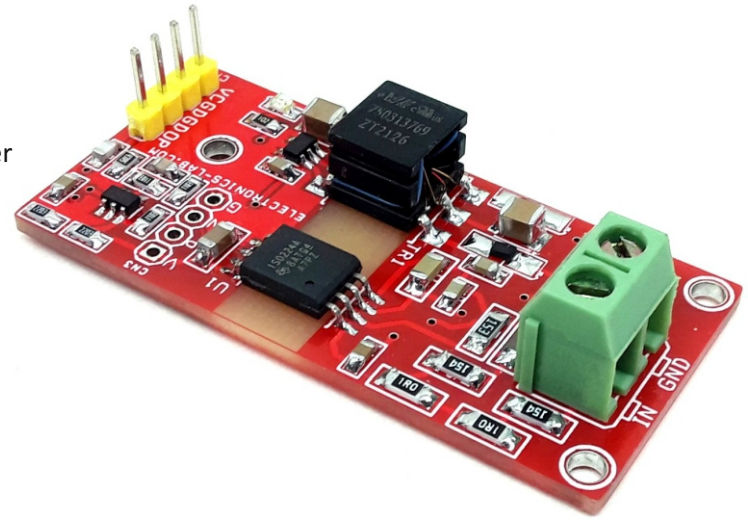
250V AC Isolated Voltage-Sensing Circuit with Single output (250V AC Input 5V Output)

The project presented here can be used in isolated voltage sensing measurements applications. The board was built using ISO224B isolated amplifier, isolated 5V DC-DC converter provides 5V DC to the input side of ISO224 amplifier, TLV6001 op-circuit converts the differential signal of ISO224 and provides single-ended output. The circuit measures the 250V AC voltage and outputs a 5V signal, the output is optically isolated and the output voltage will change proportional to the input voltage. The operating supply of the project is a single 5V DC. The divider resistor reduces the voltage from AC 250V to +/-7.5V which is within the input range of ISO224 (+/-12V). The circuit can be used to measure the DC voltage as well AC voltage.



Features

- Operating Supply 5V DC
- Onboard Isolated 5V to 5V DC-DC Converter to Power The input Side of ISO224 Amplifier
- Input 250V AC
- Frequency Response 1Hz to 20Khz (Tested)
- Can be Configured to Measure the DC +/-7.5V DC or Higher
- Can be Configured for differential Output
- Output 5V
- Onboard Power LED
- PCB Dimensions 53.50 x25.24 mm

AC Voltage Measurement

The existing circuit can measure the AC voltage up to 250V AC and provide a 5V sinewave, output level depends on the input voltage level. When the input is off, the output is 2.5V DC. Users may change the input to output ratio by altering input divider resistors R3, R4, R5, R6, and R8. It is recommended to use 1% tolerance for all these resistors, C4 is to prevent the noise coming from input. This board can be configured to measure the +/-480V by altering the values of the divider resistors.

DC Voltage Measurement

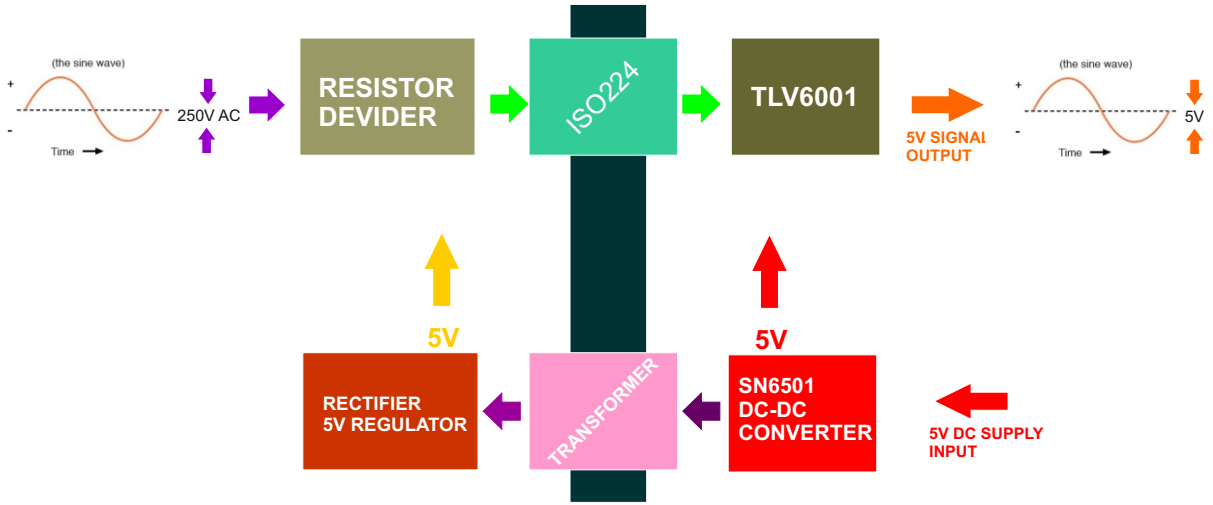
This circuit can measure dual input +/-7.5V DC and provides 0 to 5V DC (2.5V DC when input is Zero or OFF). When R3, R4, R5, R6, resistor values are 0 Ohms and R8 is not used. For higher voltage measurement use appropriate divider resistors R3, R4, R5, R6, R8. It is important to maintain a maximum output of +/-7.5V after divider resistors.

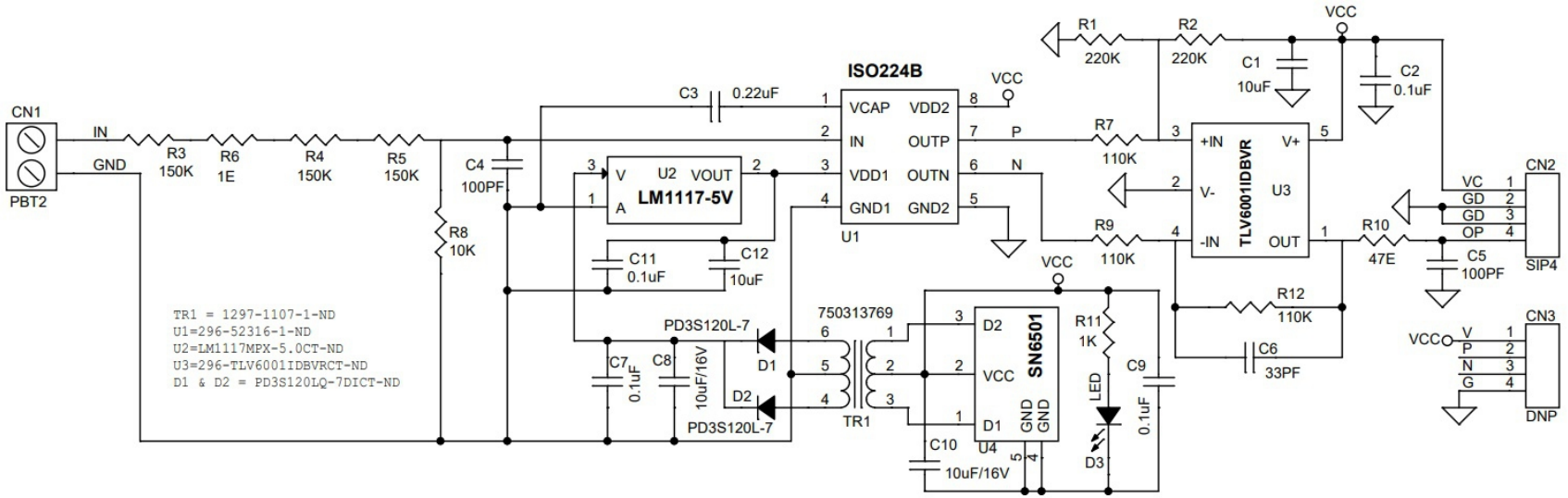
Differential Output for ADC Interface: Make the following changes to configure this board for differential output

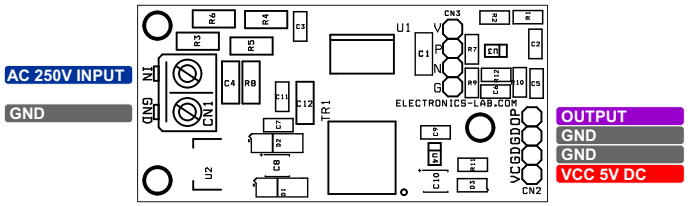
- Do not Install R1, R2, R10, R7, R9, R12, C6, C5, U3, Cn2
- Use CN3 for the interface: Pin 1 VCC-5V DC input, Pin 2 +P Output for ADC, Pin 3 -N Output for ADC, Pin 4 GND
- R3, R4, R5, R6 = 0 Ohms 1206 size, do not install R8
- Project Provides differential output +/-4V with input +/-12V
- Calculate and Choose divider resistor R3, R4, R5, R6, and R8 for higher voltage measurements

This board can be configured for differential output which is important for analog-to-digital converters (ADC) interface. ISO224 is optimized for accurate sensing of +/-12V signals that are widely used in industrial applications. Do not populate the following components R1, R2, R10, R7, R9, R12, C6, C5, U3, CN2 to optimize the board for differential output. Optional Connector CN3 helps for the ADC interface.

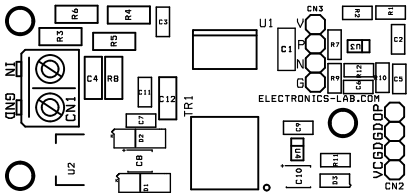
The ISO224 is a precision isolated amplifier with an output separated from the input circuitry by an isolation barrier with high immunity to magnetic interference. This barrier is certified to provide reinforced galvanic isolation of up to 5 kVRMS with an exceptionally long lifetime and low power dissipation. When used with isolated power supplies, this device separates parts of the system that operate on different common-mode voltage levels and protects lower-voltage devices from damage. The input of the ISO224 is optimized for accurate sensing of ±10-V signals that are widely used in industrial applications. The device operates of a single supply on the high-side. This unique feature simplifies the design of the isolated power supply and reduces the system cost. The integrated high-side supply voltage detection feature simplifies system-level diagnostics. The ±4-V output of the ISO224 allows lower-cost analog-to-digital converters (ADCs) to be used. The differential structure of the output supports high immunity to noise.



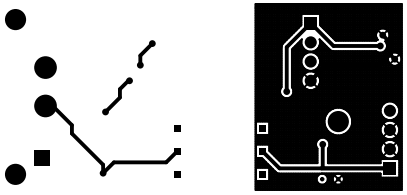

CN1
PBT2
IN
GND
R3 150K
R6 1E
R4 150K
R5 150K
R8 10K
C4 100PF
C3 0.22uF
ISO224B
VCAP
VDD2
IN
OUTP
VDD1
OUTN
GND1
GND2
U1
VCC
P
N
U2 LM1117-5V
V
VOUT
A
C11 0.1uF
C12 10uF
R1 220K
R2 220K
C1 10uF
C2 0.1uF
R7 110K
R9 110K
TLV6001IDBVR
+IN
V+
V-
U3
-IN
OUT
R10 47E
C5 100PF
CN2
SIP4
VC
GD
GD
OP
R12 110K
C6 33PF
CN3
DNP
V
P
N
G
VCC
PD3S120L-7
D1
D2
PD3S120L-7
C7 0.1uF
C8 10uF/16V
750313769
TR1
SN6501
D2
VCC
D1
GND
GND
U4
C10 10uF/16V
R11 1K
LED
D3
C9 0.1uF
TR1 = 1297-1107-1-ND
U1=296-52316-1-ND
U2=LM1117MPX-5.0CT-ND
U3=296-TLV6001IDBVRCT-ND
D1 & D2 = PD3S120LQ-7DICT-ND

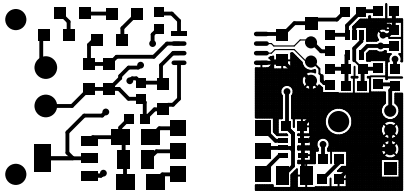


BOM						
NO.	QNTY.	REF.	DESC.	MANUFACTURER	SUPPLIER	SUPPLIER PART NO
1	1	CN1	2 PIN SCREW TERMINAL PITCH 5.08MM	PHOENIX	DIGIKEY	277-1247-ND
2	1	CN2	4 PIN MALE HEADER PITCH 2.54MM	WURTH	DIGIKEY	732-5317-ND
3	1	CN3	DNP			
4	2	C1,C12	10uF/16V SMD SIZE 1206	MURATA/YAGEO	DIGIKEY	
5	4	C2,C7,C9,C11	0.1uF/50V SMD SIZE 0805	MURATA/YAGEO	DIGIKEY	
6	1	C3	0.22uF/50V SMD SIZE 0805	MURATA/YAGEO	DIGIKEY	
7	2	C4,C5	100PF/50V SMD SIZE 0805	MURATA/YAGEO	DIGIKEY	
8	1	C6	33PF/50V SMD SIZE 0805	MURATA/YAGEO	DIGIKEY	
9	2	C8,C10	10uF/16V SMD SIZE 1210	MURATA/YAGEO	DIGIKEY	
10	2	D1,D2	PD3S120L-7	DIODE INCORP	DIGIKEY	PD3S120LQ-7DICT-ND
11	1	D3	LED SMD SIZE 0805	OSRAM	DIGIKEY	475-1278-1-ND
12	2	R1,R2	220K 1% SMD SIZE 0805	MURATA/YAGEO	DIGIKEY	
13	3	R3,R4,R5	150K 1% SMD SIZE 1206	MURATA/YAGEO	DIGIKEY	
14	1	R6	1E 5% SMD SIZE 1206	MURATA/YAGEO	DIGIKEY	
15	3	R7,R9,R12	105K 1% SMD SIZE 0805	MURATA/YAGEO	DIGIKEY	
16	1	R8	10K % SMD SIZE 1206	MURATA/YAGEO	DIGIKEY	
17	1	R10	47E 5% SMD SIZE 0805	MURATA/YAGEO	DIGIKEY	
18	1	R11	1K 5% SMD SIZE 0805	MURATA/YAGEO	DIGIKEY	
19	1	TR1	750313769 TRANSFORMER	WURTH	DIGIKEY	1297-1107-1-ND
20	1	U1	ISO224B	TI	DIGIKEY	296-52316-1-ND
21	1	U2	LM1117-5V	TI	DIGIKEY	LM1117MPX-5.0CT-ND
22	1	U3	TLV6001IDBVR	TI	DIGIKEY	296-TLV6001IDBVRCT-ND
23	1	U4	SN6501	TI	DIGIKEY	296-30388-1-ND



SILK SCREEN TOP


BOTTOM LAYER


TOP LAYER

PCB DIMENSIONS 53.50MM X 25.24MM