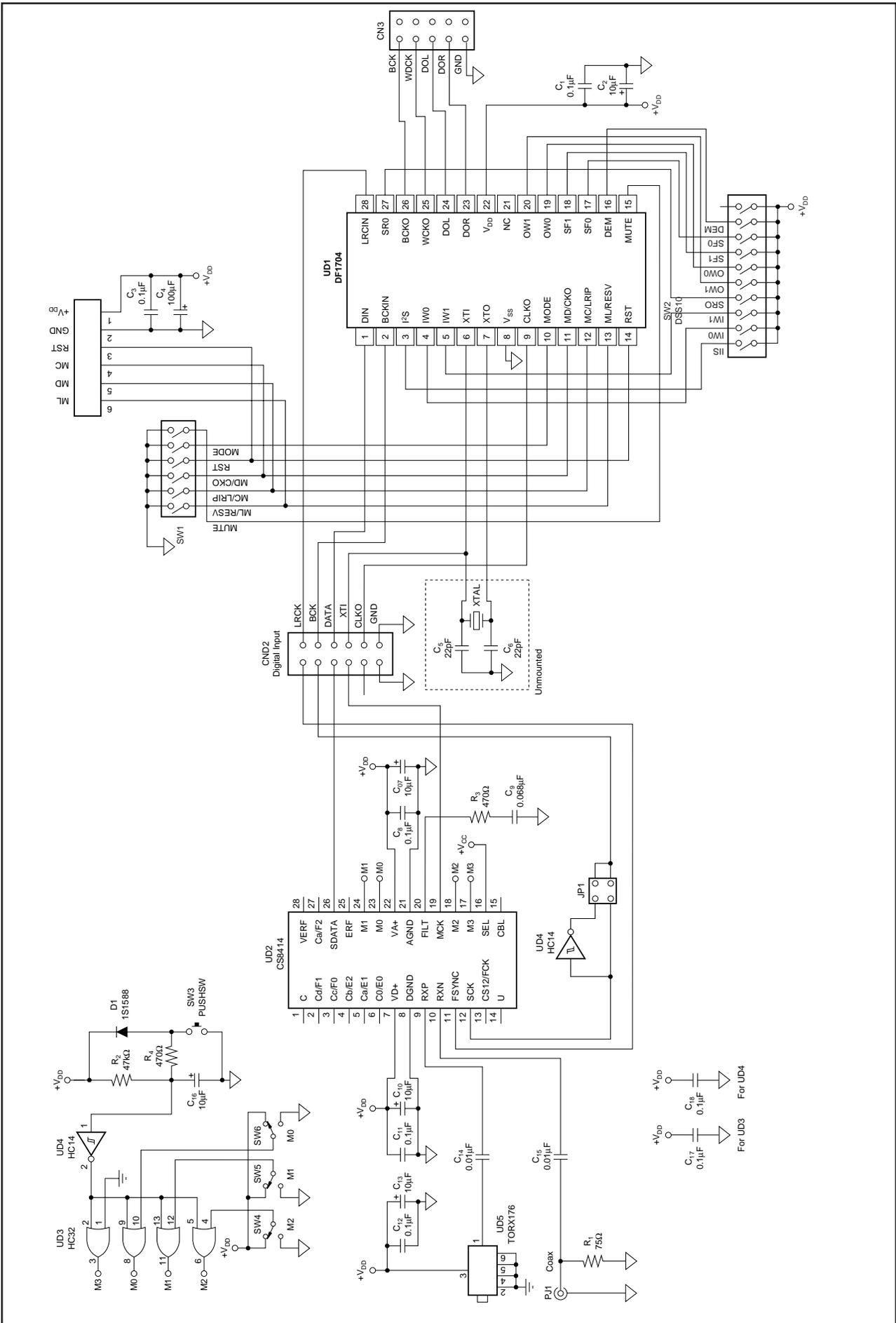


FIGURE 1. Digital Section for the DEM-DAI1704.

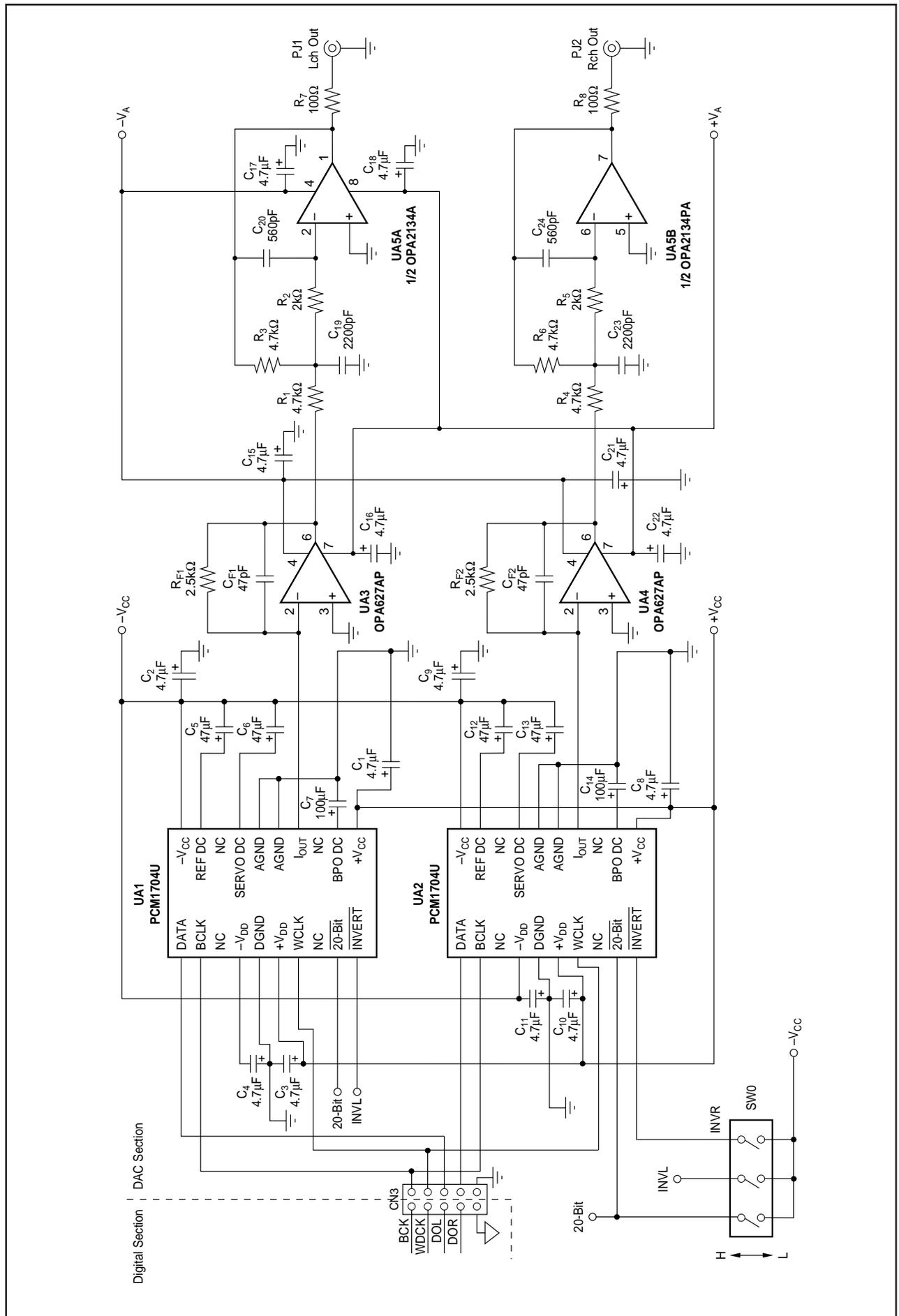


FIGURE 2. Analog Section for DEM-DAI1704.

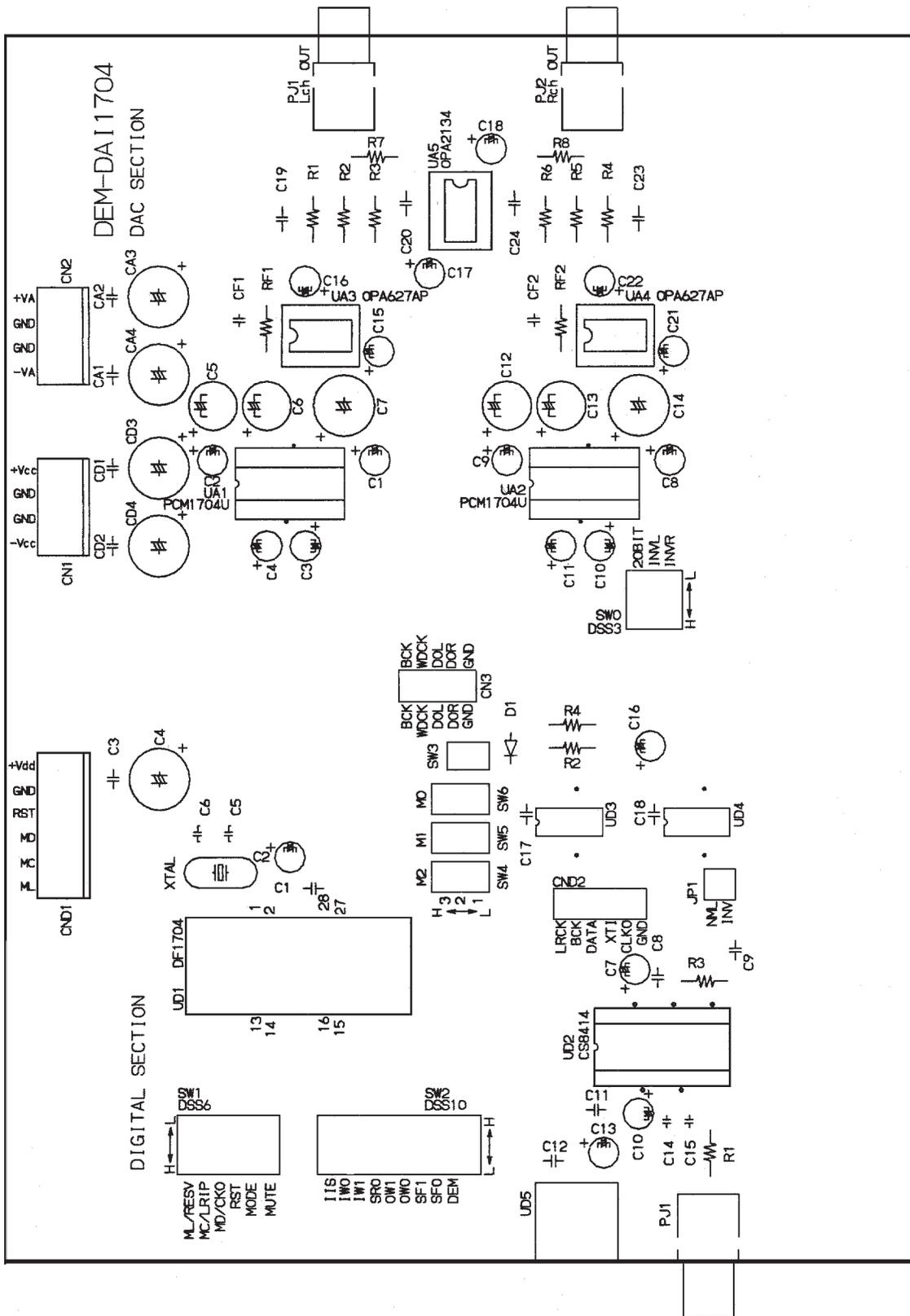


FIGURE 3. Silk Screen for the DEM-DAI1704.

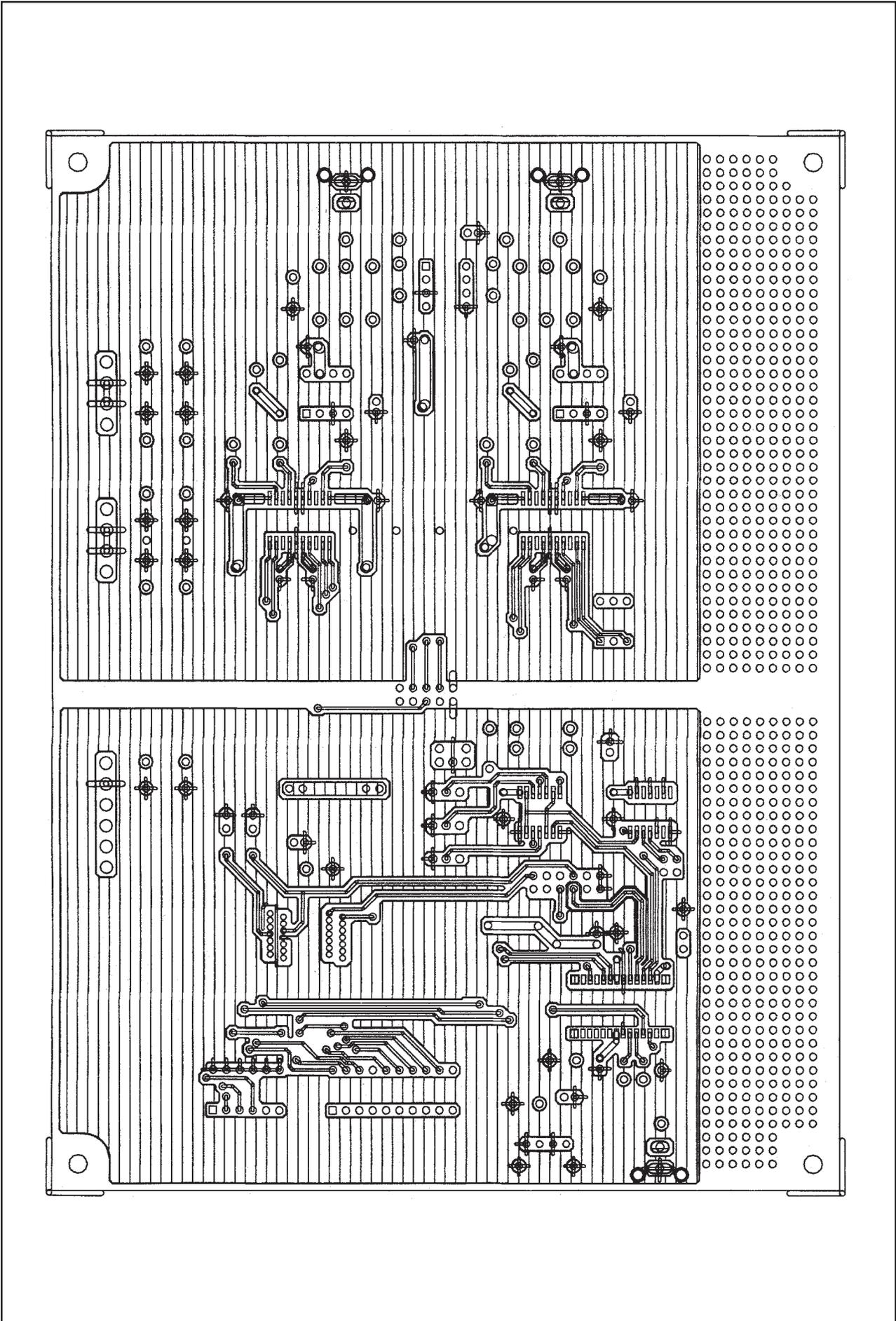


FIGURE 4. Top Layer for the DEM-DAI1704.

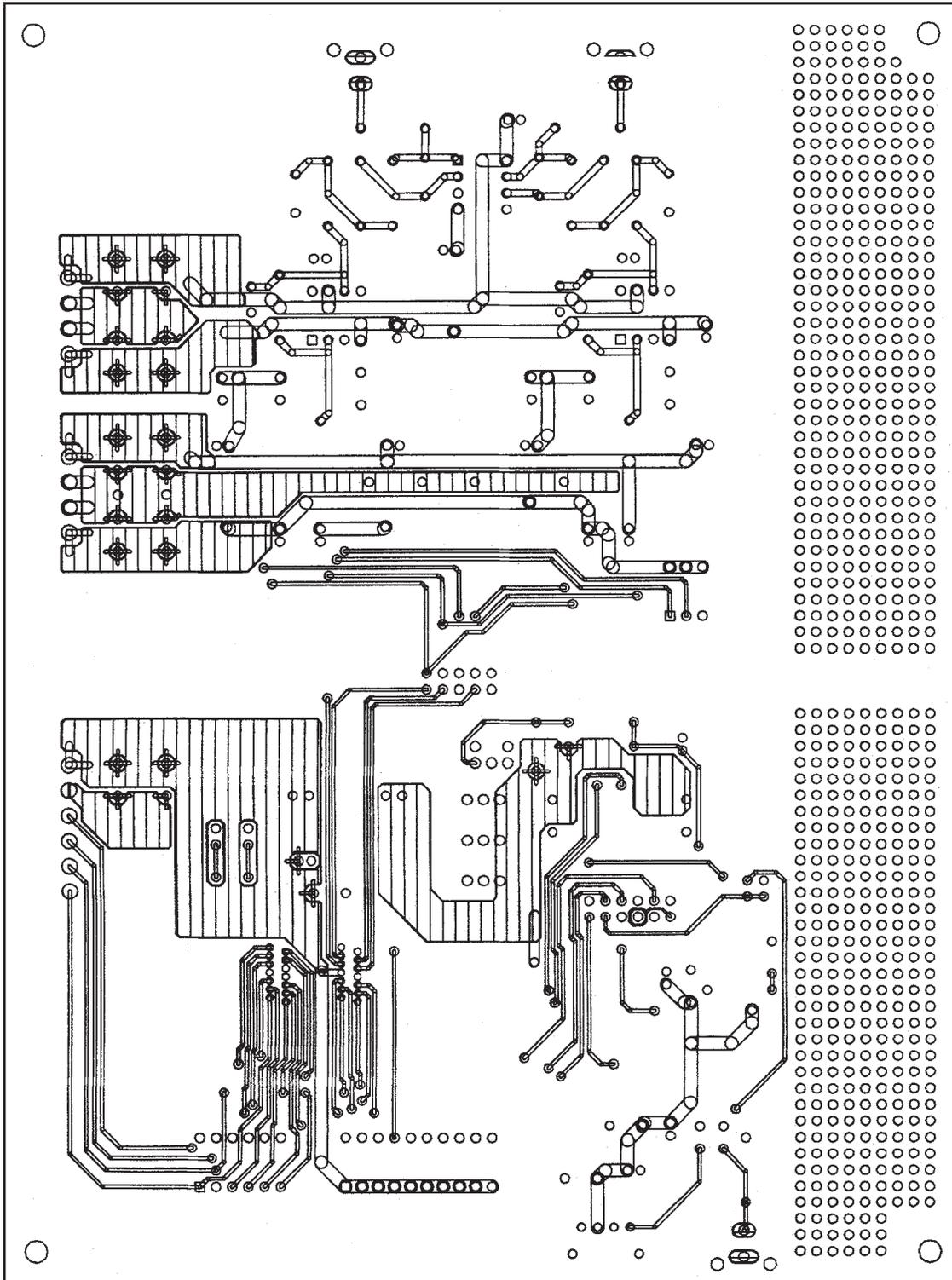


FIGURE 5. Bottom Layer for the DEM-DAI1704.

# DEMONSTRATION SOFTWARE

Software is provided with the DEM-DAI1704 to allow programming of the DF1704's internal registers.

The software will operate on computers running Microsoft Windows 3.1, 95, or 98. The demo software requires that the PC printer port be connected to CND1 of the DEM-DAI1704 using a standard printer cable and the supplied PC interface cable.

## INSTALLATION

The demo software is distributed on a 3.5-inch floppy disk. There is a single folder on the disk, named "Dem1704." This folder contains the application and all support files.

To install the software on your computer, first create a new folder on your hard drive with an appropriate name (e.g., Dem1704, Pcm1704, etc.). Then open the "Dem1704" folder on the installation floppy and copy all of the files to your new folder.

Open the configuration settings file named "Dem1704" with a text editor, such as Notepad. When the file is opened, find the following line:

PCMIFADR = &h378

The &h378 indicates the printer port address that the demo software will use to communicate with the

DEM-DAI1704. This address must be set to &h378, &h278, or &h3BC. Most PC's use &H378 as the default printer port address. If your printer port is not located at &h378, edit the address to match your computers port address.

## USING THE DEMO SOFTWARE

Double click on the application file named "dem1704". A window will appear on your screen, as shown in Figure 6. There are two menus near the top of the DF1704 Control window, named Execute and Window.

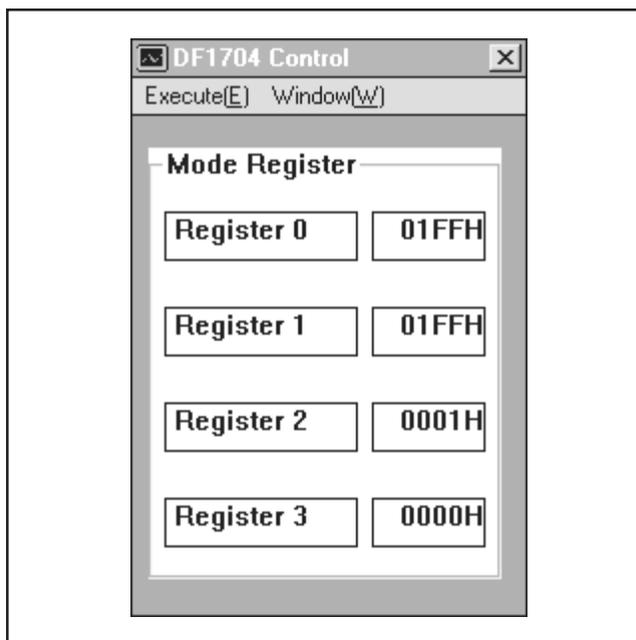


FIGURE 6. DF1704 Control Window.

The Execute menu includes three selections: Initialize, Reset, and Exit. Selecting Initialize will instruct the program to write all of the DF1704's internal registers with the default values. Selecting Reset will instruct the program re-write the DF1704's internal registers with the data currently selected in the application windows. Selecting Exit will close the application.

The Window menu includes three selections: Attenuate, Function, and DataForm. The following sections provide an explanation of each window.

## HOLD and PASS

Each window has a button near the top. It's labeled either HOLD or PASS. The current setting is toggled by clicking on the button. When set to HOLD, you can change the settings in a window, but they will not be written to the register(s) until the OK button (which appears at the bottom of the window) is pressed. When set to PASS, changes made in a window are immediately written to the corresponding register(s).

## Attenuation Window

The Attenuate window is used to set the digital attenuation registers internal to the DF1704 and is shown in Figure 7. There is an separate attenuator for both the left and Right output channels, each with it's own independent register to control it's level. In the Attenuation window, there is a slider for each attenuator. Use the slider handle or the arrows at each end of the slider to adjust the attenuation level. The left and right arrow keys on the keyboard can also be used to adjust the level. Just below each slider is a status display showing the current step setting (in decimal) and the corresponding attenuation level in decibels (dB) relative to the input signal level.

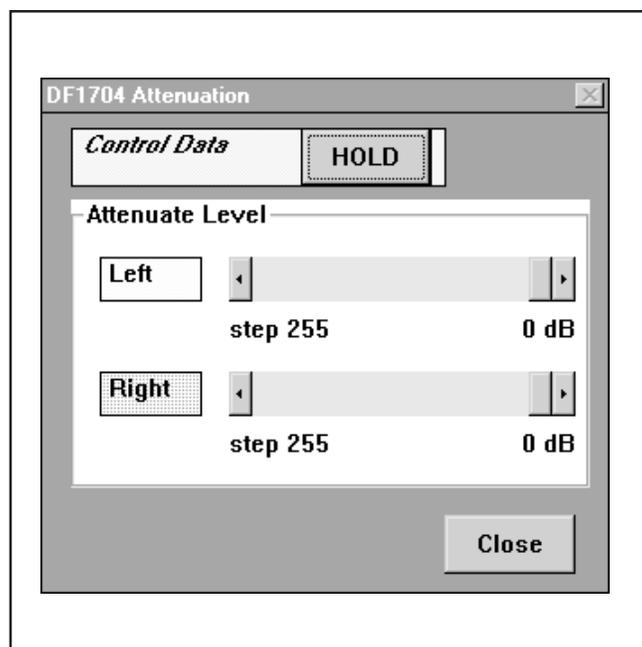


FIGURE 7. Attenuation Window.

## Function Window

The Function window is used to set the DF1704 input and output data formats, as well as the soft mute and digital de-emphasis functions. The data format and de-emphasis functions are programmed using pop-up menus, while the soft mute function is operated using a check box. Figure 8 shows the contents of the Function window.

For more information regarding the functions controlled by this window, please refer to the DF1704 data sheet.

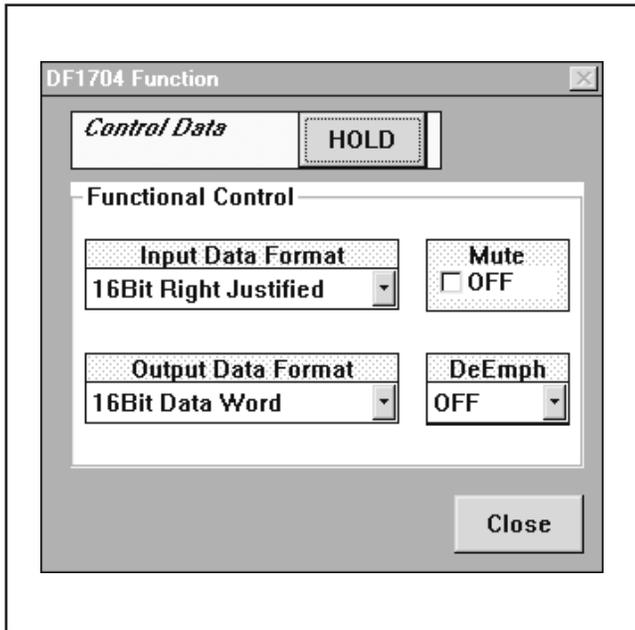


FIGURE 8. Function Control Window.

## DataForm Window

The DataForm window is used to set DF1704 digital filter roll off, dependent or independent attenuation control, LRCIN polarity (for Standard and Left-Justified data formats), and the CLKO output frequency.

Pop-up menus are used to set all functions in the DataForm window, as shown in Figure 9.

For more information regarding the functions controlled by this window, please refer to the DF1704 data sheet.

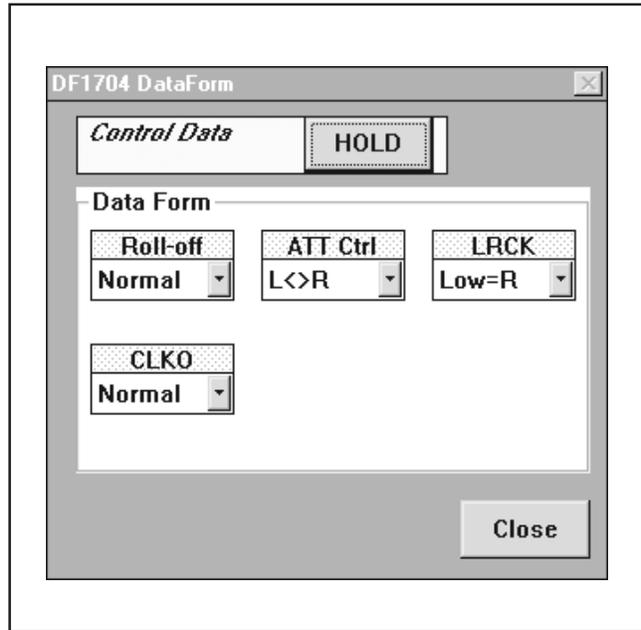


FIGURE 9. Operational Control Window.