

# 4.0 - Voltage Regulator

## About voltage regulators

Voltage regulators produce a constant and stable output voltage by actively matching their output to the instantaneous load required by a circuit. Switching regulators are commonly used in computer power supplies, but the CHRP circuit uses a much simpler, and also less efficient, linear regulator design. This particular regulator produces a clean, stable 5V output from a higher input voltage, and converts the excess input voltage into heat. The regulator is bolted to the circuit board and uses the copper ground plane on the top layer of the circuit board as a heat sink.

## Voltage regulator activity

1. Before installing the regulator, you will need to 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		—	
U2			
U3			
U4			
U5			
U6			
U7			
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 mark the location at which the regulator pins need to be bent. Bend the regulator pins with pliers and install the regulator with a machine screw inserted through the bottom of the circuit board.**

2. Install capacitors C9 and C10 into your CHRP circuit board. **Note: C9 and C10 are polarized capacitors. Be sure to observe the correct polarity during installation.**

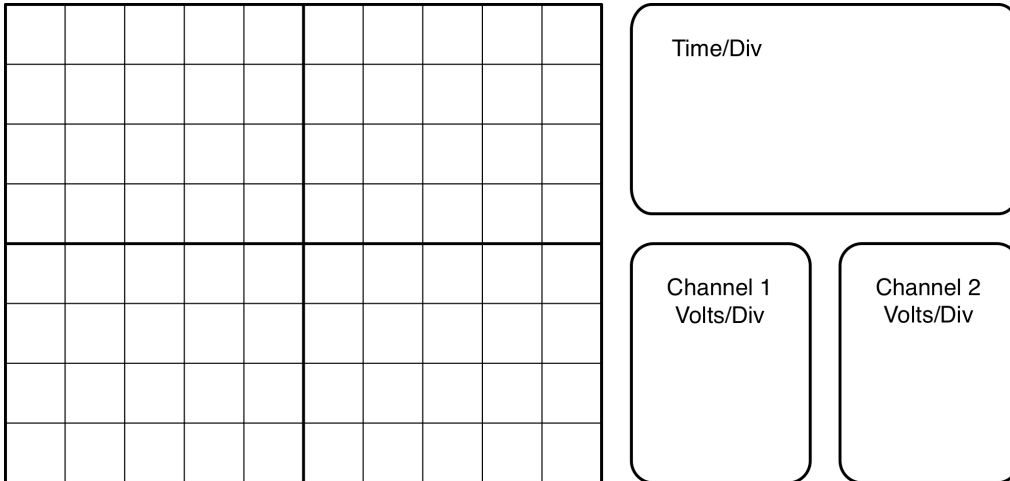
Teacher Check

- Verify the operation of the voltage regulator by measuring its input and output voltages using a multimeter.

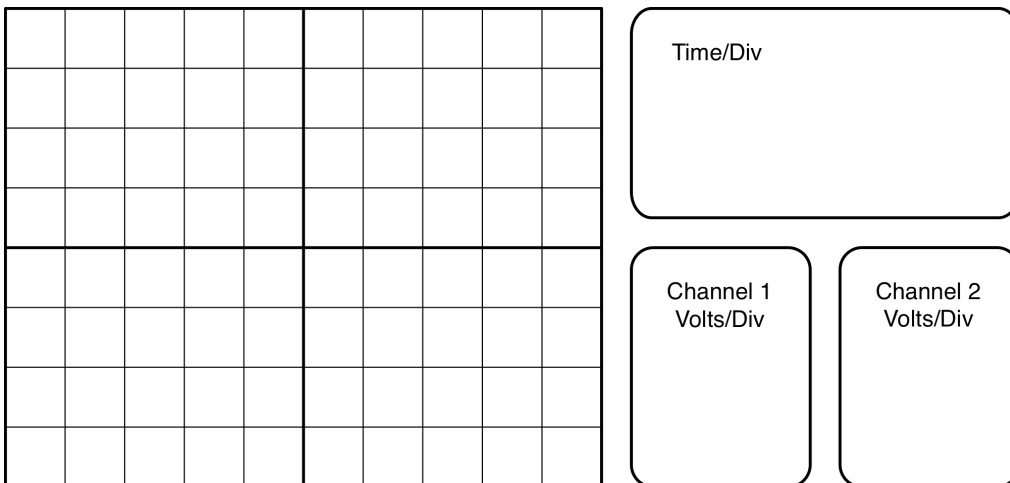
$V_{IN} =$

$V_{OUT} =$

- Using channel 1 of an oscilloscope, measure the filtered DC input voltage applied to U1. While measuring the DC input on channel 1, use channel 2 to measure the regulator's DC output.



- Switch the oscilloscope to measure AC, and record the input ripple voltage at U1.



- While measuring input ripple on channel 1, use channel 2 of the oscilloscope to ascertain the amount and type of any output voltage fluctuations.

Teacher Check

## Voltage regulator analysis

- Is the output fluctuation of the regulator considered to be ripple? Hint: Does it correlate with the input ripple? How does output noise amplitude compare with the input ripple amplitude?