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DEM-PCM1792, DEM-DSD1792, DEM-PCM1794, DEM-DSD1794 EVM Board

User's Guide

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During normal operation, some circuit components may have case temperatures greater than 55°C. The EVM is designed to operate properly with certain components above 55°C as long as the input and output ranges are maintained. These components include but are not limited to linear regulators, switching transistors, pass transistors, and current sense resistors. These types of devices can be identified using the EVM schematic located in the EVM User's Guide. When placing measurement probes near these devices during operation, please be aware that these devices may be very warm to the touch.

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Read This First

About This Manual

This document provides a description and instructions for use of an EVM board for the PCM1792, DSD1792, PCM1794, and DSD1794 stereo audio DACs.

How to Use This Manual

This document contains the following chapters:

❑ Chapter 1—Description

❑ Chapter 2—Schematic and Printed-Circuit Board

Related Documentation From Texas Instruments

❑ *DSD1792 24-Bit, 192-kHz Sampling, Advanced Segment, Audio Stereo Digital-to-Analog Converter* data sheet, SLES067

❑ *PCM1792 24-Bit, 192-kHz Sampling, Advanced Segment, Audio Stereo Digital-to-Analog Converter* data sheet, SLES069

❑ *DSD1794 24-Bit, 192-kHz Sampling, Advanced Segment, Audio Stereo Digital-to-Analog Converter* data sheet, SLES077

❑ *PCM1794 24-Bit, 192-kHz Sampling, Advanced Segment, Audio Stereo Digital-to-Analog Converter* data sheet, SLES080

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This equipment is intended for use in a laboratory test environment only. It generates, uses, and can radiate radio frequency energy and has not been tested for compliance with the limits of computing devices pursuant to subpart J of part 15 of FCC rules, which are designed to provide reasonable protection against radio frequency interference. Operation of this equipment in other environments may cause interference with radio communications, in which

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Description

The DEM-PCM/DSD1792/1794 is an evaluation module for the PCM1792 (DEM-PCM1792), DSD1792 (DEM-DSD1792), PCM1794 (DEM-PCM1794) and DSD1794 (DEM-DSD1794) stereo audio DACs. For the PCM devices, this EVM board accepts 24-bit linear PCM data at sampling rates up to $f_S = 96$ kHz via the S/PDIF interface. For the non-S/PDIF interface, at a sampling rate of $f_S = 192$ kHz, 24-bit PCM data or 64-f_S, 1-bit DSD data can be interfaced directly at a connector on the board.

The DEM-PCM/DSD1792/1794 uses an NE5534 op amp for I/V conversion in the analog output circuit to obtain excellent audio performance. There are three analog signal output functions onboard as 2-V rms single-ended (RCA), 4.5-V rms single-ended (RCA), and 9-V rms balanced (XLR).

The DEM-PCM/DSD1792/1794 is operated by a $\pm$15-V analog power supply, 5-V DAC power supply and 5-V digital power supply. A single 5-V power supply can be used to power the DAC and digital circuitry by setting a jumper connection, but to obtain the specified audio performance, use of separate power supplies is recommend.

Typical audio performance is as follows:
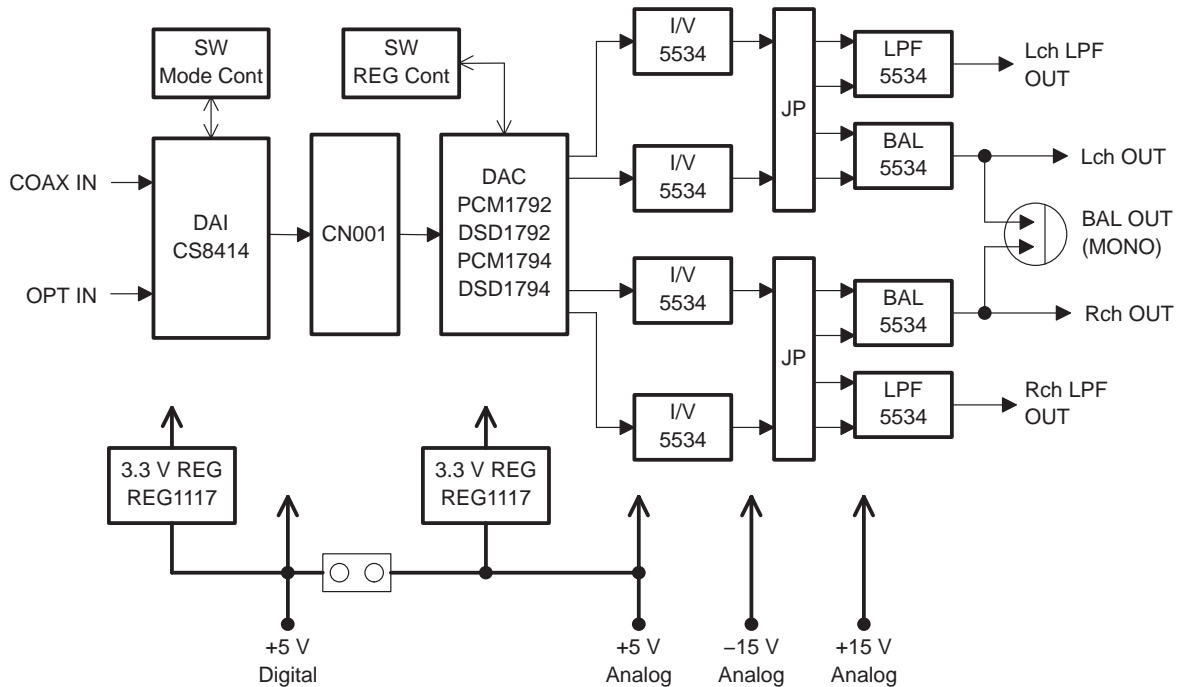
   THD+N = 0.0004%

   Dynamic range (EIAJ) = 128 dB (4 V rms)

   Dynamic range (EIAJ) = 125 dB (2 V rms)

1.1 Block Diagram

Figure 1−1. DEM-PCM/DSD1792/1794 Block Diagram

1.2 DEM-PCM/DSD1792/1794 Power Supply Connection

❑ Connect the ±15-V analog power supply to TM5 (−VA), TM6 (AGND), and TM7 (+VA). Power supply current is typically ±40 mA, maximum ±70 mA.

❑ Connect the 5-V DAC power supply to TM4 (+VCC) and TM3 (AGND). A 3.3-V regulator IC is connected to provide a 3.3-V power supply for the DAC device. Power supply current is typically 50 mA, maximum 60 mA (at f_S = 44.1 kHz).

❑ Connect the 5-V digital power supply at TM2 (+VDD) and TM1 (DGND). A 3.3-V regulator IC is connected to provide a 3.3-V logic supply to the digital section. Power supply current is typically 70 mA, max +120 mA.

❑ Jumper JP-P is for the selection of separate 5-V +VCC and +VDD power supplies, or a common 5-V power supply.

■ 1−2: Separate power supplies

■ 3−4: Common power supply; connect 5 V to either TM4 (+VCC) or TM2 (+VDD).

1.3 S/PDIF Connection

Connect the S/PDIF interface at either PJ-1 (RCA phono jack, coaxial cable) or U001 (optical cable). The DEM-PCM/DSD1792/1794 accepts sampling rates up to f_S = 96 kHz at the S/PDIF interface. The optical input or coaxial input is automatically detected by the DAI receiver. For the f_S = 192-kHz

sampling audio data interface, the interface signal can be connected at the right side of the CN001 connector or at ext-xxxx of CN004 (not mounted).

1.4 Audio Output Connection

The audio output signal can be obtained on either the RCA stereo pin jacks or the XLR connector. The audio output signal level and format are selected by jumper, using the jumper connections listed in Section 1.5.5.

❑ Connect RCA cables at either PJ-3 and PJ-5 (2 V rms, L ch/R ch) or PJ-2 and PJ-4 (4.5 V rms L ch/R ch) for stereo mode operation.

❑ CN-M (XLR connector) is a 9-V rms mono output for the mono operation mode of the PCM/DSD1792.

1.5 Configuration Control

1.5.1 DAI Receiver Data Format

Switches SW001 through SW003 are used to set the DAI receiver output audio interface format as shown in Table 1–1. The initial (default) format of the PCM1792/DSD1792 is I^2S format.

Table 1–1. Digital Audio Receiver Configuration

SW001	SW002	SW003	Receiver Output Data Format
L	L	L	16- to 24-bit left-justified
L	H	L	16- to 24-bit I^2S
H	L	H	16-bit right-justified (or standard)
L	H	H	18-bit right-justified (or standard)

1.5.2 Reset of DAI Receiver IC

Switch SW004 is a normally-open, momentary-contact pushbutton switch used to reset the digital audio receiver when necessary.

1.5.3 DAI Interface Selection

The demonstration board also supports direct interfacing to audio decoders and signal processors via connector CN004 (unpopulated). SCLK, BCK, LRCK, and DATA are available and buffered by U005. Switch SW005 is used to select between the digital audio receiver and connector CN004 as the source of the audio interface. Table 1–2 shows the available switch settings.

Table 1–2. Digital Audio Source Selection

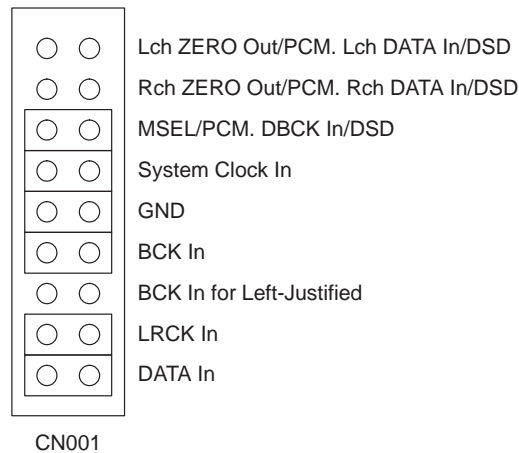| SW005 Setting	Source Selection
INT	Digital audio receiver (U002)
EXT	Connector CN004 via buffer U005

CN004 is not supplied. However, the board has the necessary wiring and holes so that the user can mount the connector if desired.

1.5.4 PCM Audio/DSD Interface

Connector CN001 allows selection of the audio data interface connection by jumper settings. In the case of a linear PCM audio data interface between the DAI receiver and the PCM/DSD1792/1794 DAC, system clock, BCK, LRCK, DATA and GND should be jumper connected. The MSEL jumper connection is for the selection of SPI/I^{2}C register control on the PCM1792. In the case of a DSD audio data interface between the DSD decoder LSI and the DSD1792 DAC, DSDL, DSDR, DBCK and system clock should be connected at right side pins of CN001. The MSEL jumper must be connected (to GND) for SPI mode operation of the PCM1792.

Figure 1−2. CN001 Connection

Lch ZERO Out/PCM. Lch DATA In/DSD
Rch ZERO Out/PCM. Rch DATA In/DSD
MSEL/PCM. DBCK In/DSD
System Clock In
GND
BCK In
BCK In for Left-Justified
LRCK In
DATA In

CN001

1.5.5 Analog Output Selection

Jumper connections JP-1 through JP-4 are for selection of the analog output function. Jumper connections JP-1 through JP-4 must all have either pins 1−2 connected or pins 3−4 connected.

❏ 1−2: 4.5-V rms single-ended output (PJ-2, PJ-4) and 9-V rms balanced output (CN-M)

■ Cutoff frequency of this analog output circuit is 200 kHz

❏ 3−4: 2-V rms single-ended output (PJ-1, PJ-3)

■ Cutoff frequency of this second-order active post-LPF analog output circuit is 70 kHz.

1.5.6 Hardware Control Switches S01−S07

Switches S01−S07 are hardware controls for the PCM1794. S01 is a reset control for both PCM/DSD1792 and PCM/DSD1794. S02, S03, S05 and S06 are for audio format selection as shown in Table 1−3. Switches S02−S07 must be set to the N position for the PCM/DSD1792 and DSD1794.

S01	RESET	H: Normal Operation	L: RESET
S02	FMT1	Audio format select	
S03	FMT0	Audio format select	

S04	MUTE	H: MUTE ON	L: MUTE OFF
S05	DEM	H: De-emphasis ON	L: De-emphasis OFF
S06	CHSL	Audio format select	
S07	MONO	Audio format select	

Table 1–3. Audio Data Format Select

MONO	CHSL	FMT1	FMT0	FORMAT	STEREO/MONO	DF ROLLOFF
0	0	0	0	I^2S	Stereo	Sharp
0	0	0	1	LJF	Stereo	Sharp
0	0	1	0	Standard, 16-bit	Stereo	Sharp
0	0	1	1	Standard, 24-bit	Stereo	Sharp
0	1	0	0	I^2S	Stereo	Slow
0	1	0	1	LJF	Stereo	Slow
0	1	1	0	Standard, 16-bit	Stereo	Slow
0	1	1	1	DF bypass	Mono	–
1	0	0	0	I^2S	Mono, L-channel	Sharp
1	0	0	1	LJF	Mono, L-channel	Sharp
1	0	1	0	Standard, 16-bit	Mono, L-channel	Sharp
1	0	1	1	Standard, 24-bit	Mono, L-channel	Sharp
1	1	0	0	I^2S	Mono, R-channel	Sharp
1	1	0	1	LJF	Mono, R-channel	Sharp
1	1	1	0	Standard, 16-bit	Mono, R-channel	Sharp
1	1	1	1	DF bypass	Mono, R-channel	Sharp

1.5.7 CN-2 I^2C Interface/Zero Out

CN-2 is the I^2C control interface connector and zero output.

Figure 1–3. CN-2 Connection


SDA/ZERO
SCL
ADRI
ADRO
GND

CN–2
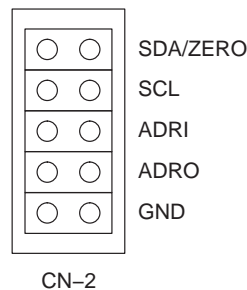
1.6 Demo Software

Demonstration software is provided to control the PCM1792/DSD1792 internal register using a PC under Microsoft™ Windows™. The software uses a printer cable to connect between the PC and connector CN003 on the DEM-PCM/DSD1792.

Demonstration software includes a total five files in the DEM1792 directory. These files are:

❏ DEM1792.exe
❏ DEM1792.ini
❏ Vbrjp200.dll
❏ Ver.dll
❏ Inpout.dll

Copy these files to a convenient directory (folder) such as C:\DEM1792.

Then, change the printer-port address in DEM1792.ini to &H378, &H278, or &H3BCO (Most PCs use &H378 as the default printer port address.)

Top menu   Function window

Operation window   Attenuation window
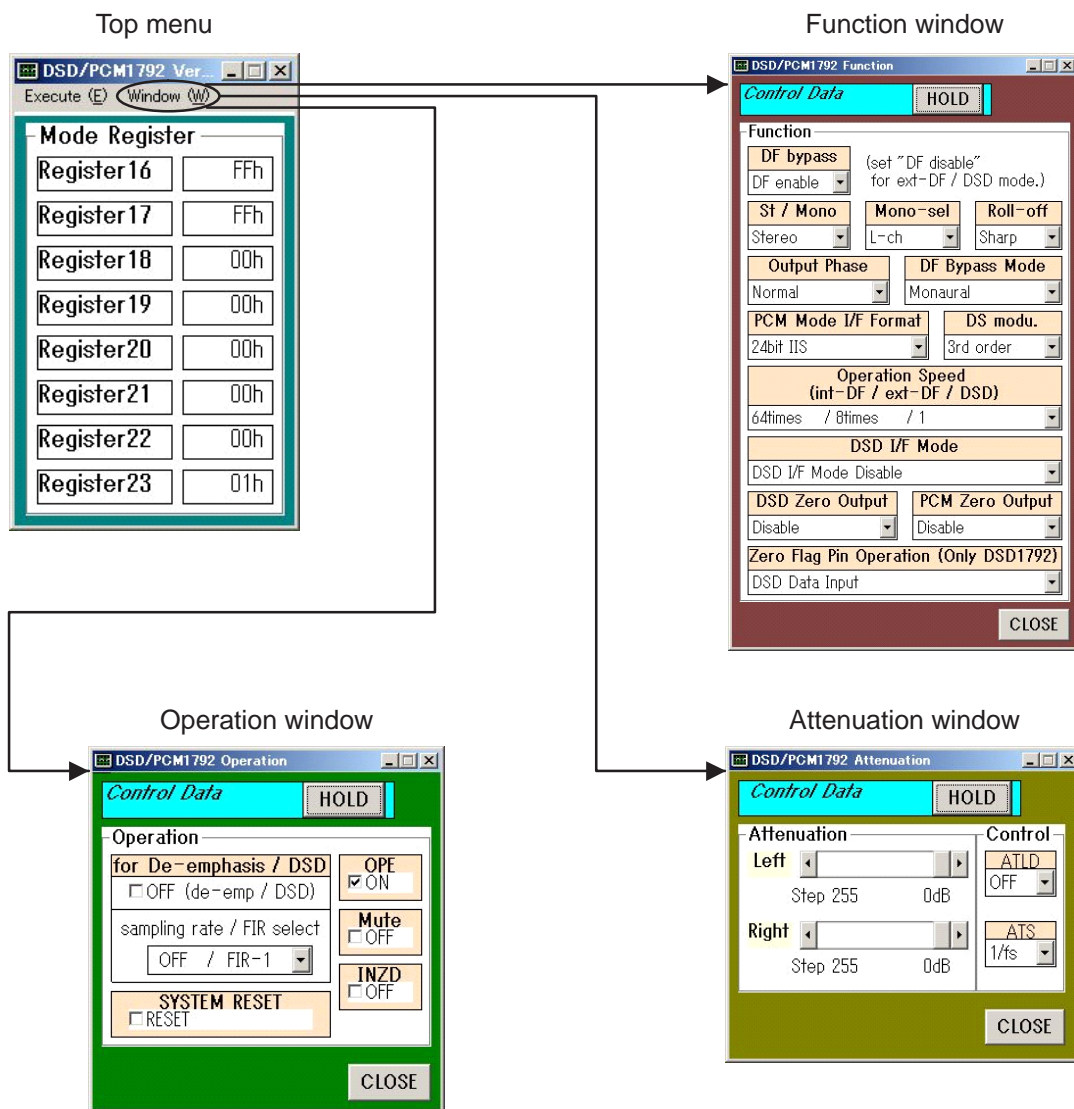
1.7 DEM-PCM/DSD1792/1794 Parts List (BOM)

Ref No.	Value	Part Type	Part Name	Manufacturer
C001	0.01 µF	Film capacitor	AMFF0050J103	Nissei
C002	0.01 µF	Film capacitor	AMFF0050J103	Nissei
C003	10 µF/16 V	AL electrolytic capacitor	ROA-16V100M	ELNA
C004, 006	0.1 µF	Film capacitor	AMFF0050J104	Nissei
C005	10 µF/16 V	AL electrolytic capacitor	ROA-16V100M	Nissei
C007	10 µF/16 V	AL electrolytic capacitor	ROA-16V100M	ELNA
C008	0.1 µF	Film capacitor	AMFF0050J104	Nissei
C009	0.068 µF	Film capacitor	AMFF0050J683	Nissei
C010	0.1 µF	Ceramic capacitor	D55Y5V1H104A	NEC
C011	0.1 µF	Ceramic capacitor	D55Y5V1H104A	NEC
C012	10 µF/16 V	AL electrolytic capacitor		
C013	0.1 µF	Ceramic capacitor	D55Y5V1H104A	NEC
C014	0.1 µF	Ceramic capacitor	D55Y5V1H104A	NEC
C015	100 µF/16 V	AL electrolytic capacitor	ROA-16V101M	ELNA
C016	0.1 µF	Film capacitor	AMFF0050J104	Nissei
CA1, 3	10 µF/16 V	AL electrolytic capacitor	Cerafine	ELNA
CA5–8	10 µF/16 V	AL electrolytic capacitor	Cerafine	ELNA
CA2, 4, 9	0.047 µF	Film capacitor	APFF	Nissei
CA10–13	22 pF	Ceramic capacitor		
CA18, 19	22 pF	Ceramic capacitor		
CA26, 27	22 pF	Ceramic capacitor		
CA14–17	2700 pF	Film capacitor	APSF0100J272	Nissei
CA20, 23	8200 pF	Film capacitor	APSF0100J822	Nissei
CA21, 22	1800 pF	Film capacitor	APSF0100J182	Nissei
CA24, 25	1800 pF	Film capacitor	APSF0100J182	Nissei
CF1–4	2200 pF	Film capacitor	APSF0100J222	Nissei
CN001		18-pin connector	FFC-18BMEP1	Honda Tsushin
CN002		2-pin connector	FFC-2BMEP1	Honda Tsushin
CN003		L connector	57LE40360-7700(D3)	Daiichi Denshi
CN-M		XLR connector	NC3MAH-0	Meutrick
CP1, 2, 3	220 µF/25 V	AL electrolytic capacitor	Cerafine	ELNA
CP4, 5, 6	0.047 µF	Film capacitor	APFF	Nissei
CP7, 8	1 µF/16 V	AL electrolytic capacitor	Cerafine	ELNA
CP9, 10	1 µF/16 V	AL electrolytic capacitor	Cerafine	ELNA
CP11–26	1 µF/16 V	AL electrolytic capacitor	Cerafine	ELNA
CPD1	220 µF/25 V	AL electrolytic capacitor	Cerafine	ELNA
CPD2	0.1 µF	Ceramic capacitor		
D001		Diode	1SS133	ROHM
FIL001	Unmounted	Unmounted	Unmounted	Unmounted
JP1–4		4-pin connector	FFC-4BMEP1	Honda Tsushin
JP-P		4-pin connector	FFC-4BMEP1	Honda Tsushin

Ref No.	Value	Part Type	Part Name	Manufacturer
L001	Unmounted	Unmounted	Unmounted	Unmounted
PJ-1		RCA connector (yellow)	LPR6520-0804	SMK
PJ-2, 3		RCA pin (white)		Wake
PJ-4, 5		RCA pin (red)		Wake
R001	75 Ω	1/8-W resistor		
R002	470 Ω	1/8-W resistor		
R003	47 kΩ	1/8-W resistor		
R004	470 Ω	1/8-W resistor		
RA001	47 kΩ ×5	Resistor array		
RA1	10 Ω	1/8-W resistor		
RA2–9	360 Ω	1/8-W resistor		
RA10, 11	100 Ω	1/8-W resistor		
RA12, 13	1.3 Ω	1/8-W resistor		
RA18, 19	1.3 Ω	1/8-W resistor		
RA14–17	620 Ω	1/8-W resistor		
RA20–23	620 Ω	1/8-W resistor		
RA24, 25	100 Ω	1/8-W resistor		
RF1–4	820 Ω	1/8-W resistor		
RP1, 2, 3, 4	22 kΩ	1/8-W resistor		
RP5	10 Ω	1/8-W resistor		
SW001		DIP SW 1-pole double	FT1D-2M	Fujisoku
SW002		DIP SW 1-pole double	FT1D-2M	Fujisoku
SW003		DIP SW 1-pole double	FT1D-2M	Fujisoku
SW004		Push SW	FP1F-2M	Fujisoku
SW005		DIP SW 2-pole double	FT2D-2M	Fujisoku
SW006		DIP SW 4-element	DSS104	Fujisoku
TM1, 3, 6		Banana jack (black)		
TM2, 4		Banana jack (red)		
TM5		Banana jack (blue)		
TM7		Banana jack (orange)		
U001		TOSLINK	TORX173/179	Toshiba
U002		Digital audio I/F receiver IC	CS8414-CS	Crystal
U003		Logic IC	TC74HC14AF	Toshiba, TI
U004		Logic IC	TC74HC32AF	Toshiba, TI
U005, U006		Logic IC	TC74VHC244F	Toshiba, TI
UA1–8		8-pin DIP IC socket		
UP1, 2		Regulator IC	REG1117-3.3	Burr-Brown/TI
		Shorting plug × 5	DIC130	Honda Tsushin
		Spacer (H:20-25 mm) × 4		

Schematic and Printed-Circuit Board

This chapter presents the DEM-PCM/DSD1792/1794 printed-circuit board and schematics.

2.1 DEM-PCM/DSD1792/1794 Printed-Circuit Board
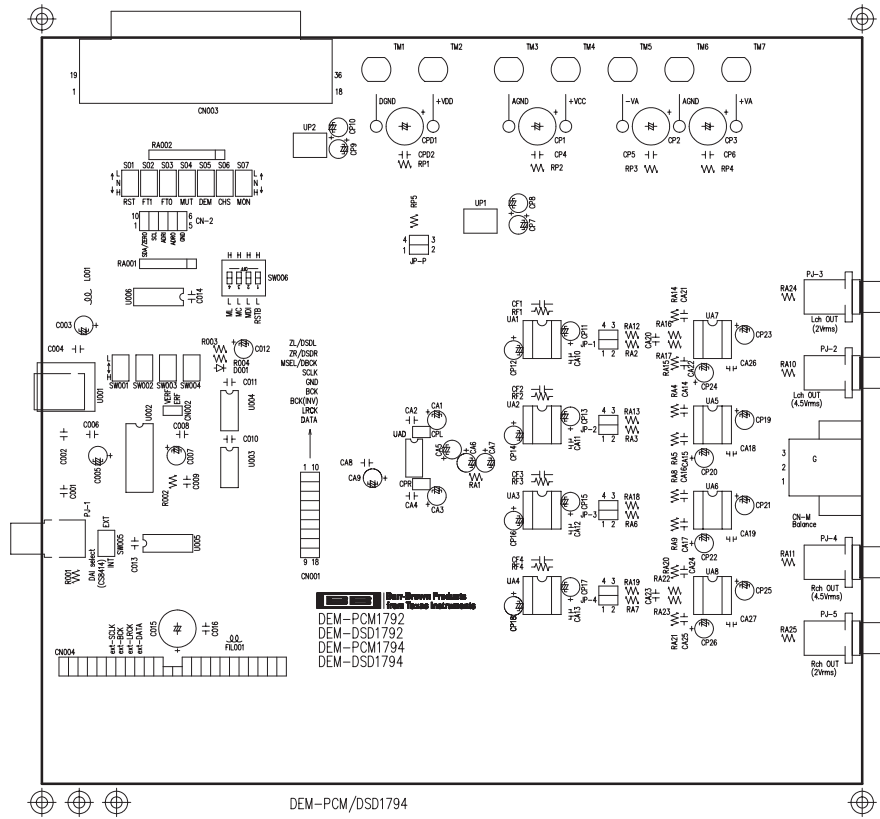
Figure 2−1. DEM-PCM/DSD1792/1794 Silkscreen

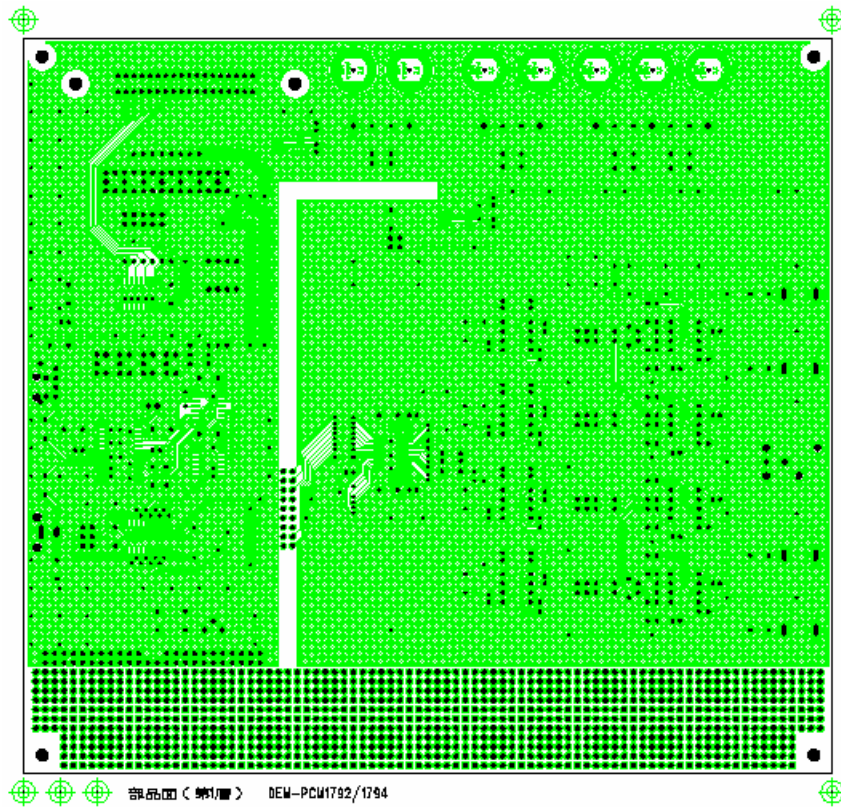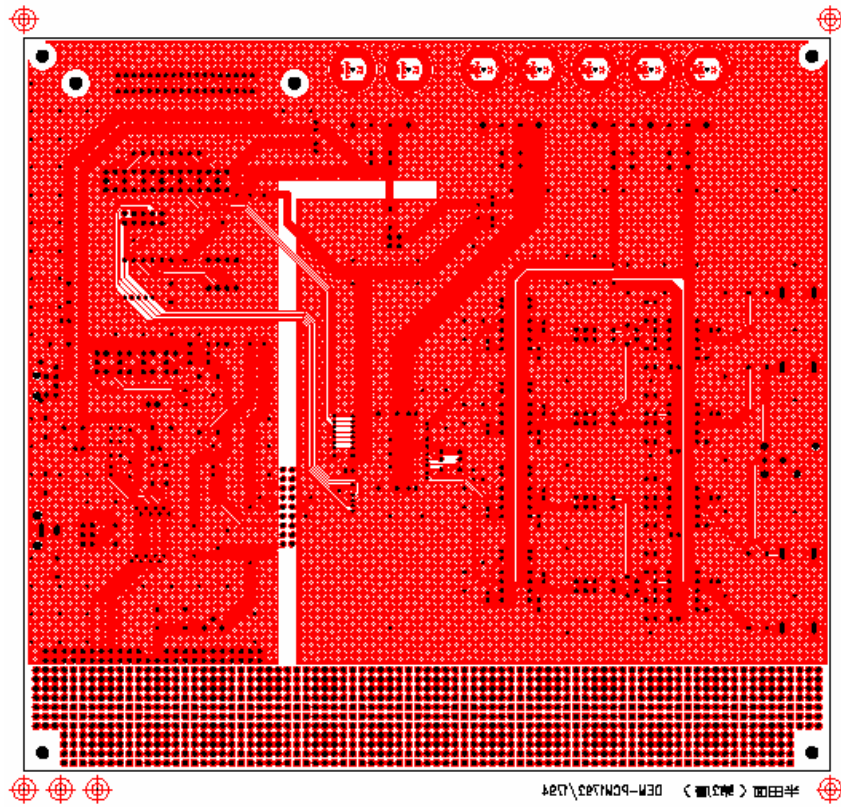*Figure 2–2. DEM-PCM/DSD1792/1794—Top View*

Figure 2–3. DEM-PCM/DSD1792/1794—Bottom View

2.2 DEM-PCM/DSD1792/1794 Schematics

Figure 2–4. DEM-PCM/DSD1792/1794 DAC, Analog Section

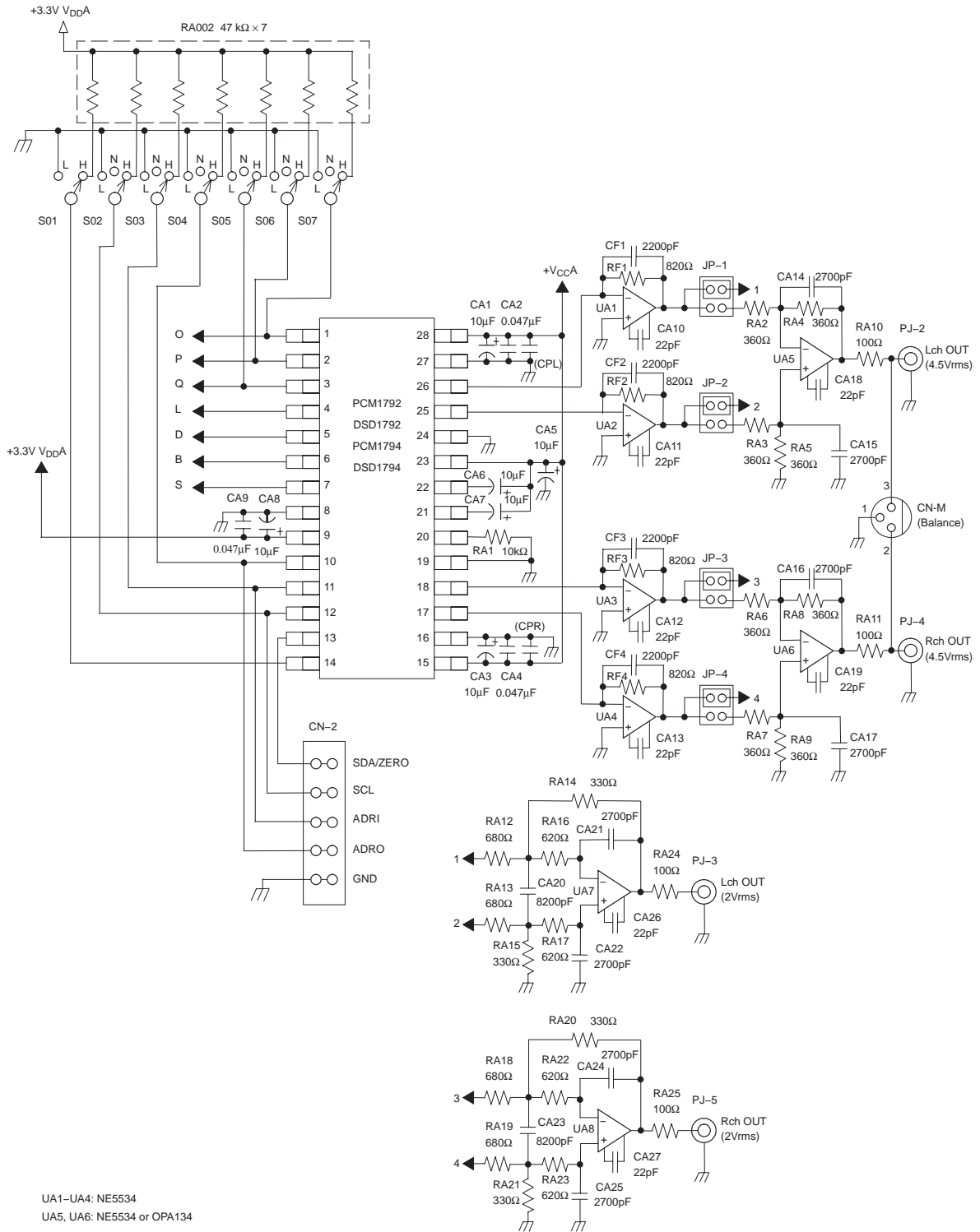UA1–UA4: NE5534
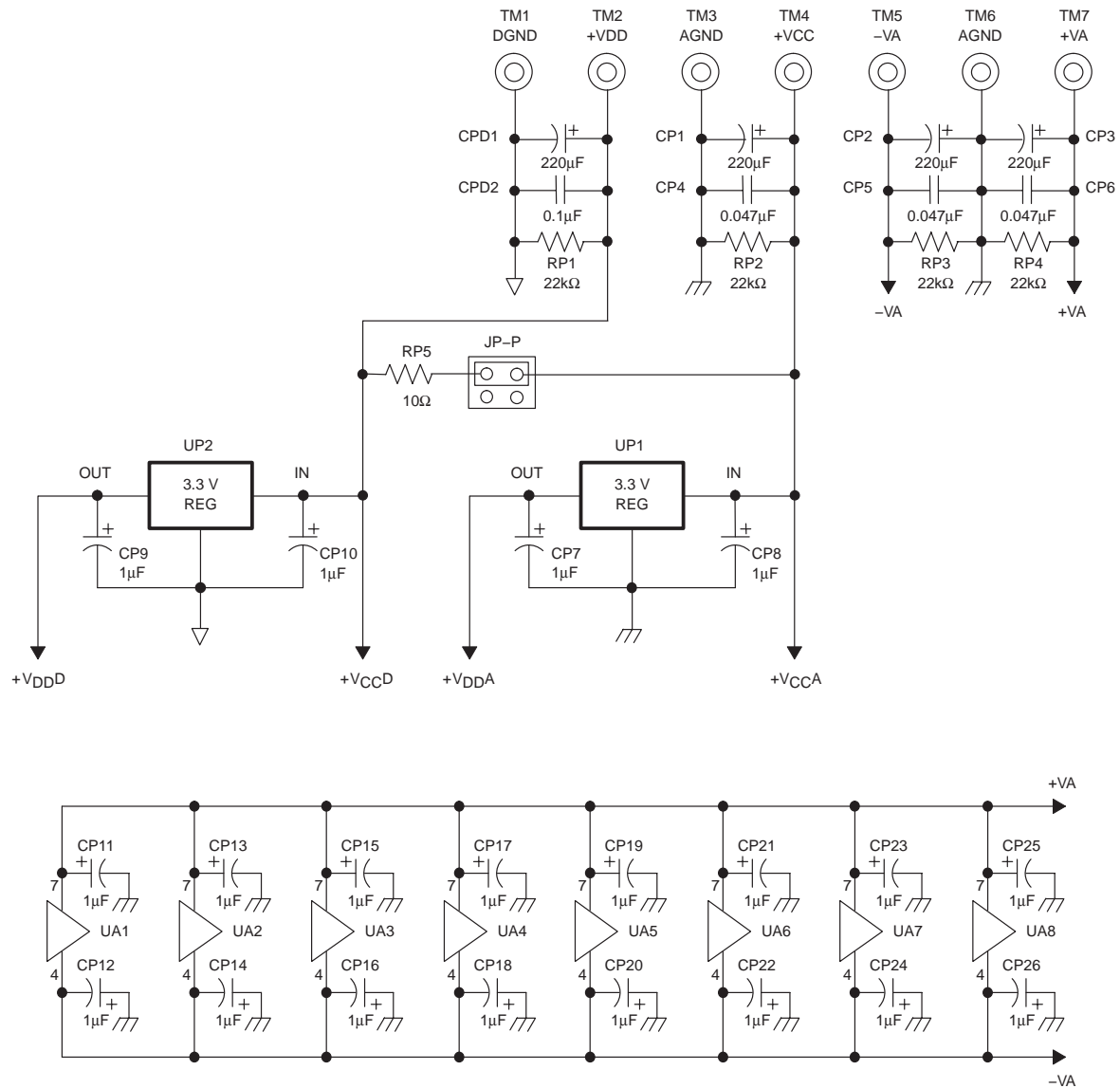UA5, UA6: NE5534 or OPA134

Figure 2–5. DEM-PCM/DSD1792/1794 Power-Supply Section

Figure 2−6. DEM-PCM/DSD1792/1794 Digital Section