4.0 - Voltage Regulator

About voltage regulators

Voltage regulators provide constant and stable potentials to a circuit. Switching regulators are commonly used in home computer power supplies, but the CHRP circuit uses a much simpler, and also less energy efficient, linear regulator design. Linear regulators convert the difference between the higher input potential and the regulated output potential into heat. For this reason, the regulator is bolted to the circuit board and uses the copper ground plane on the circuit board as a heat sink.

Voltage regulator activity

1. Before installing the regulator, you will test your CHRP circuit to verify that the power pins of all major components connect to the 5 V power supply and are not shorted to ground.

   Identify the +5 V power supply pins (often labelled V_{CC} or V_{DD}) of each of the major components. Use a meter (set to measure resistance or continuity) to confirm that each power supply pin has a low resistance connection to the 5V output of U1, and has no connection to ground (GND).

Component	+5 V pin number	Ohms to U1 output	Ohms to GND
U1	3	—	
U2			
U3	20		
U4			
U5			
LCD1			

If all connections check out, install regulator U1 into your CHRP circuit board. **Note: Align the hole on the regulator mounting tab with the mounting hole on the circuit board, and, using pliers, bend the regulator leads so that the mounting holes align when the regulator is installed. Install the regulator with a machine screw inserted through the bottom of the circuit board.**

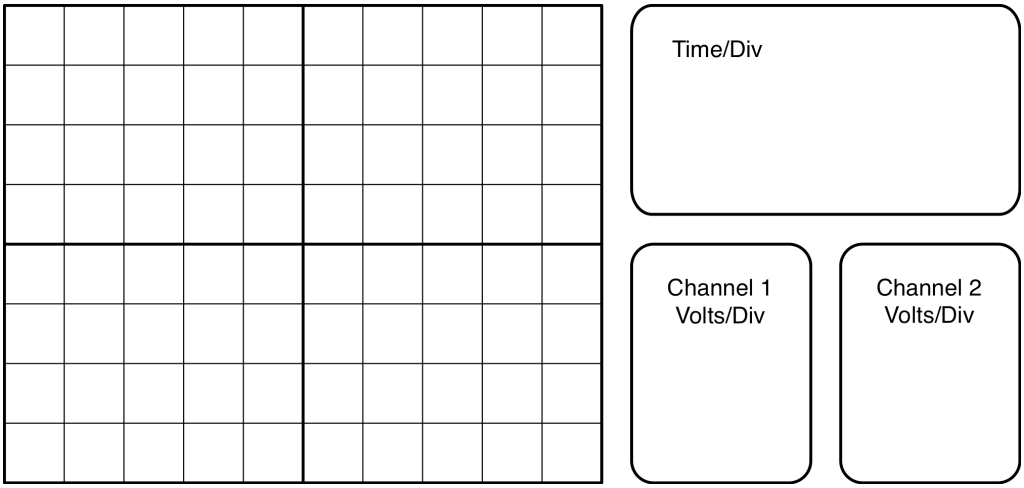
2. Install capacitors C2 and C3, and header J1 into your CHRP circuit board. **Note: C2 and C3 are polarized capacitors. Be sure to observe the correct polarity during installation.**

Teacher Check ☐

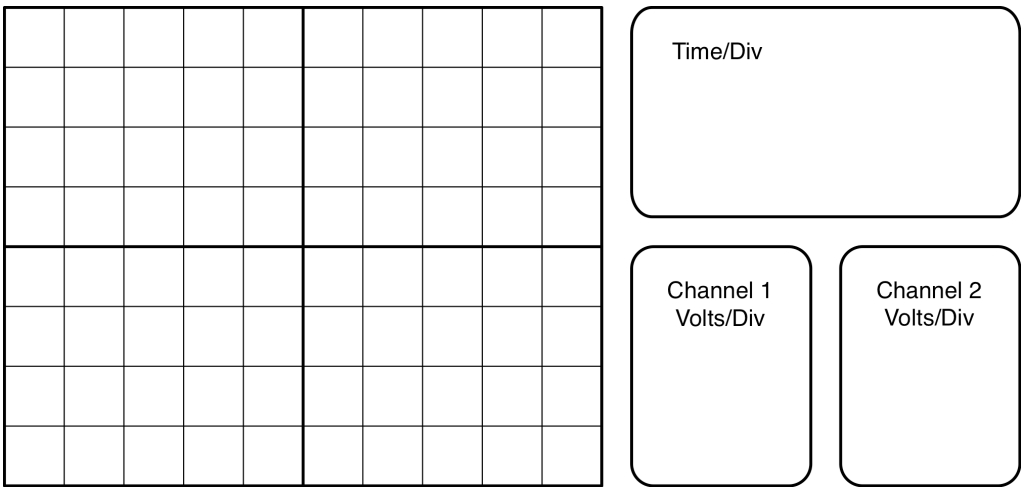
3. Next, you will verify the operation of the voltage regulator and filter capacitors. Start by measuring the voltage regulator's input and output potentials using a multimeter.

   V_{IN} = V_{OUT} =

4. Measure the filtered DC potential at the input of the regulator using channel 1 on the oscilloscope. Compare the input to the regulator's DC output using channel 2 of the oscilloscope.



5. Switch the oscilloscope to measure AC on channel 1, and record the input ripple voltage at U1.



6. While measuring input ripple on channel 1, use channel 2 of the oscilloscope to ascertain the amount and type of any voltage fluctuations at the regulator's output.

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Voltage regulator analysis

7. Would you classify any output fluctuations of the regulator as ripple? Hint: Does it correlate with the frequency of the input ripple?

8. What is the amplitude of the output noise? How much smaller is the output noise amplitude than the input ripple amplitude?