Use a 555 timer as a switch-mode power supply

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ost switch-моде power supplies rely on a PWM (pulse-widthmodulated) output that is controlled via voltage feedback. A 555-timer IC can inexpensively perform PWM. The circuit in Figure 1 shows how to turn a 555 PWM circuit into an switch-mode power supply with only one simple equation. The design uses two 555s. IC₁, in astable mode, triggers IC, in PWM mode. IC, is set to oscillate at approximately 60 kHz at a high duty cycle. The output is low for only approximately 2.5 µsec to trigger the PWM circuit and then goes high for the rest of the period. The PWM circuit has a maximum pulse width of approximately 85 µsec, and it becomes shorter, depending on the control voltage from the feedback circuit. You can reduce the chip count by using a 556 or another

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continuous-trigger source. The input must be $(1.5V_{OUT}+Margin)$, so for 5V output you need 9V minimum input. If you use CMOS chips and small timing capacitors C_1 and C_2 , you can keep the operating current low. Thus, you can use a simple zener-diode regulator for the 555 and increase the input voltage to more than 30V. The input-voltage limit is a function of how much power the zener supply can handle while delivering 5 to 10 mA to the 555s.

 Q_1 has low $R_{DS(ON)}$ and low V_{GS} and can handle more than 40V. D_1 clamps any voltage spikes, such as those that occur when a large current flow ceases, causing a large magnetic field to be left in the inductor. You should select D_1 according to the output voltage you need. For 5V output, use a 5.6V zener diode, for example. IC_3 , R_1 , R_2 , and V_1 form the feedback circuit to set the output voltage. The outputvoltage equation is $V_{OUT} = V_1(R_1/R_2 + 1)$. The TL431 is a popular part for setting a voltage reference and can easily create the 1.25V shown for V₁. You can supply 5V at 1.5A with an input of 9 to 40V. At voltages higher than 12V, you can add a 10V zener-diode supply for the chips. The zener supply only slightly reduces the efficiency. With 12V input, 5V, 1.5A output efficiency is approximately 70%, and it drops to 65% with a 40V input and a zener circuit. The zener diode's influence is more noticeable at lower current levels; at a 50-mA load the efficiency drops to approximately 50%.

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Here's one more use for the ubiquitous 555 timer: a switch-mode power supply.