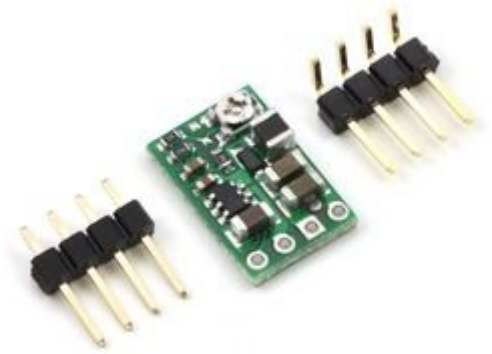
Using the Regulator



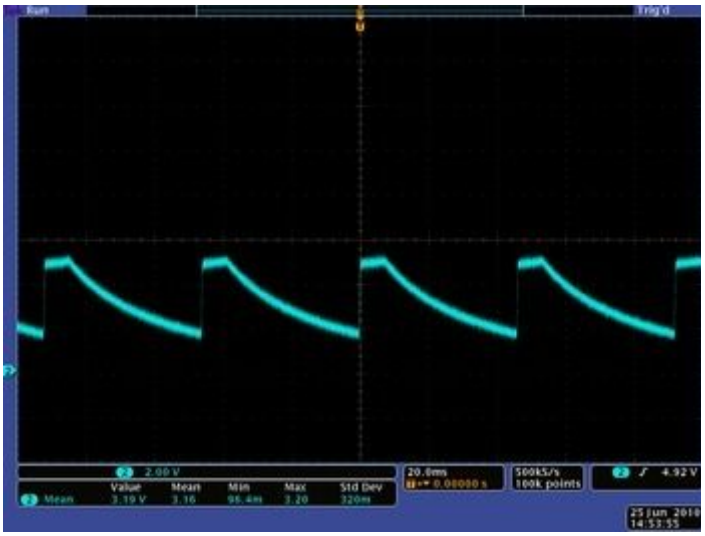
Connections

The buck regulator has four connections: shutdown (SHDN), input voltage (VIN), ground (GND), and output voltage (VOUT).

The SHDN pin can be driven low (under 0.3 V) to turn off the output and put the board into a low-power state that typically draws 20 µA, and it can be driven high (above 2.3 V) to enable the board. If you do not need to use the shutdown feature, the SHDN pin can be directly connected to VIN to permanently enable the board. **You should not leave this pin disconnected** as this can result in unpredictable behavior.

The input voltage, VIN, should be between 4.5 V and 42 V. If the input voltage gets too close to the output voltage, the output will start to drop, so you should ensure that VIN is at least a few volts above VOUT. You should also ensure that noise on your input does not exceed the 42 V maximum, and you should be wary of destructive LC spikes (see below for more information).

The output voltage, VOUT, is determined by the trimmer potentiometer position. Setting the output voltage to be higher than the input voltage will not damage the board, but it will produce an oscillating output rather than a clean power rail (see the oscilloscope capture below), so we recommend you avoid setting the output voltage to be higher than the input voltage. The available output voltage range depends on your input voltage, VIN, and the regulator version you have: 2.5 V to 7.5 V (D24VxA**LV**) or 4 V to 25 V (D24VxA**HV**). The maximum available output current also depends on your regulator version: 300 mA (D24V**3**Axx) or 600 mA (D24V**6**Axx). Exceeding the maximum output current can cause the output voltage to drop below its set value.

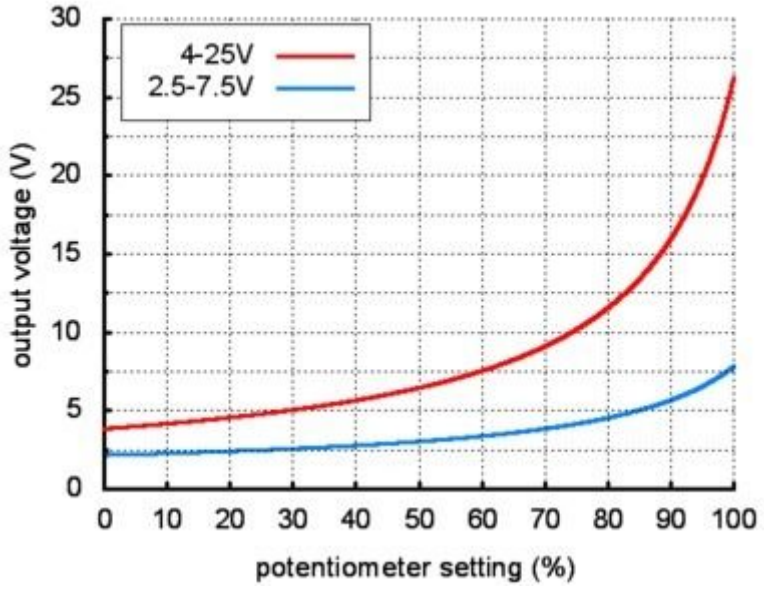


VOUT of the Pololu step-down regulator D24V3ALV when VIN is 5 V and the output voltage setting is higher than 5 V.

The four connections are labeled on the back side of the PCB, and they are arranged with a 0.1″ spacing along the edge of the board for compatibility with solderless breadboards, connectors, and other prototyping arrangements that use a 0.1″ grid. You can solder wires directly to the board or solder in either the 4×1 straight male header strip or the 4×1 right-angle male header strip that is included.

Setting the output voltage

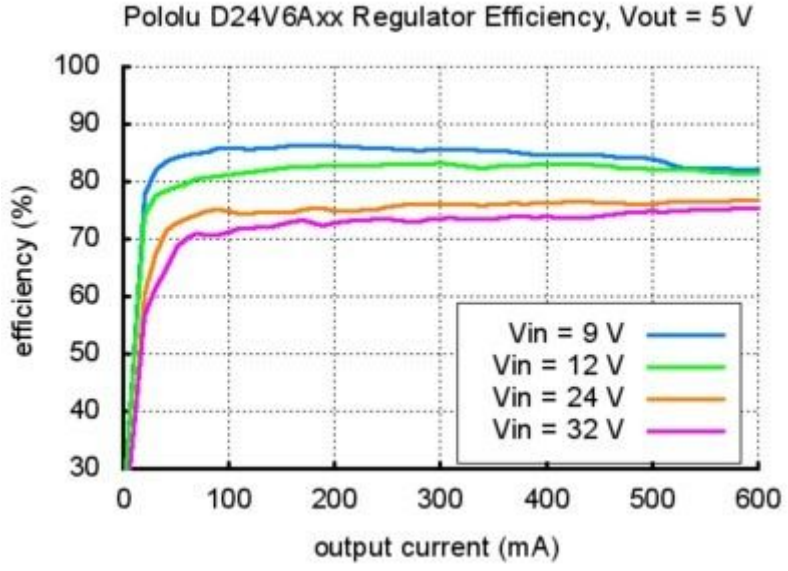
The output voltage can be measured using a multimeter. Turning the potentiometer clockwise increases the output voltage. The output voltage can be affected by a screwdriver touching the potentiometer, so the output measurement should be done with nothing touching the potentiometer. When setting the output voltage, note that the buck regulator can only produce voltages lower than the input voltage.

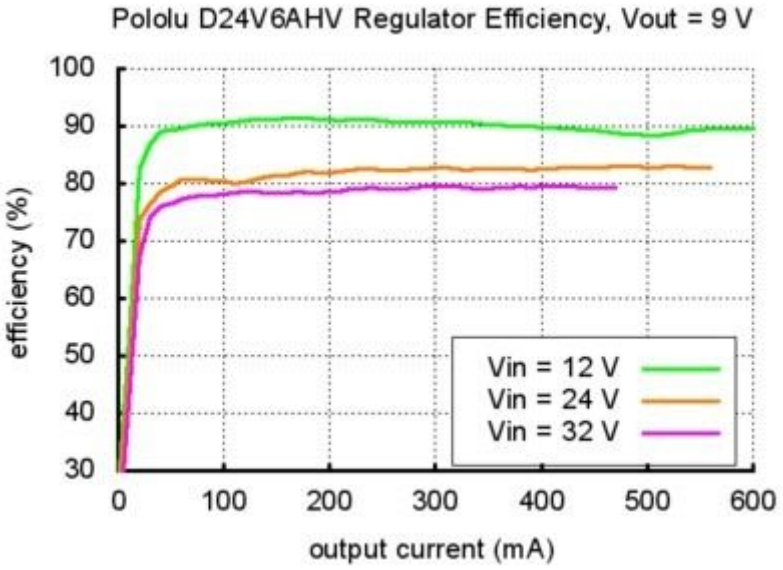


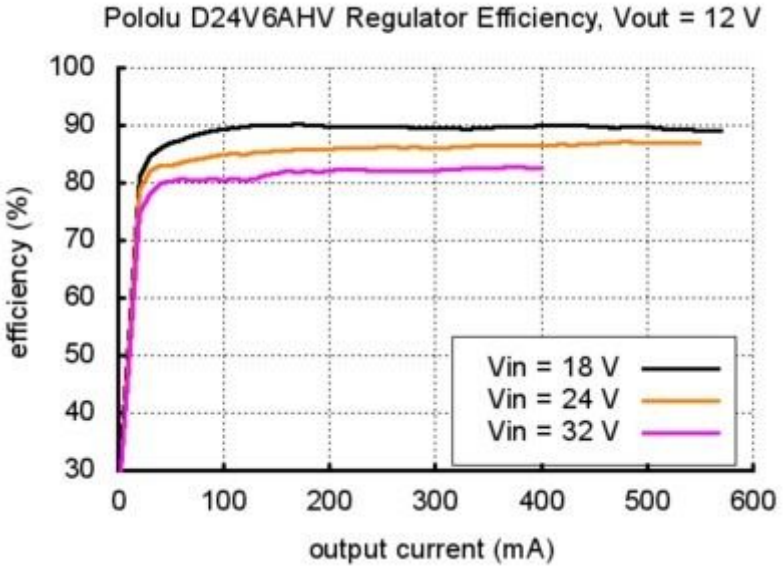
Output voltage settings for the adjustable 2.5-7.5V and 4-25V buck regulators (D24VxAxx).

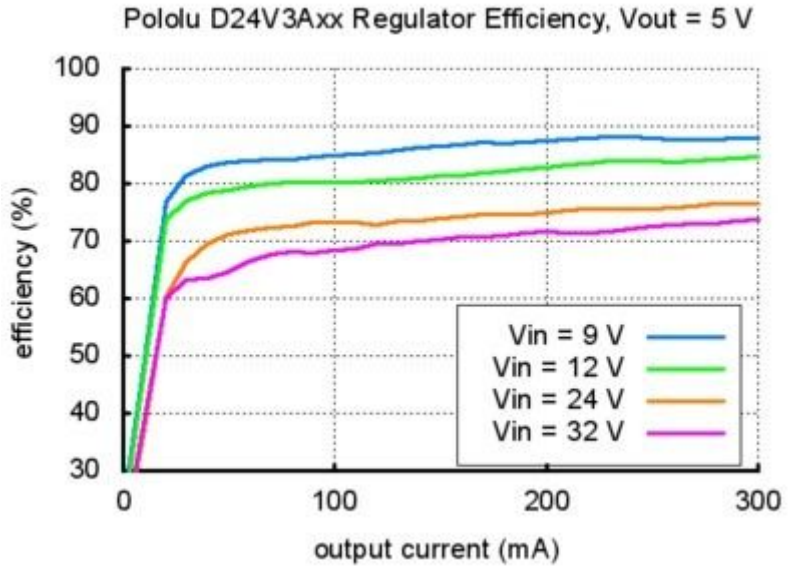
Typical Efficiency and Output Current

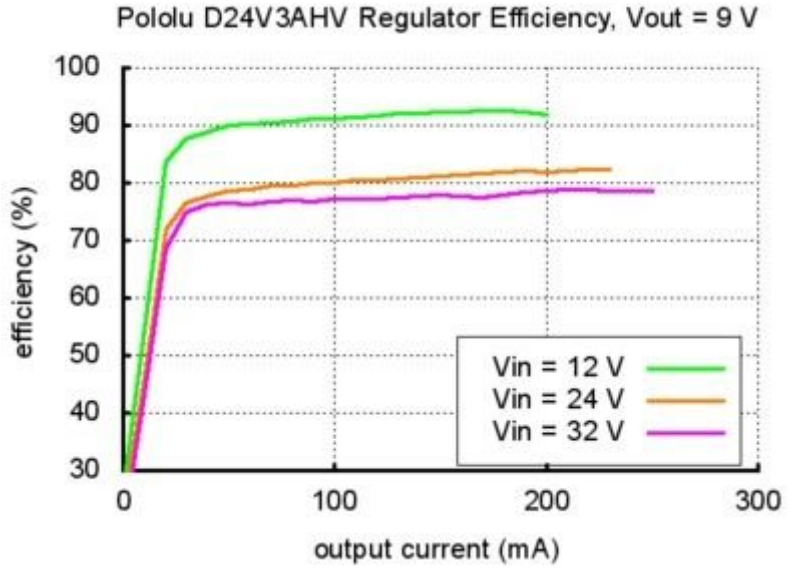
The efficiency of a voltage regulator, defined as (Power out)/(Power in), is an important measure of its performance, especially when battery life or heat are concerns. As shown in the graphs below, this switching regulator typically has an efficiency of 70% to 90%. The maximum achievable output current of the board depends on many factors, including the ambient temperature, air flow, heat sinking, and the input and output voltage. See the graphs below for more details on the typical efficiency and output currents for this voltage regulator.

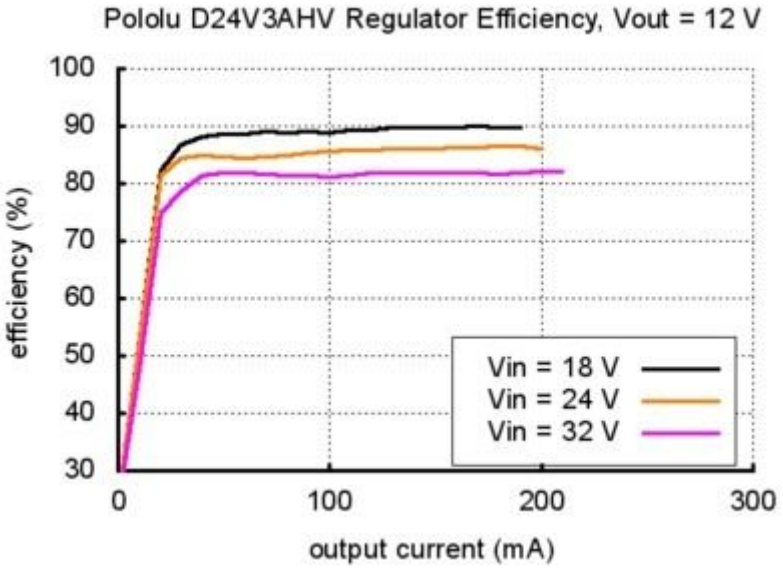



Pololu D24V6AHV Regulator Efficiency, Vout = 9 V
efficiency (%)
100
90
80
70
60
50
40
30
0
100
200
300
400
500
600
output current (mA)
Vin = 12 V
Vin = 24 V
Vin = 32 V

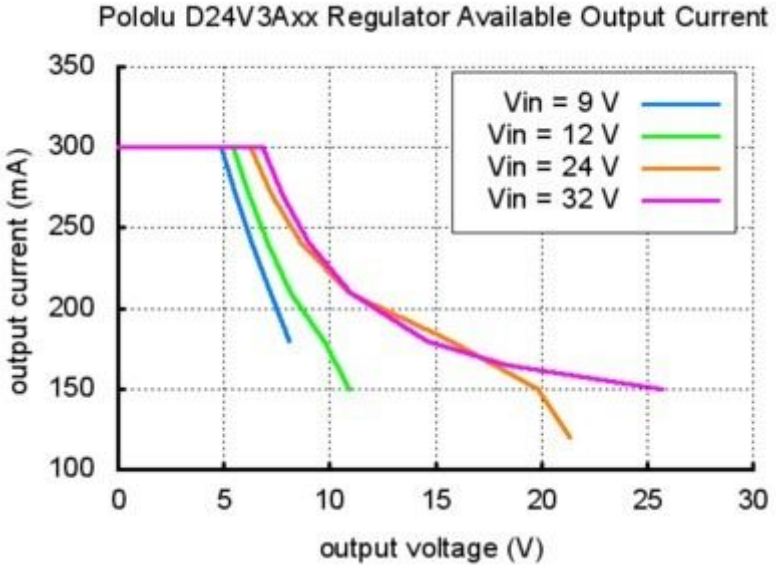

Pololu D24V6AHV Regulator Efficiency, Vout = 12 V
efficiency (%)
100
90
80
70
60
50
40
30
0
100
200
300
400
500
600
output current (mA)
Vin = 18 V
Vin = 24 V
Vin = 32 V


Pololu D24V3Axx Regulator Efficiency, Vout = 5 V
efficiency (%)
100
90
80
70
60
50
40
30
0
100
200
300
output current (mA)
Vin = 9 V
Vin = 12 V
Vin = 24 V
Vin = 32 V


Pololu D24V3AHV Regulator Efficiency, Vout = 9 V
efficiency (%)
100
90
80
70
60
50
40
30
0
100
200
300
output current (mA)
Vin = 12 V
Vin = 24 V
Vin = 32 V



Note that the achievable output current of the two 300 mA D24V3Axx regulators depends on the input and output voltage, as shown in the graph below.



Typical available output current of Pololu step-down voltage regulator D24V3Axx.

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 (42 V), the regulator can be destroyed. In our tests with typical power leads (~30″ test clips), input voltages above 20 V caused spikes over 42 V. If you are connecting more than 20 V or your power leads or supply has high inductance, we

recommend soldering a 33µF or larger electrolytic capacitor close to the regulator between VIN and GND. The capacitor should be rated for at least 50 V.