POLOLU 5V STEP-UP/STEP-DOWN VOLTAGE REGULATOR S18V20F5/

POLOLU 6V STEP-UP/STEP-DOWN VOLTAGE REGULATOR S18V20F6/

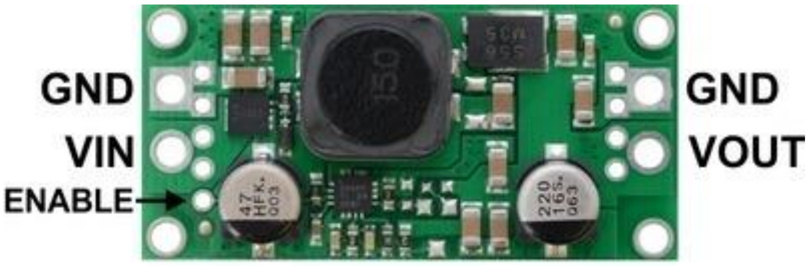
POLOLU 9V STEP-UP/STEP-DOWN VOLTAGE REGULATOR S18V20F9/

POLOLU 12V STEP-UP/STEP-DOWN VOLTAGE REGULATOR S18V20F12

USER'S GUIDE

CONNECTIONS

This step-up/step-down regulator has four connections: input voltage (VIN), ground (GND), and output voltage (VOUT), and ENABLE.



The input voltage, VIN, should be between 2.9 V and 32 V. Lower input voltages can cause the regulator to shut down or behave erratically; higher input voltages can destroy the regulator, so you should ensure that noise on the input is not excessive. 32 V should be treated as the absolute maximum input voltage. Our recommended maximum operating voltage is 30 V, which is the limit of the reverse voltage protection.

The regulator is enabled by default: a 100 kΩ pull-up resistor on the board connects the ENABLE pin to reverse-protected VIN. The ENABLE pin can be driven low (under 0.7 V) to put the board into a low-power state. The quiescent current draw in this sleep mode is dominated by the current in the pull-up resistor from ENABLE to VIN and by the reverse-voltage protection circuit, which will draw between 10 µA and 20 µA per volt on VIN when ENABLE is held low (e.g. approximately 30 µA with 3 V in and 500 µA with 30 V in). If you do not need this feature, you should leave the ENABLE pin disconnected. Note that the SEPIC topology has an inherent capacitor from input to output; therefore, the output is not completely disconnected from the input even when the regulator is shut down.

Pololu fixed step-up/step-down voltage regulator S18V20Fx with included optional terminal blocks and header pins.

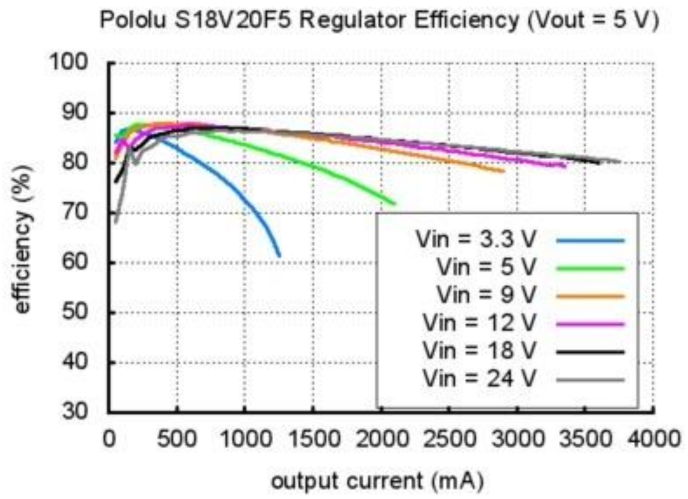
Pololu fixed step-up/step-down voltage regulator S18V20Fx, assembled with included terminal blocks.

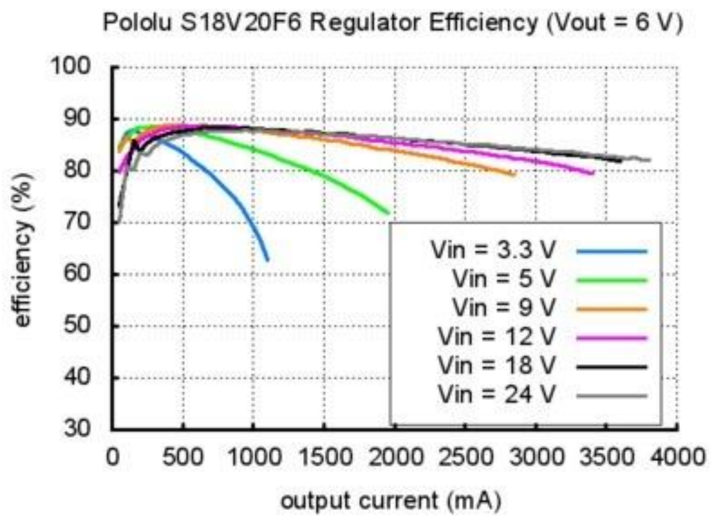
The connections are labeled on the back side of the PCB, and the board offers several options for making electrical connections. You can solder the included 2-pin 5mm-pitch terminal blocks to the two pairs of larger holes on the ends of the board. Alternatively, if you want to use this regulator with a solderless breadboard, 0.1″-pitch connectors, or other prototyping arrangements that use a 0.1″grid, you can solder pieces of the included 9×1 straight male header strip to the 0.1″-spaced smaller holes (each large through-hole has a corresponding pair of these smaller holes). For the most compact installation, you can solder wires directly to the board.

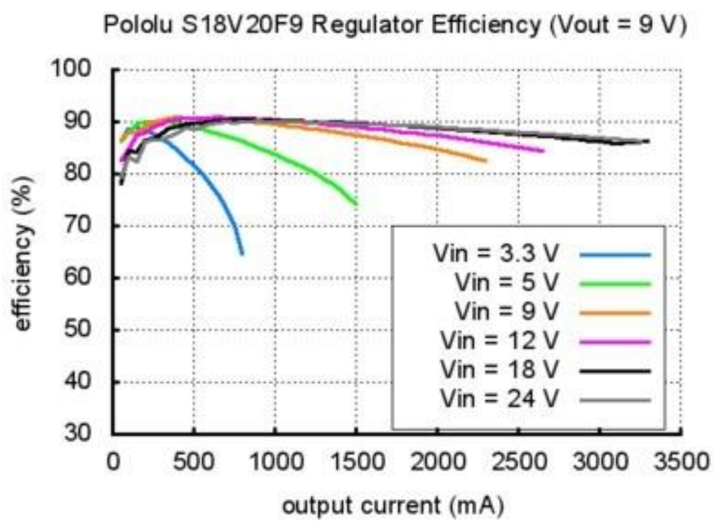
The board has four 0.086″ mounting holes intended for #2 or M2 screws. In applications where mounting screws are not used and wires are soldered directly to the board, the insulated part of the wires can be passed through the mounting holes for strain relief. The picture above shows an example of this with 20 AWG wire, which was close to the limit of what would fit through the mounting holes.

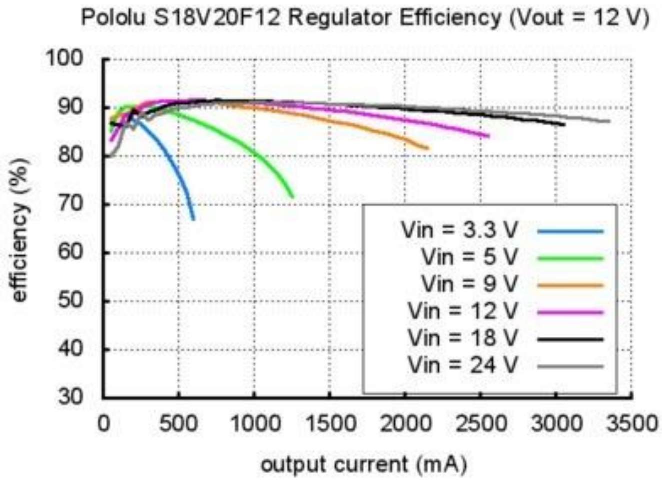
TYPICAL EFFICIENCY AND OUTPUT CURRENT

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, these switching regulators have an efficiency of 80% to 90% for most combinations of input voltage, output voltage, and load.


Pololu S18V20F5 Regulator Efficiency (Vout = 5 V)
efficiency (%)
output current (mA)
Vin = 3.3 V
Vin = 5 V
Vin = 9 V
Vin = 12 V
Vin = 18 V
Vin = 24 V
100
90
80
70
60
50
40
30
0
500
1000
1500
2000
2500
3000
3500
4000

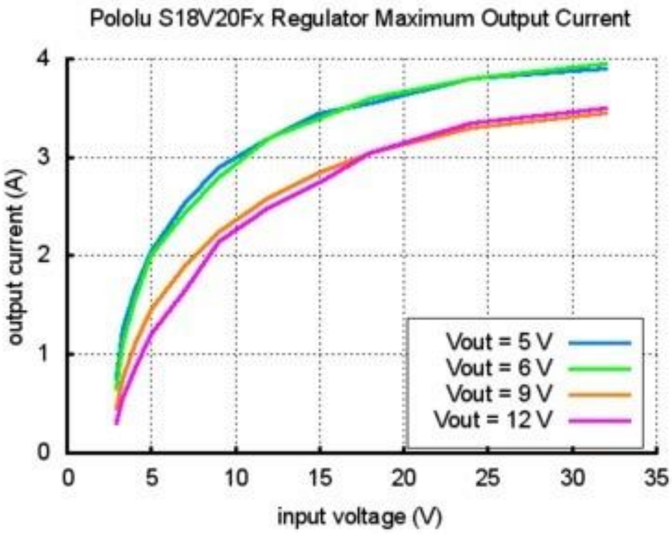

Pololu S18V20F6 Regulator Efficiency (Vout = 6 V)
efficiency (%)
output current (mA)
Vin = 3.3 V
Vin = 5 V
Vin = 9 V
Vin = 12 V
Vin = 18 V
Vin = 24 V
100
90
80
70
60
50
40
30
0
500
1000
1500
2000
2500
3000
3500
4000


Pololu S18V20F9 Regulator Efficiency (Vout = 9 V)
efficiency (%)
output current (mA)
Vin = 3.3 V
Vin = 5 V
Vin = 9 V
Vin = 12 V
Vin = 18 V
Vin = 24 V
100
90
80
70
60
50
40
30
0
500
1000
1500
2000
2500
3000
3500



We manufacture these boards in-house at our Las Vegas facility, which gives us the flexibility to make batches of regulators with customized components to better meet the needs of your project. For example, if you have an application where the input voltage will always be below 20 V and efficiency is very important, we can make these regulators a bit more efficient at high loads by replacing the 30V reverse voltage protection MOSFET with a 20V one. We can also customize the set output voltage. If you are interested in customization and want at least a few dozen units, please contact us.

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 graphs below show output currents at which this voltage regulator's over-temperature protection typically kicks in after a few seconds. These currents represent the limit of the regulator's capability and cannot be sustained for long periods, so the continuous currents that the regulator can provide are typically several hundred milliamps lower.



<u>During normal operation, this product can get hot enough to burn you. Take care when handling this product or other components connected to it.</u>