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1. Introduction

The Texas Instruments TPIC8101EVM evaluation module set (EVM) helps designers evaluate the operation and performance of the TPIC8101 dual-channel knock sensor interface IC. The EVM set contains one TI communication board (TIger), one IC EVM board and TPIC8101 IC (See Table 1).

Table 1: Device and Package Configurations

CONVERTER	IC	PACKAGE
U1	TPIC8101DWG4	DW-20

2. Setup

This section describes the setup of EVM sets, including EVM set hardware connection and GUI operation.

2.1. EVM set hardware connection.

The TI communication board should be connected to the IC EVM board via a 30-pin connector in the shipment box. Please connect them if they are not connected yet, as shown in Figure 1.

Figure 1: TIger communication board (left) and IC EVM board (right)

Please insert one end of a USB cable into TIger communication board, the other end to the USB port in a PC.

5V voltage supply

- 5V could be supplied by TI communication board if *Jumper 5V* is connected (default setting)
- 5V could be also supplied by connecting probe VDD with and external power supply, and disconnecting *Jumper 5V*

High frequency oscillation input (e.g., 8MHz)

- High frequency oscillation signal could be supplied by TI communication board if *Jumper TLCK* is connected (default setting)
- High frequency oscillation signal could be also supplied by connecting probe XCLK with and external function generator, and disconnecting *Jumper TLCK*

Integration window signal (e.g., 5ms)

- Integration window signal could be supplied by TI communication board if *Jumper INH/H* is connected (default setting)
- Integration window signal could be also supplied by connecting *jumper pin INH/H* with and external function generator, and unplugging *Jumper INH/H.*

Knock sensor output signal (e.g., 10KHz)

- Knock sensor output signal could be connected at probe **CH1** or **CH2** (for channel 1 and 2 correspondingly), from a knock sensor, or an external function generator.

2.2. GUI operation

Software package:
There are 5 files in the zipped software package, please unzip them into one folder and run the executable file **TPIC8101EVM.exe** to start the GUI.

The GUI will be shown as Figure 2. By default, the IC will be working on default SPI mode after power up, which happens after USB cable is plugged into PC. If USB cable is consistently plugged into PC, the IC could stay in either default SPI mode or advanced SPI mode, depending on the very last operation. If the IC is in the advanced SPI mode, need to restart the IC to return to default SPI mode.

Operation in default SPI mode:
The SPI is in the default mode on the power up sequence. In this case, the SDO directly equals the SDI (echo function). In this mode, five commands can be transmitted by the master controller (TI communication board) to configure the IC. Details setting could be found at page 13 of the datasheet.
In each setting, select a value from the combo boxes, and press *Send SPI* button. Exact the same SPI response should be read, if the IC works correctly.

- Set the prescaler and SDO status
- Select the channel
- Set the band-pass center frequency
- Set the gain
- Set the integration time constant
- Enter advanced SPI mode. Once entered the advanced mode, there is no way to return to normal mode, unless restart the IC.

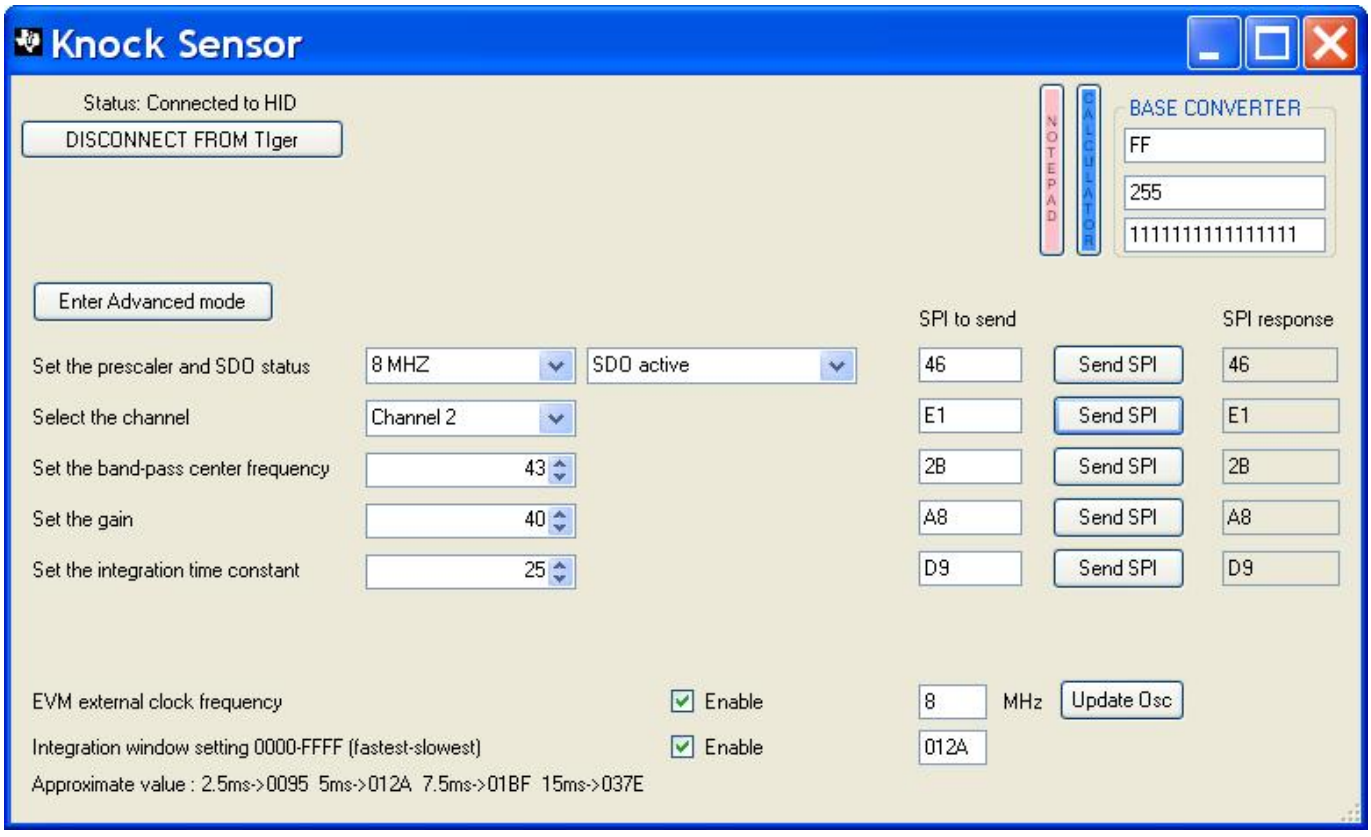

Figure 2: GUI : default SPI mode

Operation in advanced SPI mode:
The advanced SPI mode has additional features to the default SPI mode. A control byte is written to the SDI and shifted with the MSB first. The response byte on the SDO is shifted out with the MSB first. The response byte corresponds to the previous command. Therefore, the SDI shifts in a control byte n and shifts out a response command byte n−1. Each control/response pair of commands requires two full 8-bit shift cycles to complete a transmission. The control bytes with the expected response are shown in page 14 of datasheet. In the advanced SPI mode, only a power-down condition may reset the SPI mode to the default state on the subsequent power-up cycle.

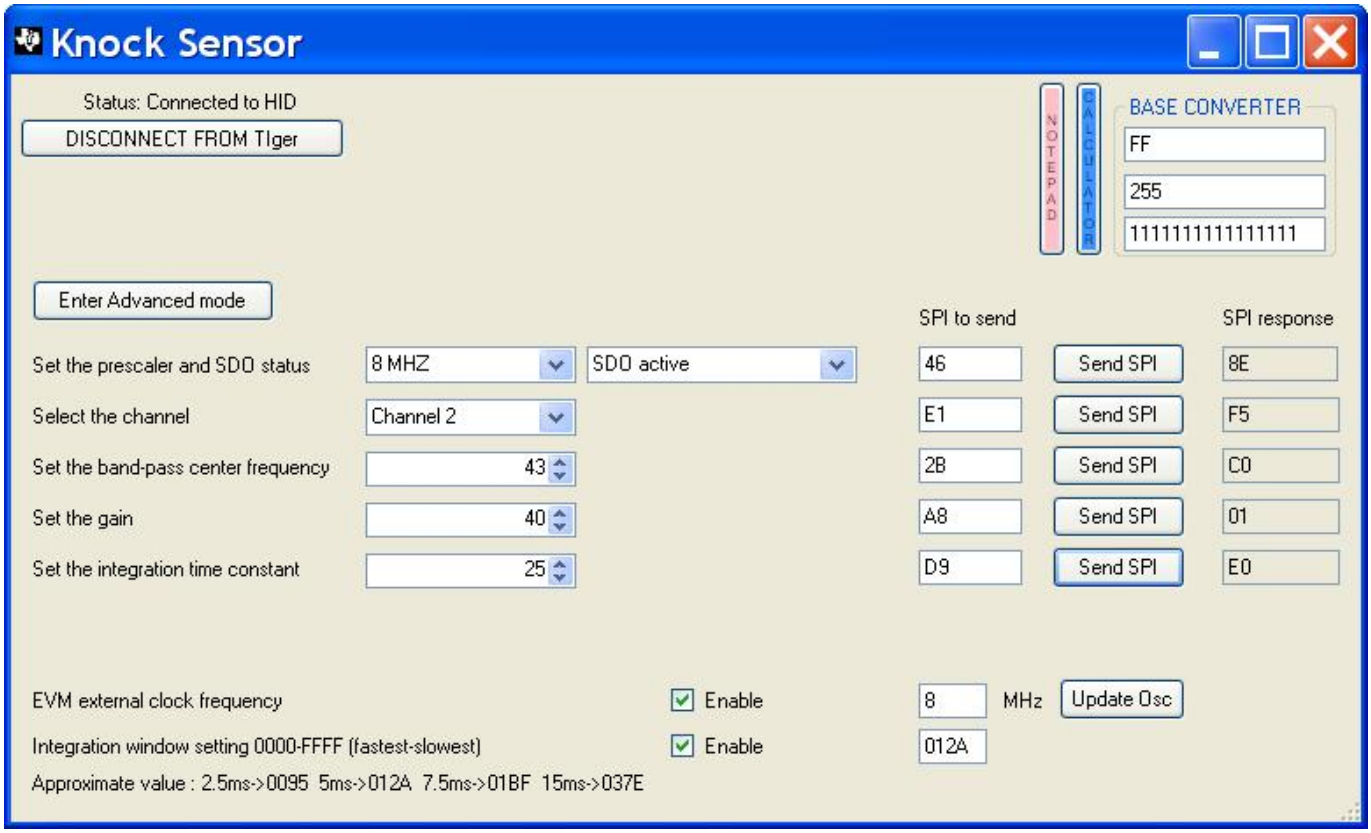

Figure 3: GUI : advanced SPI mode

Clock and integration window settings:

TI communication board could generate 2 square wave forms, a high frequency one which could be used as an external clock frequency signal, such as 8Mhz; and a low frequency one which could be used as a integration window, such as 5ms.

To use the external clock, check the *enable* box and enter a desired frequency in the edit box. Press the *Update Osc* button once the settings has been updated.

To use the integration window, check the *enable* box and enter a 4 digit hex number in the edit box. Hex 0000 is the fastest square waveform the TI communication board could produce, and hex FFFF corresponds to the slowest waveform. It is generated by the a GPIO of the micro controller, therefore the frequency is approximate. E.g, hex 012A could generate a 100Hz square waveform, which could be used to serve as a 5ms integration window.

Sample waveforms of knock sensor output, integration window and IC analog output are shown in Figure 4.

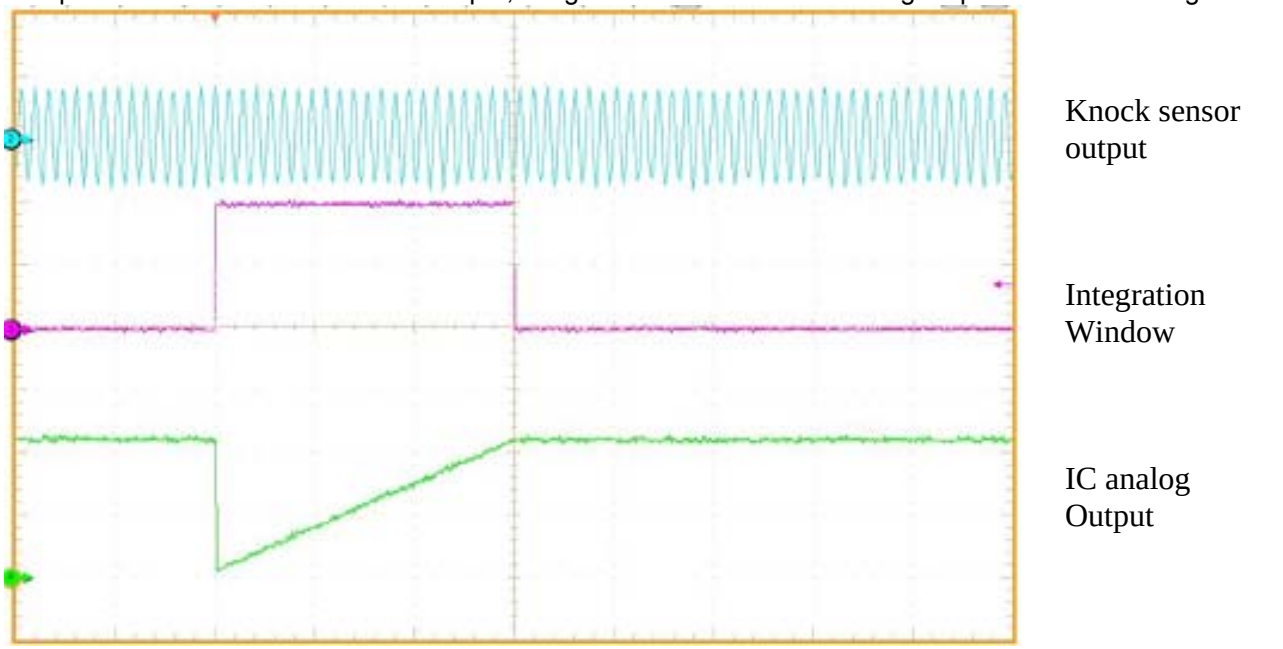

Figure 4: Sample waveforms

3. Board Layout

Figure 5, Figure 6 and Figure 7 show the board layout for the TPIC8101EVM PWB. The board layout and the PWB for TIger communication board are not provided.

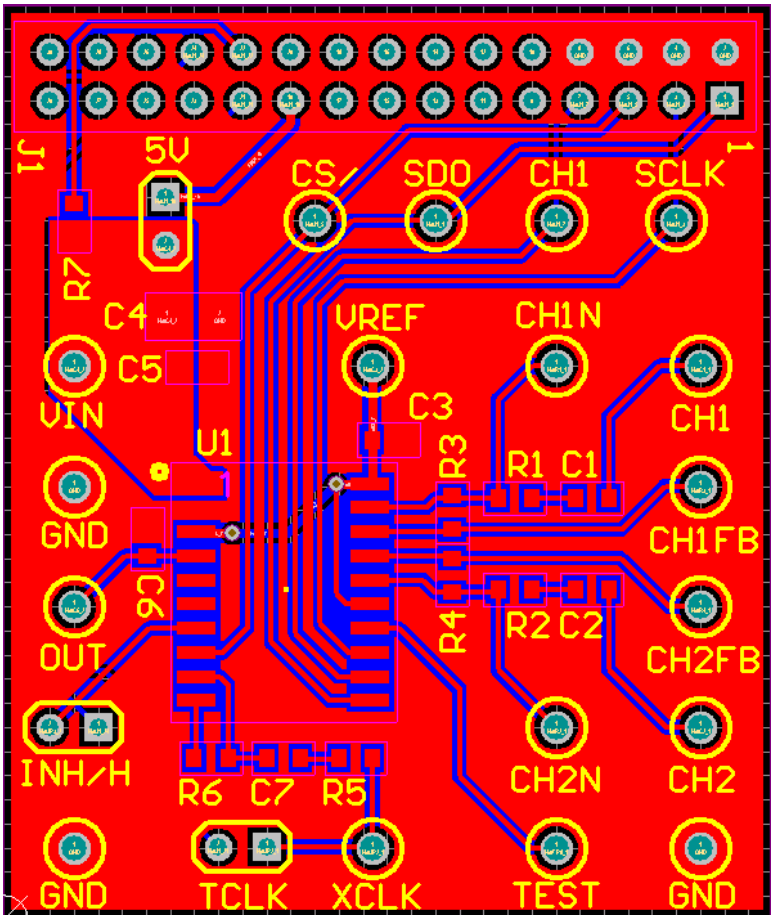

Figure 5: Top Assembly Layer

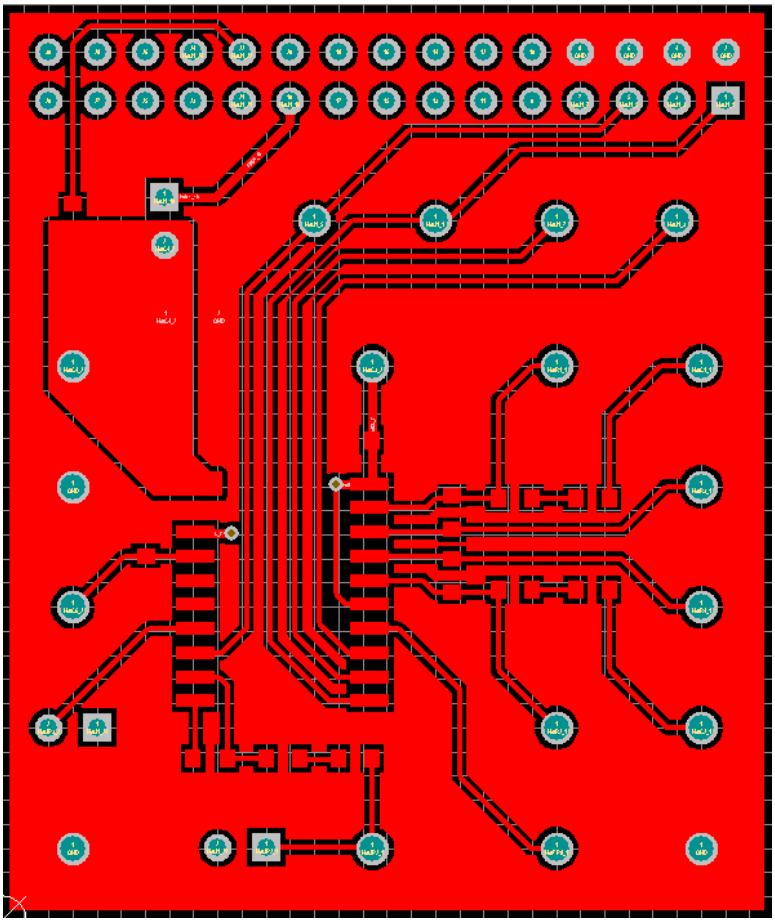

Figure 6: Top Layer Routing

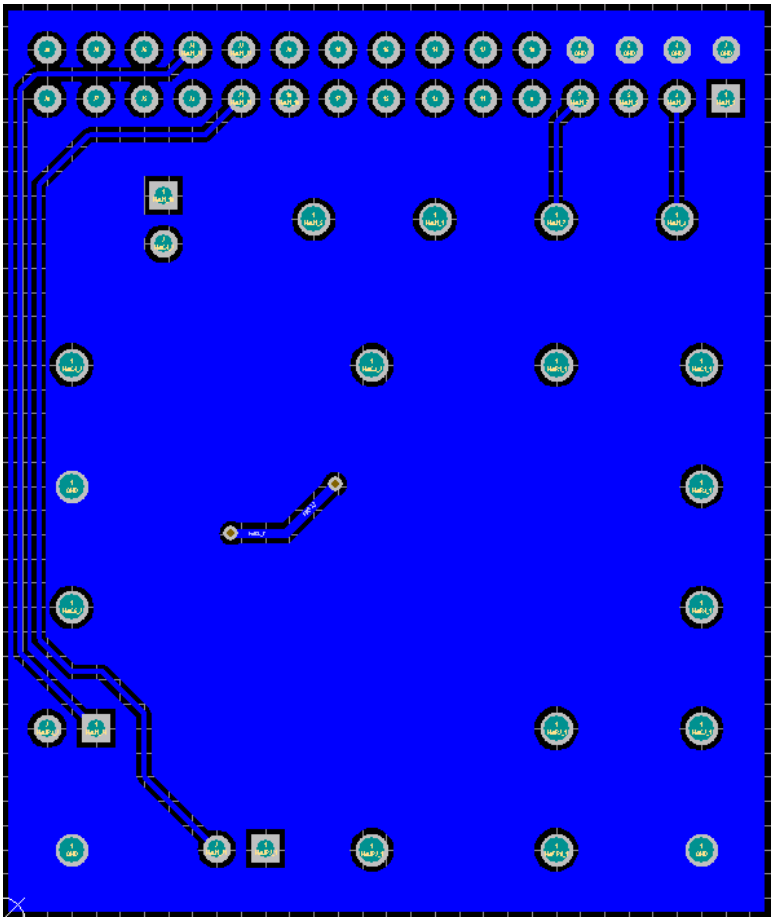

Figure 7: Bottom Layer Routing

4. Schematic

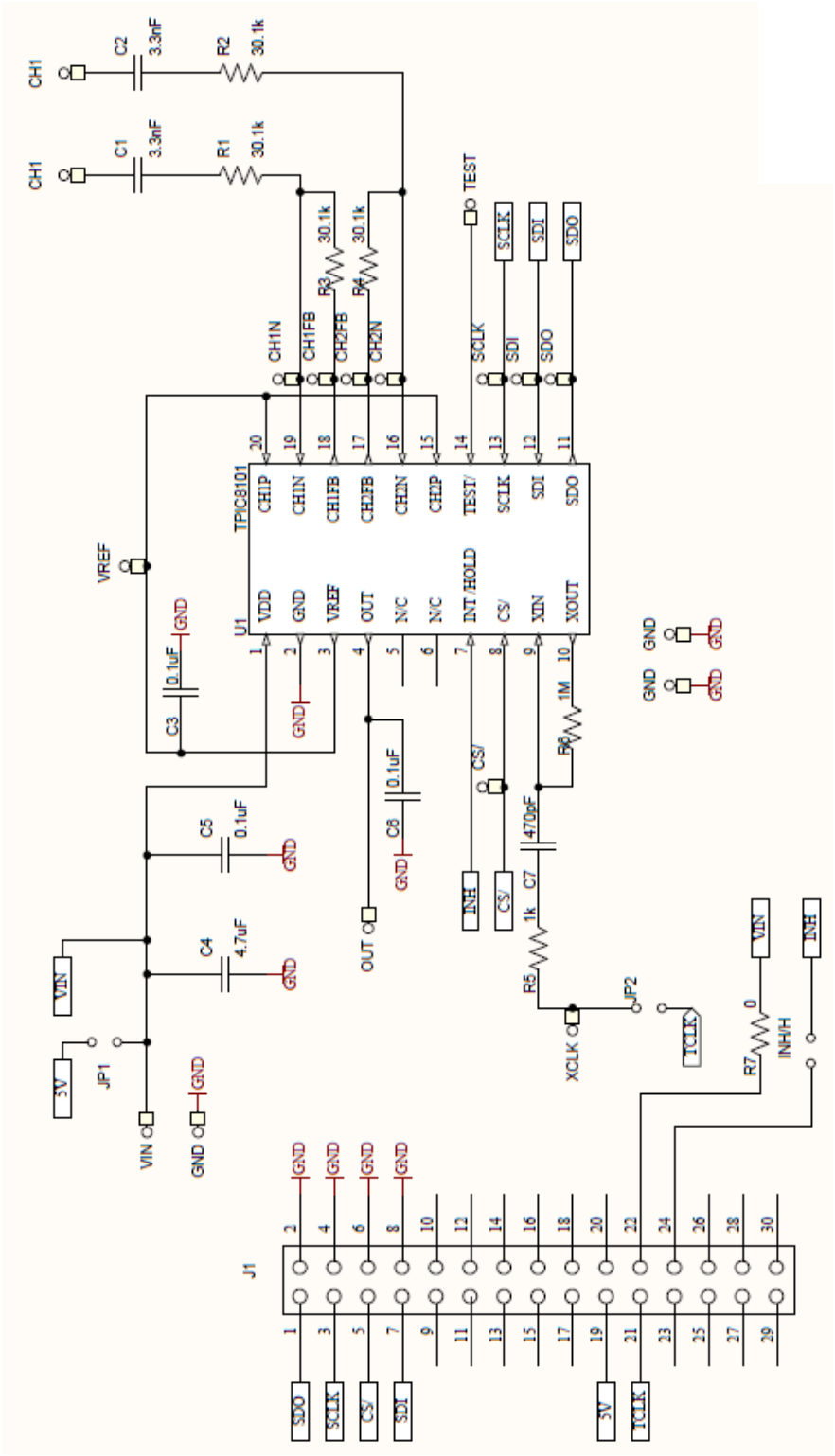

Figure 8: TPIC8101EVM Schematic

Table 2: TPIC8101EVM Bill of Materials

COUNT	REF DES	DESCRIPTION	SIZE	MFR	PART NUMBER
2	C1, C2	Capacitor, ceramic, 3300pF, 50V, 10%	603	muRata	GRM188R71H332KA01D
3	C3, C5, C6	Capacitor, ceramic, 0.1uF, 50V, 10%	603	muRata	GRM188R71H104KA93D
1	C4	Capacitor, ceramic, 4.7uF, 16V, 10%	1206	muRata	GRM31CR61C475KA01L
1	C7	Capacitor, ceramic, 470pF, 50V, 10%	603	muRata	GRM188R71H471KA01D
1	J1	Dual row header right angle, 30-pin, 100-mil spacing, (80-pin strip)	0.100 x 15	Tyco	9-146308-0
3	5V, INH/H, TCLK	Header, 2-pin, 100-mil spacing, (36-pin strip)	0.100 x 2	Sullins	PEC02SAAN
3	5V, INH/H, TCLK	Connector jumper, shorting, 100-mil spacing	0.1	Sullins	SPC02SYAN
4	R1, R2, R3, R4	Resistor, chip, 30.1 kΩ, 1/10W, 1%	603	Panasonic	ERJ-3EKF3012V
1	R5	Resistor, chip, 1 kΩ, 1/10W, 1%	603	Panasonic	ERJ-3EKF1001V
1	R6	Resistor, chip, 1 MΩ, 1/10W, 1%	603	Panasonic	ERJ-3EKF1004V
1	R7	Resistor, chip, 0 Ω, 1/10W, 1%	603	Panasonic	ERJ-3GEY0R00V
19	CH1, CH1FB, CH1N, CH2, CH2FB, CH2N, CS/, GND (x3), OUT, SCLK, SDI, SDO, TEST, VIN, VREF, XCLK	Test point, 52-mil	0.052	Kobiconn	151-103-RC
1	U1	IC, TPIC8101DW		TI	TPIC8101DW
1	-	PCB, 1.6-inch x 1.9-inch x 0.062		Any	TPIC8101, REV B

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It is important to operate this EVM within the input voltage range of -0.3 V to 48 V and the output voltage range of 0.9 V to 18 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 85° C. The EVM is designed to operate properly with certain components above 60° 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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