Evaluating the ADG7421F Low Voltage Fault Protection and Detection, 12 Ω R_{ON}, Dual SPST Switch

FEATURES

- Supply voltages
  - Dual supply: ±1.8 V to ±2.5 V
  - Single supply: 1.8 V to 5.5 V
- Protected against overvoltage on source pins
- Signal voltages up to −60 V and +60 V
- LED for visual overvoltage indication
- Parallel interface compatible with 1.8 V logic

EVALUATION KIT CONTENTS

- EVAL-ADG7421FEBZ evaluation board

DOCUMENTS NEEDED

- ADG7421F data sheet
- EVAL-ADG7421FEBZ user guide

EQUIPMENT NEEDED

- DC voltage source
  - ±2.5 V for dual supply
  - 5 V for single supply
- Optional digital voltage source: 5 V
- Analog signal source
- Method to measure voltage, such as a digital multimeter (DMM)

GENERAL DESCRIPTION

The EVAL-ADG7421FEBZ is the evaluation board for the ADG7421F, which features two single-pole/single-throw (SPST) switch channels. The ADG7421F has overvoltage detection and protection circuitry on the source pins and is protected against signals up to −60 V and +60 V in both the powered and unpowered states.

Figure 1 shows the EVAL-ADG7421FEBZ in a typical evaluation setup. The ADG7421F is soldered to the center of the evaluation board, and two wire screw terminals are provided to connect to each of the source and drain pins. Three screw terminals are used to power the device. A fourth terminal is used to provide a user defined digital voltage, to supply the LED, which is mounted to provide visual indication of the fault status of the switch.

Full specifications on the ADG7421F are available in the product data sheet, which must be consulted in conjunction with this user guide when using the evaluation board.

TYPICAL EVALUATION SETUP

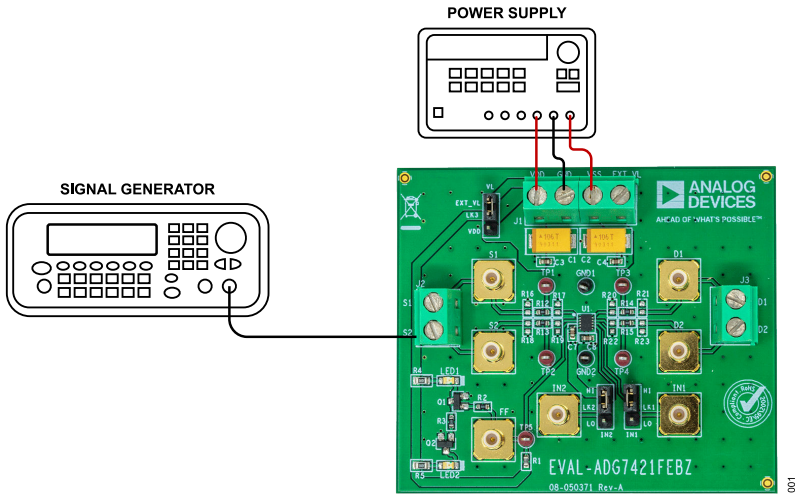

Figure 1. EVAL-ADG7421FEBZ (on Right), Power Supply, and Signal Generator

TABLE OF CONTENTS

REVISION HISTORY

7/2021—Revision 0: Initial Version

GETTING STARTED

EVALUATION BOARD SETUP PROCEDURE

The EVAL-ADG7421FEBZ evaluation board is designed to be operated independently and does not require any additional evaluation boards or software to operate. An external 5 V digital power supply (EXT_VL) is required for the LED if using a V_{DD} supply of less than 5 V.

Supply the evaluation board with a dual power source of up to ±2.5 V or a single supply of up to 5 V by connecting the VSS and GND terminals together.

Set up a simple functionality test as follows:

1. Connect a 5 V power supply to J1. Connect the VSS and GND terminals together if a single supply is required. Set LK3 to the VDD position.
2. Control the digital signals for the switch channel on the ADG7421F by using LK1 and LK2. In Position LO, the switches are open and presents as an open circuit. In Position HI, the switch is closed and presents with a resistance of approximately 12 Ω.
3. The green LED lights up to indicate that the switch is operating normally.

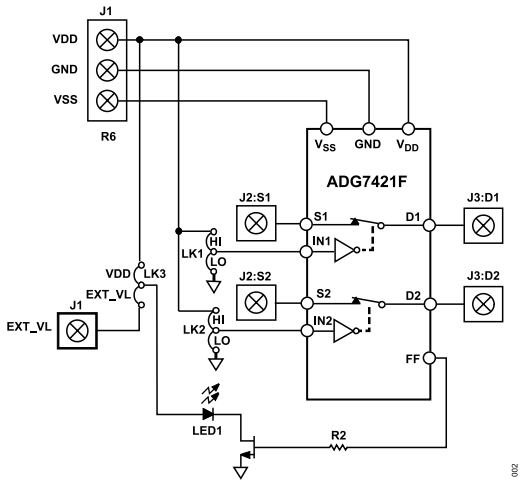

Figure 2. EVAL-ADG7421FEBZBlock Diagram

EVALUATION BOARD HARDWARE

The operation of the ADG7421F is evaluated using the EVAL-ADG7421FEBZ. Figure 1 shows a typical evaluation setup where only a power supply and signal generator are required. Figure 2 shows the block diagram of the main components of the evaluation board.

Using this evaluation board, the ADG7421F is used to pass signals from either the source or drain connectors. The source pins have fault detection circuitry that reacts to an overvoltage event. During an overvoltage event, the switch is turned off, and the FF pin is pulled low. See the ADG7421F data sheet for more details.

POWER SUPPLY

Connector J1 provides access to the supply pins of the ADG7421F. VDD, GND, and VSS link to the respective VDD, GND, and V_{SS} pins on the ADG7421F. For dual supply voltages, the evaluation board can be powered from ±1.8 V to ±2.5 V. For single-supply voltages, the GND and VSS terminals must be connected together, and the evaluation board can be powered from 1.8 V to 5 V. A secondary voltage source can be connected to EXT_VL and used as the power supply for the indicator LEDs. This secondary voltage source is required if the V_{DD} voltage is less than 5 V. To use EXT_VL, move the LK3 link into the EXT_VL position.

INPUT SIGNALS

Two 2-pin screw connectors are provided to connect to both the source and drain pins of the ADG5401F. Additional Subminiature Version B (SMB) connectors are available if extra connections are required. The ADG7421F is overvoltage protected on the source side, and each source terminal (S1 and S2) can be presented with a voltage of up to +60 V or −60 V. See the ADG7421F data sheet for more details.

Each trace on the source and drain terminals includes two sets of 0603 pads, which can be used to place a load on the signal path to ground. A 0 Ω resistor is placed in the signal path and can be replaced with a user defined value. The resistor combined with the gold pin connectors can be used to create a simple RC filter.

The ADG7421F uses a parallel interface to control the operation of the switch channel. The switch operation can be manually controlled using the headers on LK1 and LK2, or an external controller can be interfaced directly to the control pins by using the SMB connectors (IN1 and IN2) and removing the link headers on LK1 and LK2.

OUTPUT SIGNALS

The FF pin is an open-drain output. This pin indicates when the device is operating normally or whether there is an overvoltage fault on one of the source pins. For visual indication, LEDs are mounted on the EVAL-ADG7421FEBZ. When the device operates normally, the FF pin remains high (a pull-up resistor required), and LED1 illuminates green. If an overvoltage occurs at any of the source pins, the FF pin pulls low, and LED2 illuminates red.

JUMPER SETTINGS

LINK HEADERS AND 0 Ω RESISTORS

The link headers are used to control the ADG7421F manually and configure the digital control voltage. 0 Ω resistors are used to isolate the LED from the rest of the system. Table 1 shows a summary of the link headers, the pull-up resistor, and 0 Ω resistors, and how they are used on the evaluation board.

LK1 and LK2 are used to control the switch channels of the ADG7421F. Position LO opens the switch, and Position HI closes the switch.

Resistors R2 and R3 connect the FF pin of the ADG5401F to the LED controls.

Table 1. Link Header Descriptions

Label	Position	Description
LK1	HI	S1/D1 switch closed
	LO	S1/D1 switch open
LK2	HI	S1/D1 switch closed
	LO	S1/D1 switch open
LK3	EXT_VL	On-board LEDs powered with VDD
	VDD	On-board LEDs powered with EXT_VL
R2, R3	Inserted	FF pin connected to LED
	Removed	FF pin disconnected from LED
R1	Inserted	1 kΩ pull-up resistor at FF pin
	Removed	No external pull-up resistor at FF pin

SMB CONNECTORS

The parallel interface of the ADG7421F is controlled manually using the link headers, LK1 and LK2, or it can be accessed using the SMB connectors, IN1 and IN2. To use the SMB connectors, remove the LK1 and LK2 link headers. The FF SMB connector is used to access the FF digital output from the ADG7421F.

EVALUATION BOARD SCHEMATICS AND ARTWORK

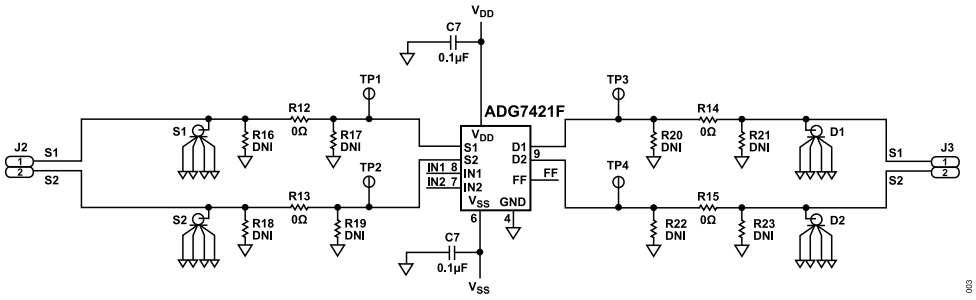

Figure 3. EVAL-ADG7421FEBZ Evaluation Board Schematic—Page 1

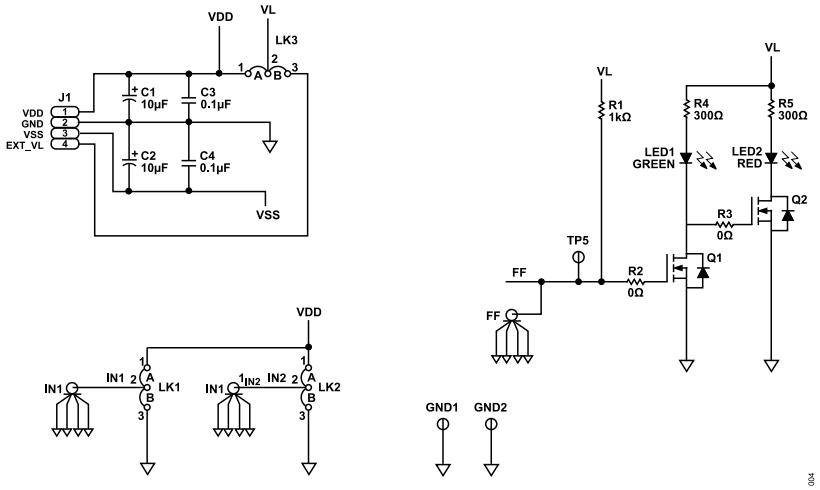

Figure 4. EVAL-ADG7421FEBZ Evaluation Board Schematic—Page 2

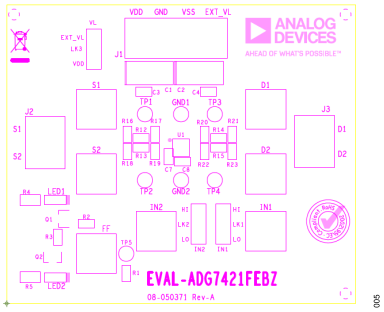

Figure 5. EVAL-ADG7421FEBZ Silkscreen

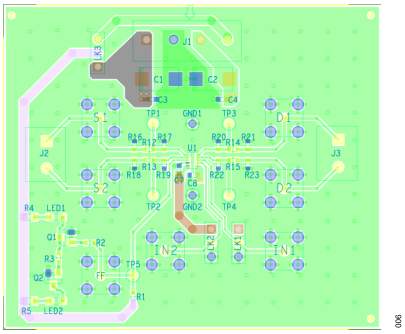

Figure 6. EVAL-ADG7421FEBZ Top Layer

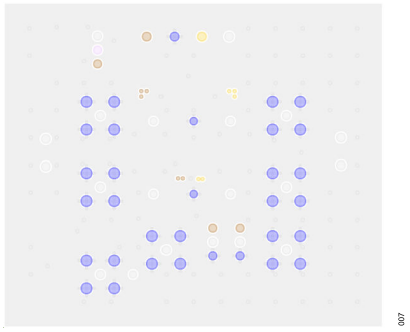

Figure 7. EVAL-ADG7421FEBZ Layer 2

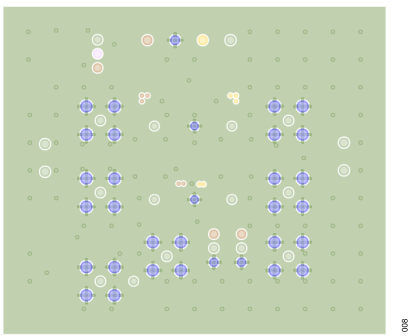

Figure 8. EVAL-ADG7421FEBZ Layer 3

EVALUATION BOARD SCHEMATICS AND ARTWORK

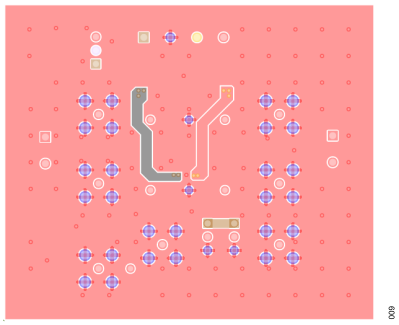

Figure 9. EVAL-ADG7421FEBZ Bottom Layer

ORDERING INFORMATION

BILL OF MATERIALS

Table 2.

Reference Designator	Description
C1, C2	50 V, 10 µF tantalum capacitors, D size
C3, C4, C7, C8	50 V, X7R, 0.1 µF multilayer ceramic capacitors, 0603
S1, S2, D1, D2	50 Ω, SMB socket
IN1, IN2	50 Ω, SMB socket
GND1, GND2	Black test point
J1	4-pin terminal block (5 mm pitch)
J2, J3	2-pin terminal block (5 mm pitch)
LED1	LED, SMD, green, 0805
LED2	LED, SMD, red, 0805
LK1, LK2, LK3	3-pin, single inline (SIL) header and shorting link
Q1, Q2	Transistor, N channel MOSFET, 60 V, 0.23 A, SOT-23
R1	Resistor, 1 kΩ, 0.063 W, 1%, 0603
R2, R3, R12 to R15	Resistor, 0603, 1%, 0 Ω
R4, R5	Resistors, 300 Ω, 0.1 W, 1%, 0805
TP1 to TP5	Red test point
U1	ADG7421F, overvoltage protection switch