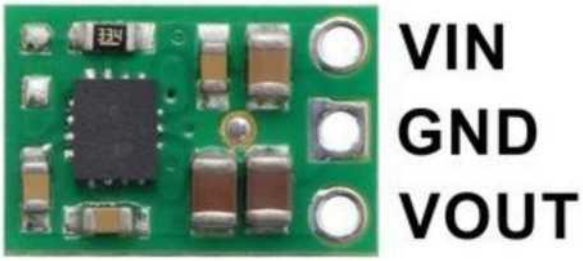
# POLOLU 5V STEP-UP/STEP-DOWN VOLTAGE REGULATOR S9V11F5

# USER'S GUIDE

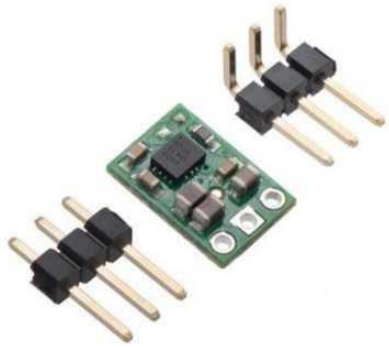
## CONNECTIONS

The step-up/step-down regulator has just three connections: the input voltage (VIN), ground (GND), and the output voltage (VOUT). These through-holes are arranged with a 0.1" spacing along the edge of the board for compatibility with standard solderless breadboards and perfboards and connectors that use a 0.1" grid. You can solder wires directly to the board or solder in either the 3x1 straight male header strip or the 3x1 right-angle male header strip that is included. VOUT is labeled on the silkscreen on one side of the board, and GND is in the middle and can be identified by its square pad.



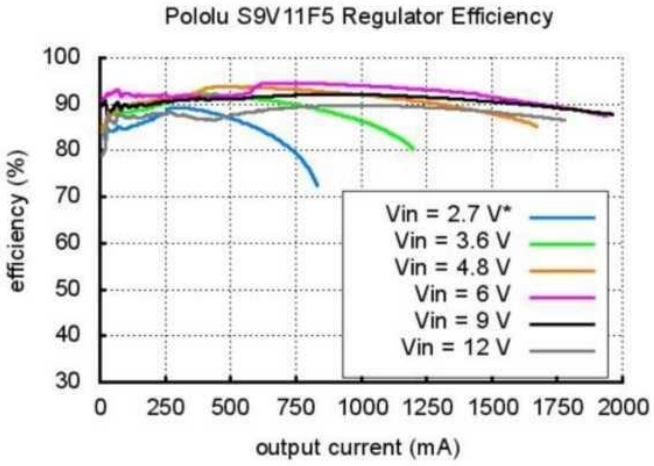

The input voltage, VIN, should be between 3 V and 16 V when the regulator is first powered. After it is running, it can continue operating down to 2 V. Lower inputs can shut down the voltage regulator; higher inputs can destroy the regulator, so you should ensure that noise on your input is not excessive, and you should be wary of destructive LC spikes (see below for more information).

The output voltage, VOUT, is regulated to a fixed 5 V, but it can be as high as 5.2 V when there is little or no load on the regulator.



## TYPICAL EFFICIENCY AND OUTPUT CURRENT

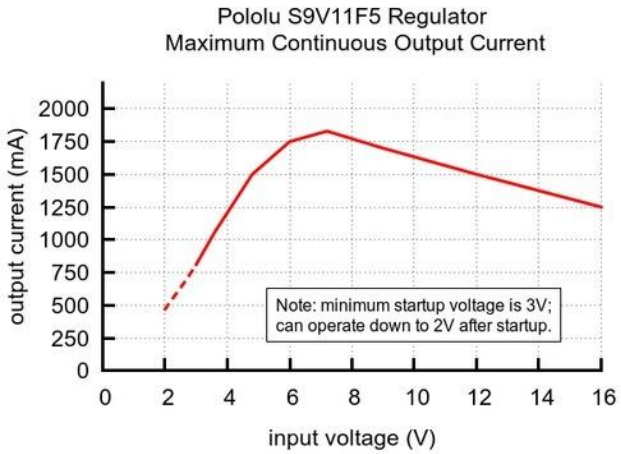
The efficiency of a voltage regulator, defined as (Power out)/(Power in), is an important measure of its performance, especially when battery life or heat are concerns. As shown in the graph below, this switching regulator typically has an efficiency of 85% to 95%. A power-saving feature maintains these high efficiencies even when the regulator current is very low.




*Minimum startup voltage is 3V; can operate down to 2V after startup.

The maximum achievable output current of the board varies with the input voltage but also depends on other factors, including the ambient temperature, air flow, and heat sinking. The graph below shows maximum output currents that the regulator can deliver continuously at room temperature in still air and without additional heat sinking. The regulator can temporarily

deliver up to around 2 A, though it will typically quickly overheat under such conditions and go into thermal shutdown.




Note that the startup current is limited to approximately 700 mA, and currents in excess of this are only available after the output has finished rising to 5 V. Large capacitive loads will generally not pose a problem because they will gradually charge up even with the current limit active, so while they may increase the time it takes the regulator to start up, the regulator should still eventually get to 5 V. A purely resistive load, however, could prevent the regulator from ever reaching 5 V. For example, if you put a 5 Q resistor between VOUT and GND and then apply power to the regulator, the output voltage will never rise past 3.5 V, the voltage at which the current draw reaches the 700 mA limit. As such, this regulator is intended for applications like robotics, where any large loads are controllable and can be applied only after the regulator has finished starting up.

## LC VOLTAGE SPIKES

When connecting voltage to electronic circuits, the initial rush of current can cause voltage spikes that are much higher than the input voltage. If these spikes exceed the regulator's maximum voltage, the regulator can be destroyed. If you are connecting more than about 12 V, using power leads more than a few inches long, or using a power supply with high inductance, we recommend soldering a 33 pF or larger electrolytic capacitor close to the regulator between VIN and GND. The capacitor should be rated for at least 20 V.