

***EVM-1704***  
***Instruction Manual***

*User's Guide*

## IMPORTANT NOTICE

Texas Instruments Incorporated and its subsidiaries (TI) reserve the right to make corrections, modifications, enhancements, improvements, and other changes to its products and services at any time and to discontinue any product or service without notice. Customers should obtain the latest relevant information before placing orders and should verify that such information is current and complete. All products are sold subject to TI's terms and conditions of sale supplied at the time of order acknowledgment.

TI warrants performance of its hardware products to the specifications applicable at the time of sale in accordance with TI's standard warranty. Testing and other quality control techniques are used to the extent TI deems necessary to support this warranty. Except where mandated by government requirements, testing of all parameters of each product is not necessarily performed.

TI assumes no liability for applications assistance or customer product design. Customers are responsible for their products and applications using TI components. To minimize the risks associated with customer products and applications, customers should provide adequate design and operating safeguards.

TI does not warrant or represent that any license, either express or implied, is granted under any TI patent right, copyright, mask work right, or other TI intellectual property right relating to any combination, machine, or process in which TI products or services are used. Information published by TI regarding third-party products or services does not constitute a license from TI to use such products or services or a warranty or endorsement thereof. Use of such information may require a license from a third party under the patents or other intellectual property of the third party, or a license from TI under the patents or other intellectual property of TI.

Reproduction of information in TI data books or data sheets is permissible only if reproduction is without alteration and is accompanied by all associated warranties, conditions, limitations, and notices. Reproduction of this information with alteration is an unfair and deceptive business practice. TI is not responsible or liable for such altered documentation.

Resale of TI products or services with statements different from or beyond the parameters stated by TI for that product or service voids all express and any implied warranties for the associated TI product or service and is an unfair and deceptive business practice. TI is not responsible or liable for any such statements.

### Mailing Address:

Texas Instruments  
Post Office Box 655303  
Dallas, Texas 75265

## EVM IMPORTANT NOTICE

Texas Instruments (TI) provides the enclosed product(s) under the following conditions:

This evaluation kit being sold by TI is intended for use for **ENGINEERING DEVELOPMENT OR EVALUATION PURPOSES ONLY** and is not considered by TI to be fit for commercial use. As such, the goods being provided may not be complete in terms of required design-, marketing-, and/or manufacturing-related protective considerations, including product safety measures typically found in the end product incorporating the goods. As a prototype, this product does not fall within the scope of the European Union directive on electromagnetic compatibility and therefore may not meet the technical requirements of the directive.

Should this evaluation kit not meet the specifications indicated in the EVM User's Guide, the kit may be returned within 30 days from the date of delivery for a full refund. **THE FOREGOING WARRANTY IS THE EXCLUSIVE WARRANTY MADE BY SELLER TO BUYER AND IS IN LIEU OF ALL OTHER WARRANTIES, EXPRESSED, IMPLIED, OR STATUTORY, INCLUDING ANY WARRANTY OF MERCHANTABILITY OR FITNESS FOR ANY PARTICULAR PURPOSE.**

The user assumes all responsibility and liability for proper and safe handling of the goods. Further, the user indemnifies TI from all claims arising from the handling or use of the goods. Please be aware that the products received may not be regulatory compliant or agency certified (FCC, UL, CE, etc.). Due to the open construction of the product, it is the user's responsibility to take any and all appropriate precautions with regard to electrostatic discharge.

**EXCEPT TO THE EXTENT OF THE INDEMNITY SET FORTH ABOVE, NEITHER PARTY SHALL BE LIABLE TO THE OTHER FOR ANY INDIRECT, SPECIAL, INCIDENTAL, OR CONSEQUENTIAL DAMAGES.**

TI currently deals with a variety of customers for products, and therefore our arrangement with the user **is not exclusive**.

TI assumes **no liability for applications assistance, customer product design, software performance, or infringement of patents or services described herein**.

Please read the EVM User's Guide and, specifically, the EVM Warnings and Restrictions notice in the EVM User's Guide prior to handling the product. This notice contains important safety information about temperatures and voltages. For further safety concerns, please contact the TI application engineer.

Persons handling the product must have electronics training and observe good laboratory practice standards.

No license is granted under any patent right or other intellectual property right of TI covering or relating to any machine, process, or combination in which such TI products or services might be or are used.

Mailing Address:

Texas Instruments  
Post Office Box 655303  
Dallas, Texas 75265

## **EVM WARNINGS AND RESTRICTIONS**

It is important to operate this EVM within the input voltage range of  $\pm 15$  V and the output voltage range of  $\pm 10$  V.

Exceeding the specified input range may cause unexpected operation and/or irreversible damage to the EVM. If there are questions concerning the input range, please contact a TI field representative prior to connecting the input power.

Applying loads outside of the specified output range may result in unintended operation and/or possible permanent damage to the EVM. Please consult the EVM User's Guide prior to connecting any load to the EVM output. If there is uncertainty as to the load specification, please contact a TI field representative.

During normal operation, some circuit components may have case temperatures greater than 52°C. The EVM is designed to operate properly with certain components above 52°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.

Mailing Address:

Texas Instruments  
Post Office Box 655303  
Dallas, Texas 75265

# Read This First

---

---

---

---

### ***About This Manual***

This user's guide provides a description of the EVM-1704 evaluation module, including product specifications, board layout and silkscreening, and schematic diagrams.

### ***How to Use This Manual***

This document contains the following chapters:

Chapter 1 – *Description*

Chapter 2 – *Schematics and Printed-Circuit Board*

### ***Related Documentation From Texas Instruments***

*PCM1704 SoundPLUS™ 24-Bit, 96kHz BiCMOS Sign-Magnitude Digital-to-Analog Converter* – Literature No. SBAS097

### ***FCC Warning***

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 case the user at his own expense will be required to take whatever measures may be required to correct this interference.

### ***Trademarks***

SoundPLUS is a trademark of Texas Instruments.  
Other trademarks are the property of their respective owners.



# Contents

---

---

---

<b>1</b>	<b>Description</b>	<b>1-1</b>
1.1	Block Diagram	1-2
1.2	Power Supply Requirements	1-2
1.3	Switch and Jumper Settings	1-2
1.4	Audio Dynamic Performance ( $f_S = 44.1$ kHz, 24-Bit Data, EIAJ Method)	1-3
<b>2</b>	<b>Schematics and Printed-Circuit Board</b>	<b>2-1</b>
2.1	EVM-1704 Printed-Circuit Board	2-2
2.2	EVM-1704 Schematics	2-5
2.3	EVM-PCM1704 Schematics	2-8

# Figures

---

---

---

1-1	EVM-1704 Block Diagram	1-2
2-1	EVM-1704 Silkscreen	2-2
2-2	EVM-1704—Top View	2-3
2-3	EVM-1704—Bottom View	2-4
2-4	Digital Section Circuit Diagram	2-5
2-5	Digital Power Supply and Isolation Section Circuit Diagram	2-6
2-6	DAC/Analog Power Supply and Isolation Section Circuit Diagram	2-7
2-7	DAC and Analog Section Circuit Diagram (Lch)	2-8
2-8	DAC/Analog Section Circuit Diagram (Rch, Component Value Is Same as Lch)	2-10



# Description

---

---

---

---

The EVM-1704 is an evaluation module for Burr-Brown’s sign-magnitude 24-bit DAC, PCM1704.

The EVM-1704 is constructed using a CS8414 DAI receiver, DF1704 oversampling digital filter, ISO150 analog/digital isolator, two PCM1704s per channel for a balanced connection, an OPA627 I/V amplifier, and an OPA2134 analog output amplifier with post LPF.

The digital input uses an S/PDIF digital audio interface, with a sampling rate up to  $f_s = 96$  kHz.

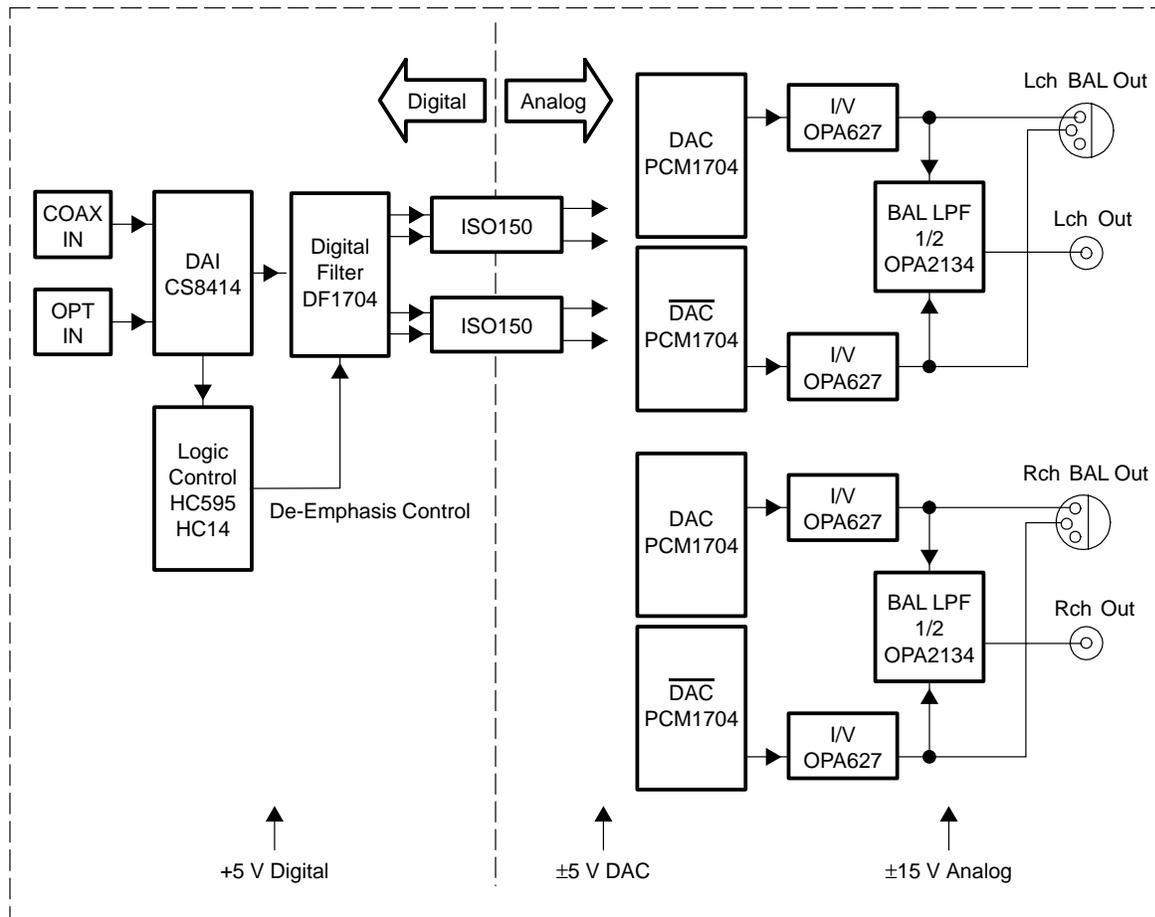
There are two types of analog output, balanced direct output without post-LPF and single-ended, post-LPF-output.

Power supply requirements are 5 V for digital,  $\pm 5$  V for the DAC, and  $\pm 12$  V to  $\pm 15$  V for analog.

<b>Topic</b>	<b>Page</b>
<b>1.1 Block Diagram</b> .....	<b>1-2</b>
<b>1.2 Power Supply Requirements</b> .....	<b>1-2</b>
<b>1.3 Audio Dynamic Performance</b> .....	<b>1-2</b>

## 1.1 Block Diagram

Figure 1–1. EVM-1704 Block Diagram



## 1.2 Power Supply Requirements

5 V digital, +V <sub>DD</sub> :	4.5 V to 5.5 V	+I <sub>DD</sub> :	70 mA typ, 100 mA max
±5V DAC, ±V <sub>CC</sub> :	±4.75V to ±5.25V	±I <sub>CC</sub> :	+52 mA, -120mA typ, +70 mA, -160 mA max
±15 V analog, ±V <sub>A</sub> :	±12V to ±15 V	±I <sub>A</sub> :	±32 mA typ, ±40 mA max

## 1.3 Switch and Jumper Settings

The EVM-1704 is designed as a D/A converter unit that can be used without any external control. The board has the following user controls installed:

- SWD1 – Pushbutton switch. Press to reset the board.
- SWD2 – Digital filter rolloff selection switch  
SLOW: slow rolloff  
FAST: fast rolloff

#### 1.4 Audio Dynamic Performance ( $f_S = 44.1$ kHz, 24-Bit Data, EIAJ Method)

THD+N at 0 dB: -100 dB typ, -97 dB max  
Dynamic range: 110 dB typ, 106 dB min  
SNR: 118 dB typ, 112 dB min



# Schematics and Printed-Circuit Board

---

---

---

---

This chapter presents the EVM-1704 printed-circuit board and schematics for the EVM-1704 and EVM-PCM1704.

<b>Topic</b>	<b>Page</b>
<b>2.1 EVM-1704 Printed-Circuit Board .....</b>	<b>2-2</b>
<b>2.2 EVM-1704 Schematics .....</b>	<b>2-5</b>
<b>2.3 EVM-PCM1704 Schematics .....</b>	<b>2-8</b>

## 2.1 EVM-1704 Printed-Circuit Board

Figure 2-1. EVM-1704 Silkscreen

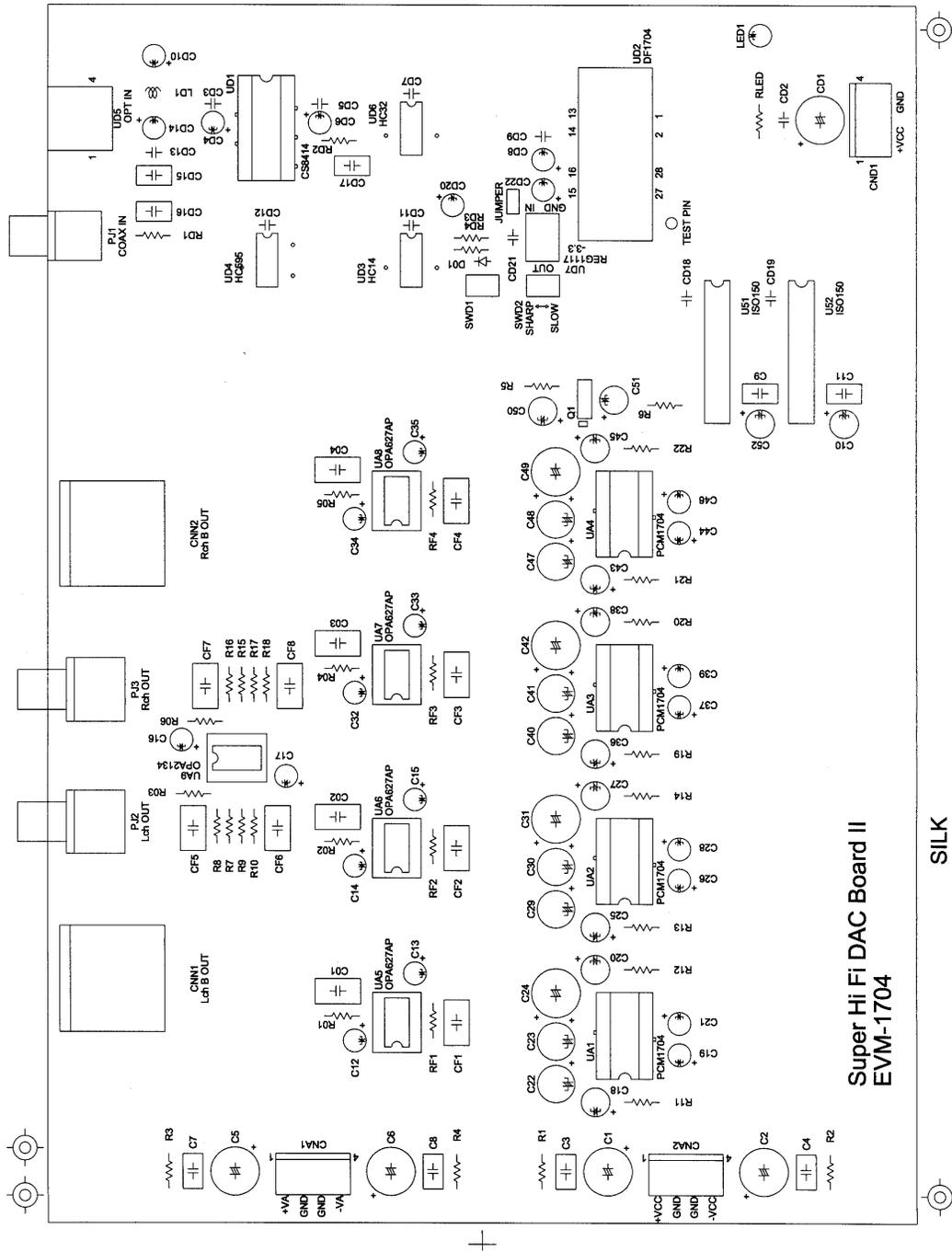


Figure 2-2. EVM-1704—Top View

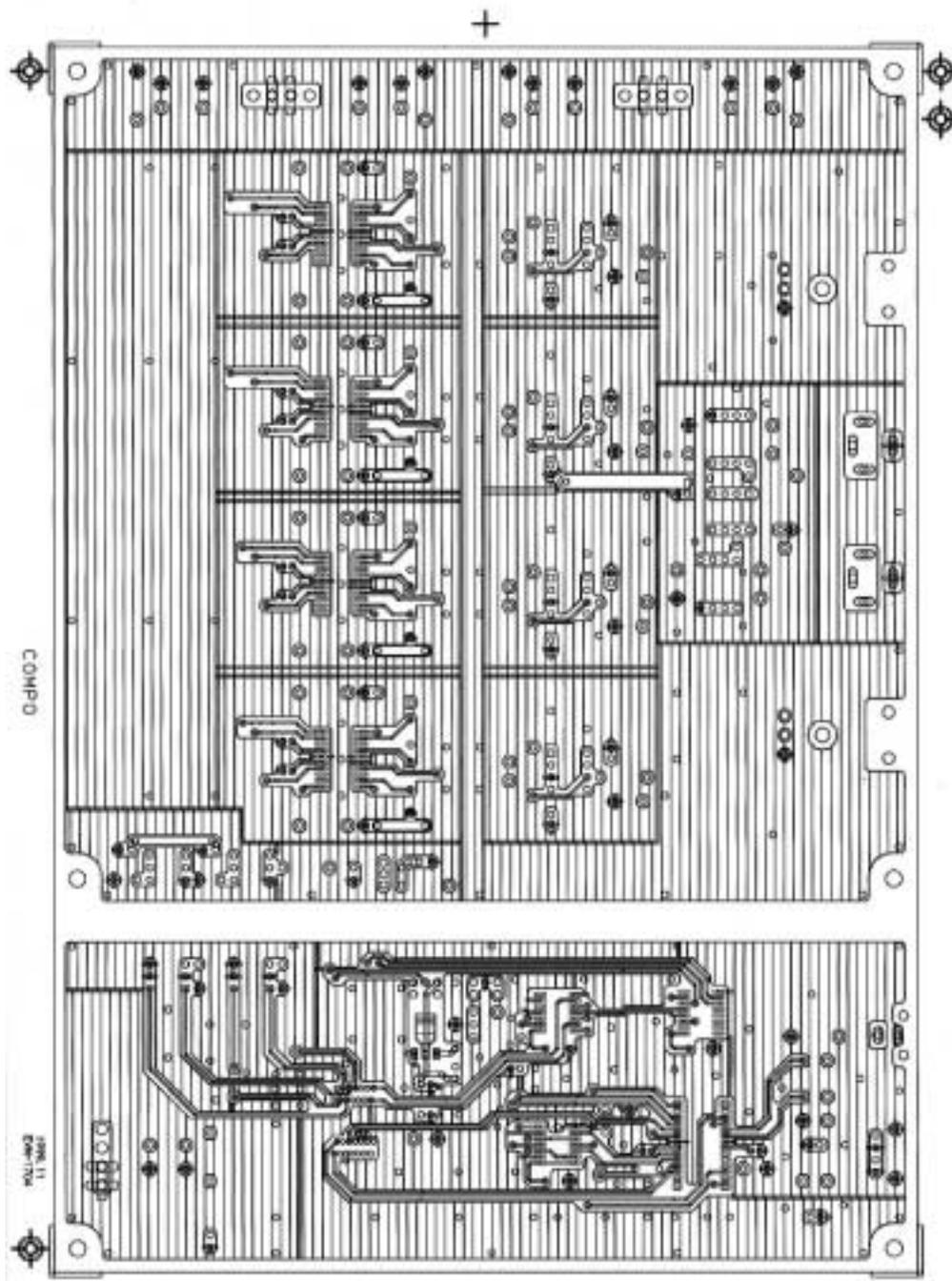
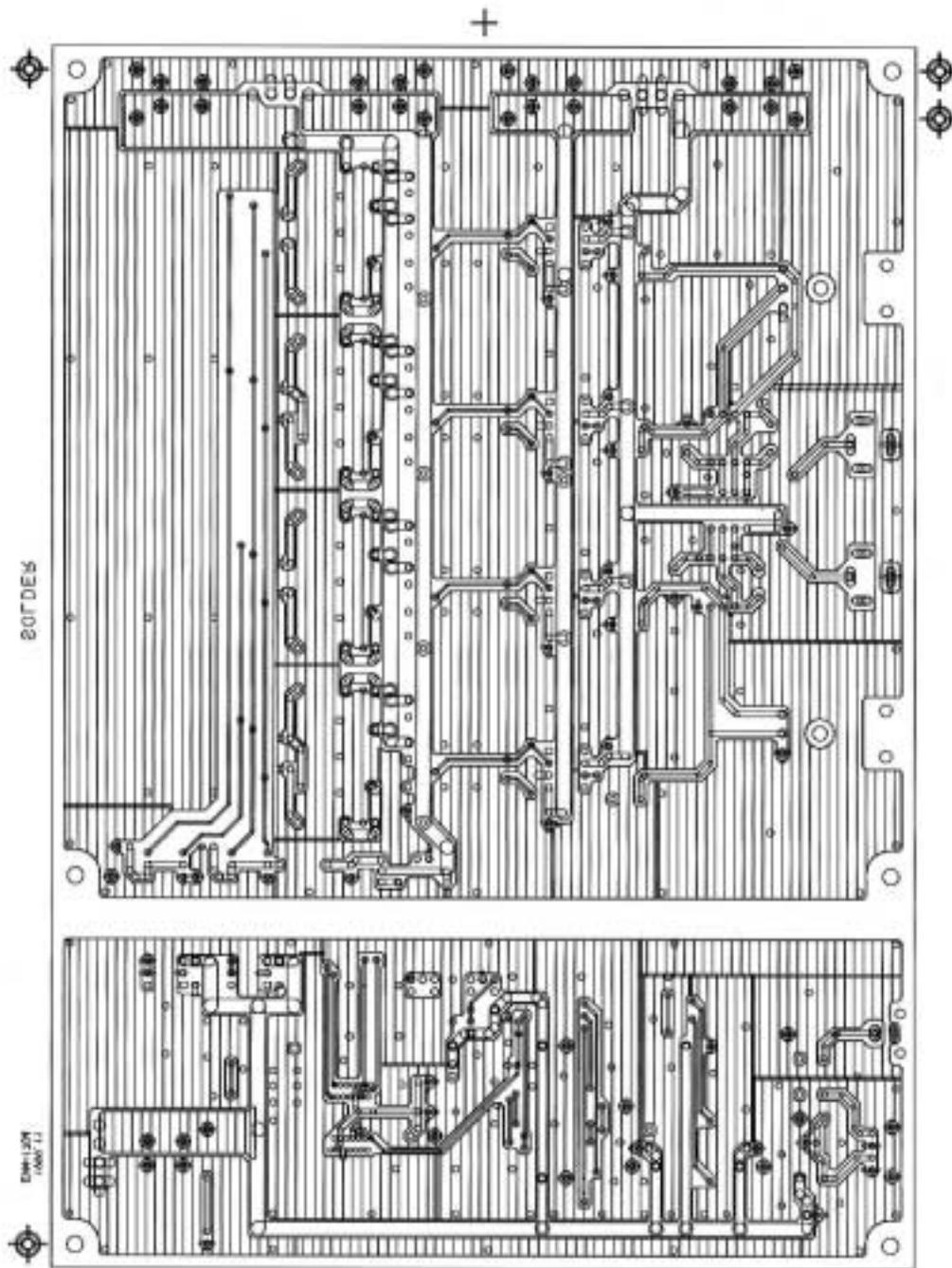


Figure 2-3. EVM-1704—Bottom View



## 2.2 EVM-1704 Schematics

Figure 2–4. Digital Section Circuit Diagram

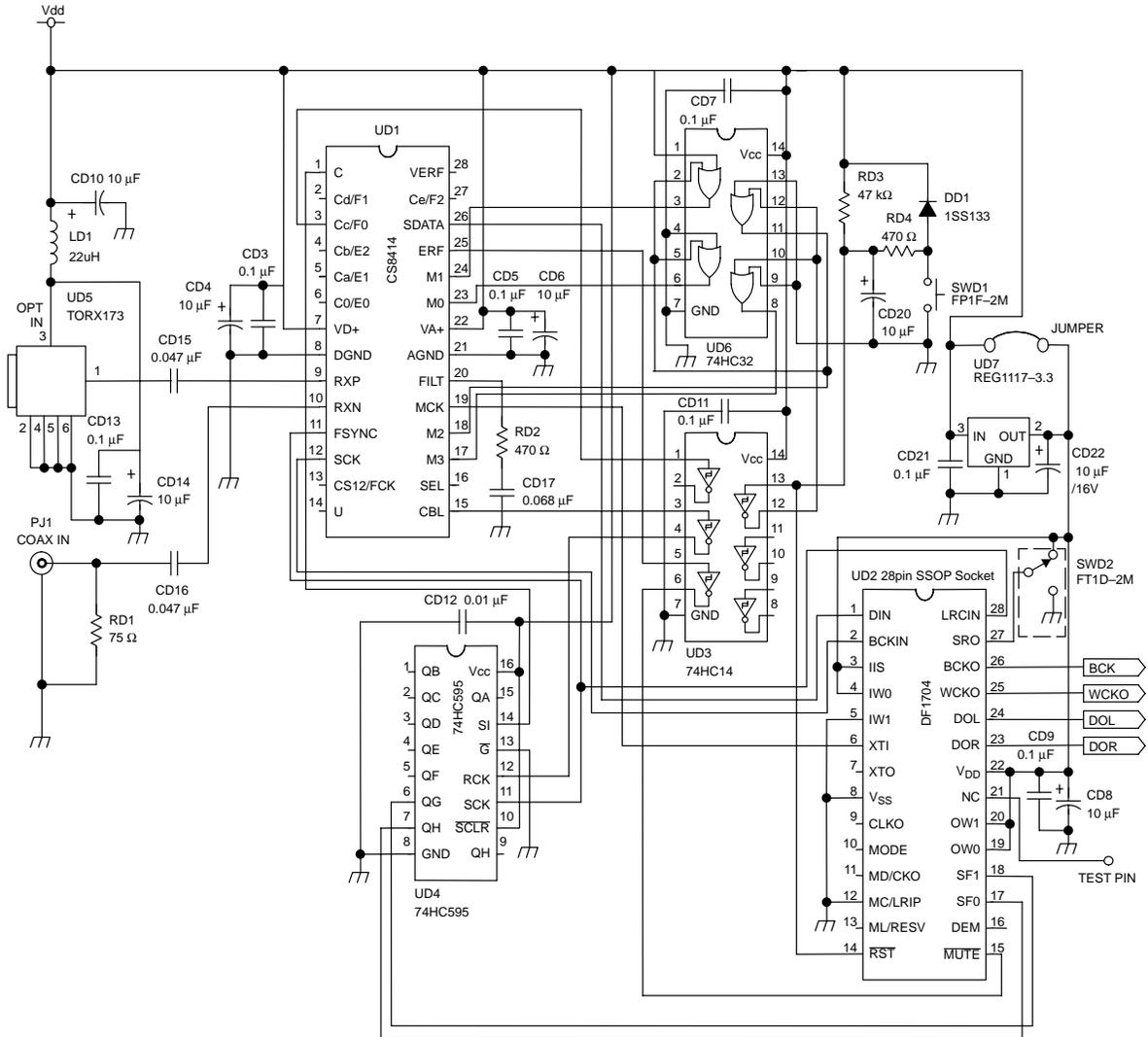


Figure 2–5. Digital Power Supply and Isolation Section Circuit Diagram

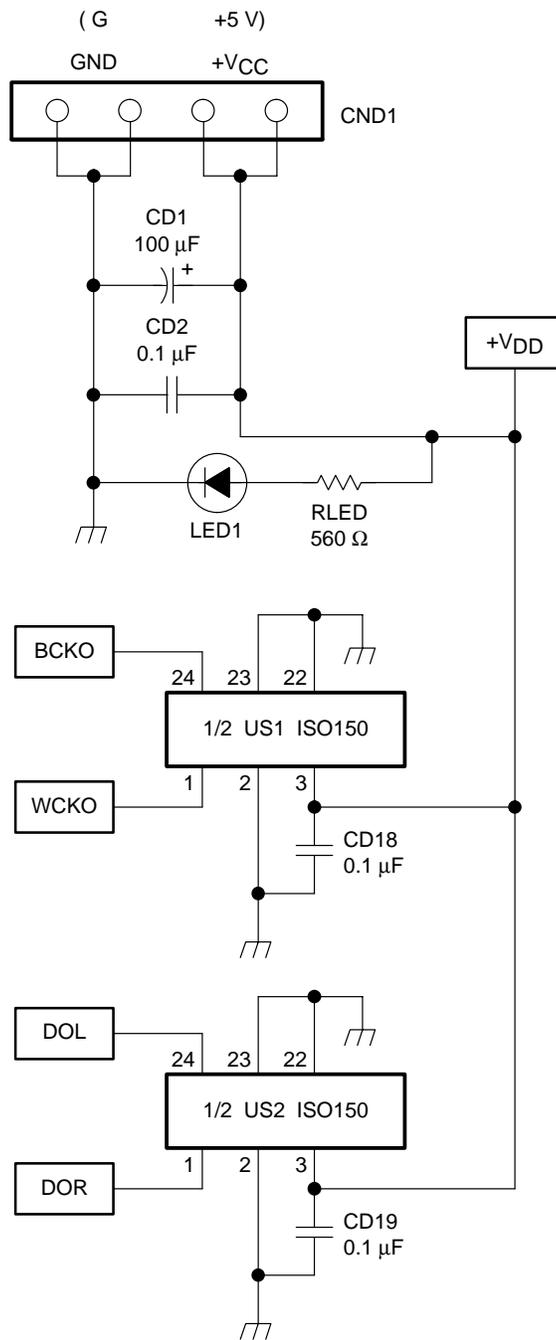
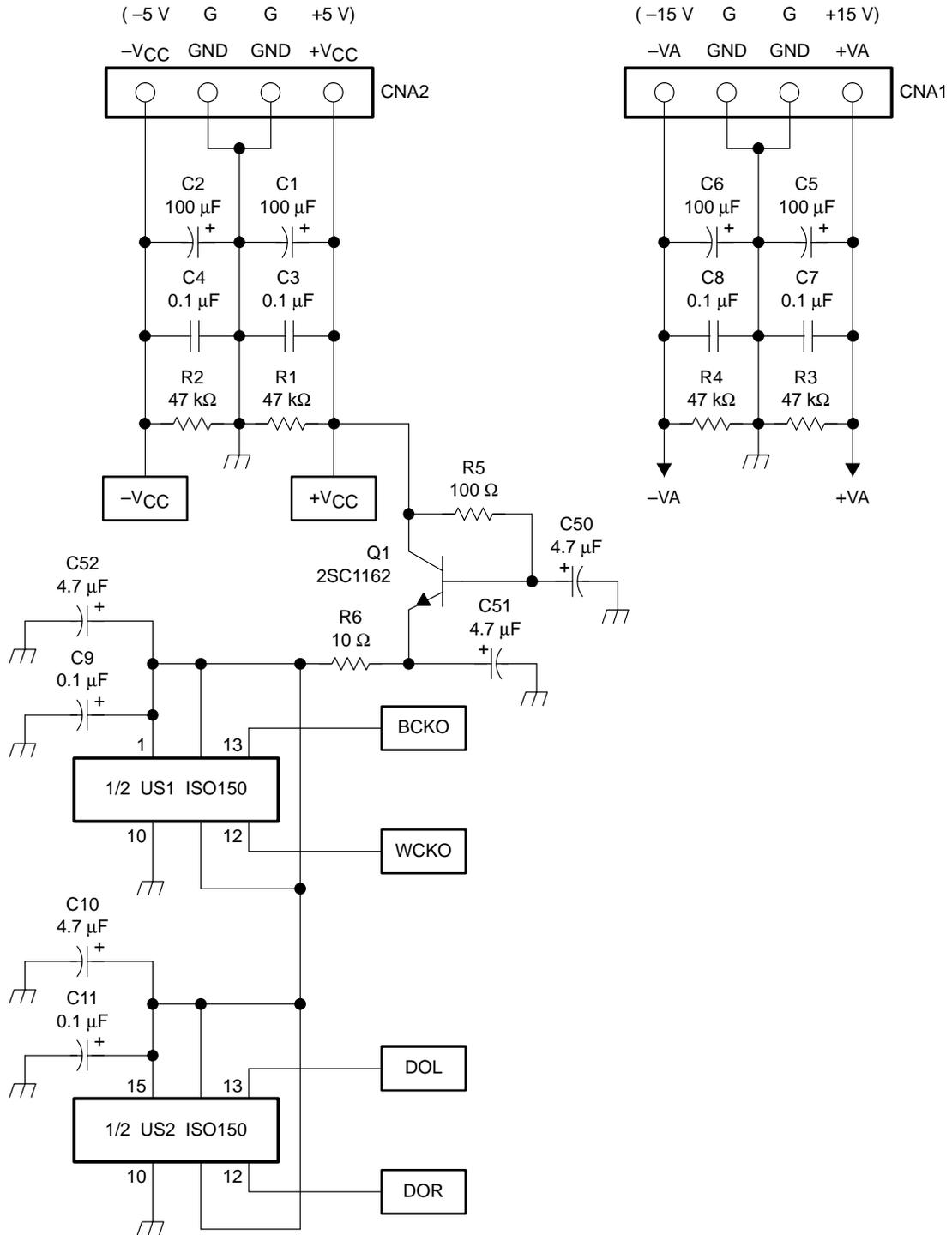


Figure 2–6. DAC/Analog Power Supply and Isolation Section Circuit Diagram



### 2.3 EVM-PCM1704 Schematics

Figure 2–7. DAC and Analog Section Circuit Diagram (Lch)

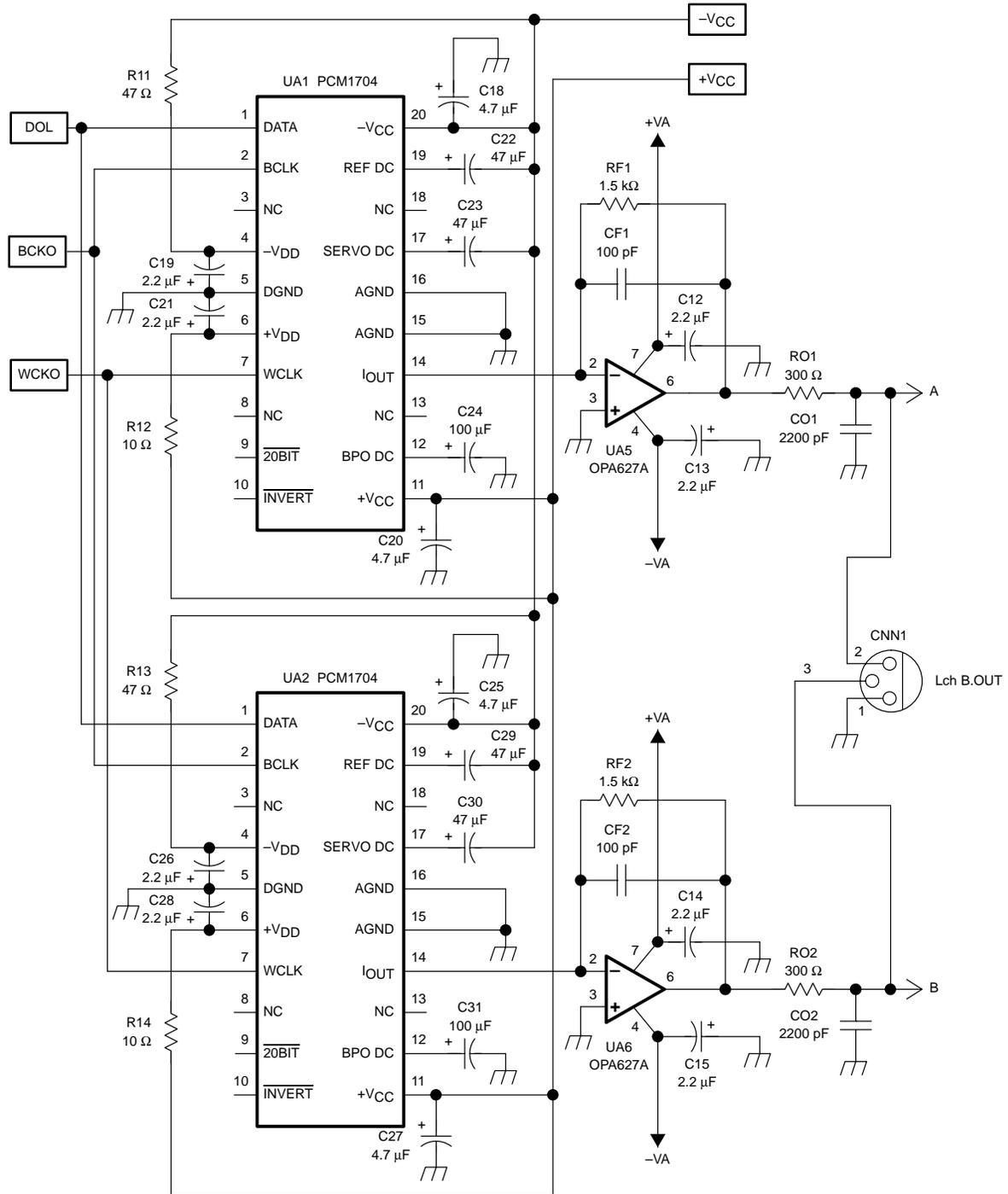


Figure 2–7. DAC and Analog Section Circuit Diagram (Lch) (Continued)

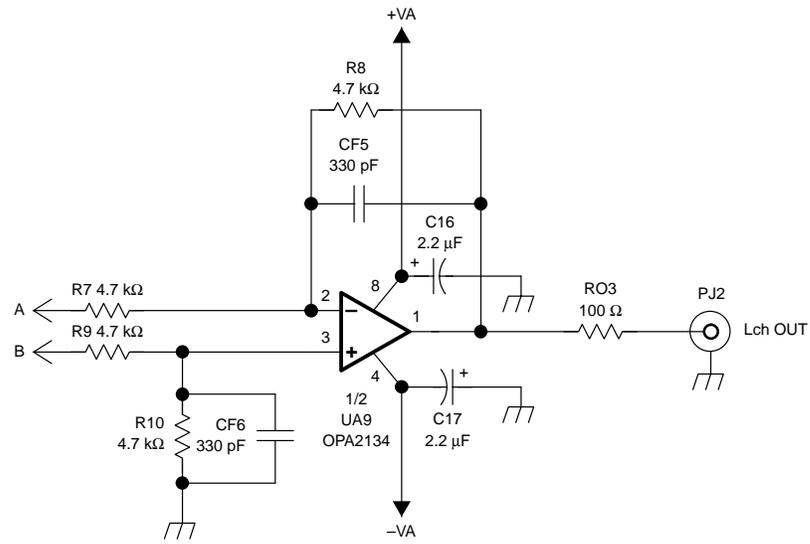


Figure 2–8. DAC/Analog Section Circuit Diagram (Rch, Component Value Is Same as Lch)

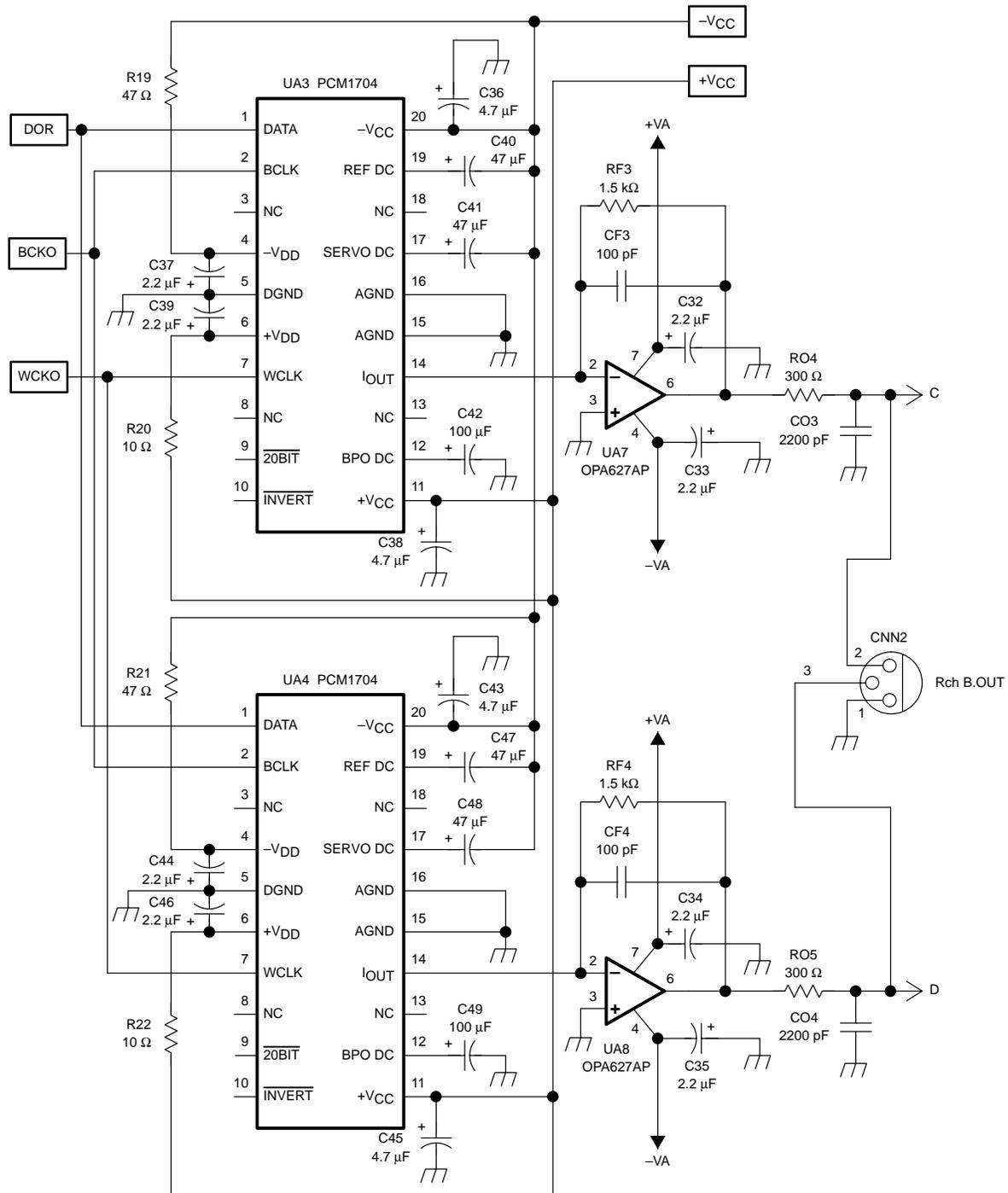


Figure 2–8. DAC/Analog Section Circuit Diagram  
(Rch, Component Value Is Same as Lch) (Continued)

