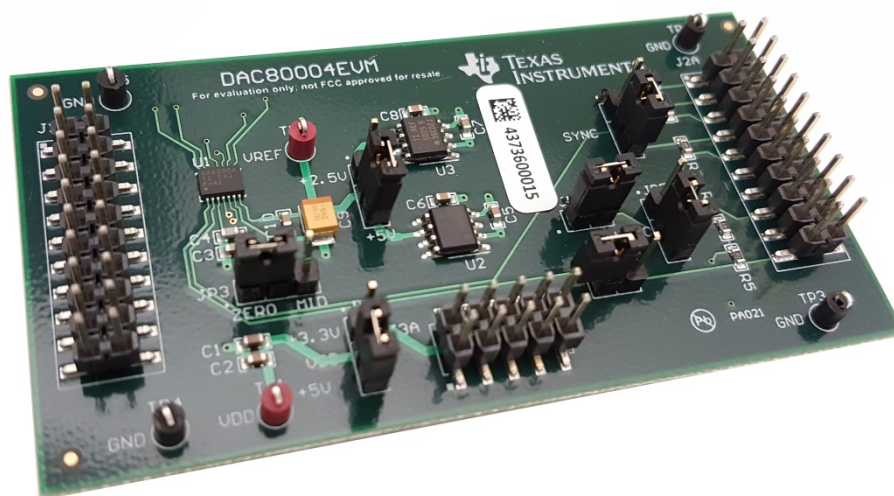


DAC80004EVM



DAC80004EVM

This user's guide describes the characteristics, operation, and use of the [DAC80004EVM](#). The evaluation model (EVM) is an evaluation board for the [DAC80004](#). The DAC80004 is a low-power, buffered voltage-output, 16-bit, quad channel digital-to-analog converter (DAC) with an integrated reference. This converter is controlled through a serial peripheral interface (SPI) that can operate at clock rates of up to 50 MHz. Additionally, the EVM includes a 2.5 V and a 5.5 V external reference voltages, resulting in an output ranges from 0 to 2.5 V and 0 to 5 V. The EVM allows evaluation of all aspects of the device and allows user control over every pin on the DAC80004. Complete circuit descriptions, schematic diagrams, and bill of material are included in this document.

The following related documents are available for download through the Texas Instruments web site at <http://www.ti.com>.

EVM-Related Device Datasheets

Device	Literature Number
DAC80004	SLASE44
REF5025	SBOS410
REF5050	SBOS410

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1 EVM Overview

1.1 Features

The DAC80004EVM has the following features:

- Full-featured evaluation board for the DAC80004
- Onboard external reference selection
- Wide selection of digital and I/O voltages
- Hardware and software control logic
- Compatible with the TI Modular EVM Motherboard MMB0

This manual covers the operation of the DAC80004EVM. The abbreviation EVM and the term evaluation module are synonymous with the DAC80004EVM.

1.2 Introduction

The DAC80004 is a 16-bit, low-power, buffered voltage-output, dual channel digital-to-analog converter (DAC) that operates from a single 2.7-V to 5.5-V supply. The DAC is controlled through a serial peripheral interface (SPI) that can operate at clock rates of up to 50 MHz. The EVM is designed to highlight the features and the performance of the 16-bit DAC. Additionally, the EVM includes a 2.5-V and 5-V external references, resulting output ranges from 0 to 2.5 V or 5 V.

The DAC80004EVM is designed to give the user easy access to all pins on the DAC80004. The evaluation module allows the user to control the DAC logic using onboard jumpers, or digitally through the J2 header. By default, the evaluation module is configured to be used with an onboard 2.5-V external reference, but can be easily modified to use the other 5-V external reference.

1.3 Power and Motherboard Requirements

This DAC80004EVM board can be used as a standalone board or as a daughter card to the MMB0 Modular EVM motherboard.

1.3.1 Supply Voltage Ranges

[Table 1](#) lists the supply voltage ranges for the EVM.

Table 1. Supply Voltage Ranges

Signal	Range
VDD	2.7 V to 5.5 V
VREF_VIN	2.7 V to 15 V
VREF_EXT	0 V to VDD

1.3.2 Motherboard Supply Mode

The MMB0 motherboard can supply the digital interface as well as the power supply voltage required by the DAC80004EVM. This user's guide focuses on the motherboard supply mode and its software.

1.3.3 Standalone Supply Mode

The DAC80004EVM can also be used without a motherboard, provided that the digital interface is driven by an external source. The supply voltage must be applied at TP1/VDD according to the specifications in [Table 1](#).

The MMB0 can still be used as a digital interface while using an external power supply. Remember to disconnect any shunt from JP1.

1.3.4 Reference Voltage

The EVM includes an on-board reference as well as the option to provide an external reference voltage. JP2 chooses between the on-board reference and the external reference. TP2 can be used to measure the selected reference, which is the on-board reference by default.

1.4 EVM Default Hardware Setup

[Table 2](#) lists the default jumper settings for the MMB0 modular EVM motherboard and [Table 3](#) lists the default jumper settings for the DAC80004EVM.

Table 2. Default Jumper Settings for the MMB0 Modular EVM Motherboard

Jumper	Position
J12	CLOSED
J13A	OPEN
J13B	CLOSED

Table 3. Default Jumper Settings for the DAC80004EVM

Jumper	Position
JP1	2-3
JP2	1-2
JP3	2-3
JP4	1-2
JP5	2-3
JP6	CLOSED
JP7	OPEN

Figure 1 illustrates the default jumper settings for the DAC80004EVM.

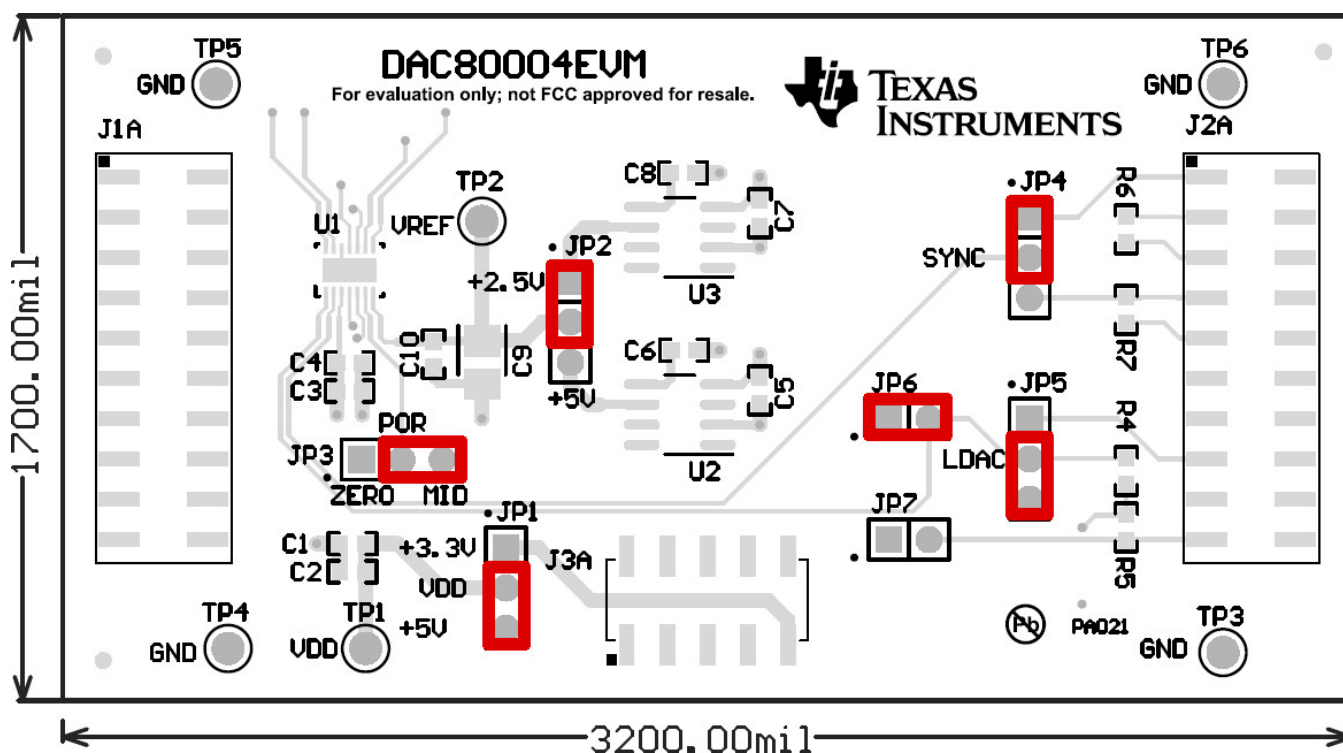


Figure 1. Default Jumper Settings for the DAC80004EVM

1.5 Questions and Support for This or Other Precision Data Converter EVMs

Join TI's E2E precision data converter support forum at
e2e.ti.com/support/data_converters/precision_data_converters

Post your question in the forum and one of our experts will assist you.

2 EVM Hardware

This section provides descriptions of the hardware interface and a quick-start guide.

2.1 Hardware Interface

[Table 4](#) provides hardware descriptions.

Table 4. Hardware Description

Jumper	Default Position	Description
JP1	2-3	VDD selector. Selects between 5VA on J3A.3 and 3.3VD on J3A.9.
JP2	1-2	VREF selector. Selects between the 2.5 V and 5 V on-board references.
JP3	2-3	POR selector. Selects between the power-on state of the output. Default position powers-on to midscale, position 1-2 powers-on to zero-scale.
JP4	1-2	SYNC selector. Selects the SYNC signal between J2.1 and J2.7.
JP5	2-3	LDAC selector. Selects between an LDAC signal from J2A.15 and J2A.17.
JP6	CLOSED	LDAC GND tie. Selects between an LDAC signal from J2A with a pull-up resistor and GND.
JP7	OPEN	CLR GND tie. Selects between a RST signal from J2A.19 with a pull-up resistor and GND.

NOTE: For more details, view the [Section 4.1](#).

2.2 Quick-Start

This section explains a quick method to test the EVM's functionality without using a motherboard.

The minimum requirements are:

- An external source to provide the SPI master signals
- An external 5-V power supply
- A DC digital multimeter

Use the following steps:

1. Ensure that all of the jumpers are in their default position.
2. Ensure that all the power supplies are switched off.
3. Connect the power supply ground to any of the ground leads on the EVM board.
4. Connect the SPI master ground to any of the ground leads on the EVM board.
5. Connect the DC DMM ground probe to any of the ground leads on the EVM board.
6. Connect 5 V to J3A.3.
7. Connect the DC DMM signal probe to J1A.8.
8. Power on the power supplies.
9. The DC DMM should display mid-scale 1.25 V. This means that the hardware setup is working.
 - If it does not, something may be wrong. Please check your connections and the jumper settings.
10. Send the SPI code 0x19FFFF using the DXP software.
11. The DC DMM should display full-scale 5 V. This means that your hardware and software setup are working.
 - If it does not, something may be wrong. Please check your digital interface implementation by looking at the digital signals on a signal analyzer or an oscilloscope.

3 EVM Operation

3.1 DXP Software Installation

The DXP software required to use the DAC80004EVM with the MMB0 must be downloaded from the Texas Instruments website, available at www.ti.com/dxp. The software is listed under the “Software” category in this product folder, as shown in [Figure 2](#).

Description

DAC Exerciser Program (DXP) is a software tool from Texas Instruments for evaluating DACs without the requirements of expensive pattern generators or writing complex software. When used with a Texas Instruments DAC EVM and a modular motherboard, it allows for simple and easy digital signal generation for the DAC to produce analog outputs for measurement and evaluation purposes.

Features

- Modular design allows additional EVMs to be supported
- Graphical user interface provides easy setup to send signals to a DAC

Free Evaluation Tool Description

Software:

[Download DXP Setup](#)

Figure 2. EVM Software Link

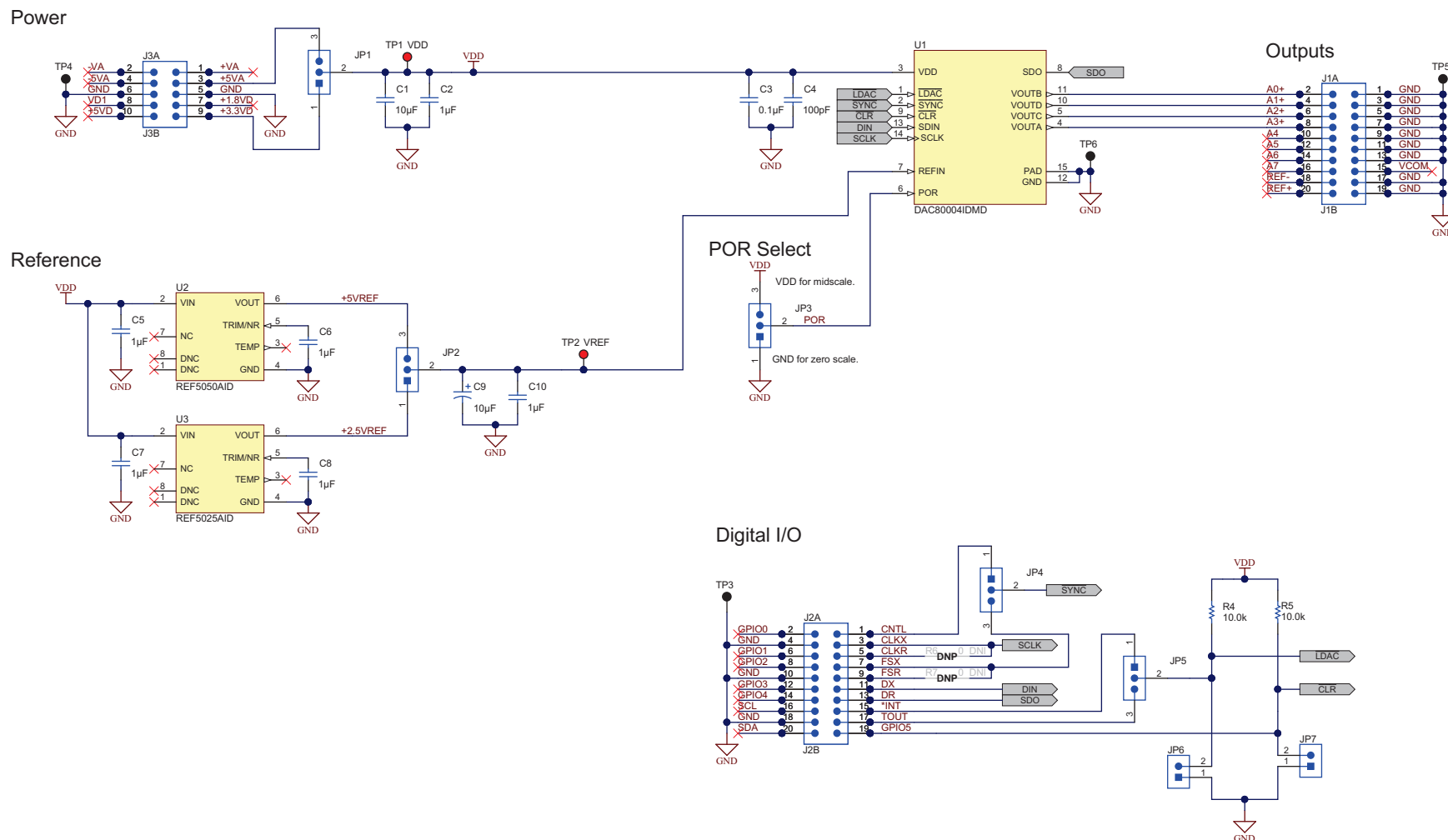
Once the download is complete, run the executable file and follow the installer instructions. After the DXP software installs, copy the DAC80004.xml file into the “Devices” directory that the installer created. Typically located in ‘C:\Users\Public\Documents\DXP\Devices’. If you cannot find the “Devices” directory, go to the DXP install directory, typically “C:\Program Files\DXP” and open the file “DXP.ini”. Locate the line that starts with “DXPDevices”; it will contain the location of the “Devices” directory.

4 Schematic, PCB Layout, and Bill of Materials

This section contains the [DAC80005EVM schematic](#), [DAC80005EVM PCB layout](#), and the [DAC80005EVM BOM](#).

4.1 Schematic

Figure 3 illustrates the DAC80004EVM schematic.



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Figure 3. DAC80004EVM Schematic

4.2 PCB Layout

Figure 4 shows the DAC80004EVM PCB layout.

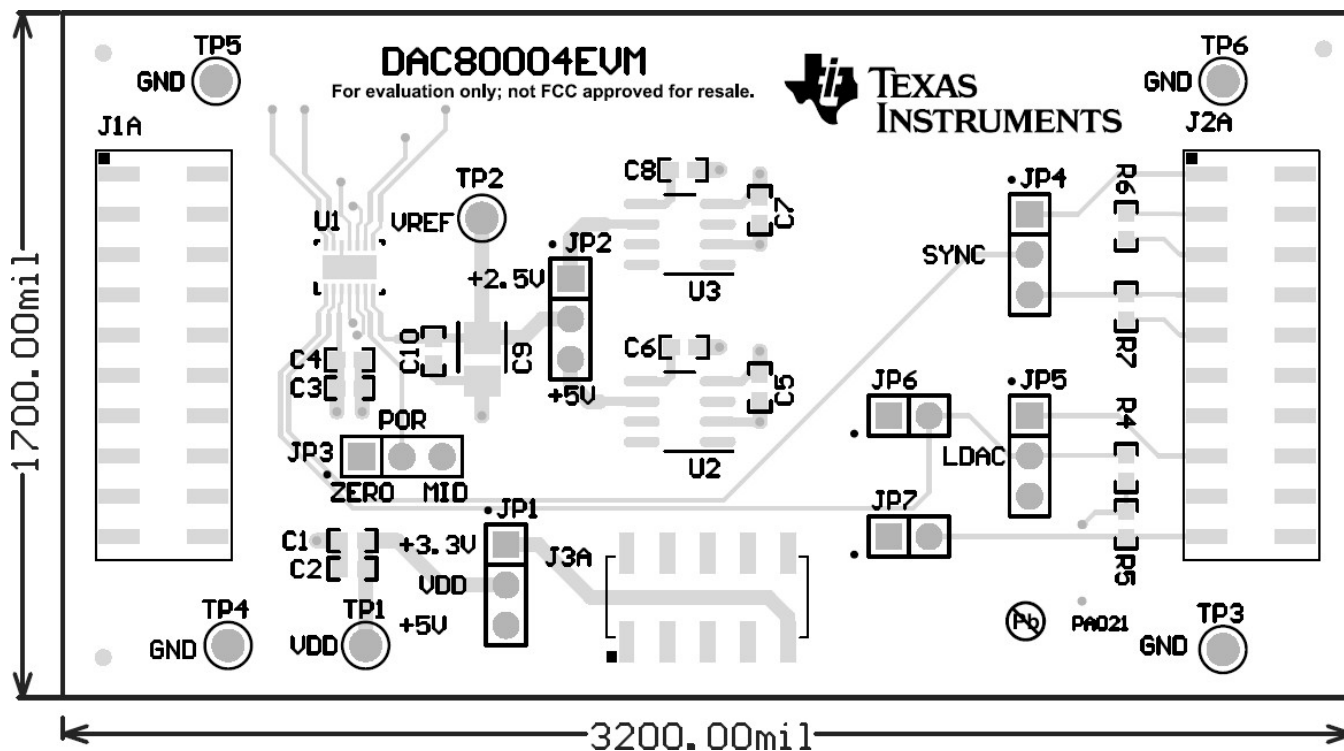


Figure 4. PCB Layout

4.3 Bill of Materials

Table 5 lists the BOM for the DAC80004EVM.

Table 5. DAC80004EVM Bill of Materials

Designator	Qty	Description	Manufacturer	Part Number
!PCB	1	Printed Circuit Board	Any	xxxxxxx
C1	1	CAP, CERM, 10uF, 25V, +/-20%, X5R, 0603	Murata	GRM188R61E106MA73
C2, C5, C6, C7, C8, C10	6	CAP, CERM, 1uF, 25V, +/-10%, X5R, 0603	TDK	C1608X5R1E105K080A C
C3	1	CAP, CERM, 0.1uF, 50V, +/-10%, X7R, 0603	Kemet	C0603C104K5RACTU
C4	1	CAP, CERM, 100pF, 50V, +/-5%, C0G/NP0, 0603	Murata	GRM1885C1H101JA01 D
C9	1	CAP, TA, 10 uF, 16 V, +/- 10%, 0.8 ohm, SMD	AVX	TPSB106K016R0800
J1A, J2A	2	Header, 100mil, 10x2, SMD	Samtec, Inc.	TSM-110-01-T-DV-P
J1B, J2B	2	Connector, Receptacle, 100mil, 10x2, Gold plated, SMD	Samtec, Inc.	SSW-110-22-F-D-VS-K
J3A	1	Header, 100mil, 5x2, SMD	Samtec, Inc.	TSM-105-01-T-DV-P
J3B	1	Connector, Header, 10-Pos (10x2), Receptacle, 100x100-mil Pitch	Samtec, Inc.	SSW-105-22-F-D-VS-K
JP1, JP2, JP3, JP4, JP5	5	Header, TH, 100mil, 3x1, Gold plated, 230 mil above insulator	Samtec, Inc.	TSW-103-07-G-S
JP6, JP7	2	Header, TH, 100mil, 2x1, Gold plated, 230 mil above insulator	Samtec	TSW-102-07-G-S
R4, R5	2	RES, 10.0k ohm, 1%, 0.1W, 0603	Yageo America	RC0603FR-0710KL
R6, R7	2	RES, 0 ohm, 5%, 0.1W, 0603	Yageo America	RC0603JR-070RL
TP1, TP2	2	Test Point, Miniature, Red, TH	Keystone	5000
TP3, TP4, TP5, TP6	4	Test Point, Miniature, Black, TH	Keystone	5001
U1	1	QUAD 16-BIT, 1LSB INL, BUFFERED, VOLTAGE-OUTPUT DIGITAL-to-ANALOG CONVERTERS, DMD0014A	Texas Instruments	DAC80004IDMD
U2	1	Low-Noise, Very Low Drift, Precision VOLTAGE REFERENCE, D0008A	Texas Instruments	REF5050AID
U3	1	Low-Noise, Very Low Drift, Precision VOLTAGE REFERENCE, 2.5V, D008A	Texas Instruments	REF5025AID

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