5V, 3A Step-Up/Step-Down Voltage Regulator S13V30F5

Pololu item #: 4082
Brand: Pololu
Status: Active and Preferred
✔ RoHS3
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30 in stock
supply outlook

Price break	Unit price (US$)
1	12.95
5	11.91

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This powerful synchronous switching step-up/step-down regulator efficiently produces 5 V from input voltages between 2.8 V and 22 V. Its ability to convert both higher and lower input voltages makes it useful for applications where the power supply voltage can vary greatly, as with batteries that start above but discharge below 5 V. The board measures 0.9" × 0.9", has a typical efficiency of 85% to 95%, and can supply typical continuous output currents between 2 A and 4 A depending on the input voltage. The regulator also features reverse voltage protection and an optional enable input that can be used to put the regulator in a low-power state with a current draw of less than 10 µA per volt on VIN.

Alternatives available with variations in these parameter(s): continuous output current Select variant...

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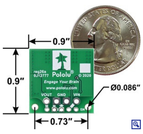
Overview

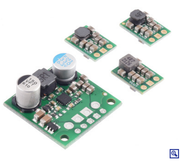
The S13VxF5 family of efficient switching regulators (also called switched-mode power supplies (SMPS) or DC-to-DC converters) use a buck-boost topology to convert both higher and lower input voltages to a regulated 5 V output. They take input voltages from 2.8 V to 22 V and increase or decrease them as necessary, offering a typical efficiency of over 85% and typical continuous output currents between 1 A and 3 A . The flexibility in input voltage offered by this family of regulators is especially well-suited for battery-powered applications in which the battery voltage begins above 5 V and drops below as the battery discharges. Without the typical restriction on the battery voltage staying above the required voltage throughout its life, new battery packs and form factors can be considered.



The different members of this family offer different continuous output currents:

- S13V10F5: 1 A continuous output current
- S13V15F5: 1.5 A continuous output current
- S13V20F5: 2 A continuous output current
- S13V30F5: 3 A continuous output current

The regulators have under-voltage lockout, output over-voltage protection, and over-current protection. A thermal shutdown feature also helps prevent damage from overheating and a soft-start feature limits the inrush current and gradually ramps the output voltage on startup. The larger 3 A S13V30F5 has reverse-voltage protection up to 20 V, but the S13V10F5, S13V15F5, and S13V20F5 do not.

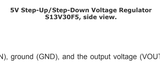


Details for item #4082

Features

- Input voltage: 2.8 V to 22 V
- Output voltage: 5 V with 3% accuracy
- Typical maximum continuous output current: 2 A to 4 A, depending on input voltage (see the maximum continuous output current graph below)
- Typical efficiency of 85% to 95%, depending on input voltage and load (see the efficiency graph below)
- 10 mA to 20 mA typical no-load quiescent current (see the quiescent current graph below); can be reduced to 2 µA to 10 µA per volt on VIN by disabling the board
- Input under-voltage lockout and output over-voltage protection
- Soft-start feature limits inrush current and gradually ramps output voltage
- Integrated reverse-voltage protection up to 20 V, over-current protection, and over-temperature shutoff
- Fixed switching frequency of ~500 kHz
- Compact size: 0.9" × 0.9" × 0.38" (22.9 mm × 22.9 mm × 9.7 mm); see the dimension diagram (294k pdf) for more information
- Two 0.086" mounting holes for #2 or M2 screws

5V Step-Up/Step-Down Voltage Regulator S13V30F5, with included hardware.



5V Step-Up/Step-Down Voltage Regulator S13V30F5, side view.

Connections

The step-up/step-down regulator has four connections: enable (EN), the input voltage (VIN), ground (GND), and the output voltage (VOUT). The input voltage, **VIN**, powers the regulator. Voltages between 2.8 V and 22 V can be applied to VIN. **VOUT** is the regulated output voltage.

The regulator, which is enabled by default, can be put into a low-power sleep state by bringing the **EN** pin low. The rising threshold for the EN pin is between 1 V and 1.2 V, and the falling threshold is at most 160 mV lower than that (i.e. the falling hysteresis is 160 mV max). This allows a precise low-VIN cutoff to be set, such as with the output of an external voltage divider powered by VIN, which can be useful for battery powered applications where draining the battery below a particular voltage threshold could permanently damage it. The quiescent current draw in sleep mode is dominated by the current in the 475 kΩ pull-up resistor from ENABLE to VIN and in the reverse-voltage protection circuit, which altogether will be between 2 µA and 10 µA per volt on VIN.

The regulator has two sets of through-holes: five smaller holes 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) and four larger holes intended for 3.5 mm-pitch terminal blocks. VIN, GND, and VOUT are available at both the smaller holes and larger holes, but EN is only available on the smaller row of through-holes.

5V Step-Up/Step-Down Voltage Regulator S13V30F5, with included hardware.

The regulator includes a 5×1 straight male header strip and two 2-pin, 3.5 mm-pitch terminal blocks, and it can be assembled with either the header or terminal blocks, **not both**. The 0.1" male header can be soldered into the smaller through-holes. Alternatively, the terminal blocks can be locked together and soldered into the larger holes to allow for convenient temporary connections of unterminated wires (see our short video on terminal block installation). You can also solder wires directly to the board for the most compact installation.

5V Step-Up/Step-Down Voltage Regulator S13V30F5, on breadboard.

5V Step-Up/Step-Down Voltage Regulator S13V30F5, with terminal blocks installed.

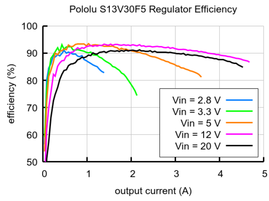
If the terminal blocks are used, a small wire (not included) can be soldered to the enable pin as shown below, so it will not interfere with the VIN terminal block connection.

5V Step-Up/Step-Down Voltage Regulator S13V30F5, with terminal blocks and EN wire installed

5V Step-Up/Step-Down Voltage Regulator S13V30F5, using all five connections with terminal blocks installed.

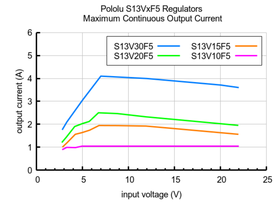
Typical efficiency

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.



Maximum continuous output current

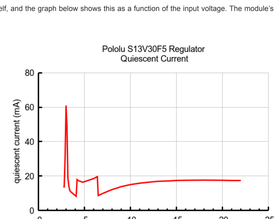
The maximum achievable output current of the regulator varies with the input voltage but also depends on other factors, including the ambient temperature, air flow, and heat sinking. The graph below shows maximum output currents that the regulators in the S13VxF5 family can deliver continuously at room temperature in still air and without additional heat sinking.



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

Quiescent current

The quiescent current is the current the regulator uses just to power itself, and the graph below shows this as a function of the input voltage. The module's EN input can be driven low to put the board into a low-power state where it typically draws between 2 µA and 10 µA per volt on VIN.



Typically the quiescent current of the S13V30F5 is below 20 mA, but for input voltages between about 3 V and 3.3 V the quiescent current of some units can rise to near 100 mA. Keeping connections short and adding a capacitor of a few tens of microfarads greatly reduces this spike in quiescent current.

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