

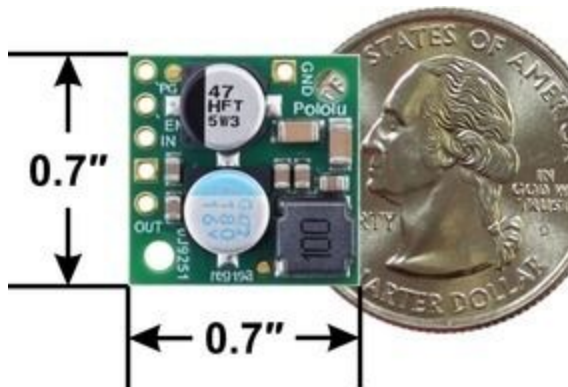
Pololu 6V, 2.5A Step-Down Voltage Regulator D24V22F6



This small synchronous switching step-down (or buck) regulator takes an input voltage of up to 36 V and efficiently reduces it to **6 V**. The board measures only 0.7" × 0.7" yet delivers a typical continuous output current of up to **2.5 A** and features reverse voltage protection. Typical efficiencies of 85% to 95% make this regulator well suited for powering moderate loads like sensors or small motors. An optional shutdown pin enables a low-power state with a current draw of around 30 μA to 350 μA , depending on the input voltage, and a power-good output indicates when the regulator cannot adequately maintain the output voltage.

Select options: (any output voltage) 3.3 V 5 V 6 V 7.5 V 9 V 12 V [Go ▶](#)

Overview



The D24V22Fx family of step-down voltage regulators generates lower output voltages from input voltages as high as 36 V. They are synchronous switching regulators (also called switched-mode power supplies (SMPS) or DC-to-DC converters) with typical efficiencies of 85% to 95%, which is much more efficient than linear voltage regulators, especially when the difference between the input and output voltage is large. These regulators can typically support continuous output currents of over 2 A, though the actual available output current is a function of the input voltage and efficiency (see the *Typical efficiency and output current* section below). In general, the available output current is a little higher for the lower-voltage versions than it is for the higher-voltage versions, and it decreases as the input voltage increases.

These regulators have a typical quiescent (no load) current draw of around 1 mA, and an enable pin can be used to put the boards in a low-power state that reduces the quiescent current to approximately 5 μ A to 10 μ A per volt on VIN.

The modules have built-in reverse-voltage protection, short-circuit protection, a thermal shutdown feature that helps prevent damage from overheating, and a soft-start feature that reduces inrush current.

The different voltage versions of this regulator all look very similar, so you should consider adding your own distinguishing marks or labels if you will be working simultaneously with multiple versions. This product page applies to all versions of the D24V22Fx family.

The D24V22Fx family is intended to replace our older D24V25Fx family of step-down voltage regulators. The two designs have the same size and similar current capabilities and input voltage ranges, but they do not have the same pinout and are based on different internal circuits, so there are fundamental differences in operation. In particular, these newer D24V22Fx regulators have much lower dropout voltages and provide a “power good” signal, and the newer design allows for higher output voltages (e.g. 12 V).

Features

- Input voltage:
 - 4 V to 36 V for the version that outputs 3.3 V
 - $[\text{output voltage} + \text{dropout voltage}]$ to 36 V for output voltages of 5 V and higher (see below for more information on dropout voltage)
- Fixed 3.3 V, 5 V, 6 V, 7.5 V, 9 V, or 12 V output (depending on regulator version) with 4% accuracy
- Typical maximum continuous output current: >2 A
- Typical efficiency of 85% to 95%, depending on input voltage, output voltage, and load
- Switching frequency: ~400 kHz
- Integrated reverse-voltage protection, over-current protection, over-temperature shutoff, and soft-start
- 1 mA typical no-load quiescent current; this can be reduced to approximately 5 μA to 10 μA per volt on VIN by disabling the board
- “Power good” output indicates when the regulator cannot adequately maintain the output voltage
- Compact size: 0.7" \times 0.7" \times 0.31" (17.8 mm \times 17.8 mm \times 8 mm)
- Two 0.086" mounting holes for #2 or M2 [screws](#)

Using the regulator

Connections

These buck regulators have five main connection points for five different electrical nodes: power good (PG), enable (EN), input voltage (VIN), ground (GND), and output voltage (VOUT). The board also features a second ground connection point off the main row of connections that might be convenient for applications where you are soldering wires directly to the board rather than using it in a breadboard.



The input voltage, **VIN**, powers the regulator. Voltages between 4 V and 36 V can be applied to VIN, but for versions of the regulator that have an output voltage higher than 4 V, the effective

lower limit of VIN is VOUT plus the regulator's dropout voltage, which varies approximately linearly with the load (see below for a graph of dropout voltages as a function of the load).

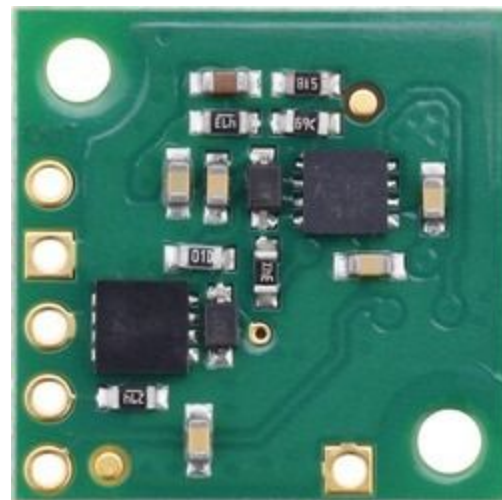
The output voltage, **VOUT**, is fixed and depends on the regulator version: the D24V22F3 version [outputs 3.3 V](#), the D24V22F5 version [outputs 5 V](#), the D24V22F6 version [outputs 6 V](#), the D24V22F7 version [outputs 7.5 V](#), the D24V22F9 version [outputs 9 V](#), and the D24V22F12 version [outputs 12 V](#).

The regulator is enabled by default: a 270 k Ω pull-up resistor on the board connects the **EN** pin to reverse-protected VIN. The EN pin can be driven low (under 1 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 EN to VIN and by the reverse-voltage protection circuit, which altogether will draw between 5 μ A and 10 μ A per volt on VIN when EN is held low. If you do not need this feature, you should leave the EN pin disconnected.

The “power good” indicator, **PG**, is an open-drain output that goes low when the regulator's output voltage falls below around 85% of the nominal voltage and becomes high-impedance when the output voltage rises above around 90%. An external pull-up resistor is required to use this pin.



Pololu Step-Down Voltage Regulator D24V22Fx with included hardware.



Pololu Step-Down Voltage Regulator D24V22Fx, bottom view.

The five main connection points are labeled on the top of the PCB and are arranged with a 0.1" spacing for compatibility with solderless [breadboards](#), [connectors](#), and other prototyping arrangements that use a 0.1" grid. Either the included 5×1 [straight male header strip](#) or the 5×1

[right angle male header strip](#) can be soldered into these holes. For the most compact installation, you can solder wires directly to the board.



Pololu Step-Down Voltage Regulator D24V22Fx, side view.

The board has two 0.086" (2.18 mm) diameter mounting holes intended for #2 or M2 [screws](#). The mounting holes are at opposite corners of the board and are separated by 0.52" (13.21 mm) both horizontally and vertically. For all the board dimensions, see the [dimension diagram](#) (204k pdf).

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. This family of switching regulators typically has an efficiency of 85% to 95%, though the actual efficiency in a given system depends on input voltage, output voltage, and output current. See the efficiency graph near the bottom of this page for more information.

The maximum achievable output current is typically over 2 A, but this depends on many factors, including the ambient temperature, air flow, heat sinking, and the input and output voltage.

Typical dropout voltage

The dropout voltage of a step-down regulator is the minimum amount by which the input voltage must exceed the regulator's target output voltage in order to ensure the target output can be achieved. For example, if a 5 V regulator has a 1 V dropout voltage, the input must be at least 6 V to ensure the output is the full 5 V. Generally speaking, the dropout voltage increases as the output current increases. See the "Details" section below for more information on the dropout voltage for this specific regulator version.

Details for item #2859

The graphs below show the typical efficiency and dropout voltage of the 6 V D24V22F6 regulator as a function of the output current:

