



## DEM-DAI1738 Instruction Manual

Hajime Kawai

DAV Digital Audio/Imaging Japan (DAI)

### ABSTRACT

This user's guide describes the DEM-DAI1738 evaluation fixture for the PCM1738 stereo digital-to-analog (D/A) converter.

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## Features and Description

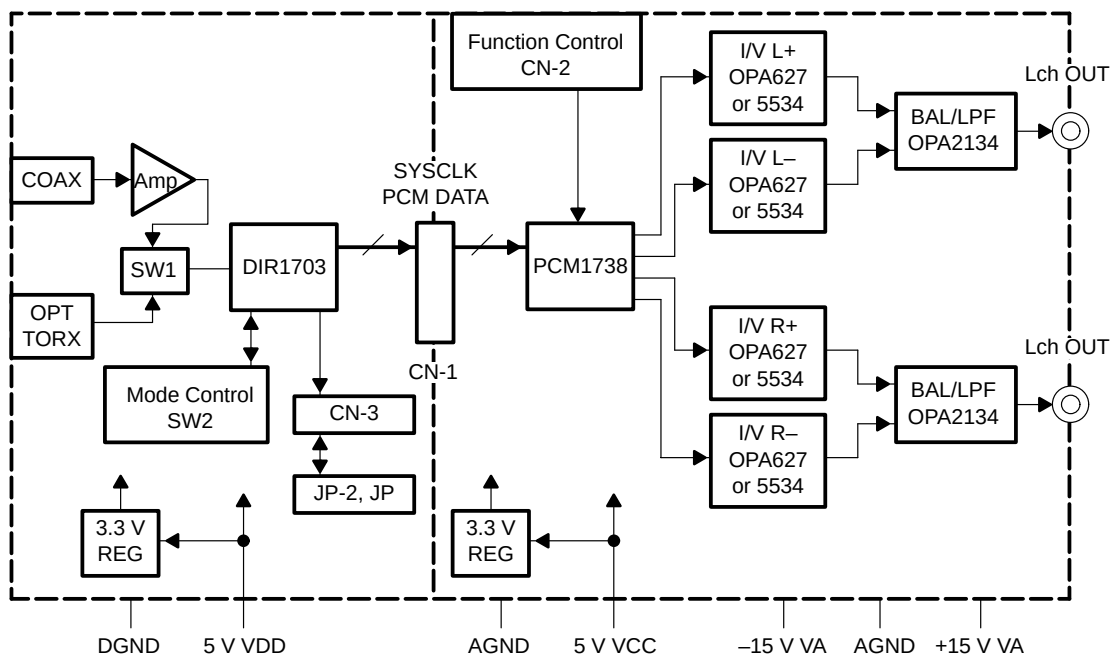
The DEM-DAI1738 is an evaluation fixture for the PCM1738 24-bit, 192-kHz sampling stereo D/A converter. This evaluation fixture utilizes a DEM-DAI1738 demonstration board and demonstration software for function and operation control of the PCM1738.

The DEM-DAI1738 consists of a DAI (S/PDIF) section that uses a DIR1703 DAI receiver, a PCM1738 DAC section, a differential I/V section, and a balanced amplifier with post LPF section.

The DEM-DAI1738 requires a 5-V digital power supply for its digital circuits, a 5-V analog power supply for the PCM1738, and  $\pm 15$ -V analog power supply for the I/V and balanced amplifier circuits.

The DAI section has both coax and optical inputs that can be selected by a mounted switch and are capable of handling sampling rates up to 96 kHz.

The PCM1738 accepts up to 192-kHz sampling PCM audio data input and 64  $f_s$  DSD signal input through function control and jumper connection on board.

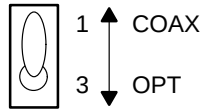


**Figure 1. Block Diagram**

## Operation and Function Control of DAI Section

- **optical/coax input selection**

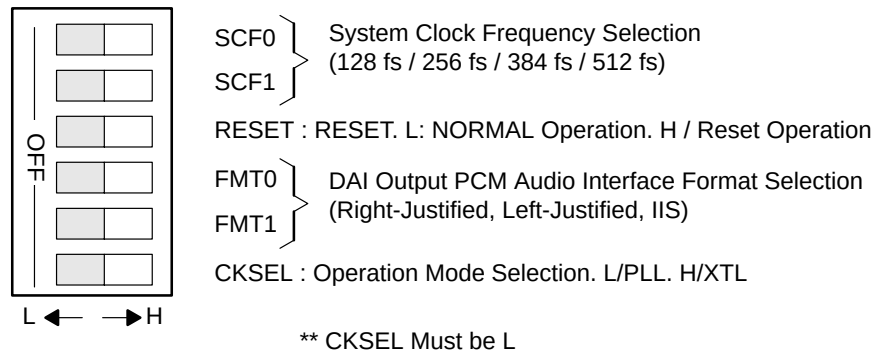
SW1 is the optical/coax S/PDIF digital input selection switch. This switch is illustrated in Figure 2.



**Figure 2. Optical/Coax Input Selection**

- **function and operation control of DIR1738**

SW2 is the function and operation control switch for the DIR1738. This switch is illustrated in Figure 3.



**Figure 3. Function and Operation Control of DIR1738**

**Table 1. System Clock Frequency**

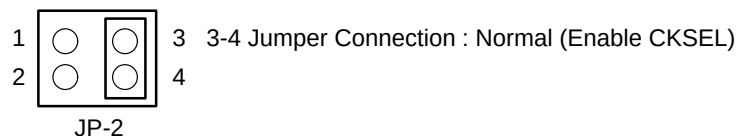
| SCF0 | SCF1 | SYSTEM CLOCK FREQUENCY |
|------|------|------------------------|
| L    | L    | 128 f <sub>S</sub>     |
| L    | H    | 256 f <sub>S</sub>     |
| H    | L    | 384 f <sub>S</sub>     |
| H    | H    | 512 f <sub>S</sub>     |

**Table 2. Audio Interface Format**

| FMT0 | FMT1 | AUDIO INTERFACE FORMAT             |
|------|------|------------------------------------|
| L    | L    | 16-bit, MSB first, right-justified |
| L    | H    | 24-bit, MSB first, left-justified  |
| H    | L    | 24-bit, MSB first, right-justified |
| H    | H    | 24-bit, IIS                        |

- **JP-2 Connection**

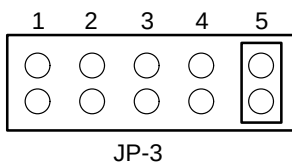
JP-2 is used to enable CKSEL. Jumper on 3–4 enables CKSEL. This jumper connection is illustrated in Figure 4.



**Figure 4. JP-2 Connection**

## Crystal/External Clock Selection

Jumper JP-3 is used for selection of crystal oscillator or external clock frequency. This jumper connection is shown in Figure 5. Table 3 gives the external clock frequencies that can be selected using JP-3 for different sampling rates.



**Figure 5. Crystal/External Clock Selection**

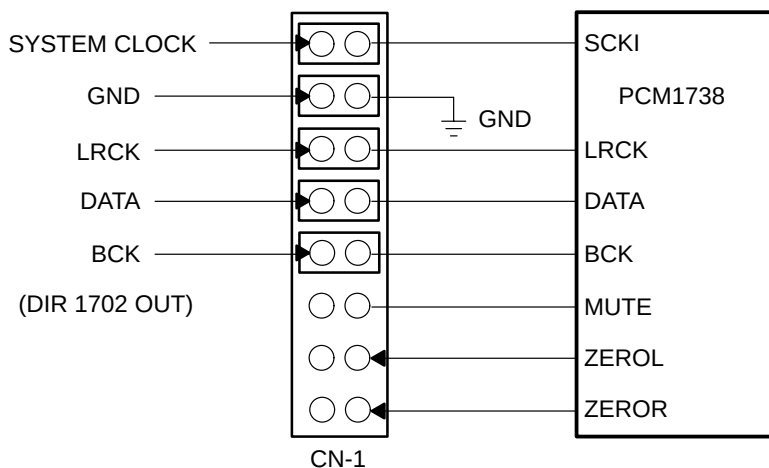
**Table 3. External Clock Selection**

| SAMPLING RATE | 128 f <sub>s</sub> | 256 f <sub>s</sub> | 384 f <sub>s</sub> | 512 f <sub>s</sub> | BRSEL CONNECTED TO |     |
|---------------|--------------------|--------------------|--------------------|--------------------|--------------------|-----|
| 32 kHz        | 4.096 MHz          | 8.192              | 12.288             | 16.384             | BFRAME             | → 1 |
| 44.1 kHz      | 5.6448             | 11.2896            | 16.9344            | 22.5792            | EMFLG              | → 2 |
| 48 kHz        | 6.144              | 12.288             | 18.432             | 24.576             | Open               | → 5 |
| 88.2 kHz      | 11.2896            | 22.5792            | 33.8688            | 45.1584            | URBIT              | → 3 |
| 96 kHz        | 12.288             | 24.576             | 36.864             | 49.152             | CSBIT              | → 4 |

## PCM Audio Interface

The PCM audio data and system clock from the DIR1701 can be connected to the digital input of the PCM1738 by a jumper connection on CN-1.

External audio data input can be interfaced using the right side pins on CN-1. Refer to the current version of the PCM1738 data sheet, TI literature number SBAS174, for interface connections of digital filter (DF) and direct stream digital (DSD) modes.



**Figure 6. PCM Audio Interface**

## 5-V Power Supply for Digital VDD

The DEM–DAI1738 requires 5-V digital and analog power supplies. These supplies must be kept separate to prevent interference between the digital and DAC/analog sections.

The JP–1 connection allows common connection of the 5-V  $V_{DD}$  and 5-V  $V_{CC}$  supplies for limited power supply availability during actual evaluation.

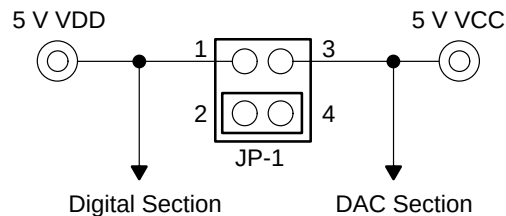


Figure 7. 5-V Power Supply

## AC/DC Coupling Selection

Jumpers 4 and 5 are used for dc or ac-coupling selection between I/V converter output and balanced amplifier input.

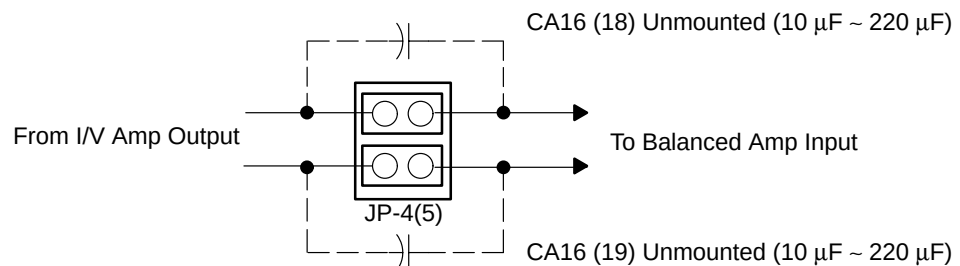
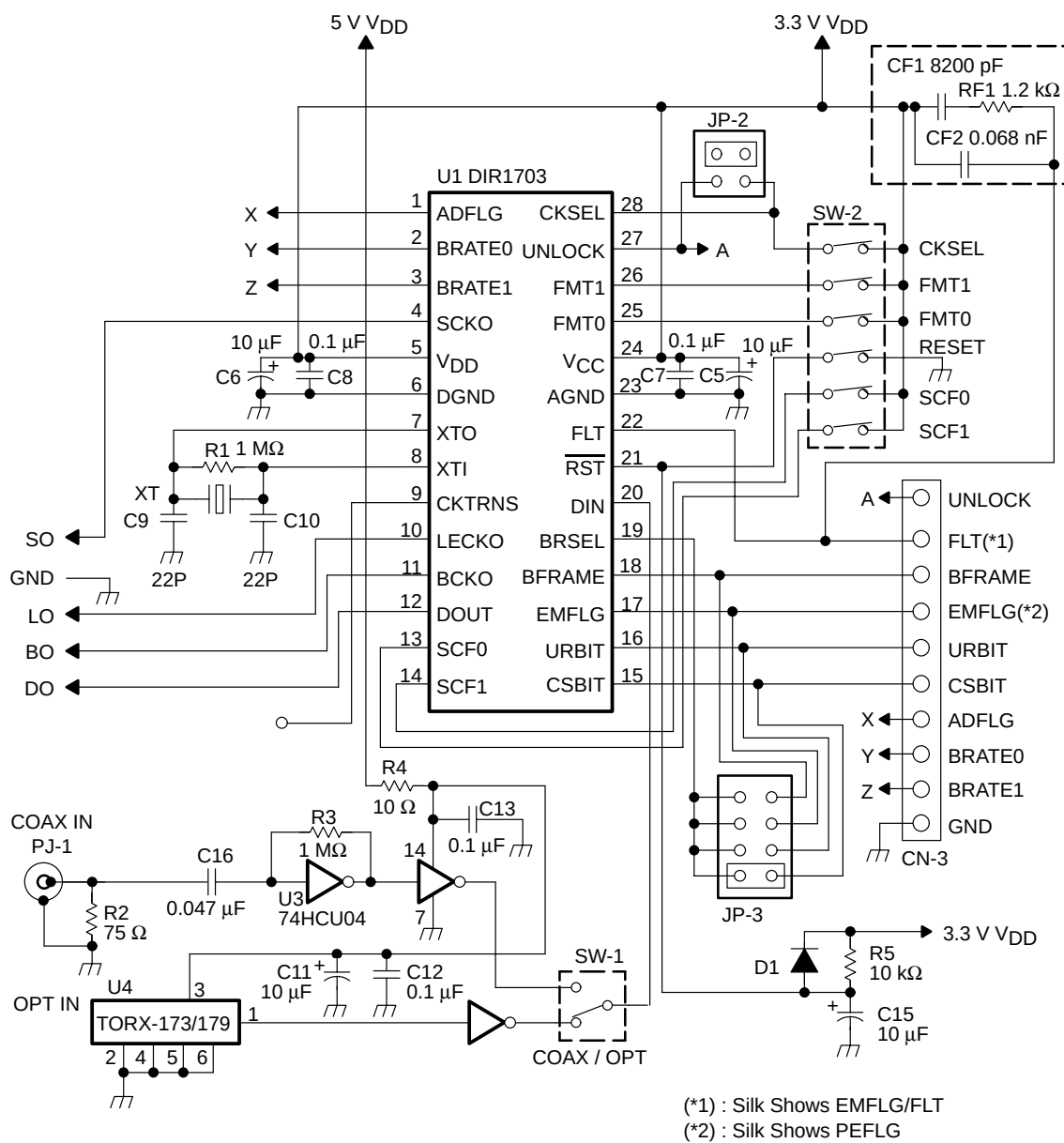


Figure 8. AC/DC Coupling Selection

## Schematic Diagram—DIR Section

Figure 9 shows the schematic diagram for the DIR section.



**Figure 9. DIR Section**

## Schematic Diagram—DAC, Analog, and Power Supply Section

Figure 10 shows the schematic diagram for the DAC, analog, and power supply section.

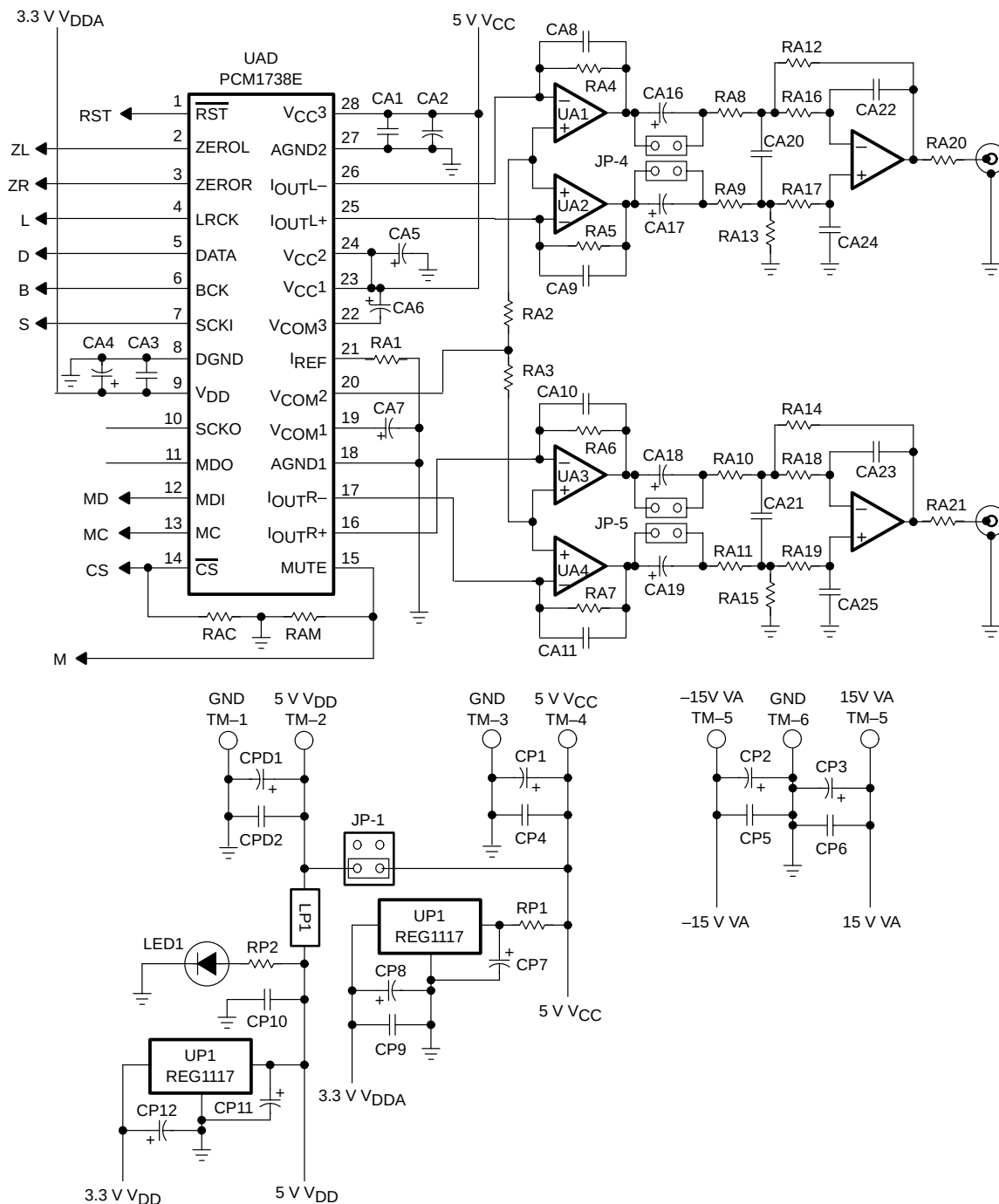


Figure 10. DAC, Analog, and Power Supply Section

Table 4 presents the component values for the DAC, analog, and power supply section.

**Table 4. Component Values for DAC, Analog, and Power Supply Section**

| COMPONENT NUMBER                    | COMPONENT VALUE       |
|-------------------------------------|-----------------------|
| CP1, CP2, CP3                       | 220 $\mu$ F, 25 V     |
| CP7, CP11–CP20                      | 1 $\mu$ F, 25 V       |
| CP8, CPD1                           | 100 $\mu$ F, 16 V     |
| CA2, CA4, CA5, CA6, CA7, CP11, CP12 | 10 $\mu$ F, 16 V      |
| CA16–CA19                           | 47 $\mu$ F, 25 V      |
| CP4, CP5, CP6, CP9, CA1, CA3        | 0.047 $\mu$ F         |
| CA8, CA9, CA10, CA11                | 5600 pF               |
| CA20, CA21                          | 8200 pF               |
| CA22–CA25                           | 1800 pF               |
| CP10, CPD2                          | 0.1 $\mu$ F           |
| LP1                                 | 47 $\mu$ F            |
| RP1                                 | 10 $\Omega$ , 1/4 W   |
| RA1                                 | 16 k $\Omega$ , 1/8 W |
| RA2, RA3, RA20, RA21                | 100 $\Omega$ , 1/8 W  |
| RA4–RA19                            | 620 $\Omega$ , 1/8 W  |
| RP2                                 | 330 $\Omega$ , 1/8 W  |
| RAC, RAM                            | 10 k $\Omega$ , 1/8 W |

CA16, CA17, and CA18 are not mounted



## Schematic Diagram—Power Supply for Operational Amplifier and CN-1/CN-2 Connectors Section

Figure 11 shows the schematic diagram for the power supply for the operational amplifier, CN-1, and CN-2 connector section.

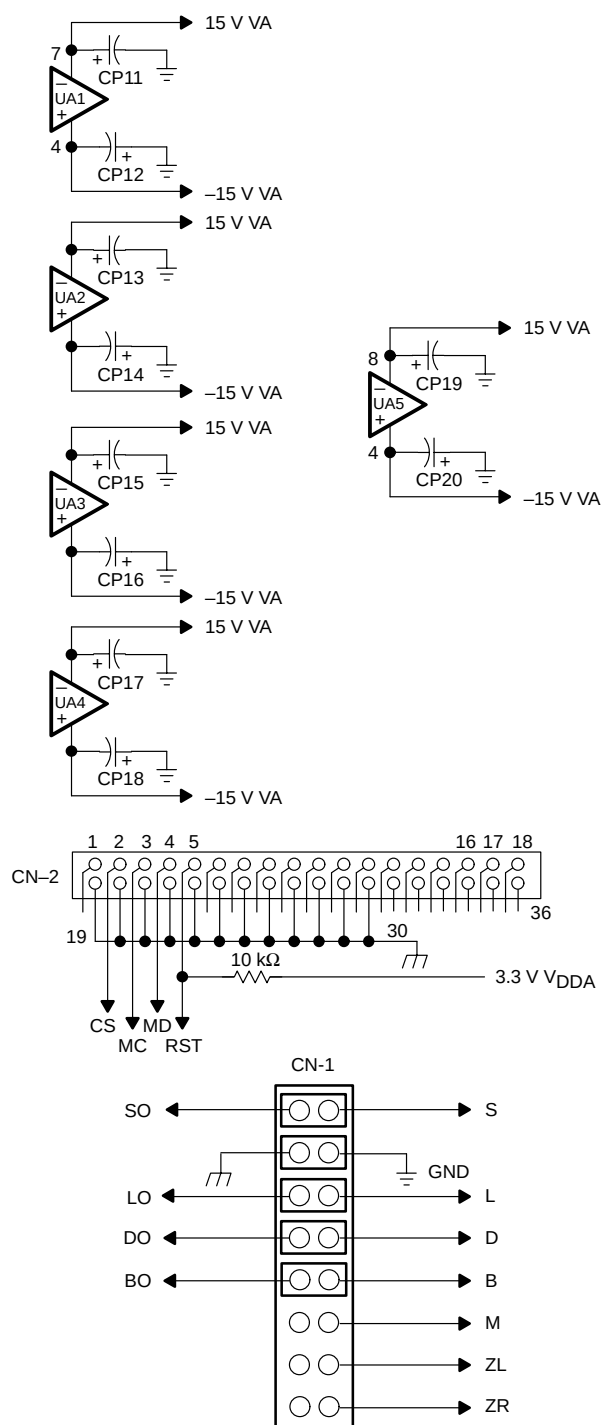
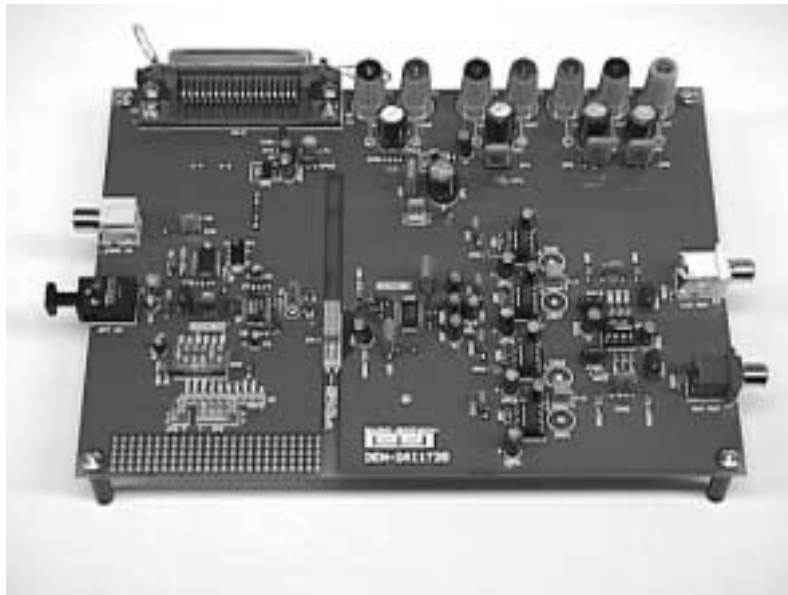


Figure 11. Power Supply for Operational Amplifier and CN-1/CN-2 Connectors Section

## Printed-Circuit Board

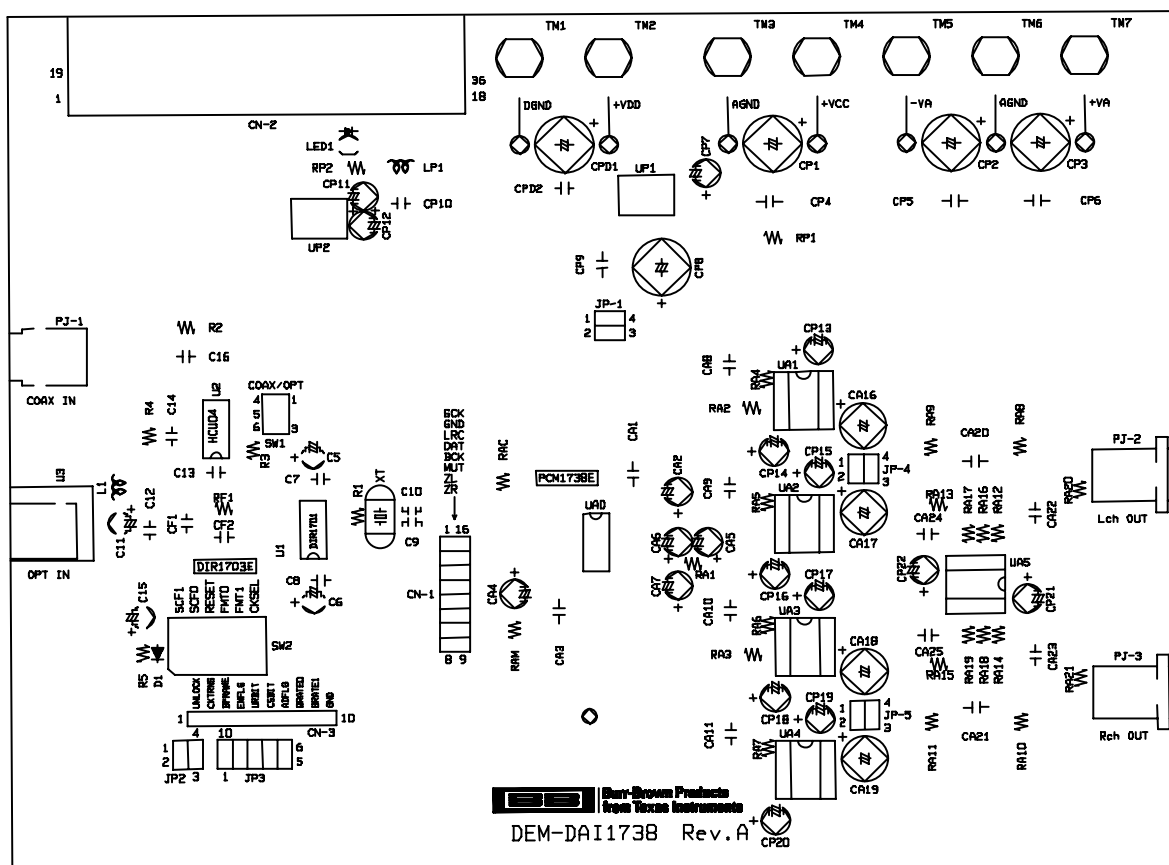
Figure 12 shows the printed-circuit board.



**Figure 12. Printed-Circuit Board**

- parts location

Figure 13 shows the printed circuit layout.

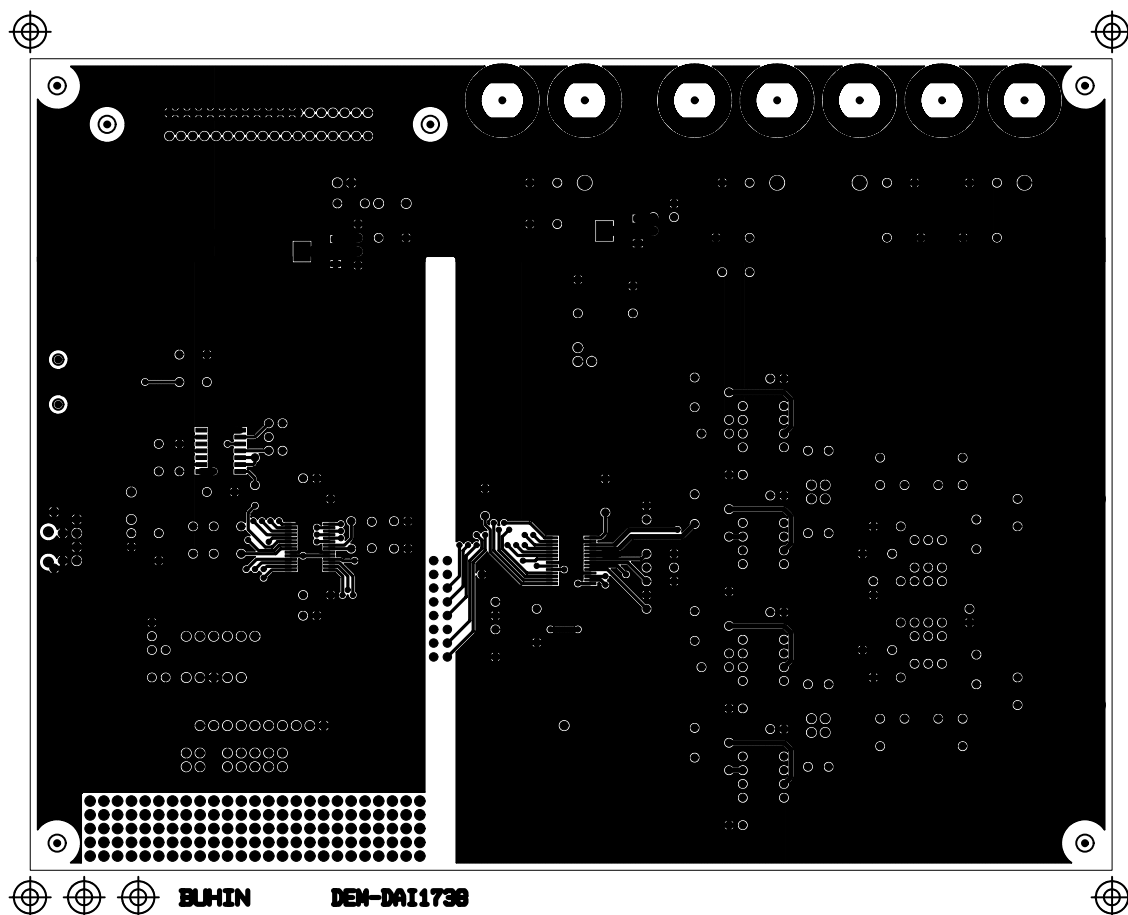


TOP SILK DEM-DAI1738

Figure 13. Printed-Circuit Layout—Parts Location

- **top-side layer**

Figure 14 shows the top-side layer of the DEM-DAI1738 printed-circuit board.



**Figure 14. Top-Side Layer**

- **bottom-side layer**

Figure 15 shows the bottom-side layer of the DEM–DAI1738 printed-circuit board.

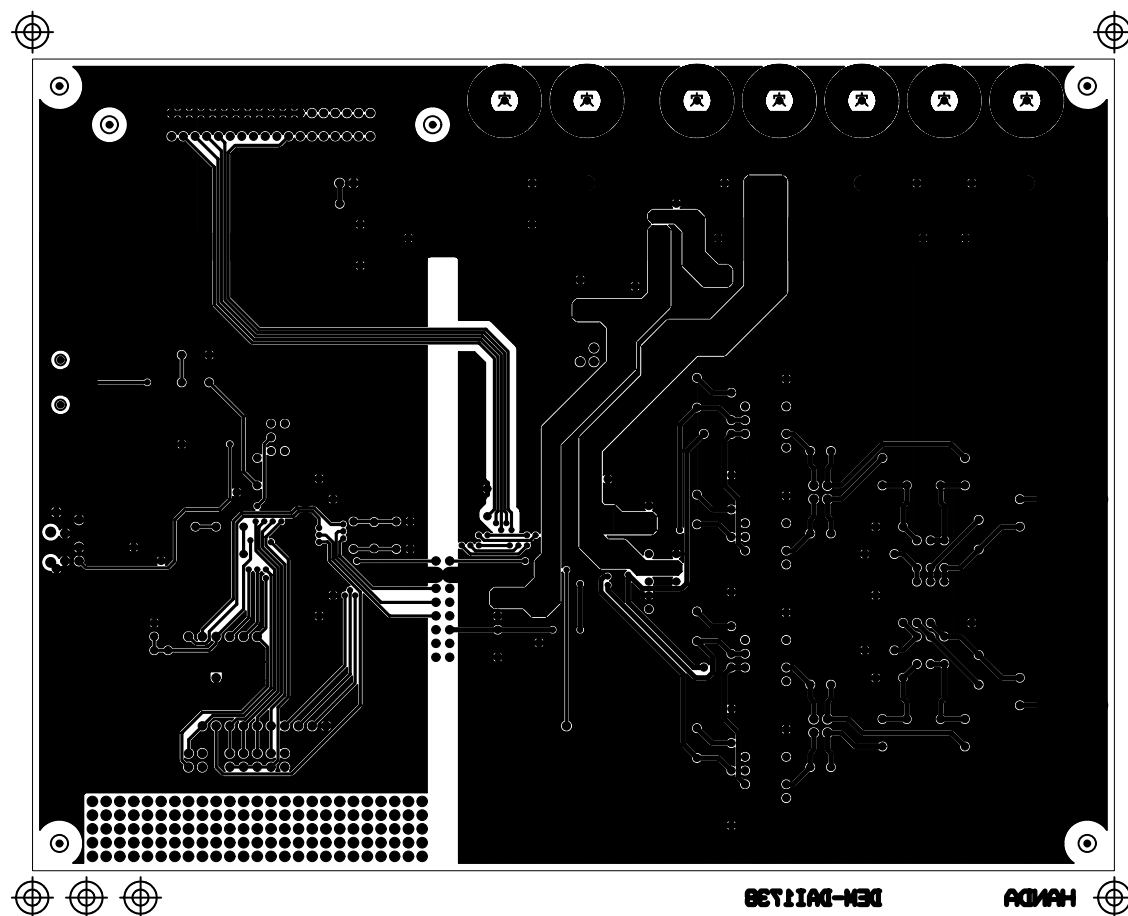


Figure 15. Bottom-Side Layer

## Demonstration Software

Software is provided with the DEM–DAI1738 to allow programming of the PCM1738's internal registers. The software operates on computers running Microsoft Windows™ 3.1, 95, or 98.

The demonstration software requires connection of the PC printer port to CN–2 of the DEM–DAI1738 using a standard printer cable.

- **installation**

The demonstration software is distributed on a 3.5-inch floppy disk.

To install the software on your PC computer, first create a new folder on your hard drive with an appropriate name (such as *DEM1738*). Then open the *Dem1738* folder on the installation floppy disk and copy all its files to your new folder.

Open the configuration setting file named # *Dem1738* using a text editor, such as Notepad™. After the file opens, search for the following line:

PCMIFADR = &h378

The &h378 indicates the printer port address that the demonstration software uses to communicate with the DEM–DAI1738.

This address must be set to %h378, &h278, or &h3BC. Most PCs use &h378 as the default printer port address. If your printer port is not located at &h378, edit the address to match your computer's port address.

- **using the demonstration software**

Double-click on the application file named DEM1738. A window appears on your screen, as shown in Figure 16. There are two menu selections (Execute and Window) near the top of the window.

The Execute menu includes three selections: Initialize, Reset, and Exit. Selecting Initialize instructs the program to write all of the PCM1738's internal registers with the default values.

Reset instructs the program to rewrite the PCM1738's internal registers with the data currently selected in the application windows. Exit closes the application.

The Window menu includes four selections: Attenuation control, Operation control, Function control, and Register read. The following sections provide an explanation of each window.

- **HOLD and PASS**

Each window has a button near the top which is labeled either HOLD or PASS. The current setting is toggled by clicking on this button. When set to HOLD, the settings in a window can be changed, but are not written to the register(s) until the OK button (which appears at the bottom of the window) is pressed.

When set to PASS, any setting changes made in a window are immediately written to the corresponding register(s).

- **function control**

Enable operation and function control of the DEM–DAI1738 are shown in the following table.

**Table 5. Function Control**

| FUNCTION                                                                                                                                                | DEFAULT                           | REGISTER                                               | BIT                                      |
|---------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------|--------------------------------------------------------|------------------------------------------|
| <b>Functions available for both write and read</b>                                                                                                      |                                   |                                                        |                                          |
| Digital attenuation control<br>0 dB to 120 dB and mute, 0.5 dB step                                                                                     | 0 dB                              | Register 16 for L-channel<br>Register 16 for L-channel | ATL[7:0]<br>ATR[7:0]                     |
| Attenuation load control<br>Disable, enable                                                                                                             | Attenuation disable               | Register 18                                            | ATLD                                     |
| Attenuation speed selection<br>$\times 1 f_s$ speed selection                                                                                           | $\times 1 f_x$                    | Register 19                                            | ATS[1:0]                                 |
| Soft mute control<br>Mute disable, enable                                                                                                               | Mute disable                      | Register 18                                            | MUTE                                     |
| Infinite zero mute control<br>Disable, enable                                                                                                           | Disable                           | Register 19                                            | INZD                                     |
| Input audio data format selection<br>16/20/24-bit standard (right-justified)<br>24-bit MSB-first left-justified<br>16/24-bit standard (right-justified) | 16-bit standard format            | Register 18                                            | FMT[2:0]                                 |
| De-emphasis control<br>Disable, enable                                                                                                                  | De-emphasis disable               | Register 18                                            | DME                                      |
| Sampling rate selection for de-emphasis<br>Disable, 44.1 kHz, 48 kHz, 32 kHz                                                                            | De-emphasis disable               | Register 18                                            | DMF[1:0]                                 |
| Digital filter rolloff selection<br>Sharp rolloff, slow rolloff                                                                                         | Sharp rolloff                     | Register 19                                            | FLT                                      |
| Output phase reversal<br>Normal, reverse                                                                                                                | Normal                            | Register 19                                            | REV                                      |
| DAC operation control<br>Enable, disable                                                                                                                | DAC operation enabled             | Register 19                                            | OPE                                      |
| System clock (SCKO) output control<br>Output enable, disable                                                                                            | Output enabled                    | Register 19                                            | CLKE                                     |
| System clock (SCKO) rate control<br>SCK1, SCK2                                                                                                          | SCKI                              | Register 19                                            | CLKD                                     |
| System reset control<br>Reset operation, normal operation                                                                                               | Normal operation                  | Register 20                                            | SRST                                     |
| Mode register reset control<br>Reset operation, normal operation                                                                                        | Normal operation                  | Register 20                                            | MRST                                     |
| Digital filter bypass control<br>DF enable, DF bypass                                                                                                   | DF enabled                        | Register 20                                            | DFTH                                     |
| Delta-Sigma oversampling rate selection<br>$\times 64 f_s$ , $\times 128 f_s$ , $\times 32 f_s$                                                         | $\times 64 f_s$                   | Register 20                                            | OS[1:0]                                  |
| Delta-Sigma order selection<br>3rd order, 5th order                                                                                                     | 3rd order                         | Register 20                                            | DSOS                                     |
| Monaural mode selection<br>Stereo, monaural                                                                                                             | Stereo                            | Register 20                                            | MONO                                     |
| Channel selection of monaural mode data<br>L-channel, R-channel                                                                                         | L-channel                         | Register 20                                            | CHSL                                     |
| <b>Functions available only for read</b>                                                                                                                |                                   |                                                        |                                          |
| Zero-detection flag<br>Not zero, zero detected                                                                                                          | Not-zero = 0<br>Zero detected = 1 | Register 21                                            | ZFGL for L-channel<br>ZFGR for R-channel |

- PCM1738 demonstration software window

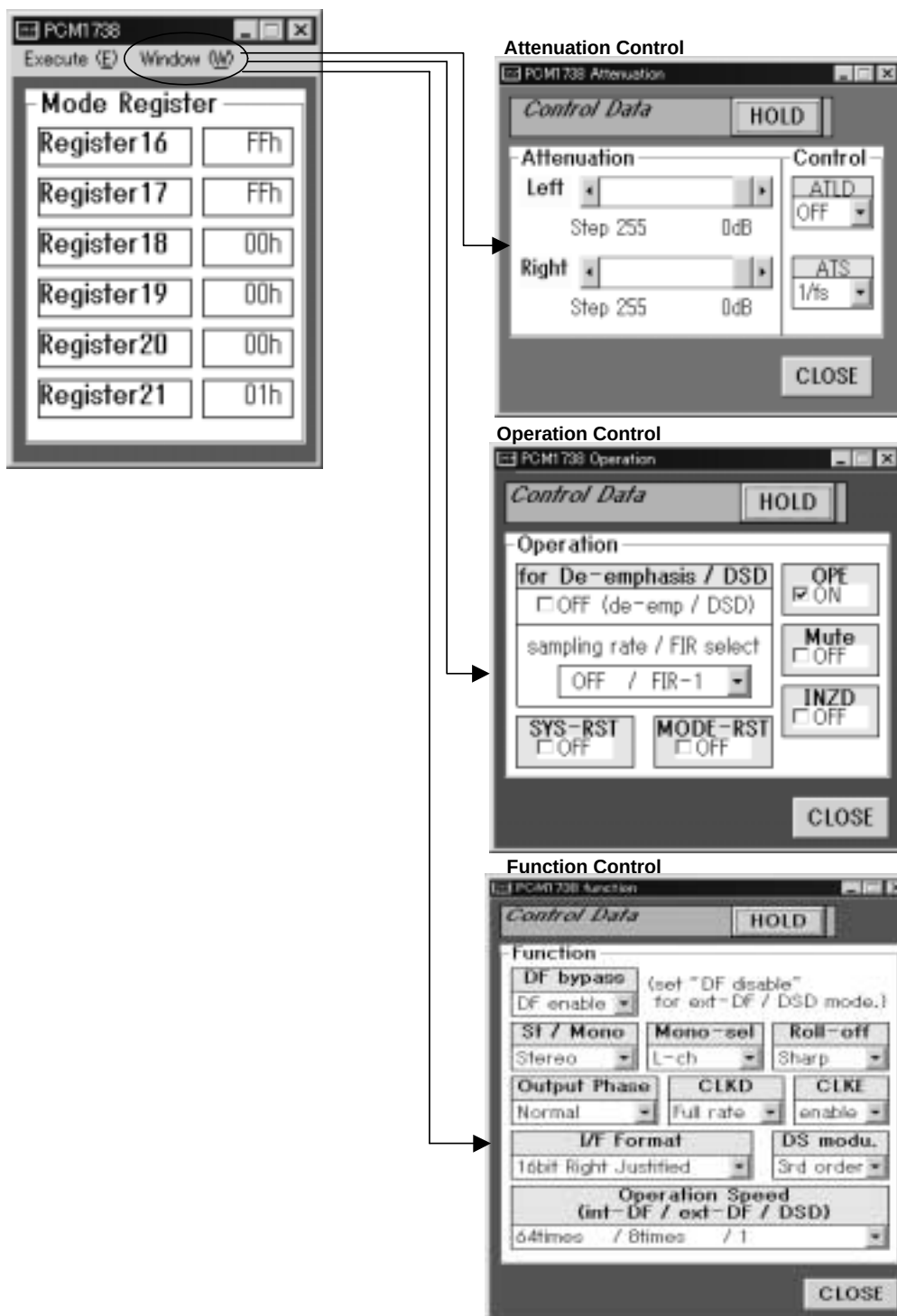


Figure 16. Demonstration Software Window



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Mailing Address:

Texas Instruments  
Post Office Box 655303  
Dallas, Texas 75265