DEM-PCM1780/81/82 EVM

PCM1780/PCM1781/PCM1782 Evaluation Module

User's Guide

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Read This First

About This Manual

The DEM-PCM1780/81/82 EVM is a complete evaluation platform for the PCM1780/PCM1781/PCM1782 series of 24-bit, 192-kHz stereo audio digital-to-analog converters (DACs). This user's guide provides the information needed to set up and operate the DEM-PCM1780/81/82 EVM, a test platform for the eight-channel, 24-bit PCM1780, PCM1781, and PCM1782 audio DACs. For a more detailed description of the PCM1780/81/82 product line, refer to the product data sheet available from the Texas Instruments web site at http://www.ti.com. Support documents are listed in the section of this guide entitled ***Related Documentation from Texas Instruments***.

How to Use This Manual

Throughout this document, the abbreviation *EVM* and the term *evaluation module* are synonymous with the DEM-PCM1780/81/82 EVM.

Chapter 1 discusses the block diagram and primary features of the DEM-PCM1780/81/82 EVM. This chapter also provides general information regarding the default switch and jumper configurations.

Chapter 2 explains how to use the software provided with the DEM-PCM1780/81/82 EVM.

Chapter 3 includes the EVM electrical schematics, printed circuit board (PCB) layout, and the bills of material.

Information About Cautions and Warnings

This document contains caution statements.

CAUTION

This is an example of a caution statement. A caution statement describes a situation that could potentially damage your software or equipment.

The information in a caution or a warning is provided for your protection. Please read each caution and warning carefully.

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Related Documentation From Texas Instruments

The following document provides information regarding Texas Instruments integrated circuits used in the assembly of the DEM-PCM1780/81/82 EVM. These documents are available from the TI web site. The last character of the literature number corresponds to the document revision that is current at the time of the writing of this document. Newer revisions may be available from the TI web site at http://www.ti.com/ or call the Texas Instruments Literature Response Center at (800) 477–8924 or the Product Information Center at (972) 644–5580. When ordering, identify the document(s) by both title and literature number.

Data Sheet	Literature Number
PCM1780/PCM1781/PCM1782 Product data sheet	SLES132B

If You Need Assistance

If you have questions regarding either the use of this evaluation module or the information contained in the accompanying documentation, please contact the Texas Instruments Product Information Center at (972) 644–5580 or visit the TI web site at www.ti.com.

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 is required to take whatever measures may be required to correct this interference.

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Description

The DEM-PCM1780/81/82 EVM is an evaluation board for the PCM1780/PCM1781/PCM1782, a 24-bit, 192-kHz, enhanced multi-level, Delta-Sigma (ΔΣ) audio DAC. This EVM provides all necessary connectors and circuitry for interfacing to audio test systems and commercial audio equipment.

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1.1 Functional Block Diagram

Figure 1-1 illustrates the functional block diagram of the DEM-PCM1780/81/82 EVM.

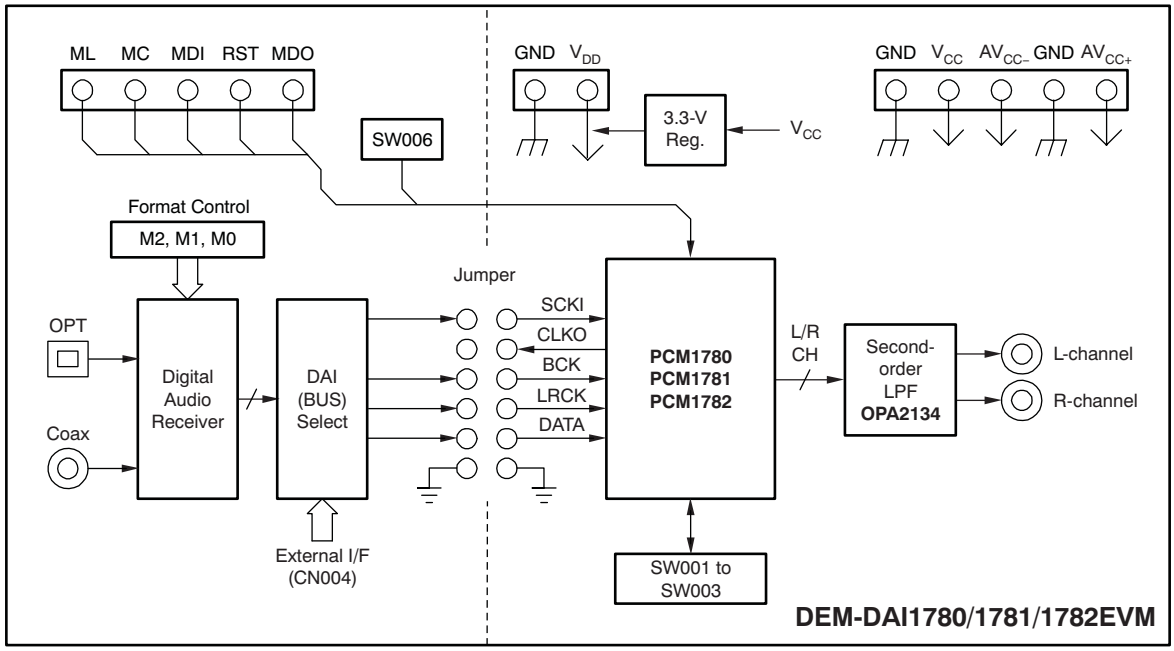

Figure 1-1. DEM-PCM1780/81/82 EVM Functional Block Diagram

1.2 EVM Features

The DEM-PCM1780/81/82 EVM offers the following features:

- Complete evaluation platform for the PCM1780/81/82 stereo audio DAC
- Onboard low-pass filters for the left and right channels
- Easy configuration using onboard switches and jumpers
- 96-kHz digital audio receiver accepts S/PDIF inputs
- Centronics connector for interfacing to a PC parallel port (required for the demonstration software)
- Power-supply requirements: +5 V, +15 V, and –15 V
- CD-ROM containing demonstration software for programming the PCM1780/81/82 internal registers (requires a PC running Microsoft® Windows® 3.1, 95, 98, 2000, or XP operating system), a copy of this user's guide, and a PCM1780/81/82 product data sheet

If any of these items are missing or damaged, please contact your local Texas Instruments representative.

1.3 Hardware Description

1.3.1 Power Supplies

The DEM-PCM1780/81/82 evaluation fixture requires three power supplies for operating the PCM1780/81/82, the digital support circuitry, and the low-pass filter operational amplifier (op amp). Standard banana jacks are provided for all power-supply connections.

Connector CN054 provides the 5-V supply required for V_{CC}. It is used to power the PCM1780/81/82 as well as the digital audio receiver (U002) and associated logic (U003 and U004).

Connectors CN051 (AV_{CC+}) and CN (AV_{CC-}) are used to power the OPA2134 dual operational amplifer (U101) that performs the DAC output low-pass filter function. AV_{CC+} can be set from 5 V to 18 V, while AV_{CC-} can be set from –5 V to –18 V.

Ground connections are made at connectors CN052 and CN055. Both are connected to the ground plane of the DEM-PCM1780/81/82 board.

1.3.2 Analog Output

The left and right audio outputs are available at RCA jacks CN104 and CN105, respectively. The outputs are taken from the low-pass filter, which has a gain of 2. The low-pass filter can be configured for one of two cutoff frequencies: 54 kHz or 108 kHz. Typically, the 54-kHz cutoff frequency is used for all measurements.

- For f_{-3} dB = 54 kHz, jumpers JP101 through JP106 must all be installed.
- For f_{-3} dB = 108 kHz, jumpers JP101 through JP106 must all be removed.

1.3.3 Digital Audio Interface

A digital audio receiver (U002) is provided for easy connection to S/PDIF and optical signal sources, including audio test systems (Audio Precision and Rhode and Schwarz, for example) and commercial audio equipment (CD and DVD players). The receiver can operate at rates up to 96 kHz with 24-bit audio data.

Switches SW001 through SW003 are used to set the receiver output data format, as shown in Table 1-1. Table 1-2 shows the jumper configuration for JP001 for normal operation.

Table 1-1. Digital Audio Receiver Configuration

SW001	SW002	SW003	Receiver Output Data Format
L	L	L	16-bit to 24-bit, left-justified format
L	H	L	16-bit to 24-bit, I²S™ format
H	L	H	16-bit, right-justified (or standard)
L	H	H	18-bit, right-justified (or standard)

Table 1-2. JP001 Jumper Configuration(1)

JP001 Jumper	16-bit, Right-Justified Format	16-bit to 24-bit, I²S Format	16-bit to 24-bit, Left-Justified Format
CLKO	X	X	X
SCLK	O	O	O
GND	O	O	O
BCK	O	O	N/C
BCK (left-justified)	N/C	N/C	N/C
LRCK	O	O	O
DATA	O	O	O

(1) O = Install jumper, N/C = Remove jumper, X = Do not care

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

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. In addition, +5 V (V_{CC}) and ground are available at CN004. Switch SW005 is used to select between the digital audio receiver and connector CN004 as the source of the audio interface. Table 1-3 shows the available switch settings.

Table 1-3. Digital Audio Source Selection

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

1.3.4 DIP-Switch Configuration

Switch SW006 is not used for the PCM1780/81/82. It is included for future products that may be compatible with this demonstration board. All switch elements must be set to the OFF position for the PCM1780/81/82.

1.3.5 Connector to PC Parallel Port/Host

The evaluation fixture includes a Centronics connector, CN003, that is used to connect to a PC parallel port or an alternative host controller. This connector is used to access the serial control port of the PCM1780/1782. The serial control port is used to program the PCM1780/1782 internal registers. A standard printer cable is used to connect CN003 of the evaluation fixture to a PC parallel port. The port signals are buffered using U006.

1.3.6 Operation Controls for PCM1781

SW001 on the daughtercard is the operating control for the PCM1781.

- **SW001:** Data format select
  - R/J-16 = 16-bit, Right-justified format
  - I^2S = 16- to 24-bit, I^2S format

SW006 on the DAI/DAC motherboard is also used as the operating control for the PCM1781. Table 1-4 summarizes the options for SW006.

Table 1-4. ML, MC/SW006 Options

MC	ML	De-Emphasis
LOW	LOW	OFF
LOW	HIGH	ON fs = 48 kHz
HIGH	LOW	ON fs = 44.1 kHz
HIGH	HIGH	ON fs = 32 kHz

MD/SW006 control options:

- MUTE CONTROL
- LOW MUTE OFF
- HIGH MUTE ON

1.4 Electrostatic Discharge Warning

Many of the components on the DEM-PCM1780/81/82 EVM are susceptible to damage by electrostatic discharge (ESD). Customers are advised to observe proper ESD handling precautions when unpacking and handling the EVM, including the use of a grounded wrist strap at an approved ESD workstation.

CAUTION

Failure to observe ESD handling procedures may result in damage to EVM components.

Demonstration Software

Software is provided with the EVM board to allow programming of the PCM1780 internal registers. The software operates on computers equipped running Microsoft Windows 3.1, 95, 98, 2000 or XP operating systems. The demo software requires that the PC printer port be connected to CN-2 of the DEM-DAI/DAC using a standard printer cable.

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2.1 Installation

The demo software is available for download from the PCM1780 product folder (*Tools & Software* link, slac239.zip) on the TI web site as a compressed file.

To install the software on your computer, first create a new folder on your hard drive with an appropriate name (for example, DEM1780_82, PCM1780, etc.). Then open the *Demxxxx* folder in the installation download file, and copy all of the files in it to the new folder that you created on your hard disk.

Open the configuration setting file named *DEMxxxx.ini* with a text editor, such as Notepad or WordPad. 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-DAI1780/82. 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 port address.

2.2 Using the Demo Software

Double-click on the application file named *demxxxx.exe*. A startup window will appear on your screen, with two menus near the top of the window, named **Execute** and **Window**.

The Execute menu includes three selections: Initialize, Reset, and Exit. Selecting *Initialize* instructs the program to write all of the PCMDAC internal registers with the default values. Selecting *Reset* instructs the program to rewrite the PCMDAC internal registers with the data currently selected in the application windows. Selecting *Exit* closes the application.

The Window menu includes three selections: *Attenuation*, *Operational Control*, and *Function Control*. The following sections provide an explanation of each window.

2.3 Hold and Pass

Each window has a button near the top, labeled either HOLD or PASS. Toggle the setting by clicking on this button. When set to HOLD, the user can change the settings in a window, but the changes will not be written to the register(s) until the OK button (which appears at the bottom left corner of the window) is pressed. When set to PASS, changes made within a window are immediately written to the corresponding register(s).

Schematic, PCB Layout, and Bill of Materials

This chapter provides the electrical and physical layout information for the DEM-DAI/DAC and the DEM-PCM1780/81/82. The bill of materials (BOM) is included for component and manufacturer reference.

Note: Board layouts are not to scale. These are intended to show how the board is laid out; they are not intended to be used for manufacturing DEM-PCM1780/81/82 EVM PCBs.

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3.1 DEM-DAI/DAC Schematics

The schematic for the sections of the DEM-DAI/DAC is shown in Figure 3-1 through Figure 3-3.

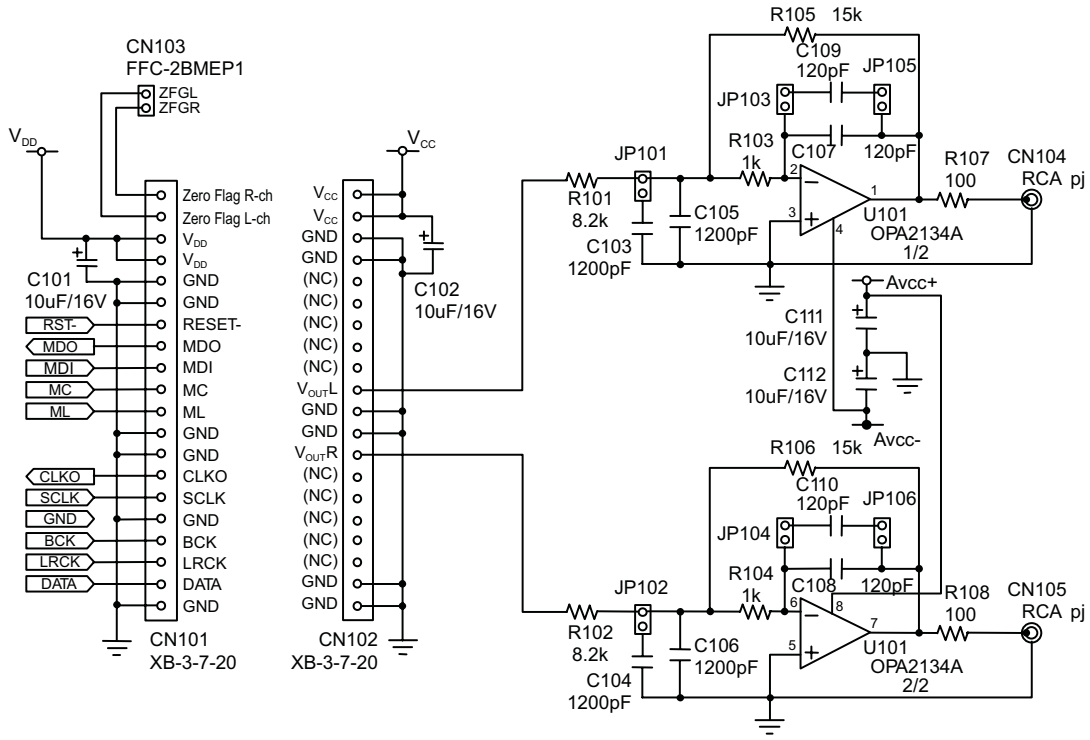

Figure 3-1. DEM-DAI/DAC Daughtercard Sockets Schematic

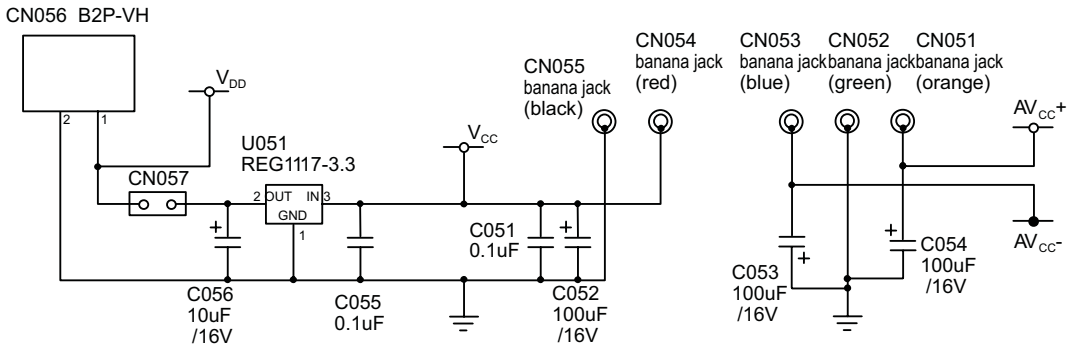

Figure 3-2. DEM-DAI/DAC Connector and Regulator Schematic

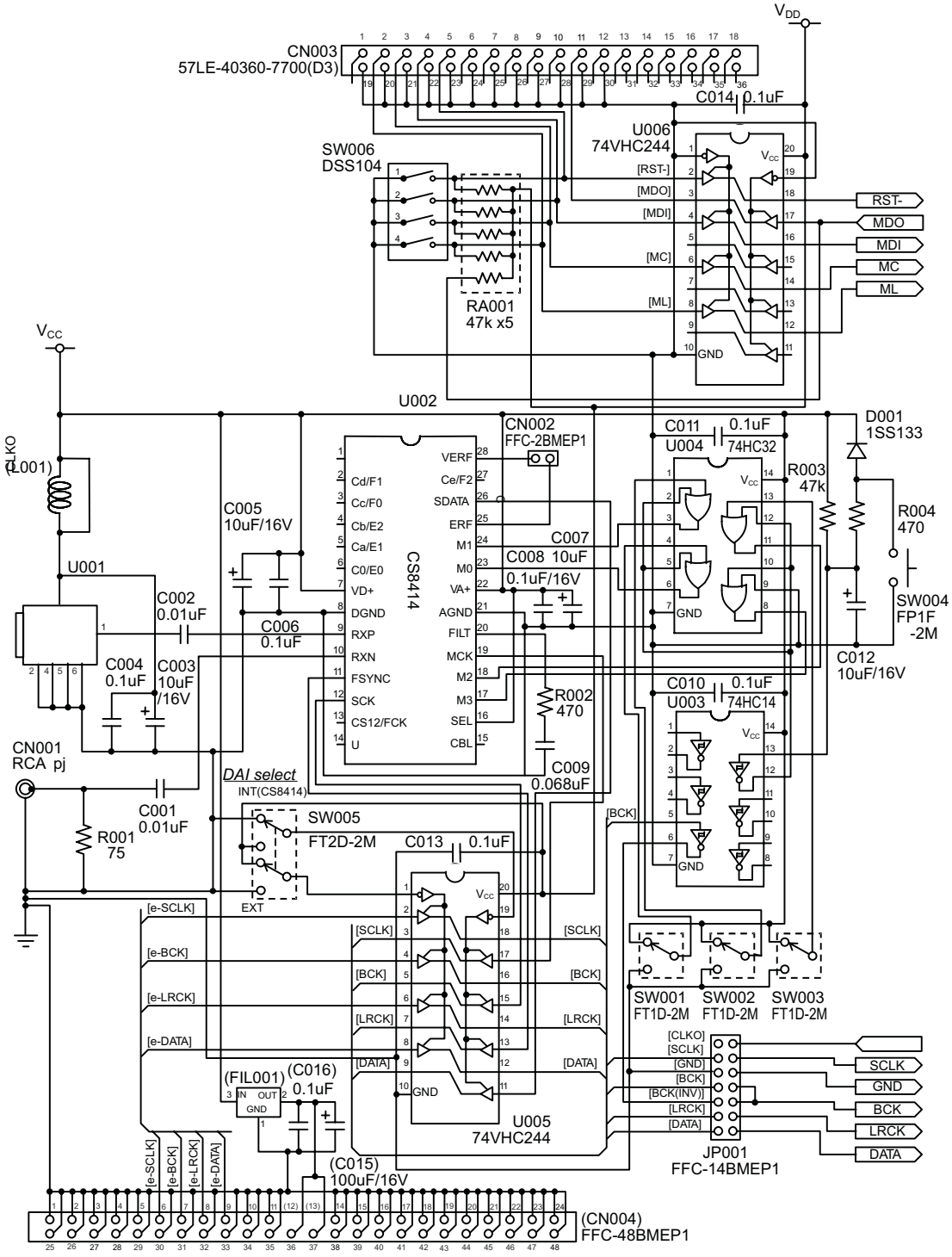

Figure 3-3. DEM-DAI/DAC Digital Audio Interface Schematic

3.2 DEM-PCM1780/81/82 Daughtercard Schematic

This daughtercard is a common board for both the PCM1680 (8-channel DAC) and the PCM1780/1781/1782; both footprints are the same. Figure 3-4 illustrates the schematic for the DEM-PCM1780/81/82.

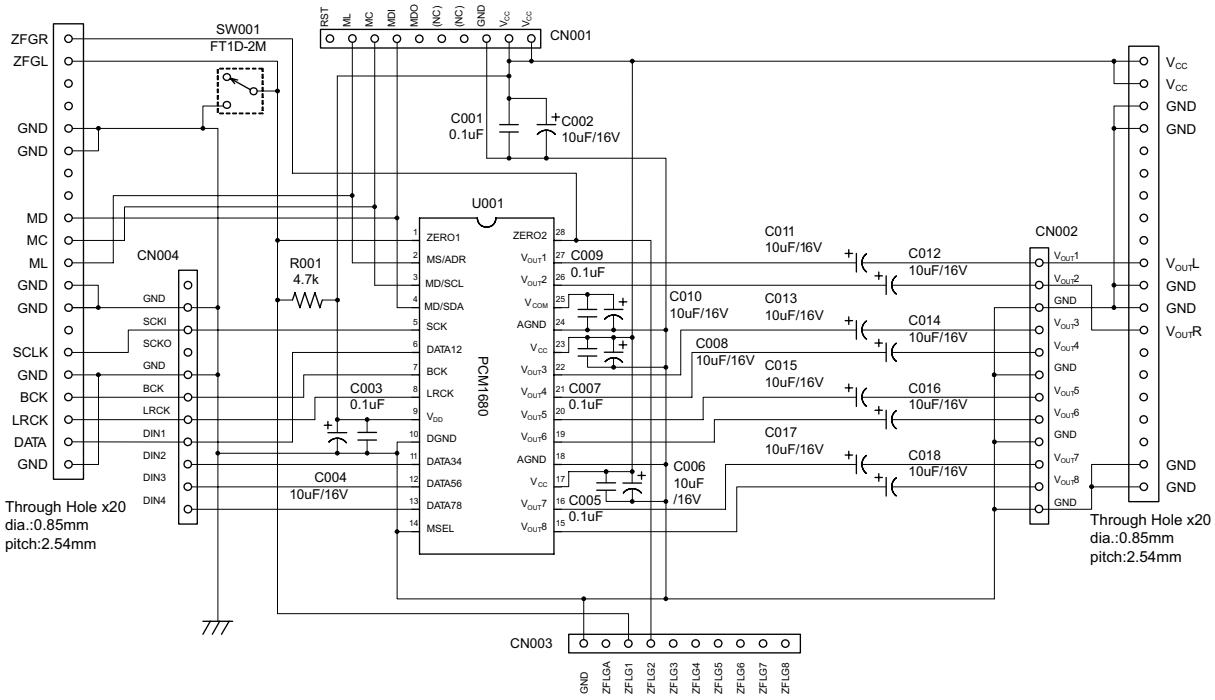

Figure 3-4. DEM-PCM1780/81/82 Daughtercard Schematic

3.3 Printed Circuit Board Layout—DEM-DAI/DAC

Figure 3-5 through Figure 3-7 illustrate the printed circuit board (PCB) layout for the DEM-DAI/DAC.

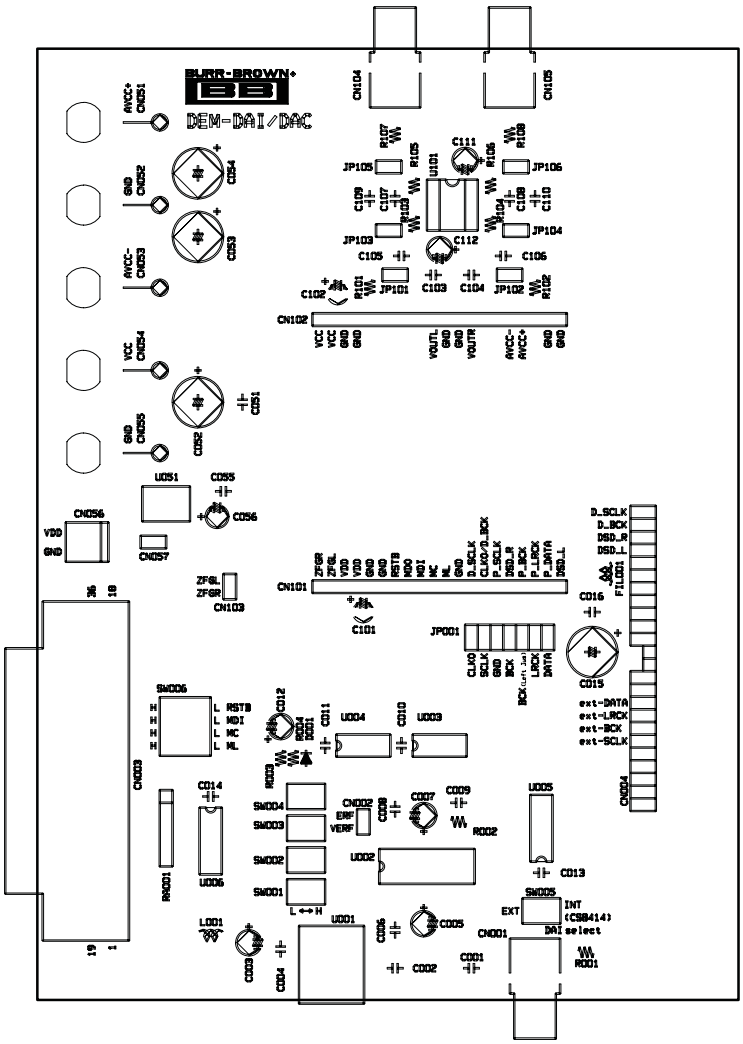

Figure 3-5. DEM-DAI/DAC Board Layout—Silkscreen

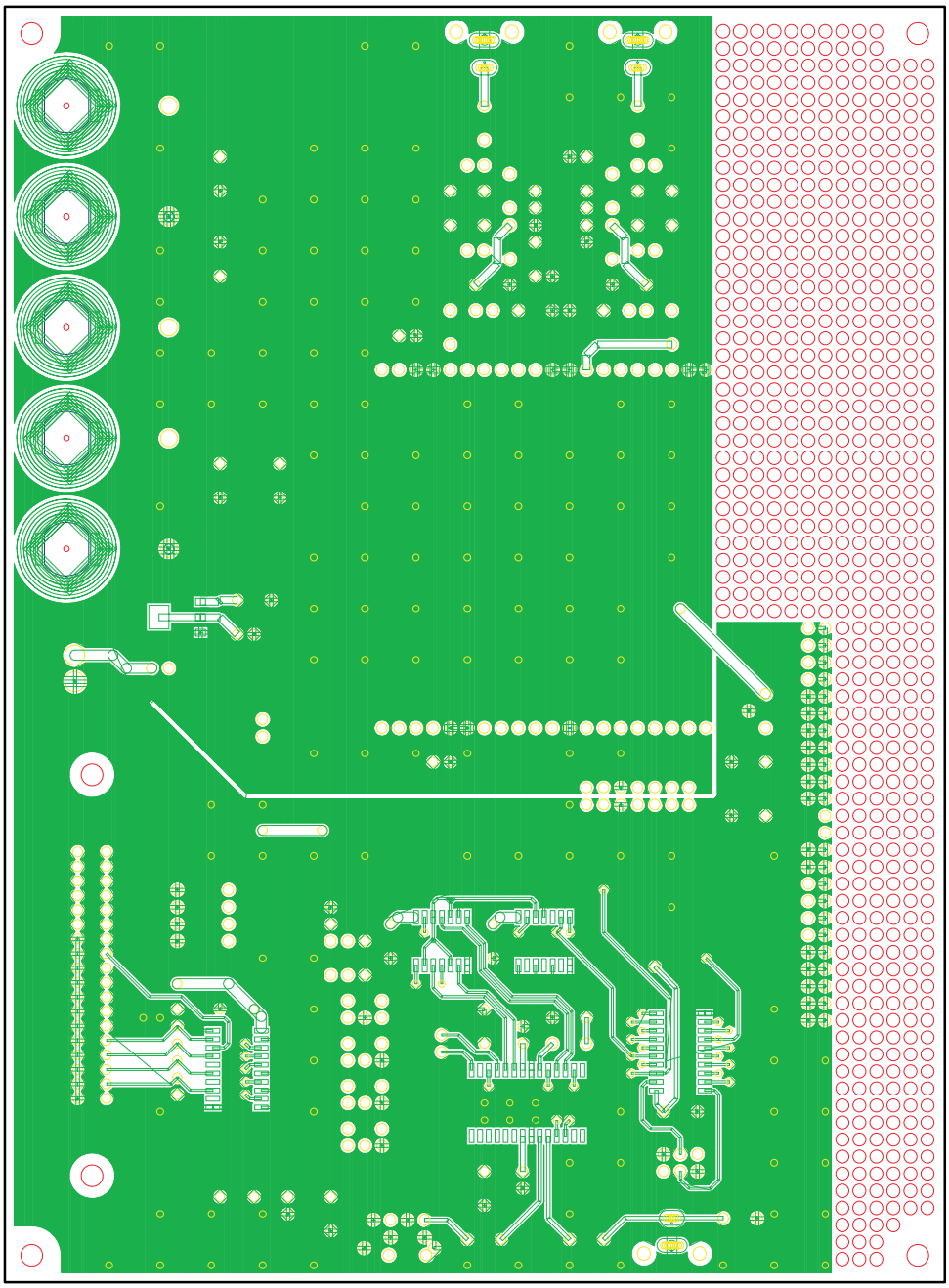

Figure 3-6. DEM-DAI/DAC Board Layout—Top (Component) Side

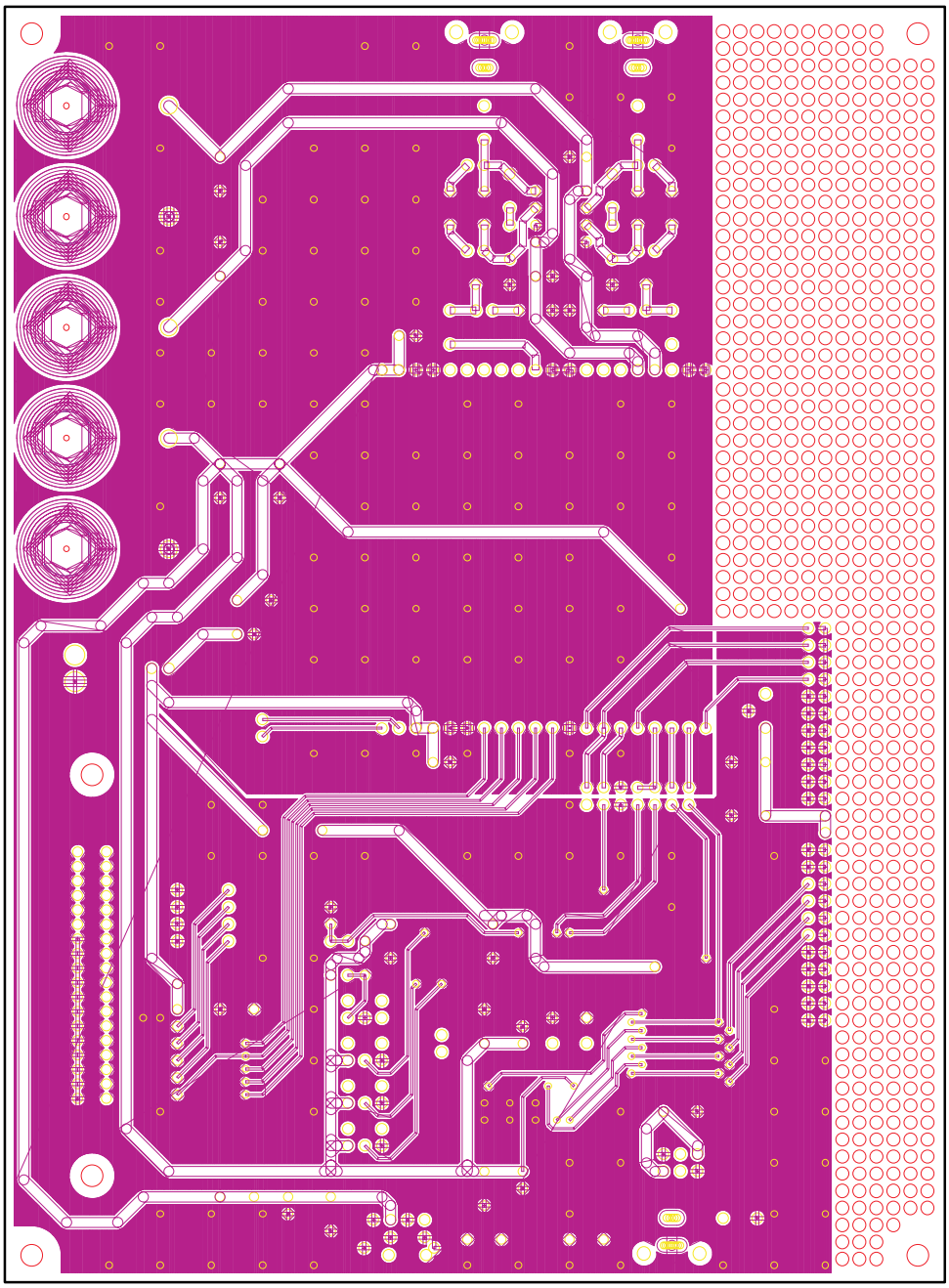

Figure 3-7. DEM-DAI/DAC Board Layout—Bottom View

3.4 Printed Circuit Board Layout—DEM-PCM1780/81/82 Daughtercard

Figure 3-8 through Figure 3-10 illustrate the PCB layout for the DEM-PCM1780/81/82.

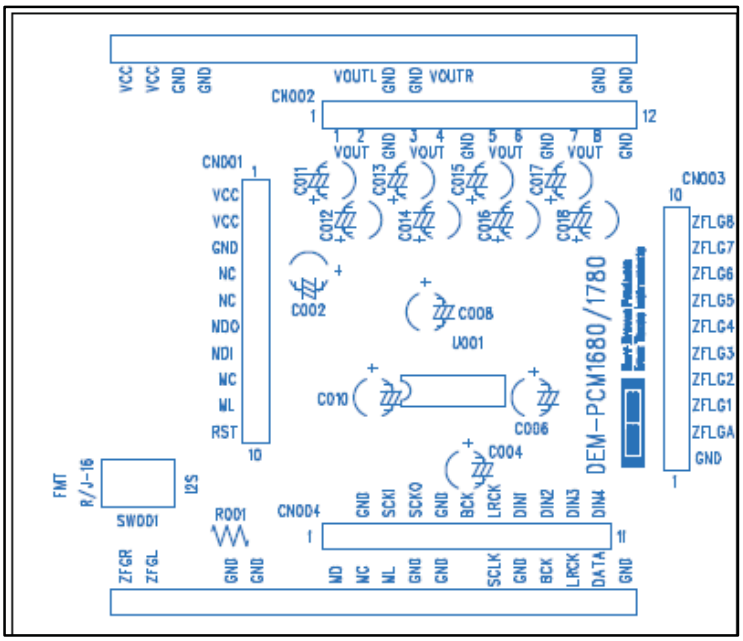

Figure 3-8. DEM-PCM1780/81/82 Board Layout—Silkscreen

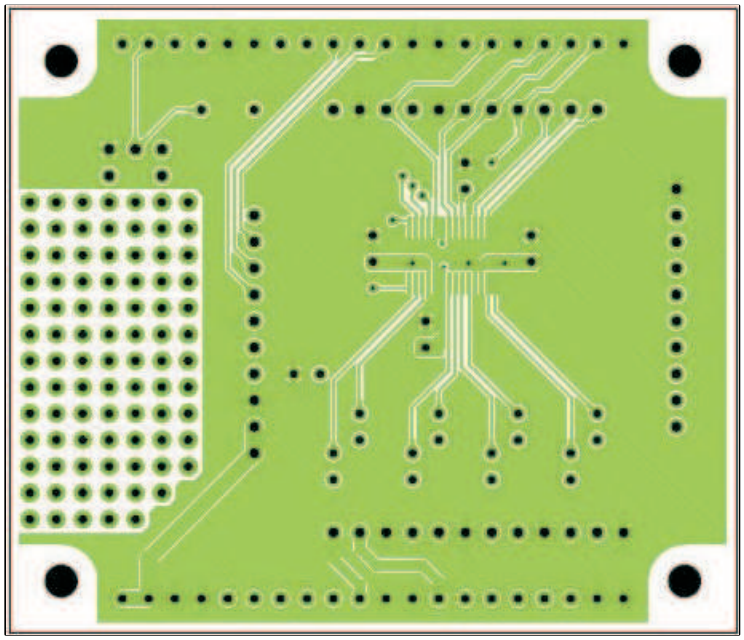

Figure 3-9. DEM-PCM1780/81/82 Board Layout—Top (Component) Side

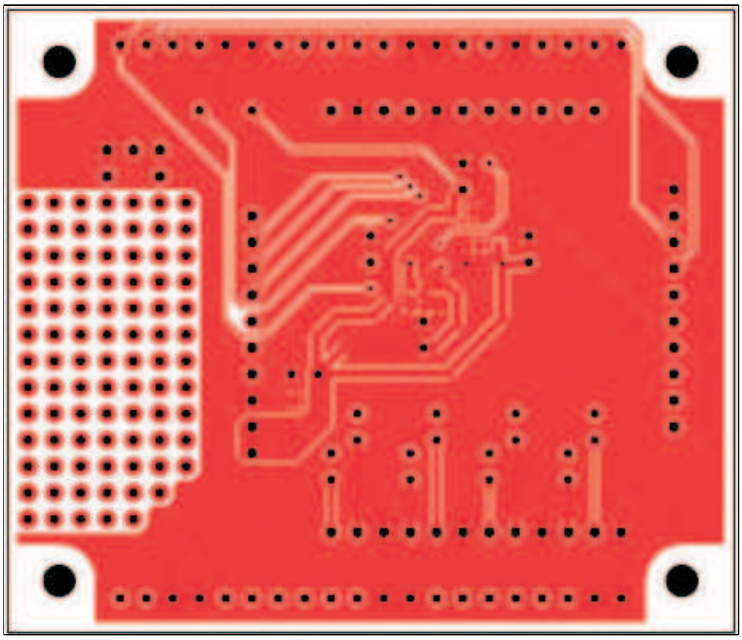

Figure 3-10. DEM-PCM1780/81/82 Board Layout—Bottom View

3.5 Component Lists

3.5.1 Bill of Materials for DEM-DAI/DAC

Table 3-1 lists the bill of materials for the DEM-DAI/DAC.

Table 3-1. Bill of Materials—DEM-DAI/DAC

Qty	Ref Des	Item	Value	Mfr Part No.	Manufacturer
2	C001,C002	Polyester film capacitor	0.01 µF, J	AMFF0050J103	NISSEI
4	C004, C006, C008, C016,C051	Polyester film capacitor	0.1 mF, J	AMFF0050J104	NISSEI
1	C009	Polyester film capacitor	0.068 mF, J	AMFF0050J683	NISSEI
5	C010, C011, C013, C014,C055	Ceramic capacitor	0.1 mF	D55Y5V1H104Z51	NEC
5	C003,C005,C007,C 111,C112	Aluminum electrolytic capacitor	10 mF/16 V	ROA-16V100M	ELNA
3	C015, C052–C054	Aluminum electrolytic capacitor	100 mF/16 V	ROA-16V101M	ELNA
2	C101, C102	Aluminum electrolytic capacitor	10 mF/16 V	R3A-16V100M	ELNA
4	C103–C106	Polypropylene capacitor	1200 pF	APSF0100J122	NISSEI
4	C107–C110	Polypropylene capacitor	120 pF	APSF0100J121	NISSEI
1	C012	Aluminum electrolytic capacitor	10 mF/16 V	SME16VB10M	Nippon Chemi Con
1	C056	Tantalum capacitor	10 mF/16V	DN1C100M1S	NEC
1	CN003	Centronics		57LE40360-7700(D3)	DAIICHI DENSHI
3	CN002, CN057, CN103	2-pin connector		FFC-2BMEP1	HONDA TSUSHIN
1	CN105	RCA connector	Red	LPR6520-0802	SMK
1	CN104	RCA connector	White	LPR6520-0803	SMK
1	CN001	RCA connector	Yellow	LPR6520-0804	SMK
1	CN051	Banana jack	Orange	T-45	SATO PARTS
1	CN052	Banana jack	Green	T-45	SATO PARTS
1	CN053	Banana jack	Blue	T-45	SATO PARTS
1	CN054	Banana jack	Red	T-45	SATO PARTS
1	CN055	Banana jack	Black	T-45	SATO PARTS
1	CN056	VH connector 2-pin		B2P-VH	J.S.T. Connector
2	CN101,CN102	Connector 20-pin		XB-3-7-20	MAC8
1	D001	Diode		1SS133	ROHM
1	JP001	14-pin connector		FFC-14BMEP1	HONDA TSUSHIN
6	JP101–JP106	2-pin connector		FFC-2BMEP1	HONDA TSUSHIN
1	R001	1/4W resistor	75 Ω, F, 1/4 W	SN14C2C	KOA
2	R107, R108	1/4W resistor	100 Ω, F, 1/4 W	SN14C2C	KOA
2	R002, R004	1/4W resistor	470 Ω, F, 1/4 W	SN14C2C	KOA
2	R103, R104	1/4W resistor	1 kΩ, F, 1/4 W	SN14C2C	KOA
2	R101, R102	1/4W resistor	8.2 kΩ, F, 1/4 W	SN14C2C	KOA
2	R105, R106	1/4W resistor	15 kΩ, F, 1/4 W	SN14C2C	KOA
1	R003	1/4W resistor	47 kΩ, F, 1/4 W	SN14C2C	KOA

Table 3-1. Bill of Materials—DEM-DAI/DAC (continued)

Qty	Ref Des	Item	Value	Mfr Part No.	Manufacturer
1	RA001	Resistor array	47 kΩ x 5	M6-1-473J	BI
1	U001	TOSLINK™ optical connector		TORX179P	TOSHIBA
1	U002	Digital audio I/F receiver IC		CS8414-CS	CIRRUS
1	U003	Logic IC		TC74VHC14AF	TOSHIBA
1	U004	Logic IC		TC74HCT32AF	TOSHIBA
2	U005, U006	Logic IC		TC74VHC244F	TOSHIBA
1	U051	Regulator IC		REG1117-3.3	Burr-Brown
1	U101	IC socket DIP 8-pin		100-008-000	3M
3	SW001, SW002, SW003	DIP switch		FT1D-2M	FUJISOKU
1	SW004	Push switch		FP1F-2M	FUJISOKU
1	SW005	DIP switch		FT2D-2M	FUJISOKU
1	SW006	DIP switch		DSS104	FUJISOKU
4		Spacer		AR-325B	HIROSUGI KEIKI

3.5.2 Bill of Materials for DEM-PCM1780/81/82

Table 3-2 lists the bill of materials for the DEM-PCM1780/81/82.

Table 3-2. Bill of Materials—DEM-PCM1780/81/82

Qty	RefDes	Description	Size	Mfr Part Number	MFR
3	C001, C007, C009	Chip ceramic capacitor(2125)	0.1 mF	GRM40F104Z50PT	MURATA
5	C002, C008, C010–C012	Aluminum electrolytic capacitor	10 mF/16V	R3A-16V100M	ELNA
1	R001	1/4 W resistor	4.7 kΩ	SN14C2C-4.7kWF	KOA
1	SW001	DIP switch		FT1D-2M	FUJISOKU
1	U001	Logic IC		PCM1780	Texas Instruments

EVALUATION BOARD/KIT IMPORTANT NOTICE

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EVM WARNINGS AND RESTRICTIONS

It is important to operate this EVM within the input voltage range of –0.3 V to +5 V and the output voltage range of –15 V to +15 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.

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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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