

EE 230 Experiment - 7

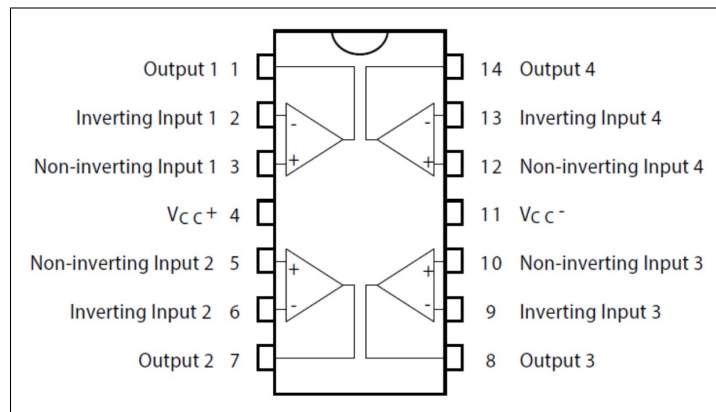
Instrumentation Amplifiers

24th September, 2021

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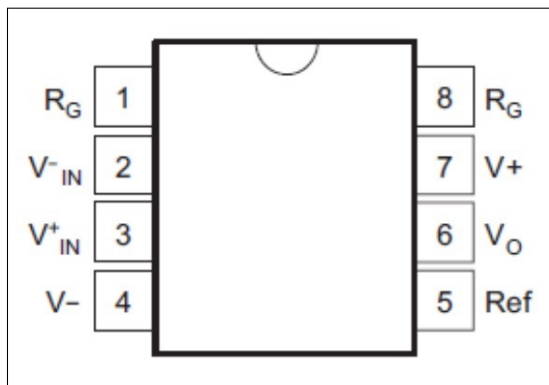
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1 Three-Opamp Instrumentation Amplifier using TL084

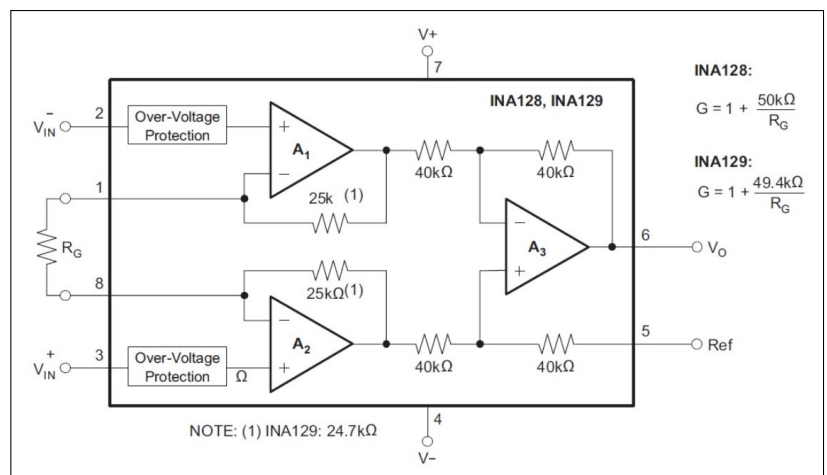


TL084 Quad JFET Pinout Diagram

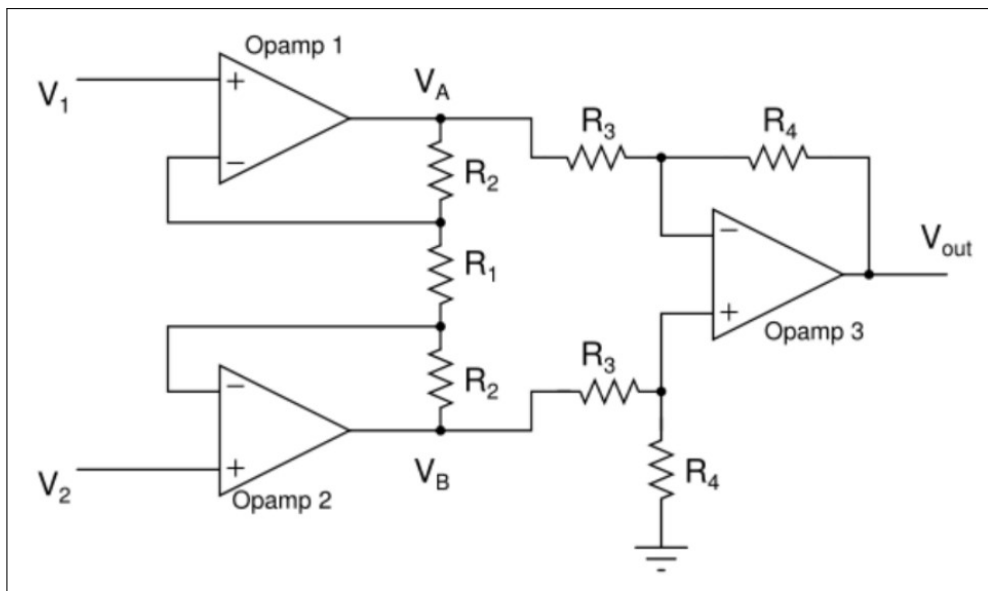
2 INA128 Instrumentation Amplifier



(a) INA128 Instrumentation Amplifier Pinout Diagram



(b) INA128 Instrumentation Amplifier internal structure



Three-OpAmp Instrumentation Amplifier

Questions

1. In Sec 3.2 and 3.3, even under no-load conditions V_{out} was found to be non-zero. Give one or two reasons for this.

The output voltage (V_{out}) is non-zero even in no load conditions because of the Common-Mode Gain, A_{CM} . The V_{out} of INA128 < that of TL084.

2. Give two or three major advantages of the three-OpAmp instrumentation amplifier as compared to the single-OpAmp difference amplifier of Experiment 6.

The advantages of the Three-OpAmp Instrumentation Amplifier over the single-OpAmp difference amplifier are:

- a The Three-OpAmp Instrumentation Amplifier has a very high input resistance.
 - b The Common-Mode Rejection Ratio is much higher.
 - c It has a higher Gain-Bandwidth product.
 - d The differential gain (A_d) is easily modifiable (by changing resistor R_1).
3. Look at the data sheets of TL084 and INA 128. Identify the major differences between these two ICs – i.e. OpAmp parameters crucial for difference amplifier applications, such as the Loadcell application discussed in this experiment.
 - a CMRR of INA128 = 125 dB for a gain of 100 or 1000. CMRR of TL084 = 86 dB.
 - b Input bias current of INA128 = 2 nA. Input bias current of TL084 = 20 pA.
 - c Input offset current of INA128 = 1 nA. Input offset current of TL084 = 5 pA.
 - d Offset voltage of INA128 = $\pm 10 \pm 100/G$. Offset voltage of TL084 = 3 mV.
 - e Slew rate of INA128 = 4 V/ μ s. Slew rate of TL084 = 16 V/ μ s.
 4. Identify one or two parameters of the INA128 that makes it superior to the TL084 based instrumentation amplifier.
 - a The CMRR of INA128 >> TL084.
 - b The Offset Voltage of INA128 << TL084.

Learnings: Learnt the structure, working, advantages & disadvantages of the Three-OpAmp Instrumentation Amplifier.