

# ***TLC4541/5EVM, TLC3541/5EVM, TLC2551/2/5EVM AND TLV2541/2/5EVM***

## *User's Guide*

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It is important to operate this EVM within the input voltage range of  $\pm 12$  V and the output voltage range of 0 V and +5 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 70°C. The EVM is designed to operate properly with certain components above 70°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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## Preface

# Read This First

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

This user's guide describes the EVM used to evaluate ten different serial analog-to-digital converters. These converters are the TLC4541/5, TLC3541/5, TLC2551/2/5, and TLV2541/2/5; 16-bit, 14-bit, 12-bit, and 12-bit devices respectfully. A complete circuit description as well as a schematic and bill of materials are included.

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

This document contains the following chapters:

Chapter 1 - EVM Overview

Chapter 2 - Layout

Chapter 3 - EVM Bill of Materials and EVM Schematic

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

To obtain a copy of any of the following TI documents, call the Texas Instruments Literature Response Center at (800) 477-8924 or the Product Information Center (PIC) at (972) 644-5580. When ordering, please identify this booklet by its title and literature number. Updated documents can also be obtained through our website at [WWW.TI.COM](http://WWW.TI.COM).

| Data Sheets    | Literature Numbers |
|----------------|--------------------|
| TLV2541/2/5    | SLAS245            |
| TLC2551/2/5    | SLAS276            |
| TLC3541/5      | SLAS345            |
| TLC4541/5      | SLAS293            |
| OPA132         | SBOS054            |
| REF102         | SBVS003            |
| SN74HC1G125DBV | SCLS377            |

### ***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.

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# EVM Overview

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This chapter provides an overview of the TLC4541/5EVM, TLC3541/5EVM, TLC2551/2/5EVM and TLV2541/2/5EVM.

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## 1.1 Introduction

The series of TLC4541/5, TLC3541/5, TLC2551/2/5 and TLV2541/2/5 are high-performance low-power, miniature, CMOS, serial analog to digital converters (ADCs). The low power performance of these ADCs is further enhanced by an auto-power-down mode incorporated in each series. Three series of the devices run at a maximum sample rate of 200 Ksps and have their own internal conversion clock. The TLC2551/2/5 series runs at 360 Ksps and uses the external SCLK for conversion.

The EVM is designed to accommodate all of the above devices. The analog input signal is buffered through an operational amplifier follower. The data output (DO) signal, from the device under test (DUT), is conditioned through a digital buffer. An on-board voltage reference is generated and buffered to drive the DUT. An off-board reference, which is user optional, can be supplied by reconfiguring jumper (W3). The analog electronics operates with bipolar or unipolar power supplies, by changing two jumpers.

## 1.2 Features

The EVM is a full featured board designed to accommodate ten serial ADCs. Device types and resolutions are listed in the following tables:

*Table 1-1. Single Input Channel*

| Device  | Resolution |
|---------|------------|
| TLC4541 | 16 Bits    |
| TLC3541 | 14 Bits    |
| TLC2551 | 12 Bits    |
| TLV2541 | 12 Bits    |

*Table 1-2. Pseudo Differential Input Channels*

| Device  | Resolution |
|---------|------------|
| TLC4545 | 16 Bits    |
| TLC3545 | 14 Bits    |
| TLC2555 | 12 Bits    |
| TLV2545 | 12 Bits    |

*Table 1-3. Dual Input Channels*

| Device  | Resolution |
|---------|------------|
| TLC2552 | 12 Bits    |
| TLV2542 | 12 Bits    |

### 1.3 Default Jumper Settings

*Table 1-4. TLC4541EVM, TLC3541EVM, TLC2551EVM, and TLV2541EVM*

| Designator |                                                                        | 1-2           | 2-3           |
|------------|------------------------------------------------------------------------|---------------|---------------|
| W1         | Enables reference offset for single-supply amplifier U1                | Not installed | N/A           |
| W2         | Connects or bypasses buffer U1 to DUT                                  | Not installed | Installed     |
| W3         | Connects onboard or offboard REF                                       | Installed     | Not installed |
| W4         | Connects FS to pin 7 on single input DUTs                              | Not installed | Installed     |
| W5         | Connects - SCLK to pin 5 for single input ADCs                         | Installed     | Not installed |
| W6         | Connects either +Va or +5 V to positive power pin of op-amps U1 and U3 | Installed     | Not installed |
| W7         | Connects either -Va or GND to negative power pin of op-amps U1 and U3  | Installed     | Not installed |

*Table 1-5. TLC4545EVM, TLC3545EVM, TLC2552/5EVMs, and TLV2542/5EVMs*

| Designator |                                                                        | 1-2           | 2-3           |
|------------|------------------------------------------------------------------------|---------------|---------------|
| W1         | Enables reference offset for single-supply amplifier U1                | Not installed | N/A           |
| W2         | Connects or bypasses buffer U1 to DUT                                  | Not installed | Installed     |
| W3         | Connects onboard or offboard REF                                       | Installed     | Not installed |
| W4         | Connects SCLK to pin 7 on dual input DUTs                              | Installed     | Not installed |
| W5         | Connects -AIN0 to pin 5 on dual input DUT                              | Not installed | Installed     |
| W6         | Connects either +Va or +5 V to positive power pin of op-amps U1 and U3 | Installed     | Not installed |
| W7         | Connects either -Va or GND to negative power pin of op-amps U1 and U3  | Installed     | Not installed |

## 1.4 Analog Interface

The EVM board is designed for easy interfacing to analog sources such as signal generators and sensors. The buffer amplifier U1 is in a follower configuration, non-inverting gain of one. Output of this buffer drives the AIN(+) pin of the DUT through a 33-Ω resistor (R4). If desired, the user can bypass U1 by connecting pins 1-2 of jumper W2. *For low level common mode rejection (< 0.2V P-P) dual input pseudo-differential devices TLC4545, TLC3545, TLC2555 or TLV2545 can be used, byassing U1.*

Table 1-6. Analog Input Connector J1

| Pin   | Signal | Description                                          |
|-------|--------|------------------------------------------------------|
| J1.2  | AIN0   | Analog input signal to the non-inverting input of U1 |
| J1.4  | -AIN0  | Second input to dual and pseudo differential devices |
| J1.6  |        | N/C                                                  |
| J1.8  |        | N/C                                                  |
| J1.10 |        | N/C                                                  |
| J1.12 |        | N/C                                                  |
| J1.14 |        | N/C                                                  |
| J1.16 |        | N/C                                                  |
| J1.18 | REF+   | External refence voltage for the DUT                 |
| J1.20 |        | N/C                                                  |

## 1.5 Digital Interface

The EVM is designed for easy interfacing to multiple platforms. Samtec part numbers SSW-110-22-F-D-VS-K and TSM-110-01-T-DV-P provide a convenient 10-pin dual-row header and socket combination at P2. This header/socket provides access to the digital control and serial data pins for all 10 of the 12-, 14-, and 16-bit ADCs. Consult Samtec at [www.samtec.com](http://www.samtec.com) or 1-800-SAMTEC-9 for a variety of mating connector options.

Table 1-7. Digital Connector J2

| Pin Number | Signal          | Description                                                                     |
|------------|-----------------|---------------------------------------------------------------------------------|
| J2.1       | $\overline{CS}$ | Chip select – Active low signal, enables data transfer and device configuration |
| J2.3       | CLKXa           | Serial clock—damped with 33-Ω resistor                                          |
| J2.5       | CLKRa           | Serial Clock                                                                    |
| J2.7       | FSXa            | Frame sync—damped with 33-Ω resistor                                            |
| J2.9       | FSRa            | Frame sync (see Note)                                                           |
| J2.11      | Reserved        |                                                                                 |
| J2.13      | DXRa            | Serial data out                                                                 |
| J2.15      | Reserved        |                                                                                 |
| J2.17      | Reserved        |                                                                                 |
| J2.19      | Reserved        |                                                                                 |

**Note:** When using a single input ADC, TLC4541, TLC3541, TLC2551 or TLV2541, Frame Sync must be held at V<sub>DD</sub>.

## 1.6 Power Supplies

The EVM requires three power supplies.

- 1) A dual-tracking  $\pm 12$ -V supply for the dual-supply op amps U1 and U3. The voltage reference (REF02) is supplied by the +12-V supply. Jumpers W6 and W7 are default settings for this voltage condition.
- 2) A single +5-V supply is used for the ADC (DUT) and the digital interface. *Op amps U1 and U3 can be used in a unipolar power supply mode (+5 V and ground) by shorting pins 2-3 of jumper W6 and W7.*

## 1.7 Voltage References

The EVM can be configured to use its onboard reference (REF02) by connecting pins 1-2 of jumper W3. For an external reference source, configure W3 by connecting pins 2-3 and a DC supply reference voltage to pin 18 of J1.

## 1.8 EVM Operation

DC voltages can be applied to the EVM board either through the 10-pin standard power connector (J3) or the test points labeled  $-12$  V,  $+12$  V,  $+5$ , and GND. Apply the appropriate current limited (500 mA max) DC sources to the board prior to connecting the analog input and digital control signals. The digital control signals are applied directly to P2, or the EVM can be connected to a DSP interface board. The interface board is equipped with a power connector to mate with the 10-pin power connector (J3) on the EVM to supply the required voltages.

There are a number of interface options available for this style of EVM. Consult the product folder for a complete list of DSP interface cards and optional analog interface modules. If the interface options listed are not suitable, contact the PIC at (972) 644-5580, for the latest information.

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## Layout

This chapter provides the board layouts.

Figure 2-1. Top Assembly Layer

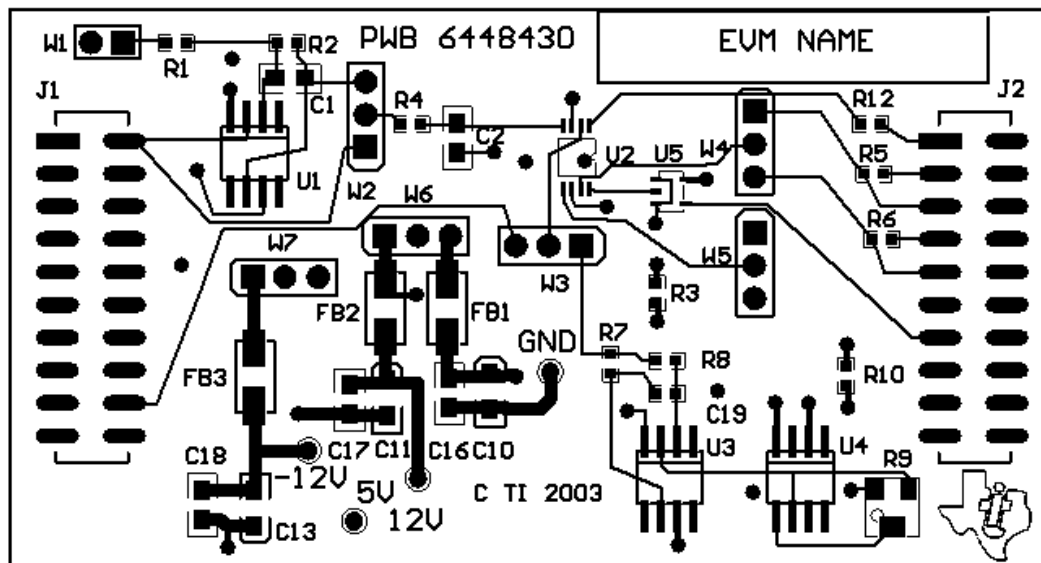


Figure 2-2. Ground Plane Layer

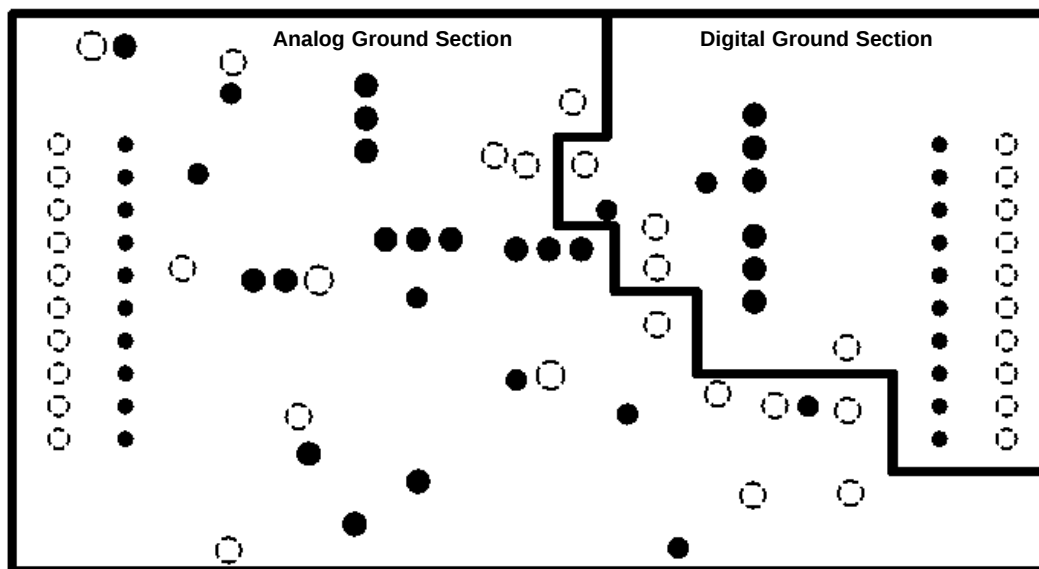


Figure 2-3. Voltage Plane Layer

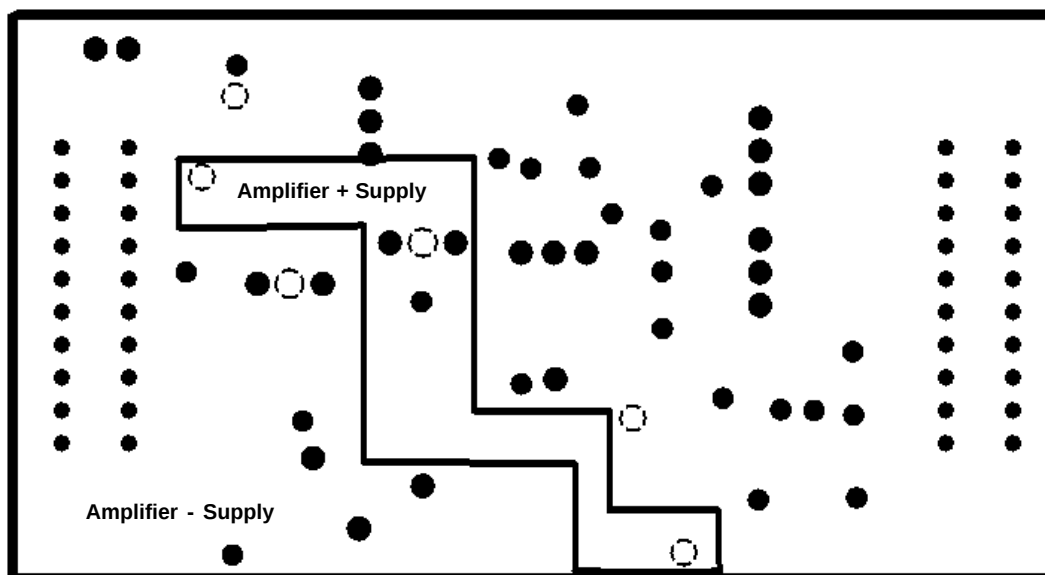
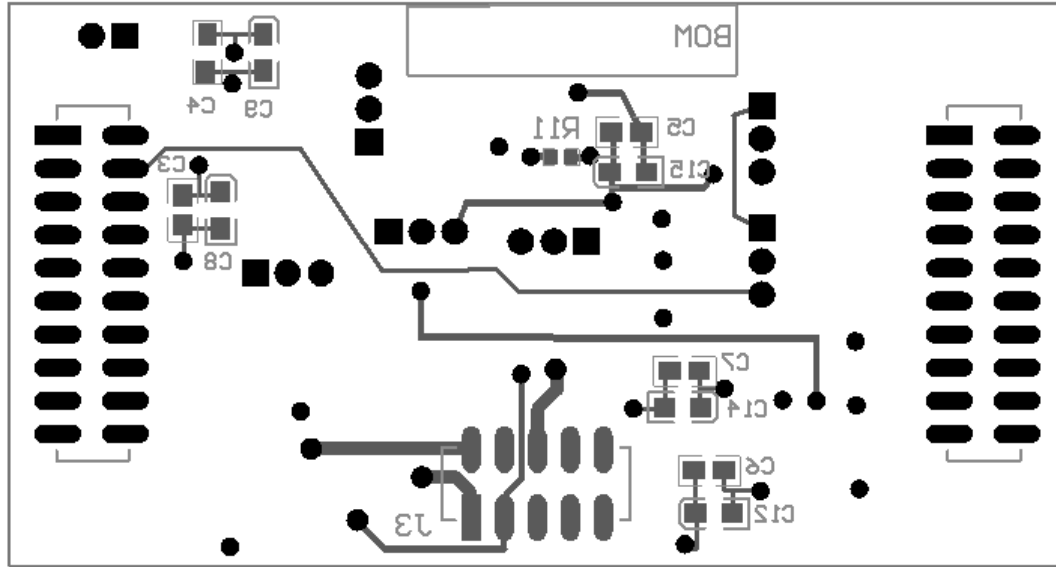


Figure 2-4. Bottom Assembly (Viewed From Top)



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# **EVM Bill of Materials and EVM Schematic**

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This chapter provides a bill of materials and schematic for the TLC4541/5EVM, TLC3541/5EVM, TLC2551/2/5EVM and TLV2541/2/5EVM.

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### 3.1 EVM Bill of Materials

The following table contains a complete bill of materials for the TLC4541/5EVM, TLC3541/5EVM, TLC2551/2/5EVM and TLV2541/2/5EVM. Contact the Product Information Center (PIC) or e-mail [dataconvapps@list.ti.com](mailto:dataconvapps@list.ti.com) if you have questions regarding this EVM.

*Table 3-1. EVM Bill of Materials*

| Ref Des         | Description           | Vendor                  | Part Number         |
|-----------------|-----------------------|-------------------------|---------------------|
| C1 C2           | NI                    |                         |                     |
| C19             | 10 pF                 | Panasonic or equivalent | ECJ-1VC1H100D       |
| C3 C4 C5 C6     |                       |                         |                     |
| C7 C16 C17 C18  | 0.1 $\mu$ F           | Panasonic or equivalent | ECJ-2YB1H104K       |
| C8 C9 C10 C11   |                       |                         |                     |
| C12 C13 C14 C15 | 10uF                  | Panasonic or equivalent | ECS-T1CX106R        |
| FB1 FB2 FB3     | SM_FB_2773044447      | Fair-Rite               | 2744044447          |
| J1 J2           | Header 10 $\times$ 2  | Samtec                  | TSM-110-01-T-DV-P   |
| J3              | Header 5 $\times$ 2   | Samtec                  | SSW-105-22-F-D-VS-K |
| P1 P2           | Socket 10 $\times$ 2  | Samtec                  | SSW-110-22-F-D-VS-K |
| PCB             | Gerbers               | Texas Instruments       | 6448430             |
| R1 R3 R10       | NI                    | Panasonic or equivalent |                     |
| R2 R11 R12      | 0R                    | Panasonic or equivalent | ERJ-3GEY0R00V       |
| R4 R5 R6        | 33R                   | Panasonic or equivalent | ERJ-3GEYJ330V       |
| R7 R8           | 100R                  | Panasonic or equivalent | ERJ-3GEYJ101V       |
| R9              | NI                    | Bourns                  | 3214W-103E          |
| SH1 - SH7       | Shunts                | Samtec or equivalent    | SNT-100-BK-T-H      |
| U1 U3           | Precision op amp      | Texas Instruments       | OPA132AU            |
| U2              | TLC4541               |                         | TLC4541IDGK         |
| U4              | REF02                 | Texas Instruments       | REF02AU             |
| U5              | SN74AHC1G125DBV       | Texas Instruments       | SN74AHC1G125DBV     |
| W1              | 2POS_JUMPER           | Samtec                  | TSW-102-07-L-S      |
| W2 W3 W4        | 3POS_JUMPER           | Samtec                  | TSW-103-07-L-S      |
| W5 W6 W7        |                       |                         |                     |
| GND             | Black test point loop | Keystone                | 5001                |
| 12V 5V 12V      | Red test point loop   | Keystone                | 5000                |

## **3.2 EVM Schematic**

The schematic diagram for the TLC4541/5EVM, TLC3541/5EVM, TLC2551/2/5EVM and TLV2541/2/5EVM is furnished as an attachment to this chapter.

